

CLIL module - A.S. 2020/21

# Computer Networks

Lesson 1

# In this lesson:

- Use of computer networks
- Network classification by the type of transmission
  - Broadcast
  - Point to Point
- Network classification according to size
  - LAN
    - LAN classification by topology
      - Bus
      - Ring
      - Tree / star
  - MAN
  - WAN ( → Internet )



# Use of Computer Networks in every day life

... BRAINSTORMING ...

# Use of Computer Networks in every day life

- **accessing remote information, e.g.:**
  - home banking;
  - e-commerce;
  - Surfing the Web;
- **communication between people:**
  - E-mail;
  - Videoconference;
  - Chat;
- **fun / entertainment:**
  - video on demand
  - Interactive games.

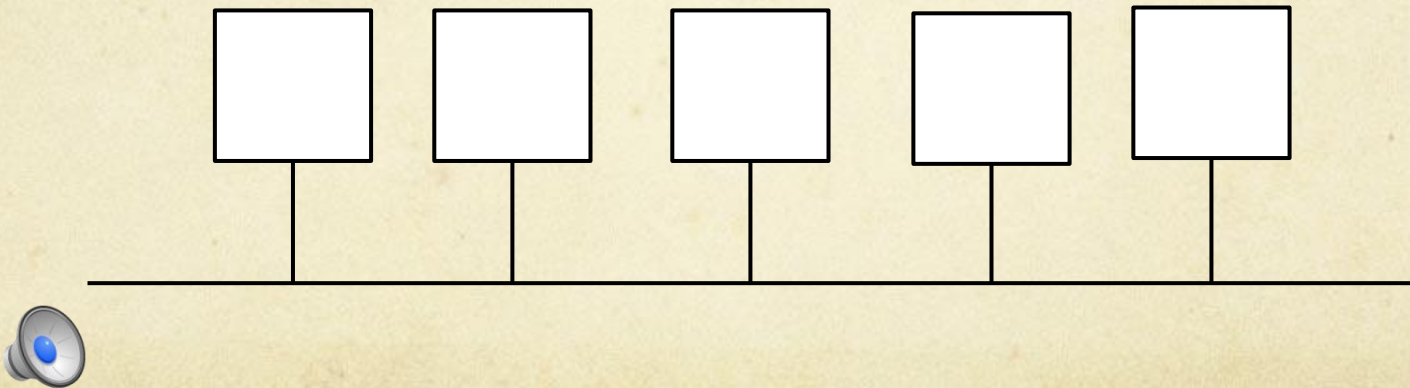


# Type of transmission

## ○ Broadcast:

One communication channel shared by all machines. Each machine can send messages (**packets**) to another; all messages are received by all machines, but only the destination machine processes the message; other machines discard it.

Typical of bus topology

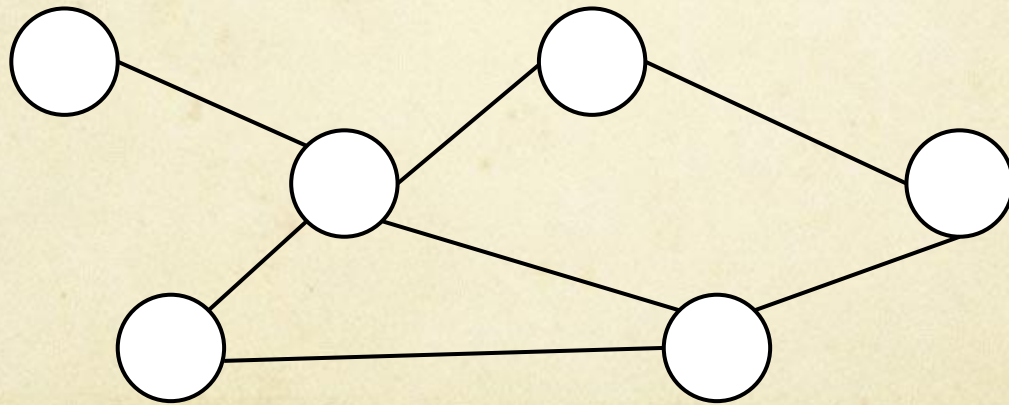


# Type of transmission

## ○ Point-to-Point:

Direct connection between two machines; we can have many point-to-point connections, forming a network.

There can be many different paths to get from a source node to a destination one.





# Type of transmission

## ○ Broadcast or Point-to-Point ?

Usually (there are some exceptions) Local Area Networks employ **Broadcast**, while bigger **networks** (WAN) use **point-to-point** connections.

# Classification by size

1 m	1 square Meter	Personal Area Network
10 m	Room	} Local Area Network
100 m	Building	
1 km	Campus	
10 km	Town	Metropolitan Area Network
100 km	State	} Wide Area Network
1000 km	Continent	
10000 km	Planet	Internet



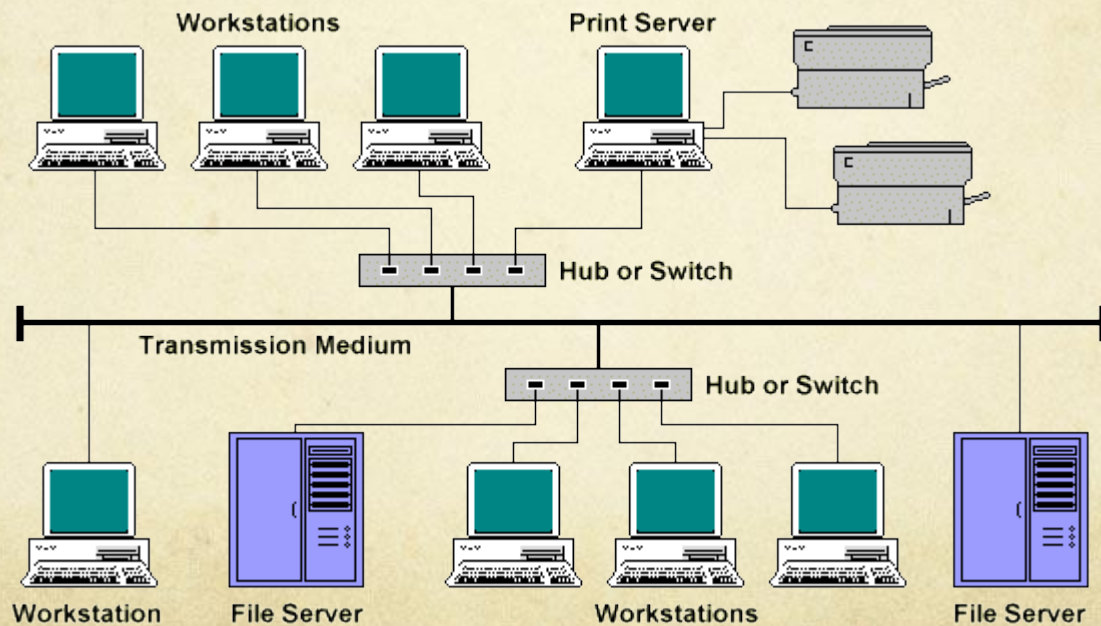
# Classification by size

- A **Personal Area Network** is designed for a person; it allows wireless connection (usually IrDA or bluetooth) within few meters.
- Communication is based on the **master-slave** model



# Classification by size

- Local Area Networks, are private networks within a single building or campus (few kilometers maximum). They are typically used in offices or labs to share resources and information.



Computer Networks - LAN



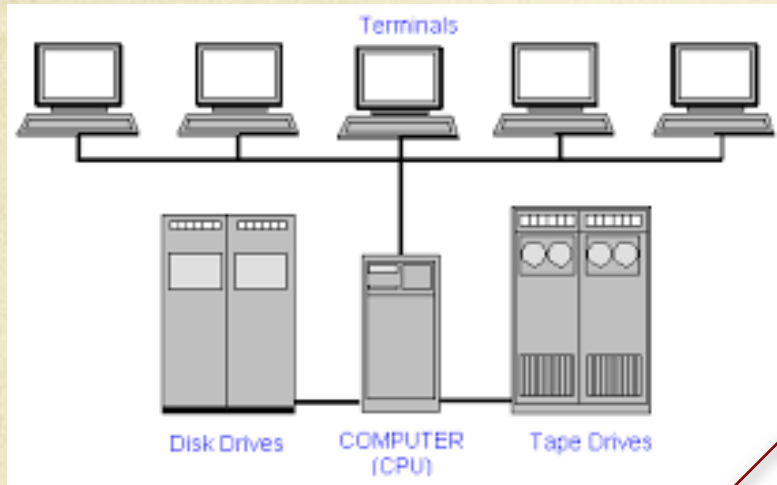
# Definition of LAN

Communication system for information exchange between **autonomous** computers within a **limited area** through a **reliable** and **high-speed** transmission medium.

Transmission medium:

- **Shared** (→ broadcast transmission)
- **Speed** : initially (**ethernet**) 10 Mbps; now 1-10 Gbps
- **Reliable**: low delay, low error rate
- **Topology**: bus, ring, tree / star ...

# Origin of LANs

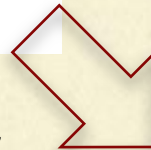


## Mainframe (1960s)

- processing power
- Runs applications

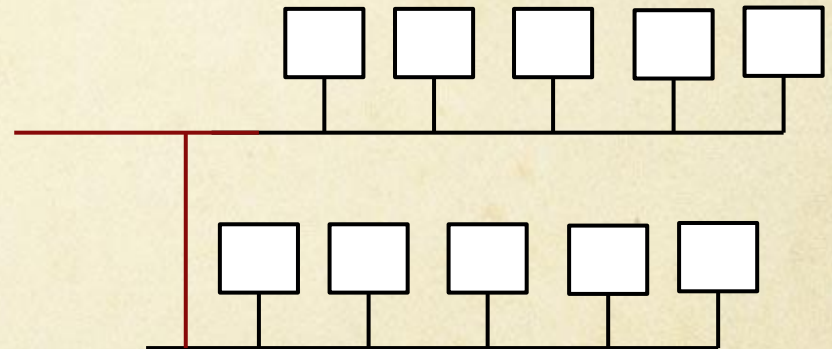
**Terminals:** no processing power

down-sizing



## LAN (1970s)

- distributed processing power





# Mainframe vs LANs

## PROs and CONs

... BRAINSTORMING ...

# Mainframe vs LANs

## Mainframe

### PROs

- sharing data
- sharing applications
- easy to maintain

### CONs

- fault vulnerability
- high cost
- no scalability

## LAN

### PROs

- distributed processing power
- Fault tolerance
- reduced costs / scalability
- sharing resources

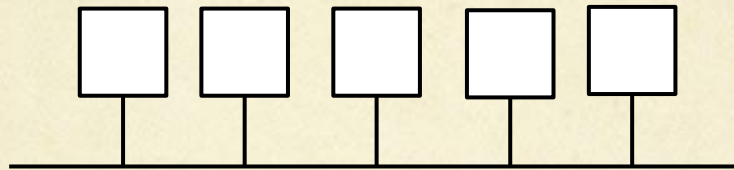
### CONs

- Many copies of data
- SW intalled on every machine
- maintenance

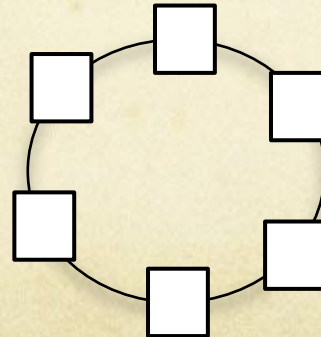


# Classification by topology

- **Bus topology:** (see Ethernet or *IEEE 802.3*): the transmission medium is **shared** by all devices ; a protocol is needed to handle collisions (CSMA/CD protocol)

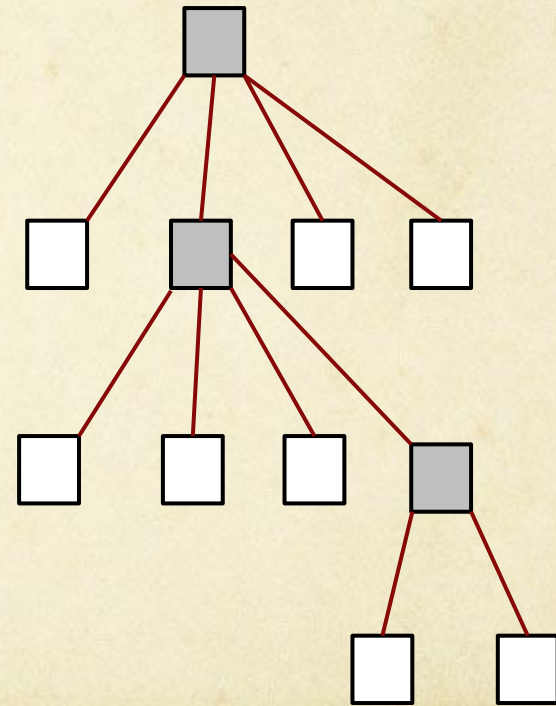
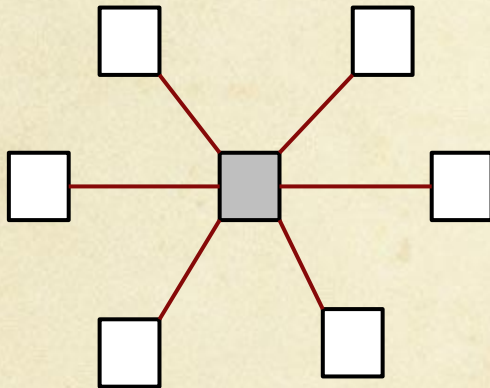


- **Ring topology:** to access the transmission medium a “**token**” is passed between nodes, to provide fair access for all stations (see *IEEE 802.5*)



# Classification by topology

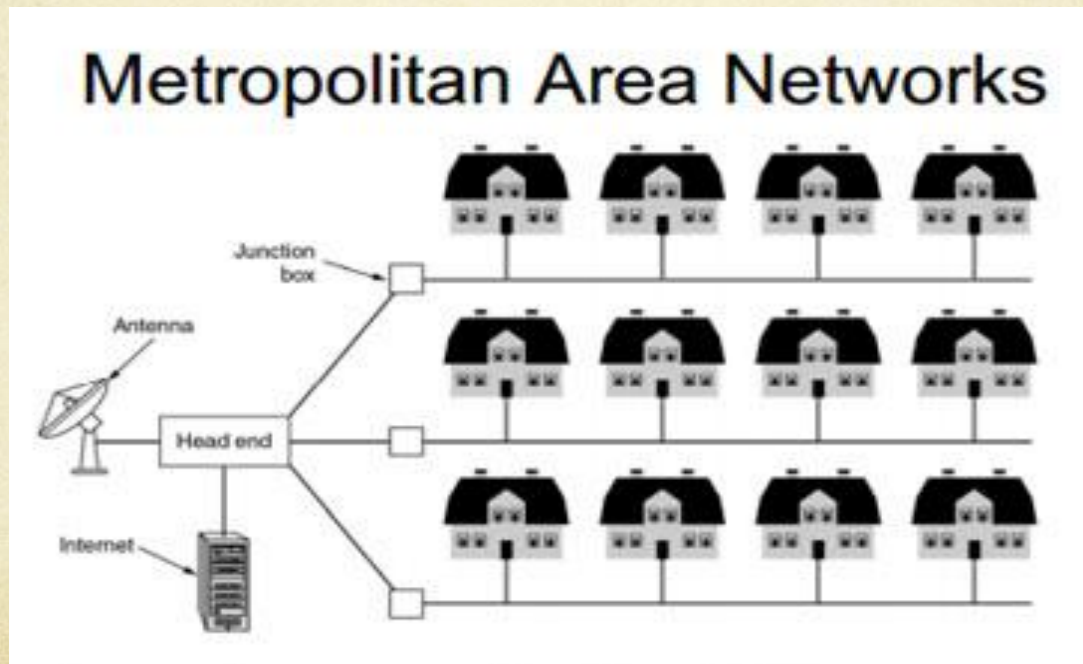
- Star / tree topology: (evolution of bus topology)





# Classification by size

- **Metropolitan Area Networks** have the size of a town. They emerged in USA thanks to **cable TV** in 1990s. They were then converted to provide Internet services



# Classification by size

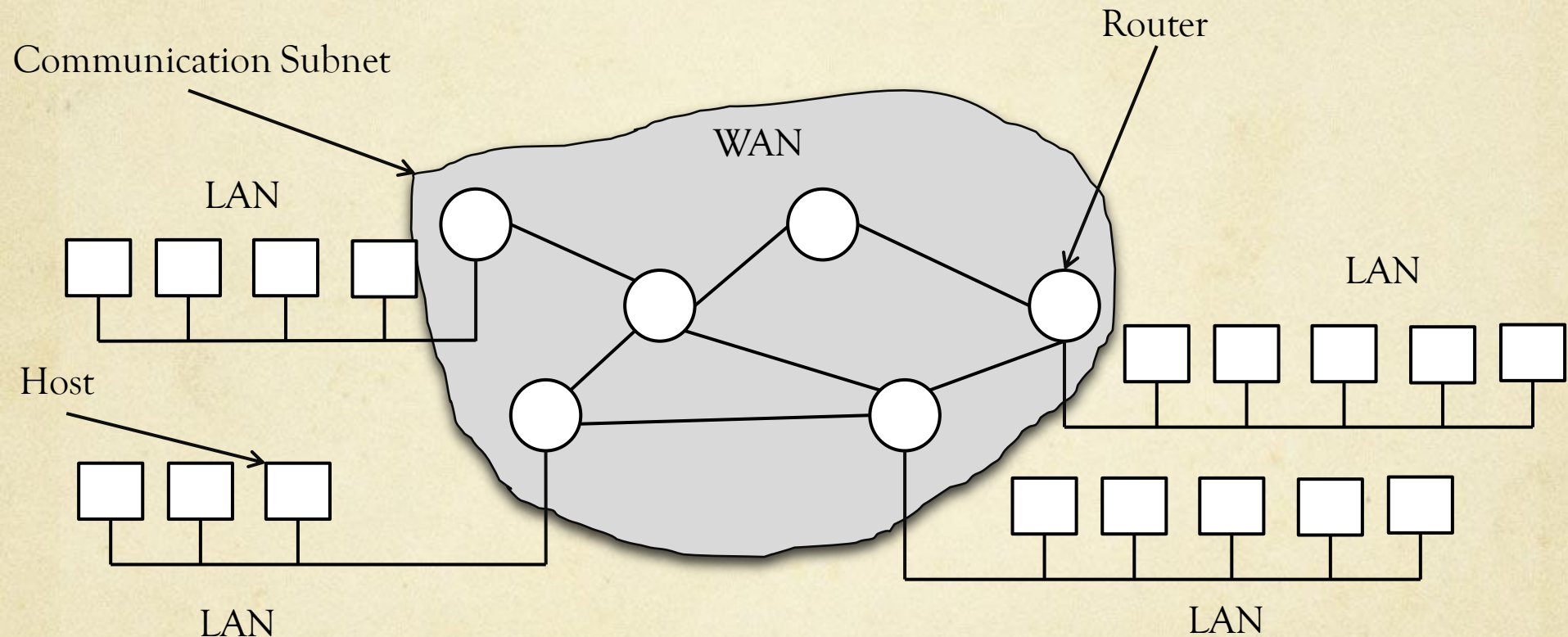
- Wide Area Network are as wide as a state or continent or even the whole planet.

A WAN is composed by:

- Private user computers (host or end system)
- a communication subnet (subnet) owned by a Telecommunication Company or Internet Service Provider that connects *host* each other through **transmission media** and **intermediate systems** (e.g. routers)



# Classification by size

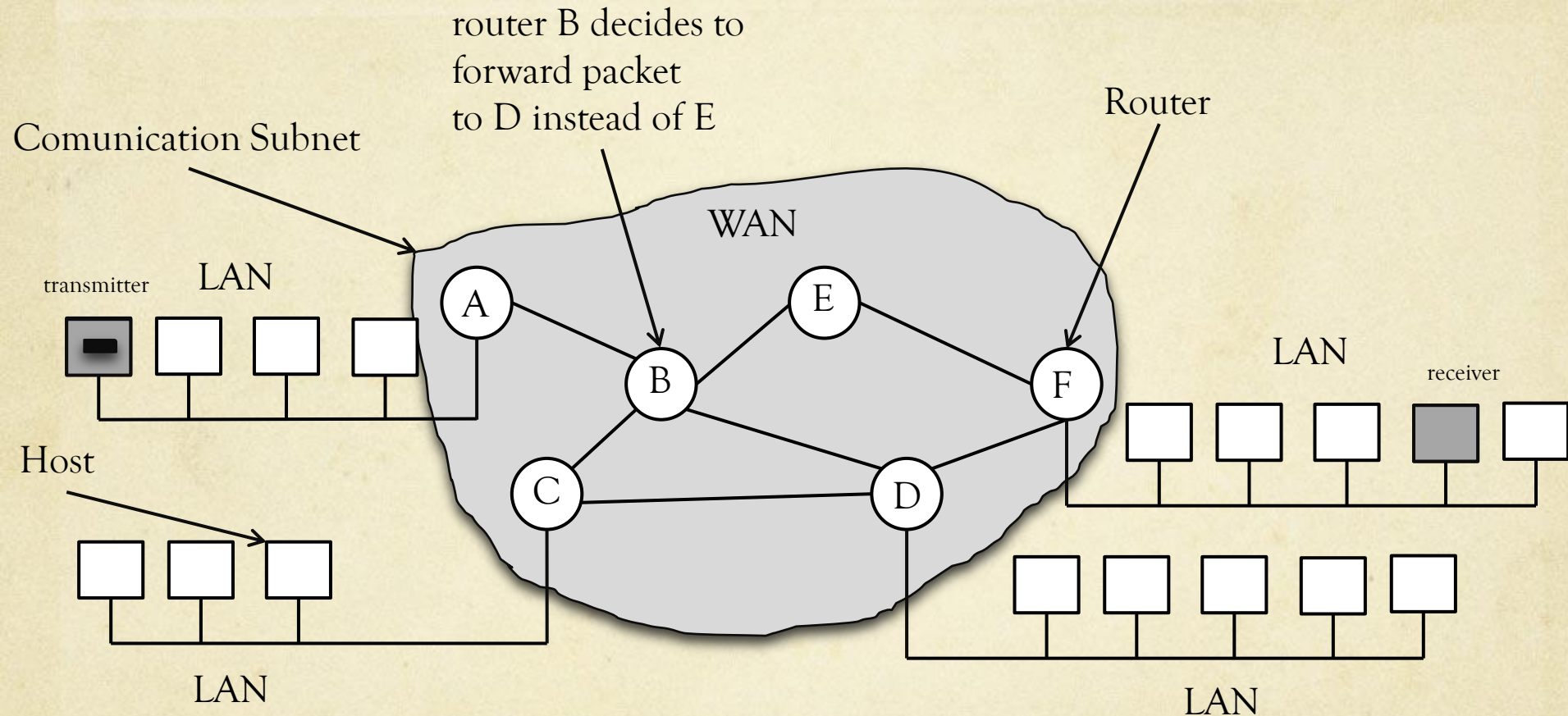


# Classification by size

- WAN are usually based on the **packet switching** (or **store-and-forward**) approach: a message is broken into packets that travel along the subnet; each packet can go on a different path.



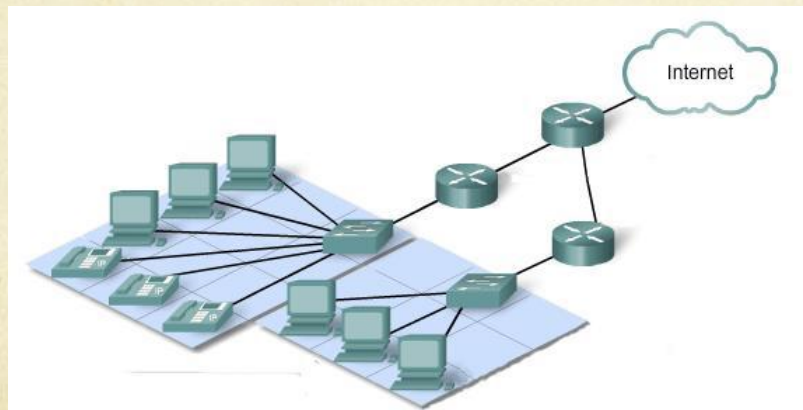
# Packet flow example



Each router decides next destination according to a **routing Algorithm**.

# What is a internetwork?

- A sort of “Virtual Network” formed by many networks connected each other; single networks can employ different technologies.
- Each node of the internetwork is given a **unique identifier (address)**





# Internet: a network of networks

- Worldwide **internetwork** : it's hard to determine the real size.

# Internet : a bit of history

[ Video from EdPuzzle ]



# Word Wide Web

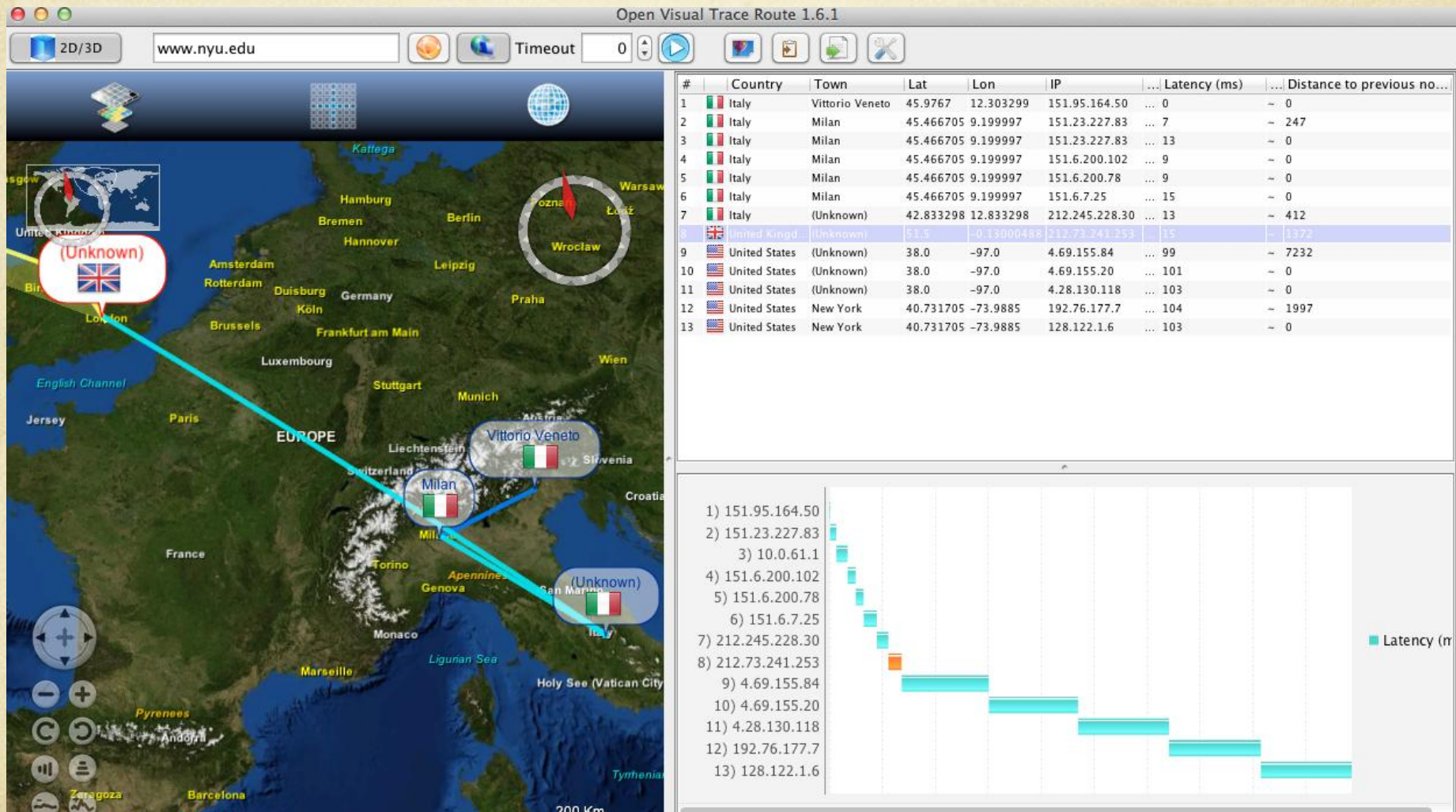
- An enormous **hypertext** composed by an uncountable number of documents (**web pages**) linked together
- Web pages are grouped in web sites, and hosted in **web servers**.
- In 1991 at CERN Tim Berners-Lee defined the protocol to access web pages (HTTP).
- **URL** (Uniform Resource Locator) is the address of a web page that we type in our **browser**.
- **1995**: 16 million users → **2015**: 3360 million users (3.36 billion users) [ Source: internetworldstats.com ]
- Over **1 billion web sites** right now [Source: internetlivestats.com ]

# Traceroute

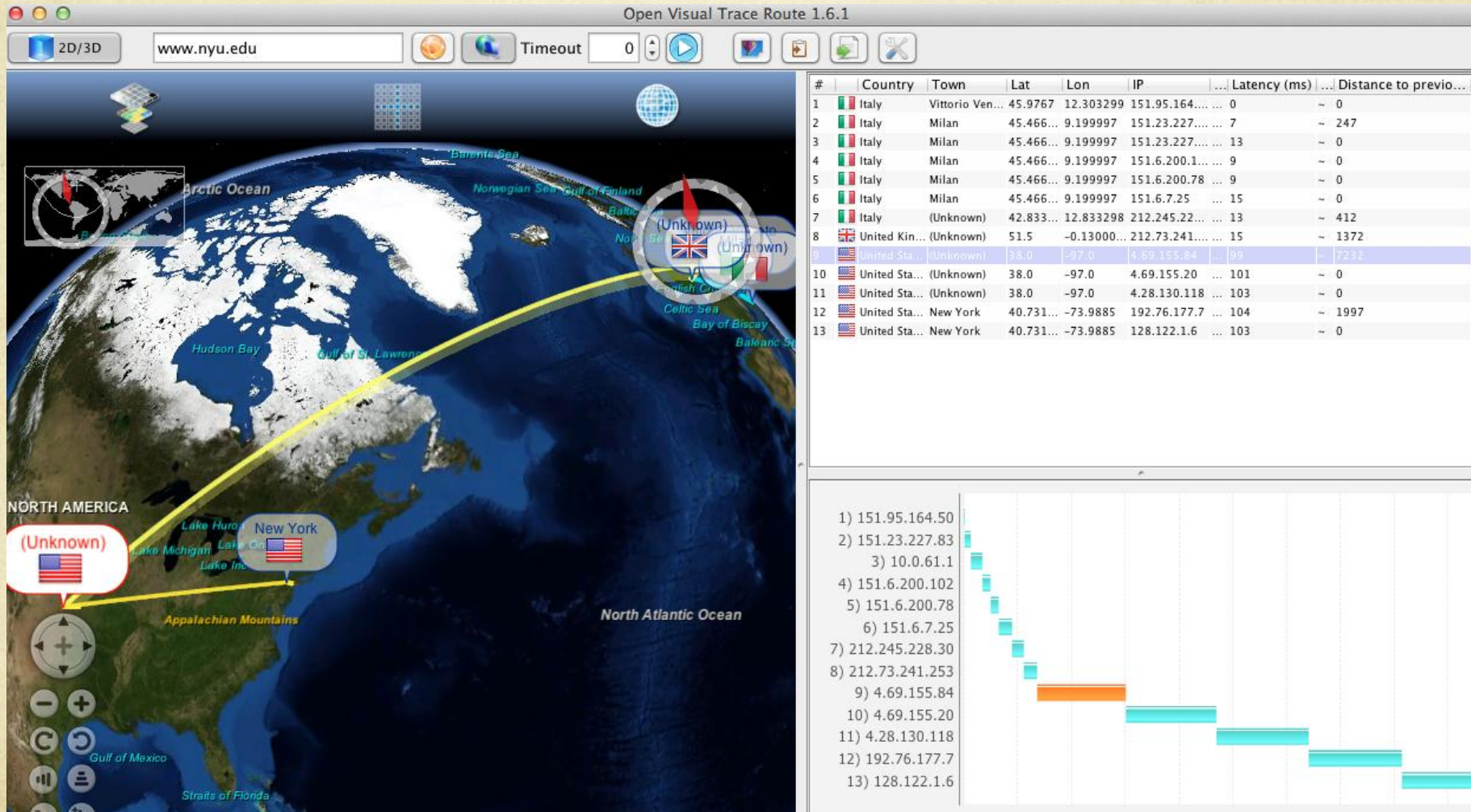
- It's an application aimed at determining the path followed by packets to get to the destination.
- From command line:
  - Mac OS X → **traceroute**
  - Microsoft Windows → **tracert**
  - Linux → **tracert** or **traceroute**
- There are many other softwares; an example:  
OpenVisualTrace  
(<https://sourceforge.net/projects/openvisualtrace/>)



# OpenVisualTrace

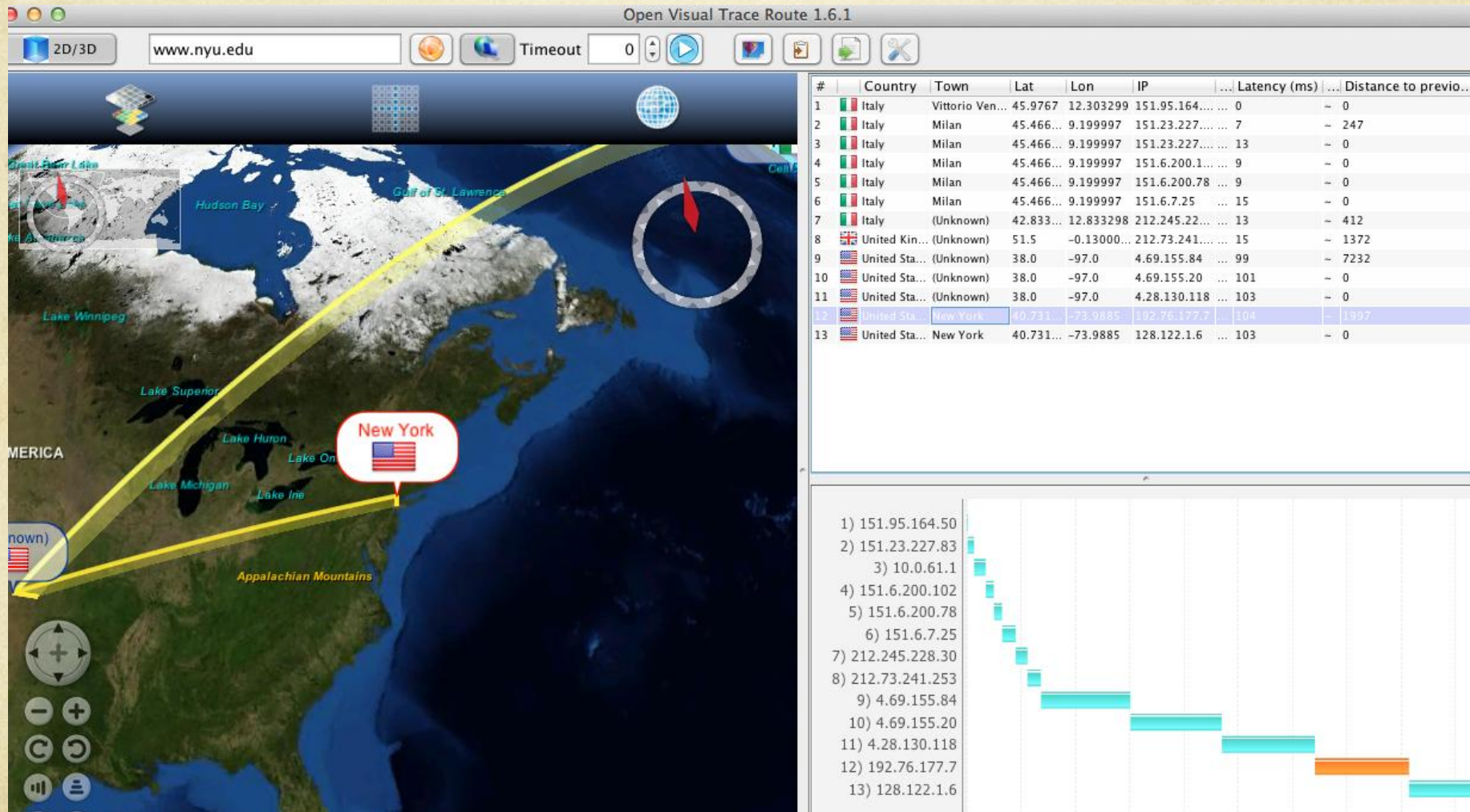


# OpenVisualTrace





# OpenVisualTraceroute



# Exercise

- Download and install OpenVisualTrace.
- Then try to visualize the path followed by packets to get to Google web servers.



# Conclusion

- Round-up
- HOMEWORK
  - Video on EdPuzzle
  - Create a time-line, describing main events
  - Collect magazines, envelops, seasons