Wireless Communication

tfal - KUMO

What's wireless communication?

Transferring information between two or more points without physical connection

1. Radio Wave
2. Infrared
3. Laser Beam

Types of Wireless Networks

Type	Range	Applications	Standards
Personal area network (PAN)	Within reach of a person	Cable replacement for peripherals	Bluetooth, ZigBee, NFC
Local area network (LAN)	Within a building or campus	Wireless extension of wired network	IEEE 802.11 (WiFi)
Metropolitan area network (MAN)	Within a city	Wireless inter-network connectivity	IEEE 802.15 (WiMAX)
Wide area network (WAN)	Worldwide	Wireless network access	Cellular (UMTS, LTE, etc.)

https://hpbn.co/introduction-to-wireless-networks/

IEEE802.11

- A set of media access control (MAC) and physical layer (PHY) specifications for implementing wireless local area network (WLAN) computer communication in the 900 MHz and 2.4, 3.6, 5, and 60 GHz frequency bands.

- Created and maintained by the Institute of Electrical and Electronics Engineers (IEEE)

- Has many protocols and still in development to provide faster data transfer.
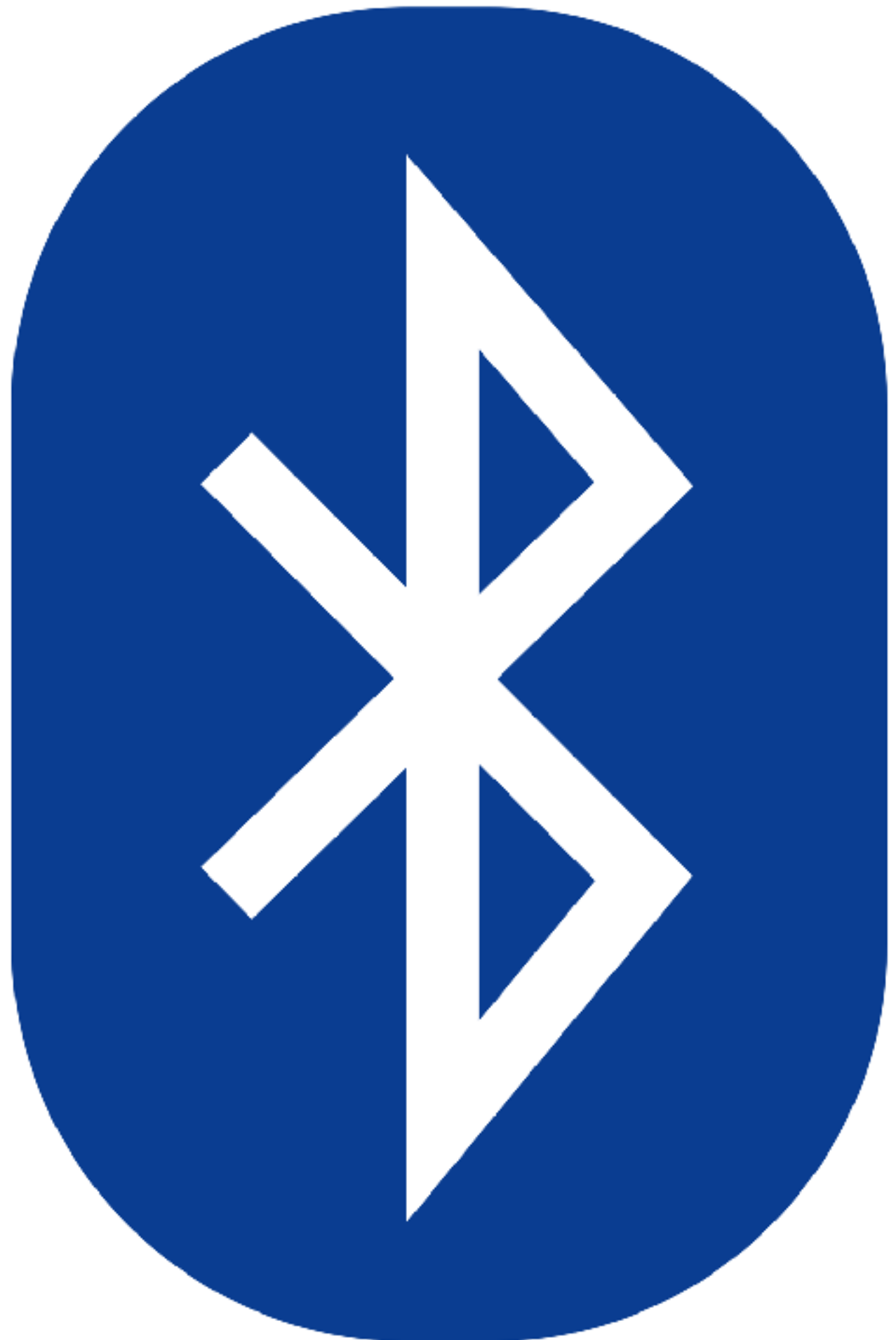
IEEE802.11b & g

- Invented in early 2000

- Works in the 2.4 GHz band

- Max transfer rate
  - b = 11Mbit/s
  - g = 54 Mbit/s

IEEE802.11n

- Published in 2009

- Works in the 2.4 & 5 GHz band

- maximum net data rate from 54 Mbit/s to 600 Mbit/s

Bluetooth

- Same as IEEE802.11b/g, utilize 2.4GHz frequency

- Bluetooth v.2 has maximum transfer speed of 3Mbps

- Depending on the radio wave, able to reach 1m, 10m, even 100m

- Able to connect up to 8 devices

- Applied on laptops, smartphone, keyboard, mouse, etc.

WiMAX

- Worldwide Interoperability for microwave access

- Able to utilize both DSL and FTTH

- Categorized as MAN (metropolitan area network)

- Utilizing IEEE802.16

ZigBee

- Categorized as PAN (Personal area Network)

- Based on IEEE802.15.4

- Usually utilized for short-range low-rate wireless data transfer e.g. to control light at home

PPP (Point-to-Point Protocol)

A datalink protocol used to establish direct communication between two nodes, enable two routers to connect directly without any host.
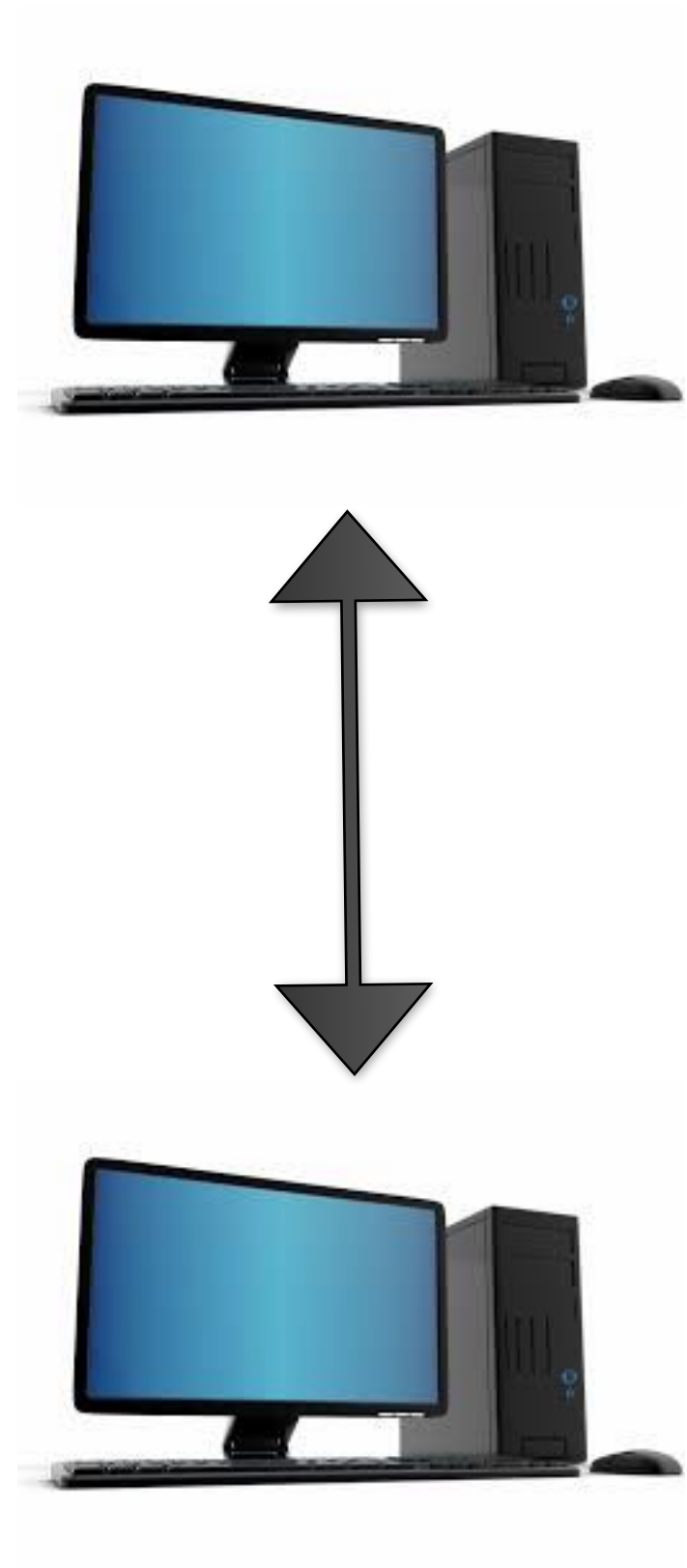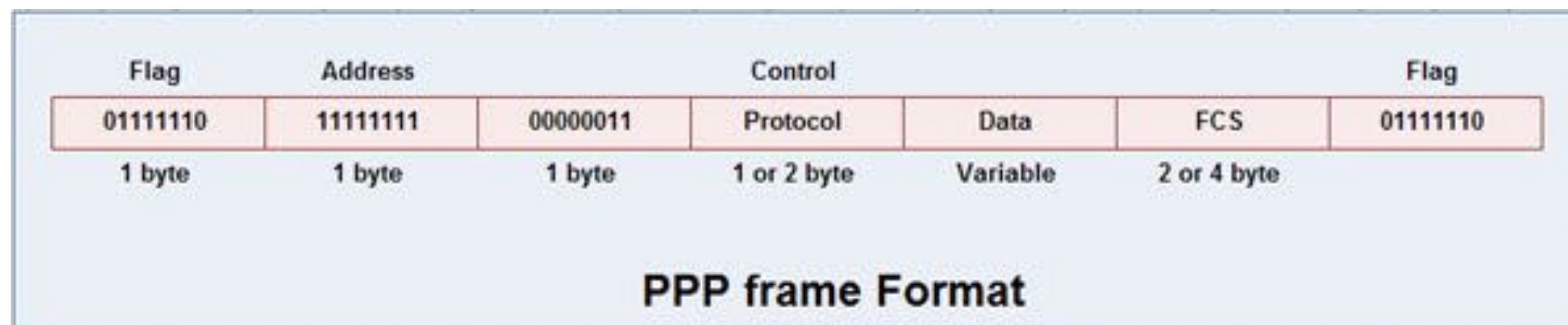
LCP & NCP

LCP (Link Control Protocol) and NCP (Network Control Protocol) are two of three key component of PPP.

- LCP: Establish, configure, and test link as well as negotiate capabilities

- NCP: Negotiate optional configuration parameters and facilities for network layer. (PPP must have one or more of NCP; one for each higher layer)

PPP Configuration

- Authentication: Either use PAP (password authentication protocol) or CHAP (Challenge handshake authentication protocol)

- Compression: Increases the effectiveness of PPP by reducing the amount of data that travel across the link. The protocol decompresses the frame at its destination

- Error Detection: Identifies fault conditions such as loop

- Multilink: Provides load balancing several interfaces used by PPP through Multilink PPP

Flag	Address	Control				Flag
01111110	11111111	00000011	Protocol	Data	FCS	01111110
1 byte	1 byte	1 byte	1 or 2 byte	Variable	2 or 4 byte	

PPP frame Format

PPPoE

PPoE (Point-to-Point Protocol over Ethernet) is a network to encapsulate PPP frame inside ethernet frame and then connect to ISP's IP network, enabling to connect to the rest of internet.
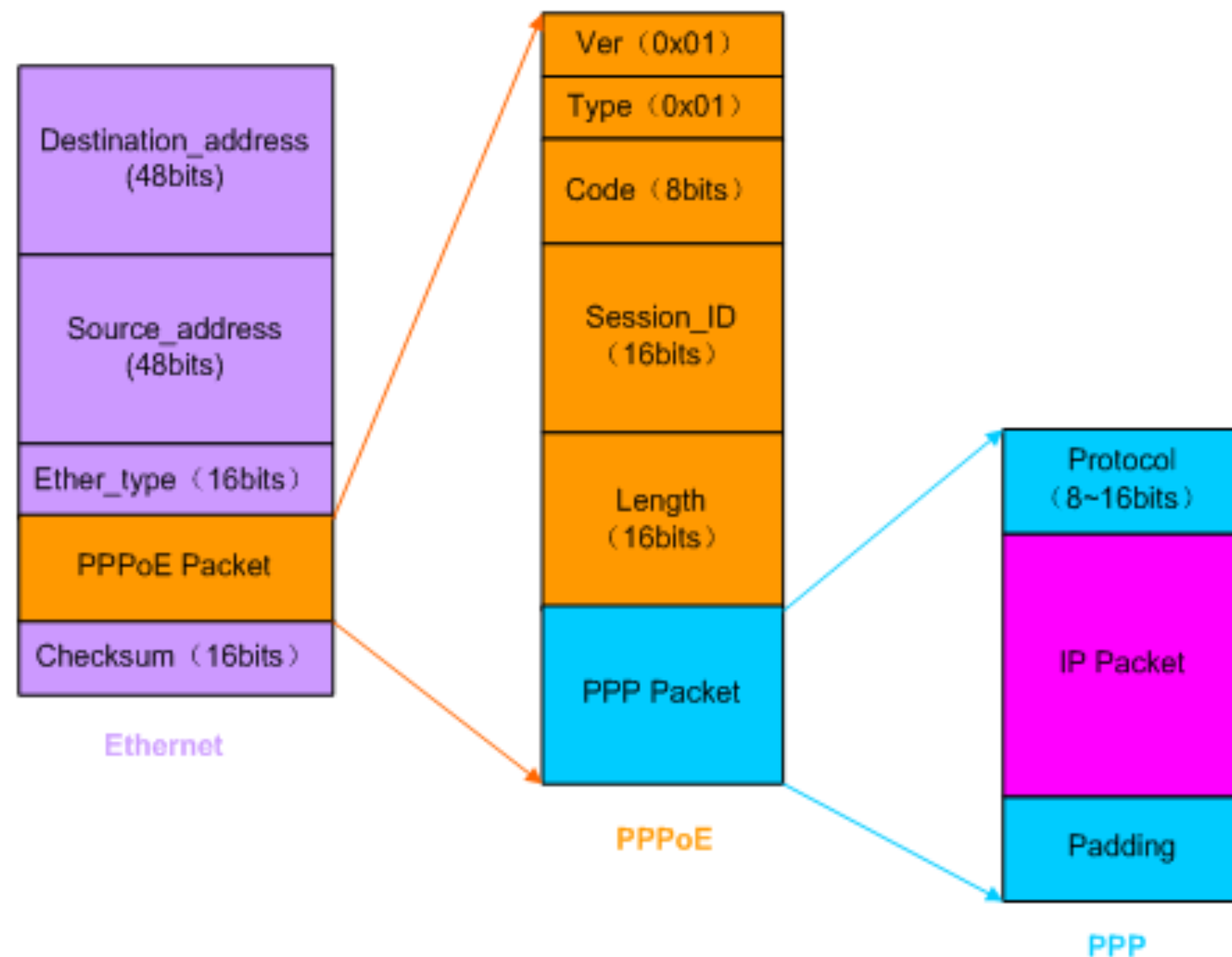
その他のデーターリンク

ATM

- ATM (Asynchronous Transfer Mode)

- Is a switching technique that utilizes asynchronous time-division multiplexing to encode data

- Being able to carry complete range of user traffic, including voice, data, and video signals, ATM designed to unify telecommunication and computer networks by utilizing

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Marconi ForeRunnerLE 25 ATM PCI network interface card

Feature	Data Communications	Telecommunications	ATM
Traffic support	Data	Voice	Data, voice, video
Transmission unit	Packet	Frame	Cell
Transmission length	Variable	Fixed	Fixed
Switching type	Packet	Circuit	Cell
Connection type	Connectionless or Connection-oriented	Connection-oriented	Connection-oriented
Time sensitivity	None to some	All	Adaptive
Delivery	Best effort	Guaranteed	Defined class or guaranteed
Media and operating rate	Defined by protocol	Defined by class	Scalable
Media access	Shared or dedicated	Dedicated	Dedicated

Packet Over SONET/SDH

Couldn't find any relevant pic

- Transmitting data through lasers or LED over optical fibre at high line rates in form of PPP.

- POS able to support the sending of IP packets across WAN

- Large amounts of traffic on the Internet are carried over POS links.

FDDI (Fiber Distributed Data Interface)

- a standard for data transmission in a local area network (LAN). It uses optical fiber as its standard underlying physical medium

- Able to provide a 100 Mbit/s optical standard for data transmission in local area network that can extend in range up to 200km

- Uses token bus timed token protocol

- Able to support thousands of users

- **Token Ring**: a LAN in which a node can only transmit when in possession of a sequence of bits (the token), which is passed to each node in turn.

- **100VG-AnyLAN**: carry both Ethernet and token ring frame types

- **Fiber Channel**: high-speed network technology (up to 128 Gigabits/second) primarily used to connect computer data storage to servers

- **HIPPI**: (High Performance Parallel Interface) is a computer bus for the attachment of high speed storage devices to supercomputers, in a point-to-point link.

- **HDMI**: (High-Definition Multimedia Interface) is a proprietary audio/video interface for transmitting uncompressed video and digital audio data from a device

- **ISCSI**: Internet Small Computer Systems Interface, an Internet Protocol (IP)-based storage networking standard for linking data storage facilities.

- **InfiniBand**: features very high throughput and very low latency (delay before a transfer of data begins) to interconnect among & within computers.

公衆アクセス網

- **アナログ電話回線**(dial-up internet access?): form of Internet access that uses the facilities of the public switched telephone network (PSTN) to establish a connection to an Internet service provider (ISP) by dialing a telephone number on a conventional telephone line.

- **移動体通信サービス**(cellphone): PHS accessible almost anywhere. WiMAX & LTE nowadays enable us to access internet in higher speed compared to previous technology.

- **ADSL**: (Asynchronous digital subscriber line) utilize copper telephone wires, allowing high-speed Internet access and simultaneous use of the line for voice transmission.

- **FTTH**: (fiber to the home) Utilize optical fiber to transmit data from your home in a relatively high speed. It requires ONU (Optical Network Unit)

- **Cable TV**: Nowadays cable TV doubles as internet provider too; utilizing available channel to transfer data
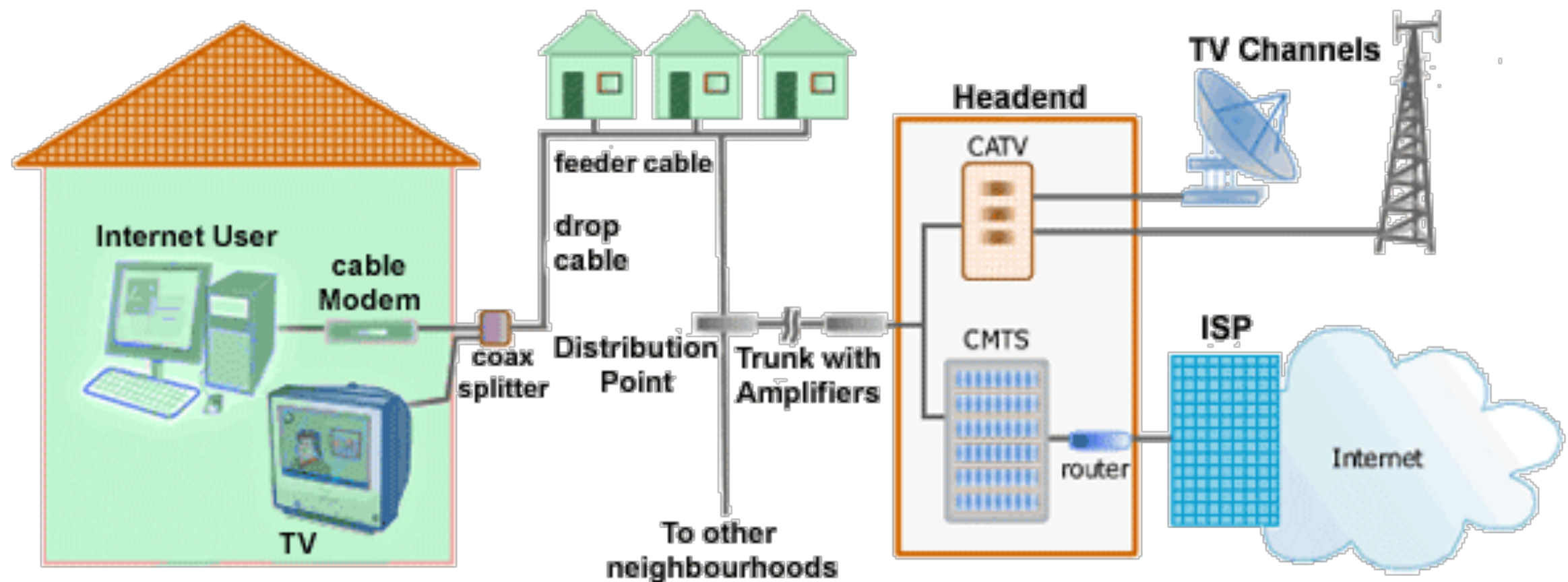

- **専用回線(Private Line?)**: Special service provided by the ISP to allocate more bandwidth to those who willing to pay more. e.g. businesses

VPN

(Virtual Private Network) constructed by public wires to connect to a private network

- **IP-VPN**: based on IP protocol & MPLS, it extends a private network across a public network, and enables users to send and receive data across shared or public networks as if their computing devices were directly connected to the private network.

- 広域**Ethernet**: Using VLAN (Virtual LAN) that allowed

  multiple tag LAN to share common trunking and able to use not just IP protocol. Able to reach further in range and accommodate more data types.

Internet VPN
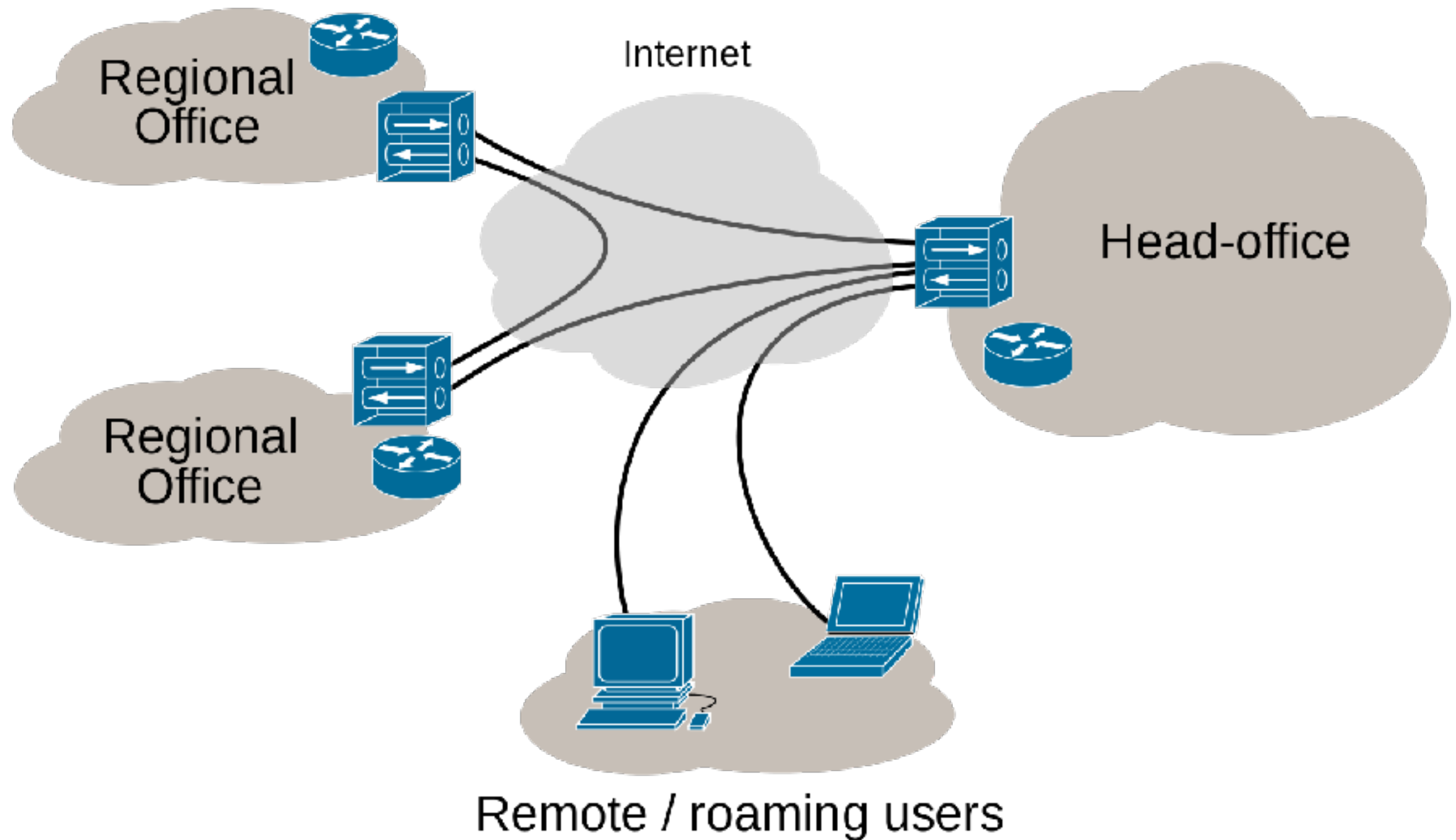
- **Public Wireless LAN**: Utilizes wifi (IEEE802.11b etc.) usually available in certain areas such as stations, restaurants/cafe, and others (HotSpot). a good Hot Spot utilize IPsec to authenticate and encrypt our packets.

- **X.25**: is an ITU-T standard protocol suite for packet switched wide area network (WAN) communication. An X.25 WAN consists of packet-switching exchange (PSE) nodes as the networking hardware, and leased lines, plain old telephone service connections, or ISDN connections as physical links.

- **Integrated Services Digital Network (ISDN)**: a set of communication standards for simultaneous digital transmission of voice, video, data, and other network services over the traditional circuits of the public switched telephone network.