Peer To Peer Networks
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Lecture 34
MOOC Wrap-Up: Summary of the Course

This is the final concluding lecture of the MOOC Series. I would like to summarize here, whatever we have done so far in the whole 20 hours of video recording which had been shared with you. Unfortunately, due to pandemic not everything could have been done in the studio. A lot of it actually has been done at my home on my laptop so where the quality has degraded but still we tried our best. And of course, maybe in future we will actually have better versions of this.

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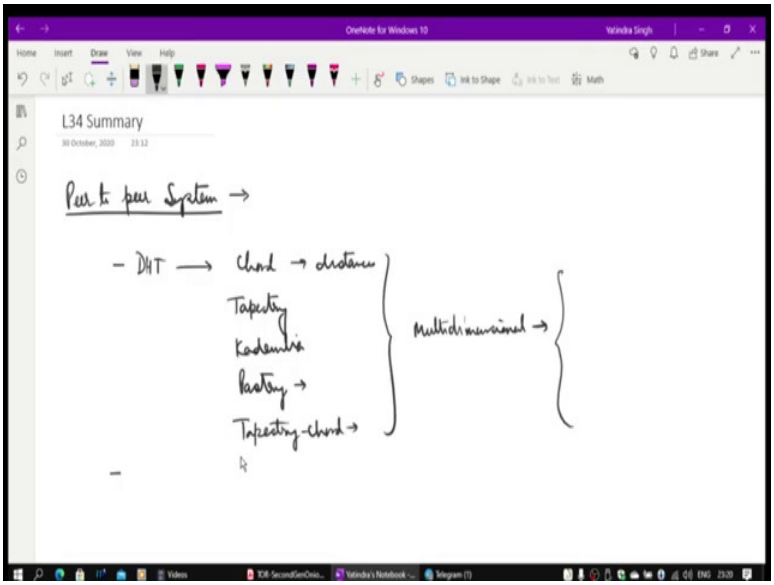

So, the lecture, this whole series was about peer to peer systems. And idea was there through essentially sensitised people to get them introduce why this is required and why this is important. And the reason why actually I went to this, in fact, this whole thing is started with development of the Brihaspati system, which I did as a learning management system for on a web based as a web portal, and this is what actually runs on Brihaspati portal, brihaspati.nmeict.in.

And at some point of time, I figured out that you cannot scale it massively and that is what my interest actually peer to peer systems and I studied them and we started this project on

Brihaspati-4. And during all that process, when I was learning, I taught as a course and then thought of giving it as a MOOC and I actually figured out that not many people are aware of it. Not many people know that this how it can be used. And what of the powers which are going to be derived out of the application of the system.

Now, one of the biggest thing which I see that you can actually scale the whole system is scales has more number of users grow, it is becomes better and better and more and more users come into the system. And they are actually again two kind of system one are structured other one is unstructured. We have talked about them earlier in the beginning and in any structured system, idea is that we have unique node IDs and that is where the distributed hash table actually comes into picture.

And then there is whole mathematics that they can be all assume to be like place somewhere in the hash ID space. And they become responsible for some of the key-value pairs. And so there is a unique mapping. In henceforth if you want to search for some key value pair technically computing is all have to do about finding out to from whom to get the resource. There is always key and value. Key always tells what resource you are trying to find out. And value tells from where you can get it actually. The idea came from where the DHT algorithms can be used.

And then we have talked about voice over IP system, we have talked about distributed file system. That actually becomes important. And the DFS was a remarkable idea, which we have worked upon is that all users extra resources, which they actually get now with their own machines because their machines are pretty powerful and not every user using it.

We can actually build up collaboration between the machines. And that idea came up with a DFS and of course, with that came, all kind of security, the resilience mechanism, okay, so we had talked about that stuff during the, we have talked about the overlaid multicasting. Where by live streaming systems actually can also built. We have talked about the onion services which we have done in the last the hidden systems. There is a lot of things which have been left out which have not been covered.

For example, delay tolerant networks also come in the same category where there is no internet or there is no underlying communication infrastructure. When you come in communication in the

proximity of somebody, you communicate that guy comes in proximity to somebody it communicates. Now those that is also another interesting actually domain which can be explored here and which have remained unexplored. There have been search engines how to create them. We have explored them. I have actually talked search engines in the MOOC. Let us, write down what all we actually have done.

So, we started with DHT based system. We looked into lot of DHT algorithms typically, I talked about Chord, the their stability, how to define the distances. We talked about Tapestry. We talked about Kademlia. We talked about Pastry, and during Pastry thing, we actually figured out how the neighbours proximity in terms round trip relay time can also be involved which was not possible in chord. We have talked about the tapestry chord hybrid, which we has been used in Brihaspati-4 implementation.

We have talked about distances when we have then we have talked about multidimensional DHT which was kind of a new thing for me, and so mathematically we were able to establish a generic thing. We also have looked into why we require sometimes what we call the leaf sets. So your neighbourhood information why that is important, so simply having logarithmic partition may not be, sometimes good enough. So, you need that for a stable routing system.

So, we have proved that such a scenario that why you need leaf set without leaf set you may not be able to go to the at the optimum configuration you will never be able to reach to the node sometimes even if when it is existing. So, this was all behind the mathematics we have talked about unstructured system.

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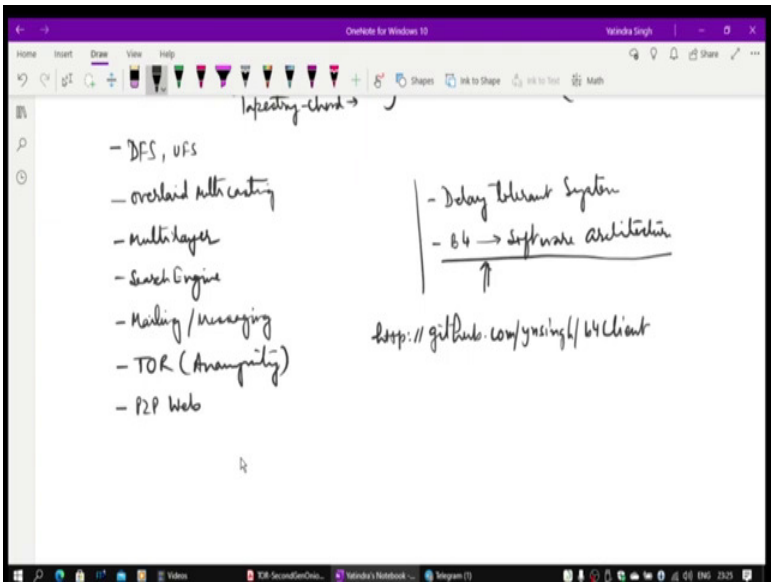

So as I mentioned earlier. DFS we have done we have done over lane multicasting. So I am not doing it, putting it in order, just whatever I am recalling and writing it down. And I would also mention what we have not done. So, delay-tolerant networks we have not done so those actually very welcome in this thing. We have not done the software architecture for b4. So, there is a software component architecture of a client which is important. We have done multi-layer DHT that is important. We have done UFS system here. A search engine, there is a mailing system, we have done. And we can call it as messaging.

We have done anonymous messaging system which was like talks chat kind of thing. So, there is no user ID. These are all user ID list. Let me write down this is what we have missed out so it that does not matter that you have missed out all these things. This is kind of an exposure now after this it has to be your own journey further explore and built up the things on your own. So, this has been one of the interesting things I have learned.

And then of course Yes, I think more or less and then of course the onion anonymity part we have looked into this. And ofcourse, as I mentioned, there is nothing like unstructured system nowadays, people do go with DHT based routing. The neural networks never get partitioned networks other prominent things. So this is all what basically we have covered and this has a lot of bearing on us.

Tomorrow I think the systems will move with this direction and we will not be requiring servers to do all authentications. We will end up in doing the mutual authentication. And of course, we may not be requiring lot of servers. Yes, there something more which I now recall we have did peer to peer web design; how to create a different kind of web where you do not require web servers those actually can be created here yes, that is a kind of structures which we have done and since it is a new course it requires a lot of background and understanding of already communication networks of computer networks beforehand.

And the data structures especially distributed, this is basically an example of distributed systems, and most of it actually has derived from my journey with my own students how to build this Brihaspati-4. And I think you can always download the code Brihaspati-4 from Github. So, this is a continuously evolving work, and from there you can actually keep track of, What is happening, you can also contribute to this project.

And I think this is going to grow and we will have a better version of this whole teaching learning experience going to come in future so with that, I wish you all the best for the exams which will be happening in the end. We have tried to put up the questions, whatever we can with all the stress of pandemic and teaching and other things. So this and of course if there are deficiencies then I accept all the responsibility for whatever deficiencies which are there and please do point out will rectify all these in time to come. Thank you.