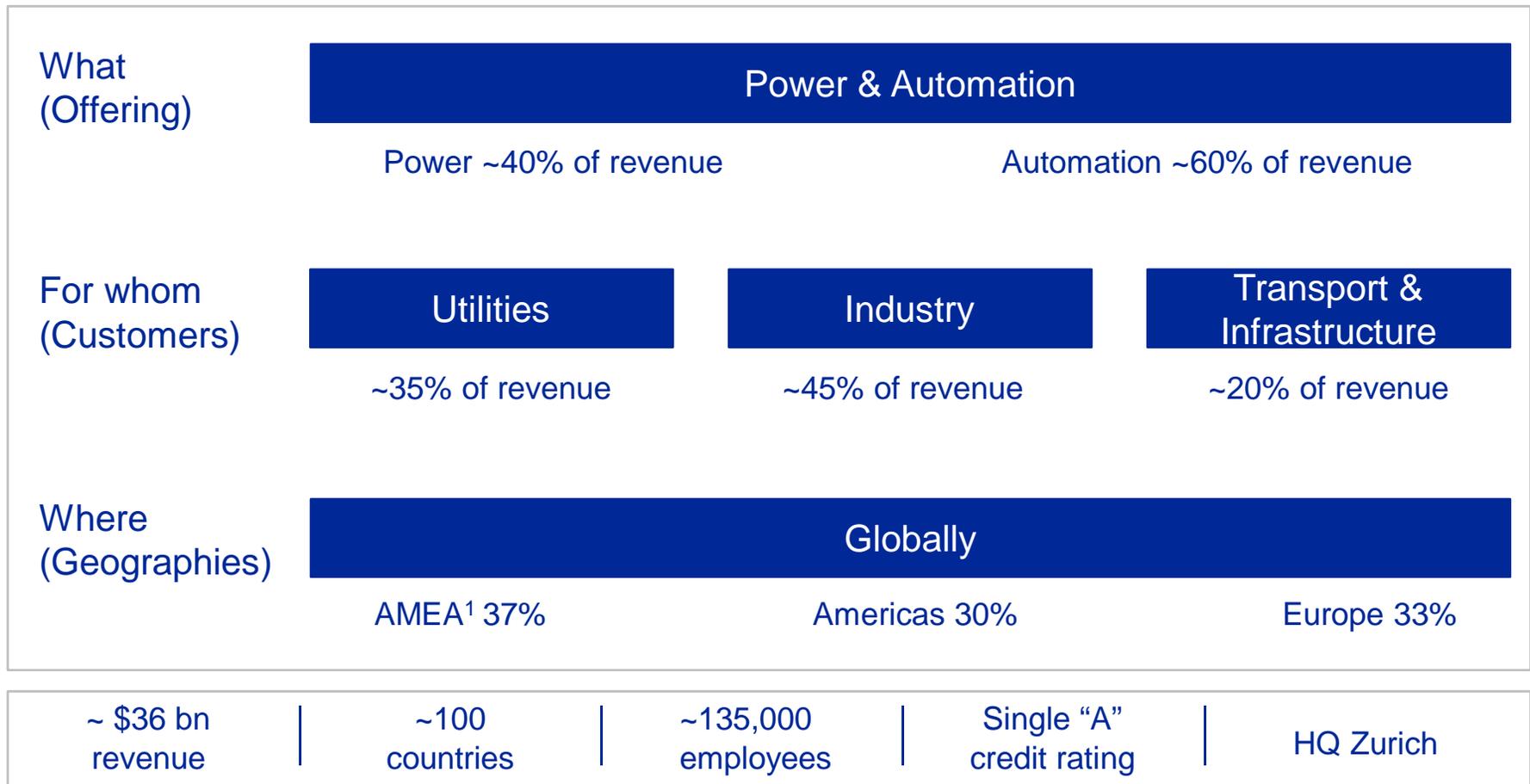


Dr Eduardo Gallestey, Global Technology Manager Process Industries, ABB.

# Optimizing Process Industries in the Digital Era

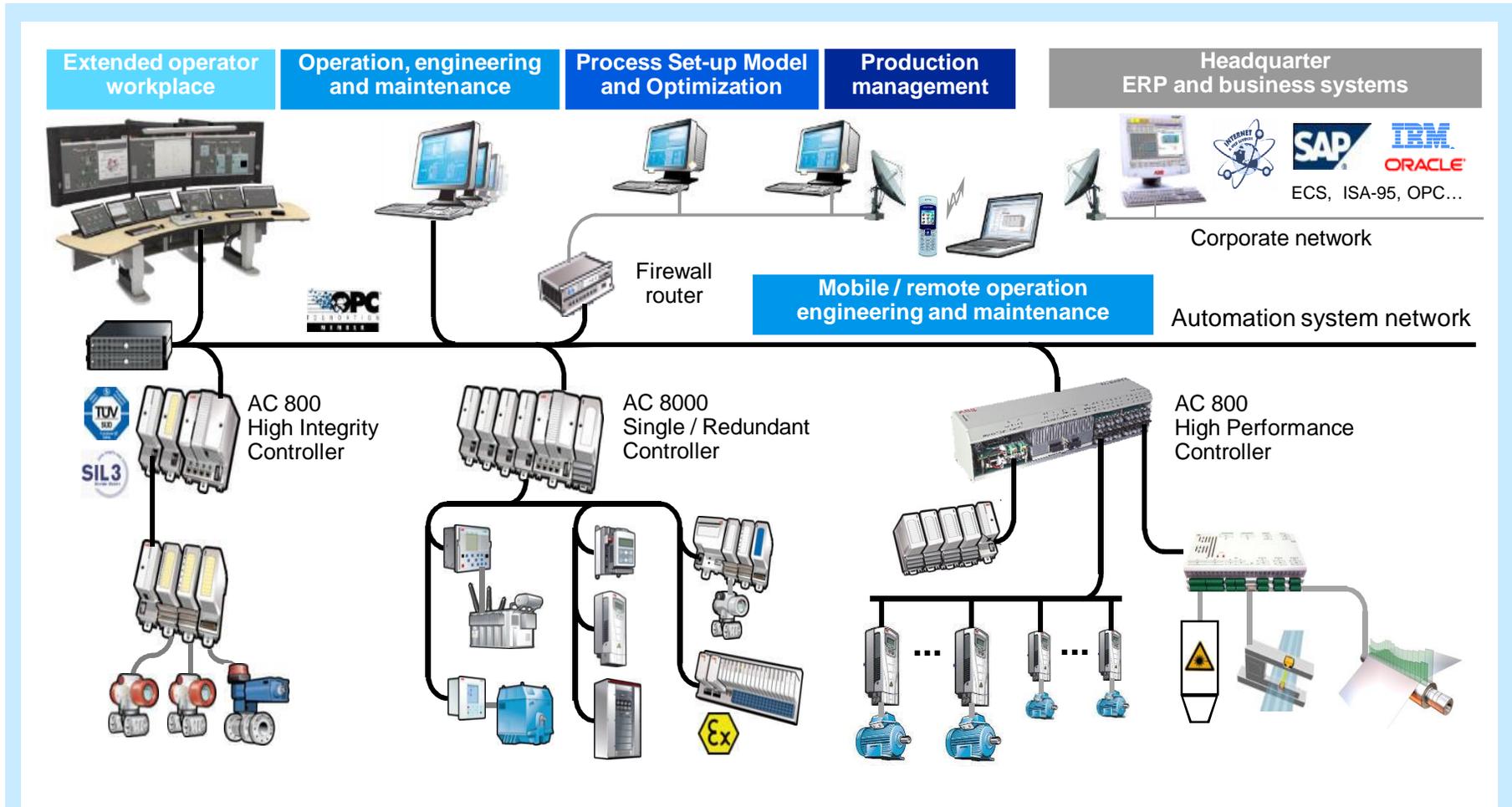
# ABB today

A global leader in power and automation technologies



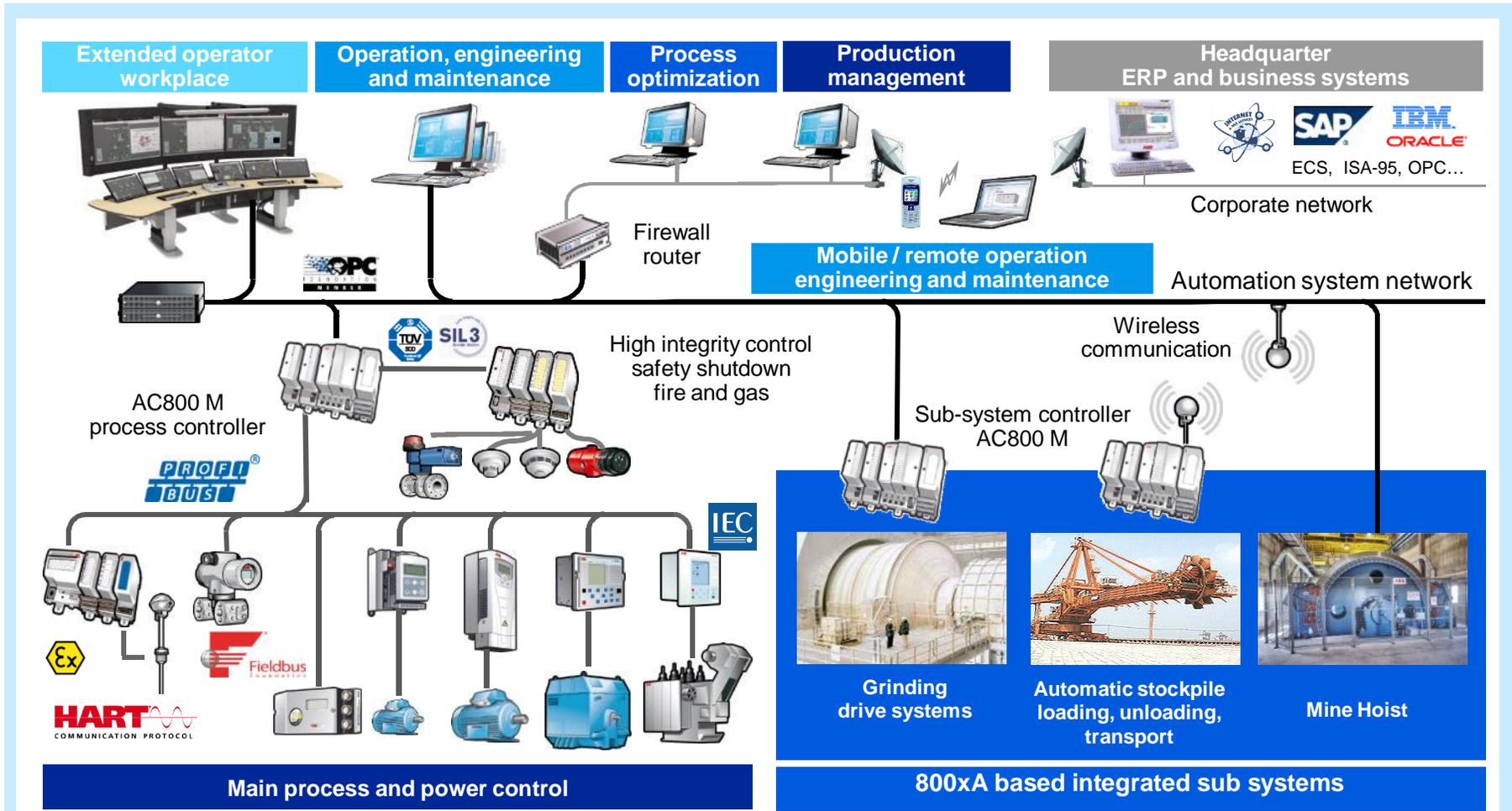
# ABB in Metals – System and Service

## All in One-system approach



# ABB in Mining today

## Fostering a one-system approach



# ABB in mining today

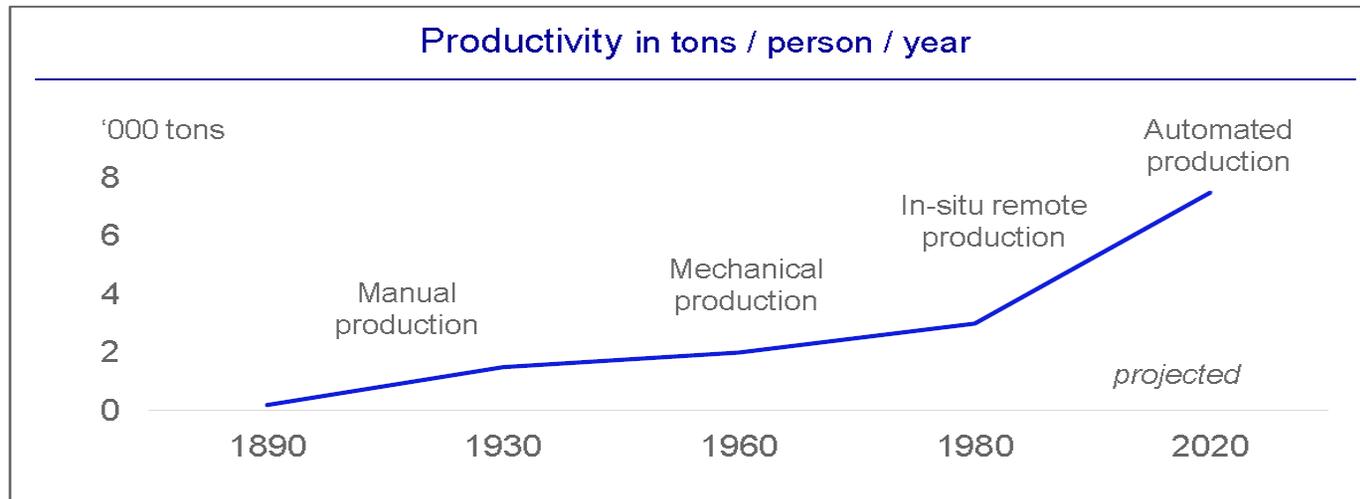


- 1200+ Distributed control system
- 600+ Mine hoist solutions
- 720+ Km of belt conveyor system
- 250+ Bucket-wheel excavators
- 200+ patents into mining industry
- 125+ Gearless mill drives systems
- 80+ Turnkey electrification & automation
- 50+ Countries references

# MineOptimize Business Case

# The mining and metals industry today

## The main challenge is productivity improvement



### Five key mining industry requirements

- Productivity
- Safety
- Sustainability
- Reliability

### Mechanization

- Standardization of processes
- Mechanization means dramatic shifts in production capabilities
- Operation of equipment still requires human interaction

### Automation

- Integrated modeling and planning for higher quality yield
- Greater visibility into parts of the value chain
- More detailed information coming from equipment and plant to enable remote mining

### Optimization

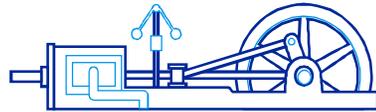
- Reduce total ownership cost
- More responsive demand and supply
- Higher level of automation driven by labor shortages and remote locations
- Limiting bottlenecks by adopting more continuous processes
- High levels of visibility across the value chain and between operations

# The Internet of ...

## Global trend – 4th industrial revolution

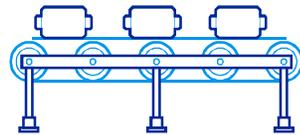
### Industry 1.0 – 1712

First practical steam engine



### Industry 2.0 – 1870

First elevated conveyor belts



### Industry 3.0 – 1969

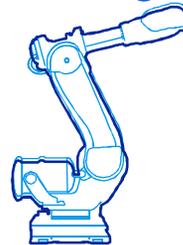
Electronics / software based control



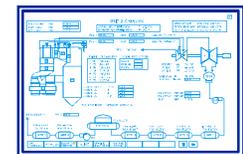
### Industry 4.0 – today and tomorrow

Internet of ...

Things



Services



Internet  
of

People



**ABB leads proactively with new connected offerings**

# The mining and metals industry future

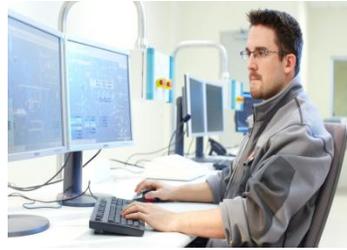
## Attractive changes moving forward

### ... people further away from processes

Reduce cost, increase productivity, and safety by remote monitoring, diagnostics and interventions



The traditional way



Remote monitoring of equipment, preventive maintenance

### ... equipment closer to processes

Move automation and electricity to where the ore is extracted, minimize haulage, and transport



The traditional way



Underground electrical and autonomous equipment

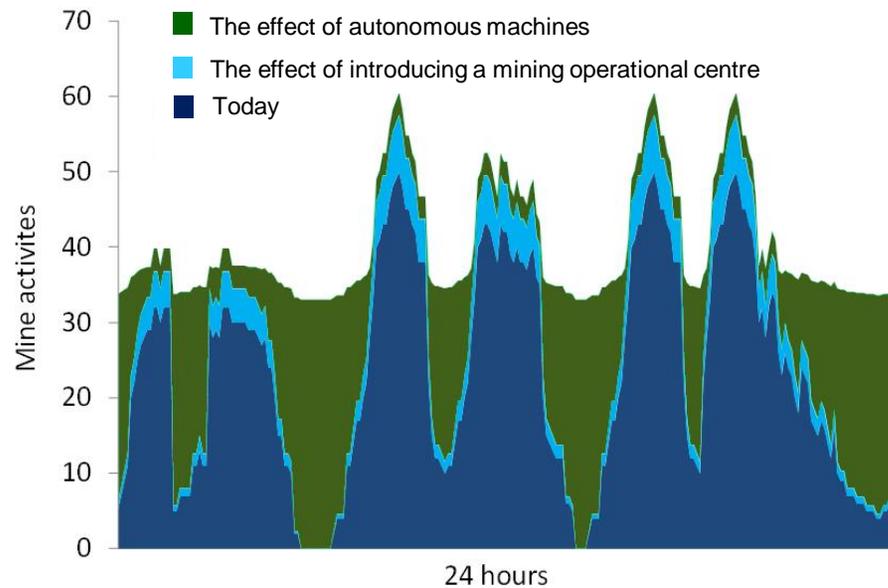
... enabled by integrated operations from pit to port, fully automated, and remotely controlled

### Key features of future mining and metals operations

- Limited human presence in production area
- Continuous production and mechanical excavation
- Central control room
- Continuous availability of ore, people, and equipment

# Integrated Mine Automation Improvement potential

Mining activities during 24 hours



Source: Boliden

## Improvement potential

Autonomous Machines 40-80%

- Work through shift changes
- Work through blasting
- safety

Mining Operational Centre 10-20%

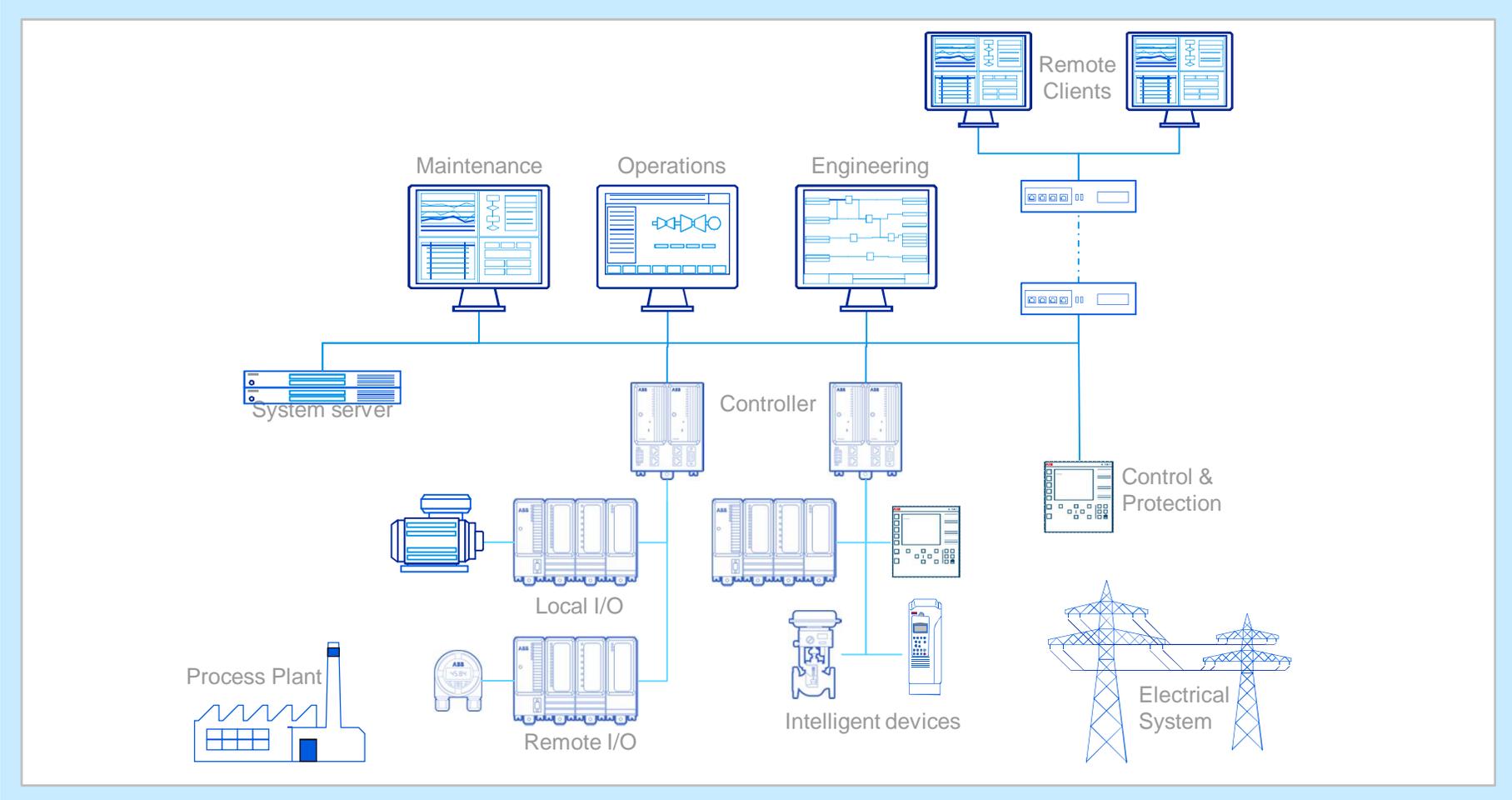
- Improved processes
- Improved face utilization

# MineOptimize

## State of the Art Mine

# Automation systems

## The Intranet of Things



# MineOptimize

## Building blocks enable integrated value chain



# MineOptimize Condition Monitoring

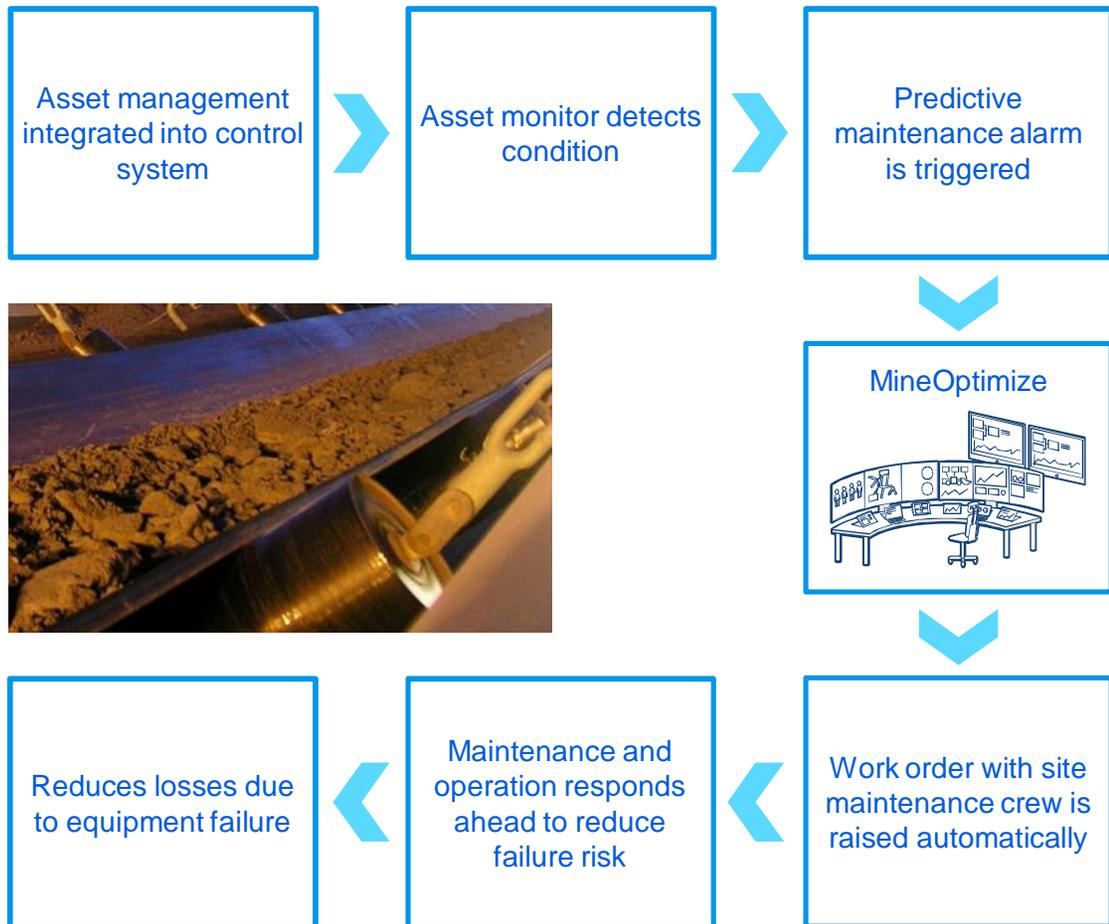
## React to asset condition in real time

### The MineOptimize way

Reduce maintenance costs while improve equipment reliability and reduce unplanned shut-downs

### The traditional way

- Reactive maintenance
- High operating costs
- Unexpected breakdown of critical assets
- Catastrophic impact on production targets



# MineOptimize Advanced Process Control

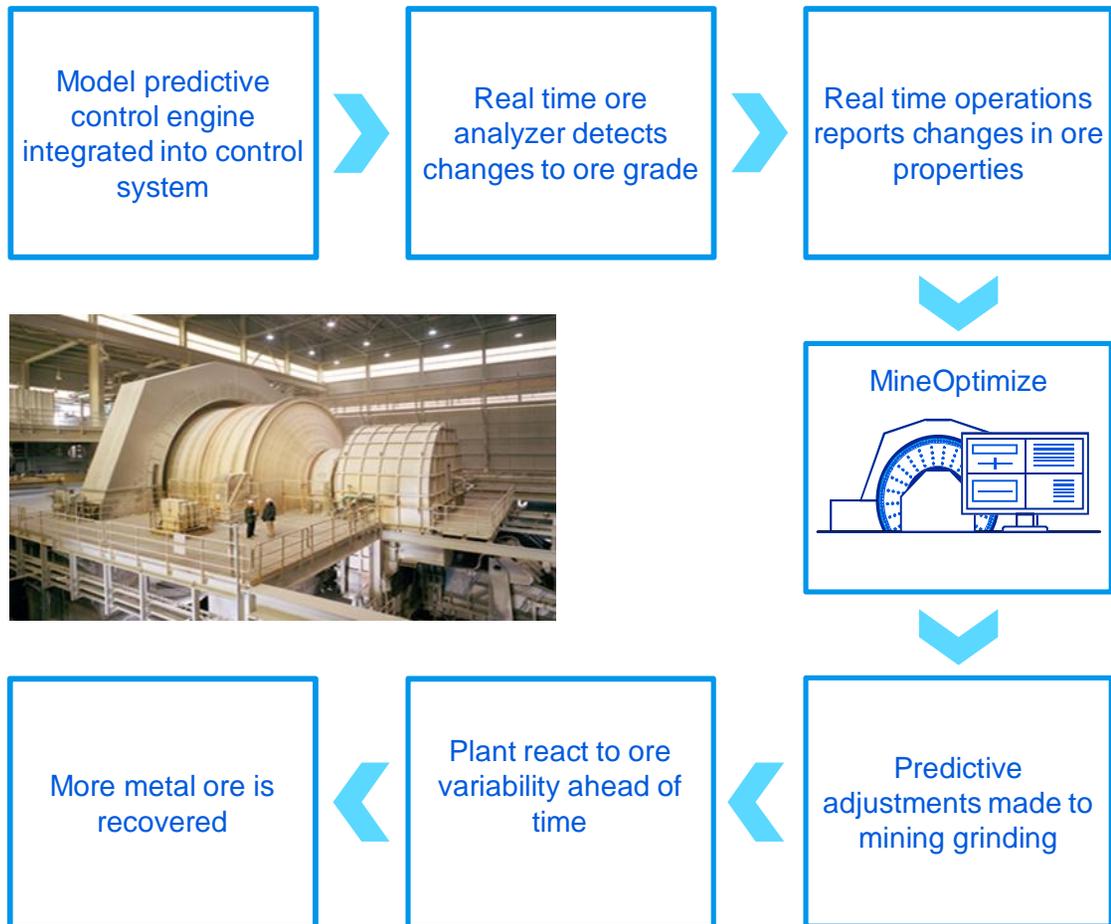
## Process optimization according to ore properties

### The MineOptimize way

Higher equipment utilization,  
increased recovery and  
lower energy consumption

### The traditional way

- No information on upstream downstream impact
- Can't prioritize significant data volumes



# MineOptimize Scheduling & Dispatching

## Just-in-time optimal process management

**The MineOptimize way**

High degree of automation and information access enables safety and production as per plan

**The traditional way**

- No information about the location and status of mobile/fixed equipment
- Cannot prioritize works plans and loading sequences

Personnel, mobile and fix equipment integrated into control system

Mine operators schedule, dispatch and track operations in real time

Mobile and fixed equipment report local conditions, task status and location



Operations team working in the optimum level

Production analyses and statistics can be retrieved on-line

New task plans and loading sequences are calculated and executed

# MineOptimize Information Management

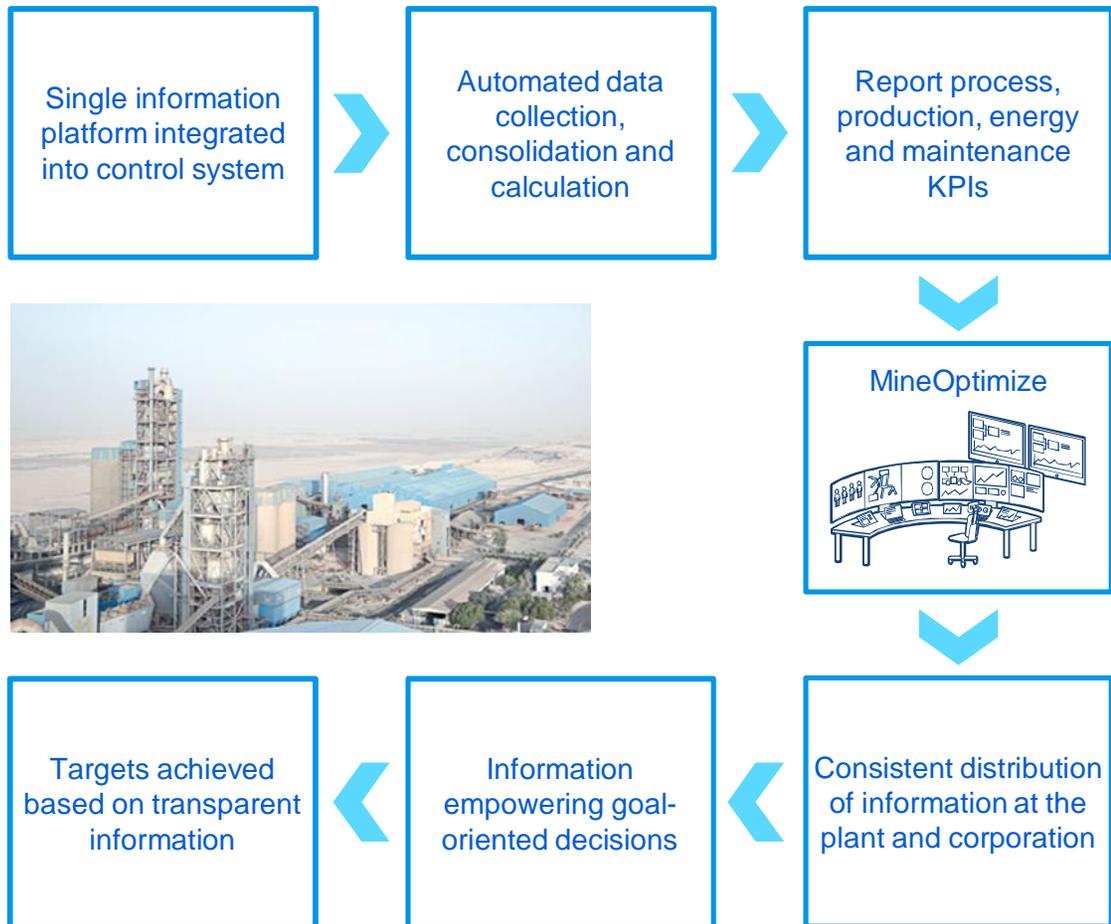
## Make goal-oriented decisions

### The MineOptimize way

Make the right decisions based on consolidated, consistent and transparent information

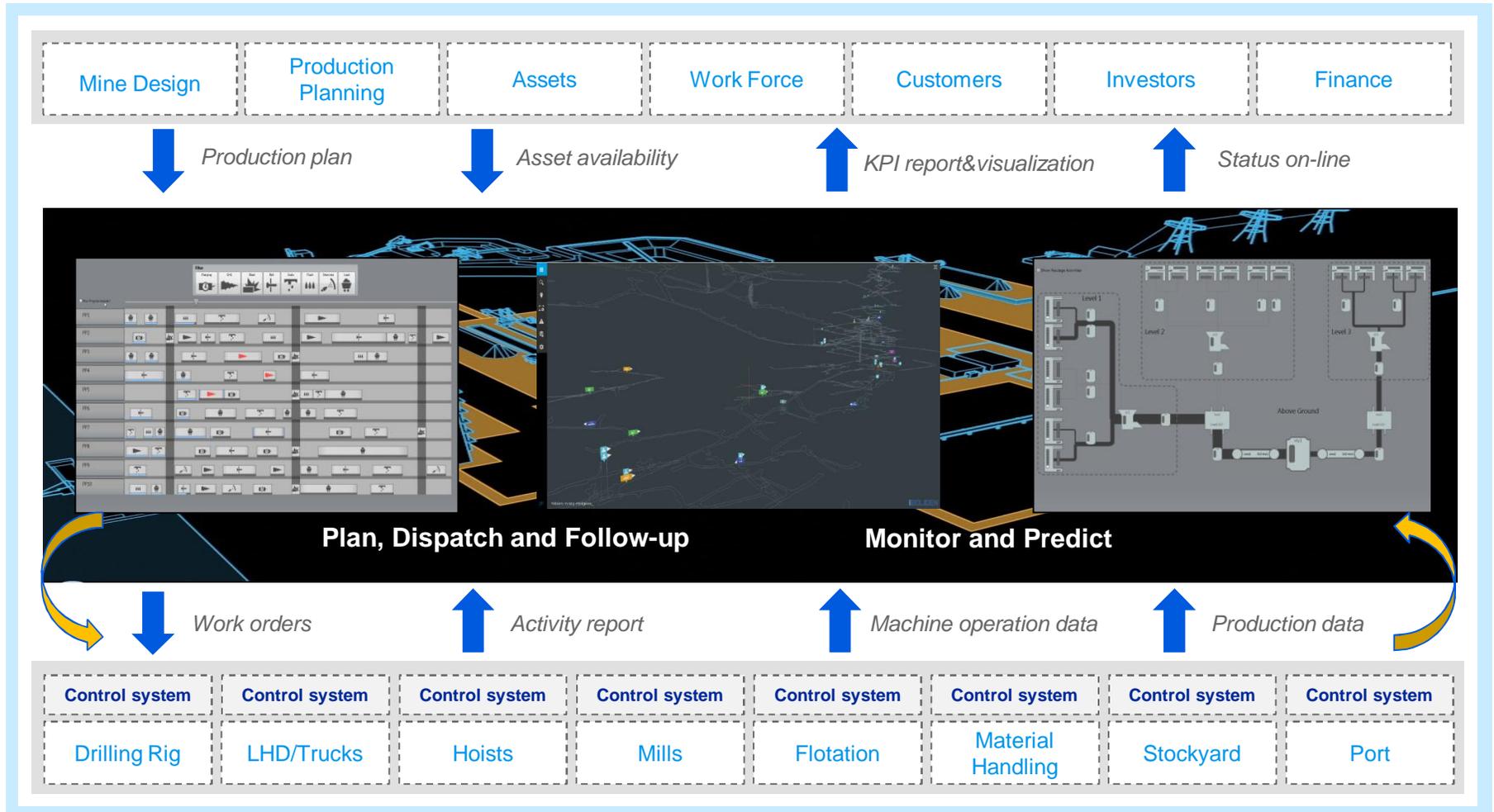
### The traditional way

- Manual data collection and calculations
- Information available in segregated documents
- Difficulty to identify differences among multiple sources and versions



# Integrated Mine Operations

## Ultimate link between real time and medium term goals



# Technology & Business Models Internet of Things, Services and People (IoTSP)

# The Internet of Things

## ABB things

### Things

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The Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data [1]

The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure [2]

**Smart, communicating devices by ABB**

### Robots

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### Motors

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### Switchgear

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### Controllers

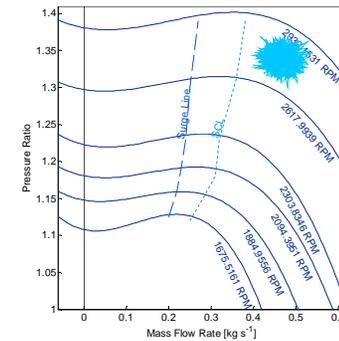
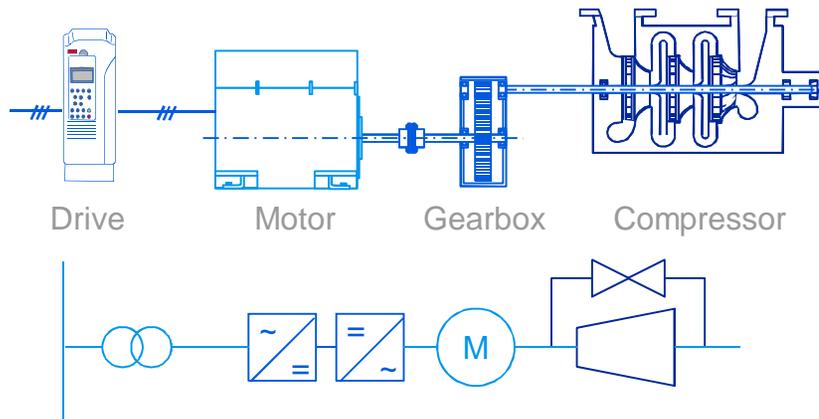
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[1] "Internet of Things Global Standards Initiative"  
[2] [https://hbr.org/resources/pdfs/comm/verizon/18980\\_HBR\\_Verizon\\_IoT\\_Nov\\_14.pdf](https://hbr.org/resources/pdfs/comm/verizon/18980_HBR_Verizon_IoT_Nov_14.pdf)

# Package monitoring

## Monitoring and diagnostic potential



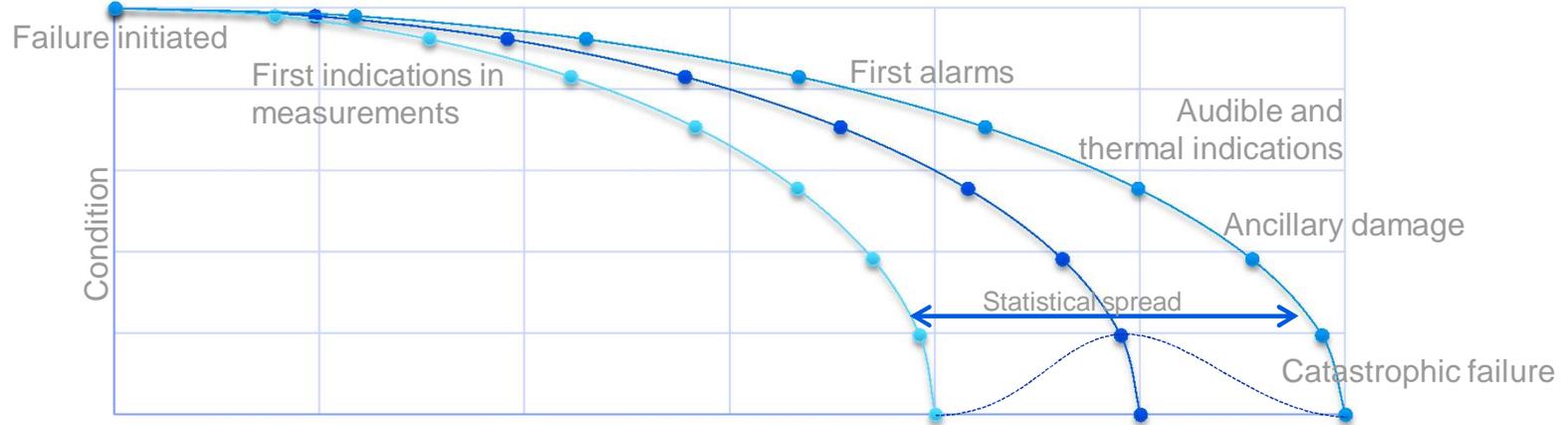
Device health and performance is derived from the analysis of the devices diagnostic data collected

Health or performance can also be observed in measurements from devices along mechanical, electrical, or control connections

**Integrating monitoring data from all sources in the plant including electrical and control systems provide thorough information**

# Fleet management

## Predictive maintenance potential



Good statistical knowledge important for accurate predictive maintenance

Time to react increased with improved predictive methods

Failure patterns observed in the fleet can be identified early in measurements

**Integrating and analyzing monitoring data from a variety of installations of the same device type throughout the industry is essential**

# Optimizing maintenance and operations

## Combining plant view with fleet view

Unique combination of asset focused maintenance optimization vs. plant focused operations optimization

### Fleet view

Data analysis across a fleet of devices installed in different sites

Data analytics potential:

- Predictive maintenance
- Benchmark
- Asset lifecycle optimization
- Usage-driven product improvement

**Focus on maintenance optimization**

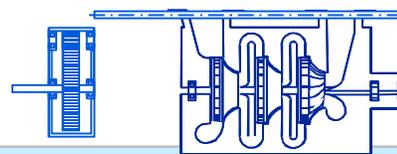
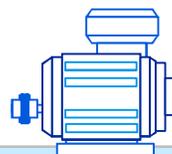
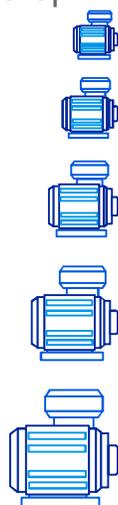
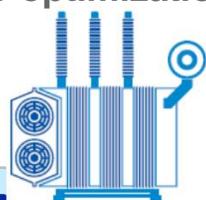
### Plant view

Data analysis across a site or a number of similar sites

Data analytics potential:

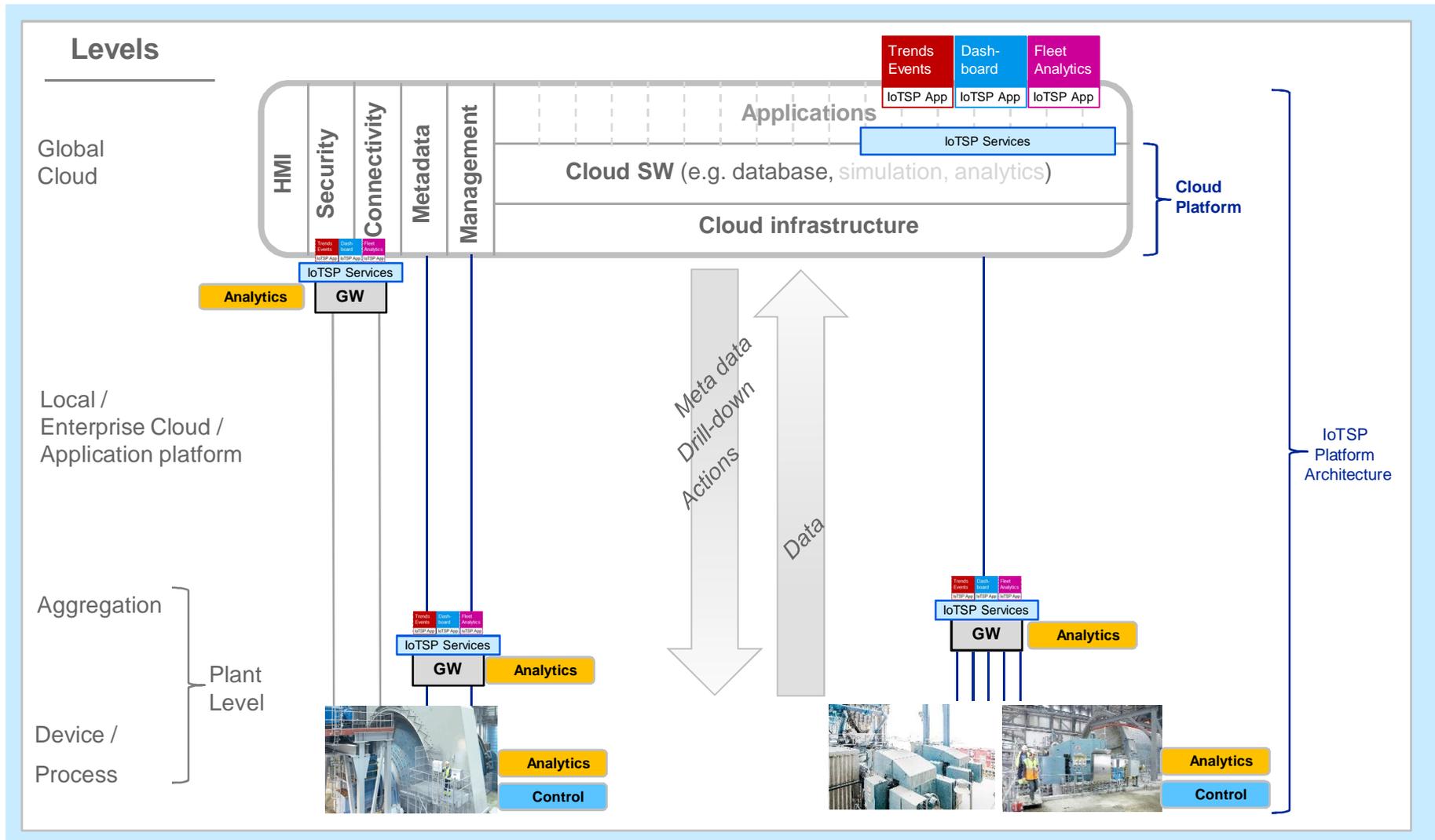
- Data engineering
- Process performance optimization
- Energy efficiency optimization
- Operational excellence

**Focus on operations optimization**



# ABB IoTSP platform

- Standardized integration approach + analytical capabilities



# Application – real life example: Mining

- Gearless mill drive monitoring



Customer's situation:

ABB receives an automatically generated e-mail indicating a problem with a gearless mill drive.

Data analysis shows that the device will probably fail within 8 days

ABB solution:

Based on the data analysis, the customer was advised to immediately interrupt production for <30 min to clean dust filters to survive operation until next planned outage

At next planned outage, resolution of the problem by replacing components that were organized in time by the service organization

Outage could be kept at a minimum, avoiding unplanned production loss of ca. 1.4MUSD

# MineOptimize

## Some References

# We are implementing the mine of the future today

## Integrated solution for iron ore mine in Brazil



### New Iron Ore Mine & Beneficiation Plant

- 90Mtpy
- 11BUSD CAPEX
- Truck-less system



### ABB Delivered

- Integrated power & automation control system
- 230 kilovolt in-feed substation and 42 secondary substations
- High, medium and low voltage electrification, motors, and drives
- Main control room design and infrastructure;
- IT / OT integration, advanced asset management
- Condition monitoring solutions & consulting

# MineOptimize

## Integrated solution for underground mine in Sweden

**BOLIDEN**

Underground mine expansion

- from 1.5mn ton/year
- to 2.5mn ton/year

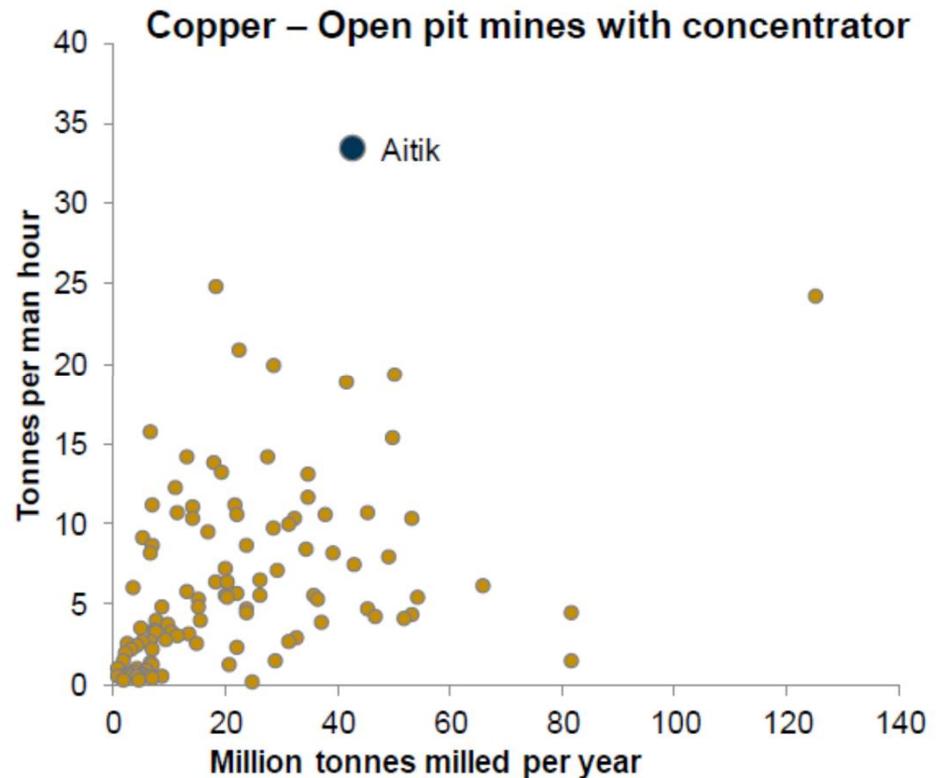
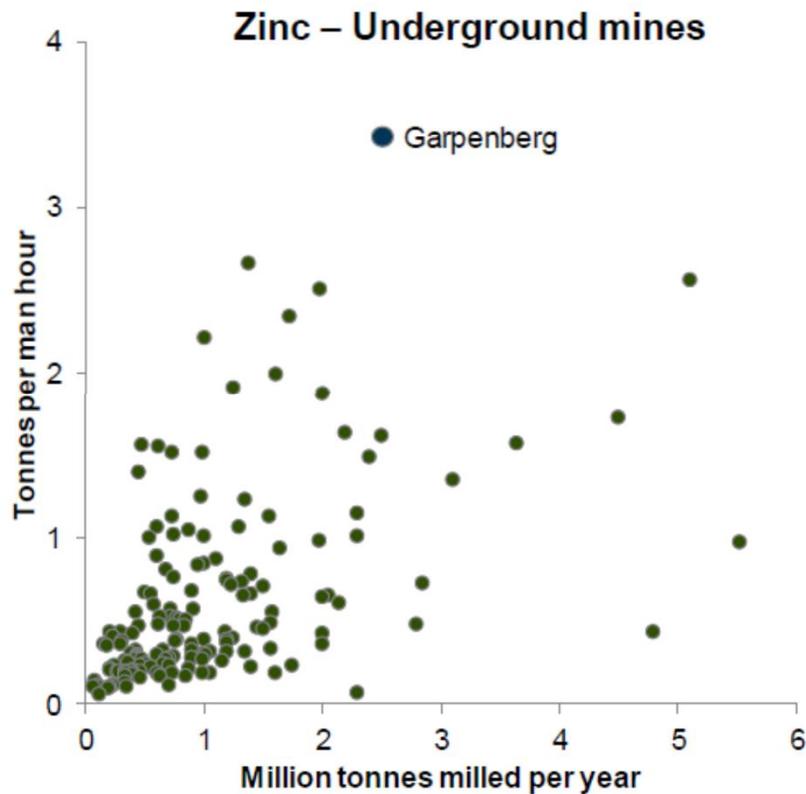


ABB Delivered

- Integrated power & automation control system across the value chain from mine to mill
- IT / OT integration, advanced process control
- Remote monitoring capabilities
- High, medium and low voltage electrification, motors, and drives
- Energy efficiency solutions
- Ventilation on demand, smart switchgear
- Mining specific drive-motor packages

# Boliden customer case

## World-leading productivities



Source: Wood Mackenzie, 2016. Graph to the right includes open pit and mines with mix open pit-underground.

# Summary

# Integrated Process and Operation Management

## Improve visibility, planning and real-time coordination

### Top benefits

### How can help

Improve visibility

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▶ By providing complete, accurate and timely data

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Reduce asset utilization

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▶ By providing better visibility and real-time management system integration, coordination among functional silos

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Higher throughput

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▶ By providing better planning capabilities that minimize the effect of bottlenecks

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Increased safety

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▶ By removing people from hazardous environments through better information and communications systems

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# Internet of Things, Services and People

- Conclusions



## Intranet of Things – Internet of Things

Intelligent devices equipped with sensors are providing large amounts of data that is today used in the controls system

Today's essential requirements remain valid (safety, reliability), cyber security and data privacy become more important for all players along the value chain

## Internet of People

People will not be obsolete in the future context, as they remain in control of the production process. People will be the decision makers

## Internet of Services

Services will become more advanced through the use of data analytics. If the analytics results are not turned into improvement actions, customer benefits remain low. Opportunities for new service models that build on collaboration with partners and customers will evolve.

# Securing the future of mining and metals industry

- Digital technologies provide visibility and optimization across the value chain
- These new products and systems drive fundamental change in the way the modern enterprise works, creating dramatic increases in
  - Process productivity
  - Predictability of operations
  - Asset reliability
  - Energy efficiency
  - Health, safety
  - Protection of the environment



Power and productivity  
for a better world™

