Blockchains Architecture, Design and Use Cases
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Lecture – 36
Blockchain in Supply Chain – II

Hello everyone, welcome back to the next lecture in our block chains course. So, we have been discussing supply chain use cases.

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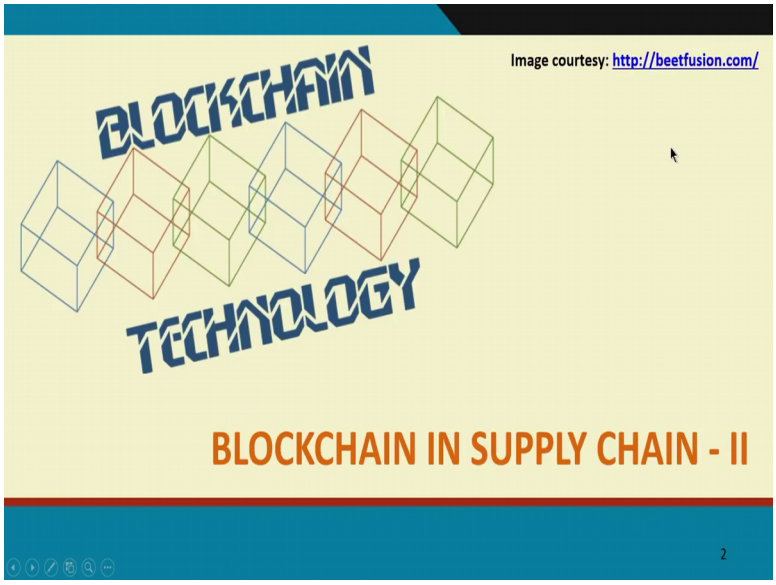

So, this lecture we will also focus on some couple of very interesting supply chain use cases. These are actually things running in production today. So, I wanted to highlight some of those in the above very interesting take on way a similar kind of a problem like what we discuss before where we have an interesting take on it. So, this first one is on diamond problems. So, you can imagine diamonds are one of the costliest things in the world today and there are many issues associated with them.

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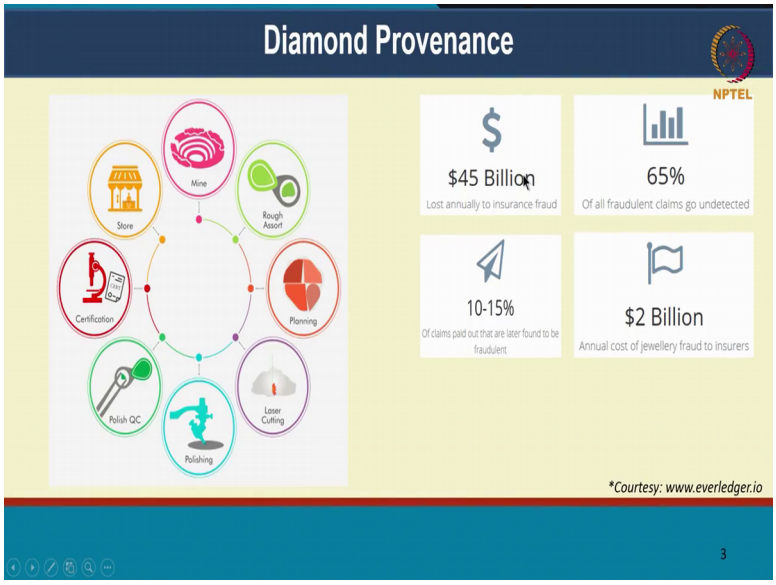

So, today it is estimated that about 45 billion dollars is lost annually in just insurance fraud. So, people claiming that diamonds they won. So, they buy a diamond they insure it and then they claim that the diamond is been lost. Then the insurance company pays for it right. So, there is just a lot of this insurance fraud that happens which cost billions of dollars, so that is the first one. And the fraud might not even be at the consumer end right fraud might happen anywhere along the supply chain. We will we will look at the diamond supply chain in the next slide.

All the way from just mining a raw diamond to polishing it, cutting it and so on till it reaches a retail store is a lot of these steps involved and fraud could actually happen in any of these steps. And it is estimated that about 65 percent of all fraudulent claims go on detective. So, you do not even know that these are undertaken. And these are all statistical estimates right, so take them with a pinch of salt, but they are at least we know that there is a big problem, this 65 percent number might be higher or lower, but we know that there is a big problem, where a lot of these fraud goes undetected today.

And people actually detect some of this after they pay out right. So, that sometimes that also is a problem. Once I paid out how you are going to recover them that money. Even if you detect that it was a fraud. Then about 2 billion is the annual cost of just jewelry fraud not overall diamond industry. Just once it become jewelry it is about 2 billion dollars.

So, here on the left are some of the steps involved. So, you are going to be mining from a mine. And let us say this is in South Africa for instance they mine a lot of diamonds. Then you going to do rough assortment of them based on you going to quickly look at them look at whether they are high quality low quality. There are different aspects to it the size and so on. They all have an effect on the eventual price that you can get from the diamond, then you kind of Plan what I can a do with this diamond right.

So, is this some of the diamonds actually get used in industrial use cases right. Some of them become jewelry right. So, the kind of decide what to you are going to do with this diamond. Then there is a some laser cutting involved to bring them to a good shape right, so that they can be may be used in industrial devices or in jewelry. And then there is some polishing to make that look shiny, and nice and bright then the certification.

Now, another major problem in the diamond industry is actually blood diamonds. If you (Refer Time: 03:18) about it, so diamonds are have been used is a means of funding terrorist activities predominantly in Africa in many countries there. And people lose their lives over diamonds right. So, there is a big push by several industry leaders in the space to actually eliminate blood diamonds.

So, there is a lot of regulation that governments are trying to put in. To track and prevent the sale of blood diamonds and blood diamonds are basically diamonds that are sold to fund war or terrorism or whatever you might call it all those activities that actually affect human lives. After this kind of certification, it is this is actually come from this place. And it is not a associated with the with a with a country that is using diamonds for war. Then you can store how, so how where is it getting stored. So, this a whole set of activities that are happening here.

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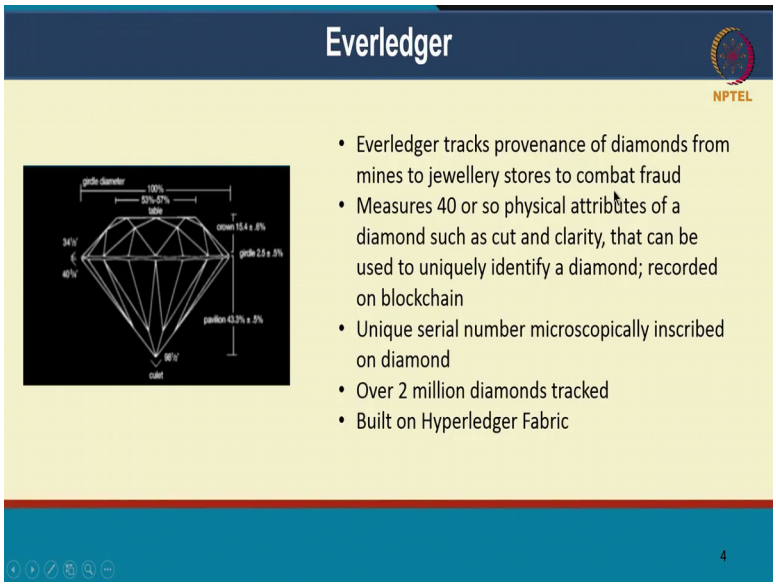

So, ever ledger is a very interesting startup that is working in the space. So, everyone I think that is made a significant progress in the space. Today they have over 2 million diamonds that they are tracking. Almost right from the time they are mined till it reaches the retail store or customer. it is built on hyper ledger fabric. So, they have for something running a production. And there actually have a lot of these participants on board for providing this information. So, what are they doing? So they are actually tracking the problems of diamonds from mines to jewelry stores. And their predominant use case is how do they combat fraud. And they have a very nice way of doing this.

So, today they measure about when the diamond gets mined, and may be right after polishing and cutting, they measure about 40 different physical attributes of the diamond. So, this could be about they will pass the light through it and see. How much light is getting refracted and what is the size of the diamond what is the different cut and so on right. So, these are all physical attributes, which together will uniquely be able to define to identify a diamond.

So, let us say what happens in today's let us say a diamond gets lost when the insurance company pays up for that diamond, the ownership of the diamond actually comes to the insurance company. Now, tomorrow or I am saying tomorrow, but let us say 2 years from, now the bonus may actually manage to get back the (Refer Time :05:35) diamond. They are able to retrieve the diamond from the robbers.

Now, the owners is then on the insurance companies to prove that this is their diamond. And there might actually be multiple in the insurance companies all trying to claim that this diamond is actually mine right. So, then they can recover the cost of the payout, the claim that they paid out for.

Now, how does insurance company prove that was actually theirs? Today is very adhoc right. They are they are unable to prove that it is actually their diamond. And so they do not get that money back. They do not get the diamond back, but with these physical attributes. If you can capture these physical attributes, store them on block chain.

Even if those diamonds get lost, and may be in insurance company pays up for it. Eventually it could also you sometimes these diamonds get found after generations right. After like maybe 150 years they might find the diamond. These things have happened in reality. After that if you retrieve the diamond, you go back to the block chain, because it still has full history of everything that is happened.

You can trace that this diamond has the same physical attributes as something that was stored on the block chain several years back. And then the insurance the ownership is also tracked on the block chain. And the insurance company can them claim that, this is actually my diamond right. Then I can retrieve that and that is a huge business for these insurance companies are very much interested in this. And also police authorities and government are interested in this, because they want to address fraud

Apart from these physical attributes what they also do is, they have a the microscopically inscribe a unique serial number on the diamond, which becomes like the identifier on block chain as well. So, they have a very interesting way of combining a physical asset like a diamond. And they are doing some very interesting physics around it to capture certain attributes put that on block chain then that together becomes a unique identifier for that block chain.

So, it is a very interesting way of converting something with physical in the world today to a digital representation of it that can uniquely capture. So, this works in the diamond industry, because diamonds are luxury goods and very very expensive. So, you can actually it is to spend a little bit of little bit of money in some of these innovation, and inscribing. These things on the on the diamond itself it is obviously, not going to work for may be a shirt right. So, for all the luxury goods this might actually work.

So, this is actually people are trying to do this for different kinds of goods. And as the cost of doing some of these attributes collecting these attributes or having IOT devices track these. As the cost comes down the I envision that, we will have more and more these devices being the physical or sorry more and more of these physical goods being can digitized and captured on block chain. So, I think this is a very interesting way of handling of using block chain to actually combat fraud.

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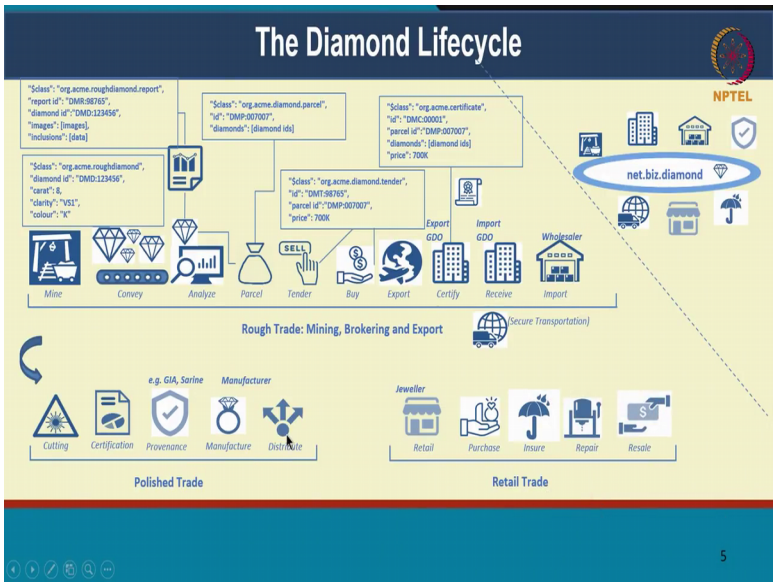

So, this just captures the diamond life cycles so which is just wanted to give you a flavor of what are the things that are getting captured, how is the data being represented. So, there are two segments of this of this process itself. One is the polished trade process where there are a set of entities involved, then cutting certification, tracking provenance manufacturing, the diamond jewelry maybe and then distributing it.

And as a whole trade ecosystem all the way from the retail store. They are going to purchase it, they are going to a insure this diamond. It might it is also involved repair right maybe I have this diamond; I want to change its form to something else, so that it fits with some other kind of jewellery that I have.

And it might also involved multiple resales right. So, it can change the ownership over time. So, all of this we want to track on the block chain. And at every stage there are certain unique attributes are captured. So, at the mining stage you might captured that this is a rough diamond what is the how many carats is it what is the clarity and so on.

When you are looking to this maybe a analyzer who takes this diamond to figure out what the value of the diamond is and they might create a report of this.

So, they might even capture images of the diamond they might have some other data about the diamond. So, this might be where you are capturing the various different attributes. So, the physical attribute of the diamonds putting that on the block chain. And then at every stage you will see that there are new documents the new informations that is added about this diamond or this pieces (Refer Time: 09:58) jewellery right.

So, all the away from the mine to wholesaler or even a retailer right. So, the way that is the kind of the process that ever ledger is capturing. And along the way they also have this certification process where you kind of handle the problem of (Refer Time: 10:14) diamonds and making sure.

So, this is the process called the crumbly process that was brought into force may be 15 years ago, 10-15 years ago that brings in certain regulations on what should and should not be done especially to combat fraud and to combat blood diamonds and the ever ledger shows you proof that process is actually been followed. So, you can capture that process as a contract as a smart contract on block chain, so that is was one very interesting use cases.

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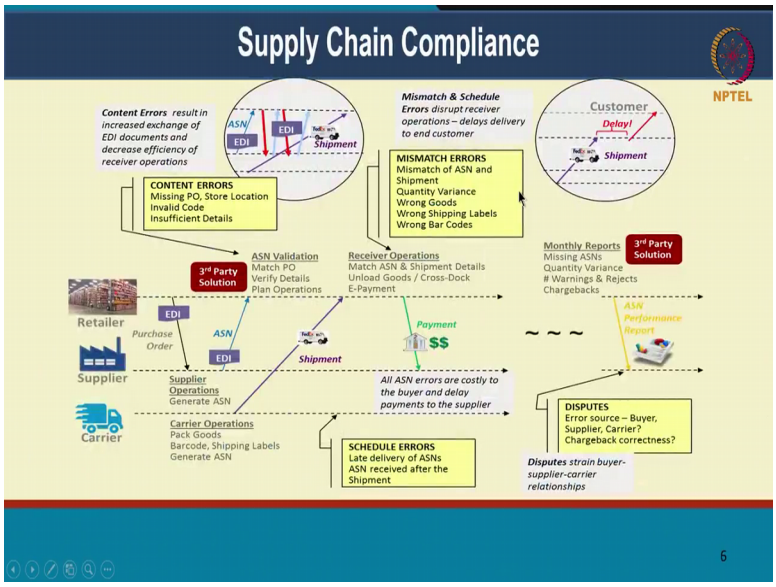

So, let us look at another interesting use cases. This is also this is again the compliance side of things in the supply chain space. So, here I actually have a process might look a little complex, but I will walk you through these whole picture itself. So, there is a retailer who is buying certain goods from a supplier. And there is a carrier involved who is transporting this.

So, this simple scenario so, let us take examples retailer might be Wal-Mart. A suppler might be an agricultural farm or somebody who has produced let us say mangoes. Now, Wal-Mart is going to send a purchase order to say hey a I want ten cartons of mangoes sent to this particular retail store. Now, the supplier creates what is called a advance shipment note. So, this some of these are EDI messages - electronic data interchange if you know about that is a standard message exchange format.

So, they send so Wal-Mart first sent a purchase order over this kind of EDI message. And then the supplier sent a message back saying, hey I have shipped the goods. Along the way and there is a shipment that actually comes through and a payment that needs to happen from Wal-Mart to this supplier.

Now, along the way there might be many errors that happen. For instance there might be a mismatch errors. So, what are the some of these like. ASN said I sent you 10 cartons of mangoes, whereas the actual shipment I got only 8 cartons. So, where do those two cartons go no one knows so that might be a mismatch. It could be a quantity variance. So, I just give you that ex example of a quantity variance.

It might be a wrong goods right, I ordered ten cartons of mangoes; I got ten cartons of oranges right. So, it is something went wrong there. So, it could be wrong shipping labels although it is actually mangoes inside was may probably labelled as oranges. And it might be wrong barcodes. And if their labelled wrong may be the cost is also wrong and the invoice might be wrong, and then things are messed up right. So, the how much should Wal-Mart pay now. So, there could be lot of these errors that crop up.

And there could also be schedule errors. And typically is some of these large retailers what they do is they have certain compliance norms that they impose on their suppliers. So, for instance Wal-Mart is will say whenever I send you a purchase order, I expect you to respond to it within 2 days. And I expect the shipment to reach my wear house within 4 days right.

So, they will have these kinds of terms and conditions. And there might be even penalties involved if those terms and conditions are not met. And instead of 4 days, if you send the produce in 6 days, there might actually be a penalty involved because Wal-Mart also enclose a cost. Because you run out of mangoes in your retail store, and your stock is empty and of course, you are not making sale of those. And because of late shipments it might also be that you are whatever goods you have has actually been spoiled right. So, if these are time sensitive goods. So, it might be the schedule errors might happen.

And there might also be content errors right. So, there might be might be an I sent you saying I I have shipped goods with this particular code, but that could might not be recognized on the other end. So, then what do we do? So that many of these errors that happen routinely today, and it would be great if we can track all these the if you are tracking all of these information on block chain. Then the block chain smart contracts can actually verify this automatically right. So, they can actually detect all of these much earlier than may be a human can go detect them.

This might involve correlating information across multiple documents, across multiple messages and so on, but this whole compliance aspect can be automated on block chain and that can significantly reduce some of the time involved in this supply chain process is some of the cost involved and also the risk of non compliance and a non delivery.

And lot of a disputes we can have probably even eliminate some of the disputes because there will be a trusted record on block chain that everyone can see. So, the disputes might not even arise right. Supplier claims that they sent the mangoes and retailer claims that they got only 8 out of 10 boxes right. So, then some of those things at least partially maybe correctable right or the payment not come through properly might be correctable using block chain.

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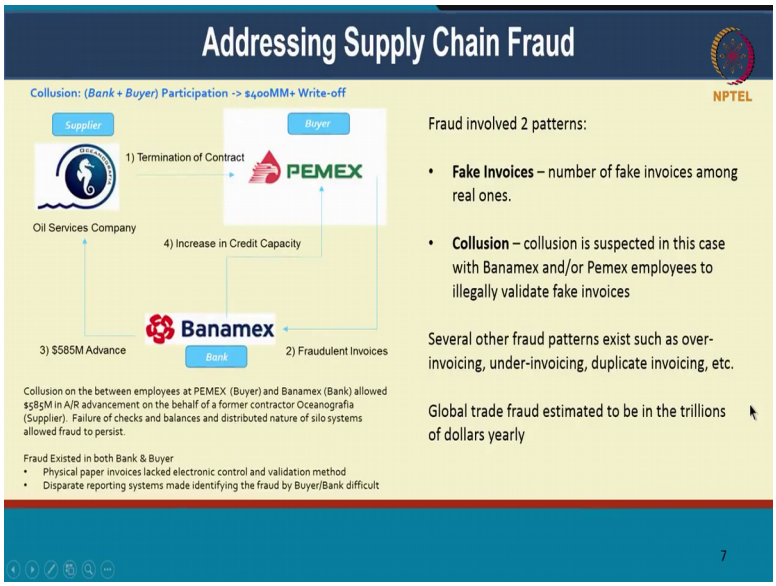

And supply chain fraud is again a very big issue worldwide. So, I am going to take just one example of again a real world incident that happened again in the millions of dollars actually 585 million dollars was the quantum of that fraud. So, this was one large company called PEMEX, this is the buyer. Banamex was the bank.

So, now what happened was between the buyer and the supplier, they are they were actually trading goods, they were actually the buyer was buying goods from the supplier, but at one point they actually terminate with the contract. So, they no longer officially working with each other. But then what PEMEX was do is actually I should not say PEMEX actually certain fraudulent employee is within PEMEX what they did was they colluded with employees on with the bank. And what they did is they sent fraudulent invoices to the bank and based on these fraudulent invoices there is actually collusion between PEMEX and the supplier right

So, what is they sent fraudulent invoices here, and based on those fraudulent invoice the bank actually advanced a significant amount of money 585 million dollars, they sent they gave that money to the supplier. And what they are interrupt doing is because PEMEX was doing a lot more business than the originally anticipated, they also increase the credit capacity of PEMEX which might they could pump in even more invoices right.

So, this cycle actually continued for a while they actually went under activate for quite a while. So, this will norm. So, what was really the fraud pattern the fake invoices number

of invoices again over cycles right, fake invoices were created, because actually a collusion between the employees of the two companies.

And they were able to illegally validate some of this fake invoice. And there are probe probably many other this is just a one example of a fraud pattern. there are many other in patterns as well I mentioned some of these before got duplicate invoices what if the same invoices are submitted to 2 banks, and you try and get the money from both the banks right, so that is kind that is duplicate invoice.

There is also under invoicing that also happens right. So, under invoicing and over invoicing I might actually shift goods only for 10000 dollars, but then I create a invoice for 1 million dollars and ask the bank to pay off right. So, there is a lot of that kind of fraud that happens in the global supply chain world today. And lot of this is also because of some the paper process is the physical paper documents manual process reasons and so on; again automating some of these on block chain can make a tremendous impact.

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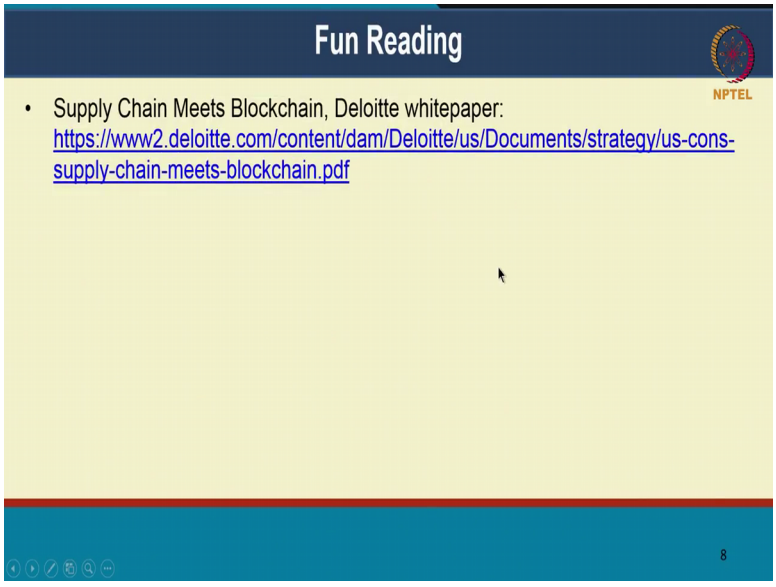

So, that concludes this lecture and again a fun reading on this there is a very interesting white paper written by the Deloitte. On some of these things that we can do when supply chain meets block chain. So, these two chains are actually meeting with each other and there are interesting use cases that, that one could invasion in the space. So, this is just a flavor of the use cases a many more use cases in the supply chain industry, but I just

wanted to give you a flavor of the various things people are thinking about of how block chain can make a difference in the supply chain industry today.

With that thank you, we will see you at the next lecture.