Indian Institute of Technology Kanpur

National Programme on Technology Enhanced Learning (NPTEL)

Course Title
Digital Switching

Lecture – 16

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Okay in the previous video what we had looked at was the multi casting scenario and I had given you an expression or which was actually done on my own while teaching in a class and so the middle number of switches the switches which are in the middle stage has to be greater than that particular value so that value which I had written was this.

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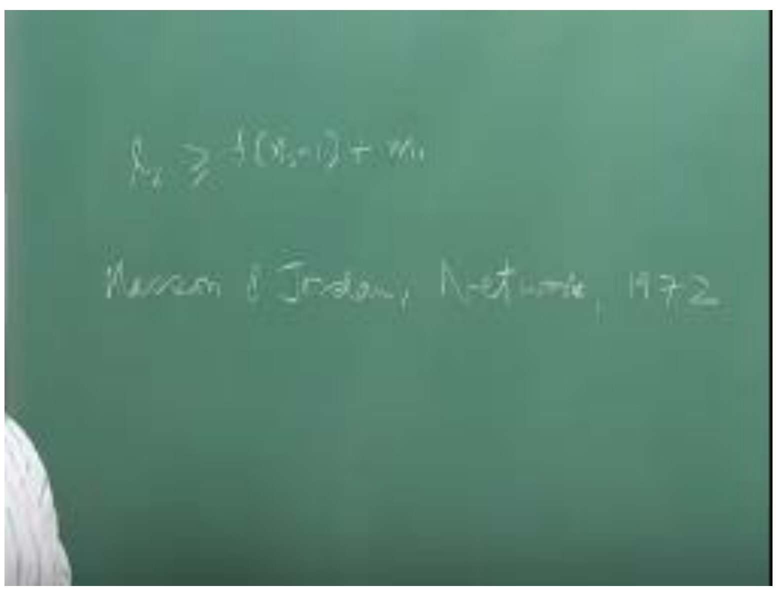

Okay so in this video what we will be doing is will be slightly looking into there are two more kind of efforts which have been done earlier in the past and I will be just giving another expression which came out from that and then of course how it compares with whatever we have got and there is another approach actually of solving it we will not solve it with due to lack of time.

Okay but I will give the intuitively the idea behind how that expression or what is approach what is the thought process behind computing the number of middle states which is which are required at least to compute to ensure that for a multi casting system the switch will be strictly a strict sense non-blocking okay so the first one was this actually came by mason in Jordan you can actually download the paper this was in network.

Which is a journal swim and this came in1972 is quite old actually okay and but is a very ,very intuitive and very simple result this even talks about the non-blocking system for multi casting scenarios in fact we will be doing a slip- n- druid theorem but that will be a for a unicast encase not for multicasting scenario okay and that is basically the extension slip- n- druid n theorem which has been actually used by them so but only their unicast part I am discussing here so in this case they actually said that there will be a switch .

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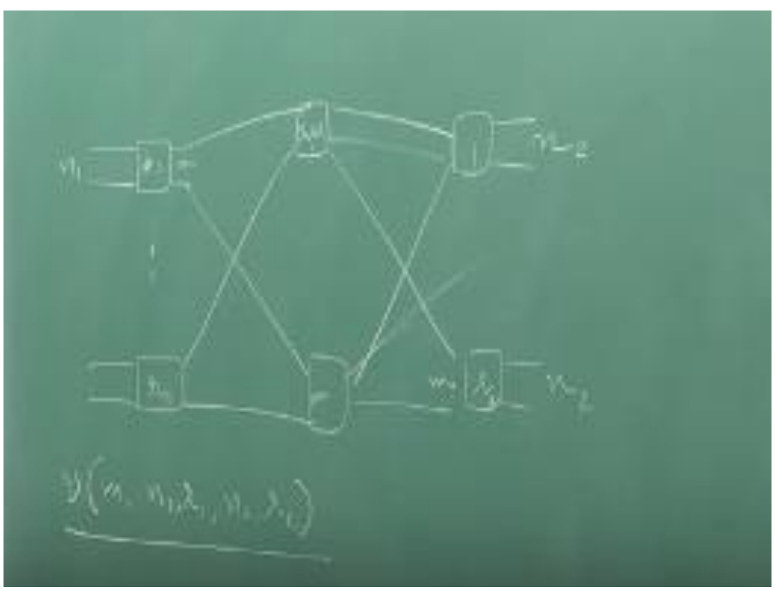

And in fact now one word I am also going to use a very general framework we call this whole class network will be identified by N and there will be such R switches and this dimension so n by M switches will be there so each of this which is R cross R and their total M switches if it is symmetric 1. I have N here and this will be M and this will be R and amore generic version says that it this will be n 1 this will be n 2 okay so this will only depend only on this particular so this input and this input has to be same they will depend on this number of switches .

Only thing which difficult not changes the number of switches which are here and number of switches which are here r1 and r2 so in general these switches is being represented by your m1, r1,and r2 these   five parameters are good enough to specify the switch ok so I am actually going to use the same thing this is what has been consistently used in the literature so but before this I was added almost everything in a different format so this is a standard which is followed.

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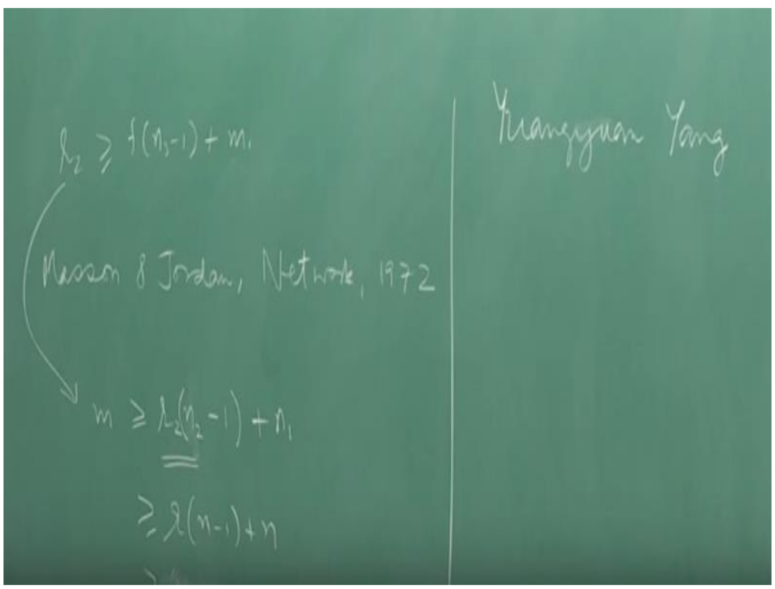

So in this case so now number of multicast one of the important things which one has to remember is I should not worry about the same number of ports which are here I have mentioned it earlier also so far I am able to reach from input to this switch I can do a fan out to from here itself to all these outgoing ports ok so in worst case scenario so Mason and Jordan actually computed this using a worst-case scenario in worst case scenario this input one input is being connected to all the switches.

Okay so what can happen is you will have the number of these links which will be occupied will be now n 1 into whatever is this number of these switches which are there n1 r 2 those many number will be occupied now if one of those links in worst case if all these are connected ok so in a scenario there is a one free port in one of the switches and there is a one free port here basically there is a port which is already connected in a multicast but that multicast has to be extended to this ok so there is one less equally he has taken n 1 r 1 r 2 -1 which will be here and these out of these remaining n 2 -1must be connected to some other switches here so I need one extra switch here by which I can take this free port and connect to this outgoing port .

This is slightly absurd I also then figured out that this is not the correct version which he did okay so he actually just uses this + 1 only problem actually is with me is here I cannot understand this because if all these n are being connected in a multicast fashion to everybody that is N1 R 2 number of links which will be required because this one the fan-out actually is happening here there is no fan out in the middle stage.

So that was the assumption which has been made by him okay so there will be n1 r 2 - 1 which is which will be a or links will be occupied from this side and they will be connecting to all the outgoing switches and then they will be doing a fan out here okay. So if but y-1 okay it means minus 1 means only one link has not been occupied but why that question was not where it has to be n1-1 and they have been making connection to all of them R2 only one of the input is available.

So this should have been n1-1-1R2 kind of thing but this is the way they actually Mason and Jordan has done and he says that my this value m the number of metal says switches has to be greater than or equal to this but this is anyways a flawed thing but since it was there in the paper have given the exact expression here if I would have computed I would have done it in a slightly different fashion in fact this turns out to be same thing which I told you earlier except this whole thing now has to be reformatted as per that notation.

So if I reformat this will become m is equal to f will become our two because that is the maximum number of fan out which you can have remember there is no fan out here there is only one to one connections which have been made in the middle stage switches so this is not an efficient system ideally I should actually allow the multicasting to happen here as well as well as here okay so this should be our two into this and three will then turn out to be in this case it will be n2 - 1 + so this one was the input dimension here.

So this will be converted to n1 okay so this is the what we had actually and they are both if you look at the complexity is here it is r_2 n_2 if it is symmetric case it becomes our n - 1+ n for a symmetric case it will become rn - 1 + n in fact I can write the expansion rn - Rn + n so order is r x n same is true here so this is also off order and in our one but remember here it is n1 which is being used here it is n_2 which has been used okay this comes because only because of the legitimacy conditions of the Paull's matrix.

Now but both of these when I did the pulse matrix thing I have never specified that there is no fan out which is happening at the middle stages fan out was only happening at the first one and the third stage but if the first one I in fact why we should disallow a fan out here so we can get a better bound so that is what a professor in Stoney brook State University of New York actually did so this is what is so this Prof actually has come up with an idea that we should allow the fan outs in the middle stages and then she actually went through nitrated process.

So I am going to give you an idea how this estimate actually is done okay let me give the complete Genesis on which it is actually based so the idea says.

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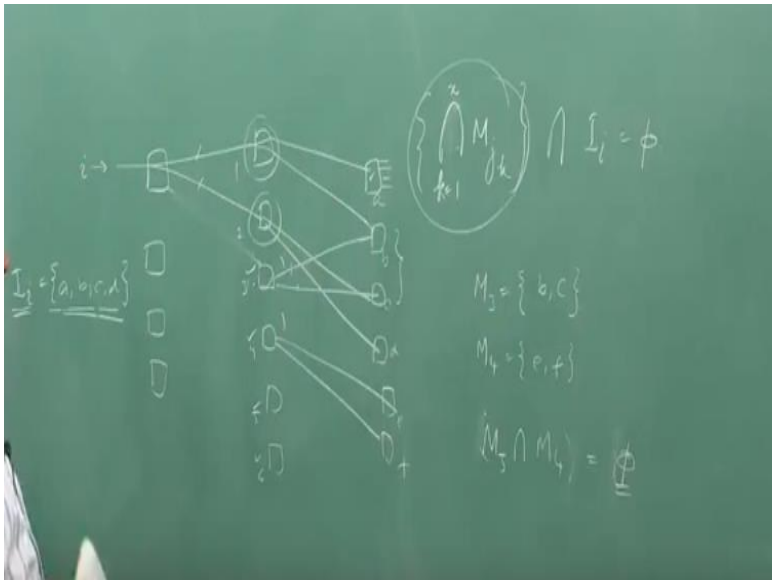

That the way she actually says that again if I build up the first stage second stage and we have the third stage in this case when it goes this can actually bifurcate here itself this can also further bifurcate here now this is what we are now permitting which was not being considered in the earlier cases okay there was no fan out being considered. So we knew that was an upper bound that probably we can get tighter bound than that actually a better estimate was possible.

So this was an attempt in that direction, so there is what the way we define the multicast is a input now this switch in fact these ports does not matter so far I can reach this switch I will be able to do a fan out air and beach to all the output ports of this one. So I only worry about these switches actually so any connection request I from a port number I will be given by the set of this which is where they want to reach.

So this will be set for example if this is ABC and D so this set will consist of ABCD. So this is that connection request which will be there. Now another important thing is that this particular switch can reach to because there are already some connection being set up so those we cannot consider, but there will be certain switches which are available for example this which is available because there is no connection this which is available.

Okay from these available switches I have to find out for each one of them from these available it might be connecting here this might be connecting somewhere here there are other links which are available in this case. So the already connections which have been made we call them destination set, so destination set for this one if this is 1, 2, 3, 4, 5, 6 or destination set for three will consist of B and C destination set of 4 will consist of something here E and F.

So the way we actually do it we have to find out this connection request II and we just look into that to which all ones or basically if I look at this, this switch certainly cannot be used for setting up a connection from to BC because this connections have already made. So if BC appears here also I cannot use this middle states which okay. Now if I look at the other one this cannot be used for setting off connection to E and F.

But if I were looking at this pair let me find out the intersection of these two. So m3 and m4 intersection this will be there is no nothing common so it is ϕ so if I use these two their intersection is ϕ so whatever is the available ones so we will actually can use that this intersection among all that. So if I can find out the X such available nodes available middle state switches for this switch or basically their input links are available for them I find out their destination sets their intersection if the intersection with input request II is ϕ that actually means I can actually use this particular combination of X, X different available switches to set up the multicast tree for this connection request this shall be possible.

So I need to find out the minimum number of X middle stages witches so that this condition gets satisfied so under this premise she has computed and she found

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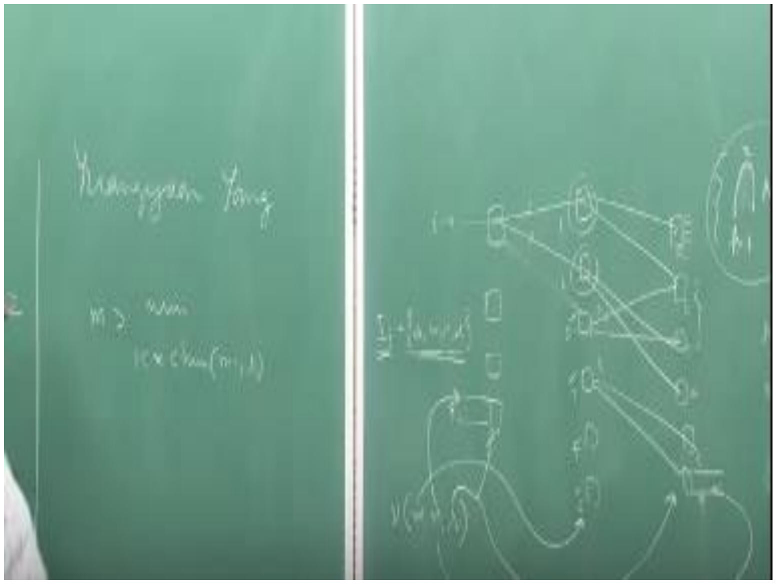

That it will be possible to set up a connection so I am giving the final result which actually came if my number of metal stress which is greater than minimum of this is for a symmetric switch so symmetric which means where the number of switches here is R number of switches here is M the number of inputs are N number of outputs are also N okay .

So we define that thing by (m, n, r) okay so that is a switch so M stands for then number of metal stage ones r stands for the number of switches here n stands for the number of ports on the switches actually okay so the result turns out to be this so you have to just iterate overall the possible values.

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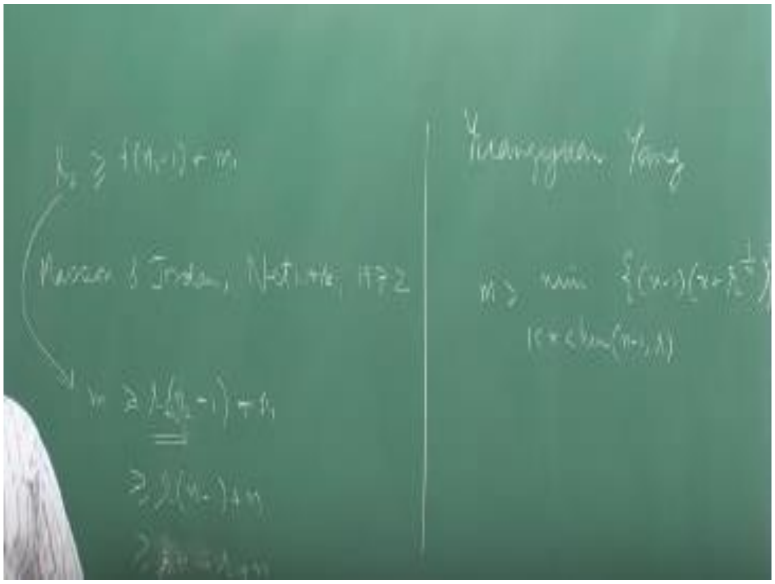

Of x which will range from 1 to whatever is the minimum of these two and for each one of them compute this expression and the whatever the minimum value which will get that M which is required this is a tighter bound than what we had estimated earlier for a multicast encase in a cross network.

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