Virtual LANs

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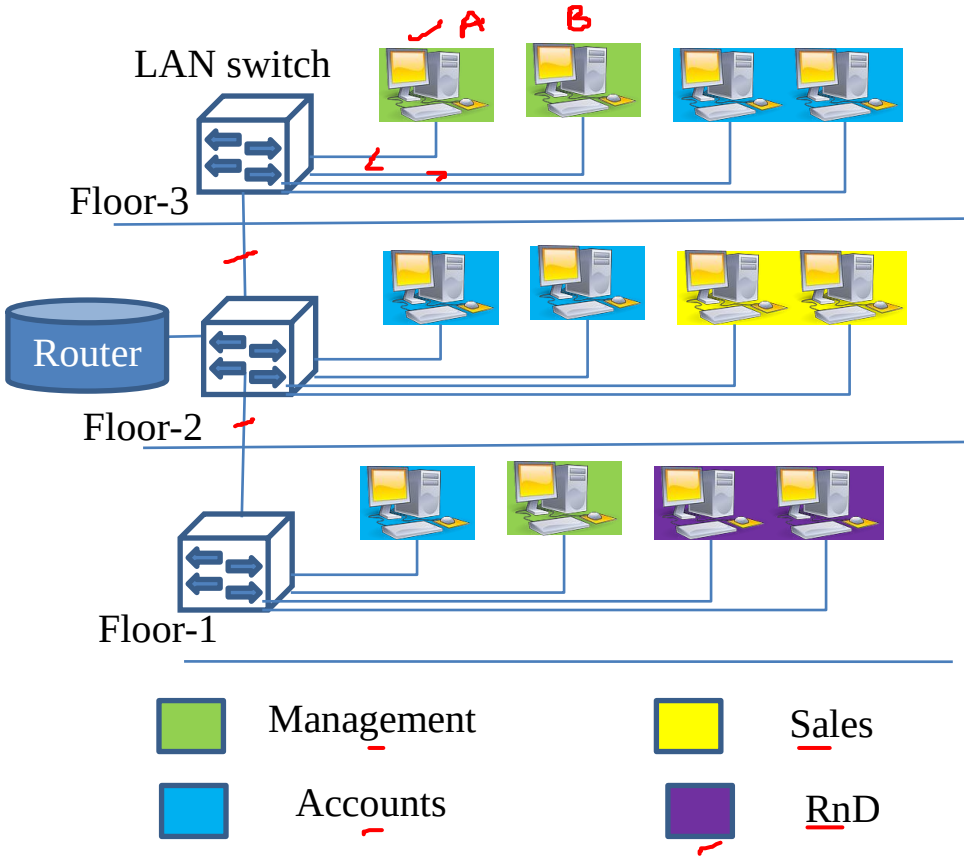
Typical Configuration

Issue-1:

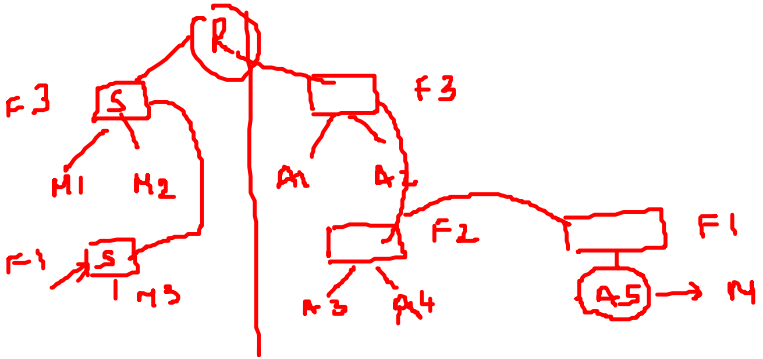
- Lack of Traffic Isolation: Broadcast traffic traverses the entire extended LAN
  - Performance issues: Broadcast traffic eats into bandwidth
  - Security concerns: Management traffic should not be received by any others

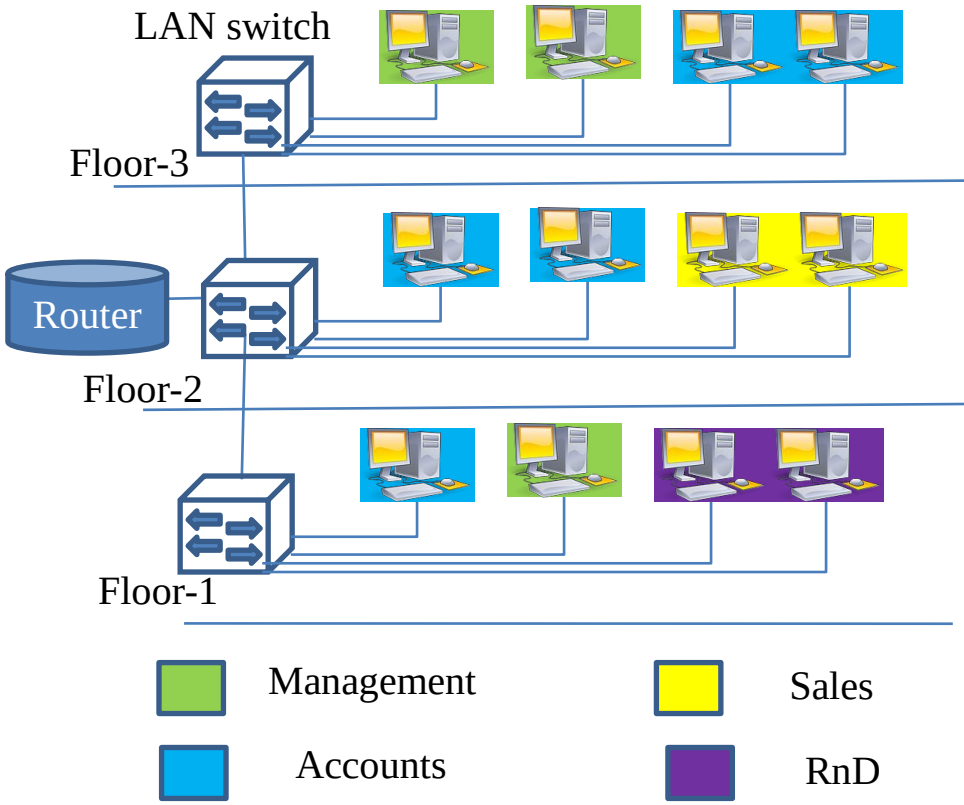


Modified Configuration

Solution:

- For a given floor, connect each group to a switch and inter connect the switches via a router





Modified Configuration

More Issues:

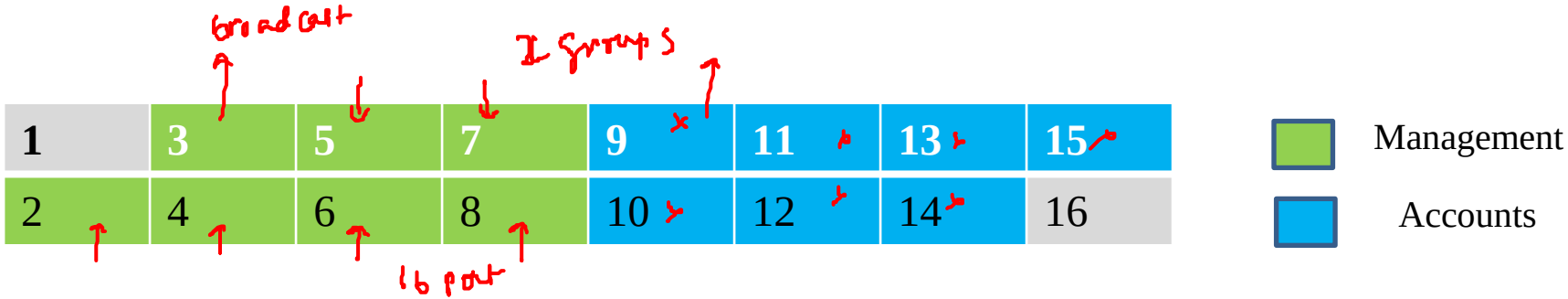
- Increases Cost:
  - Inefficient use of switch ports; too many switches and a router
- User Management:
  - An employee moves between groups, physical cabling has to be changed

Virtual Local Area Networks (VLANs)

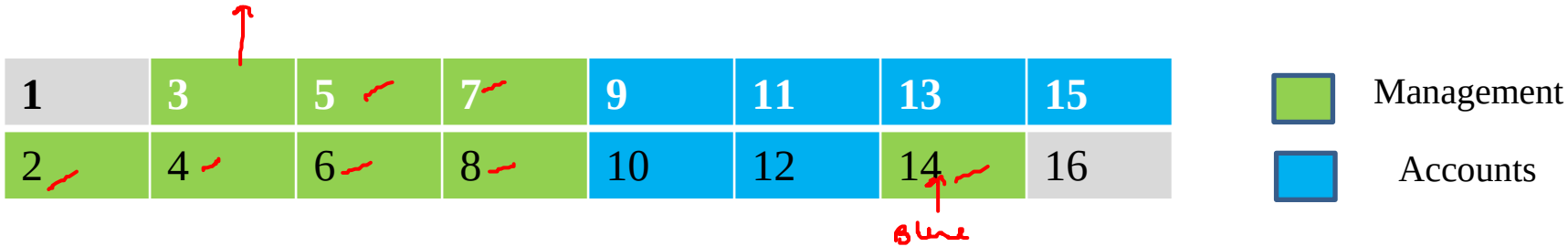
- Partition the extended LAN into several seemingly separate LANs
  - Impose logical topology in software without rewiring
- VLANs can be defined in several ways
  - **Port based VLANs**
  - MAC address based VLAN
  - Network Protocol based VLAN

Port based VLAN

- Ports of a switch are divided into groups (colors)
- Each group constitutes a VLAN
- VLAN switch ensures that broadcast traffic from one group does not reach other group



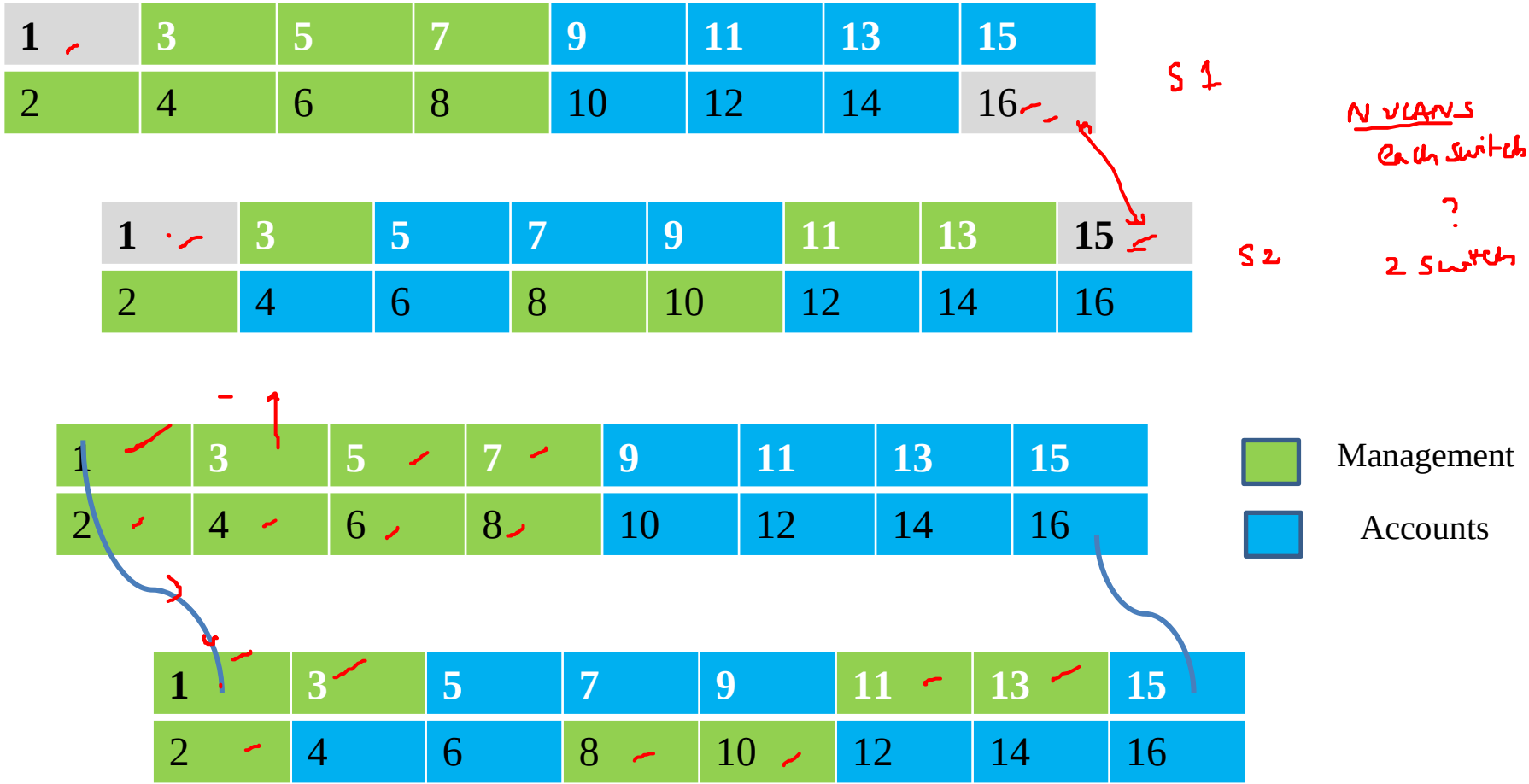
- Traffic Isolation ✓
- Cost ✓ (One switch suffices)
- User Management ✓
  - Reconfigure the VLAN software so that the port reflects the right color



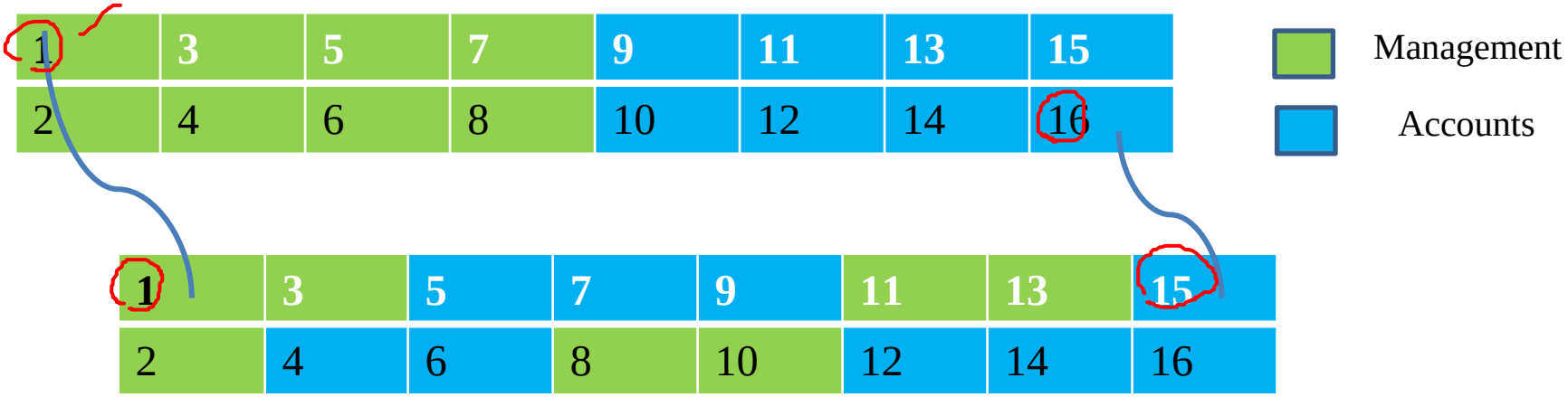
Issue of Forwarding

- How to route traffic from Management to Accounts? (they are completely isolated)
- Connect via a router (just as with separate switches
  - Vendors of VLAN switches often include the router functionality (no need for external router)

Issue of Interconnecting Switches

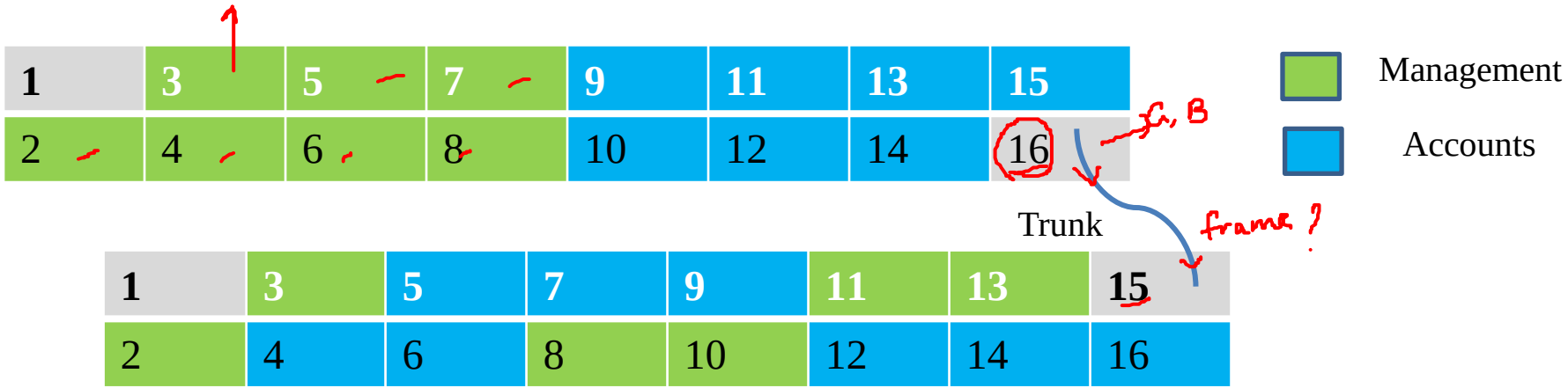


- Solution not scalable
  - N VLANs require N ports on each switch



VLAN Trunking

- A special port on each switch configured as Trunk port
  - Trunk port belongs to all VLANs (assigned all VLAN colors)
  - Frames sent to any VLAN are forwarded over trunk port and reach the other switch



Issue for Frame Identification

- Which VLAN does the received frame on trunk port belong to?

  frame → identify VLAN

  - Need an extended Ethernet frame format that carries the identity of the VLAN
  - Defined by 802.1Q protocol
    - A 4-byte VLAN tag added into the header by the sender switch and removed by the receiver switch
    - Transparent to clients

Summary

- Extended LANs suffer from traffic isolation problem
- VLANs are an interesting concept that partition an extended LAN into several virtual LANs
- Port-based VLANs assign colors to ports to aid frame forwarding
- VLAN trunking helps interconnect switches in a scalable fashion