Network Switch Overview
Ethernet History
Switch Basics
TRENDnet Switch Families
GREENnet Technology
Web Smart Advantages
Power Over Ethernet Overview
10Mbps
- IEEE 802.3 Standard, released in 1983

100Mbps
- IEEE 802.3u Standard and was released in 1992

1000Mbps (Gigabit)
- IEEE 802.3ab, IEEE 802.3z Standard and was released in 1996

10 x 1000Mbps (10Gbps)
- IEEE 802.3ae, ratified in June 2002
What’s a Switch?

- A device that adds port density to the network
- A network appliance that connects network segments to one another
- Operates at the Data Link layer of the OSI model, or better known as Layer 2
- Replaces Hub technology

Switch Applications

- Expanding the wired network
- Used for advanced network management
  - VLAN - Isolate Users and/or Workgroups
  - QoS - Prioritize specific types of network traffic (e.g. VoIP)
  - SNMP - Network monitoring using technology
- To Add Power over Ethernet (PoE) Capabilities to the wired network.
Copper Switch
- Most common switch type
- Utilizes Cat. 5, 5e, 6 cabling w/ RJ-45 connector
- Maximum cabling distance of 328ft (100m)

Fiber Optic Switch
- Used for long distance network connections that exceed 328ft (100m)
- Utilizes Fiber Optic cabling
  - Single Mode: 8~10 Micron
  - Multi Mode: 50 or 62.5 Micron
- Maximum cabling distance
  - Single Mode – Up to 100Km
  - Multi Mode – Up to 2Km
Unmanaged Switch
- Plug & Play
- GREENnet

WebSmart Switch
- Plug & Play
- Web-based Management
- Basic Port management, VLAN & QoS
- Optional Fiber modules

Managed Layer 2 Switch
- Console, Telnet or Web-Based Management
- SNMP support, VLAN, Trunking and more
Switch-based technology that can reduce power consumption by up to 70%.
How 'GREENnet' Technology Works

1. Link Down Detection - Ethernet port is inactive. Power for the inactive port is in standby mode.
2. Cable Length Detect - Less power is required to send data over shorter cable lengths. Automatically adjust power and requires no management.
   - **GREENnet 10/100Mbps Switch Ports**
     - 1-20 meters (1 - 65 ft) = Reduced Power
     - 21+ meters (66+ ft) = Full Power
   - **GREENnet Gigabit Switch Ports**
     - 1-10 meters (1- 32 ft) = Significantly Reduced Power
     - 11-60 meters (32 - 197 ft) = Reduced Power
     - 61+ meters (198+ ft) = Full Power
   - TRENDnet GREENnet switch operates in standby mode.
IEEE Standards
- 802.3 10Base-T
- 802.3u 100Base-TX
- 802.3x Full Duplex Flow Control

Compatible with Windows, Linux, and Mac OS’s

Store-and-Forward Switching Method

Non-blocking Architecture

Diagnostic LEDs

Plug & Play

3-Year Warranty
IEEE Standards
- 802.3 10Base-T
- 802.3u 100Base-TX
- 802.3ab 1000Base-T
- 802.3x Full Duplex Flow Control

- Full/half duplex on 10/100Mbps
- Full duplex for 1000Mbps
- Supports Jumbo Frames for enhanced performance
- Auto-MDIX on all ports
- Plug-n-Play Design
- 3-Year Warranty
IEEE Standards
- 802.3 10Base-T
- 802.3u 100Base-TX
- 802.3af Power over Ethernet

Full/half duplex on Fast Ethernet Ports
Compatible with Windows, Linux, and Mac OS’s
LED Indicator for PoE Link Status
Auto-MDIX on all ports
Plug-n-Play Design
3-Year Warranty

Unmanaged PoE Switches
TPE-S80
TPE-S160
TPE-TG44

TRENDnet
Web Smart Switches are Ethernet Switches with light management functions
Easy to use Web GUI
Users can learn how to operate the switch within minutes
Configure through a standard web browser
Centrally monitor multiple switches on one screen
<table>
<thead>
<tr>
<th>Switch</th>
<th>Model</th>
<th>10/100/1000Mbps Ports</th>
<th>19” Rack Mountable</th>
<th>Mini-GBIC Slots</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEG-160WS</td>
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<td>TEG-240WS</td>
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<td>2</td>
<td></td>
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<tr>
<td>TEG-424WS</td>
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<td>2</td>
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<td>TEG-2248WS</td>
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</tbody>
</table>
Key “Smart” Switch Feature

Local Management via Web Browser

Easy setup only takes minutes
VLAN (Virtual Local Area Network)

- Allows network administrators to logically segment a LAN into different broadcast domains
- Logical segmentation not physical ones; workstations do not have to be physically in the same vicinity

Benefits
- Increase network performance
- Improve manageability
- Physical topology independence
- Security

Types of VLAN
- Port-Based VLAN
- MAC Address Based VLAN
- IEEE 802.1Q tagged VLAN
Key “Smart” Switch Feature

VLAN Application

Engineering Department

Accounting Department

VLAN Application
Types of Virtual LANs

**Port-Based VLAN:** each physical switch port is configured with an access list specifying membership in a set of VLANs.

**MAC-based VLAN:** a switch is configured with an access list mapping individual MAC addresses to VLAN membership.

**Protocol-based VLAN:** a switch is configured with a list of mapping layer 3 protocol types to VLAN membership - thereby filtering IP traffic from nearby end-stations using a particular protocol such as IPX.
The most flexible VLAN arrangement can be achieved by the use of 802.1Q tags. Edge switches allow the use of both VLAN-aware and VLAN-unaware and stations.
Asymmetric VLAN

Shared VLAN Learning (SVL)

Asymmetric VLAN is a mechanism to allow you to have a multiple bridged networks to transparently share the same physical network link without leakage of information between networks. It uses port tagging to enable this feature by creating a Virtual ID for a group of network ports.

- Typically, two stations X and Y belonging to the same VLAN use the same VID to communicate.
- Asymmetric VLAN: X -> Y and Y <-X use different VIDs.
- VLAN unaware devices
Trunking

- Port Trunking combines two or more RJ-45 ports together to make a single high-bandwidth data pipeline between Switches.
- Create load balancing between links to provide a redundant connection to mission-critical network connections.
- MAC Address-Based Trunking uses MAC address on the connected devices to determine the trunk ports.
- Port-Based Trunking defines the trunk by using the port number.
Key “Smart” Switch Feature

**TRUNKING Application**

TEG-240WS

4-port trunk with 4Gbps
(4 x 1000Mbps) Half Duplex

TEG-240WS
QoS (Quality of Service)

The primary goal of QoS is to provide priority including dedicated bandwidth, controlled jitter and latency, and improved loss characteristics.

Improves video quality when using Video Streaming and Video Conferencing on the network.
Key “Smart” Switch Feature(s)

QoS – Quality of Service

Voice Priority #1

Video Priority #2

Data Priority #3
<table>
<thead>
<tr>
<th>Features</th>
<th>Unmanaged</th>
<th>Web Smart</th>
<th>Managed Layer 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/100/1000 Copper Ports</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Gigabit Fiber</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Port Flow Control</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Priority(QOS)</td>
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<td>✔</td>
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<tr>
<td>IGMP / Broadcast Control</td>
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<td>✔</td>
</tr>
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<td>Jumbo Frames</td>
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<td>✔</td>
</tr>
<tr>
<td>Port Mirroring</td>
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<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Port Trunking</td>
<td>N/A</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>VLAN Support</td>
<td>N/A</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Dynamic VLAN Support</td>
<td>N/A</td>
<td>N/A</td>
<td>✔</td>
</tr>
<tr>
<td>SNMP Support</td>
<td>N/A</td>
<td>v1</td>
<td>v1, v2c, v3</td>
</tr>
<tr>
<td>STP Support</td>
<td>N/A</td>
<td>STP</td>
<td>STP, RTSP, MSTP</td>
</tr>
</tbody>
</table>
**Features:**

- Includes all Web Smart switch functions plus more
- Capture, monitor and analyze performance of the network per port or switch using SNMP v1, v2c, v3 protocols
- Maintains network health and security:
  - HTTPS, SSH, 802.1x
- Proven solutions for highly scalable and secure managed networks
- Remote management from any web browser
- Manage using the Command Line Interface (Telnet or RS-232)
- Advanced network management and security supports multiple protocols
- Spanning Tree Support: STP, RSTP, MSTP
- Dynamic VLAN Support
- Advanced Bandwidth Management
<table>
<thead>
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<th>Switch</th>
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<th>10/100/1000Mbps Ports</th>
<th>19” Rack Mountable</th>
<th>Mini-GBIC Slots</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL2-E284</td>
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<td>2</td>
<td></td>
</tr>
<tr>
<td>TL2-G244</td>
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<td>Yes</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
Layer 2 Overview

Upgrading to Layer 2 Switches

TEG-424WS → TL2-E284
Web Smart → Managed Layer 2

TEG-240WS → TL2-G244
Layer 2 Overview

Steps To Install or Upgrade Existing Switch

Basic (Minutes To Install)

- Start
- IP Address
- Password
- Ready To Use

Advanced (For Later Configuration)

- ACL
- RTSP
- VLAN
- QOS
- Broadcast Storm Control
- MORE
System Information displays basic information about the switch such as; Hardware Version, Firmware Version, and Device Name.
The administrator can create user accounts that have different levels of access to the switch web management. Administrator accounts (15) have full access whereas guest accounts (1) can only view switch statistics.
On this page you can set the IP address of the switch. The switch can be configured as a DHCP client or with a static IP address.
This page is to set an authorized administrator source IP address, and the services, interfaces, or VLANs that it is allowed to visit.

### IP Authorized Manager

<table>
<thead>
<tr>
<th>IP Address</th>
<th>Subnet Mask</th>
<th>Port List (Incoming)</th>
<th>VLANs Allowed</th>
<th>Services Allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>192.168.1.116</td>
<td>255.255.255.0</td>
<td>1-28</td>
<td>1-4094</td>
<td>□ ALL □ SNMP □ TELNET □ HTTP □ HTTPS □ SSH</td>
</tr>
</tbody>
</table>

**Basic Features**

**IP Authorized Manager**
Port Controls settings allows the administrator to set Duplex, Speed, Flow Control and MDI/MDIX mode.
The Storm Control feature provides the ability to control the receive rate of Destination Lookup Failed (DLF) unicast, multicast and broadcast packets.
VLAN gives you the capability to divide the Layer 2 switch into different logical networks without the need to purchase any additional switches.
Dynamic VLAN*

- GARP (Generic Attribute Registration Protocol) VLAN
- Exchange VLAN configuration information with other GVRP switches.
- Refers to the method of assigning hosts to the VLANs
  - Hosts are assigned to a VLAN according to the MAC address of the host itself.
  - Assignment is accomplished through a VLAN Membership Policy Server

*Layer 2 Switch Feature
Dynamic VLAN

Dynamic Vlan Global Configuration

Garp System Control
Start

Dynamic Vlan Status
Enabled

Apply

Note: To shutdown GARP, Dynamic Vlan should be disabled.
QoS

IEEE 802.1p

Specification enables Layer 2 switches to prioritize traffic and perform dynamic multicast filtering.

802.1p is an extension of the IEEE 802.1Q (VLAN tagging) standard and they work in tandem.

The 802.1p header includes a three-bit field for prioritization, which allows packets to be grouped into various traffic classes.

Establishes eight levels of priority (0~7)

*Layer 2 Switch Provides Advanced QoS Configurations
Using QoS allows your network to handle specific types of traffic more efficiently. Used with VLANs you can segment your network traffic while prioritizing those VLANs based on traffic type.
Spanning Tree Protocol (STP)

IEEE 802.1D

A link management protocol that provides path redundancy while preventing undesirable loops in the network.

STP defines a tree with a root switch and a loop-free path from the root to all switches in the network. STP forces redundant data paths into a standby (blocked) state.

- RTSP (802.1w) reduced the time responses to topology change
- MSTP (802.1s) incorporates RTSP with the addition of VLAN support. The idea is that several VLANs can be mapped to a reduced number or spanning tree instances because networks do not need more than a few logical topologies.
### Port Status Configuration

#### IEEE 802.1D

<table>
<thead>
<tr>
<th>Select</th>
<th>Port</th>
<th>Port Role</th>
<th>Port Priority</th>
<th>RSTP Status</th>
<th>Path Cost</th>
<th>Protocol Migration</th>
<th>AdminEdge Port</th>
<th>Admin Point To Point</th>
<th>Auto Edge Detection</th>
<th>Restricted Role</th>
<th>Restricted TCN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
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<td>128</td>
<td>Enable</td>
<td>200000</td>
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<td>False</td>
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<tr>
<td>2</td>
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<td>Disabled</td>
<td>128</td>
<td>Enable</td>
<td>200000</td>
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<td>False</td>
<td>Auto</td>
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<td>3</td>
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<td>128</td>
<td>Enable</td>
<td>200000</td>
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<td>False</td>
<td>Auto</td>
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<td>128</td>
<td>Enable</td>
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<td>Auto</td>
<td>True</td>
<td>False</td>
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<tr>
<td>5</td>
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<td>Disabled</td>
<td>128</td>
<td>Enable</td>
<td>200000</td>
<td>False</td>
<td>False</td>
<td>Auto</td>
<td>True</td>
<td>False</td>
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</tr>
<tr>
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<td>128</td>
<td>Enable</td>
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<td>Auto</td>
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<td>False</td>
<td>Auto</td>
<td>True</td>
<td>False</td>
<td>False</td>
</tr>
</tbody>
</table>
Mirroring allows a designated (sniffer) port to see all the network packets passing thru the different port(s).
**Troubleshooting – Mirror Setting**

**Why Do Port Mirror?**

- Method of monitoring network
- Forward packet from selected port to a selected “sniffer port”
- Used for network performance monitoring, security monitoring, troubleshooting.

Packet Analyzer
Layer 2 Managed Switches Are Recommended For:
- Medium to large size businesses
- Multiple vendor devices using SNMP (open standard)
- Centralized administration from local or remote location
- Growing network using modular components

Mixed Environment Layer 2 Managed with Web Smart Switch are Recommended For:
- Business with multiple locations
- Business who requires SNMP support yet would like to reduce overall costs
GBIC Module:

- Mini-GBIC Module
  - Support 1000Mbps speed
  - Support 1000Base-T, 1000Base-SX, or 1000Base-LX
  - Hot Swappable
  - Seamless Integration
  - Economical & Flexible

Compatible with Gigabit Ethernet networking equipment that supports the industry standard GBIC/Mini-GBIC interface.
Questions?