NREN Community Performance Scenarios and Tools

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• This talk presents an overview of work done in the former GÉANT SIG-PMV (Performance Monitoring and Verification) group
  • [https://wiki.geant.org/display/PMV/SIG-PMV](https://wiki.geant.org/display/PMV/SIG-PMV)
• Focus lies on identifying measurement and monitoring scenarios and documenting appropriate tools and best practices to support those scenarios on a wiki
  • [https://wiki.geant.org/display/PMV/PMV+Scenarios](https://wiki.geant.org/display/PMV/PMV+Scenarios)
• Derived from NREN and campus community requirements

• The following slides reflect the wiki content
• RED is dated content from the wiki, GREEN is potential new content
• Which scenarios should we keep working on in GN4-3 (the current GEANT project)? What scenarios are missing? Where are the gaps?
• All comments welcome…
Scenario 1: Data intensive science transfers

• **Description:**
  • Researchers from a growing number of disciplines are moving increasingly large volumes of data, locally, nationally and internationally.
  • Likely to see the Science DMZ model more widely deployed

• **Challenges:**
  • Identifying poor performance and troubleshooting the causes, which may lie in end systems or on the network path (end-to-end troubleshooting)

• **Solution space:**
  • perfSONAR (widely used by the WLCG, i.e., the CERN experiments)
  • In-application monitoring (e.g., FTS application reports)
  • GTS FIONA DTNs; open soon for testing (?)
  • What DTN test infrastructure might GÉANT or the NRENs provide?
  • What about 100G performance testing, of the network and DTNs?
Scenario 2: Multi-domain networks

- **Description:**
  - Monitoring performance between multiple administrative domains
  - Understanding in which domains issues lie
  - Focus tends to be on the networking aspect, and network issues.

- **Challenges:**
  - Likely to need multiple measurement systems deployed
  - Coordination between the administrative domains
  - Understand how it can be automated (alongside provisioning)

- **Solution space:**
  - perfSONAR - pscheduler tests between specific nodes, new pShooter
  - GÉANT GN4-2 JRA1 T4 work heading towards solutions
  - Drawing together multiple sources of data to enhance analysis, e.g.,
    - Netsage - [https://portal.netsage.global/grafana](https://portal.netsage.global/grafana)
    - SAND - [https://sand-ci.org/](https://sand-ci.org/)
Scenario 3: Wireless networks

• **Description:**
  - Measuring the utilisation and performance of a site’s local WiFi infrastructure
  - Likely to be providing eduroam if at an academic site
  - (At the moment not including 5G, IoT tech, but might do...)

• **Challenges:**
  - Difficult to run tests from an end user’s system when that is likely to be BYOD
  - High variability in performance depending on exact location
  - Multiple frequency channels and standards, emerging 802.11ac
  - RF interference

• **Solution space:**
  - Crowd-sourced measurement data (WiFiMon)
  - Hybrid approach of crowdsourced and infrastructure measurement data?
  - What about monitoring the eduroam authentication infrastructure?
Scenario 4: Layer 2

• **Description:**
  • Measurement of L2 performance, below IP layer
  • Includes Ethernet, MPLS, Carrier Ethernet

• **Challenges:**
  • Variety of L2 media
  • Visualisation

• **Solution space:**
  • Work reported in GÉANT GN4-2 JRA1/2 in 2013 (Cyan, Juniper, Ciena, Accedian equipment)
  • Embedded probes (e.g. CFM/Y.1731)
  • What about L2VPNs – or is that covered by other scenarios? (See #7 later...)
Scenario 5: Virtual network environments

• **Description:**
  • Measurement of performance on VM infrastructure
  • May include measurements to/from cloud services; AWS, Azure, Google
  • Increasingly important as university / research services deployed to cloud

• **Challenges:**
  • Abstraction of systems, impact of hypervisor, etc
  • Variability of cloud performance depending on instance; e.g. AWS performance will vary depending on specific virtual platform/size
  • Tunnelling to cloud; MS Expressroute, etc.
  • Extending address space to the cloud

• **Solution space:**
  • GÉANT GN4-2 JRA2 Task1 connection services might be applicable
  • Monitoring of Kubernetes and microservices?
    • Example presented at SIG-PMV, Dublin, 2019
Scenario 6: IPv6 usage

• Description:
  • Measure IPv6 adoption, traffic levels
  • Growth of IPv6 deployment and usage, and relative performance to IPv4

• Challenges:
  • Can’t differentiate IPv4 and IPv6 in all devices given state of MIB support
  • Operation in an IPv6-only environment

• Solution space:
  • IETF moving towards YANG
  • (In theory, everything we do should be IP version agnostic)
  • Where are NRENs publicly reporting these stats, if anywhere?
  • Focus of measurement seems to be on www, dns, mail IPv6 capabilities
  • Possible use of perfSONAR measurements (now pS supports http, dns)
Scenario 7: Overlay networks

• **Description:**
  • Measurement of performance of overlay networks
  • Do we mean the overlay, or the infrastructure over which it runs (e.g., under a L2VPN) or both?
  • Understanding which layer has issues
  • MD-VPN (used in ~20 NRENs)
  • GÉANT Testbed Service? (GTS)

• **Challenges:**
  • Separation of overlay and underlying infrastructure
  • Difficult for a network like GÉANT to “peer into” tunnels
  • User has no way to understand where the problem is

• **Solution space:**
  • ??
Scenario 8: IP multicast

• **Description:**
  • Monitor performance and delivery of multicast traffic
  • May be within a site, or inter-domain

• **Challenges:**
  • Apparently minimal use of multicast in the NRENs?
  • Probably peaked in interest last decade?
  • Superseded to some point by multi-point VPNs, CDNs, ...

• **Solution space:**
  • Multicast beacons
  • But are NRENs using multicast?
  • IETF mboned WG is deprecating **inter-domain ASM**
What is missing?

- **Knowledgebase of best practice and experience?**
  - We have eduPERT - https://wiki.geant.org/display/public/EK/Welcome+to+the+eduPERT+Knowledge+Base

- **Integration with OSS / management platforms**
  - Monitoring in itself is only part of the solution
  - Use of network management as a service (NMaaS)?

- **Monitoring network services**
  - Network protocols and their operation, such as BGP
  - Network services, such as DNS or HTTP(S)
  - New models – in-band network telemetry, streaming telemetry, ...

- **Integration and analysis of results**
  - What can we learn from projects such as SAND?
  - How should we apply analytics / machine learning?
Thank you

Any questions?

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