Lecture 2.a

Networking 1

Introduction

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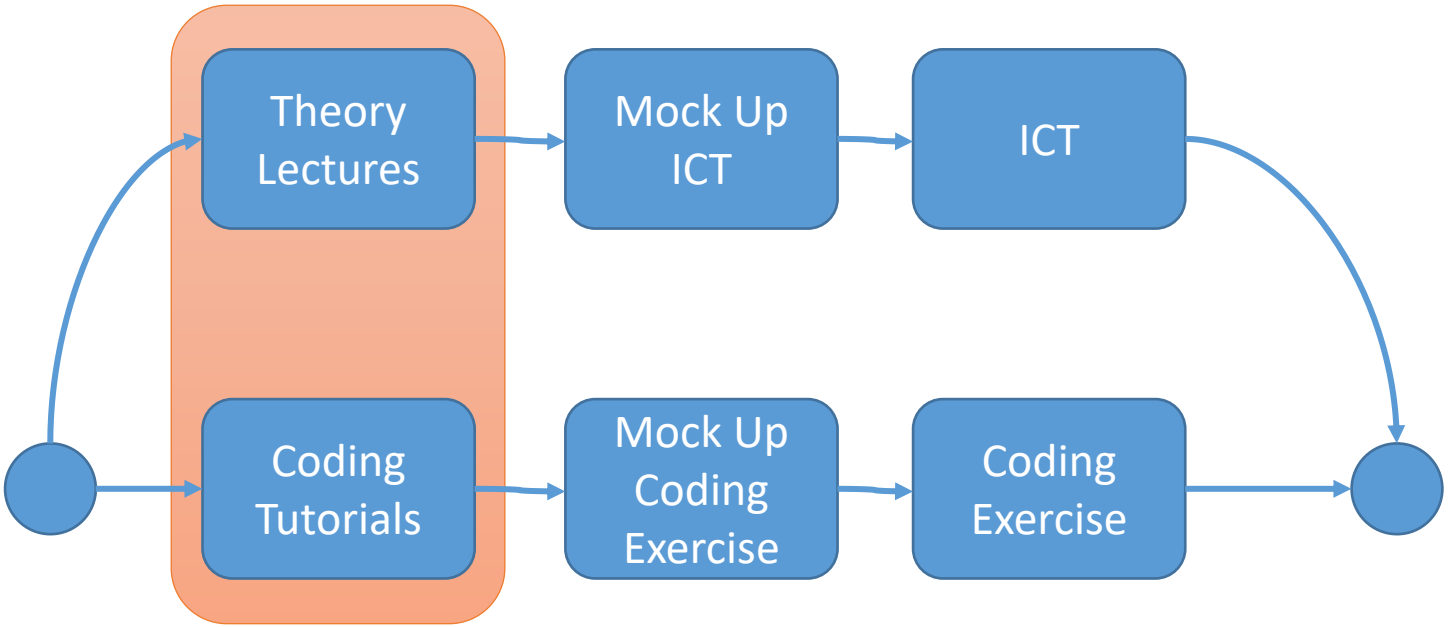
Module Conceptual Map – Where we are.

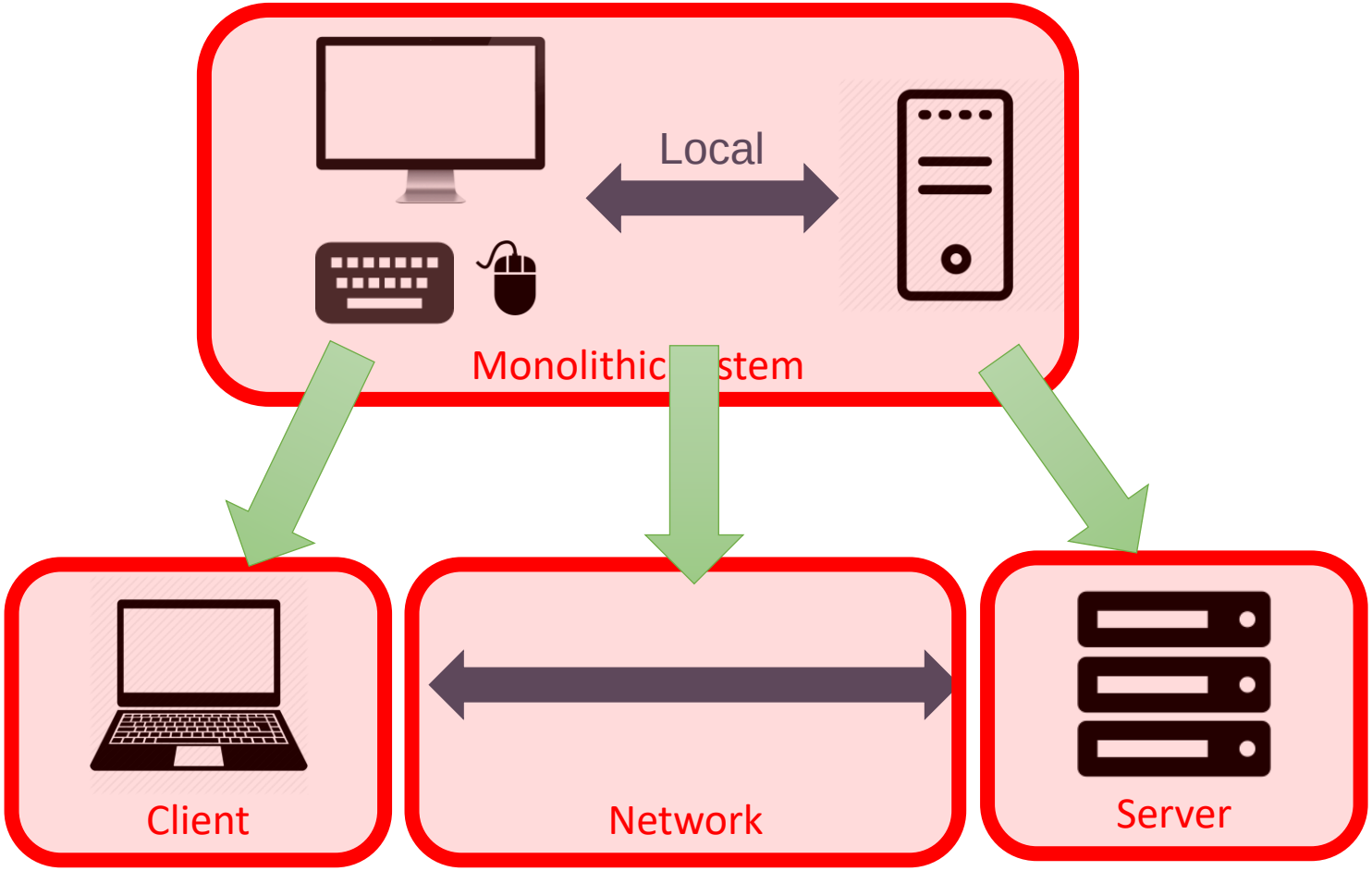


Today Contents

- Client/Server and Networking
- Networking

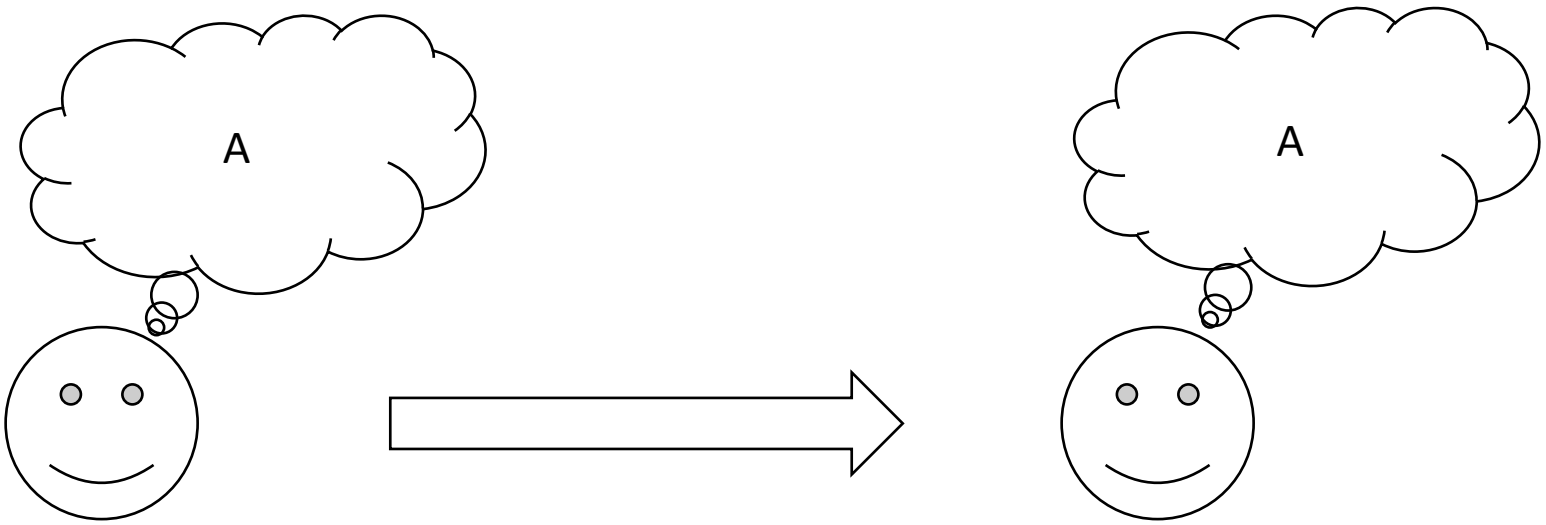
Client-Server Programming (1)

Let's separate the user interface and the main execution of the program, i.e. two basic components of the system.



Communication

Two way communication



Two way communication

- For (effective) two-way communication to take place we need to agree some basic functionalities:
  - Encoding (what each unit of signal means)
  - Synchronization (who will go first, will we take turns?)
  - Clarification (to deal with interference, for instance)
  - Transmission speed (don’t talk to fast!)
  - Medium (something to transmit the message)

Modern networking

- We have the same things to consider in networking:
  - Encoding
  - Synchronization
  - Clarification
  - Transmission Speed
  - Medium

Modern networking: basic ideas

- The basic ideas behind data transmission:
  - Our data will be encoded as energy, and we will transmit the energy
  - Energy decoded back to data at the destination
  - What kind of energy?
    - Electrical (across a wire)
    - Optical (light, across an optical fiber)
    - Radio (wireless!)
  - Each with different properties and requirements.
  - Special hardware needed for data encoding, and hardware connection required to the transmission medium.

TCP/IP History

- 1972: Email! Ray Tomlinson

Previously, mail could be sent only to others who used the same computer. To achieve this, he used the @ sign to separate the user name from the name of their machine,

- 1974: TCP/IP developed. This was crucial to the development of the Internet.
  - Key idea: **open network architecture** (similar to “galactic network”) idea.
  - Although there were currently very few computers in existence the presence of an open architecture made it easy to add new machines small and large. Eventually millions of computers would be added.

1981 = SMTP

TCP/IP Principles

- **Each network should be able to work on its own**
  - Developing its own applications without restraint, and requiring no modification to participate in the Internet

- **Within each network there will be a gateway computer**
  - This will link the network to the outside world. This will usually be a larger computer (in order to handle the volume of traffic) with the necessary software to transmit and redirect any package.

- **The gateway software will retain no information about the traffic passing through**
  - This was designed to reduce workload and speed up the traffic, but it also removes a possible censorship/control mechanism.

TCP/IP Principles

- **Packages will be directed via the fastest available route**
  - If one computer was blocked or slow the packages will be routed through another one until they eventually reached their destination.
- **The gateways between the networks would always be open**
  - They should route the traffic without discrimination
- **Operating principles will be freely available to all the networks**
  - Freeing the design information greatly facilitates subsequent technological advancement of the Internet.

The Internet History

- 1982: Arpanet adopts the TCP/IP standard. The Internet is born: a connected set of networks using the TCP/IP standard.
- 1984: British government announced the construction of JANET (Joint Academic NETwork) to serve British universities.
- 1985: US National Science Foundation establishes NSFNet to unite US universities.
- 1987: UUNET, the first commercial subscription-based service founded.

The Internet History

- The internet is still quite a forbidding place at this time:
  - Accessing data is complicated
  - Documentation available is mostly highly technical and scientific (and the presentation is generally unattractive)
  - Very hard to find what you are looking for
  - Transfer times are (relatively) slow
- The main attraction for the commercial sector is e-mail facilities, and access to newsgroups, “chat” and games.
- 1990: ARPANET winds up
- 1990: “Archie” developed at McGill university, Montreal. The first search engine!
- 1991: NSF removes restriction on private access to its backbone computers
- **1991: the World Wide Web released to the public.**

WWW 1st version

- The **World Wide Web** is a network of sites that can be accessed (searched, retrieved, edited) by a special protocol called the Hypertext Transfer Protocol (HTTP). The protocol simplified the writing of addresses for “resources” – fragments of information, whole documents, images, etc.
  - WWW concept originated in 1989 by Tim Berners-Lee1 at CERN, Geneva (the European Centre for High Energy Physics)
  - Goal was to make it easier to share research documents in a bewildering array of formats
  - Within a year he had developed a “browser/editor” program (which he distributed for free) and coined the name “World Wide Web”
  - Pages are marked up in HTML. The WWW is a hypertext

WWW 2nd Version

*The Internet ('Net) is a **network of networks**. Basically, it is made from computers and cables.*

***The Web is an abstract (imaginary) space of information. (where) you find document, sounds, videos,.... information**. On the Net, the connections are cables between computers; on the Web, connections are hypertext links. The Web exists because of programs which communicate between computers on the Net. The Web could not be without the Net. The Web made the net useful because people are really interested in information (not to mention knowledge and wisdom!) and don't really want to have know about computers and cables.*

Computer Networks

- **Network**: A network is an interconnected collection of two or more co-operating devices
  - “Connected” here means that the two devices are able to exchange information

- **Internet**: a set of networks connected by routers that are configured to pass traffic among any computers attached to these networks.

Computer Networks

- **Computers to transmit bits between each other**
  - The meaning or significance of these bits depends on the application
  - Initially communication was only possible over short distances and at a modest number of bits per second
  - Today both communication speeds and distances have increased significantly

- **Two important points:**
  - Connectivity: Once connected to a network, a machine is potentially connected to all machines on that network
  - “The network is the computer”: The backbone of most organization’s computing facilities is no longer the a centrally located computer room but instead its network infrastructure

Computer Networks, why ?

- **Resource Sharing**: share data, programs, and equipment across geographic boundaries.
- **Communications**: co-operation between dispersed groups.
- **Reliability**: replication of files and resources allows operation to continue despite hardware failures
- **Cost:** small computers have a better price/performance ratio than large ones
- **Scalability**: We can add more computers to the network as required

Transparency

Each network architecture presents us with a **transparent way of moving information between A and B**. When you upload a file from your computer to the college web server you use a file transfer program such as sftp; when you download a page from a web server using your browser the process is transparent. You appear to have a direct connection.

Transparent is a word that has a special meaning in computer science:

- In CS the term means something akin to “hidden” – you can see through the feature as if it was not there.

CS = Client Server