

Siemens Industry Analyst Briefing Call

Siemens Digitalization Strategy & Sinalytics Platform

Dr. Horst J. Kayser, Chief Strategy Officer Siemens AG

Dr. Norbert Gaus, Head of Siemens Research and Technology Center | Munich, January 20, 2016

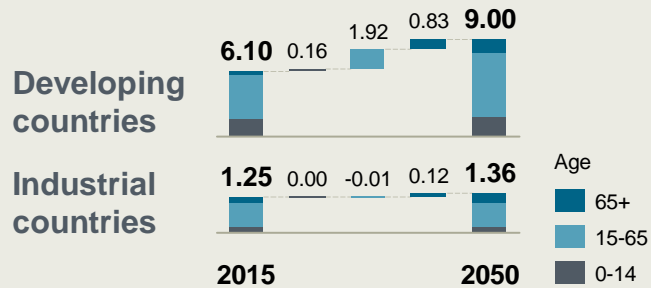


- 26 high-speed trains at Renfe Spanish Rail Company (Madrid-Barcelona-Malaga)
- Performance contract with availability guarantee
- Passengers are reimbursed for delays >15 mins
- On-time rate of 99.9%
- 60% passengers switched from aircraft to train

Five Megatrends shaping our world of tomorrow – changes in the markets are accelerating

Demographic change

World population¹, in bn

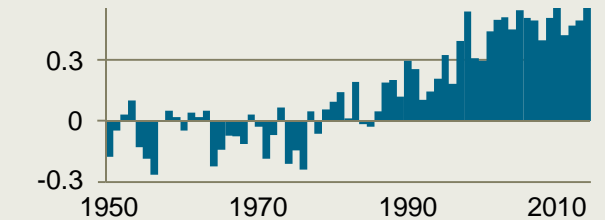


Growing and ageing population

Global warming and weather extremes

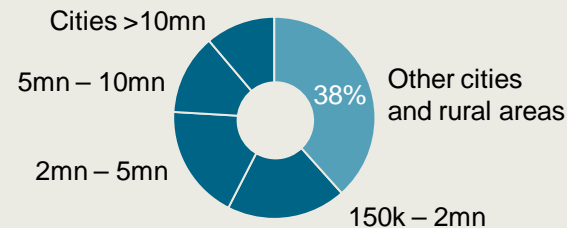
Climate change

Annual mean temperature variations 1950-2014² (in °C)



Urbanization

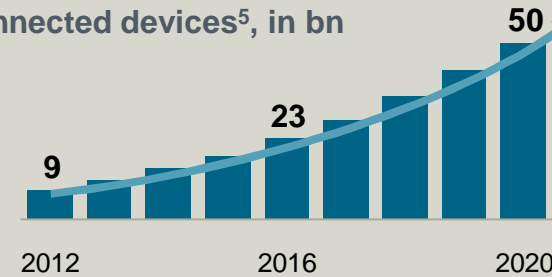
Contribution to global GDP growth, 2007-2025³, in %



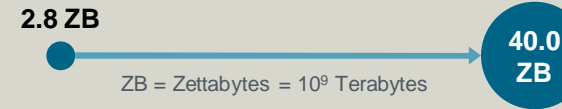
Digital transformation

Connected devices⁵, in bn

Exponential growth of connected devices ...



... and digital data⁶

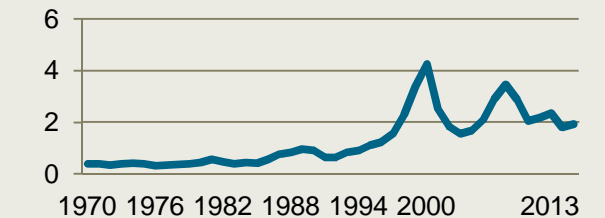


Cities as main driver of GDP growth

Trend to increase investment abroad

Globalization

Foreign direct investment vs. global GDP, in %⁴



1 UN World Population Prospects (2015)
2 Met Office Hadley Centre observations (2014)

3 McKinsey Global Institute Cityscope (2011)
4 UNCTAD (2013)

5 Cisco: The Internet of Everything (2013)
6 IDC: The Digital Universe (2012)

Siemens strategy – ‘Ingenuity for Life’

Global trends

Digital transformation

Networked world of complex and heterogeneous systems

Globalization

Global competition driving productivity and localization

Urbanization

Infrastructure investment needs of urban agglomerations

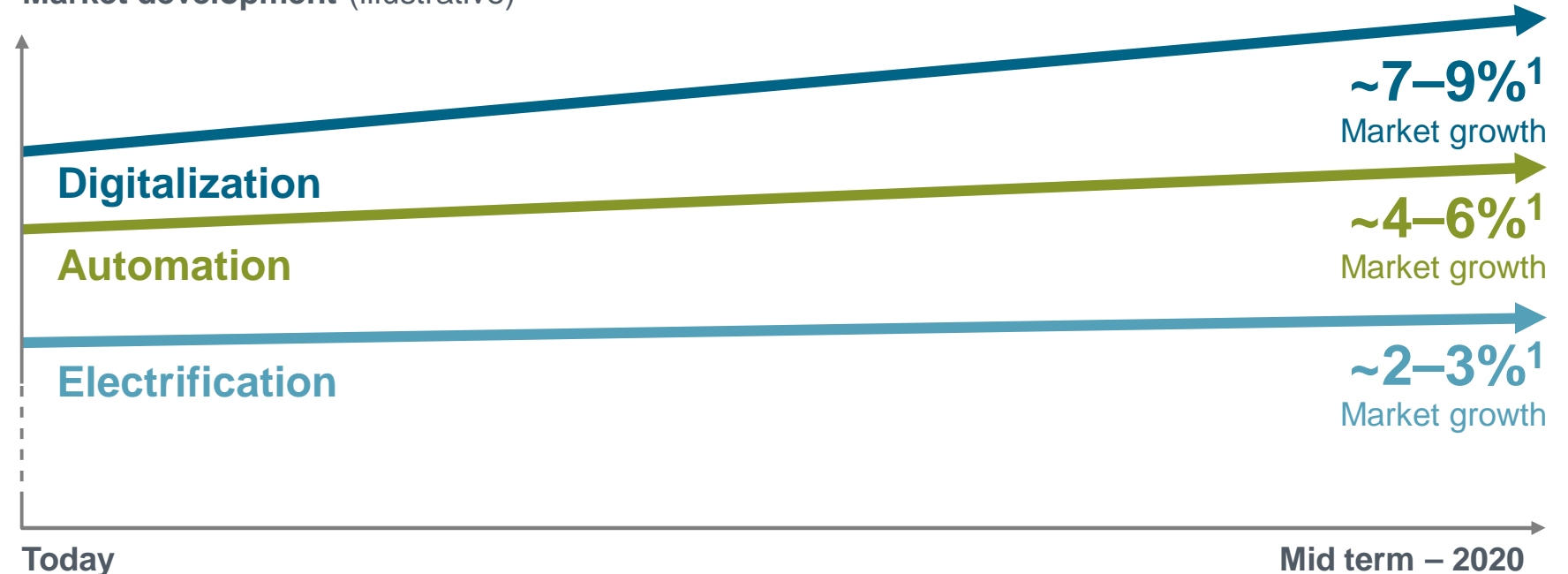
Demographic change

Decentralized demand of a growing and aging population

Climate change

Higher resource efficiency in an all-electric world

Market development (illustrative)








Innovating along the electrical value chain



¹ Est. market growth (CAGR) over cycle

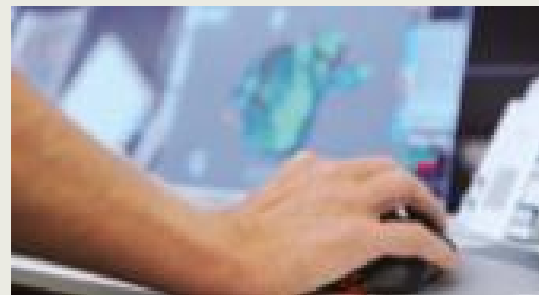
Siemens Digitalization – Leveraging digital technology trends for concrete customer benefits

Siemens Digitalization

-  Collaboration and mobile
-  Smart data and analytics
-  Cloud technologies
-  Connectivity and Web-of-systems
-  Cyber-Security

Improved productivity & time-to-market

Design & engineering



Higher flexibility & resilience

Automation & operation



Increased availability & efficiency

Maintenance & services



**Combining the virtual & physical world ...
... across entire customer value chains**

Customer benefit translates to substantial revenue growth for Siemens – Siemens Digitalization

Digital services



€0.6 billion revenue in FY15

+15% yoy growth FY15

>300k devices

- Remotely monitored and administered
- Data driven
- Analytics enabled

Vertical software



€3.1 billion revenue in FY15

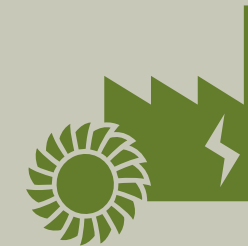
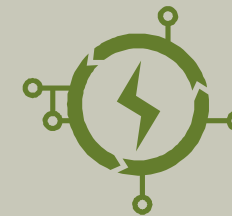
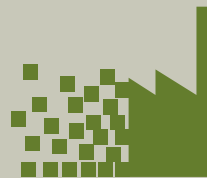
+16% yoy growth FY15

Leading provider across verticals



Digitally enhanced electrification and automation

#1 automation player in industry, buildings, grids, power plants, and rail



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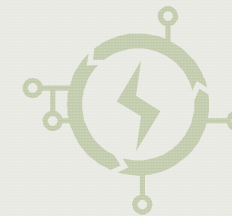
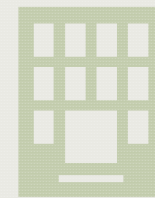
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Leading provider across verticals

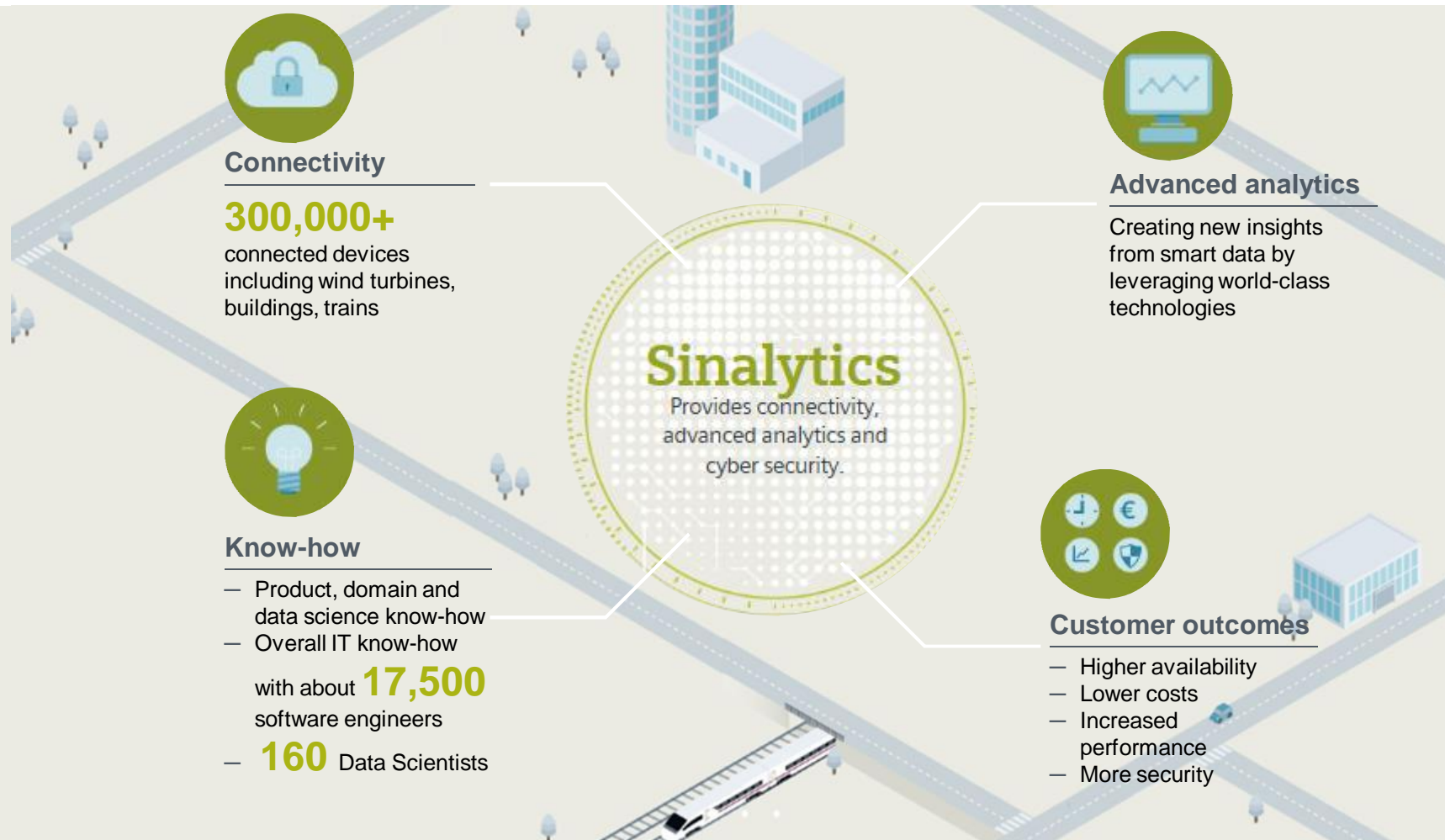


Digitally enhanced electrification and automation

#1 automation player in industry, buildings, grids, power plants, and rail



Sinalytics Platform powers Siemens Digital Services



The Digital Transformation of Services

Classical Time &
Material Maintenance

Performance & Outcome
based Contracting

Network
Platforms

Improving efficiency of classical services



E.g. Digital
diagnostics



E.g. digitally
optimised work
scheduling



E.g. Augmented
Reality for training
and Maintenance
Repair and
Overhaul

The Digital Transformation of Services

Classical Time & Material Maintenance

Performance & Outcome based Contracting

Network Platforms

1. Predictive Maintenance



E.g. Healthcare

Objectives

Prevent unplanned downtime of CT scanners caused by tube failures

2. Performance-based contracts



E.g. Mobility

Objectives

Increase availability and reliability of trains

3. Outcome-oriented contracts



E.g. Power Services

Objectives

Improve customer ROI through flexible service in any market condition

Reactive Maintenance

Preventive Maintenance

Condition-based Maintenance

Predictive Maintenance

Prescriptive Maintenance

Siemens Digital Services Portfolio – Overview

Digital Service

Remote services based on device connectivity

- Data generated by connected devices and transferred for evaluation

Data analytics-enabled services

- Value added by additional insights generated from available data

Network Platforms

- Generation of additional value by bringing together relevant experts and data

Division view (examples)

Power generation, transmission & distribution



- Power Plant optimization, remote support/-operation
- Flex LTP, data-driven upgrades of turbines
- Fleet statistics of power plants and wind farms
- Wind farm optimisation
- Performance contracts / consulting
- SCADA, WTC3 and vibration diagnostics
- Remote Monitoring (Switchgear and Transformers)
- Smart Grid Asset performance management / security services
- Smart Grid Asset operation services

Building Technologies



- System performance services
- Building performance / energy optimisation services

Mobility



- Smart Guidance
- Smart Monitoring
- Smart Data Analysts
- 3D printing for optimised parts logistics

Digital Factory & Process and Drives



- Master Asset Uptime
- Optimise energy performance
- Maximise process efficiency
- Enhance Industrial Cyber security

Healthcare



- Predictive maintenance
- Network platform for diagnostic exchange

Digital Services Example – Digital Factory



Master asset uptime



Machine tool analytics



Drive train analytics



Industrial Network Analytics

Optimize Energy Performance



Energy analytics

Maximize process efficiency



Control performance analytics



Process event analytics



Dynamic process optimization

Enhance Industrial Cyber-Security

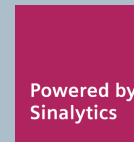


Security Assessments and Implementation



Security Managed Services

Siemens Digital Services demonstrate proven success in diverse industries



Cement

Antea Cement (ALB)
Asset Analytics

! **No unplanned system downtimes**

Minerals

EU Manufacturer of asphalt
Energy Analytics

! **147% RoI**

Glass

Pilkington (UK)
Energy Analytics

! **Over £1 million energy cost savings**

Chemical

Int. Oil & Gas company
Security Services

! **0% incidents within 18 months**

Automotive

EU car manufacturer
Asset Analytics

! **Higher plant availability**

US car manufacturer
Energy Analytics

! **Higher resource efficiency**

Pharma

Global pharma company
Energy Analytics

! **12% energy cost savings**

Food and Beverages

EU Coffee Producer
Energy Analytics

! **Target – 5% energy cost savings**

The Digital Transformation of Services

Classical Time & Material Maintenance

Performance & Outcome based Contracting

Network Platforms

Teamply – connect, compare, collaborate

Mindsphere – Cloud for Industry

Benefit

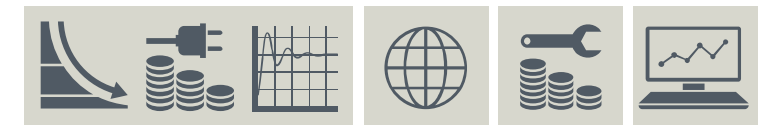
- Increased utilization
- Improved dose quality
- Enhanced fleet management & standardization
- Clinical collaboration

- Optimized energy performance
- Increased asset up-time
- Maximized process efficiency
- Enhanced cyber-security

Network Platform Focus



MindApps



Field level

Usage, dose, protocol, image data



Industrial equipment data





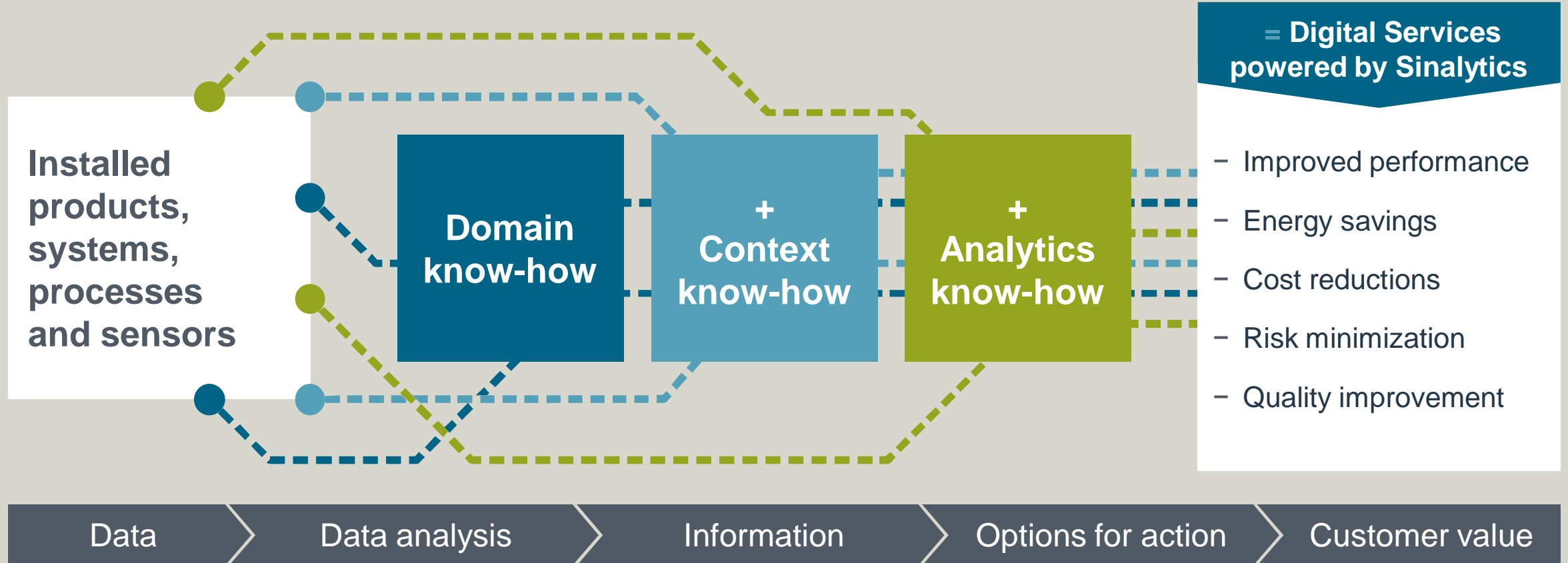
- Availability guarantee and shared risk is only possible with highly advanced analytics
- Trains are fitted with hundreds of sensors to monitor critical parameters
- Siemens Sinalytics provides the data basis to ensure very high availability and reliability



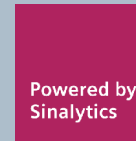
Siemens Digital Services powered by Sinalytics – Combining technology with domain and context know-how for customer value



Context of data from installed basis



Siemens Digital Services powered by Sinalytics – Example: Predictive maintenance of trains and locomotives



Rail Transport

- Market drivers
- Rail operator challenges
- Rail user demands



Trains/Locomotives

- Rail vehicle engineering
- Mechanical vibrations
- Sensor properties
- Maintenance operations



Data Science

- Pattern identification
- Machine learning
- Automated alert generation

Results

Improved asset availability

Avoidance of unnecessary maintenance

Reduction of maintenance costs

Domain know-how



Context know-how



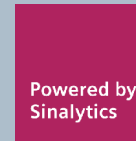
Analytics know-how



Customer value

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Siemens Digital Services powered by Sinalytics – Example: Optimization of gas turbine operations



Results

Reduced NOx Emissions

Extension of service intervals

Energy System

- Market drivers
- Customer needs
- Product cycles

Gas Turbines

- Mechanical Engineering
- Thermodynamics
- Combustion chemistry
- Sensor properties

Autonomous Learning

- Neural Networks
- Smart Data Architecture processes data from 5,000 sensors per second

Domain know-how



Context know-how



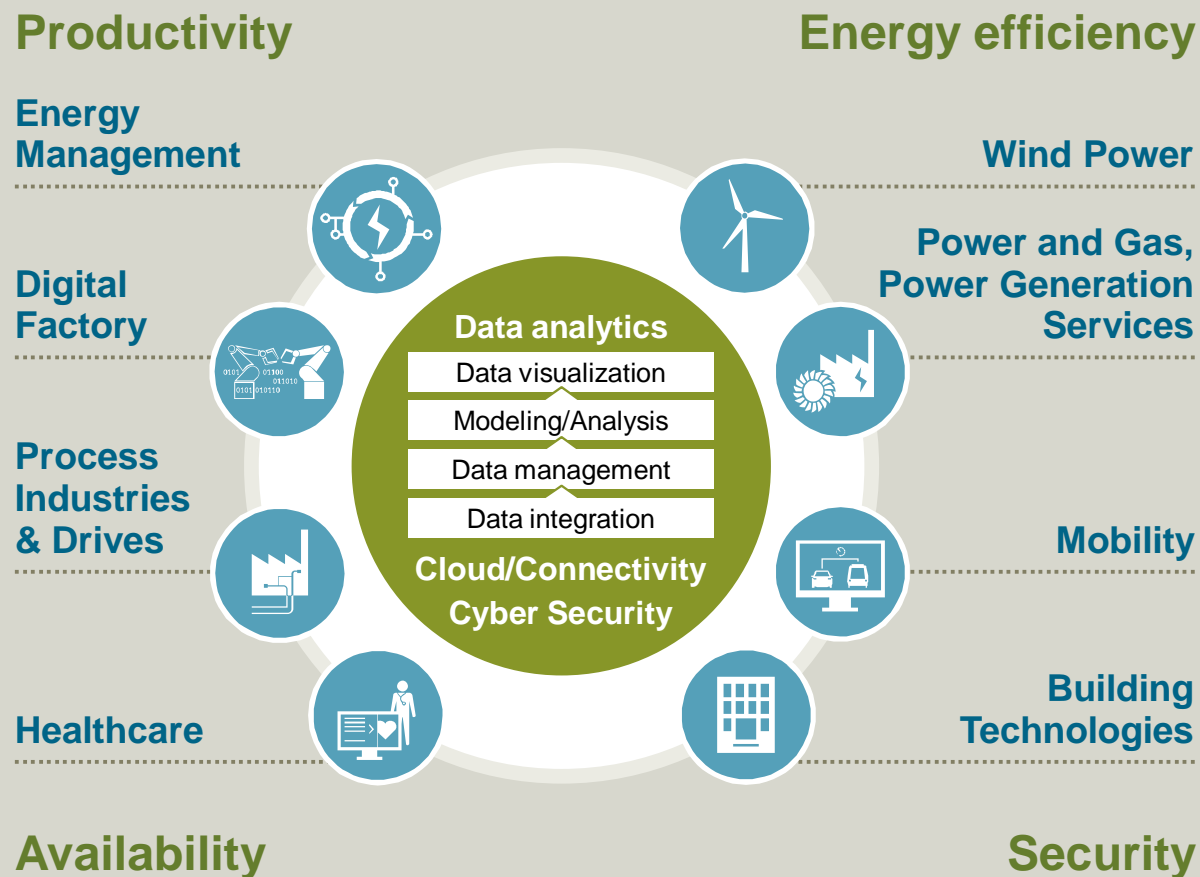
Analytics know-how



Customer value

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Sinalytics: Our new platform architecture for data-based services



We build on common technology platforms ...

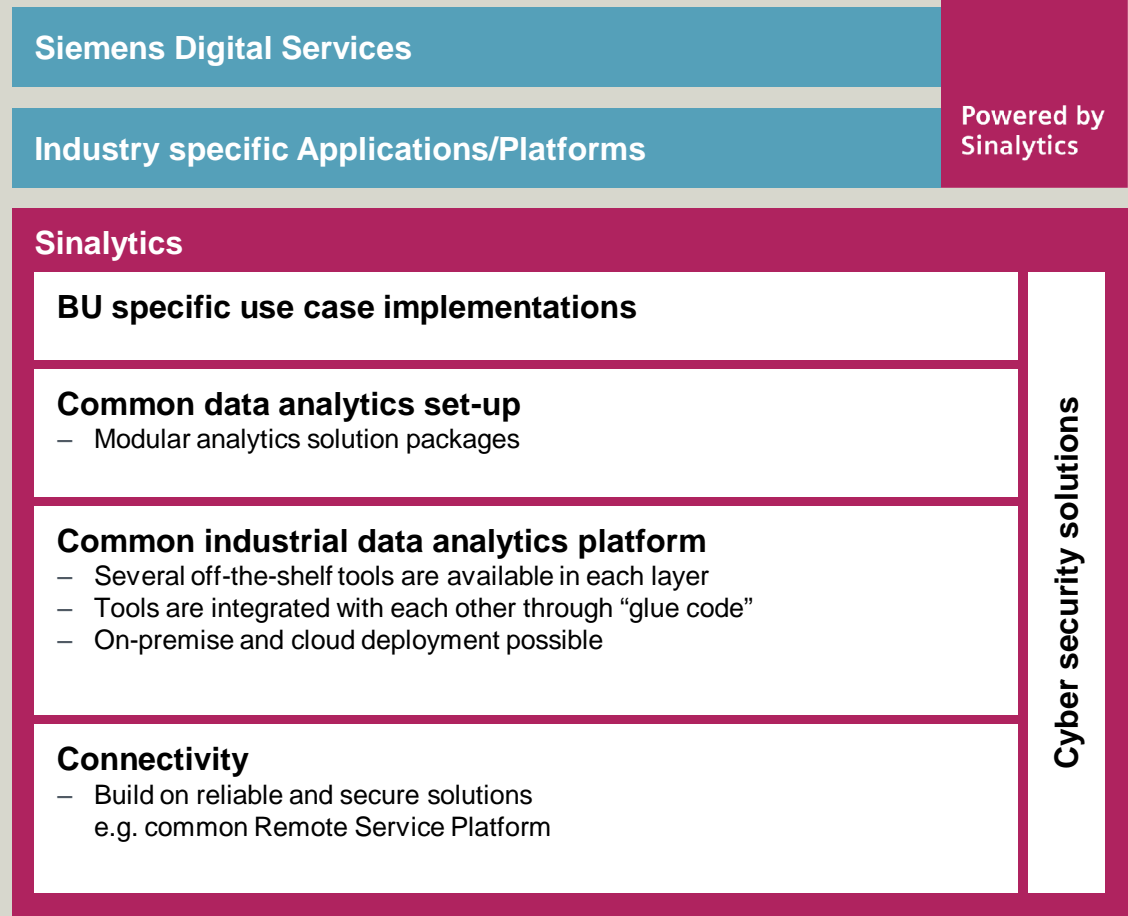
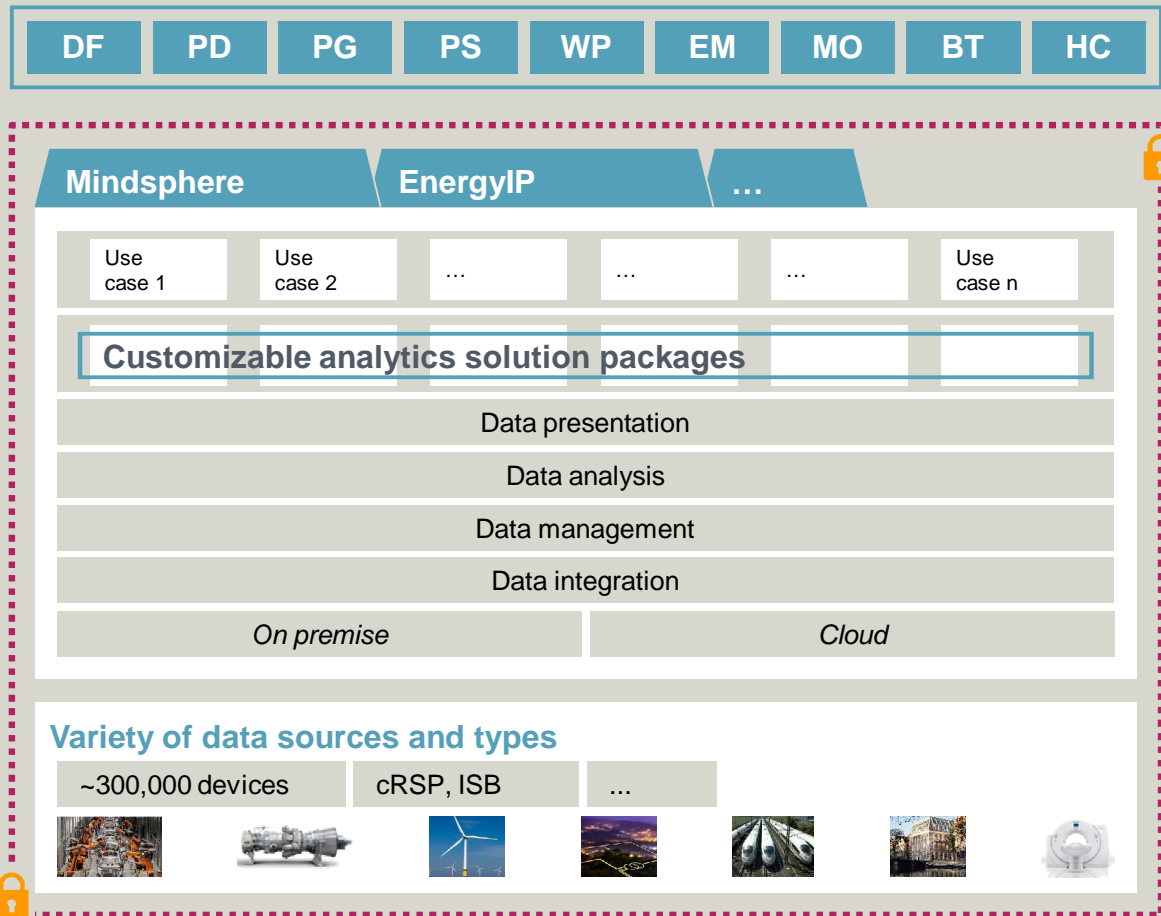
- + Latest technology for all Siemens businesses
- + Reduction of technical complexity in the company
- + Leveraging synergies through scaling
- + Faster development

... and use the customer proximity of our operating units to develop applications

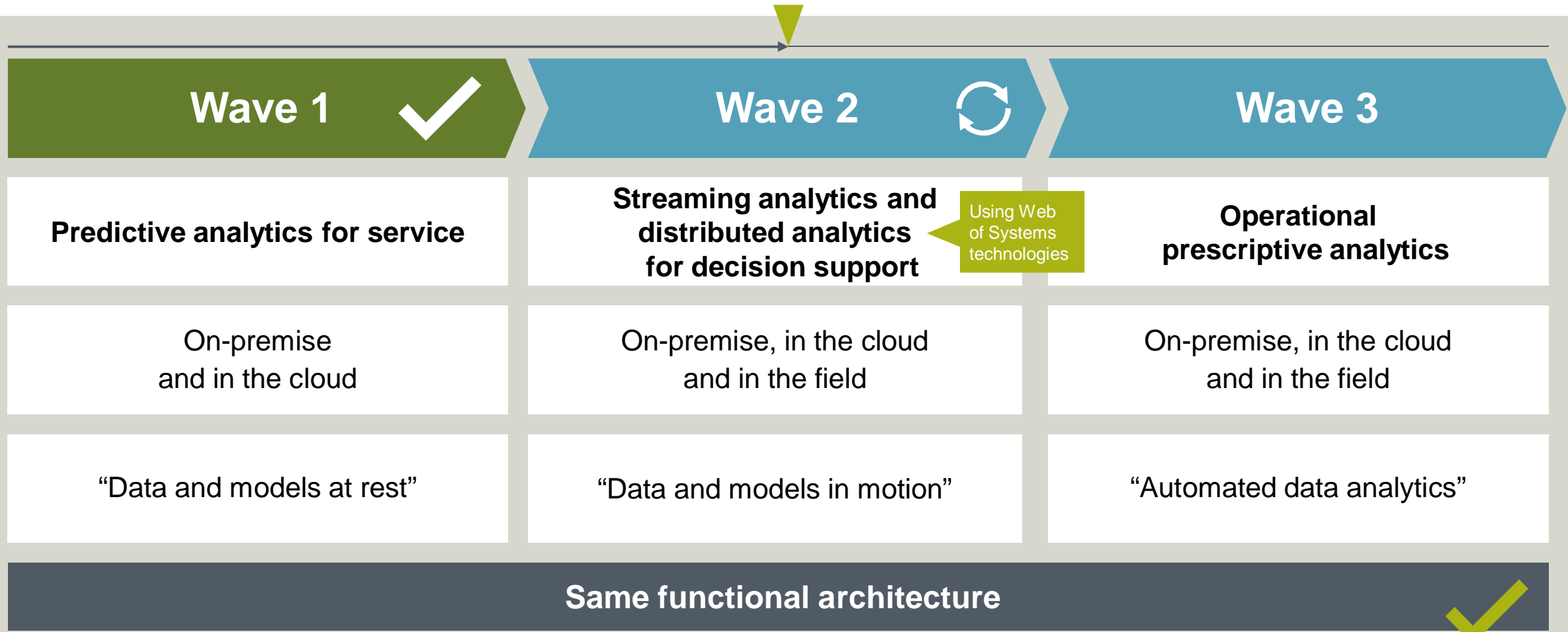
- + Know-how regarding large installed bases of products and systems
- + Deep know-how of customer processes and challenges
- + Many existing applications that already generate value for our customers

Sinalytics builds on a strong technology stack for connectivity, data analytics supported by state-of-the-art cyber security

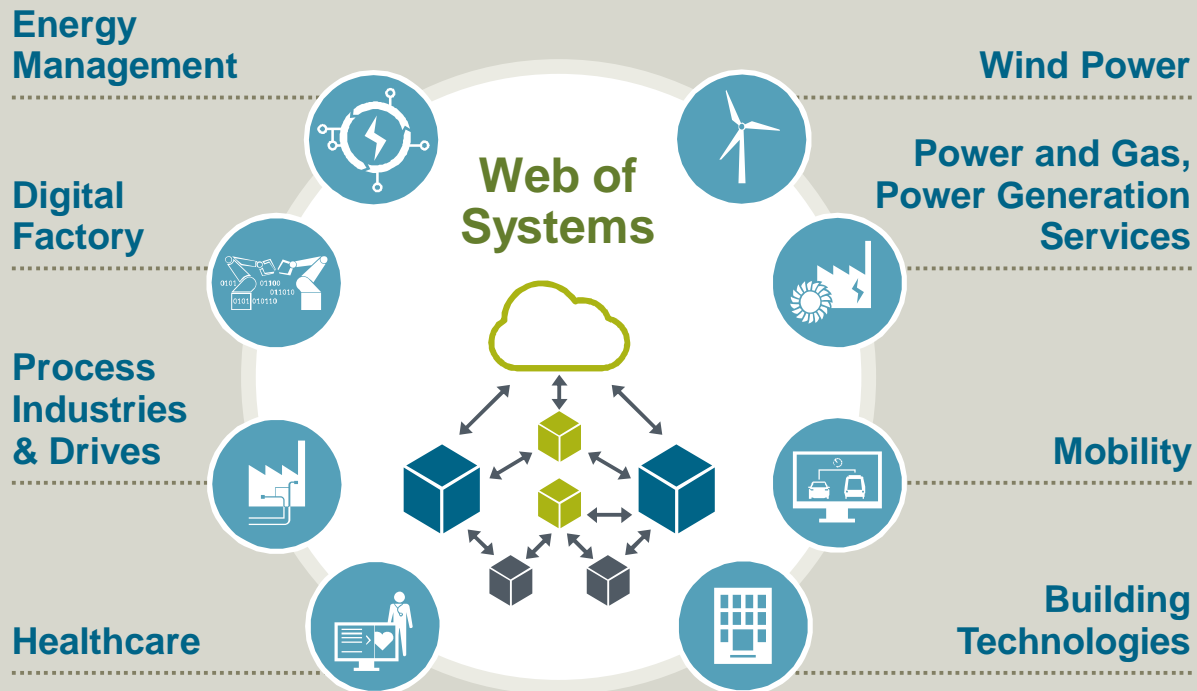
Powered by Sinalytics



We continue developing data analytics capabilities of Sinalytics: From predictive to prescriptive analytics

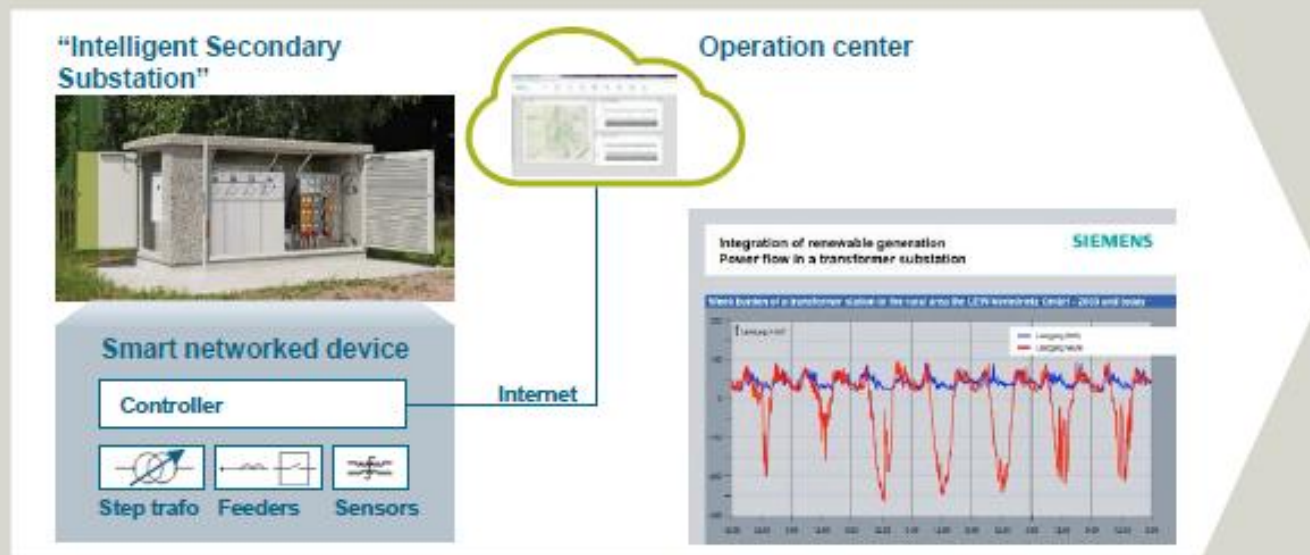


Siemens leverages the Internet of Things to the needs of our customers in industry and infrastructure



- + The Web of Systems puts devices, machines and their interactions in the center of digitally-networked industries
- + Devices process data locally and make decisions
- + Owners decide what happens with their data
- + Devices organize themselves and communicate with each other
- + New functionalities can be installed as with apps on smartphones
- + The installed base can be digitalized with the Web of Systems
- + Siemens delivers infrastructure and industry solutions characterized by:
 - **Reliability**
 - **Durability**
 - **Data security**

Web of Systems technologies already work – Example: The Intelligent Secondary Substation in a Smart Grid



“Intelligent Secondary Substation” for reliable, stable and cost efficient smart grids

- **Smart Devices:** Local control (e.g. voltage control) using attached sensors & actuators, plug-and-play device2cloud connectivity (e.g. for grid management, monitoring, data analytics)
- **App-powered devices:** Dynamically add features (e.g. control, metering, monitoring, add-on services) and keep ISS “fresh”
- **Interacting devices:** Mesh network of ISSs for fast fault localization and self healing, decentralized operation coordination
- **Cross domain integration:** interlinked infrastructures of smart grid, power network and buildings

- + **Minimized engineering effort:** Plug-and-play capabilities, remote software update and feature enhancements, asset monitoring
- + **Reliable system operation at lower cost:** Supervised autonomous local control enables reliable and stable smart grid operation although making use of highly cost efficient but unreliable Internet connections to the operation center

Sinalytics brings together the technologies needed in an increasingly digitalized world

Powered by Sinalytics

SIEMENS

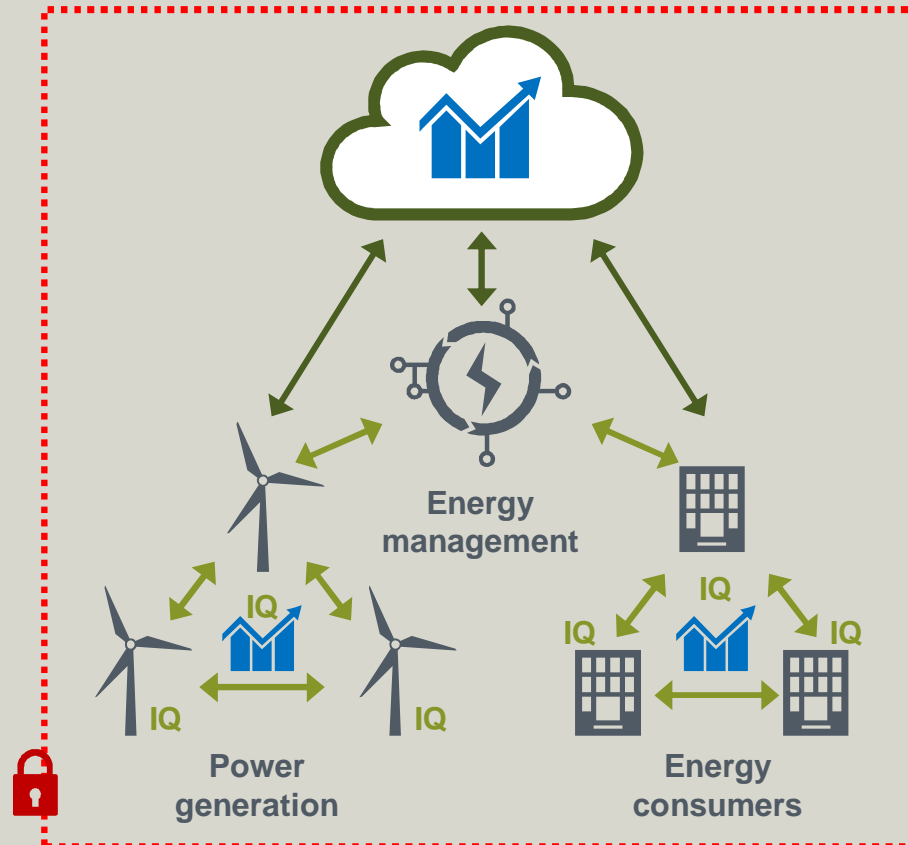
Sinalytics

Data analytics

On-premise, in the cloud and soon in-the-field leveraging Web of Systems technologies

Cyber security

Protecting customer data in open, interconnected industrial IT systems



Connectivity

Secure and proven technologies connecting already ~300k devices

Smart networked devices & systems

System-aware, autonomous and app-enabled to meet industry and infrastructure needs