

Industry-standard CLI Syntax with Enhanced Manageability Features

Consistent Show, Configuration, Debugging and CLI Navigation Commands Across Switch/Router Product Lines

### The Power of One: Consistency

FTOS, the Force10 Operating System, is the operating system that runs on Force10 switch/router product lines. Force10 delivers a single version of FTOS for all platforms that follows a linear, sequential release path. By delivering the same OS across its entire switch/router line, including the E-Series, C-Series and S-Series switch/router platforms, Force10 ensures that customers benefit from stable code, a consistent feature set and simpler software management.

- Common management functionality and a common user interface across the Force10 product line makes operating the network easier
- Streamlined product training and learning curve because system configuration, diagnostics, troubleshooting and software maintenance are identical across all platforms
- Support for the same CLI, SNMP and XML management models throughout the entire network greatly simplifies life-cycle management of the infrastructure

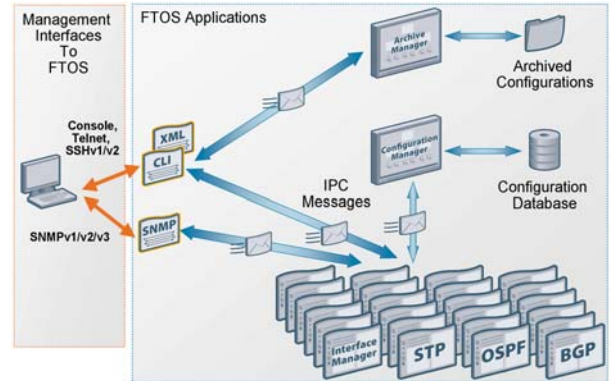


Figure 1. FTOS software architecture

### FTOS: Not Your Father's CLI

The FTOS CLI combines an industry-standard show, configuration and debugging syntax with enhanced usability and navigation features. As a result, configuration and troubleshooting is just like working on an IOS platform, but more comfortable.

- CLI is accessible over the serial console, Telnet or SSHv1/v2 for interactive or automated management
- "terminal xml" command enables XML front end to CLI
- Support for common tools such as Expect and RANCID
- Integration of Unix-like features such as "grep" and "diff" for configuration management

The CLI is the primary method of managing an FTOS switch/router, and supports interactive or automated logins using CLI scripting. It is also responsible for communicating with the FTOS application processes over IPC for sending configuration information or requesting output for a show command.

Configurations can be archived by the archive manager, and used for automated configuration rollback to restore a known working configuration.

```

E300#show version
Force10 Networks Real Time Operating System Software
Force10 Operating System Version: 1.0
Force10 Application Software Version: 7.6.1.0
Copyright (c) 1999-2007 by Force10 Networks, Inc.
Build Time: Sat Dec 15 16:46:30 2007
Build Path: /sites/sjc/work/sw/build/special_build/Release/E7-6-1/SW/SRC
E300 uptime is 4 week(s), 0 day(s), 11 hour(s), 36 minute(s)

System image file is "flash://FTOS-EF-7.6.1.0.bin"

Chassis Type: E300
Control Processor: IBM PowerPC 750FX (Rev D2.2) with 536870912 bytes of memory.
Route Processor 1: IBM PowerPC 750FX (Rev D2.2) with 1073741824 bytes of memory.Route Processor
2: IBM PowerPC 750FX (Rev D2.2) with 1073741824 bytes of memory.
128K bytes of non-volatile configuration memory.

 1 Route Processor Module
 2 Switch Fabric Module
 1 48-port 10/100/1000Base-T line card with RJ-45 interfaces (EP3)
 1 FastEthernet/IEEE 802.3 interface(s)
 48 GigabitEthernet/IEEE 802.3 interface(s)

C300#show version
Force10 Networks Real Time Operating System Software
Force10 Operating System Version: 1.0
Force10 Application Software Version: 7.6.1.0
Copyright (c) 1999-2007 by Force10 Networks, Inc.
Build Time: Sat Dec 15 17:05:47 2007
Build Path: /sites/sjc/work/sw/build/special_build/Release/E7-6-1/SW/SRC
C300 uptime is 17 minute(s)

System image file is "flash://FTOS-CB-7.6.1.0.bin"

Chassis Type: C300
Control Processor: IBM PowerPC 750FX (Rev D2.2) with 1090519040 bytes of memory.
128K bytes of non-volatile configuration memory.

 2 Route Processor/Switch Fabric Module
 2 48-port GE 10/100/1000Base-T line card with RJ45 interfaces (CB)
 1 48-port GE 10/100/1000Base-T line card with RJ45 interfaces and PoE (CB)
 2 FastEthernet/IEEE 802.3 interface(s)
 144 GigabitEthernet/IEEE 802.3 interface(s)

S50N#show version
Force10 Networks Real Time Operating System Software
Force10 Operating System Version: 1.0
Force10 Application Software Version: 7.6.1.0
Copyright (c) 1999-2007 by Force10 Networks, Inc.
Build Time: Sat Dec 15 17:31:02 2007
Build Path: /sites/sjc/work/sw/build/special_build/Release/E7-6-1/SW/SRC
S50N uptime is 3 day(s), 5 hour(s), 53 minute(s)

System Type: S50N
Control Processor: MPC845IE with 254947328 bytes of memory.

32M bytes of Boot-Flash memory.

 1 48-port E/FE/GE (SB)
 48 GigabitEthernet/IEEE 802.3 interface(s)
 2 Ten GigabitEthernet/IEEE 802.3 interface(s)
    
```

Figure 2. FTOS running on the E-Series, C-Series and S-Series switch/router platforms

# FTOS Command Line Interface

## Force10 FTOS Features

- Identical CLI on all platforms
- Ranges and aliases for bulk configuration
- Line card preconfiguration
- Command history shows timestamp, users and CLI commands
- Configuration locking
- Configuration commit and rollback
- Online serviceability and diagnostics
- Full-featured "grep" and "no-more" pipe for all commands with unlimited pipes
- ACLs and routing policies with sequence numbers, remarks and "resequence" command
- "do" command in configuration mode
- "send" command to write all users (Unix write/wall functionality)
- "show configuration" context while in configuration mode
- "monitor interface" command
- "show run <context>" command
- Configuration file "diff" command



Table 1. Simplified operations through the FTOS CLI

## Specifications: FTOS

### IEEE Compliance

802.1AB	LLDP
802.1D	Bridging, STP
802.1p	L2 Prioritization
802.1Q	VLAN Tagging, Double VLAN Tagging, GVRP
802.1s	MSTP
802.1w	RSTP
802.1X	Network Access Control
802.3ad	Link Aggregation with LACP
ANSI/TIA-1057	LLDP-MED
Force10	FRRP (Force10 Redundant Ring Protocol)
Force10	PVST+

### RFC and I-D Compliance

#### General Internet Protocols

768	UDP
793	TCP
854	Telnet
959	FTP
1321	MD5
1350	TFTP
1661	PPP
1989	PPP Link Quality Monitoring
1990	PPP Multilink Protocol
1994	PPP CHAP
2474	Differentiated Services
2615	PPP over SONET/SDH
2698	Two Rate Three Color Marker
3164	Syslog
draft-ietf-bfd-base-03	BFD

#### General IPv4 Protocols

791	IPv4
792	ICMP
826	ARP
1027	Proxy ARP
1035	DNS (client)
1042	Ethernet Transmission
1191	Path MTU Discovery
1305	NTPv3
1519	CIDR
1542	BOOTP (relay)
1812	Routers
1858	IP Fragment Filtering
2131	DHCP (relay)
2338	RRRP
3021	31-bit Prefixes
3046	DHCP Option 82
3069	Private VLAN
3128	Tiny Fragment Attack Protection

#### General IPv6 Protocols

1981	Path MTU Discovery (partial)
2460	IPv6
2461	Neighbor Discovery (partial)
2462	Stateless Address Autoconfiguration (partial)
2463	ICMPv6
2464	Ethernet Transmission
2675	Jumbograms
3587	Global Unicast Address Format
4291	Addressing

#### RIP

1058	RIPv1
2453	RIPv2

### OSPF

1587	NSSA
2154	MD5
2328	OSPFv2
2370	Opaque LSA
2740	OSPFv3
3623	Graceful Restart
4222	Prioritization and Congestion Avoidance

### IS-IS

1142	IS-IS
1195	IPv4 Routing
2763	Dynamic Hostname
2966	Domain-wide Prefixes
3373	Three-way Handshake
3567	MD5
3784	Wide Metrics
5120	Multi-topology
draft-ietf-isis-igp-p2p-over-lan-06	Point-to-Point Operation
draft-ietf-isis-ipv6-06	IPv6 Routing
draft-ietf-isis-ext-eth-02	Extended Frame Size

### BGP

1997	Communities
2385	MD5
2439	Route Flap Damping
2545	Multiprotocol Extensions for IPv6
2796	Route Reflection
2842	Capabilities
2858	Multiprotocol Extensions
2918	Route Refresh
3065	Confederations
4360	Extended Communities
4893	4-byte ASN
draft-ietf-idr-bgp4-20	BGPv4
draft-ietf-idr-restart-06	Graceful Restart
draft-michaelson-4byte-as-representation-05	4-byte ASN Representation (partial)

### Multicast

1112	IGMPv1
2236	IGMPv2
2710	MLDv1
3376	IGMPv3
3569	SSM for IPv4/IPv6
3618	MSDP
3810	MLDv2
3973	PIM-DM
4541	IGMPv1/v2/v3, MLDv1 Snooping
draft-ietf-pim-sm-v2-new-05	PIM-SM for IPv4/IPv6

### Network Management

1155	SMLv1
1156	Internet MIB
1157	SNMPv1
1212	Concise MIB Definitions
1215	SNMP Traps
1493	Bridges MIB
1724	RIPv2 MIB
1850	OSPFv2 MIB
1901	Community-based SNMPv2
2011	IP MIB
2012	TCP MIB
2013	UDP MIB
2024	DLSw MIB
2096	IP Forwarding Table MIB

2558	SONET/SDH MIB
2570	SNMPv3
2571	Management Frameworks
2572	Message Processing and Dispatching
2574	SNMPv3 USM
2575	SNMPv3 VACM
2576	Coexistence Between SNMPv1/v2/v3
2578	SMLv2
2579	Textual Conventions for SMLv2
2580	Conformance Statements for SMLv2
2618	RADIUS Authentication MIB
2665	Ethernet-like Interfaces MIB
2674	Extended Bridge MIB
2787	RRRP MIB
2819	RMON MIB (groups 1, 2, 3, 9)
2863	Interfaces MIB
2865	RADIUS
3273	RMON High Capacity MIB
3416	SNMPv2
3418	SNMP MIB
3434	RMON High Capacity Alarm MIB
3580	802.1X with RADIUS
5060	PIM MIB
ANSI/TIA-1057	LLDP-MED MIB
draft-grant-tacacs-02	TACACS+
draft-ietf-idr-bgp4-mib-06	BGP MIBv1
draft-ietf-isis-wg-mib-16	IS-IS MIB
IEEE 802.1AB	LLDP MIB
IEEE 802.1AB	LLDP DOT1 MIB
IEEE 802.1AB	LLDP DOT3 MIB
ruzin-mstp-mib-02	MSTP MIB (traps)
sFlow.org	sFlowv5
sFlow.org	sFlowv5 MIB (version 1.3)
FORCE10-BGP4-V2-MIB	
FORCE10-FIB-MIB	
FORCE10-CS-CHASSIS-MIB	
FORCE10-IF-EXTENSION-MIB	
FORCE10-LINKAGG-MIB	
FORCE10-CHASSIS-MIB	
FORCE10-COPY-CONFIG-MIB	
FORCE10-MON-MIB	
FORCE10-PRODUCTS-MIB	
FORCE10-SS-CHASSIS-MIB	
FORCE10-SMI	
FORCE10-SYSTEM-COMPONENT-MIB	
FORCE10-TC-MIB	
FORCE10-TRAP-ALARM-MIB	

### Management Features

Industry-standard CLI  
XML configuration and command output  
Telnet, SSHv1/v2  
TFTP, FTP, scp  
NTPv3  
SNMPv1/v2/v3  
Syslog  
sFlow traffic accounting  
RADIUS/TACACS+ authentication  
RMON (groups 1, 2, 3, 9)  
Port monitoring  
HP OpenView support

Feature capabilities vary between the E-Series, C-Series and S-Series due to hardware differences. Consult the data sheets and product manuals for specific details on supported software features for each platform.



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