MEF 30.1
Service OAM Fault Management Implementation Agreement

Agenda

- **Approved MEF Specifications**
- **This presentation**
- **About this Specification**
- **In Scope / Out of Scope**
- **Terminology, Concepts & Relationship to other standards**
- **Section Review**
  - Major topics
    - Minor topics
- **Examples/Use Cases**
- **Summary**

Approved MEF Specifications

REF	Description
MEF 2	Requirements and Framework for Ethernet Service Protection
MEF 3	Circuit Emulation Service Definitions, Framework and Requirements in Metro Ethernet Networks
MEF 4	Metro Ethernet Network Architecture Framework Part 1: Generic Framework
MEF 6.1	Metro Ethernet Services Definitions Phase 2
MEF 7.2	Carrier Ethernet Management Information Model
MEF 8	Implementation Agreement for the Emulation of PDH Circuits over Metro Ethernet Networks
MEF 9	Abstract Test Suite for Ethernet Services at the UNI
MEF 10.2	Ethernet Services Attributes Phase 2
MEF 11	User Network Interface (UNI) Requirements and Framework
MEF 12.1	Metro Ethernet Network Architecture Framework Part 2: Ethernet Services Layer
MEF 13	User Network Interface (UNI) Type 1 Implementation Agreement
MEF 14	Abstract Test Suite for Traffic Management Phase 1
MEF 15	Requirements for Management of Metro Ethernet Phase 1 Network Elements
MEF 16	Ethernet Local Management Interface

*** MEF 6.1 replaced MEF 6., MEF 7.1 replaced MEF 7, MEF 10 .2 replaced MEF 10.1.1, MEF 10.1, MEF 10 which replaced MEF 1 and MEF 5.**

Approved MEF Specifications

REF	Description
MEF 17	Service OAM Framework and Requirements
MEF 18	Abstract Test Suite for Circuit Emulation Services
MEF 19	Abstract Test Suite for UNI Type 1
MEF 20	User Network Interface (UNI) Type 2 Implementation Agreement
MEF 21	Abstract Test Suite for UNI Type 2 Part 1: Link OAM
MEF 22	Mobile Backhaul Implementation Agreement Phase 1
MEF 23	Class of Service Implementation Agreement Part 1
MEF 24	Abstract Test Suite for UNI Type 2 Part 2: E-LMI
MEF 25	Abstract Test Suite for UNI Type 2 Part 3: Service OAM
MEF 26	External Network Network Interface (ENNI) – Phase 1
MEF 27	Abstract Test Suite For UNI Type 2 Part 5: Enhanced UNI Attributes & Part 6: L2CP Handling
MEF 28	External Network Network Interface (ENNI) Support for UNI Tunnel Access and Virtual UNI
MEF 29	Ethernet Services Constructs
MEF 30.1	Service OAM Fault Management Implementation Agreement
MEF 31	Service OAM Fault Management Definition of Managed Objects

Approved MEF Specifications

REF	Description
MEF 32	Requirements for Service Protection Across External Interfaces
MEF 33	Ethernet Access Services Definition
MEF 34	Abstract Test Suite for Ethernet Access Services
MEF 35	Service OAM Performance Monitoring Implementation Agreement
MEF 36	Service OAM SNMP MIB for Performance Monitoring
MEF 37	Abstract Test Suite for ENNI
MEF 38	Service OAM Fault Management YANG Modules Technical Specification
MEF 39	Service OAM Performance Monitoring YANG Module Technical Specification
MEF 40	UNI and EVC Definition of Managed Objects

What is MEF 30.1 about?

MEF 30.1 - Service OAM (SOAM) Fault Management Implementation Agreement	
Purpose	An Implementation Agreement (IA) with default profiles of 802.1ag and Y.1731 protocols for use across 1 or more Operators to support Fault Management (FM) of MEF Services.
Audience	All, since it provides the fundamentals required to deliver Carrier Ethernet services.

Overview of MEF 30.1

About this presentation

- **Purpose:**
  - This presentation is an introduction to MEF 30.1 - Service OAM Fault Management Implementation Agreement
- **Audience**
  - Vendors building devices supporting OAM functions for Carrier Ethernet Services.
  - Service Providers delivering Carrier Ethernet Services

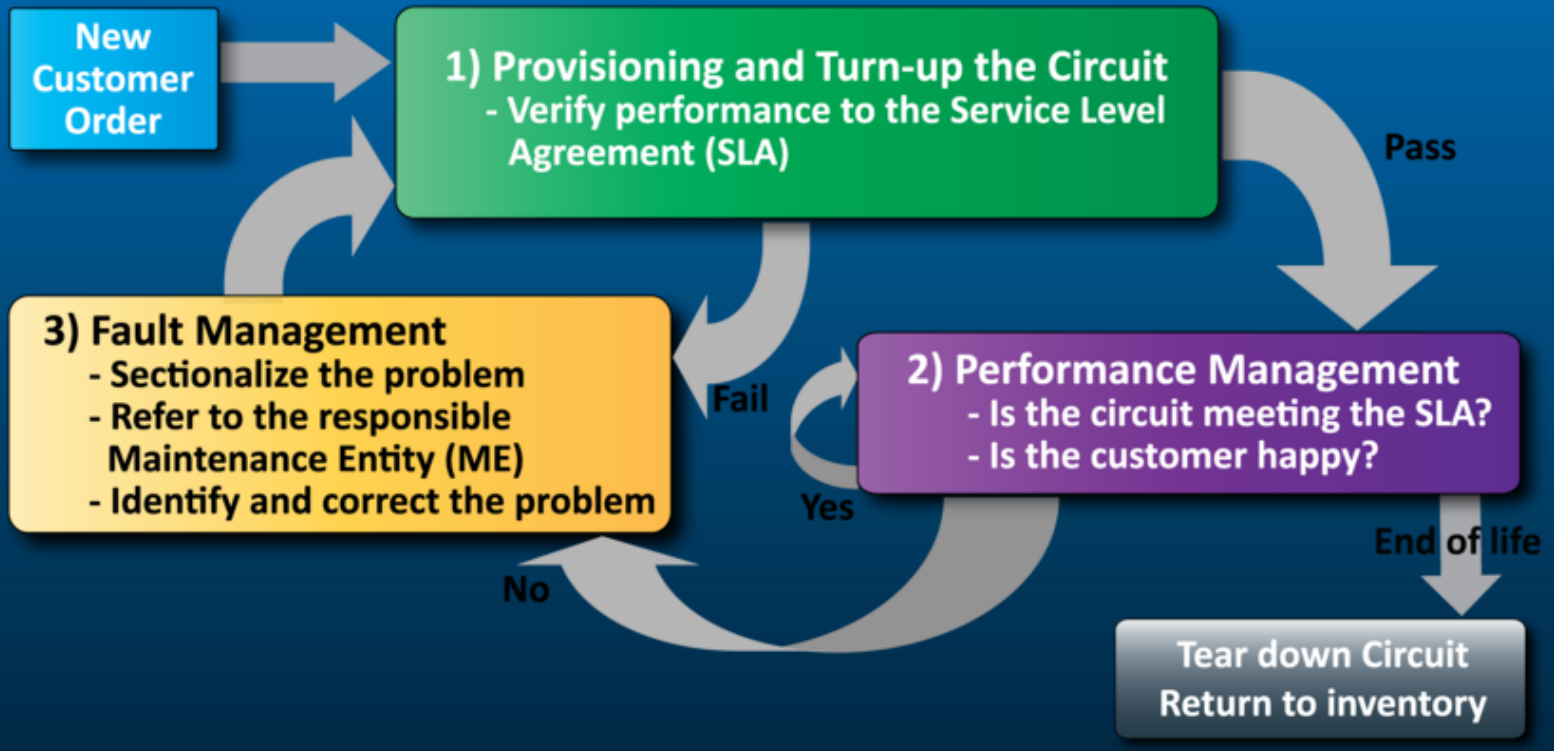
- **Note: Other MEF Specifications**
  - Overview of all specifications are available on the MEF web site

Service OAM

- **MEF 17 provides the framework**
  - Relevant for Subscribers (customers), Operators and Service Providers
- **Fault Management IA (MEF 30.1)**
  - FM of MEF Services
  - Specifies profile of protocols defined in IEEE 802.1ag and ITU-T Y.1731
- **Performance Management IA (MEF 35)**
- **Related Work**
  - MIBs (SNMP) for PM and FM covered in MEF 31
  - Interface Architecture (UNI, ENNI) covered in MEF 12.1

MEF Service Lifecycle and SOAM

Network Management



Fault management is a critical part of a services lifecycle

MEF

MEF Specification Section Review

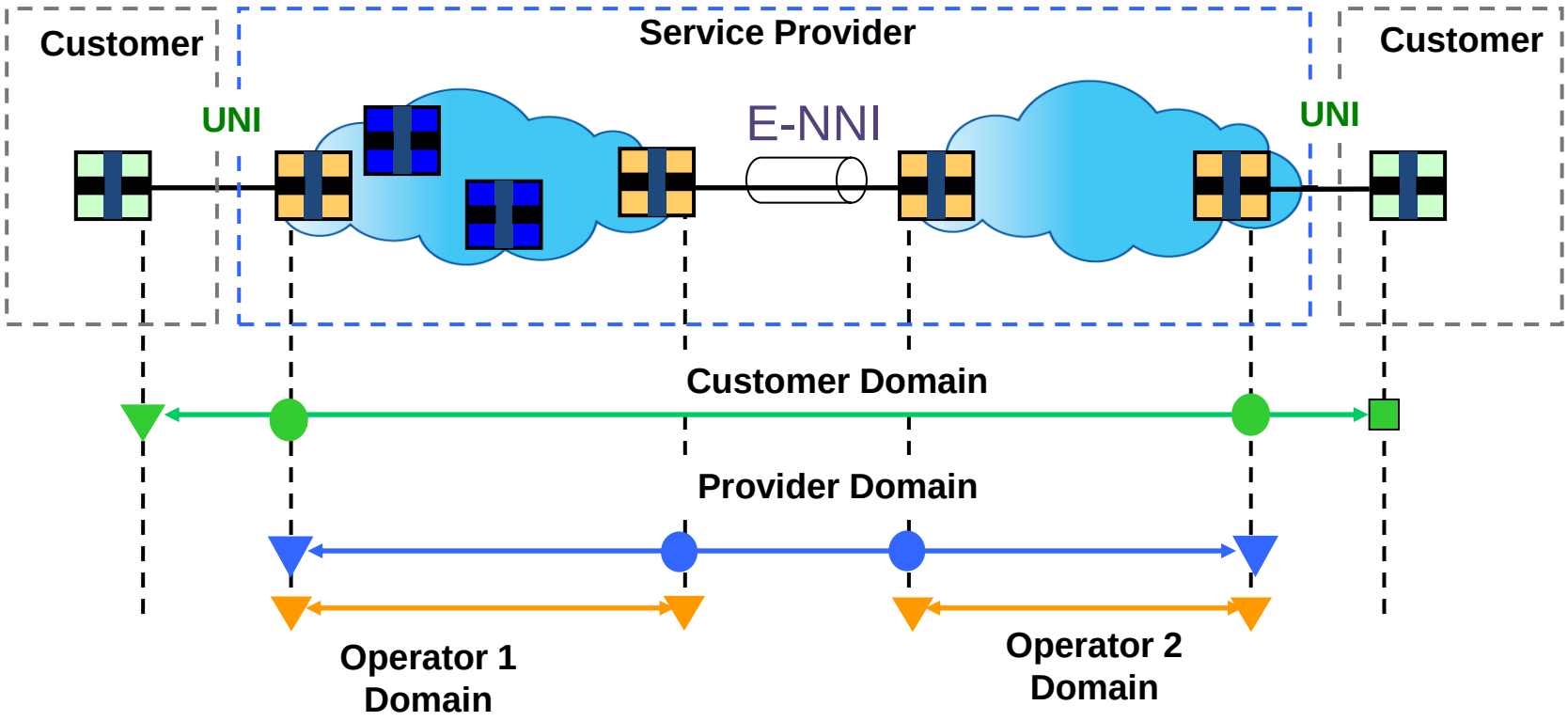
Introducing MEF 30.1

- **The presentation is organized into the following sections:**
  - Overview
  - Hierarchical OAM domains
    - Default MEG Level usage
    - MEP/MIP functionality
  - SOAM FM mechanisms and Use Cases
  - Summary

Fault Management

- **Model based on IEEE 802.1ag standard**
  - Defined for IEEE 802.1 Bridged Networks
  - 8 hierarchical Maintenance Domains. Higher Maintenance domains are transparent to lower domain levels
  - Can extend across one or more Operators
- **Enhanced with ITU-T Y.1731 definitions**
  - Extended 802.1ag with additional protocols/mechanisms
- **Protocols or Fault Management mechanisms**
  - Continuity Check
  - Remote Defect Indication Signal
  - Alarm Indication Signal
  - Linktrace
  - Loopback
  - Locked Signal
  - Test Signal

Hierarchical OAM Domains



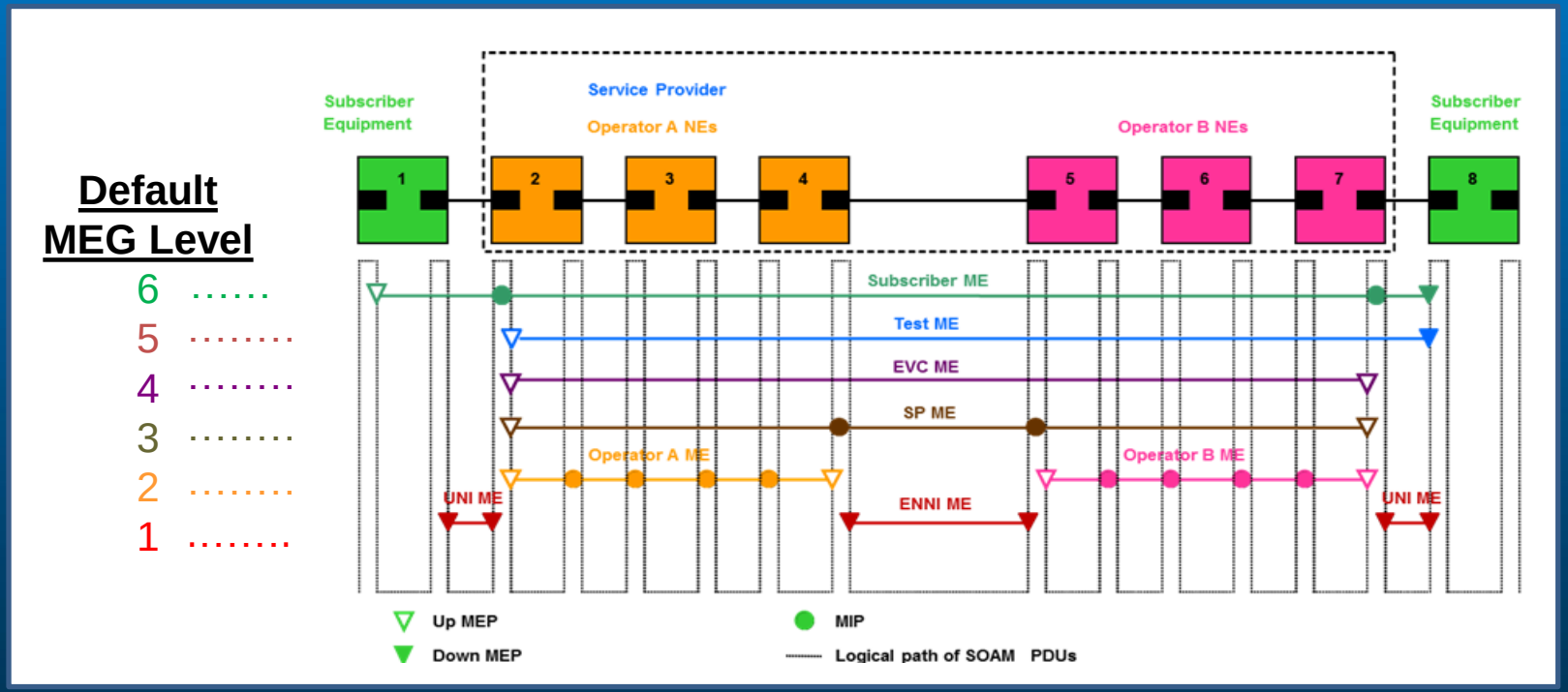
Hierarchical maintenance domains bind OAM flows & OAM responsibilities

Terminology and Concepts

- **MEF 30.1 builds upon MEF 17 defined SOAM components including:**
  - Maintenance Entity (ME)
  - Maintenance Entity Group (MEG)
  - MEG End Point (MEP)
  - MEG Intermediate Point (MIP)
  - MEG Level
  - MEG Class of Service (CoS)

MEF 30.1 based on terminology found in ITU G.8013/Y.1731

Default MEG Level Usage



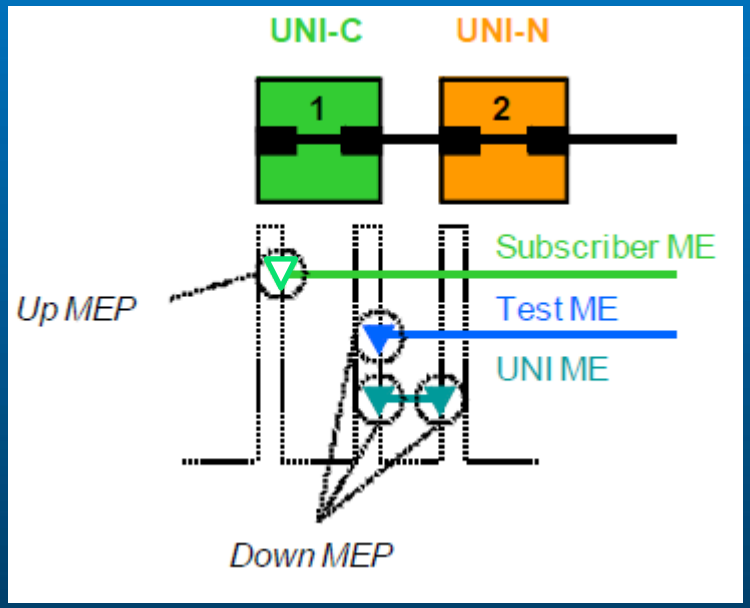
- This is the complete set of default MEG levels
- Not all MEG levels are required in every application

MEF

Key Maintenance Entity Groups (MEGs)

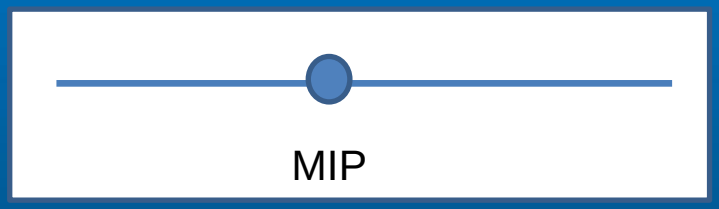
MEG	Suggested Use	Default Direction for MEPs	Default MEG Level
Subscriber MEG	Subscriber monitoring of an Ethernet service	Up or Down	6
Test MEG	Service Provider isolation of subscriber reported problems	Down	5
EVC MEG	Service Provider monitoring of provided service	Up	4
Service Provider MEG	Service Provider Monitoring of Service Provider network	Up	3
Operator MEG	Network Operator monitoring of their portion of a network	Up	2
UNI MEG	Service Provider monitoring of a UNI	Down	1
ENNI MEG	Network Operators' monitoring of an ENNI	Down	1

MEG End Point (MEP) Orientation



- Down MEP - is a MEP residing in a Bridge that receives SOAM PDUs from, and transmits them towards, the direction of the LAN. Note that in the MEF service model, the LAN is a transmission facility in the egress direction, rather than towards the Bridge Relay Entity.
- Up MEP - is a MEP residing in a Bridge that transmits SOAM PDUs towards, and receives them from, the direction of the Bridge Relay Entity . Note that in the MEF service model, the Bridge Relay Entity itself is out of scope.
- A given MEG can be terminated by either Up or Down MEPs
- Up MEPs are the most commonly used MEP and are recommended for the following MEG levels: EVC, Service Provider, Operator and optionally the Subscriber

MEG Intermediate Point (MIP)

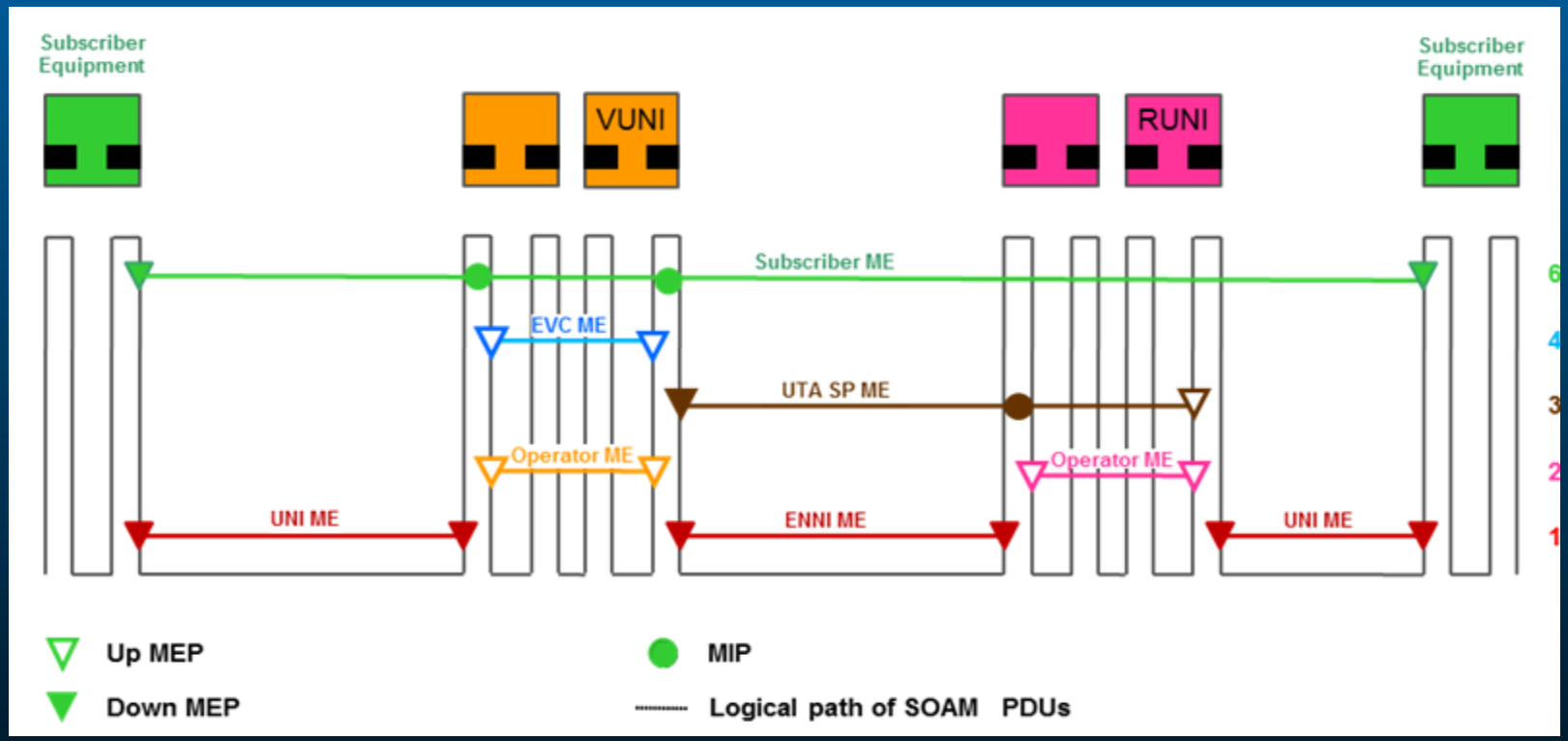


MEG Intermediate Point – MIP

- **SOAM points associated with a single MEG level (and a single Maintenance Domain)**
- **Can respond to SOAM protocols, but cannot generate requests**
- **Defined to be located at External Interfaces such as ENNIs (or UNIs). In practice can also be used in additional internal operator locations where monitoring is desired**

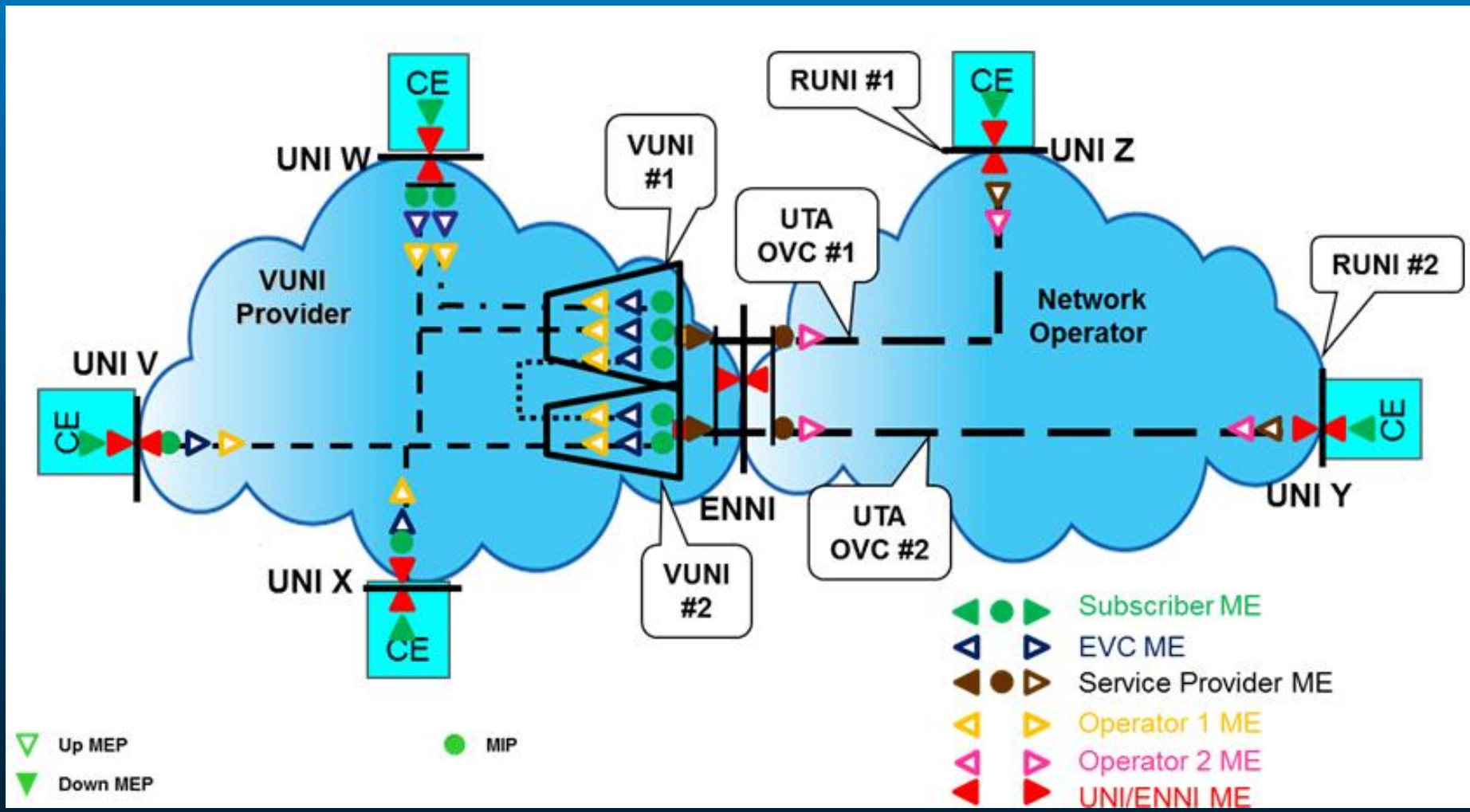
UNI Tunnel Access Measurement Point Placement

- Placement of measurement points changes when UNI Tunnel Access is used



MEF

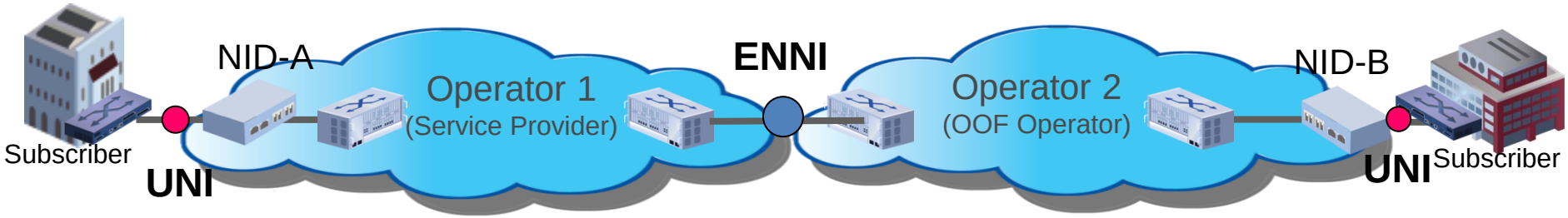
UTA MP Placement Example



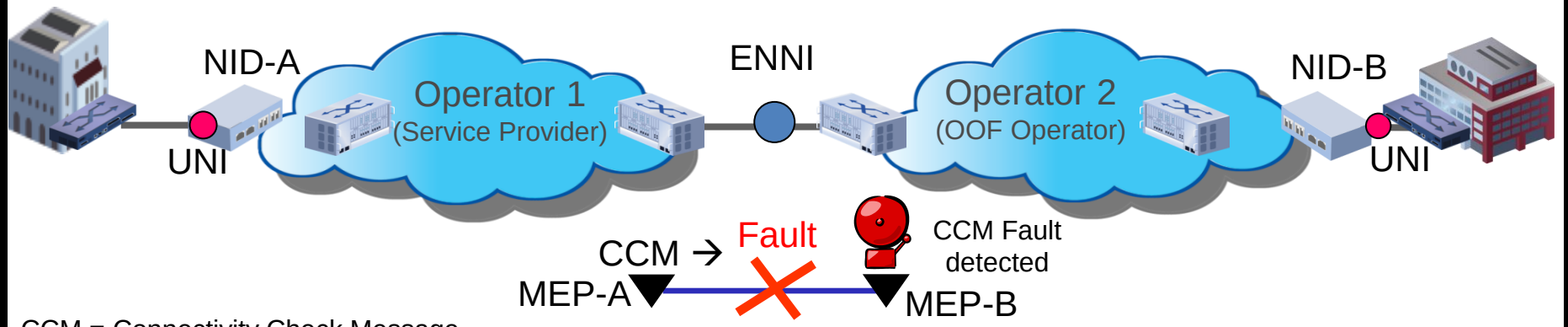
SOAM Fault Management Mechanisms Examples/Use Cases

SOAM FM Functions

- Continuity Check (CCM)
- Remote Defect Indication Signal (RDI)
- Alarm Indication Signal (AIS)
- Linktrace
- Loopback
- Locked Signal
- Test Signal



Connectivity Check Overview

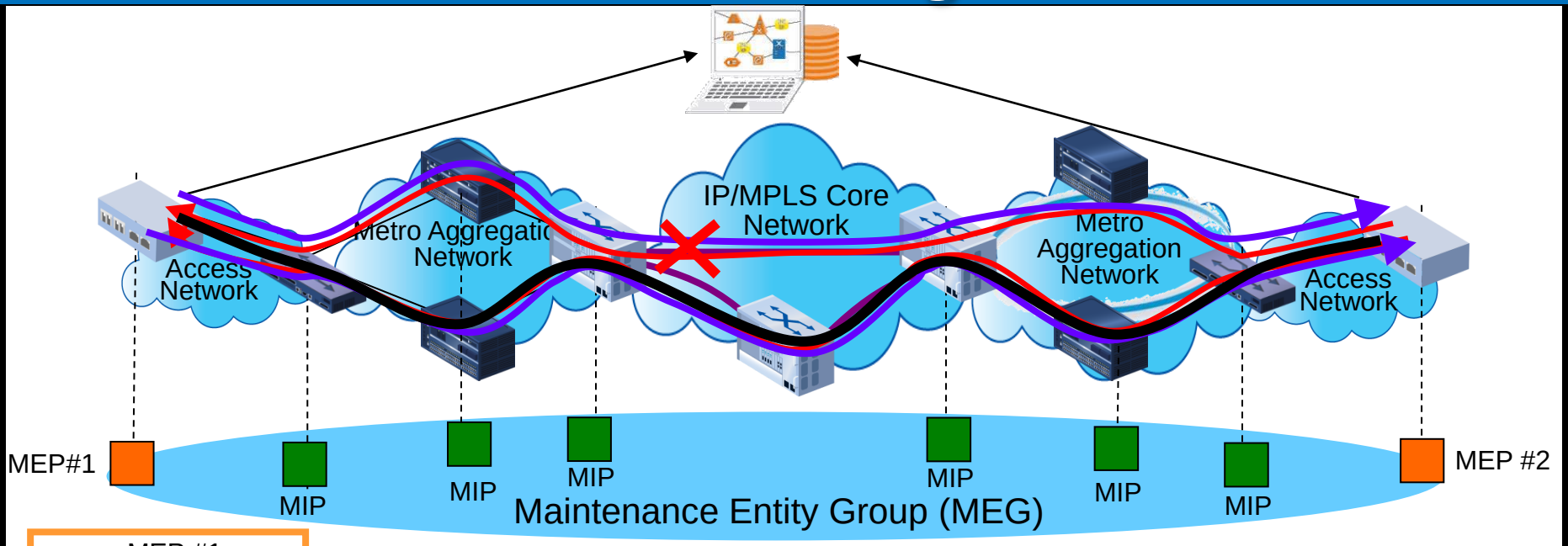


CCM = Connectivity Check Message

Single direction shown

- Connectivity Check Messages (CCMs) verify basic service connectivity and health
- CCM transmissions enabled by default on the UNI MEG and the ENNI MEG
  - CCM transmissions disabled by default on the Subscriber, Test, EVC, SP and Operator MEGs
- A MEP MUST support the CCM frame transmission periods of *1 & 10 seconds (1s default for UNI/ENNI MEG) – Other MEG level default = 10s*
  - A MEP SHOULD support the CCM frame transmission periods of *3.33ms, 10ms, 100ms – for time critical applications such as protection switching*
  - CCM default CoS ID should correspond to the CoS which yields the lowest frame loss
- When 3 consecutive CCM messages are lost, connectivity failure is declared
- When a MEP detects a CCM fault, the RDI bit is set in the CCM message in the opposite direction

Continuity Check Application – Protection switching



MEP #1
CCMs sent every 10ms on working/protect paths
Check for CCMs received from MEP #2 on working/protect paths

MEP #2
CCMs sent every 10ms
Check for CCMs received from MEP #1

MEP #1
No CCMs received from MEP #2 within 30ms (3 x 10ms)

MEP #1
Report CC fault to management system

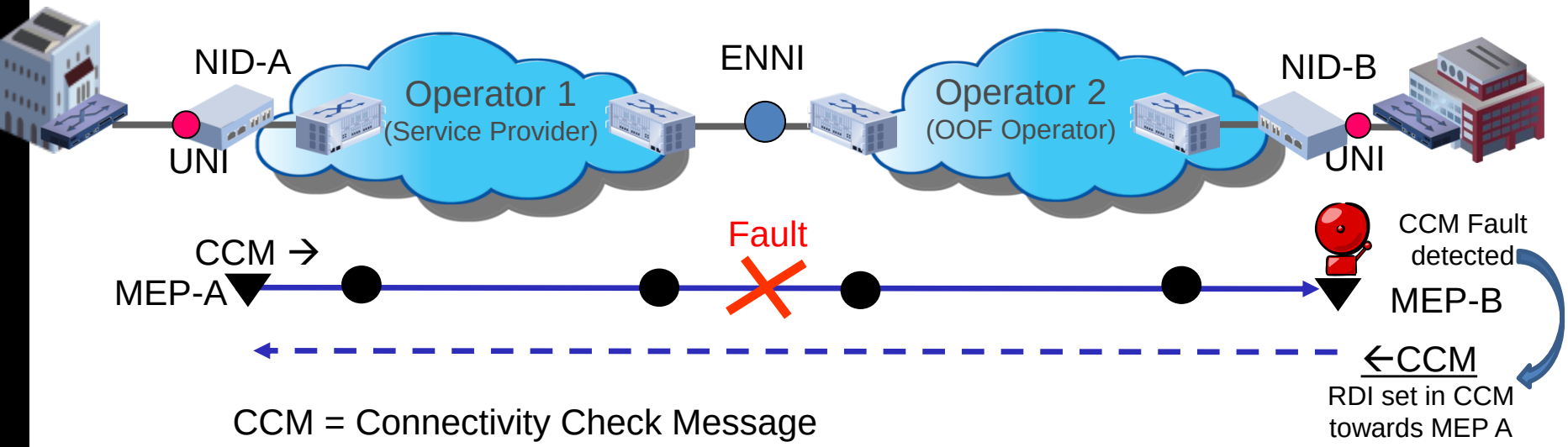
MEP #2
Declare CC fault if no CCMs are received from MEP #1 for 30ms

MEP #1
Send CCMs with RDI flag set

MEP #2
Send CCMS with RDI flag set
Report CC alarm to management system

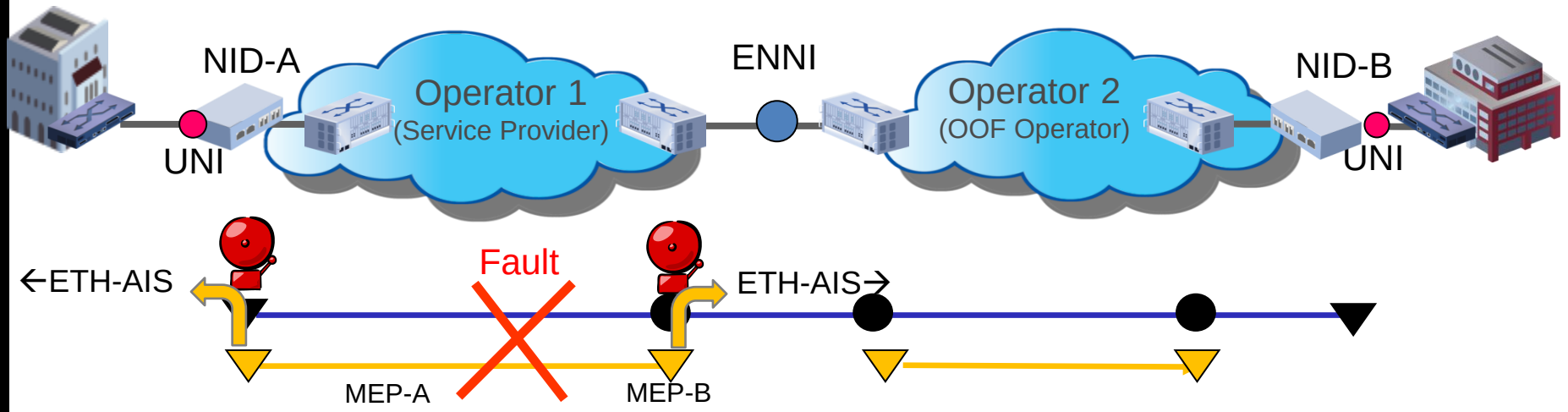
MEP #2
Initiate protection switchover

Remote Defect Indication - RDI



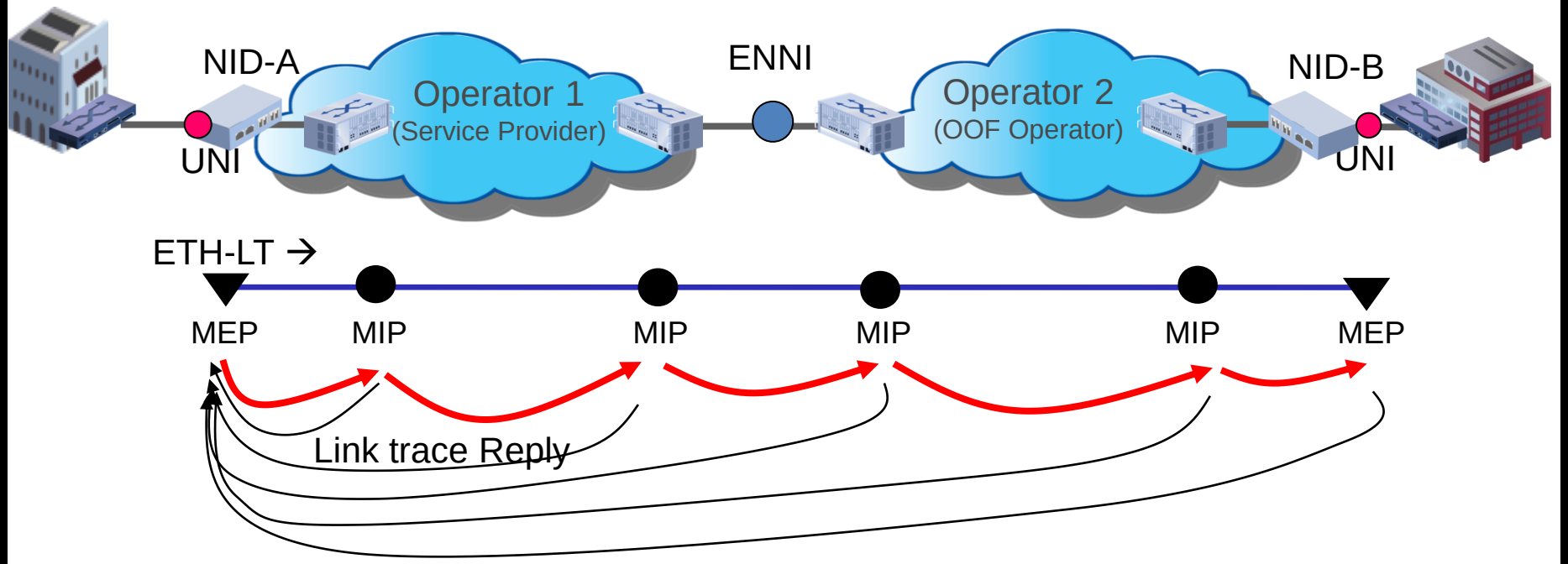
- **RDI is analogous to RDI found in traditional TDM/SONET networks**
- **RDI is signaled between peer MEPS to indicate a network fault**
  - Eg MEP-A and MEP-B
- **Connectivity Check Messages (CCM) must be enabled in order to detect the fault**
- **When a MEP detects a CCM fault, the RDI bit is set in the CCM message in the <u>opposite</u> direction**

Alarm Indication Signal - AIS



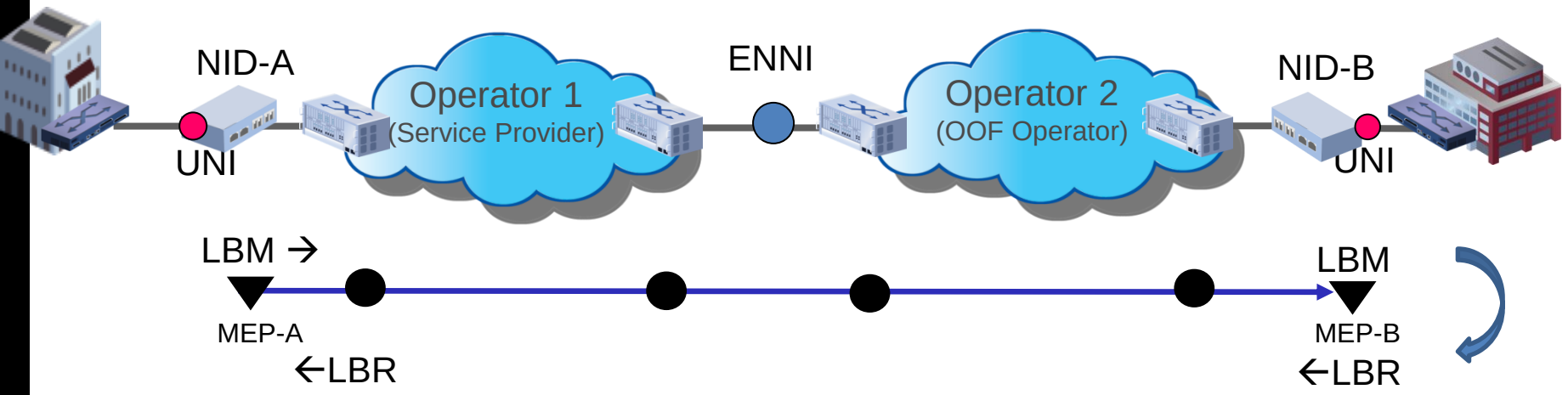
- **Provides indication of service interruption upstream**
- **Recommended for pt to pt services**
- **AIS is signaled by peer MEPs away from each other to indicate a network fault - Not created by MIPs**
- **AIS gets sent at the next available MEG level, and is propagated at higher MEG level at MEPs**
  - **AIS messages must be sent immediately and then at regular intervals (default = 1/second)**
  - **AIS default CoS ID should correspond to the CoS which yields the lowest frame loss**
  - **AIS is declared immediately upon reception of an AIS PDU, and cleared after not receiving an AIS PDU for 3.5 times the transmission interval**

Ethernet Link Trace



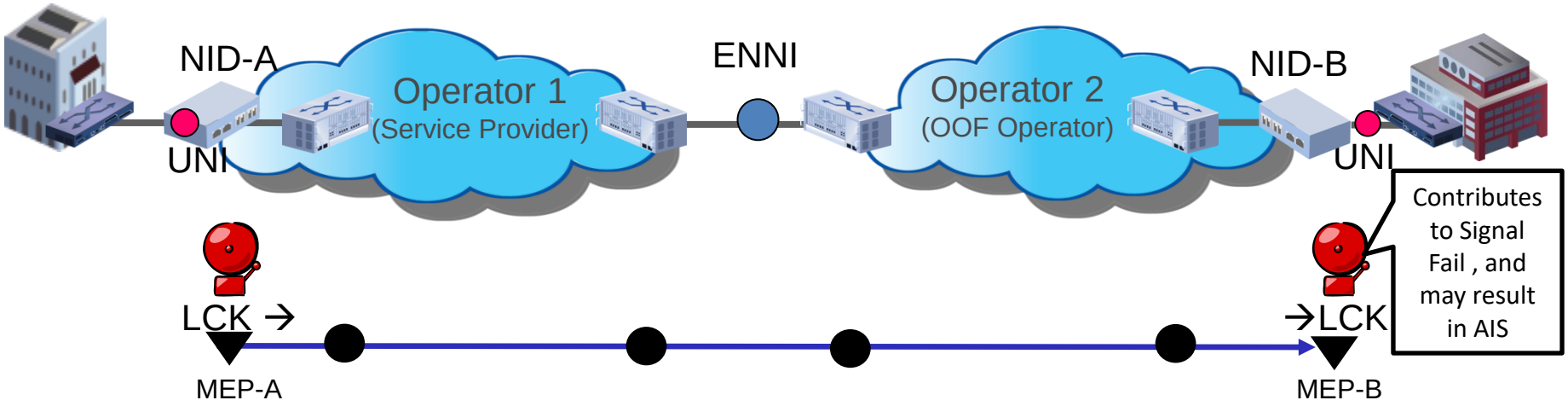
- Link Trace is analogous to IP's Traceroute
- MEP/MIPs must support Link Trace Messages (LTMs) & Link Trace Reponses (LTRs)
- MIPs and the MEP(s) decrement the TTL and forward the LTM to the next MP

Loopback



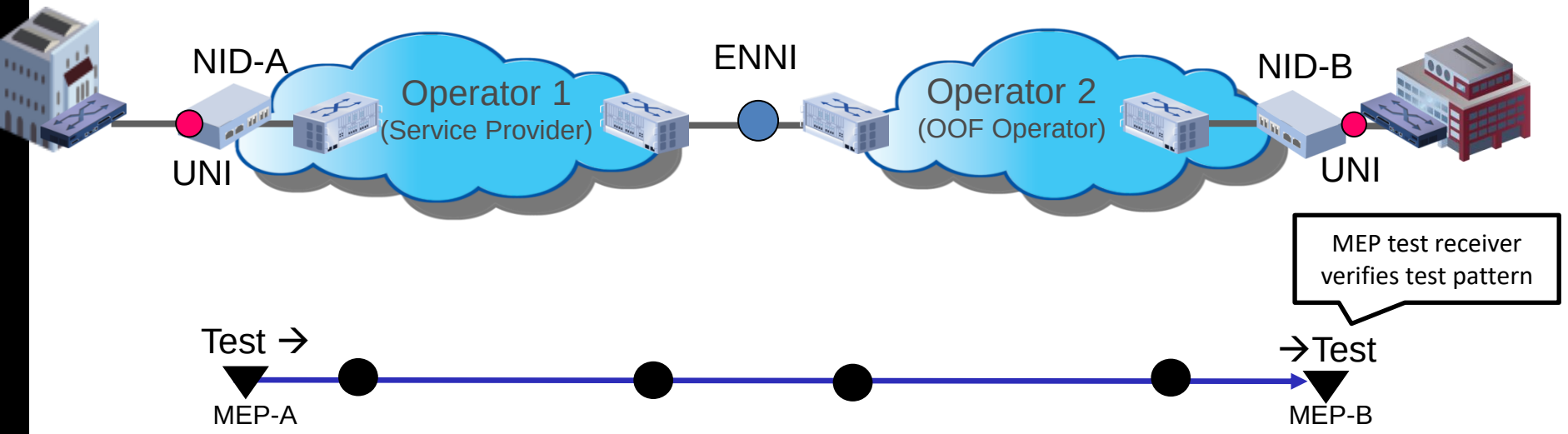
- **Analogous to ICMP Ping**
- **Loopback message/Loopback response is used for fault isolation/detection, not performance/SLA verification**
- **Each MEP & MIP can be uniquely addressed and individually tested**

Lock



- **LCK is signaled by peer MEPS to indicate an administrative lock condition**
  - **It signals to the MEP that testing may be in progress and so that the MEP can differentiate between an administratively locked and a defect condition**
- **It is often used in conjunction with ETH-TST**
- **A locked MEP transmits LCK frames to its client level MEGs, similar to the way AIS works**
- **LCK messages must be sent immediately and then at regular transmission intervals (default = 1/second)**
- **LCK default CoS ID should correspond to the CoS which yields the lowest frame loss**
- **LCK is declared immediately upon reception of an LCK PDU, and cleared after 3.5 times the transmission interval**

Test



- **Test is used between peer MEPS to provide a one-way in-service or out-of-service test**
  - Can measure throughput, frame-loss, bit errors, etc.
  - Out of service testing is usually preceded by setting the Eth-Lck state
- **Test default CoS ID should correspond to the CoS which yields the lowest frame loss**
- **Optional data stream can contain: pseudo random bit stream 2^{31}-1 pattern, all "0" or other test pattern**

Summary MEF 30.1

- **SOAM FM IA is an important MEF specification**
  - Fault Management of MEF Services includes basic connectivity checking and troubleshooting across one or more Operators
  - Enables both Subscribers (Customers) and Operators to independently verify MEF Services
- **SOAM FM IA specifies default profiles of IEEE 802.1ag and ITU-T Y.1731 protocols**
  - Simplifies interoperability between Operators
- **Additional enhancements to protocol behaviors are being addressed in SOAM FM IA Phase 2 project. Some are listed below:**
  - SOAM FM interaction with LAG
  - Per-service monitoring across an ENNI
  - Extra MD levels of SP/Op hierarchy
  - VUNI/RUNI MEP and MIP requirements
  - Interactions with link OAM and E-LMI
  - Test MEG Requirements

Related Specifications

- **MEF 30.1 section 6 lists a full list of related MEF specifications**
- **IEEE 802.1Q 2011 clause 18 (802.1ag)**
  - Principles of Connectivity Fault Management Operation
- **ITU-T Y.1731**
- **MEF 31 SOAM FM MIB**
- **MEF 17 SOAM requirements and frameworks phase 1**
- **MEF 12.1 Carrier Ethernet Network Architecture Part 2 – ETH Service Layer**

Final Word

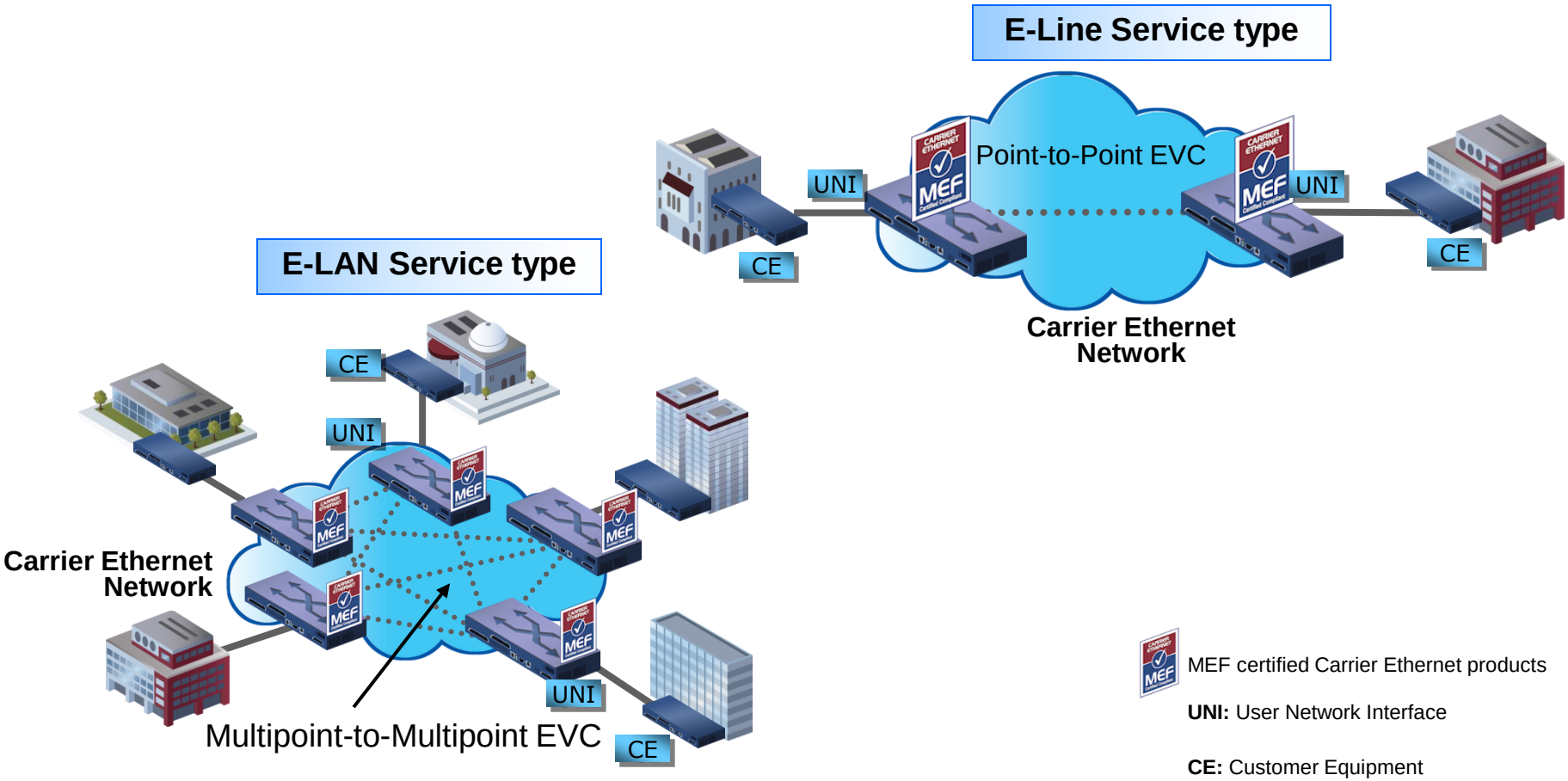
- **Service OAM**
  - In the context of MEF 30.1, mechanisms are defined that support service-level OAM in MENs.

- **Next Actions**
  - Read the MEF 30.1 specification
  - Review of MEF 17, MEF 10 and MEF 15 may also be helpful
  - Understand the principal service OAM components and capabilities
  - Review also MEF 31, MEF 38 and MEF 12.1 specification

For Full Details …

Please visit www.metroethernetforum.org

to access the full specification



MEF

Accelerating Worldwide Adoption of Carrier-class Ethernet Networks and Services

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