An XML-Based Protocol for Distributed Event Services

Warren Smith
NASA Ames Research Center

Dan Gunter
Lawrence Berkeley National Laboratory

Darcy Quesnel
Argonne National Laboratory

Motivation

- Government agencies and academia developing computational grids
- Large-scale distributed systems with high-performance resources
- Requires resource, service, and application monitoring
  - Load on a computer, status of a service, performance of an application
- Different requirements for different types of monitoring
- Several projects addressing performance monitoring in grids
- Define standard protocols and data representations for interoperability in the Grid Forum

Approach

- Define a relatively simple event protocol
  - TCP
  - XML
- Implement the protocol
- Provide to the community
- Gain experience
- Improve the protocol
- In this talk: architecture, events, and event protocol

Grid Monitoring Architecture
Events

- An event consists of:
  - Name
  - A set of elements
    - Name
    - Value
    - Optional attributes (units and accuracy)
- Has associated input parameters
  - Name
  - A set of elements
- Defined using XML Schema
- Define a base Event and EventParameters type and elements in separate namespaces
- Anyone can define their own namespace and events

CPU Load Event

- Event elements
  - HostName: The name of the host the measurement is made on.
  - Load1: The 1 minute CPU load reported by uptime.
  - Load5: The 5 minute CPU load reported by uptime.
  - Load15: The 15 minute CPU load reported by uptime.
  - TimeStamp: The time the measurement was made in a standard format.
- Event parameters
  - Period: How often to perform the measurement.

CPU Load Event in XML

```xml
<EventParameters
  xmlns="http://www.gridforum.org/Performance/EventParameters"
  <Period units="min">2</Period>
</EventParameters>

<Event
  xmlns="http://www.gridforum.org/Performance/Event">
  <Load1>1.5</Load1>
  <Load5>1.4</Load5>
  <Load15>1.3</Load15>
  <HostName>foo.nas.nasa.gov</HostName>
  <TimeStamp>2000-11-09T21:51:45Z</TimeStamp>
</Event>
```

Round Trip Time Event

- Event elements
  - SourceHostName: The name of the host performing the ping command.
  - TargetHostName: The name of the host being pinged.
  - RoundTripTime: The round trip time reported by the ping command in milliseconds.
  - TimeStamp: The time the measurement was made.
- Event parameters
  - TargetHostName: The name of the host being pinged.
  - Period: How often to perform the measurement.
Round Trip Time Event in XML

Event Parameters

```xml
<Event
    xmlns:hsn="http://www.gridforum.org/Performance/EventParameters">
    <TargetHostName>bar.lbl.gov</TargetHostName>
    <Period units="min">1.5</Period>
</Event>
```

General Message Format

- Length (in bytes) as a 32-bit integer in network byte order
- XML tags that indicate the message type:
  - `<SubscribeRequest>` ...
  - `<SubscribeReply>`
- Message specific data inside the tags

Protocol Interactions

- Subscription: A request that initiates the transmission of a series of events
  - Consumer subscription
    - Consumer subscribes for events from a producer
    - Producer sends events to the consumer
  - Consumer unsubscriptions for events
  - Producer subscription
    - Producer initiates a subscription for a consumer
    - Producer sends events to the consumer
    - Producer or consumer unsubscribes
  - Consumer query
    - Consumer asks the producer for an event and producer replies with the event

Example Interaction I

- Consumer→Producer
  ```xml
  <SubscribeRequest xmlns="http://www.gridforum.org/Performance/Protocol" requestID="2">
    <Event
        xmlns:hsn="http://www.gridforum.org/Performance/EventParameters">
        <TargetHostName>bar.lbl.gov</TargetHostName>
        <RoundTrip time units="ma">7</RoundTrip>
        <Timestamp>2000-11-09T31:53:45Z</Timestamp>
    </Event>
  </SubscribeRequest>
  ```

- Producer→Consumer
  ```xml
  <SubscribeReply xmlns="http://www.gridforum.org/Performance/Protocol" requestID="2">
    <ReturnSuccess>RETURN</ReturnSuccess>
    <SubscriptionID>1234</SubscriptionID>
  </SubscribeReply>
  ```
Questions?

- Global Grid Forum
- http://www.gridforum.org
- Performance Working Group

Future Work

- Use our implementations to gain experience
- Extend the protocol
- Experiment with other protocols
- Standardize the most appropriate protocols