Location Management - II

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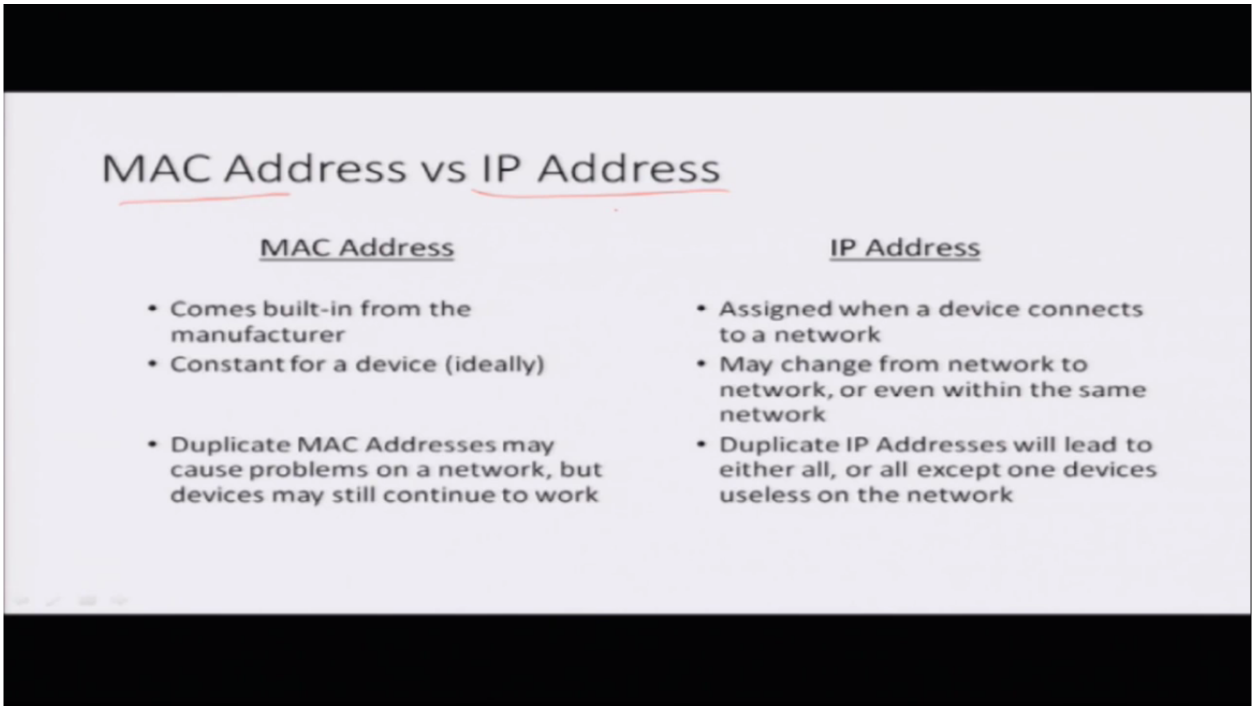
Welcome back. This is the second part of our lecture on location management. In this lecture we will try to figure out how in some cases the identity of a particular entity can be mapped to its location.



MAC Address vs IP Address

MAC Address

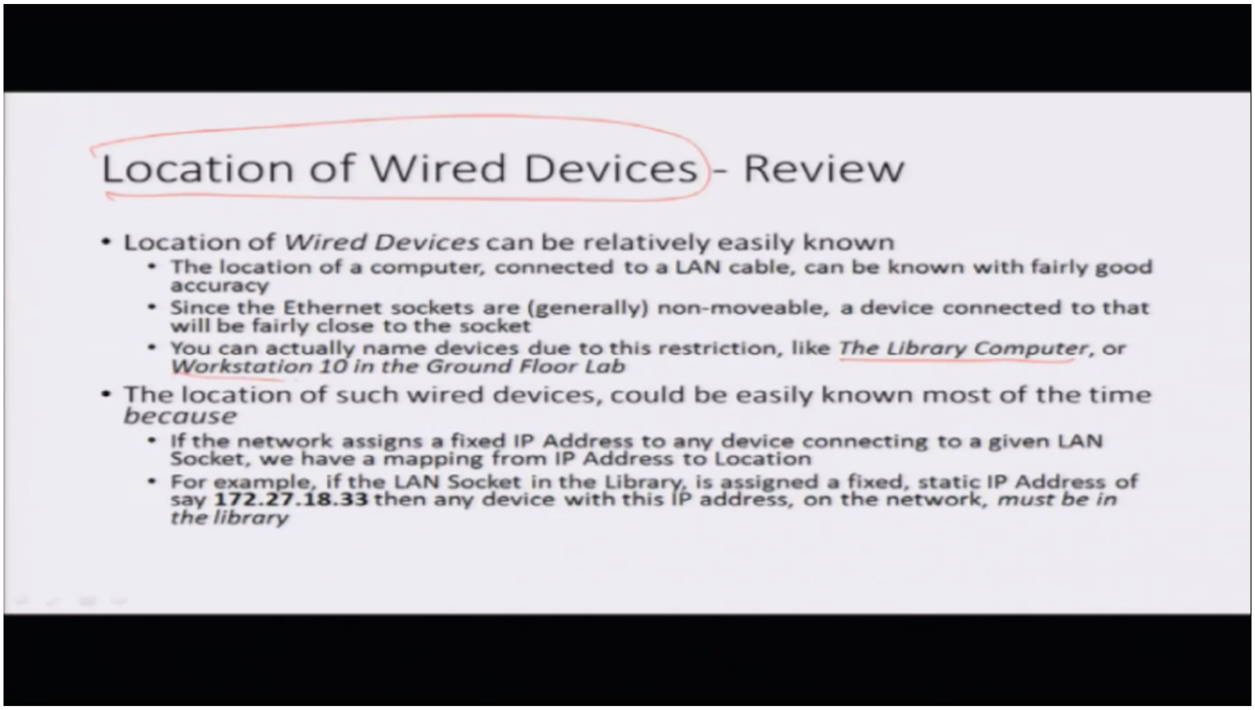
- Comes built-in from the manufacturer
- Constant for a device (ideally)
- Duplicate MAC Addresses may cause problems on a network, but devices may still continue to work

IP Address

- Assigned when a device connects to a network
- May change from network to network, or even within the same network
- Duplicate IP Addresses will lead to either all, or all except one devices useless on the network

So last time we had a look at MAC addresses and IP addresses. We will just quickly have a look at what they were. So MAC addresses are something that comes in built from the manufacturer and IP addresses are something that are assigned by a system when a device connects to the network. The MAC address is actually a constant for a device. It ideally should never change. However, we talked about that it can be spoofed at the software level. The IP addresses may actually change from network to network. So if a device connects to a different network it may be given a different IP address and even on the same network if it's reconnect it is possible that the IP address may change.

The duplicate MAC addresses may cause some problems on the network. They can probably cause some havoc at the lower levels of routers and switches and all that stuff but in general the network will still probably continue to work. In case of duplicate IP addresses though the system will take an action and then it will kick out either all the ring entities or it will simply keep one entity and kick out the others. So basically at the end only one entity with one IP address will be able to sustain itself on network and others will be kicked out. So that is why IP addresses are almost always unique. In fact always unique on the network.

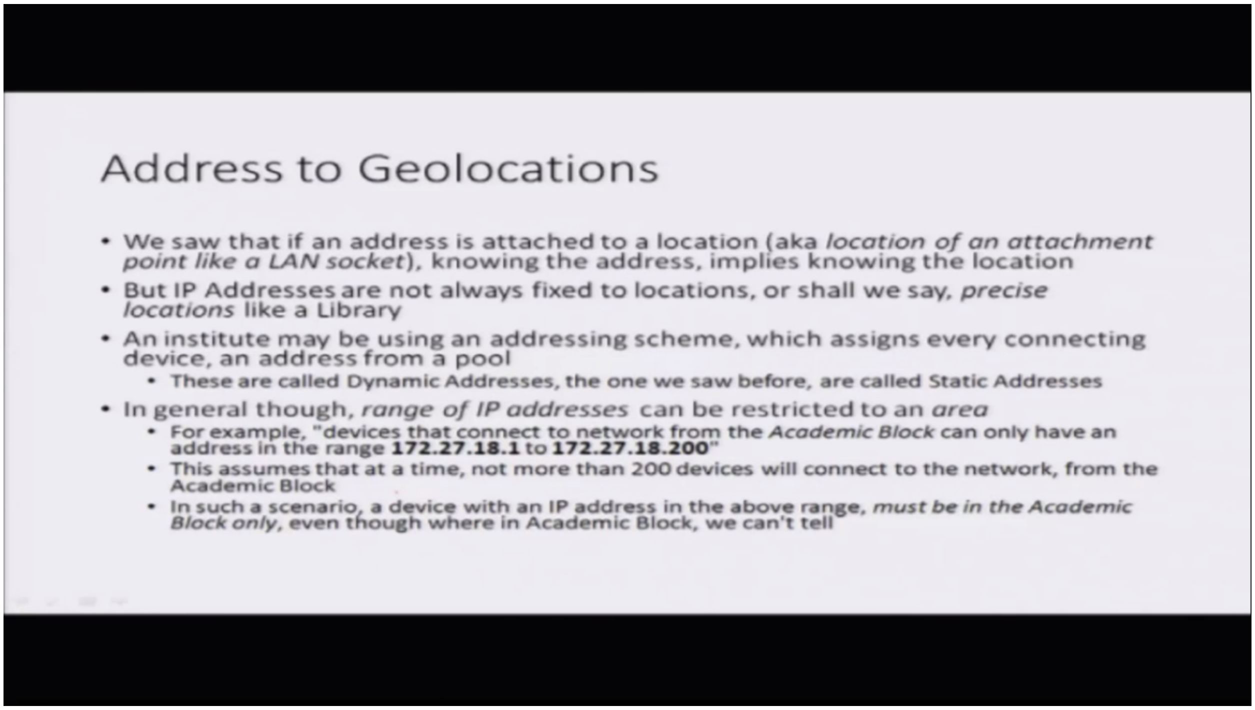


Location of Wired Devices - Review

- Location of *Wired Devices* can be relatively easily known
  - The location of a computer, connected to a LAN cable, can be known with fairly good accuracy
  - Since the Ethernet sockets are (generally) non-moveable, a device connected to that will be fairly close to the socket
  - You can actually name devices due to this restriction, like *The Library Computer*, or *Workstation 10 in the Ground Floor Lab*
- The location of such wired devices, could be easily known most of the time *because*
  - If the network assigns a fixed IP Address to any device connecting to a given LAN Socket, we have a mapping from IP Address to Location
  - For example, if the LAN Socket in the Library, is assigned a fixed, static IP Address of say **172.27.18.33** then any device with this IP address, on the network, *must be in the library*

Now we are going to talk about identity that can be mapped to location. So we have already talked about what identities are in the previous lectures and we talked about what addresses are. Now we are going to have a look at house in some cases these addresses can actually be translated to locations. So we will just have a review of something that we called location of wired devices. We talked about something called a library computer or say workstation 10 in the ground floor. We said that if a computer is connected to a LAN cable and that LAN socket is say in library or something we can actually fix the location of the computer because of the fact that it is a wired device. We still didn't say anything about exactly how can a particular land socket be mapped to an address or how can just by having look at a particular device's IP address or some other address how can we say this is the device which is the library computer or the workstation.

So now we are going to have a look at this. So whenever a device connects to a network if the network somehow enforces a rule that it will always be given a particular address then we can have some kind of a mapping between device and address. We are still not talking about location but yeah we can somehow fix a mapping between device and IP address. So let's take an example of the library computer that we were talking about. Let us just say any computer which connects to the network from the library is given the IP address say one seven 172.27.18.33. So once we are able to somehow enforce this rule we are pretty much sure that any device with this particular IP address on my network is in library because I've imposed a rule; any any device connecting to library will get this particular IP address. So on my network all I need to check is if any device is having this address I'm pretty much sure that it is the library computer only because I've somehow enforced a ruling. We haven't yet talked about how that enforcement can be done. Let's just assume that there is some way I can enforce a particular IP address on a particular land socket but basically there are techniques available to do that. So if I can somehow ensure that the library socket any device connecting to that will get the same IP address in future whenever I see that IP address on my network I'm pretty much sure that it is the device connecting from library.



Address to Geolocations

- We saw that if an address is attached to a location (aka *location of an attachment point like a LAN socket*), knowing the address, implies knowing the location
- But IP Addresses are not always fixed to locations, or shall we say, *precise locations* like a Library
- An institute may be using an addressing scheme, which assigns every connecting device, an address from a pool
  - These are called Dynamic Addresses, the one we saw before, are called Static Addresses
- In general though, *range of IP addresses* can be restricted to an *area*
  - For example, "devices that connect to network from the *Academic Block* can only have an address in the range **172.27.18.1** to **172.27.18.200**"
  - This assumes that at a time, not more than 200 devices will connect to the network, from the Academic Block
  - In such a scenario, a device with an IP address in the above range, *must be in the Academic Block only*, even though where in Academic Block, we can't tell

The next thing is mapping these addresses to geo locations. So we had to talk about how I can probably fix a particular IP address to a socket. So if that particular socket is being used by any device I can clearly say that that particular device is actually connecting from that particular location. Now this mapping need not just be at a very micro level. Right now we just talked about locations within a say an institute or something. These can actually be done at a much much much higher level as well. So we can do these things on city level, on state level. They can actually be done on any level we want.

So we just saw how a particular IP address could be mapped to a location if we somehow and force this tool in the network but that solution is not very neat because we need to define these mappings at a very micro level. We've got to figure out addresses for all the land sockets in my institute probably and then I could be sure that any device connecting to that land socket will get this particularly IP address and with the help of this IP address I will be able to identify the device but this mapping is not very neat.

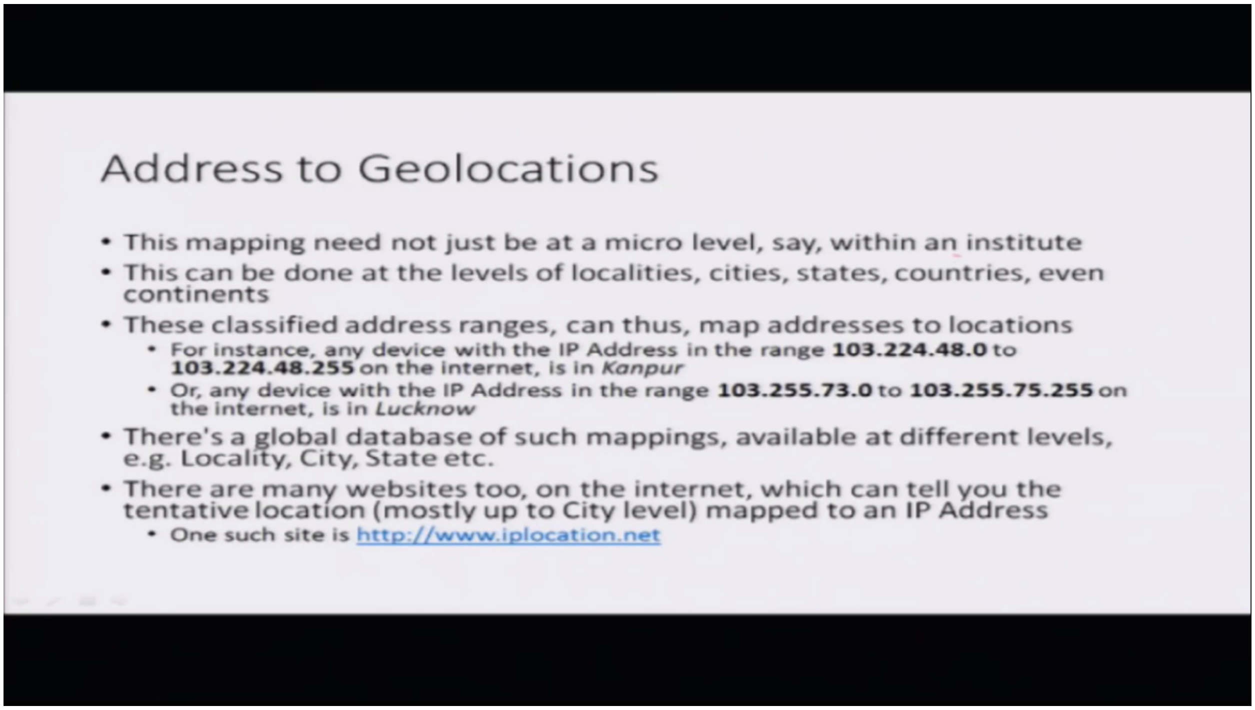
But what we can probably do is we can have it have some kind of both ways; we can try to do little bit of mapping and then leave the things dynamically as well. So we will come back to this but before that what we are going to do is we'll have a look at – so we saw that if an address is attached to a location somehow then we can actually know the location of a particular device with that address because we have mapped it. So for example in the previous case we saw that if a particular IP address is mapped to this LAN socket in library whenever we see a device with that particular IP address we will be pretty much sure it's in library. But IP addresses are not always fixed to locations. Maybe we can clearly say they're not fixed to precise locations like a library socket. So in an institute they may actually use an addressing scheme which assigns every connecting device an address from a particular pool.

So now we are just going to concentrate on a pool of addresses. We are not going to fix particular addresses to particular sockets. We are just going to give the devices an address from a given pool. So we are not going to do some kind of hard fixing of addresses. Now this addressing scheme is called dynamic addressing scheme and what we just saw before for the library computer was static addressing scheme.

Now in general a range of IP addresses can still be mapped to a particular area. Again we are not going to talk about how exactly these rules can be enforced. Just assume that there are hardware and software solutions which can assign certain range of IP addresses to devices connecting from a certain say building or something. So there are solutions available for doing that. We are not going to go in technical details of it but – so what we are going to say is for example devices that connect to a network from the academic block will get an IP address in this particular range 172.27.18.1 to 172.27.18.200.

Now assume that we get a particular device with the IP address say 172.27.18.15. Now we have pretty much sure that this device is from the academic block because its IP addresses in this particular range. We really don't know we're in academic block the device is but yeah because we enforced the rule that all devices in this particular building called academic block will get address from this range we can still say that any device having an address within this range is going to be from academic block; where we don't know but from academic block.

So in such a scenario a device with a particular IP address can still be located. I would say not precisely located but it can still be located. So within a particular block, a particular building so what we've actually done is this done this mapping at a much more higher level instead of doing it for a particular socket. We are not doing it for buildings or blocks.

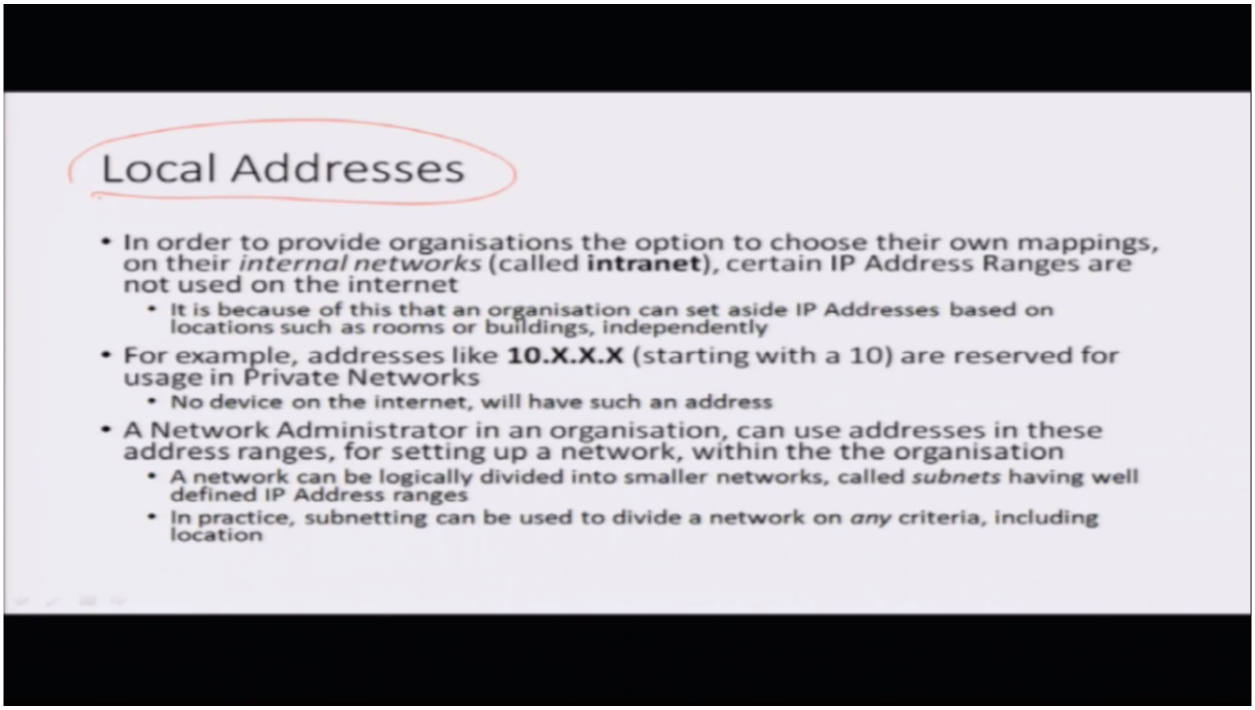


Address to Geolocations

- This mapping need not just be at a micro level, say, within an institute
- This can be done at the levels of localities, cities, states, countries, even continents
- These classified address ranges, can thus, map addresses to locations
  - For instance, any device with the IP Address in the range **103.224.48.0** to **103.224.48.255** on the internet, is in *Kanpur*
  - Or, any device with the IP Address in the range **103.255.73.0** to **103.255.75.255** on the internet, is in *Lucknow*
- There's a global database of such mappings, available at different levels, e.g. Locality, City, State etc.
- There are many websites too, on the internet, which can tell you the tentative location (mostly up to City level) mapped to an IP Address
  - One such site is http://www.iplocation.net

Now this may not just be restricted to a level of an institute. It can actually this kind of mappings can be done for locality, cities, states, countries. It can actually be done even at the continent level. So I will give you an example if you see any IP address on internet in this particular range you know 103.24.48.0 to 103.24.48.25 then it has to be a device connecting from Kanpur so because this IP range has been assigned to Kanpur. Similarly the range 103.255.73.0 to 103.255.73.255 is allocated to Lucknow. So any device on internet with an IP address in this range is connecting from Lucknow surely. So basically there is a global database of such mappings and these are available at different levels. They are available at locality, city, state levels, country level. So if you have that particular database with you with the help of that database if you're given a particular IP address on Internet you can actually tell the location of that particular device, that particular entity.

So there are many websites which can actually tell you the location of a particular IP address. I have given one here www.iplocation.net there are actually many others like these. So one of the home works in this particular lecture is to figure out your IP address and see where your location is.



Local Addresses

- In order to provide organisations the option to choose their own mappings, on their *internal networks* (called **intranet**), certain IP Address Ranges are not used on the internet
  - It is because of this that an organisation can set aside IP Addresses based on locations such as rooms or buildings, independently
- For example, addresses like **10.X.X.X** (starting with a 10) are reserved for usage in Private Networks
  - No device on the internet, will have such an address
- A Network Administrator in an organisation, can use addresses in these address ranges, for setting up a network, within the the organisation
  - A network can be logically divided into smaller networks, called *subnets* having well defined IP Address ranges
  - In practice, subnetting can be used to divide a network on *any* criteria, including location

The last part of this lecture is about local address. So we just saw in the case of the library computer that the library computer was assigned an address like 172.27.18.33. Now the problem is that even though all the things that we studied right now they are equally applicable say on a local network within an institute or say on the Internet but the addresses which can actually be assigned to a device on Intranet, Intranets are actually the internal networks. We call them Intranet. Just like Internet is the network we connect to Intranets are the networks which are internal to a particular organization. So there are certain IP address ranges that are fixed for the use within an organization and they are not used on Internet. So these are called local addresses.

So one example of such is any particular IP address that starts with 10. So 10 dot anything dot anything dot anything they are addresses which are only used within an Intranet. You will never find a device on Internet which will have this kind of an address which starts with 10. So this is actually an example of local address.

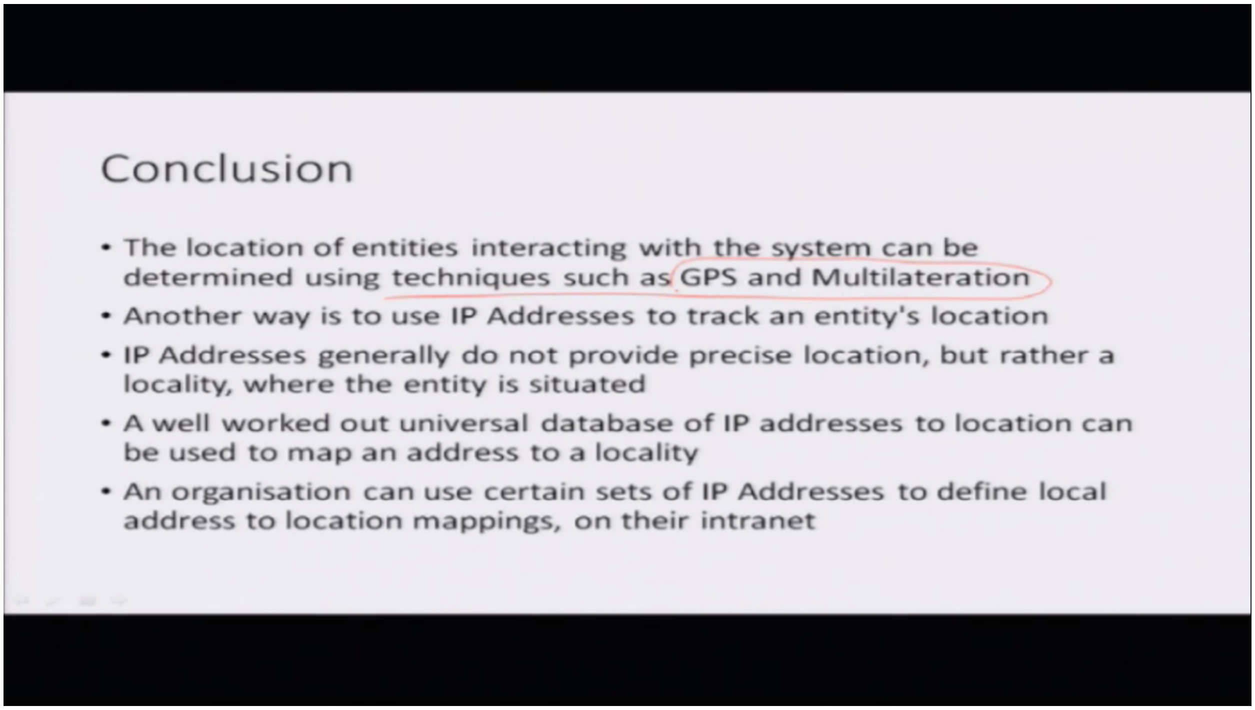
So there are some ranges located in the IP address domain which are only applicable to Intranets. Now a network administrator can actually make use of these ranges and it can actually apply some kind of local mappings. We talked about mappings in which a particular set of IP addresses are reserved for say academic block. These are actually achieved using something called subnets. Subnets are basically sub-networks. So a network administrator can actually use these IP addresses and then he can divide it in partitions or something and one particular partition can go to say academic block, one particular partition can go to say hostels, another one can go to say lecture halls and all that stuff. So basically subnets are something which are used very commonly by a network administrator to actually partition the IP address ranges.

Now these are actually used on Internet as well but for now we are just going to concentrate on their mappings that we saw in the case of an institute but this can pretty much be done on Internet as well. You can actually assign some basically this is how all the stuff works. The mappings we saw on the basis of continents and cities and states they are all done using subnets. So a particular sub network is going to be assigned to a particular geo location.

Quick Recap

What we learnt?

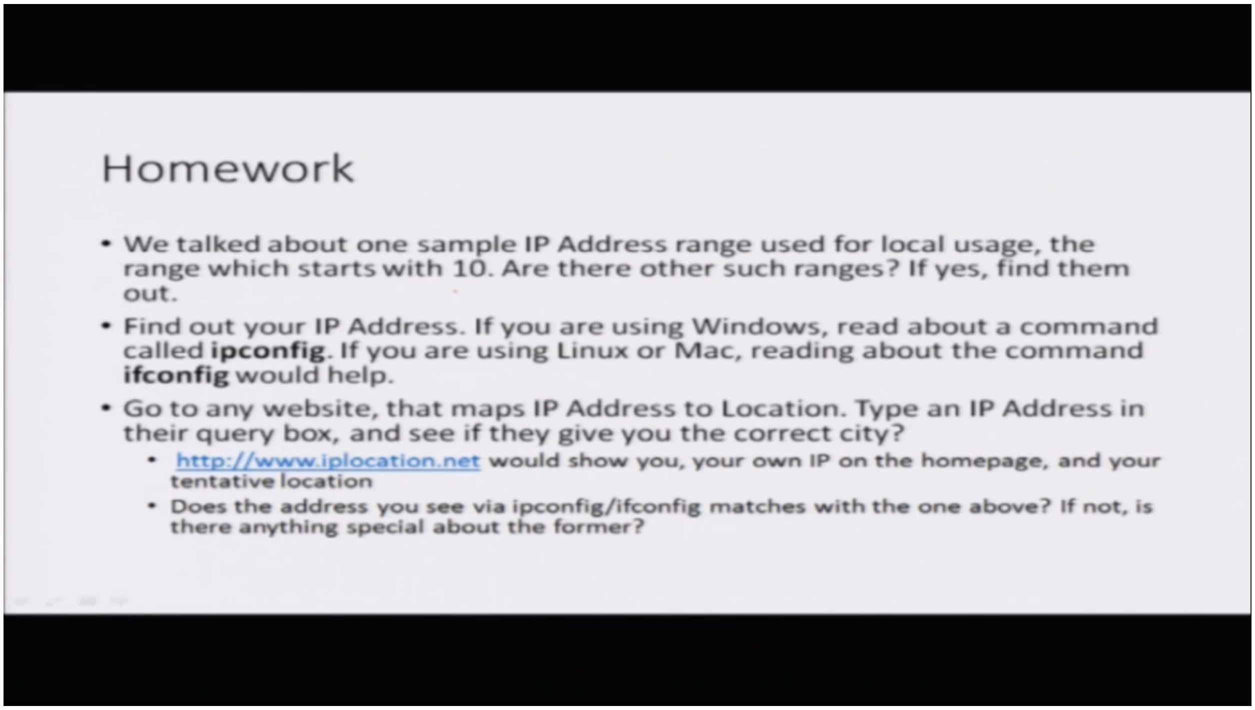
We will just have a quick recap of what we did in this particular lecture.



Conclusion

- The location of entities interacting with the system can be determined using techniques such as GPS and Multilateration
- Another way is to use IP Addresses to track an entity's location
- IP Addresses generally do not provide precise location, but rather a locality, where the entity is situated
- A well worked out universal database of IP addresses to location can be used to map an address to a locality
- An organisation can use certain sets of IP Addresses to define local address to location mappings, on their intranet

The location of entity is interacting with the system can be determined using techniques such as GPS and multilateration. So GPS was technique which makes use of satellites and multilateration is something that is done by the mobile service provider. Another way by which entities can actually be identified first on the system is their IP address. This is the identity of a particular entity and then these IP addresses can then be mapped to a particular location using a universal database. So this database is something which stores some kind of mappings so with the help of this database you can actually pinpoint and tell me where a particular device is. Athe last thing we saw was is that an organization can use certain set of IP addresses to define local addresses and these were the local address ranges.



Homework

- We talked about one sample IP Address range used for local usage, the range which starts with 10. Are there other such ranges? If yes, find them out.
- Find out your IP Address. If you are using Windows, read about a command called **ipconfig**. If you are using Linux or Mac, reading about the command **ifconfig** would help.
- Go to any website, that maps IP Address to Location. Type an IP Address in their query box, and see if they give you the correct city?
  - http://www.iplocation.net would show you, your own IP on the homepage, and your tentative location
  - Does the address you see via ipconfig/ifconfig matches with the one above? If not, is there anything special about the former?

So homework. So we talked about local addresses and we saw that any IP address that starts with 10 is actually a local address. Well there are some more address ranges. So what you can do is probably just find them out. So basically there are three local address ranges. One I already told you there are two others. Just find them out. The other thing is try to find out your own IP address. So there are some commands in operating systems which can actually do that for you. For example in Windows it is a command called ipconfig. If you are using Linux or Mac you can use ifconfig. Just use these commands and find out what your IP address is. Then you can go to any particular website which can map the IP address to location. One example is iplocation.net. So go there and try to figure out what your particular IP address is and what location it is getting mapped to.

Iplocation.net by the way can do that for you. It will on its home page it will show you your IP address as well as your location. Now what you do have to do is match whether the IP address that you are seeing on this particular website matches the one that you saw in ipconfig, whether they are same or not if they are not same for some people it won't be same by the way, you need to figure out the address that you saw with ipconfig is there anything special about that address. There would be something special by the way. So just figure out what it is and you will be able to figure out something more about location management with the help of this. That address may not be something that is used on Internet. So just try to figure out what that is.

So this is the end of the lecture on location management. Thank you.