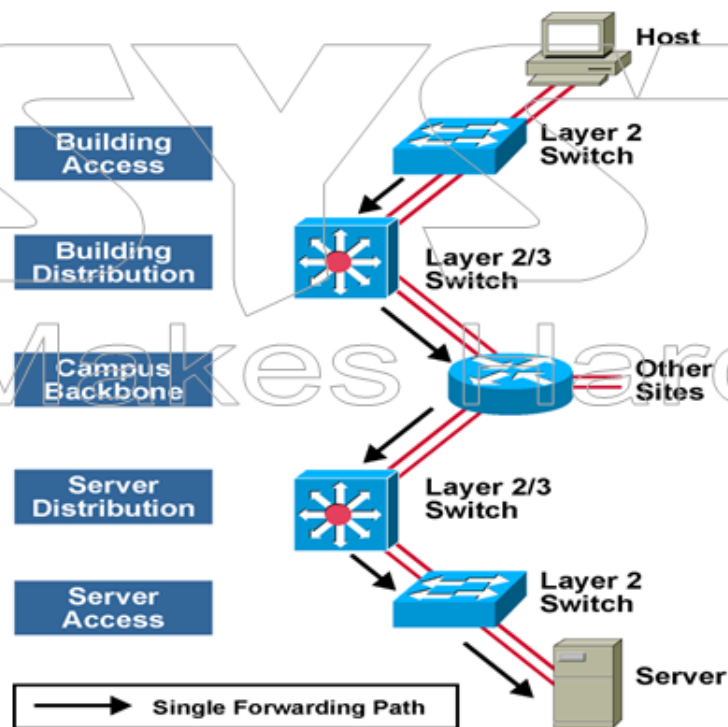
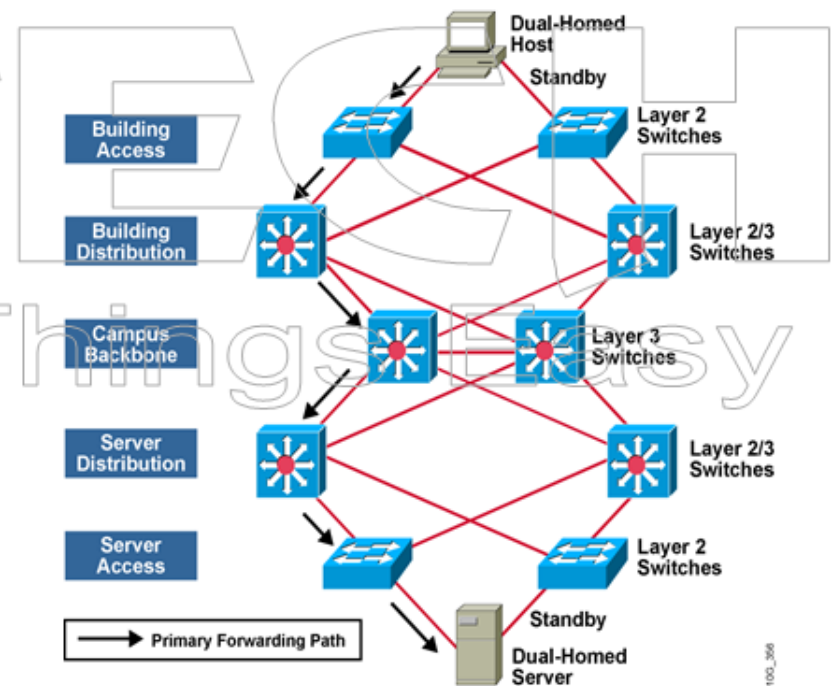


Redundancy in a Multilayer Switched Network

Switched Network with Fault-Tolerant Devices and Single Points of Failure



Redundant Switched Network with No Single Point of Failure



0100_306

Supervisor Redundancy

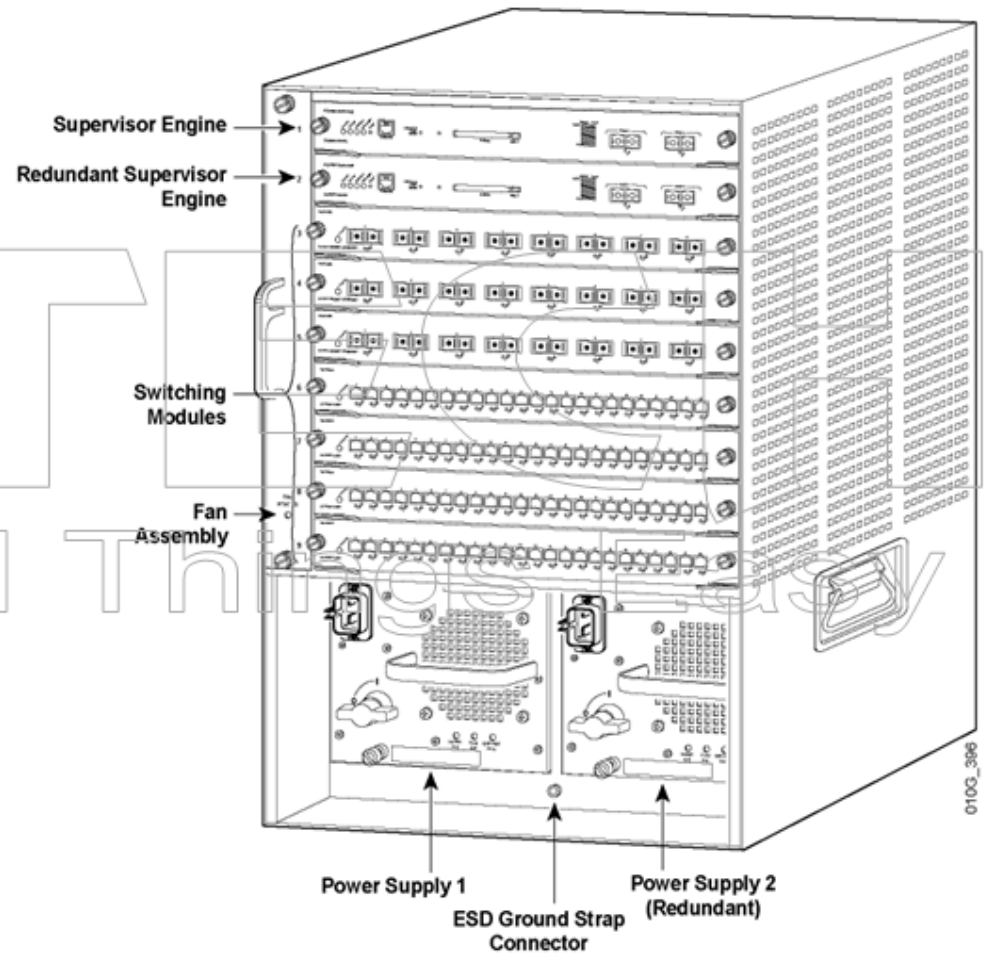
✓ **Redundancy within a device**

✓ **Catalyst Supervisors**

✓ **Power supplies**

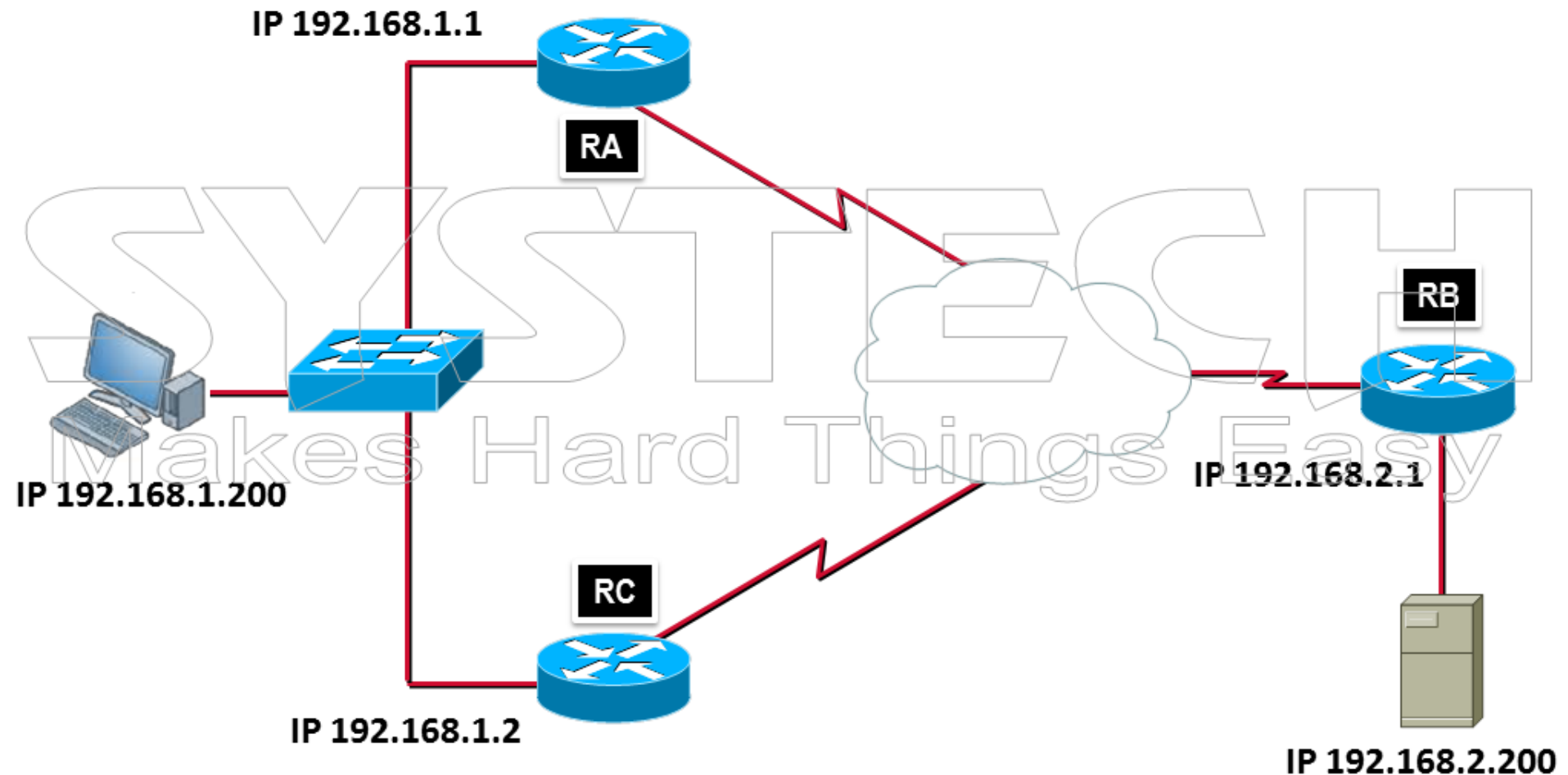
✓ **Fans**

✓ **Hot-swappable Module**



Problem in Redundancy

Using Default Gateway, Proxy ARP & IRDP (ICMP Router Discovery Protocol)

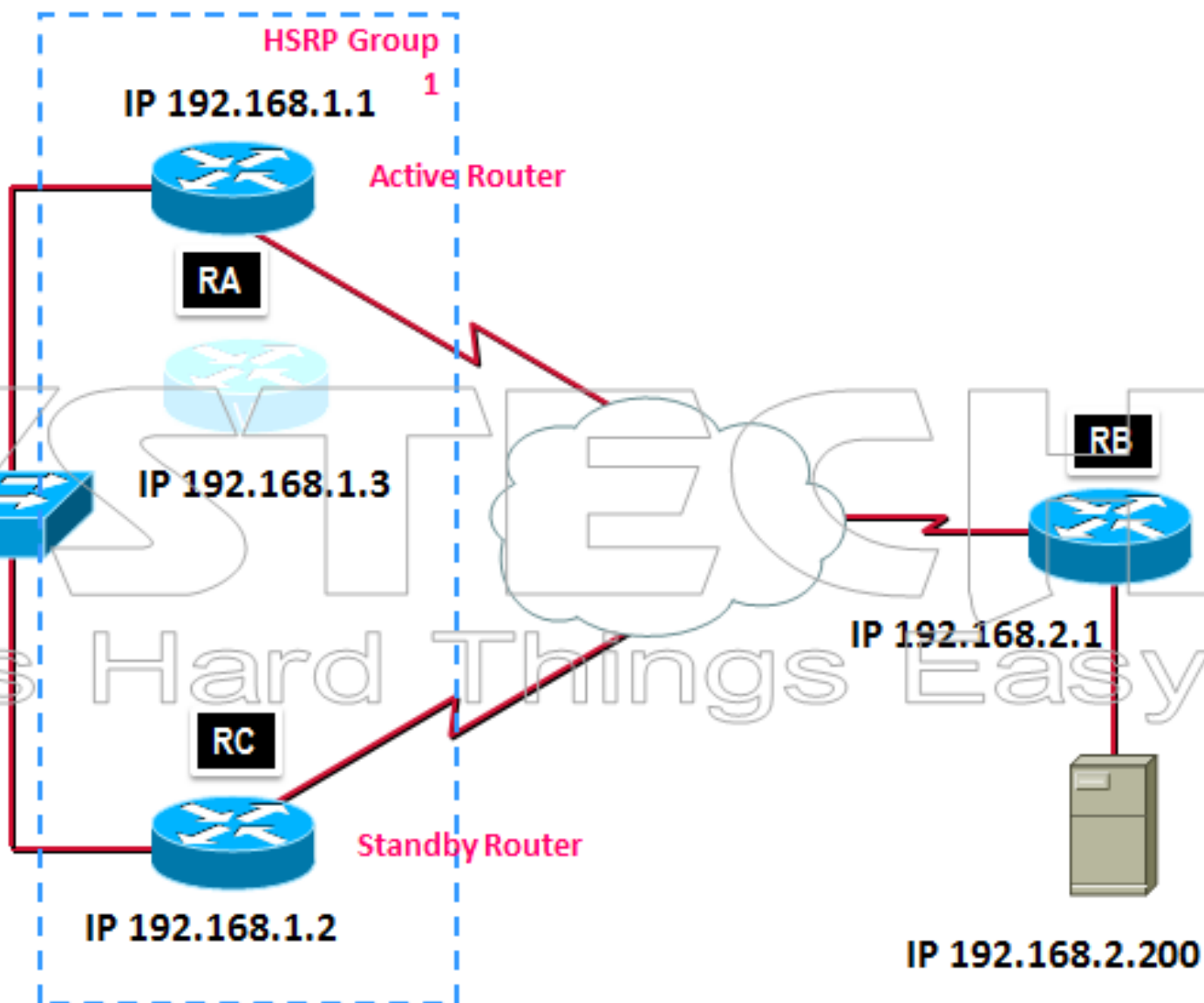


HSRP(Hot Standby Routing Protocol)

- ✓ **Cisco proprietary**
- ✓ **Provides Router and switch redundancy**
- ✓ **Routers are grouped together, to work as one virtual router**
- ✓ **Group is identified by Group ID (maximum 16 groups)**
 - **Range 0 – 255 (default is 0)**
 - **A router can be member of multiple group**
- ✓ **Two roles of Router**
 - **Active Router**
 - **Standby Router**
- ✓ **Hello time is 3 seconds**
- ✓ **Hold time is 10 seconds**
- ✓ **Default priority is 100**
- ✓ **By default router or switch with highest priority will become the active HSRP device**
- ✓ **If priority is same than router or switch with highest IP address will become active HSRP device**
- ✓ **HSRP is Application Layer Protocol**
- ✓ **Uses UDP port 1985, multicast address 224.0.0.2 for hello message**

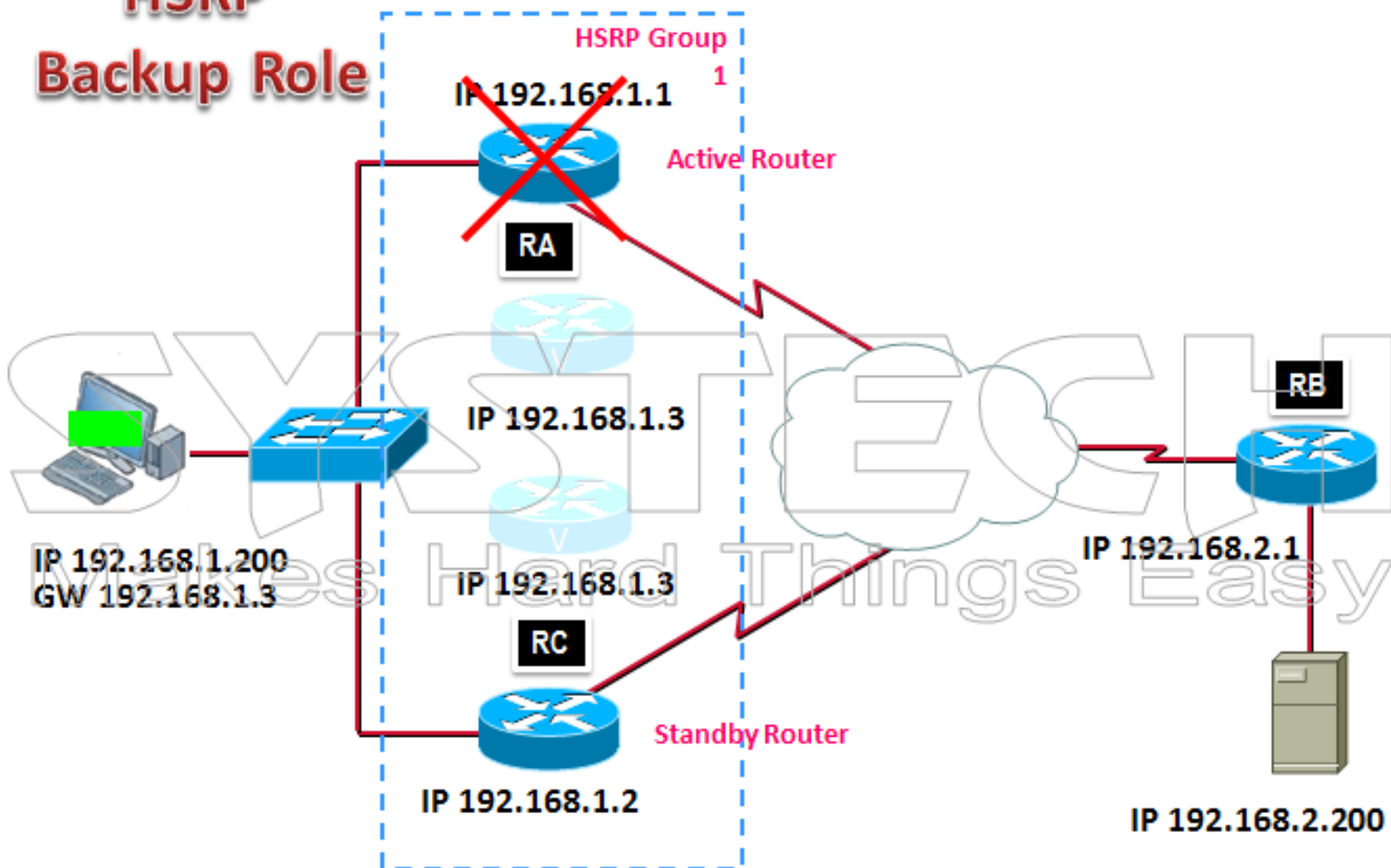
HSRP

IP 192.168.1.200
GW 192.168.1.3

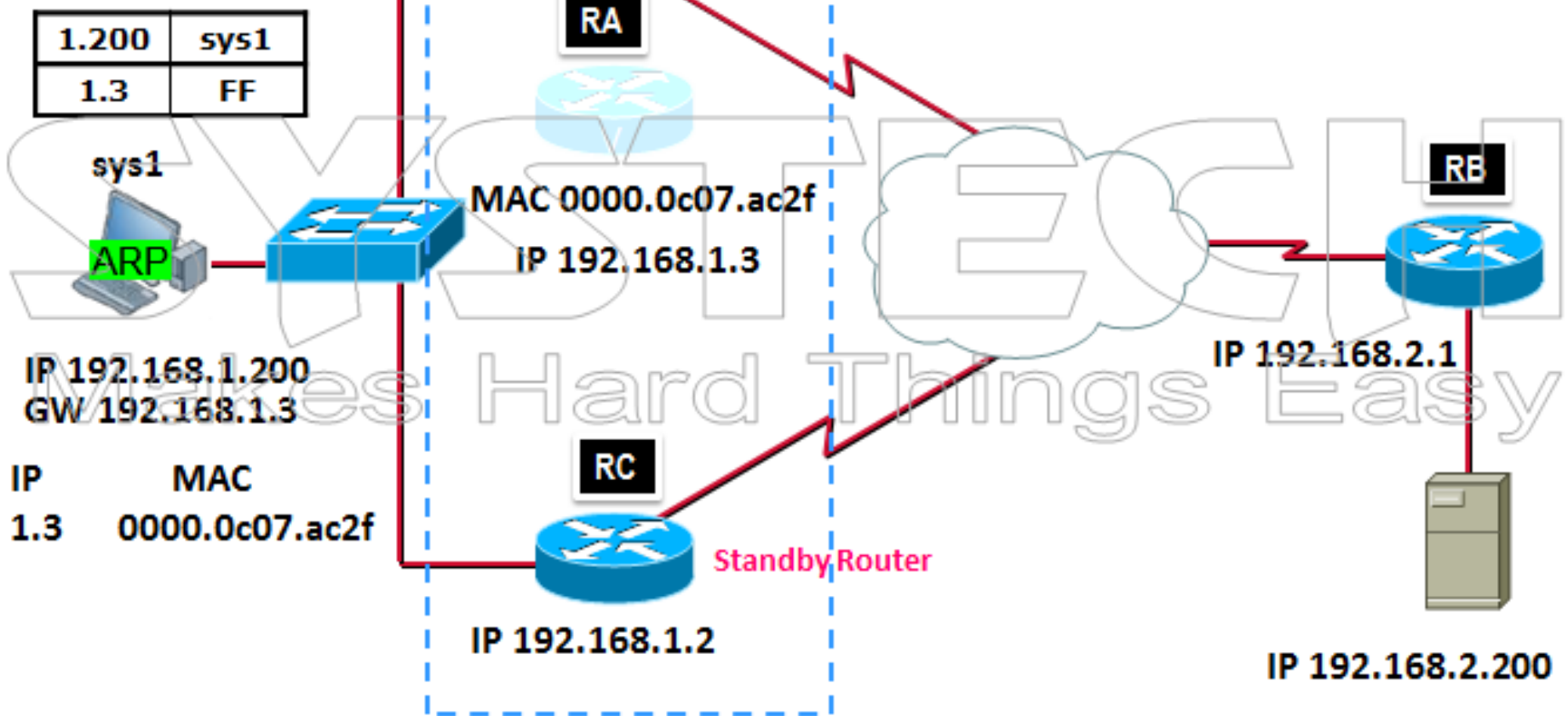


HSRP

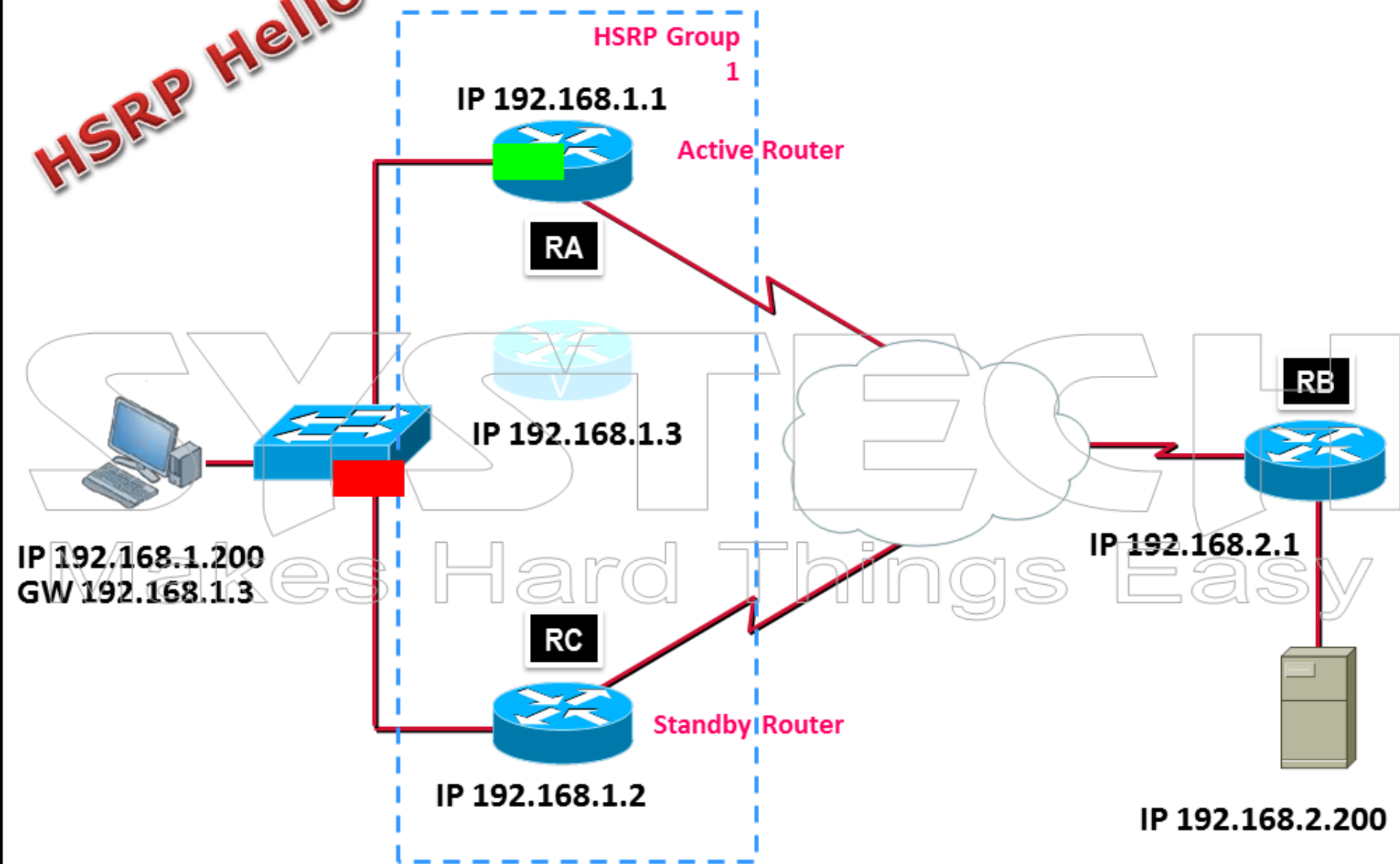
Backup Role



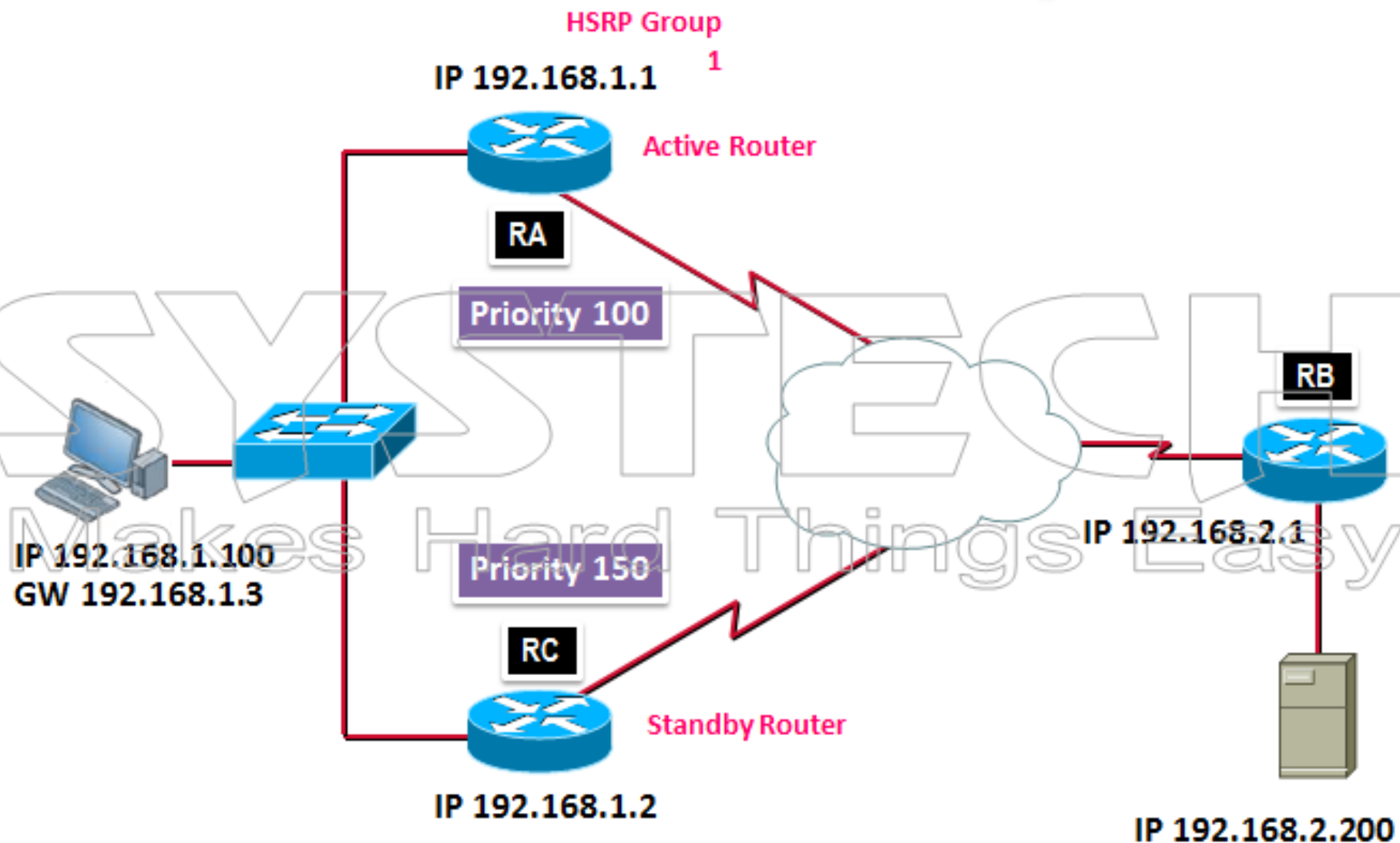
HSRP ARP



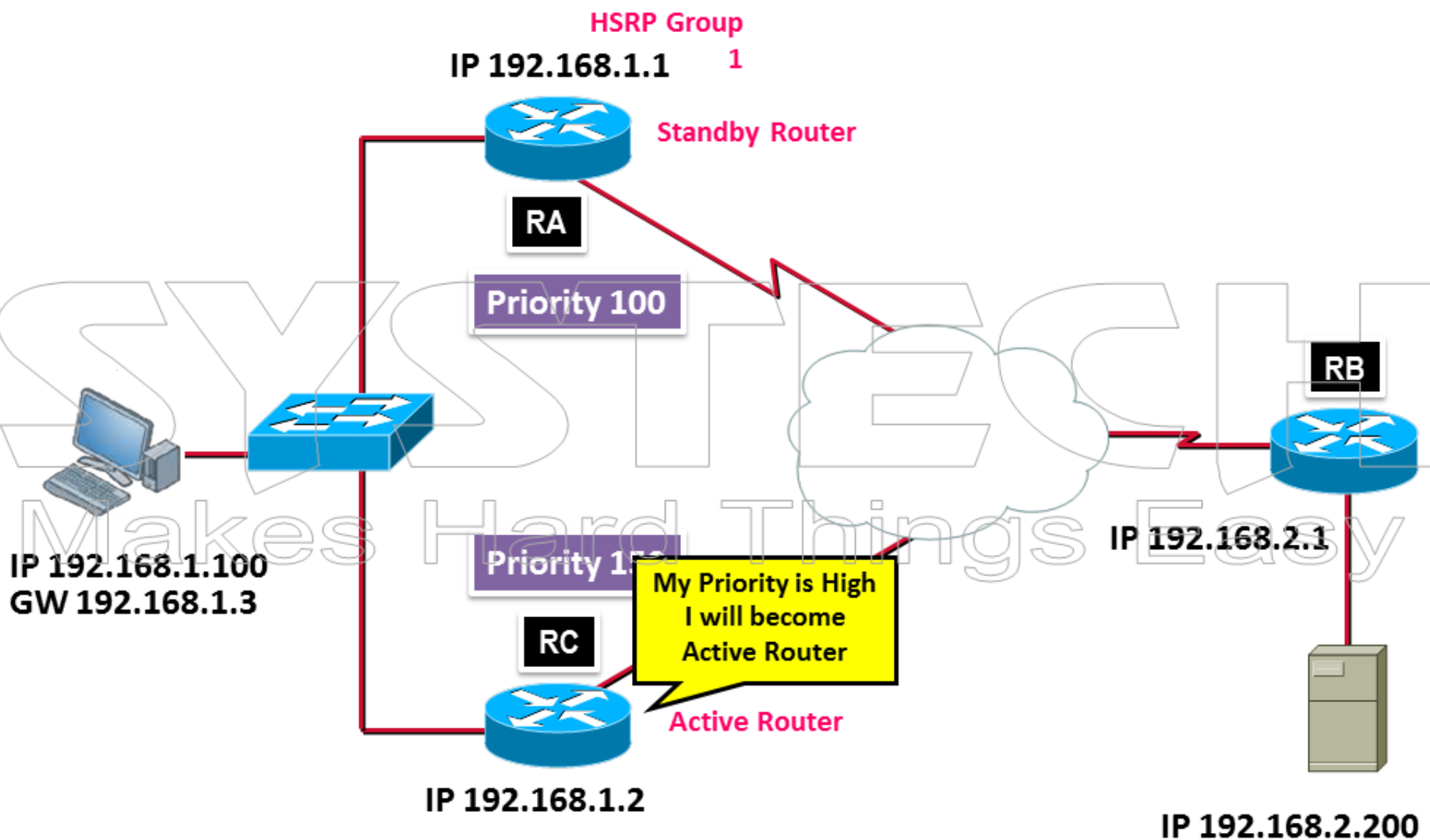
HSRP Hello



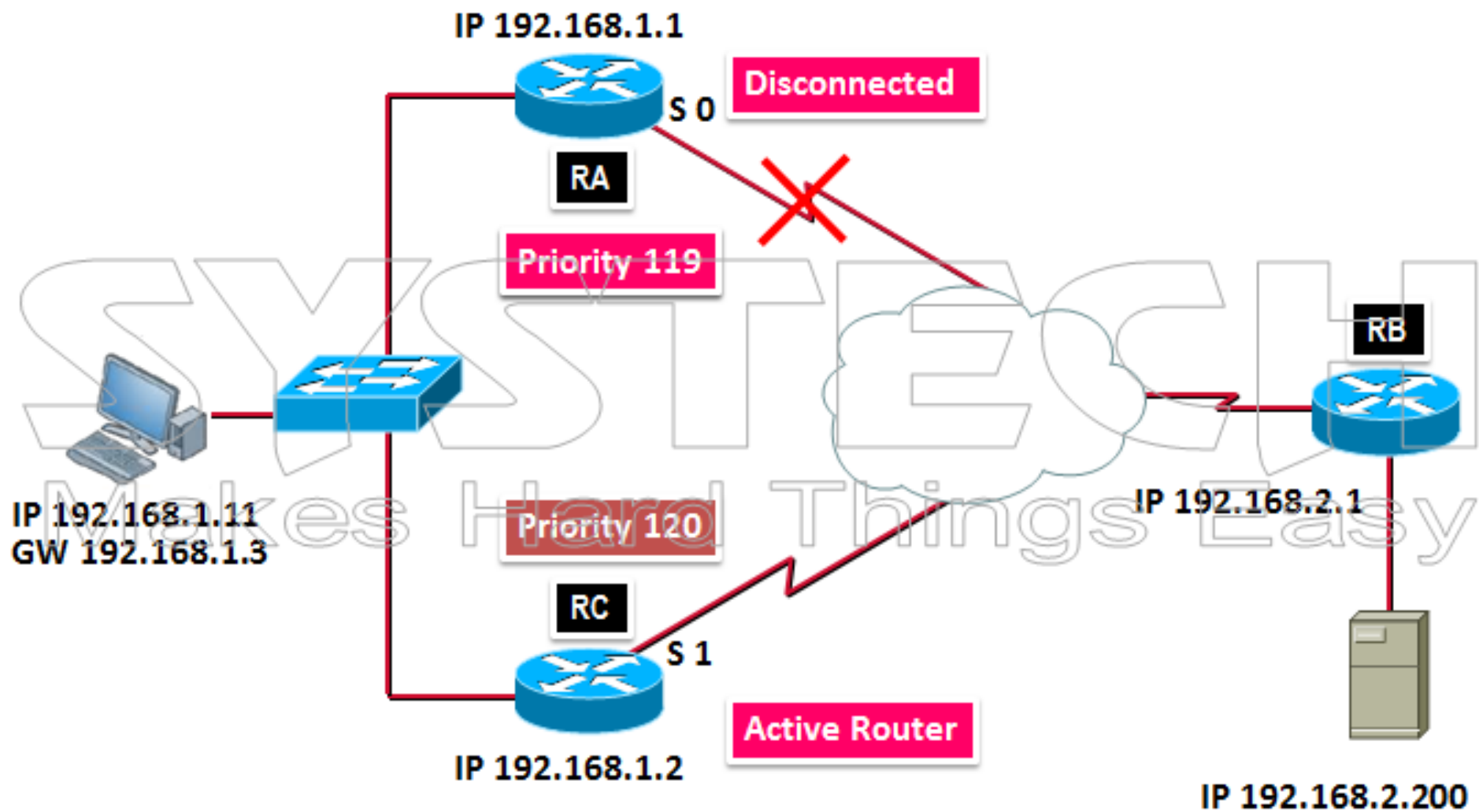
HSRP Before Preempt



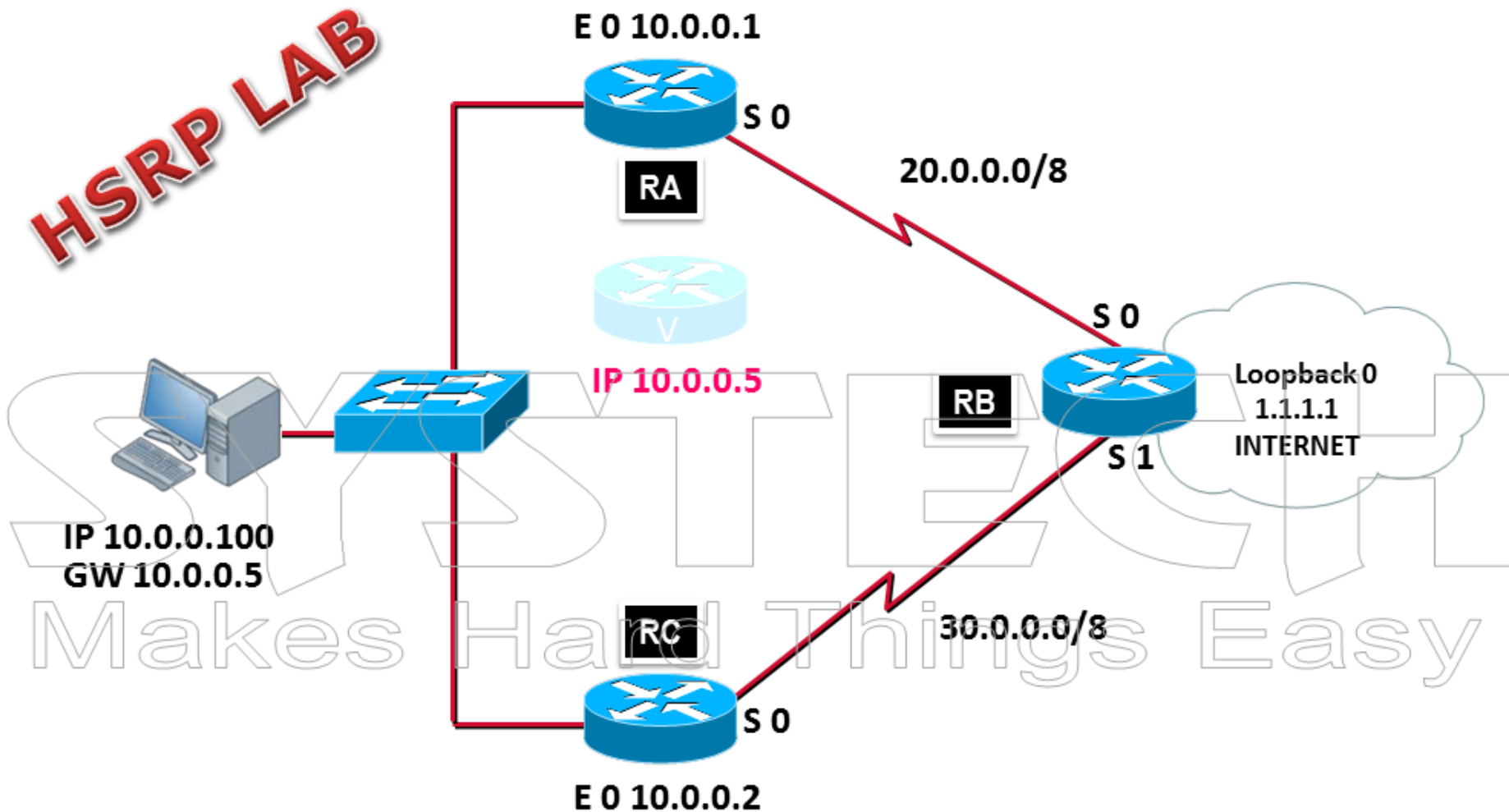
HSRP After Preempt



HSRP Interface Tracking



HSRP LAB



**Enable interfaces and configure any protocol e.g. EIGRP 100
&
Ping 1.1.1.1 from PC 10.0.0.100**

HSRP

RA

```
# int e0
# standby 1 ip 10.0.0.5
# standby 1 priority 150
```

RC

```
# int e0
# standby 1 ip 10.0.0.5
# standby 1 priority 160
```

RA&RC

```
# show standby
# debug standby events
```

Ping & tracet 1.1.1.1
from PC 10.0.0.100

HSRP Preempt

RC

```
# int e0
# standby 1 priority 180
# standby 1 preempt
# show standby
```

Ping & tracet 1.1.1.1
from PC 10.0.0.100

HSRP Interface Tracking

RC

```
# int e0
# standby 1 preempt
# standby 1 track s0 31
# int s0
# sh
```

Ping & tracet 1.1.1.1
from PC 10.0.0.100

HSRP Authentication

RA&RC

```
# int e0
# standby 1 authentication md5 key-string md5pass
```

HSRP Timer

```
# int e0
# standby 1 timer msec 100 msec 300

# int e0
# standby 1 preempt delay minimum 60
```

HSRP Version 2

```
# standby 1 version 2
```

Version 1&2 are not compatible

	HSRP V1	HSRP V2
Group Numbers	0 - 255	0 - 4095
Virtual MAC Address	000.0c07.acxx (XX = group number)	0000.0c9f.fxxx (XXX = group number)
Multicast Address	224.0.0.2	224.0.0.12

VRRP(Virtual Router Redundancy Protocol)

- ✓ Open Standard protocol (IETF –RFC 3768)
- ✓ Provides Router redundancy
- ✓ Routers group together to work as one virtual router
- ✓ Group is identified by Group ID (maximum 255 groups)
Range 0 – 255 (default is 0)

- ✓ Group have two type of router

Master router

Backup Router

- ✓ Master Router
 - Only one master per group
 - Actively forwards traffic coming for virtual IP

- ✓ Backup Router
 - Multiples Backup per Group

- ✓ VRRP is Network Layer Protocol

- ✓ Uses 224.0.0.18 for hello

- ✓ Hello will be send only by master

- Hello = 1 sec and hold = 3 X hello + skew timer
- Skew = $(256 - \text{priority}) / 256$

- ✓ VRRP Election priority

- Router with physical IP = Virtual IP
- Router with highest Priority
- Router with highest Physical IP

```
# int e0
# vrrp 1 ip 10.0.0.5
# vrrp 1 priority 150
```


Load-Balancing with HSRP & VRRP

IP 10.0.0.100
GW 10.0.0.5

E0 10.0.0.1

Active Router

Int E 0

Standby 10 ip 10.0.0.5

Standby 10 priority 150

Standby 20 ip 10.0.0.6

IP 10.0.0.5

IP 10.0.0.6

IP 192.168.2.1

Standby Router

E0 10.0.0.2

Int E 0

Standby 10 10.0.0.5

Standby 20 ip 10.0.0.6

Standby 20 priority 150

IP 192.168.2.200

IP 10.0.0.101
GW 10.0.0.6

IP 10.0.0.100
GW 10.0.0.5

E0 10.0.0.1

Disconnected

Int E 0
Standby 10 ip 10.0.0.5
Standby 10 priority 150
Standby 20 ip 10.0.0.6

IP 10.0.0.5
IP 10.0.0.6

IP 192.168.2.1

Active Router

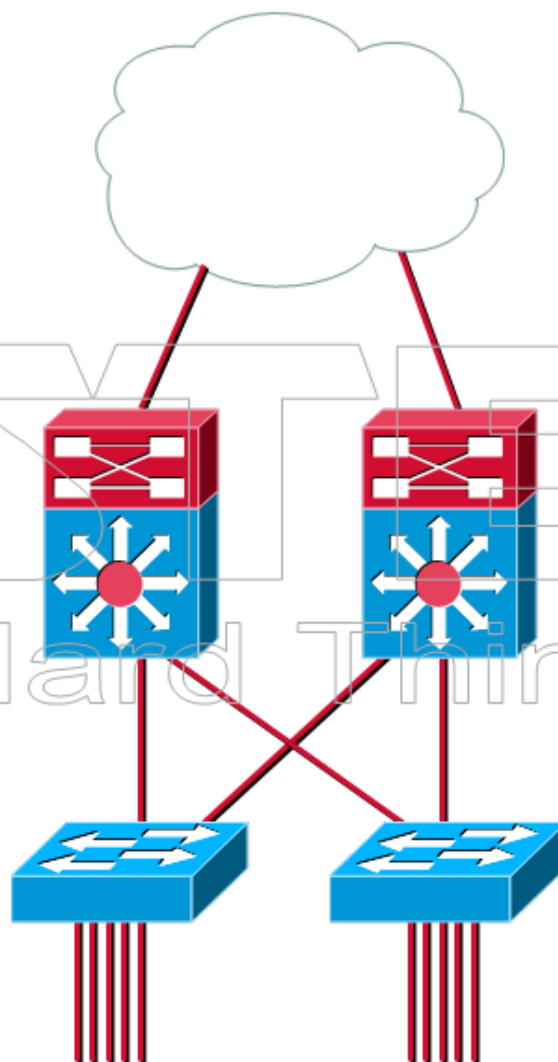
E0 10.0.0.2

Int E 0
Standby 10 10.0.0.5 IP 192.168.2.200
Standby 20 ip 10.0.0.6
Standby 20 priority 150

IP 10.0.0.101
GW 10.0.0.6

Load-Balancing With HSRP/VRRP in Multilayer Switch

Int VLAN 10
IP address 10.10.0.100 255.255.255.0
Standby 10 ip 10.10.0.1
Standby 10 priority 150
Int VLAN 20
IP address 10.20.0.100 255.255.255.0
Standby 20 ip 10.20.0.1



Int VLAN 10
IP address 10.10.0.200 255.255.255.0
Standby 10 ip 10.10.0.1
Int VLAN 20
IP address 10.20.0.200 255.255.255.0
Standby 20 ip 10.20.0.1
Standby 20 priority 150

GLBP(Gateway Load Balancing Protocol)

- ✓ Cisco proprietary protocol
- ✓ Provides Router redundancy with load balancing
- ✓ Routers group together to work as one virtual router
- ✓ Group is identified by Group ID
 - ✓ Range 0 – 1024 (default is 0)
- ✓ Group have two type of router
 - ✓ AVG
 - ✓ AVF
- ✓ AVG
 - ✓ Active Virtual Gateway
 - ✓ One per group
 - ✓ Reply for ARP coming for Virtual IP
 - ✓ Divides load among AVF
- ✓ AVF
 - ✓ Active Virtual Forwarder
 - ✓ Forwards user traffic coming for Virtual MAC
 - ✓ There can be up to four forwarder per group
- ✓ GLBP have two elections per Group
 - ✓ Active Virtual Gateway
 - ✓ Router with Highest Priority (default 100)
 - ✓ Router with Highest Physical IP
 - ✓ Only one AVG Per group
 - ✓ Election are non-preemptive
 - ✓ Active Virtual Forwarder
 - ✓ Router with Highest weight (default 100)
 - ✓ Router with Highest Physical IP
 - ✓ Up to four AVF Per group
 - ✓ Election are preemptive

GLBP Load Balancing Methods

Round-robin: the AVG will hand out the virtual MAC address of AVF1 then AVF2,AVF3 and get back to AVF1 etc

Host-depenent: A host will be able to use the same virtual MAC address of an AVF as long as it is reachable

Weighted: if you want some AVFs to forward more traffic than others you can assign them a different weight

```
# int e0
# glbp 1 ip 10.0.0.5
# glbp 1 priority 150
```

```
# glbp 1 weighting track s0 decrement 20
# glbp 1 weighting 100 lower 70 upper 90
```

IP 192.168.1.1
GW 192.168.1.3

IP 192.168.1.1

AVG/AVF
V-IP 192.168.1.3
V-MAC 0000.0c00.0001

IP MAC
1.3-0000.0c00.0001

IP MAC
1.3 - 0000.0c00.0002

V-MAC 0000.0c00.0002

AVF

IP 192.168.1.2

IP 192.168.1.2
GW 192.168.1.3

IP 192.168.2.1

IP 192.168.2.200