Guidance for the Training Course

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Contents

0.Course description

This chapter is about the training development preparations and materials for the computer teachers from the Assumption Samutprakarn School.

I am Cao Jianhua, with nickname Peter, from the college of computer science and information technology, Tianjin University of Science and Technology, Tianjin City, China and will be responsible for this 3-days training course. I am now interested in the computer application research, and a skillful programmer to some extent.

Since in June of 2018, the headers of Assumption Samutprakarn School came to visit our college and officially signed the contract with our university, which is about the acception of the students graduated from your high school as international students to go further college study in Tianjin University of Science and Technology, China. And course of *Fundamentals of Computers* is the one of essential course requirements for the students in their first-year study in our college. Usually they will have 32-hours study for the course, 4 hours per week, and have an examination at the end of the semester. And one of your requirements is that the international students from your high school want to be excused from this course, which is also the purpose of this training course, for you to know what the main contents or requirements for the students and then combine with your normal computer or information technology teaching schedules through the semesters.

So to better understanding the course and the total requirements, especially about the contents about the *Fundamentals of Computers*, we now hold this 3-days training course for you. And I will be the speaker or teacher during the 3 days training. I personally think that it is not only about the communications of the teaching method or pattern for this computer course, but also a very efficient and good opportunity to have discussion with the teachers present here about the development of computer science and information technology.

And now there comes to the core phase, which is also the most concerned part for both you and me. We have only three days, totally 24hours, for the training part. What is the coverage and how will we organize the class, these questions or problems are still confused me. I am still thinking about them.

For the course of *Fundamentals of Computers* in our university, we are also thinking about it every year since the computer information technology develops so fast. We are now getting to enter a more and more intelligent world. Actually computers show more and more powerful muscles and also potential magic powers. So I think for teaching students about computer sciences, we need to be steady at imparting the basics or fundamental theories of computer sciences, especially adding more theories other than applications. As we know that computer sciences and technology are the

integral of electro-engineering, mathematics, physics, mechanical engineering, human activities research, and many other knowledge. The computer itself is abstract and complicated. So when we stand at the platform and discuss the computers before the students, we need pay more attention on leading students to think and widen their eyes to the fundamentals of computers, not just letting them to be skillful application users. On the other hand, we as teachers or tutors should also keep up with the developing technology year by year, month by month, or even week by week. Now the whole world is actually the internet world, where is full of public information or personal comments. The changing rhythm is much tense and faster than the old times. We ourselves need to learn and also be trained, so that we have more competence and confidence to open up one window for students to know the internet world or updated computer sciences in our own teaching ways, although the students might not major in computers when he steps into colleges. The more and updated information we know or grasp with, the wider windows we will open up for our students. We may not be the expert in that filed, but we need to try to be not lagged behind the world. That is the essence for such training course.

Thus during the next several days, I will focus not only on the fundamental knowledge in computer field, but also try to discuss some latest development in information technology. I sincerely hope this can help your computer teachers to organize your computer syllabus more reasonable and more comprehensive.

As scheduled, the total course will cover three days, which means we have three mornings and three afternoons. I will show you our requirements for the first-year college students, and the patterns we have in the classroom. It may not be fit for the students in middle and high school, so you can consider it thoroughly about how to add to or complement with your current syllabus.

Here is the timetable for the three-day training course.

TIME PERIOD	COURSE SCHEDULE
27th, morning	Computer basics
27th,afternoon	Computer basics/software basics
28th,morning	Network fundamentals
28th,afternoon	Internet fundamentals/internet securities
29th,morning	Programming basics
29th,afternoon	Frontier of computer sciences

I will discuss the first part, the computer basics, for the first day. Maybe one day, and we will wait and see then. The details have been illustrated in the following descriptions. So here is the skeleton. The contents include history of computers, binary system, computers' structure and hardware components. For this part, we want the students to understand the basic theories of computers, so we spend more time on the binary system explanation and basic structure for all computers.

The second part is the software system, including operating system, and common useful applications, and some introduction of software engineering. For this part, we want students to be aware of how the computer software works and how the software develops, so that they can know more about the fundamental of those popular applications, not only just being a skillful apps users or phone-users.

The third part and the fourth part will be discussed together. The two parts are the fundamentals for the popular internet world. In the network fundamental part, we teachers need to discuss the network theories, network components and network build-up. There will have some communication background knowledge, for instance, about how the text messages, images, voices or videos could be transferred from here to China very fast. There has theory of one 7-layer structure to build a network, so that it is not only about the infrastructure, like cables, twisted pairs, hubs, etc., also about the communication rules or formats, especially now we might get access to 5G times. If possible, we can let students to build up a local computer network. For the internet part, we just expand the area to an open wide field, other than the local one. So we can let students know the history of internet, how to get access to the internet and also how to better use the internet. And in this part, there has some practice to teach students to write HTML pages, which might be a little introduction for the internet programming.

Now there comes to the computer security part. For this part, we need to emphasize the importance of security, especially the information security. The coverage includes the security theories, security ensure approaches, virus program and intelligence property. We want our students to develop the security awareness. There have many proved cases you can introduce to them in the class. For this part, it is just more like ideological education for students.

Those above-mentioned parts may take us one and a half day. The so-called half means the half day of the second day. We have leant about also half of the course. It is might be easier compared with the following day. We can see that there have many introduction parts or you can use it as some kind of story-telling hours.

And now we might step into the programming parts. It is complicate and very abstract, maybe high level of abstract. For we want our students to get to know the logical thinking methods when trying to solve the practical problems with computers. We want to lead them into the programming world using high-level languages. There has

not only the programming language usage, but also the data structure and mathematical algorithms. It is very abstract, and we can use some cases to introduce that to the students. Since the time is also limited, we have only 4-hours in this part in our normal teaching. Thus we can pay more attention on the control-flow part and the algorithms. Students who are interested in computer programming may go further easily after attending such class.

For the office suite applications, we usually arrange it as practical part in the computer rooms for students to practice using word, excel, ppt ,access or visio modules by themselves.

The last part for this course is the frontier of the computer sciences. This part is just for introducing the latest computer technology to students, such as the AI, big data, deep learning, cloud computing, blockchain, etc. For this part, the teachers need to be familiar with the newly developed computer and internet technology and may have some practical experiences. For example, machine learning is the foundation for big data analysis. Although we can easily list some examples or show some videos in the class, it is not safe or confident when some smart students ask you the things inside the example or video. So we should be always nerves as computer teachers and also hungry for the computer knowledge. This part is just for students to widen their eyes and also for us teachers.

Till now, I just show you what we are going to learn about and as a teacher, how to impart these information to our students. Since there has obvious difference between my students and your students, the syllabus or plan I have made for our college students may not be feasible for the students in your high school. I have also read your syllabus, there covers a lot of computer knowledge. It might be less abstract and more practical, and you can discuss later about how to combine more theory part into your class teaching.

That is the brief description for the three-day training course. It should not be perfect or satisfactory, and we can communicate these things in later cooperation years. Thank you for the presence and patience.

Objectives of Fundamentals of Computers -- TUST

The course of ***Fundamentals of Computers*** is set for the students in their first year of college period. It covers the computer basic knowledge, including computer system, hardware and software, network, internet, information security, programming, and practical applications. And also introduce the frontier of the computer science.

The course objectives for the students are:

1. to know the basic knowledge of computers and the computer systems, to be able to use and maintain the computer software and hardware equipment, to be familiar with operating system and office software and can complete the scientific paper formatting and give elegant presentations.

2. to understand the data and information coding principles, computer network system and the network configuration and management.

3. to master the relevant knowledge of computer internet, and have the ability to obtain information from internet, to get to know the risks of internet.

4. to understand the importance of information security, to know the computer virus, to have the ability to deal with information security problems correctly.

5. to understand the computer programming, to be able to organize algorithms and flowcharts for the practical problems.

6.to follow the development of computer science, and to have the ability to understand the frontier techniques of computer science and applications.

The contents of this course are organized as 8 chapters: computer basics, software basics, network fundamentals, internet fundamentals, information security basics, computer programming basics, office suites application, and frontier of computer science.

The course is scheduled as 54 hours of learning for the teachers, including 22 hours of class room, 12 hours of computer practice, and 20 hours of self-study after class.

1. Computer basics

Objective: to know the history and development of computer system, to grasp the information coding techniques, to understand the composition of computer system and the basic hardware.

Contents:

1.An overview of the computer. Topics include: The definition of computer; the history of computers (ENIAC, ABC, the development of the computer era, four logic components, application scope); Turing machine; classification and its applications (scientific computing, data processing, process control, computer aided engineering).

2.Binary code and multimedia information coding. Topics include: Coding schemes, the conversion of different coding schemes; byte (bit), Byte, KB, conversion unit of storage; ASCII code; multimedia data compression; graphics and images, vector graphics and bitmap, bitmap space, JPEG compression, image file format; analog audio and audio, audio compression and file format; digital video, video file format.

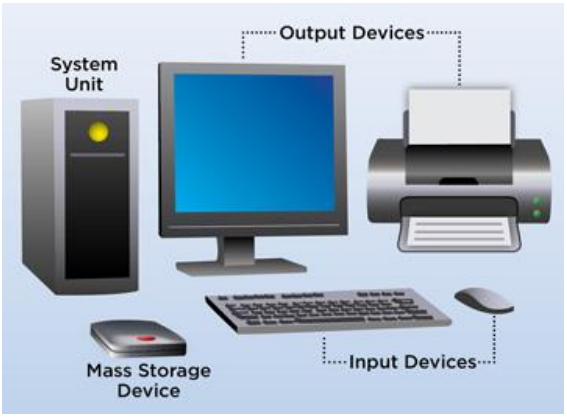
3.The composition of a computer system. Topics include: The Von Neumann architecture, Arithmetic-logic unit (ALU), Control unit, memory, input device and output device; computer basic working principle

4.The hardware basics. Topics include: The structure of the microcomputer, the bus, the address bus, the data bus, and the control bus. System unit, main-board; microprocessor, performance indicators (frequency, word length, kernel number, cache memory, ROM and RAM); external memory, hard disk, mechanical hard disk, Solid state hard disk, CD, USB flash storage, memory card; Graphic card index (display chip, memory , display card interface) SATA interface, USB interface, PCI interface, PCI-E interface, HDMI interface; the external device, input device (keyboard, mouse, scanner, touch screen), output device (monitor, printer, projector); commonly used computer desktop, notebook, tablet computer, intelligent mobile phone and other digital products.

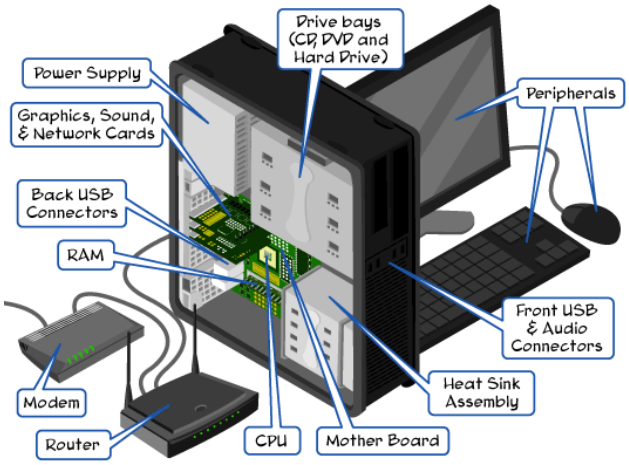
For this chapter, there have both practical and theoretical sides. We want students to be aware of what is computer and how computer works. If possible, we can move a real computer to the class and open up the assembling box to show the inside parts. We can teach students to assemble a computer DIY, so that they can intuitively see and touch the components. And the topics can be instantly linked to the computer theoretical structure -- Von Neumann architecture. Then the main function for each part and the relations between them can be introduced briefly. This might be one layer of abstract. Next the question of how computer works has to be answered. Binary coding system is the core, and the calculation of binary system should be discussed, since computer only understands 0 or 1. So how the data , such as digital number, text, pictures, voice, videos, etc, can be recognized by computer, and can be saved and transported by computer can also be discussed in detail. And concepts like Byte, Bit,

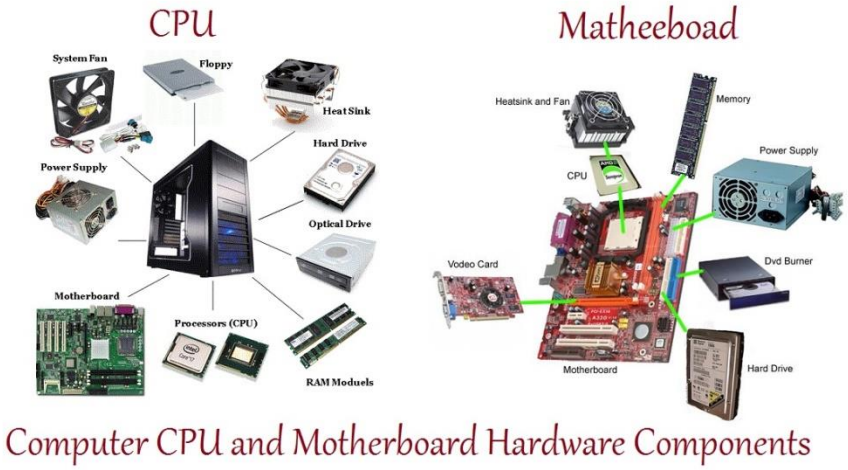
KB, MB, GB, PB and TB are popularly used now and considered as commonsense. The history of computer and the great related scientists is very interesting. We can list some cases in the class.

Lets' Start from the physical desktop computer:



The hardware components:

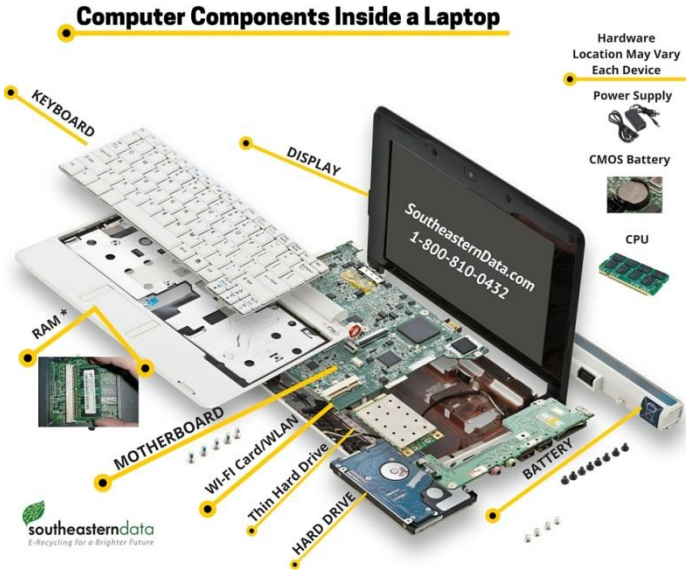




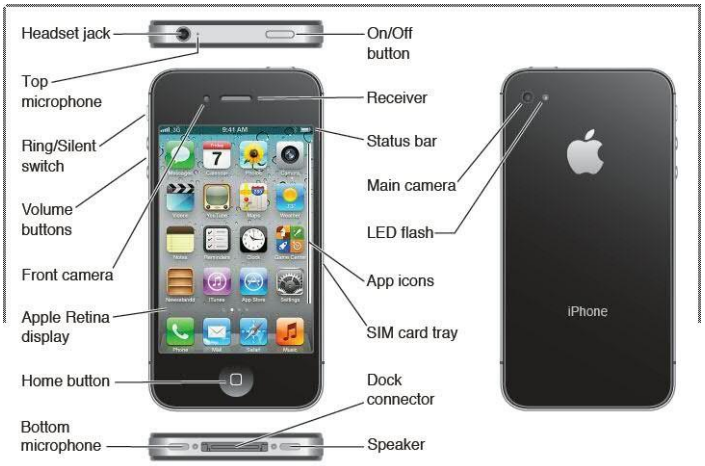
If possible, we can arrange one hour for students to do the computer assembling practice and get access to the hardware physically.

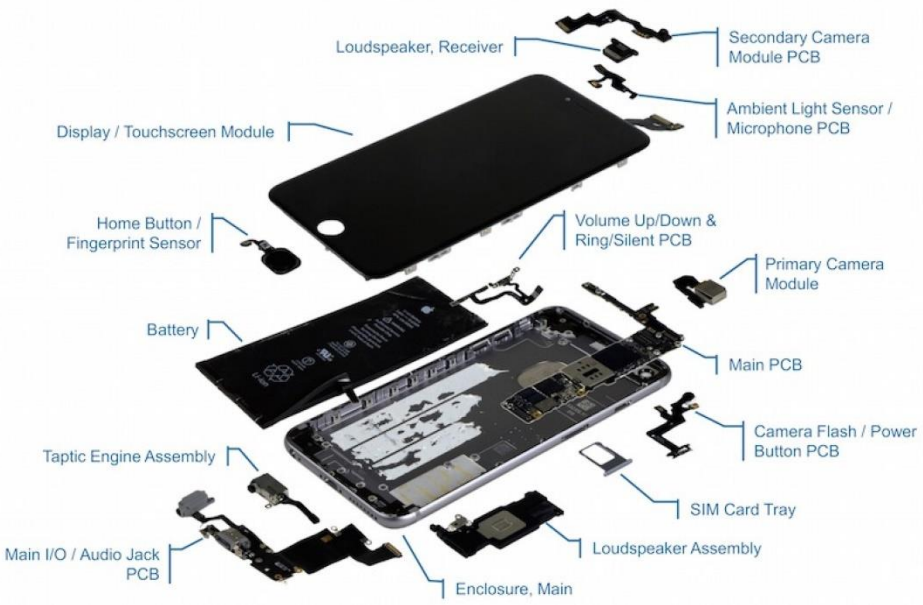
The links: https://slideplayer.com/slide/7691072/

And then can show the laptop computer hardware

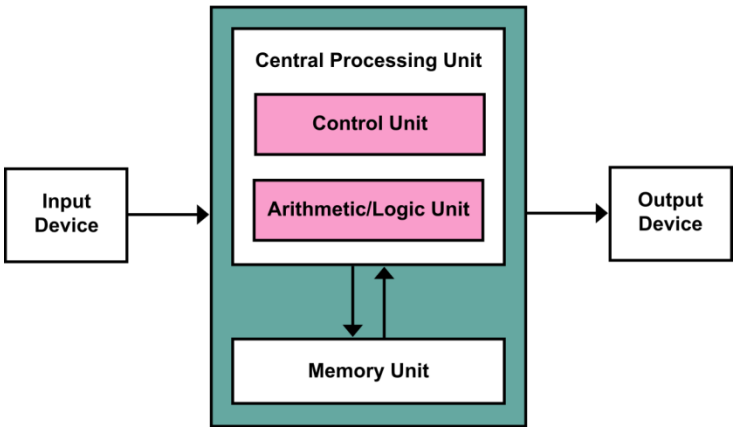


And the cell phone:





Next is the theory for computer architecture and data presentation in computer. Here the computer template is meaningful and set the basis for all modern computers.



I/O unit: encode keyboard characters to binary order for computer
CPU: order processing and arithmetic data processing
RAM: store the data

Data presentation in computer: binary systems. We need students to be able to do the binary calculation, which is the core for the computer data processing.

Number	0	1	2	3	4	5	6	7
Binary	0000	0001	0010	0011	0100	0101	0110	0111
Hexadecimal	0	1	2	3	4	5	6	7

Number	8	9	10	11	12	13	14	15
Binary	1000	1001	1010	1011	1100	1101	1110	1111
Hexadecimal	8	9	A	B	C	D	E	F

Addition	Subtraction	Multiplication	Division
0 + 0 = 0 1 + 0 = 1 0 + 1 = 1 1 + 1 = 0 and carry 1	0-0=0 1-0=1 0-1=1 and carry 1 1-1=0	0 × 0 = 0 1 × 0 = 0 0 × 1 = 0 1 × 1 = 1	0 ÷ 1 =0 1 ÷ 0 = not defined 0 ÷ 0 =0 1÷ 1 =1
Example: 11 11 110 Here, 1+1 (right most) = 0 and its carry 1 is added to left columns as 1+1+1=11 Hence, 11+11=110	***Example:*** 10 01 01 Here, 0-1 (right most) =1 because we take carry 2 from left column, and left remains 0. Hence, 10-01=01	***Example:*** 1 1 1 0 0 0 1 1 × 1 1 0 Tryout: (a) 1001 × 11 (b) 1100 × 101 (c) 1111 × 110 (d)1010 × 1001	***Example:*** 11) 1 1 0(10 1 1 × 0 0 Try out: (a) 111 ÷ 11 (b) 1100 ÷ 11 (c) 1001÷ 11 (d) 1011÷ 100 (e) 1111÷ 1011

Bit is the smallest unit, and 1 byte has 8-bits. 1 byte can represent 256 symbols.

The final part is some interesting cases both about computer history and computer scientists. There has a lot of computer scientist and the data are easy to download from the internet.

http://www.computerhistory.org/timeline/computers/

2. Software Basics

Objective: to know the definition of the operating system, operating system function, operating system classification, to be familiar with OS system (windows 10).

Contents:

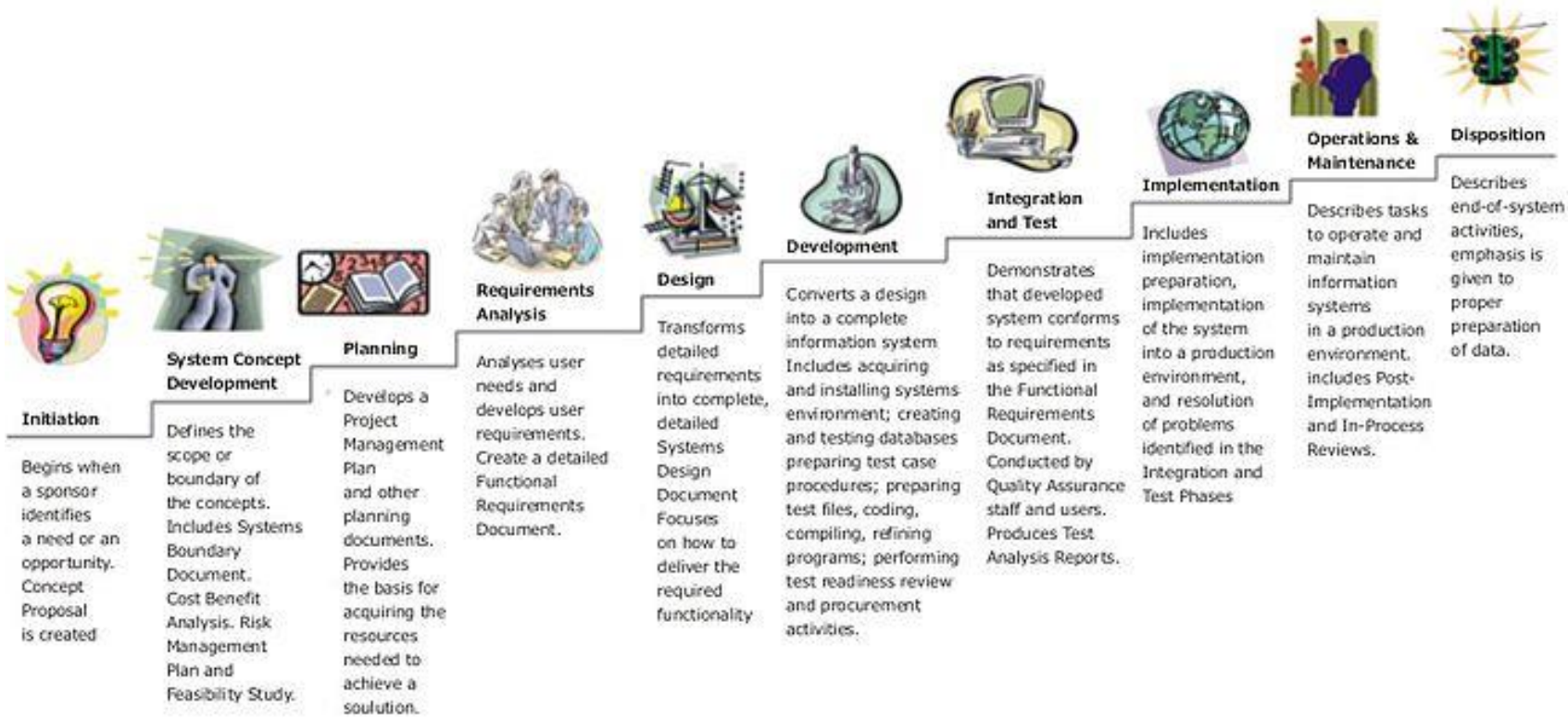
1.Introduction of software and hardware. Topics include: The meaning of hardware, the meaning of software, the relationship between hardware and software, system software, operation system, language processing program, database management system, diagnostic program service program.

2.An overview of the operating system and software applications. Topics include: Operating system definition, operating system function, common operating system. Windows, MS-DOS, UNIX/Linux, Macintosh and Apple. The classification of the operating system. Single user and multi-user operation system, single task and multitask operation system, batch operation system, time-sharing operation system, real-time operation system, network operation system, distributed operation system, and embedded operation system. the application software in Windows, the application software in Android, and the application software in IOS.

Here we have just limited time to illustrate the software basics. It is hard and difficult to get to know everything. But the template for the platform is always the same, and the concept can be introduced in the class.

For this part, it is just like Wikipedia for the software introduction in computer. We often let students learn by themselves. There has software classification, software applications and software engineering. We want to add more time on introducing the software engineering, especially the logical organization to develop software. Software engineering is defined as the systematic application of scientific and technological knowledge, methods, and experience to the design, implementation, testing, and documentation of software. It is truly integration of wisdom, endeavor and ability for a developer. There have industrial principles and mature software industry. Actually, this part can be discussed with the programming part together.

Systems Development Life Cycle (SDLC)
Life-Cycle Phases



Initiation

Begins when a sponsor identifies a need or an opportunity. Concept Proposal is created

System Concept Development

Defines the scope or boundary of the concepts. Includes Systems Boundary Document. Cost Benefit Analysis. Risk Management Plan and Feasibility Study.

Planning

Develops a Project Management Plan and other planning documents. Provides the basis for acquiring the resources needed to achieve a soulution.

Requirements Analysis

Analyses user needs and develops user requirements. Create a detailed Functional Requirements Document.

Design

Transforms detailed requirements into complete, detailed Systems Design Document Focuses on how to deliver the required functionality

Development

Converts a design into a complete information system Includes acquiring and installing systems environment; creating and testing databases preparing test case procedures; preparing test files, coding, compiling, refining programs; performing test readiness review and procurement activities.

Integration and Test

Demonstrates that developed system conforms to requirements as specified in the Functional Requirements Document. Conducted by Quality Assurance staff and users. Produces Test Analysis Reports.

Implementation

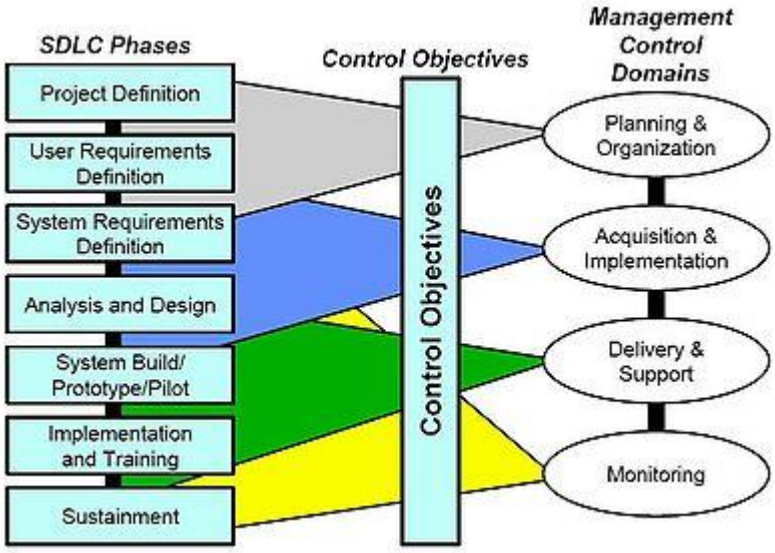
Includes implementation preparation, implementation of the system into a production environment, and resolution of problems identified in the Integration and Test Phases

Operations & Maintenance

Describes tasks to operate and maintain information systems in a production environment. Includes Post-Implementation and In-Process Reviews.

Disposition

Describes end-of-system activities, emphasis is given to proper preparation of data.



Software is very magic, and there has nothing that cannot be programmed, which is someone's words. Thus it is very important to get to cultivate the interest in programming. But it is not just code, the software system is one complex system. There has different phase, and has industry principle. To be simple, the workflow includes: requirements analysis, system framework definition, system prototype, coding and test, sustainment. Each part can be one project and busy for a certain time.

3. Network fundamentals

Objective: to get to know the definition of the network, to be familiar with network topology and data transmission system, OSI model, to know the network hardware and the configuration rules, to be able to set up a LAN network.

Contents:

1.An overview of the network and its classification. Topics include: Network definition, main function, composition; development history of network (terminal online system, computer network, architecture standardization network, Internet); the classification of network by geographic scope-- local area network, metropolitan area network, wide area network; the classification by network application-- public network, private network; VPN

2.Network topology and OSI model. Topics include: the classification of network by topology-- the star topology, tree topology, bus topology, ring topology, interconnected topology and irregular network topology. Data and information, analog data and digital data; data communication system; signal, analog and digital signals; error control, parity check and cyclic redundancy check (CRC) code.OSI model.

3. Network protocols, hardware and LAN construction. Topics include: The definition of the network protocol, the common protocol, the network operating system. Network main device, host, server, client; Wired transmission medium, twisted pair, coaxial cable, optical fiber , wireless transmission medium, radio wave, microwave, infrared ray, laser and Bluetooth;Network connection device, network adapter, hub and switch, routers, wireless routers. The process of building a LAN, the setting of a wireless router, the network account, the MAC address filtering, the IP address filtering, and the domain name filtering, share a folder in a LAN, share a printer, share a broadband connection, and share a mobile wireless hot spot.

For this part, it is everywhere now, and very popular in the world. But as a network basics introduction, more attention can be paid on answering three questions: what is network? How does network work? How to build a local network? These questions are closely linked with computers. Two or more computers are linked together with twisted pairs or wireless devices, and then the data can be transferred between the computers. Such status could be defined as a simple network.

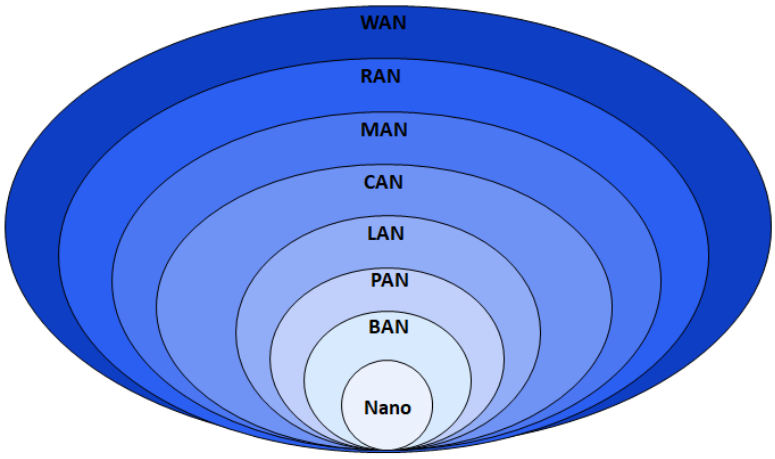
Start from the Q1: what is computer network?

The following is from the Wikipedia when I input the computer network:
Computer networking may be considered a branch of electrical engineering, electronics engineering, telecommunications, computer science, information technology or computer engineering, since it relies upon the theoretical and practical application of the related disciplines.

A computer network facilitates interpersonal communications allowing users to communicate efficiently and easily via various means: email, instant messaging, online chat, telephone, video telephone calls, and video conferencing. A network allows sharing of network and computing resources. Users may access and use resources provided by devices on the network, such as printing a document on a shared network printer or use of a shared storage device. A network allows sharing of files, data, and other types of information giving authorized users the ability to access information stored on other computers on the network. Distributed computing uses computing resources across a network to accomplish tasks.

And now the cell phone has also great magic power, which links people into one virtual social network, and there has deep thinking about the effect and meaning.
When introducing the network definition, we cannot let alone the internet field. This chapter focuses more on the network itself and we will talk about the internet network next chapter.

The figure is computer network types by spatial scope.



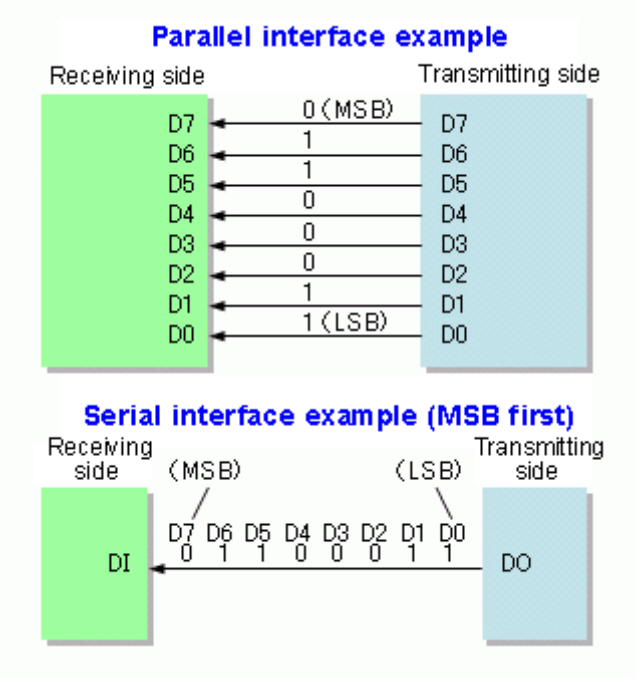
The Q2 is: how does network work?
There have lots of abstract contents to interpret this part in the class and it is very necessary yet. When the computers are linked together, how can the data be transferred between the computers? Or how can we text one message to friends with our cell phones? So we need to start from the data coding or decoding system and also communication principles for the network.

Data communication basics

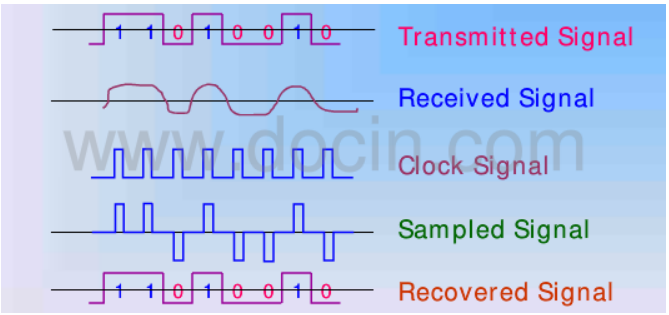
Data includes numbers, text message, pictures, sounds, videos, etc. Now there has big data along with the internet development. Big data simply means the data has big volume. So how the data can be transferred through the internet?

Data communication requires: at least two devices, a transmission medium, protocols(transmission contracts), standard data representation, serial or parallel transmission, signal encoding and decoding rules.

Two types of data transmission ways: parallel and serial. For the former, all bits of a byte are transmitted simultaneously on separate wires. If two devices are close to each other, it is practicable using the parallel transmission. For the latter, bits are transmitted one after the other. It is suitable over long distance.



When data is transmitted through wired suites, the signal needs to be processed (encoded / decoded).



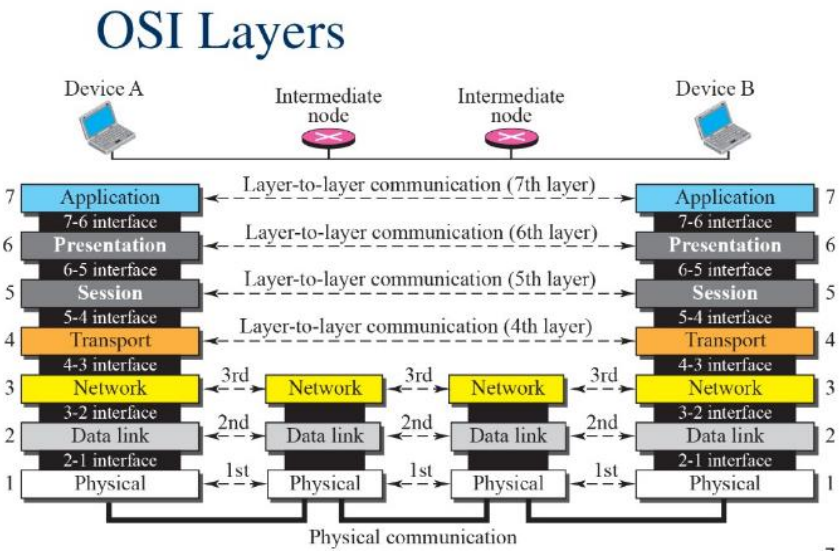
There has several types of transmission medium, such as electrical, optical, microwave, electromagnetic wave, etc. since bit-data has only 0 and 1 status, when the bit-data is transmitted, the status is encoded along with the cycled-changing property of the medium(clock signal). When the data is received, there has decoding process. And the correction process is necessary within the transmission.

OSI layer model

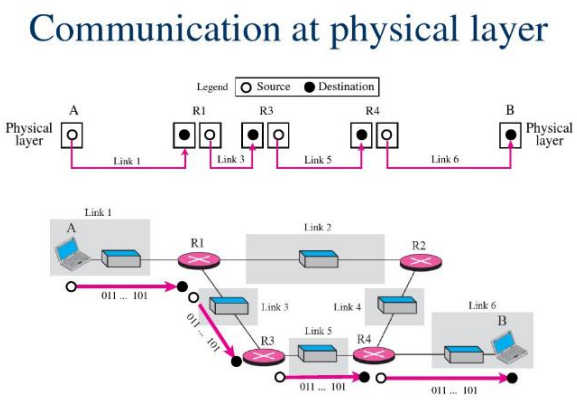
For the networks, the OSI seven-layer model is the foundation for all the network connection and communication. There has interpretation for each layer in the following paragraph.

OSI (Open Source Interconnection) 7 Layer Model

Layer	Application/Example		Central Device/ Protocols			DOD4 Model
Application (7) Serves as the window for users and application processes to access the network services.	**End User layer** Program that opens what was sent or creates what is to be sent Resource sharing • Remote file access • Remote printer access • Directory services • Network management		**User Applications** SMTP	GATEWAY		Process
Presentation (6) Formats the data to be presented to the Application layer. It can be viewed as the "Translator" for the network.	**Syntax layer** encrypt & decrypt (if needed) Character code translation • Data conversion • Data compression • Data encryption • **Character Set Translation**		JPEG/ASCII EBDIC/TIFF/GIF PICT			
Session (5) Allows session establishment between processes running on different stations.	**Synch & send to ports** (logical ports) Session establishment, maintenance and termination • Session support - perform security, name recognition, logging, etc.		**Logical Ports** RPC/SQL/NFS NetBIOS names			
Transport (4) Ensures that messages are delivered error-free, in sequence, and with no losses or duplications.	**TCP** Host to Host, Flow Control Message segmentation • Message acknowledgement • Message traffic control • Session multiplexing	PACKET FILTERING	TCP/SPX/UDP			Host to Host
Network (3) Controls the operations of the subnet, deciding which physical path the data takes.	**Packets** ("letter", contains IP address) Routing • Subnet traffic control • Frame fragmentation • Logical-physical address mapping • Subnet usage accounting		**Routers** IP/IPX/ICMP		Can be used on all layers	Internet
Data Link (2) Provides error-free transfer of data frames from one node to another over the Physical layer.	**Frames** ("envelopes", contains MAC address) [NIC card — Switch — NIC card] (end to end) Establishes & terminates the logical link between nodes • Frame traffic control • Frame sequencing • Frame acknowledgment • Frame delimiting • Frame error checking • Media access control		**Switch Bridge WAP** PPP/SLIP	Land Based Layers		Network
Physical (1) Concerned with the transmission and reception of the unstructured raw bit stream over the physical medium.	**Physical structure** Cables, hubs, etc. Data Encoding • Physical medium attachment • Transmission technique - Baseband or Broadband • Physical medium transmission Bits & Volts		**Hub**			



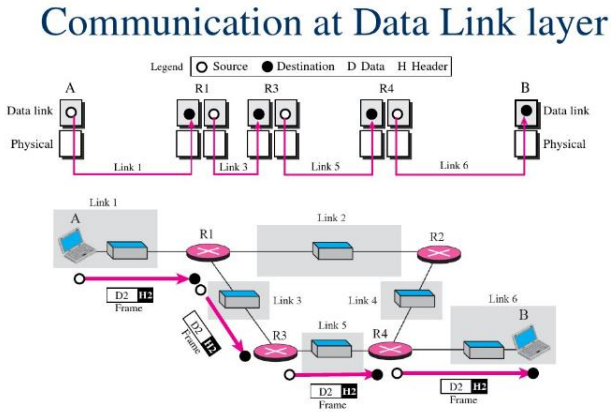
The physical layer： is responsible for the transmission and reception of unstructured raw data between a device and a physical transmission medium. It converts the digital bits into electrical, radio, or optical signals. Layer specifications define characteristics such as voltage levels, the timing of voltage changes, physical data rates, maximum transmission distances, and physical connectors. This includes the layout of pins, voltages, line impedance, cable specifications, signal timing and frequency for wireless devices. Bit rate control is done at the physical layer and may define transmission mode as simplex, half duplex, and full duplex. The components of a physical layer can be described in terms of a network topology. Bluetooth, Ethernet, and USB all have specifications for a physical layer.



The data link layer： provides node-to-node data transfer—a link between two directly connected nodes. It detects and possibly corrects errors that may occur in the physical layer. It defines the protocol to establish and terminate a connection between two physically connected devices. It also defines the protocol for flow control between them.

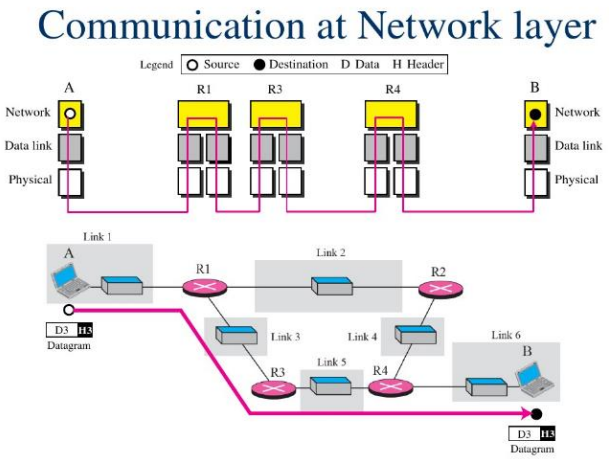
IEEE 802 divides the data link layer into two sublayers:Medium access control (MAC) layer – responsible for controlling how devices in a network gain access to a medium and permission to transmit data. Logical link control (LLC) layer – responsible for identifying and encapsulating network layer protocols, and controls error checking and frame synchronization.

The MAC and LLC layers of IEEE 802 networks such as 802.3 Ethernet, 802.11 Wi-Fi, and 802.15.4 ZigBee operate at the data link layer.The Point-to-Point Protocol (PPP) is a data link layer protocol that can operate over several different physical layers, such as synchronous and asynchronous serial lines.The ITU-T G.hn standard, which provides high-speed local area networking over existing wires (power lines, phone lines and coaxial cables), includes a complete data link layer that provides both error correction and flow control by means of a selective-repeat sliding-window protocol.

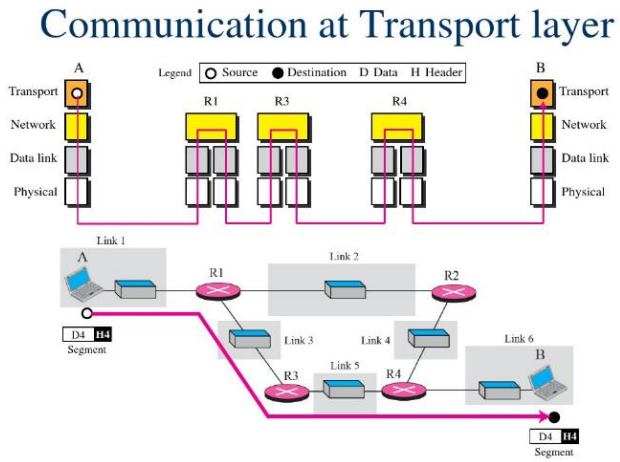


The network layer ： provides the functional and procedural means of transferring variable length data sequences (called packets) from one node to another connected in "different networks". A network is a medium to which many nodes can be connected, on which every node has an address and which permits nodes connected to it to transfer messages to other nodes connected to it by merely providing the content of a message and the address of the destination node and letting the network find the way to deliver the message to the destination node, possibly routing it through intermediate nodes. If the message is too large to be transmitted from one node to another on the data link layer between those nodes, the network may implement message delivery by splitting the message into several fragments at one node, sending the fragments independently, and reassembling the fragments at another

node. It may, but does not need to, report delivery errors. Message delivery at the network layer is not necessarily guaranteed to be reliable; a network layer protocol may provide reliable message delivery, but it need not do so. A number of layer-management protocols, a function defined in the management annex, ISO 7498/4, belong to the network layer. These include routing protocols, multicast group management, network-layer information and error, and network-layer address assignment. It is the function of the payload that makes these belong to the network layer, not the protocol that carries them.



The transport layer： provides the functional and procedural means of transferring variable-length data sequences from a source to a destination host, while maintaining the quality of service functions.The transport layer controls the reliability of a given link through flow control, segmentation/desegmentation, and error control. Some protocols are state- and connection-oriented. This means that the transport layer can keep track of the segments and re-transmit those that fail delivery. The transport layer also provides the acknowledgement of the successful data transmission and sends the next data if no errors occurred. The transport layer creates segments out of the message received from the application layer. Segmentation is the process of dividing a long message into smaller messages.OSI defines five classes of connection-mode transport protocols ranging from class 0 (which is also known as TP0 and provides the fewest features) to class 4 (TP4, designed for less reliable networks, similar to the Internet). Class 0 contains no error recovery, and was designed for use on network layers that provide error-free connections. Class 4 is closest to TCP, although TCP contains functions, such as the graceful close, which OSI assigns to the session layer. Also, all OSI TP connection-mode protocol classes provide expedited data and preservation of record boundaries.

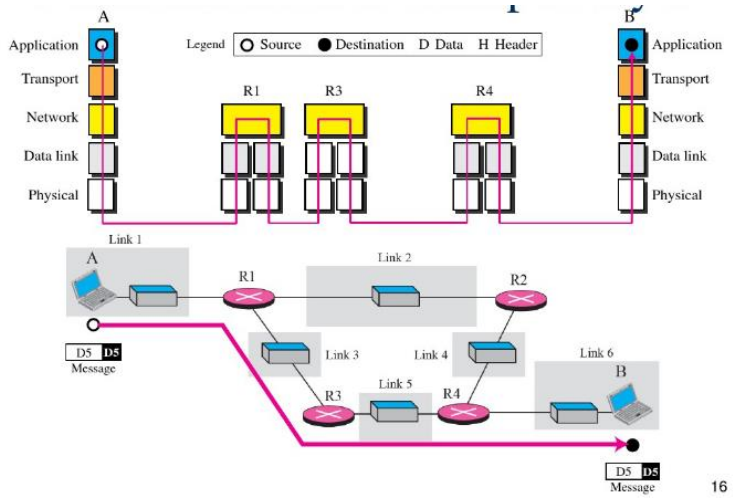


The session layer: The session layer controls the dialogues (connections) between computers. It establishes,

manages and terminates the connections between the local and remote application. It provides for full-duplex, half-duplex, or simplex operation, and establishes checkpointing, adjournment, termination, and restart procedures. The OSI model made this layer responsible for graceful close of sessions, which is a property of the Transmission Control Protocol, and also for session checkpointing and recovery, which is not usually used in the Internet Protocol Suite. The session layer is commonly implemented explicitly in application environments that use remote procedure calls.

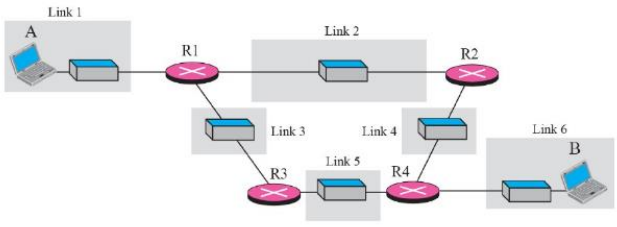
The presentation layer: establishes context between application-layer entities, in which the application-layer entities may use different syntax and semantics if the presentation service provides a mapping between them. If a mapping is available, presentation protocol data units are encapsulated into session protocol data units and passed down the protocol stack.

The application layer: is the OSI layer closest to the end user, which means both the OSI application layer and the user interact directly with the software application. This layer interacts with software applications that implement a communicating component. Such application programs fall outside the scope of the OSI model. Application-layer functions typically include identifying communication partners, determining resource availability, and synchronizing communication.



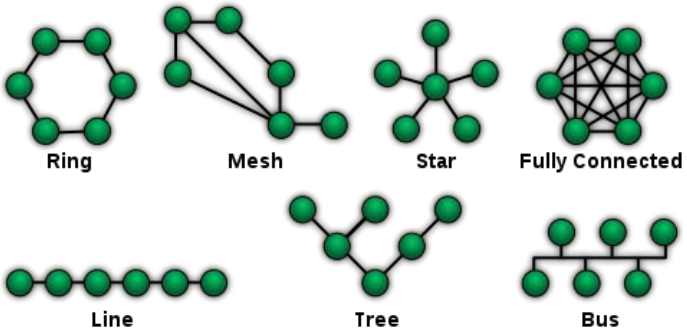
Q3 is: how can we set up a local network?

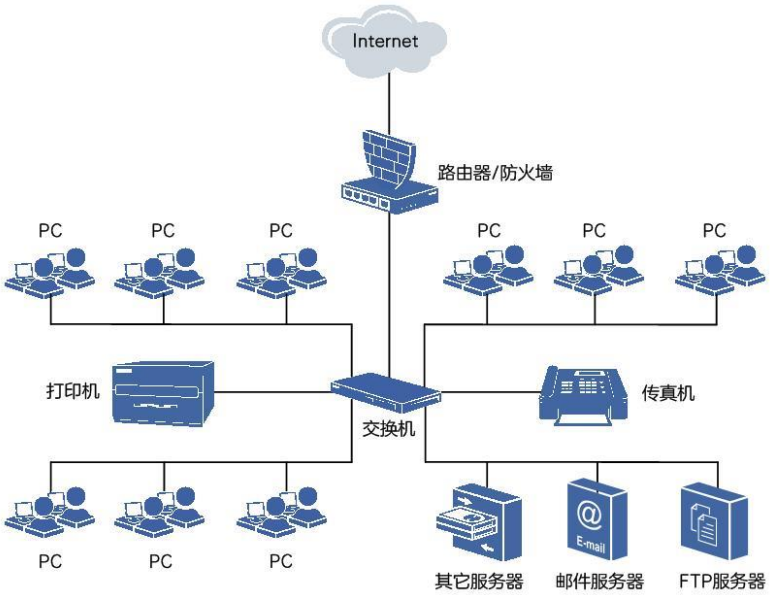
If possible, we can arrange one hour for students to set up a local network in the computer room. Prepare the hardware devices: twisted pairs, switch, computers, and routers.



A Computer Network

Then topology is also should be considered when setting up the LAN.


Ring
Mesh
Star
Fully Connected
Line
Tree
Bus


Internet
路由器/防火墙
PC
PC
PC
PC
PC
PC
打印机
交换机
传真机
PC
PC
PC
其它服务器
邮件服务器
FTP服务器

4. Internet fundamentals

Objective: to be familiar with internet knowledge, TCP/IP protocols, IP address, WWW, URL, to be able to finish simple web programming, to get to know the internet advantage and disadvantages.

Contents:

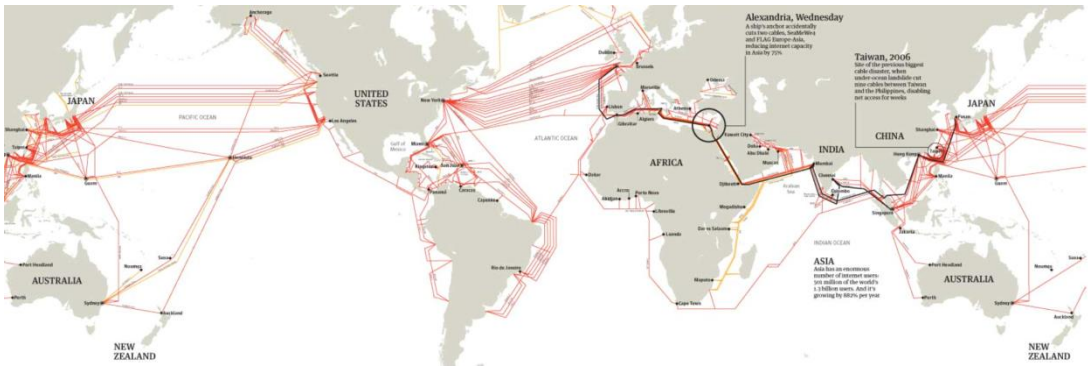
1.Introduction of WWW, TCP/IP, DNS and Routers. Topics include: Internet definition; client / server working mode; multiple access to Internet; TCP/IP, the definition of IP, IP address; Ping command function; port number; DNS,network error checking process, ipconfig command.WWW meaning, URL; Web browser; SMTP, FTP, Telnet.

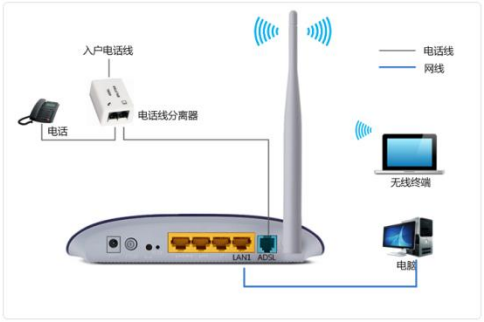
2.Website programming using HTML,CSS, JSP. Topics include: HTML language , webpage layout with CSS, element action with JSP.

3.Other Internet services, internet configuration and management. Topics include: BBS Forum; blog, micro-blog; network learning, network course; cloud storage; e-commerce shopping, searching information.

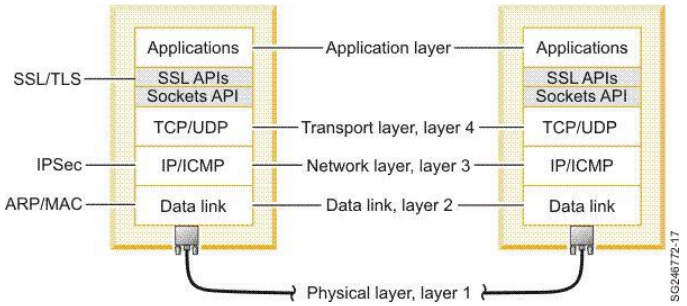
We are very familiar with internet since we are now just in a practical earth and virtual internet world. It is convenient for us to go e-shopping, web chatting, search unknown things through internet, do business and find jobs through website. I do not how much you or students know the internet itself. And for this part, we try to introduce the internet itself.

Internet network belongs to the network circle. It is not intranet, but internet, which means connections between computers have been extended outside the LAN network and to the whole world. How could that happen? How can we get access to the internet website and find something on it?

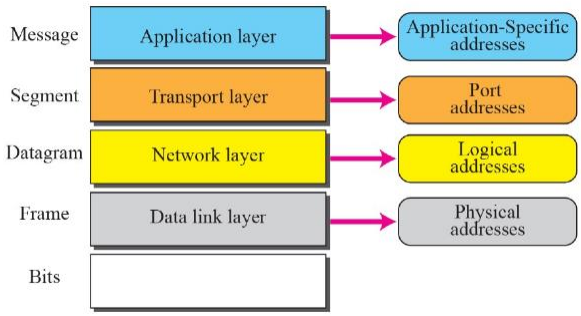




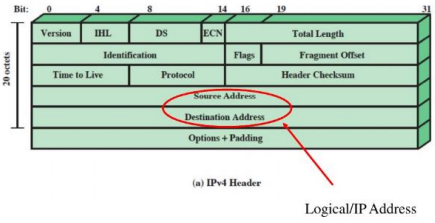
N1: Internet protocols: TCP/IP. The OST 7-layer is too complicated and for internet, it has been simplified as 5-layers: physical layer, data link layer, network layer, transport layer and application layer.



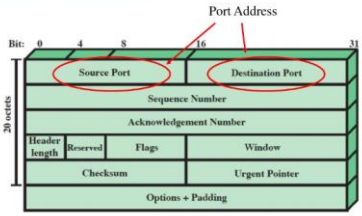
Addressing is critical for the internet network. Each computer needs a unique address, and there has four layers of addresses for a computer in a network: physical address (MAC), logical address, port address and application-specific address.



IPv4 Header

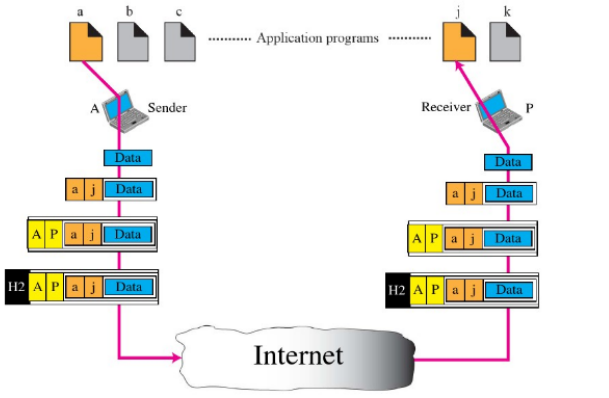


TCP Header



TCP ports: FTP(20 & 21), SSH(22), TELNET(23), SMTP(25), HTTP(80)

Example



The sending computer is running three processes at this time with port addresses a, b, and c. The receiving computer is running two processes at this time with port addresses j and k.

Concepts for internet: www, DNS, URL, web, email, FTP, telnet
Testing command: ping, IPconfig

N2: What is the background for webpages? HTML with shell languages

HTML is hypertext markup language, and it is used for webpages. HTML is very easy and powerful. Now the version has been upgraded to 5. Combined with the powerful server programming language ,such as PHP, JSP or ASP, HTML5 can be used to write beautiful and effective codes for websites and web games. And it can also be used to make up the mobile apps with the hybrid developing mode.

The webbrowers such as IE, opera, firefox, etc, are the interpreters for the html files. The process is called rendering. All the elements in the html files are rendered and showed as webpages.

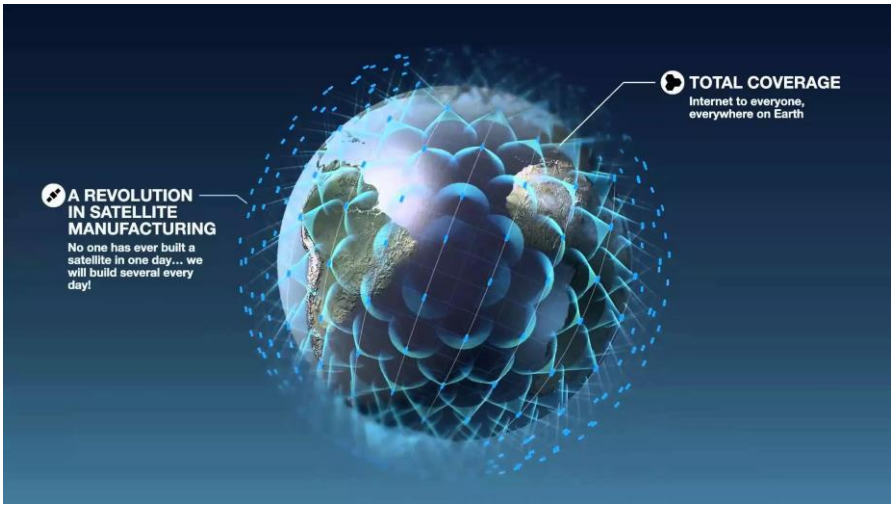
```
<html>

<head>
<meta http-equiv="Content-Type" content="text/html; charset=gb2312">
<title>This is a heading</title>
</head>

<body>
<h1>This is a heading</h1>
<h2>This is a heading</h2>
<h3>This is a heading</h3>

</body>

</html>
```



5. The computer information securities

Objective: to understand the fundamental principles of information security, and to get to know the security measures and management for information including electronic files, internet online safety, physical environment, etc., to understand the computer virus and protection steps

Contents:

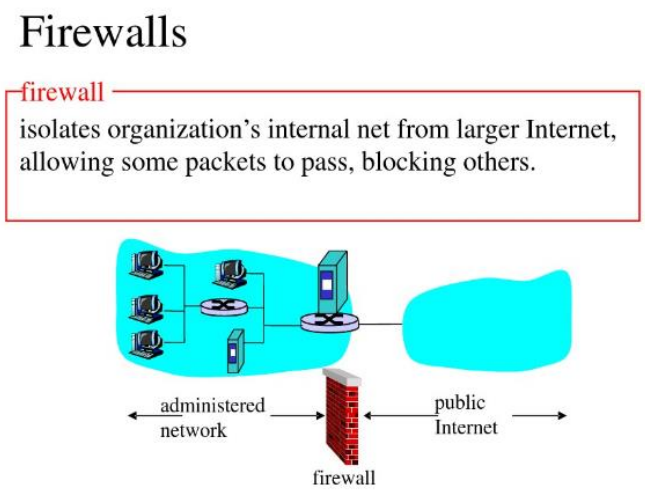
1. The definition of information security. Topics includes: the definition of information security, the main risk source for the information system, the security levels for the information security
2. The security measure and management for information. Topics includes: Data backup and recovery; data encryption, including Caesar's encryption, symmetric and unsymmetric encryption system, winrar encryption and decryption, NTFS encryption, digital certification; digital signature, password authentication, accredited certification, biometric recognition (fingerprint identification, hand geometry recognition, retinal iris recognition); firewall configuration and OS patch update; safeguard the physical security configuration.
3. The computer virus. Topics includes: introduction of computer virus, the characteristics of computer virus, classification of virus, the transmission of the virus, virus detection and prevention, virus check and remove measures, the antivirus software, to have the habit of personal files and internet safety.

This chapter is of great meaning. Now it is easy to get access to the internet and the internet social network. You can visit the website and download files, and you can also upload files to the website. When you want to buy something or read books through one website, you have to register the information first. Sometime it needs your cell phone number, credit card information, or some other important personal information. All the actions in the internet are recorded somewhere and might be collected or analyzed using in commercial ads or unknown purpose. Thus it is serious, and when we discuss this chapter in the class, we need to encourage student to use the internet but at the same time, we should also talk about the security and guarding measures. The risk comes from some malicious attack, deliberate information leek, and virus programs. There have techniques for both cybersecurity guard and cyber-malicious attack.

Cybersecurity, computer security or IT security is the protection of computer systems from theft of or damage to their hardware, software or electronic data, as well as from disruption or misdirection of the services they provide. Cybersecurity includes controlling physical access to system hardware, as well as protecting against harm that may be done via network access, malicious data and code injection. Also, due to malpractice by operators, whether intentional or accidental, IT security personnel are susceptible to being tricked into deviating from secure procedures through various methods of social engineering.

There have lots of security measures for cybersecurity, and there also always exists threat or risk when using computer on the internet. So when discussing this part in the class, we often list some famous cases for students to get the security information into mind. And there have theories for security measures, such as the biological recognition, data encryption, data backup and recovery,

etc. The biometric recognition has now been one of the hottest research points in the internet-to-things area.



Computer virus is so common nowadays, and it itself is a program. It is developed by some genius computer programming developer but used as attack purpose. So anti-virus now is the necessary application when installing computer. And we will talk about cloud computing and internet of things research later. It is the advanced internet technology, with great business and industry potential. Along with the techniques improved, the virus or malicious attack programs are also evolving. Thus security is one of the critical techniques in computer science.

Another topic in the class is the intelligence copyright. There have lots of products made by endeavor and smart people. These products include the hardware invention, software, and also the papers and patents. Some are publicly free, and some are private or payable. So when we want to use them as references, we need to label their origin, which shows our respect to the author. And when we invent some thing or write some innovation ideas, we need to apply for the patents to protect our own copyrights.

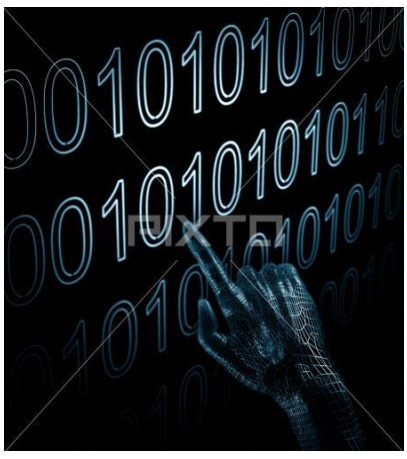
6. The computer programming basics

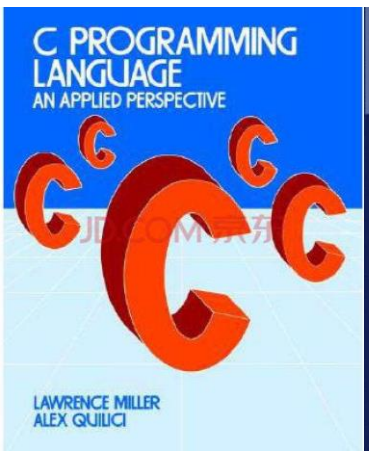
Objective: to get to know the development history of programming, to be able to schedule the flowcharts of simple problems, to learn the basic data types,expressions and statements, functions, etc., to understand the concept of object orientated programming.

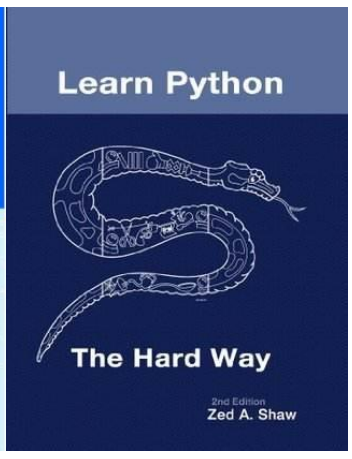
Contents:

1. The introduction of computer languages. Topics include: history of computer language and programming, low-level machine language(assembly language), high-level machine language(Java, C++,Python,etc.)
2. The computer programming basics. Topics include: the basic principles of computer programming, the compile and execution process of programming, common algorithms to solve practical problems.
3. The programming flowcharts. Topics include: organization of execution steps of programming for practical problems, pseudo code programming, layout flowcharts of programming.
4. The basic statement structure: data types, statements and functions.Topics include: data types (variables, constant, lists, dictionaries,arrays), expressions, conditional statements, loops, main functions and sub-functions, parameter transfer, procedure-oriented programming, etc.
5. The object orientated programming. Topics include: concept of objects, attributes and methods, classes, abstraction, encapsulation, inheritance, delegation and polymorphism, etc.

This part is the basics for programming. Besides introducing the history or current status of programming languages, we will focus more on data structure, algorithm, functions, class, object, and object-oriented programming. We start from the most efficient language C, and end up this with using python.







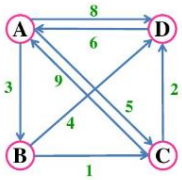
Start from data presentation in programming:

Data structure	Representation	Example
variable	Double, integer, character	Int a=2; char a='a'
array	Double, integer, strings	Int a[10][10]; String str="china"

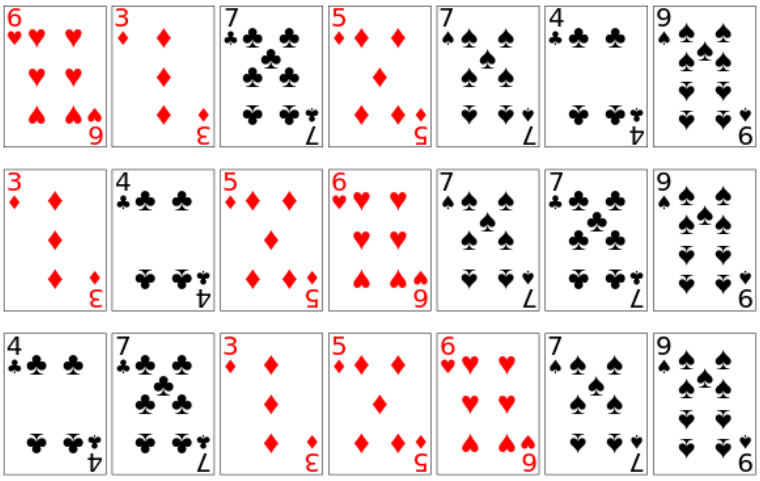
Struct	Struct name
	{ data type;
	}
		struct user
		{ int userID; struct user students;
		double age; students.userID=10;
		doublesalary; students.salary=5000;
		}

Linked lists	struct node {
	int x;
	struct node *next;
	};
		struct node *root;
		struct node *conductor;
		root = malloc(sizeof(struct node));
		root->next = 0;
		root->x = 12;
		conductor = root;
		if (conductor != 0) {
		while (conductor->next != 0)
		{ conductor = conductor->next;
		}
		}
		conductor->next= malloc(sizeof(struct node));
		conductor = conductor->next;

Binary trees	struct node
	{
	int key_value;
	struct node *left;
	struct node *right;
	};
		insert(int key, struct node **leaf)
		{ if(*leaf == 0)
		{ *leaf = (struct node*) malloc(sizeof(struct node));
		(*leaf)->key_value = key;
		/* initialize the children to null */
		(*leaf)->left = 0;
		(*leaf)->right = 0;
		}
		else if(key < (*leaf)->key_value)
		{ insert(key, &(*leaf)->left); }
		else if(key > (*leaf)->key_value)
		{ insert(key, &(*leaf)->right); }
		}

Diagram		• **ADT Graph:** ▪ **Graph(self)** ▪ **vertex_num(self)** ▪ vertices(self) ▪ add_vertex(self, v) ▪ add_edge(self, v1, v2) ▪ get_edge(self, v1, v2) ▪ **out_edges(self, v)** ▪ degree(self, v)

Then the algorithm presentation is discussed. We can list some interesting and easy-to-understand algorithms in the class. For example, the sorting algorithm:



Sorting a list of cards first by suit (order: clubs (♣), diamonds (♦), hearts (♥), spades (♠)), and then by rank within each suit. This is done by first sorting by rank (using any sort), and then using a stable sort to sort by suit. This demonstrates one application of stable sorting.

Classical algorithms:

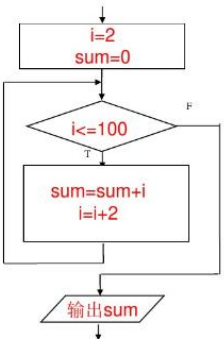
- divide and conquer.
- graph algorithms.
- greedy algorithms.
- dynamic programming.
- network flows.
- NP-completeness.

These algorithms are very abstract and complex. It needs patience, wisdom and steady mathematical foundation. And also computer programming ability is necessary for the practice.

For the beginner, the simple control structure: step by step, if statements, loops

$$c=sqr\ (a\hat{}2+b\hat{}2)$$

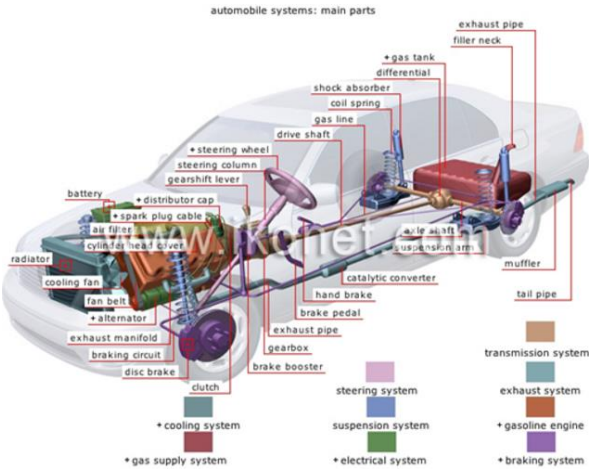
$$pay=\begin{cases} 3*pesrson & (n<=4\ ) \\ 4*person & (4<n<=10) \\ 5*person & (n>=11) \end{cases}$$



Class is just like struct, but it is dynamic. It is used for objects, which is the core of object-oriented programming. For one object, it has its own property and method. And it might be classified into one class. If we use class to describe the object, we can first set up one class and get access to the object.

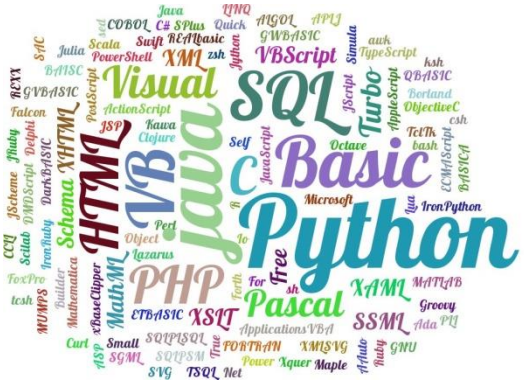
Take one car as an example. We know that car has lots of components for the automobile. It is a

very complicated system. We can regard each part as an object.



Class automobile // automobile , the class name
{ public double speed; // speed property
Public double shape; // shape property
Public string producer; // producer property
function brakesystem(){ return status;} // braking system function
function enginesystem(){} // engine system function
function electricalsystem(){} // electrical system function
function transmissionsystem(){} // transmission system function
…
}
Then if we want to describe an A6L car when programming, we can set:
Automobile A6L= new automobile() ; //java code, A6L now is an object of the automobile class
A6L.speed=150 // set the speed property for A6L
A6L.producer= ‘vokswagon’ //set the producer property for A6L
A6L. brakesystem() =1 // to check the braking system status
This is the object-oriented programming. We can set many details and then encapsulate them inside the class, thus when we want to use it, we need not care about the details but give the parameters and then get the result. The class can also be rewritten, and inherited from another father class.

Python is one of the popular OOP languages. And it might be the top one used in the world. Along with the big data analysis and AI research wave around the world, python gets more and more attentions. It is open-source and shared. And the rules are simple and easily acceptable. Thanks to the community. There have many useful libraries or packages. We just write in the shell window: import the name of the package, and then use it freely.



1.py - C:/Python27/1.py (2.7.11)

File Edit Format Run Options Window Help

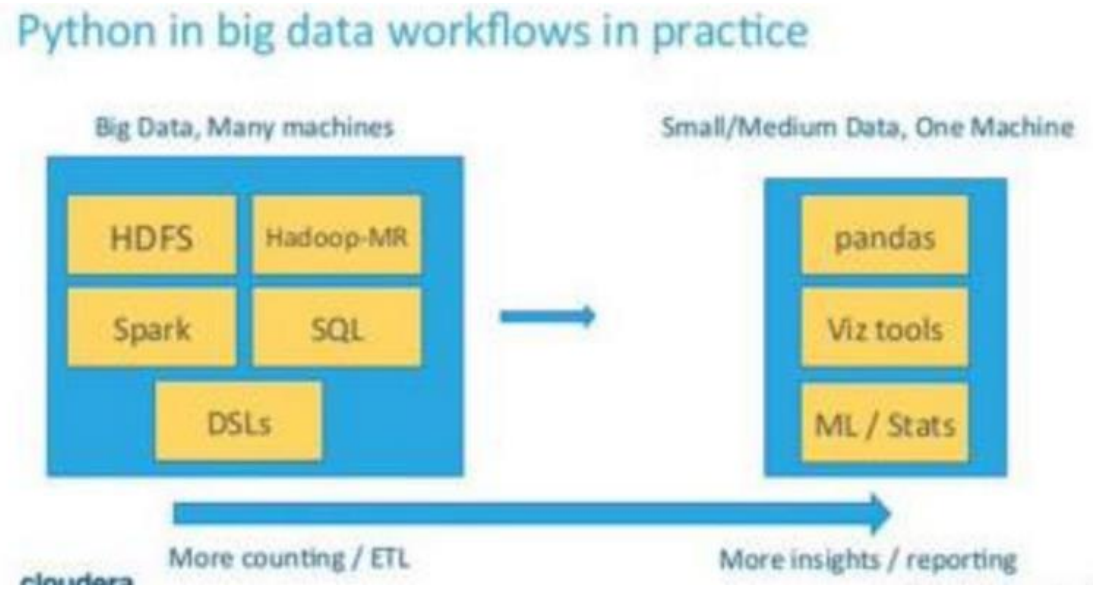
```
#!/usr/bin/python
# -*- coding: UTF-8 -*-

class Thailand_train:
    def __init__(self, name,day):
        self.name = name
        self.day=day

    def displayTeacher(self):
        print "Teacher is: %s" % self.name

    def Train(self):
        return self.day*5


t=Thailand_train('caojianhua',10)
t.displayTeacher()
print t.Train()
```



7. The advanced Office suites practice

Objective: to grasp the skills in using word-editing or table-editing suites including Microsoft Word, Excel and Powerpoint. To be able to format the papers with scientific requirements using Word, process numerical data and plot figures using Excel and accomplish elegant presentation using Powerpoint.

Contents:

1. The MS word. Topics include: set formats for the words and paragraphs, set the styles for the chapters' titles, header and footer, and page layout. To be familiar with formating papers with standard journal requirements.
2. The MS Excel. Topics include: data input, basic operations, numerical data processing using built-in functions, charts including histogram, scatter, polygon, etc.
3. The MS Powerpoint. Topics include: slides design, organization of texts and figures, automation effects of slides show, etc.

This part is just for practice. We only focus on three types of office software suites: word,excel and powerpoint. For the college students, they have to learn writing papers in their major study period, and even thesis some time. So it is necessary to get familiar with some practical skills in using office suites. Some middle and high school also have such classes, and it is not repeated in college. The requirements are different or for college students, the level is sure to be higher.

8. The frontier of computer science

Objective: to get to know the development of computer science and current popular computer techniques, including cloud computing, artificial intelligence, IOT,etc.

Contents:

1. The artificial intelligence and machine learning. Topics include: robots, machine learning, deep learning, and applications.

2. The cloud computing. Topics include: definition of cloud service, cloud computing development and future trends.

3. The internet of things. Topics include: definition of IOT, the topology, sensors, data gathering, and the classical application of IOT.

4. Big data and data mining. Topics include: basic data mining examples, the mathematical algorithms (KNN, decision tree, Bayes classifier, linear regression, artificial network), data mining framework, python application.

5. The block chains. Topics include: basics of block chains, organization of decentralized network, bitcoin development.

There have lots of newly developed internet technology. They might exist in the early history, and begin to get booming along the internet development.

First one is the machine learning and data mining. It is just computer learning. We know that computer is just machine, and it does not fill tired or boring or have any ethnics and feelings. It is our human that give computer ability to read data, write data, and make decisions after data analysis. The learning rules are made by human or by the programmers. That is the essence of machine learning. Algorithms give computer ability to learn from data, and then make predictions and decisions. Although computer might not have the human's intelligence, and the computer scientists are working hard to improve the computer's intelligence. That is artificial intelligence. And machine learning is the most important technology that boosts AI getting ambitious and higher goals.

Machine learning is difficult for students to understand in their first college year since there have lots of complicated mathematical algorithms. So we can just talk about the concepts other than the details.

Here is a simple example. There has a famous Iris dataset for machine learning or classification.

Fisher thought there have three types of iris based on the sepal length, sepal width, petal length and petal width. The length and width data are called features, and there are totally three types (iris Setosa, Versicolour and Virginica) . So if we have the four features data, how can we know it belongs to which type of iris. This kind of problems is called classification. And the algorithms used are called classifiers. There are totally 150 lines.

Iris Data Set

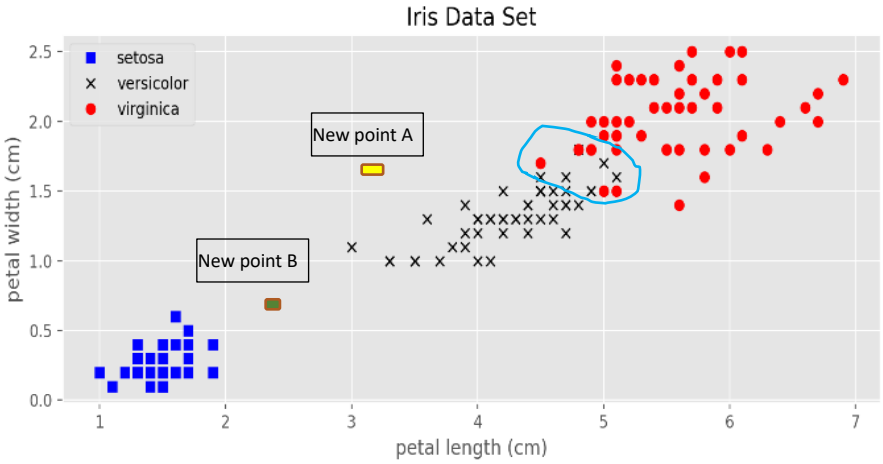
Download: Data Folder, Data Set Description

Abstract: Famous database; from Fisher, 1936

Data samples

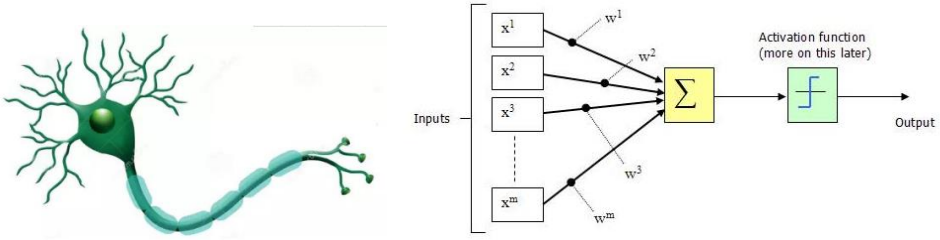
sepal length	sepal width	petal length	petal width	type
5.1	3.5	1.4	0.2	Setosa
7.0	3.2	4.7	1.4	Versicolour
6.3	2.9	5.6	1.8	Virginica

We can use crossplot to visualize these data:



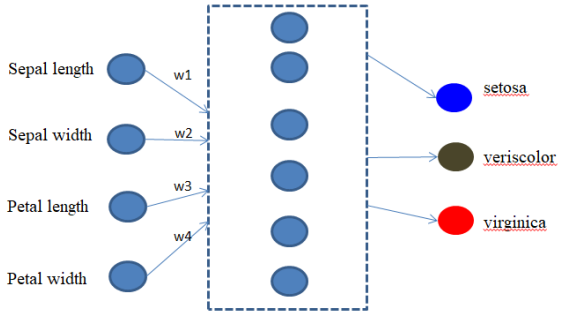
We can see that from the crossplot the type boundary is clear, and there has certain overlapping area between the versicolor and virginica type. These are the original data. Now we add new data (A and B in the crossplot), and which type they should be? Totally there have several steps: the first step is the original data normalization, the 2nd step is to train the original data and get a model to fit the types, the 3rd step is the model validation and prediction. Here the model also means the classifier for the example. There have many algorithms for such classification question. The simplest algorithm is the KNN using the Euclidean distance to decide the type. Here in the crossplot, point A is clearly has the shortest distance away from the Veriscolor type in 2-D plane. Thus we may predict it as Veriscolor iris.

The example here is very classical and a little bit simple. There have more complicated scenario and need more powerful machine learning algorithms. Most of the algorithms are originated from statistics, such as decision tree, binary trees, support vector machine, Bayes probability analysis, etc. And some algorithms are not based on statistics. Most notable are artificial neural networks, which were inspired by neurons in our brains. The next figure shows the idea from signal process of brain neurons to the mathematical non-linear model. When we input features at the input layer, and give them bias and weights, we can get the output after kernel activation process.



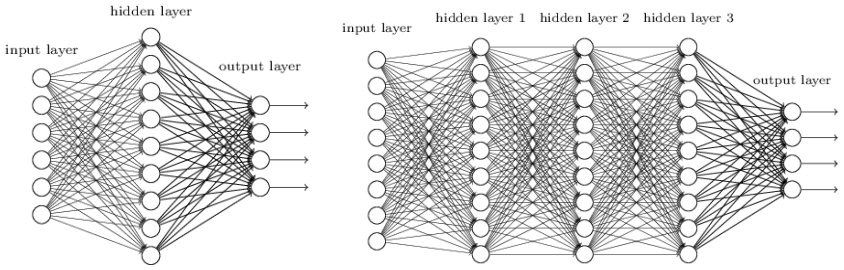
We still use iris classification as the task. Now we know that we have four features, and the output

is three types of iris. And the model can be set up as follows:

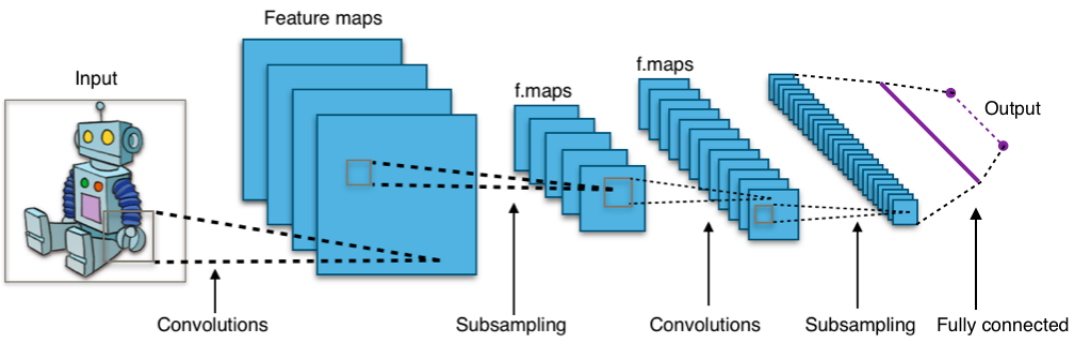


Normally it is three-layer structure. At the input layer, each node stands for one feature separately, and at the output layer, each node stands for one type. The middle part is called hidden layer. The hidden layer is the critical, and we can set different number of nodes according to the problem. For each input node, there has initially set the weights and bias. In the hidden layer, the summation process is calculated for each input node and then use the kernel activation function to get the output nodes. It is forward calculation from the input layer to hidden layer , and then the output layer . There must be errors at the output layer between the real type and the calculated type value. Thus to improve the accuracy, we need to adjust the weights and bias. The way to automatically reset the values is the back-propagation algorithm. The forward and backward calculation cycle will be repeated many times until the error is manually acceptable. The process is called network learning and training. After the ANN network model is optimally set up, we can input the newly-collected data and predict the classification result.

The process is non-linear, and without statistics theory support. Surprisingly it works now, especially in AI research and applications. The above example just uses one hidden layer. After scientific research, computer scientists found the hidden layer could be used as abstraction layer to get the more accurate or representative features compared with the input layer. So more layers could be added into the network models. That is the basic idea for deep learning.



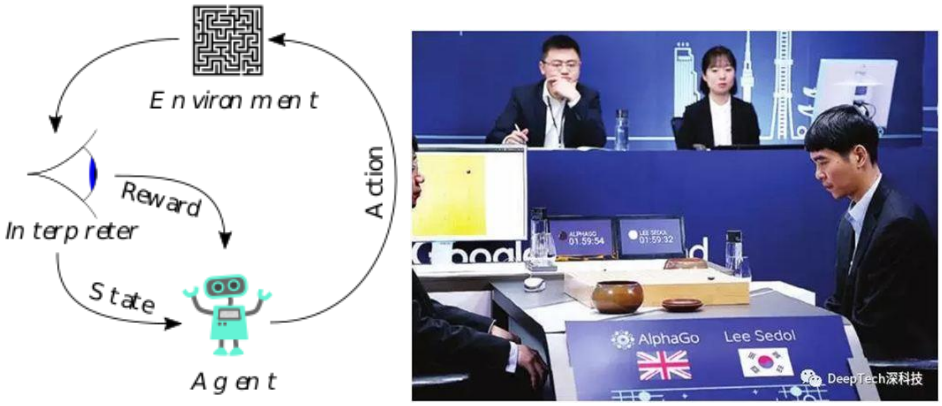
The following figure is for visual recognition practice using deep learning.



Deep learning means learning using ANN model with more than one hidden layer. Training these more complicated networks takes a lot more computation and data. Deep learning shows its advantage in face recognition and computer vision process. Many literatures or achievements about the deep learning theroies and applications have been published. You can easily google it and download the materials.

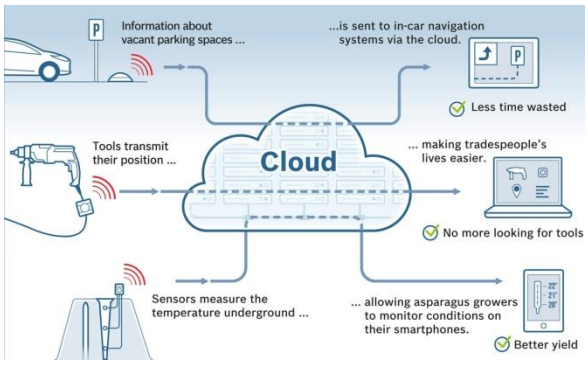
What we talk about is the advanced computer technoloy, deep learning. We use these ANN to do the classification and prediction, and the learning prerequisites are the known features of similar objects. The ANN model needs input guidance, and show intelligence at specific task.

Reinforcement learning is another super powerful approach. Its learning way is similar to human being. People don't just magically acquire the ability to walk after taking thousands of hours of trial and error to figure it out. Computer scientists are trying to apply the same learning strategy into the computer model. For many narrow problems, the reinforcement learning is already widely used.



These advanced learning algorithms have been applied into our real life. The face recognition, robots, natural language processing and computer vision research have shown great convenience and impact. We do not have so much time to get into the detail, thus we just introduce the idea and the current research status into the class.

Second one is big data and cloud computing. Big data is now one of the commercial mode and industry. Almost all the internet companies have developed their big data analysis business. They have earned billions of money and will earn more. For example, there may have billions of people in the world using tweeters or facebook. Every minute there will have new information or new picture or new comments on tweeters or facebook platform. That is huge data. The internet company has the ability to shuffle these data and analyze them. Thus the users' favorites, activity pattern, focus, etc, can be analyzed as a report, which may have great commercial and social value. Mr. Trump, the current US president, is very good at using these social products. The technical basis is the machine learning and data mining, and also the cloud computing. Especially for the hug data, the cloud computing is the dominant.



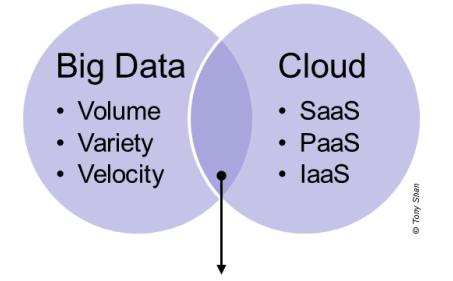
The cloud computing is both a commercial business and a technical innovation along the internet development. The big data is huge, and how to store these data, how to data mining or execute processing based on these big data. The traditional way is not feasible, since the single storage disk has limit and the single CPU has limit. The distributed or parallel computing is the solution. The big data can be stored parallel on different disks after reorganized using distributed file system, and calculation jobs can be executed separately and finally the result can be regrouped as one. The whole process needs lots of higher-computation level computers and special network devices. Those rich internet companies like Google and Amazon, after they build such computing environment, have ideas to set up new commercial way to get richer. That is renting the computing power through the internet to the costumers. The costumers just pay for what they want. They do not need to build up such expensive computer devices and rooms, hire technical system-management employee, and pay for the maintenance by themselves. This is the simple explanation for cloud computing.

Till now, there have four types of cloud computing. The first is called IaaS, which is the brief name for infrastructure as service. The second is called PaaS, which is for platform as service. This type is built up on the first IaaS. The third and the fourth types are all about the application layer. The third is SaaS, which is for software as service. The last one is DaaS, which is for data as service.

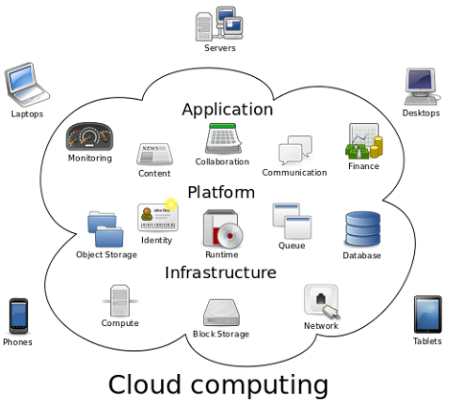
The simplest IaaS example is the website. When we want to have our own website, we need to pay for renting a server from the integrated service provider. We can buy our domain name, and pay for the IP server for uploading or storing our webpages. The whole process is renting other than buying . Since the services are not forever, and there have time limits. The server machine is not in your office, and it is provided through the internet by the service provider. You just rent it for the usage right as your server machine.

SaaS is about software applications for costumers. The service is provided on the internet, and you just buy the service when you need it. For example, if you are running an e-shop business, and the whole process of orders, finance, cost and after-sale online service is necessary. You can organize a team to develop such complex applications or software installed on local computer, and maintain the applications every few days, which will cost your money and time. Thus now you can choose to rent such applications developed by the professional service provider. It is very convenient and economical.

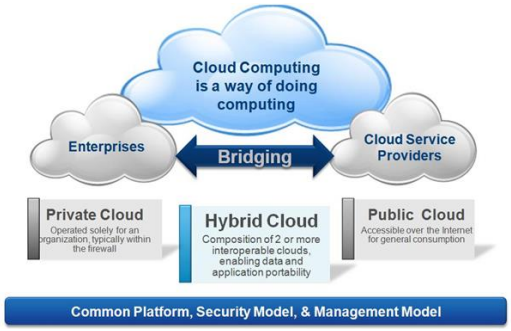
PaaS is between the IaaS and SaaS. PaaS is of platform as service. The provider has set up necessary platform environment for the customers. DaaS is the newly developed service , which is of data as service. It is also the application layer. For example, you have big data for some specific usage. Now you can just upload your data to the applications and get the analysis result. You do not care about the infrastructure, the framework and even the algorithm detail.



	Volume	Variety	Velocity
SaaS	Semantics	Visualization	Real-time
PaaS	Distributed processing	Schemaless	Integration on the fly
IaaS	Scalable storage	Federated store	On-demand resources

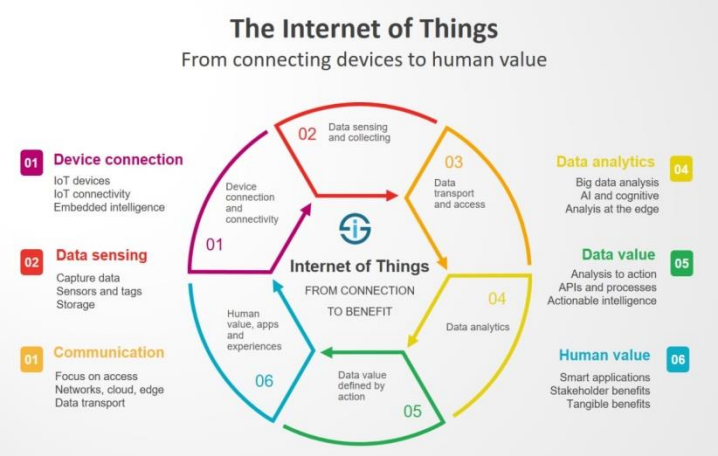


The cloud computing can also be classified as three types according to the providers' settings. The first is public cloud, which means accessible over the internet for general consumption. For this one, the provider needs a lot of money to build the network, buy the high-level computers and hire the skillful engineers, and then provide service to the public. Sometimes the costumers may not fell safe, since all the information and data are online to the internet. So if they have their own plans, they can set up a private cloud just for their own use, which has reliable safety. And there has also a type between the former two, which is called hybrid cloud. If the private cloud cannot meet the requirements, the costumer can use the public cloud for a limited time. After the calculation task finished, they will go back to private cloud.



The third one is internet of things, which is briefly called as IOT. It is part of AI industry. Take air conditioner as an example. Traditionally, we install air conditioner and open it with the remote controller, and adjust the parameters like pattern, temperature, etc. manually using the controller at hand. If the IOT technique is applied to air conditioner, which means adding some smart sensors to the device and developing terminal applications installed on your cell phone, the conditioner now is connected to the internet. You can control the air conditioner just clicking on the apps installed your cell phone. You can open it while you just leave your office to home, and when you arrive at home, there has a comfortable and cool room for you. That is a typical application of IOT. And there has more complicated IOT.

The IOT is a trend for the manufacture industry. Thanks to the internet and cloud computing, the IOT becomes feasible and applicable. And it becomes more and more popular.

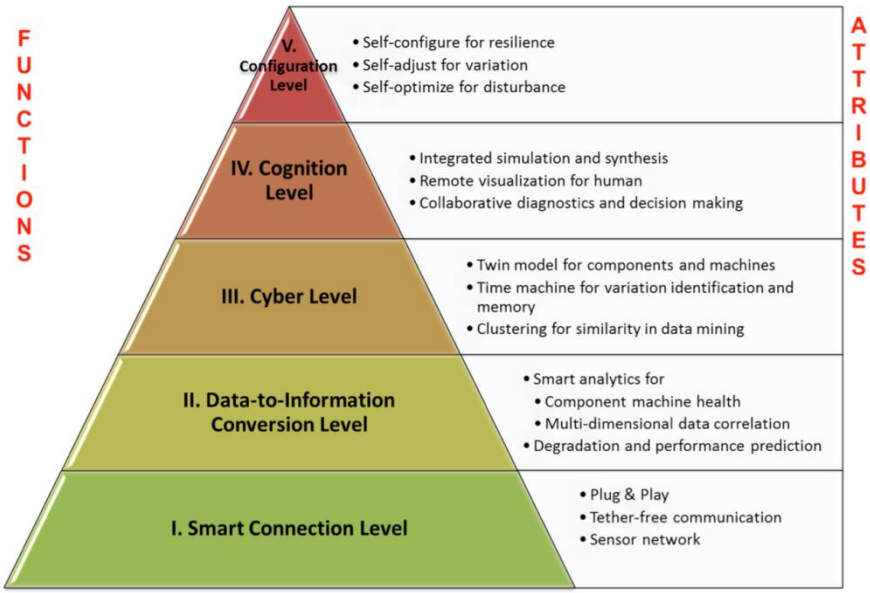


There are numerous real-world applications of the internet of things, ranging from consumer IoT and enterprise IoT to manufacturing and industrial IoT (IIoT). IoT applications span numerous verticals, including automotive, telco, energy and more.

Wearable devices with sensors and software can collect and analyze user data, sending messages to other technologies about the users with the aim of making users' lives easier and more comfortable. Wearable devices are also used for public safety -- for example, improving first responders' response times during emergencies by providing optimized routes to a location or by tracking construction workers' or firefighters' vital signs at life-threatening sites.

In healthcare, IoT offers many benefits, including the ability to monitor patients more closely to use the data that's generated and analyze it. Hospitals often use IoT systems to complete tasks such as inventory management, for both pharmaceuticals and medical instruments.

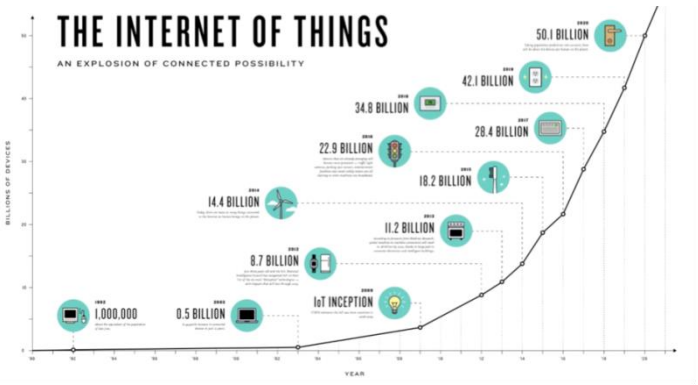
The IoT can realize the seamless integration of various manufacturing devices equipped with sensing, identification, processing, communication, actuation, and networking capabilities. Based on such a highly integrated smart cyberphysical space, it opens the door to create whole new business and market opportunities for manufacturing. Network control and management of manufacturing equipment, asset and situation management, or manufacturing process control bring the IoT within the realm of industrial applications and smart manufacturing as well. The IoT intelligent systems enable rapid manufacturing of new products, dynamic response to product demands, and real-time optimization of manufacturing production and supply chain networks, by networking machinery, sensors and control systems together.



The internet of things connects billions of devices to the internet and involves the use of billions of data points, all of which need to be secured. Due to its expanded attack surface, IoT security and IoT privacy are cited as major concerns.One of the most notorious recent IoT attacks was Mirai, a botnet that infiltrated domain name server provider Dyn and took down many websites for an extended period of time in one of the biggest distributed denial-of-service (DDoS) attacks ever seen. Attackers gained access to the network by exploiting poorly secured IoT devices.

Because IoT devices are closely connected, all a hacker has to do is exploiting one vulnerability to manipulate all the data, rendering it unusable. And manufacturers that don't update their devices regularly -- or at all -- leave them vulnerable to cybercriminals.Additionally, connected devices often ask users to input their personal information, including names, ages, addresses, phone numbers and even social media accounts -- information that's invaluable to hackers.However, hackers aren't the only threat to the internet of things; privacy is another major concern for IoT users. For instance, companies that make and distribute consumer IoT devices could use those devices to obtain and sell users' personal data. Beyond leaking personal data, IoT poses a risk to critical infrastructure, including electricity, transportation and financial services.

The IOT has great potentials, and the following figure shows the business value in the future:



9. Conclusions

Computer science is very complicated and it is integral of communication, mechanics, electronics, physics and mathematics. The technologies develop so fast, and we need to learn it every day. But the computer itself is just a tool, and its advantage or potential can only show up with its application in practical problems. So when we introduce the computer basics in the class, we need to confirm that students keep this in mind. Thus in their middle or high school study, mathematics, physics and logical study can be strengthened or more efforts can be paid on these courses.

For our college education, we focus both theoretical and practical teaching, and most of time the former is more important. So for this course, when we discuss the related knowledge in the class, we always want to give more theoretical details for students. Although the time is limited, we need to stick with such teaching rules and lead students to think about the background techniques. It is always useful when they get into study with their majors.

For this training course, I just write the above words for you to read. It is just basics and there has limit time to get into the details. It is sure that there have lots of shortcomings or incorrect descriptions about the computer basics. More details can be referred from the internet. There have lots of videos and literatures related to the topics. You can search them using google or baidu.com.

Thank you for your kindness and hospitality, and also for the organization.

10. Additional references

1. Course sketch schedule for the semester

The course is totally scheduled as 54 class-hours, including 22 hours of class room learning and 14 hours of computer practice, and 18 hours of self-study after class.

No.	Contents	Teaching mode	Assessments	Classroom hours	Compute room Practice hours	Selfstudy after class
I	Computer basics	Classroom, Compulsory	Required	6	2	2
II	Software basics	Classroom, Compulsory	Required	2	1	2
III	Network Fundamentals	Classroom, Compulsory	Required	3	1	2
IV	Internet Fundamentals	Classroom, Compulsory	Required	3	1	2
V	Information Security	Classroom, Compulsory	Required	4	1	2
VI	Computer programming basics	Classroom, Compulsory	Required	4	2	2
VII	Office suites practice	Computer Room, Compulsory	Required		6	2
VIII	The frontier of computer science	Selective	Required			4
Total hours counting				22	14	18

2. Course schedule assignment

No.	**Course schedule**	**Classroom**	**Computer Practice**
I	**Computer basics**	**6 hours**	**2 hours**
	Overview of computers	1	
	The binary principle and information coding	2	1
	Computer systems components and working patterns	2	

	Computer hardware introduction	1	1
II	**Software basics**	**2 hours**	**1 hours**
	Overview of software and hardware	1	
	Operating system and software applications	1	1
II	**Network Fundamentals**	**3hours**	**1hours**
	Overview of network and website	1	
	Network topology and OSI model	1	
	Network protocols and communications, LAN components and its construction	1	1
IV	**Internet Fundamentals**	**3 hours**	**1 hours**
	Introduction of WWW, TCP/IP, DNS and Routers	1	
	Website programming using HTML,CSS, JSP	1	1
	Internet configuration and management	1	
V	**Information Security**	**4 hours**	**1 hours**
	Definition of information security	1	
	The information security measure and management	2	
	Computer virus	1	1
VI	**Computer programming basics**	**4 hours**	**2 hours**
	Overview of computer languages and programming	1	
	Computer programming basics, algorithm and flowcharts	1	1
	Introduction of data types, expression, statement, functions	1	1
	Introduction of OOP	1	
VIII	**Office suites practice**		**6 hours**
	MS Word practice		2
	MS Excel practice		2
	MS Powerpoint practice		2

3. Examination

The scores for this course are composed of three parts: Part A, the practice operation level; Part B, the presentation of Powerpoint or the formatted paper related to the frontier of computer science; Part C, the final examination.

The total score is made up of the above-mentioned three parts, and the proportion is as follows: **The total score (100 %)= Part A (30%)+ Part B(20%)+ Part C (50%)**

For the Part A, the score is given by the evaluation of the practice assignments in the class.

For the Part B, the score is given by the assessment of the assignments after class.Students should read materials about the frontier of computer science in the library or use search engine from website and write down personal understanding, then hand in the printed paper formatted in standard journal requirements, or give the presentation report using Powerpoint before the class.

For the final part C, there has an organized two-hour test after finishing all the compulsory lessons at the end of the semester. The test paper includes three types: single choice(20 scores, 1 score per question), short-answer questions(20 scores, 4 score per question), and discussion (10 scores, one question).

So that the final score is given by the summation of the above-mentioned three part testing results. And here is the assessment guideline:

Level class	Level A	Level B	Level C	Level D
Total Scores	>=85	>=70	>=60	<60, unpassed