WIS Fault Isolation

IEEE P802.3ae Interim, New Orleans
Sept.12-14, 2000

Roy Bynum…………………………………………… WorldCom
Gary Nicholl, Howard Frazier……………….….… Cisco Systems
Norival Figueira, Paul Bottorff, David Martin...… Nortel Networks
Tom Alexander, Stuart Robinson, Gary
    Bourque, Richard Cam………………………….. PMC-Sierra
Pankaj Kumar…………………………………….... Intel/Level One
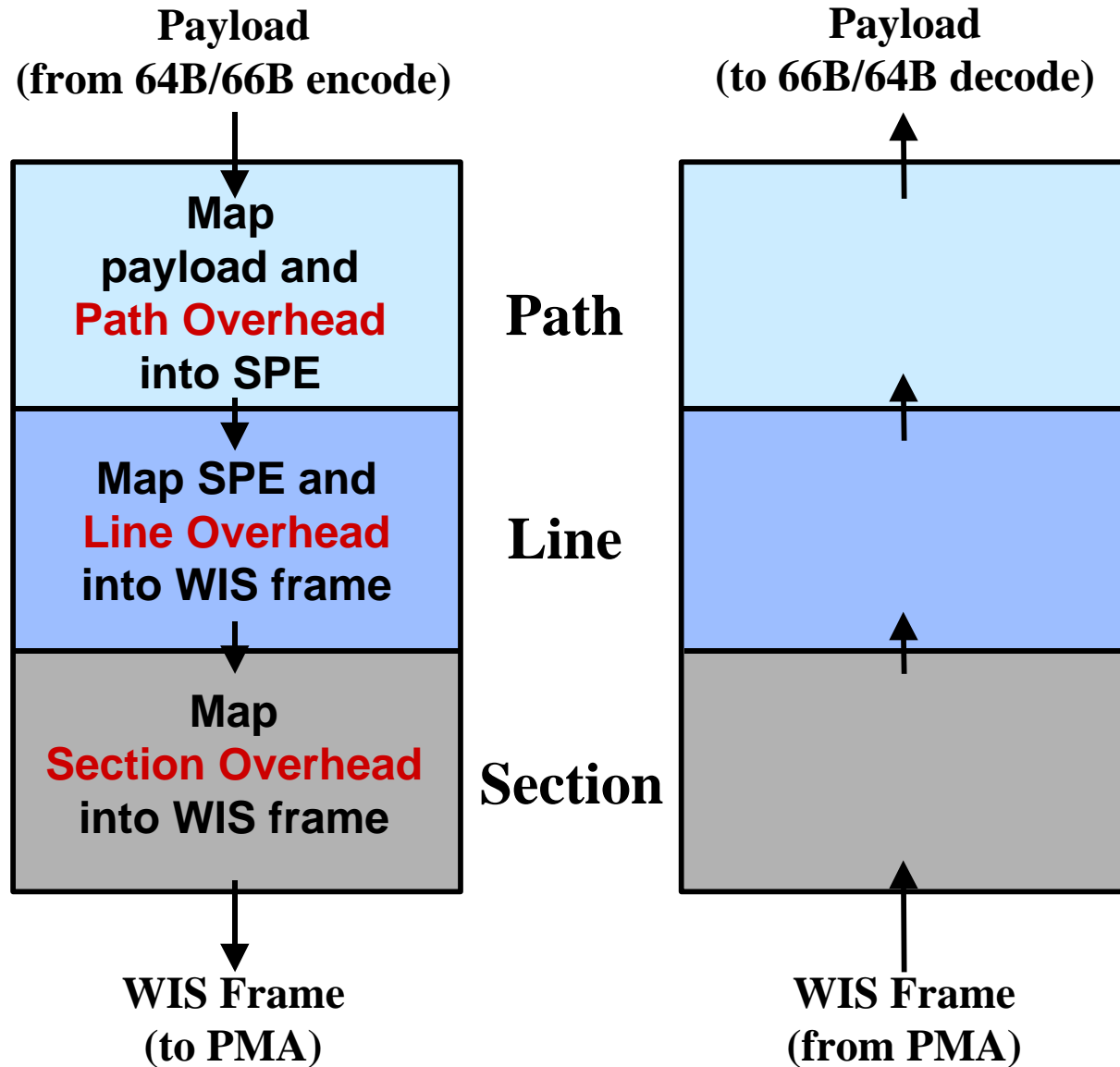Fred Weniger……………………………………… Vitesse

v0.5

Fault Isolation

- **Two presentations at the May/Ottawa interim discussed the value in having some additional WIS overhead processing to facilitate 10GE WAN PHY fault isolation:**
  - http://grouper.ieee.org/groups/802/3/ae/public/may00/bynum_1_0500.pdf
  - http://grouper.ieee.org/groups/802/3/ae/public/may00/nicholl_1_0500.pdf

- **This presentation addresses those requests.**

WIS Location

SONET Framing &
x^7+x^6+1 Scrambler

Upper Layers

MAC Control (Optional)

Media Access Control (MAC)

Reconciliation

XGMII

XGXS

XAUI

XGXS

Physical Coding Sublayer (**PCS**)

WAN Interface Sublayer (WIS)

16-bit parallel

SS

SUPI

SS

Physical Medium Attachment (**PMA**)

Physical Medium Dependent (**PMD**)

MEDIUM

SS = SUPI Sublayer

From - http://grouper.ieee.org/groups/802/3/ae/public/jul00/figueira_1_0700.pdf

WIS Overhead Layers

Payload
(from 64B/66B encode)

Payload
(to 66B/64B decode)

Map payload and Path Overhead into SPE

Map SPE and Line Overhead into WIS frame

Map Section Overhead into WIS frame

Path

Line

Section

WIS Frame
(to PMA)

WIS Frame
(from PMA)

From -   http://grouper.ieee.org/groups/802/3/ae/public/jul00/figueira_1_0700.pdf

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Single-Ended Maintenance: Soft Failure

- **Ability to determine a *degradation* of the transmit link from Enterprise or Carrier end.**

errors   errors

| Router | 10GE WAN | ELTE | DWDM Backbone | ELTE | 10GE WAN | Router |

?   ?

Enterprise   Carrier Network   Enterprise
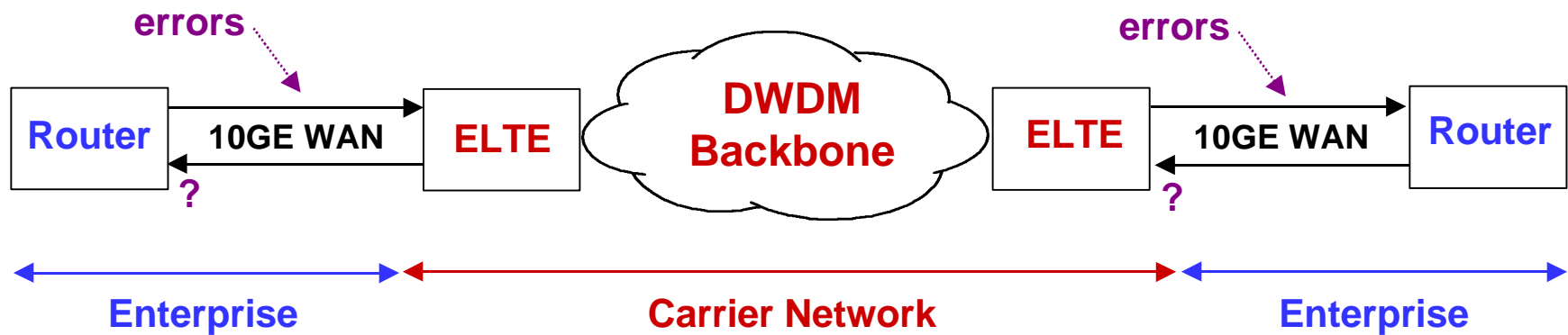
ELTE = Ethernet Line Terminating Equipment

From -   http://grouper.ieee.org/groups/802/3/ae/public/mar00/law_1_0300.pdf

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B2/M1 Example - Line layer view

1
B2 insert

2
errors

3
B2 violations

Router — **10GE WAN** — **ELTE** — **DWDM Backbone** — **ELTE** — **10GE WAN** — **Router**

M1 extract
5

M1 insert (REI-L)
4

← **Enterprise** → ← **Carrier Network** → ← **Enterprise** →
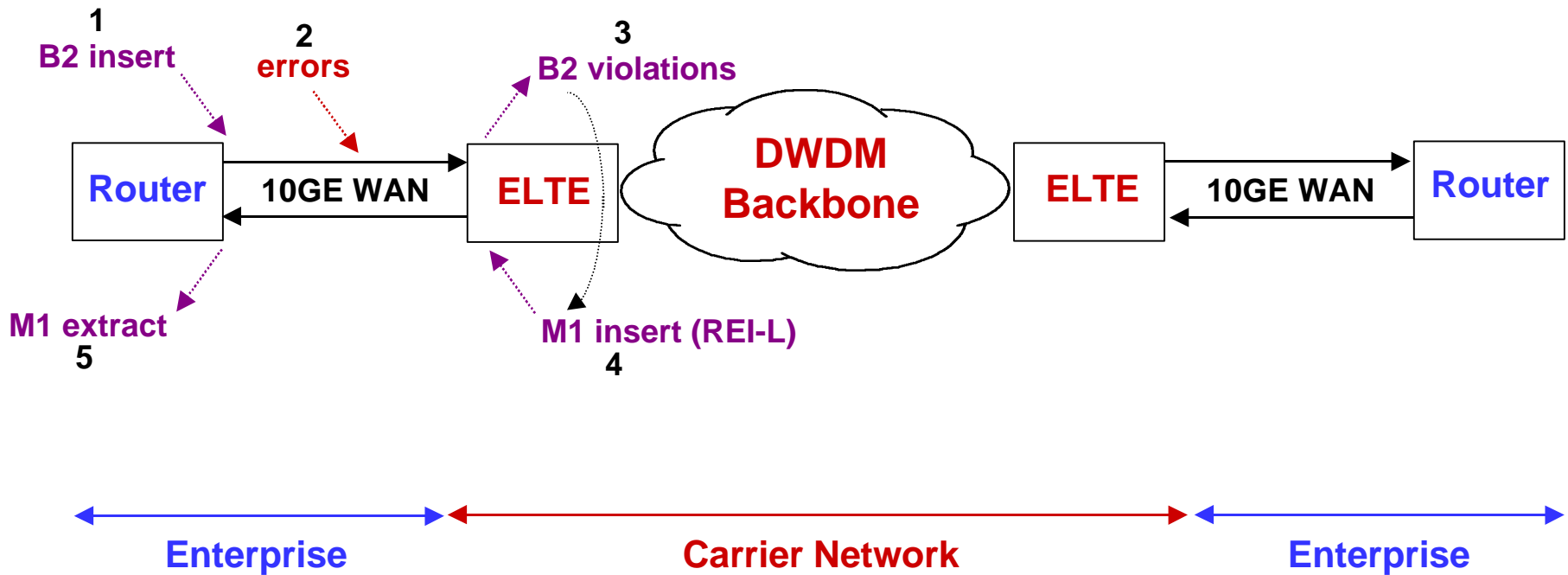
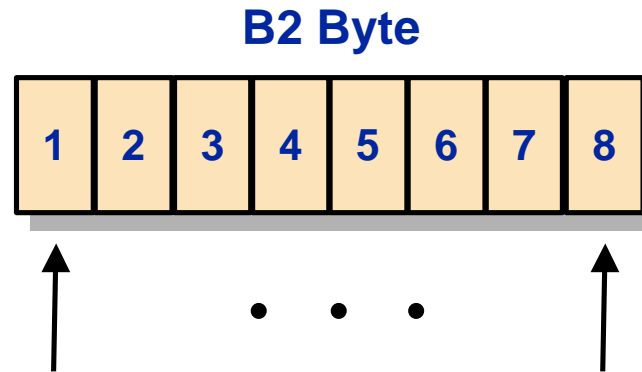**REI-L = Remote Error Indication-Line Layer**

B2/M1 Example - With path layer view
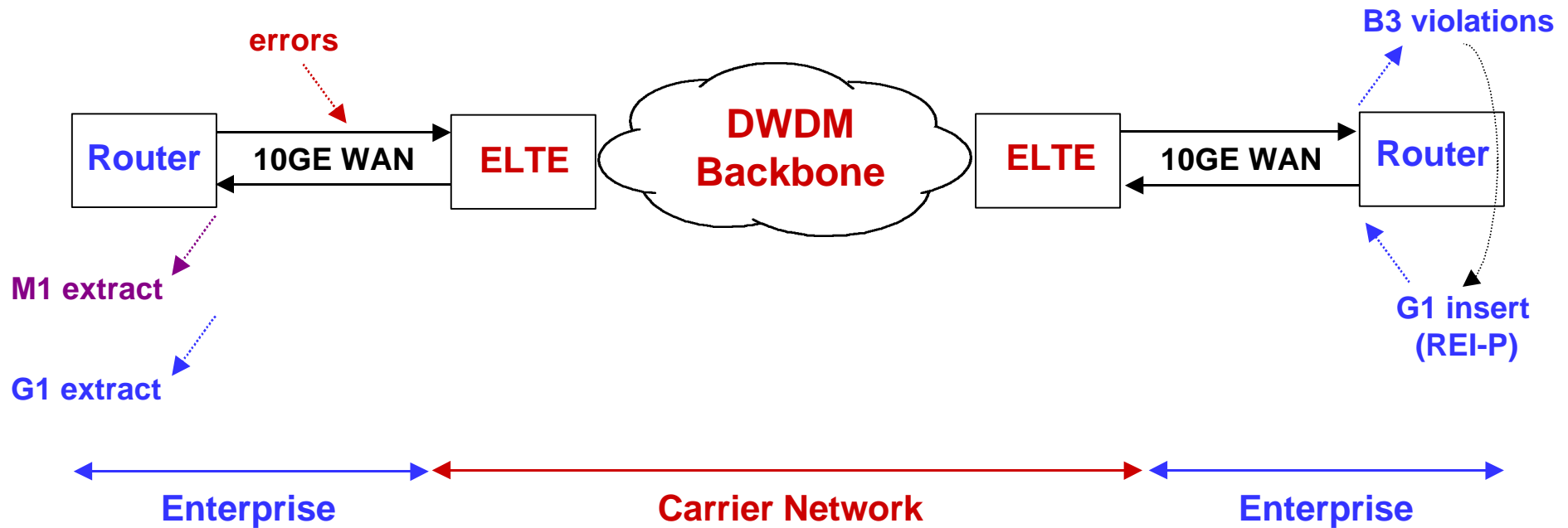
- **B3 violations are fed back in G1, but without M1, fault isolation between Enterprise and Carrier networks is not possible.**

REI-P = Remote Error Indication-Path Layer

B2 (Line BIP-8) Definition

B2 Byte

1	2	3	4	5	6	7	8

• • •

**Even parity calculated over
all bit 1s from entire STS-1 frame
excluding section overhead**

**Even parity calculated over
all bit 8s from entire STS-1 frame
excluding section overhead**

**There are 192 B2 Bytes in the WIS frame,
one in each STS-1 of the simplified OC-192c**

- **In the transmit direction the WIS calculates & inserts the B2s**

- **In the receive direction the WIS calculates Line BIP-8s & compares
with the extracted B2 values, discrepancies are B2 code violations**

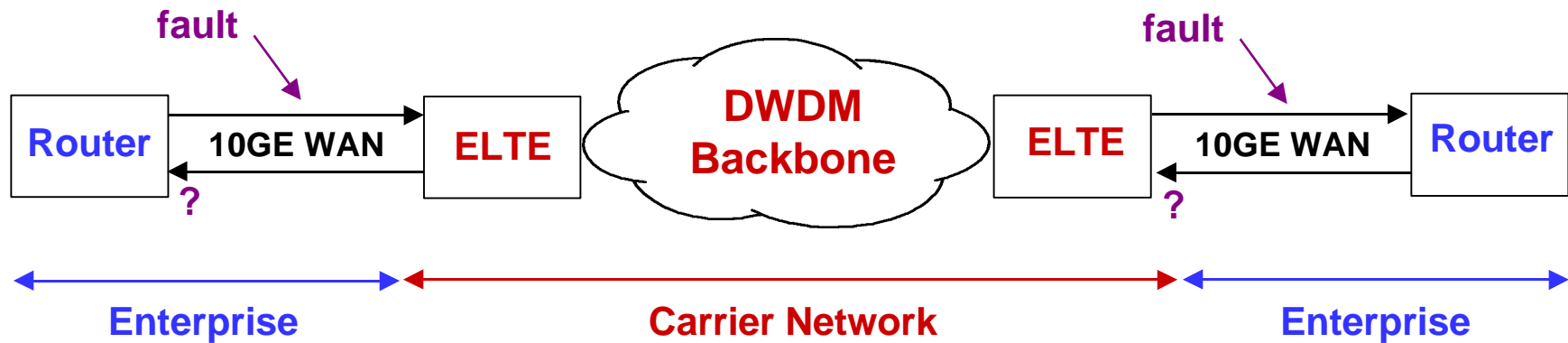**BIP-8 = Bit Interleaved Parity-8 bits wide**

M1 (REI-L) Definition

M1 Byte

1	2	3	4	5	6	7	8

← ——————————————————→ **8 bit binary value**
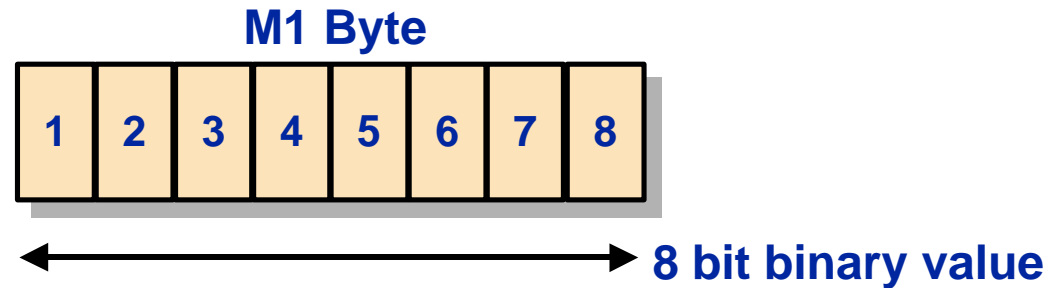
- **In the transmit direction the WIS inserts the summed B2 violation count (truncated to 255) from its partner receiver into the outgoing M1 timeslot**

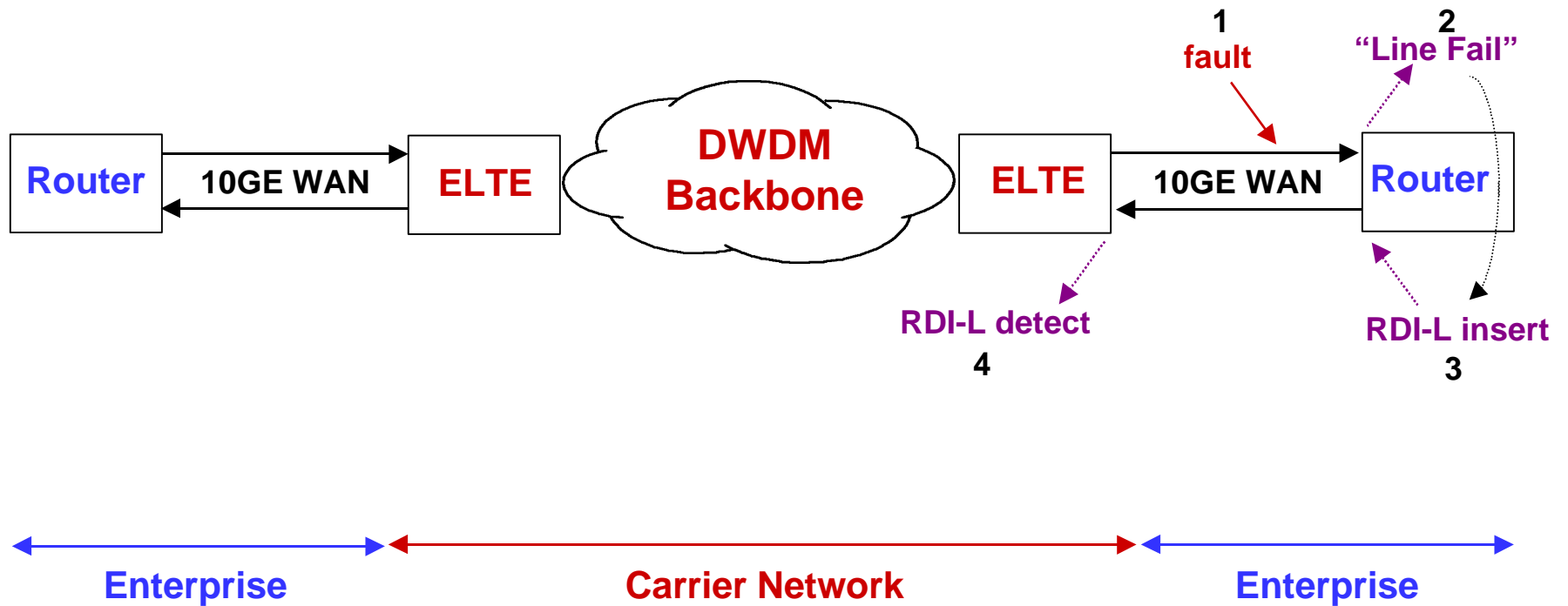- **In the receive direction the WIS simply extracts the M1 value**

REI-L = Remote Error Indication-Line Layer

Single-Ended Maintenance: Hard Failure

- **Ability to determine a *failure* of the transmit link from Enterprise or Carrier end.**

fault

fault

Router — 10GE WAN → ELTE — DWDM Backbone — ELTE — 10GE WAN → Router

?

?

Enterprise ⟷ Carrier Network ⟷ Enterprise

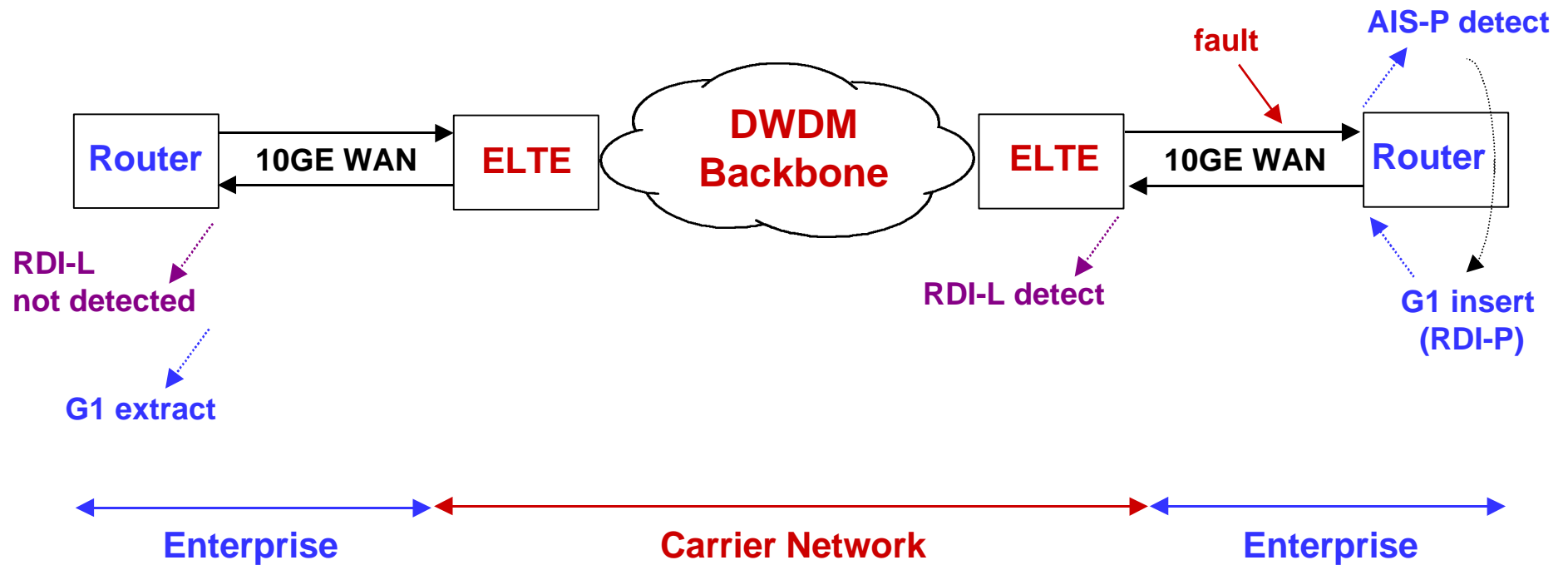**ELTE = Ethernet Line Terminating Equipment**

Line Fail/RDI-L Example - Line layer view

Line Fail = LOS + LOF + AIS-L
LOS = Loss Of Signal
LOF = Loss Of Frame
AIS-L = Alarm Indication Signal-Line layer

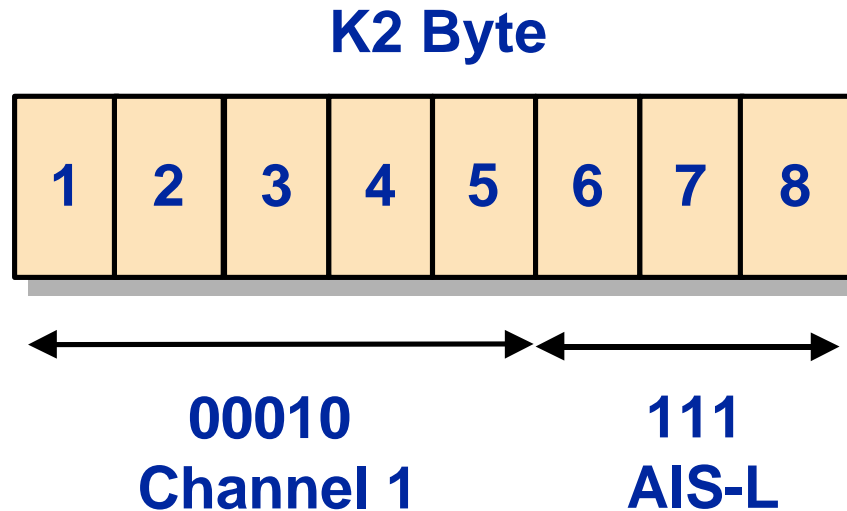RDI-L = Remote Defect Indication-Line layer

Line Fail Example - With path layer view

Router — 10GE WAN → ELTE — DWDM Backbone — ELTE — 10GE WAN → Router

fault

AIS-P detect

RDI-L not detected

G1 extract

RDI-L detect

G1 insert (RDI-P)

Enterprise — Carrier Network — Enterprise

- **RDI-P is fed back in G1, but without RDI-L, fault isolation between Enterprise and Carrier networks is not possible.**

RDI-L = Remote Defect Indication-Line layer
AIS-P = Alarm Indication Signal-Path layer
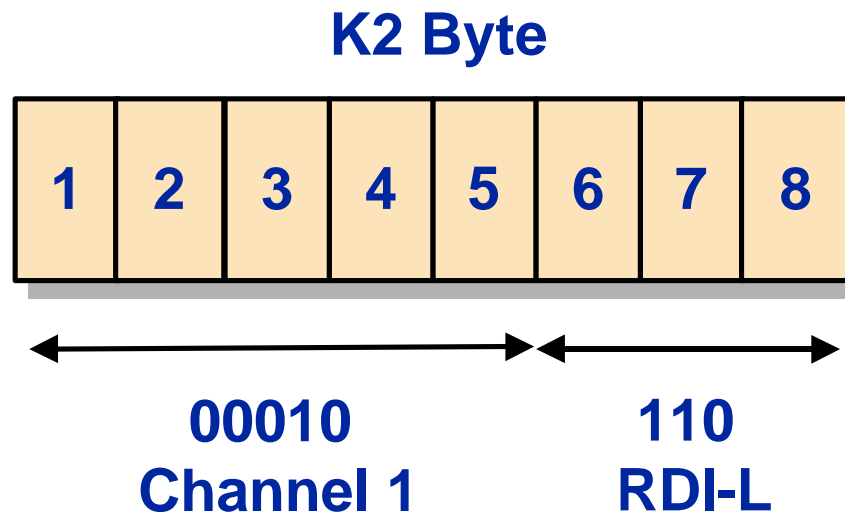RDI-P = Remote Defect Indication-Path layer

AIS-L Definition

K2 Byte

1	2	3	4	5	6	7	8

←——————— 00010 ———————→ ←—— 111 ——→

00010
Channel 1

111
AIS-L

- **WIS normally generates K2 = 00010000**

- **The setting of bits 6-8 = 111 would occur in the Carrier's network at a Regen**

- **WIS only needs to detect AIS-L as a trigger to generate RDI-L**

RDI-L = Remote Defect Indication-Line layer
AIS-L = Alarm Indication Signal-Line layer

RDI-L Definition

K2 Byte

1	2	3	4	5	6	7	8

00010
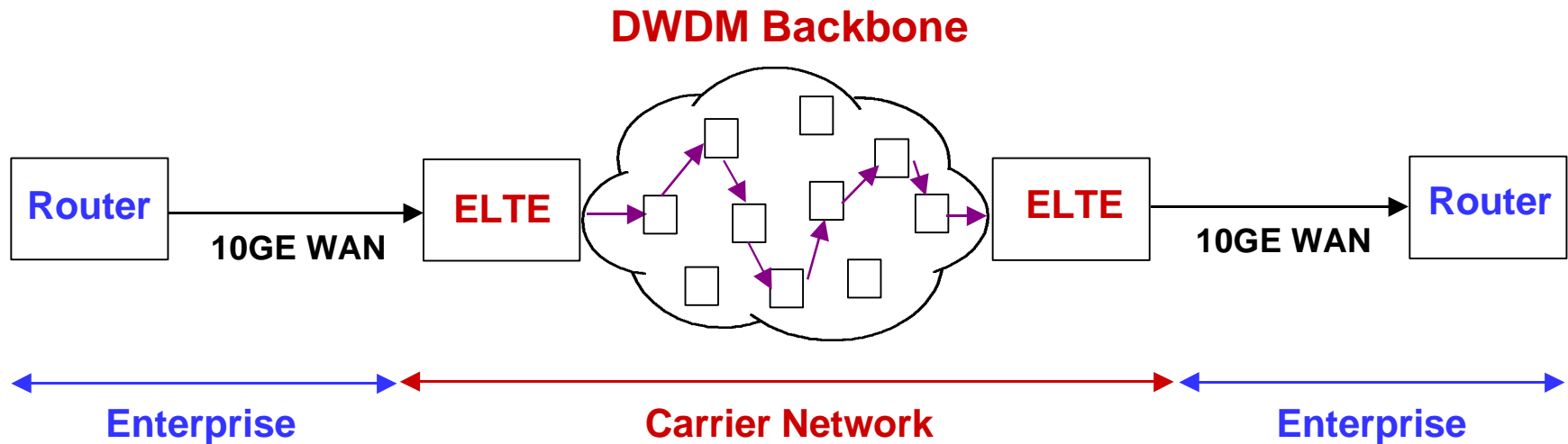**Channel 1**

110
RDI-L

- **WIS normally generates K2 = 00010000**

- **The setting of bits 6-8 = 110 is done by WIS only upon detection of a receive Line Fail**

Line Fail = LOS + LOF + AIS-L
LOS = Loss Of Signal
LOF = Loss Of Frame
AIS-L = Alarm Indication Signal-Line layer
RDI-L = Remote Defect Indication-Line layer

Path Connectivity
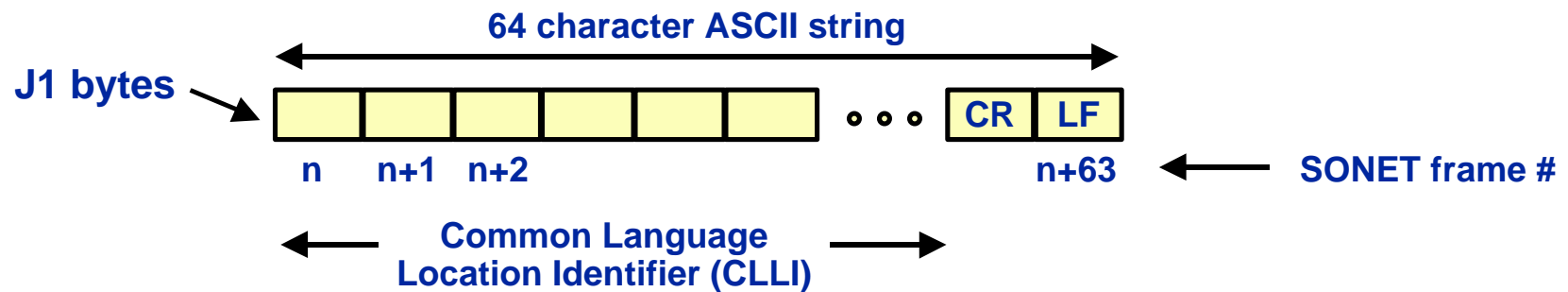
- **Ability to ensure correct connectivity within a large network.**

DWDM Backbone

| Router | 10GE WAN → | ELTE | | ELTE | 10GE WAN → | Router |

Enterprise ↔ Carrier Network ↔ Enterprise

ELTE = Ethernet Line Terminating Equipment

J1 Path Trace

64 character ASCII string

J1 bytes → | | | | | | | ○ ○ ○ | **CR** | **LF** |

n   n+1   n+2   n+63   ← **SONET frame #**

**Common Language
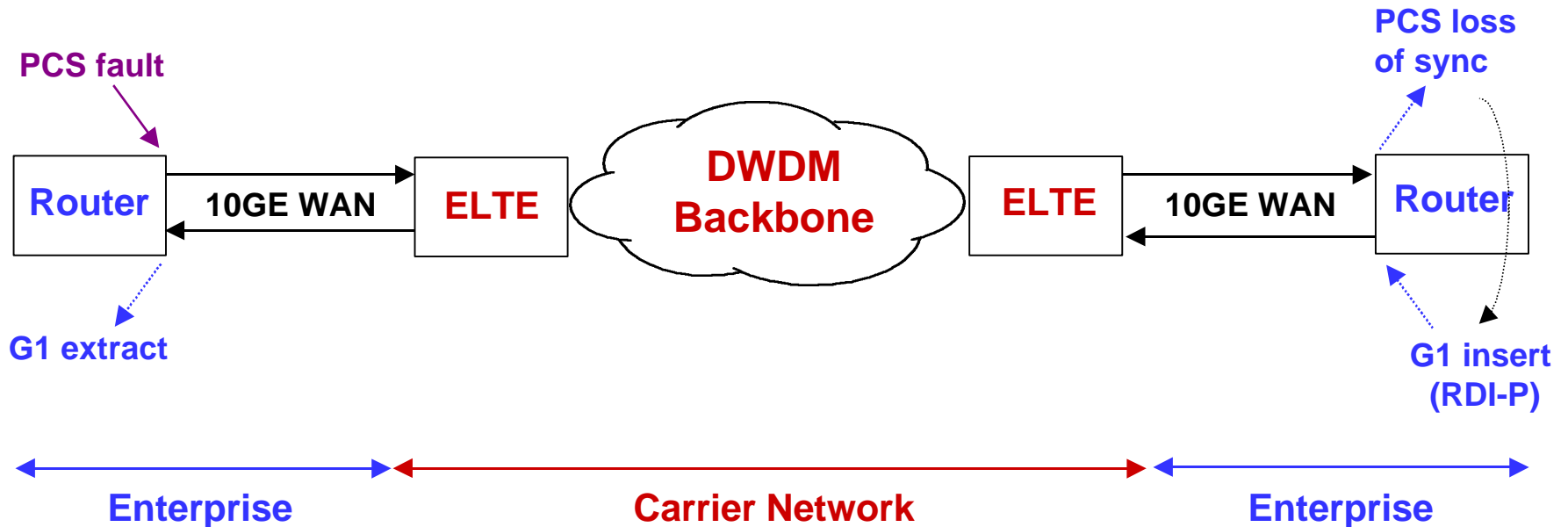Location Identifier (CLLI)**

- **A path overhead byte sent once per frame (every 125usec) comprising a 64 byte label, verified by intended receiver.**

**CR = Carriage Return
LF = Line Feed**
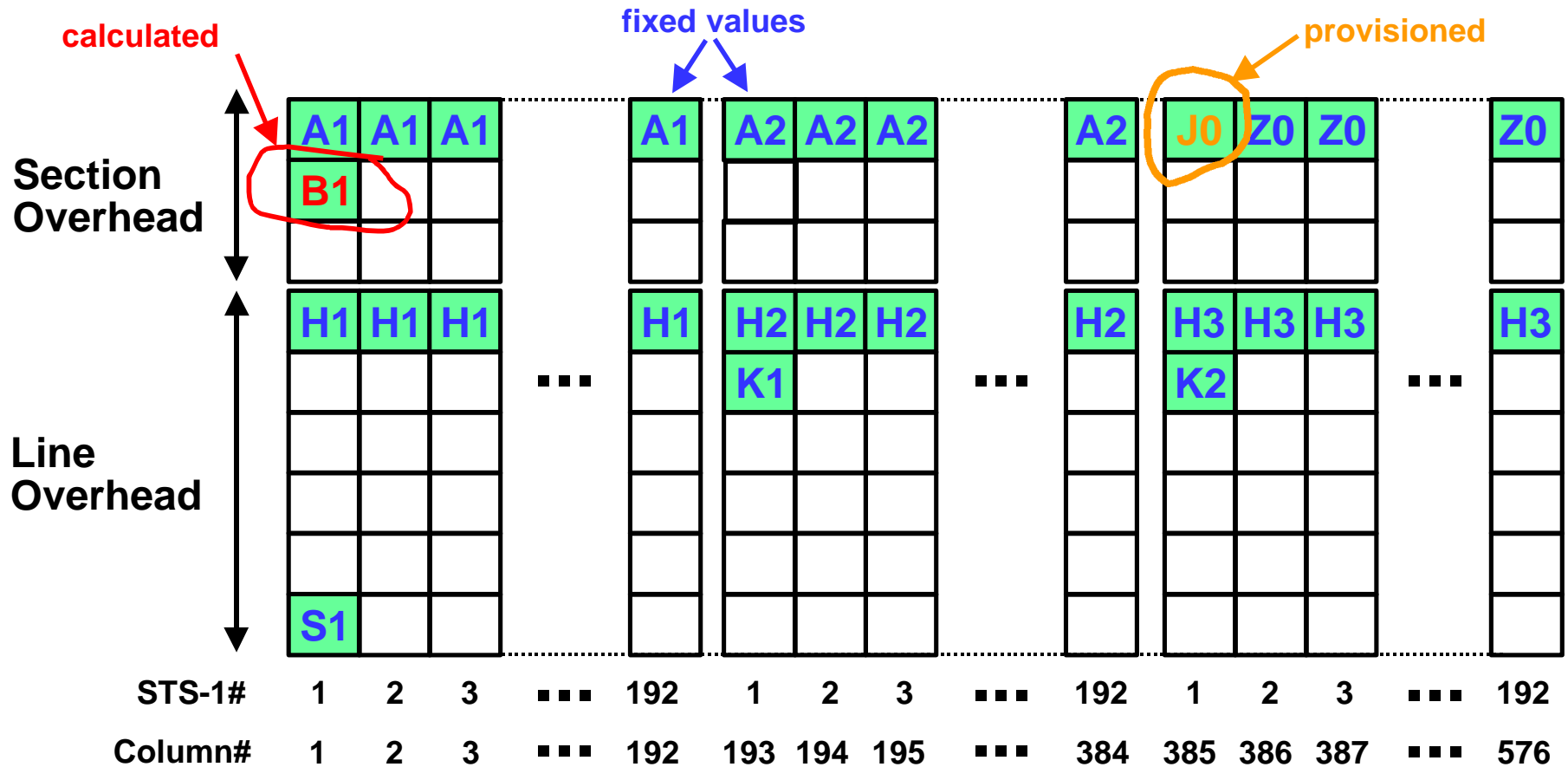
PCS Loss of Sync

- **"PCS loss of sync" (i.e. inability to sync to 64b/66b frames) is passed to WIS where it is integrated to become "LCD-P", then the outgoing G1 byte is coded with "Payload Defect" in RDI-P field**
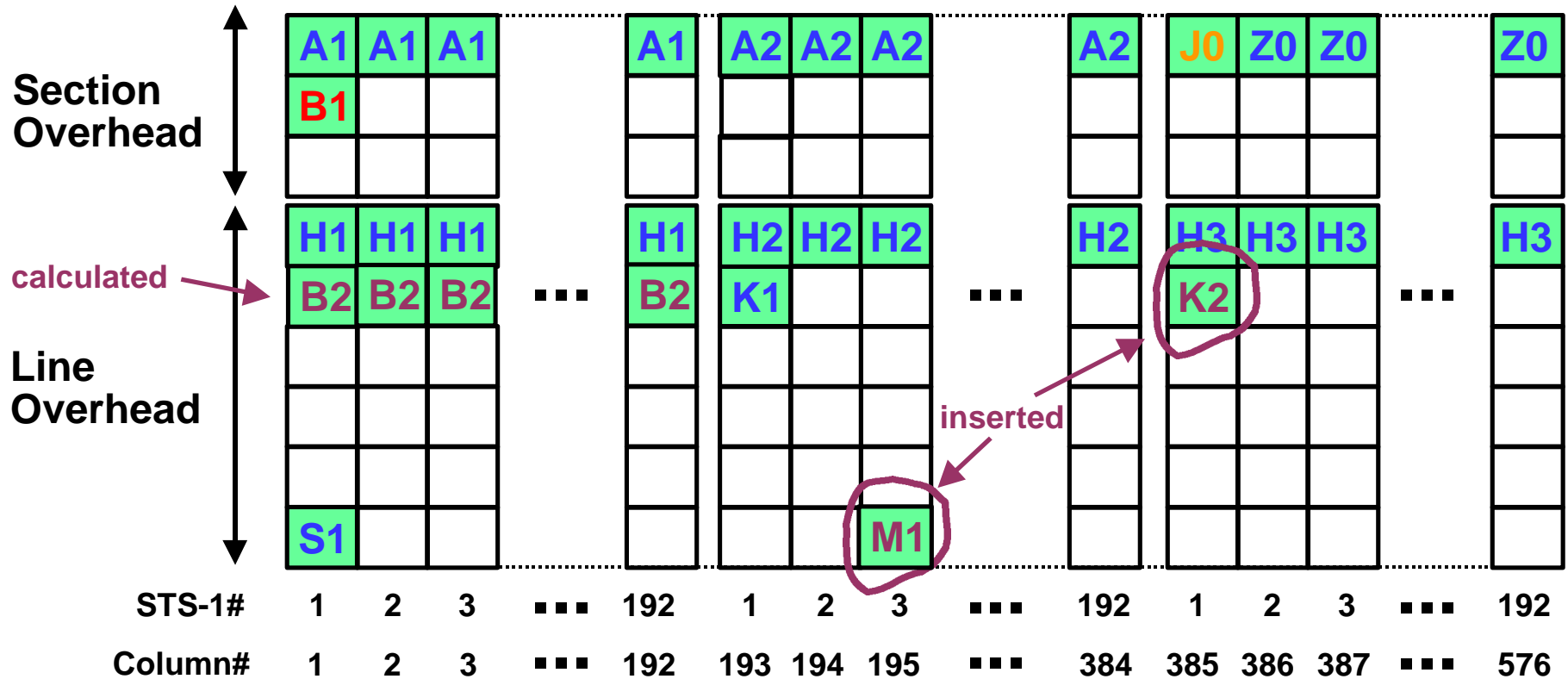 - notifies source of a transmit payload (i.e. PCS) problem

LCD-P = Loss of Cell Delineation-Path
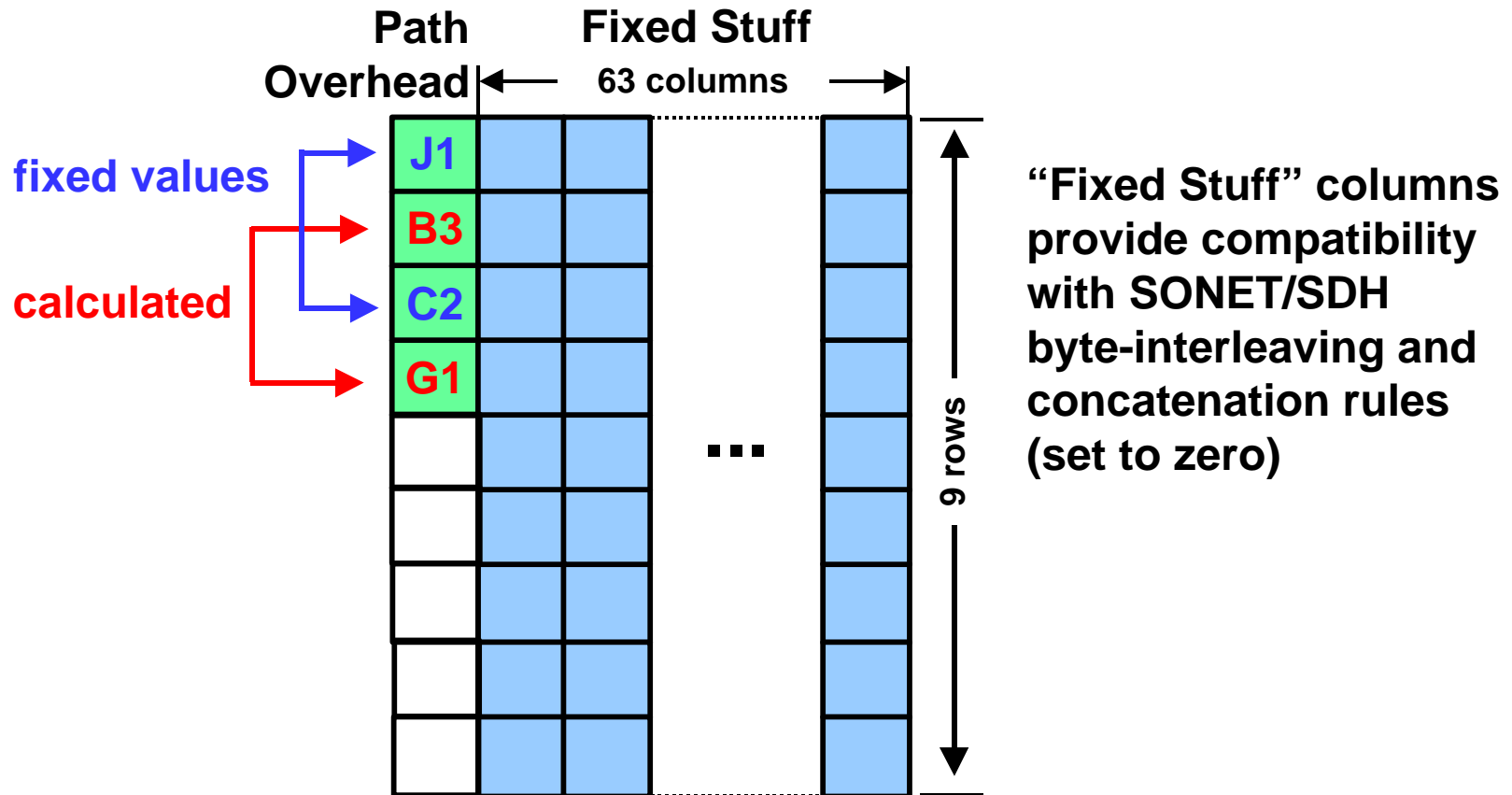**RDI-P = Remote Defect Indication-Path**

Transport Overhead

calculated

fixed values

provisioned

	A1	A1	A1		A1		A2	A2	A2		A2		J0	Z0	Z0			Z0
Section Overhead	B1																	
	H1	H1	H1		H1		H2	H2	H2		H2		H3	H3	H3			H3
				...			K1			...			K2			...		
Line Overhead																		
	S1																	

STS-1#	1	2	3	▪▪▪	192	1	2	3	▪▪▪	192	1	2	3	▪▪▪	192
Column#	1	2	3	▪▪▪	192	193	194	195	▪▪▪	384	385	386	387	▪▪▪	576

☐ = Undefined overhead octets (set to zero)

From -   http://grouper.ieee.org/groups/802/3/ae/public/jul00/figueira_1_0700.pdf

Transport Overhead - Addition

Path Overhead and "Fixed Stuff"

Path Overhead

Fixed Stuff
63 columns

fixed values

calculated

J1
B3
C2
G1

9 rows

"Fixed Stuff" columns provide compatibility with SONET/SDH byte-interleaving and concatenation rules (set to zero)

☐ = Undefined overhead octets (set to zero)

From - http://grouper.ieee.org/groups/802/3/ae/public/jul00/figueira_1_0700.pdf

Path Overhead - Addition

Path Overhead

Fixed Stuff
63 columns

provisionable value → J1, B3, C2, G1

9 rows

"Fixed Stuff" columns provide compatibility with SONET/SDH byte-interleaving and concatenation rules (set to zero)

☐ = Undefined overhead octets (set to zero)

Overhead Addition Summary

- **B2 calculation/insertion & error detection/reporting**

  — four 192x8 DPRAMs + ~1000 gates

- **M1 insertion & reporting**

  — ~70 flops + ~500 gates

- **RDI-L insertion & detection/reporting, plus AIS-L detection/reporting**

  — ~20 flops + ~200 gates

- **J1 (provisionable) insertion & reporting**

  — ~300 gates + two 64x8 RAMs

- **PCS loss of sync integration to LCD-P**

  — ~2 flops + 20 gates

How to Modify the WIS Clause

- **Proposes changes to the definitions by cross-references contained in the "WIS Update" presentation approved for D1.0**

  — http://grouper.ieee.org/groups/802/3/ae/public/jul00/figueira_1_0700.pdf

- **WIS Clause still written by cross-referencing ANSI T1.416-1999**

  — ANSI T1.416-1999 can be obtained at the following URL: http://www.atis.org/atis/docstore/index.asp

Changes to Cross-References

- **Section 4 "Common Criteria"**
  - Referring to Table 1 (SONET Overheads at NIs)

  - Add support for the following
    - Section: B2 and M1
    - Path: J1

  - Note: B2, M1, and J1 support are to be added to the WIS draft per instructions contained in the presentation indicated below for the case where these overheads are supported. However, the WIS Clause should not define a default Path Trace message, as indicated in that presentation (since it is already defined in T1.105, which is referenced in T1.416-1999, as being composed of 64 NULL characters, i.e., Hex 00).
    - "WIS Update" used as the basis for D1.0
      http://grouper.ieee.org/groups/802/3/ae/public/jul00/figueira_1_0700.pdf

Changes to Cross-References (cont'd)

- **Section 4 "Common Criteria" (cont'd)**

  — Change the following overhead to be partially supported
  - Line: K2 (set to 00010xxx)
    - Where bits 6-8[*] (i.e., xxx) shall be set to either RDI-L or 000. No other codes for bits 6-8 shall be generated by the WIS.
    - A receiver WIS shall only process bits 6-8 of K2. All other bits of K2 shall be ignored
    - A receiver WIS shall only detect AIS-L and RDI-L codes on bits 6-8 of received K2. All other codes (including 000) shall be ignored and shall have no effect on the receiver WIS

    - Note: K1/K2 settings still indicate a working channel rather than the protection channel

    (*) This slide uses the SONET bit numbering convention, where bits are numbered from 1 (MSB) to 8 (LSB) and bit 1 is the leftmost bit.

Changes to Cross-References (cont'd)

- **Section 7 "Maintenance"**
  - Section 7.1, Table 2 "Near-end events and far-end reports"
    Add support for the following

    - Defects: AIS-L (as defined in Section 7.4.1)
      The WIS shall not generate AIS-L, but shall
      detect the presence of AIS-L in the received signal

      RDI-L (as defined in Section 7.4.1)

  - Note: BIP-N(L) and REI-L support is to be added to the WIS draft per
    instructions contained in the presentation indicated below for the case where
    B2 and M1 are supported.
    - "WIS Update" used as the basis for D1.0
      http://grouper.ieee.org/groups/802/3/ae/public/jul00/figueira_1_0700.pdf

Changes to Cross-References (cont'd)

- **Section 7 "Maintenance" (cont'd)**

    — Add LCD-P to the list of supported defects:

    - Uses same G1 RDI-P Payload Defect code as PLM-P
    - LCD-P is indicated when the *PCS loss of sync* signal is continuously asserted for a period of 3 ms
    - The LCD defect terminates when the *PCS loss of sync* signal is de-asserted for a period of 1 ms
    - *PCS Loss of sync* is a signal from the PCS and defined in the PCS clause

Motion

Move that the P802.3ae Task Force add the following proposal, as presented, to draft D2.0: martin_1_0900 "WIS Fault Isolation".