NREN Community Performance Scenarios and Tools

Tim Chown
Jisc

Performance Management Workshop,

Zagreb, 4 March 2020

www.geant.org

NREN Community Performance Scenarios and Tools

- 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
- 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
- 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 GÉANT 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
    - SAND - 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?
  - Superceded 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
    - https://tools.ietf.org/html/draft-ietf-mboned-deprecate-interdomain-asm-06

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?

GÉANT
Networks • Services • People

Thank you

Any questions?

Email: tim.chown@jisc.ac.uk

www.geant.org

The research leading to these results has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 856726 (GN4-3).