1-1-1989

State-of-the-art Assessment For Simulated Forces

Merrell M. Bailey

Michael A. Companion

INSTITUTE FOR SIMULATION AND TRAINING

[redacted]

State-of-the-Art Assessment

for

Simulated Forces

Technical Report

CDRL A003

November 22, 1989

Bailey, Companion

[redacted]

IST

STATE-OF-THE-ART ASSESSMENT

FOR

SIMULATED FORCES

Merrell Mary Bailey

Michael A. Companion

November 22, 1989

Prepared under Contract Number N61339-89-C0044

For

U.S. ARMY PROJECT MANAGER FOR TRAINING DEVICES

12350 RESEARCH PARKWAY

ORLANDO, FLORIDA 32826-3276

By

UNIVERSITY OF CENTRAL FLORIDA

INSTITUTE FOR SIMULATION AND TRAINING

12424 RESEARCH PARKWAY

ORLANDO, FLORIDA 32826

Approved by:

Brian Goldiez

Brian Goldiez

Program Manager

ABSTRACT

This report provides a summary of the review of the state of the art in simulated forces conducted to support the research objectives of contract N61339-89-C-0044, Research and Development for Intelligent Simulated Forces. The specific objective of this effort was to examine other research and development in the area of intelligent simulated forces and determine what concepts could be transferred to the project being undertaken by the University of Central Florida, Institute for Simulation and Training (IST). The review focused on ARMY ground based battlefield environments, specifically on heavy armored vehicle forces. The review provided a large data base of information on current efforts in modeling simulated forces and a basis for understanding the requirements for simulated forces models; however, there appears to be little direct technology transfer to the IST effort. A number of shortcomings in existing approaches were identified. Several of these shortcomings are the focus of the research being conducted by IST.

LIST OF FIGURES

LIST OF TABLES

INTELLIGENT SIMULATED FORCES

STATE-OF-THE-ART ASSESSMENT

1.0 INTRODUCTION

This report provides a summary of the review of the state-of-the-art in simulated forces conducted to support the research objectives of Contract N61339-89-C-0044, Research and Development for Intelligent Simulated Forces. The report is submitted in compliance with CRDL 004 of the above contract. The specific objective of this effort was to examine other research and development in the area of intelligent simulated forces and determine what concepts could be transferred to the project being undertaken by the University of Central Florida, Institute for Simulation and Training. The review focused on ARMY ground based battlefield environments, specifically on heavy armored vehicle forces. Other types of simulated forces activities were examined where the general transfer of technology might be available. The following sections outline the basic procedures used during the review, information sources, descriptions of several major activities, and findings of the study. A number of appendices are included which represent the databases derived as part of this effort.

1.1 Purpose

The purpose of this report is to document the results of a study conducted to investigate the current DoD efforts in intelligent targets/simulated forces. This examination was undertaken to assess the effectiveness and resource requirements of current intelligent simulated forces efforts, and to provide guidance for future enhancements.

2.0 APPROACH

2.1 Overview

Ongoing activities to develop simulated opposing forces models have been identified and data on these efforts gathered through the investigation of existing documentation and personal contacts. Information was sought on the types of hardware and software strategies currently in use, the span of the force accommodated by the model, and the degree of intelligence and realism shown. In addition, lessons learned, availability of models and databases, areas of improvement, strengths, weaknesses, and possible contacts were also examined.

2.1.1 Procedures

This section discusses the approaches taken to research this effort. Figure 1 summarizes the methods utilized to gather information. Subsequent paragraphs in this section provide synopses of each technique.

- **Directed Literature Searches**
- **Review of CBD to Determine Agencies Funding Work in Simulated Forces**
- **Personal Contacts**
- **Site Visits**
- **Vendor Visits/Briefings**
- **Conferences**

Figure 1. Simulated Forces Review Procedures.

2.1.1.1 Directed Literature Search

The directed literature search involved both computerized on-line searches of major data bases and manual search techniques.

An on-line search was performed using the DIALOG computerized search system. This search identified more than three hundred (300) articles related to the key word list derived for simulated forces. A copy of the article listing is provided in Appendix A. Based on an examination of the titles, detailed abstracts were requested for sixty-eight of the articles. These abstracts were used to identify specific articles to be reviewed for application to the Institute for Simulation and Training (IST) project. A copy of these sixty-eight abstracts is included in Appendix B.

In addition to the computerized literature search, articles and abstracts were gleaned from magazines, journals, and

conference and symposium proceedings. Some of the proceedings represented include those from Interservice\Industry Training Systems Conferences, the Florida Artificial Intelligence Research Symposium, the Annual AI Systems in Government Conference, and the Summer Simulation Conference. Documentation published by both Perceptronics and BBN for SIMNET Intelligent Simulated Forces was also extensively examined during the course of the literature review. A bibliography of the material examined as part of the manual literature review is presented in Appendix C.

Based on the above literature reviews, copies of the books, papers, and articles deemed relevant were acquired from several sources, and placed on file in the IST library. All material contained in the IST library is available for review upon request. Additionally, IST library information has been shared with the PM TRADE data base on a limited basis. A copy of the titles and IST library file numbers of articles of relevance to the simulated forces effort is contained in Appendix D.

2.1.1.2 **Commerce Business Daily Postings**

A second potential source of information on existing or new simulated forces research and development was derived from a review of recent issues of the Commerce Business Daily. This analysis was used to identify government agencies funding work in this topic area and identify points of contact for follow-up as necessary. The Commerce Business Daily publications for the months of January 1989 through July 1989 were reviewed for postings that related to intelligent simulated forces. Sixteen postings were considered relevant. Among the sponsoring

organizations were the Rome Air Development Center, the Naval Underwater Systems Center, Kirtland Air Force Base, the Defense Nuclear Agency, and the Naval Training Systems Center. These organizations posted an interest in funding work in the area of intelligent simulated forces; the respondent firms were not investigated in the course of this literature search. This review indicated a wide interest in simulated forces models across a very diverse group of government agencies. The orientations of these efforts were evenly distributed across ground, air, sea and general battlefield environments. A list of the sixteen postings related to simulated forces resulting from this review is included in Appendix E.

2.1.1.3 **Direct Contacts**

Under this category of direct contacts, four different approaches for information gathering were employed. The first involved personal contacts with individuals whom IST knew were involved in some manner with simulated forces modeling. The second and third techniques involved direct discussions with vendors identified as part of the literature review; either at their facilities or at IST. A total of fourteen vendors were queried on their activities in simulated forces modeling through these direct discussions. Finally, contacts with several individuals/companies were made at conferences. Vendors from whom information was received include the Software Engineering Institute at Carnegie-Mellon University, Fort Leavenworth, Perceptronics, Lawrence Livermore National Laboratory, SPARTA, Inc., Texas Instruments and Consultant's Choice Inc. In

addition, a peer review of the BBN SIMNET simulated forces effort held at DARPA was attended to obtain a better feeling for the state of this effort. The vendors contacted as part of this activity are listed in Figure 2.

Simulation Technologies, Inc.	**BBN**
Sparta, Inc.	**Texas Instruments**
Perceptronics	**Lockheed**
SAIC	**TSI**
General Dynamics	**McDonnell-Douglas**
Lawrence Livermore Laboratories	**Los Alamos Laboratories**
CCI, Inc.	**BDM**
Fort Knox	**Fort Leavenworth**
Software Engineering Laboratory	**PAR Government Systems**

Figure 2. List of Primary Contacts.

3.0 RESULTS

The following sections provide a summary of the findings of this review. Topics examined include emphases of various efforts, hardware strategies, software strategies, and basic shortcomings of existing activities in this area. Brief descriptions of a number of the major efforts in simulated forces are also provided.

3.1 Emphasis of Modeling Approaches

In the major activities that were examined, the emphases of the activities in intelligent simulated forces could be

classified into two categories. The first category can be referred to as Intelligent Simulated Forces. This category is exemplified by the BBN approach to SAFOR (Semi-Automated Opposing Forces). BBN focuses on developing simulated forces models which can be embedded in a simulation environment for training troops/crews. This type of effort tends to focus on the development of models which exhibit realistic micro behavior at the individual vehicle to company level. The second category of models can be classified as Battlefield Simulation. This type of model is often more oriented toward training at the commander level. It tends to deal with larger units of the force and seems to emphasize exercising of strategies and tactics. The program efforts appear to be evenly divided between the two categories of models.

In some cases, there has been an attempt to develop a model which effectively encompasses both classes of models. This is a difficult task because the training goals of the two types are very different. Though the emphasis of the BBN SIMNET SAFOR effort is aimed at the development of an intelligent simulated force model, there has been an attempt to extend it to extremely large battlefield environments which provide a degree of command training as well. At the peer review of the BBN SAFOR conducted by DARPA in August, 1989, the team of Artificial Intelligence (AI) experts on the review committee viewed this attempt to make the BBN SAFOR fit both model categories as one of the potential problems. The experts felt that this was a clear example of a model that appeared efficient when directed toward the

application for which it was designed, but began to break down when extended to cover both classes of models. The consensus was that the different goals of the two categories of models precluded making a model which met both purposes effectively. Given current technology, it appears that it is necessary to develop specialized models for each type of emphasis.

This conclusion is somewhat perplexing because there is a logical relation between the two types of models. It would appear that it should be possible at a minimum to transfer simulation concepts between the two categories, but the differences in modeling techniques for intelligent simulated forces and battlefield simulation appear to preclude this currently. The inability to develop a single model that encompasses both types of model applications, or transfers concepts between the classes of models, appears to be a limitation of the current state of intelligent systems understanding and technology. The area of applied intelligent systems technology is still effectively in its infancy. Hopefully, in time, given a better understanding of the requirements and a more mature intelligent systems technology, it will be possible to build more generic models that can effectively and efficiently encompass both applications. Unfortunately, however, it is beyond the state-of-the-art at this time.

3.2 **Hardware Environments**

The hardware environments used to accommodate the

intelligent simulated forces and battlefield simulation approaches tend to be very different.

Simulated forces type models, which have a higher degree of individual vehicle intelligence, generally utilize some type of LISP processor. This type of computational resource is needed for AI rule-based models which impart the intelligence to the model. This may be supplemented by other computing resources to provide the calculation capabilities needed to handle other simulation tasks. A prime example of this additional computing resource is BBN's use of a Butterfly parallel processor in addition to the Symbolics computers. While most simulated forces' developers took this approach, some, such as PAR, utilize PC 286/386 class machines for the simulation, while still utilizing AI techniques. In general, intelligent simulated force models have been somewhat smaller and have been hosted in the workstation environment rather than mainframe environment.

Battlefield simulation models tend to use a more conventional hardware environment, such as a VAX configuration. This is a function of the software approach, described below, which tends to be stochastic and hence requires such computational capabilities. Additionally, this class of model tends to simulate a much larger force, which also drives the computational needs.

3.3 **Software Strategies**

The two classes of simulation models also tend to vary in their software approach. All models in the intelligent simulated

forces category have a large AI component. In the state-of-the-art models, this intelligence component is usually rule based. The primary software implementations in these models tend to be at the LISP programming level or use a blackboard approach. Some modeling efforts, including those at PAR, have employed expert system shells. Additionally, languages, such as C++ and SMALLTALK, have been used to develop intelligent simulated forces.

Of the three potential AI implementation approaches (low level languages, tools, and shells), the predominant approaches are low level language and tool implementations. This is somewhat explainable because both shells and tools generate such software overhead that hardware, with its limitations on speed, has been unable to effectively support such approaches. As more efficient high level tools and shells are developed and the price of hardware falls, speed limitations should become minimal. The maturation of efficient expert system shells should provide a significant advancement in the state-of-the-art, because models will be able to be developed faster and more efficiently, and, most importantly, will be more easily modifiable.

Though there are no major examples of neural network technology in the current simulated forces area, the application of this technology to model intelligence appears to be under examination. As this technology matures, it is expected to also become a major software strategy in modeling intelligent simulated forces.

The battlefield simulation models are all basically stochastic/deterministic programs. The most common programming language for this class of simulations is FORTRAN. Other languages, such as C, may be of equal efficiency for this application, but they have not been widely used to date.

One aspect of the software strategies that needs to be noted is the general lack of use of ADA in simulated forces models. Because ADA is the DoD standard programming language, the feasiblity of implementing or reimplementing simulated forces models in ADA must be examined. Battlefield simulation models do not appear to impose major problems to ADA implementation. Rule based intelligent simulated forces models will be more difficult to convert to ADA. These rule based models tend to rely on specialized LISP code, which has no direct parallel in ADA. It is not impossible, however, to implement expert systems in ADA. PAR Government Systems, for example, has developed several expert systems tools to support their simulation work. One of the tools, Embedded Rule-Based System (ERS), was originally developed in C. PAR has recently developed an ADA version of this tool. Hence, there is some initiative within industry to address the need to meet ADA requirements in the development of simulated forces models.

3.3.1 **Summary Table**

Table 1 identifies the major efforts examined as part of the review. Both the company or agency responsible and the corresponding simulation activity are delineated. These efforts

were examined to determine applicable concepts. General insights were obtained from these models, but few concepts had direct transfer to the IST simulated forces project.

TABLE 1

Summary of Major Related Efforts

Company/Agency	Simulation Activities
BBN	SIMNET SAFOR
Sparta	AWSIM - Computer Simulation of Combined Arms Close Combat
Texas Instruments	CACTUS - LISP Based, Goal Oriented Force Simulation
Perceptronics	CBTSIM (BBS) - Computer Battle Simulation
	Context Dependent Simulated Forces
Ft. Leavenworth	Battle Command Integration Program
Lawrence Livermore Labs.	ConMod - Automated, large scale AirLand Battle Simulation at Corps Level
Ft. Lewis	BASE - Brigade Automated Simulation Exercise

3.3.2 Description of Several Major Models

A brief synopsis of each model in Table 1 is provided in the following sections.

Though not included in Table 1 or discussed below, a brief

mention of the relevant activities at PAR Government Systems is warranted. The PAR activities were not included in Table 1 because their previous modeling efforts have not been in the ground based battlefield environment. However, their work for government agencies has produced a number of tools relevant to simulated forces modeling. The tools that PAR has developed to aid their activities are public domain due to the funding source, and include both expert system shells and an AI blackboard development tool. The PAR tools are available in several languages and operating environments. A list of the available PAR tools includes:

PROGRAM	LANGUAGE	HARDWARE	OPERATING SYSTEM
ERS (EMBEDDED RULE-BASED SYSTEM)	C	IBM PC	MS DOS XENIX V 2.3
	ADA	VAX	UNIX 4.X BSD VMS 4.0
GEN. BAYES (GENERALIZED BAYESIAN INFERENCING SYSTEM)	ZETALISP	SYMBOLICS	(VERSION 7.1)
BBTHING (BLACKBOARD BUILDING TOOL FOR HIERARCHICAL INFERENCING)	C++	VAX	UNIX 4.3 BSD XENIX V 2.3

3.3.2.1 Lawrence Livermore National Laboratory

Conflict Simulation Laboratory

The Conflict Model (ConMod)

The Conflict Model (ConMod) is an automated, high resolution, large-scale, AirLand Battle simulation developed by

the Conflict Simulation Laboratory (CSL). The mission of CSL is to simulate conflict in order to evaluate the utility of the weapons developed at Lawrence Livermore National Laboratory. As such, the emphasis at CSL is somewhat different from battle simulations developed for training purposes. ConMod appears to be the CSL product most useful for the intelligent simulated forces effort.

ConMod explicitly models the military command and control hierarchy using an object-oriented approach. It is designed to operate at the corps level, with the capability to model echelons-above-the-corps. Echelons below the user level have intelligence needed to develop operation and task orders for lower echelons, to coordinate with parallel echelons, and to submit status reports to higher echelons. ConMod has an easily learned graphic user interface.

ConMod separates modeling the physical world of actual force-on-force conflict from the cognitive world of military Command and Control. This delineation could facilitate using ConMod as an intelligent command and control interface to a SIMNET SAFOR. In this configuration, the model or simulation of the physical conflict would be replaced by an interface to the SIMNET environment. Customizing the force structure for the SIMNET SAFOR should involve creating the appropriate data files, because ConMod appears to be a data driven system.

ConMod is written in ADA, and runs on a VAX/VMS operating system. The graphics user interface is a Tektronix 4120/4225

series workstation. ADA is claimed to be portable between machines.

3.3.2.2 Texas Instruments Command, Control, and Communications Testbed CACTUS

CACTUS is Texas Instrument's entrant in the tactical decision support arena. CACTUS runs on Texas Instrument's Explorer LISP machine. CACTUS offers three models; command and control, agent-world interaction, and agent-agent interaction.

The command and control model simulates the features of the battlefield domain, including:

1. an agent organization of the force structure, from unit (platoon of 3-5 vehicles or 20-30 men) to regiment or brigade;

2. resource configuration and allocation, whereby commanders can reorganize the lower level agents by cross-attaching them to other formations;

3. imperfect control simulated by limiting the command resources, which represent the limited ability of headquarters to assess data and plan. The allocation and conservation of command resources are an important part of the command and control process. Formation commander agents are represented by headquarters units, which are subject to disruption and destruction by hostile action, resulting in impaired planning

capabilities. Also, the cumulative effects of losses and combat can result in formations becoming unresponsive to orders;

4. imperfect information, where information flow is constrained with the use of bandwidth and hostile interference. Message activity is limited by the flow of simulated time. The agent is forced to make judgments concerning the value of the information sent versus the cost of sending it. A unit will make better decisions about communications by modeling other agents' probable knowledge. The reports received from the simulation system describe activities viewed by the unit's simulation entity. Probabilistic visibility models and dynamic line of sight calculations are combined to determine what information the simulation reports to the units;

5. a variety of agent capabilities are available, including models of 40 different unit types, each with a number of weapon systems, movement characteristics, and defensive ratings. Multiple unit types can be present within a single formation.

In the Agent-World model, the terrain is represented at the lowest level as hexagonal cells, or hexes. The terrain within a hex is assumed to be homogeneous. The boundary between adjacent hexes may have associated properties as well. Each hex also has an elevation value. A discrete elevation scale is in proportion

to the horizontal scale, so that all simulation calculations are done in terms of hex-widths and not feet or meters. This is important if the scale is changed. A feature oriented model of the terrain is provided where contiguous masses of like hexes are collected and an appropriate cultural feature extracted.

Movement may be impeded by difficult terrain; the specification of difficult depends upon the mobility class of the unit. The deployment mode (march/column or combat/deployed) and the maximum speed achievable are other unit specific considerations. Road networks are also included in the terrain characterization for movement.

Combat may also be affected by terrain. CACTUS includes line of sight calculations taking into account all aspects of the terrain (elevation, cover, obstacles, and smoke). Units may use surrounding terrain for concealment and securing dug-in fire positions if they explicitly state when they are attempting to conceal themselves. Future fire combat is then modified to reflect the lower probability of successful destruction of concealed units.

Two models are available in the Agent-Agent Interaction. Agents can communicate with each other through both visual and electronic means. Visual contact features include terrain concealment, use of chemical and incendiary smoke, and thermal sights. Electronic communication devices are individually simulated, and a model of signal transmission determines the interactions between the message objects and devices.

Combat is the second mode of agent interaction. Individual weapon systems are characterized by effectiveness versus various target classes. Ammunition load and rate of fire constraints are imposed to limit fire. Range effects on accuracy and effectiveness are modeled. Unit types are rated for passive defense capabilities. Combat losses incrementally reduce the combat power of units. Losses reflect destruction and disabling of unit components. Combat is resolved as it occurs, with both sides able to initiate fire with eligible units at a given instant. The form and content of communication between planning agents through the simulation system network is unconstrained beyond the requirement that it be text so that transmission times can be determined.

Automated commanders have been constructed to add a degree of intelligence. Low level formations behave realistically because they are controlled by knowledge based systems. Probabilistic models are used to vary the responses of the formations within the range of intelligent options for a given situation.

The interface is based on user interaction through a sequence of menus. The agents are partially automated; the user invokes knowledge based subsystems. Any number of such subsystems can be integrated into the agent system. As more functions are automated, the user participation could be reduced to inspection of choices made and control of the flow of the simulation.

The planner does not have direct access to the mechanics of the simulation system. The planner can demand retrieval of less common information; reports on enemy unit sightings, friendly unit status, and combat results are volunteered.

Two areas of improvement have been targeted by Texas Instruments. The first is the distribution of the objects and processes of the simulation over multiple TI Explorer LISP machines. The second is the realism of the simulated communication network. The current model is object oriented, so modification is transparent to the rest of the simulation; only the responsiveness of the simulated devices is planned for change.

3.3.2.3 I Corps/Fort Lewis Battle Simulations Center Brigade Automated Simulation Exercise BASE

The Brigade Automated Simulation Exercise (BASE) located at Fort Lewis, Washington, is represented in a three-dimensional data base where elevation is defined to the nearest 100 meters. The map may be scrolled and zoomed to display an area 3-4 km square, or moved through six different zoom levels to display an area 30-40 km square. Four different types of symbols can be chosen to picture units including standard tactical symbols and icons. Speed of movement is affected by the terrain, weather, and tactical posture of the unit. Movement is at the order of the commander.

At Fort Lewis, the commander currently has three choices of geographical locations: the Fulda region of West Germany, the NTC at Fort Irwin, and the Sinai Desert. Terrain disks for South Korea and Yakima Firing Center in Washington are being obtained. Other battle centers use different areas. The commander can interpret the map by drawing a fan around a specified point, shading in the deadspace areas, and drawing a vertical cross section of the terrain between the two points, or by displaying a three-dimensional perspective drawing that simulates how the surrounding terrain would look to a person standing on the ground.

When the enemy is within sight of the Blue units, the enemy symbol shows. If the commander tells the computer to engage the enemy, the computer determines the results of the engagement based on the types of equipment and weapons used, the target's posture, terrain conditions, light and weather data, and range. Engagement results determine how many personnel, weapons, and vehicles (mobility or catastrophic kill) were lost. In addition, BASE offers other features, including calculation of ammunition, POL expenditures and required resupplies, and artillery fire, including chemical and nuclear munitions, illumination and smoke. It also offers close air support and reconnaissance mission, Army aviation/air mobile operations, air defense artillery, electronic warfare, remote sensors, and night observation devices.

The first step in the preparation for the BASE exercise is for the training unit commander to formulate training objectives and determine the type of scenario that would best help to

achieve them. Decisions include the task organization, location of the scenario, and the type of mission to be fought.

The task organization is critical. The scenario can be tailored to fit almost any brigade or battalion size unit. A BASE software technician constructs a unit data base that exactly replicates the unit and slice units included in the Modification Table of Organization and Equipment. After the training unit data base is designed, the commander decides what generic type (a deliberate attack, a delay, rear area operations, etc.) of mission to conduct. The BASE intelligence officer/opposing force (OPFOR) specialist, the unit commander, and the S2 discuss what configuration of OPFOR would best fit the unit training objectives, and what broad based course of action the OPFOR should take. Then the BASE software technician constructs an OPFOR data base similar to that for the training unit. Finally, someone from the training unit or its higher headquarters writes the actual higher headquarters operations order, which the commander presents to his staff when the unit arrives at BASE.

The hardware required by BASE includes a computer system with eight different workstations. Each workstation consists of a CORVUS computer and assorted peripherals, including a 19 inch color monitor, a printer and a mouse. CORVUS stand-alone microcomputers are networked into a disk server. A communications system designed to replicate four radio nets is hard-wired allowing the unit to run a command net, an admin/log net, an operations/intelligence net, and a fire direction net, so

the commander and his staff can talk to all their subordinate commanders according to their tactical SOP. Video cameras monitor the area so that the control building can see what is happening. Off-site CPs may be set up, and hooked up to AN-GRA 39 (communication terminal) remotes. Alternatively, long-distance sites may be chosen if wire is laid or radios are connected remotely.

A strength of BASE is the decision aiding computer based interactive expert system COTES (combat orders training and evaluation system). COTES's objective is to aid the decision making process by collecting, analyzing, and arranging data for input into operations orders, appendices, annexes, and reports. Some of the features offered in COTES are:

1. provides information on the details for planning fire support, obstacle emplacement and other actions;

2. has course of action analyzer to graphically array specific opposing forces and visualize the possible flow of the battle;

3. computes personnel and equipment losses, line-of-sight, movement rates, combat power ratio, and range fans;

4. displays Soviet-type doctrinal templates;

5. workstations may be operated individually or linked together;

6. may be used as part of, or operated independently of,

the unit BASE exercise.

The hardware required by COTES consists of three workstations, each with a computer, two monitors, floppy disk drive, printer, and a mouse.

Valuable lessons have been learned through the use of BASE. For example, experience indicates that most of the learning takes place in the after-action review. Also, the use of slice units is more realistic and provides better staff training when the unit participants are actually there.

3.3.2.4 **Combined Arms Center (CAC)**

Fort Leavenworth, Kansas

Battle Command Integration Program (BCIP)

The Battle Command Integration Program is the Army's effort to consolidate and coordinate all aspects of command and control. BCIP is located at Fort Leavenworth, Kansas, under the aegis of the Combined Arms Center. BCIP has been developed to provide the structure for a comprehensive command and control system. The CAC C2 Integration Council has been organized to ensure that C2 systems designed at the CAC are integrated and coordinated.

The initial steps taken by the BCIP include:

1. Battle Command Training Program (BCTP), an exercise system for division and corps commanders and staffs in a command post environment;

2. Advanced Command and Control Facility (AC2F), a

classroom facility to train Command and General Staff College Students utilizing command and control automation devices;

3. Future Battle Laboratory (FBL), a research facility dedicated to future requirements for systems, doctrine, tactics, and procedures; designed as a facility where students, faculty, contractors, and other selected personnel can conduct research relating to C2, and also as a test bed for the evaluation of currently fielded C2 systems.

4. National Simulation Center (NSC), a center to support training and analysis through simulation.

In addition, the BCIP is foreseen as the vehicle to develop norms for command and control, and develop and validate doctrine, tactics, techniques, and procedures for future systems. The BCIP is expected also to improve the capability to model C2 processes, establish a "world class" opposing force (OPFOR), and create a full range of simulations for worldwide use. The Army plans to coordinate the use of BCIP with fielded programs; an example is using the Center for Army Lessons Learned (CALL) to exploit lessons learned at BCIP, while BCIP studies the use of the data housed at CALL's database. Finally, the Tactical Commander's Development Program (TCDP) has been another development from the BCIP. The TCDP is an effort to bolster the training of battalion and brigade maneuver commanders in the synchronization of combat

power.

3.3.2.5 **Sparta, Inc.**

AWSIM 89

Sparta has been involved in several simulated forces efforts for a variety of clients. The simulation model designed by Sparta with the most relevance to the goals of the IST simulated force project is AWSIM 89, sponsored by MICOM, AMSAA, AND LABCOM. AWSIM is a computer simulation of close combat. AWSIM is a high resolution, quick response simulation useful as a flexible, sophisticated force effectiveness analysis tool, and respected within the Army analysis community. It includes combined arms such as armor, infantry, aircraft, AD, and artillery. It has a digitized terrain, with smoke and artillery dust effects. AWSIM simulates up to battalion/regiment scenarios.

AWSIM evaluates the battlefield utility of weapons. It has maneuver, search, acquisition, and engagement functional models, in addition to a detailed laser weapon model. Sparta has both stochastic and event-sequenced modeling philosophies. The stochastic modeling includes probability distribution sampling using the Monte Carlo technique. Many replications yield an outcome distribution. The event-sequenced modeling allows for events to occur instantaneously. The clock jumps from event to event, with continuous processes modeled in fixed time steps.

AWSIM was developed using standard Fortran 77 for transportability. Structured programming techniques were utilized in AWSIM's development. The program has modularity and

top-down flow, with mnemonics, naming conventions, and a logically partitioned data structure. Its sophisticated support software offers dynamic memory allocation, an interactive database editor, and event processing and list processing routines.

AWSIM utilizes existing models in its design. For example, the terrain representation, line-of-sight determination, vehicle movement, and armor/anti-armor weapon effects approaches and algorithms were obtained from Carmonette. EOSAEL87 contributed its natural atmosphere, smoke and dust effects. The passive target acquisition code came from CCNVEO/AMSAA, the laser weapon effects from LELAWS, the laser active detection performance from PHI, and the air defense weapon effects from INCURSION.

The Army interacted during AWSIM's development and review. During development, AMSAA, TRAC/WSMR, USAIS, LABCOM, CECOM, CACDA, MICOM, VAL, AND CCNVEO all held simulation/modeling reviews. AMSAA proffered substantial modeling guidance in the areas of air defense, artillery effects, infantry weapons, and laser weapon effects. AWSIM code is installed on VAX computers at the government facilities at AMSAA, MICOM, AND LABCOM. AMSAA also has AWSIM on CRAY hardware. AWSIM was approved in August of 1987 for Directed Energy weapon analysis by the multi-agency army Directed Energy Modeling Committee chaired by LABCOM, and was recommended for validation by DUSA-OR in early 1989.

The scenarios available in AWSIM are the European Mechanized Infantry Defense (DAZER scenario), and the TRADOC High Resolution Scenario #1. The DAZER scenario implements a close range

armored/dismounted assault by two companies on a dismounted U.S. platoon. It is fully operational, and has been exercised in several studies. The TRADOC scenario is an intense armor battle between a U.S. Armor Battalion and a Soviet Motorized Rifle Regiment. The TRADOC scenario is also fully operational, and has been exercised in an unconventional beam weapon study.

3.3.2.6 **Perceptronics**

Computerized Battle Simulation

CBTSIM (BBS)

BBS is a system to train and exercise brigade and/or battalion commanders and staffs in the conduct of the AirLand Battle. Using the CBTSIM battalion level model originally designed for the Australian Army as a base, BBS is patterned using distributed processing architecture. Each station in a local area network has all the computational power, data and communications means necessary to complete their assigned function on a stand alone basis. This information is then shared with the other stations.

Six types of workstations are represented in the BBS simulation. Higher control (HICON) is the workstation responsible for the overall control of the game. Maneuver workstations are responsible for managing and controlling the ground units which fight the battle. Artillery (ARTY) workstations are responsible for managing and controlling artillery firing and support units assigned or attached. Air support and air defense (AIR/AD) workstations manage and control close air support,

rotary and fixed wing missions, and coordinate air defense support. Personnel and logistics (PERSLOG) workstations are also available, as are ENEMY. Enemy workstations are responsible for all of the same functions for threat forces as are controlled by the Maneuver, ARTY, AIR/AD and PERSLOG workstations.

BBS utilizes IBM or compatible hardware combined with video disc technology. The Australian COMBAT-SIM utilizes an IBM PC/AT or compatible, with an IBM PC Net Adapter card, an IBM Game card, a Hercules Monochrome Graphics card, 2-14 MB RAM expansion, a 20 MB HD, and an IBM Monochrome Monitor. Additionally, the system requires an IEV I-60512 Color Graphics Generator, a Pioneer LDP 6010 Video Disc Player, a Sony PVM1910QM Color Monitor, a Polytel Keyport 300, a Keyboard, a Hayes Joystick, and an Okidata printer. Seven stations are used for battalion level exercises, with ten required for brigade play. BBS systems will perform in the same manner, with exception for changeable data peculiar to tactics and doctrine. A ten station system linked by LAN produces warfare in real time, with updates every 15 seconds (and many events reported in under one second), for up to 128 units, 50 air strikes, and 50 artillery missions. The US Army has also asked Perceptronics to ensure that BBS can operate on Digital Equipment MicroVAX II networked microcomputers so that on-hand hardware may continue to be of use.

Functions of the system include representation of the threat raised to the division level with assets appropriate from the combined arms army. US data can be expanded to include 100 active units. Other functions include 200 ammunition types, 38

smoke missions, 600 mines and obstacles, 120 hours of continuous data recording, 10,000 square kilometers of terrain, 30 equipment types per unit, and 175 equipment types in the system. BBS also offers a weapons effectiveness matrix upon which its conflict algorithm is based. For each weapon, vehicle, or system, there is a performance profile (data), plotted over range and based on mission status against various types of targets. Mathematical probabilities associated with a weapon's terminal effects are based on detection of the target, identification, ability to acquire and whether or not a hit was recorded are included.

BBS' three modes of operation are:

1. single echelon battalion staff exercise, wherein only the battalion commander and his staff are in the field;

2. multi-echelon exercise for both brigade and battalion staffs, which places both the brigade and battalion commanders and staffs in the field requiring the control staff to represent division level activities;

3. a brigade staff exercise, which places only the brigade command and his staff in the field, with the subordinate battalion commanders and staff activities represented in the control room. Combat is resolved at the individual weapon. Results are reported by platoon and section to the company role player to the battalion players.

BBS has a 15 second update cycle. Line of sight

calculations are computed from the center of mass of unit symbol. The level of resolution required is entered during initialization and determined by the training objective for the exercised unit. The greater the detail (i.e., data describing platoons and sections), the greater the degree of flexibility in making decisions and reports. However, beyond a point, the large number of reports could overload the simulation's report writing process. The videodisc map display allows each workstation to pan and zoom independently, provide a cross-sectional view, and a perspective or three-dimensional view from a specified target location in addition to the use of an intervisibility fan which indicates dead ground. Weather conditions are specified during game initialization, and may be changed at any time. Also during initialization, each unit to be played is given a starting location. Speed is limited to the speed of the slowest equipment in the unit, in addition to the constraints placed by the type of terrain, degree of suppression, and MOPP status. Minefields and obstacles can be emplaced or cleared at any time during an exercise. Conflict can only be initiated by a role player, based upon a tactical decision to employ direct fire, indirect fire, aerial bombardment, or a combination of the three and the resources available. Direct fire is aimed at a unit, indirect fire at a grid coordinate.

3.3.2.7 Perceptronics

Context Template-Driven SAFOR

Modeling and Simulation

Perceptronics is currently examining a conceptual design for

a semi-automated force that will allow SIMNET to successfully scale up to a larger warfighting capability by reducing manning requirements and crew stations. This predominantly procedural and rule-based SAFOR would be implemented in the LISP language on BBN's Butterfly machines. The technical approach is a "divide and conquer" methodology that uses "context templates" (an enumeration of all the relevant variables that pertain to the prevailing context used as a basis for determining the relevant rule set from the existing rule base) to partition the existing rule base and eliminate the "overhead" rules that result from ad hoc introduction of context. The overall context of operation is designed as a multidimensional network of nodes that are associated with specific states of the system and interconnecting arcs that specify the conditions for proceeding from one state to the next. The SAFOR behaviors associated with the context template are invoked and executed until completion, or suspended if a significant event occurs that requires a change in the context template. If such an event occurs, the SAFOR behavior associated with the prevailing template is aborted and behavior associated with the new template started.

A state vector (the collection of all the situationally relevant variables and their current values) is associated with the SAFOR node for each echelon represented and "controlled" by the node. Any one of three types of events or actions may alter the values of one or more variables in the state vector, which will change the state vector. These three events are:

1. FRAGORDER from higher echelon;

2. Own actions/decisions;

3. Subordinate unit request/reports.

Frames representing an important perspective that ultimately contributes to SAFOR behaviors preprocess raw state vector information and convert it to tactically meaningful information with all supporting assumptions and conditions.

After aggregating the relevant information from each of the frames, the current context is determined. The context template that is nearest to the current context in some sense becomes the current context template. SAFOR behaviors are stored in a segmented rule base. Each segment corresponds to a specific context template, which is invoked and executed when a context template fires.

The knowledge bases that support context templates will be developed utilizing standard knowledge engineering techniques. Interview with subject matter experts, and a review of pertinent Army literature will result in a knowledge base that will then be refined by testing to assess if individuals and units actually behave in accordance to expectations and doctrine. The design objective for force behavior is to assume a level of intelligence of the semi-automated force and maximize tactical efficiency on both sides.

Perceptronics intends to allow multiple levels of decision-making autonomy. The distribution of functions allocates some tasks strictly for the SAFOR station operator, some to be shared by humans and machines, some for machine with human

monitor/override only, some for machine with machine request for help, and some tasks for machines only.

Several technical issues dealing with defining the scope, or bounds of all possible SAFOR models are involved with the development and implementation of this proposed system. These include:

1. How many unique contexts are there that subsume all valid SAFOR behaviors?,

2. How many factors affect a given context?,

3. How does one ensure that all context templates are mutually exclusive and collectively exhaustive? Do these really have to be mutually exclusive?,

4. How are rules associated with contexts?,

5. How can we exhaustively categorize key tactical behaviors (features)?,

6. How do we establish the adequacy and sufficiency of the feature set, i.e., the tactical behavior?,

7. What data should we collect in SIMNET?,

8. How will "learning" occur in the SIMNET environment and how long will it take?,

9. How do we refine behavior based on experience?

3.3.2.8 **Bolt Beranek and Newman, Inc.**

SIMNET Semi-Automated OPFOR

BBN has designed a semi-automated OPFOR of platoon, company and battalion size to support the SIMNET-D FAADS program. The goals of the OPFOR project are:

1. to represent enemy units with behavior sufficiently realistic so that an observer will be unaware that the vehicles seen are not manned by human crews, and

2. to provide large numbers of OPFOR vehicles without requiring large numbers of humans as crew.

BBN's OPFOR system is semi-automated, with a supervisory control operator familiar with Soviet doctrine and tactics required. The operator is expected to input orders to the system at a high level, and may drop down the command chain at will, and interrupt, modify, or override any automated system behavior. Deviation from Soviet dogma must be deliberate and planned. The SAFOR operating logic is designed to execute human command guidance in operationally realistic ways by applying doctrine to carry out high level directives. Certain decisions have been reserved for the human operator, such as change of missions, approval of fire support and CAS targets, commitment of reserves, movement or artillery, reconstitution and reorganization starts, movement of logistic installations, and the firing and lifting of final protective fires. All interaction between the human and automated components of the system are in the form of Operations Orders, Fragmentary Orders, Requests, and Reports.

Guiding objectives in the development of the SIMNET OPFOR include the desire to exercise large forces with a very limited number of people at extremely low costs, retain the semi-automated force's identity, uniqueness, special attributes, and distinguishability, require man in the loop at critical decision points, and allow both sides to fight to win in a fair fight. BBN plans for the workstation to have variable levels of intelligence. The Battalion Commander and staff can issue orders via voice communication (phone or radio) to all OPFOR personnel under their command.

In the initial OPFOR project, four SYMBOLICS workstations represent the critical command posts for the Red Team, allowing the operators to control the vehicles organized according to Soviet doctrine, on the SIMNET simulated battlefield. One workstation supports the function of the Rotary Wing Air Direction Officer and one supports the Fixed Wing Air Direction Officer function. Additionally, there are two Company Headquarters Workstations, one under the command of a Tank Company Commander, and one under the command of a Motorized Rifle Company Commander. The Tactics display portion of the workstation screen provides a plan view of the battlefield above interactive menus which offer extensive lists of commands and options for monitoring and controlling the OPFOR vehicles and assets under the operator's control. The workstation's interface to the SIMNET local area network, over which information packets are broadcast. Of importance to OPFOR are the appearance and impact packets.

The OPFOR models the T80 Main Battle Tank, the BMP Infantry Fighting Vehicle, the 152 mm 2S3 Self Propelled Gun, the Hind Helicopter equipped with either the AT-6/SPIRAL or AT-3/SAGGER Antitank Guided Missile, and the FROGFOOT Fixed Wing Aircraft. The values of the constants that are used by the OPFOR system have been derived from the values being used in the SIMNET simulations of comparable vehicles, published sources, and/or generated by the developers. These values can be easily changed if more accurate values become available.

An intervisibility algorithm is used by OPFOR to determine whether targets are visible, partly visible, or invisible. The algorithm will detect both terrain and structural obstacles. Detector and target features, in addition to terrain and behavior are the parameters used for target detection probability modeling. Hit probability is determined by range, weapon and ammunition type, and situation. Combat damage modeling for the OPFOR vehicles uses the same model as SIMNET, but with different probabilities. Information constraints have been modeled in an effort to limit the quality, quantity, and timeliness of battlefield information available to the OPFOR operator.

3.4 **Assessment of Shortcomings**

Based on the review of the state-of-the-art in simulated forces, several shortcomings were identified. Several of these shortcomings are directly related to the research areas being pursued under the IST simulated forces project. The shortcomings can be summarized as follows:

1. Intelligent simulated forces and battlefield simulations are quite similar in that they both attempt to simulate the behavior of vehicles, tactics, and combat engagements on a terrain data base. Discussions of these models tend to sound very alike in their basic descriptions and functionality. However, because of the differences in software implementations, the possibility of transferring concepts between these two parallel types of models is limited.

2. The models, when developed, tend to be fixed. That is, modification of the rule base (necessary, for example, if the behavior of the model is inadequate) on which intelligent simulated forces models are dependent requires intervention by a skilled programmer. A basic problem is how to develop a method for on-line modification to the rule bases by non-programmers.

3. The semi-automated forces have picked a particular level of human intervention for implementation, which requires that the operator know a rigid set of skills to effectively operate the simulated force model. Hence, certain types of people must be available to run the model. This is not a luxury that exists all the time. There is need for a more flexible interface that permits a wider variety of people to operate the simulated force without compromising the realism of the

behavior. To provide effective training, the behavior of the force should effectively be independent of the human skill. If a degraded level of expertise for the simulated force is desired, it should be provided through biases in the program, not limitations of the operator. Without this structure, there is no way to effectively control the training environment.

4. One of the shortcomings of some semi-automated forces models is that the role of the human operator does not correspond to actual individual crew or commander positions. Accordingly, all operators of the modeled simulated force have to be extensively trained to effectively operate all facets of the simulated force. The operators' differing levels of expertise and ability provide an opportunity for the behavior of the force to be degraded. Additionally, the training required restricts operator availability. Ideally, the role of the human operator should correspond to actual roles to maximize the potential operator population and minimize the need for special training to operate the simulated force model.

5. The final shortcoming, the manner in which human intervention has been implemented in previous models, may be a symptom of the problems of the shortcomings discussed above. The trend in past models has been to select a specific level of intervention and develop a

model-specific interface. Because each model has a different implementation for human intervention, the scheme of intervention is prevented from being generic and transferable. The goal should be to develop a generic implementation that is applicable to a wide variety of force size models.

Several of the shortcomings discussed above are directly related to the research areas being pursued under the IST simulated forces project (Contract Number N61339-89-C-0044). This project offers IST the opportunity to develop a testbed on which to examine and test different ideas for transferring knowledge from Subject Matter Experts to simulations, and for varying the amount and type of human intervention required to direct the simulations. This state-of-the-art assessment for simulated forces is a deliverable under that contract.

4.0 CONCLUSIONS AND RECOMMENDATIONS

There has been a significant amount of research and development devoted to developing models of simulated forces. The earliest efforts were devoted to developing battlefield simulations that could be used for command and control training. While this type of simulated force modeling has continued, in recent years there has been an increasing interest in the development of intelligent simulated forces models. This rise has paralleled increasing interest and capability in the intelligent/expert systems area. While some of these "intelligent" models have been oriented toward battlefield type

simulations, an interest has arisen in developing intelligent simulated forces models which can be used to augment the training of combat units, from the individual unit through company levels. This new emphasis has paved the way for new concepts in simulated force model development which are leading to an ever increasing state-of-the-art capability.

This review has pointed out that although the classes of simulated forces models have related objectives, they have tended to vary significantly in structure and implementation. This has inhibited the cross-fertilization of concepts between the two types of models. While this barrier still exists, it is expected that technological advances in the next generation may provide a vehicle for converging these two classes of simulated forces models.

The type of models classified as intelligent simulated forces in this review reflect the emphasis of the simulated forces research being conducted by IST for PM TRADE and DARPA. By far, the most sophisticated model in this class is the BBN model developed to support the SIMNET environment. While this model has many limitations, it was the first major effort in this area. It represents a major learning experience and has achieved an impressive degree of success within its design constraints. It stands as the state-of-the-art in intelligent simulated forces. New concepts which build upon the experience of the BBN effort (for example, Perceptronics concept of a context driven simulated forces model) are being investigated. Significant research and development will be required before the state-of-

the-art completely achieves the goals and capabilities of a full scale intelligent simulated force model, but the state-of-the-art is advancing rapidly and is expected to continue to do so.

Several key shortcomings were identified in current simulated forces efforts. Two of these correspond to the research initiatives being pursued by IST. There is a need for techniques to facilitate the ease of modifications to simulated forces databases. These techniques are necessary to more effectively refine/modify/augment the behavior of the model without extensive programming intervention. Without this capability, the generalizability of the models and the tailoring of models to specific or changing combat environments cannot be realized efficiently. There is also a need for a semi-automated opposing force offering a variable user interface that can accommodate controllers with different levels of expertise. Such an environment would most likely require the use of artificial intelligence and expert systems techniques in addition to traditional hardware and software design paradigms.

In conclusion, while significant advancement has been made in this area of simulation modeling in recent years, many issues remain to be resolved. The observation of these models as they evolve has been a major source of insight for future improvements. In addition, new approaches based on advanced knowledge based or neural network based modeling techniques should provide the opportunity to significantly enhance the behavior and effectiveness of these models. The benefits of this

type of model to future combat training have been established. Now, the iterative evolution of intelligent simulated forces must demonstrate its ability to meet the user's needs.

Appendix A
On-Line Search Articles

2/6/1
1407258 DE89012297/XAB
Structured Command History for UNIX Using a Parallel Distributed Processing Model
(Thesis (M.S.))
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A05/MF A01

2/6/2
1406419 AD-A209 401/9/XAB
International Conference on Vector and Parallel Computing (2nd)
NTIS Prices: PC A03/MF A01

2/6/3
1406150 AD-A209 132/0/XAB
Parallel Vision Algorithms
(Annual technical rept. no. 2, 1 Oct 87-28 Dec 88)
NTIS Prices: PC A05/MF A01

2/6/4
1405739 PB89-866917/XAB
Computer Networks: Data Communication Architecture and Development. January 1975-July 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database)
(Rept. for Jan 75-Jul 89)
NTIS Prices: PC N01/MF N01

2/6/5
1405071 N89-23373/8/XAB
Decentralization of Databases and the Communication between Them
NTIS Prices: (Order as N89-23362/1, PC A06/MF A01)

2/6/6
1405007 N89-23183/1/XAB
Specifying Real-Time Systems with Interval Logic
(Final Report)
NTIS Prices: PC A05/MF A01

2/6/7
1405004 N89-23073/4/XAB
Implementing Nested Conditional Statements in SIMD (Single Instruction Multiple Data) Machines
(Final Report)
NTIS Prices: PC A03/MF A01

2/6/8
1403583 AD-A208 271/7/XAB
Parallel Vision Algorithms
(Annual technical rept. no. 1, 1 Oct 86-30 Sep 87)
NTIS Prices: PC A04/MF A01

2/6/9

1403124 N89-22358/0/XAB
DeMAID: A Design Manager's Aide for Intelligent Decomposition User's Guide
NTIS Prices: PC A03/MF A01

2/6/10
1402924 ED-303 177
Technology Options for Libraries. ERIC Digest
Available from ERIC Document Reproduction Service (Computer Microfilm International Corporation), 3900 Wheeler Ave., Alexandria, VA 22304-5110.
NTIS Prices: Not available NTIS

2/6/11
1400748 PB89-184360/XAB
Methodology for the Design of Comtinuous-Dataflow Synchronous Systems (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/12
1400638 N89-21542/0/XAB
Parallel Solution of Sparse One-Dimensional Dynamic Programming Problems (Final Report)
NTIS Prices: PC A03/MF A01

2/6/13
1400633 N89-21537/0/XAB
Language Comparison for Scientific Computing on MIMD Architectures (Final Report)
NTIS Prices: PC A03/MF A01

2/6/14
1399531 AD-A207 609/9/XAB
Implementation Indices (1975-1979). Volume 1
(Technical rept.)
NTIS Prices: PC A08/MF A01

2/6/15
1399489 AD-A207 567/9/XAB
Real-Time Signal Processing Data Acquisition Subsystem
(Journal article)
NTIS Prices: PC A03/MF A01

2/6/16
1398122 N89-20638/7/XAB
Run-Time Scheduling and Execution of Loops on Message Passing Machines (Final Report)
NTIS Prices: PC A03/MF A01

2/6/17
1398121 N89-20637/9/XAB
Optimal Feedback Control Infinite Dimensional Parabolic Evolution Systems: Approximation Techniques
(Final Report)
NTIS Prices: PC A04/MF A01

2/6/18
1396042 AD-A206 657/9/XAB
Lexical Analysis on a Moderately Sized Multiprocessor
(Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/19
1395831 TIB/B89-80939/XAB
Graphenalgorithmen fuer MIMD-Rechner. (Graph algorithms for MIMD (Multiple-Instruction-Stream, Multiple Data Stream) processors)
(Diploma Thesis)
NTIS Prices: PC E11

2/6/20
1395803 TIB/B89-80904/XAB
Fairness in parallel programs: The transformational approach
NTIS Prices: PC E09

2/6/21
1394837 N89-19830/3/XAB
Artificial Intelligent Decision Support for Low-Cost Launch Vehicle Integrated Mission Operations
NTIS Prices: (Order as N89-19817/0, PC A22/MF A01)

2/6/22
1394836 N89-19829/5/XAB
CIRCA 2000 Operations Criteria
NTIS Prices: (Order as N89-19817/0, PC A22/MF A01)

2/6/23
1393513 DE88015374/XAB
Automated COBOL Code Generation for SNAP-I (Shipboard Nontactical ADP Program) CAI (Computer Aided Instruction) Development and Maintenance
Procedures
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A09/MF A01

2/6/24
1393174 AD-A206 371/7/XAB
Heuristics for Cooperative Problem Solving
(Final rept.)
NTIS Prices: PC A04/MF A01

2/6/25
1391131 N89-18601/9/XAB
Study of Communication Options in a Distributed Data Handling System and Survey of Advanced Man Machine Communication Schemes, Work Package 2.1 and 2.2 (Final Report)
NTIS Prices: PC A04/MF A01

2/6/26
1391044 N89-18479/0/XAB

Task Interactions in Distributed Machines of Embedded Computer Systems
NTIS Prices: (Order as N89-18446/9, PC A18/MF A01)

2/6/27
1391041 N89-18476/6/XAB
Definitions and Requirements for Distributed Real-Time Systems
NTIS Prices: (Order as N89-18446/9, PC A18/MF A01)

2/6/28
1391023 N89-18458/4/XAB
Debugging Distributed Ada Avionics Software
NTIS Prices: (Order as N89-18446/9, PC A18/MF A01)

2/6/29
1391020 N89-18455/0/XAB
Embedding Formal Methods in SAFRA
NTIS Prices: (Order as N89-18446/9, PC A18/MF A01)

2/6/30
1391019 N89-18454/3/XAB
Avionics Systems Engineering and Its Relationship to Mission Software Development
NTIS Prices: (Order as N89-18446/9, PC A18/MF A01)

2/6/31
1391014 N89-18449/3/XAB
Software Productivity through Ada Engines
NTIS Prices: (Order as N89-18446/9, PC A18/MF A01)

2/6/32
1389945 DE89001134/XAB
PCP (Parallel C Preprocessor): A Parallel Extension of C That Is 99% Fat Free
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A03/MF A01

2/6/33
1388857 AD-A205 406/2/XAB
Three Short Papers on Language and Connectionism
(Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/34
1387880 N89-12255/0/XAB
Study of the Deveopment of On-Board Distributed Software Systems Using Ada
NTIS Prices: PC A04/MF A01

2/6/35
1387870 N89-12222/0/XAB
Support Architecture for Reliable Distributed Computing Systems.
Semiannual Status Report, June 9, 1987-June 8, 1988
NTIS Prices: PC A03/MF A01

2/6/36
1385855 N89-18098/8/XAB
CO-OP Method: A Method for Compositional Derivation of Canonical Testers (M.S. Thesis)
NTIS Prices: PC A05/MF A01

2/6/37
1385854 N89-18097/0/XAB
High Level Synchronization Services of OSI (Open Systems Interconnection): Commitment, Concurrency and Recovery
NTIS Prices: PC A03/MF A01

2/6/38
1383265 N89-17422/1/XAB
Parallel Gaussian Elimination of a Block Tridiagonal Matrix Using Multiple Microcomputers
NTIS Prices: PC A03/MF A01

2/6/39
1381250 AD-A204 126/7/XAB
QLISP for Parallel Processors
(Final rept. 15 Jul 86-31 Jul 88)
NTIS Prices: PC A02/MF A01

2/6/40
1380067 N89-16371/1/XAB
Database Management Capability for Ada
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/41
1380049 N89-16353/9/XAB
Using Ada to Implement the Operations Management System in a Community of Experts
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/42
1380043 N89-16347/1/XAB
Comparing Host and Target Environments for Distributed Ada Programs
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/43
1380038 N89-16342/2/XAB
Implementing Distributed Ada for Real-Time Applications (Abstract Only)
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/44
1380035 N89-16339/8/XAB
Ada Implementation for Fault Detection, Isolation and Reconfiguration Using a Fault-Tolerant Processor
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/45

1380033 N89-16337/2/XAB
Lessons Learned in Creating Spacecraft Computer Systems: Implications for Using Ada (R) for the Space Station
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/46
1380032 N89-16336/4/XAB
Transparent Ada Rendezvous in a Fault Tolerant Distributed System
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/47
1380027 N89-16331/5/XAB
Some Design Constraints Required for the Assembly of Software Components: The Incorporation of Atomic Abstract Types into Generically Structured Abstract Types
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)

2/6/48
1380010 N89-16314/1/XAB
Impact of Common APSE (Ada Program Support Environment) Interface Set Specifications on Space Station Information Systems
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)

2/6/49
1379992 N89-16296/0/XAB
Distributable APSE (Ada Program Support Environment)
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)

2/6/50
1379991 N89-16295/2/XAB
Distributing Program Entities in Ada
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)

2/6/51
1379989 N89-16293/7/XAB
Distributed Ada: Methodology, Notation and Tools
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)

2/6/52
1379988 N89-16292/9/XAB
Distributed Programming Environment for Ada
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)

2/6/53
1379980 N89-16284/6/XAB
Testability of Ada Programs
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)

2/6/54
1379975 N89-16279/6/XAB
First International Conference on Ada (R) Programming Language Applications for the NASA (National Aeronautics and Space Administration) Space Station, Volume 1
NTIS Prices: PC A18/MF A01

2/6/55
1379928 N89-15972/7/XAB
Transportation Node Space Station Conceptual Design
NTIS Prices: PC A10/MF A01

2/6/56
1379661 DE89005619/XAB
Floating Point Engine for Lattice Gauge Calculations
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A02/MF A01

2/6/57
1378569 AD-A203 982/4/XAB
Performance Evaluation of Parallel Algorithms and Architectures in Concurrent Multiprocessor Systems
(Final rept. Jan-Sep 87)
NTIS Prices: PC A03/MF A01

2/6/58
1377891 TIB/B89-80016/XAB
Einsatz des OCCAM/Transputerkonzepts als busloses Multiprozessorsystem fuer einen digitalen Regler. (Application of the OCCAM/transputer conception as busless multiprocessor system in a digital controller)
NTIS Prices: PC E09

2/6/59
1377085 N89-15601/2/XAB
Very Large Area Network (VLAN) Knowledge-Base Applied to Space Communication Problems
NTIS Prices: (Order as N89-15549/3, PC A21/MF A01)

2/6/60
1373911 AD-A203 087/2/XAB
Virtual Time Machine
(Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/61
1372087 N89-14946/2/XAB
Resident Database Interfaces to the DAVID System, a Heterogeneous Distributed Database Management System
(Final Report)
NTIS Prices: PC A03/MF A01

2/6/62
1372001 N89-14695/5/XAB
Analysis of FDDI Synchronous Traffic Delays
NTIS Prices: PC A03/MF A01

2/6/63
1369604 PB89-150296/XAB
Distributed-Feedback Laser-Diode Module with an Optical Isolator for Multigigabit Optical Transmission

Included in Mitsubishi Denki Giho, v62 n10 p77-80 1988.
NTIS Prices: (Order as PB89-150221, PC E05/MF A01)

2/6/64
1369597 PB89-150221/XAB
Mitsubishi Denki Giho, Vol. 62, No. 10, 1988
NTIS Prices: PC E05/MF A01

2/6/65
1369112 N89-13991/9/XAB
Strategy for Reducing Turnaround Time in Design Optimization Using a Distributed Computer System
NTIS Prices: PC A02/MF A01

2/6/66
1369107 N89-13975/2/XAB
Using Data Tagging to Improve the Performance of Kanerva's Sparse Distributed Memory
NTIS Prices: PC A03/MF A01

2/6/67
1368737 N89-12938/1/XAB
Automatic Control of a Multi-Channel Millimeter Wave Radiometer
NTIS Prices: (Order as N89-12936/5, PC A99/MF E04)

2/6/68
1365726 N89-13214/6/XAB
Two Alternate Proofs of Wang's Lune Formula for Sparse Distributed Memory and an Integral Approximation
NTIS Prices: PC A03/MF A01

2/6/69
1365721 N89-13173/4/XAB
European Seminar on Neural Computing
NTIS Prices: PC A03/MF A01

2/6/70
1364167 AD-A201 042/9/XAB
Operating Environment for the Jellybean Machine (Memorandum rept.)
NTIS Prices: PC A08/MF A01

2/6/71
1361012 N89-11438/3/XAB
Sopmcr: An Operating System for the Multiprocessor for Communication Networks
NTIS Prices: PC A12/MF A01

2/6/72
1361011 N89-11429/2/XAB
Parallelizing Recursive Programs
NTIS Prices: PC A03/MF A01

2/6/73
1360975 N89-11287/4/XAB

CSM (Computational Structural Mechanics) Testbed Software System: A Development Environment for Structural Analysis Methods on the NAS (Numerical Aerodynamic Simulator) Cray-2
NTIS Prices: PC A03/MF A01

2/6/74
1360264 DE88016468/XAB
BLAZE Family of Languages: Programming Environments for Shared and Distributed Memory Architectures
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A03/MF A01

2/6/75
1358578 PB89-116859/XAB
Langage Modulaire de Specifications de Programmes Paralleles et Sa Compilation (These) (Modular Language of Parallel Program Specifications and Its Compilation)
NTIS Prices: PC E10/MF E10

2/6/76
1358316 N89-10216/4/XAB
High Speed Fiber Optics Local Area Networks: Design and Implementation. Final Report, January 1, 1984-December 31, 1987
NTIS Prices: PC A02/MF A01

2/6/77
1358248 N89-10096/0/XAB
Advanced Data Management Design for Autonomous Telerobotic Systems in Space Using Spaceborne Symbolic Processors
NTIS Prices: (Order as N89-10063/0, PC A99/MF E04)

2/6/78
1358229 N89-10077/0/XAB
Hierarchically Distributed Architecture for Fault Isolation Expert Systems on the Space Station
NTIS Prices: (Order as N89-10063/0, PC A99/MF E04)

2/6/79
1356758 PB89-122394/XAB
GRAMPS (General Real-Time Asynchronous Multiprocessor System) Operating System: User's Guide
NTIS Prices: PC A03/MF A01

2/6/80
1356433 PB89-116388/XAB
Platinum Jubilee Conference on Systems and Signal Processing. Held at Bangalore, India on December 11-13, 1986
NTIS Prices: PC E15/MF A01

2/6/81
1356360 PB89-115349/XAB
Languages and Methods for the Interface I1
NTIS Prices: PC E03/MF E03

2/6/82

1356357 PB89-115315/XAB
ESPRIT SPAN Project: A Kernel System for Integrating Parallel Symbolic and Numeric Processing (Technical rept.)
NTIS Prices: PC E05/MF E05

2/6/83
1356037 N88-30350/8/XAB
Parallel and Distributed Computation for Fault-Tolerant Object Recognition
NTIS Prices: (Order as N88-30330/0, PC A19/MF A01)

2/6/84
1356011 N88-30321/9/XAB
Performance Analysis of FDDI (Fiber Distributed Data Interface)
NTIS Prices: PC A03/MF A01

2/6/85
1355342 NTN88-0747
Bibliography on Multiprocessors and Distributed Processing: This computerized data base yields citations, indexes, and cross-references (NTIS Tech Note)
FOR ADDITIONAL INFORMATION: Contact: COSMIC 112 Barrow Hall, University of Georgia, Athens, GA 30602; (404) 542-3265. Refer to ARC-11568/TN.
NTIS Prices: Not available NTIS

2/6/86
1354072 AD-A199 271/8/XAB
United States Air Force Program Office Guide to Ada (4th Edition)
NTIS Prices: PC A05/MF A01

2/6/87
1353917 PB89-851109/XAB
Microcomputer Hardware Standards: Extended Industry Standard Architecture (EISA). January 1983-November 1988 (Citations from The Computer Database) (Rept. for Jan 83-Nov 88)
NTIS Prices: PC N01/MF N01

2/6/88
1353023 N88-29425/1/XAB
Networking and AI (Artificial Intelligence) Systems: Requirements and Benefits (Abstract Only)
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)

2/6/89
1353013 N88-29415/2/XAB
Design Consideration in Constructing High Performance Embedded Knowledge-Based Systems (KBS)
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)

2/6/90
1353009 N88-29411/1/XAB
Expert System for a Distributed Real-Time Trainer
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)

2/6/91
1352989 N88-29391/5/XAB
AI (Artificial Intelligence) and Simulation: What Can They Learn from Each Other
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)

2/6/92
1352984 N88-29386/5/XAB
Distributed Cooperating Processes in a Mobile Robot Control System
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)

2/6/93
1352969 N88-29371/7/XAB
Intelligent Test Integration System
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)

2/6/94
1352226 DE88013609/XAB
Tools to Aid in the Analysis of Memory Access Patterns for Fortran Programs: LAPACK Working Note No. 6
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A03/MF A01

2/6/95
1348416 AD-A198 201/6/XAB
Information Processing Research (Final rept. Jan 85-Sep 87)
NTIS Prices: PC A10/MF A01

2/6/96
1347904 PB88-253299/XAB
Data Management for Integrated Control Systems
Included in Fuji Electric Jnl., v61 n6 p414-418 1988.
NTIS Prices: (Order as PB88-253281, PC E04/MF A01)

2/6/97
1347313 PB88-245196/XAB
Database Snapshots: A Mechanism for Replication of Data in Distributed Databases
NTIS Prices: PC E08/MF E08

2/6/98
1345026 AD-A197 197/7/XAB
Parallel Debugging Using Graphical Views (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/99
1344933 AD-A197 103/5/XAB
Voyeur: Graphical Views of Parallel Programs (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/100
1344931 AD-A197 101/9/XAB

Experiences with POKER
NTIS Prices: PC A03/MF A01

2/6/101
1344386 PB88-242250/XAB
Distributed Programming with Shared Data
NTIS Prices: PC E03/MF A01

2/6/102
1344375 PB88-242144/XAB
Programming Languages for Distributed Systems
NTIS Prices: PC E04/MF A01

2/6/103
1344015 N88-26823/0/XAB
Correctness Criteria for Process Migration
NTIS Prices: PC A03/MF A01

2/6/104
1342170 AD-A196 931/0/XAB
Parallel Programming Paradigms (Doctoral thesis)
NTIS Prices: PC A07/MF A01

2/6/105
1341664 AD-A196 419/6/XAB
Poker (4.1): A Programmer's Reference Guide (Technical rept.)
NTIS Prices: PC A05/MF A01

2/6/106
1341661 AD-A196 416/2/XAB
Type Architectures, Shared Memory and the Corollary of Modest Potential (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/107
1341275 PB88-868625/XAB
DECNET: Digital Equipment Corporation Network Architecture. January 1976-September 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for Jan 76-Sep 88)
NTIS Prices: PC N01/MF N01

2/6/108
1340814 PB88-234927/XAB
Introduction to CSP (Communicating Sequential Processes) (Technical rept.)
NTIS Prices: PC E04/MF E04

2/6/109
1339597 AD-A196 133/3/XAB
Exploiting Replication (Special rept.)
NTIS Prices: PC A04/MF A01

2/6/110
1339013 AD-A195 520/2/XAB

TAC-1: A Knowledge-Based Air Force Tactical Battle Management Testbed (Interim rept. Oct 86-Sep 87)
NTIS Prices: PC A05/MF A01

2/6/111
1337246 AD-A195 395/9/XAB
ACCESS: A Communicating and Cooperating Expert Systems System (Final rept. 30 Jun 87-31 Jan 88)
NTIS Prices: PC A06/MF A01

2/6/112
1335868 PB88-221056/XAB
Ship Performance Monitoring System Development (Final rept.)
NTIS Prices: PC A09/MF A01

2/6/113
1335651 N88-24206/0/XAB
Aerospace Energy Systems Laboratory: Requirements and Design Approach
NTIS Prices: PC A03/MF A01

2/6/114
1335646 N88-24199/7/XAB
Mentat: An Object-Oriented Macro Data Flow System
NTIS Prices: PC A03/MF A01

2/6/115
1335640 N88-24193/0/XAB
TALOS (Telemetry Analysis Logic for Operating Spacecraft): A Distributed Architecture for Intelligent Monitoring and Anomaly Diagnosis of the Hubble Space Telescope
NTIS Prices: (Order as N88-24188/0, PC A04/MF A01)

2/6/116
1335635 N88-24188/0/XAB
Third Conference on Artificial Intelligence for Space Applications, Part 2
NTIS Prices: PC A04/MF A01

2/6/117
1333285 N88-23489/3/XAB
Timestamp Ordering Mechanism with Dynamic Selection of Rollback Objects
NTIS Prices: (Order as N88-23485/1, PC A06/MF A01)

2/6/118
1333269 N88-23467/9/XAB
Distributed Matchmaking
NTIS Prices: PC A03/MF A01

2/6/119
1333254 N88-23436/4/XAB
Very Simple Construction for Atomic Multiwriter Register
NTIS Prices: PC A02/MF A01

2/6/120
1332983 N88-23083/4/XAB
Strategies for Concurrent Processing of Complex Algorithms in Data Driven Architectures
NTIS Prices: PC A04/MF A01

2/6/121
1332768 DE88008019/XAB
Graphical Multiprocessing Analysis Tool (GMAT)
NTIS Prices: PC A03/MF A01

2/6/122
1332523 AD-A194 128/5/XAB
Cauldrons: An Abstraction for Concurrent Problems Solving. Revision (Memorandum rept.)
NTIS Prices: PC A03/MF A01

2/6/123
1332082 AD-A193 681/4/XAB
Programming N-Cubes with a Graphical Parallel Programming Environment Versus an Extended Sequential Language
(Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/124
1332050 AD-A193 648/3/XAB
Combined And-Or Parallel Execution of Logic Programs
NTIS Prices: PC A03/MF A01

2/6/125
1331894 AD-A193 465/2/XAB
Programming Language Concepts for Multiprocessors
(Interim rept.)
NTIS Prices: PC A03/MF A01

2/6/126
1331892 AD-A193 463/7/XAB
Force. (Parallel Programming Language) (Interim rept.)
NTIS Prices: PC A03/MF A01

2/6/127
1331037 PB88-203997/XAB
Distributed Application Programming with Extended Prolog (Distribuerad Applikationsprogrammering med Utvidgad Prolog)
NTIS Prices: PC E03/MF A01

2/6/128
1330891 N88-22589/1/XAB
Colored Stochastic Petri net (Cs-Pn) Software: Application to the Validation and the Performance Evaluation of Distributed Systems
NTIS Prices: PC A03/MF A01

2/6/129
1330817 N88-22399/5/XAB

Computational Structural Mechanics for Engine Structures
NTIS Prices: (Order as N88-22382/1, PC A14/MF A01)

2/6/130
1330042 AD-A193 466/0/XAB
Comparing Barrier Algorithms (Interim rept.)
NTIS Prices: PC A03/MF A01

2/6/131
1329891 AD-A193 298/7/XAB
Hearts: A Dialect of the Poker Programming Environment Specialized to Systolic Computation (Technical rept.)
NTIS Prices: PC A02/MF A01

2/6/132
1329890 AD-A193 297/9/XAB
Poker on the Cosmic Cube: The First Retargetable Parallel Programming Language and Environment (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/133
1329888 AD-A193 295/3/XAB
Programming Solutions to the Algorithm Contraction Problem (Technical rept.)
NTIS Prices: PC A02/MF A01

2/6/134
1329298 PB88-211156/XAB
Architecture for Distributed Data Management in Computer Integrated Manufacturing
NTIS Prices: PC A04/MF A01

2/6/135
1329055 PB88-201769/XAB
Optimal Database Allocation in Distributed Computer Network Systems Included in Mitsubishi Denki Giho, v61 n12 p26-29 1987.
NTIS Prices: (Order as PB88-201751, PC E04/MF A01)

2/6/136
1328768 N88-21841/7/XAB
Optimal CMOS Structure for the Design of a Cell Library
NTIS Prices: PC A04/MF A01

2/6/137
1328685 N88-21709/6/XAB
Technology Mapping from Boolean Expressions to Standard Cells (Master's thesis)
NTIS Prices: PC A04/MF A01

2/6/138
1328676 N88-21696/5/XAB
Proposta de Um Sistema Paralelo Com Aplicacoes Em Processamento de Imagens (Proposal for a Parallel System with Image Processing Applications)
NTIS Prices: PC A03/MF A01

2/6/139
1328674 N88-21694/0/XAB
Conception of a Knowledge-Based System for Designing Distributed Systems (Thesis)
NTIS Prices: PC A10/MF A01

2/6/140
1328670 N88-21688/2/XAB
Distributed Operating Systems: An Overview
NTIS Prices: PC A03/MF A01

2/6/141
1328650 N88-21659/3/XAB
ESKISS: A Program for Optimal State Assignment (Master's thesis)
NTIS Prices: PC A04/MF A01

2/6/142
1328649 N88-21658/5/XAB
Generating Layouts for Random Logic: Cell Generation Schemes
NTIS Prices: PC A03/MF A01

2/6/143
1328642 N88-21650/2/XAB
Higher Levels of a Silicon Compiler (Master's thesis)
NTIS Prices: PC A05/MF A01

2/6/144
1328498 N88-21396/2/XAB
GADL: A Gate Array Description Language (Master's thesis)
NTIS Prices: PC A06/MF A01

2/6/145
1328156 NTN88-0343
Position and Force Control for Multiple-Arm Robots: The number of arms can be increased without introducing undue complexity
(NTIS Tech Note)
FOR ADDITIONAL INFORMATION: Inquiries concerning rights for its commercial use should be addressed to Edward Ansell, Director of Patents and Licensing, Mail Stop 301-6, California Institute of Technology, 1207 East California Boulevard, Pasadena, CA 91125; Refer to NPO-16811/TN.
NTIS Prices: Not available NTIS

2/6/146
1326737 AD-A192 387/9/XAB
Force User's Manual (Revision) (Interim rept.)
NTIS Prices: PC A03/MF A01

2/6/147
1326531 TIB/B88-81046/XAB
SUPRENUM. Semi-automatic parallelization of Fortran programs
NTIS Prices: PC E07

2/6/148
1326261 PB88-865043/XAB
Computer Networks: Data Communication Architecture and Development. January 1975-May 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for Jan 75-May 88)
NTIS Prices: PC N01/MF N01

2/6/149
1325709 N88-21082/8/XAB
German Processing and Archiving Facility for ERS-1
(Final Report)
NTIS Prices: PC A12/MF A01

2/6/150
1325659 N88-20892/1/XAB
Amoeba Replicated Service Organisation
NTIS Prices: PC A02/MF A01

2/6/151
1325650 N88-20875/6/XAB
GM: A Gate Matrix Layout Generator (Master's thesis)
NTIS Prices: PC A04/MF A01

2/6/152
1325649 N88-20874/9/XAB
Two Normal Form Theorems for Communicating Sequential Processes (CSP) Program
NTIS Prices: PC A03/MF A01

2/6/153
1325647 N88-20872/3/XAB
Designing Equivalent Semantic Models for Process Creation
NTIS Prices: PC A05/MF A01

2/6/154
1325518 N88-20549/7/XAB
Gridless Routing for Generalized Cell Assemblies: Report and User Manual
NTIS Prices: PC A03/MF A01

2/6/155
1323071 PB88-188446/XAB
Issues and Recommendations Associated with Distributed Computation and Data Management Systems for the Space Sciences
NTIS Prices: PC A06/MF A01

2/6/156
1321989 DE88006223/XAB
Activities and Operations of the Advanced Computing Research Facility, October 1986-October 1987
NTIS Prices: PC A03/MF A01

2/6/157

1321572 AD-A191 432/4/XAB
Year of Programming (Final technical rept.)
NTIS Prices: PC A04/MF A01

2/6/158
1321242 AD-A191 094/2/XAB
Proceedings from the Workshop on Large-Grained Parallelism (2nd) Held in Hidden Valley, Pennsylvania on October 11-14, 1987 (Final rept.)
NTIS Prices: PC A06/MF A01

2/6/159
1321106 AD-A190 956/3/XAB
UNIX Based Programming Tools for Locally Distributed Network Applications (Master's thesis)
NTIS Prices: PC A06/MF A01

2/6/160
1321087 AD-A190 936/5/XAB
Proceedings of the National Conference on Ada (trade mark) Technology (6th) Held on 14-18 March 1988 in Arlington, VA
NTIS Prices: PC A99/MF A01

2/6/161
1320158 N88-19147/3/XAB
Distributed Computation of Graphics Primitives on a Transputer Network
NTIS Prices: PC A02/MF A01

2/6/162
1320048 N88-18794/3/XAB
Design and Implementation of the Technical Facilities Controller (TFC) for the Goldstone Deep Space Communications Complex
NTIS Prices: (Order as N88-18774/5, PC A10/MF A01)

2/6/163
1319646 DE88005815/XAB
DIME (Distributed Irregular Mesh Environment): A Programming Environment for Unstructured Triangular Meshes on a Distributed-Memory Parallel Processor
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A03/MF A01

2/6/164
1318792 AD-A190 630/4/XAB
Programming Environments for Systolic Arrays (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/165
1318555 AD-A190 383/0/XAB
MultiScheme: A Parallel Processing System Based on MIT (Massachusetts Institute of Technology) Scheme (Doctoral thesis)

NTIS Prices: PC A11/MF A01

2/6/166
1318554 AD-A190 382/2/XAB
Argus Reference Manual (Technical rept.)
NTIS Prices: PC A08/MF A01

2/6/167
1318350 AD-A190 171/9/XAB
Automated Interactive Simulation Model (AISIM) VAX Version 5.0 User's Manual (Final rept. 14 May 86-15 May 87)
NTIS Prices: PC A17/MF A01

2/6/168
1317109 N88-18289/4/XAB
Experiences with Serial and Parallel Algorithms for Channel Routing Using Simulated Annealing
NTIS Prices: PC A04/MF A01

2/6/169
1315702 AD-A189 856/8/XAB
Mobile Remote Manipulator System Simulator
NTIS Prices: PC A02/MF A01

2/6/170
1315695 AD-A189 849/3/XAB
Implementation of a Distributed Adaptive Routing Algorithm on the Intel iPSC (Intel Personal Super-Computer) (Master's thesis)
NTIS Prices: PC A06/MF A01

2/6/171
1315545 AD-A189 697/6/XAB
Architecture of MRMS Simulation: Distributing Processes
NTIS Prices: PC A02/MF A01

2/6/172
1314503 PB88-162862/XAB
Duality of Fault Tolerant System Structures
NTIS Prices: PC E03/MF E03

2/6/173
1314374 N88-17326/5/XAB
Implementation and Use of Ada on Distributed Systems with High Reliability Requirements. Annual Progress Report, January 1, 1987-February 14, 1988
NTIS Prices: PC A03/MF A01

2/6/174
1314371 N88-17312/5/XAB
Systeme de Programmation Parallele Occam/Ada (Occam/Ada Parallel Programming System) (Doctoral thesis)
NTIS Prices: PC A07/MF A01

2/6/175

1314341 N88-17263/0/XAB
Communication and Control in an Integrated Manufacturing System
NTIS Prices: (Order as N88-17206/9, PC A23/MF A01)

2/6/176
1314340 N88-17262/2/XAB
Software for Integrated Manufacturing Systems. Part 2
NTIS Prices: (Order as N88-17206/9, PC A23/MF A01)

2/6/177
1314339 N88-17261/4/XAB
Software for Integrated Manufacturing Systems, Part 1
NTIS Prices: (Order as N88-17206/9, PC A23/MF A01)

2/6/178
1314337 N88-17259/8/XAB
Implementing Clips on a Parallel Computer
NTIS Prices: (Order as N88-17206/9, PC A23/MF A01)

2/6/179
1314316 N88-17238/2/XAB
Teaching Artificial Neural Systems to Drive: Manual Training Techniques for Autonomous Systems
NTIS Prices: (Order as N88-17206/9, PC A23/MF A01)

2/6/180
1314308 N88-17230/9/XAB
Task Allocation in a Distributed Computing System
NTIS Prices: (Order as N88-17206/9, PC A23/MF A01)

2/6/181
1314289 N88-17211/9/XAB
Development of a Comprehensive Software Engineering Environment
NTIS Prices: (Order as N88-17206/9, PC A23/MF A01)

2/6/182
1314284 N88-17206/9/XAB
First Annual Workshop on Space Operations Automation and Robotics (SOAR 87)
NTIS Prices: PC A23/MF A01

2/6/183
1312882 AD-A189 569/7/XAB
Why We Can't Program Multiprocessors the Way We're Trying to Do It Now (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/184
1312569 AD-A189 245/4/XAB
Interface between Object-Oriented Systems (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/185
1312531 AD-A189 202/5/XAB
Design of the CONSUL Programming Language (Technical rept.)

NTIS Prices: PC A03/MF A01

2/6/186
1311249 N88-16576/6/XAB
Proposta de Uma Metodologia Para O Projeto Conceitual de Bancos de Dados Distribuidos (Proposal of a Methodology for the Conceptual Design of the Distributed Data Base) (Master's thesis) NTIS Prices: PC A09/MF A01

2/6/187
1311169 N88-16442/1/XAB
Prototype Space Station Automation System Delivered and Demonstrated at NASA (National Aeronautics and Space Administration)
NTIS Prices: (Order as N88-16360/5, PC A18/MF A01)

2/6/188
1311167 N88-16440/5/XAB
Framework for Real-Time Distributed Expert Systems: On-Orbit Spacecraft Fault Diagnosis, Monitoring and Control
NTIS Prices: (Order as N88-16360/5, PC A18/MF A01)

2/6/189
1311156 N88-16429/8/XAB
Neural Network Based Speech Synthesizer: A Preliminary Report
NTIS Prices: (Order as N88-16360/5, PC A18/MF A01)

2/6/190
1311120 N88-16393/6/XAB
Application of Parallel Distributed Processing to Space Based Systems
NTIS Prices: (Order as N88-16360/5, PC A18/MF A01)

2/6/191
1311119 N88-16392/8/XAB
Problem Solving as Intelligent Retrieval from Distributed Knowledge Sources
NTIS Prices: (Order as N88-16360/5, PC A18/MF A01)

2/6/192
1311107 N88-16380/3/XAB
Knowledge-Based System for Monitoring the Electrical Power System of the Hubble Space Telescope
NTIS Prices: (Order as N88-16360/5, PC A18/MF A01)

2/6/193
1311106 N88-16379/5/XAB
Distributed Architecture for Intelligent Monitoring and Anomaly Diagnosis of the Hubble Space Telescope (Abstract Only)
NTIS Prices: (Order as N88-16360/5, PC A18/MF A01)

2/6/194
1311087 N88-16360/5/XAB
Third Conference on Artificial Intelligence for Space Applications, Part 1

NTIS Prices: PC A18/MF A01

2/6/195
1310087 DE88003582/XAB
Parallel Discrete Event Simulation: A Shared Memory Approach
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A03/MF A01

2/6/196
1308401 PB88-162896/XAB
Objects and Actions in Reliable Distributed Systems
(Technical rept.)
NTIS Prices: PC E04/MF E04

2/6/197
1308115 PB88-159223/XAB
Mitsubishi Denki Giho, Vol. 61, No. 10, 1987
NTIS Prices: PC E04

2/6/198
1307787 N88-15731/8/XAB
Interface between Astrophysical Datasets and Distributed Database Management Systems (DAVID) (Progress rept.)
NTIS Prices: PC A03/MF A01

2/6/199
1307775 N88-15635/1/XAB
Expert System Development for Commonality Analysis in Space Programs
NTIS Prices: (Order as N88-15601/3, PC A99/MF E03)

2/6/200
1307755 N88-15615/3/XAB
Microprocessor Control and Networking for the AMPS Breadboard
NTIS Prices: (Order as N88-15601/3, PC A99/MF E03)

2/6/201
1307587 N88-15114/7/XAB
Study of Communication Options in a Distributed Data Handling System and Survey of Advanced Man Machine Communications Schemes. Work Package 1: Interprocess Communication (Final rept.) NTIS Prices: PC A04/MF A01

2/6/202
1306589 AD-A188 142/4/XAB
Implementing Dynamic Arrays: A Challenge for High-Performance Machines
NTIS Prices: PC A02/MF A01

2/6/203
1306289 AD-A187 824/8/XAB
Performance Measurements of Distributed Simulation Strategies
(Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/204
1306288 AD-A187 823/0/XAB
Roll Back Chip: Hardware Support for Distributed Simulation Using Time Warp (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/205
1306285 AD-A187 820/6/XAB
Shared Memory Algorithm and Proof for the Alternative Construct in CSP (Communicating Sequential Processes) (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/206
1305006 N88-14641/0/XAB
Algorithms and Programming Tools for Image Processing on the MPP:3. Final Report, May 1984-July 1987
NTIS Prices: PC A09/MF A01

2/6/207
1302419 N88-13886/2/XAB
Introduction to Local Area Network Design on Ariane 5 and Future Launchers
NTIS Prices: PC A03/MF A01

2/6/208
1301283 AD-A187 559/0/XAB
Theory and Practice of Fault Tolerance in Distributed Systems (Final rept. 15 Jun 85-14 Oct 86)
NTIS Prices: PC A03/MF A01

2/6/209
1301241 AD-A187 516/0/XAB
Advanced Teleprocessing Systems Defense Advanced Research Projects Agency (Technical rept. (Final) 1 Oct 81-30 Sep 87)
NTIS Prices: PC A03/MF A01

2/6/210
1299807 N88-12934/1/XAB
Comparing Barrier Algorithms (Final rept.)
NTIS Prices: PC A03/MF A01

2/6/211
1297430 PB88-126693/XAB
Strongly Sequential Term Rewriting Systems
NTIS Prices: PC E03/MF A01

2/6/212
1297257 N88-12287/4/XAB
Mapping a Battlefield Simulation onto Message-Passing Parallel Architectures (Final rept.)
NTIS Prices: PC A03/MF A01

2/6/213
1294485 DE88000714/XAB

Managing Distributed Derived Data: A Preliminary Proposal
Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.
NTIS Prices: PC A03/MF A01

2/6/214
1293593 DE87013093/XAB
Domain Decomposition in Distributed and Shared Memory Environments: 1, A Uniform Decomposition and Performance Analysis for the NCUBE and JPL Mark IIIfp Hypercubes
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A03/MF A01

2/6/215
1293232 AD-A185 616/0/XAB
Air Force Scientific Report for AFOSR Grant AFOSR-85-0252 (Final rept. 15 Jun 85-14 Oct 86)
NTIS Prices: PC A03/MF A01

2/6/216
1293195 AD-A185 579/0/XAB
Communications for the DTroll Distributed Database System (Master's thesis)
NTIS Prices: PC A03/MF A01

2/6/217
1291994 PB88-105499/XAB
Multi-Processor Architectures for Artificial Intelligence Processing
NTIS Prices: PC E05/MF E05

2/6/218
1291923 N88-11440/0/XAB
Methodologie d'Evaluation des Performances des Systemes Repartis en Temps Reel (Methodology of Performance Evaluation of Real Time Distributed Systems)
NTIS Prices: PC A06/MF A01

2/6/219
1291911 N88-11402/0/XAB
Report from the MPP (Massively Parallel Processor) Working Group to the NASA (National Aeronautics and Space Administration) Associate Administrator for Space Science and Applications. Technical Memorandum Report, October 1, 1985-September 30, 1986
NTIS Prices: PC A04/MF A01

2/6/220
1291909 N88-11398/0/XAB
Cache-Based Error Recovery for Shared Memory Multiprocessor Systems
NTIS Prices: PC A03/MF A01

2/6/221
1291899 N88-11379/0/XAB

Systeme Memoire pour Architecture Multiprocesseur sur Bus Unique. Application au Systeme SCQM (Memory Systems for Single Bus Multiprocessor Architecture. Application to the SCQM System)
(Doctoral thesis)
NTIS Prices: PC A11/MF A01

2/6/222
1289457 PB88-110853/XAB
Summary Record of Presentations to the Federal Telecommunication Standards Committee/Fiber Optics Task Group
NTIS Prices: PC A07/MF A01

2/6/223
1289249 PB88-105218/XAB
Early Stopping Algorithms for Distributed Agreement under Fail-Stop, Omission, and Timing Fault Types (Technical rept. series)
NTIS Prices: PC E03/MF E03

2/6/224
1289032 N88-10513/5/XAB
Nonmythical Generalization of Dekker's Algorithm and Its Ramifications
NTIS Prices: PC A03/MF A01

2/6/225
1289026 N88-10506/9/XAB
Associative Memory ME7
NTIS Prices: PC A04/MF A01

2/6/226
1285508 DE87012519/XAB
Unified Approach to Parallel Computation: Performance Evaluation and Architecturally Independent Parallel Programming: Progress Report, September 1, 1986-August 31, 1987
NTIS Prices: PC A02/MF A01

2/6/227
1285013 AD-A184 969/4/XAB
Test and Evaluation of the Transputer in a Multi-Transputer System (Master's thesis)
NTIS Prices: PC A09/MF A01

2/6/228
1284195 N87-29173/8/XAB
Votierungsverfahren als Teil der Fehlertoleranz in Verteilten Pdv-Systemen (Vote Methods as a Part of the Fault Tolerance in Distribution Process Data Processing Systems)
(Doctoral thesis)
NTIS Prices: PC A09/MF A01

2/6/229
1281120 PB87-234969/XAB

Distributed Infimum Approximation (Technical rept.)
NTIS Prices: PC E03/MF A01

2/6/230
1280257 N87-28325/5/XAB
Support Architecture for Reliable Distributed Computing Systems. Interim Report, November 9, 1983-December 3, 1985 C" k wi 1 rept.)
NTIS Prices: PC A04/MF A01

2/6/231
1280248 N87-28307/3/XAB
Performance Issues for Domain-Oriented Time-Driven Distributed Simulations
NTIS Prices: PC A02/MF A01

2/6/232
1280235 N87-28294/3/XAB
Ada Pilot Project (Final rept.)
NTIS Prices: PC A03/MF A01

2/6/233
1280017 N87-27894/1/XAB
Sistema de Comunicacao Para Ambiente de Multiprocessamento (Communication System for a Multiprocessing Environment)
NTIS Prices: PC A02/MF A01

2/6/234
1278782 DE87010832/XAB
Prescriptive Concepts for Advanced Nuclear Materials Control and Accountability Systems
Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.
NTIS Prices: PC A02/MF A01

2/6/235
1277652 AD-A184 266/5/XAB
Exploiting Virtual Synchrony in Distributed Systems. Revision (Special technical rept.)
NTIS Prices: PC A02/MF A01

2/6/236
1277155 PB87-867958/XAB
DECNET: Digital Equipment Corporation Network Architecture. January 1976-September 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for Jan 76-Sep 87)
NTIS Prices: PC N01/MF N01

2/6/237
1276980 PB87-226098/XAB
Network Protocols: Proceedings of the Joint IBM (International Business Machines)/University of Newcastle upon Tyne Seminar Held in the University Computing Laboratory, September 3-6, 1985

NTIS Prices: PC E12/MF E12

2/6/238
1276525 N87-27444/5/XAB
Automated Problem Scheduling and Reduction of Synchronization Delay Effects (Final rept.)
NTIS Prices: PC A03/MF A01

2/6/239
1276515 N87-27433/8/XAB
Detection of Faults and Software Reliability Analysis. Annual Report, July 1, 1985-June 30, 1987 (Progress rept.)
NTIS Prices: PC A02/MF A01

2/6/240
1276514 N87-27432/0/XAB
Implementation and Use of ADA on Distributed Systems with High Reliability Requirements. Semiannual Report, March 5, 1982-February 14, 1988 (Progress rept.)
NTIS Prices: PC A03/MF A01

2/6/241
1276511 N87-27425/4/XAB
Parallel Software Support for Computational Structural Mechanics. Semiannual Report, December 1, 1986-May 31, 1987
NTIS Prices: PC A02/MF A01

2/6/242
1276506 N87-27420/5/XAB
Parallel Simulated Annealing Algorithm for Standard Cell Placement on a Hypercube Computer
NTIS Prices: PC A05/MF A01

2/6/243
1276504 N87-27418/9/XAB
Implementation and Use of ADA on Distributed Systems with High Reliability Requirements. Semiannual Report, March 5, 1982-December 31, 1986
NTIS Prices: PC A06/MF A01

2/6/244
1276064 N87-26555/9/XAB
Experience in Highly Parallel Processing Using DAP (Distributed Array Processor)
NTIS Prices: (Order as N87-26531 PC A13/MF A01)

2/6/245
1274820 AD-A183 946/3/XAB
Data Multiplex System (DMS) - Aspects of Fleet Introduction
NTIS Prices: PC A02/MF A01

2/6/246
1274207 PB87-867149/XAB
Distributed Data Base Management Systems. October 1984-September 1987 (Citations from the INSPEC: Information

Services for the Physics and Engineering Communities Database)
(Rept. for Oct 84-Sep 87)
NTIS Prices: PC N01/MF N01

2/6/247
1273956 PB87-219937/XAB
Replicated Distributed Processing
(Technical rept. series)
NTIS Prices: PC E03/MF E03

2/6/248
1273786 PB87-217592/XAB
Distributed Computer System for Factory Automation
Included in Mitsubishi Denki Giho, v61 n4 p17-20 1987.
NTIS Prices: (Order as PB87-217584, PC E05/MF A01)

2/6/249
1273334 N87-26581/5/XAB
Comparison Between Sparsely Distributed Memory and Hopfield-Type Neural Network Models
NTIS Prices: PC A03/MF A01

2/6/250
1273332 N87-26577/3/XAB
EOS: A Project to Investigate the Design and Construction of Real-Time Distributed Embedded Operating Systems. Mid-Year Report, 1987
NTIS Prices: PC A11/MF A01

2/6/251
1273331 N87-26576/5/XAB
Parallel Discrete Event Simulation: A Shared Memory Approach
NTIS Prices: PC A03/MF A01

2/6/252
1273329 N87-26574/0/XAB
PISCES 2 Users Manual
NTIS Prices: PC A03/MF A01

2/6/253
1273328 N87-26573/2/XAB
PISCES 2 Parallel Programming Environment (Final rept.)
NTIS Prices: PC A02/MF A01

2/6/254
1273325 N87-26568/2/XAB
Network Protocols for Real-Time Applications
NTIS Prices: PC A02/MF A01

2/6/255
1273324 N87-26567/4/XAB
Two Demonstrators and a Simulator for a Sparse, Distributed Memory
NTIS Prices: PC A02/MF A01

2/6/256
1273314 N87-26520/3/XAB
Force User's Manual (Revised)
NTIS Prices: PC A03/MF A01

2/6/257
1273312 N87-26518/7/XAB
Parallel Algorithm for Channel Routing on a Hypercube
NTIS Prices: PC A02/MF A01

2/6/258
1272530 DE87010147/XAB
Performance of Three Hypercubes
Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.
NTIS Prices: PC A02/MF A01

2/6/259
1271733 AD-A183 216/1/XAB
Methodologies for Concurrent Programming
(Final rept. for 1 Mar 86-28 Feb 87)
NTIS Prices: PC A02/MF A01

2/6/260
1271456 AD-A182 935/7/XAB
Parallel and Distributed Computing
(Final rept. 1 Jun 85-30 Nov 86)
NTIS Prices: PC A02/MF A01

2/6/261
1270513 PB87-200960/XAB
Bus-Type Home Control System Using Coaxial Cables
Included in National Technical Report (Matsushita Electric Industrial Company), v32 n6 p37-44 Dec 86.
NTIS Prices: (Order as PB87-200945, PC E07/MF E01)

2/6/262
1270383 N87-25890/1/XAB
Integration of Communications and Tracking Data Processing Simulation for Space Station
NTIS Prices: (Order as N87-25884 PC A13/MF A01)

2/6/263
1269083 AD-A182 557/9/XAB
Mediation and Automatization
(Technical rept. for period ending Dec 86)
NTIS Prices: PC A02/MF A01

2/6/264
1269040 AD-A182 513/2/XAB
CRONUS, A Distributed Operating System: CRONUS DOS Implementation (Final rept. Oct 84-Jan 86)
NTIS Prices: PC A04/MF A01

2/6/265

1267878 N87-24949/6/XAB
New Technology Impacts on Future Avionics Architectures
NTIS Prices: (Order as N87-24940 PC A07/MF A01)

2/6/266
1266715 DE87008558/XAB
Parallel Solution of Triangular Systems on Distributed-Memory Multiprocessors
Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.
NTIS Prices: PC A03/MF A01

2/6/267
1265970 AD-A182 240/2/XAB
Exact Performance Analysis of Two Distributed Processes with One Synchronization Point (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/268
1265948 AD-A182 216/2/XAB
Distributed Sensor Networks (Semiannual technical summary rept. 1 Apr-30 Sep 86)
NTIS Prices: PC A03/MF A01

2/6/269
1265911 AD-A182 178/4/XAB
Data Replication in Nested Transaction Systems (Technical rept.)
NTIS Prices: PC A05/MF A01

2/6/270
1265909 AD-A182 176/8/XAB
Remote Pipes and Procedures for Efficient Distributed Communication (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/271
1265908 AD-A182 175/0/XAB
Correctness of Orphan Elimination Algorithms (Master's thesis)
NTIS Prices: PC A03/MF A01

2/6/272
1265037 PB87-180857
Programming the Parallel Processor (Final rept.)
Pub. in The Role of Language in Problem Solving 2, p321-333 1987. NTIS Prices: Not available NTIS

2/6/273
1264037 DE87008229/XAB
Effect of Distributed Computing Technology on Wide Area Network Capacity Requirements Portions of this document are illegible in microfiche products.
NTIS Prices: PC A02/MF A01

2/6/274
1262291 PB87-196010/XAB
Graph Model for Efficient Reachability Analysis of Description Languages, Series B, Number 34 (Research rept.)
NTIS Prices: PC E03/MF E01

2/6/275
1259984 AD-A180 847/6/XAB
ParLance: A Para-Functional Programming Environment for Parallel and Distributed Computing (Research rept.)
NTIS Prices: PC A03/MF A01

2/6/276
1254966 DE87003740/XAB
Numerical Computation on Massively Parallel Hypercubes
NTIS Prices: PC A02/MF A01

2/6/277
1254677 AD-A179 958/4/XAB
Debugging Parallel Programs with Instant Replay (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/278
1254622 AD-A179 902/2/XAB
Debugging Parallel Programs with Instant Replay (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/279
1254235 PB87-860052/XAB
Distributed Data Processing. October 1985-May 1987 (Citations from the NTIS Database) (Rept. for Oct 85-May 87)
NTIS Prices: PC N01/MF N01

2/6/280
1254234 PB87-860045/XAB
Distributed Data Processing. November 1981-September 1985 (Citations from the NTIS Database) (Rept. for Nov 81-Sep 85)
NTIS Prices: PC N01/MF N01

2/6/281
1252186 AD-A179 407/2/XAB
Experiment in Knowledge-Based Signal Understanding Using Parallel Architectures (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/282
1250889 N87-19932/9/XAB
Computer Sciences and Data Systems. Volume 2
NTIS Prices: PC A15/MF A01

2/6/283
1250888 N87-19931/1/XAB
Computer Sciences and Data Systems, Volume 1

NTIS Prices: PC A16/MF A01

2/6/284
1249337 PB87-858429/XAB
Computer Networks: Data Communication Architecture and Development. January 1975-April 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for Jan 75-Apr 87)
NTIS Prices: PC N01/MF N01

2/6/285
1248435 N87-19022/9/XAB
Distributed Computer System Enhances Productivity for SRB (Solid Rocket Booster) Joint Optimization
NTIS Prices: PC A02/MF A01

2/6/286
1248419 N87-18988/2/XAB
Concurrent Extensions to the Fortran Language for Parallel Programming of Computational Fluid Dynamics Algorithms
NTIS Prices: PC A03/MF A01

2/6/287
1247784 DE87004030/XAB
Advanced Distributed Processing with Focus and PC/Focus: Planning Considerations and Phased Implementation
NTIS Prices: PC A03/MF A01

2/6/288
1247084 AD-A178 975/9/XAB
Durra: A Task-Level Description Language Preliminary Reference Manual (Final rept.)
NTIS Prices: PC A03/MF A01

2/6/289
1243898 DE86014102/XAB
Performance Evaluation of the HEP, ELXSI and CRAY X-MP Parallel Processors on Hydrocode Test Problems
NTIS Prices: PC A02/MF A01

2/6/290
1242319 N87-17441/3/XAB
Comparison of Five Benchmarks
NTIS Prices: PC A02/MF A01

2/6/291
1241827 N87-16851/4/XAB
Distributed Data Acquisition System for Aeronautics Test Facilities
NTIS Prices: PC A02/MF A01

2/6/292
1239787 AD-A176 907/4/XAB
Naval C(3) Distributed Tactical Decision Making
(Quarterly rept. 1 Oct-31 Dec 86)

NTIS Prices: PC A03/MF A01

2/6/293
1239707 AD-A176 827/4/XAB
Survey of Fault Tolerant Computer Security and Computer Safety (Final technical rept. Apr 85-Apr 86)
NTIS Prices: PC A10/MF A01

2/6/294
1239234 N87-16656/7/XAB
Database Interfaces on NASA's (National Aeronautics and Space Administration's) Heterogeneous Distributed Database System (Semiannual rept)
NTIS Prices: PC A03/MF A01

2/6/295
1239221 N87-16528/8/XAB
Overview of Database Projects
(Semiannual status rept)
NTIS Prices: PC A10/MF A01

2/6/296
1235417 AD-A176 258/2/XAB
Development of Real-Time Speech Recognition
(Final technical rept. 3 Jun 85-2 Dec 86)
NTIS Prices: PC A02/MF A01

2/6/297
1234157 N87-14914/2/XAB
Placement d'UN Reseau de Processus Communicants Decrit en FP2 sur Une Structure de Grille en Vue d'Une Implantation Parallele de Ce Langage (Location of the Communication Process Network Described in FP2 on a Graph Structure in Order to Implement the Parallel Processing of That Language)
NTIS Prices: PC A05/MF A01

2/6/298
1234151 N87-14907/6/XAB
Aspecten van Het Amsterdams Multiprocessor Prolog Systeem (Aspects of the Amsterdam Multiprocessor Prolog System)
NTIS Prices: PC A02/MF A01

2/6/299
1229732 DE86015570/XAB
Portable Environment for Developing Parallel Fortran Programs
Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.
NTIS Prices: PC A02/MF A01

2/6/300
1227996 N87-12270/1/XAB
ELAND: An Expert System for the Configuration of Local Area Networks Applications
NTIS Prices: PC A03/MF A01

2/6/301
1227995 N87-12265/1/XAB
Implementation and Use of Ada on Distributed Systems with High Reliability Requirements
(Progress rept. 5 Mar 82-31 Dec 86)
NTIS Prices: PC A04/MF A01

2/6/302
1227984 N87-12247/9/XAB
Parallel Scheduling of Recursively Defined Arrays (Final rept)
NTIS Prices: PC A03/MF A01

2/6/303
1227974 N87-12169/5/XAB
Application of a Sparse, Distributed Memory to the Detection, Identification and Manipulation of Physical Objects. Semiannual Status Report October 1985-March 1986
NTIS Prices: PC A02/MF A01

2/6/304
1227329 DE86014770/XAB
Data Management of a Multilaboratory Field Program Using Distributed Processing Portions of this document are illegible in microfiche products.
NTIS Prices: PC A02/MF A01

2/6/305
1227052 AD-A174 506/6/XAB
Cooperative Intelligence for Remotely Piloted Vehicle Fleet Control. Analysis and Simulation (Interim rept.)
NTIS Prices: PC A04/MF A01

2/6/306
1227032 AD-A174 486/1/XAB
Assessment of the Computer Science Activities of the Office of Naval Research
NTIS Prices: PC A03/MF A01

2/6/307
1226827 AD-A174 276/6/XAB
Processor Renaming in Asynchronous Environments
(Technical rept.)
NTIS Prices: PC A02/MF A01

2/6/308
1225747 N87-11510/1/XAB
EOS (Embedded Operating Systems): A Project to Investigate the Design and Construction of Real-Time Distributed Embedded Operating Systems
NTIS Prices: PC A10/MF A01

2/6/309
1225308 AD-A173 989/5/XAB
Serial Order: A Parallel Distributed Processing Approach

(Technical rept. Jun 85-Mar 86)
NTIS Prices: PC A04/MF A01

2/6/310
1223941 DE86014683/XAB
Unified Approach to Parallel Computation: Performance Evaluation and Architecturally Independent Parallel Programming. Progress Report, September 1, 1985-August 31, 1986
NTIS Prices: PC A02/MF A01

2/6/311
1223263 AD-A173 283/3/XAB
Applying Activation Theory for Modeling Task Interference in Dual-Task Situations (Final rept. Mar 85-Jun 86)
NTIS Prices: PC A02/MF A01

2/6/312
1223009 AD-A173 028/2/XAB
Information Processing Research (Final rept. Jan 81-Dec 84)
NTIS Prices: PC A07/MF A01

2/6/313
1222214 N86-33032/1/XAB
First 3 Years of Operation of RIACS (Research Institute for Advanced Computer Science) (1983-1985) (Final rept)
NTIS Prices: PC A02/MF A01

2/6/314
1220744 N86-32112/2/XAB
Multiple Grid Problems on Concurrent-Processing Computers
NTIS Prices: PC A06/MF A01

2/6/315
1219350 AD-A172 224/8/XAB
Distributed Control in Computer Networks and Cross-Sections of Colored Multidimensional Bodies (Interim research rept.)
NTIS Prices: PC A02/MF A01

2/6/316
1219323 AD-A172 196/8/XAB
RAMBOT (Restructuring Associative Memory Based on Training): A Connectionist Expert System That Learns by Example (Technical rept. Oct 85-Apr 86)
NTIS Prices: PC A03/MF A01

2/6/317
1219099 PB86-877123/XAB
DECNET: Digital Equipment Corporation Network Architecture. 1976-October 1986 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database)
(Rept. for 1976-Oct 86)
NTIS Prices: PC N01/MF N01

2/6/318

1219057 PB86-876687/XAB
IBM System 370. 1975-October 1986 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for 1975-Oct 86)
NTIS Prices: PC N01/MF N01

2/6/319
1218318 N86-31261/8/XAB
Optimal Partitioning of Random Programs Across Two Processors (Final rept)
NTIS Prices: PC A03/MF A01

2/6/320
1217862 DE86013517/XAB
Denelcor HEP Multiprocessor Simulator
Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.
NTIS Prices: PC A02/MF A01

2/6/321
1216029 N86-30380/7/XAB
Force on the Flex: Global Parallelism and Portability (Final rept)
NTIS Prices: PC A02/MF A01

2/6/322
1216028 N86-30379/9/XAB
Dynamic Remapping of Parallel Computations with Varying Resource Demands (Final rept)
NTIS Prices: PC A04/MF A01

2/6/323
1215030 PB86-875507/XAB
Distributed Data Base Management Systems. October 1984-September 1986 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for Oct 84-Sep 86)
NTIS Prices: PC N01/MF N01

2/6/324
1214437 N86-29562/3/XAB
UCLA Design Diversity Experiment (DEDIX) System: A Distributed Testbed for Multiple-Version Software
NTIS Prices: PC A02/MF A01

2/6/325
1214435 N86-29551/6/XAB
Statistical Methodologies for the Control of Dynamic Remapping (Final rept)
NTIS Prices: PC A03/MF A01

2/6/326
1214434 N86-29550/8/XAB
Approximate Algorithms for Partitioning and Assignment Problems
NTIS Prices: PC A03/MF A01

2/6/327
1210685 AD-A169 981/8/XAB
High Performance Parallel Computing
(Final rept. 1 Feb 84-31 Jan 85)
NTIS Prices: PC A02/MF A01

2/6/328
1201386 N86-25142/8/XAB
Implementation and Use of Ada on Distributed Systems with High Reliability Requirements (Annual rept)
NTIS Prices: PC A05/MF A01

2/6/329
1199173 PB86-870466/XAB
Micro-Mainframe Links: Forecasts and Markets. 1983-June 1986 (Citations from The Computer Database) (Rept. for 1983-Jun 86)
NTIS Prices: PC N01/MF N01

2/6/330
1198619 N86-24347/4/XAB
Performance Tradeoffs in Static and Dynamic Load Balancing Strategies (Final rept)
NTIS Prices: PC A02/MF A01

2/6/331
1196115 N86-23319/4/XAB
Display System Software for the Integration of an Adage 3000 Programmable Display Generator into the Solid Modeling Package C.a.D. Software (Contractor rept., 26 Sep 84-31 Mar 86)
NTIS Prices: PC A08/MF A01

2/6/332
1195222 DE86007645/XAB
Environments for Prototyping Parallel Algorithms
NTIS Prices: PC A02/MF A01

2/6/333
1193603 N86-21516/7/XAB
Three-Dimensional Boundary Layer Analysis Program Blay and Its Application
NTIS Prices: PC A02/MF A01

2/6/334
1192839 DE86007309/XAB
Forward Spectrometers at the SSC
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A02/MF A01

2/6/335
1191949 PB86-866829/XAB
Distributed Information Systems. 1975-April 1986 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for 1975-Apr 86)

NTIS Prices: PC N01/MF N01

2/6/336
1184451 AD-A164 897/1/XAB
Semi-Applicative Programming. Examples of Context Free Recognizers (Technical rept.)
NTIS Prices: PC A03/MF A01

2/6/337
1183966 PB86-862703/XAB
Computer Networks: Data Communication Architecture and Development. 1975-March 1986 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for 1975-Mar 86)
NTIS Prices: PC N01/MF N01

Appendix B
On-Line Search Abstracts

1387880/7
1387880 N89-12255/0/XAB
Study of the Development of On-Board Distributed Software Systems Using Ada
Porcherlabreuille, B. ; Dellatorre, A.
CISI Ingenierie, Toulouse (France).
Corp. Source Codes: 093451000; CP773641
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: ESA-CR(P)-2651; ETN-88-93247
May 88 71p
Languages: English
Journal Announcement: GRAI8906; STAR2703
Prepared in Cooperation with Carlo Gavazzi Controls S.p.a., Milan, Italy.
NTIS Prices: PC A04/MF A01
Country of Publication: France
Contract No.: ESA-6572/85-NL-PP
Use of Ada technology for the design and implementation of large distributed systems in the context of the Columbus space station program was assessed by developing in Ada a prototype of an on-board data management system (DMS). Results and lessons learned by applying a virtual node approach together with hierarchical object oriented design contribute to a better understanding and management of the use of Ada technology. This approach provides the definition of a development framework very well adapted to the Columbus DMS context. By defining applications and services software as Ada virtual nodes it is possible to design the whole system as a single Ada program, structured according to the architecture adopted for DMS. The applications could be developed in parallel on geographically distributed sites and be validated individually using this initial model and the corresponding interface specification. The final integration process could concentrate on the operational validation of the system in distributed configuration (the functional validation in centralized configuration being obtained at the end of the first phase). The efficient implementation of this method requires support tools for: checking the rules imposed by the virtual node approach; and scanning virtual node specifications (Ada packages) in order to generate a surrogate software layer to provide syntactically transparent communication between virtual nodes located on distinct physical processors.

1387870/7
1387870 N89-12222/0/XAB
Support Architecture for Reliable Distributed Computing Systems. Semiannual Status Report, June 9, 1987-June 8, 1988
Dasgupta, P. ; LeBlanc, R. J.
Georgia Inst. of Tech., Atlanta.
Corp. Source Codes: 010263000; GW167534
Sponsor: National Aeronautics and Space Administration, Washington, DC.

Report No.: NAS 1.26:183235; NASA-CR-183235
30 Sep 88 36p
Languages: English
Journal Announcement: GRAI8906; STAR2703
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NAG1-430

The Clouds project is well underway to its goal of building a unified distributed operating system supporting the object model. The operating system design uses the object concept of structuring software at all levels of the system. The basic operating system was developed and work is under progress to build a usable system.

1381250/7
1381250 AD-A204 126/7/XAB
QLISP for Parallel Processors
(Final rept. 15 Jul 86-31 Jul 88)
McCarthy, J.
Stanford Univ., CA. Dept. of Computer Science.
Corp. Source Codes: 009225004; 094120
Jan 89 4p
Languages: English
Journal Announcement: GRAI8912
NTIS Prices: PC A02/MF A01
Country of Publication: United States
Contract No.: N00039-84-C-0211; ARPA Order-5826

The goal of the Qlisp project at Stanford is to gain experience with the shared-memory, queue-based approach to parallel Lisp, by implementing the Qlisp language on an actual multiprocessor, and by developing a symbolic algebra system as a testbed application. The experiments performed on the simulator included: 1. Algorithms for sorting and basic data structure manipulation for polynomials. 2. Partitioning and scheduling methods for parallel programming. 3. Parallelizing the production rule system OPS5. Computer programs. (jes)

1380043/7
1380043 N89-16347/1/XAB
Comparing Host and Target Environments for Distributed Ada Programs
Paulk, M. C.
System Development Corp., Huntsville, AL.
Corp. Source Codes: 030459000; S8792091
Sponsor: National Aeronautics and Space Administration, Washington, DC.
1986 10p
Languages: English
Journal Announcement: GRAI8911; STAR2708

In NASA, Lyndon B. Johnson Space Center, First International Conference on Ada (R) Programming Language Applications for the NASA Space Station, Volume 2 10 p.
NTIS Prices: (Order as N89-16326/5, PC A22/MF A01)
Country of Publication: United States

The Ada programming language provides a means of

specifying logical concurrency by using multitasking. Extending the Ada multitasking concurrency mechanism into a physically concurrent distributed environment which imposes its own requirements can lead to incompatibilities. These problems are discussed. Using distributed Ada for a target system may be appropriate, but when using the Ada language in a host environment, a multiprocessing model may be more suitable than retargeting an Ada compiler for the distributed environment. The tradeoffs between multitasking on distributed targets and multiprocessing on distributed hosts are discussed. Comparisons of the multitasking and multiprocessing models indicate different areas of application.

1380010/7
1380010 N89-16314/1/XAB
Impact of Common APSE (Ada Program Support Environment) Interface Set Specifications on Space Station Information Systems
Diaz-Herrera, J. L. ; Sibley, E. H.
George Mason Univ., Fairfax, VA.
Corp. Source Codes: 063190000; GV714519
Sponsor: National Aeronautics and Space Administration, Washington, DC.
1986 11p
Languages: English
Journal Announcement: GRAI8911; STAR2708
In NASA, Lyndon B. Johnson Space Center, First International Conference on Ada (R) Programming Language Applications for the NASA Space Station, Volume 1 11 p.
NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)
Country of Publication: United States
Certain types of software facilities are needed in a Space Station Information Systems Environment; the Common APSE (Ada Program Support Environment) Interface Set (CAIS) was proposed as a means of satisfying them. The reasonableness of this is discussed by examining the current CAIS, considering the changes due to the latest Requirements and Criteria (RAC) document, and postulating the effects on the CAIS 2.0. Finally, a few additional comments are made on the problems inherent in the Ada language itself, especially on its deficiencies when used for implementing large distributed processing and data base applications.

1379988/7
1379988 N89-16292/9/XAB
Distributed Programming Environment for Ada
Brennan, P. ; McDonnell, T. ; McFarland, G. ; Timmins, L. J. ; Litke, J.
D.
Grumman Data Systems Corp., Woodbury, NY.
Corp. Source Codes: 093982000; G7180425
Sponsor: National Aeronautics and Space Administration, Washington, DC.
1986 11p
Languages: English
Journal Announcement: GRAI8911; STAR2708

In NASA, Lyndon B. Johnson Space Center, First International Conference on Ada (R) Programming Language Applications for the NASA Space Station, Volume 1 11 p.

NTIS Prices: (Order as N89-16279/6, PC A18/MF A01)

Country of Publication: United States

Despite considerable commercial exploitation of fault tolerance systems, significant and difficult research problems remain in such areas as fault detection and correction. A research project is described which constructs a distributed computing test bed for loosely coupled computers. The project is constructing a tool kit to support research into distributed control algorithms, including a distributed Ada compiler, distributed debugger, test harnesses, and environment monitors. The Ada compiler is being written in Ada and will implement distributed computing at the subsystem level. The design goal is to provide a variety of control mechanics for distributed programming while retaining total transparency at the code level.

1377085/7

1377085 N89-15601/2/XAB

Very Large Area Network (VLAN) Knowledge-Base Applied to Space Communication Problems

Zander, C. S.

Colorado State Univ., Fort Collins.

Corp. Source Codes: 006665000; CU102466

Sponsor: National Aeronautics and Space Administration, Washington, DC.

Oct 88 9p

Languages: English

Journal Announcement: GRAI8910; STAR2707

In NASA, Marshall Space Flight Center, Fourth Conference on Artificial Intelligence for Space Applications p 401-409.

NTIS Prices: (Order as N89-15549/3, PC A21/MF A01)

Country of Publication: United States

This paper first describes a hierarchical model for very large area networks (VLAN). Space communication problems whose solution could profit by the model are discussed and then an enhanced version of this model incorporating the knowledge needed for the missile detection-destruction problem is presented. A satellite network or VLAN is a network which includes at least one satellite. Due to the complexity, a compromise between fully centralized and fully distributed network management has been adopted. Network nodes are assigned to a physically localized group, called a partition. Partitions consist of groups of cell nodes with one cell node acting as the organizer or master, called the Group Master (GM). Coordinating the group masters is a Partition Master (PM). Knowledge is also distributed hierarchically existing in at least two nodes. Each satellite node has a back-up earth node. Knowledge must be distributed in such a way so as to minimize information loss when a node fails. Thus the model is hierarchical both physically and informationally.

? t 1372001/7;t 1369604/7;t 1369112/7;t 1365721/7;t 1361012/7;t 1351011/7

1372001/7
1372001 N89-14695/5/XAB
Analysis of FDDI Synchronous Traffic Delays
Johnson, M. J.
National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Corp. Source Codes: 019045001; NC473657
Report No.: NAS 1.26:183223; RIACS-TR-88.3; NASA-CR-183223
Jan 88 21p
Languages: English
Journal Announcement: GRAI8909; STAR2706
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NCC2-387
The Fiber Distributed Data Interface (FDDI) high-speed token-ring protocol provides support for two classes of service: synchronous, to support applications which require deterministic access to the channel, and asynchronous, to support applications which do not have such stringent response-time requirements. The purpose of this paper is to determine how to set ring parameters to support synchronous traffic most efficiently. Both theoretical results and results obtained from a simulation study are presented.

1369604/7
1369604 PB89-150296/XAB
Distributed-Feedback Laser-Diode Module with an Optical Isolator for Multigigabit Optical Transmission
Yamashita, J. ; Nakamura, T. ; Suganuma, R. ; Ito, S. ; Kakimito, S.
Mitsubishi Electric Corp., Tokyo (Japan).
Corp. Source Codes: 076350000
c1988 3p
Languages: Japanese
Journal Announcement: GRAI8908
Text in Japanese.
Included in Mitsubishi Denki Giho, v62 n10 p77-80 1988.
NTIS Prices: (Order as PB89-150221, PC E05/MF A01)
Country of Publication: Japan
The module, which has a thermoelectric cooler, has the following advantages: a smooth frequency response up to 5GHz, relative intensity noise less than -145dB/Hz, side-model suppression ratio better than 35dB during high-bit-rate modulation, high output-power stability (< or = 0.2dB) over a wide 0 approx. 60 degrees C operating-temperature range, and efficient cooling.

1369112/7
1369112 N89-13991/9/XAB
Strategy for Reducing Turnaround Time in Design Optimization Using a Distributed Computer System
Young, K. C. ; Padula, S. L. ; Rogers, J. L.
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.

Corp. Source Codes: 019041001; ND210491
Report No.: NAS 1.15:101519; NASA-TM-101519
Oct 88 10p
Languages: English
Journal Announcement: GRAI8908; STAR2705
Presented at the Asme Design Technology Conferences-the Design Automation Conference, Kissimmee, Fla., 25-28 Sep. 1988.
NTIS Prices: PC A02/MF A01
Country of Publication: United States
There is a need to explore methods for reducing lengthly computer turnaround or clock time associated with engineering design problems. Different strategies can be employed to reduce this turnaround time. One strategy is to run validated analysis software on a network of existing smaller computers so that portions of the computation can be done in parallel. This paper focuses on the implementation of this method using two types of problems. The first type is a traditional structural design optimization problem, which is characterized by a simple data flow and a complicated analysis. The second type of problem uses an existing computer program designed to study multilevel optimization techniques. This problem is characterized by complicated data flow and a simple analysis. The paper shows that distributed computing can be a viable means for reducing computational turnaround time for engineering design problems that lend themselves to decomposition. Parallel computing can be accomplished with a minimal cost in terms of hardware and software.

1365721/7
1365721 N89-13173/4/XAB
European Seminar on Neural Computing
Zomzely-Neurath, C.
Office of Naval Research, London (England).
Corp. Source Codes: 021603000; OH736806
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: ONRL-8-010-C
31 Aug 88 38p
Languages: English Document Type: Conference proceeding
Journal Announcement: GRAI8907; STAR2704
Seminar Held in London, United Kingdom, Feb. 1988.
NTIS Prices: PC A03/MF A01
Country of Publication: Other
Topics range from neural systems and models through languages and architectures to the respective European and American perspectives on neurocomputing.

1361012/7
1361012 N89-11438/3/XAB
Sopmcr: An Operating System for the Multiprocessor for Communication Networks
Martins, E. ; Ambrosio, A. M. ; Oshiro, S. K.
Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
Corp. Source Codes: 058511000; IO601891
Sponsor: National Aeronautics and Space Administration,

Washington, DC.
Report No.: INPE-4675-NTE/284
Aug 88 270p
Languages: Portuguese
Journal Announcement: GRAI8905; STAR2702
In Portuguese; English Summary.
NTIS Prices: PC A12/MF A01
Country of Publication: Brazil
This work presents a distributed system developed at INPE, designed for the Multiprocessor for Network Communications (MCR). The system supports execution of application processes by request from other processes or external events. These processes communicate with each other by asynchronously exchanging messages; the use of a logical entity called channel permits the interprocess communications, independently of where theprocesses are being executed. The MCR was designed to bepart of a packet-switching communications subnetwork node, among other applications; therefore the system must support the implementation of the lower layers of a communications protocol (layers 2 and 3 in the ISO/OSI architecture).

1351011/7
1351011 TIB/B88-81947/XAB
Nichtnukleare Energieforschung in der Bundesrepublik Deutschland. Bilanz und Ausblick. (Non-nuclear energy research in the Federal Republic of Germany. Balance and outlook)
Nitsch, J.
Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Stuttgart (Germany, F.R.). Inst. fuer Technische Physik.
Corp. Source Codes: 062740003
Report No.: DFVLR-ITP/IB-441/463-83
Jun 83 83p
Languages: German
Journal Announcement: GRAI8901
In German,
NTIS Prices: PC E09
Country of Publication: Germany, Federal Republic of
After taking a look at the present situation of energy supply in the Federal Republic of Germany the book reports on the non-nuclear energy research of 1972-1982. The topic is divided into following main points: 1) Criteria of supporting technologies; 2) A comprehensive look at the support programs and the classification of the individual areas; 3) The program 'non-nuclear energy systems'; 4) The partial program 'rational utilization of energy in the spheres of application and secondary energy'; 5) The partial program 'new energy sources';and 6) The partial program 'coal and other fossil energy sources'. (UA). (Copyright (c) 1988 by FIZ. Citation no. 88:081947.)

? t 1360264/7;t 1358316/7;t 1344931/7;t 1344375/7;t 1342170/7;t 1341664/7;t 1341275/7

1360264/7
1360264 DE88016468/XAB
BLAZE Family of Languages: Programming Environments for Shared and Distributed Memory Architectures
Mehrotra, P. ; Van Rosendale, J.
Argonne National Lab., IL. Mathematics and Computer Science Div. Corp. Source Codes: 001960004; 9502076
Sponsor: Department of Energy, Washington, DC.
Report No.: ANL/MCS-TM-108
Jun 88 15p
Languages: English
Journal Announcement: GRAI8905; NSA1300
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: W-31109-ENG-38
Designing software environments for parallel computers is a central issue in parallel computing research. This paper discusses this issue and the alternate approaches to resolving it which are being studied. We also look at the way in which the type of parallel architecture constrains the design of the programming environments. Shared memory multiprocessors provide the most freedom in the design of effective programming environments, but are more costly than nonshared memory architectures of comparable power. After this general discussion, we describe two new parallel programming languages, BLAZE 2 and KALI. The first of these, BLAZE 2, is a high level language for shared memory multiprocessors. The second, KALI, is a moderately high-level language for distributed memory architectures. We conclude with a brief discussion of the differences between these two languages, which are a consequence of the difference between shared and non-shared memory multiprocessors. 13 refs., 3 figs. (ERA citation 13:052904)

1358316/7
1358316 N89-10216/4/XAB
High Speed Fiber Optics Local Area Networks: Design and Implementation. Final Report, January 1, 1984-December 31, 1987
Tobagi, F. A.
Stanford Univ., CA.
Corp. Source Codes: 009225000; S0380476
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: NAS 1.26:182432; NASA-CR-182432
29 Sep 88 9p
Languages: English
Journal Announcement: GRAI8904; STAR2701
NTIS Prices: PC A02/MF A01
Country of Publication: United States
Contract No.: NAG2-292
The design of high speed local area networks (HSLAN) for communication among distributed devices requires solving problems

in three areas: (1) the network medium and its topology; (2) the medium access control; and (3) the network interface. Considerable progress has been made in all areas. Accomplishments are divided into two groups according to their theoretical or experimental nature. A brief summary is given in Section 2, including references to papers which appeared in the literature, as well as to Ph.D. dissertations and technical reports published at Stanford University.

1344931/7
1344931 AD-A197 101/9/XAB
Experiences with POKER
Notkin, D. ; Socha, D. ; Snyder, L. ; Bailey, M. L. ; Forstall, B.
Washington Univ., Seattle. Dept. of Computer Science.
Corp. Source Codes: 005042231; 395224
Apr 88 12p
Languages: English
Journal Announcement: GRAI8824
Sponsored in part by Grant AFOSR-88-0023.
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: N00014-86-K-0264; NSF-CCR84-16878
Experience from over five years of building nonshared memory parallel programs using the Poker Parallel Programming Environment has positioned us to evaluate our approach to defining and developing parallel programs. This paper presents the more significant results of our evaluation of Poker. The evaluation is driving our next effort in parallel programming environment; many of the results should be sufficiently general to apply to other related efforts. Keywords: Algorithms; Programming language. (kr)

1344375/7
1344375 PB88-242144/XAB
Programming Languages for Distributed Systems
Bal, H. E. ; Steiner, J. G. ; Tanenbaum, A. S.
Vrije Univ., Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica.
Corp. Source Codes: 019507011;
Sponsor: Mathematisch Centrum, Amsterdam (Netherlands).
Report No.: IR-147
Feb 88 84p
Languages: English
Journal Announcement: GRAI8823
Prepared in cooperation with Mathematisch Centrum, Amsterdam (Netherlands).
NTIS Prices: PC E04/MF A01
Country of Publication: Netherlands
The paper presents a survey of recent research in programming distributed systems, with the emphasis on new programming languages specifically designed for this purpose. Short descriptions are given of 20 languages. In addition, a comprehensive bibliography provides over 250 references to more than 100 languages for distributed programming.

1342170/7
1342170 AD-A196 931/0/XAB
Parallel Programming Paradigms (Doctoral thesis)
Nelson, P. A.
Washington Univ., Seattle. Dept. of Computer Science.
Corp. Source Codes: 005042231; 395224
Report No.: TR-87-07-02
Jul 87 142p
Languages: English Document Type: Thesis
Journal Announcement: GRAI8823
Sponsored in part by Grant NSF-DCR84-16878.
NTIS Prices: PC A07/MF A01
Country of Publication: United States
Contract No.: N00014-86-K-0264; N00014-85-K-0328
Paradigms for the development of sequential algorithms, such as divide-and-conquer and the greedy method, are well known. Paradigms for the development of parallel algorithms, especially algorithms for non-shared memory MIMD machines, are not well known. These paradigms are important, not only as tools for the development of new algorithms, but also because algorithms using the same paradigm often have common properties that can be exploited by operations such as contraction. This dissertation identifies four primary paradigms used by non-shared memory MIMD algorithms. They are compute-aggregate-broadcast, divide-and-conquer, pipelining, and reduction. Compute-aggregate-broadcast is used, for example, in numerical approximation algorithms like the conjugate gradient iterations. Three variations of the compute-aggregate-broadcast paradigm are studied. Divide-and-conquer is shown to be applicable to parallel algorithms. The relationship between divide-and-conquer algorithms and the n-cube is studied. Systolic techniques are known to be broadly applicable for the development of MIMD algorithms. Systolic algorithms are shown to be members of the more general pipelining paradigm. Finally, the reduction paradigm is briefly studied. The contraction problem, the problem arising when an algorithm requires more processors than are available on the execution machine, is studied. Special attention is given to common solutions to the contraction problem in each paradigm. (KR)
1341664/7
1341664 AD-A196 419/6/XAB
Poker (4.1): A Programmer's Reference Guide (Technical rept.)
Snyder, L.
Washington Univ., Seattle. Dept. of Computer Science.
Corp. Source Codes: 005042231; 395224
Report No.: TR-83-03-03
Apr 88 97p
Languages: English
Journal Announcement: GRAI8823
NTIS Prices: PC A05/MF A01
Country of Publication: United States
Contract No.: N00014-86-K-0264; NSF-CCR84-16878
This document gives a succinct description of the facilities

available with the Poker Parallel Programming Environment. The emphasis is on what is available rather than how to achieve particular results. Although the sections are self-contained, so that they may be referred to independently, there are a few things you should know: 1) Poker uses interactive graphics. The graphics are described in Section 2; the interaction is described in Section 3; 2) The usual programming language notion of a 'source program' as a monolithic piece of symbolic text has been replaced in Poker by a database. The way to create, view, and change the database is described in Section 4; 3) Object programs (the 'compiled database') are executed or emulated by Poker and snapshots of the execution can be continuously displayed; 4) Poker supports a variety of CHiP architectures; the current one can be displayed or changed using the CHiP Parameters facility; Section 7; 5) The back page of this document gives a summary of the commands; and 6) Other versions of Poker exists; consult Appendix B for your particular system. (kr)

1341275/7
1341275 PB88-868625/XAB
DECNET: Digital Equipment Corporation Network Architecture. January 1976-September 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for Jan 76-Sep 88)
National Technical Information Service, Springfield, VA.
Corp. Source Codes: 055665000
Sep 88 63p
Languages: English Document Type: Bibliography
Journal Announcement: GRAI8822
Supersedes PB87-867958.
NTIS Prices: PC N01/MF N01
Country of Publication: United States
This bibliography contains citations concerning the network architecture DECNET provided by the Digital Equipment Corporation. Topics include hardware and software for implementing communications between different computer operating systems. DECNET's ability to create resource sharing, communications networks, and distributed computing is examined by employing specialized protocol layers which serve the functions of network control, data access control, interprogram communications, and automatic error detection and retransmission. Applications for medical information systems, chemical laboratories, electronic mail systems, and industrial process control are presented. (This updated bibliography contains 126 citations, 40 of which are new entries to the previous edition.)
? t 1356758/7;t 1356357/7;t 1356011/7;t 1353023/7;t 1353013/7;t 1353009/7;t 1352984/7

1356758/7
1356758 PB89-122394/XAB
GRAMPS (General Real-Time Asynchronous Multiprocessor System) Operating System: User's Guide

Mansbach, P. ; Shneier, M.
National Bureau of Standards, Gaithersburg, MD.
Corp. Source Codes: 081914000;
Sponsor: Philips Labs., Briarcliff Manor, NY.
Report No.: NBSIR-88/3776
Sep 88 43p
Languages: English
Journal Announcement: GRAI8903
Prepared in cooperation with Philips Labs., Briarcliff Manor, NY. NTIS Prices: PC A03/MF A01
Country of Publication: United States
The guide describes the GRAMPS real-time multiprocessor operating system from an applications viewpoint. It presents the information needed to use GRAMPS in implementing distributed processing applications. Additional information needed by an administrator to set up and maintain a specific application appears in the Administrator's Guide.

1356357/7
1356357 PB89-115315/XAB
ESPRIT SPAN Project: A Kernel System for Integrating Parallel Symbolic and Numeric Processing (Technical rept.)
Refenes, A. N. ; McCabe, S. C. ; Treleaven, P. C.
University Coll., London (England). Dept. of Computer Science.
Corp. Source Codes: 019989026
Report No.: UCL-CS-TR-149
May 88 30p
Languages: English
Journal Announcement: GRAI8903
NTIS Prices: PC E05/MF E05
Country of Publication: United Kingdom
Within ESPRIT, Europe's $3 billion Information Technology research program, projects are developing next generation parallel computers. Each project is undertaken by a consortium of companies and universities. One such consortium (SPAN) is investigating the integration of numeric and symbolic processing involving research at the applications, language, and architecture levels. The core of the SPAN project consists of a Kernel System which connects languages and applications to a range of parallel computer architectures. The Kernel System comprises a Target Machine Language and its corresponding Virtual Machine. The paper describes the design of the SPAN Target Machine Language and its Virtual Machine. The Target Machine Language is a procedural programming language providing explicit constructs to facilitate parallel execution of programs and primitive n-ary list operations to support array and list-processing in a uniform way.

1356011/7
1356011 N88-30321/9/XAB
Performance Analysis of FDDI (Fiber Distributed Data Interface)
Johnson, M. J.
National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Corp. Source Codes: 019045001; NC473657

Report No.: NAS 1.26:183206; RIACS-TR-88.11; NASA-CR-183206
Apr 88 20p
Languages: English
Journal Announcement: GRAI8903; STAR2624
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NCC2-387

The Fiber Distributed Data Interface (FDDI) is an emerging ANSI and ISO standard for a 100 megabit per second fiber optic token ring. The performance of the FDDI media access control protocol is analyzed using a simulation developed at NASA Ames. Both analyses using standard measures of performance (including average delay for asynchronous traffic, channel utilization, and transmission queue length) and analyses of characteristics of ring behavior which can be attributed to constraints imposed by the timed token protocol on token holding time (including bounded token rotation time, support for synchronous traffic, and fairness of channel access for nodes transmitting asynchronous traffic) are included.

1353023/7
1353023 N88-29425/1/XAB
Networking and AI (Artificial Intelligence) Systems: Requirements and Benefits (Abstract Only)
Gold Hill Computers, Inc., Cambridge, MA.
Corp. Source Codes: 092849000; G1146597
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Aug 88 2p
Languages: English
Journal Announcement: GRAI8902; STAR2623
In NASA, Marshall Space Flight Center, Second Conference on Artificial Intelligence for Space Applications p 623-624.
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)
Country of Publication: United States

The price performance benefits of network systems is well documented. The ability to share expensive resources sold timesharing for mainframes, department clusters of minicomputers, and now local area networks of workstations and servers. In the process, other fundamental system requirements emerged. These have now been generalized with open system requirements for hardware, software, applications and tools. The ability to interconnect a variety of vendor products has led to a specification of interfaces that allow new techniques to extend existing systems for new and exciting applications. As an example of the message passing system, local area networks provide a testbed for many of the issues addressed by future concurrent architectures: synchronization, load balancing, fault tolerance and scalability. Gold Hill has been working with a number of vendors on distributed architectures that range from a network of workstations to a hypercube of microprocessors with distributed memory. Results from early applications are promising both for performance and scalability.

1353013/7
1353013 N88-29415/2/XAB
Design Consideration in Constructing High Performance Embedded Knowledge-Based Systems (KBS)
Dalton, S. D. ; Daley, P. C.
Martin Marietta Aerospace, Denver, CO. Denver Div.
Corp. Source Codes: 100103001; MI411300
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Aug 88 6p
Languages: English
Journal Announcement: GRAI8902; STAR2623
In NASA, Marshall Space Flight Center, Second Conference on Artificial Intelligence for Space Applications p 591-596.
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)
Country of Publication: United States
As the hardware trends for artificial intelligence (AI) involve more and more complexity, the process of optimizing the computer system design for a particular problem will also increase in complexity. Space applications of knowledge based systems (KBS) will often require an ability to perform both numerically intensive vector computations and real time symbolic computations. Although parallel machines can theoretically achieve the speeds necessary for most of these problems, if the application itself is not highly parallel, the machine's power cannot be utilized. A scheme is presented which will provide the computer systems engineer with a tool for analyzing machines with various configurations of array, symbolic, scaler, and multiprocessors. High speed networks and interconnections make customized, distributed, intelligent systems feasible for the application of AI in space. The method presented can be used to optimize such AI system configurations and to make comparisons between existing computer systems. It is an open question whether or not, for a given mission requirement, a suitable computer system design can be constructed for any amount of money.

1353009/7
1353009 N88-29411/1/XAB
Expert System for a Distributed Real-Time Trainer
Purinton, S. C. ; Wang, C. K.
National Aeronautics and Space Administration, Huntsville, AL. George C.
Marshall Space Flight Center.
Corp. Source Codes: 019043002; ND736801
Aug 88 9p
Languages: English
Journal Announcement: GRAI8902; STAR2623
In Its Second Conference on Artificial Intelligence for Space Applications p 545-554.
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)
Country of Publication: United States
The problem addressed by this expert system concerns the expansion of capability of a Real Time Trainer for the Spacelab flight crew. As requirements for more models or

fidelity are placed upon the system, expansion is necessary. The simulator can be expanded using a larger processor or by going to a distributed system and expand by adding additional processors. The distributed system is preferable because it is more economical and can be expanded in a more incremental manner. An expert system was developed to evaluate modeling and timing capability within a real time training simulator. The expert system is based upon a distributed configuration. Components of the modeled system are control tasks, network tasks, emulator tasks, processors, displays, and a network. The distributed module expert system (DMES) allows the configuring of processors, tasks,display use, keyboard use, and selection of alternate methods to update the data buffer. Modules can be defined with execution occurring in a specific processor on a network. The system consists of a knowledge front end editor to interactively generate or update the knowledge base, an inference engine, a display module, and a recording module.

1352984/7
1352984 N88-29386/5/XAB
Distributed Cooperating Processes in a Mobile Robot Control System
Skillman, T. L.
Boeing Co., Seattle, WA.
Corp. Source Codes: 004210000; BR564481
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Aug 88 12p
Languages: English
Journal Announcement: GRAI8902; STAR2623
In NASA, Marshall Space Flight Center, Second Conference on Artificial Intelligence for Space Applications p 325-336.
NTIS Prices: (Order as N88-29351/9, PC A99/MF E04)
Country of Publication: United States
A mobile inspection robot has been proposed for the NASA Space Station. It will be a free flying autonomous vehicle that will leave a berthing unit to accomplish a variety of inspection tasks around the Space Station, and then return to its berth to recharge, refuel, and transfer information. The Flying Eye robot will receive voice communication to change its attitude, move at a constant velocity, and move to a predefined location along a self generated path. This mobile robot control system requires integration of traditional command and control techniques with a number of AI technologies. Speech recognition, natural language understanding, task and path planning, sensory abstraction and pattern recognition are all required for successful implementation. The interface between the traditional numeric control techniques and the symbolic processing to the AI technologies must be developed, and a distributed computing approach will be needed to meet the real time computing requirements. To study the integration of the elements of this project, a novel mobile robot control architecture and simulation based on the blackboard

architecture was developed. The control system operation and structure is discussed.

? t 1339013/7;t 1337246/7;t 1332983/7;t 1332768/7;t 1332523/7;t 1332050/7;t 1331894/7;t 1331892/7

1339013/7
1339013 AD-A195 520/2/XAB
TAC-1: A Knowledge-Based Air Force Tactical Battle Management Testbed (Interim rept. Oct 86-Sep 87)
Nugent, R. O. ; Tucker, R. W.
MITRE Corp., McLean, VA.
Corp. Source Codes: 045505000; 402364
Sponsor: Rome Air Development Center, Griffiss AFB, NY.
Report No.: RADC-TR-88-10
Jan 88 78p
Languages: English
Journal Announcement: GRAI8822
NTIS Prices: PC A05/MF A01
Country of Publication: United States
Contract No.: F19628-87-C-0001; 5581; 27
This report describes the framework for, and a demonstration vehicle of, a knowledge-based testbed for integrating multiple artificial intelligence systems into a distributed processing network for purposes for evaluation and exploitation. TAC-1 is a version of the testbed applied to the domain of Air Force tactical battle management. The domain-independent framework includes a centralized control subnet, including a message router and a common protocol language for message passing among component systems. A Common Database and a Common Knowledge Base are essential components of the testbed. The Router directs data queries to the Common Database (one of the hosted systems) and, through the use of a Common Knowledge Base, directs service requests to the systems which can handle them. Keywords: Knowledge based systems, Distributed artificial intelligence, Cooperating knowledge based systems, Knowledge based tactical battle management. (sdw)

1337246/7
1337246 AD-A195 395/9/XAB
ACCESS: A Communicating and Cooperating Expert Systems System (Final rept. 30 Jun 87-31 Jan 88)
Cottman, B. H. ; Paslay, R. C.
Symbiotics, Inc., Caambridge, MA.
Corp. Source Codes: 092500000; 419151
31 Jan 88 112p
Languages: English
Journal Announcement: GRAI8821
NTIS Prices: PC A06/MF A01
Country of Publication: United States
Contract No.: DAAB10-87-C-0053
The primary focus of Phase I was to prototype a development environment, ACCESS, for A Communicating and Cooperating Expert Systems System. More generally, this work explored the

question of what capabilities were needed in a development environment for embedding distributed knowledge-based systems applications on personal computer or work-station class platforms. The stated goal of the Phase I research and development effort was to investigate and implement a software environment for the realization of cooperating knowledge sources on personal computers. This system was to be Lisp based, distributed processing was to be facilitated by message passing using TCP/IP, control was to be accomplished by meta-level objects and a variety of features were to be provided to aid developers in building such systems. Underlying these goals was the assumption that the tools needed to support such an effort, mainly Common Lisp, Portable Common Loops and TCP/IP, were adequate to do so. During the course of this work Symbiotics found several short-comings in these software tools and identified a need for higher level tools to facilitate distributed processing development. This report documents that work and the results of the Phase I effort.

1332983/7
1332983 N88-23083/4/XAB
Strategies for Concurrent Processing of Complex Algorithms in Data Driven Architectures
Stoughton, J. W. ; Mielke, R. R.
Old Dominion Univ., Norfolk, VA.
Corp. Source Codes: 045163000; OS853217
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: NAS 1.26:181657; NASA-CR-181657
Feb 88 73p
Languages: English
Journal Announcement: GRAI8819; STAR2616
NTIS Prices: PC A04/MF A01
Country of Publication: United States
Contract No.: NAG1-683
Research directed at developing a graph theoretical model for describing data and control flow associated with the execution of large grained algorithms in a special distributed computer environment is presented. This model is identified by the acronym ATAMM which represents Algorithms To Architecture Mapping Model. The purpose of such a model is to provide a basis for establishing rules for relating an algorithm to its execution in a multiprocessor environment. Specifications derived from the model lead directly to the description of a data flow architecture which is a consequence of the inherent behavior of the data and control flow described by the model. The purpose of the ATAMM based architecture is to provide an analytical basis for performance evaluation. The ATAMM model and architecture specifications are demonstrated on a prototype system for concept validation.

1332768/7
1332768 DE88008019/XAB
Graphical Multiprocessing Analysis Tool (GMAT)
Seager, M. K. ; Campbell, S. ; Sikora, S. ; Strout, R. ; Zosel,

M.
Lawrence Livermore National Lab., CA.
Corp. Source Codes: 068147000; 9513035
Sponsor: Department of Energy, Washington, DC.
Report No.: UCID-21348; ISCR-87-2
Mar 88 47p
Languages: English
Journal Announcement: GRAI8819; NSA1300
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: W-7405-ENG-48

The design and debugging of parallel programs is a difficult task due to the complex synchronization and data scoping issues involved to aid the programmer in parallel code development we have developed two methodologies for the graphical display of execution of parallel codes. The Graphical Multiprocessing Analysis Tools (GMAT) consist of stategraph, which represents an inheritance tree of task states, and timeliness, which represents task as flowing sequence of events. Information about the code can be displayed as the application runs (dynamic mode) or played back with time under user control (static mode). This document discusses the design and user interface issues involved in developing the parallel application display GMAT family. Also, we present an introductory user's guide for both tools. 4 figs. (ERA citation 13:032031)

1332523/7
1332523 AD-A194 128/5/XAB
Cauldrons: An Abstraction for Concurrent Problems Solving. Revision (Memorandum rept.)
Haase, K.
Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
Corp. Source Codes: 001450241; 407483
Report No.: AI-M-673
Sep 86 45p
Languages: English
Journal Announcement: GRAI8819
Revision of report dated Dec 82.
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: N00014-79-C-0260

The abstractions we have for serial programming are powerful: concepts like data types, variable binding, generalized operators, the subroutine. We do not yet have the same sort of powerful abstractions for distributed computation, but I believe that the place to look for them is the same place that we found many of our abstractions for serial computation--in our own minds. This research extends a tradition of distributed theories of mind into the implementation of a distributed problem solver. In this problem solver a number of ideas from Minsky's Society of Mind are implemented and are found to provide powerful abstractions for the programming of distributed systems. These

abstractions are the cauldron, a mechanism for instantiating reasoning contexts, the frame, a way of modularly describing those contexts and the goal-mode, a mechanism for bringing a particular context to bear on a specific task. The implementation of both these abstractions and the distributed problem solver in which they run is described, accompanied by examples of their application to various domains.

1332050/7
1332050 AD-A193 648/3/XAB
Combined And-Or Parallel Execution of Logic Programs
Gupta, G. ; Jayaraman, B.
North Carolina Univ. at Chapel Hill. Dept. of Computer Science.
Corp. Source Codes: 045592060; 409668
Report No.: TR88-012
Mar 88 23p
Languages: English
Journal Announcement: GRAI8819
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: N00014-86-K-0680; NSF-DCR86-03609
A number of approaches have recently been proposed for the parallel execution of logic programming languages, but most of them deal with either or-parallelism or and-parallelism but not both. This paper describes a high-level design for efficiently supporting both and-parallelism and or-parallelism. Our approach is based on the binding arrays method for or-parallelism and the RAP method for and-parallelism. Extensions to the binding-arrays method are proposed in order to achieve constant access-time to variables in the presence of and-parallelism. The RAP (Restricted And-Parallelism) method becomes simplified because backtracking is unnecessary in the presence of or-parallelism. The author's approach has the added effect of eliminating redundant computations when goals exhibit both and- and or-parallelism. The paper first briefly describes the basic issues in pure and-parallelism and or-parallelism, states desirable criteria for their implementation (with respect to variable access, task creation and switching), and then describes the combined and-or implementation.

1331894/7
1331894 AD-A193 465/2/XAB
Programming Language Concepts for Multiprocessors
(Interim rept.)
Jordan, H. F.
Colorado Univ. at Boulder. Computer Systems Design Group.
Corp. Source Codes: 068646038; 418831
Report No.: CSDG-87-4; ECE-TR-87-1-3
Sep 87 14p
Languages: English
Journal Announcement: GRAI8819
NTIS Prices: PC A03/MF A01
Country of Publication: United States

Contract No.: N00014-86-K-0204

It is currently possible to build multiprocessor systems which will support the tightly coupled activity of hundreds to thousands of different instruction streams, or processes. This can be done by coupling many monoprocessors, or a smaller number of pipelined multiprocessors, through a high concurrency switching network. The switching network may be couple processors to memory modules, resulting in a shared memory multiprocessor system, or it may couple processor/memory pairs, resulting in a distributed memory system. The need to direct the activity of very many processes simultaneously places qualitatively different demands on a programming language than the direction of a single process. In spite of the different requirements, most languages for multiprocessors have been simple extensions of conventional, single stream programming languages. The extensions are often implemented by way of subroutine calls and have little impact on the basic structure of the language. This paper attempts to examine the underlying conceptual structure of parallel languages for large scale multiprocessors on the basis of an existing language for shared memory multiprocessors, known as the FORCE, and to extend the concepts in this language to distributed memory systems.

1331892/7
1331892 AD-A193 463/7/XAB
Force. (Parallel Programming Language)
(Interim rept.)
Jordan, H.
Colorado Univ. at Boulder. Computer Systems Design Group.
Corp. Source Codes: 068646038; 418831
Report No.: CSDG-87-1; ECE-TR-87-1-1
Jan 87 44p
Languages: English
Journal Announcement: GRAI8819
Sponsored in part by grants NAG-1-640, NAS1-17070.
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: N00014-86-K-0204; AFOSR-85-1089

The FORCE is a parallel programming language and methodology based on the shared memory multiprocessor model of computation. It is an extension to Fortran which allows a user to write a parallel program that is independent of the number of processes executing it and in which the management of processes is suppressed. Multiple instruction streams are managed as a group by operations that synchronize them and allocate work. The system is implemented on several machines as a macro preprocessor which expands FORCE programs into Fortran code for the host system.

? t 1331037/7;t 1329890/7;t 1329055/7;t 1328670/7;t 1326261/7;t 1321106/7;t 1320158/7

1331037/7
1331037 PB88-203997/XAB

Distributed Application Programming with Extended Prolog (Distribuerad Applikationsprogrammering med Utvidgad Prolog)
Stroemberg, D.
Foersvarets Forskningsanstalt, Stockholm (Sweden).
Corp. Source Codes: 063330000
Report No.: FOA-B-30121-3.3
Jan 88 31p
Languages: English
Journal Announcement: GRAI8818
NTIS Prices: PC E03/MF A01
Country of Publication: Sweden
Many tasks in office oriented environments engage several experts and office workers. The increasing use of workstation based tools for such tasks calls for simpler and more appropriate ways to specify program distribution and user communication. The authors propose a facility to specify such task sharing. The main point in the approach is the localization term, which is an extension to a Prolog-like language. This allows us to describe a multi-user application as one unified program instead of as a set of distributed single-user programs.

1329890/7
1329890 AD-A193 297/9/XAB
Poker on the Cosmic Cube: The First Retargetable Parallel Programming Language and Environment (Technical rept.)
Snyder, L. ; Socha, D.
Washington Univ., Seattle. Dept. of Computer Science.
Corp. Source Codes: 005042231; 395224
Report No.: TR-86-02-05
Jun 86 17p
Languages: English
Journal Announcement: GRAI8818
Sponsored in part by Contract N00014-85-K-0328.
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: N00014-86-K-0264; NSF-DCR84-16878
This paper describes a technique for retargetting Poker, the first complete parallel programming environment, to new parallel architectures. The specifics are illustrated by describing the retarget of Poker to CalTech's Cosmic Cube. Poker requires only three features from the target architecture: MIMD operation, message passing inter-process communication, and a sequential language (e.g. C) for the processor elements. In return Poker gives the new architecture a complete parallel programming environment which will compile Poker parallel programs without modification, into efficient object code for the new architecture.

1329055/7
1329055 PB88-201769/XAB
Optimal Database Allocation in Distributed Computer Network Systems
Inamoto, A.
Mitsubishi Electric Corp., Tokyo (Japan).

Corp. Source Codes: 076350000
c1987 4p
Languages: Japanese
Journal Announcement: GRAI8817
Text in Japanese.
Included in Mitsubishi Denki Giho, v61 n12 p26-29 1987.
NTIS Prices: (Order as PB88-201751, PC E04/MF A01)
Country of Publication: Japan
The report concerns optimal database allocation and optimal location of processors in the distributed processing networks used for sales and product distribution management systems. The problems are formulated, and a mathematical methodology for solving these problems is presented. To minimize the system expense, the methodology is used to analyze the hardware cost of the distributed processors, the cost of the magnetic disk drive for database storage, the cost of communications over a packet switching network, and the cost of leased lines.

1328670/7
1328670 N88-21688/2/XAB
Distributed Operating Systems: An Overview
Aksit, M.
Technische Univ. Twente, Enschede (Netherlands). Dept. of Computer Science.
Corp. Source Codes: 090700004; TJ309982
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: INF-87-29; ETN-88-91830
Oct 87 26p
Languages: English
Journal Announcement: GRAI8817; STAR2614
NTIS Prices: PC A03/MF A01
Country of Publication: Netherlands
Layered systems, operating systems, and distributed computer systems are defined. The differences between parallel and distributed processing are identified. Existing distributed operating systems are listed. Distributed operating system design issues are summarized.

1326261/7
1326261 PB88-865043/XAB
Computer Networks: Data Communication Architecture and Development. January 1975-May 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for Jan 75-May 88)
National Technical Information Service, Springfield, VA.
Corp. Source Codes: 055665000
Jun 88 147p
Languages: English Document Type: Bibliography
Journal Announcement: GRAI8816
Supersedes PB87-858429.
NTIS Prices: PC N01/MF N01
Country of Publication: United States
This bibliography contains citations concerning

architecture and development of computer networks for data communication systems. Data network design, operation, performance analysis, reliability, security, maintenance and evolution are discussed. Techniques of packet switched and distributed data communication networks are presented. Applications of data communication technology are included. (This updated bibliography contains 345 citations, 22 of which are new entries to the previous edition.)

1321106/7
1321106 AD-A190 956/3/XAB
UNIX Based Programming Tools for Locally Distributed Network Applications (Master's thesis)
Frank, W. C.
Naval Postgraduate School, Monterey, CA.
Corp. Source Codes: 019895000; 251450
Dec 87 105p
Languages: English Document Type: Thesis
Journal Announcement: GRAI8815
NTIS Prices: PC A06/MF A01
Country of Publication: United States
The Graphics and Video Laboratory of the Department of Computer Science has a growing need for easy to use programming tools in support of distributed processing applications. The most pressing need is for software on three UNIX-based workstations connected via Ethernet. The remote interprocess communication tools that UNIX provides for using Ethernet are effective but complicated to learn. This requires researchers to spends much of their time becoming proficient with them instead of concentrating on the distributed application at hand. This work presents the design and implementation of several programming tools that allow programmers to establish and experiment with distributed programs in the graphics laboratory environment. The tools allow a higher level of abstraction for remote interprocess communications and establish a straightforward method for implementing distributed programs. Additionally, they support code reuseability with software templates and are modularized to be both understandable and changeable. Recommendations are made for future research and management efforts that have been highlighted by these new tools.

1320158/7
1320158 N88-19147/3/XAB
Distributed Computation of Graphics Primitives on a Transputer Network
Ellis, G. K.
National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.
Corp. Source Codes: 019039001; ND315753
Report No.: NAS 1.15:100814; ICOMP-88-3; NASA-TM-100814
1988 7p
Languages: English
Journal Announcement: GRAI8814; STAR2611

Prepared for Presentation at the Summer Computer Simulation Conference, Seattle, Wash., 25-28 Jul. 1988; Sponsored in Part by the Society for Computer Simulation.
NTIS Prices: PC A02/MF A01
Country of Publication: United States
A method is developed for distributing the computation of graphics primitives on a parallel processing network. Off-the-shelf transputer boards are used to perform the graphics transformations and scan-conversion tasks that would normally be assigned to a single transputer based display processor. Each node in the network performs a single graphics primitive computation. Frequently requested tasks can be duplicated on several nodes. The results indicate that the current distribution of commands on the graphics network shows a performance degradation when compared to the graphics display board alone. A change to more computation per node for every communication (perform more complex tasks on each node) may cause the desired increase in throughput.

? t 1314371/7;t 1314308/7;t 1312882/7;t 1312569/7;t 1306589/7;t 1306289/7;t 1302419/7

1314371/7
1314371 N88-17312/5/XAB
Systeme de Programmation Parallele Occam/Ada (Occam/Ada Parallel Programming System) (Doctoral thesis)
Nekkache, M.
Institut National des Sciences Appliquees de Lyon, Villeurbanne (France).
Lab. d'Informatique Appliquee.
Corp. Source Codes: 067950006; II354902
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: ISAL-IDI1-87-11; ETN-88-91630
1987 133p
Languages: French Document Type: Thesis
Journal Announcement: GRAI8812; STAR2609
In French; English Summary.
NTIS Prices: PC A07/MF A01
Country of Publication: France
A programming tool to specify and develop real time applications in Ada language is presented. The Occam system was chosen as a basis and translated into Ada language. Programming is regarded as a scheduling activity rather than a sequencing one. The problems involved included splitting systems in smaller parallel systems, synchronizing of the components, and mutual exclusion of shared variables. Application experience indicates that Occam may be considered a language for specification and development in Ada.

1314308/7
1314308 N88-17230/9/XAB
Task Allocation in a Distributed Computing System
Seward, W. D.

Air Force Inst. of Tech., Wright-Patterson AFB, OH. Dept. of Electrical and Computer Engineering.
Corp. Source Codes: 000805001; AI174479
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Oct 87 9p
Languages: English
Journal Announcement: GRAI8812; STAR2609
In NASA. Lyndon B. Johnson Space Center, Houston, Texas,First Annual Workshop on Space Operations Automation and Robotics (SOAR 87), p173-181.
NTIS Prices: (Order as N88-17206/9, PC A23/MF A01)
Country of Publication: United States
A conceptual framework is examined for task allocation in distributed systems. Application and computing system parameters critical to task allocation decision processes are discussed. Task allocation techniques are addressed which focus on achieving a balance in the load distribution among the system's processors. Equalization of computing load among the processing elements is the goal. Examples of system performance are presented for specific applications. Both static and dynamic allocation of tasks are considered and system performance is evaluated using different task allocation methodologies.

1312882/7
1312882 AD-A189 569/7/XAB
Why We Can't Program Multiprocessors the Way We're Trying to Do It Now (Technical rept.)
Baldwin, D.
Rochester Univ., NY. Dept. of Computer Science.
Corp. Source Codes: 010090065; 410386
Report No.: TR-224
Aug 87 36p
Languages: English
Journal Announcement: GRAI8812
Sponsored in part by Grant NSF-DCR83-20136.
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: DACA76-85-C-0001; NSF-DMC86-13489
Parallel computation is an area in which software technology lags considerably behind hardware technology. The need for parallel computing in a number of applications (e.g., scientific computing, machine vision, artificial intelligence) is unquestioned, and computers with hundreds of processors are now readily available (for instance, the Butterfly or the many derivatives of the Cosmic Cube). However, these machines are programmed in essentially the same way as existing sequential machines. The best available parallel programming languages are variants of standard sequential languages, with extensions to let the programmer explicitly divide a program into tasks and pass information between those tasks. Although designers of these languages claim that they are no harder to use than conventional sequential ones, programmers still face the problem of figuring out how to partition their application into

tasks in addition to the usual problem of translating it into a program. An appealing alternative is to leave partitioning of programs to compilers. By hiding partitioning problems from programmers, this approach should make multi-processor computers easier to program than they are now. Unfortunately efforts to develop parallelizing compilers have so far been rather unsuccessful.

1312569/7
1312569 AD-A189 245/4/XAB
Interface between Object-Oriented Systems (Technical rept.)
Crowl, L. A.
Rochester Univ., NY. Dept. of Computer Science.
Corp. Source Codes: 010090065; 410386
Report No.: TR-211
Apr 87 23p
Languages: English
Journal Announcement: GRAI8812
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: DACA76-85-C-0001; NSF-DCR83-20136
The Chrysalis operating system for the Butterfly Parallel Processor presents an object-oriented programming environment based on shared memory. However, because of Chrysalis's low level orientation and its use of type-unsafe features of the C programming language, programs using the environment are difficult to program and highly error-prone. Using C as the primary programming language for the Butterfly does not fully realize the benefit of Chrysalis's object orientation. An object-oriented programming language is natural candidate for improving the Chrysalis environment. The C ++ programming language provides a number of advantages in developing such an interface. This paper reports the successes and problems encountered in the development of Chrysalis ++, a C ++ interface to Chrysalis ++ uncovered many strengths and weakness in C ++. Some apply to C ++ in general, others apply only to its adaptation to a parallel programming environment. It is important to note that C++ is a sequential language; it is use in a parallel programming environment is therefore outside the bounds of its design.

1306589/7
1306589 AD-A188 142/4/XAB
Implementing Dynamic Arrays: A Challenge for High-Performance Machines
Mago, G. ; Partain, W.
North Carolina Univ. at Chapel Hill. Dept. of Computer Science.
Corp. Source Codes: 045592060; 409668
1986 3p
Languages: English
Journal Announcement: GRAI8810
NTIS Prices: PC A02/MF A01
Country of Publication: United States
Contract No.: DAAL03-86-G-0050
There is an increasing need for high-performance AI

machines. What is unusual about AI is that its programs are typically dynamic in the way their execution unfolds and in the data structures they use. AI therefore needs machines that are late-binding. Multiprocessors are often held out as the answer to AI's computing requirements. However, most success with multiprocessing has come from exploiting numerical computations' basic data structure-the static array (as in FORTRAN). A static array's structure does not change, so its elements (and the processing on them) may be readily distributed. In AI, the ability to change and manipulate the structure of data is paramount; hence, the pre-eminence of the LISP list. Unfortunately, the traditional pointer-based list has serious drawbacks for distributed processing. The dynamic array is a data structure that allows random access to its elements (like static arrays) yet whose structure-size and dimensions-can be easily changed, i.e., bound and re-bound at run-time. It combines the flexibility that AI requires with the potential for high performance through parallel operation. A machine's implementation of dynamic arrays gives a good insight into its potential usefulness for AI applications. Therefore, the authors outline the implementation of dynamic arrays on a machine that we are developing.

1306289/7
1306289 AD-A187 824/8/XAB
Performance Measurements of Distributed Simulation Strategies (Technical rept.)
Fujimoto, R. M.
Utah Univ., Salt Lake City. Dept. of Computer Science.
Corp. Source Codes: 016669107; 404949
Report No.: UUCS-87-026
1987 29p
Languages: English
Journal Announcement: GRAI8810
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: N00014-87-K-0184; NSF-DCR85-04826

Although many distributed simulation strategies have been developed, to data, little empirical data is available to evaluate their performance. A multiprocessor-based, distributed simulation testbed is described that was designed to facilitate controlled experimentation with distributed simulation algorithms. Using this testbed, the performance of simulation strategies using deadlock avoidance and deadlock detection and recovery techniques was examined under various synthetic workloads. The distributed simulators were compared with a uniprocessor-based event list implementation. Results of a series of experiments are reported that demonstrate that message population and the degree to which processes can look ahead in simulated time play critical roles in the performance of distributed simulators using these algorithms. An avalanche phenomenon was observed in the deadlock detection and recovery simulators as message population was increased, and was found to be a necessary condition for achieving good performance. It is demonstrated

that these distributed simulation algorithms can provide significant speedups over sequential event list implementations for some workloads, even in the presence of only a moderate amount of parallelism and many feedback loops. However, a moderate to high degree of parallelism was not sufficient to guarantee good performance for all workloads that were tested.

1302419/7
1302419 N88-13886/2/XAB
Introduction to Local Area Network Design on Ariane 5 and Future Launchers
Durand, Y. ; Pic, J.
Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
Corp. Source Codes: 071736000; SQ445108
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: SNIAS-872-422-102; ETN-88-91203
17 Jan 86 11p
Languages: English
Journal Announcement: GRAI8808; STAR2605
NTIS Prices: PC A03/MF A01
Country of Publication: France
The impact of real time local area networks (LAN) on launchers is discussed. Communication needs of a launch vehicle that call for distributed processing techniques are reviewed. The design drivers of the system are identified. A method to ensure the fulfillment of design goals, i.e., to benefit from the potentials of real time LAN is outlined.
? t 1297257/7;t 1291911/7;t 1291909/7;t 1285013/7

1297257/7
1297257 N88-12287/4/XAB
Mapping a Battlefield Simulation onto Message-Passing Parallel Architectures (Final rept.)
Nicol, D. M.
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Corp. Source Codes: 019041001; ND210491
Report No.: NAS 1.26:178396; ICASE-87-51; NASA-CR-178396
Oct 87 18p
Languages: English
Journal Announcement: GRAI8806; STAR2603
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NAS1-18107
Perhaps the most critical problem in distributed simulation is that of mapping: without an effective mapping of workload to processors the speedup potential of parallel processing cannot be realized. Mapping a simulation onto a message-passing architecture is especially difficult when the computational workload dynamically changes as a function of time and space; this is exactly the situation faced by battlefield simulations. This paper studies an approach where the simulated battlefield domain is first partitioned into many regions

of equal size; typically there are more regions than processors. The regions are then assigned to processors; a processor is responsible for performing all simulation activity associated with the regions. The assignment algorithm is quite simple and attempts to balance load by exploiting locality of workload intensity. The performance of this technique is studied on a simple battlefield simulation implemented on the Flex/32 multiprocessor. Measurements show that the proposed method achieves reasonable processor efficiencies. Furthermore, the method shows promise for use in dynamic remapping of the simulation.

1291911/7
1291911 N88-11402/0/XAB
Report from the MPP (Massively Parallel Processor) Working Group to the NASA (National Aeronautics and Space Administration) Associate Administrator for Space Science and Applications. Technical Memorandum Report, October 1, 1985-September 30, 1986 Fischer, J. R. ; Grosch, C. ; McAnulty, M. ; ODonnell, J. ; Storey, O. National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center. Corp. Source Codes: 013129001; NC999967 Report No.: NAS 1.15:87819; REPT-87B0265;s jPT]5B;C Kj&h'oY 87 64p
Languages: English
Journal Announcement: GRAI8804; STAR2602
NTIS Prices: PC A04/MF A01
Country of Publication: United States
NASA's Office of Space Science and Applications (OSSA) gave a select group of scientists the opportunity to test and implement their computational algorithms on the Massively Parallel Processor (MPP) located at Goddard Space Flight Center, beginning in late 1985. One year later, the Working Group presented its report, which addressed the following: algorithms, programming languages, architecture, programming environments, the way theory relates, and performance measured. The findings point to a number of demonstrated computational techniques for which the MPP architecture is ideally suited. For example, besides executing much faster on the MPP than on conventional computers, systolic VLSI simulation (where distances are short), lattice simulation, neural network simulation, and image problems were found to be easier to program on the MPP's architecture than on a CYBER 205 or even a VAX. The report also makes technical recommendations covering all aspects of MPP use, and recommendations concerning the future of the MPP and machines based on similar architectures, expansion of the Working Group, and study of the role of future parallel processors for space station, EOS, and the Great Observatories era.

1291909/7
1291909 N88-11398/0/XAB
Cache-Based Error Recovery for Shared Memory Multiprocessor Systems
Wu, K. ; Fuchs, W. K. ; Patel, J. H.

Illinois Univ. at Urbana-Champaign.
Corp. Source Codes: 034597000; IB655059
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: NAS 1.26:181470; NASA-CR-181470
20 Nov 87 21p
Languages: English
Journal Announcement: GRAI8804; STAR2602
Sponsored in cooperation with Texas Instruments, Inc. and Digital Equipment Corp. Presented at FTCS 18, Tokyo, Japan, June 27-30, 1987.
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NAG1-613
The problem of recovering from processor failures in shared memory multiprocessor systems is examined. A cache-based checkpointing scheme is developed utilizing a checkpointing algorithm which guarantees that a consistent global state is always maintained. Processes can recover from errors due to a faulty processor by restarting from the consistent saved computation state. There are no difficulties with checkpoint propagation in that when a process p takes a checkpoint, no other process is forced to join p in the checkpoint. The recovery algorithm allows only those processes encountering errors to perform rollback recovery while other unaffected processes on fault free processors continue normal execution. The checkpointing recovery schemes are shown to be easily integrated into standard bus-based cache coherence protocols. An analytical model is used to estimate the checkpointing frequency and the performance degradation incurred by the checkpointing scheme during normal execution.

1285013/7
1285013 AD-A184 969/4/XAB
Test and Evaluation of the Transputer in a Multi-Transputer System (Master's thesis)
Filho, J. V.
Naval Postgraduate School, Monterey, CA.
Corp. Source Codes: 019895000; 251450
Jun 87 200p
Languages: English Document Type: Thesis
Journal Announcement: GRAI8802
NTIS Prices: PC A09/MF A01
Country of Publication: United States
The purpose of this thesis is to start the evaluation of the Transputer, a 32 bit microprocessor on a chip, to verify its potentials and limitations for real time applications, in distributed systems. The evaluation concentrates on the four physical communication links, and its advertised capability to operate in parallel with the main processor (CPU), each one of them at rate of 10 mbit/sec in each direction. It also presents to the reader an introduction to the machine itself, to the Occam Programming Language, a description of the environment at the Naval Postgraduate School (NPS), and suggests to the novice a learning sequence. The evaluation programs and other

example programs presented in this thesis were implemented using the Occam Programming Language (Proto-Occam) in either the Occam Programming System (OPS) or the Transputer Development System (TDS), both resident on the VAX 11/780 computer under the VMS Operating System (VAX/VMS). ? t 1277155/7;t 1276980/7;t 1273325/7;t 1269040/7;t 1267878/7;t 1264037/7;t 1254966/7

1277155/7
1277155 PB87-867958/XAB
DECNET: Digital Equipment Corporation Network Architecture. January 1976-September 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for Jan 76-Sep 87)
National Technical Information Service, Springfield, VA.
Corp. Source Codes: 055665000
Oct 87 44p
Languages: English Document Type: Bibliography
Journal Announcement: GRAI8723
Supersedes PB86-877123.
NTIS Prices: PC N01/MF N01
Country of Publication: United States
This bibliography contains citations concerning the network architecture DECNET provided by the Digital Equipment Corporation. Topics include hardware and software for implementing communications between different computer operating systems. DECNET's ability to create resource sharing, communications networks, and distributed computing is examined by employing specialized protocol layers which serve the functions of network control, data access control, interprogram communications, and automatic error detection and retransmission. Applications for medical information systems, chemical laboratories, electronic mail systems, and industrial process control are presented. (This updated bibliography contains 86 citations, 28 of which are new entries to the previous edition.)

1276980/7
1276980 PB87-226098/XAB
Network Protocols: Proceedings of the Joint IBM (International Business Machines)/University of Newcastle upon Tyne Seminar Held in the University Computing Laboratory, September 3-6, 1985
Randell, B.
Newcastle upon Tyne Univ. (England). Computing Lab.
Corp. Source Codes: 020410010
c1986 279p
Languages: English Document Type: Conference proceeding
Journal Announcement: GRAI8723
NTIS Prices: PC E12/MF E12
Country of Publication: United Kingdom
Contents: The performance of LAN protocols; Open systems interconnection communication architecture; Realization of open systems; Electronic messaging; Another look at computer

communication protocols; Computerized commerce; High layer protocol standardization for distributed processing; IBM logical unit type 6.2--An overview; Verifying a protocol algebraically using CCS; Communication architectures for distributed systems; The state of the art in testing protocol implementations; Notes on automated protocol analysis; Standardization for open systems; On protocol engineering.

1273325/7
1273325 N87-26568/2/XAB
Network Protocols for Real-Time Applications
Johnson, M. J.
National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Corp. Source Codes: 019045001; NC473657
Report No.: NAS 1.26:180977; RIACS-TR-87.15; NASA-CR-180977
May 87 17p
Languages: English Document Type: Conference proceeding
Journal Announcement: GRAI8722; STAR2520
NTIS Prices: PC A02/MF A01
Country of Publication: United States
Contract No.: NCC2-387
The Fiber Distributed Data Interface (FDDI) and the SAE AE-9B High Speed Ring Bus (HSRB) are emerging standards for high-performance token ring local area networks. FDDI was designed to be a general-purpose high-performance network. HSRB was designed specifically for military real-time applications. A workshop was conducted at NASA Ames Research Center in January, 1987 to compare and contrast these protocols with respect to their ability to support real-time applications. This report summarizes workshop presentations and includes an independent comparison of the two protocols. A conclusion reached at the workshop was that current protocols for the upper layers of the Open Systems Interconnection (OSI) network model are inadequate for real-time applications.

1269040/7
1269040 AD-A182 513/2/XAB
CRONUS, A Distributed Operating System: CRONUS DOS Implementation (Final rept. Oct 84-Jan 86)
Schantz, R. ; Schroder, K. ; Barrow, M. ; Bono, G. ; Dean, M.
Bolt Beranek and Newman, Inc., Cambridge, MA.
Corp. Source Codes: 004246000; 060100
Sponsor: Rome Air Development Center, Griffiss AFB, NY.
Report No.: BBN-6183; RADC-TR-86-183
Dec 86 70p
Languages: English
Journal Announcement: GRAI8721
NTIS Prices: PC A04/MF A01
Country of Publication: United States
Contract No.: F30602-84-C-0171; 2530; 01
This is the final report for the second contract phase for development of the CRONUS Project. CRONUS is the name given to the distributed operating system (DOS) and system architecture for distributed application development

environment being designed and implemented by BBN Laboratories for the Air Force Rome Air Development Center (RADC). The project was begun in 1981. The CRONUS distributed operating system is intended to promote resources which are shared. Its major purpose is to provide a coherent and integrated system based on clusters of interconnected heterogeneous computers to support the development and use of distributed applications. Distributed applications range from simple programs that merely require convenient reference to remote data, to collections of complex subsystems tailored to take advantage of a distributed architecture. One of the main contributions of CRONUS is a unifying architecture and model for developing these distributed applications; as well as support for a number of system-provided functions which are common to many applications.

1267878/7
1267878 N87-24949/6/XAB
New Technology Impacts on Future Avionics Architectures
Mejzak, R. S.
Naval Air Development Center, Warminster, PA.
Corp. Source Codes: 032381000; NO000154
Sponsor: National Aeronautics and Space Administration, Washington, DC.
c1987 7p
Languages: English
Journal Announcement: GRAI8720; STAR2518
In AGARD Advanced Computer Aids in the Planning and Execution of Air Warfare and Ground Strike Operations, 7p.
NTIS Prices: (Order as N87-24940 PC A07/MF A01)
Country of Publication: United States
An interpretation of avionics architecture is provided with respect to system components, organization, and design factors. Initially, general avionics architecture characteristics are addressed followed by discussions on emerging technologies and their impact on advanced systems. Information handling requirements are projected for future tactical aircraft. In addition, advanced avionics architecture design consideration and technical issues are addressed relative to achieving improved performance, reliability, survivability, flexibility, and low life cycle cost.

1264037/7
1264037 DE87008229/XAB
Effect of Distributed Computing Technology on Wide Area Network Capacity Requirements
Hall, D. ; Johnston, W. ; Hutchinson, M. ; Rosenblum, M. ; Robertson, D.
Lawrence Berkeley Lab., CA.
Corp. Source Codes: 086929000; 9513034
Sponsor: Department of Energy, Washington, DC.
Report No.: LBL-22948; CONF-870277-1
Feb 87 12p
Languages: English Document Type: Conference proceeding
Journal Announcement: GRAI8719; NSA1200

Federal Coordinating Council on science, engineering and technology, San Diego, CA, USA, 17 Feb 1987.
Portions of this document are illegible in microfiche products.
NTIS Prices: PC A02/MF A01
Country of Publication: United States
Contract No.: AC03-76SF00098
This report identifies a need to increase wide area network capacity by as much as three orders of magnitude over the next ten years. These increases are necessary to support new distributed computing products. Such products increase productivity, but are currently available only on local area networks. There is no technical reason for limiting these products to tightly constrained geographical areas, however. They can operate perfectly well over any terrestrial distance provided sufficient bandwidth is available. Such bandwidth is available today with fiber optics. To quantify capacity requirements, network traffic generated by this newer technology is compared with traditional traffic in a local network environment. An extrapolation to wide area networks is made. Speculation about the long term future of distributed computing technology and its effect on network capacity requirements is offered. It is argued that an increase of network capacity by one order of magnitude is sufficient to accommodate new distributed computing technology on existing wide area networks. Two orders of magnitude are needed to accommodate a fully integrated distributed system such as interactive graphics. Three orders of magnitude are needed to accommodate increases in hardware speed anticipated in the next five to ten years. Availability of highly integrated, nationwide distributed computing service would significantly increase the competitive edge of the United States in science and computing. (ERA citation 12:028235)

1254966/7
1254966 DE87003740/XAB
Numerical Computation on Massively Parallel Hypercubes
McBryan, O. A.
Los Alamos National Lab., NM.
Corp. Source Codes: 072735000; 9512470
Sponsor: Department of Energy, Washington, DC.
Report No.: LA-UR-86-4218; CONF-8609173-9
1986 20p
Languages: English Document Type: Conference proceeding
Journal Announcement: GRAI8716; NSA0000
Conference on hypercube multiprocessors, Knoxville, TN, USA, 29 Sep 1986.
NTIS Prices: PC A02/MF A01
Country of Publication: United States
Contract No.: AC02-76ER03077; W-7405-ENG-36
We describe numerical computations on the Connection Machine, a massively parallel hypercube architecture with 65,536 single-bit processors and 32 Mbytes of memory. A parallel extension of COMMON LISP, provides access to the processors and network. The rich software environment is further enhanced by a powerful virtual processor capability, which extends the degree

of fine-grained parallelism beyond 1,000,000. We briefly describe the hardware and indicate the principal features of the parallel programming environment. We then present implementations of SOR, multigrid and pre-conditioned conjugate gradient algorithms for solving partial differential equations on the Connection Machine. Despite the lack of floating point hardware, computation rates above 100 megaflops have been achieved in PDE solution. Virtual processors prove to be a real advantage, easing the effort of software development while improving system performance significantly. The software development effort is also facilitated by the fact that hypercube communications prove to be fast and essentially independent of distance. 29 refs., 4 figs.
? t 1249337/7;t 1247084/7;t 1227996/7;t 1227984/7;t 1218318/7;t 1216028/7;t 1214434/7

1249337/7
1249337 PB87-858429/XAB
Computer Networks: Data Communication Architecture and Development. January 1975-April 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for Jan 75-Apr 87)
National Technical Information Service, Springfield, VA.
Corp. Source Codes: 055665000
Apr 87 135p
Languages: English Document Type: Bibliography
Journal Announcement: GRAI8713
Supersedes PB86-862703.
NTIS Prices: PC N01/MF N01
Country of Publication: United States
This bibliography contains citations concerning architecture and development of computer networks for data communication systems. Data network design, operation, performance analysis, reliability, security, maintenance and evolution are discussed. Techniques of packet switched and distributed data communication networks are presented. Applications of data communication technology are included. (This updated bibliography contains 323 citations, 37 of which are new entries to the previous edition.)

1247084/7
1247084 AD-A178 975/9/XAB
Durra: A Task-Level Description Language Preliminary Reference Manual (Final rept.)
Barbacci, M. R. ; Wing, J. M.
Carnegie-Mellon Univ., Pittsburg, PA. Software Engineering Inst. Corp. Source Codes: 005343014; 416208
Sponsor: Electronic Systems Div., Hanscom AFB, MA.
Report No.: CMU/SEI-86-TR-3; ESD-TR-86-207
Dec 86 49p
Languages: English
Journal Announcement: GRAI8713
NTIS Prices: PC A03/MF A01

Country of Publication: United States
Contract No.: F33615-84-K-1520; ARPA Order-4976

Durra is a language designed to support the development of large-grained parallel programming applications. This document is a preliminary reference manual for the syntax and semantics of the language. We are using the term description language rather than programming language to emphasize that a task-level application description is not translated into object code of some kind of executable machine language. Rather, it is to be understood as a description of the structure and behavior of a logical machine, that will be synthesized into resource allocation and scheduling directives. These directives are to be interpreted by a combination of software, firmware, and hardware in a heterogeneous machine. Although our ultimate goal is to design and implement a task-level description language that can be used for different machines and for varying applications, our first pass is influenced by both a specific architecture and by a specific application, the Autonomous Land Vehicle (ALV), and more specifically, the perception components of the ALV. We assume there is a cross-bar switch, intelligent buffers on the switch sockets, and a scheduler that can communicate with all processors, buffers, and I/O devices.

1227996/7
1227996 N87-12270/1/XAB
ELAND: An Expert System for the Configuration of Local Area Networks Applications
Tanca, L. ; Ceri, S.
Politecnico di Milano (Italy).
Corp. Source Codes: 016875000; PX565076
Sponsor: National Aeronautics and Space Administration, Washington, DC.
Report No.: REPT-86-008; ETN-86-97941
1986 30p
Languages: English
Journal Announcement: GRAI8705; STAR2503
NTIS Prices: PC A03/MF A01
Country of Publication: Italy

A rule-based expert system for configuring Local Area Networks (LAN) and for designing distributed database applications over them is described. The system includes a general-purpose inference machine for solving synthesis problems, based on two separed modules: the Tree Traversal and the Matcher. The former performs a recursive descent on a tree-structured solution space and generates a description of requirements that the final solution should posses; the latter matches these requirements to existing commercial products. The inference machine and its concrete application to the design and configuration of LAN information systems are described.

1227984/7
1227984 N87-12247/9/XAB
Parallel Scheduling of Recursively Defined Arrays
(Final rept)

Myers, T. J. ; Gokhale, M. B.
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Corp. Source Codes: 019041001; ND210491
Report No.: NAS 1.26:178195; ICASE-86-66; NASA-CR-178195
Oct 86 26p
Languages: English
Journal Announcement: GRAI8705; STAR2503
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NAS1-18107; UDRF-LTR860114
A new method of automatic generation of concurrent programs which constructs arrays defined by sets of recursive equations is described. It is assumed that the time of computation of an array element is a linear combination of its indices, and integer programming is used to seek a succession of hyperplanes along which array elements can be computed concurrently. The method can be used to schedule equations involving variable length dependency vectors and mutually recursive arrays. Portions of the work reported here have been implemented in the PS automatic program generation system.

1218318/7
1218318 N86-31261/8/XAB
Optimal Partitioning of Random Programs Across Two Processors (Final rept)
Nicol, D. M.
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Corp. Source Codes: 019041001; ND210491
Report No.: NAS 1.26:178159; ICASE-86-53; NASA-CR-178159
Aug 86 27p
Languages: English
Journal Announcement: GRAI8626; STAR2422
NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NAS1-18107
The optimal partitioning of random distributed programs is discussed. It is concluded that the optimal partitioning of a homogeneous random program over a homogeneous distributed system either assigns all modules to a single processor, or distributes the modules as evenly as possible among all processors. The analysis rests heavily on the approximation which equates the expected maximum of a set of independent random variables with the set's maximum expectation. The results are strengthened by providing an approximation-free proof of this result for two processors under general conditions on the module execution time distribution. It is also shown that use of this approximation causes two of the previous central results to be
false.

1216028/7
1216028 N86-30379/9/XAB
Dynamic Remapping of Parallel Computations with Varying

Resource Demands (Final rept)
Nicol, D. M. ; Saltz, J. H.
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Corp. Source Codes: 019041001; ND210491
Report No.: NAS 1.26:178150; ICASE-86-45; NASA-CR-178150
Jul 86 56p
Languages: English
Journal Announcement: GRAI8625; STAR2421
NTIS Prices: PC A04/MF A01
Country of Publication: United States
Contract No.: NAS1-17070; NAS1-18107

A large class of computational problems is characterized by frequent synchronization, and computational requirements which change as a function of time. When such a problem must be solved on a message passing multiprocessor machine, the combination of these characteristics lead to system performance which decreases in time. Performance can be improved with periodic redistribution of computational load; however, redistribution can exact a sometimes large delay cost. We study the issue of deciding when to invoke a global load remapping mechanism. Such a decision policy must effectively weigh the costs of remapping against the performance benefits. We treat this problem by constructing two analytic models which exhibit stochastically decreasing performance. One model is quite tractable; we are able to describe the optimal remapping algorithm, and the optimal decision policy governing when to invoke that algorithm. However, computational complexity prohibits the use of the optimal remapping decision policy. We then study the performance of a general remapping policy on both analytic models. This policy attempts to minimize a statistic W(n) which measures the system degradation (including the cost of remapping) per computation step over a period of n steps. We show that as a function of time, the expected value of W(n) has at most one minimum, and that when this minimum exists it defines the optimal fixed-interval remapping policy. Our decision policy appeals to this result by remapping when it estimates that W(n) is minimized. Our performance data suggests that this policy effectively finds the natural frequency of remapping. We also use the analytic models to express the relationship between performance and remapping cost, number of processors, and the computation's stochastic activity.

1214434/7
1214434 N86-29550/8/XAB
Approximate Algorithms for Partitioning and Assignment Problems
Iqbal, M. A.
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Corp. Source Codes: 019041001; ND210491
Report No.: NAS 1.26:178130; ICASE-86-40; NASA-CR-178130
Jun 86 31p
Languages: English
Journal Announcement: GRAI8624; STAR2420

NTIS Prices: PC A03/MF A01
Country of Publication: United States
Contract No.: NAS1-17070; NAS1-18107
The problem of optimally assigning the modules of a parallel/pipelined program over the processors of a multiple computer system under certain restrictions on the interconnection structure of the program as well as the multiple computer system was considered. For a variety of such programs it is possible to find linear time if a partition of the program exists in which the load on any processor is within a certain bound. This method, when combined with a binary search over a finite range, provides an approximate solution to the partitioning problem. The specific problems considered were: a chain structured parallel program over a chain-like computer system, multiple chain-like programs over a host-satellite system, and a tree structured parallel program over a host-satellite system. For a problem with m modules and n processors, the complexity of the algorithm is no worse than O(mnlog(W sub T/epsilon)), where W sub T is the cost of assigning all modules to one processor, and epsilon the desired accuracy.
? t 1183966/7

1183966/7
1183966 PB86-862703/XAB
Computer Networks: Data Communication Architecture and Development. 1975-March 1986 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities Database) (Rept. for 1975-Mar 86)
National Technical Information Service, Springfield, VA.
Corp. Source Codes: 055665000
Apr 86 210p
Languages: English Document Type: Bibliography
Journal Announcement: GRAI8611
Supersedes PB85-859098.
NTIS Prices: PC N01/MF N01
Country of Publication: United States
This bibliography contains citations concerning architecture and development of computer networks for data communication systems. Data network design, operation, performance analysis, reliability, security, maintenance, and evolution are discussed. Techniques of packet switched and distributed data communication networks are presented. Applications of data communication technology are included. (This updated bibliography contains 286 citations, 32 of which are new entries to the previous edition.)

Appendix C
Bibliography

BIBLIOGRAPHY

Intelligent Simulated Forces
Literature Search

Prepared by

Institute for Simulation and Training
University of Central Florida

Alluisi, Earl A. "The Promise of Interactive Networking: New Levels of Training and Readiness in Peacetime." Simulation and Training Research Symposium on Interactive Networked Simulation for Training. Orlando, FL: 26 April 1989, 38 pages.

Alluisi, Earl A. "Wargaming: Applications of Human Performance Models to System Design and Military Training." Research Study Group 9 Workshop, Orlando, FL: 9-13 May 1988, 27 pages.

Ash, Michael. "Object Oriented Systems Design with Logical CPU's." Proceedings of the Interservice/Industry Training Systems Conference, 29 Nov-1 Dec 1988, pp. 41-53, 13 pages.

"Battle Command Integration Program Initiated." C2 Mug Bulletin, Vol. VIII, No. 2, March/April 1989, p. 1+, two pages.

Battle Simulation Software Survey. PM TRADE Naval Training Center, Orlando, FL: Nov 1986, 61 pages.

Biegel, John E., Murat Draman, Gajanana Nadoli, and George H. Brooks. "Control and Inferencing Paradigms for an Intelligent Simulation Training System." Proceedings of the First Florida Artificial Intelligence Research Symposium, 4-6 May 1988, pp. 254-256, three pages.

Bloedorn, Gary W. and William H. Crooks. SIMNET Command Modules After Action Review: Draft. Perceptronics. Woodland Hills, CA: 17 March 1989, 23 pages.

Capabilities of the Intelligent Information Systems Division. Perceptronics. 4 April 1988, 52 pages.

Ceranowicz, A., S. Downes-Martin, M. Saffi. SIMNET Semi-Automated Forces Version 3.0: Implementation Issues: Report No. 6940, BBN Systems and Technologies Corporation, Cambridge, MA: 27 Oct 88, 42 pages.

Ceranowicz, A., S. Downes-Martin, M. Saffi. SIMNET Semi-Automated Forces Version 3.0: A Functional Description:

Report No. 6939. BBN Systems and Technologies Corporation, Cambridge MA: 27 Oct 1988, 89 pages.

Chappell, David B. "Push button War: The Base for Command and Staff Training." Army Trainer, Winter 1988, p. 44, four pages.

Cheng, Linfu. "RiC--Integrating Rules into C for Near Real-Time Applications." Proceedings of the First Florida Artificial Intelligence Research Symposium, 4-6 May 1988, pp. 202-207, six pages.

Childs, Ernest L. "Chet". Computerized Battle Simulation (COMBAT-SIM) Systems Description. Perceptronics. March 1987, 22 pages.

COMBAT-SIM Information Briefing. Perceptronics, (no date), 16 pages.

COMBAT-SIM Computerized Battle Simulation. Perceptronics, (no date), eight pages.

Cushman, John et al. SIMNET Command Modules Data Handbook Draft. Perceptronics. Woodland Hills, CA: 22 Dec 1988, 955 pages.

Cushman, John et al. SIMNET Command Modules Semi-Automated Forces (Version 4.0) Functional Specification Draft. Perceptronics. Woodland Hills, CA: 17 March 1989, 966 pages.

Cushman, John H., et al. SIMNET Command Modules Data Handbook Draft. Perceptronics, Woodland Hills, CA: 12 March 1989, 969 pages.

Downes-Martin, Stephen, and Maureen Saffi. SIMNET Semi-Automated OPFOR: A Functional Description: Report No. 6555. BBN Systems and Technologies Corporation, Cambridge MA: 29 September 1987, 46 pages.

FRED Attack Configuration Operator's Manual (Draft). Perceptronics, Inc. 23 August 1988, 32 pages.

FRED Scout Configuration Operator's Manual (Draft). Perceptronics, Inc., 23 August 1988, 28 pages.

Garvey, Richard E. and Thomas Radgowski. "Data Collection and Analysis: The Keys for Interactive Training for Combat Readiness." Proceedings of the Interservice/Industry Training Systems Conference, 29 Nov-1 Dec 1988, pp. 572-576, five pages.

Goodnight, James W.P. Communications Network Specification for the SIMNET M1 Simulator: Preliminary . Perceptronics, 22 August 1986, 24 pages.

Hofer, Ronald, Halim Ozkaptan, and J. Peter Kincaid. "Training Systems R&D Program: Progress and Challenges." Proceedings of the Interservice/Industry Training Systems Conference, 30 Nov-2 Dec 1987, pp. 32-51, ten pages.

Karplus, Walter J. and Alan Rogers. "Parallel Computing: A Cost-Effective Way to Achieve Real-Time Simulators and Trainers." Proceedings of the Interservice/Industry Training Systems Conference, 29 Nov-1 Dec 1988, pp. 263-273, six pages.

Katcher, Daniel I. "A Flexible Expert System Architecture for Tactical Trainers." Proceedings of the Interservice/Industry Training Systems Conference, 29 Nov-1 Dec 1988, pp. 482-487, six pages.

Lehnert, Kevin J., and Michael Sullivan. "Development and Evaluation of Artificial Intelligence Techniques for Tactical Decision Support Systems." Proceedings of the Annual AI Systems in Government Conference, 27-31 March 1989, pp.____, eight pages.

Lehnert, Kevin. "Evaluation of Planning Paradigms in the Cactus Testbed." Proceedings of the 1988 Summer Simulation Conference, 25-28 July 1988, pp._____, six pages.

Madni, A. and F. Meshkinpour. PERCNET. Perceptronics, Inc. January 1988.

Madni, Azad M., Robert Ahlers, and Yee-Yeen Chu. "Knowledge-Based Simulation: An Approach to Intelligent Opponent Modeling for Training Tactical Decision Making." Proceedings of the Interservice/Industry Training Systems Conference, 30 Nov-2 Dec 1987, pp. 179-183, five pages.

Miller, Duncan C., Arthur R. Pope, and Rolland M. Waters. "Long-Haul Networking of Simulators." Proceedings of the Interservice/Industry Training Systems Conference, 29 Nov-1 Dec 1988, pp. 577-582, six pages.

Moshell, Michael J., Charles E. Hughes, and Mikel D. Petty. "Constraints as a Specification Mechanism for Automated Opposing Forces in Networked Simulators." _____, 1989, pp. 84-98, seven pages.

Pollack, Andrew. "What is Artificial Reality? Wear a Computer and See." New York Times, 10 April 1989, pp. A1+, two pages.

Portman, Craig. Perceptronics Sound Guy Memorandum: SIMNET-M1 Sound System Interface Protocol. Perceptronics, 18 August 1986, ten pages.

Saffi, Maureen. SIMNET Semi-Automated Forces: The Air Direction Officer's Workstation User's Guide: Report No. 6784 Draft. BBN Laboratories, Inc., Cambridge MA: 25 March 1988, 24 pages.

Saffi, Maureen. SIMNET Semi-Automated OPFOR: The Company Commander's Workstation User's Guide: Draft No. 6539. BBN Laboratories Inc., Cambridge MA: 19 Nov 1987, 26 pages.

The Division 86 Tank Company SOP Coordinating Draft. United States Army Armor School, Fort Knox, KY: April 1983, 58 pages.

Thorpe, Jack A. "Warfighting with SIMNET--A Report From the Front." Proceedings of the Interservice/Industry Training Systems Conference, 29 Nov-1 Dec 1988, pp. 263-273, 11 pages.

Appendix D
IST Library Titles

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE PERFORMANCE EVALUATION OF THE COMPUTER NETWORK DYNAMIC TABLE ALOGORITHM

AUTHOR(S) C. A. NIZNIK

PUBLISHER IEEE TRANSACTIONS ON COMPUTERS

DATE OF PUBLICATION FEB. 1988

PAGE NUMBER 150 - 159

FILE # B - 01

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE INTEGRATED SERVICE DIGITAL NETWORKS: MARKET ASPECTS JANUARY 1983 - AUGUST 1988

AUTHOR(S) VARIOUS

PUBLISHER CITATIONS FROM THE COMP. DATA BASE

DATE OF PUBLICATION AUG. 1988

PAGE NUMBER 143

FILE # B - 02

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: COMPUTING ON AN ANONYMOUS RING

AUTHOR(S): H. ATTIYA
M. SNIR
M.K. WARMUTH

PUBLISHER: JOURNAL OF ASSN. COMPUT. MACHINERY
DATE OF PUBLICATION: OCT. 1988
PAGE NUMBER: 845 - 875
FILE #: B - 03

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: A GRAPH MATCHING APPROACH TO OPTIMAL TASK ASSIGNMENT IN DISTRIBUTED COMPUTING SYSTEMS USING A MINIMAX CRITERION

AUTHOR(S): WEN-HSIANG TSAI
CHIEN-CHUNG SHEN

PUBLISHER: IEEE TRANSACTIONS ON COMPUTERS
DATE OF PUBLICATION: MAR. 1985
PAGE NUMBER: 197 - 203
FILE #: B - 04

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE NETWORKS AND DISTRIBUTED COMPUTATION: CONCEPTS, TOOLS, AND ALGORITHMS

AUTHOR(S) MICHEL RAYNAL

PUBLISHER MIT PRESS, CAMBRIDGE, MASS.

DATE OF PUBLICATION 1988

PAGE NUMBER 166

FILE # B - 05

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE EFFICIENT COMPUTATION OF OPTIMAL ASSIGNMENTS FOR DISTRIBUTED TASKS

AUTHOR(S) J. B. SINCLAIR

PUBLISHER JOURNAL OF PARALLEL AND

DATE OF PUBLICATION 1987 VOL 4

PAGE NUMBER 342 - 362

FILE # B - 06

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE MODELING OF COMPUTER COMMUNICATION SYSTEMS

AUTHOR(S) ISRAEL MITRANI

PUBLISHER CAMBRIDGE UNIV. PRESS, NY
DATE OF PUBLICATION 1987
PAGE NUMBER 192
FILE # B - 07

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE HANDBOOK OF COMPUTER COMMUNICATION STANDARDS THE OPEN SYSTEMS INTERCONNECTION (OSI) MODEL AND OSI RELATED STANDARDS VOLUME 1

AUTHOR(S) WILLIAM STALLINGS

PUBLISHER HOWARD & SAMS PUBLISHING
DATE OF PUBLICATION 1988 VOL 3
PAGE NUMBER 206
FILE # B - 08

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: DATA AND COMPUTER COMMUNICATIONS

AUTHOR(S): WILLIAM STALLINGS

PUBLISHER: MACMILLAN PUBLISHING COMPANY
DATE OF PUBLICATION: 1988 VOL 2
PAGE NUMBER:
FILE #: B - 09

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: GATEWAYS COMBINE WITH STANDARDS TO BROADEN INTERCONNECTIVITY OPTIONS FOR DISSIMILIAR DEVICES

AUTHOR(S): M. EDWARDS

PUBLISHER: COMMUNICATION NEWS
DATE OF PUBLICATION: 1988 VOL 25
PAGE NUMBER: 44 - 49
FILE #: B - .0

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: SUPPORTING EXISTING TOOLS IN DISTRIBUTED PROCESSING SYSTEMS: THE CONVERSION PROBLEM

AUTHOR(S): SANDRA A. MARMAK
HONG-CHIH KOU
DILIP SONI

PUBLISHER: DISTRIBUTED COMPUTING SYSTEMS
DATE OF PUBLICATION: 1982
PAGE NUMBER: 847 - 853
FILE #: B - 11

SUBJECT: MODELING OF COMPUTER COMMUNICATIN SYSTEMS
TITLE: A NEW GATEWAY

AUTHOR(S): CARL GEIGER

PUBLISHER: DATAMATION
DATE OF PUBLICATION: OCT.1 , 1988
PAGE NUMBER: 4
FILE #: B - 12

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: THE EVOLUTION OF ARPANET

AUTHOR(S): BRAD SCHULTZ

PUBLISHER: DATAMATION
DATE OF PUBLICATION: AUG. 1, 1988
PAGE NUMBER: 71 - 74
FILE #: B - 13

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: COMMUNICATION ASPECTS OF ANSA

AUTHOR(S): A. HERBERT

PUBLISHER: COMPUTER STANDARDS AND INTERFACE
DATE OF PUBLICATION: 1988 VOL 8 # 1
PAGE NUMBER: 49 - 56
FILE #: B - 14

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE PERFORMANCE MODELS OF TOKEN RING LOCAL AREA NETWORKS

AUTHOR(S) ROBERT BERRY
K. MANI CHANDY

PUBLISHER ACM
DATE OF PUBLICATION 1983
PAGE NUMBER 266 - 274
FILE # B - 15

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE ETHERNET: DISTRIBUTED PACKET SWITCHING FOR LOCAL COMPUTER NETWORKS

AUTHOR(S) ROBERT M. METCALFE
DAVID R. BOGGS

PUBLISHER ASSOCIATION FOR COMPUTING
DATE OF PUBLICATION 1976
PAGE NUMBER 395 - 403
FILE # B - 16

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE COMPUTER NETWORKS "A CARRIER SENSE MULTIPLE ACCESS PROTOCOL FOR LOCAL NETWORKS"

AUTHOR(S) SIMON S. LAM

PUBLISHER NORTH-HOLLAND PUBLISHING CO.

DATE OF PUBLICATION 1980 VOL 4 # 1

PAGE NUMBER 21 - 32

FILE # B - 17

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE COMPUTER NETWORKS "PERFORMANCE ANALYSIS OF CARRIER SENSE MULTIPLE ACCESS WITH COLLISION DETECTION

AUTHOR(S) FOUAD A. TOBAGI
V. BRUCE HUNT

PUBLISHER NORTH-HOLLAND PUBLISHING CO.

DATE OF PUBLICATION 1980 VOL 4

PAGE NUMBER 245 - 259

FILE # B - 18

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE SIMULATION OF ETHERNET PERFORMANCE BASED ON SINGLE SERVER AND SINGLE QUEUE MODEL

AUTHOR(S) KANTI PRASAD
ASHWANI SINGHAL

PUBLISHER IEEE SIMULATION CONFERENCE ON
DATE OF PUBLICATION 1987
PAGE NUMBER 74 - 85
FILE # B - 19

SUBJECT MODELING OF COMPUTER COMMUNICATION NETWORKS

TITLE PROGRAMMING CONNECTIONIST ARCHITECTURES

AUTHOR(S) MARK A. JONES

PUBLISHER AT&T TECHINICAL JOURNAL
DATE OF PUBLICATION JAN/FEB 1988 VOL 67 #1
PAGE NUMBER 65-68
FILE # B - 20

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: ROUTING WITH PACKET DUPLICATION AND ELIMINATION IN COMPUTER NETWORKS

AUTHOR(S): ARIEL ORDA
RAPHAEL ROM

PUBLISHER: IEEE TRANSACTIONS ON
DATE OF PUBLICATION: JULY 1988 VOL 36 # 7
PAGE NUMBER: 860 - 866
FILE #: B - 21

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: NETWORK ACCESS PROTOCOLS FOR REAL-TIME DISTRIBUTED SYSTEMS

AUTHOR(S): ASOK RAY

PUBLISHER: IEEE TRANSACTIONS ON INDUSTRY
DATE OF PUBLICATION: SEPT/OCT 1988 VOL 24 #5
PAGE NUMBER: 897 - 904
FILE #: B - 22

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE MEASURED PERFORMANCE OF AN ETERNET LOCAL NETWORK

AUTHOR(S) JOHN F. SHOCH
JON A. HUPP

PUBLISHER COMMUNICATIONS OF THE ACM
DATE OF PUBLICATION DEC 1980 VOL 23 #12
PAGE NUMBER 711 - 720
FILE # B - 23

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE PERFORMANCE CHARACTERISTICS OF 2 ETHERNETS: AN EXPERIMENTAL STUDY

AUTHOR(S) TIMOTHY A. GONSALVES

PUBLISHER ACM
DATE OF PUBLICATION 1985
PAGE NUMBER 78 - 86
FILE # B - 24

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: A TASK ALLOCATION MODEL FOR DISTRIBUTED COMPUTING SYSTEMS

AUTHOR(S): PERNG-YI RICHARD MA
EDWARD Y. S. LEE
MASAHIRO TSUCHIYA

PUBLISHER: IEEE TRANSACTIONS ON COMPUTERS
DATE OF PUBLICATION: JAN 1982 VOL C-31 #1
PAGE NUMBER: 41 - 46
FILE #: B - 25

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: PEER-TO-PEER PROTOCOL FACILITIES REAL-TIME COMMUNICATION

AUTHOR(S): DEIF N. ATALLAH

PUBLISHER: EDN
DATE OF PUBLICATION: AUG 18, 1988
PAGE NUMBER: 179 - 186
FILE #: B - 26

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: ROUTING WITH PACKET DUPLICATION AND ELIMINATION IN COMPUTER NETWORKS

AUTHOR(S): ARIEL ORDA
RAPHAEL ROM

PUBLISHER: IEEE TRANSACTIONS ON COMPUTERS
DATE OF PUBLICATION: JULY 1988 VOL 36 # 7
PAGE NUMBER: 860 - 866
FILE #: B - 27

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: NETWORKED SIMULATORS: USING MODELS AND EXPERIENCED FOR DESIGN

AUTHOR(S): GORDON ANDERSON
STEVE SEIDENSTICKER

PUBLISHER: PROCEEDINGS INTERACTIVE NETWORKED
DATE OF PUBLICATION: APRIL 26&27, 1989
PAGE NUMBER: 91 - 95
FILE #: B - 28

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: PLANNING THE DESIGN OF TRAINING FOR A STATE-WIDE DATA COMMUNICATIONS NETWORK

AUTHOR(S): CANDACE M. ZACHER

PUBLISHER: EDRS

DATE OF PUBLICATION: 1987

PAGE NUMBER: 1 - 9

FILE #: B - 29

SUBJECT: MODELING OF COMPUTER COMMUNICATIONS SYSTEMS

TITLE: RECENT DEVELOPMENTS IN INTERNATIONAL STANDARDS FOR INFORMATION TECHNOLOGY

AUTHOR(S): BRYAN WOOD

PUBLISHER: NETWORKING TECHNOLOGY AND

DATE OF PUBLICATION: JUNE 1988

PAGE NUMBER: 7-19

FILE #: B - 30

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATIONS SYSTEMS
TITLE: PROGRESS AND PRACTICE IN CONFORMANCE TESTING AND CERTIFICATION

AUTHOR(S): DR. JEREMY TURFF

PUBLISHER: NETWORKING TECHNOLOGY AND
DATE OF PUBLICATION: JUNE 1988
PAGE NUMBER: 31-37
FILE #: B - 31

SUBJECT: MODELING OF COMPUTER COMMUNICATIONS SYSTEMS
TITLE: RECENT PROGRESS IN PROFILES FOR OSI

AUTHOR(S): RICHARD LLOYD

PUBLISHER: NETWORKING TECHNOLOGY AND
DATE OF PUBLICATION: JUNE 1988
PAGE NUMBER: 21-29
FILE #: B - 32

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATIONS SYSTEMS

TITLE: BOUNDING THE MAXIMUM SIZE OF A PACKET RADIO NETWORK

AUTHOR(S): CRAIG C. PROHAZKA

PUBLISHER: IEEE TRANSACTIONS ON COMPUTERS

DATE OF PUBLICATION: OCT. 1988

PAGE NUMBER: 1184-1190

FILE #: B - 33

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: A MONITORING SYSTEM FOR AN ETHERNET INSTALLATION

AUTHOR(S): MICHELLE S. LEUNER
JOSEPH L. HAMMOND

PUBLISHER: PROCEEDINGS: SOUTHEASTERN

DATE OF PUBLICATION: 1988

PAGE NUMBER: 160-164

FILE #: B - 34

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATIONS SYSTEMS

TITLE: AN EFFICIENT METHOD FOR SIMULATING TOKEN RING BUS ACCESS PROTOCOLS

AUTHOR(S): D. PANCHMATIA
J.L. HAMMOND
W. TIPPER

PUBLISHER: PROCEEDINGS: SOUTHEASTERN
DATE OF PUBLICATION: 1988
PAGE NUMBER: 165-169
FILE #: B - 35

SUBJECT: MODELING OF COMPUTER COMMUNICATIONS SYSTEMS

TITLE: SHIPNET: A REAL-TIME LOCAL AREA NETWORK FOR SHIPS

AUTHOR(S): ROBERT SIMONCIC
ALFRED C. WEAVER
BRENDAN G. CAIN
M. ALEXANDER COLVIN

PUBLISHER: UNIVERSITY OF VIRGINIA
DATE OF PUBLICATION: 6 JUNE, 1988
PAGE NUMBER: TR-88-15
FILE #: B - 3

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATIONS SYSTEMS
TITLE: XTP/PE OVERVIEW

AUTHOR(S): GREG CHESSON

PUBLISHER: SILICON GRAPHICS
DATE OF PUBLICATION: INFORMATION NOT AVAILABLE
PAGE NUMBER: 292 - 296
FILE #: B - 37

SUBJECT: MODELING OF COMPUTER COMMUNICATIONS SYSTEMS
TITLE: INTEGRATION VOICE/DATA SWITCHING

AUTHOR(S): THOMAS M. CHEN
DAVID G. MESSERSCHMITT

PUBLISHER: IEEE COMMUNICATIONS MAGAZINE
DATE OF PUBLICATION: JUNE 1988
PAGE NUMBER: 16 - 26
FILE #: B - 38

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE MILITARY STANDARD COMMON LONG HAUL AND TACTICAL COMMUNICATION SYSTEM TECHNICAL STANDARDS

AUTHOR(S) NONE

PUBLISHER DEPARTMENT OF DEFENSE

DATE OF PUBLICATION 15 NOVEMBER, 1972

PAGE NUMBER 186

FILE # B - 39

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE VERY LARGE AREA NETWORKS (VLAN) KNOWLEDGE-BASE APPLIED TO SPACE COMMUNICATION PROBLEMS

AUTHOR(S) CAROL S. ZANDER

PUBLISHER DEPT. COMPUTER SCIENCE COLORADO

DATE OF PUBLICATION OCTOBER 1988

PAGE NUMBER 401 - 409

FILE # B - 40

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: EUROPEAN SEMINAR ON NEURAL COMPUTING

AUTHOR(S): CLAIRE ZOMZELY-NEURATH

PUBLISHER: US OFFICE OF NAVAL RESEARCH,
DATE OF PUBLICATION: 31 AUGUST 1988
PAGE NUMBER: 35
FILE #: B - 41

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: THE FORCE

AUTHOR(S): HARRY JORDAN

PUBLISHER: NTIS - COMPUTER SYSTEMS DESIGN
DATE OF PUBLICATION: JANUARY 1987
PAGE NUMBER: 42
FILE #: B - 42

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: CRONUS, A DISTRIBUTED OPERATING SYSTEM: CRONUS DOS IMPLEMENTATIONS

AUTHOR(S): R. SCHANTZ, M. BARROW, M. DEAN, K. LAM, S. LIPSON, R. SANDS, K. SCHRODER, G. BONO, R. GURWITZ, K. LEBOWITZ, P. NEVES

PUBLISHER: NTIS - ROME AIR DEVELOPEMENT

DATE OF PUBLICATION: OCT. 31, 1988

PAGE NUMBER: 55

FILE #: B - 45

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: NUMERICAL COMPUTATIONS ON MASSIVELY PARRALLEL HYPERCUBES

AUTHOR(S): OLIVER A. McBRYAN

PUBLISHER: NTIS - LOS ALAMOS NATIONAL

DATE OF PUBLICATION: OCT. 1, 1986

PAGE NUMBER: 18

FILE #: B - 46

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: CACHE BASED ERROR RECOVERY FOR SHARED MEMORY MULTIPROCESSOR SYSTEMS

AUTHOR(S): KUN-LUNG WU
KENT FUCHS
JANAK H. PATEL

PUBLISHER: NTIS - COMPUTER SYSTEMS GROUP
DATE OF PUBLICATION: JUNE 27-30, 1987
PAGE NUMBER: 21
FILE #: B - 47

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: POKER 4.1: A PROGRAMMER'S REFERENCE GUIDE

AUTHOR(S): LAWRENCE SNYDER

PUBLISHER: NTIS - UNIVERSITY OF WASHINGTON
DATE OF PUBLICATION: APRIL 1988
PAGE NUMBER: 94
FILE #: B - 48

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: NETWORK PROTOCOLS: PROCEEDINGS OF THE JOINT IBM/UNIVERSITY OF NEWCASTLE UPON TYNE SEMINAR HELD IN THE UNIVERSITY COMPUTER LABATORY

AUTHOR(S): EDITED BY B. RAYNDELL

PUBLISHER: NTIS
DATE OF PUBLICATION: NOV. 9, 1987
PAGE NUMBER: 273
FILE #: B - 49

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: TAC - 1: KNOWLEDGE BASED AIRFORCE TACTICAL BATTLE MANAGEMENT TESTBED

AUTHOR(S): RICHARD O. NUGENT
RICHARD W. TUCKER

PUBLISHER: THE MITRE CORPORATION
DATE OF PUBLICATION: JAN. 1988
PAGE NUMBER: 84
FILE #: B - 50

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: CITATIONS FROM THE INFORMATION SERVICES FOR THE PHYSICS AND ENGINEERING COMMUNITIES INSPEC DATABASE
COMPUTER NETWORKS: DATA COMMUNICATION ARCHITECTURE AND

AUTHOR(S):

PUBLISHER: NTIS
DATE OF PUBLICATION: 1988
PAGE NUMBER: 130
FILE #: B - 53

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: CITATIONS FROM THE INFORMATION SERVICES FOR THE PHYSICS AND ENGINEERING COMMUNITIES INSPEC DATABASE
DECNET: DIGITAL EQUIPMENT CORPORATION NETWORK ARCHITECTURE

AUTHOR(S):

PUBLISHER: NTIS
DATE OF PUBLICATION: SEPT 1988
PAGE NUMBER: 62
FILE #: B-54

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: PARALLEL PROGRAMMING PARADIGMS

AUTHOR(S): PHILIP ARNE NELSON

PUBLISHER: NTIS - UNIVERSITY OF WASHINGTON
DATE OF PUBLICATION: JULY 1987
PAGE NUMBER: 132
FILE #: B - 51

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: APPROXIMATE ALGORITHMS FOR PARTITIONING AND ASSIGNMENT PROBLEMS

AUTHOR(S): M. ASHRAF IQBAL

PUBLISHER: NASA LANGLEY RESEARCH CENTER
DATE OF PUBLICATION: JUNE 1986
PAGE NUMBER: 30
FILE #: B - 52

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE EUROPEAN SEMINAR ON NEURAL COMPUTING

AUTHOR(S) CLAIRE ZOMZELY-NEURATH

PUBLISHER OFFICE OF NAVAL RESEARCH

DATE OF PUBLICATION AUG. 31, 1988

PAGE NUMBER 38 (presently on microfiche)

FILE # B - 55

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE OPTIMAL PARTITIONING OF RANDOM PROGRAMS ACROSS TWO PROCESSORS

AUTHOR(S) D. M. NICOL

PUBLISHER LANGLEY RESEARCH CENTER

DATE OF PUBLICATION AUG. 1986

PAGE NUMBER 27 (presently on microfiche)

FILE # B - 56

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE AN EXPERT SYSTEM FOR THE CONFIGURATION OF LOCAL AREA NETWORKS APPLICATIONS

AUTHOR(S) L. TANCA
S. CERI

PUBLISHER POLYTECHNICAL OF MILANO
DATE OF PUBLICATION 1986
PAGE NUMBER 30 (presently on microfiche)
FILE # B - 57

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE MAPPING A BATTLEFIELD SIMULATION ONTO MESSAGE-PASSING PARALLEL ARCHITECTURES

AUTHOR(S) D.M. NICOL

PUBLISHER NASA LANGELY RESEARCH CENTER
DATE OF PUBLICATION OCT. 1987
PAGE NUMBER 18 (presently on microfiche)
FILE # B - 58

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: ANALYSIS OF FDDI SYNCHRONOUS TRAFFIC DELAYS

AUTHOR(S): MARJORY J. JOHNSON

PUBLISHER: NASA
DATE OF PUBLICATION: JAN. 1988
PAGE NUMBER: 21 (presently on microfiche)
FILE #: B - 59

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: THE EFFECT OF DISTRIBUTED COMPUTING TECHNOLOGY ON WIDE AREA NETWORK CAPACITY REQUIREMENTS

AUTHOR(S): DENNIS HALL
WILLIAM JOHNSTON
MARGE HUTCHINSON
MENDEL ROSENBLUM
DAVID ROBERTSON

PUBLISHER: NTIS - LAWRENCE BERKELEY LABATORY
DATE OF PUBLICATION: FEB. 1987
PAGE NUMBER: 10
FILE #: B - 60

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: THE BLAZE FAMILY OF LANGUAGES: PROGRAMMING ENVIRONMENTS FOR SHARED AND DISTRIBUTED MEMORY ARCHITECTURES

AUTHOR(S): PIYUSH MEHROTRA
JOHN VAN ROSENDALE

PUBLISHER: NTIS - ARGONNE NATIONAL LABATORY
DATE OF PUBLICATION: JUNE 1988
PAGE NUMBER: 13
FILE #: B - 61

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: EFFICIENT PARALLEL ARCHITECTURE FOR HIGHLY COUPLED REAL-TIME LINEAR SYSTEM APPLICATIONS

AUTHOR(S): CHESTER C. CARROLL
ABDOLLAH HOMAIFAR
SOUMAVO BARUA

PUBLISHER: BUREAU OF ENGINEERING RESEARCH THE
DATE OF PUBLICATION: JANUARY 1988
PAGE NUMBER: 85
FILE #: B - 62

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: ESTIMATION AND IDENTIFICATION OF NONLINEAR DYNAMIC SYSTEMS

AUTHOR(S): D. JOSEPH MOOK

PUBLISHER: AIAA JOURNAL

DATE OF PUBLICATION: JULY 1989

PAGE NUMBER: 968 - 974

FILE #: B - 63

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: SIMULATION NETWORKING PROTOCOL ALTERNATIVES

AUTHOR(S): DR. MICHAEL GEORGIOPOULOS

PUBLISHER: IST

DATE OF PUBLICATION: 1 AUGUST 1988 THRU 31 JULY 1989

PAGE NUMBER: 78

FILE #: B - 64

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: PROGRAMMING LANGUAGES FOR DISTRIBUTED SYSTEMS

AUTHOR(S): H. E. BAL
J. G. STEINER
A. S. TANENBAUM

PUBLISHER: NTIS - VRIJE UNIVERSITY, AMSTERDAM
DATE OF PUBLICATION: FEB. 1988
PAGE NUMBER: 84
FILE #: B - 65

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: WHY WE CAN'T PROGRAM MULTIPROCESSORS THE WAY WE'RE TRYING TO DO IT NOW

AUTHOR(S): DOUG BALDWIN

PUBLISHER: NTIS - DEPT. OF COMPUTER SCIENCE
DATE OF PUBLICATION: AUGUST 1987
PAGE NUMBER: 33
FILE #: B - 66

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: IMPLEMENTING DYNAMIC ARRAYS: A CHALLENGE FOR HIGH-PERFORMANCE MACHINES

AUTHOR(S): GYULA MAGO'
WILL PARTAIN

PUBLISHER: NTIS - DEPT. OF COMPUTER SCIENCE
DATE OF PUBLICATION: NOV. 23 1987
PAGE NUMBER: 491 - 493
FILE #: B - 67

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: UNIX BASED PROGRAMMING TOOLS FOR LOCALLY DISTRIBUTED NETWORK APPLICATIONS

AUTHOR(S): WILLIAM C. FRANK

PUBLISHER: NTIS - NAVAL POSTGRADUATE SCHOOL
DATE OF PUBLICATION: DECEMBER 1987
PAGE NUMBER: 105
FILE #: B - 68

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: HANDBOOK OF COMPUTER COMMUNICATIONS STANDARDS LOCAL NETWORK STANDARDS VOLUME 2

AUTHOR(S): WILLIAM STALLINGS

PUBLISHER: HOWARD W. SAMS & COMPANY

DATE OF PUBLICATION: 1988 BOOK

PAGE NUMBER: 244

FILE #: B - 69

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: HANDBOOK OF COMPUTER COMMUNICATIONS STANDARDS DEPARTMENT OF DEFENSE (DOD) PROTOCOL STANDARDS VOLUME 3

AUTHOR(S): WILLIAM STALLINGS

PUBLISHER: MACMILLAN PUBLISHING

DATE OF PUBLICATION: 1988

PAGE NUMBER: 240

FILE #: B - 70

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE HIGH SPEED FIBER OPTICS LOCAL AREA NETWORKS: DESIGN AND IMPLEMENTATION

AUTHOR(S) F. A. TOBAQI

PUBLISHER STANFORD UNIVERSITY

DATE OF PUBLICATION SEPTEMBER 29, 1988

PAGE NUMBER 9 (presently on microfiche)

FILE # B - 71

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE AN INTERFACE BETWEEN OBJECT ORIENTED SYSTEMS

AUTHOR(S) LAWRENCE A. CROWL

PUBLISHER UNIVERSITY OF ROCHESTER COMPUTER

DATE OF PUBLICATION APRIL 1987

PAGE NUMBER 20

FILE # B - 72

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: DISTRIBUTED OPERATING SYSTEMS: AN OVERVIEW

AUTHOR(S): MEHMET AKSIT

PUBLISHER: TECHNICAL UNIVERSITY OF TWENTE
DATE OF PUBLICATION: OCTOBER 1987
PAGE NUMBER: 23
FILE #: B - 73

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: DISTRIBUTED COMPUTATION OF GRAPHICS PRIMATIVES ON A TRANSPUTER NETWORK

AUTHOR(S): G. K. ELLIS

PUBLISHER: NASA
DATE OF PUBLICATION: 1988
PAGE NUMBER: 7
FILE #: B - 74

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE PERFORMANCE ANALYSIS OF FDDI

AUTHOR(S) M. J. JOHNSON

PUBLISHER NASA
DATE OF PUBLICATION APRIL 1988
PAGE NUMBER 18
FILE # B - 75

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE NETWORK PROTOCOLS FOR REAL TIME APPLICATIONS

AUTHOR(S) M. J. JOHNSON

PUBLISHER NASA, AMES RESEARCH CENTER
DATE OF PUBLICATION MAY 1987
PAGE NUMBER 17 (presently on microfiche)
FILE # B - 76

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: TEST AND EVALUATION OF THE TRANSPUTER IN A MULTI-TRANSPUTER SYSTEM

AUTHOR(S): JOSE VANNI FILHO

PUBLISHER: NAVAL POSTGRADUATE SCHOOL

DATE OF PUBLICATION: JUNE 1987

PAGE NUMBER: 201

FILE #: B - 77

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: ANSI/IEEE INTERNATIONAL STANDARD 8802/3 "Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specification"

AUTHOR(S):

PUBLISHER: IEEE Computer society press

DATE OF PUBLICATION: 1985

PAGE NUMBER:

FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: ETHERNET DISTRIBUTED PACKET SWITCHING FOR LOCAL COMPUTER NETWORKS

AUTHOR(S): R.M. METETCALFE
D.R. BOGGS

PUBLISHER: COMMUNICATION ASS. COMPUT. MACH.
DATE OF PUBLICATION: 1976 VOL. 19 # 7
PAGE NUMBER: 395 - 403
FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: A DECENTRALIZED CONFLICT FREE PROTOCOL, GBRAM FOR LARGE SCALE LOCAL NETWORKS

AUTHOR(S): T.T. LIU
L. LI
W.R. FRANTA

PUBLISHER: COMPUTER NETWORK SYMPOSIUM
DATE OF PUBLICATION: DEC. 1981
PAGE NUMBER: 39 - 54
FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: ANSI/IEEE - INTERNATIONAL STANDARD 8802/5 "Token Ring Access"

AUTHOR(S):

PUBLISHER:
DATE OF PUBLICATION: 1985
PAGE NUMBER:
FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: "Measured Performance of the Ethernet" ADVANCES IN LOCAL AREA NETWORKS

AUTHOR(S): T.A. GONSALVES
EDITORS:
K. KUMMERLE
J.O. LIMB
F.A. TOBAGI

PUBLISHER: IEEE PRESS
DATE OF PUBLICATION: 1987
PAGE NUMBER: 383 - 410
FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE "Local Area Networks - Major Technologies and Trends" in LOCAL AREA NETWORKS

AUTHOR(S) K. KUMMERLE
M. REISER
EDITORS:
K. KUMMERLE
J.O. LIMB
F.A. TOBAGI

PUBLISHER IEEE PRESS
DATE OF PUBLICATION 1987
PAGE NUMBER 2 - 27
FILE # can be accessed upon request

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE "Architecture and design of a reliable token ring network" in LOCAL AREA NETWORKS

AUTHOR(S) W. BUX F.H. CLOSS
K. KUMMERLE H.J.KELLER
H.R. MUELLER
EDITORS:
K. KUMMERLE J.O. LIMB
F.A. TOBAGI

PUBLISHER IEEE PRESS
DATE OF PUBLICATION 1987
PAGE NUMBER 67 - 80
FILE # can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: "Description of FASNET - a Unidirectional Local Area Communications Network" in LOCAL AREA NETWORKS

AUTHOR(S): J.O. LIMB
C. FLORES
EDITORS:
K. KUMMERLE
J.O. LIMB
F.A. TOBAGI

PUBLISHER: IEEE PRESS

DATE OF PUBLICATION: 1987

PAGE NUMBER: 190 - 205

FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: "Optic Fibers in Local Area Networks" in LOCAL AREA NETWORKS

AUTHOR(S): M.R. FINLEY JR.
EDITORS:
K. KUMMERLE
J.O. LIMB
F.A. TOBAGI

PUBLISHER: IEEE PRESS

DATE OF PUBLICATION: 1987

PAGE NUMBER: 224 - 243

FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: "A Distributed Experimental Communication System" in LOCAL AREA NETWORKS

AUTHOR(S): J.D. DETREVILLE
W.D. SINCOSKIE
EDITORS:
K. KUMMERLE
J.O. LIMB
F.A. TOBAGI

PUBLISHER: IEEE PRESS

DATE OF PUBLICATION: 1987

PAGE NUMBER: 533 - 542

FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: SIMNET NETWORK PERFORMANCE

BBN REPORT 6711

AUTHOR(S): D. FRIEDMAN
V. HAIMO

PUBLISHER: BBN COMMUNICATIONS CORP.,

DATE OF PUBLICATION: JAN. 1988

PAGE NUMBER:

FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: THE SIMNET NETWORK AND PROTOCOLS

BBN REPORT NUMBER 6787

AUTHOR(S): A. POPE

PUBLISHER: BBN LABORATORIES, INC., CAMBRIDGE,

DATE OF PUBLICATION: MAY 1988

PAGE NUMBER:

FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: BRAM THE BROADCAST RECOGNITION ACCESS METHOD

AUTHOR(S): I. CHLAMTAC
W.R. FRANTA
K.D. LEVIN

PUBLISHER: IEEE TRANSACTIONS ON

DATE OF PUBLICATION: AUGUST 1989 VOL COM-27 # 8

PAGE NUMBER: 1183 - 1189

FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE "Long Haul Networking of Simulators" PROCEEDINGS 10th INTERSERVICE/INDUSTRY TRAINING SYSTEMS CONFERENCE

AUTHOR(S) D.C. MILLER
A. POPE
R.M. WATERS

PUBLISHER
DATE OF PUBLICATION NOV 29 - DEC 1, 1988
PAGE NUMBER 577 - 582
FILE # can be accessed upon request

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE "ISDN 83" special issue on ISDNs

AUTHOR(S) F.T. ANDREWS JR.

PUBLISHER IEEE COMMUNICATIONS MAGAZINE
DATE OF PUBLICATION JAN 1984 VOL 22 #1
PAGE NUMBER 6 - 10
FILE # can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE "Transition to ISDN - an Overview" special issue on ISDNs

AUTHOR(S) D.J. KOSTAS

PUBLISHER IEEE COMMUNICATIONS MAGAZINE

DATE OF PUBLICATION JAN 1984 VOL 22 #1

PAGE NUMBER 11 - 17

FILE # can be accessed upon request

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE ISDN PROTOCOL ARCHITECTURE

AUTHOR(S) N.Q. DUC
E.K. CHEW

PUBLISHER IEEE COMM. MAG

DATE OF PUBLICATION MARCH 1985 VOL 23 #3

PAGE NUMBER 15 - 22

FILE # can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: DESIGN APPROACHES AND PERFORMANCE CRITERIA FOR INTERGRATED VOICE/DATA SWITCHING

AUTHOR(S): M. ROSS

PUBLISHER: PROC. IEEE
DATE OF PUBLICATION: SEPT 1977 VOL 65 #9
PAGE NUMBER: 1283 - 1295
FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: TELECOMMUNICATION NETWORKS

AUTHOR(S): M. SCHWARTZ

PUBLISHER: ADDISON AND WESLEY
DATE OF PUBLICATION: 1987
PAGE NUMBER:
FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: DATA NETWORKS

AUTHOR(S): D. BERTSEKAS
R. GALLAGER

PUBLISHER: PRENTICE HALL
DATE OF PUBLICATION: 1987
PAGE NUMBER:
FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: SIMULATION MODELING AND SIMNET

AUTHOR(S): H.A. TAHA

PUBLISHER: PRENTICE HALL
DATE OF PUBLICATION: 1988
PAGE NUMBER:
FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE "Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specification" ANSI/IEE - INTERNATIONAL STANDARD 8802/3

AUTHOR(S)

PUBLISHER IEEE COMPUTER SOCIETY PRESS

DATE OF PUBLICATION 1985

PAGE NUMBER

FILE # can be accessed upon request

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE "Token-Passing Bus Access Method" ANSI/IEE - DRAFT INTERNATIONAL STANDARD ISO/DIS 8802/4

AUTHOR(S)

PUBLISHER IEEE COMPUTER SOCIETY PRESS

DATE OF PUBLICATION 1985

PAGE NUMBER

FILE # can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: "Token Ring Access" ANSI/IEEE - INTERNATIONAL STANDARD 8802/5

AUTHOR(S):

PUBLISHER: IEEE COMPUTER SOCIETY PRESS

DATE OF PUBLICATION: 1985

PAGE NUMBER:

FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: "Performance Models of Token Ring Local Area Networks" PROCEEDINGS OF ACM SIGMETRICS CONFERENCE ON MEASUREMENT AND MODELING OF COMPUTER SYSTEMS

AUTHOR(S): R. BERRY
K. CHANDY

PUBLISHER:

DATE OF PUBLICATION: 1983

PAGE NUMBER: 29 - 31

FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: SIMSCRIPT II.5 PROGRAMMING LANGUAGE

AUTHOR(S): CACI INC.

PUBLISHER: CACI, INC. FEDERAL LOS ANGELES, CA
DATE OF PUBLICATION: 1987
PAGE NUMBER:
FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: A TOKEN RING NETWORK FOR LOCAL DATA COMMUNICATION

AUTHOR(S): R. DIXON
N. STROLE
J. MARKOV

PUBLISHER: IBM SYSTEM JOURNAL
DATE OF PUBLICATION: 1983 VOL 22
PAGE NUMBER: 62-74
FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: "SIMNET ETHERNET Performance" BBN TECHNICAL REPORT No 6711

AUTHOR(S): D. FRIEDMAN
V. HAIMO

PUBLISHER: BBN COMMUNICATIONS CORP. MA
DATE OF PUBLICATION: 1988
PAGE NUMBER:
FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: DATA COLLECTION AND ANALYSIS: THE KEYS FOR INTERACTIVE TRAINING FOR COMBAT READINESS

AUTHOR(S): R. GARVEY
T. RADGOWSJKI

PUBLISHER: PROCEEDINGS OF I/ITSC CONFERENCE
DATE OF PUBLICATION: 1988
PAGE NUMBER: 572 - 576
FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: "Concurrent C" TECHNICAL REPORT

AUTHOR(S): N. GEHANI
W. ROOME

PUBLISHER: AT & T BELL LABORATORIES
DATE OF PUBLICATION: 1986
PAGE NUMBER:
FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: "Benchmarking LAN Protocol Analyzers"PROCEEDINGS OF 13th IEEE CONFERENCE ON LOCAL COMPUTER NETWORKS

AUTHOR(S): J. HAUGDAHL

PUBLISHER:
DATE OF PUBLICATION: 1988
PAGE NUMBER: 375 - 384
FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: HP 4792A LAN PROTOCOL ANALYZER: VOL I: GETTING STARTED, VOL II: OPERATING MANUAL

AUTHOR(S): HEWLETT-PACKARD

PUBLISHER: HP TELECOMMUNICATIONS DIVISION

DATE OF PUBLICATION: 1987

PAGE NUMBER:

FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: CONCURRENT EUCLID, THE UNIX SYSTEM AND TUNIS

AUTHOR(S): R. HOLT

PUBLISHER: ADDISON-WESLEY, READING MA

DATE OF PUBLICATION: 1983

PAGE NUMBER:

FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: STRUCTURED CONCURRENT PROGRAMMING WITH OPERATING SYSTEM APPLICATIONS

AUTHOR(S): R. HOLT ET.AL

PUBLISHER: ADDISON-WESLEY, READING MA
DATE OF PUBLICATION: 1978
PAGE NUMBER:
FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: THE C PROGRAMMING LANGUAGE

AUTHOR(S): B. KERNIGHAN
D. RITCHIE

PUBLISHER: PRENTICE-HALL
DATE OF PUBLICATION: 1978
PAGE NUMBER:
FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: "First FDDI Local Area Network" PROCEEDINGS OF 12th IEEE CONFERENCE ON LOCAL COMPUTER NETWORKS

AUTHOR(S): I. KOLNIK
J. GARODNICK

PUBLISHER:
DATE OF PUBLICATION: 1987
PAGE NUMBER: 7 - 11
FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: COMPUTER PERFORMANCE MODELING HANDBOOK

AUTHOR(S): S. LAVENBERG

PUBLISHER: ACADEMIC PRESS
DATE OF PUBLICATION: 1983
PAGE NUMBER:
FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE EMMERGING STANDARDS, HARDWARE, AND SOFTWARE LIGHT THE WAY TO FDDI

AUTHOR(S) K. MARRIN

PUBLISHER COMPUTER DESIGN

DATE OF PUBLICATION APRIL 1989 VOL 28 # 7

PAGE NUMBER 51 - 57

FILE # can be accessed upon request

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE "ETHERNET: DISTRIBUTED PACKET SWITCHING FOR LOCAL COMPUTER NETWORKS

AUTHOR(S) R. METCALF
D.R.BOGGS

PUBLISHER COMMUNICATIONS OF ACM

DATE OF PUBLICATION 1976 VOL 19 # 7

PAGE NUMBER 395 - 403

FILE # can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: "The SIMNET Network and Protocols" BBN Report No. 7102

AUTHOR(S): ARTHUR POPE

PUBLISHER: BBN COMMUNICATIONS CORP., MA

DATE OF PUBLICATION: JULY 1989

PAGE NUMBER:

FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: "The SIMNET Network and Protocols" BBN Report No. 6369

AUTHOR(S): ARTHUR POPE

PUBLISHER: BBN COMMUNICATIONS CORP., MA

DATE OF PUBLICATION: FEBRUARY 1987

PAGE NUMBER:

FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: INTRODUCTION TO SIMULATION AND SLAM II (2nd edition)

AUTHOR(S): A. PRITSKER

PUBLISHER: SYSTEMS PUBLISHING CORP., WEST
DATE OF PUBLICATION: 1984
PAGE NUMBER:
FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: "SHIPNET: A Real-Time Local Area Network For Ships" PROCEEDINGS OF 13th IEEE CONFERENCE ON LOCAL COMPUTER NETWORKS

AUTHOR(S): R. SIMONSON et al

PUBLISHER:
DATE OF PUBLICATION: 1988
PAGE NUMBER: 424 - 432
FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: "Performance Analysis of the FDDI Token-Ring" TECHNICAL REPORT TR-8802

AUTHOR(S): R. SIMONSON

PUBLISHER: DEPT. COMPUTER SCIENCE UVA
DATE OF PUBLICATION: 1988
PAGE NUMBER:
FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: LOCAL NETWORKS

AUTHOR(S): W. STALLINGS

PUBLISHER: ACM COMPUTING SURVEYS
DATE OF PUBLICATION: MARCH 1984 VOL 16 # 1
PAGE NUMBER: 3 - 42
FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: "Evaluation of Real-Time Transport Protocols" TECHNICAL REPORT TR-88-21

AUTHOR(S): W. STRAYER
A. WEAVER

PUBLISHER: DEPT. OF COMPUTER SCIENCE UVA

DATE OF PUBLICATION: 1988

PAGE NUMBER:

FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE: A LOCAL COMMUNICATION NETWORK BASED ON INTERCONNECTED TOKEN RINGS: A TUTORIAL

AUTHOR(S): N STROLE

PUBLISHER: IBM JOURNAL ON RESEARCH AND

DATE OF PUBLICATION: 1983 VOL 27 #5

PAGE NUMBER: 481 - 496

FILE #: can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE CALCULATING THE MAXIMUM MEAN DATA RATE IN LOCAL AREA NETWORKS

AUTHOR(S) B. STUCK

PUBLISHER IEEE COMPUTER

DATE OF PUBLICATION MAY 1983

PAGE NUMBER 72 - 76

FILE # can be accessed upon request

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE NETWORK PROTOCOLS

AUTHOR(S) A. TANENBAUM

PUBLISHER ACM COMPUTING SURVEYS

DATE OF PUBLICATION DEC. 1981 VOL 13 # 4

PAGE NUMBER 453 - 490

FILE # can be accessed upon request

IST LIBRARY "B"

DATE: 09/14/89

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: LOCAL COMPUTER NETWORK TECHNOLOGIES

AUTHOR(S): C. TROOPER

PUBLISHER: ACADEMIC PRESS
DATE OF PUBLICATION: 1981
PAGE NUMBER:
FILE #: can be accessed upon request

SUBJECT: MODELING OF COMPUTER COMMUNICATION SYSTEMS
TITLE: "A Real-Time Message System for Token Ring Networks" TECHNICAL REPORT TR-88-08

AUTHOR(S): A. WEAVER
M. COLVIN

PUBLISHER: DEPT. OF COMPUTER SCIENCE UVA
DATE OF PUBLICATION: 1988
PAGE NUMBER:
FILE #: can be accessed upon request

SUBJECT MODELING OF COMPUTER COMMUNICATION SYSTEMS

TITLE "Simulation of Local Computer Networks" PROCEEDINGS OF 4th IEEE CONFERENCE ON LOCAL COMPUTER NETWORKS

AUTHOR(S) J. YEH

PUBLISHER

DATE OF PUBLICATION OCTOBER 1979

PAGE NUMBER 1 - 4

Appendix E
Commerce Business Daily Postings' Review

Date Posted:	12 Jan 89
Sponsoring Organization:	Rome Air Development Center
Title:	Object Oriented Battlefield Simulation Development
Objective:	Design and build a scenario-generation capability and implement a ground force on force model compatible with current simulation.
Closing/Response Date:	RFP 10 days from publication of notice
Contact:	Technical POC-- Craig Anken RADC/COES 315-330-4833 CPM Non-technical inquiries-- Joseph Christofaro RADC/PKRZ 315-330-3204

Date Posted:	18 Jan 89
Sponsoring Organization:	Naval Underwater Systems Center
Title:	Quantitative Evaluations of Simulated Engagements through use of SIM II
Objective:	Perform analyses/evaluations, validate accuracy and identify strengths and weaknesses
Closing/Response Date:	3 Apr 89
Contact:	Neg D'Gomes 203-440-4617

Date Posted:	19 Jan 89
Sponsoring Organization:	AFCMD/PKRA, Kirtland AFB
Title:	Battlefield Simulation Support
Objective:	Theater level, man-in-the-loop battlefield simulation for an assessment of the utility of joint surveillance target attack radar system (STARS).
Closing/Response Date:	23 Mar 89
Contact:	Eileen M. Murer AFCMD/PKRA 505-844-8514

Date Posted:	23 Jan 89
Sponsoring Organization:	AFDW Contracting Office, Andrews AFB
Title:	C-31 Model Support and Data Base Development
Objective:	Specific tasks shall include: modelling of current strategic issues, data base development to support real time analysis in response to quick turn around issues, model documentation and validation and graphics software
Contact:	Carol Smith, Contract Specialist Jack E. Bynane, Contr. Officer 301-981-2437

Date Posted:	26 Jan 89
Sponsoring Organization:	Rome Air Development Center
Title:	Distributed Situation Development
Objective:	Develop a high level design of an ES that will support an automated situation assessment capability, the prediction of enemy courses of action, and the dynamic proactive tasking of friendly forces.
Contact:	Capt. David S. Blocker, Contr. Specialist 315-330-2203 Lt. Glenn Fye, Program Mgr. 315-330-3175

Date Posted:	31 Jan 89
Sponsoring Organization:	Contracting Office, Naval Research Laboratory
Title:	Battle Management System
Objective:	Requirement for a battle management systems project in support of four areas
Closing/Response Date:	RFP closing 35 days after issuance
Contact:	Anna Beckett, Contr. Specialist, Code 2210.AB 202-767-3003

Date Posted:	3 Feb 89
Sponsoring Organization:	Rome Air Development Center
Title:	Enemy Structure Modeling
Objective:	Design a data base for storage and analysis of enemy situational activities based on tables of equipment doctrine, tactics, and deployment to support R&D efforts.
Contact:	John C. Corbin Contr. Specialist 315-330-3844 James Papagni Program Mgr 315-330-3175

Date Posted:	8 Feb 89
Sponsoring Organization:	DCA Center for Control and Command
Title:	DCA Demonstration and Technology Survey Program
Objective:	Technology survey and demonstration of mapping systems is planned
Closing/Response Date:	10 days after notice
Contact:	Anne Bradel DCA/C4S/A510 703-883-6598

Date Posted:	17 Feb 89
Sponsoring Organization:	Directorate of Contracting, Contracting Div, USAFB, Ft. Belvoir, For ARI, Ft Knox
Title:	Research Support for Soldier Training and Performance Issues
Objective:	Six Task Areas--third is developing prototype simulation software for table top simulators and developing prototype hardware/software for soldier-in-the-loop networked simulators.
Closing/Response Date:	Sol available on 3 Apr 89
Contact:	Gloria J Daws 703-664-6301 x 40 Contr. Officer Wm E. Campbell Jr. 703-664-6031 x-34

Date Posted:	6 Apr 89
Sponsoring Organization:	Defense Nuclear Agency
Title:	Battlefield Information and Targeting System
Objective:	One of the tasks is to demonstrate the capability of the system to collect, monitor, and analyze statistics that would demonstrate the value of interfaces developed.
Contact:	Tim Sherer 202-325-6626

Date Posted:	10 Apr 89
Sponsoring Organization:	Naval Training Systems Center
Title:	BAA--Experimental Developmental, Basic and Applied Research Work Opportunities at the office of PM TRADE and ARI.
Objective:	General in, nature, this BAA includes Engagement Simulation and Instrumentation, Simulation Networking, Battle Simulation, Embedded Training, etc
Closing/Response Date:	Remains open until superseded.
Contact:	PM TRADE POC: Stan Goodman 407-380-8165 ARI POC Dr. Bruce Knerr 407-380-4387

Date Posted:	10 Apr 89
Sponsoring Organization:	Naval Air Development Center
Title:	Develop and Maintain Tactical Environment Simulation and Scoring Software
Objective:	Requirement includes developing real-time and faster than real time digital weapon system simulations to support air to air, air to surface, surface to air and surface to surface weapons training for training systems supported by the Naval Air Development Center.
Closing/Response Date:	Due 31 May 89
Contact:	Contr. Off. John Stabilito 215-441-2683

Date Posted:	3 May 89
Sponsoring Organization:	Kirtland Contracting Center, Kirtland AFB
Title:	Computer Hardware and Software Operations, Maintenance and Simulation Development
Objective:	Primary purpose is to simulate at the execution level the Air Defense functions of detection, tracking, identification, weapons allocation, engagement, weapons control, and kill assessment.
Contact:	Technical contact Maj Mason 505-846-0883

Date Posted:	16 May 89
Sponsoring Organization:	Rome Air Development Center
Title:	Ground Attack Fighter MDL Software (GAFMS II)
Objective:	Develop a new Ground Attack fighter MDL Software program to provide Foreign Technology at Wright Patterson AFB OH, the capability to simulate and conduct system effectiveness studies on air ground attack tactical fighter missions and est acft capabilities and performance for various missions in a hostile environment.
Contact:	POC Nancy McCann 315-330-7555 Contr Spec James Maier 315-330-7557

Date Posted:	15 May 89
Sponsoring Organization:	AFDW CO/CNX, Andrews AFB
Title:	TAC Thunder Simulation Model
Objective:	Include in-house support for minor changes, debugging, assistance in study and wargame preparation and execution, documentation, training and installation, user group administration and configuration control.
Closing/Response Date:	23 Jun 89
Contact:	POC Carol Smith Contr Specialist Jack Bynane Contr Officer 301-981-2437

Date Posted:	2 Jun 89
Sponsoring Organization:	Defense Supply Service the Pentagon
Title:	USACAA Wargame & Political/Military (P/M) Game Assistance
Objective:	For on-call assistance in conducting theater level wargaming on behalf of the US Army Concepts Analysis Agency using computer simulations
Contact:	Harry W. Shatto 202-695-2563 Edna M. Clark 202-695-2564