On the Suitability of ping to Measure Latency

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We Use Ping

- But, what is the actual distribution of the RTTs?

- Could there be a rich distribution?

- We were using Atlas and found ping variance to be unexpectedly high

- So we decided to calibrate our tools

- So we ran a paris traceroute series from Roma Tre to Ashburn

Paris Traceroute Uses Flow-ID To Explore Hashed ECMP / LAGged Alternative Paths

Source port	Destination port
Length	Checksum

Figure 1: UDP header [16]. Fields in bold are part of the flow-id.

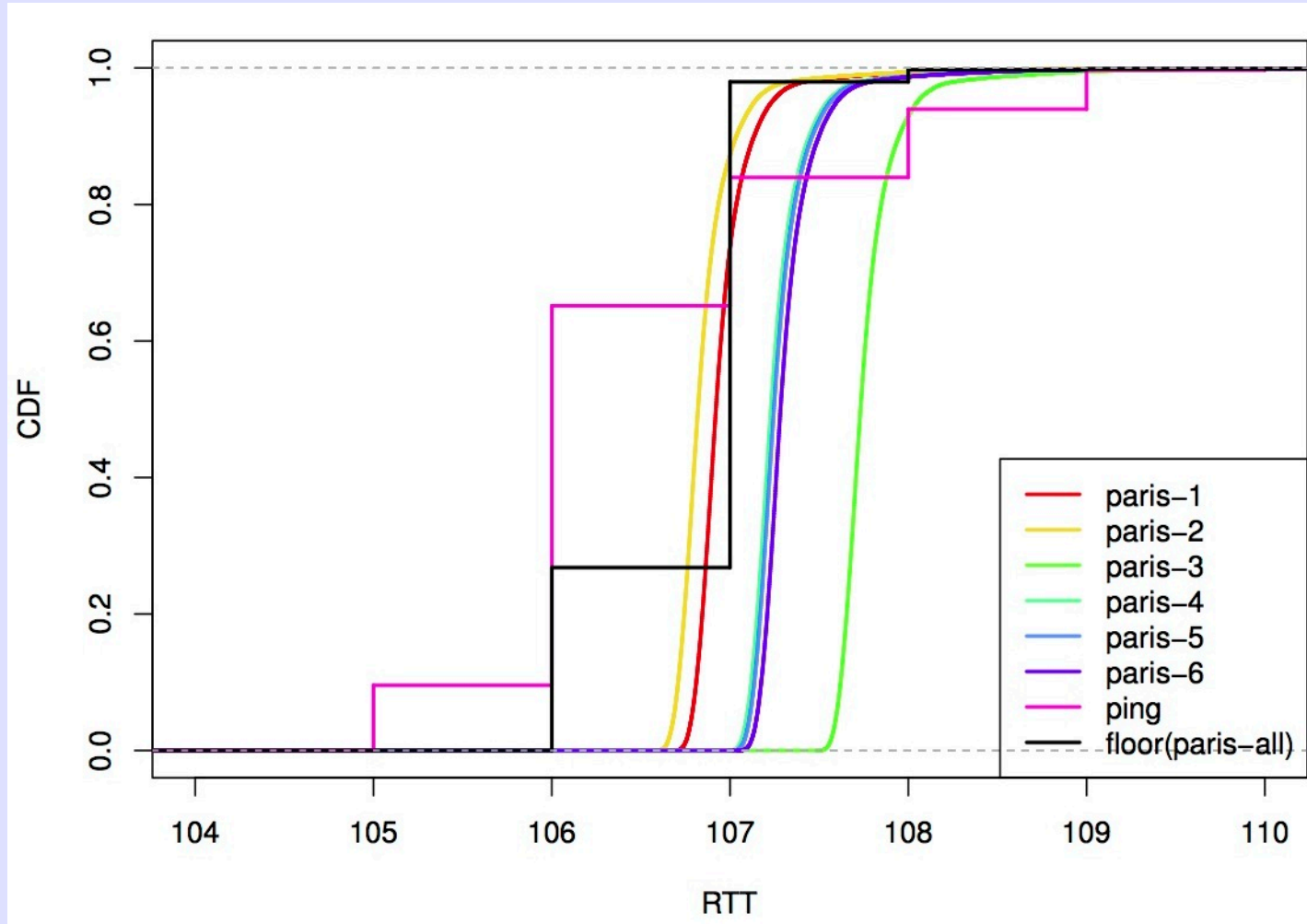| Type	Code	Checksum
Identifier		Sequence Number

Figure 2: ICMP echo message [17]. Echo request messages have type=8 and code=0. Echo reply messages have type=0 and code=0.

Type	Code	Checksum
unused (zero)		
IP Header + 64 bits of payload		

Figure 3: ICMP port unreachable message [17]. Type and code fields are both set to 3.
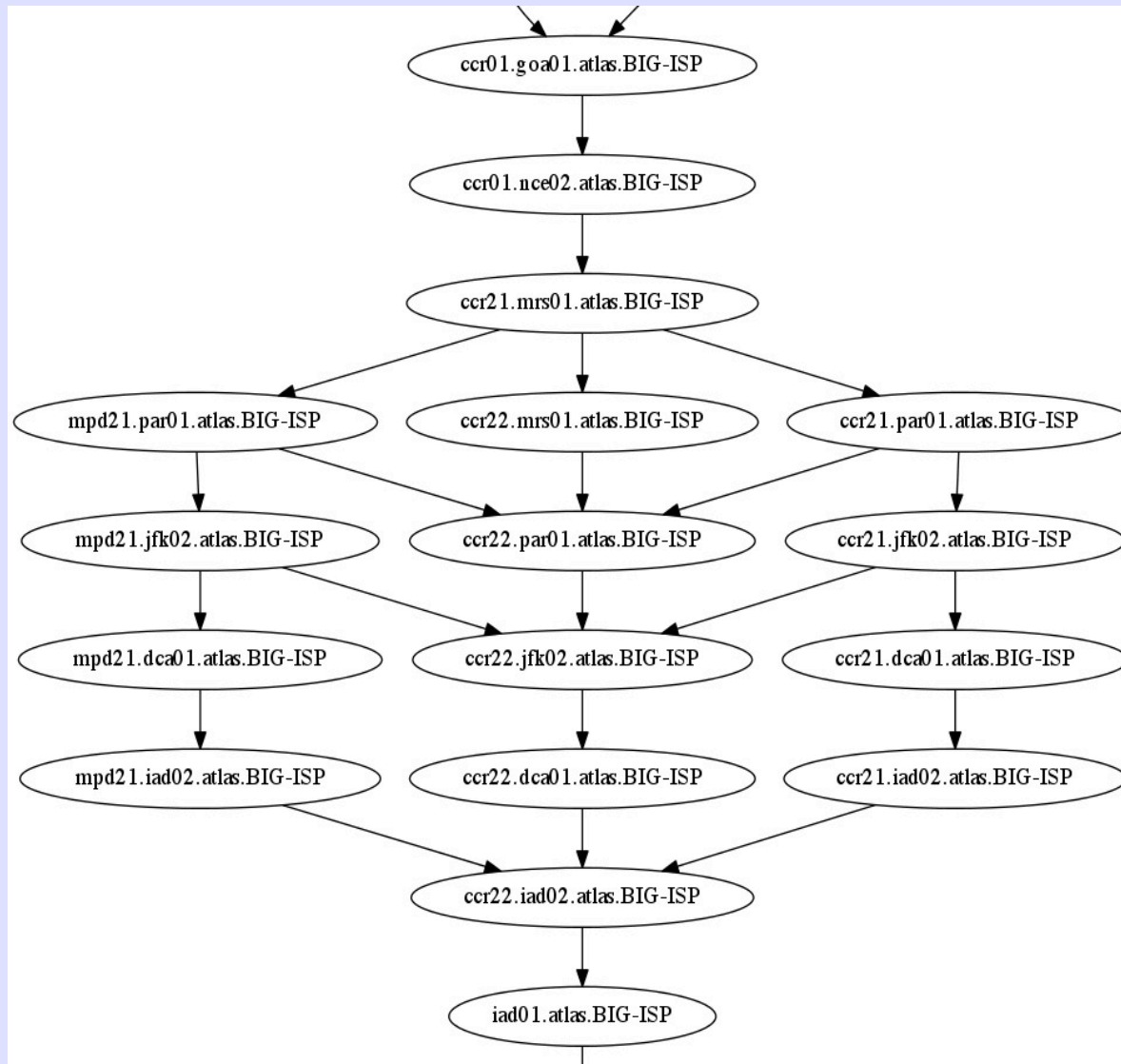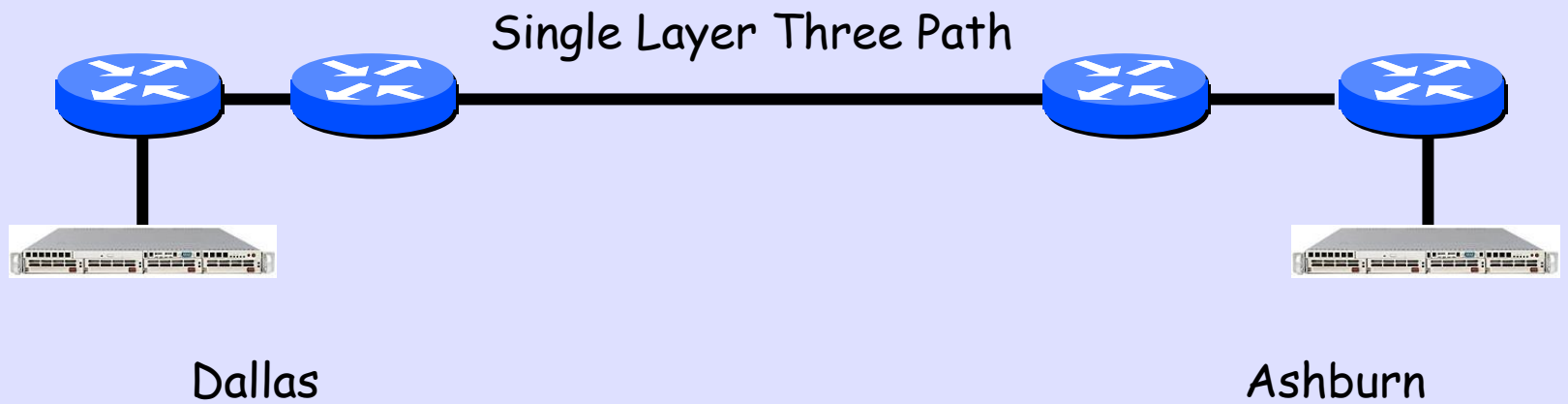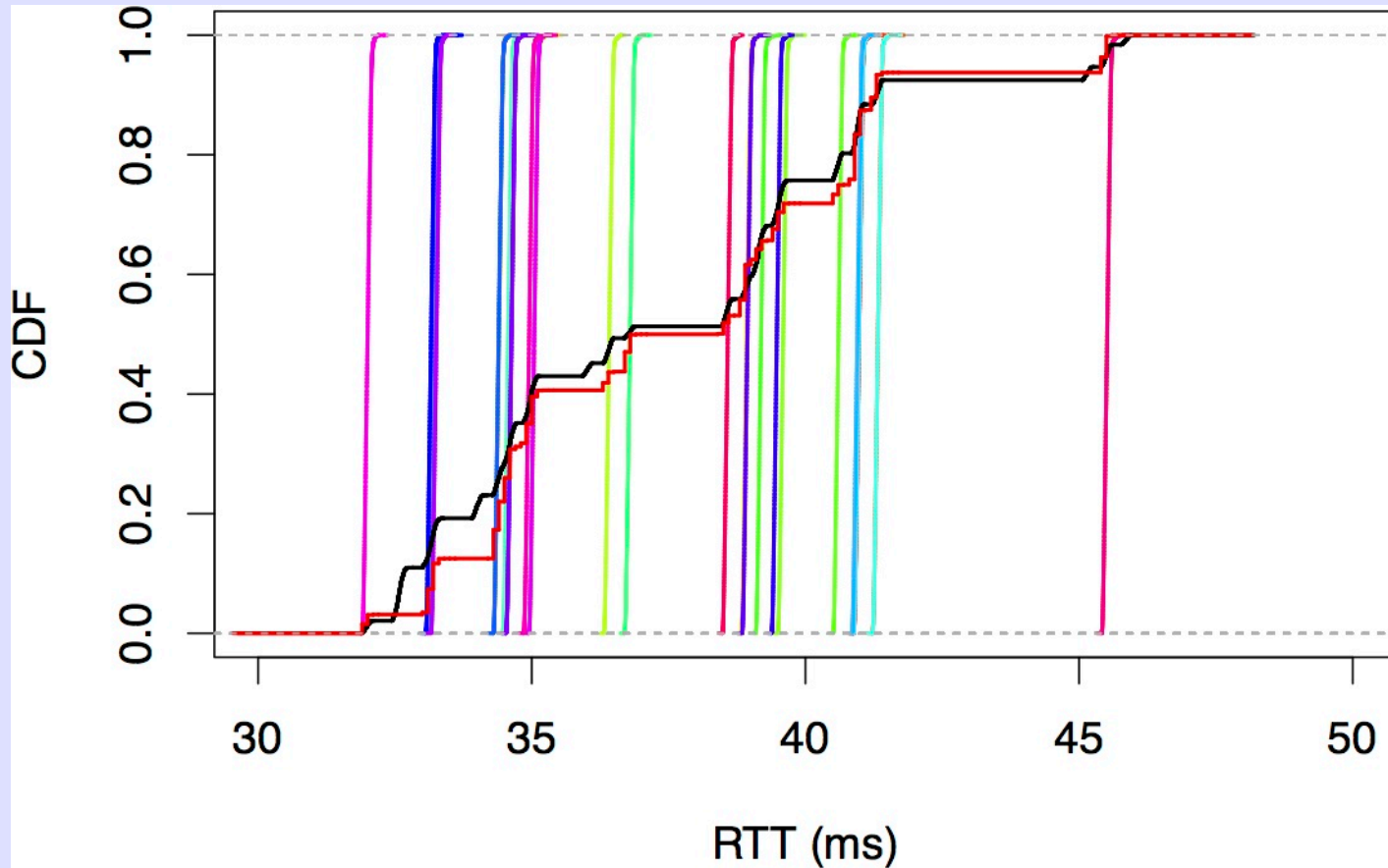
Roma Tre - Ashburn

Notice Linux Rounding

ECMP
!= Equal Latency Multi-Path

So, A Simple Path

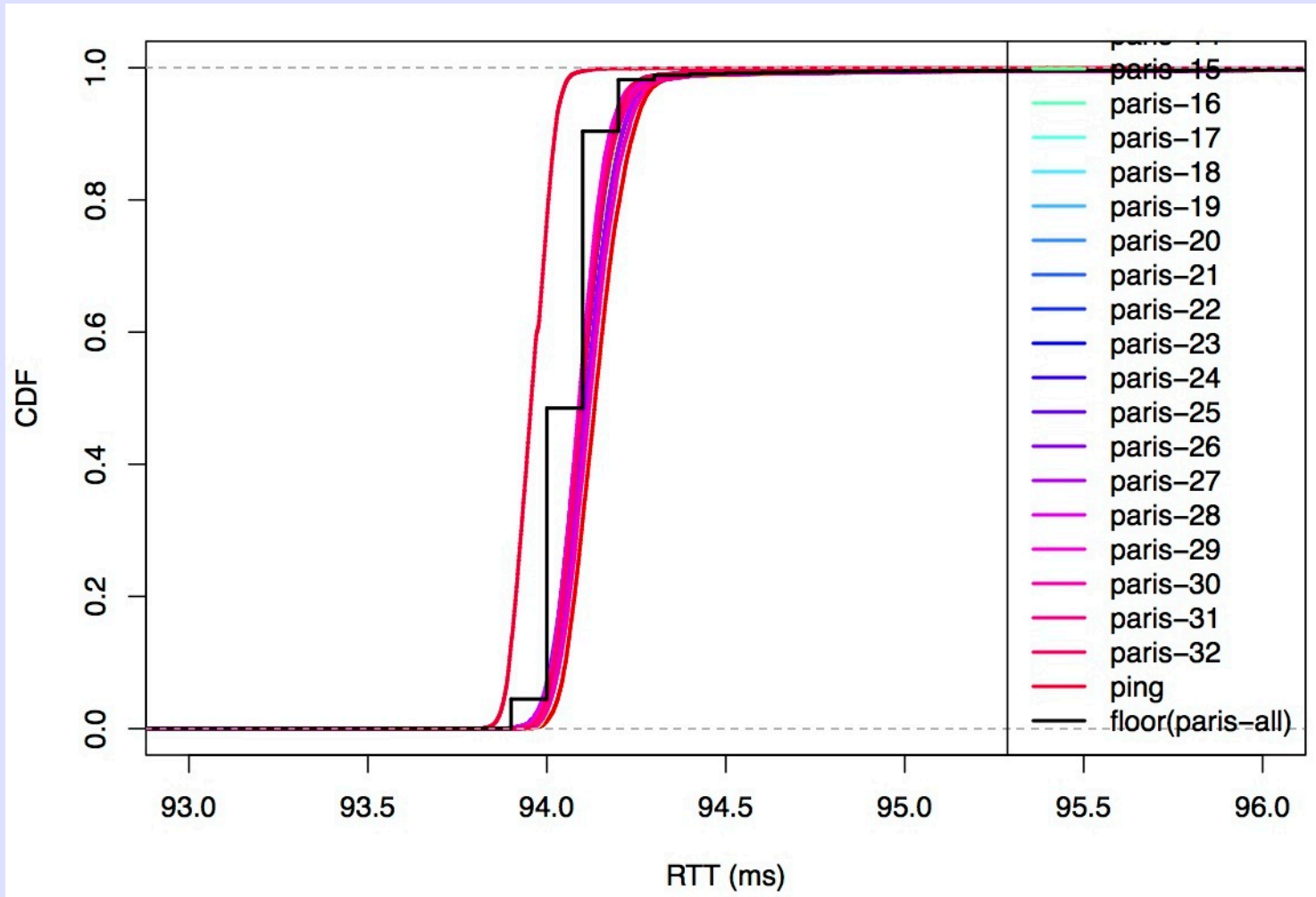Single Layer Three Path

Dallas
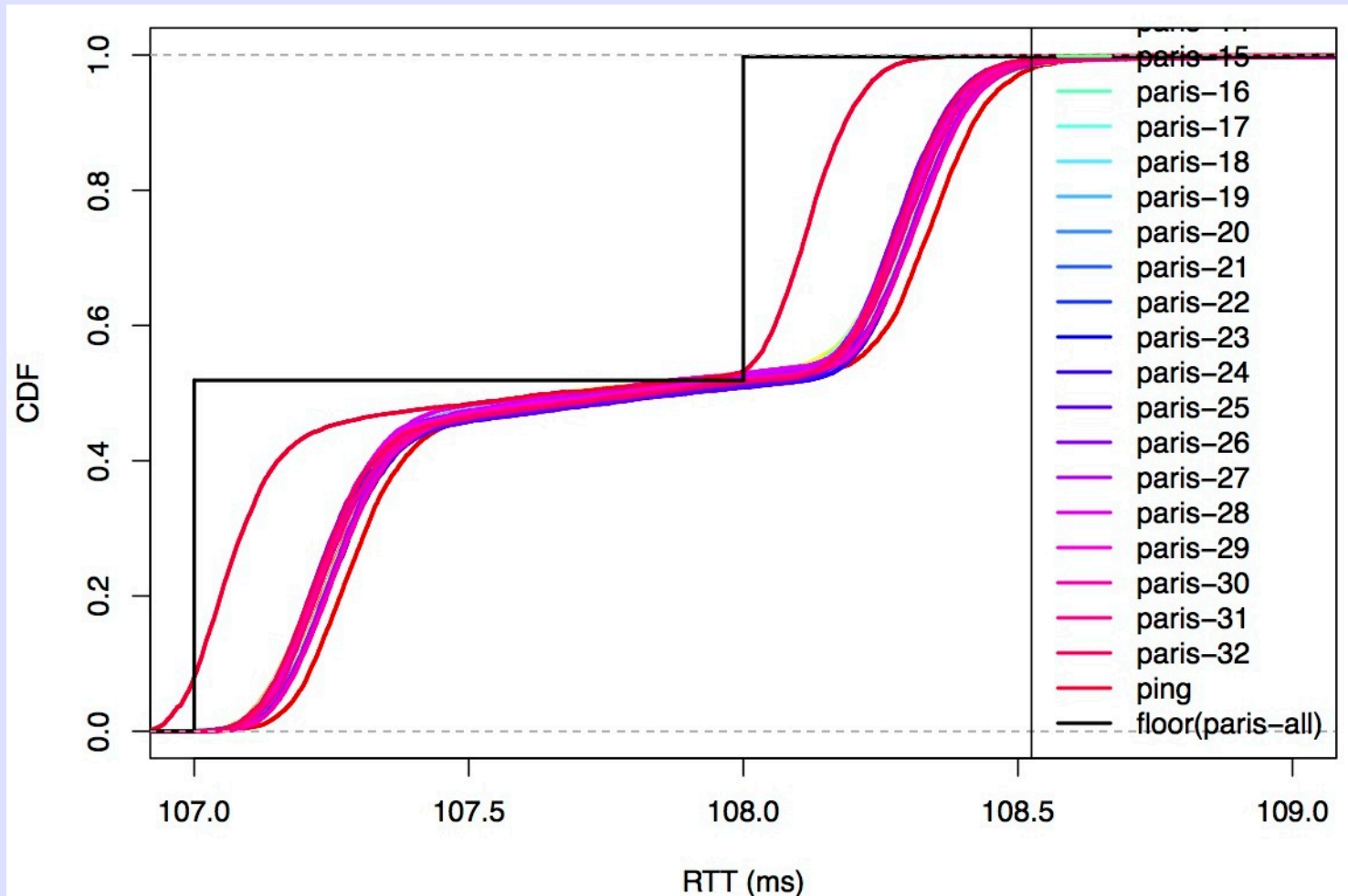
Ashburn

Simple Path Used LAG

FreeBSD Not Rounding

Looking for Causes

- Very Reproducible
- Circuit Loading <= 50%
- Same different times of day
- Same different probe timing/spacing
- Same UDP or ICMP

- Layer < 3 Hashing => Large Effect

Layer-3 Only Hash

Event During Run

Selected Summary

Src	Dst	ISPs	ECMP	LAG	Dispersion
ROM	ASH	> 1	yes	yes	4.21%
ROM	BXL	> 1	yes	yes	5.02%
ROM	LON	> 1	yes	yes	5.20%
TYO	SJO	1	yes	yes	23.59%
DAL	LON	1	no	yes	24.32%
PAR	ASH	1	no	yes	0%
DAL	ASH	1	no	yes	42.23%
DAL	SEA	1	yes	yes	15.46%
DAL	DAL	1	no	no	0.57%
DAL	DAL	1	no	yes	1.39%