# RAMI 4.0

## *An architectural Model for Industrie 4.0*

Plattform INDUSTRIE 4.0

**Dr.-Ing. Peter Adolphs**

**Berlin, 18th of June 2015**

# Platformproject today and tomorrow as bracket for all Industry 4.0 relevant activities in Germany

- The Platform Industry 4.0 sees itself as a cooperation of all stakeholders
- The goal is a broadly supported consensus


**Platform Industry 4.0**

- **AG1 Strategy and Framework**
- **AG2 Referencearchitecture, Standards and Norms**
- **AG3 Innovation and Research**
- **AG4 Security of networked systems**

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**VDI/VDE**

- Focusproject Industry 4.0
- GMA 7.21 Industry 4.0
- GMA 7.20 CPS

**BITKOM**

- Cyber Physical Systems
- I4.0 Inter-operability
- I4.0 Market & Strategy

**ZVEI**

- Leaderchip circle Industry 4.0
- SG1 see above
- SG2 -"-
- SG3 -"-
- SG4 -"-

**VDMA**

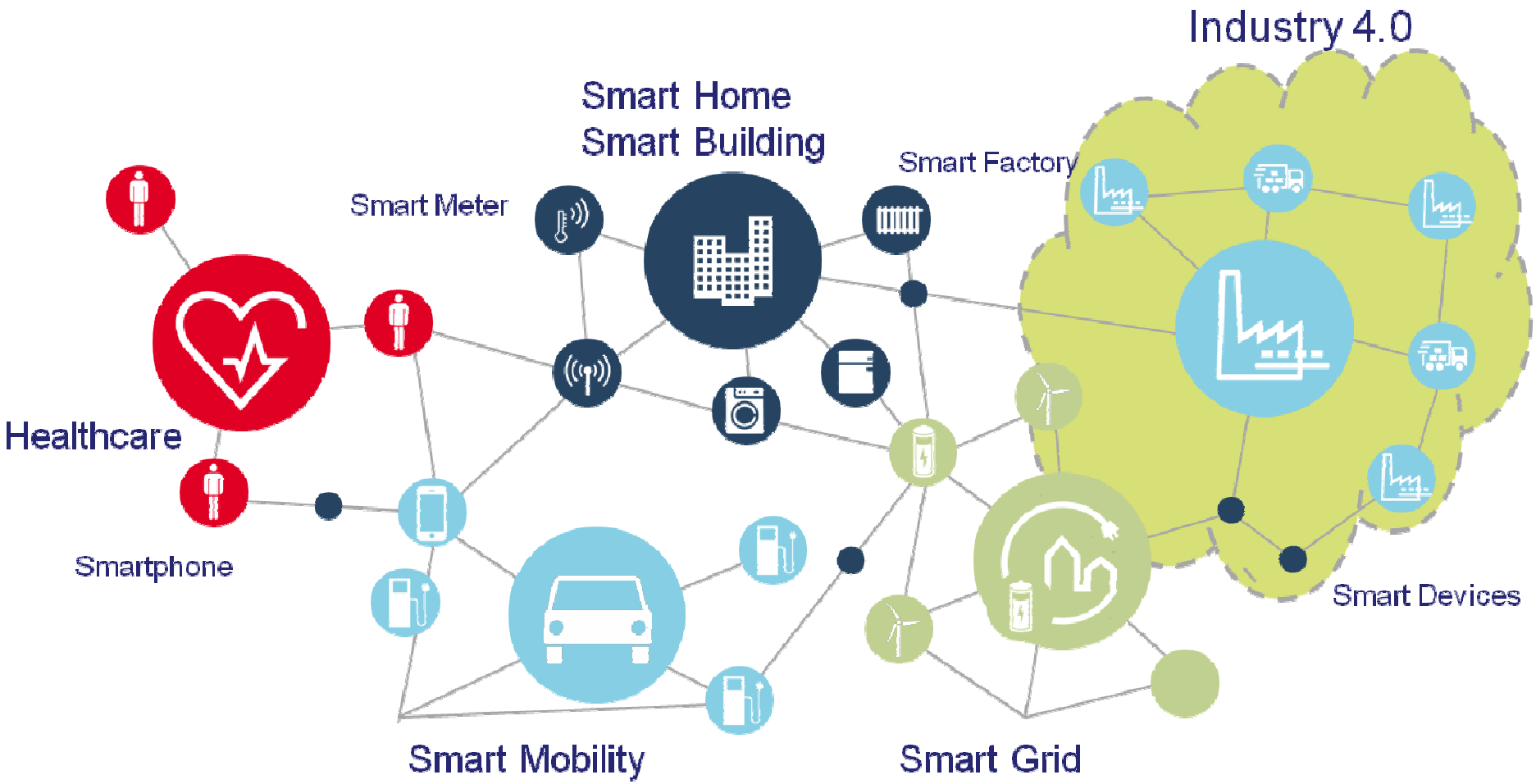
- Forum Industry 4.0

**DIN/ DKE**

- Mgt. circle Industry 4.0

Quelle: Roland Heidel, SIEMENS

# Internet of Things and Services

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# Targets for the Reference Model

## 1. Illustrative and simple architectural model

- Structuring of all Industry 4.0 aspects into manageable partial contents for focused discussions

## 2. Localization of existing norms and standards

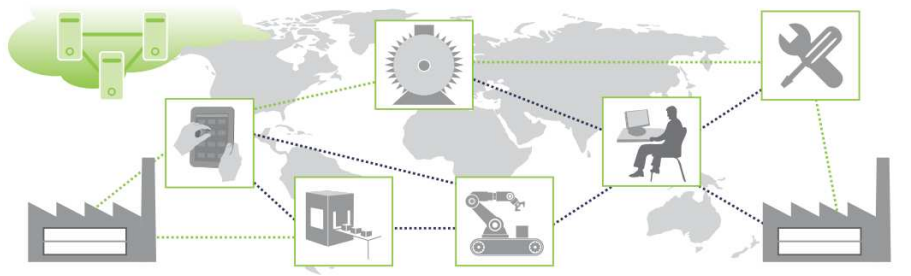
- Identification and closing of gaps
- Identification of overlaps and establishing preferred solutions
- Identification of subsets of a norm or a standard for rapid implementation of partial contents of Industry 4.0

## 3. Localization of Use Case content

- To identify and close technical gaps for the implementation of use cases
- Identification of development opportunities for the future

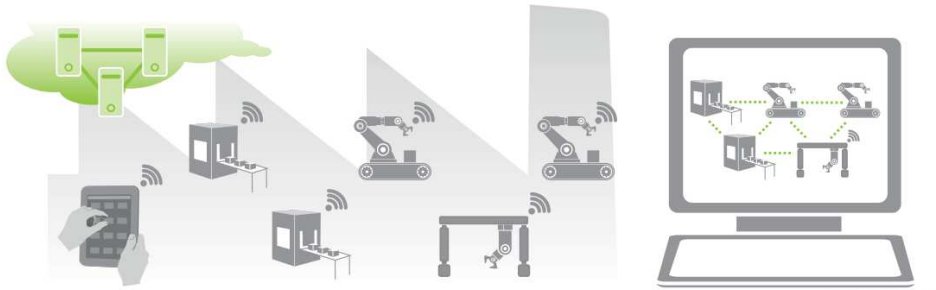
# Four main aspects for Industrie 4.0

## Horizontal Integration



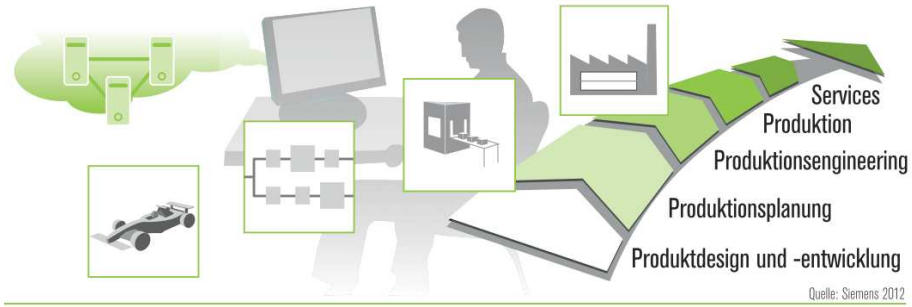

Worldwide value chains

## Vertical Integration



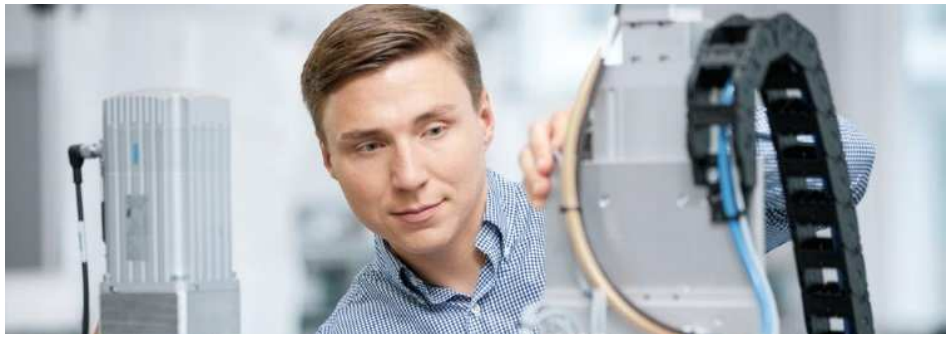

High-flexibility • lot-size 0

## consistent Engineering




Systems Engineering through out the life cycle • digital production

## People as main director of the value chain



Systems follow the people needs
Qualification for people

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**Basic Element for Industrie 4.0 systems**

**the**

**Industrie 4.0 component**

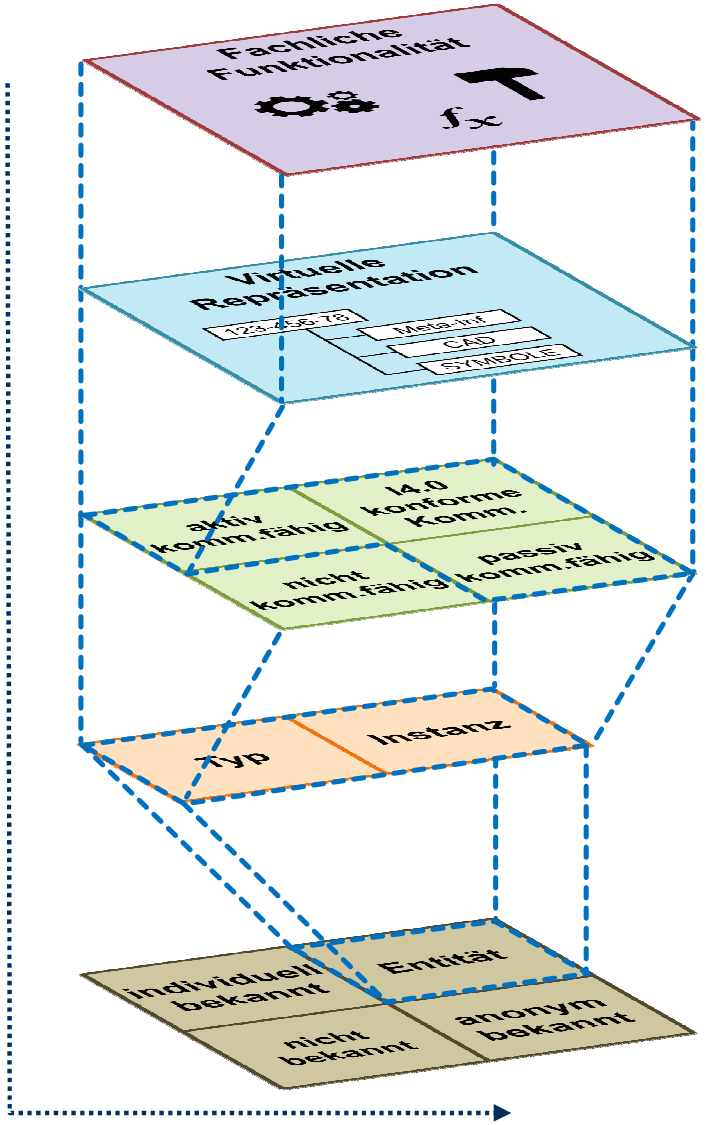
# I4.0 component

- Unified model for description of
  - assets (from sensor/actuator til the whole plant)
  - products
  - All IP used in the plant

- It consists out of an asset enriched by the so called „Administration Shell“
  - Virtual representation of the real asset
  - Data for status information of the asset
  - But also all data which was generated during life cycle in a consistent format

- The administration shell is the central Data-Warehouse for the asset during the whole life cycle

# The model for the administration shell



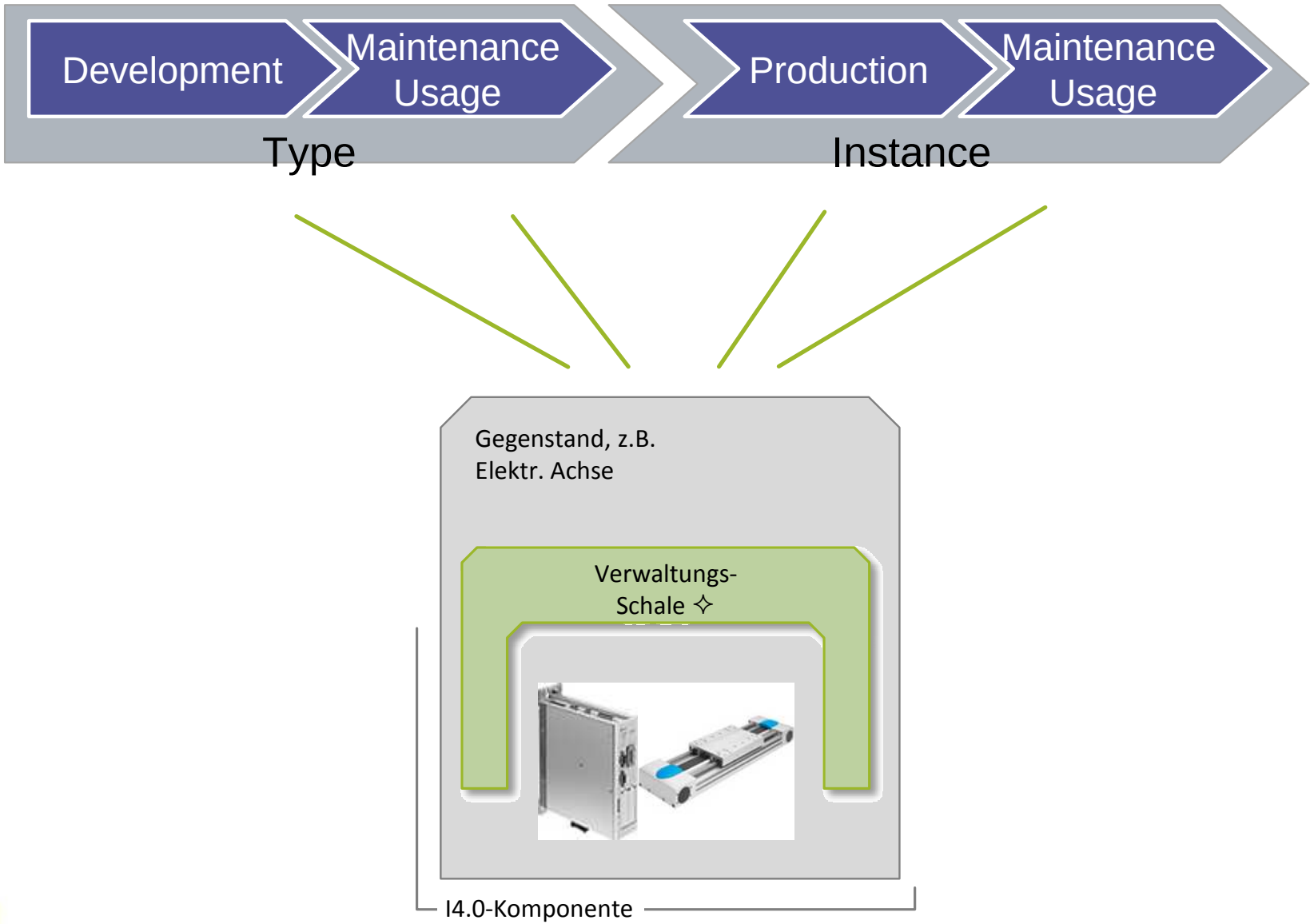

Administration shell

Communication

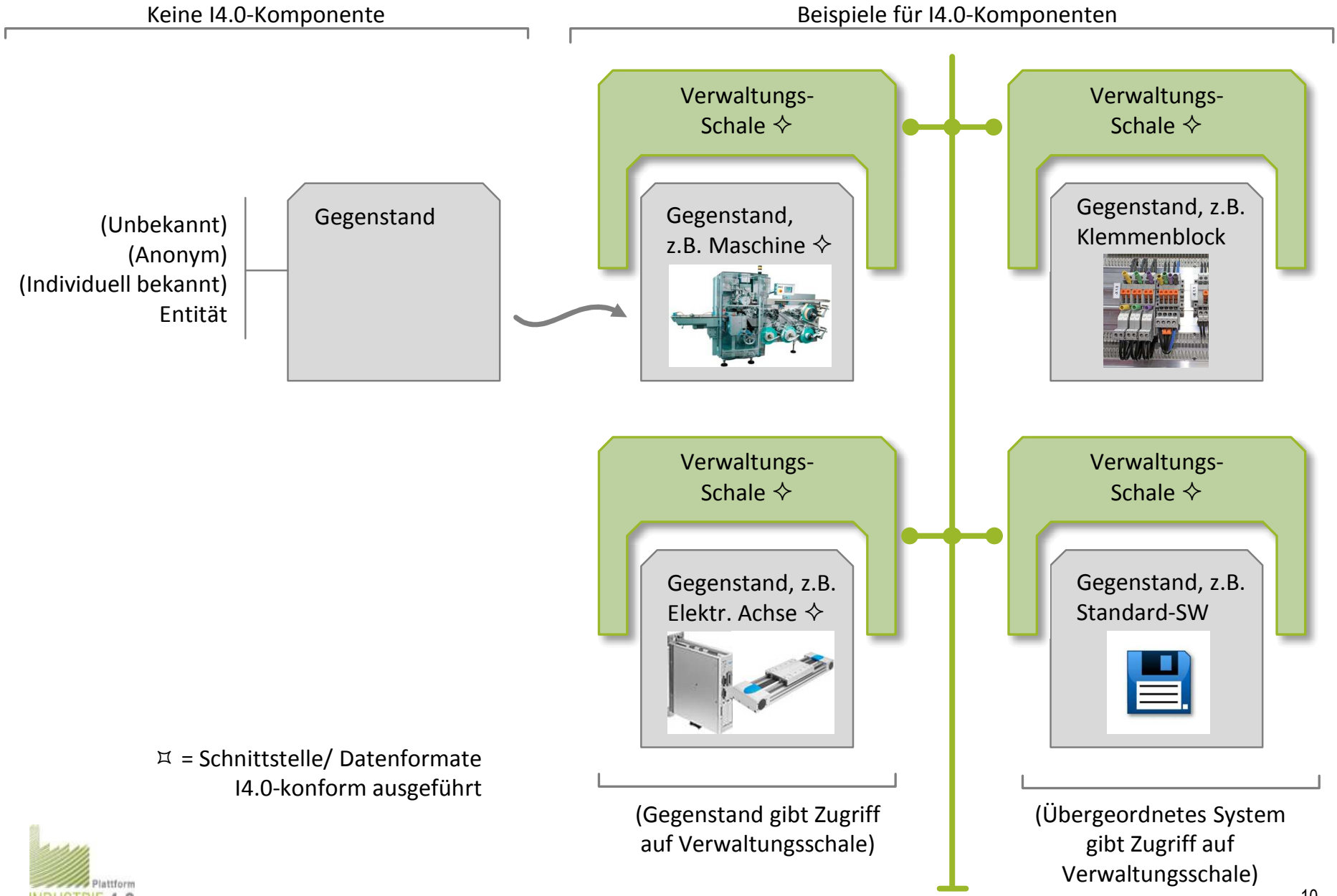
Type/instance

Asset/entity

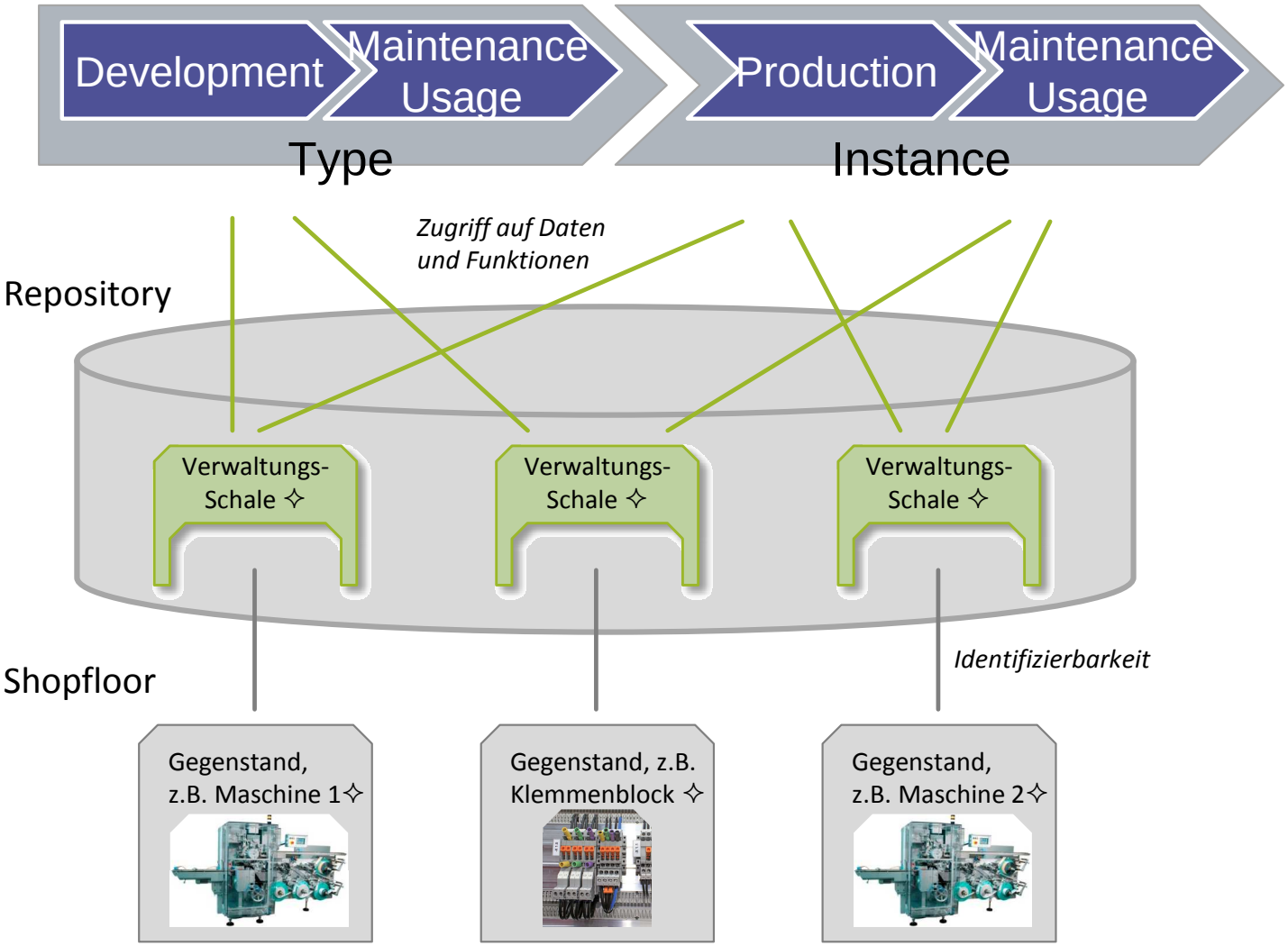
# Data & functional access during the whole life cycle



# I40 components can be defined during engineering according to relevance



# Administration shell can be hosted on the asset or centrally

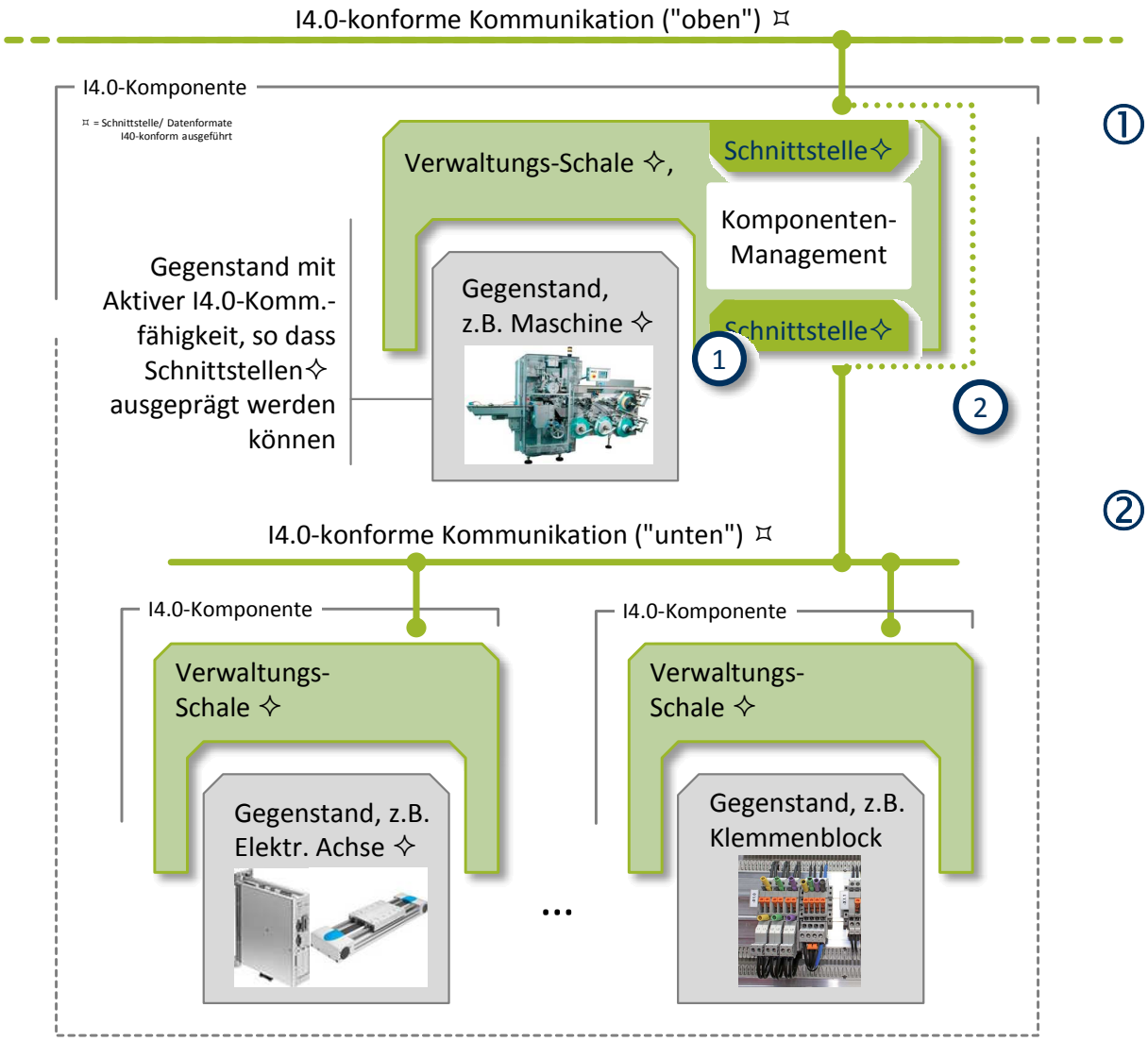



Access during whole life cycle

Realisation of administration shell on a central server possible

assets

# I4.0 components can be interleaved




① For several aspects the view on a whole functional unit is useful

→ e.g. control functions of a machine

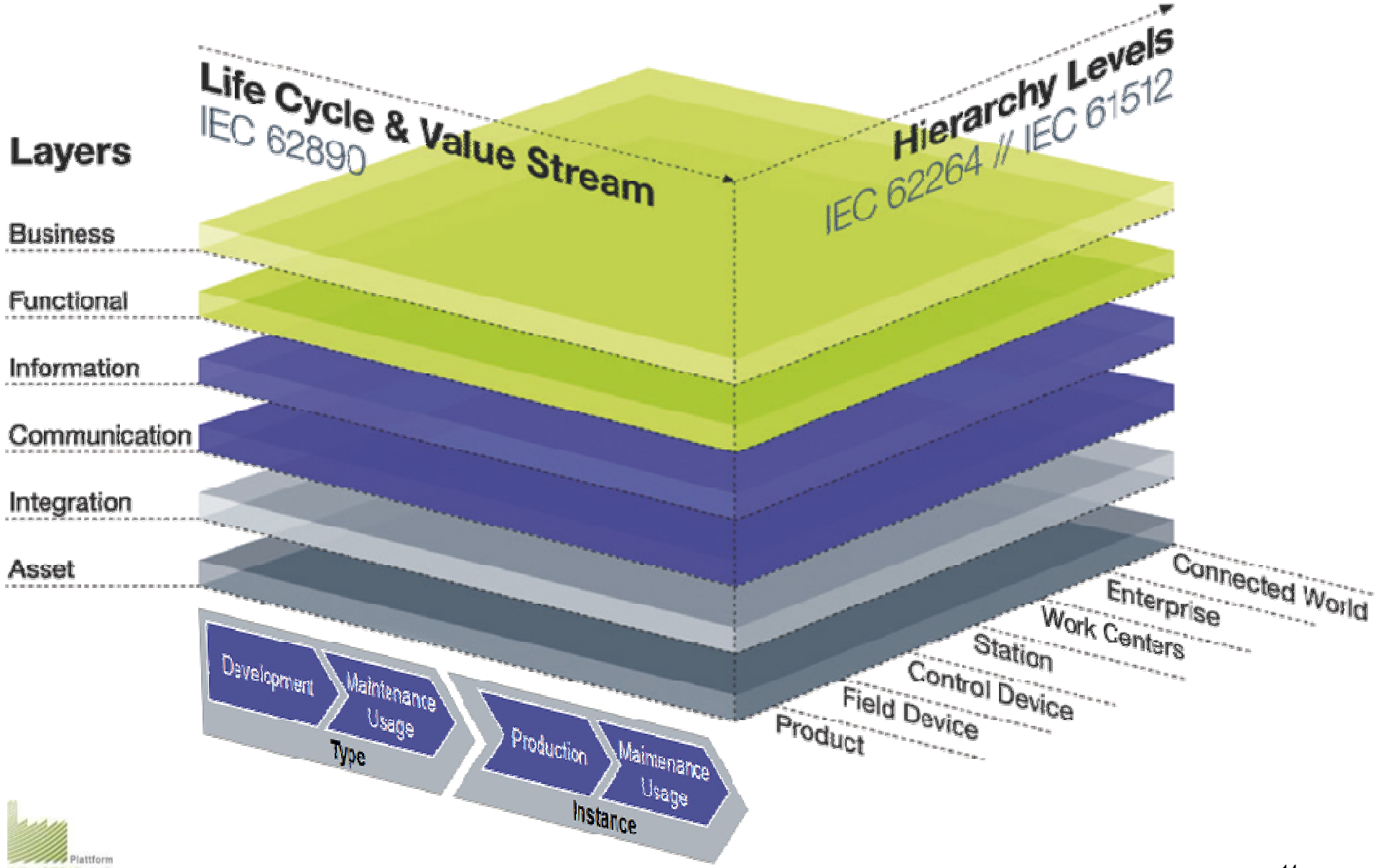
② For other aspects the direct access to basic Assets is needed:

→ e.g. Condition Monitoring

→ e.g. Asset-Management

# Reference Model Industrie 4.0

# Reference Architecture Model Industry 4.0 (RAMI4.0)

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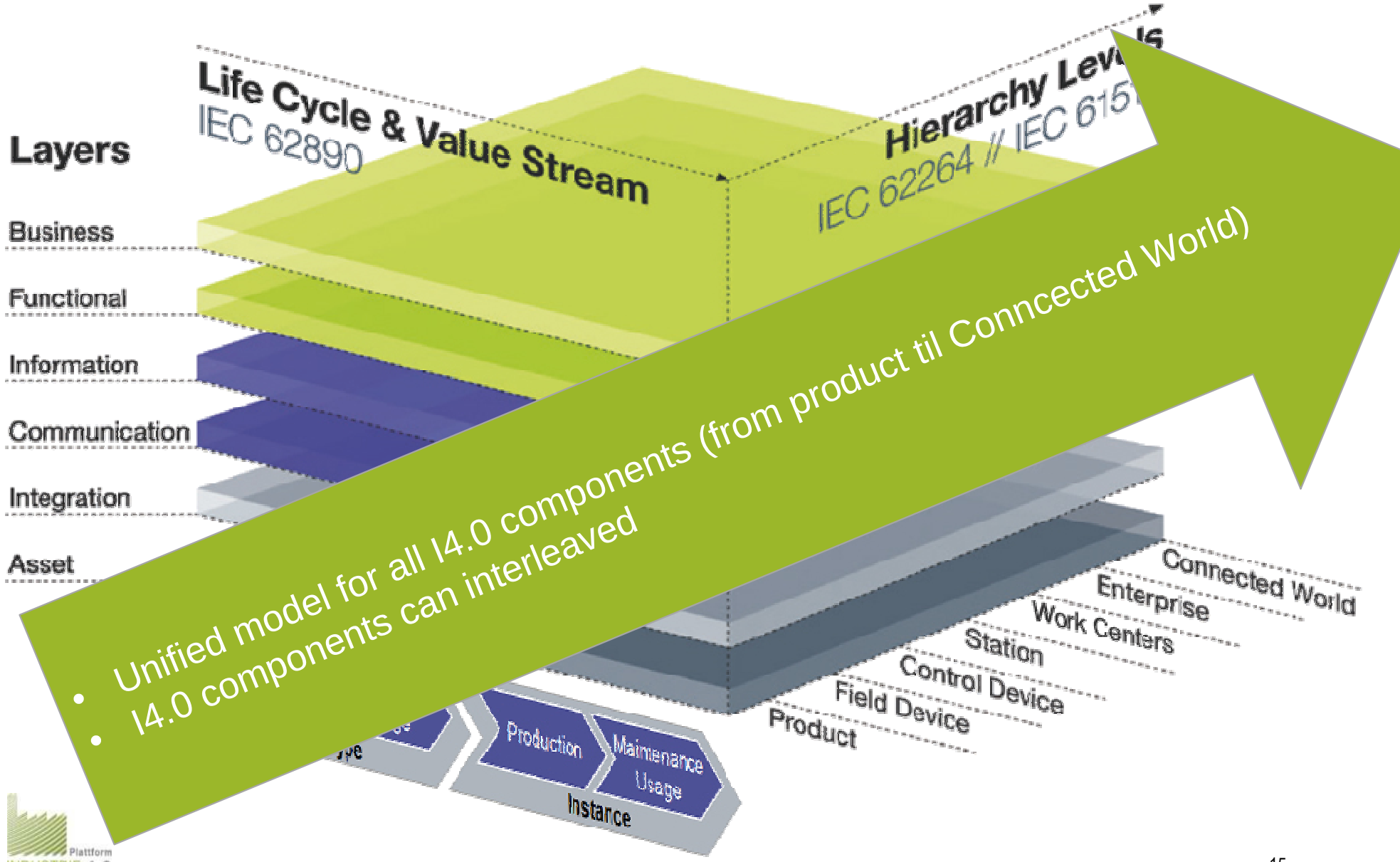
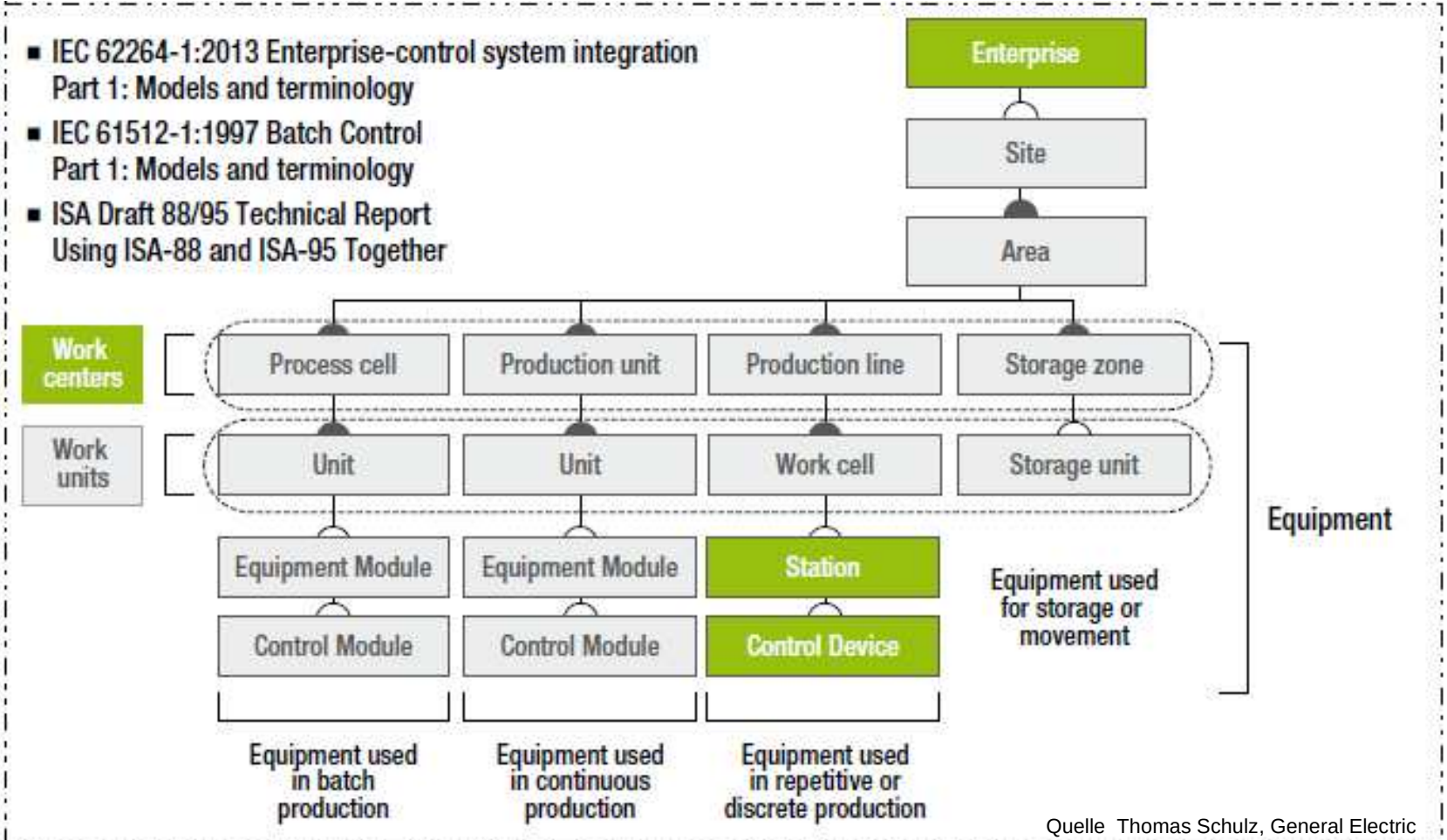
# View: Functional hierarchy for Industrie 4.0 components

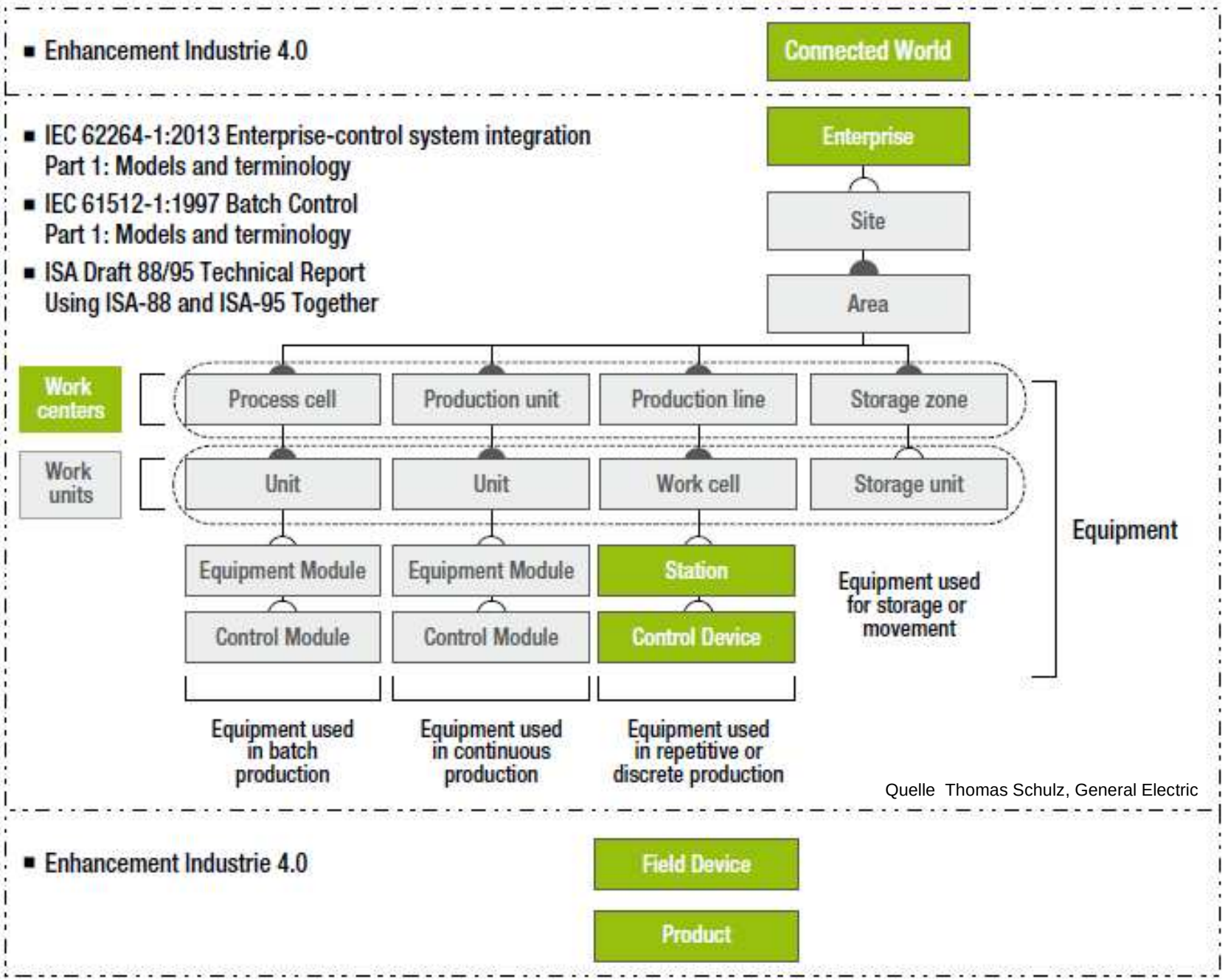


# Technical asset of IEC and ISA

- IEC 62264-1:2013 Enterprise-control system integration
  Part 1: Models and terminology
- IEC 61512-1:1997 Batch Control
  Part 1: Models and terminology
- ISA Draft 88/95 Technical Report
  Using ISA-88 and ISA-95 Together

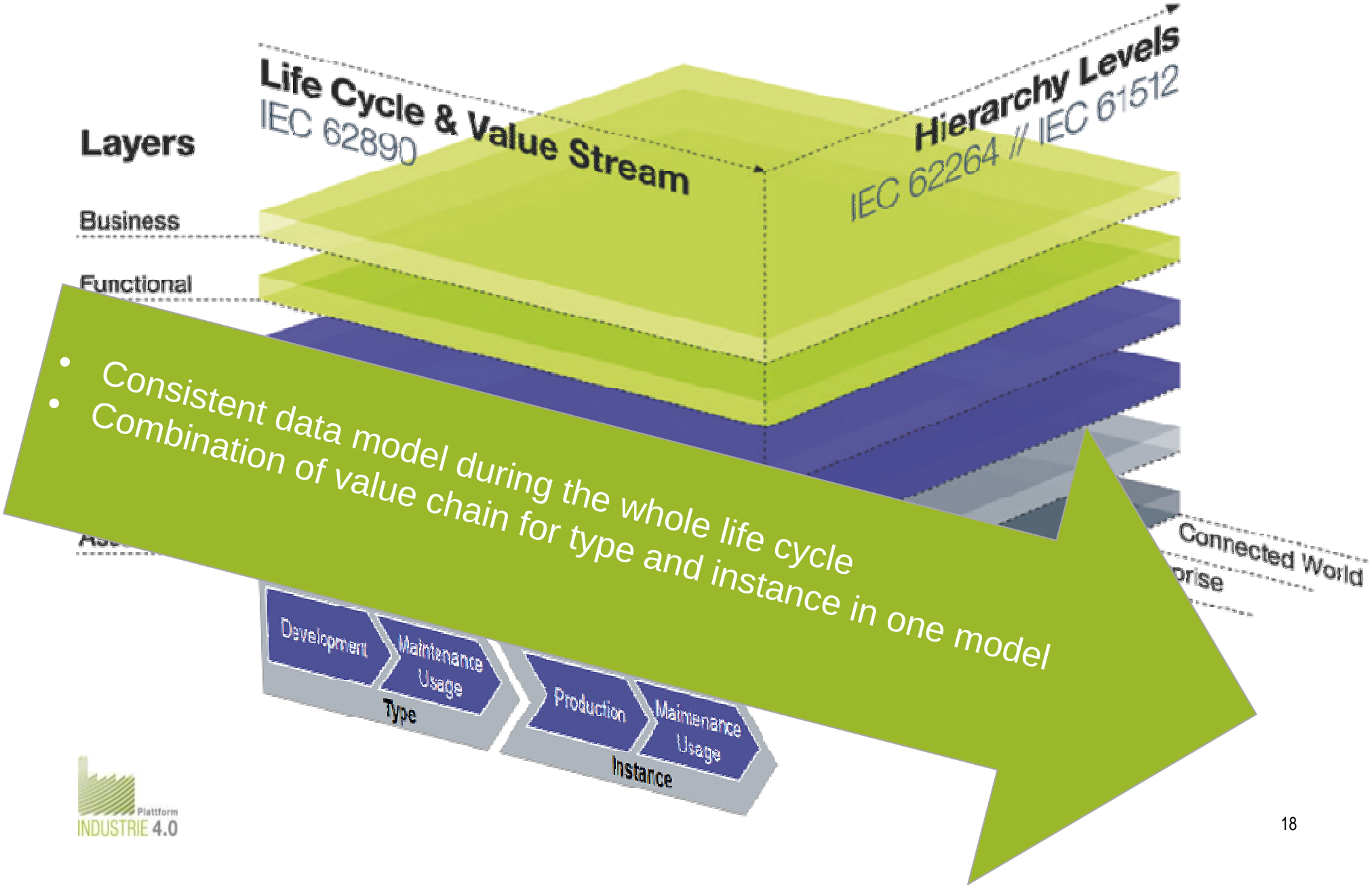



Quelle Thomas Schulz, General Electric




Quelle Thomas Schulz, General Electric

# View: Life cycle & value added chain

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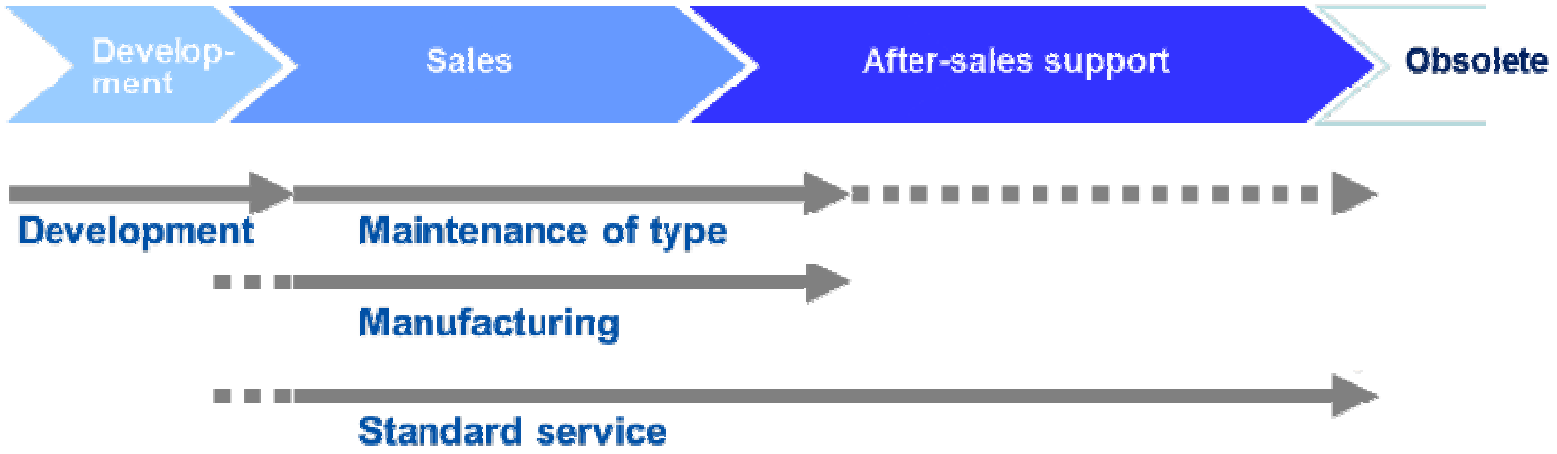
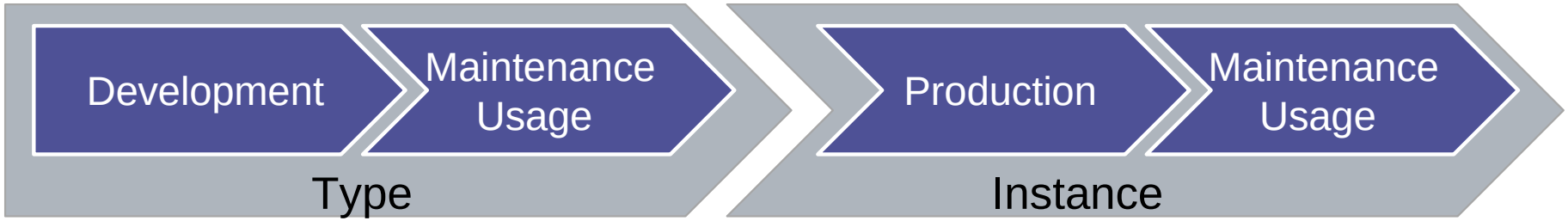
# Life cycle according to IEC CD 62890



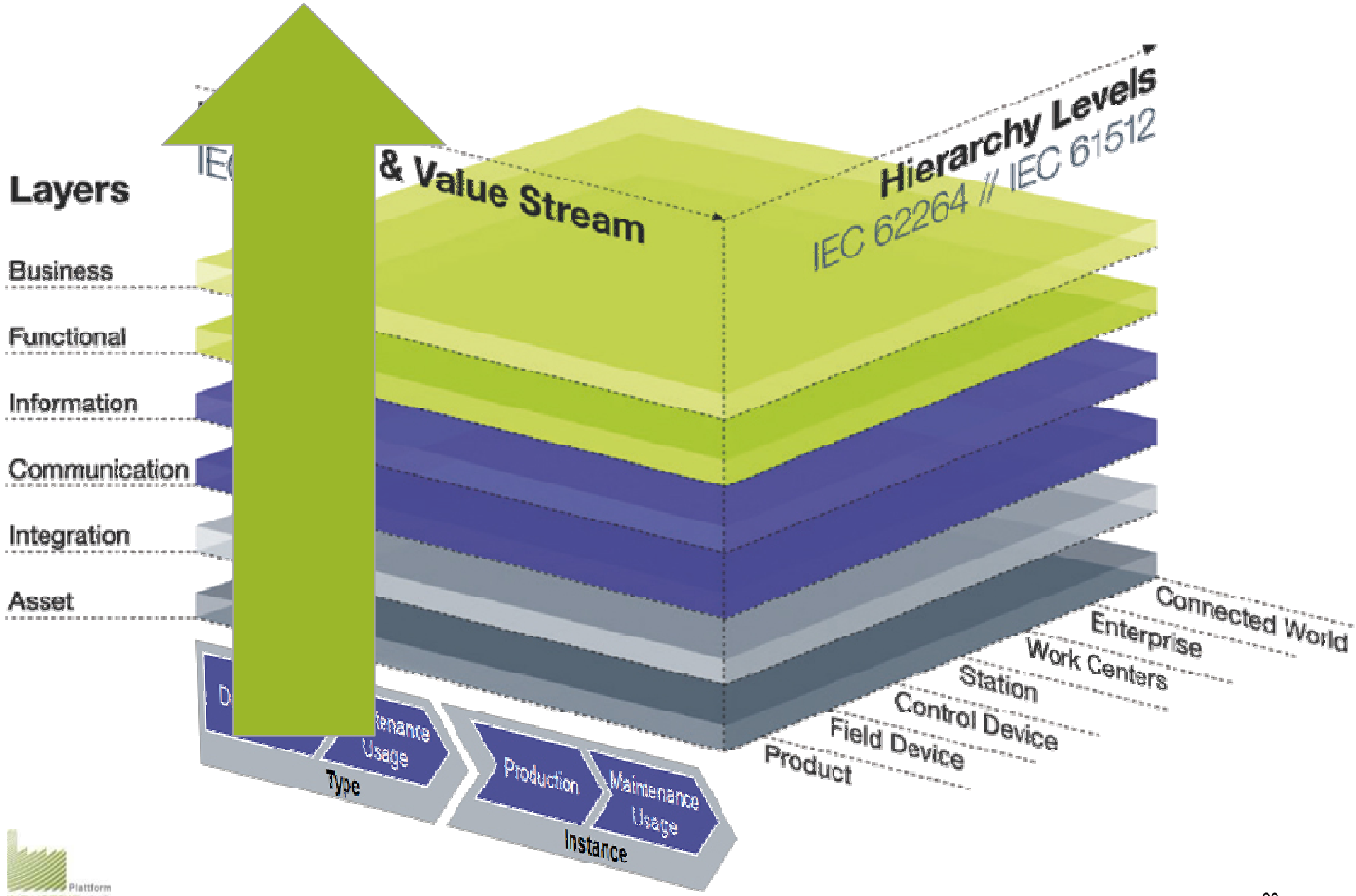

Quelle IEC CD 62890

## Realisation in RAMI4.0




Quelle Plattform Industrie 4.0

# View: IT Layer

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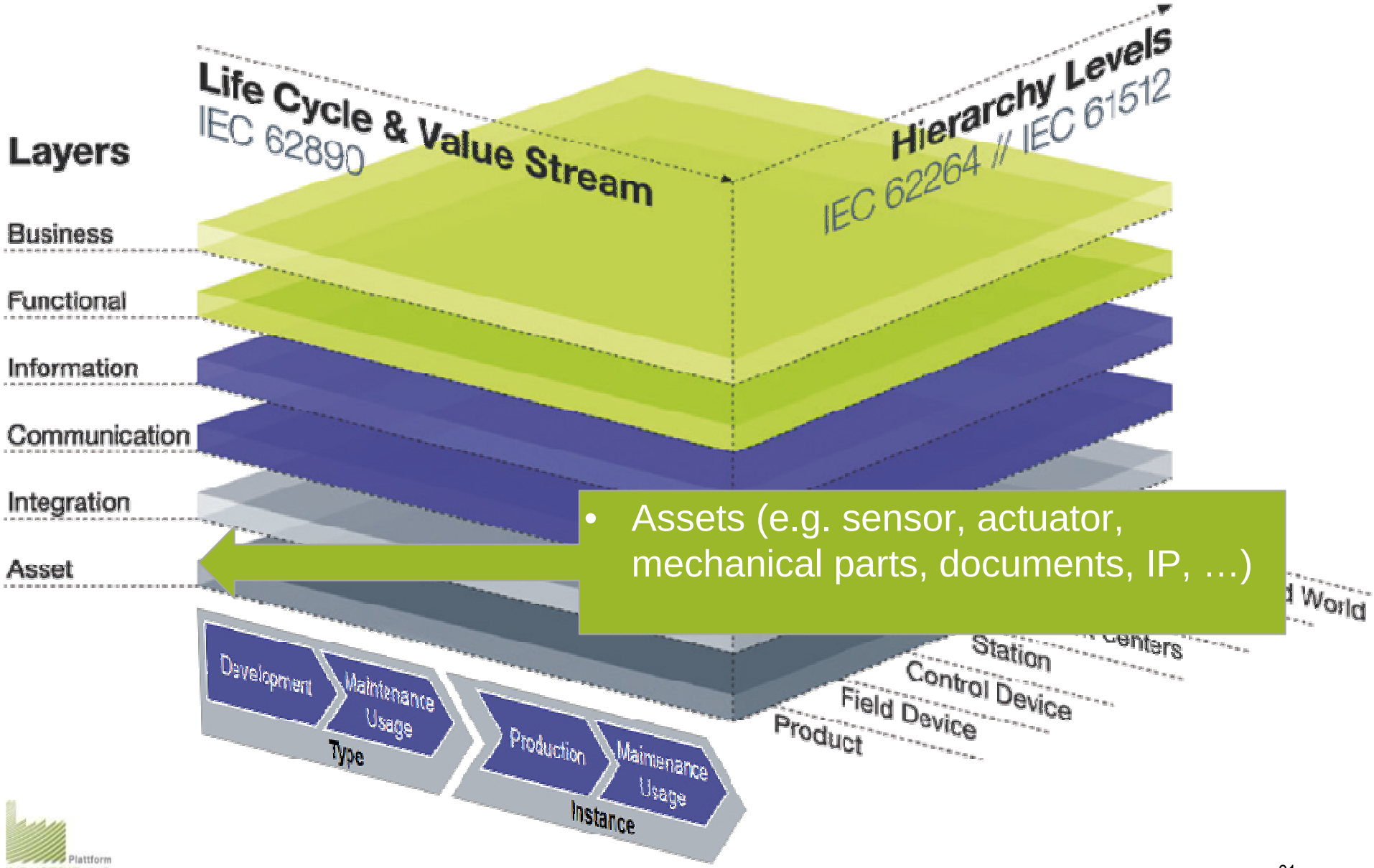
# View: IT Layer




- Assets (e.g. sensor, actuator, mechanical parts, documents, IP, …)

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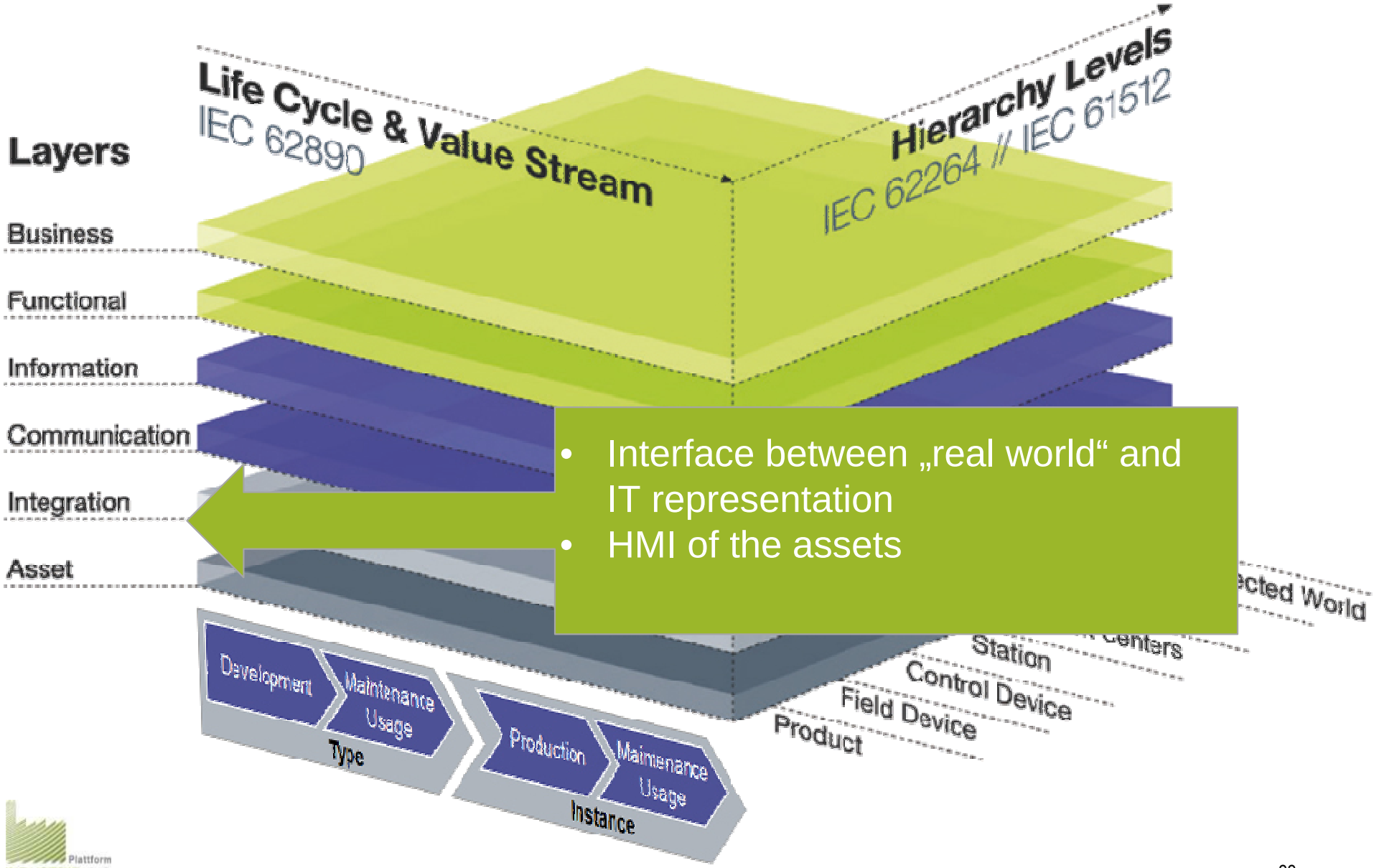
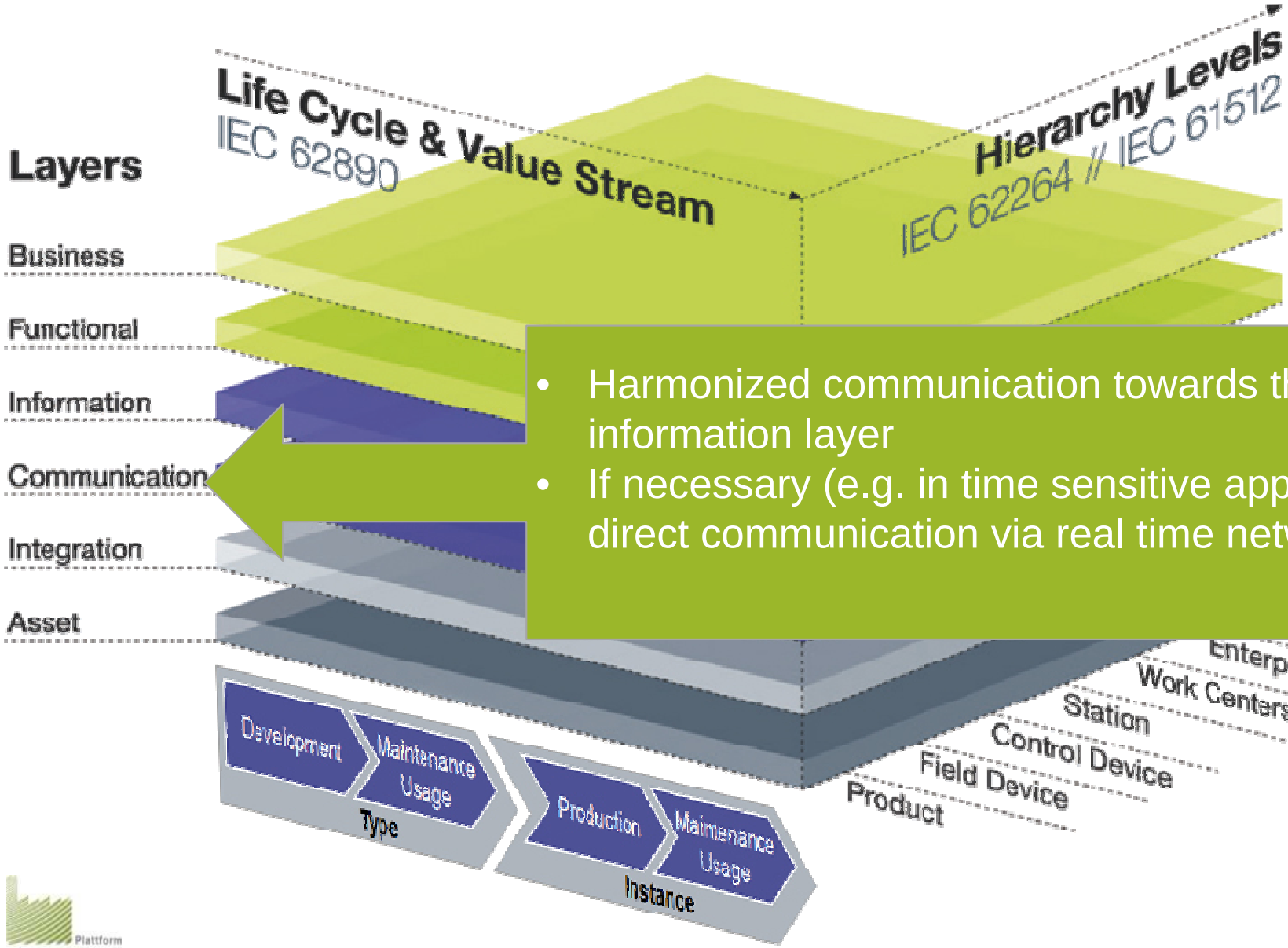
# View: IT Layer



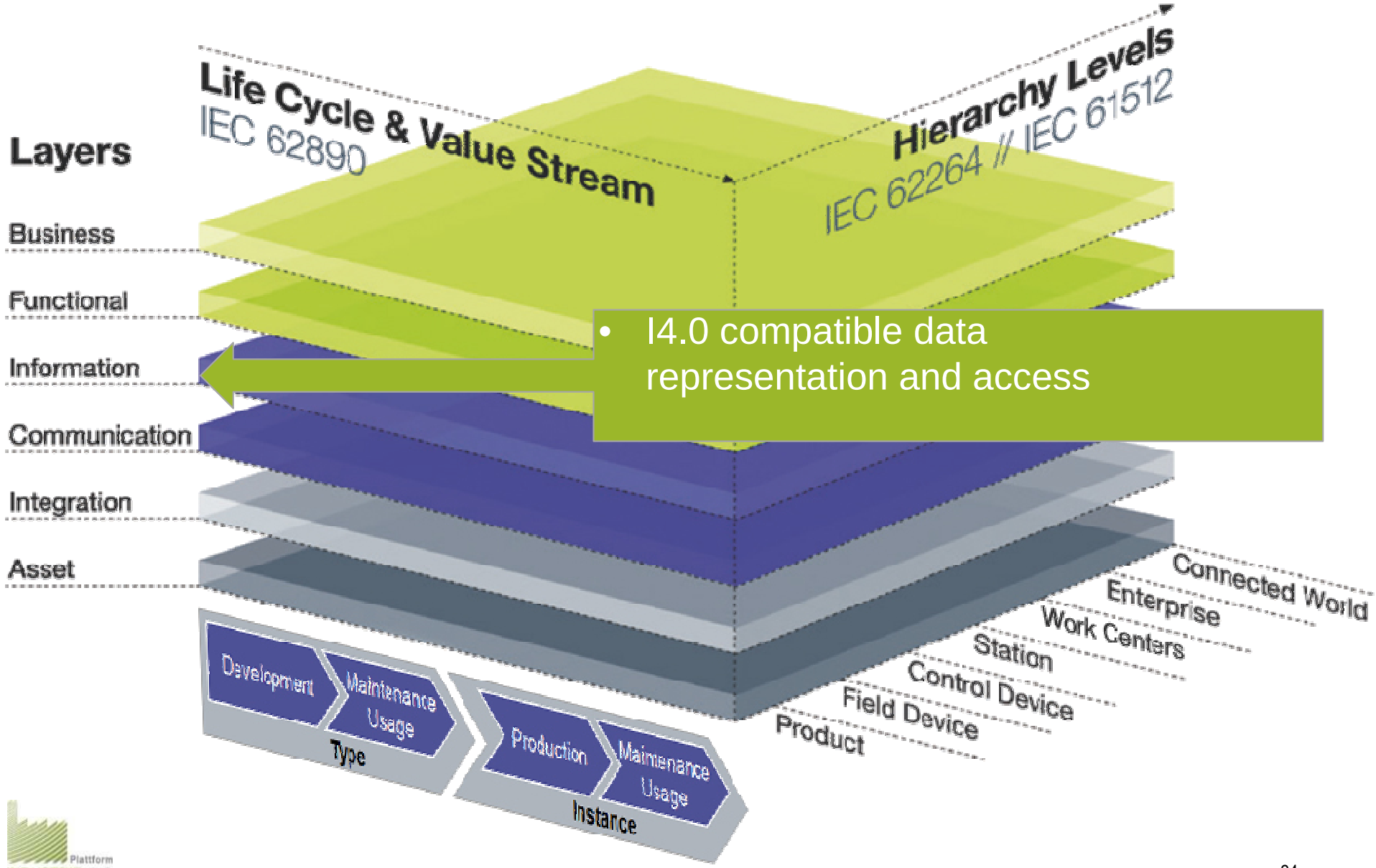

- Interface between „real world“ and IT representation
- HMI of the assets

# View: IT Layer

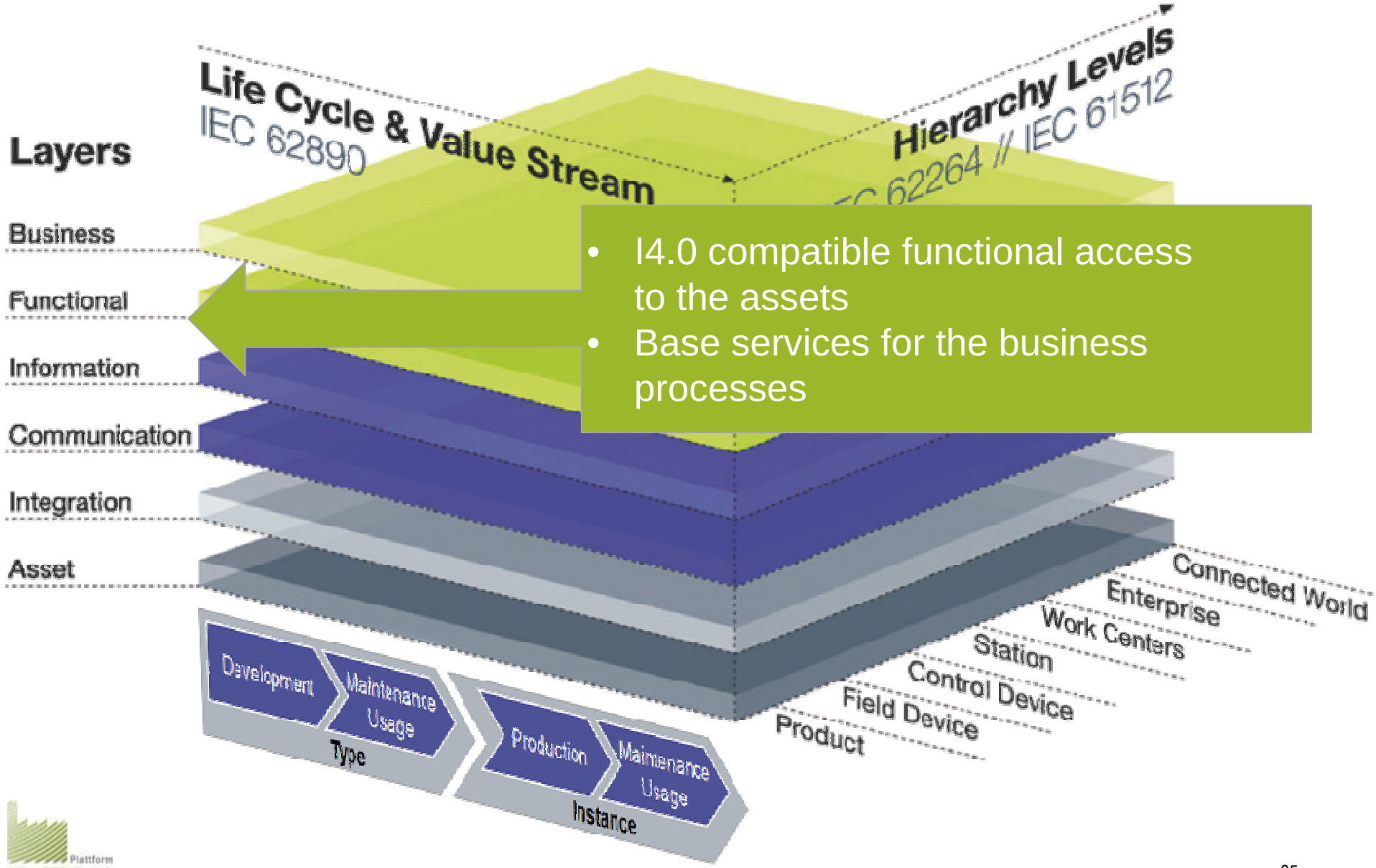



- Harmonized communication towards the information layer
- If necessary (e.g. in time sensitive applications) direct communication via real time network

# View: IT Layer

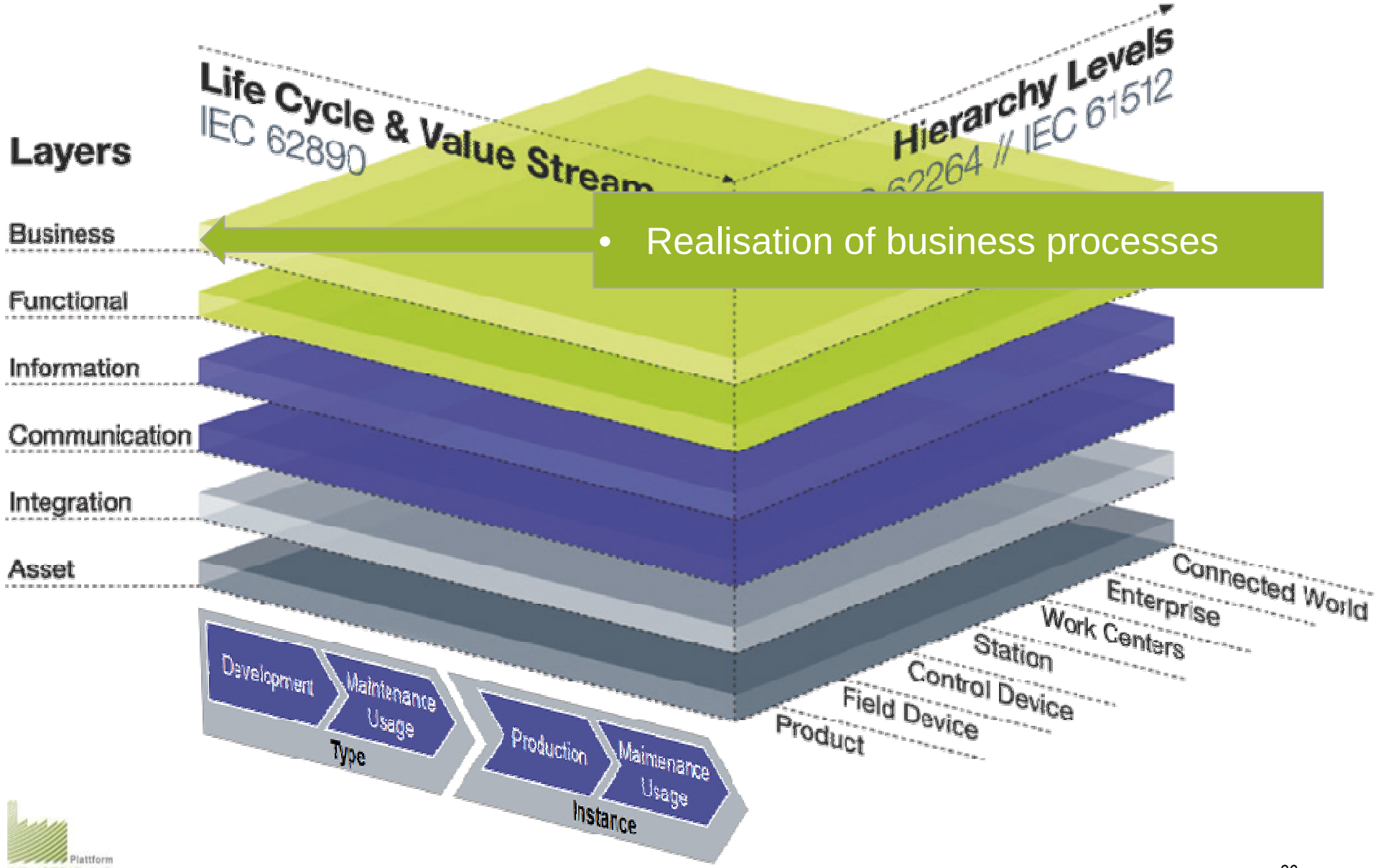


# View: IT Layer




- I4.0 compatible functional access to the assets
- Base services for the business processes

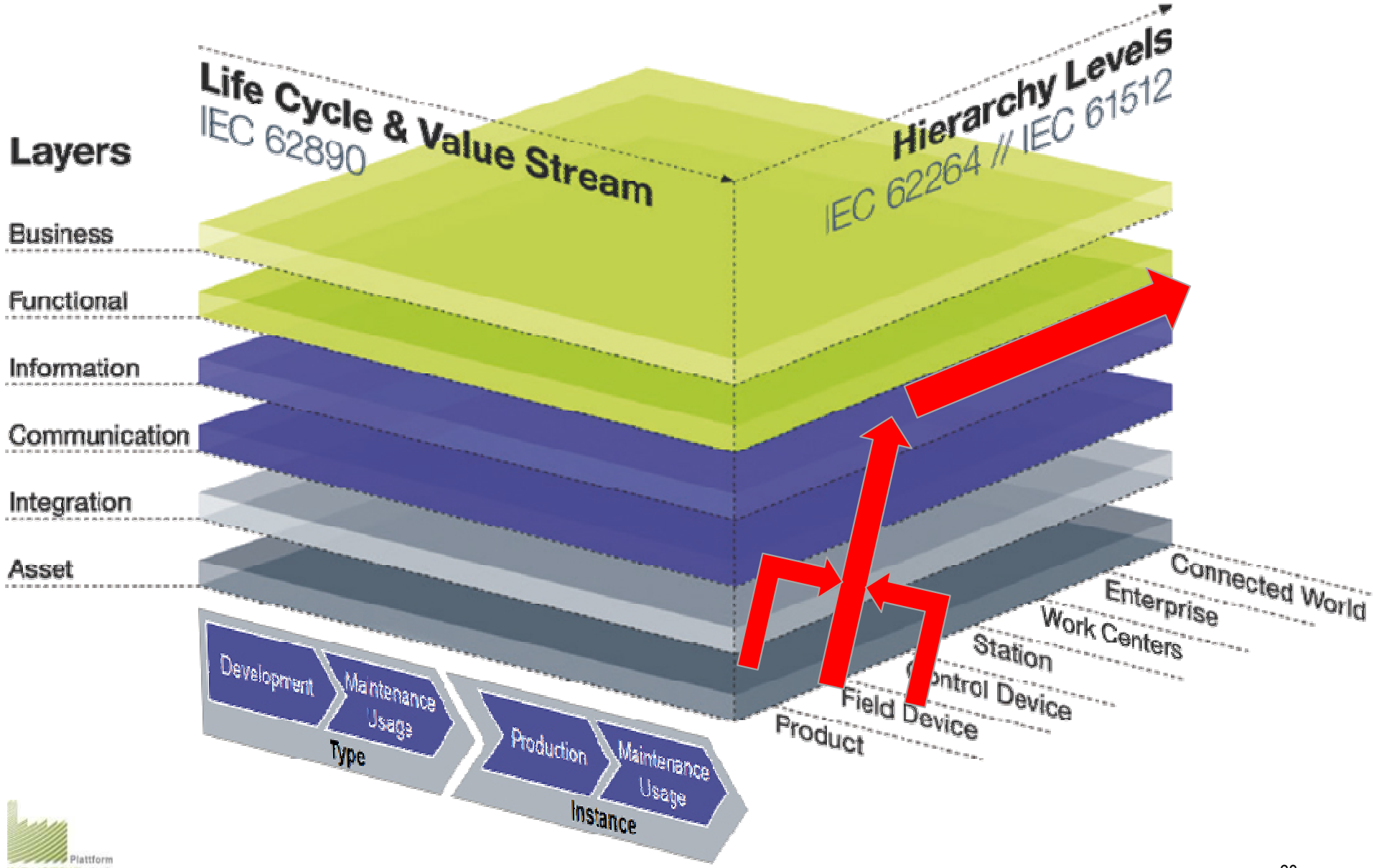
# View: IT Layer



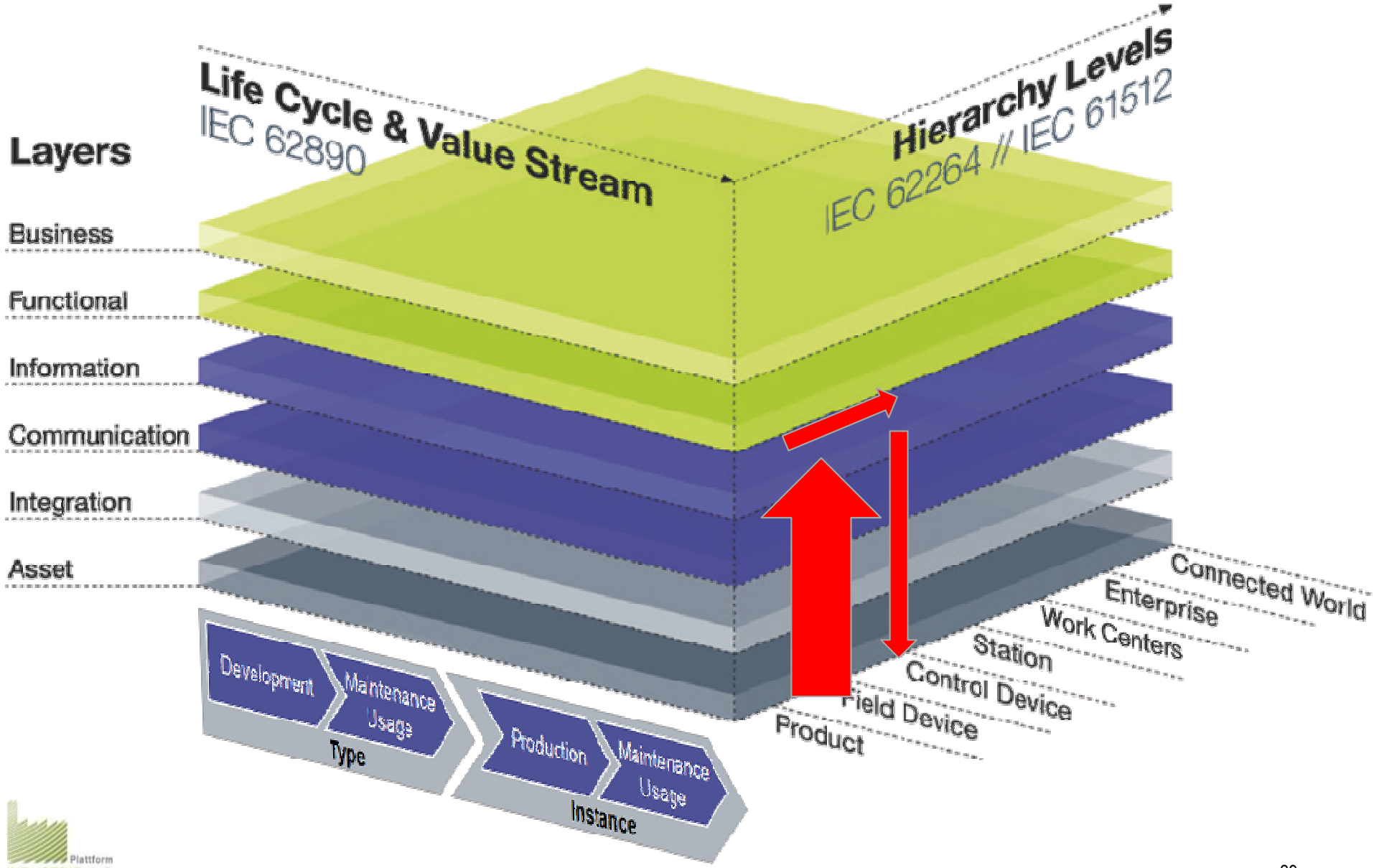
# What is the practical relevance?

# … shown on the example sensors

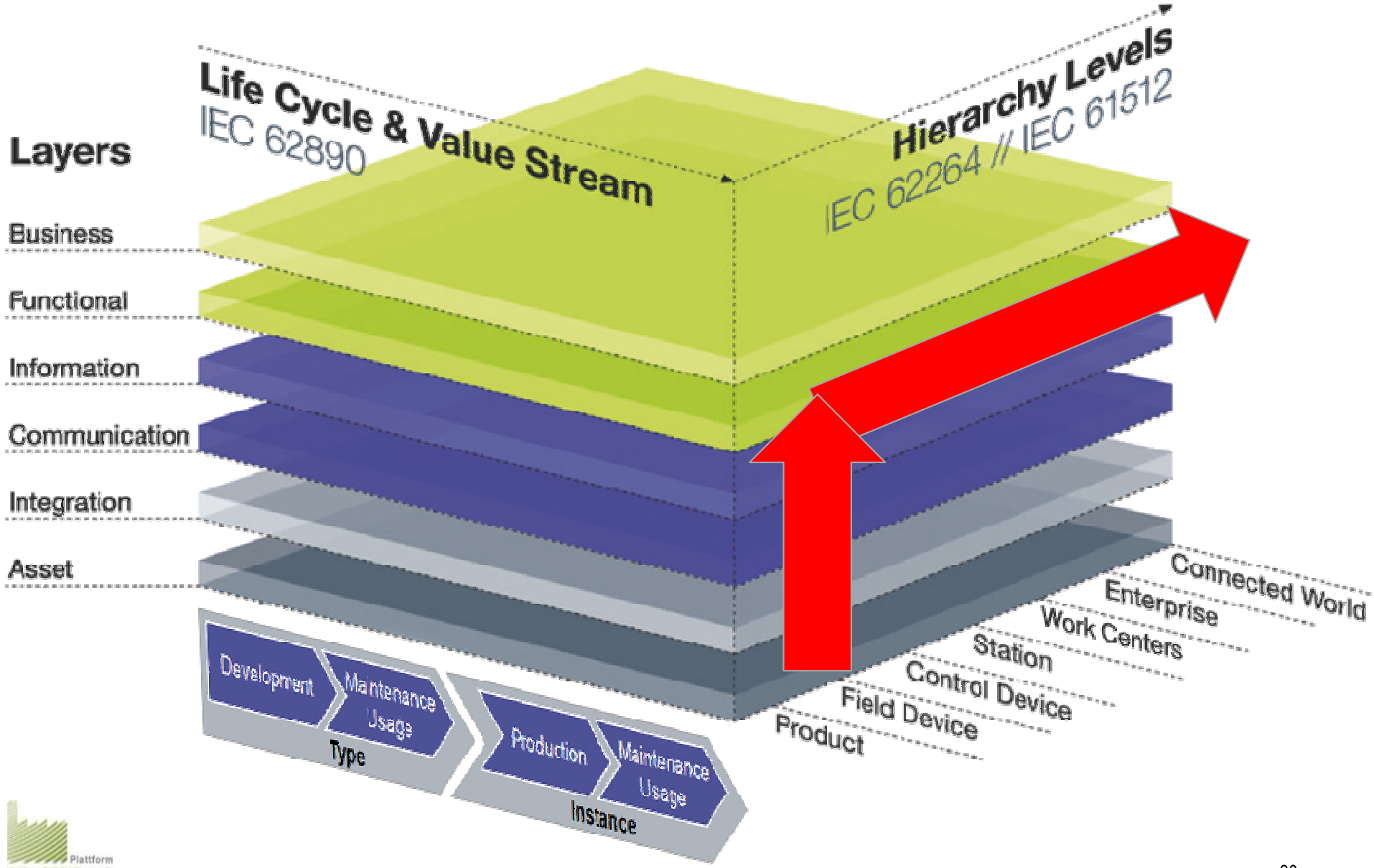
# Example: Sensor-Data-Fusion



# Example: Sensor-Data-Preprocessing



# Example: Big-Data-Transfer from sensor



# Thank you for your attention!