

# U-3 (SDN)

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Data Center - • building that uses a sophisticated network, computing & storage infrastructure to give shared access to appl<sup>n</sup> & data.

- physical location where computer systems are securely kept before being used to store & exchange data for client systems to process.

Data Center Architecture → Key Design Components:

- Servers
- Storage Devices
- Infrastructure for networks & communications
- Security

Data Center Architecture Components:

- Data Center Computing
- Data Center Storage
- Data Center Networks

Factors

- Uptime
- Investment
- Redundancy
- Fault Tolerance level.

Data Centre Demands

- Adding
- Moving
- Deleting Resources
- Failure Recovery.
- Multitenancy.

\* Traffic Engineering  
necessary for appropriate distribute of network load as well as  
exploiting path diversity.

### Challenges →

- Scale → many switches, hosts & virtual machines.
- Churn → large no. of component failures / VM migration
- Traffic → high traffic vol & dense traffic matrix / volatile, unpredictable pattern
- Performance requirements → delay - sensitive appl<sup>n</sup> / Resource isol<sup>n</sup> b/w tenants

### Opportunities →

- efficient network — Low propagation delay & high capacity
- specialized topology — Fat tree, clos network, etc / opportunities for hierarchical
- control over both network & hosts —
- Flexible movement of work load — VM migration

\* Tunneling methods are -

- 1) Virtual extensible local area Network (VxLAN)
- 2) Network Virtualization using Generic Routing Encapsulation (NVGRE)
- 3) Stateless Transport Tunneling (STT).



# 1) Virtual extensible LAN.

- VMware & Cisco → mitigate inflexibility & limitations of networking technologies
- uses Mac In IP tunneling
- tunnels are stateless.
- segment end points are switches perform encapsulation & called VTEPs.
- each virtual network or overlay is called VXLAN segment.
- VXLAN segments are identified by a 24 bit segment ID, allowing for up to 224 segments.
- UDP based & port no. for 4789 (VXLAN)

# 2) Network Virtualization using GRE. (NVGRE)

- developed by Microsoft with Intel, Dell & HP.
- GRE tunnels → stateless.
- unicast between → two NVGRE end points → running on switch
- utilizes MAC-in-IP tunneling.
- virtual network or overlay is called virtual layer two network.
- packets are unicast.

# 3) Stateless Transport Tunneling (STT)

- utilizes Mac In IP tunneling.
- virtual network exists → STT
- context IPs are 64 bits.
- attempts to achieve performance gains over NVGRE & VXLAN by leveraging TCP found in NICs of many servers.
- packets are unicast b/w tunnel end points.
- TCP synchronization & flow control.

## SDN uses in Data Centers -

- 1) Network Virtualization
- 2) Network Automation & Orchestration
- 3) Dynamic Load Balancing
- 4) Traffic Engineering & QoS.
- 5) Reducing Security Rules
- 6) VM communication simplification
- 7) connecting Enterprise PC
- 8) Integrating legacy Networks
- 9) Wireless Networking.



\* **VLAN (Virtual local area network)** —  
virtualized link that unites various network nodes & devices from several LANs into single logical network.

- Adv →
- saves cost
  - simplified administration.
  - enhanced security
  - offer greater security.
  - improved flexibility.
  - simplified network management
  - efficient resource utilization

\* **Ethernet VPN (EVPN)** —  
gives big businesses a standardized framework for controlling their campus & data centre networks.

- Adv →
- simple to automate
  - backward & forwards compatibility
  - Layer 2 & Layer 3 connection that is efficient & integrated.
  - simple network scalability depending on business.
  - get safely isolate traffic via network segmentation inside.
  - reduced fault domain improves network dependability.
  - MAC address mobility offers easy but flexible deployment.
  - loop free technology spanning tree protocol
  - network bandwidth is entirely used by active-active redundancy.

- scalability
- seamless connectivity
- efficient traffic forwarding
- simplified mgmt
- interoperability