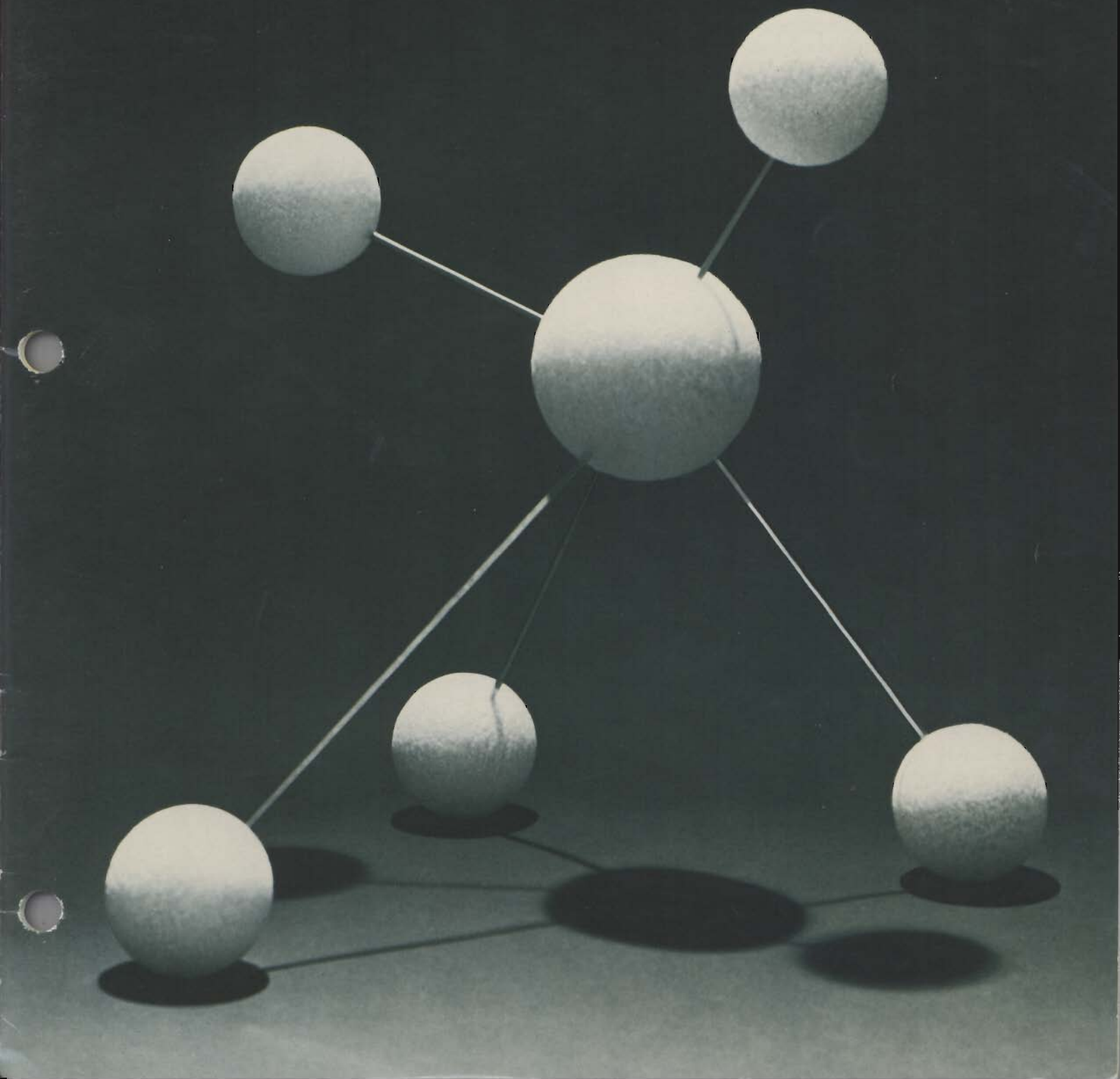
HEWLETT hp PACKARD

Distributed Systems



HP Distributed Systems... A Working Solution

In industry, business, and research labs, the promise of more efficient operations and faster information flow between functions is stimulating interest in the interconnection of minicomputer systems in comprehensive distributed system information networks. Today, virtually alone among minicomputer system manufacturers, Hewlett-Packard can provide complete distributed systems – satellite computer systems for measurement and control, disc-based real-time multiprogramming central systems, *and the hardware-software interfacing that establishes, controls, and monitors distributed system communications.* HP distributed systems capability is comprehensive; it provides . . .

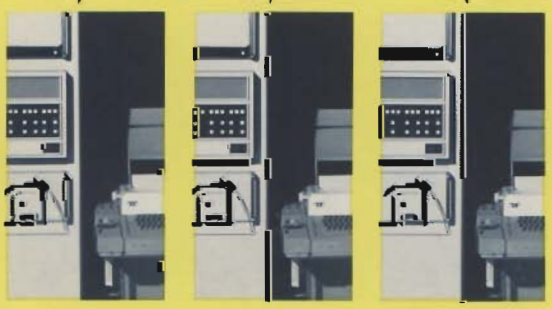
- **Quick response to local events,** because HP satellite systems operate independently.
- **Maximum availability**; failure at central or a satellite leaves other satellites up and working.
- **Fast, disc-based program processing at central** so productive operations of satellites can continue without interruption for program development.
- **Storage of satellite programs on central disc,** with quick, easy retrieval by program name, speeds satellite operations and saves time and money.
- **A solid base for implementation of real-time reporting**; information from satellites is easily stored and accessed in named files on central disc, available for predigestion by central system, and transmission up to the top-level EDP complex for merging with other management-level data.
- **Sharing of the use of high-cost peripherals** (disc, line printer, card reader, plotter, etc.) among all the satellites and central, which minimizes total system cost.
- **A multiprocessor environment** in which satellites can call on central to process data for them, and data can be transferred directly between programs in the satellites and in central, maximizing productivity.
- **Easy access to all distributed system capabilities through high-level program calls and operator commands** speeds and simplifies system programming, implementation, and use.

TOP MANAGEMENT LEVEL. An IBM 360/370 computer in the EDP complex receives processed information from multiple supervisory-level distributed system central computers. User's programs in the EDP computer can merge the real-time distributed systems information to provide comprehensive, up-to-the-minute reports on operations to top managers. At the same time, the tremendous processing power and extensive library of data processing and evaluation programs at the EDP level are accessible to, and can serve, the lower-echelon computers of the distributed system on a remote job entry basis.

Synchronous Communications. The supervisory-level central systems exchange information with the EDP complex at rates to 9600 bps, via synchronous modem and the telephone network.

SUPERVISORY-LEVEL, DISC-BASED HP RTE-II CENTRAL COMPUTER SYSTEMS with communications hardware-software concurrently support communications with satellites computer systems and the top management level EDP complex. At the same time, they can also provide centralized program development, program and data storage, and additional data processing for the satellite computer systems.

Hardwired or Modem Communications. The satellite computer systems can communicate with the central systems via direct wire over distances up to 10,000 feet. Over longer distances, or for greater routing flexibility, they may be equipped to communicate via synchronous or asynchronous modem and the telephone network.



OPERATIONAL-LEVEL HP SATELLITE COMPUTER SYSTEMS using low-cost, cpu memory-based design are typically used for computer-aided manufacturing, lab experiment control, and similar operational-level applications. In addition to their measurement, control, and data reporting capabilities, communications hardware-software gives HP satellite systems the ability to exchange programs and data and to share processing workloads and the use of peripherals with central, considerably enhancing their effectiveness. Today, HP offers a choice of three different satellite computer systems, which are discussed on page 10.

HP Computer Museum
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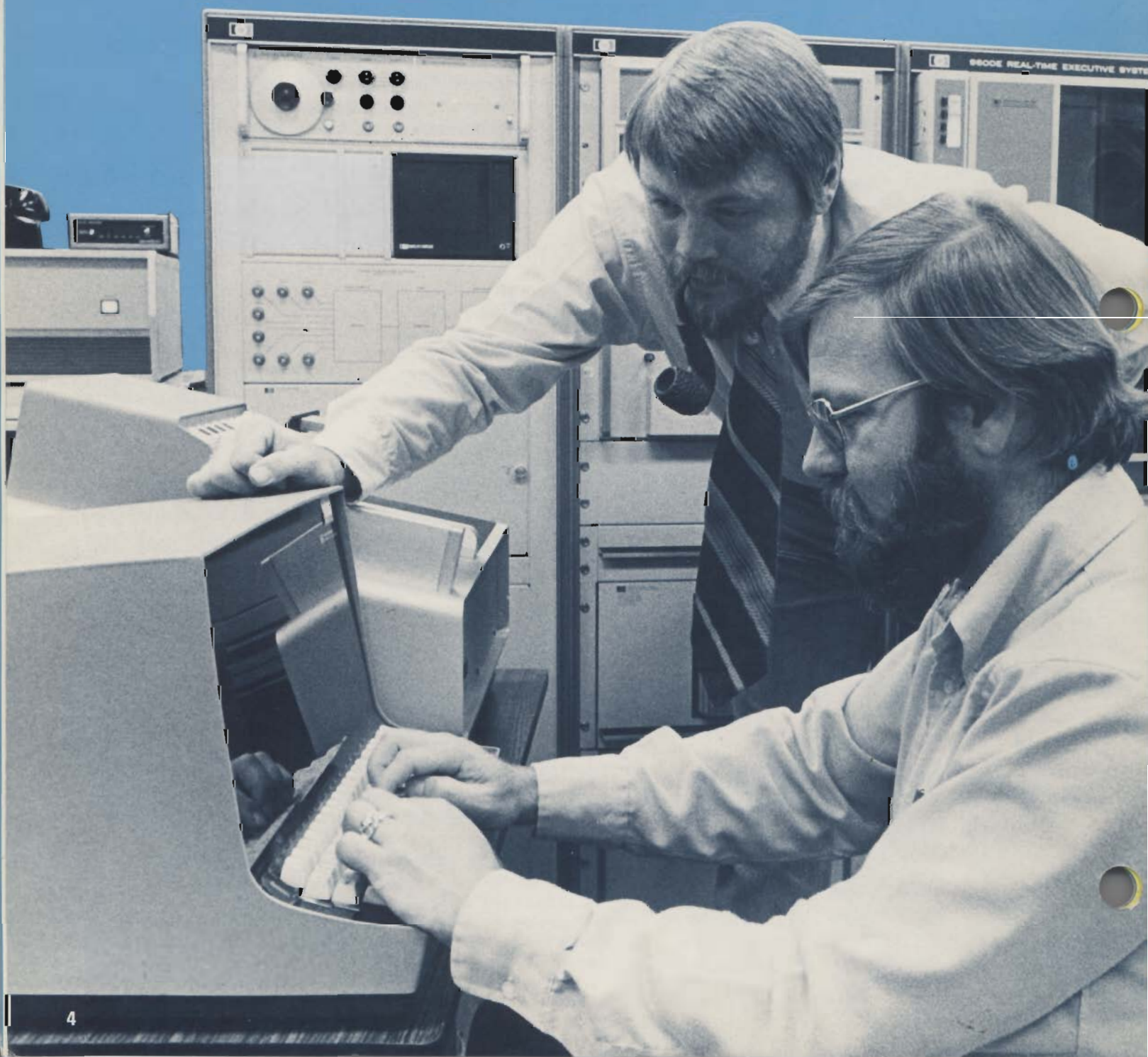
Centralized Operational Support



SATELLITE SYSTEM GENERATION AT CENTRAL

We live in a fast-changing world. The satellite computer system hardware configuration (memory size and set of instrument and peripheral subsystems) that handles today's job effectively may have to be extended or changed next month or next year to meet new operational needs. When this is done, the satellite's operating system has to be re-generated. In the HP distributed system environment, the detailed interactive process of satellite system re-generation can be accomplished entirely on the central RTE-II system while the satellites continue to be serviced. This saves several hours of interrupted operations whenever there is a change of configuration. Satellite system down-time is only required to make *hardware* changes. The operating system can be generated in advance, using a Satellite System Generator and Cross-Loader included with the distributed system software. Then it is down-loaded into the satellite immediately after the related hardware changes have been made, using the central-to-satellite communications link.

PROGRAM DEVELOPMENT

Program Development at Central. FORTRAN IV, FORTRAN II, HP ALGOL, and HP Assembly language programs for two of the satellite operating systems can be compiled or assembled, edited, and converted to absolute, executable form on the central RTE-II system again using the cross-loader. Disc-based program development eliminates punching intermediate copies of programs. The full facilities of the central system can be used to minimize program development time. The RTE-II central includes a Batch-Spool Monitor package to run program development operations on an unattended basis, concurrently with all other distributed system operations. *Productive operations of the satellites do not have to be interrupted for program development.*

Program Development for RTE-B Satellites. Satellites using the BASIC-programmable Real-Time Executive (RTE-B) operating system provide for conversational programming and interpretive execution of programs. Programs developed can be interactively stored and retrieved from the central system disc and updated by the satellite operator-programmer.

Remote Job Entry. It is possible to enter program inputs remotely from satellites using the CPU memory-based Real-Time Executive (RTE-C) operating system. All processing of such remotely-entered jobs can be done on the central system *under remote control from the satellite*, without any assistance from an operator at the central system.

Remote Program Test. Programs for RTE-C satellites can also be transported and pre-tested on the RTE-II central system. They may then be stored in relocatable form on the central disc and down-loaded to the RTE-C satellite for final testing and use. The satellite's operations do not have to be interrupted for program pre-testing. It is not necessary to modify the source statements that comprise the program. Finally, because all of this is done at central, the programmer doesn't have to travel physically from the central system location to the satellite to pre-test programs for the satellite system.

PROGRAM STORAGE ON CENTRAL DISC

Named Files. In addition to batch processing operations, the Batch-Spool Monitor handles another essential function. It organizes disc storage capacity into automatically-extendable, named files which are created on request for storage of program and data records. Operator commands and program calls from either satellites or central provide for the creation, storage, transfer, renaming, saving, and purging of named program files. Cataloging of files, the details of disc track and sector addressing, and access to files by file name are handled automatically.

Program Transfers. The cooperating Central and Satellite Communications Executives provide transfers of programs between the central disc and the satellites, with the aid of the Batch-Spool Monitor. This includes saving Real-Time BASIC programs from RTE-B satellites in named files on the central disc, and the "down-loading" of programs from the disc to the satellite computer for execution. The simple cpu memory-based satellite systems thus gain the operational flexibility of a disc-based system.

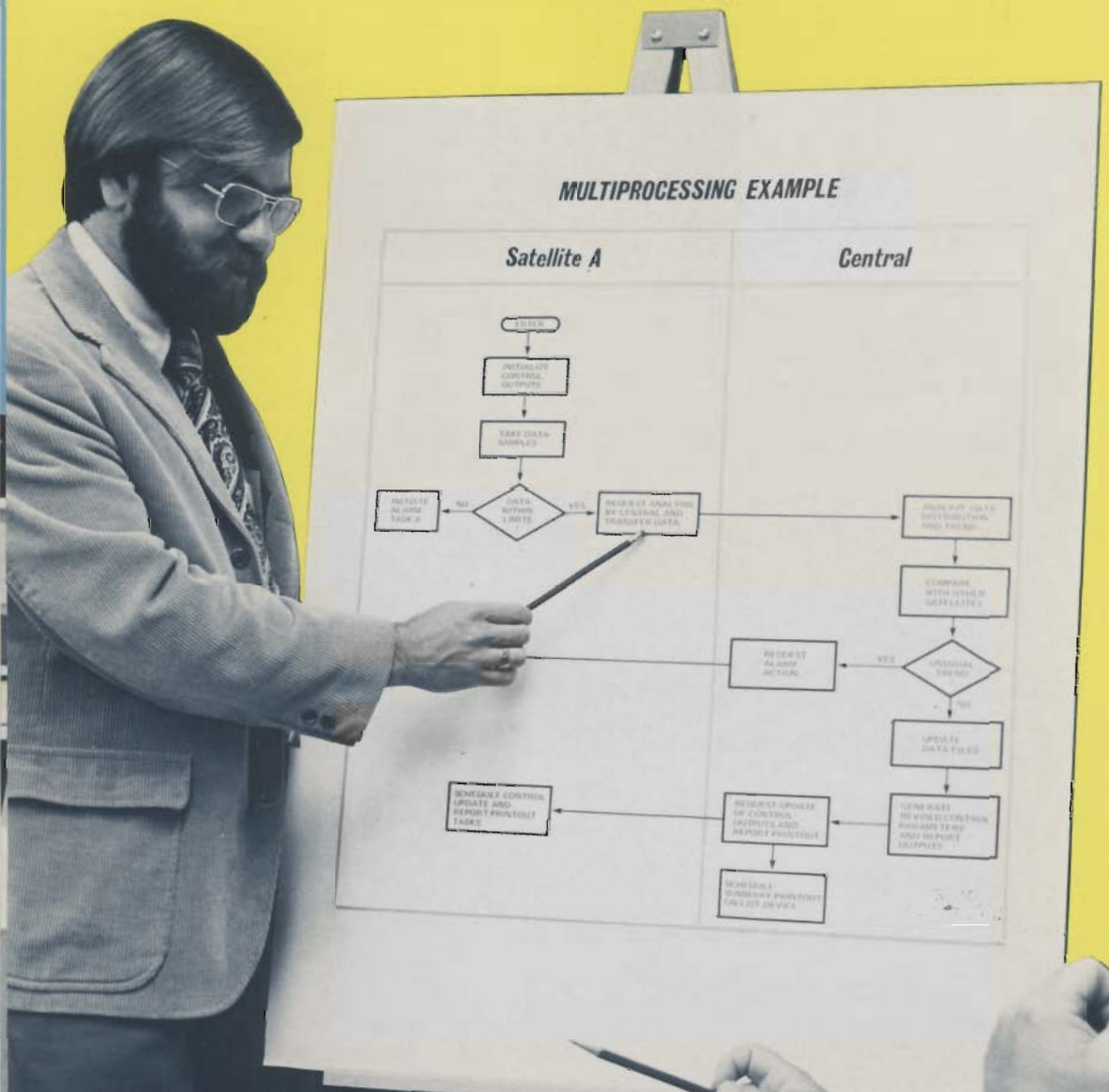
SHARED PERIPHERALS

The distributed system can afford a powerful set of supporting peripherals at the central RTE-II computer. This is cost-effective because the distributed system communication network provides for sharing the high-performance printout capabilities of a line printer, the fast card input of a card reader, the high-density, high-capacity data logging capability of a magnetic tape unit, and the graphic presentation capability of a plotter among all of the systems, not just one or two.

POOLING OF PROGRAMMING TALENT

Distributed system integration also makes possible the pooling of programming talent among the various satellite system applications. Centralized programming support is directed toward the efficient fulfillment of overall objectives. Costly duplication, or re-invention of programs designed to accomplish similar objectives is largely avoided, giving more effective programming support at a lower total cost.

Distributed Processing



REMOTE ACCESS TO DATA FILES

HP distributed systems provide for the systematic accumulation of data by giving the various satellite systems remote access to create, open, write into, read from, close, and purge data files on the central disc. This capability is exercised by easily-programmed, high-level calls from programs in the satellites, through the Satellite and Central Communications Executives.

A variety of options permit remote file accesses and file security to be optimized, file-by-file, to safeguard file integrity and to satisfy the specific information handling requirements of the distributed system. The same file can be opened to as many as seven different programs in the same or different satellites and/or central simultaneously. Simple, easy-to-use security codes can be used to grant file access to designated programs and satellites only, and to control the nature of that access (read only, or read *and* write).

REMOTE TASK SCHEDULING

A very powerful aspect of HP distributed systems is remote task scheduling. High-level calls from programs in the satellites can schedule tasks in the central computer to process data for them. Just as easily, a program at central can initiate execution of tasks at RTE-B or RTE-C satellites, to take additional data, for example, in the event of a suspected alarm condition.

COOPERATIVE REAL-TIME MULTIPROCESSING

Where the satellites are equipped for work-specialized operations, it may be essential to pass their data to the central computer for processing. The centrally-processed data can then be passed back for use by the satellite. Data can be transferred for this type of cooperative real-time multiprocessing via remote access to intermediate files on the disc, but that requires the structuring of intermediate files. HP distributed systems provide direct program-to-program data transfer to eliminate intermediate files and speed processing.

Data from satellite programs in one language can be transferred directly to central programs in other languages. A program executing in the central computer can communicate simultaneously with several satellite programs executing under RTE-B and RTE-C systems. All coordination of execution and transfers of data for cooperative processing are handled by the communications executives and the RTE-II operating system, in response to easily-programmed, high-level calls via a transparent communication process, leaving the programmer free to concentrate on the design of data collection, processing, and control tasks specific to his application.

DYNAMIC MASTER-SLAVE SWITCHING

With respect to RTE-B and RTE-C satellite systems, either the central system or the satellite can take the lead in initiating and controlling remote tasks and/or data transfers. The respective master-slave roles of central and these satellites are dynamically reversible, and central can be operating concurrently as master with respect to one satellite and as slave with respect to another.

REMOTE INPUT/OUTPUT

In HP distributed systems, data is easily input or output at the central RTE-II computer to or from the satellites, using the line printer and other peripherals, all of which may be shared among the various satellites. The Batch-Spool Monitor at central stores peripheral input or output records on the disc for later routing to the proper device or destination if it is initially busy. The spooling of input or output is logically equivalent to the requested operation, which is actually completed later under the direction of the Batch-Spool Monitor. This speeds completion of the requesting program and helps to keep throughput of the overall distributed system at a high level.

REMOTE PROGRAM LOADING

The program files on the central disc provide an easily-accessed resource of operating procedures for the satellites. A local operator at any satellite can load programs by name (which can be a number if desired) when a change of operation necessitates a change of procedure. The complications of handling paper tape or other program storage media are avoided, and the satellite operator's data processing qualifications can be minimal.

LINKING OF PROGRAM SEGMENTS

Most types of program transfers may be requested by either an operator or by a program, either in central or a satellite. Thus, one program in a satellite can link to another without operator intervention.

FORCED PROGRAM LOADING

Programs can also be down-loaded and run on an RTE-C satellite system at the request of the operator or a program at the central computer. This latter aspect of program distribution *makes possible unattended operation of satellite systems under remote control of the central computer* after the satellite has been brought on-line.

A Choice of Three Satellites

Hewlett-Packard offers a wide variety of minicomputer systems. We have systems for sensor-based automatic measurement, control, and reporting in both industrial and general-purpose hardware configurations. We build systems for automatic stimulus-response testing of electronic equipment and subassemblies. Specialized HP systems are also available for automatic network analysis and automatic spectrum analysis in the microwave spectrum. We can integrate into HP distributed system satellites any of the following three operating systems used in sensor-based automatic measurement and control applications in industry or research and development.

The Basic Control System (BCS) is an interrupt-oriented system providing fast execution of dedicated programs. Interrupt processing and output buffering assure efficient use of satellite facilities, but the system has no time-scheduling capability. It is programmable in FORTRAN IV, FORTRAN II, HP ALGOL, or HP Assembly language. It uses Satellite Communication Executive 1, 2, or 3 to communicate with central in the distributed system.

The Real-Time Basic (RTE-B) System is a cpu memory-based system combining the speed, ease, and power of conversational HP Real-Time BASIC language programming with operation of up to 16 different time- and event-scheduled tasks. It uses Satellite Communication Executive 1 or 4 to communicate with central in the distributed system.

The Real-Time CPU Memory-Based (RTE-C) System is a time- and event-scheduled multiprogramming system with the advantage of maximum program transportability with respect to central. It is programmable in FORTRAN IV, FORTRAN II, HP ALGOL, and HP Assembly language. It uses Satellite Communication Executive 1 or 5 to communicate with central in the distributed system.

DISTRIBUTED SYSTEM CAPABILITIES	RTE-C	RTE-B	BCS
Satellite System Generation at Central	X	X	X
Program Development at Central	X		X
Remote Job Entry (for program development at Central)	X		
Remote Program Test (Satellite program test-executed at Central)	X		
Program Storage on Central Disc	X	X	X
Shared Peripherals	X	X	X
Remote Access to Data Files	X	X	X
Remote Task Scheduling (Satellite-to-Central)	X	X	X
Remote Task Scheduling (Central-to-Satellite)	X	X	
Cooperative Real-Time Multiprocessing	X	X	
Dynamic Master-Slave Switching	X	X	
Remote Program Loading	X	X	X
Linking of Program Segments	X	X	X
Forced Program Loading	X		

SATELLITE SYSTEM SPECIFICATIONS		BCS SATELLITE			RTE-B SATELLITE		RTE-C SATELLITE	
Uses Satellite Communication Executive		SCE1	SCE2	SCE3	SCE1	SCE4	SCE1	SCE5
Memory Required ($words_{10}$) for Operating System (including BASIC interpreter in RTE-B system), SCE, and Data Communication and system console drivers		2 150	2 860	4 590	11 620	14 890	6 710	10 000
Additional Memory ($words_{10}$) for REMAC (RTE-C operator communications interface)								1 660
Minimum Recommended System Memory Size ($words_{10}$)		4k	4k	8k	16k	16k	8k	16k
I/O Channels used for data communication interface			1			1		1
Programming Languages	FORTRAN IV/II, ALGOL, HP Assembly		x					x
	Real-Time BASIC					x		
Operator/Program Control	With SCE1	Operator can request program downloading and execution by entering octal program number in bit positions 0 through 5 of the computer switch register and hitting computer RUN button.						
	With SCE2/3/4/5	See operator requests and program calls on pages 14 and 15.						

Communication with Other Systems

IBM SYSTEM/360 or SYSTEM/370. The RTE-II central-coordinated distributed system communicates with an IBM SYSTEM/360 or SYSTEM/370 via a Remote Data Transmission Subsystem (RDTS), which consists of an IBM 2780 Emulator and a Synchronous Data Set Interface. Externally, RDTS connects to the IBM computer via an appropriate modem and the telephone network or equivalent communication facilities. Concurrently with other distributed capabilities, the Remote Data Transmission Subsystem . . .

- Operates with IBM BTAM, TCAM, and HASP software.
- Emulates the IBM 2780 Data Transmission Terminal, eliminating the need for special data handling software in the large computer.
- Transmits and receives batched data in card and printer images for efficient transmission using the card reader, line printer, tape reader/punch, magnetic tape unit, system console, or disc files.
- Provides ASCII, EBCDIC, or EBCDIC-transparent codes.
- Communicates at line rates to 9600 bits per second on both half- and full-duplex communication lines.

Another RTE-II System. The distributed systems data communication software can be used for program-to-program communication between RTE-II systems. The RDTS can also be used for communication between two RTE-II systems, for exchanging programs and data.

HP 3000 System. The RTE-II central system can communicate with an HP 3000 system via the HP 30300A programmable Controller Subsystem, which consists of a hardware-software interconnection kit and an HP 2100 series Computer with BCS operating system. Connection to that computer through the Data communication Interface, Satellite Communication Executive 1 or 3, and application programs completes a link for program, data, and task assignment communication between the RTE-II central and the HP 3000.

Additional information on the HP 30300A Programmable Controller Subsystem is provided in a separate data sheet, HP Literature Request Number 5952-4512.

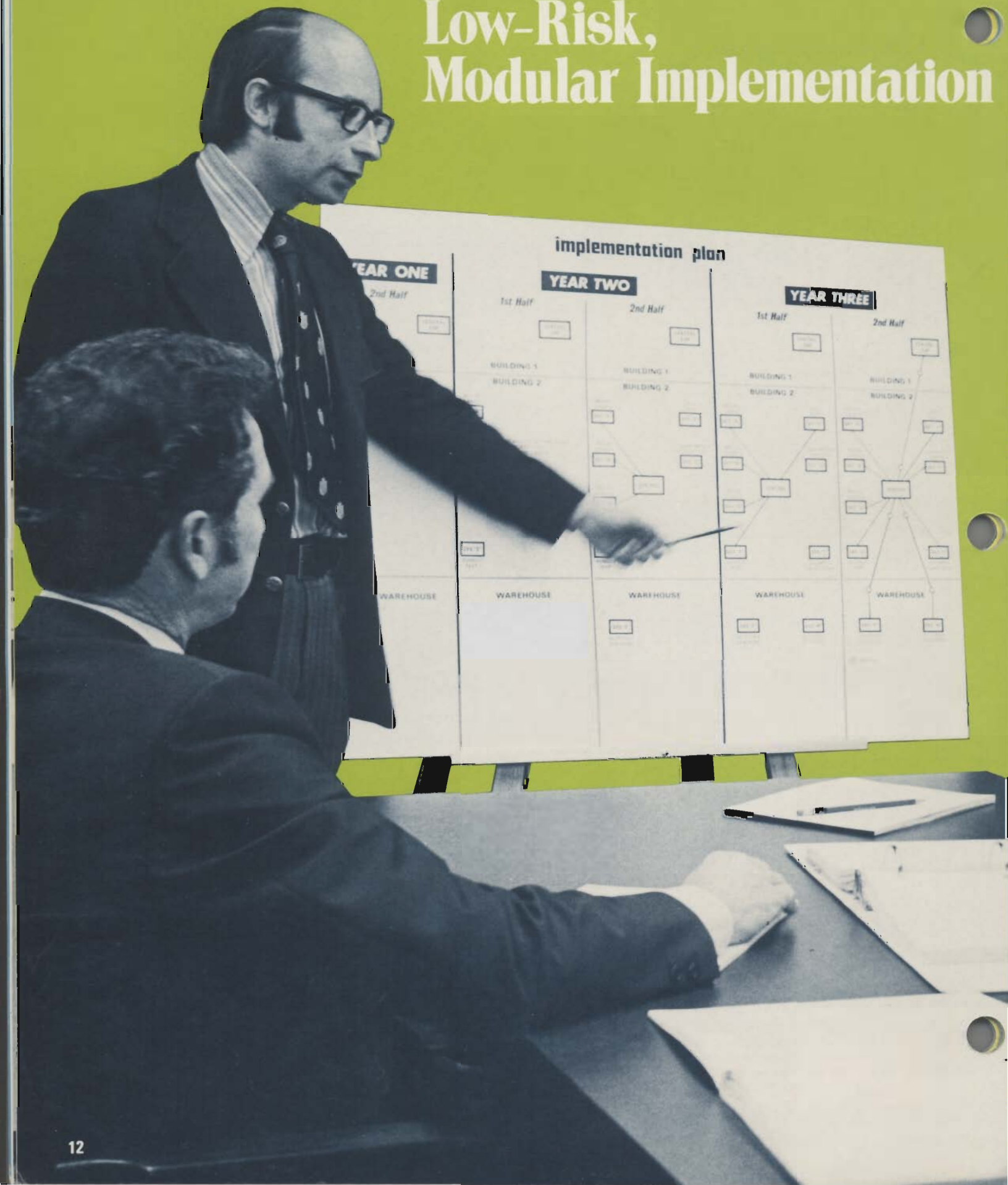
HP Coupler/Controller Systems. RTE-II central systems and BCS and RTE-C satellite systems can also command, and receive data from, systems based on HP coupler/controllers. The coupler/controller-based systems provide a low-cost remote terminal capability for simple applications.

Additional information on HP Coupler/Controller systems is provided in a separate data sheet, HP Literature Request Number 5952-1576.

CENTRAL-TO-IBM 360/370 REMOTE DATA TRANSMISSION SUBSYSTEM (RDTS) CONTROL

REQUESTS	PURPOSE AND DESCRIPTION
From Operator	
ON,#RDTS	Schedules RDTS to transmit or receive data, designating the local source and/or destination(s) by logical unit number of the peripheral device(s) involved, or by file name(s) in a previously prepared configuration file.
ON,#INRP	Interrupts data stream being received from remote IBM SYSTEM/360 or SYSTEM/370 computer, permitting insertions of comments or other data using the system console.
ctrl-D	Terminates #INRP, permitting continuation of the original processing.
OF,#RDTS	Terminates line activity to get line out of data mode in absence of #D or #T input stream command.
From Program	
EXEC 9,#RDTS	Sets up data transfer to/from remote IBM SYSTEM/360 or SYSTEM/370 computer, with choice of local dialing or answering, with or without translation. Provides for specifying the input device or file and the print and punch output or file, using logical unit numbers or a configuration file containing the names of source and destination files.
From Input Stream	
#E	Automatic line turnaround with 30-second listen time.
#R	Automatic line turnaround as with #E, but with 90-second listen time.
#D	Transmission of disconnect sequence.
#I	Temporary substitution of system console as source of input data stream.
#C, xx	Change source and/or destination(s) of list, print, and punch streams.
#T,xx	Switching of RDTS to transparency mode for input from device with logical unit number xx or file with name xx until end-of-file for that data stream.

Low-Risk, Modular Implementation



Most anyone who has considered implementing a computerized solution to a measurement and control problem has faced a seemingly-infinite web of conflicting constraints. It is necessary to plan years in advance to attain a long-term strategy, *yet* funds are normally allocated to solve only the most immediate, most pressing problem. Moreover, this first problem is bound to grow and change even while it is being solved, *yet* the first solution must be compatible with the solution for the next problem, which isn't even defined, and so on . . . More than ten years of experience in helping our customers deal with the considerations outlined above have enabled us to design an approach to implementation that gives you maximum flexibility in your planning and execution of computer systems solutions of all sizes.

This approach builds from the systems themselves. The stand-alone HP automatic measurement and control system you put to work today can be easily upgraded to an RTE-II central configuration tomorrow, without discarding its existing capabilities. Additional stand-alone systems can be put to work as needed. HP distributed systems software-hardware can be added at any time to extend communications to some or all of the stand-alone HP systems to convert them to satellites. All of this can be done in easy stages and proven step-by-step. In this way, you can build a solid, reliable distributed communications, multiprocessing, and program development support structure that is paying for itself as it is growing.

We invite you to call in one of our HP Systems Field Engineers from our nearest local office to help you plan implementation of computerized solutions to your measurement and control problems, right up to the establishment of complete distributed systems. He can help you do it without having to put all your chips on the line at once.

Comprehensive Control

OPERATOR'S REQUESTS TO CENTRAL AND SATELLITE

AT CENTRAL	AT BCS SATELLITE	AT RTE-B SATELLITE	AT RTE-C SATELLITE	PURPOSE	REQUEST AT CENTRAL APPLIES TO
ON,name	ON,name	ON,name	ON,name	Schedules program to run in remote (Satellite or Central) system	RTE-B & RTE-C
LOAD	LOAD*	LOAD	LOAD	Loads executable program from Central disc file into Satellite	RTE-C only
		MERGE		Merges an additional executable program from Central disc file with program already in the Satellite	
	RUN*	RUN	ON	Runs program in Satellite	
	RUN,name*	RUN,name	not required	Loads named program from Central disc file into Satellite and runs it	
	RUNAT*		not required	Runs program at specified Satellite memory address	
		SAVE		Saves program currently in the Satellite in a file on the Central disc	
	ABORT		OF	Terminates execution of Satellite program	
TELLOP	TELLOP	TELLOP	TELLOP	Sends message from local operator to remote operator	RTE-B & RTE-C
TIME	TIME		TIME	Displays time of real-time clock at remote (Satellite or Central) system	RTE-C only
BTRAP				Issues a "TRAP" (event) interrupt from Central to Satellite system	RTE-B only
PLIST			PLIST	Lists information from ID segments of programs in Satellite system	RTE-C only
OF,8				Removes program from Satellite system without intervention by remote operator	RTE-C only
	CREATE	CREATE	CREATE	Creates a new file on the Central disc	
	CLOSE	CLOSE	CLOSE	Closes file on the Central disc	
TRANSFER			TRANSFER	Transfers input control to Central file or local device	Central
	PURGE	PURGE	PURGE	Deletes a file from the Central disc	
	DLIST	DLIST	DLIST	Lists Central file directory at the Satellite	
	RENAME	RENAME	RENAME	Renames a file on the Central disc	
STORE			STORE	Stores from Satellite or Central input device to file on the Central disc; creates a new file	RTE-C/Central
DUMP			DUMP	Dumps a file from Central disc to Satellite or Central output device	RTE-C/Central
SWITCH	automatic		SWITCH	Switches command execution from Satellite to Central or vice versa, using commands from remote system	RTE-C only

* *Request available from SCE2 as well as SCE3.*

OPERATOR'S REQUESTS AT CENTRAL TO SATELLITE SYSTEM GENERATOR AND CROSS-LOADER

REQUEST	PURPOSE
!!	Aborts Satellite System Generator and Cross-Loader.
BOUNDS	Defines upper and lower memory bounds of absolute code generated by loader.
DISPLAY	Displays contents of symbol table or names of undefined symbols or values of defined symbols.
END	Specifies the end of the relocatable input phase of operation.
LINKS START AT	Transfers base page linkage information (established during generation) to the loader via the Snapshot tape. Does not allocate a link, but tells of one already allocated.
MAP	Requests core map of system.
RELOCATE	Reads and relocates a routine.
SEARCH	Provides selective relocation of modules with entry points which satisfy undefined external references.
SET	Transfers base page, current location counter, and symbol table information (established during generation) to the loader via the Snapshot tape.
TRANSFER	Transfers input control to file or peripheral designated by logical unit number.

RTE-B EXTENSIONS TO PROGRAM CALL VOCABULARY

PROGRAM STATEMENT	PURPOSE
ASSIGN	Creates or opens named central disc file and assigns it a logical unit number usable in PRINT # and READ # statements
PRINT #N	Prints on central disc file N or output device N
READ #N	Reads from central disc file N or input device N
STATUS	Returns status of central disc file N or peripheral device N
UNASGN	Closes central disc file and dissociates it from logical unit number N

PROGRAM CALLS TO CENTRAL AND SATELLITE COMMUNICATIONS EXECUTIVES

(All program calls at the RTE-C Satellites and Central are a networking extension of the Central system providing program transportability.)

AT CENTRAL	AT BCS SATELLITE	AT RTE-B SATELLITE	AT RTE-C SATELLITE	PURPOSE	CENTRAL CALL APPLIES TO
UTILITY AND REMOTE EXECUTIVE CALLS					
FLOAD	RLOAD		DEXEC 9	Loads program from Central into Satellite	RTE-C only
DEXEC 10	CHAIN	CHAIN	DEXEC 10	Loads program from Central into Satellite and runs it	RTE-C only
	IDLE	automatic	automatic	Returns to Satellite monitor from user's program	
DMESG	RMESG	DMESG	DMESG	Sends message to operator at remote (Satellite or Central) system	RTE-B & RTE-C
	RNPGM		DEXEC 10	Executes loaded program on Satellite system	
STRAP				Issues a "TRAP" (event) interrupt from Central to Satellite system	RTE-B only
DEXEC 1	REXEC 1	Via	DEXEC 1	Reads from input device of remote (Satellite or Central) system	RTE-B & RTE-C
DEXEC 2	REXEC 2	Batch-Spool	DEXEC 2	Writes on output device of remote (Satellite or Central) system	RTE-B & RTE-C
DEXEC 3	REXEC 3	Monitor	DEXEC 3	Issues control request to I/O device of remote (Satellite or Central) system	RTE-B & RTE-C
DEXEC 10	REXEC 10	CSCHED	DEXEC 10	Schedules program in remote (Satellite or Central) system for execution (without wait)	RTE-C only
DEXEC 11	REXEC 11	CTIM	DEXEC 11	Requests time from real-time clock in remote (Satellite or Central) system	RTE-C only
DEXEC 12	REXEC 12	CAXTM CEXTM	DEXEC 12	Sets execution interval and absolute start time of program in remote (Satellite or Central) system	RTE-C only
DEXEC 13	REXEC 13		DEXEC 13	Requests status and device type of I/O device (identified by logical unit number) at remote (Satellite or Central) system	RTE-B & RTE-C
REMOTE FILE ACCESS CALLS (D-prefixed calls in this group used with RTE-C satellites and central are a networking extension of RTE file management calls providing program transportability)					
DCRET	RCRET	DCRET	DCRET	Creates file on the Central disc	RTE-C program test
DPURG	RPURG	DPURG	DPURG	Deletes file and directory entry from Central disc	
DOPEN	ROPEN	DOPEN	DOPEN	Opens desired Central disc file (prior to read or write access)	
DCLOS	RCLOS	DCLOS	DCLOS	Closes Central disc file (after read or write)	
DREAD	RREAD	DREAD	DREAD	Transfers one record from Central file to user's program buffer	
DWRIT	RWRIT	DWRIT	DWRIT	Transfers one record from user's buffer to file on Central disc	
DPOSN	RPOSN	DPOSN	DPOSN	Directs next read/write to a specific record in file on Central disc	
DAPOS	RAPOS	DAPOS	DAPOS	Positions file on disc to a known record address	
DWIND	RWIND	DWIND	DWIND	Resets file addresses to first record; also generates rewind request to peripheral (magnetic tape unit) accessed as type zero file	
DCONT	RCONT	DCONT	DCONT	Issues control request to peripheral accessed as type zero file	
DSTAT	RSTAT		DSTAT	Returns 125 words of directory from Central disc	
DLOCF	RLOCF	DLOCF	DLOCF	Returns status of specified file on Central disc	
DNAME	RNAME	DNAME	DNAME	Renames specified file	RTE-C program test
PROGRAM-TO-PROGRAM TRANSFER CALLS FOR COOPERATIVE REAL-TIME MULTIPROCESSING					
POPEN		POPEN	POPEN	Initializes communication between calling "master" program and "slave" program in remote (Satellite or Central) system	RTE-B & RTE-C
PWRIT	#TAM 6	PWRIT	PWRIT	Sends data from "master" program to "slave" program in remote (Satellite or Central) system	BCS, RTE-B & RTE-C
PREAD	#TAM 5	PREAD	PREAD	Accepts data from "slave" program in remote (Satellite or Central) system for calling "master" program	BCS, RTE-B & RTE-C
PCONT		PCONT	PCONT	Sends "tag" field for user-defined control requests from calling "master" program to "slave" program in remote (Satellite or Central) system	RTE-B & RTE-C
GET		GET	GET	Prepares calling "slave" program to respond to next call (Open, Read, Write, or Close) from "master" program in remote (Satellite or Central) system	Central
ACEPT		ACEPT	ACEPT	Accepts "master" call received from remote (Satellite or Central) system program following GET	
REJCT		REJCT	REJCT	Rejects "master" call received from remote (Satellite or Central) system program following GET	
FINIS		FINIS	FINIS	Terminates calling program's operations as "slave" to program in remote (Satellite or Central) system	Central
	#TAM 8			Sends data from "slave" program in Satellite to "master" program in Central, on demand	
	#TAM 2			Terminates program-to-program transfer operations by Satellite	
	PTPON	not required	not required	Initiates automatic inhibition of response to Satellite operator's requests for attention during remote program-to-program transfers	
	ESCON	not required	not required	Checks for any Satellite operator requests for attention received during program-to-program transfers	
	PTPOF	not required	not required	Restores normal response to Satellite operator's requests for attention (used after completion of program-to-program transfers)	
	GETLU	automatic	automatic	Obtains Satellite's logical unit number from Central	

Ordering Information

Hewlett-Packard distributed systems capabilities are offered in totally-modular form to facilitate phased implementation, from the working systems up, or from the central EDP complex down to the working level. Detailed ordering information for these capabilities and for the related working-level systems is available in the following publications:

- Distributed Systems Ordering Information and Configuring Notes, HP literature request number 5952-1669.
- Remote Data Transmission Subsystem Ordering Information, HP literature request number 5952-1665.
- Configuring Guide for 9600/9601 Computer Systems for Measurement and Control, HP literature request number 5952-1691.
- Configuring Guide for 9610 Industrial Measurement and Control Systems, HP literature request number 5952-1671.
- Real-Time Executive Software Ordering Information, HP literature request number 5952-1695.

Licensing

All Hewlett-Packard Distributed System software, Real-Time Executive software, and related subsystem and peripheral control drivers and special program modules are provided subject to customer's acceptance, at the time the order is placed, of HP's licensing agreement for proprietary software.

Distributed System Technotes

The following HP TechNotes are available to facilitate implementation of Hewlett-Packard distributed systems:

- TechNote 73-1: Hardwired Interconnection of HP Distributed Systems, HP literature request number 5952-1647.
- TechNote 73-2: Modem Interconnection of HP Distributed Systems, HP literature request number 5952-1648.
- TechNote 73-3: Choosing Between Interconnection Methods in HP Distributed Systems, HP literature request number 5952-1649.

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