Quality Statement

AMS-IX offers high quality services over a technologically advanced and resilient platform supported by a professional organisation. In practice this means we are offering carrier grade service levels[1].

All our connected members receive the same high level of service based on the quality parameters in this document. These parameters have been defined by the need to comply with the high quality expectations of our members. The service quality is measured continuously by a Trusted Third Party (namely the RIPE NCC through their publicly available Test Traffic Measurement Service) and is published in the monthly report on our website.

Service Demarcation

AMS-IX is responsible for the correct functioning of its switching infrastructure. The AMS-IX service consists of delivering, operating and interconnecting member ports on our switches, including service from the member ports up to and including the local AMS-IX patch panel.

The member is responsible for the necessary cabling between the member's router and the AMS-IX switch patch panel through the arrangements made with an AMS-IX co-location or in case of a remote layer-2 connection, arrangements made with a partner/carrier. The member is always responsible for arranging its own BGP peering with other AMS-IX members and for the correct functioning of its own network infrastructure, i.e. router equipment.

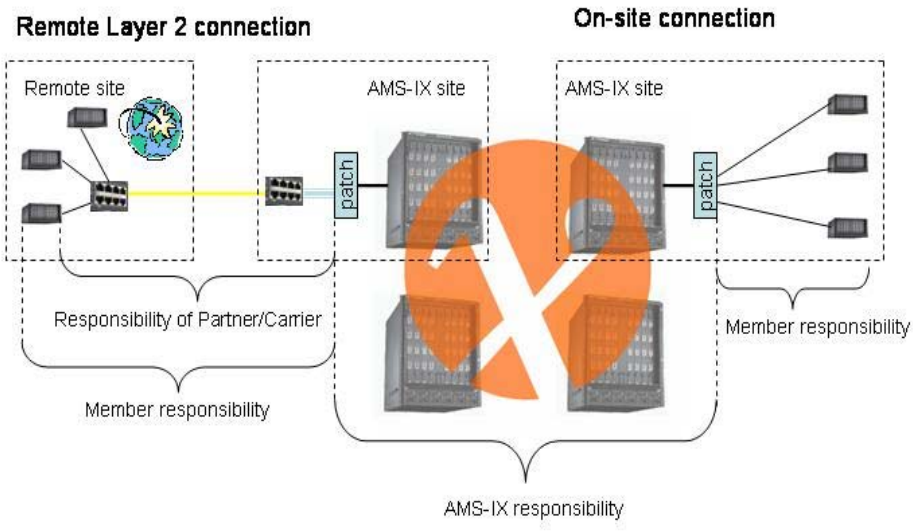


Figure 1: Responsibility diagram

[1] Since we are a mutual organisation we do not have penalty schemes associated with our quality of service performance and therefore this document should not be seen as a Service Level Agreement (SLA).

Service Delivery

Initial connection
The initial delivery of service is a maximum of 3 working days (for 10GE a 15 working day period is valid) after acceptance of the member to the Association and after return of the signed Connection Agreement by the candidate member, or on the envisaged date of connection, as indicated by the member in the membership request form. The acceptance process to the Association may take up to 3 working days.

Upon first delivery of service the port will initially be placed in the quarantine VLAN. This allows the member to physically install/configure their router and other equipment at the housing location(s), finalise the cabling arrangements with the co-location or layer-2 service provider and subsequently verify basic (L1/L2 and ping) connectivity to the AMS-IX platform. Also, this stage of the process allows the AMS-IX NOC to verify that the member's equipment is configured according to the AMS-IX rules for connecting. Once this is done and the AMS-IX NOC has concluded that the interface is “clean” (see item service quality), the interface is placed into the appropriate production VLAN.

Connection changes
For changes in the configuration without contractual implication we schedule a provisioning time of 1 working day.

For configuration changes with a contractual implication, e.g. additional connections or port upgrades, we schedule a provisioning time of a maximum of 3 working days after receipt of the signed revised Connection Agreement (for upgrading to 10GE a 15 working day period is valid).

The member can always indicate his own envisaged date of delivery, which AMS-IX will honour as much as possible.

Network & Service Availability

The aim of the AMS-IX Network Operations Centre is to have a network availability of at least 99.99%. AMS-IX considers both service interruption as well as deterioration of service as service failure.

Excluded from this definition are service failures due to:

- ⇒ scheduled maintenance
- ⇒ violations of AMS-IX regulations by members causing dis-functioning of the exchange
- ⇒ force majeure

Service deterioration is defined as not performing according to the set performance parameters outlined below.

Service Quality

Port Hygiene

AMS-IX strives to maintain very high levels of quality of service for all of its members. We are able to maintain this high service quality because of our rigorous testing of new installations and equipment, our adhering to standard procedure where possible, while being flexible where necessary. In addition we make sure when connecting new members that the member is aware of, and adheres to, the rules for allowed traffic types on the AMS-IX infrastructure. These rules are enforced in part by actively monitoring the platform, in part by switch configuration statements. In this way we limit the potential risk, that is inevitably present in a layer 2 network environment, of ill-behaving member equipment adversely affecting other members' service. We sometimes refer to these rules as 'port hygiene measures'.

Service quality targets

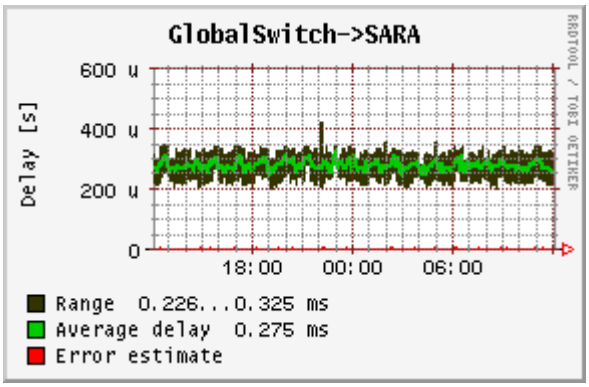
Port availability ('uptime')*	The individual service availability objective per port is at least 99,99 % per year.
Packet loss**	The packet loss between two typical customer ports on the AMS-IX platform should be less than 0.05% in any 24 hour timeframe. An exception is made for ports with a 5 minute average traffic load larger than 80% for either incoming or outgoing traffic. Packet loss is measured between ports on each edge switch on the AMS-IX platform. These ports are used as being representative for customer ports. Measured packet loss between these ports should be less than 0.05% in any 24 hour timeframe.
Packet delay***	Packet delay is measure between ports on each edge switch in the AMS-IX platform. These ports are used as representation for customer ports on these edge switches. The target performance in packet delay is for 97.5% of the packets to have a delay less than 0.5 ms
Inter packet delay variation (IPDV)	Jitter (or IPDV) is measured between ports on each edge switch in the AMS-IX platform. These ports are used as being representative for customer ports on these edge switches. The target performance in IPDV is for 97.5% of the packets to be between -0.1 and +0.1 ms.

The above targets are will be monitored by an independent party (see next paragraph) and results will be reported on the AMS-IX website, as well as independently.

Performance Measurement
The performance of the network is measured continuously by a neutral and trusted third party, RIPE NCC – through the TTM project. RIPE's Test Traffic Measurement Service (TTM) measures key parameters of the connectivity between points on the Internet, in this case the AMS-IX switches. TTM Measurements used by AMS-IX include one-way delay, packet loss, and delay variation (jitter).

The TTM data for the AMS-IX platform is accessible via the AMS-IX monthly report, as well as via a real-time look at the data. The monthly report includes detailed statistics providing delay, packetloss and jitter graphs. The real-time look provides delay and packetloss graphs.

Real-time delay statistics

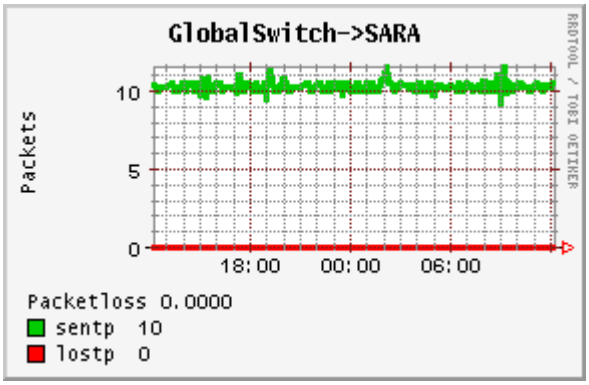


Graph 1: real-time view at the RIPE TTM data for delay statistics

In the real-time view for delay statistics several parameters are visible:

- Average delay – A 5 minute delay average
- Range – The range is a 5 minute view on the minimal and maximal values
- Error estimate – This is a projection of the accurateness of the GPS time calibration antenna. If the error estimate rises, the delay data is less accurate.

Real-time packetloss statistics

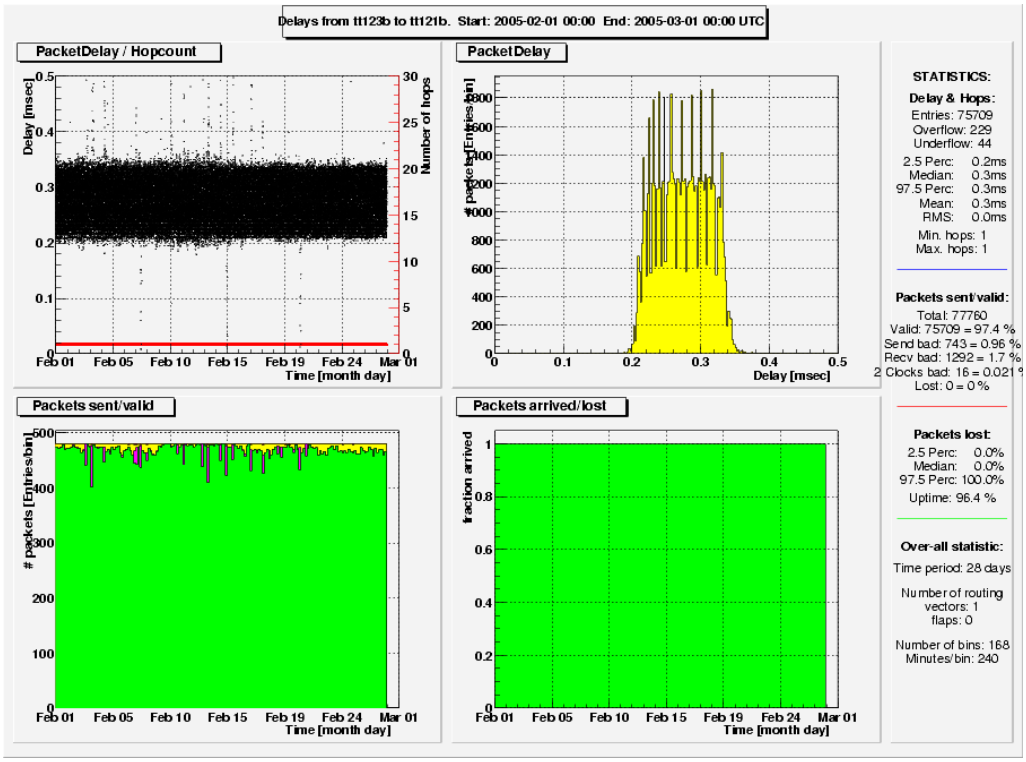


Graph 2: Real-time view at the RIPE TTM data for packetloss statistics

In the real-time view for delay statistics several parameters are visible:

- sentp – This is the average amount of sent packets for the visible area of the graph
- lostp – This is the average amount of lost packets for the visible area of the graph
- packetloss – This is the calculated packetloss derived from the sentp and lostp values

Monthly report delay statistics

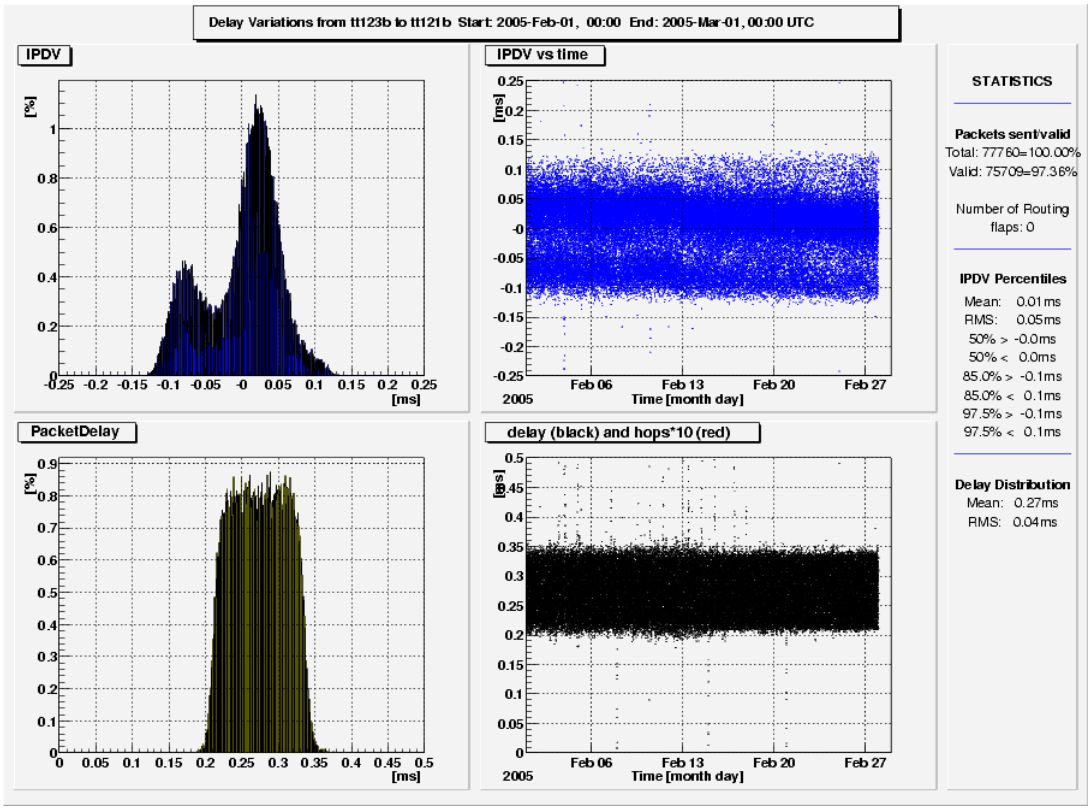


Graph 3: Delay and packetloss statistics from the AMS-IX monthly report

In this figure several graphs are visible:

- PacketDelay / Hopcount – This is a graph providing insight in the delay statistics. Every black dot represents a uni-directional measurement consisting of one packet. Time is shown on the X-axis and delay in milliseconds is shown on the Y-axis.
- PacketDelay – This is an alternative view on the delay statistics providing information about spread of the packet measurements. The X-axis represents the delay in milliseconds and the Y-axis represents the amount of packets.
- Packets sent/valid – This is a view on the amount of packets that are sent with a valid timestamp. The timestamp is calibrated using a GPS antenna. When the reception conditions are well not enough to generate a valid timestamp, a packet will be discarded. This does not say anything about the switch platform.
- Packets arrived/lost – This is a view on the amount of lost packets in the platform.

Monthly report jitter statistics



Graph 4: Jitter statistics from the AMS-IX monthly report

In this figure several graphs are visible:

- IPDV – This graph shows a view on the variation in delay of uni-directional, consecutive packets (packet 1 and 2, 2 and 3 etc).
- IPDV vs Time – This graphs shows the variation of the IPDV over time.
- PacketDelay – This graph shows the variation of the delay. On the X-axis is the delay in milliseconds, on the Y-axis the amount of packets in (%).
- Delay (black) and hops*10 (red) – This is the delay and hops*10 over time. At the AMS-IX switch platform all hopcounts are 1. This is why there is no variation in hop counts.

Trouble ticket support

Our Network Operations Centre actively monitors the AMS-IX infrastructure 24 hours/day, 7 days/week. Problems can be reported to the AMS-IX NOC via email or telephone. The NOC operates normal office hours (09:00 - 17:00 CET Monday to Friday). Outside of these hours there are engineers on-call that can be reached 24x7 for issues that require immediate attention. Note that the 24x7 on-call engineer is to be contacted in case of emergency only.

When a problem is reported, the AMS-IX NOC opens a trouble ticket and assigns an engineer to resolve the problem. The member is kept up to date of resolution by email. In exceptional cases, e.g. when a member cannot be reached via email because of the reported network failure, the NOC can agree to keep the member's staff up-to-date by phone instead.
In case of service failure (disruption or deterioration) we aim to resolve within 4 hours of reporting. Other issues or requests will be resolved as soon as possible.
A ticket will not be closed without the member's consent.

In case a member feels there is a need to escalate a problem, the requests are relayed to our Chief Technical Officer.

All trouble tickets can be reviewed through the member portal on the AMS-IX website. In many cases problems are discussed on our interactive tech-l@ams-ix.net mailing list to which the AMS-IX NOC and most members' technical contacts are (or can be) subscribed

Maintenance

To ensure the required Quality of Service and facilitate continuous growth, the AMS-IX platform is maintained on a day-to-day basis and upgraded regularly. Such upgrades are always carried out during scheduled maintenance, for which two maintenance window time frames are in use:

- Non-disruptive maintenance: Mondays to Fridays between 00:00 and 04:00 hours CET.
- Disruptive (or potentially disruptive) maintenance: Tuesday or Thursday between 04:00 and 06:00 hours CET.

Scheduled maintenance is always announced to the following mailing lists: tech-l, grxtech and ops-announce-l.

Scheduled maintenance is defined as follows:

- A period of time during which the AMS-IX platform may not perform at the usual quality level. This is typically related to work being done to fix or improve the platform. Scheduled maintenance is always announced to the relevant mailing lists at least 72 hours before it is taking place.

In addition to the above, it may occur that equipment needs to be replaced immediately, because of hardware or software malfunctioning detected by the AMS-IX NOC. In such cases the replacement work may involve so called Unscheduled Maintenance which will also be announced to the above mentioned mailing lists, however it will not be announced well in advance. This, of course, follows from the immediate nature of the required repair activity and is always up to the discretion of the AMS-IX technical team.