On the Suitability of ping to Measure Latency

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We Use Ping

- We were using RIP Atlas and found ping variance to be unexpectedly high
- So we wanted to understand what is the actual distribution of the RTTs?
- Could there be a rich distribution?
- So we decided to calibrate our tools
- 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.

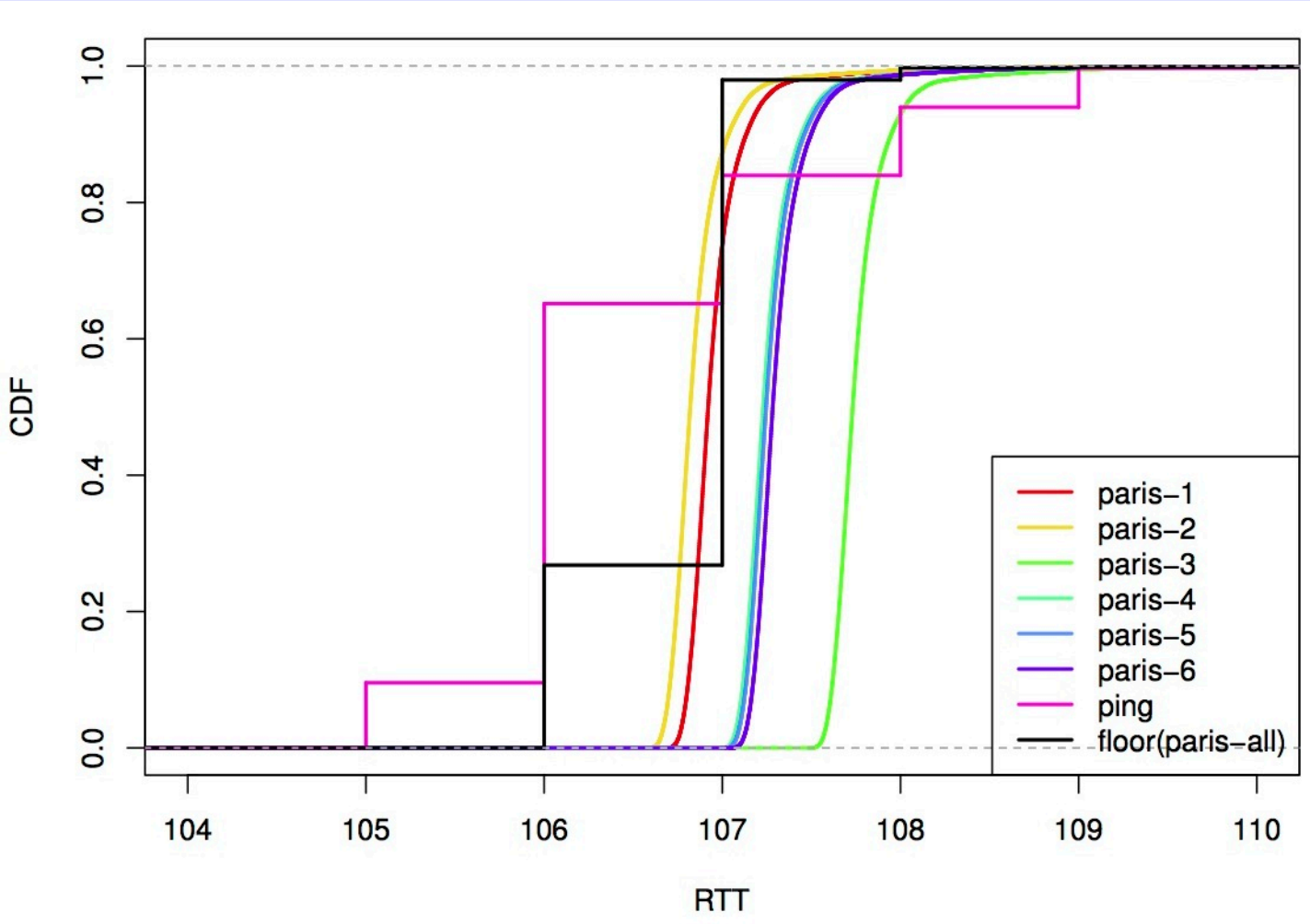
Type	**Code**	**Checksum**
Identifier		Sequence Number

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.

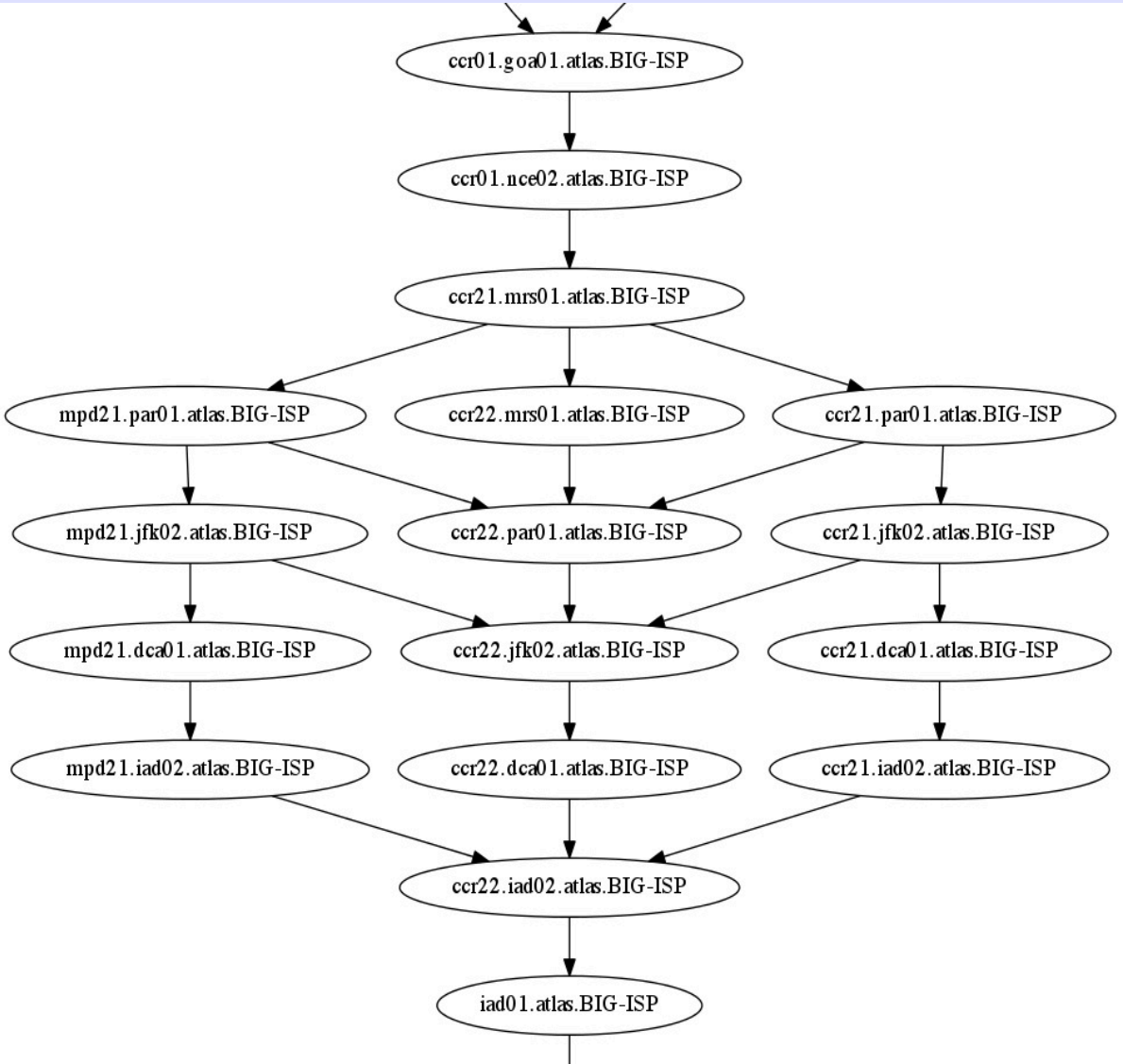
Roma Tre - Ashburn



Notice Linux Rounding

ECMP

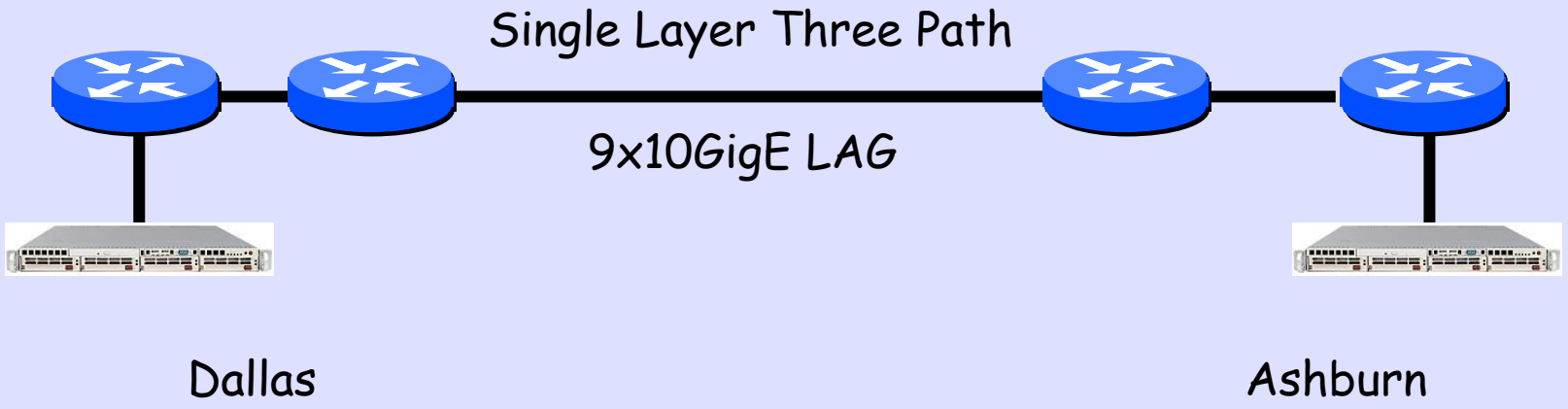
!= Equal Latency Multi-Path



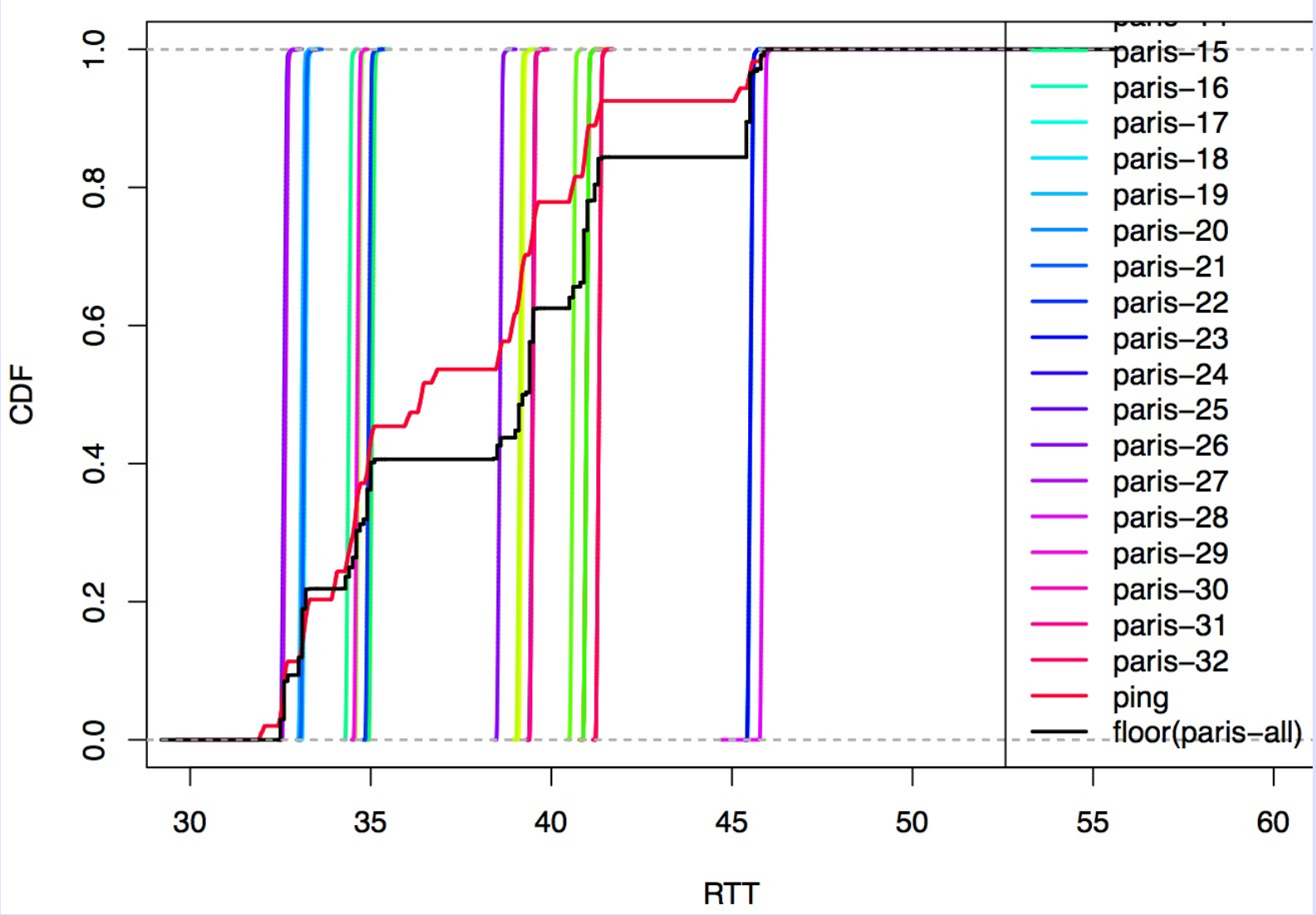
Too Complex
Too Much Happening

So Look at a
Simple Path

A Simple Path

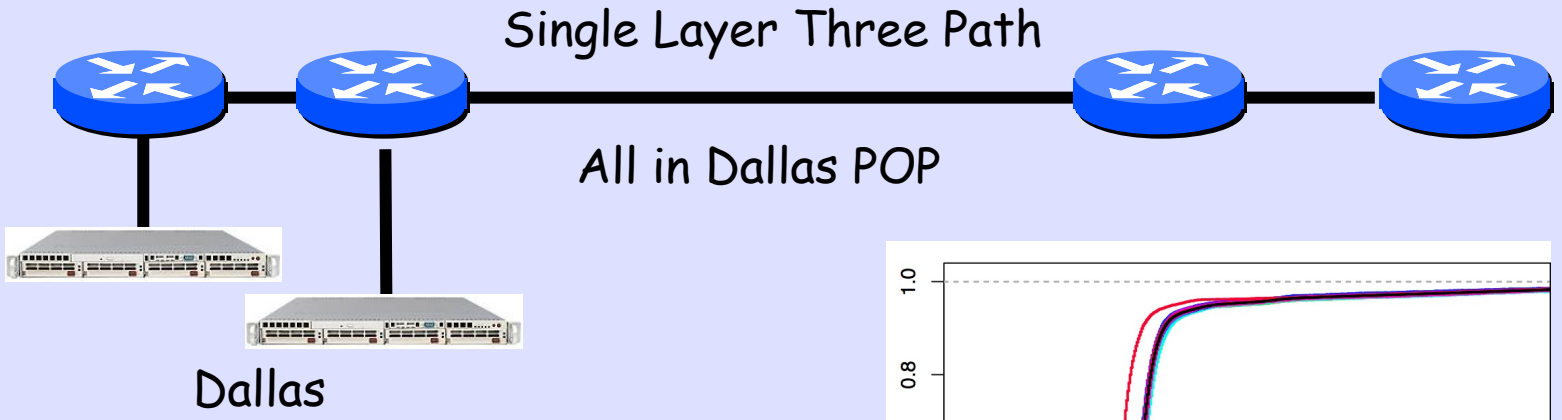


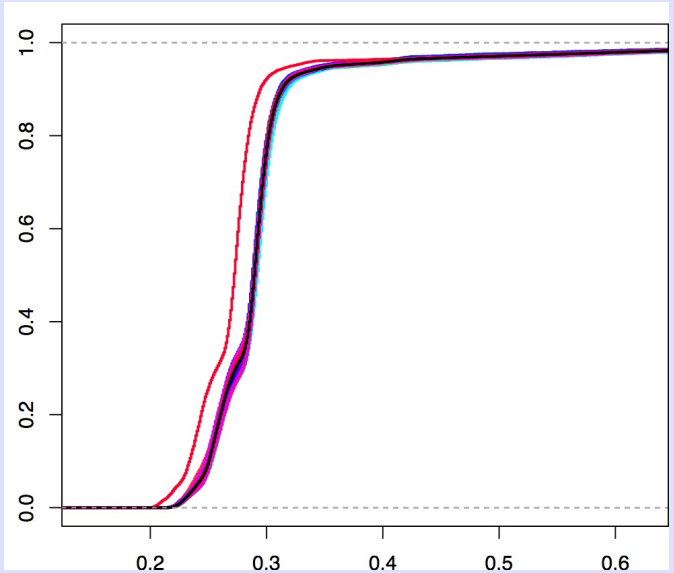
Simple Path Used LAG



FreeBSD Does Not Round (yay!)

It's Not The Hosts

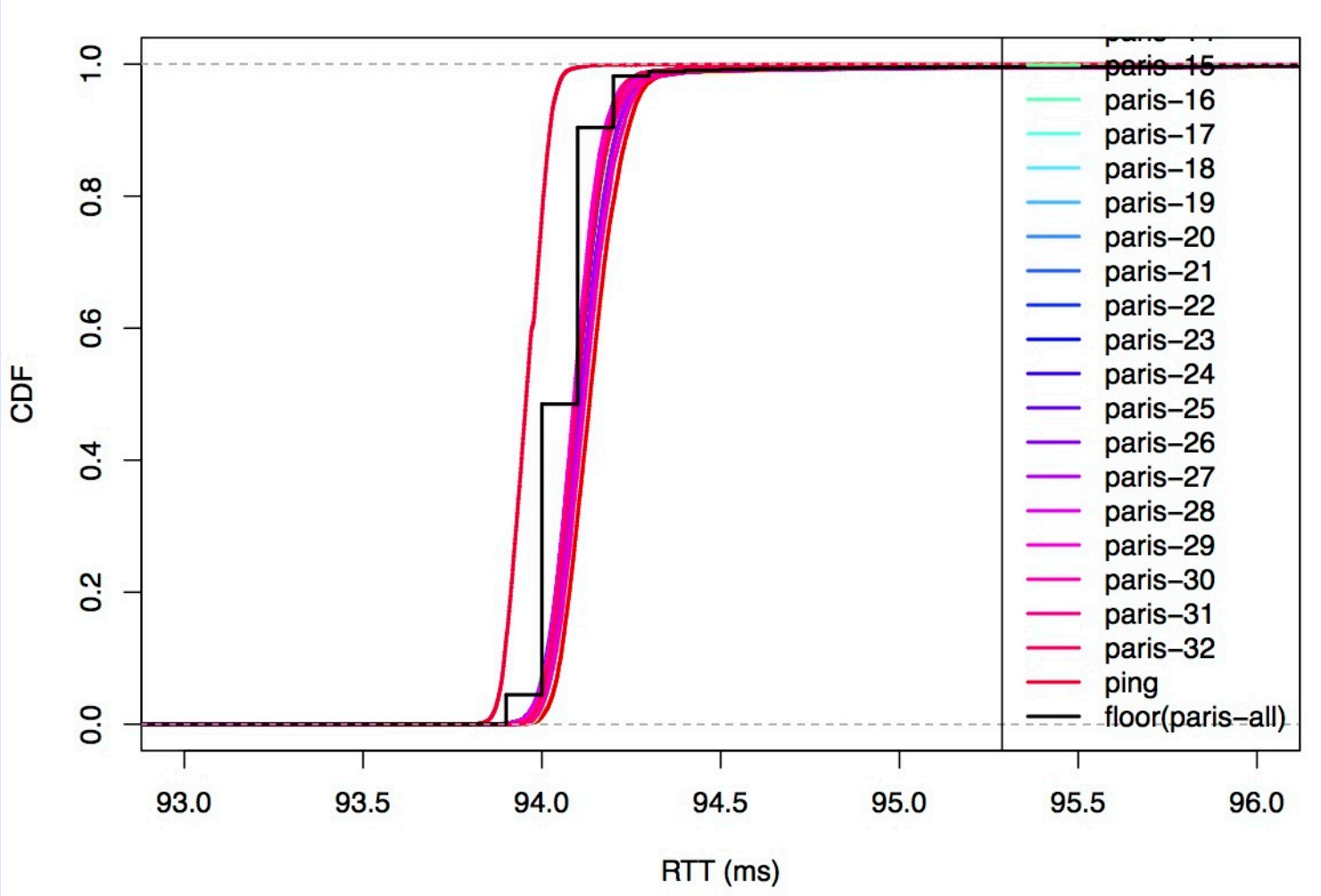




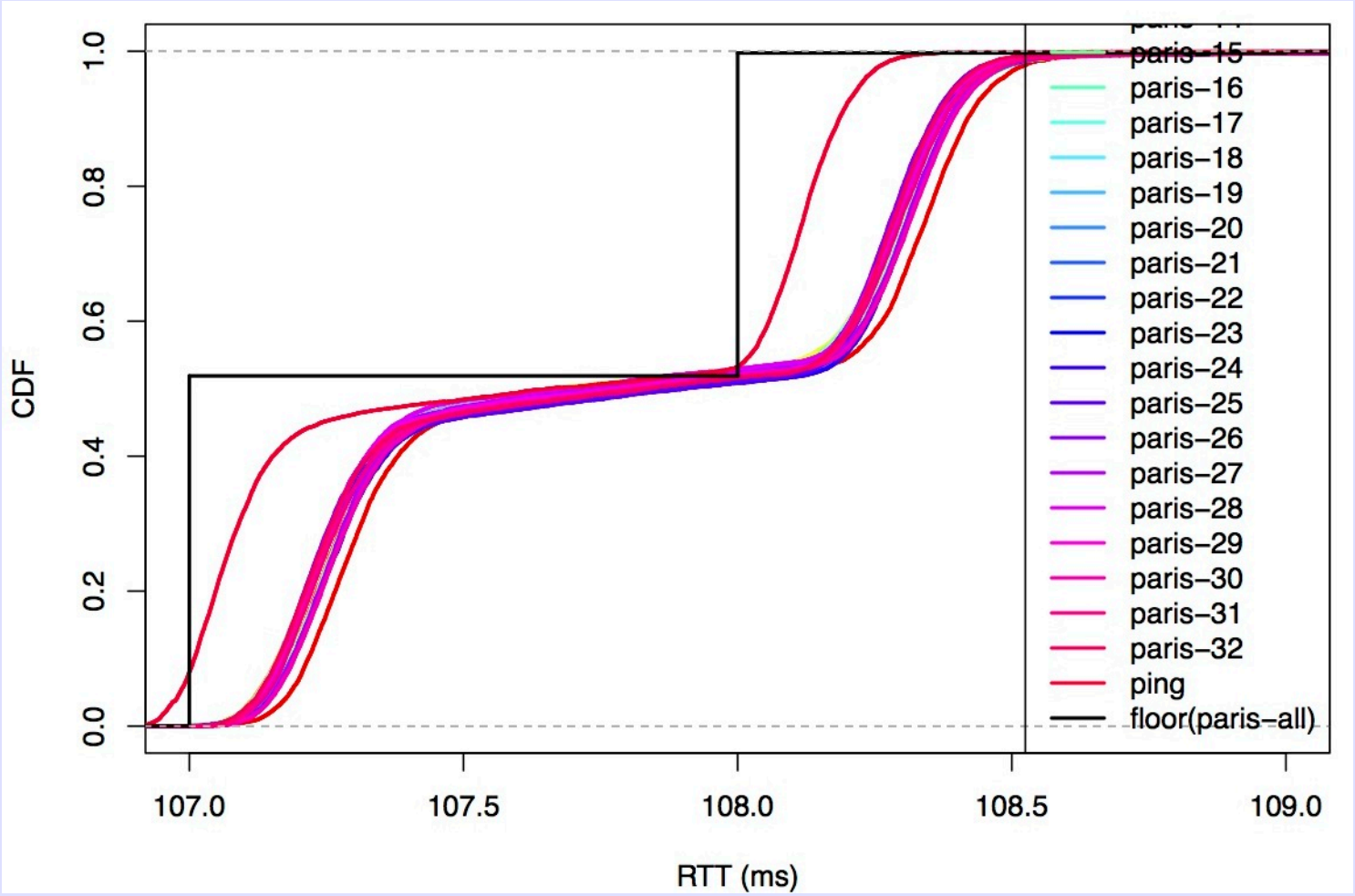
Looking for Causes

- Very Reproducible
- Circuit Loading under 50%
- Same at different times of day
- Same different probe timing/spacing
- Same UDP or ICMP
- MPLS seems not to affect
- 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%

We'd Like a Large Number of Measurements

But Atlas is Imprecise

Take Away

- Researchers, beware of simple ping for latency measurements
- Operators, measure critical circuits and think about the effects of latency distributions
- Applications, beware of effects. Video may differ from audio.