Cloud Computing

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Lecture – 30
Broker for Cloud Marketplace

Hello. Today we will discuss a aspect of Cloud Computing, where we will see that if there are number of providers. So, how do I select whether there is a way to select the things and how what should be the approach of the things. So, what we see in a present day scenario that there are increasingly availability of number of provider, at various level is level pas level SaaS level. So, at various level and there are several requests on the from the customer side right.

So, customer has a expectation or requirement per se, and the providers provides a particular things with some miscalis right. So, first of all the customer wants to know that where which provider, how to select a provider out of a branch of providers available, where the customers expectation will be satisfied and the SLA will be honored and the providers also wants to maximize his profit right.

Some of the aspects already we have been seen. So, given all these security and other aspects in place we do not to look at that whether in this cloud quote unquote marketplace, how do I whether the what whether there is a possibility or approach to look at the things. So, that is exactly we like to look at. So, it is broker for cloud marketplace. So, what we look at there is a number of providers available there are several customers. So, it is a marketplace to how to select the thing.

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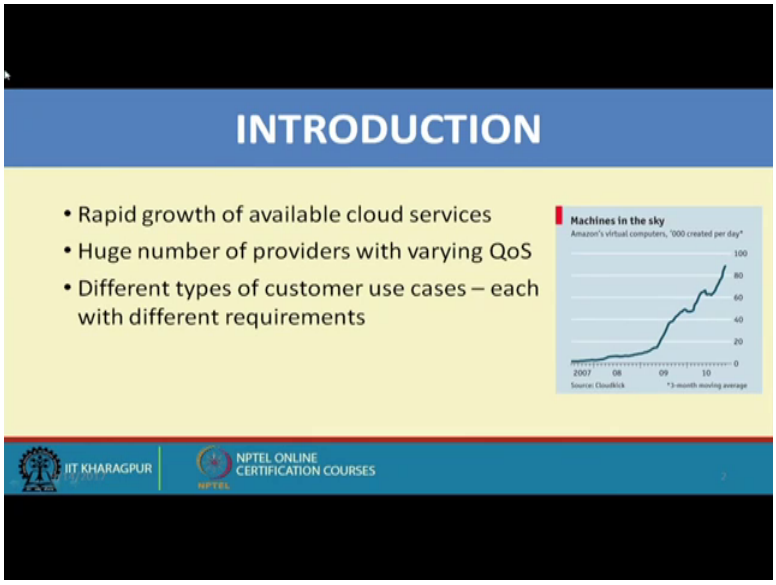

So, if you look if we see that there is a rapid growth on available cloud services right. So, it is there are several providers, several service providers right; and there is a rapid growth of the things like and huge number of providers with varying quality of services are things are there right.

So, different providers has different quality of services and type of things different type of customer use cases. So, customer based use cases each with different requirements or with several requirements customer use cases are there. So, thus the review the requirement of the customer is based on the need of the customer, it varies from customer to customer. So, that is another aspects and from a from some reference what we see that this number of amazons VMs created per day from 2007 to somewhere 2011 it has it has remarkably changed right. So, there is a huge demand for the things.

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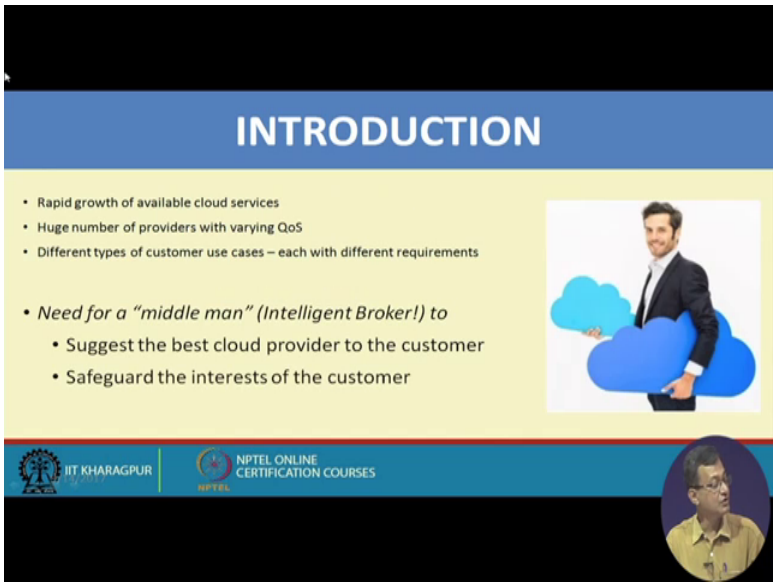

So, keeping all those things in the offering or in keeping in this mind there is a need of a middleman right. So, I we there is a need of a middleman we can called as a agent or broker or sometimes it may be a intelligent broker to suggest the best cloud provider to the customer or safeguard the interest of the customer right.

So, I require a quote unquote middleman or intelligent broker, serve broking service which safeguard the definitely safeguard the interest of the customer, and also suggest the best cloud provider or cloud service provider of the customer based on its requirements right. So, this is nee this is a need of our or people are working on it that how can I select how can I broke, how can I select a things with a intelligent agent or broker.

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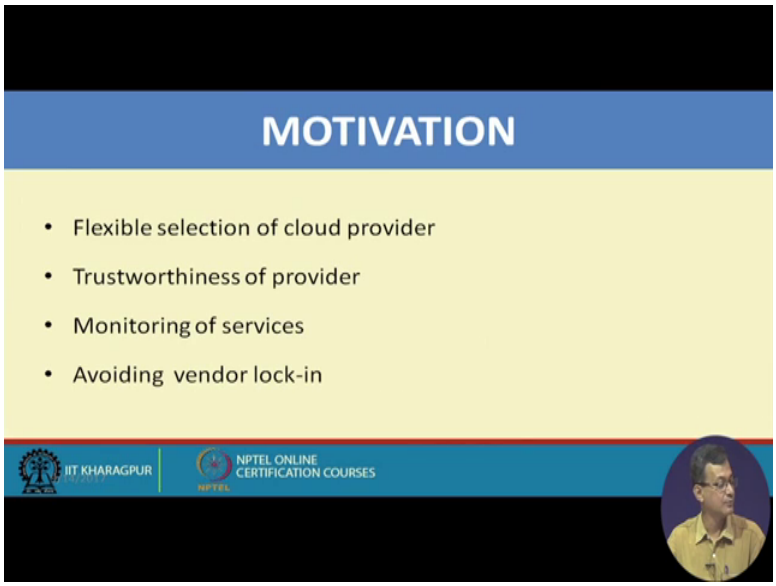

So, there are definitely motivation that these flexible selection of cloud provider, there is one of the things trustworthiness of the provider plays a important role how much I trust or I can be able to trust a provider is there, how do I calculate the trust is a big challenge yes some of the aspects we have looked into or discussed during the security, when we discussed about cloud security. So, starts worthiness is important right.

So, that is one of the factor monitoring the service that whatever the things are there, how services are monitored and of course, there is important aspects of vendor lock in right. So, whenever there is a vendor. So, there is a problem of vendor lock in so that means, you work with some provider and you get locked with the provider because of the services right now if the providers is not giving the service up to the mark, or the provider or the CSP does not provide the service then going to another vendor is difficult; and it is not only that now you need to go for a in the terms and condition of the or the customer has to go for the terms and condition of the provider.

So, vendor lock in is also important aspects which we need to look into the thing. So, there are several motivations there may be several other motivation, but end of the day what we look at that I may need I need a the mechanisms to or a broker to find in find the best possible cloud things.

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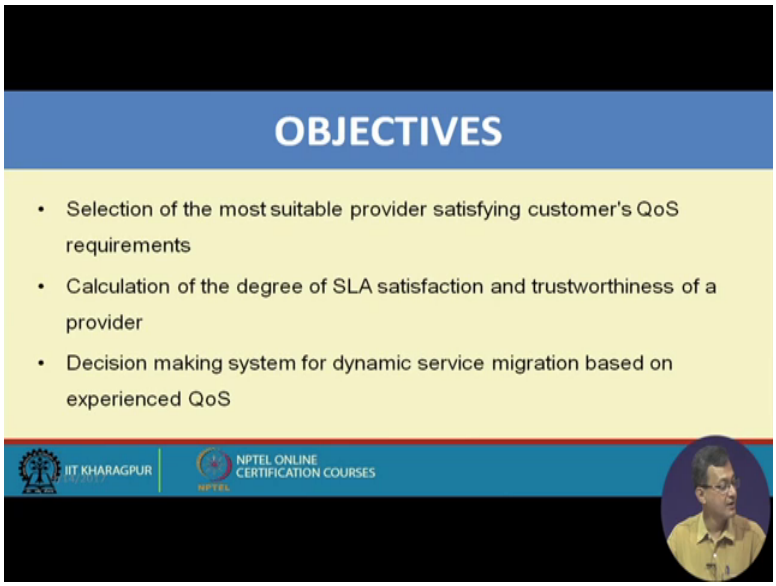

So, based on this motivation if you look at the objectives, so one is the selection of most suitable provider satisfying customers QoS requirements that is the major objective; calculation of the dis degree of SLA satisfaction trustworthiness of the provider may be one of the subjo sub objective right like how I can guarantee that the degree of SLA satisfaction and trustworthiness of the provider, that is the other objective which one is selecting and type of things decision making system for dynamic service migration based on the experienced QoS is another aspects right.

So, it is if the provider if I do not get that appropriate service or that is from the customer point of view or from the aspects of the that a middle ware, that whether I can migrate the service from one provider to another provider right like we look at that VM migration if the my if there is a any outage on the VM whether the application will be migrated on the things.

This type of things has been supported by various organizations as we look at on the hardware and type of things like at the VM level, but whether this type of migration on the whole application from the one provider to another provider that is may be there. So, once we do a migration or any of this or many of these aspects, we need to take a call all right.

So, there should be a decision making process into the things right that is one aspect. So, I need to have a some sort of a decision making support, which allows me to do that.

Secondly, another aspects is there that most of the cases things are not very crisply defined right the requirement wise the your performance wise, the thing is the thing is the all these parameters not very crisply reach us there is lot of fuzziness; specially in fine in giving the details of the customer. So, I what we need to do we need to account for the overall those aspects also.

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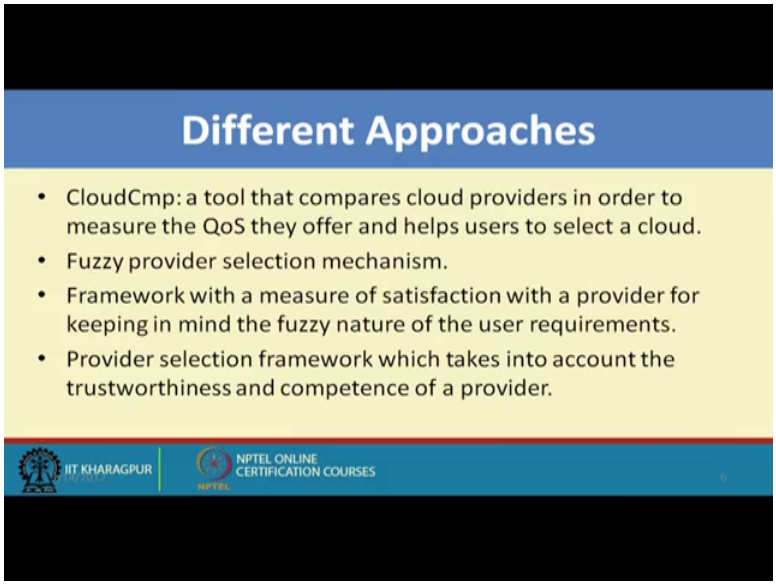

So, there are different approaches what its tried few of them are here, but there are different approaches people have tried like one is that cloud Cmp, a tool that compares cloud providers in order to measure the QoS the offer and helps user to select a cloud. So, there is a cloud there is a tool which compares the cloud providers in order to measure the quality of service they provide. So, based on that the a user or customer can select a cloud, there can be fuzzy selection mechanism right.

So, there is there can be fuzzy provider selection mechanism. So, that is fuzzy provide a selection mechanism. So, that if which takes care of the fuzziness that is also which well suited because there are a lot of fuzziness into the description. There is a framework with a measure of satisfaction with a provider satisfaction with the provider for keeping in mind the fuzzy nature of the user requirements right.

So, keeping considering the fuzzy nature of the user requirement, measure of satisfaction with a provider how to calculate that based on this measure the consumer can take a call; provider selection framework which takes into account the trustworthiness and

competence of the provider. So, there is other way of another way of looking at it is that provide there is a folk provider selection framework which takes into account, the trustworthiness and competence of the provider all right this trustworthiness competence of the provider.

So, if you look at these different approaches. So, this one is there that it attempts to find a suitable provider for the things. Secondly, there are several overlaps between those type of things right may overlap in the sense that how they consider the user or the customer requirements or inputs the overall mechanism of selection and so and so forth, right.

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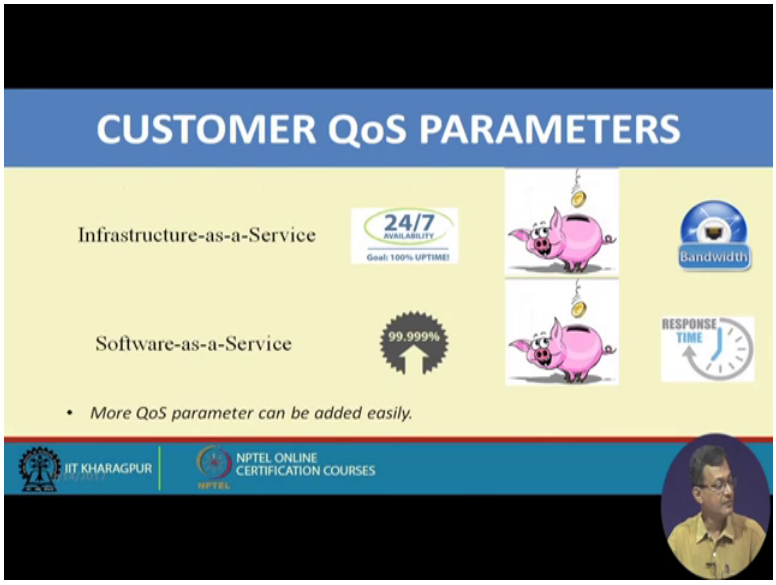

So, if you look at customer QoS parameters some of the things, like if we consider infrastructure as a service. So, what we look at that 24 cross 7 availability with hundred percent requirement like it is the I get a returned what I pay for it, and there are requirements in terms of the bandwidth requirements other type of things. In case of a software wise service the uptime requirement may be male vary again the response times is critical. Rather if you look at this these are the several type of a components which are there. So, more QoS parameters can be there are like in terms of things like even I can talk about we can talk about storages, we can talk about other quality of services like even security, trustworthiness, competence risk and so and so, forth like availability and so and so forth.

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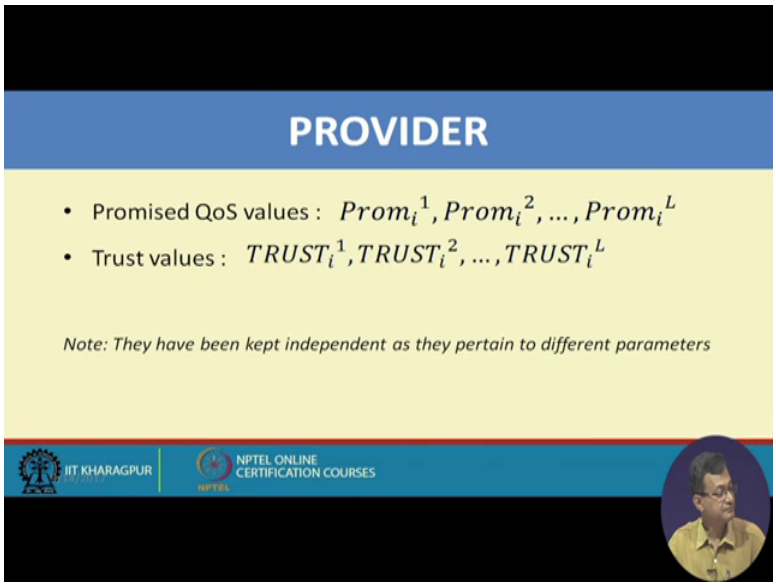

So, that is in case of any cloud provider, we have a set of parameters which the provider provide or the promised QoS values right they based on thing that they provider promise different type of provider, different type of QoS values or QoS parameters like I the provider says there is a 99.99 percent uptime or so much security level or maybe this much bandwidth available and so on and so forth and there are based on that we can have different trust.

On those things the trust can be overall over all the provider or I can even trust on a on different parameters like I like availability things. I say that that this based on the experience this trust on these things trust on a particular provider is something right 029 scale I trust it in 0.029 scale I trust it in point 8.8 value and trust value of 0.8 and so forth right.

So, there are different trust values and they have been kept independent as they pertain to different parameters right, there the trust value can be kept independent as there can be different type of parameters for looking at the as those trust values like promise a particular promise one can have a trust value 1, promise 2 and trust value 2 and (Refer Time: 13:06). There are different mechanism for trust calculation several things for trust computation type of things it goes for a for history of those things, and looking at the history and then calculate and or third party auditor or third party monitoring units, which monitors those trusts and there are mechanisms to calculate the trust.

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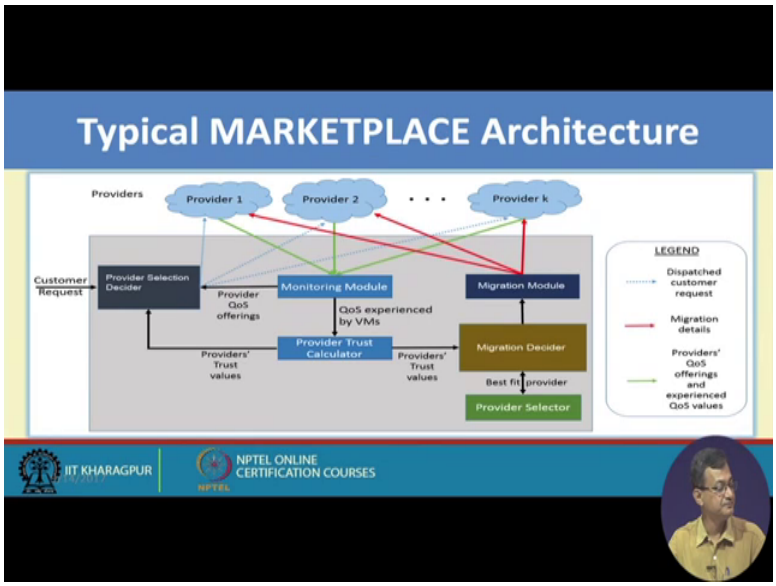

So, if we look at a typical marketplace architecture. So, there can be several components right; one is a there are set of providers right like a provider 1, 2, 3 p 1, p 2, p 3 pk there are components like the major black box may be the provider selection decider right. So, the customer comes with a set of requirement and requests the this particular selection box and it takes the other inputs and decide the things.

The other blocks are like maybe there can be monitoring module which are constantly monitoring, whether there is a request or not it is monitoring the providers right there can be a migration module. So, this was monitoring module it says that the QoS experienced by the VMs for different providers and you put it put to the provider trust calculator right and there is other component is a migration module, which is the migration deciders. So, based on this provider trust calculation I can this is it has goes for a input of the migration decider, and this migration module no keep a track that which are the providers there what are their loading capacity and type of things, and based on those it goes on a which need to be which providers need to be selected. So, it goes for a provider selection right.

So, one side that requests requirement, so the selection procedure provider selection procedure is dictated primarily this monitoring of the different QoS parameters, and type of things. So, this may be one such approaches, but there are a lot of nitty gritty into the things, like customer requirement how it will be taken, whether it is a very crisply

defined or there are fuzziness of the things. If there is a fuzziness how to handle this fuzziness, or how to account for these fuzziness, there can be furry fuzzy inference engine which are can be deployed out here. This particular things which we are discussing is to of my students work for their projects one for b tech and one for m tech projects, on working on an intelligent broker for cloud market phase using a fuzzy approach using a fuzzy inference engine.

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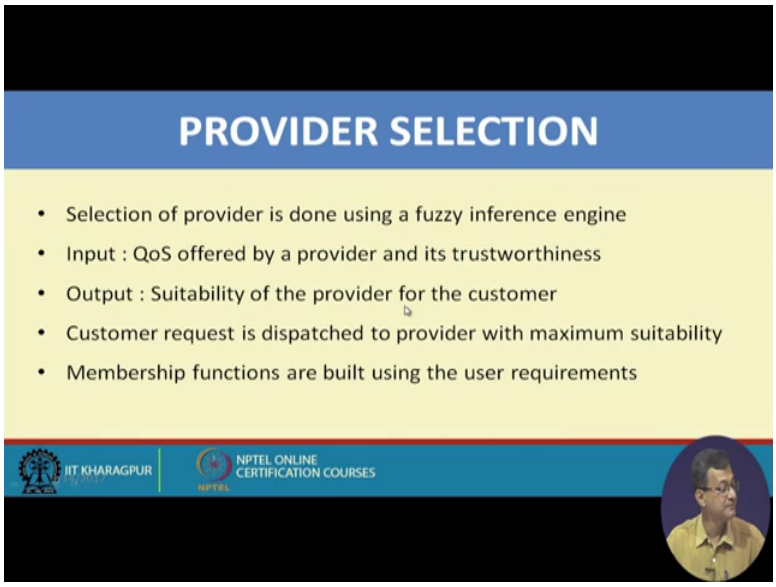

So, there are a major block diagram of this architecture. So, provider selection if you look at selection of the provider is done using a fuzzy inference engine right. So, there can be other approaches, but in this case what we did in fuzzy inference engine. So, input is the QoS offered by a provider and its trustworthiness right. So, it takes the input as a QoS from offered by the provider and its trustworthiness, output is suitability of the provider for the customer right.

So, I have that one side that provider's competence. So, to say that quality of services offered by things and its trustworthiness other size what we have these customers or the user's requirement right.

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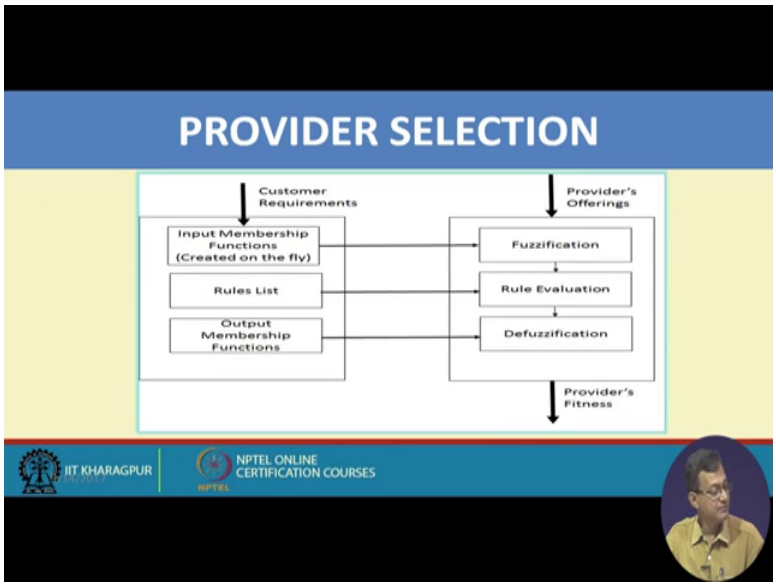

So, and these this fuzzy inference engine in this case takes care or consider these two, and finally, give a output that which should be the base providers for this particular customer.

So, that is the goal of the finding a suitable provider in a cloud marketplace right; customer request is dispatched to provide with maximum suitability, membership function are build using user requirement. So, the membership for function on the providers on the customer side can based on user requirement that can be build on the fly and then put into the system.

So, they are not only that there will be a set of rule set on the customer side that need to be accounted for also. So, in from the customer requirement input membership function for the fuzzy system, and there is a rule list and there is output membership function based on those things right whereas, the there is providers offerings like what the provider can offer, fuzzification of those things there is a rule evaluation based on the customer rule list and defuzzification and providers fitness to the customer requirement, there is other aspects of the other aspect of the thing right.

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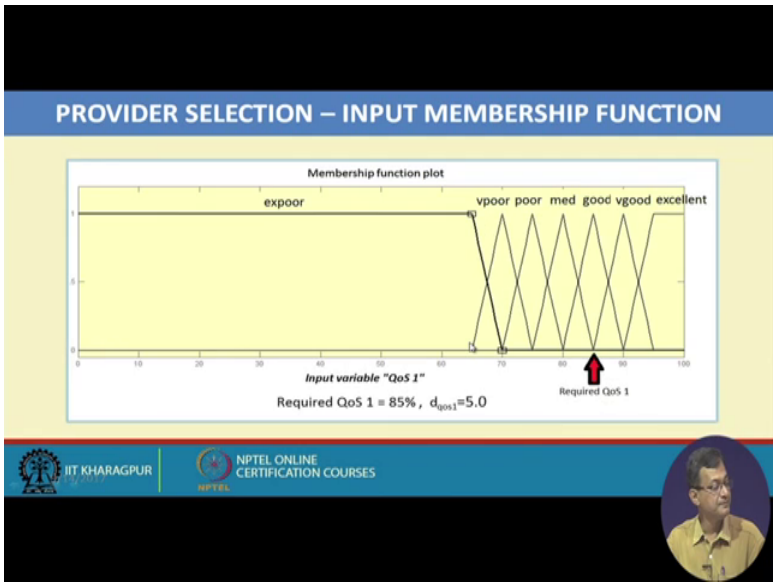

So, this whole thing leads to provider selection. So, this this basically fits into the system and it keeps provider selection. So, like a typical scenario where for this experimentation that provider selection input membership function, with different thing like extremely poor very poor medium, good very good excellent and this type of different states and using this input fuzzy membership function.

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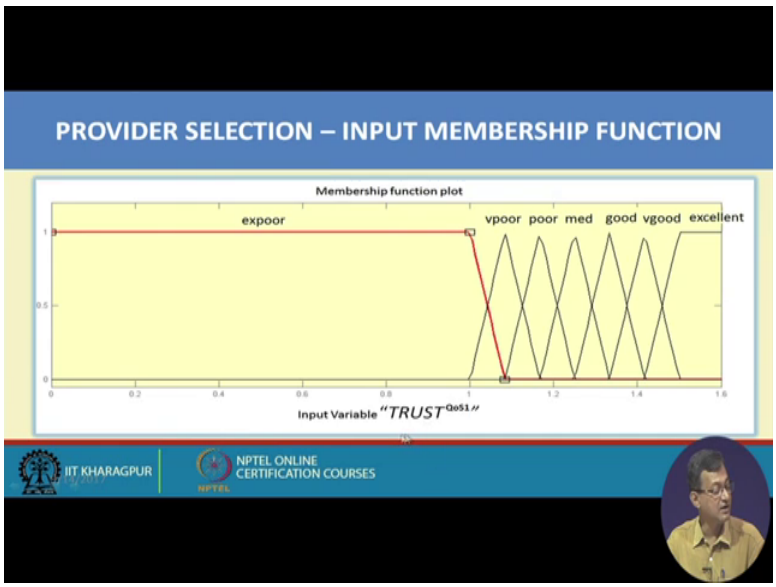

So, what we do that is based on the QoS and based on these, that what is the input variable is the I means with input has trust that having that membership function again at different scale.

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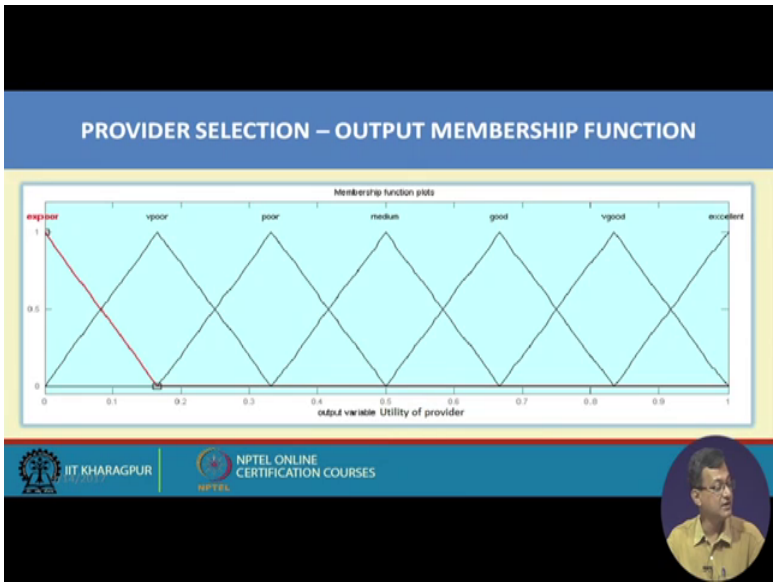

Then we construct that output membership function, generally the output membership function with those levels of extremely poor very poor medium good very good and excellent. Based on this we calculate that what should be the suitable provider for the things.

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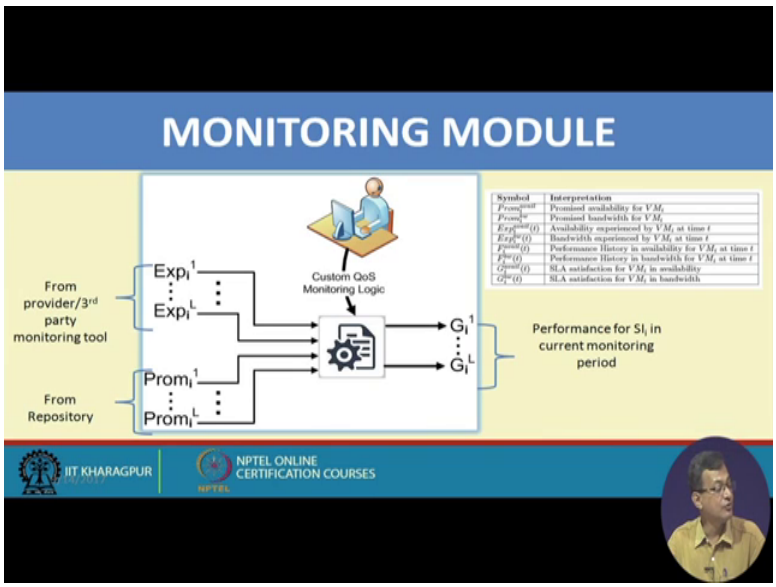

There is a monitoring module which monitors the overall processes. So, it takes different available experience values that is availability experienced by the particular VM bandwidth experienced by a particular VM or a particular time then the what are the different promise for different VMs by a particular provider and so and so forth, and generate that SLA satisfaction for a particular VM I on availability SLA satisfaction of a particular VMI on bandwidth and so and so things.

So, performance of this sort of service provider or service instances for a particular service instance I, in the current monitoring period is generated. So that means, what we try to do this, they are we are trying to monitor be service they are performances of different providers and based on different service instances right or a size right that how they are performing this is important for selecting a particular provider.

So, what we are doing if you look at the big story. So, we have one side the customer it has some requirement, I need to fit this requirement to some provider or a set of provider and such as the customer that. See this is the provider is there for the provider in there is a continuous monitoring of the thing right, that with even with performance histories right. So, what are the different performance, what is the promise value and what is the experienced value right one is the promise what the cloud provider gives, and what the experience and the based on this promise like availability bandwidth how much is experienced by the user or the customer with at different point of time.

So, while calculating a at time t, I consider for different provider this monitoring unit gives that for different service instances what how is the performance of this of a particular provider or at a particular provider I based on that. And taking the suitability of the customer we the system sets a then this is the possible provider, or it can even rank that is the first one second one and so and so forth.

There will be a different other factors like here may because we are considering availability and bandwidth there can be other different other factors, even cost is a factor and requirement plays a big role that whether mine is a time critical or say data critical or more accuracy is more important or the time is more important and type of things come into play.

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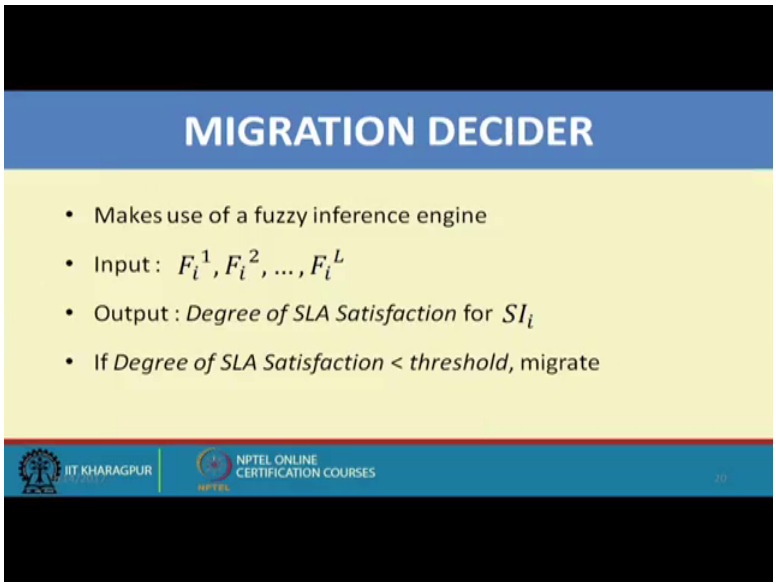

So, if there is something running on a particular system provider then if there is a need of migration from one provider to another. So, there is a need to have a thing called fuzzy there is a another decider block is needed for migrating for the migration decision right. So, it used again it uses the fuzzy inference engine, there can be different input f one f two f three f three for different providers and output will be the degree of a SLA satisfaction for a service instance I right. If the degree of a SLA satisfaction is less than threshold is then migrate.

So, what I what we are doing? I am think I am my particular from the customers particular service instance is running. So, and degree of satisfaction is being calculated if the degree of satisfaction is less than the threshold there is a need to migrate to a new provider or a new service instance right.

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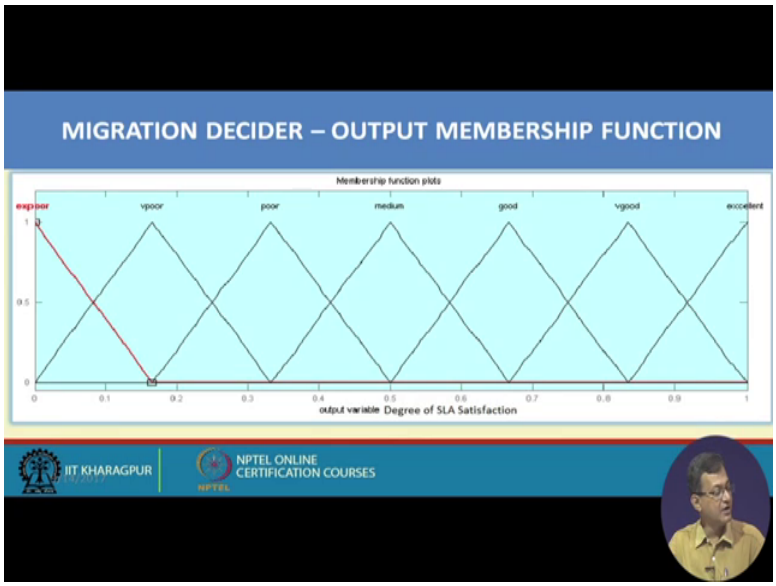

Here also this it is done through fuzzy inference engine, and this is a typical instance of a output membership function with different levels.

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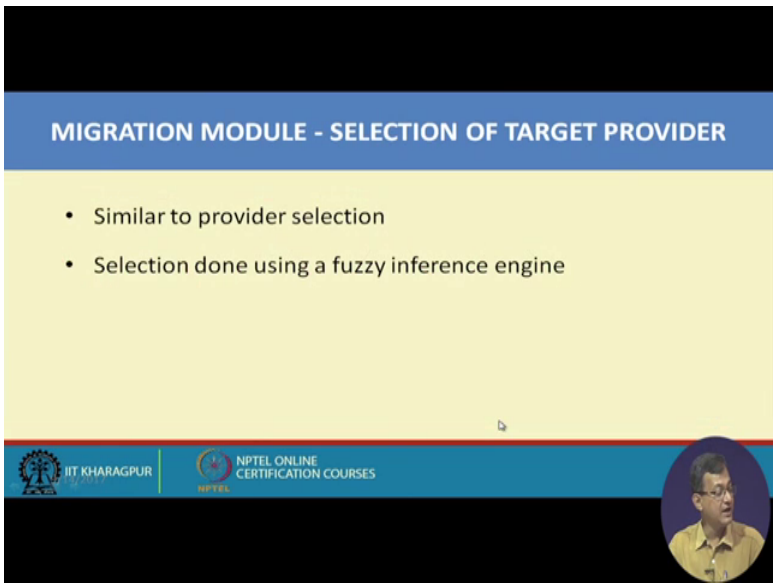

I will shows that the degree of SLA satisfaction based on that, it is decided that whether the migration is needed or migration is need to be executed for the for a particular service instance.

So, similar the selection of the target provider is somewhat similar there similar to this provider selection procedure, which is being monitored and so on and so forth selection done using a fuzzy in inference engine in this case also.

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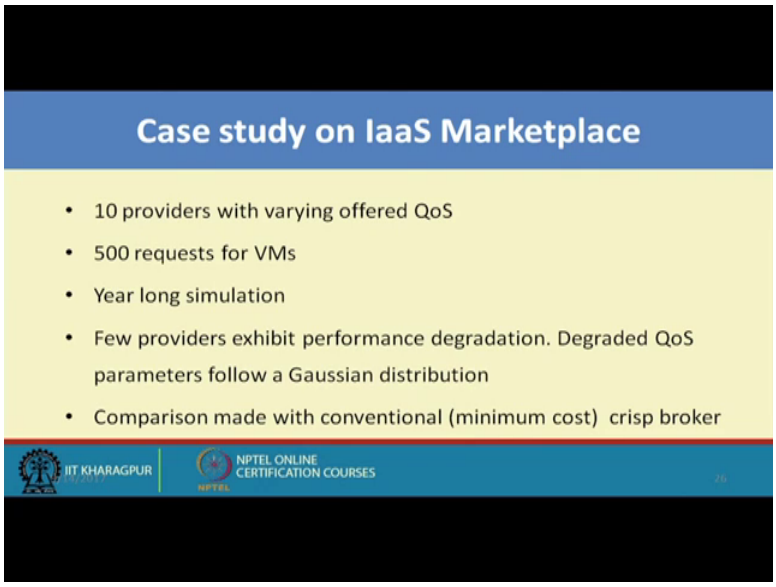

So, what we have here is that, it is true for any type of service provider though primarily it is more pertinent for is type of market place, where this infrastructure as a service it is being provided, but it is true for any type of cloud right. So, here we did some case study is to. So, that whether how much effective it was that whether it makes sense to fuzzify the or using this fuzzy approach.

So, we did a simulation with 10 providers with varying offer here varying offered keyways 500 requests for VM are considered, there is a done through a yearlong simulation; that means, over a year the time period has been taken as a year taking on a daily basis. Few provider exhibit performance degradation. So, degraded QoS parameter follows a Gaussian distribution. So, the if there is a some sort of a degraded QoS has been done using a Gaussian distribution and comparison made with conventional minimum cost crisp broker.

So; that means, there is no this sort of fuzzy system if there is a crisp broker; that means, it takes a call yes or no type of a things then with a with minimal cost on those decision making.

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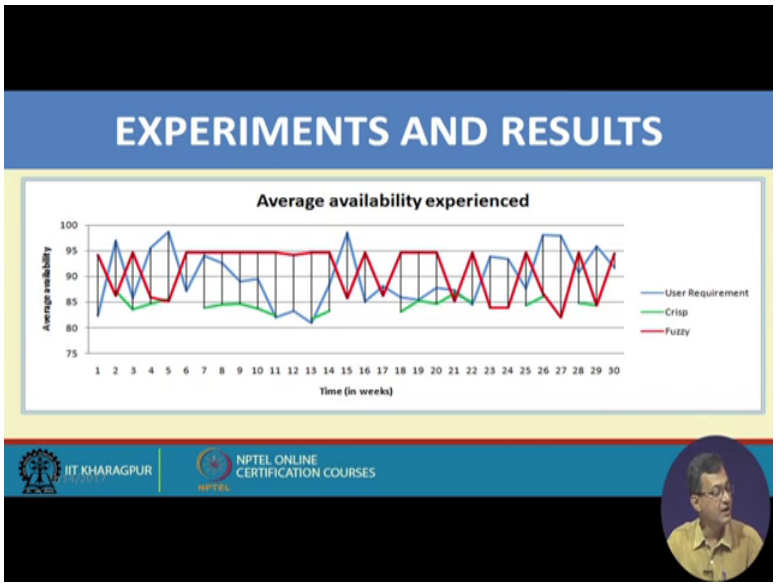

So and then how it performs compared to that. Like one the one is showed that the average availability this blue color is the user requirement green is the for the crisp broker and red is the fuzzy. So, what we see that it is it may not be always following, that user requirement, but in a sense it is better than the crisp approach.

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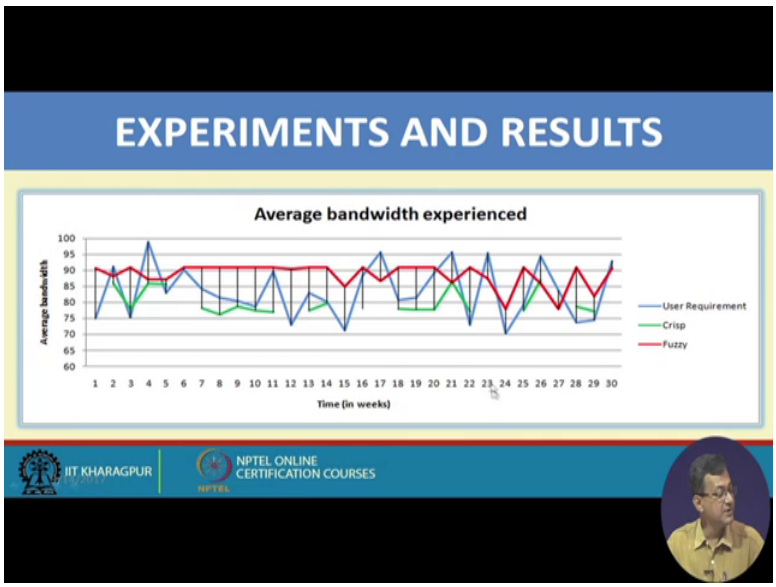

Similarly, this is for average bandwidth again, here blue is the user requirement, red is the fuzzy and green is the crisp broker.

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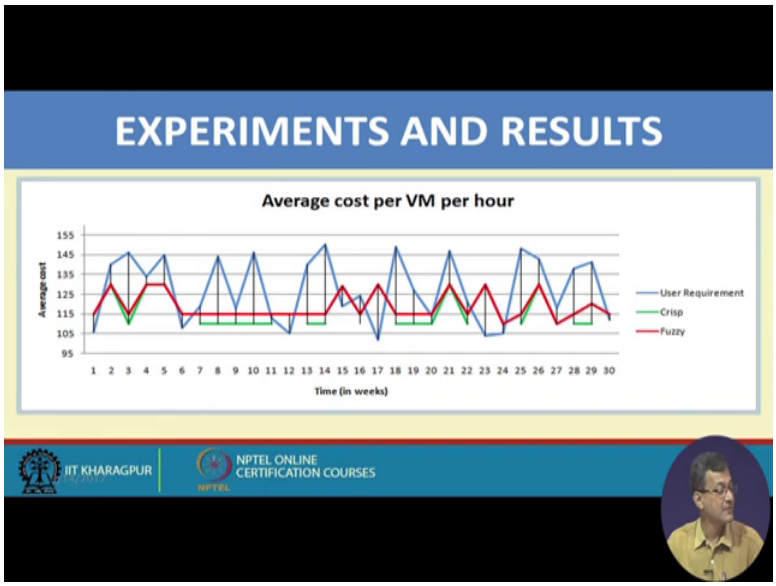

So, here also we can see that is better than this crisp broking type of thing. Similarly average cost per VM per hour the if we look at the same way, that over a scale the fuzzy gives a better result.

So, similarly though it is predominantly for SaaS is type of provider, but we did some experimentation on the SaaS or some simulation on the SaaS marketplace. So, here also some sort of a 10 providers are considered with 500 service requests again simulated over 365 days, few provider exhibit performance degradation QaS parameter follow a Gaussian means QoS degraded degradation degraded QoS follow a Gaussian thing and compression with the conventional crisp thing.

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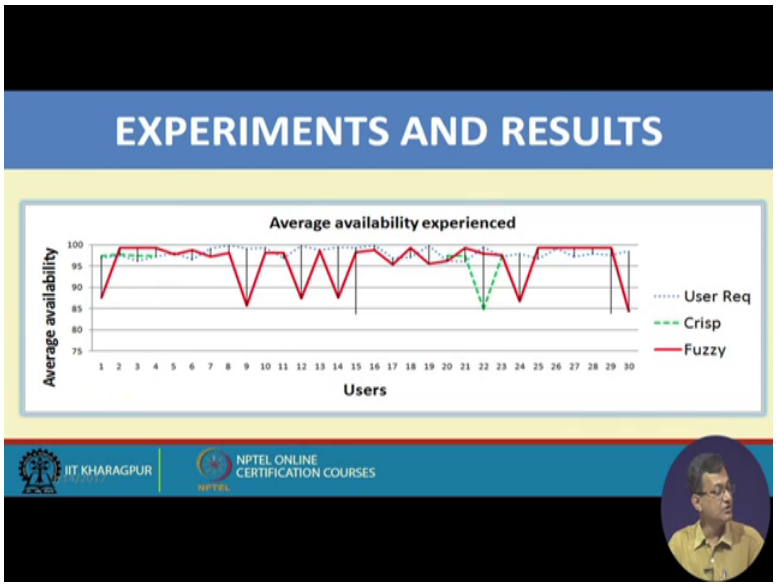

Here also what we see that you the dotted line is the user requirement, red is the fuzzy and crisp is the green. So, over again arrange the fuzzy seems to be following better, that may not be always the case, but it is likely to be better it is likely to be mapping the user requirement better way that fuzzy inference engine.

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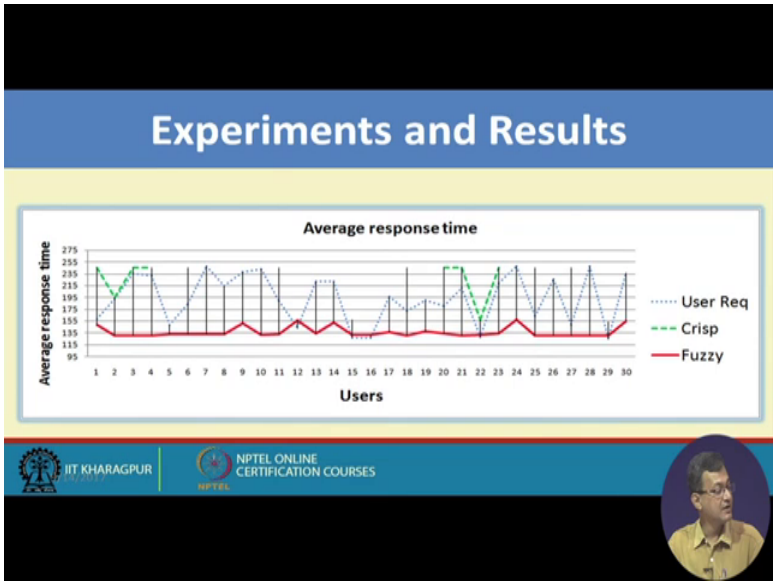

Similarly, this is on the average response time over again the particular period of here in this case 30 days and that how the overall performance is there with fuzzy crisp.

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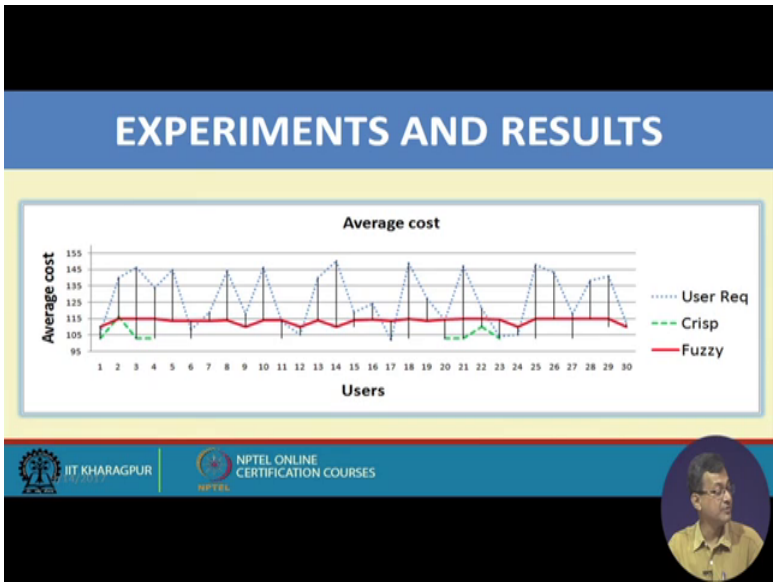

And with respect to user requirement similarly this is the average cost of a particular the instance of the things.

So, what we see that we basically implement this sort of a fuzzy inference engine, in order to map these ah user requirement two way to the rather mess the user requirement with the providers offerings and try to feed the best provider with the user with the particular user requirement or set a for a particular user of the for a particular service instances.

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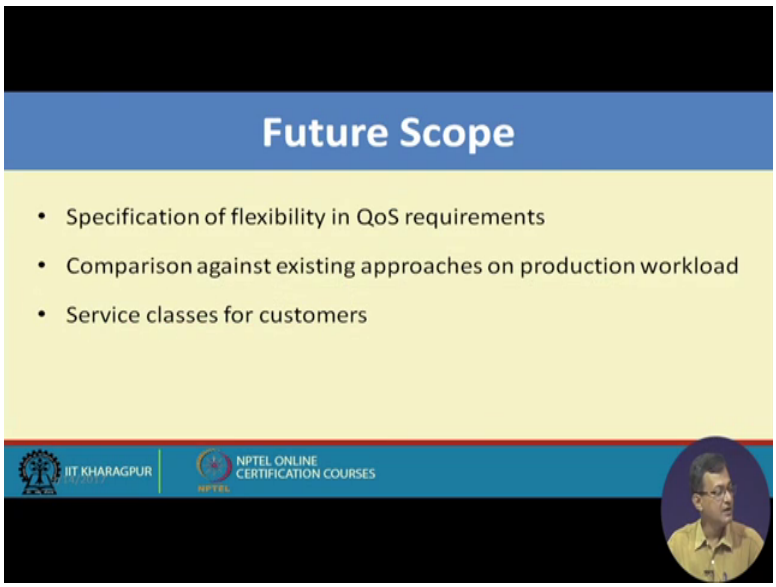

And what we like to look at there are several future scope, especially in the research formed for a birth for this particular one there is a specification of flexibility in the user QoS requirement is there right that is whether we can make it flexible of QoS the requirement, comparison again existing approaches on production workload right.

So, that on a life workload whether we can compare several classes of customers, now there can be you see there customers can be categorized into different classes of customers right it is instead of taking individual customer or user I say that this is user is this category of customer this user is this class area customer and so and so forth. And it all and also depends on the type of applications type of services is looking for, in those type of things and extending the things for any type of services or x rays type of services may be a important aspects of the things.

Never delays this type of finding appropriate match in a cloud marketplace is gaining a lot of interest both from the real life point of view or commercial point of view, and from the research point of view how to find a suitable things how to measure or how to say it formally that what has been selected suitable is the best possible things right. If not the best, but it is something near based with some sort of a guaranteed type of services

So, this is again those who are interested in future study research. So, this is a important aspects of a because it involves lot of aspects right. is that how to monitor them how to calculate trust competence and SLA guarantees or SLA values says or how SLAS has been satisfied over time and based on that at a current at a at a present time t how to project that what are the things are there. So, it is it plays the important role in in modern day cloud infrastructure or making clou computing more popular across the things

So, with this discussion we stop today. And we will continuing with some of some of the new some of these aspects of cloud computing, from different perspective in our future lectures.

Thank you.