



# EUMETCast Terrestrial over AMT

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# Agenda

## EUMETSAT Introduction

## EUMETCast Terrestrial over AMT

- System overview
- Characteristics
- Status

## GEANT Introduction

## AMT Relay Setup

- AMT Relay configuration and installation
- Performance evaluation
- Evolution

## Q&A



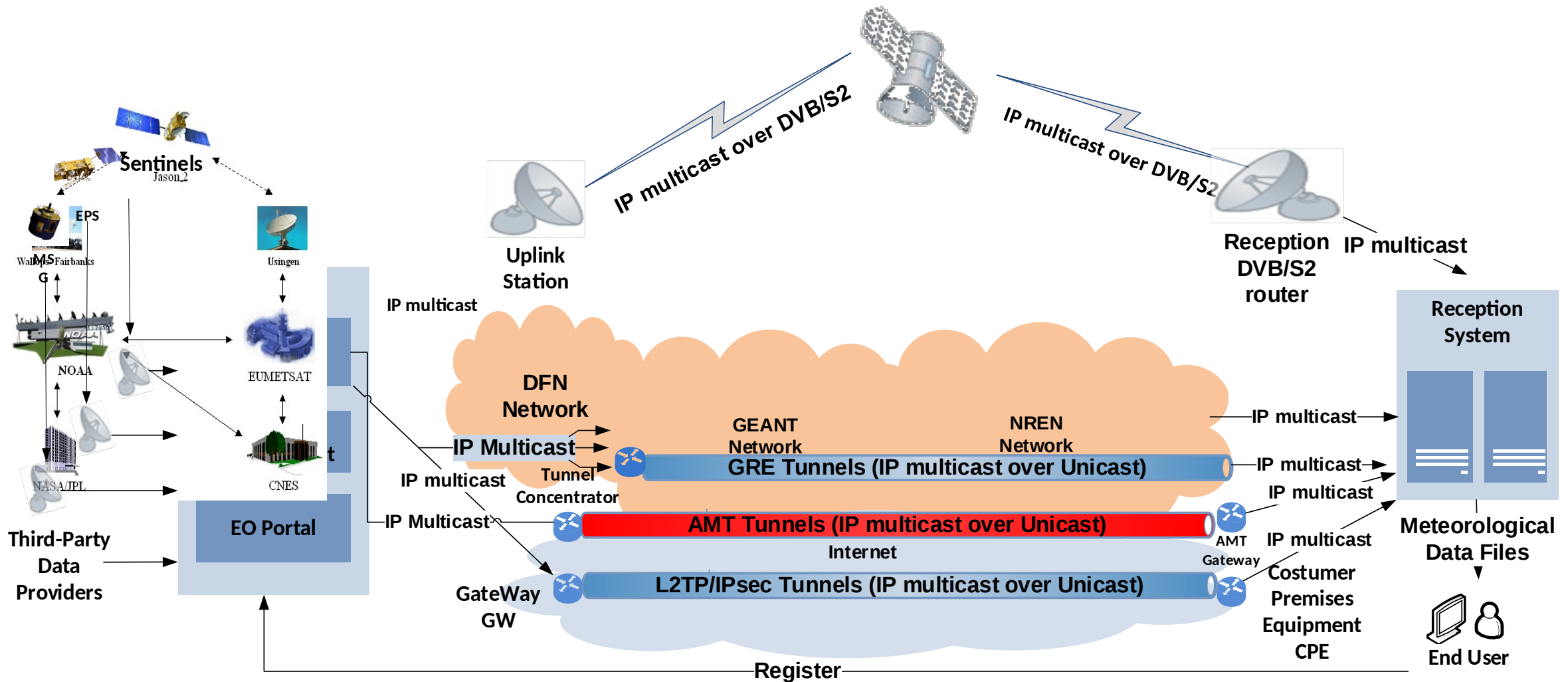
# EUMETSAT Introduction

- European Organization for the Exploitation of Meteorological Satellites
- Intergovernmental public sector organization created in 1986 through an international convention and agreed by a current total of 30 European Member States.
- Primary objective is to establish, maintain and exploit European systems of operational meteorological satellites. EUMETSAT is responsible for the launch and operation of the satellites and for **delivering satellite data to end-users** as well as contributing to the operational monitoring of climate and the detection of global climate changes.
- Established cooperation with operators of Earth observation satellites from Europe, China, India, Japan, Russia, South Korea and the United States



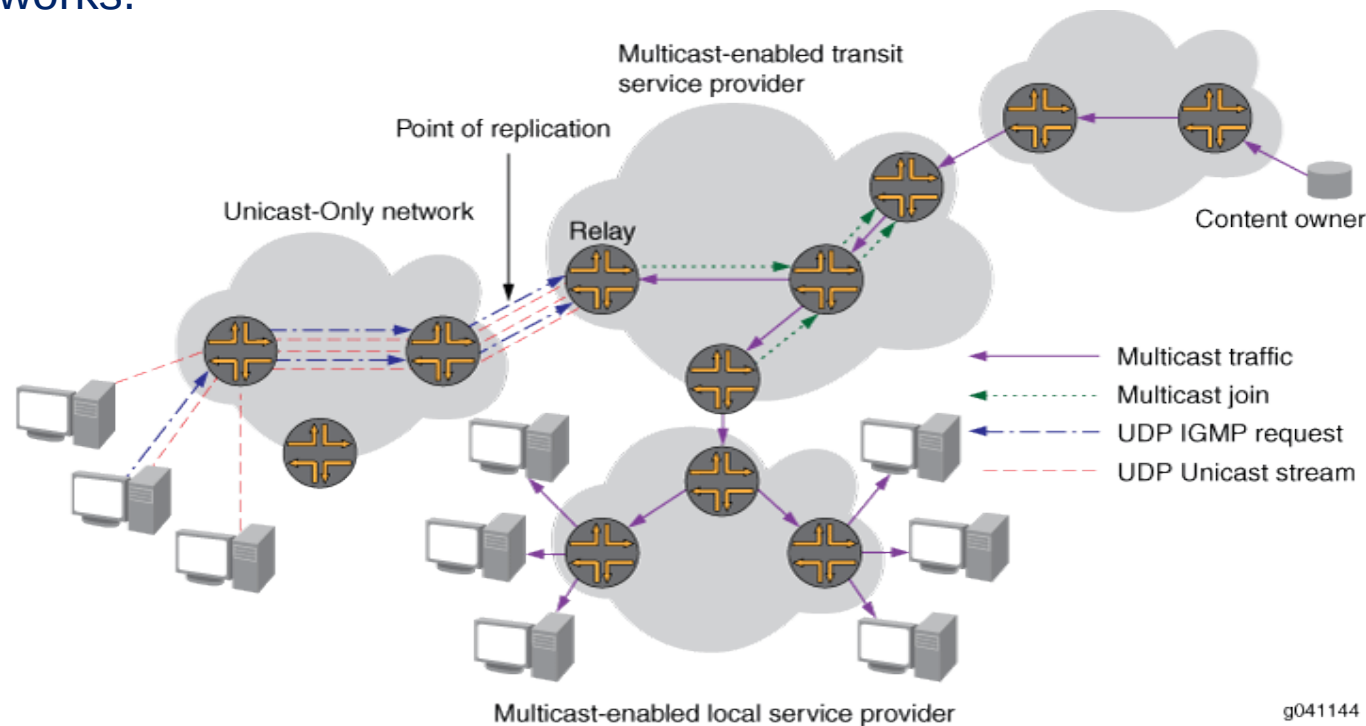
■ Member states  
■ Cooperating states

# EUMETCast Satellite and Terrestrial Services



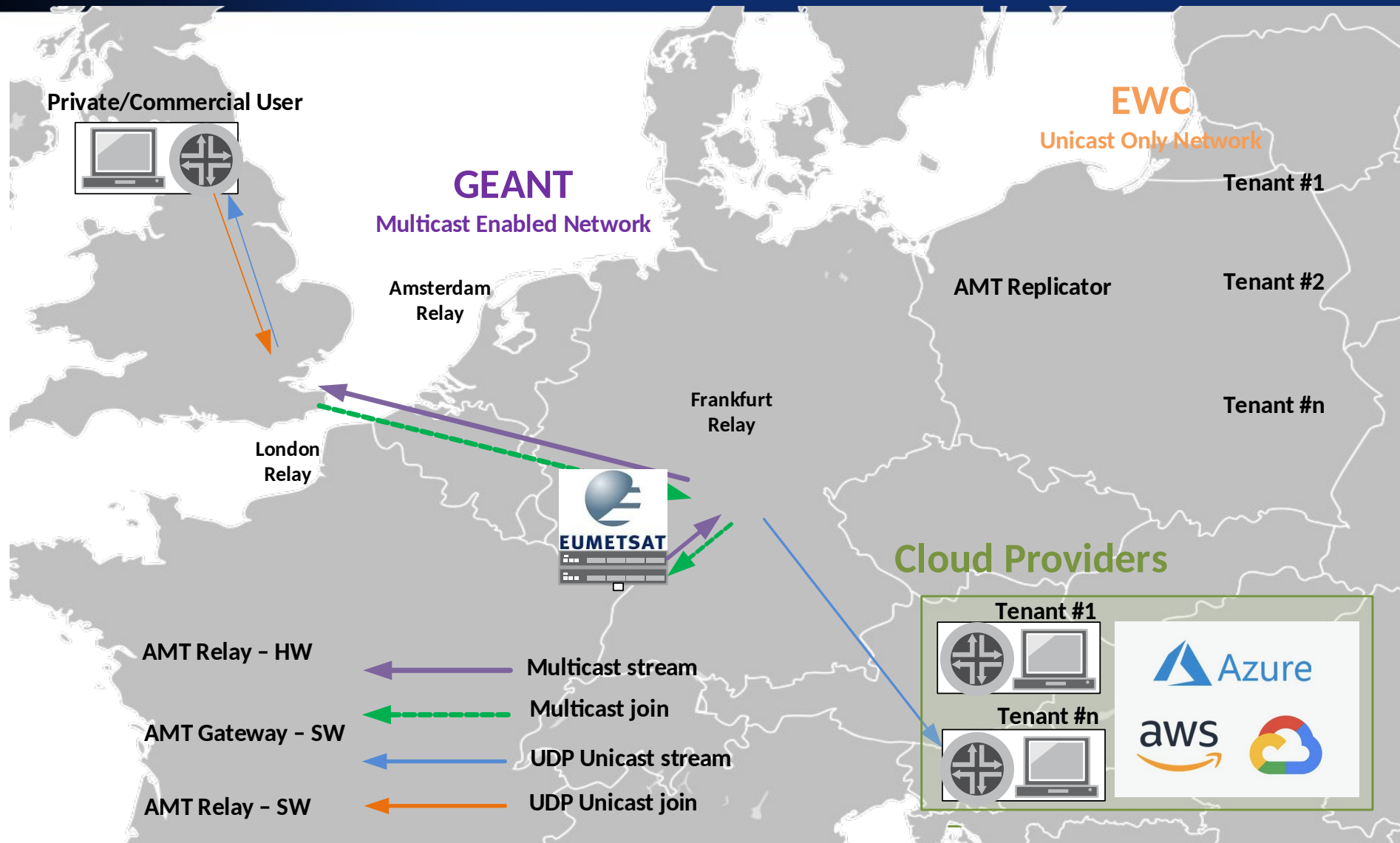
# EUMETCast Terrestrial over AMT

- **Problem:** The Internet is not multicast enabled and therefore, this service is not available to everyone
- **Solution:** Automatic Multicast Tunnelling
- **Purpose:** Creates multicast tunnels dynamically between multicast-enabled networks across islands of unicast-only networks.



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# EUMETCast Terrestrial over AMT



# AMT Software

- Open source software supported by Juniper Networks as a product of the MBONED Working Group of the Operations and Management Area of the IETF
- Software repositories:
  - AMT SW Gateway: <https://github.com/GrumpyOldTroll/amt/>
  - AMT SW Relay: <https://github.com/GrumpyOldTroll/amtrelayd>
- Challenges identified on VM:
  - Steal time monitoring
  - UDP Buffer size tuning
  - Failover functionality

# AMT Benefits

- ✓Carrier independent: Internet, NRENs,...
- ✓Software solution
- ✓Straightforward setup
- ✓NAT Traversal: No router configuration necessary by end user
- ✓Firewall Friendly: No rule updates necessary
- ✓Registration and Subscription management via the EO Portal
- ✓EUMETSAT data is encrypted
- ✓EUMETSAT is fully in control of what files are delivered to what user

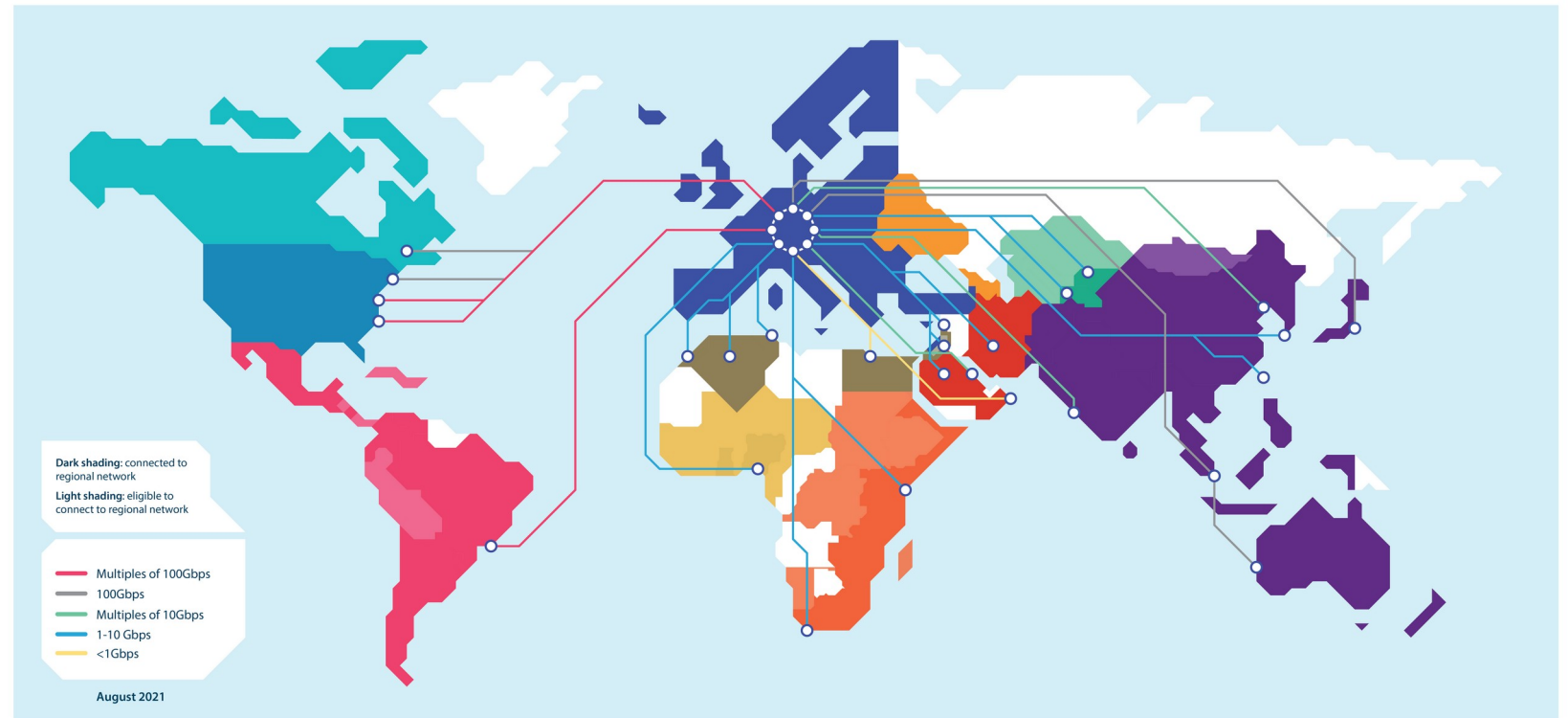
# Status

- Throughput and performance testing complete
  - ✓ 99.986% availability on EWC client!
- EUMETCast Terrestrial over AMT station setup in EWC
- EUMETCast Terrestrial over AMT station setup in AWS
- Ongoing discussions with EUM member states and bilateral partners regarding AMT setup
- Planned operational service: Q3 2023!

# GEANT Introduction

The GÉANT network interconnects research, education and innovation communities worldwide, with secure, high-capacity networks.

We design, plan, build and operate the large-scale, high-performance GÉANT network that connects European NRENs to each other and the rest of the world for sharing, accessing and processing the high data volumes generated by research and education communities and for testing innovative technologies and concepts.



Canada & USA	Latin America	Europe	North Africa & Eastern Mediterranean	West & Central Africa	Eastern & Southern Africa	Central Asia	Asia-Pacific	Other R&E Networks

# Membership Association

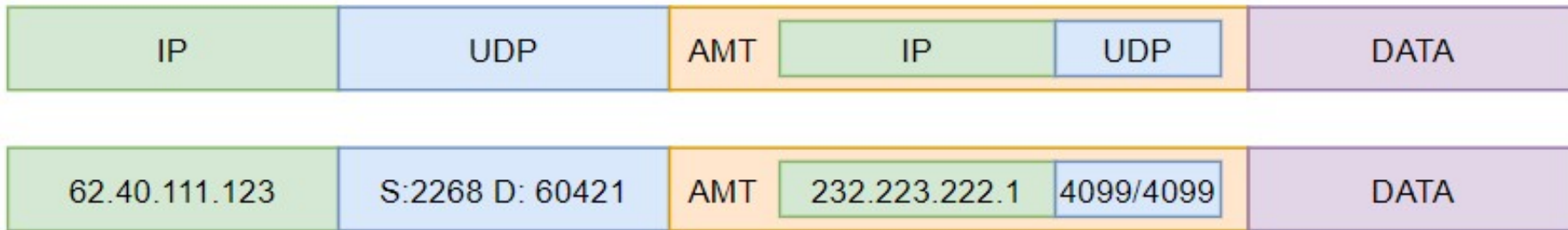
**Mission:** To empower Research and Education with an open, innovative, and trusted information ecosystem.

**In Europe:** 38 NRENs + NORDUnet, supporting 10,000 institutions and 50 million academic users



# AMT Overview

- Multicast over Unicast
- Providing Multicast services for customers on unicast only networks.
- Dynamic AMT sessions remove the requirement for static GRE tunnels.



```
> Internet Protocol Version 4, Src: 62.40.96.18, Dst: 62.40.111.123
> User Datagram Protocol, Src Port: 2268, Dst Port: 60421
v Automatic Multicast Tunneling
  0000 .... = Version: 0
  .... 0110 = Type: Multicast Data (6)
  Reserved: 00
  Multicast Data: 45000594764640000611681dc1110903e8dfde0110031003058070ed0231fd2f636905e8...
  > Internet Protocol Version 4, Src: 193.17.9.3, Dst: 232.223.222.1
  > User Datagram Protocol, Src Port: 4099, Dst Port: 4099
  > Data (1400 bytes)
```

# AMT Relay Design



- Juniper MX204
  - AMT in hardware using tunnel services and ASIC
  - Vendor supported.
  - Automation using standard tools (Ansible/Jenkins/Robots)
- Relay-On-A-Stick
  - Single upstream connection using Aggregated Ethernet (LACP)
  - Simple deployment, very basic protocol configuration.
  - Redundancy client side with connections to multiple relays.

# Base Configuration

```
protocols {
  amt {
    relay {
      family {
        inet {
          anycast-prefix 62.40.96.41/32;
          local-address 62.40.96.41;
        }
      }
      tunnel-limit 10000;
      unicast-stream-limit 999;
      accounting;
    }
  }
  igmp {
    interface all {
      version 3;
    }
    amt {
      relay {
        defaults {
          version 3;
        }
      }
    }
  }
}
```

# Diagnostic Output

```
amt1> show amt tunnel detail
```

```
AMT gateway address: 64.225.128.44, port: 60737  
AMT tunnel interface: ud-0/0/0.1048576  
AMT tunnel state: Active  
AMT tunnel inactivity timeout: 239  
Number of groups: 60  
  Group: 232.223.222.1 Include Source: 193.17.9.3  
  Group: 232.223.222.2 Include Source: 193.17.9.3  
  Group: 232.223.222.8 Include Source: 193.17.9.3  
  Group: 232.223.222.69 Include Source: 193.17.9.3
```

```
AMT message count:
```

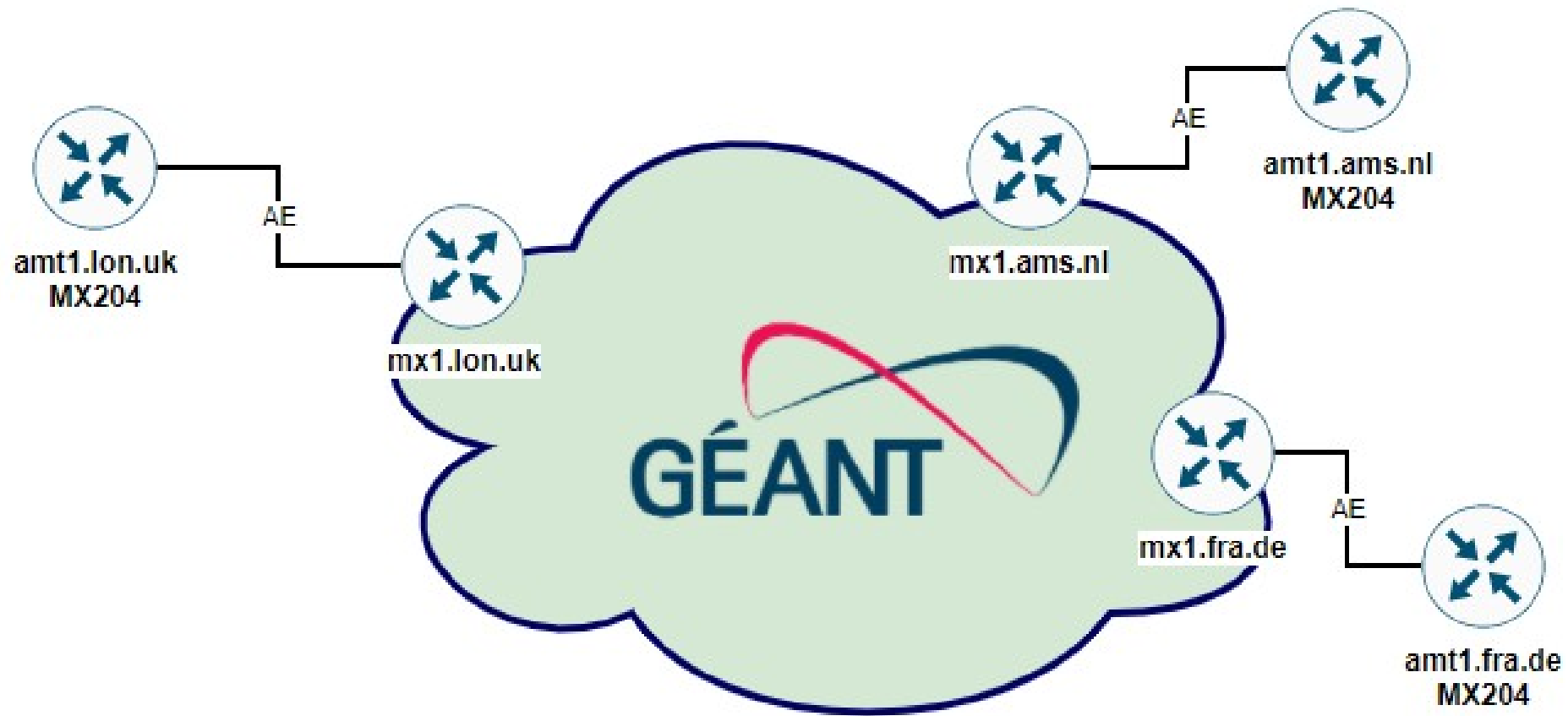
```
AMT Request      AMT membership update  
71157            70065
```

```
AMT gateway address: 64.225.133.162, port: 60735  
AMT tunnel interface: ud-0/0/0.1048577  
AMT tunnel state: Active  
AMT tunnel inactivity timeout: 241  
Number of groups: 21  
  Group: 232.223.222.1 Include Source: 193.17.9.3  
  Group: 232.223.222.20 Include Source: 193.17.9.3  
  Group: 232.223.222.21 Include Source: 193.17.9.3
```

```
AMT message count:
```

```
AMT Request      AMT membership update  
69882            69846
```

# Relay Locations



# Caveats and Challenges

- Service Caveats
  - Protocol authentication – manual client range activation.
  - Global IGMP enable.
  - MTU restrictions.
- Deployment Issues
  - Packet Forwarding Engine dropping AMT traffic.
  - AMT on VMX not currently supported.

# Service Testing

- Customer acceptance testing using Telecast Client
- iperf 2.0.13+ or 2.1+
- VideoLAN 4.x (Nightly Builds)
- Custom Go SSM packet sweep client/server.
- Continuous Integration Certification (CIC) testing for new software.

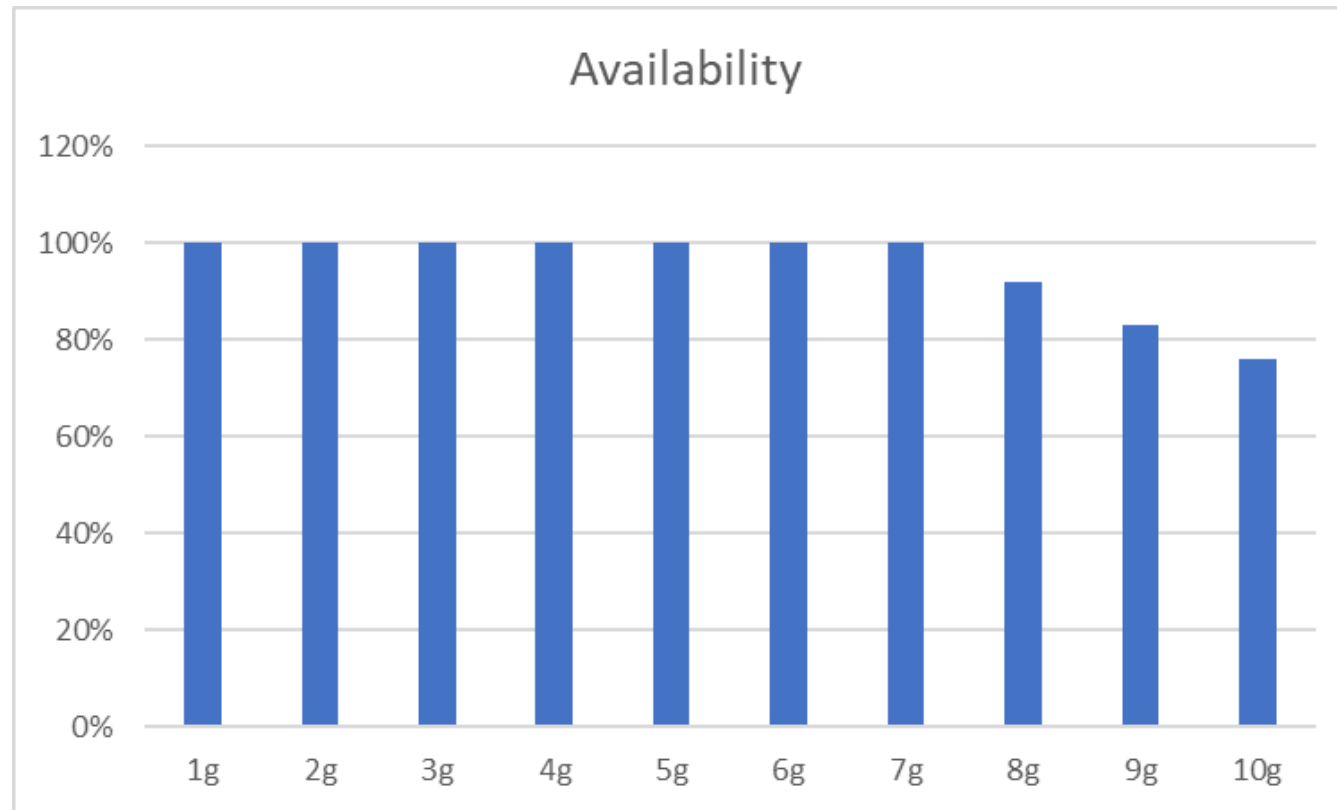
# Service Testing

## Test Execution Log

<input type="checkbox"/> <b>SUITE</b> 513 AMT	00:11:28.872
<b>Full Name:</b>	513 AMT
<b>Documentation:</b>	Suite is starting traffic connecting to AMT relay MX, performs several stream tests and validates the results.
<b>iperf/ssm source:</b>	ssm-inet0-05.lab
<b>Source:</b>	<a href="#">/var/lib/jenkins/workspace/junos-tat/05_throughput/513_AMT.robot</a>
<b>Start / End / Elapsed:</b>	20221103 10:26:56.032 / 20221103 10:38:24.904 / 00:11:28.872
<b>Status:</b>	5 tests total, 5 passed, 0 failed, 0 skipped
<input type="checkbox"/> <b>SETUP</b> geant_linux . Activate amtgwd, establish connection to AMT relay.	00:00:10.508
<input type="checkbox"/> <b>TEST</b> Start iperf stream.	00:00:02.358
<input type="checkbox"/> <b>TEST</b> Start iperf receiver and check for traffic.	00:05:32.581
<input type="checkbox"/> <b>TEST</b> Start SSM packet sweep client.	00:00:02.415
<input type="checkbox"/> <b>TEST</b> Start SSM packet sweep server. Check client receives all packets.	00:05:32.387
<input type="checkbox"/> <b>TEST</b> Close clients and amtgwd, check AMT relay no longer has test AMT tunnel/PIM joins.	00:00:07.792

# Service Testing

- Throughput Testing using EXFO tester.
- Sustained ~7.5gbps throughput likely due to 10gbps tunnel services.



# Looking to the Future

- 100G testing
- Using VMX to spin up relays.
- Firewall abstraction layer for dynamic access.

# Thank you

# Any questions?

[www.eumetsat.int](http://www.eumetsat.int)

[www.geant.org](http://www.geant.org)



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