Hello and welcome to the Part 3 of our lecture. In this part we'll talk about Architecture of Internet.
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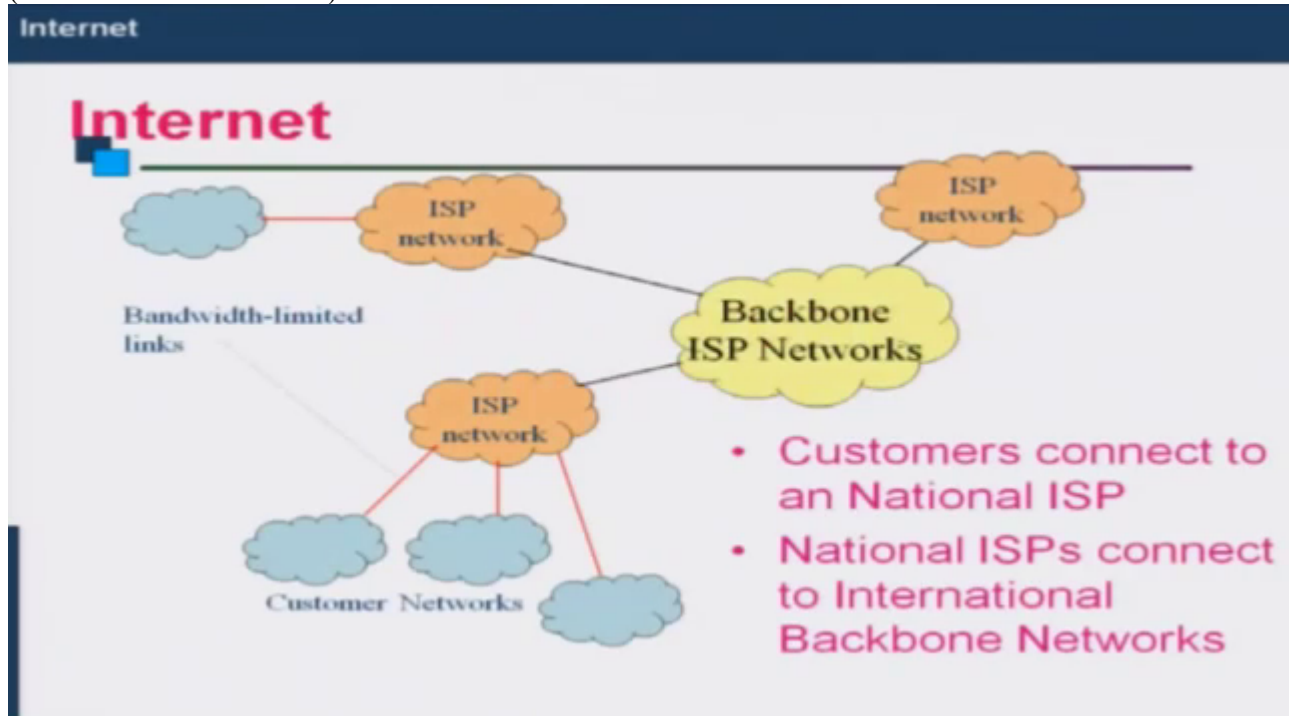
What is Internet? It is said that Internet is network of networks. It connects millions and millions of computers across the globe. The way Internet is architecture is the following. Every customer has customer network. So every organization has got its own network and we have talked about different architectures which are used in setting up different types of networks. So every customer network would be there and these customer networks connect to what are called as the ISPs or Internet Service Providers. There are two types of Internet Service Providers; National ISPs and International ISPs. National ISPs are the Internet Service Providers which have got national presence. So they have network which spans across a nation. For example in India we have Reliance, Airtel as National ISPs and there are many more. In North America for example we have Cable & Wireless, AT&T which are National ISPs.

So every country would have National ISPs which would have national networks and they provide Internet connectivity. So the customer networks connect to the National ISPs. These National ISPs further connect to International ISPs. International ISPs are service providers which have networks which span multiple continents. Examples are Teleglobe, British Telecom, Singapore Telecom; these are international ISPs and have got presence in different parts of the globe. So the customer networks connect to the National ISPs. The national ISPs interconnect to each other within a nation and they also interconnect to International ISPs. The international ISPs interconnect to multiple international ISPs at different parts of the world. And by this interconnection of customer networks, National ISPs and multiple international ISPs a very large global network is formed which is called as a Internet. So

Internet is nothing but a very very large network of networks, a very large network which is created globally by interconnecting multiple small networks across the globe.
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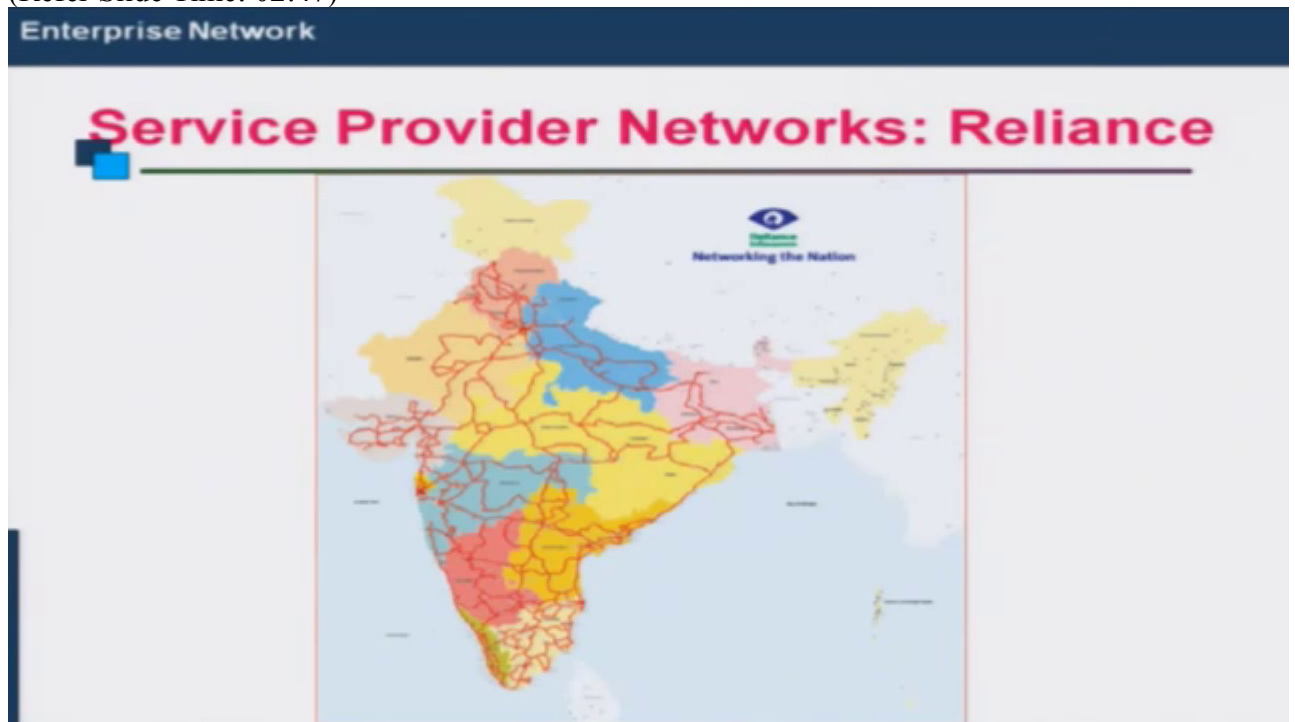
If you see what is the architecture of National ISPs? Or how do the National ISPs look like? This figure that you see here is the network diagram of one of a very prominent National ISPs in India, Reliance Telecom. The red lines that you see here are the fiber optic cables that they have laid across the country. In different cities they would have POPs or Point of Presence POPs or the Point of Presence are the points at which they interconnect to the customer networks. So smaller cities would have one POP and bigger cities may have multiple POPs. So they have a fiber optic network laid across the country and they have got POPs in different cities and add these POP locations customer networks connect to this National ISPs. This is how they provide connectivity to multiple customer networks across the whole country.
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Similarly what you see in this diagram is the network diagram of a very prominent International ISP, Teleglobe. The green lines that you see in this diagram are the fiber optic cables that have been laid across continents and most of it is submarine cable, it is laid under the sea. So they have a very large network which spans multiple countries, multiple continents, for example in this network it spans Southeast Asia, Europe, Middle East and North America. And again International ISPs have got Points of Presence in different countries at which they connect to the National ISPs of those countries. So what you have is that you have National ISPs and International ISPs. The national ISPs have got fiber optic network across a country and they interconnect at multiple points to other National ISPs, the point of interconnection of National ISPs is also called as Internet Exchange and this National ISPs interconnect to International ISPs which spanned multiple countries. These International ISPs are again interconnected to each other using internet exchanges and this is how a very very large global network is formed which is formed by interconnecting National ISPs in different countries and International ISPs which span multiple continents.

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How Web Works?

- Let's say you want to visit the google website.
- First you enter the address or URL of the website in your web browser.
- Then your browser requests the DNS Server to get the IP address of the web server
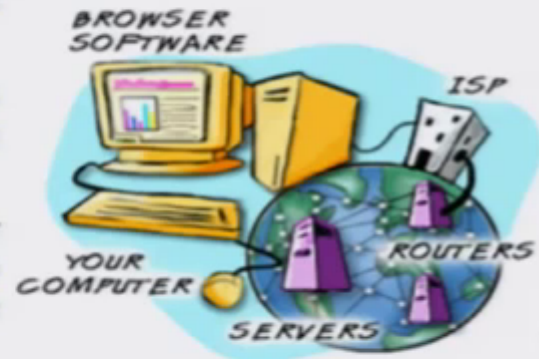
Now, what is the application of this Internet? Internet is nothing but a network, the price or the cost I pay for Internet connectivity is not for the content, it is for the setting up and maintaining this large global network. In most of the cases the content or the information is free. The cost for the Internet connection that I pay is for the infrastructure of setting up this large global network is what I pay for. The information that is coming on the internet which typically most of the time comes through World Wide Web, the most popular application of Internet is World Wide Web which provides me information which is searchable. I can search for that information on the Internet and I can access that information on my computer.

Now let us see very briefly how the World Wide Web works. In World Wide Web we have a server which is called as the Web Server. So Web Server is a server which hosts the information and on the client computers we have what is called as a Browser. The Browser like Mozilla or Chrome are client applications which access information from the Web Server and application protocol that is used to access this information is also called as the HTTP protocol or Hyper Text Transfer Protocol. So, on the client side I have application which are called as Browser. On the server side I have application which are called as the Web Server Application, a very popular web server application is Apache Web Server and there are many others also. So on the server side I have a Web Server running. On the client side I have a client browser running and this client browser sends a request to the Web Server to get the information.
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How Web Works?

- Then your machine sends an HTTP request to the web server that hosts the google site.
- The server sends the data over the Internet to your computer.
- Your web browser interprets the data, displaying it on your computer screen.
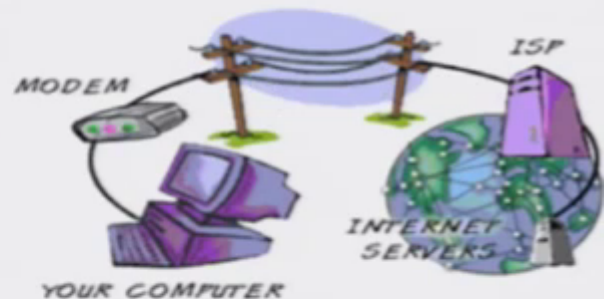
The way it works is like this. On the client side I write the address of the website which I want to access. The name of the website, examples could be www.google.com. So www.google.com is a name of the Google web site or Google web server. So if I write www.google.com on a browser it means that I'm telling my browser that I want to access the content of Google web server. Now on Internet all servers have got a name and they have got an address which is called as an IP address. IP address is a numeric address which is used to uniquely identify the machine on the internet. For accessing information, for the human interface we use a name like www.google.com. But machines when they communicate to each other use IP address to identify machines on the internet.

So that when I write www.google.com on the Browser my Browser first requests a DNS server DNS server, DNS is domain name server to get the mapping between the name and the IP address. So www. Google.com is also called as a domain name and a DNS server maintains a mapping between the domain name and the IP address of that server. So my browser will request the DNS server please give me the IP address of www.google.com. Once my browser gets the IP address it sends an HTTP request to the Google web server whose IP address is known and request for the contact. Once this HTTP request is sent to the server an HTTP connection is established between the client browser and the server and the content requested is sent back by the server to the client browser and it is displayed on my screen. It happens so fast that it only takes a few seconds for me to get the content even if the server is across the globe.

Now one would wonder that there are millions and millions of users who are accessing Google server, is there only one server which maintains all the information and is serving these millions of users. Logically speaking we can guess that it should be multiple servers because most likely one server cannot support millions of simultaneous users. So what Google does is that they would have multiple servers which have got the same content and

what is done is that when my browser requests for the IP address different clients are given different IP addresses. So all the clients write the same name www.google.com but when the DNS reply is given, different clients are given IP address of different servers which have the same content. So you might maintain multiple mirror servers which have the same content and you divert clients on to this multiple servers so then you can load balanced that request on multiple servers.

Furthermore, what they do is that instead of keeping all the servers at one physical location they distribute the servers across the globe. So Google would have servers in North America, South America, Europe, India, Singapore, everywhere and depending on the location, the geographical location of the client the IP address of the physically nearest server is provided. So if I write www.google.com on a client machine in India I will be connected to the Google servers in India. If I do the same thing in Singapore I will be connected to servers in Singapore and if I do it in North America or US I would be connected to servers in US. And just in case if I am in India and India servers are down or not reachable then I will be redirected to servers which are nearest to India which could be say Singapore. So this is how the World Wide Web works.

Fundamentally the content is stored on servers which are called as Web Servers. It is accessed by client using browsers, using the HTTP protocol and in case the site has got large number of visitors then the content is mirrored across multiple servers which generally would be distributed geographically and the clients are directed to servers which are physically located nearest to the client location. With this I end the Part 3 of this lecture series and I also end this lecture series. Thank you very much.