



Hierarchical monitoring architecture and OAM Handler

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ECOC 2015



Introduction

- Toward agile and programmable networks:
 - configurable transmission parameters depending on the current physical conditions [a,b]
 - reduction of margins: possibility to have not-considered degradations, e.g. aging [c,d]

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[d] Y. Pointurier, invited talk, OFC 2016



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- In such networks, Operation, Administration, and Maintenance (OAM) are key functionalities to verify quality of transmission
 - Monitoring: coherent receiver offers monitors, e.g. LSP pre-FEC BER, linear dispersions

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In this paper:

- Hierarchical monitoring architecture with ABNO OAM Handler at the root
- High scalability

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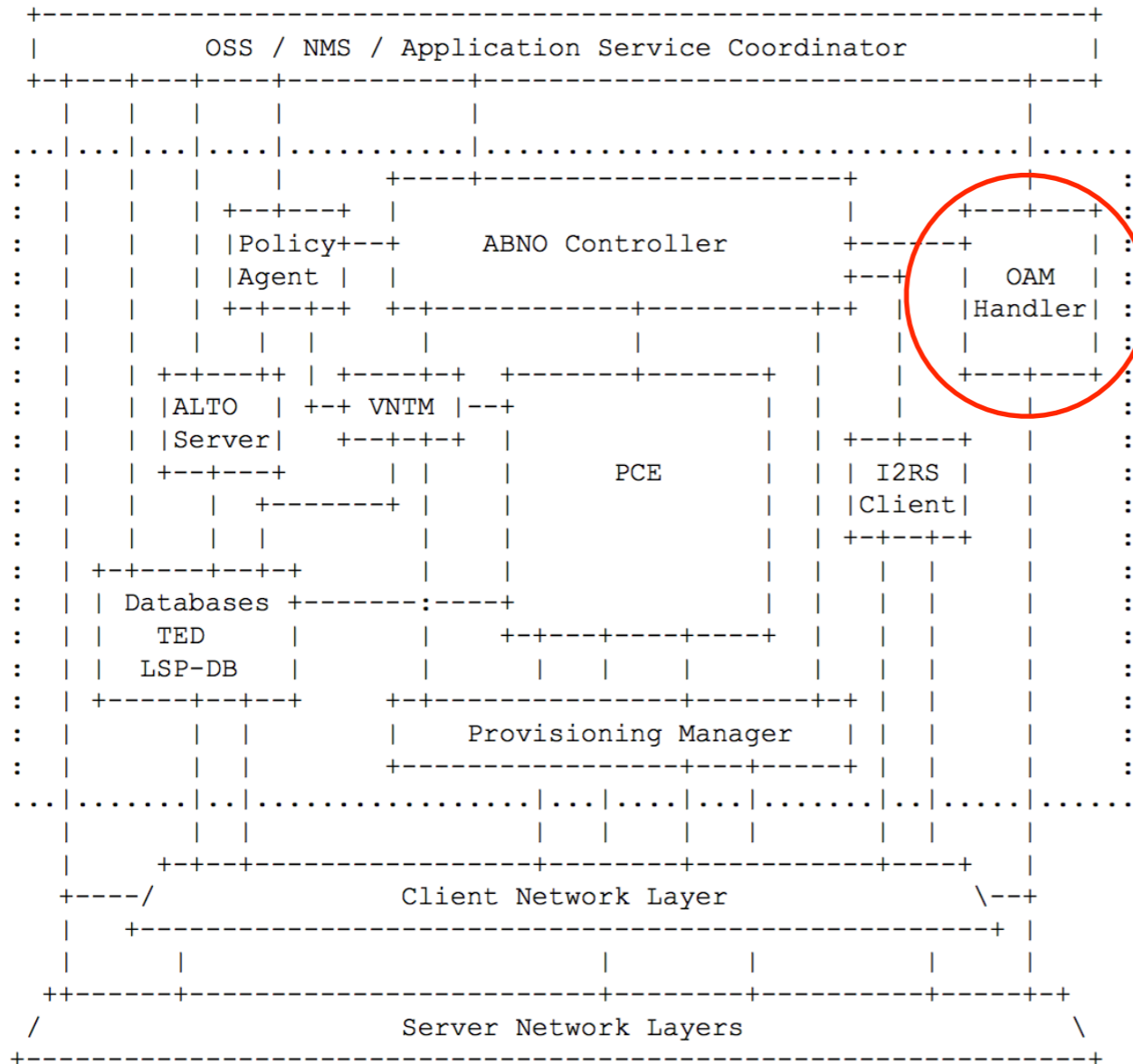
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Application-based Network Operations (ABNO)

IETF RFC 7491

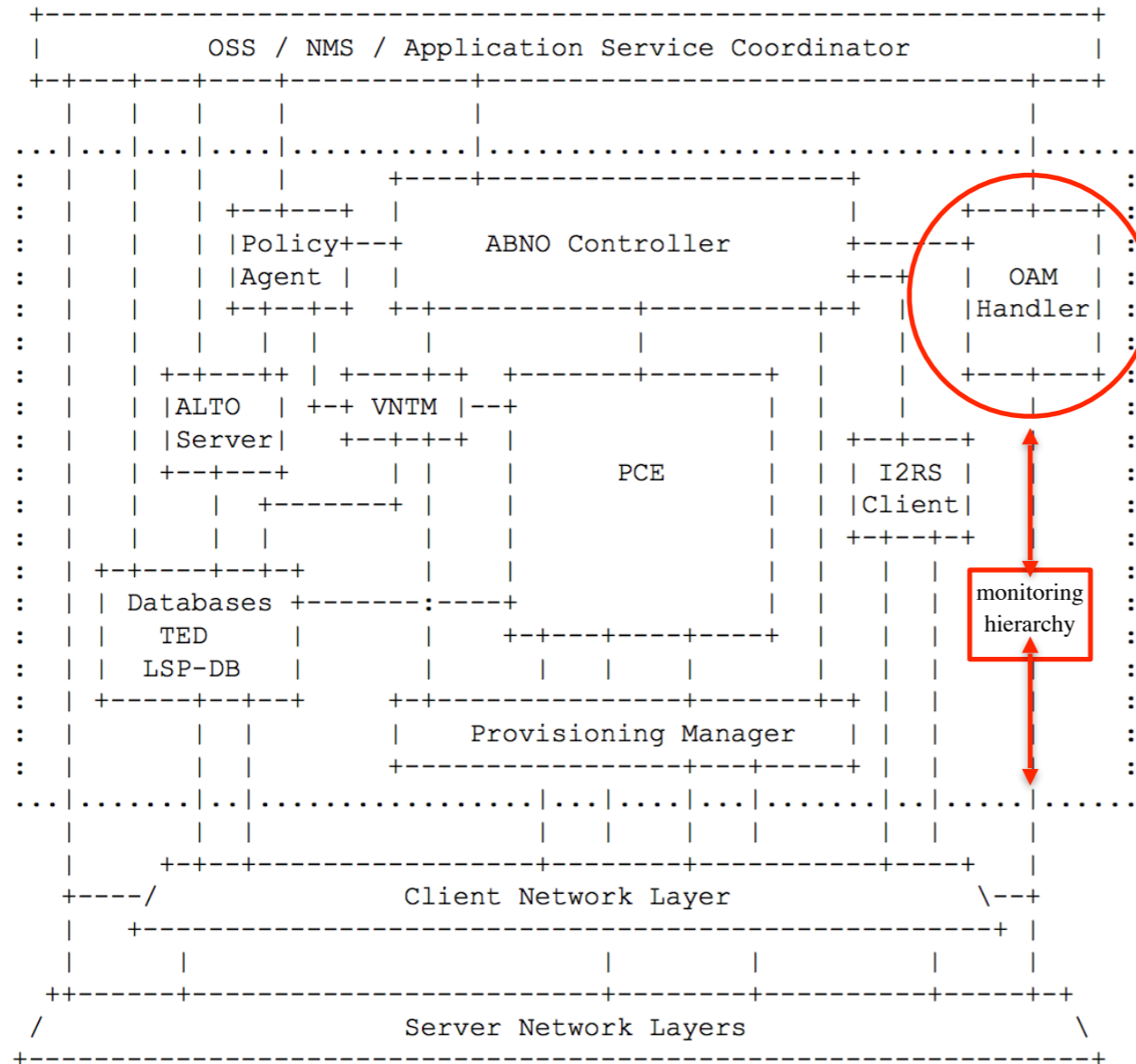


- OAM receiving **alerts** about potential problems
- **correlating** them
- **triggering other components** of the ABNO system to take action to preserve or recover the services

Figure 1 : Generic ABNO Architecture



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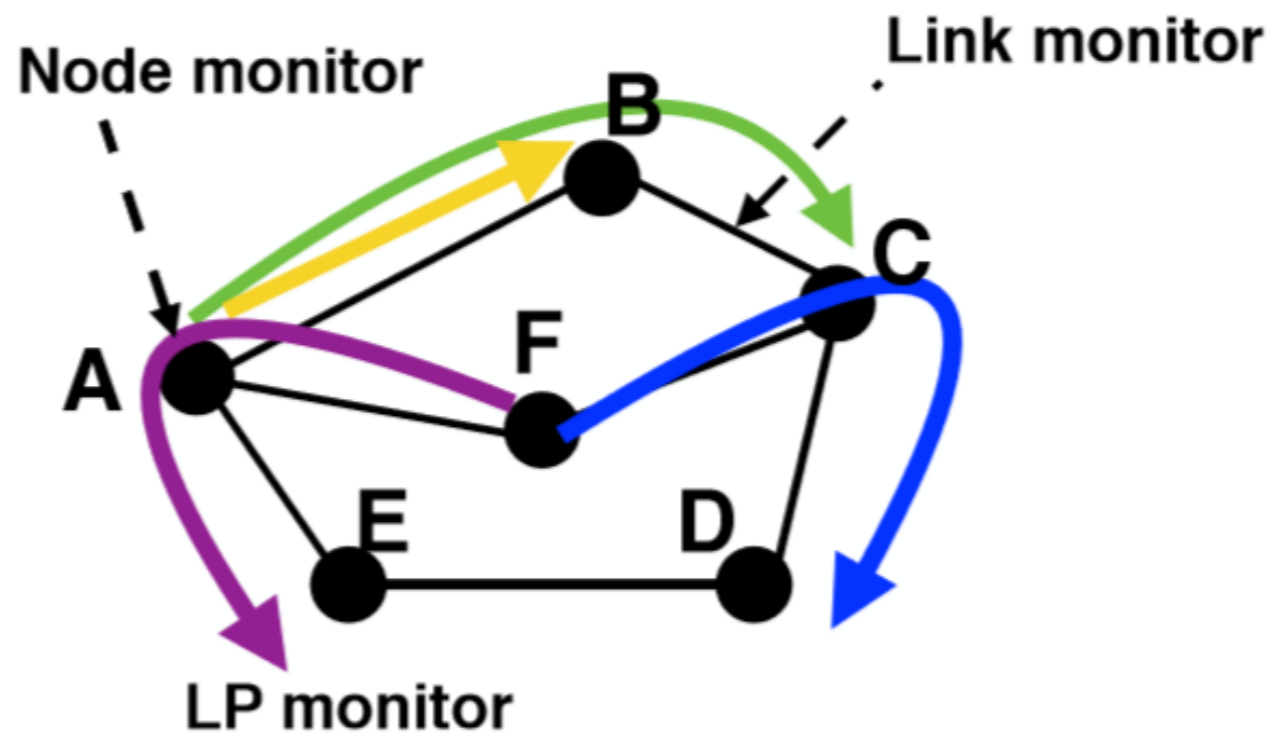


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Figure 1 : Generic ABNO Architecture



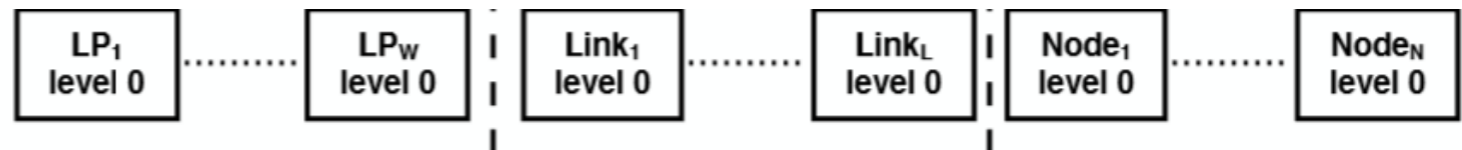
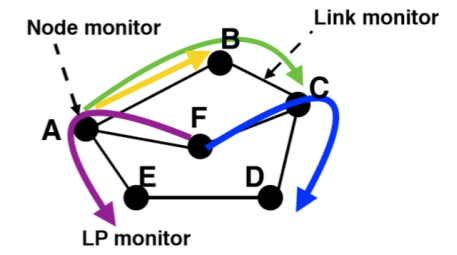
Scenario



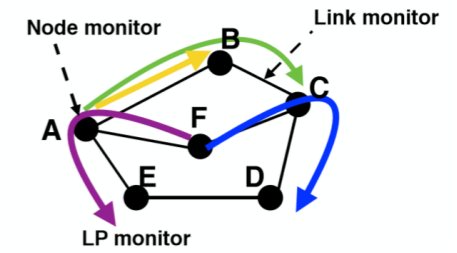
- LP monitors are assumed integrated in the DSP of each lightpath coherent receiver (e.g., pre-forward-error-correction bit error rate monitors)
- Power monitors can be assumed for links and nodes



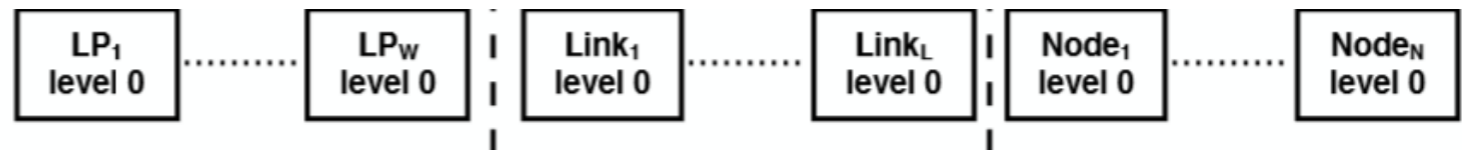
Hierarchical monitoring architecture



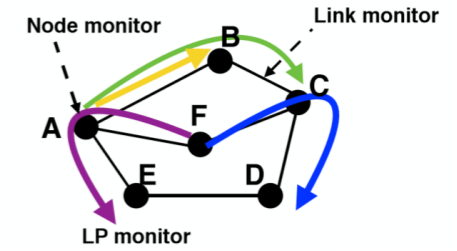
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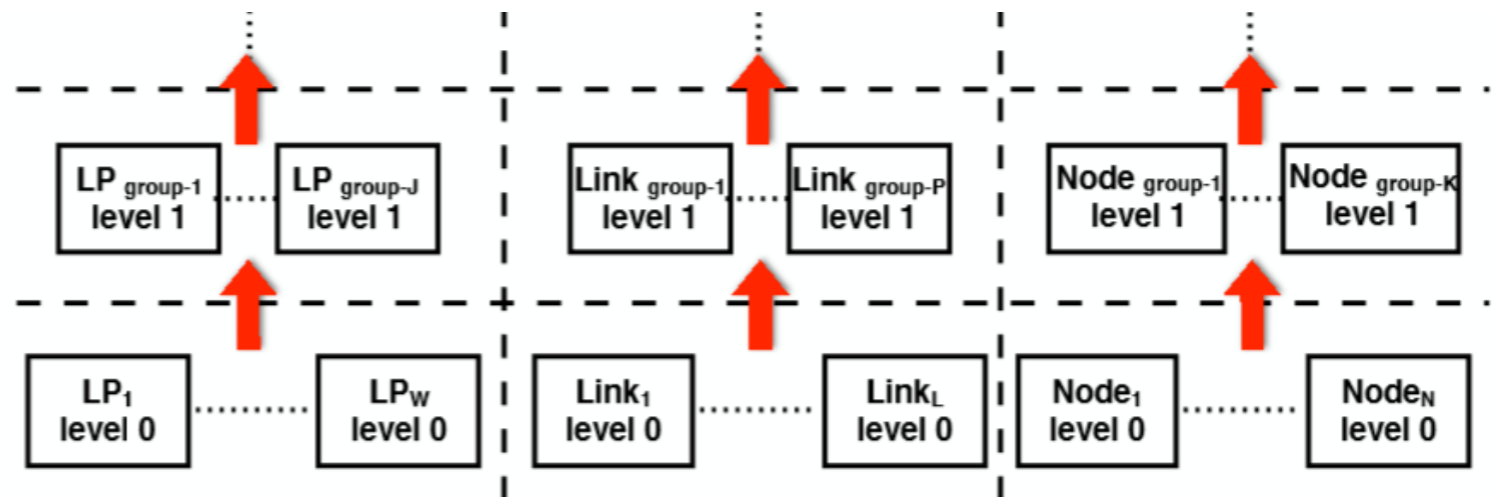
- EX: **LP level 0**: 1 per active lightpath



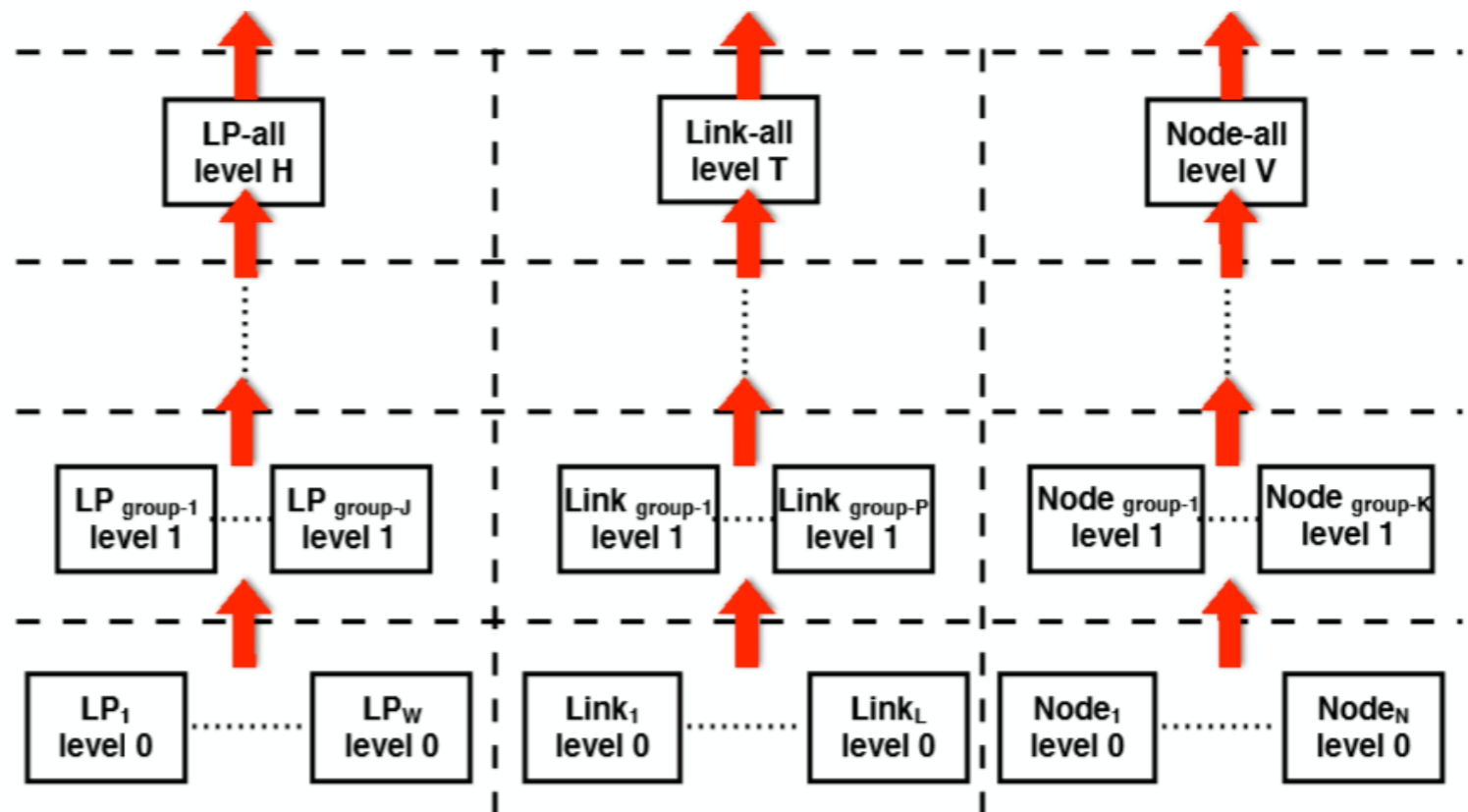
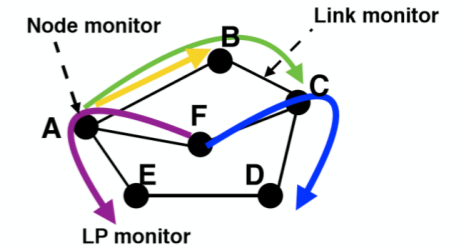
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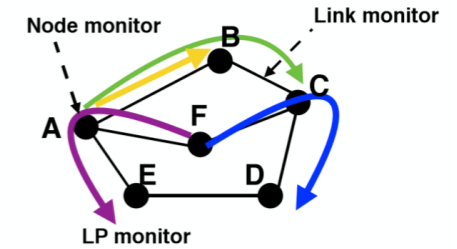
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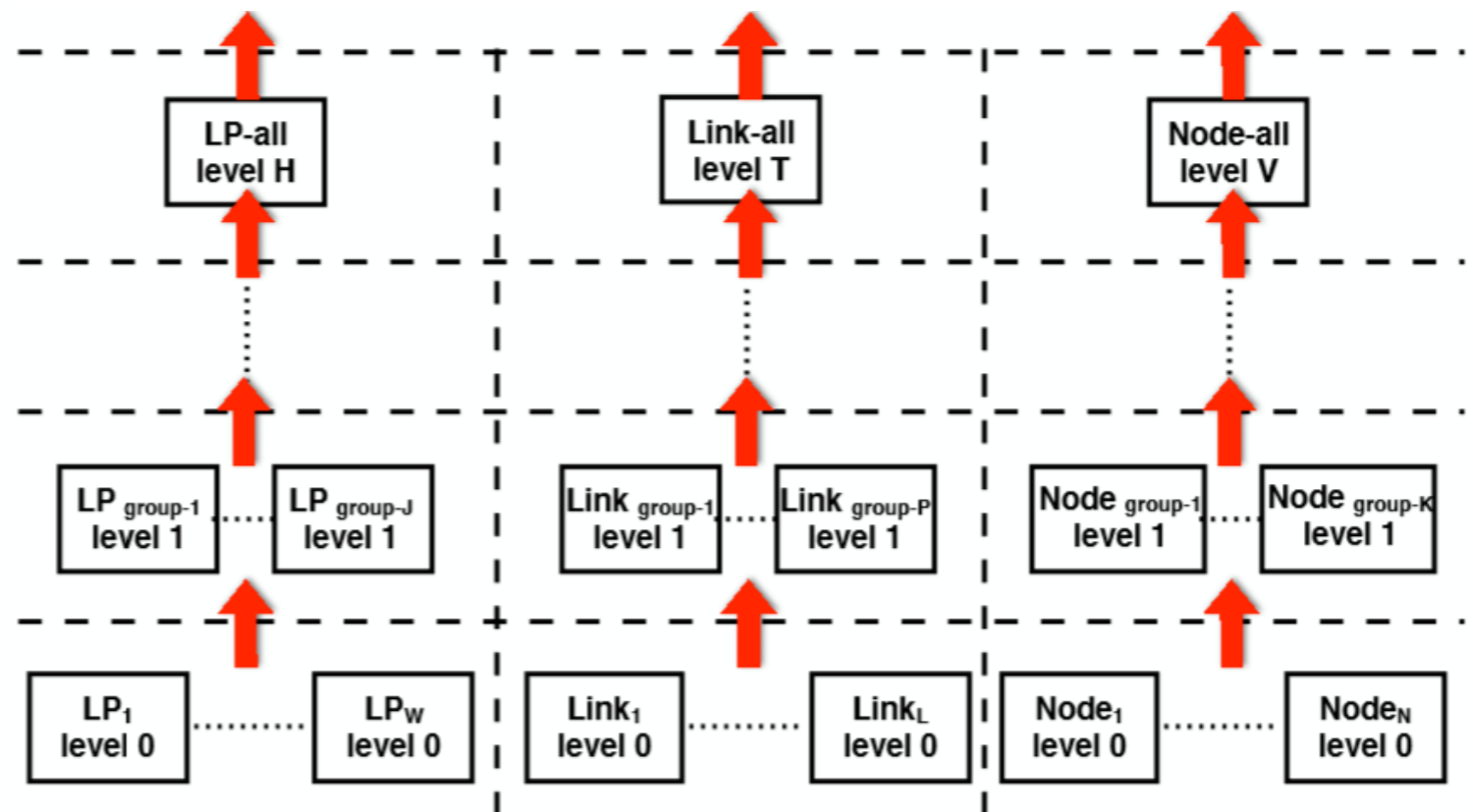
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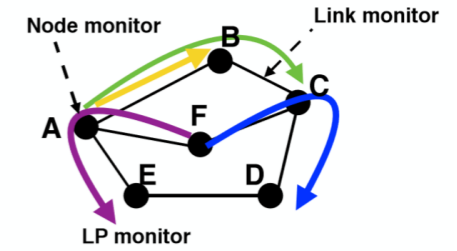
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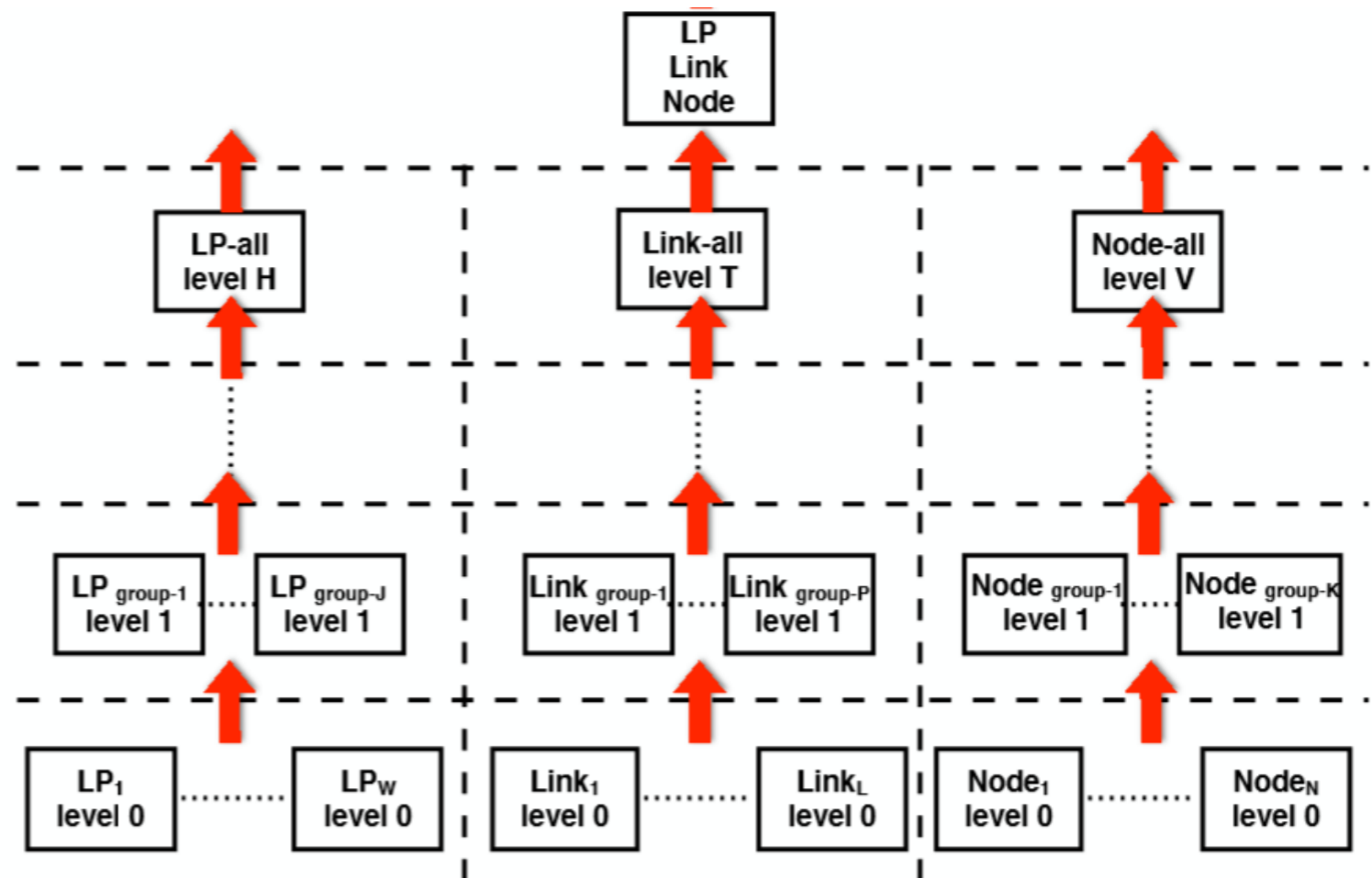
- Each entity is responsible for specific elements: e.g. a set of lightpaths
- each layer receives information from down layers
 - correlation
 - actions
 - notifications to the upper layers
- Going up to higher layers, more responsibility
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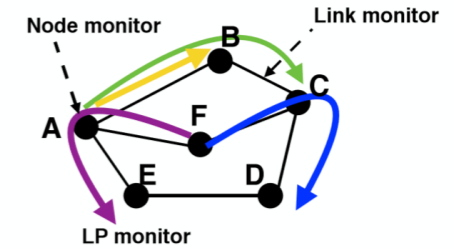
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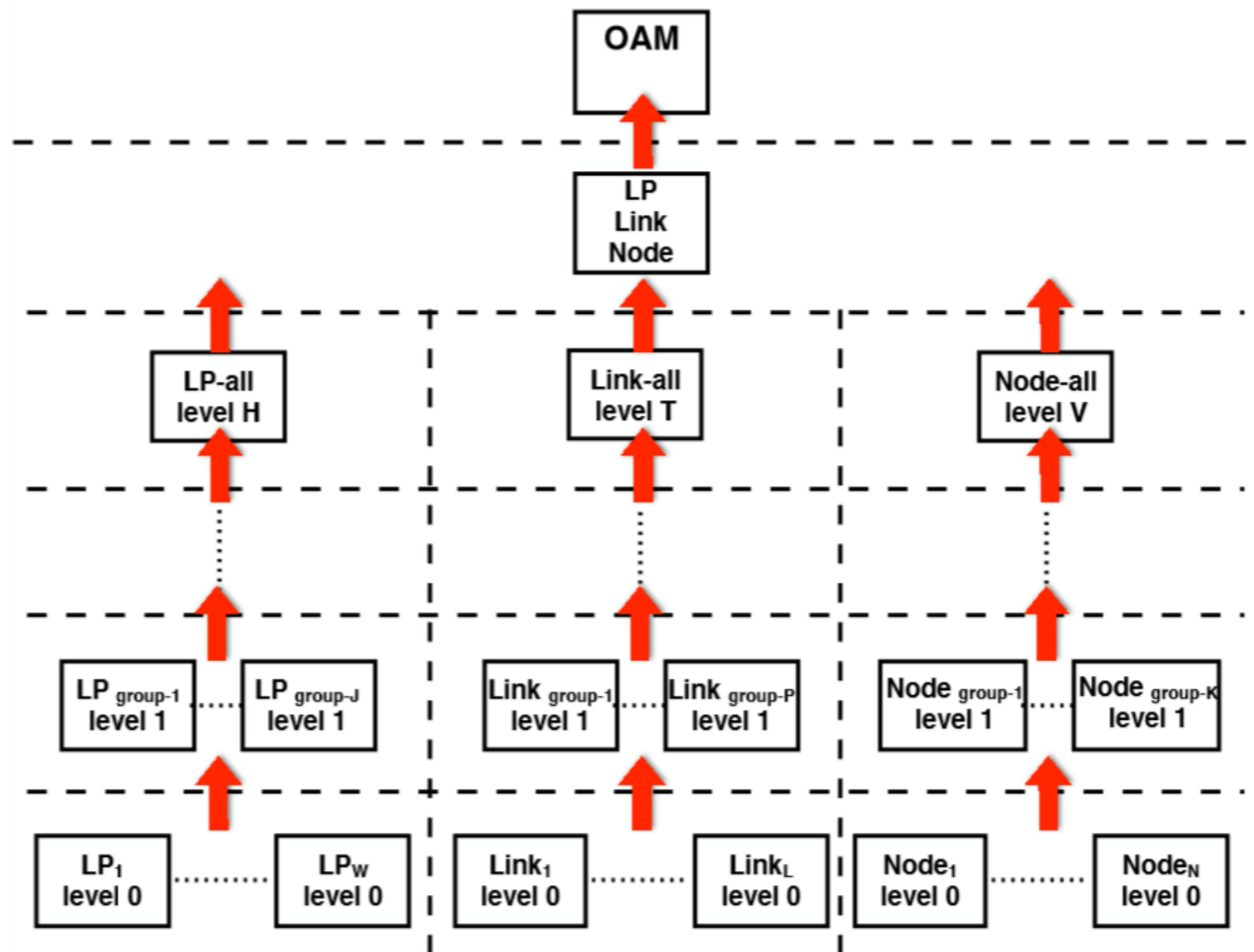
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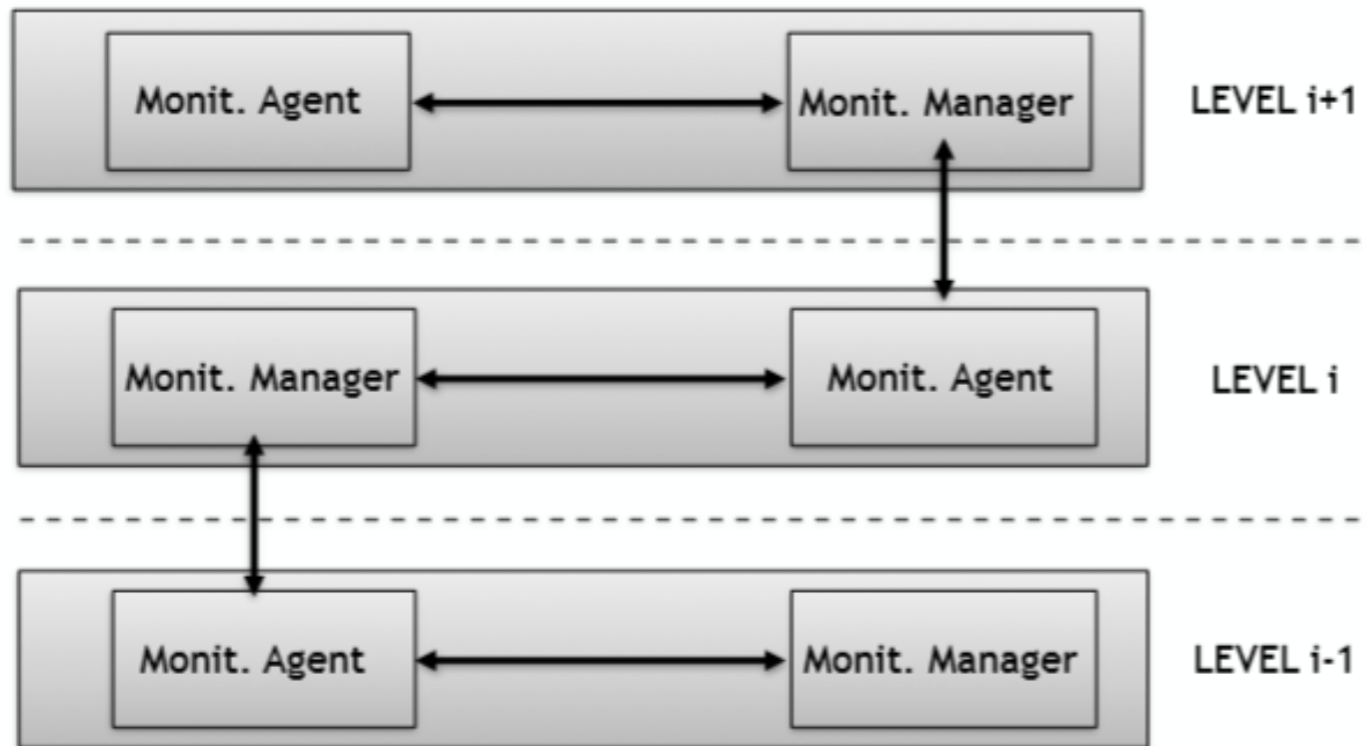
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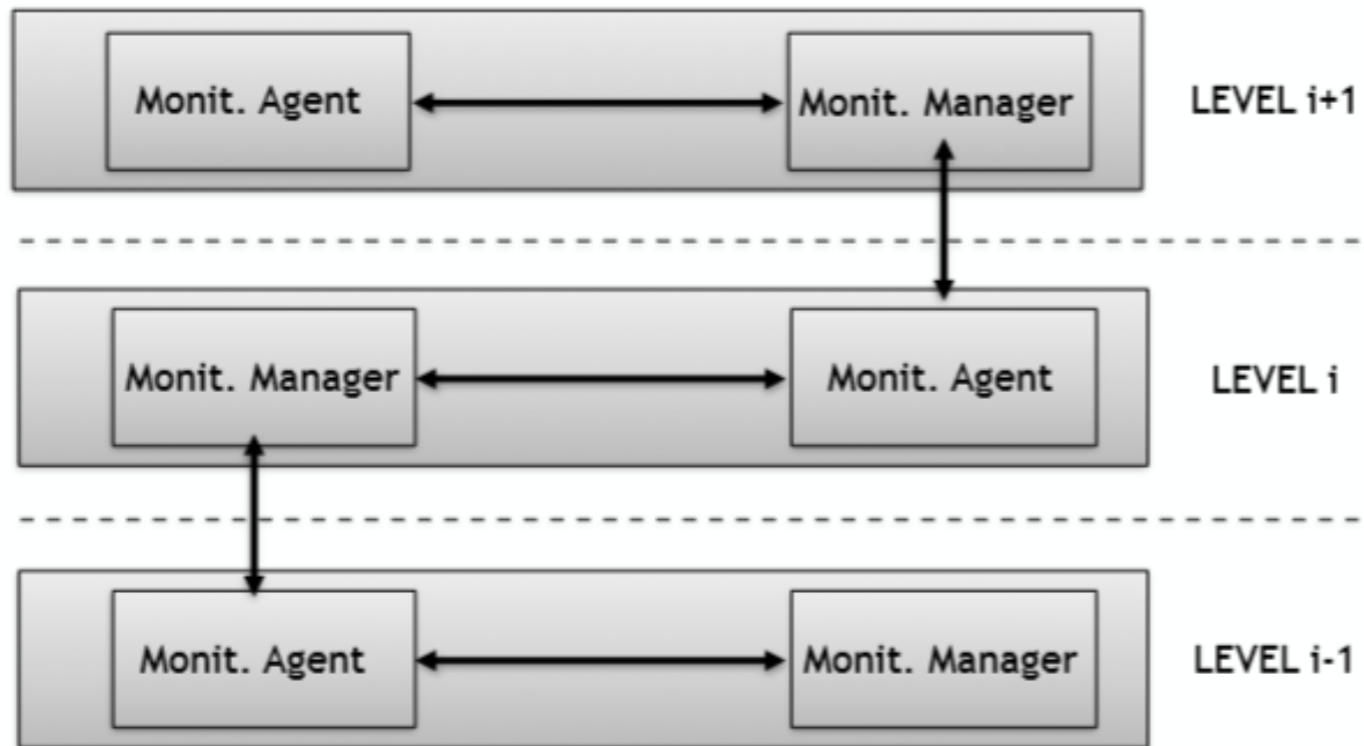
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Monitoring entity



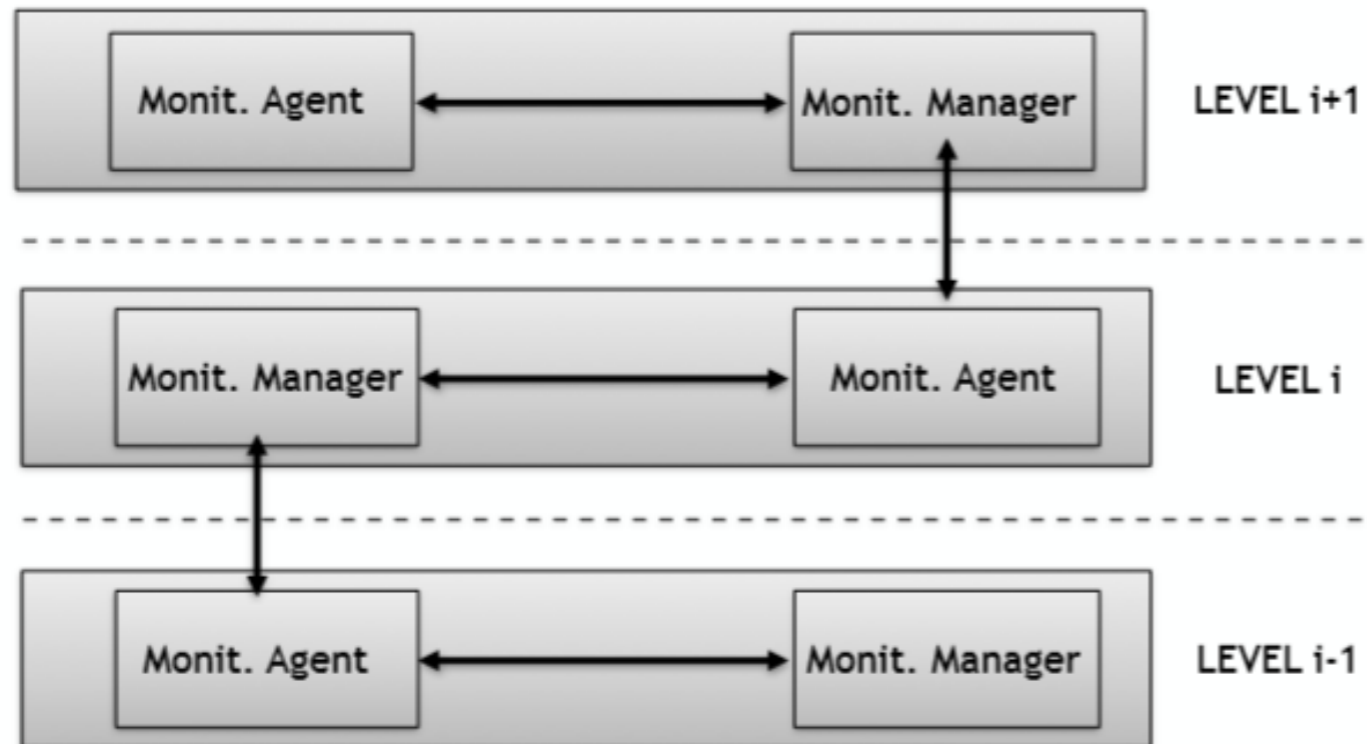
Monitoring entity



- **Agent** disseminates monitoring information to the upper layer



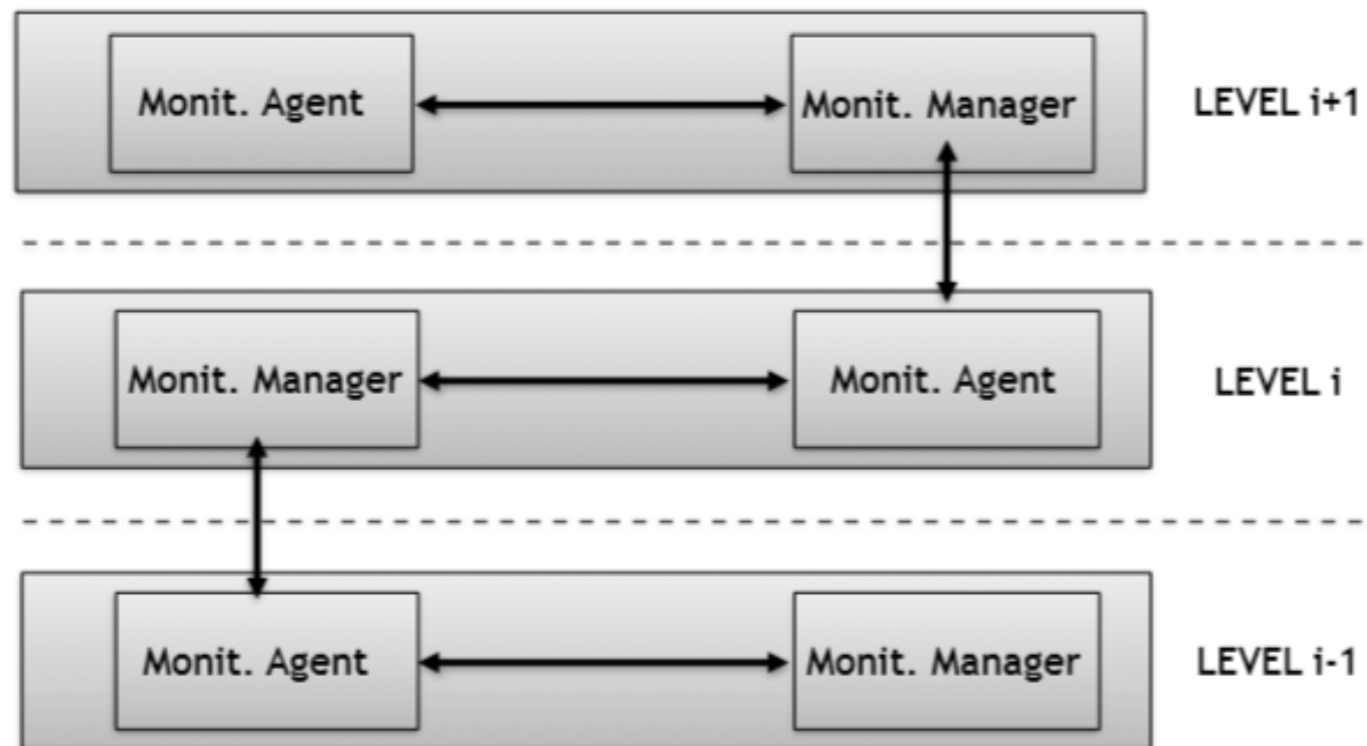
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- **Agent** disseminates monitoring information to the upper layer
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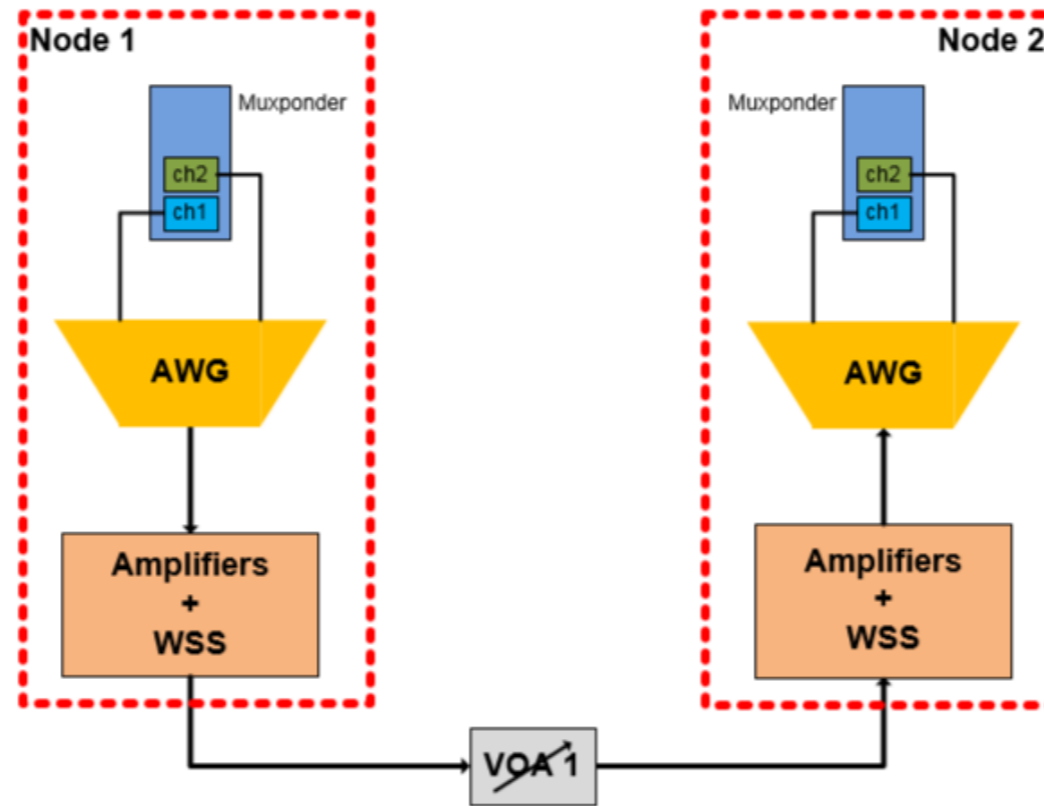
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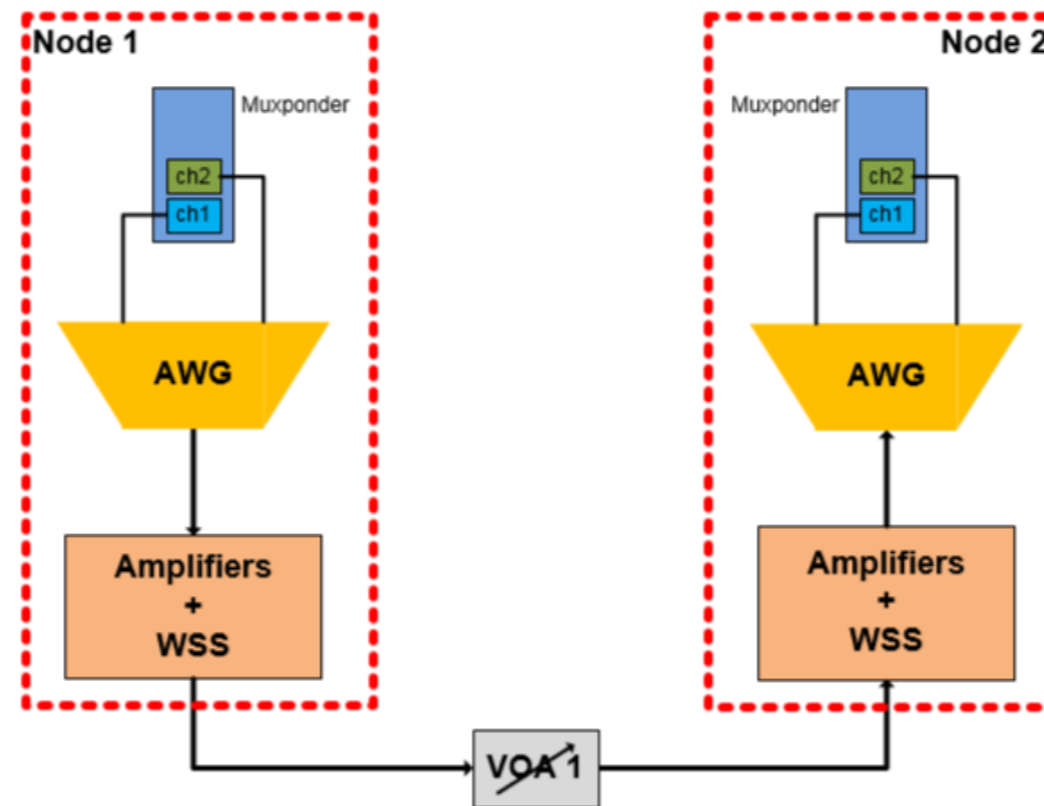
- **Agent** disseminates monitoring information to the upper layer
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- **Manager** correlates and processes info coming from agents at the level $i-1$



Alarms generated in a commercial system



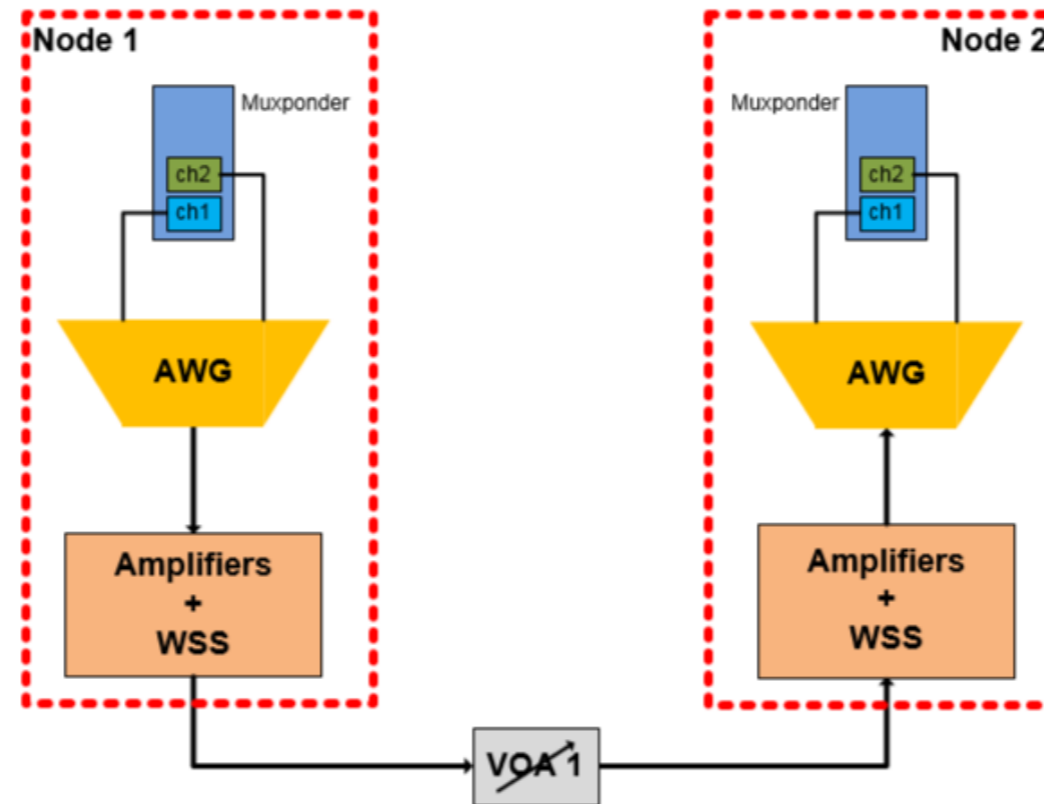
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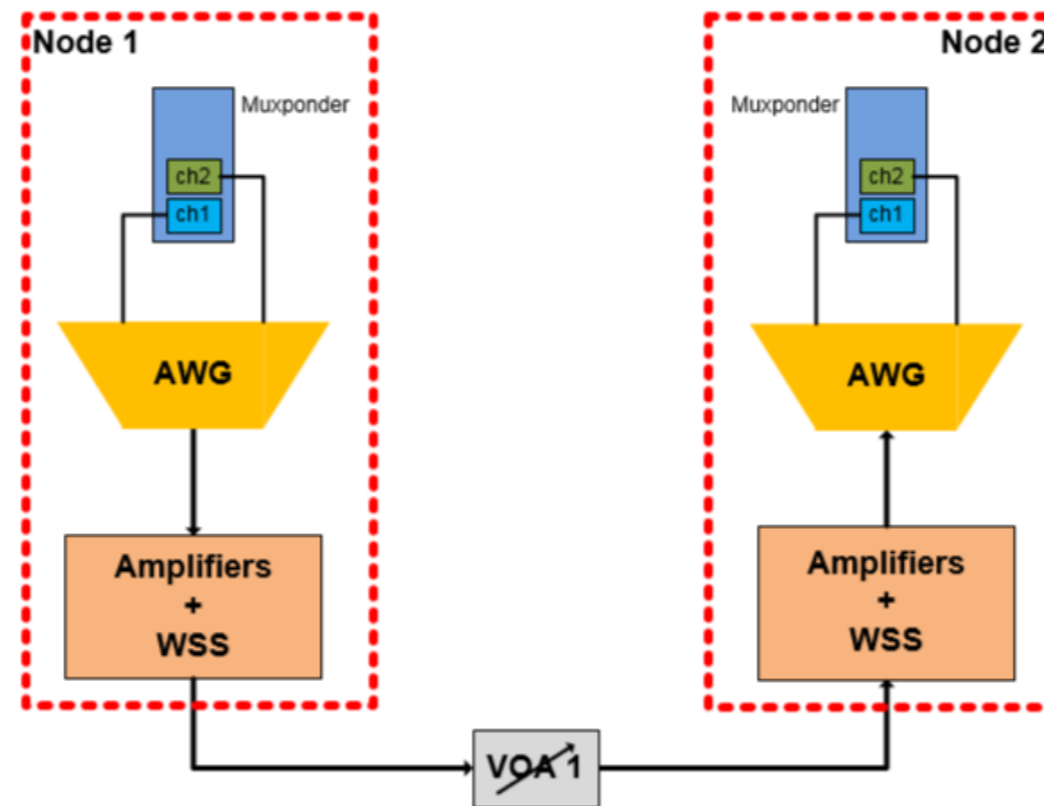


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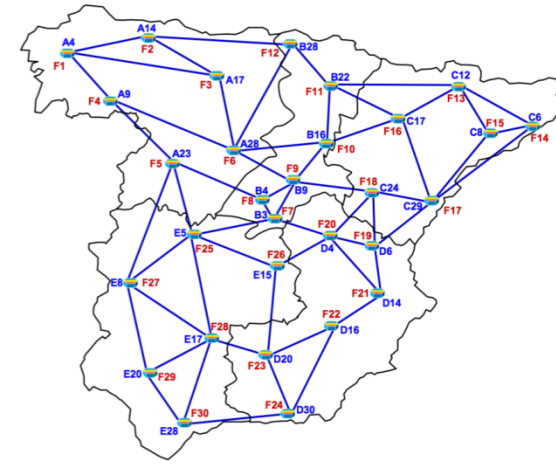


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USED IN SIMULATIONS TO EVALUATE SCALABILITY

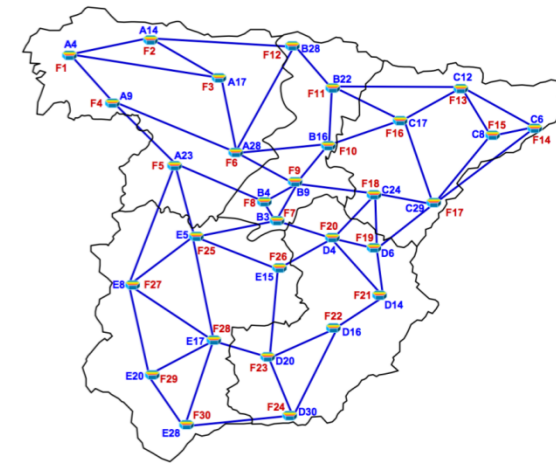


Simulation scenario



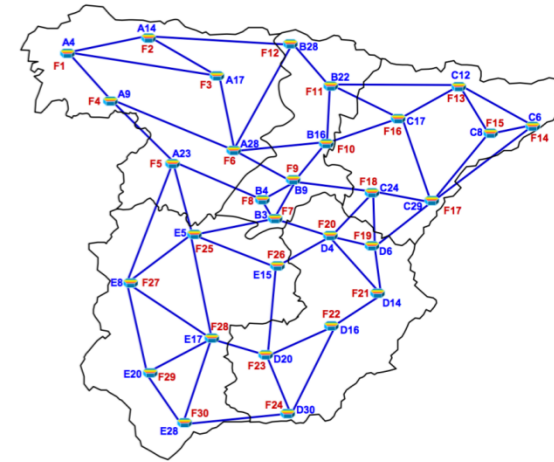
Simulation scenario

- Comparison of two management architectures:
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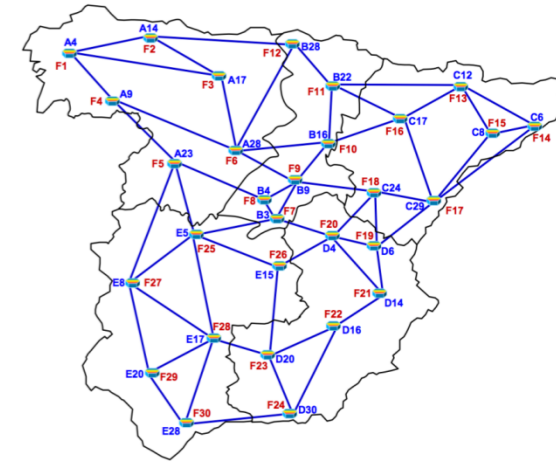


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 - link **hard-failure**: all lightpaths traversing the failed link are disrupted and each one is source of alarms;
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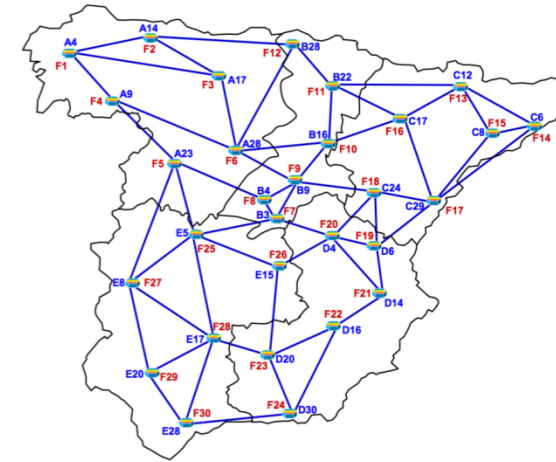


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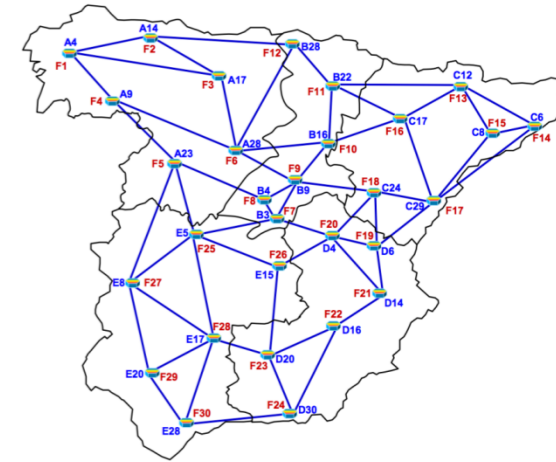
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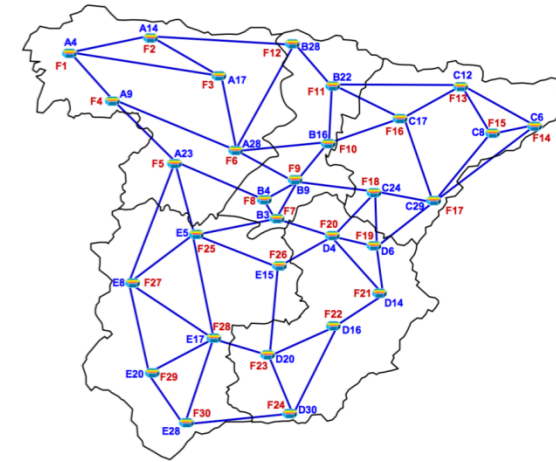
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 - Level 2: responsible of all LPs
 - OAM Handler

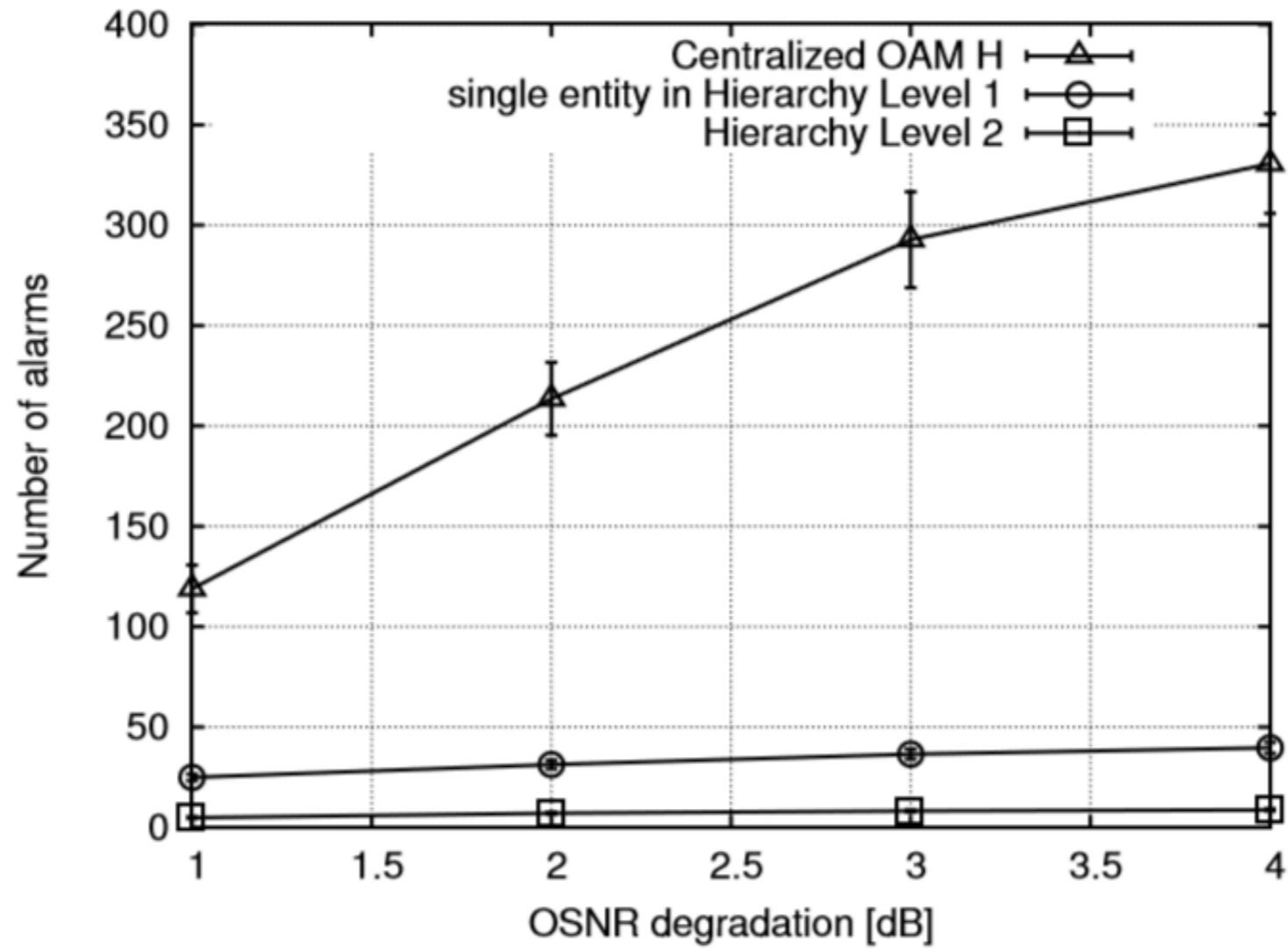
Hard failure

Tab. 1: Number of received alarms per monitoring entity at each *Level* in case of link hard failure.

	Level 1	Level 2	OAM Handler
Centralized	not present	not present	420.03
Hierarchical	47.97	9.2	1



Soft failure



Conclusions

- This paper presented the hierarchical monitoring architecture proposed within the EU ORCHESTRA
- 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 solutions.
- Measurements have been performed to identify the generated alarms in a commercial system.
- Simulations: the proposed hierarchical architecture guarantees high scalability



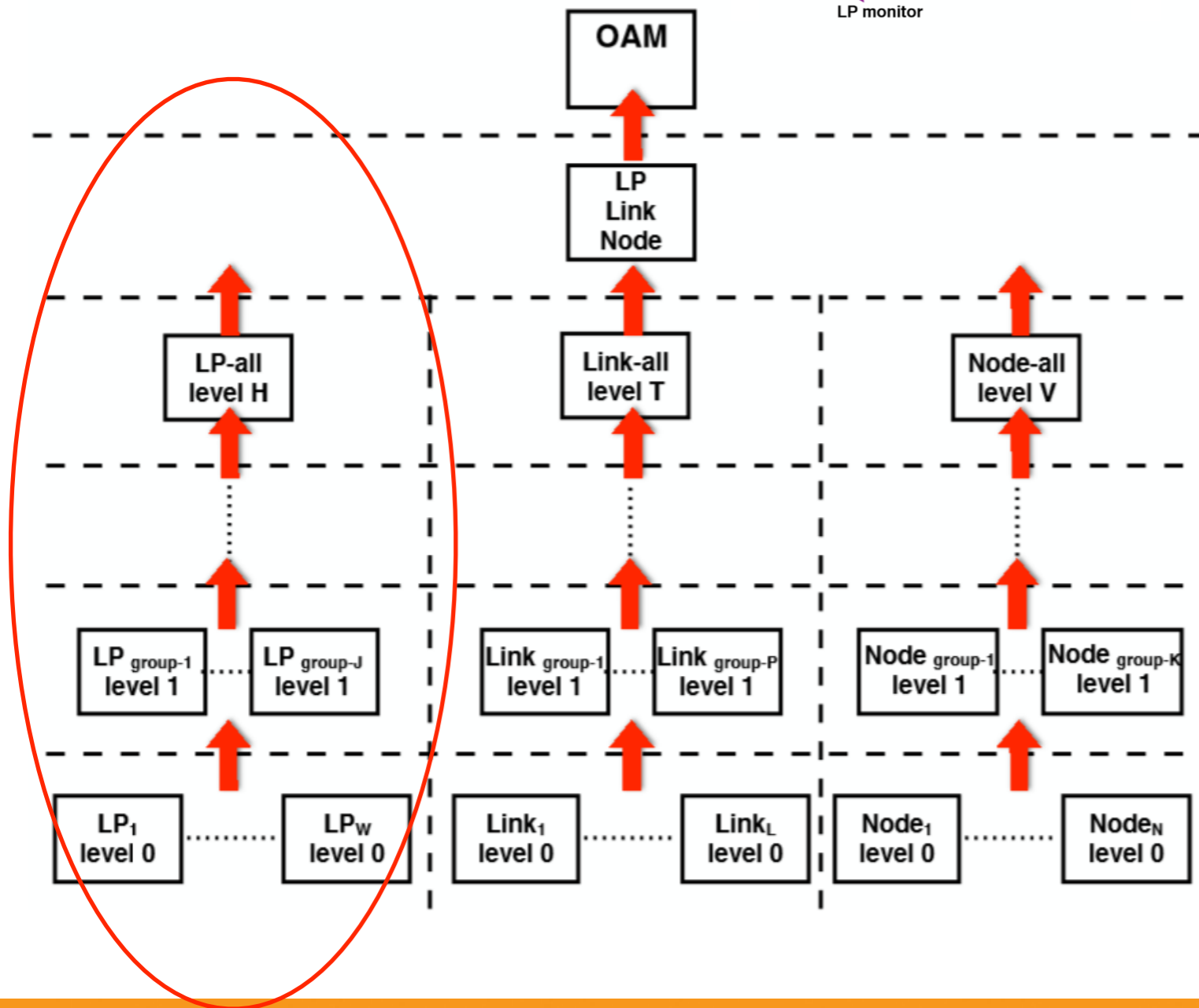
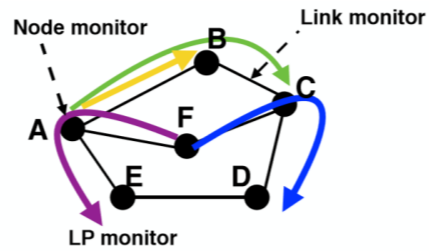
ACK: The work has been partially supported by the ORCHESTRA project.



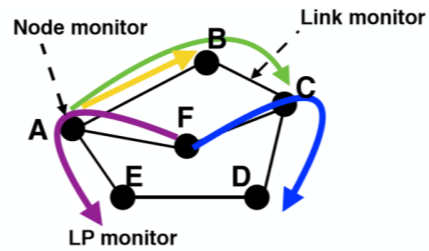
email: nicola.sambo@sssup.it



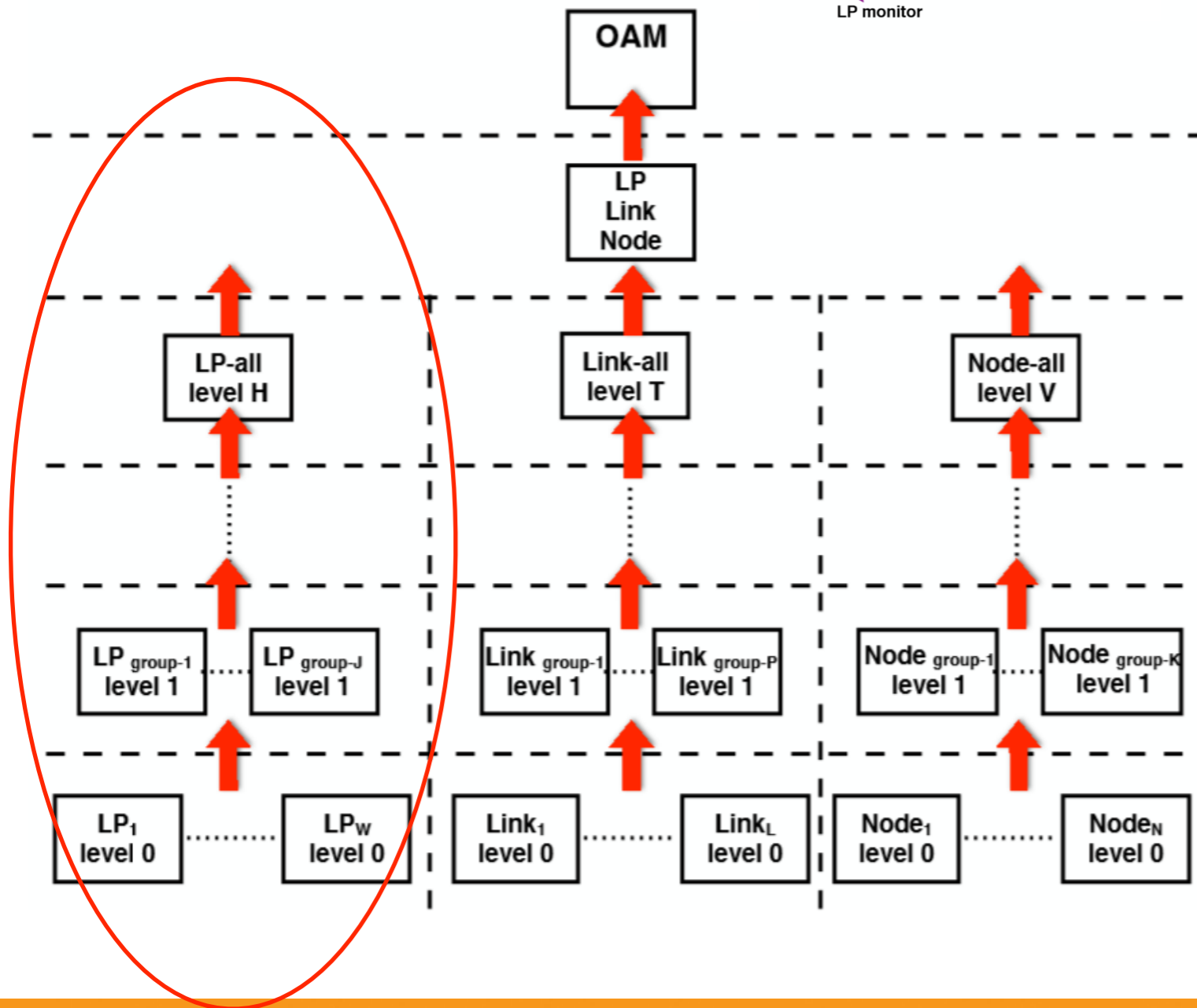
Hierarchical monitoring architecture: example of responsibility



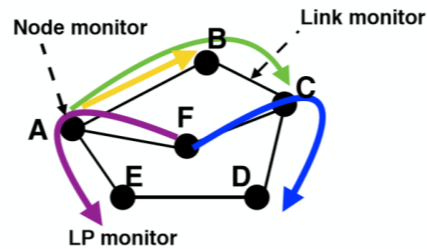
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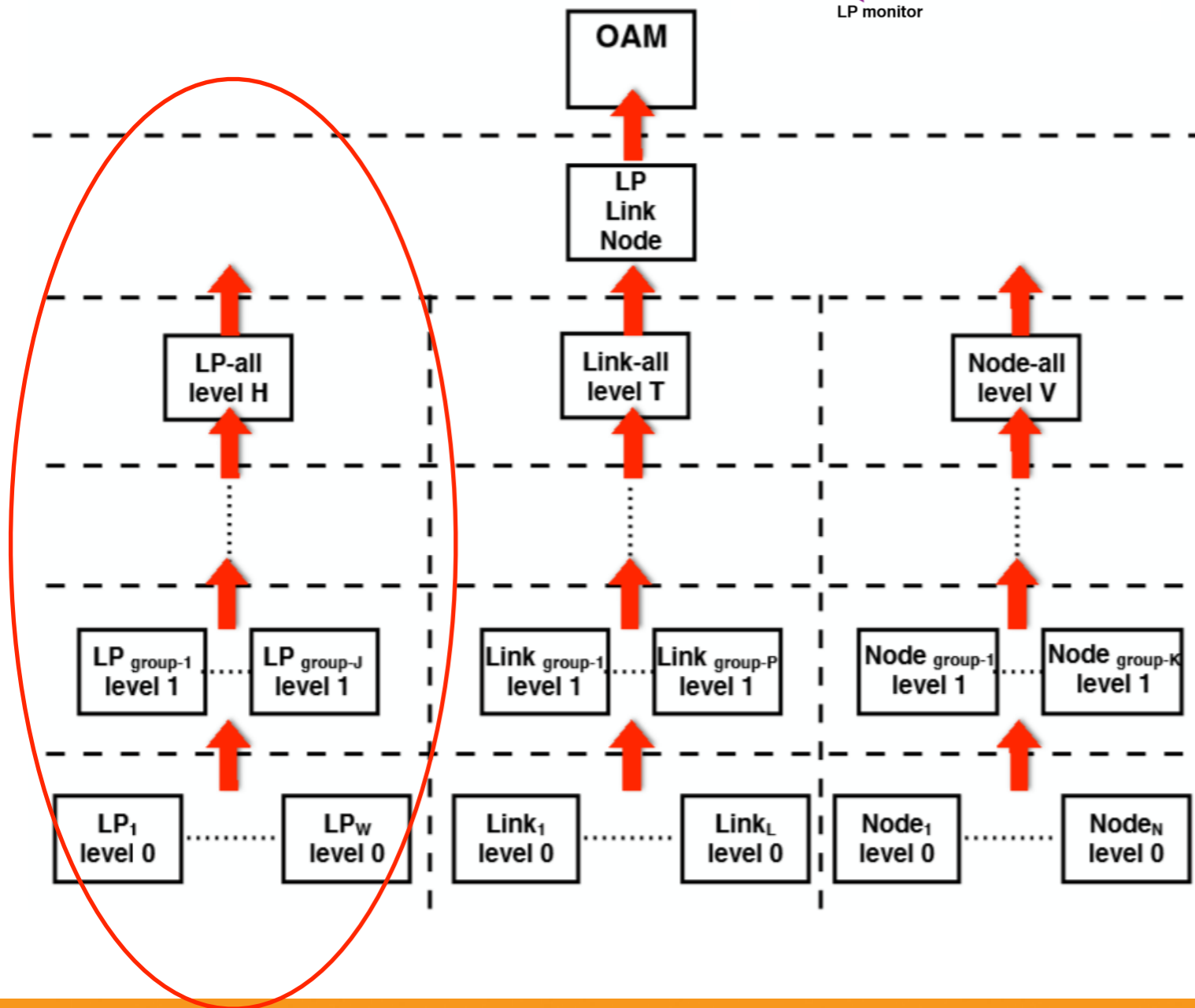
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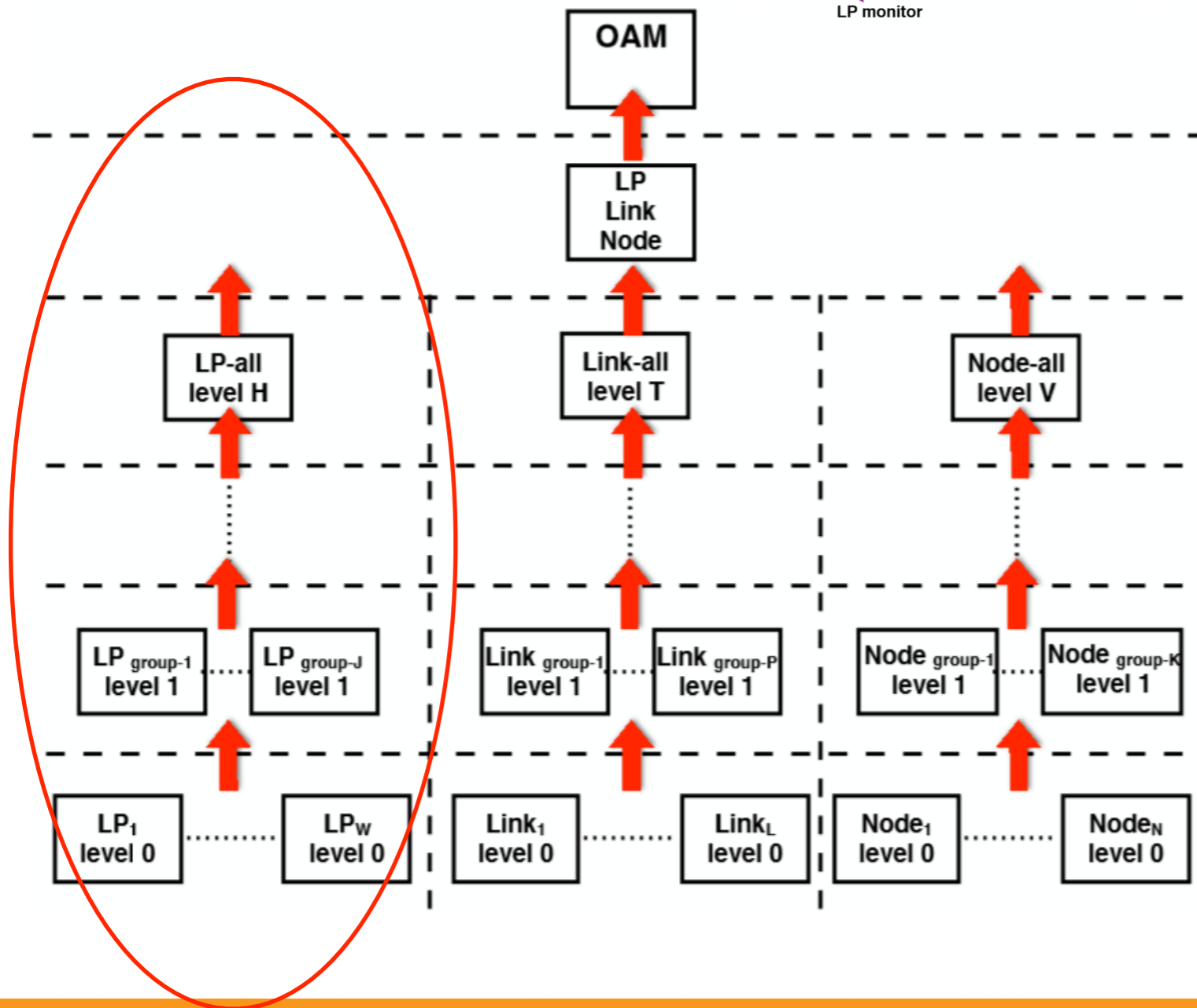
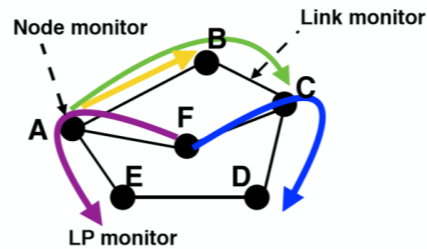
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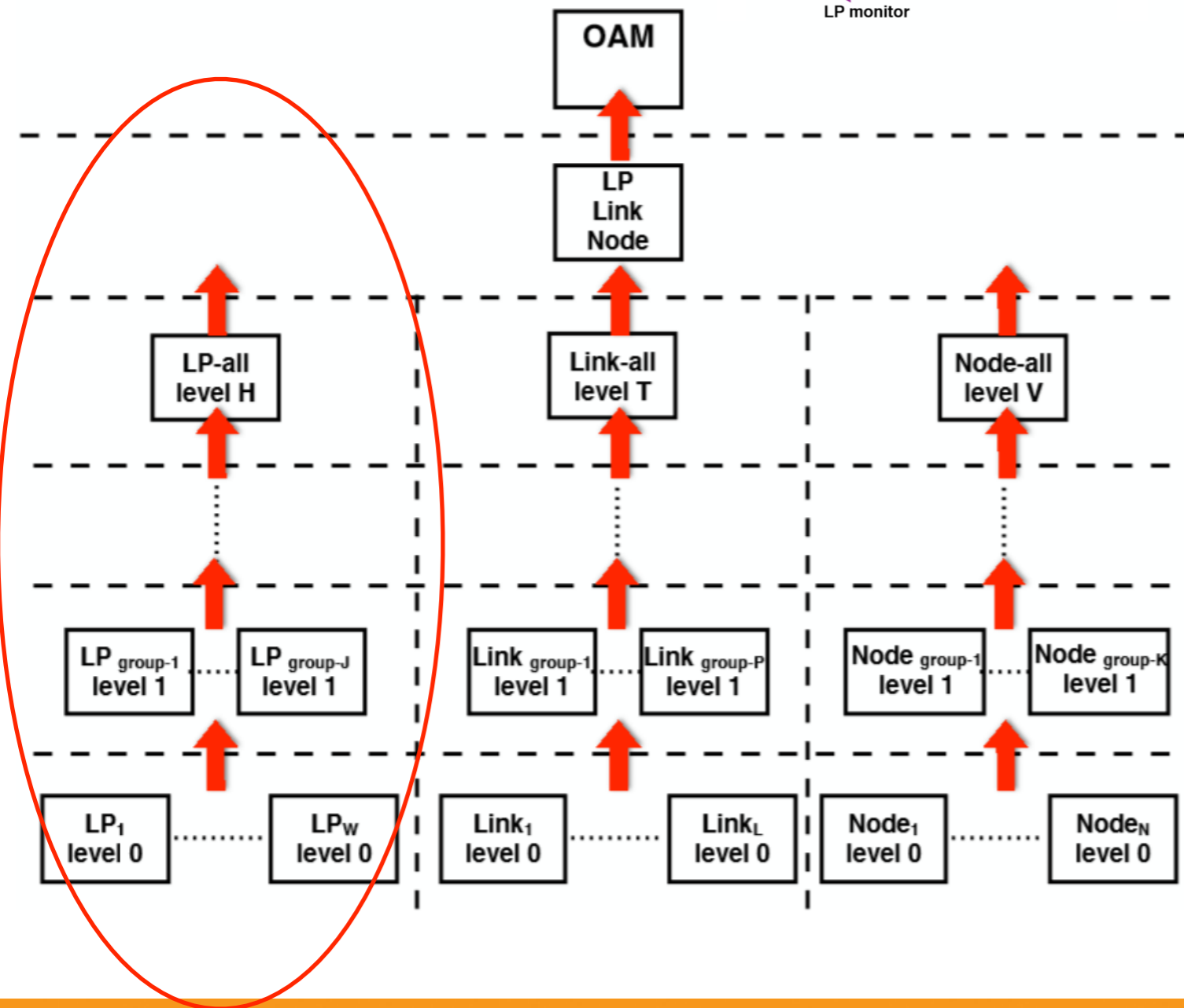
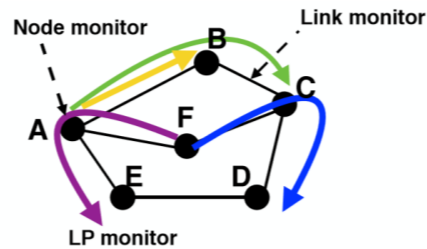
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- Assuming an amplifier malfunction in link A-B → alarms generated for the A-B LP and for A-C LP
- Alarms sent to level 1: by correlating this information, a problem can be identified in the segment A-B.



