Megaplex-2100/2104

Modular Integrated Access Multiplexers

TDMoIP Driven™

FEATURES

- Flexible Integrated Access Multiplexers
- Integrate data, voice/fax and video traffic over up to 4 full E1 or 5 full T1 main links with non-blocking, DS0 cross-connect
- Supports multiple Fractional E1/T1 main links, with combined TDM capacity of 8 Mbps (124 timeslots)
- 10/100 Mbps IP access link for transparent circuit extension over IP using RAD's TDMoIP technology
- Support ring topology:
  - Self-healing TDM E1/T1 rings
  - Resilient Fast Ethernet Ring (RFER) technology providing Fast Ethernet networks with self-healing protection within 50 msec
- PCM, ADPCM digitization and G.723.1 low-bit-rate compressed voice
- Optional redundant configurations support critical applications
- Wide range of I/O modules support multiple channels:
  - 40 high speed data
  - 132 low speed data
  - 55 full BRI (2B+D)
  - 120 PCM voice
- Two chassis types:
  - MP-2100 (4U-high) supports up to 12 modules
  - MP-2104 (2U-high) compact version supports up to five modules
- V5.1 support for standard POTS and ISDN interface to the local exchange
- Support R2 signaling
- Ethernet LAN modules
- Built-in fiber optic and HDSL modems reduce deployment and maintenance costs
- Management through ASCII terminal or SNMP
- RADview SNMP management with graphical user-interface on PC or UNIX (HP OpenView) platform
- Telnet support for remote management
- Non-volatile, Flash memory for software upgrade and configuration download
- DL (download) and TFTP support for Common Logic software upgrade
- Support standard management protocols: SLIP, PPP, PPPHDLC, IP Over Frame Relay (RFC 1450) and RIP2

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DESCRIPTION

- Megaplex-2100/2104 is a modular integrated access TDM multiplexer, that enables integration of multiple dedicated data, voice, ISDN, video and LAN channels over multiple main (network) links. Megaplex features a traffic payload capacity of up to 124 DS0 timeslots. This 8 Mbps capacity can be transmitted over 4 full E1 or 5 full T1 links, or alternatively, over multiple Fractional E1/T1 links.

  Note: Megaplex units with CL.2 common logic provide a maximum payload capacity of 124 timeslots (8 Mbps). Units with CL.1 common logic have a maximum capacity of 62 timeslots (4 Mbps).

- Megaplex's modular design with its wide choice of I/O (user interface) modules, has the flexibility to support applications ranging from small campus networks to multi-site corporate networks or extensive carrier access solutions. Due to Megaplex's standards-adherence, central office based cross-connect units (DACS) can separate voice and data, sending each to the appropriate carrier or service.

- Megaplex enables carriers to successfully deploy bundled services, ISDN services and Internet access. The integration of a broad range of services makes Megaplex a cost-effective access device, with reduced deployment and maintenance costs.

- Megaplex conforms to international standards, ensuring compatibility in multi-vendor environments worldwide.

TDMoIP

- Megaplex offers an optional IP main link module that transmits TDM traffic directly over IP networks. This TDMoIP access module converts user TDM traffic into IP frames that can be transmitted on 10/100BaseT or 100BaseF Ethernet networks. Megaplex with TDMoIP technology provides a cost-effective and versatile, modular solution for supporting legacy TDM equipment over IP networks. This is especially suitable for large corporations, utilities or power companies that are seeking a gradual migration to IP networks.

SYSTEM

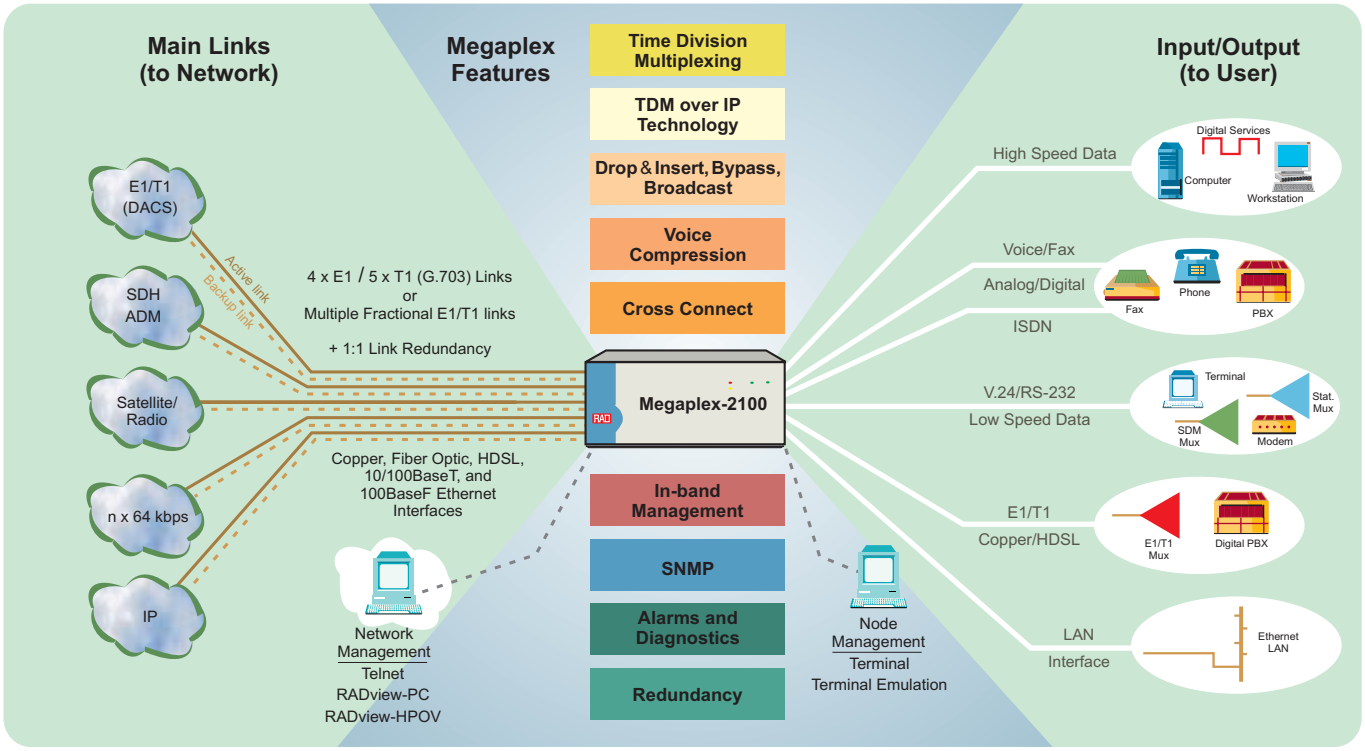
Chassis

- Megaplex is available in two basic unit chassis variants:
  - **Megaplex-2100** (4U high) chassis providing slots for up to 12 ML and I/O modules
  - **Megaplex-2104** (2U high) chassis providing slots for up to 5 main link and I/O modules.

Timing

- Multiple system timing options are available:
  - Internal crystal oscillator clock
  - Clock received from any link (loopback)
  - Clock from any high speed module channel
  - External station (master) clock
  - Adaptive timing received from any bundle (with ML-IP only).

  Any clock source can be set as fallback in the event of primary clock source failure.



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System Redundancy

- Megaplex's modular, distributed architecture enables redundancy at different levels of the network and provides a system with no single point of failure.
- System hardware redundancy is provided through optional redundant power supply and common logic (MP-2100 chassis only).
- 1:1 protection switching on the main link modules protects against network or cable failure. Additional ML modules can be installed and interconnected via Y-cables to provide protection against ML hardware failures.
- Bundle redundancy provides backup for IP transmissions (functions similarly to E1/T1 link "parallel TX" redundancy).
- In case of link failure, Megaplex enables alternate routing. This is achieved by storing multiple configuration databases and flipping (switching) between them in case of any network event.

RING REDUNDANCY

- Megaplex supports RAD's ring topology to provide higher transmission reliability with no single point of failure for critical applications. This topology is based on two transmission paths for each Megaplex unit, to form a closed dual-ring topology (as in SDH network rings).
- Although data is received simultaneously from two different paths, only the signals received from one is processed. If that link is interrupted, the signal received from the other path is used instead. The ring topology is best implemented using the dual-port main link modules, although it can also be supported using ports located on different modules.
- The TDMoIP link module features RAD's Resilient Fast Ethernet Ring (RFER) technology for creating self-healing Ethernet ring networks. RFER reroutes traffic within 50 msec of a ring segment failure, providing fast redundancy performance similar to SDH networks. Survivability is further enhanced by RFER's scalable support for multiple rings.

FULL CROSS-CONNECT

- The built-in, non-blocking, DS0 cross-connect matrix enables freely routing any channel's timeslots to any link. This capability enables, for example, Megaplex to maximize efficiency by splitting voice and data channels and redirecting the traffic, via separate links, to the appropriate service.
- The cross-connect matrix also enables routing timeslots from any link to any other link. This facilitates drop insert, bypass or broadcast multi-link applications.
- A total of 124 timeslots can be allocated, either for transmission of I/O channels or for bypassing timeslots between links of different modules.

Note: Refer to the *Megaplex-2100/2104 with CL.2 System Version* data sheet or the *System Installation and Operation Manual* for which modules can utilize the full 124 timeslot payload.

APPLICATIONS

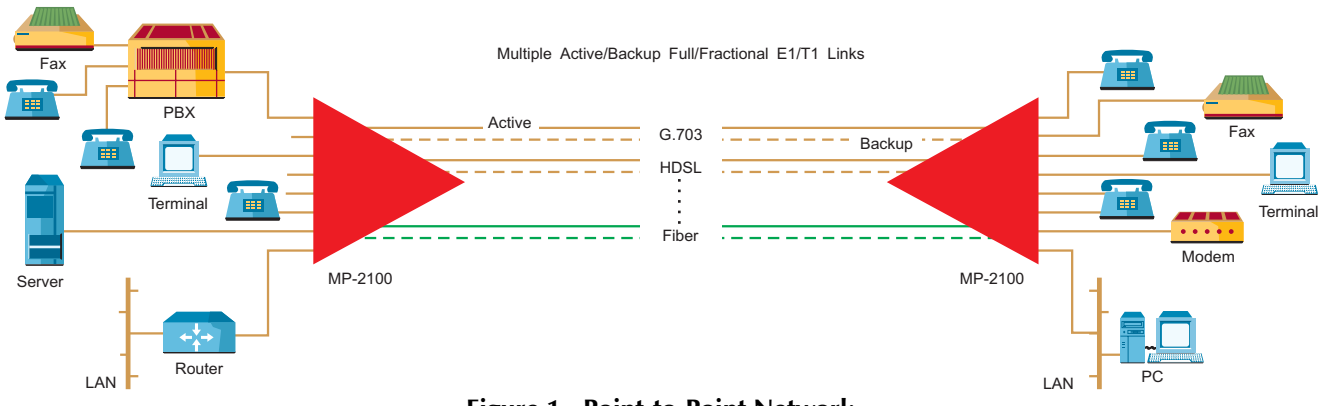

Figure 1. Point-to-Point Network

Megaplex is suitable for integrating all the traffic requirements between two sites, over a wide variety of E1/T1 links: leased lines, fiber optic, HDSL, radio or satellite.

Multiple fractional or full E1/T1 links can support load sharing between the links, as well as automatic backup, with prioritization of voice and data services. Link redundancy is supported, providing 1:1 protective switching between any two links (within 50 msec between dual links of same ML module).

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V5.1 SUPPORT

- Megaplex's V5.1 main link interfaces facilitate the connection of both residential and SOHO PSTN and ISDN BRI users to V5.1 local exchanges. The V5.1 protocol provides concentration similar to ISDN PRI.

R2 SIGNALING SUPPORT

- Main link (ML) modules support R2 signaling with transparent MFC/DECADIC, so that the Megaplex can be placed between an older R2-PBX and a digital (E1-CAS) PBX. The MFC/DECADIC signaling is not terminated by the Megaplex, but passed on to the PBX. In addition to the ITU-T standard R2 protocol, several predefined national PTT protocols, as well as user-defined variations, are also supported. Since the R2 signaling support is provided by the ML, all voice module types support R2.

COMMON LOGIC MODULES

- The Common Logic (CL) module controls the Megaplex's operation and is the interface for its configuration and management. It stores the application software and up to 10 configuration databases (depending on complexity) for multiple independent configurations. The CL also stores all system event information. Flash EPROM for software download is provided.
- Two dedicated ports are provided on the CL module for management purposes. One port has a 9-pin DCE interface for direct connection of a management terminal or PC. The other is ordered with one of the following interface options:
  - Ethernet 10BaseT (UTP)
  - Ethernet 10Base2 (BNC)
  - V.24/RS-232 DTE.

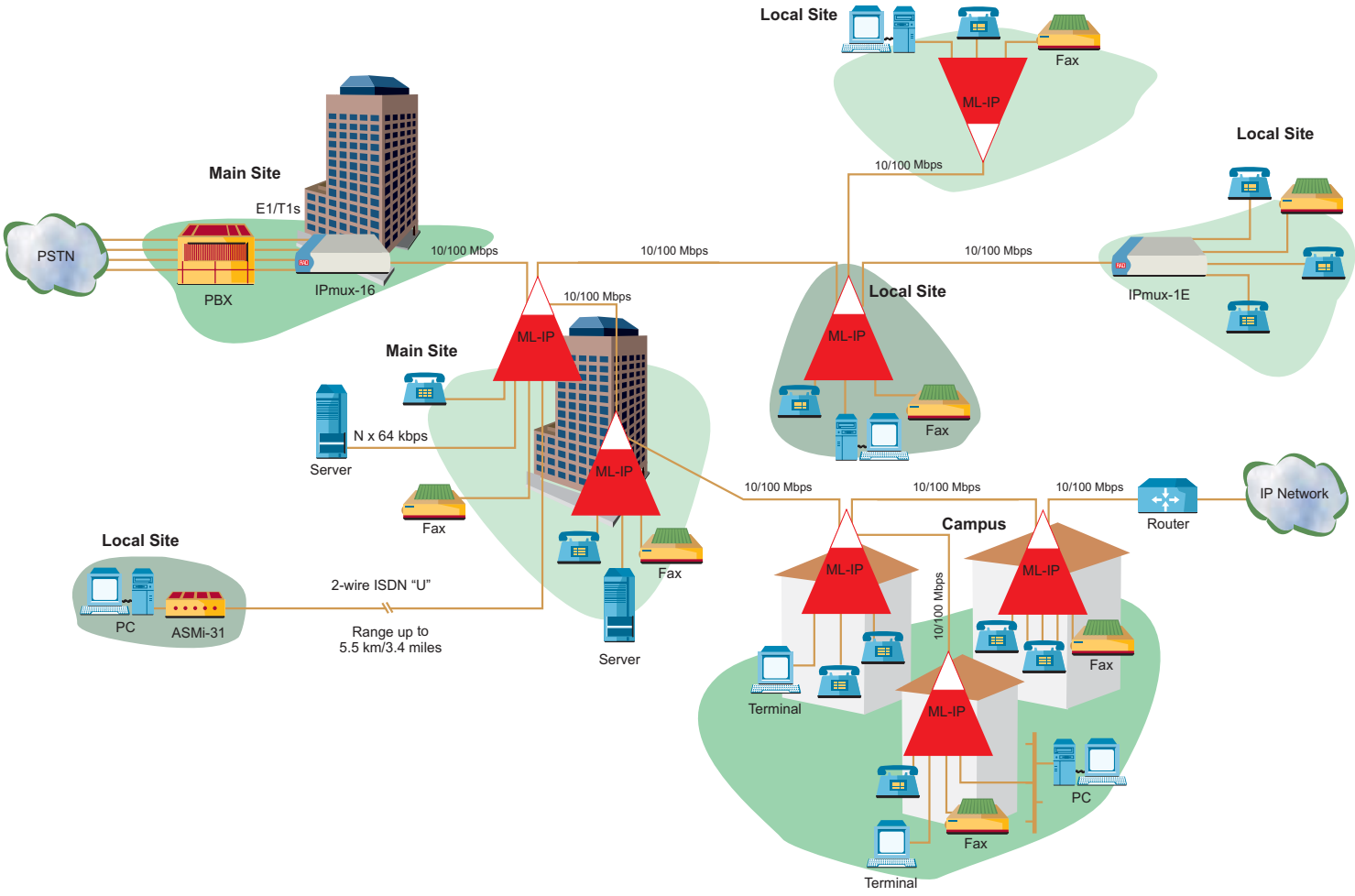

Figure 2. Megaplex with ML-IP Extending TDMVoice and Data Services to Multiple Sites over an IP Network

ML-IP provides standard Ethernet connectivity for the Megaplex. The module can work opposite other standard 10/100BaseT or 100BaseF Ethernet equipment, including RAD's IPmux family of TDMoIP Gateway units, to be part of an integrated corporate/campus IP network.

MAIN LINK MODULES

E1/T1 Main Links

- Megaplex TDM E1/T1 main link modules allow direct connection to a wide range of services, eliminating the need for external equipment. Multiple active links can operate in each chassis. Additional modules can also be installed for link redundancy.
- The various ML modules can be used for a broad range of configurations: from single link non-redundant operation, to multiple full or Fractional E1/T1 link applications supporting drop & insert and broadcast.
- Single or dual E1/T1 link modules with built-in fiber optic modems (range up to 100 km/62 miles) or E1 link modules with HDSL modems (range up to 4.0 km/2.5 miles) are available. These special links reduce the cost of local loop solutions by lowering equipment deployment and maintenance costs.
- The dual-trunk main link modules increase efficiency and support 1:1 protective switching between the two links within 50 msec.

TDMoIP Main Link

- The unique ML-IP main link module converts the TDM bit stream delivered over the internal Megaplex back plane into IP frames, for transmission over IP networks. ML-IP provides three Ethernet ports, with 10/100BaseT or 100BaseF interfaces. The module conforms to IEEE 802.3 and 802.3u and provides reliable, high quality of service (QoS), including VLAN tagging and priority labeling (ToS).
- ML-IP places TDM timeslots into IP bundles with VLAN tagging that can be used for supporting point-to-multipoint applications. Duplicate bundles can be transmitted simultaneously on different paths for redundancy.
- Each ML-IP module can convert and uplink a TDMoIP payload of up to 4 Mbps (a second module can be installed in the Megaplex to increase this capacity to 8 Mbps). The module's multiple Ethernet ports can be employed for daisy-chaining the output of additional ML-IP equipped Megaplex units. This enables transmitting a TDM capacity of up to the equivalent of 40 E1/50 T1 links, over a single 100 Mbps Ethernet link.
- ML-IP's uplink ports feature RAD's Resilient Fast Ethernet Ring (RFER) technology to construct self-healing Fast Ethernet fiber or copper ring topologies. In case of link failure on any segment of the ring, RFER reroutes the traffic (both the TDMoIP traffic and the protected IP traffic) within 50 msec, fast enough to maintain required voice quality. ML-IP's resilient ring performance was independently tested and certified for service resilience and quality by an independent network test center.

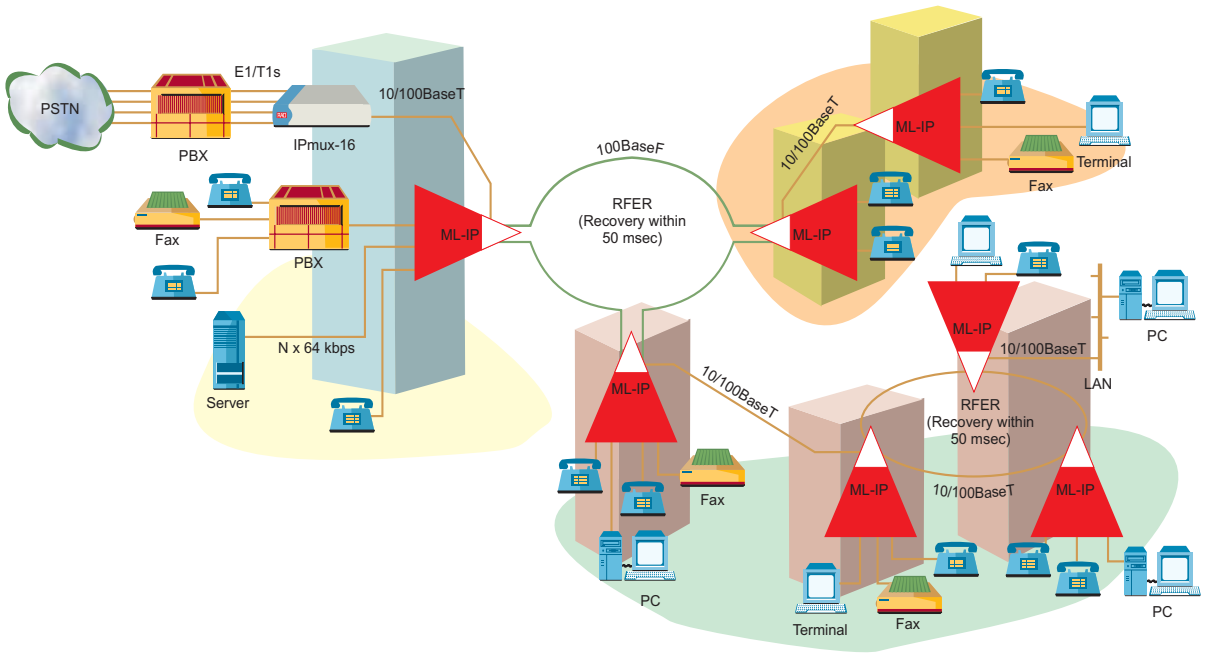

Figure 3. Resilient Fast Ethernet Ring (RFER) Provides 50 msec Self-healing IP Networks

Megaplex ML-IP with RAD's RFER technology, enables corporations, campuses, utilities, and transportation companies to create highly reliable IP networks with 50 msec link protection switching, using dark fiber or copper wire in a ring topology.

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I/O MODULES

- Up to 11 I/O modules can be placed in an MP-2100 chassis (up to 4 I/O modules in an MP-2104). If more I/O modules are required, multiple Megaplex units can be cascaded.

High Speed Data Modules

- High speed data interface modules, operating at multiples of 56 or 64 kbps, up to 2.048 Mbps, support connection to routers, bridges, front-end processors, and other high speed devices.
- E1 interface modules with built-in HDSL modems, enable cost-effective long range deployment of high speed services over 2 or 4-wire copper lines. Range up to 4.0 km.
- ISDN BRI modules with up to 12 channels, enable extension of ISDN services over non-ISDN facilities, supporting data, voice and video applications. The "U" interface modules include IDSL technology for "last mile" applications.

Low Speed Data Modules

- Sub-rate multiplexer modules for low speed (2.4 to 19.2 kbps) synchronous and asynchronous data channels. Modules available to support standard X.50, X.58 or SDM (DS0-B) multiplexing techniques.
- Low speed modules with 6 or 12 sync/async V.24/RS-232 channels, with independent channel rates up to 64 kbps are available. A 4-channel sync/async data module with V.110 rate adaptation is also available.

Voice/Fax Modules

- Voice/fax modules provide toll-quality voice transmission using standard PCM (ITU-T G.711), as well as ADPCM (G.726), MPMLQ (G.723.1), or P-CELP 4.8 kbps compression. Standard analog interfaces are available to enable direct connection to POTS, public payphones, LB (local battery) field phones, PBX extensions or 2/4-wire E&M trunks. Alternatively, voice compression modules with E1 and T1 digital PBX interfaces are available. Loop, wink and ground-start signaling are also supported.

LAN Modules

- Ethernet router/bridge internet modules, compatible with the LAN RANger remote access family or third party routers/bridges are featured. These modules enable LAN to LAN extension over E1/T1 services.

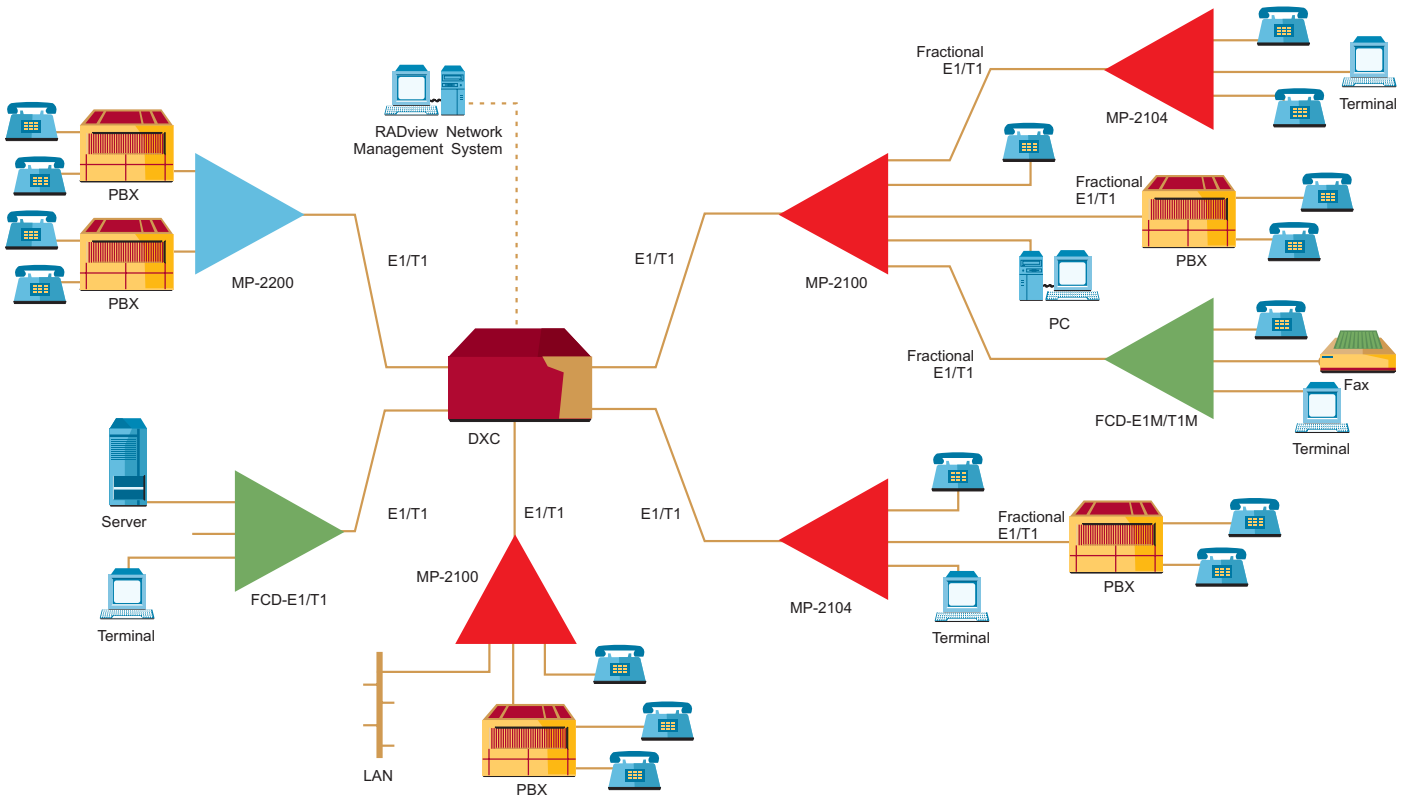
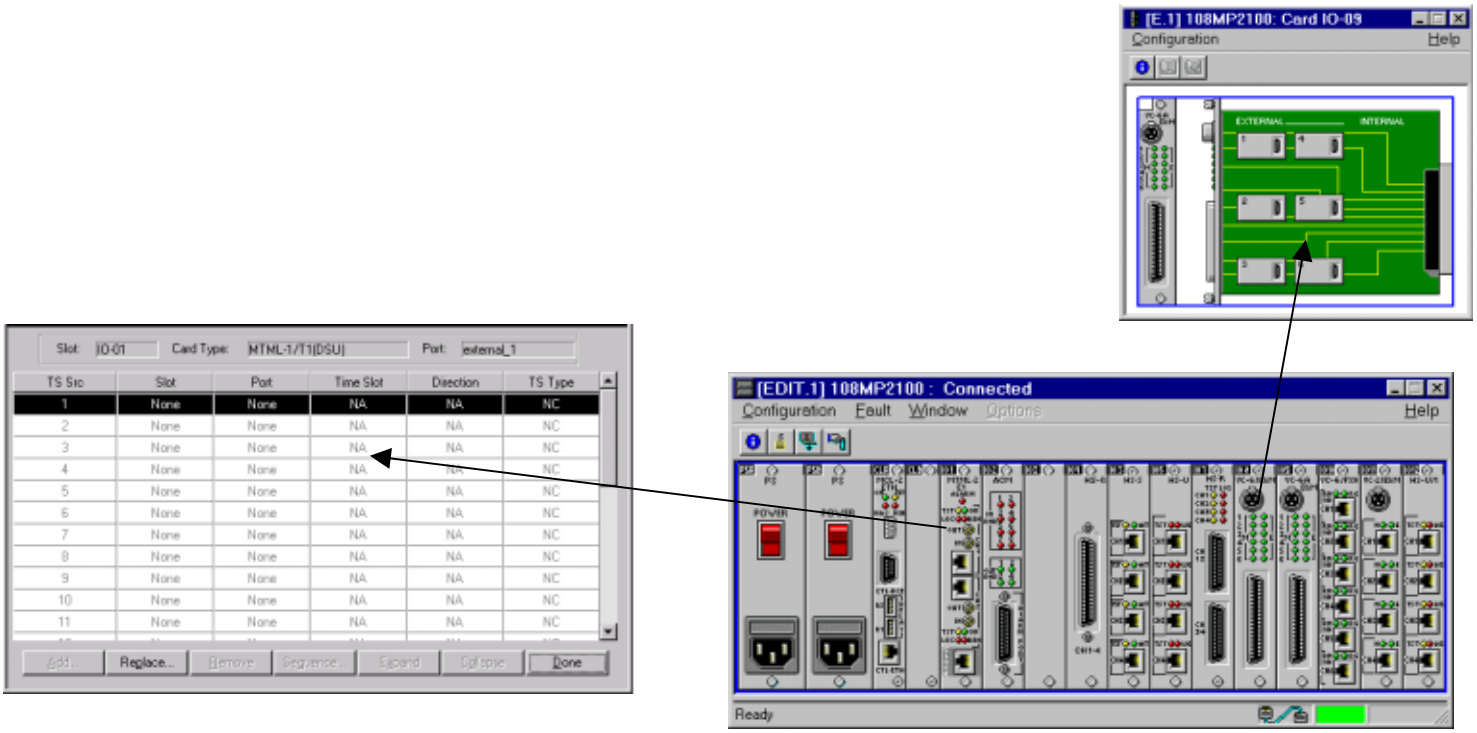


Figure 4. Mesh Corporate Network

RAD's DXC (Digital Cross-connect) DACS complements Megaplex's own cross-connect capabilities, to provide a comprehensive network solution. DXC enables flexible routing of timeslots between different Megaplex and other E1/T1 equipment sites, together with an integrated network management for easy control and monitoring.



GUI-based RADview Network Management System for Megaplex-2100/2104

MANAGEMENT

- Megaplex's configuration parameters are user-programmable, with all configurations saved in non-volatile memory.
- Megaplex communicates with the management station by means of its SNMP agent (via a SLIP/PPP or TCP/IP connection). Network management provides centralized control of all network nodes, including interface configuration, connection setup, alarms and management.
- Megaplex can be managed by SNMP network management systems. The user-friendly *RADview* network management applications are GUI-based to facilitate management of both individual units and entire networks.
- Programming and setup of a remote Megaplex can be performed:
  - Out-of-band, using the Ethernet management port. This simple and efficient method takes advantage of IP bandwidth on demand, while saving link bandwidth for user traffic
  - In-band over a dedicated timeslot, supporting standard PPP, FR encapsulation, and RIP2 protocols
  - Over a modem link or over a FRAD, via the control port of the remote unit.

Diagnostics

- Megaplex incorporates test features for rapid fault detection and easy maintenance. Upon power-up, all system and modules perform self-testing. Any problems are reported to the management system. Loopbacks, BERTs and tone injections can be run on individual channels or main links, towards both the network and users side.
- Megaplex features a signal monitoring capability useful for voice application diagnostics. It enables displaying a "snapshot" of the current ABCD signaling bit states of any selected timeslot that carries voice traffic.

Alarms

- All alarms, including state and frequency of occurrence, are stored in the CL's alarm status buffer. Last 256 alarms are kept in a separate alarm history buffer.
- Alarm status can be automatically read online by the management system from any node. User-set alarm masking, filtering and inversion, as well as 5-level prioritization are also supported.

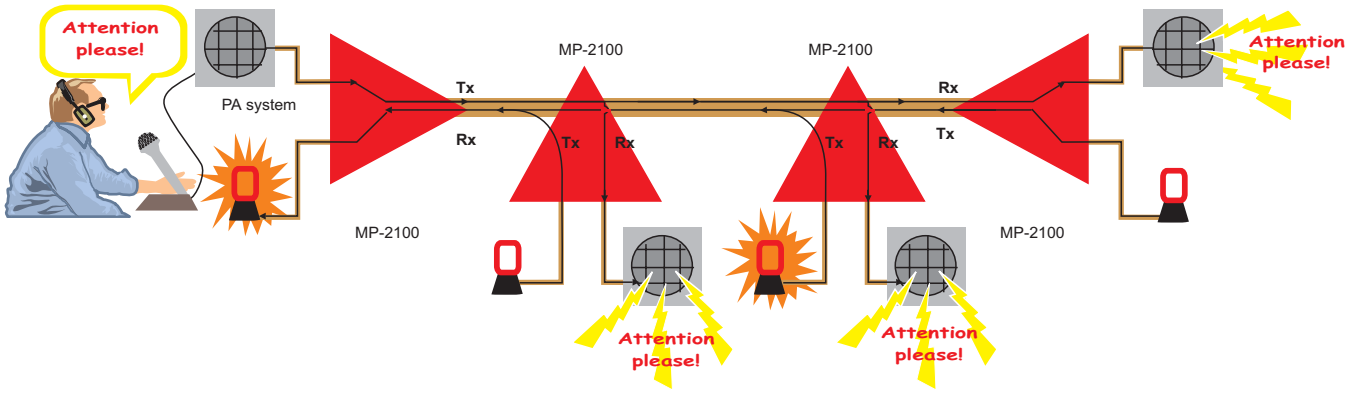


Figure 5. Chain Topology Application with Unidirectional Broadcast

For connectivity between three or more sites, Megaplex supports drop & insert, and bypass applications in V, ring, or chain topologies.

Enhanced Unidirectional Broadcast capability improves bandwidth utilization for applications with asymmetric traffic. In the application above, a public announcement is transmitted to all sites using a timeslot in the Tx line only. Meanwhile, the same timeslot in the Receive (Rx) direction, is utilized to carry an alarm signal from one of the sites back to the main site.

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NEBS-COMPLIANT EQUIPMENT

- The Megaplex-2100 is also offered in a special NEBS-compliant version which meets the Type 3 and Type 4 requirements, and permits reliable operation at harsher temperatures and environmental conditions.
- To meet the Type 3 requirements in applications where the lines extend outdoors, a line protection unit may be required. RAD offers a dedicated line protection unit, MP-2100-LP-MN, to safeguard the lines of up to 12 Megaplex voice modules.

  Contact your RAD distributor for more information on NEBS-compliant equipment.

SPECIFICATIONS

- **Main Link and I/O Modules**
  See accompanying data sheets
- **Configuration**
  Performed by ASCII Terminal or PC, connected to terminal interface or via Telnet;
  Using RADview SNMP management system
- **Physical – MP-2100 (4U-high)**
  - 2 power supply module slots
  - 2 CL module slots
  - 12 slots for I/O and ML modules
  - Height: 18 cm / 7 in (4U)
  - Width: 44 cm / 17 in
  - Depth: 33 cm / 13 in
  - Weight: less than 12 kg / 26 lb
- **Physical – MP-2104 (2U-high)**
  - Built-in power supply (optional built-in ringer for voice/ISDN power feeding is available)
  - 1 CL module slot
  - 5 slots for I/O and ML modules
  - Height: 9 cm / 3.5 in (2U)
  - Width: 44 cm / 17 in
  - Depth: 33 cm / 13 in
  - Weight: less than 6 kg / 13 lb

  (All weights are for fully loaded units)
- **Power Supply Input**

  MP-2100:
  - AC: 100, 115 or 230 VAC
  - DC: 24 or -48 VDC

  MP-2104:
  - AC: 100, 115 or 230 VAC
  - DC: 24 or -48 VDC
- **Power Supply Output Currents per Internal Voltage Line (in Amps)**

Power Supply	+5V	-5V	+12V	-12V	-48V	+72V/ +60V
MP-2100						
PS180/AC	25	5	1.2	0.6	-	-
PS200/AC	40	6.5	2	2	-	-
PS180/48V	25	1.5	1	1	-	-
PS130/24V	10	1.5	1	1	-	-
MP-2104						
AC	10	0.8	4	0.8	-	-
DC	5	1	3	1	-	-
ACw/Ringer	10	0.8	4	0.8	0.6	0.5
DCw/Ringer	5	1	3	1	-	0.5

- **Environment**
  Temperature
  Operating: 0–45°C / 32–113°F (NEBS version: up to 55°C / +131°F)
  Storage: -20–70°C / -4–160°F
  Humidity: up to 90%, non-condensing

NEBS-Compliant Megaplex-2100 Chassis

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ORDERING

BASIC UNITS

Standard Megaplex-2100/2104 systems are comprised of a **Basic Unit**, as well as **Main Link** and **I/O Modules**, which are ordered separately.

Basic units include a chassis, single CL module, single power supply, and power supply cables.

See *separate module data sheets* for main link and I/O module details and ordering information.

MP-2100/*/&/#
4U-high chassis with 12 module slots and CL.1 common logic

MP-2100/*/&/2#
4U-high chassis with 12 module slots and CL.2 common logic

MP-2104/*/+/#
2U-high chassis with 5 module slots and CL.1 common logic

MP-2104/*/+/2#
2U-high chassis with 5 module slots and CL.2 common logic

SYSTEM MODULES

System modules can be ordered separately for redundancy or special requirements

MP-2100M-PS180/*
Power Supply Module for MP-2100 (not available for 24 VDC input)

MP-2100M-PS200/*
Higher Power Supply Module for MP-2100
(available only for AC input)

MP-2100M-PS130/24
24 VDC Input Power Supply Module for MP-2100

MP-2100M-CL/#
Common Logic 1 Module

MP-2100M-CL.2/#
Common Logic 2 Module

ORDERING OPTIONS

* Specify power supply input voltage:
100 for 100 VAC
115 for 115 VAC
230 for 230 VAC
24 for 24 VDC
48 for -48 VDC

& Specify redundancy (MP-2100 only):
R for full (2 x PS, 2 x CL)
RP for partial (2 x PS, 1 x CL)
Default is for 1 x PS, 1 x CL

+ Specify **RI** for built-in ringer (MP-2104 only)

Specify CL second management port (*in addition to standard 9-pin DCE port*):
UTP for Ethernet 10BaseT (UTP)
BNC for Ethernet 10Base2 (BNC)
V24 for V.24/RS-232 DTE

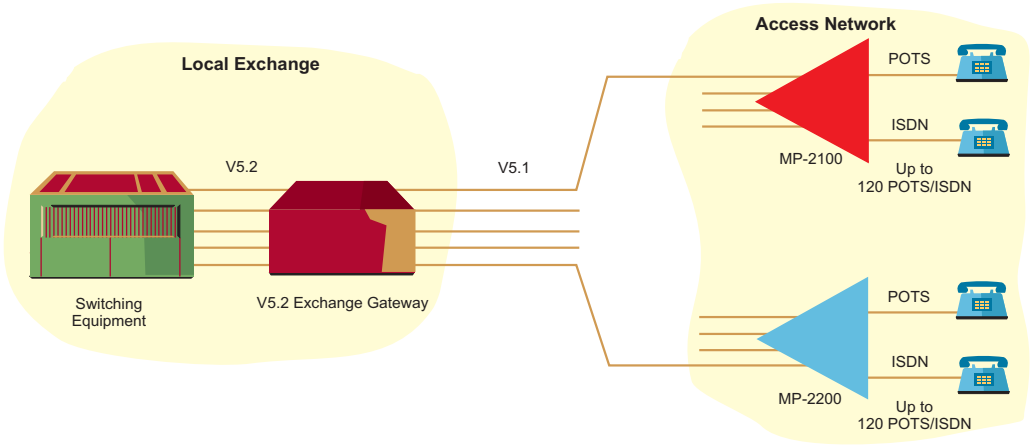

Figure 6. V5 Application

Megaplex-2100 supports the V5.1 protocol and can be used, together with a V5.2 exchange gateway, for connection to local exchanges that use the V5.2 protocol. Each Megaplex-2100 or ETSI/ANSI compliant chassis Megaplex-2200 unit can support up to 120 POTS or ISDN phones.

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