Multicast tests on the GÉANT Network

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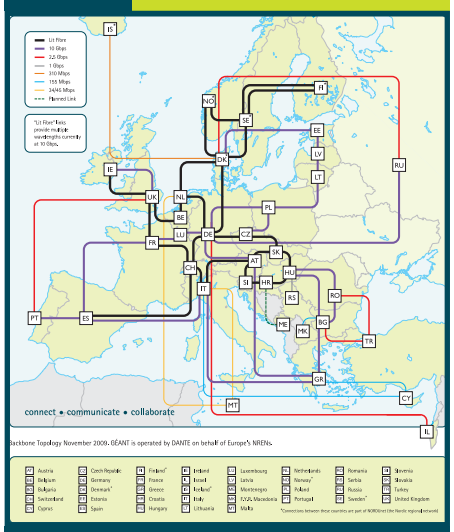
GÉANT
connect • communicate • collaborate

1 GÉANT



The GÉANT network is the fast and reliable pan-European communication infrastructure serving Europe's research and education community.

The GÉANT network is now in its third generation. It is co-funded by NREN members and the EC under the EUs 7th R&D framework programme.

2 Multicast

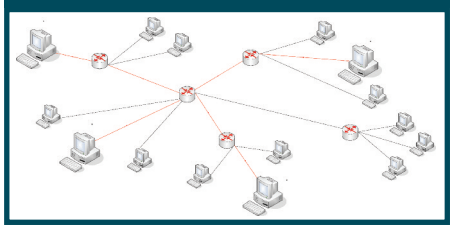
Multicast is an efficient technique to deliver messages to several destinations in a network when several hosts are interested in the same message and/or when the receivers are unknown to the sender.

Messages are sent to a group. A group is identified by a group address. Interested hosts join the group.

Routers collaborate to create distribution paths for messages sent to multicast groups.

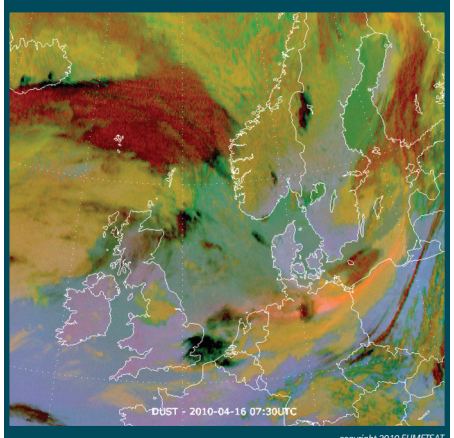
The multicast distribution tree for a group is constructed when the receivers join the group. The tree construction is initiated by the routers that are close to the receiver.

Just one copy of the message is sent by the source to the group: the links are used only once and copies of the message are generated just when the links to the multiple destinations split.



3 EUMETSAT

Operating a fleet of meteorological satellites, one of the main objectives of the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) is to deliver weather and climate-related satellite data, images and products– 24 hours a day, 365 days a year.



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EUMETSAT is interested to gain some technical expertise on the possibilities of high volume multicast via terrestrial links, and in cooperation with DANTE, several tests on such high volume multicast file transfers will be conducted using the GÉANT-NREN production network.

The measurements presented in this poster were designed to test the performance of the network, in preparation for the high volume file transfer tests.

4 Tests methodology

Software tools used during the tests:
- UDPmon: unicast tests to characterize the hosts involved
- Mcastmon: multicast tests
- custom made scripts

Tests carried out:
- throughput
- packet loss
- inter-packet spacing

The tests were run to investigate the multicast capabilities of the GÉANT network. Some tests were run in preparation for a collaboration with EUMETSAT.

The servers involved were first tested for their network capabilities, then for their multicasting ones.

UDP was the network protocol used to investigate the network capabilities of the hosts, so that no effect from congestion control mechanism would affect the results.

5 The sites involved in the tests

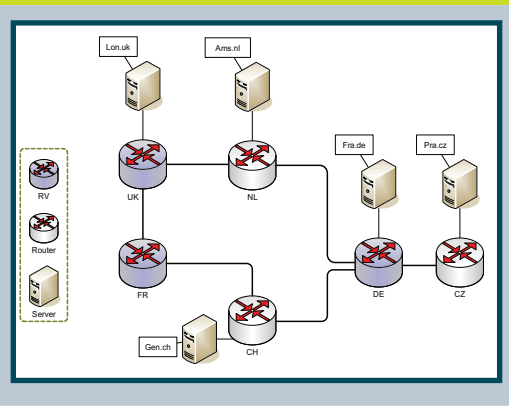
The GÉANT network is an Autonomous System identified by the AS number 20965.

The multicast GLOP addresses available to this network are class D addresses in the range between 233.81.229.0. and 233.81.229.255. They are calculated according to RFCs 2770 and 3180.

Eleven group addresses have been used during the tests presented here: 233.81.229.10 →20.

Three sets of nodes have been employed for testing purposes:
- Amsterdam, Geneva, Prague;
- Amsterdam, Frankfurt, Geneva, London, Prague.
- London and Prague

Rendez-Vous points (RV) are located in Paris, Frankfurt and London. The nodes were chosen according to their relationship with the RVs.



6 Hosts characterization

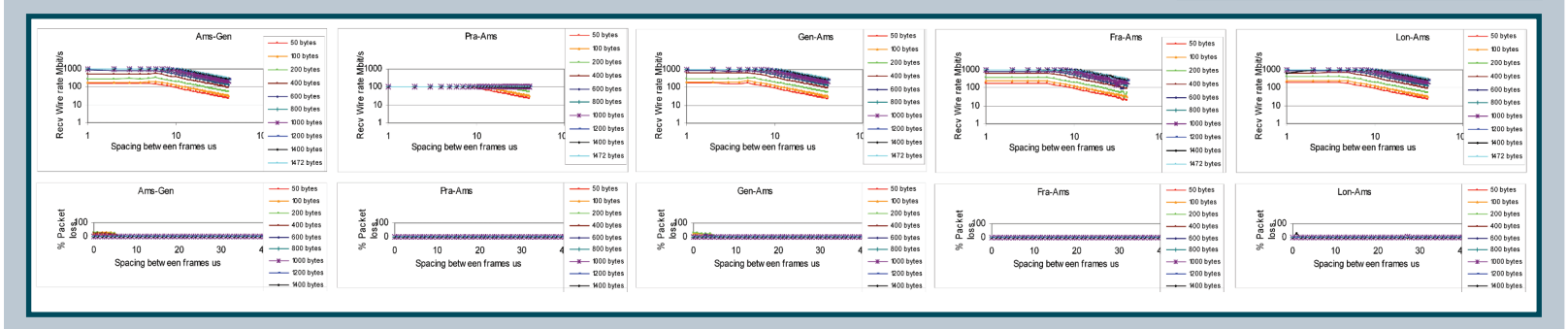
UDP throughput and packet loss

Ideally the log-log unicast throughput plot of a 1 Gbps network interface should look like the one plotted at the right.

Depending on the packet size, the lines start at the maximum available throughput and then fall like 1/t for inter packet spacing larger than the one corresponding to the line speed.

1472 Bytes packets reach line speed at 12.3 µs, while 50 Bytes packets reach it at 0.9 µs. The packet loss should ideally be zero.

In the real world, the network elements connected on the route between the hosts can affect their performances. The following are the plots related to the servers involved in the multicast tests:

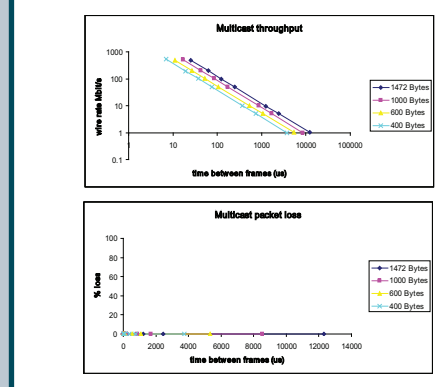


According to the preliminary tests, all the servers are suitable to be used for multicast testing. The server in Prague had the network interface incorrectly set to 100 Mbps. Once its configuration was correctly set, the server in Prague was tested again and proved to be suitable to be used for multicast testing.
The range of interest is the one between 1 and 500 Mbps, corresponding to inter packet spacing between 12304 and 25 µs: no packet loss is experienced in the range of interest.

7 Multicast test results

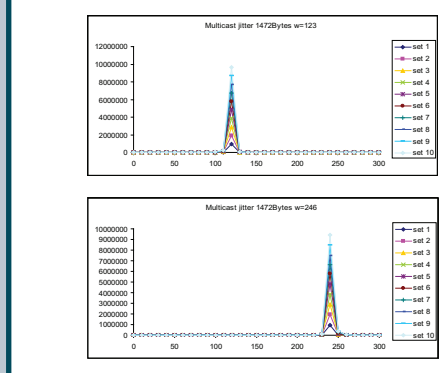
Multicast throughput

Multicast throughput tests were run with different packet sizes and different desired bandwidth.



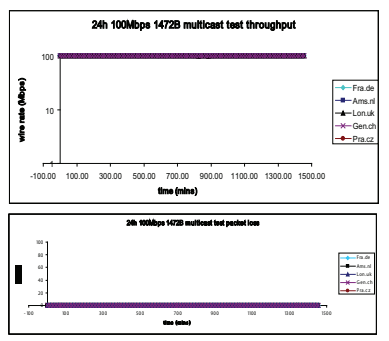
Multicast jitter

Multicast jitter tests reported the inter-packet arrival time being the desired inter-packet spacing.



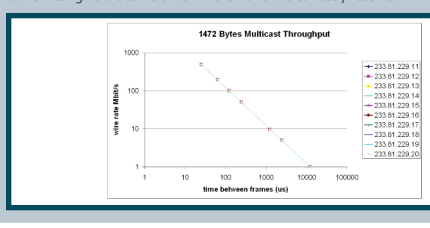
Long run throughput tests

Long run multicast tests have shown that the network can sustain long term multicast transmission.



Multiple flows

Tests of multiple simultaneous multicast flows (up to 10) were run.
Different receivers were listening to their own group while different senders were transmitting at the same time. All the flows are correctly received.



Conclusions

The multicast tests showed that:
- The GÉANT network is capable of successfully transporting high-bandwidth multicast traffic.
- Once the multicast distribution tree is set up, no packet loss is experienced under normal conditions.
- The GÉANT network also supports simultaneous multicast flows using different groups.

DANTE
www.dante.net

EUMETSAT

www.geant.net

References
UDPmon, mcastmon by Richard E. Hughes-Jones (DANTE and The University of Manchester)
Multicast: RFC 3171, RFC 2770, RFC 3180. http://www.ietf.org/rfc.html
EUMETSAT: http://www.eumetsat.int

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