CONTROLLING THE DATACOM MONSTER: ONE COMPANY'S APPROACH

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Introduction

In 1983 when I started working for Ireco, a Utah based international explosives company, our datacomm consisted of several local terminals and one 9.6 point-to-point leased line. This line connected our Salt Lake City office and our West Jordan plant, 20 miles away. In June 1985 Ireco acquired the Explosives and Nitrogen Products division of Hercules Inc., an acquisition tripling the size of the company overnight. In the area of datacomm, this meant we added five major manufacturing plants and one distribution facility with which we had to establish nationwide communications. We were very much in the dark as to what the needs of these sites would be. Adding to the complexity, we were just making a recommendation to replace our current hardware with Hewlett-Packard equipment. We knew we had to act quickly, so we took our best guess, ordered data lines and began implementation. Four months after the network was installed we realized what we had in place was totally inadequate. We also realized that we did not have the expertise to design a network that would handle our needs. There were questions concerning response time, redundancy, and reliability. We weren't sure how to solve these and many other questions. What were we to do? After a great deal of thought, we came up with a plan as to what we <u>thought</u> we should do.

About The Paper

This paper will discuss the approach taken to tackle the datacomm monster before us: one company's approach to achieving results in the world of data communications. I need to emphasize at this point that in no way do I feel that our approach is the only approach, or the best approach. I'm not even sure there is such a thing as the best approach. What we have done is develop a method that works for Ireco in it's particular situation. I hope that by reading this paper you can gather some ideas and generate some questions in your own mind as to how to control the datacomm monster in your company. The remainder of this paper will be a chronology of the events and steps taken at Ireco over the last three years in the area of datacomm.

A Word About Ireco

Ireco Incorporated is an international explosives manufacturer and distributor headquartered in Salt Lake City, Utah. It has operating facilities in 26 countries located on every continent in the world. Ireco is owned by Dyno Industrier A.S. of Oslo, Norway. Dyno is one of Norway's oldest and largest companies with it's history dating back to 1865, when it was producing dynamite based on Alfred Nobel's patents. Ireco consists of three manufacturing divisions: Industrial Explosives, Nitrogen Products and Defense Products. Ireco has four marketing divisions: Western U.S., Central U.S., Eastern U.S. and International Sales. Ireco also has wholly owned subsidiaries in Canada and Chile. Ireco is considered to be a full-line explosives manufacturer spanning all explosives markets.

Early Datacomm Network

Factors Involved

As mentioned before, Ireco was a very unsophisticated datacomm user when the Hercules acquisition took place. During this time we were a very small shop consisting of five people, none of which were "datacomm experts." What faced us seemed like a monumental task. We now had a total of six manufacturing plants and one distribution facility with which we had to establish data communications. We had been told of the pending acquisition in April of 1985 but were allowed no contact with the new sites until the final papers were signed. Once the papers were signed an agreement was made with Hercules to continue to allow the plant sites to use their existing applications for one year. We all breathed a sigh of relief since we thought we had some time to plan our strategy. The one task we immmediately needed to worry about was establishing a connection from Salt Lake to Wilmington, Delaware (Hercules' computer center) in order to allow corporate office personnel access to the existing Hercules computer systems. This was accomplished without too much headache. We sat back and started to plot our strategy for handling these new needs. We thought we had time! Before we knew it we were into September and were told that as of January 1, 1986 the manufacturing plants had to be online with Salt Lake. At this point we still had not been able to gather an adequate amount of information on the data processing needs of these plants. What we did have was a list of applications and equipment used to access the Hercules system. We also found out that it took 45-60 working days to get a leased circuit installed. Realize that while all of this was going on, there was the problem of finding adequate software packages to handle the increased needs of the company, and we were also in the process of converting to HP hardware. WHEW! It gives me a headache just thinking about it.

Why Our Decisions

Based on what little we did know, and with advice from a couple of vendors, decisions were made and the lines, modems and multiplexers were ordered. We were feeling pretty good and were excited about what was to come. Boy were we naive.

The design consisted simply of two multidrop 9600 baud leased lines with three drops each. At the remote sites, 9600 baud modems were to be installed to act as slave units as well as multiplexers capable of handling eight devices each. The one site that we had been communicating with was to be left as is. In Salt Lake there would be two master modems and a major multiplexer node capable of handling all the remote devices. We had at the time two HP3000's and it was decided that we would use DS/3000 with the DS pt-to-pt link for system to system communications. (see illustrations 1 & 2)

There are a few key points about the decisions that need to be emphasized here. First, the design was a best guess based on the information gathered. Second, the modems were purchased from the only company we had a history with. Third, the multiplexers were purchased from the same company that our existing equipment had been purchased from in order to protect what we thought at the time was an already substantial investment. This was done even though the local HP support people had had no experience with this company's equipment communicating with the HP3000.

Implementation and Problems

I would like to say at this point that the implementation of this network went smoothly, but I would be lying. The datacomm lines were supposedly all installed around the first part of November and the modems and multiplexers were also arriving. Again we thought, "no problem, we have almost two months to get ready." A trip was organized and I was sent out to install the equipment at three of the sites in early November. In addition there was cable to be strung in the offices. Well, to make a very long story short, there were problems at all three sites. Some of the problems were: the telephone companies not installing an RJ41C terminator, or if it was installed, not in the right place; the lines that were supposed to have been tested, were not working; not knowing how to properly configure the modems; bad cards in the multiplexer equipment; missing reels of cable for connecting terminals and printers; and countless other minor problems. After a two week trip I did manage to arrive back in Salt Lake with things semi-working. Over the next month+ we continued to try and iron out the problems and get things working by January 1. After many sleepless nights we finally did. The second week of January we were off and running.

The Next Step

Underlying Major Concerns

The implementation of our first network taught us one important thing: "We didn't know very much about data communications." It was decided that at this point some education was essential. A class was found and a couple of key people were sent to school. Some questioning and re-evaluation of our network was an important result of this education. We were already seeing some problems. There seemed to be alot of down time in the phone company circuits which caused lost work time. The network was already slowing down and all we were running was Payroll. The sites had too much effect on each other. This raised major concerns about performance and response time, reliability of the network, and contingencies in the case of a circuit being down for a long period of time. We were really worried since we were just beginning to add the load of applications that we were to eventually reach, and the sites were going to become increasingly dependent on the computer. We knew we needed a better network. We didn't panic and decided that we would take the time to do it right. For this we sought some outside help in the guise of network consulting.

Steps Taken in Design of Network

Once a consultant, or I should say consultants, were selected and fees negotiated, the first step was to interview some of the key users and management personnel. This was done for two reasons: first, to determine what some of the complaints about the way the network was functioning now were; and second, to make a determination of how long they could afford to not have access to the computer. The overwhelming answers to the first part were the system is just too slow and the lines go down too often. The concensus answer to the second surprised us. Users felt that anything more than a couple of hours downtime during the day would cost the company money. From this it was decided that two key criteria for the new network design would be to dramatically increase the performance (response time) and to provide for redundancy to avoid excessive downtime. Another criteria added was that the network had to be flexible enough to easily add sites. This was for both terminals and CPU's. The next step was to learn as much as possible about the traffic that this network would be expected to handle. Information was gathered from each site concerning applications used, volume of transactions/day, number of pages printed/day and peak processing times daily, weekly and monthly. This was an exhaustive list as even an application that was only accessed on a monthly basis was considered. Next we looked at the applications themselves. A program was written to run on a datascope that would measure the number of characters being communicated between the CPU and terminal while running an application. To me, some of these numbers were quite amazing. For instance in our order management system it takes approximately 10,000 characters to enter an order header and one line item. Added to this data was the area code and telephone prefix of each of our plants. We also decided at this time that we were going to install another HP3000, this one being in our Port Ewen, New York plant. One thing that made the design of our network difficult was that our plants are not isolated to any given CPU. They need to be able to access any CPU quickly at any given time.

Armed with all the information they could carry, the consultants went back to their office and hashed out a design. Much of the data gathered was input into a software package that analyzes traffic to suggest line speeds and helps in determining the most cost effective routing of datacomm lines. After a period of time, a design proposal was presented to Ireco. This design was discussed and refined several times before a final design was achieved.

The Design

The design in its final form is shown in illustrations 3 & 4. As can easily be seen, the new network was drastically different from the old network and much more complex. Following are some of the key parts of the design:

1. There are no multidrop circuits involved. It was determined that the line traffic was too great for multidrop circuits to be feasible.
2. The speed of many of the circuits was boosted to a speed of 19.2 in order to handle traffic demands.
3. There are in reality two paths between Port Ewen, New York and Salt Lake City: one running effectively at 9.6 and one running at 19.2. This provides for redundancy and the capability to keep running if one of the circuits fails.
4. Several modems have been added that have split streaming capability. This was done to allow the splitting of a 19.2 line into two 9.6 chunks.
5. Through the use of either dual dial restoral or re-routing of modems, every plant has the capability of continuing to function if their main circuit fails.
6. Louisiana, Missouri became a central hub for communcations.
7. DS X.25 link was chosen to do system to system communications. This was chosen because in conjunction with the multiplexer each system is only

one jump from another. It was decided, the system to system would be mostly limited to program to program communications, spool file transfers and network file transfers. The plan has also been to supply a PDN type link to our parent company in Oslo, Norway.

8. Even local terminals in Salt Lake and Port Ewen would be connected to the multiplexer in order to allow one-step access to any system. The multiplexers act as port selectors and the first menu a user sees is from the multiplexer.
9. It was determined that a network management system was needed to monitor the datacomm lines and control all of the modems from one central place. This provides a distinct advantage when dealing with AT&T. When a line is having a problem we can tell exactly what the problem is and relay this information to AT&T. This has helped us solve bad line problems quickly.

Test Phase

The biggest question mark in the new design was the multiplexing equipment. As mentioned earlier, the vendor was an unknown in the HP3000 world and we had experienced some problems with the multiplexors that had taken awhile to resolve. We knew there was other equipment available that was proven with the HP3000 but again we wanted to protect our investment and our jobs. So, in order to answer this question, a test plan was developed in which all possible types of connections and all possible applications were to be tested. A complete copy of the test plan is contained in Appendix A. An agreement was reached with the multiplexer vendor for enough equipment to conduct this test. HP was also involved in supplying modems, test sets and software for the HP3000. This test was conducted afterhours over a series of nights so as not to cause down time to users. There were a couple of significant factors that came out of this test:

1. It was determined that we would need 25 pin ATP ports on the 3000 instead of 3 pin. The reason was that if the phone line was dropped, or the session on the multiplexer was dropped, it left the session on the HP3000 and anyone could grab it. This was a security risk that we could not live with. A special cable was developed to solve this problem thanks to the efforts of engineers from both vendors.
2. We also found that we would have to leave the packet size in X.25 on the HP3000 at 128K because we were telling the 3000 that it was talking to a PDN. This would be a drawback, but we felt we could live with it.

After completing all of the tests, it was determined that the multiplexers would function adequately for our needs and orders were placed.

How Did We Implement?

At this point one thing was for sure; this implementation was going to be extremely tricky. First, we were adding two more CPU's to the network. Second, we already had a network in place and a good deal of the existing equipment was to be used in the new network. Third, we had to keep downtime to an absolute minimum. We thought, "If we can pull this one off it will be a miracle." The whole implementation was a carefully thought out phased plan, and it worked.

Phase I: Install the HP3000/52 in Salt Lake and add the users to it as well as those local users that would be going through the network to the multiplexer. Once the 52 had been installed, the setup of the multiplexer and rewiring of the computer room was completed over a three-day weekend. This also involved the establishment of X.25 communications between the systems, and the capability to move spool files and data files from system to system.

Phase II: This involved the installation of equipment at two of our plant sites; Louisiana, Missouri and Donora, Pennsylvannia. These were the two sites in addition to Port Ewen that were to have more than one modem. In these situations the modems would be back to back and required that the configurations be exactly right, which was nowhere close to default, and a user contact be trained to make the cutover.

Phase III: This would be the most difficult and complicated phase. This involved the installation of the HP3000/58 and extensive datacomm equipment in Port Ewen. It would also require additional equipment to be installed in Salt Lake and the cutover of the whole company to the new network. Again, this phase was done on a three-day weekend plus one working day down time. The 58 and the datacomm equipment was installed and readied over a period of 1 1/2 weeks. On Friday a company wide coordinated effort was made and the phone line cutover was completed. Over the next three days the cabling was re-done and the network tested. By Tuesday morning the whole network, with the exception of one site due to an out of specification line, was up and running. Even the site with the bad line was brought up with the DDR option.

The experiences we had gained from our first network installation helped us greatly in preparing for this one, and contributed to it being a success.

Strengths and Weaknesses

Now that we have been functioning on this network for a little over a year, there are some strengths and weaknesses that should be pointed out.

Strengths:

1. The strongest point of this network is probably the performance (response time) for terminal users. There is not much difference between a local (SLC) terminal and a remote site terminal, even at peak use times.
2. The ability for any terminal user to access any CPU directly is definitely a positive. This allows us to save X.25 for file transfers and the moving of spool files.
3. Although we don't use it very much, the ability to resume communications even when a phone circuit is down has helped us on occasion. We do limit the use of the DDR feature due to the cost of long distance phone calls.

Weaknesses:

1. The X.25 traffic should not be sharing the same multiplexer as the terminal traffic. It tends to cause performance problems for the file transfers and moving of spoolfiles. This problem is partially due to the before mentioned packet size limitation, and also to the fact that our projected load has increased.
2. We have had trouble with the quality of some of the 19.2 circuits. These have taken time to resolve, even with the help of our network management system. We have also had trouble with one of our 9.6 circuits and getting that fixed by a RBOC (Regional Bell Operating Company).
3. There remains a problem with performing file transfers using a PC connected through the network. This appears to be a problem with the way the multiplexer handles ENQ/ACK flow control.

All in all the network has done its job and performed according to design.

Where Are We Now

What Has Happened Since

One thing that I have been able to count on in the 4 1/2 years that I've been at Ireco is that things are going to change. There have been further acquisitions, the company's marketing organization has been re-structured, and our Canadian subsidiary wants to come online. This has all placed new demands and requirements on our datacomm network. We have once again been faced with the question of "What are we going to do?" Although we have learned alot in our experiences, we are nowhere near experts. So, once again, we have called on the consultants to help us meet the new needs that are before us.

The New Design

What we are doing with the new design at this point is to take our existing network and add to it. (see illustrations 5 & 6) We are adding tail circuits to accommodate our Olympia, WA. office and our Montreal, Canada office. We are also adding a subnet that will accommodate our central marketing region. As a part of this we are hoping to add another CPU in Salt Lake. We have added a PC LAN to the Salt Lake office, and we are going to LAN connections for system to system communications in the Salt Lake office. We're also pulling the remaining X.25 communications out of the multiplexers. Not shown in the illustrations but of equal importance is that connectivity within the manufacturing plant sites has become extremely important. We are currently investigating different ideas for accomplishing this. The implementation has not begun yet as the plans have just been finalized, but it should once again be challenging.

Future Considerations

In the future we hope to merge the new subnet into the older network to take advantage of hubbing and cheaper phone line costs. We will have an office in Atlanta, GA. that we will need to bring online, and we still hope to establish communications with our parent company. Eventually we would like to include the 58 in Port Ewen into the system LAN that will be present in Salt Lake. The main thing for us is to remain as flexible as possible so that further changes within the company will not continue to cause us headaches and sleepless nights, and so that we can react quickly to these changes.

Conclusion

I hope that sharing our experiences at Ireco will help others in controlling their own datacomm monster. With the speed at which equipment and standards keep changing, things can get out of control in a hurry. In closing I would like to reiterate some of the things that have been key to us.

1. Get outside help. There is no way we could have done it without the consultants. We are not datacomm experts. With the speed at which things

are progressing, and with new technologies, there is no way we can keep up. Besides, it's the consultant's job to keep up; that's what they're paid for.

2. Plan ahead and test the equipment before implementing. Salesmen can tell you anything. The sky is the limit for them. Make sure what they tell you will really work.
3. Get a network management system. Our network really isn't that big, but we could not manage without it. This has allowed us to have one person manage the entire network.
4. Remain flexible. You never know when things are going to change. There will always be new requirements and increased demands that cannot be anticipated.

Last but not least, it is also very important to have good people. As my boss likes to say, "You can have the best system in the world, but without good people you don't have squat."

IRECO US DATACOMM NETWORK

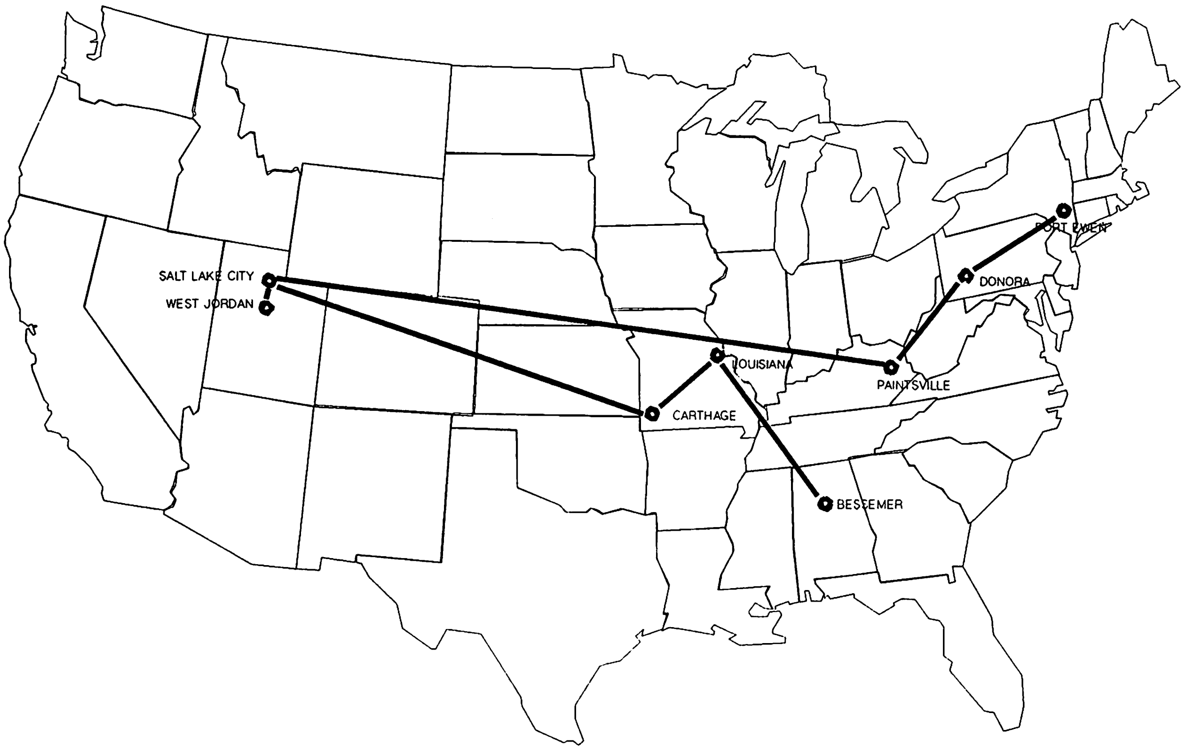

Illustration 1

ORIGINAL IRECO DATACOMM NETWORK

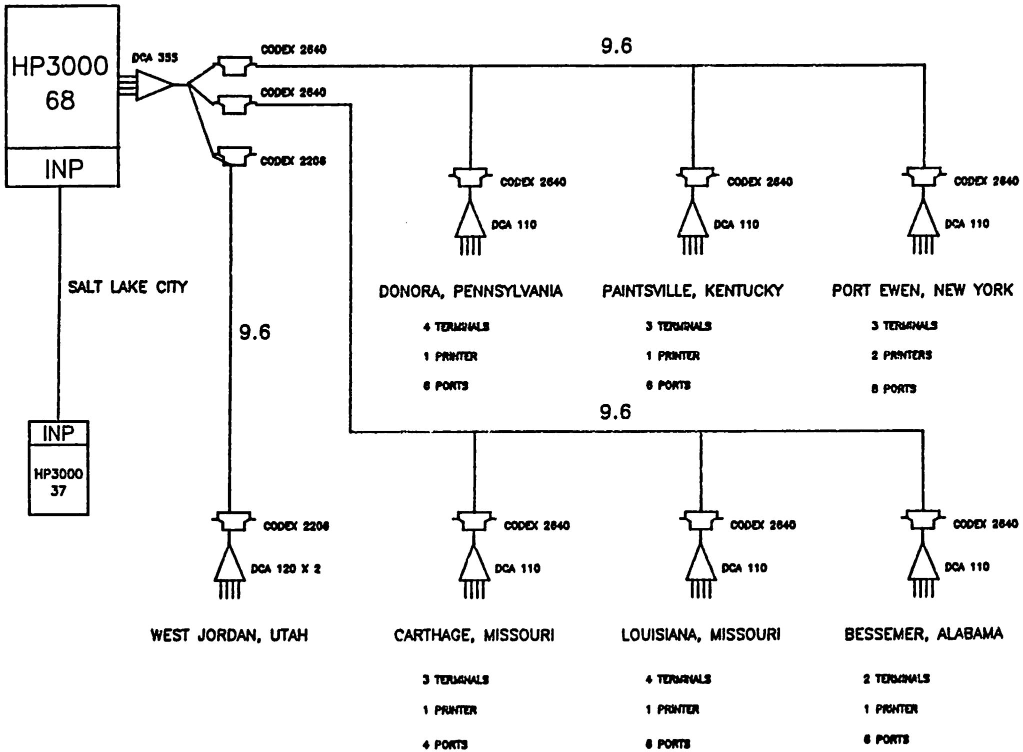

Illustration 2

IRECO US DATACOMM NETWORK

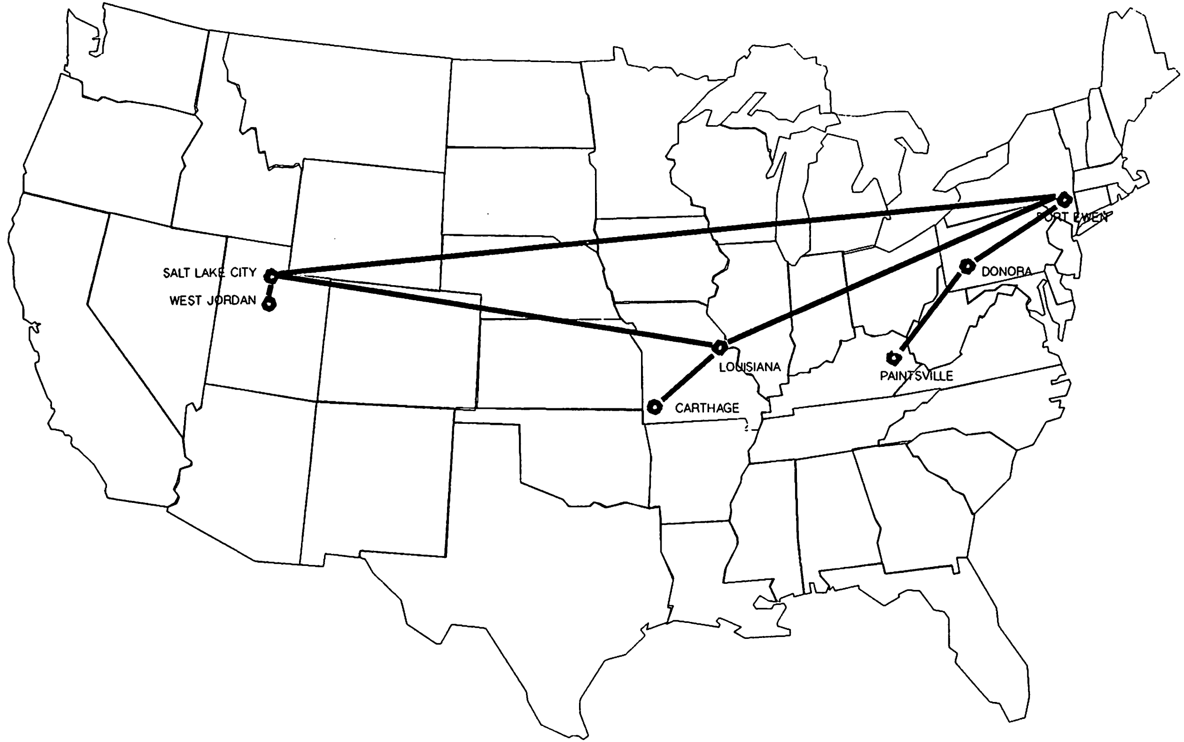

Illustration 3

IRECO
Data Communications Network

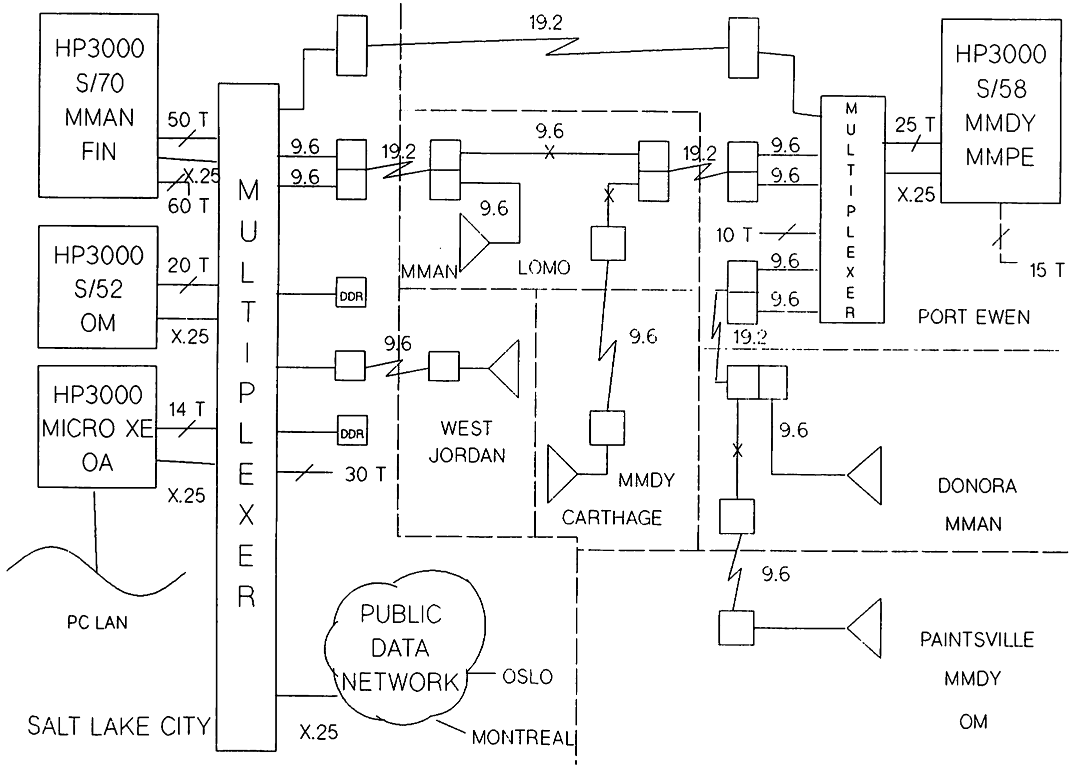

Illustration 4

IRECO US DATACOMM NETWORK

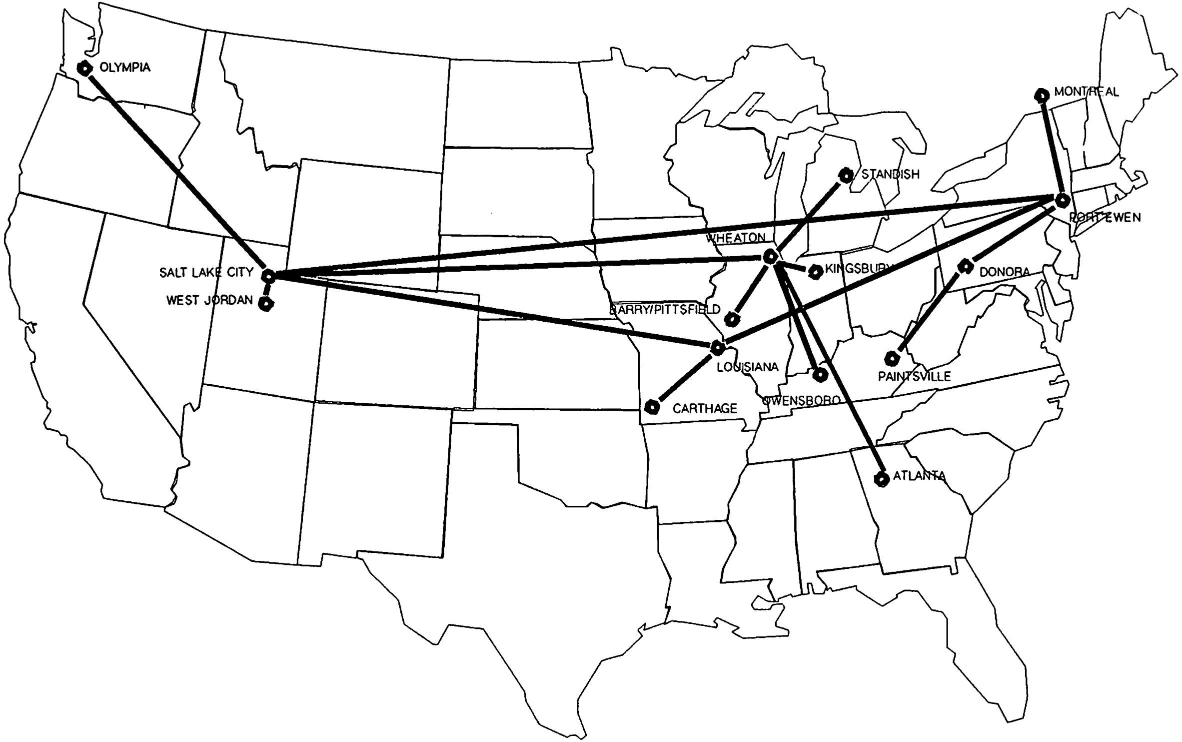

Illustration 5

IRECO Incorporated Communications Network

Processing and Switching Nodes

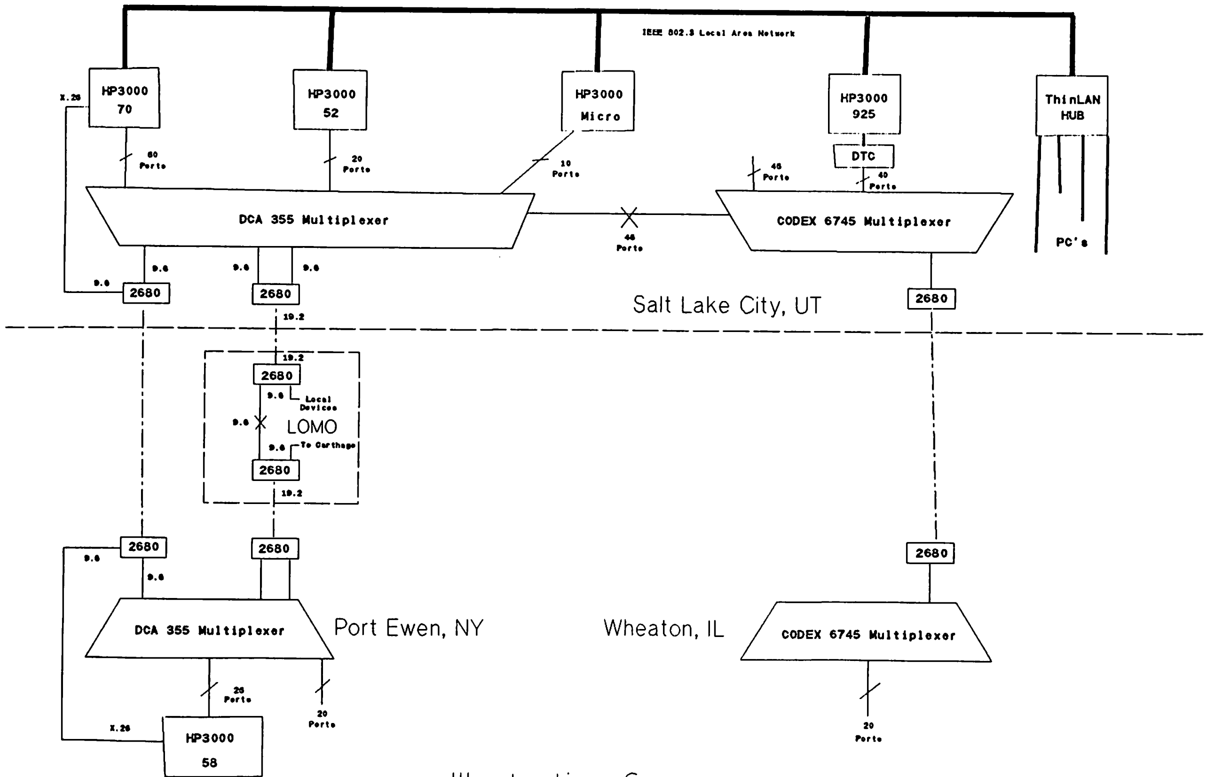

Illustration 6

04/23/88 RWS

IRECO MULTIPLEXER TEST PLAN

<u>OBJECTIVE 1</u> VERIFY DCA355, DCA110 PERFORMANCE WITH HP PRODUCT SET FOR TERMINAL - CPU COMMUNICATIONS

Terminal-Oriented Product

PRIORITY:

(1) HPWORD V
(2) HPWORD 150
(3) HPDRAW
(4) ADVANCELINK 2392 (File Transfer)
(5) OM
(6) MM
(7) DELUXE VISICALC
(8) EASYCHART
(9) REMOTE SPOOLED PRINTING
(10) ADAGER MODEL II
(11) SECURITY/3000
(12) MPEX
(13) LISTKEEPER
(14) INFORM
(15) REPORT
(16) PAYROLL
(17) ACCOUNTS PAYABLE
(18) GENERAL LEDGER

TOPOLOGIES:

(1) Single DCA 355 (SLC) used as Data Switch, Terminals to S/68 and S/37
(2) Two DCA 355, Point-To-Point, Terminals to S/68
(3) DCA 110 to DCA 355, Point-To-Point, Terminals to S/68
(4) DCA 110 to DCA 355 to DCA 355, Point-To-Point, Terminals to S/68
(5) DCA 110 to DCA 355 to DCA 355, MultiDrop 110 and Point-To-Point DCA 355's, Terminals to S/68
(6) DCA 120 to DCA 355, Point-To-Point, Terminals to S/68

HARDWARE REQ'D:

<u>DCA</u>	1 EA	DCA 355 with	HP Option Ports (4 Ports) 2 Composite Ports
	2 EA	DCA 355	Composite Port Boards for existing DCA 355

HP	4 EA	37230A 9.6KBPS Shorthauls	(Bellevue)
	2 EA	37210T 4.8KBPS Modems	(Bellevue)
IRECO	1 EA	HP150 Misc Cabling	
	1 EA	2392, 2934, 2686	

ACCEPTABILITY CRITERIA:

(1) DCA as Network Vendor -
No errors in using the following products:
- (1) MM
- (2) PM
- (3) OM
- (4) PCM
- (5) DESKMANAGER

(2) DCA as Conditionally Acceptable Network -
No errors in using the following products:
- (1) HPWORD V
- (2) HPWORD 150
- (3) HPDRAW
- (4) AdvanceLINK 2392 (File Transfer)
- (5) Deluxe Visicalc
- (6) EasyCHART
- (7) HPACCESS

Errors using a product will eliminate the use of that product at a site. Therefore, IRECO will decide whether to restrict the use of the product to hard-wired terminals or eliminate DCA as network vendor.

METHODOLOGY:

(1) HPWORD V
- (a) Run HPWORD - Observe and time download. Observe LDEV
- (b) Edit existing document
- (c) Print existing document to:
  - (1) Spooled Printers (2932 & 2686)
  - (2) Attached Printers (2932 & 2686)
- (d) Exit HPWORD
- (e) LOG OFF
- (f) LOG ON w/2nd terminal
- (g) LOG ON w/HP150
  - (1) Make sure LDEV is different from step (A) above
- (h) Complete step A above. Download should take less than 10 seconds

(2) HPWORD 150

(a) Transfer HPWORD 150 document from HP150 to HP3000. Observe and time file transfer

(b) Use HPWORD to convert display and print document

(c) Evaluate printed document for errors

(d) Transfer HPWORD document from HP3000 to HP150. Observe and time file transfer

(e) Use HP150 to display and print document

(f) Evaluate printed document for errors

(3) HPDRAW

(a) Use HPDRAW to display and edit an existing drawing

(b) Plot drawing using system plotter

(c) Plot drawing using eavesdrop mode

(d) Observe drawings for errors

(4) ADVANCELINK 2392

(a) Transfer ASCII file of approximately 100 records from HP150 to HP3000. Verify correct transmission

(b) Transfer binary file of approximately 1000 records from HP150 to HP3000. Verify correct transmission

(c) Transfer ASCII file of approximately 1000 record from HP3000 to HP150. Verify correct transmission

(d) Transfer binary file of approximately 1000 records from HP3000 to HP150. Verify correct transmission

(e) Compare time required for above transfers to time required when HP150 is connected directly to HP3000 @ 9600 BPS

(5) ORDER MANAGEMENT/ACCOUNT RECEIVABLE

(a) Get into the main menu and enter the OMS subsystem

(b) Add a sales order

(c) Inquire into an existing order

(d) Print order acknowledgements online

(e) Print shipping papers on a remote slave printer

(f) Enter into OMR subsystem and run a couple of reports

(g) Enter the AR subsystem and enter a daily cash entry

(h) Perform a customer inquiry

(i) Enter into the GM subsystem and enter a new customer

(j) Enter into the GMUTIL subsystem and perform at least one function
(k) Run a TREG to test the interface to MM

(6) MM
(a) Have the software start a terminal
(b) Use the "start" command to bring up a terminal
(c) Start a terminal as a logged in terminal
(d) Perform the following functions on each of the above terminals:
1. Transfer between each of the four subsystems
2. Transfer between copies of MM
3. Add a part number
4. Add a work order
5. Issue to the work order
6. Receive against a work order
7. Add a purchase order
8. Receive against the PO
9. Review activity and other things online
10. Transfer to the SAI terminal and back
11. Follow a menu tree down from top to bottom
(e) Terminate the MM session
(f) Submit a job to the SAI

(7) DELUXE VISICALC
(a) Create 50 row x 12 column spreadsheet
(b) Fill with data (50% entry, 50% calculated)
(c) Print spreadsheet to spooled and stand alone printers (use compressed format)
(d) Save spreadsheet
(e) Retrieve spreadsheet
(f) Examine all cells for correct content
(g) Compare timing with direct connected terminal @9600 BPS

(8) EASYCHART
(a) Use HPEASYCHART to display and edit an existing chart
(b) Plot chart using eavesdrop mode
(c) Observe chart for errors
(d) Plot chart to screen

(9) REMOTE SPOOLED PRINTING
(a) Create 10 copies of an approximately 132 line spoolfile with monotonically increasing line lengths

(b) Place properly configured HP4951 between system and multiplexer port

(c) Release spoolfile for printer. Observe proper printing. Look for:

    (1) Proper handling of status request (Esc ? DC1)

    (2) Proper handling of XOFF's (DC3 followed by status request properly answered followed by XON [DC1])

(d) Interrupt printer operation by

    (1) Taking printer offline, then placing online

    (2) Causing paper out and correcting paper out

    (3) Pressing reset

(e) Power off printer. Observe proper console message

(f) Verify (a) - (e) above at 1200, 2400, 4800 and 9600 BPS

Notes: Channel must be 7 bit odd parity or 8 bit no parity

Channel must have Flow Control disabled

Printer must be Type 32, SubType 14, Term-Type 19

(10) ADAGER MODEL II

(a) Change the capacities in at least three datasets of two separate databases and verify integrity

(b) Run Detpack on at least three datasets of two separate databases and verify integrity

(c) Move at least three datasets of two separate databases from one ldev to another and verify integrity

(11) SECURITY/3000

(a) Login to a user that is set up in security with a menu and verify no problems getting in

(b) Use three or four of the menu functions to verify that they work

(c) Verify that the logoff utility works, time inactivity period

(d) Verify that timeout on the DCA and on the HP3000 are in sync

(e) Stream a job using Streamx and an asked for parameter to verify that it works properly

(12) MPEX
- (a) Verify that MPEX can be entered with all capabilities set properly.
- (b) Use the extended LISTF command options
- (c) Use the Altfile command to change the attributes of at least two files
- (d) Use the extended fileset capabilities

(13) LISTKEEPER
- (a) Get into Listkeeper and edit a list
- (b) Create a new list from an old list
- (c) Print a list to the system line printer
- (d) Print list to a slaved printer

(14) INFORM
- (a) Enter Inform and select into several groups
- (b) Modify (or create) a report and display to terminal
- (c) Print a report to the system line printer

(15) REPORT
- (a) Run a compiled report and print to display
- (b) Run a compiled report and print to printer

(16) PAYROLL
- (a) Enter the payroll system and input some time transactions
- (b) Run the time transaction edit
- (c) Perform maintenance on several employee records
- (d) Run a report using the report writer subsystem

(17) ACCOUNTS PAYABLE
- (a) Get into the AP system and enter the Batch Input Processor. Use the functions to add, change, delete, and copy a batch
- (b) Enter the Online Services. Use the functions for log procedures, vendor entry, voucher edit, master file inquiry, and control file inquiry
- (c) Enter the standard jobstreams and use the functions to do control file maintenance, daily processing, and period end processing
- (d) Bring up online and then bring it down

(18) GENERAL LEDGER

(a) Get into the GL system and enter the Batch Input Processor. Create and save a batch

(b) Enter the Standard Jobstreams and run a control file update and a master file update

(c) Enter Online Services and enter a journal entry

(d) Run the Post jobstream

OBJECTIVE 2 VERIFY DCA 355 PERFORMANCE WITH HP X.25 (VT & NFT) BETWEEN SLC S/68 & S/37

TOPOLOGY:

Back-to-back DCA 355's used as X.25 switches between S/68 and S/37

HARDWARE REQ'D:

DCA Same as OBJECTIVE 1 adding X.25 capability to DCA 355's

HP
4 EA 37230A shorthaul modems
2 EA 30221A (?) RS232 modem cables
X.25 LINK S/W on S/68 & S/37

IRECO Same as OBJECTIVE 1

ACCEPTABILITY CRITERIA:

No Observed Errors
No CS or DS Reported Errors
Throughput not less than 80% of computed value

METHODOLOGY:

(1) Virtual Terminal (VT) Operation

Repeat all items in OBJECTIVE 1 using Terminal/150/Printer/Plotter on S/37, applications on S/68

Note: Observed results and compare with those obtained in OBJECTIVE 1 testing

(2) Network File Transfer (NFT) Operation

(a) Create file containing 1000 100 Byte noncompressible ASCII records on S/37

(b) Transfer file from S/37 to S/52 using DSCOPY and noting time required. Verify error free transfer

(c) Compute throughput. 1 19.2KBPS and 1 9.6KBS line with traffic balancing should net approximately:

$$\frac{19,200 + 9600}{8} = 1800 \text{ CPS less overhead}$$

(d) Transfer file S/68 to S/37 using DSCOPY and noting time required. Verify error free transfer

(e) Compare throughput with C above