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VULCAN
(Virtual Core Manager)

FEATURES

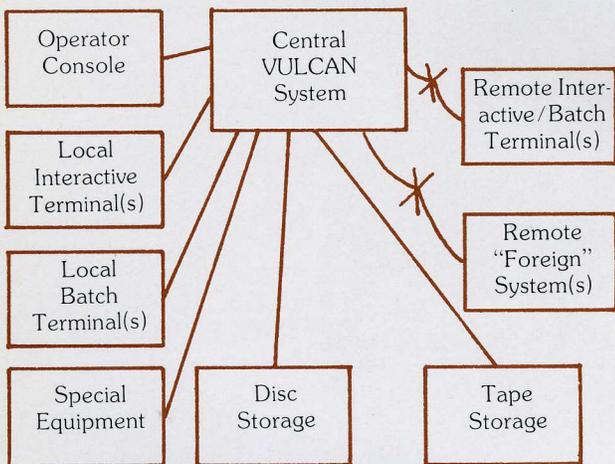
- Concurrent Time-Sharing, Multi-Batch and Real-Time Processing
- Virtual Memory Hardware/Software
- File Management and System Accounting
- Re-entrant Processors, Libraries and Code Generation

PRODUCT BULLETIN



HARRIS
COMMUNICATIONS AND
INFORMATION HANDLING

- VULCAN is a virtual core management operating system that provides concurrent time-sharing, multi-batch and real-time processing.
- VULCAN is a software system, developed concurrently with the SLASH 4 Virtual Memory hardware system, that provides an efficient, "friendly" user-oriented total system.
- VULCAN is expandable from a minimal batch configuration to a large-scale system that supports remote interactive terminals and RJE terminal simulation to "foreign" systems (e.g., CDC, IBM, Univac).
- VULCAN is field operational.



EXAMPLE VULCAN SYSTEM CONFIGURATION

TOTAL MULTI-PROGRAMMING

- Multi-batch jobs run concurrently on a time-sharing basis; each job having its own dynamically allocated control point (a private program control area associated with each active job). The jobs may be initiated from any spooled input device or terminal and they run at the lowest priority range within VULCAN. Maximum system throughput is attained by running those batch jobs requiring the least memory, run time and output at the higher end of the priority range.
- Interactive terminals are run in the priority range above that of batch jobs (control points) for fast response time to users.
- Real-time, response critical programs may run core-resident in the highest priority range, without being connected to an interactive terminal or control point, to provide high-response processing. Less critical real-time programs may be run at lower priorities. In this case, they are paged in order to minimize resident core requirements.

VIRTUAL MEMORY SYSTEM

Under VULCAN, the SLASH 4 Virtual Memory System (VMS) is transparent to the user. The VMS permits program addressing up to 256K words (K=1024). Up to 64K may be pure re-entrant procedure; the remainder may be private or shared data.

Programs are assigned non-contiguous, and even non-resident, memory pages by means of hardware page address registers. Pages consist of 1K 24-bit words. An 18-bit effective memory address is mapped automatically by the hardware into the appropriate memory page—without increasing the CPU cycle time. If a non-resident page is referenced, an executive interrupt is generated to allow VULCAN to perform a page swap. Page swapping is based upon parameters such as program priority, page usage and whether the page has been modified.

PROGRAM PROTECTION

There are two executive modes under VULCAN: Monitor mode and User mode. Executive services run in the privileged Monitor mode. User programs, even if privileged, are not permitted to execute instructions which modify paging hardware registers. Only privileged, real-time programs are permitted to use I/O and interrupt control instructions. The VULCAN hardware/software prohibits user programs from accessing any page of memory not allocated in its own page register group. This provides maximum protection for the system as well as for the other user programs.

FILE MANAGEMENT AND SECURITY

VULCAN supports multiple discs, as required, for a given system application. A disc directory is maintained for each pack in the system. A master directory on the "system pack" contains entries for all packs in the system. Optionally, directory entries for disc areas requiring rapid access may be made core-resident.

All disc areas are identified by an eight-character area name plus an eight-character qualifier. The qualifier is comprised of an account number and a name. When a user signs on at a VULCAN terminal, a sign-on qualifier is specified. This becomes a default qualifier for subsequent disc area references not specifying a qualifier.

Disc area access can be restricted to the originator, a member of the originator's account, the public or certain combinations of these three:

- Originator—delete and execute access.
- Account—read, write, delete and execute access.
- Public—read, write, delete and execute access.

Additionally, each user is assigned an access level. Access is denied to levels higher than that assigned.

Work area names specified during system generation are automatically appended with the user's terminal or control point identifier. Thus, two concurrent tasks may reference the same work area name. The work areas are automatically created when referenced and deleted when the user signs OFF a terminal.

Disc areas are created and expanded in single granule increments. A granule consists of N sectors; N being specified at creation or assumed to be a default value. Areas are automatically expanded as required by appending non-contiguous granules, up to a specified limit.

RE-ENTRANT PROCESSORS AND LIBRARIES

All standard system processors are re-entrant; thereby minimizing the amount of core memory required by additional users. Re-entrant libraries (FORTRAN, RPG, Indexed Sequential and Sort/Merge) expand the capabilities of the system. One or more re-entrant subroutines may be cataloged together to form a re-entrant public sub-program that may be shared by multiple user programs at execution time without being included in the user programs. In addition, selected re-entrant library routines may be included as an element of a user program at catalog time.

RE-ENTRANT CODE GENERATION

The FORTRAN IV and BASIC Compilers automatically produce a re-entrant code that is compatible with ASSEMBLY language object code. This feature provides the user with the convenience of an efficient, high-level language in conjunction with the more basic assembly language and standard library routines for applications software.

SPOOLING

VULCAN provides input and output spooling for local and remote terminals. Spooling may be job stream input/output or data requested by active real-time programs. Spool files are created dynamically—with output device allocation being explicit or by default.

INTER-PROGRAM COMMUNICATIONS

VULCAN provides several methods of passing data from one program to another:

- Multiple Global Common areas of various sizes.
- Messages queued from one program to another.
- Initiation parameter passed to a program being initiated.

SYSTEM ACCOUNTING

System accounting is an integral part of VULCAN operations. Accounting information on all CPU and peripheral usage is accumulated and then periodically stored in a disc accounting file. An Accounting Utility program is provided for listing accounting and billing information according to User, Account, etc. Accounting files also may be accessed by "qualified" user programs for special report processing.

SUPPORT SERVICES

VULCAN provides a variety of re-entrant support services:

- Logical I/O and dynamic device assignment at execution time.
- Conditional DELAY and operator HOLD.
- Dynamic core allocation.
- Disc area allocation and maintenance.
- System information such as date, time and program initiation.
- Text and number conversion.

REMOTE JOB ENTRY SUBSYSTEM

Remote Job Entry (RJE), as an integrated subsystem of VULCAN, provides remote terminal emulation to other computer systems. RJE consists of a communications handler and an appropriate protocol interpreter for each terminal emulation, and a remote job spooler for queueing RJE requests from VULCAN terminals. Most RJE terminals require operator interaction. The VULCAN RJE subsystem performs most of the operator actions; yet it allows the user at a VULCAN terminal to transfer normal status requests to the remote site and receive responses at the user's terminal.

The user may either spool a remote job from a spooled input device (such as a card reader) or generate an RJE file and initiate it from an interactive terminal. An output response from a remote job may be spooled automatically to the user's terminal, to a

specified list device or retained on a permanent user disc file. Output response may also initiate another user job or program for processing the response data.

SYSTEM GENERATION

GENASYS is the VULCAN interactive system generation program. Once loaded from the appropriate media (e.g., magnetic tape), GENASYS immediately initiates a dialogue with the operator to determine the configuration parameters. The required system modules and support processors are selected from the system generation media; based upon these configuration parameters.

PROCESSORS

FORTRAN IV—The FORTRAN Compiler meets ANSI X3.9 specifications with numerous extensions. Some of the more powerful features supported are: Asynchronous I/O; Free-Format I/O; In-Line and Free-Format Assembly code; Indexed Sequential File handling; Implied Do Lists in DATA statements; Encode-Decode; Random-access I/O; quoted Hollerith constants in DATA and arithmetic statements; extended subscript expression; and automatic generation of re-entrant code.

BASIC—The BASIC compiler and library routines provide an easy to learn and easy to use programming language. The BASIC compiler is re-entrant and automatically generates re-entrant code to provide more efficient core usage when multiple users are active. The BASIC programming language contains several extensions to the standard BASIC including character variables and extended logical operations.

FORGO—The FORGO processor is a diagnostically-oriented, load-and-go compiler for FORTRAN program debugging. This processor compiles directly into core, thereby greatly increasing throughput on small jobs. With FORGO, large jobs are more easily and rapidly debugged due to extensive execution time error checking. Therefore, the time from debug to production is decreased, resulting in cost savings to the user.

SNOBOL—The SNOBOL compiler is a full SNOBOL 4 compiler and execution interpreter. SNOBOL is a problem-oriented language that facilitates string manipulation and pattern-matching operations.

RPG II—The RPG compiler provides a convenient means of preparing reports from information available in machine-readable form and of updating or establishing information files. RPG is designed primarily for the non-technical user who must produce reports in a minimum of time. The emphasis of RPG is on problem description rather than machine programming.

SORT/MERGE—The Sort/Merge package is available to perform generalized sort and merge functions, utilizing any number and type of mass storage device(s). The Sort/Merge package may be used from a simplified Job Control language, which symbolically defines the function to be performed, or it may be referenced from FORTRAN IV or Assembly language to perform a specialized Sort/Merge during program execution.

INDEXED SEQUENTIAL PACKAGE—The VULCAN Indexed Sequential Package provides generalized Indexed Sequential access to user files. Basic procedures such as initializing, loading, listing and simple editing may be performed on an Indexed Sequential File through the Indexed Sequential Utility Program. This Utility is accessed through a straight-forward symbolic Job Control-type language. Indexed Sequential Utility functions may also be performed through subroutine calls from FORTRAN IV, RPG II or Assembly language.

MACRO ASSEMBLER—The Free-Format Macro Assembler provides several special pseudo-operations to facilitate the generation of re-entrant user programs. The assembler recognizes over 600 machine operation codes and many pseudo-operations. A highly flexible macro capability provides the user with a means to create custom pseudo-operations. A facility for creation of libraries of these macros is also provided.

XREF—The Cross Reference program produces a cross reference of assembly language programs. The program produces an alphabetic listing of all symbols or labels defined in the program and all references to local and external labels. Symbols referenced in Macro statements are also cross referenced.

DEBUG—The DEBUG is an interactive, easy to use, utility program. DEBUG allows run-time breakpoints, memory and register modifications and dump, bit-pattern scan and several other features.

MAJOR VULCAN CHARACTERISTICS

INTERACTIVE TERMINAL CONTROL

- File Editing
- Processing (BASIC, FORTRAN, RPG, etc.)
- Batch Job Initiation
- Real-Time Program Initiation
- Remote Job Initiation

MULTI-BATCH PROCESSING

- Concurrent Job Processing
- Re-entrant Processors and Support Libraries
- Re-entrant Code Generation
- Remote Job Entry
- Automatic Input, Output Spooling

REAL-TIME EXECUTION

- High-Response Program Execution
- Direct I/O Communications
- Periodic Initiation
- Conditional Wait
- Inter-Program Communications

Specifications subject to change without written notice.

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