DATA COMMUNICATION

by Heinz Jurack

INTRODUCTION

The data communications world has begun to undergo a major change in recent years, from an ad hoc array of "home brew" systems that worked more in spite of, than due to, publicity available facilities, to a more planned and integrated set of facilities designed both for communications of data and for public use.

At the same time, the data communications needs of users have been growing, measured in terms of sophistication, volume and geographic coverage.
In an age of transcontinental and multinational business, users require access to a full range of services and coverage.
Thus, the same user demands that lead to the development of high capability public data networks will inevitably also lead to the interconnection of these data networks.

ENVIRONMENT

The current data communications networking environment is characterized by unprecedented innovation and growth. New technologies are moving from the laboratory to commercial application in record time, and a variety of new service offerings are being presented to customers. The result is both widened opportunities for users to avail themselves of these new services and confusion on the part of carriers and customers alike as to the service effectiveness and economic viability of all the new offerings.

THE PROBLEM

The basic problem is to device a strategy for the interconnection of computer communications networks that is workable and acceptable for users, carriers and regulatory authorities.

- USERS seek solutions that are technically efficient, easy to use, and which enable them to take full advantages of all facilities on any of the networks.

- CARRIERS also seek solutions that are efficient, though they are unwilling to alter the internal operation of their systems. Any system for interconnection must also permit them to protect the integrity of their own network and to account to all services supplied .

- REGULATORY AUTHORITIES seek methods that are understandable, controllable and for which tariffs can be devised. Not all of these goals are congurent and compromises will need to be made along the way.

TECHNOLOGICAL BACKGROUND

A clear understanding of basic networking concepts is necessary to appreciate the issues in network interconnection.

- INTERFACE COMPONENTS

An interface, simple enough,is something between two systems, devices or components that serves to connect them.
The interface may be a system, device or component itself, or a set of specifications to which the connected things adhere.

Computer communications interfaces are generally composed of both devices or components and specifications.
There are many different aspects or ways of describing a computer communications interface.
One possible breakdown, and the one chosen here, is to destinguish between different levels of function, viz., physical, electrical, logical procedural.

- PHYSICAL

The physical portion of the interface specifies the way in which the two devices are actually connected mechanically. This includes the number of wires and the dimensions of the physical connectors in which the wires terminate.

- ELECTRICAL

The electrical portion of the interface specifies the voltage levels and duration (or for some interface specifications the current flow) to be used for signaling on the various leads.
The basic capability provided by adherence to the standards at this level is the transfer of data bits across the interface. These bits may be identifiable as parts of characters and/or be used for higher level signaling functions within the interface.

- LOGICAL

The logical portion of the interface specifies how the data bits and/or characters are grouped into fields for the purposes of signaling and data transfer.
In a sense, the logical specification of a computer-communications interface provides a language that may be employed for controlling and effecting data exchange across the interface.
STANDARDS at this level are sometimes called "elements of procedure".

- PROCEDURAL

If the logical level of the interface is viewed as specifying the syntax of the data flow across the interface, then the procedural specifications should be viewed as providing the semantics.
Specifications at this level determine the legal sequences of communications control characters, or the legal contents of various fields, or the valid commands and responses in controlling data flow.

The same basic set of control characters or fields may be used in a variety of different ways according to the procedural specifications.
Standards for these different ways are sometimes called "CLASSES OF PROCEDURE".

PROTOCOL

The term "protocol" is generally used to refer to the logical and procedural aspects of an interface.
Thus, a protocol specification includes both syntax and semantics.
Semantics also include relative timing information - not just the legal commands, but who can issue them and when.
A complex interface may contain several levels of protocol. An appreciation of this aspect of protocols is quite important in designing and evaluating network interconnections.

It has been suggested that the term "protocol" be used to designate communications conventions between entities at the same level while "interface" be used to designate conventions between entities at adjecent levels.
This is an attractive suggestion, and some confusion may be eliminated if the use of these terms in this way becomes widespread.

HEWLETT hp PACKARD

HP'S DATA COMMUNICATIONS PRODUCTS OVERVIEW

HJ 1

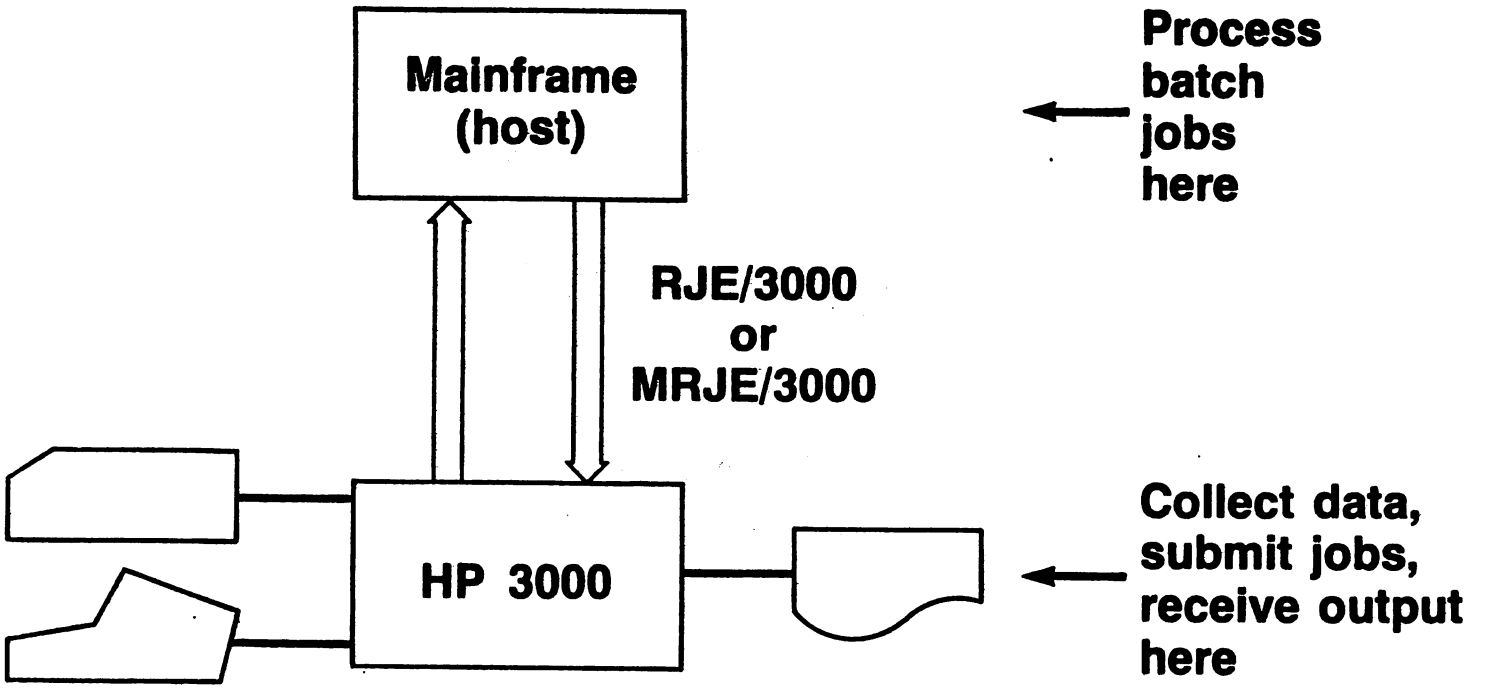
RJE/3000

Remote Job Entry
(2780/3780 emulator)

MRJE/3000

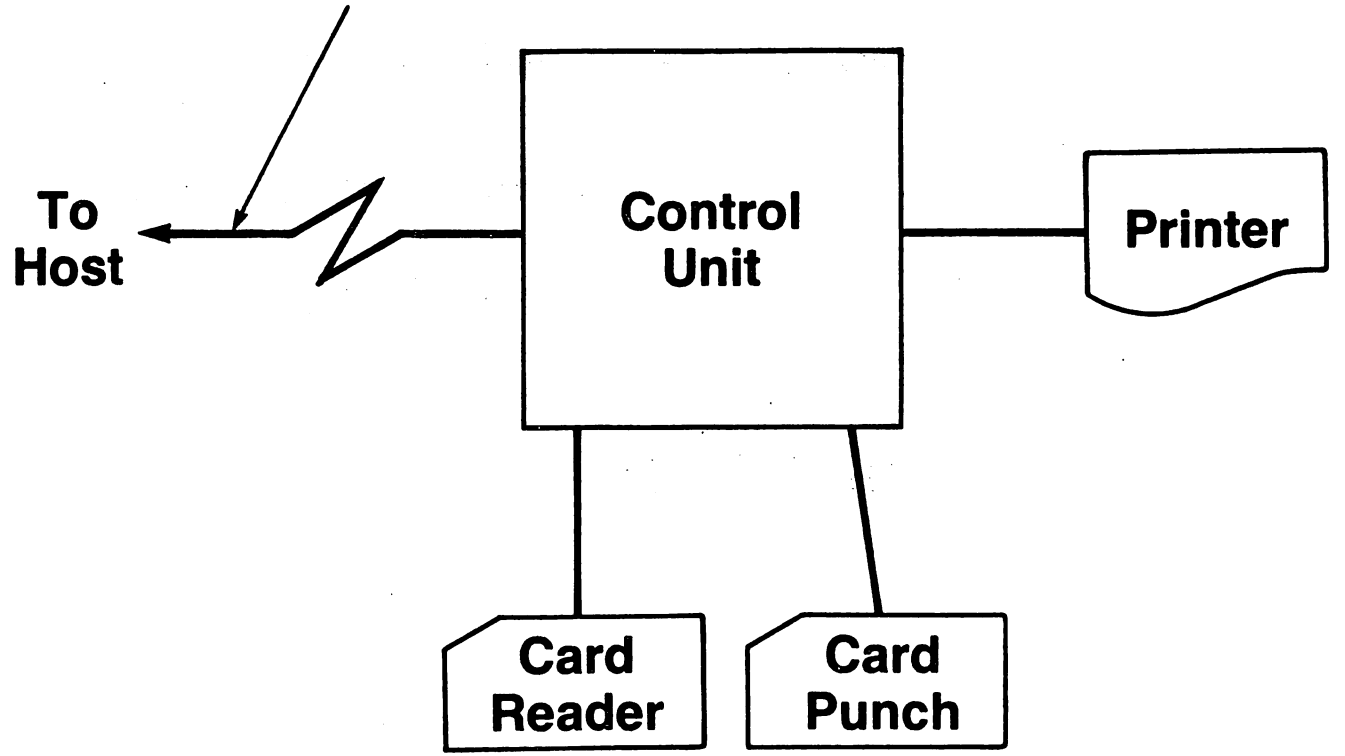
Multileaving Remote Job Entry

RJE and MRJE


Mainframe
(host)
Process
batch
jobs
here
RJE/3000
or
MRJE/3000
HP 3000
Collect data,
submit jobs,
receive output
here

IBM 2780/3780: NON-MULTILEAVING

Only one job stream on communication line at a time



IBM 2780

① Introduced 1967

② Non-multileaving

③ Used bisync (BSC) protocol

④ No CRT — punched cards provide control

IBM 3780

① Introduced 1972

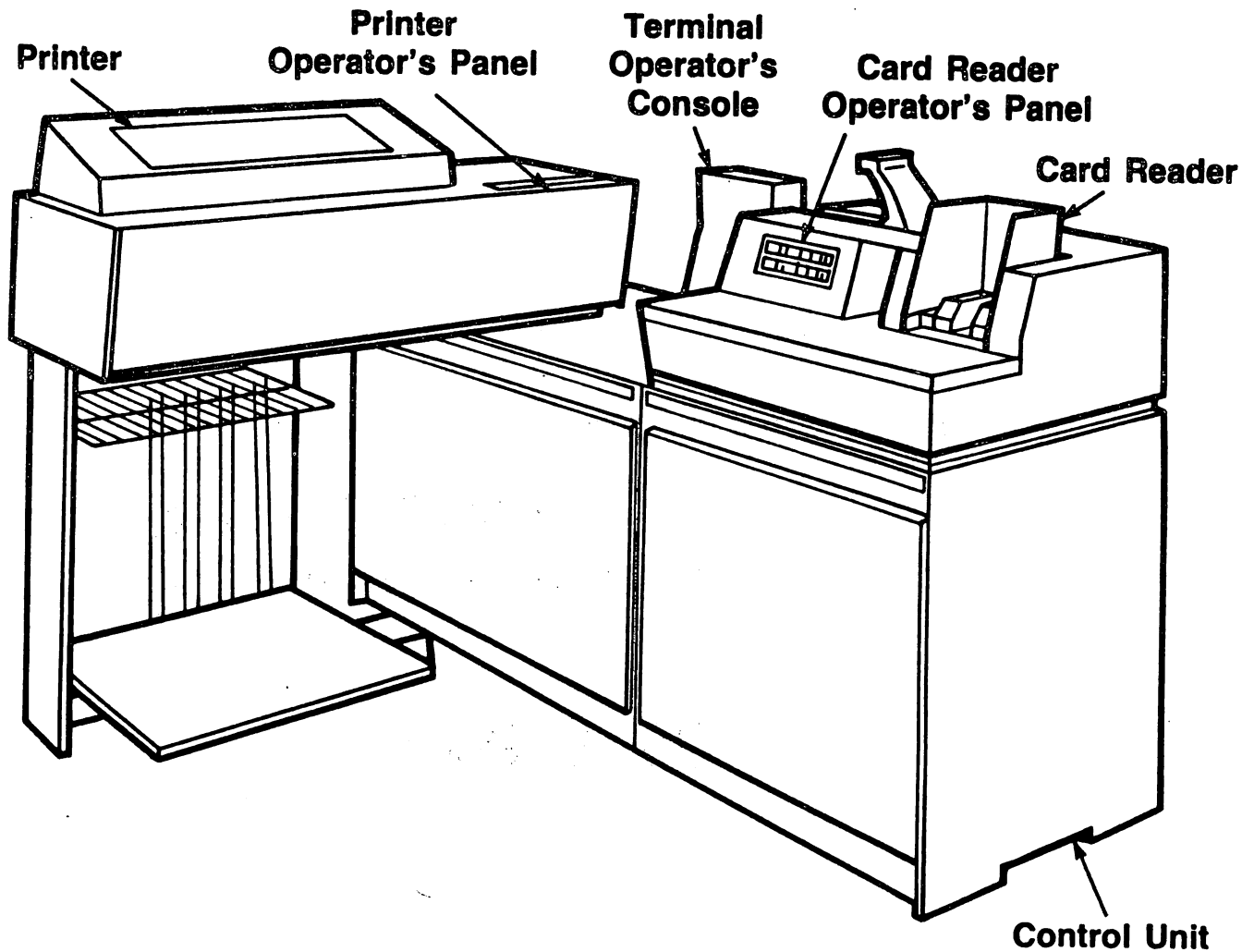
② Non-multileaving

③ Better performance than 2780:

- Faster data transmission
- 3780 compresses blanks (2780 has no data compression)
- Higher-speed devices

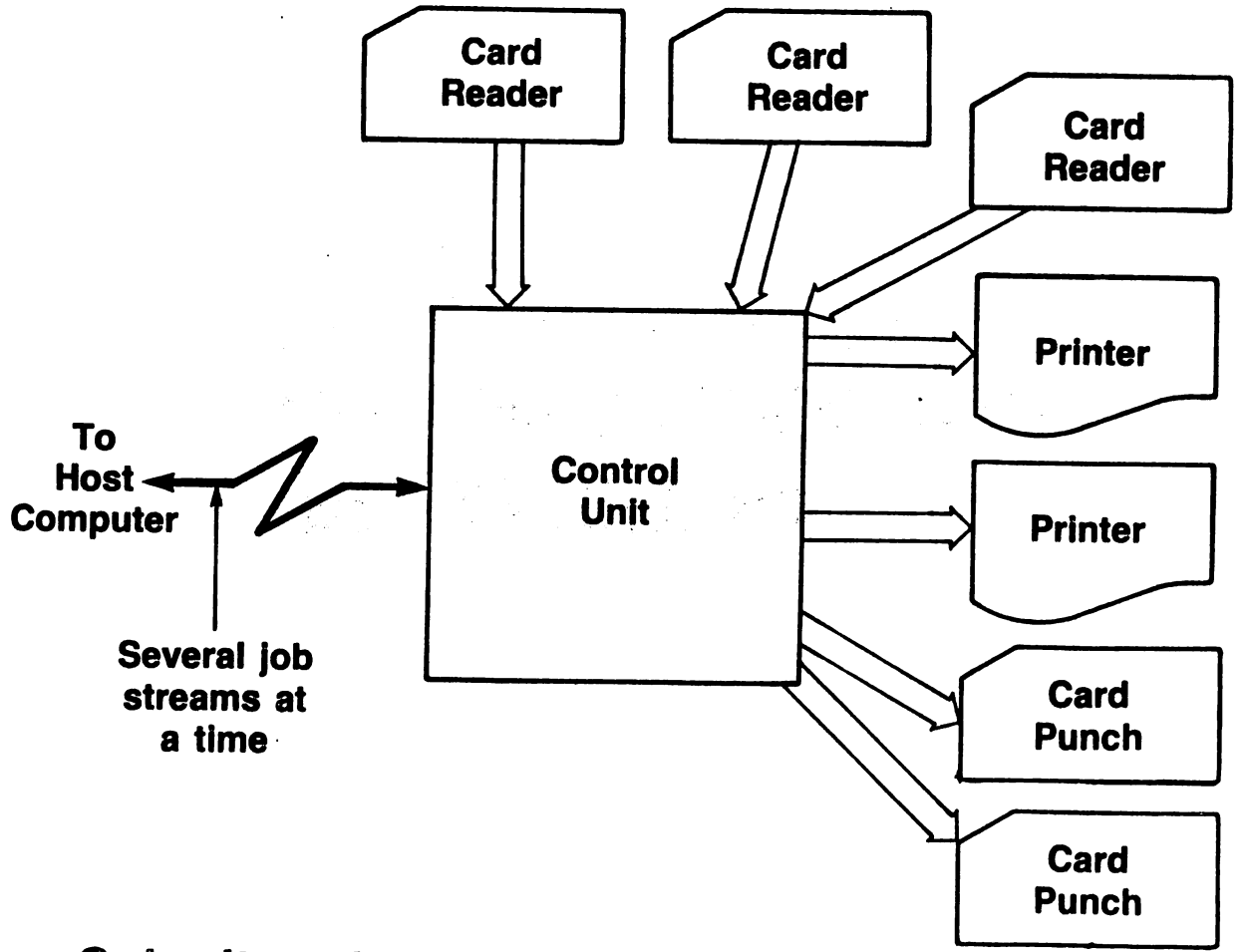
2780 + Better Performance = 3780

IBM 2780/3780



IBM 2780/3780, AND MULTILEAVING WORKSTATIONS

MULTILEAVING WORKSTATION



Submit and receive jobs at the same time

IBM 360 MODEL 20

(360/20)

① Original multileaving workstation

② Smallest system of the IBM 360 series

③ Called a "HASP Workstation"
(a misnomer)

④ IBM 360/30 is similar to 360/20

A COMPARISON

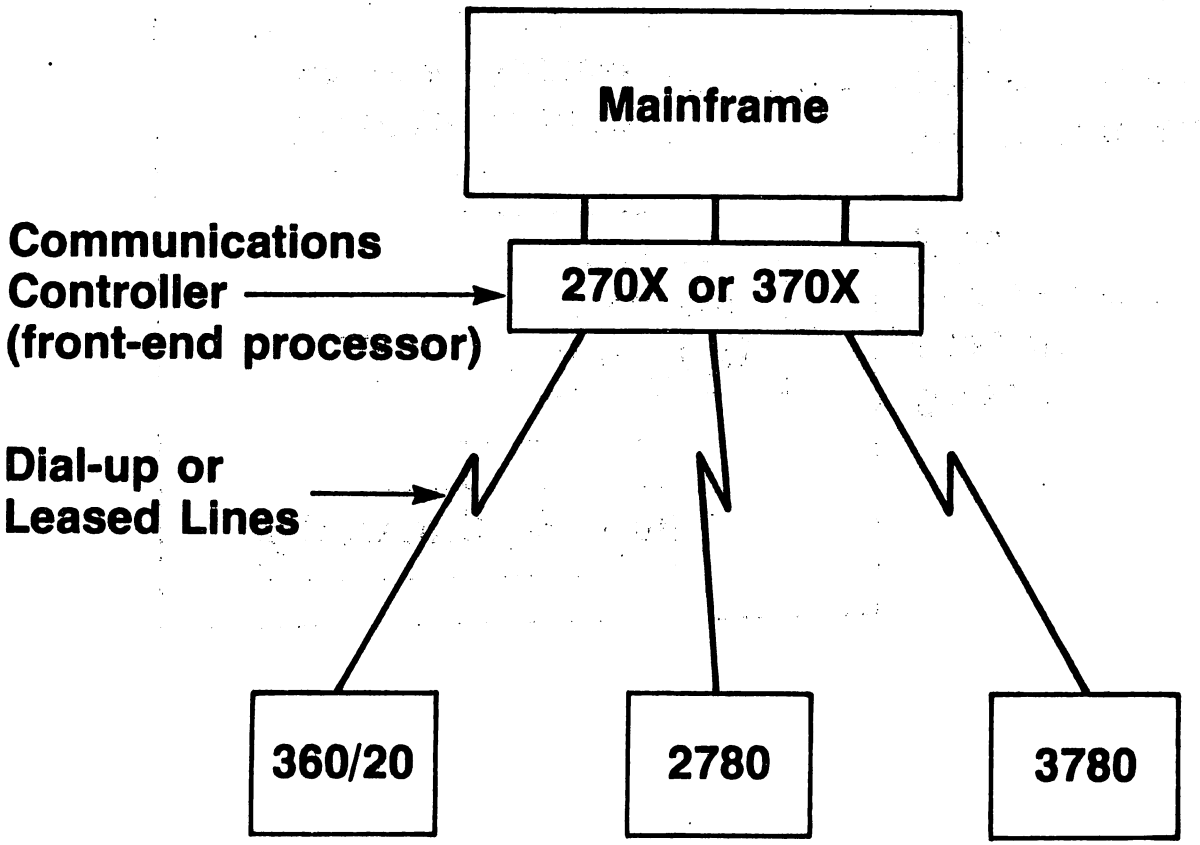
IBM 2780/3780

- *Non*-multileaving
- Handles:
  - 1 Printer
  - 1 Card Reader (opt)
  - 1 Card Punch (opt)
- No console
- 2780 — no character compression
  3780 — compresses blanks

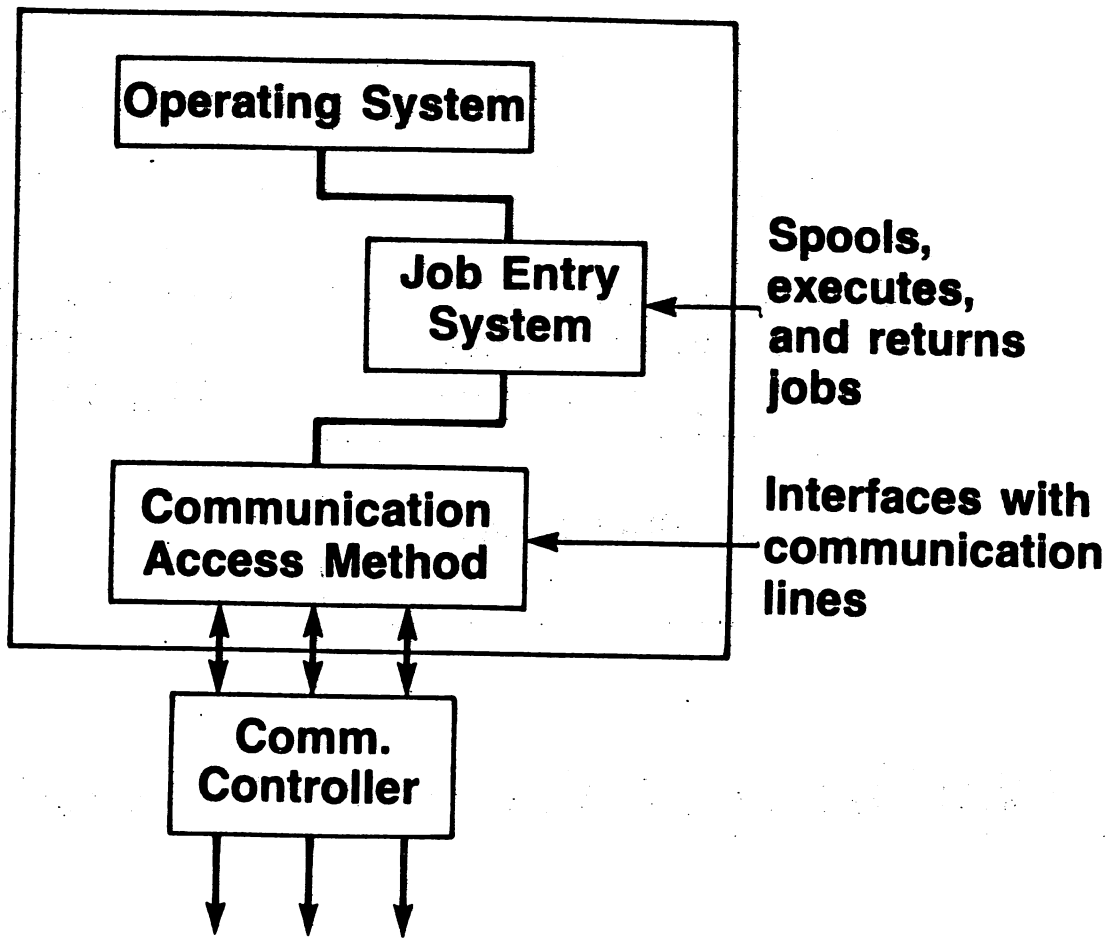
IBM 360/20

- Multileaving
- Handles:
  - Several printers, card readers, card punches
- *May* have command console
- Full character compression

CONNECTING TO THE HOST



REQUIRED HOST SOFTWARE



JOB ENTRY SUBSYSTEMS

Receive, spool, execute, and return batch jobs

JES/RES

RSCS

JES 3

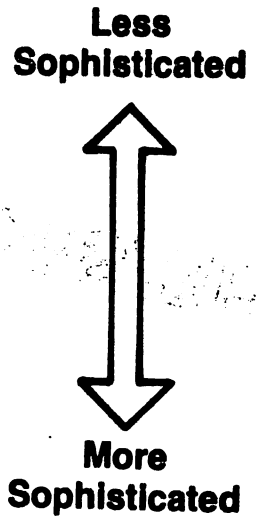
HASP II

JES 2

ASP

POWER

COMMUNICATION ACCESS METHODS



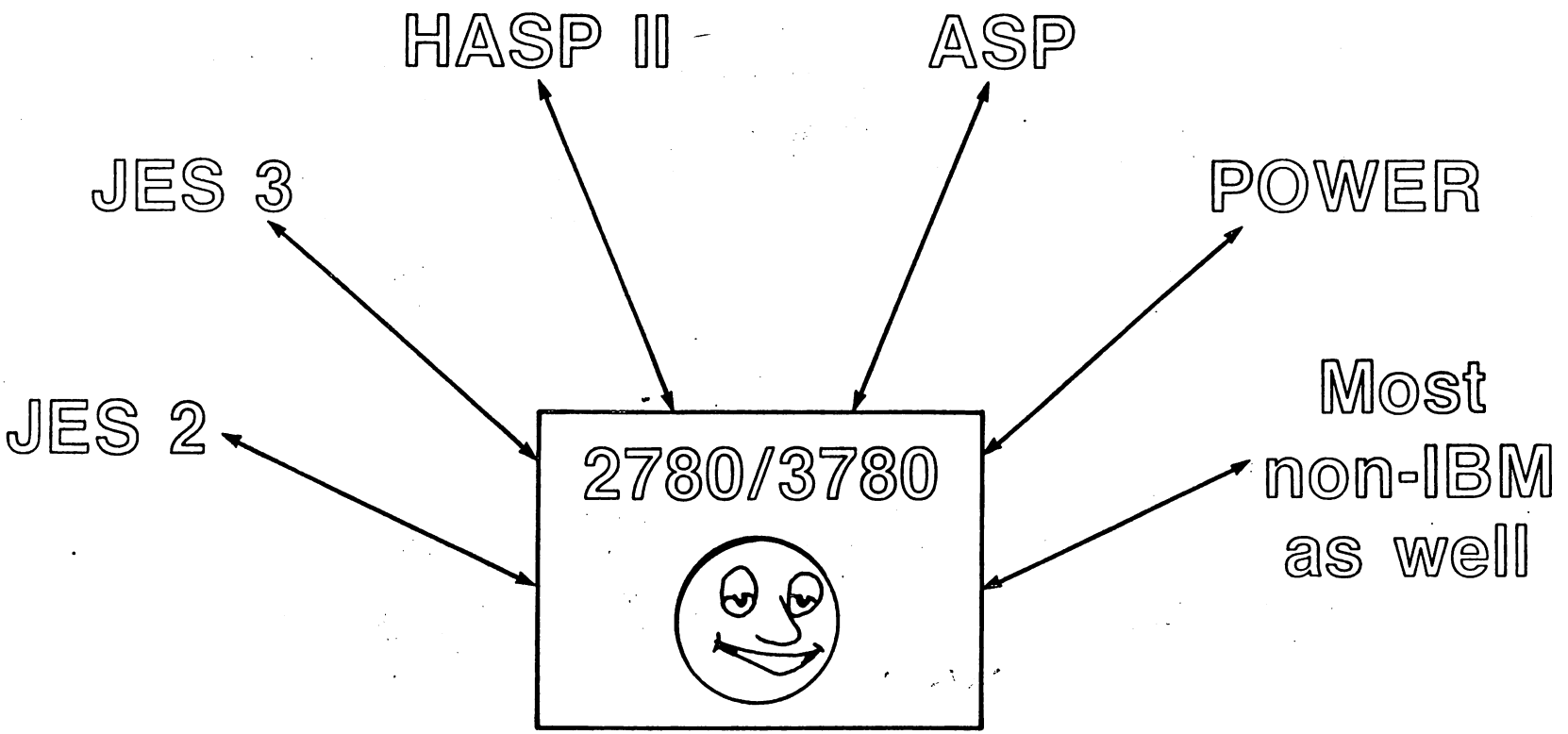
BTAM — Basic Telecommunication Access Method

TCAM — Telecommunication Access Method

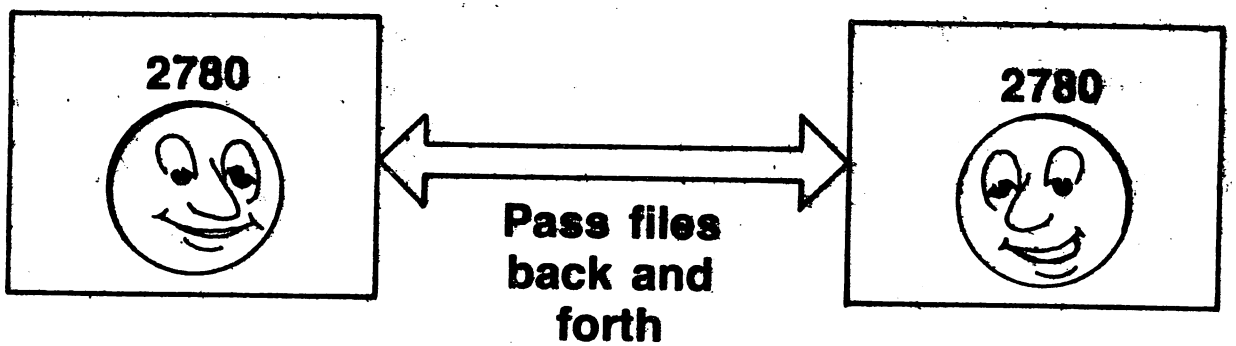
VTAM — Virtual Telecommunication Access Method

RTAM — Remote Telecommunication Access Method
(RTAM comes built-into HASP)

2780/3780'S: COMPATIBLE WITH ESSENTIALLY ANY JOB ENTRY SYSTEM

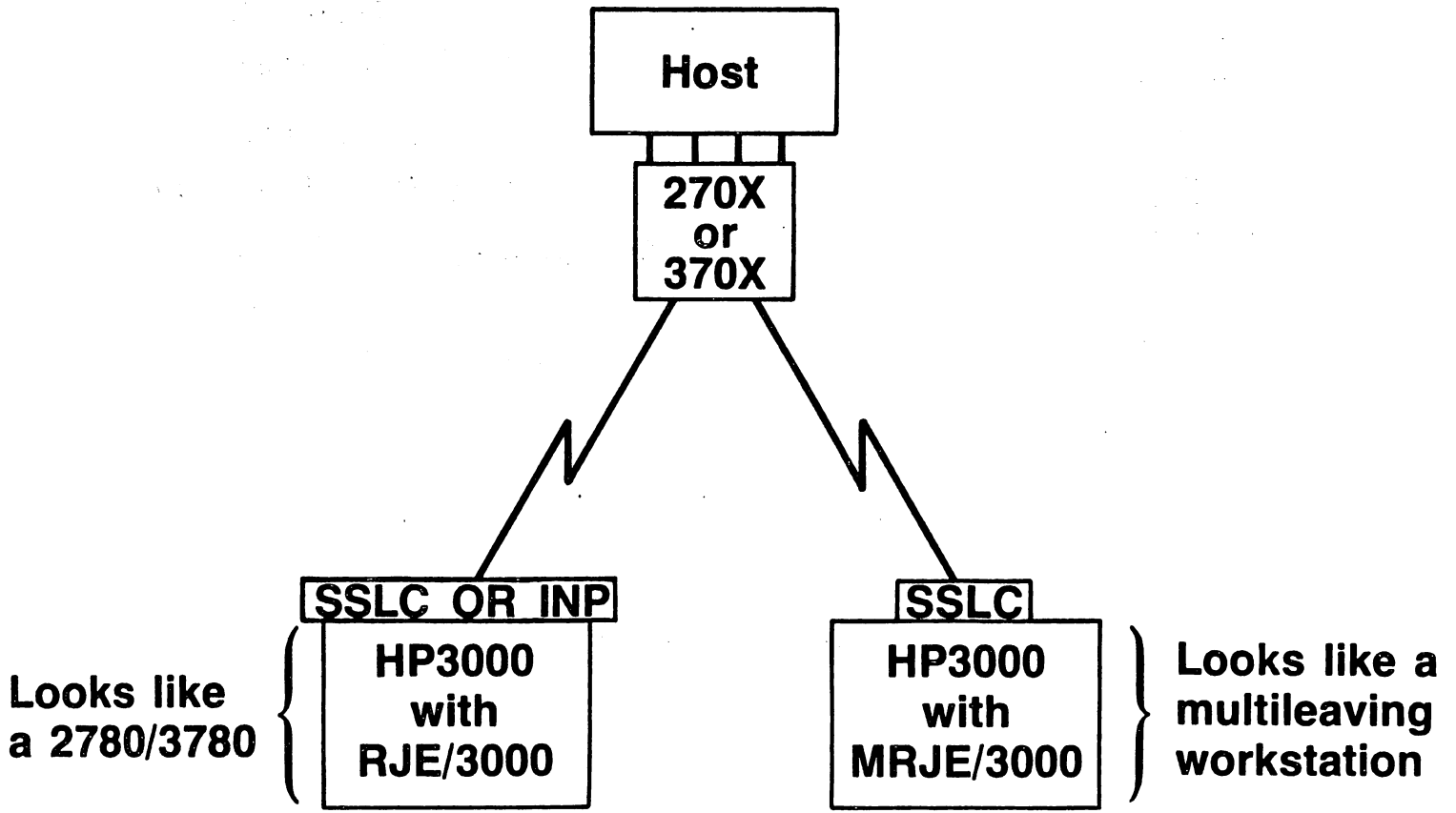


2780/3780'S CAN COMMUNICATE AMONG THEMSELVES



Note: "Communication" ≠ Remote Job Entry

CONFIGURATION OF RJE/3000 OR MRJE/3000



COMPATIBILITY WITH OTHER SYSTEMS

RJE/3000

1) Any IBM mainframe
2) Most non-IBM mainframes
3) Most systems that emulate or support 2780/3780's

MRJE/3000

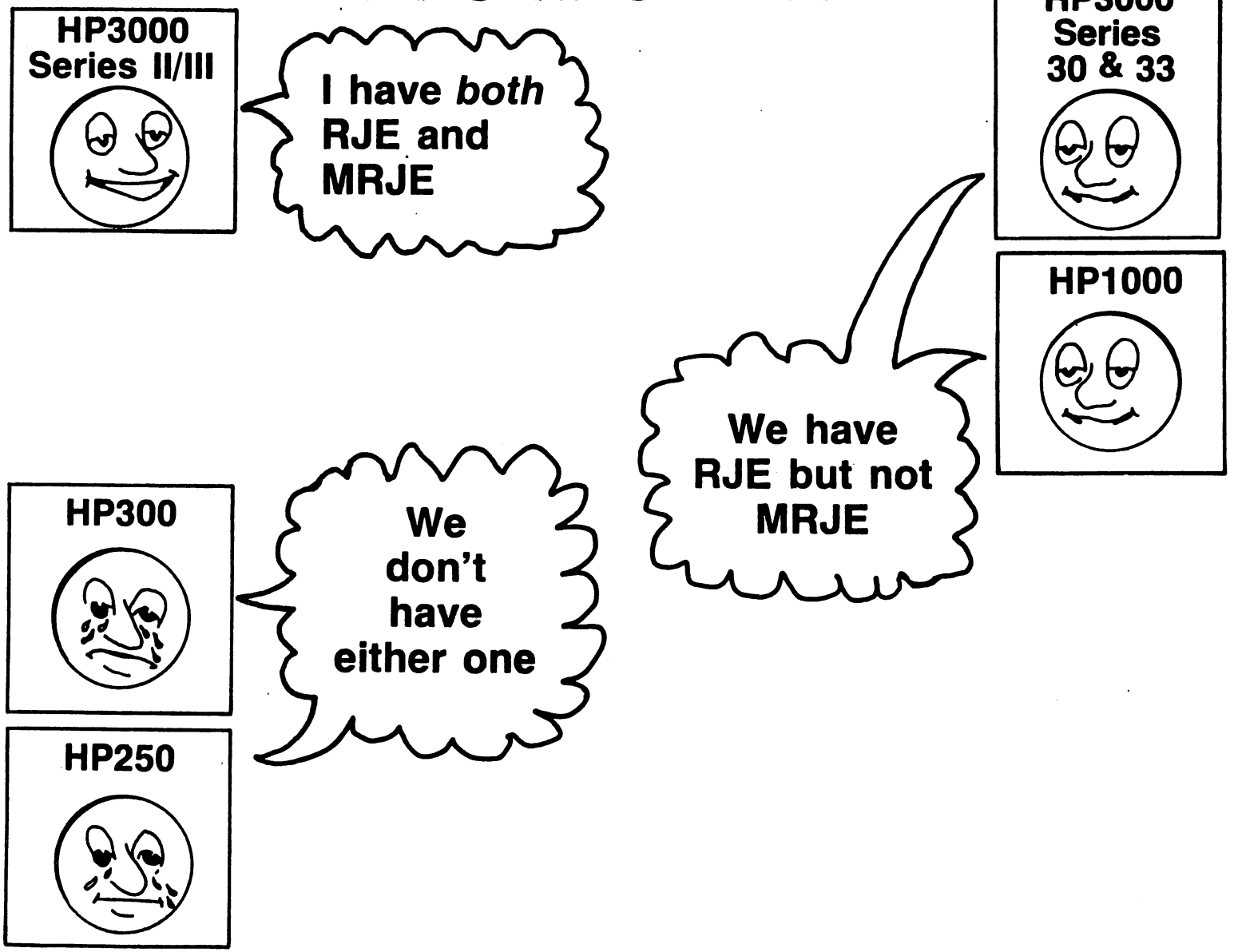
HASP II,
JES 2,
JES 3,
or ASP
only

RJE/3000 HAS BEEN USED WITH:

Hosts	Non-Hosts
Burroughs 6800	IBM System/3
Control Data	Data 100's
Honeywell	DEC PDP-11

Your SE should always test from HP sales office first

WHO HAS WHAT

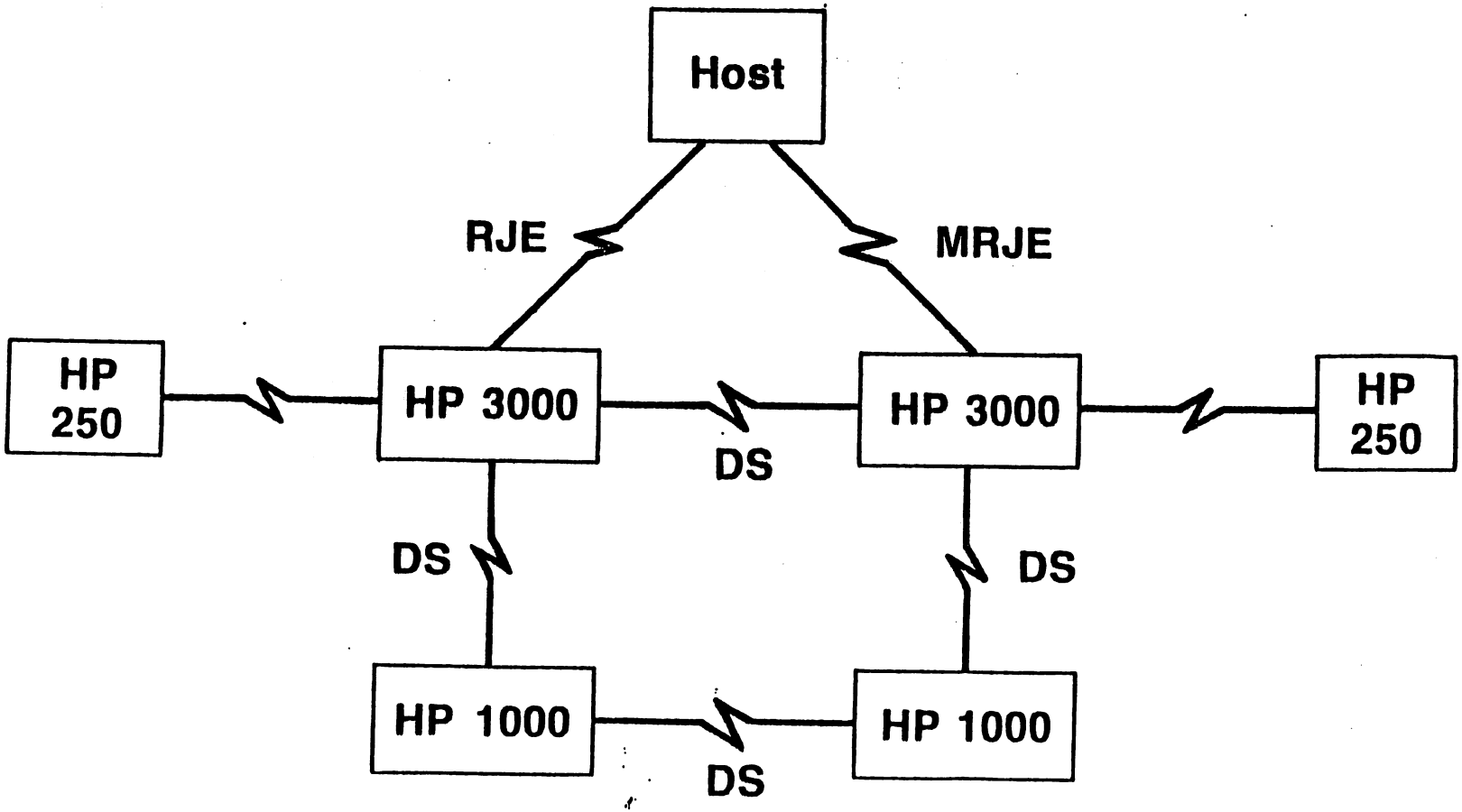

HP3000
Series II/III
I have *both*
RJE and
MRJE
HP3000
Series
30 & 33
HP1000
We have
RJE but not
MRJE
HP300
We
don't
have
either one
HP250

SUMMARY OF MAIN POINTS

- **MRJE is more capable than RJE**
  - Multiple users
  - Job output management
  - MRJE manager
  - Joblog file
  - Submit jobs on-line or off-line
- **MRJE is more restricted than RJE**

  MRJE — HASP II, JES 2, JES 3, and ASP only
  RJE — Any 2780/3780 system
- **MRJE has higher overhead than RJE**

RJE AND MRJE: PART OF HP — DSN



HP — Distributed Systems Network

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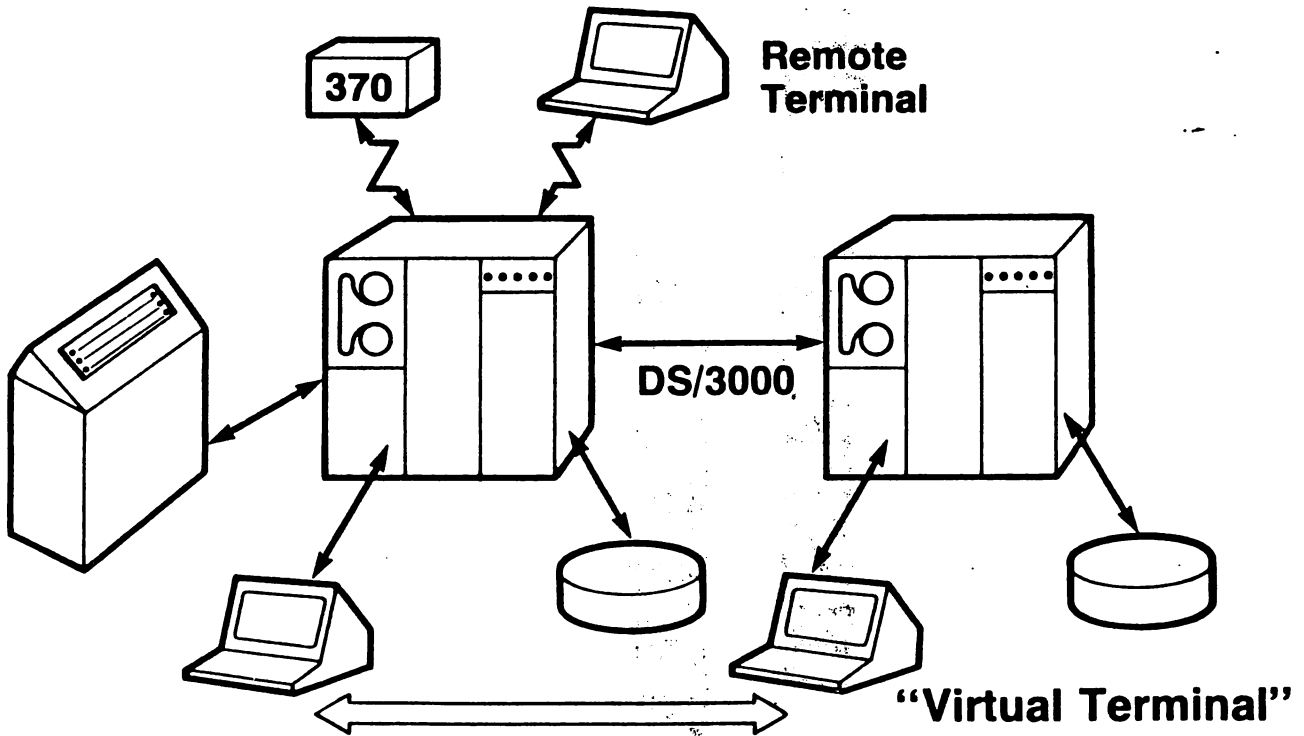
HP'S DISTRIBUTED NETWORK

HJ 2

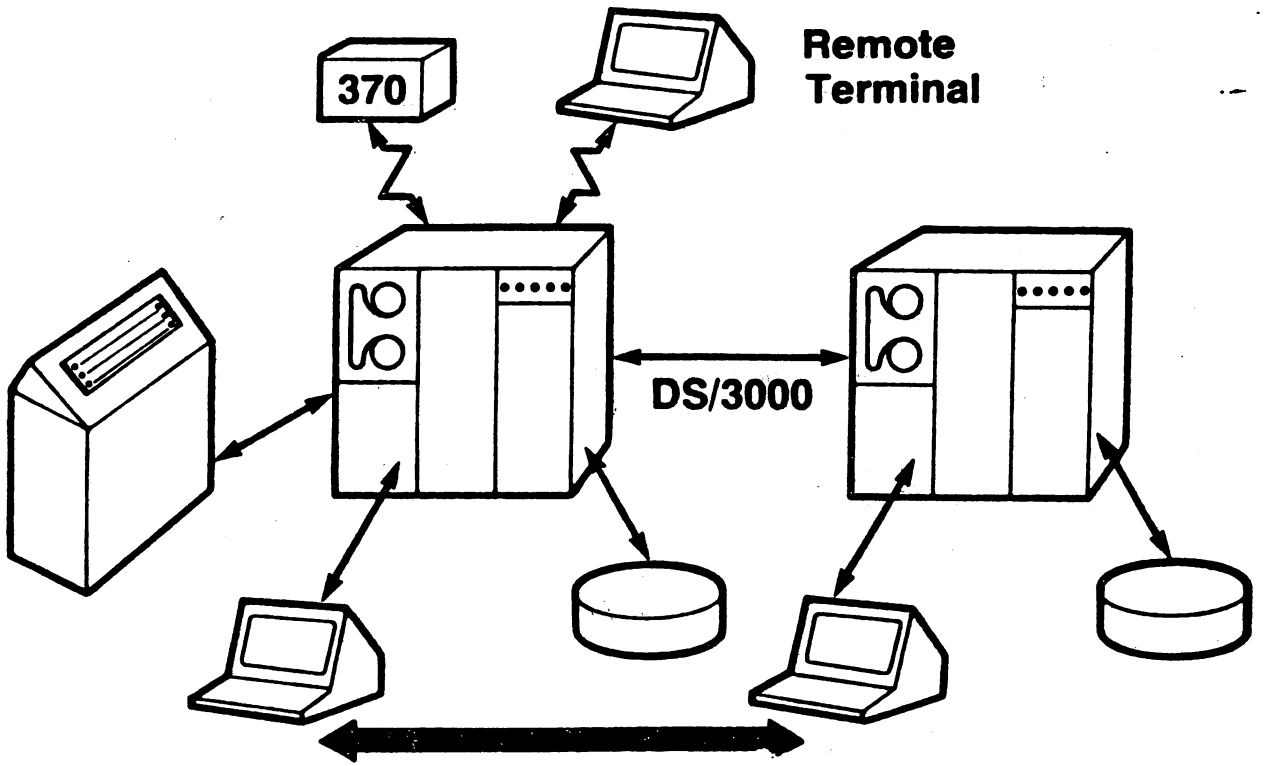


Remote Commands

Run all compilers & subsystems

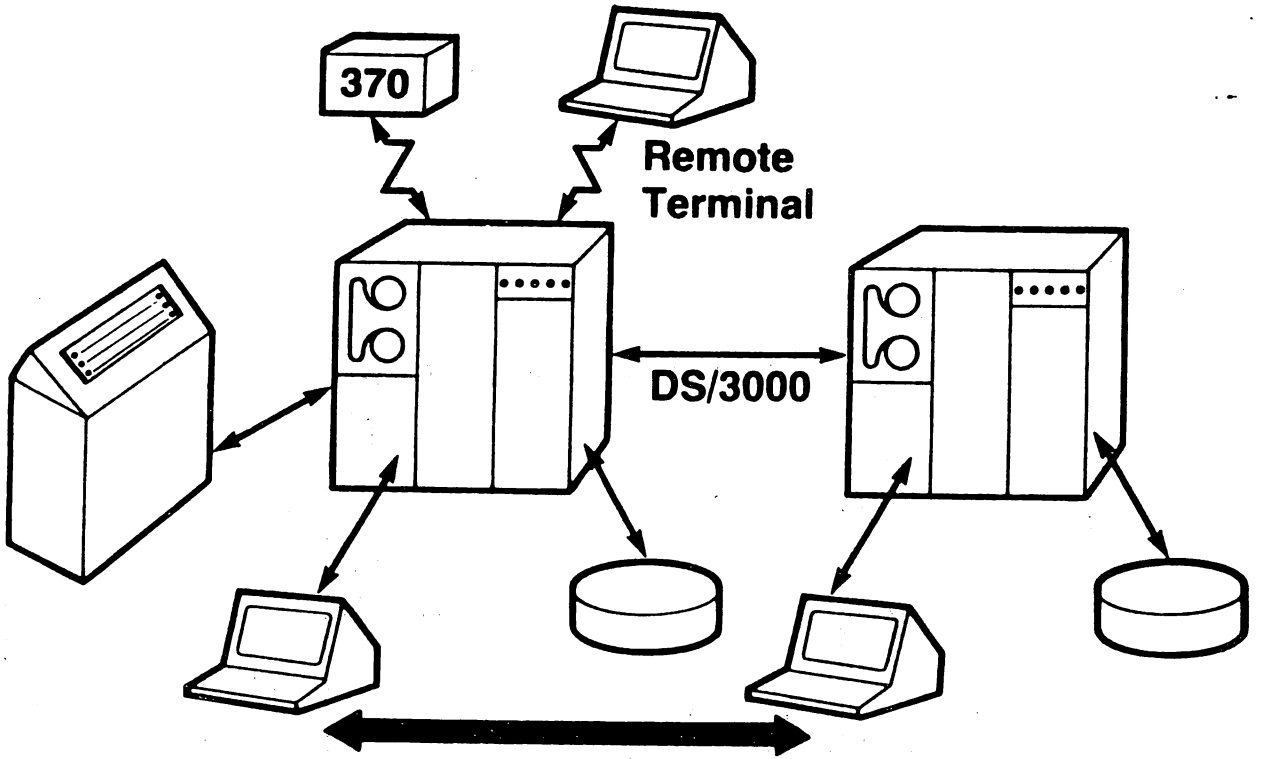
SPL, COBOL, FORTRAN, RPG, BASIC, APL, LISTF, STREAM, RESTORE, SAVE, BUILD, PURGE, PREP, use of peripherals, acct/system manager, system supervisor

RFA



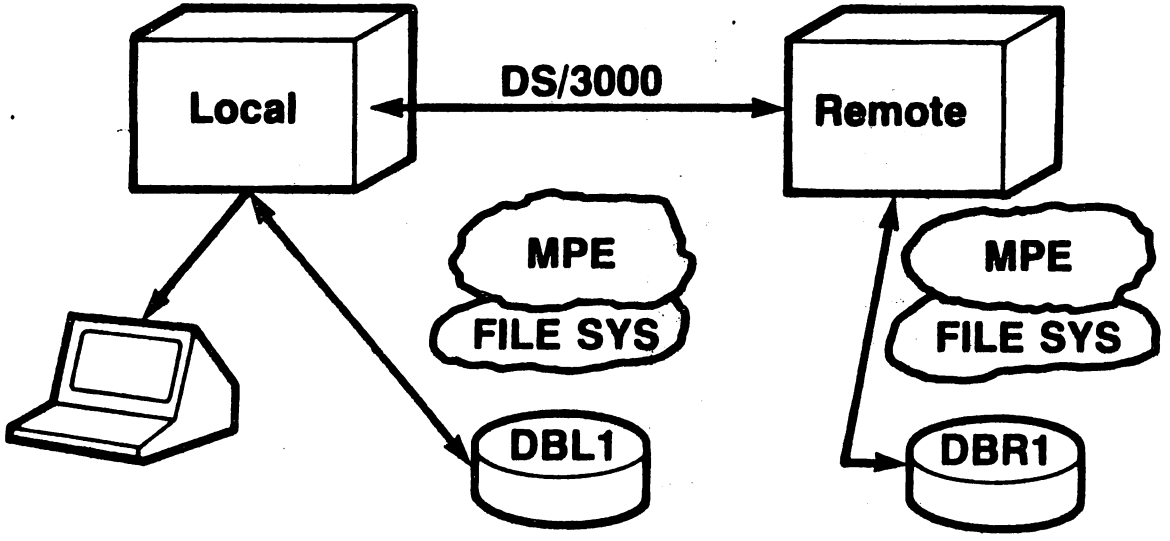
FCHECK	FUNLOCK	FREAD	FUPDATE
FCLOSE	FOPEN	FRELATE	FREADLABEL
FCONTROL	FPOINT	FRENAME	FWRITE
FGETINFO	FREADDIR	FSPACE	FWRITEDIR
	FREADSEEK	FSETMODE	

PTOP



Master		Slave
POPEN PWRITE PCLOSE	PREAD PCONTROL PCHECK	GET ACEPT REJECT

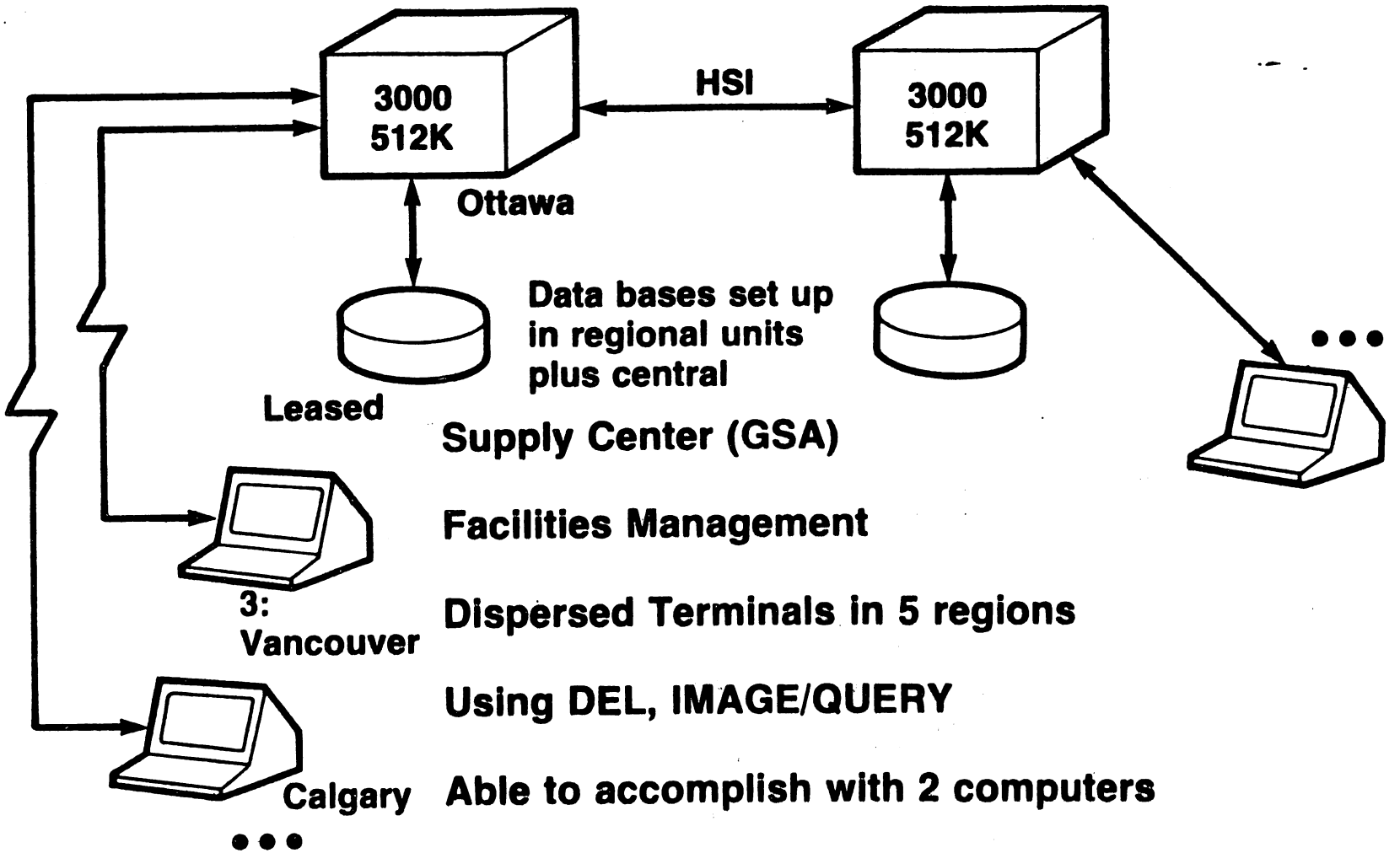
Remote
Data Base Access



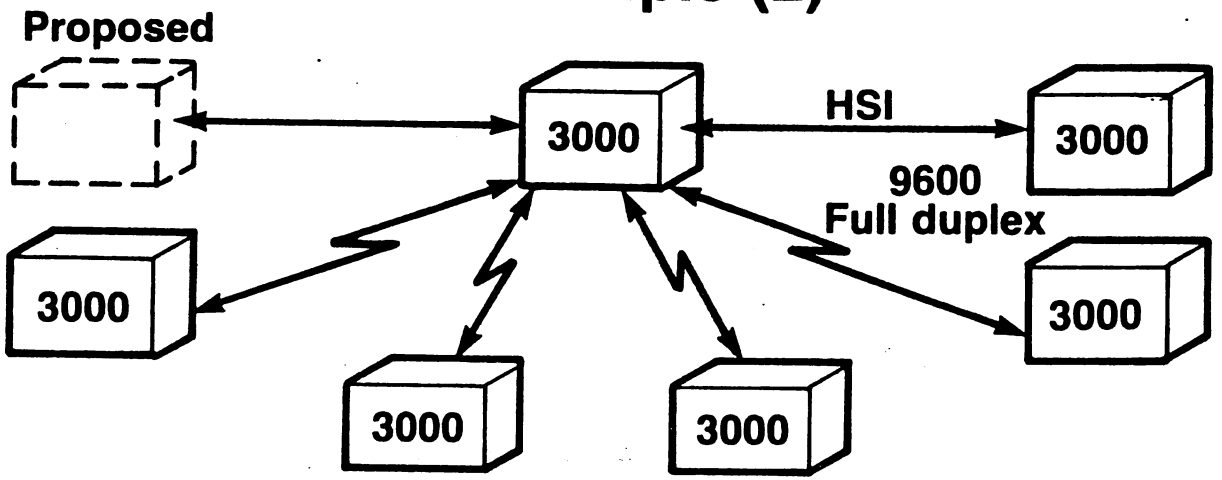
DS-NETWORK-
EXAMPLES

HJ 3

DS Example (1)


3000
512K
HSI
3000
512K
Ottawa
Data bases set up
in regional units
plus central
Leased
Supply Center (GSA)
Facilities Management
3:
Vancouver
Dispersed Terminals in 5 regions
Using DEL, IMAGE/QUERY
Calgary
Able to accomplish with 2 computers
Original plans were to disperse 5 units geographically

DS Example (2)



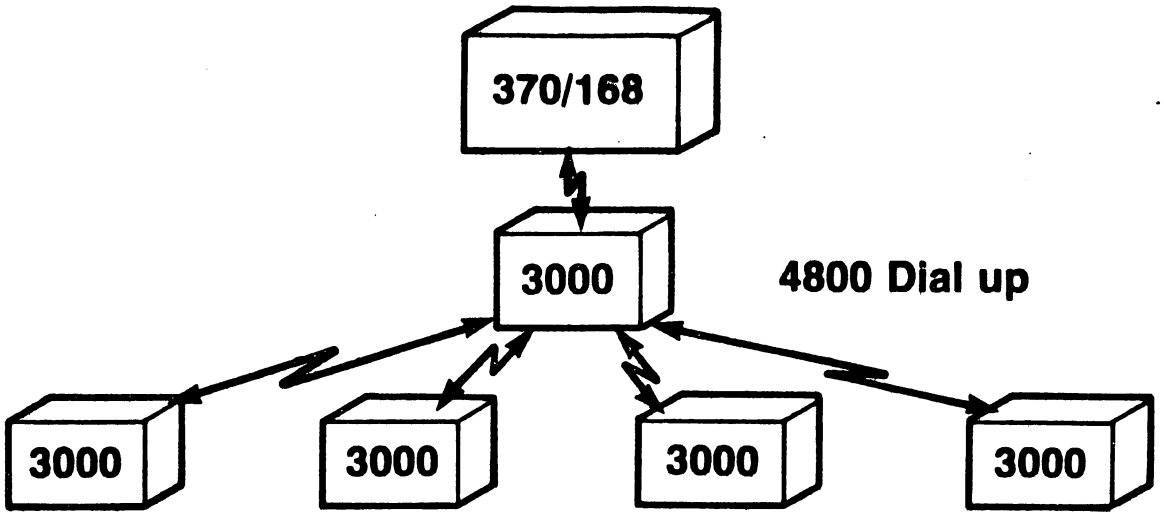
Remote 3000's used for high school instructional purposes, and payroll

DS Requirements (for each system)

Daily	100 records	256 bytes
	50 records	275 bytes
2 weeks	3000 records	24 bytes
	12000 records	220 bytes

When using FCOPY dissatisfied with performance

DS Example (3)



Corporate data transfer

17 3000's dispersed geographically

Transfer profit/loss accounting data to corporate headquarters

Central EDP group

- Do all programming
- Other 3000's don't need compilers
- Use UDC (user defined commands)

Auto dial capability — special uses:

- Accounting data
- Transfer programs & files
- Electronic mail

What DS/3000 Can't Do

Store & forward

- The Data Buffer does not contain address information

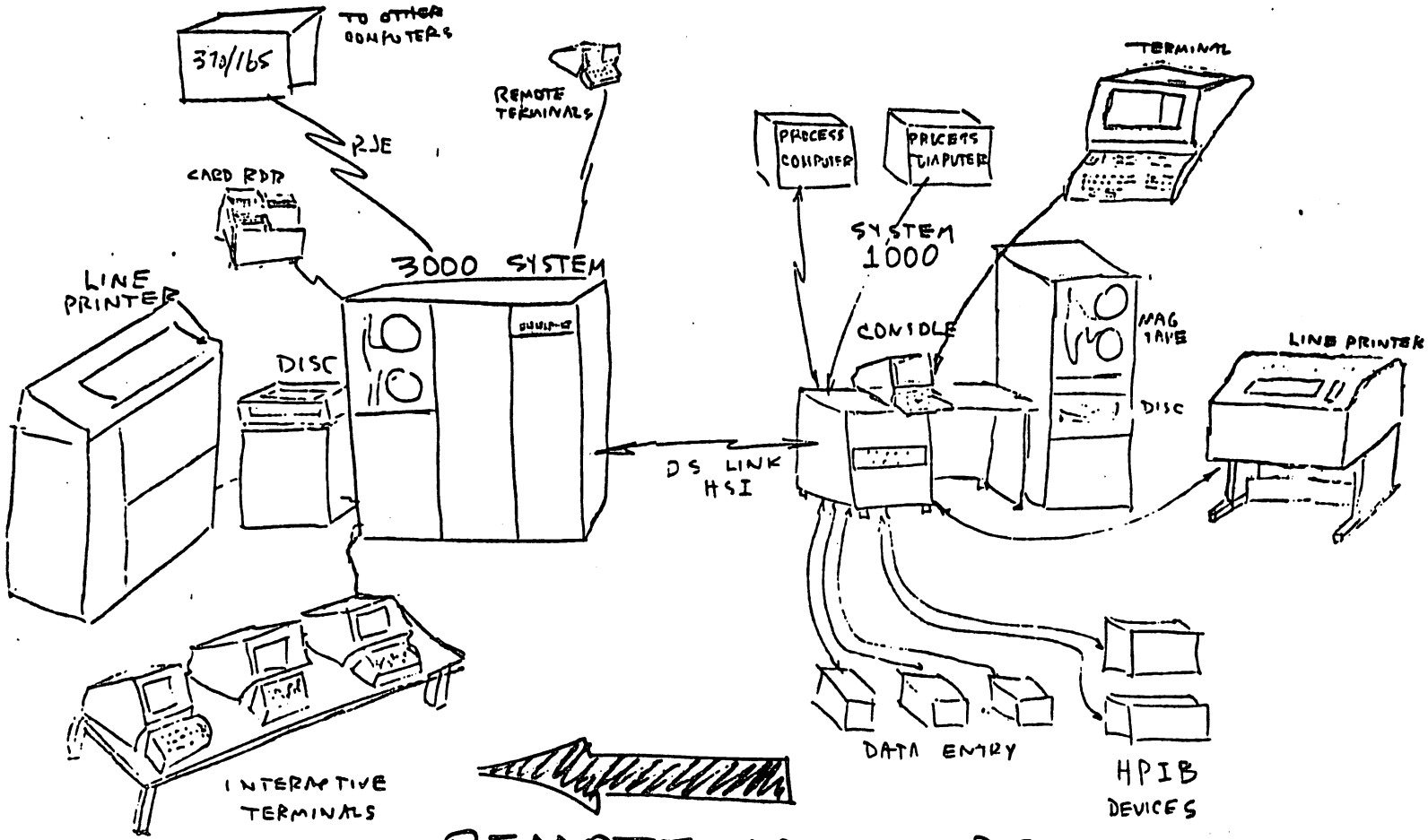
Automatic routing through network

- Routing must be specified with the FILE equation or with PTOP programs at each node

Autodialing

- Coded by applications using an ATC port

Nodal addressing



REMOTE COMMANDS

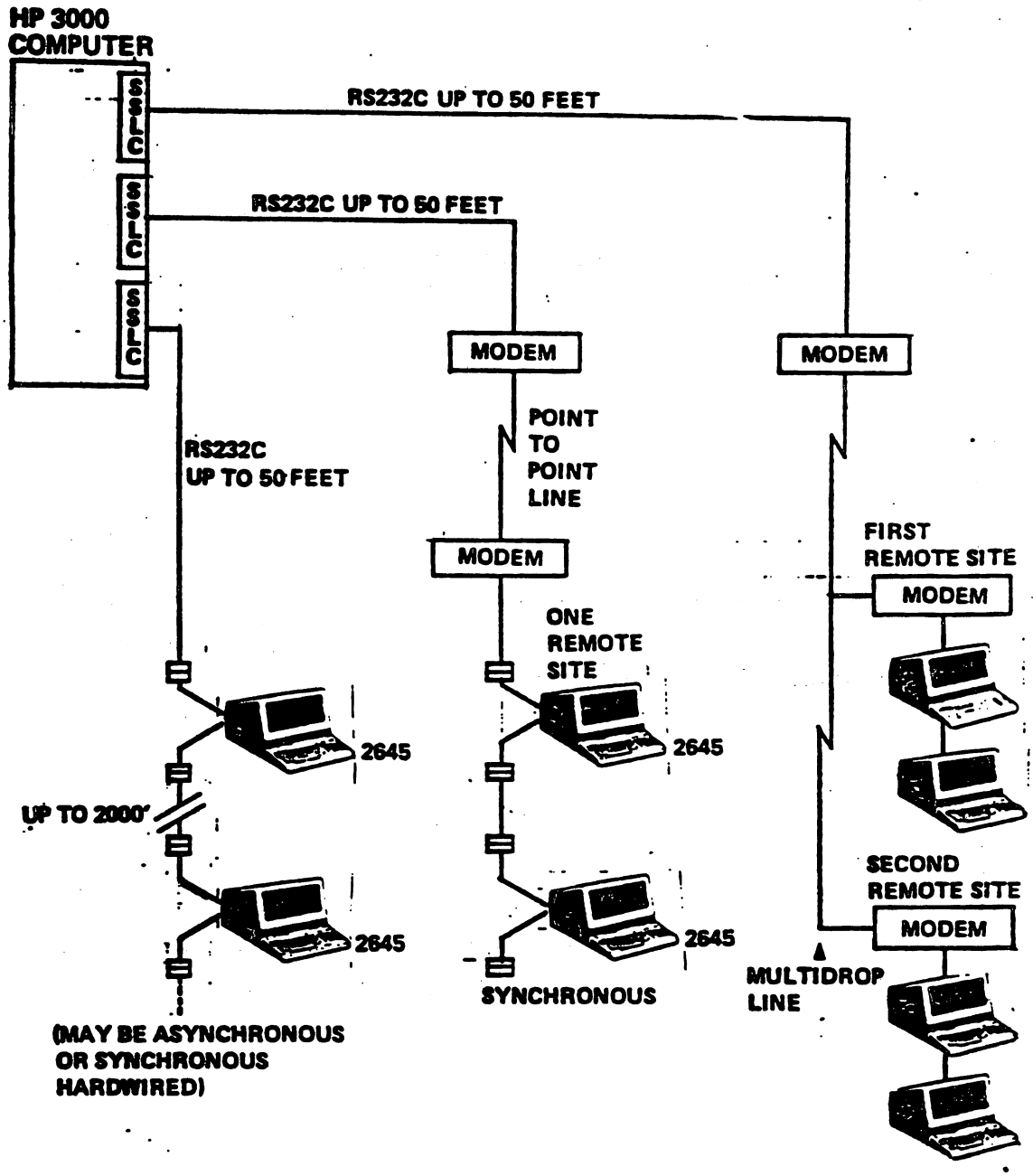
RUN ALL COMPILIERS/SUBSYSTEMS
- SPL, COBOL, FORTRAN, RPG, BASIC, APL
- LISTF, STREAM, RESTORE, SAVE
- BUILD, PURGE, PREP
- ACCT/ SYSTEM MANAGER, SYSTEM SUPERVISOR

PROVIDES USE OF PERIPHERALS

TERMINAL–TO–COMPUTER COMMUNICATION

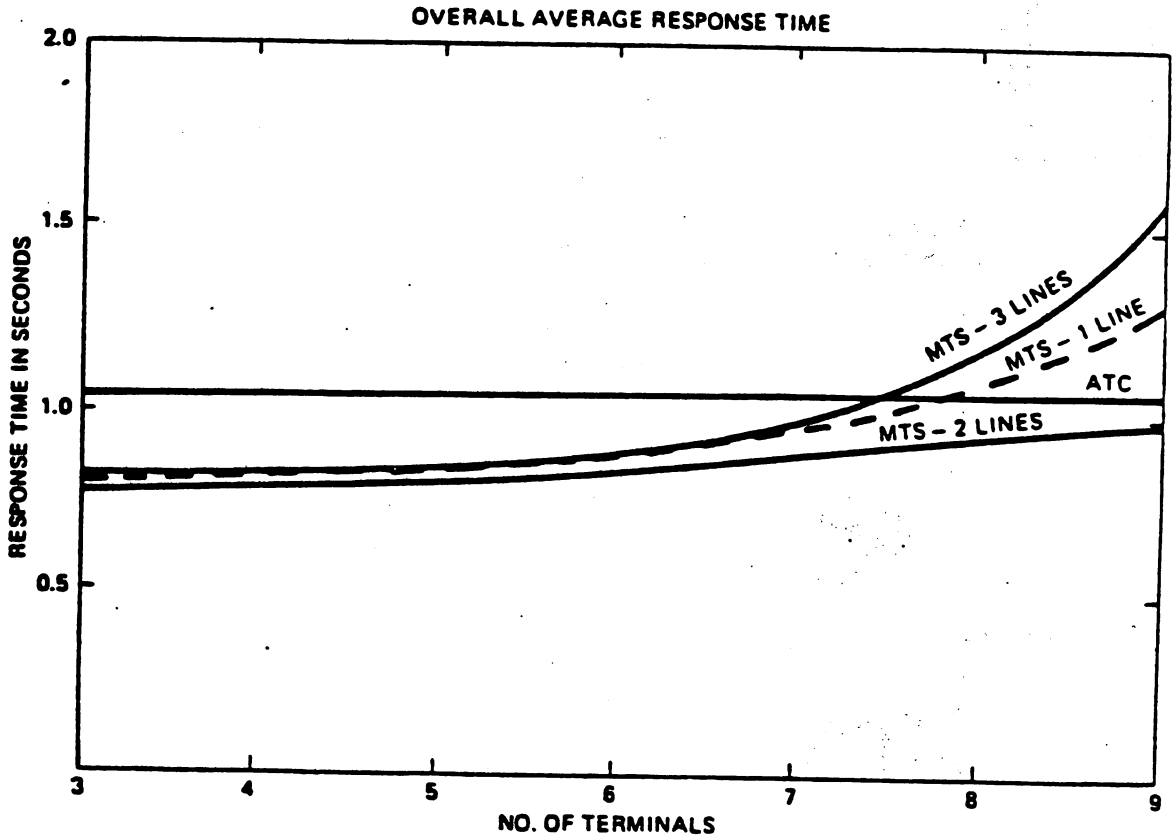
- **ATC – ASYNCHRONOUS CONTROLLER**
- **MTS – MULTIPOINT**

HP 3000
MTS/3000 TERMINAL CONFIGURATIONS



NOTE: HARDWIRED CONFIGURATIONS WITH THE ASYNCHRONOUS REPEATER (HP 30037A) ARE NOT SHOWN.

ATC VERSUS MTS/3000



Control Sequences

- **Polling — An "Invitation to send a message"**

  EOT PAD AA " " ENQ PAD

- **Selection — A "Command to receive a message"**

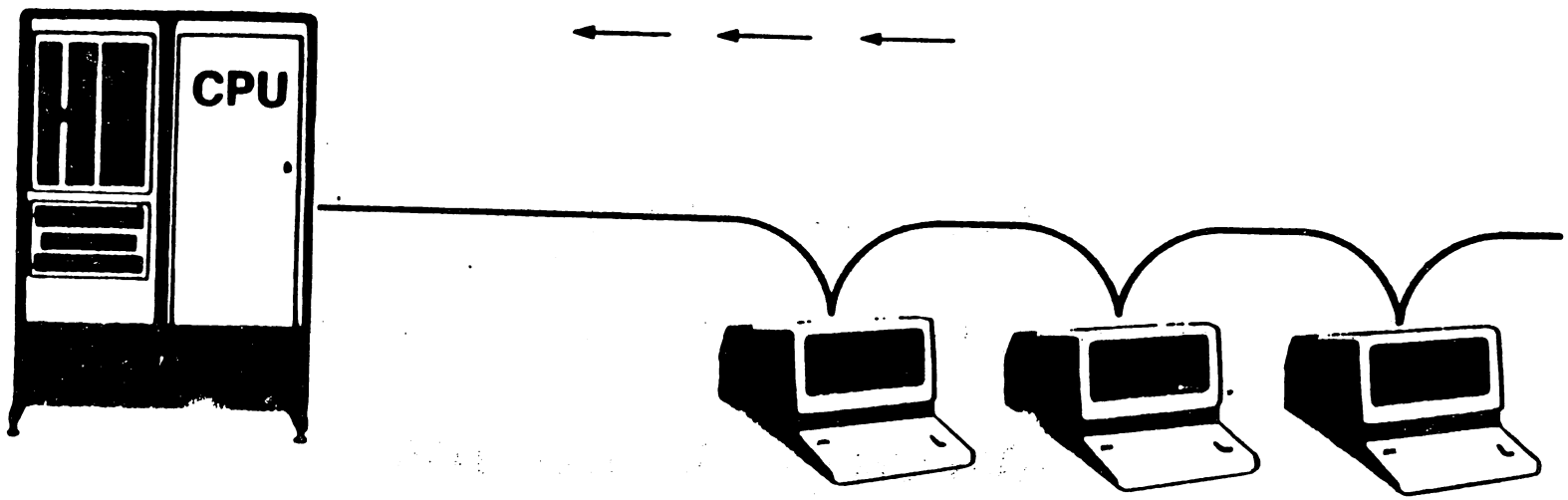
  EOT PAD aa BB ENQ PAD

Poll: Do You Have Anything To Send Me?

→ → → → →

Yes or No

← ← ←



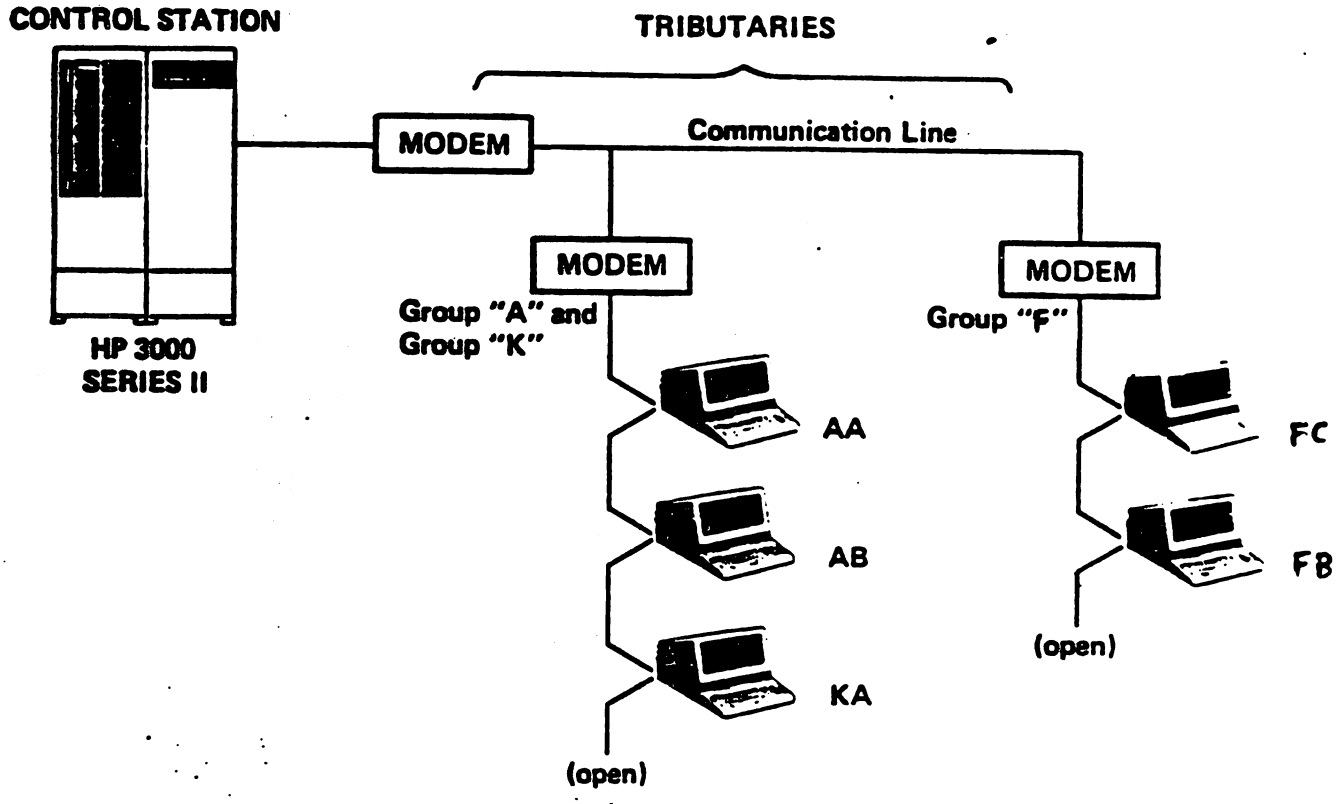
Select: May I Send You Something?

→ → → → →

Yes or No

← ← ←

MTS/3000 TERMINAL ADDRESSING



Synchronous Polling Addressing

<SYN><EOT><PAD><SYN><GROUP ID><GROUP ID><DEV ID><DEV ID><ENQ><PAD>

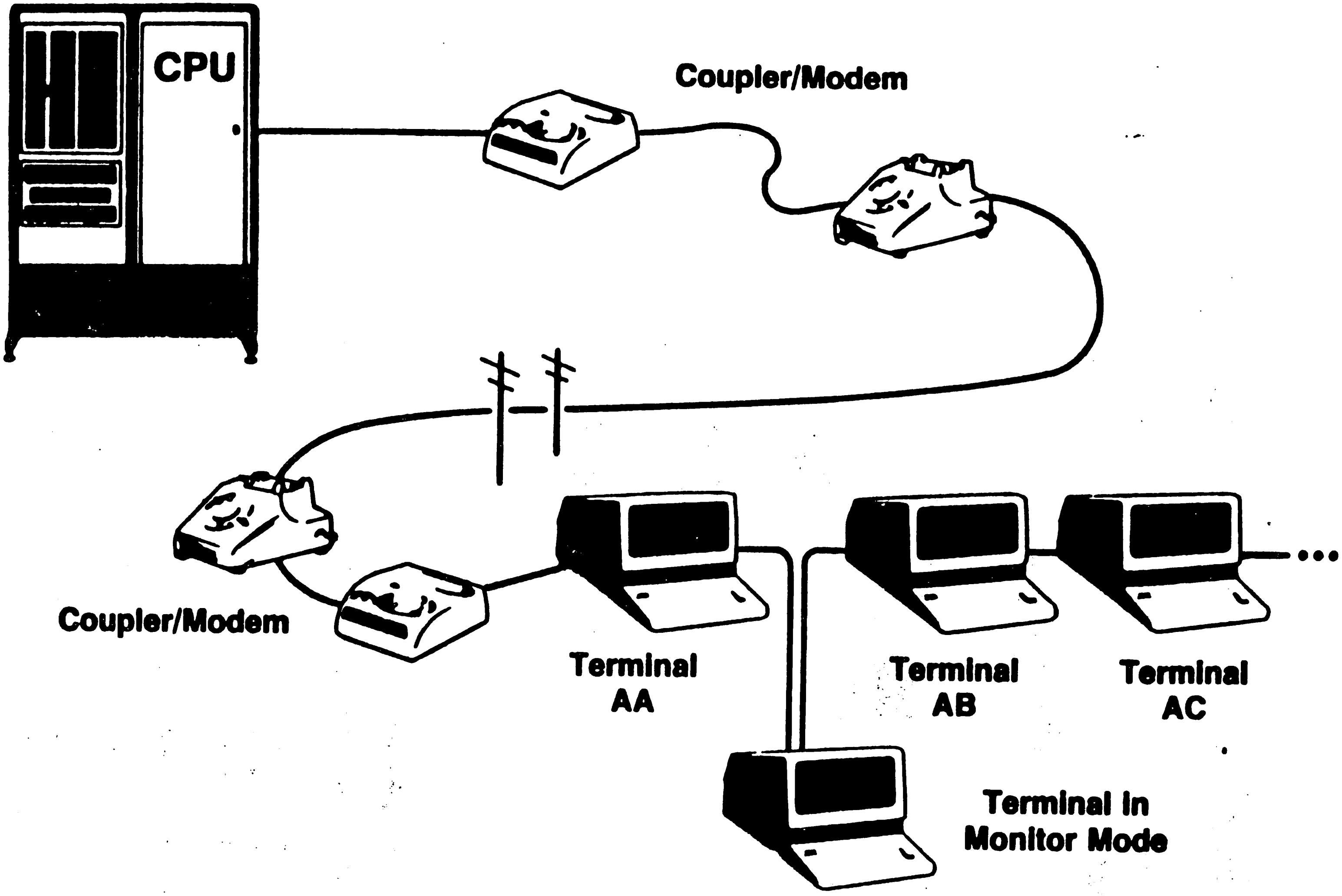
SSS	E	P	SSS	A	A	"	"	E	P
YYY	O	A	YYY					N	A
NNN	T	D	NNN					Q	D

Synchronous Selection Addressing

<SYN><EOT><PAD><SYN>><GROUP ID><GROUP ID><DEV ID><DEV ID><ENQ><PAD>

SSS	E	P	SSS	a	a	B	B	E	P
YYY	O	A	YYY					N	A
NNN	T	D	NNN					Q	D

12


CPU
Coupler/Modem
Coupler/Modem
Terminal AA
Terminal AB
Terminal AC
Terminal in Monitor Mode

P 35-45

B C C

GOOD

ACK 1/0 — Acknowledge

WACK — Wait before transmit

RVI — Reverse interrupt

BAD

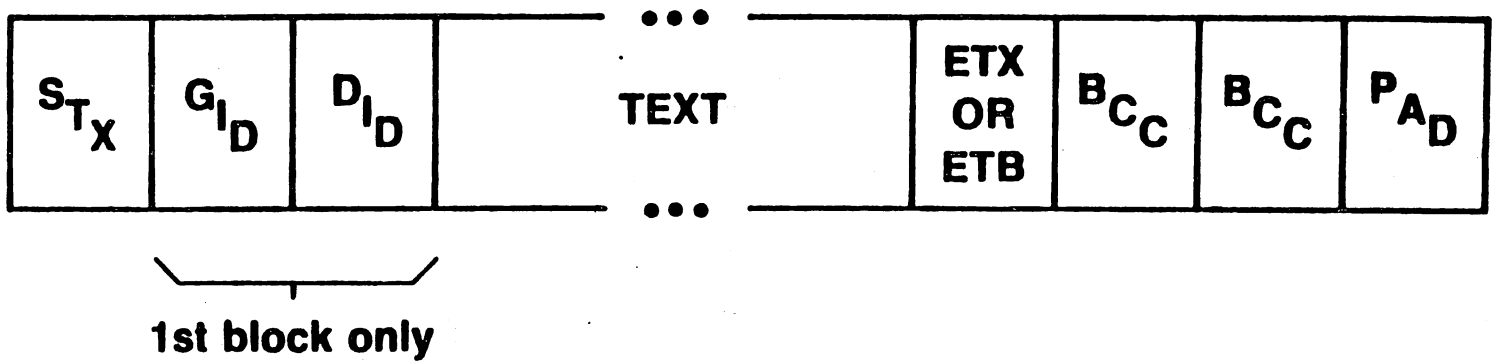
NAK — Negative acknowledge

(EOT — Buffer overflow)

Block Check Characters
B C C

- Vertical Redundancy Check (VRC) — Parity
- Longitudinal Redundancy Check (LRC)
- Cyclic Redundancy Check (CRC 16)

Text Block



Current Telecommunications Service Offering:

The three primary categories of telecommunications services available to domestic users in Europe are summarized in Figure 1:

- Switched network offerings have historically been the private domain of the PTT's in Europe and are likely to remain so for the forseeable future and this also includes the dedicated or leased line services. Both these traditional families of offerings may in a gross sense be regarded as data-transparent "bit-banging" types of services since the common carriers have traditionally been solely concerned with providing a virtually error free replica of the serial bit stream at the sink location.

MOREOVER, both of these types of offerings are generally concerned with providing a transmission environment that minizizes the absolute time delay in propagating bits or characters through the carrier networks.

Another characteristic of today's traditional offerings is that they tend to be protocol-independant to the extent that most services do not get more than superficially involved with the innards of user computers such as line control software, telecommunications access methods, buffering etc.

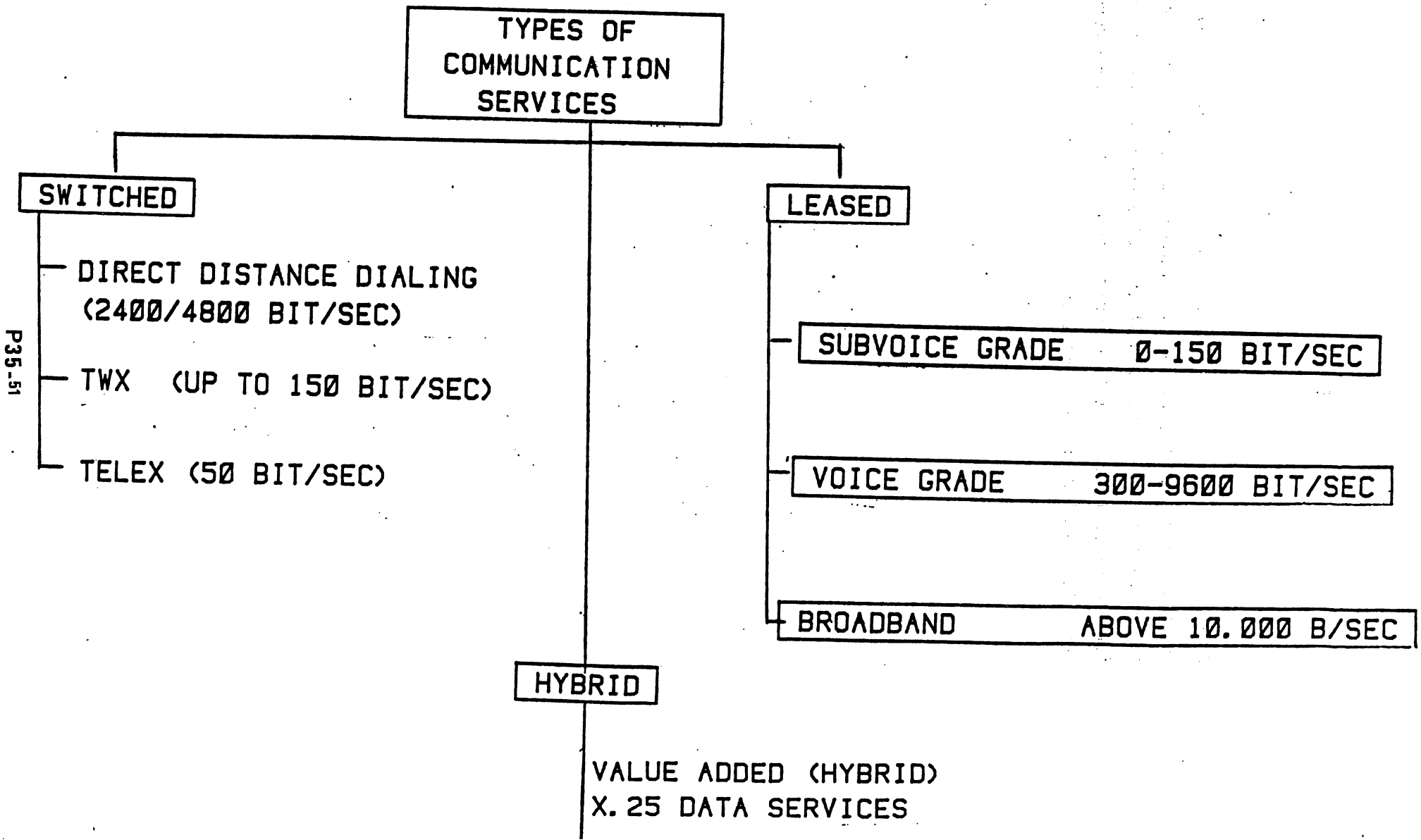
Insight into the potential communications requirements of computer networks is gained by noting that switched services are currently unavailable at bit rates faster then 4800 bits/sec. For leased lines the upper speed limit is about 48 Kbits in most of the European countries.

- HYBRID TELECOMMUNICATIONS SERVICE OFFERINGS

For the purpose of this discussion a hybrid data service offering here is one which has some characteristics (as seen by the user) of both switched and leased line offerings (This is not to be confused with a composite or hybrid data processing/data communications service in which both data processing and communications services are packaged into a single offering).

Also known as a "value added network service", it will provide an important new category of domestic common carrier service in which common carriers (in the form of the value added network vendors) for the first time in history depart from numerous time-honored concepts embodied in the traditionalservice categories.

CURRENT TELECOMMUNICATIONS SERVICE OFFERRINGS



POTENTIAL PROBLEM AREAS

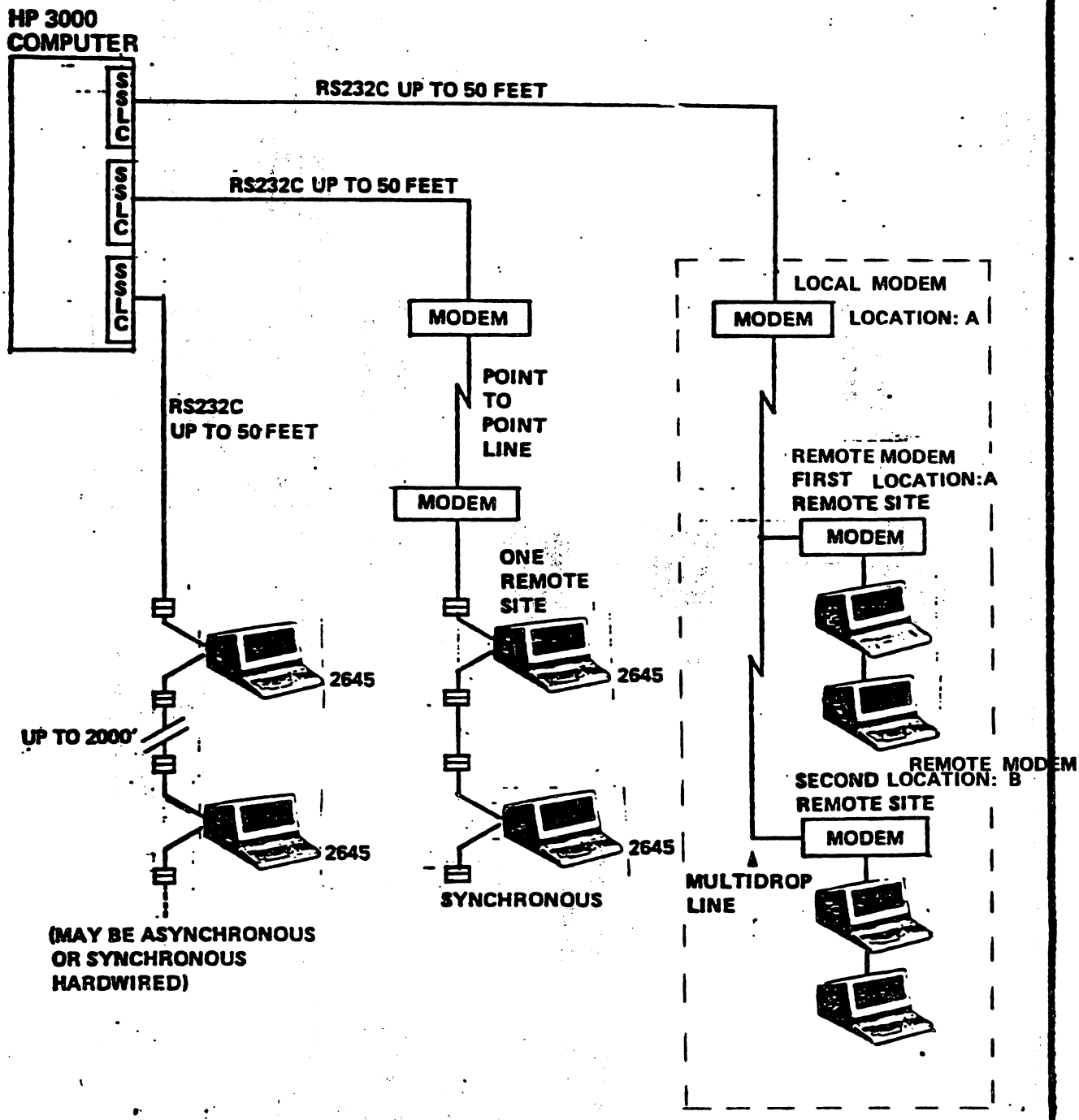
- APPLICATION (PERFORMANCE)
- MODEM
- PTT TELEPHONE NETWORKS
- CARRIERS AND REGULATORY AUTHORITIES

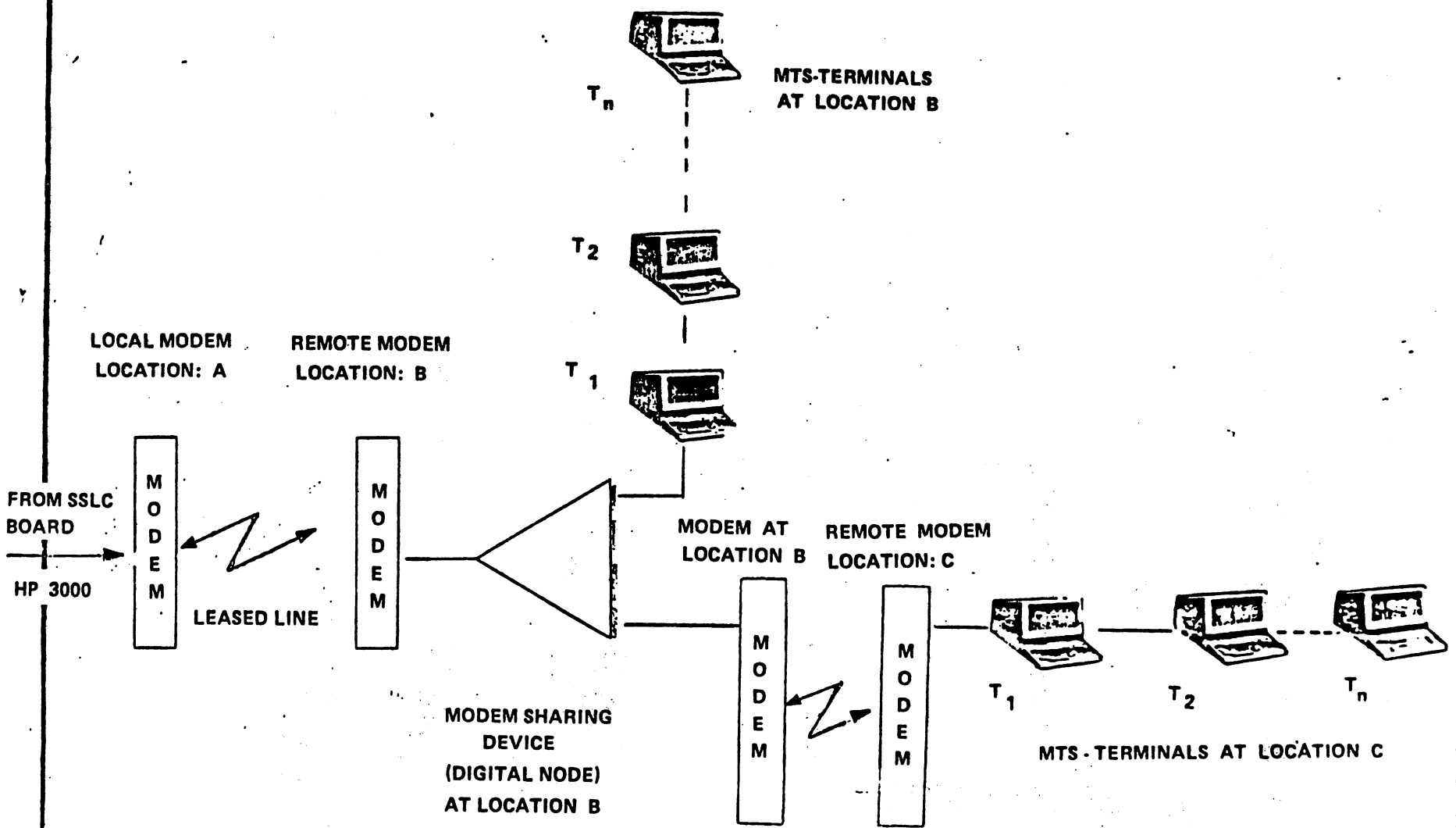
TYPE OF PROBLEMS

- DIFFERENCES IN V.24/RS 232 C INTERFACE
- DIFFERENCES IN MODULATION TECHNIQUES
- DIFFERENCES IN LINE CONNECTION- AND DISCONNECTION PROCEDURES
- DIFFERENCES IN LINE QUALITIES
- DIFFERENCES IN MODEM MODULATION TECHNIQUES
- DIFFERENCES IN MODEM LINE TURN AROUND TIMES
- DIFFERENCES IN ERROR HANDLING AND ERROR RECOVERY
- DIFFERENCES IN DOMESTIC AND/OR INTERNATIONAL TELEPHONE NETWORKS
- DIFFERENCES IN MODEM ORDER PROCEDURES

HJ 8

HP 3000
MTS/3000 TERMINAL CONFIGURATIONS





IMPLEMENTATION OF A MULTI DROP CONNECTION USING A DIGITAL NODE CONFIGURATION

HPSA REGULATORY AGENCY NETWORK (CRAC)

FRANCO MARIOTTI
MANAG. DIRECTOR HPSA

PAUL BAIRD
CORP.ASSURANCE
ENGINEERING MANAGER

DIETER GANN
TECHNICAL REGULATION
MANAGER EUROPE

GERMANY

WALTER MOROFF
DIV. P.S. ADMIN.

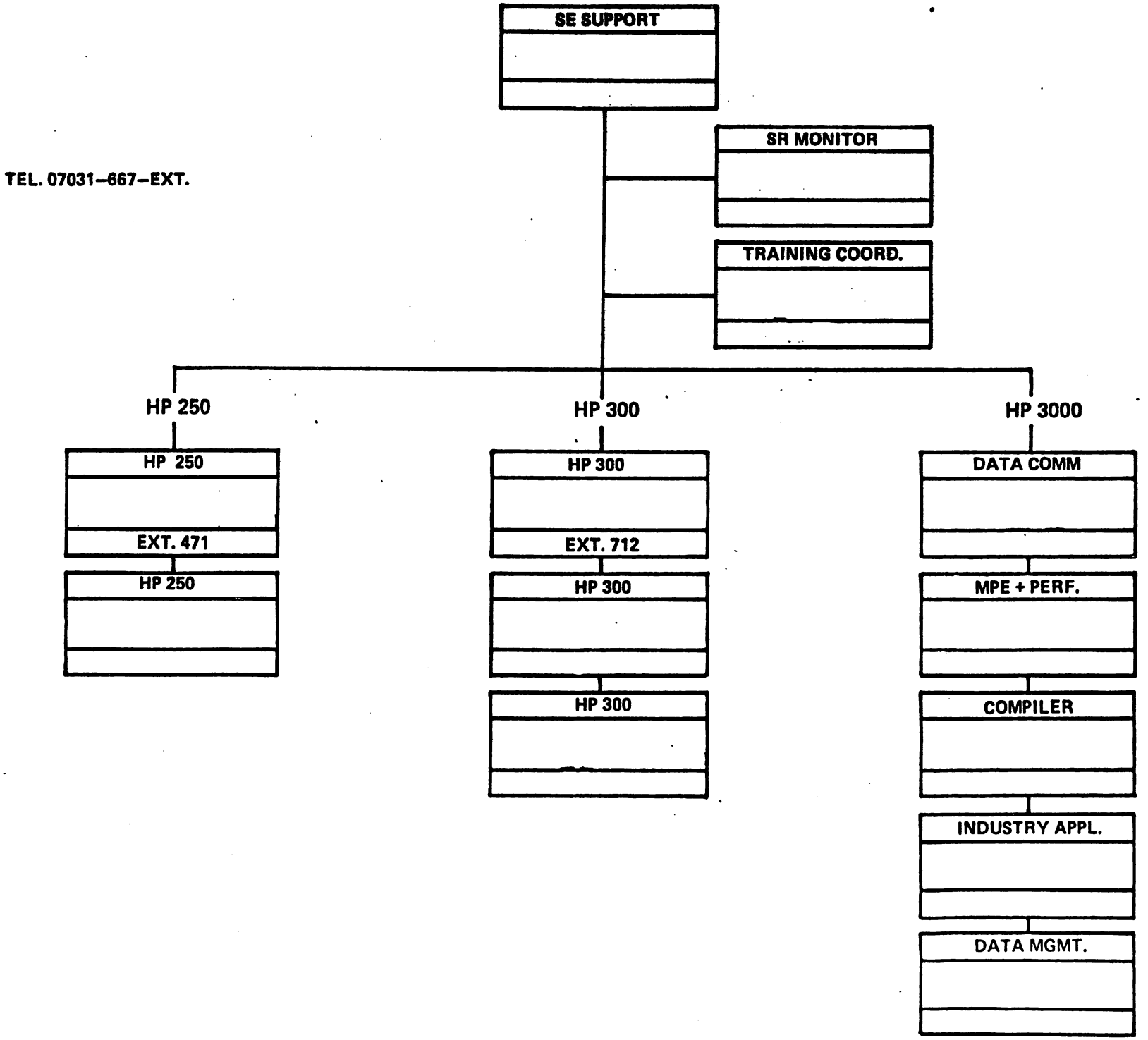
ULRICH SATTLER
X-RAYS
CALIBRATIONS

N.N.
CRAC GERMANY

COUNTRY REG. AGENCY CONTACTS

SPAIN, PEDRO SANTOS
AUSTRIA, HERBERT FELLHOFER
UNITED KINGDOM, ERIC OWENS
UNITED KINGDOM, DAVE BUTLER
FRANCE, ALAIN GODEFROY
ITALY, PIERO DEL BONO
BELGIUM, JEAN LONAY
NETHERLANDS, GERARD VOGEL
SWITZERLAND, WALTER SCHAFROTH
SWEDEN, LARS BLOMQVIST
FINLAND, PERTTI TAHTINEN
NORWAY, ARVID HANSEN
DENMARK, KURT NIELSEN

DG/July 1979


SE SUPPORT
SR MONITOR
TRAINING COORD.
TEL. 07031–667–EXT.
HP 250
HP 300
HP 3000
HP 250
EXT. 471
HP 250
HP 300
EXT. 712
HP 300
HP 300
DATA COMM
MPE + PERF.
COMPILER
INDUSTRY APPL.
DATA MGMT.

EUROPEAN REGULATORY AGENCY NETWORK

EUROPEAN DATACOMM APPROVAL SUMMARY (MAY 79/R. DALPRA)

	V24 CONNECTION	MODEM AND MONOPOLY
AUSTRIA	NO V24 APPROVAL REQUIRED AS AT FEB 77 BUT MAY CHANGE C. 1980.. PROBABLY TAKE OVER 1 YEAR. NO SPECIAL APPROVAL LABEL. NO STATUS INDIC. REQUIRED.	MODEMS TO BE PTT SUPPLIED FROM C.1980
BELGIUM	PER INSTALLATION APPROVAL IN TEMPORARY PHASE. FORMAL AGGREGATION FOLLOWS. 7-12 MONTHS; 150-750 DOLLARS. NO SAFETY APPROVAL REQUIRED. NO SPECIAL APPROVAL LABEL. NO STATUS INDIC REQUIRED.	* MONOPOLY UP TO 4800 BD 4800 BD IN TRIAL STATUS 2400 BD IN OPERATION
DENMARK	NO V24 APPROVAL REQUIRED IF CARD DECLARED V24 COMPATIBLE.	
FINLAND	V24 APPROVAL REQUIRED IF PTT MODEM USED. 1 MONTH; FREE. GERMAN APPROVAL ACCEPTED (DEE)	MONOPOLY ON DIAL-UP. MODEM TESTS INCLUDE VIBRATION TEMPERATURE AND HUMIDITY
FRANCE	NOT REQUIRED. ON SITE CHECK FOR V24 COMPLIANCE BY PTT.	
GERMANY	APPROVAL REQUIRED ON PTT LEASED OR DIAL-UP LINES. 2-6 MONTHS; 200 $ / FTZ; VDE SELF CERTIFICATION REQUIRED. APPROVAL LABEL REQUIRED. DSR (DATA SET READY) INDIC. REQUIRED FOR ATTENDED OPERATION.	MODEM MONOPOLY ON DIAL-UP AND LEASED LINES BETWEEN DIFFERENT COMPANIES

EUROPEAN REGULATORY AGENCY NETWORK

EUROPEAN DATACOMM APPROVAL SUMMARY (MAY 79/R.DALPRA)

	V24 CONNECTION	MODEM AND MONOPOLY
HOLLAND	NOT REQUIRED.	NO MODEM MONOPOLY. TD 285 TECH REQUIREMENTS OUT OF DATE. NOW TD 280.0,280.5, ETC.
ITALY	NOT REQUIRED.	MODEM MONOPOLY ON DIAL-UP
NORWAY	NOT REQUIRED.	MODEM MONOPOLY
SPAIN	NOT REQUIRED.	MODEM MONOPOLY
SWEDEN	* FORMAL APPLICATION WITH PTT FORMS. SAMPLES OF FORMS HAVE BEEN SENT ON JUNE 15,1979	MODEM MONOPOLY
SWITZERLAND	NOT REQUIRED AT PRESENT IF CARD DECLARED V24 COMPATIBLE 2/77	MODEM MONOPOLY ON DIAL-UP
UK	REQUIRED WITH PTT MODEMS. 2-4 MONTHS; 400 $. NO SEPARATE SAFETY APPROVAL REQUIRED. NO SPECIAL LABEL REQUIRED. DSR (DATA SET READY) INDIC REQUIRED FOR ATTENDED OPERATION. ISOLATORS SIMPLIFY SAFETY PART OF PTT APPROVAL.	MODEM MONOPOLY ON DIAL-UP UP TO 2400 BD. THIS SPEED LIKELY TO INCREASE SOON.

MAY '79 / JUNE '79
DG/RP

INTERNATIONAL LINKS

What to expect when operating on foreign networks.
Before a user prepares for an international hookup, he must know the limits on service available and rectify some misconceptions.

For the accomplished telecommunication professional, implementing an international corporate data communications network for the first time can be a frustrating and confusing experience.
Available services, tariffs, public policy and issues affecting users can vary greatly from country to country.
And each country presents its own complexities and unique circumstances.
Six primary services available throughout the world are domestic and international telephone, domestic and international TELEX and deomestic and international private leased circuits.

Thanks to domestic and international telephone services, any nation can join the world telephone network and thus be effeciently and effectively reached by international telephone.

In the more highly developed Western European countries, leased telephone services and circuits may be readily available and rapidly installed or be subject to extensive delays based upon the existing availablility or shortage of physical facilities in each locality.

The local subscriber to telephone services in London, Paris, or Madrid for instance, may find that telephone service can be quickly installed in one part of the city, but take from six months to a year for installation in another section of the same city.

In addition, although basic telephone equipment may be available rapidly, a particular type of private branch exchange or associated telephone equipment may not be.

It is less difficult to connect two international points than to link local circuits within a country.

The company, that orders a circuit between, say, Manchaster, England and Barcelona, Spain will find that the international link between the hub cities, London and Madrid, will be installed relatively quickly. The local link within the country is a different matter, however. As with telephone, local service is often subject to a variety of factors that vary from point to point. In most developed countries, a point-to-point private leased circuit can be obtained in six months or less.

There are notable exceptions and in these case circuit installation can take up to a year or more.
Users also have to contend with a limited choise of modems and equipment because of varying administration and PTT regulations.

The costs for international private leased circuits is two to 1o times the cost, on a mileage basis, for similar quality circuits in NOTH AMERICA.

The cost of a quality telephone circuit between any points in the United States and Western Europe varies from a minimum of approximately $ 9.ooo to a maximum of approx. $ 15.ooo per month depending on the local termination points at each end.

It should also be noted that the terms used in defining the nature and quality of international and domestic circuits outside of NORTH AMERICA are not those with which U.S. users are familiar.

C-2-type conditioning is an unheard of acronym outsinde of NORTH AMERICA.
The more common terms include M 111, M 1o2, or M 58 as the designation of circuit quality to be installed.

Each type has its own CCITT definition.

A number of other specialized services exist in the international market place, but are only available on a limited basis.
In fact, such services are often not offered throughout an entire country.

PUBLIC NETWORKS a long way off:

A considerable number of countries in Western Europe and Asia are in the process of developing new packet-switching public data networks that will be in place and available to the enduser during the next few years.
The availability, tariff and reliability of these networks are yet to be established, and various countries are still concentrating on such fundamentals as common protocols and interface specifications. So the use of these new networks cannot yet be relied upon by the large user in establishing short-term plans for international data communications.

Regulations and policies differ from country to country within the same region and even for countries in similar economic states. Also, users in most every foreign nation have little resource to appeal, alter or change a policy with which they are unhappy. In more developed countries, such as England, France, West Germany and Japan, regulation and policy are formal activities whereby general official guidelines or documents exist that provide the user with a summary of what he can and cannot do. New regulations are developed after careful consideration

by a formal committee or group and discussion with users.
In many countries, regulation and policy evolve on a de facto basis and are subject to revision or change without any formal procedure. Often, policy is changed as the result of an internal meeting or discussion between two or more individuals within a particular administration.

There are 18 CCITT study groups and approximately a dozen other specialized organizations and regional planning groups that are concerned with literally hundrets of standards and regulatory issues.

PTT policies and issues that effect users maintaining international private networks are:

- TIMESHARING AND DATABASE SERVICES
- JOINT USE AND LINE SHARING
- DATA ACROSS BORDERS
- DATA TRANSMISSION ON THE TELEPHONE NETWORK
- AUTODIAL TELEX
- ENCRYPTION
- NETWORK PROTECTION **
- COMMON MISCONCEPTIONS

** NETWORK PROTECTION

Almost every administration on PTT requires that a new type of device be submitted for approval before being installed by a user or on a public facilitiy.
In theory, the reason for requiring approval is to protect a PTT's network and facility from damage that can be caused by non-standard or faculty equipment.

In addition it is mandatory in some countries, that users obtain modems and terminals for some or all services directly from the PTT!

Some PTTs require the user to provide his own equipment or terminals from an established list of type-approval devices, while others optionally provide equipment or allow the user to select his own from an approved list.
In all cases, the user cannot select a device unless it is either provided or approved in advance by the PTT.

A recent complication in type approvals is the tendency of modem manufacturers to integrate modems or line separator devices into a more sophisticated terminal, multiplexer, or other equipment. When this occurs, it is difficult to tell whether the individual subassembly or the entire integrated device must be type approved.

Various PTTs have adapted different requirements concerning this issue.

TOOLS AND TECHNIQUES AVAILABLE FOR PERFORMANCE IMPROVEMENT

HJ 4

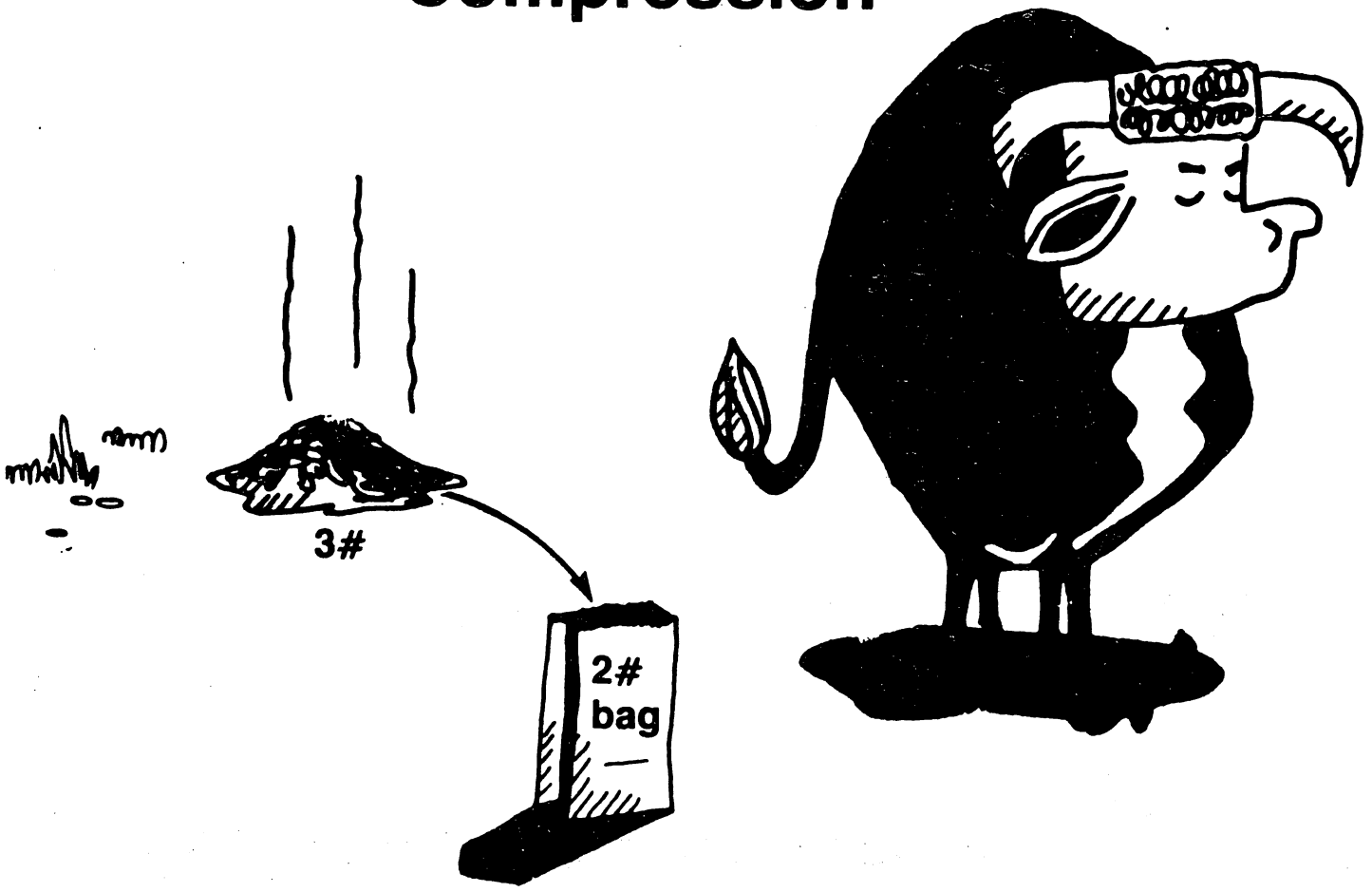
To evaluate a system,the user need a set of performance criteria that encompasses both the carrier facilities and the data communi-cations hardware and treats them as a single system. There are nine criteria I can think off for accessing how well a system handles information interchange from the user's viewpoint.

It also presents typical values to apply as yard sticks in comparing services and equipment.

The nine parameters do not represent all possible performance criteria but are the most essential factors.
The need for such criteria has become all the more urgent with the introduction of such alternatives to the voice-grade telephone system as packet switching, satellite links, and all-digital terrestrial networks. This development has complicated system evaluation because the parameters of these carriers are sometimes made under different conditions or differently defined from those of the conventional voice-grade telephone lines. But the criteria mentioned here can be applied to any system, whatever the natur of the carrier and porvide the user with a much-needed basis for comparison of dissimilar systems.

- TRANSFER RATE
- AVAILABILITY
- RELIABILITY
- ACCURACY
- CHANNEL-ESTABLISHMENT TIME
- NETWORK DELAY
- LINE TURNAROUND DELAY
- TRANSPARENCY
- SYSTEM SECURITY

Compression



How can you put 3#'s into a 2# bag?

Compress it!

Performance Optimization

Data transfer

Time & system load is function of the number of DS requests

1) Improve with:
   a) Use blocked file transfer with file created with large blocking factor
   b) Use PTOP and pack buffer
   c) Prepare special file for transfer with larger record size
2) Use largest line buffer size commensurate with error rate
3) Use compression where appropriate

Performance Optimization (cont.)

Interactive activity

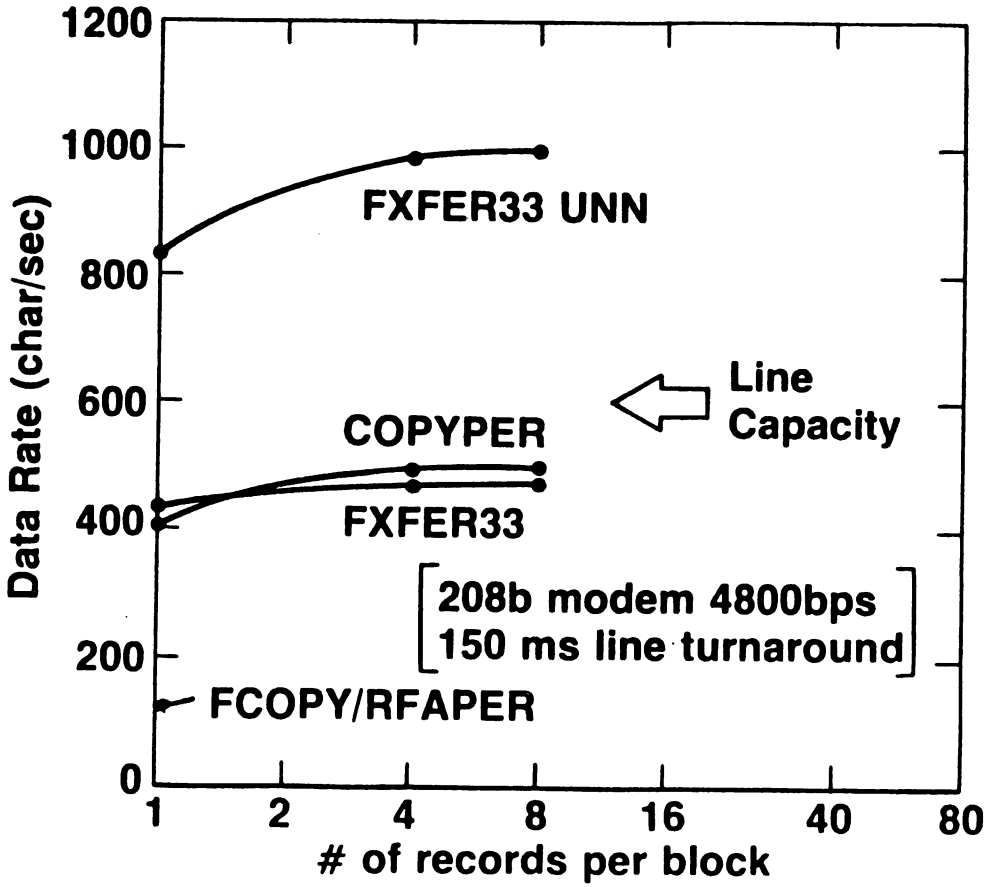
Execute repetitive operations on appropriate system using stream jobs or UDC's.

Data base activity

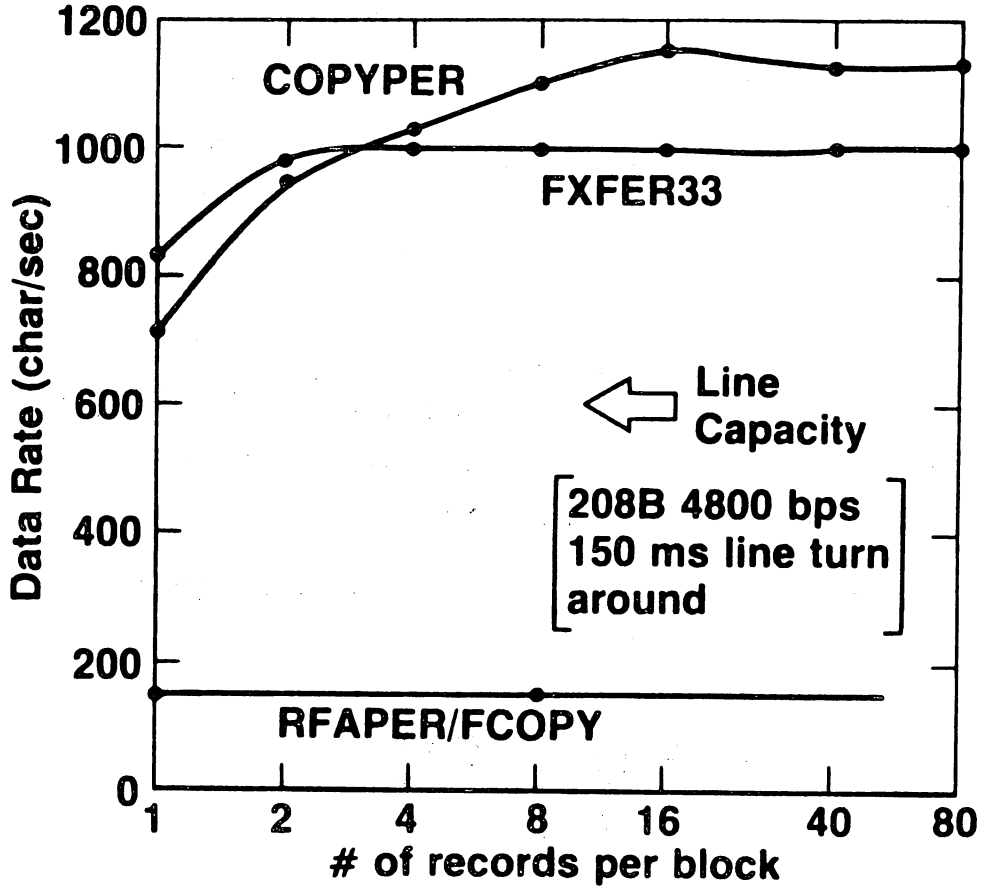
Program so that all data base access is local. Use PtoP programs to transfer summary information (80/20 rule)

Verify operation as designed with CSTRACE.

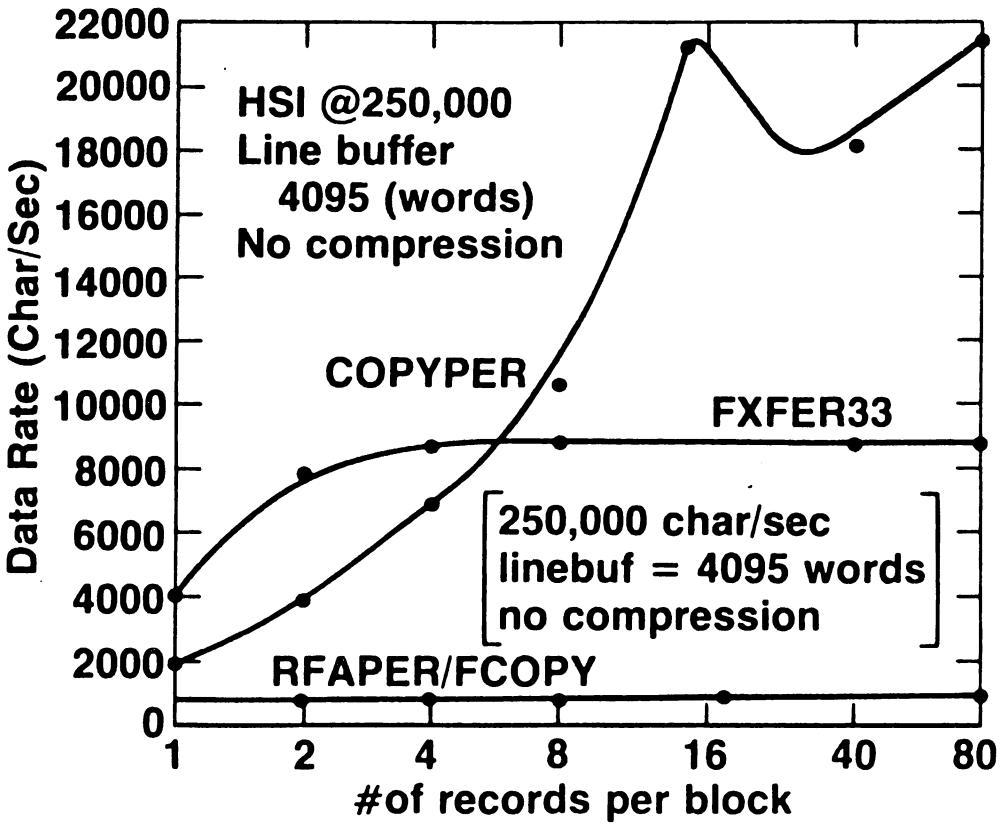
SSLC (nocomp)
Data Rate



SSLC (comp)
Data Rate



HSI
Data Rate



DATA COMMUNICATIONS STANDARDS

Effective communication of data among computer centers and remote terminals is essential to maximum utilization of current data processing resources.
However, there are significant compatibility problems to be solved due to the broad differences inherent in existing ADP and communications systems an equipment.

Steps are being taken to solve these problems by identifying and developing uniform standards and practices to satisfy the needs of specific, and in some cases general, communities of interest.

A number of organizations, including professional societies, trade associations, government agencies at both the Federal and state levels and national and international standards bodies, are invlolved in these activities.

A review of the working relationships among these organizations, their current efforts, and some 50 existing standards per training to data communications should be of interest to everyone concerned with information processing and communications.

To an increasing extent telecommunication networks, data links, and communication terminal facilities are employing computers.
There are presently in excess a broad number of computers installed worldwide and not all of these existing computers are involved in teleprocessing operations.

Such computer applications, involving communication networks and facilities, may be classified according to one of two general categories:

- Those computer applications that are concerned with the use of computers as a part of the communications function, for network control, circuit or message switching, or customer billing operations.

- Those computer applications that employ data communications facilities and networks to provide information interchange to remote locations.

The first application category is the principal concern of the communication system specialist in that computers are employed primarily in support of the communication function.

The second category, frequently referred to as teleprocessing, is primarily the responsibility of the information processing system designer and ADP specialist.

Here, communication facilities are used to support the computer users requirements for the remote processing and interchange of information.

Personnel in either application category generally require varying degrees of interdisciplinary knowledge of both technologies - computer and communications.
This is particulary true in the areas of system design, operating procedures and standards.

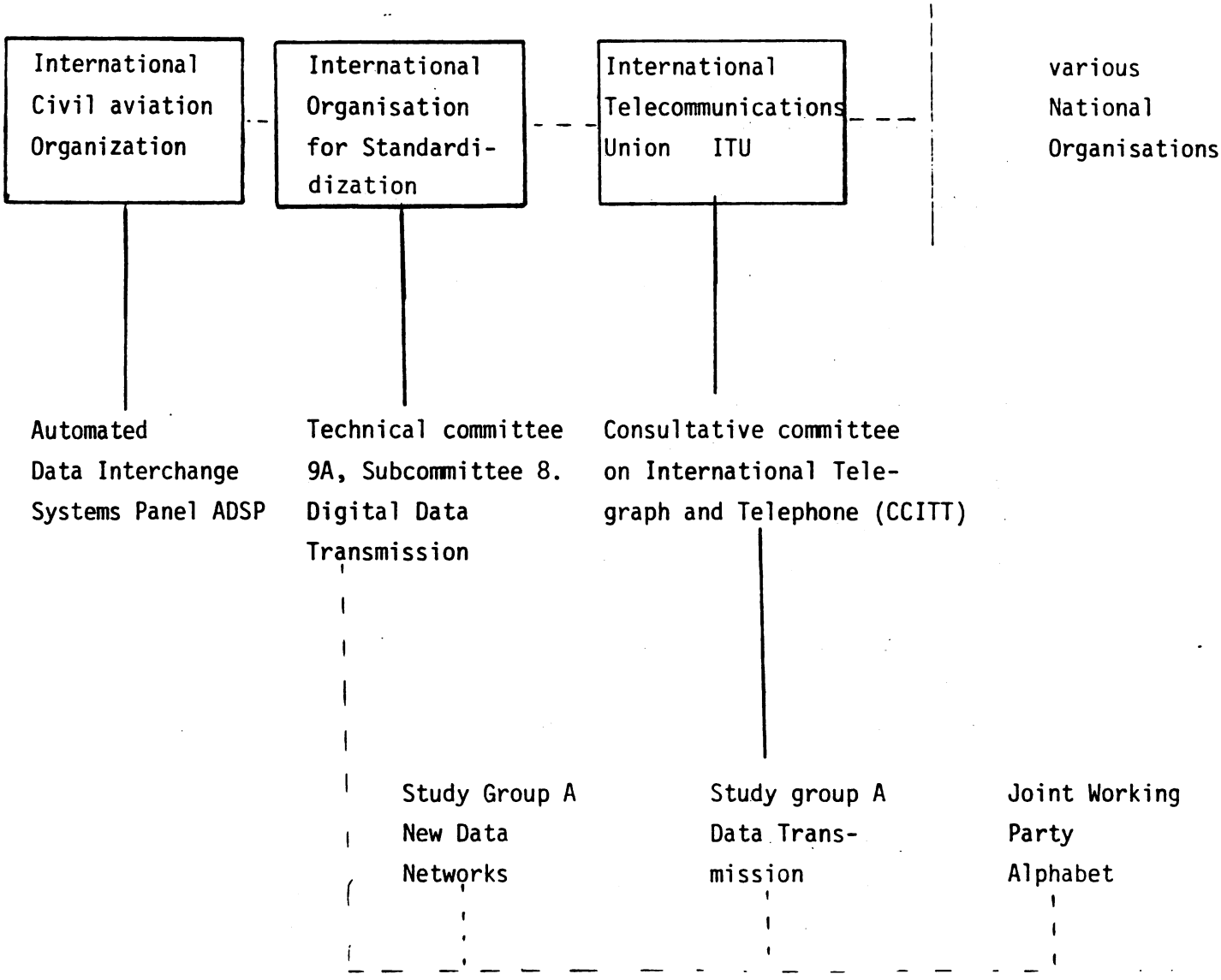
The organisations that deal with standards development for telecommunications technology are both older and separate from those corresponding organizations established for information processing standardization. Furthermore, because of fundamental differences among the industries servicing these technologies as well as among the population of users there are significant differences in both the standards development and implementation processes.

However, the increasing interaction between computer and communication systems has created a growing awareness of the need of consistent procedures and common practices between these two technologies, particularly with respect to data communication standards.

As a result, both technologies have established formal standards coordination and review arrangements among their respective trade associations, industry groups and national and international organization dealing with data communication standards.

Various internal coordination arrangements have also been evolved by indivuduals who cross the technological boundary to participate in both communications and computer standards activities.

Organizations concerned with data communications standardization and some of their more formal coordinating arrangements are outlined in Figure 2:



ISO / TC 97 / SC-6:

Internationally, there are a number of organizations involved either directly or indirectly with the development of data communication standards.
FOREMOST among these is the INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO), Technical Committee (TC) 97, Subcommittee (SC) 6 concerned with digital data transmission.

Membership in this subcommittee, as in all ISO activities, is provided by the national standards organizations of the participating countries.
The scope and program of work of this group include the continual surveillance of the telecommunication environment as it affects the development of data communications standards and the ability to build, install, operate and maintain data processing systems using telecommunications.
This surveillance involves monitoring the technologies employed by the member country's common carrier and postal telephone and telegraph services, so as to take into account the communication environment in developing standards and to react when these services do not meet the requirements of the data processing community.

ITU: The International Telecommunications Union is an intergovernmental organization concerned with establishing international agreements, treaties and standards with respect to telecommunication.
It seeks to coordinate the works of national governments and private bodies by promoting the development of technical facilities and their efficient operation and to improve the efficiency, usefulness, and availability of telecommunication services.
The ITU studies technical, operating and tariff questions relating to the telecommunications, makes recommendations, and collects, publishes and disseminates information for its memebership.

CCITT (ITU): The Consultative Committee on International Telegraph and Telephone is a technical group operating under the ITU established to examine and make recommendations on technical, operational, and tariff matters relating to telegraphy, facsimile, and telephony.CCITT membership is made up to five categories.

- member country telecommunication adminstrations (A-members);
- recognized private agencies as AT & T (B-members);
- scientific or industrial organizations such as equipment manufacturer associations (C-members);
- international organizations such as the INTERNATIONAL OIVIL AVIATION ORGANIZATION and the ISO (D-members)
- specialized agencies operating in related fields such as the WORLD METEOROLOGICAL ORGANIZATION (E-members)

Only A-type members have voting powers at the plenary session where decisions are made.
e.g. The United States is represented on CCITT by the Department of State with domestic common carriers, the FCC and the Office of Telecommunications Policy serving as its principal technical consulting agents.
Data Communication standards are coordinated in CCITT affairs through direct participation of C and D type members that include ISO and the European Computer Manufacturers Associations (ECMA).

The CCITT program of work is divided over some 25 STUDY GROUPS , WORKING PARTIES AND AREA plan committees who discuss and prepare the detailed recommendations for their particular areas of specialty.

Three groups are of prime interest to the data communications community:

- Special Study group A.
  Data Transmission, is the principal point for the data processing community's contact with CCITT. The work progress includes all matter relevant to data transmission including interfaces, modems and maintenance procedures.

- JOINT WORKING PARTY ALP,
  Alphabet is responsible for work on alphabets, codes and related matters pertaining to character transmission structure and key-boards.

- STUDY GROUP VII, NEW DATA NETWORKS
  is responsible for working on new data networks, with the emphasis on digital (in contrast to a alog) networks for data transmission and related uses.

ADISP (ICAO) the International Civil Aviation Organization is one of a number of intergovernmental application oriented organizations whose constituents are involved with international commerce and who are increasinlgy dependent on data interchange in the conduct of their respective business.

ICAO has established the Automated Data Interchange System Panel (ADISP) to develop data communication standards to be employed in international air traffic control.

UNRESOLVED ISSUES IN DATA COMMUNICATION STANDARDS

As of this writing, a number of outstanding issues in the data communication standards arena remain to be resolved. Each of the previously described standards organizations is involved to varying degrees in attempting to resolve these issues.

Perhaps the most controversial of these issues is related to bit-oriented control procedures for terminal-to-terminal and terminal-to computer data interchange.

Some domestic and international groups are anxious to reach agreement on point-to-point, two-way simultaneous modes of operation, leaving the development of standards for multi-point for a later date. Others are just as adamant that only a single standard be developed covering the many different modes of operation that are possible.

The resultant differences of opinion probably will delay any agreements on an initial standard by as much as 2 years.

Another outstanding issue is the technique to be standardized for providing the necessary controls for point-to-point, two-way simultaneous operation.
Substantial agreements had been reached as recently as 1971 on the subject and some standards were written into the Annex to the ICAO contract based on this concept of data link control procedures.

However, due to the desire on the part of some international bodies to develop a multi-point procedure which could be incorporated in a single standard, and the delays that ensured, another concept for point-to-point two-way simultaneous operation has been introduced. This issue has somewhat simplistically been called the single numbering controversy.

At this moment, still much need to be done to resolve the differences that have cropped up on this subject.

A number of interesting developments have occured within the last year in the area of data communications standards. Some task groups have developed a draft standard on "MESSAGE HEADING FORMATS" for Information Interchange Using the ASCII for Data Communications System Control. This is a character-oriented network control system.

The same document or its equivalent, was introduced into the international area at the ISO/TC-97/SC-6 Meeting in Stockholm 1973. However, a number of international organizations, such as ICAO and IATA are working on bit-oriented network control procedures. There is some question as to the advisability of introducing a character-oriented control procedure for networks since it appears that most of the newer networks being planned will utilize the bit-oriented rather than the character-oriented procedure.

A great deal of attention is now being given to the relationship between the value added networks, such as the ARPA Network, the SITA Network, the CIDIN etc. and the public data networks now being planned by the BELL SYSTEM and other international organizations in the United Kingdom, Germany and France.

It is increasingly apparent that the interworking of these very closely related networks will not be possible unless close attention is given to the standards that are developed for these systems.

Internationally, ISO/TC-97/SC-6 has initiated projects in the public data network area and has formed task groups which will work closely with the working groups on control procedures. CCITT, COMMITTEE SPECIAL A, has established a project on packed switching which is one of the "VALUE ADDED NETWORKS" (VAN) activities.

The various groups working on these closely connected projects are analyzing the existing standardization process in light of these networks.

They have been considering the restructuring of their organizations to meet the challenges of this new technology for which very little, if any precedent has been established.

EXISTING DATA COMMUNICATION STANDARDS AND RECOMMENDATIONS

The approved international recommendations of ISO and CCITT plus several others (eg. ANSI, EIA etc.) relating to data communications are provided below:

INTERNATIONAL RECOMMENDATIONS (ISO)

ISO	1155 ... 1969	The use of Longitudinal Parity to detect errors in Information Messages.
ISO	1177 ... 1970	Character Structure for START/STOP and Synchronous Transmission
R	1745 ... 1971	Basic Mode Control Procedures for Data Communication Systems.
ISO	211o ... 1972	Data Communication - Data Terminal and Data Communication Equipment Interchange Circuits Assignment of Connector Pins.
ISO	2111 ... 1972	Data Communication-Basic Mode Control Procedures-Code-Independent Information Transfer.
ISO	2593 ... 1973	Connector-Pin allocations for the High Speed Data Terminal Equipment.
ISO	2628 ... 1973	Basic Mode Control Procedures - Complements
ISO	2629 ... 1973	Basic Mode Control Procedures - Conversational Information Message Transfer

INTERNATIONAL RECOMMENDATIONS (CCITT)

V. 1. Equivalence between binary notation symbols and the significant conditions of a two-condition code.

V. 2. Power levels for data transmission over telephone lines

V. 3. International alphabet number 5 for transmission of data and messages.

V. 4. General structure of signals of the 7-unit code for data and message transmission.

V.10. Electrical characteristics for unbalanced double-current interchange circuits

V.11. Electrical characteristics for balanced double-current interchange circuits

V.13. Answer back unit similators.

V.15. Use of acoustic couplers for data transmission

V.21. 200-Baud Modem standardized for use in the general switched telephone network

V.22. Standardization of modulation rates and data-signalling rates for synchronous data transmission in the general switched telephone network

V.22B. Standardization of modulation rates and data-signalling rates on leased telephone circuits.

V.23. 600/1200 Baud Modem standardized for use in the general switched telphone network

V. 24. Functions and electrical characteristics of circuits at the interface between DATA TERMINAL EQUIPMENT and DATA COMMUNICATION EQUIPMENT.

V. 25 Automatic calling and/or answering on the general switched telephone network.

V. 26 2400 Bits/s modem for use on four-wire leased point-to-point circuit

V. 26B 2400 Bits/s modem for use on the general switched telephone network.

V. 27 Modem for data signalling rates up to 4800 Bits/sec. over leased circuits

V. 28 Electrical characteristics for interface circuits

V. 30 Parallel data transmission systems for universal use on the general switched telephone network

V. 31 Electrical characteristics for contact closure type interface circuits.

V. 35 Transmission of 58 Kilobits/second data using 60 to 108 KHz group bank circuits

V, 40 ERROR indication with electro-mechanical equipment

V. 41 Code-independent error control system

V. 50 Standard limits for transmission quality of data tranmission

V. 51 Organization of the maintenance of international telephone - type circuits used for data transmission.

V. 52 Characteristics of distortion and error rate measuring apparatus for data transmission

V. 53 Limits for the maintenance of telephone type circuits used for data transmission

V. 56 Comprehensive tests for modems that use their own interface circuits

V. 57 Comprehensive test set for high transmission rates

X. 1. User classes of service and data signalling rates for public data networks

X. 2. Recommended user facilities available in public data networks

X. 20. Interface between data terminal equipment and data circuit terminating equipment for start-stop services in use classes 1 and 2 on public data networks.

X. 21. Interface between data terminal equipment and data circuit terminating equipment for synchronous operation on public data networks.

X. 50. Fundamental parameters of a multplexing scheme for the international interface between synchronous data networks.

x. 70. Terminal and transit control signalling system for start-stop services on international circuits between anisochronous data networks.

AMERICAN NATIONAL STANDARDS (ANSI)

X. 3.1. ...	1969	Signalling Speeds for Data Transmission
X. 3.4.	1968	American Standard Code for Information Interchange
X. 3.15 ...	1966	Bit Sequencing of the U.S.A. Standard Code for Information Interchange in Serial-by-Bit Data Transmission.
X. 3.24	1968	Signal Quality at Interface between Data Processing Terminal Equipment and Synchronous Data Communication Equipment for Serial-Data Transmission (EIA RS 334)
X. 3.25	1968	Character Structure and character Parity Sense for Parallel-by-Bit Data Communication in the U.S.A. Standard Code for Information Interchange.
X. 3.28. ...	1971	Procedures for the use of the Communication Control characters f the U.S.A. Standard Code for Information Interchange in Specified Data Communication LINKS.

ELECTRONIC INDUSTRY ASSOCIATION STANDARDS (EIA)

RS 232 C	Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange
RS 334	Signal Quality at Interface between Data Terminal Equipment and Synchronous Data Communication Equipment for Serial Data Transmission.
RS 366	Interface between Data Terminal Equipment and Automatic Calling Equipment for Dat Communication.