# Measuring the Network

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## Agenda

1. Introduction
2. bwctl and owamp

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## Measuring the Network: Definition of Network Performance

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- Functional definition of network performance
  - speed of the network
  - latency
  - jitter
  - packet corruption

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## Measuring the Network: Types of Measurement

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- Passive Measurements
  - Measure and monitor the quality of the service offered
- Active Measurements
  - ping and traceroute
  - bwctl (Iperf) and owamp

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# Measuring the Network: Active Measurements

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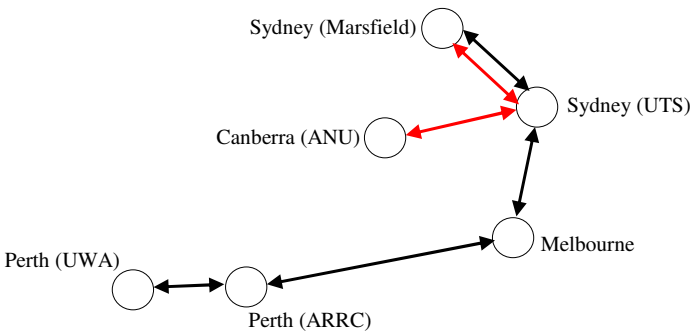
## Network Schematic

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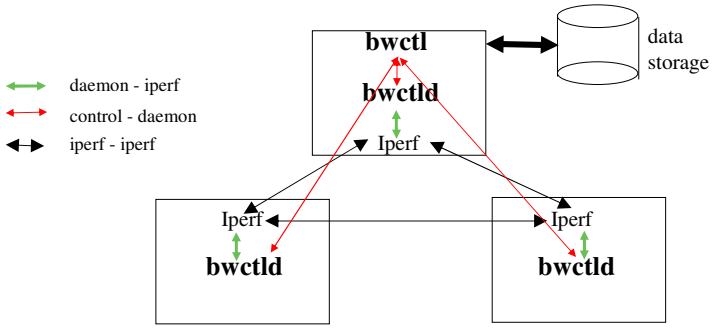
# Measuring the Network: Active Measurements



## bwctl – typical scenario

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# Measuring the Network: Active Measurements



## bwctl

- The following slides show some results obtained using the bwctl software.
- All measurements were made by requesting udp transfers at 90 Mbps between two hosts.
- To avoid beating effects and to minimise the impact of these measurements on the network, they were carried out for 30 seconds approximately once an hour.
- A page of “normal” results is shown here.

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# Measuring the Network: Active Measurements

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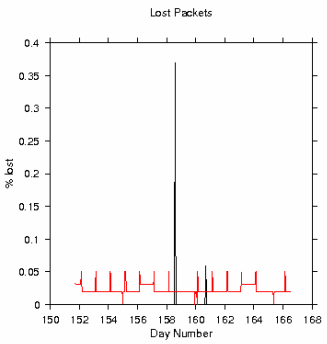
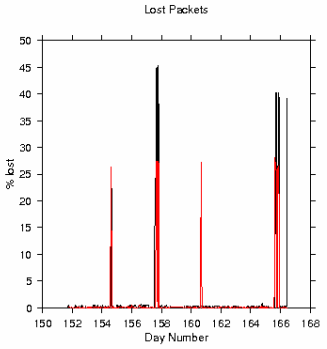
bwctl

**lister ⟷ omega**




**lister ⟷ orac**

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# Measuring the Network: Active Measurements

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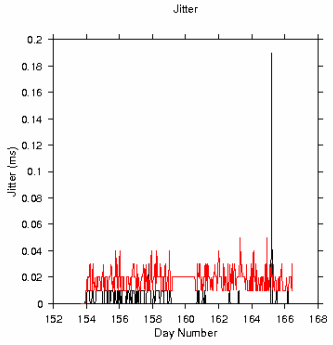
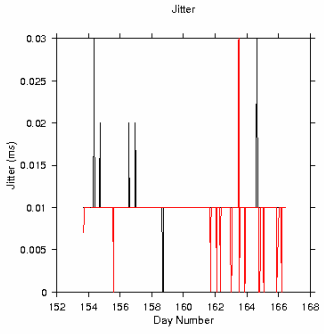
bwctl

**artemis ⟷ omega**




**lister ⟷ kryten**

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# Measuring the Network: Active Measurements



## One-Way Measurements - OWAMP

**How it works**

- The protocol expects that probe senders and probe receivers using synchronized clocks be deployed – the daemon *owampd*.
- The sender records the precise time a probe packet was transmitted into the network.
- The receiver records the precise time that same packet arrived at the receiver.
- The difference in these times gives the measurement.

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## One-Way Measurements – OWAMP example

```
./owping 172.20.4.118

--- owping statistics from [kryten.mgmt.CeNTIE.NET.AU]:1123 to [orac.mgmt.CeNTIE.NET.AU]:2235 -
--
SID: ac140476c65b85970333b96a3d046775
100 packets transmitted, 0 packets lost (0.0% loss)
one-way delay min/median = -139.999/-138.000 ms  (precision 0.14087 s)
no reordering


--- owping statistics from [orac.mgmt.CeNTIE.NET.AU]:3689 to [kryten.mgmt.CeNTIE.NET.AU]:1124 -
--
SID: ac14043dc65b8596ef55ffe6b552988a
100 packets transmitted, 0 packets lost (0.0% loss)
one-way delay min/median = 193.338/194.000 ms  (precision 0.14087 s)
no reordering


PING 172.20.4.118 (172.20.4.118): 56 data bytes

--- 172.20.4.118 ping statistics ---
100 packets transmitted, 100 packets received, 0% packet loss
round-trip min/avg/max/stddev = 54.328/54.418/54.560/0.051 m
```

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# Measuring the Network: Active Measurements



## One-Way Measurements – ntpq output

- kryten

| remote | refid | st | t | when | poll | reach | delay | offset | jitter |
|---|---|---|---|---|---|---|---|---|---|
| +cantor | ntp.thistledown | 2 | u | 14 | 64 | 377 | 54.400 | 99.849 | 36.471 |
| +newton | ntp.thistledown | 2 | u | 20 | 64 | 377 | 54.393 | 71.230 | 31.614 |
| -kermit | yarrina.connect | 3 | u | 10 | 64 | 157 | 61.319 | 202.231 | 46.258 |
| *bob.greenwood | ntp.hobart.nml. | 2 | u | 57 | 64 | 377 | 17.583 | 154.663 | 137.050 |
| -ppp178-205 | time-C.timefreq | 2 | u | 56 | 64 | 367 | 77.670 | 236.747 | 70.949 |

server 0.au.pool.ntp.org
server 1.au.pool.ntp.org
server 2.au.pool.ntp.org
server 172.20.4.119
server 172.20.4.116

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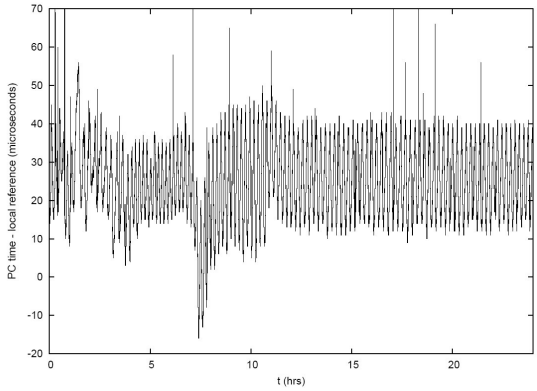
## One-Way Measurements – ntp time variation




Supplied by Bruce Warrington of the Time and Frequency Division of the National Measurement Institute.

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### One-Way Measurements – OWAMP working

- Is there anything that can be done?
- Use stratum 1 servers to create two stratum 2 servers on the network.
- Use these stratum 2 servers exclusively to set the time inside the CeNTIE network.
- Much improved results obtained to the extremities of the network.
  - orac → artemis 25.6 ± 1.2
  - artemis → orac 29.1 ± 1.2
  - artemis ↔ orac 54.7 ± 2.4
  - ping mean artemis ↔ orac 54.6

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**Any Questions?**

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# Measuring the Network



## Public Domain or Free Network Monitoring Tools

Applications Monitoring
- ANL Web100 based Network Configuration Tester
- H.323 Beacon aslookup arpwatch Dig Netdisco D-ITG

Finger Printing
- Nmap TBIT sscan Autobuf bbcp bbftp Firehose GSIFTP SafeTP NcFTP RFT WU-FTPD
- Internet Detective JetMon Lachesis LinkRank

Mapping tools
- GeoPlot Mapnet NetGeo

Monitoring Infrastructures
- Cheops CycleTraders Ganglia Mon Nagios NetMeter Network Performance Advisor
- NIMI OSSMON Scriptroute Website Monitoring Wombat mrtg NetLogger NetNow netstat
- NetStat Live Network Diagnostic Tool ns NIST Net Ntop NOCOL nslookup

Packet capture tools
- Analyzer Argus Bro intrusion detection system Cflowd Crypto-PAn Ethereal flstats Natas NetraMet

PasTmon sniffit
- Snoop Snuffle Tcpdpriv tcpdump TCPurify TCPshow Tcptrace trafd trafshow WinPcap

Path Characterization & Bandwidth Estimation
- ABwE Bandwidth Estimation Tools Bing Bprobe cprobe Clink Nettimer Pathchar PathChirp
- Pathload Pathprobe Pathrate Pchar Pipechar STAB fping Fpinger FREEping pathping MTR Ping
- Pingroute.pl Synack Tping Traceping Visual Ping hping2 Zinger Qcheck Bronc Cricket NMIS Orca
- remstats SmokePing RouteViews Analyse It STC UCD SNMP public domain tools
- Spong Sting TCPtune telnet

Throughput tools
- gen_send/gen_recv I2perf IPerf MGEN netperf RUDE Tcpspray TReno ttcp UDPmon

Traceroute
- Gtrace NeoTrace pathping Prtraceroute TCPtraceroute Traceroute-nanog VisualRoute

Web Benchmarking Tools
- WCAT WebStone WWW performance monitoring

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