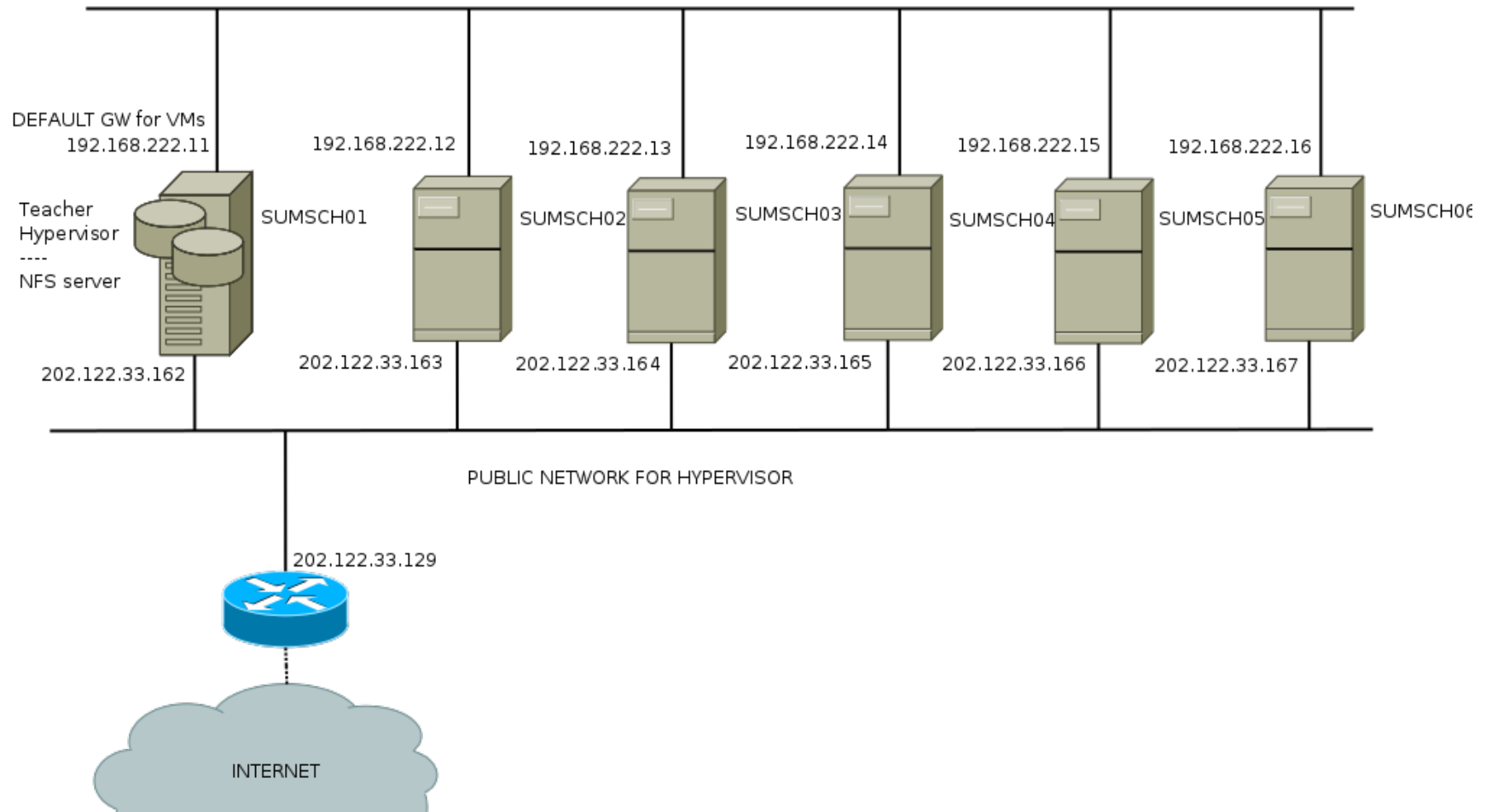# Internetworking recap

Some concepts to remind before
starting build a cloud infrastructure

Antonio Amoroso

Cloud Infrastructure
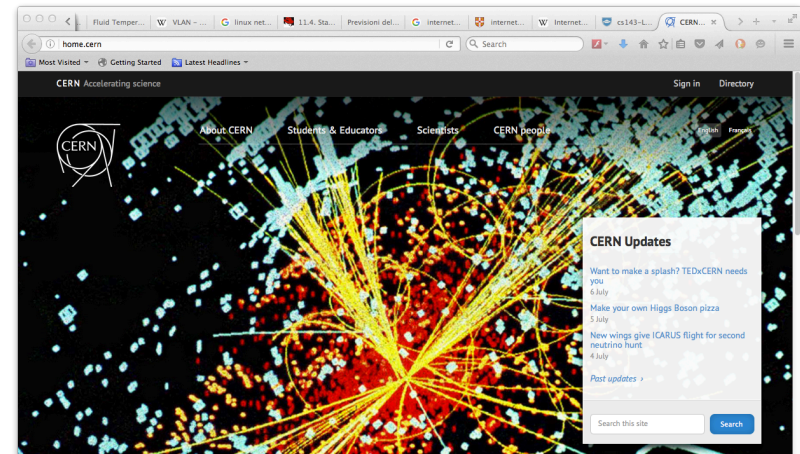
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Internetworking is the communication between 2 (or more) computers

http://www.cern.ch   =>   index.html

ssh root@sumschxx.ihep.ac.cn

DNS (Domain Name System)

Hierarchical decentralize naming system for any resources connected to the network (public or private)

It translates more readily memorized domain names to the numerical IP addresses needed for the purpose of locating and identifying computer services and devices with the underlying network protocols.
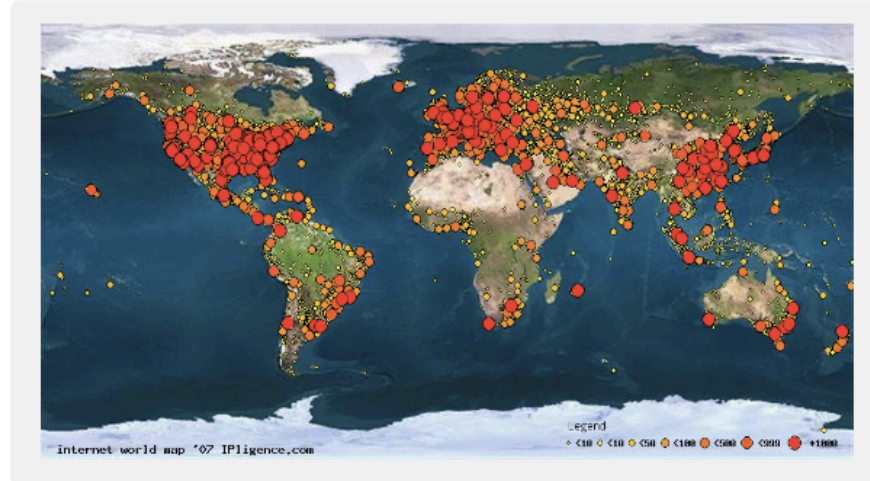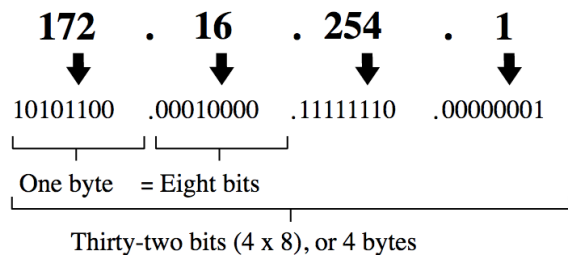
Two principal namespaces, the domain name hierarchy and the Internet Protocol address spaces

NAME
sumsch01.ihep.ac.cn

IP
202.122.33.163

IPv4 (Internet Protocol address)

numerical label assigned to each device (e.g., computer, printer) participating in a computer network (public/ private)

An IPv4 address (dotted-decimal notation)

172	. 16	. 254	. 1
↓	↓	↓	↓
10101100	.00010000	.11111110	.00000001

One byte = Eight bits

Thirty-two bits (4 x 8), or 4 bytes

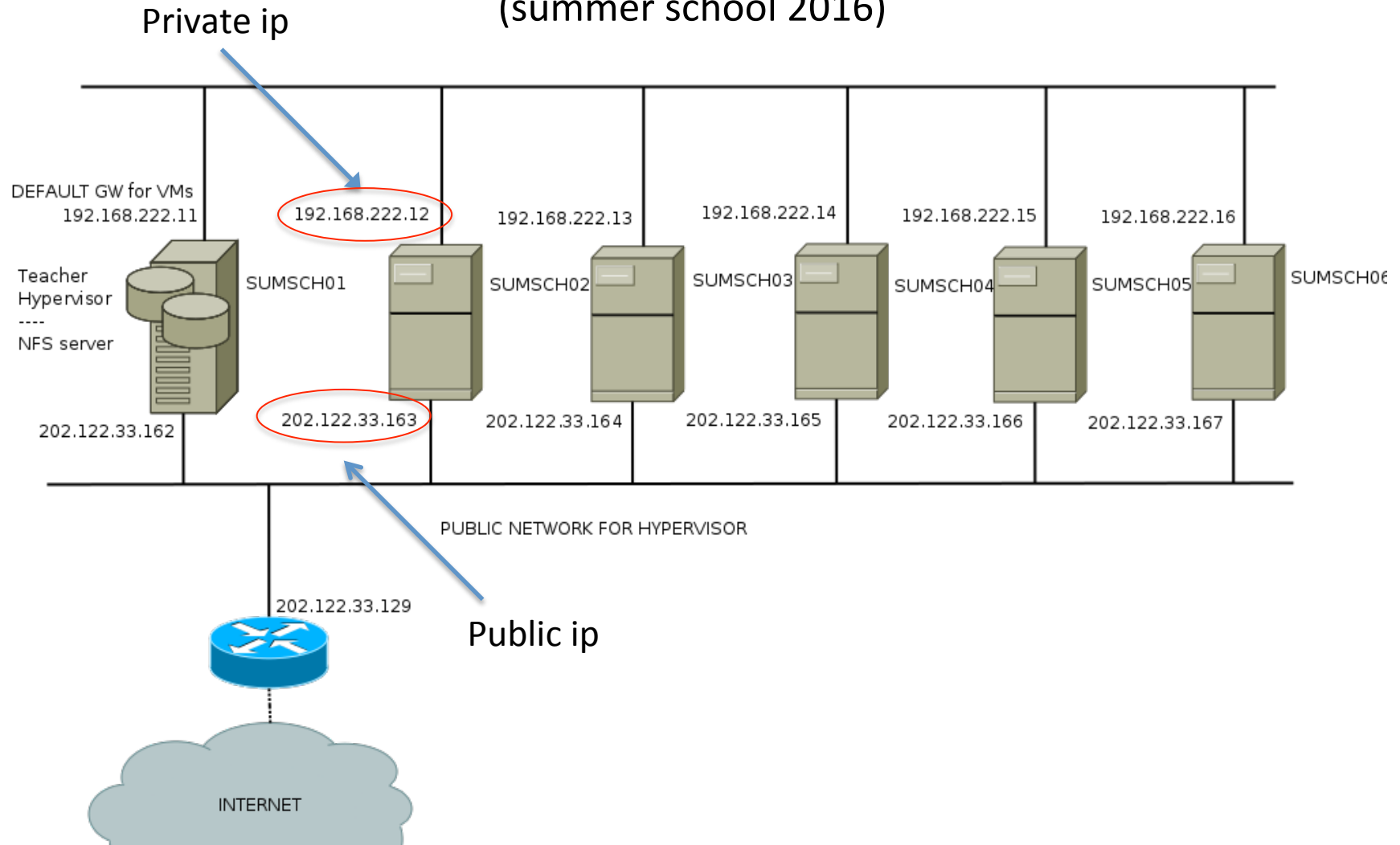internet world map '07 IPligence.com

The Internet Assigned Numbers Authority (IANA) manages the IP address space allocations globally and delegates five regional Internet registries (RIRs) to allocate IP address blocks to local Internet registries (Internet service providers) and other entities.

10.0.0.0 (private networks)
127.0.0.0 (loopback)
172.16.0.0-172.31.255.255 (private networks)
192.168.0.0-192.168.255.255 (private networks)

Geographic area	Number of addresses	Percentage
Africa	40241664	1.519%
Antartica	15620	0.001%
Asia	371297015	14.015%
Caribbean	1681866	0.063%
Central America	2557340	0.097%
Europe	569838903	21.510%
Middle East	12011131	0.453%
North America	1481754661	55.932%
Oceania	76417711	2.885%
South America	93409304	3.525%

Cloud Infrastructure
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Private ip

DEFAULT GW for VMs
192.168.222.11

192.168.222.12 192.168.222.13 192.168.222.14 192.168.222.15 192.168.222.16

Teacher
Hypervisor

NFS server

SUMSCH01 SUMSCH02 SUMSCH03 SUMSCH04 SUMSCH05 SUMSCH06

202.122.33.162 202.122.33.163 202.122.33.164 202.122.33.165 202.122.33.166 202.122.33.167

PUBLIC NETWORK FOR HYPERVISOR

202.122.33.129

Public ip

INTERNET

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PORT

A network port is a number that identifies one side of a connection between two computers.

As network addresses are like street address, port numbers are like room numbers. Any program may use any port, though some port numbers have a standard use and some programs may be limited in which ports they can use for security reasons.

Firewalls often block access to ports based on the network address and port of the source or destination computer.

Program	Port number
SSH	22
HTTP	80
HTTPS	443

GATEWAY

In a TCP/IP network, nodes (servers, workstations ect.) have a defined default route setting, (default gateway), defining where to send packets for IP addresses for which they can determine no specific route.

The node that is assumed to know how to forward packets on to other networks.
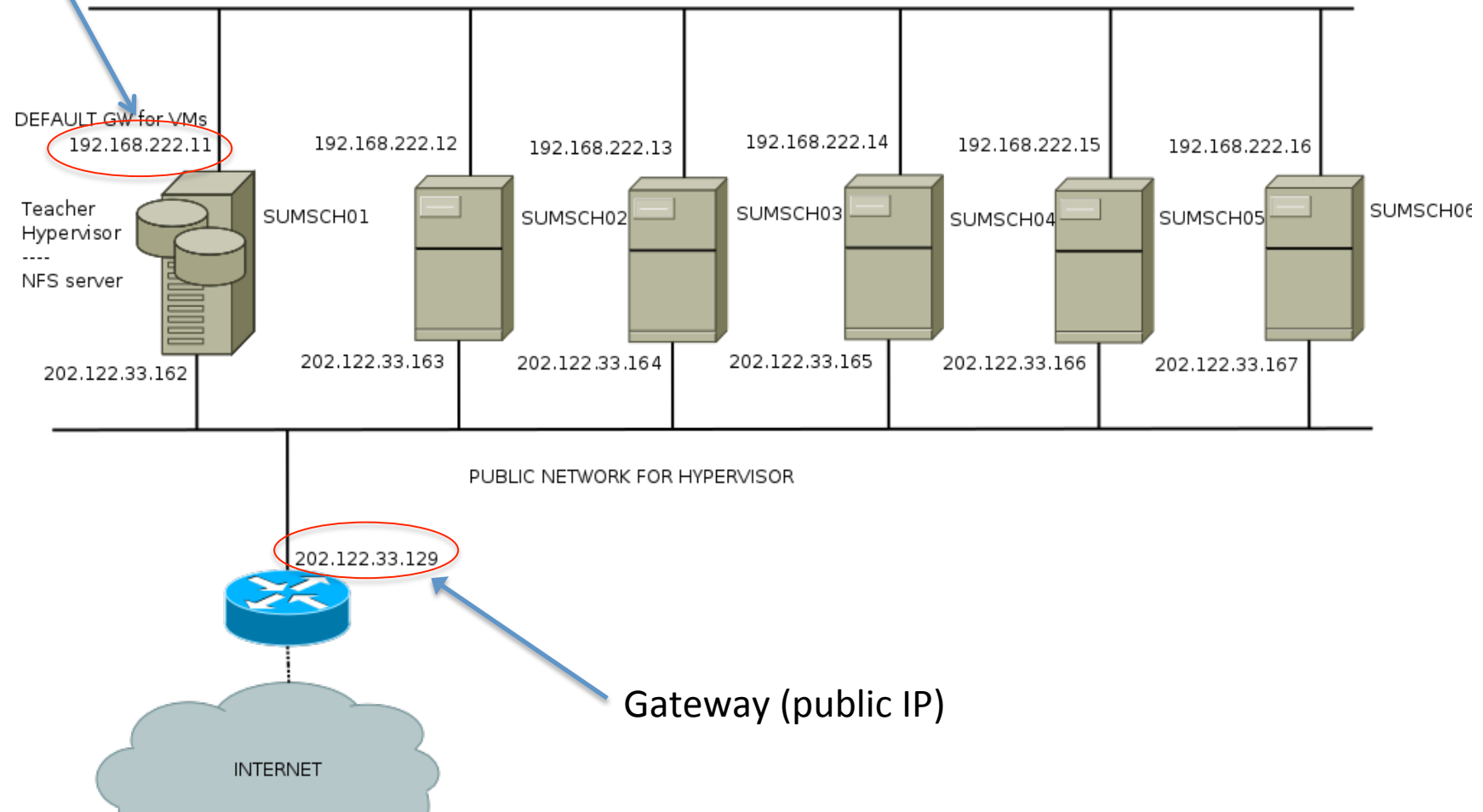
The gateway is by definition a router
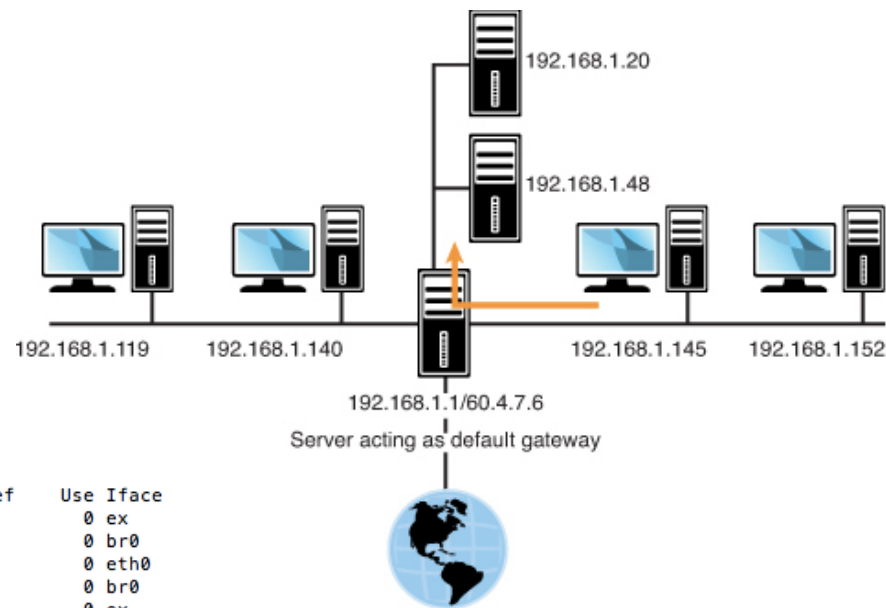

```
[root@sumsch01 ~]# route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
202.122.33.128  *               255.255.255.128 U     0      0        0 ex
192.168.222.0   *               255.255.255.0   U     0      0        0 br0
link-local      *               255.255.0.0     U     1002   0        0 eth0
link-local      *               255.255.0.0     U     1004   0        0 br0
link-local      *               255.255.0.0     U     1008   0        0 ex
default         202.122.33.129  0.0.0.0         UG    0      0        0 ex
```

Cloud Infrastructure
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Gateway (private IP)

DEFAULT GW for VMs
192.168.222.11

192.168.222.12

192.168.222.13

192.168.222.14

192.168.222.15

192.168.222.16

Teacher
Hypervisor

NFS server

SUMSCH01

SUMSCH02

SUMSCH03

SUMSCH04

SUMSCH05

SUMSCH06

202.122.33.162

202.122.33.163

202.122.33.164

202.122.33.165

202.122.33.166

202.122.33.167

PUBLIC NETWORK FOR HYPERVISOR

202.122.33.129

Gateway (public IP)

INTERNET

ROUTER

A router is a networking device that forwards data packets between computer networks.
A data packet is forwarded from one router to another through the networks until it reaches its destination node.

A router is connected to two or more data lines from different networks (as opposed to a network switch, which connects data lines from one single network).

 the router reads the address information in the packet to determine its ultimate destination, using information in its routing table or routing policy

Cloud Infrastructure
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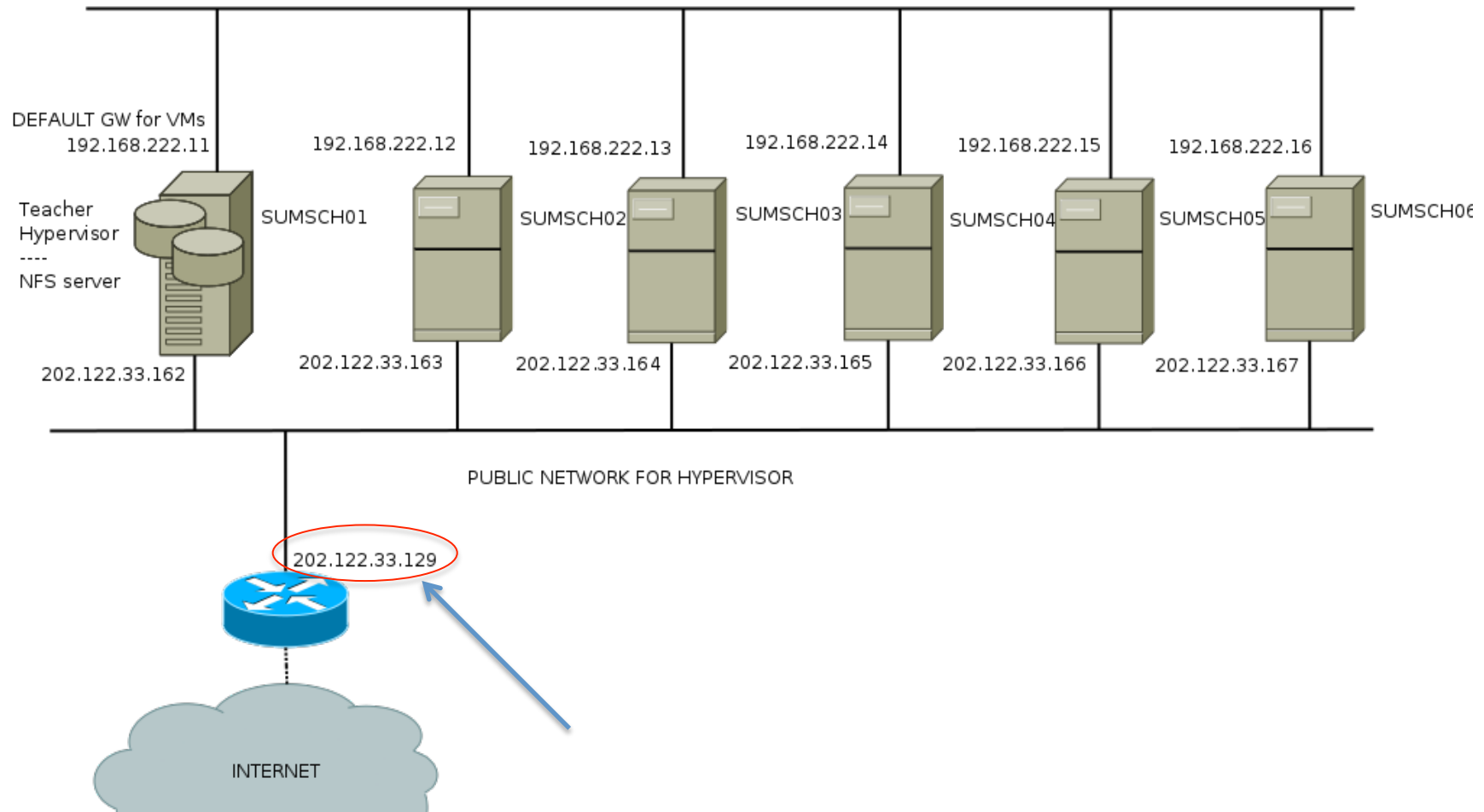
Network Interface

A network interface is a system's (software and/or hardware) interface between two pieces of equipment or protocol layers in a computer network

- eth0 – physical device
- br0 – bridge (VM)
- ex – public ip
- int – private ip
- lo - localhost

```
[root@sumsch01 ~]# ifconfig
br0       Link encap:Ethernet  HWaddr FC:15:B4:0B:2D:98
          inet addr:192.168.222.11  Bcast:192.168.222.255  Mask:255.255.255.0
          inet6 addr: fe80::fe15:b4ff:fe0b:2d98/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:35819838 errors:0 dropped:0 overruns:0 frame:0
          TX packets:24223331 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:46083311778 (42.9 GiB)  TX bytes:30306508710 (28.2 GiB)

eth0      Link encap:Ethernet  HWaddr FC:15:B4:0B:2D:98
          inet6 addr: fe80::fe15:b4ff:fe0b:2d98/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:53094443 errors:0 dropped:0 overruns:0 frame:0
          TX packets:28826614 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:56738248171 (52.8 GiB)  TX bytes:22591996457 (21.0 GiB)

ex        Link encap:Ethernet  HWaddr FC:15:B4:0B:2D:98
          inet addr:202.122.33.162  Bcast:202.122.33.255  Mask:255.255.255.128
          inet6 addr: fe80::fe15:b4ff:fe0b:2d98/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:17406624 errors:0 dropped:0 overruns:0 frame:0
          TX packets:4509685 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:15155772017 (14.1 GiB)  TX bytes:729803375 (695.9 MiB)

int       Link encap:Ethernet  HWaddr FC:15:B4:0B:2D:98
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:33677899 errors:0 dropped:0 overruns:0 frame:0
          TX packets:17996302 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:40730137664 (37.9 GiB)  TX bytes:21806146466 (20.3 GiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:83372 errors:0 dropped:0 overruns:0 frame:0
          TX packets:83372 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:51599990 (49.2 MiB)  TX bytes:51599990 (49.2 MiB)
```

MAC Address
(Media Access Control)

Unique identifier assigned to network interfaces for communications on the physical network segment (physical address).

Used as a network address for most IEEE 802 network technologies, including Ethernet and WiFi.

Assigned by the manufacturer of a network interface controller (NIC) and are stored in its hardware

Encodes the manufacturer's registered identification number

3C	:	07	:	54	:	0D	:	E1	:	B5

Vendor (Apple)

A network node may have multiple NICs and each NIC must have a unique MAC address.

Switch/Bridge

A switch is a device in a single computer network that connects together other devices.

Data cables (physical or virtual) plugged into a switch enable communication between different devices.

Switches manage the flow of data across a network by transmitting a received message only to the one or more devices for which the message was intended. Each networked device connected to a switch can be identified using a MAC address, allowing the switch to regulate the flow of traffic

Physical topology:

Logical topology:

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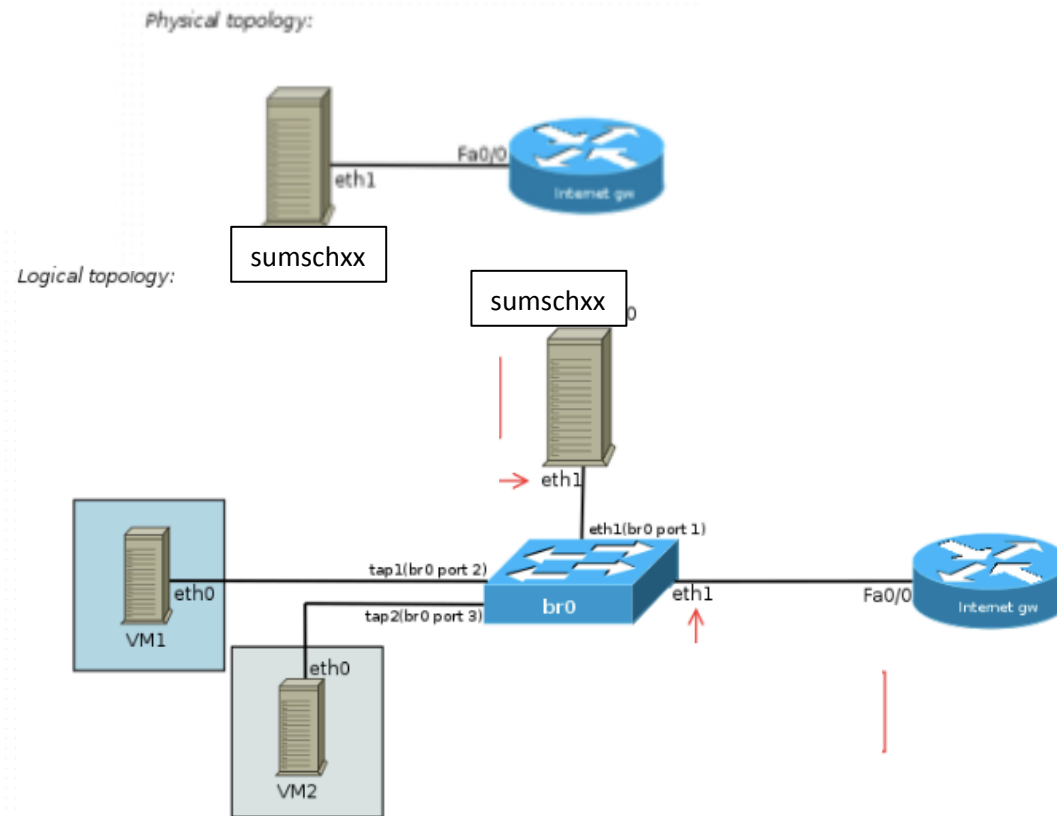
/etc/hosts

the mapping of some hostnames to IP addresses before DNS can be referenced is kept in the /etc/hosts file.
In the absence of a name server, any network program on your system consults this file to determine the IP address that corresponds to a host name.

/etc/resolv.conf

Is used to configure the system's Domain Name System (DNS) resolver.

```
[root@sumsch01 ~]# more /etc/resolv.conf
; generated by /sbin/dhclient-script
search ihep.ac.cn
nameserver 202.122.33.70
nameserver 202.38.128.58
```

/etc/sysconfig/network

is used to specify information about the desired network configuration.

```
[root@sumsch01 ~]# more /etc/sysconfig/network
NETWORKING=yes
HOSTNAME=sumsch01.ihep.ac.cn
GATEWAY=202.122.33.129
```

NFS (Network File System)

Distributed file system protocol originally developed by Sun Microsystems in 1984, allowing a user on a client computer to access files over a computer network much like local storage is accessed.

Allows remote hosts to mount file systems over a network and interact with those file systems as though they are mounted locally.

A way to mount an NFS share from another machine is to add a line to the /etc/fstab file on the client (as root) and to the /etc/exports on the server.
Hostname of the NFS server, the exported dir, the directory mounted on the local machine.

```
[root@sumsch01 ~]# more /etc/exports
/Datastore      192.168.222.*(sync,rw,no_root_squash)
/SharedHome 192.168.222.*(sync,rw,no_root_squash)
```

```
#
# /etc/fstab
# Created by anaconda on Wed Jun 22 09:52:38 2016
#
# Accessible filesystems, by reference, are maintained under '/dev/disk'
# See man pages fstab(5), findfs(8), mount(8) and/or blkid(8) for more info
#
UUID=dd2daae4-6551-487c-84b7-d8cbf5d4538d /                         ext4    defaults        1 1
UUID=4f907dea-bf12-4781-ac92-7f79493c9952 /boot                     ext4    defaults        1 2
UUID=53ac8d05-8cb3-4496-8251-1ecda1d1ae06 swap                      swap    defaults        0 0
tmpfs                   /dev/shm                tmpfs   defaults        0 0
devpts                  /dev/pts                devpts  gid=5,mode=620  0 0
sysfs                   /sys                    sysfs   defaults        0 0
proc                    /proc                   proc    defaults        0 0
192.168.222.11:/Datastore/groupTEST /var/lib/one/datastores nfs mountvers=3,defaults,_netdev 0 0
```

Cloud Infrastructure

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Server NFS

DEFAULT GW for VMs
192.168.222.11 192.168.222.12 192.168.222.13 192.168.222.14 192.168.222.15 192.168.222.16

Teacher
Hypervisor

NFS server

SUMSCH01 SUMSCH02 SUMSCH03 SUMSCH04 SUMSCH05 SUMSCH06

202.122.33.162 202.122.33.163 202.122.33.164 202.122.33.165 202.122.33.166 202.122.33.167

PUBLIC NETWORK FOR HYPERVISOR

202.122.33.129

INTERNET

Clients NFS