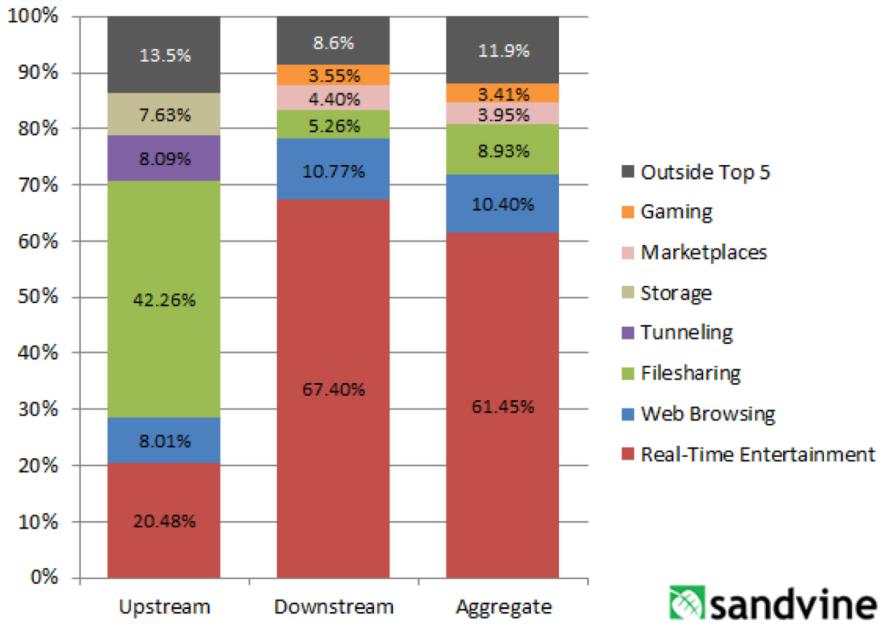


# Infrastructure QoS support

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## Peak Period Traffic Composition (North America, Fixed Access)

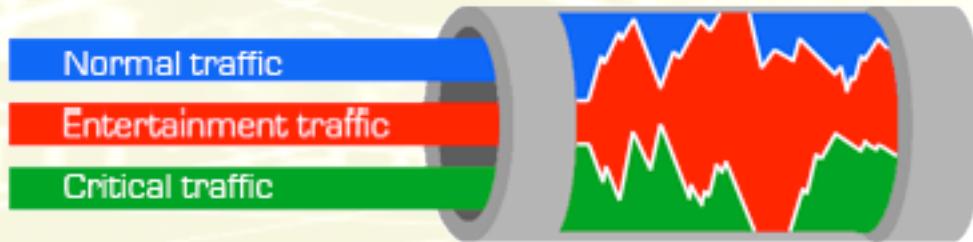


Rank	Upstream		Downstream		Aggregate	
	Application	Share	Application	Share	Application	Share
1	BitTorrent	36.35%	Netflix	31.62%	Netflix	28.18%
2	HTTP	6.03%	YouTube	18.69%	YouTube	16.78%
3	SSL	5.87%	HTTP	9.74%	HTTP	9.26%
4	Netflix	4.44%	BitTorrent	4.05%	BitTorrent	7.39%
5	YouTube	3.63%	iTunes	3.27%	iTunes	2.91%
6	Skype	2.76%	MPEG - Other	2.60%	SSL	2.54%
7	QVoD	2.55%	SSL	2.05%	MPEG - Other	2.32%
8	Facebook	1.54%	Amazon Video	1.61%	Amazon Video	1.48%
9	FaceTime	1.44%	Facebook	1.31%	Facebook	1.34%
10	Dropbox	1.39%	Hulu	1.29%	Hulu	1.15%
	<b>Top 10</b>	<b>66.00%</b>	<b>Top 10</b>	<b>76.23%</b>	<b>Top 10</b>	<b>73.35%</b>

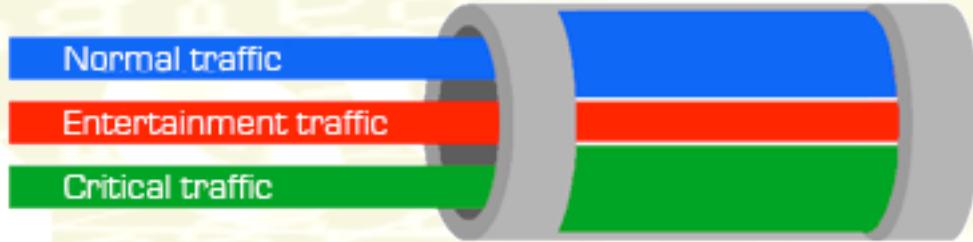


# QoS in the Internet

Bandwidth Use without QoS control



Bandwidth Use with QoS control

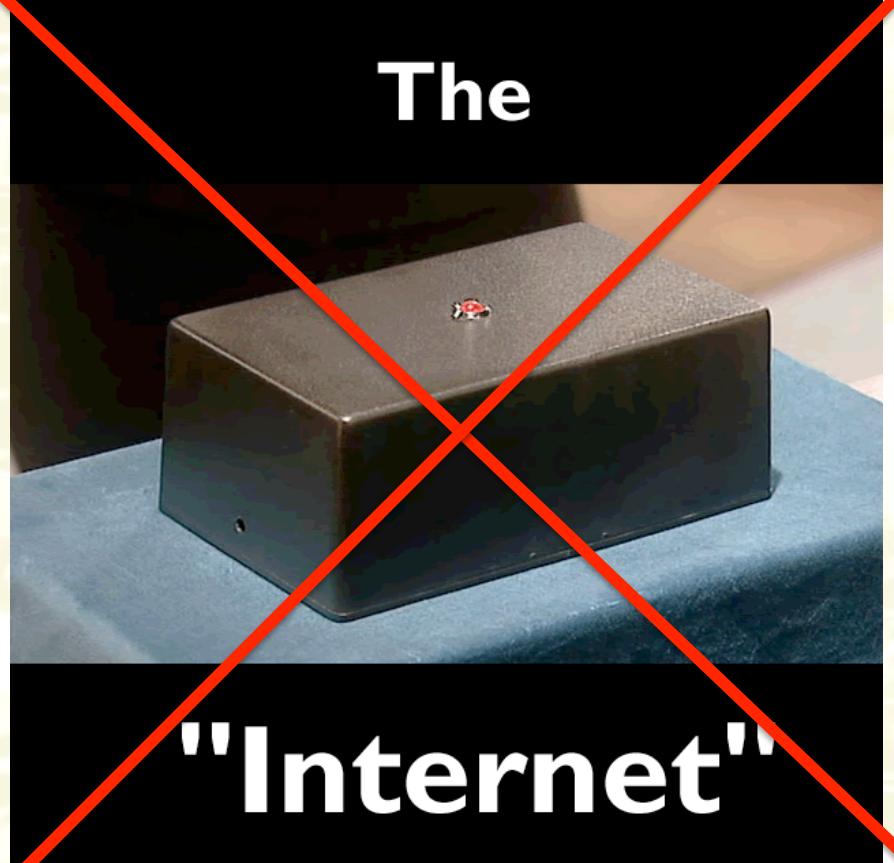


E.g. VoIP requires packets to be delivered with a delay which is in the worst case in the order of 150ms one-way





# Infrastructure QoS support



# Cisco IOS: Basic commands

---

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# Basic commands

- Show current configuration:
  - show running-config
- Save permanently configuration:
  - copy running-config startup-config
- Reboot a router:
  - reload



# Interface configuration

- Configuration:
  - configure terminal
- Configure an interface:
  - interface Ethernet0/0
  - ip address 192.168.1.1 255.255.255.0
  - no shutdown
- Set DHCP server:
  - ip dhcp pool localnetwork
  - network 192.168.1.0 255.255.255.0
  - default-router 192.168.1.1



# RIP configuration

- Configuration:
  - router rip
  - network 10.0.0.0
  - network 192.168.1.0
- Show routing-table:
  - show ip route

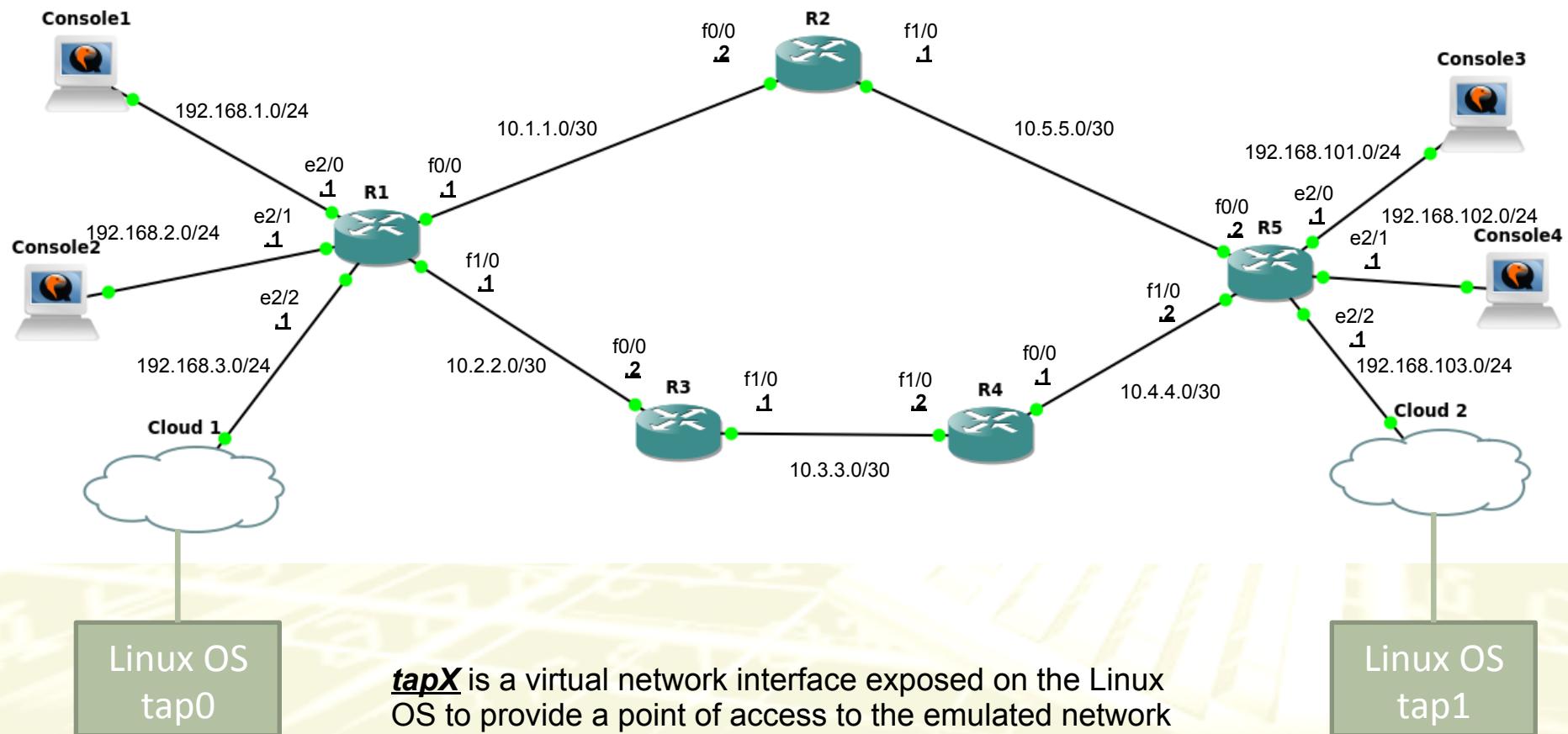
# Basic Network

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# Network Architecture

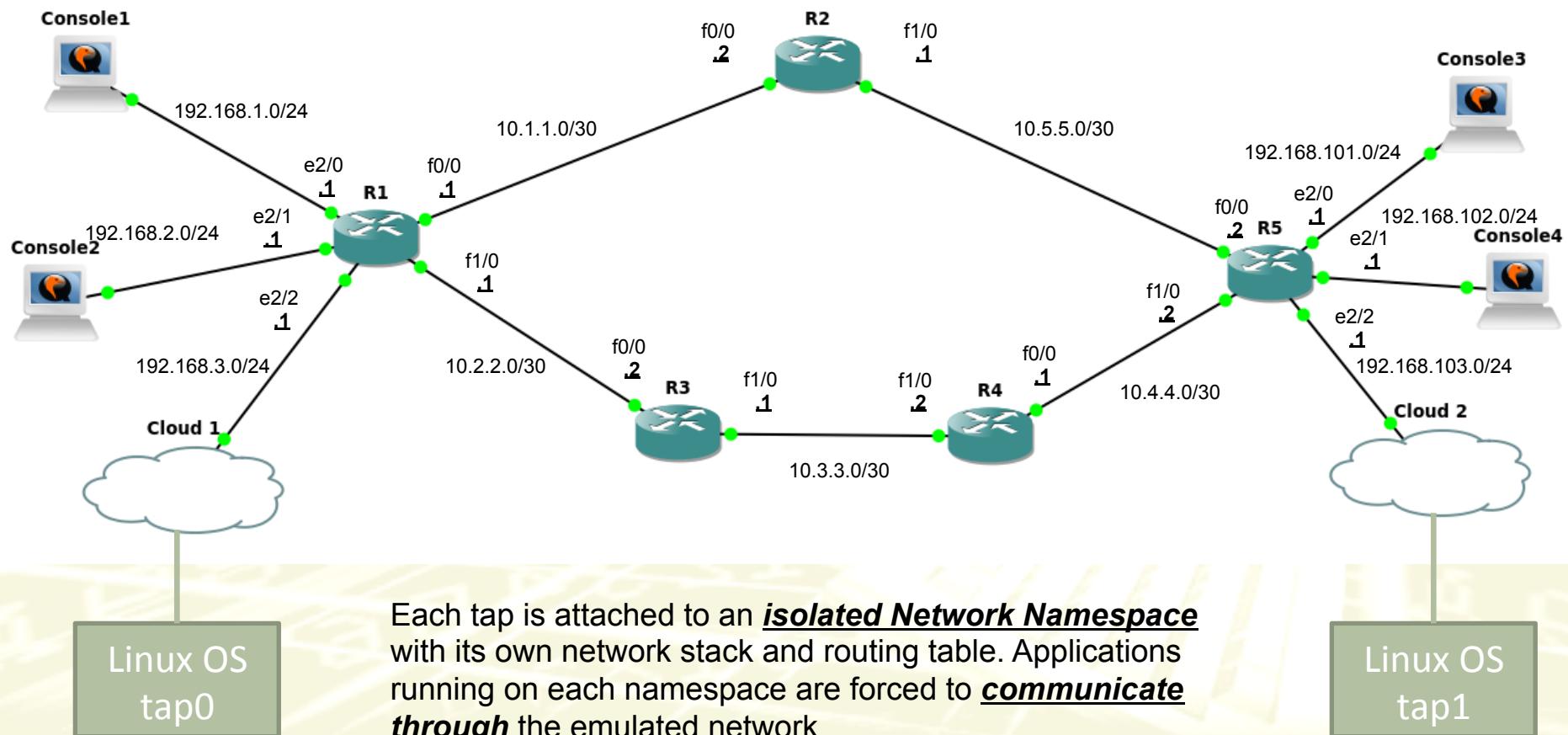


Linux OS  
tap0

Linux OS  
tap1



# Network Architecture



Linux OS  
tap0

Linux OS  
tap1

# IPv6 Configuration

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# IPv6 address configuration

- Configuration:

- interface Ethernet0/0
- ipv6 enable
  - (Automatically configure an IPv6 link-local address on the interface, and enable the interface for IPv6 processing)
- ipv6 address 2001:aaaa:bbbb:cccc::/64 eui-64
- ipv6 unicast-routing
  - Enable forwarding of IPv6 unicast data packets

- Check configuration status:

- show ipv6 interface Ethernet0/0



# IPv6 host configuration

- Go to Linux Console 1:

- ifconfig
    - Address already obtained! When a Router Advertisement is received by a client, and IPv6 autoconfiguration is enabled (default on non-router), the client configures itself an IPv6 address according to the prefix contained in the advertisement.

- Ping:

- ping6 [IPv6 address]
    - From Host, try both link-local and global
  - Use wireshark to see what's going on the net!



# 6to4 Tunneling Configuration

- On R1 create a new tunnel interface :
  - interface Tunnel0
  - no ip address
  - no ip redirects
  - ipv6 address 2002:a01:101:1::1/64
  - tunnel source 10.1.1.1
  - tunnel mode ipv6ip 6to4
- Add manually routing information:
  - ipv6 route 2001:bbbb:bbbb:cccc::/64 2002:a05:502:1::1
  - ipv6 route 2002:a05:502:1::1/64 Tunnel0
- Replicate configuration on R5

a01:101 corresponds  
to 10.1.1.1



# Tunnel IPv6

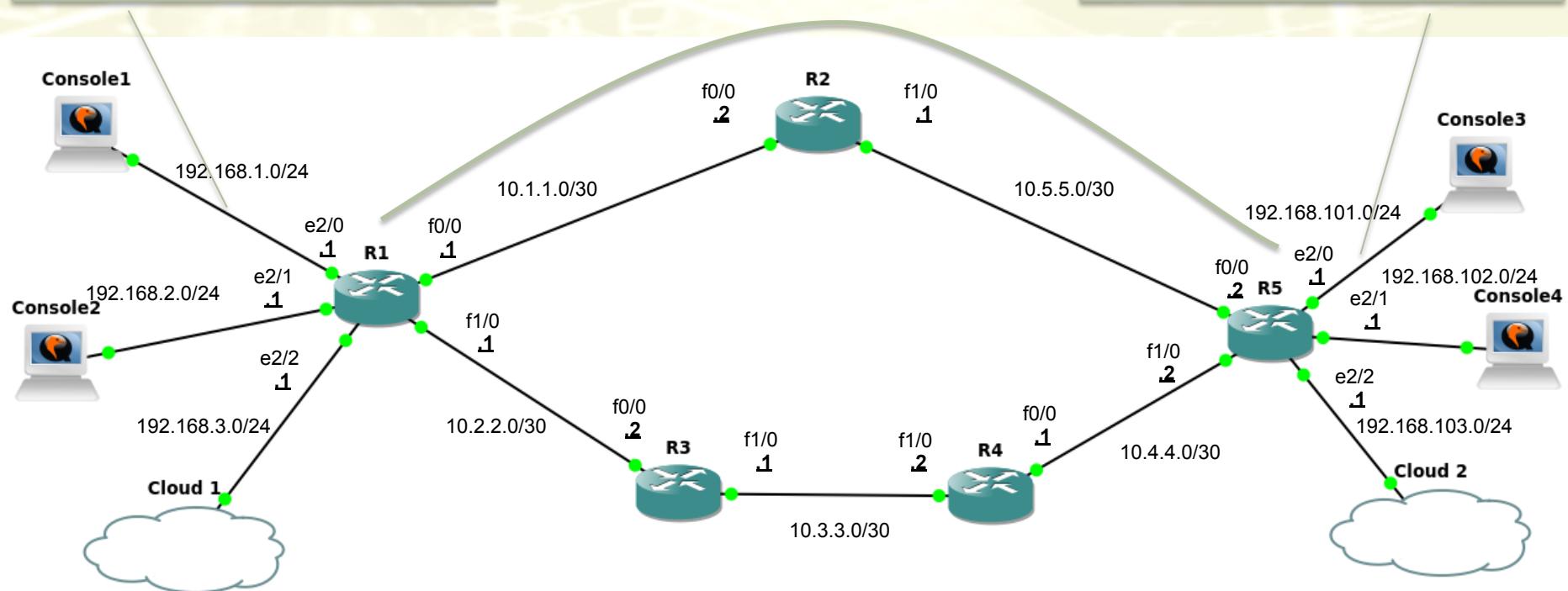
IPv6/IPv4 link

2001:aaaa:bbbb:cccc::/64

6to4 Tunnel

IPv6/IPv4 link

2001:bbbb:bbbb:cccc::/64



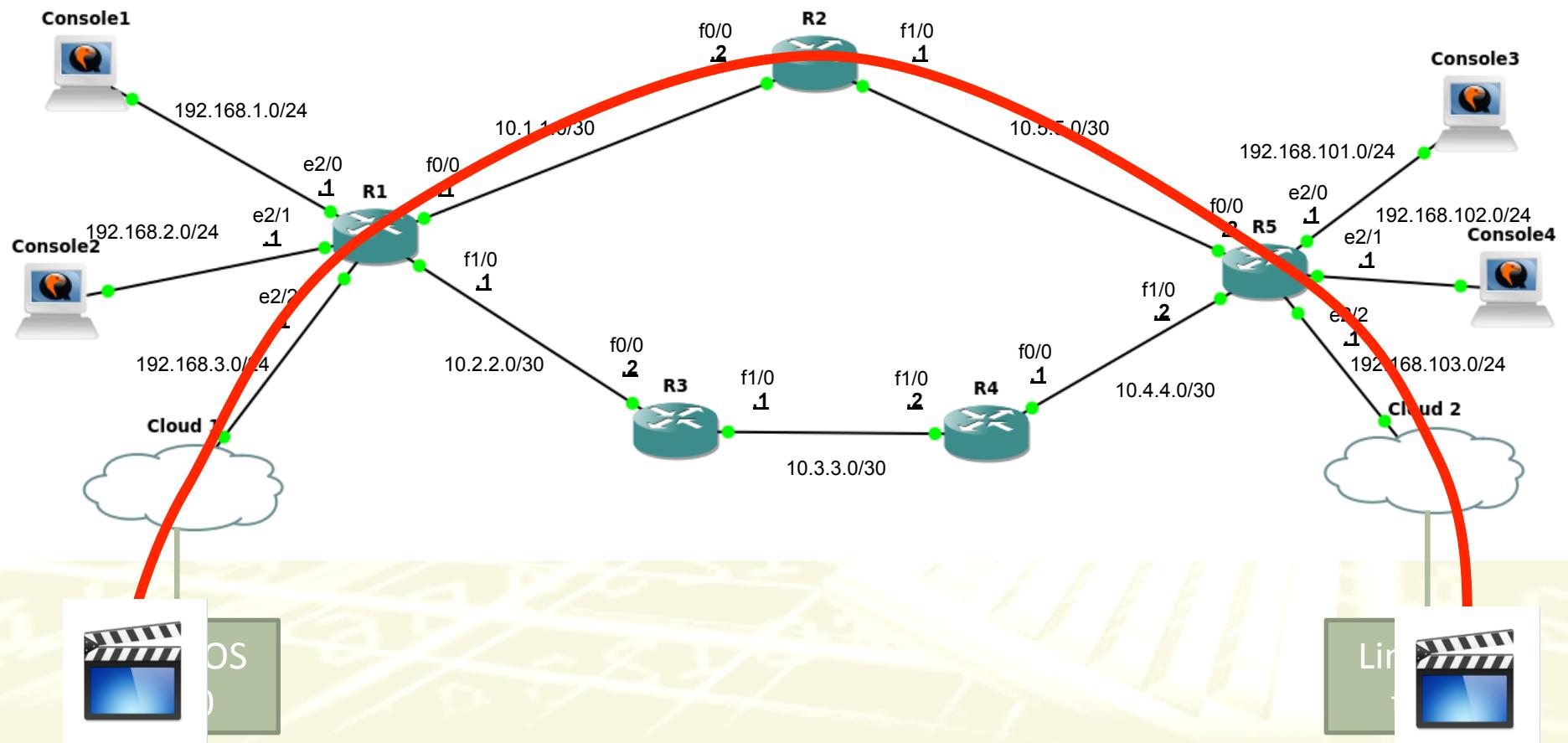
# Best Effort

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# Network Architecture





# Soft real-time traffic – Video

- Initialize Linux Namespaces:
  - [http://www.sample-videos.com/video/mp4/240/big\\_buck\\_bunny\\_240p\\_50mb.mp4](http://www.sample-videos.com/video/mp4/240/big_buck_bunny_240p_50mb.mp4)
- Install vnc on the virtual machine if needed
  - sudo apt-get install vlc vlc-nox



# Soft real-time traffic – Video

- Download video from:
  - cd streaming
  - ./init.sh
- Verify Server IP address:
  - sudo ip netns exec server ifconfig
  - inet addr:192.168.103.2
  - Modify the file server.sh and client.sh accordingly
- Start Server:
  - sudo ip netns exec server ./server.sh
- Start Client:
  - sudo ip netns exec client ./client.sh



# Soft real-time traffic – Video

- Video is flowing
- Start UDP traffic
- Open Console3:
  - iperf3 -u -c 192.168.1.2 -b 100M
- Open Console1:
  - iperf3 -s



# References

- IPv6 configuration:  
[http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/ipv6/configuration/12-4t/ipv6-12-4t-book/ip6-addrg-  
bsc-con.html](http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/ipv6/configuration/12-4t/ipv6-12-4t-book/ip6-addrg-bsc-con.html)
- Tunnel 6to4:  
[http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/ipv6/configuration/12-4t/ipv6-12-4t-book/ip6-  
tunnel.html#GUID-26B4E1CE-B36F-4C82-8A38-78199FBCA0DF](http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/ipv6/configuration/12-4t/ipv6-12-4t-book/ip6-<br/>tunnel.html#GUID-26B4E1CE-B36F-4C82-8A38-78199FBCA0DF)