FIBERROAD

TECH NOTE

STP/RSTP
Configuration Guide
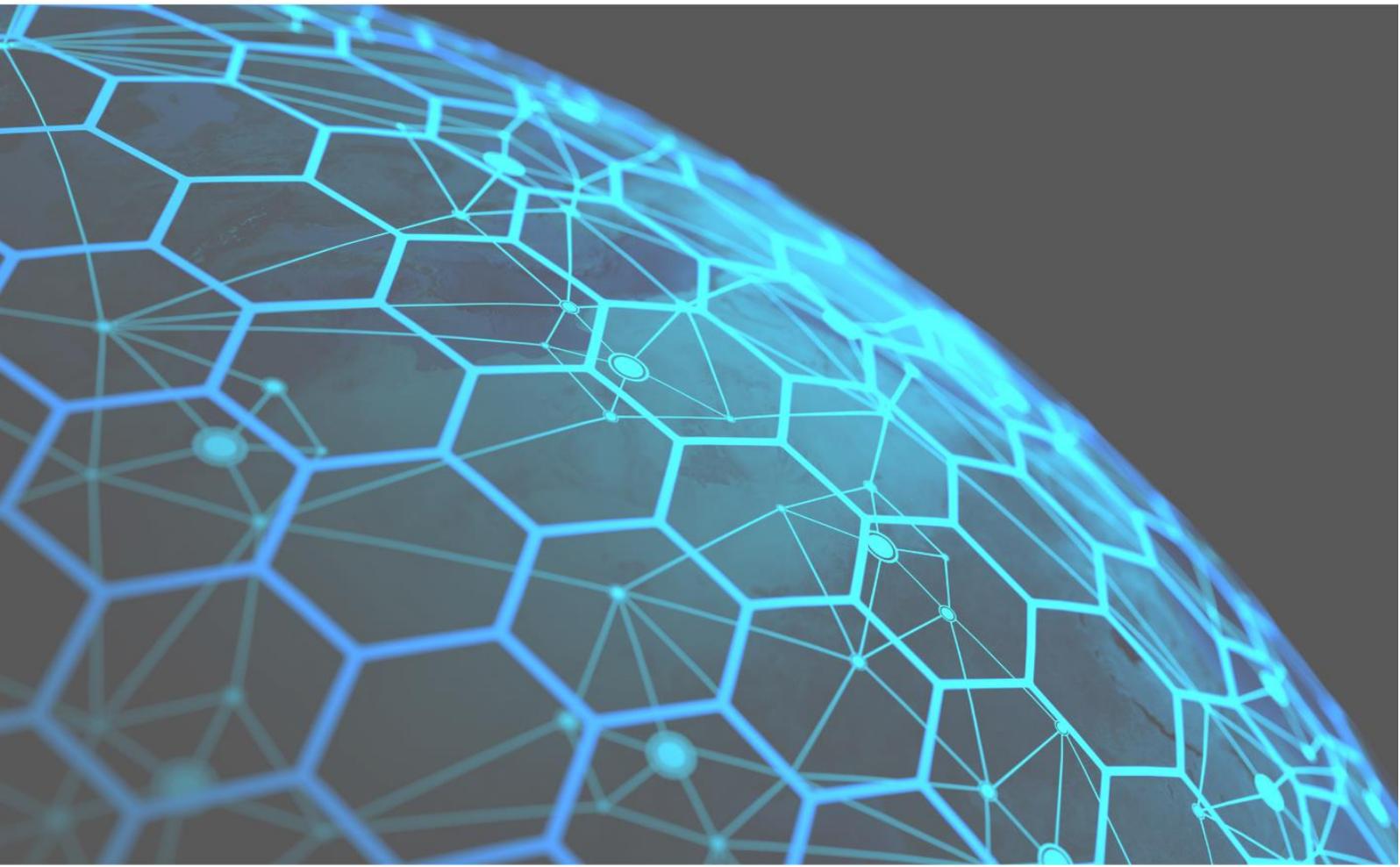
About The Tech Note

Introduction
This document includes an introduction to the Fiberroad Ethernet Switch products family and its features, network protocol, etc. To give you a quick overview of the Fiberroad products.

Conventions
This document contains notices, figures, screen captures, and certain text conventions.

Figures and Screen Captures
This document provides figures and screen captures as an example. These examples contain sample data. This data may vary from the actual data on an installed system.

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Units of Measurement
Units of measurement in this publication conform to SI standards and practices.

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STP/RSTP Configuration Guide

1. STP Overview

Spanning Tree Protocol (STP) was designed to help reduce link failures on a network, and provide an automatic means of avoiding loops. This is particularly important for networks that have a complicated architecture, since unintended loops in the network can cause broadcast storms. Fiberroad switches' STP feature is disabled by default. To be completely effective, you must enable RSTP/STP on every Fiberroad switch connected to your network.

Rapid Spanning Tree Protocol (RSTP) implements the Spanning Tree Algorithm and Protocol defined by IEEE 802.1D-2004. RSTP provides the following benefits:

- The topology of a bridged network will be determined much more quickly compared to STP.
- RSTP is backwards compatible with STP, making it relatively easy to deploy. For example:
  - ◇ Defaults to sending 802.1D style BPDUs if packets with this format are received.
  - ◇ STP (802.1D) and RSTP (802.1w) can operate on different ports of the same switch, which is particularly helpful when switch ports connect to older equipment such as legacy switches.

2. STP Mechanism

STP (802.1D) is a bridge-based system that is used to implement parallel paths for network traffic. STP uses a loop-detection process to:
• Locate and then disable less efficient paths (i.e., paths that have a lower bandwidth).
• Enable one of the less efficient paths if a more efficient path fails.

The figure below shows a network made up of three LANs separated by three bridges. Each segment uses at most two paths to communicate with the other segments. Since this configuration can give rise to loops, the network will overload if STP is NOT enabled.
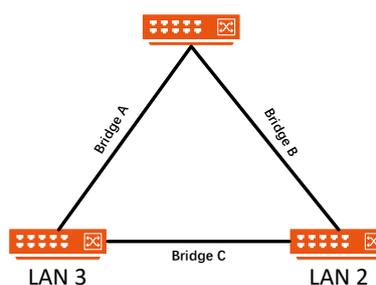
If STP is enabled, it will detect duplicate paths and prevent, or block, one of the paths from forwarding traffic. In the following example, STP determined that traffic from LAN segment 2 to LAN segment 1 should flow through bridges C and A since this path has greater bandwidth and is, therefore, more efficient.
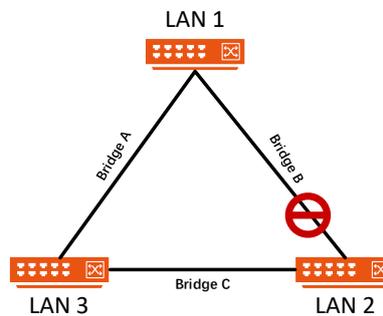
What happens if a link failure is detected? As shown in next figure, the STP process reconfigures the network so that traffic from LAN segment 2 flows through bridge B.
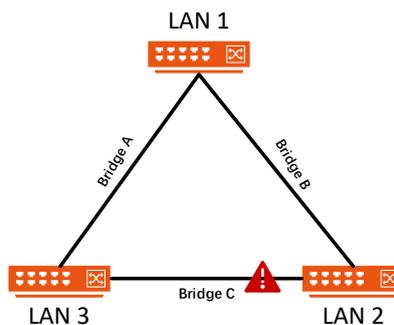
STP will determine which path between each bridged segment is most efficient, and then assign a specific reference point on the network. When the most efficient path has been identified, the other paths are blocked. In the previous 3 figures, STP first determined that the path through bridge C was the most efficient, and as a result, blocked the path through bridge B. After the failure of bridge C, STP re-evaluated the situation and opened the path through Bridge B.

2.1 How STP Works

When enabled, STP determines the most appropriate path for traffic through a network. The way it does this is outlined in the sections below.

2.2 STP Requirements
Before STP can configure the network, the system must satisfy the following requirements:
• All bridges must be able to communicate with each other. The communication is carried out using Bridge Protocol Data Units (BPDUs), which are transmitted in packets with a known multicast address.

• Each bridge must have a Bridge Identifier that specifies which bridge acts as the central reference point, or Root Bridge, for the STP system—bridges with a lower Bridge Identifier are more likely to be designated as the Root Bridge. The Bridge Identifier is calculated using the MAC address of the bridge and a priority defined for the bridge. For example, the default priority setting of Fiberroad switches is 32768.

• Each port has a cost that specifies the efficiency of each link. The efficiency cost is usually determined by the bandwidth of the link, with less efficient links assigned a higher cost.

2.3 STP Port Role

2.3.1 Root

A tree-shaped network structure must have a tree root, so STP introduces the concept of a Root Bridge. There is only one bridge in the entire network, and the root bridge will change according to changes in the network topology, so the root bridge is not fixed. After the network converges, the root bridge will generate and send configuration BPDUs at certain time intervals, and other devices will BPDUs are forwarded to ensure topology stability. The root bridge is selected based on the bridge priority and the bridge MAC address group.

Synthesized bridge ID (Bridge ID), the bridge with the smallest bridge ID will be the root bridge in the network.

2.3.2 Root Port

Root port refers to the port closest to the root bridge on a non-root bridge device. The root port is responsible for communicating with the root bridge letter. There is only one root port on a non-root bridge device, and there is no root port on a root bridge.

2.3.3 Designated Ports

A designated port is specifically designated to reach the port with the lowest bridge cost through its root port. The specified port will be marked port forwarding.

2.4 STP Calculation

The first step of the STP process is to perform calculations. During this stage, each bridge on the network transmits BPDUs. The following items will be calculated:

• Which bridge should be the Root Bridge. The Root Bridge is the central reference point from which the network is configured.

• The Root Path Costs for each bridge. This is the cost of the paths from each bridge to the Root Bridge.

• The identity of each bridge's Root Port. The Root Port is the port on the bridge that connects to the Root Bridge via the most efficient path. In other words, the port is connected to the Root Bridge via the path with the lowest Root Path Cost. The Root Bridge, however, does not have a Root Port.

• The identity of the Designated Bridge for each LAN segment. The Designated Bridge is the bridge with the lowest Root Path Cost in that segment. If several bridges have the same Root Path Cost, the one with the lowest Bridge Identifier becomes the Designated Bridge. Traffic transmitted in the direction of the Root Bridge will flow through the Designated Bridge. The port on this bridge that connects to the segment is called the Designated Bridge Port.

2.5 STP Configuration and Re-configuration

After all of the bridges on the network agree on the identity of the Root Bridge, and all other relevant parameters have been established, each bridge is configured to forward traffic only between its Root Port and the Designated Bridge Ports for the respective network segments. All other ports are blocked, which means that they will not be allowed to receive or forward traffic.

Once the network topology has stabilized, each bridge listens for Hello BPDUs transmitted from the Root Bridge at regular intervals. If a bridge does not receive a Hello BPDU after a certain interval (the Max Age time), the bridge assumes that the Root Bridge, or a link between itself and the Root Bridge, has ceased to function. This will trigger the bridge to reconfigure the network to account for the change. If you have configured an SNMP trap destination, the first bridge to detect the change will send out an SNMP trap when the topology of your network changes.

2.6 Differences between STP and RSTP

RSTP is similar to STP, but includes additional information in the BPDUs that allow each bridge to confirm that it has taken action to prevent loops from forming when it decides to enable a link to a neighboring bridge. Adjacent bridges connected via point-to-point links will be able to enable a link without waiting to ensure that all other bridges in the network have had time to react to the change. The main benefit of RSTP is that the configuration decision is made locally rather than network-wide, allowing RSTP to carry out automatic configuration and restore a link faster than STP.

STP and RSTP spanning tree protocols operate without regard to a network's VLAN configuration, and maintain one common spanning tree throughout a bridged network. Thus, these protocols map one loop-free, logical topology on a given physical topology.

	STP	RSTP
Similarity	1. There is only one spanning tree in the entire switching network, and topology convergence is affected by the scale of the network topology; 2. The connectivity of the network is affected by the symmetry of the network structure.	

	3. The link is blocked The link does not carry any traffic.	
Difference	1. It can't migrate quickly, need to wait 2 times forward delay time delay; 2. On point-to-point or edge ports need to wait. 2 times delay; 3. The edge port needs to wait 2 times the time delay.	1. Fast migration, when the root port/designated port fails, the replacement port/backup port will be processed without delay into the forwarding state; 2. The designated port only needs to do a handshake with the downstream bridge that can enter the forwarding state without delay; 3. Connect directly to the terminal instead of connecting to other bridge ports are defined as edge ports. The edge port can directly enter the forwarding state without any delay.

Table 1: STP and RSTP Introduction

3, STP Configurations
3.1 STP Global Configuration

Figure1: STP Global Configurations

Configuration Steps:

1. Select [Advanced/STP/Global Settings] in the navigation bar to enter the STP [Global Settings] interface.

2. In the [Global Settings] interface, you can view the global configuration information of STP.

3. If you need to modify the relevant configuration, you can directly enter the value to be configured in the configuration column of the corresponding configuration item, as shown in Figure 1.

Item	Description
STP Mode	Default RSTP, Compatible with STP
System Priority	STP System priority, Range<0-61440>, the step must be 4096
Forward Delay	Delay when port switch between disabled / listening/learning/ forwarding, Range<4-30>
Hello Time	The time interval sent by STP protocol message in a stable state, Range<1-2>
Max Age	The maximum survival time of the STP protocol packet received

	by the bridge. If no new protocol packets are received at this time, the packet will be discarded. Range<6-40>
TX Hold Count	The maximum number of STP protocol packets sent by Port per second. Range<1-10>

3.2 STP Port Configuration

Port	STP Admin Status	Priority	Path Cost Mode	Path Cost
*	<>		<>	
GE/1	Disabled	128	Auto	0
GE/2	Disabled	128	Auto	0
GE/3	Disabled	128	Auto	0
GE/4	Disabled	128	Auto	0
GE/5	Disabled	128	Auto	0
GE/6	Disabled	128	Auto	0
GE/7	Disabled	128	Auto	0
GE/8	Disabled	128	Auto	0
GE/9	Disabled	128	Auto	0
GE/10	Disabled	128	Auto	0

Apply   Refresh

Configuration Steps

1. Select [Advanced / STP / Port Configurations] in the navigation bar to enter the STP [Port Configurations] interface.

2. The STP port configuration information can be viewed in the [Port Configurations] interface.

3. To modify the port configuration, you can click [Modify] on the right side of the corresponding port to enter the port configuration interface of the STP.

Item	Description	Notes
Port	Port Name	
STP Admin Status	Enabled / Disabled	Default: Disabled
Priority	Every switch taking part in spanning tree has a bridge priority. The switch with the lowest priority becomes the root bridge. If there's a tie, then the switch with the lowest bridge ID number wins. The ID number is typically derived from a MAC address on the switch.	
Path Cost Mode	The calculation of STP port path overhead, [Auto] or [Managed]	Default: Auto
Path Cost	Path cost - The path cost is the metric STP uses to calculate the shortest path to elect root port to reach the root-bridge .	

Note: The STP BPDU message requires a certain Path overhead for each Root port. The Path overhead of each bridge is cumulative, and this value is called Root Path Cost. The path overhead is different corresponding to the root ports of different rates, as shown in the following table:

Port Rate	Path Cost
10Mbps	2,000,000
100Mbps	200,000
1000Mbps	20,000

3.3 STP Information

STP Information						
STP Mode	rstp					
Bridge ID	001893-171CBE / 32768					
Root ID	001893-171CBE / 32768					
Root Path Cost	0					
Admin Timers Value	Forward Delay		Hello Time		Max Age	Transit Limit
	15 (second)		2 (second)		20 (second)	6 (per second)
Operative Timers Value	Forward Delay		Hello Time		Max Age	Message Age
	15 (second)		2 (second)		20 (second)	0 (second)

Refresh

Configuration Steps

1. Select [Advanced / STP / STP Information] in the navigation bar and enter the STP [STP information] interface.

2. The STP current running information can be viewed in the [STP information] interface.

3. Click [Refresh] to show the latest running information.

3.4 Port Information

Port:GE/1					
Port:GE/2					
STP enabled	Disabled				
Priority	128	Role	disabled port	PartnerVersion	stp
State	discarding	AdminPathCost	0	AutoPathCost	Enabled
OperPathCost	0	OperEdge	Disabled	OperP2P	Disabled
Port:GE/3					
Port:GE/4					
Port:GE/5					
Port:GE/6					
Port:GE/7					
Port:GE/8					
Port:GE/9					
Port:GE/10					

Refresh

Configuration Step

1. Select [Advanced / STP / Port Information] in the navigation bar and enter the STP [Port information] interface.

2. The STP current running information can be viewed in the [Port Information] interface.

3. Click [Refresh] to show the latest running information.

STP Port Info	Description
STP Enabled	Enabled: STP in Enabled Status Disable: STP in Disable Status
Priority	Port Priority
Role	Root Port: The root port, which connects to the port in the direction of the root bridge, provides the minimum path overhead. Designated Port: A port that connects to the root port and provides minimal path overhead Disable Port: It's not responsible for packets Forwarding, blocked state Alternate Port: which provides an alternate path from the current root port to the root bridge.

	Backup Port: It provides a backup path for the specified port.
PartnetVersion	STP/RSTP
State	Forwarding/Block
AdminPathCost	Path cost value
AutoPathCost	Disable: Disable auto path cost Enable: Enable auto path cost
OperPathCost	Operating path cost
OperEdge	Disable: Non-edge port Enable: Edge port
OperP2P	Disable: Non-point to point mode Enable: Point to point mode

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