Indian Institute of Technology Kanpur

National Programme on Technology Enhanced Learning (NPTEL)

Course Title
Digital Switching

Lecture – 09

by
Prof. Y. N. Singh
Dept. of Electrical Engineering
IIT Kanpur

Okay so previous lecture we looked at the cross point complexity for a clos network but that is a very ideal scenario okay that is a basically we know the value after which if the middle switches are grown up then it will lead to a strictly non blocking property but as I actually have explained earlier in dual light situation we do not want to build up strictly non blocking switches we actually build up blocking switches in fact we do two things.

We either build only the blocking switches and use then to reduce the cost because certain amount of blocking is acceptable or we do create a strictly non blocking switch and then introduce blocking by using concerned data units that basically means.

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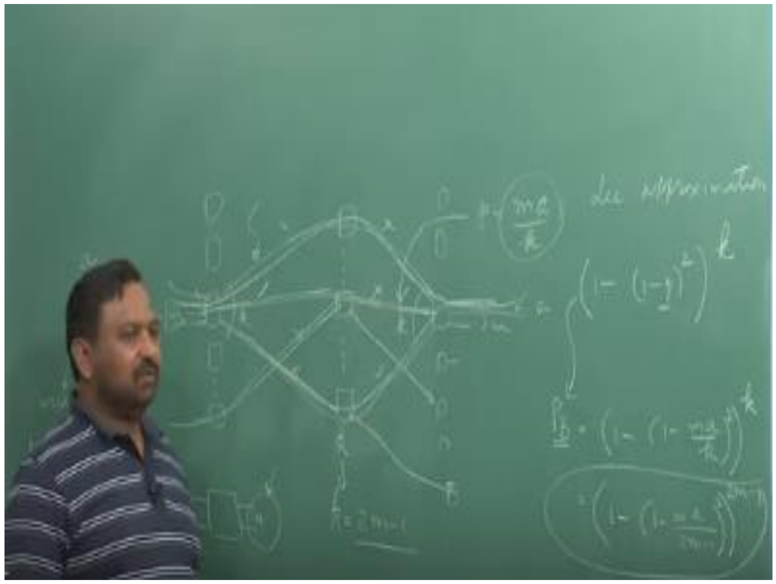

I am going to have a special kind of switch where number of inputs are large number of outputs are small users strictly non blocking switch and connect to the large one so I have introduced the blocking by use this is known as concerned data unit okay and that is a switch this configuration also has been used in lot of telecom switch implementations okay so in fact most of them actually where using this so if I am going to actually do not satisfy that condition of 2xm-1 those many number of middle state switches.

Is going to be less than that what will be blocking probability so that question actually remains so if you have a switch like here so it is a three stage clos network now one important things is that I want to set up a connection between two free incoming and outgoing port there other switches also here which you should ask question what is going to happen with those how those will be incorporated but now you take any pair you take this pair and this pair this is independent of when you set up a connection between these input output port pairs because these links in these are known as input links these are output links that is a totally different set when I am considering these input and output ports.

Okay so the blocking here will only be dependent on the availability of a common link a free link has to be available here and a free link has to be available here. Whether this link is available or not or this link is available or not is immaterial, so those need not be accounted for and the situation you take any pair the situation is same, so whatever blocking probability which have an estimate for these two.

Is going to be true for any other possible pair, in fact that is the premise which we use to estimate the blocking probability. So but we do know if my number of middle stage switches if this is this ports are m these ports are m, the moment it is greater than 2m-1 it should become 0, that's what the Clos theorem actually says we are actually we have seen this thing in the previous lecture.

Now, how to estimate it here? So there actually various ways so we will discuss two of them so one is the lee's approximation, okay. So this is very simple entry will exercises this is not a great deal, so the caller arrival rate we define as A, the probability that this link will be active or a call will be coming up, okay. So if this is m and these are k number of links KR the middle stage switches.

And it is a Clos configuration, so what is the probability this link will be occupied is a very simple calculation. So which actually means there are m number of ports each one of them can be occupied with probability F this should be equal to the probability of the any one of this link getting occupied that probability is PV call it, so P should be equal to yeah, let us call it this way so P should be the probability that can any one of this links will get occupied is MA/K.

MK is larger than M so this is going to be smaller, see I am not assuming that blocking is happening because of this switch this switch the blocking will happen remember the M/N composite switch when N is M/N composite switch was something like this, when this N is a smaller than M then blocking happens here if N > = M there is no blocking, the condition here is K > = M, okay.

This even can be even larger in fact this lee's approximation gives you an estimate, okay. But this is still says the blocking is going to happen when it cannot happen when your case going to be 2m – 1 the formula will is still blocking is going to happen so this the probability that this link will be occupied okay, and similarly I can estimate what is a blocking probability what is the probability that this link will get occupied this will also be P this is them so call which is coming here is going to have an impact connecting to anyone of the outgoing inputs.

So affectively when I am looking at the probability that call will coning here the arrival rate that is because of all these so this should also be a I am looking at a complete symmetric condition any input is trying to connect to any output with equal probability under those symmetric conditions both side it is a so this occupancy probability will also the so this is here is k will also be given by ma/k now the probability when the blocking will be happening when you cannot find the out a path.

Now how many possible paths are there you can actually you can route through this that case such possible paths and when a path is not available or blocked when this is been used to make a connection to somebody else by some other busy port so this is occupied even if this link is free you cannot use this path there is a possibility that some other output from a x this n connect here so this is occupied even if this is available you cannot use this path there is a possibility that some input here is connected some other output here.

And both of them are occupied you can always set up a connection between them only when both input and output both links are available so essentially we have to find out when the links will be available so when this a path will be busy either then when both of them are busy of one of them is going to be busy or one man is that both of them are available so the both of them are going to be available so this is the occupancy probability of a link this link is not being occupied that probability is 1 – p.

This link is also not occupied is 1 – p so I will say $1- p^2$ is the probability that this path is not occupied and can be used. Okay, so one this should means the part is going to be occupied this essentially can happen because this is busy or both of this links are busy so all three are being now taken here so remember this is not nothing but equal to that both of them are busy which is going to be p^2 +this is busy and this is not busy and this is busy this is not busy which will be 2 x t x 1- p so remember this both are same so I have just computed in the other way around.

So this is the probability that this part is busy now if all the possible part of all of them all k of them are occupied then you cannot set up the communication between this and this free input and free output port. So that is what is going to be give you a probability of blocking remember this is the switch being in block testate this is a time congestion this is not a call congestion this is the probability has which is in the blocking state okay.

So this is what is known as lees approximation and of course I can replace p/ this so this will be come 1-, now the problem is if I actually put k = 2m-1 this would become 0 but that does not happen you actually you can compute this or any value which is higher than this you take any value of m compute take some value of a which is the probability can take value from 0 to 1 this is not going to be 0 in this case.

So this is start deviating actually this start deviating for larger numbers but is a good approximation if my case and if we are doing randomly the things than that will going to be a good approximation okay but this is still in approximation is not by exact value of probability of blocking and I think the mistake is that the probability that the call blocking will happen that depends on the switches state we have not taken that so I think we have to modify this approach so modified approach was given by Carlo

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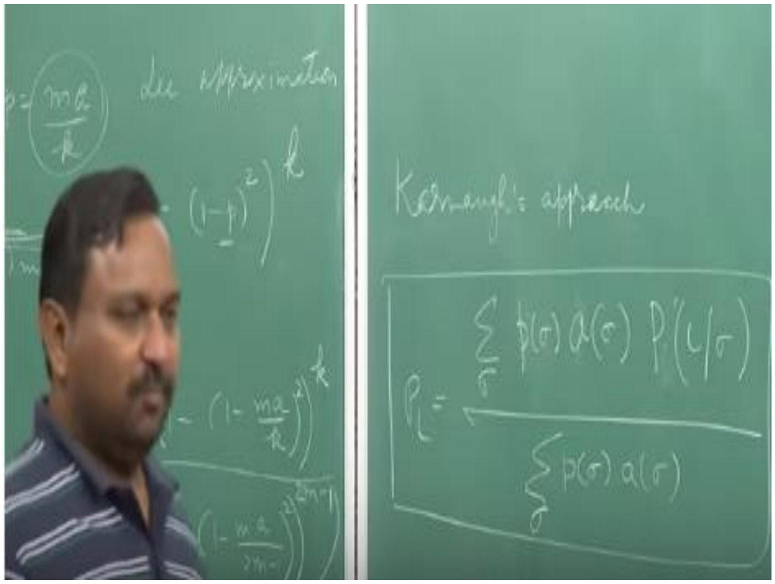

So there is a Carlo approach which will give you more exact blocking probability but this blocking probability will be call loss probability so you will actually represent this switch by some state σ and then there is going to be caller arrival probability which is because of σ okay.

So infect so arrival probability which cause σ probability that you are switches in σ state and the probability that call will get lost when you in state σ and you submit up over all possible states and this is the all the cause which will be arriving this will give you PL the corlos loss probability and interestingly this call loss probability and corresponding the switch being in probability of switch being in blocked state ,time conjunction they are also related by the same relation which we have derived earlier .

So next lecture we will be looking in to the Carlos approach carols approximation for finding out the call loss probability.

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Ministry of Human Resources & Development

Prof. Satyaki Roy

Co-ordinator, NPTEL, IIT Kanpur

NPTEL Team

Sanjay Pal

Ashish Singh

Badal Pradhan

Tapobrata Das

Ram Chandra

Dilip Tripathi

Manoj Shrivastava

Padam Shukla

Sanjay Mishra

Shubham Rawat

Shikha Gupta

K. K. Mishra

Aradhana Singh

Sweta

Ashutosh Gairola

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