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Business Models and Reference Architecture for IIoT

Reference Architecture – Part 2

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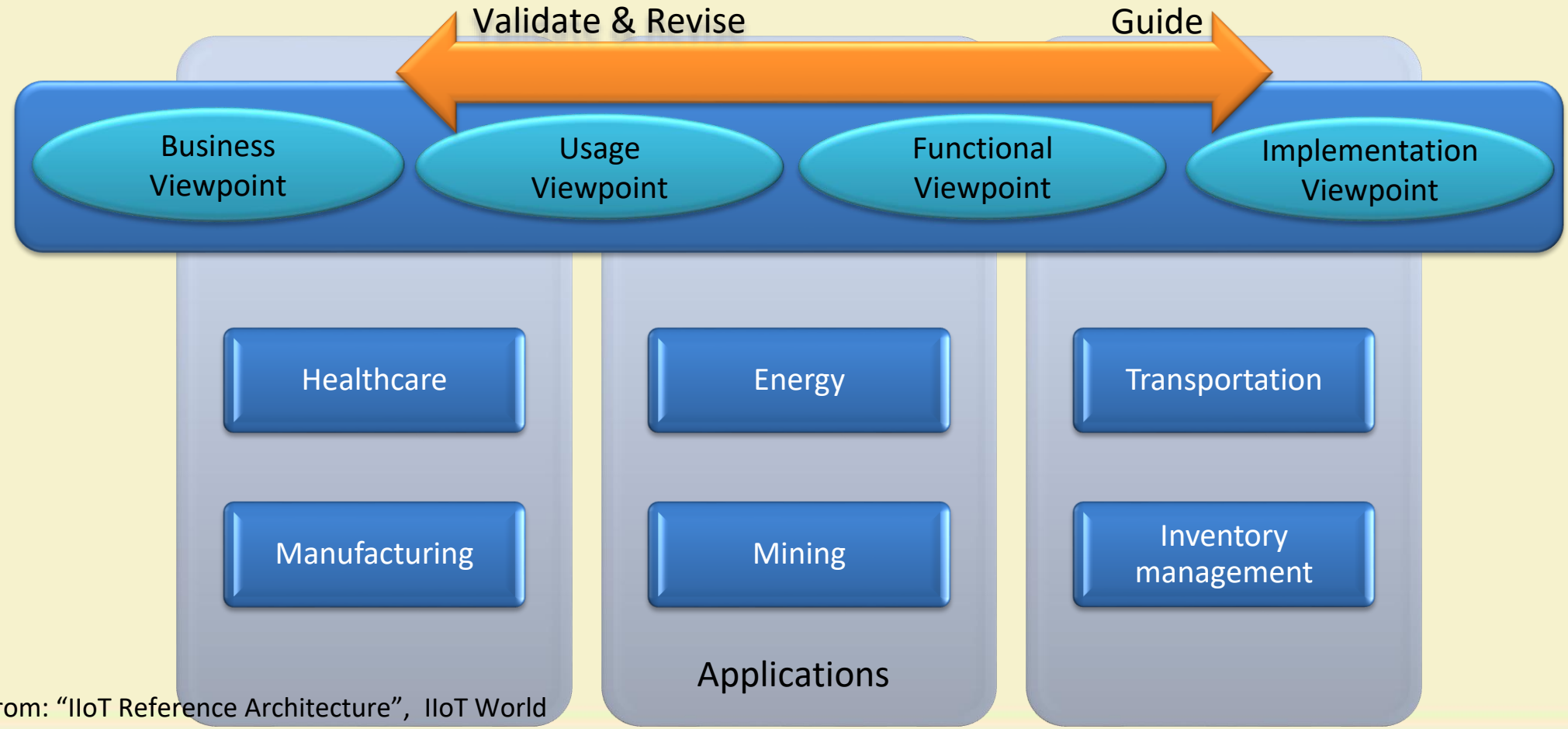
IIRA Viewpoints

- IIRA viewpoints are described analyzing the use cases developed by Industrial Internet Consortium (IIC), which are as follows:
  - Business viewpoint
  - Usage viewpoint
  - Functional viewpoint
  - Implementation viewpoint

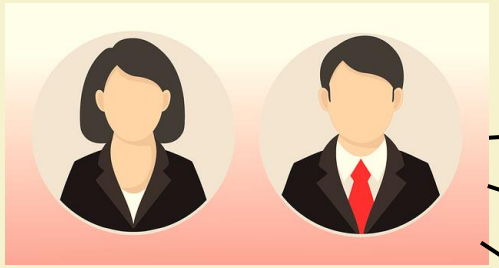
"IIoT Reference Architecture", IIoT World

IIRA Viewpoints (contd.)



Concept taken from: "IIoT Reference Architecture", IIoT World

Business Viewpoint



Business Decision Makers

System Engineers

Vision

Values

Key Objectives

Usage Activities

System Requirements

Fundamental Capabilities

Concept taken from: "IIoT Reference Architecture", IIoT World

Business Viewpoint (contd.)

- The business viewpoint from the perspective of an IIoT system is related with
  - business value
  - expected return on investment
  - cost of maintenance
  - product liability

"IIoT Reference Architecture", IIoT World

Business Viewpoint (contd.)

- Stakeholders play a
  - major supportive role in the business
  - strongly influence its direction
  - drives the conception and development of IIoT systems.

- Vision describes
  - future state of the organization
  - provides business direction towards which the organization works

"IIoT Reference Architecture", IIoT World

Business Viewpoint (contd.)

- Values indicate
  - vision recognized by stakeholders involved in funding
  - provide the logic regarding the merit of vision.
- Key objectives are measurable and time-bound. They are expressed as
  - high-level technical
  - business outcome expected from the system.

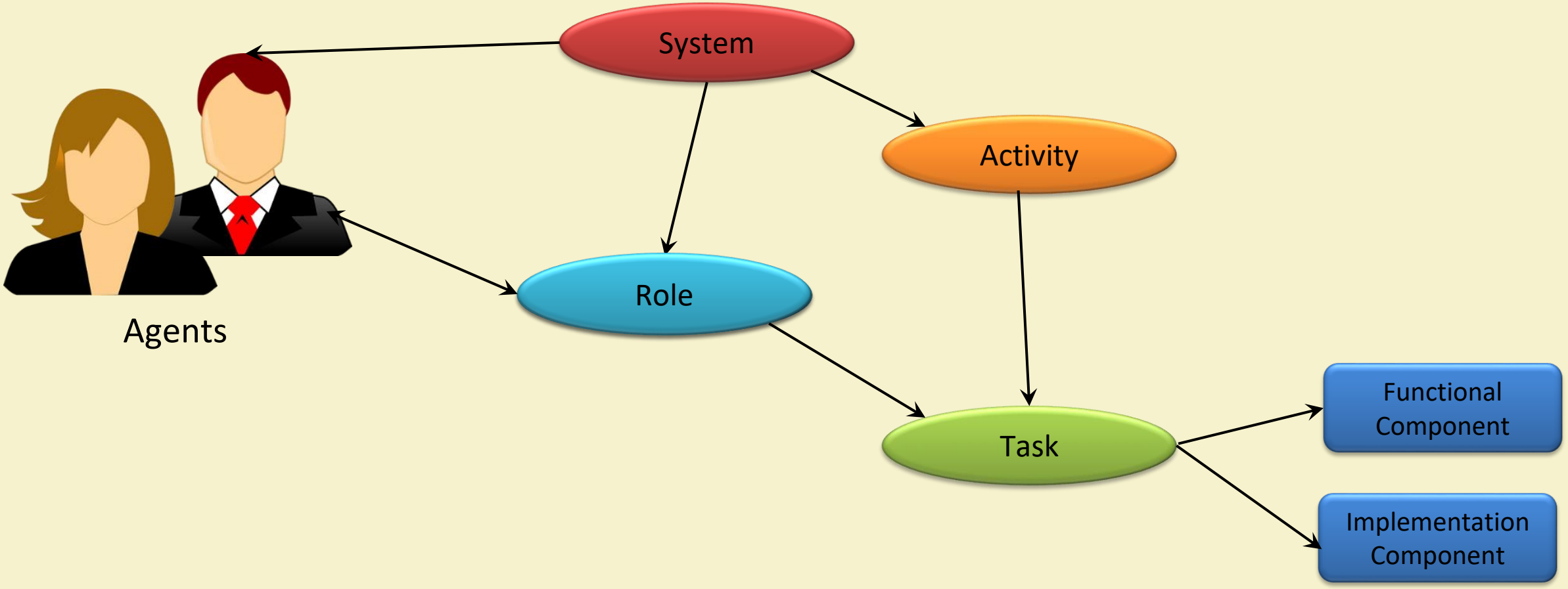
"IIoT Reference Architecture", IIoT World

Business Viewpoint (contd.)

- Fundamental capabilities are high-level specifications which are essential to complete business tasks.
  - Key objectives are basis for the identification of fundamental capabilities.
  - Capabilities are the ability of the organization to perform any function. They are specified independently.
  - Stakeholders obtain the fundamental capabilities from the objectives, which are necessary for a system.

"IIoT Reference Architecture", IIoT World

Usage Viewpoint



Concept taken from: "IIoT Reference Architecture", IIoT World

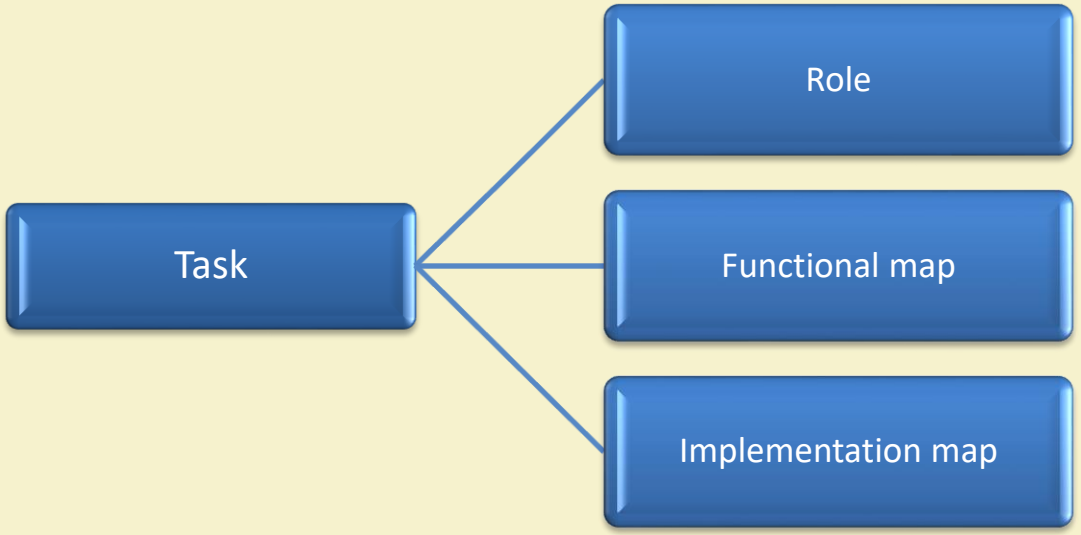
Usage Viewpoint (contd.)

- Usage viewpoint are related with the
  - key capabilities identified in the business viewpoint
  - activities that coordinate the different units of work.
- Task is
  - basic unit of work
  - carried out by a party assuming a role

Source: "IIoT Reference Architecture", IIoT World

Usage Viewpoint (contd.)

- Execution of a ***Task***
  - Role
  - Functional map: describes the functional component of the task maps.
  - Implementation map: depends on the execution of the task.



- Role
  - set of capacities assumed by an entity or organization
  - initiates or participates in the execution of tasks.

Source: "IIoT Reference Architecture", IIoT World

Usage Viewpoint (contd.)

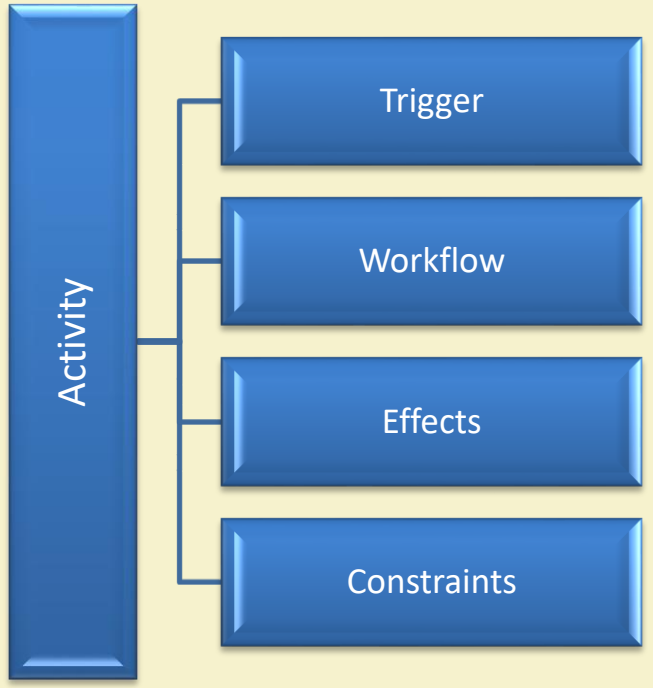
- Activity is
  - coordination of specific tasks
  - required to realize a well-defined usage of a system
  - executed repeatedly

- Activity has trigger, workflow, constraints, and effects

Source: "IIoT Reference Architecture", IIoT World

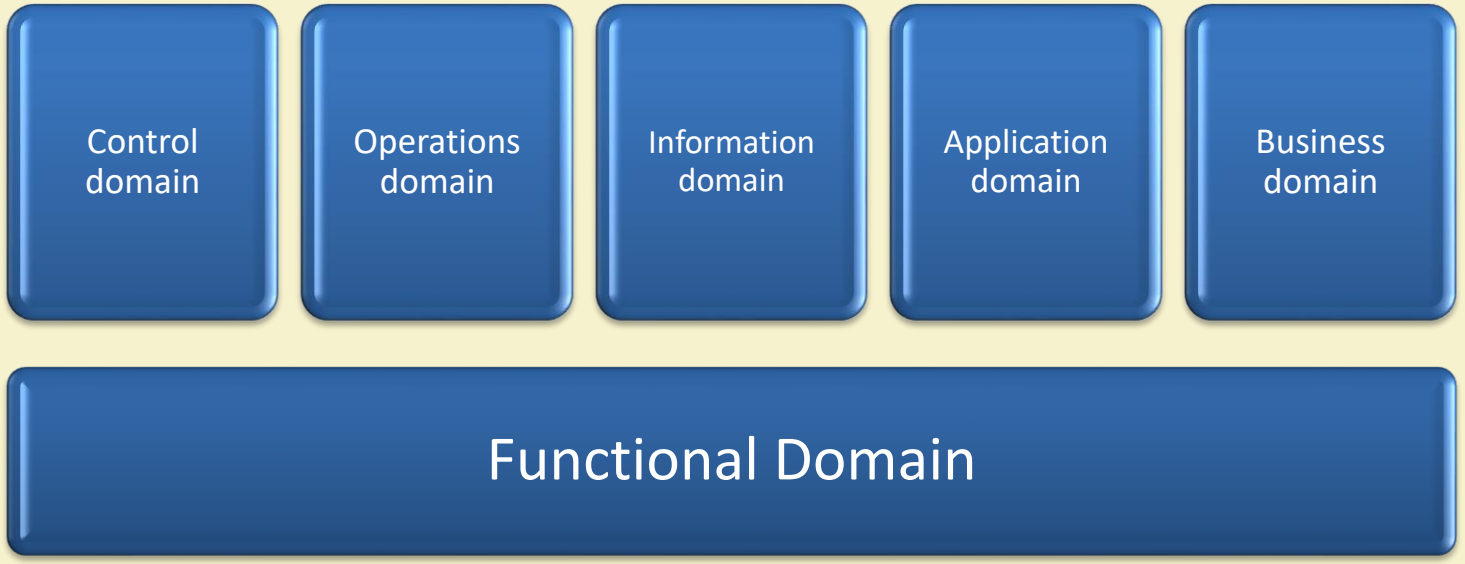
Usage Viewpoint (contd.)

- The elements of an *activity* are
  - **Trigger:** conditions under which the activity is initiated.
  - **Workflow:** sequential, parallel, conditional, iterative organization of tasks.
  - **Effect:** state of the IIoT system after successful completion of an activity.
  - **Constraints:** system characteristics which must be preserved during execution.



Source: "IIoT Reference Architecture", IIoT World

Functional Viewpoint



Source: "IIoT Reference Architecture", IIoT World

Functional Viewpoint (contd.)

Functional Domain

Operations domain

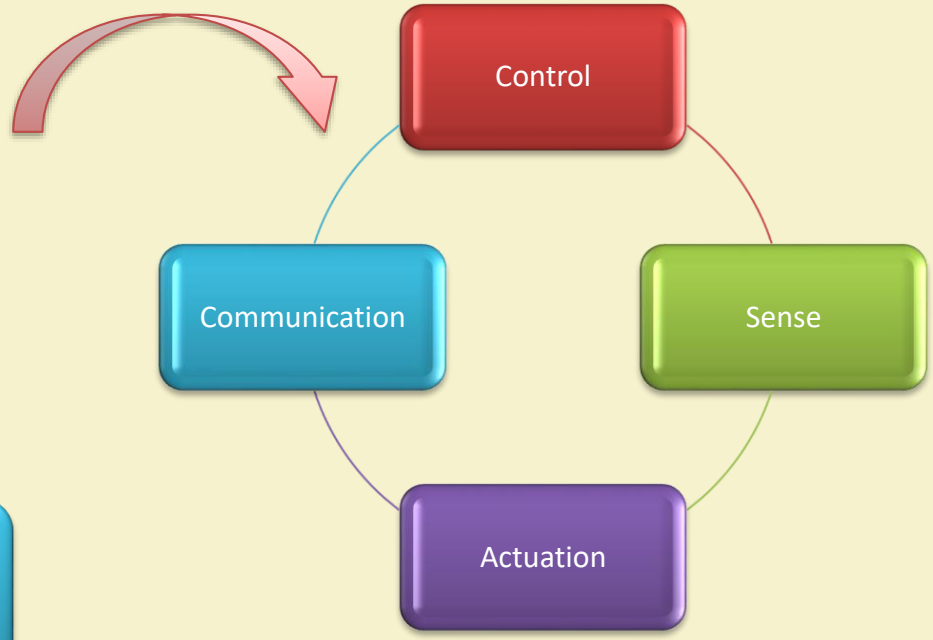
Information domain

Application domain

Business domain

Control domain

Physical Systems



Source: "IIoT Reference Architecture", IIoT World

Functional Viewpoint (contd.)

- The control domain represents the set of functions performed by industrial control systems, which are as follows:
  - Sensing: Reading the data from sensor nodes.
  - Actuation: Writes data and control signals into an actuator.
  - Communication: Connects the sensors, actuators, gateways and other edge devices.

Source: "IIoT Reference Architecture", IIoT World

Functional Viewpoint (contd.)

- The operations domain represents the set of functions responsible for
  - Provisioning and deployment: Configure, track, register, and deploy assets online remotely, securely and at scale.
  - Management: Enables management of assets which is focused on the suite of management commands.

Source: "IIoT Reference Architecture", IIoT World

Functional Viewpoint (contd.)

- Prognostics: Acts as a predictive analytics engine of the IIoT systems.
- Monitoring and diagnostics: Responsible for real-time monitoring, and enables detection and prediction of occurrence of problems.
- Optimization: improves asset reliability and performance, reduces energy consumption, increases availability, and output in according to the assets used.

Source: "IIoT Reference Architecture", IIoT World

Functional Viewpoint (contd.)

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

Source: "IIoT Reference Architecture", IIoT World

Functional Viewpoint (contd.)

- The information domain represents the set of functions responsible for
  - assembling data from various domains
  - transforming
  - persisting
  - modelling/analysis of data

Source: "IIoT Reference Architecture", IIoT World

Functional Viewpoint (contd.)

- The application domain represents the set of functions which implement application logic to realize specific business functions
  - Logics and Rules: Implements specific functions required for the use case.
  - APIs and UI: Enables an application exposes its functions as *API*s for other applications to consume.

Source: "IIoT Reference Architecture", IIoT World

Functional Viewpoint (contd.)

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

Source: "IIoT Reference Architecture", IIoT World

Implementation Viewpoint

- The implementation viewpoint relates to the
  - technical representation of an IIoT system including interfaces, protocols, and behaviors
  - identification of system characteristics
  - general architecture of IIoT-its structure, distribution and the topology of interconnection of the components
  - Implementation map of the activities as recognized from usage viewpoint to the functional components, and from functional components to implementation components

Source: "IIoT Reference Architecture", IIoT World

References

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[6] P A Wordworth, “A Reference Architecture for Enterprise Architecture”.

[7] William Ulrich, “Business Architecture: The Art and Practice of Business Transformation”.

[8] Graham Meaden and Jonathan Whelan, “Business Architecture: A Practical Guide”.

Thank You!!