

## Analyzing Network Management Data with the SAS® System

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### ABSTRACT

Network Management challenges are growing at a rapid pace. With more businesses becoming dependent on their network infrastructure, the need for proactive network diagnostic analysis is becoming a necessity. Network problems and outages have devastating impacts to businesses. The methods of collecting and analyzing network data continue to be an integral part of maintaining "network harmony". This paper describes a method for analyzing Network Management data including the building of an Information Warehouse, data interrogation, and report presentation via the Web. Sharing this data with network administrators and technicians has saved IBM time and money and has helped turn reactive network maintenance into proactive network monitoring.

### BACKGROUND

The IBM semiconductor plant in Essex Junction, Vermont is a world class wafer manufacturing lines. The site itself has over 8,000 employees and 100% of these employees have access to our Local Area Network (LAN). Managing a LAN of this size is a challenge. Our LAN includes over 50 routers, over 250 segments, and over 12,000 connected network devices. This paper describes the Port Charge Project we created. Our objectives were to:

1. Collect information from the network to create a Port Charge Information Warehouse (PCIW) where individual ports, cables, and workstations can be tracked.
2. Use the PCIW to bill customers for LAN port services.
3. Also use the PCIW to aid in problem analysis.
4. Perform the data collection on a daily basis and data analysis on a monthly basis.

The Port Charge Project was started in June of 1997 and was completed in January of 1998. We have a patent pending for the system and methodology we used for collecting connectivity data of an area network.

### DATA COLLECTION

Data collected regarding individual network is both live and static.

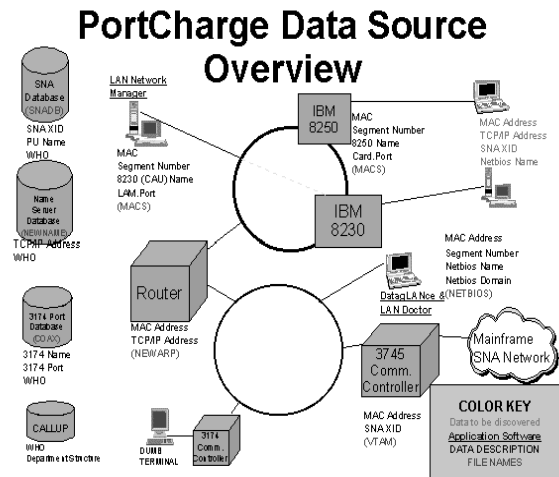
Live data is collected from active network devices such as IBM Intelligent Hubs (Model 8250 and 8224), Network Routers, IBM 3745 Communications Controllers, and LAN Network Manager. This data changes second-to-second and has to be collected live in order to get accumulative data. The databases collected live are:

1. NEWARP – list of ARP (Address Resolution Protocol) table entries collected from all routers.
2. VTAM – list of MAC addresses (hardware address for each workstation) and IBM - SNA (System Network Architecture) connectivity information.
3. A MAC – list of MAC addresses, ports, and segments collected from intelligent network hubs and switches.
4. NETBIOS – list of NetBIOS (a network protocol) machine names and MAC addresses collected with NAI's SNIFFER product.

Static data is in the form of databases. The Network Administrator does the updating manually. Static data includes a list of routers within the network, the Name Server file, LAN SNA Connection Database, and the Coax Database. Static data collected are:

1. PRINTERS – list of network printers
2. COAX – list of coax workstations.
3. NEWNAME – the Dynamic Name Server (DNS) file (a file containing a list of all IP addresses and the name of the workstation).
4. SNADB – LAN SNA connection database and Token Ring attached control units.
5. CALLUP – employee directory listing with names, phone numbers, departments, locations, e-mail and addresses.

Below is the Port Charge Data Source Diagram:



All of these files are created and saved as standard ASCII text files and are stored on our IBM MVS host. We run SAS on MVS for all applications on this project.

Below is a chart of what data is stored in each file:

### PortCharge Data Source Information

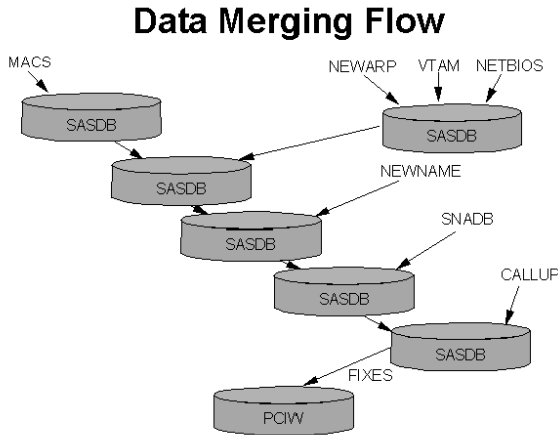
Names in square brackets: [] refer to file names referenced on previous page.

COLLECTED DATA	DATA SOURCE	COMMENTS
MAC Address	Intelligent Hub (8224, 8250, etc.) [MACS] LAN Network Manager database [MACS] Router ARP Table [NEWARP] Netview/370 SNA Information [VTAM] Netbios Domain Inventory [NETBIOS]	
Port Information (Segment/Hub/Port)	Intelligent Hubs [MACS] LAN Network Manager database [MACS] Derived from Router ARP Table [NEWARP] Derived from SNA Information [VTAM] Netbios Domain Inventory [NETBIOS]	If port information is not available from intelligent hubs or LNM, a port is assumed to be accessed if the MAC address is available from ARP, SNA collection information, or Netbios Domain Inventory
TCP/IP Address	Router ARP Table [NEWARP] Name Server file [NEWNAME]	
SNA XID Information	Netview/370 SNA Information [VTAM] SNA Administration Database [SNADB]	
Employee Serial Number	Name Server File [NEWNAME] SNA Administration Database [SNADB] CALLUP Information [CALLUP]	
Division/Department	CALLUP [CALLUP]	
Netbios Machine Name & Domain	Netbios Domain Inventory [NETBIOS]	

## THE BUILDING OF THE PORT CHARGE INFORMATION WAREHOUSE

Each of the 9 data files has erroneous data associated with them as part of the collection process. Prior to merging the files the data is interrogated for validity. The data files are merged using common database variables.

Below is the process flow for the merging of files.



Once merged, the data is interrogated and erroneous data is deleted. The data is then stored every month and reports are generated. Our current monthly PCIW has 58 variables and over 15,000 observations.

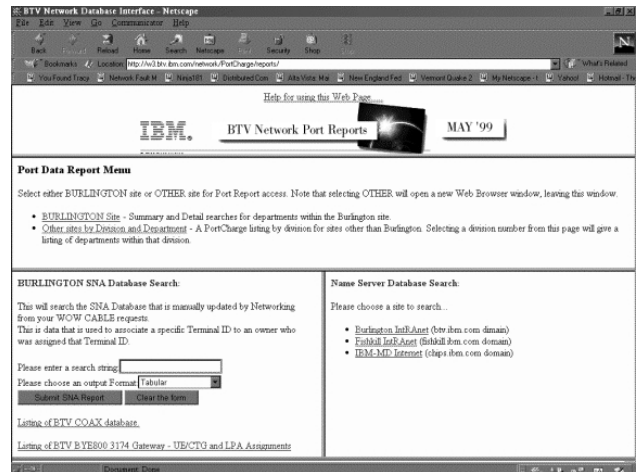
## REPORTS

Because of the diversity of customers using the PCIW there are numerous reports created. These reports include:

1. Numbers Report - total number of connections, billable ports, LAN activities, etc.
2. Web Summary – List of LAN connections by person, department, project, building, etc.
3. Web Detail – List of all information by port - used as problem determination tool.
4. Billing Report - Division, Department, Number of LAN, WAN and LAN/WAN ports.
5. Unbillable Report - All records that do not have a Division or Department - for accounting follow-up.
6. Unused IP addresses – List DNS IP addresses with no activity for the past 3 months. Used to clean up the DNS file.

We have also built a Web search engine page that allows customers access to the PCIW with the flexibility to query the database in different ways.

Below is a screen shot of the Port Charge Web Site:



Our current customer base include:

- Network Administrators – this group of customers view data for information about network capacity/loading. Their queries are searches for connection data and device mapping information.
- Administration Accountants – this group of customers use the data to track port usage by customer. A monthly bill is administered to each dept. based on the number of ports their employees have used for that month.
- Network Technicians – this group of customers view data for debug and diagnostics purposes. Their queries are searches for connectivity data and device location information.

## CONCLUSIONS

With the growing necessities for Intranet connectivity, Network Management is a vital priority for businesses of all sizes. Collecting network data for inclusion in an Information Warehouse can help answer some of the questions key people might have about the status of the LAN. Our method of data collection and distribution has helped solve many networking problems for our growing IBM site.

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