OAM CFM

OAM is abbreviation of Operations, Administration, and Maintenance. It consists of several protocols able to monitor and control Layer 2 networks in different ways:

- Connectivity;
- Traffic limit allowance;
- Traffic measurement;
- Latency;
- Breakpoint isolation;
- SNMP traps and alerts;
- Events propagation;
- Protection switching etc.

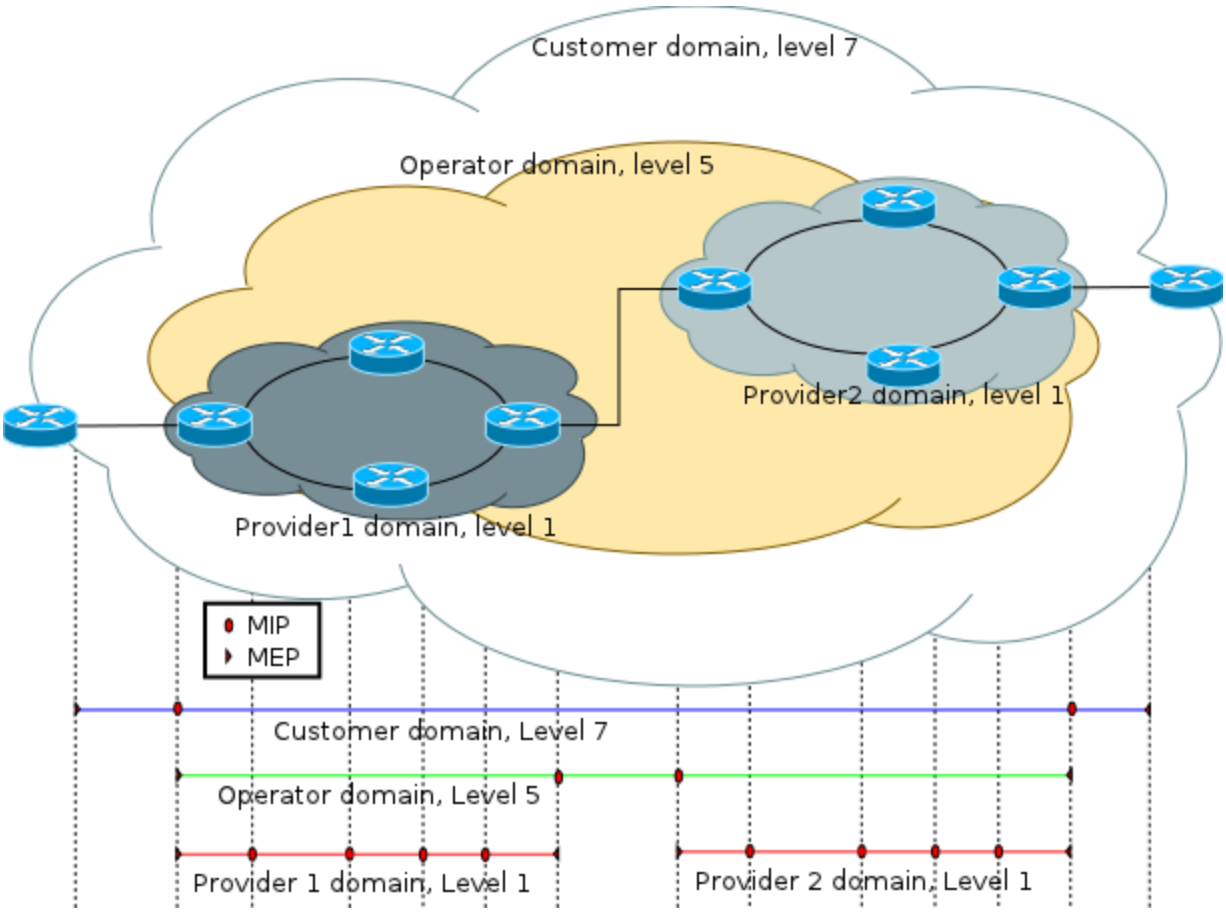
In few words, OAM provides the Layer 2 (and Layer 2.5) networks, the tools for control and monitor Layer 3 networks have.

CFM is the protocol of this family that provides Connectivity Fault Management (CFM). If we are to put Layer 2 and Layer 3 tools side by side, you may notice some similarities (and differences):

Layer 3	Layer 2	Similarity
traceroute	linktrace	Full
ping	loopback	Almost full
TCP keep alive messages	Continuity check messages	Almost the same
IP/Name resolution	Sender ID content	Not very
Routing	Protection switching	Has some similarities
TCPdump / IPTraf	SAA Y1731 test	SAA is more sophisticated.
ping -f	RFC2544 throughput test	Not very

Layer 3	Layer 2	Similarity

Those are some of the similarities. The implementation however is nothing the same as in the Layer 3 network. The L2 CFM protocol uses 8 different Maintenance Domains (MD) for monitoring the different levels of service providers, core networks or system operators. Every level has it’s own number of Maintenance Associations (MA) dedicated to monitor specific provider/provider or provider/customer service, or a VLAN in the network. And every Maintenance Association depends on a set of Maintenance Points (Called also MEPs and MIPs) for it’s monitoring purposes:



OAM monitored network

To explain this diagram, we need to know some of the dry-theory language set, used inside.

Maintenance Domain (MD): The network or the part of the network for which faults in connectivity can be managed. The boundary of a Maintenance Domain is defined by a set of MAs and MEPs, each of which can be a connection point to other Maintenance Domains or to customer equipment.

Maintenance Domain name: In addition to the MD Level every domain has it's own name.

Maintenance Association (MA): A set of MEPs, each configured with the same MAID and MD Level, established to verify the integrity of a single service instance or a single VLAN ID. An MA can also be thought of as a full mesh of MEPs.

Maintenance Association Identifier (MAID): An unique name (*identifier*) for a Maintenance Association. There are 2 parts of every MAID: the Maintenance Domain Name and the Short MA Name. This way, even with same names in different domains, the MA ID is unique.

Maintenance association End Point (MEP): An actively managed CFM entity, associated with a specific port of a service instance, which can generate and receive CFM PDUs and track any responses. It is an end point of a single MA, and is an endpoint of a separate Maintenance Entity for each of the other MEPs in the same MA.

Maintenance domain Intermediate Point (MIP): A CFM entity that is not actively managed. It is a physical port member of the monitored VLAN or service in the network.

Continuity Check Message (CCM): A multicast CFM PDU transmitted periodically by a MEP in order to ensure continuity over the MA to which the transmitting MEP belongs. No reply is sent by any MP in response to receiving a CCM.
OAM frames from higher domain levels go absolutely transparent over the MPs of lower level domains. This way, a customer line (or service) monitored with Domain of level 7 will have its CFM packets all the way through the Service operator and network provider domains untouched. If the Customer support wants to monitor the line between the border switches in this network, the service provider domain will pass the OAM packets to their destination untouched.

Same is valid with the two Network provider's Rings in the diagram. They will allow the level 5 domain CFM packets to go to their destination over the active or the backup link of their Rings.

The End points (MEPs) are responsible to filter or process the CFM packets on the ports they are set. If an equal to their Domain level CFM packets are received, the MEPs need to process them. If higher then their level CFM frames are received, the MEPs need to pass them transparently. And if they receive lower level CFM packets – the MEPs need to drop them so they don't go to supposedly higher level domains behind the Maintenance End point. With this logic – customer equipment is not supposed to receive CFM packets from Provider or Operator equipment and the Operator equipment will not receive CFM packets from the Provider.

The End points (MEPs) also distinguish the different Maintenance associations (MAs) and do not process packets from other associations different from their own. So far, any MA can have a set of no more than 8192 MEPs identified by their ID number (1..8192) and different MAs can have MEPs with same ID numbers (*This proved to be bad practice in my work*). No matter if the local MEP expects to receive a CCM message from MEP with ID 100, it will discard it if this CCM is sent from another MA. With this logic, regardless Provider 1 and Provider 2 are monitoring their ring networks with the same maintenance domain level, their OAM packets will not interfere with each other. This is important logic, because OAM controlled ring (e.g. R-APS ring) can easily be looped if wrong control packet is received.
Every maintenance point (MEP or MIP) is a physical port on the device. Every MEP generates CCMs (Continuity Check messages). Every MIP has to pass those CCMs to the next MIP or MEP in the same VLAN (or service) as his own.

CCMs are the heartbeat of the OAM monitored network. If the Heartbeat stops – then there is a failure. This failure will generate an event or an SNMP trap. Those events and traps can trigger actions or be logged for later analysis. This is basically what OAM protocol family is all about. (check the next chapter CCMs and MEP types)

Source : http://www.m0rd0r.eu/category/l2/page/3/