



# Virtual Extensible Local Area Network (VXLAN)

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References: <https://www.comparitech.com/blog/vpn-privacy/ipsec-vs-ssl-vpn/>



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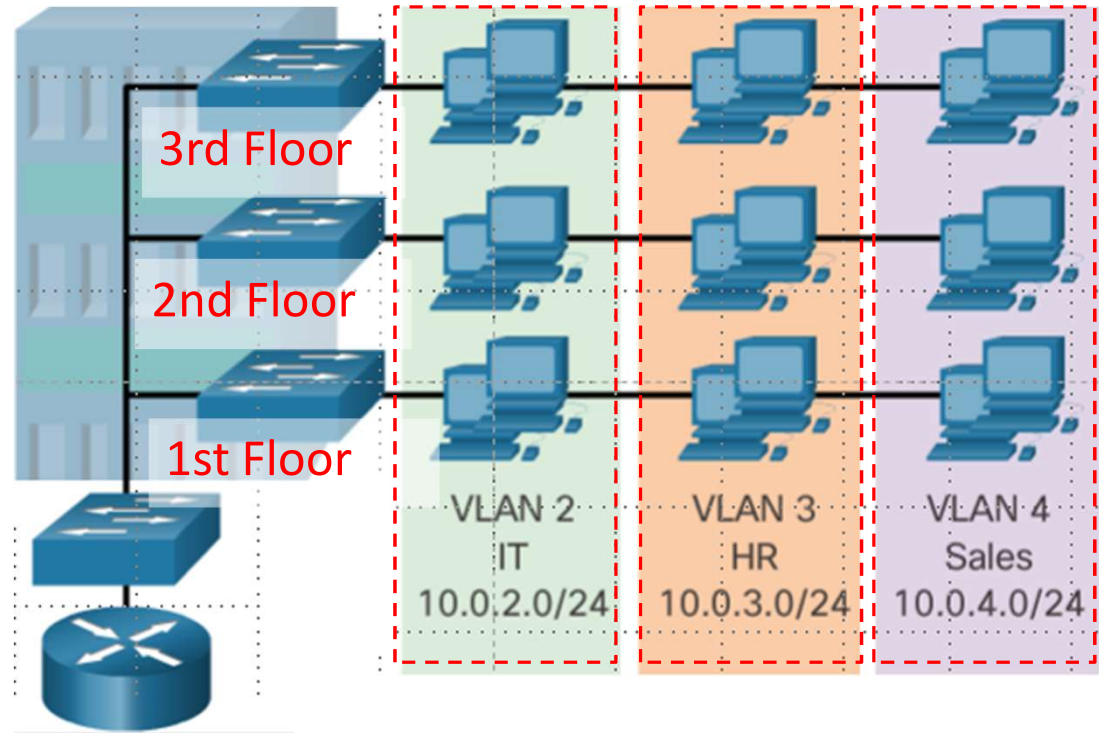


- Local area network (LAN)
  - a computer network that interconnects computers within a limited area of a single broadcast domain.
    - a residence, school, lab, campus or office building.
- Virtual LAN (VLAN)
  - a broadcast domain that is partitioned and isolated in a computer network at the data link layer (OSI layer 2).
- For LAN Isolation

Network traffic that is **physically** on a **single network** but **acts as** if it is **split between separate networks**.

# VLAN Usages

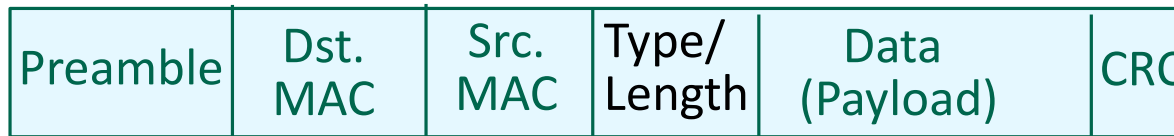
- VLANs provide a way to group devices within a LAN
  - To communicate as if they were attached to the same cable
    - via logical connections, instead of physical connections
- May segment networks
  - Based on function, project team, or application,
  - Without considering physical location of users or devices



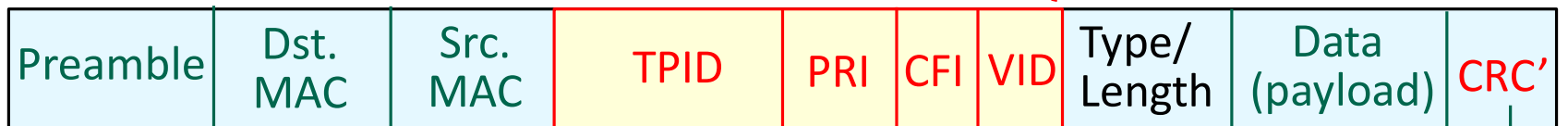
- Reference: Cisco

## 802.1Q VLAN Frame Format (1/2)

- Extending Ethernet Frame Format for VLAN Trunk
  - Adding a 4-byte field between source MAC and EtherType
- 802.3 Frame



- 802.1Q Frame (See next slide)



2-byte Tag Protocol Identifier (TPID)  
(Value: 0x8100)

2-byte Tag Control Information  
(3-bit Priority, 1 bit CFI, 12-bit VLAN ID)

Recomputed CRC  
(FCS for Ethernet)

- CRC: Cyclic Redundancy Check
- FCS: Frame Check Sequence

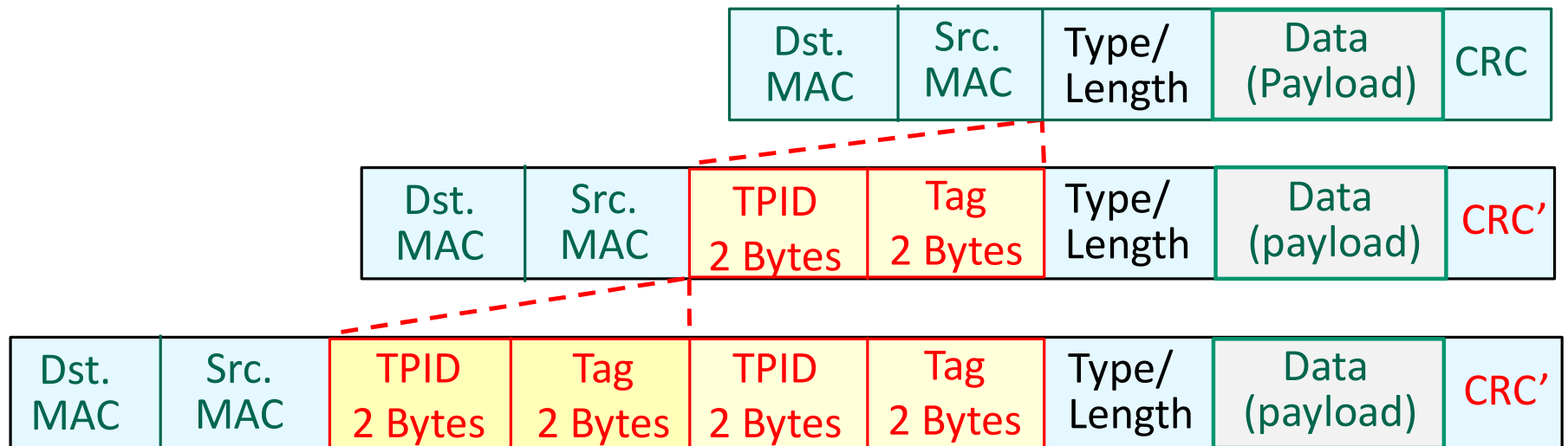


## 802.1Q VLAN Frame Format (2/2)

- VLAN tag fields:
  - **Tag Protocol ID (TPID)**: 2-byte value
    - Type compliant with Ether type, value of 802.1Q Header: **0x8100**
  - **User priority** - 3-bit
    - level or service implementation (like IP TOS)
  - **Canonical Format Identifier (CFI)** - 1-bit
    - Identifier that enables Token Ring frames to be carried across Ethernet links
  - **VLAN ID (VID)** - 12-bit
    - VLAN identification number, **up to 4096 VLAN IDs**
- Recalculates FCS/CRC values and inserts the new FCS into the frame
  - FCS/CRC: Fault Check Sequence/Cyclic Redundant Code

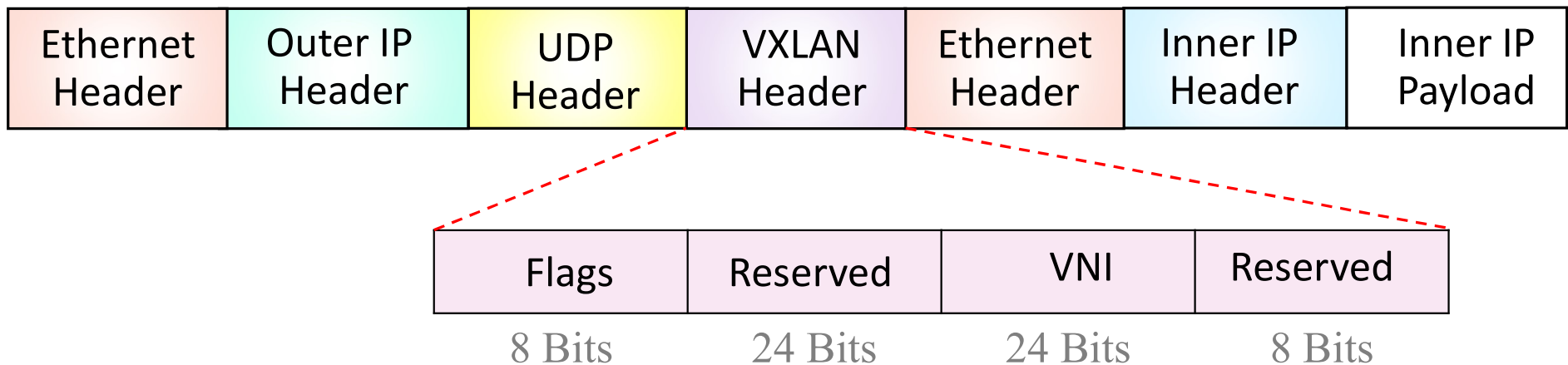
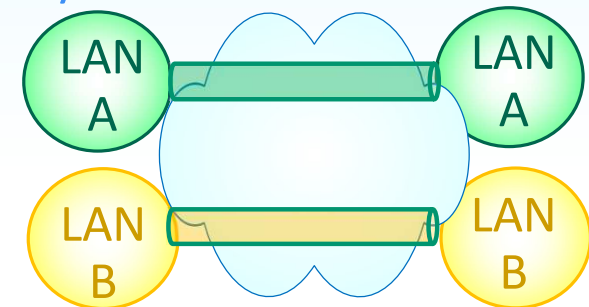
## QinQ (IEEE 802.1ad)

- Increasing users in networks or VMs in Datacenter
  - Require large numbers of VLAN IDs.
- QinQ (also known as **stacking VLAN** or **double VLAN**)
  - Encapsulates VLAN tag with two layers
    - An **802.11Q tagged packet** is encapsulated in another 802.1Q tag
  - to extend the VLAN numbers up to 4096x4096



# Virtual Extensible Local Area Network (VXLAN) [RFC 7348]

- Offer VLAN services, but with greater extensibility and flexibility.
  - Resolve shortage of VLAN ID
  - Extend Layer 2 over Layer 3 networks
- Provide layer 2 overlay networks on top of layer 3 networks
- VXLAN Packet Format:



- VNI: VXLAN Network Identifier

# VXLAN Overlay

- VXLAN Tunnel between two VTEPs
    - VTEP: VXLAN Tunnel End Point
  - VNIs identify layer 2 segments and maintain layer 2 segment isolation
    - 24 bits: up to 16-million layer 2 segments.
- Multi-tenant networks

