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# Paper Session III-B - Shuttle Processing Data Management System (SPDMS) Network Documentation System

Charles L. Schuerger

*Lockheed Space Operations Co., Senior Software Engineer, Kennedy Space Center*

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# SHUTTLE PROCESSING DATA MANAGEMENT SYSTEM (SPDMS) NETWORK DOCUMENTATION SYSTEM

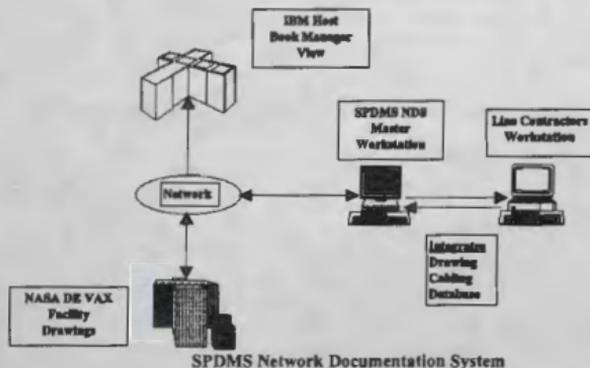
By: Charles L. Schuerger  
Lockheed Space Operations Co.  
Senior Software Engineer  
Kennedy Space Center, Florida

## Abstract

The Shuttle Processing Data Management System II (SPDMS II) Network Documentation System, was designed and implemented at Kennedy Space Center Florida for NASA, Lockheed Space Operations Co., and KSC line contractors. To provide a means for network tracking and configuration. The NASA DE VAX, IBM host SQL, Intergraph MicroStation, and workstation based dBASE IV are being used to link hardware, network, and cable records into a CAD type drawing.

The National Aeronautics and Space Administration and members of the Shuttle Processing Contract team perform the tasks necessary to prepare NASA Shuttles for space flight. For the SPC, 'processing' is the word that describes the life cycle of a Shuttle mission. That life cycle begins immediately after an orbiter returns from space, and concludes the moment the Shuttle clears the launch tower. During that life cycle, there are literally thousands of computers used to process information vital to the successful launch of the Shuttle. Most of these computers are networked to various host systems, which generates a logistics nightmare for the configuration control, tracking, and planning of the premise wiring for all these networks.

Prior to the development of the Network Documentation System at KSC, there was no single source available for reference of premise wiring. At the same time, SPDMS was on its fourth cabling subcontractor. The documentation was hand drawn on copies of facility floor plans, and accessibility was limited to the possession of 3 copies provided. Considering the magnitude of this network, and the wide distribution over several facilities and floors, the potential risk for the loss of data integrity was great. SPDMS in cooperation with NASA Network Documentation System (NDS), designed and implemented the capability of providing facility drawings electronically for documentation. In order to maintain compatibility with the existing facility drawings, Intergraph MicroStation is used on the master PC workstation, and dBASE IV is used to link network and cable records into the CAD drawing. This workstation is also used to provide a means for tracking, configuration and control of SPDMS network data.



The design for this documentation system includes electronic access to facility drawings, that originate on the NASA DE VAX host computer, copied to a master PC workstation that has been established as the authoritative source of cabling as-built. This workstation is then used to provide the line contractors with a referenced facility drawing, seed file, and individual database tables of that facility, for them to document. In addition to the CAD type drawing, individual database records can be linked to any picture element within the drawing, allowing for database records to be displayed, by simply selecting an element. For KSC-wide reference capabilities, the master PC workstation is used as a staging area, for the completed drawings and data to be copied to the network directories on the NASA DE VAX host. In addition, through a series of conversions the drawing can also be placed on the IBM host computer. Where anyone capable of using an IBM host session on an OS/2 work station can 'VIEW' the network drawing.

## DATA BASE CONFIGURATION

### DATA ELEMENT MANIPULATION

Another major problem that we were having prior to the development of this system, was the ability to effectively identify the path from each individual user's CPU through each segment of the Local Area Network (LAN) up to the host. In using a database for the storage medium, queries and reports could be written to provide the user with this type of meaningful data.

#### Common Generic Fields

In order to provide the capability of complete transitional reports, the primary database tables were designed with a generic semi-link list concept in mind. The hardware and network tables have 4 columns that have common names (CONTROL\_NO, DEVICE\_NAME, DEVICE\_TYP, and REF\_LINK). Where CONTROL\_NO can take on different definitions based on the value of the data contained in DEVICE\_TYP or DEVICE\_NAME. This allows reports to cross the boundaries between both tables, and generate a list of every path a particular signal would take to get from the local workstation through to the host. Or, in the reverse direction to list all nodes attached to a specific bridge, etc.

	DEVICE_NAME	DEVICE_TYP	REF_LINK
<b>HARDWARE</b>			
1037276 (NASA tag# of CPU)	855701	CPU	822 191.1 A6 (ICB Drop)
1036741 (NASA tag# of Monitor)	851283	MONITOR	1837276 (Ref. back to CPU)
1128999 (NASA tag# of Printer)	OL400	PRINTER	1837276 (Ref. back to CPU)
<b>NETWORK SNA</b>			
022 101.1 A6 (ICS drop#)	CONNECT	IPTRISM (NDS Cell name)	K61200A.11137.01
K61200A.1137.01	HSPD164	RACK	MAU1 (Ref. MAU in rack)
MAU1 (Multisport Access Unit)	MAU1	MAU/HUB	40000016001
400000016001	B0001 (Backbone)	BRIDGE	40000001F001 (Uaddr)
40000001F001 (Uaddr)	LSLTIC1 (Redundant TIC)	NCPTIC	MACTIC (Eseq)
<b>NETWORK TCP/IP</b>			
128.159.166.184 (IP address)	FL6001	TOKENRING	1837276 (Ref. to CPU installed on)
128.159.168.001 (IP address)	KT06001	ETHERNET	1837276 (Ref. to CPU installed on)

## SPDMS NETWORK DOCUMENTATION APPLICATION DESIGN

A set of dBASE IV menus and panels were created to provide the line contractor with a user friendly system for data entry and report generation. This uniquely provides us with the opportunity to do in-depth edit checking and multiple table data entry from a single panel, reducing operator errors. Also, a function to automate the initial creation of each facility/network drawing, as well as, a library type 'Check-in / Check-out' procedure to track the status of the 'in work' drawings.

### MAIN MENU PANEL

The SPDMS Network Documentation application Main Menu, is used to transverse through the various menus and panels required for initial table creation, data entry, import/export, database query, and reports.



Main Menu

The SPDMS Network Documentation main menu is generated on screen, through the use of a dynamic table driven driver. Each record in the table contains the 2 character menu selection code, a menu item description, five fields to hold optional dBASE pre-execution commands, and the name of the program to execute.

### CREATE NEW TABLES PANEL

This panel is used the user to input the data required to create/update the tables, create the directories, and copy the seed files for a new facility documentation section.



Create New MicroStation Table Panel

## EXPORT DRAWING AND DATA PANEL

This panel is used to get the information needed to provide a library function 'Check Out' configuration management tracking system, and export of the CAD drawing, along with its associated data to a floppy disk.

This disk is then provided to the 'Line Contractors' for import to their workstation, where the actual network drops and cables will be overlaid on a referenced facility drawing. They also have the responsibility of entering the data, using the 'Edit/Enter Full Screen Data' panel. This data is then linked to its reference point, an associated picture element in the network drawing.



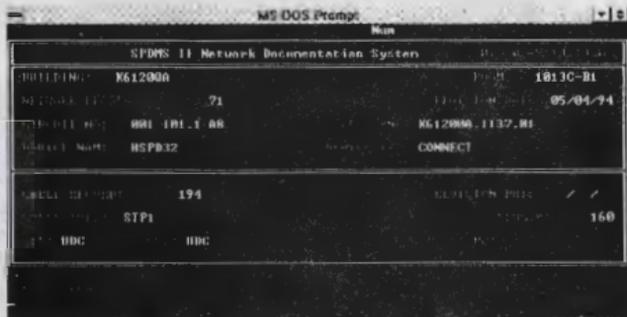
Export Drawing & Data Panel

## IMPORT DRAWING AND DATA PROCEDURE

On the 'Line Contractors' workstation, this function creates the directories, imports the database tables and drawings from the floppy disk, in preparation for being worked on. On the 'Master Workstation', it also resets the CHKOUT flag in the facility table.

## FULL SCREEN NETWORK/CABLE EDIT PANEL

The purpose for the Full Screen Network/Cable Edit Panel, is to provide a use friendly interface for network and cable data entry. It is a split panel, referencing 2 separate database tables (Network and Cable), that share a primary key of CONTROL\_NO.



Full Screen Network/Cable Edit Panel

When 'FS' is select from the main menu, a single prompt requesting the DB\_NAME of the desired network table, is displayed. After completing this request, the edit panel is displayed, along with the data from the first record of both the network and cable tables.

The DEVICE\_NAM, DEVICE\_TYP, CABLE TYPE, CER, and USR fields will display 'Hit F5 For The Legal Value List', when the cursor enters any of these fields. F5 activates a cursor sensitive, dynamic, table driven Data Dictionary procedure, that displays a variable width window of legal values for that panel, and field. After selecting an item from that list, it is automatically entered into the field and skips to the next field.

## QUERY MENU

The purpose for the query menu, is to provide a menu selection of individual table queries.



Query Menu

## REPORT MENU

The purpose for the report menu, is to provide a menu selection of individual reports.



Report Menu

When 'RP' is select from the main menu, the SPDMS Network Documentation report menu is displayed. The 'Cable' and 'Network' reports are standard browse panels for each table.

## ACCESSING THE FACILITY DRAWINGS

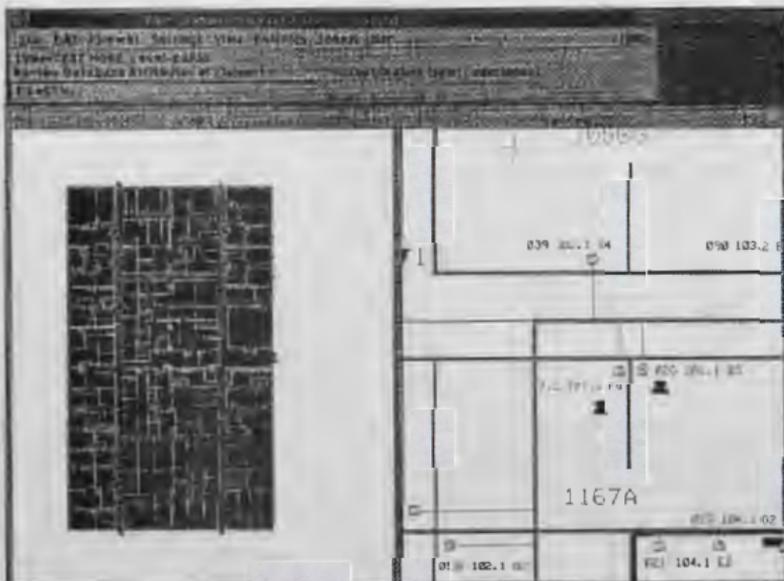
The baseline facility drawings are in the Intergraph MicroStation DGN format, and are located on the NASA-DE VAX system. To overlay the network and cable information, these facility drawings need to be referenced at the Master workstation. To access these drawings, we log on to a TCP/IP server, and then do an 'FTP' to the DE VAX system, to transfer the drawing files to/from the NASA computers.

## CREATING A NETWORK DRAWING

At the SPDMS Network Documentation main menu, select the 'CT) Create New Tables' option and enter the building, database name, CAD directory path, and Drawing name. At the completion of this function, all of the directories, database tables, seedfiles, and MicroStation control table information is updated with the required data.

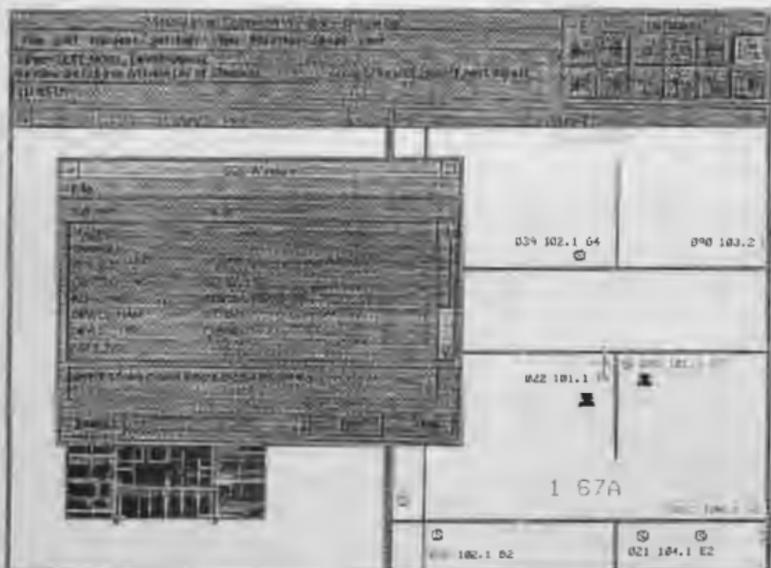
## INTERGRAPH MICROSTATION

To work with the CAD package, execute the Ustation startup command from DOS or Windows and open the (building name)NW.DGN file. As an example, the following window is displayed for complex 'A' at Kennedy Space Center.



View 1, on the left, shows the complete facility including two separate drawings. The white lines are the referenced drawing of the facility, as downloaded from the NASA DE VAX computer, and cannot be altered. The network drawing is overlaid on top, and represents all of the cable runs, end connectors, racks, panels, and computer hardware. View 2 on the right is a zoomed in area of view 1, which shows the cable, end connector and hardware symbols for a room within the complex. The line contractor uses this CAD package to complete the network facility drawing and at the same time, enter the database information with the software package described earlier in this document.

After the database information is entered, each section of the network can be linked to an associated database record. From that point on, double clicking with the mouse on an end connector will bring up a network record, a cable run brings up a cable record, and a hardware CPU symbol will bring up all associated hardware records. This unique function allows us to integrate drawing and database information, for improved configuration control of the network documentation.



In addition, a template was created that will display the 'CONTROL\_NO' field directly onto the drawing as each text node is linked to its end connector symbol on the drawing. If the 'CONTROL\_NO' field is updated in the database, we can then automatically update the drawing, by placing a FENCE around the area to be updated and select 'Load Displayable Attributes to Fence Contents' from the Microstation Database Palette.

## REFERENCING THE COMPLETED NETWORK DRAWINGS

### From the NASA-DE CAD/CAE Vax system

After the network drawing and database information is complete and imported back to the Master workstation, it is copied to the NASA-DE VAX network directories. This allows NASA to view the completed network drawings and data.

### From the SPDMS Host System

By exporting the facility/network drawing through the IGES hridge to IBMCAD, from there to GDF format to the IBM host and finally, through the PUBS conversion to ADMGDF, the drawing can be imported into a PUBS document. Where, anyone with an IBM host session can execute 'OPEN FACILITY' from the command line. This will bring up a Bookmanager index, where you can select a completed facility and view it from the host session.

### Future Enhancements

Initially, the development of this package included the Network and cable data, with future expansion to include complete network topology, hardware and software records. In addition, we will reinforce the menu driver, by re-configuring the software to use one table for all menus. We are also planning to upgrade to either the next release of dBASE for DOS or dBASE for Windows, depending on performance evaluations, compatibility issues, and operating system platforms.

### Summary

The benefits of this package provide consistent and standardized data, where before there was no single source for reference and access to documentation was limited. It gives us the ability to view the completed network drawings across the boundaries of several independent computer systems. It also, provides us with accountability and traceability of installation, as well as, an improved change request processing support. Finally, it helps to reduce cost by encouraging the use of existing cabling systems within an integrated wiring solution.