THE POWER OF RUCKUS CAMPUS FABRIC IN THE DATA CENTER

WHITE PAPER

HIGHLIGHTS

- Ruckus ICX technology enables small to mid-sized organization to deploy a modern data center networking infrastructure at a low cost without specialized data center networking experience.
- The Ruckus ICX product portfolio is designed to address a broad range of data center use cases, catering to different markets with solutions for L2 or L3 leaf-spine deployments.
- Ruckus Campus Fabric collapses spine and leaf layers into a single logical device, flattening the network and eliminating deployment complexity and arbitrary network segmentation between data center racks.
- Ruckus Campus Fabric enables L2 multi-pathing without additional complexity and provides a single point of management, configuration, and monitoring.

ADDRESSING THE DATA CENTER NEEDS OF SMALLER ORGANIZATIONS

Small to mid-sized organizations often don't have the budgets and the skillsets to support a sophisticated data center infrastructure. Ruckus ICX switching's innovative technologies enable the deployment of a modern high performance data center networking infrastructure at lower cost without specialized data center networking experience.

These organizations have similar application needs as larger organizations, but lack the budget and network technology expertise to deploy and manage the type of data center networks needed to support these applications. They often rely on a crew of IT generalists and can't afford dedicated network experts.

Cloud computing is certainly a great equalizer, as any size company can get sophisticated applications from the cloud. However, not every type of application or data is suitable for a public cloud. Private student records, for example, or sensitive financial information aren't well suited to going into a public cloud.

Network vendors targeting large corporate data centers tend to focus on complex technologies that are optimized for very large data center environments and rarely address the usability and ease of management of their network products. New products deliver higher speed, port density, sophisticated features but they often fall short in terms of being easy to install, troubleshoot and manage.

IT managers overseeing networks at smaller organizations, need solutions that simplify and automate the deployment and management of their networks. These organizations are better served by network products that can be operated without relying on costly network experts.

Ruckus Scale-out Networking architecture leverages fixed form factor switches and smart software to deliver high performance and ease of management at a lower cost. Ruckus networking platform is based on cost effective and flexible 1RU switches rather than relying on traditional, rigid chassis switches with higher operational and acquisition costs.

LEAF-SPINE: THE NEW NETWORK ARCHITECTURE IN THE DATA CENTER

The aging three-tier design in the data center is being replaced with what is commonly called the leaf-spine design. The leaf-spine architecture is adaptable to the continuously changing needs of small to large organizations with evolving data centers and is very well suited for small to mid-size data center deployments.

The traditional three-tiered model was designed for use in general purpose networks, usually segmented into pods which constrained the location of devices on the network. The architecture consists of Core routers, Aggregation (sometimes called Distribution) routers, and Access switches. These devices are interconnected by multiple pathways for redundancy which can create loops in the network. As part of the design, a protocol (e.g. Spanning Tree) that prevents looped paths is implemented. However, doing so deactivates all but the primary route. A backup path is then only brought up and utilized when the active path experiences an outage.

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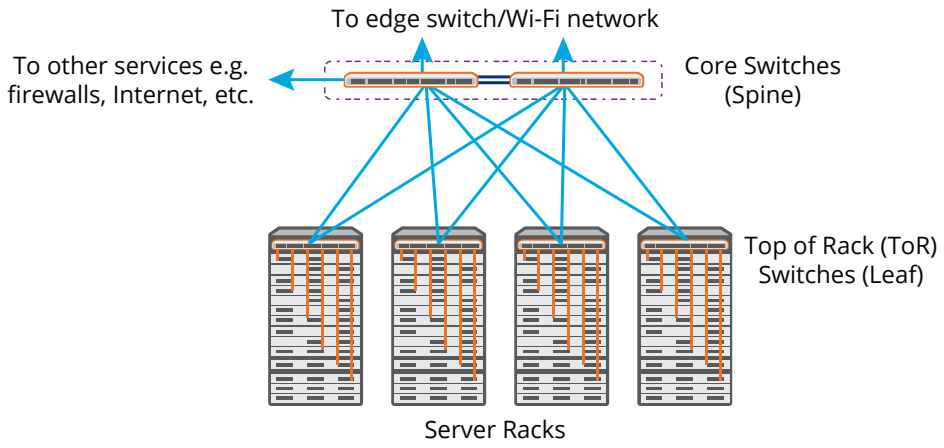
With leaf-spine configurations, all devices are exactly the same number of segments away from each other which ensures a predictable and consistent amount of latency for data traversing the system. This is possible because of the new topology design that has only two layers, the Leaf layer and Spine layer. The Leaf layer consists of access switches that connect to devices like servers, firewalls, load balancers, and edge routers. The Spine layer is the backbone of the network, where every Leaf switch is interconnected with each and every Spine switch.

To allow for the predictable hop distance between devices in this two-layered design, advanced Layer 2 protocols that support multi-pathing or Layer 3 routing are needed to interconnect the layers. These protocols allow the best path to be determined and adjusted based on responses to network change. This type of network is for data center architectures with a focus on "East-West" network traffic. "East-West" traffic contains data passing between systems inside the data center itself and not outside to a different site or network. This new approach is a solution to the intrinsic limitations of Spanning Tree with the ability to utilize other networking protocols and methodologies to achieve a dynamic network.



The Challenges of L3 Leaf-Spine Deployment

- **Deployment complexity:** Because every leaf switch is connected to every spine switch, there are multiple paths between switches in a leaf-spine architecture. Standard Ethernet protocols do not support multi-pathing at layer 2 and require the deployment of STP (Spanning Tree Protocol) to eliminate loops. STP blocks all but one path between two points which completely defeats the purpose of a leaf-spine architecture. To solve this issue, classic leaf-spine deployments rely on layer 3 links between leaf and spine switches and leverage Equal-Cost-Multi-Path (ECMP) routing to manage multiple paths.

  This approach considerably increases the level of complexity of leaf-spine deployment when L3 links are configured and managed manually by IT personnel. L3 configuration and management often requires higher network expertise and can be very time consuming without some level of automation.

- **L3 Network Segmentation:** Another major challenge comes from the use of Layer 3 routing between leaf and spine switches. This approach segments the network into a myriad of individual subnets and eliminates the spanning of VLANs (Virtual LAN) across a network. VLANs in a leaf-spine network are localized to each individual Leaf switch; any VLAN segments that are left on a leaf switch are not accessible by the other leaves. This create issues with scenarios such as guest virtual machine mobility within a data center or any other application that requires multiple servers to be on the same subnet.

RUCKUS TECHNOLOGY SIMPLIFIES LEAF-SPINE DEPLOYMENT FOR SMALLER DATA CENTERS

Ruckus offers a radically different approach that simplifies the deployment of smaller data center networks. Ruckus Campus Fabric enables L2 multi-pathing without additional complexity and provides a single point of management, configuration, and monitoring. It also unifies features, network services, and software images across the data center. A leaf-spine network based on Ruckus campus fabric technology delivers all the benefit of a traditional leaf-spine architecture without the management complexity and the additional cost.

Campus Fabric Spine: In a campus fabric, the spine is a stack of high-performance 10 Gigabit Ethernet (GbE)/40 GbE fixed form factor switches that are connected together through a high-speed "campus ring" that can span an entire data center (up to 10 kilometers). These switches are the Control Bridge (CB) devices. Together they deliver a unified network control plane that acts as the central management and traffic forwarding authority for the entire campus fabric domain.

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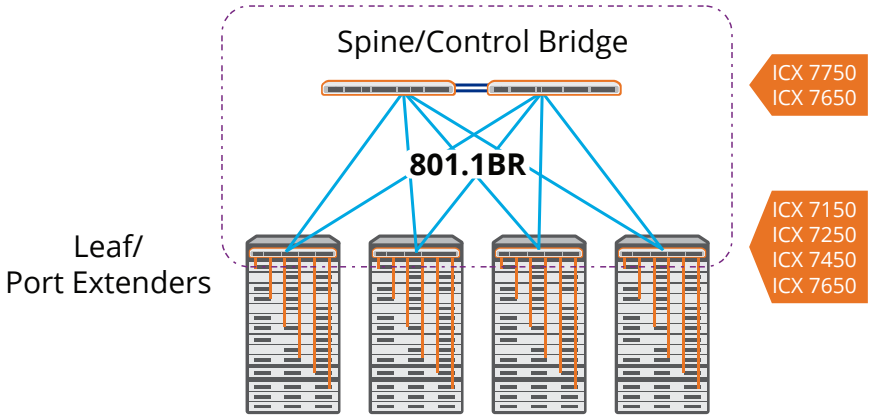
Campus Fabric Leaves: At the edge of the network, Top Of the Rack switches (TOR) are replaced by Port Extender (PE) devices connected to the CB spine devices. The PE devices transparently managed and controlled by the CB, eliminating the need to manually provision and configure individual PE switches. In fact, the entire fabric domain is managed as one logical device from a single point of management within the CB.



High Scalability and Performance

- **Elimination of STP Inefficiency:** The entire domain runs from a unified control and forwarding plane, eliminating the need to deploy a loop avoidance protocol, such as STP within the fabric domain, or complex Layer 3 protocols such as Open Shortest Path First (OSPF). Multi-pathing is supported by design within a fabric domain: All links between leaf and spine switches are active at all times, and traffic is load balanced, optimizing performance while delivering fast failover recovery from link failure with no impact on network service.
- **Flat L2 Network:** Ruckus Campus Fabric architecture flattens the network, eliminating arbitrary Layer 3 boundaries between physical locations. This architecture simplifies the deployment applications in the data center eliminating the need to deploy a complex to manage overlay network on top of the physical network. Applications and Virtual Machines can simply be deployed on subnet and VLAN regardless of the physical location of the server they are running on.
- **High Availability Design:** Ruckus CB technology at the core of the fabric delivers high availability and enables instantaneous hitless failover to a standby CB in the event of a failure of the master CB. Organizations also can use hot-insertion/removal of fabric units (CBs or PEs) to avoid interrupting service when adding a unit to increase the capacity of the fabric or replacing a unit that needs servicing.

Simplified Operations

- **Simplified Deployment:** Ruckus Campus Fabric collapses spine and leaf layers into a single logical device, flattening the network and eliminating deployment complexity and arbitrary network segmentation between data center racks.
- **Simplified Management:** The entire network is managed from a single point, including all ports attached to the CB and PE devices. The network administrator can deploy network policies across the data center from a single point of management.
- **Simplified Application Deployment:** The flattened network simplifies the deployment of applications and the implementation of network services. Tedious L3 deployment and subnet management between switches and across racks is no longer required, neither is the deployment of overlay technology to flatten the network. Ruckus Campus Fabric offers a single logical device across the data center.

Lower Cost of Acquisition and Operation

- **"Pay As You Grow" Design:** The Ruckus fixed form factor based design enables cost-effective scale-out networking. It adds PE devices when more ports are needed at the leaf layer and adds CB devices when more ports are needed at the spine layer, no excess idle capacity is required, and no "fork-lift" upgrade is needed to advance to the next capacity level.
- **Seamless Migration:** Ruckus Campus Fabric interoperates with traditional networks, so there is no need to migrate the whole network at once. Ruckus ICX 7750 and ICX 7650 Switches can act simultaneously as a CB on ports that are connected to PE devices and as a regular Layer 2/Layer 3 aggregation switch on ports that are connected to regular access switches, enabling a gradual migration strategy.

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- **Unified Features and Services:** All devices within a Ruckus Campus Fabric domain offer the same level of network services and software features, since they are all part of the same logical switch. All advanced services running at the spine layer, such as premium Layer 3 features, are available seamlessly from all leaf ports. Additionally, software images running on the various devices are automatically updated and kept in sync, so that there is no risk of version mismatch between the various devices, thus eliminating potential network downtime.

THE RUCKUS ICX 7000 PRODUCT LINE IN THE DATA CENTER

- **Broad range of use cases:** The Ruckus ICX product portfolio is designed to address a broad range of data center use cases, catering to different markets with solutions for L2 or L3 leaf-spine deployments as well as traditional L2/L3 multitier deployments. The Ruckus ICX product line was conceived with maximum flexibility in mind and is intended to cover the needs of existing and future customers using the latest Ruckus ICX 7000 Series switches. Ruckus intends to support Ruckus Campus Fabric on all existing and future Ruckus ICX 7000 Series switches.
- **Maximum Flexibility:** Ruckus ICX 7000 switches are flexible enough to operate both as regular Layer 2/Layer 3 switches, as well as running in PE mode (with the Ruckus ICX 7150, ICX 7250, ICX 7450 and ICX 7650 Switch) or CB mode (with the Ruckus ICX 7650 and ICX 7750 Switch). No licensing cost is associated with Ruckus Campus Fabric technology, and the technology comes with Ruckus ICX FastIron® software running on Ruckus ICX 7000 Series switches.
- **Futureproof with Software Defined Networking:** Build a network foundation that's ready for the future whenever you are, Ruckus ICX switches all support OpenFlow to facilitate Software Defined Networking deployment. The switches can operate in hybrid-port mode, running traditional protocols and OpenFlow-directed flows at the same time, so you can transition to software-defined networking (SDN) at your own pace, without disruption.

	Leaf			Leaf/Spine	Spine
FEATURES	**ICX 7150**	**ICX 7250**	**ICX 7450**	**ICX 7650**	**ICX 7750**
1G Server Connections	●	●	●	●	●
10G Server Connections	Very Limited	Limited	Limited	High Density	Highest Density
10G Upllinks	●	●	●	●	●
40G Uplinks			●	●	●
100G Uplinks				●	
Reversible Air Flow			●	●	●
Redundant PSU		●	●	●	●
Hot Swap PSUs and Fans			●	●	●
Long Distance Stacking	●	●	●	●	●
Stack ISSU	●	●	●	●	●
Campus Fabric	PE	PE	PE	PE/CB	CB
OpenFlow	●	●	●	●	●
VXLAN					●
Layer 3 Routing	Static Routes, RIP, OSPF, PBR	Static Routes, RIP, OSPF, PBR, VRF, GRE	Static Routes, RIP, OSPF, PBR, VRF, GRE, BGP	Static Routes, RIP, OSPF, PBR, VRF, GRE, BGP	Static Routes, RIP, OSPF, PBR, VRF, GRE, BGP

RUCKUS HELPS SMALLER ORGANIZATIONS DEPLOY STATE OF THE ART DATA CENTERS

Ruckus offers a radically different approach that simplifies the deployment of campus networks, providing a single point of management, configuration, and monitoring. It also unifies features, network services, and software images across the campus. Ruckus fixed form factor based 802.1BR solutions enable scale-out networking with a "pay as you grow" deployment model.

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