Social Networks
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Rich Get Richer Phenomenon – 2
Lecture - 135
Comparison between SIR and SIS Spreading Models

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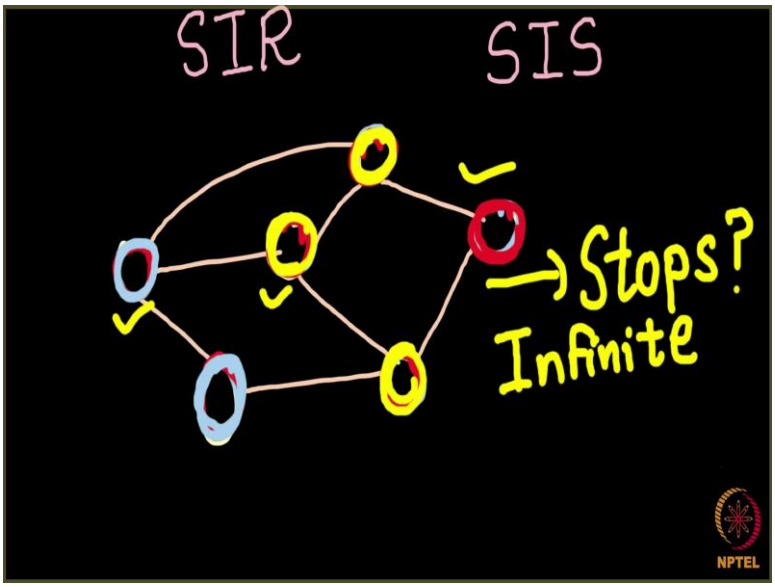

Till now we have talked about two epidemic spreading models, two disease spreading models. One was the SIR model and another was the SIS model. What was happening in both of these models was there were certain nodes in so, we were given a network and there were certain nodes in this network. And these nodes were connecting with the help of some edges, something like this.

And what was happening is, these nodes were changing their colors with time, changing their faces with time. So, initially all of these nodes were susceptible and then, some of the nodes in this network have become infected. And these infected nodes are started infecting the other people and while this was happening some nodes in the network were getting recovered as well and some nodes were turning out from infected, were going from infected state back to the susceptible state so something like this was happening.

These nodes are changing their colors with time and these nodes are changing their colors with time, shifting from one face to another. Now my question to you is this

process where these nodes are changing their colors, somebody is getting infected, and then somebody is getting susceptible, somebody is getting recovered, do you think that this process stops after some time or do this process keeps running for an infinite period of time? What do you think is the answer? You might want to pause the video two minutes and think about it.

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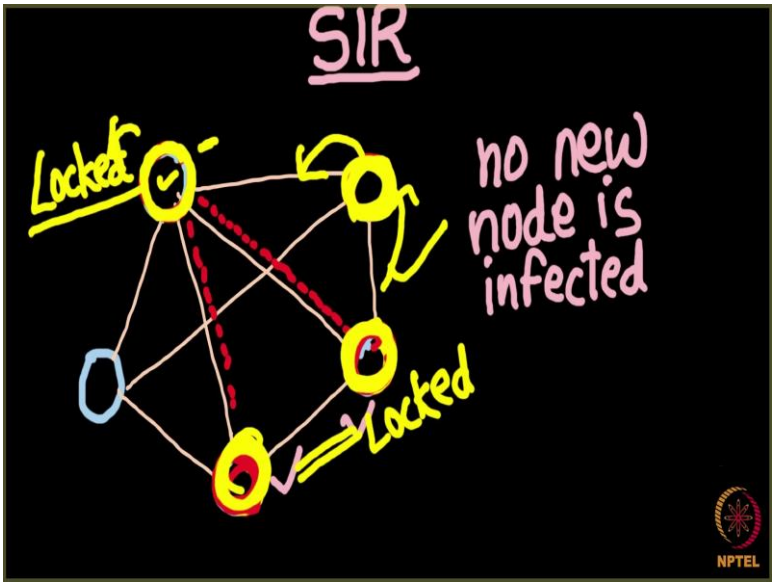

Let us first talk about the SIR model, so let us see what happens in the SIR model. In SIR model initially every node is susceptible. So, I will take a network of five nodes here and initially every node is susceptible, let me put some edges between these nodes. All these are susceptible nodes and we have some edges between these nodes these are the edges.

And then what happens is we need at least one infected person in this network to spread infection. And let us say this is the node here which is infected and this node starts the infection. What is going to happen afterwards is, this node might infect some more nodes so let's say this node passes on the infection to this node and this node here gets infected.

And let's say this node passes over the infection to this node also and this node also gets infected here. But what will happen after certain period of time? After some time this node will go back to the recovered state right or the removed state. And as soon as this node gets goes into the recovered state or removed state, you kind of see that it is locked, it is locked means it is kind of removed from a network. Now we can do nothing with this node it is out of question right.

And then we had these two infected nodes over here, and then these two infected nodes might infect some of the nodes or might not infect some of the nodes and get recovered. So, these nodes are also going to be recovered after some time. So, this is one possible configuration which can occur once the process stops. So, you see here the process will definitely stop in this case. So, let's say that this infection was spreading here. And what has happened there is there comes an iteration where no node is infected. So, this is an iteration where what happens is no new node is infected.

So, we have seen that when no new node is infected the process comes to an end. No new node was infected and with time both of these nodes they also went into the recovered state. Now this network is done, if the process stops nothing is going to happen. But let us say the process does not stop here. So, these nodes were red here these nodes were infected here and the process does not stop here, these nodes keep infecting another nodes even then don't you think that after some period of time this process will come to an end. Because there is a fix supply of nodes after some time both of these nodes are also going to become recovered and as soon as these two nodes become recovered they are also locked and so on.

The process keeps going, keeps infecting, and the nodes starts being locked more and more nodes become locked and the time will compare every other node in the network is locked. So, this process will come to an end eventually. So, what can be the ending configuration for this process?

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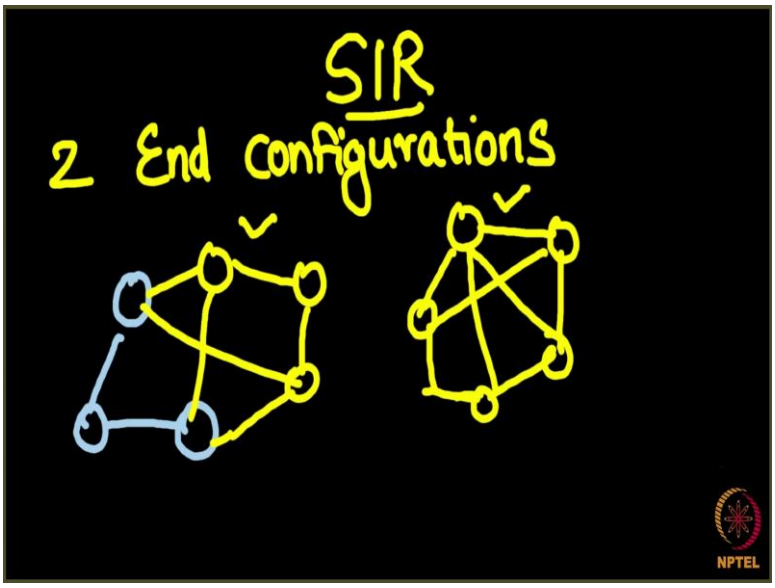

If we are talking about SIR model there are two end configurations, two end configurations. And the one ending configuration is there are certain nodes in the network which are still susceptible. And then the rest of the nodes in this network are recovered is the one possible configuration there are some edges between them. And second possible configuration is every node in this network has become recovered. And whenever the SIR process runs on any network it will end here or it will end here, it cannot keep running for an indefinite period of time.

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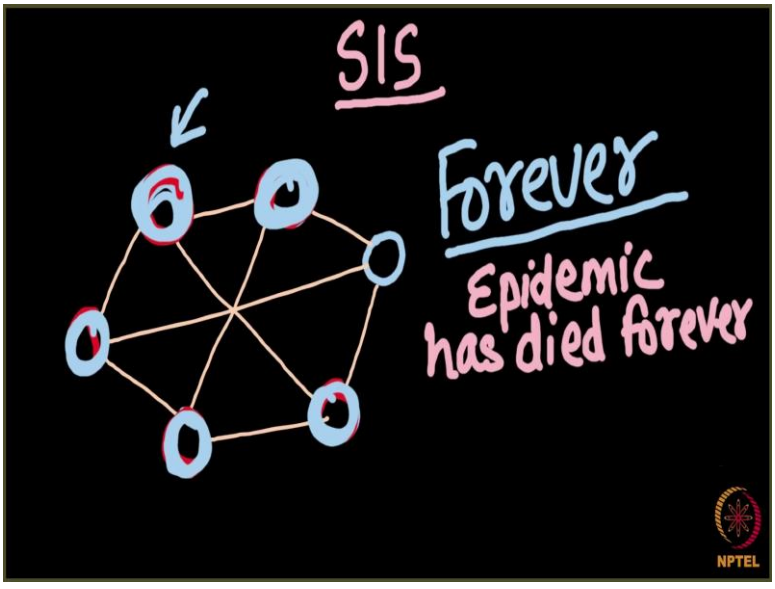

Let us now see what happens in the case of s SIS model. So, here I am talking about SIS model, let us see whether it will come to an end or not. So, there are certain susceptible nodes here I draw some susceptible nodes and these are connected with some edges here we make some edges and then the infection will start from some node. So, let us say this is the node from where the infection starts. And then what will happen with time again this node is going to infect some other nodes. Let us say this node infects these two nodes and what will happen is, this node will now go back to the susceptible state.

So, you see it is not locked here it goes back to the susceptible state and now these two nodes they will infect some more nodes let us say these and these and now these two nodes they go to the susceptible state and then these two again two infected nodes these two infected nodes they can again infect some nodes. So, let us say they infect this node over here. So, this node gets infected and you see it can be a cycle, it can be an indefinite cycle, rather the simplest form of cycle let me tell you.

So, this node over here let us say this node infects this node and it then it becomes susceptible. After some time, this node infects this node so this node is infected and this node becomes susceptible and this process can keep running for forever, this process can keep running forever. So, there is no guaranty that a SIS process will ever stop, but once it stops suppose that these two nodes are also recovered and in the next iteration this node over here it is unable to infect any other node and then it will also turn into susceptible. In this case you see what happen, in this case your epidemic or your contagion has died forever.

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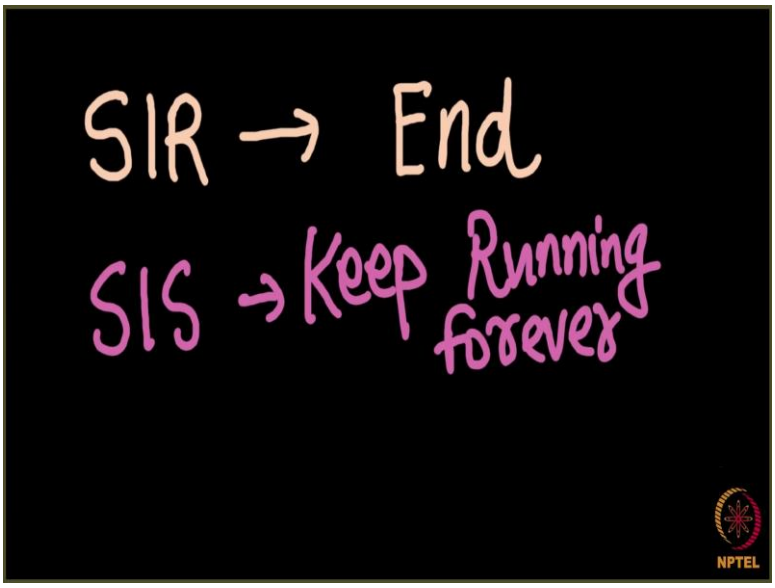

So, what did we see? We see that in the case of in this lecture we saw that, SIR model will definitely come to an end. But if we talk about the SIS model, it can keep running forever, it can keep running forever.