High Level

• Promote the use of network monitoring to aid troubleshooting of network and data issues

• perfSONAR deployed in WAN, now also need information about the LAN for complete end-to-end solution

• Make available such data in an effective, secure and applicable means to the DOE community
Participants

• BNL
• ORNL
• SLAC
• Fermilab
• ESnet
Goals

• Deployment of perfSONAR at the perimeter at End Sites
• Exposure of Site’s Internal Network Performance
• Deployment of E-Center to provide AA for measurement data and archiving of network performance data
• Accessible presentation tools for inter-domain network performance
• Application / User level monitoring
Deploy perfSONAR at Site Perimeter

• Aims to achieve
  • promote and advance the evolution of perfSONAR use and field testing
  • publicise existence of easy to use and appropriate tools for network monitoring for network engineers and scientists alike
  • set expectations for users of (network) performance achievable end-to-end - for project planning and scoping
  • provide infrastructure to help identify, diagnose and report performance issues
Site Perimeter

- Required information:
  - Site contact for issues related to bad/anomalous behaviour
  - Use perfSONAR to leverage existing work on distributed network monitoring
  - conform to common deployment path

- Site-to-Site
  - Full tests between SLAC-BNL-ORNL
  - Full tests between site perimeter to adjacent (ESnet) PoP
Perimeter Data Collection

- Provide passive and active tests between participants
  - One-way delay (OWAMP), Two way delay (Ping), achievable throughput (iperf)
  - Border router utilisations (snmp)
  - Traceroutes (Traceroute MA)
  - Establish mesh of both active and passive tests
- Provide well published endpoints for on-demand tests (as web portal etc)
  - Reverse traceroute
  - Ping
  - NDT
Site Perimeter Challenges

- Work with site’s cyber-security to enable exposure of:
  - network tests between participants
  - allow exposure of web services to consumer consumption
  - classification of network performance data for different types of users
  - approval of servers and services (port openings, kernel versions, logging and auditing of servers etc).
- Provide documentation to ease and expand perfSONAR deployment at DOE sites
Exposure of Site’s Internal LAN

- Aims to achieve
  - establish and provide true end-to-end monitoring and measurement capability
  - high level topology between routers, firewalls, switches and hosts
  - integrate with existing monitoring tools at End Sites to provide this information
  - provide and deploy consistent interface to performance data so developers can focus on data collection and analysis
perfSONAR at the WAN
Given the performance parameters of both bandwidth, packet lost rate, and RTT of the links BP₁, P₁P₂, and P₂A, what is the performance of AB?
Use Cases

- Scientists and network users think of Host-to-Host, not Site-to-Site
  - just because the perimeter performance is okay, does not mean performance end-to-end is okay
- Possible issues
  - Slow router/firewall causes many packet drops
  - Duplex mismatches on old hosts/network devices
  - Large layer 2 spanning trees causes network inefficiencies
  - High CPU or low memory on hosts
  - High IO waits caused by slow disks etc.
Internal Data Collection

- Provide perfSONAR interface for data already being collected by existing tools at Sites
- Router utilisations (SNMP-MA)
- Topology information about interconnections of devices
  - cyber-security issues?
    - security through obscurity
    - sanitisation of topology information
  - how to deal with dynamic changes of host moves etc.?
- Host issues? Disk / CPU?
  - integrate with ganglia, nagios etc?
Internal Data Collection

- Balance between visibility and cost
- Provide read-only access to data already collected
  - switch and router utilisations (SNMP)
  - network topologies (NeDI, CDP/LLDP etc)
  - higher network layers? (vlan groups, subnets etc)
- (Partial) Mesh of Active tests
  - Place perfSONAR MP's or OWAMP/BWCTL responders at strategic locations in LAN
- Integrate existing monitoring, eg Nagios, Smokeping etc.
Enterprise Monitoring

- Integrated, consistent and easy to use UI
  - Dashboards
  - Graphs
- Reports
- (Automated) Alerts and Notifications
  - Trends (deviation)
  - Emails, paging etc
- Typically focused on application/service performance
- With perfSONAR, this becomes a presentation and transformation layer service
  - Data Access Layer becomes perfSONAR client API
  - GUI(s), alerts (pubsub)
Enterprise Monitoring

- Network Centric
  - MRTG
  - Cacti
  - NeDi
  - Netflow
  - collectd

- Host Centric
  - Nagios
  - Groundworks
  - OpenView
  - Spectrum
  - Tivoli
Internal Deployment Challenges

- (Cyber) security
- identification of classes of data and who should be allowed to view it
- different sites use different internal tools to collect performance and topology information
- integrate with site’s AA policies and procedures
- Cost of active tests may be prohibitive
  - both for servers, maintenance, and traffic loads
  - need to demonstrate usefulness with specific deployment cases
  - periodic tests and archives required (perfSONAR)
E-Center

- perfSONAR data
  - each domain’s data is disjoint from the data being collected in other domains
  - difficulty in finding the data required; access issues to data
- E-Center will
  - provide building blocks for federated network services to enhance distributed computing capabilities of large-scale, global collaborations
  - advance use of perfSONAR
  - provide users with services to enable better understanding of wide-area network performance wrt to distributed computing efforts
  - present in coherent and understandable manner
  - web portals, blogs, wiki’s etc.
E-Center

- Aim to:
  - Ensure continual access and appropriate responsiveness of local e-Center gateway services to central e-Center facility
  - Adapt and deploy e-center at each site
    - provide installation and deployment feedback
    - usability and customisations at each site
  - Quantify, resolve, and document site security issues involving site perfSONAR & E-Center
  - Contribute site perspective into the strategic planning of E-Center capabilities & services
  - Integrate local AA support with E-Center data collection & other WAN perfSONAR efforts
    - Use Grid User Management System (GUMS)
      - DoE Users
      - Site and ESnet network administrators
      - Site information (IT) officers
      - DoE program officers

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Internal Deployment

- Quantify, resolve, and document site security issues involving site perfSONAR
- Train local staff to use and support perfSONAR resources, including user education
- Provide comprehensive level of perfSONAR support at sites
  - creation of generate template for end site perfSONAR deployment
  - true end-to-end monitoring
ATLAS scientist transfers file from BNL to SLAC - notices that recent transfers are taking longer than they did last week
Tying it all together... (2)

Use GridFTP MA, see all transfer from BNL to SLAC are slow
Use **Traceroute MA** service to determine end-to-end path

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Use **SNMP-MA** to determine site perimeters looks okay
Tying it all together... (5)

Use **SNMP-MA** to ensure ESnet POPs and cores looks okay.
Tying it all together... (6)

Use SLAC’s **Topology Service** to determine Internal network path
Use **SNMP-MA** to determine that SLAC farm02 is overloaded.
Description of Work

• Deploy and configure perfSONAR and related tools
• Adapt and deploy E-Center at each site
• Work with cybersecurity to classify network monitoring information and assign ACLs to each category
• Work with site users and admins to promote use of perfSONAR and e-Center
Deliverables

• Year 1:
  • full perimeter perfSONAR deployment at each site
  • passive: border snmp statistics
  • active: owamp, bwctl, ping, traceroute to ESnet PoP and other sites
  • support on-demand owamp and bwctl at perimeter
  • ACL based access to services and data
  • draft risk assessment for services
  • draft training document for local staff
  • draft site support document for AA for e-Center
  • coordinate data collection for e-Center
Deliverables

- **Year 2:**
  - leverage and adapt other monitoring tools
  - configure internal topology service
  - provide snmp data for internal network devices
  - implement persistent full mesh active measurements between sites
  - implement persistent active data to ESnet PoPs
  - support on-demand internal active measurements to off-site authorised users
  - document site security policies for topology and data
  - draft user support document for local admins
  - coordinate data collection of internal data into e-Center
  - help develop and feedback into e-Center tools and presentation
  - implement site local AA with e-Center
(Potential) Deliverables

- Year 3 (unfunded):
  - GridFTP MA
  - build interactive and integrated web GUI(s) to allow users to navigate, retrieve, visualise, manage and control data presentation
  - visualisation tools to run large amounts of monitoring data into easy-to-understand forms for human visual analytics
  - turn data into knowledge and intelligence
  - conduct performance and behaviour analysis of network traffic and build profiles of reach application and site performance
  - identify bottlenecks in site-to-site performance that may lead to system-wide failures
  - traffic analysis to identify highly-utilised network resource and hub, provide recommendations for improvement
Questions?
Other things...
Alarms and Network Alerts

- Publication of service tickets
- Correlate-able database of known performance and or service outages
  - Eg: one ESnet path is down, traffic may go through a much more congested path
  - Eg: end site taking down servers which will lead to downtime of services
- How to determine dependencies on each host/service?
- Does end-sites even have such information available?
  - Eg: afs, dns, nis etc?
- Potential to use nagios or similar as data gather, present in perfSONAR based schemata?
Application / User Level Monitoring

- GridFTP
- Working with LBNL
- Already have alpha build with schemata etc.
- Looking to try to deploy at a couple of sites
- Face many challenges with respect to the types of data exposed