Systems Analysis and Design
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Lecture - 05

We will consider this time as the first part of my talk, qualities of information. Quality is a concept, which is not very precisely definable. It is something like a beauty of a person. But, one sees the quality, the person knows that it is a good quality. So, the exact definition is not really there. But, on the other hand, if there are certain properties, which the resulting information after processing follows.

And if you are make sure, that the method of collecting data, as well as passing data follow certain minimum standards, required standards. Then, the resulting effort will be that of an information of good quality. We have been emphasizing right from the beginning, that information is processed data. So, in order to ensure the quality of information, you have to first ensure the correctness of data. And you had also ensure the correctness of processing.

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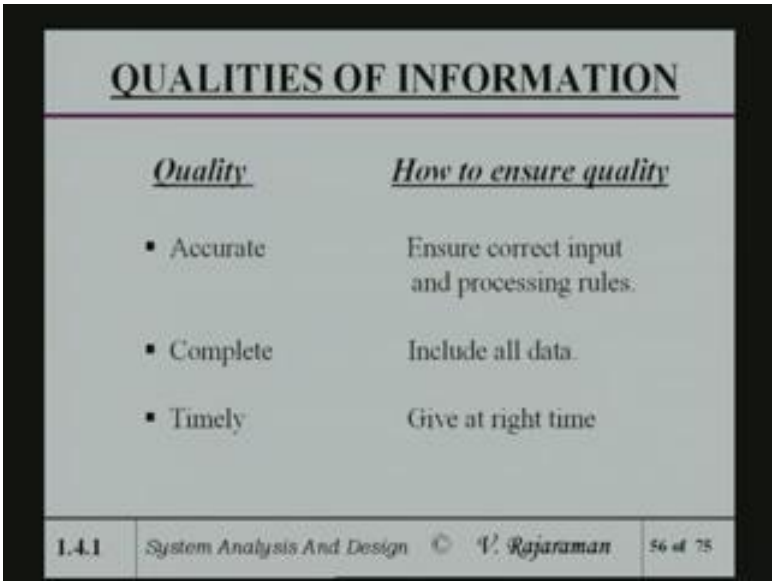

So, the most important part or the basic requirement is accuracy, in terms of the correct data input. And correct processing rules, which you follow. Normally processing rules are really incorporated, in some kind of program. So, the program has to be correct. In

order to be able to ensure, that the processed data and information is also correct. That is very whole saying in data processing, called GIGO, g i g o, Garbage In Garbage Out.

What it really means is that, if the data input is incorrect, whatever processing you may do, the output is going to be incorrect or not of right quality. This doing everything, you may have the best possible recipe to make the dish like upma. But, if you give input where the soji, which is given is full of sand. Whatever you make, in terms of correct recipe following and doing the correct process in cooking; the output will be not so edible.

So, this is always important to make sure, that the input data is correct. Now, there are number of methods of ensuring that, whatever data you input is reasonably correct; you have to make sure. And in fact, later on in this course you will see. In fact, almost whole lecture I will do it later on, to see how to ensure the accuracy of input data, which gets into a system. The reason I am emphasizing it again and again is that, when you write programs in a class room, or small projects and so on.

The volume of data you deal with is not very large. The volume of data is, may be at the most 100 or 200 data points you work with. But, in real data processing systems, the volume of data you handle is enormous. For instance, if you are going to process the examination results of CET. CET is taken by lakhs of candidates. And so the number of input data, we will get into the program to be processed will run into several lakhs.

So, when the volume becomes very large, it is much more difficult to ensure correctness at every point. So, that is the reason why, one has to have special methods of ensuring data correctness. When you are dealing with large volumes of data. Because, typically most real life data processing systems, will deal with lakhs and lakhs of data. And not a small amount of data. Of course, the correctness of program is different issue.

And there is a lot of work which is going on, in terms of ensuring the correctness of program. That is from the given specifications, to get to the right program do that, is itself a major challenge, in software design. And lot of time is spend, on various methods of ensuring the quality of correctness of programs; or processing rules in this case. So, first thing is accuracy. But, that is not sufficient. Because, quality has a pointed out is not a quantified one single scalar.

It depends upon a number of different aspects, or the information you get out with. Just like, you know beauty is not a single thing. You know beauty, when you say about beauty of a girl, you do not really, you say only about how her face looks. But, you also look at the way she reports herself, various other aspects which are there. It is not a single quantity, which defines a necessary thing like beauty. So, there are other aspects, which you have also to consider.

And the other most list many of them; and I will explain what each one of them really means. At the end whatever processing you do, to provide information to the management or to people to use it information. What I mean by management is that, you may be actually looking at operation day to day data processing. Or you may be, let you know tactical information to come out of this operational information. Or strategic information, whatever be the information which you present.

All of them have to adhere to these quality standards. And so the important second aspect of a quality is what I call, completeness. By completeness, you mean in processing all the data which are relevant for that processing, should be taken into account or incorporated. You should not by mistake leave out some part of the data, which is there. Imagine CET research processing, where you forgot to include one sentence data completely. The sentence data is not included, when you do the processing.

Ultimately what you get, is these are certain students who took the exam, in a particular centre, are not in the results. So, there will be fearer all over the place. So, this is situation where the input data is not complete, in some part it is missed. May be due to carelessness, may be whatever it is. You really have to make sure, that whatever data has to be taken into account, has been taken into account.

There must be timely, what I mean by timely is information, which is presented too late, is not much use. Therefore, instance you expect a newspaper to come every morning, to give you news of what happened in previous day and so on. People read news paper, every morning to be able to be informed about the current events. And if suppose, it is delivered at one day late, then that is as good as doing throw in an waste basket. Something which is not coming on time, is very often not use full at all for any purpose.

So, timeliness means, when the information is required at that time you got to present it. There is no point in delaying it. For doing for instance, a day to day stock taking, the

result of what is the stock at the end of the day, should be known at the end of the day. There is no point of talking about what stock was there 1 week ago. So, if you take a long termed process and your results are always out of date, then the decisions you take will not be correct. Because, that will be based on out dated information. So, everything has got to be timely.

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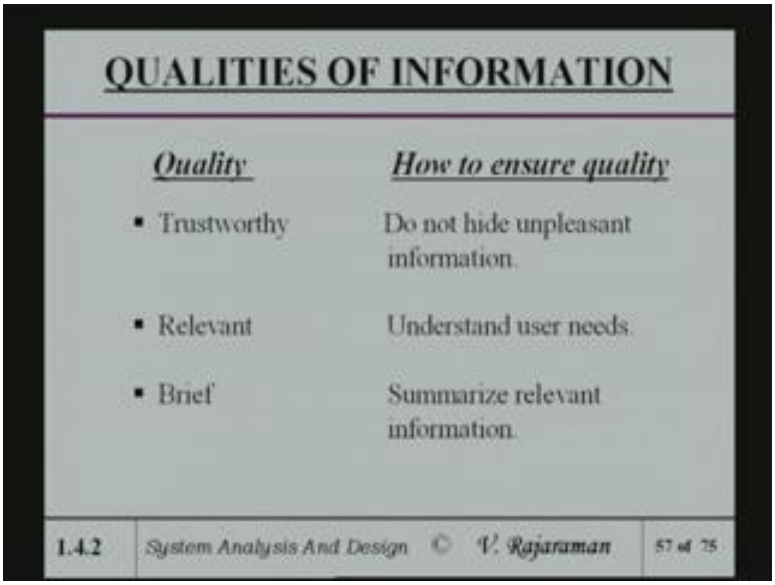

There is also quality called trustworthiness. Trustworthiness is something different from completeness. Completeness means, you include all data items. Trustworthiness means, intentionally you should not leave out certain data, so that the results is good. So, you cannot trust that information, if it happens that, you have not included unpleasant information. For instance, if you are presenting to a visiting group about the performance of your company.

And if you remove from that presentation, many transactions where effectively you made a loss. Then, the result you give are not trustworthy. Soon or later to be find out that, what has been given is incorrect. And is been done person intentionally, then of course, it is also an offence. In fact, there are reason past, many such situations of a reason, where company is have hidden information, which are not pleasant.

Like certain kind of losses, which company made, you are not made known to the stock holders. And so they come up in fact, in America with a new law, which punishes people who hide information intentionally, and some of them are actually going to jail. Similar

things are happening all over the world. That is the, because of computer processing of information. And also because of the fact of the volume, of data as increasing in leaves and bounds.

To get into every aspect is very difficult. So, certain amount of trust is based on management. And so trust ((Refer Time: 13:49)) the management, which looks after the company, should ensure that whatever they do is trustworthy. The other quality is what we call, relevance. That is relevance means, something which is useful for a person. And if it is something which is not useful, it is called irrelevant.

Take as the very simple example, when you open your E-mail box every morning, you find a few letters which are essentially meant for you. But, the whole lot of other letters come, which are advertisements trying to sell things like that. And many people call it spam, in fact it is called spam. And all that spam hides the real information which you require, namely the letters which are written for you. So, the relevance of what you get from the E-mail system, is not very good.

Unless you have some kind of a, what is known as filter which filters out, all the unknown or spam information. In presents only the wanted mail to you; and that is an important part of any relevance. In fact, this has taken a greater and greater importance, with the coming of the automated search engines on the internet. Search engines, people use all the times. Like Google, now a days is commonly used by students.

And everybody to be able to search the web, to get information which is relevant. You may like to find out, for instance what is the latest speed of a durian chips, which is made by whichever company. That is the fastest chip being made in the world today. And you put a query, which you will have say durian speed and so on. But, many of these system will retrieve so much data, that is a way through that.

To really find out, what is the one you really wanted. So, it is like searching for a needle in a proverbial face pack take a long time. So, many people in fact, do not go to a search engine. For a simple reason that, they will get 2000 heads, what they call heads, 2000 outputs, when they really require only two or three outputs. So, the relevance measurement in this case, is that it is 98 percent of what you got, is not relevant. Only 2 percent is relevant.

So, that means if that is relevant information you have to look actually wasting your time. So, relevant information is essentially what, any management needs for many information system. Of course, I broaden my area of information system to include, system such as Google. Because, after all it is also an information system, which searches the web. And in fact, today's world it is because, important information system, which are everybody uses.

So, the better somebody comes with the better so called search engine, which gives you higher relevance ratio. That is what you get out of the net, if suppose 98 percent is relevant. Only 2 percent is irrelevant, then you normally switch that kind of an engine. Of course, there is no engine which is you can really give you 100 percent. Because, very often, people do not even know very clearly what they want.

So, they kind of put the search terms, in a very careless way. And you end up with whole lot of junk information coming on your screen. So, relevance is very important from point your any system. Brief summarize information, that is relevant summarize information, is very useful. Because, brevity is say the sole of good writing, as well as good systems.

You brevity essentially ensures, that you get the essence of what you require. And a lot of inessential things are being left out. So, briefness becomes much more important, as you go up in the hierarchy of any organization. The higher the level of the manager in the organization, the briefer will be the information presented to him. Because, the higher level managers are highly paid for lot of things to do. And they do not have time to wet through a whole lot of irrelevant things, which is not presented with brevity or brief.

So, it is very important as you go along. In fact, strategic information is suppose to be the briefest a lot. And of course, operational information is quite detail. But, even there I think a lot of operational information, may not be all that useful. So, may like to kind of make sure, that what you present is necessary and sufficient. For the purpose for which it is designed.

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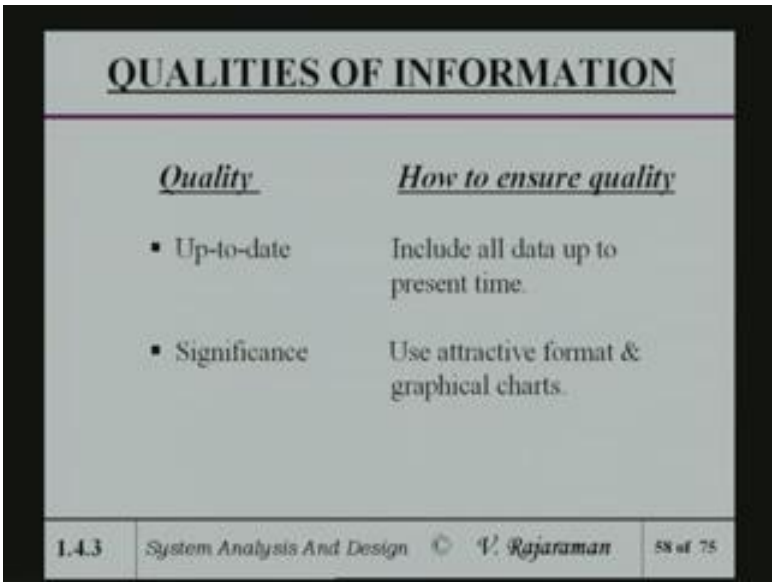

Another idea of quality is what is known as up to date. Up to date and timeliness are two different concepts. What is meant by up to date, is that all data up to the last minute is included. Like for instance, if you take a news paper example again, news paper may be timely. You will get in the morning first thing in the morning. But, if the information contained in it, the news contained in it is only old or old news, then it is not up to date, even though it is timely.

Same way, if you are processing data and you are leaving out current data. That is data of a which happened in the very recent past, I have included all the data which happened in the earlier. Then, what you are really getting is not up to date. So, the advantage of using computers is the speed, which the machines can process data. So, this speed irrelevant is what you get out of the computer is not up to date. So, the speed has got to be matched with to the fact that, you should able to include all the data.

Till the time you might say within quotes, the data is fed to the machine. So, this is important or as you have seen the newspapers, up to press time. When they go to the press time whatever news come in, they include that. And sometimes they put it to the late news. And saying that and in TV channels and so on, they have a breaking news. Saying that up to date, the new news is coming up. And they update all the time.

So, between two channels, TV channels, a channel which is able to break news faster is considered a better channel. Whereas, the channel which is not able to give new s

immediately. But, it can a delay is it, so up to dateness is an important quality. Significance is another idea, that is significance is when something presented to you, you should be able to understand what really means.

Like for instance, at the end of the year, the finance minister presents his budget. And the budget in a whole lot of numbers, those numbers do not make much sense to common man. But, normally they give a pi-chart, circular, a chart in which they said out of the income I have received. So much of income has come from income tax. So, they will show a pi, that is 30 percent of income has come from income tax. Some 40 percent has come from indirect taxes. And some part has come from loans and so on.

They show a chart and as well as you look at the chart, your quality in terms of where the money has come in from. Similarly, the budget is also going to say, where the money is going to be spend. So, the same chart, they will say this much percentage, say 30 percent is being spend on defense. 5 percent on education, 10 percent on health care and so on. And 40 percent or 50 percent on salaries. People may really wake up, saying that you are spending a lot of money on salaries for people.

And not enough money on improving the education or improving the infrastructure and so on. So, by in large when you look at chart like that, you understand immediately the relevance of what is being presented. And this same point arises, in day to day information processing also. Because, the budget is not only the budget of a country. But, for a company, they have to make a budget every year.

And in that budget you have to say, how much are you, from which areas of operation of the company are you getting highest percentage of money. So, in this case, I will put more emphasis on that area, which is giving me a lot of income. Then, I can ask the question, which area is giving me higher profitability. So, then in the profit and loss account, I have another chart which tells, which items in my company's manufacture, made the maximum percentage profit.

Then, I would like to emphasize on producing more of that. So, that is a these kind of, if you understand significance of information; then, you can take a decision, which people call informed decision. Informed decision in the long run, make the company go very very profitable. Otherwise, the company will start losing money. So, primarily then, we talked about all the aspects of quality.

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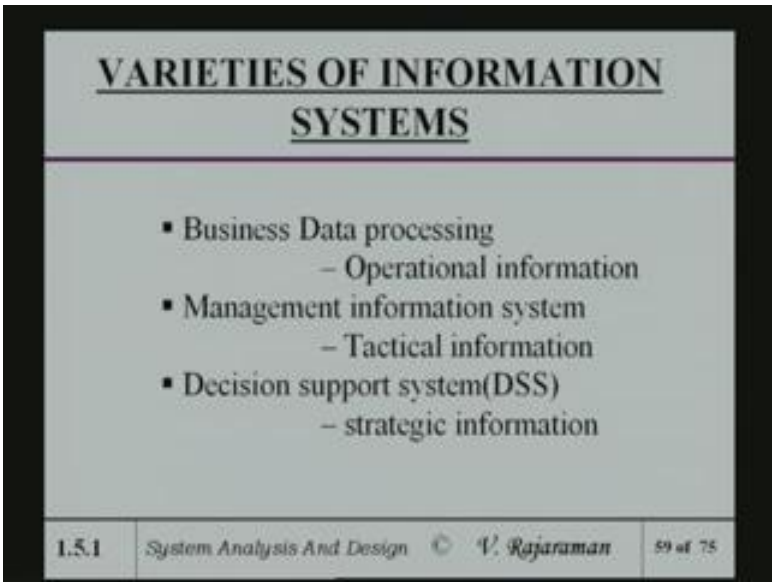

So, quality considerations are important regardless of the time information, your designing. Varieties information for operational reasons, operational information or tactical or strategic any, all of them require the quality. There you may emphasis on certain type of qualities, for certain types of information. Like for strategic decision making, it is much more important to be able to give information; which is whose significance is understood and also brief.

And for operational information, you require to make sure that it is complete; that is trustworthy. And you also make sure that it is up to date and timely. These are things, which are essential for operational information. That does not mean that, it is not relevant for or important for others. Strategic informations also it is got to be up to date and timely. But, what I am trying to say is that, some of the quality parts are lot more important. As you go higher up in the hierarchy, than the others.

By in large all these parameters of quality has to be satisfied, in designing any information system. And you have to make sure of that. So, having talked about quality of information; and various you also look at different parts of a company and so on. Now, you will get into the types of information systems, which are normally designed for use. The reason why I am going to talk about the types of information system or varieties of information systems.

Is because, each of them has a certain role to play. And they have got different names for that reason. Is always a very lot of confusion, in the minds of people about to terminology. I would like to divide the terminology of variety into three broad categories. One is business data processing. Business data processing, primarily is day to day processing of large volumes of data. And that is the one, for instance which every company has to do.

So, business data processing is an essential part of any system, you cannot avoid it. But, it is all routine. Once you have that, then people confuse this business data processing, with what is known as management information system; which is very often abbreviated as MIS system or MIS. MIS is reason why it is confused with data processing, is that both of them are used by managers. So, management information system, is also based on the type of data processing systems.

But, I would like to kind of look at it, from the point of view of our classification of tactical information. That is operational information is luminous as I said. Tactical information is based on the operational information. And further processing of operational information, to get some amount of brevity and relevance; which is of use to middle managers. For taking their tactical decisions day to day.

So, the input from MIS is the output of the business data processing system. So, the input is one, the output is MIS, a Management Information Systems. A system which whose output is tactical information. Next level, next higher level is often called decision support system. As the new employees, this system is to ensure good decision making by tact management of any company. So, decision making is very often, done by both middle managers and by top managers.

But, more often the MIS results are presented to the top management, by the middle management. And use this MIS results, to be able to take some decisions, using a system called decision support system. The nature of decision support system, is somewhat different from the nature of a business data operating system. This I will explain as I go along. Later on we will have greater explanation of what DSS means. And books have been written on DSS.

Because, it is a fairly interesting area of data processing. And it is fairly challenging area of data processing. And so getting a decision support system, very often is very

important for a company. And general feeling among the community of people, who do software system design and so on. Is that we have not reached the stage, very good stage of being able to give very good DSS. Still lots of decision taken by companies.

Particularly strategic decisions taken by top management, is not only based on the data presented, by using or by massaging MIS, operational system and so on. Whoever about this, they have to use a lot their own, what is known as great point data. That is data and things like that, which I hear in as a bus or whole rumor and stuff like that. And they use their general long term view, where economy is going, where a country is going.

And so they bring upon whatever facts and figures are presented to them. Also what is known as judgment, you know judgment. And use this judgment combined with the facts of figures, to arrive at decisions; which they consider is a decision, which will lead to a profitable in the long run. And these strategic decisions, which are suppose to come from DSS are not always correct.

Very very large number of companies have got an into difficulties. Because, they took long strategic decisions, by reading the market or situations somewhat incorrect. One very interesting examples occurred in the very recent past, is that are two things which has happened. One is IBM, for instance sold their entire PC business to a Chinese company, called Lenovo. And one may ask see PC is a very large area, lot of people use PC's.

Why should that company, which really invented that PC, gave up their entire business to Chinese company. There is a strategic decision. What the top management feels is that, may be the days of PC is coming to an end. Some other technology is going to come. The other important thing which of course, made them base decision is that. If they looking at profitability. For the amount of money invested, amount of human resource invested, the profitability of PC is very small.

Because, the margin you get in the sale of PC's is very very small, few percent. The competitors like Dell and so on. Who are able to cut cost, which large company find difficult to cut cost. So, ((Refer Time: 36:03)) profitability on PC’s are going down. Whereas, their profitability in another area, like servers, which are for higher uses. For the number of servers they sell, the percentage money they get is much more. So, even the volume may be very low, but the percentage volume may be high.

So, in that balance sheet, they find the contribution, which comes from the server is higher. So, may be if they emphasize on that, spend our money as well as human resource and everything on that. And sell this off and get as much money as you can get from that, and plunk it into other area. So, this is kind of a decision, based on decision support system, which effectively gave them this chart giving the profitability of servers, which is profitability of PC's.

Of course, this only one, what I would call numerical aspect which you had. But, the other aspect is that, why itself gut feeling. The feeling that may be in the long run, is going to be some kind of a saturation or profits going down things like that. On the other hand, ((Refer Time: 37:32)) acquired a PC company called, compact. And made a larger company. And they found, they are having done that, they are losing money.

So, that is gain similar decision, in one case they sold off their PC business. In the other case, they acquired a PC business. So, what is happened is that, the acquisition about the PC business by HP, made their profits go down. Immediately the stock holders or the people or share holders, were very unhappy. And what they did was, sat the person, sat the person or took the decision.

That is the top management, as one top manager of HP. And because of taking wrong decision, strategic decision he lost their job. So, in other words, these are what I would say, may be I will judgment is incorrect. But, partly it is based on data, because compaq is making good money. But, probably they did not look at the possibility of competition and so on. So, strategic decisions is also sometimes bad fact, on we are the other.

But, inform decision support systems, are correct information fed to DSS, helps a lot in terms of coming up with a type of a decision.

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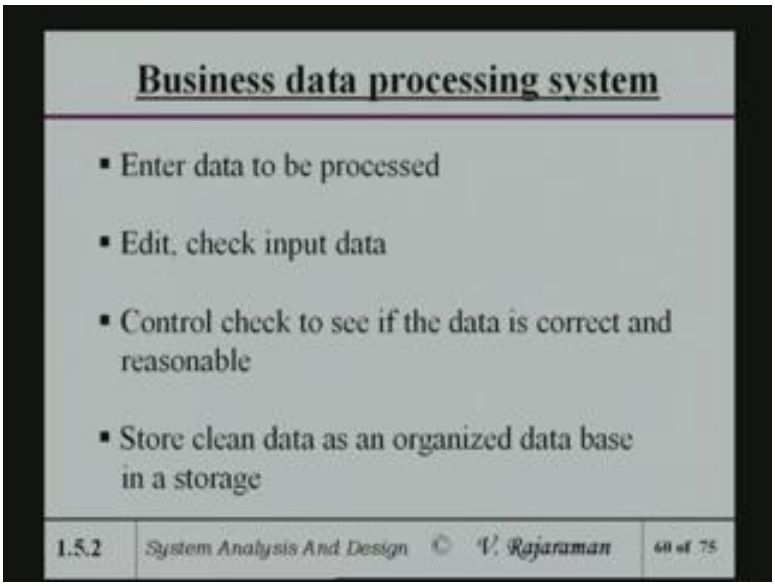

Let us start with the lowest of the run of information system. Namely business data processing systems. Business data processing system, as I said a typical example of business data processing system, would be a system to process the CET results. As I pointed out the input is lakhs and lakhs of data. So, all this data enters the processing system. And now you have to make sure that, the data which is being fed to whatever program; you have written is complete and it is correct.

So, you have to make sure that errors are removed, so it is called editing. In the editing, you use a lot of rules, lot of rules and terms as well as real rules. And sometimes, if you ((Refer Time: 40:37)) proper editing, the data is gets in, is corrected or in correct. The results would be bad. See unnecessarily some student may lose opportunity, because of incorrect data entry. So, it is the responsibility of data being entered to make sure, so edit programs do that.

Simple example of an editing, which I would have given as like say in CET. There may be three subjects or four subjects or whatever number, it may take. So, if it turns out that, after data entry, you find that a student got 90 and 90 in two subjects and got 0 and 0 in two other subjects. The probability that data is wrong or very high. So, the system in the edit stage, should be able to point out such discrepancies. So that, one can go back and check, whether in correct data is entered. And correct it at that point itself.

So, checking the edit programs are very very important part of any data processing system. In fact, I remember, that in companies, which use to do a massive data processing. Like for instance, seeing the results of examinations like, matriculation examination, SSLC examination or pre university examination and so on. Those companies use to spend a lot of effort and time, in writing edit programs. And very often when a student joins a company, as a trainee.

One of job given to that person was to write the edit programs. To kind of make sure, that student understand. The importance of data getting into system being correct. Later on in this course, we will look at in great detail, the methods of variety. And editing there are two aspects of editing of course, removing incorrect data. The other aspect of editing is that, including all data. As I pointed out is, if you lost if you did not include, one particular centre.

Then, what you end up with is a very bad result. Similarly, in a single centre, suppose say 55 students took the test. And you entered only 54 data, then you miss one. So, there must be some method of checking completeness, so this is called control. So, at the end of a batch say 55, you put one control which counts. And says I have really read so many input data. And that number is smaller than the number of students who took the exams, they immediately know, that it is in complete.

So, editing and controls to say see, whether it is complete also reasonable. For example, if you are processing data of a class. And you look at the age feel and for say class 10 in a school, you find an age to be 35, immediately you have to have a doubt. Whether data is entered correctly or not. So, this is what is meant by reasonable decision. You have to be you have to be a reasonableness, about what is being entered. So, apart from the what I mean by see incorrect data entry very often, leads to unreasonable things.

So, that is something which comes out with control things. So, you have to, then that means, what you really do is input data is being taken. And your polishing it or sending it to a laundry, to clean it up. And take out all the incorrect data, correct all of it. And what ultimately gets into a system, is normally stored in what is known as the data base. So, before things get into the data base, you have to make sure that what is put into data base, is correct and complete.

So, the organization of data base, is only how to really organize all those massive volume of data. But, what gets into that, is what comes out of the earlier part of a data processing system. Namely editing, control jacks and so on, so forth. And also certain aspects, which are spot audit. If you do spot audit, we were find out anything, which intentionally has been changed, whether those things are also done. We will look at in very detail as soon, in the later on the course.

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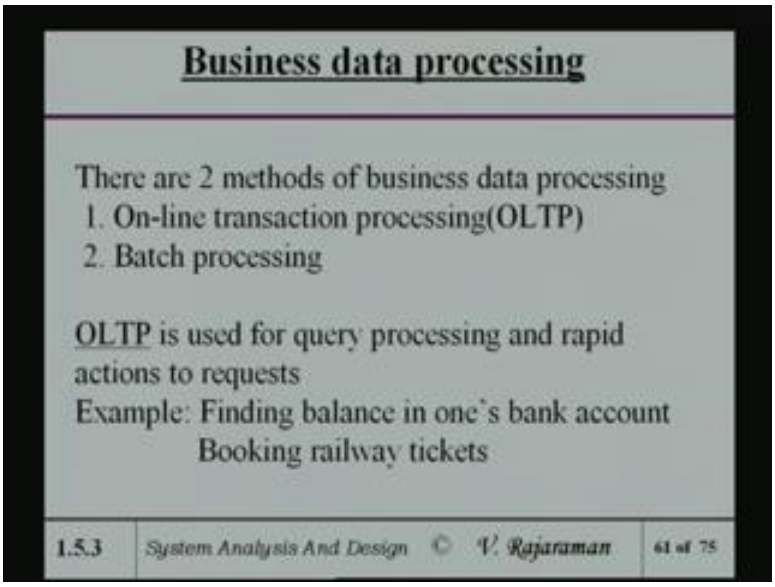

In data processing itself, there are two broad methods of data processing. One is called the on-line transaction data processing, the other is called batch processing. See the examination processing, which I talked about is an example of a batch processing. Because, you bunch all the data, that is having taken the examination, marks are assigned. And we are taking the marks of each student with roll numbers and so on.

And you are taking, as I said lakhs and lakhs of these data together as a batch and process it as a batch. These are routine data processing day to day. What I mean by day to day, CET is not day to day. CET is a periodic, say CET is once a year. The other types of batch data processing, which are periodic, like pay roll. If you are doing a pay roll processing, at the end of the month to give salary to your employees. You have to get the records of all the employees their salaries, deductions all those things; and process it.

And I create an account and then, find out how much money is to be credited to the bank account, of that employee. And automatically that amount is credited to the bank. So,

this a periodic, periodic type of a data processing. So, pay roll is an example. There is also frequency can be daily, pay roll is once a month. A daily frequency is something like at the end of the day, if you are finding out the inventory in your company.

Like if you are running a large retail store, like food world or something like that. At the end of the day, you would like to have a an idea of the current stock position. And the current stock position is got to be there, and we have got a process at the end of the day. That is caught to be there, depends upon what the methods may differ. But, by in large it periodic data processing. Or if you are doing cash collection, at the end of the day you have to find out how much cash you collected.

So, you add up all the cash, whatever was entered in the cash register. And you go on update, adding up all that in, give the cash, at the end of the day. So then, at the end month you will find out the total monthly cash inflow. So, these are things which are data processed, I mean batch processing. There is, then the whole TP is something, somewhat different, it is called on-line give up transaction processing. What is meant by on-line? It is being done immediately after the event.

Like for instance, if you are going to book the railway ticket, at the reservation counter, you are being processed on-line. Because, as soon as you give a request for a ticket. That form, whatever information is entered in the form, is entered by the clerk. And immediately that gets into the system. And while you are waiting, the result comes out. Telling you whether ticket is available and if ticket is available, your ticket is also printed and given to you.

So, on-line that sense, that it is working while you are waiting. Transaction means, the slip you gave requesting for a seat in a train, once it is entered, it is a transaction. One entry as you made and this triggers, a number of other things in the back ground. You know this particular input, will trigger look up in the data base, to find out if there is a ticket available. And create this ticket out. The reason why, the term transaction process is being used, because it came from the banking area.

When you go to a bank and look present a cheque, whatever is in the cheque is being entered on the PC right away. And there is a money transaction. And the money transaction leads to a reduction your account. And that is being debit, your account and you get money out. Another very common example of on-line transaction processing is

all ATM's. ATM’s are here, all over the place are really on-line transaction processing machines.

Because, you go there, put in your card and that card is read as a transaction and it triggers an action. The action, triggering an action leads to a cash coming at your end. There are number of other issues, which comes with on-line transaction processing, which makes it somewhat challenging to design such systems; which is primarily these challenges come.

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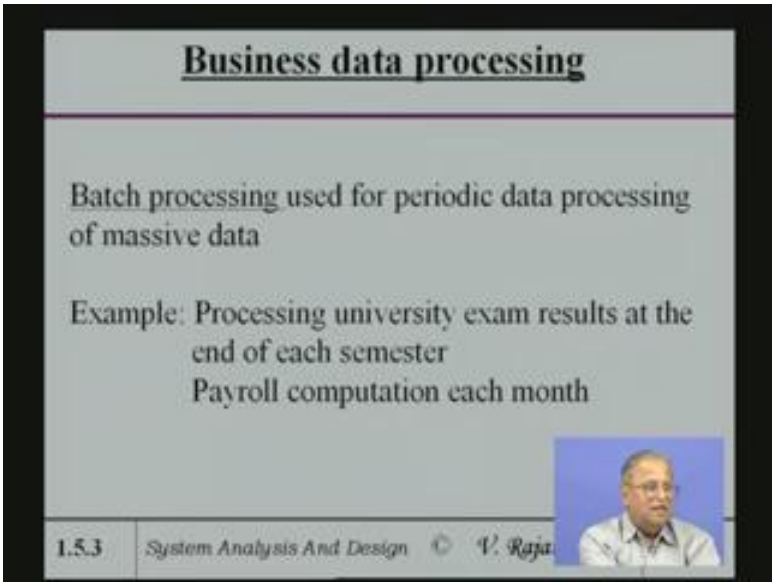

Because, of the fact that, there could be two transactions coming simultaneously, on the same data. And we have to able to make sure that, one of them is committed, before the other is committed, because both of them cannot conflict. I will give you a simple example, you may be withdrawing money from a bank. At the same time you may be given ATM, your wife may be doing in ATM transaction, on the same account.

And so if there is not enough money, if both of them are done without proper committing. What I mean by committing is, as soon as one transaction is over, your balance should go down. Does not gone down, the balance should remain the same. The other transaction also takes place, then you get money which is not in your bank, not in your account. So, it is a mistake occurred.

So, this kind of a serializing of transactions becomes important, in the on-line transaction processing systems. Of course, batch processing I already talked about the various batch processing methods.

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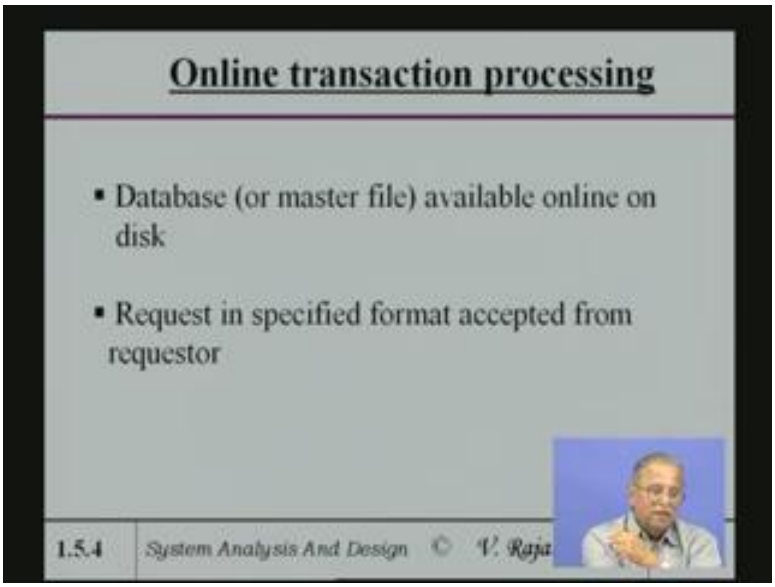

In online transaction processing, data base or master as is called available on-line. Like in a ticket booking situation, for you have to be able to do the work immediately. Request in specified format accepted from the requestor, has a form or something like that.

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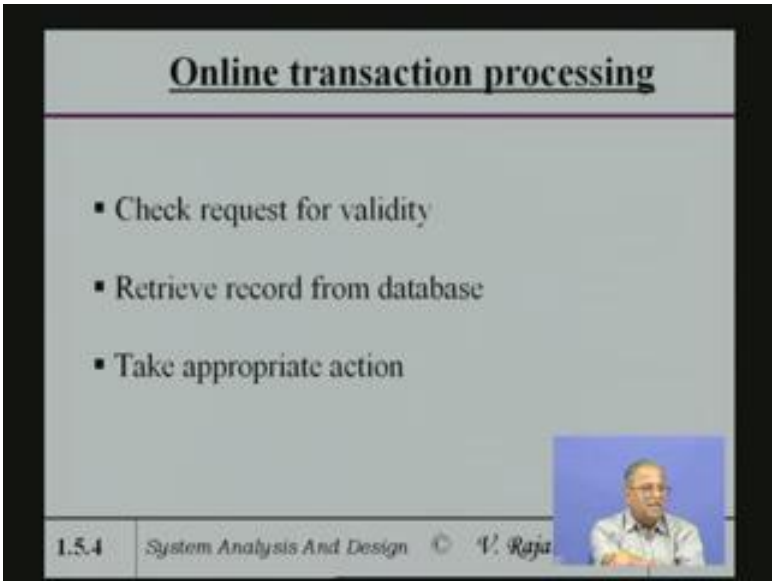

And check the request for validity, retrieve record from data base. And take appropriate action, either giving your tickets or not giving your tickets. Tell you that waiting list or whatever. So, every on-line transaction process has got this.

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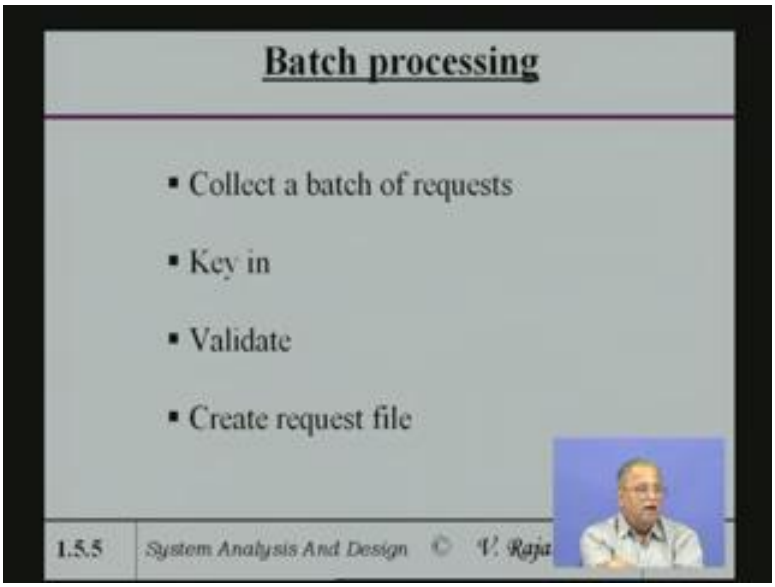

Whereas, in batch processing you collect a batch of requests, key in validate or create request file. So, in this batch you create a file.

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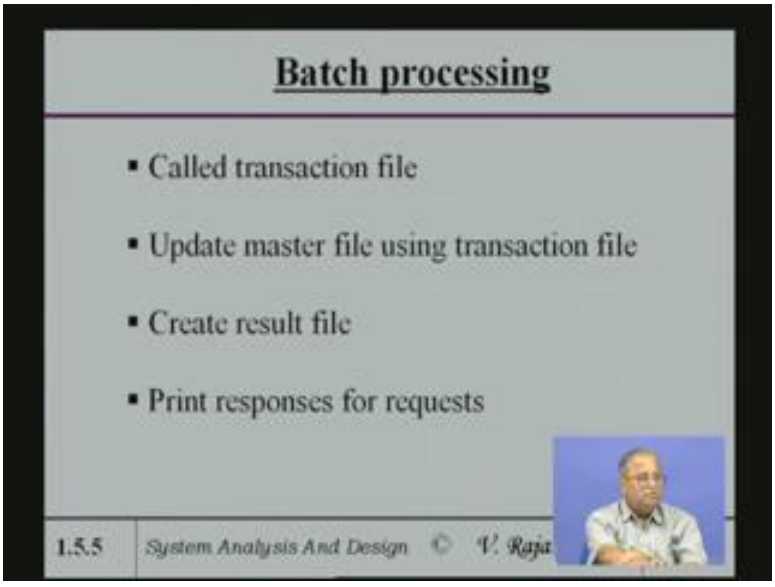

And this file is called transaction file, because you bunched up all together their file. And update master file using transaction file. In one on and if all, the in other words the

transaction file gets in. And one by one it goes in check the data base entries updates it. At the end of the file, the master file or master transaction, master data base gets updated. That is a new state and then, create the result file. Like if you have a pay roll, the result file will be a set of cheques to be a printed.

And print responses for requests. like exam processing also. In the case of requests is the results of examination, after CET, create a result file. Result file is printed and you get your big sheets of results, which you pin on the board. Or put it in the paper whatever, for the students to understand or know.

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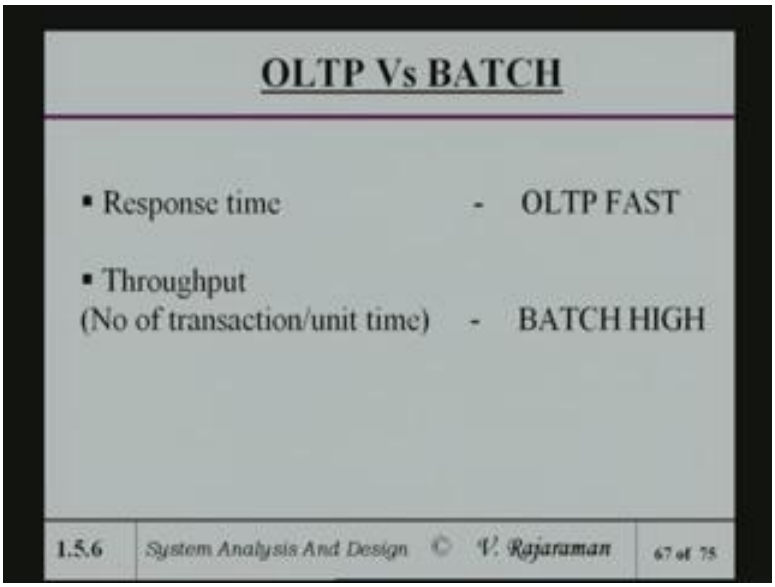

In the difference between batch and OLTP, in OLTP the requirement is that the response time should be very fast. What is meant by response time is, from the time you initiate your transaction; To time to get your result of transaction the lapse time should be small, for obvious reasons. See while you are waiting in a queue, to get you served for your ticket. You do not want to be wait half an hour to get a ticket. As soon as you get, first in the queue and you present your form very happy.

You already stood for half an hour may be in the queue. Now, you are happy that you got your turn. When you got your turn, to take another half an hour you will get frustrated. The people do not like to what, you know waiting in queues and waiting so on. For a simple reason that, they think it is a waste of time. Even that is not waste of time and nobody wants to be kind of unnecessarily stand on on-line and waste time. So, the

response time is very very important. And response time should be not more than a minute or 2. If it is goes beyond 5 minutes people start fiddling around.

Response time also depends upon situation. While using up a computer PC and then, you enter something and the result does not come out. And you go on waiting at that little hour clock goes on round and round and round. You get very frustrated, because the clients response time is not good. When you are working on a terminal on a PC, you would like to have a response time of a few seconds, 2 or 3 seconds.

Otherwise, you feel it start fidgeting, you think may be the computer is down or may be some problem with the machine. On the other hand, the machine may be slow. So, the point really is, in any kind of on-line situation, is very important to be able to get a quick response. In a batch processing system, the requirement is not immediate processing. Because, any how you have bunched up every things together.

See CET examination results, after you get all the examination results in. And input the data, which take the lot of time, because that is may be manual and so on. The computer time to process is not all that, it is only very small fraction of the total time. The time you give examination, to time your result is declared. So, that part what is more important is, from the point of view of computer, the computers time should be a present.

So, in other words, the throughput or the efficiency at which, it get processed in the computer, to reduce or minimize zip your time, becomes important. So, throughput is important consideration for a batch processing system. In fact, this throughput for is a response is a recurring theme, in lot of computer in fact, entire computer science. When you do design for a computer for instance, you can design a computer to maximize throughput.

Particularly, there is designing a server, which serves multiple terminals on multiple PC's. In a server, from the point of view of the person who is get into your server, there is from your PC, you would like to have very quick response. So, from individual point of view response is important. But, from the person who manages that server, he has to get the maximum utilization of that server. To get as much work done as possible, without any ideal time of the server. So, from each point of view, the throughput is important.

So, this kind of a design of a system, you tried a balance the two, response time versus throughput. If you try to improve the throughput, response goes down. If you make response very good, then throughput goes down. So, this ((Refer Time: 1:01:24)) always there. And of course, in data processing, you really look at two different types of systems. OLTP, the bench marks which are used or to assess the performance of the computer, it is quite different from what you use a batch.

So, at that time you know very clearly, that one is minimum response system, other is a minimum throughput system. I think this the right time to kind of a stop this talk. And next time, we will continue with the discussion.