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New Network Interfaces: Final Report

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INSTITUTE FOR SIMULATION AND TRAINING

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Division of Sponsored Research

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1. Introduction

This report is a deliverable item, CDRL A00E, under TRIDIS subtask 3.2.3.1, "New Network Interfaces," of the U.S. Army Simulation Training and Instrumentation Command (STRICOM) contract number N61339-94-C-0024, entitled "TRIDIS: A Testbed for Research in Distributed Interactive Simulation."

This report describes:

- The background and approach taken to implement a Fiberoptic Distributed Data Interface (FDDI) network in the Testbed.
- The approach taken in the selection of available hardware to install the FDDI network.
- The approach taken in the selection of available software to monitor and manage the FDDI network.

1.1 Abbreviations and Acronyms

The following abbreviations and acronyms were used in the body of this paper:

CCTT	Close Combat Tactical Trainer
COTS	Commercial-off-the-Shelf
DIS	Distributed Interactive Simulation
DNS	Domain Name Service
DSS	Distributed Sniffer Server™[1]
FDDI	Fiberoptic Distributed Data Interface
HPOV	Hewlett Packard Openview Software
IP	Internet Protocol
IST	Institute for Simulation and Training
PC	Personal Computer
RAM	Random Access Memory
RMON	Remote MONitoring Protocol
SNMP	Simple Network Management Protocol
ST™[2]	Code designation for fiberoptic connection by
STRICOM	Simulation Training and Instrumentation Command
TCP	Transmission Control Protocol
TRIDIS	Testbed for Research in DIS

[1] Distributed Sniffer Server is a registered trademark of Network General.

[2] ST is a registered trademark of AT&T.

1.2 Background

To keep up with developments in Distributed Interactive Simulation (DIS), the Institute for Simulation and Training (IST) needed to implement an FDDI capability within its DIS Testbed. This included adding FDDI cards to an SGI Onyx, two Motorola VME workstations, and other workstations capable of interfacing with FDDI. IST also added an FDDI concentrator to the Alantec PowerHub to support the FDDI ring. The network is managed using Hewlett Packard's Openview (HPOV) software, which is a Simple Network Management Protocol (SNMP) compliant network management software system.

Both Ethernet and FDDI networks' traffic throughput and packet transmissions will be monitored by Network General Sniffers™[3]. These servers will monitor certain router ports and record all the network traffic through it. This information, combined with the network connection and status monitoring of the HP Openview software, will assist in managing both networks.
With this FDDI network architecture in place, IST has an FDDI subnet capable of running a variety of applications, including CCTT modules.

2. Project Goal

The goal of this project was to provide a network structure able to support a Close Combat Tactical Trainer (CCTT) simulation. The previous structure using a standard Ethernet network was insufficient for the Testbed to be able to perform such a simulation, thus another network structure, FDDI, needed to be added to the Testbed. This project also provided the hardware and software necessary to monitor and manage both networks, maintain operational readiness, and monitor any efficiencies.

3. Approach

IST coordinated the design of the FDDI testbed with the CCTT Project to provide a compatible FDDI environment. This included acquiring the materials to integrate FDDI into the TRIDIS Testbed and adding an FDDI concentrator card to the Alantec PowerHub and FDDI adapter cards to other equipment in the laboratory.

IST manages the FDDI network using SNMP and RMON (Remote MONitoring protocol). HPOV was used to provide network management, data collection, analysis and control of the FDDI devices. IST developed network topological maps and designed a data collection paradigm for measuring network traffic and analyzing network problems on the FDDI testbed.

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[3]Sniffer is a registered trademark of Network General.

Once the installation was completed, IST attempted to borrow some CCTT equipment to be placed in the TRIDIS Testbed on a temporary basis to verify compliance with CCTT. The Team had planned to conduct experiments with SNMP control and data recording in the FDDI environment. However, access to CCTT modules was not available and these experiments were not performed.

4. Hardware Selection

4.1 FDDI Interfaces

In order for the workstations and the Testbed PowerHub router to communicate on an FDDI network, the following hardware interfaces were required:

- One Alantec six-port FDDI Concentrator Card to be installed in the Alantec PowerHub router.
- One FDDI single-attached adapter card for an SGI ONYX workstation.
- Two FDDI single-attached VME adapter cards for two of the four Motorola VME workstations.
- One FDDI single-attached adapter card for a SUN Sparc station-20 workstation.
- One Interphase M400 Desktop 8 port FDDI Concentrator.

4.2 HPOV System

A computer system was required to perform as the workstation for both the HPOV software and to communicate with the Network General Sniffers. To perform these tasks, this system required the following:

- A large-screen monitor was needed to view the complex network maps that the HPOV software would create.
- A high speed processing system with a large memory capacity was needed to run the Sniffers and HPOV software simultaneously.
- Sufficient drive capacity was required to install all the software.
- A tape backup system to ensure that hardware problems would not put potentially weeks of detection work in jeopardy as the HPOV software would continuously detect and add new nodes to the network maps over time.

The following equipment was then configured into the system:

SUN Sparc station 20 with

- Dual Supersparc processors
- 192 MB RAM
- 20" Color Monitor
- 2GB Internal Disk
- 2GB External Disk
- 8mm External Tape Drive
- Internal CD-ROM
- Internal 3.5" Floppy Drive
- Keyboard & Mouse
- Solaris 2.4 operating system

4.3 Network Analyzers

To perform network throughput and packet analysis, two Network General Sniffer hardware modules were required. An Ethernet Distributed Sniffer Server was required for monitoring Ethernet segments.
Similarly, an FDDI Distributed Sniffer Server was required for monitoring the FDDI network.

4.4 Router Hardware Upgrade

Since the main Alantec PowerHub router chassis does not have the bus structure to support an FDDI concentrator card, one Alantec PowerHub Extension Chassis was purchased:

5. Software Selection

To perform network management and connectivity monitoring, a Commercial-Off-The-Shelf (COTS) software package was chosen. IST desired that this system have

- an X-window based interface for ease of use
- the ability to use a wide range of network protocols
- the ability to continuously monitor the network and discover new nodes
- be SNMP compliant
- run under UNIX Solaris 2.4
- come with technical support and training.

The COTS product that was chosen was the Hewlett Packard Openview Network Node Manager.

In addition to the HPOV's Network Node Manager system, Network General supplied the SniffMaster™[4] software system. Sniffmaster for X-windows is Network General's interface package that communicates with the two Distributed Sniffer Server hardware modules mentioned above.

6. Network Configuration

6.1 Cable Layout

Two rings of double-stranded FDDI Cable were laid around the entire circumference of the DIS lab with loops of extra cable at periodic intervals to allow for the installation of interface panels. The two cables provided two bi-directional rings for assurance of fault-tolerance. The interface panels were created with ST connectors. ST to FDDI adapter cables were made to connect the panels to the FDDI interfaces. Interface panels were placed where selected FDDI interfaces were anticipated. This required an interface panel at the Testbed Alantec PowerHub router.

The DIS lab network is physically arranged in a ring of plastic rain gutters on the wall. This forms a cable tray for both Ethernet and fiberoptic cables. At intervals along the gutters are downspouts that lead to interface panels, some for FDDI and some for Ethernet. The Ethernet panels are labeled by number, 1 through 20. Each panel has three BNC connectors, labeled A, B, and C. Thus a networked system can be referred to by a code that will closely identify its physical position; for example, 13A, 11B, and 20C. These Ethernet lines all terminate at a set of patch panels at the Testbed router. These panels have one labeled BNC connected port for each BNC connector on an Ethernet interface panel. For example, BNC connector A on spout 15 terminates at port 15A on a patch panel.

6.2 Machine Identifications

Five workstations were selected to be on the FDDI network and have FDDI adapter cards installed; one SUN Sparc20 (the HPOV System), one ONYX, one SGI INDY, and two Motorola VME chasses. Each new FDDI interface had to be assigned a Domain Name Service (DNS) name and Internet Protocol (IP) address. Each workstation that had both an Ethernet and FDDI interface had two names and IP addresses.

The two Sniffers also contained two interfaces, one through which they would communicate with the HPOV system (called the transport interface) and one through which they would monitor

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[4]SniffMaster is a registered trademark of Network General.

network traffic (called the monitor interface). Both transport interfaces were Ethernet while the monitor interfaces corresponded to the Sniffer type; the FDDI Sniffer has an FDDI monitor interface and the Ethernet Sniffer has an Ethernet monitor interface. The transport interfaces also required DNS names and IP addresses.

6.3 Router Re-configuration

The Alantec PowerHub router used for the Testbed had to be reconfigured for the FDDI network. Alantech's PowerHub router main chassis does not have the bus structure to support an FDDI concentrator card. An extension chassis had to be installed that would support such cards. The main chassis contained cards slots one through five while the extension chassis added slots six through ten. FDDI cards could only be supported in slots three through seven. Since the FDDI router card was required by the Alantech busing structure to be at the top of the FDDI slots, the FDDI router card was moved to slot 7. To communicate with the FDDI router card, the FDDI concentrator card had to be installed at the next available lower slot, slot six.

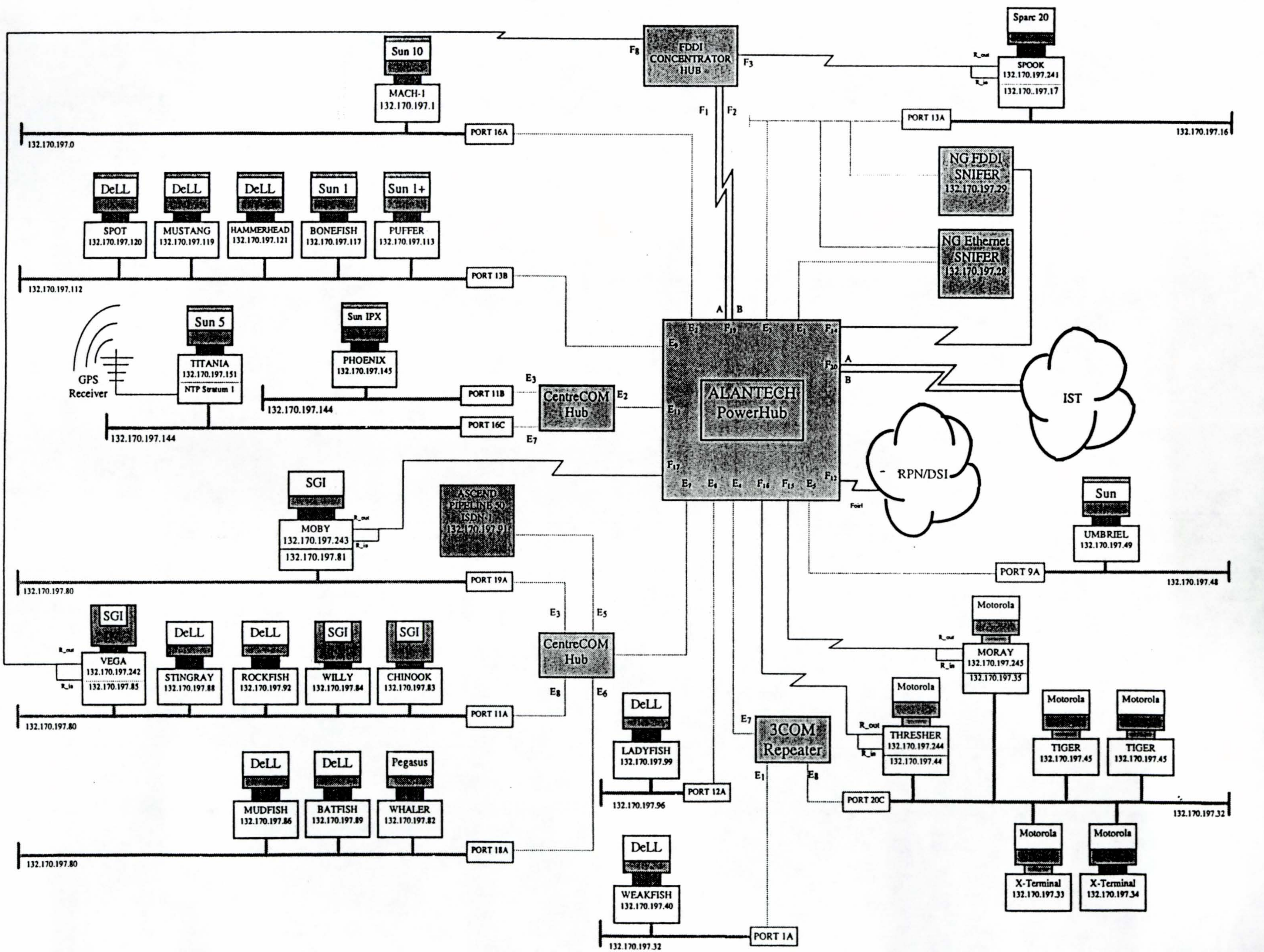
The HPOV system required that it and the Sniffers' transport interfaces reside solely on the same subnet and thus have their own port on the Testbed PowerHub. The two Sniffers also required an additional, unique port through which they would monitor network traffic. The Ethernet Sniffer required an Ethernet port and the FDDI Sniffer required an FDDI port.

6.4 Network Layout

An FDDI Concentrator card was installed on the Testbed PowerHub Router which added FDDI ports 13 through 18. The FDDI standalone M400 Concentrator was routed via the bi-directional ring to an FDDI port. The HPOV system and SGI Indy were singularly attached to the standalone concentrator. The SGI Onyx was singularly attached directly to the router at an FDDI port as were the two Motorola VME chasses.

6.5 Lab Wiring Diagram.

Figure 1 shows the logical layout of the Testbed network.



FDDI CONCENTRATOR HUB
F8
F3
F1
F2
Sun 10
MACH-1
132.170.197.1
PORT 16A
132.170.197.0
Sparc 20
SPOOK
132.170.197.241
132.170.197.17
PORT 13A
132.170.197.16
NG FDDI SNIFER
132.170.197.29
NG Ethernet SNIFER
132.170.197.28
DeLL
SPOT
132.170.197.120
DeLL
MUSTANG
132.170.197.119
DeLL
HAMMERHEAD
132.170.197.121
Sun 1
BONEFISH
132.170.197.117
Sun 1+
PUFFER
132.170.197.113
PORT 13B
132.170.197.112
GPS Receiver
Sun 5
TITANIA
132.170.197.151
NTP Stratum 1
Sun IPX
PHOENIX
132.170.197.145
PORT 11B
132.170.197.144
PORT 16C
132.170.197.144
E3
CentreCOM Hub
E2
E7
ALANTECH PowerHub
A
B
IST
RPN/DSI
SGI
MOBY
132.170.197.243
132.170.197.81
ASCEND PIPELINE 50 ISDN-1
132.170.197.91
PORT 19A
132.170.197.80
Sun
UMBRIEL
132.170.197.49
PORT 9A
132.170.197.48
SGI
VEGA
132.170.197.242
132.170.197.85
DeLL
STINGRAY
132.170.197.88
DeLL
ROCKFISH
132.170.197.92
SGI
WILLY
132.170.197.84
SGI
CHINOOK
132.170.197.83
PORT 11A
132.170.197.80
E3
E5
CentreCOM Hub
E8
E6
Motorola
MORAY
132.170.197.245
132.170.197.35
DeLL
LADYFISH
132.170.197.99
PORT 12A
132.170.197.96
E7
3COM Repeater
E1
E8
Motorola
THRESHER
132.170.197.244
132.170.197.44
Motorola
TIGER
132.170.197.45
Motorola
TIGER
132.170.197.45
PORT 20C
132.170.197.32
DeLL
MUDFISH
132.170.197.86
DeLL
BATFISH
132.170.197.89
Pegasus
WHALER
132.170.197.82
PORT 18A
132.170.197.80
DeLL
WEAKFISH
132.170.197.40
PORT 1A
132.170.197.32
Motorola
X-Terminal
132.170.197.33
Motorola
X-Terminal
132.170.197.34