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Measuring PTP Service Performance in Data Centers

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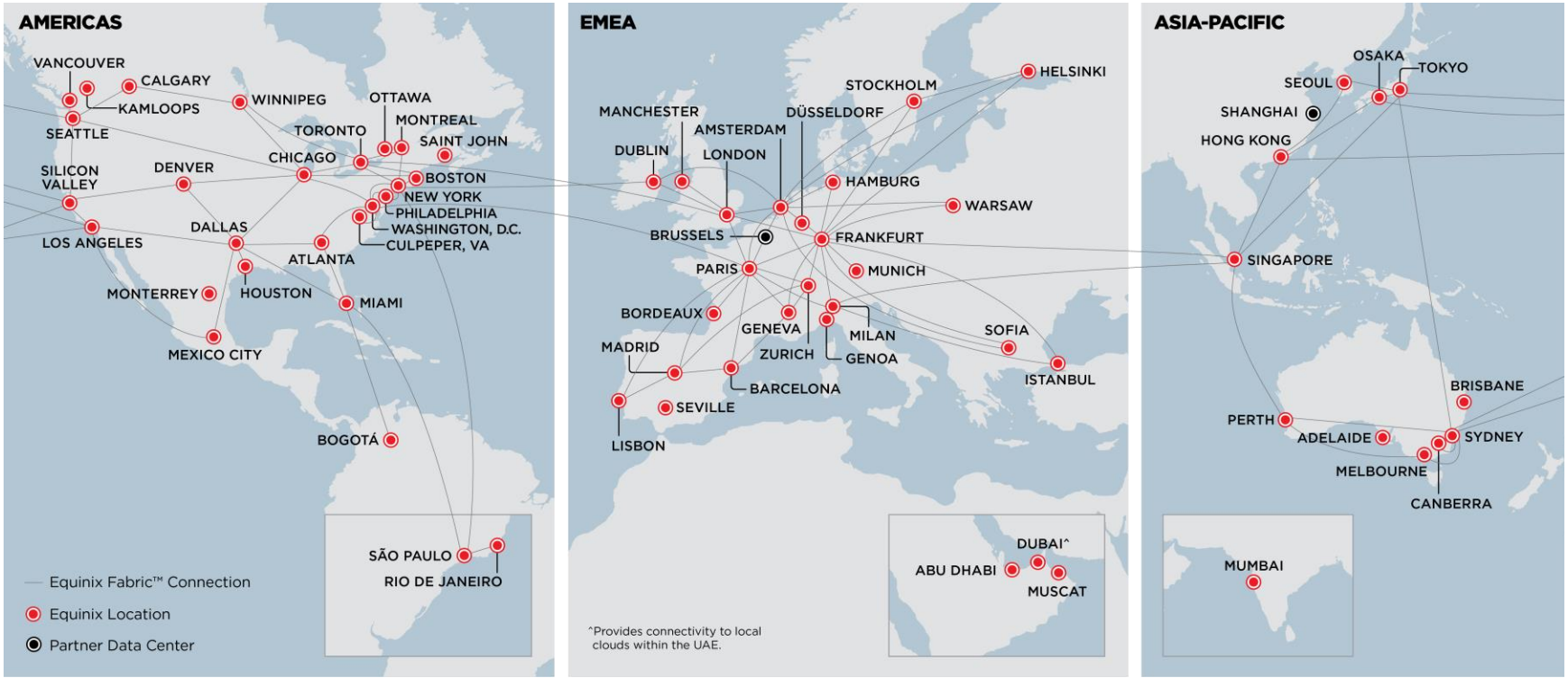
Equinix Fabric

235+ Data Centers | **10,000+** Customers | **65** Metros | **27** Countries | **>99.999%** Reliability

Low-Jitter, Secure, Worldwide Connectivity



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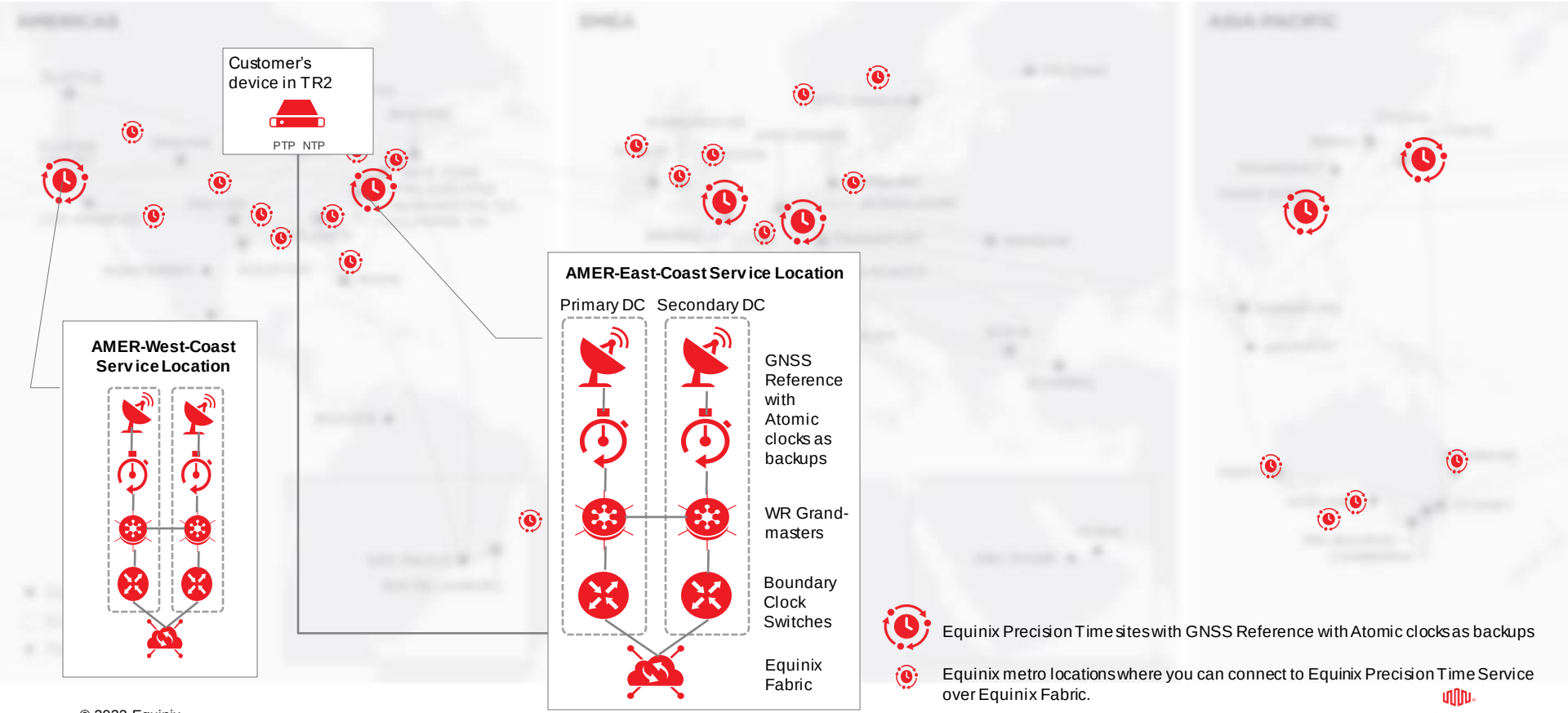
Deploying Reliable and Highly-Available Timing Architecture

Example deployments at scale



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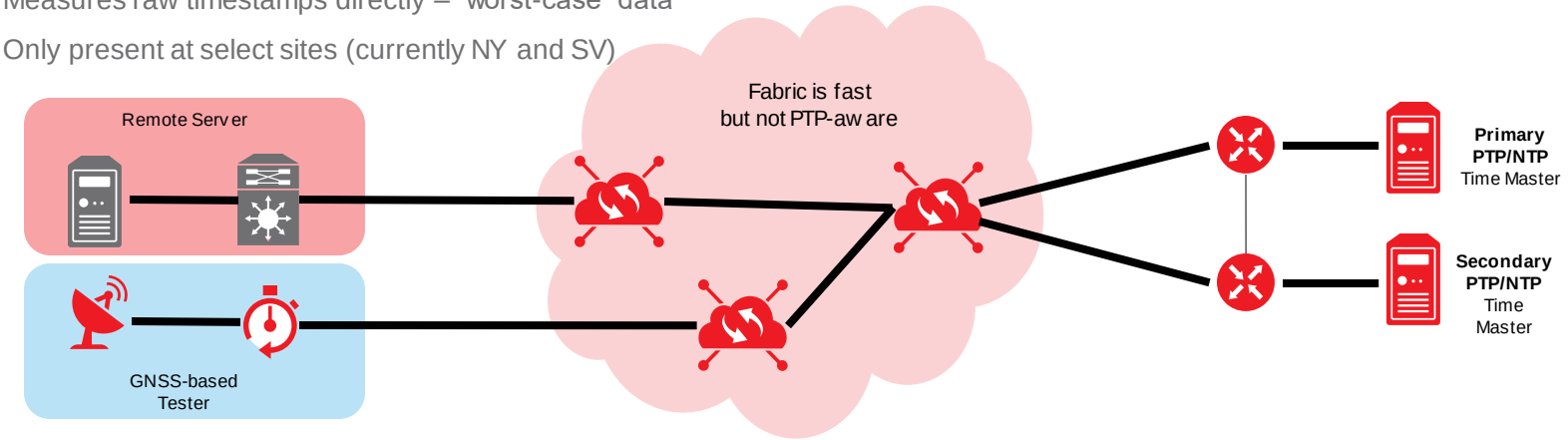
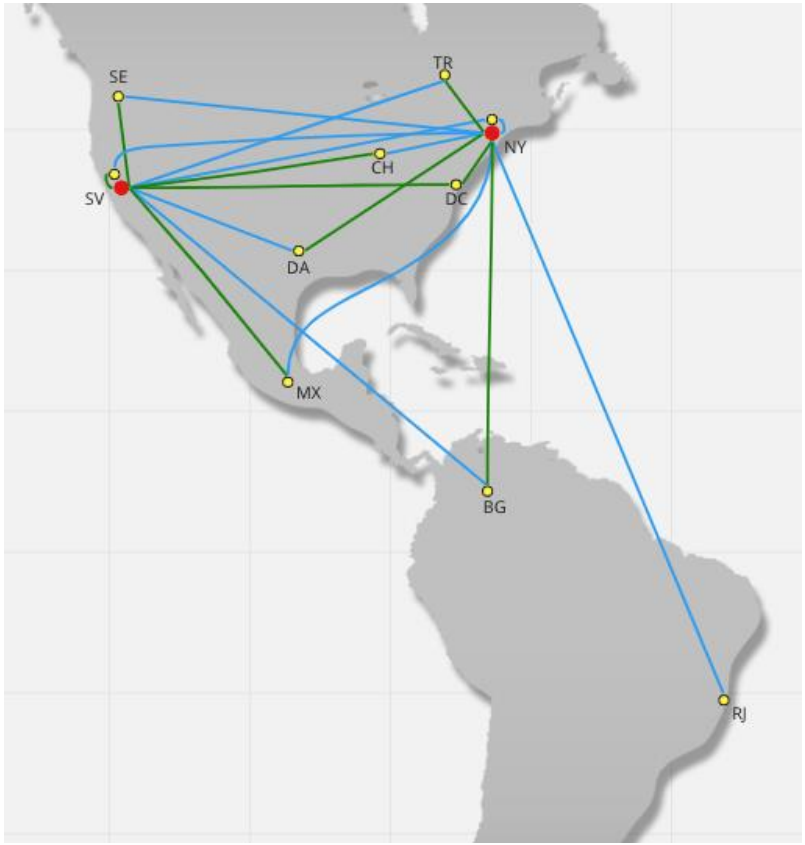
Measurement Methodology

We measure our synchronization performance over Fabric in two different ways:

- Stand-alone servers running open-source PTP daemons in remote data centers
  - Mimic customer connections, with no independent reference
  - Offset data obtained directly from PTP daemons, after filtering
- PTP Test Equipment at sites with GNSS antenna access
  - Representative of the offset from UTC that customers may encounter (but may not notice without an independent reference!)
  - Measures raw timestamps directly – “worst-case” data
  - Only present at select sites (currently NY and SV)



Measurement Server and Client Locations



Legend:

- PTP Connections
- NTP Connections
- SLA Client Location
- EPT Service Location

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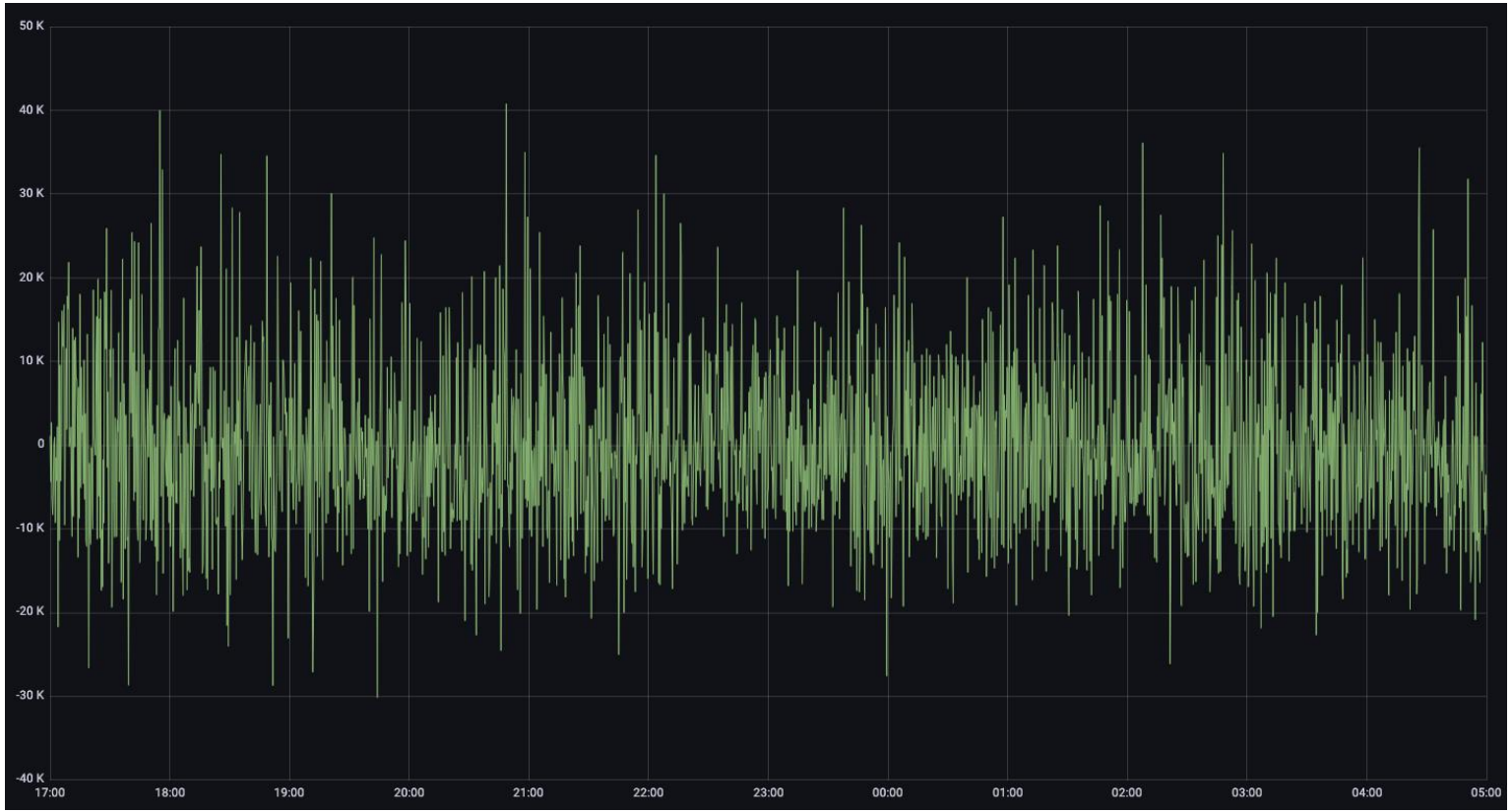
Data from Remote Servers

Data for SV client synced from NY server – offset from master reported via ptpd – 12 hours



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Data from Remote Servers

Internal Monitoring – offset from master reported via ptpd – Identical 24 hour periods

Source: Silicon Valley		
Measured At	Average (ns)	Std Dev (ns)
New York	36.82	8247
Toronto	-44.25	12066
Dallas	-35.08	11676

Source: Frankfurt		
Measured At	Average (ns)	Std Dev (ns)
London	-14.59	3434
Madrid	63.34	8803
Paris	13.10	4053

Source: Hong Kong		
Measured At	Average (ns)	Std Dev (ns)
Tokyo	12.04	8870
Sydney	-8.62	10224

Source: New York		
Measured At	Average (ns)	Std Dev (ns)
Silicon Valley	-11.38	10229
Chicago	-4.36	10518
Seattle	-0.14	12170
Mexico	-9.09	10684

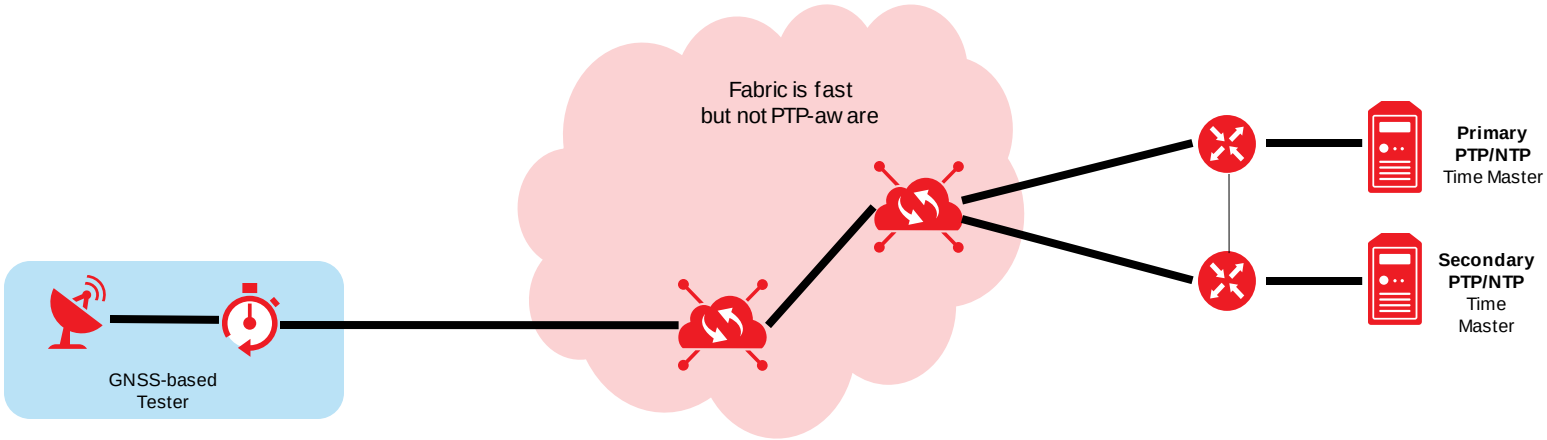
Source: London		
Measured At	Average (ns)	Std Dev (ns)
Frankfurt	7.99	2790
Amsterdam	6.48	2592

Source: Tokyo		
Measured At	Average (ns)	Std Dev (ns)
Hong Kong	52.77	11264
Singapore	-81.34	8880

Data from GNSS Test Equipment

Measurements taken between NY and SV over different 12 hour periods

GNSS-based results		
Route	cTE vs GNSS (ns)	Std Dev (ns)
NY to SV	14608	17411
SV to NY	-16961	16633



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Conclusions

Our measurements confirm the performance of our PTP service

- Confirmed accuracy to within 10's of microseconds to GNSS
- Maintains accuracy even over non-PTP-aware, long-haul WAN links
- Confirmed performance details that are not visible to standard synchronizing clients

We have identified areas of future investigation

- Examination of sources of cTE in long-haul links
- Examination of path length / number of hops on time delivery
- Confirmation of results over longer periods of time