Introduction
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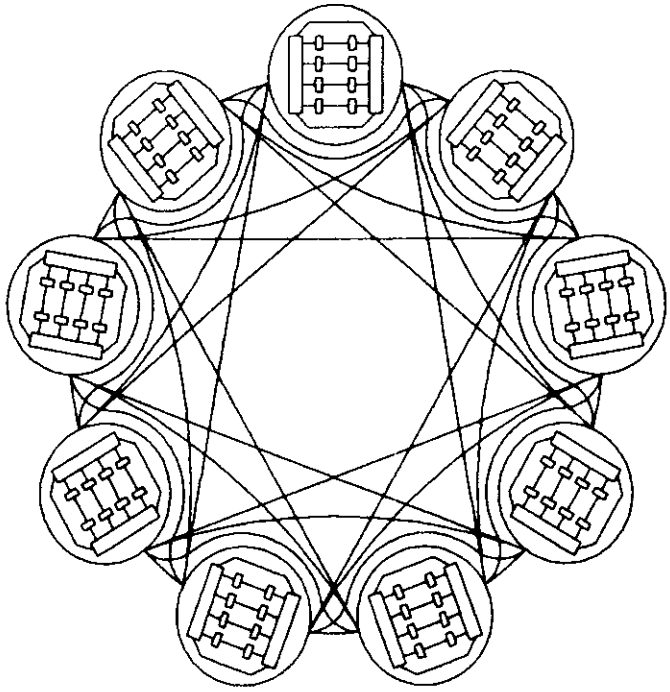
RC5000 MegaSwitch

2 Mbps Packet Switching.



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1. Introduction

The RC5000 MegaSwitch is a high speed packet switch, which utilizes 2 Mbps lines to provide a dynamic extendable transit net for an X.25 based data-communication network.

The packet transmission method has been adapted from the PAXNET data-communication network, which has been in operation in Denmark for several years based on the RC3502 Communication Processor. The PAXNET method combines bandwidth optimization with fault tolerant transmission.

Packets are transmitted in the transit network as datagrams. Thus two packets with the same sender and receiver may choose different routes through the transit network. This is of great advantage as the packets can be directed the most appropriate way through the transit network as regards loads, and errors on the lines. Thus the routing algorithm autonomously adapts to topological changes in the network.

The application of 2 Mbps lines in the transit network implies several advantages. Primarily, the larger line capacity combined with the high capacity of the RC5000 MegaSwitch, enables transfer of large data quantities very quickly through the network. Concomitantly it is cheaper as regards connection equipment (controllers, line interfaces, cables) to transfer data on one 2 Mbps line than to split up the corresponding line capacity in a number of 64 Kbps channels (typically 32) as these must be connected each with its own line interface.

A further advantage as regards 2 Mbps lines in the transit network is the reduction of transmission delay. A typical link level frame of 1,620 bit uses 25.3 msec. for transport over a 64 Kbps line, but only 0.84 msec. for transport over a 2 Mbps line (actual line speed is 1.920 Kbps). Typically, a packet makes three jumps (transport over three lines) in a transit network. Based on three jumps the total transmission time is thus 76 msec. when applying 64 Kbps lines compared with only 2.52 msec. when applying 2 Mbps lines.

2. Application of the RC5000 MegaSwitch

The RC5000 MegaSwitch can be applied to a variety of areas where a fast and reliable packet switch is needed.

High speed transit network for existing X.25 nets

The utilization of 2 Mbps lines and the high capacity of the MegaSwitch are requested when upgrading an overloaded X.25 net.

The RC5000 MegaSwitch will at the same time take the load off an existing network and protect the investments already made in such a network. Thereby the RC5000 MegaSwitch represents a very attractive alternative to a complete renewal.

In this context existing X.25 PSEs (Packet Switch Exchanges) are connected to the MegaSwitch by X.75 connections as illustrated in figure 2.1. The number of X.75 connections must equal the capacity of the PSE, but the MegaSwitch will typically be placed at the same physical location as the PSE(s). Thus the lines between the PSE and the MegaSwitch can be realized in a cost effective way.

The advantage of the RC5000 MegaSwitch is that a large number of trunk lines between the original PSEs are saved. Furthermore, the X.25 user will not be affected by a trunk line failure as the internal protocol autonomously redirects the packets via an alternative route. This redirection is totally transparent to the X.25 user.

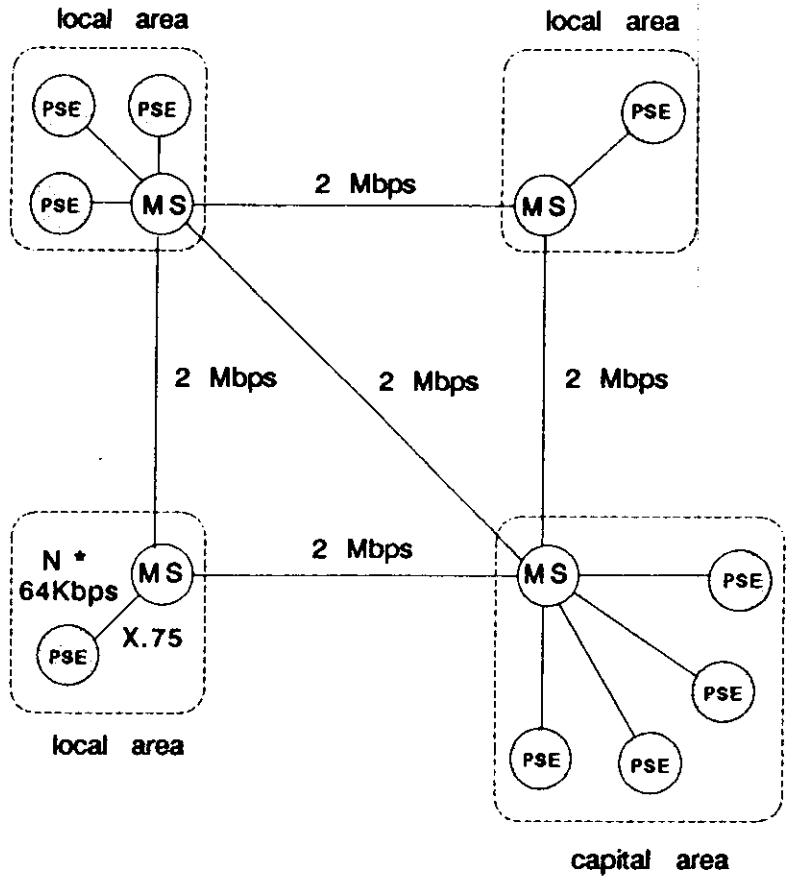

Figure 2.1 The RC5000 MegaSwitch as an X.75 backbone.

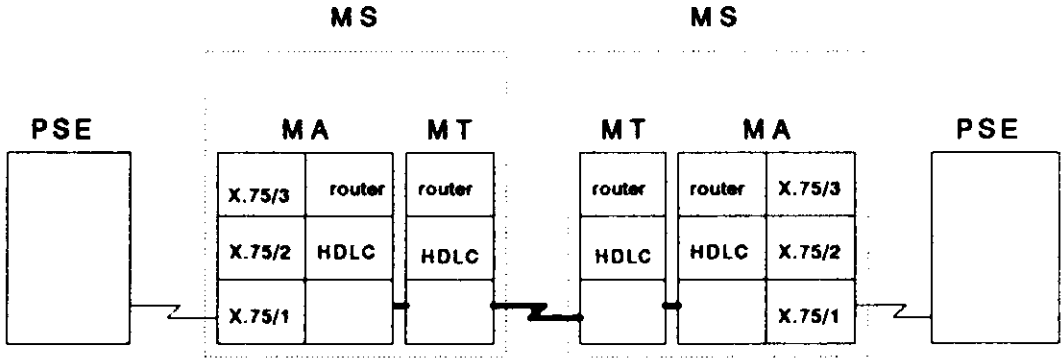

Figure 2.2 X.75 Protocol interaction.

RC5000 MegaSwitch as a building block for a new X.25 net.

The ideal solution when a new X.25 net is to be established either as a private or a public network is to use PAXNET with the RC5000 MegaSwitch as the backbone transitnet.

A linear growth path is secured through the compatibility between the RC3502 Communications Controller and the RC5000 MegaSwitch. This compatibility comprises software architecture, Network Management System and crate and power supply technology.

The internal protocol used in the RC5000 MegaSwitch will cooperate with PAXNET's access nodes (AN) typically used for 9.600 Kbps X.25 connections. This means that the benefit of the adaptive routing is extended to the X.25 access point. Furthermore, 64 Kbps DTEs can be connected to the MS to utilize the excellent response time provided by the RC5000 MegaSwitch and the 2 Mbps trunk lines.

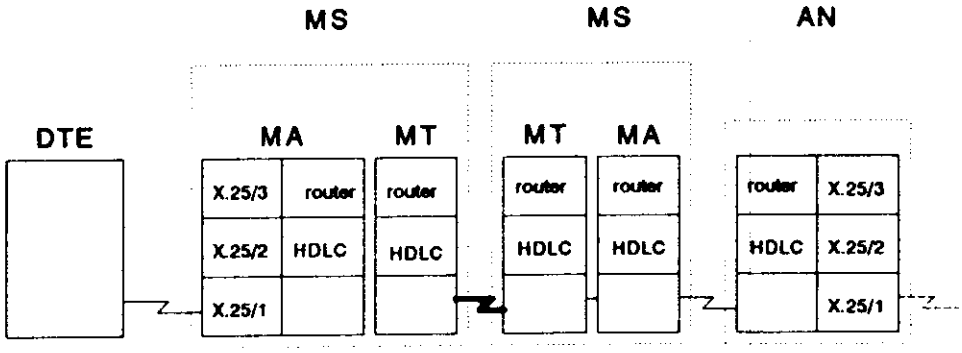

Figure 2.3 X.25 Protocol interaction

RC5000 MegaSwitch and Integration with ISDN

The integration between ISDN and an X.25 net can be established by a Mega Interworking Port (MIP) as appears from fig. 2.4.

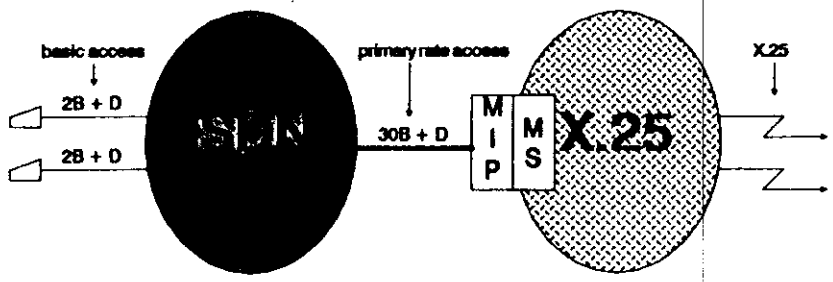

Fig. 2.4 RC5000 MegaSwitch Integration with ISDN.

ISDN and an X.25 net is integrated either as a so-called minimum or as a maximum integration (CCITT Rec. I.462).

An actual packet handler is comprised in the ISDN network at maximum integration and thus the connection between the X.25 net and the ISDN network is through X.75. In this case the MIP (see fig. 2.4) includes an X.75 DTE.

In the minimum integration senario no packet handler exists in the ISDN network. In this case the MIP includes an X.25 DCE establishing connections through the X.25 network, an ISDN D channel function for establishing connections via the ISDN network, and a conversion between X.25 adresses and ISDN numbers.

3. RC5000 MegaSwitch Architecture

An RC5000 MegaSwitch Node comprises one or more RC5000 Basic Switching Units (BSU) interconnected via local transmission lines.

An RC5000 Basic Switching Unit (BSU) comprises a system with:

- one RC5010 Control Module,

- one RC3502 System, and

- a number of RC5020 4 * 64 Kbps Modules, and

- a number of RC5030 2 * 2 Mbps Modules.

Each BSU is selfcontained in one crate with power supply.

Each BSU maintains complete routing information and independent access to Network Management.

A well balanced configuration of an RC5000 MegaSwitch Node is obtained by dividing access from 64 Kbps lines to 2 Mbps lines and transit between 2 Mbps lines on different BSUs. In the following configuration examples a transit BSU is called an MT (Mega Transit) and an access BSU is called an MA (Mega Access).

The MT has ten 2 Mbps HDLC transmission lines. Four of these are external lines, four are internal lines to MAs and two are internal backup lines to another MT.

The MA includes 32 64 Kbps external HDLC lines and two 2 Mbps HDLC lines, of which one constitutes the connection to an MT and the other is a backup line connected to another MA.

Figure 3.1 below shows a complete RC5000 MegaSwitch.

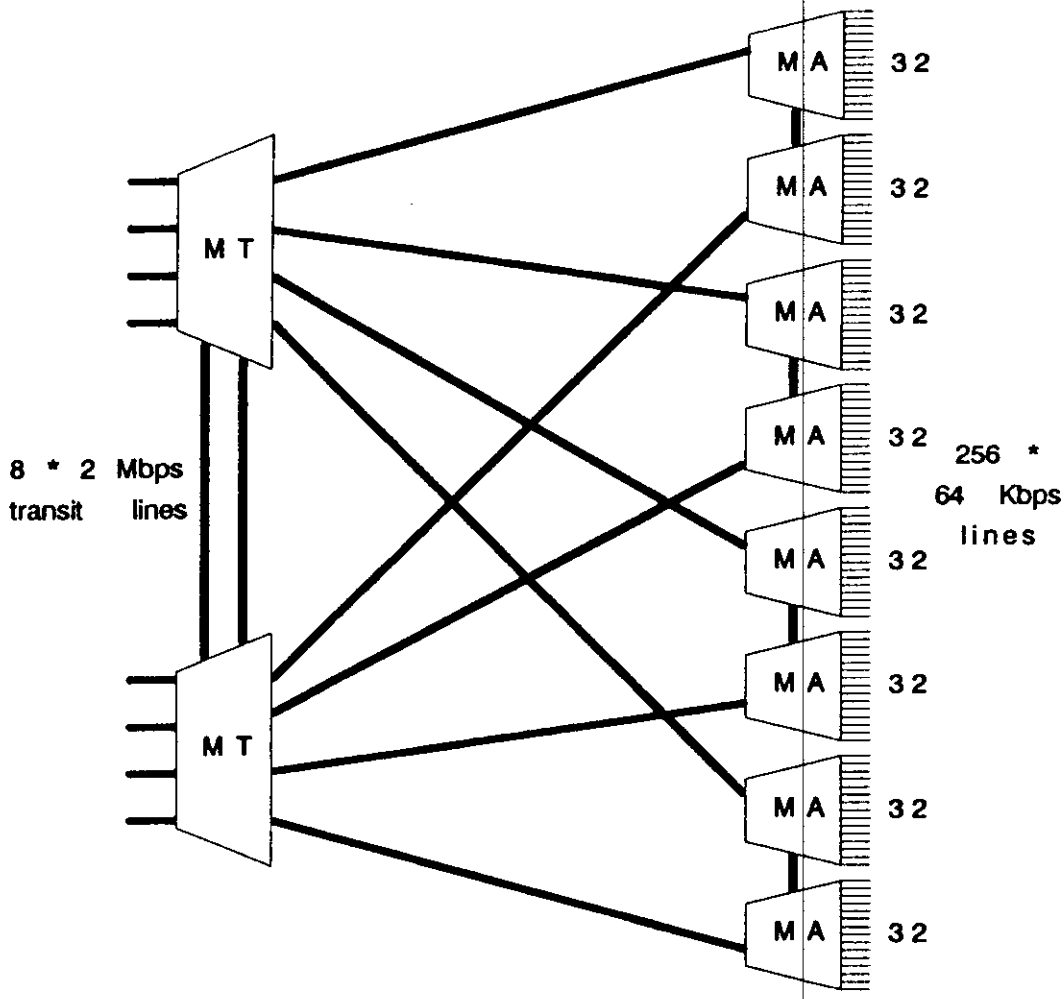

Fig. 3.1. A Complete MS (RC5000 MegaSwitch).

The RC5000 MegaSwitch offers fault tolerant operation. This is achieved by duplication of transmission lines combined with the field proven adaptive routing principle of PAXNET.

The MT and MA units may be situated at the same location whereby the internal 2 Mbps HDLC connections will be cheaper and more reliable. However, the single units can also be placed in different geographical locations. In this case the internal MS connections are actual transmission lines.

Each MT and MA unit contain network control facilities.

The Network Management System in PAXNET is applied for this network control and is implemented by linking each BSU with a RC3502 Communication Processor.

The outgoing 2 Mbps lines (8 from each MS) open up the possibility of constructing a transit network with 9 MegaSwitches as illustrated in below figure 3.2.

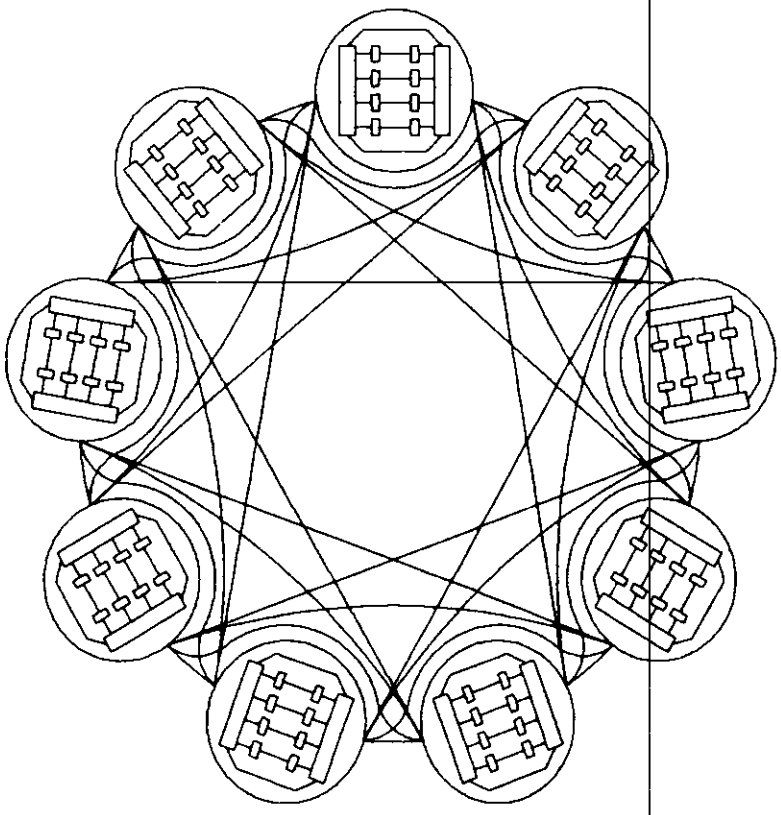

Fig. 3.2. A complete transit network with max. 2 hops.

The RC5000 MegaTransit unit

The MT unit is build around 10 processors each capable of handling one full duplex 2 Mbps HDLC line. Furthermore, one additional processor handles the following control function in the MT:

- Load, reset, and dump of the processors.
- Distribution of routing information between the processors.
- Distribution of Network Management control information to the other processors.
- Communication with the Network Management System.

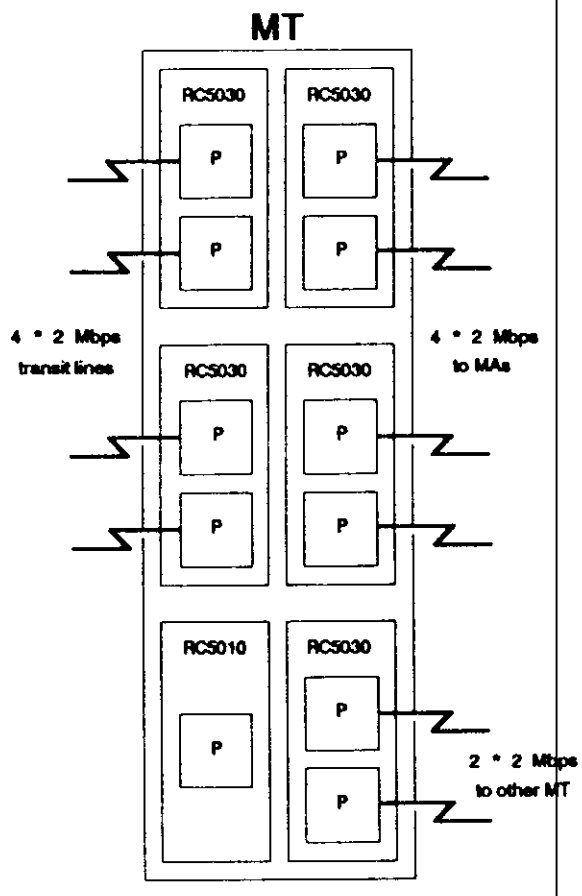

Fig. 3.3. MegaTransit (MT) unit.

Each HDLC line adaptor comprises adaptation to the physical transmission line interface. Normally, according to CCITT Recommendation G.703. In addition the line adaptor comprises loopback facilities.

A complete MT consists of five RC5030 2 * 2 Mbps Modules, one RC5010 Control Module, and an RC3502 Communication Processor interfacing to the Network Management System.

A complete MT is mounted in one standard 19" crate.

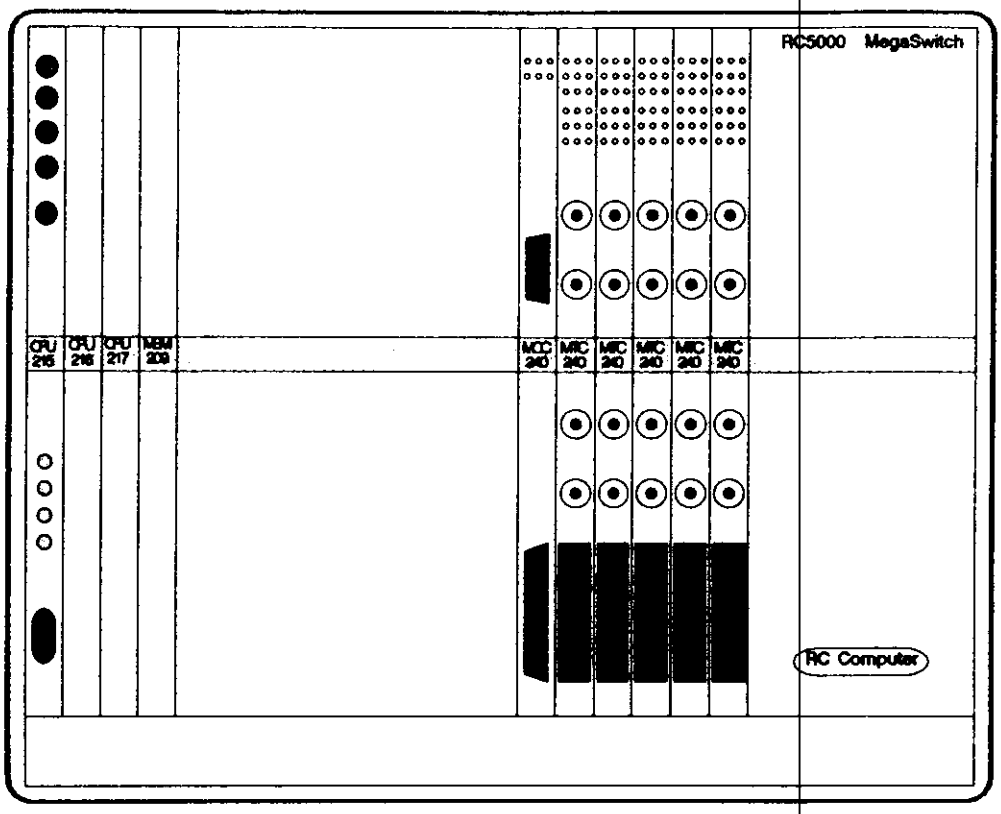

fig. 3.4 MegaTransit (MT) Crate.

The processor used in the MT is a 10 MIPS processor with very fast local memory. Integrated DMA controllers perform the communication between the processors. This provides the MT with a total processing power of 100 MIPS, and an estimated switching capacity of more than 10,000 packets/second (128 bytes packets).

The MegaAccess unit

The MA unit consists of eleven processors. Eight of these are assigned to the 64 Kbps traffic, with each processor handling 4 full duplex HDLC lines. Two processors each handles one full duplex 2 Mbps HDLC line. The last processor handles the control functions as described for the MT unit.

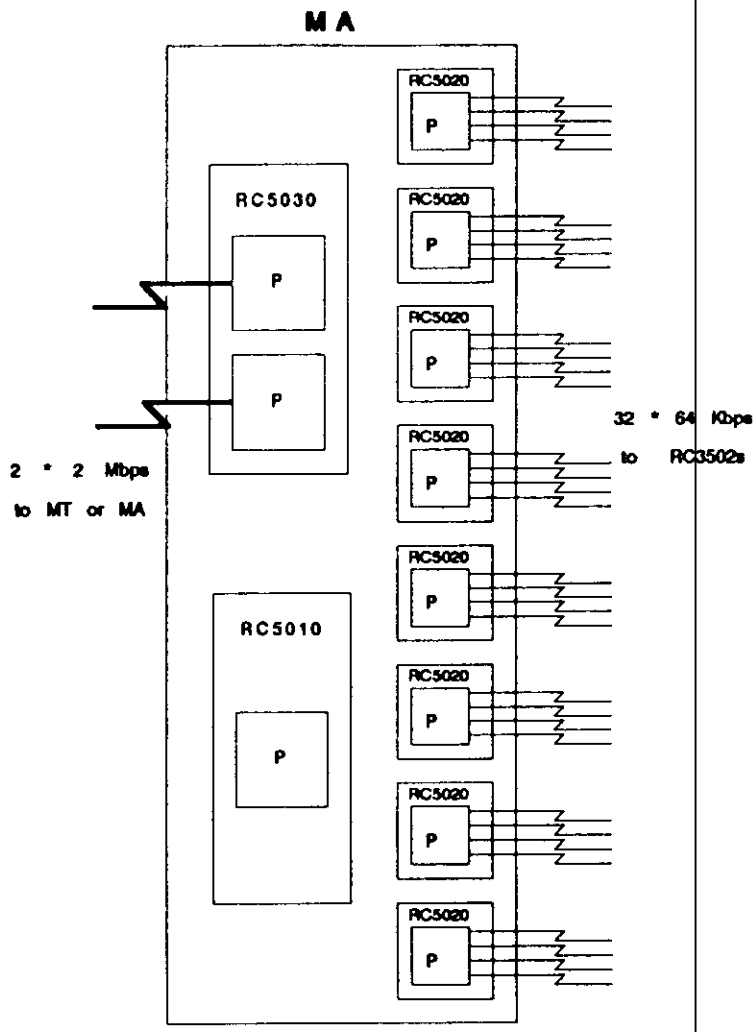

Fig. 3.5 Mega Access Unit.

The MA-unit includes 32 64 Kbits HDLC lines and two 2 Mbps HDLC lines, of which one constitutes the connection to the MT and the other is a back-up line connected to another MA (see fig. 3.1).

Each HDLC line is connected to a line adaptor, which comprises adaption to the electrical interface, primarily in accordance with the CCITT recommendation G.703. Furthermore, the line adaptor comprises loop-back facilities.

A complete MA consists of eight RC5020 4 * 64 Kbps Modules, one RC5030 2 * 2 Mbps Module, one RC5010 Control Module, and an RC3502 Communication Processor interfacing to the Network Management System.

A complete MA is mounted in a standard 19" crate.

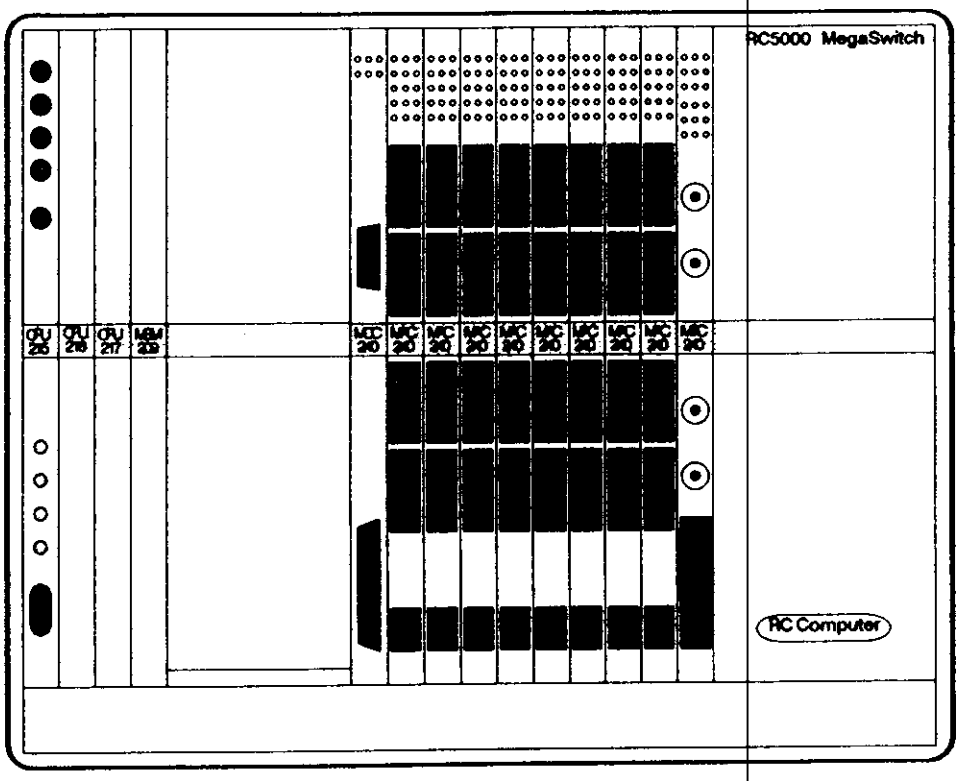

Fig. 3.6 Mega Access Crate.

The processors are identical to those of the MT, and the estimated capacity of an MA is more than 2,500 packets/second (128 bytes/packet).

4. Configuration Examples

A fully configured fault tolerant RC5000 MegaSwitch comprises two Mega Transit Units (MT) and 8 Mega Access Units (MA) as described in Section 3.

This configuration is able to switch 20,000 packets/second (128 bytes packets), and supports 2 x 4 2Mbps communication lines to other RC5000 MegaSwitches and 8 x 32 64Kbps communication lines to RC3502 nodes. This configuration is intended for 48 VDC Power Supply.

This configuration comprises:

Part No.	Nomenclature	qty
RC5010	MegaSwitch Control Module + Bus	10
RC5020	MegaSwitch 4*64Kbps Module	64
RC5030	MegaSwitch 2*2Mbps Module	18
RC3502E-20	Processing Unit, 48 VDC	10
RC3519	3 Mb Enhanced Dynamic RAM	10
RC3521-2	8 Channel I/O Interface	10
RC3563	SCSI, Adaptor	10
RC3565-20	20 MB Winchester	10
F550	48VDC Power Supply	10
F507E-1	Cabinet Medium, 48 VDC	10
SW5001	RC5000 Basic Software	10
SW5010	RC5000 MS Interworking	10
SW5011	RC5000 PAXNET Interworking	8

If fault tolerance for some reason is not essential, it is possible to configure an RC5000 to handle 20,000 pack/sec. in other ways. The most simple configuration comprises one Mega Transit Unit (MT) supporting 20 * 2 Mbps transmission lines to other RC5000 MegaSwitches.

This configuration comprises:

Part No	Nomenclature	qty
RC5010	MegaSwitch Control Module + Bus	1
RC5030	MegaSwitch 2*2Mb Transit Module	10
RC3502E-20	Processing Unit, 48 VDC	1
RC3519	3 MB Enhanced Dynnamic RAM	1
RC3521-2	8 Channel I/O Interface	1
RC3563	SCSI, Adaptor	1
RC3565-20	20 MB Winchester	1
F550	48VDC Power Supply	1
F507E-1w	Cabinet Medium, 48 VDC	1
SW5001	MegaSwitch Basic Software	1
SW5010	MegaSwitch MS Interworking	1

The number of possible configurations is almost infinite. The optimal configuration for a given application depends on factors such as:

- Total network capacity needed,
- Actual traffic distribution,
- Service quality specifications,

as well as many other factors.

RC International will be pleased to participate in RC5000 planning and configuration tasks.

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