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HyperEdge Architecture Distributed Chassis Scale- Out Solutions

Product Design Guide

BROCADE

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Preface

Today's campus network is critical for business connectivity to customers, vendors, and partners. At the same time, to ensure business agility and competitiveness, the campus network must support new applications, cloud-based services, and mobile users. However, after decades of limited innovation, legacy campus networks remain rigid, complex, and costly to maintain. Organizations are learning the hard way that these networks were not built to meet today's business challenges and user demands. The campus network for today and tomorrow should be flexible, easy to manage, and cost-effective

Since 2012, Brocade HyperEdge Architecture has been changing the status quo by offering new enabling technologies such as distributed services and consolidated management domains designed to simplify legacy three tier networks. Now with our 2014 delivery of our latest distributed chassis solution we expand HyperEdge Architecture's capabilities to mitigate issues associated with legacy networks while providing increased scalability for Pay as you grow networks that are easy to manage. The distributed chassis solution with scale-out networking flexibility provides an additional benefit of in-service scalable deployment and a single point of management.

Overview

As organizations such as research, education and government agencies feel the impact of mobile and social trends on their IT infrastructure, many are in need of a refresh for their IT networks. The primary reason for a refresh is that traditional network architecture options and legacy network switches are not suited for the delivery of large quantities of data, the proliferation of mobile devices and the additional layers of security required today that can easily scale with ever changing network demands. Many chassis based network switch solutions cause overprovisioning of the network upon initial deployment and then are often rendered obsolete before the chassis is fully populated to fulfill its original projected port density. Until now fixed form factor stackable switches were incapable of offering the performance, reliability and scale of chassis solutions.

The solution to this historical dilemma is the new Brocade® ICX® 7750 Switch, which delivers the same simplification and automation which is a hallmark of Brocade HyperEdge™ Architecture switches while also adding unprecedented scale. The Brocade ICX 7750 is the first high-density 10/40 Gigabit Ethernet (GbE) fixed-port solution purposely designed to enable scale-out solutions for campus aggregation and core.

This powerful stackable switch enables simplified distributed chassis deployments for the scale-out campus aggregation and core networks, helping organizations seamlessly add network capacity in an agile, cost-efficient manner.

Purpose of This Document

The main purpose of the document is to define the various deployment solutions using the Brocade ICX 7750 for scale out enterprise campus networks. The document will discuss the stacking capabilities of the ICX 7750 across distance along with the various topologies supported. It would then cover complete Enterprise use cases using the entire ICX product portfolio to build out the overall campus network from core to access edge.

References

For product and solution description, refer to <http://www.brocade.com/launch/effortless-network/index.html>.

Brocade ICX Stacking Reference Guide: <http://www.brocade.com/solutions-technology/industry/campus/index.page>

Brocade ICX 7750 - Overview

The Brocade ICX 7750 is a stackable 1RU high-performance, high-availability, and market-leading-10/40 GbE density switch solution that meets the needs of business-sensitive campus deployments and demanding data center Top-of-Rack (ToR) environments. With industry-leading price, performance and a low-latency, non-blocking architecture, the Brocade ICX 7750 as shown in [Figure 1](#), provides a cost-effective, robust solution for the most demanding deployments. It is part of the Brocade ICX family of Ethernet switches for campus LAN and classic Ethernet data center environments, and it runs on Brocade FastIron software operating system.

FIGURE 1 Brocade ICX 7750-1 RU solution in 3 different SKUs



The Brocade ICX 7750 offers the following benefits to customers:

- Offers industry-leading 10/40 GbE port density and flexibility in a 1U form factor with up to 32×40 GbE or 96×10 GbE ports per unit, saving valuable rack space and power in wiring closets
- Provides chassis-like high availability with up to 6×40 Gbps stacking ports per switch, Hitless Stacking Failover, Hitless Switch-Over, In-Service Software Update (ISSU)**, and hot-swappable power supplies and fan assemblies
- Delivers superior value by incorporating enterprise-grade advanced features such as VRRPe, BGP, robust IPv4/IPv6 support, Multi-Chassis Trunking (MCT)with L2 and VRRP support and Virtual Routing and Forwarding (VRF)
- Provides unprecedented stacking performance with up to 480 Gbps full duplex (6X 40G X 2) of stacking bandwidth
- Provides OpenFlow support in true hybrid-port mode, enabling Software-Defined Networking (SDN) for programmatic control of the network data flows

Brocade ICX 7750 Switches can be stacked using 6 X 40 Gbps QSFP+ ports per switch, providing up to 480 Gbps of full duplex stacking bandwidth. Two 1 Gbps HA IPC (Inter-Processor Control) ports on each switch can be used to create a dedicated path for forwarding system health and control information across the stack for maximum reliability.

The Brocade ICX 7750 Switch is available for ordering with below system options. For ease of ordering and delivery, all SKUs ship with an Advanced L3 Software feature set, though customers planning to use routing and advanced functionality should purchase the Certificate of Entitlement (ICX775-L3-COE). The Certificate of Entitlement is serialized certificate for audit compliance tracking yet is not tied to any particular switch so no switch configuration or activation is required. The optional 6 X 40 GbE QSFP pluggable module offers additional port density. The Brocade ICX 7750 can take either AC or DC power supplies but . It supports both forward and reverse airflow schemes.

Brocade ICX 7750 Stacking Overview

FIGURE 2 Brocade ICX 7750 Stacking Architecture



NOTE

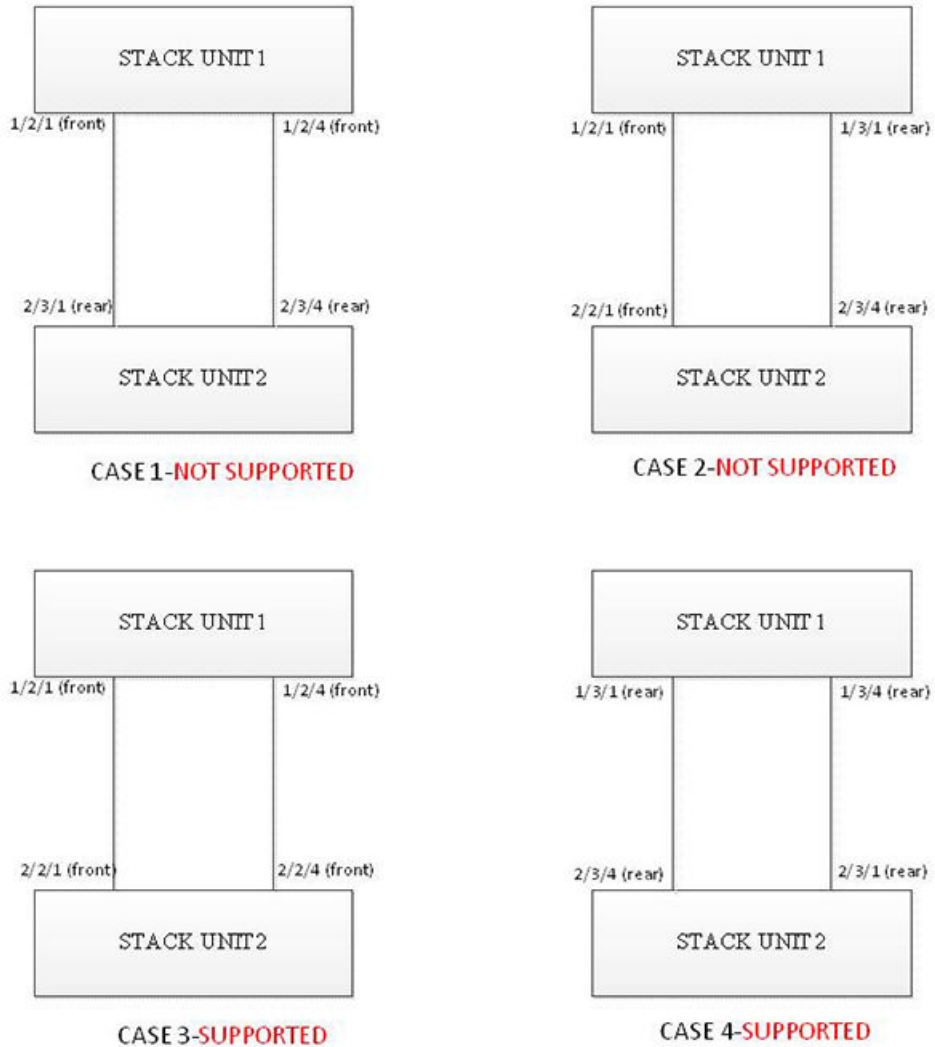
Will be supported in a future release.

The Brocade ICX 7750 can be stacked with up to 12 units with a stacking bandwidth of 480 GBPS, refer to [Figure 2](#) . The units can be stacked using the 40G ports on the front or the back (flexible) module. There are two stacking links per switch: one for uplink and one for downlink. The ports can be trunked together for higher stacking bandwidth. The trunks can be in sets of two or three ports. The maximum trunk links supported each direction is 3. The user can configure stacking links using the front 40G ports or back 40 Gig ports only but not with a mixture of the front and back in the same switch. Each switch can support up to 480G of stacking bandwidth (40 X 3(trunk) X 2(uplink and downlink) X 2(Bi directional)).

Brocade ICX 7750 Stacking Topologies

The Brocade ICX 7750 can be stacked together in a linear or ring topology. By default, the stacking ports are 1/2/1 and 1/2/4. The user can change the default ports to 1/3/1 and 1/3/4 respectively. The stack ports for the uplink and downlink connections must be on the same module (front or rear) for the same switch and the same stack. You cannot mix the front and rear ports for the connection on the same switch or the same stack. Refer to [Figure 3](#) .

FIGURE 3 Supported and Non-Supported Cases with Brocade ICX 7750 Stacking



NOTE

Port 1 of each module can connect to either 1 or 4 of the same module on the other switch, similarly 2 can connect to 2 or 5 and 3 can connect to 3 or 6.

The stack ports can be trunked together with the maximum of 3 ports in each direction. The only possible trunks configurations on the same switch are as following:

Three port Trunks

- 1/2/1 to 1/2/3
- 1/2/4 to 1/2/6
- 1/3/1 to 1/3/3
- 1/3/4 to 1/3/6

Two port Trunks

- 1/2/1 & 1/2/2
- 1/2/4 & 1/2/5
- 1/3/1 & 1/3/2
- 1/3/4 & 1/3/5

NOTE

While trunking the stacking ports, the default stacking ports need to be the primary port of the trunk and each trunk link needs to be in consecutive order.

FIGURE 4 Brocade ICX Stacking Ports on the Front Panel

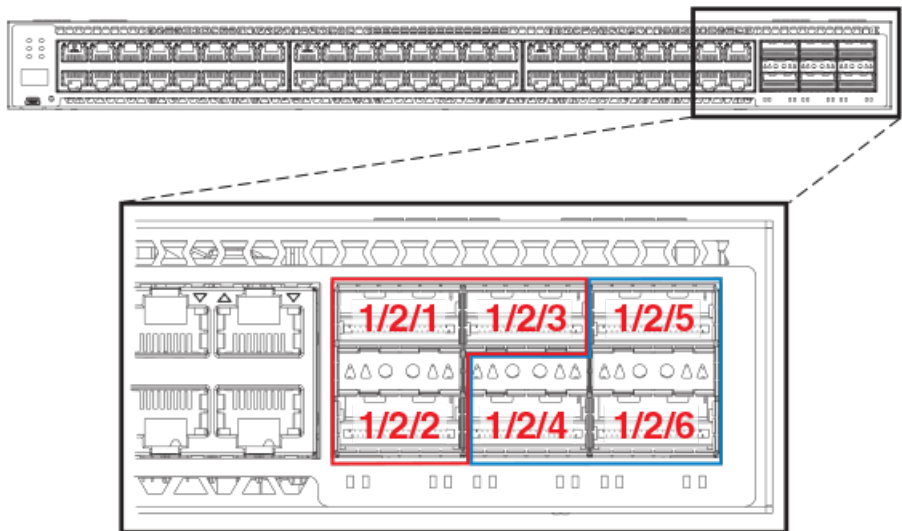


FIGURE 5 Brocade ICX Stacking Ports on the Rear Panel

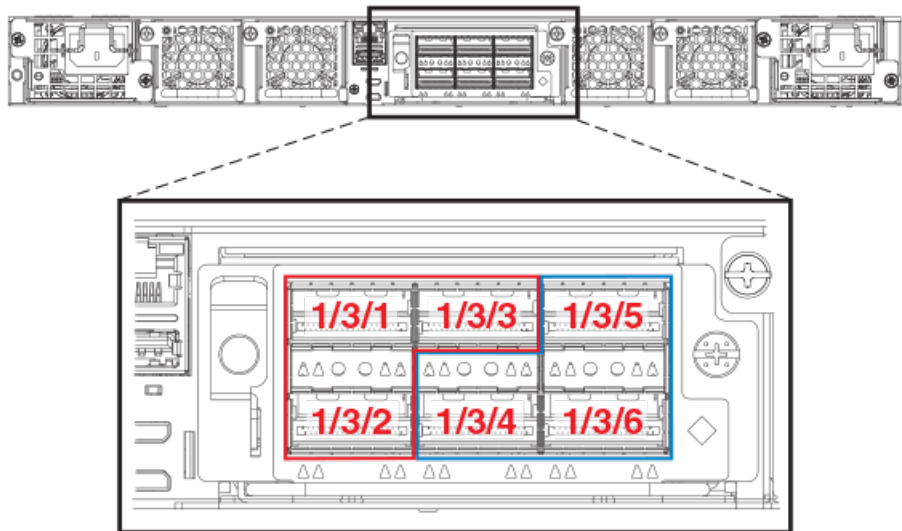


FIGURE 6 Brocade ICX Ring Stack from the Front Panel (No Stack Trunks)

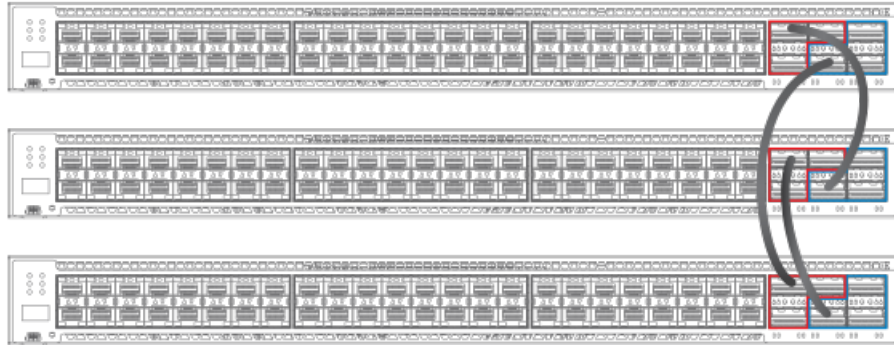


FIGURE 7 Brocade ICX Linear Stack from the Rear Panel (No Stack Trunks)

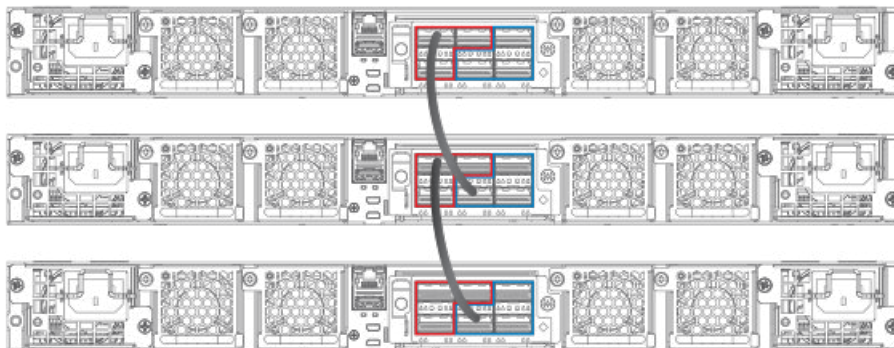
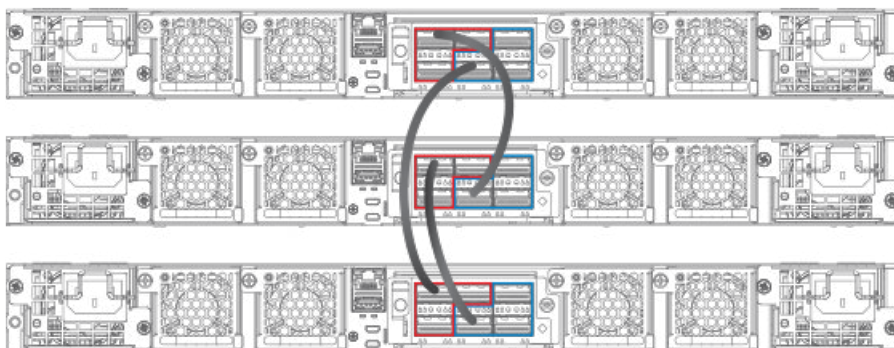


FIGURE 8 Brocade ICX Ring Stack from the Rear Panel (No Stack Trunks)

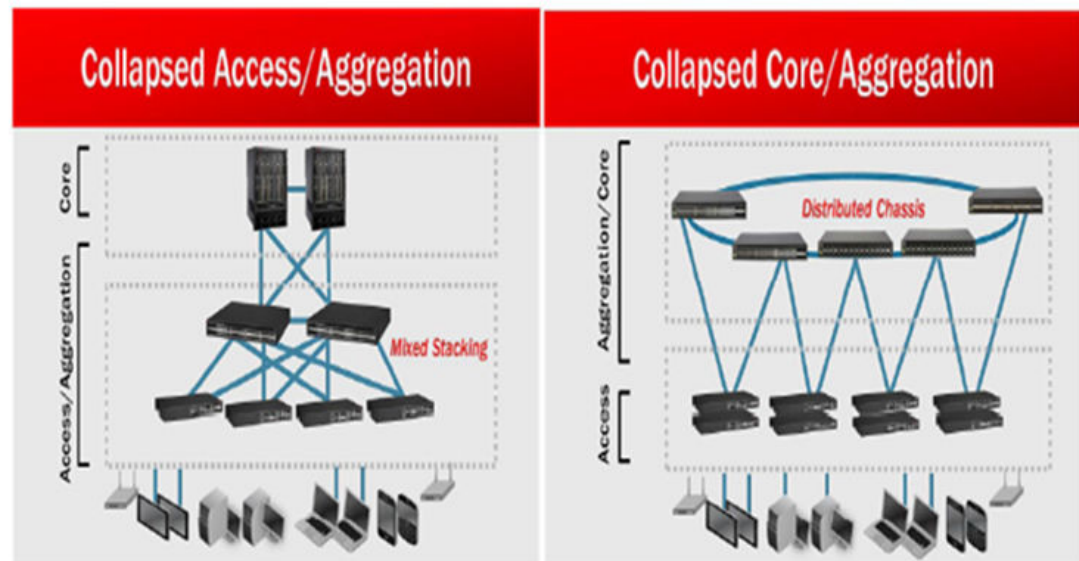


To summarize, the Brocade ICX 7750 Stacking supports Linear and Ring Topology, up to a maximum of 12 units in a stack. The maximum stacking distance supported is 100M in the initial software release (8.0.20). The 40 GbE ports on the Front (module 2) or Rear (Module3) can be used for stacking with a maximum of 3 X 40 GbE ports in each direction. The maximum supporting stacking bandwidth is 480 Gbps. The default stacking ports are 1/2/1 and 1/2/4. The default stacking ports can be changed with performing the default-ports and stack-ports command. Hitless Failover and Hitless Swichover is supported on stacking. There is no licensing required for the stack-port configuration. Users can choose to configure the stack manually or automatically using the secure setup. For more information, please refer to the Fast Iron Ethernet Switch Stacking Configuration Guide.

Brocade Hyper-Edge Architecture

The Brocade HyperEdge Architecture increases organizational agility by bringing the campus network into the modern era. This evolutionary architecture collapses the aggregation and access network layers of legacy campus architectures to radically simplify networks by eliminating legacy protocols such as Spanning Tree. HyperEdge Architecture integrates innovative new wired and wireless features with existing network technologies to streamline application deployment, simplify management, and reduce operational costs.

FIGURE 9 Simplifying Legacy Three-tier Architecture with Brocade HyperEdge Architecture

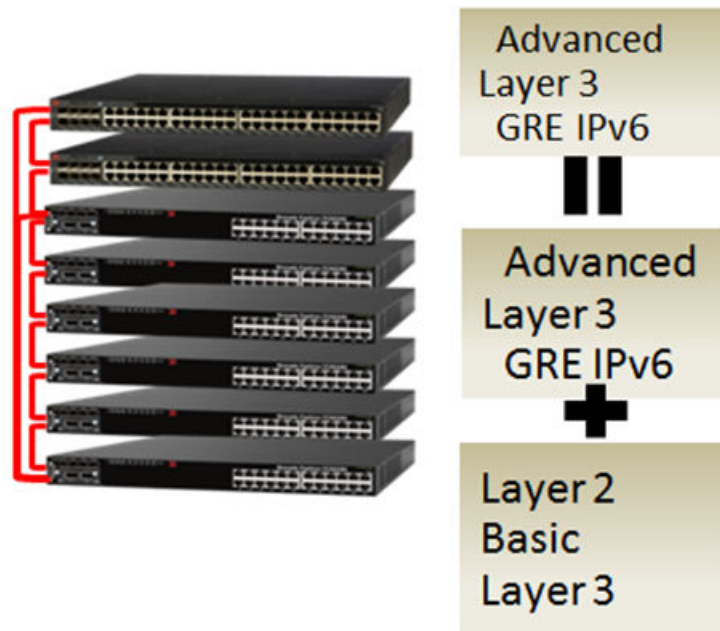


Hyper-Edge Architecture Enabling Technologies

Mixed Stacking with HyperEdge Distributed Services

Mixed stacking is the ability to combine premium and entry-level switches in the same stack. Mixed stacking provides all the benefits of traditional stacking, in which all switch members are alike, all links within the stack are active (no Spanning- Tree Protocol (STP)), and management is accomplished from a single IP address. However, when HyperEdge Distributed Services is used, a mixed stack becomes unique and powerful. HyperEdge Distributed Services enables the extension of premium switch services to all ports of all members of the stack, including entry-level switches. This capability provides two distinct advantages: significant per-port cost reduction and long-term investment protection.

FIGURE 10 Brocade Mixed stacking-enabling advanced layer 3 capabilities on access devices



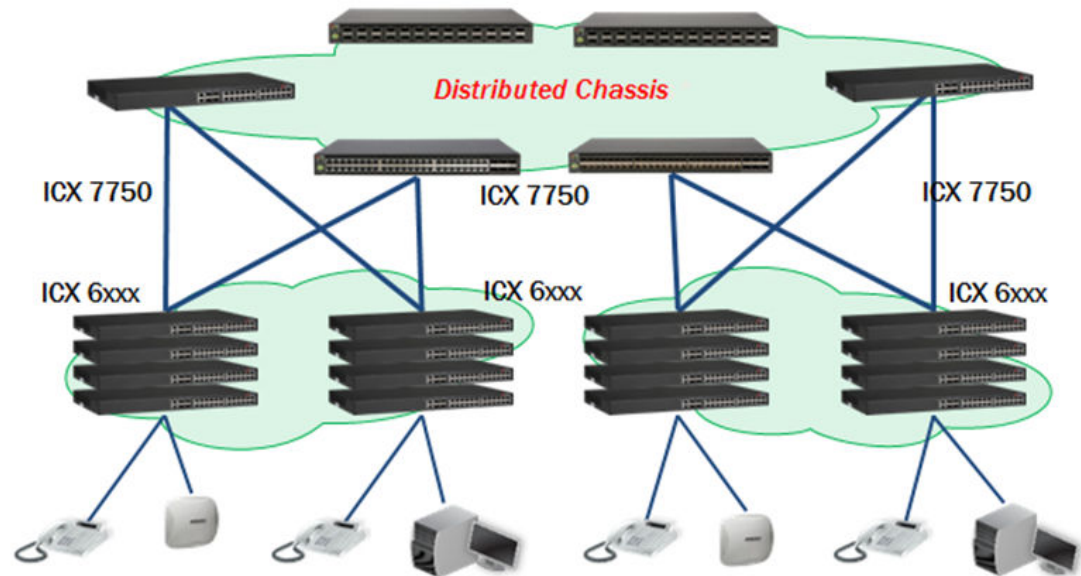
An additional benefit of combining Layer 2/3 switch functionality with Distributed Services in a single stack is the reduced management time enabled by combining the Access and Aggregation layers of traditional three tier networks while providing higher efficiency providing transparency to the applications. The solution becomes extremely cost effective with the lower acquisition and operation cost.

Scale-Out networking with Distributed Chassis

Brocade HyperEdge Architecture Distributed Chassis solutions now further simplify network deployment and maintenance, making higher port density scale out networks much more cost effective. With the legacy three-tier architecture, the network complexity requires higher maintenance resulting in the overall cost being extremely expensive.

Within the legacy enterprise three-tier architecture, the Aggregation and Core traffic is handled by bulky chassis systems that are non-flexible and cannot scale out. The port density is limited with high initial costs. The cost of maintenance is extremely high and it takes up a lot of space in the wiring closet. To improve these limitations, Brocade ICX 7750 is being introduced in the Aggregation and core layers with a distributed chassis architecture design to enable SCALE-OUT Networking. The Brocade ICX 7750 units can be stacked together horizontally where needed across the campus with the required port densities and it enables the users to expand their future network with "pay as they grow." With long distance stacking, network operators can disperse the Distributed Chassis over various locations within the campus and still be managed as one entity. The Brocade ICX 7750 comes with chassis-like capabilities on the hardware and software side and the Non-Blocking 10/40GbE port density offered is much higher and efficient when compared to a fixed chassis.

FIGURE 11 HyperEdge Architecture with Brocade ICX 7750 deployed at the aggregation/Core with distributed chassis to enable SCALE-OUT Networking

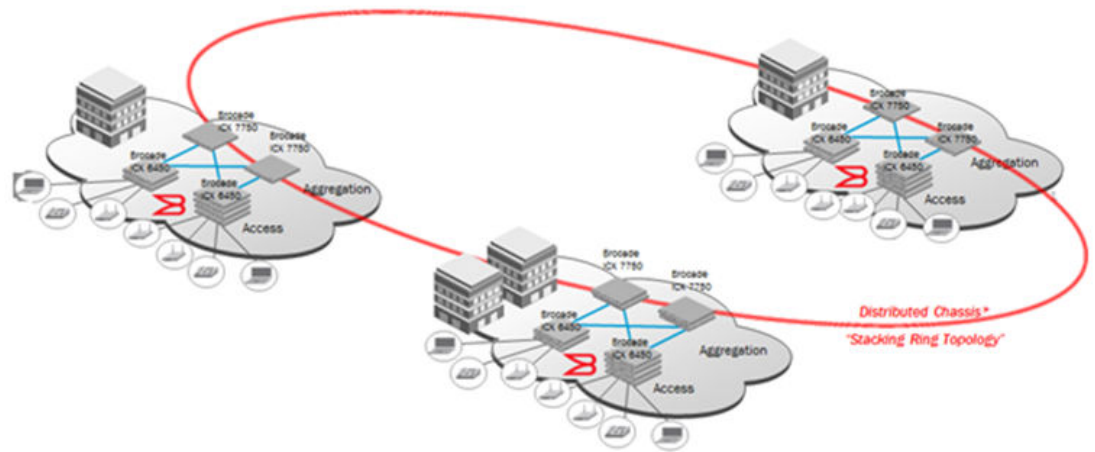


Brocade HyperEdge Architecture enables the enterprise with cost effective and scalable solutions, providing true Scale-Out Networking. Organizations can future proof their network to suffice their growing needs and be flexible to expand and pay as they grow. The highly scalable Brocade ICX 7750 provides industry leading hardware and software features including advanced layer 3 with a Trust-based License. With the approach of HyperEdge Architecture involving Mixed stacking and Distributed chassis, organizations can evolve their architectures slowly as business needs and budget permit, while also gaining increased confidence in the capabilities and savings promised.

Hyper-Edge Architecture Delivers the Effortless Network

Campus networks built with HyperEdge Architecture technologies are ready to take on the challenges of streaming video, Unified Communications, VDI, and cloud-based applications, as well as demanding mobile users with flexible, application-centric, automated, and cost-effective network solutions. With innovations such as Distributed Services, Consolidated Management, and Distributed Chassis, HyperEdge Architecture improves organizational agility by reducing network complexity, application deployment time, and operational costs. With Brocade, owning and maintaining your entire campus network is one step closer to being effortless.

FIGURE 12 Brocade HyperEdge Architecture with SCALE-OUT Networking-Enabling Effortless Network



Appendix

Stacking Configuration

The user needs to enable stacking on the units

```
ICX7750-48F Router#
ICX7750-48F Router# configure terminal
ICX7750-48F Router(config)# stac
stack Configure stack local parameters
ICX7750-48F Router(config)# stack en
enable Enable stacking
ICX7750-48F Router(config)# stack enable
```

STACKING CAN BE CONFIGURED USING STACK SECURE SETUP

```
ICX7750-48F Router# stack se
secure-setup perform secure setup for stack units
ICX7750-48F Router# stack secure-setup
ICX7750-48F Router# Discovering the stack topology...
Current Discovered Topology - RING -> TOPOLOGY IS
DETECTED
Available UPSTREAM units
Hop(s) Id Type Mac Address
1 new ICX7750-48XGF cc4e.246d.8d80
2 new ICX7750-48XGF cc4e.246d.9b00
3 new ICX7750-48XGF cc4e.246d.9c80
4 new ICX7750-20QXG cc4e.2439.2a80
5 new ICX7750-20QXG cc4e.2439.3700
6 new ICX7750-20QXG cc4e.2439.3880
7 new ICX7750-20QXG cc4e.2439.2d00
8 new ICX7750-48XGC cc4e.2439.1a00
9 new ICX7750-48XGC cc4e.2439.1680
10 new ICX7750-48XGC cc4e.2439.1d80
11 new ICX7750-48XGC cc4e.2439.1280= -> ALL UNITS ARE DISCOVERED
Available DOWNSTREAM units
```

AS THE UNITS ARE DISCOVERED, THE USER CAN CHANGE THE USER IDs AS REQUIRED.

```
Hop(s) Id Type Mac Address
1 new ICX7750-48XGC cc4e.2439.1280
2 new ICX7750-48XGC cc4e.2439.1d80
3 new ICX7750-48XGC cc4e.2439.1680
4 new ICX7750-48XGC cc4e.2439.1a00
5 new ICX7750-20QXG cc4e.2439.2d00
6 new ICX7750-20QXG cc4e.2439.3880
7 new ICX7750-20QXG cc4e.2439.3700
8 new ICX7750-20QXG cc4e.2439.2a80
9 new ICX7750-48XGF cc4e.246d.9c80
10 new ICX7750-48XGF cc4e.246d.9b00
11 new ICX7750-48XGF cc4e.246d.8d80
Do you accept the topology (RING) (y/n)? : y
Confirm Stacking Links...
UPSTREAM Unit: Id new at 2 hop(s) ICX7750-48XGF cc4e.246d.9b00
Enter the desired links(1-2) [1]: 2
UPSTREAM Unit: Id new at 4 hop(s) ICX7750-20QXG cc4e.2439.2a80
Enter the desired links(1-2) [1]: 2
UPSTREAM Unit: Id new at 6 hop(s) ICX7750-20QXG cc4e.2439.3880
Enter the desired links(1-3) [1]: 3
UPSTREAM Unit: Id new at 9 hop(s) ICX7750-48XGC cc4e.2439.1680
Enter the desired links(1-2) [1]: 2
UPSTREAM Unit: Id new at 10 hop(s) ICX7750-48XGC cc4e.2439.1d80
Enter the desired links(1-2) [1]: 2
UPSTREAM Unit: Id new at 11 hop(s) ICX7750-48XGC cc4e.2439.1280
Enter the desired links(1-2) [1]: 2
Selected Topology:
Active Id Type Mac Address
1 ICX7750-48XGF cc4e.246d.9e00
Selected UPSTREAM units
Hop(s) Id Type Mac Address
1 2 ICX7750-48XGF cc4e.246d.8d80
2 3 ICX7750-48XGF cc4e.246d.9b00
3 4 ICX7750-48XGF cc4e.246d.9c80
4 5 ICX7750-20QXG cc4e.2439.2a80
```

```

5 6 ICX7750-20QXG cc4e.2439.3700
6 7 ICX7750-20QXG cc4e.2439.3880
7 8 ICX7750-20QXG cc4e.2439.2d00
8 9 ICX7750-48XGC cc4e.2439.1a00
9 10 ICX7750-48XGC cc4e.2439.1680
10 11 ICX7750-48XGC cc4e.2439.1d80
11 12 ICX7750-48XGC cc4e.2439.1280
Selected DOWNSTREAM units
Hop(s) Id Type Mac Address
1 12 ICX7750-48XGC cc4e.2439.1280
2 11 ICX7750-48XGC cc4e.2439.1d80
3 10 ICX7750-48XGC cc4e.2439.1680
4 9 ICX7750-48XGC cc4e.2439.1a00
5 8 ICX7750-20QXG cc4e.2439.2d00
6 7 ICX7750-20QXG cc4e.2439.3880
7 6 ICX7750-20QXG cc4e.2439.3700
8 5 ICX7750-20QXG cc4e.2439.2a80
9 4 ICX7750-48XGF cc4e.246d.9c80
10 3 ICX7750-48XGF cc4e.246d.9b00
11 2 ICX7750-48XGF cc4e.246d.8d80
Do you accept the unit id's (y/n)? y
ICX7750-48F Router# T=4m43.4: Election, was alone --> active, ID=1, pri=128,
2U(1,12), A=u1, nbr#=0 1, reason: u12: port-up, ,
T=4m47.0: Election, was active, no change, ID=1, pri=128, 12U(1-12), A=u1, nbr#=11

```

ONCE THE CONFIGURATION IS IMPLEMENTED, THE UNITS REBOOT AND COME UP WITH THEIR ASSIGNED IDs

```

ICX7750-48F Router#
ICX7750-48F Router#sh stack
T=7m32.7: alone: standalone, D: dynamic cfg, S: static, A=10, B=11, C=12
ID Type Role Mac Address Pri State Comment
1 S ICX7750-48XGF active cc4e.246d.9e00 128 local Ready
2 D ICX7750-48XGF standby cc4e.246d.8d80 0 remote Ready
3 D ICX7750-48XGF member cc4e.246d.9b00 0 remote Ready
4 D ICX7750-48XGF member cc4e.246d.9c80 0 remote Ready
5 D ICX7750-20QXG member cc4e.2439.2a80 0 remote Ready
6 D ICX7750-20QXG member cc4e.2439.3700 0 remote Ready
7 D ICX7750-20QXG member cc4e.2439.3880 0 remote Ready
8 D ICX7750-20QXG member cc4e.2439.2d00 0 remote Ready
9 D ICX7750-48XGC member cc4e.2439.1a00 0 remote Ready
10 D ICX7750-48XGC member cc4e.2439.1680 0 remote Ready
11 D ICX7750-48XGC member cc4e.2439.1d80 0 remote Ready
12 D ICX7750-48XGC member cc4e.2439.1280 0 remote Ready
active
+---+ +---+ +---+ +---+ +---+
-2/1| 1 |2/4--3/1| C |3/4==2/1| B |2/4==2/1| A |2/4==2/1| 9 |2/4--2/1| 8 |2/4-
| +---+ +---+ +---+ +---+ +---+ +---+ |
| |
| standby |
| +---+ +---+ +---+ +---+ +---+ +---+ |
-2/4| 2 |2/1==2/4| 3 |2/1--2/4| 4 |2/1==2/4| 5 |2/1--2/4| 6 |2/1==2/4| 7 |2/1-
+---+ +---+ +---+ +---+ +---+ +---+
Standby u2 - Learn other units for 2 sec, protocols may not be ready in 68 s.
Current stack management MAC is cc4e.246d.9e00
ICX7750-48F Router#

```