Plugging In

Bringing New Measurements to perfSONAR

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Second European perfSONAR Workshop
pScheduler Plugins

• Test  Abstract measurement
• Tool  Carries out a test
• Archiver  Disposes of results
• Context  Changes tool’s environment
What can perfSONAR measure?

- The usual suspects:
  - Throughput
  - Latency
  - Round-trip time
  - Path
What can perfSONAR measure?

- The less-usual suspects:
  - DNS and HTTP response time
  - Network reachability
  - S3 throughput
  - SNMP values

- These ship with the current release.
What can perfSONAR measure?

- The unusual suspects:
  - Path MTU
  - VoIP call quality
  - Interface traffic dump

- These don’t exist yet.
What can perfSONAR measure?

• Way out there:
  • Stock prices
  • Weather
  • Garage door state

• These are thought exercises.
  • No plans to do them.
  • But we could.
  • If provoked.
The pScheduler Magic Formula

Test + Tool = Measurement
Requirements for Tests and Tools

• **Test:** The measurement and its results must be describable in a concrete way.

• **Tool:** There must be a program to do the measurement.

• **Tool:** That program must be usable by another program.

• **Tool:** The results must be readable by a program in the tool plugin.
Test Design
Test Design Philosophy

• Focus on what’s being measured, not the tool(s) doing the measuring.

• Survey the tool landscape and use tool capabilities to inform the design

• Don’t make the test a proxy for a single tool
  • Hampers future flexibility
The Garage Door Test

- Determine the state of a garage door
  - How far along is it in its travel?
  - Is it moving?
  - Which way?

- Garage door controllers speak several different protocols
  - DoorML
  - MegaDoor 5000

- If the door is moving, some controllers don’t give an answer until it stops.
### The Garage Door Test Specification

<table>
<thead>
<tr>
<th>Test Parameter</th>
<th>Description</th>
<th>Sample Value(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>door</td>
<td>Door address</td>
<td>dock17.chi6.example.com</td>
</tr>
<tr>
<td>protocol</td>
<td>Garage door protocol</td>
<td>doorml, megadoor5000</td>
</tr>
<tr>
<td>timeout</td>
<td>How long to wait</td>
<td>PT10S, (None)</td>
</tr>
</tbody>
</table>

*Needed to calculate time on the schedule.*

*Enables automatic selection of tools that speak one or more of the protocols.*

- Standard test specification for **all** garage door tests.
The Lowest Highest Common Denominator

• Test parameters and values don’t have to be supported by all tools.

• Tool plugins...
  • ...declare the tests they’re willing to run.
  • ...give a yes/no answer about ability to run a given specification.

• pScheduler will shop a test around to the tools to find candidates.
  • All tools that understand the test (automatic selection)
  • First in the specified list

• Those saying yes are sorted by preference order and one is selected.
### The Garage Door Test Result

<table>
<thead>
<tr>
<th>Result Parameter</th>
<th>Description</th>
<th>Sample Value(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>position</strong></td>
<td>How far open the door is as a fraction:</td>
<td>0.0, 0.3475, 1.0</td>
</tr>
<tr>
<td></td>
<td>• 0.0 = Fully closed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 1.0 = Fully open</td>
<td></td>
</tr>
<tr>
<td><strong>direction</strong></td>
<td>Which way the door is moving:</td>
<td>-1, 0, 1</td>
</tr>
<tr>
<td></td>
<td>• -1 = Toward closed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 0 = Not moving</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 1 = Toward open</td>
<td></td>
</tr>
</tbody>
</table>

- Standard result for all garage door tests.
Plugin Mechanics
General Plugin Structure

• Directory containing a standard set of *methods*.

• Each method serves a purpose.
  • Validate input
  • Determine if a measurement is possible
  • Carry out a measurement

• Each method is an executable program that...
  • ...reads standardized JSON* data on standard input.
  • ...writes standardized JSON* data on standard output.
  • ...exits 0 normally or 1 in the event of a catastrophic failure.

*Some of that JSON is free-form, i.e., any JSON is considered valid.
The Process Boundary

• Allows plugin methods to be written in any language
  • We use and recommend Python 3
  • Python `pscheduler` module available with classes and functions that do many of the operations plugins have in common

• Makes development, test and debug easier
  • Run methods individually on the command line with canned JSON input
  • No need to deal with the rest of pScheduler

• Protects pScheduler from plugin failures
Test Plugin Methods

- **enumerate**
  Describe the test plugin to pScheduler

- **cli-to-spec**
  Convert CLI switches to JSON

- **spec-to-cli**
  Convert JSON to CLI switches

- **participants**
  Determine pScheduler nodes involved

- **spec-is-valid**
  Determine if a test specification is valid

- **spec-format**
  Convert a test spec to text or HTML

- **result-format**
  Convert a test result to text or HTML

- **limit-is-valid**
  Deprecated in favor of jq

- **limit-passes**
  Deprecated in favor of jq
Tool Plugin Methods

- **enumerate**: Describe the tool plugin to pScheduler
- **can-run**: Determine if the tool can run a test
- **duration**: Calculate the time to run a test
- **participant-data**: Generate internal info for participants
- **run**: Measure and produce interim result
- **merged-results**: Combine interim results
Getting Your Plugins Developed
Help From the Development Team

- No comprehensive plugin development manual yet.
- Advice on test design
- Assistance with implementation or debugging
- Plugins of general interest may be adopted and become part of the standard perfSONAR distribution.
The Plugin Development Kit (PDK)

- Contains templates for each type of plugin
- Generates a skeleton in the pScheduler source tree
- Follow-the-numbers implementation

- Works on a standard pScheduler development cluster
- Easy with Vagrant (see `scripts/vagrant/dev-cluster`)
Questions and Answers

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Thanks!

For more information, please visit our web site:
https://www.perfsonar.net