NETWORDS

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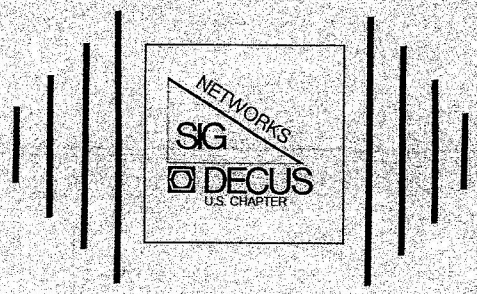

NETwords

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DECUS U.S. NETWORKS SIG STRUCTURE

By Bill Brindley
Networks SIG Chairman

The Networks SIG is composed of a Steering Committee and a number of working group coordinators. The Officers of The Networks SIG Steering Committee are:

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The Networks SIG Digital Counterpart is Gail Poulter of the Distributed Systems Group, Tewksbury, Ma.

Any of the above named individuals will be happy to answer any Network related questions.

FROM THE EDITOR'S WORKFILE

Another issue comes forth in your DECUS subscription service! You were promised four a year and this is your second one already! And next month you will get your THIRD issue!!

Yes, that's right,... we are serious about monthly issues. We believe that regularity might breed articles! About the 15th of every month, ace assistant editor Terese Marinelli gathers up our input and massages it through our word processor system (third party software running on the 73Ø Office Automation VAX) and allocates some of our time into NETwords.

How about allocating some of your time into a NETwords article or application note? DATAGRAMS, located in the back of this issue, provide a quick interchange of questions and information. Articles are even better. We would quite like to print network descriptions. Some European SIGs have found such descriptions are a good way of identifying people with possibly the same problem and maybe a shareable solution. Input that you value enough to send us is almost always valuable enough to publish. Sit down and do it today!

Send the input to: Jim Ebright
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We made it over the the European Symposia in Zurich this year. It was quite a pleasant time and the European hosts were ever so gracious. It was the third European Symposia we have attended. 13ØØ people attended in the largest symposia to date. The 42Ø sessions were scheduled in multiple parallel streams. European meetings are beginning to look like US symposia were when we first started going the them 7 years ago. The next symposia is in Amsterdam September 25-28, 1984. If you are in the DECUS leadership, you should definitely try to make it. Such travel helps to give a sense of perspective. And us language deficient Yanks don't have to worry -- everything is conducted in English, a sub-dialect of American! We attended the European Chapter's NETWORKS SIG meeting in Zurich. European readers who wish to get involved in networking and DECUS are urged to contact either the European Chariman or the appropriate national networks sig chairman.

Editor's Workfile
By Jim Ebright

The European NETWORKS SIG Steering Committee consists of the following people:

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Q-Bus/UNIBUS Hardware Hints and Kinks

Wayne Kesling, Session Chairperson
Monsanto Research Corporation
Miamisburg, OH

Reported by Marc Caffee, DECUS Scribe Service

During this session different people from the audience presented problems they had with their system and if there was one the resolution to the problem.

One of the more frequently appearing problems occurs on VAX UNIBUSs. Sometimes failures occur on machines having more than one high speed DMA device. The problem can be fixed if the DMA device can be slowed down. The details on the timing on the DMA bus transfers was not available at the session however they are available and hopefully will be appearing in a newsletter shortly. Similar problems apparently occur on at least one VAX-11/78Ø using a combination of foreign DMA devices running UNIX.

There were a variety of complaints and suggestions dealing with RKØ6s and RMØ5s. In particular on the RKØ6 the supports holding the drive motor give way and the motor falls on a transformer located underneath it. However, before it does this it does make a somewhat loud noise. Don't just assume it needs some lubricant, rather check and make sure the supports are not wearing out. Also on the RMØ5 there are rubber parts that the door closes against. If these are loose, pull them off before they fall into the disk. If they're not loose they probably won't cause a problem. The moral of the story is that they should be checked frequently. Also, caution should be used if you have to move a RKØ6 bus cable. If it is not handled gently there is a possibility of damaging it. Finally, there is a diagnostic available on the RKØ6 called operator intervention diagnostic. This diagnostic checks out the batteries that operate the head retractor. If you are powering up a unit that has been sitting idle for a while be sure and check this out.

Disk Drives:

The word is now that the RA81 disk drive is no longer on engineering hold, however there was no sure word on when retrofits would be available on RA81s already in use. Hopefully it would be soon.

If your RLØ2 temporarily goes off line check the sector transducer. Also, the RLØ2 ready lights burn out quite frequently. Additionally, an old RLØ2 controller will not necessarily work on a 11/23+ backplane.

Q-Bus/UNIBUS Hardware
Hints and Kinks
By Marc Caffee

On an 11/60 running RSX the RA80 does not spin up after a power failure. The solution to this is to "mount" the disk. The process of accessing the disk will spin it up. This might seem strange but it's true.

RX02s are not supported on the 11/23+. At this time the resolution is to fix the driver in lower memory. There are at least two outside vendors that supply boards which will support floppies. In connection to the Q-Bus problem, it is possible for a parity error to occur when using the RX02s. This problem occurs on the 22-bit system because of the extra lines in the bus. The 18-bit machine apparently never detects this error.

NASA has conducted a study on head wear versus relative humidity for high speed disks. The conclusion is that for best head wear the humidity should be kept between 40 and 50 percent.

Interfaces:

In using the DMR-11 with V3 of VMS you can go to full duplex. However, you have to remove the W17 jumper or else things will be slower than half-duplex.

The DMF-32 documentation is at odds with reality. BEWARE!! A DLV11J can be used as an interprocessor link. If two or more of the lines are used heavily the DLV11J will write PSs and PCs all over memory. The problem involved here is really quite general in that the DLV11J came into being before 4 level interrupt. In other words this device doesn't check other device priorities and this will cause severe problems. The resolution to the problem is to have this device (or any other similar device) placed behind the devices which have 4 level interrupt.

You might have problems if you try to connect a LP11 to a DMF-32. The LP11 has a 40 pin connector that doesn't fit into the DMF-32. A cable which might work is CSS LXY21-PA.

It is possible to transfer disks from a VAX to a DEC-10, however there is one problem which must be overcome. The VAX MASSBUS computes parity on 18-bits. The DEC-10 checks parity on 16-bits. In order to make the transfer work the two high order bits must both be 0's or 1's.

Others:

On an 11/34 after a RSX-11M 3.2 SYSGEN on RKØ5s the system refused to boot after several days. RT-11 and the diagnostics ran fine. Only RSX wouldn't run. It turns out that the ribbon connector on the DZV11 raked across the memory card and caused the problem.

Diagnostics are really scarce on the VAX-11/73Ø. If you have some technical questions contact Tom Provost, M.I.T./Bates Linear Accelerator, Middleton, MA.

Computer Interfacing: Hooking Up To The World

Wayne E. Kesling
Monsanto Research Corporation
Miamisburg, OH

Mack Overton, Session Chairperson
Food and Drug Administration
Chicago, IL

Reported by J. Rick Mihalevich, DECUS Scribe Service

Analogy to digital conversion typical uses are temperature measurement and data collection from laboratory instruments.

There are five types of analogy to digital converters (A/D or ADC):

1. The counting or ramp converter, counts till it matches the equipment signal. This converter has the advantage of low cost, however it is slow and has poor noise control.

2. The dual slope converter integrates the signal for a fixed time speed conversion, but has better noise control, when compared to the counting or Ramp converter.

3. The successive approximation converter represents a better and more expensive converter than the two described above. It approximates the signal by adjusting the D/A register value in powers of two. This converter is subject to noise but has a relatively good cost-to-performance ratio.

4. The parallel (flash) A/D converter is both very fast and very expensive. Signal is compared simultaneously with 15 reference signals graduated in powers of two and then fed into a comparator which is the reason for its high cost.

5. The final type of converter mentioned was a "trigometrical" converter. This type has a series of switches with a shaft encoder or a linear transducer.

The characteristics of A/D converters are accuracy, resolution, linearity, and no missing codes.

Regarding speed, "fast is fast enough." This means that just because the converter is fast does not mean that it is suitable for one's specific application.

General considerations:

1. Ground connections
2. Noise sources
3. Distance of cabling

Parallel digital interfacing is primarily used in applications where high speed data transfer is required and used as a mechanical link. This type of interfacing moves one or more pieces (Bits) of two-state information into/out of a computer. The bit states would be 1/Ø, or ON/OFF, or high/low.

The major advantages of parallel digital interfacing is the speed and ease of troubleshooting.

The major disadvantages of Parallel Digital Interfacing are:

1. Higher cabling cost than serial interfacing because it requires a wire per BIT plus grounding.

2. The use of multiple logic families of IC's available.

3. There are no interconnection standards for Parallel Digital Interfacing.

4. P/D interfacing uses multiple data formats (BCD,EBCDIC,ASCII,etc.).

Digital input one either has read switches (i.e. manual data entry, door switches) or is reading data from instruments (Digital voltmeter, ohmmeter, paper tape reader etc.)

Digital output primarily involves drive readout devices (i.e. incandescent lamps, Light emitting diodes, etc.) and drive digital I/O devices (i.e. paper tape punch, digitally controlled power supply, laboratory control purposes,etc.).

Problems generally encountered deal with the logic family incompatibilities.

The RS-232-C Serial interface is primarily concerned with the asynchronous serial interface. Again one must be aware of the misconception of "RS-232-C compatible" which doesn't guarantee that it will work.

Computer Interfacing:
Hooking Up To The World
By J. Rick Mihalevich

Types of data communication are serial and parallel serial/parallel. The modes of data communication are simplex, half-duplex and full-duplex.

For half-duplex operation, RTS is used to control the flow and direction of data sent. When the MODEM is turned on, DSR goes high. When the terminal is turned on, DTR goes high. With carrier from the CPU, RTS is high. Under these conditions the terminal will not raise RTS. When carrier from the CPU drops, the terminal raises RTS. The terminal MODEM turns on its carrier and starts sending data. When a <CR> or other terminator is sent, the terminal MODEM turns off its carrier.

When the CPU drops its carrier, it looks for line turnaround, as described above (looks for its RTS to go high). If it doesn't get RTS, it will hang up the phone.

*Note: The information above was obtained from a presentation that the 1983 Spring DECUS Symposium in St. Louis, Missouri. and a publication titled "Computer Interfacing" by Wayne E. Kesling, Monsanto Research Corp., Mound Rd., Miamisburg, Ohio 45342.

Personal Computers as Office Network Terminals

Rembert Aranda
Digital Equipment Corporation
Merrimack, NH

Eileen Deal, Session Chairperson
Digital Equipment Corporation
Merrimack, NH

Reported by Joseph Lowery, DECUS Scribe Service

Personal computer systems are providing a revolutionary driving force in the field of office automation, according to Rembert Aranda of Digital Equipment Corporation. This information was offered in analogy to what Aranda described as the three major revolutions that have occurred in the computer industry.

The first of these, the introduction of mainframe systems, occurred from the 195Øs through the mid 6Øs, when minicomputers were developed and initiated the second revolution. In the 197Øs the third and presently existing phase, that of the personal computer, began and started a trend that Aranda projects to continue to rise even more dramatically through 1986 than it has in the past few years.

The presentation then began a comparison of the personal computer (PC) and mainframe based data processing terminals (DPs.) The six major advantages of PCs were described as:

1. The Cost---PCs are less expensive in the long run than main-based terminals due to work station costs. PCs may cost more initially, but can perform an estimated 75% of the tasks usually found in an office environment, such as paper filing, word processing and documentation. The reduced time required for performance of these tasks was noted as perhaps the most important feature of utilizing a PC system. Since terminals carry higher costs for labor, hardware/software maintenance and software acquisition/development, PCs were firmly proposed as being a more economical choice.

2. The availability of color and graphics on PCs.

3. The faster response time of the PCs.

4. Users of PCs can install, acquire and develop software applications with a greater level of ease than DP users.

5. PCs possess greater capabilities for user tailoring.

6. PCs have available new kinds of software that do not exist with DP systems. No further elaborations on this topic were offered.

A brief comparison was then drawn with respect to the traditional software of DPs and the "Volksware" programs of the PC. Again most of the areas mentioned favored the PC. Included in these were documentation, modification time, availability of color, the number of users it can service and most strongly, the payback period for the two options: 5-10 years for the traditional software and six months to one year for that of the PC.

Aranda then described some of the disadvantages of the PC systems. There exists a certain lack of flexibility with the system, in that there are some situations where the programs are unable to be modified at all. Other drawbacks of the system are that the memories are often smaller than those of a DP and that the applications requested by the user can sometimes exceed the capabilities of the hardware.

Popular applications of the software for the PC were then discussed. Of these were (1) modeling, (most notably the spread sheet,) (2) data management, (3) personal word processing, and a variety of others which were felt to be of somewhat less importance, such as the utilization of graphics, communications packages, application/report generators and integrated user environments or "shells." The latter, and also the newest, is expected to undergo the most rapid growth over the next 1 1/2 years.

The services provided via the online data base of the system was then addressed, listing many of the specific features that the system is capable of performing. Highlights of these services are an integrated user interface, a private videotex, an electronic filing cabinet, nonprocedural languages, database management systems, compatibility/conversion facilities, communication gateways, and an electronic mail service. Of these, the electronic mail service was described as the most useful, due to five of its primary features. These are:

1. External gateways which allow for private, as opposed to public, transferral of information.

2. The reduced time and cost of document storage, delivery and retrieval.

3. Easier processing of incoming mail.

4. The fact that it widens a given "information community".

5. It allows the user to handle correspondence from home or any remote site.

Aranda concluded his talk by listing four metrics concerning the application space of a PC system which should be considered before purchasing a system, namely the depth, width, variety, and compatability of space of the system, and added that a wide range of capabilities, (the width of the system) is the most critical and desirable of these properties.

Giving Effective Presentations

Wesley E. Mullen
McDonnell Douglas Automation
Berkeley, MO

Adam Zavitski, Session Chairperson
Seismograph Service Corporation
Tulsa, OK

Several years ago, Mr. Mullen attended a conference where he became quite disturbed about the lack of quality in the presentations. He became so disturbed that he started taking notes. That year he attended 4 or 5 conferences and was able to continue taking notes. They were mostly negative things, things that disturbed him, so he started he started to put together a presentation that would be helpful to those called upon to present papers.

Most people have to make a presentation at one time or another. The presentation could be to a large group or to a single person. It could be an informal discussion or, as here at DECUS, a formal talk. We have probably noticed that when we begin to speak, we get weak knees, our hands shake, our voice begins to quiver, and we get this general feeling of inadequacy. The intent of this talk was to help each of you overcome these anxieties and give more effective presentations.

Mr. Mullen noted that here at the Cervantes Convention center, a group of St. Louis businessmen who created the International Speaker's Hall of Fame Award have plaques honoring the recipients. The award is for professional speakers who speak throughout the country. Their criteria for judging are: enthusiastic, entertaining, exciting, interesting, informative, inspirational and motivational. Although you are not expected to be professional speakers, you should definitely think about their criteria when you are preparing and giving a presentation. Following is a discussion of the presentation itself, its preparation, techniques for giving the presentation, and the use of visual aids. If you pick up only one of the ideas presented here, you will be leave a better speaker.

1. BE YOURSELF. It is very important to be yourself when you are giving a talk. If you pretend to be someone else, you won't look natural. Face your audience. Smile. Don't start your talk with an apology; you want your audience on your side. If you are prepared, they will find out soon enough. Be positive about yourself and your talk.

2. DON'T READ YOUR PAPER. Nothing is more boring than to listen to someone read word for word from a prepared text. There are very few people who can do this and still keep their talk interesting. If you can't keep your talk interesting, you will put the audience to sleep. Use index cards if it will help. Use an outline or use your visual aids as a guide. Ad lib. Add any thoughts that may come to you as you are giving your talk and make your talk different every time. Keep the content flexible. For instance, Mr. Mullen slipped the information on the Professional Speaker Awards into his talk.

3. ESTABLISH AUDIENCE CONTACT. Make the audience a part of your presentation. Establish eye contact. Find out who they are. What do you have in common with them? What language do they speak? What do they want?

4. INVOLVE YOUR AUDIENCE. Use the words "we" and "you". Establish objectives for them but keep them realistic. Don't have too many objectives. It is better to have one objective and present it well than to have too many of them presented poorly. Make sure that the objectives can be accomplished in a reasonable time frame. You need to know is going to happen because you gave the presentation. Know where your talk is going. You don't want to be like Alice talking to the Cheshire cat:

   "Would you tell me please which way I ought to walk from here?"

   "That depends a great deal on where you want to get to," said the cat.

   "Oh, I don't care much where," said Alice.

   "Then it doesn't much matter which way you walk," said the cat.

   "So long as I get somewhere," Alice added as an explanation.

   "Oh, you're sure to do that," said the cat. "If you only walk long enough."

   Our talks are the same way.

5. DO NOT ASSUME THAT ALL OF YOUR AUDIENCE UNDERSTANDS THE ACRONYMS AND BUZZWORDS THAT YOU USE. It is quite possible that all of you present have had a speaker use a buzzword that you did not know at this symposium.

6. BEWARE OF THE PODIUM. As you approach the podium, take it easy. Watch for wires that could trip you. Remember that the podium hides you from the audience and limits what you can do. If you do use the podium, stand erect behind the podium and don't slouch. Don't do things that might distract your audience. Don't pace. Let your hands be natural and, if you must stick them in your pocket, make sure your pockets are empty. Jingling coins or keys is distracting to the audience. Don't play with the telescoping pointer.

7. REHEARSE, REHEARSE, REHEARSE. Do a dry run with someone before hand. It isn't enough to simply go over your notes, you need to get on your feet and vocally rehearse your talk. You should be thoroughly familiar with your talk. Rehearse enough so that you feel you will be able to roll with the punches.

8. BE FAMILIAR WITH THE AUDIO/VISUAL EQUIPMENT. Know where the on/off switch is on the overhead projector. Make sure that all of the equipment is present. Have a backup. Try the equipment out. Anticipate problems.

9. BE SURE THAT YOUR AUDIENCE CAN SEE THE SCREEN. If you will block the audience's view of the screen, be prepared to step aside when you use the screen. Will any lights wash out the screen?

10. EXPEND TIME PREPARING YOUR VISUAL MATERIALS. Use white space effectively. Be careful of character sizes. Characters that are to small can not be seen. Keep the visuals simple by following the K.I.S.S. (Keep It Simple Stupid) policy. The more complicated your presentation, the more things that can go wrong. Keep the attention where you want it. After your audience has seen your visual, remove it and draw the attention back to you. If you must use a "busy" visual, use dark strips to introduce the visual to the audience in sections. Alternatively, you could highlight the important features of the visual. Put the audience's attention where you want it. After spending all of that time preparing a presentation, don't send it through the airport baggage. Carry it on with you. You may lose your luggage this way, but you won't lose your presentation materials.

11. AVOID DATED SLIDES OR FOILS. Keep your materials up-to-date or avoid putting dated items on the visuals.

12. REHEARSE WITH YOUR VISUALS. Make sure that they are in the proper order. Know when to use your visuals. Make sure that they come at the right time in your talk and that you are not talking about something and you are displaying another visual.

13. USE VISUALS AS A TOOL.

14. KEEP THINGS SIMPLE.

Mr. Mullen also had some additional remarks:

Don't talk in a monotone. Speed it up and slow it down. Add inflection and pauses to your talk. If you don't think you have the audience's attention, stop talking. Silence is a good way of getting their attention again. There are problems if handouts are passed out at the start of a talk. You will find that your audience will spend most of their time reading the handouts and missing much of what you have to say.

In a dark room, speak louder. For some reason, people cannot hear as well when the lights are dimmed.

Beware of the "opening joke" or the "opening story". You could kill your entire talk if it is not done well. In the opening part of your presentation, you want to capture your audience, you want to get their attention.

Professional 300 Series Communications

Ray Shapiro
Digital Equipment Corporation
Maynard, MA

Jeffrey H. Rudy
Digital Equipment Corporation
Maynard, MA

Stephen G. Finch, Session Chairperson
Emulex Corporation
Costa Mesa, CA

Reported by Gene Mitchell, DECUS Scribe Service

Communication was the subject of a heavily-attended session entitled "Professional 300 series communications." Speaker Ray Shapiro of Digital discussed communications services, telephone management systems, IBM communications and some future plans. Communications services include:

1. End user interface.

2. Callable service routines.

3. File transfer at speeds up to 9600 bytes. This may require an extra memory board. This file transfer also offers, among other options, a new command file transfer, password protection, and command terminal support.

Shapiro added that when the version 1.7 comes out, file transfer will be possible from Professional to Professional. He speculated that by the end of the year, the following might be included in the 1.5 or 1.7:

1. The menu could contain communications set-up, enter terminal-emulation mode, Professional-to-Professional file transfer, and call control services.

2. The 1.5 menu may include set default line characteristics, modify current line characteristics, and restore dafault line characteristics.

The file transfer set-up menu should allow the user to:

1. Accept or reject copying file.

2. Accept or reject incoming file.

3. Supersede or reject new files with previously-used names.

4. Password protection.

The terminal-emulator set-up menu includes both terminal echo and terminal type. The terminals emulated are: The VT52, VT102, VT125, and the Professional. Also available are:

1. Log keyboard input to file.

2. Access communications set-up from terminal menu.

Next on the agenda were Telephone Management Systems (TMS). Features include:

1. Integral modem. The unit has 300/1200 baud integral modem with Bell 103J and 212A asynchronous compatible modes that fit into the Professional box.

2. Four modes of operation, including voice data, serial data and touch-tone frequency.

3. An optional voice unit.

4. Easy programmer interface with capabilities for both simple and complex programming.

5. Supports two telephone lines.

6. Professional phone book: A software program allowing the user to maintain a directory of names and numbers.

Shapiro mentioned some sample applications: Telemarketing, DTMF inquiry and command, voice annotation and dictation (not done through the telephone), and teleconferencing. The TMS driver is full-sequence, with a 4096-byte buffer. It was suggested that the user use a dual-buffer approach for best results.

Shapiro concluded the TMS section by adding that it is "well-engineered," offering:

1. Several timers.

2. An emergency cutoff switch.

3. No pre-empting of telephone use.

4. A suitable dial mode: DTMF, push-button and rotary.

5. Ability to switch to voice code.

The IBM communications section dealt with connecting the Professional Series with IBM host computers. Three devices were used as illustration: The Digital RJE, the 3276-BSC from Advanced System Concepts, and the 3276 SNA from Paramim. The 3276-SNA can work as a 3287 printer emulator. The Virtual Terminal Emulator (VTE) from Advanced System Concepts works as a 3276 emulator. The VTE also includes a computer-based packaged tutor for the ease of the user, who need not go to the manual for instruction.

Using Broadband with DEC Networking

Marilyn Ressler
Digital Equipment Corporation
Tewksbury, MA

Reported by Nick Szabo, DECUS Scribe Service

Broadband is the use of CATV components and data communication protocols for distributing and switching data, voice, and video communications. CATV arose from the combination of television network program distribution and the telephone company's frequency division multiplexing (FDM). CATV now has 52 channels.

In the early 1970's, the FCC mandated that all cable vendors had to provide two-way service. This decree defined the sub-split cable system, which meant that most of the frequencies were assigned to the forward band pass, and only a few were assigned to the return band pass. In the late 1970's, the commercial world believed that the two-way cable service would be good for data; hence, single cable mid-split system. This equalized the forward band pass with the return band pass, and it had a guard band in the middle, so that the two would not mix. When data communications became more widely used on broadband, the dual cable system was developed. The channels are protocol transparent.

CATV is a medium which consists of coaxial cables, amplifiers, splitters, filters, taps, and headend and frequency translators. The signaling bandwidth of CATV is the information carrying capacity, which is 300 to 400 MHz, and the protocol is where the users information is placed.

There are three ways to allocate bandwidth on a broadband network: frequency division, time division, and space division. For the frequency division, 12 different channels can run on the same cable. Time division multiplexing is used for telephone technology, and it is very convenient for sending DIGITAL data. Space division multiplexing has more than one cable, and these cables will not mix.

Today, DIGITAL products can be used on broadband local area networks; terminals can be hooked up to CPUs, and CPUs can be hooked up to CPUs. DECnet can also be put on broadband. If there is a point to point link, it is very much like having two DMR's hooked together.

Ethernet--A Technical Overview

Rich Seifert
Digital Equipment Corporation
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Reported by Nick Szabo, DECUS Scribe Service

Ethernet is the development of a local area network. There was a need to provide a networking product which would meet a large number of networking requirements. These requirements included a minimum 10 year life, it had to be suitable for a wide range of machines, and it had to be standardized with a Digital-Intel-Xerox relationship.

There were several design goals for Ethernet. These goals included simplicity, low cost, compatibility, high speed, low delay, stability, easy maintenance, reliability, and layered architecture (modularity).

Ethernet is defined in two layers: there is a physical layer and a data link layer. At the physical layer there is a data rate of 10 million bits/sec. The maximum station separation is 2.8 kilometers, and the maximum number of stations is 1024. Ethernet's medium is a shielded coaxial cable and there are no loops in an Ethernet. At the data link, there is a fully distributed peer protocol. A statistical contention resolution (CSMA/CD), acts as a carrier sense with collision detect. The message protocol consists of variable size datagrams, which is a best effort delivery.

The physical channel transmits and receives bits. There are 64 bits in a preamble which is stuck on the front of a packet, and this initializes all the channel hardware. The framing is based on carrier sense, and the frequency harmonics on the coax is specifically limited. With Manchester encoding, there is always a transition in the middle of the bit cell.

It is able to withstand extremely harsh environments, such as 2 volts/meter fields. The temperature range is between 5 degrees and 50 degrees Celsius, and it can withstand a humidity range of 10-95%.

The data link is able to detect all single bit errors in transmission, most double bit errors, and most triple bit errors. The data link, when it receives a packet that is addressed for itself, checks the CRC.

The critical parameters of the coaxial cable design are transfer impedance, which is basically the measure of the shielding effectiveness of the cable, average characteristic impedance, sinusoidal impedance variations, velocity, attenuation, and the usage of a return air plenum (teflon cables).

The critical parameters in tapping the cable are a non-intrusive connection, a high impedance connection, reliability, and easy installation.

Communication Services

Jeff Low
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Dennis Perry, Session Chairperson
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Reported by Micheal Kintz, DECUS Scribe Service

Three communication servers are under development by Digital Equipment Corporation and will be announced in early 1984. The three communication servers--terminal, router, and gateway--will provide dedicated special communication functions in a network environment, shared resources in a network, and network communications controllers within a system.

The terminal server will provide virtual network terminal connections to hosts on or off the the Ethernet. The useful applications of the terminal server are large terminal networks, mode connections, and geographically distributed networks. The benefits of the terminal server include virtual terminal processing offloaded from hosts, fewer direct terminal connections to hosts, and non-blocking terminal switches.

The router server will provide user message routing within networks of similar architecture. The useful applications of the router server are LAN-TO-LAN interconnection, and LAN-TO-WIDE area network interconnection. The benefits of the router server include the routing function offloaded from local hosts, improved network reliability, and shared cost of connection to wide area facilities.

The gateway server will provide communications with hosts implementing foreign vendor architectures. The useful applications of the gateway server are multivendor network and mode connections, large terminal networks, and connection to public packet switching network nodes. The benefits of the gateway server are "gateway" processing offloaded from local hosts, shared cost of connection to public packet switching networks, and multivendor communication.

Mr. Low closed the presentation by saying that the communication servers will offer offload communication processing on host systems, improved network reliability, increased resource sharing, increased cost savings, and a modular growth path.

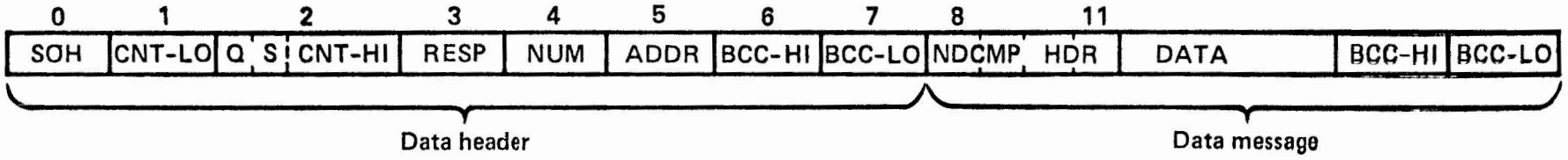
Network Layers: ISO vs. DNA

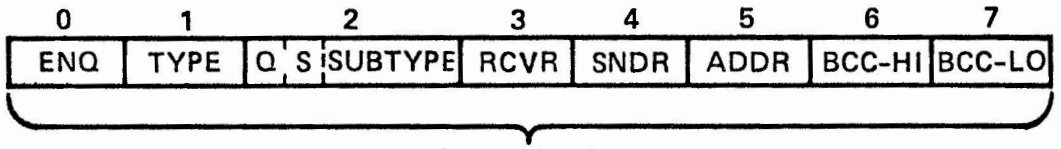
Layer	ISO	DNA	
7	Application	User	
6	Presentation	Network Applications	Network Management
5	Session	Session	
4	Transport	End Communication	
3	Network	Routing	
2	Data Link	Data Link	
1	Physical	Physical	

DDCMP: Characteristics

- Simple handshaking with few message formats
- Pipelining via message numbers (255)
- Byte count controls message length
- Error detection by CRC polynomial
- Error correction by retransmission
- Full/Half-duplex, synchronous/asynchronous transmission

DDCMP: MESSAGE FORMATS





Control header
(ACK, NAK, REP, STRT, STACK)

CONTROL MESSAGES

LL

		TYPE	SUBTYPE	RESP	SNDR
STRT	start	6	0	0	0
STACK	start Acknowledge	7	0	0	0
ACK	Acknowledge	1	0	MSG #	0
NAK	Negative Acknowledge	2	NAK Reason	MSG #	0
REP	Reply Request	3	0	0	MSG #

DDCMP: Control Flags

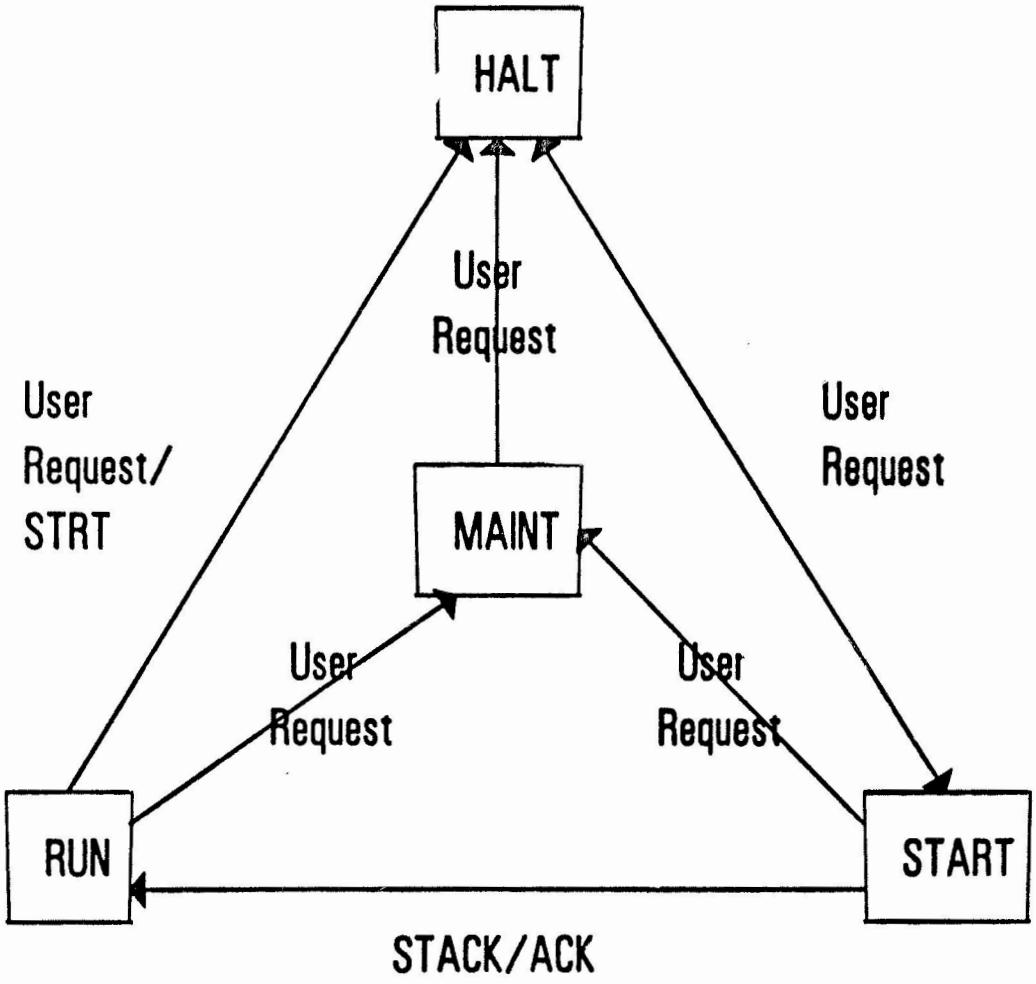
SREP - Send a REP message. Set on timeout.

SACK - Send an ACK (RESP=R). Set after successfully receiving message #R.

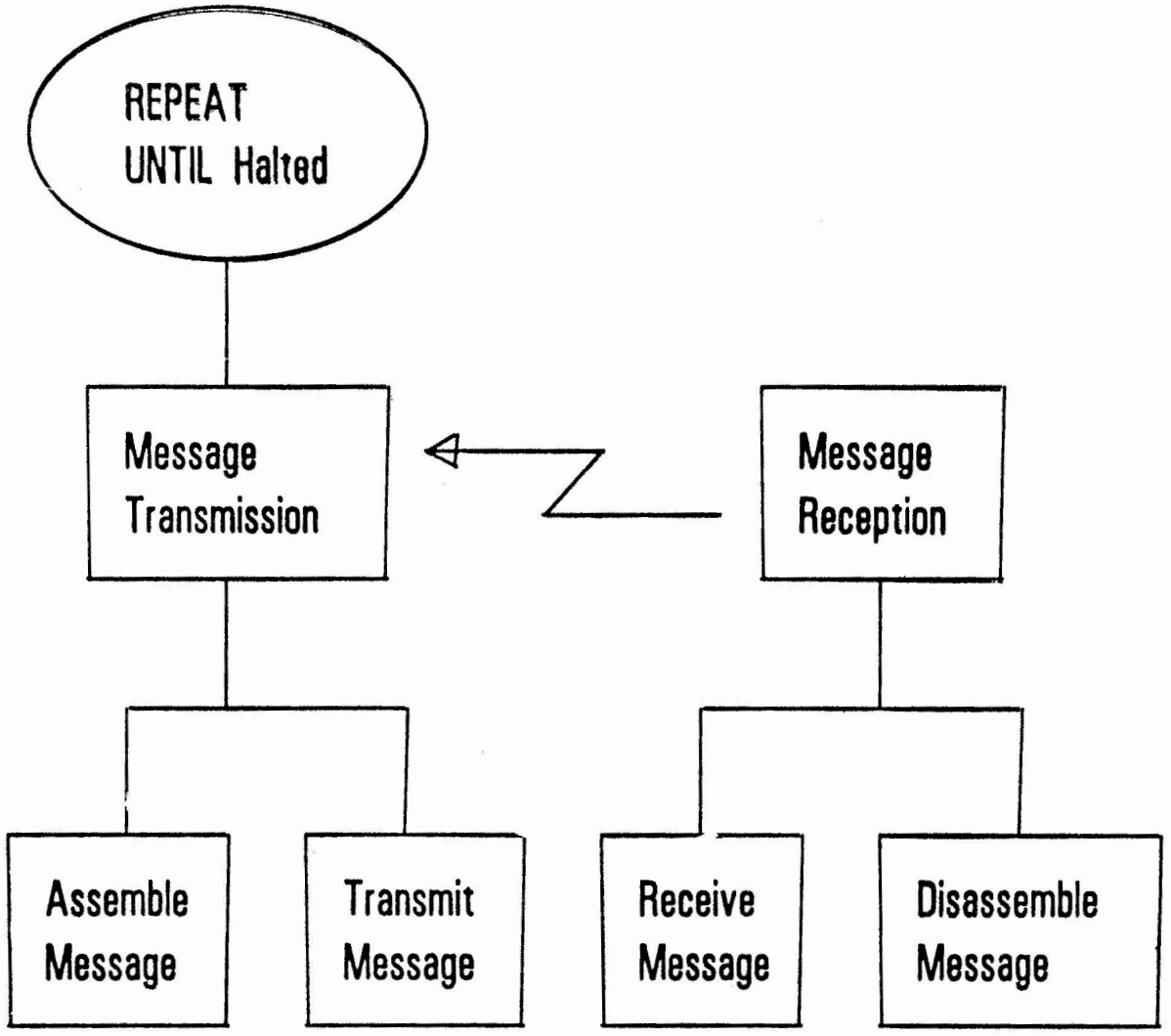
SNAK - Send a NAK (RESP=R). Set after receiving a message with errors, where message R was the last message received successfully.

Note: Each flag is cleared after the appropriate message has been sent.

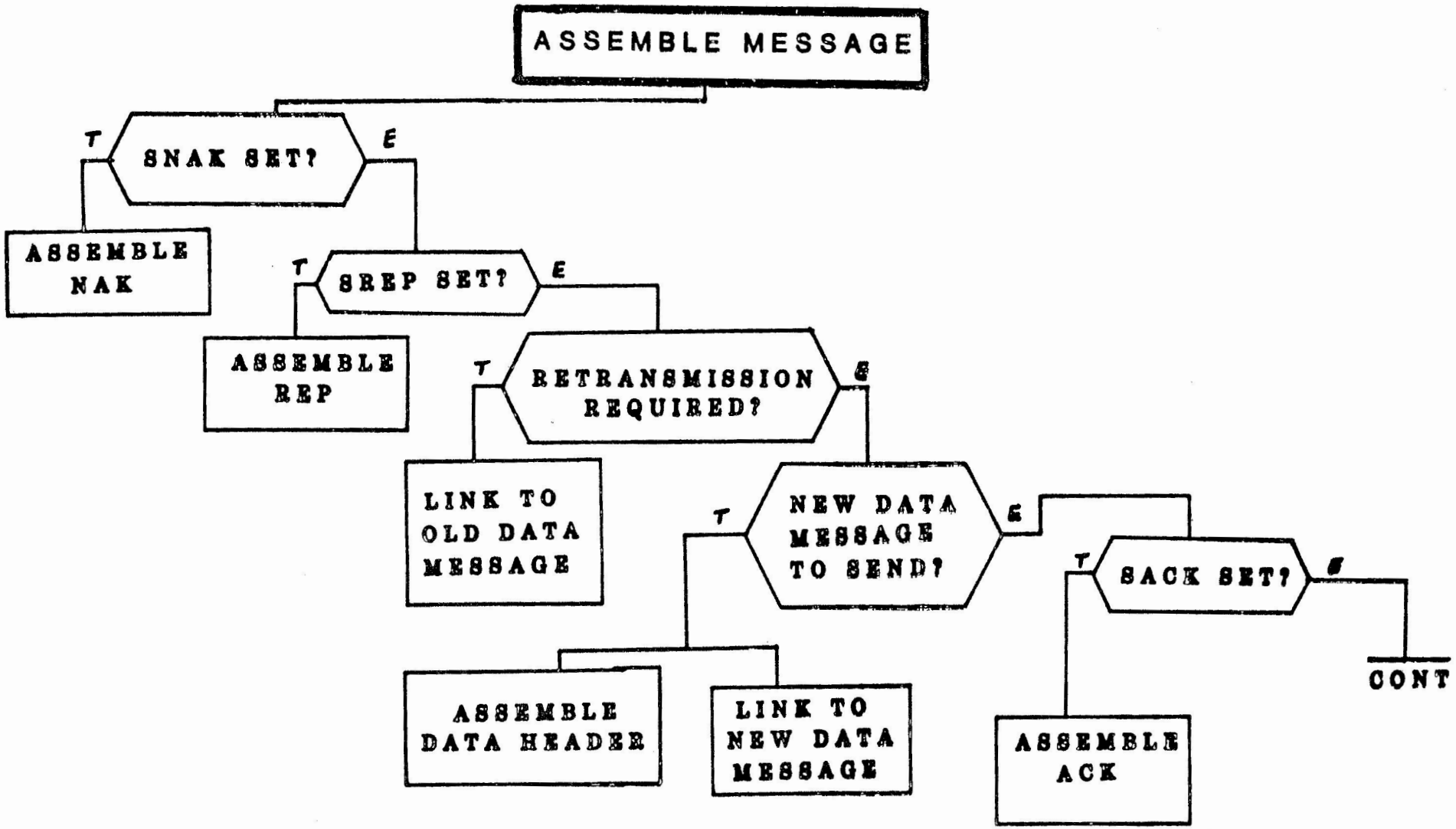
DDCMP: State Diagram



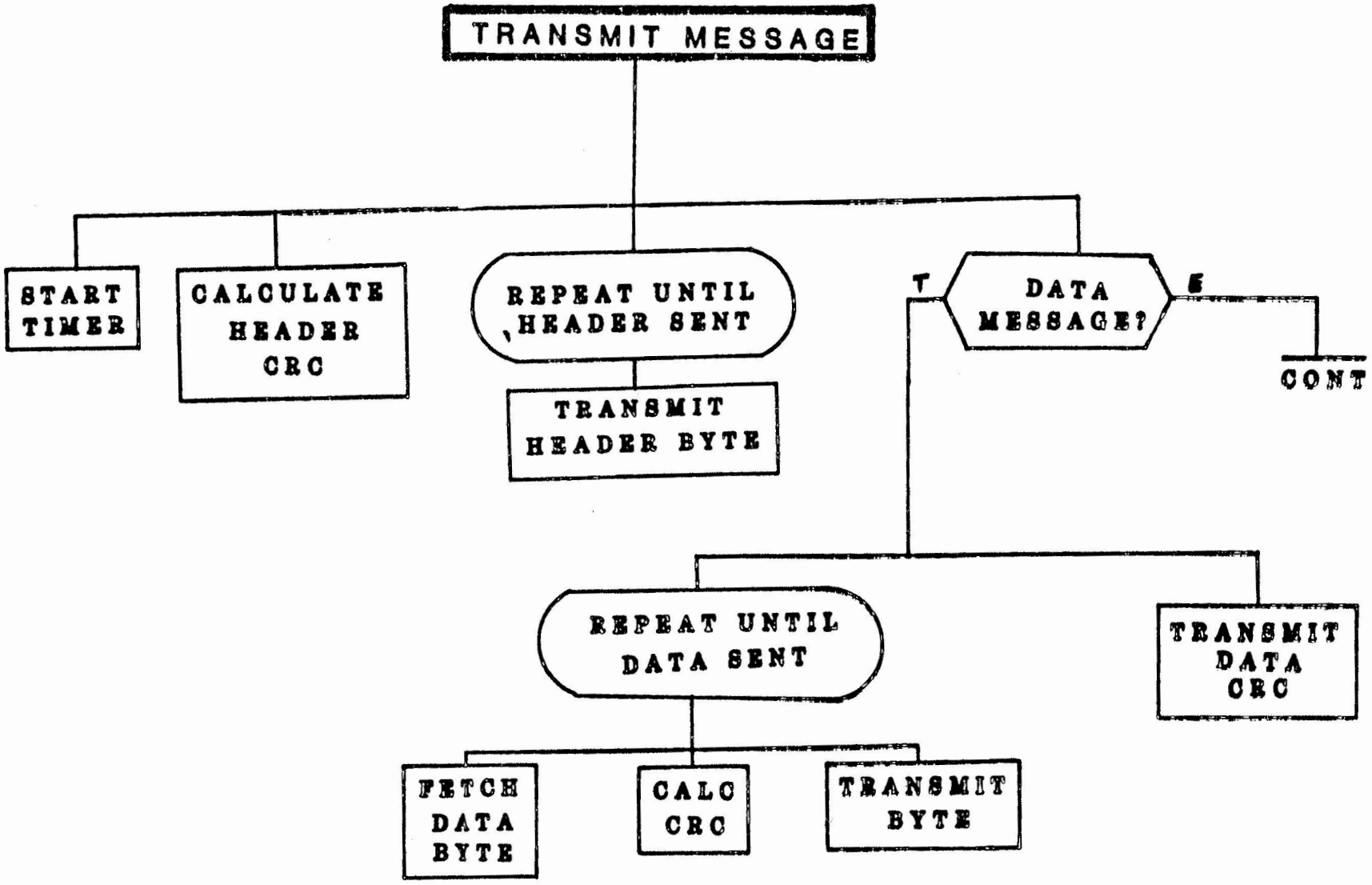
DDCMP: RUN Mode Structure Chart



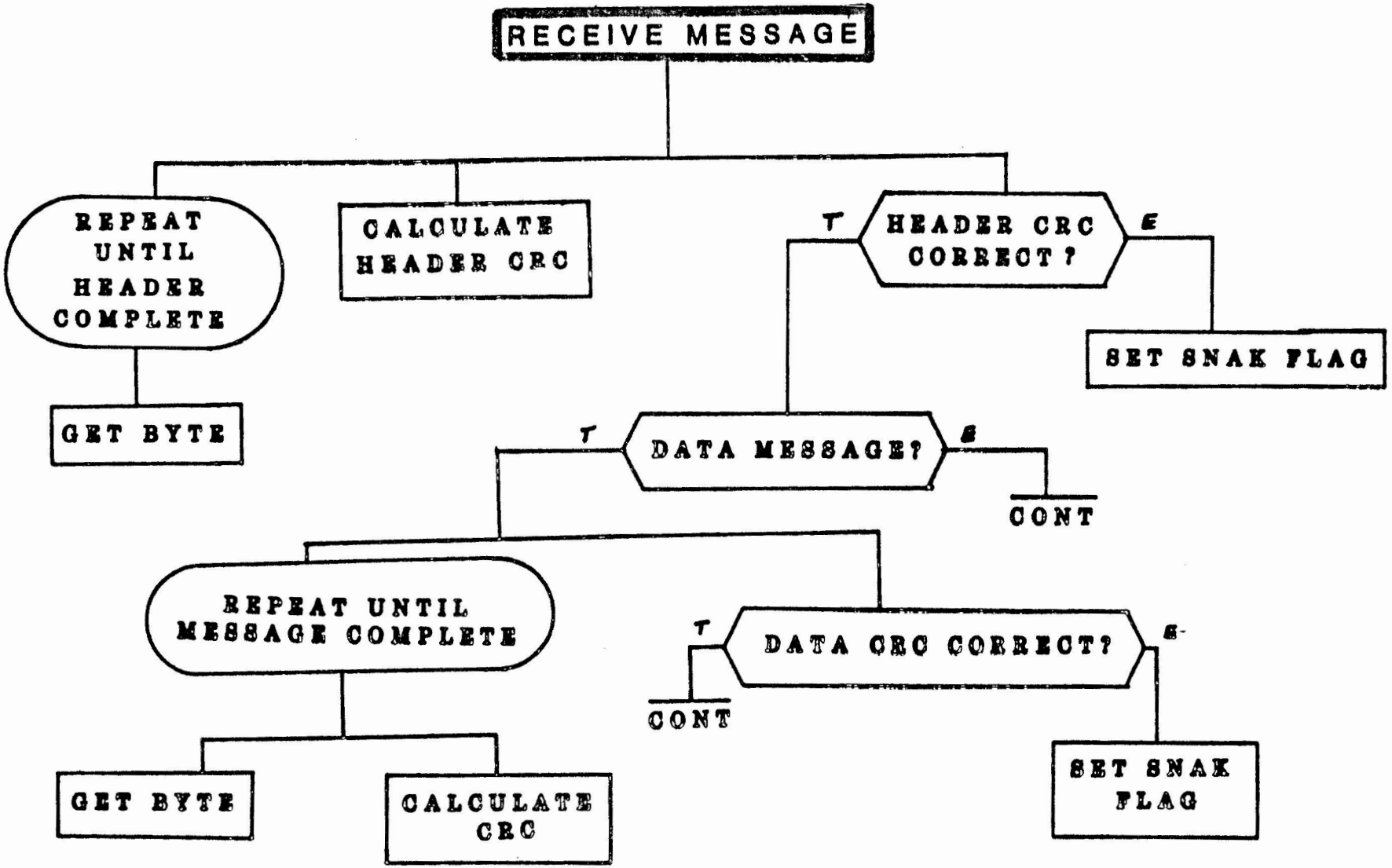
RUN Mode: Assemble Message Structure Chart



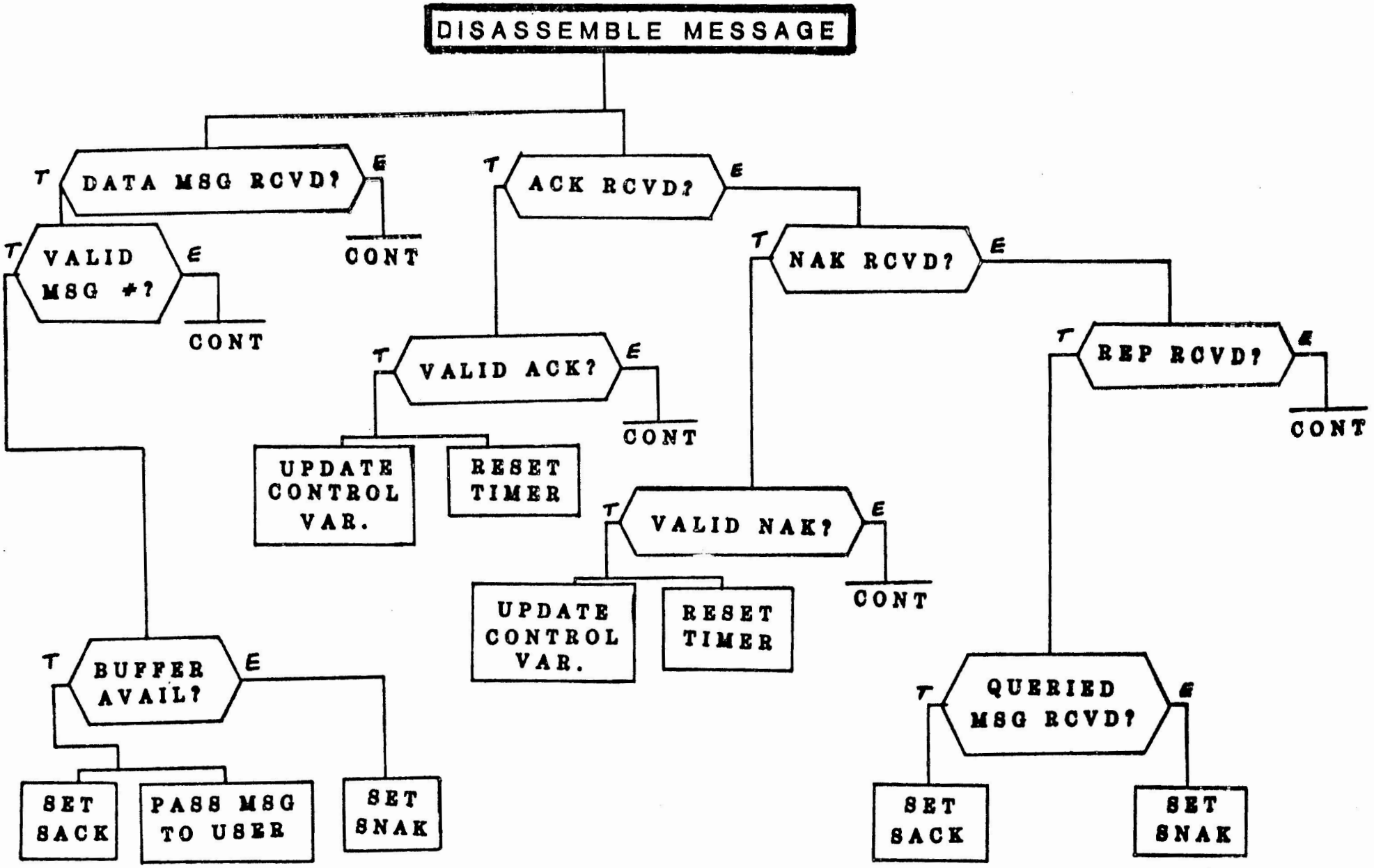
RUN Mode: Transmit Message Structure Chart



XON MODE: Receive Message Structure Chart



RUN Mode: Disassemble Message Structure Chart



DDCMP Handshaking: Start-up

Local Node		Remote Node
User requests start-up		
	STRT →	
		Acknowledge STRT request, enter RUN mode
	← STACK	
Enter RUN mode		
	ACK (RESP=0) →	

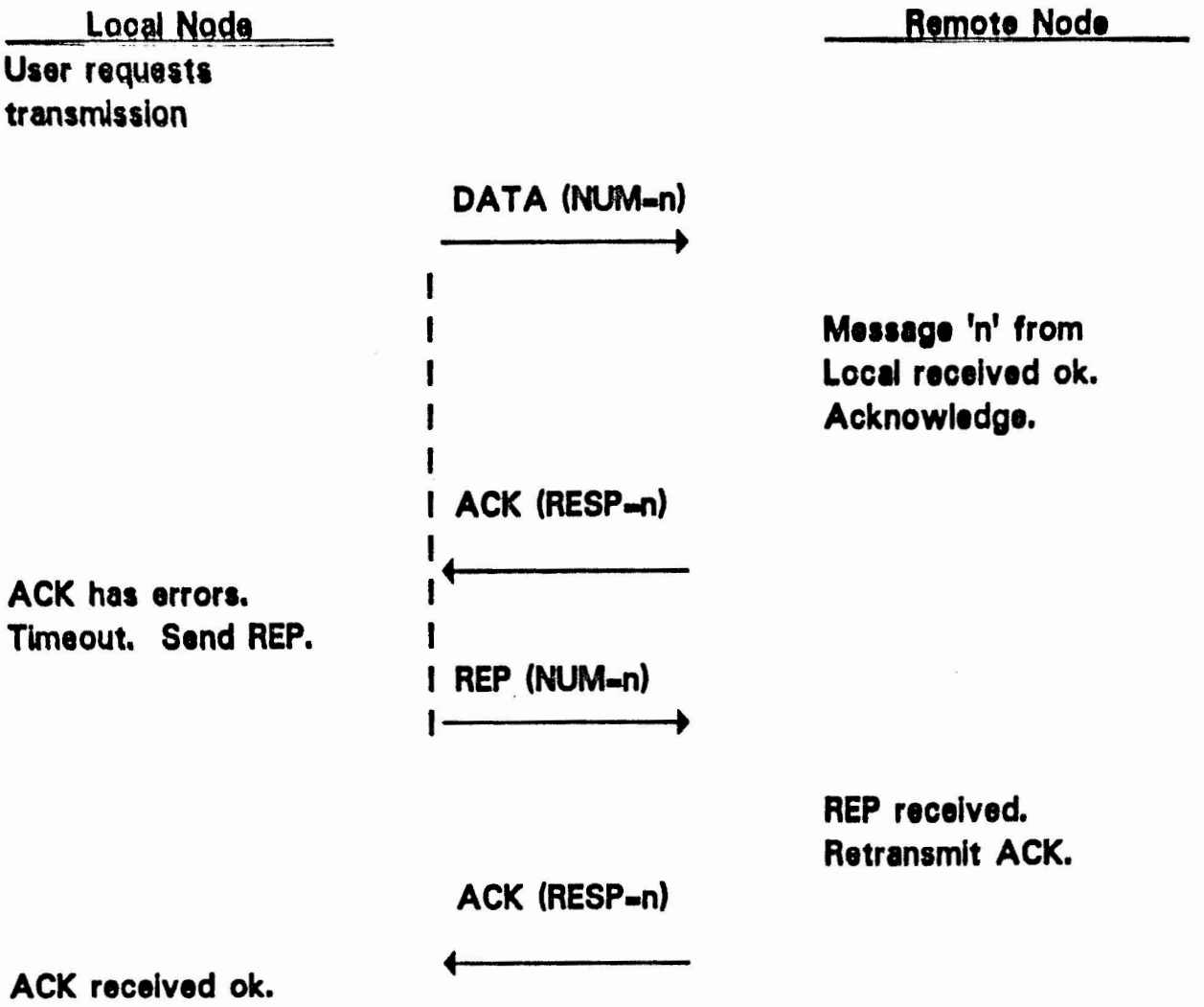
DDCMP Handshaking: Data Transmission Without Errors

Local Node		Remote Node
User requests transmission		
	DATA (NUM=n) →	
		Message 'n' from Local received.
		Send acknowledgement.
	← ACK (RESP=n)	

DDCMP Handshaking: Data Transmission With Errors

Local Node		Remote Node
User requests transmission		
	DATA (NUM=n) xxx⟶	
		Message 'n' from Local received with errors. Send NAK.
	NAK (RESP=n-1) ⟵	
NAK received. Retransmit.		
	DATA (NUM=n) ⟶	
		Message received ok.

DDCMP Handshaking: Data Transfer With Reply Time Out



DDCMP: CRC-16 Polynomial Characteristics

- Polynomial: $x^{16} + x^{15} + x^2 + 1$

- Errors detected include:
  - Errors affecting an odd number of bits
  - Errors consisting of a burst of ≤16 bits
  - 99.997% of errors consisting of a burst of 17 bits
  - 99.998% of errors consisting of a burst of ≥18 bits

- Some errors affecting four bits are not detected

Glossary: ???? [1]

NETWORK n. & v.trans. [From net "reduced slightly from gross" + work.] 1 n. The antisynergetic interconnection of noncompatible nodal systems divided by a common protocol. 2 v.trans. To reduce [net] the work rate (of a computing resource) by adding it to a network.

[1] "The Devil's DP Dictionary," S. Kelly-Bootle

Notes From Applications Panel

On DECnet/SNA Gateway

By

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The following slides were presented at the Application Development Panel for DECnet/SNA at the 1983 DECUS Spring Symposium in St. Louis

QUICK REFERENCE

VAX DECnet/SNA gateway subroutine calling sequences

```
status.wlc.v = SNA$ACCEPT[_W]  (portid.rlu.r,[efn.rlu.r],
                                [iosb.wz.dx],[astadr.c.r],
                                [astpar.rlu.r])

status.wlc.v = SNA$CONNECT[_W] (portid.wlu.r,[noddsc.rt.dx],
                                [accname.rt.dx],[circuit.rt.dx],
                                [sesaddr.rlu.r],[applic.rt.dx],
                                [logon.rt.dx],[user.rt.dx],
                                [password.rt.dx],[data.rt.dx],
                                [numrec.rlu.r],notify.c.r,
                                [bindbuf.wt.dx],[bindlen.wwu.r],
                                [efn.rlu.r],[iosb.wz.dx],
                                [astadr.c.r],[astpar.rlu.r])

status.wlc.v = SNA$LISTEN[_W]  (portid.wlu.r,[noddsc.rt.dx],
                                [accname.rt.dx],[circuit.rt.dx],
                                [sesaddr.rlu.r],
                                [numrec.rlu.r],notify.c.r,
                                [bindbuf.wt.dx],[bindlen.wwu.r],
                                [efn.rlu.r],[iosb.wz.dx],
                                [astadr.c.r],[astpar.rlu.r])

status.rlc.v = SNA$READ_EVENT[_W] (portid.rlu.r,evtcode.wlu.r,
                                   buffer.wt.dx,[datalen.wwu.r],
                                   [efn.rlu.r],[iosb.wz.dx],
                                   [astadr.c.r],[astpar.rlu.r])

status.rlc.v = SNA$RECEIVE[_W] (portid.rlu.r,
                                [seqnum.wwu.r],[rhpar.wt.dx],
                                buffer.wt.dx,[buflen.wwu.r],
                                [efn.rlu.r],[iosb.wz.dx],
                                [astadr.c.r],[astpar.rlu.r])

status.wlc.v = SNA$RECONNECT[_W] (portid.wlu.r,
                                  [bindbuf.wt.dx],[bindlen.wwu.r],
                                  [efn.rlu.r],[iosb.wz.dx],
                                  [astadr.c.r],[astpar.rlu.r])

status.rlc.v = SNA$REJECT[_W]  (portid.rlu.r,[sense.rt.dx],
                                [efn.rlu.r],[iosb.wz.dx],
                                [astadr.c.r],[astpar.rlu.r])

status.rlc.v = SNA$TERMINATE[_W] (portid.rlu.r,[sense.rt.dx],
                                  [efn.rlu.r],[iosb.wz.dx],
                                  [astadr.c.r],[astpar.rlu.r])

status.rlc.v = SNA$TRANSMIT[_W] (portid.rlu.r,traflg.rlu.r,
                                 seqnum.rwu.r,rhpar.rt.dx,
                                 buffer.rt.dx,[buflen.rwu.r],
                                 [efn.rlu.r],[iosb.wz.dx],
                                 [astadr.c.r],[astpar.rlu.r])
```

LOGIC FLOW OF APPLICATION

1) Do some initialization of things.
2) Establish connection with IBM system.
3) Validate bind received from IBM application.
4) If bind is valid send accept message to IBM. If not acceptable send reject message to IBM.
5) Receive start data traffic (SDT) from IMS.
6) Send a positive/negative response to IMS. If negative response is sent everything is over. If positive response is sent continue.
7) Receive first message from IBM application (IMS/VS).
8) Send a positive response back to IMS.
9) Get a data record.
10) Translate ASCII to EBCDIC.
11) Add 6 byte header. (AID key, curson address, set buffer address, screen address of start of field)
12) Send data record to IMS.
13) Receive message from IMS.
14) Repeat steps 9 through 13 until value returned by get_data is zero.
15) Send logoff message to IMS. (/RCLS)
16) Receive final message from IMS.
17) Wait for gateway to notify us that UNBIND has been received.
18) Do final cleanup and exit.

SNAEX.C;2

```
/*
 * include files:
 */

# include <stdio.h>
# include <descrip.h>
# include <ssdef.h>
# include <snalibdef.h>


/*
 * declarations:
 */

long int
        nef,    /* notification ast event flag */
        ref;    /* receive ast event flag */

unsigned int
        portid, /* gateway port identifier */
        traflg, /* transmit flag (0 = normal flow, 1 ` expedited flow) */
        nastpar,        /* ntraast parameter (expedited flow message) */
        evtcode;        /* event type code */

short unsigned int
        bindlen,        /* bind length */
        iseqnum,        /* input sequence number */
        oseqnum=1,      /* output sequence number */
        nseqnum,        /* expedited flow sequence number */
        ibuflen,        /* length of input data buffer */
        obuflen,        /* length of output data buffer */
        datalen;        /* notification buffer length */

struct SNABUF
        ob;     /* output data buffer */

union SNARH
        orh,    /* output RH */
        orhresp,        /* output response RH */
        nrhresp;        /* notification response RH */

struct SNAIOS
        iosb,   /* i/o status block used for general purposes */
        iiosb,  /* i/o status block used for input */
        oiosb,  /* i/o status block used for output */
        niosb;  /* i/o status block used in notification routin */

char
        hdrm[7]={0x7D,0xC3,0xD3,0x11,0xC2,0x61,0},      /* header appended  */
                                                        /* to each message */
        finalm[12]={0x7D,0xC2,0xE5,0x11,0xC2,0x61,
                    0x61,0xD9,0xC3,0xD3,0xE2,0}, /* terminate IMS link */
        sensebuf[4];     /* sense information buffer */

/* various string descriptors */
struct dsc$descriptor
        noddsc = {5,DSC$K_DTYPE_T,DSC$K_CLASS_S,"SNARK"},
        accname = {6,DSC$K_DTYPE_T,DSC$K_CLASS_S,"TIMSLM"},
        bindbuf = {0,DSC$K_DTYPE_B,DSC$K_CLASS_D,0},
        iosd = {SNAIOS$K_LENGTH,DSC$K_DTYPE_B,DSC$K_CLASS_S,iosb},
        iiosd = {SNAIOS$K_LENGTH,DSC$K_DTYPE_B,DSC$K_CLASS_S,iiosb},
```

```
        oiosd = {SNAIOS$K_LENGTH,DSC$K_DTYPE_B,DSC$K_CLASS_S,oiosb},
        niosd = {SNAIOS$K_LENGTH,DSC$K_DTYPE_B,DSC$K_CLASS_S,niosb},
        irhpar = {0,DSC$K_DTYPE_B,DSC$K_CLASS_D,0},
        orhpar = {SNARH$K_LENGTH,DSC$K_DTYPE_B,DSC$K_CLASS_S,orh},
        orhresppar = {SNARH$K_LENGTH,DSC$K_DTYPE_B,DSC$K_CLASS_S,orhresp},
        nrhresppar = {SNARH$K_LENGTH,DSC$K_DTYPE_B,DSC$K_CLASS_S,nrhresp},
        cpd = {0,DSC$K_DTYPE_T,DSC$K_CLASS_S,0},
        record = {0,DSC$K_DTYPE_T,DSC$K_CLASS_S,0},
        ibuffer = {0,DSC$K_DTYPE_T,DSC$K_CLASS_D,0},
        obuffer = {SNABUF$K_LENGTH,DSC$K_DTYPE_T,DSC$K_CLASS_S,ob},
        nbuffer = {0,DSC$K_DTYPE_T,DSC$K_CLASS_D,0},
        sense = {4,DSC$K_DTYPE_B,DSC$K_CLASS_S,sensebuf};

/* external declarations: */
extern struct dsc$descriptor
        get_name_dsc;

extern short int
        get_chan;

extern int get_data();



main()
{
  int notify(), recast();
  register int i;  /* return value from get_data */
  register int status;  /* return status value */
  struct SNABND *bp;

  /* do some initialization */
  status = SYS$ASSIGN(&get_name_dsc,&get_chan,0,0);
  if(status != SS$_NORMAL)
    LIB$SIGNAL(status);
  status = LIB$GET_EF(&nef);
  if(status != SS$_NORMAL)
    LIB$SIGNAL(status);
  status = LIB$GET_EF(&ref);
  if(status != SS$_NORMAL)
    LIB$SIGNAL(status);
  status = SYS$CLREF(nef);
  status = SYS$CLREF(ref);
  cpd.dsc$a_pointer = &ob.SNABUF$T_DATA;

  /* establish connection with IBM application */
  status = SNA$CONNECT_W(&portid,&noddsc,&accname,0,0,0,0,0,0,0,0,0,
                         &notify,&bindbuf,&bindlen,0,&iosd,0,0);
  if(status != SNA$_NORMAL){
    if(status != iosb.SNAIOS$L_STATUS)
      LIB$SIGNAL(status,0,0);
    LIB$SIGNAL(iosb.SNAIOS$L_STATUS,0,iosb.SNAIOS$L_QUAL);
    }

  /* validate the bind just received from IMS */
  bindlen -= SNABUF$K_HDLEN;
  bp = &bindbuf.dsc$a_pointer->SNABUF$T_DATA;
  if(   bindlen < SNABND$K_LENGTH
     || bp->SNABND$B_CMD != SC$K_RQ_BIND
     || bp->SNABND$B_BFMT != 1
```

```
      || bp->SNABND$B_FMP != 3
      || bp->SNABND$B_TSP != 3) goto reject;

  /* this bind is acceptable */
  status = SNA$ACCEPT_W(&portid,0,&iosd,0,0);
  if(status != SNA$_NORMAL){
    if(status != iosb.SNAIOS$L_STATUS)
      LIB$SIGNAL(status,0,0);
    LIB$SIGNAL(iosb.SNAIOS$L_STATUS,0,iosb.SNAIOS$L_QUAL);
    }

  /* wait for notification routine to handle STD command */
  status = SYS$WAITFR(nef);
  if(status != SS$_NORMAL)
    LIB$SIGNAL(status);

  /* receive first message from IBM application */
  status = SNA$RECEIVE(&portid,&iseqnum,&irhpar,
                       &ibuffer,&ibuflen,0,&iiosd,&recast,0);
  if(status != SNA$_NORMAL)
    LIB$SIGNAL(status,0,0);
  status = SYS$WAITFR(ref);
  if(status != SS$_NORMAL)
    LIB$SIGNAL(status);

  /* send back a response because we know that is needed */
  traflg = 0;
  obuflen = SNABUF$K_HDLEN;
  strncpy(&orhresp,irhpar.dsc$a_pointer,SNARH$K_LENGTH);
  orhresp.SNARH$V_FULL_RH.SNARH$R_RSPDEF.SNARH$V_RRI = 1;
  orhresp.SNARH$V_FULL_RH.SNARH$R_RSPDEF.SNARH$V_RTI = 0;
  orhresp.SNARH$V_FULL_RH.SNARH$R_RSPDEF.SNARH$V_BBI = 0;
  orhresp.SNARH$V_FULL_RH.SNARH$R_RSPDEF.SNARH$V_EBI = 0;
  status = SNA$TRANSMIT_W(&portid,&traflg,&iseqnum,&orhresppar,
                          &obuffer,&obuflen,0,&oiosd,0,0);
  if(status != SNA$_NORMAL){
    if(status != oiosb.SNAIOS$L_STATUS)
      LIB$SIGNAL(status,0,0);
    LIB$SIGNAL(oiosb.SNAIOS$L_STATUS,0,oiosb.SNAIOS$L_QUAL);
    }

  /* prepare for main transmit and receive loop */
  orh.SNARH$V_FULL_RH.SNARH$R_RQDEF.SNARH$V_RRI = 0;
  orh.SNARH$V_FULL_RH.SNARH$R_RQDEF.SNARH$V_RUC = SNARH$K_RUC_FMD;
  orh.SNARH$V_FULL_RH.SNARH$R_RQDEF.SNARH$V_BCI = 1;
  orh.SNARH$V_FULL_RH.SNARH$R_RQDEF.SNARH$V_ECI = 1;
  orh.SNARH$V_FULL_RH.SNARH$R_RQDEF.SNARH$V_DR1I = 1;
  orh.SNARH$V_FULL_RH.SNARH$R_RQDEF.SNARH$V_ERI = 1;
  orh.SNARH$V_FULL_RH.SNARH$R_RQDEF.SNARH$V_BBI = 1;
  orh.SNARH$V_FULL_RH.SNARH$R_RQDEF.SNARH$V_CDI = 1;

  /* loop until all data records have been sent */
  while(i=GET_DATA(&record)) {
#ifdef DEBUG
    LIB$PUT_OUTPUT(&record);
#endif
    cpd.dsc$w_length = record.dsc$w_length;
    obuflen = record.dsc$w_length+(sizeof hdrm)-1)+SNABUF$K_HDLEN;
    cpd.dsc$a_pointer = strncpy(&ob.SNABUF$T_DATA,&hdrm,(sizeof hdrm)-1)+
                        ((sizeof hdrm)-1);
    status = LIB$TRA_ASC_EBC(&record,&cpd);
```

```
    if( status != SS$_NORMAL )
      LIB$SIGNAL(status);
    traflg = 0;
    status = SNA$TRANSMIT_W(&portid,&traflg,&oseqnum,&orhpar,
                            &obuffer,&obuflen,0,&oiosd,0,0);
    if(status != SNA$_NORMAL){
      if(status != oiosb.SNAIOS$L_STATUS)
        LIB$SIGNAL(status,0,0);
      LIB$SIGNAL(oiosb.SNAIOS$L_STATUS,0,oiosb.SNAIOS$L_QUAL);
      }
    oseqnum++;
    status = SYS$CLREF(ref);
    status = SNA$RECEIVE(&portid,&iseqnum,&irhpar,
                         &ibuffer,&ibuflen,0,&iiosd,&recast,0);
    if(status != SNA$_NORMAL)
      LIB$SIGNAL(status,0,0);
    status = SYS$WAITFR(ref);
    if(status != SS$_NORMAL)
      LIB$SIGNAL(status);
    }

  /* transmit final message to logoff from IMS */
  strcpy(&ob.SNABUF$T_DATA,&finalm);
  obuflen = SNABUF$K_HDLEN+(sizeof finalm)-1;
  traflg = 0;
  status = SNA$TRANSMIT_W(&portid,&traflg,&oseqnum,&orhpar,
                          &obuffer,&obuflen,0,&oiosd,0,0);
  if(status != SNA$_NORMAL){
    if(status != oiosb.SNAIOS$L_STATUS)
      LIB$SIGNAL(status,0,0);
    LIB$SIGNAL(oiosb.SNAIOS$L_STATUS,0,oiosb.SNAIOS$L_QUAL);
    }
  oseqnum++;

  /* receive IMS's final message */
  status = SYS$CLREF(ref);
  status = SNA$RECEIVE(&portid,&iseqnum,&irhpar,
                       &ibuffer,&ibuflen,0,&iiosd,&recast,0);
  if(status != SNA$_NORMAL)
    LIB$SIGNAL(status,0,0);
  status = SYS$WAITFR(ref);
  if(status != SS$_NORMAL)
    LIB$SIGNAL(status);

  /* transmit the response that IMS is waiting to receive */
  traflg = 0;
  obuflen = SNABUF$K_HDLEN;
  status = SYS$CLREF(nef);
  status = SNA$TRANSMIT_W(&portid,&traflg,&iseqnum,&orhresppar,
                          &obuffer,&obuflen,0,&oiosd,0,0);
  if(status != SNA$_NORMAL){
    if(status != oiosb.SNAIOS$L_STATUS)
      LIB$SIGNAL(status,0,0);
    LIB$SIGNAL(oiosb.SNAIOS$L_STATUS,0,oiosb.SNAIOS$L_QUAL);
    }
  status = SYS$WAITFR(nef);
  if(status != SS$_NORMAL)
    LIB$SIGNAL(status);

  /* terminate the link with the gateway */
  status = SNA$TERMINATE_W(&portid,0,0,&iosd,0,0):
```

```
  if(status != SNA$_NORMAL){
    if(status != iosb.SNAIOS$L_STATUS)
      LIB$SIGNAL(status,0,0);
    LIB$SIGNAL(iosb.SNAIOS$L_STATUS,0,iosb.SNAIOS$L_QUAL);
    }

  status = SYS$DASSGN(get_chan);
  if(status != SS$_NORMAL)
    LIB$SIGNAL(status);
  return(1);

  /* bind was not acceptable so tell gateway to reject it */
reject:
  status = SNA$REJECT_W(&portid,&sense,0,&iosd,0,0);
  if(status != SNA$_NORMAL){
    if(status != iosb.SNAIOS$L_STATUS)
      LIB$SIGNAL(status,0,0);
    LIB$SIGNAL(iosb.SNAIOS$L_STATUS,0,iosb.SNAIOS$L_QUAL);
    }
  fprintf(stderr, "BIND is invalid.\n");
  return(1);
}



/*
 * notification routine called by gateway when a expedited flow message
 * has been received.  this routine has one calling parameter.  this parameter
 * is the portid on the session that has received the expedited flow message.
 */
notify(port)
unsigned int *port;
{
  int ntraast();
  register status;

  status = SNA$READEVENT_W(port,&evtcode,&nbuffer,&datalen,0,&niosd,0,0);
  if(status != SNA$_NORMAL){
    if(status != niosb.SNAIOS$L_STATUS)
      LIB$SIGNAL(status,0,0);
    LIB$SIGNAL(niosb.SNAIOS$L_STATUS,0,niosb.SNAIOS$L_QUAL);
    }

  /* PROCESS THE EVENT */
  if(evtcode<SNAEVT$K_MIN || evtcode>SNAEVT$K_MAX) {
    fprintf(stderr,
            "NOTIFY -- Event type code out of range\n\t  evtcode = %d\n",
            evtcode);
    exit(1);
    }

  switch(evtcode){
  case SNAEVT$K_RCVEXP: /* received expedited flow message */
    if((struct SNABUF *)nbuffer.dsc$a_pointer->SNABUF$T_DATA[0] ==
                (char)SC$K_RQ_SDT){
      /* this message is a SDT (start data traffic) */
      /* all is well so let's send a positive response */
      traflg = 1;
      nseqnum = (struct SNABUF *)nbuffer.dsc$a_pointer->SNABUF$W_SEQ;
      strncpy(&nrhresp,
```

```
            (struct SNABUF *)nbuffer.dsc$a_pointer->SNABUF$T_RH,
            SNARH$K_LENGTH);
      nrhresp.SNARH$V_FULL_RH.SNARH$R_RSPDEF.SNARH$V_RRI = 1;
      nastpar = (struct SNABUF *)nbuffer.dsc$a_pointer->SNABUF$T_DATA[0]&0377;
      status = SNA$TRANSMIT(port,&traflg,&nseqnum,&nrhresppar,
                            &nbuffer,&datalen,0,&niosd,
                            &ntraast,&nastpar);
      if(status != SNA$_NORMAL)
        LIB$SIGNAL(status,0,0);
      goto ret;
      }
    /* bad news -- we have one we don't know how to handle */
    fprintf(stderr,
            "NOTIFY -- Unhandled expedited-flow message\n\t  request = %d\n",
            (struct SNABUF *)nbuffer.dsc$a_pointer->SNABUF$T_DATA[0]);
    exit(1);

  case SNAEVT$K_TERM:   /* termination message received */
    if((struct SNATRM *)nbuffer.dsc$a_pointer->SNATRM$L_REASON ==
                SNA$_UNBINDREC){
      if((struct SNATRM *)nbuffer.dsc$a_pointer->SNATRM$B_UNBCOD == 1){
        /* normal unbind, all is well return quietly */
        status = SYS$SETEF(nef);
        if(status != SS$_NORMAL)
          LIB$SIGNAL(status);
        goto ret;
        }
      }
    /* let signal handle this one */
    LIB$SIGNAL((struct SNATRM *)nbuffer.dsc$a_pointer->SNATRM$L_REASON,5,
               (struct SNATRM *)nbuffer.dsc$a_pointer->SNATRM$W_SENSE0,
               (struct SNATRM *)nbuffer.dsc$a_pointer->SNATRM$W_SENSE1,
               (struct SNATRM *)nbuffer.dsc$a_pointer->SNATRM$B_UNBCOD,
               (struct SNATRM *)nbuffer.dsc$a_pointer->SNATRM$B_GWYCOD,
               (struct SNATRM *)nbuffer.dsc$a_pointer->SNATRM$B_GWYQUA);
    exit(1);

  case SNAEVT$K_UNBHLD: /* unbind hold received */
    fprintf(stderr,
            "NOTIFY -- Unexpected unbindhold received\n");
    exit(1);

  case SNAEVT$K_COMERR: /* gateway communication error */
    fprintf(stderr,
            "NOTIFY -- Unexpected gateway communications error\n");
    exit(1);
  default:      /* nothing else worked so come here */
    fprintf(stderr,
        "NOTIFY -- unknown event code check documentation.\n");
    exit(1);
  }
ret:
  return(1);
}



/*
 * ast routine used in notify routine because the software will not let you
 * use wait forms of the calls in a ast routine.  so, just check the status
```

```
 * etc.
 */
ntraast(par)
unsigned long int par;
{
  register status;

  if(niosb.SNAIOS$L_STATUS != SNA$_NORMAL)
    LIB$SIGNAL(niosb.SNAIOS$L_STATUS,0,niosb.SNAIOS$L_QUAL);
  status = SYS$SETEF(nef);
  if(status != SS$_NORMAL)
    LIB$SIGNAL(status);
  return(1);
}



/*
 * ast routine used for receive calls.  check status and set flag, etc.
 */
recast(par)
unsigned long int par;
{
  register int status;

  if(iiosb.SNAIOS$L_STATUS != SNA$_NORMAL)
    LIB$SIGNAL(iiosb.SNAIOS$L_STATUS,0,iiosb.SNAIOS$L_QUAL);
  status = SYS$SETEF(ref);
  if(status != SS$_NORMAL)
    LIB$SIGNAL(status);
  return(1);
}
```

GETDATA.C;2

```
/*
 * include files:
 */

# include <descrip.h>
# include <ssdef.h>
# include <iodef.h>


/*
 * define global data used by SNAEX
 */

struct dsc$descriptor   /* mailbox name descriptor */
        get_name_dsc = {15,DSC$K_DTYPE_T,DSC$K_CLASS_S,"lm_transfer_mbx"};

short int
        get_chan;       /* mailbox channel */

struct {        /* incomming message will look like this */
  short int group_num;
  long int time[2];
  short int action_code;
  } get_buf;



/*
 * this stuff was used for debugging this routine
 */
# ifdef DEBUG
struct dsc$descriptor
        record = {0,DSC$K_DTYPE_T,DSC$K_CLASS_S,0};

main()
{
  register int i;
  register int status;

  status = SYS$ASSIGN(&get_name_dsc,&get_chan,0,0);
  if(status != SS$_NORMAL)
    LIB$SIGNAL(status);
/* loop until all records have been processed. */
loop:
  while(i=GET_DATA(&record)) {
    LIB$PUT_OUTPUT(&record);
    }
eloop:
  status = SYS$DASSGN(get_chan);
  if(status != SS$_NORMAL)
    LIB$SIGNAL(status);
  return(1);
}
# endif



/*
 * this routine will get a record from the mailbox turn is in to ascii data
```

```
 * and then return the descriptor back to the caller.
 */
int get_data( record )
struct dsc$descriptor *record;
{
  register int status;
  short int get_iosb[4];
  static struct {
    char tran_name[9];
    char group[3];
    char bl1[9];
    char date[20];
    char bl2[4];
    char action[8];
    } msg_rec = {
    "TCI00211 "," ","          "," "," ","       "};
  struct dsc$descriptor dated = {20,DSC$K_DTYPE_T,DSC$K_CLASS_S,msg_rec.date};

  status = SYS$QIOW(0,get_chan,IO$_READVBLK,&get_iosb,0,0,&get_buf,12,0,0,0,0);
  if(get_iosb[0] == SS$_ENDOFFILE)return(0);
  if(status != SS$_NORMAL)LIB$SIGNAL(status);
  if(get_iosb[0] != SS$_NORMAL)LIB$SIGNAL(get_iosb[0]);
  sprintf(msg_rec.group,"%.3d",get_buf.group_num);
  msg_rec.bl1[0] = ' ';
  status = SYS$ASCTIM(0,&dated,&get_buf.time,0);
  if(status != SS$_NORMAL && status != SS$_BUFFEROVF)LIB$SIGNAL(status);
  if(msg_rec.date[0]==' ') msg_rec.date[0]='0';
  if(get_buf.action_code == 1) {strncpy(msg_rec.action,"SHED    ",8);}
  else if(get_buf.action_code == 2) {strncpy(msg_rec.action,"RESTORE ",8);}
  else {strncpy(msg_rec.action,"        ",8);}
  record->dsc$w_length = sizeof msg_rec;
  record->dsc$a_pointer = &msg_rec;
  return(1);
}
```

VAX TO IBM SECURITY

Often a VAX system has a rather large dial-up network. And the IBM network has quite sensitive data stored there. You may find it necessary to implement some kind of security system between the VAX and IBM networks. Here are some suggestions:

1) Protect all images associated with the gateway so one has to have SYSPRV to use them in the normal way.

2) Set up a program similar to the one following to act as a central point of contact for users wishing to use the resources of the IBM network. Each user is authorized for the applications, on the main frame, for which you wish them to have access.

I recommend that one should use the security facilities built into VMS since they have already been tried and are known to be reasonably secure.

The array in "array.h" does not have to be created by hand. You can use a relational database facility or whatever means best suits your installation. The data is stored in a tripple (username, terminal, IBM application). The data is output by an unload facility. The unload sorts the data.

The table is hard coded for the following reasons:

1) The data base is relatively nonvolital. i.e., one or two updates per week.

2) Speed.

ACCESS.H;25

```
static char param[] =  "\
S1TSO   \
S2TSO   \
S3TSO   \
S4TSO   \
SUBMIT  \
IMS     \
TESTIMS \
TEXT    \
IIPS    \
VSPC    \
";
static char *application[] =
{
"set host/sna snark/acc=any/appl=s1tso/data=",
"set host/sna snark/acc=any/appl=s2tso/data=",
"set host/sna snark/acc=any/appl=s3tso/data=",
"set host/sna snark/acc=any/appl=s4tso/data=",
"submit/sna/nolog",
"set host/sna snark/acc=ims",
"set host/sna snark/acc=ims/appl=testims",
"set host/sna snark/acc=text",
"set host/sna snark/acc=any/appl=iips",
"set host/sna snark/acc=any/appl=vspc"
};
static int application_length[] = {43,43,43,43,16,26,39,27,36,36};
static char null_command[2] = {'"','"'};
static char command[132];
static struct desc_ desc_command = {0,DESC_TYPE,DESC_CLASS,0};
```

ARRAY.H;17

```
"USER01      IMS     TTB5",
"USER01      IMS     TTE2",
"USER01      S3TSO   TTE2",
"USER01      VSPC    TTB5",
"USER01      VSPC    TTE2",
"USER02      IMS     TTB1",
"USER02      S2TSO   TTB1",
"USER03      IMS     TTB5",
"USER03      IMS     TTE2",
"USER03      S3TSO   TTB5",
"USER03      S3TSO   TTE2",
"USER03      VSPC    TTB5",
"USER03      VSPC    TTE2",
```

DEFNS.H;2

```
struct desc_
        {
        unsigned short length;
        char type;
        char class;
        char *pointer;
        };
#define DESC_CLASS      1
#define DESC_TYPE       14
#define DESCRIPTOR(name,string) \
        struct desc_ name = { sizeof(string)-1, DESC_TYPE, DESC_CLASS, string }
#define USERNAME 0x0202
#define TERMINAL 0x031D
#define YES 1
#define NO 0
```

IBM.H;8

```
#ifndef IBM
#include "defns.h"
#include "access.h"
static int user_length,term_length;
static char string[24];
struct item
        {
        short int length;
        short int code;
        char *address;
        int *return_length;
        };
static struct
        {
        struct item username;
        struct item terminal;
        struct item terminator;
        } item_list =   {
                        {12,USERNAME,&string[0],&user_length},
                        {4,TERMINAL,&string[20],&term_length},
                        {0,0,0,0}
                        };
static struct desc_ desc_string = {24,DESC_TYPE,DESC_CLASS,&string[0]};
static struct desc_ desc_try_access = {24,DESC_TYPE,DESC_CLASS,0};
static struct desc_ desc_try_param = {8,DESC_TYPE,DESC_CLASS,0};
static struct desc_ desc_user = {12,DESC_TYPE,DESC_CLASS,&string[0]};
static struct desc_ desc_term = {4,DESC_TYPE,DESC_CLASS,&string[20]};
static int space_offset,application_index,buffer_length;
static int prvadr[2] = {0x10000000,0};
static int prvprv[2];
static char buffer[80];
static struct desc_ desc_buffer = {0,DESC_TYPE,DESC_CLASS,&buffer};
static char space = {' '};
static struct desc_ desc_space = {1,DESC_TYPE,DESC_CLASS,&space};
static struct desc_ desc_acc = {0,DESC_TYPE,DESC_CLASS,&buffer};
static char access[8];
static struct desc_ desc_access = {8,DESC_TYPE,DESC_CLASS,&string[12]};
#define IBM
#endif
```

IBMMSG.MSG;4

```
.FACILITY       IBM,1 /PREFIX=IBM_
.SEVERITY       WARNING
INVALID         <Invalid parameter>
DENIED          <Gateway acccess denied>
.END
```

IBM.C;27

```
#include "ibm.h"
ibm()
        {
        int sysprv(), nosysprv();
        globalref int IBM_DENIED,IBM_INVALID;
        desc_buffer.length = 80;
        lib$get_foreign(&desc_buffer,0,&buffer_length);
        if(buffer_length == 0)sys$exit(&IBM_INVALID);
        desc_buffer.length = buffer_length;
        space_offset = lib$locc(&desc_space,&desc_buffer) - 1;
        if(space_offset == -1)space_offset = buffer_length;
        if(space_offset > 8)sys$exit(&IBM_INVALID);
        desc_acc.length = space_offset;
        str$upcase(&desc_access,&desc_acc);
        sys$getjpi(0,0,0,&item_list,0,0,0);
        application_index = linear_search();
        if(application_index == -1)sys$exit(&IBM_INVALID);
        if(!binary_search(&desc_string))sys$exit(&IBM_DENIED);
        get_command();
        sys$cmexec(sysprv,0);
        lib$spawn(&desc_command,0,0,&2);
        prvprv[0] = ~prvprv[0];
        prvprv[1] = ~prvprv[1];
        sys$cmexec(nosysprv,0);
        sys$exit(1);
        }
sysprv()
        {
        sys$setprv(1,&prvadr,1,&prvprv);
        }
nosysprv()
        {
        sys$setprv(0,&prvprv,1,0);
        }
```

GETCOM.C;19

```
#include "ibm.h"
get_command()
        {
        if(application_index < 5)
                {
                int lngth;
                lngth = application_length[application_index];
                desc_command.pointer = &command[0];
                lib$movc3(&lngth,application[application_index],&command[0]);
                desc_command.length = lngth;
                if(buffer_length == space_offset)
                        {
                        if(application_index < 4)
                                {
                                lib$movc3(&2,&null_command[0],&command[lngth])
                                desc_command.length += 2;
                                }
                        }
                else
                        {
                        int len;
                        len = buffer_length - space_offset;
                        lib$movc3(&len,&buffer[space_offset],&command[lngth]);
                        desc_command.length += lngth;
                        }
                }
        else
                {
                desc_command.length = application_length[application_index];
                desc_command.pointer = application[application_index];
                }
        }
```

BINSEARCH.C;21

```
#include "defns.h"
static struct desc_ desc_try_access = {24,DESC_TYPE,DESC_CLASS,0};
static int array[] = {
#include "array.h"
0};
binary_search(pointer_desc_string)
int *pointer_desc_string;
        {
        int mid,high,low,test;
        low = 0;
        high = sizeof(array)/4 - 2;
        while(low <= high)
                {
                mid = (low + high) / 2;
                desc_try_access.pointer = array[mid];
                test = str$compare(pointer_desc_string,&desc_try_access);
                if(test == -1)
                        high = mid - 1;
                else if (test == 1)
                        low = mid + 1;
                else if (test == 0)
                        return(YES);
                else
                        sys$exit(1);
                }
                return(NO);
        }
```

SEARCH.C;10

```
#include "ibm.h"
linear_search()
        {
        int i;
        int high;
        high = sizeof(param) / 8;
        for(i=0;i<high;i++)
                {
                desc_try_param.pointer = &param[8*i];
                if(str$compare(&desc_access,&desc_try_param)==0)return(i);
                }
        return(-1);
        }
```

NETWORKING DEC AND IBM COMPUTERS

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ABSTRACT

This paper discusses the hardware and software currently available to allow Local Area Networking of DEC and IBM computers within the structure of the ISO-OSI Seven Layer Reference Model at a raw signaling speed of 1 Mbps or greater. After an introduction to the ISO-OSI Reference Model and the IEEE-802 Draft Standard for Local Area Networks (LANs), there follows a detailed discussion and comparison of the products that are available from a variety of manufacturers to perform this networking task. A summary of these products is presented in Table 1 at the end of this paper.

1.) INTRODUCTION

For the purposes of this paper a computer network is defined as a collection of autonomous computers, called hosts, that cooperate with each other to exchange information over some form of communications channel.

Computer Networks can be classified as Local Area Networks or Long-Haul Networks. The hosts on a Local Network are generally located in a single building or campus, are connected by high-bandwidth communications, and are generally owned by a single organization. On the other hand, Long-Haul Networks typically consist of hosts that are separated by large geographical distance, use the public communication channels, and normally involve at least two organizations: the carrier, which operate the communication facility, and the users who own the hosts.

For some time we have been researching what is required to implement a true Local Area Network (LAN) of DEC and IBM/370 computers (located less than 3 Kilometers apart) using the "contention" method of acquiring the communication channel (Rebibo and Miller, 1982; Berman, 1982). This LAN is to be constructed with field proven hardware/software within the structure of the International Organization for Standardization's Reference Model for Open Systems Interconnection (ISO-OSI) seven layer model. This network is not designed to be used for security or extremely high reliability applications. Eventually it is planned to provide a "gateway" to Long-Haul Networks. Most traffic over this LAN will be bulk file transfers among hosts and will require transfer rates of 1 Mbps or greater and Direct Memory Access (DMA) interfaces to the hosts. These high speeds are necessary as the effective point-to-point transfer rate is typically a small fraction (Berman, 1982; Wood, 1981) of the electrical signaling rate if the high level protocols are implemented in the hosts. Thus a signaling rate of 1 Mbps may result in an effective rate of only several 100 Kbps.

This paper presents a review of the current (Second Quarter CY 83) products available to perform this LAN task and discusses the strengths and weaknesses of the products available.

Before starting a comparison of LAN vendor's products, we lay the necessary groundwork by:

a.) discussing the OSI Reference Model,

b.) discussing the IEEE-802 LAN Standard, including the "contention" method of using the communication channel referred to as Carrier Sense Multiple Access/Collision Detect (CSMA/CD), which has implementations in both baseband (no RF carrier) and broadband (RF carrier); we only briefly touch on the "token passing" method of acquiring the communication channel also covered in the IEEE-802 Standard,

c.) defining the terminology required to make the comparisons and finally,

d.) presenting a detailed comparision of the different vendor's products that are available.

2.) THE ISO SEVEN LAYER MODEL

The ISO seven layer Reference Model (Tanenbaum, 1981) provides the framework for

describing computer networks, both LANs and Long-Haul, and provides a uniform nomenclature. Note that it is not a standard in and of itself but helps make the standards effort manageable by providing the model (Graube, 1982). A diagram of this model appears in Fig. 1, representing communication between two hosts.

Referring to Fig. 1, if two applications on different hosts wish to communicate, the model subdivides the communication task into layers. These layers support one another in a hierarchical fashion. Layers communicate with their peers on the other host via protocols that specify how a particular task is to be carried out. These protocols consist of messages with specific formats and rules for exchanging the message. It is only at Layer 1 (Physical Layer) that there is an actual physical connection, all other connections are logical; shown in Fig. 1 as dotted lines.

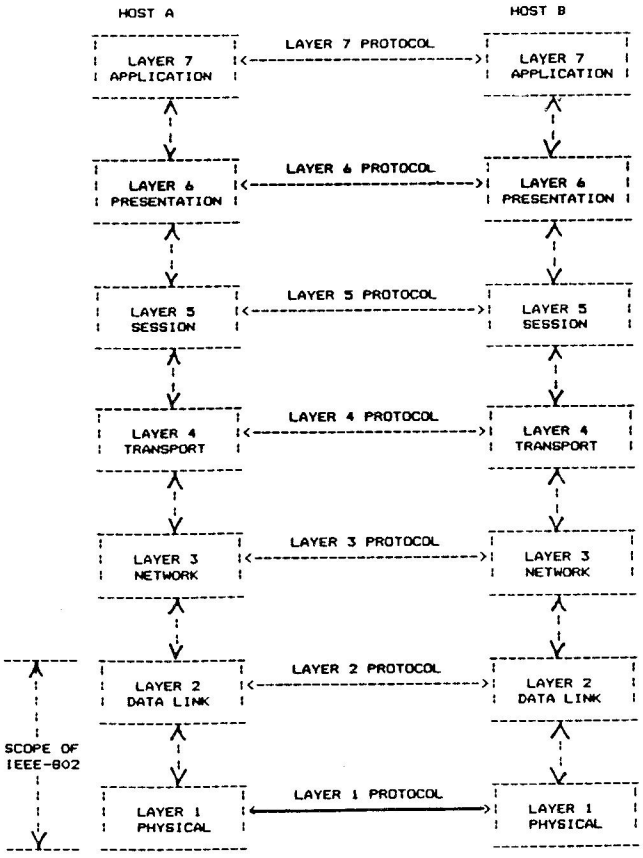

Fig. 1 ISO-OSI 7 LAYER MODEL

physical-layer 1

The physical layer is concerned with the transmission of a raw bit stream: how ones and zeros are represented, timings, pinouts, and the other electrical, mechanical and procedural details of the hardware used for transmission.

Most LANs are connected by linear (bus), tree-shaped (bus), or ring-shaped cable as shown in Fig. 2 (after Tanenbaum, 1981). Ring LANs are collections of devices interconnected via a communications path in the form of a loop. In general traffic flows in one direction only. Messages originate at a source node and then flow through intermediate nodes on the way to the destination node. On a bus network messages are broadcast onto a shared channel (bus). All devices "hear" the message. Access to the channel is controlled via a time-multiplexing technique (Tropper, 1981).

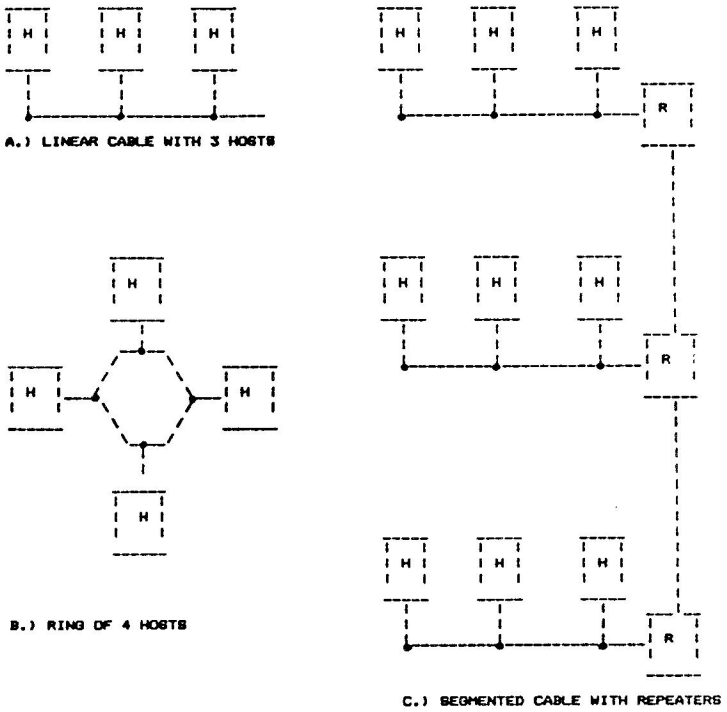

Fig. 2 LAN TOPOLOGIES

data link-layer 2

The data link layer converts a possible unreliable transmission channel into a reliable one. Reliability is obtained by breaking the raw bit stream into frames, each containing a checksum (CRC) for detecting errors. Three methods are in common use for delimiting frames: character count, character stuffing and bit stuffing. In the first method each frame contains a count that tells how many characters are contained in the frame. The method has the disadvantages of being sensitive to undetected tranmission errors which affect the count field and of enforcing a specific character size. DEC's Digital Data Communication Message Protocol (DDCMP) is an example of a character count protocol. The character stuffing protocol terminates each frame with a special "end of frame" character. The problem here is how to handle accidental "end-of-frame" characters embedded in the data, e.g., in the middle of a floating point number. The solution is to insert an "escape" character before the

accidental "end-of-frame". Accidental "escape" characters are transmitted as two consecutive "escapes". The problem with the character stuffing is that a specific character code is built into the protocol. IBM Binary Synchronous Communication (BISYNC) is an example. Modern link protocols use bit stuffing, a technique in which frames are delimited by the bit pattern: a zero, six consecutive ones, and a zero. The accidental occurence of five consecutive ones in the data stream is handled by stuffing a zero into the data, normally done by hardware, thus preventing data from interfering with framing, but not at the expense of imposing a specific character length or code. High-Level Data Link Control (HDLC) and its many variants, e.g., SDLC, ADCCP, LAP, LAPB are examples of bit stuffing protocols.

The datalink layer is often implemented in the form of a hardware protocol chip.

network-layer 3

The network layer is primarily concerned with routing and congestion control and may be resident in a device driver.

In a Local Area Network most nosts have an interface card inserted into their backplane to control access to the network. This interface card is in turn attached to the communication channel, usually a cable (see Fig. 2). Thus, in a LAN, routing and congestion control are less prominent than in Long-Haul Networks.

transport-layer 4

The transport layer hides the details of the commmunications subnet (layers 1,2 & 3) from the next layer up: the Session layer. That is, the Session layer should not have to worry about the implementation details of the network. The network layer (layer 3) does not necessarily ensure that the bit stream transmitted actually reached the destination intact. For example, packets may be lost or reordered and it is the function of the transport layer to discover these types of problems and take corrective action. The transport layer may reside in the Operating System of the host or in hardware separate from the host.

session-layer 5

The session layer sets up, manages and tears down process-to-process connections, using the host-to-host service provided by the transport layer and may reside in the operating system of the hosts.

presentation-layer 6

The presentation layer performs generally useful transformations on the data to be sent/received, e.g., text compression, format conversions, etc. This layer is often located in a set of library routines in the user's address space.

application-layer 7

The functions performed by the application layer are specific to the application and are not addressed in this paper.

3.) LOCAL AREA NETWORK (LAN) STANDARDS

The principal Standards body relating to LANs in the USA is the IEEE. IEEE-802 (IEEE-802 Draft B and D, 1982) will be the Standards Family used for the construction of LANs in the future. Although IEEE-802 is still in draft form, a large fraction of the Standard is generally accepted throughout the industry.

IEEE-802 Standard defines a LAN Reference Model (see Fig. 3), which is a layered peer-to-peer model that corresponds, but is not identical, to layers 1 and 2 of the OSI Reference Model just discussed. It defines a network capable of connecting up to 200 devices distributed along a communication medium of at least 2 Km in length at speeds of 1-20 Mbps, using CSMA/CD (bus), token rings, or token buses.

Unlike the OSI Reference Model Layer 3 the LAN Reference Model has no intermediate switching/routing modes. This is because the hosts attach directly to the LAN for direct point-to-point communications.

OSI layers 1 and 2 map onto the LAN Reference Model's Logical Link Control (LLC), Media Access Control (MAC) and Physical Layers (see Fig. 3). The LLC is based on the OSI Reference Model Layer 2 (Data Link Layer), using HDLC. The MAC provides a mechanism for timesharing access to a single-media channel either by Contention or by Token Passing.

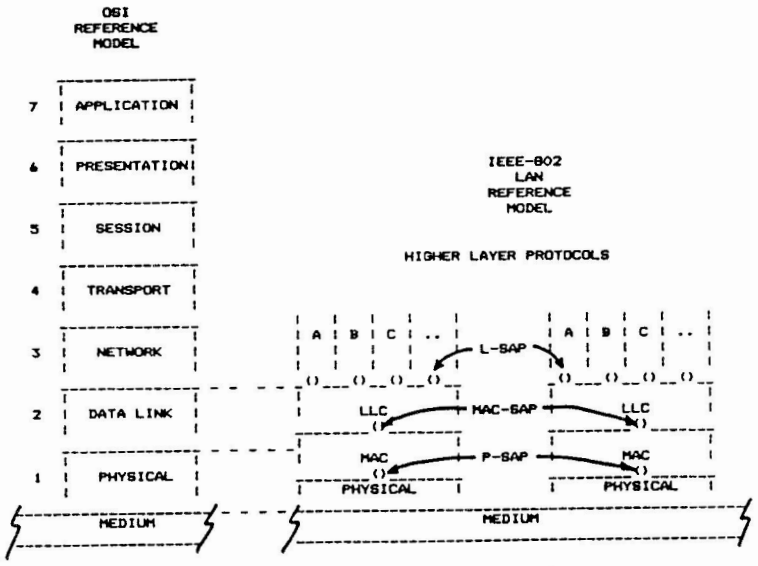

Fig. 3 LAN REFERENCE MODEL

Service Access Points (SAPs), for addressing end points, are shown in Fig. 3. To provide support for multiple higher layer client protocols (A,B,C...), LLC Service Access Points (L-SAPs) provide interface ports at the Layer 3/2 boundary for protocols A, B, and C at the Network Layer (Layer 3). A MAC-SAP provides a single interface port to a single LLC entity. Physical Service Access Points (P-SAPs) provide an interface port to a single MAC entity.

Logical Link Control (LLC)

The Link Layer is responsible for sending and receiving a unit of data. This consists of a simple packet structure with source, destination, type, data, and Cyclic Redundancy Check (CRC) fields. All stations are assigned 48 bit addresses that are unique in the world. Cyclic Redundancy Check (CRC) guarantees one bit error in 10**13. The data field is from 46-1500 bytes in length.

Connection (Virtual Circuit) service -- a logical link is established between pairs of L-SAPs prior to any exchange of user data. In the data transfer mode, frames are transmitted/delivered in sequence. Error recovery and flow control are provided.

Connectionless (Datagram) service -- frames are exchanged between LLC stations without the need for the establishment of a logical link between two L-SAPs. In LLC these frames are not acknowledged nor are there any flow control or error recovery procedures. Flow control and error recovery, in this case, would normally be handled by the Transport Layer.

Media Access Control (MAC)

Two methods of access control to the physical cable are described: (1) CSMA/CD (probabilistic method); and, (2) Token (deterministic method).

Physical Layer

Also two methods of data signaling are described: (1) Baseband (one channel via square wave signaling): for baseband operation the P-SAP is a null, as every host is connected onto one LAN; and, (2) Broadband (multiple channels via RF modulation): for broadband operation the P-SAP would be one channel assignment frequency. Most of the current broadband implementations allow for 5 P-SAPs.

3.1) CONTENTION-CSMA/CD

Briefly, the CSMA/CD media access control (MAC) mechanism is a "listen before talk" and "listen while talking" protocol. It necessarily detects collision caused by multiple hosts simultaneously starting a transmission. The collisions recovery consists of aborting the current transmission, broadcasting a noise burst to inform the other hosts of the collision, waiting a random time and trying again. Collision detection limits the geographic size of a network because the propagation delay must be short compared to the packet transmission time. A station always listens to all traffic. It receives all packets and checks destination field and CRC and only retains address matches with a good CRC. The type of service rendered can be a "datagram" service ,i.e., there is no acknowledgment by the MAC and it depends on the Transport Layer to detect and correct lost or out of order packet situations or a "connection" service where the Data Link Layer is responsible for data being transmitted correctly.

3.1.1) CSMA/CD BASEBAND (DATA SIGNALING DONE WITH NO CARRIER USING COAXIAL CABLE)

The Baseband CSMA/CD adopted by IEEE-802 Standard is almost identical to the Xerox Ethernet Specification with minor changes, most of which concern grounding. Of course Xerox, DEC and Intel adopted Ethernet as their official standard for LANs sometime ago (The Ethernet, 1982). The Ethernet specification must be licensed from Xerox at a one-time nominal fee.

ETHERNET ADVANTAGES AND DISADVANTAGES (Berman, 1982)

ETHERNET ADVANTAGES

- o well defined by standards
  - IEEE 802
  - ECMA (European Computer Man. Assoc.)
  - CCITT (expected soon)
- o accepted by major manufacturers
  - Xerox, Intel, DEC and many, many others
- o multiple indep. sources of interfaces
  - 3COM, Interlan, Ungermann-Bass
- o large installed base
- o easy installation
- o universal station address
- o 10 Mbps trunk base
- o very efficient under heavy load at physical level
- o relatively inexpensive physical interfaces
- o media-access control protocol to be in VLSI soon
- o "equal opportunity" protocol gives all users same response, lockouts unlikely
- o high level architecture derived by several vendors
- o network statistics readily captured

ETHERNET DISADVANTAGES

- o limited distance, 2.8 km max. between stations
- o limited total bandwidth on cable (10 Mbps)
- o single faulty transmitter can jam entire net
- o impedance mismatches can reflect signal and cause phantom collisions

3.1.2) CSMA/CD BROADBAND (DATA SIGNALING BY RF CARRIER USING CATV COAXIAL CABLE)

The IEEE-802 Standard specifies a broadband midsplit Community Antenna Television (CATV)

option that uses the same technology found in commercial CATV systems that distribute television signals to private residences. Transmission of digital data over CATV is a relatively recent development but CATV has been around for 20 years and is a very mature and reliable technology. This system operates at 5 or 10 Mbps using Vestigial Side Band Amplitude Modulation (VSB/AM), Manchester encoding (2 transmitted bits per data bit so as to produce a zero crossing per data bit), and CSMA/CD on standard 6-MHZ TV channel (IEEE-802, Draft B, 1982).

The use of signaling using a carrier and coaxial cables contrasts with baseband which does not employ a carrier, e.g, Ethernet. In baseband signaling the entire bandwidth of the cable is used because square wave (digital) signaling depends on the presence of high-frequency components whereas broadband modulates a carrier, which results in fewer high-frequency components and an attendant conservation of bandwidth.

The advantage of a broadband system is that it is multimedia in nature and, for example, can carry not only multiple data channels but voice and video on the same physical cable by use of frequency division techniques (see Fig. 4). The disadvantages are the costs of the modems that are required to interface digital devices and a somewhat slower signaling rate.

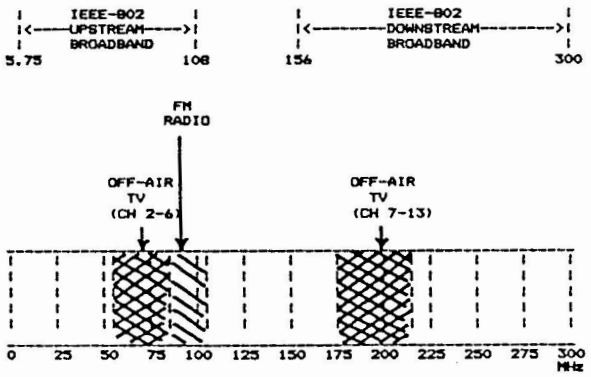

Fig. 4 BROADBAND FREQUENCY SPECTRUM

The IEEE-802 broadband system is a directional transmission system that employs two different frequency bands on the coaxial cable; the upstream, 5.75-108 MHz, is used for data being transmitted; the downstream, 156-300 MHz, for data being received. A head-end uses an analog translation device (similar to a communications satellite transponder) to translate incoming signals to the outgoing frequency. Thus, when a station transmits data to another station, it transmits to the head-end in the upstream band, whereupon the head-end translates this data to the downstream band and sends it back down the cable where it can be received by the intended station.

Because of the longer distances and high frequencies involved, the delay through the cable is a significant number of bit periods; this means collisions often will not be detected as promptly on a broadband network. In addition, the same delay applies to "carrier sense" when in the "deferring" mode while the sender has a packet to send and is waiting for a free channel. A station may not detect a channel becoming free as quickly on broadband and, even worse, there will be a delay before a station can detect that the channel is busy. This increases the probability of collisions, and mandates a longer "slot time", increasing collision recover time. Also broadband must be carefully tuned to ensure that the signal level is the same at all outlets, where this is not necessary in simpler baseband. Thus, expert design and installation are required; once installed, however, the maintenance is low and the installed cost per outlet is low, if done for an entire area at once (Berman, 1982).

BROADBAND ADVANTAGES AND DISADVANTAGES (Berman, 1982)

BROADBAND ADVANTAGES

- o high aggregate bandwidth
  as many as 17 std. 6-MHz TV channels, capable of carrying up to 10 Mbps each
- o mature, std. tran. tech. based on 20 yrs CATV exp.
- o wide geographic coverage, realistic max. dist. from headend is 10-16 Km
- o cable plant may already exist
- o wall taps at under $100
- o almost unlimited number of outlets

BROADBAND DISADVANTAGES

- o transmission system
  requires expert design and installation
  no widely accepted stds. in existence for use with data (modulation tech., spectrum allocation)
- o problems possibly caused by transmission delays in using CSMA/CD in geographically large networks (all data must travel from terminal to headend and back)
  larger "slot times" required
  delayed detection of carrier
  delayed detection of collision
  max. eff. under heavy load worse than Ethernet
  higher prob. of lockup under very heavy load
- o very limited experience with computer-to-computer high speed data transfer
- o efficient broadband data modems expensive

3.2) TOKEN PASSING

This access technique allows one device at a time to have access rights to the communication channel. When through, the device passes the "token" to another device; thus delay times are deterministic rather than statistical as in contention. In addition, contention schemes are limited in

distance for a given data rate and data unit size if collision detection is to work; token passing is not constrained by the communication line length. However, token passing is considerably more complex than contention, is just now becoming generally available, and is not included in the comparisions in this paper.

3.3) PERFORMANCE CONSIDERATIONS

The maximum throughput between 2 stations on a LAN is usually a small fraction of the trunk capacity. The trunk rate should be used as a measure of maximum aggregate load, because point-to-point throughput is more a function of network-to-host interface design. High level protocols are taxing on host computers and severely limit performance if implemented in host software; therefore, network interface units should implement as much of the protocol as possible without host assistance and should have high bandwidth (Berman, 1982).

4.0) IBM BLOCK-MULTIPLEXER INTERFACES

With the exception of Network Systems Corp. (NSC), none of the LAN vendors currently offers a channel interface to IBM hosts so that signaling rates of 1 Mbps or greater can be obtained. Thus before comparing LAN products we need to spend some time discussing the AUSCOM/IBM channel interface and the IBM Device Attachment Control Unit (DACU) that will be referred to in Table 1.

4.1) THE AUSCOM 8911 IBM CHANNEL INTERFACE

The AUSCOM 8911 enables access to an IBM standard channel interface. To use the 8911 the host must support an IBM channel (or look-alike) with one or more subchannel addresses reserved for this application. The channel can be configured as a block mux, selector, or byte-mux channel.

The 8911 consists of a DEC LSI-11 that resides in the data path between the host channel and the Ethernet Cable. AUSCOM-supplied boards plugged into the QBUS interface the IBM channel, and an Interlan-supplied board (NI 2010, see Section 5.1) plugged into the QBUS interfaces the Ethernet cable (see Fig. 5).

The software running in the LSI 11 consists of two components: the emulation software and layered software "glued together" by AUSCOM's ARIES operating system.

The emulation software is responsible for sending and receiving control information and data across the host channel. The software can emulate both standard and non-standard IBM devices, e.g., tape drive, 3272 local terminal (most popular) or a nonsupported device.

The layered software is designed to provide error free transmission between the IBM channel and one or more Ethernet stations.

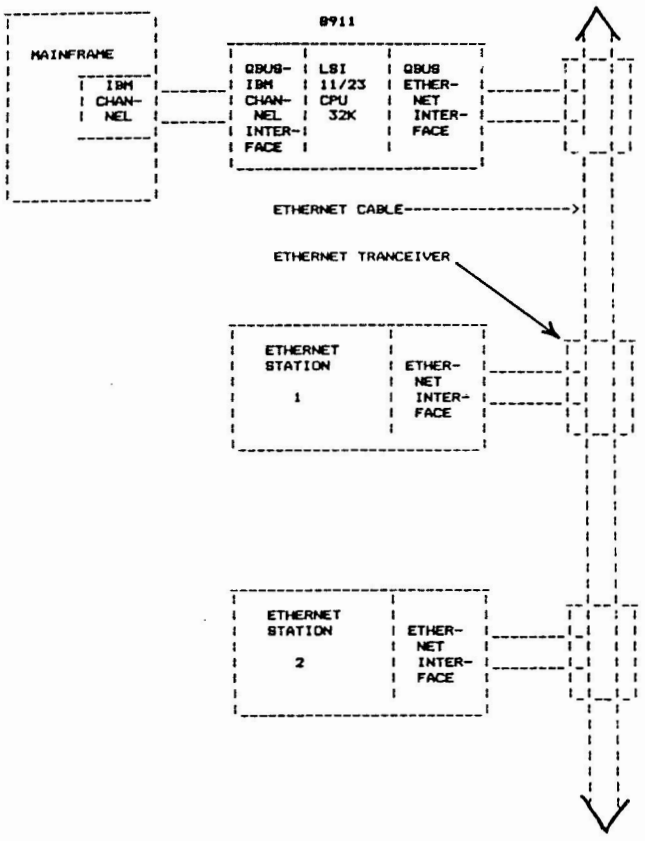

Fig. 5 AUSCOM HARDWARE CONFIGURATION

The layered software encompasses the first two layers of the ISO Reference Model and is subdivided by AUSCOM into three components: the Ethernet physical layer, the Internet gateway layer, and a custom stop-and-wait error-recovery layer called MESSAGESYS.

The physical layer consists of I/O drivers for an Interlan NI 2010 QBUS Ethernet communication controller.

The Internet Layer provides IBM-to-Ethernet addressing.

The MESSAGESYS Layer provides two functions: a.) flow control between IBM and Ethernet stations; b.) error recovery by retransmission using a stop-and-wait protocol. Also under development is a higher speed protocol tentatively called "Blastnet" (Farmer, 1983) which uses a "which-ones packet" and a "bitmap" to acknowledge more than a single packet at a time.

4.2) IBM PERSONAL COMPUTER USED AS A DEVICE ATTACHMENT CONTROL UNIT (DACU)

Interestingly, the IBM Personal Computer has been developed into a product known as the Device Attachment Control Unit (DACU), which allows the IBM block-multiplexer channel on an IBM/370 computer to be interfaced to support: RS 232-C, DEC UNIBUS, and the attachment of non-IBM devices. Control

programs are executed in the DACU (IBM Personal Computer) to support the requirements for I/O associated with the attached devices.

The DACU provides a UNIBUS interface for the attachment of UNIBUS compatible I/O devices via a connector equivalent to the DEC DD-11CK connector block. This interface provides for simulated direct memory access I/O transfers to and from the IBM/370 main storage at speeds of over 1 MByte/s. Actually the transfers are buffered through the DACU storage. Facilities for programmed I/O are also provided. The UNIBUS interface and associated DACU handle device interrupts in a manner that simulates processing in a convential UNIBUS environment.

The DACU is designed to be compatible with OS/VS2 and VM/CMS and currently will interface with the block multiplexer channel on the IBM 4300 series and the 308X series through the Bus and Tag cables.

Significant is the fact that the IBM channel architecture and UNIBUS architecture are incompatible. The IBM channel is always master of the interface, and control units and devices are always slaves; an I/O device can never control the flow of information from processor main storage to itself. On the other hand, with the UNIBUS, any device on the bus (processor or I/O device) can be master once granted bus mastership by the arbitration mechanism.

The DACU functions to solve this architectural incompatibility by serving as a mediator between the architectural differences, i.e., with respect to the IBM channnel the DACU is always a slave; with respect to the UNIBUS, the DACU may be master or slave.

Two RS 232-C ports are also provided that operate up to 19.2 Kbps.

The DACU has interesting possibilities for networking IBM machines to DEC machines, as many of the LAN vendors (see Section 5) provide UNIBUS compatible interfaces.

5.0) VENDOR COMPARISONS

The following discussion covers 8 different manufacturers of networking products. The narrative follows Table 1 at the end of this paper with respect to topics discussed. Refer to Fig. 8a for a diagram of the generic baseband system and Fig. 8b for the generic broadband system.

5.1) INTERLAN

Interlan provides microprocessor-based, firmware-driven, Ethernet boards that plug directly into a number of computer busses, as well as an Ethernet Module and Ethernet transceivers; all are manufactured to the Ethernet "Blue Book" Specification (The Ethernet, 1982). The board has 16K of FIFO memory that will buffer at least 8 received packets and 2K memory for a transmit buffer. All data transfers to the host are via DMA. The Interlan hardware continuously collects network statistics on a non-interference basis.

RANGE/SPEED

Range is 2.8 Km. The Ethernet cable is capable of burst speeds of 10 Mbps. The speed using the Interlan hardware (without operating system), according to an Interlan benchmark, is 2.5-3.0 Mbps point-to-point. Due to the fact that only OSI Layers 1 and 2 are in the Interlan hardware, speed with full protocol will be considerable less than this.

NUMBER OF CHANNELS (P-SAPs), MEDIUM, MODULATION TECHNIQUE

Because this employs baseband signaling, only one channel is available that uses the entire Ethernet coaxial cable.

IBM HARDWARE INTERFACE

As there is not presently available from Interlan a FIPS-60 interface to an IBM channel, the AUSCOM 8911 or the DACU as described in Section 4 above would be a candidate for connecting an IBM host within a LAN.

DEC HARDWARE INTERFACES

UNIBUS, QBUS (see discussion of AUSCOM above).

DRIVERS

Interlan provides driver software for UNIX V7, VAX/VMS, PDP11/RSX-11M, and LSI-11/RSX-11M and RT-11 V 4.0. The VMS driver can utilize the VMS's "buffered data paths" for improved performance using the UNIBUS.

No driver exists for the IBM; however, Century Computing (Kurtz, Miller, 1983) have software (VAX Interface Unit, VIU) that links the IBM System Network Architecture (SNA) with a VAX via an IBM 3705 communications unit. Software to link VIU to DECnet would have to be developed, however. This solution is also limited by the speed of the IBM 3705.

TYPE OF SERVICE

Connectionless (Datagram) service -- Packet address recognition, carrier deferring and automatic backoff, and retransmission on collision detection are performed by the Interlan hardware.

ISO LAYERS

Layers 1 and 2 are contained in the Interlan hardware. On the DEC side, all higher layers would be handled by DECnet. On the

IBM side, if SNA were gatewayed to DECnet SNA would handle the higher layers; other wise the customer would need to develop the higher layers. It is probably best to gateway from one computer manufacturer's networking product to another rather than develop your own, unless there are some very compelling reasons.

Interlan also sells a product called Internet Transport Protocols (ITP) based on the Xerox specifications. These provide the architectural foundation for Xerox's distributed systems. With ITP, VAX/VMS and RSX-11M systems can achieve task-to-task communications with most of the Ethernet-compatible systems manufactured by Xerox and other ITP-compatible vendors. Both connectionless and connection services are supported as well as routing.

5.2) 3COM

3COM manufactures Ethernet "Blue Book" compatible system components. They began production in December 1980 and have delivered over 200 Bus Interface Units (BIUs). They also manufacture transceivers and cables. The orientation of the company is toward selling components rather than complete systems.

RANGE/SPEED

Cable lengths of up to 1 km without repeaters and up to 2.8 km with repeaters can be installed. The Ethernet cable is capable of burst speeds of up to 10 Mbps; 3COM benchmarks between DEC machines have been measured at speeds of 1.5 Mbps using the 3COM hardware.

NUMBER OF CHANNELS (P-SAPs), MEDIUM, MODULATION TECHNIQUE

Because this employs baseband signaling, using CSMA/CD, only one channel is available that uses the entire Ethernet cable. It should be noted that although the BIU detects collisions and errors, host intervention is necessary to recover from a collision.

IBM HARDWARE INTERFACE

As there is not presently available an interface to the IBM block multiplexer channel from 3COM, the AUSCOM 8911 or the DACU both described in Section 4 would be candidates for connection to the IBM host within a LAN.

DEC HARDWARE INTERFACE

3COM offers interfaces to the UNIBUS and QBUS. 3COM uses an interfacing scheme where each board has dual-ported memory, accessible by either the Ethernet controller or the UNIBUS (or QBUS). Also, the Ethernet interface utilizes multiple "state machines", based on programmable array logic chips, instead of a single thread interrupt-driven microcomputer, in order to achieve rapid response times.

DRIVERS

3COM supplies supported drivers for the UNIBUS under DEC VAX/VMS, RT-11, and RSX-11M. No driver exists for the IBM; however, Century Computing (Kurtz, Miller, 1983) have software (VAX Interface Unit, VIU) that links IBM System Network Architecture (SNA) with a VAX via IBM 3705 communication unit. Software to link VIU to DECnet would have to be developed, however. This solution is limited by the speed of the IBM 3705.

TYPE OF SERVICE

Connectionless (Datagram) service is provided.

ISO LAYERS

Layers 1 and 2 are provided in the controllers. 3COM also markets UNET, a version of DARPA's TCP/IP transport and internet protocol that runs under UNIX and performs Layers 2.5 through 5 functions.

5.3) NETWORK SYSTEMS CORP. (NSC) - HYPERCHANNEL

Hyperchannel, available in 1977, was one of the first high-performance host-to-host or host-to-peripheral digital data links on the market. In June of 1982 there were 400 units installed at 160 different sites.

RANGE/SPEED

Raw speed of 50 Mbps can be obtained if the largest coaxial cable (1.1" OD) is used. Speed with protocol measured by NSC is in the range of 4-5 Mbps. Range, using 1.1" OD cable and 10 or less adapters, is 1.5 km without repeaters, 3 km with repeaters. NSC manufacturers a Link Adapter (A710) that will provide unlimited extension of the network via private and public communications and communications satellite (Falls, B.,1983).

NUMBER OF CHANNELS (P-SAPs), MEDIUM, MODULATION TECHNIQUE

Because this is a baseband implementation, only one channel (P-SAP) is provided over a single coaxial cable (trunk) that can range in size from 0.27" to 1.1" OD depending on distance; however, a Hyperchannel adapter can support up to 4 trunks (one at a time). The larger cable is aluminum clad, semirigid and the bending radius could be a problem in some installations. Connectors/hardware for turning corners are available, but total loss through the cable cannot exceed 20db (Falls, B., 1983).

NSC uses a variant of CSMA/CD Media Access Control which is not covered by the IEEE 802 Family of Standards. NSC calls it collision avoidance. This Media Access Control is used with two overall priorities and subpriorities based on the adapter address. The CSMA/CD backoff interval is also based on the adapter address, so some adapters

will always have priority over others. The network protocol is a variant of IBM SDLC which requires that the destination unit respond to the source after every message, so all transfers are interlocked, block by block (Thornton, 1975).

Adapters cannot be connected to the cable without the knowledge of the entire network configuration so that the appropiate backoff interval can be entered into the adapter.

IBM HARDWARE INTERFACES

NSC manufacturers a IBM Block Mux Channel interface (A222 Adapter).

DEC HARDWARE INTERFACES

The A400 adapter is used to interface UNIBUS (via PI13 card plugged into the backplane), MASSBUS (via a PI11 plugged into the backplane) and QBUS (PI 12, via a DRV-11) interfaces. The A400 will service up to 4 co-located DEC computers within 50 ft of the A400. However, only one host can transfer data through the adapter at a time.

DRIVERS

Network Access Method (NETEX) for host to host communication has been available from NSC since the Fall of 1982. NETEX contains drivers for IBM MVS, VAX/VMS and RSX 11/M.

TYPE OF SERVICE

Connection service is provided by NETEX. CRC checking and retransmission are located in the Data Link Layer in the NSC Adapter. Flow control and lost or out of order packet situations are handled by NETEX.

ISO LAYERS

NETEX has been designed to adhere to the ISO Reference Model (see Fig. 6) and encompasses Layers 3 through 5. NETEX is available for IBM MVS, VAX/VMS, and RSX11/M.

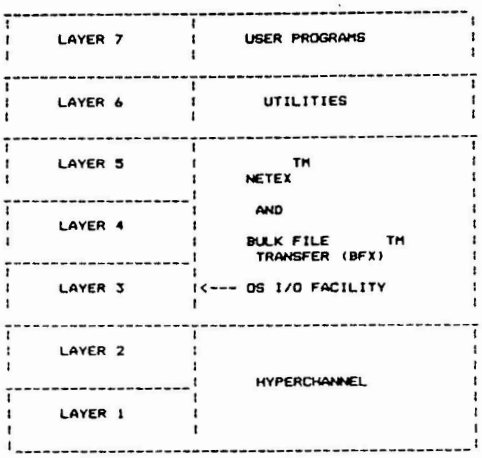

Fig. 6 NETEX AND THE ISO REFERENCE MODEL

The following is an overview of the MACROs offered by NETEX.

- SOFFER - Offer the availability of an application on a given host by logical name.
- SCONNECT- Connect to a specific offer request on a specific host.
- SCONFIRM- Confirm a connection: applications may exchange data.
- SDISCONNECT- Disconnect two applications.
- SWRITE- Sends data to the connected application.
- SREAD- Waits for and accepts data from a connected application.
- SSTATISTICS- Gathers raw session activity statistics.

There is also available an associated NETEX product called Bulk File Transfer (BFX) for the transfer of bulk data in conjuction with NETEX.

5.4) UNGERMANN-BASS(U-B) INC.NET/ONE SYSTEM

Net/One supports both baseband on Ethernet cable and mid-split broadband on CATV cable, both using CSMA/CD, and adhering to the IEEE-802 Draft Standard. In addition several different types of interfaces are supported (RS 232, IEEE-488, 8, 16 and 32 bit parallel some with DMA). The Net/One baseband and broadband products are identical except for the Physical Layer logic and modem/transceiver modules in the Network Interface Units (NIUs) and in the Network Configuration Facility (NCF). The NCF is a Z80 microprocessor-based product that runs the CP/M operating system and is used to configure the network and to download the software to the NIUs and to run diagnostics. This feature is especially useful when software maintenance needs to be applied to the NIUs. However, it also constitutes a single point of failure for activating the network. The NIUs are also Z80 based and are user programmable.

Net/One can be operated in both the Connectionless (Datagram) mode and the Connection (Virtual Circuit) mode. In the Connection mode, speeds are limited to 19.2 Kbps; and this mode would be used, for example, to connect terminals to a host. In the Connectionless mode, the higher speeds are available for host-to-host transfers. U-B has announced a 16-bit NIU for later in 1983.

RANGE/SPEED

Range for the baseband and broadband systems are 2.8 Km and 16 Km, respectively. Raw signaling speeds are 10 Mbps for baseband and 5 Mbps for broadband, with a U-B benchmark showing end-to-end rates of 1.5-2.0 Mbps with a very basic driver using

VAXes; end-to-end rates with full protocol are probably in the range of 900 Kbps.

NUMBER OF CHANNELS (P-SAPs), MEDIUM, MODULATION TECHNIQUE

Net/One baseband, using Ethernet cable, supports the usual single channel, however Net/One broadband (like Sytek's LN-40, see Secton 5.5) supports five 6 MHz TV channels (P-SAPs). However, unlike LN-40, these are not software switchable, but require hardware to be physically moved. The modulation technique for broadband is Vestigial Side Band (VSB).

IBM HARDWARE INTERFACE

No IBM channel interface for high speed transfer is currently available. However, with Net/One operated in the Connection mode (up to 19.2 Kbps) the RS 232 port can be interfaced to an IBM 3705 communication controller. A high speed possibility may be the AUSCOM channel interface or the DACU previously discussed; however, U-B has no announced plans to support these devices.

DEC HARDWARE INTERFACE

U-B supports a UNIBUS interface that uses a DR11-W or DR11-B for 32 bit transfers via DMA.

DRIVERS

U-B offers to supply a prototype driver for the DR11 developed by one of its customers.

TYPE OF SERVICE

The following services are provided:

Connection (Virtual Circuit) service at up to 19.2 Kbps.

Connectionless (Datagram) service at the higher speeds.

ISO LAYERS

CSMA/CD is used in both the baseband and broadband implementations.

For the Connection Service, Layers 1 through 5 are provided in the NIUs.

For the Connectionless Service, Layers 1 and 2 are provided in the NIUs. All higher Layers will have to be provided by the customer, probably residing in the hosts, although it is possible for the customer to program the NIU.

5.5) SYTEK LOCAL NET 40 (LN-40)

The Sytek Local Net 40 is a broadband, mid-split system that uses standard CATV cable. Sytek is affiliated with General Instrument Corp., the world's largest supplier of CATV equipment. Sytek also markets a Local Net 20 (LN-20) product which is a 128 Kbps terminal-to-host LAN, operational in a large number of installations. Unfortunately, Sytek has encountered performance problems with the current implementation of Local Net 40 which was in beta test in 1982. An IBM channel interface, originally scheduled for March 1983, is now in the queue behind the solution to these problems (Koller, 1983). Also planned are a Network Control Center which will provide performance monitoring and traffic analysis for the network and support for data encryption (DES). Gateways to X.25 and TCP/IP networks are also planned.

RANGE/SPEED

Broadband has a range of 10 Km (5 Km radius) and LN-40 was to have a raw signaling speed of 2 Mbps; however, beta testing has revealed speeds of 500 Kbps (Koller, 1983). and this of course, is where the problem lies.

NUMBER OF CHANNELS (P-SAPs), MEDIUM, MODULATION TECHNIQUE

Five dynamically software selectable P-SAPs are supported, i.e., separate 6 MHz TV channels over standard CATV cable using CSMA/CD. LN-40 uses frequency agile modems (FAMs) using frequency shift keying (FSK) modulation. Modems do not conform to the IEEE-802 Draft Standard.

IBM HARDWARE INTERFACES

No IBM channel interface is currently available; however, one is planned after the previously mentioned performance problems are solved. Another possibility is the AUSCOM interface or the DACU previously discussed in Section 4.

DEC HARDWARE INTERFACES

The UNIBUS interface was in beta test in 1982.

DRIVERS

Along with the UNIBUS interface, Sytek plans to supply a VAX/VMS driver and an RSX-11M driver for the PDP series.

TYPE OF SERVICE

Datagram or Connection

ISO LAYERS

LN-40 uses 16-bit microprocessors called the Packet Communications Units (PCUs) that implement OSI Reference Model Layers 1 through 4 using the CSMA/CD technique to stochastically share channels. Implementing Layers 1 through 4 in the PCU should considerably off-load the host and result in improvements in the end-to-end transfer rates when the previously mentioned performance problems are solved.

Also high-level software for VAX/VMS and PDP-11/RSX-11M is to be provided: OPEN, READ, WRITE, CLOSE macros, for example.

5.6) CONTEL CONTELNET

CONTEL, a subsidiary of Continental Telecom, Inc., markets a networking product that uses either baseband (700 series) or mid-split broadband (800 series) technology that is based on the IEEE-802 Draft Standard. The Bus Interface Units (BIUs) use Z80s with a Multibus backplane running under the proprietary TICOS operating system. Configurations can be converted from baseband to broadband and from 2 Mbps to 10Mbps by substitution of proper boards. Each BIU controls four serial RS 232-C ports and a parallel port for host communications. The BIUs are down-line loaded from the Network Control Center (NCC) and can up-line dump as well. CONTEL operates as a custom applications house (Stack, 1983).

RANGE/SPEED

Range is 3 km and 16 km for baseband and broadband, respectively, with raw signaling speeds of 2-10 Mbps. End-to-end transfer rates with protocols were not available.

NUMBER OF CHANNELS (P-SAPs), MEDIUM, MODULATION TECHNIQUE

CONTEL baseband, using Ethernet cable, supports the usual single channel; however, CONTEL broadband (like Sytek's LN-40) supports five 6 MHz TV channels (P-SAPs). However, unlike LN-40, these are not software switchable, but require factory setup. The modulation technique for broadband is FSK.

IBM HARDWARE INTERFACE

No IBM channel interface for high speed transfer is currently available. However, with CONTELNET operated in the Connection mode (up to 19.2 Kbps), an RS 232-C port can be interfaced to an IBM 3705 communications controller. Another possibility may be the AUSCOM or DACU channel interface previously discussed; however, CONTEL has no announced plans to support this device.

DEC HARDWARE INTERFACE

A prototype QBUS interface has been developed.

DRIVERS

No drivers for IBM or DEC are currently offered.

TYPE OF SERVICE
The following services are provided:

Connection (Virtual Circuit) service at up to 19.2 Kbps.

Connectionless (Datagram) service at the higher speeds.

ISO LAYERS

CSMA/CD is used in both the baseband and broadband implementations.

Layers 1 and 2 are in the BIUs, higher Layers are not presently provided.

5.7) BRIDGE COMMUNICATIONS INC. CS1 BASEBAND SYSTEM

Bridge Communications Inc. manufactures a Ethernet "Blue Book" compatible LAN product called a Communication Server 1 (CS1) that uses Multibus Boards and consists of 3 logical components shown in Fig. 7: a.) An Ethernet controller (which connects with the Ethernet Transceiver via a cable) containing a Motorola 68000 16-bit microprocessor with 128K memory for buffering packets; b.) a CPU unit, also a 68000 with 384K RAM, that runs through ISO Layer 4; c.) up to 4 serial I/O boards, each containing a 68000, that drive up to 8 RS 232-C ports each with aggregrate speeds not to exceed 156.8 Kbps (19.6 x 8). Because of the use of the 16-bit microprocessors with lots of memory and the fact that ISO layers 1-4 are in the CS1, Bridge can obtain very high end-to-end speeds. The CS1 is user programmable. Bridge provides a 68000 cross-assembler, linker, debugger, and downline loader that run on a VAX under UNIX 4.2. Any of the CS1s on a network can be used as a Network Control Center for configuring the network.

RANGE/SPEED

The range is the normal 2.8 Km for a Ethernet compatible product, with a raw signaling speed of 10 Mbps. According to a Bridge Communications benchmark (Bush, 1983) end-to-end speeds with full protocol of 1 Mbps have been obtained (200-564 byte packets/s).

NUMBER OF CHANNELS (P-SAPS), MEDIUM, MODULATION TECHNIQUE

Because this employs baseband signaling, only one channel is available that uses the entire Ethernet coaxial cable.

IBM HARDWARE INTERFACE

Bridge may have an agreement with International Applied Systems (IAS) to modify their existing 3270 graphic display system IBM channel interface (IBM 308X, 4341 and Amdahl) to be compatible with the CS1. This interface consists of two Multibus boards that plug into Multibus slots in the CS1 along with other SI/O Boards; the IBM side attaches to Bus and Tag cable (Howell, 1983).

Connection to the IBM 3705 Communicataion adapter is supported via the RS 232-C ports in the CS1.

DEC HARDWARE INTERFACE

Intel manufacturers a multibus compatible board (ISBX) that will interface to a DR11-W.

DRIVERS

No drivers are supplies by Bridge Communication Inc.

TYPE OF SERVICE

Connection and Connectionless service are supplied.

ISO LAYERS

The 16-bit 68000 microprocessors in the CS1 runs through Layer 4 and uses CSMA/CD.

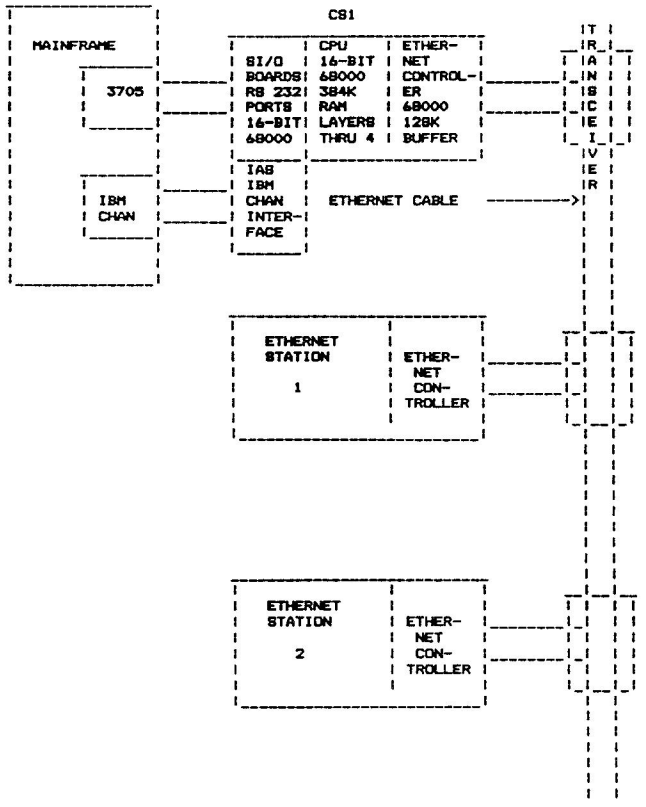

Fig. 7 THE STRUCTURE OF THE CS1

5.8) DEC BASEBAND SYSTEM

Digital Equipment Corporation has announced their intention to produce Ethernet "Blue Book" compatible products. Scheduled for release in the Summer of 1983 is the DEUNA which is a Ethernet UNIBUS controller for the VAX and PDP families, along with an Ethernet transceiver, the H4000. The DEUNA is comprised of two HEX size modules based on a microprocessor. It provides remote loopback of data from other stations, resident microdiagnostics, system identification, and the loading and remote booting of UNIBUS PDP-11 systems from other stations on the network.

RANGE/SPEED

The range is the normal 2.8 Km for a Ethernet compatible product, with a raw signaling speed of 10 Mbps. According to a an unofficial benchmark end-to-end transfer rates of 1 Mbps have been reached.

NUMBER OF CHANNELS (P-SAPS), MEDIUM, MODULATION TECHNIQUE

Because this product employs baseband signaling, only one channel is available that uses the entire Ethernet coaxial cable.

IBM HARDWARE INTERFACE

As DEC USA does not currently provide an IBM block multiplexer interface, the AUSCOM 8911 or the DACU discussed in Section 4 are possible candidates for connection to the IBM host within a LAN.

DEC CSS of Europe has entered into a contractual agreement with SCICON (London, England) to produce a DEC-IBM channel interface (KDX11) that provides communication between an IBM I/O channel and the UNIBUS. A number of KDX11's were installed in Europe in 1982 interfacing IBM 4341's and 303X's. The transfer rate of the KDX11 is said to be on the order of 200,000 characters per second.

DEC HARDWARE INTERFACE

DEC will be delivering the DEUNA, which is a Ethernet controller for the UNIBUS, in the Summer of 1983 along with the H4000 transceiver. Eventually DEC intends to supply a controller for the QBUS and the Professional 300 Series.

DRIVERS

DECnet Phase IV will support Ethernet under VAX/VMS (mid 83), then RSX (early 84), and later the Professional 300 Series.

TYPE OF SERVICE

Datagram service will be supplied.

ISO LAYERS

On the DEC side Phase IV DECnet will support Ethernet, so all of the Layers are present. No support on the IBM side is available from DEC. However, DEC does plan a Ethernet/SNA gateway, probably going in through the IBM 3705 Communications Controller in the future.

TABLE 1

	INTERLAN BASEBAND	3 COM BASEBAND	NSC BASEBAND	U-B BASEBAND	U-B BROADBAND	SYTEK BROADBAND	CONTEL BROADBAND	CONTEL BASEBAND	BRIDGE	DEC
PRODUCT	1010A (UNIBUS) 2010A (QBUS)	3C300	HYPERCHAN	NET/ONE	NET/ONE	LN-40(3)	CONTELNET (802)	(702)	CS1	DEUNA
RANGE	2.8 KM	2.8 KM	1.0 KM 3.0 KM(4)	2.8 KM	16 KM	10 KM	16 KM	2.8 KM	2.8 KM	2.8 KM
RAW SPEED	10 MBS	10 MBPS	50 MBPS	10 MBPS	5 MBPS	2 MPS	2 MBPS	10 MBPS	10 MBPS	10 MBPS
SPEED WITH PROTOCOL	2.5-3.0 MBPS	1.5 MBPS	4-5 MBPS	1.5-20 MBPS	1.5-20	500 KBPS	?	?	1 MBPS	1 MBPS
NUMBER OF CHANNELS (P-SAPs)	1	1	1	1	5 (6 MHz TV)	5 (6 MHz TV)	5 (6 MHz TV)	1	1	1
MEDIUM	ETHERNET COAX CABLE	ETHERNET COAX CABLE	0.27"-1" SEMI-RIGID COAX CABLE	ETHERNET COAX CABLE	CATV	CATV	CATV	ETHERNET COAX CABLE	ETHERNET COAX CABLE	ETHERNET COAX CABLE
MODULATION TECHNIQUE	BASEBAND	BASEBAND	BASEBAND	BASEBAND	VSB/AM MID-SPLIT	FSK MID-SPLIT	FSK MID-SPLIT	BASEBAND	BASEBAND	BASEBAND
IBM HDW INTERFACE	AUSCOM 8911(2) OR DACU	AUSCOM 8911 OR DACU	HIGH SPEED IBM INTERFACE BLOCK MUX (A222)	AUSCOM 8911 OR DACU	AUSCOM 8911 OR DACU	AUSCOM 8911 OR DACU	AUSCOM 8911 OR DACU	AUSCOM 8911 OR DACU	AUSCOM 8911 OR DACU	AUSCOM 8911 OR DACU
VAX HDW INTERFACE	UNIBUS	UNIBUS	UNIBUS (PI13)	UNIBUS (DR11W)	UNIBUS (DR11W)	UNIBUS BETA TEST	NONE	NONE	INTEL ISBX	DEUNA
PDP11 HDW INTERFACE	UNIBUS	UNIBUS	UNIBUS (PI13)	UNIBUS (DR11W)	UNIBUS (DR11W)	UNIBUS BETA TEST	NONE	NONE	INTEL ISBX	DEUNA
LSI 11 HDW INTERFACE	QBUS	QBUS	QBUS DRV11B TO A PI 12	NO	NO	NO	PROTOTYPE QBUS	PROTOTYPE QBUS	NONE	IN PROCESS
IBM MVS DRIVER	NO	NO	YES, NETEX	NO	NO	NO	NONE	NONE	NONE	NONE
VAX/VMS DRIVER	YES UNIBUS	YES UNIBUS	YES, NETEX UNIBUS	YES UNIBUS PROTOTYPE	YES UNIBUS PROTOTYPE	YES UNIBUS ?	NONE	NONE	NONE	YES UNIBUS
PDP 11/RSX 11M DRIVER	YES UNIBUS	YES UNIBUS	YES, NETEX UNIBUS	YES, PROTO-TYPE FOR DR11 FROM CUSTOMER	YES, PROTO-TYPE FOR DR11 FROM CUSTOMER	YES?	NONE	NONE	NONE	YES UNIBUS (EARLY 84)
LSI 11/RT 11 DRIVER	RT-11V4	?	NO	NO	NO	?	NONE	NONE	NONE	NONE
TYPE OF SERVICE	DATAGRAM	DATAGRAM		DATAGRAM(6) OR CONNECTION (AT 19.2)	DATAGRAM OR CONNECTION (AT 19.2)	DATAGRAM OR CONNECTION	POSSIBLE DATAGRAM OR CONNECTION	POSSIBLE DATAGRAM OR CONNECTION	DATAGRAM OR CONNECTION	DATAGRAM

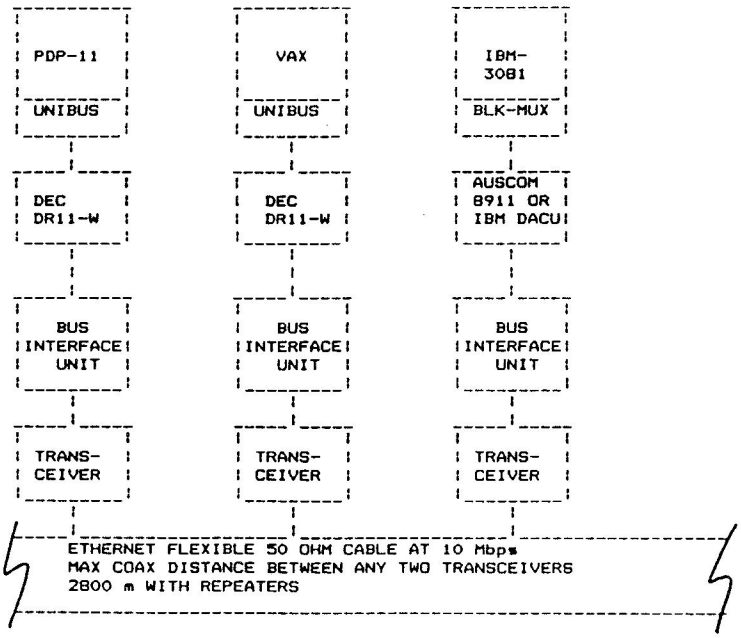

Fig. 8a GENERIC BASEBAND SYSTEM

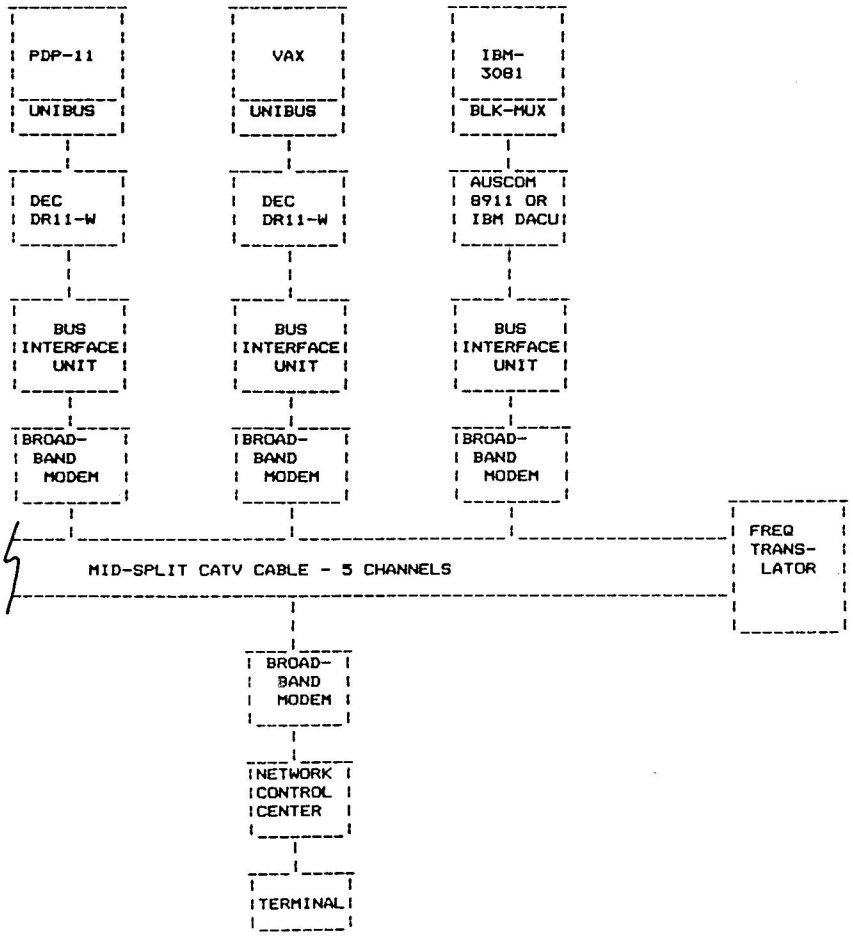

Fig. 8b GENERIC BROADBAND SYSTEM

TABLE 1 (CONT.)

	INTERLAN BASEBAND	3 COM BASEBAND	NSC BASEBAND	U-B BASEBAND	U-B BROADBAND	SYTEK BROADBAND	CONTEL BROADBAND	CONTEL BASEBAND	BRIDGE	DEC
LAYER 1 (PHYSICAL)	CSMA/CD ETHERNET CABLE	CSMA/CD[7] ETHERNET CABLE	CSMA/CD VARIANT[1] COAX CABLE	CSM/CD ETHERNET CABLE	CSMA/CD CATV CABLE	CSMA/CD CATV CABLE	CSMA/CD CATV CABLE	CSMA/CD ETHERNET CABLE	CSMA/CD ETHERNET CABLE	CSMA/CD ETHERNET CABLE
LAYER 2 (DATALINK)	IN NI1010 BOARD	IN 3C300 BOARD (BIU)	IN ADAPTER A400, A222	IN NIU-Z80 16-BIT SUMMER 83[5]	IN NIU-Z80 16-BIT SUMMER 83[5]	IN 16 BIT PCU	IN BIU	IN BIU	IN CS1	IN DEUNA & H4000
LAYER 3 (IBM) (NETWORK)	NONE	NONE	NETEX IN HOST	FOR CONNECTION ONLY[5]	FOR CONNECTION ONLY[5]	IN PCU	IN BIU	IN BIU	IN CS1	NONE
LAYER 3 (DEC) (NETWORK)	DECNET ON ETHERNET	TCP/IP UNDER UNIX	NETEX IN HOST	FOR CONNECTION ONLY[5]	FOR CONNECTION ONLY[5]	IN PCU	IN BIU	IN BIU	IN CS1	DECNET
LAYER 4 (IBM) (TRANSPORT)	NONE	NONE	NETEX IN HOST	FOR CONNECTION ONLY[5]	FOR CONNECTION ONLY[5]	IN PCU	IN BIU WITH X.25	IN BIU WITH X.25	IN CS1	NONE
LAYER 4 (DEC) (TRANSPORT)	DEC NET ON ETHERNET	TCP/IP UNDER UNIX	NETEX IN HOST	FOR CONNECTION ONLY[5]	FOR CONNECTION ONLY[5]	IN PUC	IN BIU WITH X.25	IN BIU WITH X.25	IN CS1	DECNET
LAYER 5 (IBM) (SESSION)	NONE	NONE	NETEX IN HOST	NONE	NONE	NONE	NONE	NONE	NONE	NONE
LAYER 5 (DEC) (SESSION)	DEC NET ON ETHERNET	TCP/IP UNDER UNIX	NETEX IN HOST	NONE	NONE	NONE	NONE	NONE	NONE	DECNET

(1) HYPERCHANNEL DOES NOT FIT ANY OF THE CURRENT IEEE-802 PROPOSED STDS.

(2) IBM SELECTOR, BYTE MUX OR BLOCK MUX CHANNEL VIA STD BUS & TAG CABLES.

(3) REDESIGN OF MODEL 40 UNIT IS UNDERWAY DUE TO A PERFORMANCE IFIC PROBLEM - IBM INTERFACE IS QUEUED UP BEHIND THIS REDESIGN.

(4) 3KM WITH REPEATER, 1.5 KM WITHOUT; LINK ADAPTER (A710) WILL EXTEND INDEFINITELY, E.G., SATELLITE ETC.

(5) MOTOROLA 68000.

(6) DATAGRAM-LAYER 4 RESPONSIBLE FOR ENSURING DATA ARE GETTING THROUGH CORRECTLY.
CONNECTION-LAYER 2 RESPONSIBLE FOR ENSURING DATA ARE GETTING THROUGH CORRECTLY.

(7) HOST INTERVENTION REQUIRED TO RECOVER FROM A COLLISION.

VENDORS ADDRESSES

AUSCOM Inc. 2007 Kramer Lane, Suite 102, Austin, Texas 78758.

Bridge Communications, Inc. 10401 Bubb Road, Cupertino, California 95014.

3COM, 1390 Shorebird Way, Mountain View, California 94043.

ConTel Information Systems, Information Products Division, 130 Steamboat Road, Great Neck, New York 11024.

Digital Equipment Corp., Maynard, MA 01754.

IBM Information System Group, National Accounts Division, 3715 Northside Parkway, P.O. Box 2150, Atlanta, Ga. 30055.

Interlan, 160 Turnpike Road, Chelmsford, Massachusetts 01824.

International Applied Systems (IAS), 175 East Dana St., Mountain View, California 94041.

Network System Corporation, 7600 Boone Avenue North, Brooklyn Park, Minnesota 55428.

SYTEK, 1153 Bordeaux Drive, Sunnyvale, California 94086.

Ungermann-Bass, One Burlington Woods Drive, Burlington, Massachusetts 01803.

6.) References

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new
VAX-48

DMF32 Parallel Port Driver

Version: January 1983

Author: Kwang H. Kim, RCA, Burlington, MA

Operating System: VAX/VMS

Source Language: VAX MACRO

Special Hardware Required: DMF32 Board

The DMF32 parallel port driver is a general purpose program to interface a parallel in/out user device. The driver is written for VAX 11/780 systems but no problems are expected with other VAX systems. This driver implements DMA data transfer by block mode on the device, but it does not implement DR11-C compatibility mode, nor silo mode.

Restrictions: Only DMA mode has been implemented.

Media (Service Charge Code): Write-Up and Listing (DA),
600' Magtape (MA)

Format: VAX/ANSI (Blocked at 2048)

Keywords: DMF32 Driver, Driver
Category Index: 12
Operating System Index:
VAX/VMS

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DATAGRAM

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CAPTION: MODEMS BEHIND PBX's

MESSAGE: Some direct connect modems do not draw enough current to look "off hook" to some PBX's. This is evidenced by losing the line after having hung up an attached telephone. The long-term solution is to use the modem on a non-PBX'ed line. A workaround is to not hang up the phone, but disconnect the modular plug from the handset after passing control to the modem. In this way, the attached telephone will adequately load the line, and disconnecting the handset will prevent room noise from interfering.

CONTACT:

NAME Jonathan M. Prigot

ADDRESS W. R. Grace & Co., Polyfibron Division, 55 Hayden Ave., Lexington, MA 02173

TELEPHONE (617) 861-6600 X 2791

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SIGNATURE Jonathan M. Prigot DATE 8/24/83

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DATAGRAM

A SIG INFORMATION INTERCHANGE

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CAPTION: PRIME to VAX Network Needed

MESSAGE: Currently, at the University of Rhode Island, we have PRIMENET and DECNET operational. What we would like to implement is a gateway between these two networks. A PRIME to VAX network is needed.

CONTACT:

NAME Donald Borsay

ADDRESS 307A Bliss Hall, Kingston RI 02881

TELEPHONE 401-792-2559

IF THIS IS A REPLY TO A PREVIOUS DATAGRAM, WHICH NUMBER? _____

SIGNATURE Donald Borsay DATE 6/16/83

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DATAGRAM

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CAPTION: ETHERNET FRU DIAGNOSIS MATRIX

MESSAGE: As of today the Ethernet controller DEUNA is in various field test sites throughout the U.S. Attached is a matrix which should prove to be of assistance in installing DEUNA's and allied components. SEE PAGES 90 AND 91.

The VAX diagnostics come with VMS V3.2 and the PDP-11 diagnostics come as the XXDP package.

CONTACT: Mo Marikar

NAME Mo Marikar

ADDRESS 1925 ANDOVER ST. TEWKSBURY MA 01876

TELEPHONE 617-858-2748

IF THIS IS A REPLY TO A PREVIOUS DATAGRAM, WHICH NUMBER? _____

SIGNATURE M.N.Q. Marikar DATE 4/18/83

By Mo Marikar.
Distributed Systems Maintainability Engineering.

ETHERNET FRU DIAGNOSIS MATRIX

The FRU's are the DEUNA, H4000, bulkhead and cables.
The DEUNA is the controller DEC supports for the Ethernet.
The H4000 is the transceiver DEC supports for the Ethernet.
Drop cable is the cable between the H4000 and the bulkhead.
Internal cable is the cable between the bulkhead and the link module of the DEUNA.
Interconnecting cables are the cables between the link and port modules of the DEUNA.

Refer to the DEUNA User's Guide, EK-DEUNA-UG-PRE for definitions of registers PCSR0,PCSR1 and their contents.

Fault Insertion	VAX/VMS Functional	VAX Repair	PDP-11 Functional. In internal loopback mode	PDP-11 Functional. In external loopback mode	PDP-11 Stand alone
Drop cable disconnected at bulk head	Ext lpbk set in PCSR1	Ext lpbk set in PCSR1	Ext lpbk set in PCSR1	XPWR and Ext lpbk set in PCSR1	Ext lpbk set in PCSR1
Drop cable disconnected at transceiver	Ext lpbk set in PCSR1	Ext lpbk set in PCSR1	Ext lpbk set in PCSR1	Ext lpbk set in PCSR1	Ext lpbk set in PCSR1
Internal cable disconnected at link module	XPWR and Ext lpbk set in PCSR1	XPWR and Ext lpbk set in PCSR1. SERI set in PCSR0 implies fault to be at link	XPWR and Ext lpbk set in PCSR1	XPWR and Ext lpbk set in PCSR1	XPWR set in PCSR1
Internal cable disconnected at bulk head	XPWR and Ext lpbk set in PCSR1	Ext lpbk set in PCSR1	Ext lpbk set in PCSR1	Ext lpbk set in PCSR1	Ext lpbk set in PCSR1

By Mo Marikar.
Distributed Systems Maintainability Engineering.

Fault Insertion	VAX/VMS Functional	VAX Repair	PDP-11 Functional In internal loopback mode	PDP-11 Functional In external loopback mode	PDP-11 Stand alone
Inter-connecting cable disconnected at port module	STS-TIMO set in IOSB2. Also Ethernet default address is 00-00-00-00-00-00	XPWR, ICAB and Ext lpbk set in PCSR1	XPWR and ICAB set in PCSR1	ICAB set in PCSR1	ICAB set in PCSR1
Inter-connecting cable disconnected at link module	STS-TIMO set in IOSB2. Correct Ethernet address indicated	XPWR, ICAB and Ext lpbk set in PCSR1	Bus gets hung	Bus gets hung	Bus gets hung
Wrong Vector	STS-TIMO set in IOSB2. Also Ethernet default address is 00-00-00-00-00-00	Catches it correctly stating expected and actual The actual was within the floating vector range	Instead of concluding with 0 total errors DR> is preceded by error messages which do not translate easily	Fails test 9 i.e., Interrupt logic test	Fails Test 14 i.e., Inter-rupt test
Wrong CSR	VMS crashes with a register and Kernel /interrupt stack dump	Cannot access PCSR0 indicated	Instead of concluding with 0 total errors DR> is preceded by RESTRT ADR	States that PCSR0 does not exist	States that PCSR0 does not exist

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CAPTION: _____

MESSAGE: _____

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CONTACT:

NAME _____

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