July 22nd 2013, XSEDE Network Performance Tutorial

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OWAMP

OWAMP: What is it

- OWAMP is:
  - Command line client application
  - Policy and scheduling daemon
  - Used to determine ***one way*** latencies between hosts.
- Implementation of the OWAMP protocol as defined by http://www.rfc-editor.org/rfc/rfc4656.txt
  - Command Protocol to speak between client and server, server and server
  - Test protocol
- Different attempts to do this in the past:
  - Surveyor
  - RIPE

Why *One Way* Latency?

- Passive Measurements (e.g. SNMP)
  - Higher polling interval may mask queue depths
  - Active probing gives a better picture of *real* traffic
- Round Trip Measurements:
  - Hard to isolate the direction of a problem
  - Congestion and queuing can be masked in the final measurement
  - Can be done with a single 'beacon' (e.g. using ICMP responses)
- One Way Measurements:
  - Direction of a problem is implicit
  - Detects asymmetric behavior
  - See congestion or queuing in one direction first (normal behavior)
  - Requires '2 Ends' to measure properly

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OWAMP Control Protocol

- Supports authentication and authorization of the users that will test
- Used to configure the parameters of a test
  - Endpoint controlled port numbers
  - Extremely configurable *send schedule*
  - Configurable packet sizes
- Used to start/stop tests
- Used to retrieve results
  - Provisions for dealing with partial session results in the event of a failure

OWAMP Test Protocol

- "*Lightweight*" compared to the control protocol
- Uses UDP as the transport protocol, since the protocol needs to be able to measure individual packet delivery times
- Supports varying packet sizes
- Data needed to calculate experimental errors on the final result is in every packet
- Packets can be "open", "authenticated", or "encrypted"

Sample Implementation

- Applications
  - Daemon (owampd)
  - Clients (owping, powstream)
- Open Source License & Development
  - Modified BSD (http://www.internet2.edu/membership/ip.html)
  - Mailing lists for developer communication – come join us!
- Protocol Abstraction Library
  - Will support development of new clients
  - Add custom 'hooks' into the policy (e.g. add authentication via OpenID or similar)

OWAMP – Quick Demo

- Basic syntax:
  - **`owping HOST`**
  - **`owping –c 1000 –i .01 HOST`**
- Try at your own risk to other servers, suggestions:
  - owamp.losa.net.internet2.edu
  - To not overwhelm the server, also try replacing 'losa' with:
    - atla
    - chic
    - hous
    - kans
    - newy
    - salt
    - seat
    - wash

OWPING Example

boote@nms-rlat.chic.net.internet2.edu: /home/boote

```
boote@nms-rlat:~[360]$ owping nms-rlat.newy.net.internet2.edu
Approximately 13.0 seconds until results available

--- owping statistics from [64.57.17.34]:45355 to [nms-rlat.newy.net.internet2.e
du]:44244 ---
SID:    40391162cbec228e81118c1953a5eef9
first:  2008-05-31T19:16:31.627
last:   2008-05-31T19:16:43.362
100 sent, 0 lost (0.000%), 0 duplicates
one-way delay min/median/max = 11/11/11 ms, (err=0.0442 ms)
one-way jitter = 0 ms (P95-P50)
Hops = 3 (consistently)
no reordering


--- owping statistics from [nms-rlat.newy.net.internet2.edu]:44247 to [64.57.17.
34]:45356 ---
SID:    40391122cbec228ebb1bde827906fe35
first:  2008-05-31T19:16:31.608
last:   2008-05-31T19:16:41.979
100 sent, 0 lost (0.000%), 0 duplicates
one-way delay min/median/max = 10.9/11/11 ms, (err=0.0442 ms)
one-way jitter = 0 ms (P95-P50)
Hops = 3 (consistently)
no reordering

boote@nms-rlat:~[361]$
```

OWAMP GUIs - Mesh

OWAMP – Internet2 Network IPv4 Latency

http://owamp.net.internet2.edu/cgi-bin/owamp.cgi

MLab Apple Yahoo! Google Maps YouTube Wikipedia News (12550) Popular

OWAMP - Internet2 Network IPv4 Latency

powstream	Senders									
		Atlanta Latency	Chicago Latency	Houston Latency	KansasCity Latency	LosAngeles Latency	NewYorkCity Latency	SaltLakeCity Latency	Seattle Latency	Washington Latency
Receivers	Atlanta Latency		9.57 ms / 2011-02-03 12:58:25UTC	11.77 ms / 2011-02-03 12:58:01UTC	14.13 ms / 2011-02-03 12:58:21UTC	27.59 ms / 2011-02-03 12:58:04UTC	9.51 ms / 2011-02-03 12:57:56UTC	27.07 ms / 2011-02-03 12:58:03UTC	35.50 ms / 2011-02-03 12:57:41UTC	6.80 ms / 2011-02-03 12:57:54UTC
	Chicago Latency	9.91 ms / 2011-02-03 12:57:28UTC		12.51 ms / 2011-02-03 12:57:31UTC	4.62 ms / 2011-02-03 12:57:45UTC	28.33 ms / 2011-02-03 12:57:39UTC	13.67 ms / 2011-02-03 12:57:54UTC	17.56 ms / 2011-02-03 12:58:24UTC	25.99 ms / 2011-02-03 12:57:56UTC	8.45 ms / 2011-02-03 12:58:25UTC
	Houston Latency	11.75 ms / 2011-02-03 12:57:33UTC	12.16 ms / 2011-02-03 12:58:07UTC		6.18 ms / 2011-02-03 12:58:05UTC	15.88 ms / 2011-02-03 12:57:58UTC	21.21 ms / 2011-02-03 12:58:20UTC	19.12 ms / 2011-02-03 12:58:08UTC	28.67 ms / 2011-02-03 12:58:25UTC	18.50 ms / 2011-02-03 12:58:12UTC
	KansasCity Latency	15.89 ms / 2011-02-03 12:58:08UTC	6.05 ms / 2011-02-03 12:58:16UTC	7.95 ms / 2011-02-03 12:57:32UTC		23.78 ms / 2011-02-03 12:58:29UTC	19.66 ms / 2011-02-03 12:57:27UTC	13.00 ms / 2011-02-03 12:57:46UTC	21.43 ms / 2011-02-03 12:58:08UTC	14.44 ms / 2011-02-03 12:58:13UTC
	LosAngeles Latency	27.92 ms / 2011-02-03	28.32 ms / 2011-02-03	16.21 ms / 2011-02-03	22.32 ms / 2011-02-03		37.37 ms / 2011-02-03	11.82 ms / 2011-02-03	12.85 ms / 2011-02-03	34.65 ms / 2011-02-03

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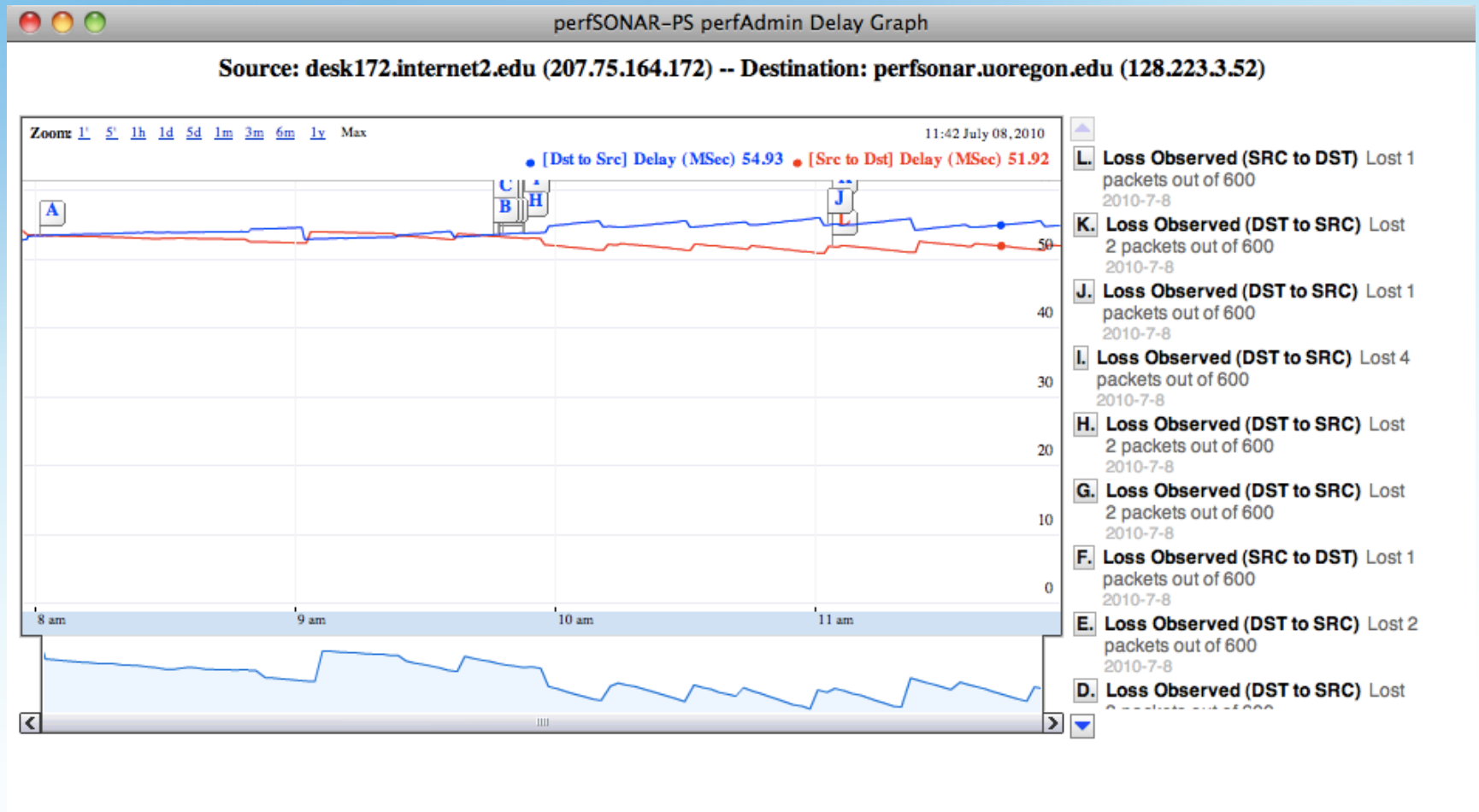
OWAMP GUIs – Delay/Loss Plot



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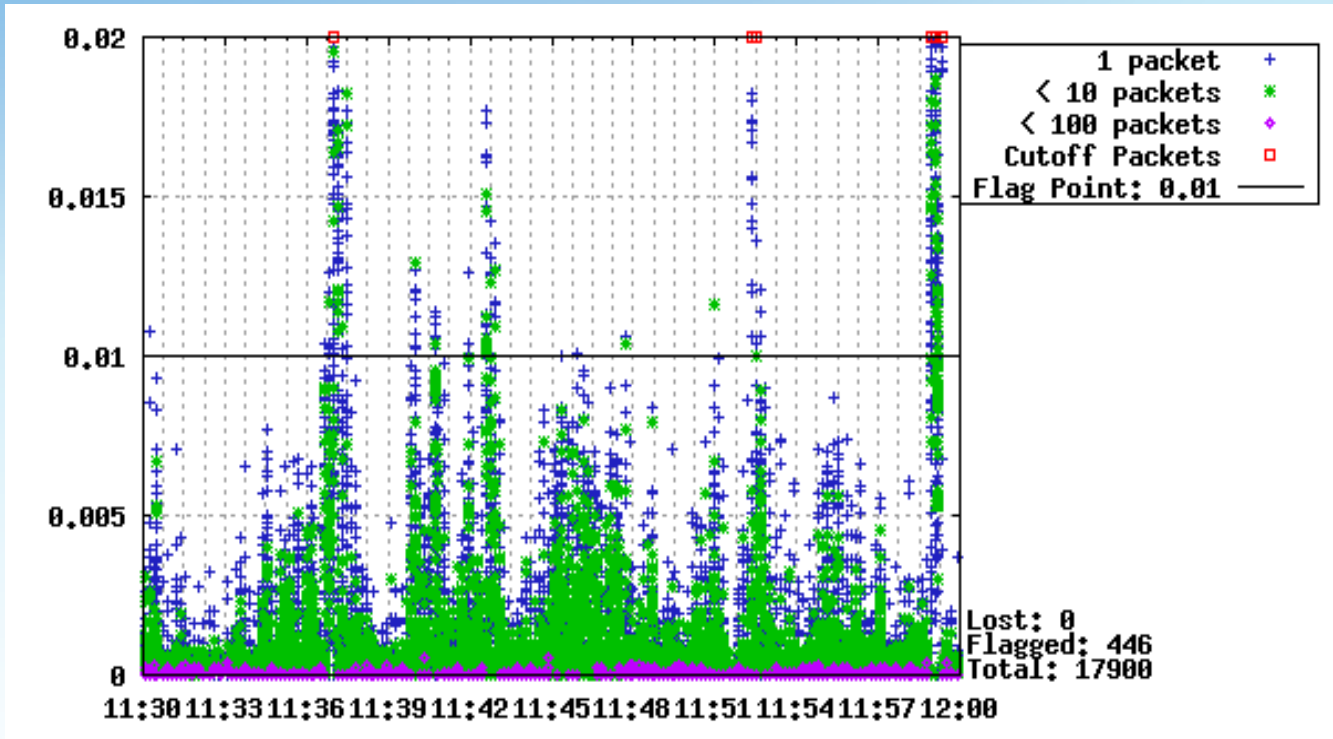
OWAMP GUIs - Jitter



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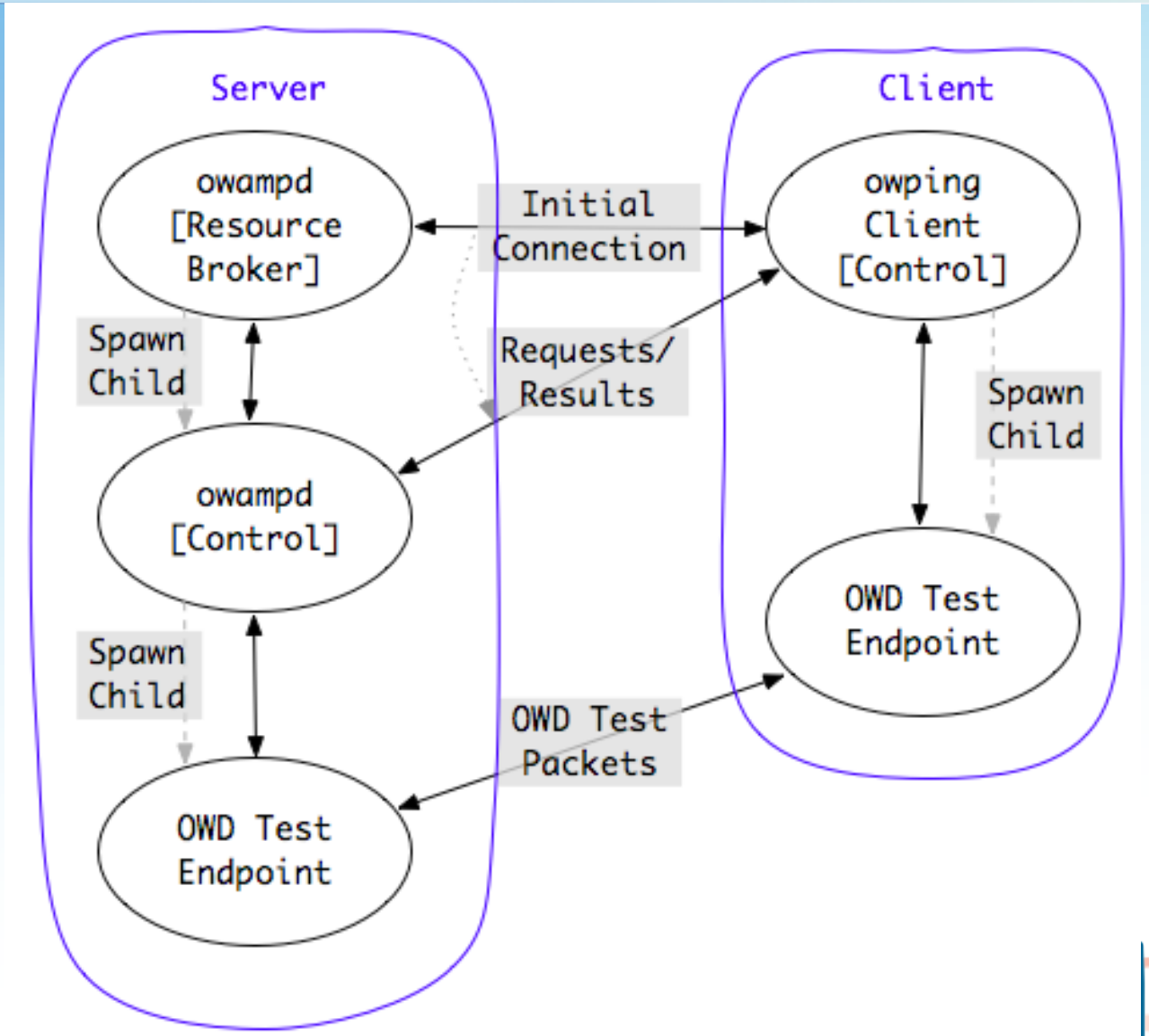
Architecture



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OWAMP Requirements

- Clock requirement is the strongest
  - Doesn't work well in virtualized environments
  - Doesn't work well when machine is doing heavier testing (e.g. BWCTL), results may be suspect
- NTP (ntpd) synchronized clock on the local system
  - Specific configuration requirements as specified in NTP talk…
  - Strictly speaking, owamp will work without ntp. However, your results will be meaningless in many cases

General Requirements – Time Source

- NTP (ntpd) synchronized clock on the local system
  - Configure NTP properly (don't rely on system defaults!)
  - Strictly speaking, owamp will work without NTP. However, your results will be meaningless in many cases
  - More info here: http://www.internet2.edu/performance/owamp/details.html#NTP

General Requirements – Support

- Source Code
  - All modern Unix distributions (Free BSD/Linux)
  - OS X
- Packages
  - Support for CentOS 5.x and 6.x (x86 and 64 Bit)
  - Packages have been shown to operate on similar systems (Fedora, RHEL, SL)
  - Avoid 'alien' on the non-RHEL variants, go with source instead

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Hardware

- "Bare Metal" – virtualization is tricky
- Stable System Clock
  - Temperature controlled environment
  - No power management of CPU
  - Reduction of "background" services – may institute noise
- No strict requirements for CPU, Memory, Bus speed
  - More tasking schedules will require more capable hardware

Operational Concerns

- Time:
  - NTP issues predominate the problems
  - Determining an accurate timestamp "error" is in many ways more difficult than getting a "very good" timestamp
  - Working as an "open" server requires UTC time source (For predefined test peers, other options available)
- Firewalls:
  - Port filter trade-off
    - Administrators like pre-defined port numbers
    - Vendor manufactures would probably like to "prioritize" test traffic
    - Owampd allows a range of ports to be specified for the receiver

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Policy/Security Considerations

- Third-Party DoS source
  - Compromised server may send packets to other locations.
- DoS target
  - Excessive traffic will harm measurement results
  - Someone might attempt to affect statistics web pages to see how much impact they can have
- Resource consumption
  - Time slots
  - Memory (primary and secondary)
  - Network bandwidth
- Restrict overall bandwidth to something relatively small
  - Most OWAMP sessions do not require much
- Limit "open" tests to ensure they do not interfere with precision of other tests

Availability

- Currently available
  - http://www.internet2.edu/performance/owamp
  - http://software.internet2.edu
- Mail lists:
  - https://lists.internet2.edu/sympa/info/owamp-users
    - owamp-users@internet2.edu
  - https://lists.internet2.edu/sympa/info/owamp-announce
    - owamp-announce@internet2.edu

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For more information, visit http://www.internet2.edu/workshops/npw