

FORCE10

FORCE10®

Z-SERIES • E-SERIES • C-SERIES • S-SERIES

---

## HIGH-PERFORMANCE SOLUTIONS FOR THE DATA CENTER AND BEYOND



*At Force10 we specialize in high-performance open solutions* for the data center and beyond with our Open Cloud Networking framework. At the heart of Open Cloud Networking are hardware and software systems powering the world's largest Web 2.0 and portals, high-performance computing environments, enterprise data centers, and cloud and hosting networks. Our systems are also found in enterprise backbones and wiring closets as well as service provider exchange points and access networks.

Our products are engineered from the ground up to deliver uncompromising performance, feature-rich flexibility, scalability and non-stop operation whether it is for a small workgroup or the Internet's largest search engine site. Today we offer a range of high-performance fixed configuration and chassis-based Ethernet switching and routing systems—*Z-Series, E-Series, C-Series, S-Series*—designed to meet various price points, performance characteristics, and customer applications. This includes the industry's only end-to-end 40 GbE data center solution.

All of our systems run the same customer-proven and feature-rich *Force10 Operating System*, providing maximum flexibility and dependability. And all systems can be managed using the Force10 Management System for intuitive, GUI-based control. Additionally, for larger deployments or virtualized environments, our *Open Automation framework* is a natural complement to simplify tasks and streamline operations. Force10 equipment can also be managed by a range of third party management platforms through standard management interfaces.

# HIGH-DENSITY 10/40/100 GIGABIT ETHERNET CORE SYSTEMS

The Z-Series, or ZettaScale Series, includes the fixed configuration 2.5 Tbps Z9000 and the 9.6Tbps Z9512 chassis system. Z9000, at just 2 rack units and equipped with (32) 40 GbE ports (128 10 GbE ports), is ideal for small-footprint, high-performance, core networks.

The Z9000 serves as a primary building block in our Open Distributed Core architecture, our ultra-scalable data center leaf-spine fabric solution. The Open Distributed Core

architecture is intended principally for large-scale compute cluster infrastructure providing ultra-fast, ultra-low latency connectivity up to 160 Tbps at a fraction the cost, footprint, and power consumption of competing fabric solutions.

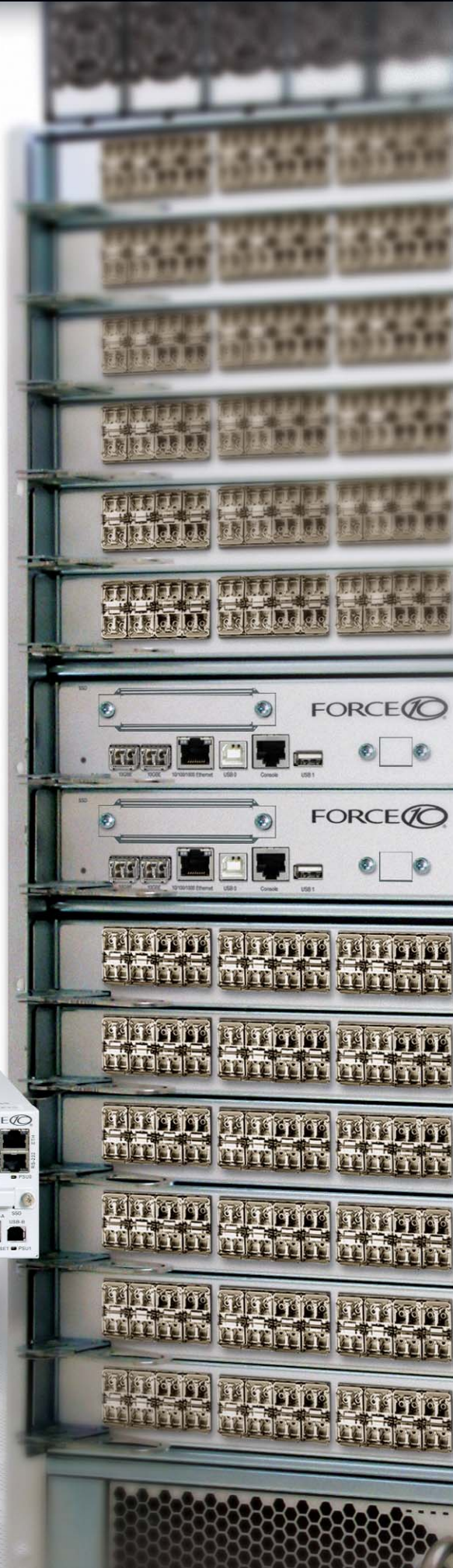
The Z9512 system complements the Z9000 providing a completely modular chassis-based platform supporting high-density 10 GbE, 40 GbE, and 100 GbE core applications. The Z9512 is ideally suited for conventional data center core architectures with performance needs up to 20 Tbps.

Performance:	Z9000	Z9512
Raw Switching Capacity	2.5 Tbps	9.6 Tbps
Slot Capacity – Half Duplex (Gbps)	—	400
Forwarding Capacity (Mpps)	1,904	7,142
Ports:		
Line-rate 10 GbE	128 (QSFP+ breakout)	480 (10 GbE SFP+)
Total 10 GbE	128	480
Line-rate 40 GbE	32 (40 GbE QSFP+)	96 (40 GbE QSFP+)
Total 40 GbE	32	96
Line-rate 100 GbE	—	48 (Line rate 100 GbE)



The 2RU Z9000

The Modular  
Chassis Z9512



## HIGH-DENSITY 1/10/40 GIGABIT ETHERNET CHASSIS CORE, AGGREGATION AND END-OF-ROW SYSTEMS

The E-Series and C-Series chassis systems are the workhorses of our product line. The E-Series, including the 1st generation TeraScale and 2nd generation Exascale systems, provide extremely high-density 1/10 GbE connectivity as well as 40 GbE connectivity on Exascale systems. This makes the E-Series ideal for cost-effective collapsed core designs and large-scale aggregation capabilities.

The C-Series also excels at 1/10 GbE networking and is ideal for data center end-of-row and aggregation applications. All C-Series systems also support Power over Ethernet allowing them to also be deployed in campus LAN and wiring closet environments.



*The TeraScale and ExaScale  
Powered 1/10/40 GbE  
E-Series Family*

*The Modular 1/10 GbE  
C-Series Family*

	C-Series		TeraScale E-Series			ExaScale E-Series	
	C150	C300	E300	E600i	E1200i	E600i	E1200i
<b>Performance:</b>							
Raw Switching Capacity	768 Gbps	1,536 Tbps	400 Gbps	1.75 Tbps	3.5 Tbps	1.75 Tbps	3.5 Tbps
Slot Capacity – Half Duplex (Gbps)	96	96	25	125	125	125	125
Forwarding Capacity (Mpps)	476	952	196	1,042	2,083	1,042	2,083
<b>Ports:</b>							
Line-rate 10/100/1000Base-T	192	384	132	336	672	630	1,260
Total 10/100/1000Base-T	192	384	288	630	1,260	630	1,260
Line-rate GbE (SFP)	192	384	132	336	672	350	700
Total GbE (SFP)	192	384	144	336	672	350	700
Line-rate 10 GbE	32	64	12	28	56	70	140
Total 10 GbE	32	64	48	112	224	280	560
Line-rate 40 GbE	—	—	—	—	—	14	28
Total 40 GbE	—	—	—	—	—	28	56
Line-rate OC-3c/OC-12c/OC-48c	—	—	—	28	56	—	—
Power over Ethernet (IEEE 802.3af Class 3)	192	384	—	—	—	—	—

# 1/10/40 GIGABIT ETHERNET TOP-OF-RACK AND ACCESS SYSTEMS

Our S-Series product line offers a range of fixed configuration 1/10/40 GbE systems designed principally for data center top-of-rack and access applications. This includes the low-latency 48-port 1/10 GbE S55 and the deep buffer 1/10 GbE S60. This also includes the S4810 for customers seeking industry leading 1/10 GbE top-of-rack densities combined with 40 GbE capabilities.

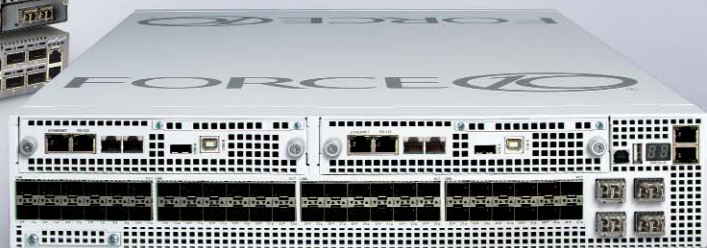
Our latest S-Series platform, the S7000, provides industry-leading integration of networking, storage and appliance computing functionality in a single system. The S7000 packs a 640 Gbps switching engine and 1/10/40 GbE networking along with built-in Fiber Channel and Fiber Channel over Ethernet capabilities. This is ideal for

customers seeking SAN interworking solutions and for customers looking to converge storage traffic over a common Ethernet infrastructure. The S7000 is also equipped with optional appliance compute modules to run off-the-shelf or custom developed applications. This provides an entirely new level of capability at the top-of-rack and is especially well-suited for cloud environments and cloud-in-a-rack applications

Performance:	S25P	S25N/50N	S25V/50V	S2410CP/P	S55	S60	S4810	S7000
Switch Fabric Capacity	128 Gbps	128 / 176 Gbps	128 / 176 Gbps	480 Gbps	176 Gbps	176 Gbps	1.28 Tbps	1.28 Tbps
Forwarding Capacity (Mpps)	144	96 / 144	96 / 144	360	144	132	960	960
Buffer Size	2 MB	2 MB / 4 MB	2 MB / 4 MB	2 MB	4 MB	1.25 GB	9 MB	9 MB
Latency	< 5 $\mu$ s	< 5 $\mu$ s	< 5 $\mu$ s	300 ns (CX4) / 700 ns (XFP)	< 5 $\mu$ s	< 9 $\mu$ s	sub 700 ns	sub 700ns
Ports:								
10/100/1000Base-T	4 (shared)	24 / 48	24 / 48	—	44	44	—	—
1 GbE	24 (GbE or 100Base-FX SFP)	4 (SFP, shared)	4 (SFP, shared)	—	4 (SFP)	4 (SFP)	48	48
10 GbE	4 (SFP+)	4 (XFP or CX4)	4 (XFP or CX4)	20 (CX4) + 4 XFP/24 (XFP)	4 (SFP+)	4 (SFP+)	64 (4xQSFP+ breakout)	64 (4xQSFP+ breakout)
40 GbE (QSFP+)	—	—	—	—	—	—	4	4
1/2/4/8 G Fiber Channel	—	—	—	—	—	—	—	12
FCoE/DCB	—	—	—	—	—	—	64	64
Power over Ethernet	—	—	24 / 48 (IEEE 802.3af Class 3)	—	—	—	—	—



The Fixed Configuration  
S-Series Family

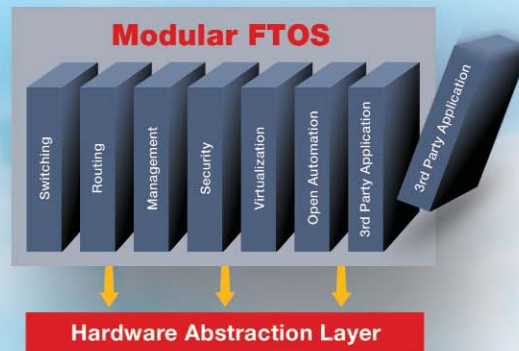


The New  
Cloud Friendly S7000

## HIGH-PERFORMANCE & RESILIENT OPERATING SYSTEM WITH INDUSTRY-LEADING AUTOMATION SOFTWARE



*The Force10 Operating System* (FTOS) is a powerful and robust Layer 2 and Layer 3 operating system powering the Force10 product lines. The feature-rich software is architected for high performance, resiliency, and portability. FTOS includes a Hardware Abstraction Layer (HAL) making applications portable across product lines and the modular design dramatically increases code reuse and accelerates application delivery and feature velocity. FTOS is based on NetBSD, with application code developed and maintained by Force10.



### Key Features

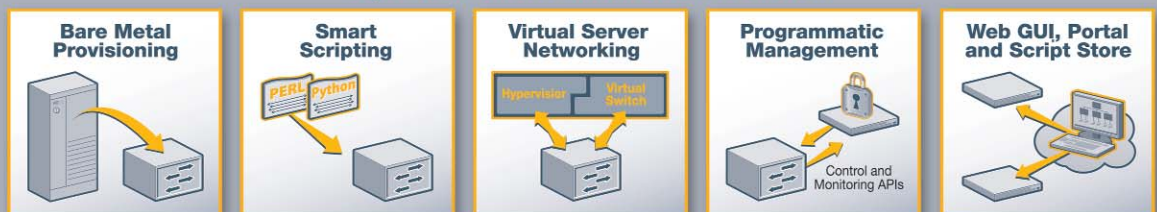
- Out-of-the-box stability, resiliency, performance, and security advantages
- Software portability and modularity bringing high performance application features to the entire product line
- Based on NetBSD, an industry's leading, freely available open source operating system that is highly reliable, portable and efficient
- Compliant with the de facto industry-standard CLI

Force10's Open Automation framework leads the industry providing an open standards-based automation solution for data center operations. The portfolio offering allows data centers big and small, virtual and conventional, to simplify operations, while increasing operational efficiency and deployment velocity.

*The Open Automation Framework* comprises a suite of inter-related network management tools that can be used together or independently. These tools provide data center managers with a complete set of capabilities required in today's dynamic, virtual data center environments:

- Bare Metal Provisioning reduces installation time, eliminates configuration errors and enforces standard configurations by automatically configuring network switches
- Smart Scripting improves network monitoring and management with a robust, Perl/Python scripting environment
- Virtual Server Networking increases network flexibility by automatically provisioning VLANs when VMs are migrated
- Programmatic Management simplifies network management by integrating with multiple third party system management tools
- Web GUI, Portal & Script Store increases Web connectivity to platforms via the Extensible Web GUI and the user community via the Dev Exchange portal

### Open Automation Framework



## Open Automation Dev | Exchange

Powered by  FORCE10®

### **Bare Metal Provisioning**

Automated bare metal configuration reduces operational expenses, accelerates switch installation, simplifies OS upgrades and increases network availability by automatically configuring Force10 switches. This eliminates

the need for a network administrator to manually configure the switch,

resulting in faster installation, elimination of configuration errors and enforcement of standard configurations. Upon installation, the Force10 switch searches the network for a DHCP server. The DHCP server provides the Force10 switch with an IP address and the location of a TFTP server. The TFTP server maintains a configuration file and an approved version of FTOS, the operating system for Force10 switches. The Force10 switch automatically configures itself by loading the configuration file and FTOS.

### **Smart Scripting**

Smart scripting increases network availability and manageability by allowing network administrators to deploy custom monitoring and management scripts on Force10 switching platforms. With this capability, network administrators can implement version control systems, automatically generate alerts, create custom logging tools and automate management of network devices. Virtually any function that can be performed through the CLI can be implemented with smart scripting. Smart scripting provides a scripting environment that supports Perl and Python, making it easy for IT administrators to quickly develop scripts without having to learn a new scripting language.

### **Virtual Server Networking**

Virtual environments require network infrastructure to be dynamic in order to ensure network connectivity and security policies are maintained when VMs are migrated. Virtual server networking facilitates communications between Force10 network switches

and virtual machine management software to orchestrate automated VM/VLAN provisioning and virtual machine migration. This is a powerful capability that greatly simplifies the many of the tasks associated with virtualized computing environments. Our virtual server networking software supports VMware vSphere 4.0/4.1 and Citrix XenServer 5.6.

### **Programmatic Management**

Programmatic management greatly improves network manageability by allowing Force10 network devices to be managed by third party system management tools via standard programmatic interfaces. The programmatic management environment and set of interfaces communicate directly with third-party system management tools, avoiding the need for a dedicated network management tool.

### **Web GUI, Portal & Script Store**

Ease and breadth of connectivity remains a paramount necessity for both equipment and development communities. The Web GUI, portal and script store address Web connectivity in general and encompasses two distinct elements: an advanced Web GUI and the OA Dev Exchange Portal. The advanced Web GUI is a significant step up from traditional web-based switching platforms interfaces. Retrieval and update of switch attributes and characteristics are present, but further, the ability to drag and drop changes to the GUI to provide customized skins allow for a level of customization and functionality not previously seen in a tool of this nature. Complementing this, the OA Dev Exchange portal ([oadevexchange.com](http://oadevexchange.com)) provides an outlet for full user community interaction, development idea exchange and a script store where scripting products can be sold and development resources can be arranged and contracted.

## Power Consumption



*Independent testing from The Tolly Group demonstrated that the Force10 ExaScale core switch/router consumes less than half the power of the Cisco Nexus 7000 and 23% less power than the Juniper EX8216 in fully-loaded line-rate GbE and 10 GbE configurations, a common switching requirement in data center networks.*

*Watts per Gbps of throughput in maximum gigabit and 10 gigabit Ethernet line-rate configurations (lower numbers are better).*

*Source: The Tolly Group, June 2010*

## Energy Efficiency and Total Cost of Ownership

At Force10, we're not only committed to our customers, we're committed to doing what we can to help our environment. This includes our long-standing commitment to delivering high-density, low-power consumption switching systems like our E-Series ExaScale Systems or our new Z9000 system as well as initiatives like our one-of-a-kind TerraPass™ carbon emission offset program supporting companies that have adopted their own green business practices.



### Learn More

We're ready to help you unlock the full potential of your network, your data centers, and your business. Find out more. Visit us at [www.force10networks.com](http://www.force10networks.com)

“We are extremely happy with our Force10 equipment. The systems are delivering top-notch performance with low power consumption, a critical requirement in our performance-hungry, power-constrained data center environments. We've also found Force10's 10 GbE price advantage attractive as we migrate our server farms to a 10 GbE infrastructure.”

**Jeremy Stinson**  
 Vice President, Network Operations  
[myYearbook.com](http://myYearbook.com)



**Force10 Networks, Inc.**  
 350 Holger Way  
 San Jose, CA 95134 USA  
[www.force10networks.com](http://www.force10networks.com)

408-571-3500 PHONE  
 408-571-3550 FACSIMILE

© 2011 Force10 Networks, Inc. All rights reserved. Force10 Networks, the Force10 Networks logo, Force10, C-Series, E-Series, Traverse, and TraverseEdge are registered trademarks and ExaScale, FTOS, Open Automation, Open Cloud Networking, S-Series, ScriptStore, TeraScale, Z-Series, and ZettaScale are trademarks of Force10 Networks, Inc. All other company names are trademarks of their respective holders. Information in this document is subject to change without notice. Certain features may not yet be generally available. Force10 Networks, Inc. assumes no responsibility for any errors that may appear in this document.

CB01

811 v1.3