SWINBURNE UNIVERSITY OF TECHNOLOGY

Test and Measurement with the Ninja box (and BART)

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Outline

Introduction
Test and Measurement in CAIA

- Test and Measurement of various network characteristics is a vital part of CAIA's research.
- The Endace Ninja Box (`http://www.endace.com/ninjabox.html`) will enhance our traffic measurement and traffic generation capabilities.
- This talk will outline the Ninja Box capabilities in conjunction with:
  - The Broadband Access Research Testbed (BART) `http://caia.swin.edu.au/bart/`
  - The Synthetic Packet Pair (SPP) tool for passive Round Trip Time (RTT) measurement. `http://caia.swin.edu.au/tools/spp/`

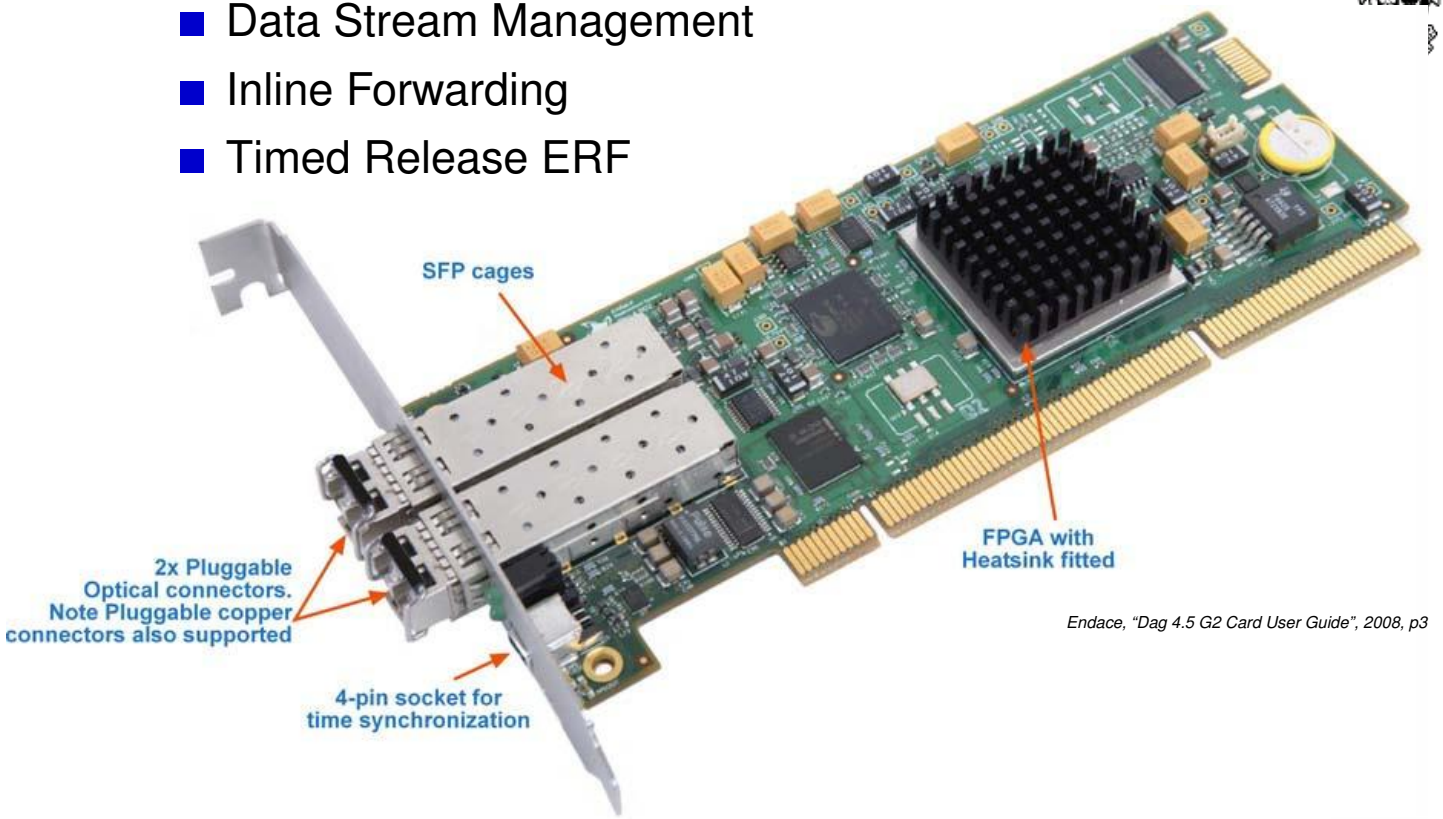
What is the Ninja Box?

`http://www.endace.com/ninjabox.html`

- Server grade machine, optimised for packet capture
- Our Configuration:
  - 2 $\times$ 2 GHz Intel(R) Xeon(R) core 2 duo
  - Linux kernel 2.6.18, Centos OS, 4G ram
  - 2TB disk (8 disk raid)
  - 2$\times$DAG 4.5G2 – Precision packet capture cards

4.5G2 DAG cards

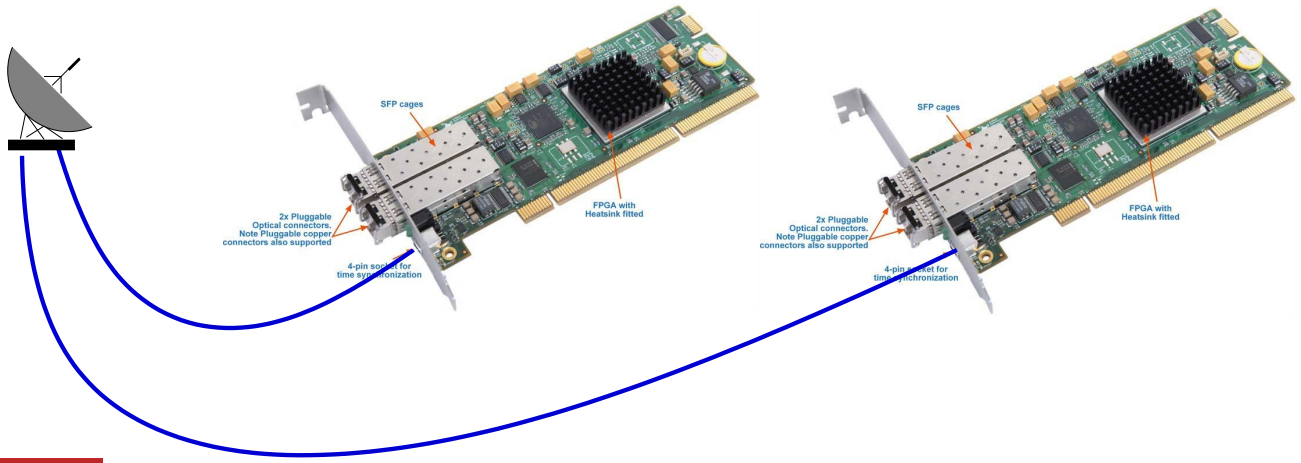
- Data Stream Management
- Inline Forwarding
- Timed Release ERF



Endace, "Dag 4.5 G2 Card User Guide", 2008, p3

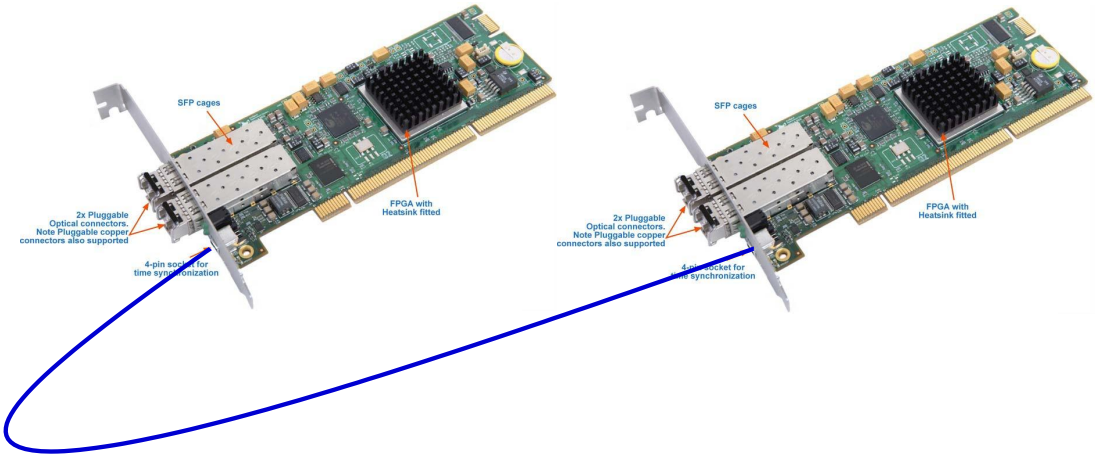
DAG Clock Synchronisation

- Geographically separated measurements
  - Synchronise with GPS



DAG Clock Synchronisation

- Geographically separated measurements
  - Synchronise with GPS
- We currently synchronise DAD 0 to the PC clock
  - Dag cards synchronised to each other
  - PC is synchronised by NTP
  - DAG cards synchronised to PC by DUCK

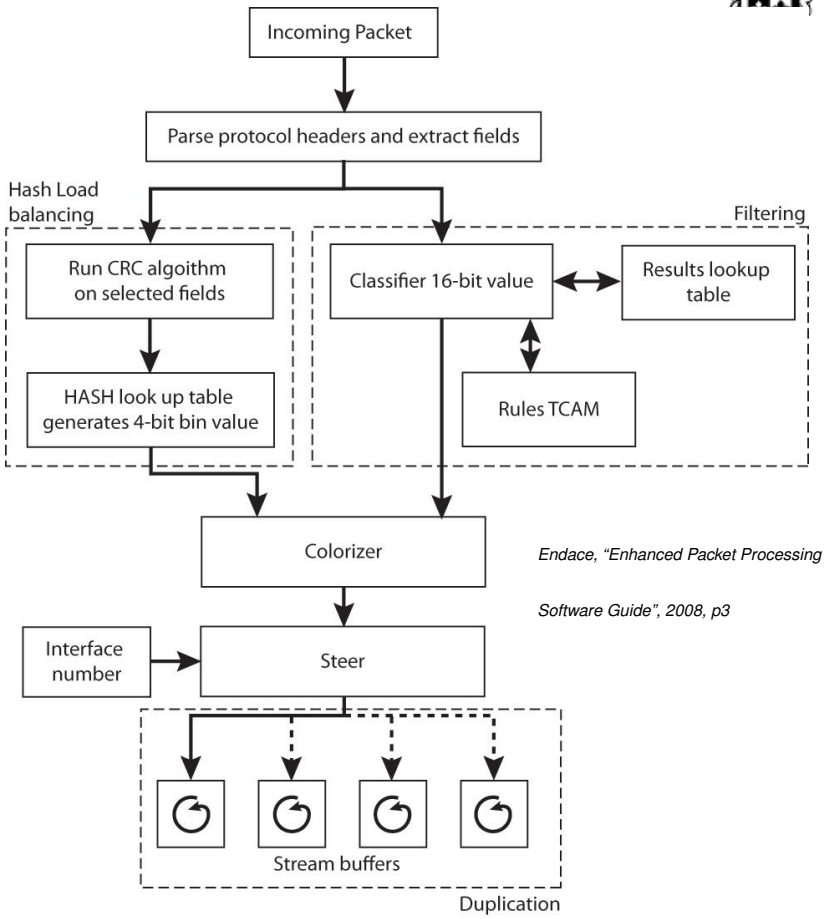


DAG Data Stream Management

- Filter/load balancing
- Packet colourising and dropping
- Packet steering

DAG Data Stream Management

- Packets are received from one or both ports
- Either:
  - Use inbuilt load balancing classifier
  - Or Classify (and drop) based on programmable filters
- Colourise (based on above result)
- Steer to stream buffer
  - 2Rx and 1Tx per DAG)
- Steering can include duplication



Endace, "Enhanced Packet Processing Software Guide", 2008, p3

Basic Capture

- dagsnap — high speed capture (erf)
  - packets from a previous capture session
- Post process if necessary (WAND libtrace (`http://research.wand.net.nz/software/libtrace.php`)
  - traceanon
  - tracefilter
  - tracesplit
  - tracemerge
- dagconvert — change format (ie to pcap)

Basic Traffic Generation

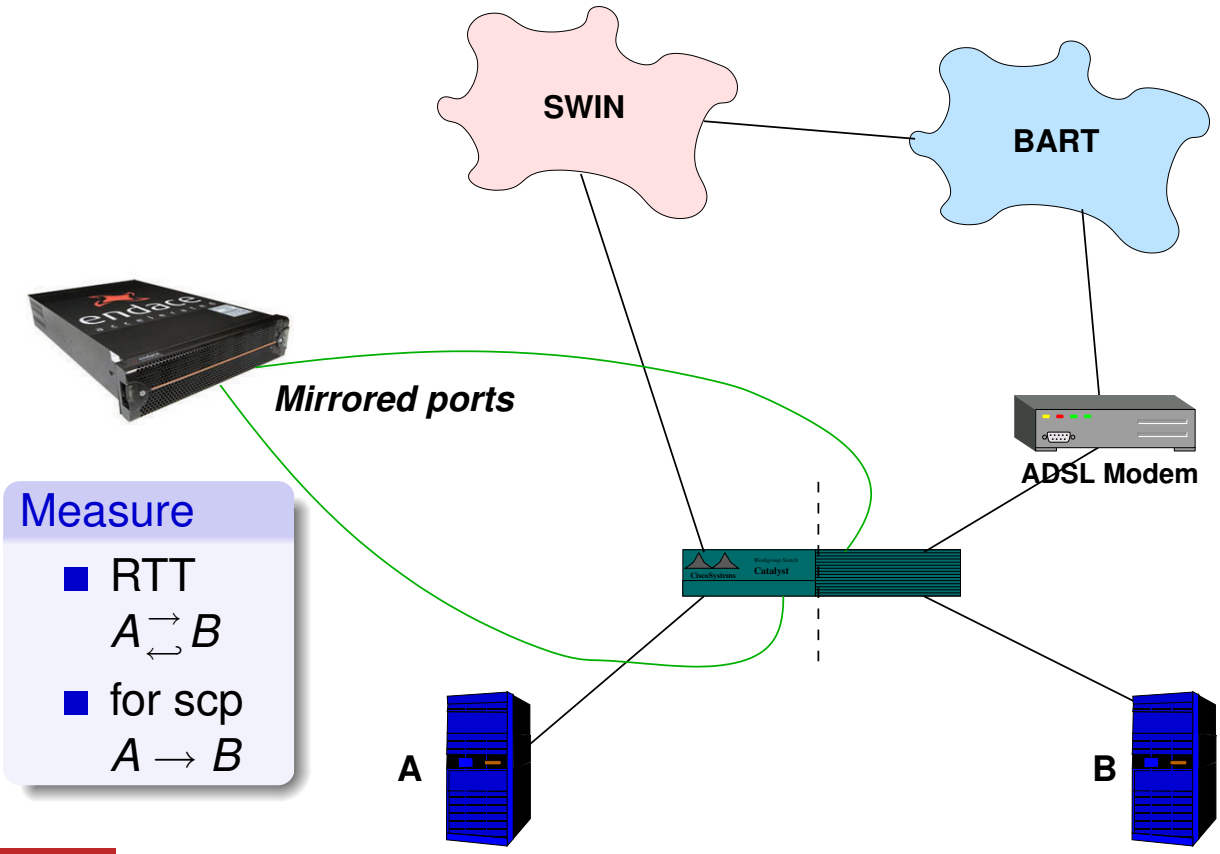
- daggen
  - Configuration file to describe traffic
  - Addresses can be random
  - Payloads can vary, deterministically or randomly
  - Outputs ERF format file (or can go direct to DAG)
- dagflood
  - Sends ERF file
  - To flood link: *dagconfig nodelay*
  - For timed replay: *dagconfig relative*

Simple Experiment

Objective

- Familiarity with:
  - NinjaBox (`http://www.endace.com/ninjabox.html`),
  - BART (`http://caia.swin.edu.au/bart/`),
  - and SPP (`http://caia.swin.edu.au/tools/spp/`)
- Compare NinjaBox and PC based tcpdump (`http://www.tcpdump.org/`) captures

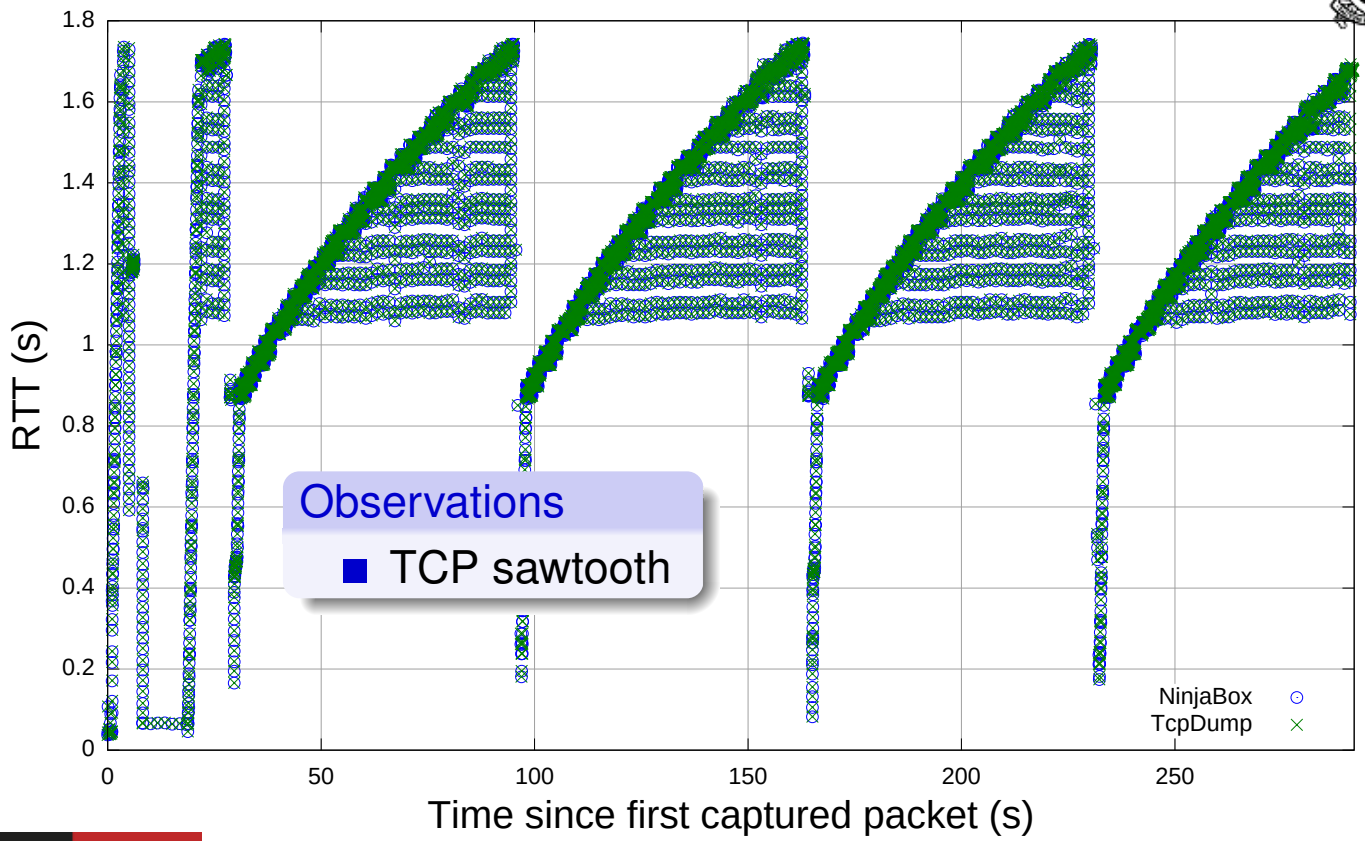
Setup



Measure

- RTT $A \rightleftarrows B$
- for scp $A \rightarrow B$

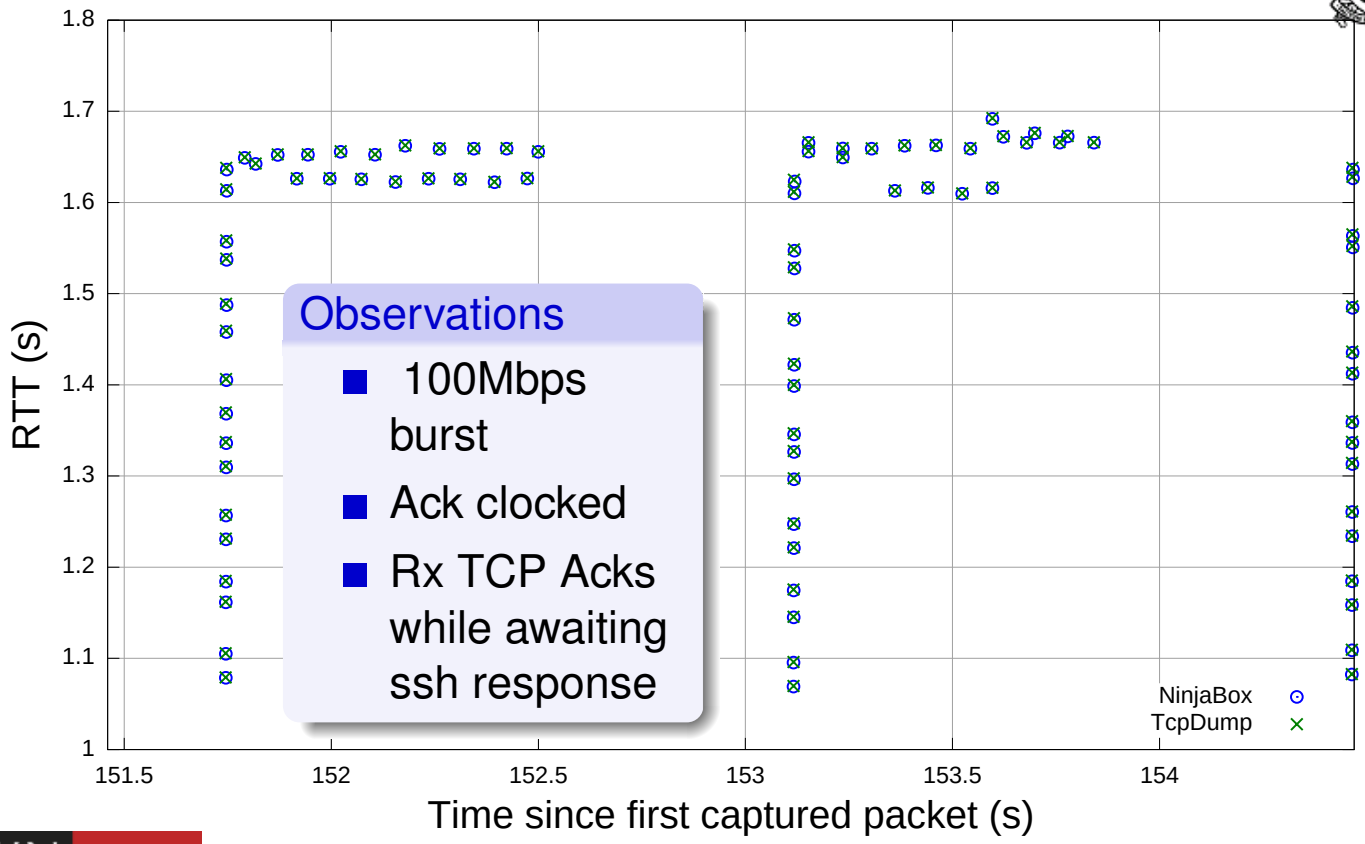
Results RTT $A \rightleftarrows B$



Observations

- TCP sawtooth

Results RTT $A \rightleftarrows B$ — Zoom



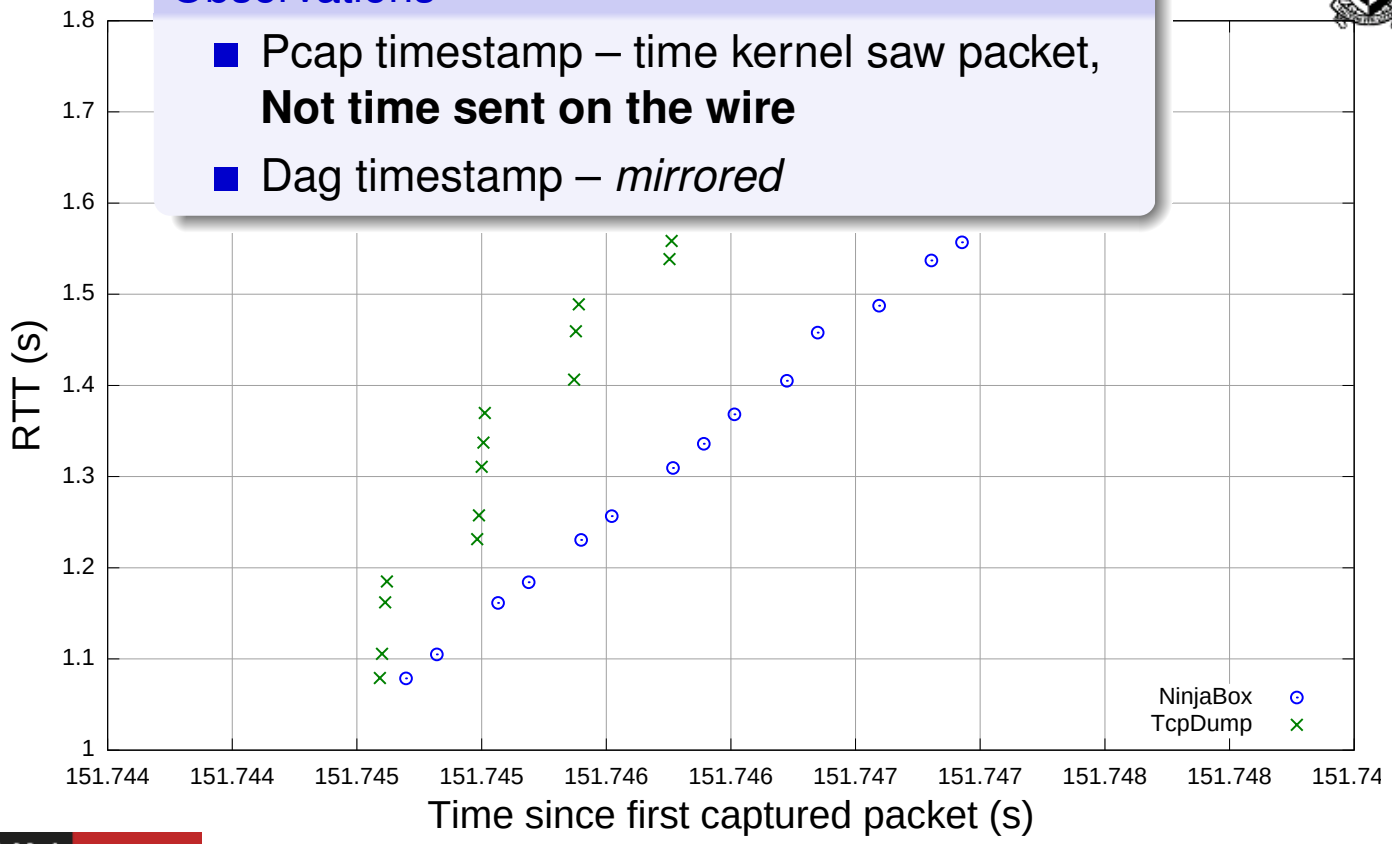
Observations

- 100Mbps burst
- Ack clocked
- Rx TCP Acks while awaiting ssh response

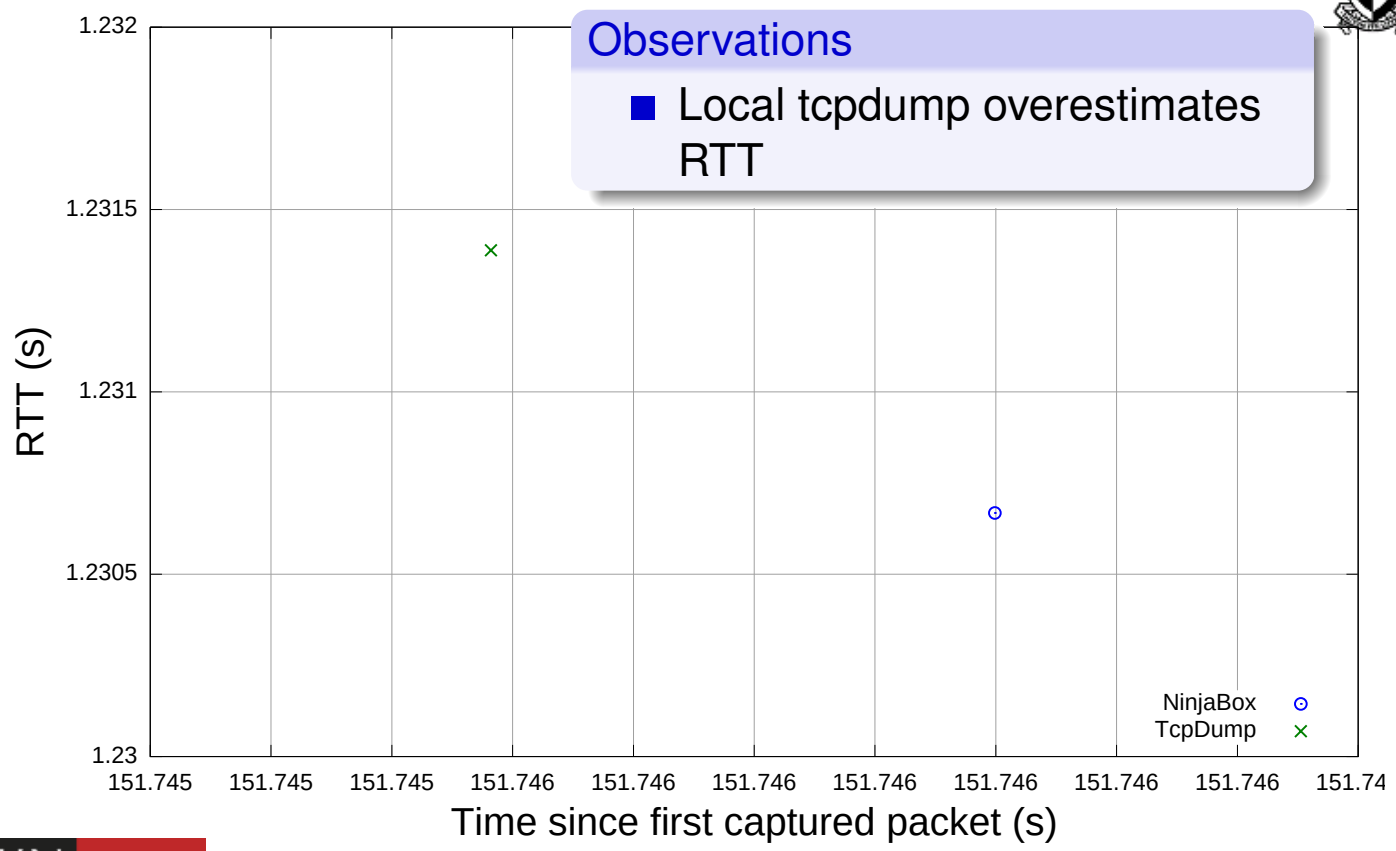
Results RTT $A \rightleftarrows B$ — Zoom

Observations

- Pcap timestamp – time kernel saw packet, **Not time sent on the wire**
- Dag timestamp – *mirrored*



Results RTT $A \rightleftarrows B$ — Zoom



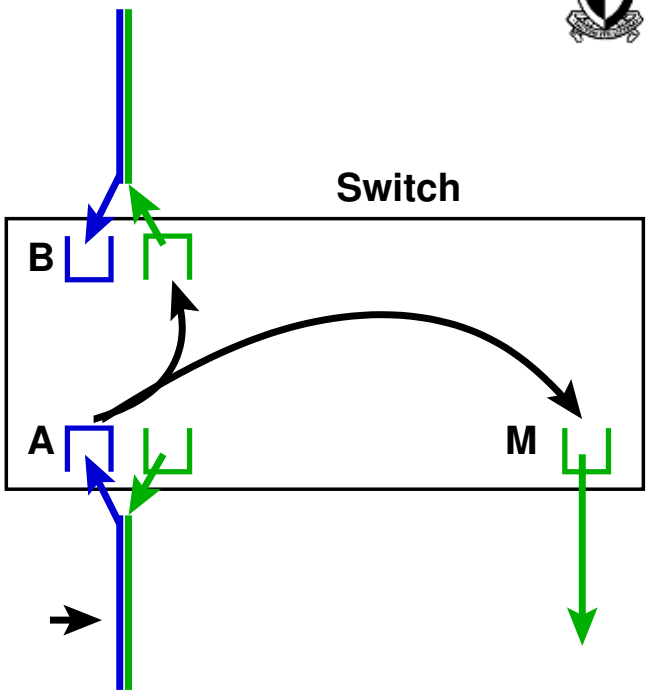
Observations

- Local tcpdump overestimates RTT

Port Mirroring Delays

UP direction

$$\Delta t_{up} = \tau_{rx} + \tau_{Ain} + \tau_{copy} + \tau_{Mout}$$



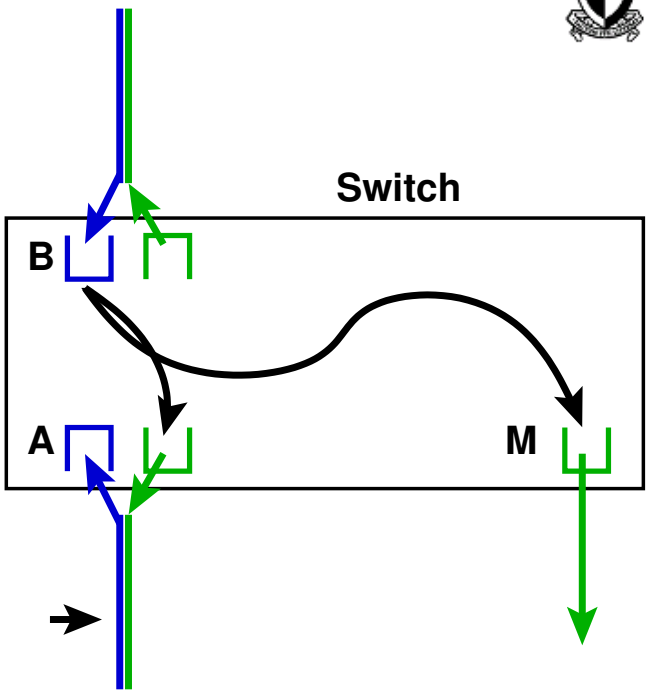
Port Mirroring Delays

UP direction

$$\Delta t_{up} = \tau_{rx} + \tau_{Ain} + \tau_{copy} + \tau_{Mout}$$

DOWN direction

$$\Delta t_{down} = \tau_{copy} + (\tau_{Mout} - \tau_{Aout})$$



- Perturbation depends on:
  - Packet size
  - Switch load
  - Full duplex utilisation

Conclusions

- Ninjabox will provide increased test and measurement capabilities for CAIA
- SPP is a great tool for RTT calculation
- When very accurate timing is required:
  - Care should be taken with the DAG clock synchronisation
  - Care should be taken with how the packets are captured

Thanks

- Jason
- Amiel
- Lawrence