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Monitoring plane architecture for modern cloud-based networks

N. Sambo[1], A. Di Giglio[2], A. Pagano[2], F. Cugini[3], P. Castoldi[1]

1: Scuola Superiore Sant'Anna, Pisa, Italy
2: TIM
3: CNIT, Pisa, Italy

ORCHESTRA

Workshop "Big Data for networking: opportunities, challenges, and requirements", ONDM 2016

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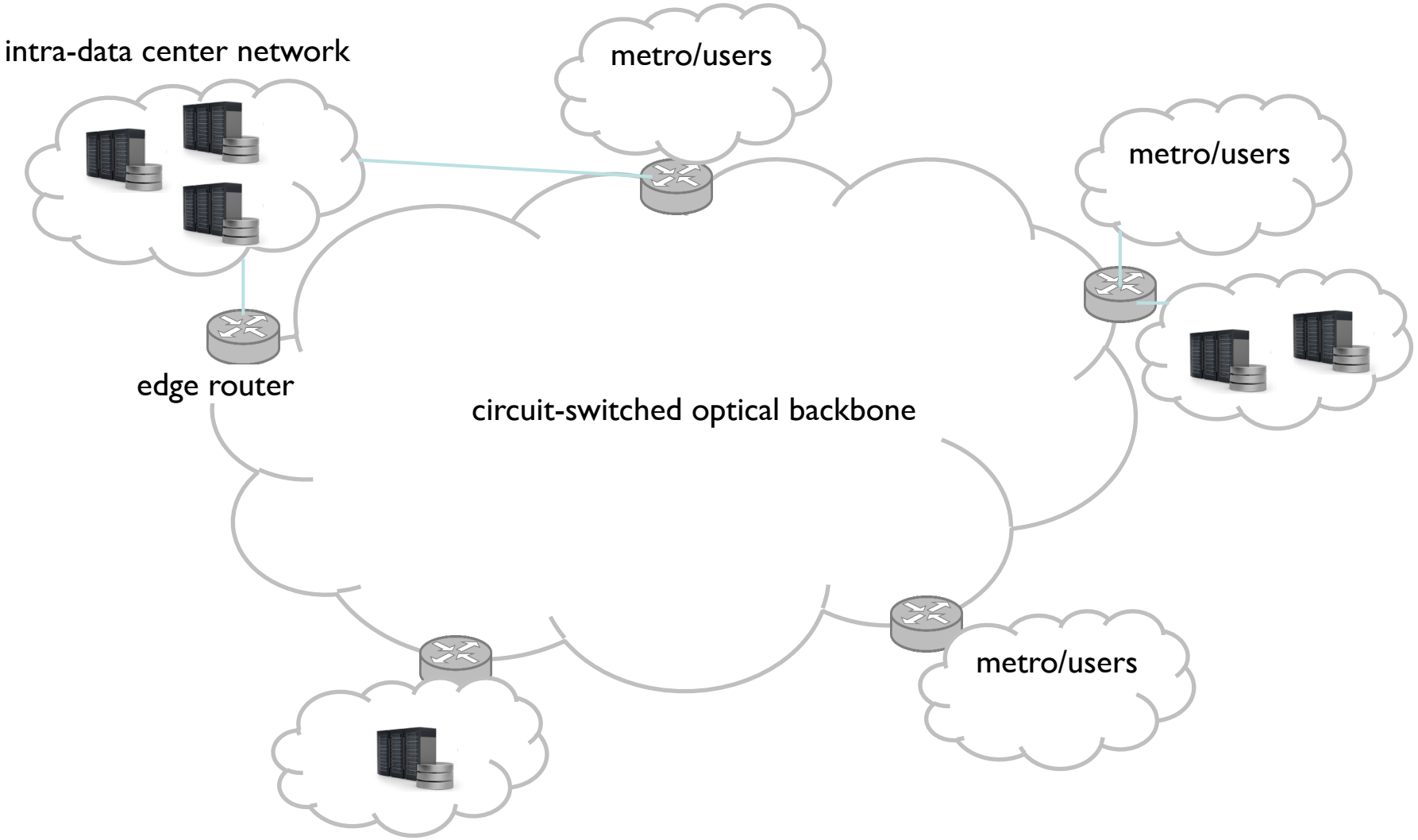
Network architecture and scenario



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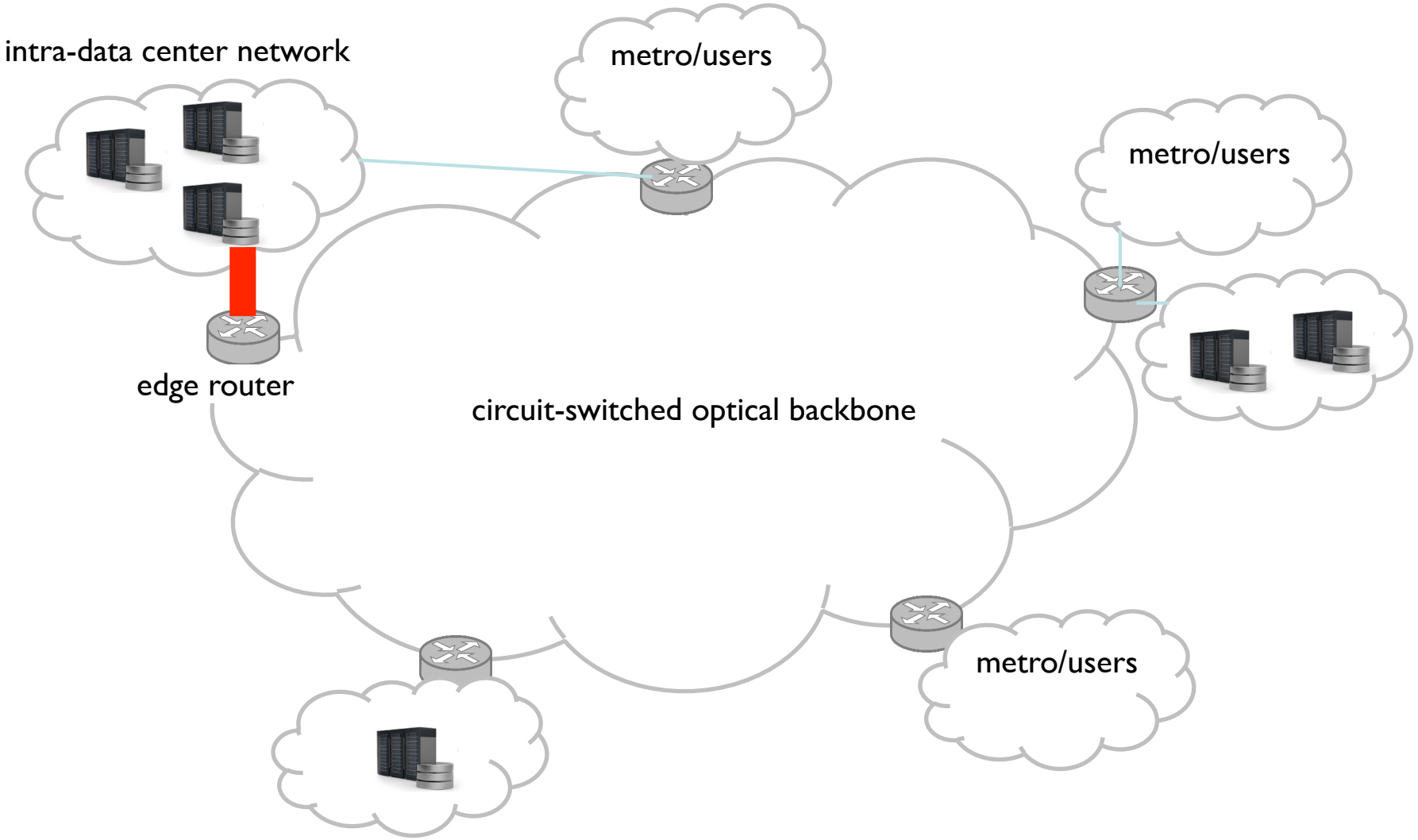

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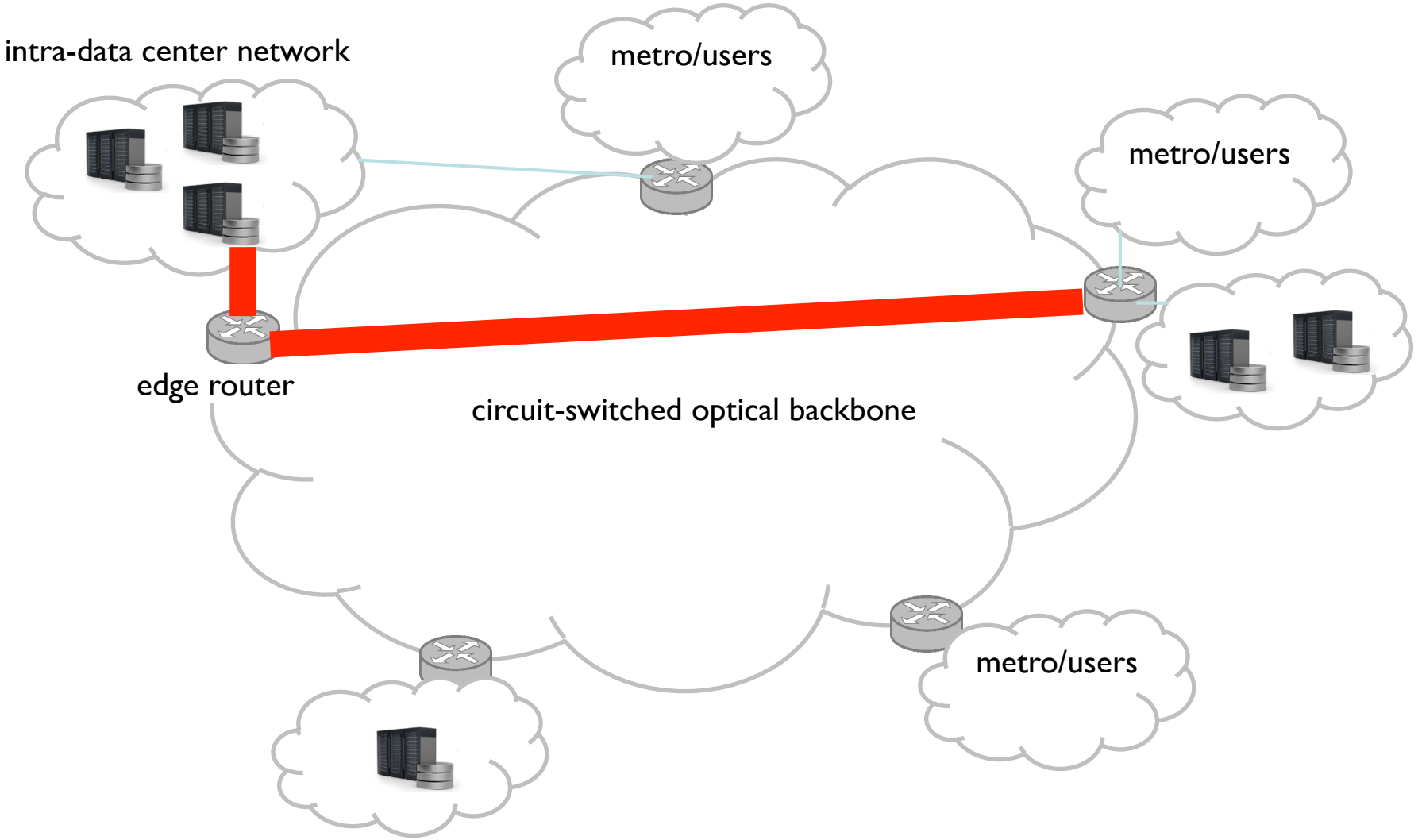

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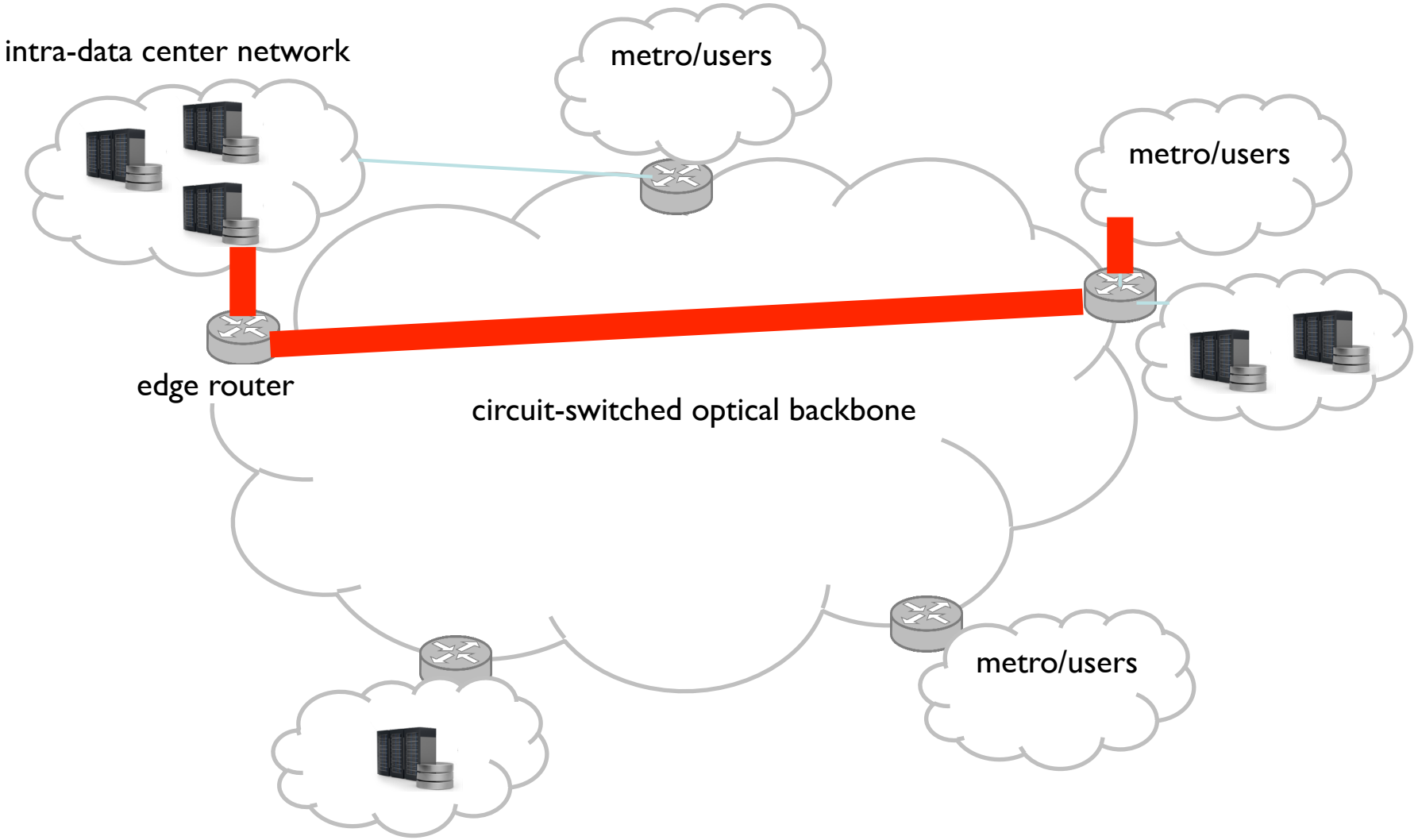

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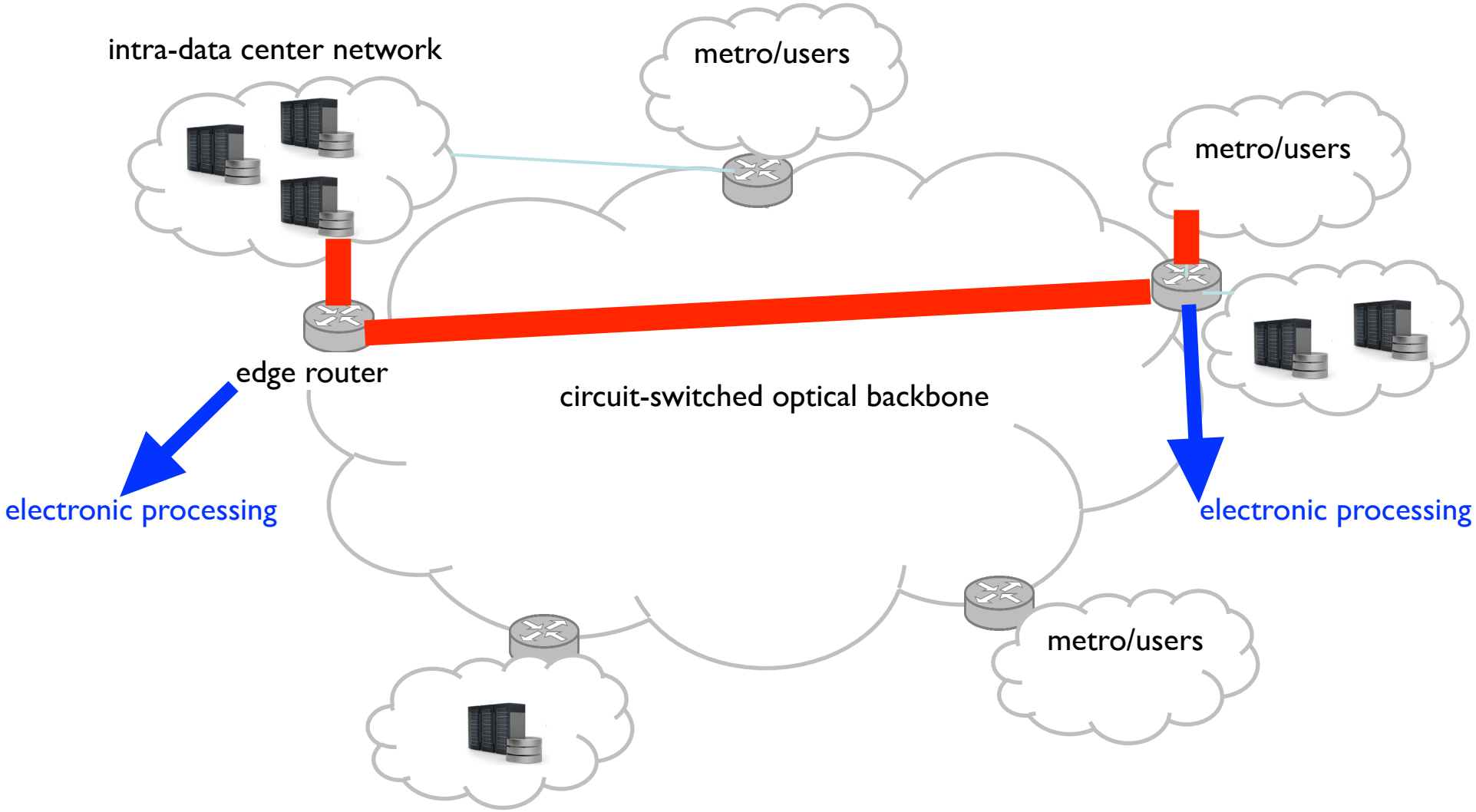

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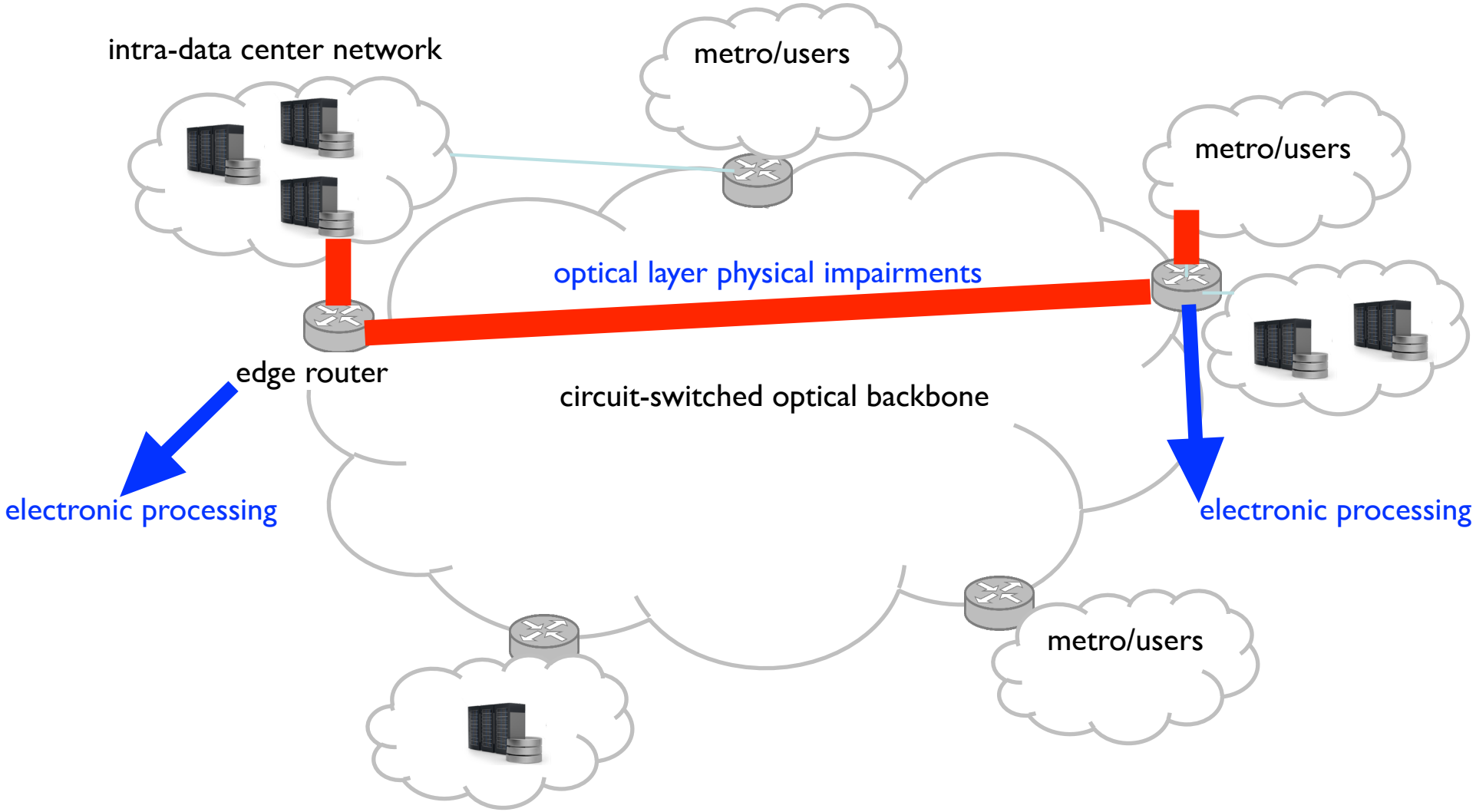

Some numbers on data centers

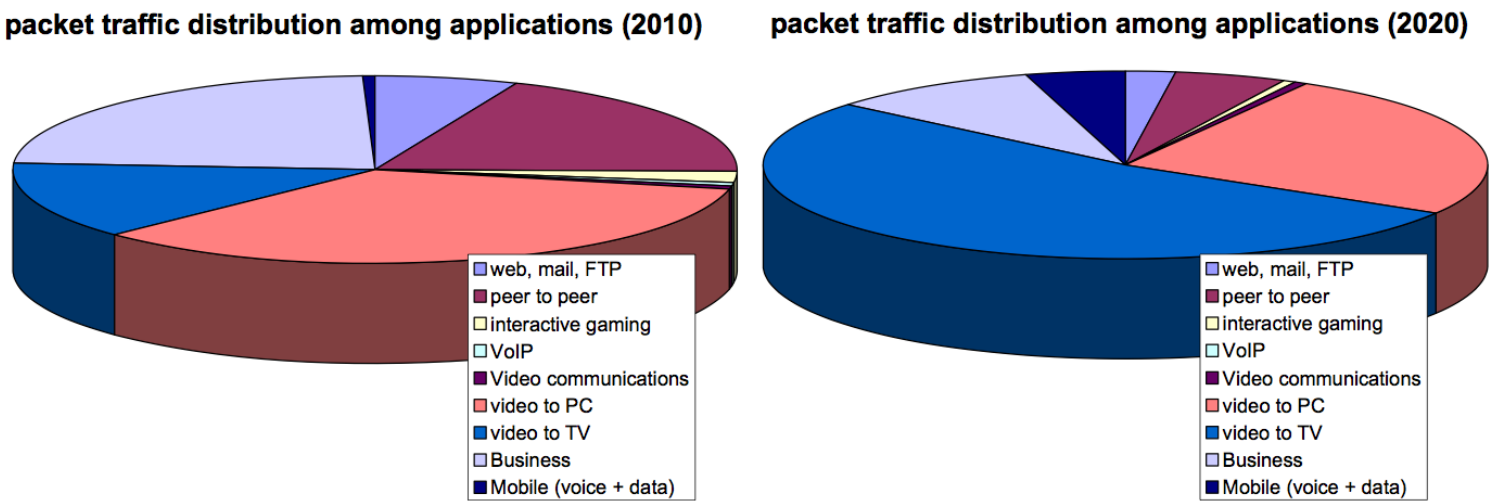

FIG. by STRONGEST D2.1

Specifics of the services, which can be classified as:

- **Interactive:** delay in RTT below 150ms and jitter below 10ms
- **Guaranteed:** delay below 400 ms, no specific requirements on jitter (buffering is enough)
- **Best effort**

Considerations on QoS and QoT

- QoS affected by QoT: e.g., packet loss rate (PLR) — thus delay and jitter because of packet retransmission — influenced by bit error rate (BER)

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ABNO architecture includes functional modules **controlling and managing networks and services**

Application-based Network Operations (ABNO)

IETF RFC 7491

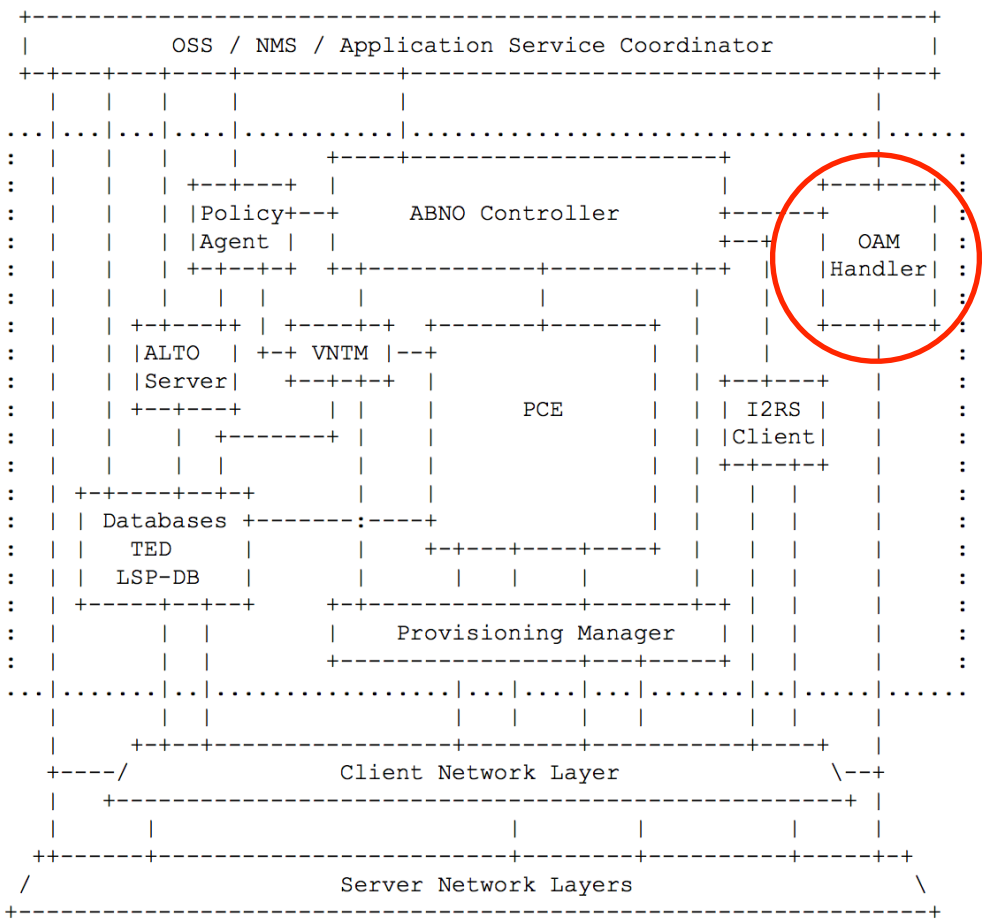

Figure 1 : Generic ABNO Architecture

- OAM receiving **alerts** about potential problems
- **correlating** them
- **triggering other components** of the ABNO system to take action to preserve or recover the services

Open issues

- Alarms are typically managed considering hard failures; soft failures are not considered
- Lack of cross-layer quality parameter correlation
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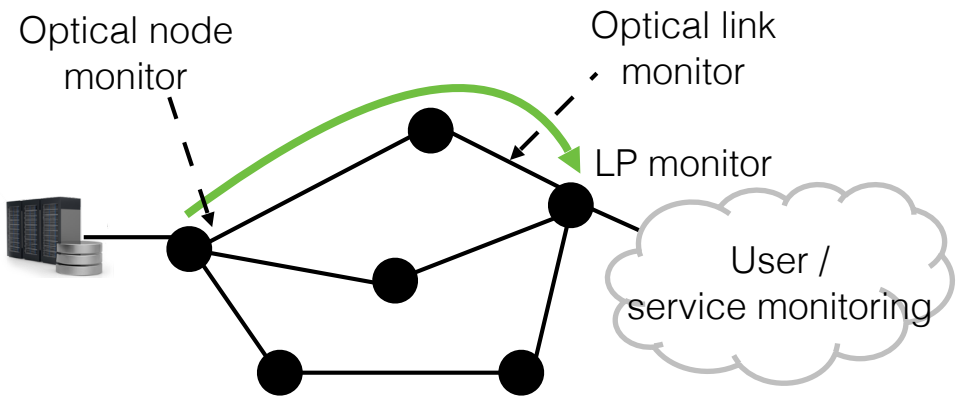
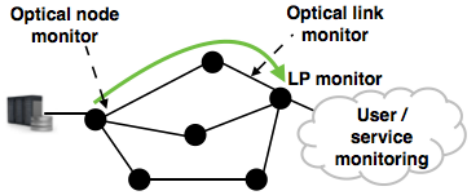
Monitors

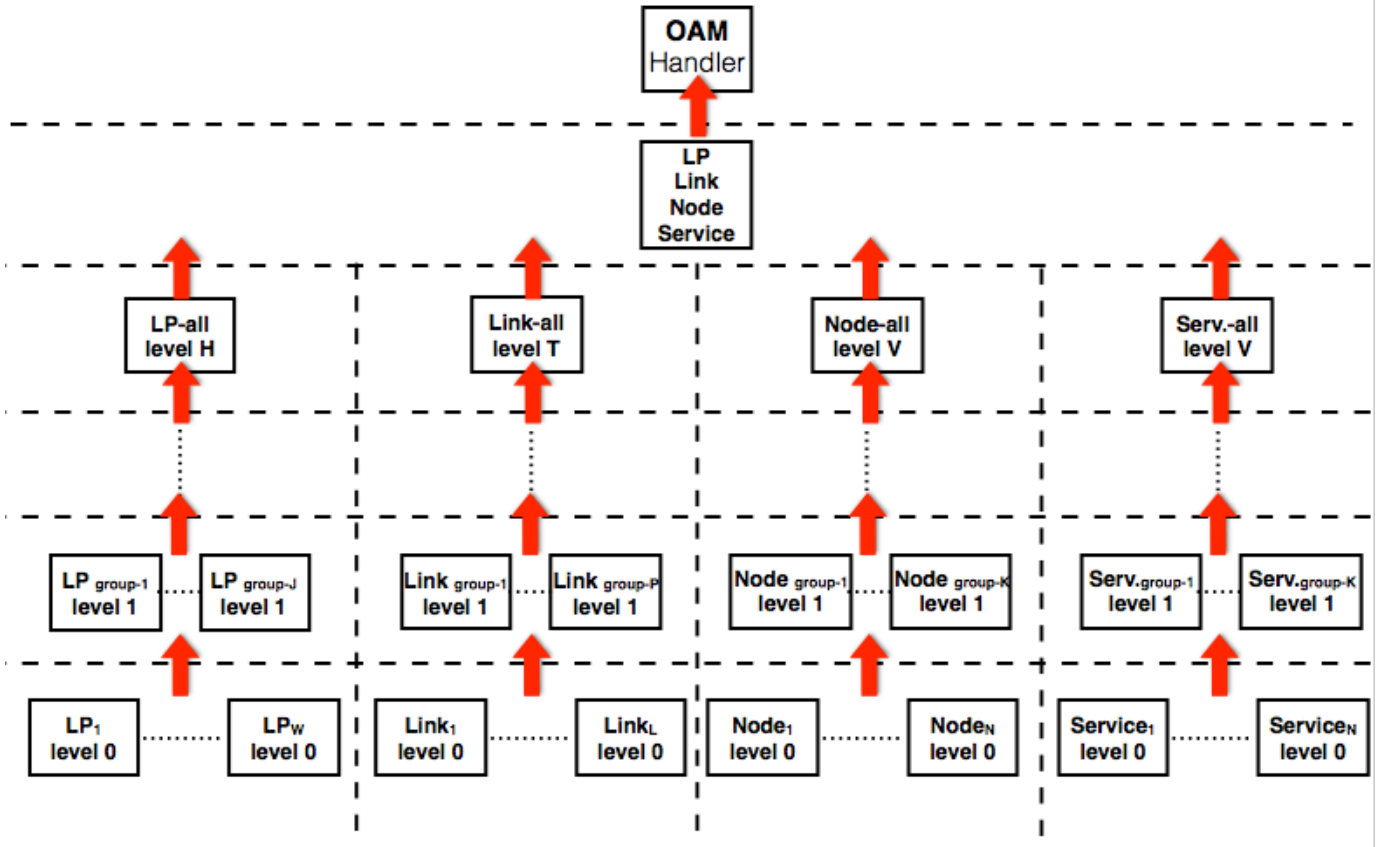


- Lightpath (LP) monitors are assumed integrated in the DSP of each lightpath coherent receiver (e.g., pre-FEC BER monitoring)
- Power monitors can be assumed for links and nodes
- Service monitors for PLR, delay, jitter

Hierarchical monitoring architecture

- Each entity is responsible for specific elements: e.g. a set of lightpaths





N. Sambo et al., "Monitoring Plane Architecture and OAM Handler", JLT, vol. 34, n. 8, 2016

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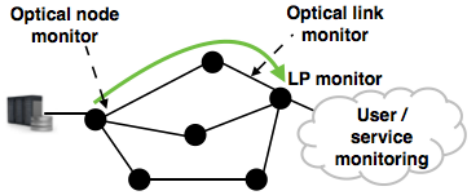

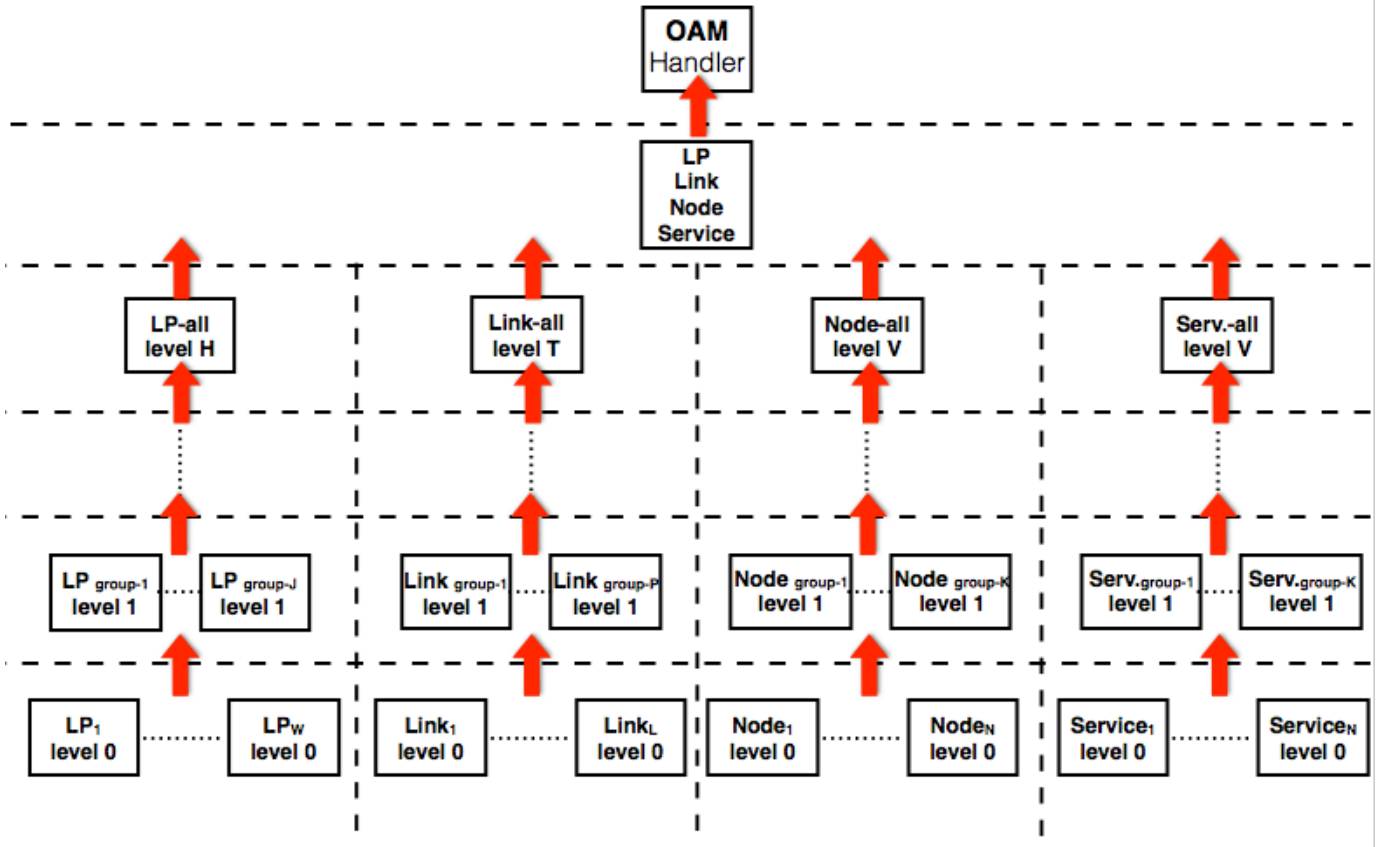

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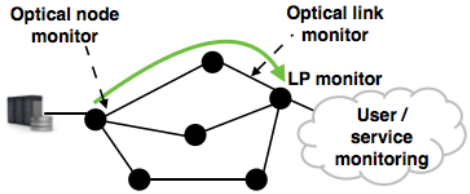

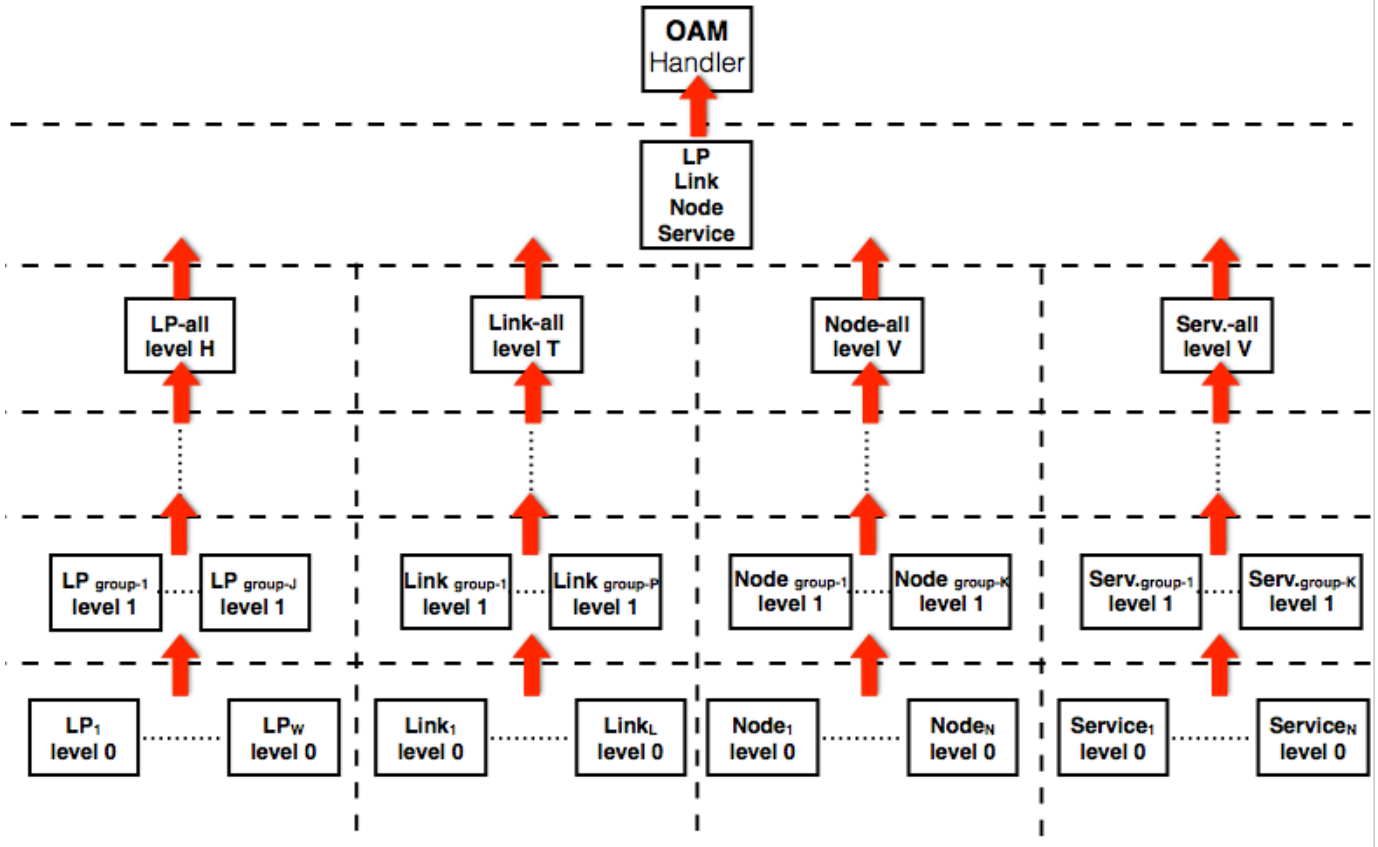

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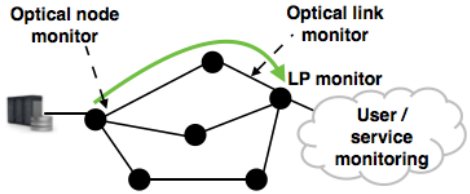

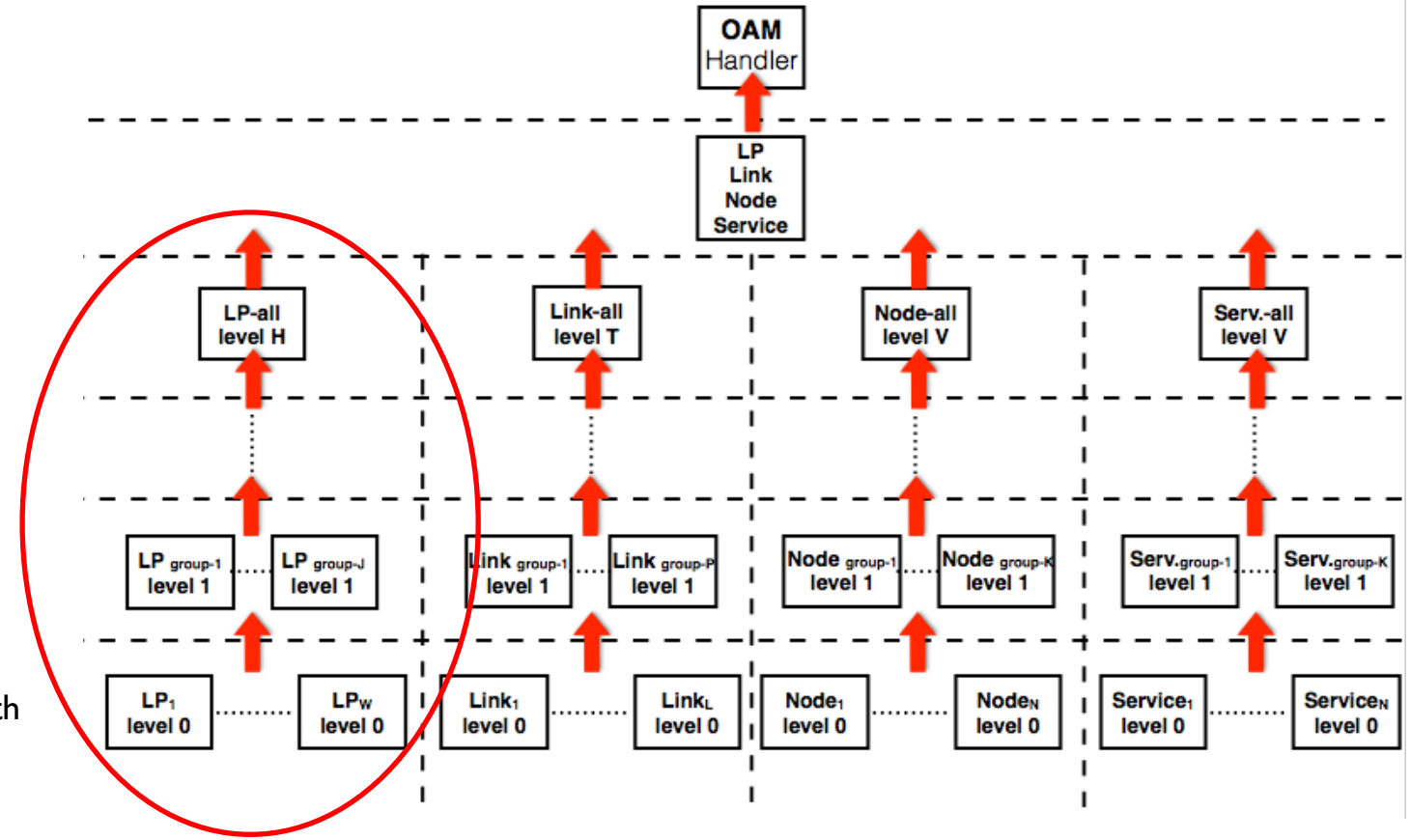

- EX: **LP level 0:** 1 per active lightpath

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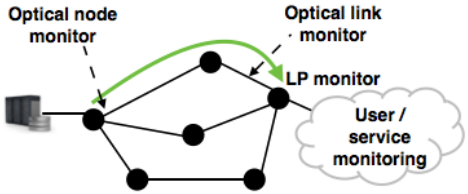

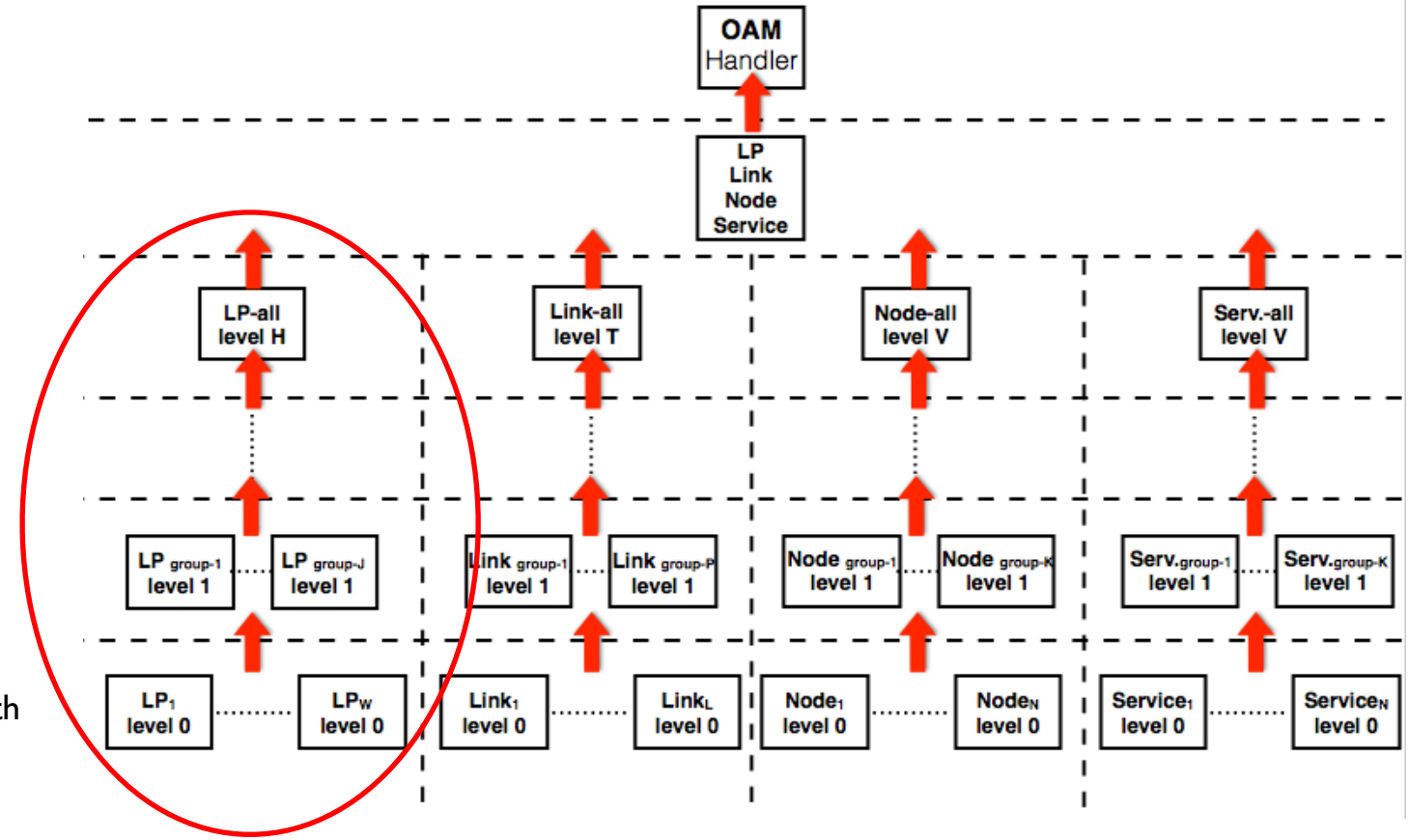

- EX: **LP group level 1:** each box group all the lightpaths starting from the same ingress node
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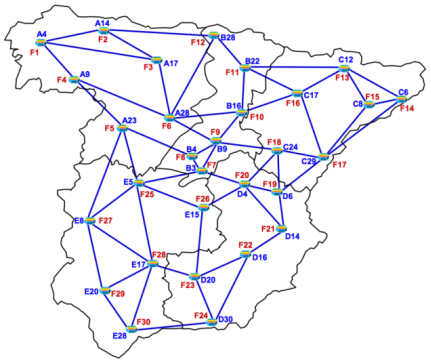
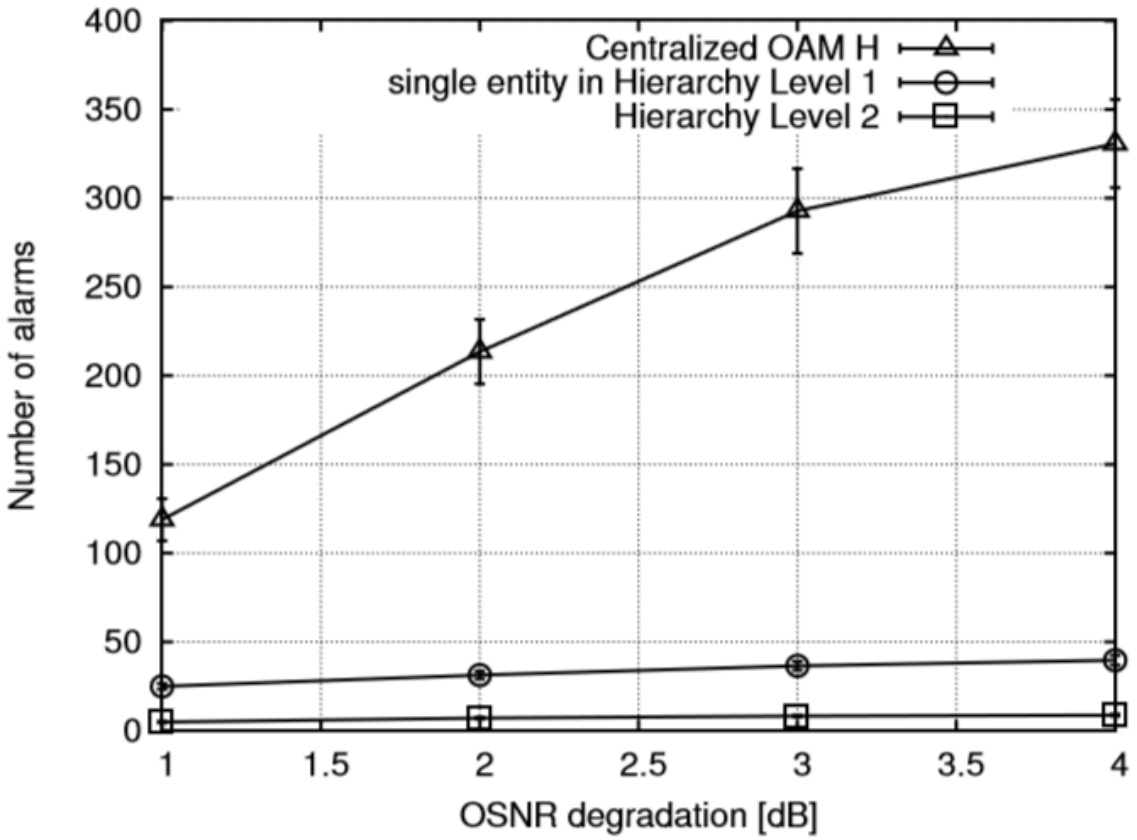
Simulation scenario



- Comparison of two management architectures:
  - i) the proposed **hierarchical** monitoring architecture;
  - ii) a **centralized OAM** receiving all monitoring information and correlating them.
- **Soft-failure**: performance of a network element – such as an amplifier – are degraded causing the OSNR decrease of traversing lightpaths → some lightpaths suffer, others not: e.g. OSNR degradation may imply a BER increase over the threshold (thus, generating alarms) or not (not generating alarms)

Soft failure



Conclusions

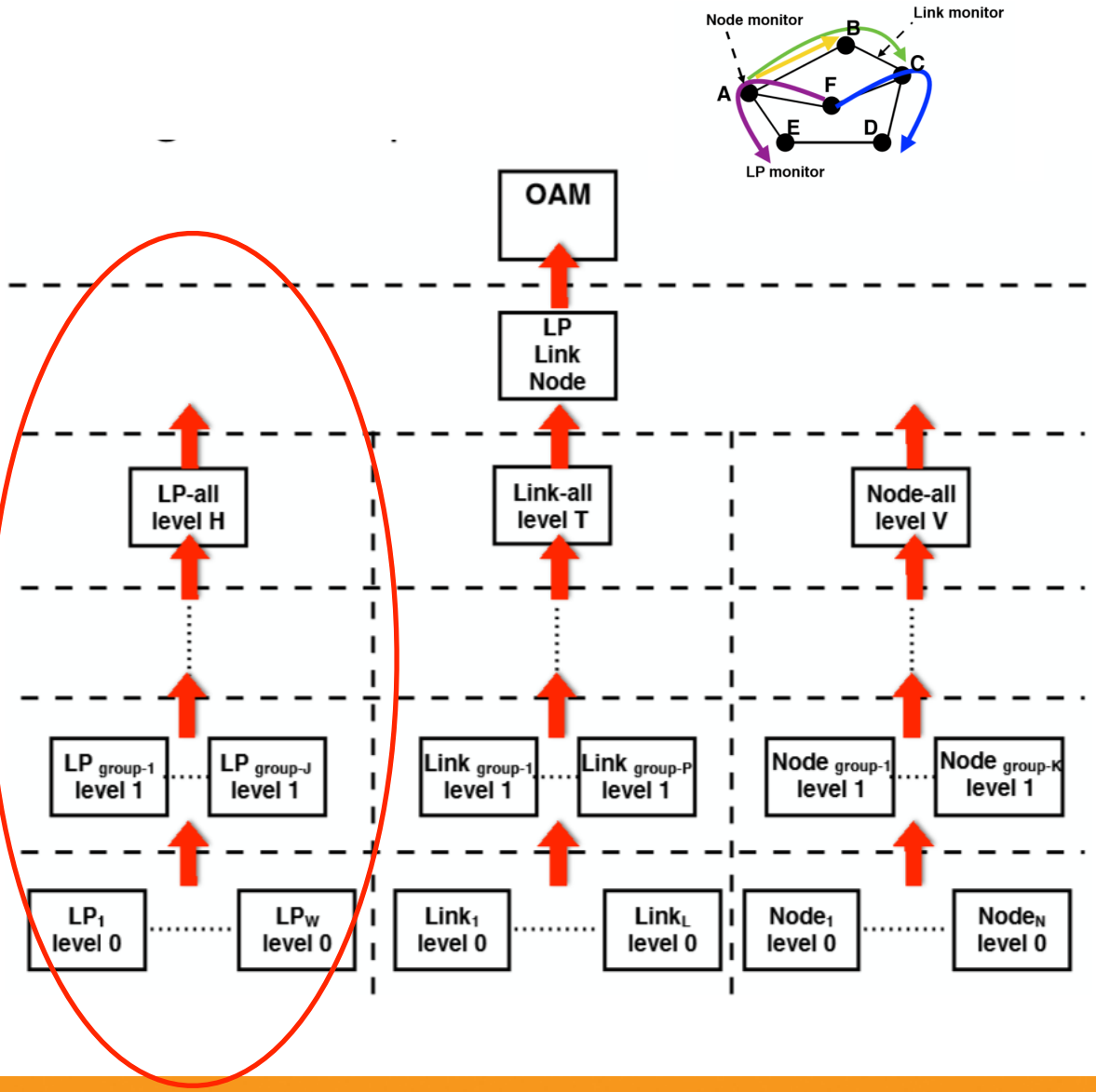
- Improve correlation for monitored parameters coming from different layers
- Management of soft failures: identification of the fault and localization
- Scalable management plane

- This work enhanced the hierarchical monitoring architecture proposed within the EU ORCHESTRA project
- ABNO OAM Handler functionalities are spread into several hierarchical layers, enabling to confine sets of monitored physical parameters within specific levels in the hierarchy:
  - Scalable solution
- Correlation of different-layer monitored parameters is enabled

ACK: The work has been supported by the ORCHESTRA project.

email: nicola.sambo@sssup.it

Hierarchical monitoring architecture: example of responsibility



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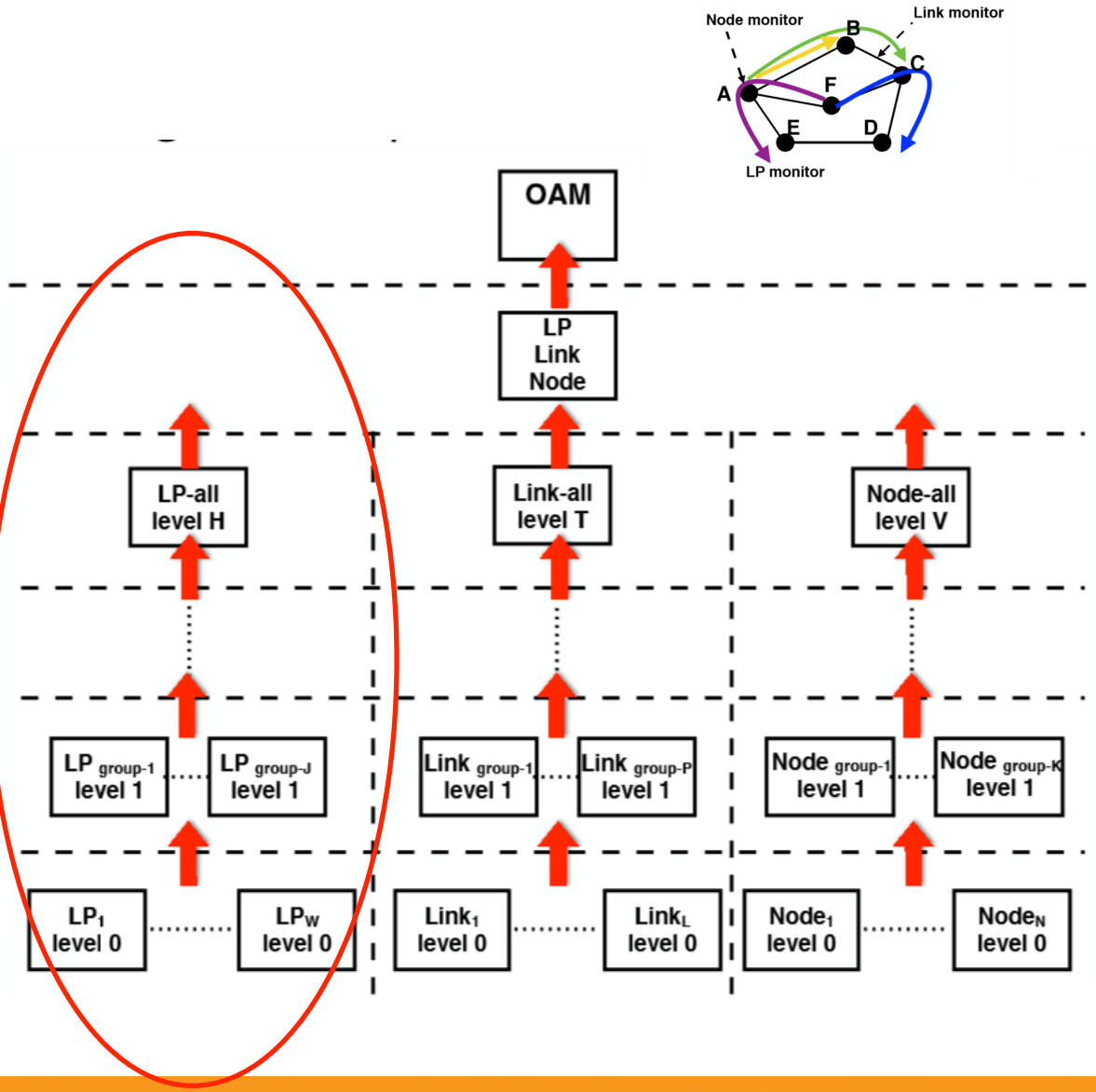

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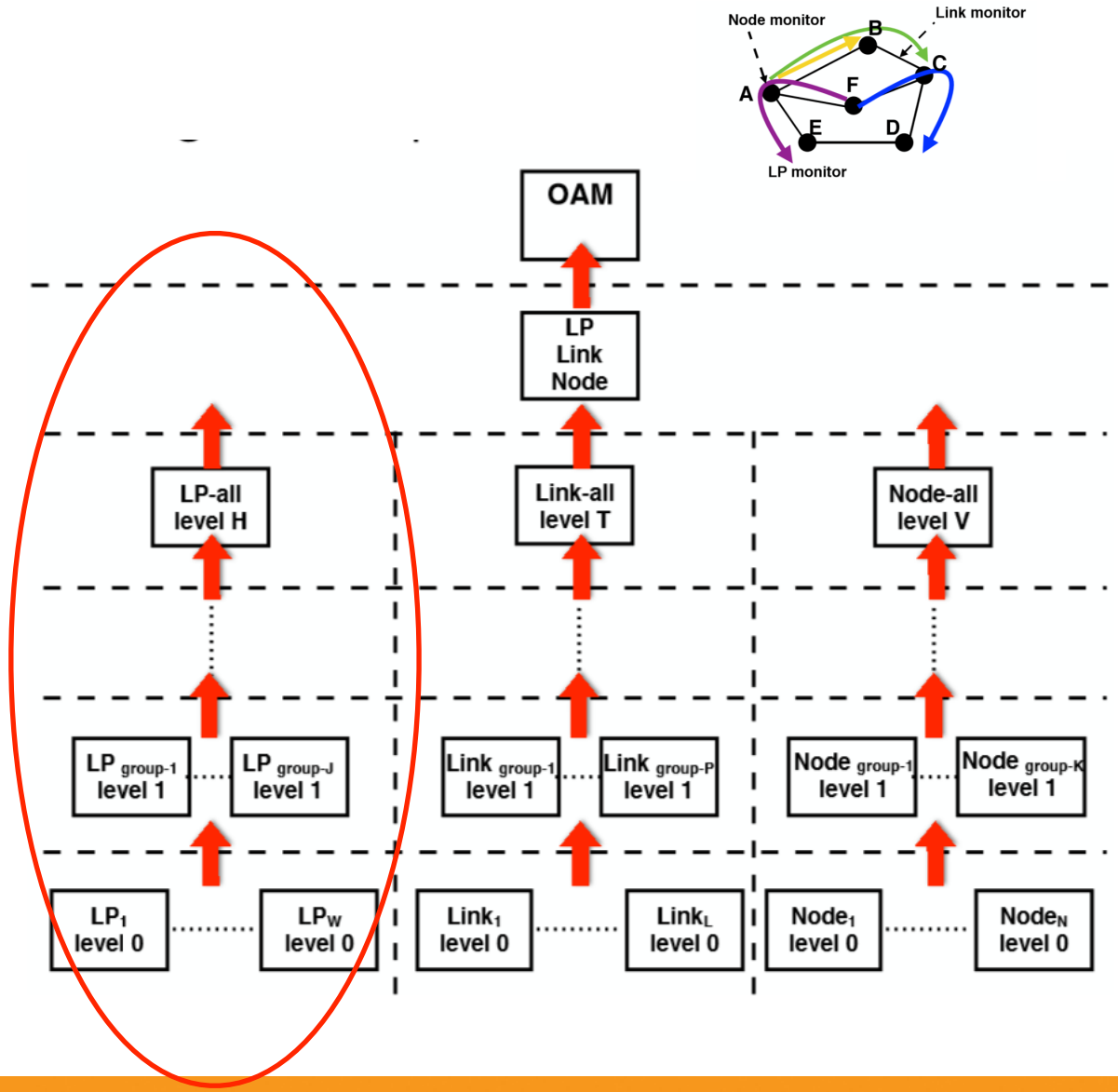

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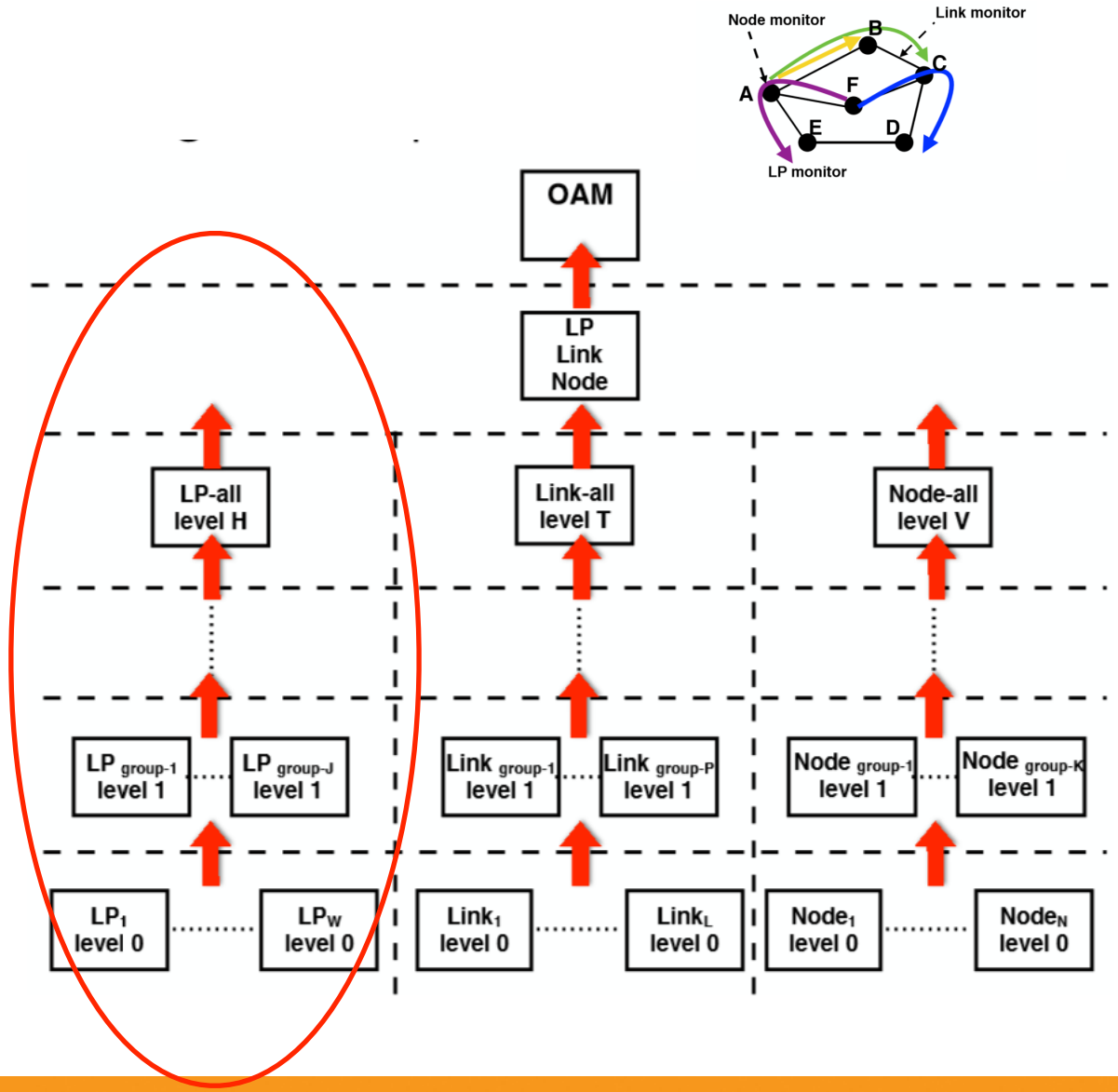

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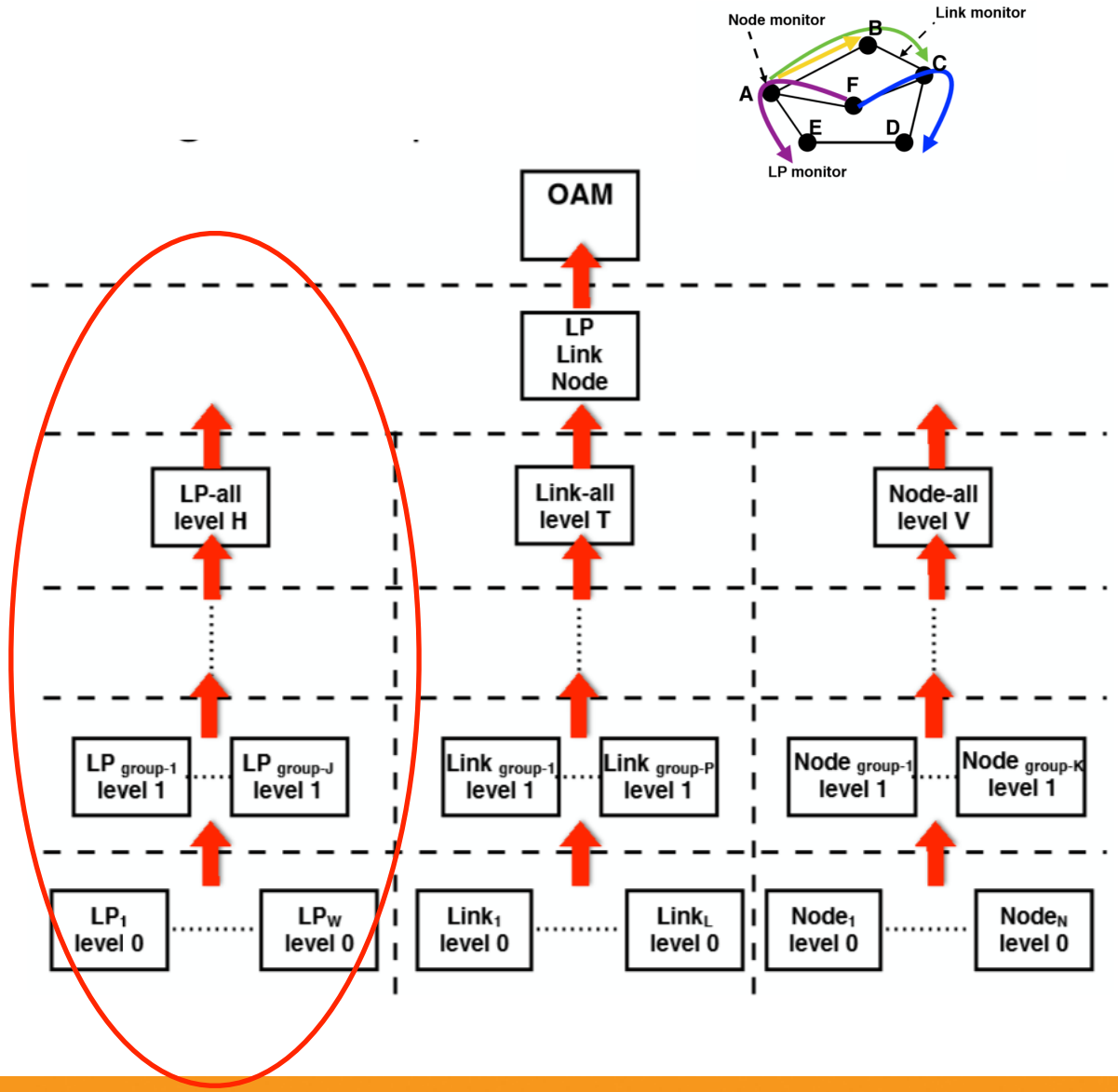

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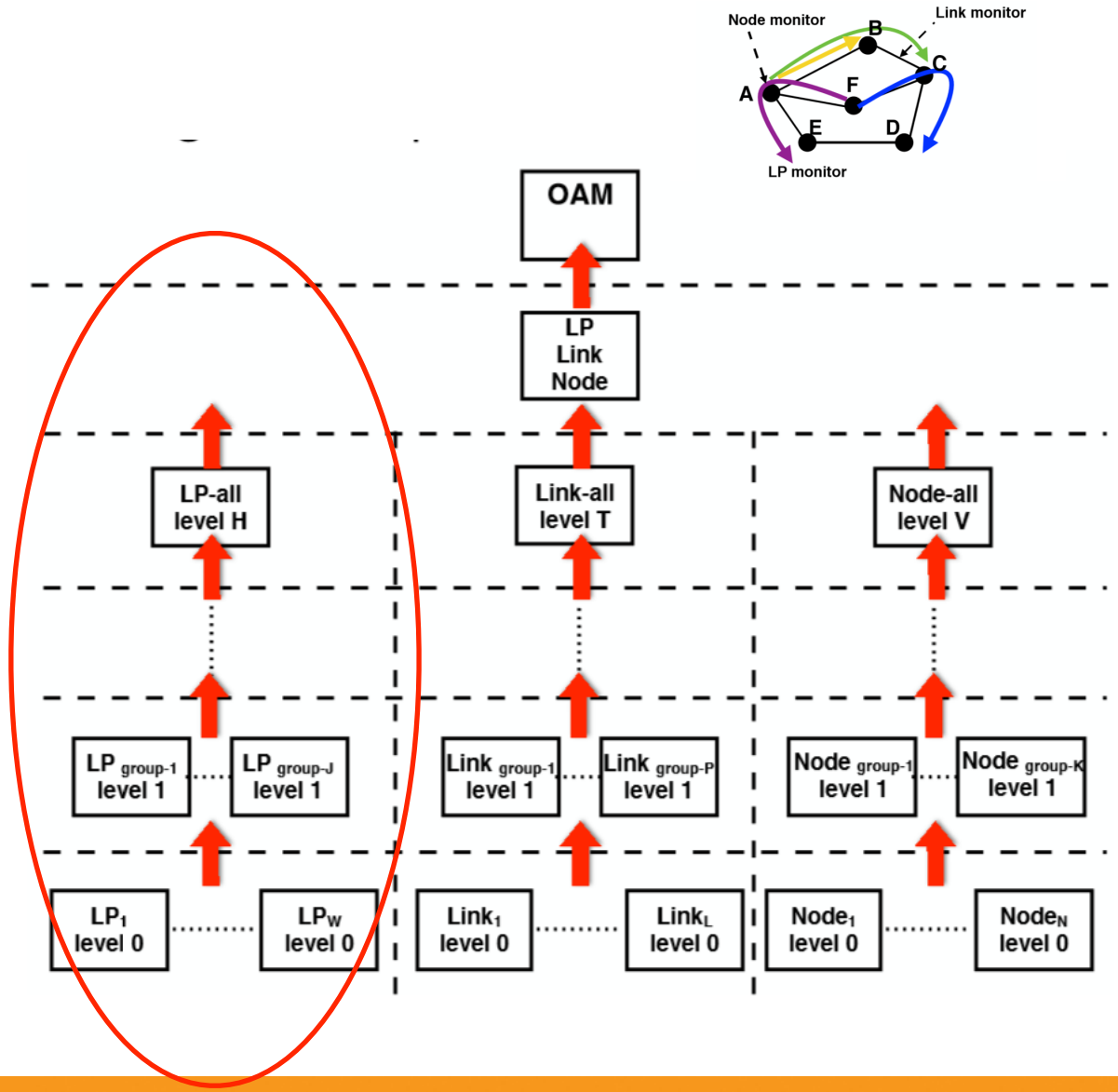

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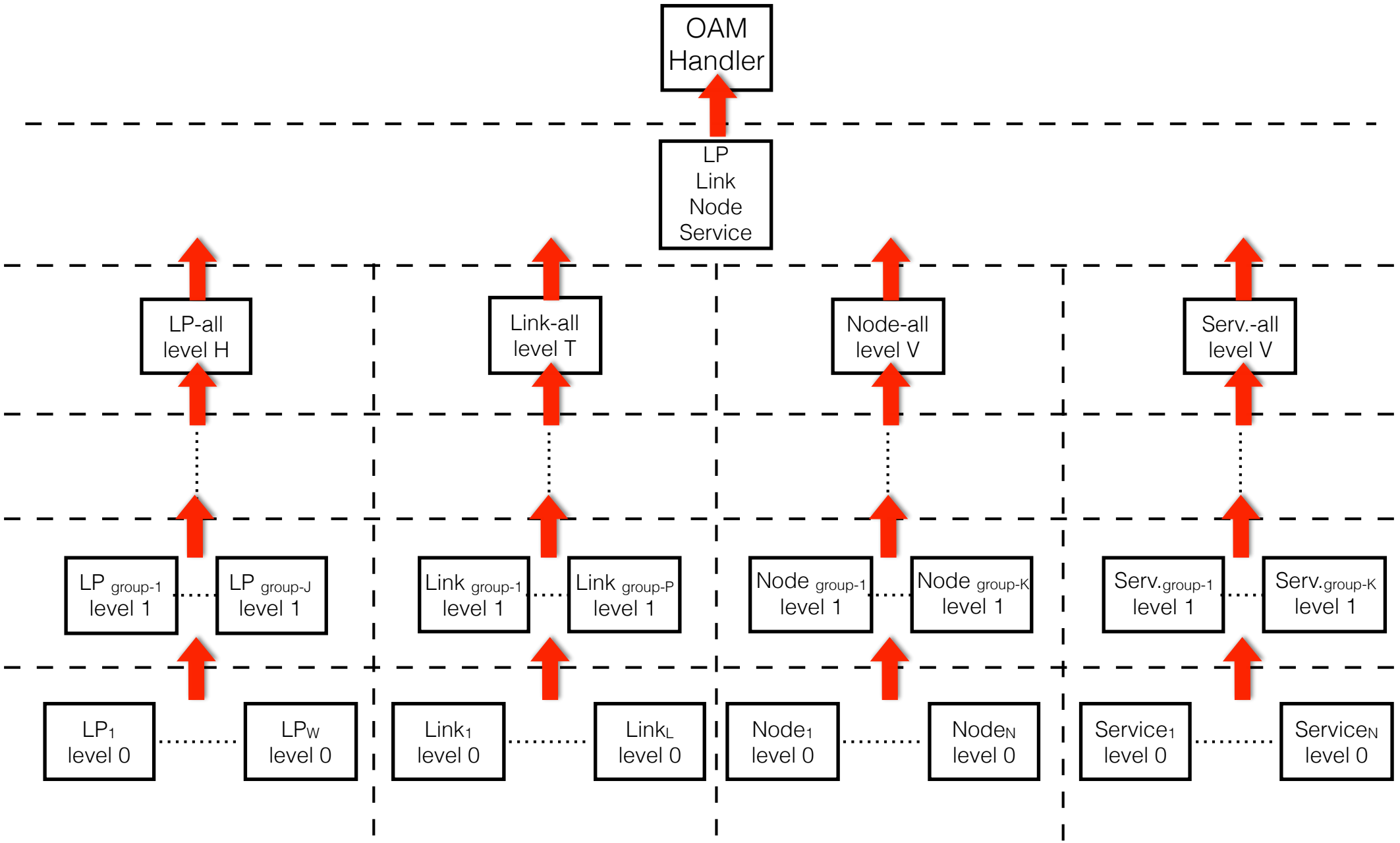
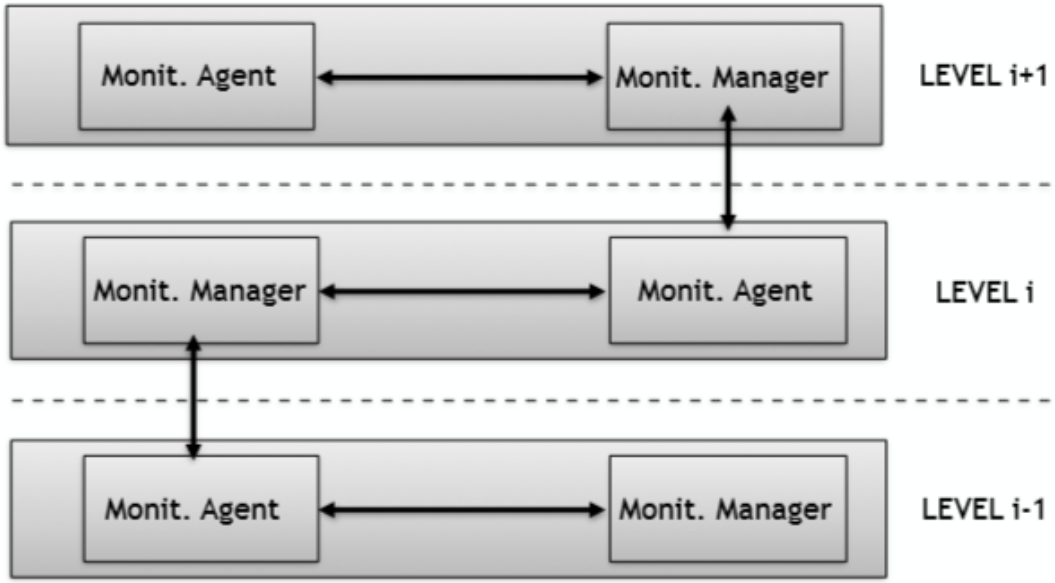
- Alarms sent to level 1: by correlating this information, a problem can be identified in the segment A-B.
- Then, LP level 2 can group all the lightpaths whose ingress node belongs to a specific region of the network and so on up to a generic level H.


OAM Handler
LP
Link
Node
Service
LP-all level H
Link-all level T
Node-all level V
Serv.-all level V
LP group-1 level 1
LP group-J level 1
Link group-1 level 1
Link group-P level 1
Node group-1 level 1
Node group-K level 1
Serv.group-1 level 1
Serv.group-K level 1
LP1 level 0
LPW level 0
Link1 level 0
LinkL level 0
Node1 level 0
NodeN level 0
Service1 level 0
ServiceN level 0

Monitoring entity



- **Agent** disseminates monitoring information to the upper layer
- Although not shown, the Manager at level *i* is connected to several monitoring entities of the level *i-1*
- **Manager** correlates and processes info coming from agents at the level *i-1*