Cisco 2520 Connected Grid Switch Q and A

Overview

Q. What is the Cisco® 2520 Connected Grid Switch (CGS 2520)?

A. The Cisco 2520 Connected Grid Switch (CGS 2520) is a rugged switch designed for the harsh, rugged environments often found in the energy and utility industries. The Cisco CGS 2520 supports the communications infrastructure needs for the energy delivery infrastructure across the generation, transmission, and distribution sectors. This infrastructure includes utility- and customer-owned energy infrastructure, such as substation applications supporting electrical transmission and distribution, renewable generation, oil and gas, water, distributed generation, co-generation, and trackside operations. The infrastructure also includes communications infrastructure for delivery applications such as transmission pipelines, distribution mains, and service lines for oil and gas and water.

The CGS 2520 is available in two 24-port SKUS: 24-port 10/100 copper with dual-purpose gigabit Ethernet uplinks and a 16-port fast Ethernet Small Form-Factor Pluggable (SFP) with 8-10/100 PoE ports (Standard and enhanced Power over Ethernet [PoE] will be supported at first customer ship; the platform is hardware-ready for PoE+. One power supply supports up to four ports of 15.4W PoE). The CGS 2520 switch is fully substation-compliant and meets IEC-61850-3 and IEEE 1613 standards for harsh utility substation environments. For detailed product information about the CGS 2520, visit http://www.cisco.com/go/cgs2500

Q. What other products are included in the Cisco Connected grid portfolio?

A. In addition to the CGS 2520, the Cisco 2010 Connected Grid Router (CGR 2010) is also a new platform in the Cisco Connected Grid portfolio, and designed for use in energy infrastructure applications. For more information on the Cisco 2010 Connected Grid Router, please visit http://www.cisco.com/go/cgr2000.

Q. What does it mean to be substation compliant?

A. A critical requirement of most substation intelligent electronic devices (IEDs), such as protection relays, is that they must operate properly under the influence of a variety of Electromagnetic Interference (EMI) phenomena commonly found in the substation. Standards such as IEEE C37.90.x and IEC 60255 define a variety of type tests designed to simulate EMI phenomena, including inductive load switching, lightning strikes, electrostatic discharges from human contact, radio frequency interference (RFI) due to personnel using portable radio handsets, ground potential rise resulting from high-current fault conditions within the substation, and a variety of other EMI phenomena commonly encountered in the substation. This will also be true of the substation LAN equipment (i.e. the Ethernet switches). Often the Ethernet switches will be installed in the same compartment or even on the same rack as protective relaying IEDs. Therefore, it has become necessary that the Ethernet equipment become “substation hardened,” from an EMI immunity perspective, to the same level as protective relaying IEDs.

Q. What are the IEEE 1613 and IEC 61850-3 standards?

A. Both the IEC and IEEE have developed and issued new standards addressing EMI immunity requirements for communications networking equipment. Both groups borrowed heavily from the respective standards used for protective relaying devices, which are critical devices used for protection and control of the power system. Since more and more protection relays are using frame-based Ethernet network connectivity for the purpose

of protection relaying, it was only natural that the communications also be made to comply with the same EMI, Electrostatic Discharge (ESD), and RFI immunity requirements.

- IEEE 1613—IEEE Standard Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations
- IEC 61850-3 Communications Systems and Networks in Substations

In both cases the standards have a minimum requirement that the networking equipment operate without any physical damage, reset, or latch-up during the application of a variety of normally-destructive EMI immunity-type tests.

IEC 61850 consists of 10 parts that provide a comprehensive set of standards for communications networks in substations. It includes everything from environmental and EMI immunity requirements (IEC 61850-3) to conformance testing (IEC 61850-10).

The IEEE 1613 was also developed as a standard to address the proliferation of Ethernet networks in substation automation. Released in August of 2003, the IEEE 1613 IEEE Standard Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations addresses the environmental and performance requirements in networking equipment in substation environments. The majority of the specification was adopted from the IEEE C37.90.x standards for protective relaying systems.

Q. What are some of the primary features of the CGS 2520?

A. The CGS 2520 offers a rugged design for harsh environments and meets IEC-61850-3 and IEEE 1613 standards. In addition, the CGS 2520 provides carrier-grade features such as redundant, hot-swappable, field-replaceable power supplies that increase the uptime of critical utility networks. The CGS 2520 also provides alarm contacts to detect changes in environmental conditions, dying gasp notifications when there is a loss of power, and loopback capabilities to quickly troubleshoot issues in the network.

In addition to the high-availability features mentioned previously, the CGS 2520 also offers Resilient Ethernet Protocol (REP), Flexlink, Link-State Tracking, and EtherChannel to increase the overall uptime of the network. By delivering all of these solutions in a single platform, the CGS 2520 helps organization such as electric utilities minimize network downtime and support mission-critical traffic such as Generic Object Oriented Substation Event (GOOSE) messages and Supervisory Control and Data Acquisition (SCADA) traffic.

Q. What configuration options are available for the CGS 2520?

A. Table 1 shows the complete list of CGS 2520 options.

Table 1. CGS 2520

Product Name (Part Number)	Description
Cisco 2520 Connected Grid Switch (CGS-2520-24TC) NEW	• 24 Ethernet 10/100 • 2 Small Form-Factor Pluggable (SFP)-based Gigabit Ethernet and 10/100/1000 dual-purpose ports • 2 slots for field-replaceable power supplies • Ethernet/serial management console • 4 external alarm inputs, 1 alarm output • 6.5-mpps forwarding rate • 1-rack unit (RU) multilayer switch • 2 Cisco IOS Software feature image options (LANBASE and IP SERVICES)
Cisco 2520 Connected Grid Switch (CGS-2520-16S-8PC) NEW	• 16 Fast Ethernet SFP ports and 8-10/100 PoE ports • 2 Small Form-Factor Pluggable (SFP)-based Gigabit Ethernet and 10/100/1000 dual-purpose ports • 2 slots for field-replaceable power supplies • Ethernet and serial management console • 4 external alarm inputs, 1 alarm output • 6.5-mpps forwarding rate • 1 RU multilayer switch • 2 Cisco IOS Software feature image options (LANBASE and IP SERVICES)
CGS 2520 field-replaceable high AC/DC power supply (PWR-RGD-AC-DC) NEW	• High AC/DC power supply for CGS-2520-24TC and CGS-2520-16S-8PC (88-300VDC, 85-264VAC)
CGS 2520 field-replaceable low DC power supply (PWR-RGD-LOW-DC) NEW	• Low DC power supply for CGS-2520-24TC and CGS-2520-16S-8PC (24-60VDC)
CGS 2520LAN BASE Software feature image NEW	• Enhanced Layer 2 feature image targeted for Layer 2 VPN services • Advanced Layer 2 Tunneling: 802.1q tunneling and Layer 2 Protocol Tunneling (L2PT) • Industry-standard Layer 2 management: 802.1ag (CFM) and E-LMI • Fast convergence: Flexlink, Link-State Tracking, Resilient Ethernet Protocol (REP)
CGS 2520 IP SERVICES Software feature image NEW	• Layer 3 feature images targeted for Layer 3 VPN services • IP routing (RIP versions 1 and 2, Enhanced Interior Gateway Routing Protocol (EIGRP), Open Shortest Path First (OSPF), Intermediate System-to-Intermediate System (IS-IS), and Border Gateway Protocol version 4(BGPv4) • Secured Layer 3: Multi-VRF CE • Enhanced routing: Policy Based Routing
Upgrade Kit for IP SERVICES from LANBASE NEW	• IP SERVICES image upgrade kit from LAN BASE image if you choose to upgrade after the time of order

Q. What Cisco IOS Software feature images does the CGS 2520 support?

A. The CGS 2520 supports two different Cisco IOS Software feature images: LAN BASE and IP SERVICES. The LAN BASE includes features for advanced Layer 2 VPN services. The optional IP SERVICES image contains all the features in LAN BASE plus features for Layer 3 VPN services. The latest version of the software is 12.2(58)EY2.

Q. Do I have options to select the software version?

A. Yes, you can select the version of software you want to be loaded on the switch at the time of order. In addition, you can select the type of accessories that come with the switch.

Technology Overview—Hardware

Q. What hardware features are available on the CGS 2520?

A. CGS 2520 hardware is designed for harsh environments. It features a rugged design and flexible mounting options for deployment where space is limited. The CGS 2520 also supports both front and reserve cabling to provide the user with rack-orientation flexibility. The CGS 2520 gives you the option to configure dual-redundant, hot-swappable power supplies to offer high availability for your customers. In addition, the Cisco Connected Grid Swap Drive allows for speed of replacement in case of a hardware failure.

Q. What is the operating temperature range for the CGS 2520?

A. CGS 2520 is designed to operate from -40º C to +60º C. In addition, temperature type tests of -40º C to +85º C have been conducted as well. Please refer to the CGS 2520 datasheet for complete details.

Q. What substation communications certifications has the CGS 2520 obtained?

A. The CGS 2520 meets or exceeds the IEEE 1613 and IEC-61850-3; industry standards for communications equipment placed in electrical substations. The CGS 2520 is also certified by KEMA, a leading independent third-party organization for IEC-61850 compliance.

Q. What other industry certifications does the CGS 2520 meet?

A. The CGS 2520 also complies with EN50121-4 and EN50155 for use on on-board rail applications and trackside rail applications.

Q. What power supply options are available for the CGS 2520?

A. The CGS 2520 supports two power supply options: 1) high AC/DC and 2) low DC. The high AC/DC (PWR-RGD-AC-DC) supports nominal voltages of either 88-300VDC or 85-264VAC. The low DC (PWR-RGD-LOW-DC) supports nominal voltages of 24-60VDC. These are the same power supply options on the Cisco 2010 Connected Grid Router.

Q. Why does the CGS 2520 offer both a low DC (24-60V) power supply and a high AC/DC (88-300VDC/85-264VAC) power supply?

A. Energy customers have a wide range of power input requirements, so providing a breadth of power input options is important to support different applications. Customers will typically connect a second power supply to a battery backup source for additional redundancy. The CGS 2520 allows a user to mix and match power supplies for maximum flexibility.

Q. Does the CGS 2520 support positive and negative DC power?

A. Yes, the CGS 2520 supports positive and negative DC power. Please reference the hardware installation guide and power installation guide for further details.
http://www.cisco.com/en/US/products/ps10978/prod_installation_guides_list.html

Q. Can the CGS 2520 run on one power supply?

A. Yes, only one power supply is needed for operation of the switch. The Cisco CGS-2520-24TC and the CGS-2520-16S-8PC support one or two field-replaceable power supplies. When both modules are used, power redundancy and load sharing are also available. In addition, the Cisco CGS-2520-24TC and CGS-2520-16S-8PC can also operate in a mixed, high AC/DC and low DC configuration where a chassis has a high AC/DC power supply in one slot and a low DC power supply in the second slot. Two power supplies are required for the CGS-2520-16S-8PC to support all eight ports of standard 15.4 W PoE.

Q. Can the Fast Ethernet ports of the CGS-2520-24TC support a power injector?

A. Yes, third-party power injector support should be possible, but Cisco does not provide any guarantees on third-party equipment. The power injector requires Ethernet connectivity on the side connected to the CGS 2520 and the port on the other end of the power injector is a PoE-capable Ethernet port. Keep in mind that the CGS-2520-24TC downlinks are 100 Mbps so the power injector will need to support that speed. In addition, the temperature operating range of the system may need to be de-rated if the power injector does not support the -40º C to +60º C temperature operating range.

Q. Are power cables included in the CGS 2520?

A. No. The CGS 2520 has a terminal block to power either from AC or DC sources in a substation. Power engineers can modify existing power cables to match the power source and desired cable length.

Q. How do the dual-redundant power supplies work on the CGS 2520?

A. When a CGS 2520 is installed with dual power supplies, it will operate in load-sharing mode even though one power supply is sufficient to power the switch. On the CGS-2520-16S-8PC model, when the PoE requirement is over 61.6 W, the second power supply supplies the additional power and the two power supplies can support up to 170 W of PoE. Dual power supplies can be the same or a combination of PWR-RGD-AC-DC and PWR-RGD-LOW-DC. In the unlikely event of a power supply failure, the other power supply takes over instantly with no downtime. In addition, PoE priority can be defined on the most critical ports requiring PoE in the event of one power supply failing in a dual power supply configuration.

Q. What is the power consumption of the CGS 2520 with single and dual power supplies, with and without PoE?

A. Power consumption details of the CGS 2520 can be found in Table A-2 in the Hardware Installation Guide at http://www.cisco.com/en/US/docs/switches/connectedgrid/cgs2520/hardware/installation/guide/higspec.html - wp1049193

Q. What SFP modules are supported on the CGS 2520?

A. CGS 2520 switches support both 100-Mbps and 1000-Mbps SFP modules in industrial operating temperature (IND), extended operating temperature (EXT), and commercial operating temperature (COM) temperature ranges. Please see table 8 of the CGS 2520 datasheet for full details. http://www.cisco.com/go/cgs2500

Q. Does the CGS 2520 support 10 M fiber?

A. No, the CGS 2520 does not natively support 10 M fiber but third-party adapters can be used.

Q. Does the CGS 2520 support ST connectors?

A. No, the CGS 2520 supports SFP modules, which are LC connectors. Third-party adapters can be used to interface with ST connectors.

Q. What is a dual-purpose port?

A. A dual-purpose port is a combination of one 10/100/1000-TX copper port and one SFP-based Gigabit Ethernet port. One of these two ports can be used at a time. This added flexibility allows cost-effective use of interfaces.

Technology Overview—Software

Q. What are the primary features in each software feature image?

A. The primary features in each software feature image are listed in Table 2.

Table 2. Primary Features for Each Software Feature Image

LAN Base		IP Services
Per port per VLAN ingress policing	Resilient Ethernet Protocol	All LAN base features plus:
SCADA protocol classification using ACLs	Flexlink	Static routing, Inter-VLAN routing
Per GOOSE VLAN classification/statistics	Link-state tracking	Multi-VRF CE (VRF-lite)
Configurable egress queue bandwidth	Unidirectional Link Detection (UDLD)	Policy-based routing
Configurable egress buffers/thresholds	xSTP: 802.1s/802.1w	RIP Versions 1 and 2
Strict priority queuing with optional policer	EtherChannel, LACP, and PAgP	EIGRP, OSPF, and IS-IS
IEEE 802.1x and identity-based network services	Dying gasp for loss of power	BGPv4
Web- and MAC-based authentication	External alarm contacts	IPv6 routing
Port security plus Cisco enhancements	Modbus memory map support	HSRP
DHCP snooping, dynamic ARP inspection, IP source guard	Express Setup	Multicast routing: PIM (SM, DM)
Spanning Tree Protocol security mechanisms	Cisco Configuration Professional	Source Specific Multicast
Storm control	Utility-specific smartport macros	Source Specific Multicast mapping
Wire-speed L2-L4 ACLs	DHCP Auto-Config and Image upgrade	Bidirectional Forwarding Detection
Private VLAN	Config Rollback and Replace	Multicast support for VRF (mVRF-Lite)
Secure connectivity: SSH, SSL, and SCP	SPAN and RSPAN	VRF-aware services (ARP, ping, SNMP, Hot Standby Router Protocol [HSRP], unicast Reverse Path Forwarding [uRPF] syslog, traceroute, FTP, and Trivial File Transfer Protocol [TFTP])
RADIUS and TACACS+	Layer 3 IP SLA	
SNMPv3 crypto	IETF Two-Way Active Measurement Protocol (TWAMP) Responder Support	
Configuration file security	Port and VLAN Loopback	
UNI/ENI and NNI port types (configurable on all ports)	Time Domain Reflectometry (Copper ports)	
Configurable per VLAN MAC learning	Digital Optical Monitoring (DOM), Optical ports	
MAC address learning and aging notifications	Ethernet OAM Connectivity Fault Management (CFM): IEEE 802.1ag Ethernet in the first mile (EFM): IEEE 802.3ah Ethernet LMI (PE) -MEF Ethernet LMI (CE): MEF CFM to E-LMI Interworking CFM to EFM Interworking 802.1ag + IPSLA (Ethernet SLAs)	
Configurable control plane security		
IEEE 802.1AR for hardware-based security		

Q. What is the Connected Grid Swap Drive?

A. The Connected Grid Swap Drive is an ease-of-use feature that speeds up replacement of failed hardware. The Connected Grid Swap Drive stores the operating system (Cisco IOS) and system configuration information such as VLANs. To replace the failed unit, the user removes the Connected Grid Swap Drive from the failed unit and places it in the replacement CGS 2520. Once the replacement CGS 2520 is powered back on, the unit does not require any additional configuration.

Q. Can I read the Connected Grid Swap Drive from a PC or laptop?

A. No, for security reasons, the Connected Grid Swap Drive does not allow for reading or writing on a PC or laptop.

Q. How do I restore a corrupted Connected Grid Swap Drive?

A. In case the Connected Grid Swap Drive image is corrupted, the following recovery procedure can be used to load a working Cisco IOS Software image: http://www.cisco.com/en/US/partner/docs/switches/connectedgrid/cgs2520/software/release/12_2_53_ex/configuration/guide/swtrbl.html - wp1342147

Q. Does the CGS 2520 support Network Address Translation (NAT)?

A. No, the CGS 2520 does not support NAT, but the Cisco 2010 Connected Grid Router does.

Q. What quality-of-service (QoS) features does the CGS 2520 provide to enhance traffic management?

A. The CGS 2520 provides two-rate three-color (2R3C) policer with byte-level statistics and inner-to-outer class of service (CoS) propagation to help enable more flexible QoS offerings. In addition, the CGS 2520 also offers standard 802.1p class of service (CoS) and VLAN-based classification, allowing for granular control and monitoring of GOOSE traffic (on a per VLAN basis).

Q. Does the CGS 2520 support Network Node Interface (NNI) ports?

A. Yes, similar to the ME3400E the CGS 2520 supports NNI ports, although one major difference is that the CGS 2520 supports NNI ports on all ports regardless of the image installed.

Q. What security features are available on the CGS 2520?

A. The CGS 2520 provides a comprehensive security solution for Ethernet access products. By dividing security into three areas—secure connectivity, threat defense, and trust and identity—the CGS 2520 delivers a highly secure solution for utility substations.

Secure connectivity helps prevent one user from affecting another one on their shared network. The CGS 2520 provides the UNI/ENI/NNI feature to create a circuit-like behavior to separate users' traffic streams. It also provides Dynamic Host Configuration Protocol (DHCP) Snooping, Dynamic Address Resolution Protocol (ARP) Inspection, and IP Source Guard to help you identify each user's MAC address, IP address, and port information, thereby preventing malicious users from unauthorized access.

Threat defense is about protecting the switch from attacks. The CGS 2520 offers features to protect the CPU and configuration files from denial of service (DoS) attacks, when dropped process control protocol packets could result in a network outage. Features such as Control Plane Security and Storm Control help protect the CPU against malicious attacks. Port Security allows you to control how many MAC addresses are allowed from each user. This protects switch memory from being overwhelmed. In addition, the CGS 2520 provides dry input alarm contacts to notify you when unauthorized physical access to the switch is detected.

Trust and Identity consists of features that filter all incoming traffic to help ensure that only valid traffic is allowed through the switch. The CGS 2520 uses features such as access control lists (ACLs) and IEEE 802.1x to identify users that are allowed to transmit traffic through the switch.

Management Overview

Q. What are the management capabilities of the CGS 2520?

A. The CGS 2520 supports numerous management features. Support for Simple Network Management Protocol (SNMP) Versions 1, 2c, and 3 and Telnet interface support enable comprehensive in-band management, and a command-line-based management console enables detailed out-of-band management.

CiscoWorks network management software provides management capabilities to the CGS 2520 on a per-port and per-switch basis, providing a common management interface for Cisco routers, switches, and hubs.

In addition, Cisco Configuration Professional, an easy-to-use graphical user interface (GUI) will be available for the CGS 2520.

Q. What other management and diagnostic tools are available on the CGS 2520 to increase service availability?

A. The CGS 2520 provides an Ethernet management console for out-of-band provisioning and monitoring capabilities. To help you take proactive actions before critical-impacting events occur, the CGS 2520 also includes Generic On-Line Diagnostics (GOLD) and Onboard Failure Logging (OBFL) to help you to troubleshoot and diagnose potential issues.

Q. What benefits do the traffic loopback features on the CGS 2520 provide?

A. The CGS 2520 provides two types of loopbacks: port loopback and VLAN loopback. Port loopback returns all traffic on a given port back to the source. VLAN loopback allows a network operator to select particular VLAN traffic to be examined without network interruption on other VLANs. Both types of loopbacks help network operators proactively determine the health of the network for critical time-sensitive traffic such as GOOSE messages. In addition, these advanced verification and troubleshooting features minimize expensive truck rolls.

Q. What Ethernet OAM&P features are supported on the CGS 2520?

A. The CGS 2520 supports both 802.1ag Connectivity Fault Management and Ethernet Local Management Interface (E-LMI). The 802.1ag feature provides the tools to monitor and troubleshoot end-to-end Ethernet networks. It allows utility network operators to check for end-to-end connectivity, and isolate network issues.

In addition the CGS 2520 also supports port loopback with destination and source MAC address swap functionality to activate and verify new services without expensive truck rolls.

Q. What MODBUS management capabilities are supported on the CGS 2520?

A. The MODBUS management capabilities on the CGS 2520 are READ ONLY. The set of capabilities provide READ ONLY information on basis switch information, system status, alarm input status, and port status/statistics. The register details are documented in the Software Configuration Guide: http://www.cisco.com/en/US/docs/switches/connectedgrid/cgs2520/software/release/12_2_53_ex/configuration/guide/swmodreg.html

Warranty, Service/Support, and Ordering Information

Q. What is the warranty for the CGS 2520?

A. The CGS 2520 comes with a 5-year limited hardware warranty. For product warranty information, go to: http://www.cisco.com/go/warranty

Select the Solution and Segment Warranties tab and see the warranty description under “Cisco Connected Grid.”

Q. What service and support is offered?

A. Cisco offers a wide range of services programs to accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. For more information about Cisco services, refer to Cisco Technical Support Services or Cisco Advanced Services at http://www.cisco.com/go/services.

Q. How can I find ordering information?

A. These products can be ordered by a Cisco authorized partner. Please refer to the partner locator on cisco.com: http://www.cisco.com/web/partners/index.html. For more information about product availability, please contact your Cisco representative.

For More Information

For detailed product information about the CGS 2520, refer to: http://www.cisco.com/go/cgs2500

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