Systems Analysis and Design
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Lecture - 25

Last time, we are concluding our discussions, on relation database design. And towards the end of the talk, I was running out of time so, I hurried through the conclusions. So, let me quickly repeat those conclusions again to just recapitulate. What we really learnt about relational database design.

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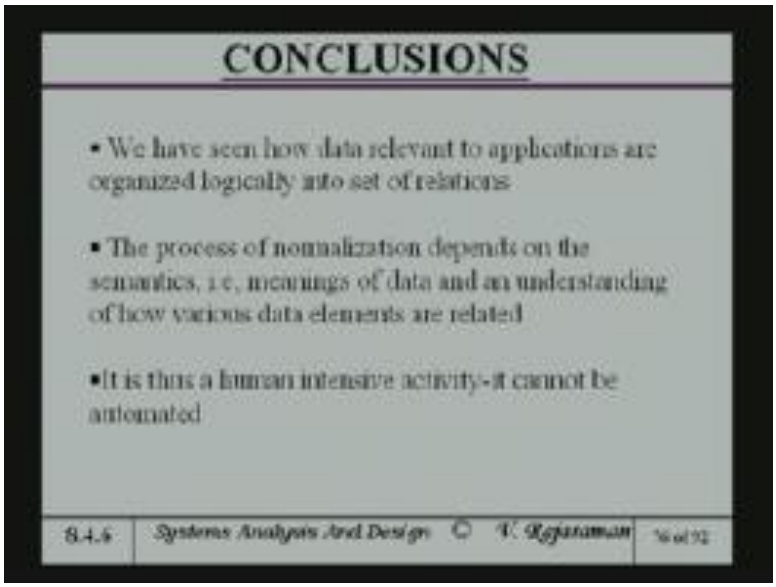

We saw how data relevant to applications are organized logically into set of relations. So, the logical organization is important part, which we talked about. The once we logically organize, there is a requirement called normalization. And normalization as I pointed out is to avoid problems on update, problems in deletion, addition and changes and so on. And to ensure that, when the database undergoes changes, nothing in-correct happens, if go through the normalization steps.

And normalization is a very important part of the relational database logical design. And it depends very much on the semantics of the problem. In other words the meaning of which is inherent in the aim in which the problem is defined. And because it is based on the meanings and getting the relationships and so on. These are human intensive activity. In other words, only people who understand the situation can go through the

normalization with the proper kind of a correctness or care. And one cannot unfortunately or fortunately dedicated to a computer.

In other words, that was not exist in a algorithm, which will automatically do the normalization. And it is fortunate from the point of view of systems analyst. Because, he can exercise his intelligence job and so on. And that is very important. So, it is a human intensive activity, it cannot be automated.

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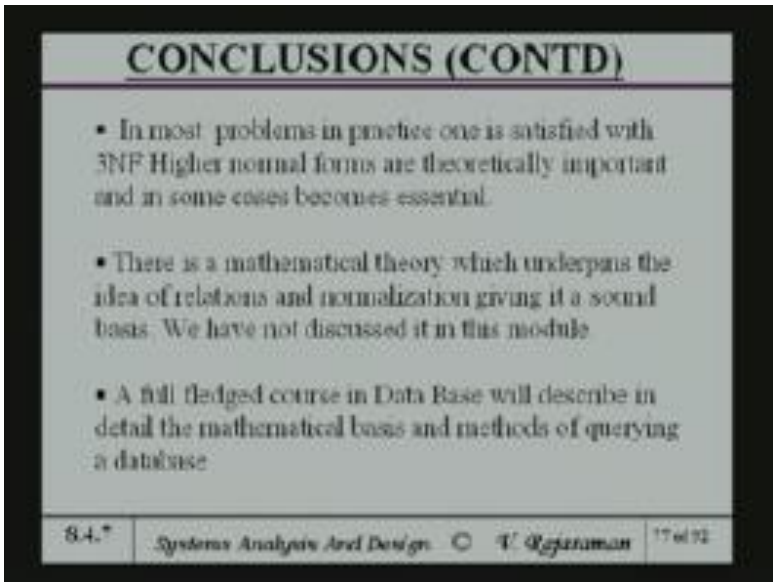

In most problems we went through a number of normal forms. One first normal form, second normal form, third normal form then BCNF; then fourth normal form and fifth normal form. And normally, in many situations people are quite satisfied after the third normal form. But, that does not mean, that one should stop at the third normal form. Depends on the problem and one has to kind of look at the, what statement of the problem.

And also look at where are the applications are going to occur of that logically designed database. And they have to go up to whatever, level of normalization is appropriate, for that problem. So, it is theoretically higher for normal form important. And practically also in some situations, you cannot ignore them you have to actually be concerned about them. But, you definitely understand up to the third normal form very well. Because, of the fact that higher normal forms always based on the lower normal forms.

In other words, the third normal form is contained in the fourth normal form. And fourth normal is contained in the fifth normal form. In other words, you cannot go to lower normalization steps, unless you satisfactorily complete the previous normalization step. So, it is a step by step normalization. There is a very sound mathematical theory, which under pins this idea of relations, idea of normalization and there is also called a relational calculus.

And we are not discussed that in this particular module, for a simple reason that those aspects are fairly important in detail. And so in a computer science curriculum, an entire course is normally devoted to that particular subject. So, because of the fact, this is a introductory course on the design of information systems. You should really understand that is we talking about systems analysis and design. And systems analysis and design, the idea of having relations and having a logical database design is very important.

And that is the reason we have discussed it at a level, which will give you the working knowledge. Without really giving you a fair amount of detail is running under pin theory; which of course, as a computer science student you should understand better as you go along. Because, that will help you, also in understanding much more deeply the reason for normalization. And the logic, behind normalization. So, this is the one aspect of database that is ending up with a normalization of a database system.

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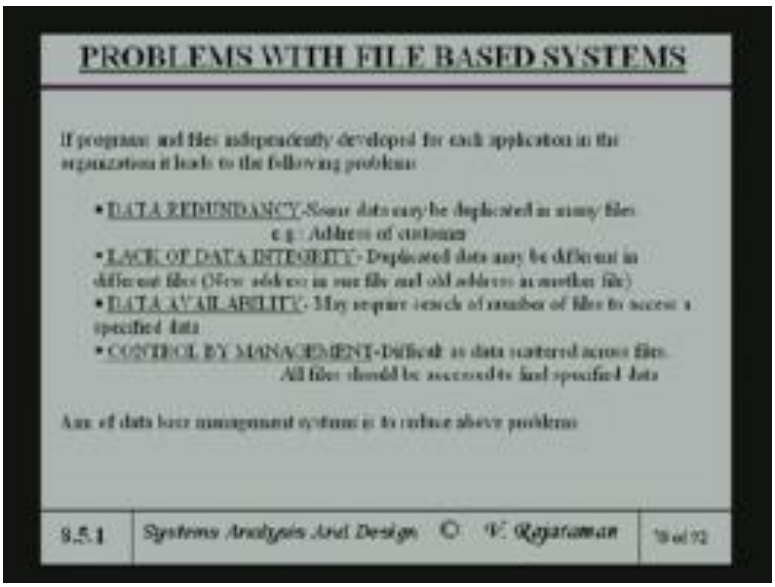

Now, let us just look at the fact, I write little bit of historical study here. The sense that what I mean, by historical is, before the advent of database systems. All designs and all systems were based on what are known as file based systems. What is mean by file base systems is suppose we have normalization, a number of different applications. For each application a file is designed. Let me take an example of what I mean by this.

Suppose, you have a university, where you want to computerize the activities of the university. Particularly when it comes to university, the most important part of the university are students. So, we want to computerize the activities related to students where, number of parts in a university which deal with it And very often what is done is one aspect of the application is started first and other aspects follow and they are normally not very well integrated.

As in fact, it is sometimes done by independent what I would say design (Refer Time: 08:44) and very often it is actually formed out in other words, it is outsourced to some small company to do this work. So, first they look at, one of the things we always look at is the academic part namely, the examination results and can be coming of the mark sheet, coming of the grade sheet and all that there is an every part to computerize.

And that is the one which is normally done in most universities first namely, the academic part namely examination processing, results processing and creating a mark sheet by computer. So, for that a file is created, the file would normally have a students, role number, students name and address and it temporary address and permanent address where the grade sheets have to be mailed, local guardians name, guardians name, the parents name or guardians name and is permanent address and many such details say age of student, which course he has taken and all that.

So, the number of what I would call fields in a card, corresponding to a student and they normally organize as a sequential file in some ascending order of roll number or and that way it is because of fact that examination results are not processed every day, they are processed periodically say once in a semester, once a year, a simple sequential file is what people designed and worked with.

So, that will be, that is the first thing people will do. Then another file system comes up normally, somebody says where we are also look at the accounts part in other words, have the accounts section to have a file, which determines whether a student has paid his

fees. And has he paid in time and various components of a fees, which universal charges had they all been paid, has been a caution deposit been taken, all those things.

That again will have the same kind of data roll number of a student, name of the student and so on. And of course, in addition to marks, which is there in the academic part here instead of marks, there will be fees paid, fees pending and stuff like that. So, there will be another file, which will be followed up if a student does not paid his fee then of course, remainder will be sent and fee will be collected and so on, whatever purpose it is.

And also it is a use for an another purpose namely, what are the total amount of fees collected. And it will be used in budgeting of the university that is fees collected is one aspect, one part of the income of the university, that will be used for various budgeting requirements and so on. And then suddenly one may decide that hostels are also need to be computerized. So, not every student may live in a hostel.

So, that will be a hostel database, it will be created which will again have roll number, name, local address, permanent address, room number, which year he is in and all those things. So, there may lot of details which are relevant to hostel, nothing else. So, that will be a file related to the hostel. Then the one more suppose, we also decide that we want to computerize library operations and a library issues of books, return of books and so on.

There again the subscribers to the library, which will be part majority will be a students of course, and of course, there will be teachers are also are are eligible to take books in the library, there will be another file created for the library. And so there are multiple files, which are created and what that means is that automatically there is a data, data redundancy same data like the name of the student, student address, guardians name, local address, permanent address and all that when they are repeated in all these files.

So, there is a redundancy and once it has been redundancy then there is also some kind of lack of integrity. In the sense that suppose, a student changes his address, he may inform the academic section about the change of the permanent address, primarily because he would like to receive his mark sheet who is from home, home address whereas, you may not have informed the library, he would have forgotten about it.

So, the library may still have this old address and the academic section will have a new address and these two will not be matching. And sometimes what happens is while

address is being entered, a wrong address may have been entered. And so there is lack of correctness and there are duplication as well as in-correct data and so on. And when you want to search a number of files starts with a specified data, in other words suppose, you want to find out.

Let me take an example, suppose you want to find out how many students are staying in the hostel, among the total number of students then you have to really, look at the hostel file and match it with the student file and if you have to get a statistics of percentage of student living in the hostel. Then you got to kind of look at the comparisons of these two files and then come up with a solutions of problem.

So, many files need to be searched to get the avail data namely, percentage student staying in a hostel and of course, the student may be staying in a hostel in a given year and they may not be in the hostel the next year. So, every year, there is need of an updation. So, this also the whenever data is duplicated, same data is duplicated when change take placed the changes may not be reflected correctly in all of them.

So, that is another, which primly question of integrity lastly the difficult exercise that may concern management control. What I currently we take an example of what I mean by management control, if this in formations are scattered all over the place. Suppose, the university decides that if a students fee is not paid on time, then he will not be allowed to write the examination or that his examination results may be withheld till he pays his fees and clear his dues and so on.

Because they are two different files, it may not be very it wont be any need to implement this management decision, about the change of you know this management decision about the fact that if a student does not pay his fee, his result will not be declared. So, in order to do that one has to search through the file for the fee paid and then searching the file of the examination and then put a special mark on those students were not paid the fee and then withhold the results, things like that.

So, it is very difficult because, you have to again go through multiple files. And if he will not deal the same update status and so on, you may get into some difficulty. So, the aim of all because of this all these problems in multiple file base systems, where same data is duplicated in many places, people looked at a better solution for the whole problem and that gave rise to the need of so called database management systems.

In other words, the computer science also you might said computer technology also came to a level where, it is possible to kind of get away from file based systems to what are known as database related systems or database management systems. Because earlier on disks were very small in fact, I remember that in the eighties the disk size was only about 2 mega bytes whereas, today the disk size and a PC is 80 GB, so it is a huge change.

So, with an advent of huge disk base, it becomes multi fusible to look at, so called databases and database management systems and so on. Even though, the idea of database and database management came about even quite early in late seventies and eighties in terms of proper implementation. It was not really all that easy and so many organizations did not embrace the idea of database management for quite some time and only when the technology became right and easy to implement database and database management system, people went for this idea.

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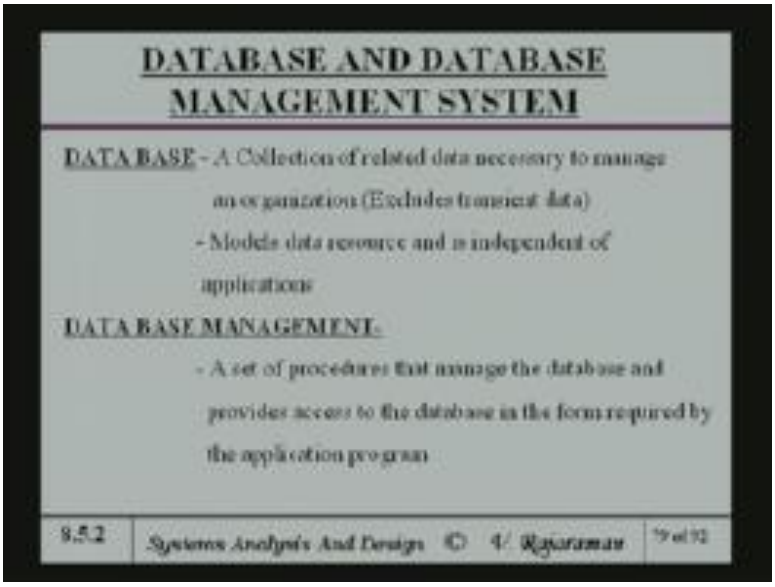

So, what I more talk about now is the idea of database management system and what it really needs to systems analyst. And in a systems analyst design kind of a scenario. In fact, the short root form of database management system is DBMS. DBMS and the design, logical design of databases in terms of relational database is integrated together as a one course, which is normally known as DBMS in most places, a DMBS course is compulsory for all computer science curricular.

So, I would like to make a distinction between what is the database and what is the database management system. Database is a collection of related data necessary to manage an organization, it excludes transient data, what is mean by transient data is something, which for instance if you are taking a students academic database. The transient data is a results or the marks, which come in a particular end of particular semester and this will be only there for a short period, till the old database gets updated and he also gets integrated into that database.

So, the transient data by itself will not be there, but it will integrated into the database and and this database is models entire data resource of an organization, independent of application. In other words, I looked at the relational database and we looked only at logical side, we did not look at the physical side. We said how to kind of do a logical data organization and how to organize, a data is a very important resource of an organization and how to logically organize that for an integrated point of view.

In other words, instead of file base system where, multiple applications all are independently looked at, in this system you look at integrated view. In other words, you look at the academic problem, academic requirements, the finance requirements, the hostel requirements, library requirements and so on of a university and look at the entire picture, as an integrated picture and then design a database.

And a database for a student for instance, a particular database, student database there will be data regarding the student, which will not be repeated which include data including the marks obtained and so on. One fee paid as well as the library books borrowed and books returned and so on all in one place. And so in other words, then the data entire data resource, regarding students will be store as an integrated database in some secondary storage, normally secondary storage being a disk.

Now, how do you store this, you need to be able to present different views of the stored data, appropriate to different applications. And for the logical database point of view, we are not concerned about the way in which data is stored on the disk. Because disk have their own (Refer Time: 23:40) there are disk as you know are organized as a tracks, centers and sectors and so on.

So, whenever a record is stored, they will be stored inside the sectors continuous sectors and so on. So, there will be a physical layout of a database, which will be appropriate in

order to be able to retrieve the data efficiently and update the data efficiently and so on. So, it is purely a physical mapping into a secondary storage device. So, this physical mapping, is an important part through which is not concerned about the logical database.

But it is concerned of a database management system. So, a set of database management system can define, a set of procedures that manage database and provide access to the database, the form required by the application program. The outlet of the stage terminology between database management systems, one provides to in a logical in a context of a logical database designer and high level languages

In a high level language, as far as application program is concerned, he only looks up the application. And he uses a higher level programming language like may be java or c plus plus or what have you, what are the appropriate languages. And the person would write a program, regardless he would not worry about which machine is going to be implemented, particularly for instance if it is java, it suppose to be able to work on in internet on many device architectures.

And so his concern is not about the efficiency of processing, his concern is only about logical correctness of the program, which person writes for a given application or given requirements. So, the translation between these logical views of the procedure or the algorithm and physically executing it on a computer is done by compilers that there is a java compiler; there is a c plus plus compiler and so on.

So, these compilers are the one, which provides an interface of translating and then the the when you go to a different computer the only translator will change, the high level language will not change. The same idea here, there is database logical design of a database will not undergo any change, when the physical system changes. And so database management system is somewhat like you might say a combination of a compiler and operating system and so on, which does this mapping and provides a proper view.

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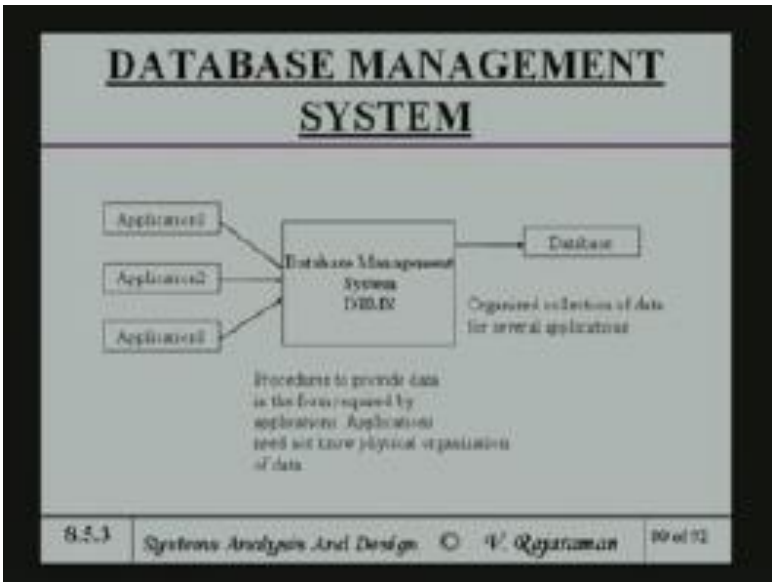

So, if you look at a picture, there are several applications and there is a verified database. An organized collection of data for several applications like, the example I gave about the university, there are several applications are there and you will look at an integrated may be relational database. There are other database systems, which are also been prevalent to earlier, but today more or less everybody is standardized on a relational database idea, because it is easy, it is hands on theoretical basis and it is good relational database management systems are available.

So, the database itself be organized as a relational database and the applications, there are several applications, which will be there for that job in other words, on that database. And as far as the applications are concerned, they are not concerned about how the data is stored, merely look at a logical view of a database, the applications are written based on the logical view of the database.

And being the database management systems and (Refer Time: 28:26), which translates the applications requirements, which are really logically expressed. On other end thus the logically designed data resource and that is the proper mapping. It also has job of mapping on a logical database appropriately in the physical medium. Procedures to provide data in the form required to the application, application need not know the physical organization of data that is whole crux of the matter.

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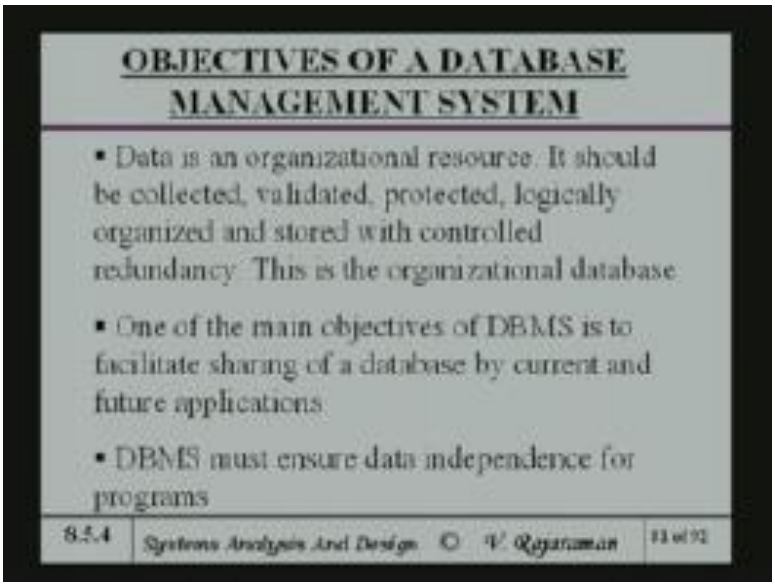

One has to realize a data is an organizational resource in other words, in the case of students, the university depends on students as their major component without students of course, university has no need to be there. Organization like for instance, if got a manufacturing company the regular resource which they have are of multiple types like, the design, design documents of the of the car and so on as one aspect.

And then the other aspect is in terms of the production, how much is produced every day, inventory and money receivable, money payable and the kind of list of all the distributors of car, list of all the vendors who supply components and so on. So, huge amount of data, which goes into an organization like a car or a truck manufacturer, which you all is a very important data resource like the vendor list and what they are capable of supplying and what is the pricing and so on and there reliability, all that is a very important data resource.

So, such kind of resources will should be collected, validated because before you store anything in a database, you have to validate it which itself. If is an indirect data in other words, in correct data there it should ensure entire system into the applications. So, it is validated, it will protect it, protected in the sense that there are two types of problems which can occur, one is that there could be a disk crash, disk crashes are fortunately rare, but do they happen, where disk crashes will try to loose the data.

So, normally you would require archive that is whatever my disk, you keep a back up of that on some other device like a tip and so on. And in fact, keep it in some other place. So, there is a question of protected from a point of view of protection due to accidents disasters and so on. And protection also from vandals, people always try to get into the database and try to steal your data or corrupt your data, particularly in this internet era.

So, you need to protect it from the vandals also, should be logically organized and stored of controlled redundancy. In other words, I am using the term controlled carefully in other words, one would ideally like to have no duplications whatsoever, no redundant data. But sometimes from the point of a efficiency, certain amount of redundancy is required and if you do in a controlled fashion then you will be careful about the possibility of inconsistency and so on.

So, they need (Refer Time: 32:40) it is a organizational database, it is an important database resource, what are the main objectives of DBMS is to facilitate sharing of those data resource by current as well as future applications. The most important part in what I am saying is the future applications, in other words I was always emphasizing throughout this course is that no information system in any organization is ever static.

New requirements come up, old requirements undergo some change and new competition comes up and so your business rules change and so on. So, when this happens, you have to look at what are the possible new applications would come. And foreseeing these new applications may come and appropriate for that two applications you put it one database. And store the database appropriately and have a DBMS, which can accommodate any change or new applications.

And the most important thing about DMBS is there ensure data independence for programs, in other words the physical way in this data is stored that independence must be there.

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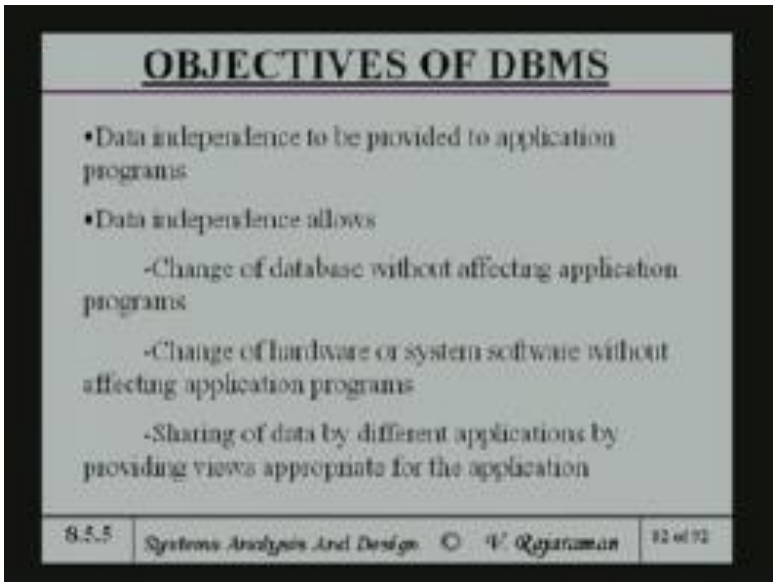

Data independence allows change of database, without affecting application programs the application programs should not (Refer Time: 34:19) affected. Suppose, the operating system changes or the layout layout of the record when the database in the disk changes or the company decides, that a new huge disk system has come, which is cheaper, which can be more reliable, they may decide to remove the old disk system and replace the new disk system.

When all this any of these things happen, in terms of either hardware change or some change in the layout of the files and so on. The application should be insulated from this, otherwise it is going to be a mess because the application should understand more about details of what is being what is the physical organization and that be is; obviously, not a good thing to have. So, application should be insulated from all these changes, changes in the hardware and software and so on.

The application program should not be affected at all, particularly the currently running application programs will continue to run with no change at all to overnight you should be able to change the disk system and the file system and. So, on in the disk storage, method of storage and next morning when somebody comes in and runs an old program, it should run with as the nothing really happen.

And sharing a data by different application programs, by providing views appropriate for the application that is of course, that is the most important part of this DBMS. So, that

the same data provides you different views depend on the application, which was shown in the previous the very first figure, various applications are there DBMS provides the appropriate view from the database.

Control of redundancy that is, as I said control a redundancy is what is the key term. So, avoid un necessary duplication. But, as I said the application sometimes what is a control way, if you are do it and consciously do it, to do a proper job. Relation between data items are specified that is part of the relational idea at all and data integrity precise consistency of data values.

Because it is all in one place, if students address will not be repeated in multiple files it is one database. So, when the students address changes, it will be change in only one place and there wont be any other so; obviously, it will be same everywhere. And data integrity preserves consistency of data values, data security permit access to authorize data only. In other words the as I said, protection of data is based on the fact that it should provide against acts of guard like disasters, crashes and so on.

As soon as acts of vandals, who try to kind of corrupt your database are kind of spy on you or change your database and stuff like that. In fact, in most organizations today, the central database is encrypted. If you look at the portion encryption later on in much greater detail, what is meant by encryption is that the data is not in the original form. It is transform to another form. So, even if you are able to access the data, unless you have the key for encryption, you will not be able to understand what the data means.

So, encryption is one of the important parts of ensuring security. The encryption key is a very important resource and normally a key is very carefully controlled, only one or two people will know, just like a key or a cash chased in the bag. The key is given only to very responsible people one or two of them and very often, some they have to have a collusion between them, in order before they can actually change the encryption key.

There were two different encryption keys, they into two different people and there have been collaborate to be able to decrypt. So, these are all issues in storage to precise security of the data, provide timely information if needed this performance. Because it is all in one centered place get good performance, I am sure management control on addition, deletion, change and dissemination.

Because in one place, you can have a proper management control and what can be changed, who are the access, who can delete, who can read and so on. So, this is all called access controls. So, the access who can access, some parts once a person may have permission to access, some other parts in database he may not have permission to access. So, on a need to may base no basis or a need to change basis, different people may be authorized to do different things.

So, these kind of management control are actually implementable. Data needs a current and future application that of course, we talked about using ER modeling for conceptual data model that is what we did.

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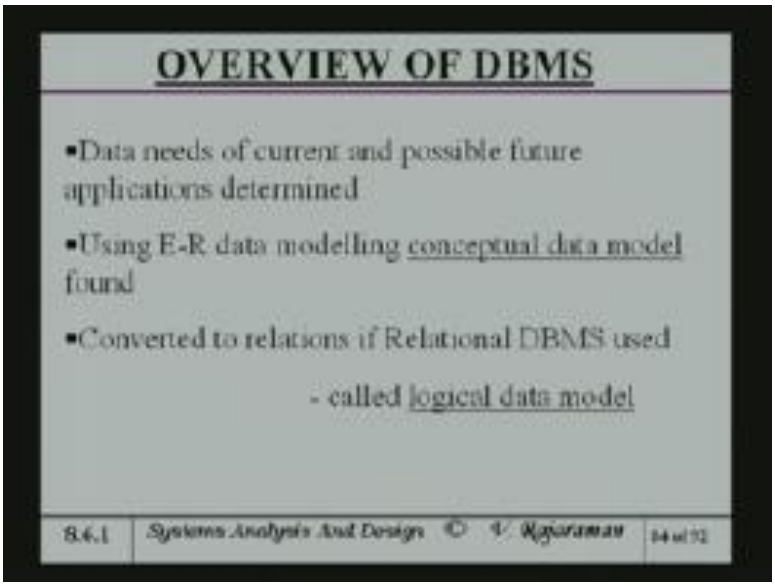

Entity relationship modeling for conceptual data model, converted relations for relational database was called logical data model. So, the point is the number of jargons, which are used or the number of technical terms, which are used and you should really understand what they really need. Conceptual data model is a based on the entity relationship model, so it is conceptually you understand what the data really means and it is converted to relations after normalization.

A normalized set of relations is called a logical data model, which is what is put in the DBMS.

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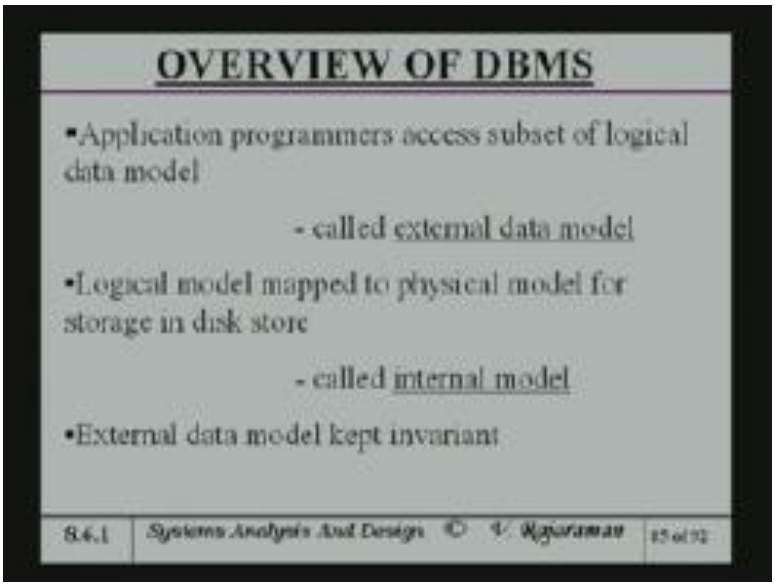

Application program is accessed subject of logic subset of the logical data model is called external data model. That is the view application programmer view of the logical data model is called the external data model. And logical model mapped to physical model for storage in disk storage.

In other words, it stored as so many in circles, in certain number, so and so in. So, many cylinders, either as a contiguous file say a number of different organizations of disk files the sequential organization, there is what is known as index sequential file organization or index sequential organization, there is direct access or key address transformation methods and so on.

So, that is internal model, which the one pick one or the other depending upon the application. In fact, in the DBMS course what is an important parts, user discuss about are this various ways of storing data on disk. And what is the method of access is appropriate for different applications, if you had a long line transaction processing one method may be better. If you have a periodic update and. So, on when sequential files are good and this is that type that is not data what I am going to talk about in this course. And external data model of course, is kept invariant.

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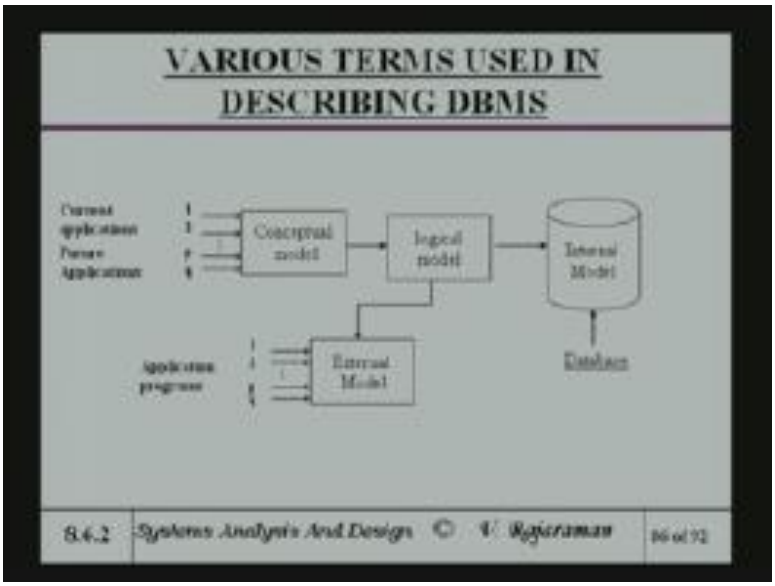

So, and put that all that in a picture for your view. Let us start in the bottom there is an application programs there external model because application program is got a view, which is appropriate for them. And conceptual model is based on the requirements, current applications and also future applications, based on that we come up with conceptual data model ER diagrams and so on.

And then it is get into mapped into logical model and which is in term, gets into mapped into internal model, which is stored in the database. And external model is what the application looks at.

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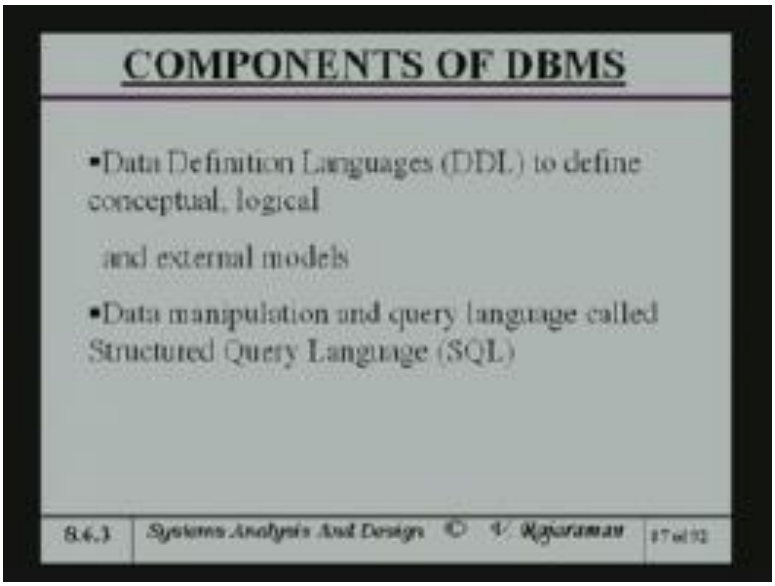

There is something called data definition language, to define conceptual, logical and external data models for instance there is a data description definition language and DDL part of the particular type of DBMS. So, these are all, one of the components you might say of a DBMS system. And they also something called a structured query language, when some database is stored, when you want to query the database in other words.

Let me take an example, what I mean by query, if you have a student database he would like be to student comes up with an enquiry saying that please give me, my mark sheet for the first year, with the am I attended. So, that is the query of student is to create this first year results to be given to him, then you translate these requirement of the student into a query saying that please retrieve a roll number, so and so, results of first year and print it.

And then, so you need an appropriate retrieval language or query language or it may be a reservation system, where a query may be that I would like to have a ticket by this particular train, on this particular day or seats available. So, the query is have to is to give the details about the date of travel, the class of travel and. So, on and they reply which comes from the database is availability of seats on that particular day because the entire database of available seats is stored in some kind of disk.

So, this is a structure called a structured query, in case structure is it is, the word structures is kind of loosely used everywhere, in computer computer parlors, what it

really means is systematically you can do a query, one after the other. Because I am being somewhere used in my definition, but it is really, it brings out the crux of the matter other words, it is a properly formulated question.

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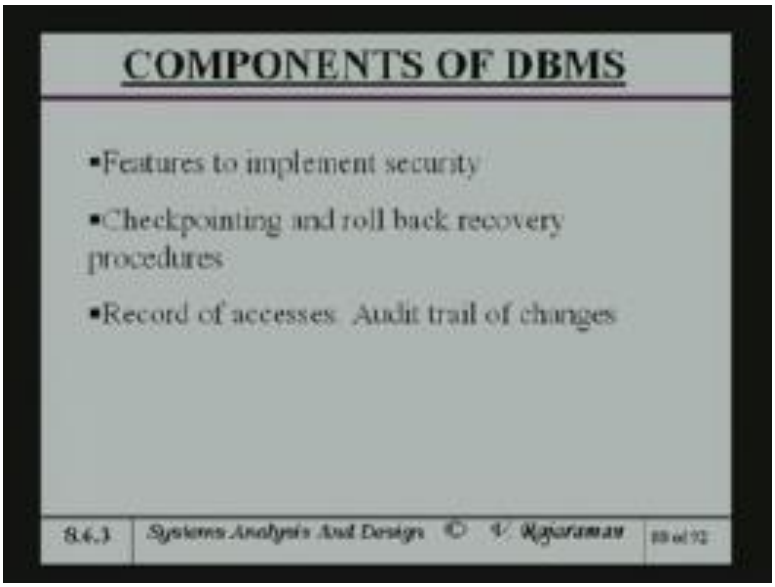

There are features implement security in any the interruptions one aspect I talked about. And the other aspect may be automatic back up, at the end of day as a management policy or it could be disaster recovery, which is maybe there are there is a another disk, which is duplicating every everything which is in disk and so called a mirror site. And if something happens to this disk, automatically things get transferred to the other disk, which is got a same physical layout and. So, for the application programmer it provides the same application view or the external view.

So, check point and roll back recovery procedure, what is mean by this is very simple. And suppose we are running a program, there is running application and suddenly in the middle of the application that is a power outage or something which happens or there is some kind of a corruption, which may be discorruption or some other data corruption or it may be even be a mistake, you made in the program.

So, what one would like to have situation where, all the work or all the programs executed to that time on this particular interruption occurred, the work done has not lost and that you can restart from the point where, the the error occurred or there be accident occurred and proceed further on. Check pointing is periodically for a application is being

run an image or a image of what is a current status, in terms the transits registers in the CPU and so on.

And the status of data, which has probably take into a temporary part for processing and so on, and hence all stored. So, wherever a failure occurs, it go to the previous check point where all this whole thing is stored somewhere and so you start from there after the repair is done. Suppose, there is a hardware failure, which left to this problem then after the hardware is repaired then you can go to the previous check point from where, everything is there.

So, you can start from that point has so nothing happened and then you proceed further. So, your check point may restart and call rollback recovery, rollback to the previous checkpoint and recover and continue with a program. There are lot of interesting problems which arise, in rollback recovery particularly in multiprocessor system, in distributed systems and. So, on and those are all challenging problems, which you will kind of read about later on, in computer science curriculum.

Now, required of access, audit trail, so is a very important point there is a when somebody is accessing data. And the particularly, if a person who is not authorized to access some data is trying repeatedly to access the data. Then suspect, if the person is not up to something may be some mischief. So, an audit trial is to kind of keep track, what else change which failed as well as actual change, which is done by some people.

Like in a financial database, if a change may affect by authorized person and later on it is found that change has like to some other consequences, which like to difficulties in the organization. Then you can go back and find out who did the change, where it was change which was proper or improper. So, it will fix responsibility of the person who changed it, even though he is authorized to change.

So, audit trail is to have these kinds of record of all changes, which took place and who did that change. So, that you can actually pin point the time, when it is done and who did it and whether, he is authorized and so on. So, there is in all the database management systems, there is an important person called database administrator.

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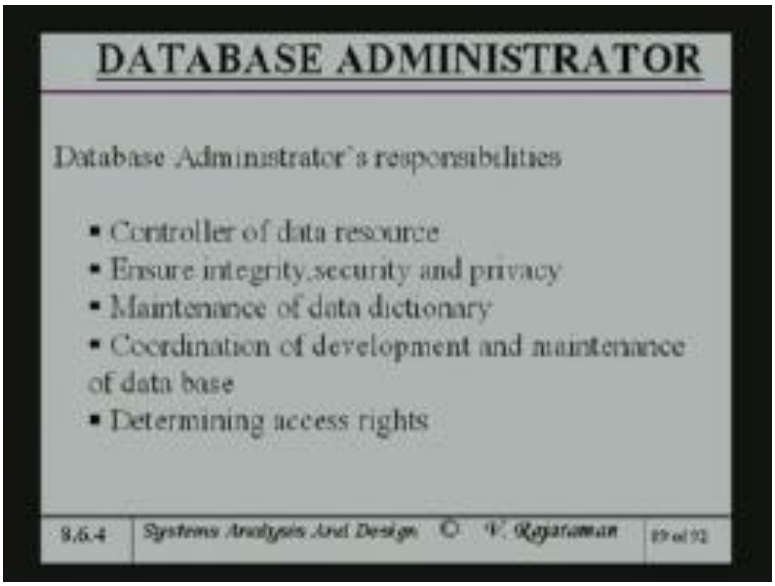

The administrator is a very important officer, you might say or an important person in the organization normally most organization have a chief information officer, who is in charge of all information systems for the company. And database administrator may be a person according to chief information officer. And there the administrator job or responsibilities is a controller of data resources. So, he should make sure that the data is that vandalized, the responsibility is to do a proper encryption, storage and stuff like that and ensure integrity security and privacy.

Integrity is that data resource, must not the incorrect particularly when the updates takes place. So, you can trust the database, integrity is a question of trusting, you can put trust on the data and security is to protection, protect the data. And privacy is some other issue, privacy is an issue of revealing data of an individual, to people who has made business of knowing that data like for instance, if you are having a medical database, the medical database may have record about various illnesses.

The patient may have add in that hospital and that record is private to that person, it should not made public this person have this kind of disease and so on. Similarly, one would not like to have, the data on once bank accounts and what kind of payments a person has made or a company has made, available to third party because no business to know about it.

So, the privacy; that means, to be should not have access to data, which they do not require and very often this privacy issue is legalized, in many countries. In other words, a database administrator or somebody is found to sold data, sorts of consideration there can be a jail term of that person. So, preceding the privacy is important part. In fact, here in India in some of the BPOs this problem arose, because some small person in the organization was able to access data about credit card and so on.

And also financial transactions and send it to somebody, which is of course, immoral, incorrect, criminal. But the model they try to kind of prevent this by masking out, all details about the individual identity, only data's be available to the BPO, and stuff like that. Of course, there is a huge area related to the privacy of data, which people are much very much more concerned about, particularly because there is a outsourcing of data happens from organizations to other computer.

Like for instance, when you say talk about business process outsourcing, a business is having their own chief information officer and keeping all their resources themselves, are giving it to third party in some other country to do their job for them. And expect the third party to maintain the privacy, integrity, security and all that. Of course, if the party is found to be failing the contract to be terminated.

But, the point is really that it is important (Refer Time: 56:00) dictionary the dictionary talked about earlier, origin of data destination of data, nature of data and data outside important will have data resource, how the dictionary will allow you to kind of access and found out what you have in your data resource. Coordination of development and maintenance of database because that is as I said, database never static, it undergo a change.

So, coordination maintenance, determining access rights who is got a access to what and who accessed keeping audit trails all those things are important for this job of database administrator, who has complete list of authorities, audit trials. So, the administrator will go back and do a post mortem, whenever something happens in an organization.

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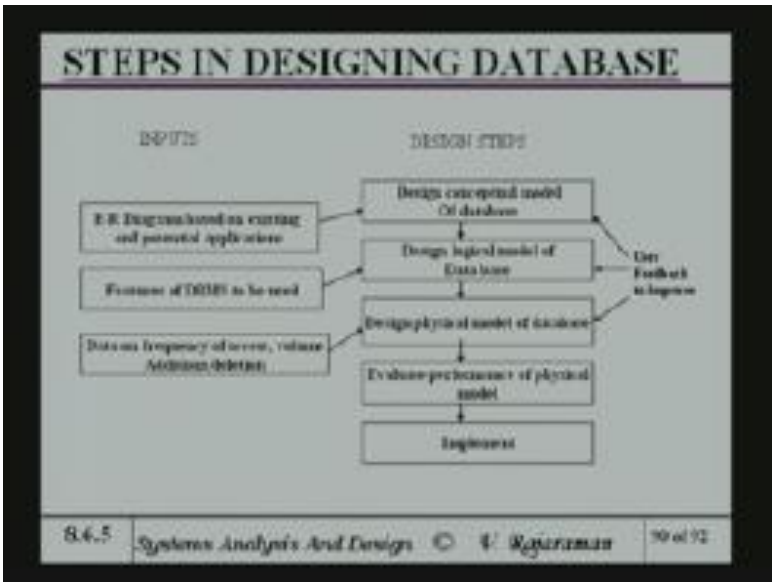

So, if I look at a steps in designing of database is started of with ER diagram based on existing and potential applications and then to design of conceptual model of a database. Here, we got some user feedback and improve that conceptual design, because user is a only person, who can talk about what are the potential applications, what are the possible future things and so on. Feature of DBMS use design of logical model of database RDBMS is going to be used (Refer Time: 57:39)

Data on frequency of access, volume, addition, deletions are useful in designing a physical model of database. Here again user feedback is necessary, particularly about the frequency of additions, deletions, access and so on performance in the physical model and implements. So, these are the steps.

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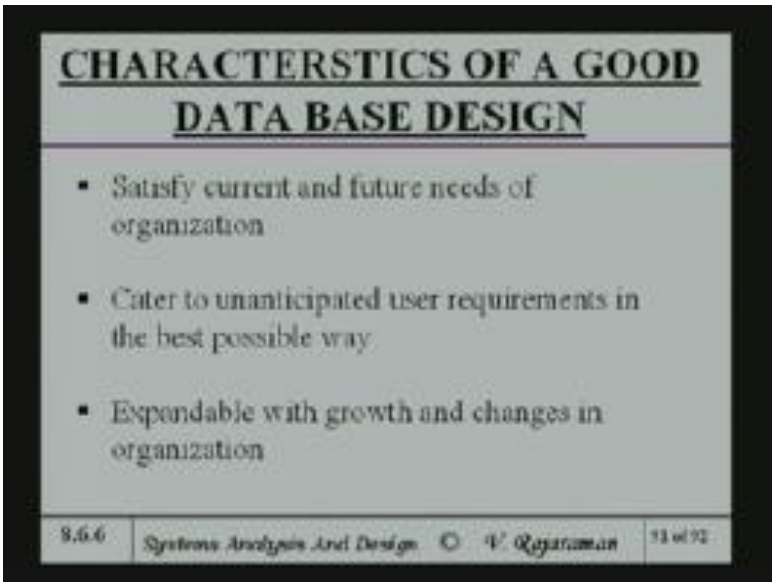

So, a good database design will satisfy current and future needs of organization, cater to unanticipated user requirements in the best possible way, which again emphasized. Expandable with growth and changes in the organization, which of course is crucial in all information systems, he need to change when hardware and software change, again that is the whole idea of DBMS.

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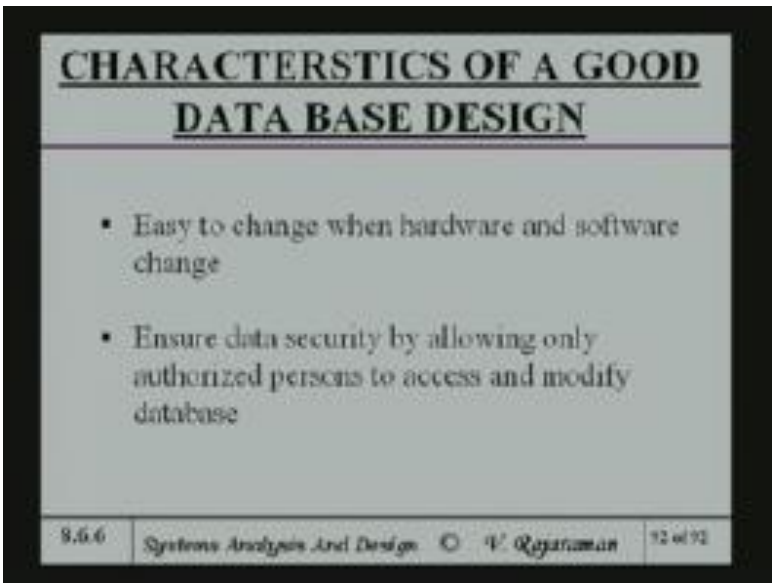

Ensure data security by allowing only authorized to person access and modify database, keep audit trails and so on. So, the base we come to a conclusion for discussion of

database, logical database design and some aspects of what is DBMS. And I said it gives you a flavor and an idea of the whole subject, which of course, I have done in three or four lectures, but you have a whole course, I had a few to learn more, but I do hope that I have laid the proper foundation for their future studies.