

Ethernet Operations Administration Maintenance

Ethernet OAM

Operations, Administration & Maintenance (OAM) refers to protocols and mechanisms that help operator to achieve the so-called FCAPS functionalities.

FCAPS is the key concept used to define the overall functionality of an enterprise management system and the acronym stands for *Fault, Configuration, Accounting, Performance, and Security*.

In particular **Ethernet operations, administration and maintenance (EOAM)** refers to protocols on Ethernet networks that provide features like fault indication, performance monitoring, security management, diagnostic functions, configuration and service provisioning.

Different standards have been developed based on the concept of EOAM, such as:

- **IEEE 802.1ag**: Connectivity Fault Management (CFM) for checks, loopbacks and link trace in enterprise and carrier networks.
- **IEEE 802.3ah**: Ethernet Link OAM or Ethernet in the First Mile defines mechanisms for monitoring and troubleshooting Ethernet access links.
- **ITU-T Y.1731**: Defines performance monitoring measurements such as frame loss ratio, frame delay and frame delay variation to assist with SLA assurance and capacity planning
- **IEEE 802.1ab**: Link layer discovery protocol (LLDP) defines a protocol to discover network topology in multivendor networks.

For sake of clarity it is important to say that the [IEEE 802.1ag](#) and the [ITU-T Y.1731](#) are identical in the connectivity management part.

What ITU provides in addition to that is performance management through the mean of performance messages.

In one of the activities carried on in GEANT3, Ethernet OAM functions were tested over a dedicated testbed established by five NRENs (JANET, NORDUnet, PSNC, SURFnet and CESNET) and one University (Essex University).

The main idea behind it was gaining some initial experience in monitoring and troubleshooting wide-area point-to-point Ethernet connections using the Ethernet OAM functions.

The equipment used in the testbed was from different vendors, including Ciena, Extreme Networks, Cisco, and Brocade. Where the equipment didn't supported the required set of Ethernet OAM functions, small OAM agents on loan from vendors

(Overture and Accedian Networks) were installed in the trial sites. The links between sites were of different types: all of them had an Ethernet User Network Interface (UNI) at both ends, but in between different combinations of Multi-Protocol Label

Switching (MPLS), OTN, and tunnelling through IP were used.

The trial objectives were:

- To monitor the state (up/down) of point-to-point Ethernet connections on an end-to-end and per- segment basis using the embedded OAM functionality of the equipment under test and of OAM agents.
- To monitor the performance (throughput, latency, and loss) of Ethernet connections.
- To evaluate the possibility of hierarchical state and performance monitoring of the connections under test.
- To evaluate the capabilities of management software systems to store and visualize monitoring data. This objective is very important as in the absence of a management system, a network administrator has no other option but to manually use appropriate

command lines to invoke state and performance data periodically, which is not ideal.

The main finding from the trial is that the Ethernet OAM functions embedded in the carrier-grade Ethernet equipment can be used for effective monitoring and visualizing of the health and performance of wide-area Ethernet services.

Some problems were experienced when measuring the One-way delay and the Jitter.

The document with all results and details can be found [here](#).

Many vendors have implemented EOAM features in their devices in order to provide powerful troubleshooting tools like [layer 2 traceroute](#).

References

- [Overview of Ethernet Operations, Administration, and Management - Cisco website](#)
- [GEANT Deliverable DJ1.1.2: Transport Network Technologies – Study and Testing \(pdf file\)](#)

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