Digital Switching
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Lecture – 5

So, last time, what we have done was m by n composite switch in blocking probability estimation for that, and we also understood what is time congestion? And what is call congestion?

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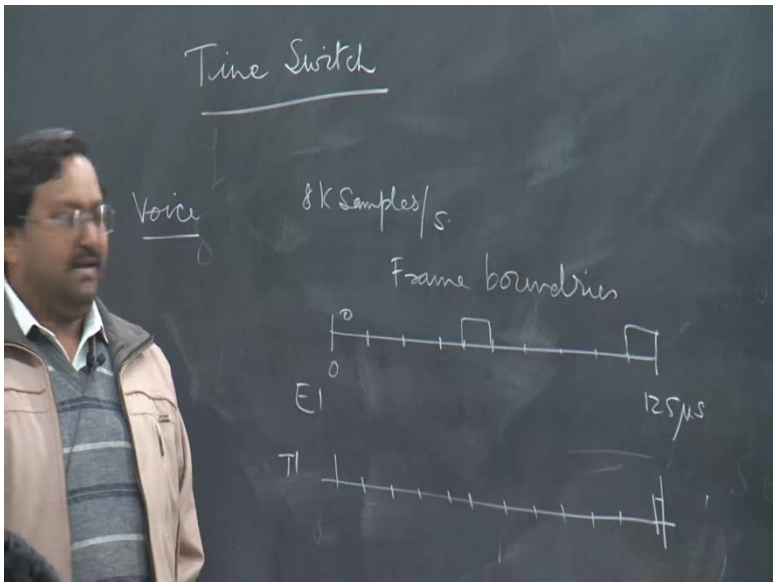

So, we will just move ahead further, but before that let me introduce something called time switching. Because, this will be an important thing and most of the time in most of the commercial systems this is what actually is being used, we will always try to use that. So, basically the idea is very simple, most of the voice; which is transported is basically usually you will be doing a sampling at 8 kilo samples per second that is…

And once you do the sampling you will for each sample you will use it, you will do analog to digital conversion of that, and what you will do? You will get 8 bits for each voice sample. And that actually means you will get 64 kilo bit per second a stream, and usually 64 k b p s is a very small bandwidth. And if you have a fiber, and if you have higher bandwidth link you will not transmit one single voice channel.

So, already there has been a standards which make a higher bit rate is seen, out of multiple voice circuits, will be a very common practice. So, I think one of the examples I had than earlier in the previous semester was e 1 carrier system, e one and t 1 both. So, e 1 carrier system is actually is going to have 32 slots, and as I had already mentioned in the previous lecture that every framing whatever is being used anywhere, is going to be of 125 micro second duration.

Everything is of 125 micro second duration whether it is a h d f frame, whether it is a e 1 frame, t 1 frame, e 3 frame, whatever you take only number of voice slots which are transported is going to change. So, if this actually means, I have anyway getting a time multiplex signal; which is available. Now, how to do switching with that; is the question. So, usually there will be slots, now another important thing that these frame boundaries are extremely important.

Because, slots location is, what it will identify the circuit. So, when you are setting up a path from the source to destination, it is the slot number which actually matters. So, if you say this is going to be from your phone to some other's phone this is slot number being given, your voice sample will only be going in this particular slot in this particular frame. So, now, this is something which we are going to use to build up a time switch. Now, one thing is this frame boundaries need to be identified. So, frame deletion mechanism has to be there. So, usually there will be some mechanism of that kind.

So, e 1 system usually uses 2 slots; 1 slot is for identification of the frame boundaries and 2^{nd} slot, which is used is for signaling purpose. So, usually this will be, and similarly there is another format called t 1 carrier system. And this 1 is still this is not used in India what we use in India is this, but with voice over I p coming even this will not be required in time to come actually. So, t 1 carrier system will be using 24 slots in 125 micro second.

Student: What is the slot duration?

This is again 125 micro second duration frame duration.

Student: E 1 means slot e 1.

We do not bother about this we have to push in 32 8 bits 32 octets, in 125micro second duration. Because, every person who is talking over the phone is going to generate 1 voice sample every 125 micro second, we have to give him chance again. So, frame has to be over within 125 micro second you cannot stop. So, usually in this case I think 16^{th} 0 it was 250 I think if it is start from 0 the 15^{th} one and the 31^{st} is what is being actually used for, this one is used for framing purpose, and this one is used for signaling purpose.

That is the way actually it is in this case, there is no octet reserved for signaling. Signaling, is done in a different fashion here one extra bit is actually going to be used for framing. So, here this one is used for framing, the whole octet itself, here there is only one bit which is being added. Now, this extra peripheral here, and similarly how the signaling will be done, is every 6^{th} frame.

So, there are n frames you will usually create the super frame of 12 frames and 6^{th} and 12^{th} frame, the voice sample will not be of 8 bits it will be of 7 bits. So, lower most order bit for every voice channel will be used for signaling. So, this provides a low bandwidth low capacity signaling channel between two end points. Now, the problem is this signaling this framing cannot be is not required in switching.

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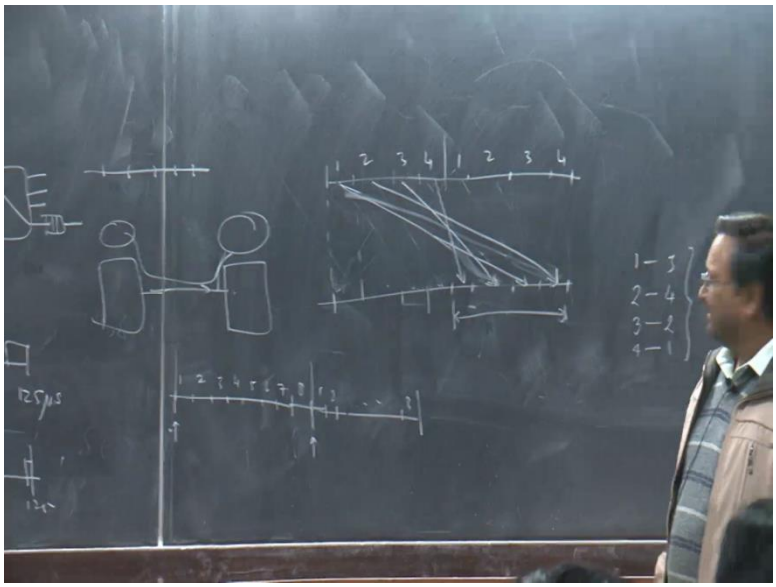

Switching is a box is a device. So, first thing which you do is you remove all this extra stuff out of the frame; you generate your internal time frame. And when the internal time frame is generated inside the box this will contain purely the markers, where the frame

boundaries are starting and ending is handled by the device inside handled by the box or the switch, it is either on a separate channel or a marker or a clocking whatever way.

But, it is not part of this frame this is a serial listing this is going over a single wire or wire or a single fiber. So, you cannot keep these frame markers cannot be send separately, within a device this can be done. With in a box this can be done. Similarly, this signaling channel is being already separated outside signaling is usually separated out, and whatever is the processor of the switch that will take care of that particular information.

So, signaling never is never required to be switched, signaling is between two boxes which are connected. For example, these are two boxes connected signaling is between these two intelligent entities. So, that is either carried by that 1 bit in every octet every 6^{th} frame in t 1 carrier system or either by this 15^{th} slot. I am starting always the slot number from 0. So, 0 to 31 it is a 32 slot system, 0 to 23, 1 extra bit will be added. So, all this is going to be stripped off, before you can do switching. Because, this is usually is a confusing point to the students.

You should be careful in this you have to strip all these off before you can actually build a time switch. So, you will get actually get a raw frame, raw frame will be like this, there will be nothing but voice samples voice circuits. So, these are for example, I am showing 8 of them. So, these are channel numbers there is no separate frame markers these are internally being maintained by the device or the switch box.

So, again the next frame will come, 1 will repeat here and so on, the 8 th one. So, this is what will be the raw thing, which will be coming into the switch box. And how the switching will happen? Because the location of a slot inside the frame itself identifies the source as well as destination. So, this corresponds to some source 1 which will depend on the interconnection of the previous switch, this also identifies to which output port it is going to go.

If might this box in somehow swap these positions, it can read this octet and put this octet here, read this octet and put it here, swapping can be done or moving the thing I will be able to achieve switching. And that is what the time switch actually does. So, I can give an example. I am just taking a four slot a simple system, and I have to now this is the input, and then there is a output thing.

I am showing two frames, now the problem is if these are happening at the same instant, I want to do switching between 1 and 3. So, the input which is coming from port number 3 has to go to port 1. I certainly cannot move it here that is not possible. Because, this has already passed through there at the same time, what can happen is; 3 can be moved to any slots which is later not earlier.

Now, this actually is one settled thing now, the two ways you can handle the switching in this case again. And this is I think implementation dependent does not matter actually honestly speaking, but one important thing that all these actual values may not remain together in the outgoing frame that is very important. So, one very good example is say I want to do a switching, I let me just put a switching pattern say 2 to 4 say 3 to 2 and 4 to 1, I just taken something arbitrary. So, these are the again I am taking all unidirectional not bidirectional switch. So, that is the way.

Student: input to output ((Refer Time: 11:29))

Input to output making inside the switch, I am only worried about the switch part, and switch is a generic device. I can use this thing even for packet switching if I can change these circuits or these maps, every packet duration, I can even create a packet switch also. So, that is why I am doing it in a generic fashion, but voice you are right if 1 has to connect to 3, 3 always has to connect to 1. Usually it should be, but it need not be, if for example, I can give you an example if it is a voice circuit it is a radio transmission over a telephone, where is to be that this kind of service earlier days.

Student: Radio wiring mode.

Radio or telephone used to be there. So, in that case there is no reversal is not required, and it usually used to be a multicast. So, 1 is being copied to multiple slots kind of thing if it is a time switch or if it is a space switch, I will do duplication. Remember, in that space switch is I have not discussed about that actually. So, if it is a cross bar certainly can be done if it is not a cross bar then this cannot be done if 1 to 1 map is there.

But, remember, I have when we were discussing switching we I have always told it is a strictly non-blocking switch and it is nothing but equivalent to a cross bar. So, if this input has to go to all four outputs this can always be done, this can always be done that is

my assumption. And if it is a two cross bars this can always be done, this depends on how you buildup the implement the switch.

.Student: ((Refer Time: 13:19)).

Mostly time switching time and space.

Student: ((Refer Time: 13:24)).

Routers working slightly different way.

Student: ((Refer Time: 13:28)).

They are sorted structures they actually use, they have a time, and time is slotted into small things. And switch will not cross or baristate or may be this interconnection map I call it input to output map. So, for one slot duration there is one I o map depending on, whatever packets are coming they will be moved to the output depending on that I o map. And next slot again it a will change and this distribute dynamically computed depending on the packets, which are going to be there in the head of tube, and if your speed here is very fast.

So, number of packets coming per slot is 1 outgoing packet number of packets going per port per slot is again 1, but incoming I can actually do transfer at much faster rate, which actually means I can actually read two packets for same output port and transfer them simultaneously that is also possible. So, that will lead to, what we call the blocking will not be there in that case, and that is known as speed of factor.

So, if it running at n times higher speed even if all packets are for same output port, in one single slot I can read all of them, and then put it at the outgoing thing. But, outgoing port cannot transfer it remember. So, let us use something call buffer. So, it will put on the tube, but only one packet per slot will be going out, when this buffer is full packet will be dropped you cannot help it actually. So, technically it is similar thing.

Student: ((Refer Time: 15:10)).

Switching is the core internally routing is identifying, what we call the paths. So, who is the next destination to I should forward the packet. Switching is actually creating the path, forwarding is by looking at routing table finding out to which outgoing port it has

to go. So, these are 3 different processes which run in every router or every switch. We call them switch or router, but it contains all the 3 things actually embedded.

So, in this case once you do this map, I can just, I will actually do the exact implementation of this particular time switch, but as of now you assume we are going to implement it through delay lines, some kind of delay. So, this can be done by delaying one by one can be moved to 3 remember 2 can be moved to 4, but whenever this destination port number is smaller this cannot be done.

So, 3 cannot go the 2 here. So, 3 have to go to this thing and of course, 4 has to go to 1. So, 4 will go to 1 and similarly, this 1 will come here at 3^{rd} slot. And 2 will come here at the 4^{th} slot. Now, this frame contains 2 octets from the current frame itself incoming frame and 2 octet from the earlier frame. So, this 1 technique you do not worry, but you try to minimize on the delay of transmission.

Second possible decode had been, you will get exact one slot delay one slot plus higher something. It will not be minimizing the delays, actually if you want to maintain all these 4 together, all the time then this 1 and 2 will be shifted here. And remember the delay line length requirement for this kind of system will be, what is the maximum?

In this case I have already done 3 is going to two that is the maximum exactly this much slot four slot delay will be required, 4 minus 1 actually 3 slots delay will be required in worst case. But, in case the other scheme, we are I am not going to do it this way the 1 has to go to 4, 2 sorry 1 has to go to 3 in this case, 2 has to go to 4, the 3 has to go to 2, 4 has to go to 1 worst case scenario, would have been if one would have gone to the 4 actually. So, you require 2 into n minus 1 that much maximum delay.

Student: ((Refer Time: 18:23)) see if I assume two delay.

I have given this map, I am trying to implement this map. So, this pattern will keep on changing if you change your map actually. So, but this will require higher amount of delay usually this is not preferred.

Student: ((Refer Time: 18:41)).

2 n minus 1.

Student: ((Refer Time: 18:45)).

Is 2 into 4 minus 1, 7. So, you require 1, 2, 3, 4, 5, 6, 7; if 1 is going to, go to 4 you require 7.

Student: ((Refer Time: 18:57)).

That is the advantage of that scheme, but you are not putting the things together voice if it is a circuit switch system does not matter. And if it is a packet switched system you will always be happy. Packet switching system does not have this time switching concept, you just do the scheduling of packets and packets are just inserted the whole packet belongs to 1 source, and is going to go to 1 destination. You transmitted faster rates the packet duration goes down, here it does not matter one slot one octet is going to come every 125 micro second. So, you do lot of aggregation this way.

Student: Can we extend beyond.

No, usually it will never be done it will never be done, this cannot go to you cannot have any octet from here, will not go to here that is not possible. That is usually will never be done, and I think there is no case where it will be required.

Student: Sir then in further case one will come to four.

One will come to four.

Student: ((Refer Time: 20:13)).

2 want to go where, for example, you give me the position for example, I change 1 to 4 that is the map you give me any other map actually. So, in this case 1 will come to 4, 2 will come to 3, 3 will come to 2, 4 will come to 1 this does not matter it will never be going to another one. Within this you should be able to finish it there are two possibilities actually. So, this is what basically the time switching concept is, and the way I think it is being told at lot of places is by using multiplexer and demultiplexer.

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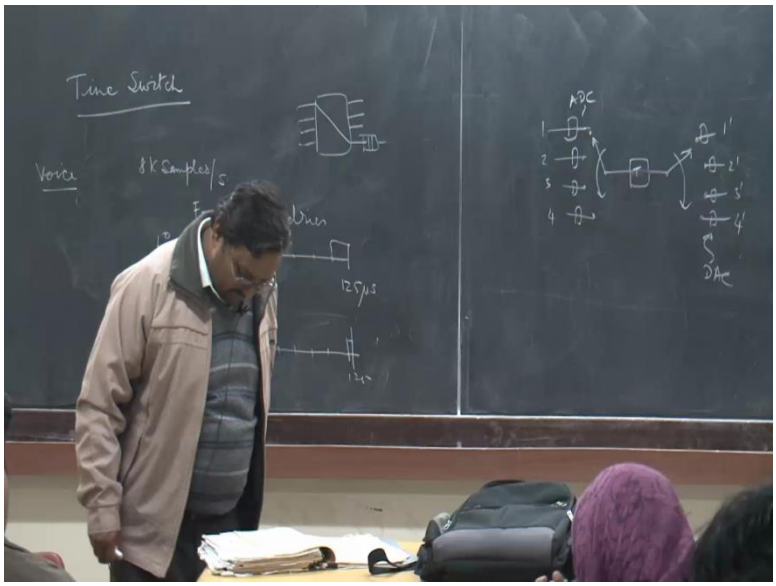

So, if you have... So, this equivalent, and I put a time switch in between. It should do this job of mapping, and I have 1, 2, 3 and 4 what I have created. So, I am still using a time switch, but using a mux and demux, rotary mux and demux. They do it synchronously actually remember it always go to 1, 2, 3, 4, that also goes to 1 prime, 2 prime, 3 prime, 4 prime. So, if I do this I am able to create a space switch remember, this is nothing but technically a space switch.

So, I am not worried about this input is sampled only every 125 micro second, if it would have been analog. So, there is a a d c and then there is one sample generated to every 125 micro seconds that always goes into the first slot of the frame. And that can be switched to any outgoing port and there is a d a c you will put it will become nothing but a cross bar. You put a d a c here digital to analog converter here you put a d c, this is equivalent of a cross bar, but you can do time switching because you are using a digital format.

So, far we have whatever we have done till the earlier lecture, we were not bothered it could have been very well analog telephony. But, only with digital format you can do time switching. So, far this is fine, but we have also done a clause network. Now, can I explain on to the clause network with this. So, can I use time switch there? My question is this.

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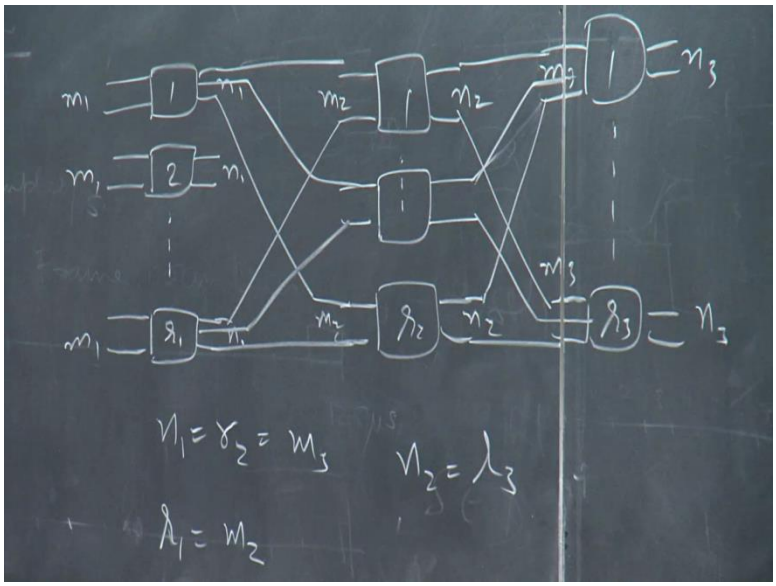

So, let us draw the clause network and then. So, as I told the clause network is here, total r 1 switches. And you have m 1 incoming ports, you have n 1 outgoing ports. And you have here m 2 and n 2 outgoing ports, and then there is a 3rd stage, that is what I had done earlier. We also had the condition that n 1 is equal to r 2, is equal to m 3 and r 1 is equal to m 2. If you want n 2 is equal to r 3 that is; what we had done. So, that is why this guy can connect to each one of the switches, if there is some middle stage one it will connect here.

So, every switch is connecting to everybody to every switch in the next stage by exactly one link. And we of course, have done the case I have also proved what is switching on blocking switch, in what in what condition if it is symmetric. Symmetricity actually means that m 1 is equal to n 3 and r 1 is equal to r 3 under that condition. You have variable r 2 you change r 2, n 1 and n 3 also will change that was the case which we took.

And irrefutable I gave a proof that r 2 has to be greater than or equal to 2 into m minus 1, for the switch to be strictly non blocking. So, formally there is actually is minimum of something it has to be greater than or equal to that will come to that thing later on. Now, my question is this purely is a space switch, how to put in a time switch?

Yes, can I do something with this time switch? Because, time switch has a peculiar problem this interchange of slots will be done because, you are writing into the memory and reading from the memory. And memory or ram has a access time limitation. So, you

have to write 2 n words, and you have to read the 2 n words back, sorry n words will be writing and you will be reading. And this has to be done in 125 micro second. So, if your access time of a memory is t access.

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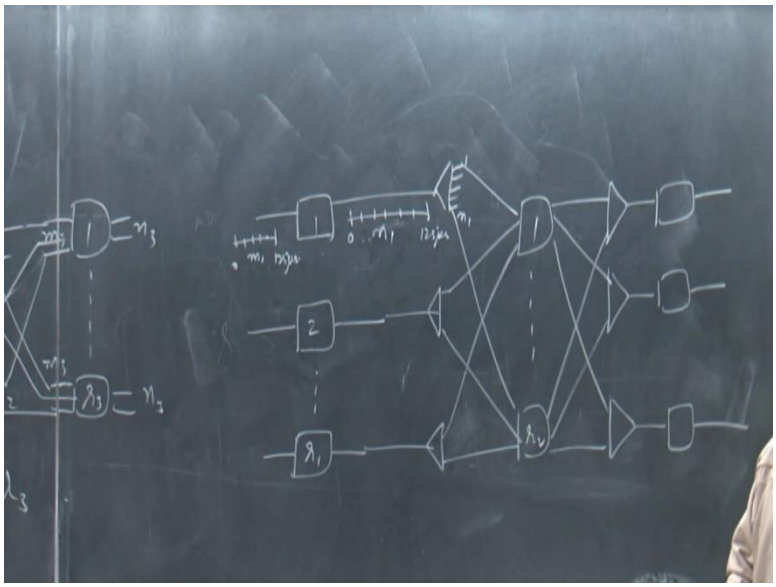

So, 125 micro second and x the n read access and n write access is 2 n. So, this is the access time, which is available for each word for read write. So, this has to be always greater than or equal to t access; which actually implies your n has to be less than equal to 125 micro second by 2 into t access. So, you require a very fast memories if you require a higher n. So, this value will if you keep as less as possible.

So, you can have higher and higher n. So, n is also limited in any time switch you cannot have n very large, n is limited. So, how to solve this particular problem? So, I cannot create a very large dimensional time switch, I have to do something. And we have to do something here. So, any guess any suggestion from you people.

Student: ((Refer Time: 28:25))

Go ahead go ahead.

Student: ((Refer Time: 28:27))

One frame is coming with 4 slots right.

Student: ((Refer Time: 28:37))

4 simultaneous times now where you would like to put the time switch, in this stage. That is a one possible configuration, but that is tricky to do the simpler version is I can use time switch here 1st and 3 rd stage. But, I will not be requiring r 2 switches there, that is the important thing. So, let me implement using time space, and time combination we call it first stage time, second space 3 rd is time the switch, is known as t s t time space time, which is also becomes a clause network nothing else.

The whole mathematics switch is represented; which is actually is need for this switch is also valid for this configuration. So, let me do it I will draw it here. So, let me take a time switch and these are the incoming frames, I will define this thing as m 1 slots, I am not worried about signaling and framing. So, that you will take care. So, for me is only m 1 voice slots which are coming in.

And I can now, but the problem is I have told you that whatever the number of incoming slots has to be the outgoing slot, I have not told that actually I have only used that thing in the example. But, that does not mean it is always going to be true you technically can have n 1 slots going out. And now that is complicated thing to handle because, whatever is seen I have to hold for swapping by providing appropriate delays those cannot be maintained in this case.

The whole octet has to be written, whole frame has to be written first in the memory then, only it can be read out at a different rate because, remember it is still the frame duration is 125 micro second that does not change. So, in reality I will again do this particular implementation of m by n time switch later on, we actually used two rams. So, when the first frame is written in first ram only writing will be done, reading will be done from the other ram actually, and that will be done with a different clocking rate. So, it can read faster, only problem is if this m 1 is smaller than n 1.

Only m 1 slots will be occupied remaining will be free that is possible switches are implemented that way, and if this n 1 is smaller than m 1 some of the slots have to be dropped, those connections cannot be made. It means those voice slots there will be busy because, what happens when a frame is generated? The switch which generates the frame or the mux will maintain the flux that which all actually slots are currently being occupied or busy or which are free.

So, whichever is a smaller value of these, only those many slots or those many voice targets can be set up. And that will be maintained as only those many will be maintained as free, busy status and the remaining will be kept as free status. Now, this is exactly equal to this, only thing m 1 was in the space here n 1 was in the space, there it is n times that is the only difference.

So, I can actually now, put in the same thing multiple of them may be I can put them, how many? r 1 now, the only problem which comes is these switches. So, how this switch is connected, you take the first input here, first input first input from this, first input from every switch here, first input from every switch here. So, may be common sense will tell I can actually do a demux here create physically 1 to n 1, and then I can have n switch connecting 1 from here similarly there is a mux in this fashion, this not required actually.

I can implement it this way, and I require again you will again have a time switch perfectly equal configuration both, only thing the switching we have implemented in this time here. And I have converted time to space using these demux separating out all voice slots. So, first outgoing port first outgoing port physically here, I have separated out first is here. So, all first are being put together in one switch this switch is equivalent to this. So, this is going to 1 to r 2 this is clear. So, far or is there any confusion I can repeat.

Student: ((Refer Time: 34:36)) will have n arguments.

They are…

Student: ((Refer Time: 34:43))

This one will also have r 2 inputs you are right 1 to r 2 inputs. So, remember n 1 is equal to r 2 that condition will always be satisfied, n 1 is equal to r 2 is equal to m 3, that condition have always have to be satisfied, that is a cross network. So, what I have done is or you look at this particular thing, this is equivalent to what? Remember I have drawn a figure here, if I can draw m 1 time multiplexer with m inputs, I can generate m slots I did the time switching I am doing demux this is nothing but this switch. So, I replace this thing with a time switch actually is equivalence.

Now, only one important thing which you will notice, during the period when the time slot number 1 is there, which one of the switch is in action now? I had all the switches in action all the time you tell me that. Only first will be will be operating only first switch is operating all other are silent because, their output second output will come only during the second period, I am not doing any time expansion in the demux.

If I simply just split them I have just use them at a pointed thing. So, one by one one by one it just is spreading out whatever is coming in the frame here. So, only first switch will be operating at this time, when the second slot time will come, second one will be operating, then r 2 will be operating then again one will operate then 2 will operate and so on. Round robin fashion they are actually all operating one by one. I can do something smart actually, I can use this itself gives a clue that I can replace this whole thing by nothing but one single space switch.

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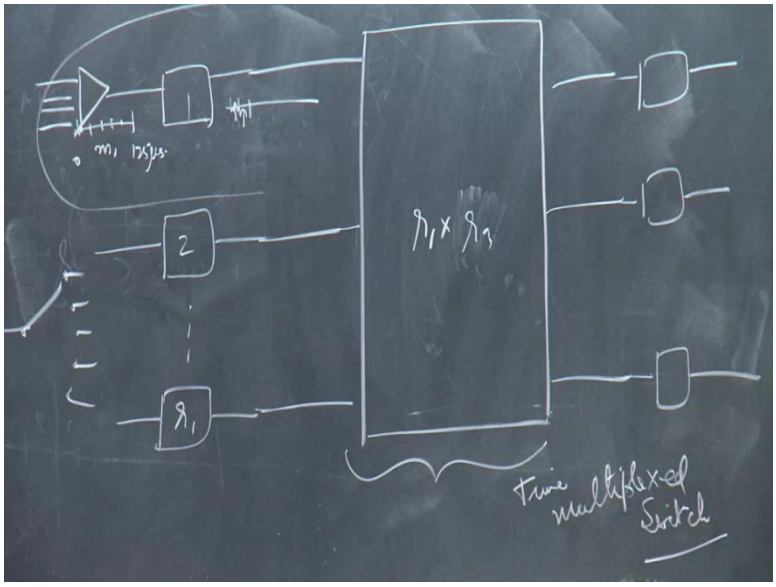

And this space switch is of, how much dimensions? r 1 by because, the r 1 inputs are there, m 2 is equal to r 1, and n 2 is equal to r 3. So, this will be r 1 by r 3 switch technically. So, there is instead of having r 2 switches I have only 1 switch only problem is, when the slot number one will come it is through some interconnection pattern, it will act like switch number 1 or middle stage, when slot 2 will come my interconnection should change.

So, I should be able to build up a control system, by which this switch configuration will keep on changing with every slot. So, it will be able to operate as r 2 switches because they are happening in different time slots. So, it is technically possible, and this is known as time multiplex switch, because of this.

Student: Sir, where to multiplexing happening in this…

This switch is a single switch, but it is acting as r 2 switches, and it is happening in time multiplex mode. So, is a time multiplex space switch actually. So, it is not multiplexing of signals, it is a multiplexing of space switches which is happening in time. So, it changes every 125 micro second, and two times it will change, n 1 times it will change. So, n 1 is the number of slots, which are here.

It will take n one different configuration every 125 micro second, and this is nothing but equivalent configuration of clause network, but this is a time space time configuration. Now, we did this spleen on blocking things last time. Now, can you give me the condition using the same clues, what will be condition here for speed on blocking switch? How you will find it out here? You should be able to do it actually.

Use same principle that, how many these ports will be busy in worst case? There is 1 free port here 1 free port here they have to be connected. So, how many maximum ports here will be busy? How many maximum ports will be busy here? So, how many slots can be in worst case busy here? m minus 1 take a symmetric case, again the way last time we did.

So, here it is m n this is again n, and here it is again m. So, in worst case here m minus 1 will get occupied, because 1 is there, 1 slot is there, which need to be connected to 1 slot here. So, only m minus 1 slots are occupied only m minus 1 will be occupied here. And this switch is operating as in every slot some switch, in worst case scenario if you look at this particular frame.

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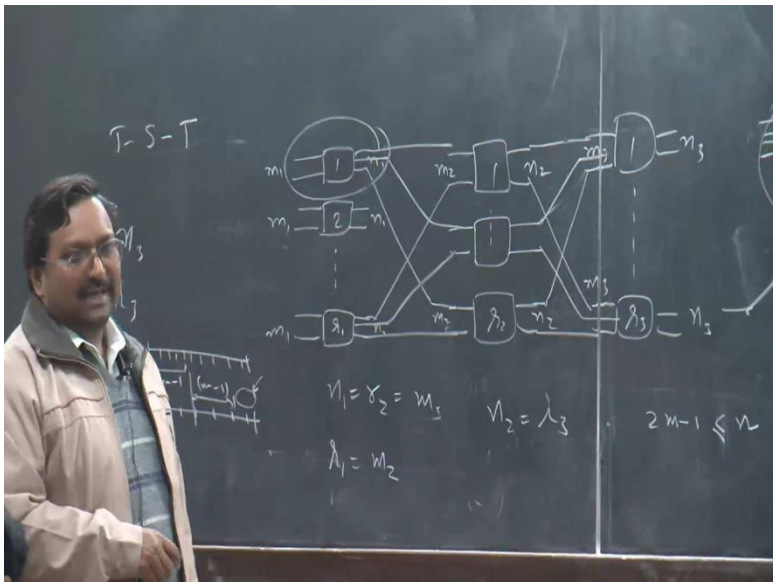

And this frame, the occupied slots may not have any overlap. They will be like this if you take these two slots, this another one. So, you have m minus 1 being occupied here, worst case scenario from here onward again m minus 1 occupied. There is no overlap of time is very similar condition, and if I can have I have these extra slots available extra slots available, I can always use that to set up the connection. So, condition is 2 into m minus 1 plus 1, and that condition was a number of switches here.

Here, switch is only one it is in time multiplex mode. So, the condition is now on the slots here. This condition is on the slots. And this condition will turn out to be same 2 into m minus 1 greater than or equal to n, is m by n switches in the 1st stage, n by m switches in the 3rd stage. And whatever number of switching elements you use here that is the cross bar size in the middle stage. But, it should be able to switch very fast. So, we will actually do this exercise is of actually building up the circuit, circuit dichromatic by which we will figure out how this switching actually happens.

Student: ((Refer Time: 42:36))

Sorry right you are right, this should be this you are right. So, now, actually I can also do because, I have about 8 minutes, blocking probability estimates. Now, this going to be valid for this case as well as for the earlier clause networks both. So, this approach, because carno's approach will take time. Let me do, what is called lease approach? And we already know when the probability of blocking goes to 0.

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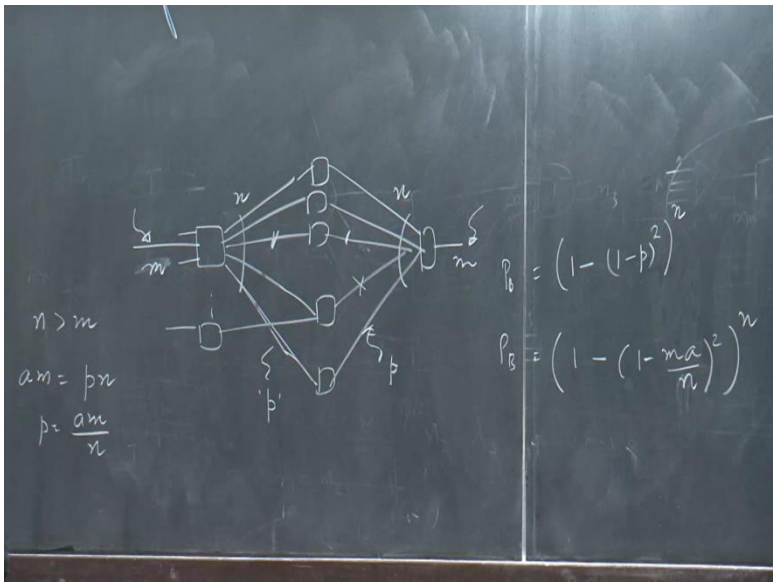

And you will be able to find out that under this condition, this approximation does not give you the blocking probability equal to 0. So, the case here is a incoming port it is connected to middle stage switches, one link to one switch. So, this is free outgoing port this is free incoming port, probability of blocking is when both are free I will not be able to set up the connection. And we assume that this switch has n incoming port, I am just let me keep m only because, that is for consistency using m by n and these are n outgoing ports.

There are other switches of similar kind, those does not matter for us actually. I can only take this it will also give me the same blocking probability. So, when the switch will I will not be able to set up the connection. I can now, do some approximations one very simple is; I can assume that this link is going to be busy. I can assume it the probability of that, let this probability be p is a probability with which the link will be occupied or busy.

Now, remember these two links are dependent I can even I can make that assumption actually that is not true, but I am making that this assumption. But, you may say because, there is only one path whenever this is busy this should be busy no that is not true. There are other switches also. So, if I set up a connection this way I can occupy this one, but this link is free that is possible. So, input links and output links that is the way we define are independent of each other.

And they get occupied with a probability p both of them. So, this also gets occupied with probability of p symmetric condition. So, this m here this n here, and when you will not be able to set up the path, if you can find out even one switch and any one of this for which incoming and outgoing input and output links both are available. You will be able to set up the connection, this is said to be non blocking this element and this element is also non blocking.

So, probability of blocking, now this to pair is not free, what is the probability of that? 1 minus that both of them are free that is the probability, that will happen either this is busy or this is busy or both are busy together sum of these three possibilities. So, I will do 1 minus p that the link will be free, both the links will be free because they are independent. So, I can simply multiply the probabilities, 1 minus of this is the probability, that the path will be through that switch will be busy. So, 1 minus of that, and how many such links are there? n such bridges are there n such branches. So, this the probability of blocking estimate.

But, how you will get the p? So, we take here simple example n usually is larger than m. If it is smaller than the blocking will happen at this itself. So, blocking is not happening because of switch it is always happening, because of the interconnection network. So, I will assume that a is the arrival rate or arrival probability, a link incoming link will be busy that occupancy probability is a.

So, a into m should be equal to p into n the balance condition always statistically. Because, when ever this link will be busy, one link has to be busy here, and since the n is larger, so probability a link will be busy will be lower actually. So, n multiplied by the p should be equal to m multiplied by m. So, I can get p from here as a into m by n. So, because m is larger n is a smaller. So, a is multiplied by a fraction. So, p will be smaller actually. So, I can write that thing here. So, this was one of the crudest approximations, which was invented earlier. Now, you put value of n is equal to 2 m minus 1, do you get a 0?

Student: ((Refer Time: 48:38))

m by n, sorry you put n is equal to 2 m minus 1, you would not get a 0. But, we know we actually have no blocking at that point p should be 0. So, this estimation is an approximation, does not give the actual estimation, and reason is that they are actually

the reasons are that your arrival rate here, is dependent on the state. I can define the state as number of incoming links is busy, and number of outgoing links is busy probability of blocking dynamically changes actually with that, depending it is a state dependent.

So, if I define this signal as a state technically probability of blocking is function of state sigma. So, I have to average it out over all states. So, here it was all state independent things. So, tomorrow's class, what I will do? Because we are making the recording. So, quiz will be done separately this time it will not be in tomorrow's class. So, most likely tomorrow night you have to sit on your computer.

So, we will do a trial run, and after that I think quiz will be done live online itself. So, there will be a time window it will open for I think 20 minutes within that you have to write down the answer on the computer. So, you will try that thing out because, I cannot afford to waste time in taking the quiz otherwise; recording will be of shorter duration all recording has to be of 50 minutes duration.

So, tomorrow you will have a regular class. So, quiz most likely will be happening, I think tomorrow night I will be doing the we will be I will be doing trial and then. So, that you also know how it is done you will get some mock result, and mock marks also in that. So, day after tomorrow you will actually have the regular quiz, depending on yesterday's result marks you will get automatically at the same time, it will be automatic grading by the machine

Student: ((Refer Time: 50:55)).

Objective, but then the problems statement made in such a way that you have to do something before you can give the answer. It will be negative marks. So, you can get minus also. So, your mark sheet will contain negative marks. So, that is the only thing.

Student: ((Refer Time: 51:49))

There can be more they have to be made more because, you should not get time to do the cut paste from all them from one person to another person. You all might sit down on the same laptop. So, from one single laptop two people cannot give the answer I have to ensure that. So, that way our system will also get tested. So, tomorrow we will do the trial around I think it will be 10 midnight 10 evening will be fine.

So, all of you can be in your house and do it from there itself, but you have to arrange for a machine that is the only thing. So, and everybody has the net connectivity, and machine log in the same Bruhaspathi log will work. So, only thing is it opens at that particular time it actually closes also at dot time. So, even if you are 1 second late it would not accept the answer after that. So, that is why I will give multiple questions if you have miss you miss only 1 question not 1 not actually, there is no it will not be 1 question may be say five questions.

Student: but any problem during happens during technical connection what is ((Refer Time: 52:26))

Then most likely there should not be that is why there is a rehearsal.

.Student: ((Refer Time: 52:36))

If it is true for that time most likely it will be working. We have tested the system, and if there is a problem we have to understand and resolve that issue. And you get more and more study, we should be able to figure out that there is actually is a problem you cannot simply say there is a problem. And if it is going to be a problem I will take I will just call you for 15 minutes probably on Saturday, and I have the quiz that time.