Introduction to Industry 4.0 and Industrial Internet of Things
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Lecture - 25
Business Models and Reference Architecture for IIoT: Reference Architecture – Part 2

In the previous lecture, part one of the reference architecture of this module on business models and reference architecture for Industrial IoT we have seen the IIRA framework, that has been proposed by the technology working group of the Industrial Internet Consortium, IIC.

So, this particular IIRA industrial internet difference architecture has different architectural components, one of which is basically the viewpoints. We have one through in the previous literature a previous lecture the different types of patterns that could be used, in order to implement IIoT in a particular industry. So, we go further ahead and look at the different aspects of viewpoints the further technicalities into the viewpoints and how there are different types of viewpoints, which could be adopted for catering to the requirements of different industrial needs.

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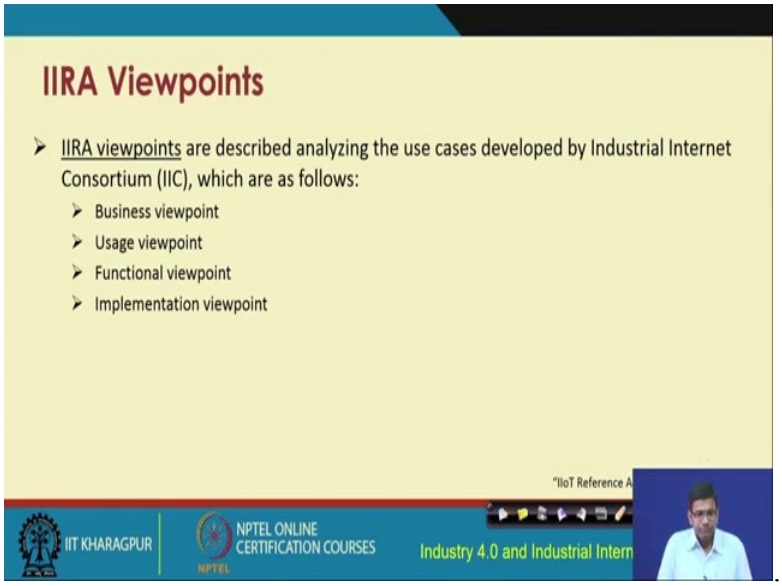

So, we have these different viewpoints IIRA viewpoints, which can help in analyzing the use cases developed by the Industrial Internet Consortium, which could be of different

types. We have the business viewpoint, usage viewpoint, functional viewpoint and the implementation viewpoint. So, just as a recap this viewpoint is something, which is like a collection of different ideas and this collection of ideas are coming from the stakeholders. These viewpoints are essentially coming from different stakeholders.

So, we have the business viewpoint which is coming from the stakeholders, who are concerned about the business aspects of it, from the usage viewpoint of different stakeholders what are the concerns what are the ideas that will need to be implemented, same goes for the functional viewpoint and the implementation viewpoint.

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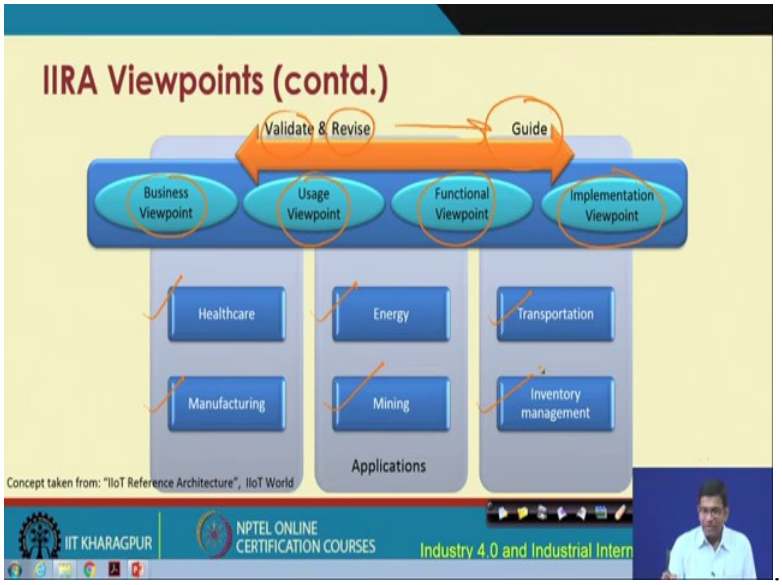

So, this is now architecturally shown over here in the form of a picture. So, you we have these different viewpoints, the business viewpoint, the usage viewpoint, the functional viewpoint, and the implementation viewpoint, and all these viewpoints are basically coming from these different stakeholders. These viewpoints of these ideas are revised and they are validated and finally, after division, these will be helping to guide further guide in the implementation and deployment of the different ideas.

So, these ideas could be implemented in different sectors healthcare, manufacturing, energy, mining, transportation and inventory management are a few to name.

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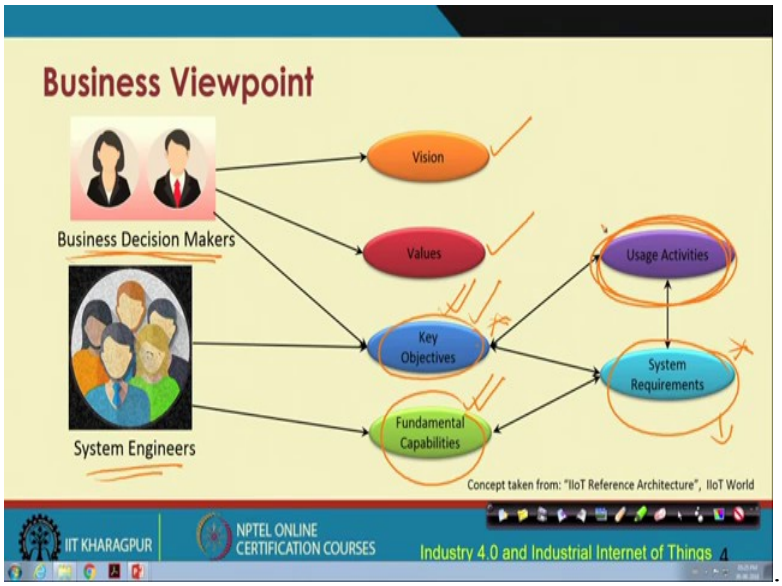

Let us look at each of these viewpoints in a little bit further detail. So, we have at first we have the business viewpoint. From the business viewpoint we are talking about business decision makers, we have the business decision makers, who have a certain vision and have certain values, in terms of improving the customer requirements, meeting the customer requirements, satisfying the customers, and the business decision makers also have certain key objectives.

On the other hand, we have these system engineers who have certain objectives and have certain fundamental capabilities. These key objectives plus the fundamental capabilities together would help in driving the listing of the system requirements of the IIoT system to be deployed. And this will also help these system requirements together with this objective the system requirement together, with this objective will help in arriving at the usage activities, for meeting the business requirements so, this is the business viewpoint.

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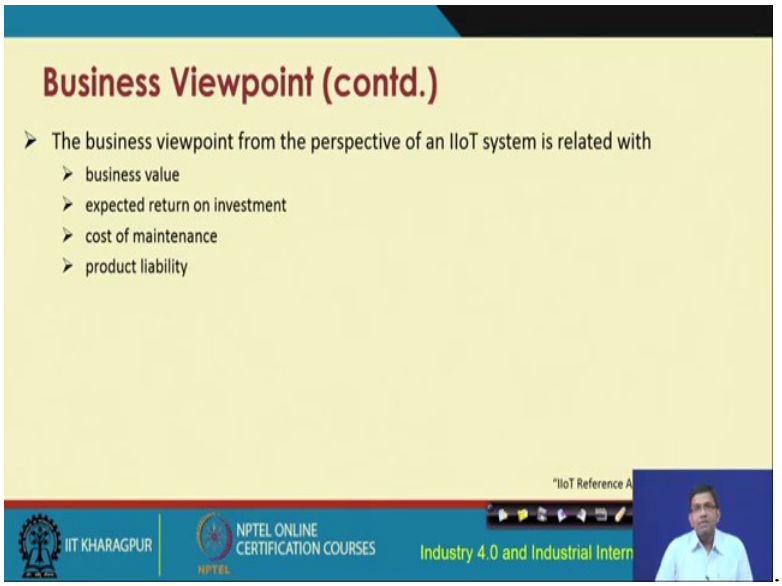

So, the business viewpoint from the perspective of an IIoT system is related to the business value, expected ROI, cost of maintenance, and product liability.

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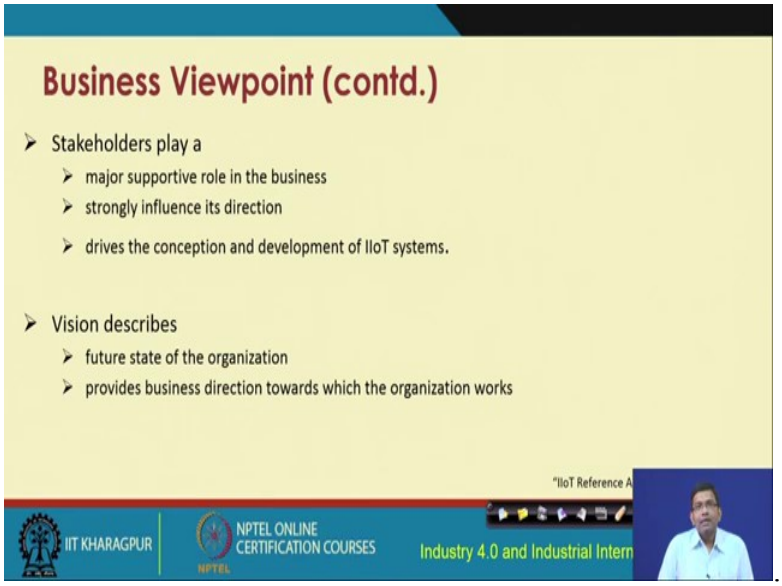

Stakeholders play a very important role in the business viewpoint, the stakeholders play the major role in supporting the business, they strongly influence the direction of the business, and driving in the conception, and development of IIoT systems. The vision attribute in the business viewpoint describes the vision of the organization where the

organization is going to be in the future, and providing direction to the business towards which the organization is going to work further.

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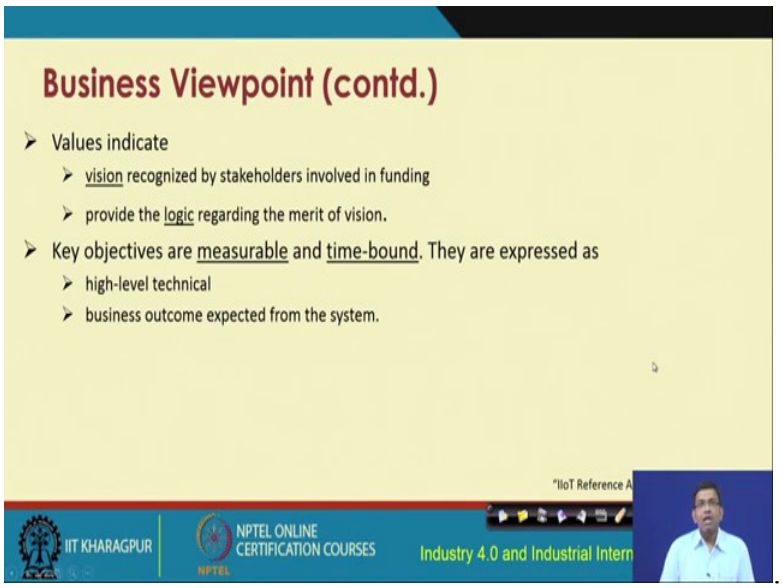

The values in the business viewpoint indicate the vision, recognized by the stakeholders, who are involved in funding providing the logic regarding the merit of vision, and so on. And there are certain key objectives these key objectives should be time-bound and should be measurable, and they are expressed as high level technical business outcome expected from the system.

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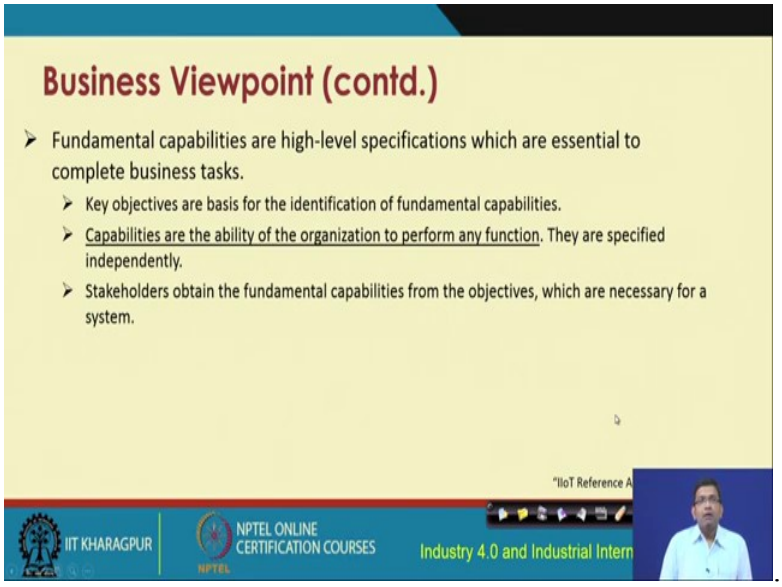

Fundamental capabilities are high level specifications, which are essential to complete business tasks. The key objectives are basis for the identification of fundamental capabilities, fundamental capabilities means the capabilities, which are fundamental in nature, which are the abilities of the organization, to perform certain basic core functions. So, they are basically specified independently. Stakeholders obtain the fundamental capabilities from the objectives, which are necessary for a particular system.

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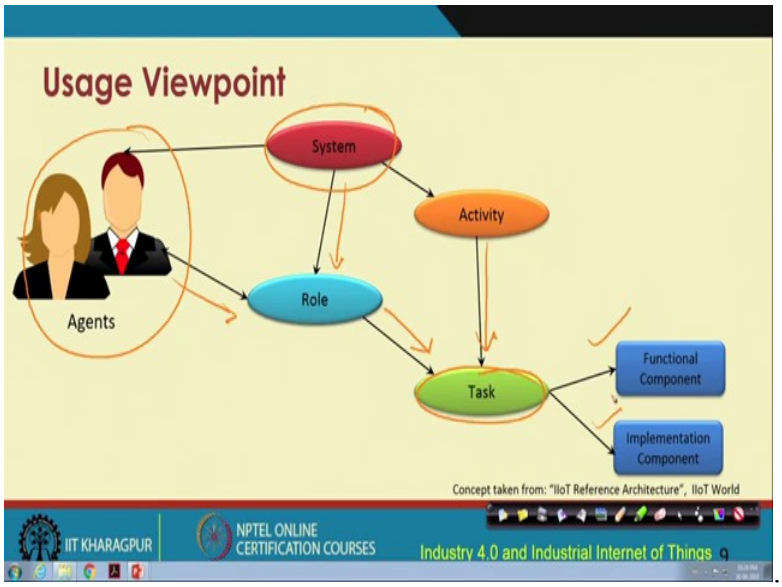

Let us now after the business viewpoint look at the usage viewpoint and as we can see over here it is basically guided through the concept of the agents. So, the agents basically are control, agents control the system. The system has certain roles, the agents basically will have certain roles on the system, in the system rather. The roles and the activities of the system will help in defining the task, the tasks to be performed. There are some functional components and implementation components of these different tasks.

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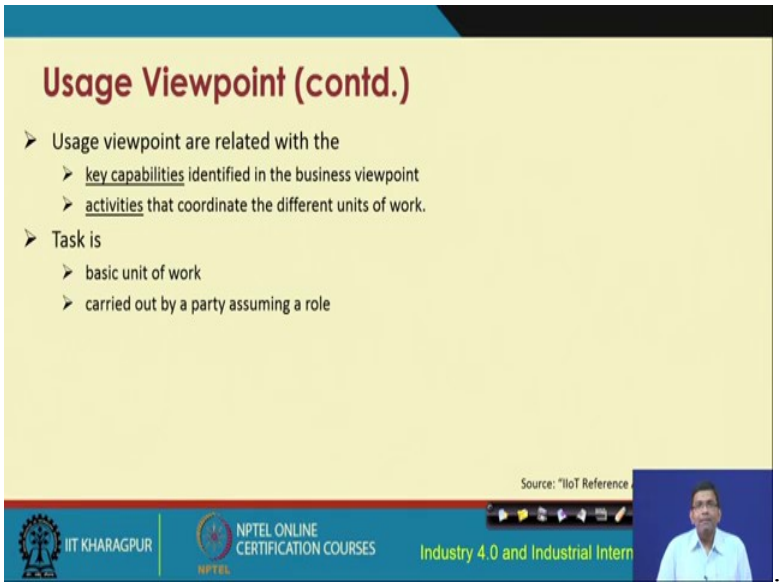

So, usage viewpoints are related with the key capabilities that are identified in the business viewpoint and the activities that coordinate the different units of work. So, the task is in the context of usage viewpoint, the task is a basic unit of work, that is carried out by a party, that assumes a specific role.

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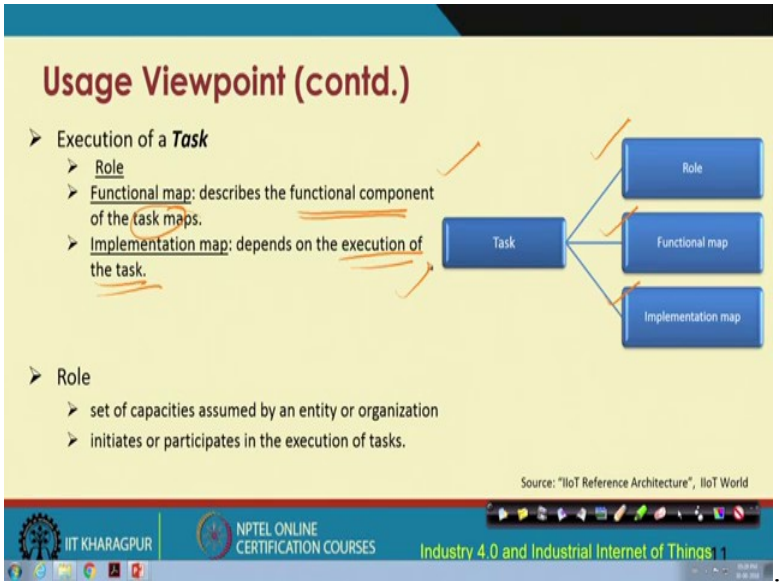

Now this task will have to be executed, these task will be executed by certain roles, and these tasks will have a functional map and an implementation map. So, these tasks basically have their roles the functional map and the implementation map, the functional

map basically talks about the functional component of the task maps, and the implementation map talks about the execution of those tasks, execution of the functional component of the tasks functional map, and the execution of the tasks implementation map.

So, the role is the set of capacities that are assumed by an entity or an organization, the roles are initiated, and roles are basically the ones, which basically help in interacting with the system for the execution of the different tasks.

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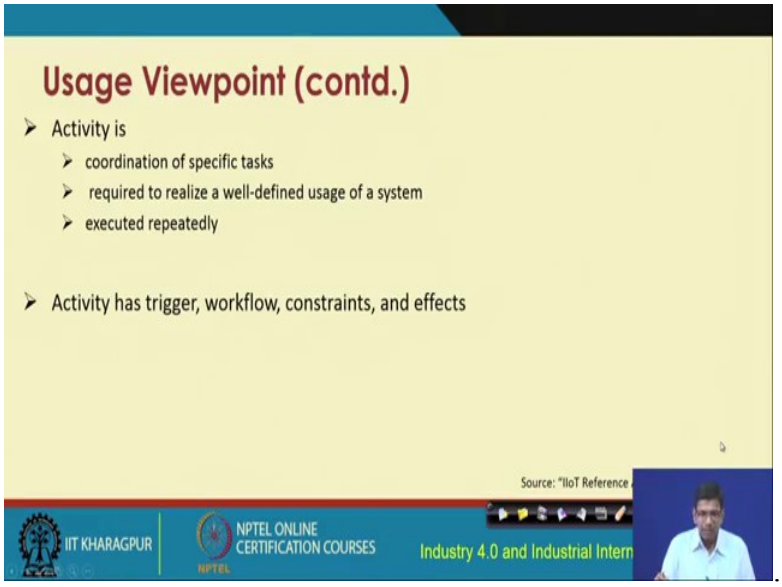

Activity is the coordination of specific tasks, that are required to realize a well-defined usage of a system and activities are executed repeatedly. Activities trigger the system execution, trigger the workflow, trigger different constraints from being executed and also interact based on the different effects of execution the interactions that happen are also taken care of by the activity.

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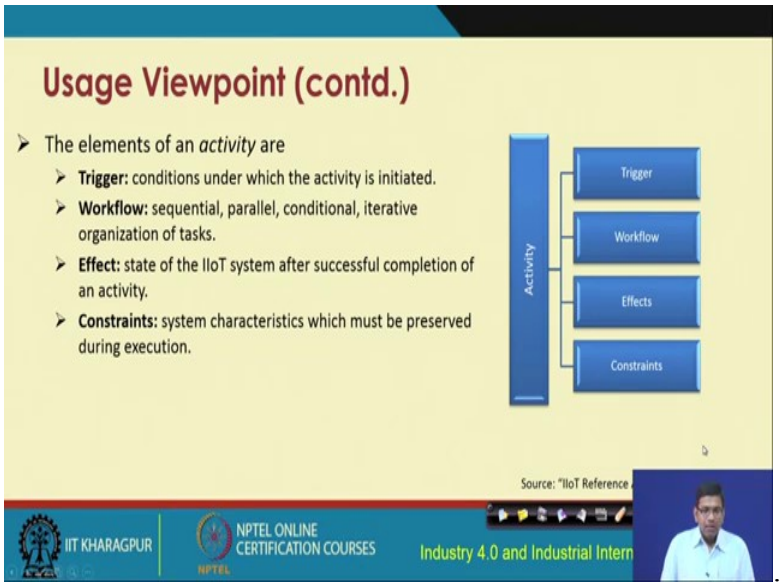

The elements of an activity are triggered, workflow, effects and constraints. Trigger basically are the conditions under which the activity is initiated, workflow can be sequential, parallel, conditional, iterative, and so on. So, workflow is basically the workflow among the different tasks that flow of different tasks. Effect is the state of the IIoT system after successful completion of an activity and constraints basically talk about the system characteristics, which must be reserved during the execution.

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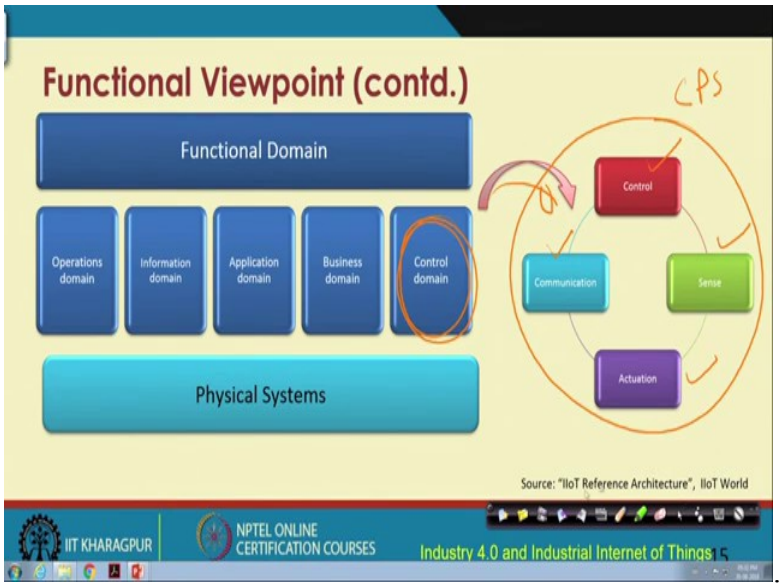

This is the functional viewpoint we have the control domain, operations domain, information domain, application domain, and the business domain. So, this is how this functional viewpoint works. The main component over here is the domain component the control domain component. So, this control domain component basically takes care of the cycle control sends actuation and communication. So, together basically this is also a cycle, which drives in the cyberphysical systems. So, this control domain and it is role in this particular cycle is a very important viewpoint, which is basically the functional viewpoint.

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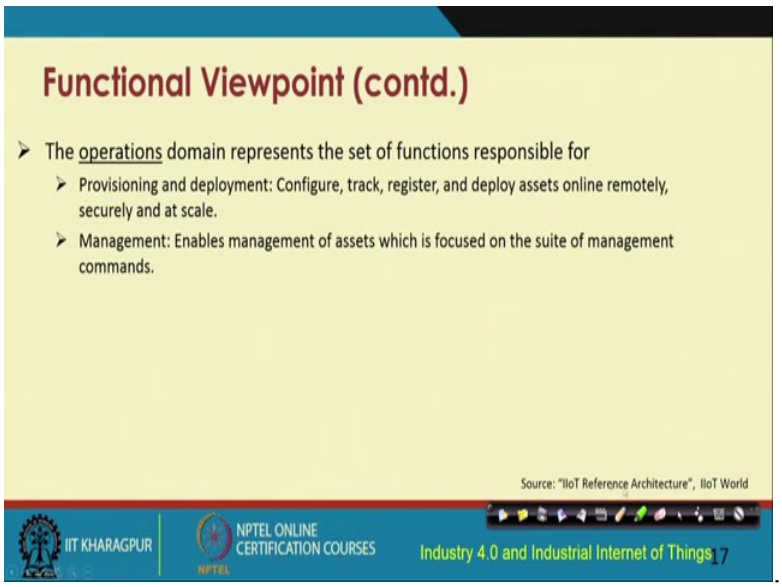

The control domain represents the set of functions that are performed by the industrial control system and these could be of different types sensing; that means, reading the data from the sensor nodes, actuation writing data and controlling signals into an actuator and communication, which basically talks about connecting the sensors, actuators, gateways, and other edge devices.

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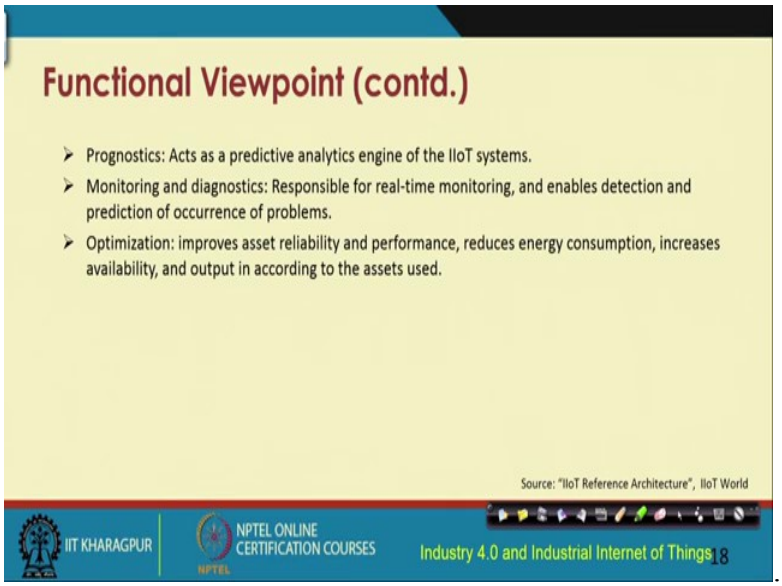

So, from a functional viewpoint few concepts are important prognostics, which is basically the act prognostics, basically is the action of some predictive analytics engine of the IIoT system. Then we have the diagnostics and monitoring, which is responsible for real-time monitoring, and enabling detection, and prediction of occurrence of problems and optimization, which improves asset reliability and performance, and reducing the energy consumption, increasing availability, and the output in accordance to the assets, that are being used.

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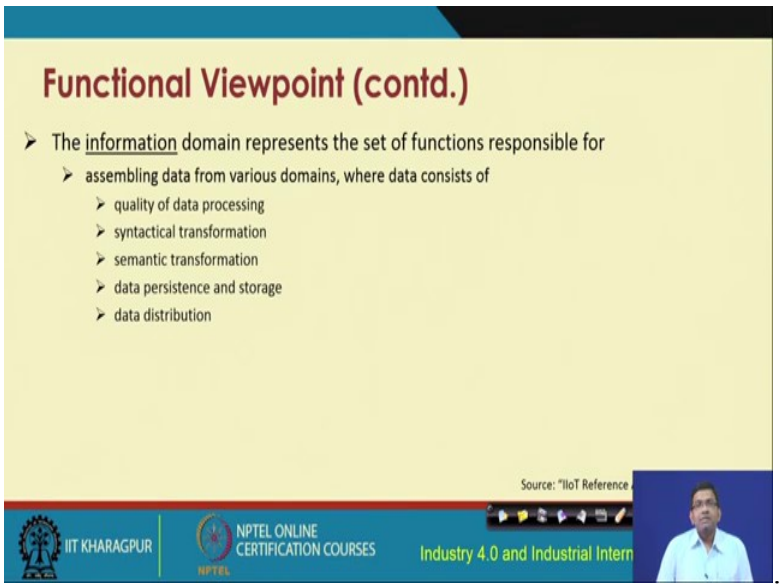

So, the information domain represents the set of functions responsible for assembling the data from various domains, where the data consists of quality of data processing, syntactic transformation, semantic transformation, data persistence, and storage and data distribution.

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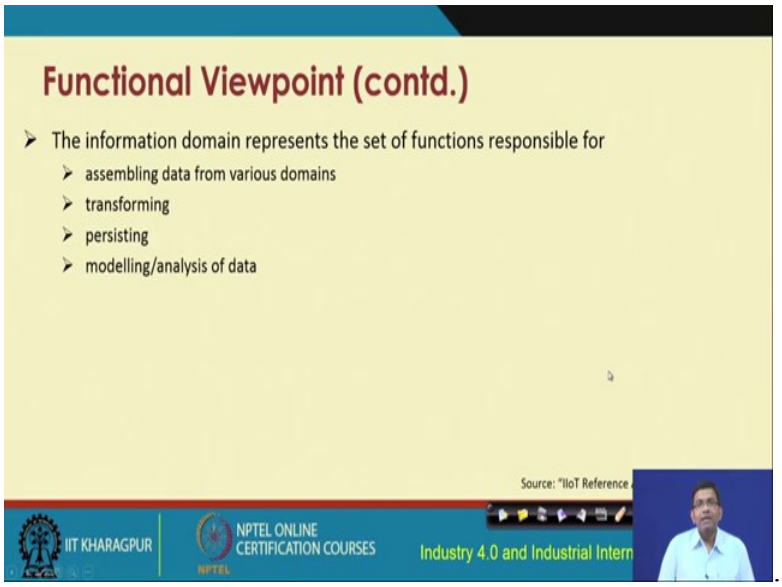

Functional domain represents the set of functions that are responsible for assembling the data from the various domains, transforming the data, persisting the data in the system and modelling and analyzing the data.

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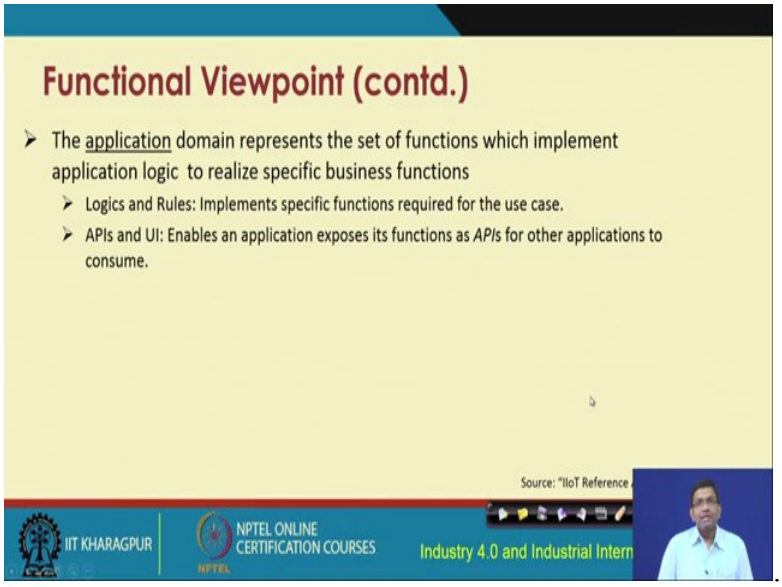

The application domain represents the set of functions which implement the application logic to realize the specific business functions. So, here basically you are talking about logics and rules APIs and UIs.

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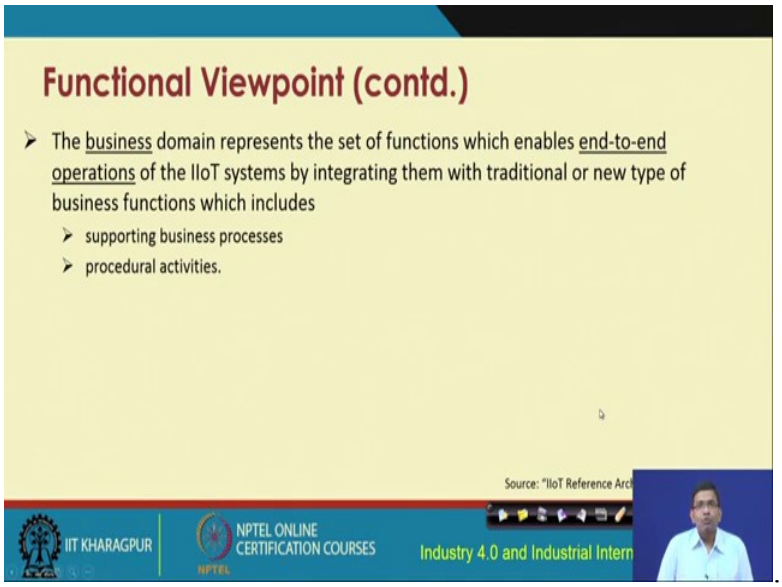

The business domain represents the set of functions which enables end to end operations of the IIoT system by integrating them with the traditional or, new type of business function, which basically includes supporting business processes and procedural activities.

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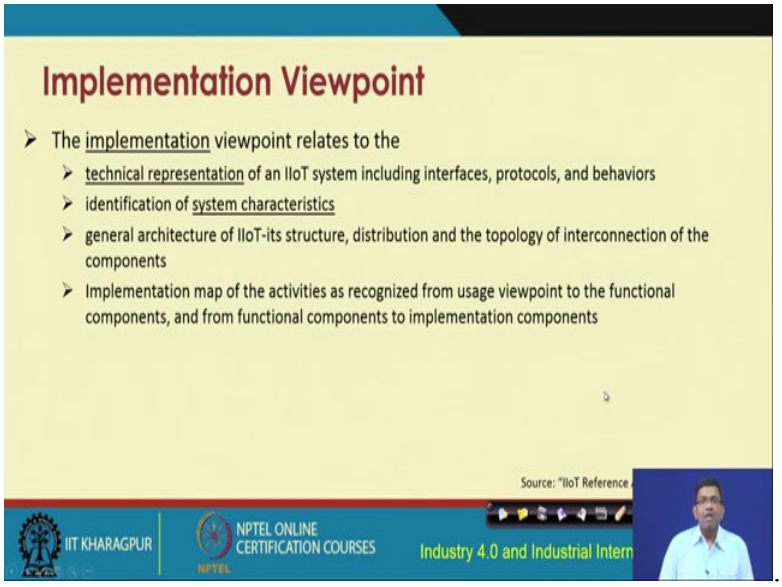

Implementation viewpoint relates to the technical presentation of the IIoT system generating architecture of the IIoT, it is structure distribution topology of interconnection, and interconnection of different components, and the implementation map of the activities, as recognized from the usage viewpoint to the functional components.

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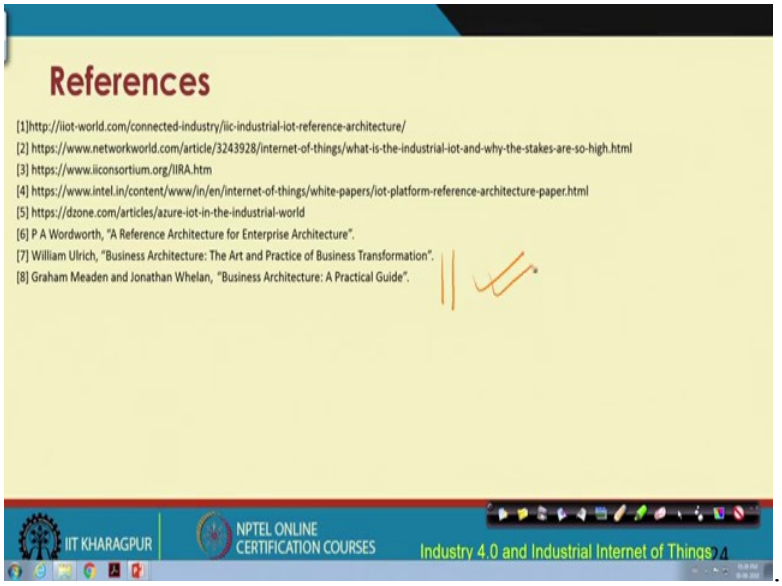

With this we come to an end of the lecture on the reference architecture that is proposed by the IIC it is the industrial internet difference architecture IIRA, proposed by the technology working group of the IIC we have in this module looked at the different business models the different types of business models, which could be adopted to transform towards the transform towards IIoT adoption, and so on. And then we have seen at some of these different patterns architectural patterns, the common patterns that could be used in order to implement technically implement these business requirements into action implement, those in order to transform the business to satisfy the IIoT requirements and expectations.

So, these are these references if you are interested you may go through them particularly these books are important this literature this will help you to have better understanding about the business architecture, in the context of IIoT and so on. So, with this we come to an end.

Thank you.