Eth-Trunk, iStack, and CSS

1 Eth-Trunk, iStack, and CSS

1.1 Network Reliability Requirements

1.1.1 Overview

- **Network reliability** ensures continuous network services Even with failures.
- Implemented at various levels: **card**, **device**, **link**.
- Essential due to the impact of Confusion on services and economics.

1.1.2 Card Reliability

1.1.2.1 Modular Switch Components

- **Chassis**: Slots for cards and modules for inter-card communication.

- **Power Module**: Supplies power to the device.
- **Fan Module**: Dissipates heat within the device.
- **Main Processing Unit (MPU)**: Manages control plane and management plane.

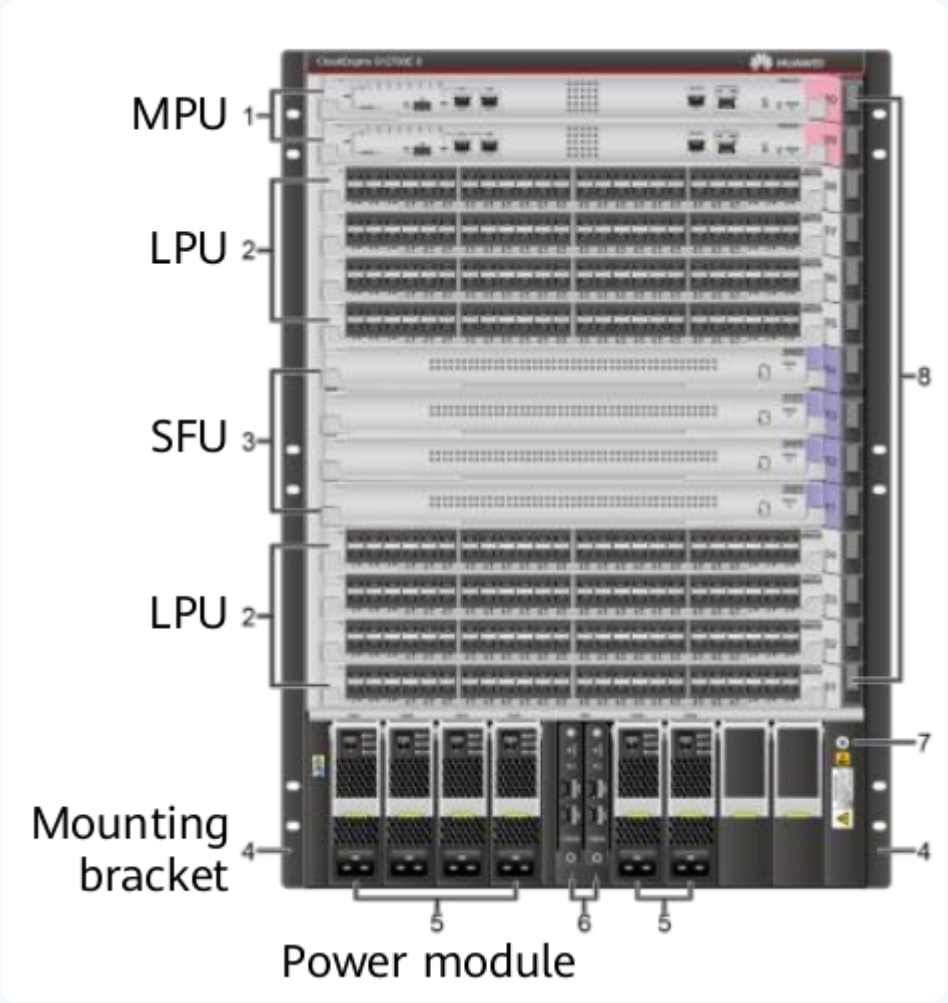
> **Control Plane:** Handles the network routing decisions, determining how data packets should flow through the network.

> **Management Plane:** Involves tasks related to administering the network, such as configuration, maintenance, and monitoring.

- **Switch Fabric Unit (SFU)**: Handles data plane with high-speed data channels.

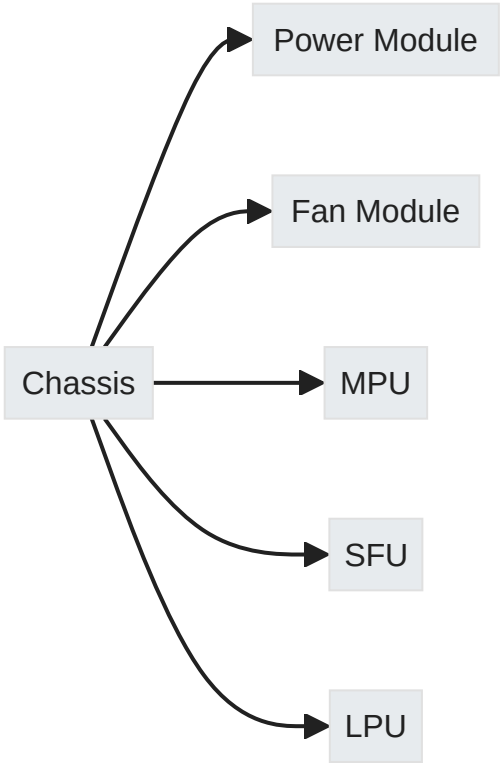
> **data plane:** is the part of a network that carries user traffic from one point to another.

- **Line Processing Unit (LPU)**: Provides data forwarding and physical interfaces.



1.1.2.2 Fault Tolerance

> The failure of a single MPU or SFU does not Stop the switch's operation. Faulty LPUs affect only their own interfaces.

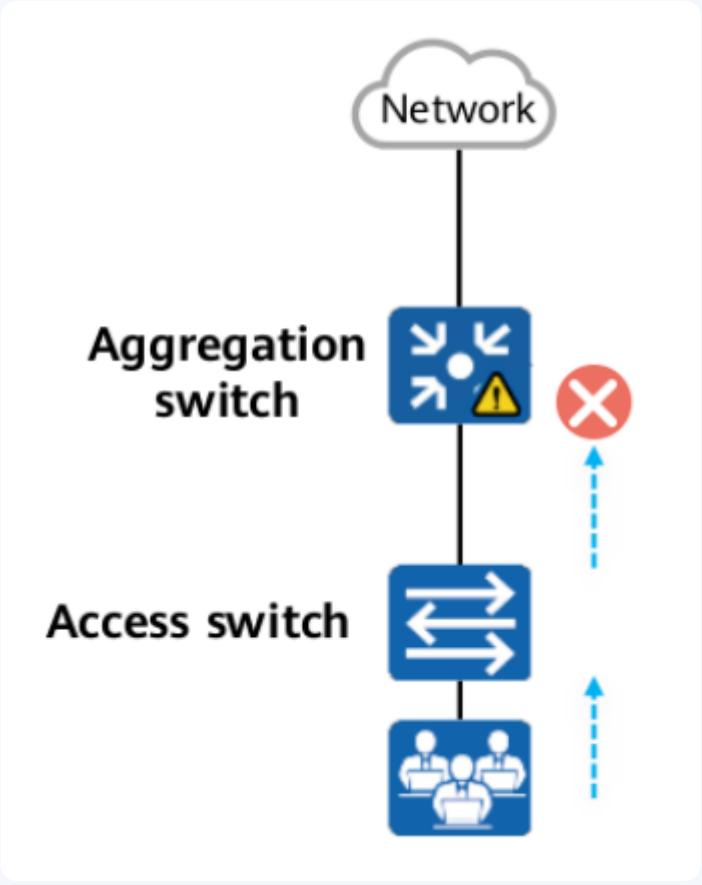


1.1.3 Device Reliability

1.1.3.1 Redundancy Modes

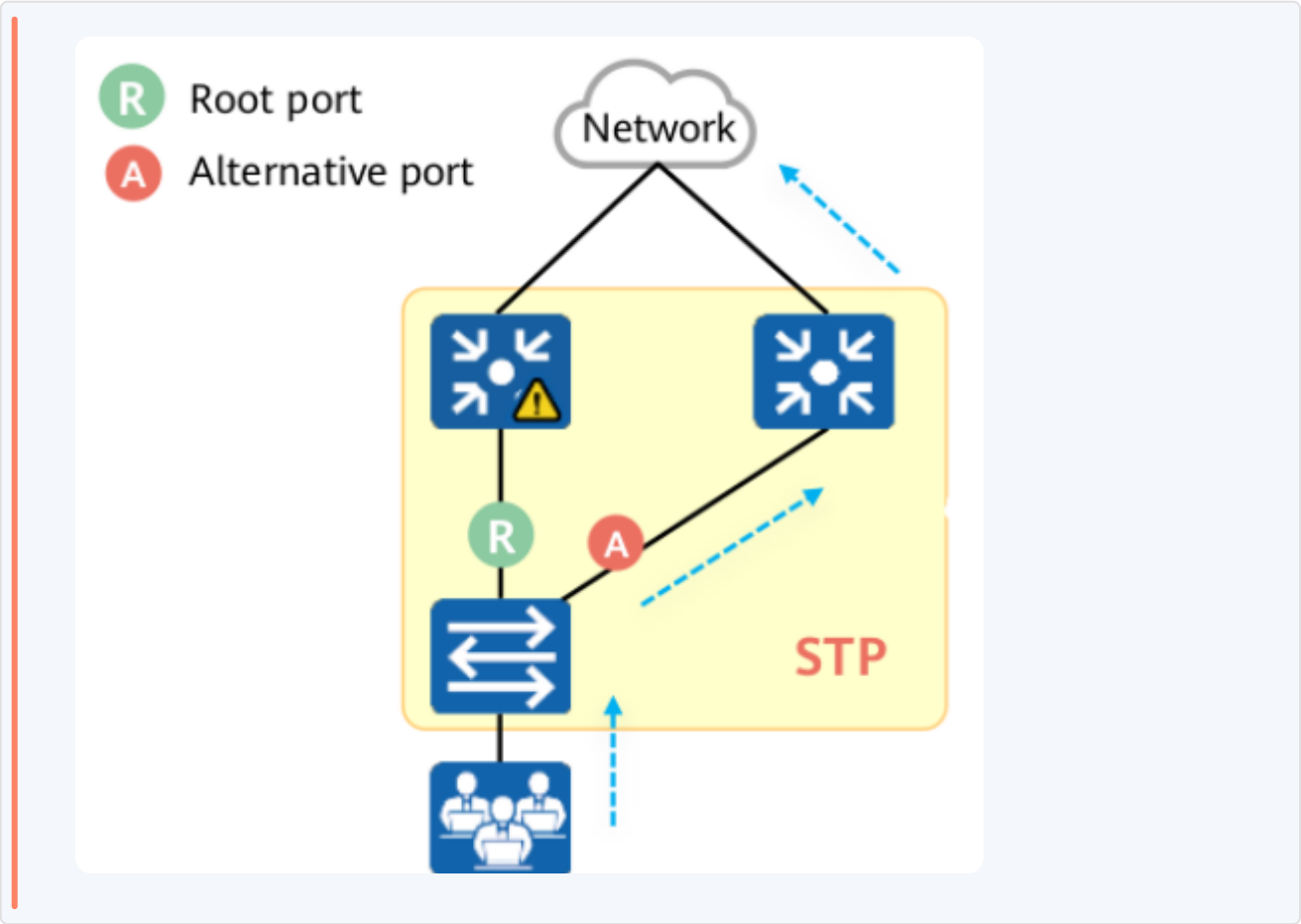
1.1.3.1.1 No Backup Mode

- If upstream fails, all downstream networks are interrupted.



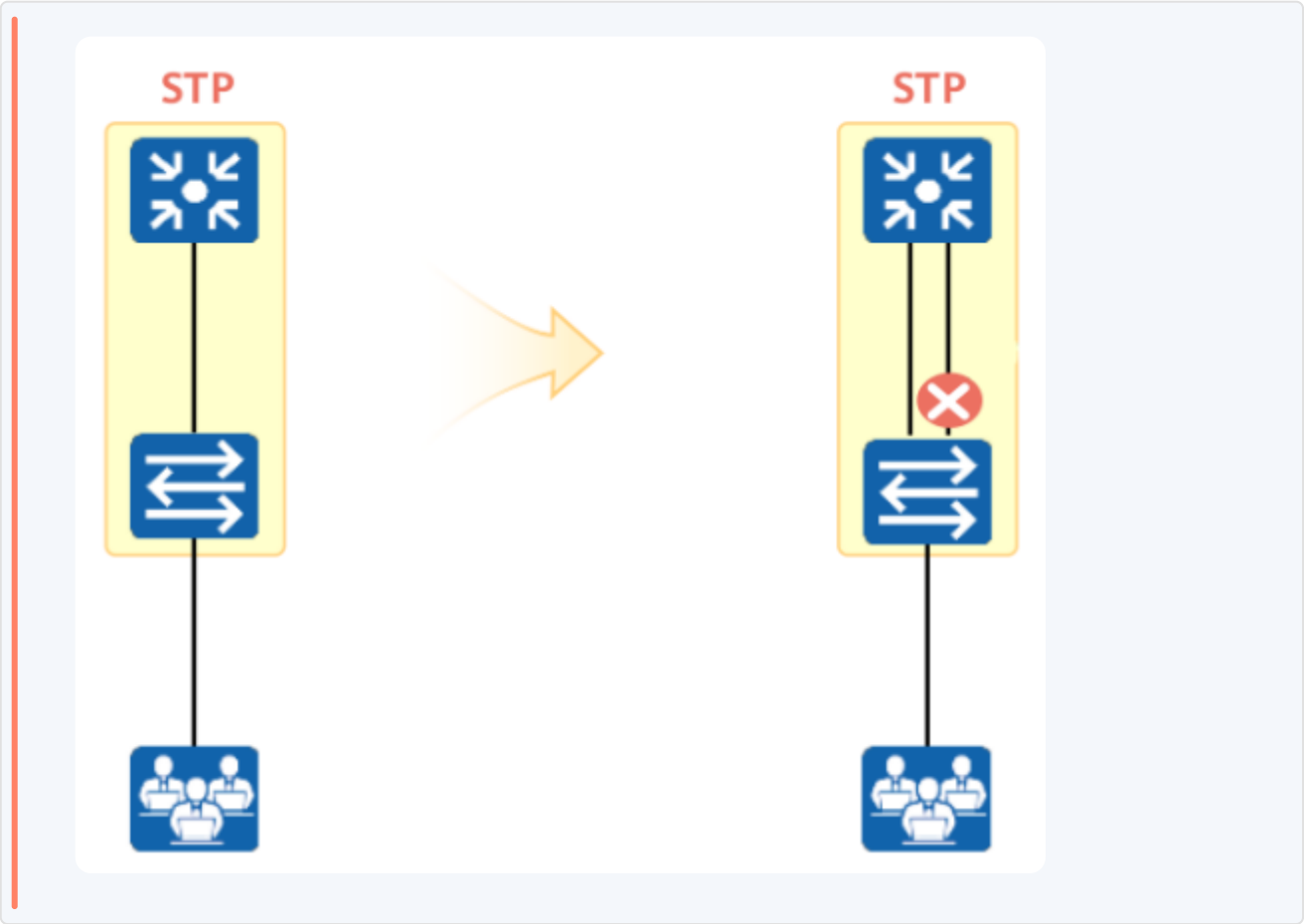
1.1.3.1.2 Master/Backup Mode (Dual-Homing)

- Alternative port takes over if root port fails. Ensures continuity.



1.1.4 Link Reliability

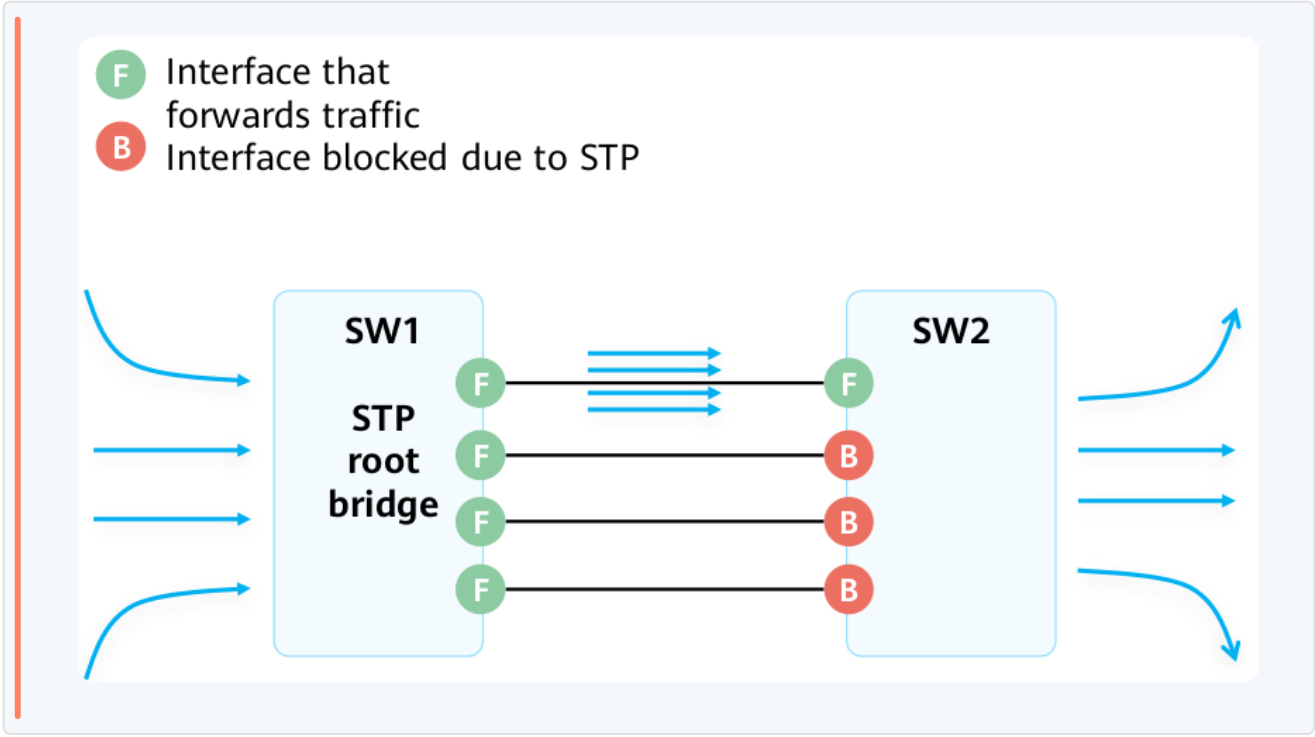
- STP blocks additional links to prevent loops; these serve as backups.



1.2 Principle and Configuration of Link Aggregation

1.2.1 Principle

1.2.1.1 Increasing Link Bandwidth

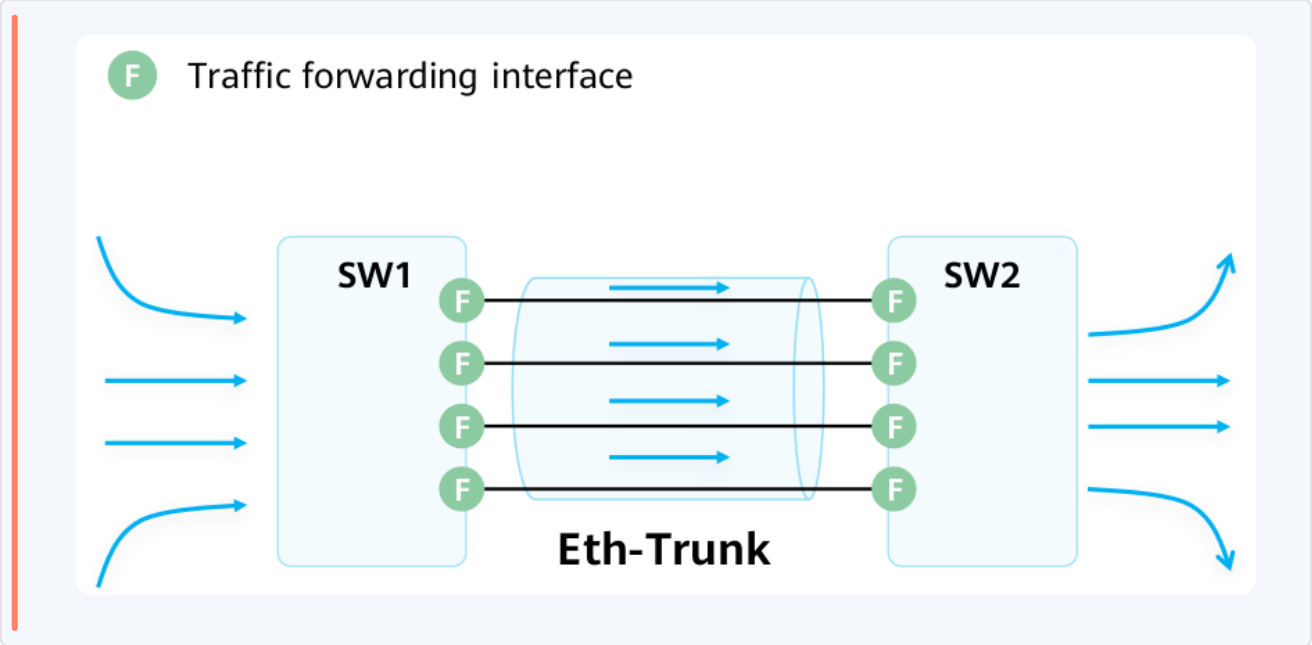


Note

With STP, only one link is active for forwarding traffic. Other links are in a blocking state.

1.2.1.2 Eth-Trunk (Ethernet Link Aggregation)

- Combines multiple physical links into a single logical link.
- Increases total link bandwidth without hardware upgrades.



1.2.1.2.1 Basic Concepts of Eth-Trunk

1.2.1.2.1.1 LAG (Link Aggregation Group)

- A logical interface created from multiple physical links.
- Known as an LAG interface or Eth-Trunk interface.

1.2.1.2.1.2 Member Interface and Member Link

- **Member interfaces:** Physical interfaces within an Eth-Trunk.
- **Member links:** actual physical connections.

1.2.1.2.1.3 Active vs Inactive Interfaces/Links

- **Active Interface/Link**: Selected for data forwarding.
- **Inactive Interface/Link**: Not selected for data forwarding.

1.2.1.2.1.4 Link Aggregation Modes

Mode	Description
Manual	No LACP; manual configuration required.
LACP	Uses LACP protocol for dynamic configuration.

> LACP (Link Aggregation Control Protocol) **automatically** manages the bundling of multiple network connections, while Manual mode requires the user to configure and manage these connections **without any protocol assistance.**

1.2.1.2.1.5 Configuration Consistency in Eth-Trunk

> ⚠ **Warning**
>
> **All member interfaces must have consistent parameters:**
>
> - Interface rate (speed)
> - Duplex mode (full/half duplex)
> - VLAN configurations (access/trunk/hybrid type, allowed/default VLANs)

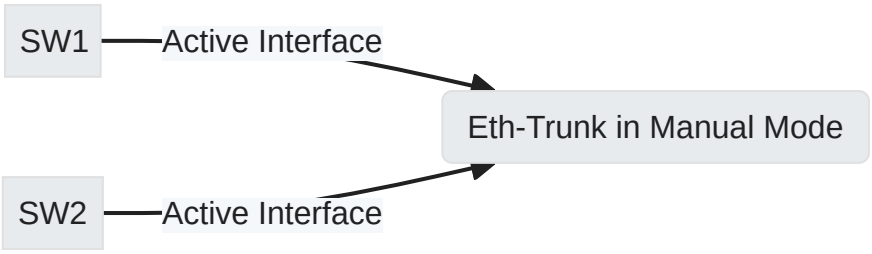
1.2.1.2.1.6 Advantages of Using Eth-Trunk

1. **Enhanced Throughput:** Combines bandwidth of individual links.
2. **Redundancy:** Provides link failover capabilities.
3. **Flexibility:** Allows addition or removal of links without disruption.

1.2.2 Manual Mode

1.2.2.1 Overview

- An Eth-Trunk is created **manually**, and member interfaces are added **without** using Link Aggregation Control Protocol (LACP).
- Typically used when one or both devices do not support LACP.
- Traffic is evenly shared across all active links.



> All links are active and forward data.

> Traffic is automatically rebalanced among remaining active links if a fault occurs.

> **Note**
>
> Manual mode requires precise Exact as no dynamic negotiation is done to confirm settings between devices.

> **Warning**
>
> **Ensure all peer interfaces in an Eth-Trunk:**
>
> - Reside on the same device.
> - Are added to the same Eth-Trunk.

1.2.2.1.1 Physical Layer Status Only

The device only uses physical layer status to determine interface health; it cannot detect higher-level faults.

1.2.3 LACP Mode

1.2.3.1 Overview

LACP facilitates automatic creation of Eth-Trunks by exchanging LACPDUs between devices.

1.2.3.1.1 Key Terms

- **LACPDU**: A protocol data unit used by LACP to carry information like device priority, MAC address, interface priority, and interface number.
- **Actor**: The participating device in an Eth-Trunk with lowest priority based on system priority or MAC address when priorities are equal.

> **Participating:** refer to helps coordinate which links are used and how data traffic is split across them.

1.2.3.2 Priorities and Election Process

1.2.3.2.1 Device Priority

- Election by lowest system priority.

> Default system priority: `32768` .

1.2.3.2.2 Interface Priority

- Election by lowest interface priority values.

> Default interface priority: `32768` .

1.2.3.2.3 Active Link Election

---

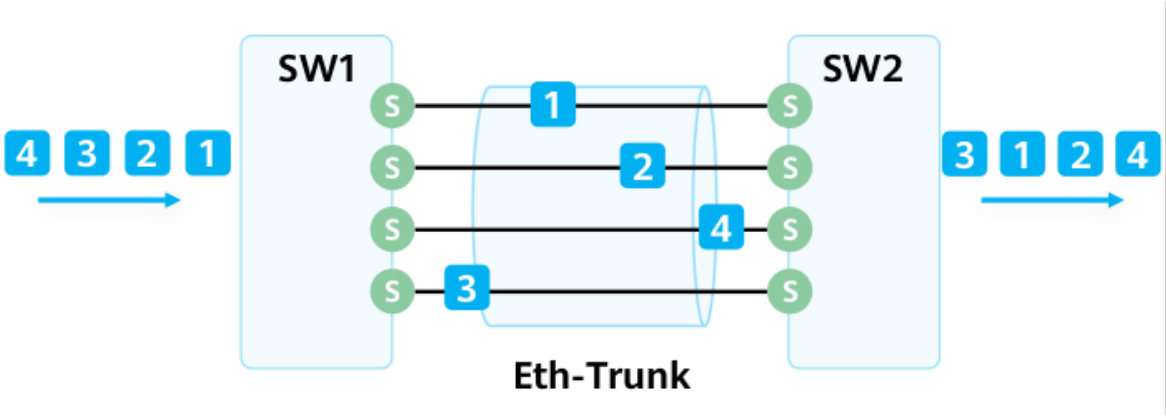
1. Devices exchange LACPDUs To Compare priority to elect actor.
2. Actor is determined based on lowest system priority or MAC address if priorities are equal.
3. Actor selects active interfaces based on lowest interface numbers when priorities are equal.
4. The actor informs the peer about the chosen active interface so that the peer can configure its interfaces to match.

> **Callout**
>
> **Flags used in an LACPDU to identify active interfaces:**
>
> - Synchronization (`1` for active)
> - Collecting (`1` for active)
> - Distributing (`1` for active)
>
> if flags set to `0` then the interface is inactive

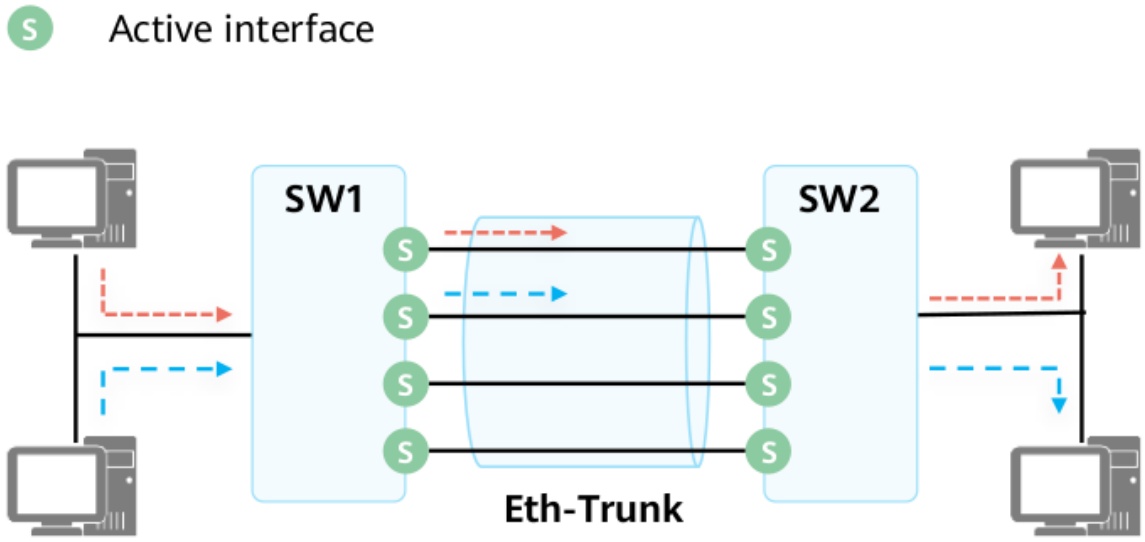
1.2.3.3 Load Balancing

1.2.3.3.1 Strategies

- **Per-packet:** Can cause out-of-order packets due to different transmission times across links.



- **Per-flow:** Ensures frames from the same flow are transmitted over the same physical link for order Uniformity.

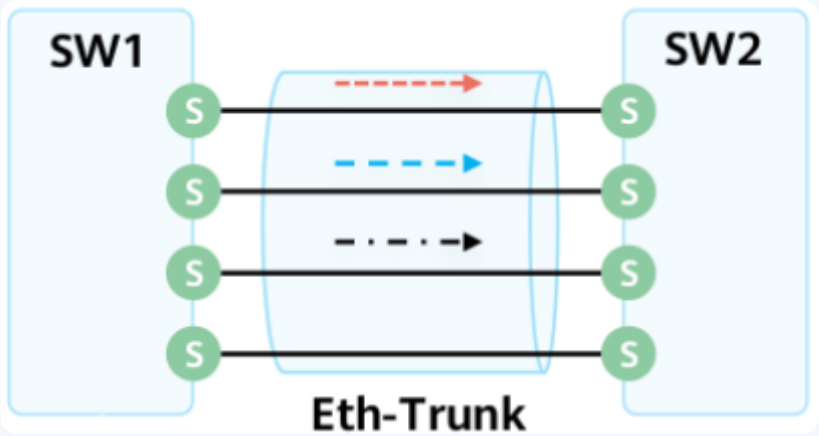


1.2.3.3.2 Load Balancing Modes

Configure load balancing modes based on traffic characteristics like IP or MAC addresses:

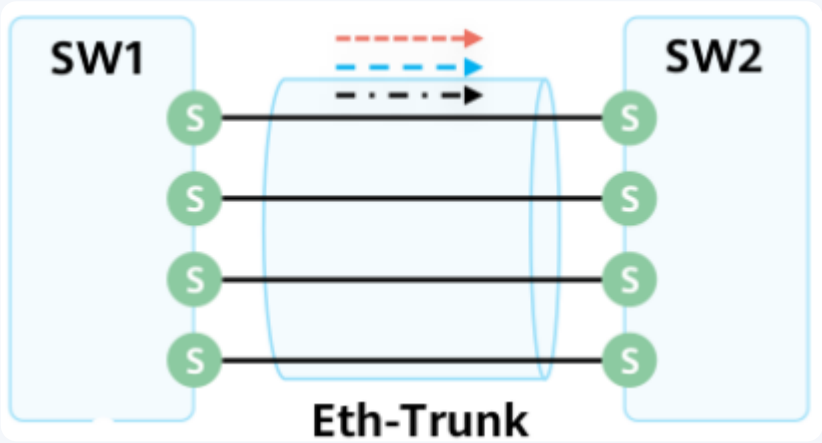
- **Proper load balancing algorithm:** IP-based load balancing algorithm that keeps the MAC addresses of the source and destination unchanged.

> Each packet may travel various links as the destination IP address typically changes.



- **Improper load balancing algorithm:** MAC-based load balancing algorithm that keeps the IP addresses of the source and destination unchanged.

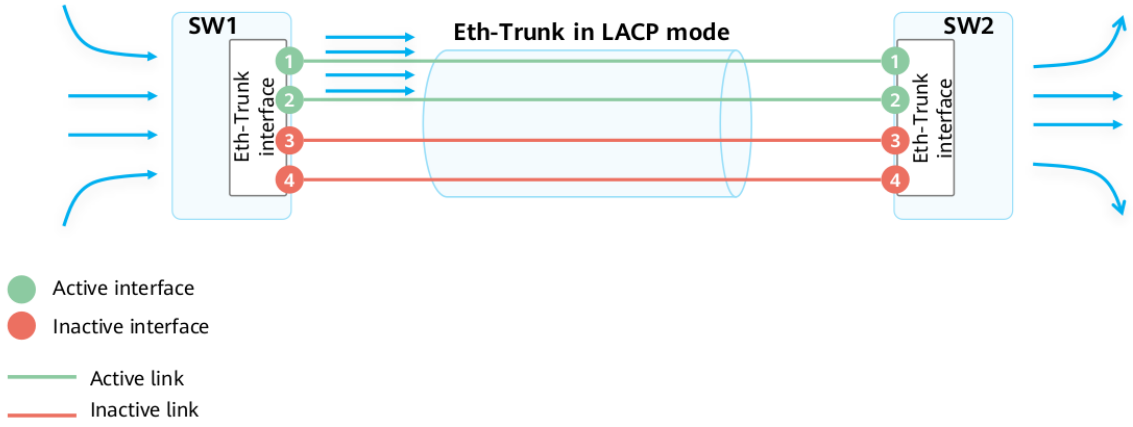
> Each packet might travel the same links, as the MAC address usually remains unchanged for a single hop towards the same destination.



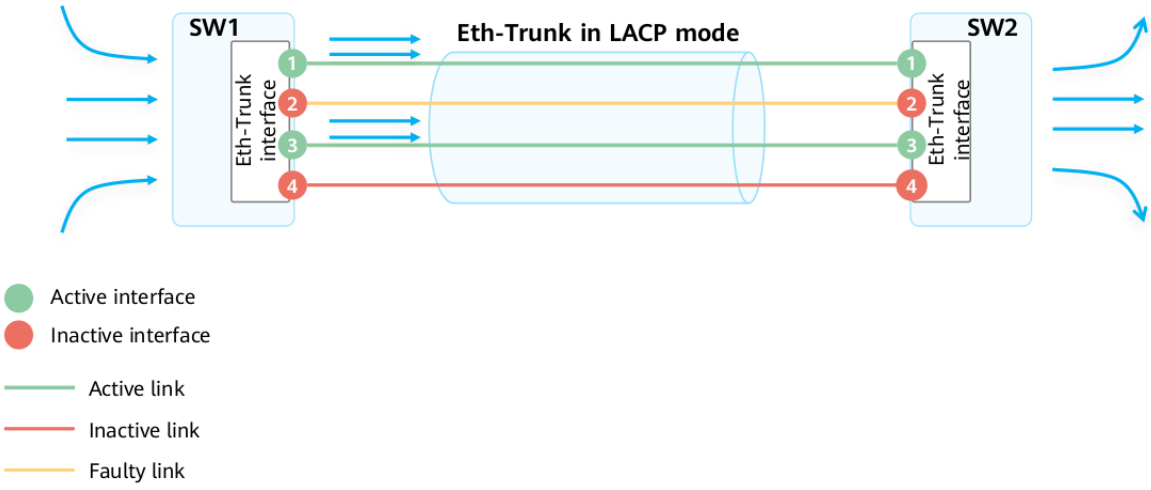
1.2.3.4 Maximum Number of Active Interfaces

You can configure a maximum number of active interfaces:

- Extra interfaces serve as backups (inactive).



- If an active link fails, Lowest-priority inactive link becomes active.



1.2.4 Typical Application Scenarios

1.2.4.1 Eth-Trunk Applications

- Between Switches (Aggregation Layer)
- Between Switch and Server (Access Layer)
- Between a Switch and iStack (Stacking)
- Heartbeat Link of Firewalls in Hot Standby Mode

1.2.5 Configuration Example

1.2.5.1 Creating an Eth-Trunk

```Markdown
[Huawei] interface eth-trunk <trunk-id>
```

1.2.5.2 Configuring Link Aggregation Mode

```Markdown
[Huawei-Eth-Trunk1] mode <lacp> || <manual load-balance>
```

> Both ends of the Eth-Trunk must have the same aggregation mode configured.

1.2.5.3 Adding Interfaces to an Eth-Trunk

1.2.5.3.1 From Ethernet Interface View

```Markdown
[Huawei-GigabitEthernet0/0/1] eth-trunk <trunk-id>
```

1.2.5.3.2 From Eth-Trunk View

```
[Huawei-Eth-Trunk1] trunkport <interface-type>
<interface-number>
```

1.2.5.4 Mixed-Rate Link Configuration

```
[Huawei-Eth-Trunk1] mixed-rate link <option>
```

- **option:** either enable or disable

> Allows interfaces with different rates to join the same Eth-Trunk (disabled by default).

1.2.5.5 LACP Configuration

1.2.5.5.1 System Priority

```
[Huawei] lacp priority <priority>
```

> Default 32768.

1.2.5.5.2 Interface Priority within an Eth-Trunk

```
[Huawei-GigabitEthernet0/0/1] lacp priority <priority>
```

> Must run this command after adding the interface to the Eth-Trunk.

> Default 32768.

1.2.5.6 Active Links Configuration

1.2.5.6.1 Maximum Number of Active Interfaces (`LACP Mode`)

```Markdown
[Huawei-Eth-Trunk1] max active-linknumber <number>
```

> Configure equal values on both ends for maximum active links in LACP mode.

> Different switches have varying maximums for active interfaces

1.2.5.6.2 Minimum Number of Active Interfaces (`Manual & LACP Modes`)

```Markdown
[Huawei-Eth-Trunk1] least active-linknumber <number>
```

1.3 Overview of iStack and CSS

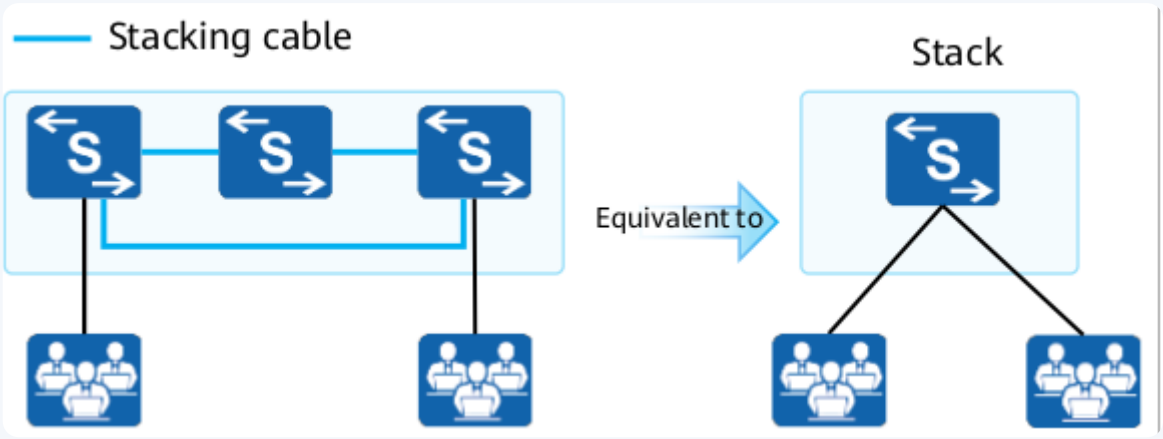
1.3.1 Key Terms

1.3.1.1 iStack

- **Definition**: A technology that allows multiple switches with iStack capabilities to be connected using stacking cables, forming a single logical switch for data forwarding.
- **Use Case**: Increases port density and uplink bandwidth; provides redundancy.

> Fixed switches support iStack.

> **Fixed switches:** network switches with a set number of ports and features that cannot be expanded by adding modules or cards.

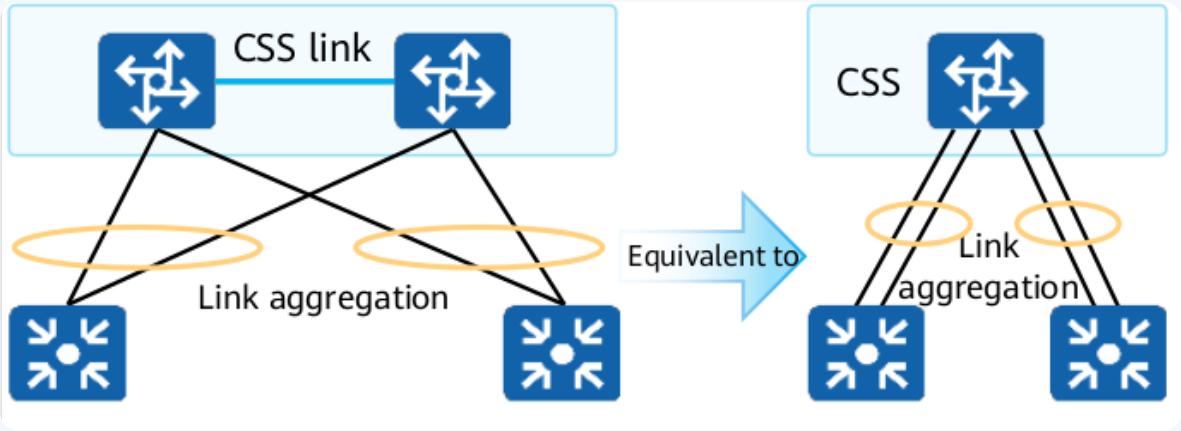


1.3.1.2 CSS (Cluster Switch System)

- **Definition**: A system where two CSS-capable switches are combined into one logical switch.
- **Use Case**: Simplifies network by eliminating the need for MSTP or VRRP; enhances network convergence and reliability.

modular switches support CSS

Modular switches: devices that can be customized with extra parts for different functions as your needs grow.



1.3.2 Advantages of iStack and CSS

Both technologies aim to simplify operations & management (O&M) while enhancing reliability by preventing single points of failure.

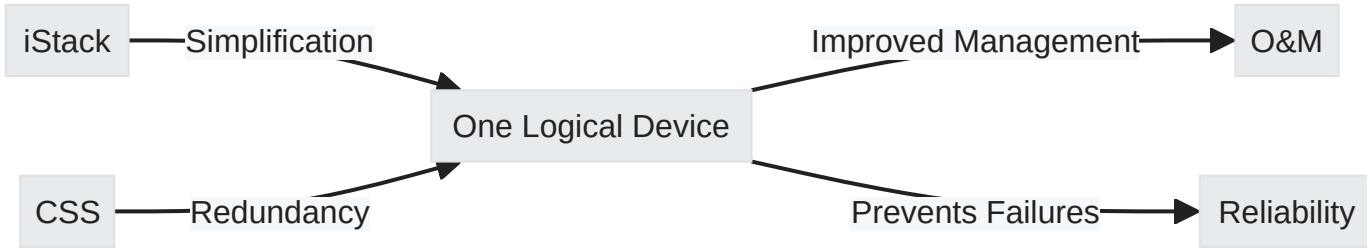
- **Many-to-one virtualization:** Switches can be virtualized into one logical switch (CSS) that has a unified control plane for unified management.
- **Unified forwarding plane:** Physical switches in a CSS use a unified forwarding plane, and share and synchronize forwarding information in real time.

The forwarding plane is the part of a network device responsible for moving packets to their destination based on pre-determined rules.

Tip

Control plane decides where packets should go while the forwarding plane actually moves the packets to their destination

- **Inter-device link aggregation:** Links between physical switches are aggregated into a single Eth-Trunk interface to interconnect with downstream devices.



1.3.3 Applications

1.3.3.1 Extending Bandwidth & Redundancy Backup

- **iStack**: Increases uplink bandwidth using multiple physical links in an Eth-Trunk, improving reliability.

1.3.3.2 Extending Port Quantity

- **iStack**: Adds new switches to increase the number of accessible ports when current port density is insufficient.

1.3.3.3 Simplified Network Configuration

- **CSS**: Forms a single logical device from two devices, streamlining network setup without MSTP or VRRP.