Network Design Workshop

High Availability

High Availability

- How can we achieve high availability?
  - Protect your network against a single device failure affecting all of your network
  - Introduce hardware resiliency and backup paths
  - Different techniques depending on the layer
  - Relationship between reliability, complexity and cost
    - The trick is to balance all variables and come up ahead

High Availability

- You need to evaluate your needs
  - Minimal need
    - Network just needs to be up for a portion of the day
    - Downtime is easily scheduled after working hours
    - Business is not impacted if the network is down
    - Users' productivity is not impacted by a network failure

High Availability

- Medium need
  - Network needs to be available for most of the day
  - Only centralized servers need to be up 24 hours/day
  - Downtime needs to be scheduled on weekends
  - If critical parts of the network fail, the business operation is impacted
  - A network failure affects user productivity

High Availability

- High need
  - Network needs to be up 24x7
  - Downtime needs to be scheduled well in advance and completed within schedule
  - A network failure causes major loss of business
  - User productivity drastically impacted by a network failure

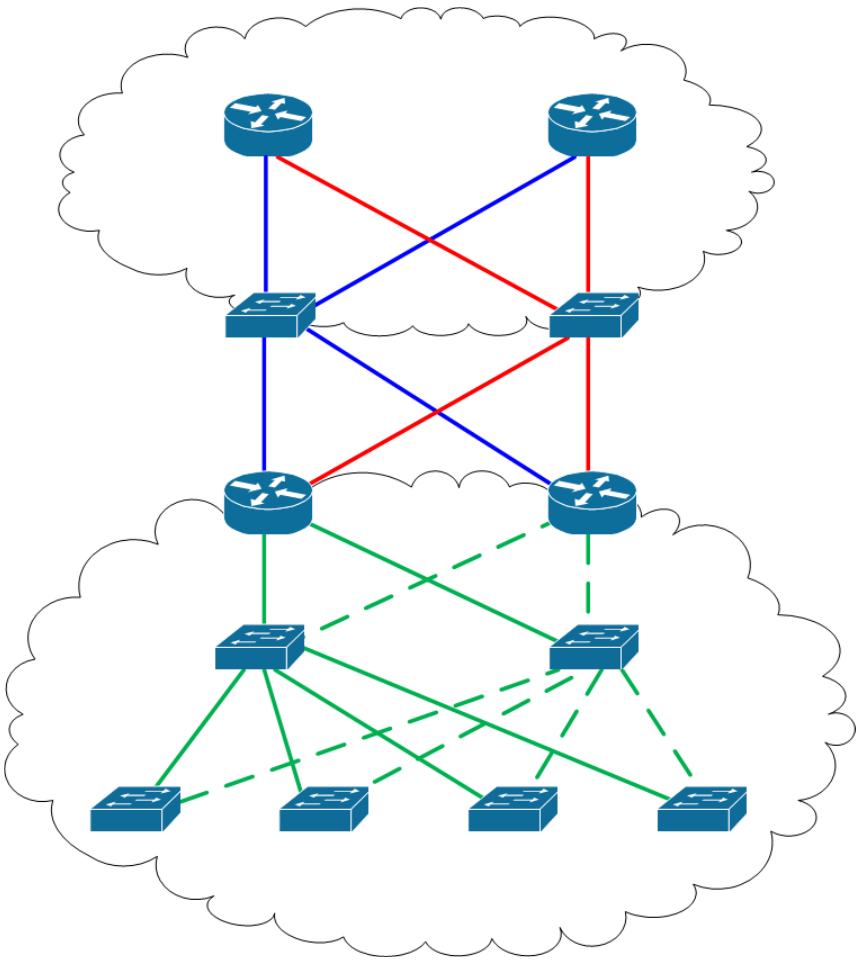
High Availability

- Methods
  - Component Redundancy
    - Duplicate or backup parts
      - Power supplies, fans, processors, etc.
  - Server Redundancy
    - Protect your data with backups
    - Use of hot standby servers
    - Use of load balancers
  - Network Link & Data Path Redundancy
    - Provide physical redundant connections between devices
    - Allow for hot backup paths (STP) and parallelism (routing)

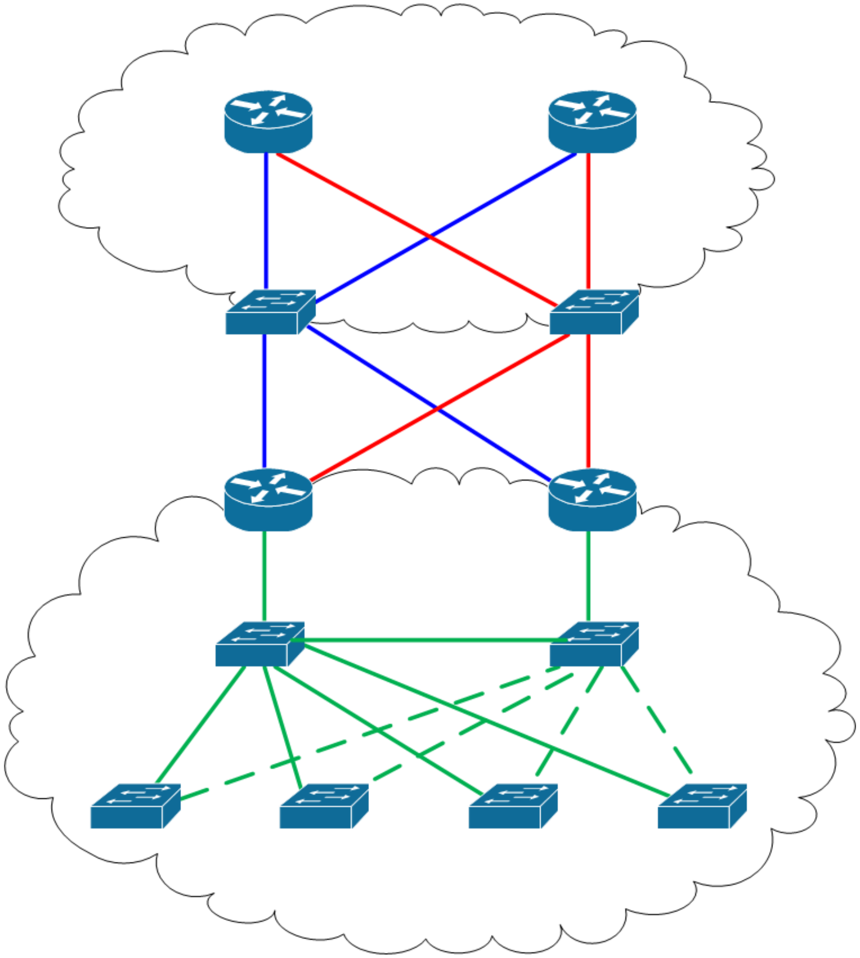
High Availability

- At core and distribution layers
  - Add redundant routers and provide dual paths to each from the lower layer
  - Make sure that you have redundant power supplies in your devices
    - This also assumes two different sources of power
  - Think about the possibility of dual routing/forwarding engines
    - Weigh this against the use of two devices
    - Or just throw that in there as yet another layer of reliability

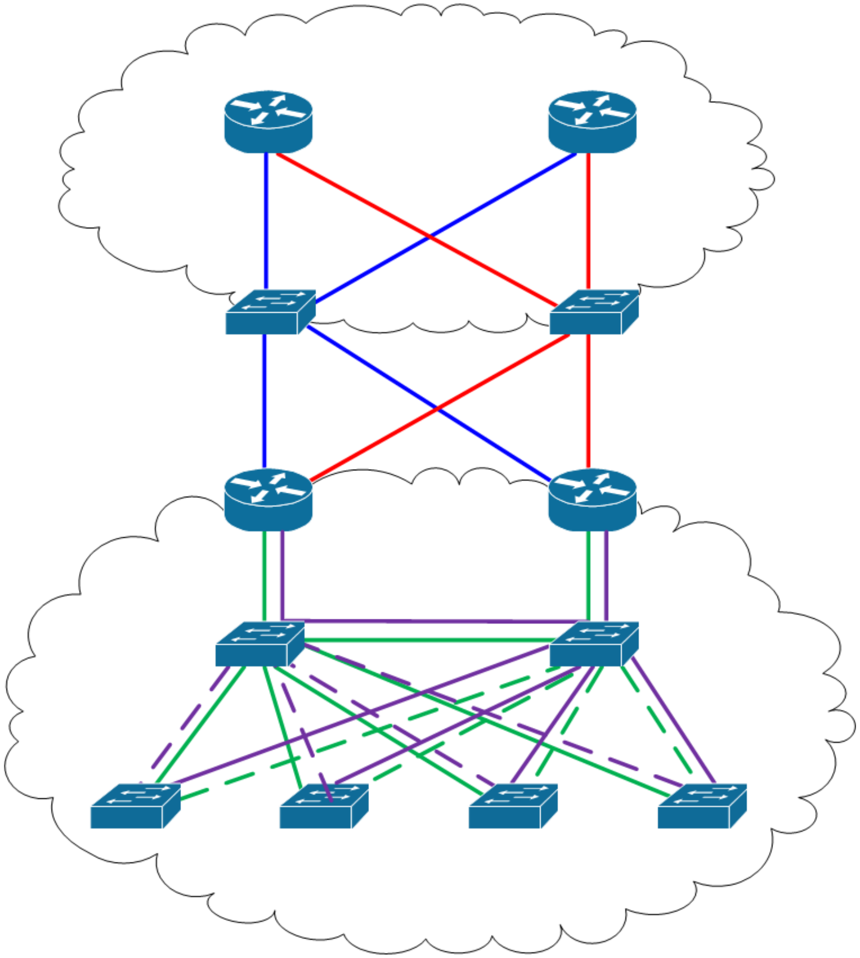
High Availability



High Availability



High Availability



Last Hop Redundancy

- So I built all this redundancy and high availability in my network, how can my end users take advantage of it?
  - You are already providing more that one router for each subnet
  - You want to provide your users with a way to move their traffic from one default gateway to another

Last Hop Redundancy

- If one of the routers fails the other one will continue to provide services to the segment
  - Be aware that redundancy is not the same as load balancing

Last Hop Redundancy

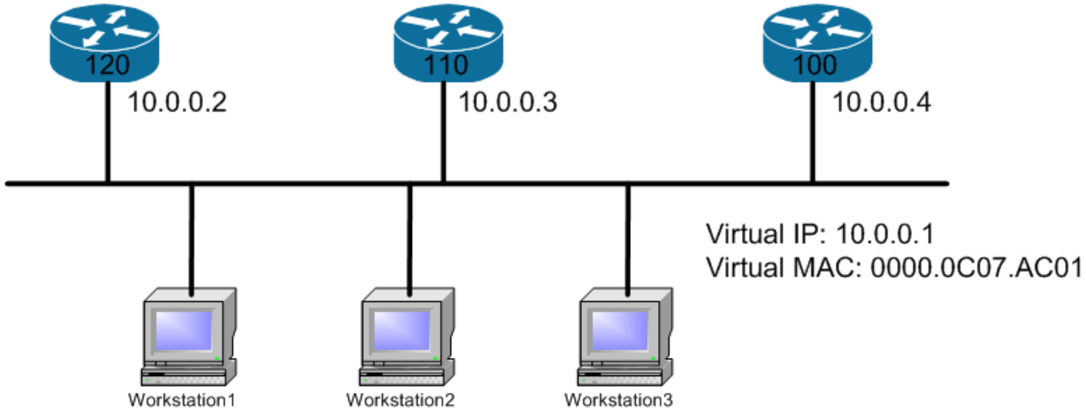
- Current solutions:
  - Hot Standby Redundancy Protocol – HSRP (Cisco Proprietary, RFC2281)
  - Virtual Router Redundancy Protocol – VRRP (RFC3768)
  - Gateway Load Balancing Protocol – GLBP (Cisco Proprietary)

Last Hop Redundancy

- The concept is very similar in all three
  - Workstations get configured with a single default gateway
  - Routers negotiate who will be the default gateway
    - They keep track of the state of the other routers
  - On router failure, standby router becomes the primary/active
    - Traffic from the workstations will go to the primary/active router
  - Incoming traffic into the segment will follow the routing decisions made by routers in the network

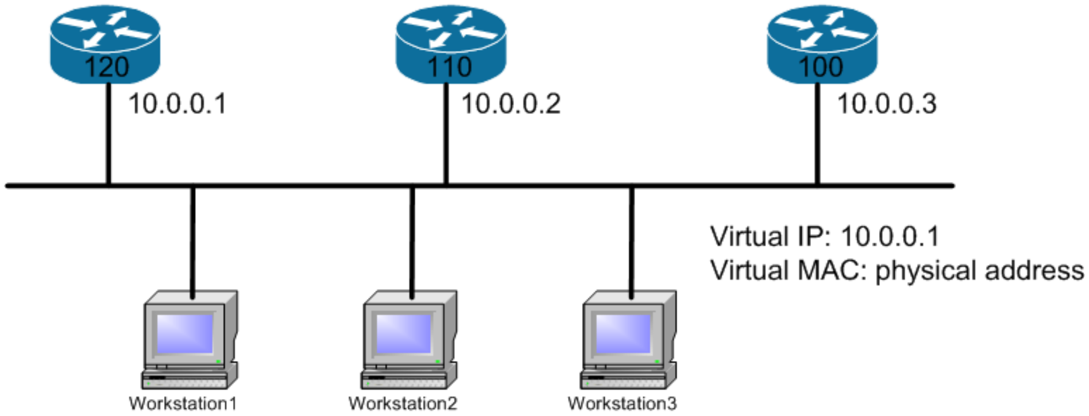
Last Hop Redundancy

HSRP



Last Hop Redundancy

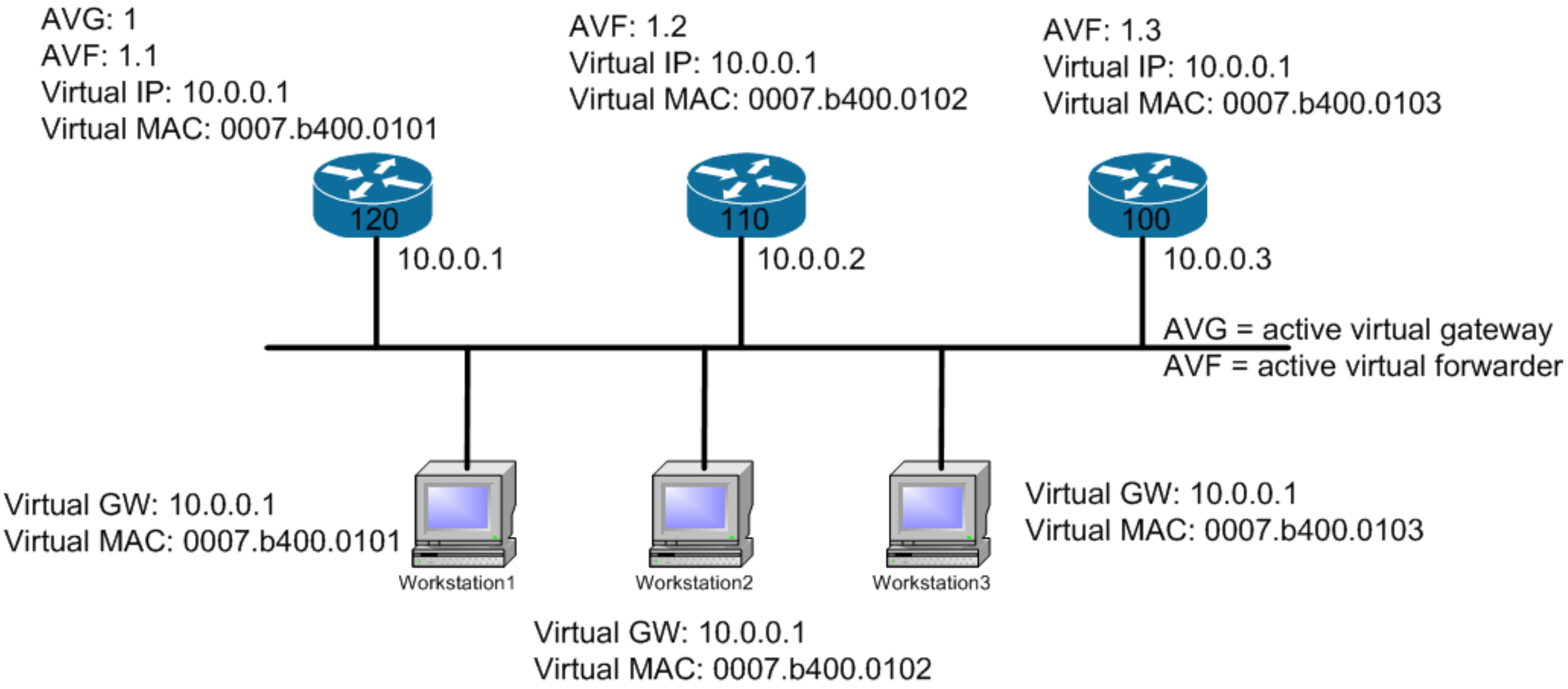
VRRP



Virtual IP: 10.0.0.1
Virtual MAC: physical address

Last Hop Redundancy

GLBP



AVG: 1
AVF: 1.1
Virtual IP: 10.0.0.1
Virtual MAC: 0007.b400.0101

AVF: 1.2
Virtual IP: 10.0.0.1
Virtual MAC: 0007.b400.0102

AVF: 1.3
Virtual IP: 10.0.0.1
Virtual MAC: 0007.b400.0103

120
10.0.0.1

110
10.0.0.2

100
10.0.0.3

AVG = active virtual gateway
AVF = active virtual forwarder

Virtual GW: 10.0.0.1
Virtual MAC: 0007.b400.0101

Workstation1

Workstation2

Workstation3

Virtual GW: 10.0.0.1
Virtual MAC: 0007.b400.0103

Virtual GW: 10.0.0.1
Virtual MAC: 0007.b400.0102

Last Hop Redundancy

- Which one should I use?
  - They all allow for a common default gateway and MAC address
  - VRRP is standardized
    - HSRP/GLBP are Cisco proprietary
  - GLBP provides load balancing
    - HSRP/VRRP do not (without introducing complexity)

Last Hop Redundancy

- VRRP can reuse the default gateway IP
  - HSRP cannot
- HSRP/GLBP support IPv6
  - VRRPv3 supports IPv6, but it is not widely available yet
- VRRP uses protocol 112 & 224.0.0.18
  - HSRP uses UDP/1985 & 224.0.0.2
  - GLBP uses UDP/3222 & 224.0.0.102

High Availability

- All this redundancy and high availability is not going to do you any good if:
  - You don’t test it
    - Make sure that it actually works the way you expect
  - You don’t monitor it
    - If the redundant devices or links are down, it won’t work!