

Optical Networks for Cloud and Data Center Networking

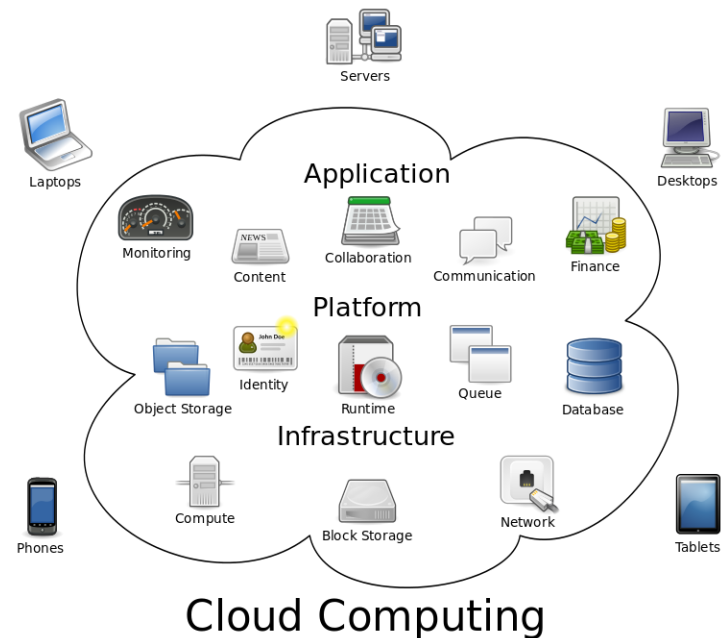
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Cloud Computing

- Centralized data storage on remote servers that allows end users to have online access to applications and services
- Three Types of Cloud Models:
 - **Private cloud:** the cloud is within and operated solely by a private organization (such as a business or household).
 - **Public cloud:** The cloud exists in a network open to the public domain. Users must have online access to use a public cloud.
 - **Hybrid cloud:** A cloud that can be utilized as both private and public. Advantages to hybrid clouds can have private files open to an organization but also can be access with an application service offline.

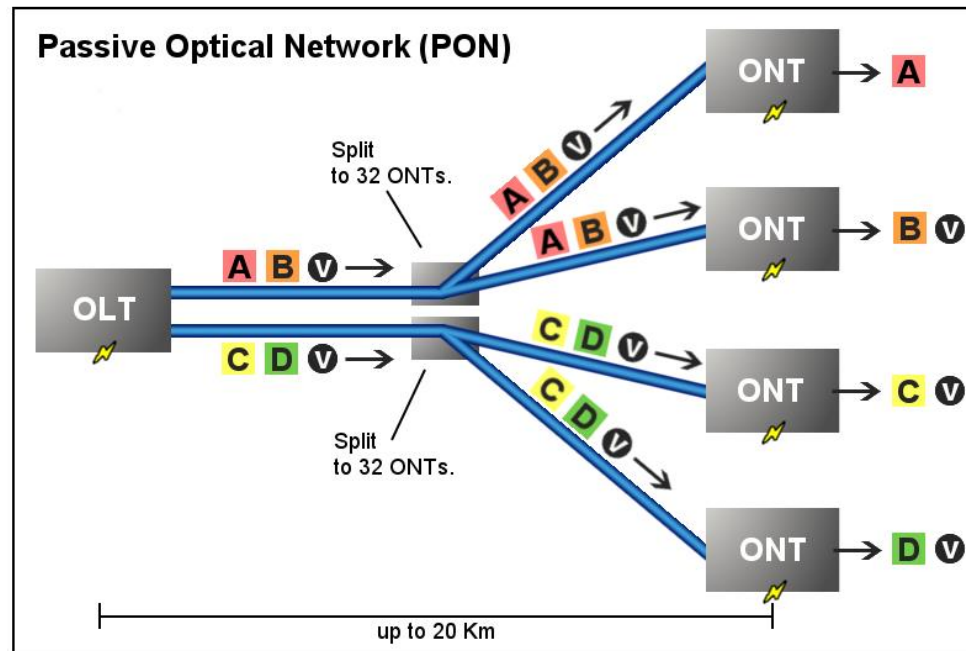


Cloud Computing

- Due to cloud networking using centralized architecture, latency and end-to-end performance are compromised.
- One solution is using **Passive Optical Networking (PON)**.
- Recent research has shown PON-based computing can support 800 optical networking units a gigabit rates.

PON-based Networks

- A network that uses point-to-multipoint fiber to the premises by using optical splitters.
- Improves latency and performance and much more cost effective (cuts equipment expenses to just one optical line terminal).



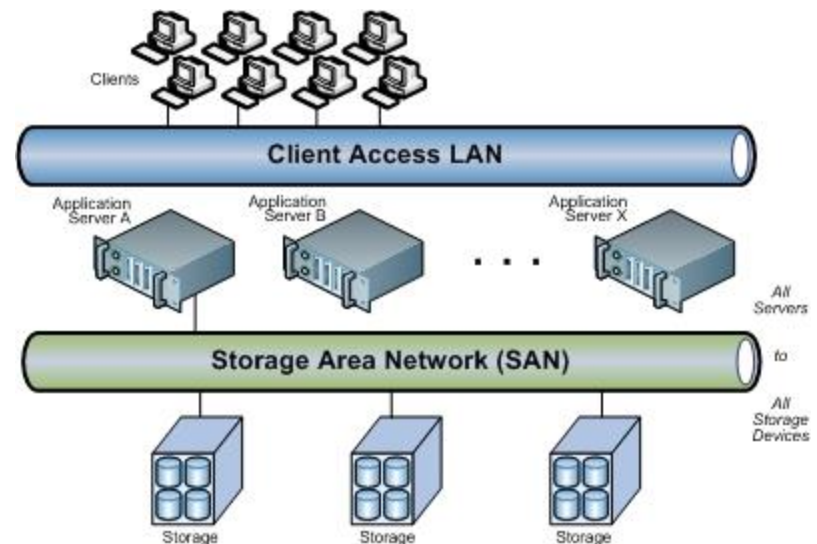
Key: **A** - Data or voice for a single customer. **V** - Video for multiple customers.

PON-based Networks

- Very compatible to cloud computing due to the popularity of PON.
- Allows networks to move closer to customers for Quality of Experience guarantee and lower latency.

Storage Area Networks (SAN)

- Specialized networks that provide fast-accessing databases with a series of storage devices.
- Located far away from customers to reduce the probability of failure in case of a disaster occurrence.



Storage Area Networks (SAN)

- Problems:
 - Scalability
 - S-PON architecture (same as PON's point-to-multipoint infrastructure)
 - Cost
 - S-PON architecture
 - Bandwidth bottlenecking
 - Time-division multiple access (TDMA)
 - Subcarrier multiple access (SCMA)
 - Wavelength-division multiple access (WDMA)

RAMCloud

- A software platform cloud of a network that stores memory from many servers in a data center.
- DRAM; reliable, low latency, and greater throughput than disk-based storages.
- High cost per bit and high energy usage.
- Requires more physical space than disk-based storages.

FAWN Architecture

- Fast Array of Wimpy Nodes (FAWN)
 - Cost-effective network that uses several nodes with low wimpy processing power that reduces I/O-induced idle cycles and executes more instructions per joule.
- FAWN-KV uses key-value store data structure to transmit information between nodes.
 - “Key” is a string (someone’s name)
 - “Value” is actual data (an Email address)

FAWN-KV Architecture

