Internet Model

The network model that dominates current hardware and software is a simpler five-layer **Internet model.** Unlike the OSI model that was developed by formal committees, the Internet model evolved from the work of thousands of people who developed pieces of the Internet. The OSI model is a formal standard that is documented in one standard, but the Internet model has never been formally defined; it has to be interpreted from a number of standards.

(**Draw figure showing 5 layers of Internet model on your own**)

Layer 1 The Physical Layer: The **physical layer** in the Internet model, as in the OSI model, is the physical connection between the sender and receiver. Its role is to transfer a series of electrical, radio, or light signals through the circuit. The physical layer includes all the *hardware* devices (e.g., computers, modems, and switches) and physical *media* (e.g., cables and satellites). The physical layer specifies the type of connection and the electrical signals, radio waves, or light pulses that pass through it. Chapter 3 discusses the physical layer in detail.

Layer 2 The Data Link Layer: The **data link layer** is responsible for moving a message from one computer to the next computer in the network path from the sender to the receiver. The data link layer in the Internet model performs the same three functions as the data link layer in the OSI model. First, it controls the physical layer by deciding when to transmit messages over the media. Second, it formats the messages by indicating where they start and end. Third, it detects and may correct any errors that have occurred during transmission. Chapter 4 discusses the data link layer in detail.

Layer 3 The Network Layer: The **network layer** in the Internet model performs the same functions as the network layer in the OSI model. First, it performs routing, in that it selects the next computer to which the message should be sent. Second, it can find the address of that computer if it doesn't already know it. Chapter 5 discusses the network layer in detail.

Layer 4 The Transport Layer: The **transport layer** in the Internet model is very similar to the transport layer in the OSI model. It performs two functions. First, it is responsible for linking the application layer software to the network and establishing end-to-end connections between the sender and receiver when such connections are needed. Second, it is responsible for breaking long messages into several smaller messages to make them easier to transmit and then recombining the smaller messages back into the original larger message at the receiving end. The transport layer can also detect lost messages and request that they be resent. Chapter 5 discusses the transport layer in detail.

Layer 5 Application Layer: The **application layer** is the application software used by the network user and includes much of what the OSI model contains in the application, presentation, and session layers. It is the user's access to the network. By using the application software, the user defines what messages are sent over the network. Because it is the layer that most people understand best and because starting at the top sometimes helps people understand better, the next chapter, Chapter 2, begins with the application layer. It discusses the architecture of network applications and several types of network application software and the types of messages they generate.

Future Trends

1. **Wireless LAN & BYOD**
2. **IoT (Internet of Things)**
3. **Massively Online**

The Internet of Things

The Internet of Things (IoT) refers to a network of physical devices, vehicles, appliances and other physical objects that are embedded with sensors, software and network connectivity that allows them to collect and share data. These devices — also known as "smart objects" — can range from simple "smart home" devices like smart thermostats, to wearable like smart watches, to complex industrial machinery and transportation systems.

Some examples of Iot systems are:

1. **Connected cars:** There are many vehicles such as cars can be connected to the internet. It can be through smart dashcams, infotainment systems, or even the vehicle's connected gateway. They collect data from the accelerator, brakes, speedometer, odometer, wheels and fuel tanks to monitor both driver performance and vehicle health. Some uses of connected cars are as follows:
    a) Predicting and preventing vehicle maintenance needs.
    b) Helping parents to track the driving behavior of their children.
    c) Notifying friends and family automatically in case of car crash.
2. **Connected homes:** smart home devices are mainly focused on improving the efficiency and safety of the house, as well as improving the network. Home security system like door locks, security cameras, water leak detectors can detect and prevent threats and send alerts to homeowners. Some uses are:
    a) Automatically turning off devices not being used.
    b) Finding misplaced items like keys, wallets etc.
    c) Automating daily task like vacuuming, making coffee etc.
3. **Smart cities:** Iot applications have made urban planning and infrastructure maintenance more efficient. Governments are using Iot to tackle problems in infrastructure, health, and the environment. Some uses are:
    a) Measuring air quality and radiation level.
    b) Reducing energy bills with smart lighting systems.
    c) Detecting maintenance needs for critical infrastructure such as streets, bridges and pipelines.
    d) Increasing profits through efficient parking management.
4. **Smart buildings:** buildings such as college, campuses and commercial buildings use IoT applications to drive greater operational efficiencies. IoT in smart buildings can be used for:
    a) Utilizing work space more efficiently.
    b) Lowering maintenance costs.
    c) Reducing energy consumption.

Some **technologies** used in IoT systems are:

a) **Edge computing:** Edge computing refers to **distributed computing framework** (the technology) used to make smart devices do more than just send and receive data to their IoT platform. It increases the computing power at the edges of an IoT network, reducing communication latency and improves response time.

b) **Cloud Computing:** Cloud Technology is used for remote data storage and Iot device management making the data accessible to multiple devices in the network.

c) **Machine Learning:** machine learning refers to the s/w and algorithms used to process data and make real- time decision based on that data. These machine learning algorithms can be deployed in the cloud or at the edge.

Massively Online

In recent years the use of mobile devices for massive online services are increasing rapidly. We have heard massively **multiplayer online games** such as World of Warcraft, Everquest, Mankind, War of Legends etc. where thousands of players can play in real time. Similarly **education** is also massively online. Lynda.com, Code Academy, Khan Academy have websites that offer thousands of education modules for children and adults in different field.

Also **Massive Open Online Courses MOOC** are available which enable students who do not have access to elite universities to get access to knowledge without having to pay the tuition. These classes are offered by universities such as Stanford, MIT, UCLA (University of California, Los Angeles) and for no credit (can pay and get credit).

Politics too have moved massively online. Activists reach to masses of people in a very short period of time. They use YouTube, Facebook Twitter etc.

Watching these three trends we can say that there will be an increasing demand for professionals who understand development of data communications and networking infrastructure to support this growth. There will be more and more need to build faster and more secure networks that will allow individuals and organizations to connect to resources, probably stored on cloud infrastructure. This process includes not only engineers but also highly social individuals who embrace technology in creative ways to allow business to achieve a competitive edge through utilizing this technology.