RC5000 MegaSwitch

General Description

Keywords:
RC5000 MegaSwitch, Hardware Components, Software Components.

Abstract:
This manual gives an overall description of the hardware and software components in the RC5000 MegaSwitch System. The manual defines concepts and terms used in the other MegaSwitch manuals.

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PN: 99001445

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1. INTRODUCTION

The RC5000 MegaSwitch node is a node in the RcPAX datagram network.

This manual gives an overview of the RC5000 MegaSwitch hardware and software components. This manual defines basic concepts and terms, and is a prerequisite for the other manuals in the RC5000 MegaSwitch series.

This manual is a revised version of:

RC5000 MegaSwitch
General Description
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1.1 Structure of this manual

Chapter 2 contains an overview of the RC5000 MegaSwitch and defines the concepts that are necessary in the other chapters.

Chapter 3 describes the RC5000 MegaSwitch hardware components. Chapter 3 is a prerequisite for reading the RC5000 MegaSwitch Hardware Manuals (ref. 6-17).

Chapter 4 describes the RC5000 MegaSwitch software components and is a prerequisite for the RC5000 MegaSwitch Software Manuals (ref. 3-5).

Chapter 5 is a guide to other manuals describing the RC5000 MegaSwitch.

Appendix A is the reference list.

Appendix B contains a survey of figures and a catchword index.

2. RC5000 MEGASWITCH OVERVIEW

The RC5000 MegaSwitch provides a routing capability for transit lines up to 2 Mbps as well as access capability for X.25/X.32/X.75 subscriber lines up to 1 Mbps.

The RC5000 MegaSwitch can be connected to other RC5000 MegaSwitch through transit lines up to 2 Mbps. The RC5000 MegaSwitch can be connected to RC5000 Network Switch nodes through transit lines up to 64 kbps.

An RC5000 MegaSwitch contains a number of different boards depending on the wanted configuration. The MTC240 (Mega Transit Controller) board supports two 2 Mbps transit lines. The MAC240 (Mega Access Controller) board supports four 64 kbps transit lines. The MAC241 board supports four 64 kbps X.25/X.32/X.75 subscriber lines or transit lines. The MAC242 board supports four X.25/X.32/X.75 subscriber lines or transit lines, with baudrate selectable from 1200 bps up to 1 Mbps. Furthermore an RC5000 MegaSwitch includes an MCC240 (Mega Central Controller) and an RC5000 CPU.

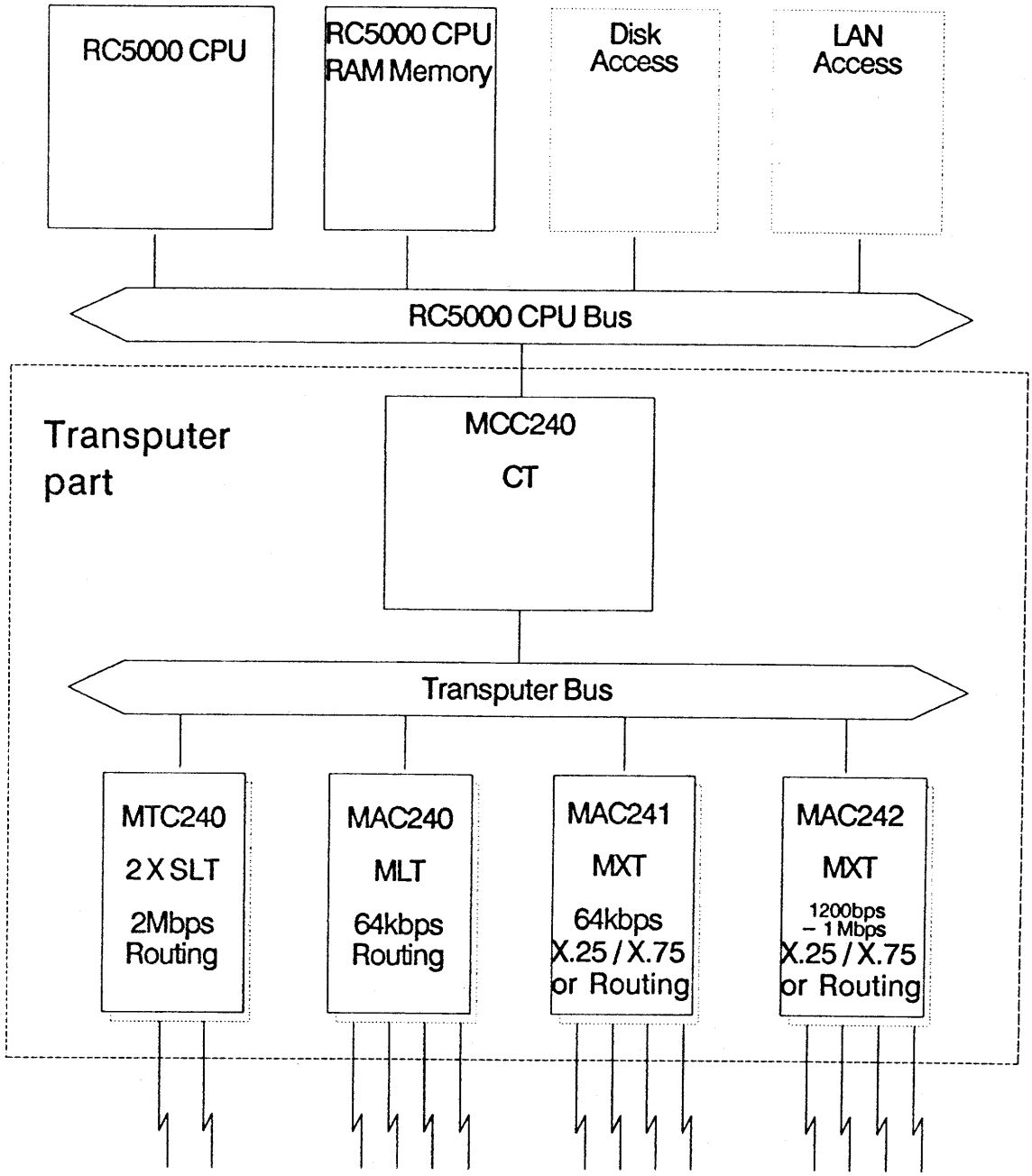

Fig. 2.1. RC5000 MegaSwitch structure

The MCC240, MTC240, MAC240, MAC241 and MAC242 boards are called the transputer part of the RC5000 MegaSwitch, as they each contain T414/T425 transputers.

All lines have an XPC chip from Motorola as protocol controller. The XPC is an intelligent communications controller implementing the CCITT X.25/2 LAPB 1984 protocol (ref. 22).

Four basic transputer elements are defined. Each element contains a transputer as processor and some memory. The following abbreviations are used:

CT: Central Transputer. The MCC holds one CT.

SLT: Single Line Transputer. The MTC holds two SLT. Each SLT serves a 2 Mbps transit line.

MLT: Multi Line Transputer. The MAC240 holds one MLT. An MLT serves four 64 kbps transit lines.

MXT: Multi X.25/X.75 Transputer. The MAC241 and MAC242 hold one MXT. An MXT serves four subscriber lines or transit lines.

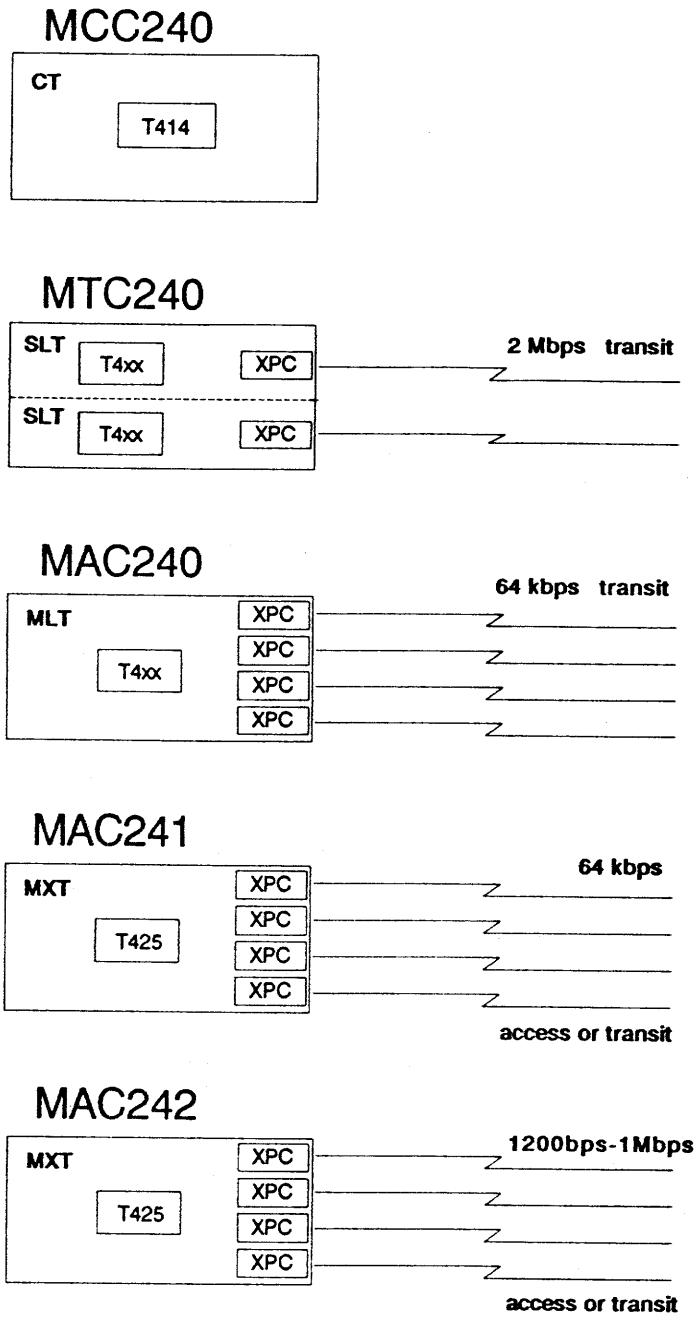

Fig. 2.2. Boards and transputers

The HDLC lines on an RC5000 MegaSwitch are numbered by connector numbers from left to right, and on one board from top to bottom. The first connector number is 2. Lines are identified by connector number (line numbers, known from RC5000 Network Switch, are not used).

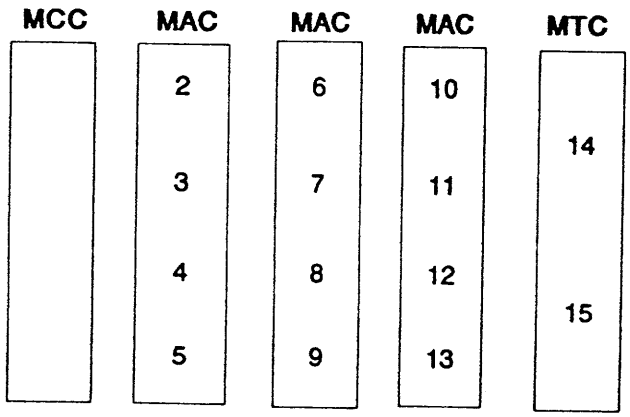

Fig. 2.3. Connector numbers (an example)

The physical layer conforms to CCITT recommendation G.703 (ref. 21) for both the 64 kbps and 2 Mbps lines on MAC240, MAC241 and MTC240. Furthermore, the 2 Mbps lines use the frame structure defined by recommendation G.704 (ref. 21). For MAC242 the physical layer conforms to either V.24/V.28, V.35, X.21 sec. 5.2 or V.36/V.11.

The data link layer conforms to the CCITT X.25/2 LAPB protocol (ref. 20). On transit lines the RcPAX Router protocol (ref. 18 and ref. 19) is used on top of the data link layer. The packet layer on subscriber lines conforms to the CCITT X.25/X.32/X.75 1980 and/or 1984 versions.

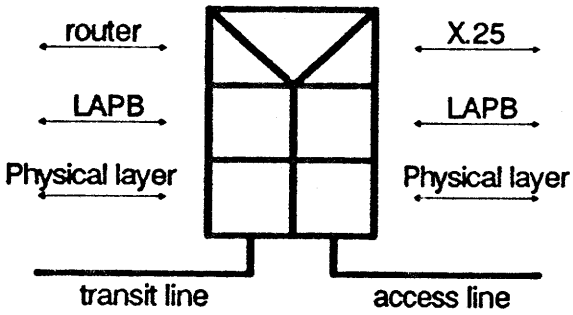

Fig. 2.4. Protocols on the lines

The unique feature of the RC5000 MegaSwitch is the utilization of 2 Mbps lines, which increases the packet switching capacity and reduces the delay through the network considerably.

A group of RC5000 MegaSwitch nodes may be connected by 2 Mbps lines, implementing a fast transit network. The nodes should be connected by lines in a way, that a single line or node failure will not separate the network into islands.

Access to the transit network is accomplished by X.25/X.32/X.75 access lines up to 1 Mbps.

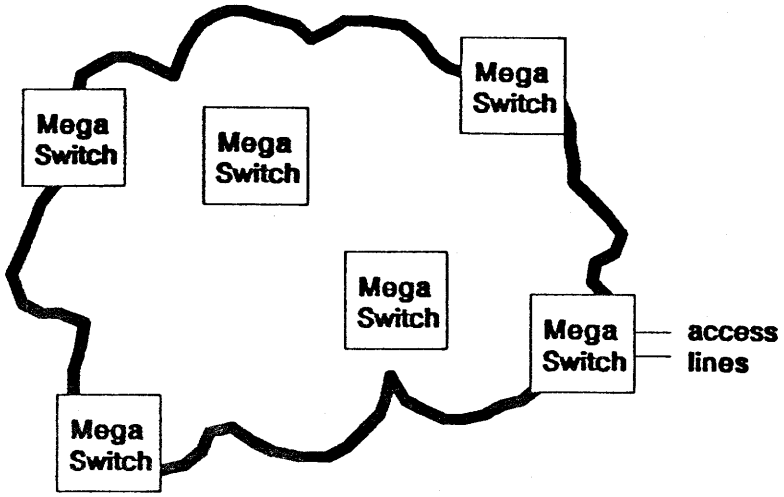

Fig. 2.5. A network

Fig. 2.6 is an example of how some RC5000 MegaSwitch nodes can be connected in order to obtain security in case of node or line failures.

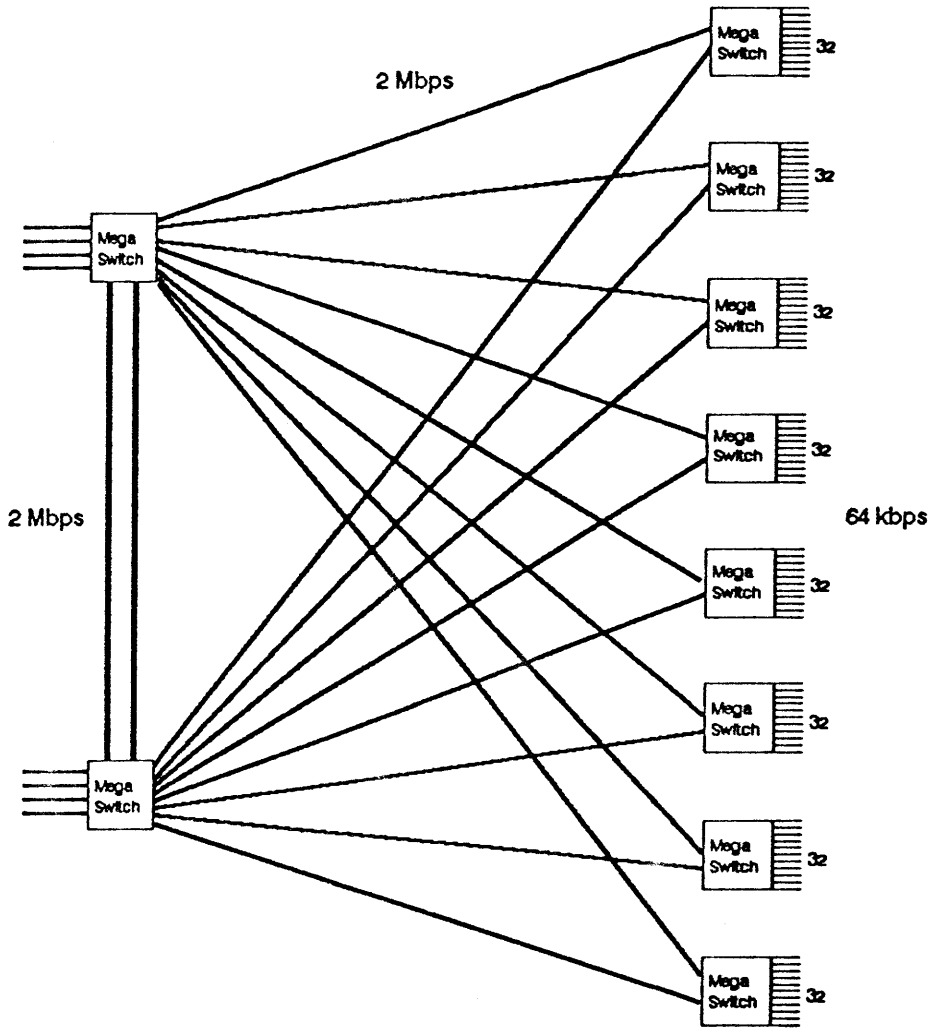

Fig. 2.6. Example with RC5000 MegaSwitch nodes

3. HARDWARE COMPONENTS

An RC5000 MegaSwitch Basic Switching Unit consists of an RC5000 CPU and a transputer part.

RC5000 MegaSwitch Basic Switching Unit

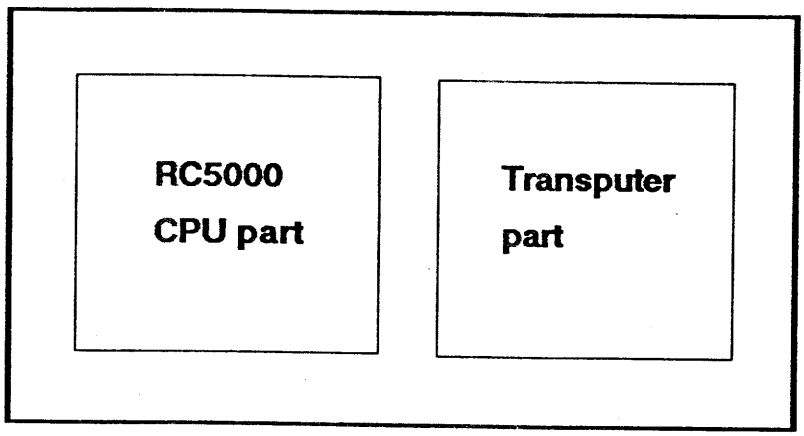

Fig. 3.1. RC5000 MegaSwitch building blocks

The RC5000 CPU part is a configurable computer system. To build an RC5000 MegaSwitch Basic Switching Unit, the minimum RC5000 CPU part consists of the following items:

1. CPU215, CPU216, CPU217 (RC5000 CPU)
2. CRA240 (F5230)
3. Powersupply (POW240, POW241)
4. MEM209 (3MB memory)

CRA240 (item 2) is a card frame in which the back plane PCBA (Printed Circuit Board Assembly) realizes both the RC5000 CPU and the transputer back planes. Identify register is included on this PCBA.

The RC5000 CPU part will not be further described in this manual.

The transputer part consists of:

1. MCC240, MegaSwitch Central Controller
2. MAC240, MegaSwitch Access Controller
3. MAC241, MegaSwitch X.25/X.75 Controller
4. MAC242, MegaSwitch X.25/X.75 Controller
5. MTC240, MegaSwitch Transit Controller
6. TEM240, Termination Board

An RC5000 MegaSwitch holds exactly one MCC240. An RC5000 MegaSwitch holds none, one or several pieces of the items MAC240, MAC241, MAC242 and MTC240.

An RC5000 MegaSwitch holds one TEM240 if the card frame is not full. If the card frame is full, TEM240 is omitted.

The MCC is the central module, which communicates with the Network Management center via an interface to the RC5000 CPU part.

The MTC handles 2 full duplex 2Mbps HDLC (LAPB) lines and the MAC240/241/242 handles 4 full duplex HDLC (LAPB) lines with line speeds up to 1 Mbps.

A main component used on the MCC, MTC and MAC boards is the INMOS T414-20 or INMOS T425-20 transputer. It is a micro processor with on-chip memory and four serial links for interconnection with other transputers. The links make the transputer very well suited to build high performance concurrent systems. Detailed information about T414-20 or T425-20 is found in ref. 22.

Another main component used only on the switching boards (MTC and MAC) is the XPC, which is an intelligent X.25 Protocol Controller implementing the CCITT X.25 LAPB recommendation (1984) (ref. 23). The XPC can support point to point communication with line speeds up to 10 Mbps.

The internal registers of the XPC is accessible from the transputer software via the XPC transputer interface on the MTC and MAC boards. Refer to blockdiagrams figures 3.3, 3.4, 3.5 and 3.6. The XPC transputer interface converts transputer 32-bits bus to XPC 16-bits bus and vice versa. The interface also contains interrupt logic and bus logic for access to RAM. During initialization the transputer configures the XPC(s). After the initialization sequence the communication between XPC and transputer takes place via data structures in shared RAM. Packet data to/from lines are stored into/read from memory by the XPC making DMA accesses.

3.1 Mega Central Controller (MCC)

With suitable software running, the MCC supports the following functions of an RC5000 MegaSwitch:

- Load, reset and dump of processors
- Distribution of routing information between the processors
- Distribution of Network Management control information to other processors
- Communication with the Network Management Center via the RC5000 CPU part
- Testfunctions included in EPROM's

The MCC contains a transputer element called CT (Central Transputer). A CT includes the following functional blocks:

- T414-20 Transputer
- 2 Mbyte Dynamic RAM
- 512 Kbyte UVEPROM
- Interface to RC5000 CPU part
- Watchdog function
- Debug console interface
- Diagnostic System interface
- Interface to Transputer Development system (TDS)

The CT blockdiagram is shown in figure 3.2.

Data transfer between the RC5000 CPU part and the transputer part takes place via an interface located on MCC board. The transfer mode may be DMA or single byte.

The watchdog function is programmable from the transputer. The watchdog is a retriggerable timer.

The Debug console interface is a standard V.24/V.28 asynchronous interface. By means of this interface it is possible to control the built in testprograms.

Through the Diagnostic System the CT can make individual reset and analysis of transputers located on other printed circuit boards (MTC, MAC) of the RC5000 MegaSwitch. The Diagnostic System also enables the CT to read error flag, and identification and version numbers of the above mentioned transputers.

The TDS interface makes it possible to connect a Transputer Development System to the MCC. The TDS is an integrated programming environment developed by INMOS to support the programming of transputer networks. TDS consists of editor, file manager, compiler and debugging system.

Detailed information about TDS can be found in ref. 24.

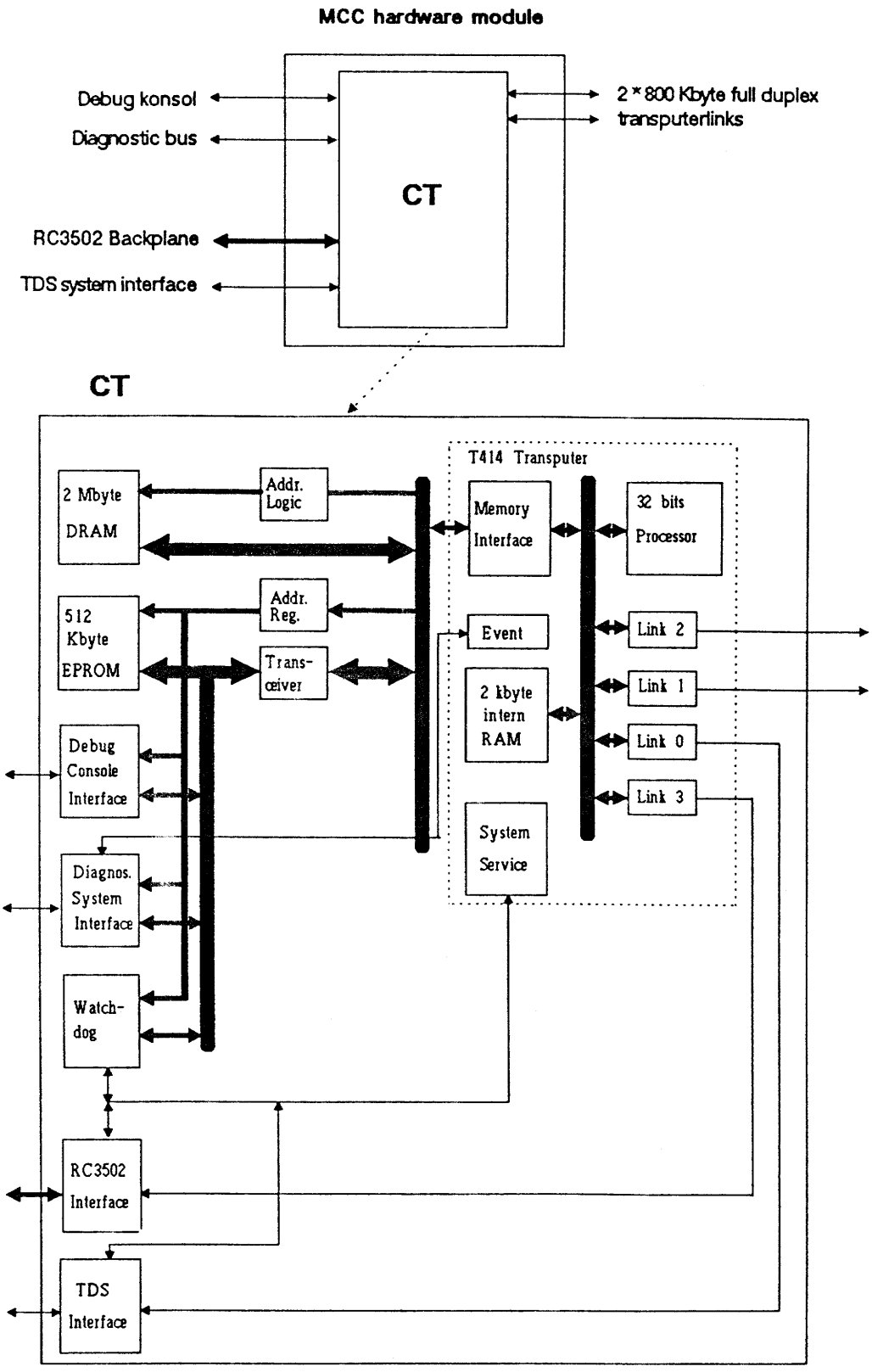

Fig. 3.2. Mega Central Controller

3.2 Mega Access Controller (MAC240)

The MAC240 contains a transputer element called MLT (Multi Line Transputer). An MLT consists of the following functional blocks:

- T414-20 or T425-20 Transputer
- Four MC68605 X.25 Protocol Controllers (XPC)
- 512 Kbytes of Static RAM
- Diagnostic System Interface. (See section 3.1)
- Four G.703 64 kbps co- and contra directional line interfaces
- Loopback function for line interface

The MLT blockdiagram is shown in figure 3.3.

Each of the four line interfaces is G.703 64 kbps type. By straps in the line cable connectors it can be individually selected if an interface shall be of co - or contra directional type.

As an error diagnostic facility a loop switch based on relays is dedicated each interface. The loop switch realizes both the near and the remote loop at the same time. The loop switch is controlled from the transputer or from an external controller, which is of the user's responsibility.

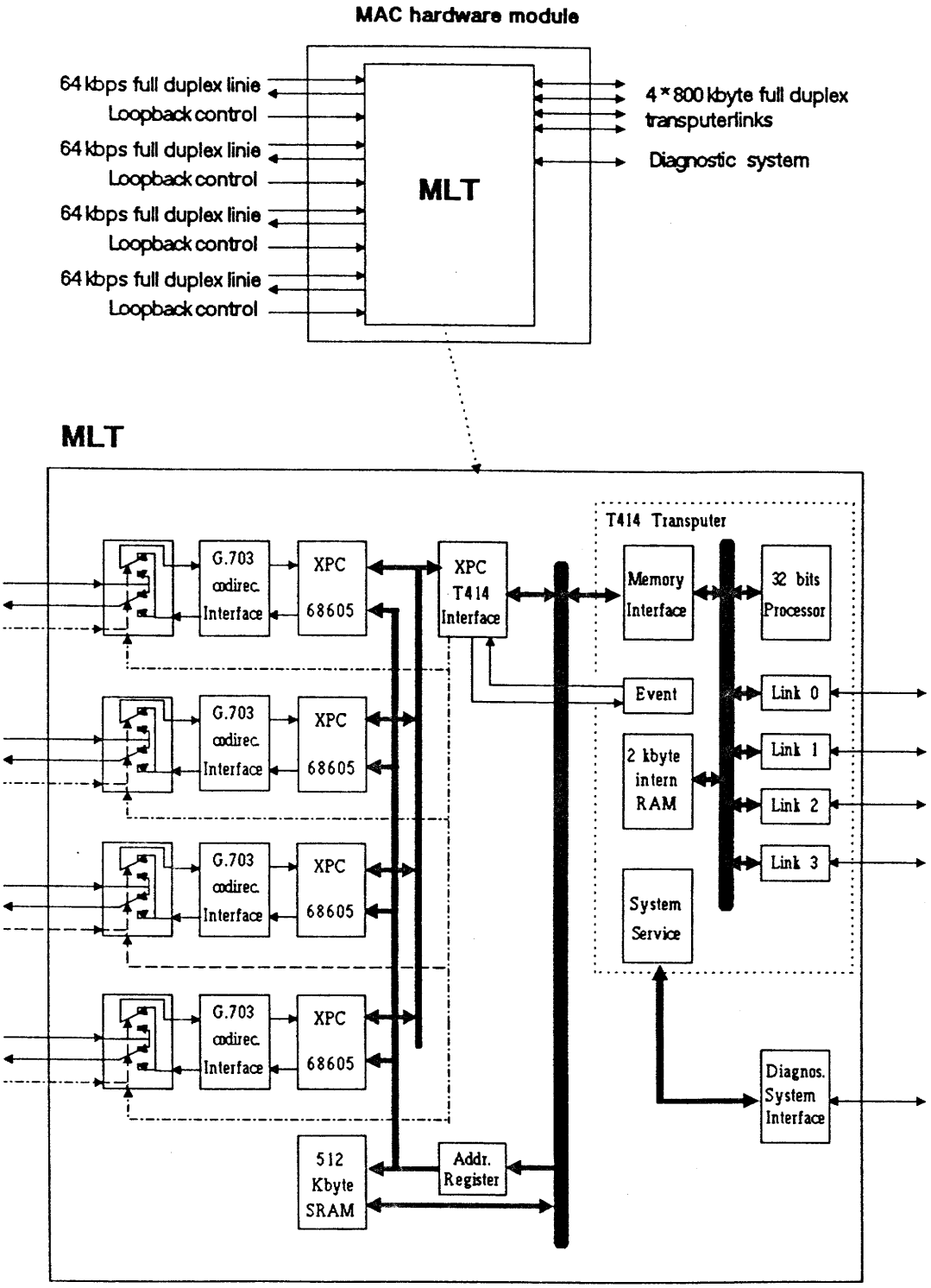

Fig. 3.3. Mega Access Controller

3.3 Mega X.25/X.75 Access Controller (MAC241)

The MAC241 contains a transputer element called MXT (Multi-Line X.25/X.75 Transputer). An MXT consists of the following functional blocks:

- T425-20 Transputer
- Four MC68605 X.25 Protocol Controllers (XPC)
- 4M bytes of Dynamic RAM
- Diagnostic System interface (see section 3.1)
- Four G.703 64 kbps co- and contra-directional line interfaces
- Loopback function for line interface

MAC241 difffers from MAC240 in the way that MAC241 has a 4 Mbytes on board dynamic RAM, while MAC240 has 512 Kbytes of on board static RAM. The 4 Mbytes of RAM makes the MAC241 well suited for X.25/X.75 access nodes with many logical channels.

The MXT block diagram is shown in figure 3.4.

Each of the four line interfaces is G.703 64 kbps type. By straps in the line cable connectors it can be individually selected if an interface shall be of co- or contra-directional type.

As an error diagnostic facility a loop switch based on relays is dedicated each interface. The loop switch realizes both the near and the remote loop at the same time. The loop switch is controlled from the transputer or from an external controller, which is of the user's responsibility.

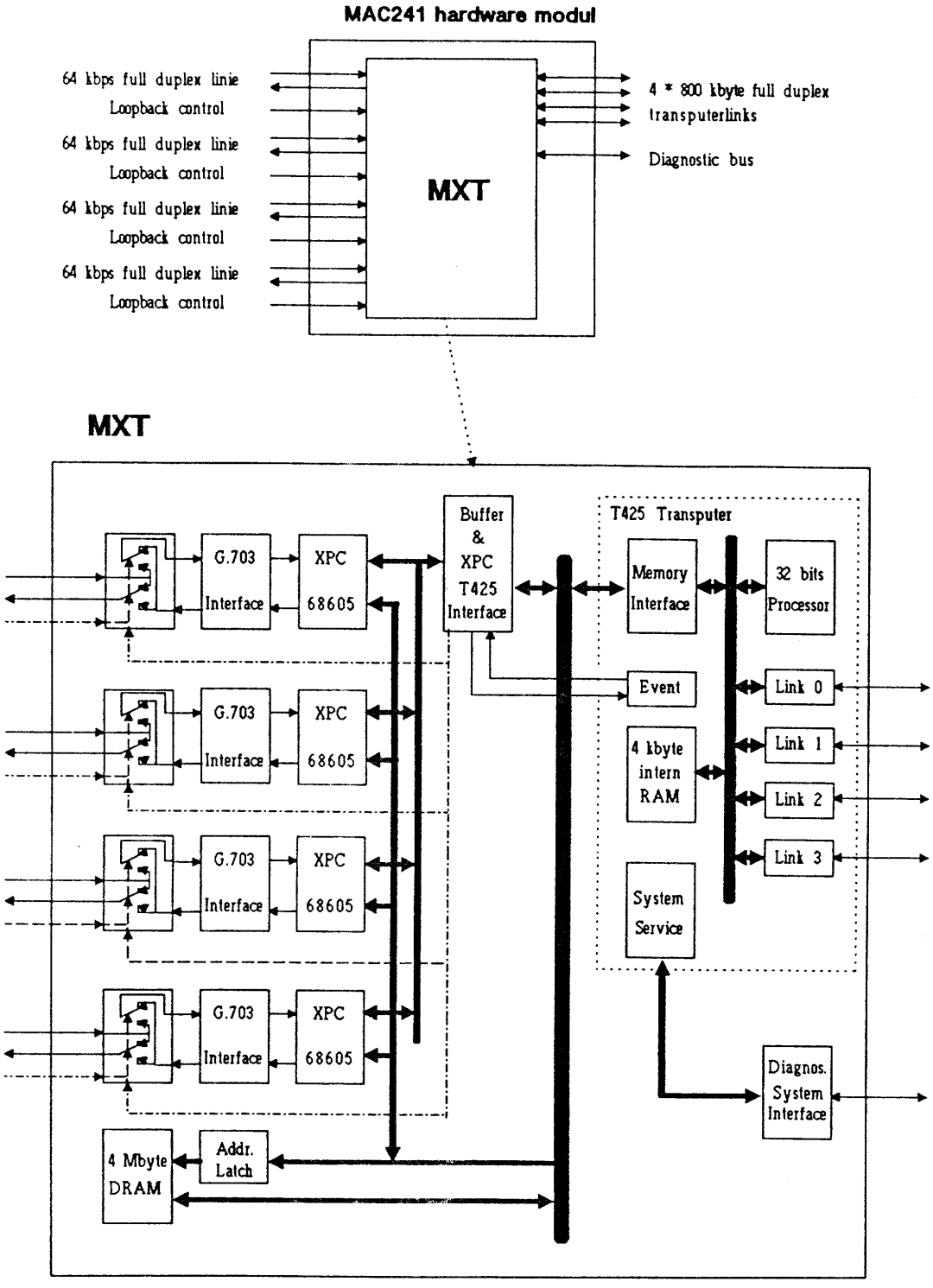

Fig. 3.4. Mega X.25/X.75 Access Controller

3.4 Mega X.25/X.75 Access Controller (MAC242)

The MAC242 contains a transputer element called MXT (Multi-Line X.25/X.75 Transputer). An MXT consists of the following functional blocks:

- T425-20 Transputer
- Four MC68605 X.25 Protocol Controllers (XPC)
- 4M bytes of Dynamic RAM
- Diagnostic System interface (see section 3.1)
- Four line interfaces

The only difference between MAC242 and MAC241 is the type of line interfaces supported.

The MXT (MAC242) block diagram is shown in figure 3.5.

Each of the four line interfaces on MAC242 complies with CCITT V.24/V.28, V.36/V.11, V.35 or X.21 sec. 5.2. All the necessary physical drivers and receivers for all 4 interface types are available on MAC242.

By straps in the line cable connectors one of the four line interface types can be selected for each channel.

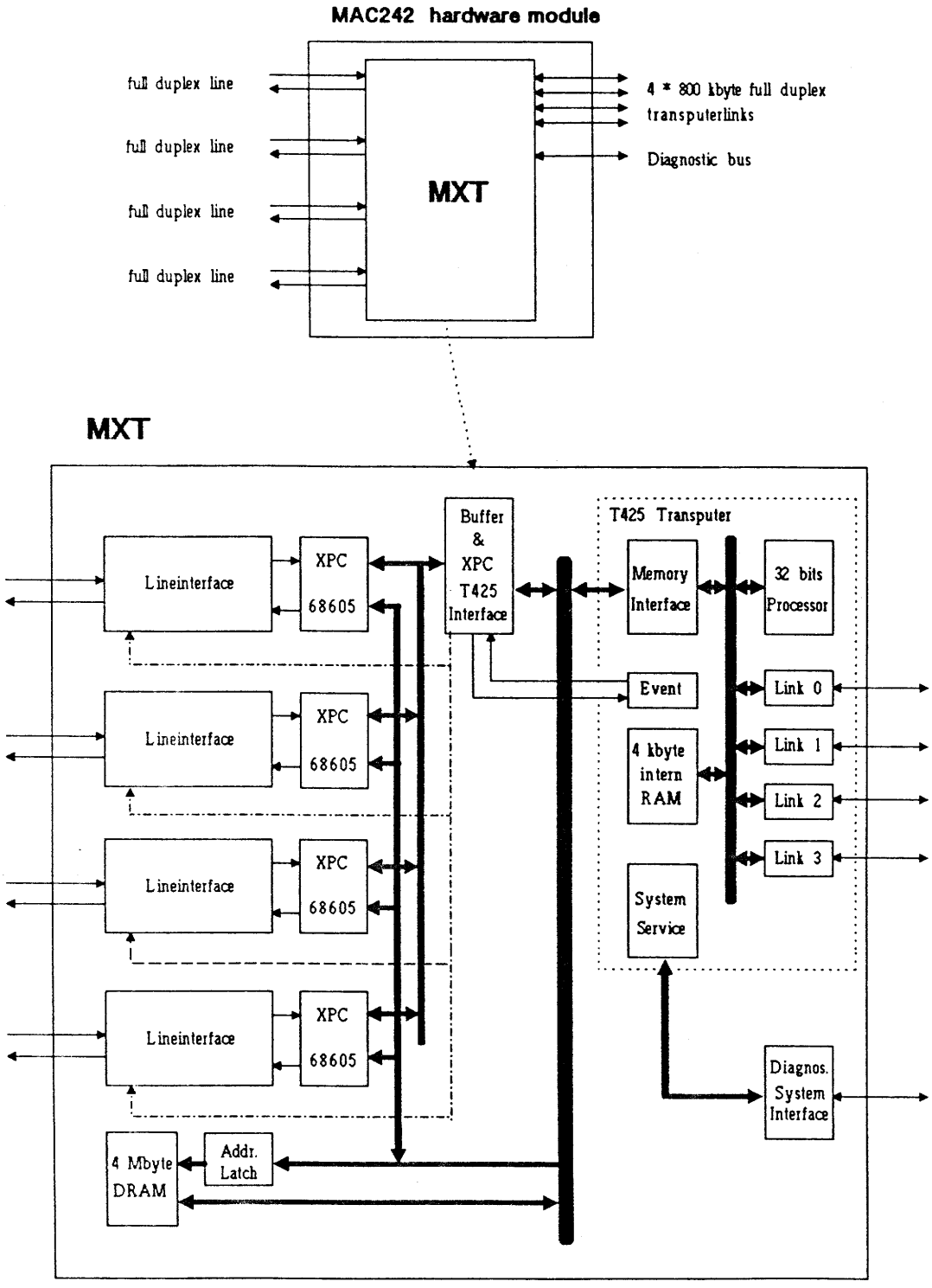

Fig. 3.5. Mega X.25/X.75 Access Controller (MAC242)

3.5 Mega Transit Controller (MTC)

The MTC has two identical transputer elements called SLT (Single Line Transputer). Each SLT consists of the following functional blocks:

- T414-20 transputer or T425-20 transputer
- MC68605 X.25 Protocol Controller (XPC)
- 256 Kbytes Static RAM
- Diagnostic System interface (See section 3.1)
- G.703/G.704 Line interface, 2 Mbps, coax version
- Loopback function for line interface

The MTC blockdiagram is shown in fig. 3.6.

The 2 Mbps full duplex line is constituted by one distinct transmit direction and one distinct receive direction.

In the transmit direction XPC serial output data are multiplexed into the 2 Mbps framing structure (CCITT G.704) and then converted from TTL to HDB3 pulses (CCITT G.703) on the transmitter line coax cable.

In the receive direction HDB3 pulses (CCITT G.703) from the receiver line coax cable are converted to TTL whereafter XPC serial input data are extracted from the 2 Mbps framing structure (CCITT G.704).

The transputer can read the value of the spare bits received in time slot 0 of the G.704 framing structure. Correspondingly it can control the value of spare bits to be sent in the transmitter direction.

Time slot 16 of the G.704 framing structure is not utilized, so the resulting bit rate for packet data is 1920 kbps.

Five status/error signals indicates the quality of the receiver transmission line.

As an error diagnostic facility a loop switch based on relays is dedicated the line interface. It realizes both the near and the remote loop at the same time. The loop switch is controlled from the transputer or from an external controller which is of the user's responsibility. Additionally, the external controller can read five line status/error signals for each SLT.

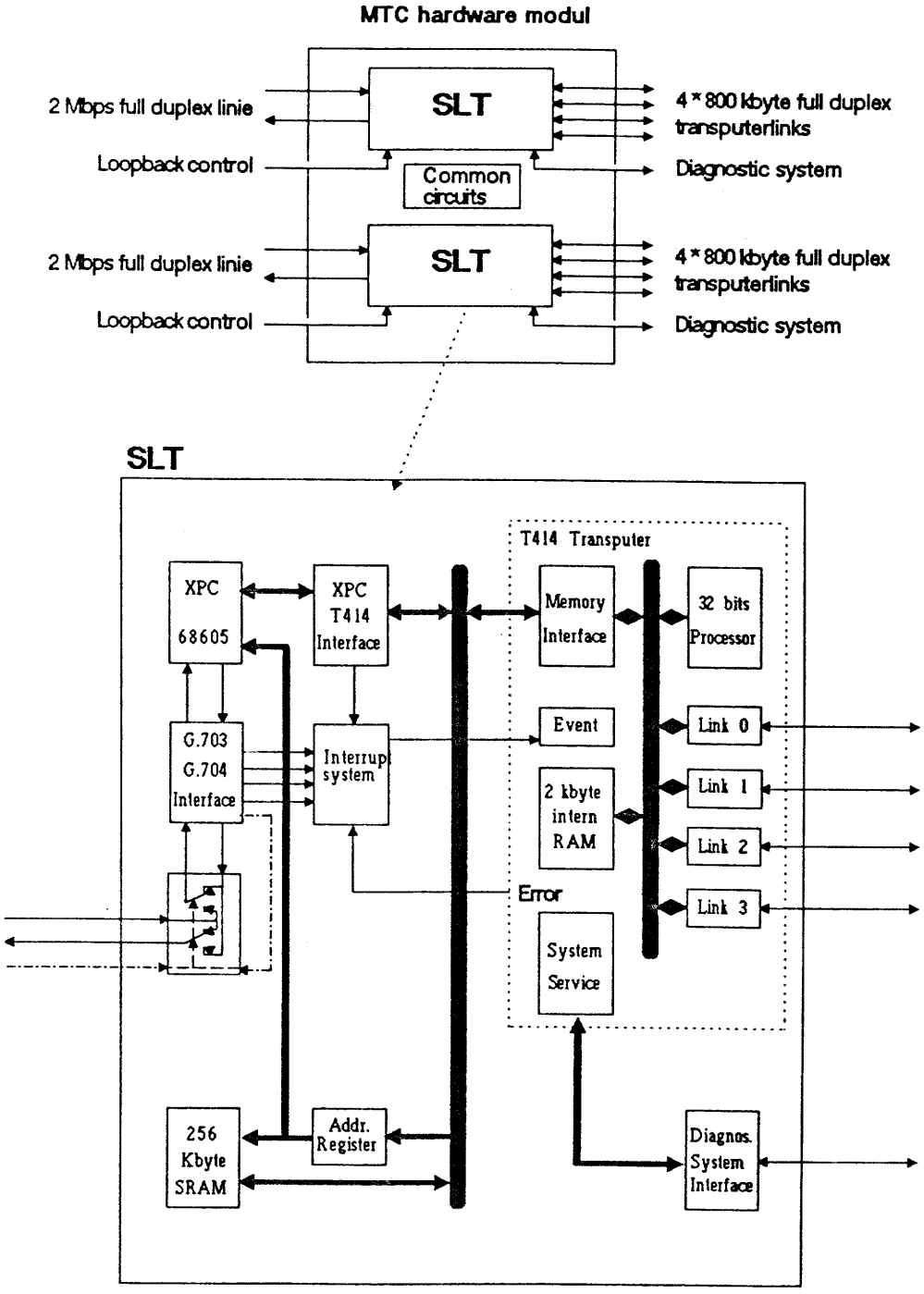

Fig. 3.6. Mega Transit Controller

3.6 MegaSwitch Back Plane and Termination board (TEM)

The links of the CT, SLT, MLT and MXT transputer elements of the RC5000 MegaSwitch are interconnected via the transputer back plane. The connection structure of the back plane is based upon circular graphs. Each point (a transputer with four links) in the graph is connected to four other points in the graph (one link on four different transputers). Only two of the CT links are connected to the transputer back plane. Figure 3.7 is an interconnection example. Also located on the back plane are wires for the Diagnostic System. Via the Diagnostic System it is possible for the CT to control Reset and Analyse signals on each of the transputers in the ring, and to read SLT, MLT and MXT Error signal status. The transputer element type (SLT, MLT or MXT) is also transferred via the Diagnostic System. Using the Diagnostic System, the CT software can configure the RC5000 MegaSwitch, i.e. calculate the number of transputers, the type of transputer elements, the position of different line interfaces.

The physical realization of the circular graph - the transputer back plane - allows an arbitrary number of transputer elements to be installed. The TErMination board (TEM) makes it possible to close the ring in any back plane position. The TEM board also terminates the back plane of the RC5000 CPU part. A TEM board is not necessary if all of the back plane positions are used, since the ring is closed by the back plane at the rightmost position. To the left the ring is closed by the MCC.

Physically the transputer back plane is located in the upper half of the back plane PCBA.

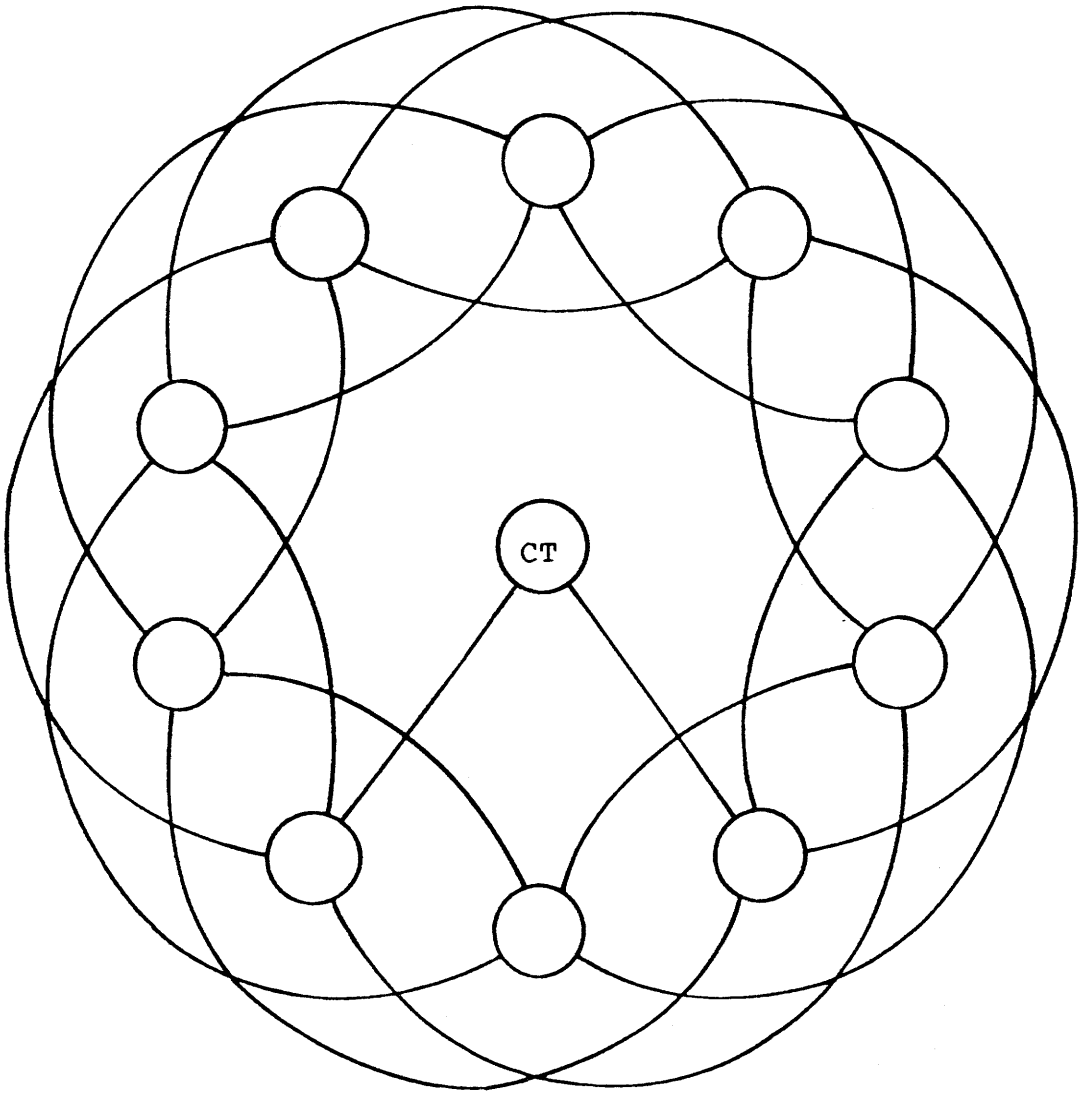

Fig. 3.7. Link interconnection example

3.7 Indicators on Front Panels

On the front panels of the RC5000 MegaSwitch printed circuits boards are found indicators reflecting the major states of the transputer elements. They are described in RC5000 MegaSwitch Hardware, Installation and Operating Guide (ref. 7).

3.8 Loop Back facilities

To ease debugging errors, the switching boards (MTC and MAC240/MAC241) provide built-in diagnostic loop back facilities. The loop back functions are realized partly in the XPC controllers and partly directly at the input/output of the Line Interface. The loop back facilities are for example utilized by the built-in testprograms. The loop back facility is schematicly shown in fig. 3.8.

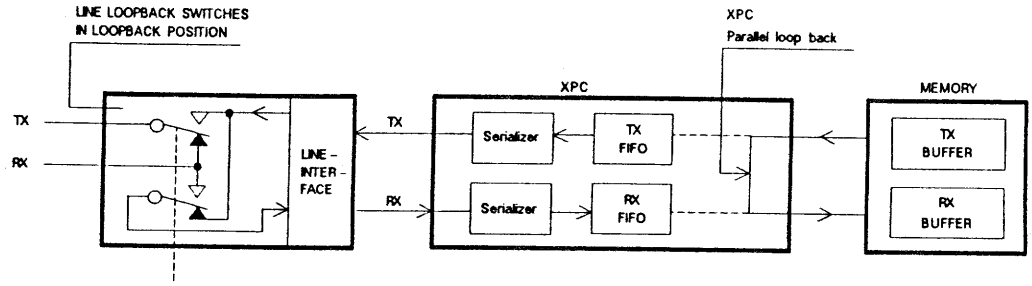

Fig. 3.8. Loop back facilities

The line interface loopback facility for MAC242 is based on modem loops and complies with CCITT recommendation V.54.

3.9 Error Flag

Each transputer element has an internal error flag, the state of which is reflected by an error output pin. The error flag indicates a runtime error or it can be explicitly set by software.

An indicator on the front panel of the modules is activated if the error flag is set. Refer to 3.6.

All error flags can through the Diagnostic System be monitored by the CT.

3.10 Maintenance

3.10.1 Preventive maintenance

Preventive maintenance is reduced to vacuum cleaning of the modules so that dust shall not prevent cooling of the IC's.

3.10.2 Built-in testprograms

Software necessary for test of modules of the RC5000 MegaSwitch (MAC240/241/242, MTC, MCC) is located in EPROM on the MCC board.

The RC5000 MegaSwitch testsystem consists of a test administrator and sub-tests valid for different modules. The sequence in which the sub-tests are executed is under control of the test administrator. Input to the test administrator is given via the MCC debug-console. Output and test results are also directed to this console. Transmission rate between MCC and console may be from 300 baud upto 9600 baud.

The test administrator includes three pre-defined test sequences:

- Power-up test
- Production test
- Long reliability test

Also a Detail test Mode is found. This mode makes it possible to run tests following special parameters (loop/not loop, stop on error etc.)

The Power-up test establishes a basic level of confidence to the hardware included in the RC5000 MegaSwitch. It requires no interaction from the operator.

The Production and long reliability test sequences are used for check of the printed circuit boards after production and as a burn-in facility respectively.

The Detail test mode supplies the Technical Service Department with a diagnostic tool.

The RC5000 MegaSwitch testsystem is described in RC5000 MegaSwitch Hardware, Installation and Operating Guide (ref. 7).

4. SOFTWARE COMPONENTS

This chapter describes the overall structure of the software in the RC5000 MegaSwitch.

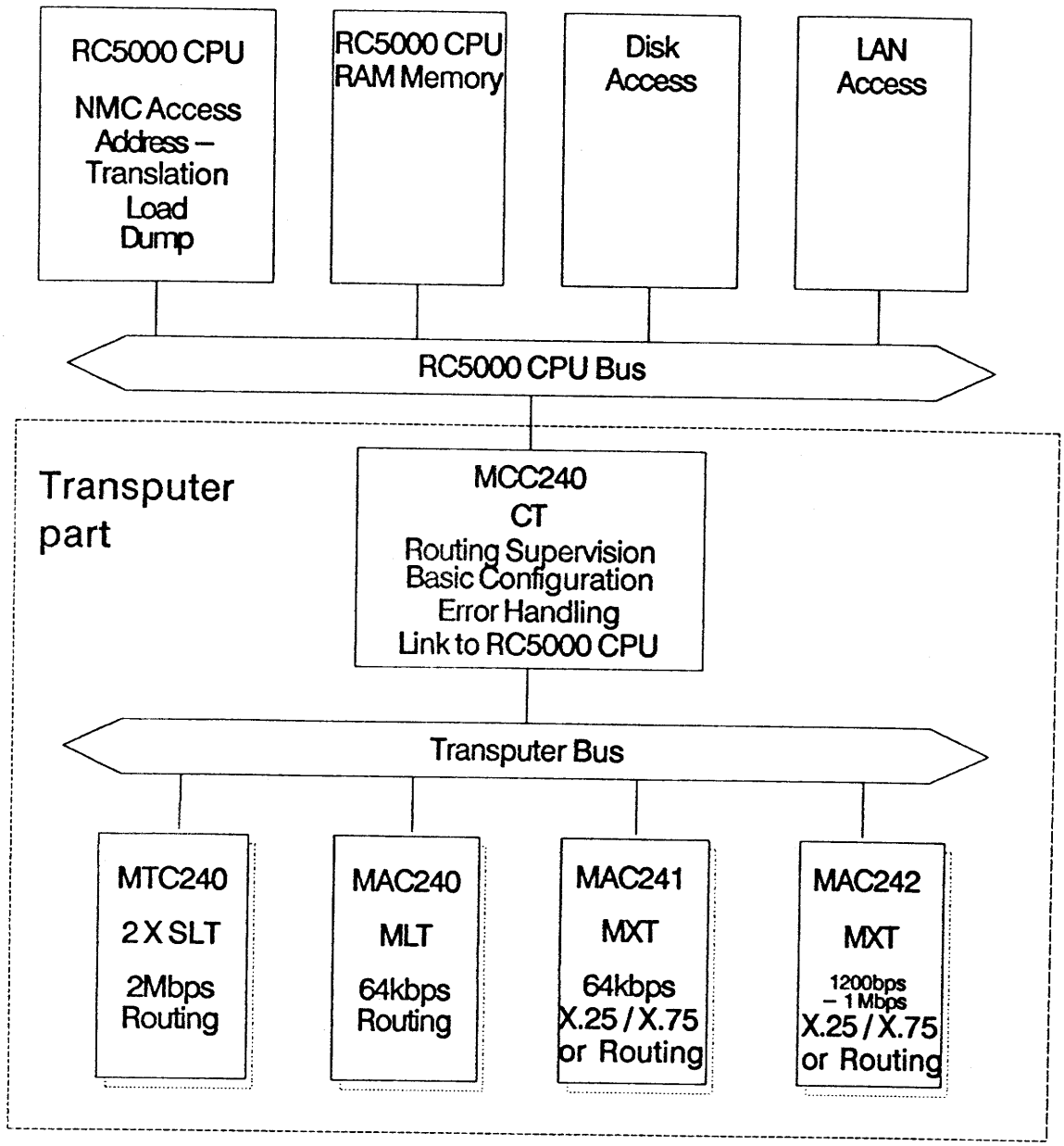

Fig. 4.1. RC5000 MegaSwitch

The following figures (fig. 4.2-4.6) show the software processes on the different boards of an RC5000 MegaSwitch. The processes implementing the LinkBus system are not shown.

A description of the software processes and their relations are given in the next sections.

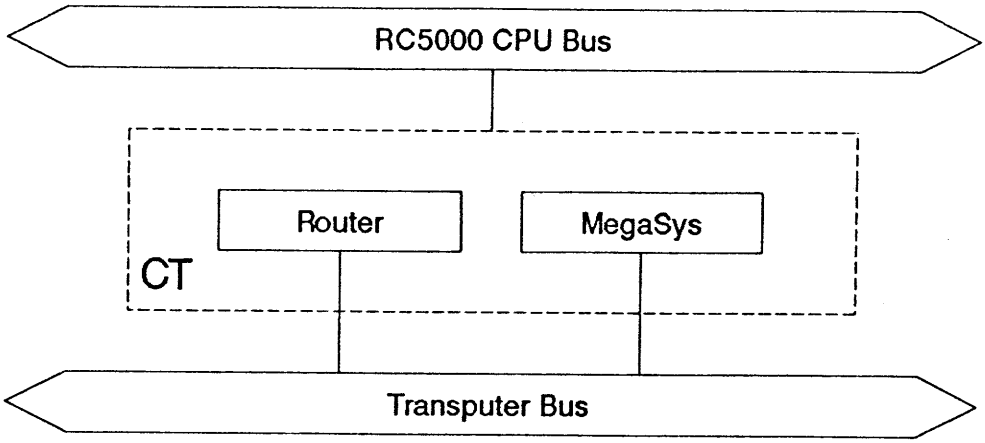

Fig. 4.2. Processes on MCC240

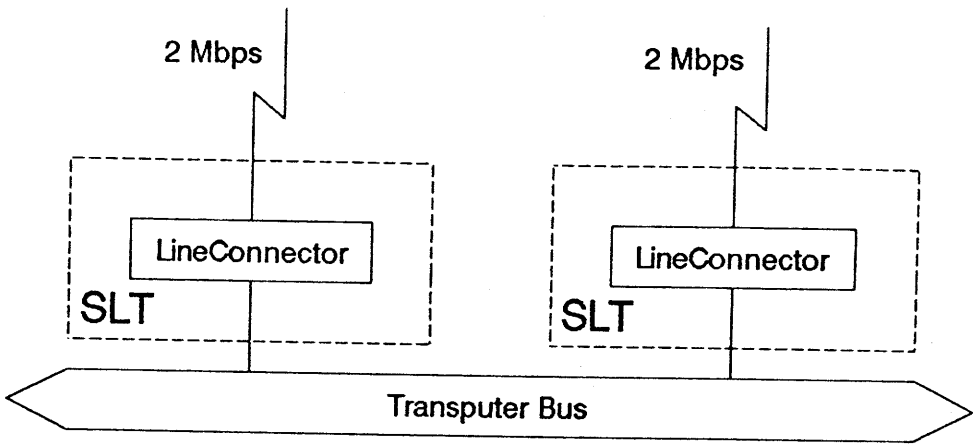

Fig. 4.3. Processes on MTC240

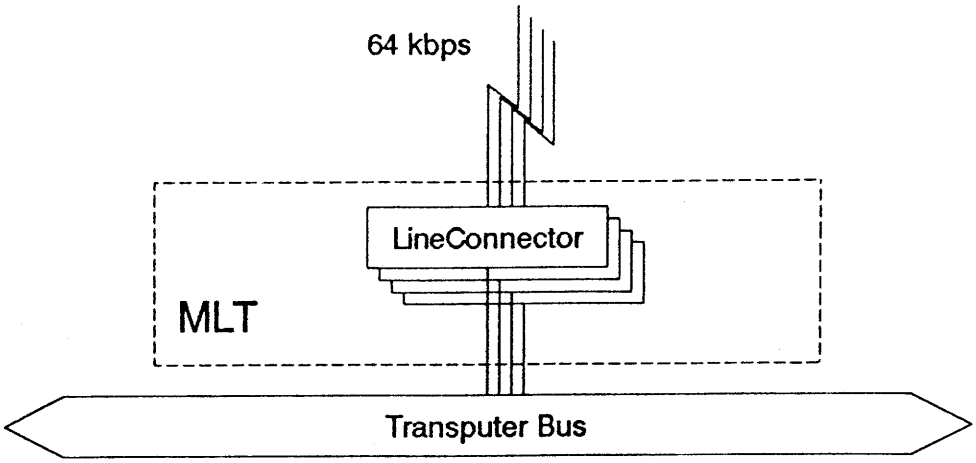

Fig. 4.4. Processes on MAC240

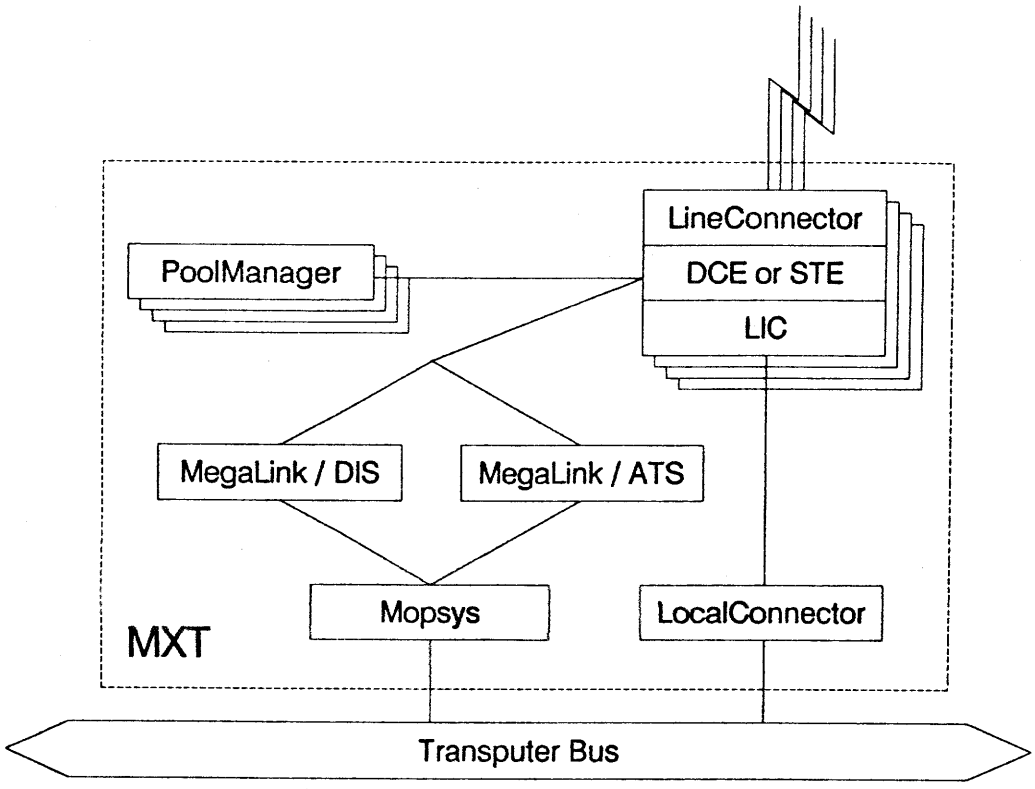

Fig. 4.5. Processes on MAC241, MAC242

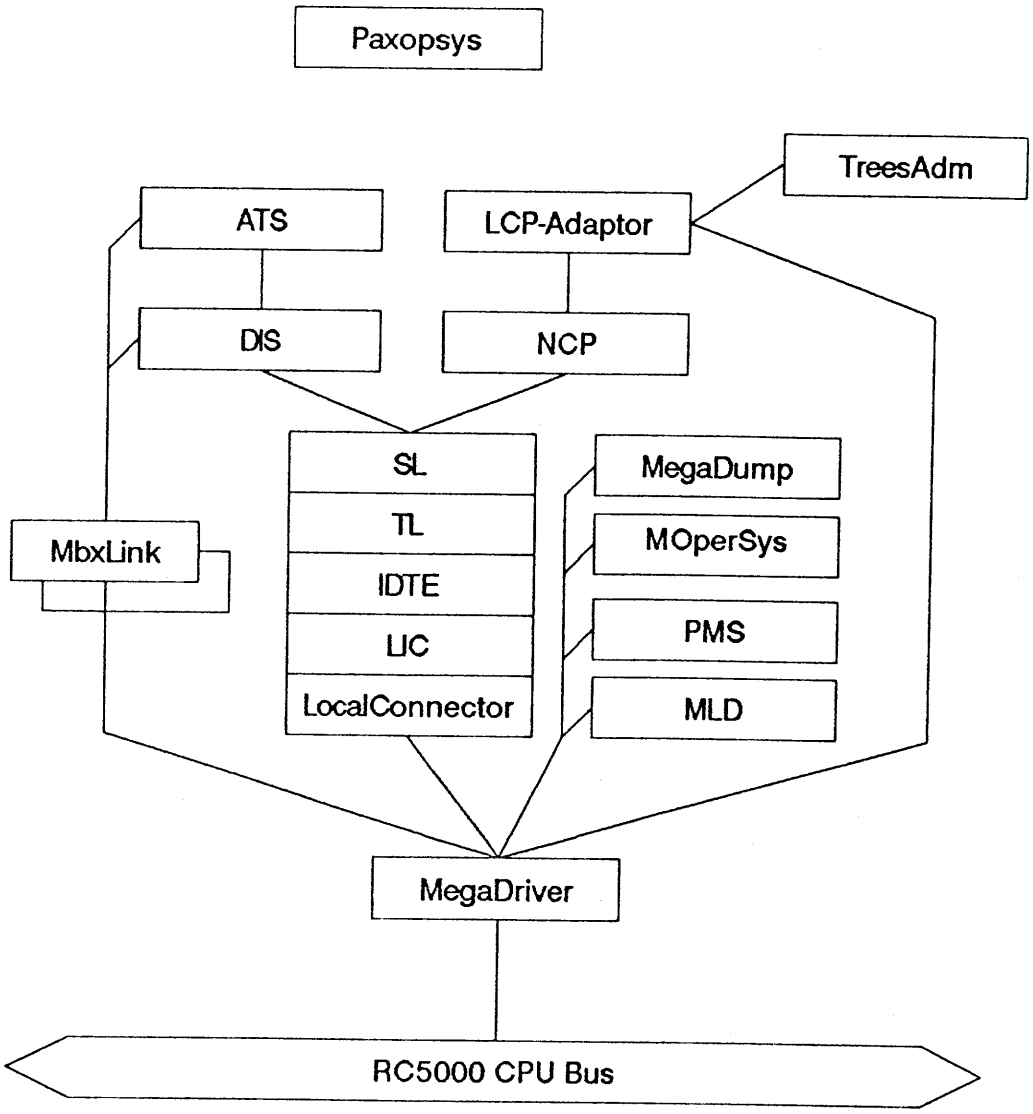

Fig. 4.6. Processes on RC5000 CPU

4.1 Internal Communication

The internal communication on the transputer part takes place through the LinkBus system. The communication between the RC5000 CPU and the transputer part is carried out by the MegaDriver process on the RC5000 CPU and the LinkBus system on the transputer part.

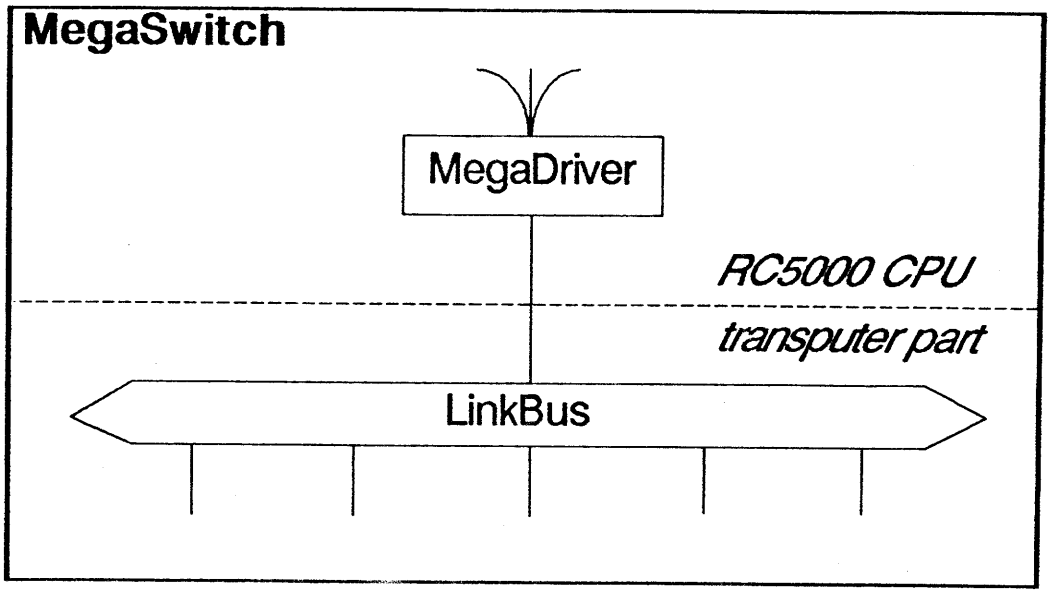

Fig. 4.7. Internal communication

The LinkBus system consists of several processes running on each transputer in the transputer part. The LinkBus system guarantees that messages sent from one process to another arrive in the same order as they are sent. The LinkBus system ensures that deadlock will not occur and treats bursts in a proper way.

A message sent through the LinkBus system is extended with a Link-Bus header, which among others contains the LinkBus address of the sender and receiver of the message.

4.2 RTP-Runtime Environment

On the MXT an RTP-runtime environment is established. This is accomplished by a set of RTP-kernel routines and the Mopsys process conducting overall process management.

The RTP-kernel routines implement the necessary basis for running RTP programs (ref. 25). The LineConnector and LocalConnector programs utilize these kernel routines although written in occam.

The Mopsys is capable of creating and removing RTP-processes, and inspecting their state. Furthermore, Mopsys can monitor resource consumption including total processor load.

The MOperSys gives RTP-processes an operator interface to the RC5000 CPU debug console.

A reduced RTP-runtime environment is established on the CT to allow MegaSys to utilize the operator interface during fault handling.

4.3 Configuration

The process MegaSys on the CT is the first process started on the transputer part of an RC5000 MegaSwitch. MegaSys reads the hardware configuration of the transputer part through the Diagnostic System (see section 3.1). Before the other processes are started, it is possible, through LCP requests to MegaSys, to change the size of buffer areas in the LinkBus system and in the LineConnector processes. It is also possible to change the configuration by excluding a board, a transputer or a line.

4.4 Link Level Service

At each line on the MTC and MAC boards an XPC chip is used to implement the data link layer according to the CCITT X.25/2 LAPB 1984 protocol.

Thus the link level protocol implemented in the RC5000 MegaSwitch, is the LAPB protocol provided by the XPC chip (ref. 23).

The XPC chip fully implements the LAPB system parameters T1, k, N1 and N2. The system parameter T3 has been implemented by the controlling software.

The XPC chip is in the RC5000 MegaSwitch controlled by the LineConnector process, i.e. the link level service is obtained through the LineConnector. A LineConnector process exists for each line on the MTC and MAC boards.

The LineConnector process implements a linetest facility, too. Linetest is used to examine the quality of a line. Linetest may generate traffic over the line, receive packets and examine the received packets. Thus for each line in the RC5000 MegaSwitch, a way of controlling the lines by artificial traffic, is implemented. The linetest facilty is usually controlled by the NMC activity.

2 Mbps lines are continuously monitored at the physical level to control the lines according to CCITT recommendation G.732.

The link level service provided by the XPC chip and the controlling LineConnector process is used to implement the datagram service, the access services and for load.

4.5 Datagram and Connection Service

The service provided by the datagram network is described in detail in The Data Transmission System, General Description (ref. 18).

The datagram service is in the RC5000 MegaSwitch implemented by the Router process, LineConnector processes and LocalConnector processes. The connection service is implemented by the LIC processes.

The Router process is running on the MCC board (fig. 4.2). The Router process contains all the routing tables and is responsible for maintaining the routing information and distributing necessary information to the LineConnector and LocalConnector processes, in order to make these able to route packets one step nearer to the destination address.

The routing algorithm is implemented by exchanging distance vectors between neighbour nodes. The LineConnectors which are controlling router lines receive distance vectors from the neighbours and pass them on to the Router. The Router sends distance vectors to the neighbour through the LineConnectors. The Router also sends distance and path vectors to the Connectors (i.e. LineConnectors and LocalConnectors).

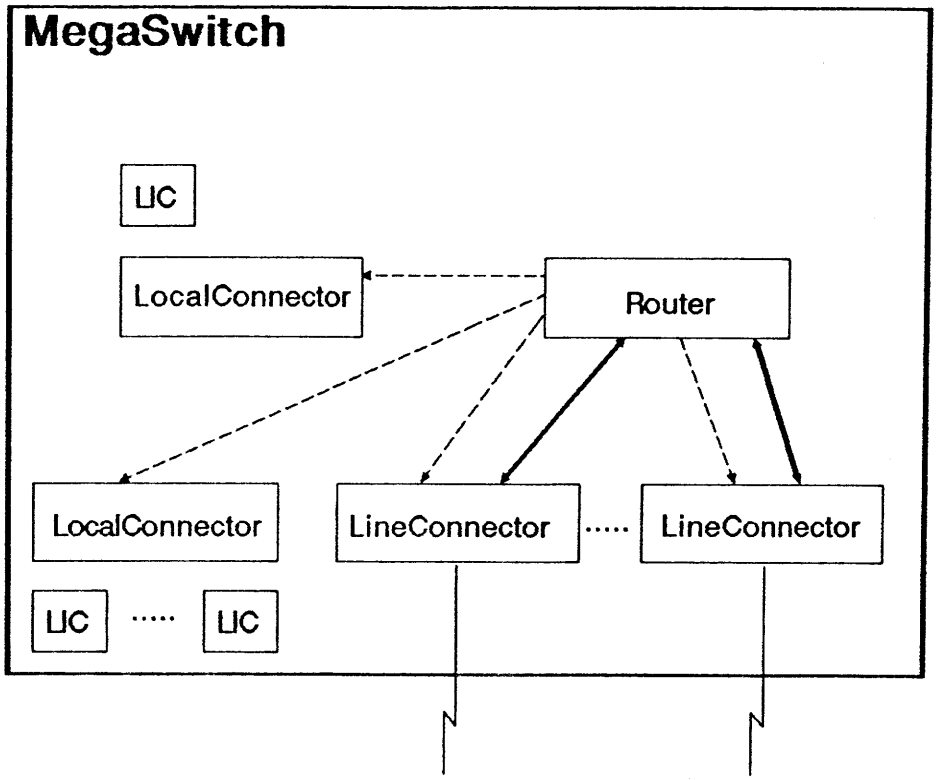

Fig. 4.8. Flow of distance vectors

The LineConnector process implements the link level service as described in the previous section. Besides this, the LineConnector process also implements parts of the datagram service. This service is, of course, only used in those LineConnector processes which are controlling router lines.

LocalConnector is the process through which access to the datagram network is obtained.

In RC5000 MegaSwitch one LocalConnector process is created on each MAC241/242 board (fig. 4.5). All users of the datagram service which are running on a MAC241/242 board is connected to the LocalConnector running on the same board. A LocalConnector process is also created to run on the RC5000 CPU (fig. 4.6). All users of the datagram service running on the RC5000 CPU are connected to this LocalConnector. The LocalConnectors on MAC241/242 and the one on the RC5000 CPU have the same external behaviour, although they are not incarnations of the same program, so minor differences may exist.

In order to implement flow control and to overcome from problems due to packets dropped or not received in sequence, a LIC process providing a connection service may be created.

All Connectors are, on the basis of the routing information received from the Router process, able to route received packets directly to the Connector which is the next on the path to the destination address. The Connector may be either a LocalConnector, which delivers the packet to a user of the datagram network, or a LineConnector controlling a router line, which transmits the packet to the next node.

The data packets routed between two such Connectors are passing through the LinkBus system a minimum number of hops. The actual routing of packets is performed by the Connectors, so data packets are not passing the Router process. Fig. 4.9 shows the flow of data packets.

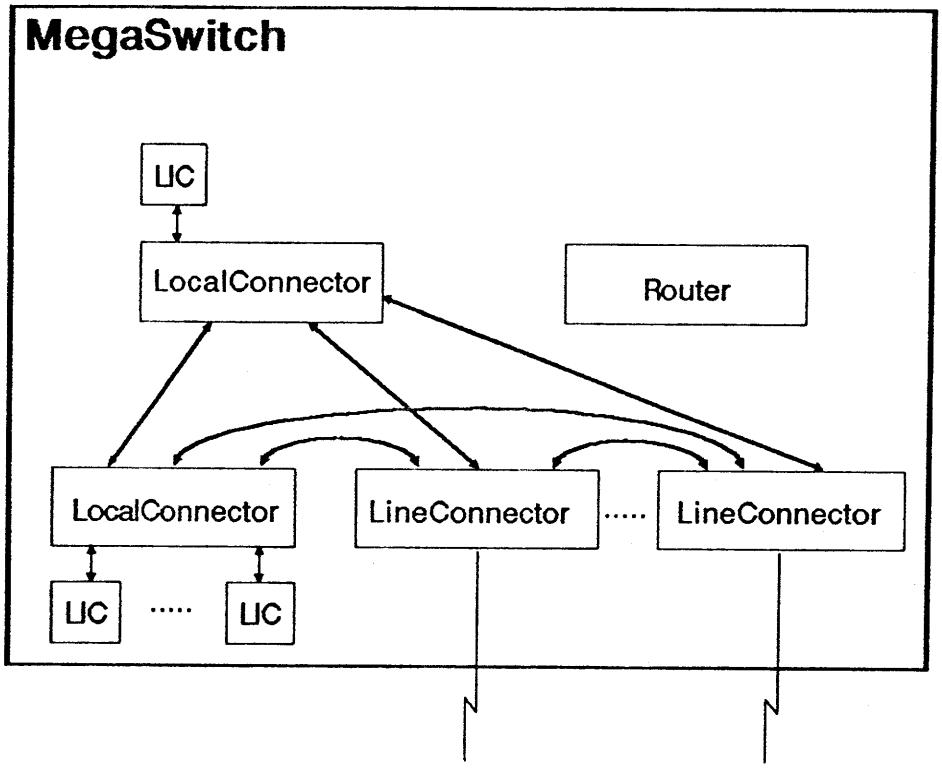

Fig. 4.9. Flow of data packets

4.6 Access Service

The access service provided by RcPAX is described in detail in The Data Transmission System, General Description (ref. 18). The different access services are implemented by the DCE, STE and IDTE processes.

The X.25 and X.32 access implemented by the DCE process is in the RC5000 MegaSwitch run on the MAC241/242 boards (fig. 4.5). A PoolManager process is also created to run on the MAC241/242 boards, to manage the buffers used by the DCE.

The DCE uses the link level service provided by a LineConnector process, and connects to the datagram network through a LIC process.

The DCE needs to communicate with the DIS, ATS processes in order to perform addressing conversion. This is described further in section 4.8.

The X.75 access is implemented by the STE process. The STE is run on the RC5000 MegaSwitch in the same way the DCE is run.

To obtain access services internally in the RC5000 MegaSwitch node an IDTE process may be created to run on the RC5000 CPU (fig. 4.6).

4.7 Session Service

The session service is made available by means of the Session Layer (SL) using the transport service made available by the Transport Layer (TL).

SL and TL are created to run on the RC5000 CPU (fig. 4.6), using the internal access service provided by the IDTE process.

The session service is used in the RC5000 MegaSwitch to provide additional services such as directory information service (DIS), address translation service (ATS) and management service.

4.8 DIS and ATS Services

The DCE and STE use both the directory information service (DIS) and the address translation service (ATS).

The address translation service is built on top of the directory information service. The directory information system consists of a number of DIS processes in different nodes communicating by means of the session service.

The DIS and ATS processes are in the RC5000 MegaSwitch run on the RC5000 CPU (fig. 4.6).

The DIS and ATS service are made available to the DCE and STE processes running on the transputer part of the RC5000 MegaSwitch, by the MegaLink, Mopsys and MbxLink processes.

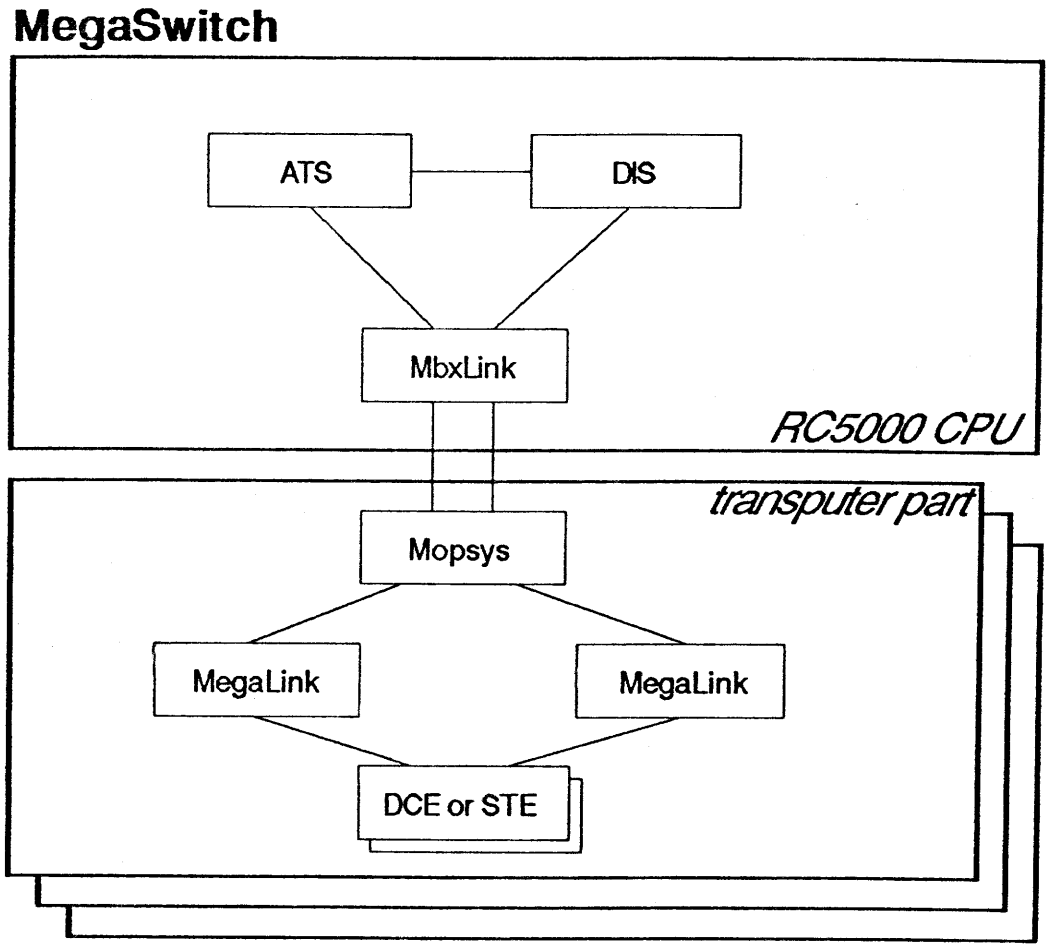

Fig. 4.10. DIS, ATS communication

MbxLink, Mopsys and MegaLink provide a link between the RTP processes running on the RC5000 CPU and the RTP processes running on the transputer part.

Two links are created for each MAC241/242 board. One link to be used for communication between the DCE and STE processes on the board and the DIS, the other link to be used for communication with the ATS.

4.9 Management Service

All MegaSwitch processes may be controlled and monitored from the Network Management Center (NMC). By means of the session service the NMC communicates with the Network Control Proble (NCP) on the RC5000 CPU of the RC5000 MegaSwitch.

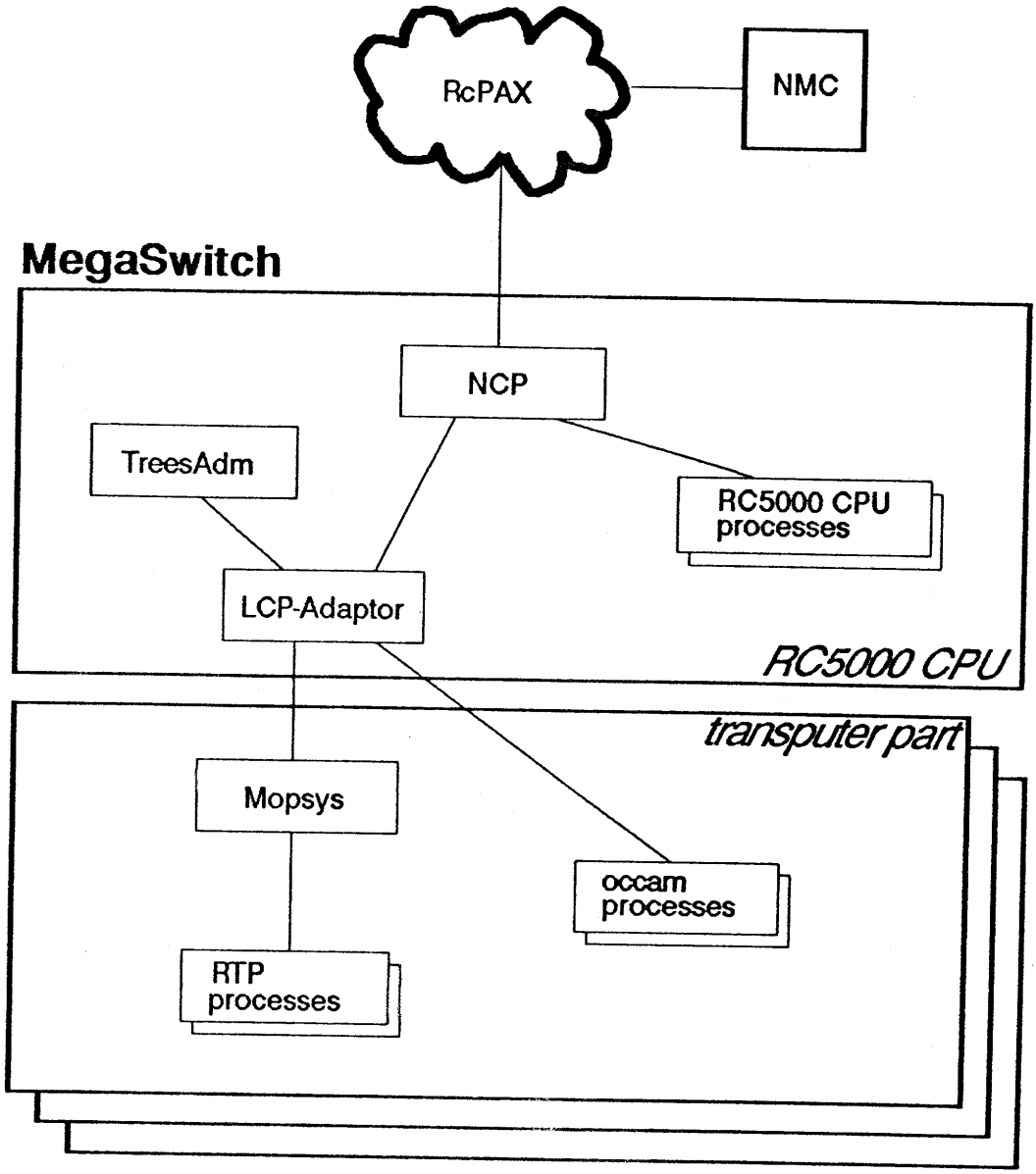

Fig. 4.11. Network Management

The NCP can only communicate directly with processes on the RC5000 CPU. The LCP-Adaptor takes care of communication with processes on the transputer part. All LCP requests, LCP answers and LCP events to processes on the transputer part pass through the LCP-Adaptor.

Two types of LCPs exist on the transputer part, LCPs implemented in occam and LCPs implemented in Real Time Pascal.

The LCPs implemented in occam communicate directly with the LCP-Adaptor.

The LCPs implemented in Real Time Pascal communicate with Mopsys, which takes care of communication with the LCP-Adaptor. For these processes, Mopsys makes the same service available as the NCP does for processes running on the RC5000 CPU. Mopsys incarnation 0 is simulated by the LCP-Adaptor and is used to redirect create and remove operations from the NMC to the Mopsys process on the MAC241/242 board in question.

Furthermore, for all LCPs implemented in Real Time Pascal, the LCP-Adaptor converts data in requests, answers and events between the transputer representation and the RC5000 CPU representation based on ASN1 descriptions (parsetrees). The TreesAdm process handles the parsetrees.

4.10 Load, Error and Dump Handling

An RC5000 MegaSwitch can either be loaded from a Winchester disc connected to the RC5000 CPU or loaded from a line. The autoload switches on the RC5000 CPU of the RC5000 define the kind of load.

Load from a line happens over an HDLC line on the transputer part. The software used on the transputer part during the load comes from the PROM on the CT. The first file loaded from the line is received by the bootloader on the RC5000 CPU. Further files loaded are received by an MLD (Mega Load Driver) process created on the RC5000 CPU.

When an RC5000 MegaSwitch is used to load a neighbour node, a PMS (Platform Mega Supervisor) process is created on the RC5000 CPU. The PMS process communicates with the LineConnector managing the line used to load the neighbour node.

Severe errors in SLT, MLT or MXT cause the transputer error flag to be set. This is detected by the MegaSys, which performs a post mortem stacktrace of the failing process and notifies the MegaDump process.

The MegaDump process is able to make a coredump controlled by parameters given previously. Usually a coredump of the transputer in error is made. The MegaDump process is envoked either by the error flag on the CT or due to notification by MegaSys.

MegaDump may be instructed to restart the RC5000 MegaSwitch node, when a severe error has occurred.

5. THE RC5000 MEGASWITCH MANUALS

This manual is one in a series on the RC5000 MegaSwitch system. The following graph (fig. 5.1) shows the order in which the documents should be read.

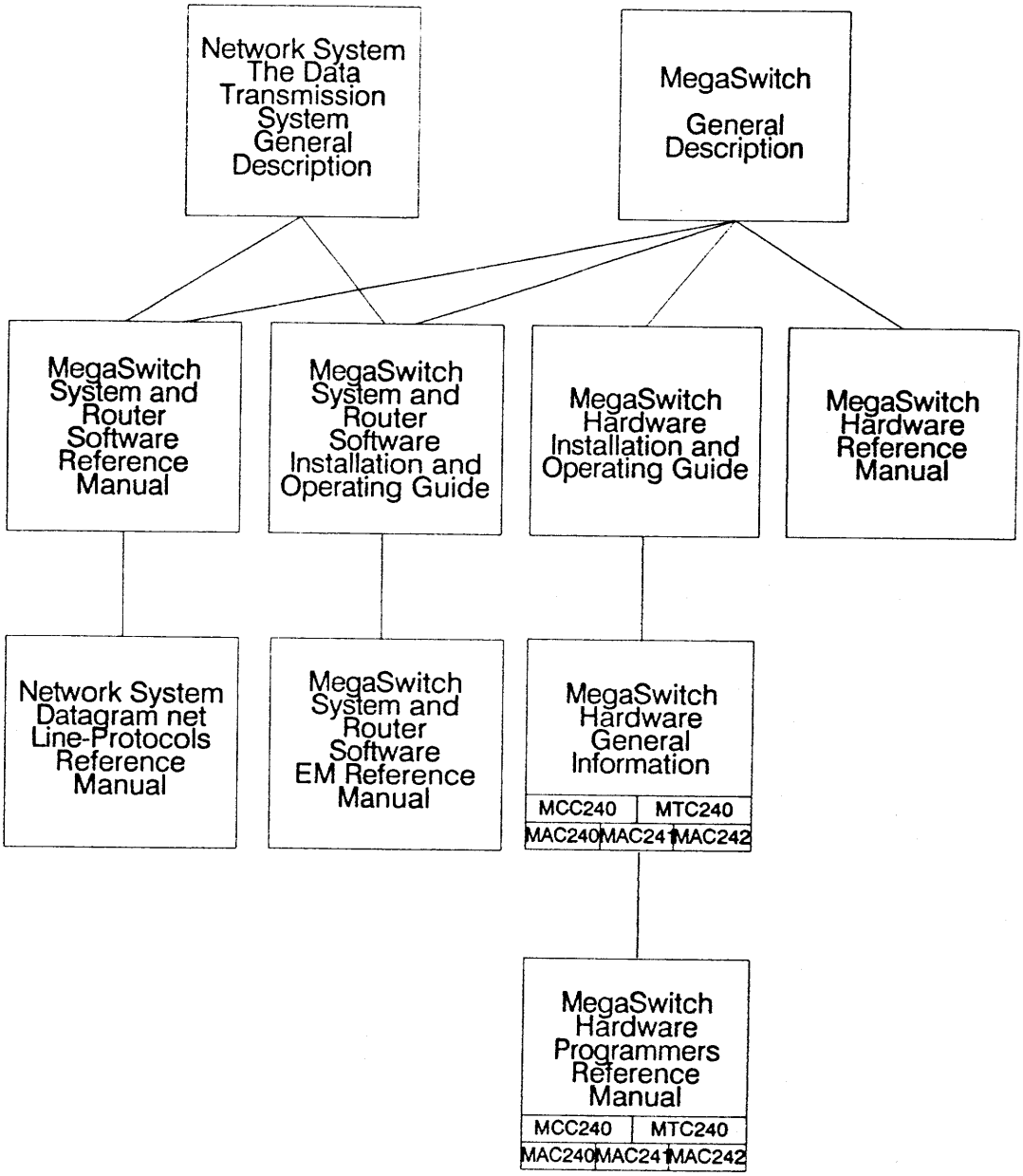

Fig. 5.1. RC5000 MegaSwitch Documentation Structure

The two manuals in the top row give a general description of the RcPAX Data Transmission System and its implementation on the RC5000 MegaSwitch. These manuals should be read first, in order to achieve an understanding of the overall system.

The first column in fig. 5.1 and the last manual in the third column are programming guides. These should only be used by programmers maintaining and developing RC5000 MegaSwitch Software.

The second and third columns contain the central documentation for the daily use of the RC5000 MegaSwitch. The second column is the documentation for the NMC operators installing and operating a network containing RC5000 MegaSwitch nodes. The third column should be followed by hardware installation and maintenance staff.

The last column is for people interested in hardware details concerning the backplane.

A short introduction to the manuals is given below. The numbers refer to the reference list in appendix A.

1. RcPAX
   An Introduction

   This manual contains an introduction to RcPAX.

2. RC5000 MegaSwitch
   General Description
   PN: 99001445

   This manual gives an overview of the hardware and software components in the RC5000 MegaSwitch system. The manual defines concepts and terms used in the other MegaSwitch manuals.

3. RC5000 MegaSwitch
   System and Router Software
   Reference Manual
   PN: 99001338

   Contains a functional description of each MegaSwitch System and Router software module and describes all the messages exchanged between the modules. This manual is programming guide to make modules which shall communicate with the RC5000 MegaSwitch software.

4. RC5000 MegaSwitch
System and Router Software
Installation and Operating Guide
PN: 99001446

This manual contains detailed information on how to install RC5000 MegaSwitch node software in the NMC. It contains information on how to load, configure and operate an RC5000 MegaSwitch node.

5. RC5000 MegaSwitch
System and Router Software
EM Reference Manual
PN: 99001447

This manual contains all LCP requests, LCP answers and LCP events concerning RC5000 MegaSwitch System and Router software. The manual is intended for NMC operators.

6. RC5000
MegaSwitch Hardware
Reference Manual
PN: 99001180

Is a technical description of the RC5000 MegaSwitch Back Plane including the Diagnostic System and connection of links on transputers.

7. RC5000
MegaSwitch Hardware
Installation and Operating Guide
PN: 99001448

Describes the installation of hardware boards and includes a user's guide to the hardware test system.

8. RC5000
MCC240 - MegaSwitch Central Controller
General Information
PN: 99001182

Describes the daily use of the MCC240 and a brief technical specification and installation guide.

9. RC5000
MCC240 - MegaSwitch Central Controller
Programmer's Reference Manual
PN: 99001183

Is a programmer's guide to the MCC240. The manual contains addresses of hardware ports etc.

10. RC5000
MTC240 - MegaSwitch Transit Controller
General Information
PN: 99001184

Describes the daily use of the MTC240 and a brief technical specification and installation guide.

11. RC5000
MTC240 - MegaSwitch Transit Controller
Programmer's Reference Manual
PN: 99001185

Is a programmer's guide to the MTC240. The manual contains addresses of hardware ports etc.

12. RC5000
MAC240 - MegaSwitch Access Controller
General Information
PN: 99001186

Describes the daily use of the MAC240 and a brief technical specification and installation guide.

13. RC5000
MAC240 - MegaSwitch Access Controller
Programmer's Reference Manual
PN: 99001187

Is a programmer's guide to the MAC240. The manual contains addresses of hardware ports etc.

14. RC5000
MAC241 - MegaSwitch X.25/X.75 Access Controller
General Information
PN: 99001328

Describes the daily use of the MAC241 and a brief technical specification and installation guide.

15. RC5000
MAC241 - MegaSwitch X.25/X.75 Access Controller
Programmer's Reference Manual
PN: 99001329

Is a programmer's guide to the MAC241. The manual contains addresses of hardware ports etc.

16. RC5000
MAC242 V.xx Access Controller
General Information
PN: 99001360

Describes the daily use of the MAC242 and a brief technical specification and installation guide.

17. RC5000
MAC242 V.xx Access Controller
Programmer's Reference Guide
PN: 99001388

Is a programmer's guide to the MAC242. The manual contains addresses of hardware ports etc.

18. RcPAX Network System
The Data Transmission System
General Description
PN: 99001391

This manual provides an overview of the Data Transmission System and gives a detailed technical description of the software components constituting it.

19. RcPAX Netværks System
Datagramnet Linie-Protokoller
Reference Manual
PN: 99001370

Describes the protocol elements sent over the line between nodes in the RcPAX datagram network. The manual is a programming guide. The manual is in Danish.

A. REFERENCE LIST

1. RcPAX
   An Introduction

2. RC5000 MegaSwitch
   General Description
   PN: 99001445

3. RC5000 MegaSwitch
   System and Router Software
   Reference Manual
   PN: 99001338

4. RC5000 MegaSwitch
   System and Router Software
   Installation and Operating Guide
   PN: 99001446

5. RC5000 MegaSwitch
   System and Router Software
   EM Reference Manual
   PN: 99001447

6. RC5000
   MegaSwitch Hardware
   Reference Manual
   PN: 99001180

7. RC5000
   MegaSwitch Hardware
   Installation and Operating Guide
   PN: 99001448

8. RC5000
   MCC240 - MegaSwitch Central Controller
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General Information
PN: 99001186

13. RC5000
MAC240 - MegaSwitch Access Controller
Programmer's Reference Manual
PN: 99001187

14. RC5000
MAC241 - MegaSwitch X.25/X.75 Access Controller
General Information
PN: 99001328

15. RC5000
MAC241 - MegaSwitch X.25/X.75 Access Controller
Programmer's Reference Manual
PN: 99001329

16. RC5000
MAC242 V.xx Access Controller
General Information
PN: 99001360

17. RC5000
MAC242 V.xx Access Controller
Programmer's Reference Manual
PN: 99001388

18. RcPAX Network System
The Data Transmission System
General Description
PN: 99001391

19. RcPAX Netværks System
Datagramnet Linie-Protokoller
Reference Manual
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Volume VIII - Fascicle VIII.3, 1984
Recommendation X.25

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Recommendations G.700 - G.956
Geneva 1985

22. INMOS The Transputer Databook
INMOS, Second Edition 1989
INMOS document number: 72 TRN 203 01

23. MC68605 TECHNICAL DATA
X.25 Protocol Controller (XPC)
Motorola ADI 1218RI

24. INMOS Transputer Development System
Prentice Hall
ISBN 0-13-928995-X

25. Reference Manual
for the Programming Language
Real-Time Pascal
PN: 99110141

B. INDICES

B.1 Survey of Figures

B.2 Catchword Index

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PN: 99001445