# FORMAL ARCHITECTURE OVERVIEW
# INDUSTRIAL IOT

Software and Services Group
IoT Developer Relations, Intel

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# INTRODUCTION VIDEO

Beckhoff
https://www.intel.com/content/www/us/en/industrial-automation/products-and-solutions/intel-beckhoff-industrial-solutions-video.html
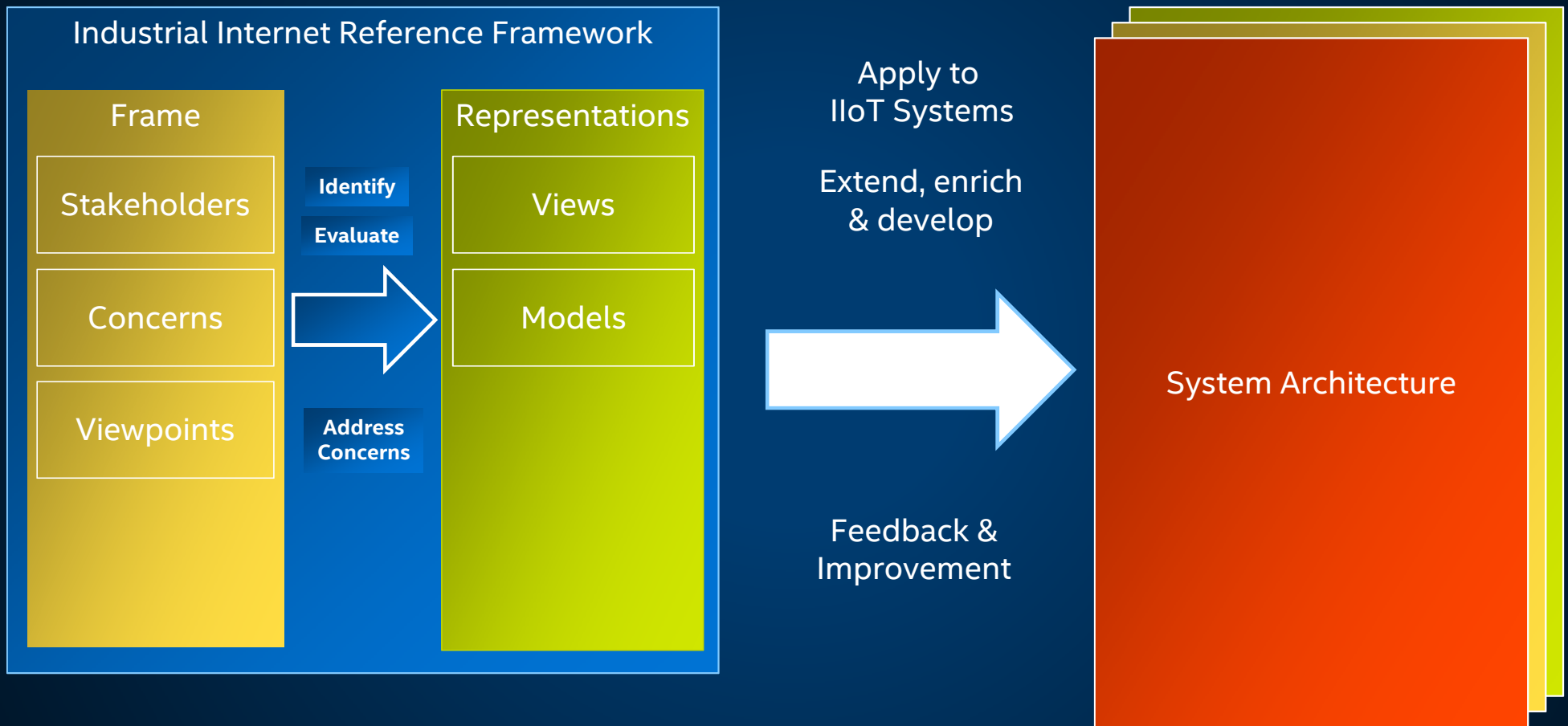
Industry 4.0 Plug&Play by Alleantia and Intel
https://vimeo.com/185239991

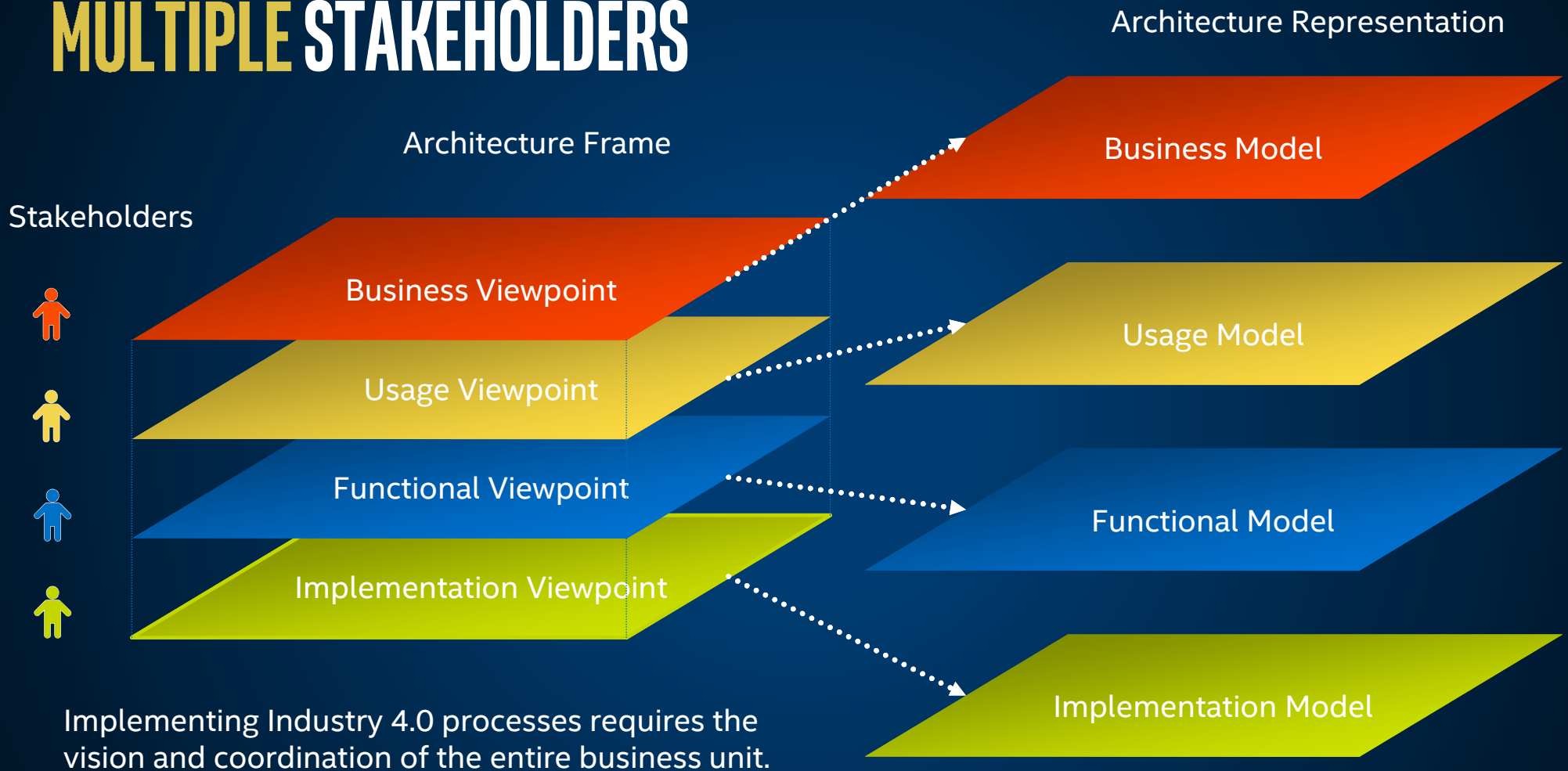# FORMALIZING THE INDUSTRIAL INTERNET OF THINGS

# ADDRESSING ENVIRONMENT COMPLEXITY

" *The IIoT landscape is replete with proprietary connectivity technologies and specialized connectivity standards optimized for a narrow set of domain-specific use cases in vertically integrated systems. These domain-specific connectivity technologies, though optimal in their respective domains, can be a hindrance to the sharing of data, designs, architectures, and communications essential to creating new value streams and unlocking the potential of a global IIoT marketplace. The overarching goal of IIoT connectivity is to unlock data in these isolated systems ("silos") and enable data sharing and interoperability between previously closed components and subsystems (brownfield) and new applications (greenfield), within and across industries.* "
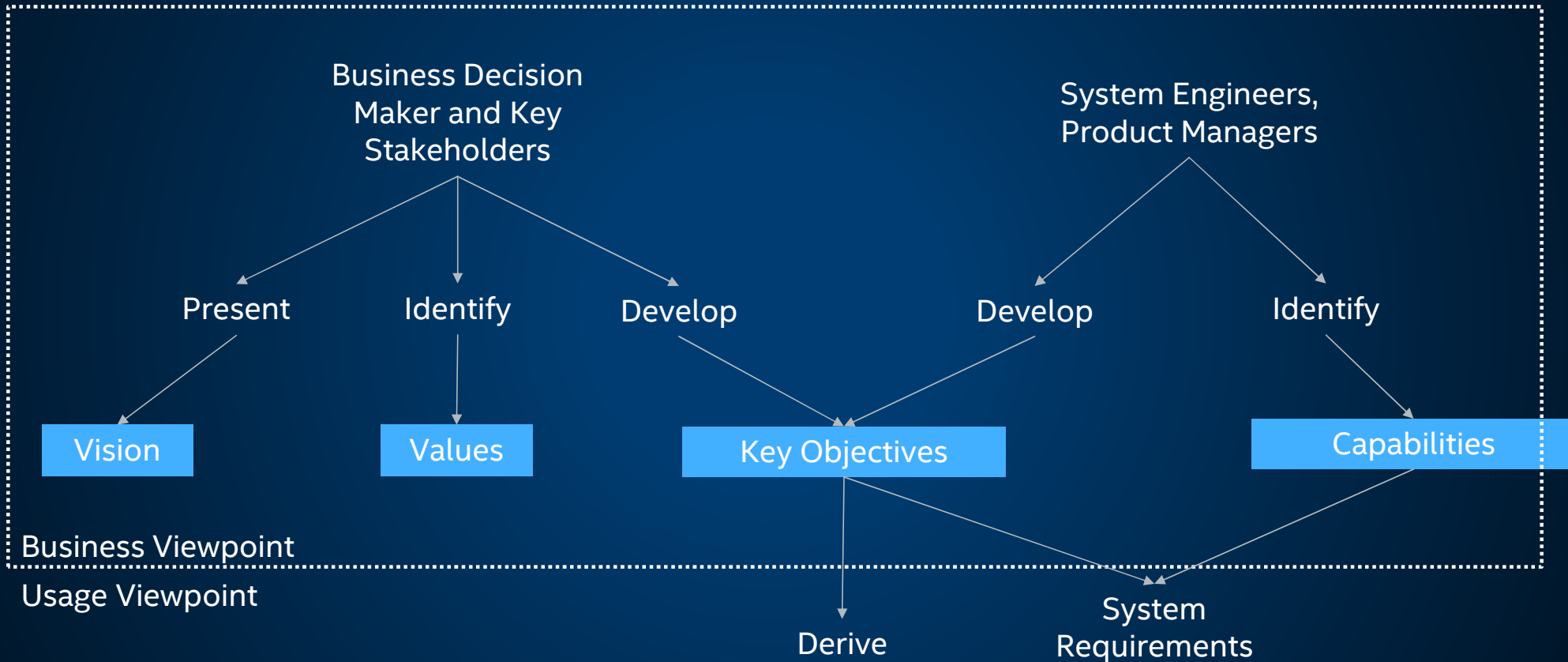
# INDUSTRIAL INTERNET REFERENCE ARCHITECTURE

## Industrial Internet Reference Framework

**Frame**
- Stakeholders
- Concerns
- Viewpoints

Identify
Evaluate
Address Concerns

**Representations**
- Views
- Models

Apply to IIoT Systems

Extend, enrich & develop

Feedback & Improvement

**System Architecture**

The Industrial Internet of Things Volume G1 – Reference Architecture

MULTIPLE STAKEHOLDERS

Architecture Representation

Architecture Frame

Stakeholders

Business Viewpoint

Usage Viewpoint

Functional Viewpoint

Implementation Viewpoint

Business Model

Usage Model

Functional Model

Implementation Model

Implementing Industry 4.0 processes requires the vision and coordination of the entire business unit.

The Industrial Internet of Things Volume G1 – Reference Architecture

# BUSINESS AND USAGE VIEWPOINTS

Business Decision
Maker and Key
Stakeholders

System Engineers,
Product Managers

Present          Identify          Develop          Develop          Identify

Vision          Values          Key Objectives          Capabilities

Business Viewpoint

Usage Viewpoint

Derive          System
Requirements

The Industrial Internet of Things Volume G1 – Reference Architecture

# FUNCTIONAL VIEWPOINT

**THE CONTROL DOMAIN**
the collection of functions that are performed by industrial control systems.

**THE OPERATIONS DOMAIN**
the collection of functions responsible for the provisioning, management, monitoring and optimization.

**THE INFORMATION DOMAIN**
the collection of functions for gathering data and transforming, persisting, modeling or analyzing that data to acquire high-level intelligence about the overall system.

**THE APPLICATION DOMAIN**
the collection of functions implementing application logic that realizes business functionalities.

**THE BUSINESS DOMAIN**
enable end-to-end operations of the industrial internet of things systems

## Functional Domains

| Business | | |
|---|---|---|
| Operations | Information | Application |
| Control | | |
| Physical System | | |
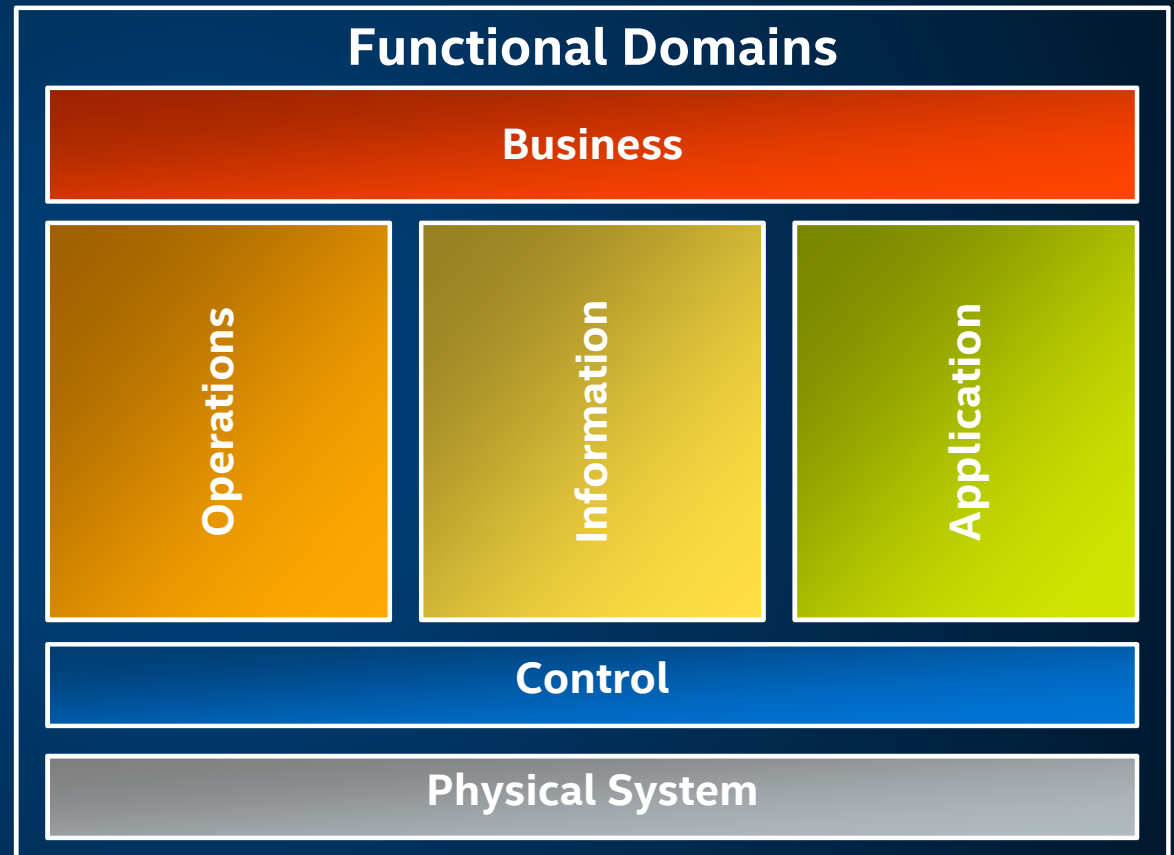
# CONTROL DOMAIN

## FUNCTIONAL VIEWPOINT

The collection of functions that are performed by Control Domain
- Sensing
- Actuating
- Entity Abstraction
- Modeling

## IMPLEMENTATION VIEWPOINT

3. Physical Sensors and Actuators
4. Communications and Protocols



**Functional Domains**

**Business**

**Operations**

**Information**

**Application**

**Control**

**Physical System**
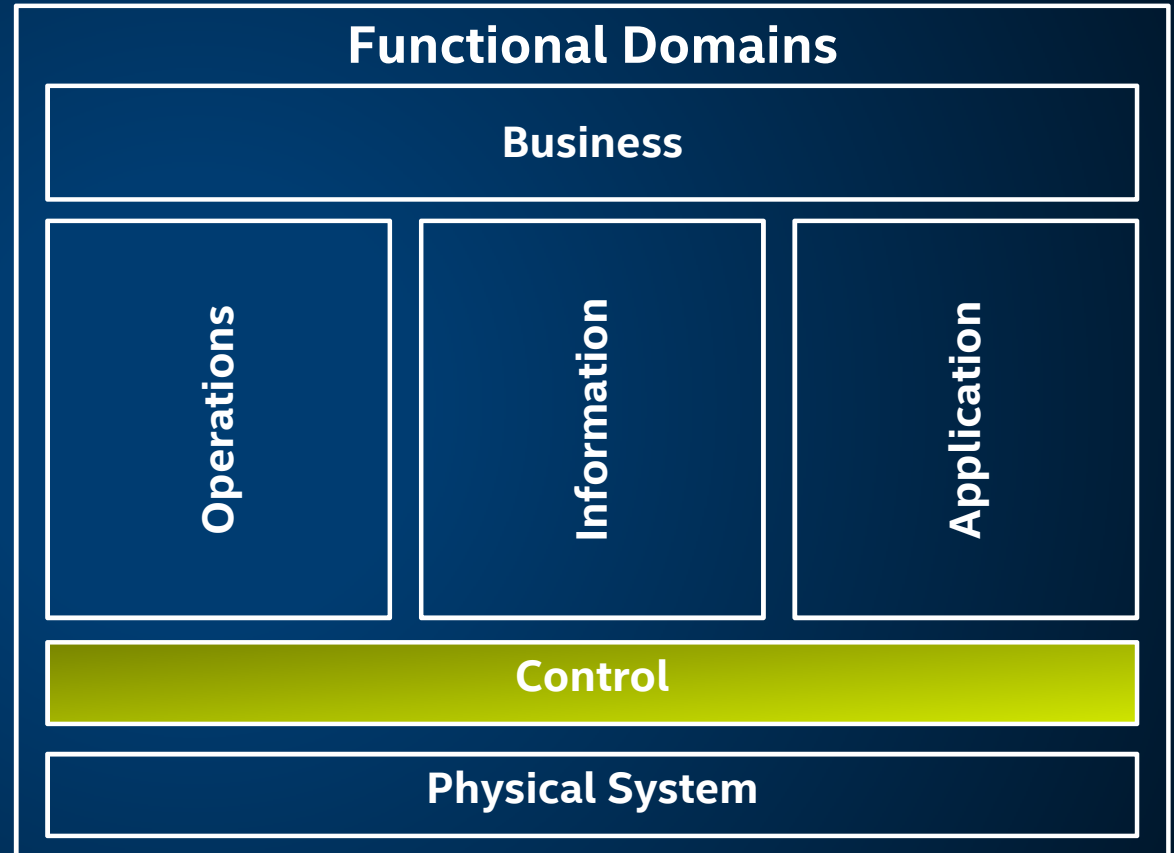
# OPERATIONS DOMAIN

## FUNCTIONAL VIEWPOINT

The operations domain represents the collection of functions responsible for the provisioning, management, monitoring and optimization of the systems in the control domain

## IMPLEMENTATION VIEWPOINT

5. Virtualization and Consolidation
6. Security and IIoT

### Functional Domains

**Business**

**Operations**

**Information**

**Application**

**Control**

**Physical System**
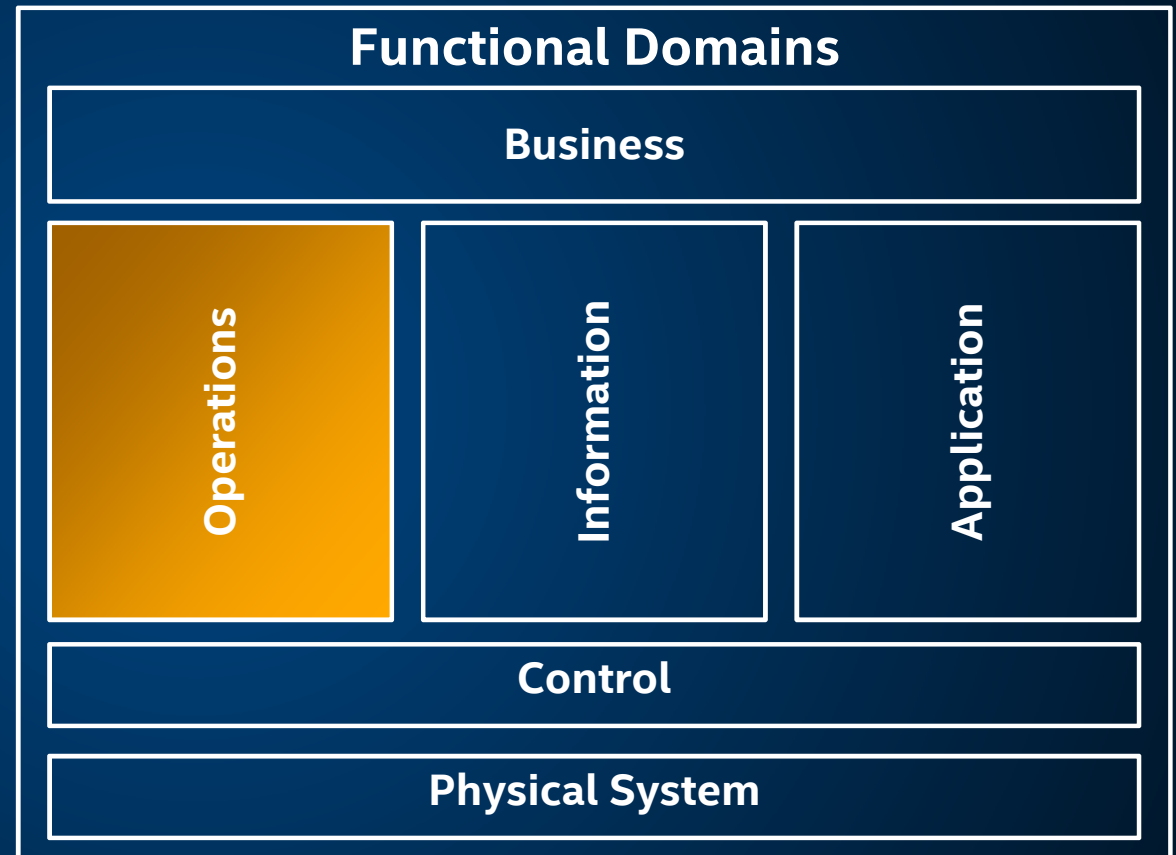
# INFORMATION DOMAIN

## FUNCTIONAL VIEWPOINT

The collection of functions for gathering data and transforming, persisting, modeling or analyzing that data to acquire high-level intelligence about the overall system.

## IMPLEMENTATION VIEWPOINT

7. Automated Control Systems
8. Smart Video Systems



Functional Domains

Business

Operations

Information

Application

Control

Physical System
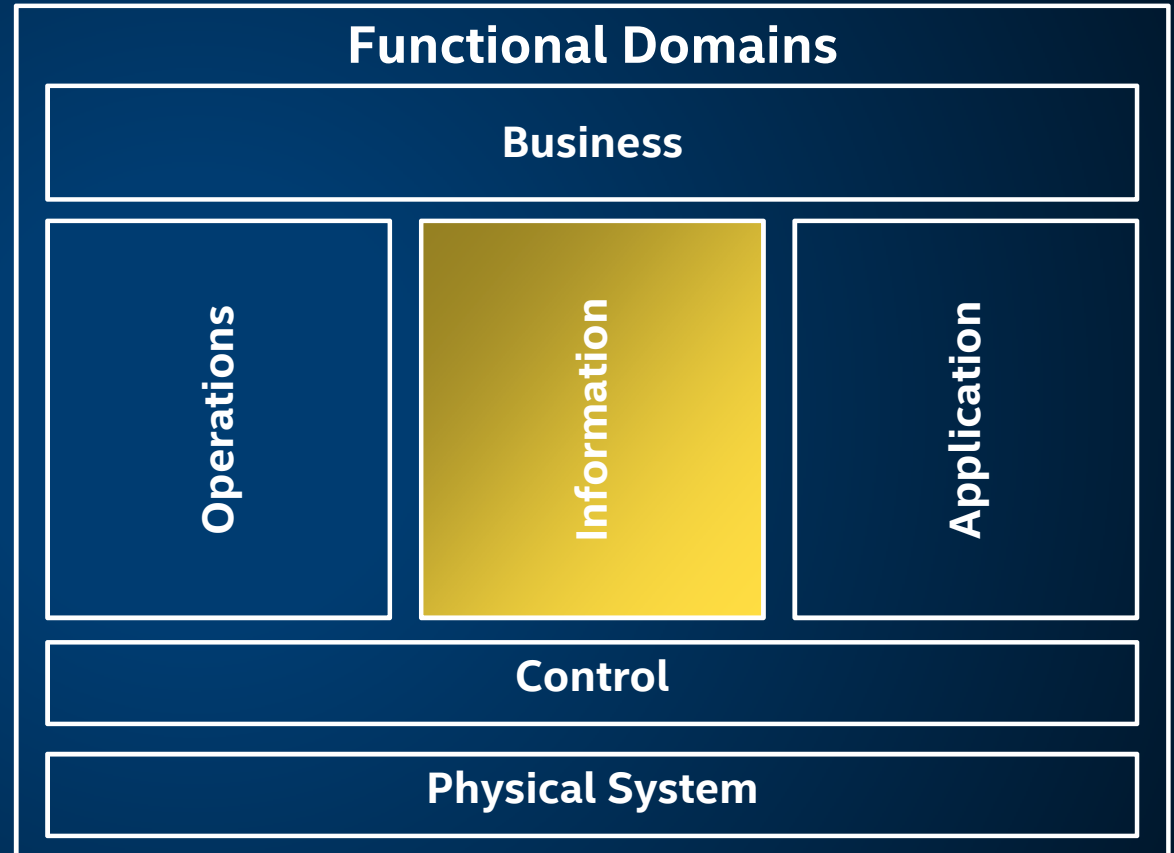
# INTELLIGENTLY USE EXISTING PRODUCTION DATA

- Existing deployments are integrated with sensors
- Data sheds light on existing processes
- Real-time monitoring allows optimization
- Data mining reveals new patterns
- Machine Learning builds predictive models of business processes

Predictive Models

**MACHINE LEARNING**

High level Modeling

**DATA MINING**

Reporting Dashboards

**DATA VISUALIZATION**

Unified Data Access

**DATA INTEGRATION**

Sensor Framework

**DATA COLLECTION**

# DIGITAL TWIN

A Digital Twin is the ability to take a virtual representation of the physical elements and the dynamics of how an IoT device operates and use that feedback to make predictions that improve the lifecycle and lifetime of a product.



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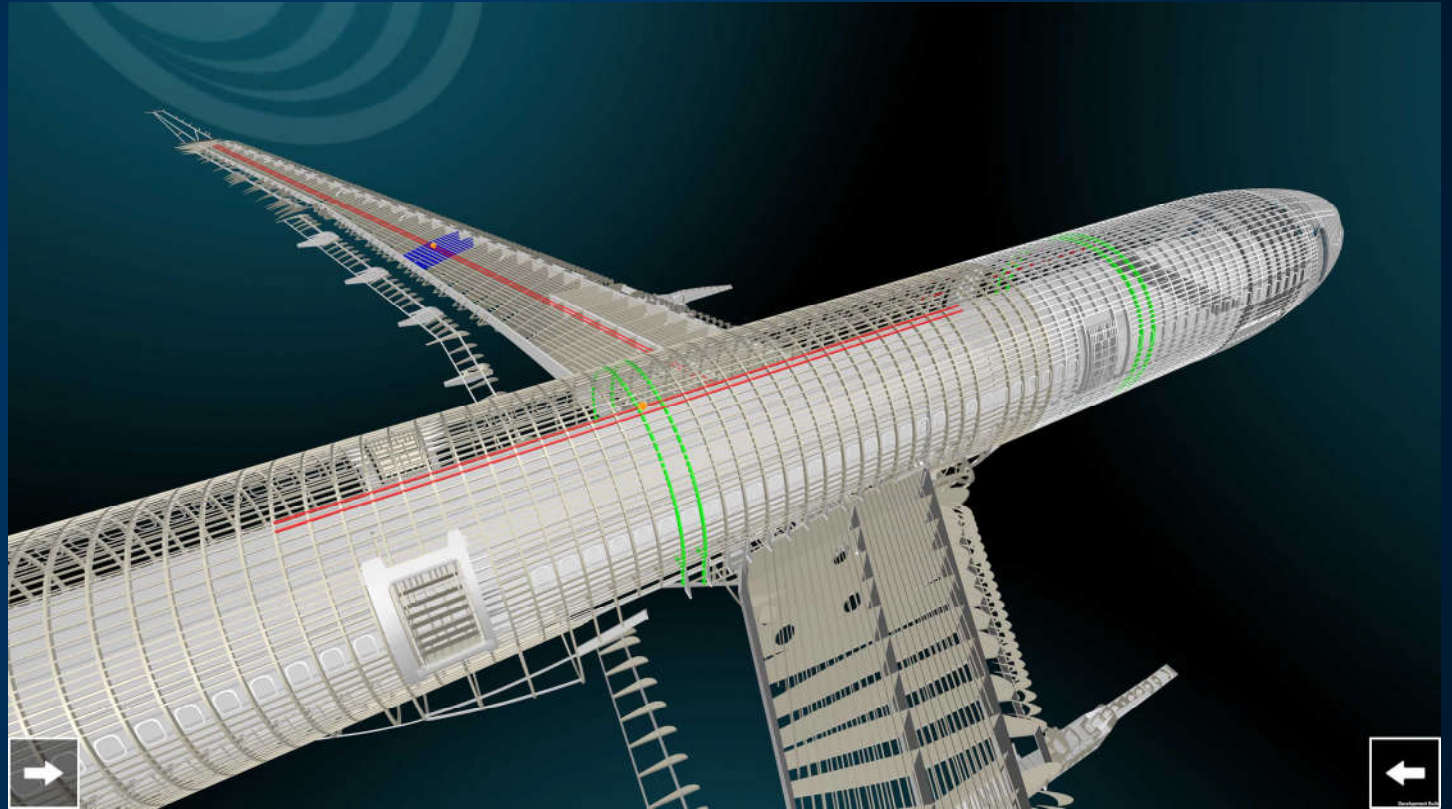
# APPLICATION DOMAIN



**MANUFACTURING ANALYTICS**

**PRODUCTION PERFORMANCE**

**PROCESS QUALITY**

**PREDICTIVE MAINTENANCE**

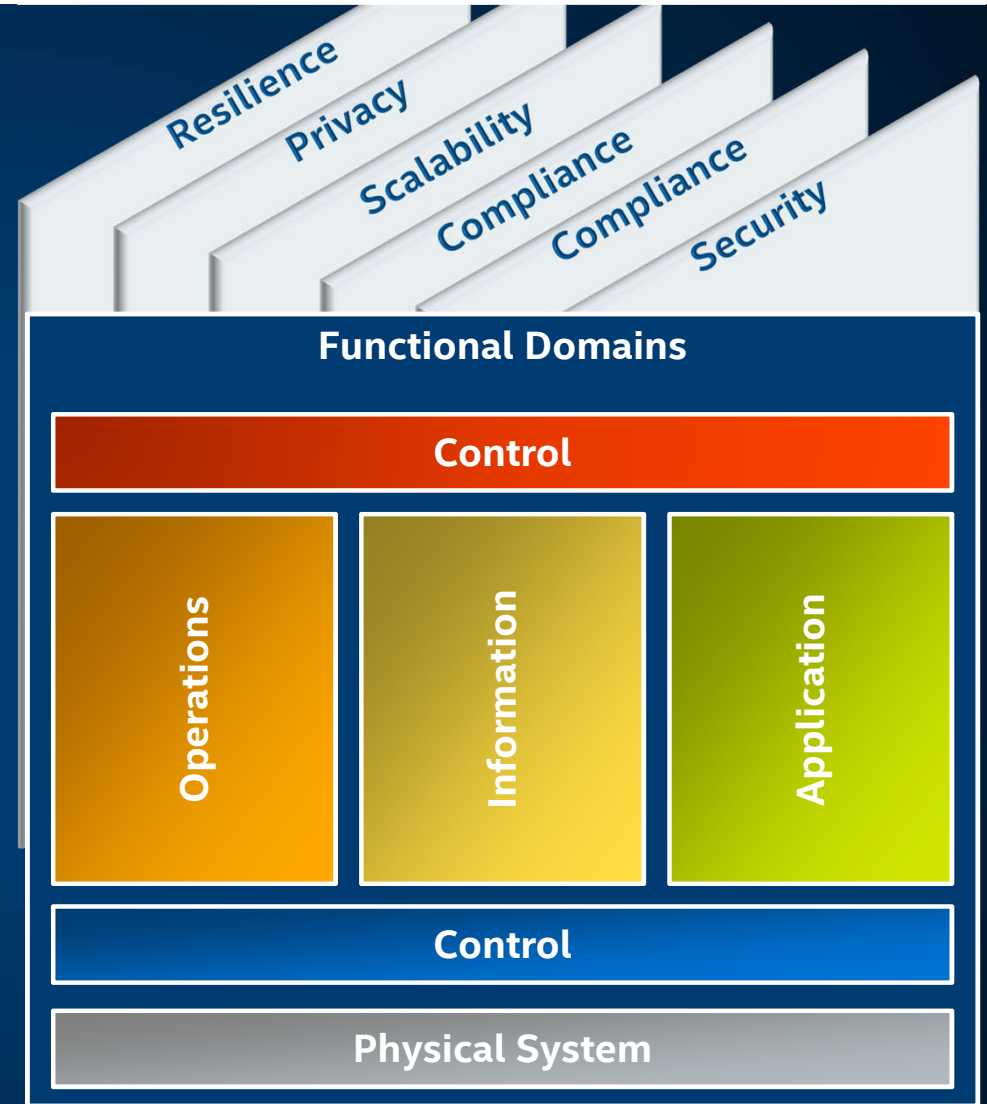**DATA PROCESSING**

**PRODUCTION RULES**

**REMOTE SERVICES**

**SENSOR CLOUD**

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# THEMES OF THE INDUSTRIAL INTERNET OF THINGS

- Current investment is focusing on Brownfield and Greenfield installations.

- IIoT is enabling real-time visibility into industrial process

- Analyzing data and extracting insight allow creates a virtuous cycle of business improvement



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# VIRTUAL POWER PLANT



B2B

B2C