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Siemens Digital Industries Partner Conference 2019

Domain Know-how

Cam Ranh, 8 November 2019

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ASRM – Overview & valued added topics

Inspiring change in intralogistics

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siemens.com/conveyor-technology-asrm

Agenda

- **General information** **3**
- Structure & Products 7
- Value added topics 17

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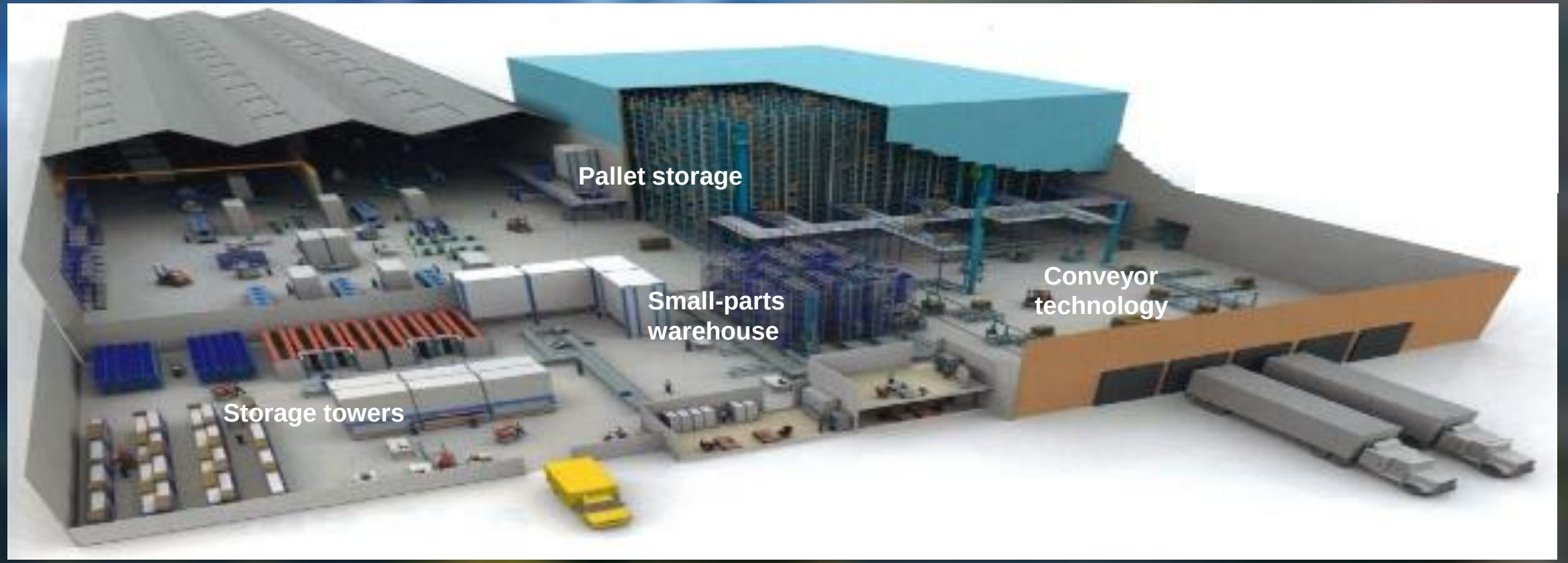
Storage technology – schematic overview



Storages – the fast buffers in the material resp. production means flow – are a core element of intralogistics

picture source: KardexMlog

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Definition:
Automatic Storage and Retrieval Machine

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An **Automatic Storage and Retrieval Machine (ASRM)** is a rail-guided, single track vehicle used to store goods in a **high-bay warehouse**. It is also known as **stacker crane** or **rack feeder.**

Curve-negotiable ASRM for reduced powers:

- ASRM to operate the entire warehouse via a switch system resp. change the aisle using a changeover system

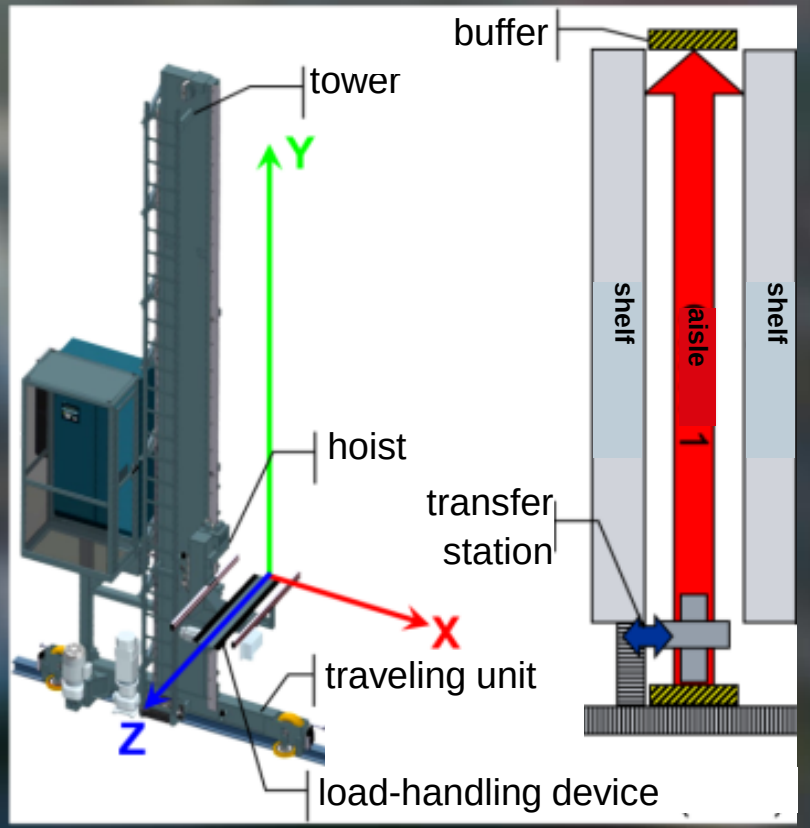
Aisle-bound ASRM for high powers:

- ASRM operated in one aisle only

The movements of an ASRM are performed along three axes:

- x = Longitudinal aisle direction ⇨ travelling unit
- y = Vertical direction ⇨ hoisting unit
- z = Traverse aisle direction ⇨ load handling device (load carrier)

(Source Wikipedia)



In addition to the conveyor technology,
Automatic Storage and Retrieval Machines are the core of storage technology

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Warehouse logistics
Requirements and trends

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The typical requirements for ASRM are:

- High positioning accuracy
- High level of automation (full automatic operation)
- High payload at low weight of ASRM

Technological trends:

- Increased throughput by
  - Optimized acceleration / deceleration
  - Oscillation damping
  - time optimized moving profiles
- Smart integrated safety concepts (acc. EN 528)
- Energy efficiency (Green Logistics)
  - Multi-axis systems with common DC-link with concepts for energy storage
  - Power and energy optimized moving profiles
- Fast and easy commissioning
- Comfortable and simple diagnostics

The products from GMC allow us to fulfill the market requirements and generate additional value added

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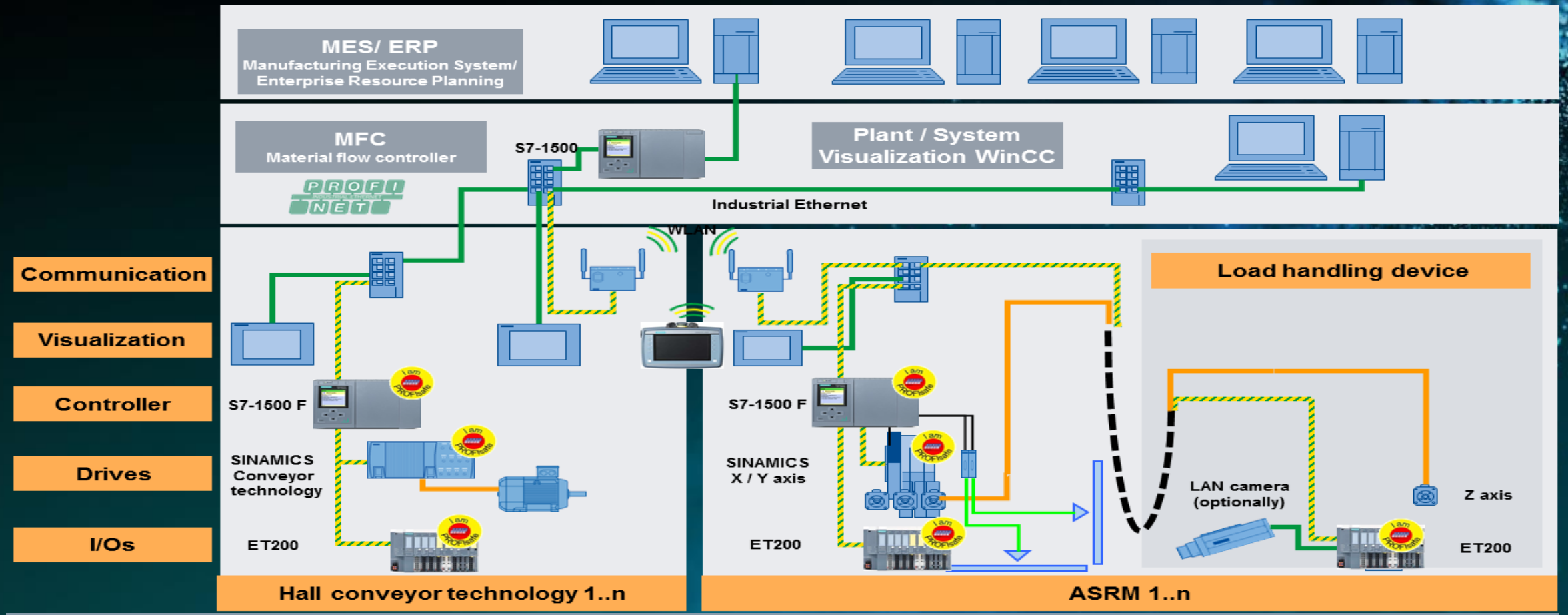
Principal structure of an intralogistics solution

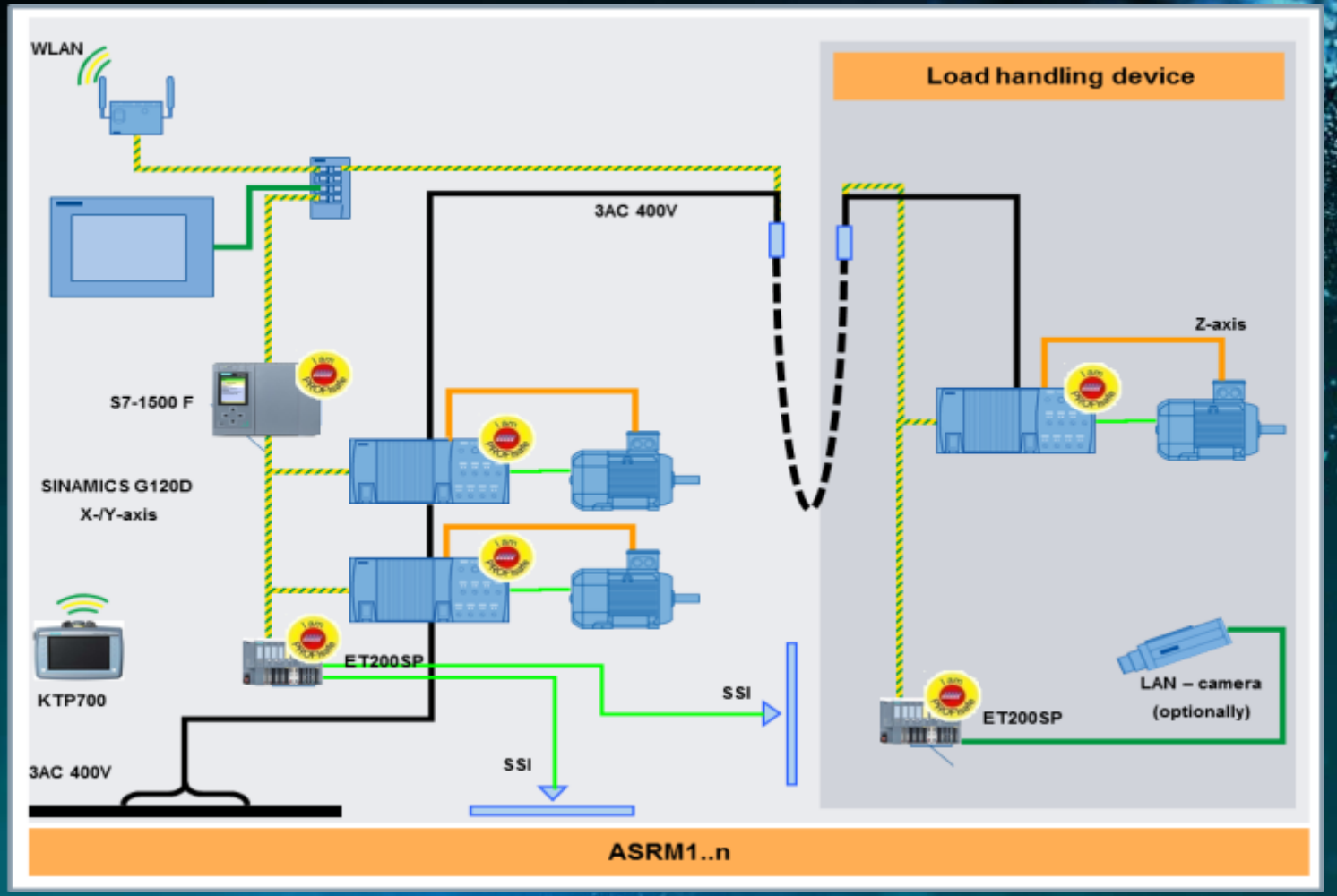


All components from one supplier optimally interact thanks to TIA

Distributed concept with SINAMICS G120D

Features

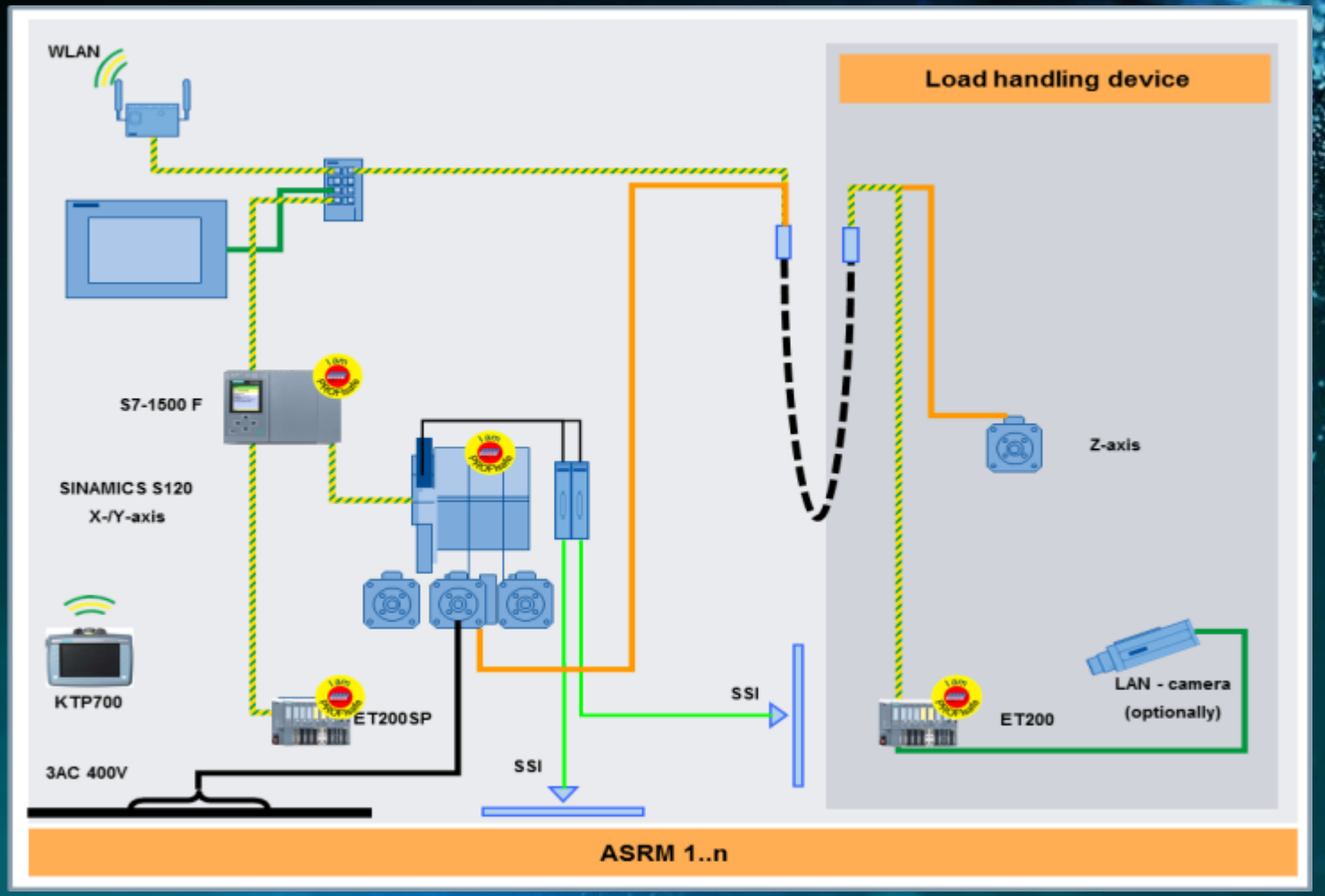
- Degree of protection IP 65
  → no control cabinet required
- Installation directly near the motor
  → reduced wiring
- Energy efficient thanks to energy regeneration capacity
- Integrated positioner (EPOS)
- Safety Integrated
- No line reactor or line filter required
- Up to 7.5 kW (nominal power); 15kW (peak power)



Central concept with SINAMICS S120 Booksize

Features

- Scalable and flexible due to modular structure
- Up to 12 axes per CU
- Central infeed / regenerative feedback
- Highly dynamic control
- Synchronous / induction motors
- Integrated positioner (EPOS)
- Numerous applications thanks to DCC
- Safety Integrated
- Energy efficient through regenerative feedback and energy balancing at the dc link; incl. concept for energy storage



Sensing and communication

Sensor systems	**SIMATIC Visionsensor** • Vision sensors for application-specific image processing
Identification systems	**SIMATIC Ident** • RFID systems for an optimization of material flow and logistics • Code reader systems for flexible reading and verification of 1D/2D codes
Communication	**SIMATIC NET** • Industrial Ethernet / WLAN • PROFINET • PROFIBUS • AS-i

Control and visualization

Controllers & I/Os

SIMATIC Controller

- Highest scalability
- Selection in the software and hardware architecture: Modular / embedded / PC-based
- Central / distributed

HMI

SIMATIC HMI

- The finely graduated product range fulfills the most diverse requirements
- From operator panels and visualization software through to the scalable SCADA system

Frequency converters

Distributed

SINAMICS G120D

- High degree of protection IP 65
- Speed control with/without encoder
- Also with integrated position control
- Safety Integrated functions
- Integrated brake control

Central

SINAMICS S120

- Single-axis and multi-axis groups
- Modular / high scalability
- Synchronous and induction motors
- Numerous applications through DCC
- Safety Integrated functions

Gearbox motors

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Servo gearbox motors SIMOTICS S-1FG1

- Based on SIMOTICS 1FK7 with Drive-CLiQ interface
- Compact direct mounting with helical, parallel shaft, bevel or worm gearbox
- Different (holding) brakes available
- Available in axis height AH36 to AH100
- Market usage installation dimensions

Standard asynchronous gearbox motors SIMOGEAR

- High quality -> long lifetime
- High performance due to high power density, high output torque and wide range of gear ratio
- Compactness and reduced weight
- Easy integration due to usual installation dimensions
- Very high energy efficiency with IE3 motors
- Power range up to 200kW

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Safety and Energy

Safety Integrated

Complete and consistent safety program

- From the sensor through to the controller to drives
- Comprehensive service and support
- Support for the application of safety standards

Energy distribution

Failsafe and efficient energy distribution using

- SIVACON switchgear
- SIVACON busbar trunking systems
- SENTRON power switches
- SENTRON multi-function measuring instruments
- SIMATIC PCS 7 powerrate resp. SIMATIC WinCC powerrate

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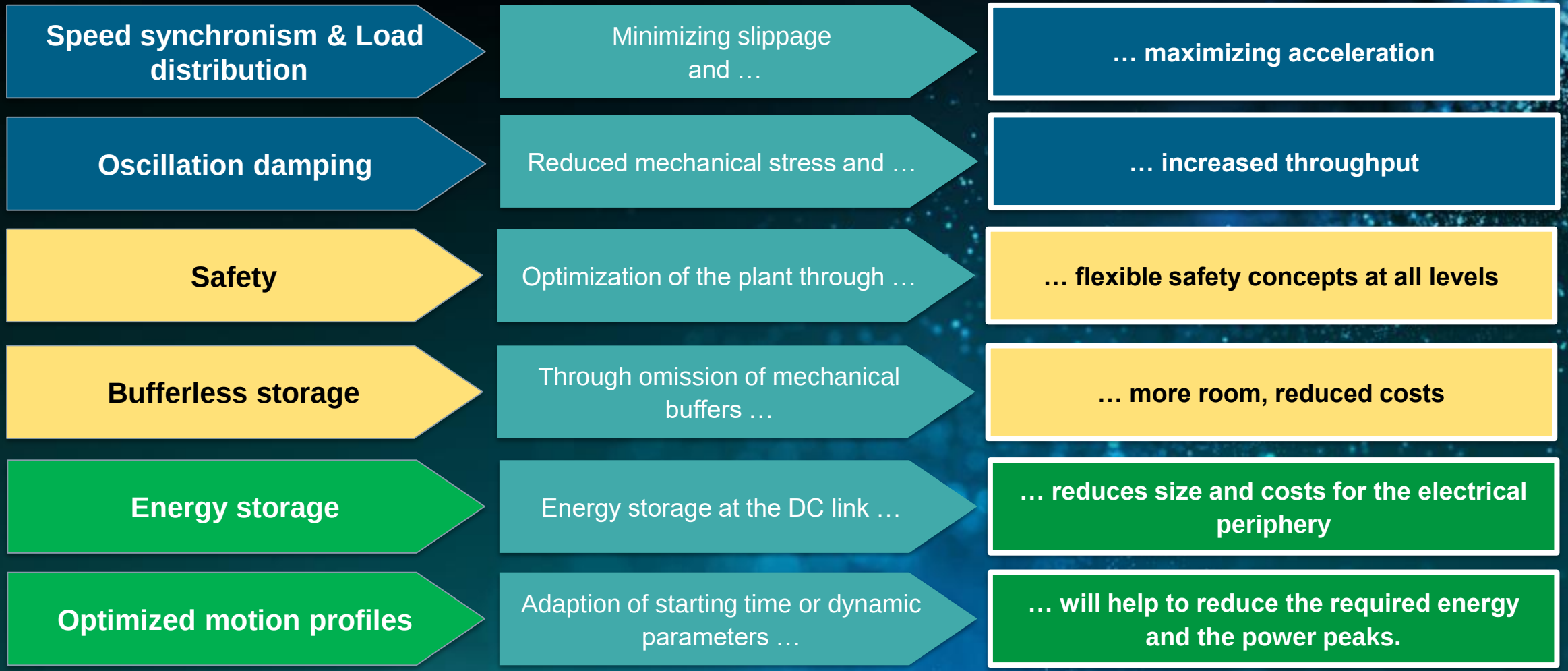
ASRM – value added topics



Speed synchronism and load distribution on ASRM with two driven friction wheels

Speed synchronism and load distribution at ASRMs with two driven wheels for the chassis

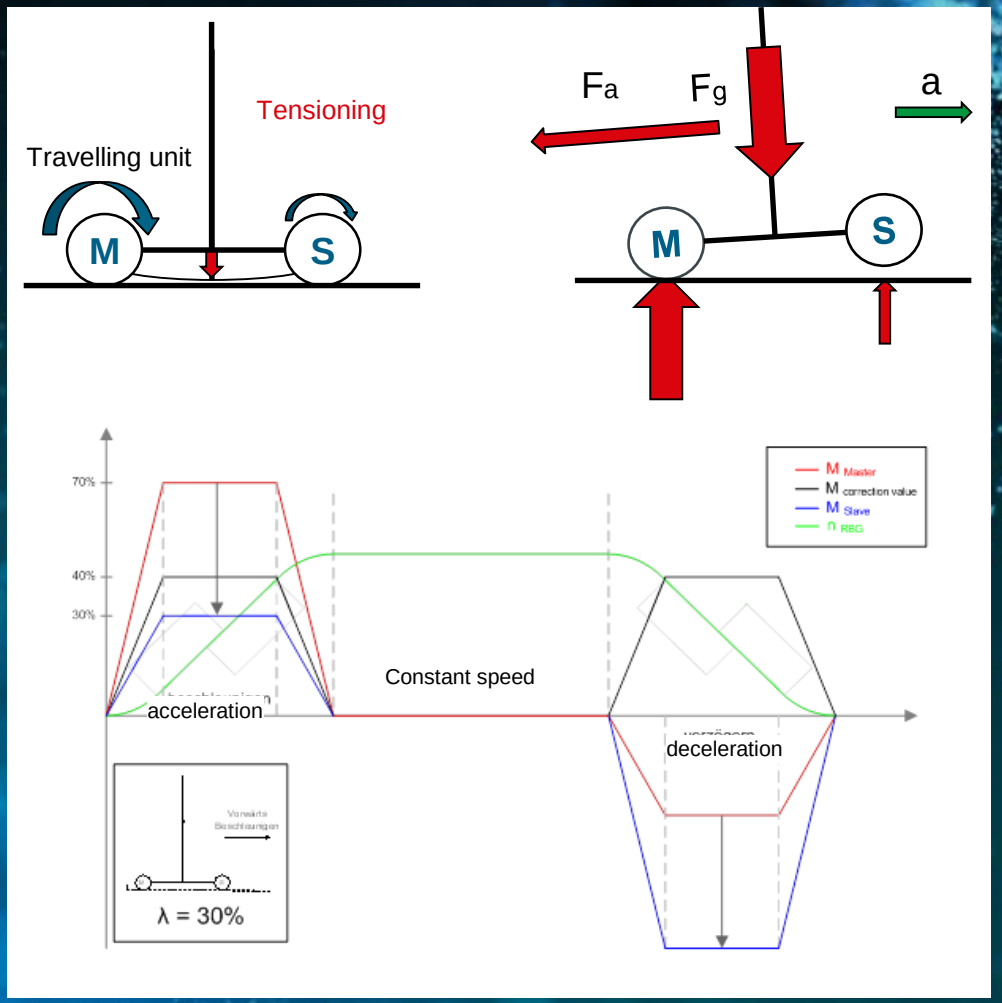
Speed synchronism

- The DCC controller distributes 50% of the load onto each drive (**M**aster/**S**lave)
- Independently of the friction wheel radius
- Additional pretensioning is possible
  → increase the stiffness of the travelling unit
  → improved control dynamics

Load distribution

- The load is distributed onto the two drives depending on the center of mass offset when accelerating or braking
- Has been implemented as precontrol for torque compensation control
- Less wear at mechanically coupled drives
- Is also used for oscillation damping by drive on top of the tower/mast

https://support.industry.siemens.com/cs/ww/en/view/72341566



Oscillation damping

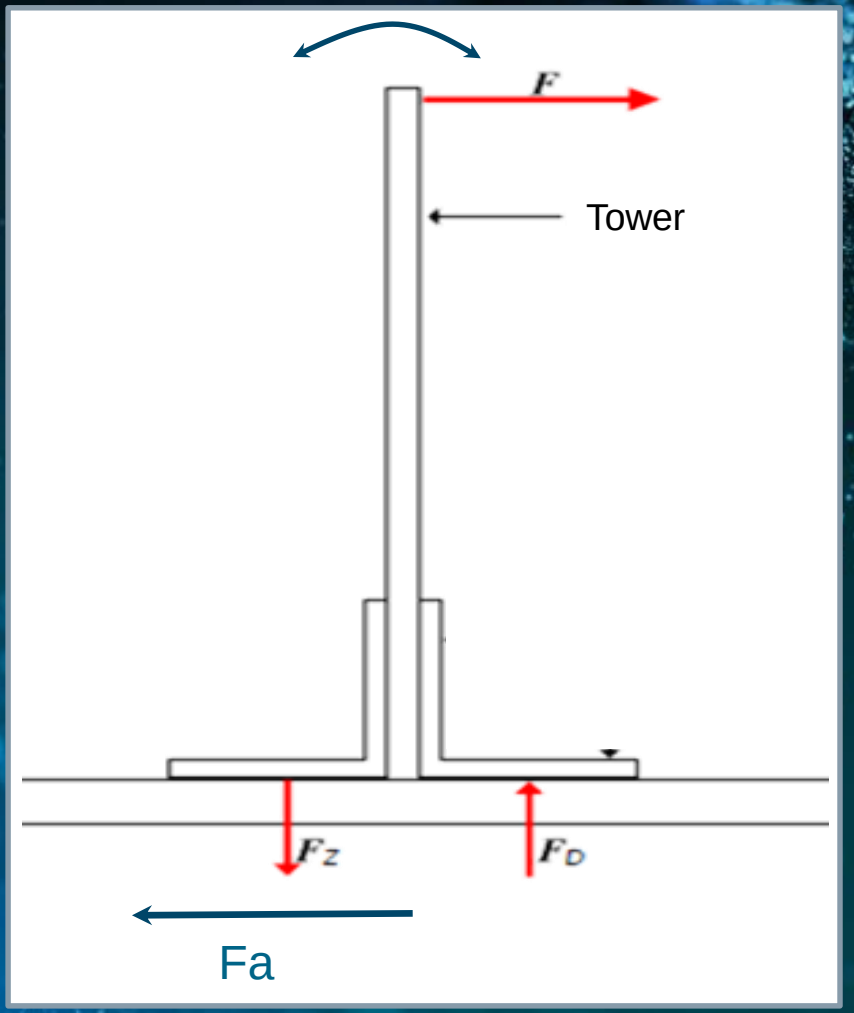
Stimulation of oscillation movement

In general via set point channel

- at acceleration of the ASRM (chassis)
- at deceleration of the ASRM (chassis)
- sometimes also by acceleration and deceleration of the load handling device (movement z axis)

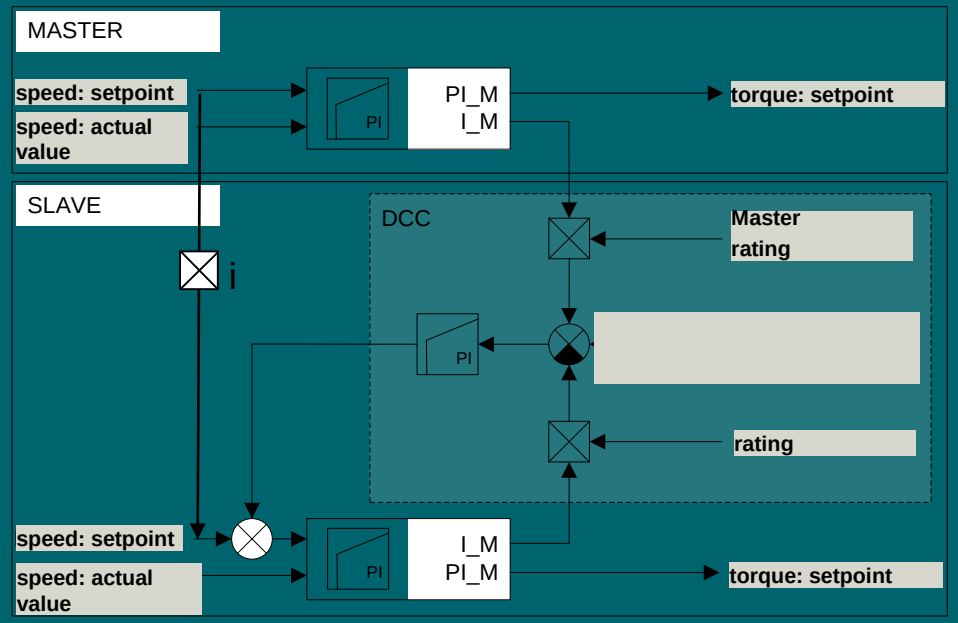
Rarely by “errors” at the actual value:

- jerk in rail
- slip
- damaged friction wheel (e.g. flat spot from braking)



Oscillation damping drive at the tower tip

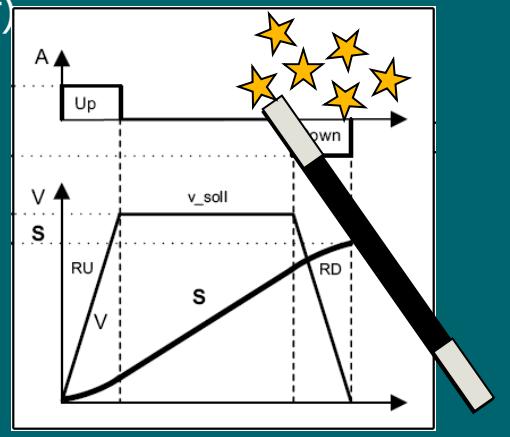
- Damping of the oscillation movement through constant speed closed loop control
- The drive can also take over a part for chassis movement (approx. 30%)
- Runs in speed synchronism with main drive
- Torque compensation control prevents rigging



Oscillation damping as software solution (VibX)

VibX – Vibration EXtinction:

- is an **SINAMICS Technology Extensions** (SINAMICS TEC) software based solution
- integrated in the set point channel of position controller
- Available for basic positioner (Epos) and external position control with DSC (e.g. for TOs of SIMATIC PLC)
- impact merely on set point (position set point filter)
- no stimulation of mechanical natural frequency
- Adaption of the frequency by an override during operation
- no (additional) actuators and sensors necessary
- no mechanical modifications, perfect for Retrofit



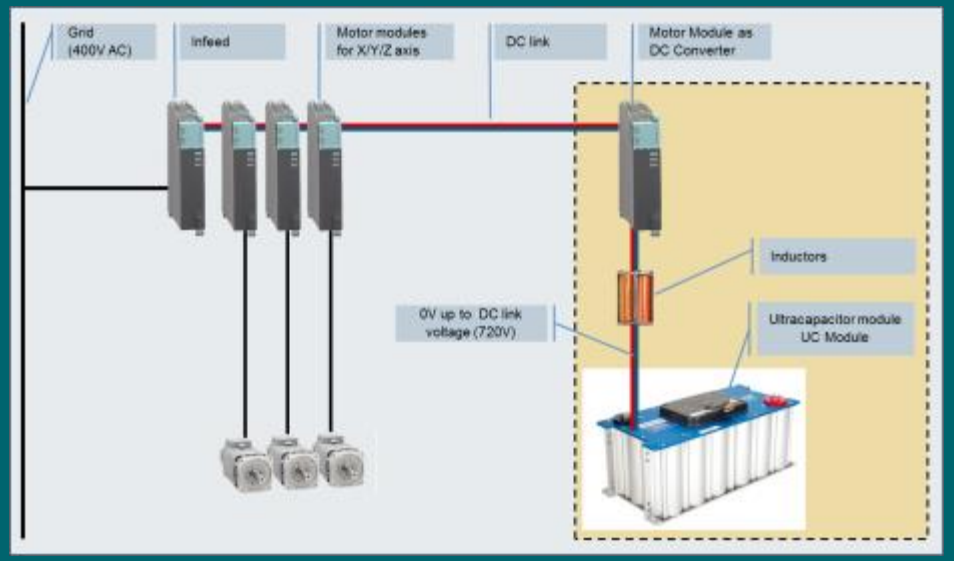
https://support.industry.siemens.com/cs/ww/en/view/109738131

Energy storage at the DC link
Ultracapacitors (UC)

Energy storage at the DC link

- Storage of surplus energy in Ultracapacitors (UC)
- Fast exchange of energy between UC and DC link
- High number of load/unload cycles in short periods (seconds)
- Reduce of infeed power up to 90%* (scalable solution)
  → explicit cost savings at electrical periphery (infeed, wiring, transformer, …)
- Regenerative feedback can be omitted
- Increased availability (at weak grids)
- New concepts for shutdown of the electrical periphery
  - Less wear for the construction
  - Less wear at mechanical brakes; electrical braking still possible

https://support.industry.siemens.com/cs/ww/en/view/109748701



Energy and power optimized moving profiles Results

1. Avoid power peaks

- Higher losses un the area of maximum power peaks
- Higher monthly costs due to higher power consumption from the grid

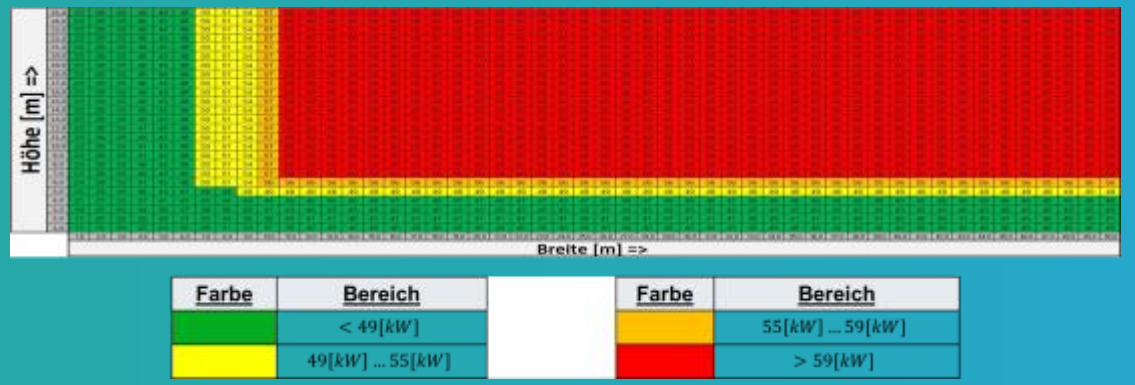
2. Usage of regenerative energy from other drive

- Feedback to the grid is not possible or wanted in every case (e.g. if BLM is in use)
- Improvement of the energy balance for the entire system

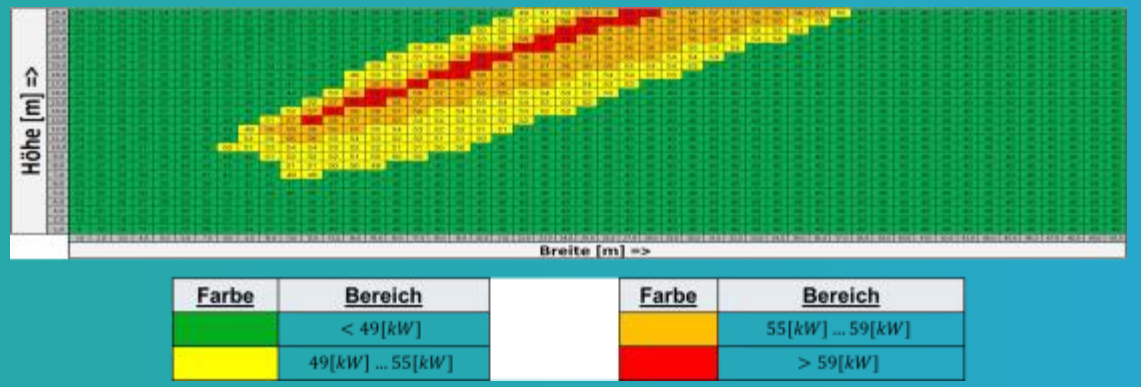
3. Preserve mechanics

- Reduced wear and tear

Electrical power needed before optimization



Electrical power needed after optimization



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XHQ Operations Intelligence

Rapid decision-making for operations excellence

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Agenda

- XHQ Operations Intelligence
- XHQ Application Examples (W&WW, F&B)
- Live Demo

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XHQ Positioning within Siemens Portfolio

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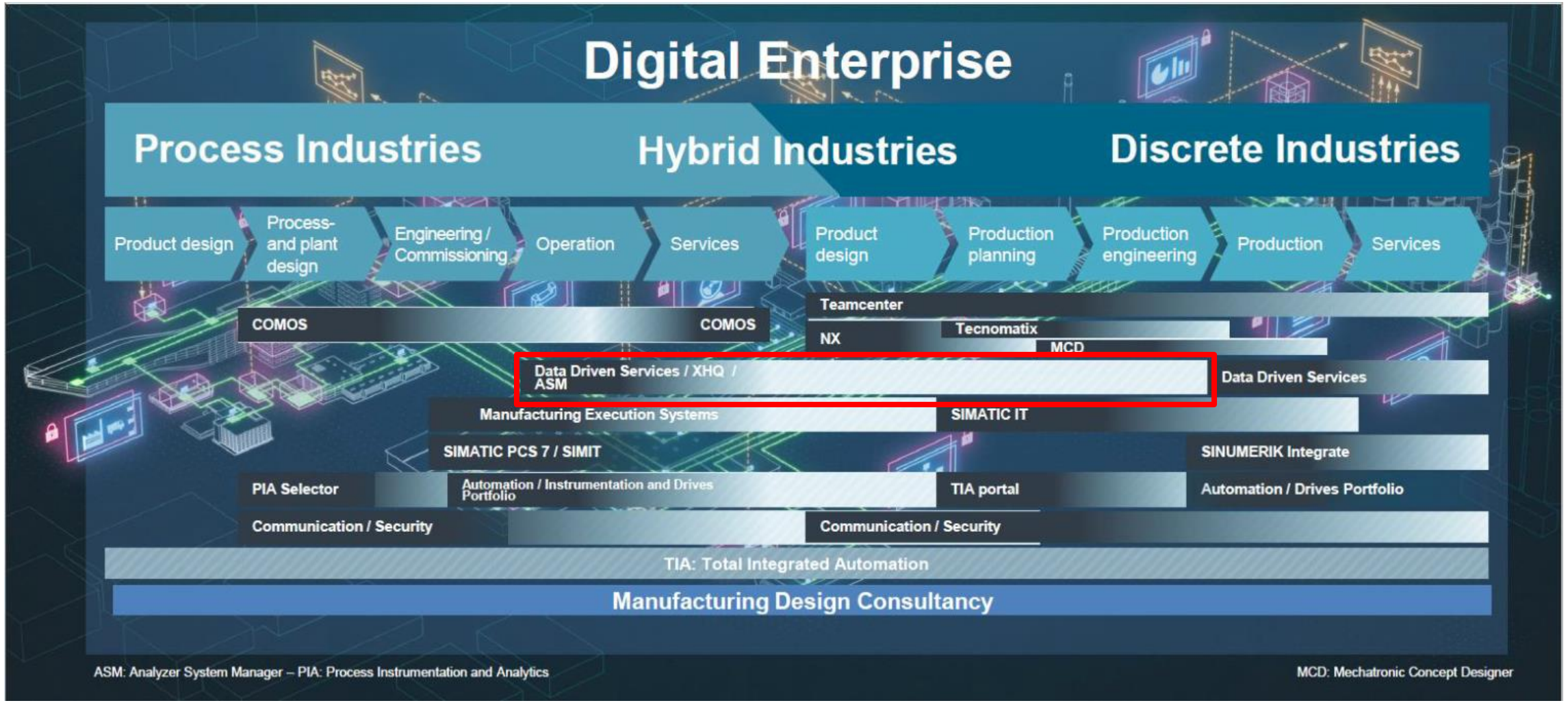

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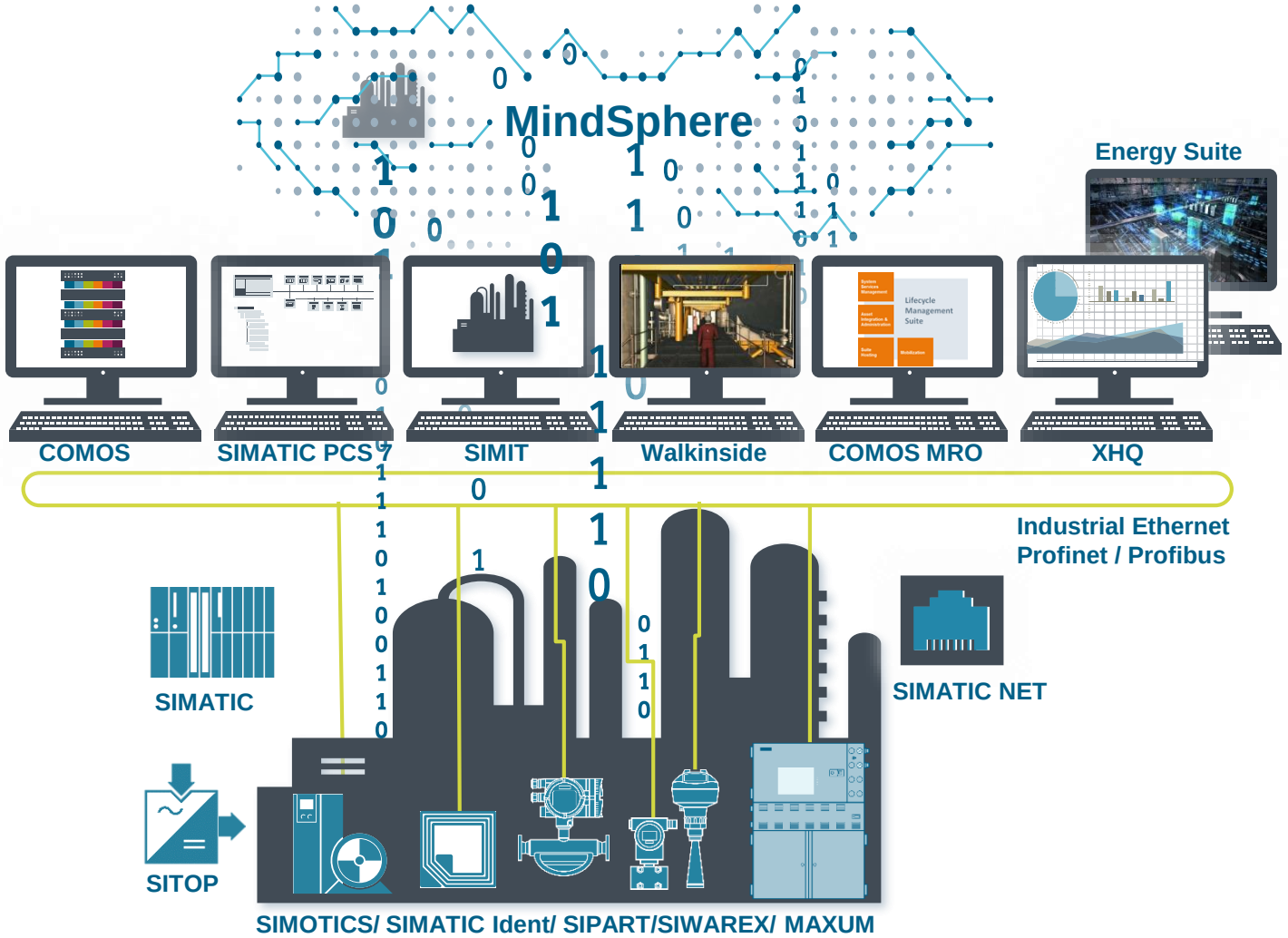
The Digital Enterprise in process industries – Intelligent data through all levels



The Siemens offering for the Digital Enterprise in process industries

- ✓ Field data turn smart in the cloud
- ✓ Optimum digital infrastructure for all requirements
- ✓ Consistent and always up-to-date data across the entire plant lifecycle
- ✓ Comprehensive connectivity
- ✓ Optimal interplay with all levels

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XHQ Architecture

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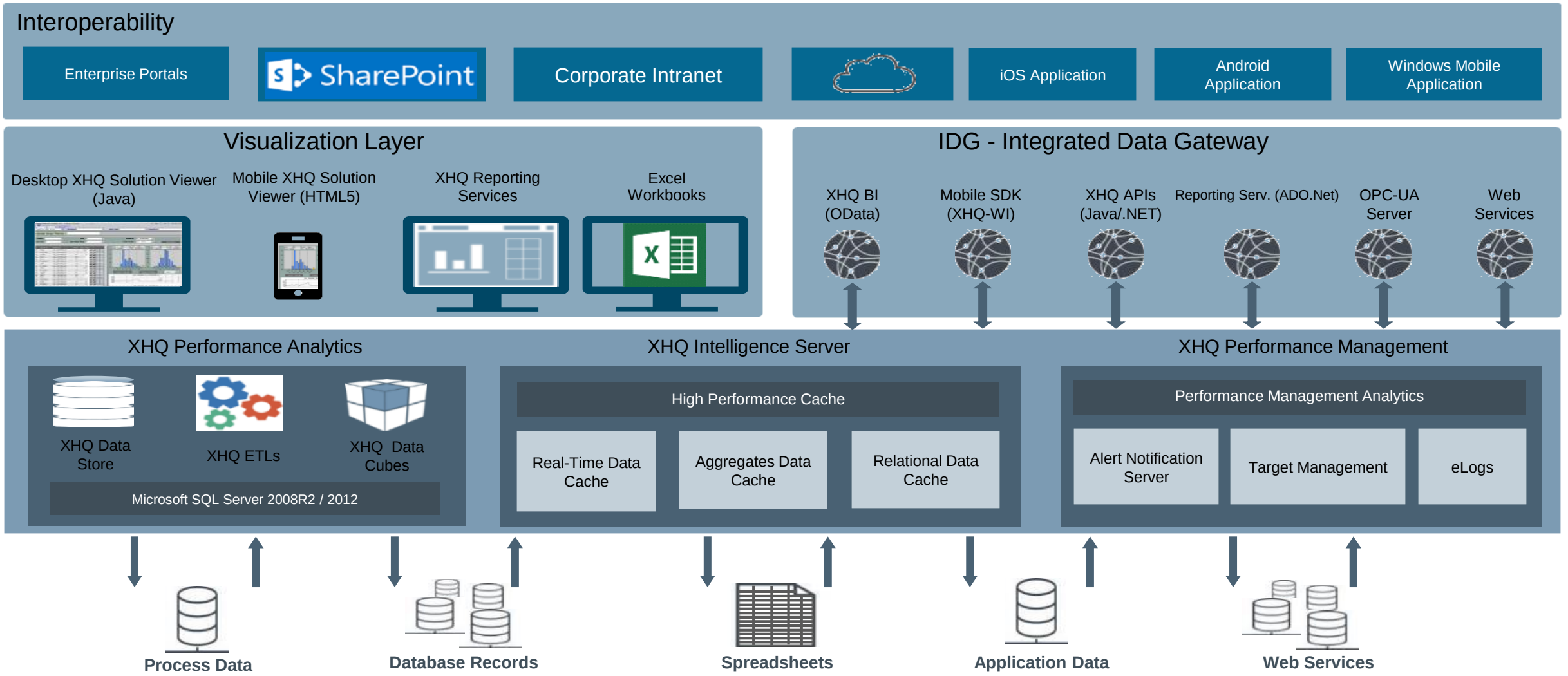

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Enterprise Digitalization – Data Driven Decisions

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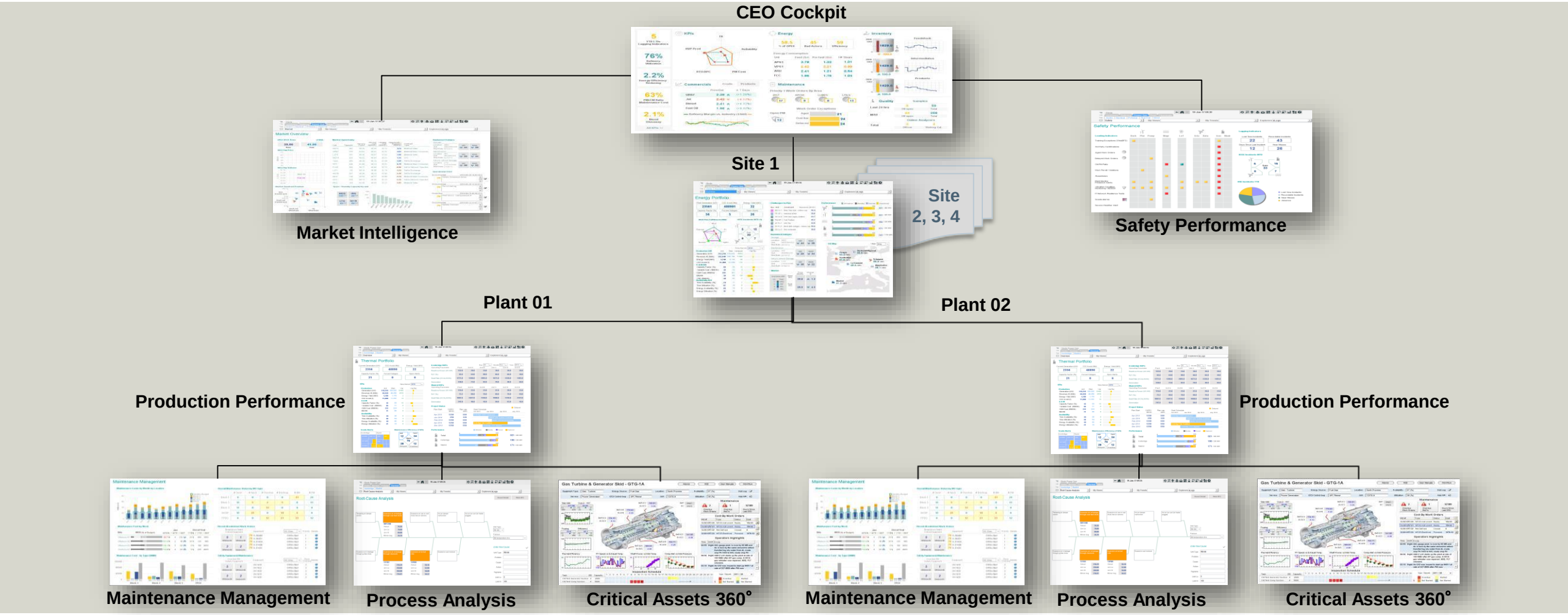

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Content presented in many different formats such as charts, maps, metrics, tables, or schematic views

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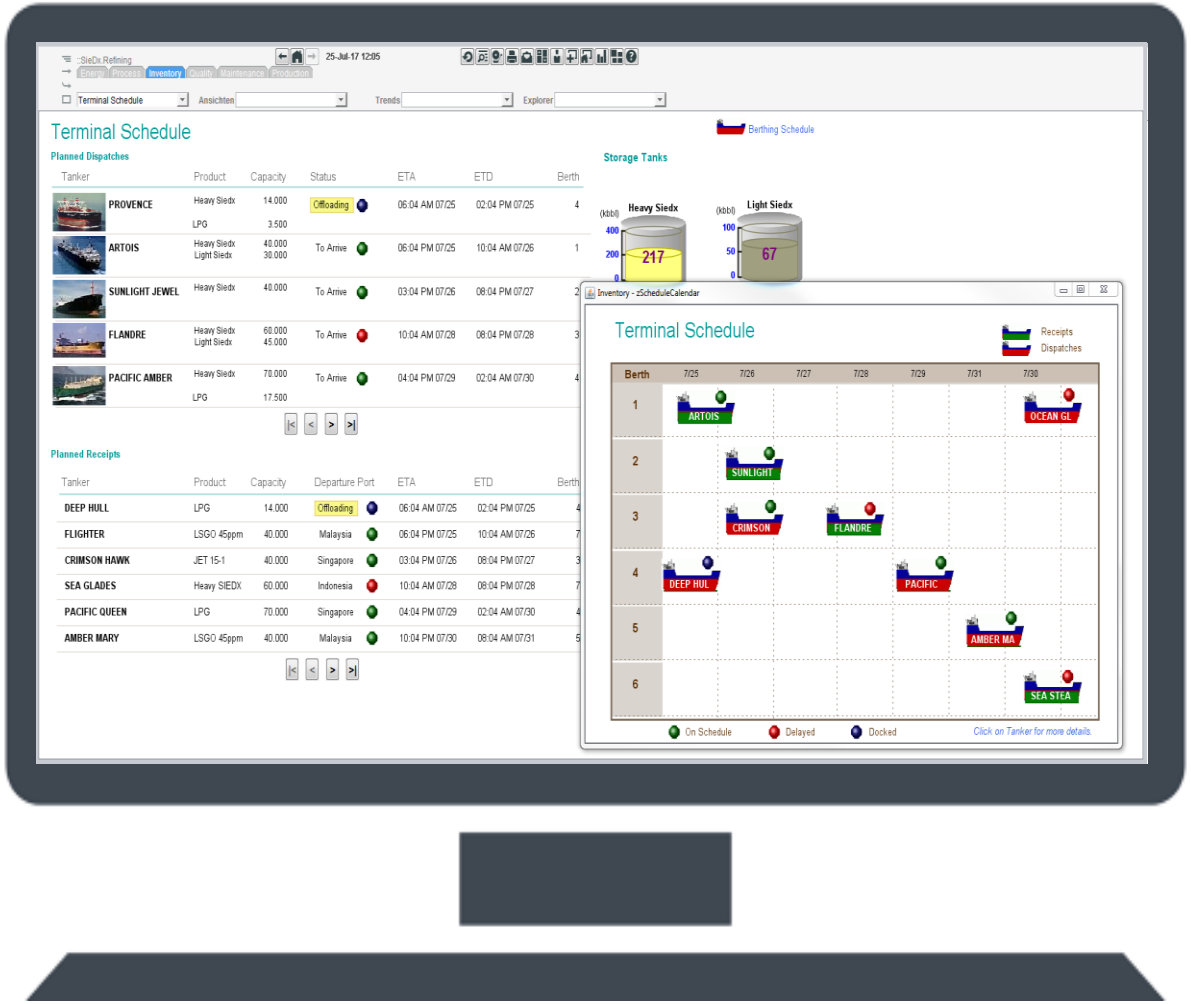

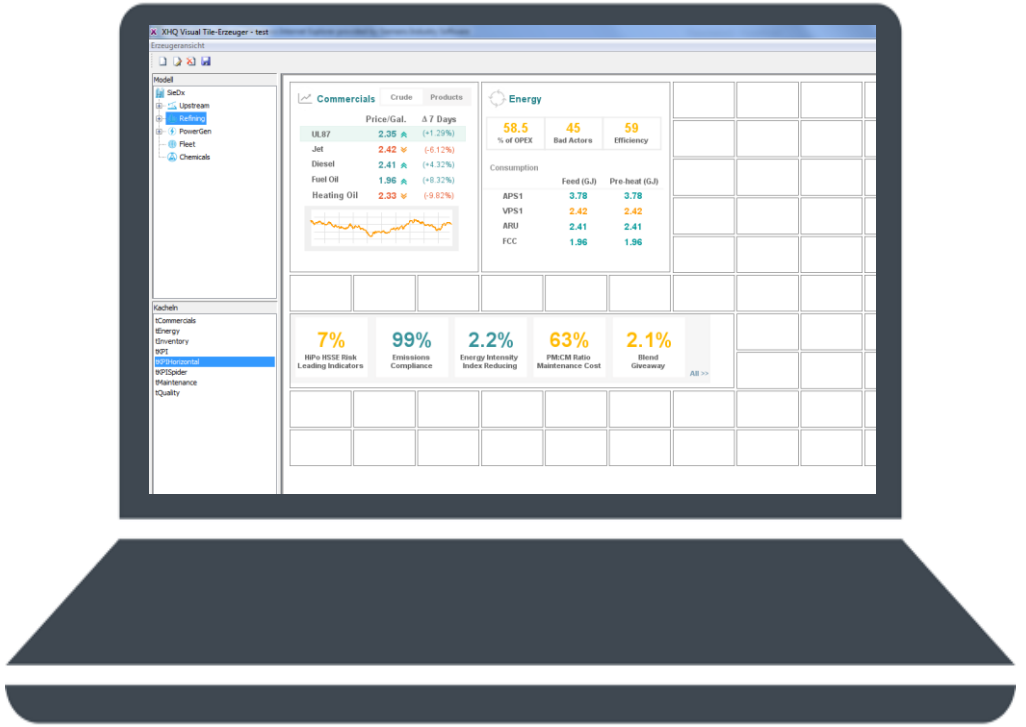

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Mobility – XHQ runs on Mobile Devices

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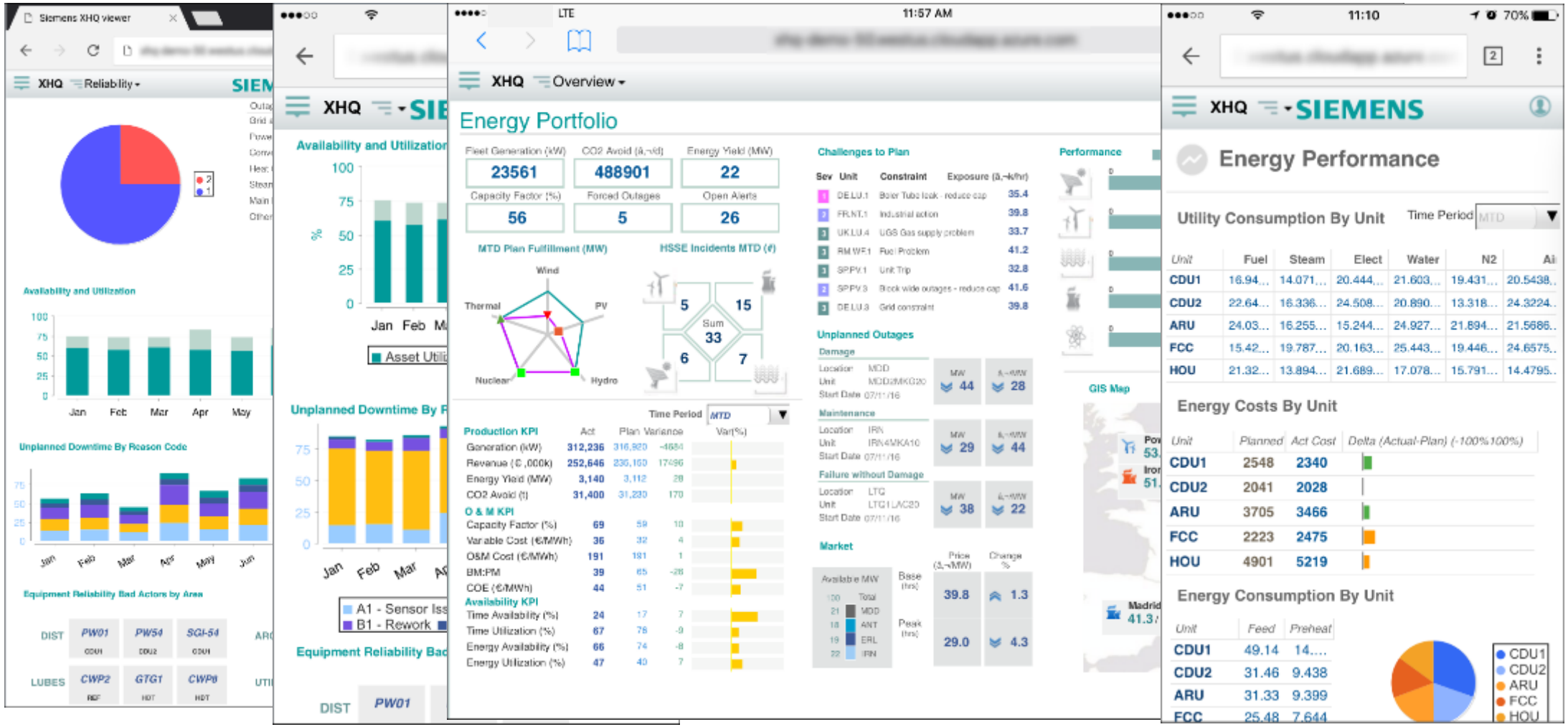

XHQ
Application Examples

XHQ –Plant Solution

F&B Industry

F&B Plant
XHQ Plant Solution landscape

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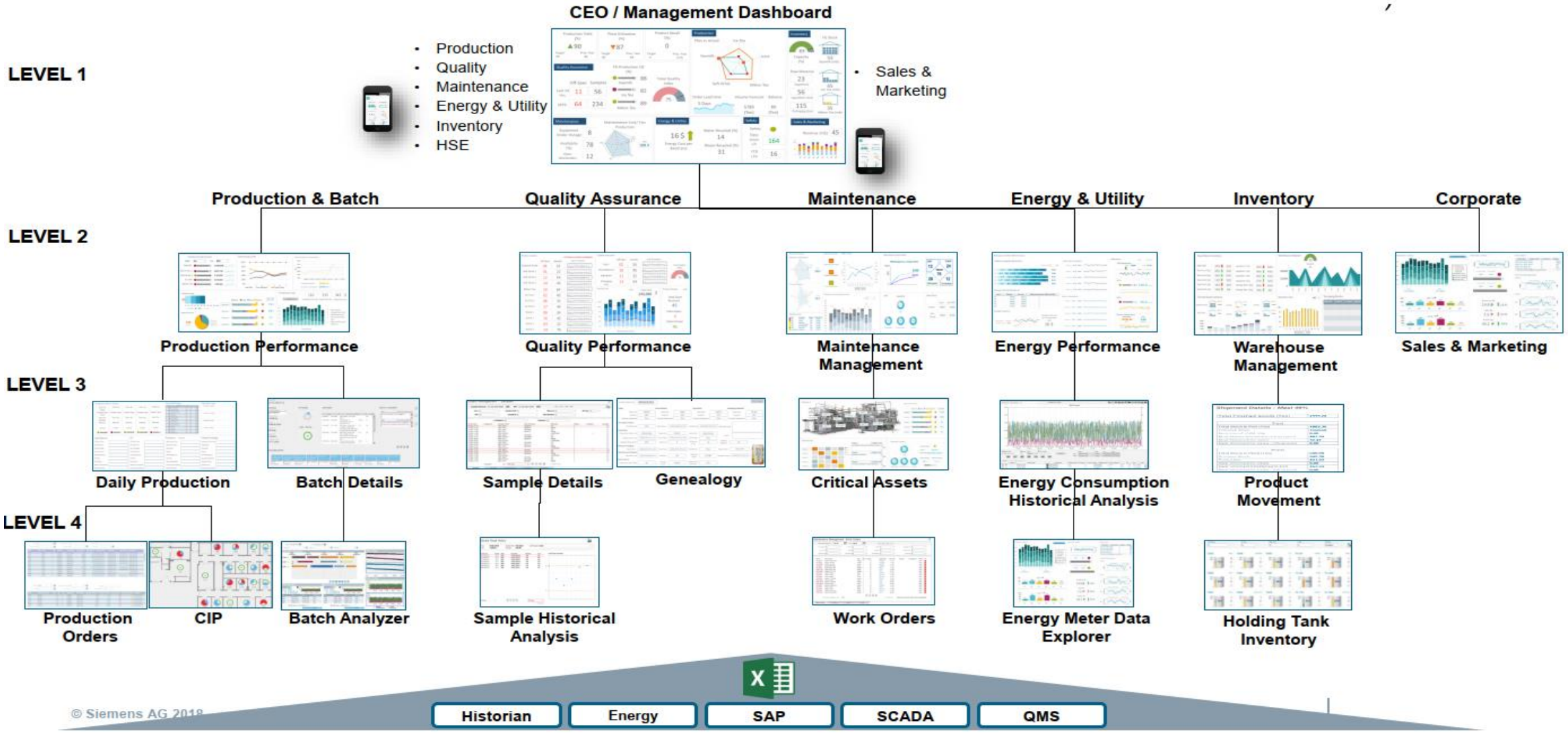

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Management Cockpit

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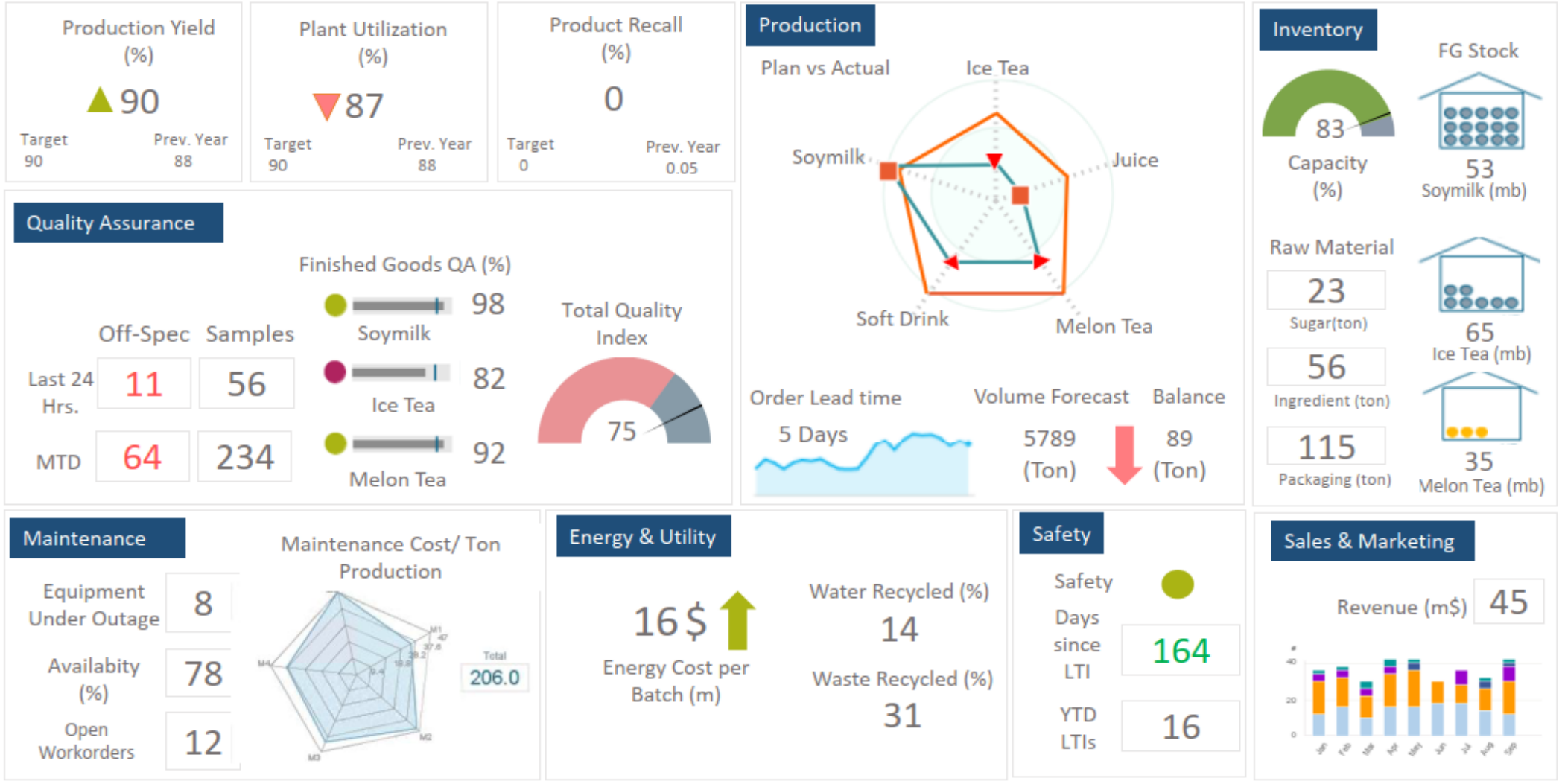
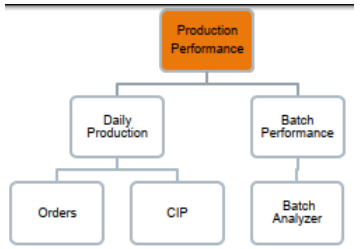


Production Performance Overview



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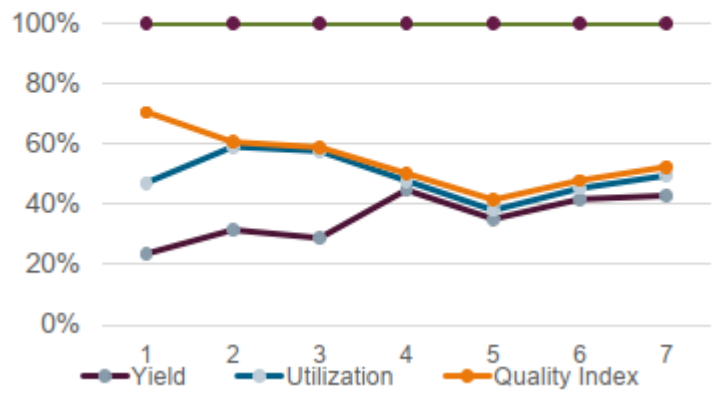
Plant Performance | Daily Performance | Batch Performance

Production Overview by product

Month: Oct Year: 2018

Soymilk	12,409,948
Soft Drinks 1	4,837,728
Soft Drink 2	3,163,095
Ice Tea	2,514,624
Melon Tea	1,060,500

Performance KPIs

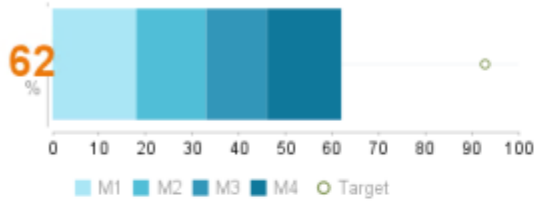


Raw Product vs Production

Overall Production 2560.0 MT

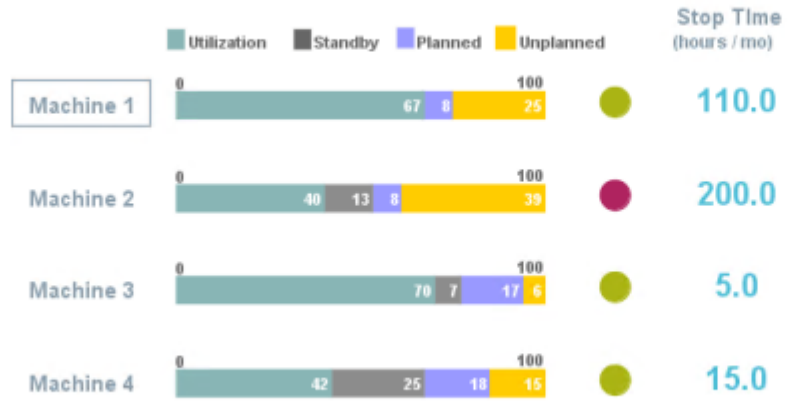
Raw Mat. Consumption 2889.0 MT

Production Capacity



Machine Stop Time

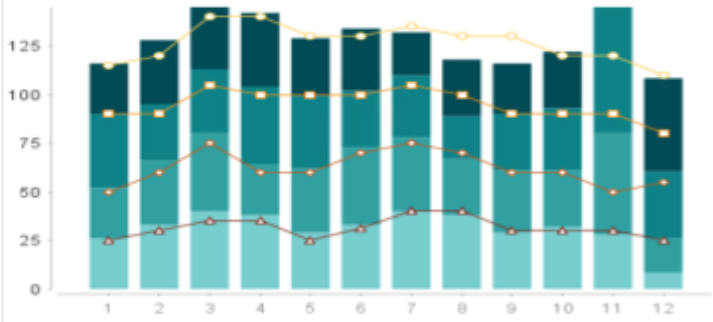
330 hours/mo



Production Cost

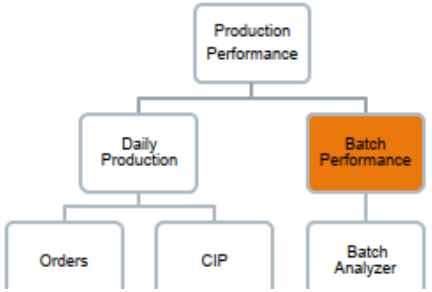
Product %

110	233	343 $
Variable Cost (m)	Fixed Cost (m)	Total Cost (m)



- Raw material
- Energy/Power Cost
- Maintenance cost
- Factory Overhead Cost
- Salary and Personal Expenses

Batch Performance Details



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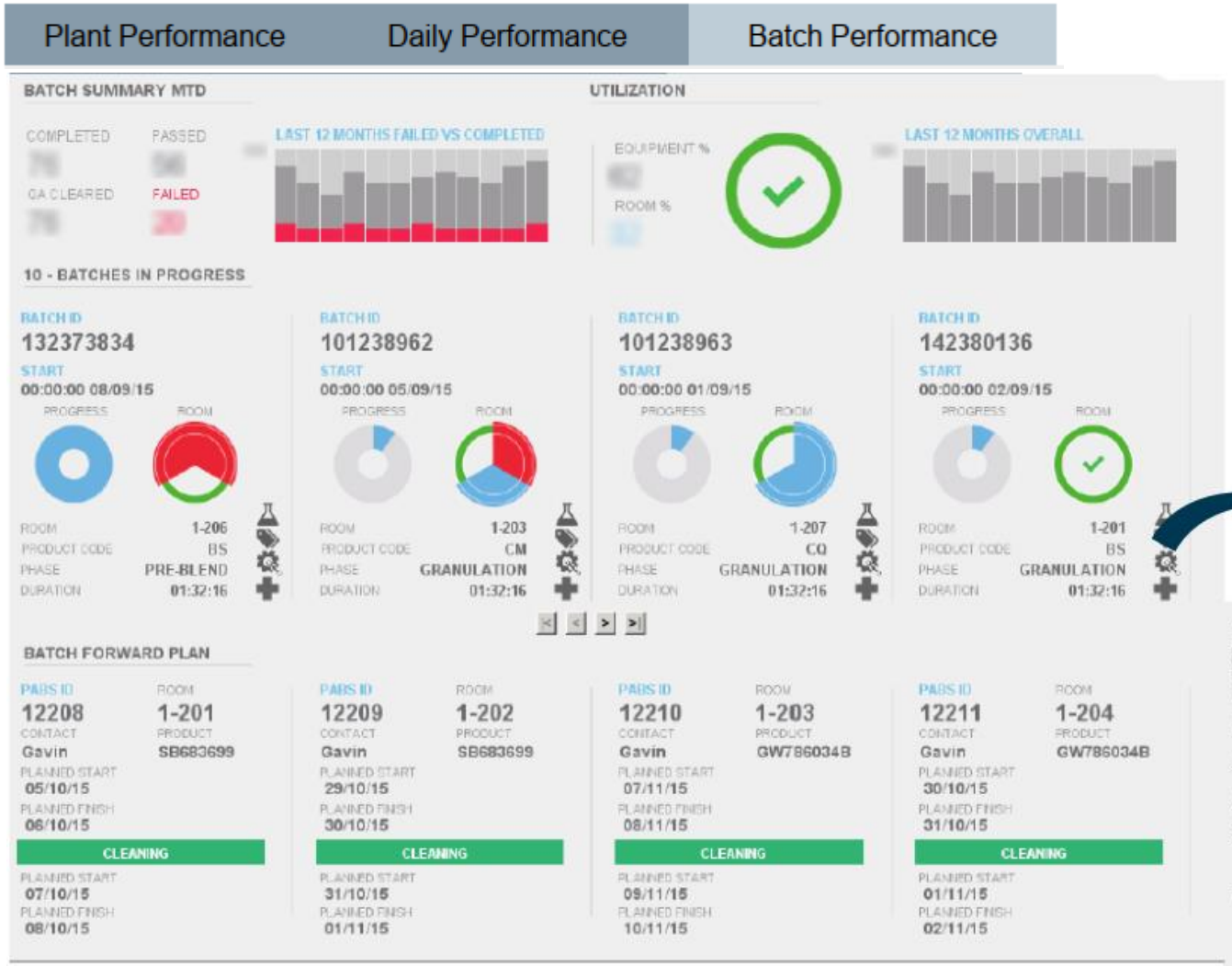
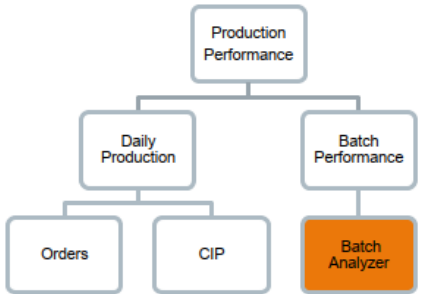


Batch Performance Details

Batch Analyzer



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Plant Performance | Daily Performance | Batch Performance

Start: 07-Jul-2017 09:2 End: 09-Aug-2017 09:

Reactor: Batch: Product:

Batch Time Navigation

09:24 07-Jul-2017 | 15:24 15-Jul-2017 | 21:24 23-Jul-2017 | 03:24 01-Aug-2017 | 09:24 09-Aug-2017

FLOAT1 - A
FLOAT1 - B
FLOAT2 - A

Batch Steps

0:00 66:00 132:00 198:00 264:00

Batch Trends

500 400 300 200 100 0

00:00 00:00 00:00 00:00 00:00

Density Level Temperature Pressure

Batch Details 1

0000000139

Product: K301NF
Reactor: FLOAT1 - A
Start: 03-Jul-2017 02:01
End: 14-Jul-2017 02:01

Step	Start	End	Dur(hh:mm)
ValueA	7/3/2017 02:01	7/5/2017 06:49	52:48
ValueB	7/5/2017 06:49	7/9/2017 16:25	106:36
ValueC	7/9/2017 16:25	7/11/2017 21:13	53:48
ValueD	7/11/2017 21:13	7/14/2017 02:01	53:48

Page 1 of 1 Go To:

Duration (hh:mm): 264:00

Batch Details 2

0000000170

Product: S4170
Reactor: FLOAT2 - A
Start: 17-Jul-2017 02:01
End: 28-Jul-2017 02:01

Step	Start	End	Dur(hh:mm)
ValueA	7/17/2017 02:01	7/19/2017 06:49	52:48
ValueB	7/19/2017 06:49	7/23/2017 16:25	106:36
ValueC	7/23/2017 16:25	7/25/2017 21:13	53:48
ValueD	7/25/2017 21:13	7/28/2017 02:01	53:48

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Duration (hh:mm): 264:00

Step Details

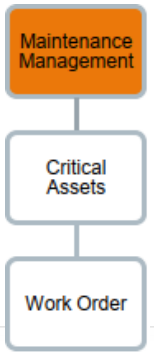
Batch: 0000000170 Product: S4170
Step: ValueB
Reactor: FLOAT2 - A
Start: 19-Jul-2017 06:49
End: 23-Jul-2017 16:25

Function	Start	End	Dur(hh:mm)
Step 04	19-Jul-2017 06:49	20-Jul-2017 18:01	36:12
Step 05	20-Jul-2017 18:01	22-Jul-2017 05:13	35:12
Step 06	22-Jul-2017 05:13	23-Jul-2017 16:25	35:12

Page 1 of 1 Go To:

Duration (hh:mm): 105:36

Maintenance Management



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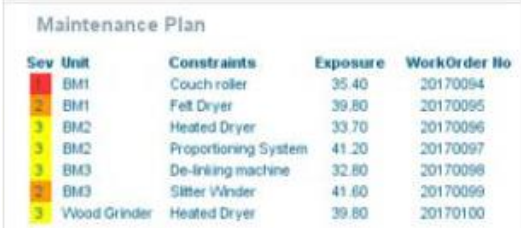
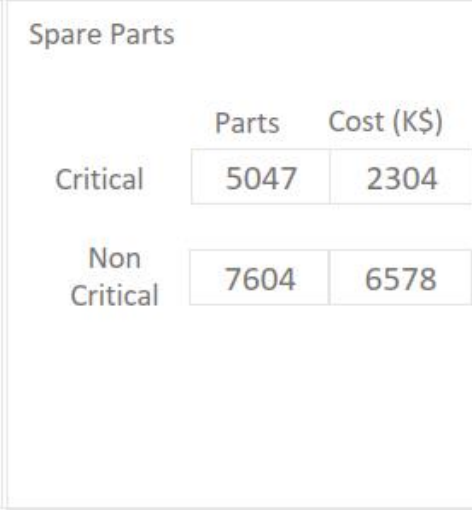
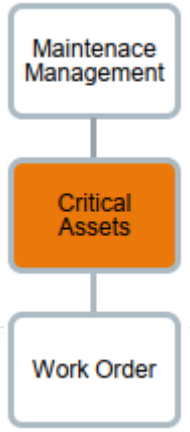




Critical Asset Monitoring



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XHQ in W&WW

Unrestricted © Siemens Vietnam 2019

Water dedicated solutions – self configurable

SIWA Water Management Cockpit - XHQ

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CEO / Management Dashboard

- Water Distribution
- Water Losses
- Overview of Tanks /filling status
- Overview Sewage Plants
- Overview Pump stations
- Energy Consumptions
- Supply reliability

- Spillovers
- Burst and Leackages

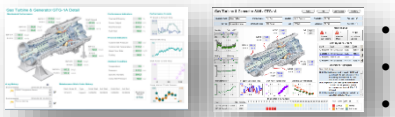
Safety & Environment

Water Distribution Networks

- Geographical Overview
- Smart Meter Data / consumption
- Supply and Demand Curve
- Billable Water consumption
- Non billable / Water losses
- Energy consumption

Sewage / Reclamation / Treatment Plants

360° Asset Critical Monitoring



Asset 01 Asset 02

- Supply & Demand curves
- Spill overs
- Water Quality
- …
- ….

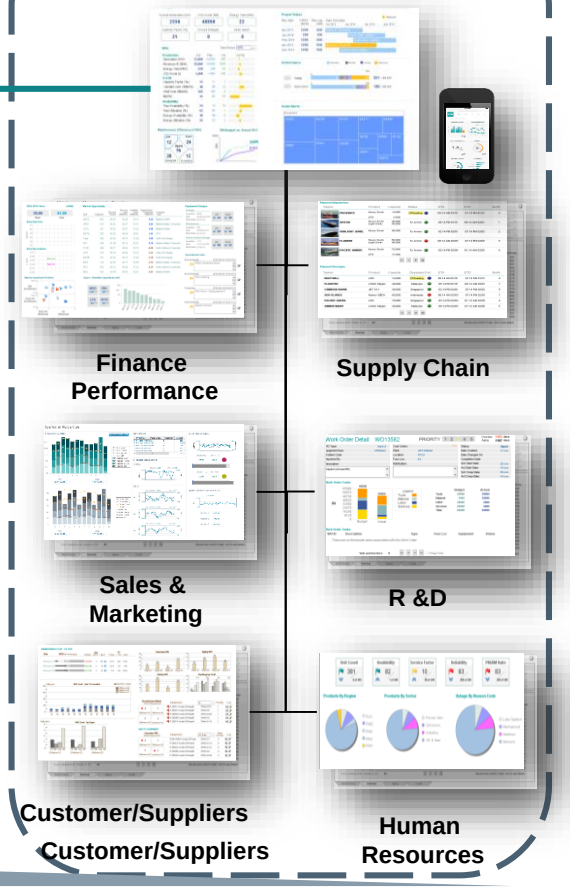
Pump Station

360° Asset Critical Monitoring

Asset 01 Asset 02

- Energy consumption
- Maintenance schedule
- Electricity tarrifs

Corporate



Control Systems | Historians | Documents | QAS | MES | SAP | CRM | Oracle

XHQ Operations Intelligence

Solution Landscape | Water & Wastewater Industries

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LEVEL 1

CEO / Management Dashboard

- Net Revenue
- Water Level and Supply
- Distribution & Losses
- Water Quality
- Energy Consumption & Cost
- Critical Assets

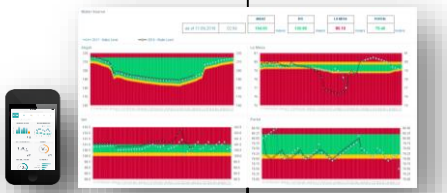
Corporate

Balance (Sales & Revenue)

- Net Revenue
- Top Revenue Account and Status
- Production vs Sales
- Revenue by Grids
- Demand & Supply Analysis
- Water Forecast

LEVEL 2

Water Treatment Plant



- Water Level and Production Curves
- Power Efficiency & Consumption
- Power Cost per Production

LEVEL 3

Inventory & Water Levels

Networking & Supply

Quality Performance

Maintenance Management

Critical Assets

Energy Performance

LEVEL 4

- Chemical Material Inventory status
- Precipitation Level
- Weather Forecast

- Highlight Water Supply and Water Loss Areas
- Water Shortage Areas in last 24 Hours
- Water Leakage Incidents

- QC Sample by Location and Results
- Quality of Drinking & Waste Water
- Contamination

- Top running pumps
- MTBF vs MTTR
- Equipment Health

- Pump Efficiency
- Pump Curve

- Energy Consumption by Pumps
- Pump Schedule & Optimization
- Consumption vs Production

WinCC | Technolog | Indosoft | LIMS | WaterGEM | SAP | CRM | SQL

Live Demo

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