ARISTA
at-a-glance

*Data Center Class*

# Scaling Data Center Networks

## INSIDE

**SCALE**
The ability for network architectures to accept increased traffic or number of devices without impacting the cost per port

**WHY**
Today demanding more ports than any switch can support without oversubscription takes six-times the number of network elements

**WHO CARES**
IT professionals who need to scale performance while maximizing efficiency. IT leaders who are passionate about technology, yet realistic about the business.

**WHAT IS NEXT**
Network technologies are being disrupted by end-user and business leader demands for lower-cost, consistent uptime, better SCALE.

Virtualization, Cloud Computing, and 10Gb/40Gb/100Gb Ethernet technologies are all disruptive elements that cause architectural change. A new design is required.

**What is Arista's definition of scalability in the context of a data center network? What are the critical requirements and what issues must be solved to address data center scalability?**

*Scalability of the data center network is the ability to construct and expand a network with simple, repeatable designs that can accommodate increased traffic or new devices without impacting applications, workflows or the cost per port. Scaling needs to be linear for both performance and cost – i.e., as a system supports more servers, the price per host and the performance per host stays very close to the same.*

Achieving this challenging goal in the data center network has several components:

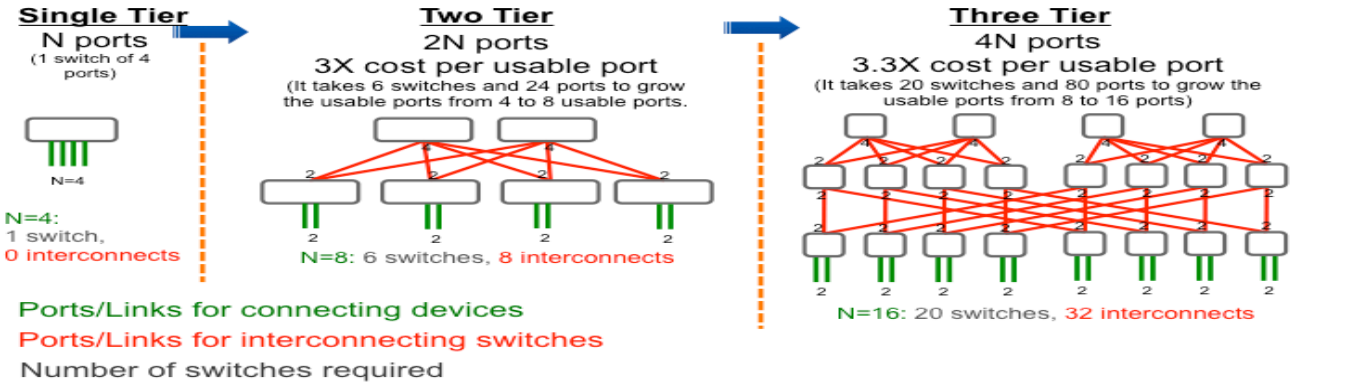
- Scaling up the performance of single systems, as this allows more price/performance linearity
- Extending or stretching the addressing of a network using open standards to embrace workload mobility across increased geographic distances and larger data center facilities
- Scaling the manageability and operational capabilities of the network infrastructure in the data center network so that administrators can effectively provision and manage a larger number of systems. Additionally provide increased visibility to the network, and all of the devices that are required to deliver IT services. This includes integration with automation systems via open and extensible APIs.
- Topologies must continue to self-organize and self-heal while converging quickly in the event of link or node failure. Technologies that make all bandwidth available, reduce the dependency on the artificial insertion of loops into the network, and enable integration of topology change with planned operational procedures are part of Arista's Extensible Operating System - EOS.

## SUB-LINEAR SCALABILITY

### TWO TIER VERSUS THREE TIER NETWORK ARCHITECTURES

Achieving linear scalability without oversubscribing the network and therefore impacting performance is the goal of modern data center network architectures. Two tier designs require less than 1/3 the number of switches and interconnects of a three tier design – reducing CapEx and OpEx while improving performance. The simple example shown below illustrates the number of devices needed to scale out a network as the number of network tiers increases.

***Arista's Cloud Network architecture using high density switches and proven standards-based MLAG and ECMP designs delivers linear scalability to thousands of 10Gb Ethernet interfaces and tens of thousands of 1Gb Ethernet interfaces***




The critical requirements of data center network scalability are:

- A portfolio of high-performance switching platforms with a consistent operating model
- Ability to provision and manage multiple devices as a single system without trading off functionality to scale operations
- Ability to construct high-performance multi-system Leaf/Spine topologies using open standards without reducing the capacities of each system, introducing blocking architectures or systems with insufficient buffers to handle large numbers of TCP flows
- Linearly scale to a larger number of high-performance interfaces that map cleanly to a servers ability to generate I/O and a storage systems ability to consume/source data

The technology innovations required to deliver on the promise of linear scalability for data center networks with increased systems densities, high capacity HVAC environments, virtualized and multi-tenant environments fall into several key areas:

- Cost effective host and network Ethernet interfaces that match the server CPU speeds - i.e., 10Gb and 40Gb Ethernet
- 10/40/100Gb Ethernet interfaces for uplinks that can be deployed and aggregated at a density that preserves clean network designs
- Efficient, stable and standards-based link aggregation technologies to scale current 10Gb Ethernet uplinks
- Scalable network operating system architecture that has open, well defined, programmable and machine readable interfaces, other than CLI, for provisioning of network services
- Trusted segmentation mechanisms that are auto-negotiated between hosts and networks and then carried across the network fabric
- Scalable solutions for deploying global network policies and the ability for these to be set and coalesced with external management systems from multiple-vendors

**Scaling Metrics For Two Tier Networks**

| Leaf Switch | Spine Switch | Host Ports MLAG | Host Ports ECMP (n-way) | End-to-End Latency (µs) | Total RU MLAG/ECMP | Total Power (KW) MLAG/ECMP |
|---|---|---|---|---|---|---|
| 7048 | 7050S | 1,440 | 3,072 (4) | 10 | 32/68 | 5.4/11.6 |
| 7048 | 7508E | 27,648 | 55,296 (4) | 12.5 | 1166/1196 | 110/220 |
| 7050S | 7050S | 336 | 3,072 (16) | 2.5 | 9/80 | 1.1/10.0 |
| 7050S | 7508E | 6,816 | 55,296 (16) | 5.1 | 164/1328 | 27.8/224 |

**What are the relative economics and costs/benefits of Arista's technologies?**

Arista aims to have the best price/ performance ratio from both a CapEx and OpEx perspective in the data center switching market with the best linear scalability.

Using only 1RU switches, Arista can scale networks up to 64 racks (more than 3,000 servers) in a Leaf/Spine architecture, while saving space, critical in a co-location environment where space consumed can be directly measured as operations expense. For larger networks, the Arista 7500E provides scalability up to 1152 racks, and more than 55,000 servers with just 16-way ECMP. Additional ECMP scale will enable larger networks.

Open standards play a critical role in building scalable networks that preserve vendor choice. Arista supports standards-based technologies to build scalable Layer 2 and Layer 3 networks, such as Multi-Chassis Link Aggregation (MLAG) and ECMP. Arista is a leader in delivering VXLAN, which extends Layer 2 domains across Layer 3 boundaries while eliminating the 4K VLAN limitations.

When deploying and expanding data center networks, provisioning and on-going configuration management is a major issue. Arista's Zero Touch Provisioning (ZTP) provides standards-based features to automate network and server provisioning. The programmability of Linux-based EOS makes it possible to leverage tools such as Chef, Puppet and CFEngine to manage the switch in a similar way to other Linux-based systems.

**What are the right metrics to measure my network scalability on?**

Key metrics in the data center networking market are:

- Price per Wire-Rate Host 10GbE Port
- Price per Million Packets per Second (for Layer 3 devices)
- Power Draw, Overall
- Power Draw per Wire-Rate 10GbE Port
- Power Conversion Efficiency
- Provisioning time for new switches
- Failover time for node failure
- Failover time for link failure
- Failover time for planned maintenance with default commands
- Failover time for software upgrade
- Disruption/loss during system boot/insertion
- Port-to-Port Latency in the data center (single-switch)
- Port-to-Port Latency in the data center (any port to any other, multi-system)

Arista's solutions are compelling on all the above metrics. Arista provides full wire-speed switches optimizing price/ performance. Wire-speed switches with larger port counts results in fewer switches in the data path, and a more scalable data center network.

Additional information and resources can be found at: www.aristanetworks.com