Advanced WAN Concepts and Troubleshooting
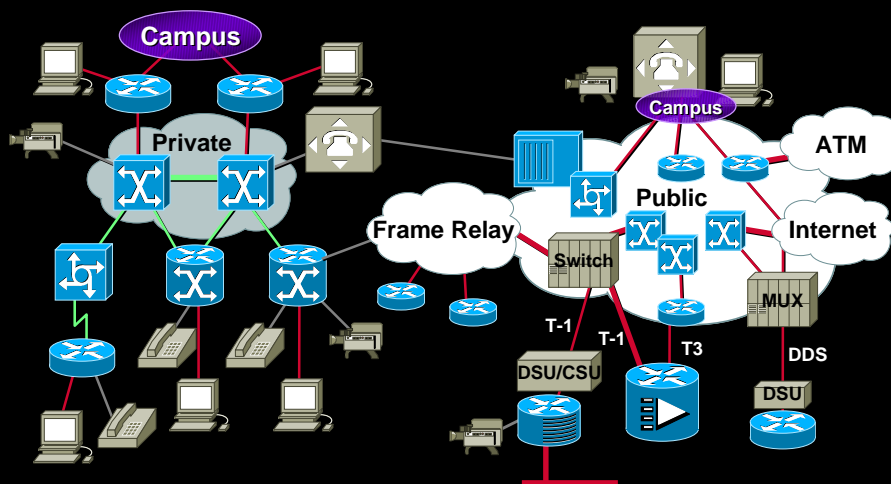
Session 103

Agenda

- **Overview of WAN Issues**
- **Network Interfaces—Routed WAN**
- **Router Tools and Concepts**
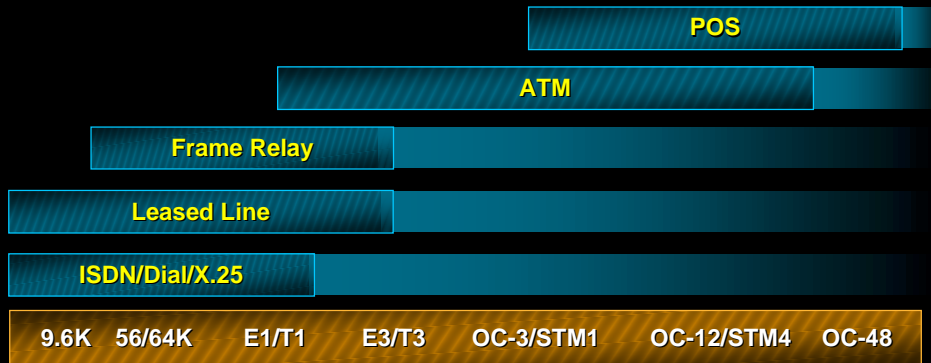- **Network Interfaces—Switched WAN**
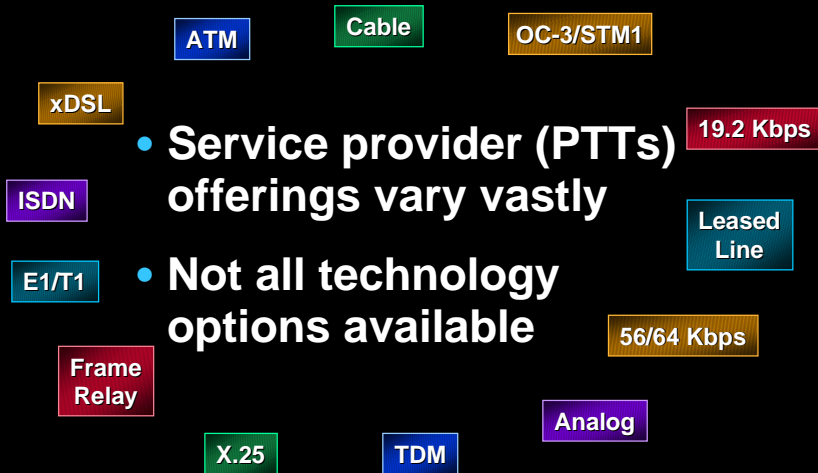- **Switch Tools and Concepts**

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The WAN Network

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The WAN Network (Cont.)

WAN Speeds

| POS |
| ATM |
| Frame Relay |
| Leased Line |
| ISDN/Dial/X.25 |

| 9.6K | 56/64K | E1/T1 | E3/T3 | OC-3/STM1 | OC-12/STM4 | OC-48 |

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The WAN Network (Cont.)

ATM Cable OC-3/STM1

xDSL

19.2 Kbps

- **Service provider (PTTs) offerings vary vastly**

ISDN

Leased Line

E1/T1

- **Not all technology options available**

56/64 Kbps

Frame Relay

Analog

X.25 TDM

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Network Interfaces

- **Customer premise side**

  Routers i.e., Cisco 7500, 7200, 2600, 3810

  DCE i.e., CSUs, DSUs, modems

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Network Interfaces (Cont.)

- **Network provider side**

  Switches: i.e., ATM, ISDN, Frame

  MUX: i.e., DACs, SONET, channel banks

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Network Interfaces (Cont.)

- **Key configuration concerns**

  Clocking—network synchronization

  Framing—ESF, M23, cbit

  Coding—B8ZS, B3ZS

Network Interfaces (Cont.)

- **Red alarm**

  Loss of signal(LOS) or out of frame
  (OOF) on RX

- **Yellow alarm**

  Signal that far end has loss of RX. Sometimes
  known as Remote Alarm Indication(RAI)

- **Blue alarm**

  Loss of signal upstream. Known as Alarm
  Indication Signal(AIS)

Network Interfaces (Cont.)

- **Clocking concerns**

  Synchronize network elements

  Clock sources—highest quality

  Design for resiliency

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Network Interfaces (Cont.)

- **Stratum levels of accuracy**
- **Stratum 1 source is usually an atomic standard**

  Stratum 1 drives strata 2-3-4

  1×10^{-11} (BSRF*) (± 1 second in 3170 years!)

- **Stratum 2 drives strata 2-3-4 clocks**

  1.5×10^{-10} (15 times worse than BSRF) (± 1 second in 5.07 years)

- **Stratum 3 drives strata 3-4 clocks**

  4.6×10^{-6} (460,000 times worse than BSRF)(± 1 second in 51.6 days)

- **Stratum 4 should never be used as source to any clock system**

  3.2×10^{-5} (3,200,000 times worse than BSRF) (± 1 second in 3.68 days)

BSRF = Bell System reference frequency

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Network Interfaces for Routed WAN

- **Router platforms with internal DSU/CSU**

  Cisco 3810 with MultiFlex Trunk (MFT)

  Cisco 2600 and 3600 WAN Interface Card (WIC)

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Network Interfaces for Routed WAN (Cont.)

Router Commands

```
wan-3810a(config)#controller e1 0
Controller configuration commands:
```

Command	Description
cablelength	Specify the cable length for a DS1 link
channel-group	Specify the timeslots to channel-group mapping for an interface
clock	Specify the clock source for a DS1 link
default	Set a command to its defaults
description	Controller specific description
exit	Exit from controller configuration mode
fdl	Specify the FDL standard for a DS1 data link
framing	Specify the type of Framing on a E1 link
linecode	Specify the line encoding method for a E1 link
loop-detect	Loopback up or down detection
loopback	Put the entire E1 line into loopback
mode	Configure the controller mode
pri-group	Configure the specified timeslots for PRI
shutdown	Shut down a E1 link (send Blue Alarm)
tdm-group	Configure DS0 group for TDM

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Network Interfaces for Routed WAN (Cont.)

Show Controller [E1|T1]

```
wan-3810a#sh cont e1 0
E1 0 is down.
     Applique type is Channelized E1 - balanced
     Transmitter is sending remote alarm.
     Receiver has loss of signal.
     Slot 3 Serial #09034728 Model TEB HWVersion 4.70 RX level = 35DB
     Framing is CRC4, Line Code is HDB3, Clock Source is Line.
     Data in current interval (867 seconds elapsed):
        8862 Line Code Violations, 0     Path Code Violations
        0 Slip Secs, 0 Fr Loss Secs, 867 Line Err Secs, 0 Degraded Mins
        0 Errored Secs, 0 Bursty Err Secs, 0        Severely Err Secs, 867 Unavail Secs
     Data in Interval 1:
        6373 Line Code Violations, 0 Path Code Violations
        0 Slip Secs, 0 Fr Loss Secs, 897 Line Err Secs, 0 Degraded Mins
        0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 900 Unavail Secs
     Data in Interval 2:
        7404 Line Code Violations, 0 Path Code Violations
        0 Slip Secs, 0 Fr Loss Secs, 898 Line Err Secs, 0 Degraded Mins
        0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 900 Unavail Secs
```

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Network Interfaces for Routed WAN (Cont.)

Router Commands

```
wan-2524(config-if)#service-module t1?
     clock                Service module clock source
     data-coding          Service module DCE line coding
     fdl                  Specify the FDL standard for a DS1 data
     framing              Framing format
     lbo                  Line Build Out format
     linecode             Line coding format
     remote-alarm-enable  Remote/Yellow alarm enable
     remote-loopback      Remote Loopback/RL disable
     timeslots            Fraction timeslots
```

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Network Interfaces for Routed WAN (Cont.)

Show Service Module

```
wan-2524#sh service-module
Module type is T1/fractional
     Hardware revision is B, Software revision is 1.2 ,
     Image checksum is 0x2162E11, Protocol revision is 1.1
Receiver has no alarms.
Framing is ESF, Line Code is B8ZS, Current clock source is line
Fraction has 24 timeslots (64 Kbits/sec each), Net bandwidth is 1536 Kbits/sec.
Last user loopback performed:
     dte loopback
     duration 00:00:48
Last module self-test (done 04:46:18): Passed
Last clearing of alarm counters 2w2d
     loss of signal          :   4, last occurred 04:20:53
     loss of frame           :   4, last occurred 00:18:01
     AIS alarm               :   1, last occurred 04:37:55
     Remote alarm            :   0,
     Module access errors     :   0,
Total Data (last 96 15 minute intervals):
     65537 Line Code Violations, 4 Path Code Violations
     0 Slip Secs, 439 Fr Loss Secs, 387 Line Err Secs, 0 Degraded Mins
     4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 439 Unavail Secs
Data in current interval (498 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
```

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Network Interfaces for Routed WAN (Cont.)

- **VIP-based WAN interfaces**

  PA-T4   **PA-CT3**

  MC-T3   **MC-T1**

  PA-POS

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Network Interfaces for Routed WAN (Cont.)

```
Router# sh int serial 1/0
Serial1/0 is up, line protocol is up
    Hardware is M4T
    Internet address is 10.10.10.1
    MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
    Encapsulation PPP, loopback not set, keepalive set (10 sec)
    LCP Open
    Open: ipcp
    Last input 00:00:09, output 00:00:09, output hang never
    Last clearing of "show interface" counters never
    Input queue: 0/75/0 (size/max/drops); Total output drops: 0
    Queueing strategy: weighted fair
    Output queue: 0/64/0 (size/threshold/drops)
        Conversations  0/1 (active/max active)
        Reserved Conversations 0/0 (allocated/max allocated)
    5 minute input rate 0 bits/sec, 0 packets/sec
    5 minute output rate 0 bits/sec, 0 packets/sec
        1675 packets input, 26792 bytes, 0 no buffer
        Received 0 broadcasts, 0 runts, 0 giants
        0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
        1676 packets output, 26806 bytes, 0 underruns
        0 output errors, 0 collisions, 0 interface resets
        0 output buffer failures, 0 output buffers swapped out
        0 carrier transitions    DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
```

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Network Interfaces for Routed WAN (Cont.)

T1 Controller Configs

```
wan-7204a(config)#controller t1 3/0

Controller configuration commands:
    bert            Start BERT test
    cablelength     Specify the cable length for a DS1 link
    channel-group   Specify the timeslots to channel-group mapping for an interface
    clock           Specify the clock source for a DS1 link
    description     Controller specific description
    exit            Exit from controller configuration mode
    fdl             Specify the FDL standard for a DS1 data link
    framing         Specify the type of Framing on a DS1 link
    linecode        Specify the line encoding method for a DS1 link
    loopback        Put the entire T1 line into loopback
    no              Negate a command or set its defaults
    pri-group       Configure the specified timeslots for PRI
    shutdown        Shut down a DS1 link (send Blue Alarm)
```

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Network Interfaces for Routed WAN (Cont.)

```
Router# show controllers t1 3/0

T1 1/0 is up.
    No alarms detected.
    Framing is ESF, Line Code is B8ZS, Clock Source is Line.
    Data in current interval (710 seconds elapsed):
        0 Line Code Violations, 0 Path Code Violations
        0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
        0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, Unavail,Secs
    Data in Interval 1:
        0 Line Code Violations, 0 Path Code Violations
        0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
        0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
```

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Network Interfaces for Routed WAN (Cont.)

T3 Controller Configs

```
wan-7204a(config)#controller t3 1/0

Controller configuration commands:
    cablelength   cable length in feet (0-450)
    clock         Specify the clock source for a T3 link
    description   Controller specific description
    framing       Specify the type of Framing on a T3 link
    idle          Specify the idle pattern all channels on a T3 interface
    loopback      Put the entire T3 line into loopback
    mdl           Maintenance Data Link Configuration
    no            Negate a command or set its defaults
    shutdown      Shut down a DS3 link (send DS3 Idle)
    t1            Create a T1 channel
```

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Network Interfaces for Routed WAN (Cont.)

MC-T3 Config

Controller T3 1/0

Clock source line

Cablelength 20

T1 1 channel-group 0 timeslots 1-24

T1 1 clock source line

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Network Interfaces for Routed WAN (Cont.)

Show Controller T3

```
wan-7204a#sh cont t3
T3 1/0 is up.  Hardware is CT3 single wide port adapter
    CT3 H/W Version : 1.0.1, CT3 ROM Version : 1.1, CT3 F/W Version : 2.1.1
    FREEDM version: 1, reset 0
    Applique type is Channelized T3
    Description:
    No alarms detected.
    FEAC code received: No code is being received
    Framing is M23, Line Code is B3ZS, Clock Source is Line
    Rx throttle total 0
    Data in current interval (55 seconds elapsed):
        0 Line Code Violations, 0 P-bit Coding Violation
        0 C-bit Coding Violation, 0 P-bit Err Secs
        0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
        0 Unavailable Secs, 0 Line Errored Secs
        0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    Total Data (last 6 15 minute intervals):
        0 Line Code Violations, 0 P-bit Coding Violation,
        0 C-bit Coding Violation, 0 P-bit Err Secs,
        0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
        0 Unavailable Secs, 0 Line Errored Secs,
        0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
```

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Network Interfaces for Routed WAN (Cont.)

Show Controller T3 (Cont.)

```
T1 1 is up
    timeslots: 1-24
    FDL per AT&T 54016 spec.
    No alarms detected.
    Framing is ESF, Clock Source is Line
    Data in current interval (73 seconds elapsed):
        0 Line Code Violations, 0 Path Code Violations
        0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
        0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
        0 Unavail Secs, 0 Stuffed Secs
    Total Data (last 6 15 minute intervals):
        0 Line Code Violations,0 Path Code Violations,
        0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
        0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
        8 Unavail Secs, 0 Stuffed Secs
    T1 2 is down............
    T1 3 is down............
    T1 4 is down............etc
```

Network Interfaces for Routed WAN (Cont.)

POS Interfaces

- **Configuration issues**

  A few items need to be known before configuring Cisco routers to support SONET; Also, depending on the specific controller type and network operations, not all of the items listed below may be supported or required

  Clock source—line or internal—specifies whether the clock is obtained from the line signal or from the internal oscillator; clock source may be set to line if router connects to a SONET/SDH ADM or set to internal if it connects to another router; (note: the internal clock will always be used to transmit an AIS alarm signal if there is an incoming LOS)

  Framing—SONET or SDH—selects whether STS or STM framing is used; (may be fixed if controller does not support both)

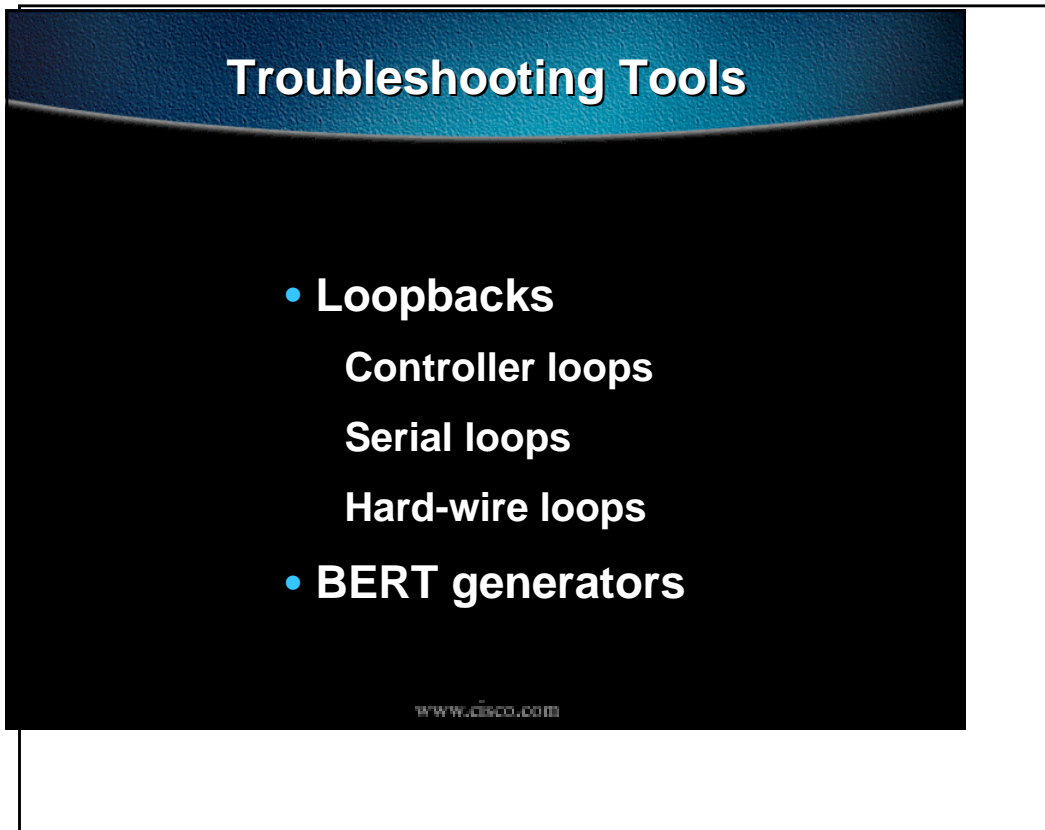# Network Interfaces for Routed WAN (Cont.)

POS Interfaces

- **Payload scramble**—on or off—normally on (sometimes this is not configurable in the controller, in which case scrambling will always be on)

- **Alarm reporting**—specify which alarms are to be reported; select none or all of items such as: b1-tca, b2-tca, sf-ber, sd-ber, los, lof, ais-l and rdi-l

- **Alarm thresholds**—specify the BER thresholds which will cause an alarm report for: b1-tca, b2-tca, sf-ber and sd-ber

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Network Interfaces for Routed WAN (Cont.)

```
router# show controller pos 2/0/0
POS2/0/0
SECTION
  LOF = 0        LOS = 2                BIP(B1) = 0
LINE
  AIS = 2     RDI = 20       FEBE = 0   BIP(B2) = 0
PATH
  AIS = 2     RDI = 2        FEBE = 0   BIP(B3) = 0
  LOP = 0   NEWPTR = 0   PSE = 0   NSE = 0
Active Defects: B2-TCA B3-TCA
Active Alarms:  None
Alarm reporting enabled for: B1-TCA
APS
  COAPS = 12612784   PSBF = 8339
  State: PSBF_state = False
  Rx(K1/K2): 00/CC  Tx(K1/K2): 00/00
  S1S0 = 03, C2 = 96
CLOCK RECOVERY ---------trying to recover
  RDOOL = 2
  State: RDOOL_state = True
PATH TRACE BUFFER: UNSTABLE
  Remote hostname :
  Remote interface:
  Remote IP addr  :
  Remote Rx(K1/K2): ../..  Tx(K1/K2): ../..
BER thresholds:  SF = 10e-3  SD = 10e-8
TCA thresholds:  B1 = 10e-7   B2 = 10e-3  B3 = 10e-6
```

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Troubleshooting Tools

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Troubleshooting Tools

- **Loopbacks**
  - **Controller loops**
  - **Serial loops**
  - **Hard-wire loops**
- **BERT generators**

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Troubleshooting Tools— Loopbacks

56k CSU/DSU Loopback Line

T1 CSU/DSU Loopback Line

Router(config-if)# loopback line

CSU/DSU Module

Cisco Router — DTE Interface — DSU | CSU

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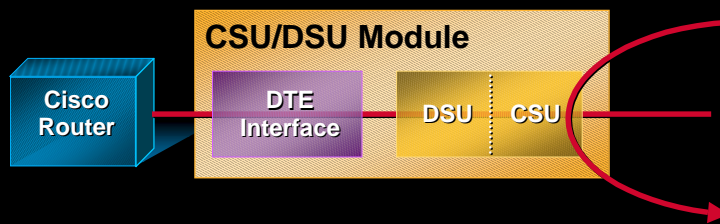
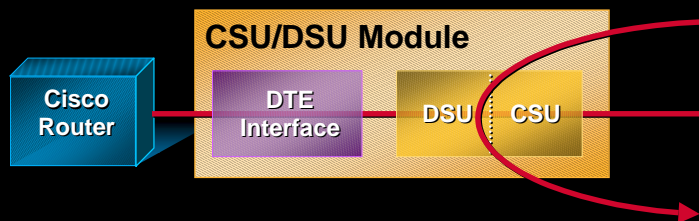
Troubleshooting Tools— Loopbacks (Cont.)

56k CSU/DSU Loopback Line Payload

T1 CSU/DSU Loopback Line Payload

Router (config-if)# loopback line payload

CSU/DSU Module

Cisco Router — DTE Interface — DSU | CSU

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Troubleshooting Tools—
Loopbacks (Cont.)

56K CSU/DSU Module DTE Loop

T1 CSU/DSU Module DTE Loop

Router (config-if)# loopback dte

CSU/DSU Module

Cisco Router — **DTE Interface** — **DSU** | **CSU** — **AIS**

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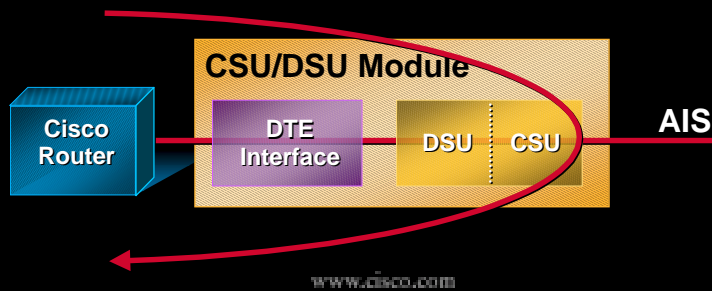
Troubleshooting Tools—
Loopbacks (Cont.)

Far End Remote Loop

Router(config-if)# loopback remote full
other type loops- payload, smart-jack

CSU/DSU Module

Cisco Router — **DTE Interface** — **DSU** | **CSU** — **CSU** | **DSU**

May require service-module t1 remote-loopback set at remote

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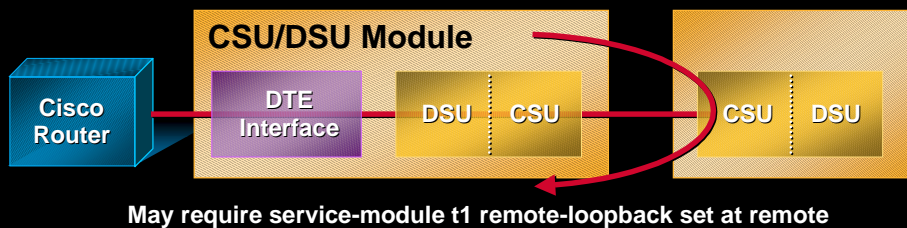
Tools BERT

- **Using the BER Test**

  t1 bert pattern {2^11 | 2^15 | 2^20 O.153 | 2^20 QRSS | 2^23 | 0s |
    1s | alt-0-1} interval minutes

  wan-7204a(config-controller)#bert pattern 0s int 5

  wan-7204a(config-controller)#no bert

  5d02h: %LINK-6-BERTSTATUS: Interface T1 3/0, BERT is completed.

Troubleshooting Tools BERT

```
Router# sh cont t1 0/0/0 b
T1 0/0/0 is up.
   DSX1 BERT pattern       : zeros
   DSX1 BERT sync          : sync
   DSX1 BERT sync count    : 1
   DSX1 BERT interval      : 2
   DSX1 BERT time remain   : 2
   DSX1 BERT total errs    : 0
   DSX1 BERT total k bits  : 43155
   DSX1 BERT errors (last) : 0
   DSX1 BERT k bits (last) : 43155
Applique type is Channelized T1
No alarms detected.
Cablelength is long gain36 0db
Framing is ESF, Line Code is B8ZS, Clock Source is Line.
Data in current interval (24 seconds elapsed):
   0 Line Code Violations, 0 Path Code Violations
   0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
   0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
```

Troubleshooting Tools— Loopbacks (Cont.)

The POSIP "line" will be "up" when SONET/SDH frames are received. The POSIP "line protocol" will be "up" when the SONET/SDH frames convey information that is recognizable by the POSIP as data

Two "loop" commands are useful in diagnosing the origin of difficulty

1. "loop internal"—all Tx frames/data are "looped" internally within the POSIP; no data is sent on the outside; this is often helpful in the diagnosis of "clocking" issue; when looped internally, both "line" and "line protocol" will be "up" and the unit should be able to "ping" its own interface and handle keepalives

2. "loop line"—all Rx data on the inbound fiber is looped to the Tx side and re-transmitted; this is often helpful in the diagnosis of an intervening SONET/SDH infrastructure in an end-to-end troubleshoot exercise

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Troubleshooting Tools BERT (Cont.)

```
POS(config-if)#bert pattern 2^23 interval 10

POS#show controller oc12 4/0:1

POS#show controller oc12 4/0:2 bert


POS(config-if)#bert errors 5
```

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Troubleshooting Tools
BERT (Cont.)

```
router#show controller oc12 4/0:2 bert
   Interface Serial4/0    : 2 (DS3 channel 2)
   BERT information:
   State                  : enabled (not sync'd)
   Pattern                : 2^15
   Interval               : 10 minutes
   Time remaining         : 00:09:50
   Total errors           : 0
   Time this sync         : 00:00:00
   Errors this sync       : 0
   Sync count             : 0
```

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WAN Connections

WAN Connections—Router

- **Frame Relay**
- **ATM**

WAN Connections
Frame Relay

- **Verify physical connections**

    Use router loops and network loops

    Run ping test using HDLC protocol

    Proper cabling

WAN Connections
Frame Relay (Cont.)

- **Verify configuration**

  LMI type

  Encapsulation type

  Display show and debugs

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WAN Connections
Frame Relay (Cont.)

```
Serial0 is up, line protocol is down
  Hardware is HD64570
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation FRAME-RELAY, loopback not set, keepalive set (10 sec)
  LMI enq sent  67458, LMI stat recvd 0, LMI upd recvd 0, DTE LMI down
  LMI enq recvd 17, LMI stat sent  0, LMI upd sent  0
  LMI DLCI 1023  LMI type is CISCO  frame relay DTE
  FR SVC disabled, LAPF state down
  Broadcast queue 0/64, broadcasts sent/dropped 33654/0, interface broadcasts 22439
  Last input 00:00:32, output 00:00:00, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: priority-list 8
  Output queue (queue priority: size/max/drops):
    high: 0/20/0, medium: 0/40/0, normal 0/60/0, low 0/80/0
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    34044 packets input, 4008077 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    34211 packets output, 4139097 bytes, 0 underruns
    0 output errors, 0 collisions, 60 interface resets
    0 output buffer failures, 0 output buffers swapped out
    78 carrier transitions
    DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
```

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WAN Connections
Frame Relay (Cont.)

show frame pvc

PVC Statistics for interface Serial0 (Frame Relay DTE)

DLCI = 980, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE,
INTERFACE = Serial0

input pkts 19	output pkts 87	in bytes 2787
out bytes 21005	dropped pkts 0	in FECN pkts 0
in BECN pkts 0	out FECN pkts 0	out BECN pkts 0
in DE pkts 0	out DE pkts 0	

pvc create time 1:17:47 last time pvc status changed 0:58:27

show frame map

Serial0 (up): ip 157.147.3.65 dlci 980(0x3D4,0xF440), dynamic,
broadcast, status defined, active

WAN Connections
Frame Relay (Cont.)

```
Debug frame lmi
*Mar  1 01:17:58.763: Serial0(out): StEnq, myseq 92, yourseen 64, DTE up
*Mar  1 01:17:58.763: datagramstart = 0x20007C, datagramsize = 14
*Mar  1 01:17:58.763: FR encap = 0x0001030800 75 95 01 01 01 03 02 5C 40
*Mar  1 01:17:58.767:
*Mar  1 01:17:58.815: Serial0(in): Status, myseq 92
*Mar  1 01:17:58.815: RT IE 1, length 1, type 1
*Mar  1 01:17:58.815: KA IE 3, length 2, yourseq 65  myseq 92
*Mar  1 01:18:08.763: Serial0(out): StEnq, myseq 93, yourseen 65, DTE up
*Mar  1 01:18:08.763: datagramstart = 0x20007C, datagramsize = 14
*Mar  1 01:18:08.763: FR encap = 0x0001030800 75 95 01 01 01 03 02 5D 41
*Mar  1 01:18:08.767:
*Mar  1 01:18:08.815: Serial0(in): Status, myseq 93
*Mar  1 01:18:08.815: RT IE 1, length 1, type 1
*Mar  1 01:18:08.815: KA IE 3, length 2, yourseq 66, myseq 93
*Mar  1 01:18:18.763: Serial0(out): StEnq, myseq 94, yourseen 66, DTE up
*Mar  1 01:18:18.763: datagramstart = 0x20007C, datagramsize = 14
*Mar  1 01:18:18.763: FR encap = 0x0001030800 75 95 01 01 00 03 02 5E 42
*Mar  1 01:18:18.767:
*Mar  1 01:18:18.815: Serial0(in): Status, myseq 94
*Mar  1 01:18:18.815: RT IE 1, length 1, type 0
*Mar  1 01:18:18.819: KA IE 3, length 2, yourseq 67, myseq 94
*Mar  1 01:18:18.819: PVC IE 0x7 , length 0x3 , dlci 980, status 0x2
```

WAN Connections—ATM

- **ATM interface troubleshooting switch to router**

  Interface remains down or intermittent transitions

  Show interface

  Show controller atm x/y/z

  Cable, clocking, configuration

  www.cisco.com

WAN Connections—ATM (Cont.)

- **ATM interface up state but traffic doesn't go through**

  Show controller/interface atm— look for errors

  Check scrambling options

  Run loopbacks

  Router(config-if)# loopback plim

  Show atm vc interface

  www.cisco.com

WAN Connections—ATM (Cont.)

Make sure the other end is up and is not reporting any kind of yellow alarm (even though your end may be up); if it is, something is wrong between our TX and their RX path

- **Show atm vc traffic**

  Check the cell counts; as long as you have some non-zero tx and rx cell counts, it is probably not an interface problem; if they are all 0

www.cisco.com

WAN Connections—ATM (Cont.)

- **Router# show atm traffic**

  4915 input packets

  2114 output packets

  2913 broadcast packets

  0 packets for nonexistent VC

  0 packets with CRC errors

  0 OAM cells received

  0 cells lost

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WAN Connections—ATM (Cont.)

Show Controller ATM

```
LS1010#show controller atm 11/1/1
IF Name ATM11/1/1    Chip Base Address A8D0A000
Port type OC3    Port rate 155 Mbps    Port medium Unknown
Port status SECTION LOS    Loopback None    Flags8300
TX Led Traffic Pattern    RX Led Traffic Patter
TX clock source  network-derived
Framing mode  sts-3c
Cell payload scrambling on
Sts-stream scrambling on

OC3 counters

    Key txcell - # cells transmitted
        rxcell - # cells received
        b2      - # line BIP-8 errors
        b3      - # path BIP-8 errors
        ocd    - # out-of-cell delineation errors - not implemented
        g1      - # path FEBE errors
        chcs   - # correctable HEC errors
        uhcs   - # uncorrectable HEC errors
```

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WAN Connections—ATM (Cont.)

```
LS1010# show atm vc 0/5

ATM0: VCD: 2, VPI: 0, VCI: 5, Connection Name: SAAL
UBR, PeakRate: 56
AAL5-SAAL, etype:0x4, Flags: 0x26, VCmode: 0x0
OAM frequency: 0 second(s), OAM retry frequency: 1 second(s), OAM retry frequency: 1 second(s)
OAM up retry count: 3, OAM down retry count: 5
OAM Loopback status: OAM Disabled
OAM VC state: Not Managed
ILMI VC state: Not Managed
InARP DISABLED
InPkts: 2044, OutPkts: 2064, InBytes: 20412, OutBytes: 20580
InPRoc: 2044, OutPRoc: 2064, Broadcasts: 0
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
OAM cells received: 0
F5 InEndloop: 0, F5 InSegloop: 0, F5 InAIS: 0, F5 InRDI: 0
F4 InEndloop: 0, F4 InSegloop: 0, F4 InAIS: 0, F4 InRDI: 0
OAM cells sent: 0
F5 OutEndloop: 0, F5 OutSegloop: 0, F5 OutRDI: 0
F4 OutEndloop: 0, F4 OutSegloop: 0, F4 OutRDI: 0
OAM cell drops: 0
Compress: Disabled
Status: INACTIVE, State: NOT_IN_SERVICE
```

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WAN Connections—ATM (Cont.)

```
router# show atm-vc 4
    ATM3/0/0.30: VCD: 30, VPI: 0, VCI: 60, etype:0x0, AAL5 - LLC/SNAP, Flags: 0xC3
    PeakRate: 44209, Average Rate: 0, Burst Cells: 0, VCmode: 0x0
    OAM DISABLED, InARP frequency: 1 minute(s)
    InPkts: 0, OutPkts: 0, InBytes: 0, OutBytes: 0
    InPRoc: 0, OutPRoc: 0, Broadcasts: 0
    InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
    InPktDrops: 0, OutPktDrops: 0
    CrcErrors: 0, SarTimeOuts: 0, OverSizedSDUs: 0
    OAM F5 cells sent: 0, OAM cells received: 0
    Status: ACTIVE
    ATM4/0: VCD: 4, VPI: 4, VCI: 4, etype:0xBAD, AAL5 - MUX, Flags: 0x34
    PeakRate: 0, Average Rate: 0, Burst: 0 *32cells
    InPkts: 164, OutPkts: 0, InFast: 0, OutFast: 0, Broadcasts: 0
```

WAN Connections—ATM (Cont.)

- OC-3—specific

Sonet PHY layer	[sts-3c|stm-1]
Clock-source	[free-running|network-derived|loop-timed]
Scrambling	[sts-stream|cell-payload]
Loopback	[line|diagnostic]

WAN Connections—ATM (Cont.)

- **OC-12—specific**

SONET PHY	[sts-12c|stm-4]
Clock-source	[free-running|network-derived]
Scrambling	[sts-stream|cell-payload]
Loopback	[line|diagnostic]

  If there are repeaters in between, make sure they put out the right format of signal, i.e. STS-12c, rather than STS-12

WAN Connections—ATM (Cont.)

- **DS3—specific**

  Framing [m23adm|cbitadm|m23plcp|cbitplcp]

  lbo [short|long]—default is short (i.e. less than 225 feet)

  Clock-source [free-running|loop-timed|network-derived]

  Scrambling [cell-payload]—default is disabled

  Loopback [line|diagnostic|cell|payload]

  Autoferf [los|oof|red|ais|lcd]—default is monitor all

WAN Switch Interfaces

Network Interface
Switched WAN

- **Cisco MGX™ 8220**

  Lines, ports, channels

  Frame Relay Service Modules—FRSM

  ATM UNI Service Modules—AUSM

Network Interface
Switched WAN (Cont.)
Line Definition

ATM

ATM

T1/E1

T1/E1
Inverse
MUX

ATM

Frame
Relay

T1/E1

T1/E1
Inverse
MUX

MGX
Network

AXIS

T1/E1

TDM

Frame
Relay

X.21

Frame
Relay

Voice,
Data, Video

T1/E1

Lines

HSSI

Frame
Relay
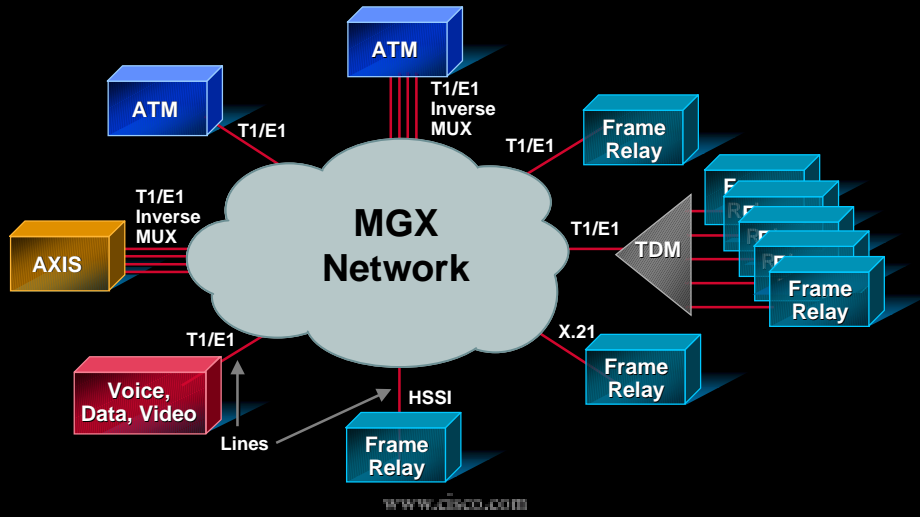
Network Interface
Switched WAN (Cont.)

Display Lines

MGX1.1.7.FRSM.a > dsplns

Line	Conn Type	Type	Status/Coding Source	Length	XmtClock Alarm	Alarm Stats
7.1	DB-15	dsx1ESF	Mod/dsx1B8ZS	0-110 ft	LocalTim	No No
7.2	DB-15	dsx1ESF	Ena/dsx1B8ZS	0-110 ft	LocalTim	Yes No
7.3	DB-15	dsx1ESF	Mod/dsx1B8ZS	0-110 ft	LocalTim	Yes No
7.4	DB-15	dsx1ESF	Dis/dsx1B8ZS	0-110 ft	LocalTim	

Network Interface Switched WAN (Cont.)

Display Line Detail

```
MGX1.1.7.FRSM.a > dspln 1

LineNum:                    1
LineConnectorType:          DB-15
LineType:                   dsx1ESF
LineEnable:                 Modify
LineCoding:                 dsx1B8ZS
LineLength:                 0-110 ft
LineXmtClockSource:         LocalTiming
LineLoopbackCommand:        LocalLineLoop
LineSendCode:               NoCode
LineUsedTimeslotsBitMap:    0x7
ConfigChangePortBitMap:     0x0
```

Network Interfaces Switched WAN Frame Relay

- **Frame Relay ports**

  Serial

  Fractional

  Channelized

Network Interfaces Switched WAN Frame Relay (Cont.)

Frame Relay Service Module

FRSM-T1	FRSM-E1	FRSM-8T1	FRSM-8E1	FRSM-HS1

Backplane

DB-15-4T1	DB-15-4E1 or BNC-4T1	RJ48-8T1	RJ-48-8E1 or SMB-8E1	SCS12-2HSSI or DB-15-4X21

4 T1 Lines	4 E1 Lines	8 T1 Lines	8 E1 Lines	2 HSSI or 4 X.21 Lines
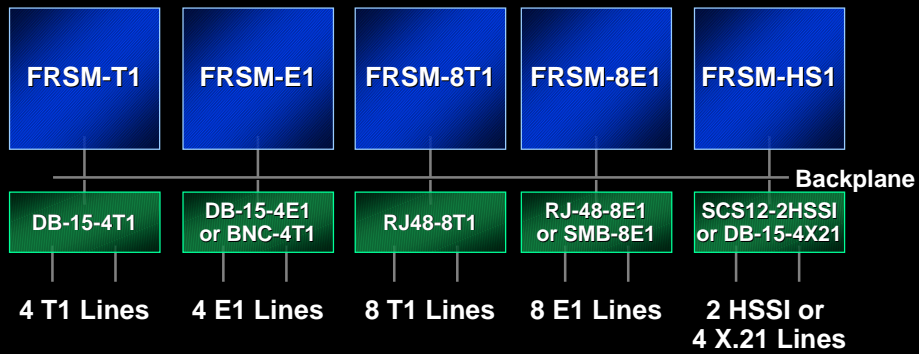
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Network Interfaces Switched WAN Frame Relay (Cont.)

Serial Frame Relay Ports

MGX

FRSM

Ports

Line — Frame Relay

Line — Frame Relay

Line — Frame Relay
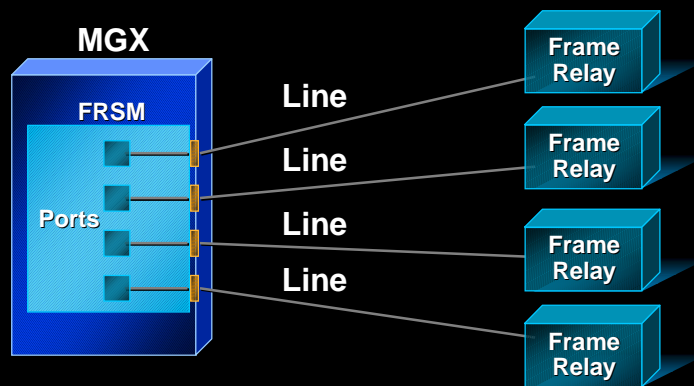
Line — Frame Relay

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Network Interfaces Switched WAN Frame Relay (Cont.)

Fractional Frame Relay Ports

MGX

FRSM

Logical Ports

Line

TDM

Frame Relay
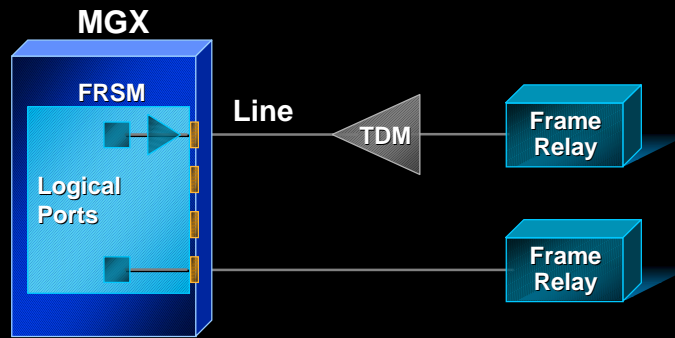
Frame Relay

www.cisco.com

Network Interfaces Switched WAN Frame Relay (Cont.)

Channelized Frame Relay Ports
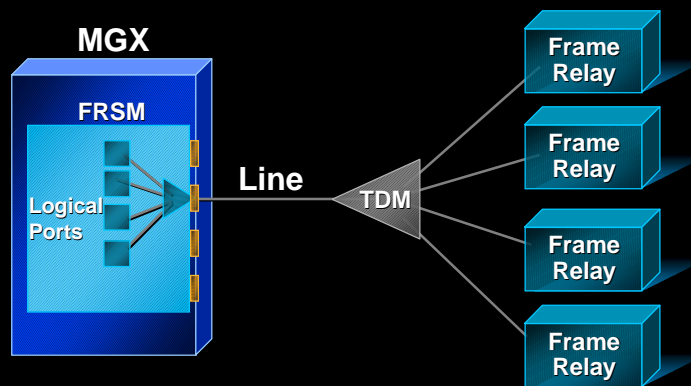
MGX

FRSM

Logical Ports

Line

TDM

Frame Relay

Frame Relay

Frame Relay

Frame Relay

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Network Interfaces Switched WAN Frame Relay (Cont.)

Display Frame Relay Ports

```
MGX1.1.5.FRSM.a > dspport 1

SlotNum:                        5
PortLineNum:                    1
PortNum:                        1
PortRowStatus:                  Mod
PortDs0Speed:                   64k
PortDs0ConfigBitMap(1stDS0):    0x2(2)
PortEqueueServiceRatio:         1
PortFlagsBetweenFrames:         1
PortSpeed:                      64kbps
SignallingProtocolType:         NoSignalling
AsynchronousUpdates:            Disable
T391LineIntegrityTimer:         10
T392PollingVerificationTimer:   15
N391FullStatusPollingCounter:   6
N392ErrorThreshold:             3
N393MonitoredEventCount:        4
EnhancedLmi:                    Off
PortState:                      Active
PortSignallingState:            No Signalling Failure
CLLMEnableStatus:               Disable
CLLMxmtStatusTimer:             0

Type <CR> to continue, Q<CR> to stop:
```

```
portType:              frameRelay
PortIngrPercentUtil:   165
PortEgrPercentUtil:    165
PortOversubscribed:    True
PortSvcStatus:         Disable
PortSvcInUse:          Not In-Use
PortSvcShareLcn:       Card-based
PortSvcLcnLow:         0
PortSvcLcnHigh:        0
PortSvcDlciLow:        0
PortSvcDlciHigh:       0

PortDs0UsedLine1:      0x00000003
PortDs0UsedLine2:      0x00010001
PortDs0UsedLine3:      0x00010001
PortDs0UsedLine4:      0x00010001
PortNumNextAvailable:  41
```

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Network Interfaces Switched WAN Frame Relay (Cont.)

Display Frame Relay Port Counters

```
MGX1.1.5.FRSM.a > dspportcnt 1

PortNum:                       1

                               Tx              Rx
                               --------------  --------------
Total Frames:                  2265            692
Total Bytes:                   1544730         63489
Frames FECN:                   12              55
Frames BECN:                   62              7
Frames Abort:                  0               0
Buf Not Available:             0               0
KbpsAIR:                       274             17
XmtFramesDiscXceedQDepth:      3
XmtBytesDiscXceedQDepth:       192
XmtFramesDuringLMIAlarm:       0
XmtByteDuringLMIAlarm:         0
XmtFramesUnderrun:             1
RcvFramesDE:                                   0
RcvFramesDiscCRCError:                         0
RcvFramesDiscIllegalHeader:                    0
RcvFramesDiscAlignmentError:                   0
RcvFramesDiscIllegalLen:                       0
```

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Network Interfaces Switched WAN Frame Relay (Cont.)

Display Frame Relay Port Counters

	Tx	Rx
RcvFramesDiscXceedDEThresh:		
RcvFramesUnknownDLCI:		0
RcvLastUnknownDLCI:		0
RcvFramesTaggedFECN:		6
RcvFramesTaggedBECN:		0
RcvFramesTaggedDE:		0
Status:	982	0
StatusInquiry:	0	981
AsynchUpdate:	5	0
RcvInvalidRequest:		0
RcvUNISeqMismatch:		0
RcvNNISeqMismatch:		2
UNISignallingTimeout:		0
NNISignallingTimeout:		0
FramesCLLM:	0	0
BytesCLLM:	0	0
CLLMFailures:		0

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Network Interfaces Switched WAN Frame Relay (Cont.)

Display Frame Relay Channel Counters

MGX1.1.5.FRSM.a > dspchancnt   16

ChanNum: 16
ChanState: alarm
ChanUpTime: 31

	Tx	Rx
AbitState:	Sending A=1	Off
ATMState:	Sending AIS OAM state	Not receiving any state
Total Frames:	541	105
Total Bytes:	324059	9345
Frames DE:	0	0
Bytes DE:	0	0
Frames Discarded:	0	0
Bytes Discarded:	0	0
FramesDiscXceedQDepth:	0	0
BytesDiscXceedQDepth:	0	0
FramesDiscXceedDEThresh:	0	0
Frames FECN:	0	0
Frames BECN:	0	0
FramesTagged FECN:	3	0
FramesTagged BECN:	0	8
KbpsAIR:	142	9

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Network Interfaces Switched WAN Frame Relay (Cont.)

Display Frame Relay Channel Counters

	Tx	Rx
FramesTaggedDE:	0	2
BytesTaggedDE:	0	89
RcvFramesDiscShelfAlarm:		0
XmtFramesDiscPhyLayerFail:	0	
XmtFramesDiscCRCError:	0	
XmtFramesDiscReAssmFail:	0	
XmtFramesDiscSrcAbort:	0	
XmtFramesDuringLMIAlarm:	18	
XmtBytesDuringLMIAlarm:	3330	
RcvFramesDiscUPC:		0
XmtFramesInvalidCPIs:	0	
XmtFramesLengthViolations:	0	
XmtFramesOversizedSDUs:	0	
XmtFramesUnknownProtocols:	0	
RcvFramesUnknownProtocols:		0

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Network Interfaces Switched WAN ATM

ATM UNI Service Module

| AUSM-T1 | AUSM-E1 | AUSM-8T1 | AUSM-8E1 |

Backplane

| DB-15-4T1 | DB-15-4E1 or BNC-4E1 | RJ-48-8T1 | RJ-48-8E1 or SMB-8E1 |

4 T1 Lines   **4 E1 Lines**   **8 T1 Lines**   **8 E1 Lines**
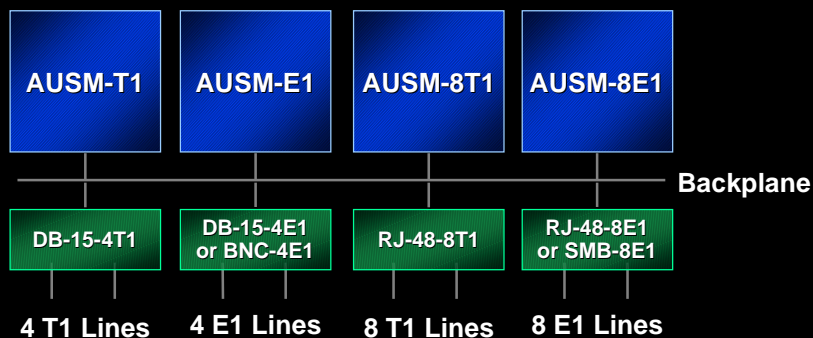
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AUSM—8T1/E1 ATM Ports

MGX

AUSM

Lines

Ports

ATM CPE

ATM CPE
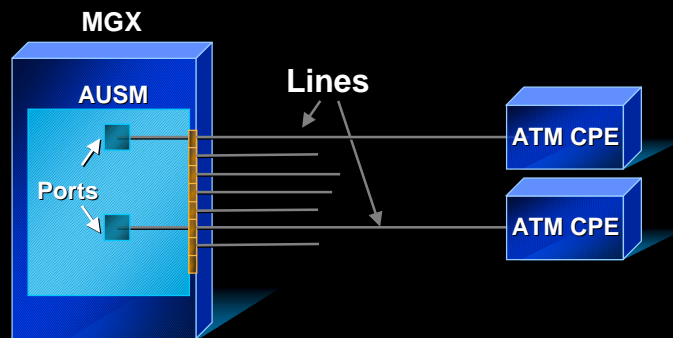
www.cisco.com

Network Interfaces
Switched WAN ATM

Display ATM Ports

```
MGX1.1.6.AUSM8.a > dspport 1


LogicalPortNumber:              1
Port Enable:                    UP
Port State:                     Active
PortType:                       UNI
PhysicalPortNumber:             1
CellFraming:                    ATM
CellScramble:                   No Scramble
Plpp Loopback:                  No Loopback
Single-bit error correction:    Disabled
```

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Network Interfaces Switched WAN ATM (Cont.)

Display ATM Port Counters

```
axe1.1.6.AUSM8.a > dspportcnt 1

PortNum:                            1
PortState:                          Active
IngressRcvCells:                    32
IngressGFCErrorCells:               0
IngressVpiVciErrCells:              0
IngressUnknownVpiVci:               0x0
EgressXmtCells:                     32
EgressPortAlarmDiscardCells:        0
EgressXmtClpSetCells:               0
EgressXmtEfciSetCells:              0
PortXmtAisCells:                    32
PortXmtSgmtLpbkCells:               0
PortRcvAisCells:                    32
PortRcvFerfCells:                   0
PortRcvSgmtLpbkCells:               0
PortRcvCrcErrOAMCells:              0
ReceivedHECErrorCells:              0
HECErroredSeconds:                  0
SeverelyHECErroredSeconds:          0
```

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MGX ATM Connection
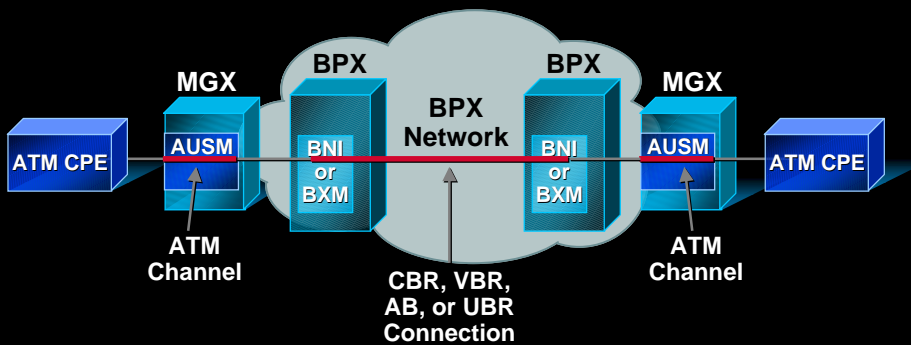
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Network Interfaces Switched WAN ATM (Cont.)

Display ATM Channel Counters

```
MGX1.1.6.AUSM8.a > dspchancnt 16

ChanNum:                          16
ChannelState:                     Alarm
ChannelEgressRcvState:            Alarm
ChannelEgressXmitState:           Sending OAM AIS
ChannelIngressRcvState:           Receiving AIS
ChannelIngressXmtState:           Sending OAM AIS
ChanInServiceSeconds:             4
ChanIngressPeakQDepth(cells):     0
ChanIngressReceiveCells:          0
ChanIngressClpSetCells:           0
ChanIngressEfciSetRcvCells:       0
ChanIngressUpcClpSetCells:        0
ChanIngressQfullDiscardCells:     0
ChanIngressClpSetDiscardCells:    0
ChanIngressTransmitCells:         0
ChanShelfAlarmDiscardCells:       0
ChanEarlyPacketDiscardCells:      0
ChanPartialPacketDiscardCells:    0
```

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Network Interfaces Switched WAN ATM (Cont.)

Display ILMI Counters

```
MGX1.1.6.AUSM8.a > dspilmicnt 1

PortNum:                  1
SNMPPDUsReceived:         12
GetRequestReceived:       10
GetNextRequestReceived:   0
SetRequestReceived:       0
TrapReceived:             0
GetResponseReceived:      2
GetResponseTransmitted:   9
GetRequestTransmitted:    3
TrapsTransmitted:         4
InvalidPDUReceived:       0
Asn1ParseError:           0
NoSuchNameError:          0
TooBigError:              0
```

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Network Interfaces Switched WAN ATM (Cont.)

Display ATM Channel

```
MGX1.1.6.AUSM8.a > dspchan 16

ChanNum:                                        16
RowStatus:                                      Add
ConnectionType:                                 VCC
ServiceType:                                    UBR
PortNum:                                        1
VPI:                                            40
VCI (For VCC):                                  40
Local VPId(for VPC):                            0
EgressQNum:                                     4
IngressQDepth(cells):                           1000
IngressDiscardOption:                           CLP hysterisis
IngressFrameDiscardThreshold                    1000
IngressQCLPHigh(cells):                         900
IngressQCLPLow(cells):                          800
QCLPState:                                      LOW
IngressEfciThreshold(cells):                    1000

UPCEnable:                                      Enabled
PeakCellRate[0+1](cells/sec):                   3622
CellDelayVariation[0+1](in micro secs):         10000
PeakCellRate[0](cells/sec):                     3622
```

Network Interfaces Switched WAN ATM (Cont.)

Display ATM Channel (Cont.)

```
CellDelayVariation[0](in micro secs):           250000
SustainedCellRate(cells/sec):                   3622
MaximumBurstSize(cells):                        1000
SCRPolicing:                                    CLP[0]
CLPTagEnable:                                   Enabled
FrameGCRAEnable:                                Disable

ForesightEnable:                                Disable
InitialBurstSize(cells):                        0
ForeSightPeakCellRate(cells/sec):               3622
MinimumCellRate(cells/sec):                     0
InitialCellRate(cells/sec):                     0

LocalRemoteLpbkState:                           Disable
ChanTestType:                                   No Test
ChanTestState:                                  Not In Progress
ChanRTDresult:                                  65535 ms

Ingress percentage util:                        100
Egress percentage util :                        0
Egress Service Rate:                            0
```
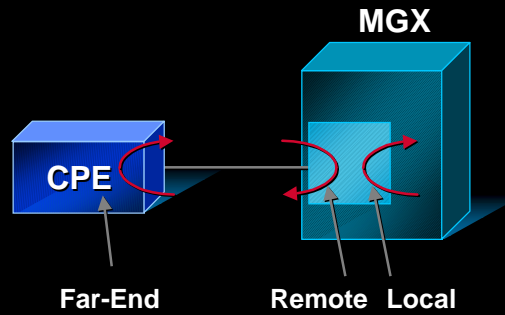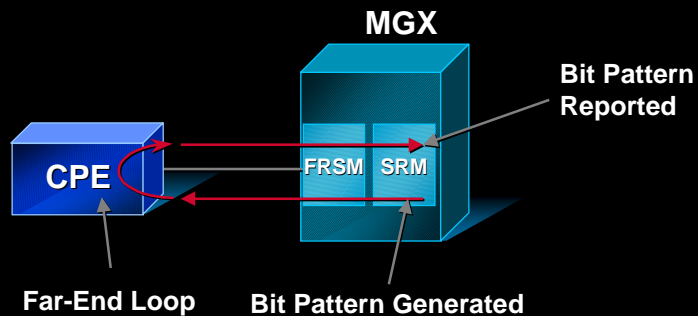
Network Interfaces Switched Testing

Generic Loop Definition

MGX

CPE

Far-End   **Remote**   **Local**

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Network Interfaces Switched Testing (Cont.)

BERT on the SRM

MGX

CPE   **FRSM**   **SRM**

Bit Pattern Reported

Far-End Loop   **Bit Pattern Generated**

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Network Interfaces Switched Testing (Cont.)

Local Loops

- ## Line or port

  ### From SRM—Cnfbert

- ## Channel

  ### From service module

  ### Addchanloop—delchanloop

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Network Interfaces Switched Testing
Channel Loopback

```
MGX4.1.9.FRSM.a > addchanloop 16

SAR-MSG>>LCN 16 rcv loopback is enabled/disabled

MGX4.1.9.FRSM.a > dspchan 16
 ChanNum:                    16
 ChanRowStatus:              Mod
 ChanPortNum:                1
 ChanMapVpi:                 9
 ChanMapVci:                 16
 ChanCBRService:             unstructured
 ChanClockMode:              Synchronous
 ChanCAS:                    Basic
 ChanPartialFill:            0
 ChanMaxBufSize:             564 bytes
 ChanCDV:                    1000 micro seconds
 C L I P:                    1000 milliseconds
 ChanLocalRemoteLpbkState:   Enabled
 ChanTestType:               TestOff
 ChanTestState:              NotInProgress
 ChanRTDresult:              65535 ms
```

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Network Interfaces Switched Testing (Cont.)

Remote Loops

- **Line**

  FRSM and AUSM from SRM

  Cnfbert

- **Port**

  FRSM and AUSM from SRM

  Cnfbert

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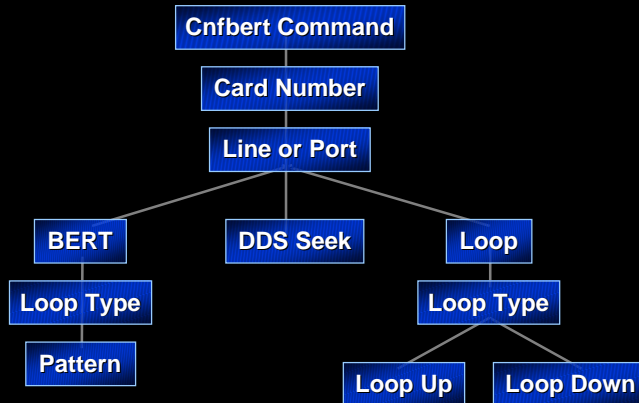## Network Interfaces Switched Testing (Cont.)

Far-End Loops

- **Line or port**

- **SRM BERT**

- **Dependent on attached end-user equipment**

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Network Interfaces Switched Testing (Cont.)

Configure BERT Menus

- **Cnfbert Command**
  - **Card Number**
    - **Line or Port**
      - **BERT**
        - **Loop Type**
          - **Pattern**
      - **DDS Seek**
      - **Loop**
        - **Loop Type**
          - **Loop Up**
          - **Loop Down**

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Network Interfaces Switched Testing (Cont.)

Display BERT Results

```
axe1.1.3.ASC.a > dspbert

    User                    : test
    Start Date              : 04/14/98
    Current Date            : 04/14/98
    Start Time              : 18:08:42
    Current Time            : 18:08:54
    Physical Slot Number    : 5
    Logical Slot Number     : 5
    Line Number             : 1 (Line test)
    DS0 Speed               : 64K
    Test Type               : BERT Pattern Test
    Device To Loop          : No Loopback
    BERT Pattern            : All Zeroes Pattern
    Error Inject Count      : 0
    Bit Count                : 9075815
    Bit Error Count         : 0
    Bit Error Rate (BER)    : 0

            BERT is in sync.
```

Note: You Must Use Delbert Command to End Test

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Please Complete Your Evaluation Form

Session 103

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