PHY OAM and Lane Fault Monitoring

Li Zeng, Min Ye, Qiwen Zhong, WB Jiang

HUAWEI TECHNOLOGIES Co., Ltd.

IEEE 802.3ba Task Force, 2008

Supporters

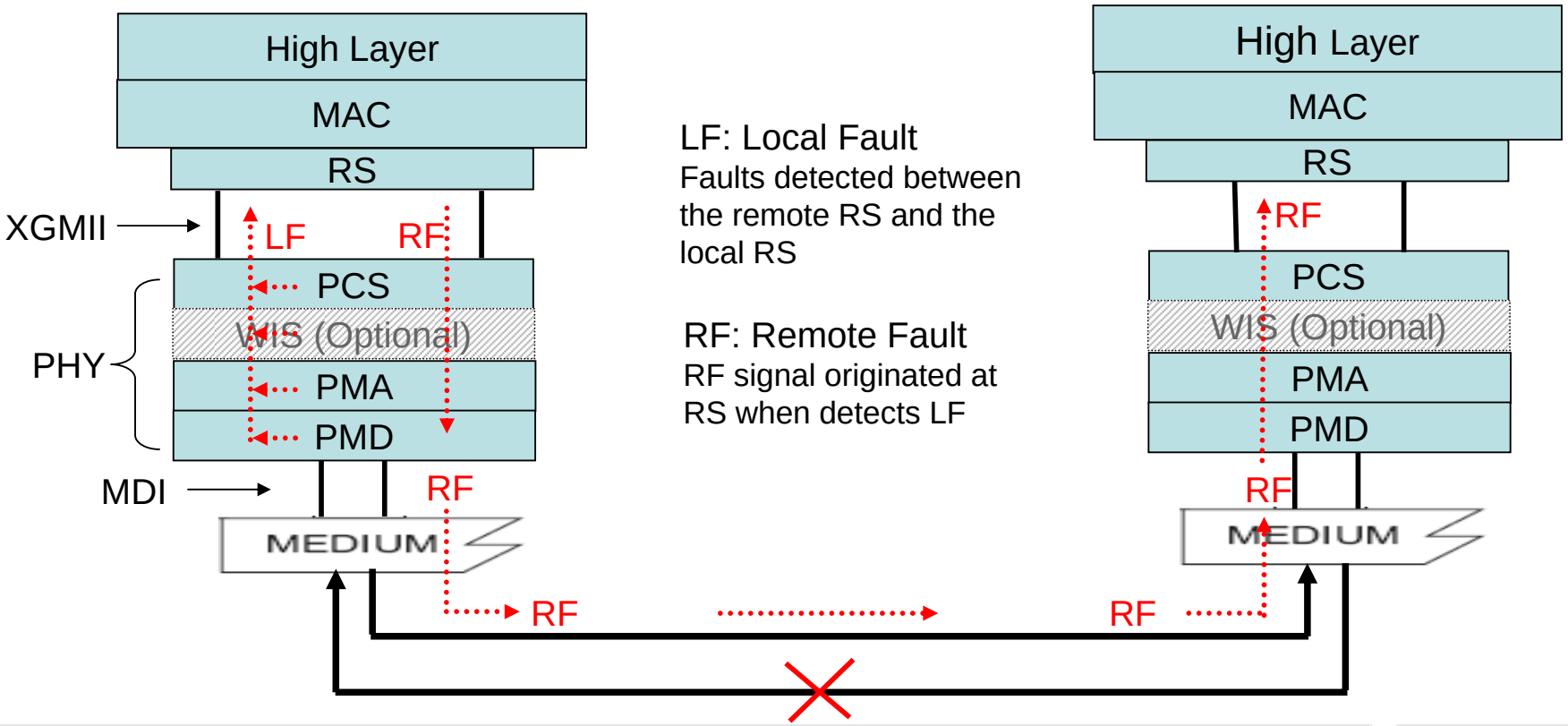
- Hidenori Takahashi, KDDI R&D Labs
- Jim Tavacoli, Santur Corporation
- Thomas Schrans, Santur Corporation
- Frank Chang, Vitesse

Outline

- PHY monitoring in 10GE
- PHY OAM and lane fault monitoring in 100GE
- PHY OAM block definition in 100GE

PHY Monitoring in 802.3ae

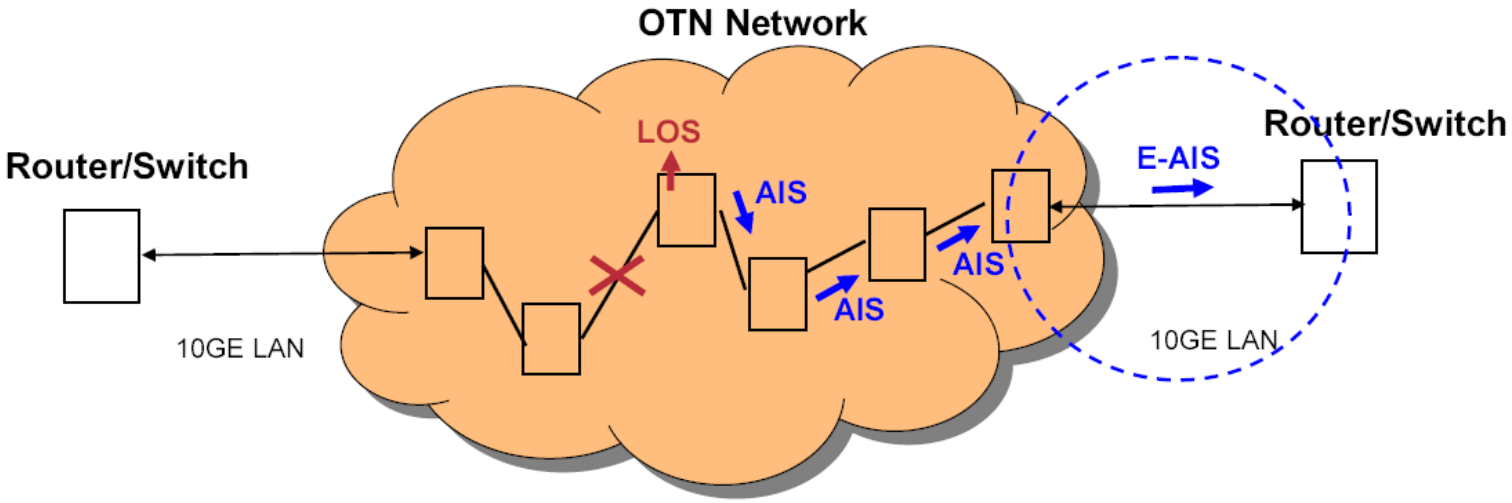
- **10GE Link Fault Signaling mechanism**
  - Reside in Reconciliation Sublayer (RS)
  - To monitor link status between local RS & remote RS and perform link status notification
  - Sublayers within the PHY are required to detect faults that render a link unreliable



PHY Monitoring in 802.3ae

- **Link fault status covers all possible defects detected between local RS and remote RS**
  - I/O Signal Detect
  - Protocol Detect, includes:
    - CODEC Synchronization
    - Lane Alignment (Multi-Lane Only, 10GBASE-X)
    - WIS Frame/Payload Acquisition
    - Link Status Report Recognized

100GE OAM Requirements



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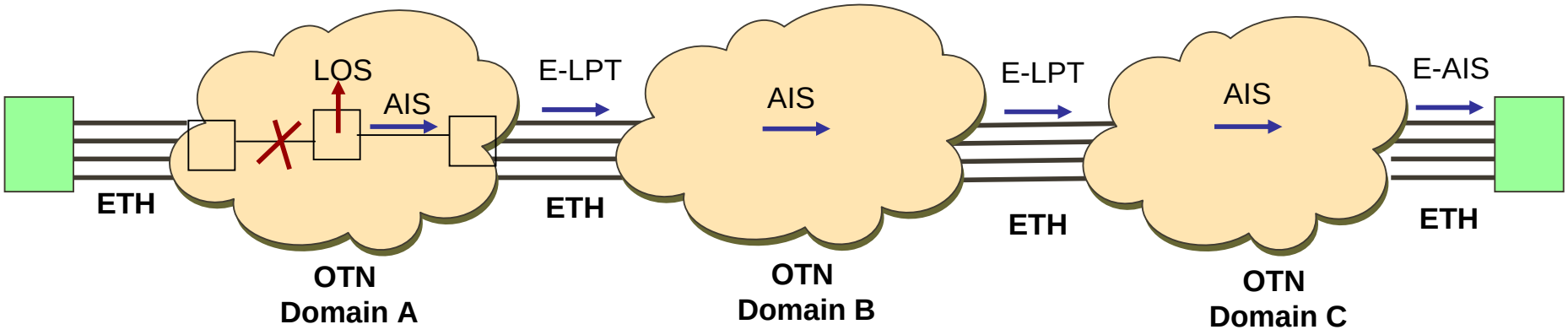
•**Need to monitor at the physical layer to maintain transparency**

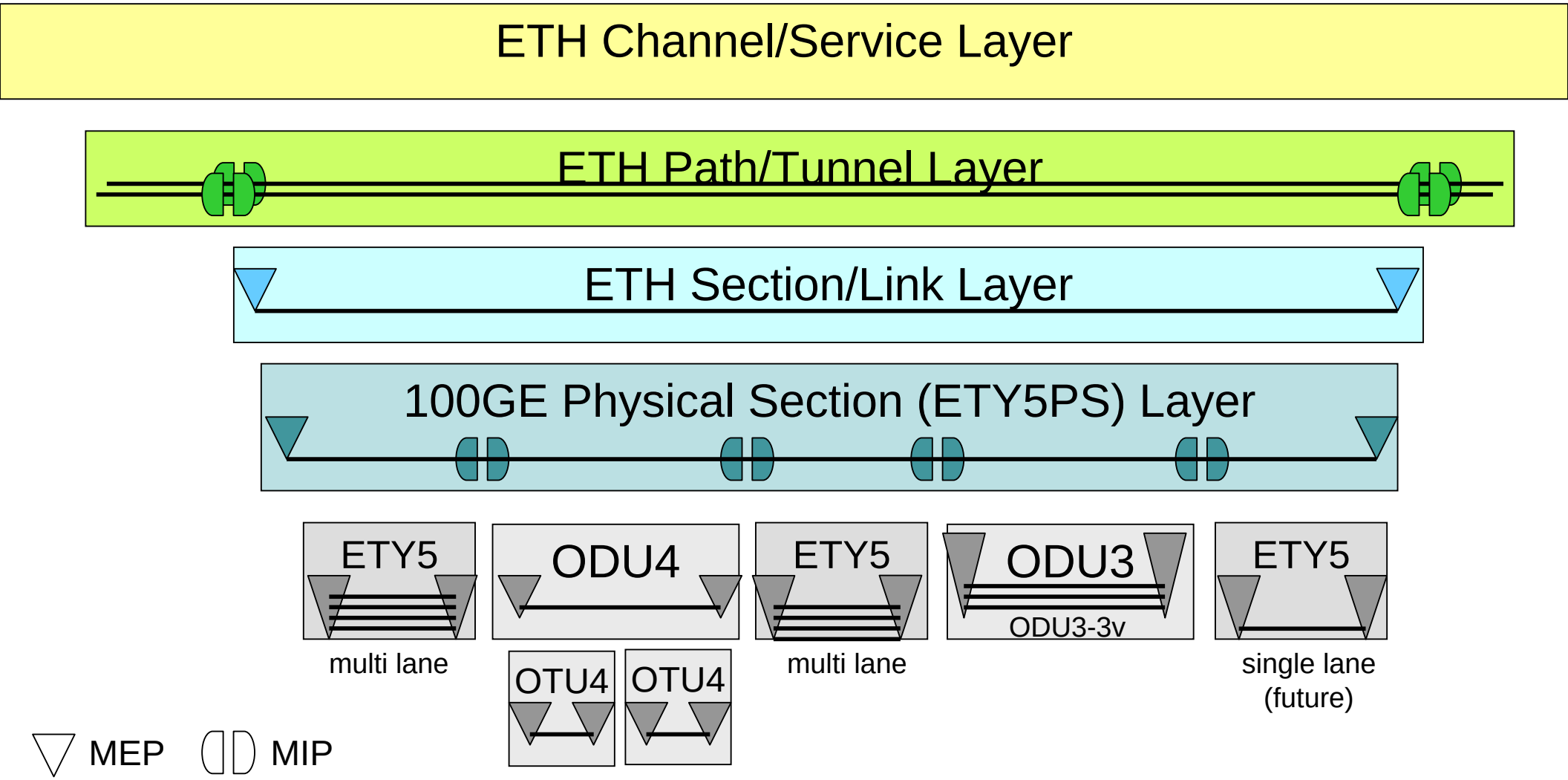
100GE OAM Requirements



- **Ethernet PHY OAM capability can be extended to the multi-lane interface**

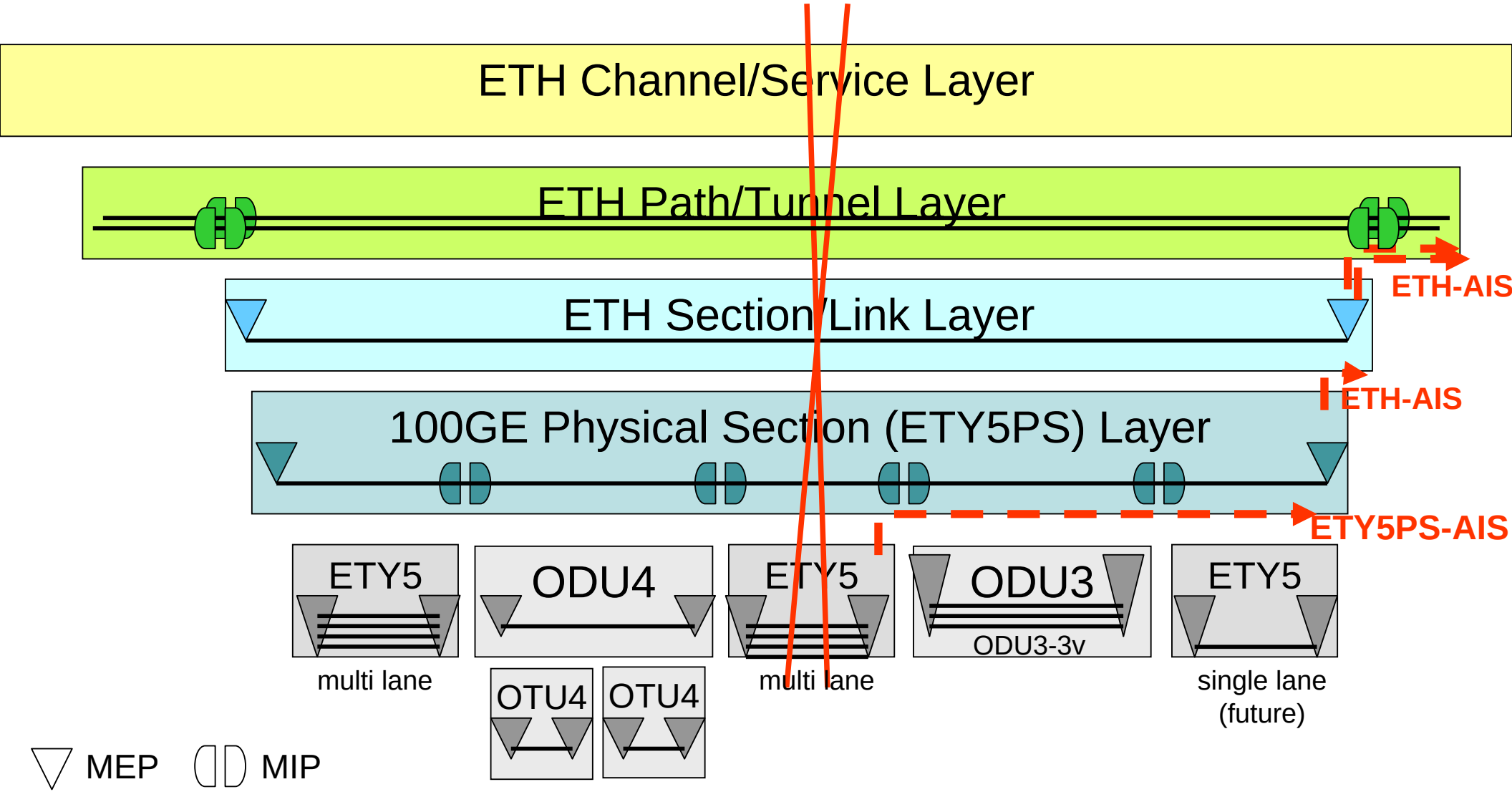
- **Ethernet PHY OAM may transport OTN's link status information between the OTN clouds**
  - E-LPT (Link status Pass-Through)

100GE Layer Stack

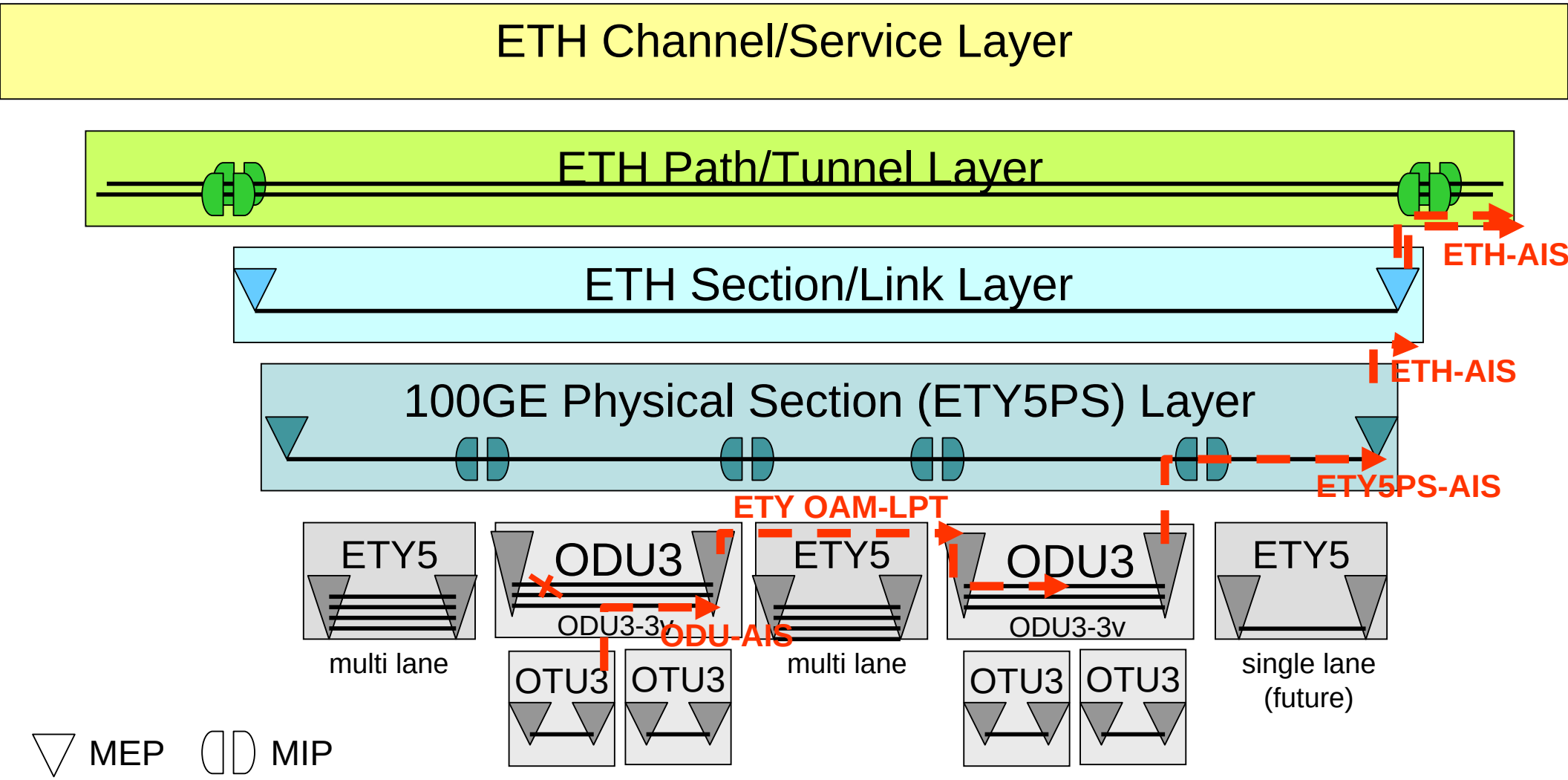


100GE Layer Stack

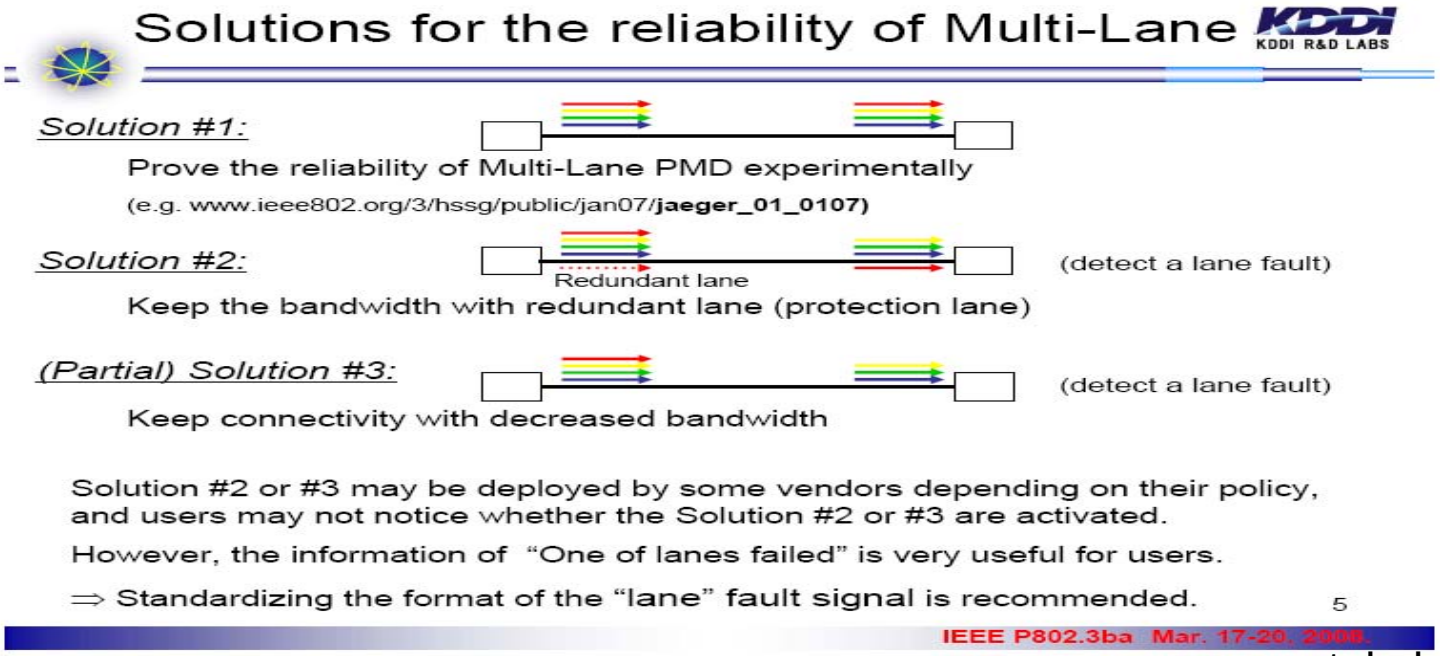
Alarm Suppression



100GE Layer Stack
Alarm Suppression



100GE Lane Fault Monitoring Requirements



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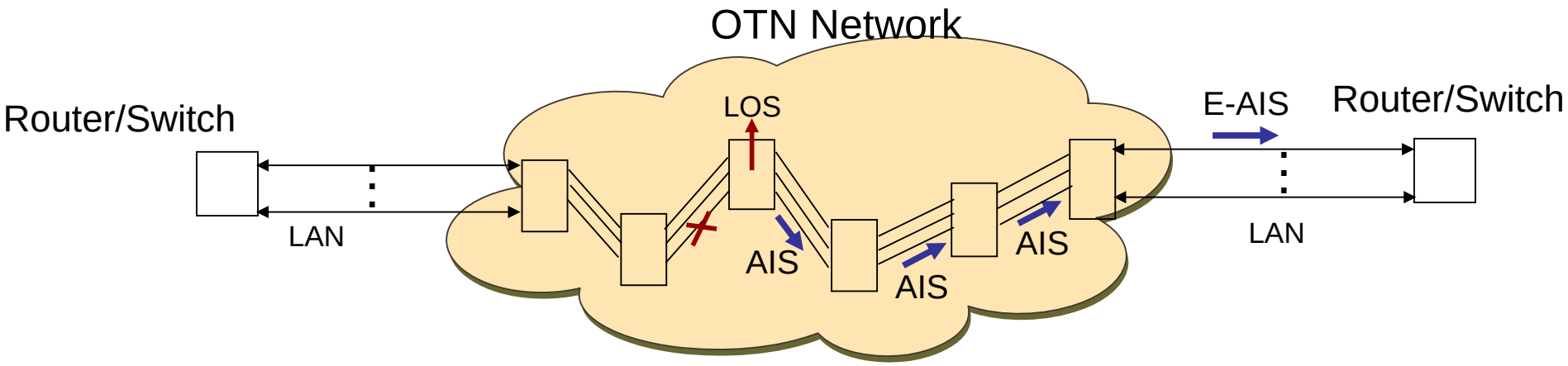
- **The breakdown of a 100GE link will have a large impact on the whole network.**
  - Flow protection and route recovery can be difficult for the 100GE path
- **Monitoring per lane can be effective for partial lane protection based on partial data flow**
- **Standardizing the format of "Lane" fault signal in 802.3ba has been recommended**

OAM on Independent Transport



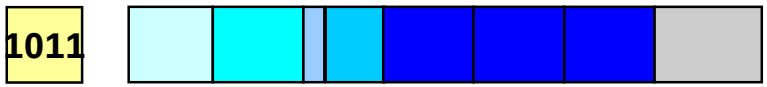
•100GE signal can be transported over an ODU4, or over a concatenated set of ODU3 or ODU2 signals (ODUk-Xv or ODUk-Xc).

•On the current transport network, a set of 40G and/or 10G path transport of 100GE service will be considered

•When on independent transport model, if one of the OTN links fails, OAM indication can be sent to relevant lanes to suppress partial flow.

PHY OAM definition

•OAM block: 64-bit data + 4-bit ctrl



0xa5 Block type:8bits

OAM type: 8bits
- •x01H:LLF
- •x02H:RLF
- •x03H:status advertisement
- •x04H:BER Monitor
- •Others: reserved

Broadcast OAM / lane OAM : 2bits

lane ID : 6bits

OAM value : 24bits

reserved

TXD/RXD								TXC/RXC	Description
D	D	D	D	D	D	D	D	0000	Data
S	D	D	D	D	D	D	D	1001	Start
C	C	C	C	S	D	D	D	1010	Start
T	C	C	C	C	C	C	C	1000	Terminate
D	T	C	C	C	C	C	C	0111	Terminate
D	D	T	C	C	C	C	C	0110	Terminate
D	D	D	T	C	C	C	C	0101	Terminate
D	D	D	D	T	C	C	C	0100	Terminate
D	D	D	D	D	T	C	C	0011	Terminate
D	D	D	D	D	D	T	C	0010	Terminate
D	D	D	D	D	D	D	T	0001	Terminate
C	C	C	C	C	C	C	C	1111	Control
A	A	A	A	A	A	A	A	1101	Alignment
O	O	O	O	O	O	O	O	1011	OAM
N	N	N	N	N	N	N	N	New	Null
X	X	X	X	X	X	X	X	New	Reserve

100GE PHY Monitoring Proposal

- **PHY OAM function in 100GE**
  - Monitor every lane separately
  - Distinguish between lane status and link status
    - LLF: Local Lane Fault
    - RLF: Remote Lane Fault
  - Indicate more detailed link or lane status information for management
    - Signal fault/defect? Protocol fault/defect? Synchronization error? Etc.
    - Fault location indicate
  - Mapping between 100GE PHY OAM and transport network OAM
  - Some more functions need to be considered
    - BER monitor
    - Auto negotiate via PHY OAM (in backplane application)

PHY OAM Mechanism

- **PHY OAM based on VL or PL or lambda**
  - Independent laser monitoring (fault, performance, laser degradation)
  - Improve Ethernet PHY reliability
- **Steal IPG block for PHY OAM??**
  - Every 16384 blocks , a PHY OAM block can be sent by stealing from IPG, which takes only 0.006%(60PPM) of the bandwidth
  - Should be discussed more

Conclusions

- PHY OAM providing the monitoring of a physical lane
  - Lane failure will be indicated. (LLF/RLF)
- Implementation of PHY monitoring/PHY OAM
  - PHY OAM will be defined by block format
  - More functions can be considered by PHY OAM
    - Auto Negotiate
    - BER monitor
    - information advertisement

Thank You