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SMART HEALTHCARE ENGINEERING

IT Infrastructure of Hospital

Part 2

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Storage Units - NAS

Network Attached Storage is a dedicated file storage device that connects to your network, allowing multiple users and client devices to **store and retrieve data from a central location.**

Main Uses of NAS

- Centralized file sharing (documents, images, backups)
- Media and archive storage
- Backup repository
- NVR

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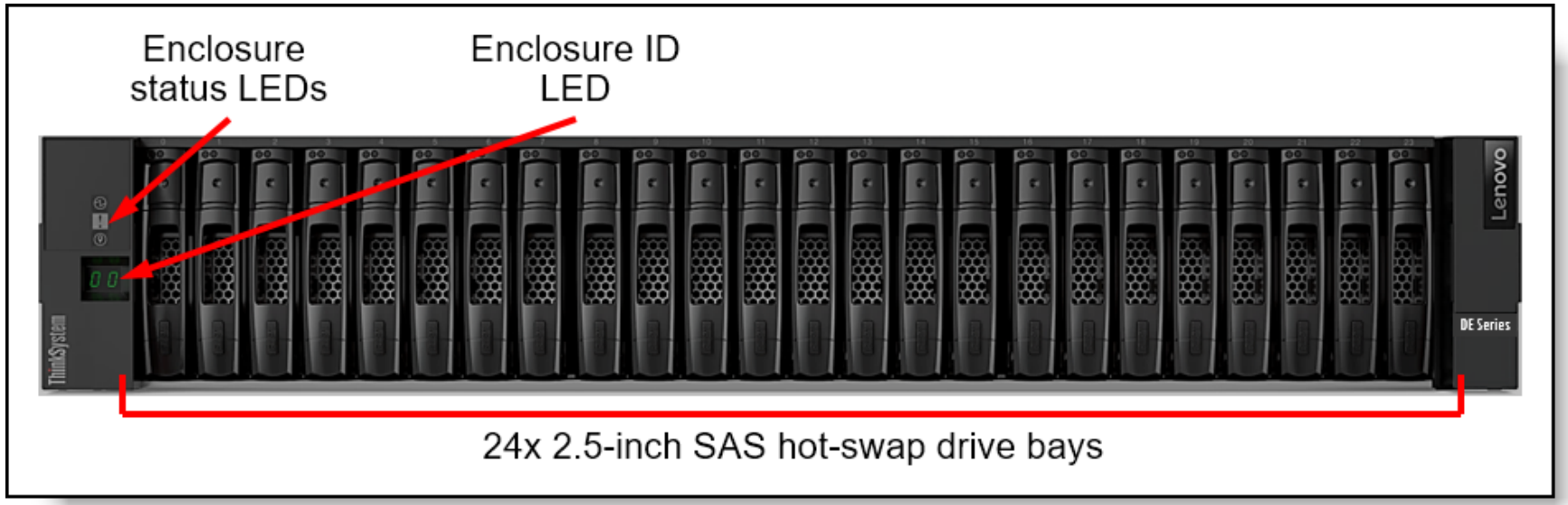
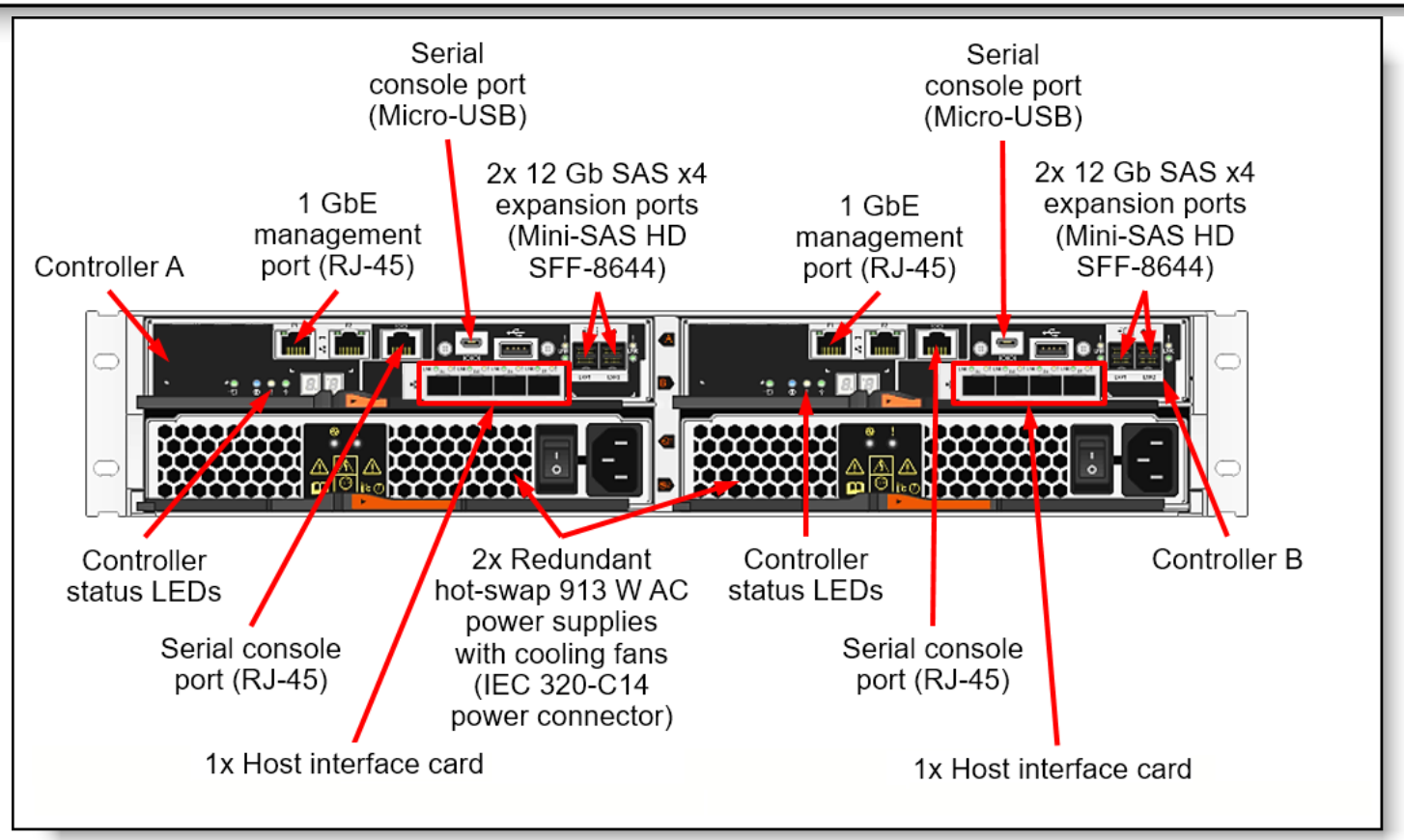
Storage Units - SAN

Storage Area Network (SAN) is a high-performance storage solution allowing applications to access and use storage as if it were a locally attached disk.

Main Uses of SAN

- High-performance databases and applications
- Virtual machine storage (VMware, Hyper-V, etc.)
- High-performance computing (HPC) environments
- Consolidated storage for critical enterprise applications


Enclosure status LEDs
Enclosure ID LED
Lenovo
DE Series
24x 2.5-inch SAS hot-swap drive bays


Serial console port (Micro-USB)
Serial console port (Micro-USB)
2x 12 Gb SAS x4 expansion ports (Mini-SAS HD SFF-8644)
2x 12 Gb SAS x4 expansion ports (Mini-SAS HD SFF-8644)
1 GbE management port (RJ-45)
1 GbE management port (RJ-45)
Controller A
Controller status LEDs
Serial console port (RJ-45)
2x Redundant hot-swap 913 W AC power supplies with cooling fans (IEC 320-C14 power connector)
1x Host interface card
Controller status LEDs
Serial console port (RJ-45)
Controller B
1x Host interface card

Difference Between NAS and SAN

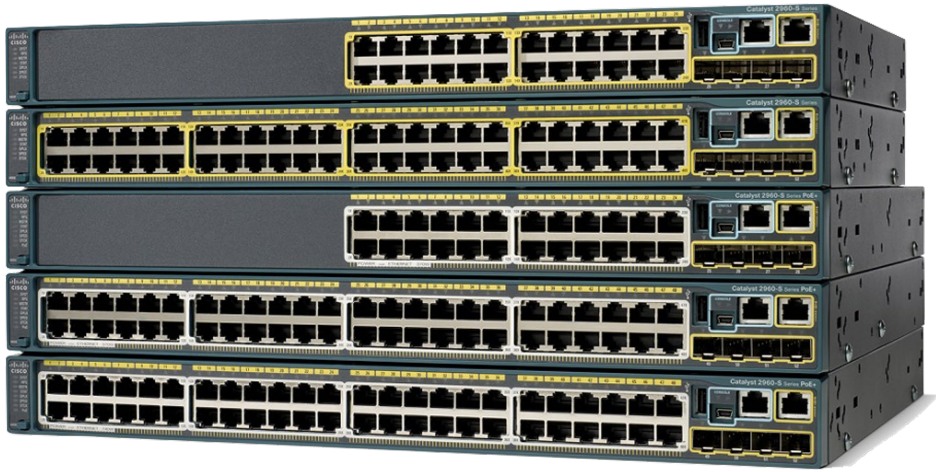
ASPECT	NAS (Network Attached Storage)	SAN (Storage Area Network)
Storage Type	File-level storage	Block-level storage
Protocols	SMB/CIFS (Windows), NFS (Linux/Unix), FTP	iSCSI, Fibre Channel
Connectivity	Standard Ethernet network (LAN)	Dedicated storage network (often Fibre Channel)
Access Method	Files and folders accessed via network share	Blocks accessed like local disks
Operating System	Has its own OS for managing file shares	Typically no OS—acts as raw storage presented to hosts
Typical Usage	File sharing, backups, archiving	Databases, virtual machines, high-performance apps
Performance	Moderate (limited by Ethernet and file protocol overhead)	High (low latency, optimized for speed)
Complexity	Easier to set up and manage	More complex to deploy and administer
Cost	Generally lower cost	Higher cost (especially Fibre Channel)

CANOVATE
DELL
DELL
DELL EMC
DELL EMC
CANOVATE
BATTERY CABINET
CANOVATE
BATTERY CABINET

DELL EMC
EATON

Network Devices - Switch

- A **network switch** is a device that connects multiple computers, servers, and other network devices within a Local Area Network (LAN). They are the backbone of LAN
- It forwards data only to the device that needs it, improving performance and reducing unnecessary traffic.
- Provide security features (port security, mac filtering, etc.)



Types of Switches

- **Unmanaged Switches**: Plug-and-play, no configuration
- **Managed Switches**: Configurable, support VLANs and monitoring, port security, QoS, ACL
- **Layer 3 Switches**: Combine switching and routing functions

Managed switches are common in hospitals and large businesses because they allow control and monitoring.

They are the backbone of any modern LAN

HUB

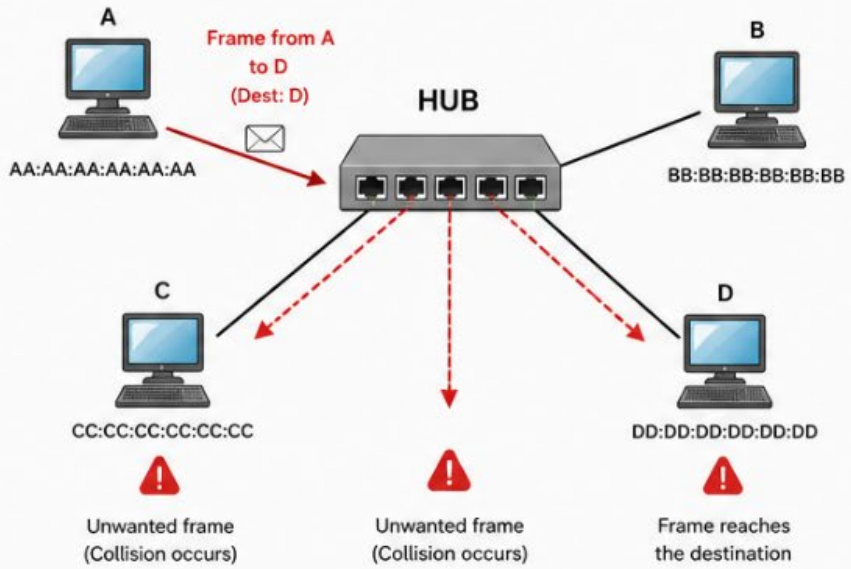
Hubs repeat incoming frames out of all ports.

This causes collisions.

Scenario

A (AA:AA:AA:AA:AA:AA) → D (DD:DD:DD:DD:DD:DD)

A sends a frame to D.



RESULT

All devices receive the frame.

Collisions occur when responses are sent at the same time.

SWITCH

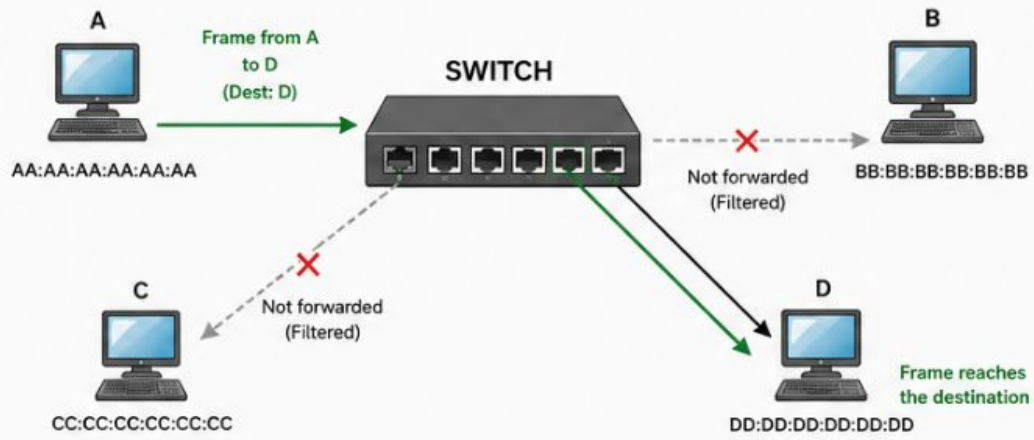
Switches read the destination MAC address and forward the frame only out the appropriate port.

This reduces collisions and improves efficiency.

Scenario

A (AA:AA:AA:AA:AA:AA) → D (DD:DD:DD:DD:DD:DD)

A sends a frame to D.



CAM (MAC) TABLE INSIDE THE SWITCH

1. The switch reads the source MAC address of the incoming frame and adds it to the CAM table.
2. The switch looks up the destination MAC address in the table. If there is a match, it forwards the frame only out the matching port; otherwise, it floods the frame.

CAM (MAC) Table Example

MAC Address	Port	Type	Age (s)
AA:AA:AA:AA:AA:AA	1	Dynamic	15
BB:BB:BB:BB:BB:BB	2	Dynamic	23
CC:CC:CC:CC:CC:CC	3	Dynamic	18
DD:DD:DD:DD:DD:DD	4	Dynamic	8

When A → D frame arrives, the destination MAC (DD....) is found in the table on port 4. The frame is forwarded only out port 4.

RESULT

Only the destination device receives the frame.

Unnecessary traffic and collisions are reduced.

Frame · Forwarded path · Flooded (sent out all ports) · Not forwarded (filtered) · Filtered · Collision

Network Devices - Router

- A **router** is a device that connects multiple networks together and directs data packets between them.
- It determines the best path for data to travel to its destination.
- It uses IP addresses to forward data packets.
- Routers are multifunctional—they can secure traffic, manage bandwidth, and create VPN tunnels.

Types of Routers

- **Home Routers:** Basic routing and Wi-Fi for small networks
- **Enterprise Routers:** High-capacity devices with advanced security and redundancy
- **Core Routers:** Handle large volumes of data in backbone networks

Enterprise and core routers are used in hospitals, ISPs, and large data centers for connectivity.

SOHO Home Router

Enterprise Router

Core Router

Network Devices - Firewall

- A **firewall** is a security device or software that monitors and controls incoming and outgoing network traffic based on predefined security rules.
- Its main purpose is to **create a barrier between trusted internal networks and untrusted external networks**.

Inspects **packets** of data traffic

Allows or blocks traffic based on IP address, ports, protocols and applications

Enforces **security policies**

Network Devices - Firewall

- Key Features:
  - VPN Support
  - Logging and reporting
  - Application and protocol control
  - Intrusion Detection and Prevention (IDS/IPS)

Infrastructure and Network

- LAN and VLAN Structure
- Wireless Network
- Internet Connectivity
- Data Center

LAN and VLAN Structure - LAN

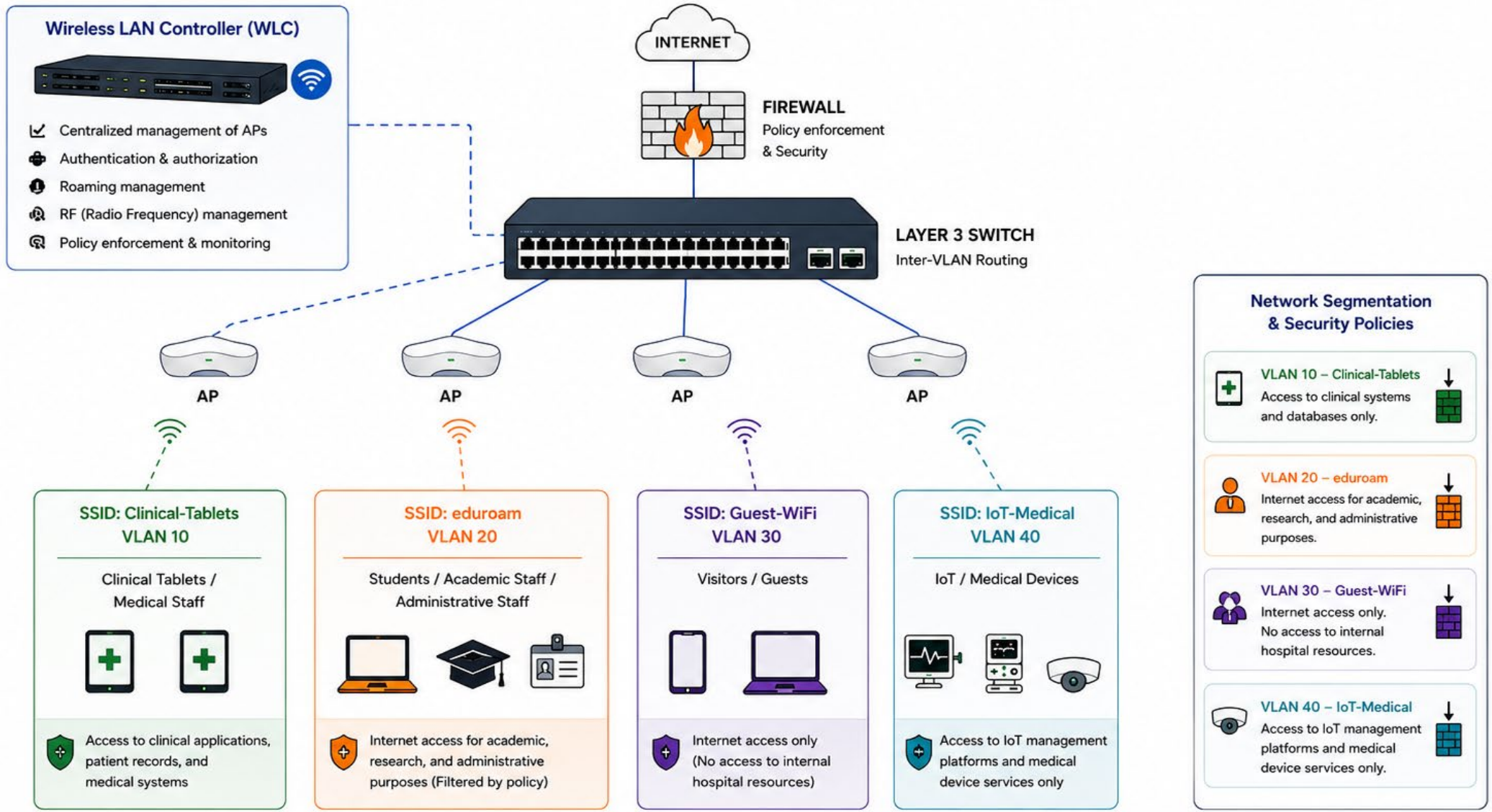
- A Local Area Network is a computer network that connects devices (computers, servers, printers, etc.) in a limited area to communicate and share resources.
- LANs can be wired (ethernet) or wireless (WLAN-Wifi)
- Componets:
  - Clients (pc, tablet, smartphone, printer,etc.)
  - Network Interface Cards
  - Network Cables
  - Switches
  - Routers
  - Wireless Access Points

LAN and VLAN Structure - VLAN

- A **VLAN**, or **Virtual Local Area Network**, is a logical segmentation of a single physical Local Area Network (LAN) into multiple, isolated broadcast domains.
- Each VLAN functions as an independent network and created at the switch.
- VLANs improve **security**, **traffic management**, and **network organization in a cost-effective way.**

Enterprise Wireless Architecture with VLAN-Based SSID Segmentation

Centralized Wireless Management – Thin APs – VLAN Tagging – Policy-Based Network Segmentation



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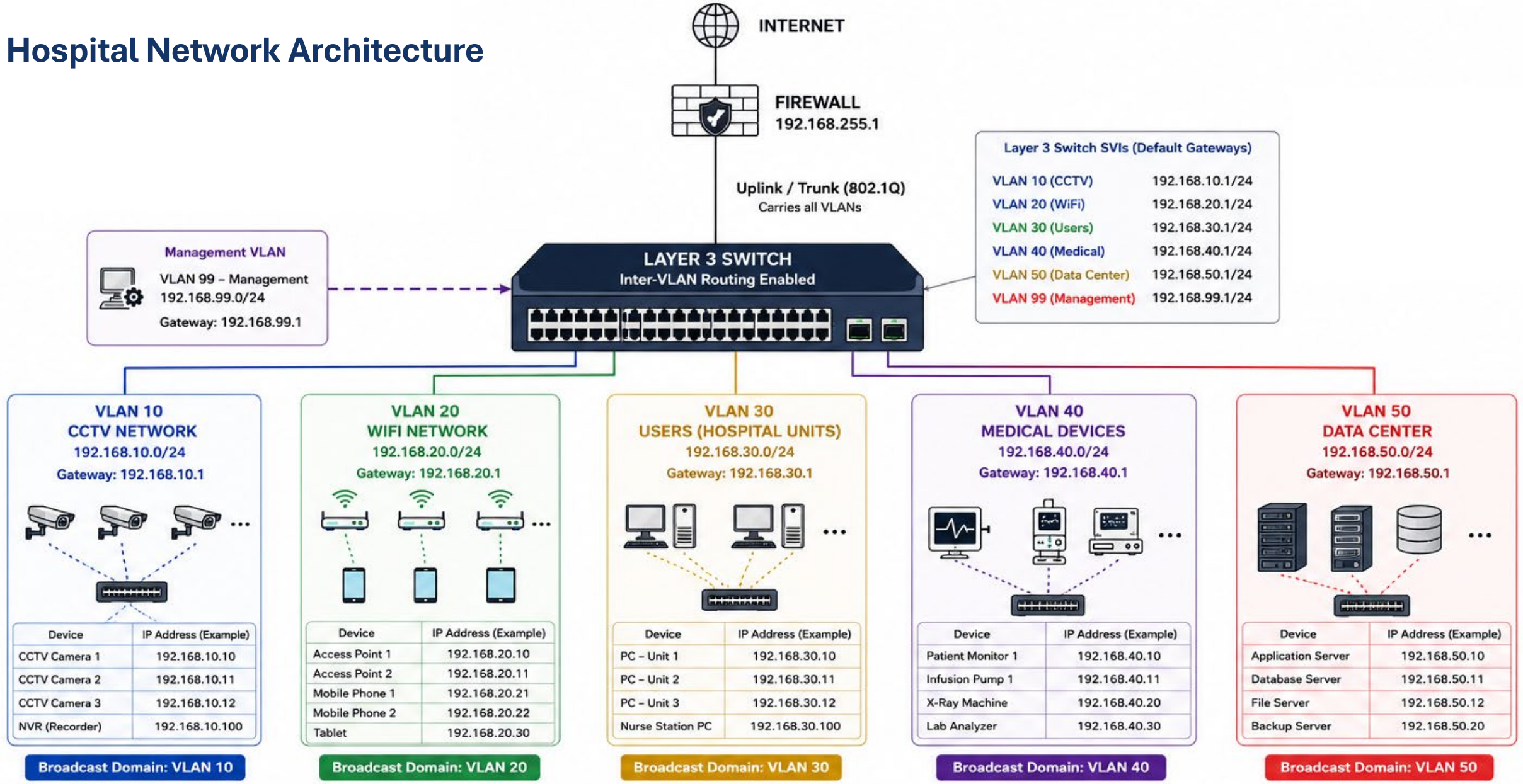
Hospital Network Architecture



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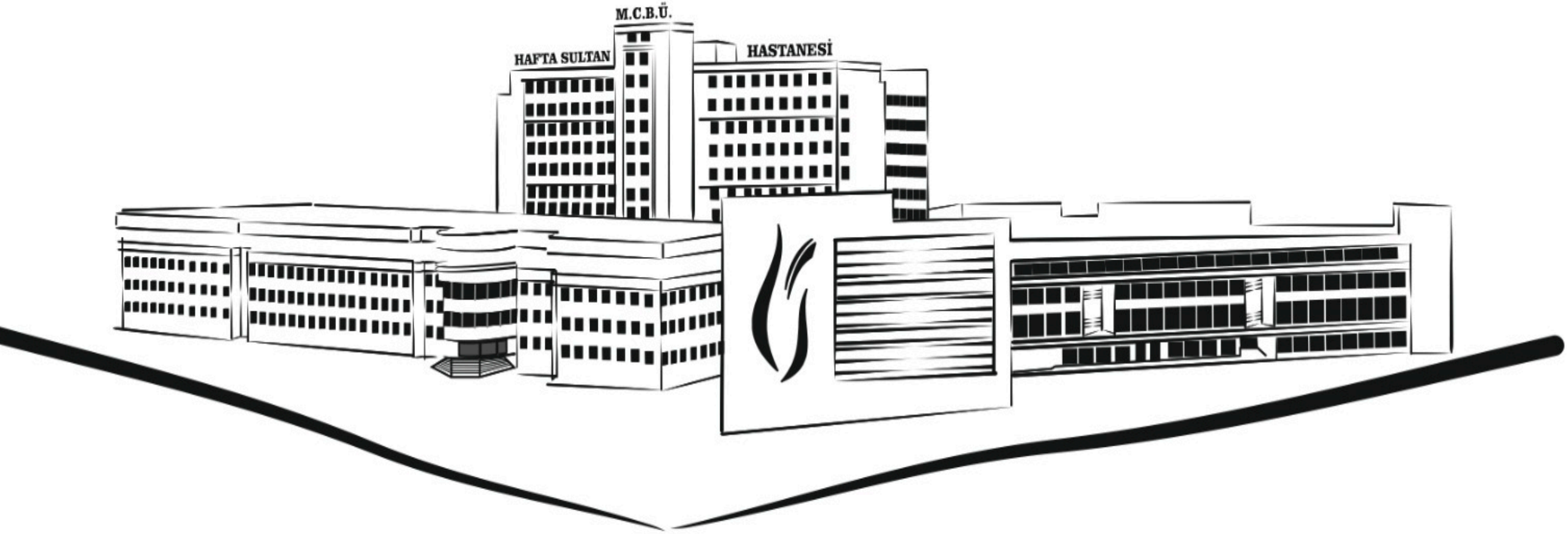

THANKS ☺

Eng. Okan Çöllü

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