HP NetMetrix Provides Rx for a Medical Center's Network Infrastructure

Case Study

HP NetMetrix empowers IT support staff to move from reactive to proactive management posture.

"While the telephone still rings, we now have the tools and reporting capabilities to allocate our limited support resources in an optimal manner."

Hospital Senior Systems Engineer

An East coast medical center is experiencing rapid growth and needs to ensure that infrastructure issues do not impede expansion initiatives.

At the hospital, the compute fabric is "mission-critical", requiring maximum up-time and flexibility to accommodate frequent changes (with little or no notice). Taking responsibility for people's health demands stringent up-time and response metrics. At the same time, the health care industry is highly competitive, and IT must demonstrate added value to end-user clients.

HP NetMetrix allowed the technical staff at the hospital to evaluate a new network design before having to expend major dollars to purchase additional equipment and bandwidth. In addition, HP NetMetrix reporting capabilities convinced management of the need for a comprehensive networked systems management solution.

The Network Challenge

Client-care applications on a rapidly growing network

The technical Information Systems (IS) staff is responsible for a fiber backbone and network that links four buildings in the Medical Center complex and has recently been extended over a wide area with T-1 links to long-term care facilities. Within the campus, there are 26 Ethernet hubs with 10BaseT segments. There is a mix of TCP/IP, IPX/SPX, DEC LAT, and SDLC traffic within the complex. Platforms accessing the network include UNIX, Windows-based PCs, and legacy 5250 and VT-100 terminals. CAT scan devices have recently been added to the network matrix and add bandwidth- hungry video to the existing fabric. All data traffic, including TCP/IP, is bridged except the Novell IPX traffic.

A lack of management tools to diagnosis problems

Before HP NetMetrix was installed, decisions were based on the decibel level of the voice calling the help desk. There was no process or information for problem resolution, and it was impossible to segregate move and change requests from the ongoing outages reported by end users. In addition, the growing client base and dynamic moves and changes made it difficult to segment common logical groupings and led to complaints of poor response time for applications.

Too many 911 calls

The IS manager found it difficult to maintain the morale of his battle-weary technicians. The latter spent all their time in classic “fire-fighting” mode, and the 24 x 7 up-time only exaggerated the problems. Without a formal support center, the telephone rang off the hook, and it was next to impossible to provide enough network connections, let alone deal with network response for the health-care applications.

The Breaking Point

The opening of new facilities in the hospital complex happened frequently and with almost no warning. Running home runs with twisted pair seemed like a full-time job. There was never enough time for a more proactive approach. The decision to install a new suite of client-server based applications caused the senior IS staff to call a halt to the insanity. There were a growing number of complaints about poor application response times and the advent of a new network-hungry client-server application suite would surely bring network performance to its knees.

A Plan Emerges to Regain Control

The easy answer was to throw bandwidth at the problem and buy new switches and routers with FastEthernet and FDDI capacity. The tough part of the easy answer was how to justify the expense and identify where to increase the bandwidth.

The decision was made to take a step back and baseline the existing network to see if realigning the LAN segments would provide short-term relief to network problems. A comprehensive traffic assessment would also be helpful with the design of a new network architecture and the justification of the funds necessary to make it real. Due to resource constraints, the IS staff decided to engage Netplex, an authorized HP NetMetrix and HP OpenView integrator, to undertake this project.

The Approach

Baseline Requirements

The Medical Center technical staff made a decision to baseline 12 of the busiest LAN segments before and after the network realignment effort. The purpose of the new segment alignment strategy was to improve short-term traffic distribution, end-user response time, and determine where, and if, new network equipment should be installed. Since network traffic is comprised of conversation pairs, it was deemed necessary that all segment measurements needed to be taken simultaneously in order to accurately identify traffic patterns. So that baselining requirements could be met, 11 HP Ethernet LanProbes and one HP Power Agent were installed on the identified LAN segments. An HP OpenView Network Node Manager (NNM) management station was installed and configured with the HP NetMetrix application suite. The combination of NNM platform, HP NetMetrix application, 11 Lan Probes, and one HP Power Agent were the only tools used to baseline LAN segment utilization and response times. The segments were numbered by floor and corresponding wiring closet; for example E11-E14, E21-E24, E31-E34, and E41-E44. One RMON agent was installed on each segment.

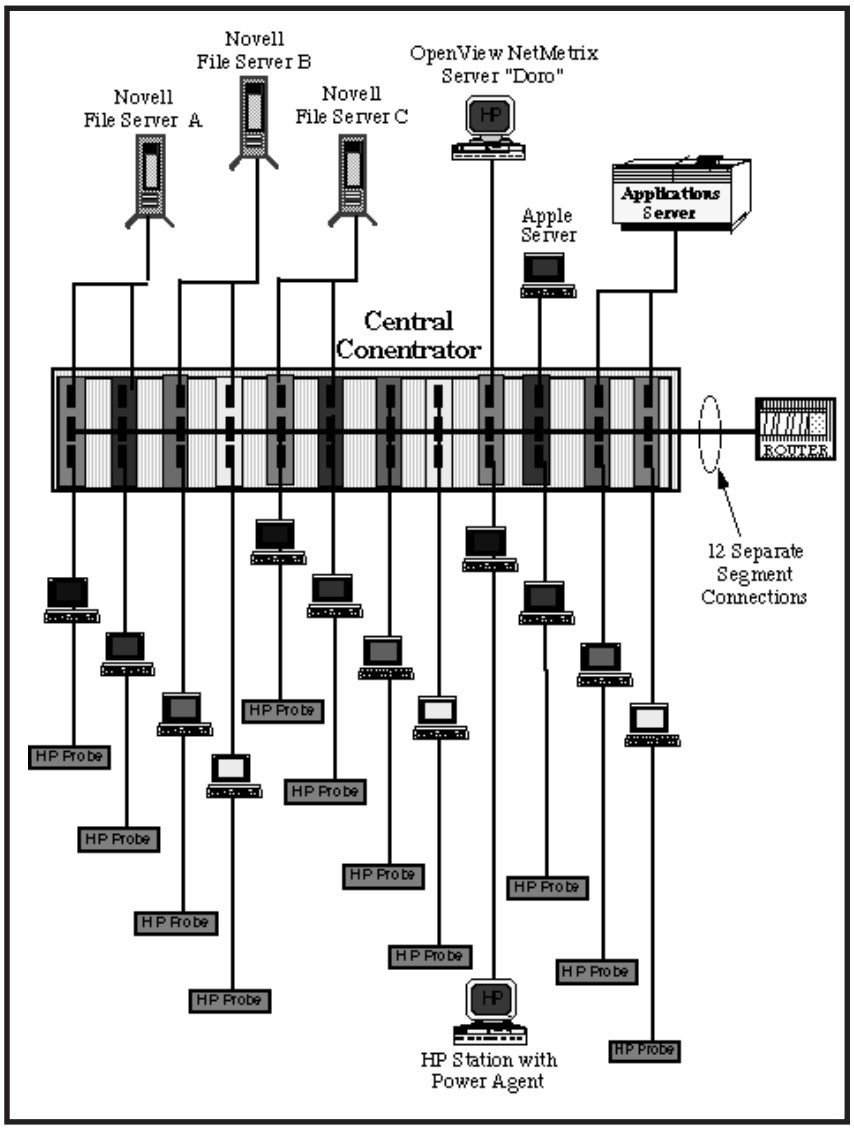
RMON probe assignments

Device	Segment	IP address	Subnet Mask	Default Gateway
Workstation	E24	150.11.240.100	255.255.0.0	150.11.250.110
Probe	E21	150.11.240.101	255.255.0.0	150.11.250.110
Probe	E22	150.11.240.102	255.255.0.0	150.11.250.110
Probe	E23	150.11.240.103	255.255.0.0	150.11.250.110
Power Agent	E24	150.11.250.80	255.255.0.0	150.11.250.110
Probe	E31	150.11.240.105	255.255.0.0	150.11.250.110
Probe	E32	150.11.240.106	255.255.0.0	150.11.250.110
Probe	E33	150.11.240.107	255.255.0.0	150.11.250.110
Probe	E34	150.11.240.108	255.255.0.0	150.11.250.110
Probe	E41	150.11.240.109	255.255.0.0	150.11.250.110
Probe	E42	150.11.240.110	255.255.0.0	150.11.250.110
Probe	E43	150.11.240.111	255.255.0.0	150.11.250.110
Probe	E44	150.11.240.112	255.255.0.0	150.11.250.110

Response time readings were taken from the HP NetMetrix and HP Power Agent/IRA workstations since the workstations could store results on the local hard drives. A dual set of response time samples were taken for each of the segments in order to better ensure the accuracy of the readings. Upon completion of the initial baseline reading, the new network segmentation strategy was deployed and the network baseline readings were taken again. The entire project spanned one month (one week to baseline, one week to re-segment, one week to baseline, and one week to correlate results). The capture process proceeded smoothly through both data capture periods.

Test setup tasks

1. Install and configure an HP-9000/700 series management workstation.
2. Install and configure a Postscript color printer.
3. Install and configure the HP OpenView Network Node Manager (NNM).
4. Install and configure HP NetMetrix into base HP OpenView management station.
5. Install 11 HP LanProbes.
6. Install one HP Power Agent/IRA.
7. Configure initial HP NetMetrix reports.
8. Generate segment utilization and response time reports for each of the segments for a period of one week before re-segmentation.
9. Generate segment utilization and response time reports for each of the segments for a period of one week after resegmentation.
10. Review baseline results against network diagrams and documentation and correlate findings in a report.

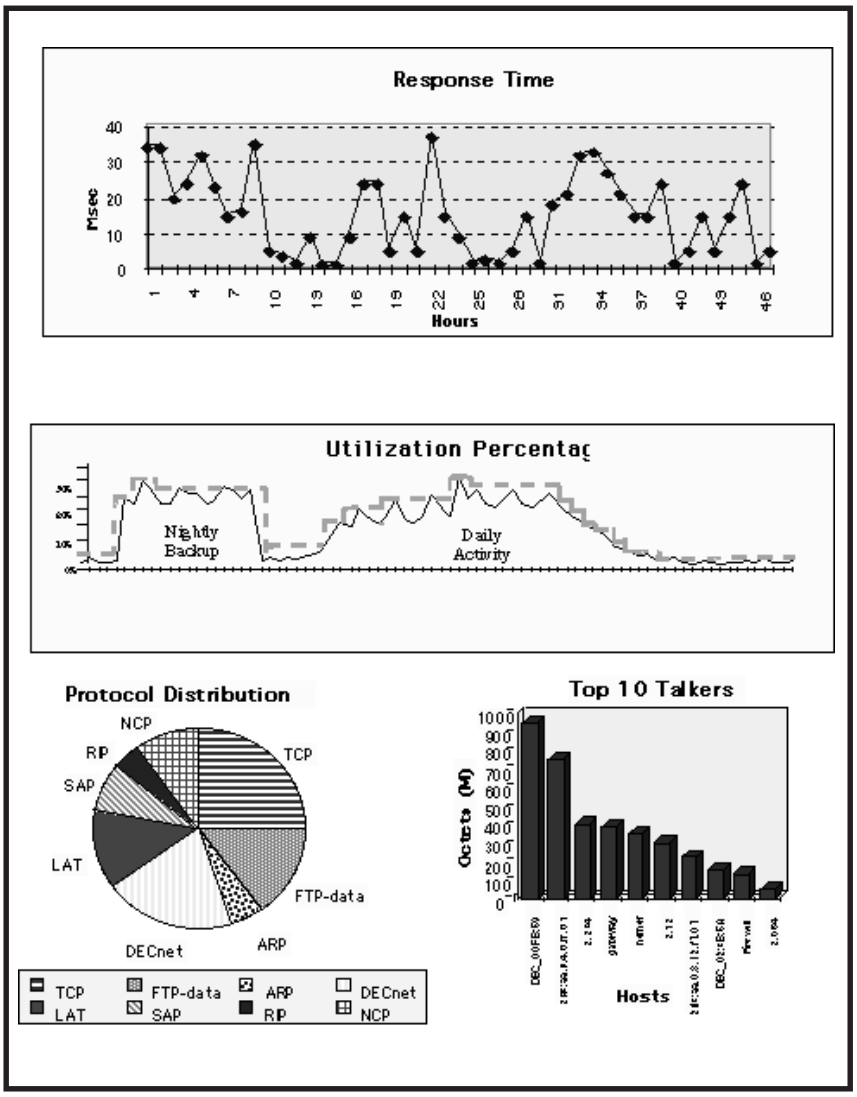


Typical graphical output

Uniform graphical and tabular outputs were used to present the data for each of the network segments.

- The first graph contains response time in milliseconds (msec) and was measured from the installed probes and the HP Power Agent/IRA workstation and management station on segment E24. The response time graphs contain data for each of the two seven-day baseline periods.
- The Network Report contains data for the capture intervals. The Top Talkers chart shows the major network traffic nodes and associated protocols. The Health Profile shows segment utilization over the two baseline intervals.
- The Protocol Distribution Over Time Report contains graphical data that shows protocol distribution for both baseline intervals.

The following output is representative of the summarized graphical reports that were generated by the HP NetMetrix application. The graphical output provided a way to visually correlate the different data points required for this baseline exercise.



Sample Detail Analysis

The data captured for baselines is dense by nature. A tabular dual baseline listing for a single segment is included as an example of the data that was captured by the HP LanProbes. The objective for capturing the data twice was to measure the effects of moving servers from one segment to another. The resegmentation option was utilized to determine whether optimizing traffic patterns could improve network response time over the short term and provide traffic profile information to design a more efficient network infrastructure.

Response Time for Segment E21

Data was captured for E21 for two seven-day baseline intervals; October 11 to October 18, and November 6 to November 14. The captured data includes the minimum, maximum, and average response time per weekday with aggregate numbers for each sampling period. The response time is measured to the probe from two separate sources, the HP NetMetrix console (Doro) on segment E24 and an external workstation on the same segment with an IRA. This approach was taken to examine response times from a local and remote segment. Measurements were taken before and after the infrastructure changes to reflect changes in the response time. Note: Values are represented in msec.

From 150.11.240.100 (Doro)

Day	Min (Oct.)	Max (Oct.)	Avg (Oct.)	Min (Nov.)	Max (Nov.)	Avg (Nov.)
Monday	1	29	1.57	1	79	1.89
Tuesday	1	17	1.6	1	33	1.7
Wednesday	1	14	1.57	1	146	2.22
Thursday	1	6	1.58	1	6	1.77
Friday	1	34	1.55	1	17	1.52
Saturday	1	33	1.55	1	20	1.79
Sunday	1	33	1.51	1	28	1.67
Total	1	23.71429	1.561429	1	47	1.794286

From 150.11.250.80

Day	Min (Oct.)	Max (Oct.)	Avg (Oct.)	Min (Nov.)	Max (Nov.)	Avg (Nov.)
Monday	2	17.5	2.64	1	301	4.38
Tuesday	2	14	2.57	2	69	2.79
Wednesday	2	4.5	2.46	1	236	4.22
Thursday	2	6.15512	2.53	1	20	2.69
Friday	2	24.5	2.69	1	33	2.81
Saturday	2	11	2.39	1	32	2.5
Sunday	2	10.5	2.47	1	25	2.67
Total	2	12.59359	2.535714	1.142857	102.2857	3.151429

Utilization for Segment E21

The data captured for E21 is from October 11 to October 18 and November 6 to November 14. This comprises a timeframe of at least seven full days. The data presented here represents the minimum, maximum, and average utilization for normal working hours; 7 am to 7 pm per weekday, with aggregate numbers for the entire sampling period. The utilization was measured on the probe in 30 second intervals and downloaded to the HP NetMetrix console every 30 minutes.

Day	Min (Oct.)	Max (Oct.)	Avg (Oct.)	Min (Nov.)	Max (Nov.)	Avg (Nov.)
Monday	0.23	23.9	2.67	0.21	18.14	2.17
Tuesday	0.12	16.33	2.66	0.28	43.75	12.95
Wednesday	0.13	14.55	2.68	0.17	20.62	2.73
Thursday	0.12	18.14	2.72	0.15	21.29	4.93
Friday	0.11	19.07	3.49	0.2	26.37	3.12
Saturday	0.12	5.54	0.31	0.2	.41	0.28
Sunday	0.12	6.09	0.32	0.19	5.76	0.29
Total	0.135714	14.80286	2.121429	0.2	19.48	3.781429

Top Talkers or Conversations for Segment E21

The examination of top talkers was confined to the top five nodes. This was done to remove nodes that generated much less traffic than the top five nodes. These were quite likely workstations that produced variable loads, rather than servers with consistent traffic patterns. The NetWare File Server was represented by an internal IPX address (X.0:0:0:0:0:1)

Before segmentation, a0000001:0:0:0:0:0:1 was responsible for most of the traffic generated on this segment. Node bbbbbbbb:0:0:0:0:0:1 and aaaaaaaa:0:0:0:0:0:1 were second and third on the top talker list and had values that were 25% of the a0000001:0:0:0:0:0:1 node. Although there were other servers on this segment, they contributed little to the overall segment traffic. The other nodes had various level of traffic that changed daily and quite likely were workstations.

After segmentation, a0000001:0:0:0:0:0:1 is still a major contributor to the traffic on the segment. A new server node cccccccc.0:0:0:0:0:1 started generating significant traffic while bbbbbbbb:0:0:0:0:0:1 disappeared from the top talker list. Other nodes appear to be either workstations or server instances.

Major Changes for Segment E21

- Average response time measured from Doro increased slightly from 1.561 to 1.794.
- Average response time measured from the IRA increased slightly from 2.535 to 3.151.
- Summarized average segment utilization increased from 2.12% to 3.78%.
- Summarized peak segment utilization increased from 14.802% to 19.48%.
- bbbbbbbb:0:0:0:0:0:1, aaaaaaaa:0:0:0:0:0:1 no longer appears in top-talkers.
- cccccccc:0:0:0:0:0:1 was added as a top-talker segment.

The major changes were obtained by evaluating the printed segment reports and comparing the major differences between the two base-line readings. A summary of the major changes to the other segments follows.

Summary of Segment Changes

Segment	Response Time	Average Utilization	General Comments
E21	up .0003 sec up .0006 sec	up 1.66%	Novell nodes bbbbbbbb & aaaaaaaa disappear as Top Talkers (TTs). Novell server cccccccc was added to TTs
E22	up .0003 sec	down 3.8%	NetFrame contributes less traffic Node av1a disappear as TCP/IP TTs. Novell nodes bbbbbbbb & aaaaaaa2 show as TTs Node clini appears as TCP/IP TTs.
E23	down .001 sec	up 6.0%	NetFrame contributes more traffic NetWare replace TCP/IP as dominant protocol Novell nodes 23.0:0, bbbbbbbb & aaaaaaa2 were added as Top Talkers (TTs).
E24	up .0003 sec	up 2.2%	NetFrame contributes more traffic Node av1a disappear as TCP/IP TTs. Novell nodes aaaaaaa2 was added to TTs.
E31	unchanged	down 1.3%	NetFrame contributes less traffic Novell nodes bbbbbbbb adds more traffic
E32	unchanged	down 5.9%	NetFrame contributes less traffic Novell nodes bbbbbbbb adds less traffic Node clini appears as TCP/IP TTs. TCP/IP traffic percentage increases
E33	unchanged	unchanged	NetFrame & Novell nodes bbbbbbbb & aaaaaaa2 were added as Top Talkers (TTs). Node av1b, hp2b, av2a and npa nodes disappear as TCP/IP TTs NetWare traffic percentage increases

Summary of Segment Changes (continued)

Segment	Response Time	Average Utilization	General Comments
E34	unchanged	down 0.2%	Node hp2b disappear as TCP/IP TTs Large AppleTalk spike occurred 11/7 NetFrame & Novell nodes bbbbbbbb, 34.0 & aaaaaaa2 were added as TTs NetWare become dominant protocol
E41	up .0007 sec	up 3.8%	Novell node aaaaaaa1 disappears as TTs. Node av1a appears as TCP/IP TTs. Novell nodes aaaaaaa2 was added to TTs. TCP/IP traffic percentage increases
E42	unchanged	up 5.3%	NetFrame contributes much more traffic NetWare traffic percentage increases
E43	unchanged	up 1.6%	NetFrame & Novell nodes bbbbbbbb decrease segment traffic volume Node hp1a and hp2b disappear as TTs. Node av1b appears as TCP/IP TTs. Node cccccccc appears as NetWare TTs. NetWare and TCP/IP traffic increase
E44	unchanged	down 4.5%	NetFrame generates much less traffic Node hp1a and hp2b disappear as TTs. Node av1b appears as TCP/IP TTs. Node cccccccc appears as NetWare TTs.

HP NetMetrix - The Perfect Network Elixir

The HP NetMetrix application and HP Network Node Manager platform provided a correlated view of the key network service level metrics for the 12 monitored network segments. The change in network utilization and response times on each of the 12 network segments was ascertained by taking measurements before and after the network resegmentation. Overall, the network resegmentation effort provided a network with better protocol alignment and unchanged utilization and response times. Although the short term initiative to improve response time was not achieved, the test results provided the medical center with the necessary justification to move forward with a high-speed switch deployment. The new switch configuration provided high-speed connection to each of the main servers that resulted in improved response time.

The HP NetMetrix network response project provided the following key benefits to the Medical Center Information Technology division.

Summary points

1. Operating parameters are now documented.
2. Better protocol alignment is achieved.
3. Utilization and response time levels have new (quantified) baselines.
4. Future changes will be more deterministic.
5. Selection and integration of a new backbone switch to improve access to the servers can be quantified for upper management.
6. Threshold levels are known and can be integrated to generate management event entries to HP OpenView so that problems can be fixed faster.
7. The need for a low-latency link-level switch with FastEthernet ports for servers was identified as a requirement to resolve the network response time and congestion problems.
8. The benefits of an integrated network management system are quantified

Plans for Enhanced Management

Shortly after the network baseline study, the medical center elected to move forward with a new switched-based infrastructure design. A decision was also made to integrate a number of third-party network and systems management applications into the HP OpenView management platform in order to provide enhanced management for all critical network and system components. The business and cost justification for both initiatives were straightforward as a result of the baseline project.

Plans for Web-based Reports

Next up for the hospital is to rollout the Web interface to HP NetMetrix and HP OpenView that will provide their customers with a flexible and powerful method of viewing service-level oriented information. Also, in the near future, the information systems group would like to integrate HP NetMetrix with their new client-server support center (help desk) solution. The IS staff must still support a very dynamic networking environment, but with the addition of HP NetMetrix, measurement and management of applications that are mission-critical to the hospital is now possible.

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