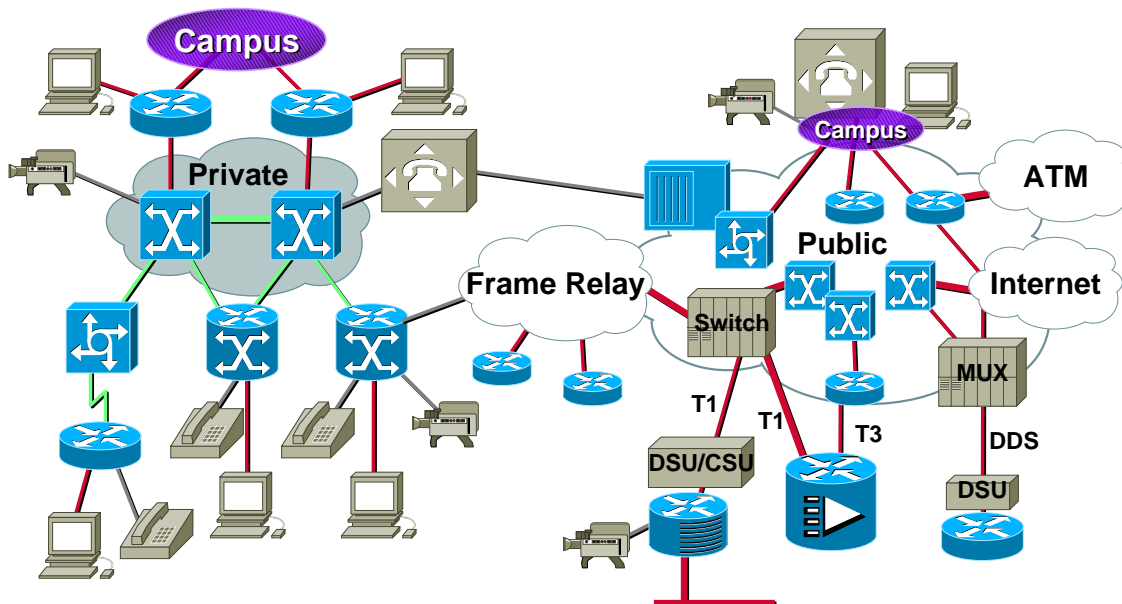




# Agenda

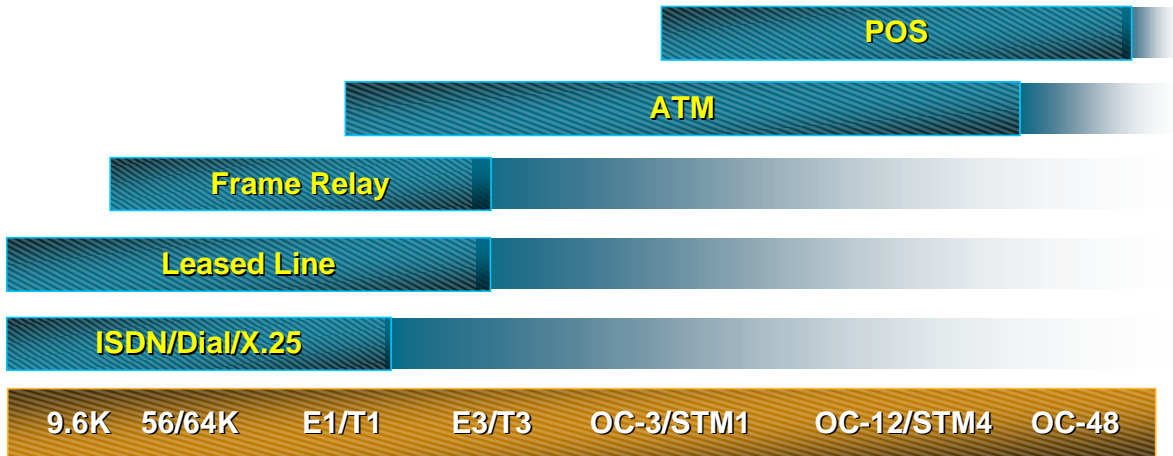
- Overview
- Network Interfaces—Routed WAN
- Router Tools and Concepts
- Network Interfaces—Switched WAN
- Switch Tools and Concepts

# The WAN Network

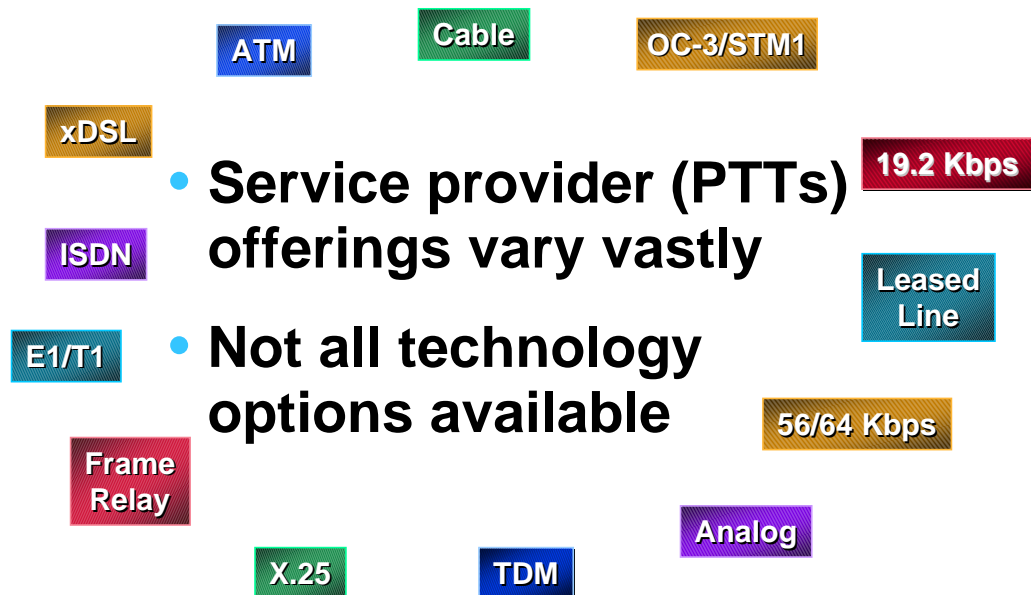


# The WAN Network (Cont.)

## WAN Speeds



# The WAN Network (Cont.)



# Network Interfaces

- **Customer premise side**

**Routers: Cisco 7500, 7200, 2600, 3810**

**DCE: CSU's, DSU's, modems**

# Network Interfaces (Cont.)

- **Network provider side**

**Switches: ATM, ISDN, Frame**

**Mux: DAC's, SONET, channel banks,  
DWDM**

## Network Interfaces (Cont.)

- **Key configuration concerns**
  - Clocking—Network synchronization**
  - Framing—SF/ESF, M23, cbit**
  - Coding—B8ZS, AMI, B3ZS**

## Network Interfaces (Cont.)

- **Clocking concerns**
  - Synchronize network elements**
  - Clock sources—Highest quality**
  - Design for resiliency**

## Network Interfaces (Cont.)

- **Stratum levels of accuracy**
- **Stratum 1** Source is usually an atomic standard
  - Stratum 1 drives strata 2-3-4
  - $1 \times 10^{-11}$  (BSRF\*) ( $\pm 1$  second in 3170 years!)
- **Stratum 2** Drives strata 2-3-4 clocks
  - $1.6 \times 10^{-8}$  (15 times worse than BSRF) ( $\pm 1$  second in 5.07 years)
- **Stratum 3** Drives strata 3-4 clocks
  - $4.6 \times 10^{-6}$  (460,000 times worse than BSRF) ( $\pm 1$  second in 51.6 days)
- **Stratum 4** Should never be used as source to any clock system
  - $3.2 \times 10^{-5}$  (3,200,000 times worse than BSRF) ( $\pm 1$  second in 3.68 days)

BSRF = Bell System reference frequency

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## 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)

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# Network Interfaces for Routed WAN

- Router platforms with internal DSU/CSU

**3810 with MultiFlex Trunk (MFT)**

**2600 and 3600 WAN Interface Card (WIC)**

# Network Interfaces for Routed WAN (Cont.)

## Router Commands

wan-3810a(config)#controller e1 0

Controller configuration commands:

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

# 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

# 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

# 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
```

# Network Interfaces for Routed WAN (Cont.)

- **VIP-based WAN interfaces**

**PA-4T+**

**PA-T3**

**MC-T3**

**MC-nT1/E1**

**PA-POS**

**PA-nH**

**PA-A3**

**PA-CT3/4T1**

# 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
```

# Network Interfaces for Routed WAN (Cont.)

## T1 Controller Configs

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

### Controller configuration commands:

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

# Network Interfaces for Routed WAN (Cont.)

```
Router# show controllers t1 3/0
```

T1 3/0 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**

# Network Interfaces for Routed WAN (Cont.)

## T3 Controller Configs

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

**Controller configuration commands:**

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

# 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**

# 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
```

# 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

# 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
```



# Troubleshooting Tools

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## Troubleshooting Tools

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

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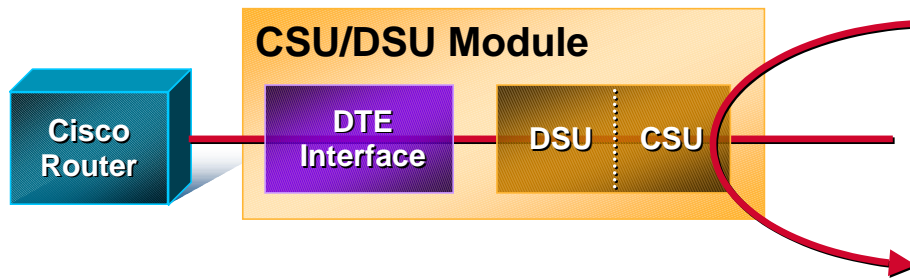
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# Troubleshooting Tools— Loopbacks

**56k CSU/DSU Loopback Line**

**T1 CSU/DSU Loopback Line**

Router(config-if)# loopback line

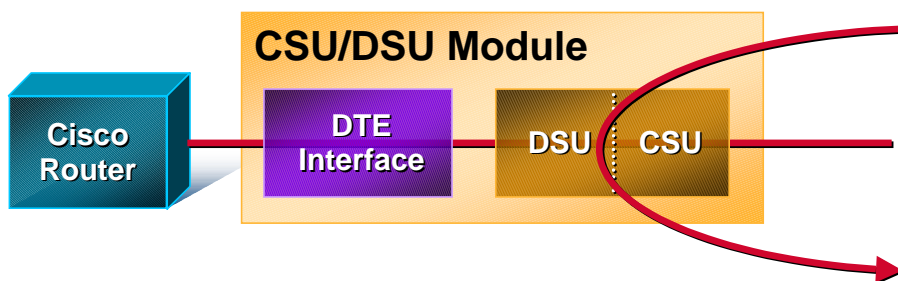


# Troubleshooting Tools— Loopbacks (Cont.)

**56k CSU/DSU Loopback Line Payload**

**T1 CSU/DSU Loopback Line Payload**

Router (config-if)# loopback line payload

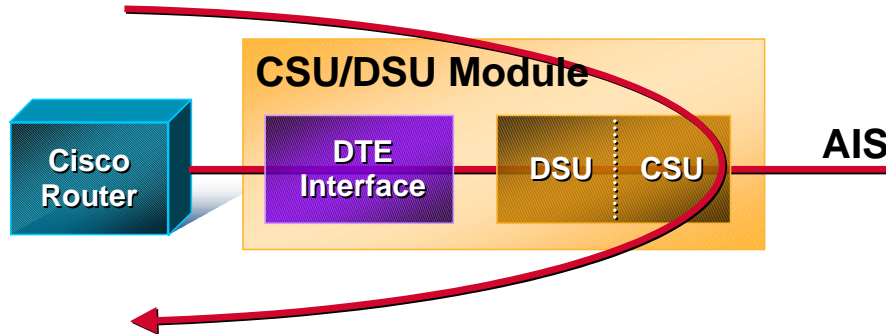


# Troubleshooting Tools— Loopbacks (Cont.)

## 56K CSU/DSU Module DTE Loop

## T1 CSU/DSU Module DTE Loop

Router (config-if)# loopback dte

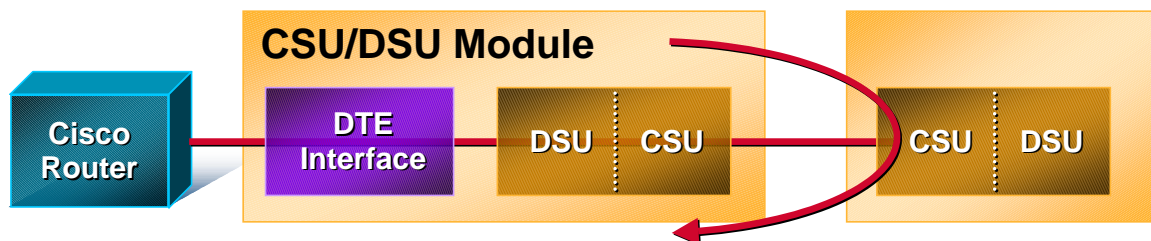


# Troubleshooting Tools— Loopbacks (Cont.)

## Far End Remote Loop

Router(config-if)# loopback remote full

other type loops- payload, smart-jack



May Require Service-module T1 Remote-loopback Set at Remote

# 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

## 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
```

# 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
```



# 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**

# 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 rcvd 0, LMI upd rcvd 0, DTE LMI down
LMI enq rcvd 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
```

# 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**

## 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**

## 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**

## 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**

# 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
```

### OC-3 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
```

# 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
```

## 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**

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

## WAN Connections—ATM (Cont.)

- **OC-12—specific**

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

**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

2305  
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## Network Interface Switched WAN

- **Cisco MGX 8220**
  - Lines, ports, channels**
  - Frame Relay Service Modules—FRSM**
  - ATM UNI Service Modules—AUSM**

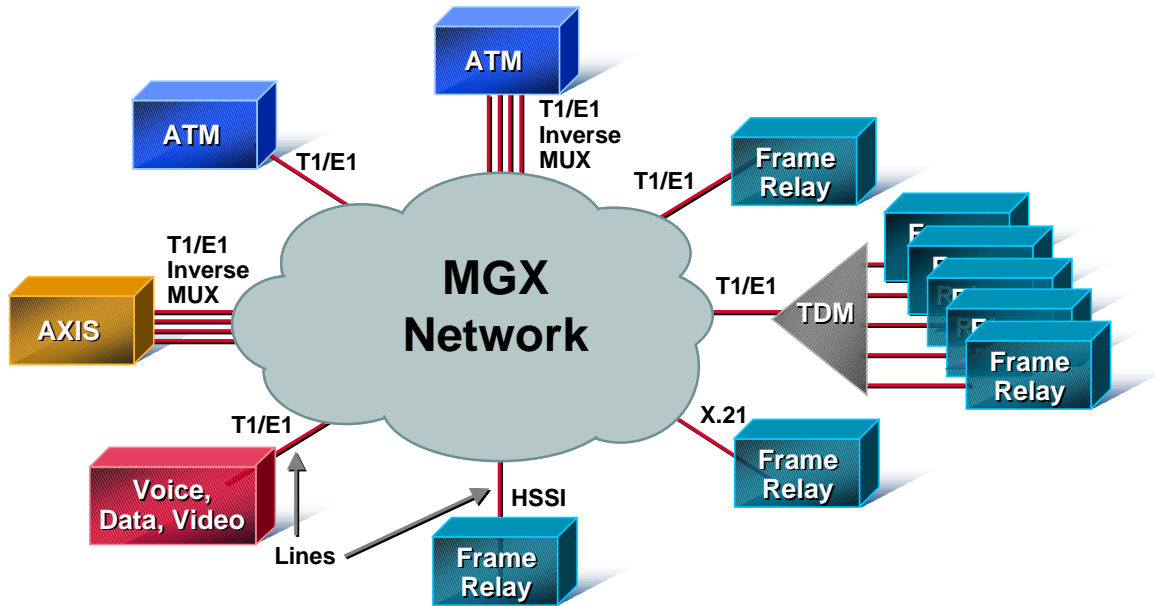
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# Network Interface Switched WAN (Cont.)

## Line Definition



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# 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		

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# Network Interface Switched WAN (Cont.)

## Display Line Detail

MGX1.1.7.FRSM.a > dspln 1

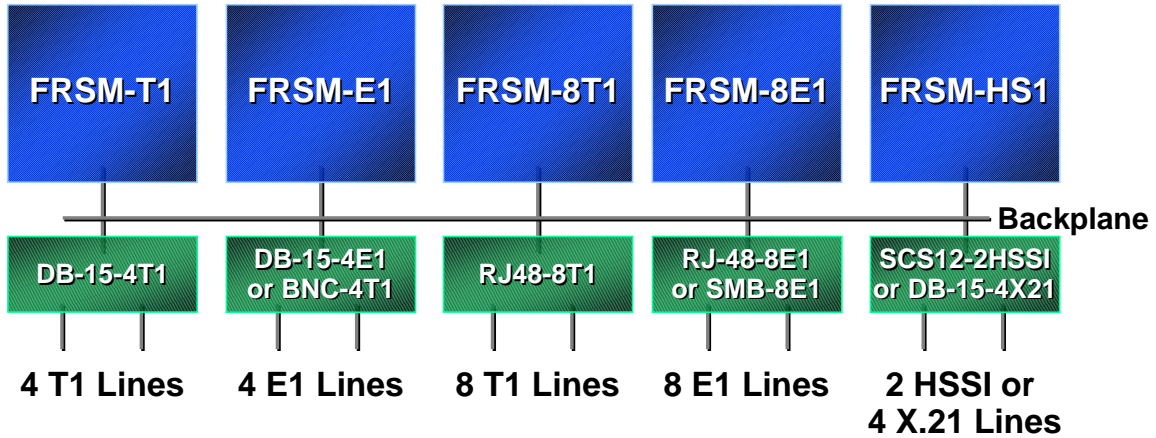
LineNum:	1
LineConnectorType:	DB-15
LineType:	dsx1ESF
LineEnable:	Modify
LineCoding:	dsx1B8ZS
LineLength:	0-110 ft
LineXmtClockSource:	LocalTiming
LineLoopbackCommand:	LocalLineLoop
LineSendCode:	NoCode
LineUsedTimeslotsBitMap:	0x7
ConfigChangePortBitMap:	0x0

# Network Interfaces Switched WAN Frame Relay

- **Frame Relay ports**
  - Serial**
  - Fractional**
  - Channelized**

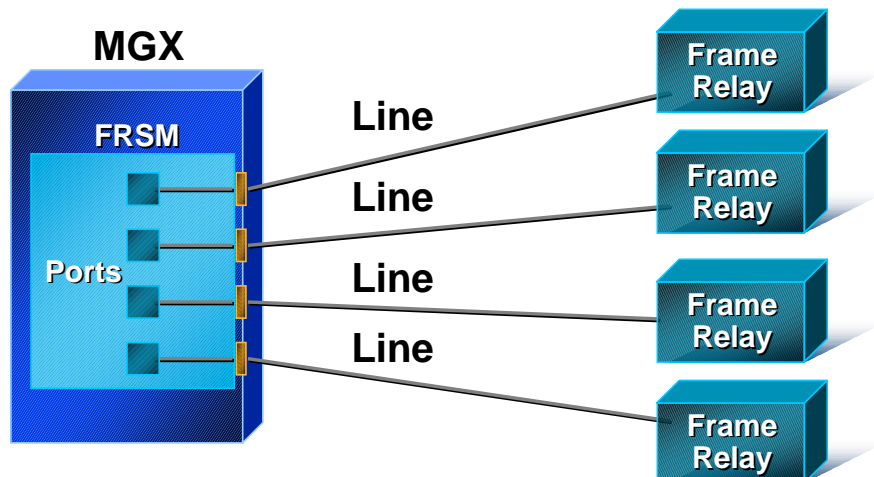
# Network Interfaces Switched WAN Frame Relay (Cont.)

## Frame Relay Service Module



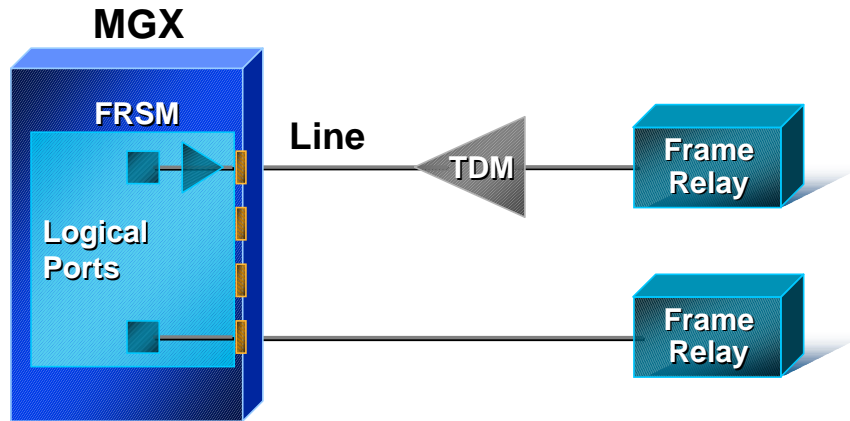
# Network Interfaces Switched WAN Frame Relay (Cont.)

## Serial Frame Relay Ports



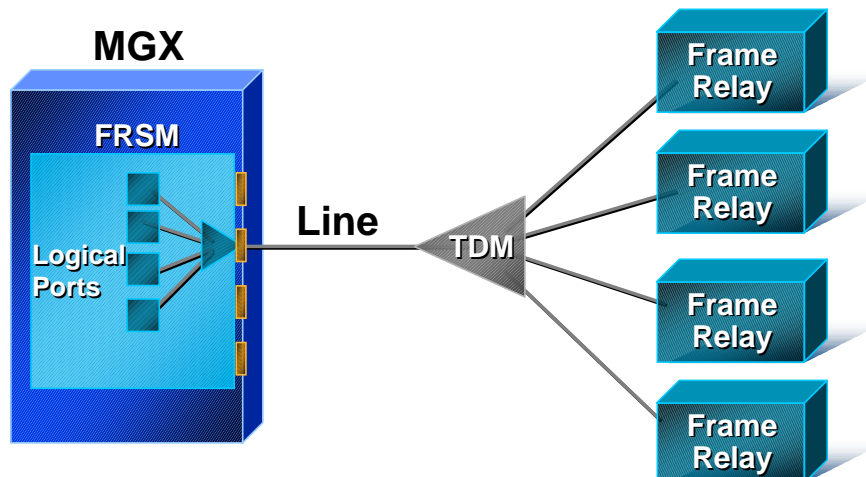
# Network Interfaces Switched WAN Frame Relay (Cont.)

## Fractional Frame Relay Ports



# Network Interfaces Switched WAN Frame Relay (Cont.)

## Channelized Frame Relay Ports



# 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
    
```

# 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	
XmtFramesDuringLMIAAlarm:	0	
XmtByteDuringLMIAAlarm:	0	
XmtFramesUnderrun:	1	
RcvFramesDE:		0
RcvFramesDiscCRCError:		0
RcvFramesDiscIllegalHeader:		0
RcvFramesDiscAlignmentError:		0
RcvFramesDiscIllegalLen:		0

# 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
<b>Status:</b>	<b>982</b>	<b>0</b>
<b>StatusInquiry:</b>	<b>0</b>	<b>981</b>
AsynchUpdate:	5	0
RcvInvalidRequest:		0
RcvUNISeqMismatch:		0
RcvNNISeqMismatch:		2
UNISignallingTimeout:		0
NNISignallingTimeout:		0
FramesCLLM:	0	0
BytesCLLM:	0	0
CLLMFailures:		0

# 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

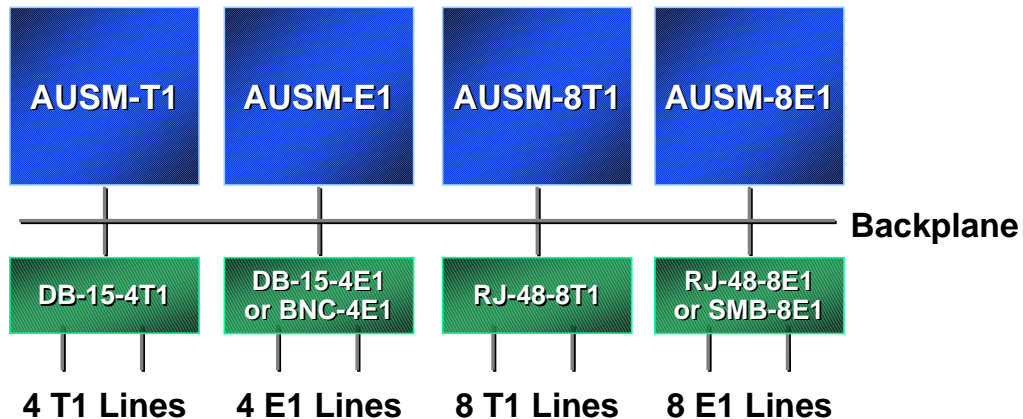
# Network Interfaces Switched WAN Frame Relay (Cont.)

## Display Frame Relay Channel Counters

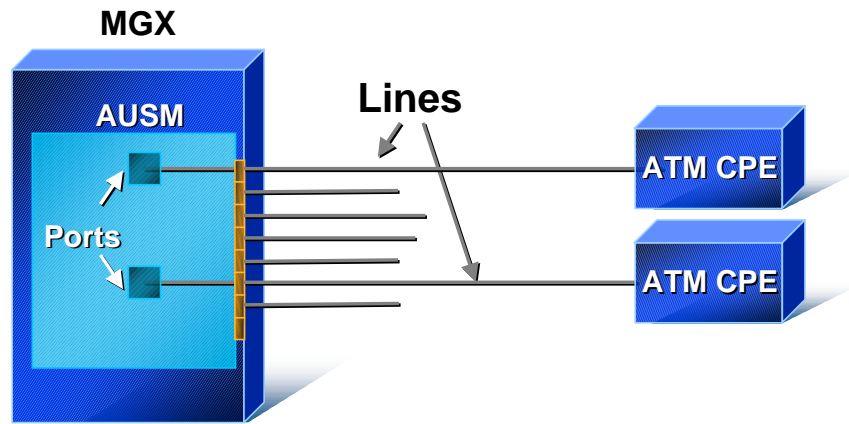
	Tx	Rx
FramesTaggedDE:	0	2
BytesTaggedDE:	0	89
RcvFramesDiscShelfAlarm:		0
XmtFramesDiscPhyLayerFail:	0	
XmtFramesDiscCRCError:	0	
XmtFramesDiscReAssmFail:	0	
XmtFramesDiscSrcAbort:	0	
XmtFramesDuringLMIAAlarm:	18	
XmtBytesDuringLMIAAlarm:	3330	
RcvFramesDiscUPC:		0
XmtFramesInvalidCPIs:	0	
XmtFramesLengthViolations: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

# Network Interfaces Switched WAN ATM

## ATM UNI Service Module



# AUSM—8T1/E1 ATM Ports



## 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
Ppp Loopback:	No Loopback
Single-bit error correction:	Disabled

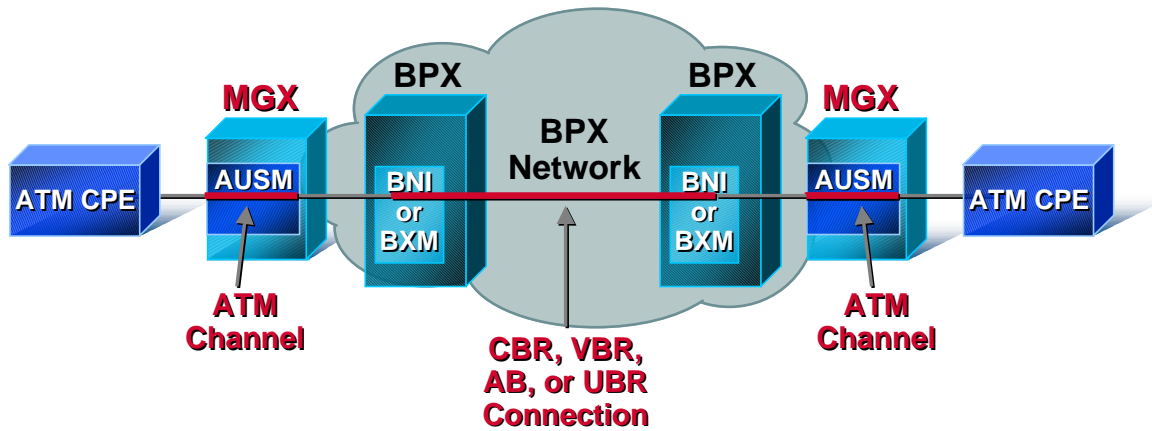
# Network Interfaces Switched WAN ATM (Cont.)

## Display ATM Port Counters

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

PortNum:	1
PortState:	Active
IngressRcvCells:	32
IngressGFCErrCells:	0
IngressVpiVciErrCells:	0
IngressUnknownVpiVci:	0x0
EgressXmtCells:	32
EgressPortAlarmDiscardCells:	0
EgressXmtClpSetCells:	0
EgressXmtEfcSetCells:	0
PortXmtAisCells:	32
PortXmtSgmtLpbkCells:	0
PortRcvAisCells:	32
PortRcvFrfCells:	0
PortRcvSgmtLpbkCells:	0
PortRcvCrcErrOAMCells:	0
ReceivedHECErrCells:	0
HECErrorSecs:	0
SeverelyHECErrorSecs:	0

## MGX ATM Connection



# 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
ChannIngressRcvState:	Receiving AIS
ChannIngressXmtState:	Sending OAM AIS
ChanInServiceSeconds:	4
ChanIngressPeakQDepth(cells):	0
ChanIngressReceiveCells:	0
ChanIngressClpSetCells:	0
ChanIngressEfcisetRcvCells:	0
ChanIngressUpclpSetCells:	0
ChanIngressQfullDiscardCells:	0
ChanIngressClpSetDiscardCells:	0
ChanIngressTransmitCells:	0
ChanShelfAlarmDiscardCells:	0
ChanEarlyPacketDiscardCells:	0
ChanPartialPacketDiscardCells:	0

# Network Interfaces Switched WAN ATM (Cont.)

## Display ILMI Counters

MGX1.1.6.AUSM8.a > dspilmicnt 1

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

# 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 VPIId(for VPC):	0
EgressQNum:	4
IngressQDepth(cells):	1000
IngressDiscardOption:	CLP hysteresis
IngressFrameDiscardThreshold	1000
IngressQCLPHigh(cells):	900
IngressQCLPLow(cells):	800
QCLPState:	LOW
IngressEfcThreshold(cells):	1000
UPCEnable:	Enabled
PeakCellRate[0+1](cells/sec):	3622
CellDelayVariation[0+1](in micro secs):	10000
PeakCellRate[0](cells/sec):	3622

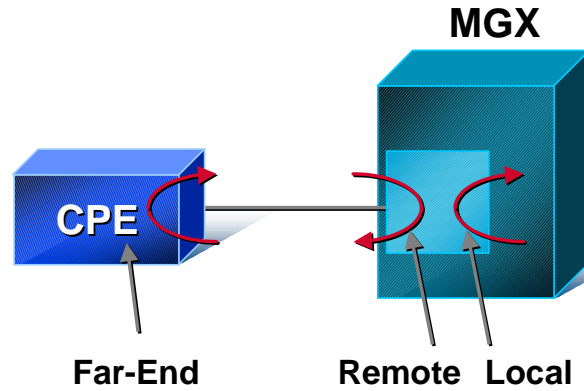
# Network Interfaces Switched WAN ATM (Cont.)

## 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

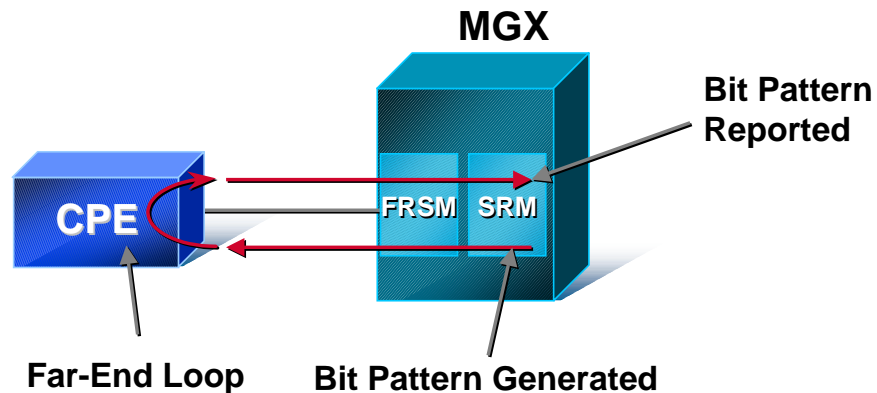
# Network Interfaces Switched Testing

## Generic Loop Definition



# Network Interfaces Switched Testing (Cont.)

## BERT On the SRM



# Network Interfaces Switched Testing (Cont.)

## Local Loops

- **Line or port**  
From SRM—Cnfbert
- **Channel**  
From service module  
Addchanloop—delchanloop

# 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
```

# Network Interfaces Switched Testing (Cont.)

## Remote Loops

- **Line**
  - FRSM and AUSM from SRM
  - Cnfbert
- **Port**
  - FRSM and AUSM from SRM
  - Cnfbert

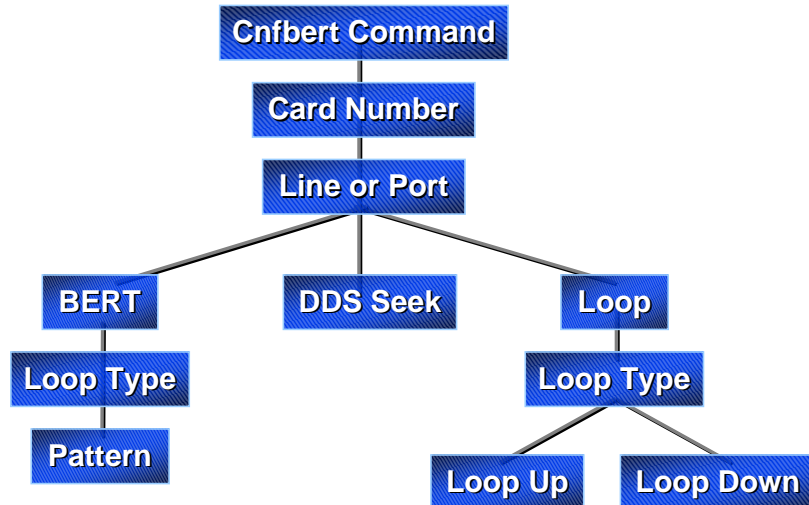
# Network Interfaces Switched Testing (Cont.)

## Far-End Loops

- **Line or port**
- **SRM BERT**
- **Dependent on attached end-user equipment**

# Network Interfaces Switched Testing (Cont.)

## Configure BERT Menus



# 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**



# Troubleshooting Wide Area Network Protocols

## Session 2305



# Please Complete Your Evaluation Form

## Session 2305

# CISCO SYSTEMS



## EMPOWERING THE INTERNET GENERATION<sup>SM</sup>