
Digital Twins
Frank Kuitems
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Atos

Ir. Frank Kuitems – Head of Industrie 4.0

Frank Kuitems

Head of Industrie 4.0

Doesburg
The Netherlands

Education

Master degree in Applied Mathematics, TU Delft
Business Administration, Institute for Career & Development
Postgraduate Action Learning, University of Huddersfield

Competences

Market lead Manufacturing
Logistics, High Tech & Process Industry, Manufacturing & Pharmaceuticals
Business Process Improvement
Supply Chain Management
Program & Project Management
Responsible for Industrie 4.0 and IIOT

Languages

Dutch (Mother tongue)
English (business fluent)

Summary

Frank Kuitems is Head of Industrie 4.0 and marketlead Manufacturing in Atos Digital. Frank combines a long track record in business management (> 20 years) with a broad experience in business and process improvement programs using digital technologies. With his former employers Frank has been involved in large business transformation projects, like the engineering and realization of an automated container terminal on the Maasvlakte and the logistics optimization of the Flower Auction.

Relevant Experience

Industrie 4.0, Program & Project management, Alliance Management with Siemens

Industry: Logistics, High Tech & Process Industry, Manufacturing & Pharmaceuticals

Professional Career

Since 1995 Various roles at Atos

- Industry Lead Manufacturing & Head of Industry 4.0 at Atos Digital Benelux & The Nordics
- Managing Partner Atos Consulting Manufacturing, Retail & Transport
- Consultant -> Partner Atos Consulting

1992-1995 Program Manager Logistics, Flower Auction Aalsmeer

1987-1992 Operations Research Engineer, Europe Combined Terminals in Port of Rotterdam

Guest lecturer Digital Twins at Vrije Universiteit Amsterdam

Speaker on various seminars on IT-OT convergence

Clients

marel
MSD INVENTING FOR LIFE
PHILIPS
DAF
ASML
AkzoNobel
AWL.
DSM

Atos

Agenda

- Market Trends
- Digital Twins
- Use cases

Market Trends

Relevant Industry Trends

Focus areas: Design, Engineering, Production, Maintenance, IoT

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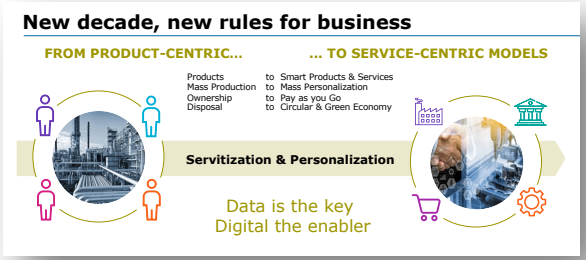
Focus areas: Design, Engineering, Production, Maintenance, IoT

1 Servitization



Relevant Industry Trends

Focus areas: Design, Engineering, Production, Maintenance, IoT

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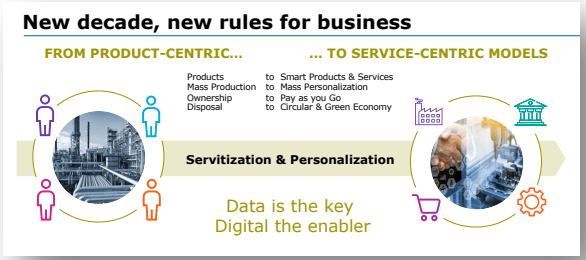
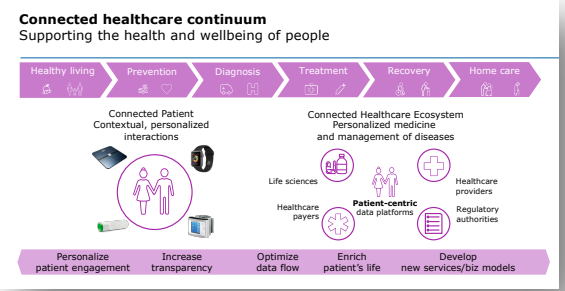


2 Connected & Personalized



Relevant Industry Trends

Focus areas: Design, Engineering, Production, Maintenance, IoT

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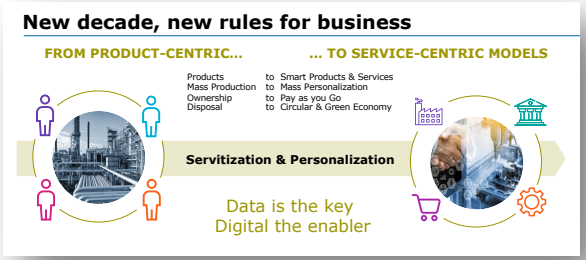

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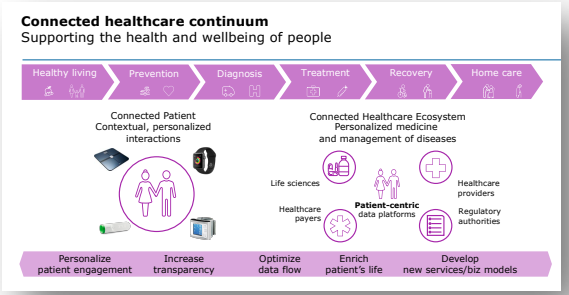
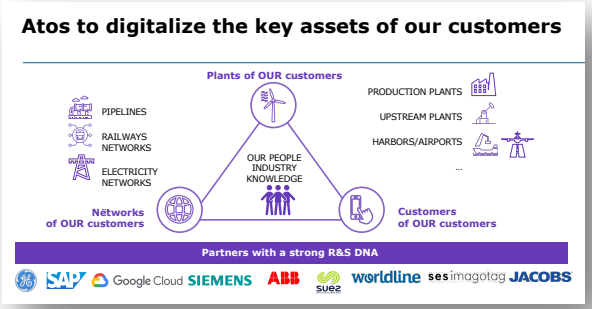


3 Digitize key assets



Relevant Industry Trends

Focus areas: Design, Engineering, Production, Maintenance, IoT

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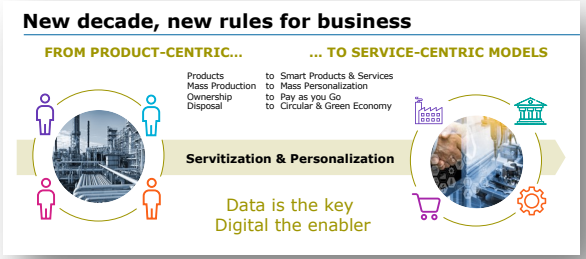

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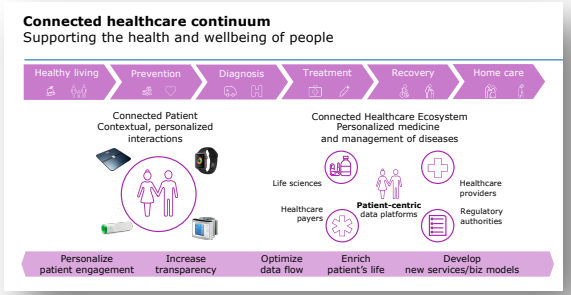

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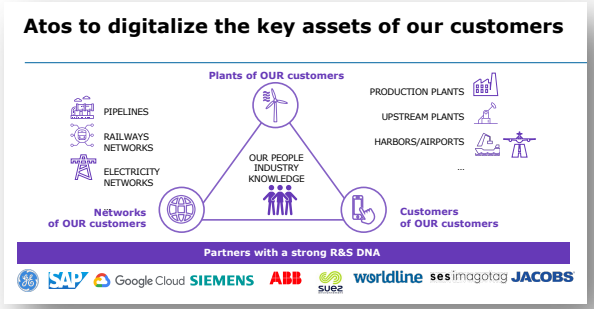
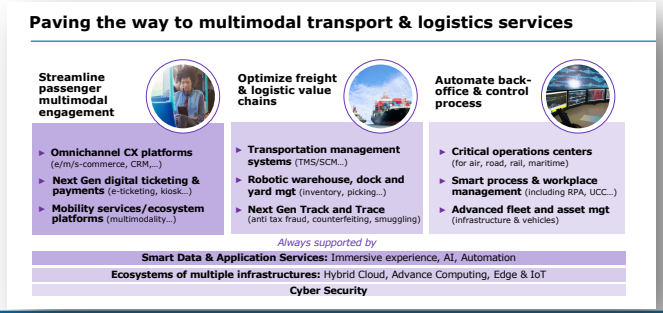


3 Optimize & Orchestration



New decade, new rules for business

FROM PRODUCT-CENTRIC…

… TO SERVICE-CENTRIC MODELS

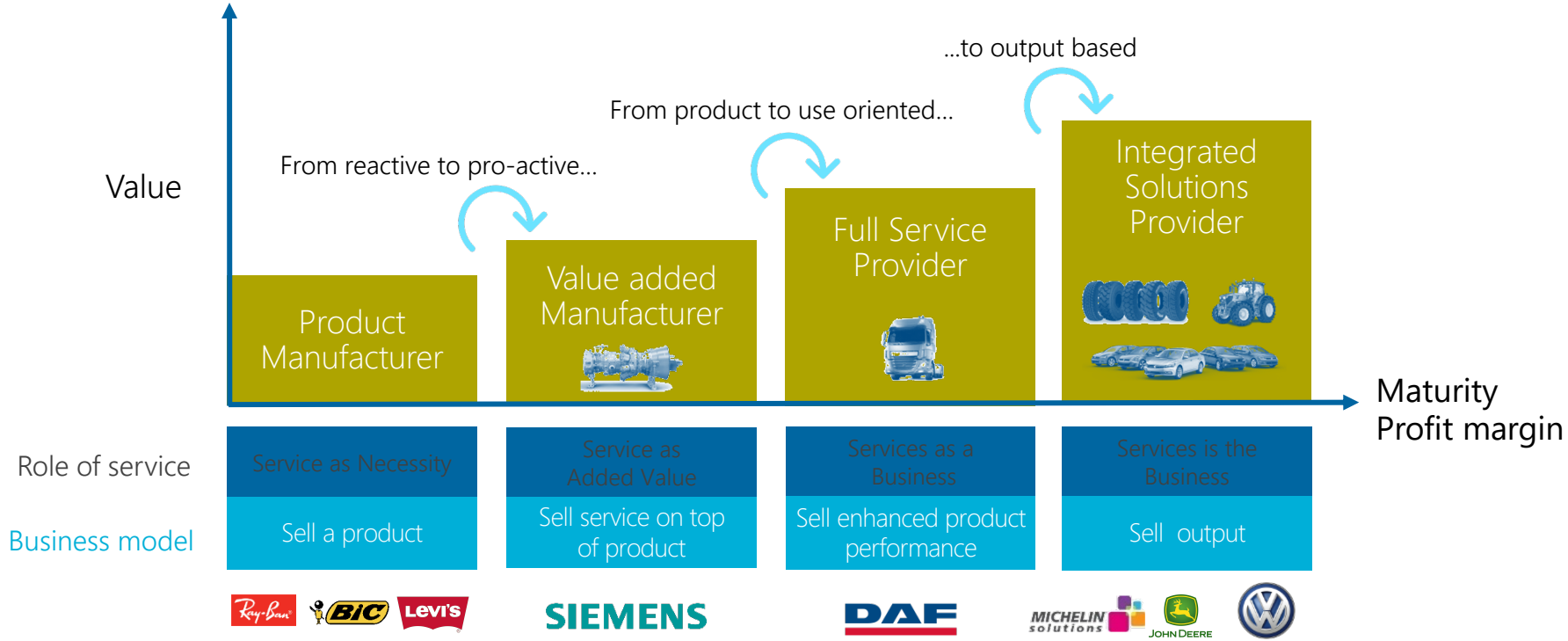
Products	to	Smart Products & Services
Mass Production	to	Mass Personalization
Ownership	to	Pay as you Go
Disposal	to	Circular & Green Economy

Servitization & Personalization

Data is the key
Digital the enabler

Products to Services: boosting profit & diversification

Digitalization beyond Uber & Co.



Digital Twins

What is a Digital Twin?

Various views in wikipedia

Definition	Authors
"The Digital Twin is a set of virtual information constructs that fully describes a potential or actual physical manufactured product from the micro atomic level to the macro geometrical level. At its optimum, any information that could be obtained from inspecting a physical manufactured product can be obtained from its Digital Twin."	Grieves & Vickers (2016)[12]
"A Digital Twin is an integrated multiphysics, multiscale, probabilistic simulation of an as-built vehicle or system that uses the best available physical models, sensor updates, fleet history, etc., to mirror the life of its corresponding flying twin"	Glaessgen & Stargel, (2012)[13]
"digital twin is a real mapping of all components in the product life cycle using physical data, virtual data and interaction data between them"	Tao, Sui, Liu, Qi, Zhang, Song, Guo, Lu & Nee, (2018)[14]
"a dynamic virtual representation of a physical object or system across its lifecycle, using real-time data to enable understanding, learning and reasoning"	Bolton, McColl-Kennedy, Cheung, Gallen, Orsingher, Witell & Zaki, (2018)[15]
"Using a digital copy of the physical system to perform real-time optimization"	Söderberg, R., Wärmefjord, K., Carlson, J. S., & Lindkvist, L. (2017)[16]
"A digital twin is a real time digital replica of a physical device"	Bacchiega (2017)[17]
"A digital twin is a digital replica of a living or non-living physical entity. By bridging the physical and the virtual world, data is transmitted seamlessly allowing the virtual entity to exist simultaneously with the physical entity."	El Saddik, A. (2018)[1]
In the context of Digital Built Britain a digital twin is "a realistic digital representation of assets, processes or systems in the built or natural environment"	The Gemini Principles (2018)[18]

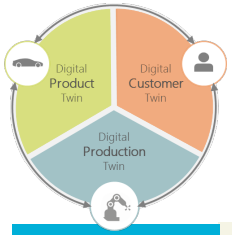
What is a Digital Twin?

According to wikipedia

A **digital twin** is a digital replica of a living or non-living physical entity.[1] Digital twin refers to a digital replica of potential and actual physical assets (physical twin), processes, people, places, systems and devices that can be used for various purposes.[2] The digital representation provides both the elements and the dynamics of how an Internet of things (IoT) device operates and lives throughout its life cycle.[3] Definitions of digital twin technology used in prior research emphasize two important characteristics. Firstly, each definition emphasizes the connection between the physical model and the corresponding virtual model or virtual counterpart.[4] Secondly, this connection is established by generating real-time data using sensors.[5]

Three “Digital Twins” empowered by I4.0

Introducing the Product-, Production- and Service Twin



Digital Twins

Use/Service

Creation

Digital **Product** Twin

Performance data

Production data

Design data

Three “Digital Twins” empowered by I4.0

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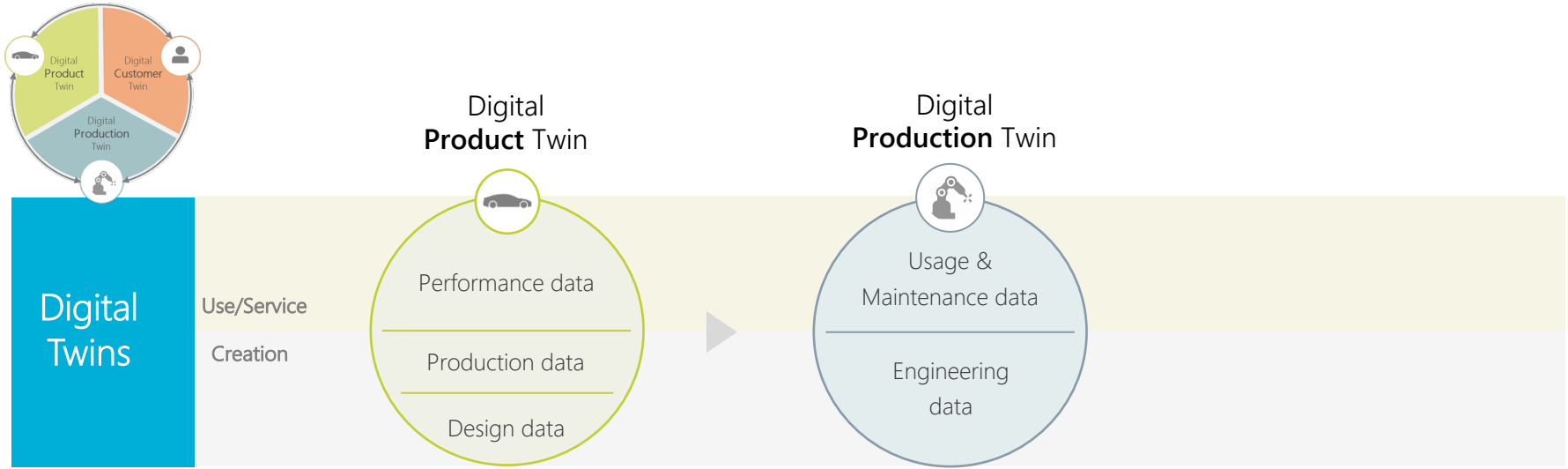

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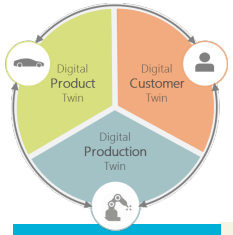


Digital Twins

Use/Service

Creation

Digital **Product** Twin

Performance data

Production data

Design data

Digital **Production** Twin

Usage & Maintenance data

Engineering data

Digital **Service** Twin

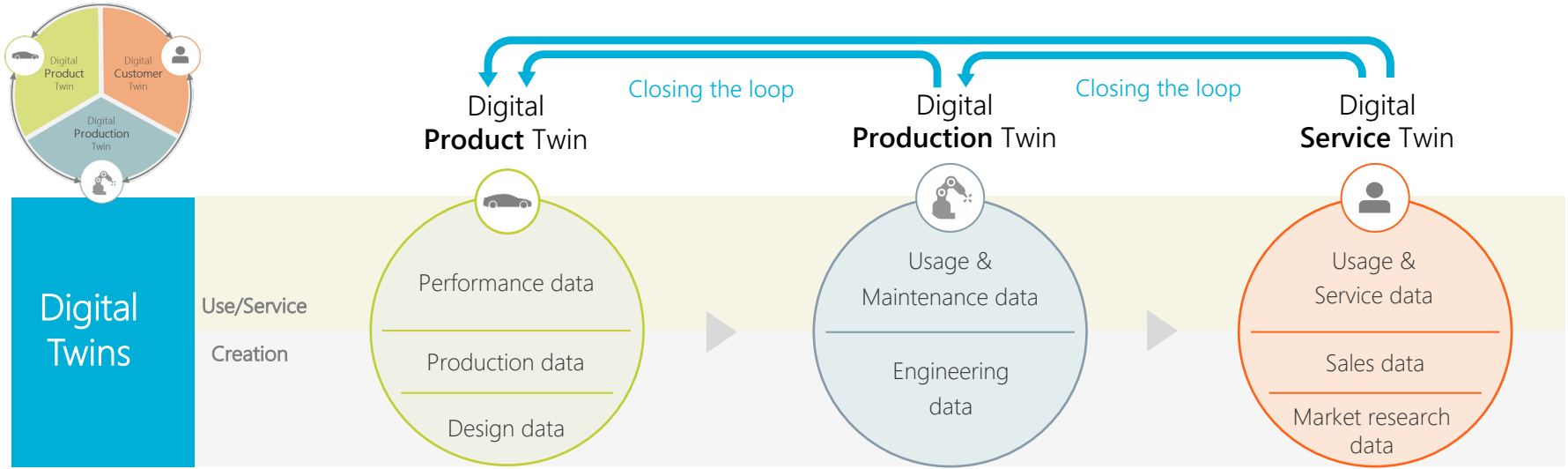
Usage & Service data

Sales data

Market research data

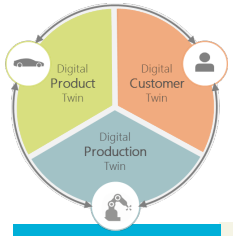
Three “Digital Twins” empowered by I4.0

Introducing the Product-, Production- and Service Twin



Three "Digital Twins" empowered by I4.0

Introducing the Product-, Production- and Service Twin



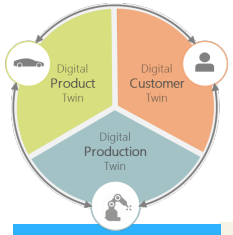
Closing the loop

Closing the loop

Digital Twins	Digital **Product** Twin	Digital **Production** Twin	Digital **Service** Twin
Use/Service	Performance data	Usage & Maintenance data	Usage & Service data
Creation	Production data Design data	Engineering data	Sales data Market research data

Data Sources			
	Consumer IoT / Industrial IoT	Industrial IoT	Consumer IoT / Industrial IoT
	Manufacturing Execution Systems		Social Media / Internet
	Enterprise Resource Planning		Customer Relationship Management
	Product Lifecycle Management		Service Lifecycle Management
	Computer Aided Design		

Our portfolio covers the value chain E2E



Digital Twins

Use/Service

Creation

Data Sources

Industrial IoT platform

Product Lifecycle Management

Consumer IoT / Industrial IoT

Manufacturing Execution Systems

Enterprise Resource Planning

Product Lifecycle Management

Computer Aided Design

Manufacturing Execution Systems

Industrial IoT

Industrial Internet of Things

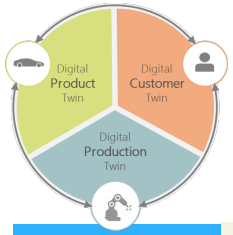
Consumer IoT / Industrial IoT

Social Media / Internet

Customer Relationship Management

Service Lifecycle Management

All software vendors invest in this area



Digital Twins

Use/Service Creation

Data Sources

thingworx | MindSphere | SAP Leonardo | Industrial IoT platform | Google | Microsoft Azure | aws

PLM

ptc Windchill

TEAMCENTER

SAP PLM

MES

SAP ME/MII

SIEMENS OPCENTER Smarter Manufacturing

OSIsoft. | Wonderware

aspentech

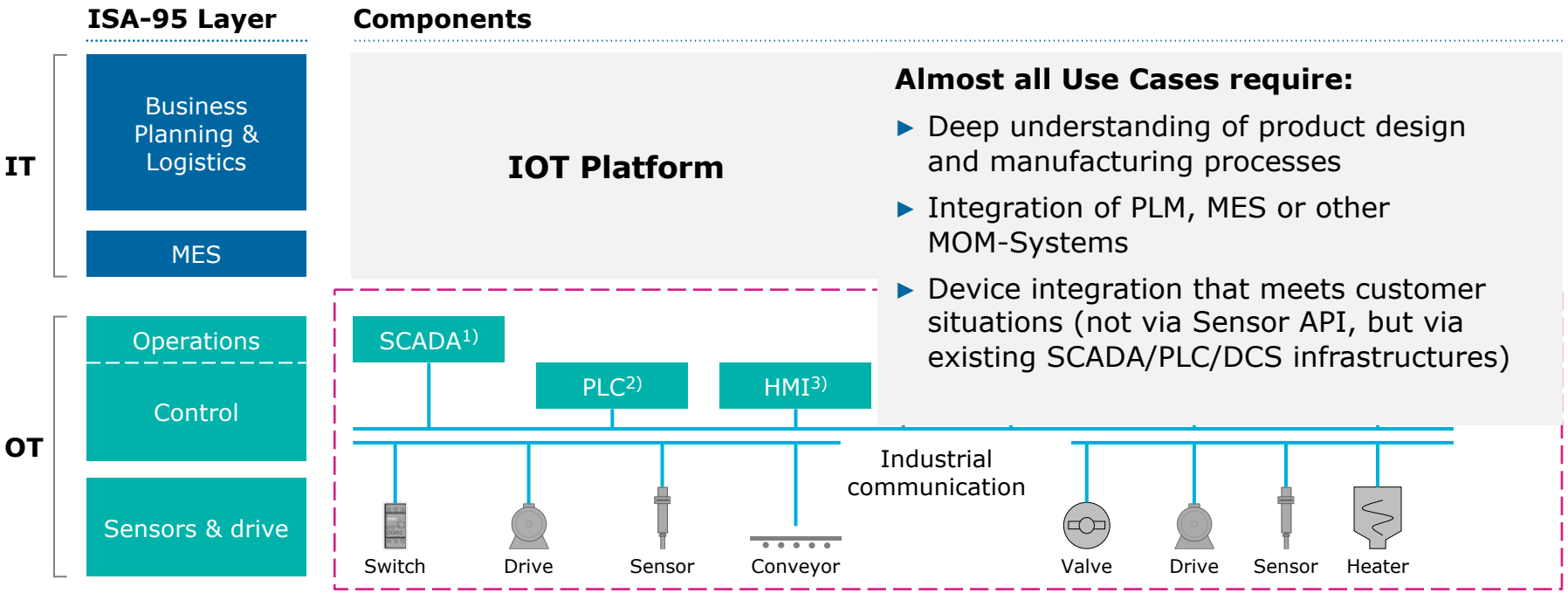
IIoT

Azure IoT Edge

mx mendix

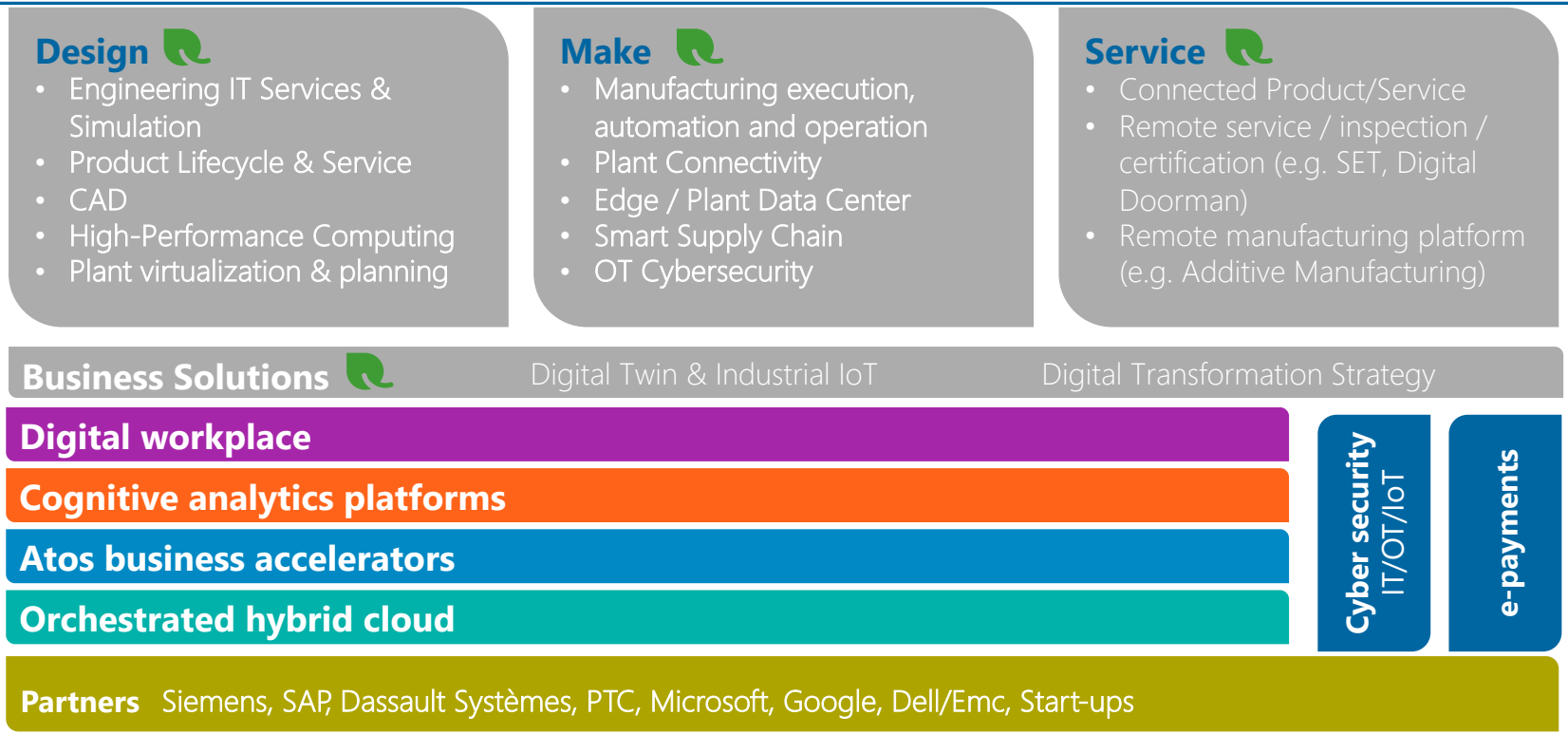
Atos

Dependencies on IT - OT Integration



1) Supervisory Control and Data Acquisition 2) Programmable logic controller 3) Human Machine Interface 4) Distributed Control System

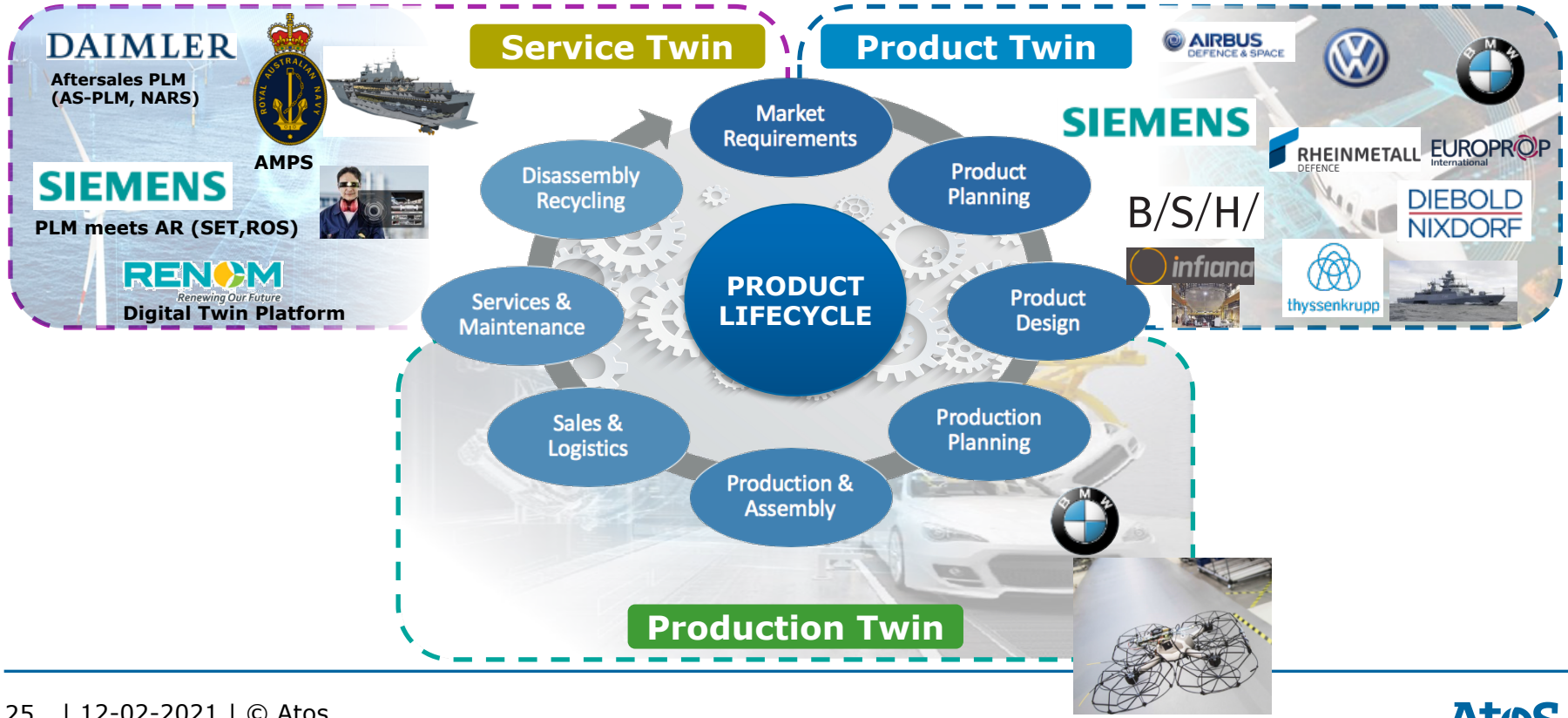
Atos services for Manufacturing



Use cases Product Twin

Digital transformation for product lifecycle management

Closed loop PLM / Digital Twin



Example PLM & Digital Twin

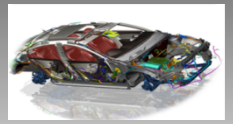
Virtual and real/physical world

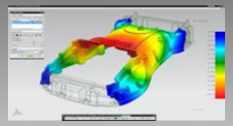
Lifecycle of a product (Example Automotive)

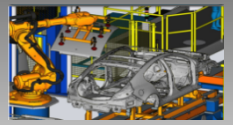
Product Planning → Product Design → Product Planning → Production & Assembly → Sales & Logistics → Service & Maintenance

Virtual


Requirements


Design


Product Validation


Process Validation

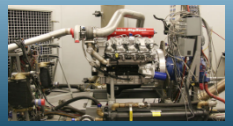

As-Built


As-Serviced

Digital Twin/Thread – Closed-Loop Product Lifecycle Management !


Customer Feedback


Styling


R&D Testing


Prototype Testing


Build Tracking


Service Reporting

Physical

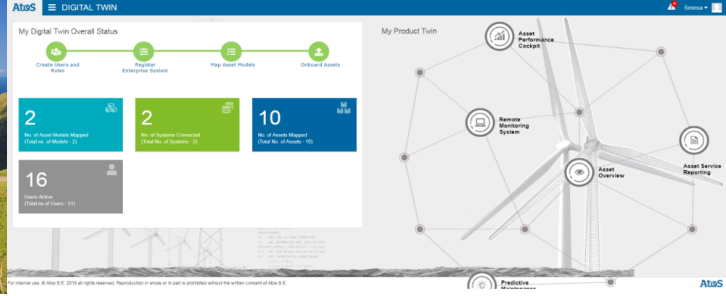
Atos

Asset Digitisation and Optimisation

RESCA- ONE SCADA Solution for Assets

AMPS- Asset Management & Planning system for PM/BM Maintenance

DT - Digital Twin for Predictive Maintenance



What Atos is delivering for a leading Windturbine service provider

Our business impact:

We enable real time Windturbine monitoring

- Digital services offered by Renom
- Predicting the Remaining Useful Life (RUL) per turbine for only the component
- Yield prediction
- Reduce unscheduled downtime due to component failures by predicting components that are at risks

Renom:

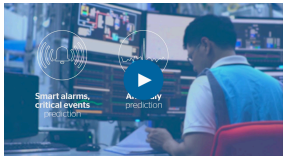
- Renom is a service provider in the renewable energy sector headquartered in India, providing maintenance and consulting services to major companies who own renewable energy assets.

The Atos solution:

- Atos built "Windturbine Digital Service Twin" that connects data from multiple sources – logs, ERP, PLM and asset management systems and onboard sensors. Leveraging data analytics, machine learning and image recognition, patterns and correlations in operations are identified. The system is deployed to provide a 360° view of the assets and predicting failures.
- Now, operators at Renom monitor their assets in real-time using an intuitive interface enabling them to quickly locate the wind turbine on a map and select the relevant part or sensor from a 3-D digital replica. All business relevant performance indicators are readily accessible and actions can be taken accordingly.

Use cases Production Twin

Smart Control Room



Improved process efficiency and less workload of production line operators, thanks to a new alarm handling solution

Based on the implementation of an open IoT ecosystem within the production line, machine learning algorithm and prediction models, processes and work of production line operators are improved and self-learning systems created.

Thanks to open ecosystem and a multi-technology, multi-vendor approach, Atos delivers an industrial-scale end-to-end solution that increases your Operation Equipment Efficiency.

The smart operation solution will increase the reliability of factory monitoring activities and simplify the workflow of production line operators.

Event Prediction

Gives the operator extra time to avoid critical events on the production line

- Avoiding shutdowns

Defect Prediction

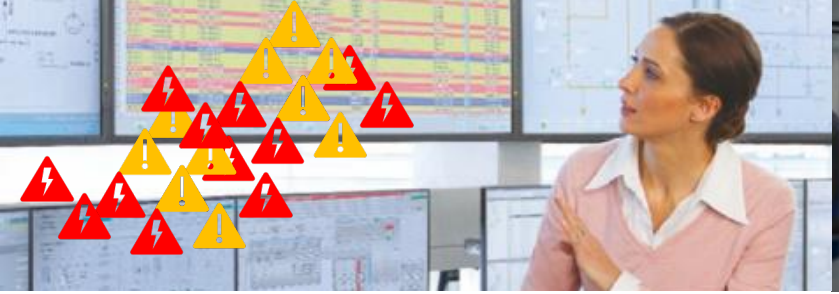
Predicts defects that increase the risk of damage and breakages

- Ensuring higher quality product and less waste

Strength Prediction

Production uptime quality & yield

- Faster product/grade change
- Optimized consumption of raw materials



What Atos delivered for a leading provider of renewable packaging and paper solutions

Our business impact:

We enable Process Event Prediction

- Predicting upcoming critical issues to avoid production downtime
- Getting guidance for upcoming critical plant situations
- Preventing unnecessary downtime by increasing OEE by 0,3%

Improved / predictive handling of control room alarms: 1% more OEE = 1M€ per line p/y => 90M per year

Business challenges:

- The automation system produces hundreds of alarm and event messages per minute.
- 80% of the alarms and events can be ignored, however filtering the relevant alarms and events requires years of experience
- Mistakes happen on a regular basis and usually result in production downtime

Atos solution:

- Process Event Prediction assesses & enables datadriven event prediction
- Smart, self-learning advisor predicting upcoming critical issues to avoid production downtime
- Supporting plant operators, at specific process lines
- Integrated into the regular workflow, with an easy-to-use notification interface

Process Digital Twin for Pharma

Smart Pharma

Deployment of a process digital twin of a pharmaceutical process with orchestrated interaction between online sensors and hybrid models enables innovative development and enhanced control of the production process.

Reduce time to market

creating economies of scale and optimum use of resources

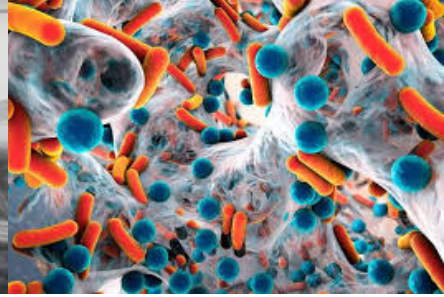
Lower costs through reduced waste

up to 20% savings

Ensure high quality of products

increase of up to 10% product-margin



What Atos delivered **for** a global vaccines company

Our business impact:

We enable faster Time2 Market

- Increased reliability to factory monitoring yield
- Less resources
- Basis for lights-out production
- Faster to market

Money: Better vaccine quality and improved yield and product margin.

10% more margin = 150M p/y

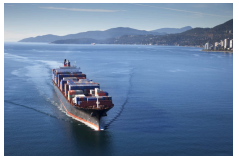
Business challenges:

- Revenue improvement by shortening time to market via digital simulation/optimization of production
- Profitability improvement by reducing waste via digital measurement and control during production

Atos solution:

- In-line/on-line Quality measurement
- Closed loop advanced process control
- Less space
- Optimized process

Smart Connected Vessels



Optimizing logistics with IoT in maritime transport

Remote connectivity

Edge computers collect data and transmit to the cloud for real-time data analytics

Predictive maintenance

Automate maintenance planning and scheduling, enable improved accuracy and response times and improve the productivity and time estimation of technicians.

Cost reduction

Reduce fuel, operational, and maintenance costs

Decarbonization

Accelerate emissions reduction and accurate environmental reporting for greener shipping

What Atos is delivering for a leading transportation company

Our business impact:

We enable real time connected vessels

- Significant fuel consumption savings
- Further cost reduction (predictive maintenance, etc.)
- Enabling new business models and open new value streams

Money: Improved vessel performance with significant fuel consumption savings. 6% fuel saving = 200M€ p/y

Business challenges:

- Marine industry is facing challenges of extreme tight profit margins and lack of visibility in maintenance efficiency on CAPEX
  - Vessel performance
  - Fuel consumption
  - High efforts on vessel maintenance

The Atos solution:

- Implement open IoT ecosystem
- Improve Waste heat recovery, Data driven maintenance and Connected machines

5

Use cases Service Twin

What Atos is delivering for DAF / PACCAR

Our business impact:

We enable real time connected trucks

- Cost reduction (predictive maintenance, etc.)
- Enabling new business models
- For DAF customers: increase vehicle availability, optimize logistical efficiency

Money: reduction operational cost, new revenue streams

Business challenges:

- Truck industry is facing challenges of extreme tight profit margins and lack of visibility in maintenance efficiency on CAPEX
  - Truck performance
  - High efforts on truck maintenance
  - Create direct link to DAF end-users
  - Competition
  - Legislation

The Atos solution:

- Via connected Vehicle Platform: turn vehicle data into comprehensive information for DAF and its customers
- Fleet services like: fleet use, geolocation, driving time & performance, fuel consumption, vehicle health & connected maintenance planning, over the air updates

Connected Cooler

Engage nearby consumers, visually monitor stock levels, and optimize your assets

Retailers and consumer-packaged-goods companies have a unique opportunity to utilize technologies such as the Internet of Things, analytics, and artificial intelligence to enhance customer experience, increase the value generated from store equipment, and reduce total cost of ownership: the Codex Connected Cooler service.

Operational Efficiency

- Cooler Utilization
- Full Automation
- Real Time Reporting
- Cooler Location Compliance
- Preventive Maintenance

Sales Force Productivity

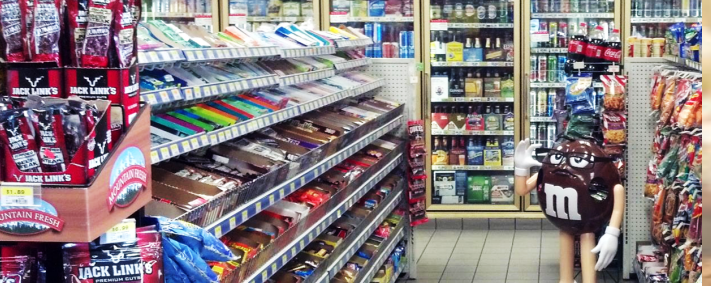
- Avoid out of stock situations
- Planogram Compliance
- Create New Revenue Streams
- Sales Analytics
- Intelligent Ordering

Consumer Engagement

- Proximity Marketing
- Real time Promotions and Offers
- Social Media Interaction
- Collect Voice of Customer

Quality Compliance

- Compliance to Product Quality and Availability
- Purity (no 3rd party products)
- Planogram (positioning of products in the cooler)
- Positioning of the cooler itself



What Atos is delivering for a world leading Coca Cola company

Our business impact:

Improved asset efficiency

- Improve asset utilization
- Cost optimization
- Predictive maintenance

Money: Overall 10% sales increase by 2% to 7% revenue increase, +3,2% increase of transactions

Business challenges:

- Visibility of cooler performance
- Track on-shelf availability
- Limited consumer engagement
- Unauthorized movements of Coolers

The Atos solution:

- Atos' connected cooler solution to utilize assets and optimize cost via f.e. predictive maintenance
- Cooler performance dashboard: power status & history, Cooler performance index, average daily door opens, cooler health status, unexpected movements

Intelligent Supply Chain

Enter the age of Logistics 4.0

According to McKinsey research, companies that aggressively digitize their supply chains can expect to boost annual growth of earnings before interest and taxes by 3.2% –the largest increase from digitizing any business area–and annual revenue growth by 2.3%.

Reliability

Enhance supply chain visibility and delivery reliability, automating entire processes with minimal manual intervention.

Cost reduction

Lower operational costs by up to 30%, ensure up to 75% fewer lost sales, and decrease inventories by up to 75%.

Risk mitigation

Reduce forecasting error by 30-50% and mitigate risk along the supply chain.

Intelligent Supply Chain

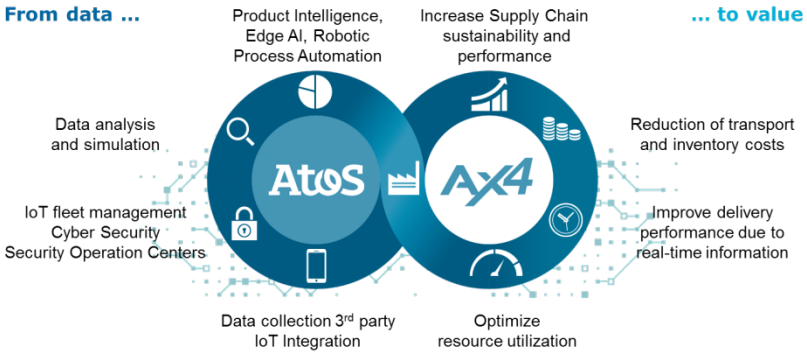
Atos & AX4 MindSphere-based IoT solution

Atos & Siemens are developing the Intelligent Supply Chain by combining logistics, manufacturing, analytics and IoT.

Potential benefits for you*:

- Logistics routing: **17% gain in operating efficiency**
- Package/container tracking: **10–25% better container utilization** and **30–50% damage avoidance.**
- Inventory optimization: **10% reduction in inventory**

Continuous solutions for your supply chain network.
From consulting, through digital transformation to global rollout.



Intelligent Supply Chain Offerings

Real-time Delivery Prediction enables informed decision and process optimization through predicting arrival times

In-Transport Visibility to always know where your individual shipments are located.

IoT integration trough Siemens MindSphere for integrating machine and production data into logistics processes

Shop floor Track and Trace tracking products as they move through plants and warehouses

Supply network simulation supporting in planning and decision making based on plan and real data

Production on Demand to enable customization and minimize speculation in production.

*Source – Unlocking the potential of the Internet of Things, McKinsey Global Institute, June 2015

Any questions?

Atos

Thanks

Frank Kuitems
Head of Industrie 4.0, Atos Benelux & The Nordics
Frank.Kuitems@atos.net