THE EVOLVING DATA CENTER

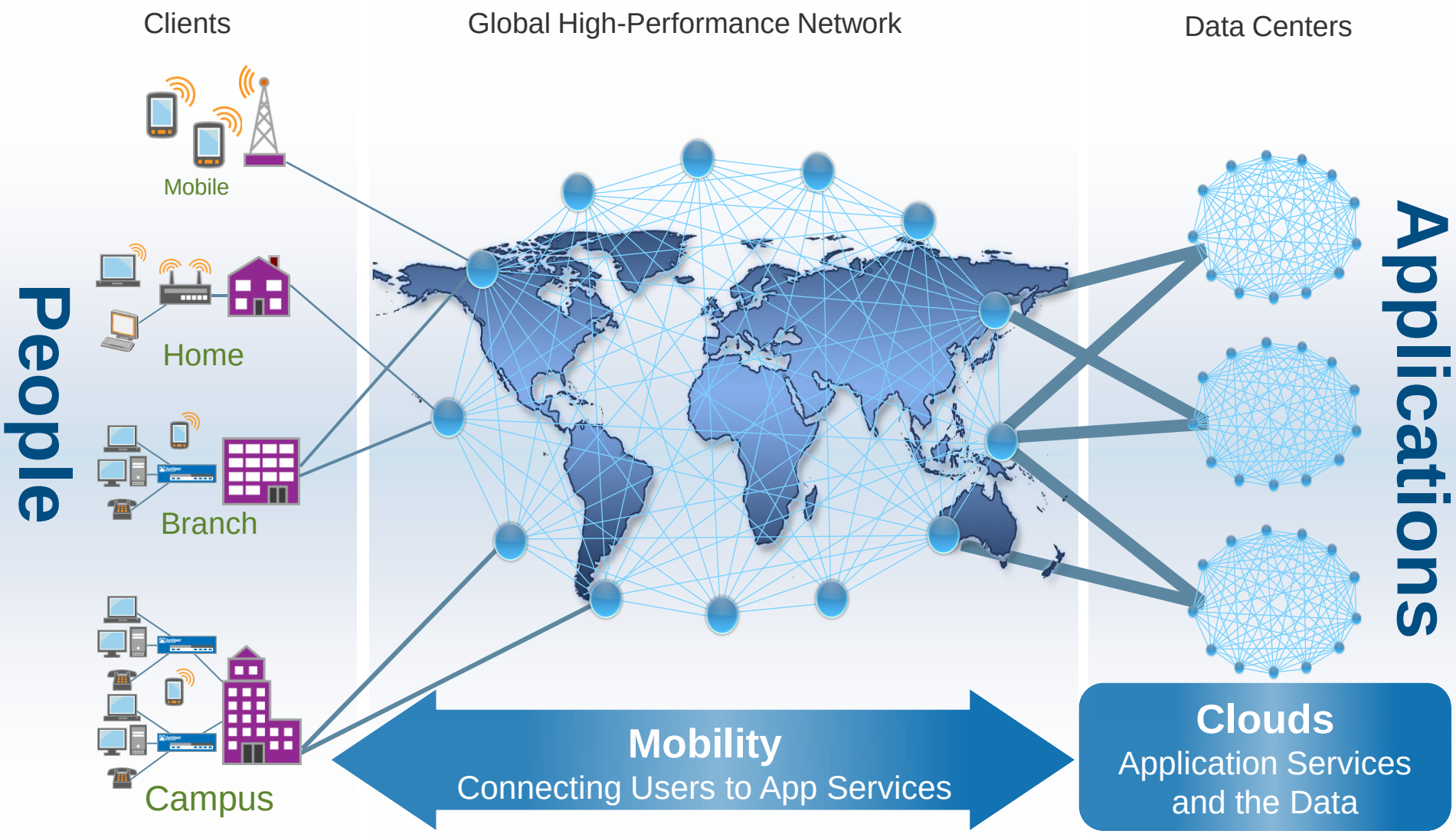
IN THE ERA OF CLOUD COMPUTING

Andy Ingram

Juniper Networks

April 2011

THE 2 ROLES OF IT INFRASTRUCTURE



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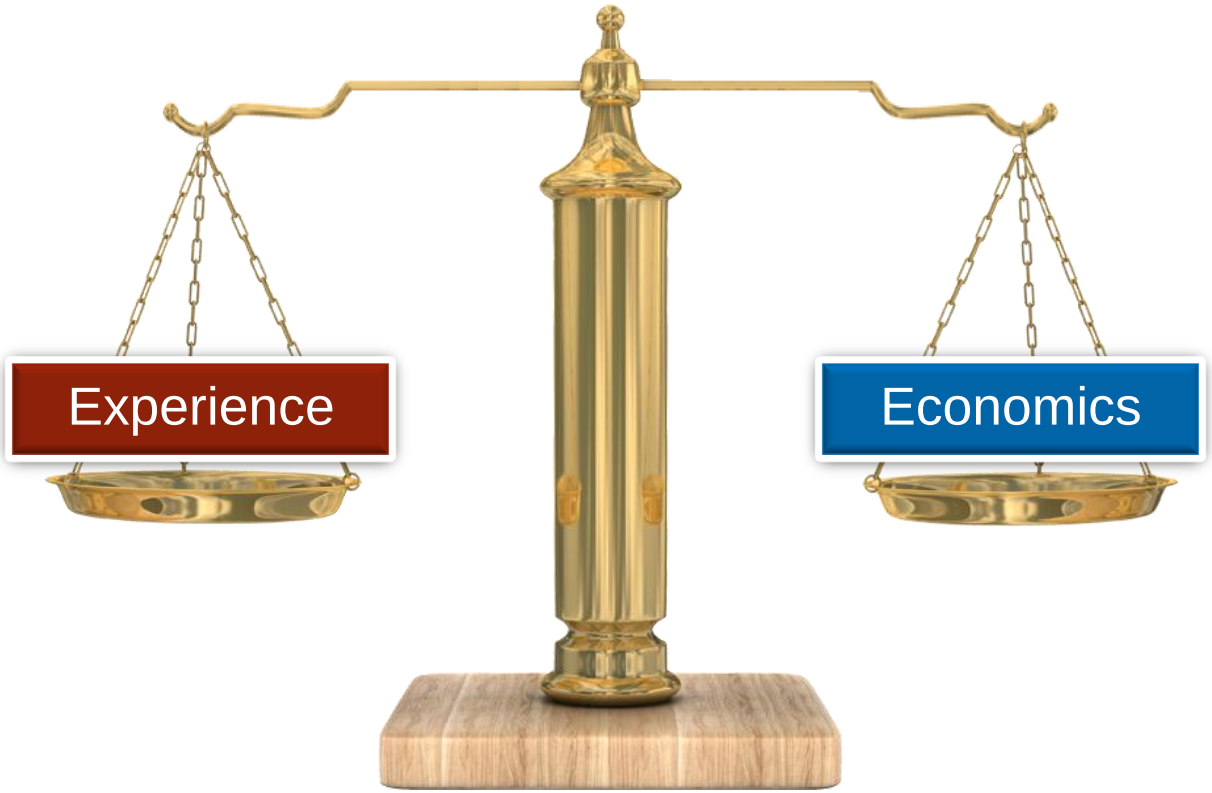
TODAY'S TRADEOFFS

Data Center Priorities



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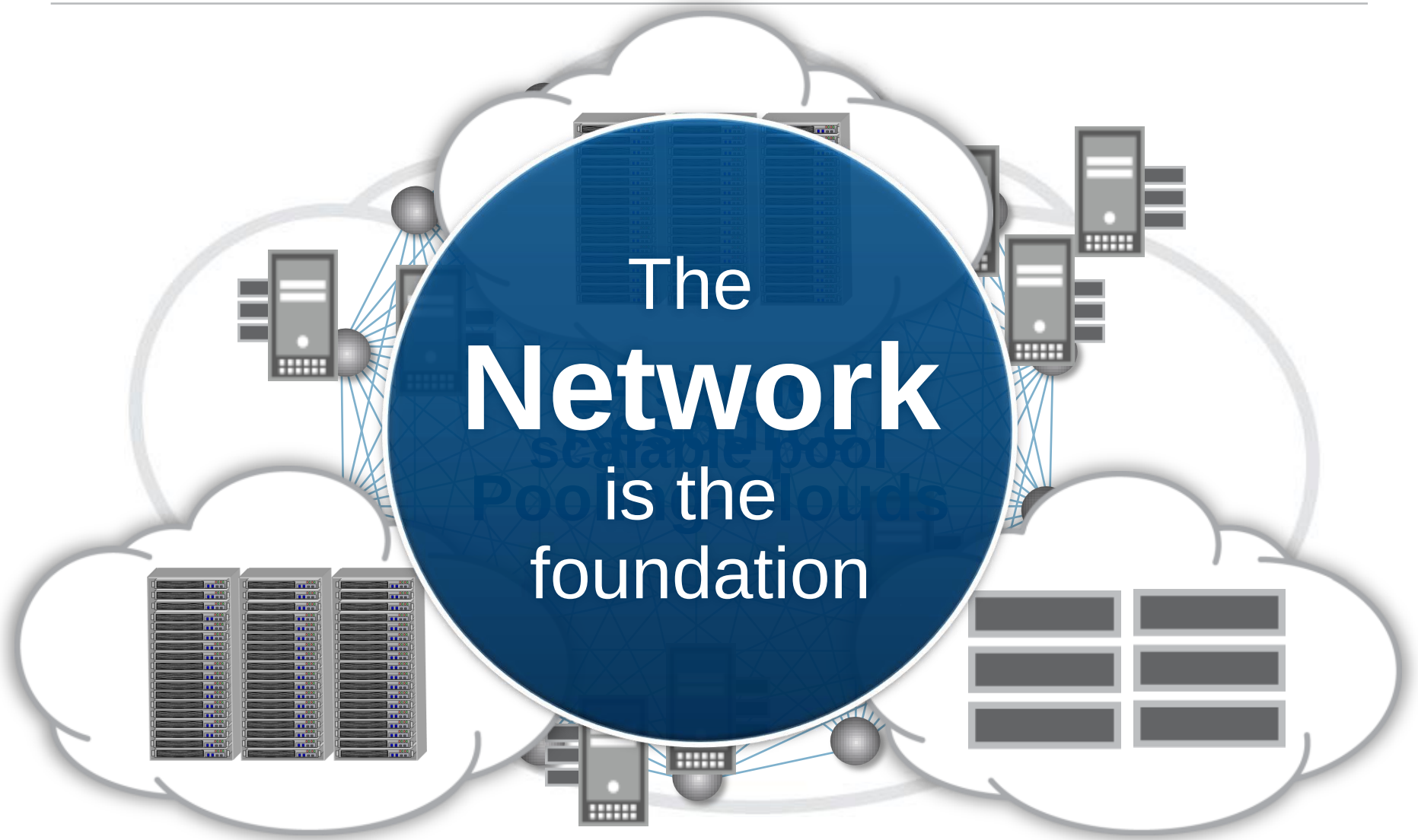
CUSTOMERS ARE BUILDING CLOUDS



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CHANGING ROLES OF THE NETWORK

Traditional role – connecting users

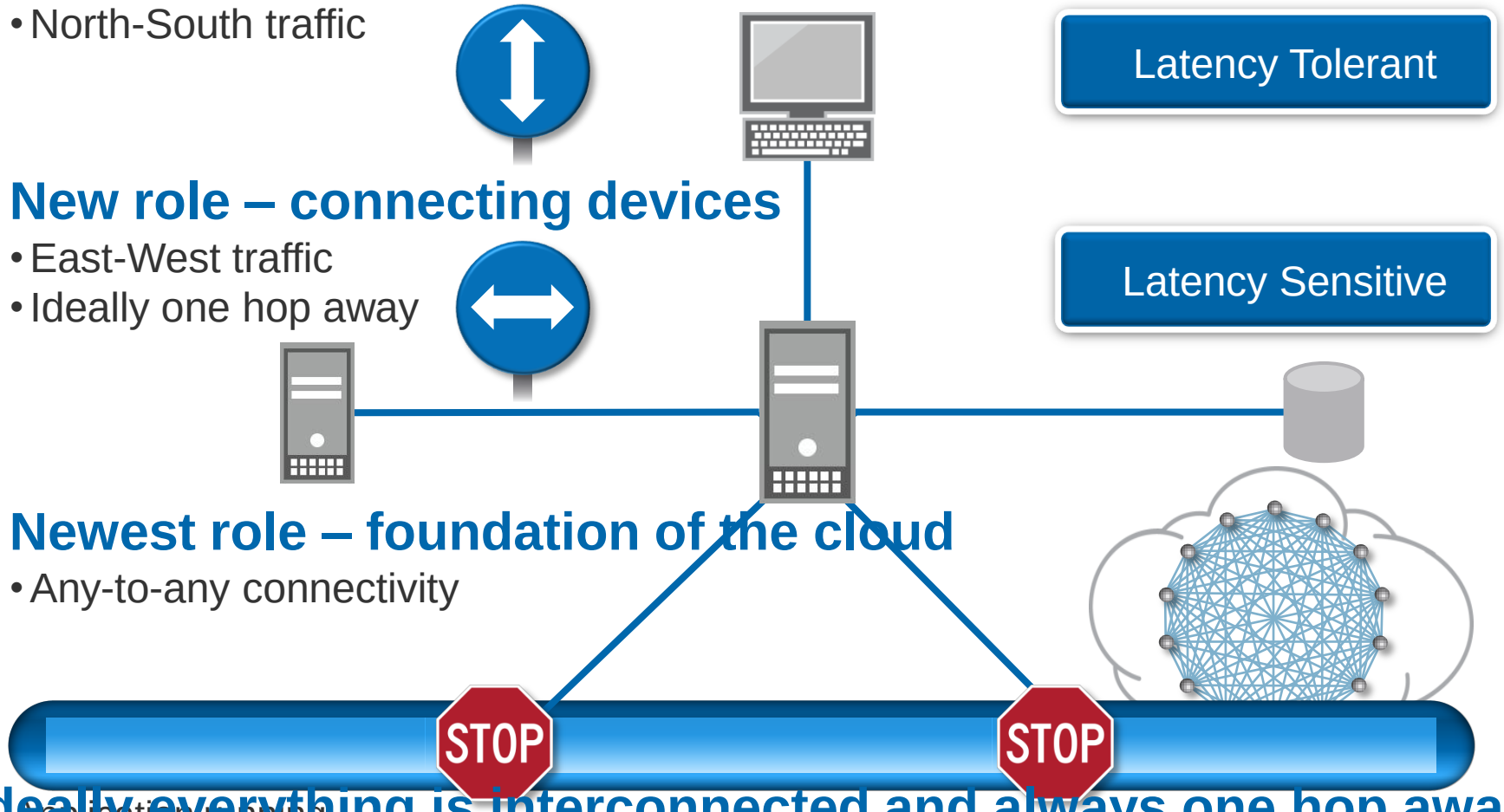
- North-South traffic

New role – connecting devices

- East-West traffic
- Ideally one hop away

Newest role – foundation of the cloud

- Any-to-any connectivity



Ideally everything is interconnected and always one hop away

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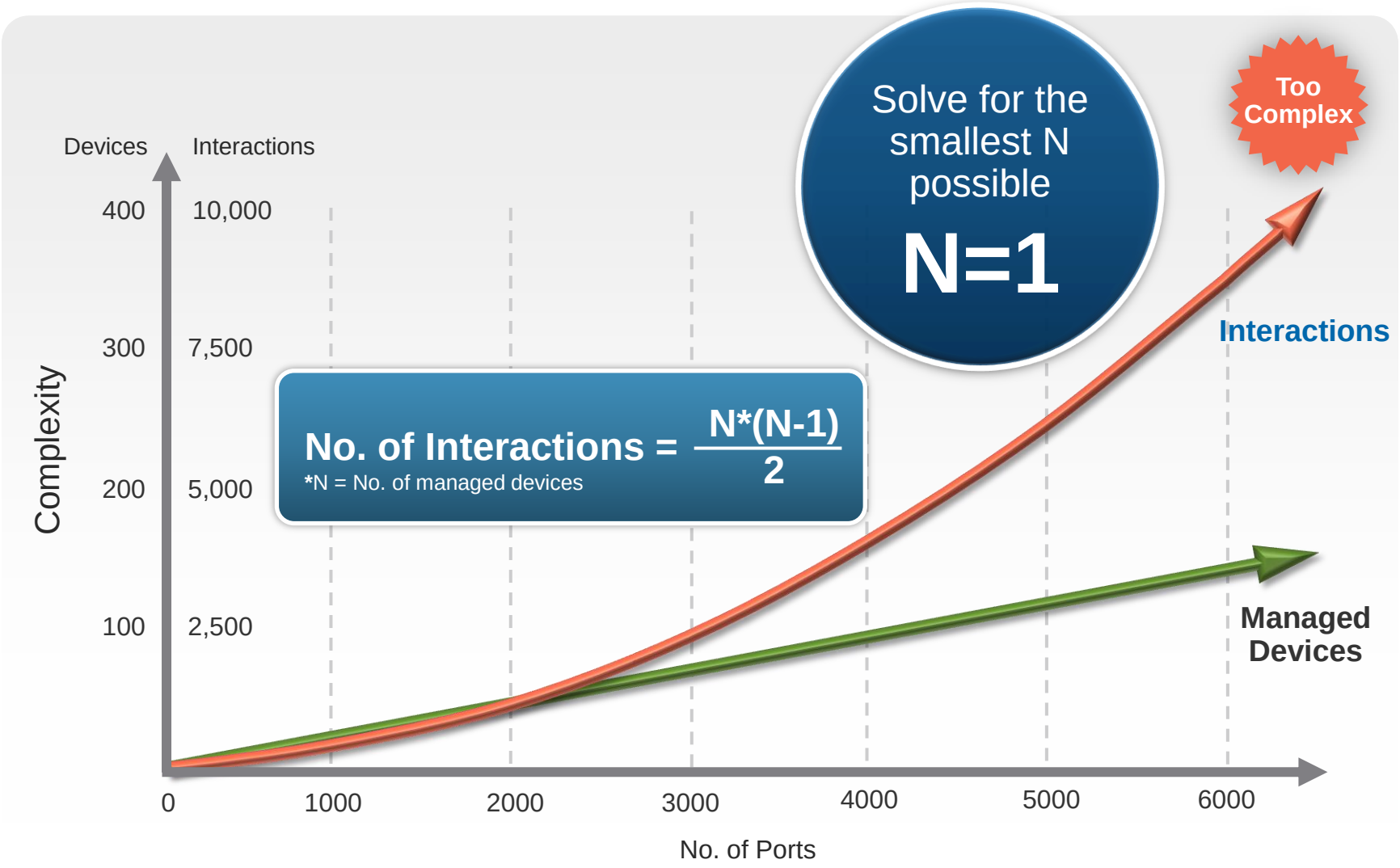
COMPLEXITY – METCALF'S REVENGE



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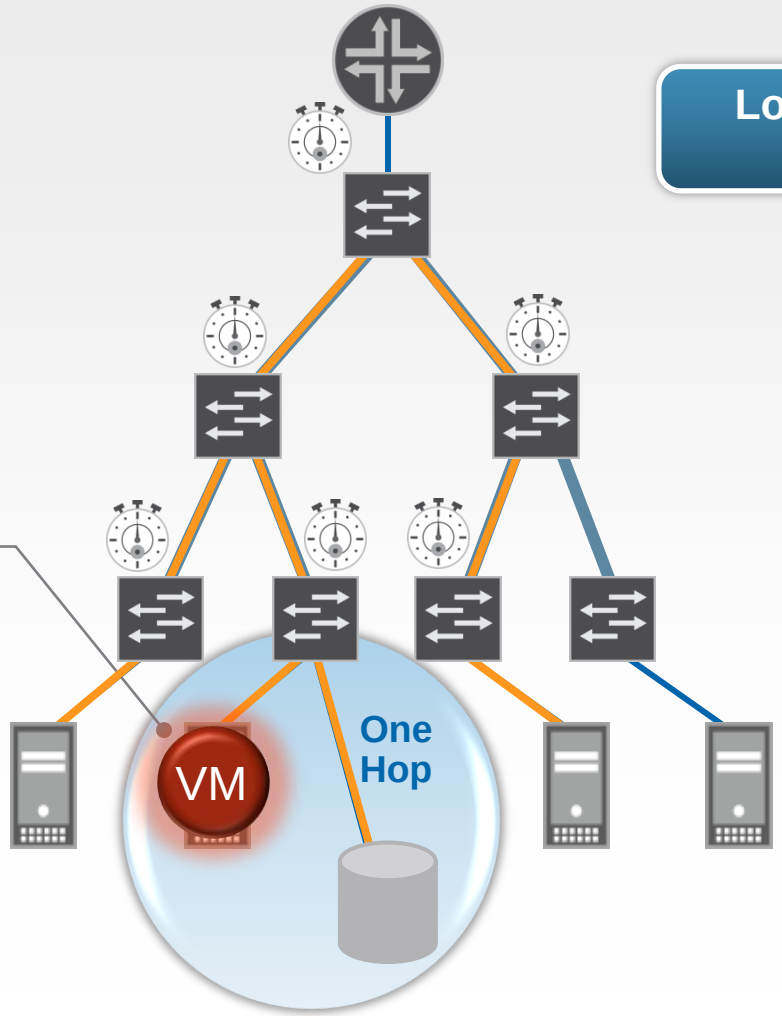
THE TYRANNY OF TREES

Typical tree configuration

Location matters in a tree architecture

Bubbles
Optimal performance



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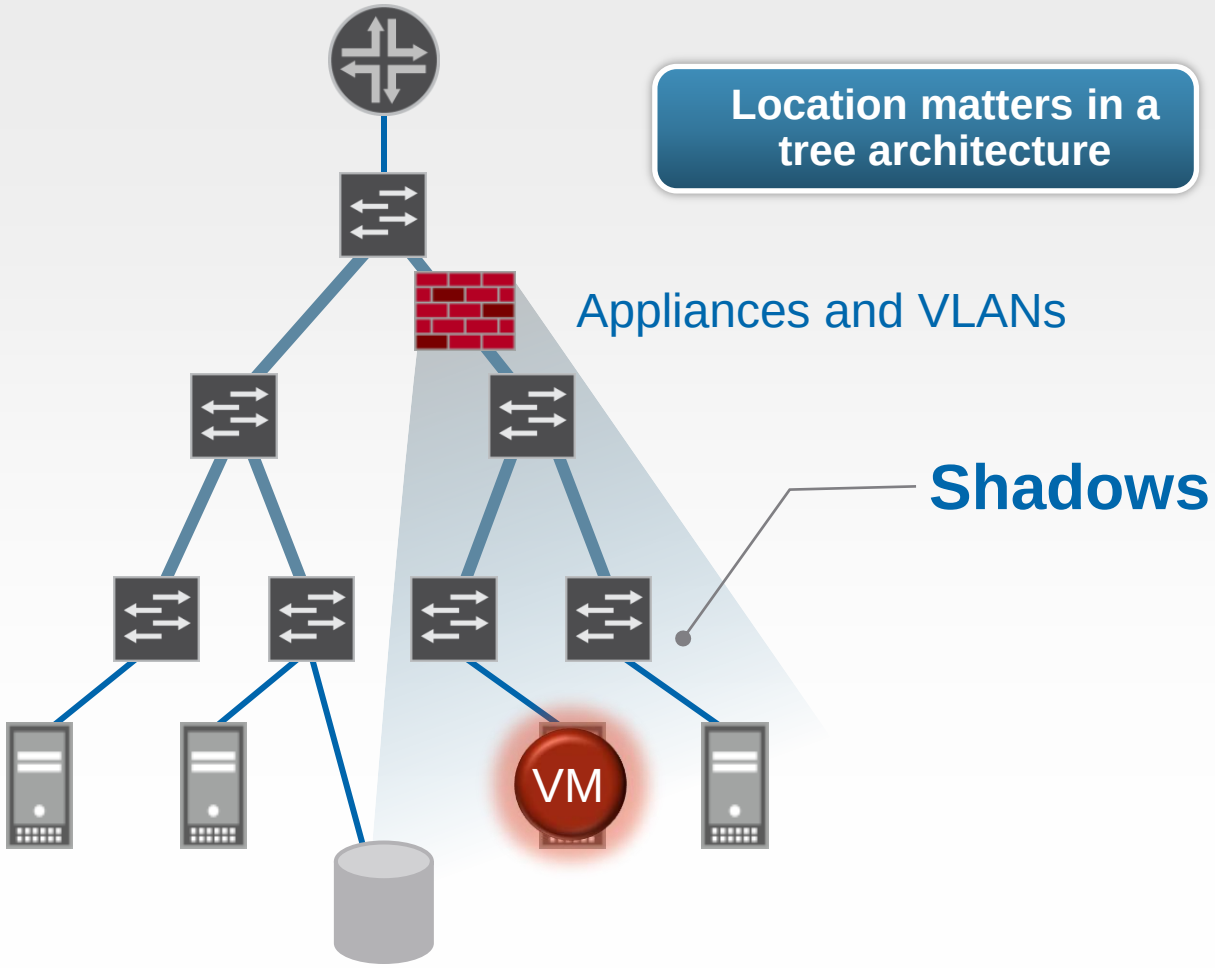
THE TYRANNY OF TREES

Typical tree configuration



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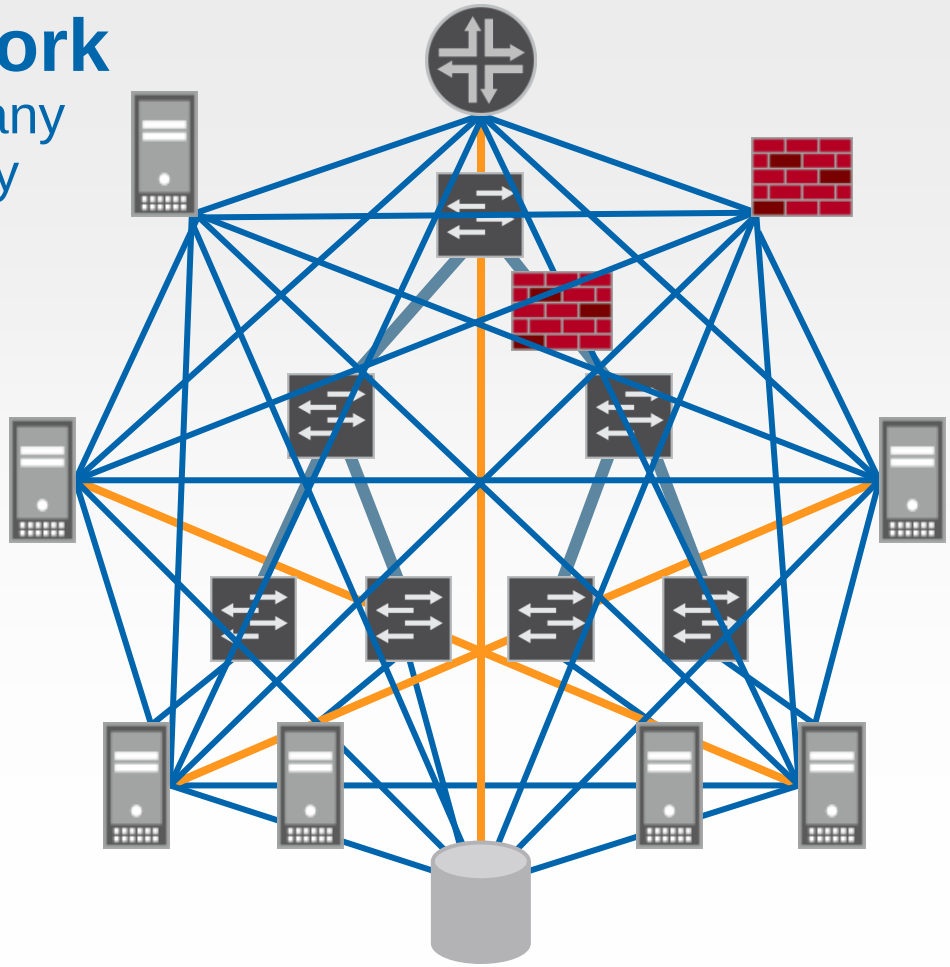
TRANSFORM THE NETWORK

One Network

Flat, any-to-any connectivity



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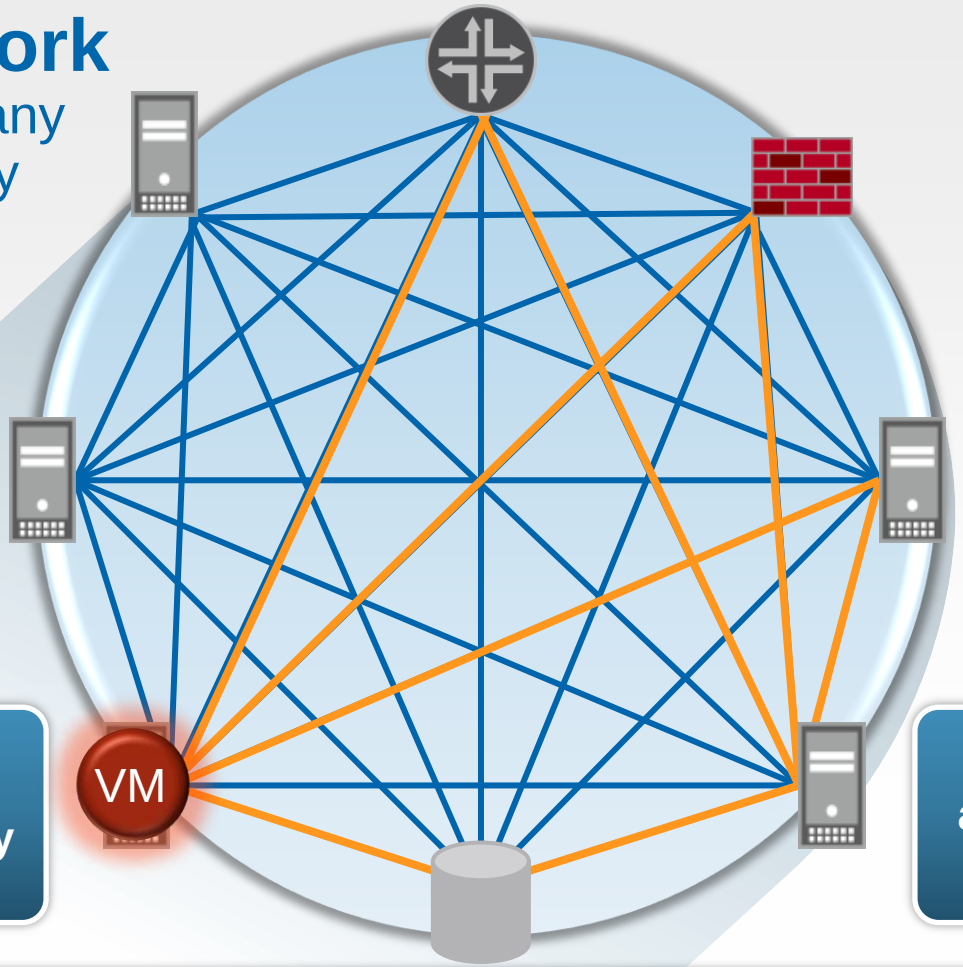
TRANSFORM THE NETWORK

One Network

Flat, any-to-any connectivity



Key resources are one hop away

Key resources are ALWAYS one hop away

Locality should not matter in a virtualized data center

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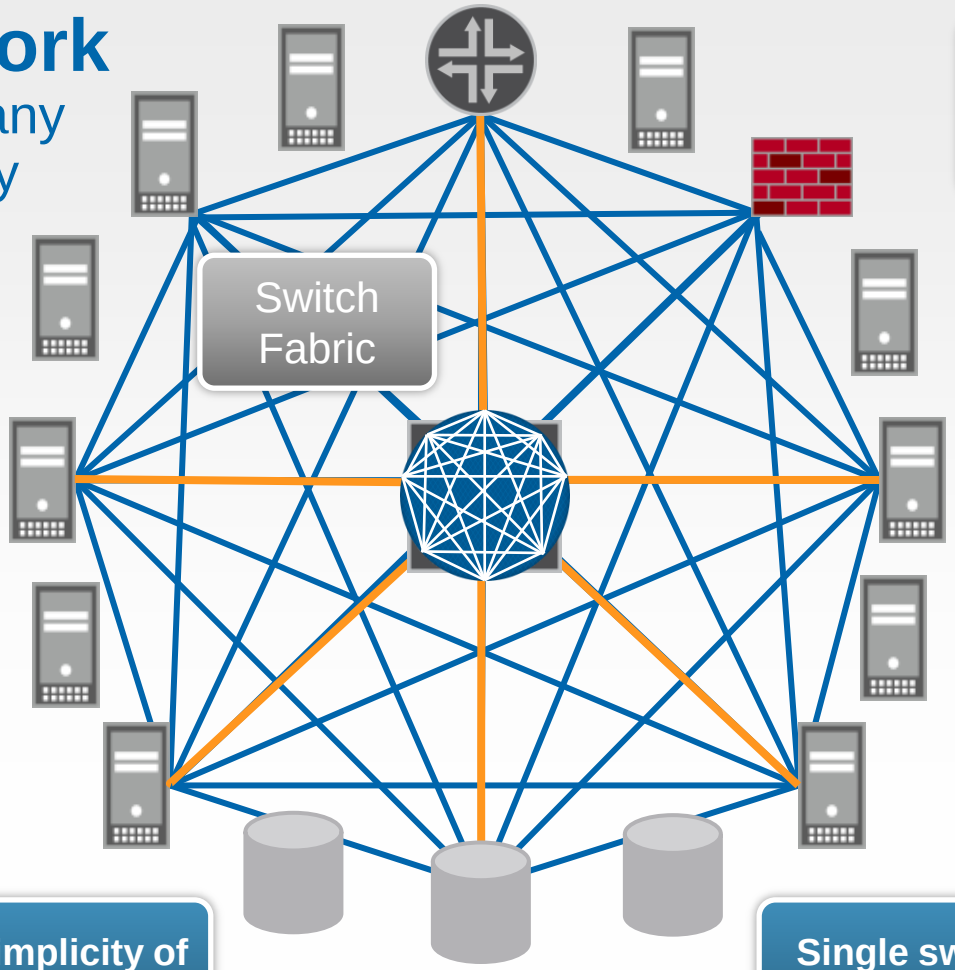
TRANSFORM THE NETWORK

One Network

Flat, any-to-any connectivity



Single device N=1

Switch Fabric

Data Plane

- Flat
- Any-to-any

Control Plane

- Single device
- Shared state

Performance and simplicity of a single switch

Single switch does not scale Single point of failure

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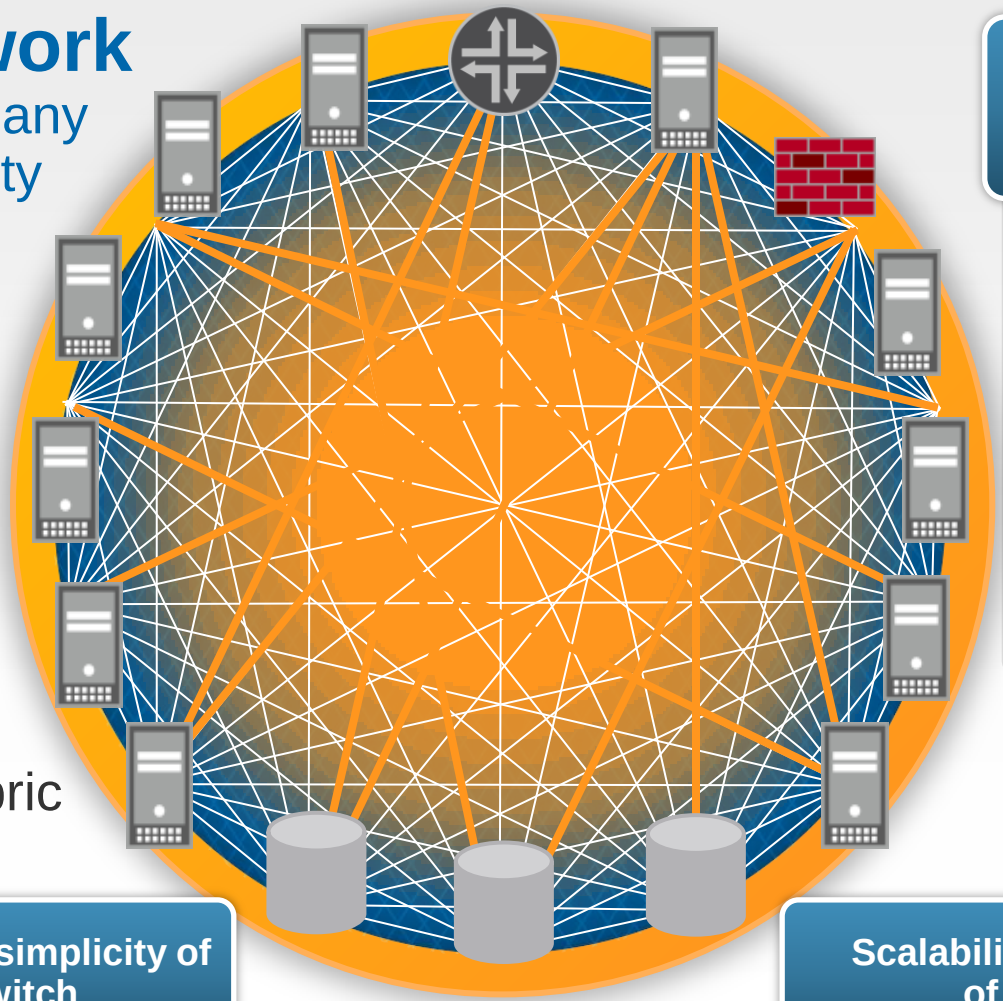
TRANSFORM THE NETWORK

One Network

Flat, any-to-any connectivity



Single device N=1

Switch Fabric

Data Plane

- Flat
- Any-to-any

Control Plane

- Single device
- Shared state

A Network Fabric has the….

Performance and simplicity of a single switch

And the…

Scalability and resilience of a network

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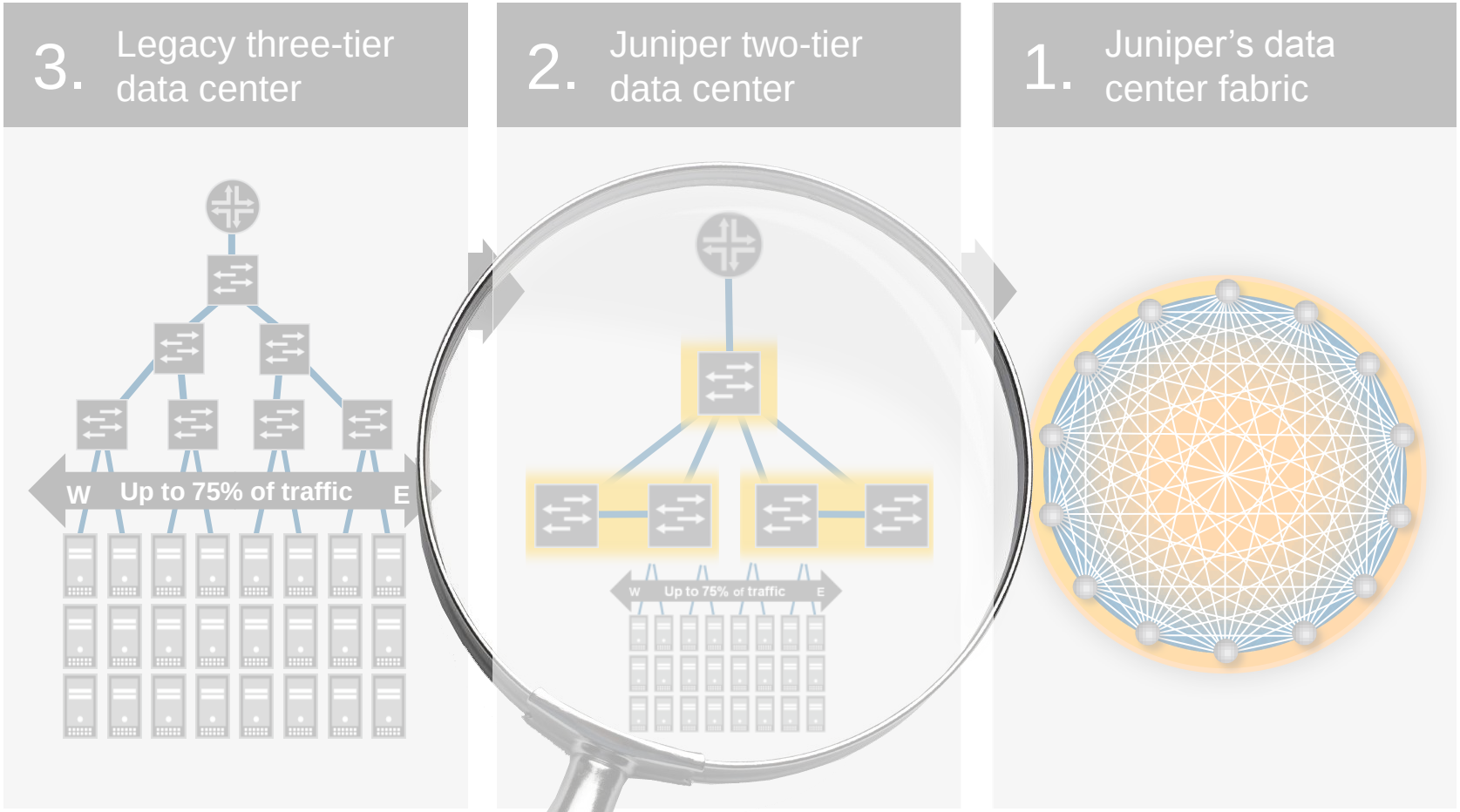
JUNIPER NETWORKS

JUNIPER HAS THE ANSWER: 3-2-1



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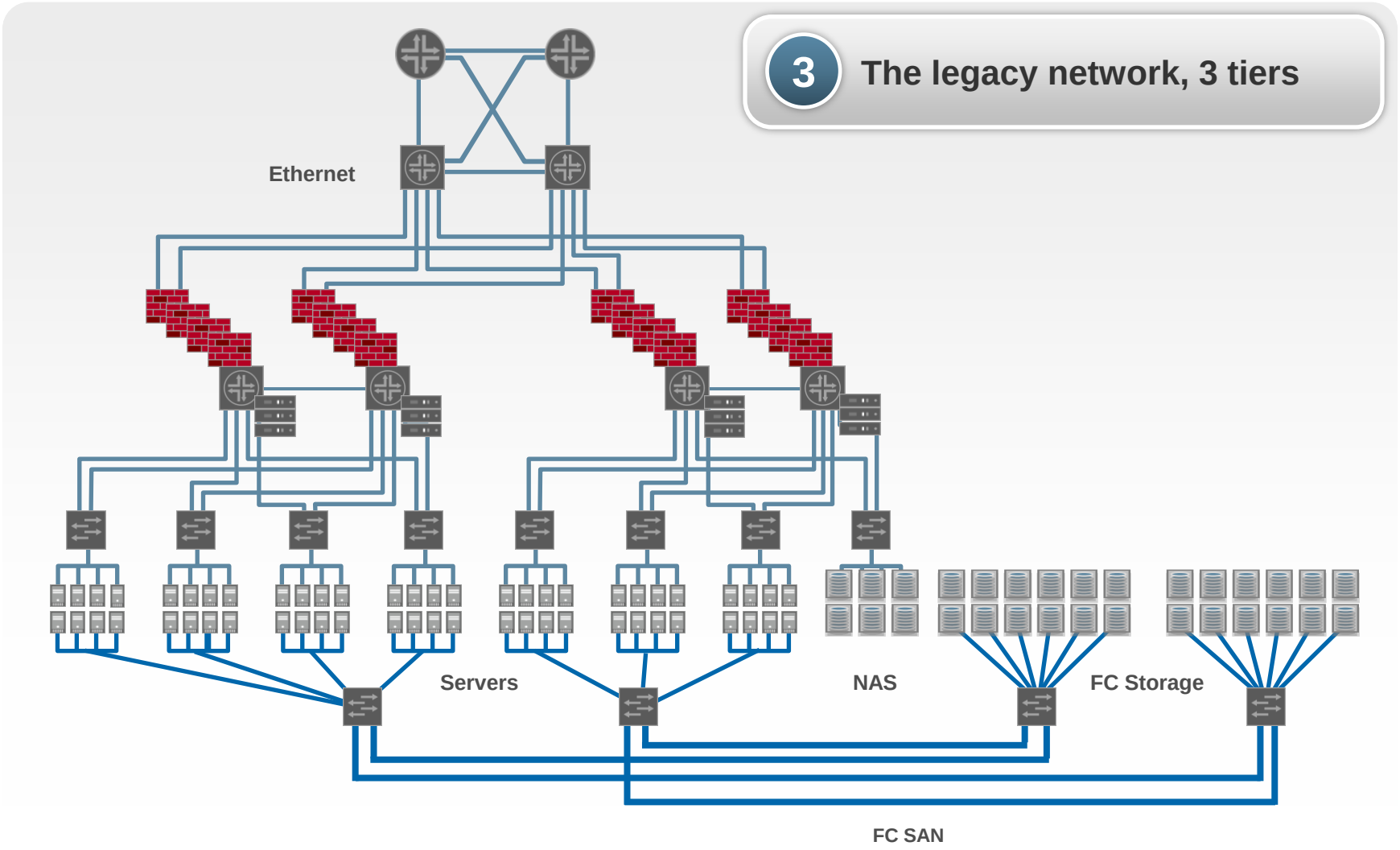
SIMPLIFY THE NETWORK

3 – 2 – 1



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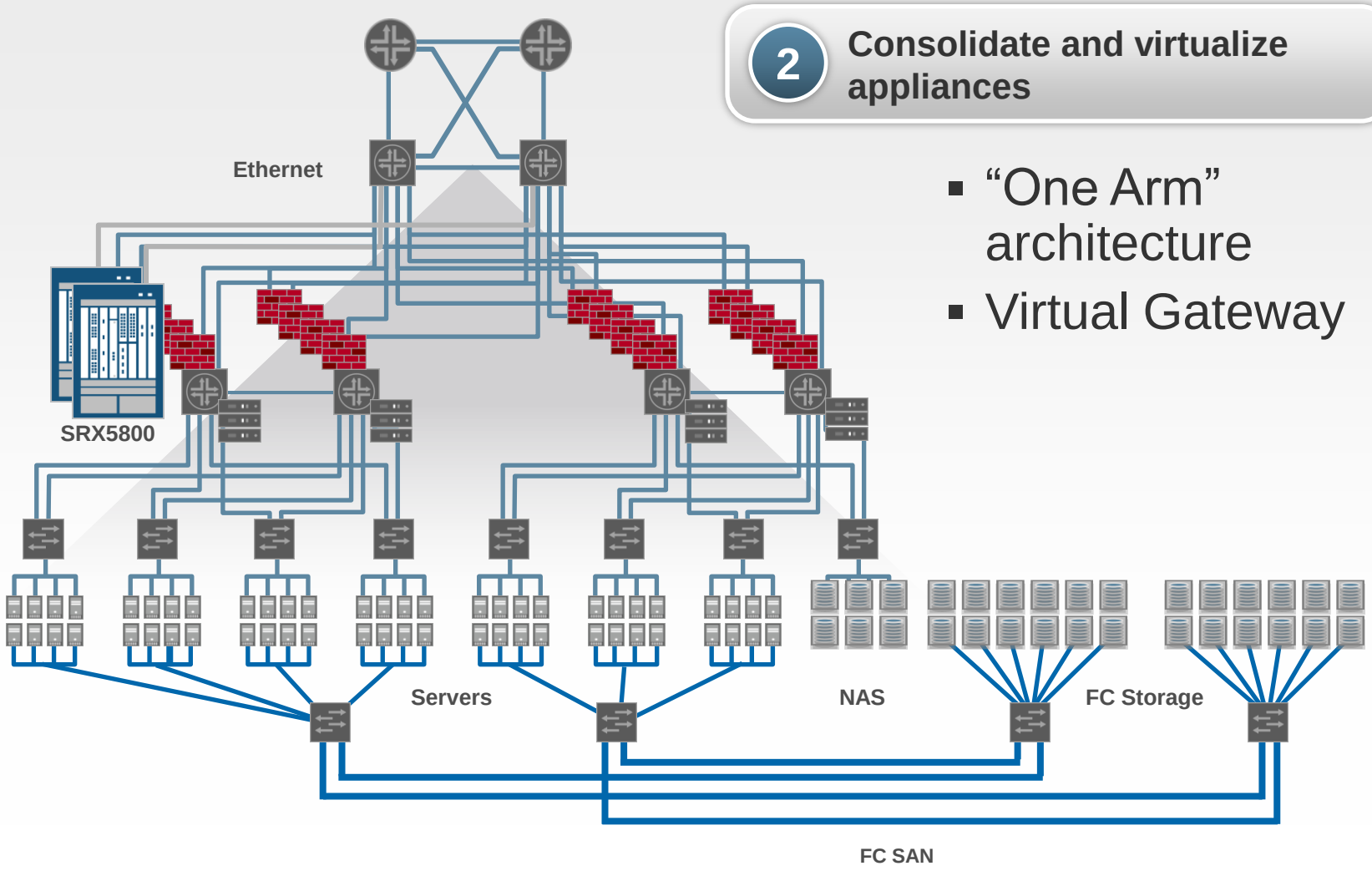
SIMPLIFY THE NETWORK

3 – 2 – 1

2 Consolidate and virtualize appliances

- "One Arm" architecture
- Virtual Gateway



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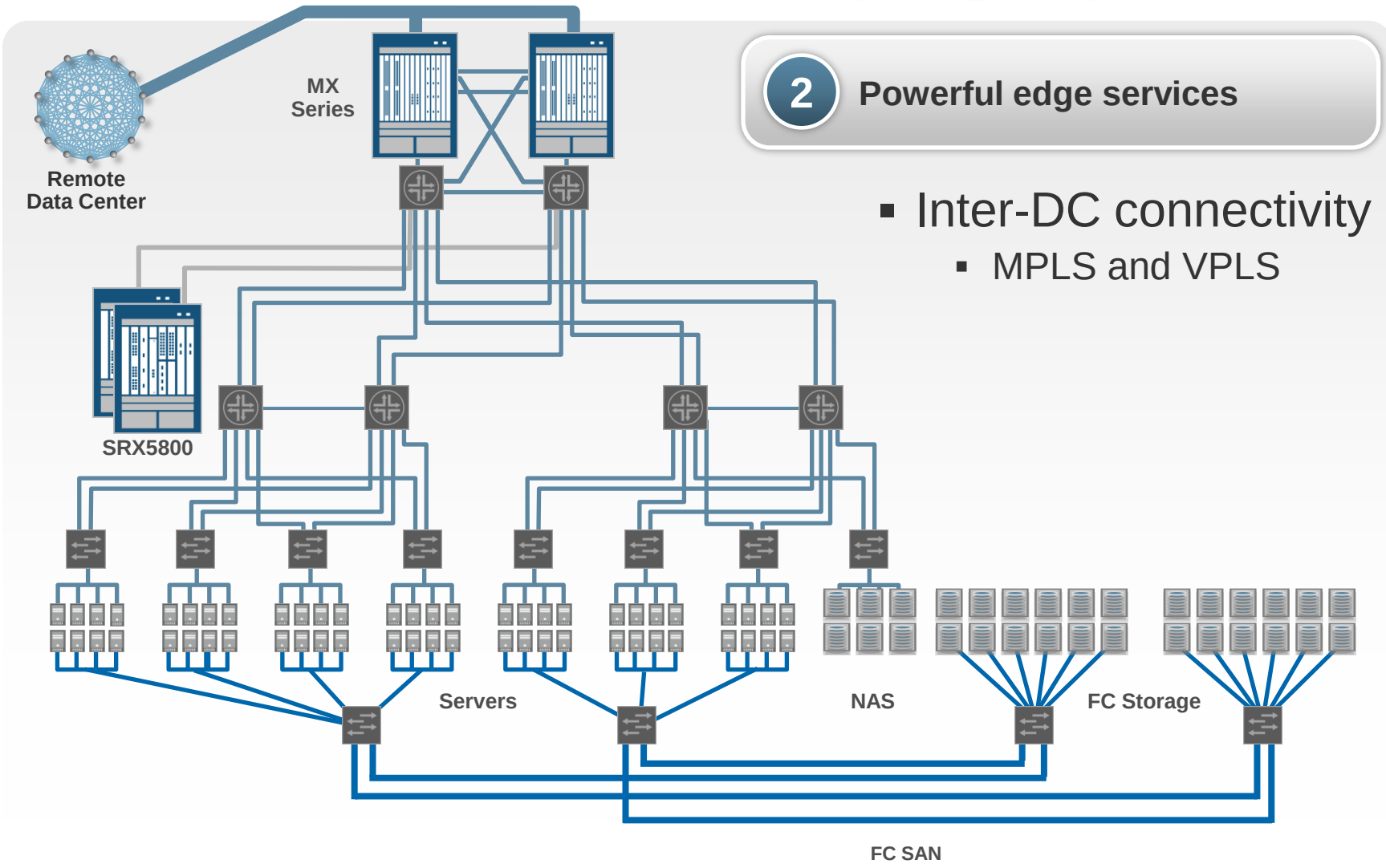
SIMPLIFY THE NETWORK

3 – 2 – 1



2 Powerful edge services

- Inter-DC connectivity
  - MPLS and VPLS

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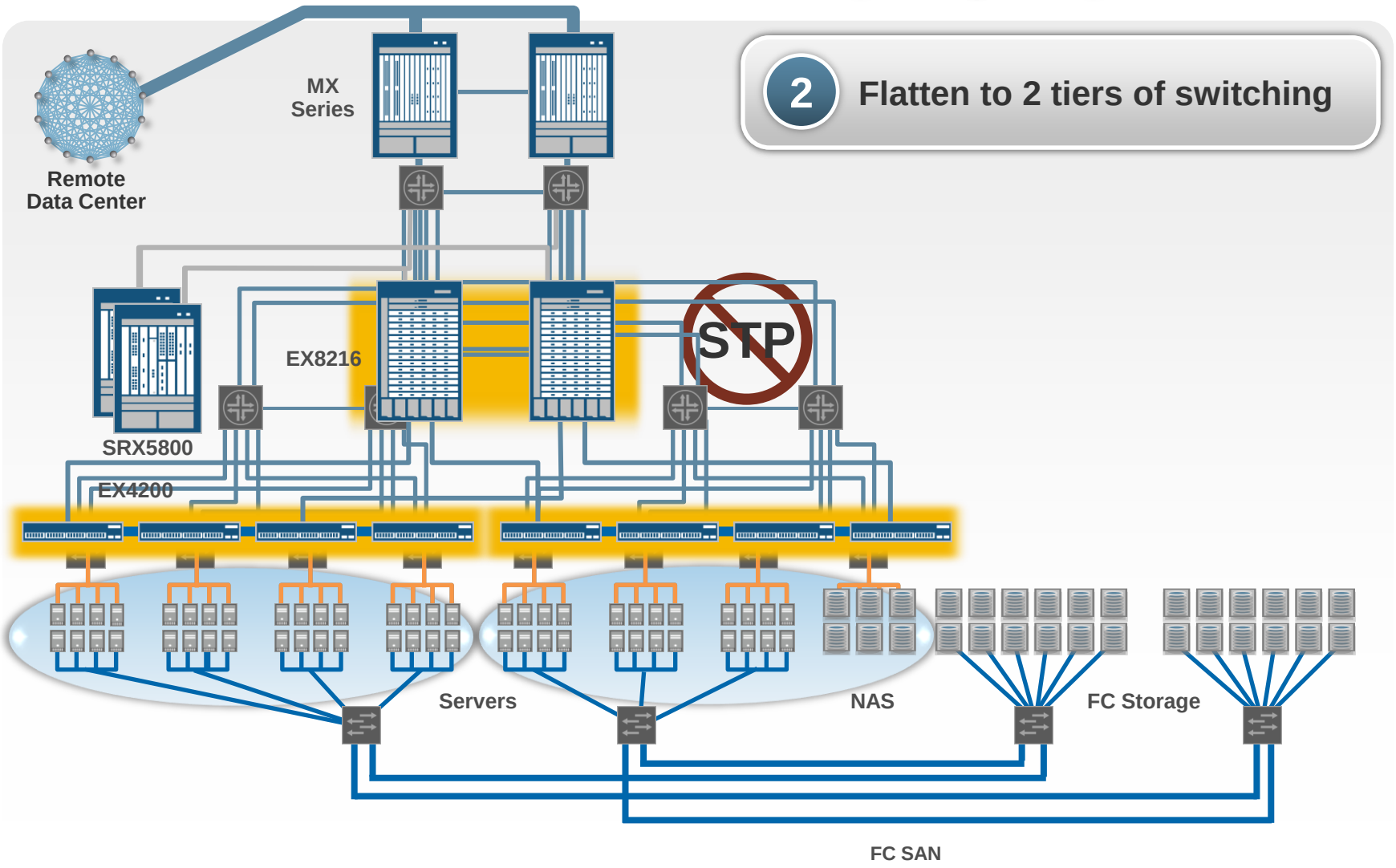
SIMPLIFY THE NETWORK

3 – 2 – 1



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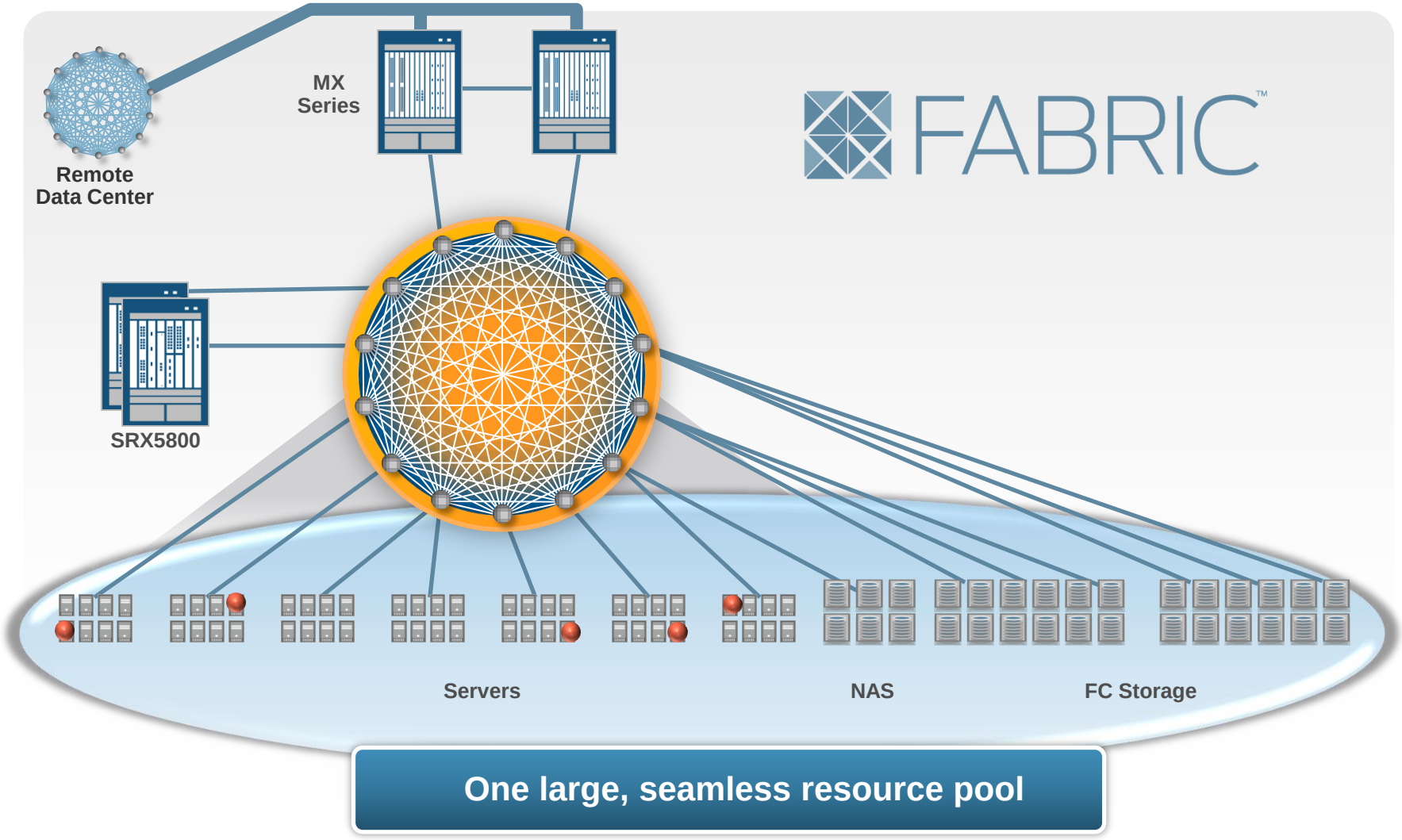
1 TIER

3 – 2 – 1



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FABRIC™

A Revolutionary New Architecture

Design Goals

Flat, resilient fabric

Everything is one hop away

Scale without complexity

The ability to add capacity without adding operational complexity

N=1

QFabric is a switch

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FABRIC™

A Revolutionary New Architecture

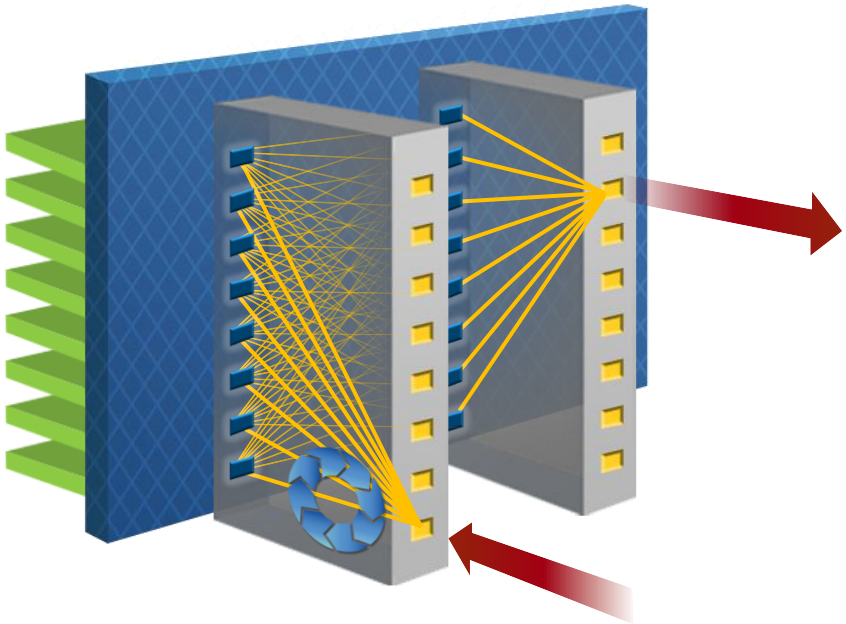
3 Design Principles

Management Plane
N=1
Operational model of a single switch

Control Plane
Federated Intelligence
Only way to scale with resilience

Data Plane
Rich edge, Simple core
Everything is one hop away

DATA PLANE IN A SINGLE SWITCH



Data Plane

1. All ports are directly connected to every other port
2. A single “full lookup” processes packets

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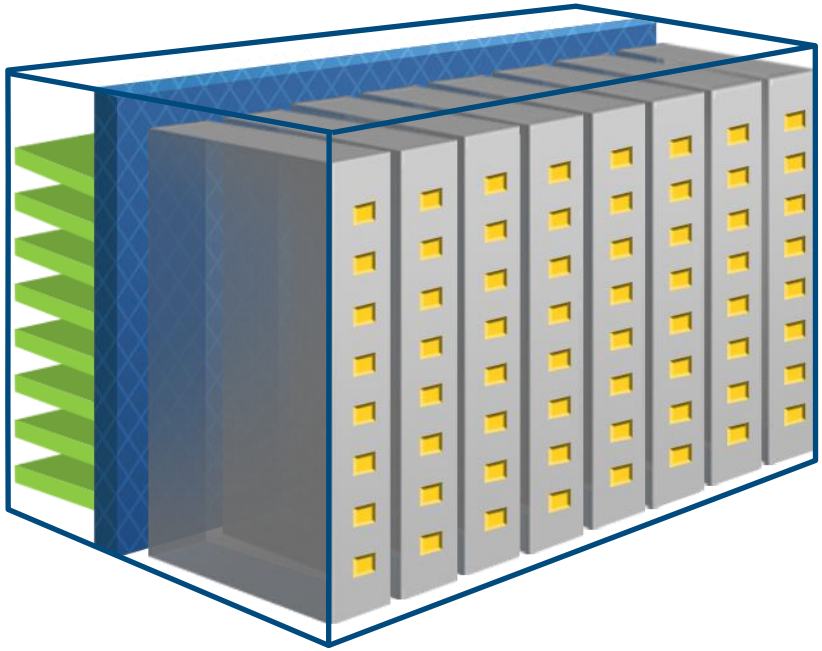
SINGLE SWITCH DOES NOT SCALE



Ports can be added to a single switch fabric.

…but eventually it runs out of real estate.

After this, the network cannot be flat.

Choice: **Sacrifice simplicity or… change the scaling model**

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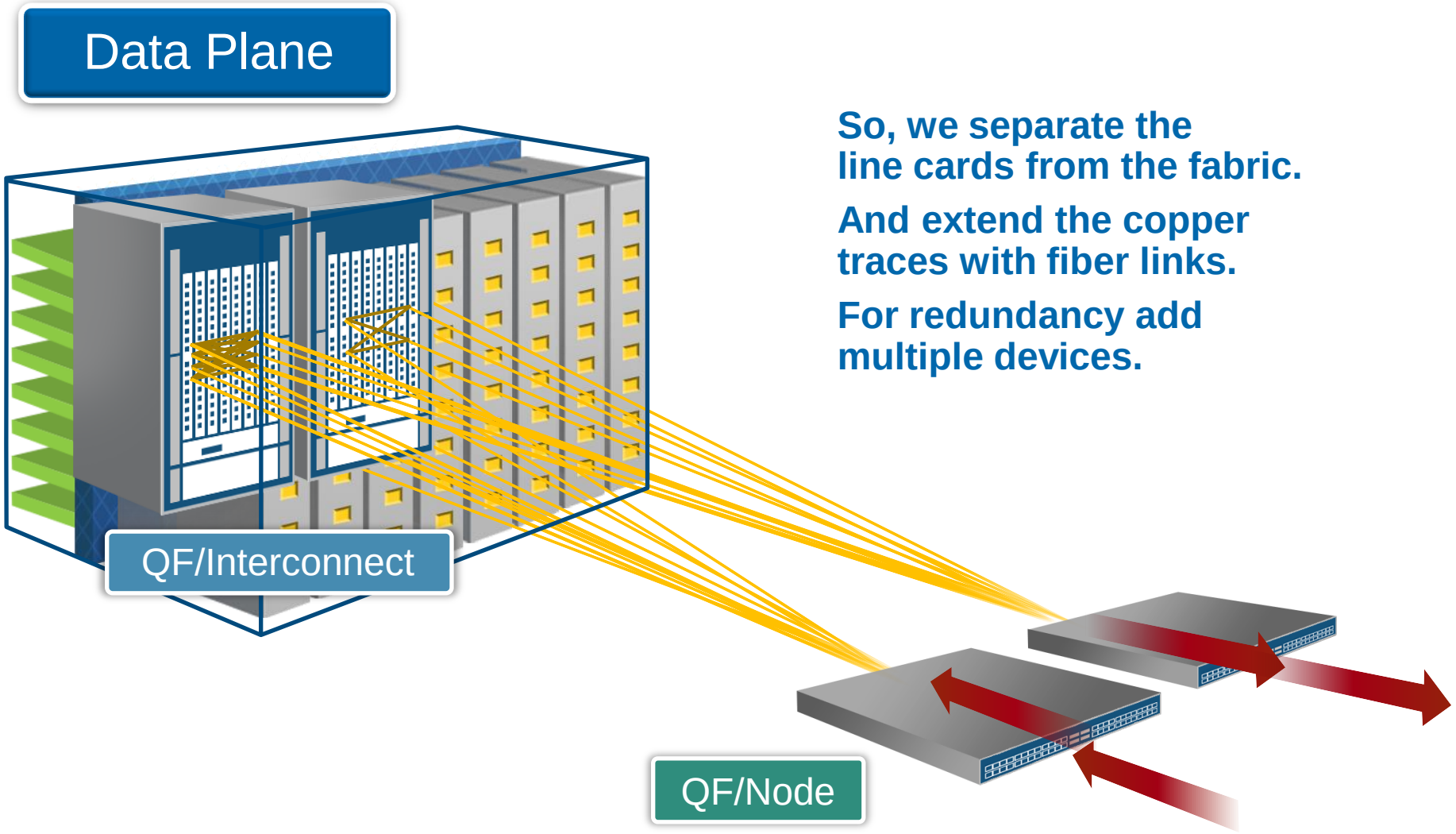
SCALING THE DATA PLANE



So, we separate the line cards from the fabric.

And extend the copper traces with fiber links.

For redundancy add multiple devices.

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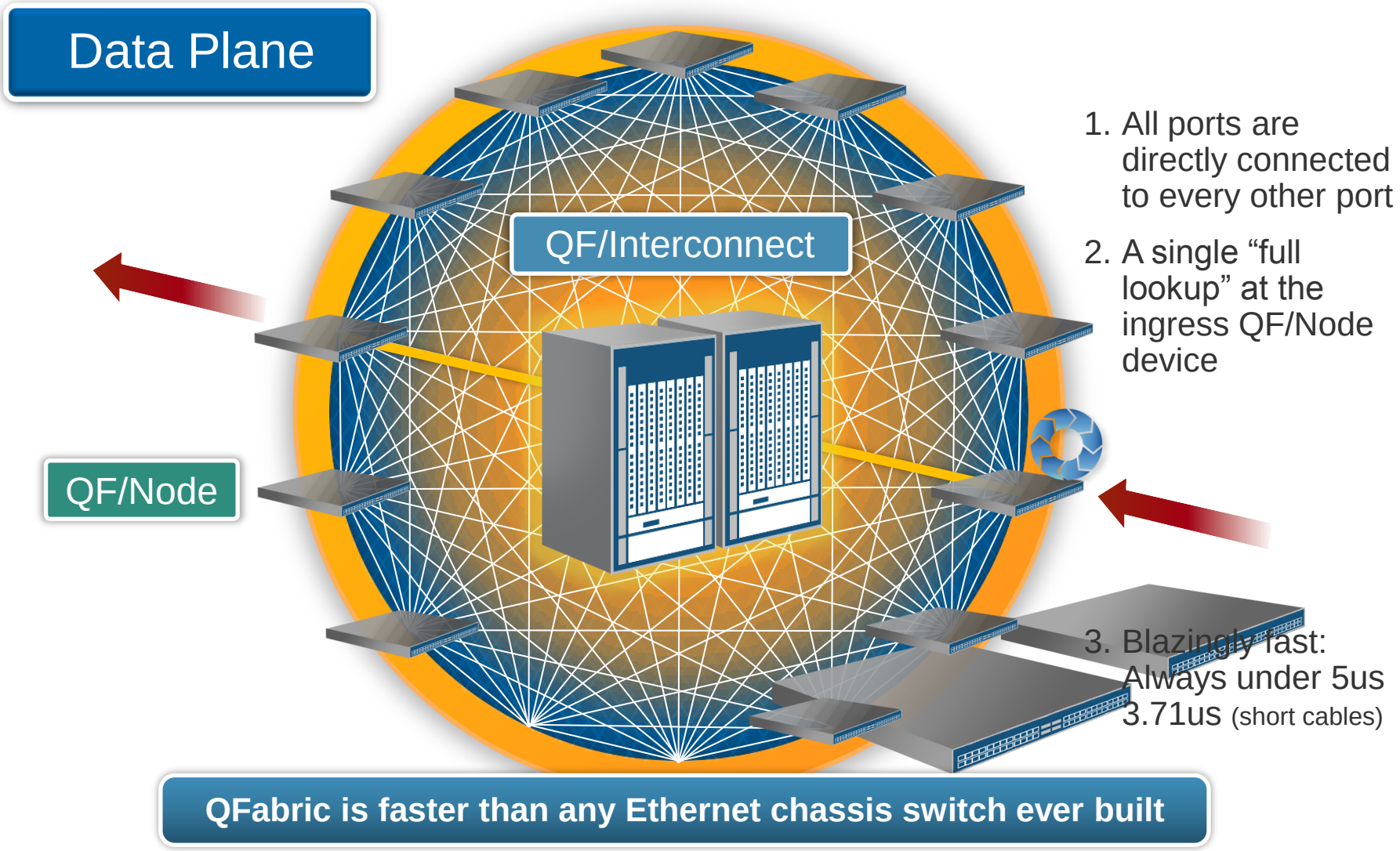
SCALING THE DATA PLANE



1. All ports are directly connected to every other port
2. A single “full lookup” at the ingress QF/Node device
3. Blazingly fast: Always under 5us 3.71us (short cables)

QFabric is faster than any Ethernet chassis switch ever built

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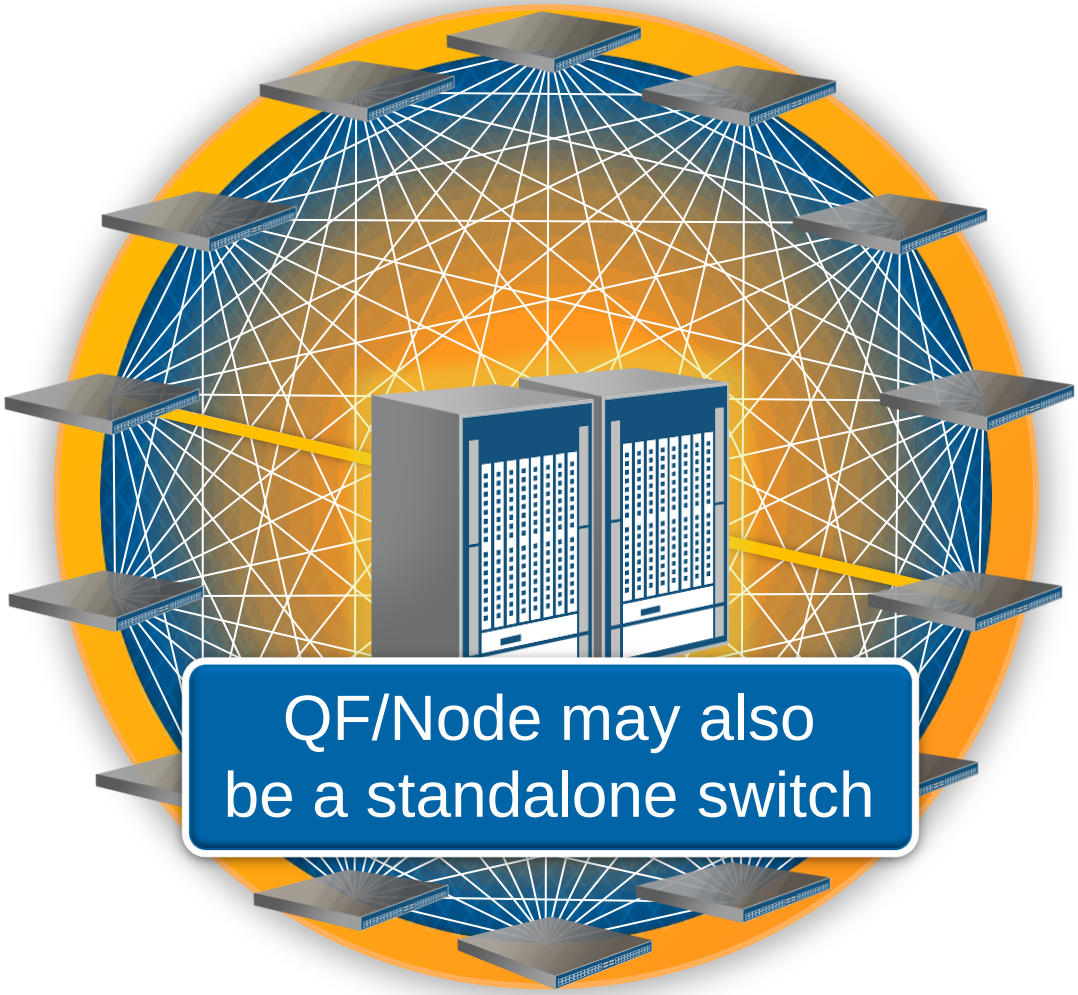
QFX3500



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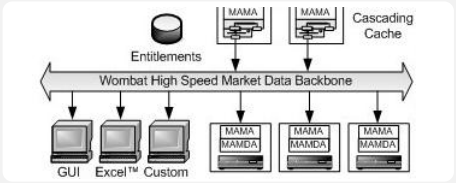
QFX3500



<1µSec; Cut-through; 40G

Ultra Low Latency

Full L3; VirtualControl; FC Gateway; HA; VPN

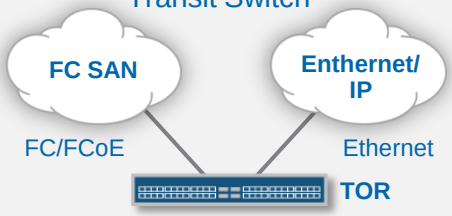
JUNOS

Feature Rich

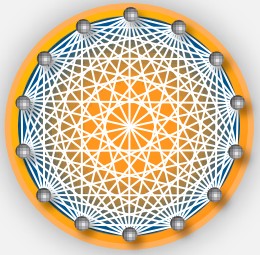
QFX3500

Converged I/O

DCB; FCoE-FC Gateway; FCoE Transit Switch



Fabric Attach



Unique Value Add to Scale

JUNOS

Low Cost Point Players

Low Cost Base configuration

ARISTA

BLADE NETWORK TECHNOLOGIES

FORCE10

extreme networks

Certify Once; Deploy Everywhere

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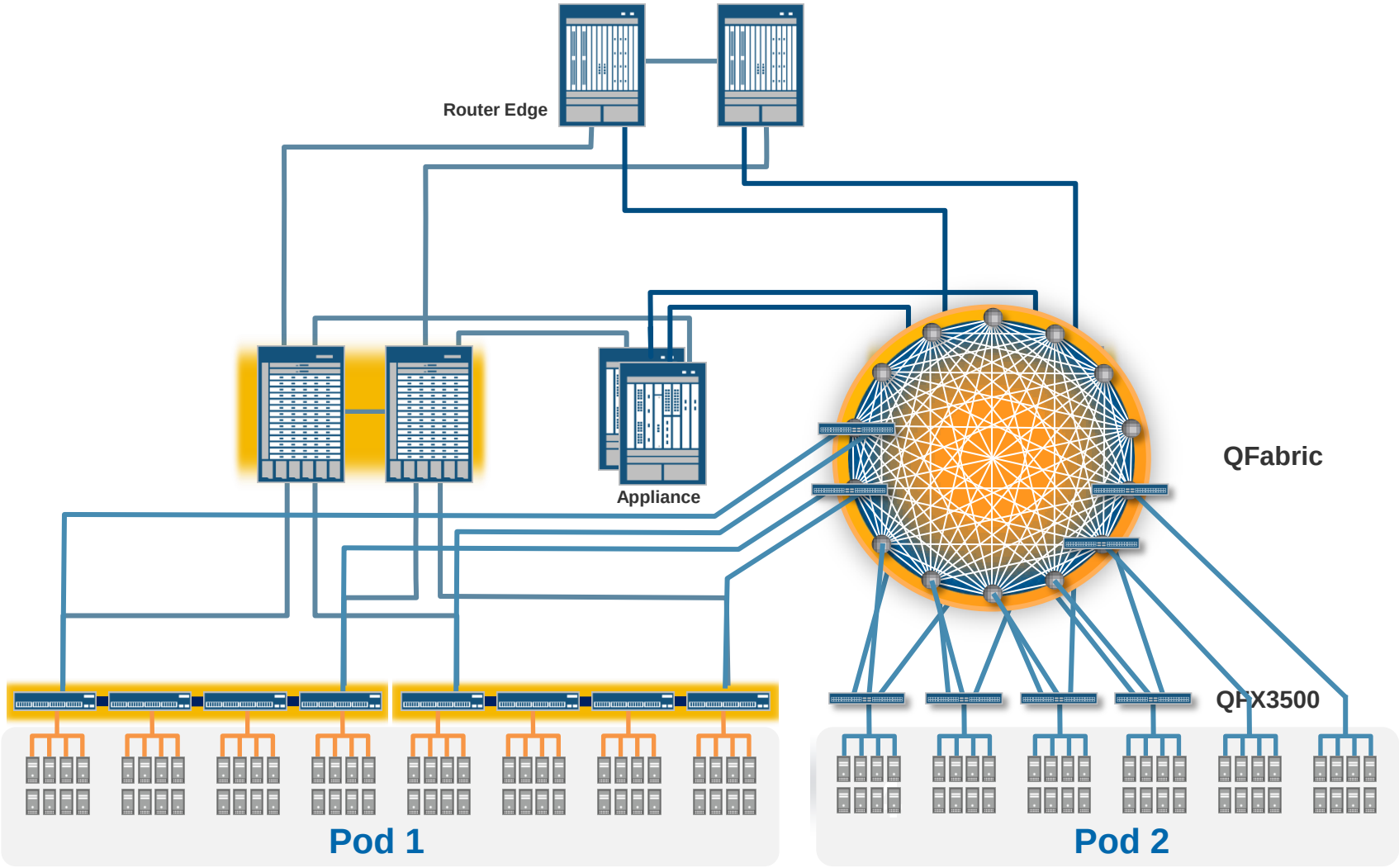
JUNIPER NETWORKS

MIGRATING TO QFABRIC



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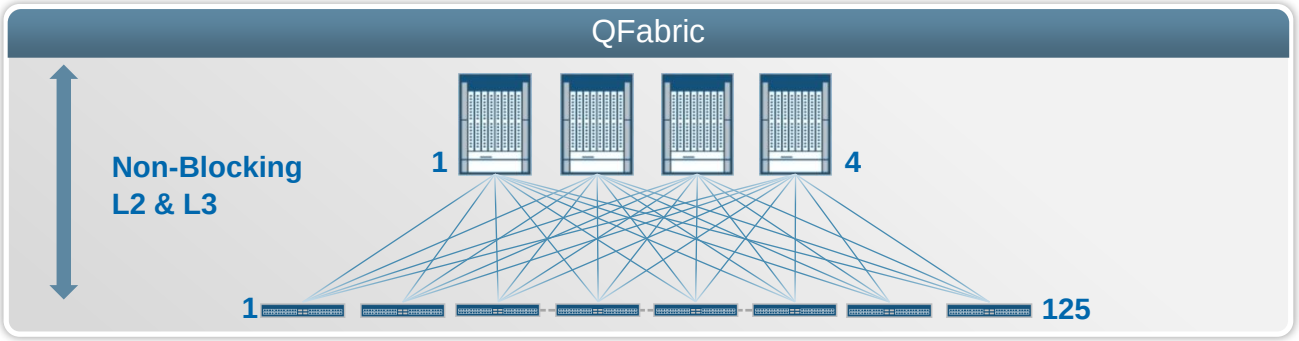
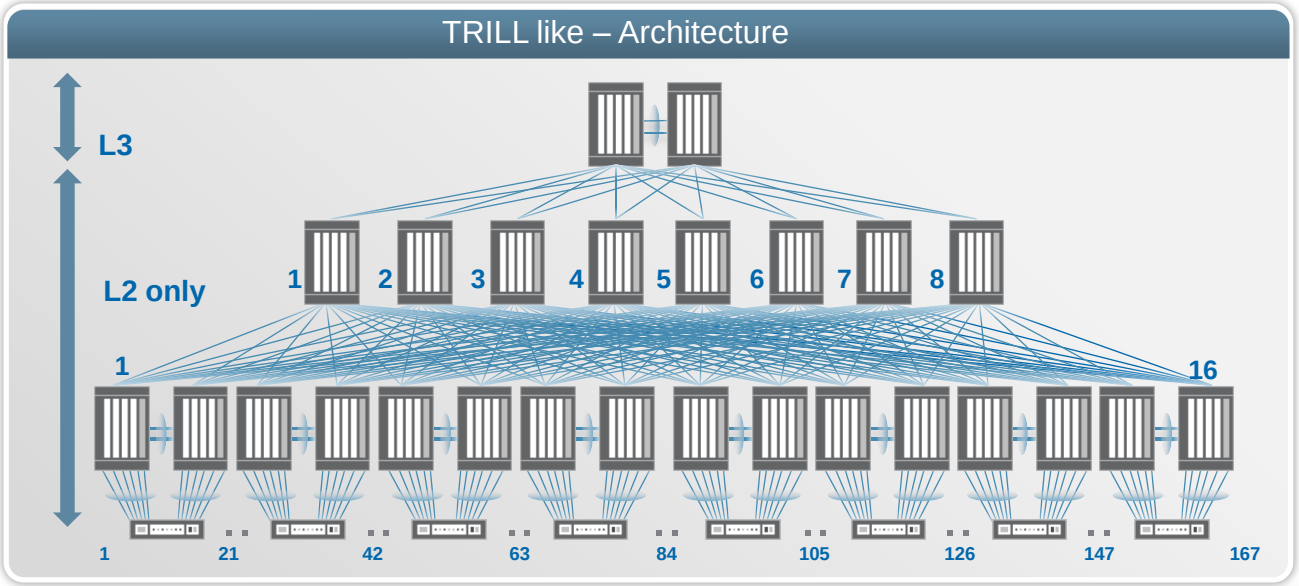
QFABRIC VS. COMPETITION – 6000 10 GbE PORTS





QFabric

- 1/3 fewer devices
- 77% less power
  Savings: $360K/Yr
- 90% less floor space
- 85% fewer links
- 12-16x faster
- Mgd. Devices
  1 vs. 193
- L2 AND L3

The QFabric is faster than any chassis switch ever built!

Note:
- OS* Over Subscription 3:1
- Ports: 6000 server ports

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JUNIPER NETWORKS

MULTIPLE PORT CONFIGURATION COMPARISONS

500 ports[1]

- 17% fewer devices
- 45% less power Savings: $28K/Yr
- 50% less floor space
- 74% fewer links
- 3-6x faster
- Mgd. Devices 1 vs. 18

1000 ports[1]

- 22% fewer devices
- 46% less power Savings: $33K/Yr
- 50% less floor space
- 80% fewer links
- 3-6x faster
- Mgd. Devices 1 vs. 32

3000 ports[2]

- 30% fewer devices
- 73% less power Savings: $180K/Yr
- 85% less floor space
- 82% fewer links
- 12-16x faster
- Mgd. Devices 1 vs. 98
- L2 & L3*

6000 ports[2]

- 33% fewer devices
- 77% less power Savings: $360K/Yr
- 90% less floor space
- 85% fewer links
- 12-16x faster
- Mgd. Devices 1 vs. 193
- L2 & L3*

1: Multi chassis LAG like
2: TRILL like
*: Non-Blocking

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JUNIPER NETWORKS

FABRIC™

Performs

Every application performs better

Scales

Build large, efficient clouds

Simplifies

Less hardware

Operational simplicity of a switch

Greater reliability

Lowers Cost

Elegance of design delivers lower OPEX and CAPEX

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TIMING AND DIRECTION

Timing

QFX3500 is shipping

QFabric is in customer trials

QFabric ships in H2 2011

Future directions

Scale down – Micro-Fabrics
Under 800 ports

Scale up – Mega-Fabrics
10s of 1000s of 10GbE ports, 100s of thousands of Virtual Ports

40 GbE and 100 GbE access speeds

Provide a fully blended fabric with full fibre channel services

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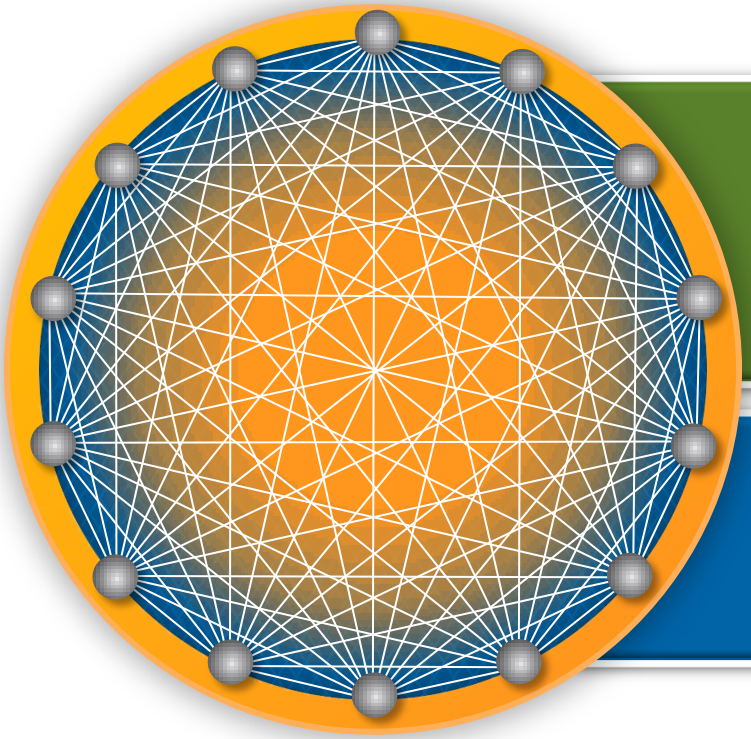
A REVOLUTIONARY NEW ARCHITECTURE

FABRIC™



Performance and simplicity of a single switch

Scalability and resiliency of a network

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NO COMPROMISES

Data Center Priorities

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WHAT IS
NOW
POSSIBLE
?

FABRIC™

everywhere