

Reference Architectural Model Industrie 4.0 (RAMI 4.0)

An Introduction

Brave New World



What is Industrie 4.0

- I4.0 connects / merges production with information and communications technology
- I4.0 merges customer data with machine data
- Machines communicate with machines
- Components and machines autonomously manage production in a flexible, efficient, and resource-saving manner



The Potential of Industrie 4.0

**EUR 78 Billion
by 2025!**



The Benefits of Industrie 4.0

- Higher quality
- More flexibility
- Higher productivity
- Standardization in development
- Products can be launched earlier
- Continuous benchmarking and improvement
- Global competition among strong businesses
- New labor market opportunities
- Creation of appealing jobs at the intersection of mechanical engineering, automation, and IT
- New services and business models

Security as a Precondition and Enabler

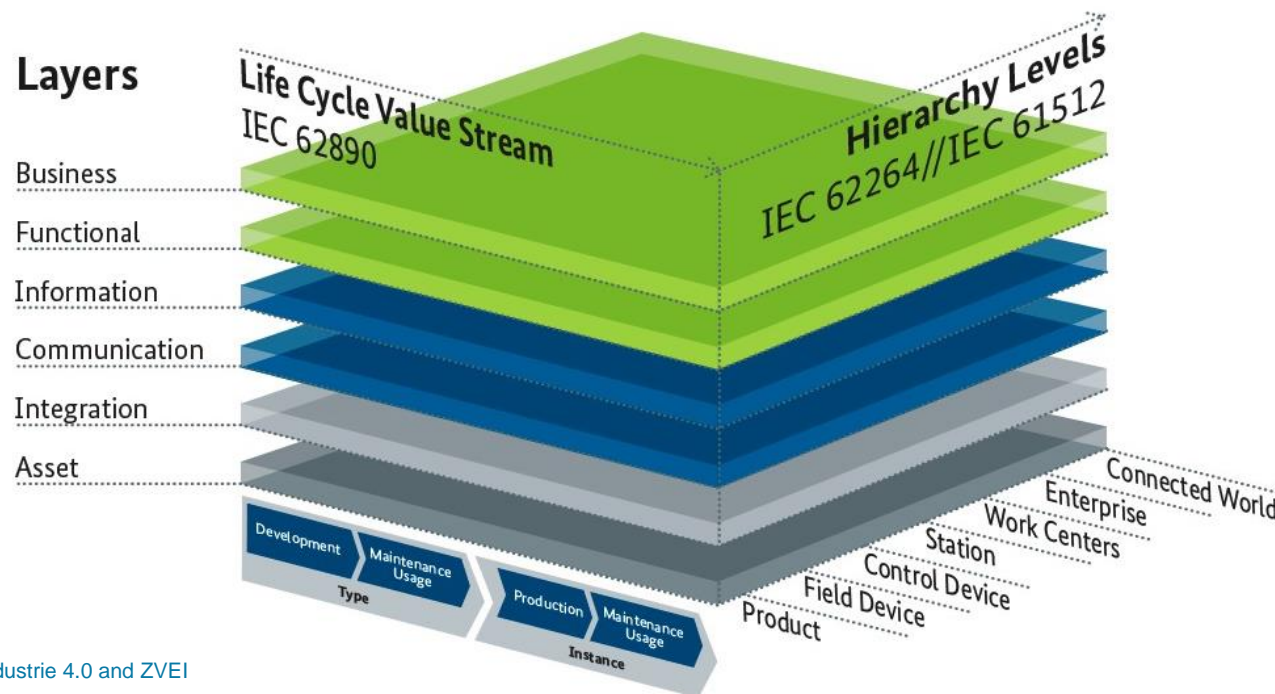
- Security by design
- The basis of all Industrie 4.0 applications



The Solution: RAMI 4.0 – The Reference Architectural Model for Industrie 4.0

RAMI 4.0 is a three-dimensional map showing how to approach the issue of Industrie 4.0 in a structured manner.

RAMI 4.0 ensures that all participants involved in Industrie 4.0 discussions understand each other.

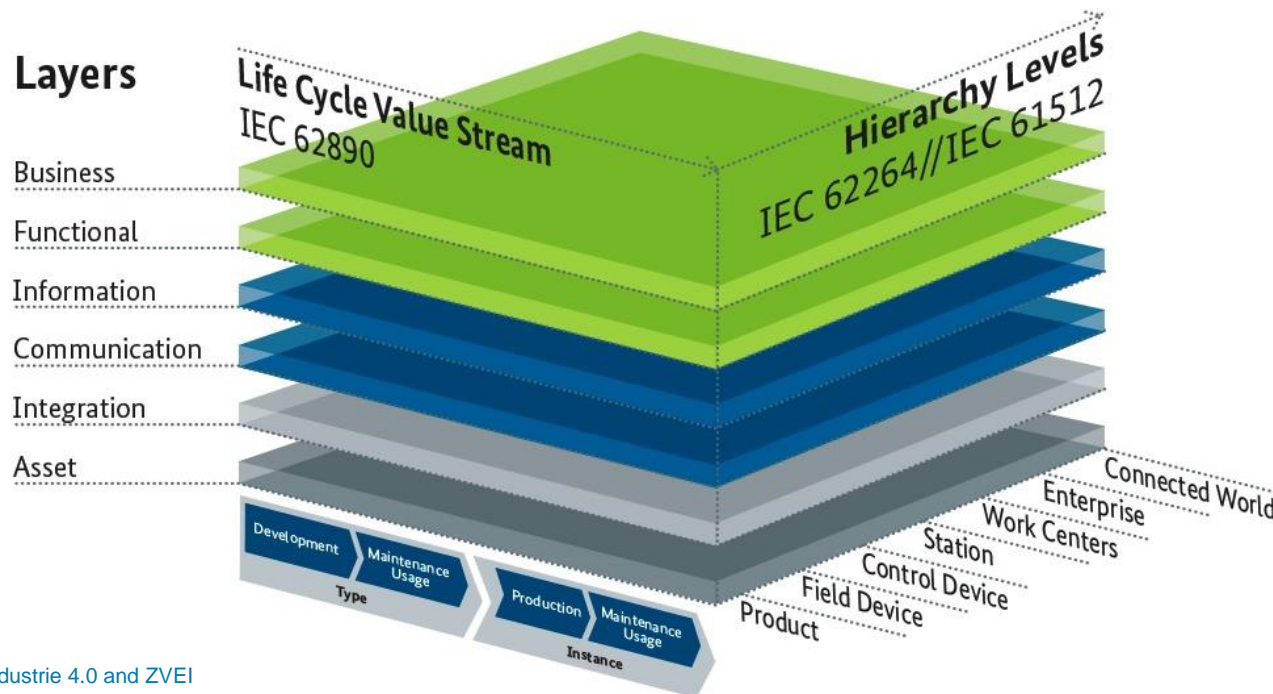


RAMI 4.0 - Benefits

RAMI 4.0 is a **SERVICE-ORIENTED ARCHITECTURE**.

RAMI 4.0 combines all elements and IT components in a layer and life cycle model.

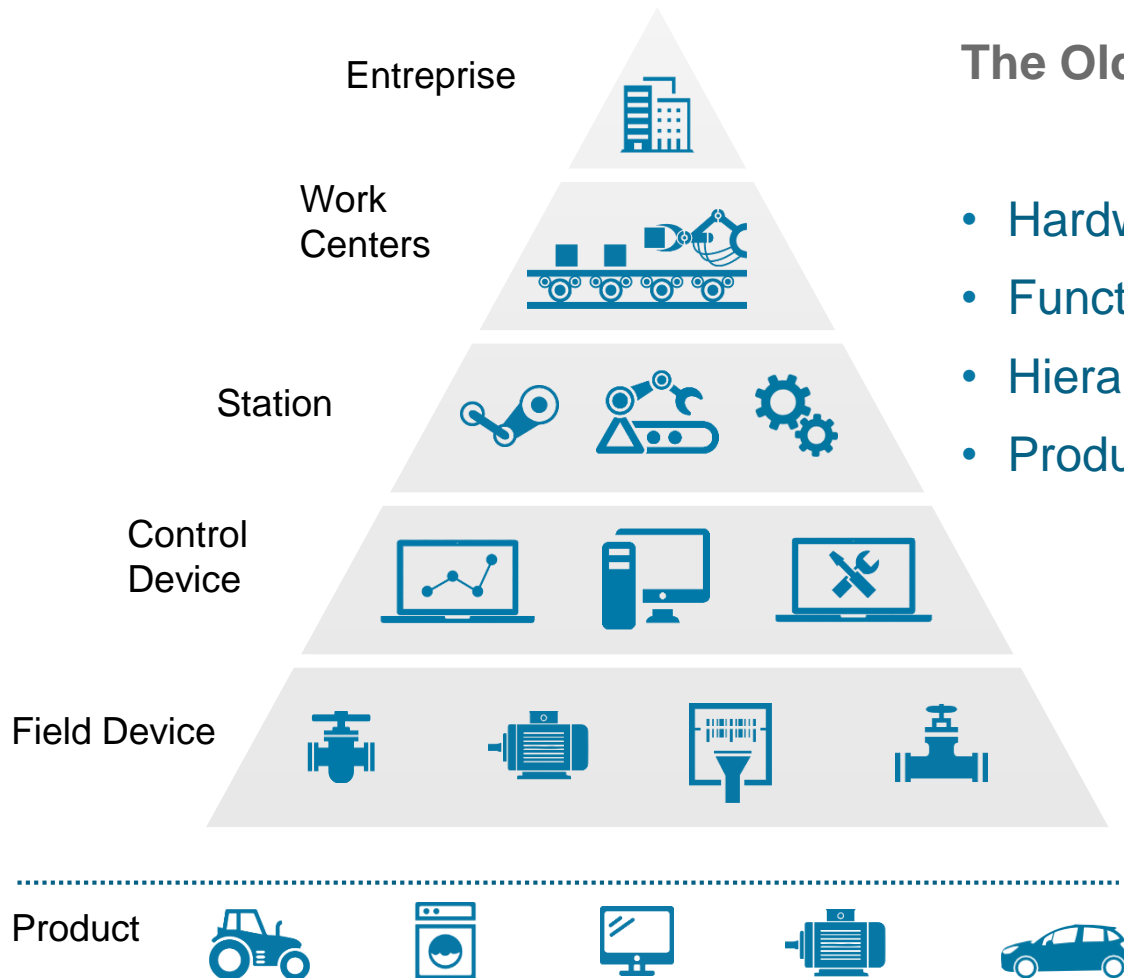
RAMI 4.0 breaks down complex processes into easy-to-grasp packages, including data privacy and IT security.



Axis 1 – Hierarchy: The Factory

The Old World: Industrie 3.0

- Hardware-based structure
- Functions are bound to hardware
- Hierarchy-based communication
- Product is isolated



Axis 1 – Hierarchy: The Factory

The New World: Industrie 4.0

- Flexible systems and machines
- Functions are distributed throughout the network
- Participants interact across hierarchy levels
- Communication among all participants
- Product is part of the network

Connected
World

Smart
Factory

Smart
Products

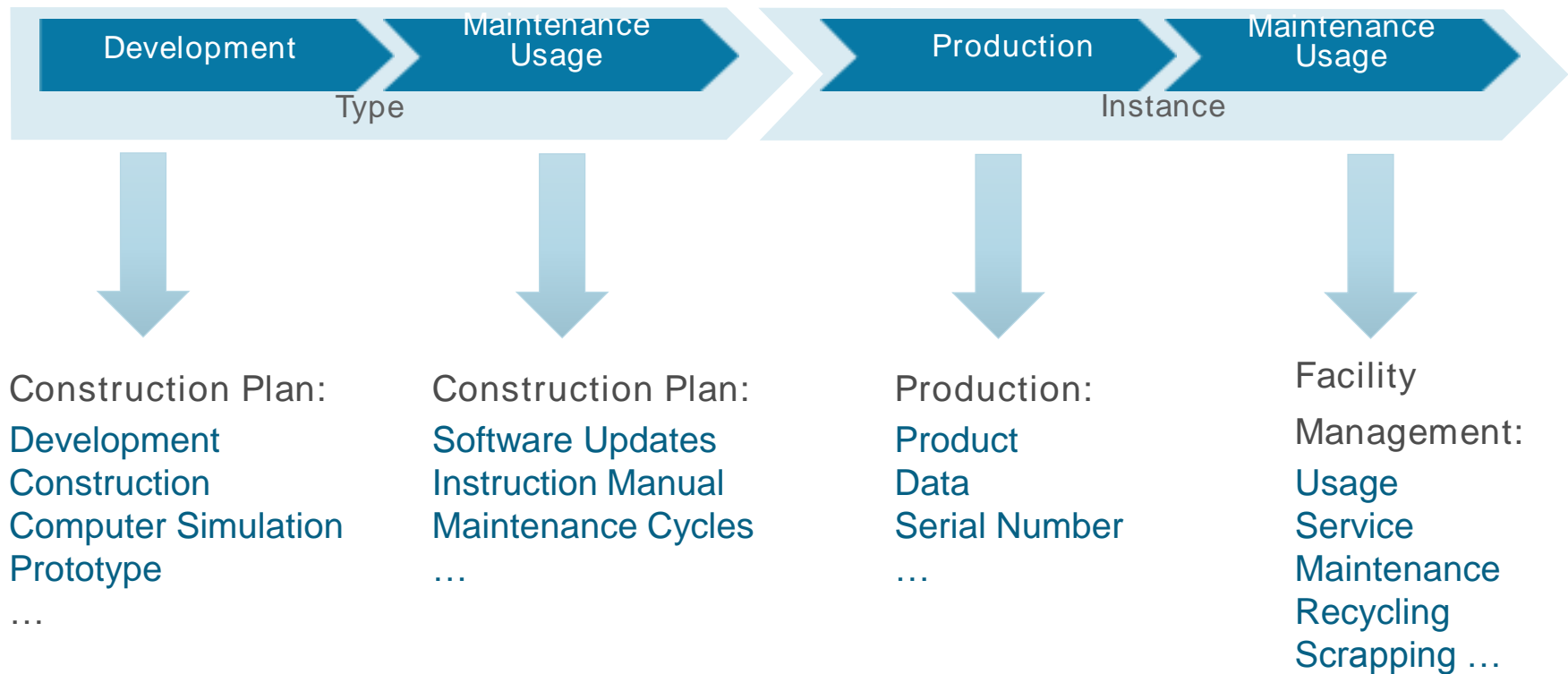


Axis 2 – Architecture

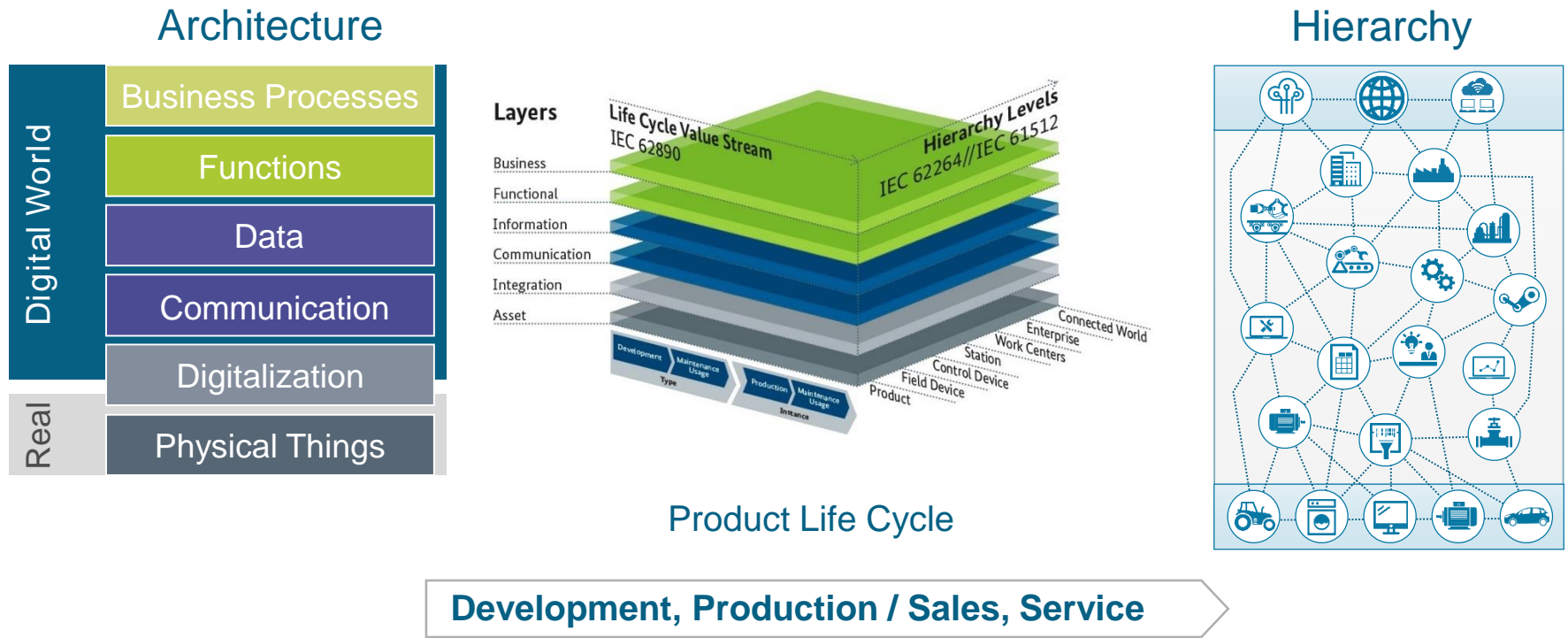


Axis 3 – Product Life Cycle

The Product: From the First Idea to the Scrapyard

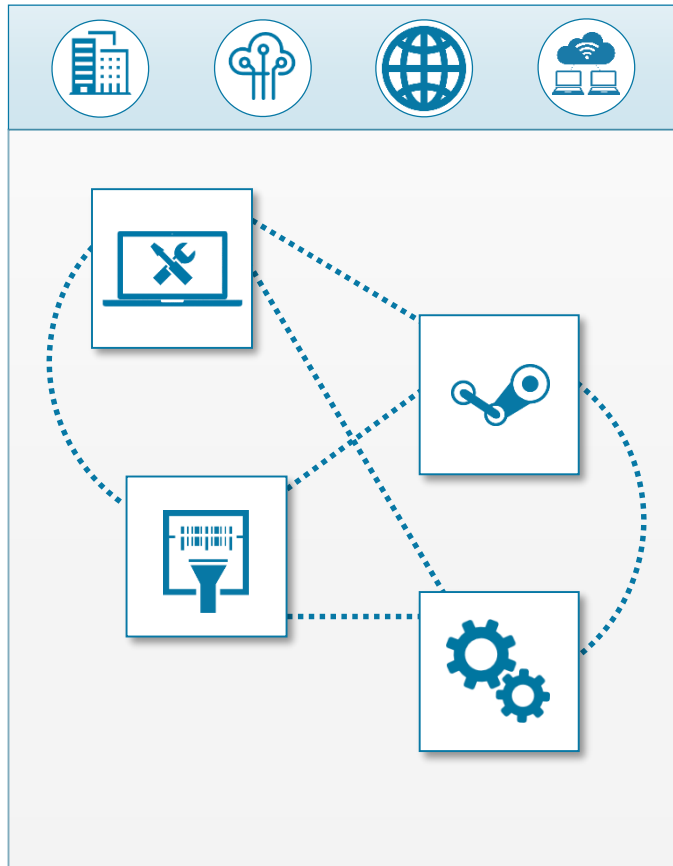


Reference Architectural Model Industrie 4.0 (RAMI 4.0)



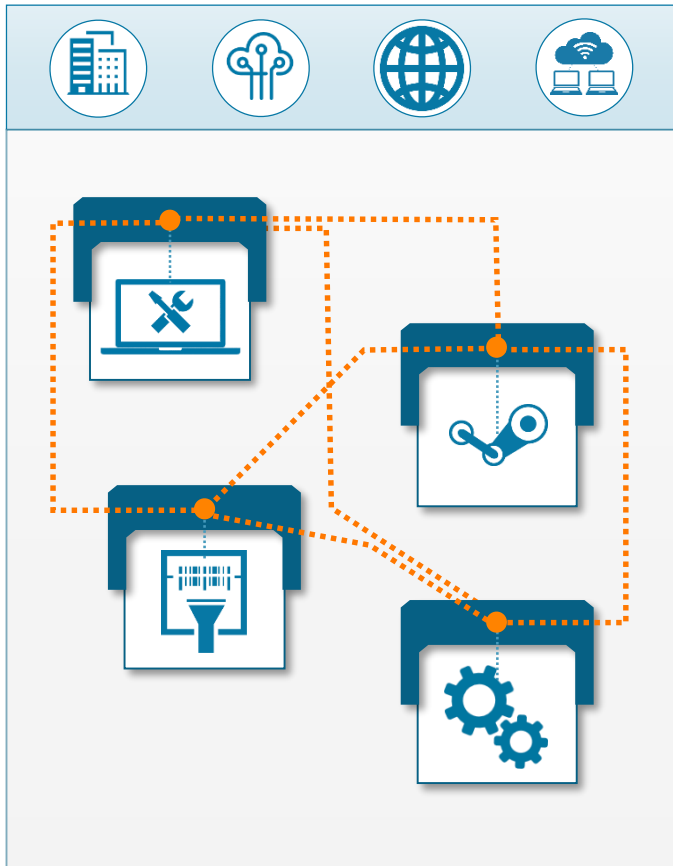
A Solution Space with a Coordinate System for Industrie 4.0

What Do Communication Participants Need?



- Globally standardized communication
- Easy installation and operation (“plug and play”)
- Standardized language for the exchange of information

Who provides interpretation? The Administration Shell...



... is the interface connecting I4.0 to the physical Thing

... stores all data and information about the asset

... serves as the network's standardized communication interface

... is also able to integrate passive assets

The Roles and Responsibilities of the Administration Shell

- Each physical thing has its own administration shell.
- Several assets can form a thematic unit with a common administration shell, several thematic units ...

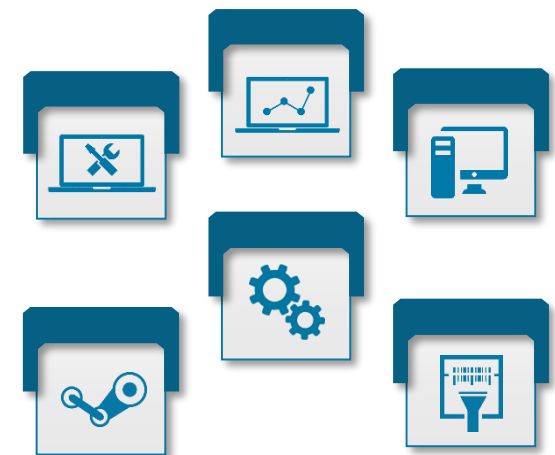
Station



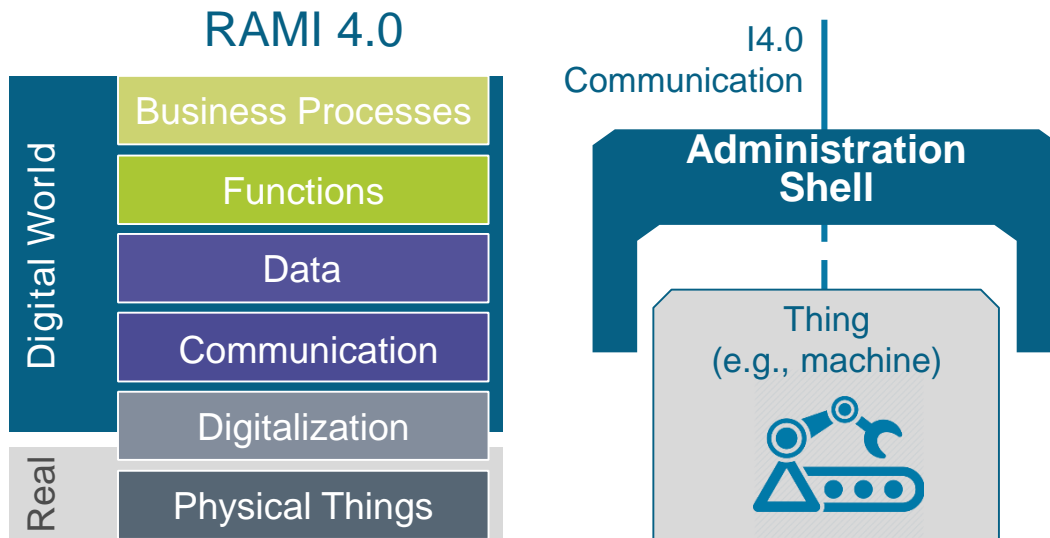
Control Device



Field Device



The Industrie 4.0 Component



- The connection takes place over the I4.0 communication
- The administration shell forms the digital part
- The Thing forms the real part

**Each object needs its own administration shell
that allows its integration into Industrie 4.0**

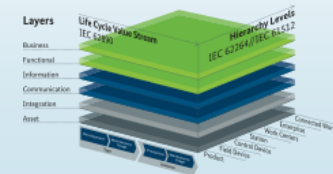
Where do we need to go from here?

Next Steps

Architecture of Industrie 4.0

Semantics – Identification – Functions – Communication

Standards – Internationalization and Partnering



Concepts for the 14.0 Component



Submodels for Individual Aspects and Processes

Verwaltungsschale	
Identifikation	Schren
Communication	Fräsen
Engineering	Tiefziehen
Konfiguration	Klemmen
Safety (SIL)	Schweißen
Security (SL)	Lackieren
Lifecycle Status	Montieren
Energie-Effizienz	Inspizieren
Condition Monitoring	Validieren
Weitere ...	Weitere ...

Language of Industrie 4.0



Recommendations for Implementation



National and international standardization (DIN SPEC 91345)

Publications of Plattform Industrie 4.0

More information:

<http://www.plattform-i40.de/I40/Navigation/EN/InPractice/Online-Library/online-library.html>