

Features

- User interface for easy file creation and manipulation
- Data storage and retrieval for local and remote files
- Data arranged in up to 8 different orders simultaneously (8 keys per file)
- Data access by multiple CPUs and tasks
- Handles multi-volume files
- Automatic or manual file expansion (up to 64 million records per file)
- Dynamic space management
- Record and file level locking for data security and integrity
- Optional transaction logging
- Utilization statistics
- Record reformatting by field or word
- Data merging, copying, and high-speed loading into key index files
- Subroutines support the following host languages: Fortran, Pascal, C, COBOL, Assembler
- Compatible with MOD-COMP CLASSIC⁺ II under MAX IV Operating System

INFINITY

Database Management System

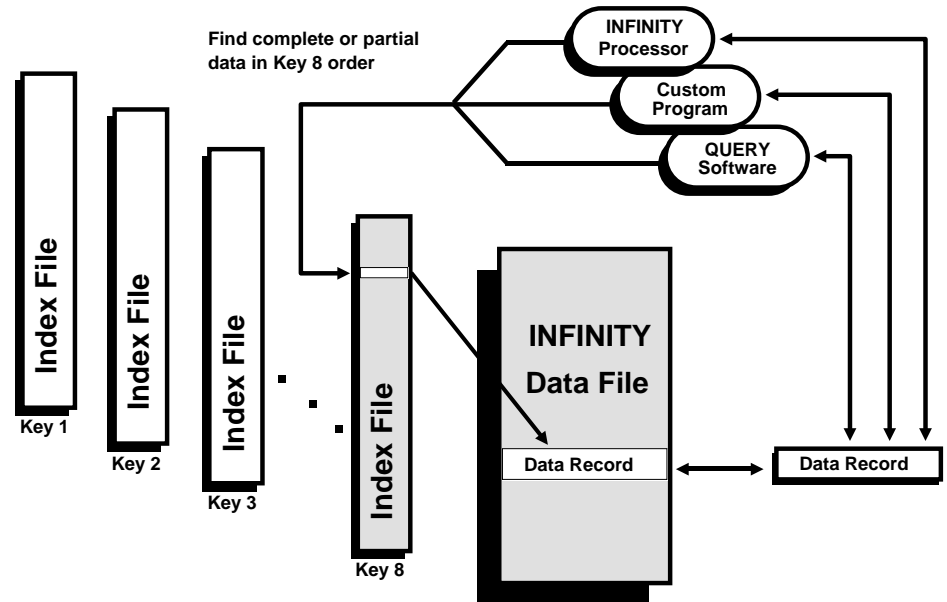


Figure 1: Rapid Retrieval of Data by Key Index

The INFINITY Database Management System is a general purpose database manager for the MODCOMP CLASSIC and CLASSIC II computer family. INFINITY supports multi-program, multi-processor access to database files through the logical Input/Output (I/O) structure of the standard MAX IV Operating System. INFINITY operates as a resident, non-map zero symbiont task processing queued user requests.

Nonresident system database processors are included for general purpose data entry, retrieval, and file maintenance.

A library of subroutines (callable from custom written programs) is also provided, making it easy for programmers to access and manipulate INFINITY files and data as desired. This facilitates custom reports and procedures above and beyond the sophisticated file access and standard print capabilities provided by the INFINITY processors.

When INFINITY files are used in conjunction with the QUERY Interactive Inquiry and Report Writer, manually or automatically formatted reports are easily generated by nontechnical personnel.

FUNCTIONAL DESCRIPTION

Basic Structure

The INFINITY Database Management System provides all of the elements needed to create, use, and manipulate

System Requirements

- **MODCOMP CLASSIC II computer with 1024 Kb or more memory and the MAX IV Operating System**
- **One or more disk devices**
- **One or more tape devices**
- **One or more video terminals (optional)**
- **One or more printers (optional)**

records in one or more data files via a Data Definition Language (DDL) and a Data Manipulation Language (DML). The functions provided by these "languages" are accessible via specific INFINITY utility commands or INFINITY subroutine calls.

The utilities provided are DBCREATE, DBEDIT, DBPAGE, DBCOPY, DBLOAD, DB-ARCHIVE, DBINIT, DBJOURNAL, and DBUTIL.

File Structure

INFINITY provides a transparent, schema-driven data record organization system for multi-keyed data files. Each key may be defined as any combination of up to eight data items (fields).

Records may be retrieved by specifying partial or complete key data values. Direct access dynamic index structures, transparent to the user, provide exceptionally rapid access to data records. Key data may be specified to locate the first or last occurrence of the data in the specified file. Sequential access in ascending or descending key data order can locate additional records until the selection criteria is exhausted. This structure is ideal for multi-user, interactive environments since no time-consuming sorting or scanning techniques are used.

Index structures dynamically expand or contract as data records either are added or deleted from the database.

Update of key index files is automatic and completely transparent to the user. As requirements change, additional key indexes may be added.

Space Management

INFINITY must be primed for use via the DBINIT utility (allocation of an initial logical volume, attachment of any necessary additional volumes, definition of system-level and operator-level passwords, and definition of the size and location for Control Files used by the system). This enables INFINITY to allocate and de-allocate space from a dynamic space pool as database files are created, used, and/or deleted. Space is released for reuse as files are removed. Adjacent free space segments are recognized and combined into a single contiguous space.

Each mapped file may utilize record space management maps that track records in use in each database file. As records are deleted, record space is immediately available for reuse. Worst case allocation of available record space in the largest file (64 million records) requires only two disk accesses.

In addition, if storage space demands exceed allocated file space, up to seven additional discontinuous extents can be allocated. INFINITY will perform these automatically, or the user can request expansion manually. Automatic expansion can be controlled for each database file.

Data Definition Language

The Data Definition Language handles file schema creation, modification, and documentation. These functions are activated through the DBCREATE utility or via subroutine calls. The needed structures are allocated through the Resident Database Processor. File creation can be performed simultaneously on-line by any number of users. Typical DDL functions allow the user to:

- Define file type as Unmapped Direct Access, Mapped, or Keyed (mapped with key indexes)
- Name or rename a data file
- Specify initial logical record allocation
- Select or deselect automatic file expansion within specified limits
- Define up to 3,000 fields per file
- Define order of up to 8 fields for up to 8 key index files
- Select or deselect transaction logging for a file
- Define security password for a data file and limit the type of access allowed
- Display or print file schemas
- Duplicate an existing file schema for a new file
- Modify an existing file schema
- Specify or remove logical volume allocation for a data file and its key index files

Data Manipulation Language

The Data Manipulation Language makes possible the use and manipulation of records in files after the files have been created. The DML can be accessed by INFINITY processors other than DBCREATE or by subroutine calls. Typical functions are:

- Open/close files
- Find a record by record number
- Find a record by matching a specified data string to data stored in a file or key index
- Move through data in a file or key index in ascending or descending order
- Read data in a record
- Modify data in an existing record
- Delete a data record or all data records in a file
- Add new data records
- Print contents of a record
- Lock or unlock a record or file
- Manually expand a file by specified number of logical records
- Transfer all or selected data to and from an INFINITY file and an accessible tape, disk, PC file, or another INFINITY file
- Load data into new or re-established key index files
- Save files in archive format and restore when necessary
- Reenact logged transactions as specified
- Access utilization statistics

Specifications

- **Database processor - 166.5 Kb (of which 61.5 Kb is sharable)**
- **Symbiont - 3 Kb**
- **Program resident Data Manipulation Routines (DMR) proportionate to use - 0 to 1 Kb**
- **INFINITY utilities - 256 Kb**
- **User program storage for each database file opened - 30 bytes (plus any required data buffers)**

SYSTEM CONFIGURATIONS

Multi-User Systems

INFINITY is designed to accommodate database access by an unlimited number of concurrent users and/or tasks. Both record and file locking are provided so activities requiring exclusive use of a file or record can be carried out without interruption by other users.

Multi-Processor Networks

INFINITY is compatible with the concepts of the MODCOMP MAXNET⁺ operating system extensions or Logical Data Corporation's Computer Network Interface (CNI). This feature permits programs in remote processors to access INFINITY services across a link. The remote access is transparent to the calling program. Access may occur simultaneously from large numbers of processors on common database files. Programs in remote processors experience very little degradation in database performance compared to local programs, since only high-level requests go across the link to INFINITY.

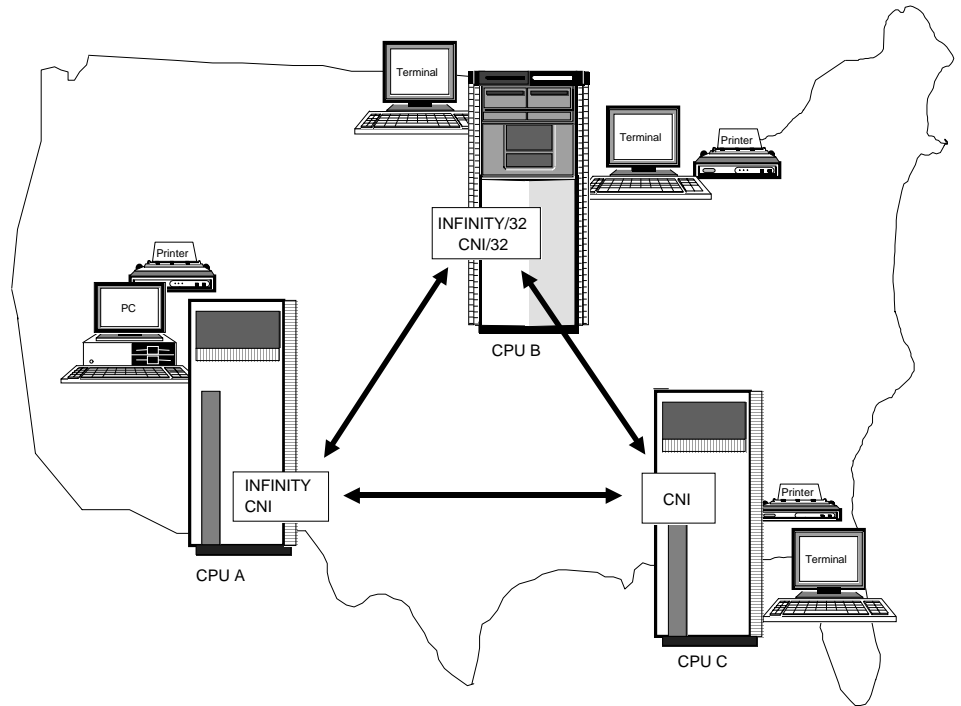


Figure 2: Distributed Database Management Network

Distributed Database Networks

Network systems with copies of INFINITY or INFINITY/32 resident in two or more CPUs may distribute different database files transparently among the INFINITY systems. Each database may have directory entries defined for database files controlled by remote INFINITY or INFINITY/32

processors. A program may open remote database files as though they were locally defined. This facilitates construction of distributed data networks or load sharing systems.

Figure 2 shows an example of a network utilizing a distributed INFINITY database system. When appropriate communications links have been established, multiple users of CPUs A, B, and C may concurrently access data in INFINITY files locally or INFINITY files in the remote CPUs. This process may be extended indefinitely with full database integrity.

SYSTEM ARCHITECTURE

Modular Approach

INFINITY is implemented in a highly modular, layered software architecture. This modular approach makes it easy to add upwardly-compatible enhancements as they become available without adversely affecting existing applications programs or complementary support software.

The only prerequisite software for an INFINITY system is the MAX IV Operating System. Other software may also be desirable, depending upon configuration requirements. For a distributed system, either MAXNET or CNI software is necessary for each processor. Access to INFINITY data files by Personal Computers requires PC FILE SUPPORT and a compatible PC communications program. QUERY software makes it possible to provide automatically or manually formatted custom reports from INFINITY data.

Installation

All INFINITY modules are supplied on the INFINITY Object Release Tape, which also contains a procedure that can be used to install the INFINITY elements on MAX IV system files. Default parameters suitable for a typical first-time installation on a standard MAX IV system will be displayed; if not suitable, other parameters may be specified. After execution, control will return to the operator and the tape may be dismantled.

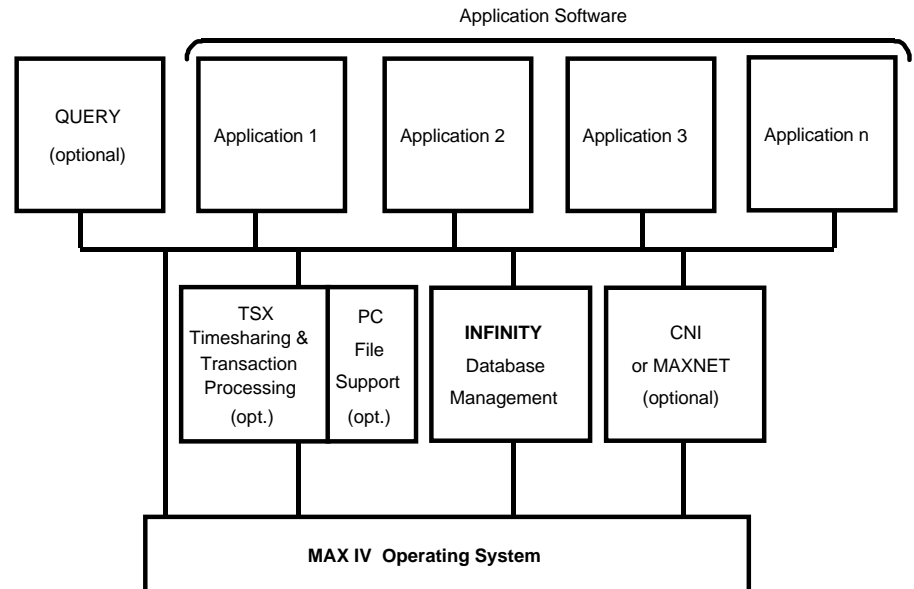


Figure 3: Layered Software Architecture

A source editor must be used to modify the current system generation program to include additional statements required to establish INFINITY as a system symbiont and to define the INFINITY logical volumes. INFINITY takes exclusive use of this logical volume set, thus protecting the database files on those volumes from unauthorized access by other tasks.

After assembly and link-edit to produce a loadable binary operating system, the new operating system is loaded with the Stand-Alone-Loader (SAL) and activated.

Before the INFINITY system is functional, each logical volume that is a member of the INFINITY volume set must be initialized by the DBINIT utility. This utility will also establish the necessary internal Control Files based on individual site requirements. After volumes have been initialized, INFINITY will automatically verify the volume set at startup.

A look-up table of standard INFINITY error messages is provided and may be installed if numeric error codes are not deemed sufficient.

USER INTERFACE

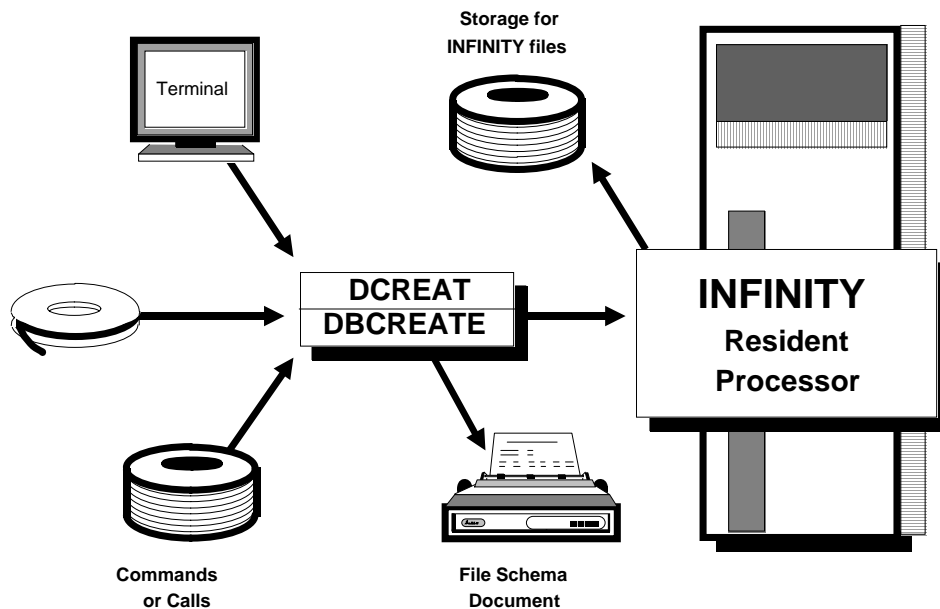


Figure 4: Database File Creation via Commands or Calls

INFINITY Utilities

The following utility programs serve as an interactive interface for INFINITY:

- DBCREATE - create, modify, or delete INFINITY files
- DBEDIT - enter, locate, print, and/or edit data in a database file
- DBPAGE - similar in function to DBEDIT but utilizes dynamically built block mode screens (requires TSX software)
- DBCOPY - copy selected data (with optional reformatting and key building) to tape or disk, or append to another database file
- DBLOAD - transfer all data quickly to or from tape, disk, or initialized data file and build specified key index files
- DBARCHIVE - label, compress, save, and restore all or specified data files using magnetic tape
- DBINIT - create and manage Control Files and logical volume labels, initialize system, establish global passwords, and select system-wide options
- DBJOURNAL - log data changes for specified files and reenact selected changes, if desired
- DBUTIL - log all transactional requests to the data base processor with user ID, date, etc.

Command Formats

Commands accepted by the INFINITY utility processors consist of keywords and parameters in easy to use formats (see Figure 5).

On-Line Help

The HELP command is available when using any of the INFINITY utility programs. It displays requested general or specific information about commands and parameters valid for the utility currently being used.

INFINITY Language Interface Library

INFINITY provides a library of subroutines and functions that can be used by programmers to access INFINITY data files from within custom written applications programs. All database function requests are queued to the resident processor task by standard reentrant input/output services supported by the MAX IV Operating System. This concept allows INFINITY to support all types of applications regardless of the language used and the structure of the program. The following standard library subroutines and functions are supplied for Fortran, Fortran 77, Pascal, C, and COBOL language support:

| | |
|--------|--------|
| DARCHV | DKILL |
| DCLOSE | DKREAD |
| DCREAT | DLOCK |
| DDEL | DOPEN |
| DDELR | DOPENL |
| DERROR | DOPENR |
| DERR | DREAD |
| DERMSG | DREADL |
| DFIND | DRFORM |
| DFINDL | DRINIT |
| DFOLLO | DRNAME |
| DFOLL | DRSCAN |
| DINFO | DUNLOC |
| DINIT | DWRITE |

SITE AND TERMINAL OPTIONS

Built-In Site Customization Options

The DBINIT utility allows the system to be tailored to your site-specific needs by the selection of system-wide options including journal logging, file utilization statistics logging, record locking requirements, and date display format. Any of these options may be set or reset at any time, but only by a user with knowledge of the system-level password.

The LOG command in DBINIT allows activation or deactivation of journal logging for all INFINITY utilities. A "LOG OFF" entered here will supersede any attempt to activate logging for any database file via the LOG command of DBCREATE. The contents of the journal log can be accessed via the DBJOURNAL utility, and selected transactions can be reenacted, if desired. This insures that data added to the database since the last backup will not be lost in case of a catastrophic system failure.

The STATISTICS command in DBINIT allows an authorized user to activate or deactivate the recording of file utilization statistics for all INFINITY utilities. These statistics, if recorded, can be accessed through the DBUTIL utility.

The WRITE command sets a system-wide option determining if a record must be locked prior to either editing data in the record or deleting the record entirely.

The site may also control the format in which dates will be displayed, either European format (DD MM YY) or American format (MM DD YYYY).

Terminal-Specific Options

The flexibility of the INFINITY software also extends to the individual user at the CRT terminal.

By using the OPTION command within any of the INFINITY utilities, the user can establish some of the "ground rules" under which the utility will function during the current interactive session. A few options will be illustrated in the following examples.

The immediate display of data after a record is located in an INFINITY file can be circumvented by specifying "OPTION NODISPLAY," and required verification of a DELETE or INITIALIZE command is deselected via "OPTION NOVERIFY." If commands are being read from an interactive device (CRT terminal), the user will be prompted for input unless the command "OPTION NOPROMPT" is entered. Action taken by the processor in the event of an error condition can be predetermined by entering "OPTION HOLD," "OPTION NOHOLD," or "OPTION ABORT."

Display length and width are also easily controllable.

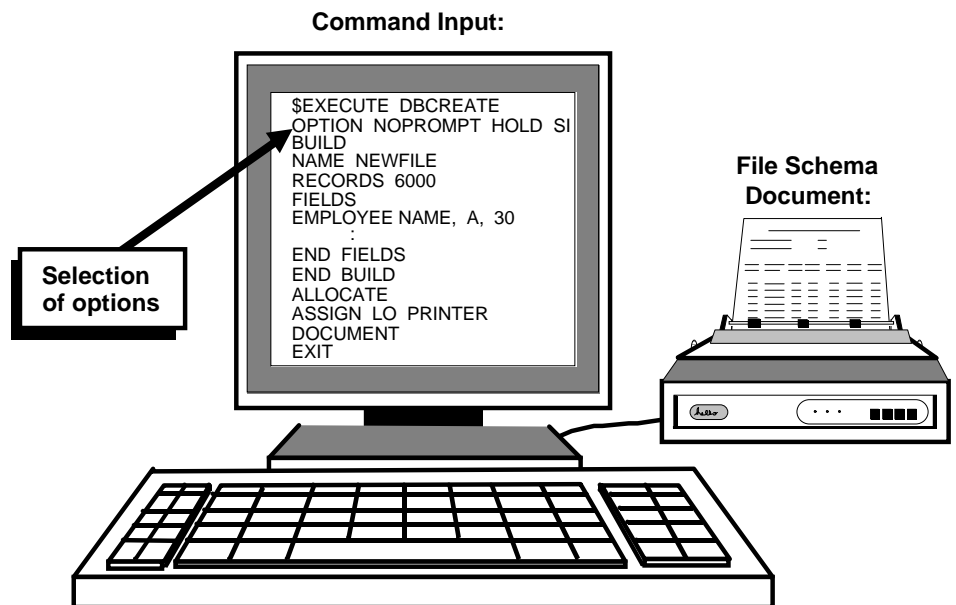


Figure 5: Selection of Terminal-Specific Options

ADDENDUM

The following provisions have been established for Software Licensing, Installation, and Maintenance for the INFINITY Database Management System software.

Documentation

Each INFINITY license includes two reference manuals. Additional copies can be purchased.

Licensing

INFINITY is a licensed software product and requires receipt of a completed, written LOGICAL DATA CORPORATION PROGRAM LICENSE AGREEMENT prior to shipment. This Agreement provides in part that the software and any part thereof may be used on only the single CPU on which the software is first licensed (provision is made for a backup system), and it may be copied in whole or in part (with the inclusion of the Logical Data Corporation copyright notice and proprietary notice(s) on the software) only for use on such CPU.

Code Availability

INFINITY software is provided to customers in object code format.

Software Release Media

The standard release of INFINITY is provided on either 9 track 800 or 1600 BPI magnetic tape. Software can be provided on alternate media subject to additional media and labor charges.

Installation

Software may be installed by the customer or by Logical Data Corporation. Installation is configuration dependent and requires a SYSGEN. Logical Data Corporation provides telephone support without additional charge to assist customers during installation. On-site installation assistance can be provided by Logical Data Corporation at additional charge. Specific information and fees regarding

on-site installation may be obtained by consulting the LOGICAL DATA CORPORATION PRODUCT CATALOG or by contacting Logical Data Corporation.

Maintenance

Each INFINITY license includes one year of software maintenance, which consists of telephone support for on-site product problems, software corrections, and all enhancements. After the first year the customer may continue maintenance under the LOGICAL DATA CORPORATION SOFTWARE MAINTENANCE AGREEMENT.

Customer Services

Logical Data Corporation supplies a complete range of services including consulting, configuration design, site planning, installation, training, and support.

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