Data Communication Network Basis

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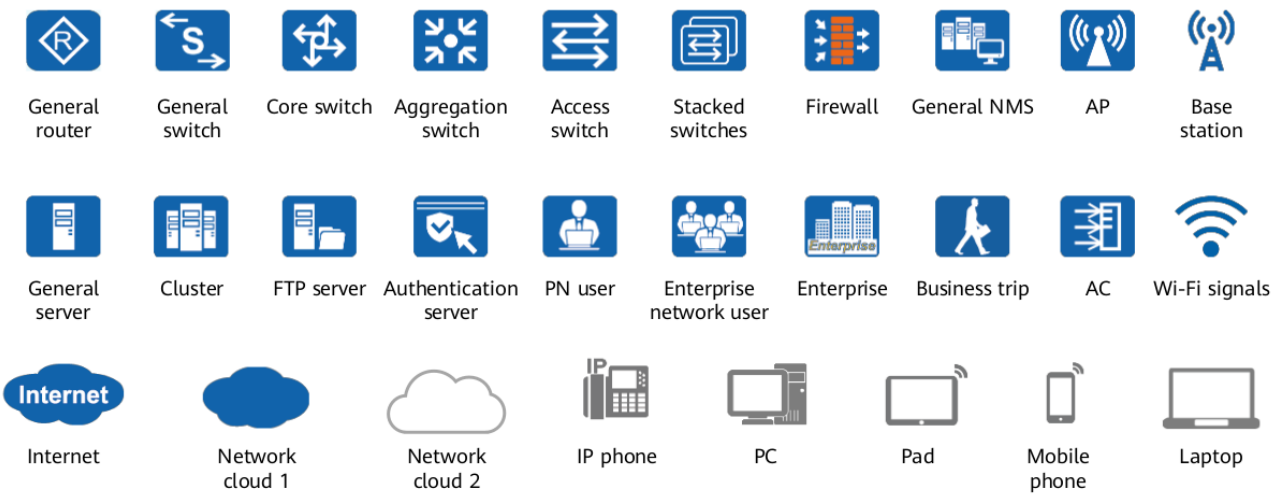
1.1 Huawei Device Icons



1.2 Communication and Networks

1.2.1 Concept of Network Communication

- **Communication:** Information exchange through various mediums and behaviors.

- **Network communication:** Occurs between terminal devices via a computer network.

> **Terminal devices** are the end-user devices such as computers, phones, or tablets that connect to a network for communication.

1.2.1.1 Examples of Network Communication:

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1. Two computers sharing files through a network cable.
2. Multiple computers exchanging files via a router.
3. Downloading files from the Internet onto a computer.

1.2.2 Information Transfer Process

1.2.2.1 Analogy: Express Delivery vs Network Communication

Express Delivery	Network Communication
Objects packaged with delivery details	Data payload encapsulated with header/tail
Sorted at distribution centers	Routed through gateways based on destination address
Delivered to recipients, unpacked for confirmation	Data packets verified by destination computer

1.2.2.2 Common Terms

Term	Description
Data payload	Core information exchanged in communication.
Packet	Unit switched/transmitted on the network containing header, payload, tail.
Header	Information added before data for transmission facilitation.
Tail	Information added after data (not always present).
Encapsulation	Adding header/tail to form packet process.
Decapsulation	Removing header/tail to obtain original data process.
Gateway	Device for protocol conversion, route selection, exchange functions.
Router	Device that selects forwarding paths for packets based on destination address.
Terminal device	End devices in communication systems as senders or receivers (e.g., PC, VoIP).

1.2.3 Network Devices and Their Functions

1.2.3.1 Switches

> Switches connect end users to the network and facilitate Layer 2 switching inside broadcast domains.

1.2.3.2 Routers

> Routers determine paths for packet forwarding across different networks while isolating broadcast domains.

1.2.3.3 Firewalls

> Firewalls act as security barriers between trust zones—controlling access and monitoring traffic between networks.

1.2.3.4 Wireless Devices:

1.2.3.4.1 WLAN Overview:

WLAN uses radio waves or other wireless signals as transmission media instead of cables.

1.2.3.4.2 WLAN Devices:

- **Fat AP**: Independent operation suited for home use; simple functions; lower cost; requires individual configuration;mainly only one used for houses.
- **Fit AP**: Works with Access Controllers; used in medium/large enterprises; managed by AC; more complex features than Fat APs;mainly used more than one.
- **Access Controller (AC)**: Manages Fit APs; provides wireless control services like large capacity & high performance; deployed at aggregation layer.

1.3 Network Types and Topologies

1.3.1 Network Types

1.3.1.1 LAN (Local Area Network)

- **Coverage**: A few square kilometers (e.g., within a building or campus).
- **Use Cases**: Office networks, cyber bars, home networks.
- **Technologies**: Ethernet, Wi-Fi.

1.3.1.2 MAN (Metropolitan Area Network)

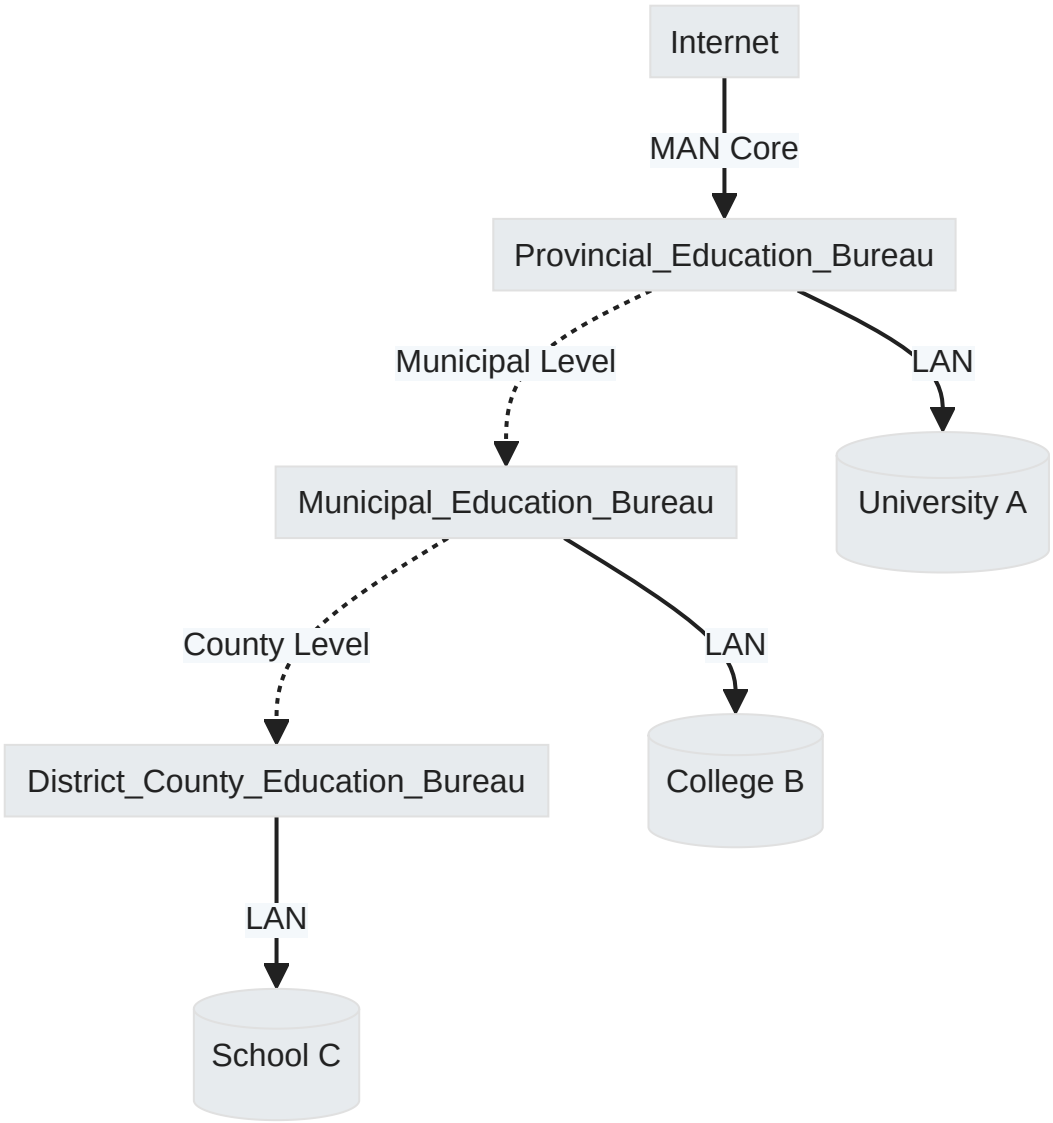
- **Coverage**: City-wide (expands the access scope of LANs).
- **Use Cases**: Broadband MANs, education MANs, e-government private lines.
- **Technologies**: Higher-speed Ethernet (10 Gbit/s or 100 Gbit/s), WiMAX.

1.3.1.3 WAN (Wide Area Network)

- **Coverage**: Large geographical areas; from tens to thousands of square kilometers.
- **Use Cases**: Connecting multiple LANs/MANs across cities or countries.
- **Technologies**: HDLC, PPP.

> **Info**
>
> The Internet is an example of a WAN.

1.3.2 Hierarchical Structure in Education Industry



Diagram

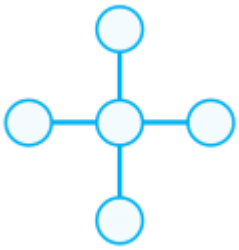
This diagram represents how LANs at educational institutions are connected through various levels of MAN cores up to the provincial level and eventually to the Internet.

1.3.3 Network Topology Types

Logical Structure:
Defines how data flows, is managed, and is controlled within the network, independent of physical connections.

> **Physical Structure:**
> Refers to the actual hardware and wiring through which data travels in a network.

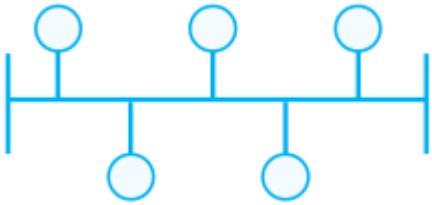
1.3.3.1 Star Topology



Advantages:

- Easy addition of new nodes.
- Centralized monitoring possible.
  Disadvantages:
- Central node failure impacts entire network.

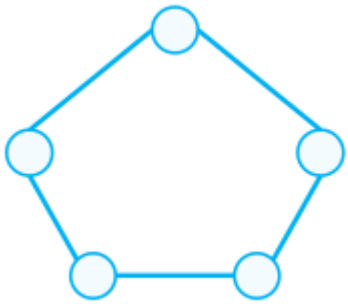
1.3.3.2 Bus Topology



Advantages:

- Simple installation; saves cable resources.
- Node failure usually doesn't affect entire network.
  Disadvantages:
- Bus fault affects all communications; low security due to shared medium.

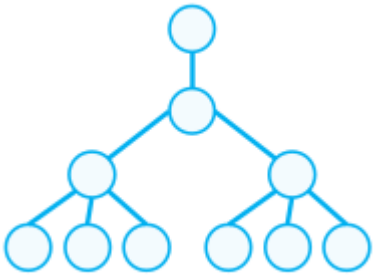
1.3.3.3 Ring Topology



Advantages:

- Saves cable resources.
  Disadvantages:
- Adding new nodes is complex; breaking the ring is required for expansion.

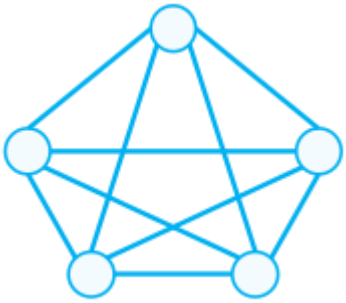
1.3.3.4 Tree Topology



Advantages:

- Easy to add more devices by connecting additional star networks together.
  Disadvantages:
- If a central node (like a root or branch) fails, it can disrupt communication for all devices connected to it.

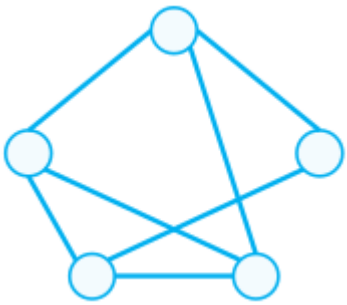
1.3.3.5 Full-Mesh Topology



Advantages:

- High reliability and communication efficiency.
  Disadvantages:
- High costs due to many ports and cables; difficult expansion.

1.3.3.6 Partial-Mesh Topology



Advantages:

- Lower cost than full-mesh topology.
  Disadvantages:
- Lower reliability compared to full-mesh topology.

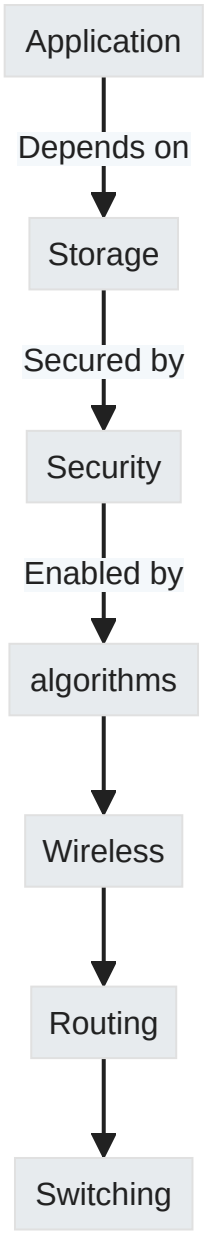
> **Tip**
>
> In practice, topologies are often combined based on specific needs for cost-efficiency and reliability.

1.4 Network Engineering and Network Engineers

1.4.1 Overview of Network Engineering

- Planning, design, implementation, Activation, and troubleshooting of network solutions.
- Integrates hardware devices, software, and technologies to create cost-effective systems.

1.4.1.1 Key Technical Modules



1.4.2 Role of a Network Engineer

- Master professional network technologies.
- Develop solutions based on customer requirements.
- Mobilize resources for project implementation.
- Provide training and documentation post-implementation.

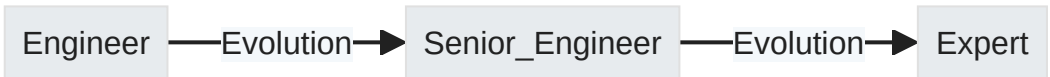
1.4.3 Technology Development Path for Network Engineers

1.4.3.1 Overall Capabilities

> Solution design, network planning, implementation, troubleshooting, and optimization.

1.4.4 Huawei Certification for Talent Development

1.4.4.1 Career Paths Provided by Certification



1.4.5 Huawei Datacom Certification Portfolio

- **HCIA-Datacom:** A single course with an exam that covers fundamental data communication, internet traffic direction, network security, wireless tech, SDN/NFV, network automation, and network setup basics.
- **HCIP-Datacom:** One core course with an exam plus a choice of six specialized courses in advanced networking topics. You must complete the main course and can select from options like routing, network design, WAN planning, SD-WAN technologies, or network automation.
- **HCIE-Datacom:** An advanced-level course split into two parts with one comprehensive exam. It covers traditional networking and command-line skills as well as Huawei's SDN solutions for enterprise networks.