XTCC - eXtended Tape Control Center

Product Characteristics

This paper gives an introduction to a graphical, Tcl/Tk based system monitoring tool called XTCC used on peripheral systems connected to mainframes. In general this application is available for SP_CC (Standard Peripheral Channel Connector) and CentricStor (a Virtual Tape Library System) systems, both systems being products from Fujitsu Siemens Computers GmbH and based on standard PC technology. XTCC is used for administering, supervising and diagnosing magnetic and virtual tape devices connected to the SP_CC or CentricStor. The clear graphical user interface enables an entire magnetic or virtual tape device configuration (channel adapter boards, SCSI boards and magnetic or virtual tape devices) to be displayed on a single screen. Bottlenecks and failures become immediately obvious and the integrated performance monitor provides an extremely quick analysis of the data backup concept so that the backup time frame can be optimized. The existing data backup equipment can therefore be perfectly coordinated by simply changing the configuration parameters. XTCC can be used both locally and remotely and hence it plays a major role in the maintenance concept for these systems. XTCC is available for MS Windows, Linux and SINIX (a Siemens UNIX derivative).

Figure: XTCC introduction screen

The mainframe environment

The SP_CC is a converter for mainframe channel to SCSI protocol. On the mainframe channel, SP_CC emulates a fixed set of dedicated mainframe tape devices. In this way it is possible to connect the latest SCSI tape drives to mainframes without any changes in the mainframe hardware or software. The base for SP_CC is a standard PC with a special channel adapter card. On the SP_CC SINIX is used as the operating system, a standard UNIX SVR4 derivative from

Siemens which has been extended with special drivers for the channel adapter board and for the SCSI host adapter board, together with an emulation software that implements the protocol conversion. On the mainframe side, the SP_CC supports IBM MVS systems and Siemens BS2000 systems (both ESCON and OEMI channel interfaces). The supported devices are IBM tape devices called Magstars with a capacity of up to 100 MB per cartridge and a performance up to 15 MB/s over the channel to the tape. There are very high requirements for availability and reliability of such tape devices when attached to mainframes, because of the usage domain of the majority of mainframe applications namely banking, civil administration, insurance or police departments. To fulfil this requirement, it is necessary to provide a very secure configuration and during operating to detect problems in the system at the earliest possible moment in time. The sum of all these requirements makes it very complicated to manage the tuning of the system. The only effective way to control all these processes is to visualize all of these dependencies in a graphical way.

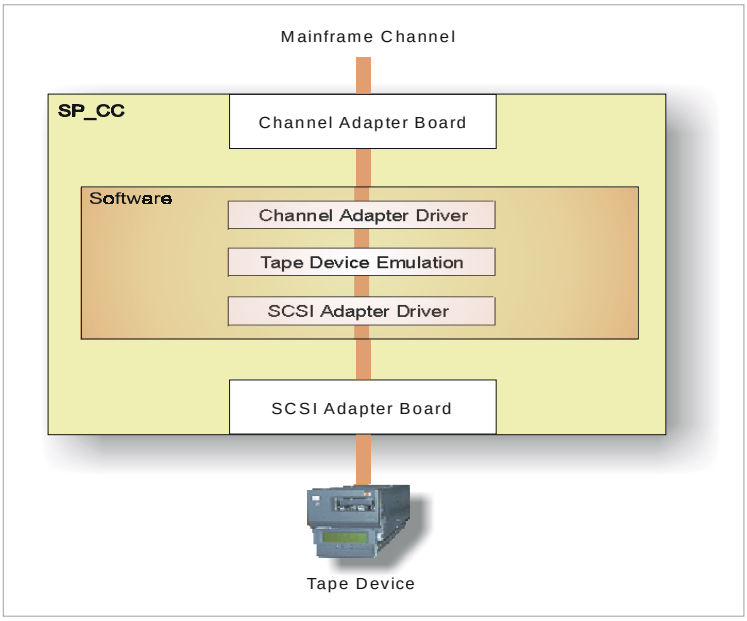


Figure: The principle of the SP_CC

CentricStor is a level more complex, because CentricStor is a cluster of several SP_CCs. The SP_CCs are connected by LAN for the control flow and by fibre channel for the data flow. The main goal is to manage the communication of all the components of that complex and to organize the co-operation of all resources. CentricStor has self organizing algorithms for resource work flow and early error detection and automatic error correction. The tape drives visible

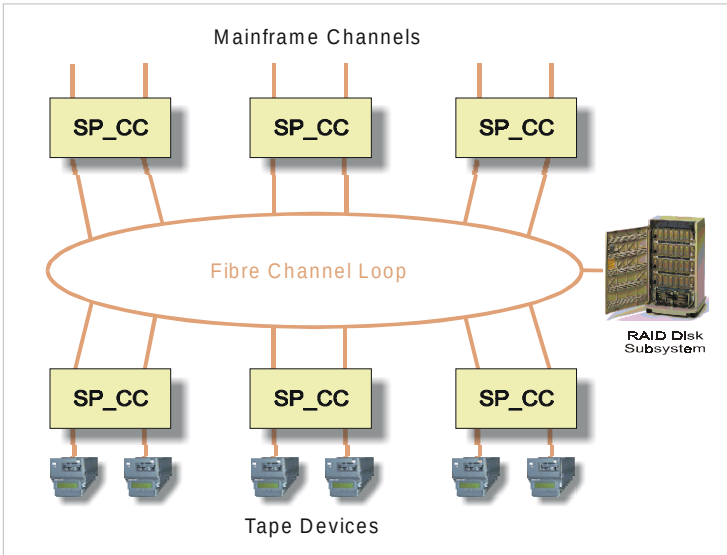


Figure: The Principle of the CentricStor

from the mainframe point of view are in reality virtual drives that are emulated in a RAID system. For this reason, the tape drives provide a very high performance for the mainframe. The RAID system is used as a cache. The contents of the cache is swapped out automatically to real tape drives in a robot library system without any influence from the mainframe. The mainframe only requests to read or write data to the tape devices and gets the same behaviour from the CentricStor as it would from real tape drives. It is therefore clear that there is a need to have a well organized administration tool to manage the complicated processes and dependencies of such systems. XTCC is able to provide that service.

Data model and realization

The accumulation of the displayed system data of the XTCC must be independent of the real graphical user interface. This is a requirement to guarantee the availability of XTCC in critical situations too. If XTCC directly observed the real hardware, then there could be situations where if the hardware hung, the XTCC would hang too. There are a lot of examples of erroneous behaviour in practice, for example if any tape drive gives a wrong answer on SCSI bus, the whole SCSI bus could be blocked. Any application that accesses the SCSI bus in that situation will block too.

For this reason, on each SP_CC there is a central database called the InfoBroker that collects all system relevant information. The main goal of the InfoBroker database is to give a common interface to get or put information from or to the system. The InfoBroker has an object oriented handling of all information from system components. So it is very easy to connect or combine different contents to form new objects and information sources. The database works together with a lot of utility programs, so called InfoBroker Managers, which are each responsible for a specific task. For instance, each Target Manager is responsible for collecting data from a certain SCSI target. If the SCSI target hangs, only the specific instance of the Target Manager that is responsible

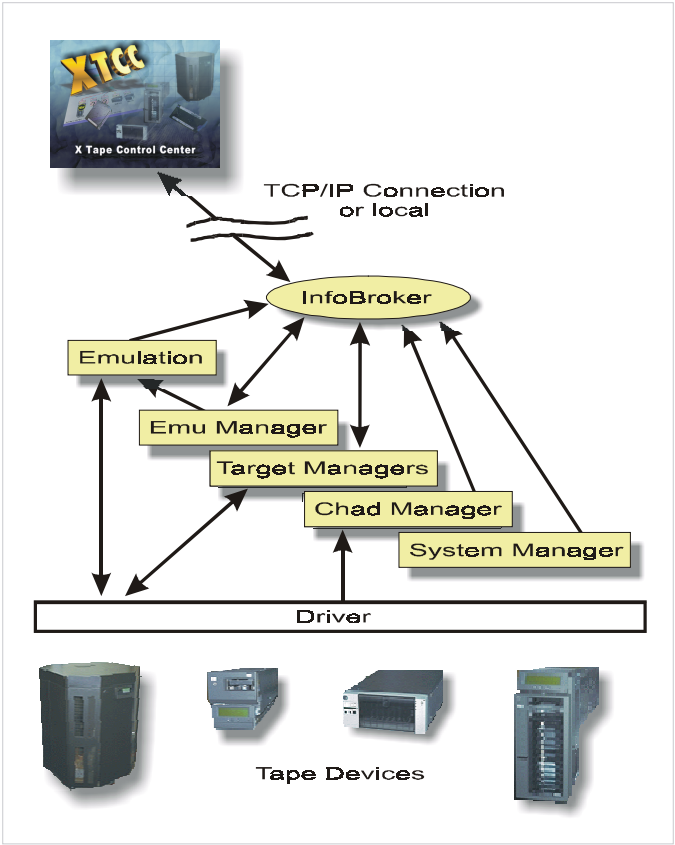


Figure: XTCC and the system dependencies

for that target will be effected. In other words the graphical user interface is able, even in the situation in which one or more utility programs are blocked, to get at the rest of available system information and to initiate actions to clear the failure, for example to reset the SCSI bus. Of course, all applications which have direct access to a device have a connection to the InfoBroker database because they are best able to decide at which moment it is possible to provide the needed system information without any adverse effect on the performance of the system. The database is constantly updated by all the components involved in the data and control flow. The InfoBroker Manager programs are on a higher level than the applications that are dealing directly with the devices. The InfoBroker Managers monitor all the common applications in the system and provide information about any incorrect behaviour of these applications. To guarantee the continuity of the system, they could restart these applications if any one of them dies. The Emu Manager, for instance, monitors the tape emulations and provides all services necessary within the environment of the emulations, like collecting traces, monitoring shared memory areas of the emulations for status information, stopping/starting/configuring emulations and so on.

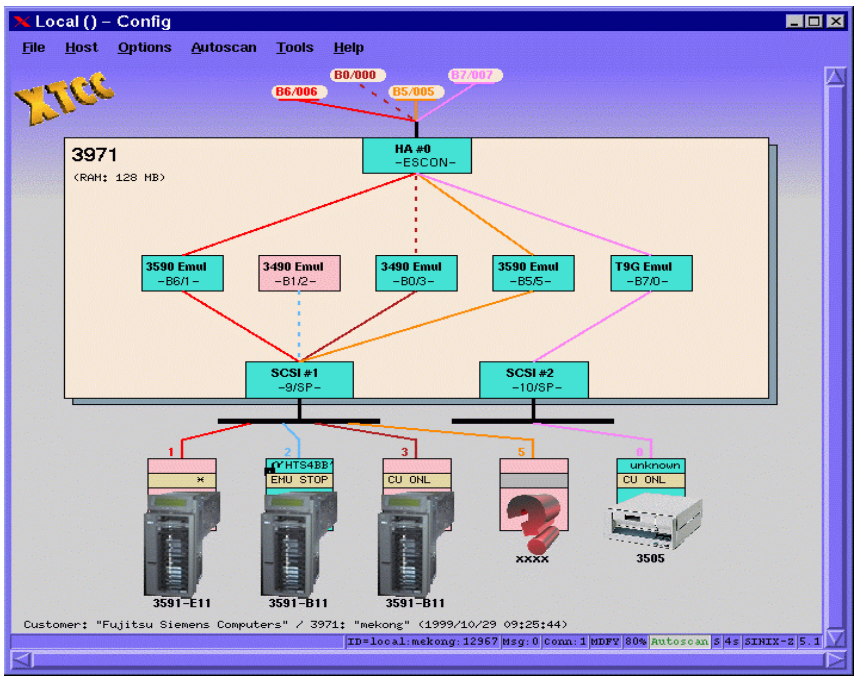


Figure: XTCC main screen. The operating status of the current tape configuration is shown. For all shown objects an information window is available by depressing the left mouse button and a function menu by depressing the right mouse button.

The main function of XTCC is to display the information provided by the InfoBroker database. XTCC connects to the InfoBroker database from any point in the network via TCP/IP. XTCC polls at a certain interval, that is dynamically varied according to the number of shown objects. It then generates a graphical overview of the system data taken from the InfoBroker database. So it is possible for an XTCC user to see all events of the system almost at the time at which they occured in the system. At the beginning there was an alphanumeric user interface called TCC. It was possible to do the same basic functions for devices and emulations as with XTCC today but it was not possible to see the real dependencies of all the parts. This lead to wrong decisions during maintenance or configuration. Furthermore, TCC observed the devices directly which often led to situations where TCC was blocked when it was

most urgently needed. Additionally, such a large amount of information and the complex states of such a system can only best be shown graphically. The first prototype of XTCC was implemented in 'C' based on the Xlib interface of UNIX. The growth of system information and numerous requests for functional extensions to XTCC resulted in a redesign of XTCC and a decision as to what kind of graphical interface should be used. A major requirement was operating system and hardware independence. Another requirement was that future extensions could be quickly made. The only way to accomplish all these requests was to use Tcl/Tk. A tool based on Tcl/Tk needs no further runtime environment and provides a very quick extension of the graphical user interface for the tools using it.

Functions and examples

XTCC provides a lot of functions in the area of device and system administration. It is possible to read the content of the tape device display, which is most convenient when the tape device stands in the basement. Moreover it is possible to change the configuration in the tape device itself, normally only possible on the devices' engineering panel. Nearly all functions that are possible over the SCSI interface are available, starting from setting display content, reading/writing log or mode pages and ending with rebooting of the drive itself. Loading or unloading the device is also available, including administration of mini libraries or cartridge stackers.

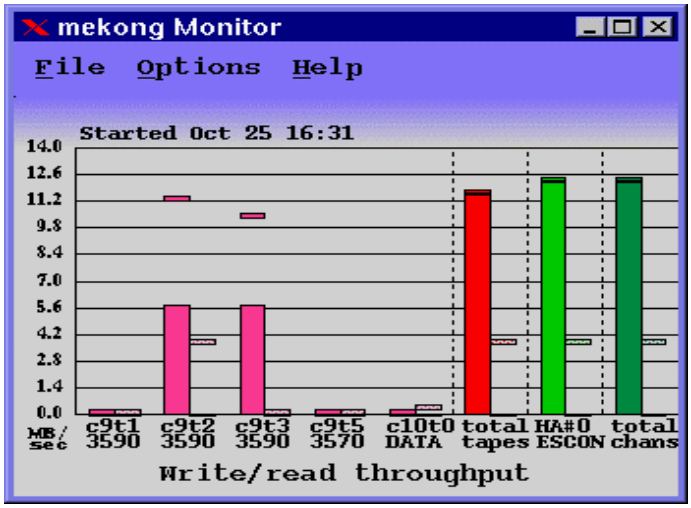


Figure: The current data throughput at the devices and channels is shown in this bar chart.

Within the system environment there are a lot of services. For instance monitoring the used capacity of file systems and automatically starting a housekeeping and log rotation task if there is no more space available. In this case unwanted dumps or trace files found on the system will be removed. A lot of special system files are monitored, to ensure that when they are changed the correct tools can be started by the system to update the objects in the database depend on the files' content. Different points of performance measurement are available in the system. They all can be shown in a graphical way too, as bar or line graphs. So it is very easy to see whether all system components are working within allowed ranges or not. For example, any system component updates or changes in components within the customer environment can quickly be seen to be working correctly and, if not, problem areas can be quickly identified.

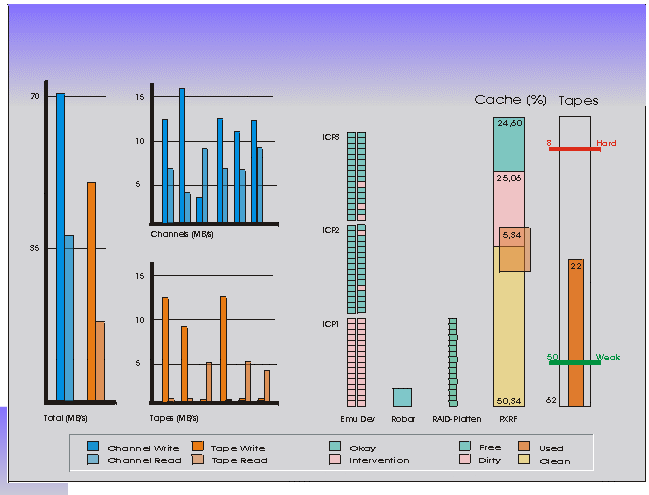
InfoBroker also has an SNMP MIB parser, so XTCC is able to function as an SNMP observing center too. For CentricStor systems this possibility is used to observe the fibre channel hubs and switches. In case of errors, SNMP traps are reported via XTCC and routed from the InfoBroker to the next available customer remote diagnostic service center. In this way, an optimum availability and serviceability are guaranteed.

A lot of configuration possibilities of the system are also available via XTCC. For instance, the complete configuration of tape or virtual device emulations. This function has also the ability to configure a group of emulations in one step. With help of this function, it is possible to configure the system within seconds.

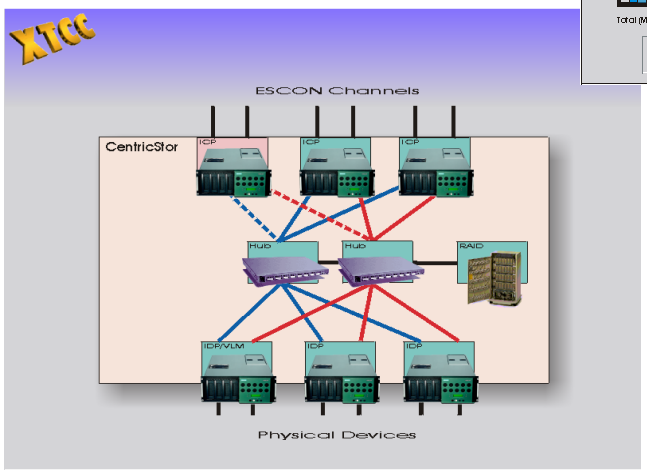
Furthermore a lot of help functions are available, like printing the system overview, file transfer, file selection, a hexdump viewer, resizing of XTCC screen and a communication feature to send messages to other XTCC users, who are connected to the same InfoBroker database. XTCC also has a security check to provide different user levels. It is possible to work in evaluation, observation and modification mode. In evaluation mode only the system overview is shown, the help information can be read but nothing else. In observation mode it is possible additionally to start the performance monitor, to read all system information like traces etc. or to pack trace information for delivery to the service center in case of problems occurring. This is in general the normal user mode for the unauthorized user. In modification mode all facilities are allowed. This mode is for the service and maintenance staff and for the system operators.

Looking into the Future

The InfoBroker will be adapted to run under other systems, like Solaris and SINIX-Y (a MIPS processor based UNIX system from Fujitsu Siemens Computers GmbH). It is possible to control and to configure via XTCC and InfoBroker all parameters of the system in principle. So the focus will change from tape administration to complete system administration. Maybe then XTCC will be renamed XSCC (X System Control Center) for instance. It should be also possible to use XTCC on any other systems, if there is at least a usage scenario between any application and a device. For instance, to control the applications running directly on a mainframe or on any other server. The possibility to control or observe devices or systems via SNMP will be expanded. Either information received via SNMP will be integrated into the known XTCC screen layout or there will be some additional screens which will display this data. In this way it is possible to visualize ESCON channel directors as well. At the moment, development of further components for the graphical user interface for CentricStor is taking place. It will be made available as the GXTCC (Global XTCC), which will show all the SP_CC nodes of a CentricStor at a single glance and will also include the other components such as the fibre channel network and the RAID cache systems. Moreover a global status screen will show all of the relevant parameters from a CentricStor, such as cache and tape pool utilization and the performance of all CentricStor nodes together. In this way the user will have a tool with which, at a single glance, it is possible to see if the system is running correctly or exhibiting deviation from the normal behaviour. The user can tune or adapt the system for optimum performance based on his own usage profile. For instance, if the user has a smaller backup window due to growing data volume or



Top: CentricStor global status screen



Left: Global XTCC shows all dependencies in a CentricStor system

increased application usage, he can easily configure some additional virtual devices to increase the speed of backup applications and then observe the system via GXTCC to see if extra physical tape units are required or if more RAID cache is needed or if everything is okay.

Examples of available functions today

For tape devices the following functions are available (selected examples, not all):

- Unload / load cartridges
- Show or change device configuration data (for 3591 and 3570) without using the control panel on the device
- Show logging data such as SCSI sense data, statistical data, MIM (Media Information Messages), SIM Service Information Messages)
- Reset tape device (reboot)
- Load firmware
- Performance monitor with bar graph and flow chart history display
- Show contents of device display
- Show loaded cassette type
- Report device faults
- Show the cartridge content
- Show the stacker content of tape device

For the system the following functions are available (selected examples, not all):

- Print graphs
- Zoom function for the graphic display
- Access control
- Save current system status for subsequent offline analysis
- Text viewer with search and highlight function for displaying any system files
- Show internal SCSI devices such as hard disks, CD-ROMs, streamers, etc.
- Start/stop magnetic tape emulations
- Start/stop the trace for magnetic tape emulation
- Memory trace for magnetic tape emulations so that information can still be retrieved in the event of a fault even though the emulation trace was not operational
- Show CCW (Channel Command Word - the mainframe I/O commands) path flow (if emulation trace is activated)
- Show channel device reservation (Attach/Detach - vary online/offline)
- Pack all error documentation
- Configure the tape device emulations

- SNMP monitor for other reachable devices via the LAN, like hubs and fibre channel switches. XTCC contains in principle the functionality of an SNMP service center
- Show BIOS and system version
- Transfers files from the remote system

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