



## Storage Access Networking Cards

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**Note**

The terms “Unidirectional Path Switched Ring” and “UPSR” may appear in Cisco literature. These terms do not refer to using Cisco ONS 15xxx products in a unidirectional path switched ring configuration. Rather, these terms, as well as “Path Protected Mesh Network” and “PPMN,” refer generally to Cisco’s path protection feature, which may be used in any topological network configuration. Cisco does not recommend using its path protection feature in any particular topological network configuration.

The FC\_MR-4 (Fibre Channel Multirate 4-port) card is a 1.0625- or 2.125-Gbps Fibre Channel/Fiber Connectivity (FICON) card that integrates non-SONET framed protocols into a SONET time-division multiplexing (TDM) platform through virtually concatenated payloads. For installation and step-by-step circuit configuration procedures, refer to the *Cisco ONS 15454 Procedure Guide*.

Chapter topics include:

- [6.1 FC\\_MR-4 Card Overview, page 6-1](#)
- [6.2 FC\\_MR-4 Card Modes, page 6-3](#)
- [6.3 FC\\_MR-4 Card Application, page 6-5](#)

### 6.1 FC\_MR-4 Card Overview

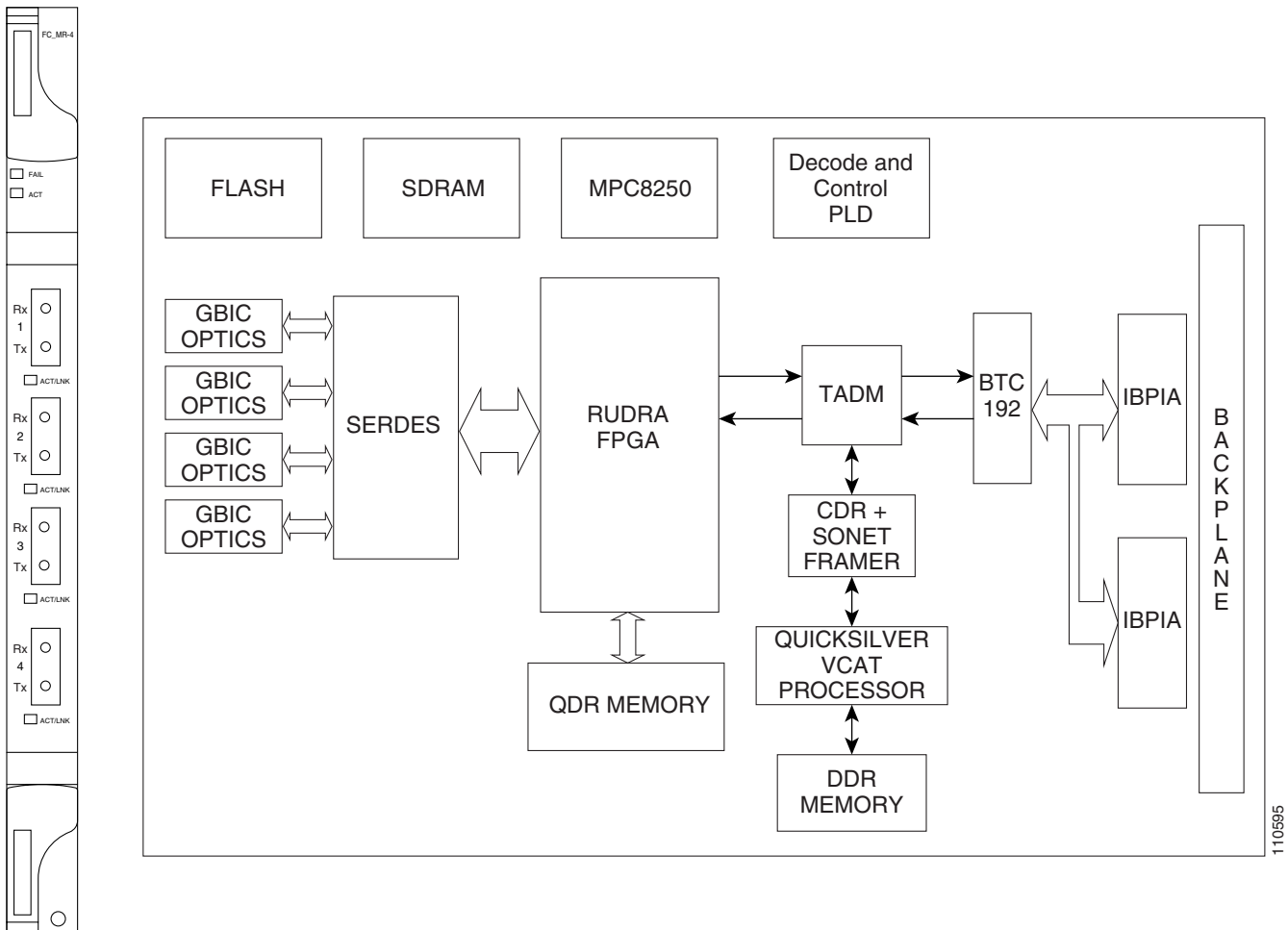
The FC\_MR-4 card uses pluggable Gigabit Interface Converters (GBICs) to transport non-SONET/SDH-framed, block-coded protocols over SONET/SDH. The FC\_MR-4 enables four client Fibre Channel (FC) ports to be transported over SONET/SDH, encapsulating the frames using the ITU-T Generic Framing Protocol (GFP) format and mapping them into either T1X1 G.707-based Virtual Concatenated (VCAT) payloads or standard contiguously concatenated SONET/SDH payloads. The FC\_MR-4 card has the following features:

- Four FICON ports operating at 1 Gbps or 2 Gbps
  - All four ports can be operational at any time due to subrate support
  - Advanced Distance Extension capability (buffer-to-buffer credit spoofing)
- Pluggable GBIC optics
  - Dual rate (1G/2G): MM (550 m) and SM (10 km)
  - Single rate (1G): SX (550 m) and LX (10 km)
- SONET/SDH support

- Four 1.0625 Gbps FC channels can be mapped into SONET/SDH containers as small as STS1/VC3 (subrate), with a minimum of STS-24c/VC4-8c for full rate, and as large as STS48c/VC4-24c.
- Four 2.125 Gbps FC channels can be mapped into SONET/SDH containers as small as STS1/VC3 (subrate), with a minimum of STS48c/VC4-24c for full rate, and as large as STS48c/VC4-24c.
- Frame encapsulation: ITU-T G.7041 Generic Framing Procedure-Transparent (GFP-T)
- High-order SONET/SDH virtual concatenation support (STS1-xv/VC-3 and STS3c-xv/VC-4)

Figure 6-1 shows the FC\_MR-4 faceplate and block diagram.

**Figure 6-1** FC\_MR-4 Faceplate and Block Diagram



## 6.1.1 FC\_MR-4 Card-Level Indicators

Table 6-1 describes the two card-level LEDs on the FC\_MR-4 card.

Table 6-1 FC\_MR-4 Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	The red FAIL LED indicates that the card's processor is not ready. Replace the card if the red FAIL LED persists.
Green ACT LED	If the ACTV/STBY LED is green, the card is operational and ready to carry traffic.
Amber ACT LED	If the ACTV/STBY LED is amber, the card is rebooting.

## 6.1.2 FC\_MR-4 Port-Level Indicators

Each FC\_MR-4 port has a corresponding ACT/LNK LED. The ACT/LNK LED is solid green if the port is available to carry traffic, is provisioned as in-service, and in the active mode. The ACT/LNK LED is flashing green if the port is carrying traffic. The ACT/LNK LED is steady amber if the port is not enabled and the link is connected, or if the port is enabled and the link is connected but there is a SONET/SDH transport error. The ACT/LNK LED is unlit if there is no link.

You can find the status of the card ports using the LCD screen on the ONS 15454 SDH fan-tray assembly. Use the LCD to view the status of any port or card slot; the screen displays the number and severity of alarms for a given port or slot. Refer to the *Cisco ONS 15454 Troubleshooting Guide* for a complete description of the alarm messages.

## 6.1.3 FC\_MR-4 Compatibility

The FC\_MR-4 cards can be installed in Slots 1 to 6 and 12 to 17 when used with XCVT and XC10G cards. The card can be provisioned as part of any valid ONS 15454 SONET/SDH network topology, such as a path protection, bidirectional line switched ring (BLSR), or linear network topologies. The FC\_MR-4 card is compatible with Software R4.6 and greater.

## 6.2 FC\_MR-4 Card Modes

The FC\_MR-4 card can operate in two different modes:

- Line Rate mode. This mode is backward compatible with the Software Release 4.6 Line Rate mod.
- Enhanced mode. This mode supports subrate, distance extension, and other enhancements

The FC\_MR-4 card reboots when a card mode changes (a traffic hit results). The FPGA running on the card upgrades to the required image. However, the FPGA image in the card's flash is not modified.

### 6.2.1 Line-Rate Card Mode

The mapping for the line-rate card mode is summarized here.

- 1 Gbps Fibre Channel/FICON is mapped into:
  - SONET CCAT: STS24c, STS48c
  - SONET VCAT: STS3c-8v, STS1c-24v
  - SDH CCAT: VC4-8c, VC4-16c

- SDH VCAT: VC4-8v
- 2 Gbps Fibre Channel/FICON is mapped into:
  - SONET CCAT: STS48c
  - SONET VCAT: STS3c-16v, STS1c-48v
  - SDH CCAT: VC4-16c
  - SDH VCAT: VC4-16v

## 6.2.2 Enhanced Card Mode

The features available in enhanced card mode are given in this section.

### 6.2.2.1 Mapping

1 Gbps Fibre Channel/FICON is mapped into:

- SONET CCAT: STS1c, STS3c, STS6c, STS9c, STS12c, STS18c, STS24c, STS48c
- SONET VCAT: STS3c-Nv (N is 1 to 8), STS1c-Nv (N is 1 to 24)
- SDH CCAT: VC4-1c, VC4-2c, VC4-3c, VC4-4c, VC4-6c, VC4-8c, VC4-16c
- SDH VCAT: VC4-Nv (N is 1 to 8)

2 Gbps Fibre Channel/FICON is mapped into:

- SONET CCAT: STS1c, STS3c, STS6c, STS9c, STS12c, STS18c, STS24c, STS36c, STS48c
- SONET VCAT: STS3c-Nv (N is 1 to 16), STS1c-Nv (N is 1 to 48)
- SDH CCAT: VC4-1c, VC4-2c, VC4-3c, VC4-4c, VC4-6c, VC4-8c, VC4-12c, VC4-16c
- SDH VCAT: VC4-16v (N is 1 to 16)

### 6.2.2.2 SW-LCAS

Virtual Concatenation Group (VCG) is reconfigurable with the software link capacity adjustment scheme (SW-LCAS) enabled, as follows:

- Out of service and out of group members can be removed from VCG
- Members with deleted cross connect can be removed from VCG
- Errored members can be autonomously removed from VCG
- Degraded bandwidth VCGs are supported
- VCG is flexible with SW-LCAS enabled (VCG can run traffic as soon as the first cross-connect is provisioned on both sides of the transport)

## 6.2.3 Distance Extension (Enhanced Mode Only)

The following list describes the FC\_MR-4 card distance extension capabilities.

- Enabling of SAN extension over long distances through buffer-to-buffer (B2B) credit spoofing.
  - 2300 Km for 1G ports (longer distances supported with lesser throughput)

- 1150 Km for 2G ports. (longer distances supported with lesser throughput)
- Negotiation mechanism to identify whether a far-end FC-over-SONET card supports the Cisco proprietary B2B mechanism
- Auto detection of FC switch B2B credits from FC-SW standards-based ELP frames
- Support for manual provisioning of credits based on FC switch credits
- Automatic GFP Buffers adjustment based on roundtrip latency between two SL ports
- Automatic Credits recovery during SONET switchovers/failures
- Insulation for FC switches from any SONET switchovers; no FC fabric reconvergences for SONET failures of less than or equal to 60 ms

## 6.2.4 Interoperability Features (Enhanced Mode Only)

The interoperability features are as follows:

- Maximum Frame Size Setting to prevent accumulation of oversize performance monitoring parameters for VSAN frames
- Ingress Filtering Disable for attachment to third party GFP over SONET/SDH equipment

## 6.2.5 Link Integrity

The link integrity features are as follows:

- Data port disabled if upstream data port is not able to send over SONET/SDH Transport
- Data port disabled if SONET/SDH transport is errored

## 6.2.6 Link Recovery

Link recovery has the following features:

- Reduces the impact of SONET/SDH disruptions on attached fiber channel equipment.
- Speeds up the recovery of ISL links (Inter Switch Links)
- Allows the monitoring of Buffer to Buffer credit depletion due to SONET outage and the full recovery of the credits, thus preventing the slow decay of the bandwidth/throughput



**Note**

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Distance Extension and Link Recovery cannot be enabled at the same time.

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## 6.3 FC\_MR-4 Card Application

The FC\_MR-4 card reliably transports carrier-class, private-line Fibre Channel/FICON transport service. Each FC\_MR-4 card can support up to four 1-Gbps circuits or four 2-Gbps circuits. Four 1.0625 Gbps FC channels can be mapped into containers as small as STS1 (subrate), with a minimum of STS-24c/VC4-8c for full rate, and as large as STS48c/VC4-24c. Four 2.125 Gbps FC channels can be mapped into containers as small as STS1 (sub-rate), with a minimum of STS48c/VC4-24c for full rate, and as large as STS48c/VC4-24c.

The FC\_MR-4 card incorporates features optimized for carrier-class applications such as:

- Carrier-class Fibre Channel/FICON
- 50 ms of switch time through SONET/SDH protection as specified in Telcordia GR-253CORE
- Hitless software upgrades
- Remote Fibre Channel/FICON circuit bandwidth upgrades via integrated Cisco Transport Controller (CTC)
- Multiple management options through CTC, Cisco Transport Manager (CTM), TL1, and Simple Network Management Protocol (SNMP)

The FC\_MR-4 payloads can be transported over the following protection types:

- Path protection
- BLSR
- Unprotected
- Protection channel access (PCA)

The FC\_MR-4 payloads can be transported over the following circuit types:

- STS
- STSn
- STS-V



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**Note** VT and VT-V circuits are not supported.

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The FC\_MR-4 card supports virtual concatenation (VCAT). See the [“10.15 Virtual Concatenated Circuits” section on page 10-29](#).

The FC\_MR-4 uses pluggable gigabit interface converters (GBICs) for client interfaces. See [Table 5-21 on page 5-26](#) for a list of GBICs that are compatible with the FC\_MR-4.