SIG-PMV Dublin

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SIG-PMV: Scenarios

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SIG-PMV

About the SIG

- SIG-PMV = Special Interest Group for Performance Monitoring and Verification
- Driven by a Steering Committee (6 people), with two face-to-face meetings per year
- Supported by the GÉANT Community Programme (GCP)
  - https://www.geant.org/People/Community_Programme
- SIG-PMV wiki: https://wiki.geant.org/display/PMV/SIG-PMV
- Full charter: https://geant.app.box.com/s/3k57vu53mas1t17bhlnrm7gj8adsj7wd

- Focus lies on measurement and monitoring scenarios
- The scenarios come from NREN and campus community requirements
- The SIG identifies appropriate tools and best practices to support those scenarios
- SIG-PMV has some relationship to eduPERT (tbd - the subject of tomorrow's discussion ☺)

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SIG-PMV Status

How are we doing in identifying scenarios and solutions?

- Some progress made during 2018
- Current and future/emerging scenarios listed on the SIG wiki
- https://wiki.geant.org/display/PMV/PMV+Scenarios – “living document”
- References are to GN4-2 activities not GN4-3 tasks (GN4-2 ended in Dec 2018)
- Gaps still exist, not least in integration with OSS and monitoring of services.

- The following slides reflect the wiki content
- RED is dated content from the wiki, GREEN is potential new content
- Which scenarios do we keep? What scenarios are missing? Where are the gaps?
- All comments welcome…

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Current scenarios - 1

Data Intensive Science Transfers

- **Description:**
  - Researchers from a growing number of disciplines are moving increasingly large volumes of data between systems, locally, nationally and internationally.
  - Likely to see the Science DMZ model deployed
- **Challenges:**
  - Identifying poor performance and troubleshooting the causes, which may lie in end systems or on the network path (true 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?

Current scenarios - 2

Multi-domain monitoring

- **Description:**
  - Monitoring network performance between multiple administrative domains
  - Understanding in which domains issues lie
  - Focus is 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, esp. with pscheduler tests between specific nodes, and pShooter
  - GEANT T4 work heading towards solutions
  - Drawing together multiple sources of data to enhance analysis (e.g., Netsage, SAND ??)

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Current scenarios - 3

Wireless Network Monitoring

- **Description:**
  - Measuring the utilisation and performance of a site's local WiFi infrastructure
  - Probably 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 a BYOD device
  - 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 data?
  - What about monitoring the eduroam authentication infrastructure separately?

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Current scenarios - 4

Layer 2 monitoring

- **Description:**
  - Measurement of L2 performance, below IP layer
  - Includes Ethernet, MPLS, Carrier Ethernet
- **Challenges:**
  - Variety of L2 media
  - Visualisation
- **Solution space:**
  - Work reported in GEANT 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…)

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Currnet scenarios - 5

Virtual network environments

- **Description:**
  - Measurement of performance on VM infrastructure
  - May include measurements to/from cloud services; AWS, Azure, Google Cloud Platform
  - 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 platform/size
  - Tunnelling to cloud; MS Expressroute, etc. Extending address space to cloud
- **Solution space:**
  - JRA2 Task1 connection services might be applicable
  - Monitoring of Kubernetes and microservices?

Current scenarios - 6

IPv6 networks

- **Description:**
  - Measure IPv6 traffic levels
  - Desire to measure growth of IPv6 deployment and usage, and relative performance to IPv4
- **Challenges:**
  - Not possible to 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 in SIG-PMV should be IP version agnostic, i.e., feature equivalent)
  - Where are NRENs publicly reporting these stats, if anywhere?
  - Focus of measurement seems to be on www, dns, mail IPv6 capabilities

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Current scenarios - 7

Overlay network monitoring

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

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Current scenarios - 8

IP Multicast monitoring

- **Description:**
  - Monitor the successful performance and delivery of multicast traffic
  - May be within a site, or inter-domain
- **Challenges:**
  - Apparently minimal use of multicast in the NRENs?
  - Superceeded to some point by multi-point VPNs
- **Solution space:**
  - Multicast beacons
  - But are NRENs using multicast? IETF deprecating inter-domain ASM.

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Emerging scenarios - 1

100G networking and beyond

- **Description:**
  - Performance measurement at 100Gbps +
- **Challenges:**
  - How to monitor/sniff/measure at such line rates
  - Knowing vendor-specific tricks; tuning, performance of end systems; do 10G recipes work at 100G? They may not.
  - Building a generic model; so we become service oriented rather than technology oriented
  - Transport tech may move at a different pace to CPU tech; other elements such as firewalls
  - Mixed speeds – 10G <-> 100G
- **Solution space:**
  - Existing systems, e.g. perfSONAR, with appropriate tuning / configuration?
  - Are there 100G perfSONAR platforms available?
  - ESnet using 40G / 100G cards across their infrastructure

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Emerging scenarios - 2

SDN-controlled monitoring

- **Description:**
  - (Not wholly sure what was meant here)
  - Monitoring a dynamically configured network?
- **Challenges:**
  - Service differences?
  - What's different to a standard IP service
  - Tools like traceroute in an OpenFlow network
  - Monitoring traffic may follow different paths to application traffic
- **Solution space:**
  - ??
  - Some related work in GEANT project; JRA2, maybe JRA1
  - Drop this one?

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Emerging scenarios – 3

Monitoring autonomic networks

- **Description:**
  - Measuring performance in self-configuring networks
- **Challenges:**
  - Solution needs to also be self-configuring
  - Network operating systems that move flows very dynamically; flow may not have a static path
- **Solution space:**
  - ..?
  - Not clear this is applicable to NREN networks; possibly for campuses with IoT?

Emerging scenarios - 4

Monitoring as a Service, NMS as a Service

- **Description:**
  - Includes OSS, BSS with monitoring and performance verification.
- **Challenges:**
  - Provision, and automatically monitor
- **Solution space:**
  - ..?
  - JRA2 T2 is doing something in this area
  - GN4-3 exploring Campus Network Management/Monitoring as a Service (CNaaS)

But what is missing?

Additional scenarios or considerations?

- **Integration with OSS / management platforms**
  - Monitoring in itself is only part of the solution
  - Craig Gallen speaking today on his open NMS platform.
- **Monitoring network services**
  - Network protocols and their operation, such as BGP – Thomas' talk today
  - Network services, such as DNS or HTTP(S)
  - New models – streaming telemetry, as per Sowmya and Bruce's talk today
- **Integration and analysis of results**
  - Should hear more on this from Shawn today with his talk on SAND
  - How should we apply analytics / machine learning

- **What else?**

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Thank you – any questions?

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