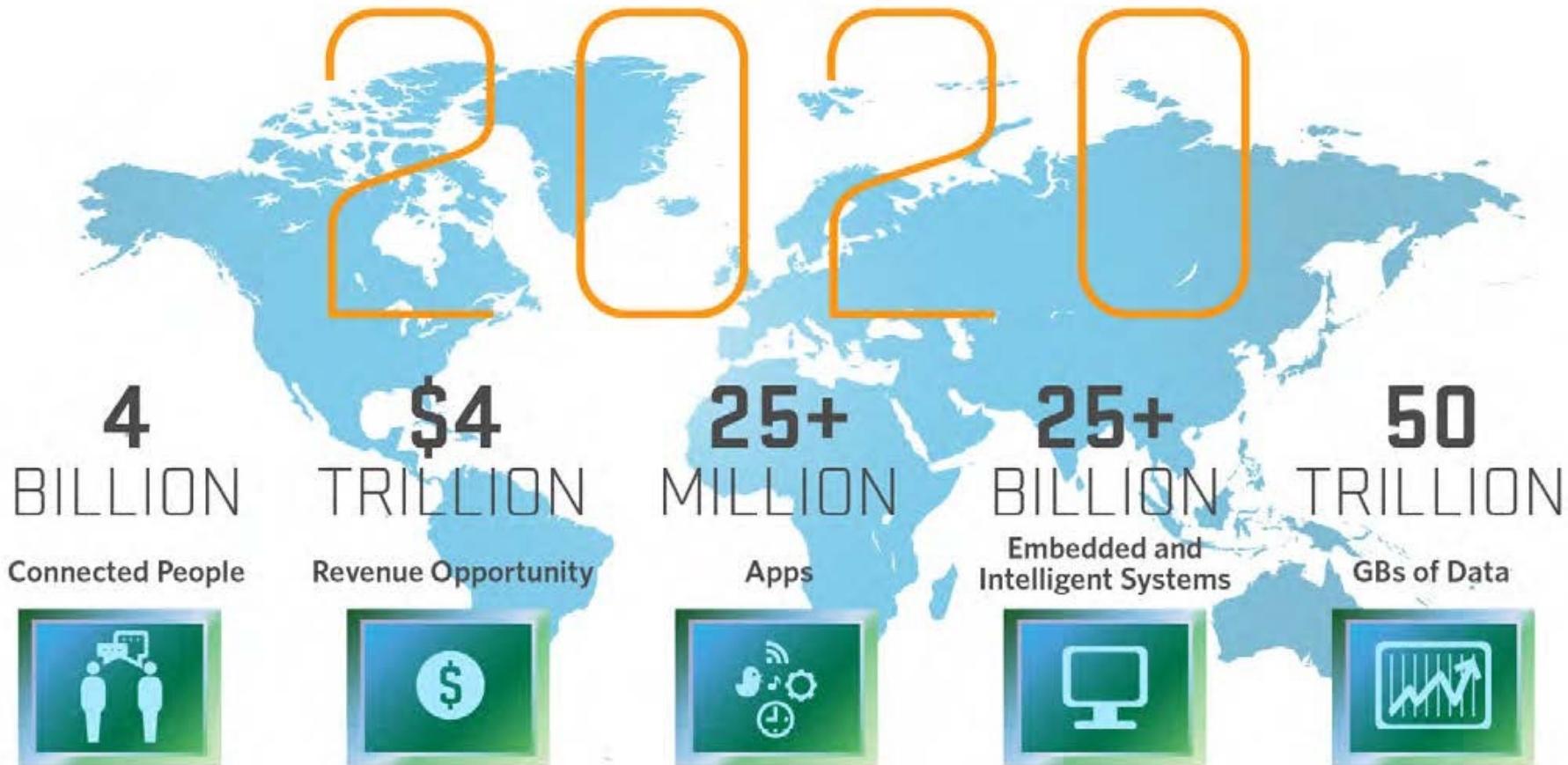


# **Technologies for E- Commerce**

**CAN302**

**Department of Communications and Networking  
Xi'an Jiaotong-Liverpool University (XJTLU)**

# Lec 3 – Internet and web servers



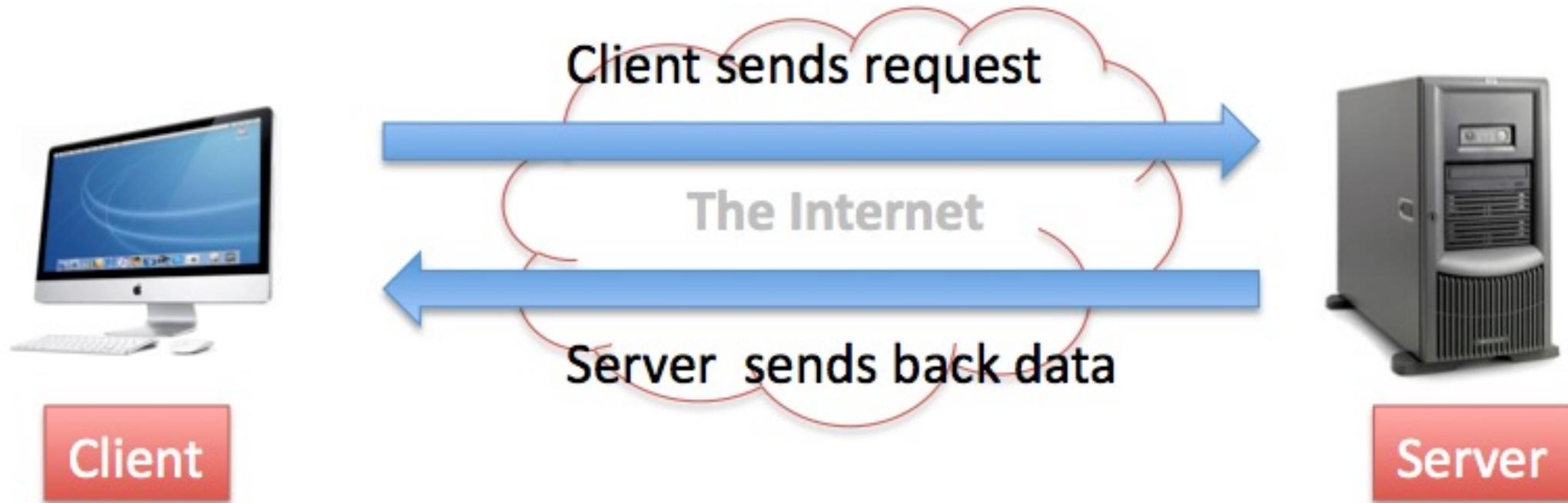
Source: Mario Morales, IDC

# Outline of Lec3

1. TCP/IP model
2. Server – Hardware, OS and clouding
3. Server – application server
4. "Hello world"



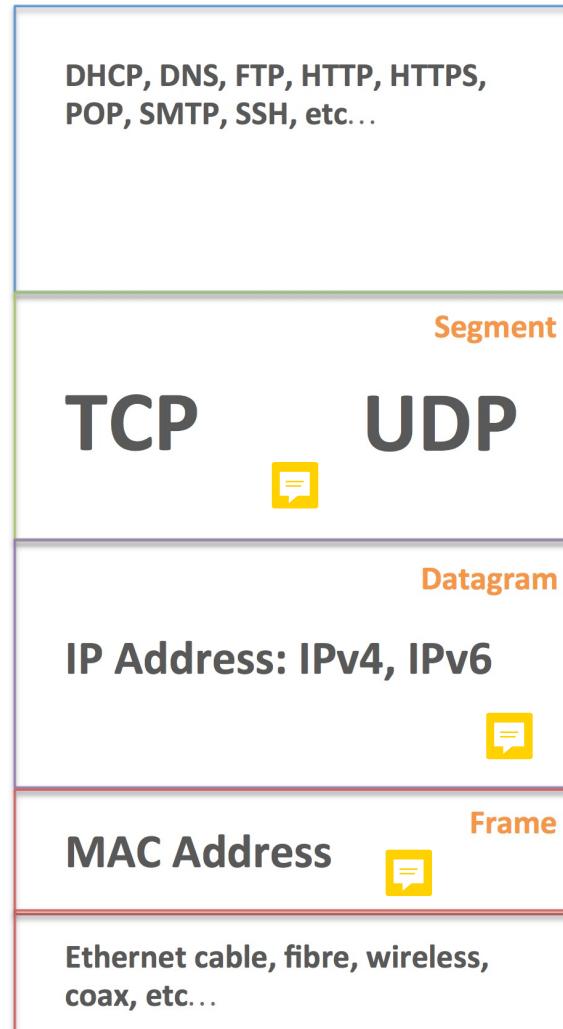
# The basic idea: “Talk” between “things”



# OSI and TCP/IP model



## The OSI Model



## The TCP/IP Model

# Network and internet layer: MAC and IP

## MAC address vs IP address

### MAC address

- 48 bit address
- Works at OSI layer 2  
(link layer)
- Physical address
- Fixed, assigned by manufacturer

00:0C:F5:09:56:E8

### IP address

- 32 bit address
- Works at OSI layer 3  
(network layer)
- Logical address
- Can change depending on the network environment

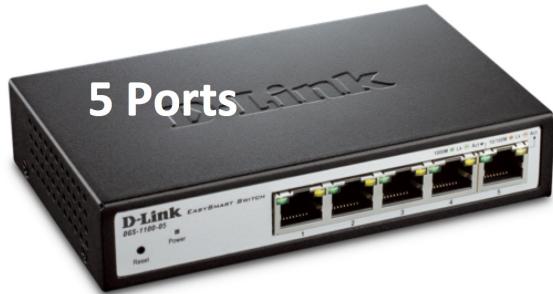
150.60.122.98

# IPv4 and IPv6

	<b>Internet Protocol version 4 (IPv4)</b>	<b>Internet Protocol version 6 (IPv6)</b>
<b>Deployed</b>	1981	1999
<b>Address Size</b>	32-bit number	128-bit number
<b>Address Format</b>	Dotted Decimal Notation: 192.149.252.76	Hexadecimal Notation: 3FFE:F200:0234:AB00: 0123:4567:8901:ABCD
<b>Prefix Notation</b>	192.149.0.0/24	3FFE:F200:0234::/48
<b>Number of Addresses</b>	$2^{32} = \sim 4,294,967,296$	$2^{128} = \sim 340,282,366,$ 920,938,463,463,374, 607,431,768,211,456

# Network and internet layer: MAC and IP

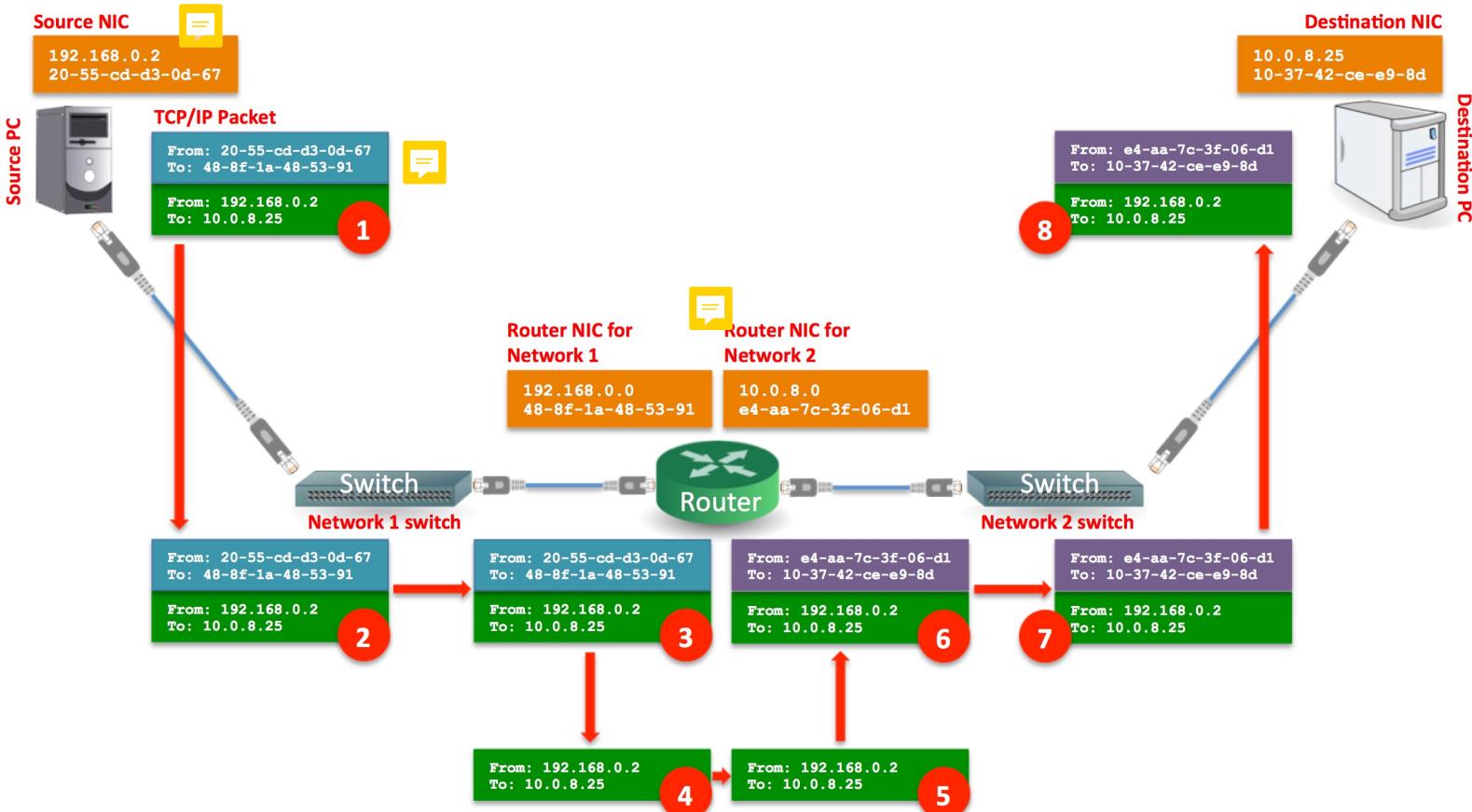
Network switches 



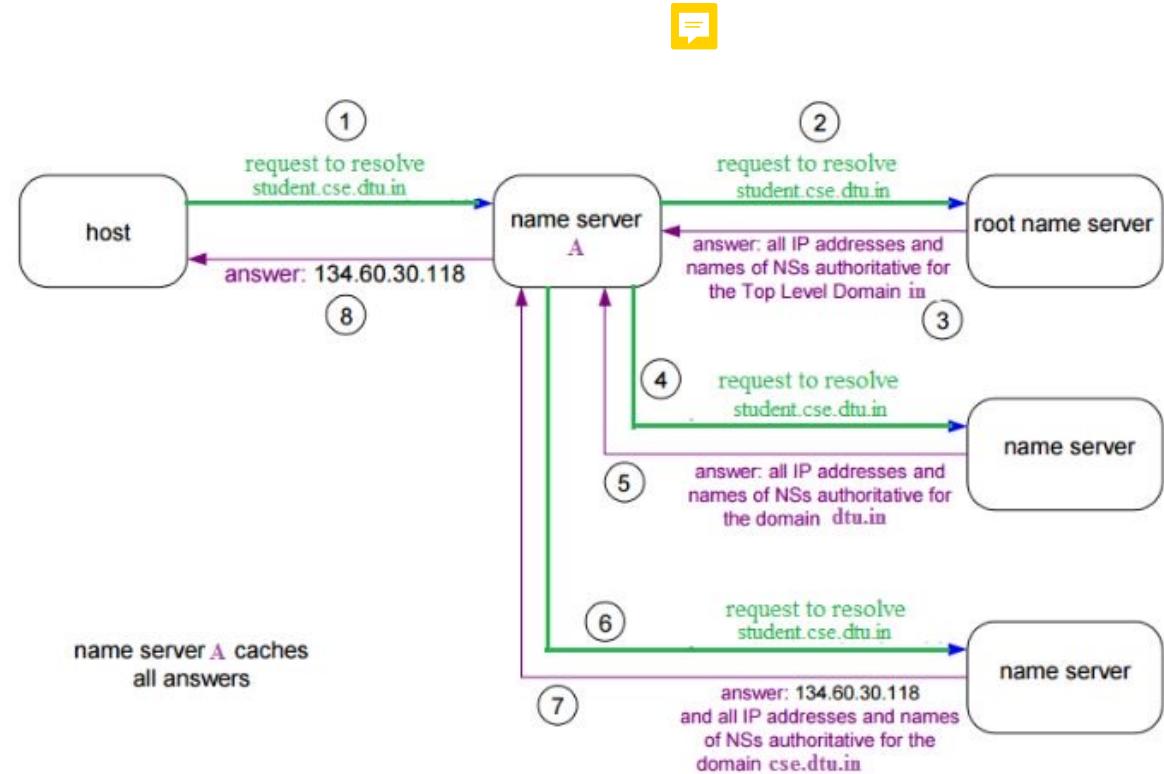
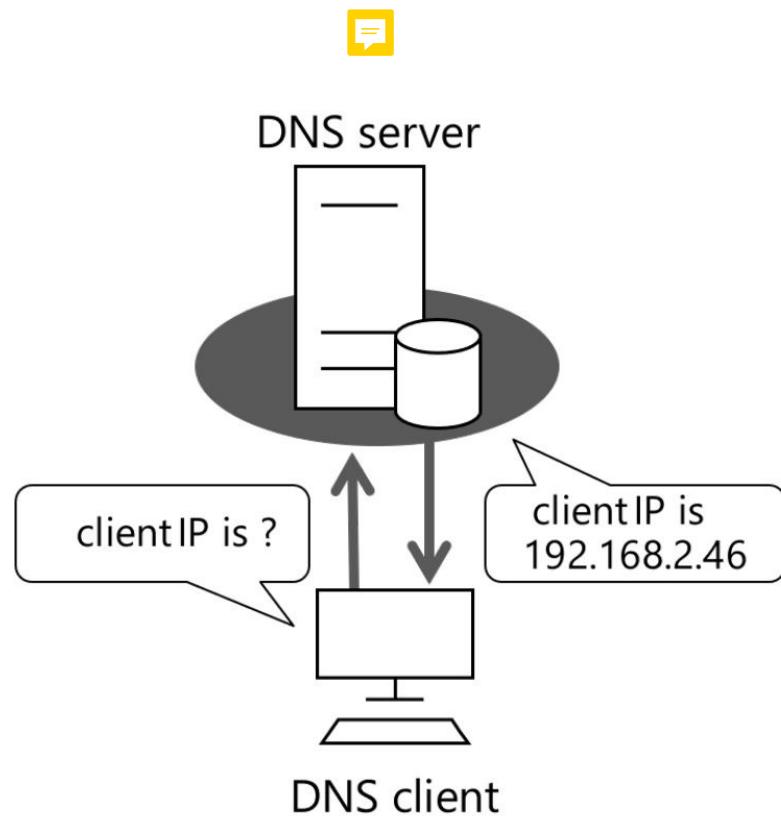
This image is part of the Bioinformatics Web Development tutorial at [http://www.cellbiol.com/bioinformatics\\_web\\_development/](http://www.cellbiol.com/bioinformatics_web_development/)

# Network and internet layer: MAC and IP

The journey of a TCP/IP packet across networks



# Network and internet layer: host name



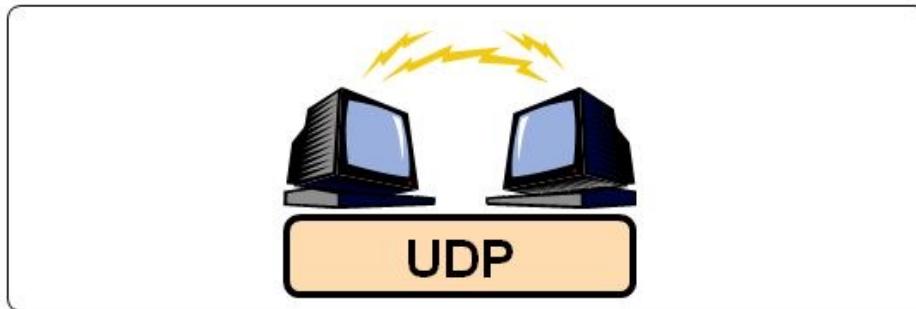
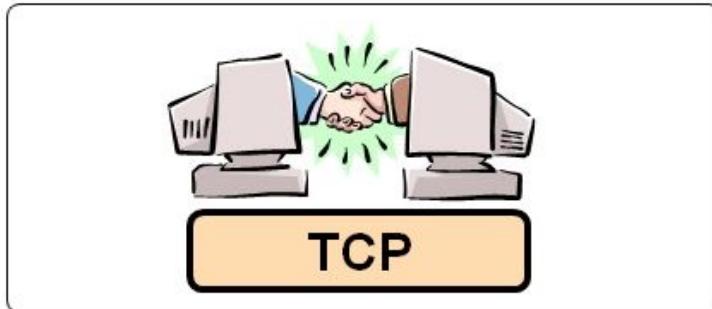
- Can you remember 221.229.203.214 or [www.taobao.com](http://www.taobao.com)?
- Or search taobao in www.baidu.com

# Network and internet layer: MAC and IP

A SOHO router derives from the merging of traditionally distinct network hardware in a single device

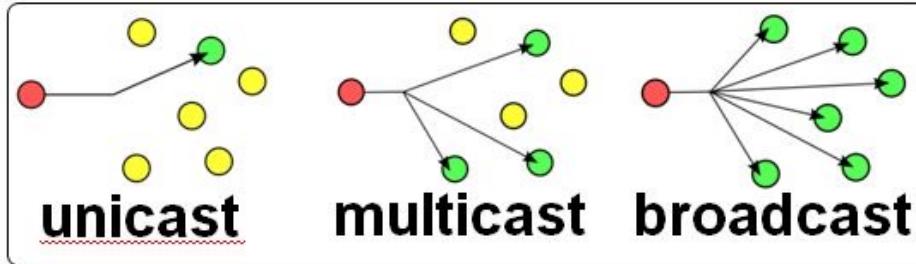
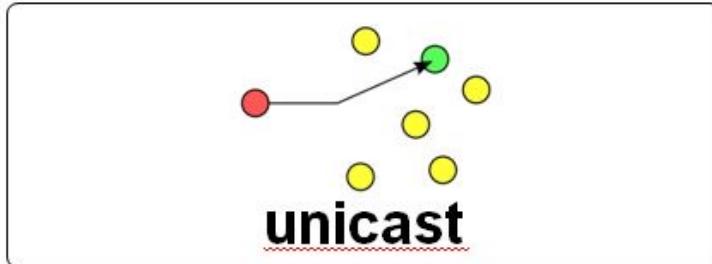


# Transport layer: TCP and UDP



- **Slower but reliable transfers**
- **Typical applications:**
  - Email
  - Web browsing

- **Fast but non-guaranteed transfers ("best effort")**
- **Typical applications:**
  - VoIP
  - Music streaming

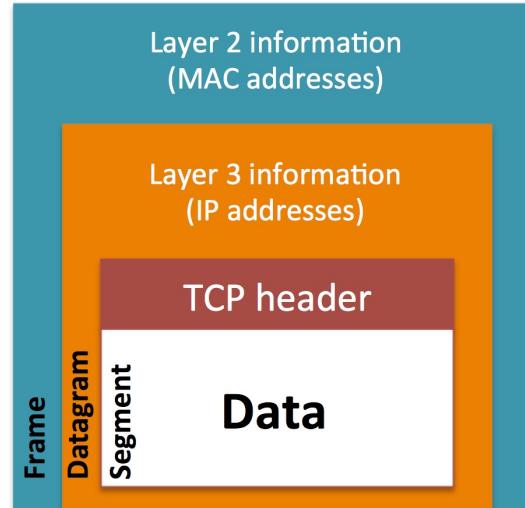


# Application layer: many protocols



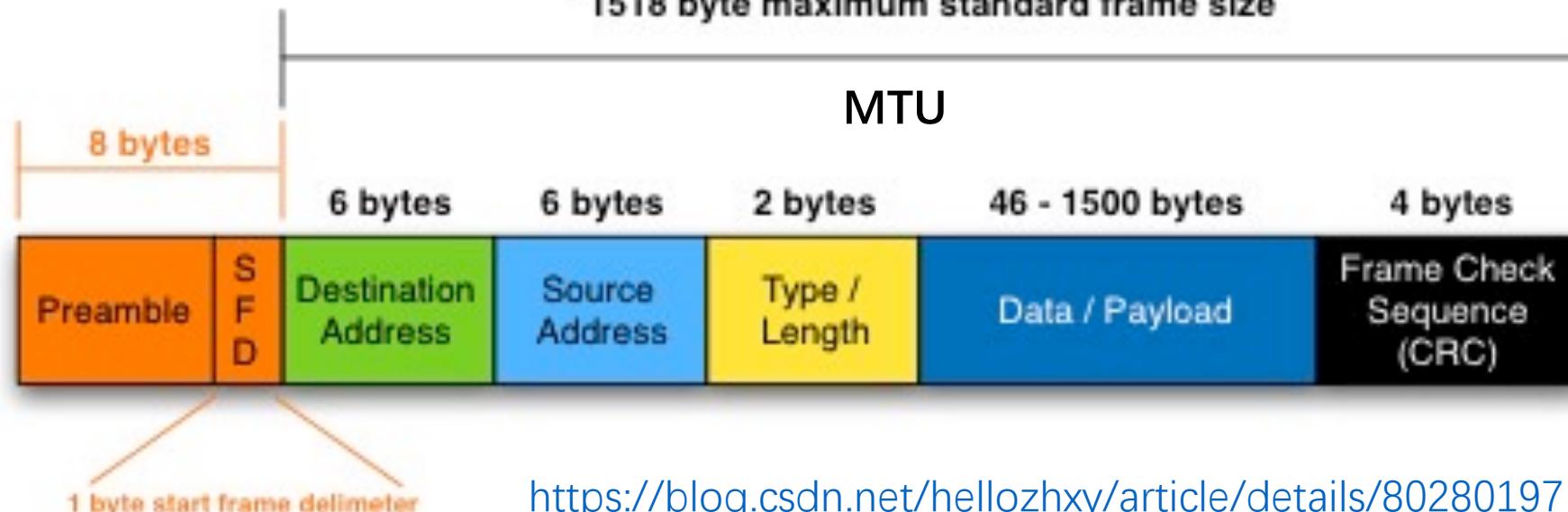
<b>Telnet</b>	Allows users to access resources on another machine. All data is seen in clear text (not recommended for use)
<b>Secure Shell (SSH)</b>	Similar to Telnet but it sets up a secure session (recommended over telnet). All data is encrypted during the session
<b>File Transfer Protocol (FTP)</b>	Allows users to transfer files between two hosts. Users must use some type of Authentication, also includes advance file search features
<b>Trivial File Transfer Protocol (TFTP)</b>	Allows users to transfer files between two hosts. Users does not need Authentication, also you lose a lot of functions such as directory browsing abilities
<b>Simple Network Management Protocol (SNMP)</b>	Pulls data from networking devices to verify status information / error messages, etc.
<b>Hyper Text Transfer Protocol (HTTP)</b>	Allows you to display graphics, text, and links correctly. manages communication between web browsers and web servers
<b>Hyper Text Transfer Protocol Secure (HTTPS)</b>	Allows you to display graphics, text, and links correctly. Manages communication between web browsers and web servers. This version make sure your web communication is secure using SSL
<b>Network Time Protocol (NTP)</b>	Synchronize devices to ensure that all computer on the network has the correct time
<b>Domain Name Services (DNS)</b>	Resolves hostnames on a network
<b>Dynamic Host Configuration Protocol (DHCP/BOOTP)</b>	Assigns IP configurations to hosts on a network <b>DHCP Conflicts:</b> two hosts have the same IP information. If conflict is detected it is removed from the pool and the will not be assigned until the admin resolves the conflict by hand.  <b>APIPA</b> - clients can automatically self-configure an IP address and subnet mask. This will allow communication if you have no DHCP available. Address: 169.254.0.1 - 169.254.255.254

# Russia Matryona: encapsulate the data



1518 byte maximum standard frame size

MTU



<https://blog.csdn.net/hellozhxy/article/details/80280197>

# IPv4 Header

Version	IHL	Type of Service	Total Length						
Identification		Flags	Fragment Offset						
Time to Live	Protocol	Header Checksum							
Source Address									
Destination Address									
Options		Padding							

# IPv6 Header

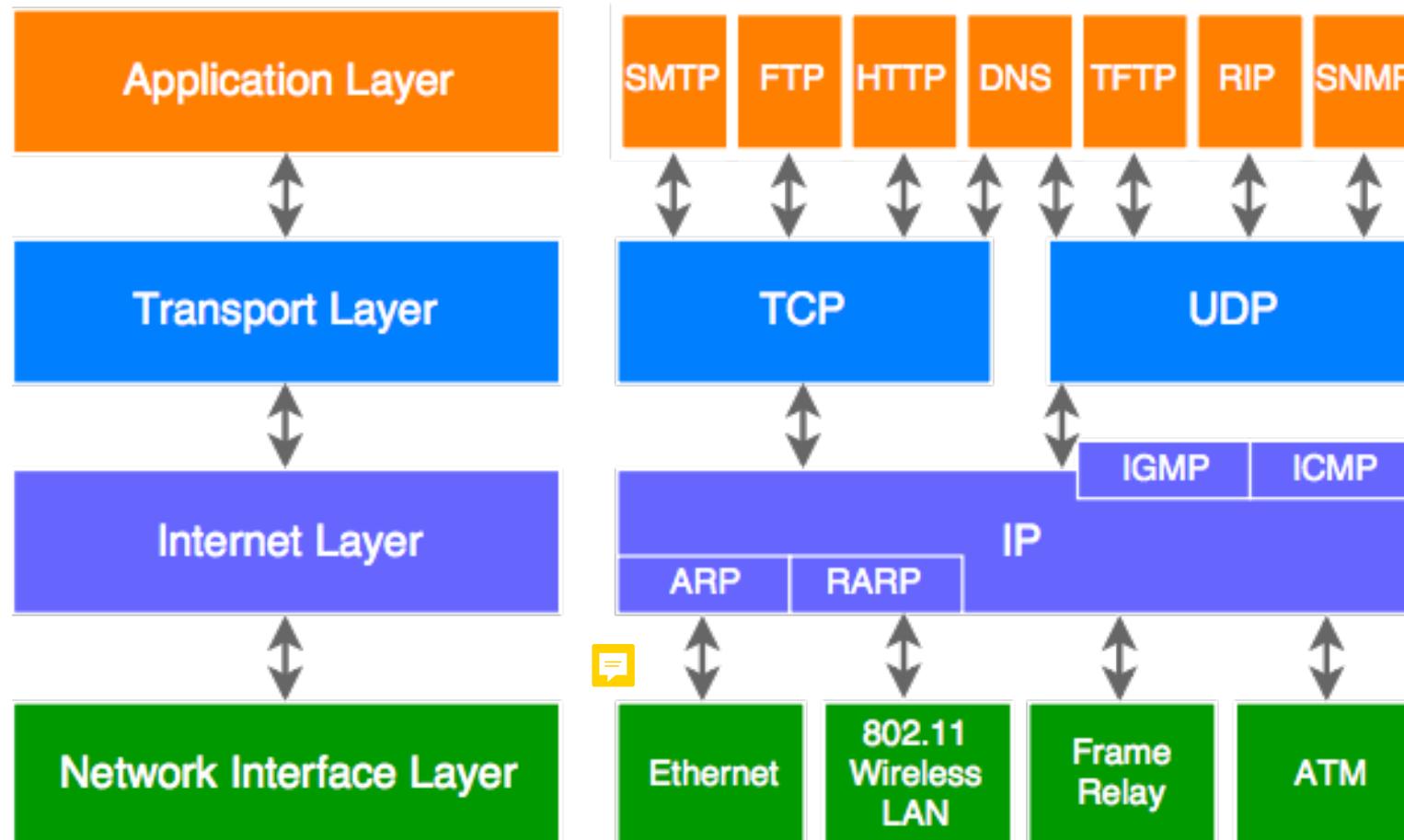
Version	Traffic Class	Flow Label	
Payload Length		Next Header	Hop Limit
Source Address			

## Legend

- Field's Name Kept from IPv4 to IPv6
- Fields Not Kept in IPv6
- Name and Position Changed in IPv6
- New Field in IPv6

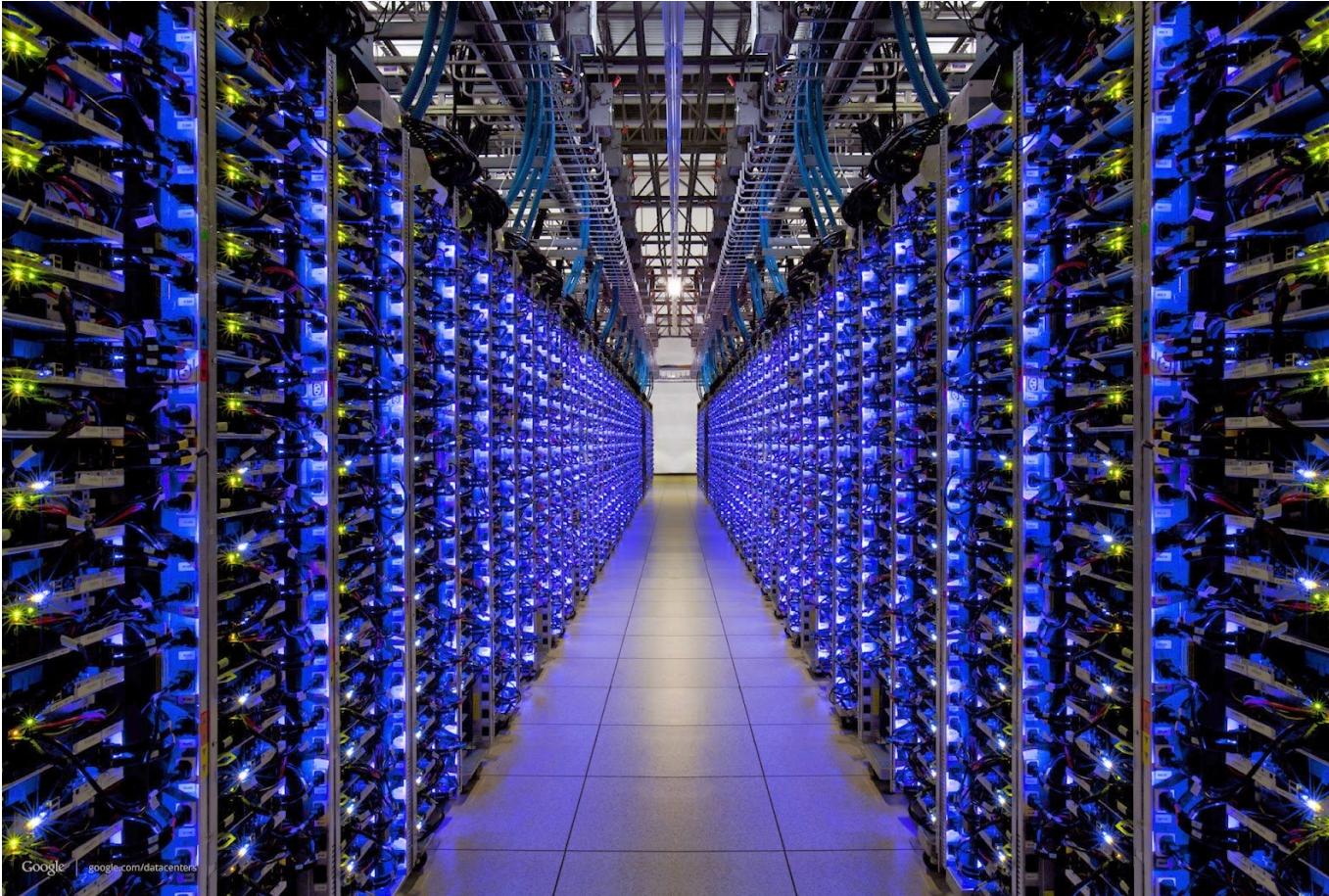
Destination Address

# Summary of TCP/IP model



<https://www.ibm.com/docs/en/cics-ts/5.3?topic=web-internet-tcpip-http-concepts>

# Server



What the same and different from our personal computer?

# Server - Hardware



**Same with personal computer:**

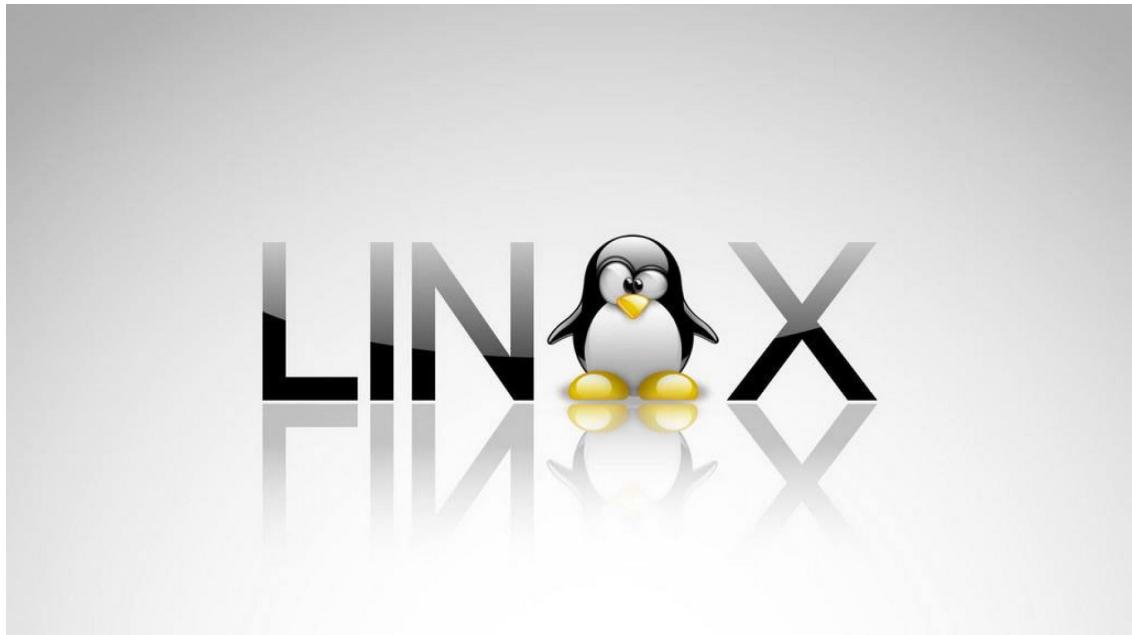
- **Just a computer**
- **Also could be a tower appearance**

**Special design:**

- **More “powerful”**
  - **Can install more CPUs and lots memory**
- **Very stable by redundancy**
  - **Back-up power supply**
  - **Raid card and hot-plug hard disks**



# Server - OS

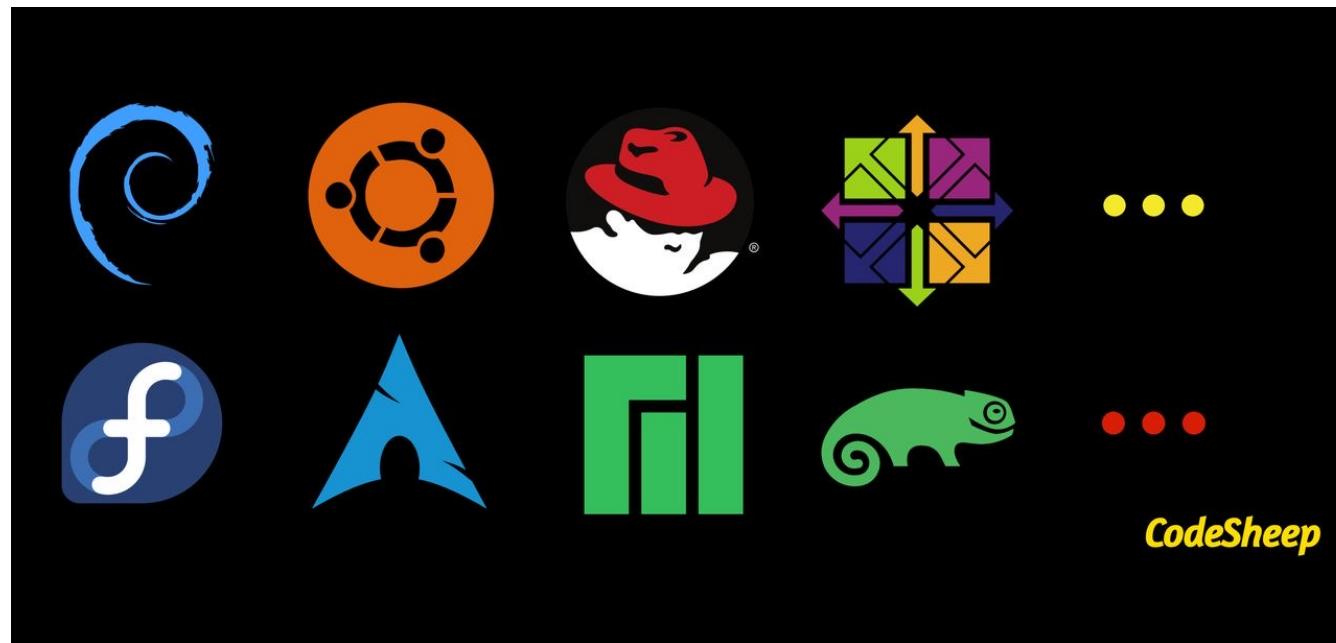


- In 2021, 100% of the world's top 500 supercomputers run on **Linux**.
- Out of the top 25 websites in the world, only 2 aren't using Linux.
- 96.3% of the world's top 1 million servers run on Linux.
- 90% of all cloud infrastructure operates on Linux and practically all the best cloud hosts use it.

<https://hostingtribunal.com/blog/linux-statistics/>

[https://www.pcworld.com/article/502784/why\\_linux\\_beats\\_windows\\_for\\_servers.html](https://www.pcworld.com/article/502784/why_linux_beats_windows_for_servers.html)

# Server – OS, a competition within Linux



OpenAnolis  
龙蜥社区

openEuler

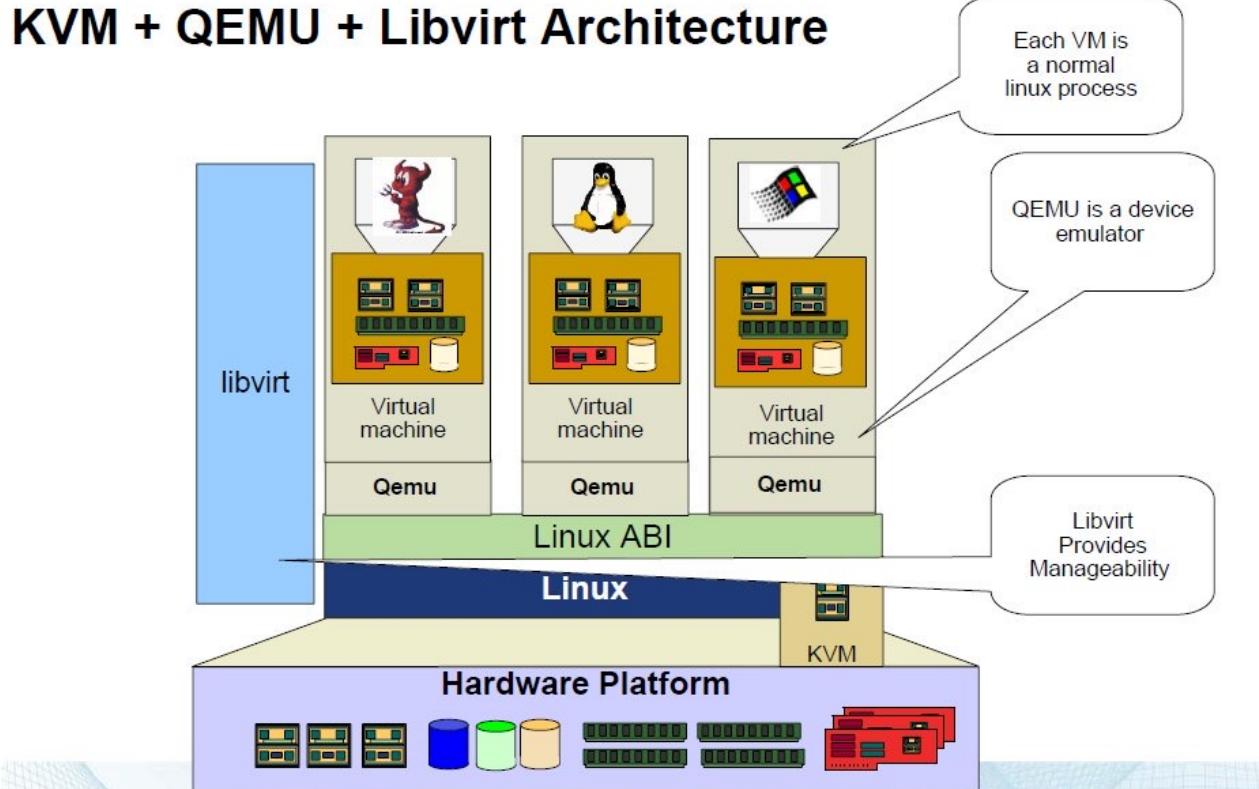
<https://zhuanlan.zhihu.com/p/139874681>

# Server – single server vs. clouding



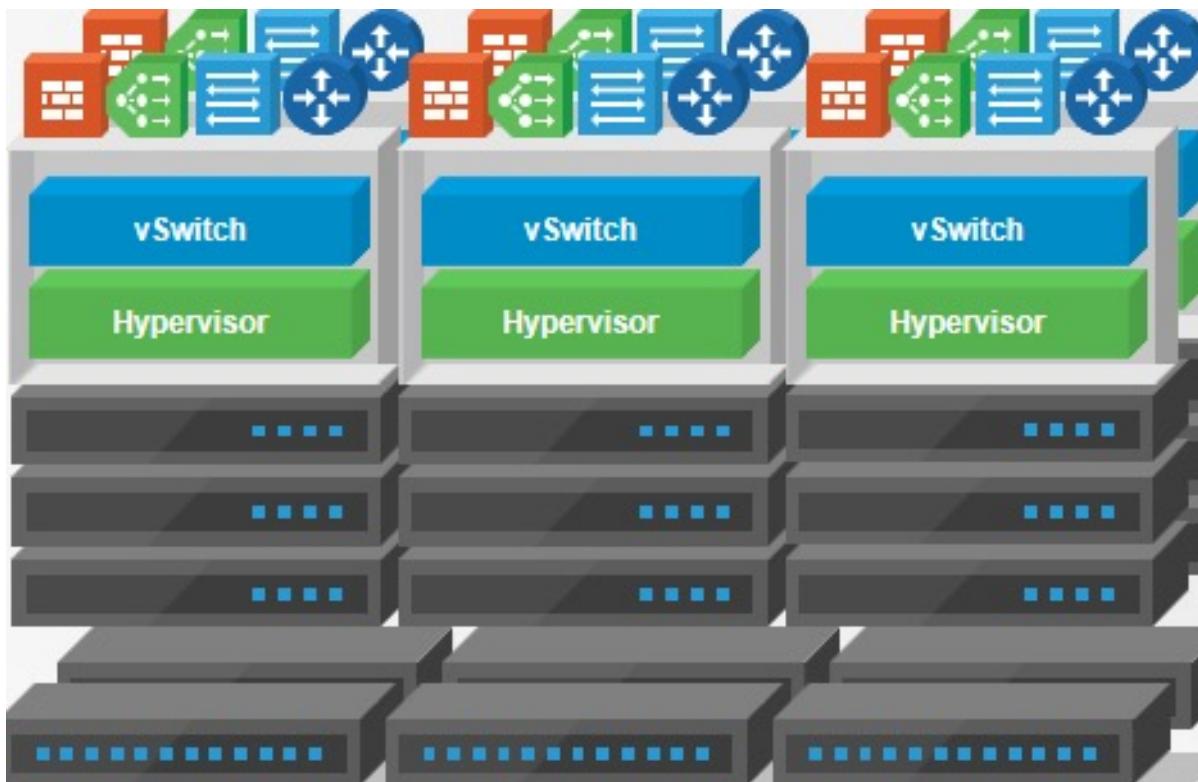
# Server – virtual machine

## KVM + QEMU + Libvirt Architecture

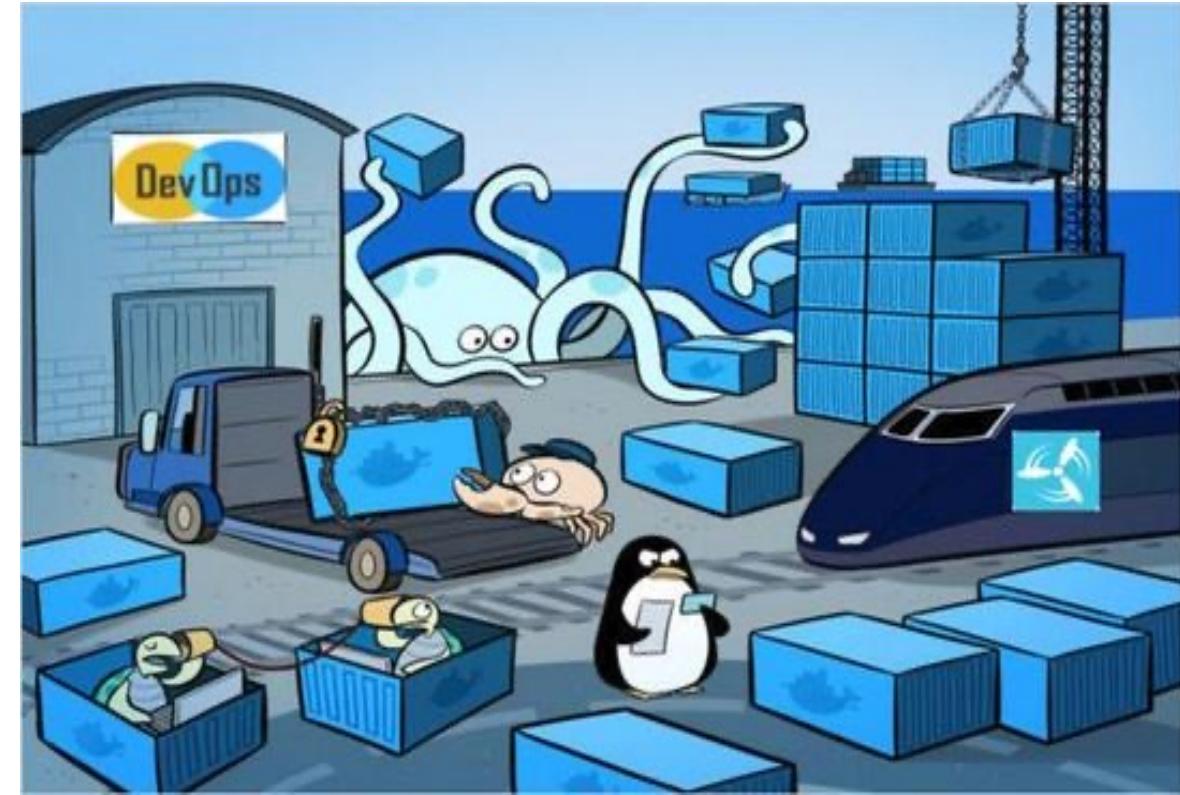
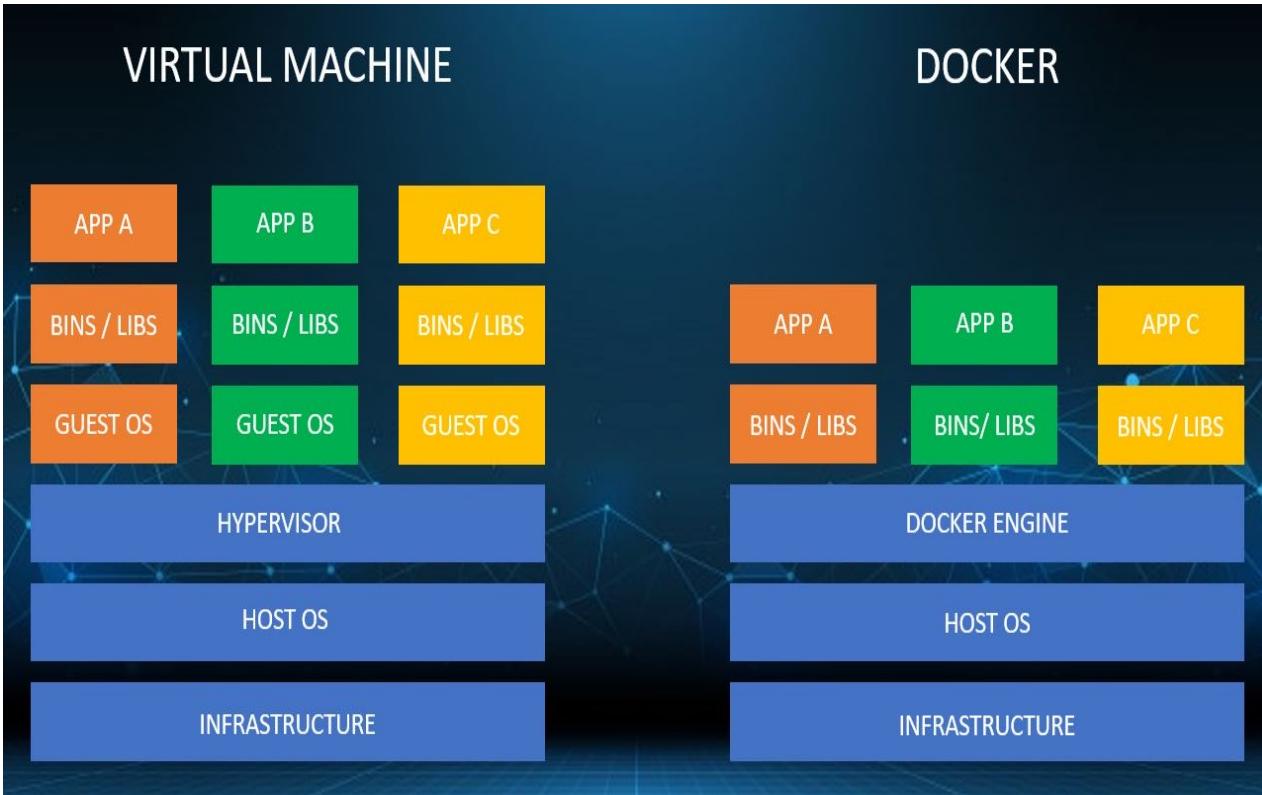


- **Simulate the hardware by software.**
- **One hardware can be safely shared by different users.**
- **The “server system” can easily migrate to another hardware.**
- **The base for “clouding”.**

# Server – clouding



# Server – docker



Docker: Less resources required and started less than 1 second;  
CP of **microservice**;  
No support for windows based application.



# Server – socket

**Bash** handles several filenames specially when they are used in redirections, as described in the following table:

**/dev/fd/fd**

If fd is a valid integer, file descriptor fd is duplicated.

**/dev/stdin**

File descriptor 0 is duplicated.

**/dev/stdout**

File descriptor 1 is duplicated.

**/dev/stderr**

File descriptor 2 is duplicated.

**/dev/tcp/host/port**

If host is a valid hostname or Internet address, and port is an integer port number or service name, **bash** attempts to open a TCP connection to the corresponding socket.

**/dev/udp/host/port**

If host is a valid hostname or Internet address, and port is an integer port number or service name, **bash** attempts to open a UDP connection to the corresponding socket.

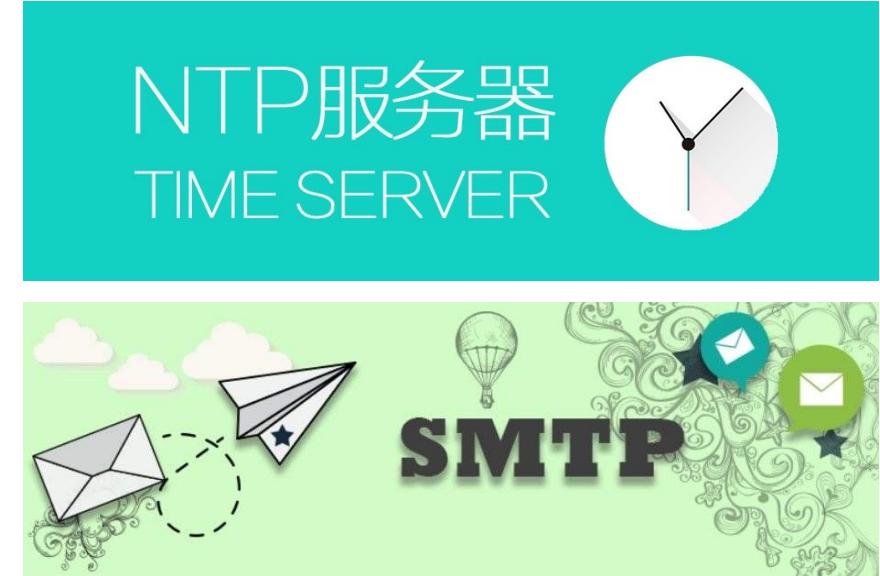
<https://blog.csdn.net/dog250>

- Everything in Linux is a 'file' 
- Linux define the TCP or UDP + host + port to a socket
- Socket is in the interface provided by Linux (OS) to applications

<https://blog.csdn.net/michaelwoshi/article/details/101107042>

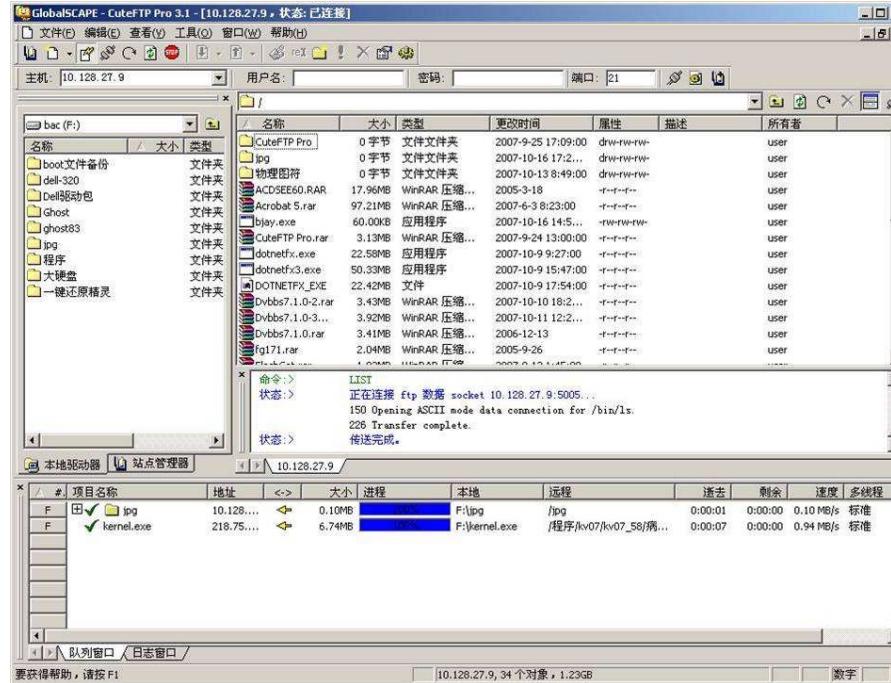
<https://www.cnblogs.com/neliangcai/p/10362751.html>

# Server – application servers



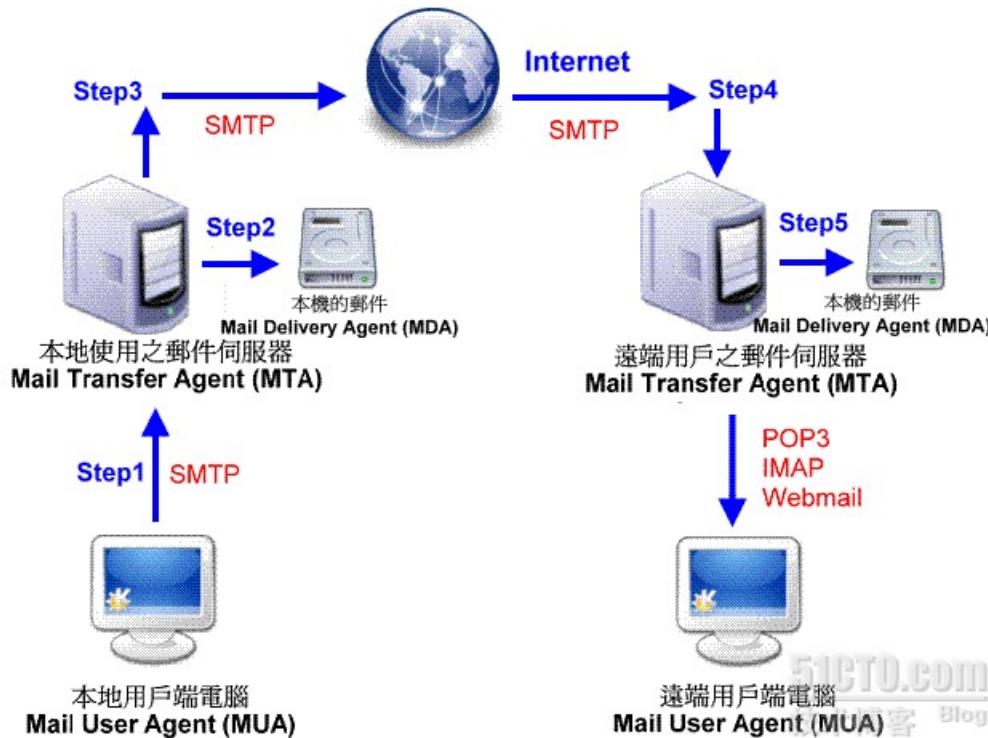
- Application server is a **software** to handle a specific application.
- Application server is always bound to a **socket**.
- Different application use different application protocols.
- Application server waits the requests from clients and will response such requests.

# Server – ftp server



- Using client application link to the server
- Upload/download files

# Server – mail server



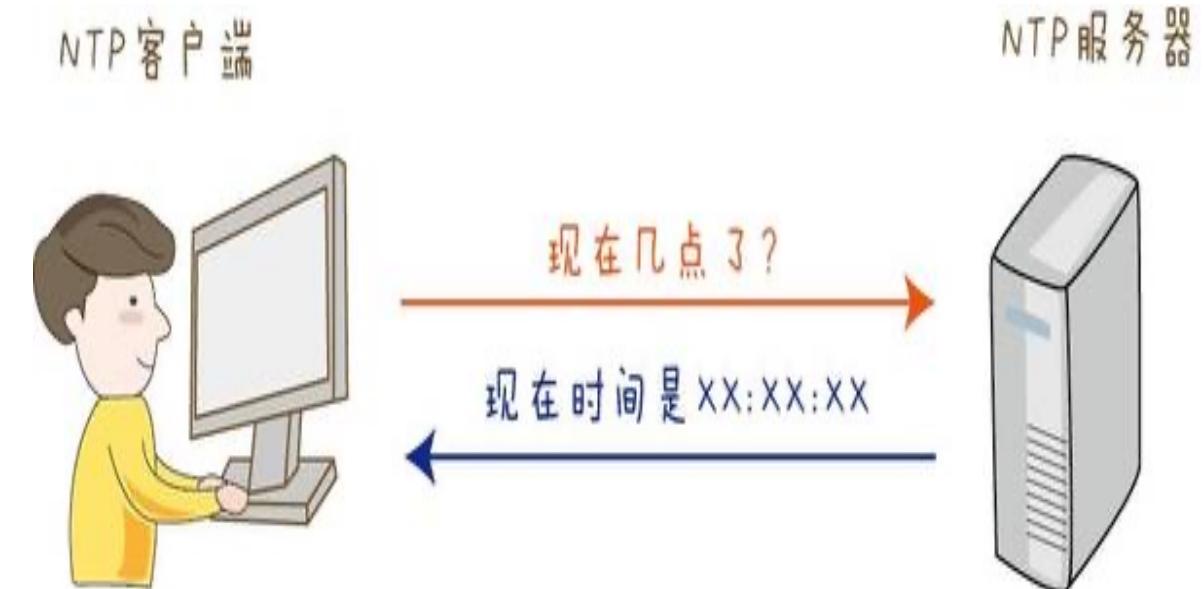
```
+OK Welcome to coremail Mail Pop3 Server <163com[e1bcd9800c6738c0b489cc004e7a0443s1]>
user xyang0917@163.com
+OK core mail
pass 123456abc
+OK 1 message(s) [1822 byte(s)]
stat
+OK 1 1822
list
+OK 1 1822
1 1822
.
retr 1
+OK 1822 octets
Received: from mail19-224.sinamail.sina.com.cn (unknown [121.14.19.224])
by mx14 (Coremail) with SMTP id QMCowEAZxU1x95PK1bLIQ--.996S2;
Mon, 18 Jun 2012 14:14:13 +0800 (CST)
X-Originating-IP: [58.62.215.109]
X-IronPort-Anti-Spam-Filtered: true
X-IronPort-Anti-Spam-Result: AtEKAKU/KE86Ptdt/3poAAyBU5w+gjGHbopPjH8IhkqFDoELBIZ0jg+KNg
Received: from unknown <HELO webmail.sinamail.sina.com.cn> ([10.71.1.38])
by irg21-218.sinamail.sina.com.cn with ESMTP; 18 Jun 2012 14:14:13 +0800
Received: by webmail.sinamail.sina.com.cn (Postfix, from userid 80)
id 3E9C05F801C; Mon, 18 Jun 2012 14:14:13 +0800 (CST)
Date: Mon, 18 Jun 2012 14:14:13 +0800
Received: from xyang0917@sina.com([58.62.215.109]) by m1.mail.sina.com.cn via HTTP;
Mon, 18 Jun 2012 14:14:13 +0800 (CST)
Reply-To: xyang0917@sina.com
From: "xyang0917" <xyang0917@sina.com>
To: "xyang0917" <xyang0917@163.com>
Subject: hello163
MIME-Version: 1.0
X-Priority: 3
```

命令提示符窗口注释：

- 登陆pop3服务器，用户名：user xyang0917@163.com，密码：pass 123456abc，登陆成功后，提示有1封电子邮件，占1822个字节。
- stat命令查询邮箱中的统计信息，显示共有1封邮件，占1822字节。
- list命令列出邮箱中的邮件列表，每封邮件都有一个编号，从1开始。编号右边是邮件的大小。
- 查看第一封邮件的内容
- 邮件的消息头，包含了邮件的发件人、收件人、主题、优先级、发送时间等信息。

- SMTP protocol was used to delivery mails
- POP3 and IMAP were used to get mails from mail server.

# Server – NTP server



- Get the current time from server

<https://baike.baidu.com/item/%E9%97%B0%E7%A7%92>

# Server – database server



- Database services

# Question – so many client applications



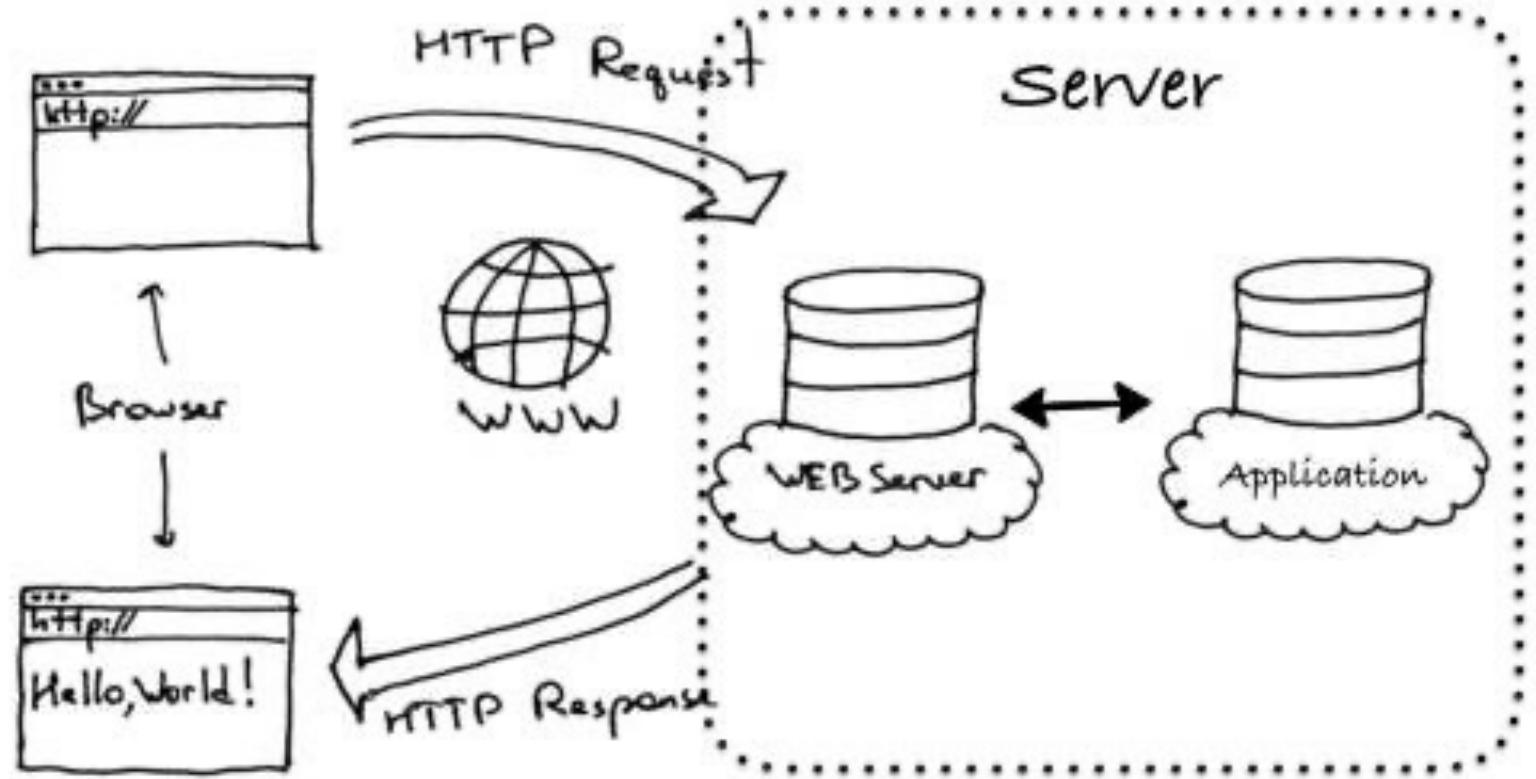
- One application need to develop **both client and server** software.
- No standers/protocols for different application.
- Client software compatibility is big headache.



# Server – http:// web server



Tim Berners-Lee



- Web server handles http(s) protocol
- **http** means hyper text transport protocol
- http can handle text, pic and so on.

# Web servers (software)



[https://blog.51cto.com/u\\_15061948/2594098](https://blog.51cto.com/u_15061948/2594098)

# Be ready for our “Hello world” page

WWW.CAN302.com:8080

199.59.243.200

8080



Discussion: what does it mean to say a server?

# Apply permissions before you go

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