# TDM/DSx

This chapter describes the level of support that Cisco ANA provides for time-division multiplexing (TDM), Digital Signal (DSx) Hierarchy, and related physical technologies, as follows:

- Technology Description, page 31-1
- Information Model Objects (IMOs), page 31-2
- Vendor-Specific Inventory and IMOs, page 31-5
- Service Alarms, page 31-5

Please see Part 1: Cisco VNEs in this guide for information about which devices support the various technologies.

# Technology Description

This section provides the following TDM/DSx technology descriptions:

- TDM
- DSx
- T3/E3
- Channelized T3, OC3, DS3 Interface
- Circuit Emulation over MPLS

## TDM

Time-Division Multiplexing (TDM) is a type of digital multiplexing in which two or more signals or bit streams are transferred apparently as subchannels in one communication channel. The transmission of these streams appears to be simultaneous, but they are actually taking turns on the channel. This is done by dividing the transmission time domain into several recurrent slots of fixed length, one for each subchannel. A sample byte or data block of subchannel 1 is transmitted during timeslot 1, subchannel 2 during timeslot 2, and so on. One TDM frame consists of one timeslot per subchannel. After the last subchannel, the cycle starts again with a new frame, starting with the second sample, byte or data block from subchannel 1, and so on.

# DSx

Digital Signal (DSx) Hierarchy refers to the rate and format of digital telecommunication circuits, as part of the North American Digital Hierarchy. DSx is related to the T-carrier designations. However, DS refers to multiplexing techniques, while the T designations refer to the underlying equipment and signaling. There are various DS levels, the most common being:

- DS0/Fractional T1 (64 Kb/s), which represents a single voice telephone call.
- DS1/T1 (1.544 Mb/s), with 24 user channels.
- DS2/T2 (6.312 Mb/s), with 96 user channels.
- DS3/T3 (44.736 Mb/s), with 672 user channels.

# T3/E3

T-carrier telecommunications is a generic name for several digitally multiplexed telecommunications carrier systems used in North America, Japan, and Korea. The basic unit of the T-carrier system is the Fractional T1, which corresponds to the Digital Signal Hierarchy's DS0, and is commonly used for one voice circuit.

The E-carrier system (the "E" stands for "European") is incompatible with the T-carrier system (though cross-compliant cards exist). It is in common use everywhere outside of North America, Japan, and Korea. It typically uses the E1 (2.048 Mb/s) and E (334.368 Mb/s) line rates.

# Channelized T3, OC3, DS3 Interface

Channelization, coupled with native edge-aggregation services such as MPLS and QoS, allows service providers and large enterprises to save dramatically on power, floor space, local-loop charges, and equipment costs, by permitting receipt and transmission of multiplexed T3, OC3 and DS 3 circuits over high-bandwidth physical media.

# Circuit Emulation over MPLS

In CEM, TDM bitstream connections (T1, E1, T3, E3) are encapsulated as pseudowires over the MPLS backbone. Both structured and structure-agnostic TDM bitstreams are supported.

# Information Model Objects (IMOs)

This section describes the following IMOs:

- DS0 Bundle Interface (IDS0Bundle)
- DS1 Physical (IDS1Pdh)
- DS3 Physical (IDS3Pdh)

# DS0 Bundle Interface

The data link layer DS0 Bundle Interface object is bound by its Containing Termination Points attribute to either DS1 Physical or DS3 Physical Layer objects. It is accessed primarily by the data link layer object, such as the ATM Interface and the Frame Relay Interface, bound by its Contained Connection Termination Points attribute.

*Table 31-1      DS0 Bundle Interface (IDS0Bundle)*

| Attribute Name | Attribute Description | Scheme | Polling Interval |
|---|---|---|---|
| Bundled Time Slots | Bundled time slots (DS1 channels). | Product | Configuration |
| Bundle Location | Bundle location/index. | Product | Configuration |
| AdminStatus | The administrative status of the interface (*Down*, *Testing*, *Up*). | IpCore | Configuration |
| OperStatus | The operational status of the interface (*Down*, *Testing*, *Up*). | IpCore | Configuration |
| IANA Type | Internet Assigned Numbers Authority (IANA) type of the sublayer. | N/A | N/A |
| Containing Termination Points | Underlying termination points (connection or physical). | Product | N/A |
| Contained Connection Termination Points | Bound connection termination points. | Product | N/A |

# DS1 Physical

The physical layer DS1 Physical and DS3 Physical objects are bound by their Containing Termination Points attribute to a Port Connector object. Each of these objects is accessed primarily by the data link layer object (such as an ATM Interface, Frame Relay Interface, or DS0 Bundle Interface) bound by its Contained Connection Termination Points attribute.

*Table 31-2      DS1 Physical (IDS1Pdh)*

| Attribute Name | Attribute Description | Scheme | Polling Interval |
|---|---|---|---|
| Framing Type | Framing type (*Null, OTHER, ESF, ANSI ESFf, D4, E1, E1 CRC, E1 MF, E1 CRC MF, UNFRAMED, E1 UNFRAMED, DS2 M12, E2, E1 Q50, E1 Q50 CRC, ANSI SF, E1 CAS CRC4, E1 CAS No CRC4, E1 No CAS CRC4, E1 No CAS No CRC4, E1 Unstructured, T1 Unstructured, CLEAR CHANNEL*). | Product | Configuration |
| Cell Mapping Type | Cell mapping type (*Null, PLCP, HEC, HCS, Direct, ADM*). | Product | Configuration |
| Loop Back Type | Loopback type (*Null, Cell, Payload, Diag, Line, None, Other, Path, Metalic, Non Metalic, Serial, Parallel, Local, Internal, Network, Inward, Dual, Remote, Inbound Local, No Loop*). | Product | Configuration |
| Scrambling Mode | Scrambling mode (*Null, On, Off*). | Product | Configuration |
| Port Description | Port description. | Product | Configuration |
| International Bit | Indicates whether the E3 international bit is set. | Product | Configuration |
| Line Code | Line-code type for T1 or E1 lines (*ami, b8zs, hdb3*). | Product | Configuration |
| Cable Length | Set cable length. | Product | Configuration |
| Recovered Clocking ID | Recovered clocking ID. | Product | Configuration |

*Table 31-2        DS1 Physical (IDS1Pdh)  (continued)*

| Attribute Name | Attribute Description | Scheme | Polling Interval |
|---|---|---|---|
| Clocking | Clocking type (*stratum1*, and so on). | Product | Configuration |
| Loopback | Transponder loopback setting (*none*, *internal*, *line*). | Product | Configuration |
| All additional attributes are the same as Physical Layer (IPhysicalLayer) | | | |

# DS3 Physical

*Table 31-3        DS3 Physical (IDS3Pdh)*

| Attribute Name | Attribute Description | Scheme | Polling Interval |
|---|---|---|---|
| Framing Type | Framing type (*Null, Other, M23, SYNTRAN, CBIT, Clear Channel, E3 Other, E3 Framed, Unframed, E3 Unframed, ITU-T G.804, ITU-T G.832, M13*). | Product | Configuration |
| Cell Mapping Type | Cell mapping type (*Null, PLCP, HEC, HCS, Direct, ADM*). | Product | Configuration |
| Loop Back Type | Loopback type (*Null, Cell, Payload, Diag, Line, None, Other, Path, Metalic, Non Metalic, Serial, Parallel, Local, Internal, Network, Inward, Dual, Remote, Inbound Local, No Loop*). | Product | Configuration |
| Scrambling Mode | Scrambling mode (*Null, On, Off*). | Product | Configuration |
| Port Description | Port description. | Product | Configuration |
| International Bit | Indicates whether the E3 international bit is set. | Product | Configuration |
| Line Code | Line-code type for T1 or E1 lines (*ami, b8zs, hdb3*). | Product | Configuration |
| Cable Length | Set cable length. | Product | Configuration |
| Recovered Clocking ID | Recovered clocking ID. | Product | Configuration |
| Clocking | Clocking type (*stratum1*, and so on). | Product | Configuration |
| Loopback | Transponder loopback setting (*none*, *internal*, *line*). | Product | Configuration |
| All additional attributes are the same as Physical Layer (IPhysicalLayer) | | | |

# Vendor-Specific Inventory and IMOs

There are no vendor-specific inventory or IMOs for this technology.

# Service Alarms

The following alarms are supported for this technology:

- Discard Packets, page 41-26
- Dropped Packets, page 41-27
- Link Down, page 41-43
- Port Down, page 41-55
- Rx Utilization, page 41-58
- Tx Utilization, page 41-62
- DS0 Bundle Service Alarm, page 41-28