



Espresso - SDN for Public Internet

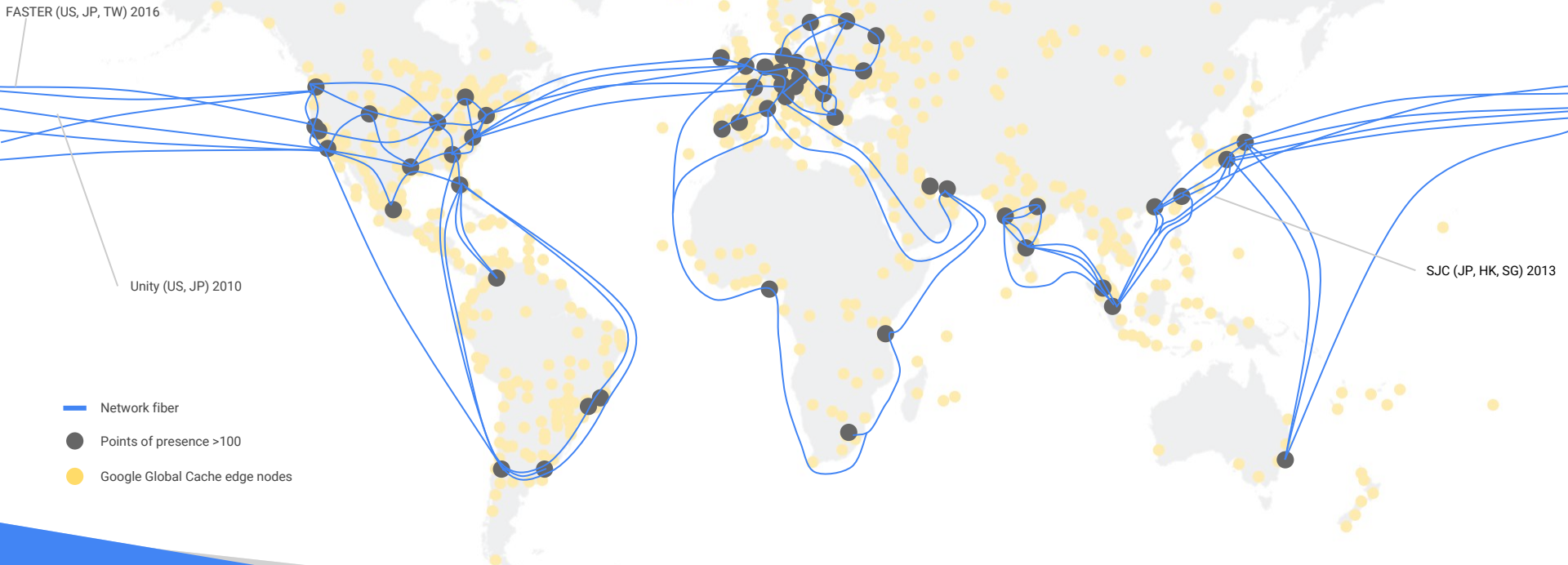
Sam K. Aldrin

On behalf of Google Technical Infrastructure and Google Cloud Platform

IETF, July 19th, 2017

Google Network

More than a collection of data centers



- Network fiber
- Points of presence >100
- Google Global Cache edge nodes

Google Cloud Regions

Adding 11 new regions



- Current regions and number of zones
- Future regions and number of zones

Ubiquitous Cloud...10x Scaling

Datacenter

Next-gen disaggregation of storage, memory and compute

10x

Campus & Metro

Cloud regions and campus expansion driving DC interconnect

10x

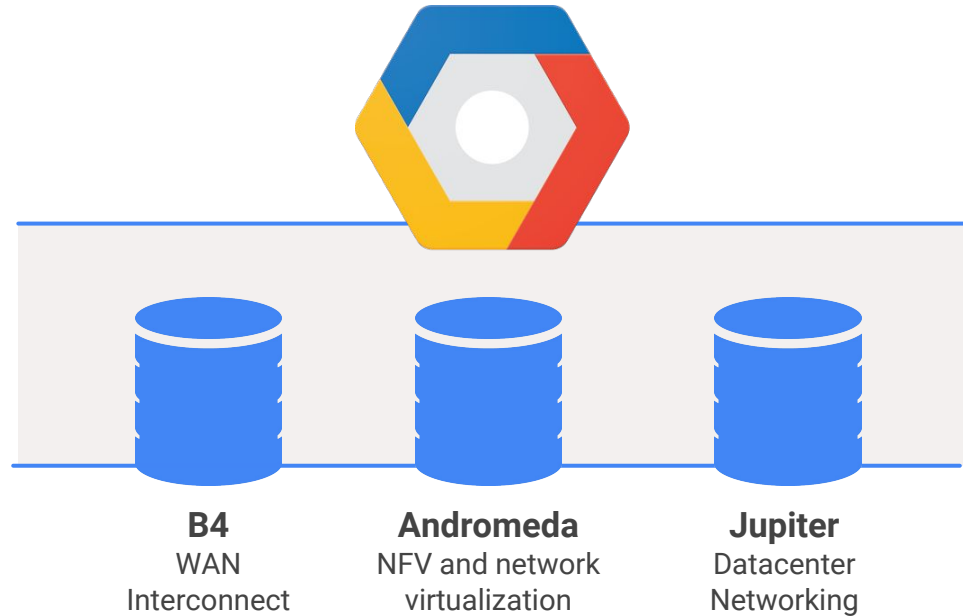
WAN

Cloud replication and bandwidth intensive cloud services (e.g., turnkey video, IoT)

10x

Step Function Disruptions: Bandwidth, Latency, Availability, Predictability

The Pillars of SDN @ Google

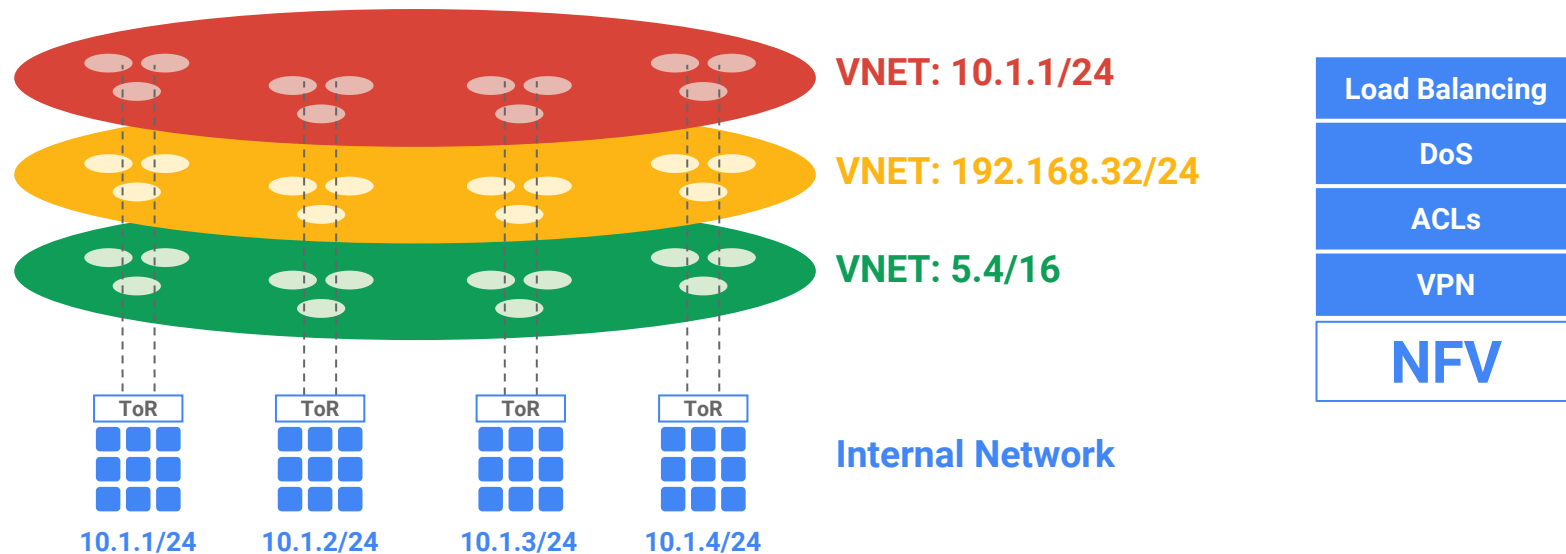


B4: Google's Software Defined WAN



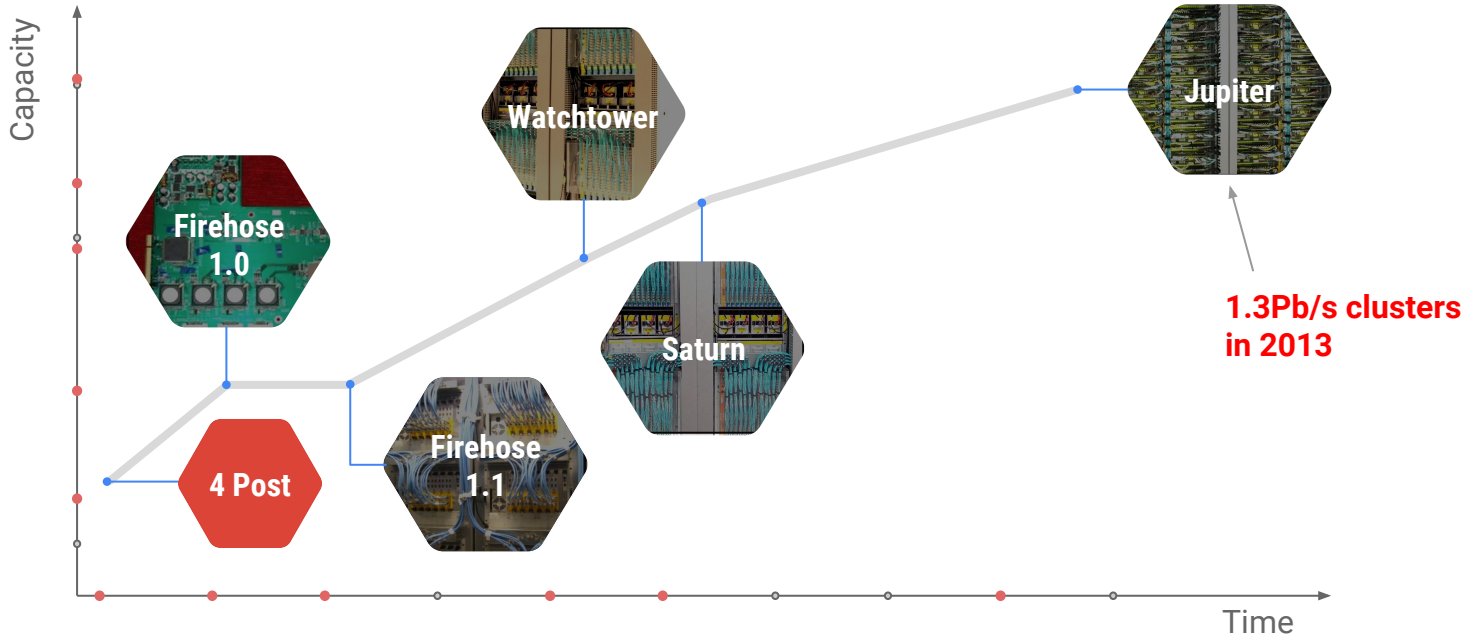
Andromeda

Google Infrastructure Services

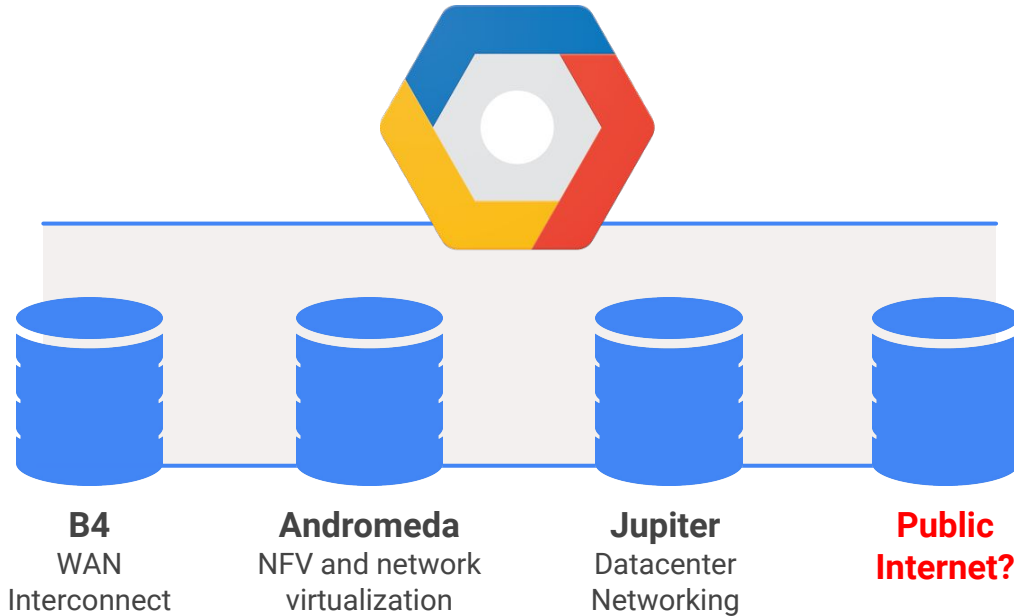


Google Datacenter Network Innovation

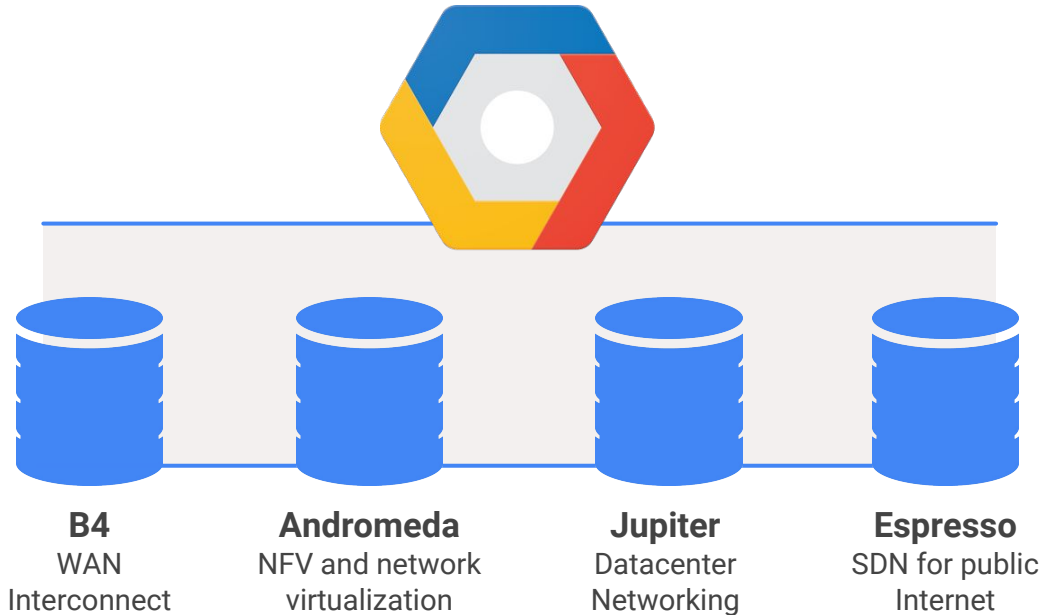
And hardware scale that we could not buy



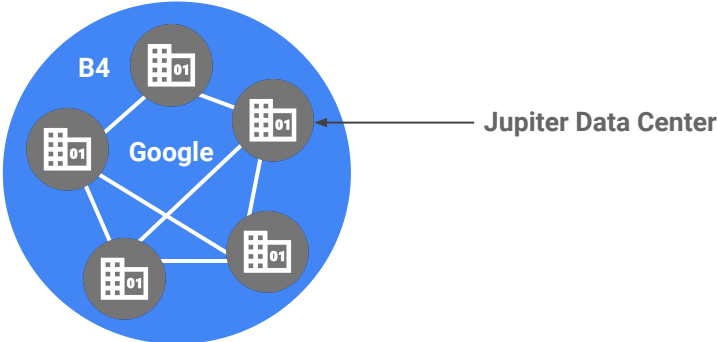
The Pillars of SDN @ Google



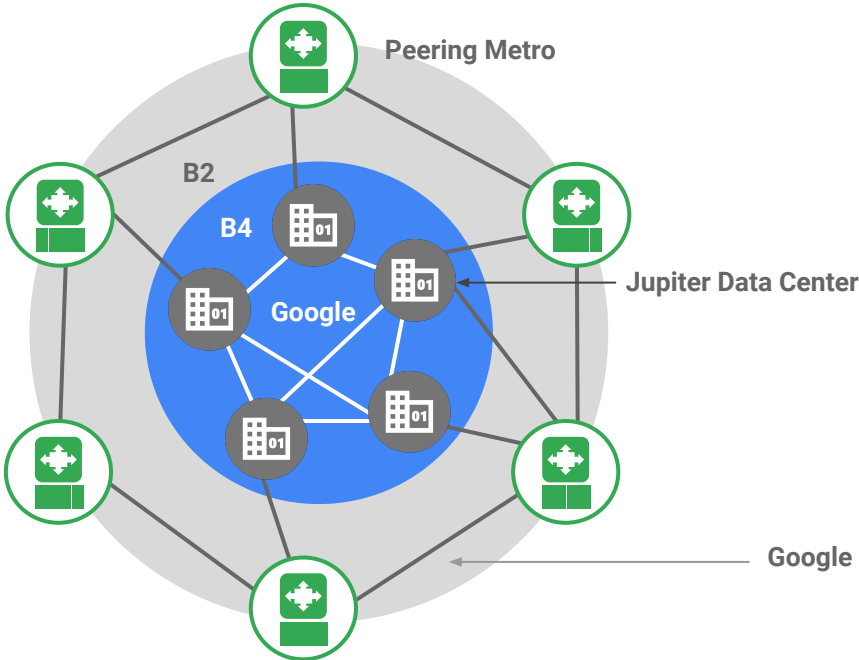
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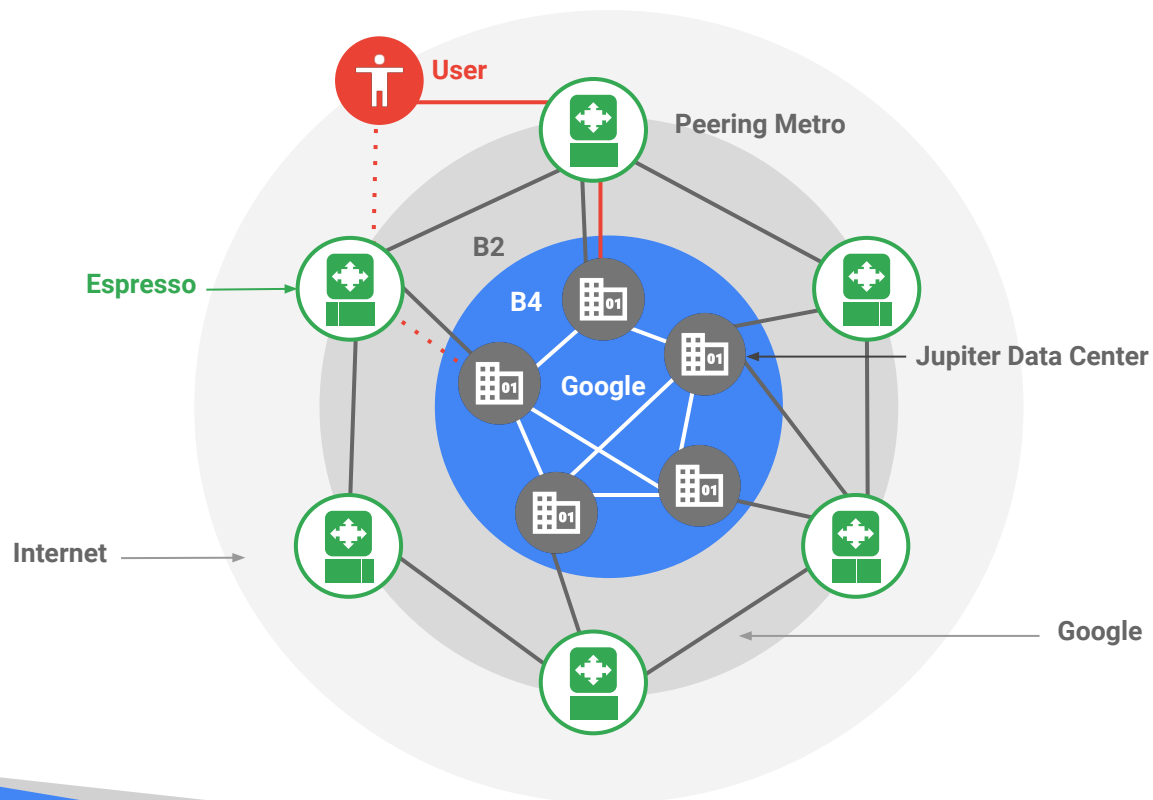
Espresso in Context



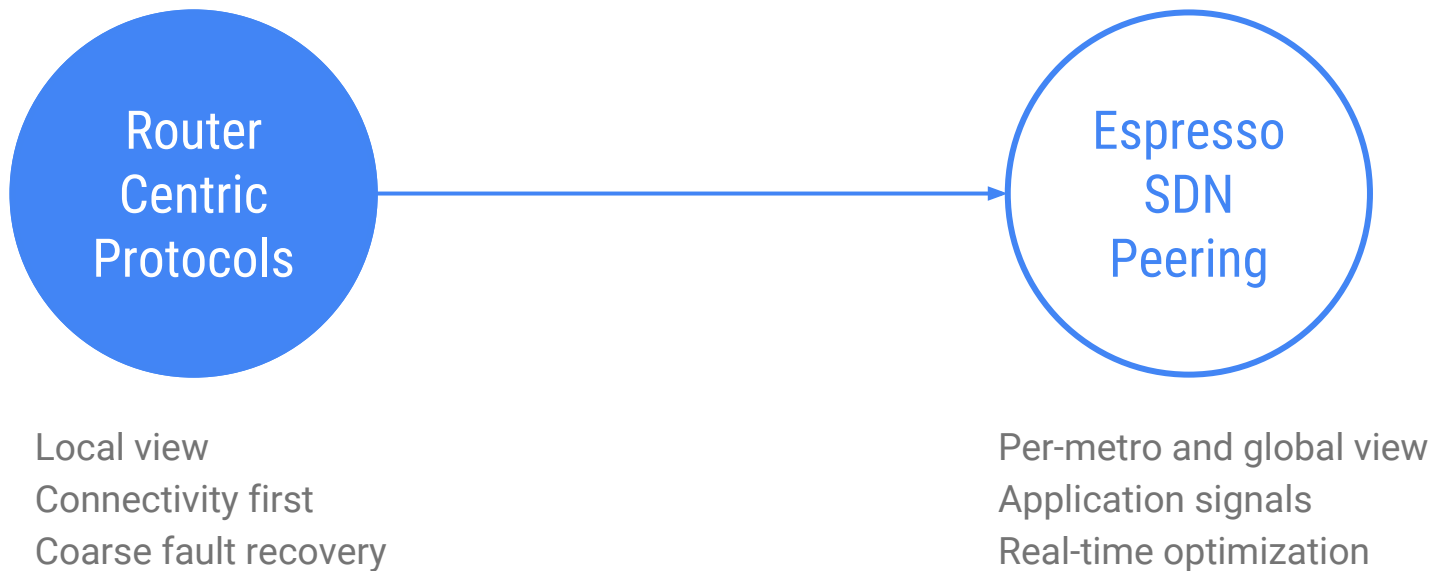
Espresso in Context



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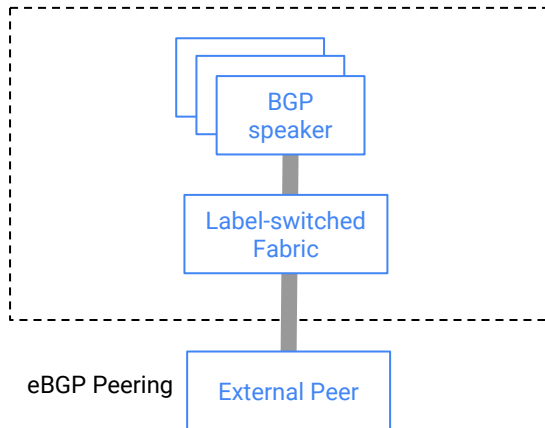
Espresso: Before and After



Espresso Architecture Overview

Espresso Metro

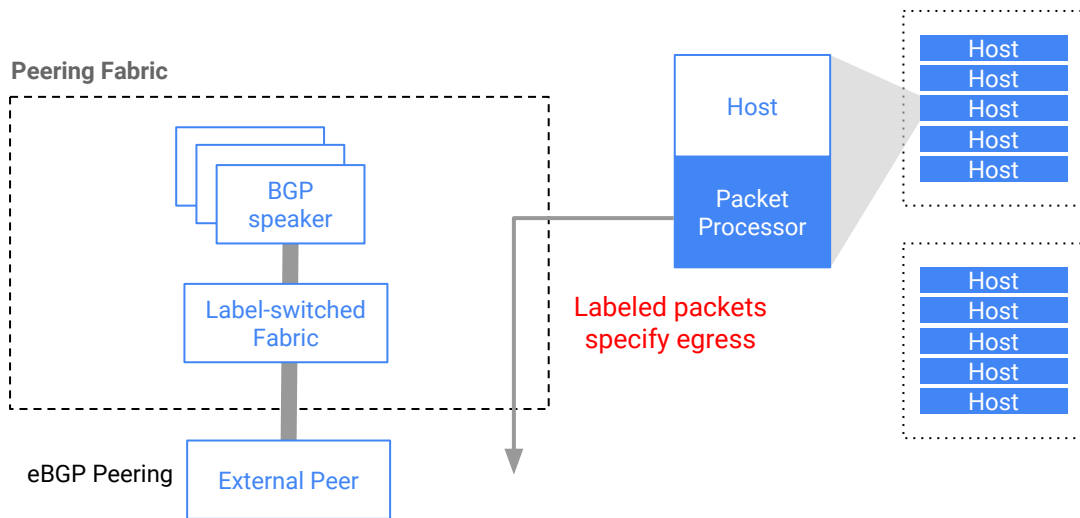
Peering Fabric



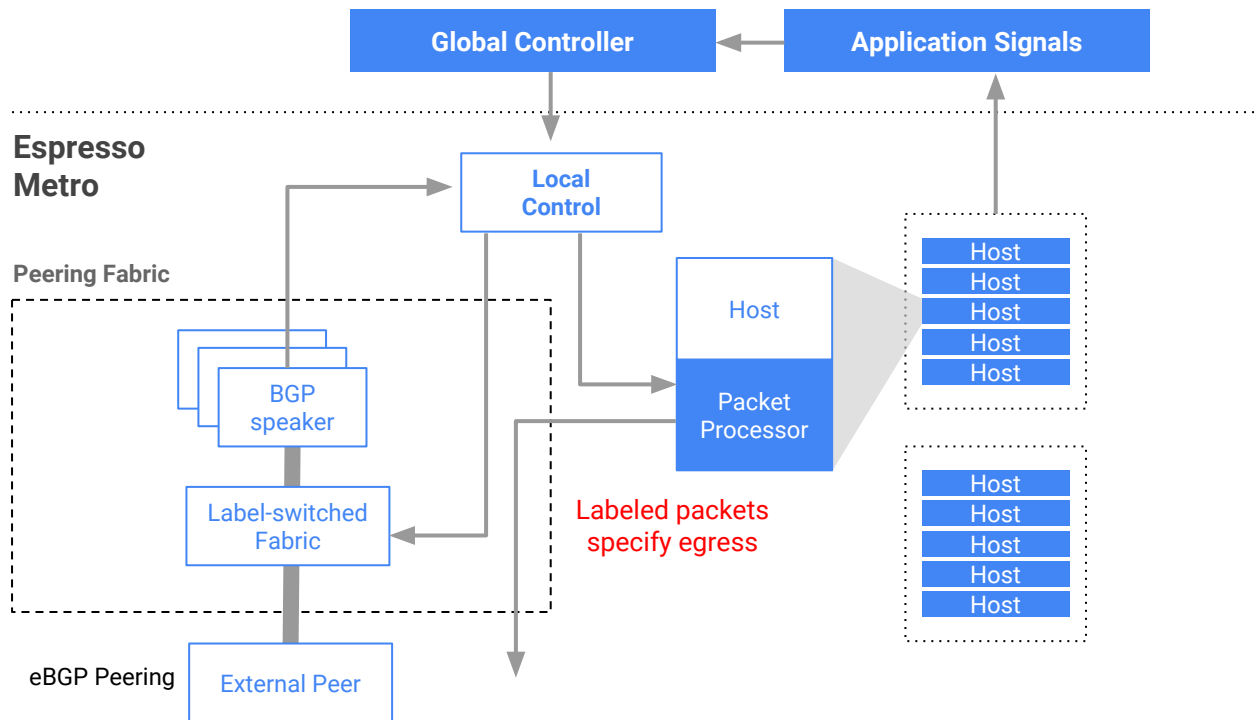
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Peering Fabric



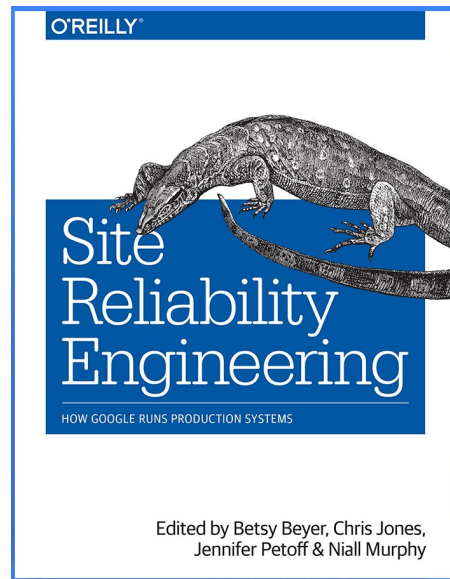
Espresso Architecture Overview



Availability is Paramount

- First things first: an insecure infrastructure is an unavailable infrastructure
- Stability is more important than efficiency
- Network management is critical
- Configuration is hard
- Automation matters but can be counter to availability

*“Evolve or Die: High-Availability Design Principles Drawn from Google’s Network Infrastructure.”
SIGCOMM 2016.*



Next Decade Challenges in Networking

The next wave of computing

- Serverless compute in Cloud 3.0
- IoT
- Tightly coupled, general purpose distributed computing

It's time to put it all together

- Agile Scale
- Jitter
- Isolation
- Performance is great, but only meaningful with availability, manageability, and velocity



Thank You!