

Features

- Transparent to Standard MODCOMP* System I/O
- Site Configurable
- Dynamic User Task Priority Control
- Controls Resident Memory Usage for Each Task
- File Manager Support
- Block and Conversational Mode Terminal Operation
- Simplifies Creation and Maintenance of CRT Forms
- Virtual Terminal Support
- Application Programs Independent of Terminal Type
- Supports Most Terminal Features
- Terminal/Printer Spooling
- Terminal Usage Statistics
- Site Definable Security
- Master Terminal Control
- User-Defined Modules Supported
- Transparent Pre/Post Processing
- Language Independent Interface
- Variable Format Control of Local Printer
- Manages Direct, Dial-Up, and Port Contention Communications
- I/O Trace

TSX

Time Sharing Executive & Transaction Processor

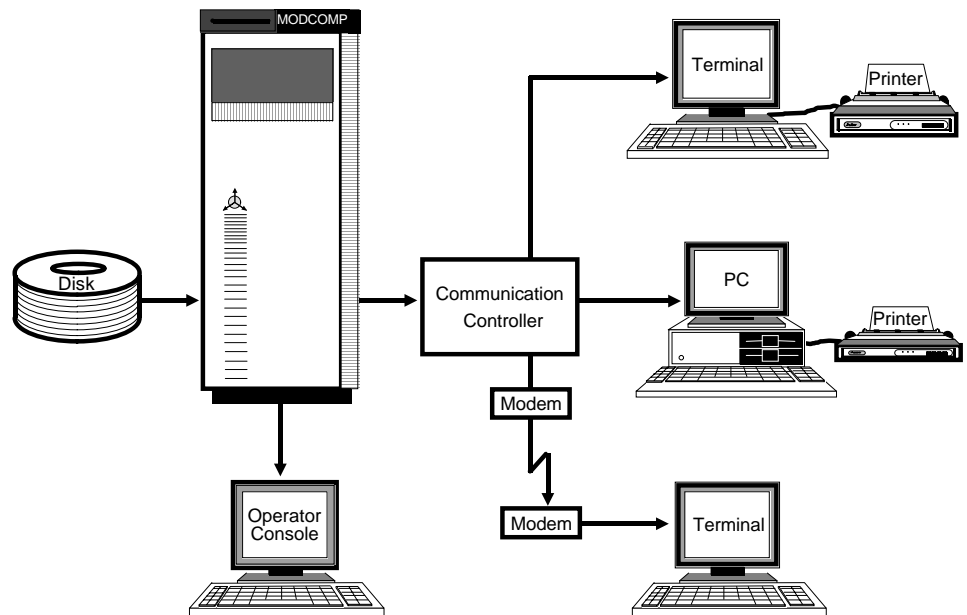


Figure 1: Typical System Configuration

The Time Sharing Executive and Transaction Processor (TSX) expands the capabilities of the MAX IV Real-Time Operating System. It provides an excellent multi-user interface for environments from process control to information systems without compromising the high speed real-time facilities of the operating system.

By supporting both conversational I/O and full screen forms using block mode I/O, TSX makes programming easier. TSX supports advanced

terminal features in a format independent of terminal type, protecting valuable applications from expensive modifications as newer devices become available. While eliminating the need to understand the complexities of each type of terminal, TSX maximizes system efficiency by utilizing the intelligence of each terminal while off-loading the central processing unit.

In addition, TSX solves communications, presentation, and security problems using a layered system architecture.

FUNCTIONAL DESCRIPTION

Basic Structure

TSX is a table-driven symbiont task. It buffers I/O between the user tasks and corresponding user terminal devices while synchronizing the roll-in/roll-out of user tasks on a demand basis. All operations are transparent to programs and users.

TSX provides log-on security control, user task activation

and monitoring, and system resource and communications management. User tasks are unrestricted by TSX and are free to perform any function permissible under the MAX IV Real-Time Operating System.

TSX can be tailored to individual site requirements by macro statements describing the terminal characteristics, tuning parameters, and security options. These state-

ments are assembled and link-edited in a process similar to that used in a System Generation. The resulting version is stored as the symbiont task, which can be scheduled to automatically begin operation whenever the system is started.

I/O Interface

TSX interfaces with individual user tasks through the I/O System. It processes all ASCII and most binary I/O operations according to the rules of the Asynchronous I/O Handler to support any asynchronous terminal device. Certain binary operations are extended to call internal or user-defined special functions.

Terminal communication occurs through full or half-duplex, asynchronous channels. Output data is routed through spooling files to the output channel while input is directly buffered by TSX. Fully spooled output allows programs to complete execution at a maximum rate, independent of communication speed. Figure 2 illustrates the TSX System Interface.

Advanced Spooling System

TSX includes a high performance output spooling task named SPL. ASCII and binary operations are supported transparently, conveying both data and I/O options. A single symbiont supports all spooling operations on as many devices as needed. Efficient queuing techniques reduce SPL overhead proportionally

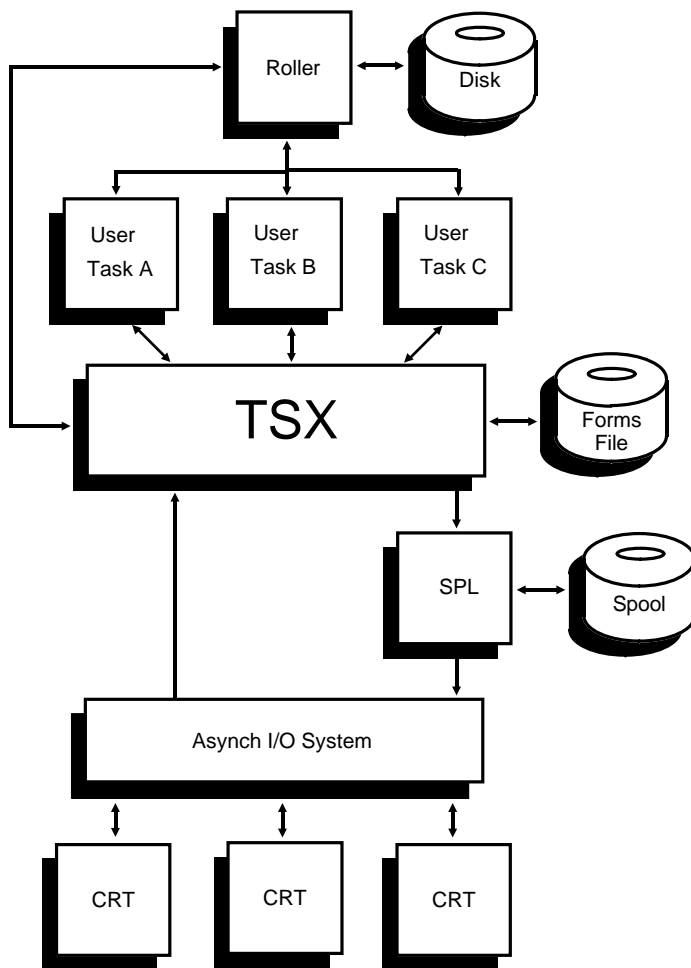


Figure 2: TSX System Interface

to actual work, not to the number of devices.

Storage can be specified in blocks located in memory and/or on disk. Single disk files can be shared among many spool files. SPL notifies the operator(s) of any condition delaying output. An Operator Control (OC) directive allows display of spool status, help, and control of spool operation. User custom code may be included to control physical device acquisition and release in order to support peripheral switching or other special handling.

Virtual Terminal Control

Extended I/O options provide additional features useful in terminal communications and transaction processing. TSX recognizes a set of terminal independent control codes and attributes that are converted at I/O time to actual escape sequences for specific terminals. Under this concept, TSX supports a variety of terminal types while maintaining independence in user application software. See Figure 3.

Input translation options may be specified to detect function key sequences and cursor position, convert input to a terminal independent format, and solicit immediate transmission of data on the CRT display.

TSX's modular architecture supports both standard and user-written translation routines. The user may select the appropriate translation at log-on.

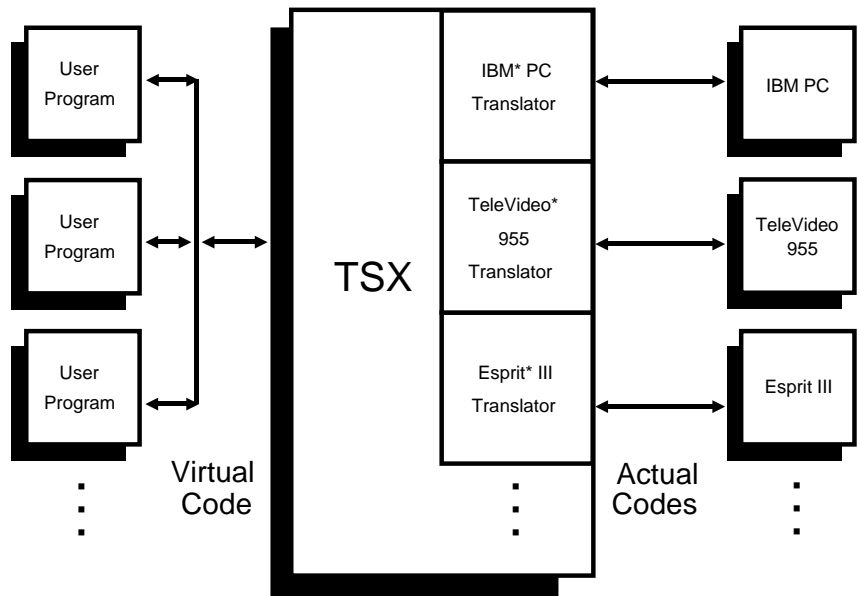


Figure 3: Virtual Terminal Control

Device Simulation

TSX models and simulates vertical format control defined for standard line printers to accurately interface between applications and slower speed serial printers, providing consistent output with end of form feedback. Programs may be written using the most efficient functions and operate identically in all configurations.

Terminals with suitable auxiliary ports may support attached slave printers or other devices. TSX simulates these as two independent logical units, automatically inserting switching codes to conserve communications links.

Communications Control

TSX supports direct connect, dial-up, and a variety of special devices and networks using its rich set of RS-232 signal options. Direct connect terminals can be attached without use of control signals. TSX supports all standard MODCOMP communications controllers including DCS for dial-up as a ring, break, and disconnect linemonitor task. Dial-up support insures proper session protection if interruption of communication occurs. TSX can control data terminal ready (DTR) at the end of a session to automatically disconnect modems or signal port contention switches.

System Requirements

- **MODCOMP CLASSIC* II or 9200 series computer with 256Kb or more memory**
- **Asynchronous Communications Interface (1905, 1907, 1908, 4807, 4808, 4809, 4811, DCS)**
- **Disk Drive**
- **MAX IV Real-Time Operating System (F.0 or later)**

TSX Specifications

- **TSX Task Nucleus - 9Kb**
- **Translator - 1100 bytes (typical)**
- **Tables and Buffers - 500 bytes per port**
- **SPL Task - 5.2 Kb code, 848 bytes per device, plus 1024 bytes per spool file when storage is active**
- **1 to 100 users (typical) are active**

Diagnostic Trace

TSX provides a complete, formatted trace of I/O flowing between an application and TSX or between TSX and any terminal. This diagnostic tool can be enabled at any time on one or more ports. This eliminates the need for line analysis in many cases and lets the programmer accurately view data flow at all interfaces. This can save hours of diagnostic programming and fault isolation for both software and hardware problems.

Memory Scheduling

TSX dynamically controls the memory residency of each user task through an internal queuing algorithm. Each task is rolled in and out of memory using standard operating system services triggered by TSX.

Application task memory residency is dependent upon memory availability and the need for execution of the task. Tasks awaiting terminal input are lowered in priority and allowed to be rolled out of memory. If input is not completed after a port-dependent time limit, the task is rolled out, freeing memory for more active tasks. When terminal input is completed, the task is elevated to a high priority. If rolled out, it is queued to be rolled in. If memory is not available, tasks currently executing may be swapped to provide a rapid response to each input operation.

MAX IV Real-Time Operating System's virtual addressing permits tasks to be segmented in any available actual memory pages for optimum memory efficiency.

TSX utilizes time-slicing techniques to guarantee equivalent resource access when user program requirements continuously exceed available memory. Tuning parameters controlling memory resources and scheduling algorithms can be controlled through the TSX generation macros and by the system operator.

Operator Controls

Operator Communication (OC) directives included with TSX allow the system operator to examine and control processing activities of each terminal, user names, communication line parameters, and terminal translation facilities.

Terminal Control Functions

Selected TSX terminal users can exercise control over their jobs from their terminal keyboard. Users may suspend or resume output, terminate processing, suppress output, and display statistics by entering special control codes. These functions, interpreted by TSX, are completely transparent to programs running under TSX. Additional site-defined control functions may be added to TSX to extend this facility.

In addition to these control functions, MAX IV users with proper security can invoke the Terminal Monitor Program (TMP) and Operator Communications (OC) features at the terminal level.

Auto Log-on

Ports may automatically be logged on to a predefined user name at start-up. This allows timeshared support of devices that do not have the capability of "logging on." If a fatal error occurs in the application used, TSX will automatically restart the program.

Security

User name security prevents unauthorized access. A TSX user must log on using an identifying user name to gain access to the system. User names can be restricted to specific terminals to provide controlled access. The system operator can add, delete, or modify access for any user name during operation. TSX can detect repeated attempts to gain access unsuccessfully. It will alert the system operator and lock or disconnect the port to prevent further attempts.

Complete application program systems can be accessed without requiring the user to use Job Control or any other "system" functions. True security is maintained by restricting users to only authorized applications.

More extensive user password security, fully integrated with TSX, is available as an optional package.

Resource Allocation

TSX allocates system resources specifically defined for each user. This makes it possible for a user to log on to different terminals and always maintain a consistent operating environment.

Sets of user resource directives are cataloged on a USL directoried source library. At log-on and log-off, these directives are processed by the TSX Program Loader to control the operating environment for each user task.

Resource files control logical file assignments, task operating options, file manager commands, pre/postprocess program definitions, and file list and copy functions. Resource files can be nested, calling other resource files.

Complete File Manager support is included to provide for automatic file creation and/or opening at log-on. At log-off, File Manager files may be destroyed or closed, as optioned, without requiring the user's attention.

Resource files may contain text string substitution meta characters to incorporate user name, user id, and port number on a dynamic basis for even greater flexibility.

User Directives

- **AVA** - display available ports
- **BRO** - broadcast (send) message to all logged-on users
- **BYE** - log off
- **MSG** - send message to specified ports or all logged-on ports
- **SET** - set terminal parameters
- **WHO** - list port, user alias, and overlay for all or specified ports

Operator Directives

- **INV** - dynamically bar specified user from specified ports
- **LOC** - lock specified port(s) or show lock status for all ports
- **POR** - display port data, clear port, control tracing
- **PDV** - display port I/O data
- **PTS** - display port status
- **UNL** - unlock specified port(s) or show lock status for ports
- **USE** - access user name data
- **VAL** - dynamically allow access to specified port(s) by specified user
- **XLT** - display or change device translators

Site Custom Elements Supported

- **Binary I/O services (similar to REX services but accessed through BIOS)**
- **Control Character Routines**
- **Terminal Translators**
- **Subscan Routines (subroutines called periodically within TSX)**
- **TSX Initialization Options: Prompt for date/time entry, Delay/hold TSX execution, Activate, kill, resume tasks, Attach tasks to timers, Attach tasks to interrupts**
- **Log-on/Log-off User Name Routines**
- **Transaction Logging Routine**
- **Port Log-off Routine**

Custom Elements

TSX recognizes the need for custom features to be added to TSX and its environment. A number of internal structures have been developed with this concept in mind. Examples of custom codes that may be added to the TSX task are summarized in the box above.

Custom pre/postprocessing application programs executed

at log-on and log-off may be included to perform accounting, file access, security, or other functions in a manner that is transparent to user applications.

Custom elements added to TSX have allowed control of TSX terminals to be given to other tasks or terminal handlers and to be returned in an orderly fashion. Others have implemented network pass-through capabilities allowing a TSX terminal to be dynamically connected to TSX on remote CPUs.

To assist in permitting user-written custom elements to be upwardly compatible with future TSX revisions, a complete set of TSX data structure equates is supplied.

Language Independence

The TSX I/O system interface guarantees language independence. Applications can be written in the most suitable language with equal access to all TSX functions.

Subroutine Libraries

Routines to support commonly used functions are available for FORTRAN, FORTRAN 77, COBOL, Pascal, C, and Assembly. These routines use terminal independent virtual codes for CRT-oriented transaction processing.

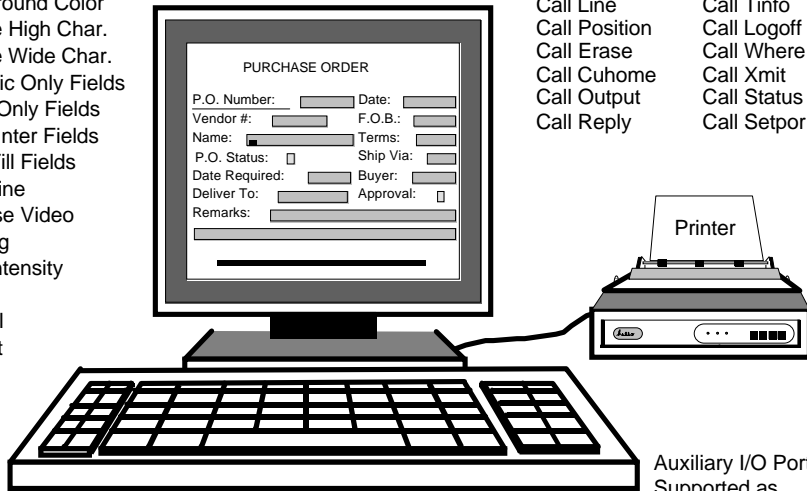
- **CALL FORM** - display data entry form on CRT
- **CALL LINE (LINE2)** - position data with or without visual attributes on specified terminal (A1 or A2 data)
- **CALL POS** - position cursor on CRT with up to 50 lines and 132 columns
- **CALL ERASE** - clear CRT screen from position specified to end of display, erase data for all unprotected blanks, or position cursor and output a virtual code to activate a different erase function
- **CALL CUHOME** - position cursor to first unprotected position on CRT
- **CALL OUTA1 (A2)** - output buffered data on specified terminal (A1 or A2 data)
- **CALL REPLY (REPLY2)** - read buffered data or Function Key input from terminal (A1 or A2 data)
- **CALL QREPLY (QREPL2)** - allow program to continue processing while receiving reply (A1 or A2)
- **CALL TREPLY** - terminate a QREPLY or QREPL2 call
- **CALL FLUSH** - request output of accumulated buffer data
- **CALL TINFO** - request information about a terminal: program name, load module, user id, resource name, loader option word, user alias, terminal name, terminal characteristics
- **CALL LOGOFF** - log off a port with or without locking it
- **CALL WHERE** - locate current position of cursor on CRT
- **CALL XMIT (XMIT2)** - transmit all unprotected data from CRT (A1 or A2 format)
- **CALL STLIN (STLIN2)** - turn off status line, display default status line, or display specified status line (A1 or A2 formatted message)
- **CALL SETPOR** - switch all I/O from caller's port to specified port (effects entire package of subroutines)

Screen Attributes:

- Foreground Color
- Background Color
- Double High Char.
- Double Wide Char.
- Numeric Only Fields
- Alpha Only Fields
- Must Enter Fields
- Total Fill Fields
- Underline
- Reverse Video
- Blinking
- High Intensity
- Zero
- Normal
- Protect

Subroutine Library:

- Call Form
- Call Line
- Call Position
- Call Erase
- Call Cuhome
- Call Output
- Call Reply
- Call Flush
- Call Tinfo
- Call Logoff
- Call Where
- Call Xmit
- Call Status Line
- Call Setpor



Status Line
Line Drawing

Application Defined,
Terminal Independent
Function Keys

Local Editing Keys
(Tab, Erase, etc.)

Send/Enter Block &
Conversational I/O

Auxiliary I/O Port
Supported as
Separate Logical
Device

Figure 4: TSX Programming Aids and Generated Form

Forms Generator

CRT forms are convenient for use as application program screens, menus, and log-on displays. The TSX Forms Generator simplifies the creation, storage, and maintenance of CRT forms. Forms up to 160 columns by 64 lines are supported. The TSX Forms Generator converts user-supplied screen source input into a compact form, utilizing the virtual terminal control codes, then stores the forms on direct-access files for later use.

Application programs can efficiently handle data entry and retrieval using TSX forms and the buffered input ability of TSX. User programs simply request a form to be displayed; TSX does the rest. Since forms are not embedded in application programs, forms maintenance can be performed without affecting executable programs.

TSX also makes terminal independent screen attributes, function keys, and local editing keys available for use.

Terminals Supported By Standard Translators

- ADDS Regent 200,60
- Ann Arbor Ambassador
- Beehive DM20
- Beehive DM5 Plus
- Data Media Color Scan 60
- Direct 800 C
- Hazeltine 1510/1520
- Hazeltine Modular One
- Hazeltine Esprit III
- Hewlett-Packard 2392A
- Hewlett-Packard 150 II
- IBM 3164
- IBM PC/XT/AT, PS/2, and compatibles
- Lear Seigler ADM 31
- Lear Seigler ADM 42
- TeleVideo 912B, 912C
- TeleVideo 920B, 920C
- TeleVideo 925, 950
- TeleVideo 955, 965
- Visual 300, 550
- Wyse WY-50
- Zentec Zephyr 8001

ADDENDUM

The following provisions have been established for Software Licensing, Installation, and Maintenance for TSX Time Sharing Executive and Transaction Processor.

Documentation

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

Licensing

TSX 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

TSX software is provided to customers in object code format.

Software Release Media

The standard release of TSX is provided on either 9 track 800 or 1600 BPI magnetic tape. Software can be provided on alternate media subject to additional media/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 LDC.

Maintenance

Each TSX 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.

Optional Software

Additional TSX companion software packages are available to provide standard solutions for extended user controlled password security, TSX and user information logging, and a flexible menu system.

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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