perfSONAR

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Measurement

Measuring network performance and monitoring network components are a critical part of any high-performance network deployed today. In-depth network measurement and monitoring services are key components to provide researchers and engineers with views into application performance and to troubleshoot network problems.
What is perfSONAR

- perfSONAR is an infrastructure for network performance monitoring.
- It is a services oriented architecture delivering performance measurements in a federated environment.
- It is an intermediate layer between the performance measurement tools and the diagnostic or visualization applications.
- A methodology for monitoring network connections that span multiple administrative domains.
- Partners include: GEANT2, ESNET, I2, RNP
- http://www.perfsonar.net/
Multi-domain Monitoring Framework

• Three components of the monitoring framework are:
  – Measurement Point Layer
  – Service Layer
  – User Interface Layer
Measurement Point Layer

• Lowest layer of the system
• Responsible for measuring and storing network characteristics.
• MPL of a domain consists of different monitoring components.
• Components provide different metrics (e.g. delay, jitter, loss, bandwidth, … etc.).
• Each network domain can deploy MP of its choice.
Service Layer

- Middle layer of the system
- Allows for the exchange of data and information between domains.
- Services within each domain are responsible for different functionality.
  - Authentication and Authorization.
  - Discovery of other entities providing functionality.
  - Resource management.
User Interface Layer

- Highest layer of the system
- Visualization tools that present performance data.
- Allow user to perform test using lower layers of the framework.
- The user interface sees the service layer as another layer of abstraction to hide differences between measurement points deployed in different domains.
Service Oriented Architecture

• Each role is implemented as an independent service forming the Services Layer:
  – Lookup (LS)
  – Authentication (AS)
  – Measurement Archive (MAS)
  – Transformation (TS)
  – Resource Protector (RPS)

• The Measurement Point Layer contains the Measurement Point Services (MPS).
Lookup Service

- Services register their existence and capabilities with a LS.
- Clients discover services by querying the LS.
- LS are found by multicast, well-known servers, local configuration, or other LSs.
- The LS are queried on attributes (service type, authentication) and more complex constructs (network location) not simply named-based.
Authentication Service

- Provides authentication and attribute authority.
- Communities of multiple domains that accept each others authentication can be formed by federating ASs.
- As a server, the AS accepts authentication requests.
- As a client, the AS registers with an LS and may query other As for attributes.
Measurement Archive Service

- Measurement Archives store data in databases and publish data produced by MPS (or TSs).
- They also provide a historical record of analysis.
- Reduces queries to the MPS by publishing to multiple clients.
- As a server, it accepts and stores setup and publication requests.
- As a client, it registers with an LS and subscribes to a MPS, other MAS and publishes data to subscribers.
Transformation Service

• The TS performs functions on measurement data (aggregation, correlation, filtering).
• The TS subscribes to services and publishes to clients.
• As a server, the TS accepts publication requests.
• As a client, the TS registers with an LS, subscribes to MPs, MAs, or other TSs, and publishes measurement data to subscribers.
Topology Service

• The ToS is a specific example of a TS used to make topological information available to the framework.
• Understanding topology is necessary for the measurement system to optimize its operations (closest nodes).
• ToS may also be used for overviews/maps clients to present measurement data.
Resource Protector Service

- The RPS is used to arbitrate the consumption of limited resources (test collision).
- The RPS has a scheduling component to deal with time-dependent resources.
- As a server, the RPS accepts authorization and resource availability requests.
- As a client, the RPS registers with an LS.
- Not all MPSs have to contact a RPS at all (used for protected resources).
Measurement Point Service

• MPS creates and publishes data by initiating active measurements or querying passive devices.
  • A setup protocol allows users to request measurements and publish the results.
  • As a server, the MPS accepts requests and publishes the data (client subscriber handle must be known in advance).
  • As a client, the MPS registers with the LS and publishes to subscribers.
Implementations


• **Reference Bundle v2.1**
  • RRD Measurement Archive
  • SQL Measurement Archive
  • Lookup Service
  • SSH/Telnet MP (router proxy)
  • Command Line MP (bwctl/owamp/traceroute/ping)
  • E2EMON MP (link status)

• **perfSONAR-PS**
  • Send email to Jeff Boote <boote@internet2.edu>
  • (not recommended) Install directly from SVN: http://anonsvn.internet2.edu/svn/perfSONAR-PS
Internet2 and TransPAC2

- perfSONAR-PS (perl version) is currently being developed with the following groups:
  - ESnet includes:
    - ESnet/LBL staff
    - Fermilab
  - Internet2 includes:
    - University of Delaware
    - Georgia Tech
    - SLAC
    - Internet2 staff
  - Internet2 and TransPAC2 are currently exporting data with perfSONAR-SP
perfSONAR-PS Motivation

- Create separate implementation of perfSONAR standard
  - Use same protocol/standards
  - Proof of interoperability (strengthens the standard)
- Targeted for University NOC deployments
  - Lightweight
  - Easier to deploy/manage
perfSONAR-PS Services

• Focus on development of major perfSONAR components
  – SNMP Based MP/MA
  – Lookup Service
  – Topology
  – Link Status ("E2EMON")

• New additions
  – OWAMP/BWCTL
  – Traceroute
  – Pinger (SLAC+Fermilab)
  – Visualization (Perfsonar UI plugins + meter)
SNMP Based MP/MA

- Alpha Version Deployed
  - Internet2 Network
  - ESNet
  - Georgia Tech/SLAC/University of Delaware
  - TransPAC2

- Compatible with perfSONAR-UI

- CPAN package in development
Lookup service

- Initially single domain only
- Features same XQuery based interface as Java version
- Currently being tested for compatibility with perfSONAR Java LS.
Topology

- Topology registration and query system in development
  - Actively being worked on with dynamic circuit control plane partners (including Internet2’s circuit service, DRAGON, ESNet Oscars, and GEANT2 JRAs)
  - Working on a common schema
Link Status Service

- Status MP/MA to provide E2EMon functionality (up/down/testing) in development

- Different architecture than E2EMon
  - Smaller ‘status’ service, with a transformation service to combine Topology/Status for E2EMonMP/MA interface
Pinger Based MP/MA

- Joint effort between Fermi Lab and SLAC
  - Present views of historic Pinger data
  - Expose interface to schedule live tests
- Development and integration into perfSONAR-PS based on LHC-OPN requirements
Visualization

• Utilizing the plugin architecture of perfSONAR-UI
  • Data visualization beyond network utilization
• Google Maps
  • Utilization by physical location
  • 'Weather Map' of Internet2 Network
• Web based speedometer to interact directly with MA code
Other services in development

- **Traceroute MP/MA**
  - Joint effort between UD and SLAC
  - Integrate into visual traceroute tools
- **Ping MP/MA**
  - Features interface for on demand and scheduled tests.
- **OWAMP MA**
  - Make regular results available
- **BWCTL MA**
  - Make regular results available
Questions or Comments

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