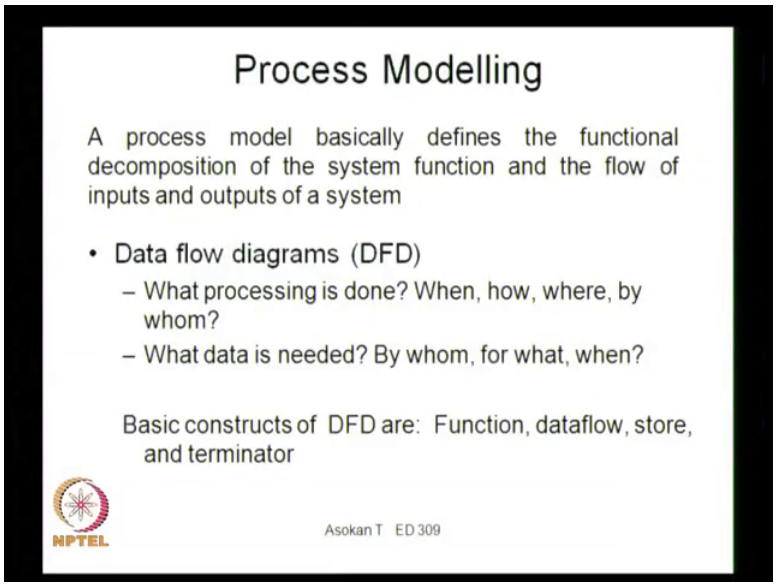
Principles of Engineering System Design
Dr. T. Asokan
Department of Engineering Design
Indian Institute of Technology, Madras

Lecture - 24
Process Modelling

Dear friends, welcome back to another session on Engineering System Design. In the last class we discussed about the graphical modeling techniques and we saw few techniques for data modeling. Basically, to identify the relationship between various entities in the system, how do you use the graphical modeling techniques to represent these relationships? We saw a few diagrams like a entity relationship diagram or ER diagram we saw about complex ER diagrams, and then we discussed about another diagram called high graph.

So, all these used for basically modeling the data in the system or the relationship between various entities in the system.

(Refer Slide Time: 00:52)



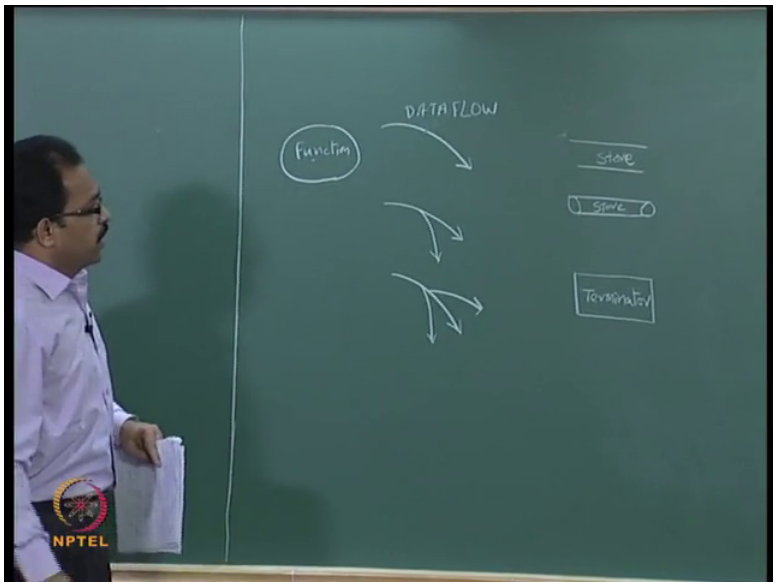
Today we will discuss about the Process Modeling. As I explain the previous class a process model basically defines the functional decomposition of the system function and the flow of inputs and outputs of a system. So, here it is more like the functional decomposition. So, we use the process modeling to identify the functions in the system,

how do we decompose the functions into small functions. So, that is the main purpose of process modeling techniques.

The one of the important diagrams use here is the known as the data flow diagram or DFD. In data flow diagram we try to identify. So, what processing is done, when is it done, or how is it done and where by whom and for this what data is needed and by whom for what and when. So, these are the things we need to represent using the data flow diagram, basically looking at what process is done, when is it done, how is it done, or by whom it is done and what kind of data is needed and who provides the data, from where the data comes, or where the data goes out and how the data processing is carried out. So, these are the basic issues we represent using the data flow diagrams.

Let us see how actually we can develop the data flow diagrams to represent these processes and then see; what are the different waves of representing the data flow diagrams. As we can see the basic constructs of DFD are function data flow, store and terminator. So, these are the 4 basic constructs for the data flow diagram, first one the function, as you know a function is the basic NDT of a any system. So, the function is basically represent using a circle in the data flow diagram.

(Refer Slide Time: 02:35)



So, we use 4 constructs. So, a circle or an owl is used to represent the function or the system. So, this is the first constructs and then we use another one called data flow. So, data flow is basically represented using arcs. So, we use this kind of arcs to represent the

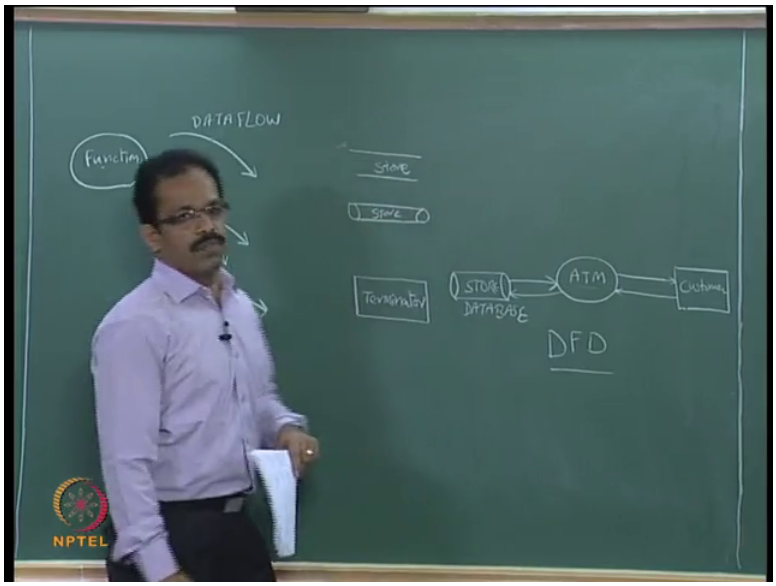
data flow. We can actually have different kinds of arcs you can have a single arc or you can have a branching arc, or you can have multiple branches also in the data flow diagram. So, we can have multiple branches representing that the same data is being flow on to different entities.

So, this is the function, this is the data flow, this is the construct one, this is the construct two data flow. The other one is known as a store or the storage space. So, this is represented in different ways you can represent the store. So, sometimes it is represented like this as a store basically to store the data or to (Refer Time: 03:38) data from the store. So, we use the term store, or it is represented the sometimes like this also. So, this is the third construct used in data flow diagram. And the forth one is known as the terminator.

So, terminator is nothing but a an external system represented using a square. So, this is the terminator. The store represents the storage of data terminator represents the termination of that particular process or the function where the output from the whole process which go through the terminator and there the flow ends. So, these are the four constructs. So, we use a function or a system we represented using a circle or an owl.

We use the data flow, we use arrows to represent the data flow, and then we have a store for database and terminating the function or it more like an external system which actually provides you, or it actually represents the end of that particular process. So, that is the terminator. Let us take few examples to show how we actually represents or use this kind of data flow diagrams to get the or to represent a particular process. So, let us take a very simple example just to see a system taking data from the database and providing to a customer. In the case of an ATM or in case of any other transaction with we do the transaction if using a database, you can provide the data from the store and give it to the customer.

(Refer Slide Time: 05:21)



So, here you can see that the system will be represented like this it is a very simplified representation of a system. So, like it take an ATM as a system. So, this is a system and then you will be having a database where the account holders will be get. So, this is the store or the database we called as database and from here the data will be going and there will be a flow from here the information flow will be from this direction also and then this will go to the customer. So, here the customer will be the terminator, because the transaction ends with the customer.

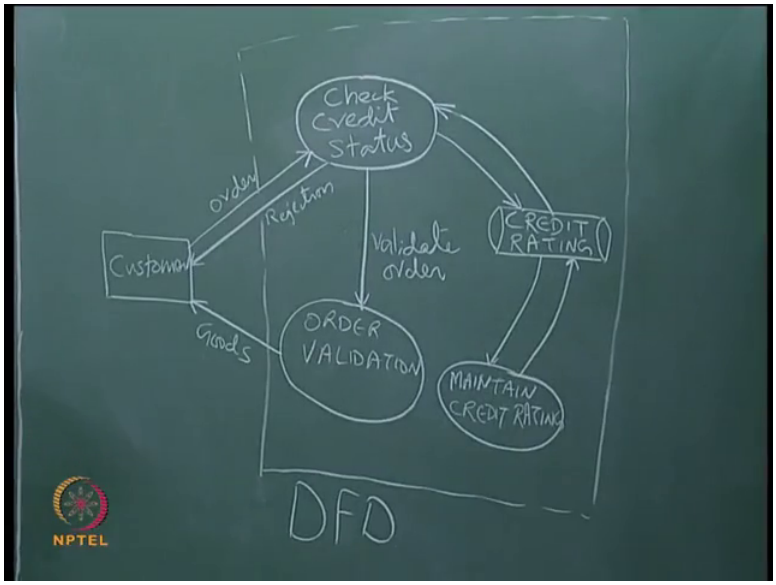
So, customer will be the terminator here. So, this will be there and there will be information flow here. So, this is the very simple data flow diagram for a transaction. Of course we need to represent all other transaction which is going on inside the ATM using complex DFDs, but this is a very simple way of representing the transaction, you have a data base you have an ATM system and you have the customer.

So, the data flows from the store to ATM storage or, database to ATM or request for database is coming from ATM to database similarly the customer ask for some transaction and ATM provides the transaction. So, it flows the processes or the flow of data within the system and it is components.

As we can see here, we are using the system representation the storage representation as well as the terminator and the data flows. So, that was a very simple example will take an

example of a credit card transaction and then see how to represent the transaction using the data flow diagram.

(Refer Slide Time: 07:14)



So, here you can actually represent the customer as a terminator here, and then you will be having different functions here.

So, one is basically credit status that is the function. So, this is check credit status, that is one function, whenever the customer wants to have a transaction or wave and he places in order customer makes an online order through credit cards, there will be a credit checking by the system. So, if you can not the whole processing system as a if you represented it inside a box and you can see there are multiple functions one function is to basically check the credit status.

Then we will be having a data base which is basically the credit writing of the person; so the data from the credit rating. So, there will be an enquiry from here to the credit rating and then there will be another function which actually maintains the credit rating. So, maintain so this is another function maintain credit rating. So, based on this there will be a data flow from here and from to here.

And based on this information, it may sees the order will be validated. So, order validation will be another function, this is the order validation and this will be connected here. So, validate the order is validated then this will be providing the service to the

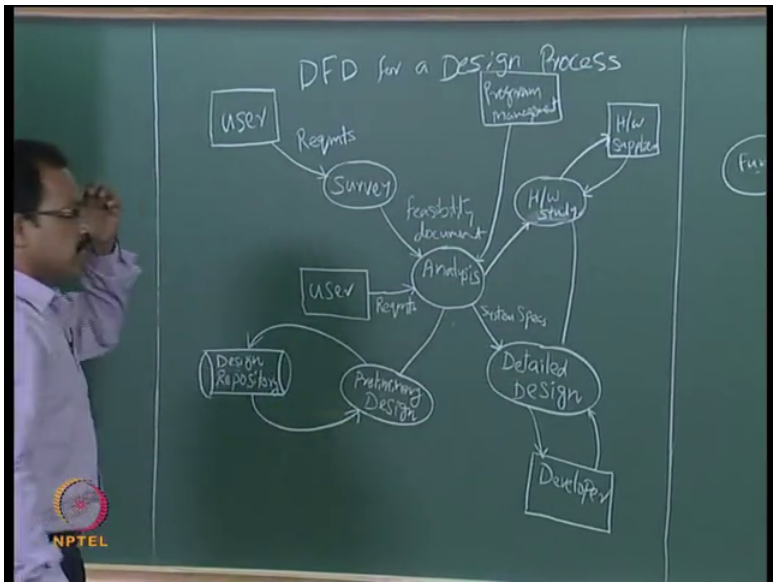
customer. So, this again a flow, so here should I have one or we can have a reject order based on the validation. So, this can be a the order. So, we are placing an order here and then this can be the rejection. So, based on the credit rating and they taking of the credit status, this will be rejected or accepted, it is accepted it will be validated here.

So, it is validation of order. And finally, the goods will be delivered to the person. So, this is the data flow diagram, DFD for a credit card transaction. As we can see here are the four constructs are here. So, this is the terminator which actually the process ends with the customer and as well as it starts with the customer, the customer places an order an online transaction and there is a process or the function which actually check the credit status of the person and to check that one relies on a database the credit rating database and based on that information the credit status it will be accepted or rejected, and it is accepted then it will be validated the order will be validated, that order validation function will do that process and then once it is validated then they goods will be delivers.

And at the same time the credit rating will be updated based on the information provided to the database, and this maintenance of the credit rating will be done this process based on the information it is gets from the credit rating database. So, this is the way how the data flow diagram is created for a particular transaction. So, like this you can actually have various transaction and various processes can be easily modelled using the data flow diagram. Let us take one example for the system engineering design. So, as you know that there are different processes in the system engineering.

So, how do we actually represent the system engineering design process using a data flow diagram? Since we are familiar with most of the processes involved in the system engineering it will be easy for you to understand how that is represented using a data flow diagram. So, here the user of course, it starts with the user.

(Refer Slide Time: 12:00)



And then there will be processes which actually surface the users. So, this is a process of customer survey, or the uses survey to find out the requirements. And then this will be analyzed by another process. So, there will be an analysis of the surveyor results, analysis and based on this will be having a preliminary design.

So, based on the analysis will be having a preliminary design process. So, this is the preliminary design. So, the I am just writing all the processes first, then we will look at the database and the other transaction of the data. And once you have this preliminary design then there will be a strategy for the design of the hardware. So, there will be a hardware design or hardware study. So, study the possible hardware solutions, then we will be going for the detailed design of the system.

So, these are the main processes involved in the design, now you look at the what kind of database is needed for this kind of a design process. So, one is that there will be a design repository or the design database. So, whenever you go for a preliminary design we look at the existing designs. So, this is the design repository or were the we have different designs already available. This is a design repository. So, there will be a interaction a dataflow from here to here.

So, whenever if you make a new design that will be going to the database if you want to take some existing design you will be taking it from the database and it will be using it. Similar, so this flow here is the user requirements, from the user then you have the

feasibility document, based on the survey and the analysis will be having a feasibility document which is coming from the user survey and then again after analysis will be taking few more customize the requirement from the users. So, there will be another input coming from directly to the analysis section instead of going through survey, the analysis team will be directly interacting with the user to get more requirement or the specific requirement of particular customers. So, that is the data flow from the user to the analysis section and then there will be a another terminator which is known as a program management it actually decides about the various strategies for the program or the design. So, this is the program management.

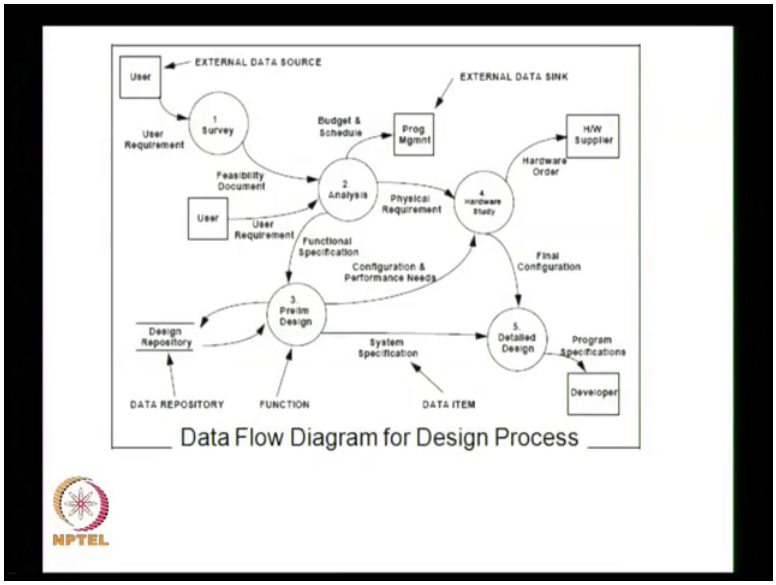
So, it is again another entity which actually will be directly interacting with the analysis team, giving the directions on how to proceed with the design. And then it will be having the hardware again based on the analysis will be having the hardware study, and then there will be other entities like hardware suppliers. So, there will be interacting with this, and then we will be having the final developer who actually produces the system.

So, this is part of the design. So, the developer is the one who actually produces the system. So, we have detailed design that will be communicated to the developer will design the system and there will interact and design the system and deliver the system. So, these is the design depository the database and then second see here the interactions are here design repository and the preliminary design, and this analysis one of the major functions in the system design process. We can see there are lot of interaction with the other entities and you can see that flow of data in this particular process the survey data will be coming the user requirements will be coming there similarly the program management the requirement of the top level management in that particular design will be coming.

Similarly, the details of the hardware accessing hardware and the requirement of hardware will be interacting with the analysis team. All these data is completed then it will be going to the detail design of course, there will be an interaction between the detailed design team and the analysis team also. So, here actually the system specification will be given system specifications, a system specs will be delivered to the detailed design team. So, this shows the DFT for a design process. So, you can say this is the data flow diagram for a design process.

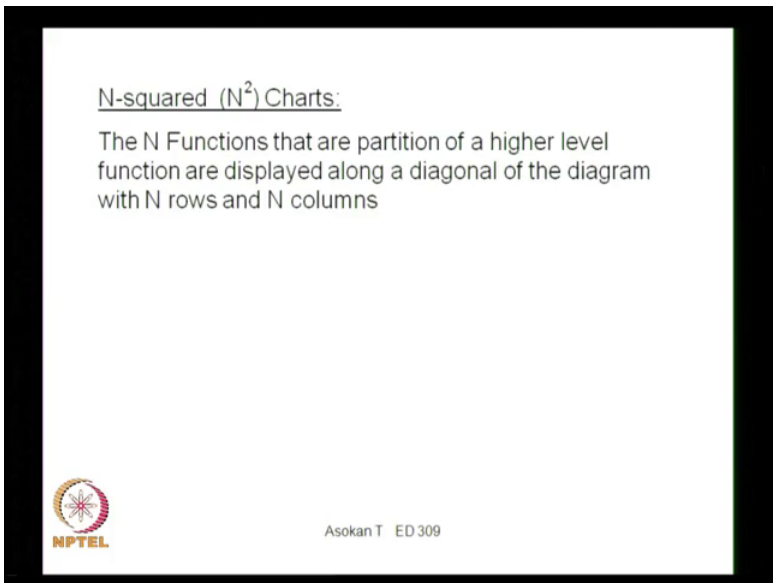
So, by looking at this kind of data flow diagrams will be able to identify what kind of interactions are taking place between various processes or what are the main processes involved in the design and what kind of interactions are taking place, what kind of database is needed or what kind of data flow is taking place between different processes can be easily understood using the data flow diagram.

(Refer Slide Time: 18:00)



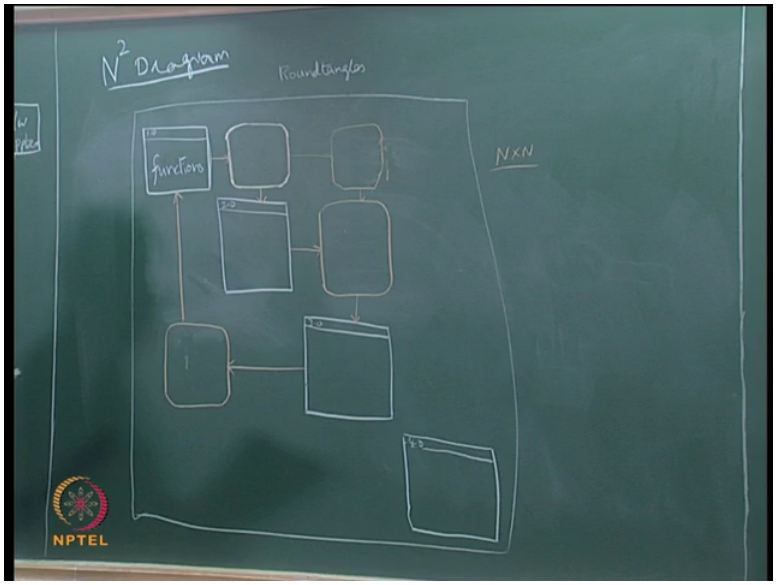
That is one type of process modeling and another one known as N 2 charts. So, N 2 charts are basically or N 2 charts or sometimes it is known as a n square diagrams.

(Refer Slide Time: 18:15)



So, the N square diagrams are basically a functional decomposition process it is giving almost the same kind of information given by the IDEF0 diagram we discussed about IDEF0 diagram in one of the lectures earlier. So, why a similar kind of information is provided by the N 2 diagrams. The name N 2 comes from the structure or the way it is appearing normally if you have N functions or N sub functions in a system.

(Refer Slide Time: 18:49)



We write all those functions sub functions as a diagonal of a rectangular shape.

So, we will write down all those functions as a diagonal of a rectangle. So, these are the N function. So, if you have N functions. So, it will make it as a N by N square, will make it as an N by N array N represent the main functions along the diagonal. So, that is how the name comes the N 2 diagram or Nn square diagram. Now the main functions will be representing along the diagonal and we give the number 1.0, 2.0, 3.0 and 4.0 and so on.

So, this is the main function or the divided functions of a system now this functions are represented using a rectangle or a square shape and the other functions are written over here, then the interaction between this functions are represented using something called I mean a shape like this. So, these are the rectangles represents the main functions or the functions will be represented here, these are the functions and the interactions are represented using we call it as the round tangles.

Basically a rectangle with the are the rounded corners. So, these actually represented the interaction between different function. So, this is the interaction where you represented using round tangles, and here the kind of data flow is represented using arrows here. So, if there is a data flow from this function to this function this represented like this and this is the forward flow of data.

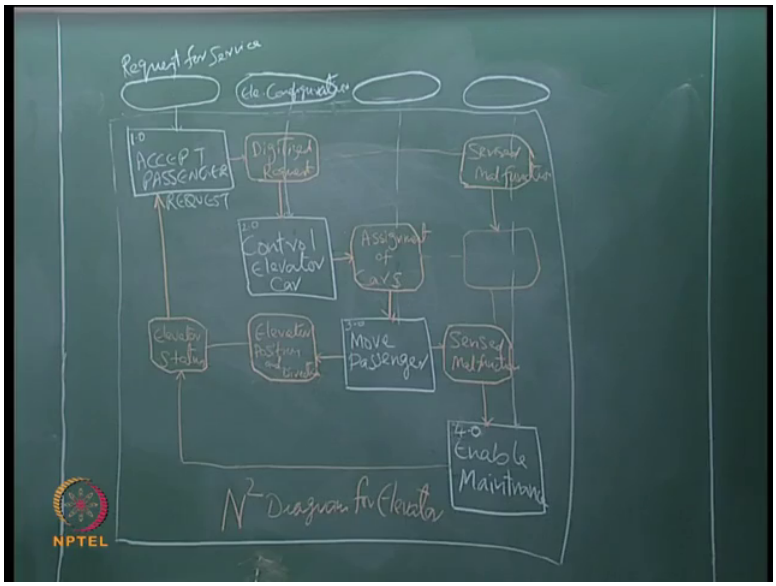
Similarly, you can actually have this here also round tangles which actually represents the interaction function or interaction between these functions. And whenever there is a feedback from this function to the other function then which will be given represented like this here also again we will use the round tangles to represent the interaction.

So, finally, you will be getting an N by N array, because when we have N functions along the diagonal you will be having an N by N array of functions as well as the interactions and that is why this is known as an N 2 diagram or N square diagram by the convenient for functional decomposition. As I mention it provides you almost the same data as IDEF0 diagram IDEF0 is more of a standard developed for the air force, but this is commonly used diagram employed by many industries, is not a standardized one, but the actually provides you almost the same information as the IDEF0 diagram.

You can use any one of these diagrams to represents the functional decomposition. So, this is the way how the interactions are represented, you can have many kind of interaction over here. And, you can have this actually directly interacting to this also like that you can have all kinds of interaction can be easily represented using this N 2 diagram can have the functions along the diagonal and the interactions represented along the sides. So, you can have on the right side will be more of a data flow to the next function, on the left side will be the data flow back to the functions.

Will take a few examples and then see how to use this kind of N 2 diagrams for actual functional decomposition. One familiar system should we have discussed few times is the elevator system. So, we will see how to represent the functional decomposition of elevator using the N 2 diagram. So, here as I mentioned we will start with sub functions.

(Refer Slide Time: 23:43)



So, we can actually identify many sub function for the elevator, the first one is the; I will write it as accept passenger request. So, this is one function.

So, (Refer Time: 24:00) now 1 and then we have other functions. So, we have 1 2 3 4 functions here. So, we will draw four rectangles. So, this is 2. So, accept passenger request then control elevator car, then move passengers basically move passenger between floors, then enable maintenance. So, these are the four main functions of the elevator. Now we need to find out what kind of interactions are taking place between these functions and what kind of information processing confirmation is pass between the functions.

So, this can actually be represented using the N 2 diagram. So, we have 1 2 3 4 sub functions, now you see what kind of inputs are. So, with this is the N 2 charts, basically this is the N by N array, now we can see what kind of inputs are coming to the function external inputs can be represented and the top for are the sub functions. So, any input coming from the outside and that will curve here can be represented like this.

For example this will be the request for service. So, that can be one inputs similarly you can have different inputs like emergency support, or etcetera supports for those are the inputs coming to the first function accept passenger request similarly you will be having the input here as the elevator configuration, like this there maybe many inputs coming to

the system like regulations, safety regulations and the building regulations those things maybe an input to the main net service.

So, these are the input coming from the external to the system to this functions. Now you are to see what kind of inputs are coming from internally or from this functions. So, here this will be the will be represented as using a round tangle. So, this is basically a digitized request. So, the digitized request will be coming from this function the first function to the second function. So, this is the digitized request coming from here and then flowing to this one. Similarly there will be a output coming from this function, this will be basically the assignment of cars.

So, assignment of cars for various flows will be the output from here, which will be going to the move passenger function. Similarly here sensed malfunction could be a output, so when there is a malfunction in one of the cars that will be sense and so that will be another output from here sensed malfunction. If any one of the car is not functioning, but that will be given as an input here and output and there will be given as an input to the enable maintenance.

So, this way you can identify or the process or the information passing from one function to other function. Similarly there will be a sensed malfunction coming from all these functions. So, here if it is not working properly or there is a malfunction in one of this function. So, this will be a sensed malfunction, similarly here also you can have a similar one. So, all these will be connected to this one. So, if there is any problem with any one of these functions that will be sensed and that information will be passed to the enable maintenance section.

Similarly, there will be some kind of feedback coming here also, from move passengers the output from here will be the present position of elevator, because we need that information to provide the output to the passenger, or the feedback to the passenger. So, whenever there is a movement of passenger the position of the elevator will be given as a feedback. So, elevator position and direction of motion will be given as an output, through the complete elevator status will be generated here.

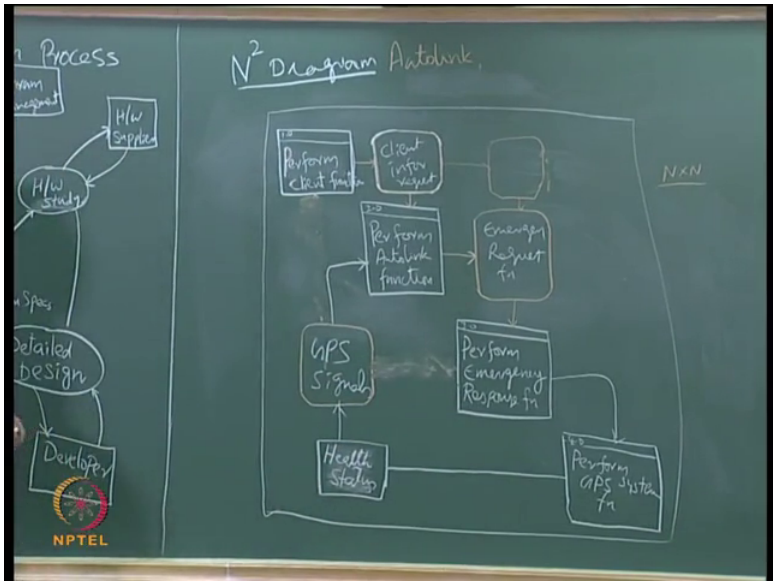
So, elevator status and that will be going as a input to the accept passenger request function. This is the output from here which is coming as a feedback to the first function. Similarly you can actually have this elevator maintenance also will be giving a output

here about the position of the status of elevator and that will be given as here and then compare that output will be going to the accept passenger request function.

It should be giving an output to the passenger. So, this is again a simplified representation you can have more complex or you can represent all other functions also in this one. So, this is the N 2 diagram for elevator. So, this is almost similar to the IDEF0 diagram what you already studied you can see that these are the functions and again you can actually go to the next level you can take this function alone and then identify all the sub functions and then again create another N 2 chart, and identify all the sub functions as well as the data flowing from one function the other function as well as the feedback coming from the functions back to the sub functions.

And here we can represent are the inputs to these functions. So, this can actually be extended you can have many charts like this and to find out all the sub functions as well as to find out the interaction between these sub functions. Let us take one more example. So, here I am taking the example what we already discussed while explaining some of the system design examples. So, here I will take the example of the auto link system.

(Refer Slide Time: 31:25)



So, we already discussed about the auto link system, which is a system developed for helping the drivers to locate themselves and to get the directions as well as for emergency support.

So, in this auto link systems you want to develop a N 2 diagram, or the functional decomposition we will identify are the sub functions needed. So, we will write down the sub functions here like, perform client function then perform auto link function. So, these are the sub functions. Perform emergency response function, then perform GPS function, GPS system function, we can consider these are the four main functions to be performed by the auto link system and then and it for request will be provided by this perform client function and that will be passed to the auto link function.

So, this request will be passed here and then there will be an emergency request function basically the auto link function one of the functions is basically to provide the emergency services. So, that emergency request will be passed to the emergency response function, and then perform the emergency response. So, here there will be perform emergency response will be another function and similarly here from the GPS will be getting the data GPS signals will be coming here.

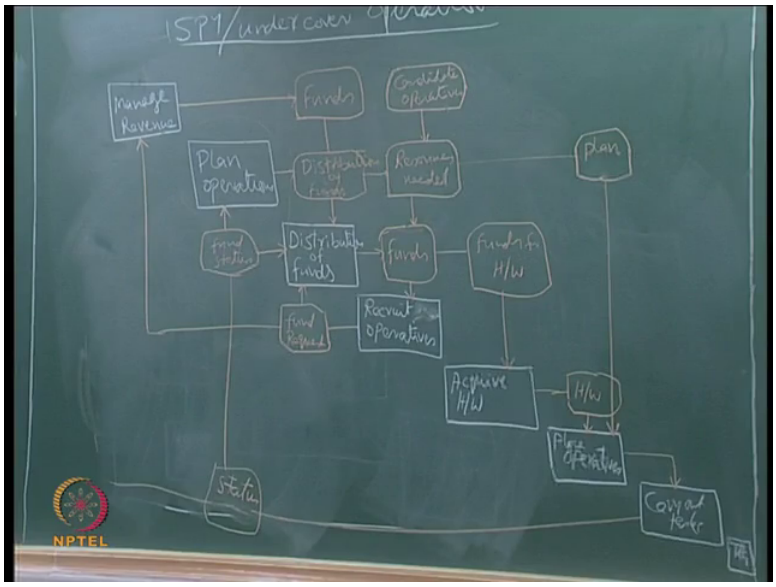
So, the GPS health status as well as the information, so the health status will be provided sorry the health status and there will be the GPS signals and this will be. So, this will be connected to this one, this, this is GPS signals; here there will be the GPS data will be coming here and this information will connected to this one and this data will be coming of the health status and then the GPS signals will be coming and that will be communicated to the auto link functions.

So, this again a N 2 diagram or the functional decomposition using N 2 diagram for a an auto link system. So, like this you can actually develop the N 2 diagrams for many systems or it can actually take some live examples of the system and the how various organizations work also can be represented using N 2 diagram. I will take a example can actually see it operational in various situations. So, this is basically a system were many of the military or the spy agencies or organization which work different situations like underworld operations, or we need to have lot of secrecy in operations. So, such organizations try to have minimal communication between various entities.

So, there may be having various organization entities and various organizational functions, but they will try to ensure that the interactions between these entities are very minimal. So, further they need to ensure that the transaction of data from one entity to other entities very minimal and there will not be any direct transaction of data or money

or whatever the other information is highly restricted. So, how these kind of organization work and how their functions can be represented using N 2 diagram. We will see an example and then look at how they are successful in maintaining the secrecy of their operation by limiting the data exchange between various functional entities.

(Refer Slide Time: 36:11)



So, I will take the something like a spy operation, spy or a undercover operations. So, though they are not really engineering systems, we can actually analyze their operations using the N 2 diagrams, I am trying to explain the utility of N 2 diagram under various situations. So, look at how they work basically there will be a function to manage their revenues.

So, whatever maybe the operation there should be a entity which actually manages the revenues of the organization or the process, then there will be another function lies basically the plan their operations, the other one will be distribution of funds, then recruit and place operatives. So, they need to have people who can actually carry out their job. So, they need to recruit the people and then place the people are for different operations. Then they need to occur the necessary hardware, then the place the operatives so here it is recruit and train operatives basically.

This is then the place the operatives and carry out task, and there maybe another additional function also separate training function also can be added, but depending on whether they recruit and training as a single function or recruitment is one particular

function and the training is another one, then there will be having a another function called training or so. So, I am putting it as t r g training. So, these are the main functions which we can identify with any kind of operations, where they want to limit the interaction between various entities.

So, the person who is actually managing the revenue may not be knowing anything about what is happening over here because there may not be any interaction. So, that can actually be represented using the N 2 diagram and how they actually work. So, here you can see that the manage fund the main operation where is basically to get the funds only. So, here actually the job of this entities basically to get the funds, so that is the interaction here and then go to the distribution of fund agency. And the feedback that will be getting the requirement for the funds from here. So, the funding request will be coming, fund request for recruitment as well as for training that will be from here it will be going to this as well as to the this agency.

And here of course, there will be a distribution of fund function. So, the distribution of funds will be carried out here; distribution of funds and then there will be a feedback about the availability of fund status. So, one important thing you can note down here is basically the interaction with the (Refer Time: 40:57) managing the revenue it will be interacting only with this distribution of fund agency, there will not be even have any interaction about what kind of operations are being plant there will not be knowing because you can see there are now interaction between this entity and this entities and all other entity.

So, the only interaction with this basically the over is distributing the fund. So, the revenue management and the distribution of funds are the only things happening here and all other things are independent of these one. So, there will not many interactions between this function and this function. Similarly you can see that in all other cases also here also the here for the recruitment operation. So, here the job here this is to basically provide the funds only. So, it will be providing funds for the recruitment operation and then the resources needed will be intimated what kind of resources are needed.

And that will be informed here and then the candidate operates will be selected. So, we can see here that the interaction for the plan operate is basically doing this distribution of funds as well as the resource requirements and that will be given to the funds will be

provided to the recruit operation and there will be doing the other recruitment operation I can see that there will not be any the interaction with the manage revenue and a recruitment operation. Similarly the supply funds here and then fund for hardware. So, for caring the hardware, you have to provide a funds for hardware will be provided and then there will be the planning the action.

So, the plan for the activities for the spy work or whatever maybe the undercover operations; so this is the planning plan for action will be given to the these operatives, and this is the acquire hardware, and this hardware will be used for the operations, operatives will be carrying out the operations. So, either will be direct interaction with this one and then the feedback finally, may be going back to the manager revenue or the sorry here to the plan operation.

So, these are the various activities involved in this kind of a spy work or undercover operation, you can see that there will be minimal interaction between various entities you can see that those who are carrying out the actual task or the plans will not be interacting with any other agency accept the operatives on n. Finally, to the planning operation when it is completed. So, none of the (Refer Time: 44:32) people involved in any of these activities will be knowing what kind of operations, or what kind of hardware and what kind of places of training are provided to this agencies.

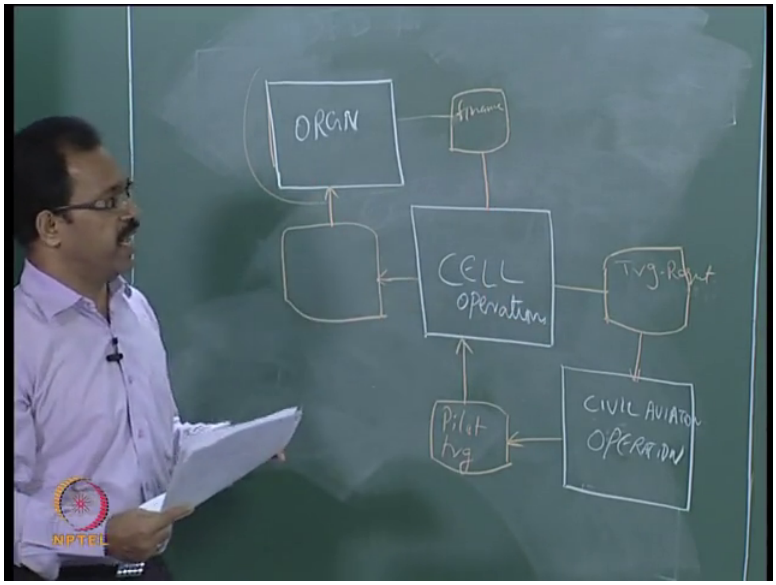
So, we always ensure that the interactions between the entities are minimal by providing this kind of a separate group of managing the resources as well as managing the communication between the functions. So, this actually shows the way how n 2 diagrams can be used for explaining the interaction between various entities or various functions in a real system, that is an engineering system or a social system or a at defense system. We can use the N 2 diagrams to represent the functional decomposition as well as to show the interaction between this functions.

One famous example for this kind of interaction and or lack of interaction in different entities were actually shown in one of the research papers. It is actually analyze the famous or a in famous incident of world trade centre attack as we know that the world trade centre attack by using hijack aircrafts and they were actually all those who were part of this hijacking were trained in the us aviation schools. So, they were actually undergoing the training and they were preparing for it, but it was not possible for the

intelligent agencies to capture them, because this kind of lack of interaction between the agencies who are actually planning the attacks and the those who are really executing the attack.

So, if you represent them in very simple format, you can see that this can be actually represent by three functions.

(Refer Slide Time: 46:25)



It can actually represent by three main functions, or main entities in this one. So, this was the organization, which was actually planning those attacks and this is the cell operations. Basically they call it as the sleeping cells, the cell operation and this was the civil aviation schools or civil aviation training schools or civil aviation operation. I call it as civil aviation operation.

From here there was lot of interaction and from here also interaction was there in and of course, between these two functions there were interactions and here there were interactions. So, here basically the finance and all other help were provided by the organization for the cell operation and here actually the training requirement and all other requirements were managed by this operation only. So, you can see that this particular organization had not direct link with this civil aviation operation, or the interaction between cell and civil aviation operation was totally independent of this organization.

And similarly the output was the pilot training. So, pilots were trained using the civil aviation operation and they were actually pass getting into this loop only. So, this loop was completely away from this loop and that is one of the reasons why nobody could actually trace this cells, or they can identify the people who are actually undergoing cell and what is there intention, because there were no interaction between the main organization as well as the cell operations directly and or those with the civil aviation or operation only the cells were really interacting with that.

So, this actually shows that by providing this kind of framework, where we tried to reduce the interaction is it possible to keep the data safe or to keep the data away from the people who are actually looking for data. So, we can actually use this kind of diagrams to analyze this kind of social systems as well as the security concerns you can analyze the behavior and then try to use this data to understand the type of interaction the type of data flow and then where the various entities interact with the system. So, this is one of the main methods used for modeling the engineering systems and their interactions.

So, in this class we discussed about the process modeling; process modeling is basically to look at what kind of data what kind of information passing is needed, and what are different functions involved, and the when a particular process is to be done by whom it is to be done in what kind of resources are needed for that one and what kind of data flow is taking place. And we saw two methods: one is the data flow diagram we represent the various functions using circular or oval shapes and then the data flow using arcs. And we have another two terms called the terminator as well as database to represent the various entities in the system and then represent flow between this function through the entities using the data flow diagram.

Another method of process modeling is the N 2 diagram, where we have an N by N array of functions and their interactions the main functions are represented along the diagonal and all other interactions are represented using off diagonal elements. This N 2 diagrams basically can be used for functional decomposition that the same time it can be used to identify all kinds of interaction taking place between the functions and sub functions and that actually helps us to identify the various requirements of communication as well as data exchange and gives us the a complete picture of what kind of interactions take place, what are the sub functions, and then how do we actually develop the functional

architecture from the functional decomposition. N 2 diagram gives almost the same information as the IDEF0 diagram, but then again it is a more in formal way of providing the architecture, or providing the functional decomposition in a graphical way.

The next modeling technique is behavior modeling where we try to identify the control and activation of various functions and then the control are structure and how a particular activities activated, or how a particular activity can be stopped or it how can it can be started under various situations. So, all this can be modelled using behavior modeling techniques.

We will discuss about the behavior modeling techniques in the next class, till then goodbye.