Cloud Computing
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Lecture – 01
Cloud Computing – Overview

Welcome to the course on cloud computing. Today we will have our first lecture. So, as you might have seen the broad overview of the course. So, in this particular series of lectures, we will try to give an overall picture of what cloud computing is, and what are it is major components, and what are the recent trends. And at the end may be; what are the different type of a research opportunities, or this trends of future trends in the cloud computing, right. So, before going to the details of cloud computing, we will try to have a quick overview of course, and the basic paradigm of computing.

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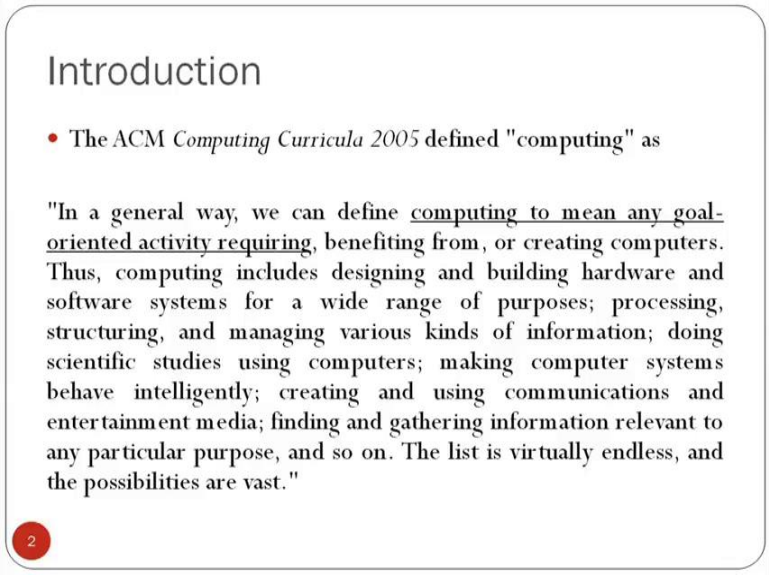

Now, if you look that as defined by ACM computing curricula in 2005; as they defined computing, it is a general way we can define computing to mean; as a mean to solve any goal oriented activity, right. So that means, it can include starting from hardware software system for a wide range of purposes, and also making computing systems intelligent using communications, finding gathering information from relevant to any particular purpose and so on. So, if you look at it has anything where some sort of a computing is needed, it falls under the computing paradigm. So, this gives us broad

spectrum of thing; not only in terms of resources, also in terms of the terms are category a level of people who can who are going to use it. Staring from a high end researcher or a professional, to a student, to even to a housewife, or a citizen in general, look one to use it for it is benefit or something which serves particular purpose.

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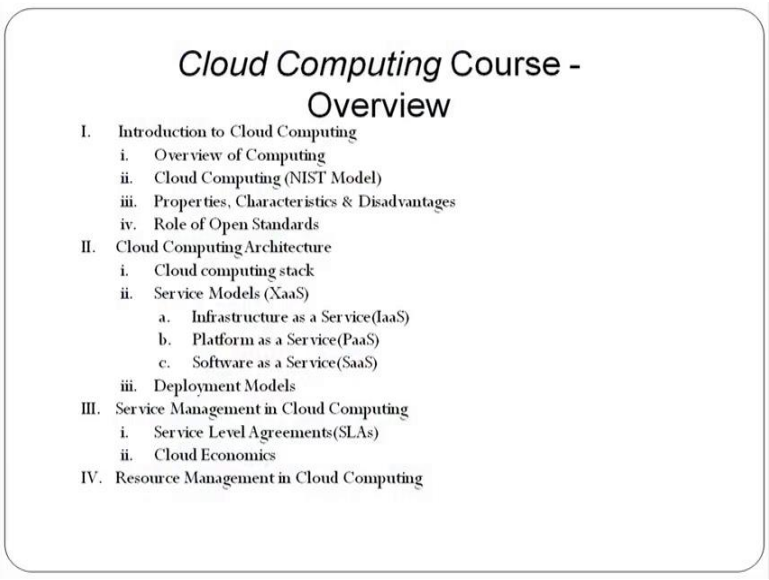

Before going to other overview of this computing, I will; let us try to reiterate the type of a codes or type of things, we will like to cover.

So, initial lectures, we will have a more things most likely today and may be something on the next day, that introduction to cloud computing which has gives overview what that NIST models says, what are the typical properties, characteristics advantage and disadvantages of cloud computing or role of open standards. So, whether there is a standardization need or things, then we will look at more on a cloud computing architecture, like what is the typical computing cloud computing stack moving towards a service oriented architecture. So, what sort of service models are available in cloud like typically infrastructure as a service, platform as a service, or software as a service, or anything as a service; later we will see that anything as a service, whether we can realize; what are the different deployment models, right in case of a cloud how; when I want to deploy, whether it is in a; what all be the different deployment models of a cloud.

Then one of the another major aspect of cloud is the service management. Like as we whenever we try to purchase any service, or whenever I want to leverage any service,

there is a need of service management, like from the say consumer end, I would like to have what is the guarantee of minimal services, from the provider end, the cloud provider or cloud service provider CSP one to see that may be the profit or may be may be that how this guarantee; what are the resource requirement at the back end to surf so much computers.

So, from the; if you look at the provider consumer for any type of services, not only cloud services, any type of services in our day today life, we require some sort of a agreement between the service provider and the consumer. What in; what we say something call; service level agreement, like I want to say that my availability will be 100 percent or near 100 percent, based on my thing like I say when a exam is going on, I want to have redundant services, So that the availability of the resources is 100 percent or very near to 100 percent; whereas, when my practice session is going on, requirement of availability may come down to 90 percent.

Now based on the availability, the resource pooling or resource management will be done by the at the provider end. And the provider will charge based on the type of type of his resources type of availability etc. Then there are issues of down time what will be there are issues of quality of services, there are several other issues that we will try to discuss under the paradigm of service level agreements and other things. There is another important person another important aspects is cloudonomics, or economy of using cloud computing. It may not be whether it is always good that if I use cloud, it will be beneficial, whether it is true like it is as we see like suppose if you want to commute 220 kilometer per day for your office or work. Then it may be economical to purchase a car, right, but if you are commuting say even 50 kilometer or 100 kilometer, once in a month it may not be economical then purchasing a car, right it may be more economical than hiring a car, right. Similarly, when I suit hire when I suit purchase whether there is a relationship, whether there is a economic model behind it or what if at all how to how do I from my say organization point of view, may be from a particular say even point of view, whether I can see that whether purchasing or hiring a resources or is economical or what is the what is the economic model of the things.

So, that type of things economics in cloud or economy in cloud we have to see, another aspect is the resource management. Like this is more in the service provider end right, or cloud service provider, how these resources will be manage right like I. So, what I what I

see that I have I need to surf so many people. So, what sort of resources I need to manage at the things. This is true for anything like if I say if I have a stationary shop or who which takes care of stationary is related to say academic things like I says a note books pen and etcetera, etcetera. So, how much I need to stock or it depend on how much maybe myself projection etcetera or so, I donot have some a situation when I am starving for my store or I should not have a situation when I am say my shop is full and I need to keep some thing outside the soft type of things, right.

So, it is I should not have a overloading. So, I have a proper resource management. So, it is very tricky when we have a computing as a resource, or when I provide computing as a resource, then I have to manage several type of resources. Like typically of I look at a in a typical computing system forget about cloud or anything. So, what are the things we are basically looking for? Maybe one maybe the processor or the CPU popularly, or maybe or one maybe the your working memory or popularly the RAM or hard disk and maybe network connectivity and there are other several other resources which are they are right.

So, how much resources I need to maintain, manage, etcetera, right. So, any resources has a inherent costing into the things. So, if I need to manage huge volume of resources without utilization, then I have to incur what we say more cost on the resources, or than in maintaining the things. So, this appropriate or optimally management of resources is a serious challenge. And they are here like to see that; what are the different type of resource management issues in these particular cloud computing thing. So, other aspects of these cloud computing one is the data management, right.

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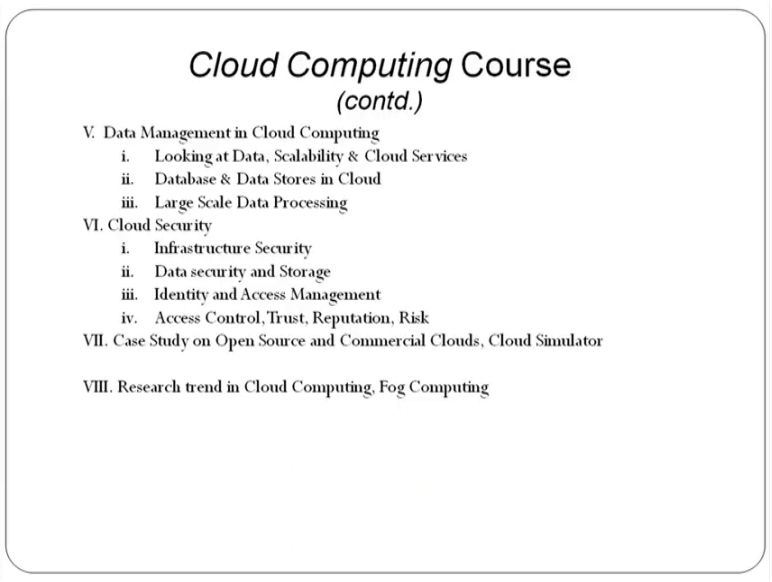

So, data is the very tricky thing, like we look to look at this how these data will be stored manage, scalability, and cloud services over this data services over that. If it is a not only data of it is a data bases and data stores. So, there is a separate type of looking at the data things in the cloud. And if it is a large scale data processing, then I need to look at the how this data management will be there. So, our conventional way of approaching normal data or data base management system whether it is still good for cloud, or whenever I want to give as data storage or type of services. So, what type of things; I need to do for the things like we are popularly using different type of storage as a service stuffs and in our day today life like one of the popular thing may be the dropbox. So, how things at the background need to be managed? So, it is not like that I need to build a data services all the qualities, but at least looking at that what are the architecture and what are the issues in data management type of things.

Another major aspects of a cloud is security right. So, your data is in some other place, you are computing in some other others domain. So, what will be the different type of security aspects? So, at it has like what will be the security which has a infrastructure as thing, or what are data related or storage related security, because data is a important aspects of our all things like, what many people say that you can regenerate a or reinstall an application, but you cannot reinstall your data right, write a report of 100 or 10 pages and it gets system get crashed and then data is lost along with the application I can reinstall the OS, I can reinstall the Word processing tool, but reinstalling the data is not

possible. That particular report is not possible if not; you have a recovery mechanism expect them, right.

Whenever I have on my personal system like it may be personal computing desktop or in a laptop or wherever, then it is my responsibility to take backups or I have redundancy things in that things. But whenever I store the data into the others place then one is one is how things are saved and type of things in case of loss or another typical thing comes up whether my data is being accessed or over retained ride somebody else right. So that means, whether this; what is the security of this particular data. There are issues of identity and access management. So, this is this is another important aspects where particular identity and access management of the collaborating parties need to be there. There are issues of access control trust reputation risk.

So, there are several issues like how access control will be there whether it is a our standard access control mechanism. So, whether role base access control mechanism or whatever things we can we work on the security, how much trust on having I have a cloud service provider whether I trust service provider one more than the service provider 2 or whether it is how to calculate a particular service provider. So, there are issues of the reputation I want to look at a reputation there are issues of risk of losing data losing application losing your, because your own customers like you are purchasing cloud to surf somebody, right.

So, you may intern things. So, this trust reputation risk goes somewhere what we say 3 nodes of a triangle. So, they are interlinked have a in for any systems; they have a lot of what we say; a lot of influence on working of the whole systems, right. So, I need to assure that how it is assured in the in cloud computing paradigm that you see. Then we will try to look at some of case studies or some what we say demo type of things on open source and on commercial cloud may be some cloud simulator. There are various commercial cloud in things in the in the market. So, we will try to see that; what are the basic property or how they work etcetera, then there are open source cloud.

So, we are try to see that how we open source things are there, even we will if time permits we will try to see that; what are the different type of installing a open source cloud. And there are few cloud simulators also. So, we like to; if it is time permits we like to see the simulator. And at the end of the things as one of our major motivation of

this academic world to take things in a in future, right. We want to see that something more in the future. So, we will try to look at the recent trend in cloud computing.

So, those who are interested in research or even some of projects in pg level ug level. So, they can they can have a pointer that what are the different aspects of sentence in cloud computing, there are there are people are talking about fog computing and other different technologies. So, we like to see that; what are the different aspects of those things. So, this is broadly the overall code structure we will try to give a proper weightage based on the importance of the course we will and we will give more details as an when we will we will basically going through those lectures, right.

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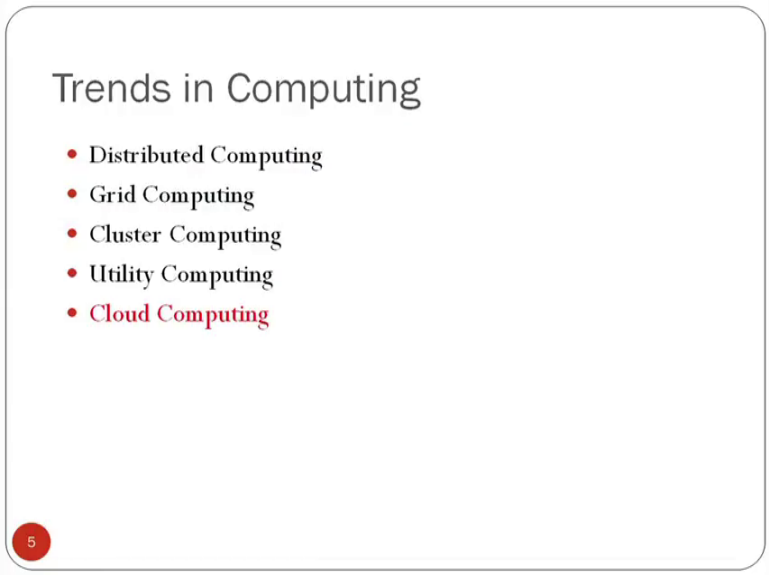

So, with this; we will try, we will have a quick overview of; what are the different computing trend which actually made this cloud computing a reality. So, it is not that it is from the day one something was there. So, it as we say that all invention or all any type of development is primarily come up with some necessity or requirement of the what we say community scientific community, or even general citizen at large. So, that drives that to what think is there one of the things there are definitely sky searches where we it is driven by that in own things, but we will like to see that so much computing is already was in place or is in place while still it has the importance. Whether it is a totally new baby or new stuff or it is a amalgamation or evolve through the things, right.

So, what we see it is in different literatures or even in if you look at the cloud computing as all. It is not a suddenly new stuff which came into the play. It has evolved and it has different other development which is already in place which has basically helped in bringing this into play. So, if we look at that different type of computing paradigm which are or which were they are for long time and still in a it is there in a big way.

So, one first of all; the mother of the things all those things is known as the distributed or people say that it is a distributed computing, right. So, distributed computing, then we have differ and other computing, it is not that it came in the sequence like one after another, but it is more of the these are the different aspects what we look at the things. So, it is a distributed computing we have grid computing, we have cluster computing, we have utility computing and we are talking about cloud computing. Now if we see that these different development where different needs, everybody has advantages; some disadvantages, and they helped in making some other things in a feasible way. So, we will go quickly because these are some of the things already known to you, and are available in the literature just to have that why what is the how it came up this cloud computing may be things.

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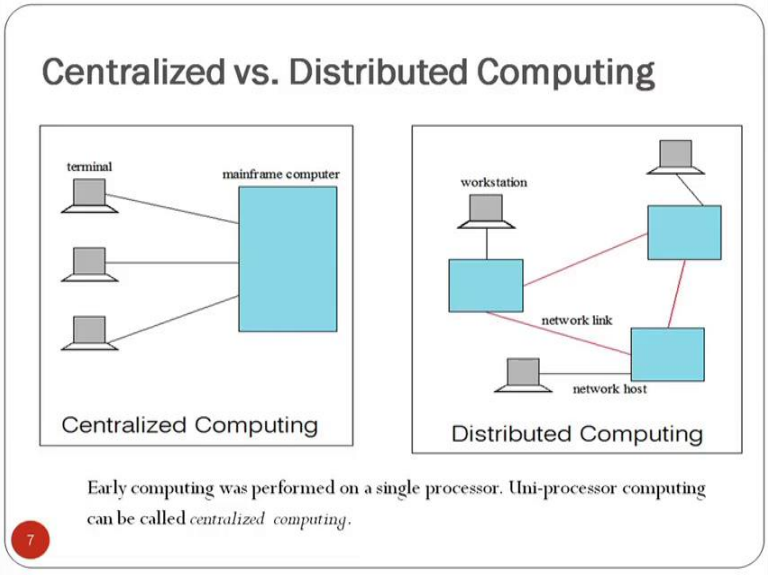

So, if you look at distributed computing, so we started with or still; we are; we work with centralized computing, like primarily in previous days, we used to use mainframe, where

different terminals are there. So, jobs are submitted to the mainframe that get executed and being used by the or being viewed by the user.

So, primarily it is a something which is has a logically single processing thing, right. So, or what we say some sort of a uni processor computing or centralized computing type of things. Now also in different places is there; it is not like that we need to throw out the things there is a particular necessity of the things and if these are still useful in several places and being used at several areas. So, the other thing which evolved is the distributed computing, we where you have different systems distributed over a particular geographical space. Typically it may vary from a lab type of a scenario, to a scenario where you have large geographical boundaries also. Again on depends on the type of requirements are there, right. And one important aspects came up is that network link availability of seemless network connectivity during between this collaborating systems, like they or what we say different network systems, right.

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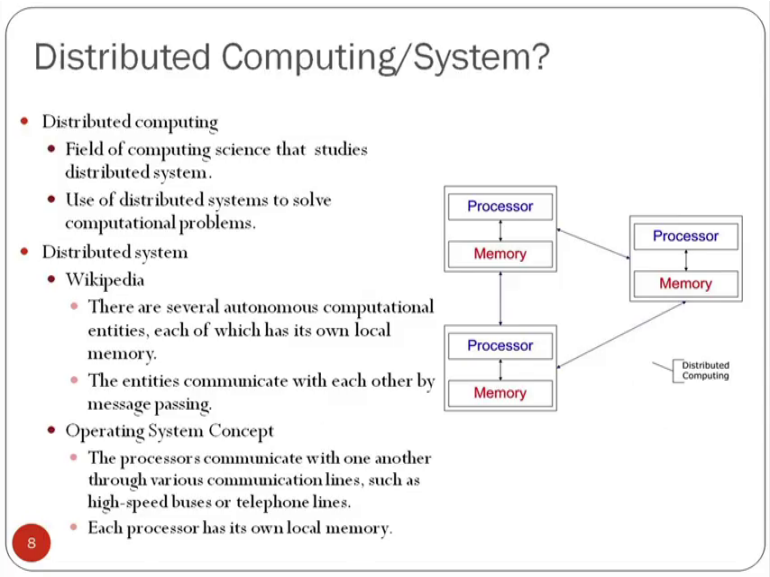

So, it is basically a field of computing science that studies distributed systems, it was there for long time; use of distributed system to solve computational processes; right. There are different other type of other definitions which come up if you look at the internet several definitions come.

So, there are several; it is one says that there are several autonomous computational entities each of has it is own local memory. So, it is separate autonomous independent

computing entities having their own local memory. The entities communicate with each other by message passing over a backbone communication network, right. So, that is one thing if we look at the operating system point of or way of the concept the processor communicates with each other through various communicational line say at high speed busses or even telephone lines where the things each processor has it is own local memory, right.

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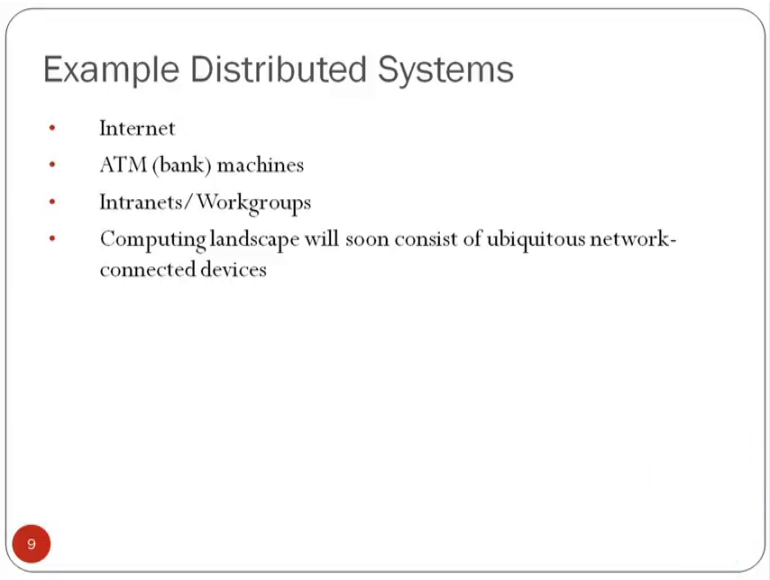

So, there are several type of example people put different things in the distributed computing paradigm, starting from over internetworking is a distributed system. Or this ATMs, bank machines, different branches of the banks or even different collaborating. And doing executing different functions that can be a things. Intranet or workgroups within the Internets may be a distributed system. Computing landscape will soon consist of ubiquitous network connected devices, right or rather not will be it is already we have ubiquitous network connected devices. So, or what we say it is something ad hoc type of establishment which comes and type of things.

And these days we see different type of networks which are which form as a adhoc network they are different volatile like one example is vehicular adhoc networks right like vehicles smart vehicles with their own on board units communication path once they come together they form ad hoc network, and it executes different type of function like

maybe safety related things may be entertainment related or infotainment related type of things and different type of stuff are there.

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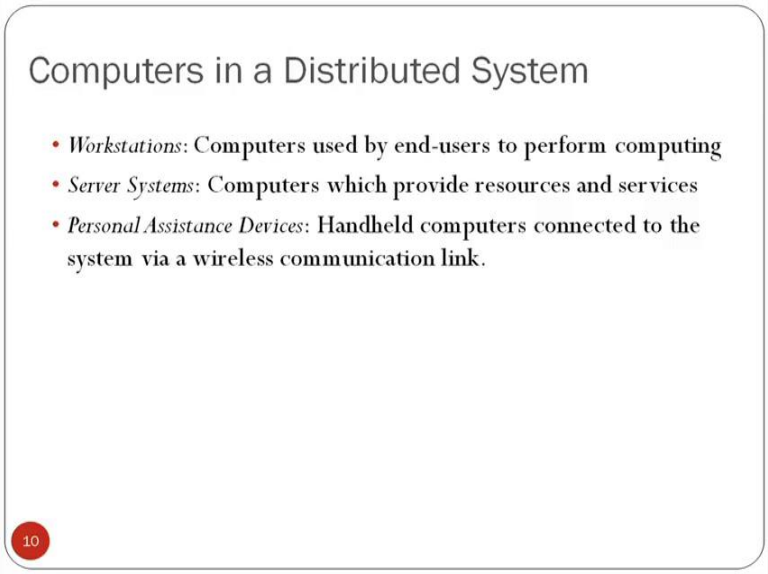

So, if we look at the broad type of computers in distributed systems. So, they are primarily what we say workstation, server systems and personal assistance devices like it may so. workstation is computers which are in the end user to perform computing. Server systems which works on a which give some provide some services per say. So, computers which provide resources and services right there can be personal assistance devices like handheld computers connected to systems where wireless communication network, I can be any type of things like any type of communication paradigms which helps in communicating with a things. So, these are the different what we say typical end nodes in a distributed systems, right. There can be other type of nodes also, like which has more network capabilities network processing type of things etcetera, but this what we can say broadly these are the typical loads in a in a typical distributed system.

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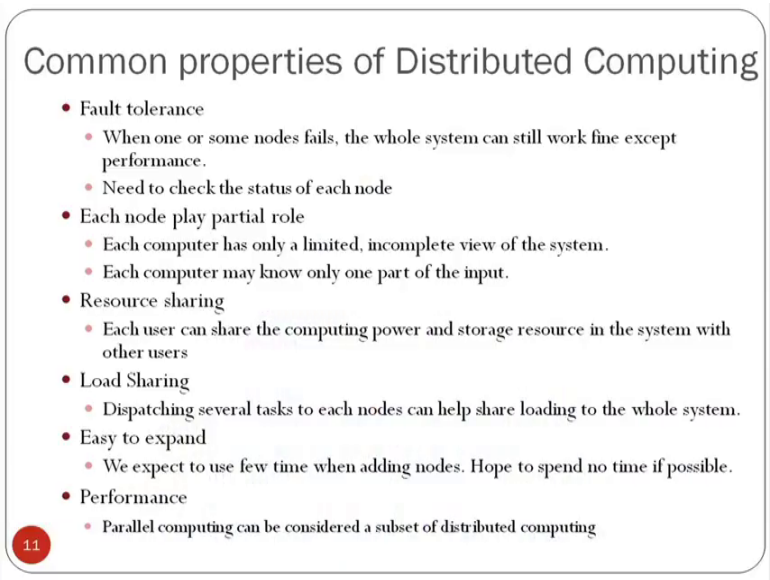

So, if we look at the why such of thing some common properties or common advantages, or what we say benefits of distributed system one is fault tolerant like you have one or more means several systems are working. So, even with some node failures it works faithfully, right or may be at a lower performance, but it is not totally out of service right, had it been a centralized system. So, if down the whole thing is down what do you get to do something in a lower thing. So, it also to make it fault tolerant, there are different mechanism etc. Many of you may be knowing and to make the things. So, there are other thing that each node, another typical aspect is each node play it is partial role, right.

So, each node in the distributed system plays it is partial role, there is another aspects of or a property of resource sharing the share resources among themselves, there is a load sharing. So, what is not only resource sharing that computing resource sharing, but also load sharing like if it is a load or what we say that load balancing among the things can be realized, easy to expand, so, usually systems may be like that that we can easy to expand like I can have I can add distributed system more system into the network as and when as and when I have it or use it. Performance is a issue. So, parallel computing can be considered as a subset of distributed systems where I can have higher performance and need to be monitor.

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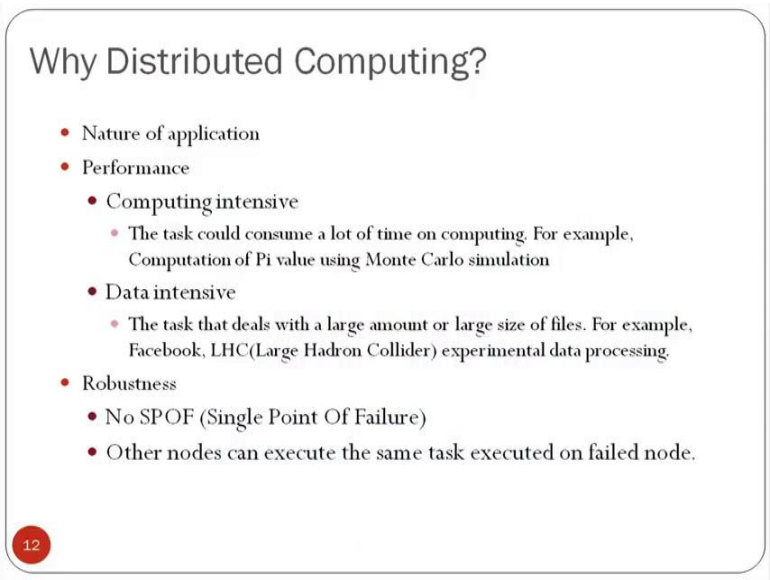

So, what we will, so another aspect of distributed system is that why we require maybe the nature of application demands it, maybe the different performance like I have computing intensive, data intensive type of a things. And in some of the cases I require robustness into the system that should be no single point failure. I don't want any single point failure I may be doing a miss and critical things which may not be very computing intensive or memory intensive, but I can not afford to do any failure on the system, right. So, in the several cases there is a need of the things or in other sense this need primarily one of the primary what we say motivation of developing or development of this distributed systems. So, we will we will break for now and we will continue our discussion in the subsequent in the next lecture.

Thank you.