Lecture 8b - Spanning Tree Protocol - Basics

Type	Lecture
Materials	Empty
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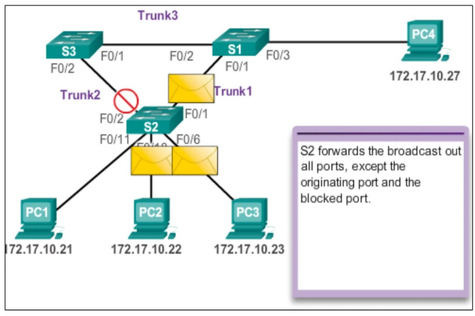
1. Introduction

- STP ensures that there is **only one logical path** between all destinations on the network by intentionally blocking redundant paths that could cause a loop

  ⇒ Loop-free network
- A port is considered **blocked** when user data is **prevented** from **entering or leaving that port**. This **does not include** bridge protocol data unit (**BPDU**) frames that are used by STP to prevent loops.
- The **physical paths** still exist to provide **redundancy**, but these paths are **disabled** to prevent the **loops** from occurring.
- If the path is ever needed to compensate for a network cable or switch failure, STP **recalculates** the paths and **unblocks the necessary ports** to allow the **redundant path** to become active



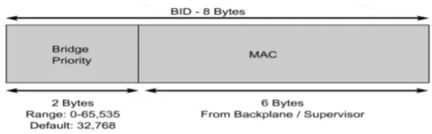
- STP uses the **Spanning Tree Algorithm (STA)** to determine which switch **ports** on a network need to be **blocked**
- **The algorithm** selects a single **switch** as the **root bridge** and uses it as the reference point for all STA calculations
  - **Three steps:**
    - Elect one root bridge/switch
    - Elect the root port on all non-root bridges
    - Elect the designated and non-designated ports

2. Port Roles in a Spanning Tree Network

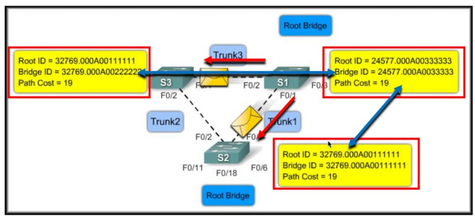
- **Root port** – port with **cheapest path** to **root bridge**
  - **Lowest** next hop's **bridge ID** and then **port ID** are **tiebreakers**
  - Only **one root-port** for each **non-root** bridge
  - Can **send** and **receive** traffic
- **Designated ports** – all **other active ports**
  - Each link **MUST** have **one designated port**
  - **Other end** of segment of **root port**, OR **end** with **cheapest path** to root bridge (bridge ID is tiebreaker)
  - On the **root bridge**, **all ports** are **designated ports**
  - Can **send** and **receive** traffic
- **Non-designated ports** – all other ports
  - **Sends no** traffic (**except BPDU**)
  - **Drops all** received traffic (**except BPDU**)

3. Step 1 - Electing the Root Bridge

- **All switches** in the **broadcast domain** participate in the **election process**:
  - After a switch boots, it sends out **BPDU** frames containing the **switch BID** and the **current root ID** every 2 seconds
  - **Initially**, each switch **identifies itself** as the **root**
- **As switches receive BPDU frames from adjacent switches:**
  - Update **root ID** based on information from other switches
  - Forward **new BPDU frames** with the **lower root ID** to other adjacent switches
  - Eventually, the switch with the **lowest BID** ends up being identified **as the root bridge** on all switches
  - Regular BPDU frames ensures re-election if a switch fails



- **Bridge ID (BID)** is used to identify each bridge/switch
- The **BID** is used in determining the **root bridge**
- **Consists of two components:**
  - A **2-byte Bridge Priority:** Cisco switch defaults to 32,768 (decimal)
  - A **6-byte MAC address** (hexadecimal)
- **Lowest Bridge ID** is the **root**.
- If all devices have the same priority, the bridge with the lowest MAC address becomes the root bridge.



- If the **root bridge fails**, the **election** process begins again.

4. Step 2 – Electing Root Ports

- After the **root bridge** has been **elected**, the **STA** starts the process of **determining the best paths** to the **root bridge**
- We **sum the individual port costs** along the **path** from the **destination to the root bridge**

5. Step 3 – Electing (Non-)Designated Ports

- **All ports** on the **root bridge** will be **Designated** ports
- **All links connected to root ports** will be **Designated** ports
- On other links, **port with lowest path cost** to the root bridge is **designated**, other side is **Non-designated**
- **Lowest BID** is used as a **tie breaker**