

X JORNADAS TÉCNICAS – ABB EN CHILE, 11-12 ABRIL, 2017

Next Level mining

ABB Ability for integrated mine operations

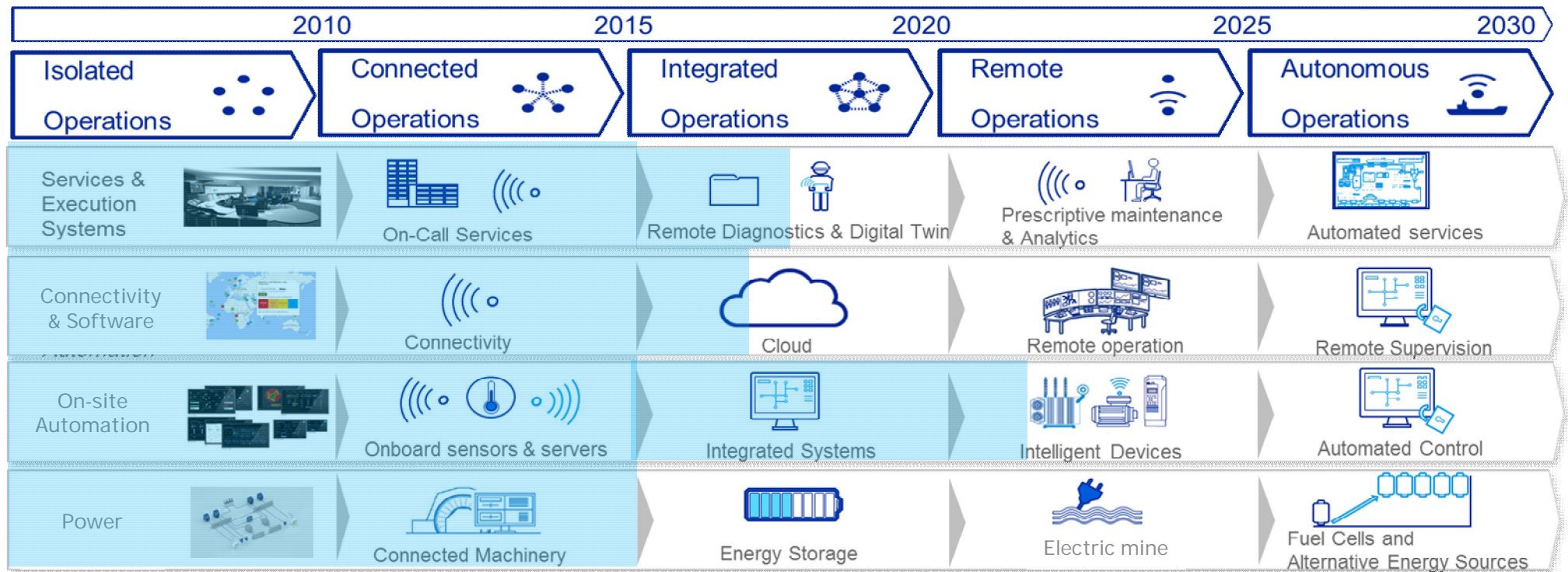
Eduardo Lima, Global Product Manager

Agenda

1. Collaboration
2. Integrated Mine Operations
 - ABB Ability products, devices and sensors
 - ABB Ability automation and control systems
 - ABB Ability plant and enterprise solutions
 - ABB Ability cloud platform and services
3. Conclusion

Digital transformation landscape

Underground mine



Boliden Mineral – Garpenberg 2.5

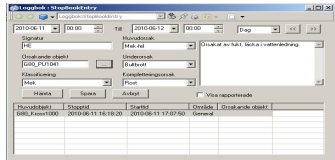
Many autonomous systems for different purposes in Garpenberg



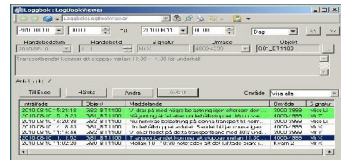
1. Mine hoist
2. Mine ventilation
3. Dewatering and water system
4. Pressurized air system
5. Sub stations (LV, MV and HV)
6. Conveyors
7. Crushers
8. Grinding mills
9. Flotation cells
10. Concentrators
11. Tailings storage
12. Maintenance system
13. Document Management System
14. Stop/log reporting system
15. PA system (radio)
16. Video system
17. Facility/building automation (BAC)
18. Underground comm. network
19. Process instrumentation, positioners & valves
20. Motors & drives systems
21. Fleet manager
22. Mine Localization Intelligence

Production in focus

The user in center, using one system only



Stop reporting



Operator notebook

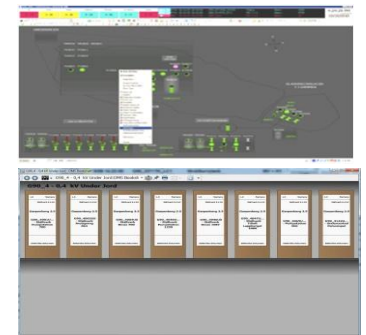


An integrated, unified and efficient operator environment

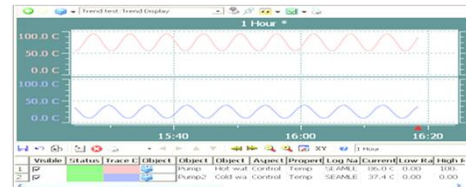
Maintenance system



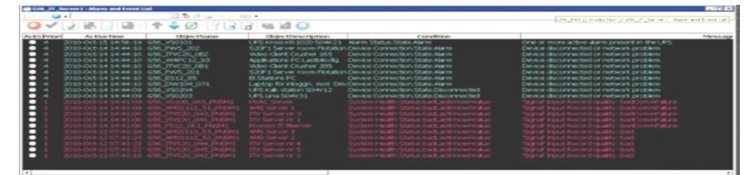
Documents Drawings



Process displays



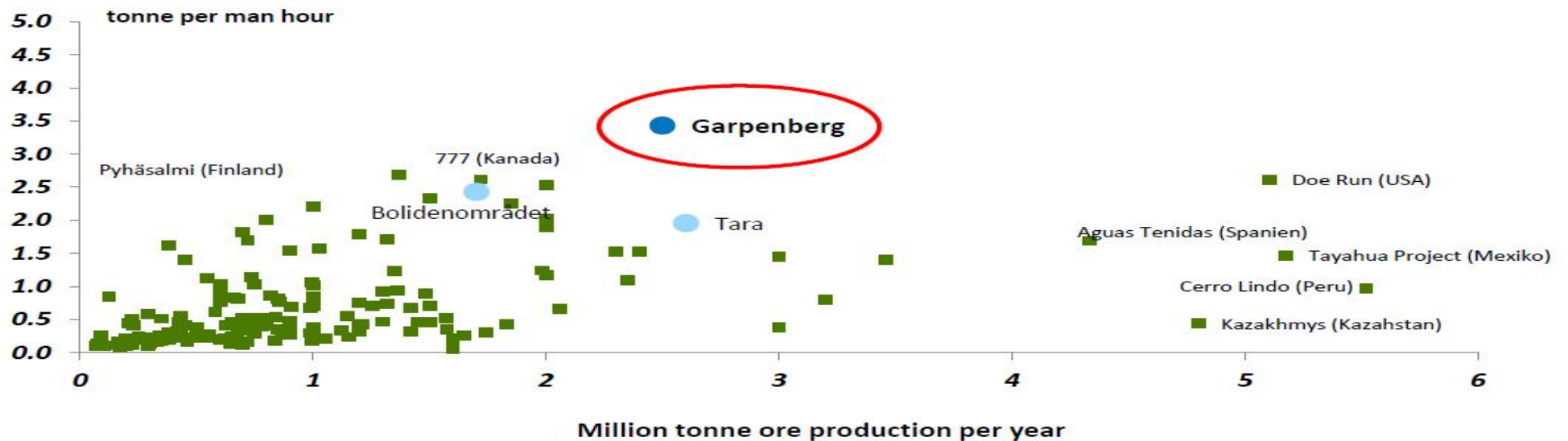
History & Trends



Alarms and Events

Boliden Garpenberg

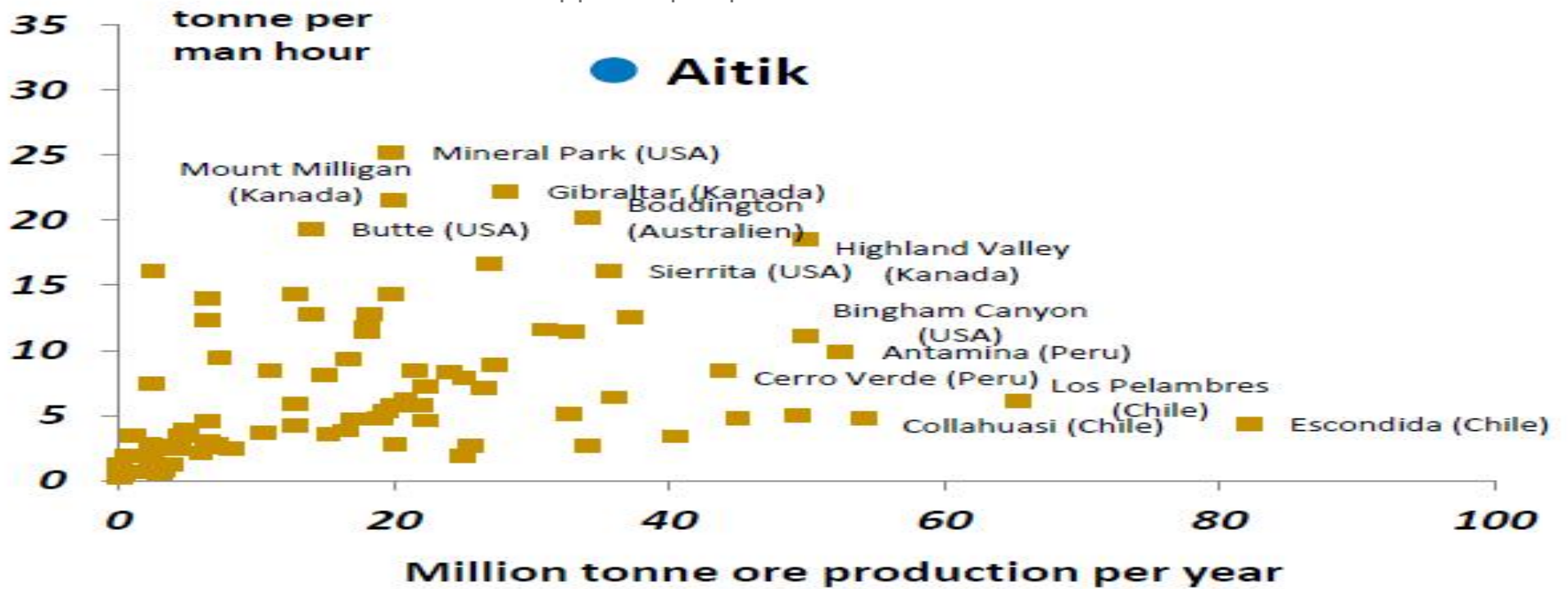
Planned to be shutdown – now the world´s most effective zink mine



Boliden Aitik

The world's most effective open pit copper mine

Copper – open pit with mill 2014



—
Always access to correct information – everywhere

Everyone shares the same information – in real time



It's all about Collaboration



ABB Ability

ABB Ability™: creating one common offering for digital end-to-end solutions

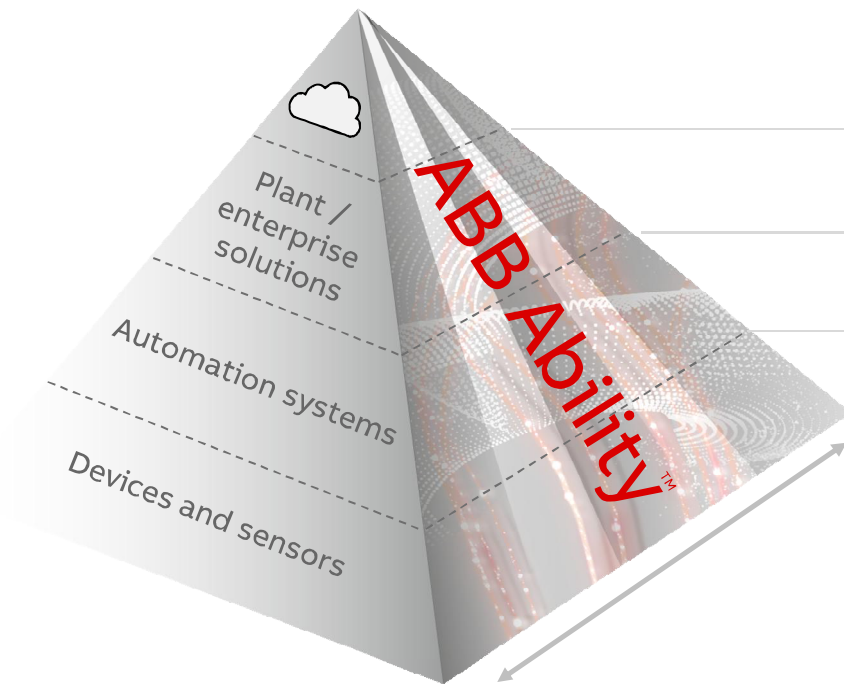


ABB Ability categories:

ABB Ability cloud platform and services:
Integrated Operations centers, Remote monitoring solutions
EV fast-charging apps

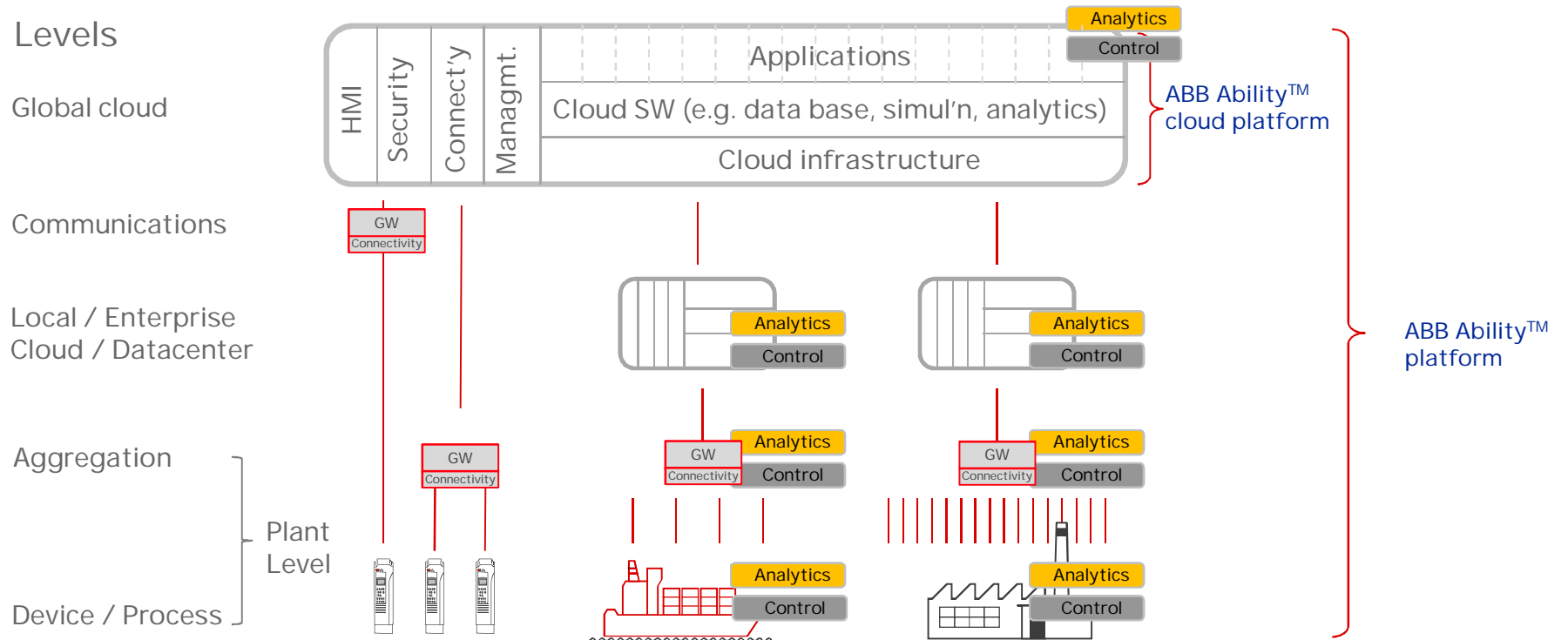
ABB Ability plant and enterprise solutions:
Mining solutions, Marine solutions, power generation solutions
Network management systems, Substations, HVDC stations

ABB Ability automation and control systems:
DCS systems: 800xA, Symphony+
Substation automation systems

ABB Ability products, devices and sensors:
Robots, motors, drives, solar converters, EV charging stations
MV breakers, LV breakers, Transformers, GIS, Generator circuit
breaker, HV breaker
Sensors, analyzers

ABB Ability Platform

Architecture Overview



Ore Factory

BMI Operator Workplace 1
Screen Tab
3/7/2017
09:59

Alarm Controller **422 / 60** System **422 / 60**

Process
System
Controller



Fixed equipment Activities Mobile Machines
Crusher Pumps

Loading areas North

Simulate shortage

Tonnage:
(Actual/Planned)

N300PDR

N300_S

General Loading

N350LS110

Bolting

N325HD106

N350LS110

N375FDL

Trucks in area: 3

Show

Show

Show

Loading areas

Tonnage:
(Actual/Planned)

S250S206

Transport

S330PS206

General Loading

S250_S

S330PS206 : Faceplate

S330PS206

9

Base Control

Activities

Disturbance



Current activity	
General Loading	LD66 LHD
Started	2017-2-16 10:22
Plan end	2017-2-17 14:21
Active time	18d 22h 37m
Next activity	
Stope Loading	OE13 Lift
Started	2017-3-7 09:36
Finished	2017-3-7 09:42
Worked time	5m

LD66 LHD
Table view

LD66 LHD : Faceplate

LD66 LHD
1.1.6166

Base Control

Remote Monitoring

Activities

Disturbance

Analog sign



- Hydraulics
 - Leaking hose, connection
 - Hose is broken!
- Lack of supplies
 - Bolts, Spacers
- Operator somnade
- Location access

S_Area/S_Ramp/S330/S330PS206
Table view

Minim

1094mn

110mn

1150mn

1175mn

11094mn

110mn

1150mn

1175mn

11094mn

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11094mn

110mn

GIN_PU004 : Faceplate

GIN_PU004

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ABB Ability for Integrated Mine Operations

On-site, multi-site, collaborative and remote working place

ABB Ability product offering in underground mining:

- 800xA system – extended process automation & integration platform
- Extended workplace – control room layouts
- Execution and fleet manager – mobile fleet management and control
- Localization – 3D resource visualization and search engine
- Process and power control as mine ventilation, dewatering, substation



ABB Ability – Execution and Fleet Manager

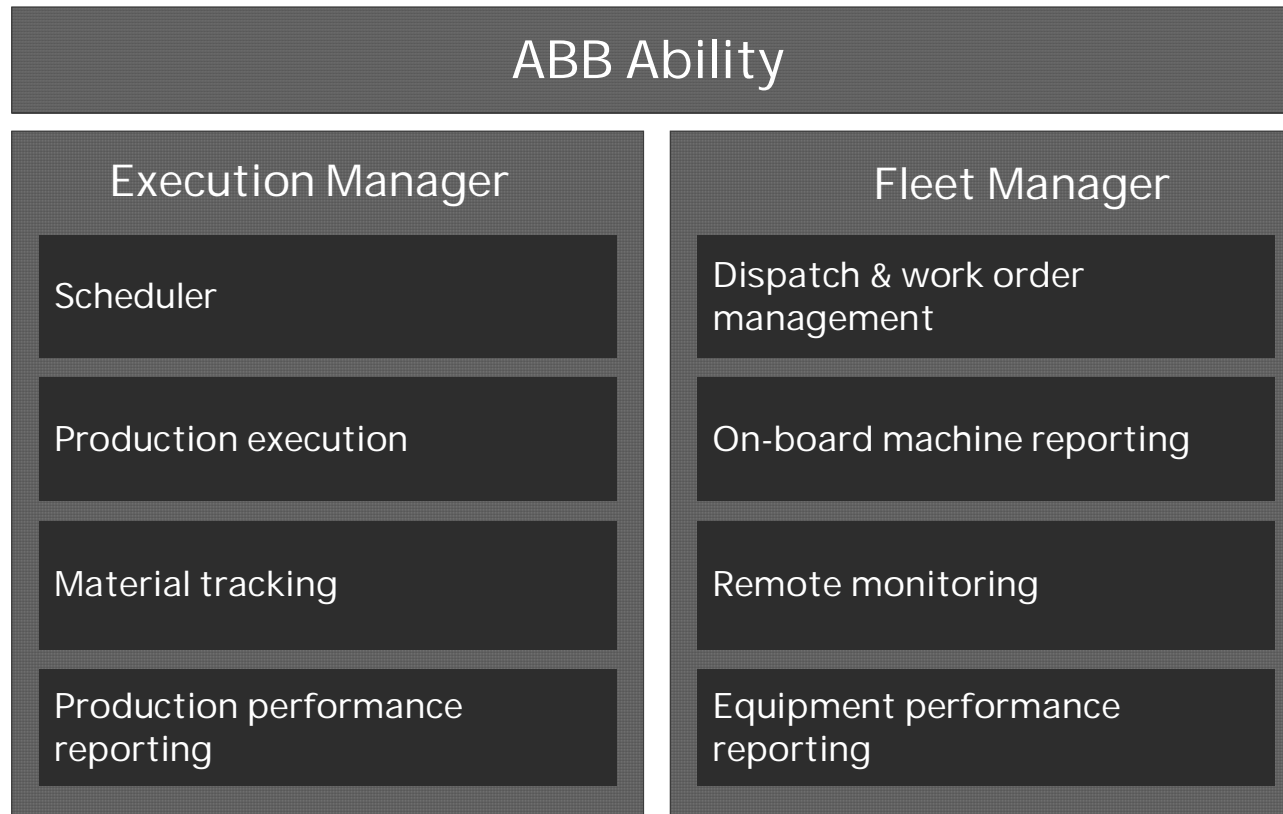


ABB Ability – Execution and Fleet Manager

ISA 95 Process Model

ISA-95 covers a set of specifications (or models) and terminology that capture the manufacturing process. Users can configure the ISA-95 classes and define instances for:

- Process segments: loading, drilling, blasting, bolting
- Equipment classes: drifts, loaders, drilling, machine
- Materials: electricity, water, ore, final product

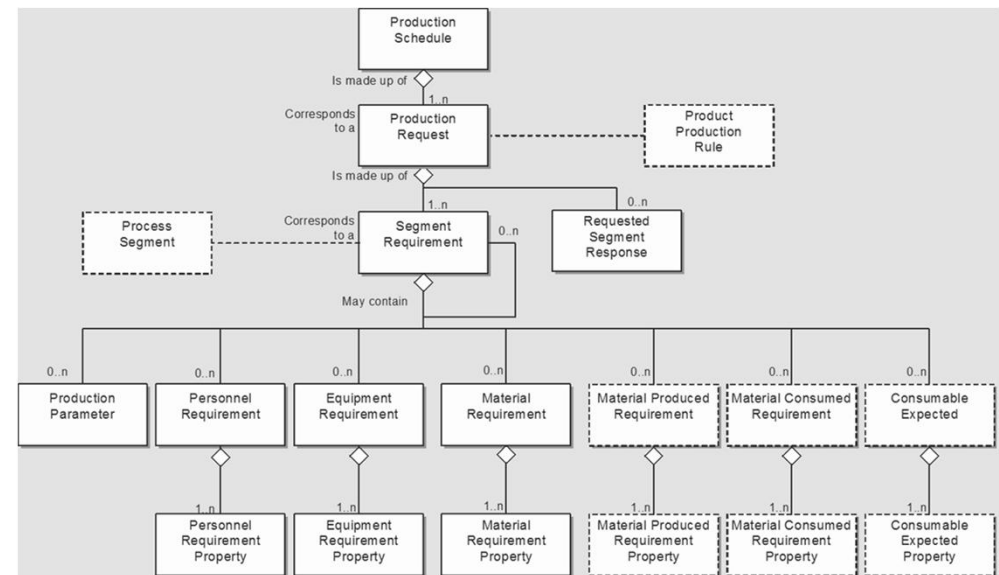
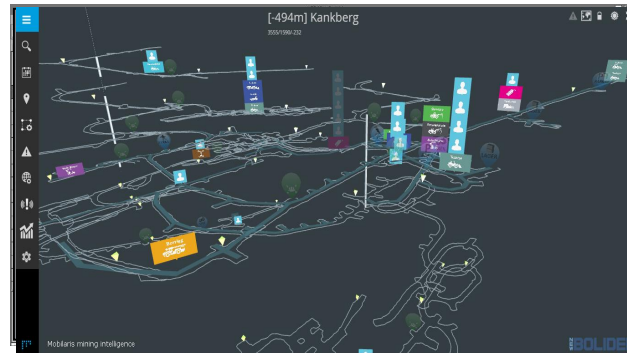


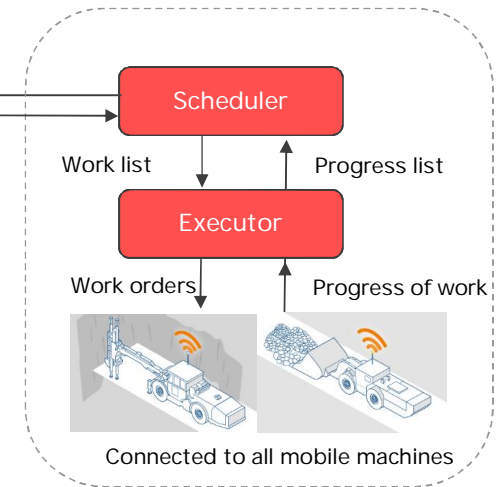
ABB Ability – Execution and Fleet Manager

Short term scheduling in closed loop

Real-time visualization of actual status and on-line replanning



Weekly/Monthly production plan order
Personell and machine availability
Machine characteristics and mine distances
ABB Gantt or 3rd party



A predictive production from the beginning of the value chain – replanning in seconds

ABB Ability – Execution Manager

Real-time control Gantt and schedule engine

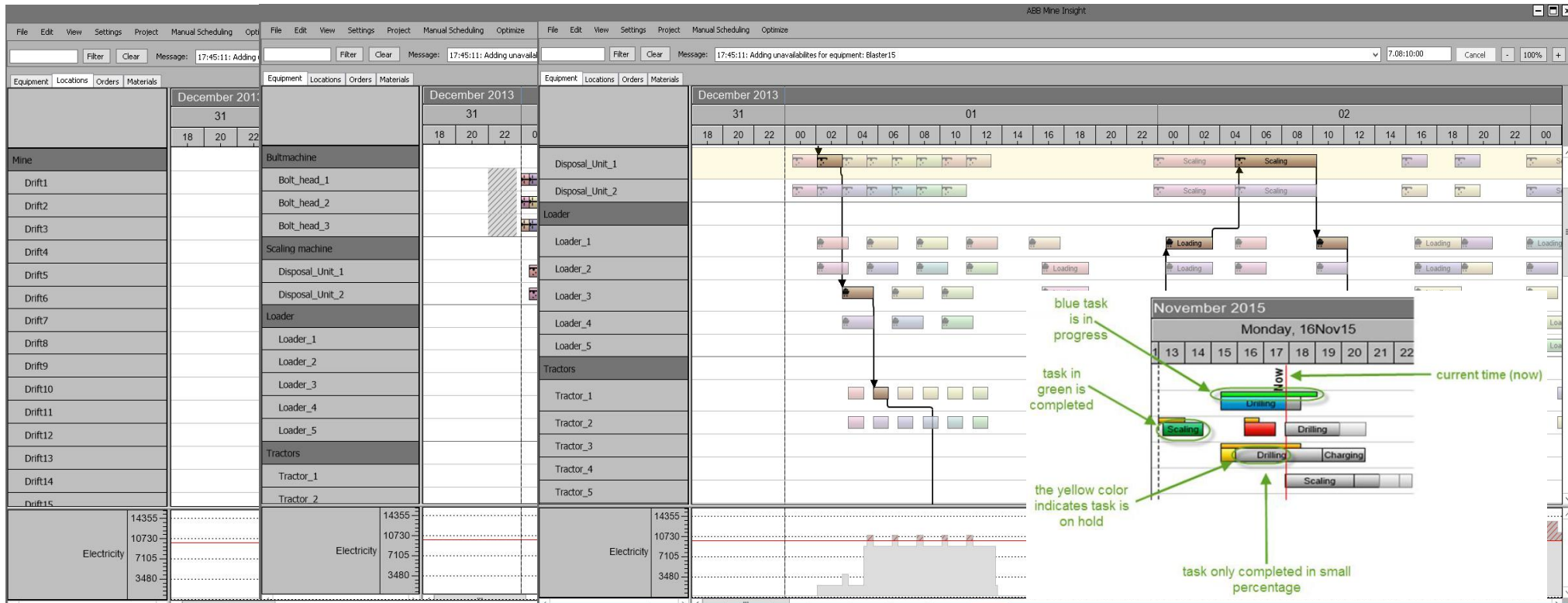


ABB Ability – Fleet Manager

On-board activity reporting

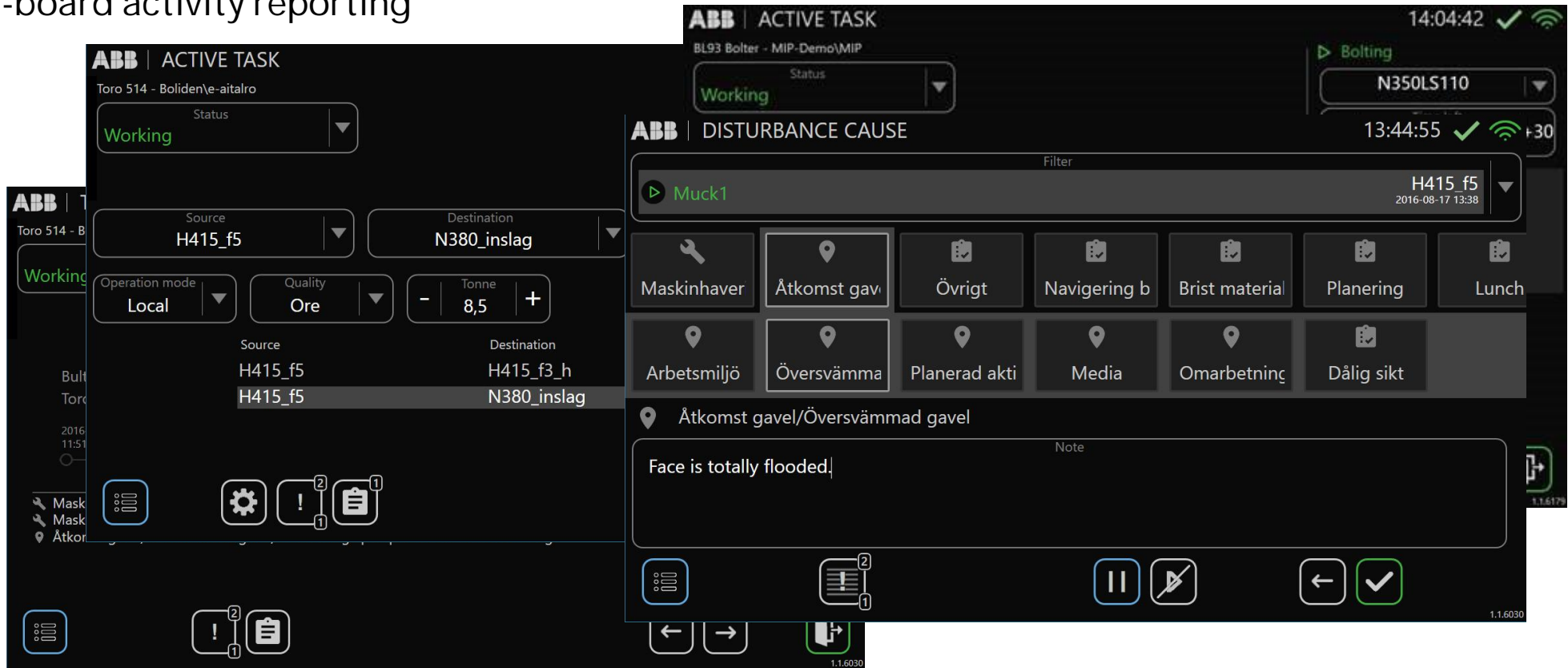


ABB Ability – Execution Manager

Production Execution

Bolting identified as the critical process
Resulted in depth analysis of bolting activity
..based on machine data measurements
Change of the bolting process
Potential 20% increase of bolting efficiency

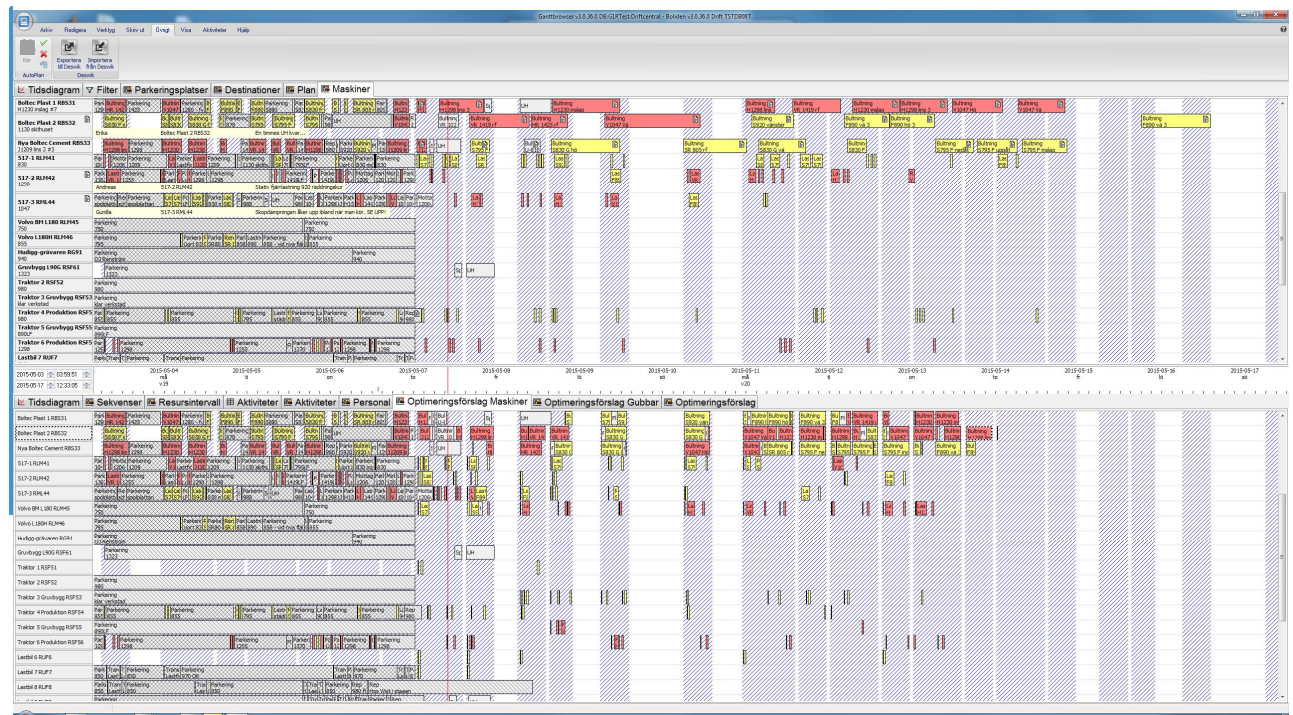
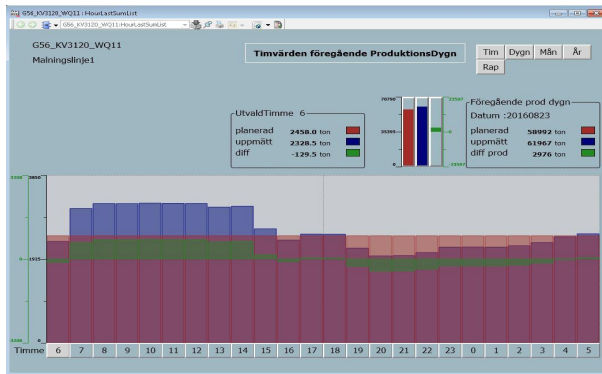


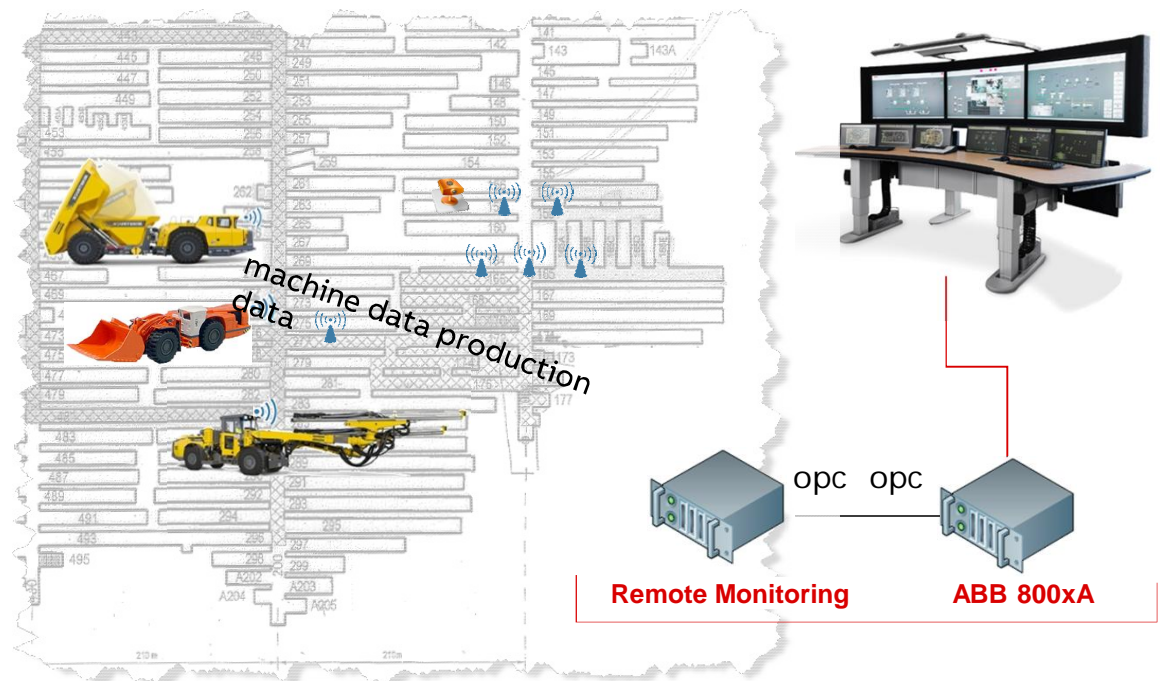
ABB Ability – Fleet Manager

Remote monitoring

Interface to 3rd party on-board system servers

On-board data logger module supporting standard interfaces like J1939, Modbus, RS232, I/O or other standard fieldbus protocol.

Data is stored on board and forwarded to the MineInsight server



Demo System // DEMO Operator Workplace

Process

Power

PSD ESD

<input type="checkbox"/>	3	ACT	12 00:29:11	Boltec 2	COMPRESSOR_TEMP	Condition Active
<input checked="" type="checkbox"/>	3	ACT	29 00:05:39	Simba 3	ENGINE_OVERSPEED	Condition Active
<input checked="" type="checkbox"/>	3	ACT	29 00:05:24	Simba 3	ENGINE_OIL_PRESSU	Condition Active

Plant Assets

System

1

30

6/4/2012 10:24

Boltec 1

Replace

No Filter

Mobile Equipments:Fleet Overview

Fleet Overview

LHD's

DRILL RIGS

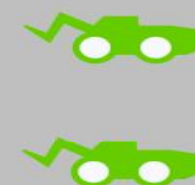
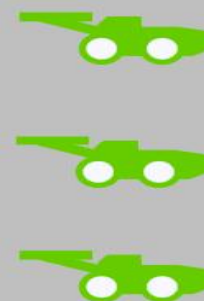
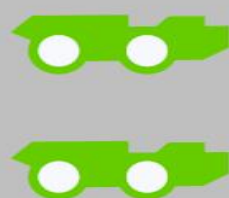
Mine Truck Fleet

Boltec Fleet

Boomer Fleet

Scaletec Fleet

Simba Fleet



Scooptram 1

Machine Name	Alarm Status	Number of Alarms Today	Duration of Alarm State Today
Engine Coolant Temperature	■	0	0
Engine Oil Pressure		0	0
Hydraulic Oil Temperature		0	0
Hydraulic Oil Level		0	0
Transmission Temperature		0	0

Minetruck 1: Faceplate

Minetruck 1

Status

Alarm

Atlas Copco

Tramming

Equipment Location

not connected

Latest Update

4/4/2012 6:13:18 PM

Boltec 1: Faceplate

Boltec 1

Status

Alarm

Atlas Copco

Standstill

Equipment Location

not connected

Latest Update

4/11/2012 11:42:34 PM

Boomer 3: Faceplate

Boomer 3

Status

Alarm

Atlas Copco

Standstill

Equipment Location

not connected

Latest Update

3/27/2012 7:15:02 PM

Scaletec 2: Faceplate

Scaletec 2

Status

Alarm

Atlas Copco

Standstill

Equipment Location

not connected

Latest Update

3/28/2012 9:59:36 PM

Simba 1: Faceplate

Simba 1

Status

Alarm

Atlas Copco

Standstill

Equipment Location

not connected

Latest Update

3/28/2012 10:28:48 PM

Mine Overview

ABB Ability – Production face analytics

Real-time visualization of face status in 800xA system





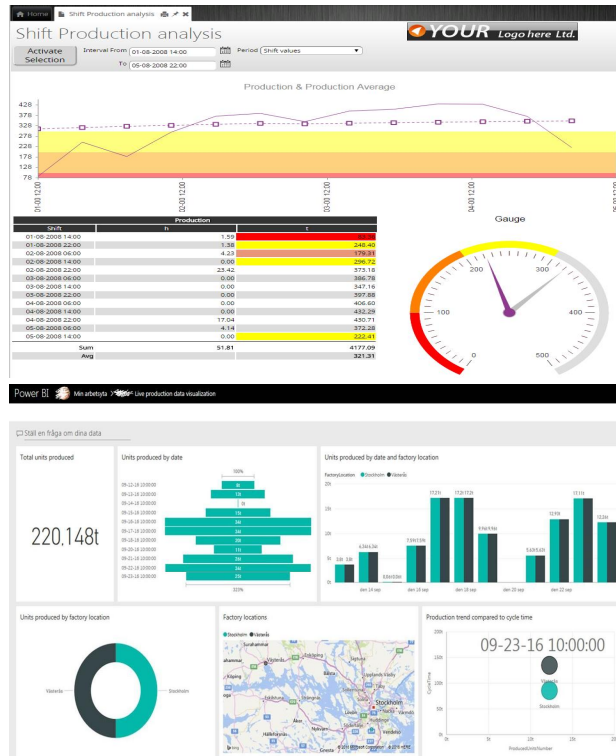
ABB Ability – Fleet Manager

Machine Performance reporting

Equipment effectiveness (OEE)														T		A												
YEARLY REPORT																												
														(Nyttjandegrad)		Tillgänglig operativ tid		Anläggningsnyttjande (Ne										
Month:														1	2	3	4	5	6	7	8	9	10	11	12	Average Utilization	Average Availability	Average Performance
EQ GROUP	EQUIPMENT	Calendar time, h	744	672	744	720	744	720	744	744	720	744	720															
		Shift hours	620	560	620	600	620	600	620	620	600	620	600															
		Shifts	62	56	62	60	62	60	62	62	62	60	62															
PROD DRILLS	DRILL RIG 1	Usage, h	420,5	465	360,5	485	391	398,5	180	266	360,5	485	391	398,5														
		Utilization, %	68%	83%	58%	81%	63%	66%	29%	43%	58%	81%	63%	66%	61%													
		Availability	57%	69%	48%	67%	52%	55%	24%	36%	48%	67%	52%	55%		44%												
		Performance	83%	83%	83%	83%	83%	83%	80%	82%	83%	83%	83%	83%	62%													
	DRILL RIG 2	Usage, h	349	234	118	300	417	276	259	316	118	300	417	276														
		Utilization, %	56%	42%	19%	50%	67%	46%	42%	51%	19%	50%	67%	46%	47%													
		Availability	47%	35%	16%	42%	56%	38%	35%	42%	16%	42%	56%	38%		33%												
		Performance	82%	81%	77%	82%	83%	82%	82%	82%	77%	82%	83%	82%	61%													
	DRILL RIG 3	Usage, h	307	363	242	456	513	468	370	350	242	456	513	468														
		Utilization, %	50%	65%	39%	76%	83%	78%	60%	56%	39%	76%	83%	78%	63%													
		Availability	41%	54%	33%	63%	69%	65%	50%	47%	33%	63%	69%	65%		48%												
		Performance	82%	83%	81%	83%	83%	83%	83%	82%	81%	83%	83%	83%	62%													
	GROUP AVERAGE:														57%		42%	61%										
DEV DRILLS	DRILL RIG 4	Usage, h	115	245	396	464	445	443	246	391	396	464	445	443														
		Utilization, %	19%	44%	64%	77%	72%	74%	40%	63%	64%	77%	72%	74%	56%													
		Availability	15%	36%	53%	64%	60%	62%	33%	53%	53%	64%	60%	62%		45%												
		Performance	77%	81%	83%	83%	83%	83%	81%	83%	83%	83%	83%	83%	62%													
	GROUP AVERAGE:														56%		45%	62%										
CHARGERS	CHARGER 1	Usage, h	82,5	212	107	359	332	122	251	192	107	359	332	122														
		Utilization, %	13%	38%	17%	60%	54%	20%	40%	31%	17%	60%	54%	20%	34%													
		Availability	11%	32%	14%	50%	45%	17%	34%	26%	14%	50%	45%	17%		27%												
		Performance	74%	81%	77%	82%	82%	78%	81%	80%	77%	82%	82%	78%	60%													
	CHARGER 2	Usage, h	379	315	407	398	444	388,5	74	290	407	398	444	388,5														
		Fuel consumption, l													687	687	687	687	687	687	687	687						
		Tonnes moved, t													748	748	748	748	748	748	748	748						
		Fuel consumption, l													798	798	798	798	798	798	798	798						
	TRSP13																											

ABB Ability – Execution Manager

Production performance monitoring



Process and production monitoring
Calculations and data consolidation
Multiple periods like shift, daily, weekly, monthly

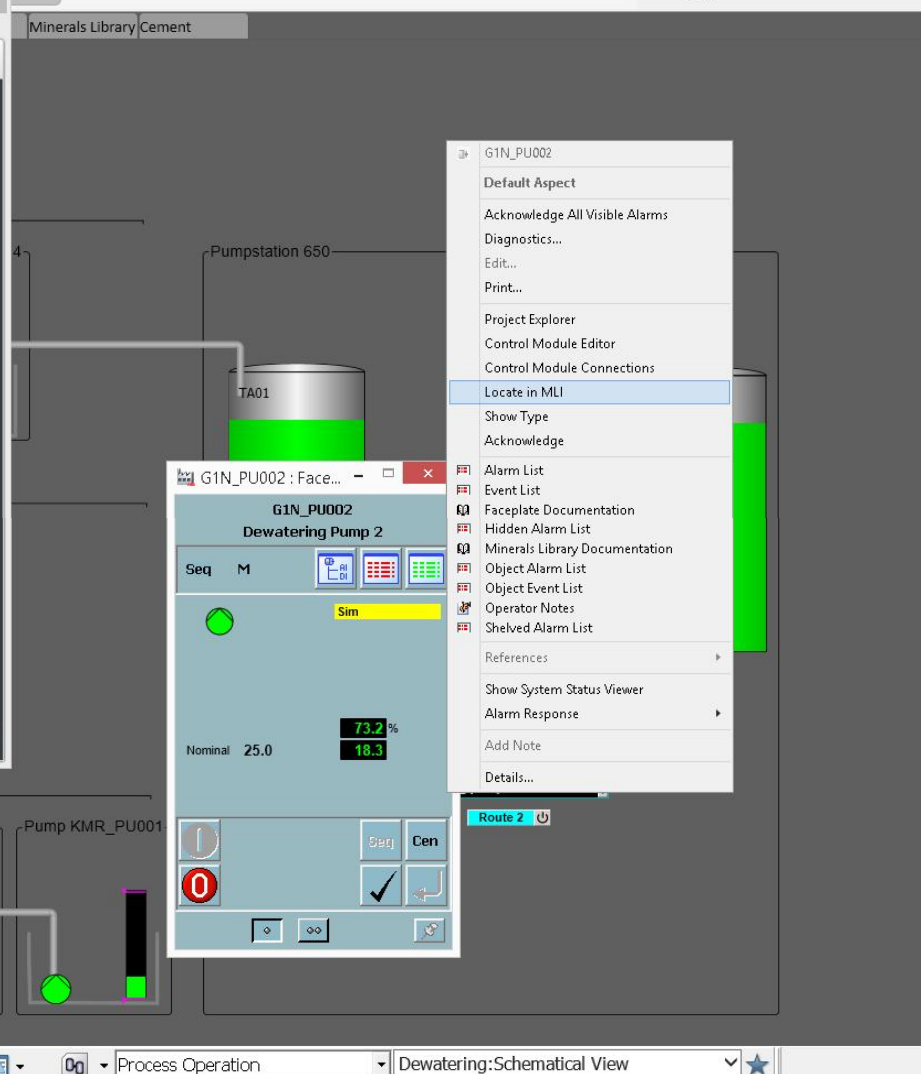
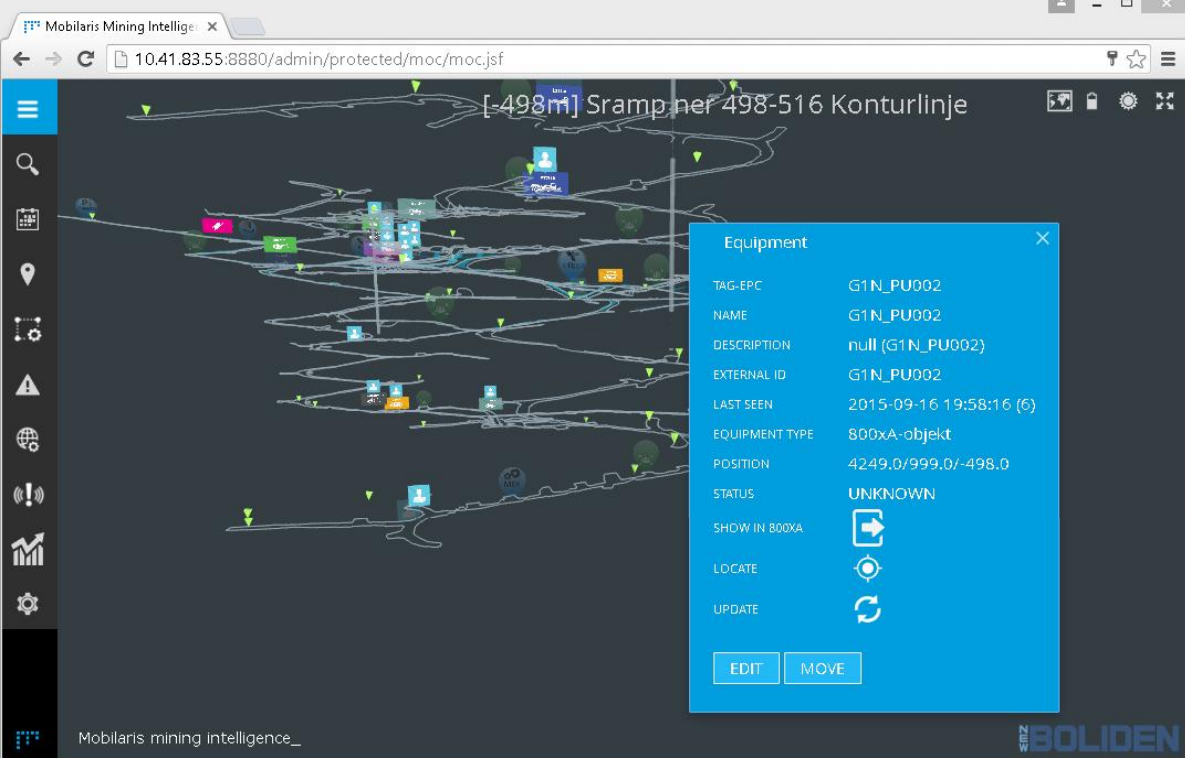
KPI overview
Throughput, actual vs. planned, productive time, efficiencies

Electrical energy cost tracking:
Individual equipment counters
Plant sections totals
Plant totals

Specific energy consumption calculations per
Production unit (eg, tons)
Product

Mining localization intelligence





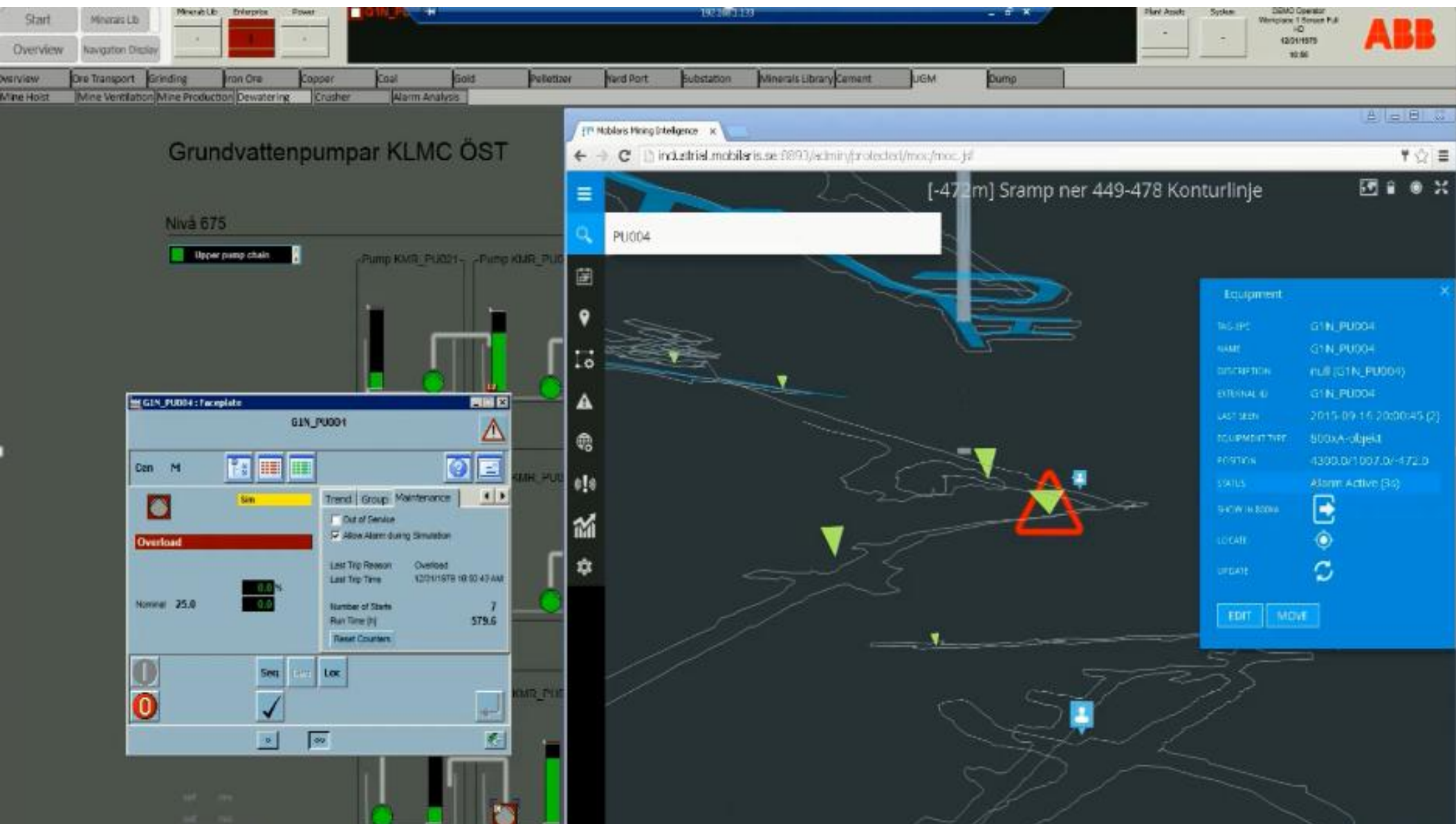
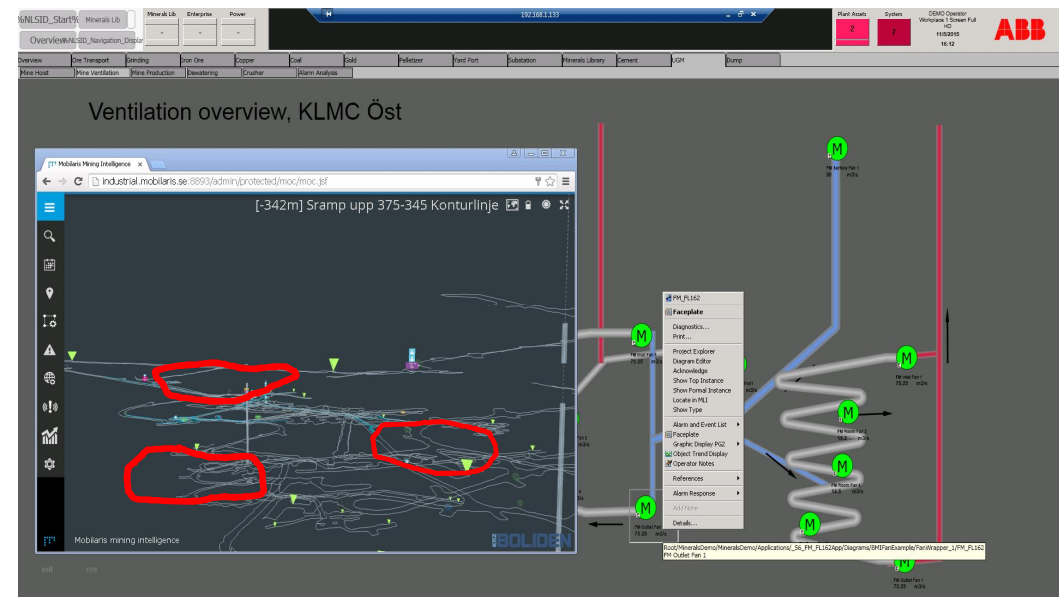
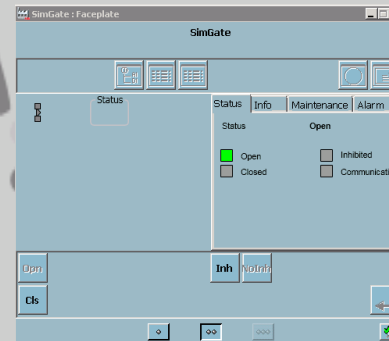
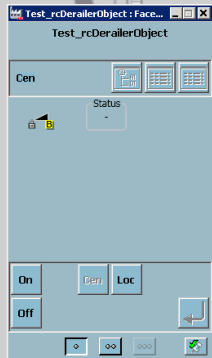
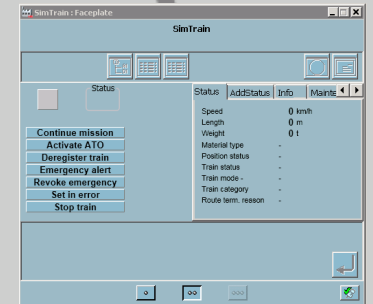
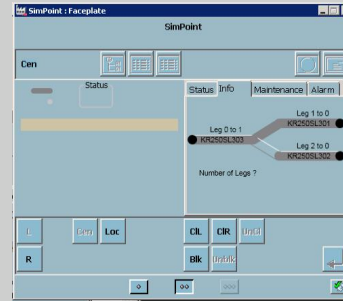
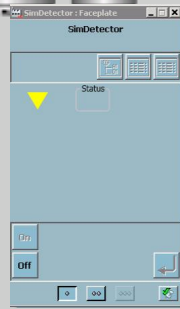
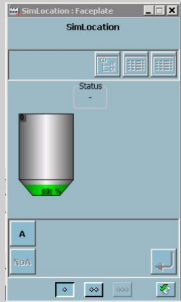
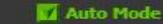


ABB Ability – Mine ventilation control

- Three levels of function
- Basic control as remote, event, sensor and time control
- Ventilation on demand control
- Energy optimization of fans for autonomy
- Use case showed 54% reduction of energy consumption and
- 21% reduction of heating







Maintenance Mode

Maintenance Mode

P: 65.59 MW PF: 1.000
Q: 0.79 MVar

P: 65.59 MW PF: 1.000
Q: 0.79 MVar

S130 150kV

T1
80MWA

S20A1_09

T2
80MVA

S20A1_16

T3
80MWA

S20A1_22

S20A1 20kV

A
B

1

S20M1

09

S20M3

☒ Drift

S20M3 U	21.8kV
S20M3 THD	0.9%

S20A3

Drift

S20A3 U	21.8 kV
S20A3 THD	0.8 %

S20M4

☒ Drift

S20M4 U	22.0kV
S20M4 THD	1.8%

S20M3_C1_S

S20M3_C2_S

S20M3_C3_S

S20A3_C1_S

S20A3_C2_S

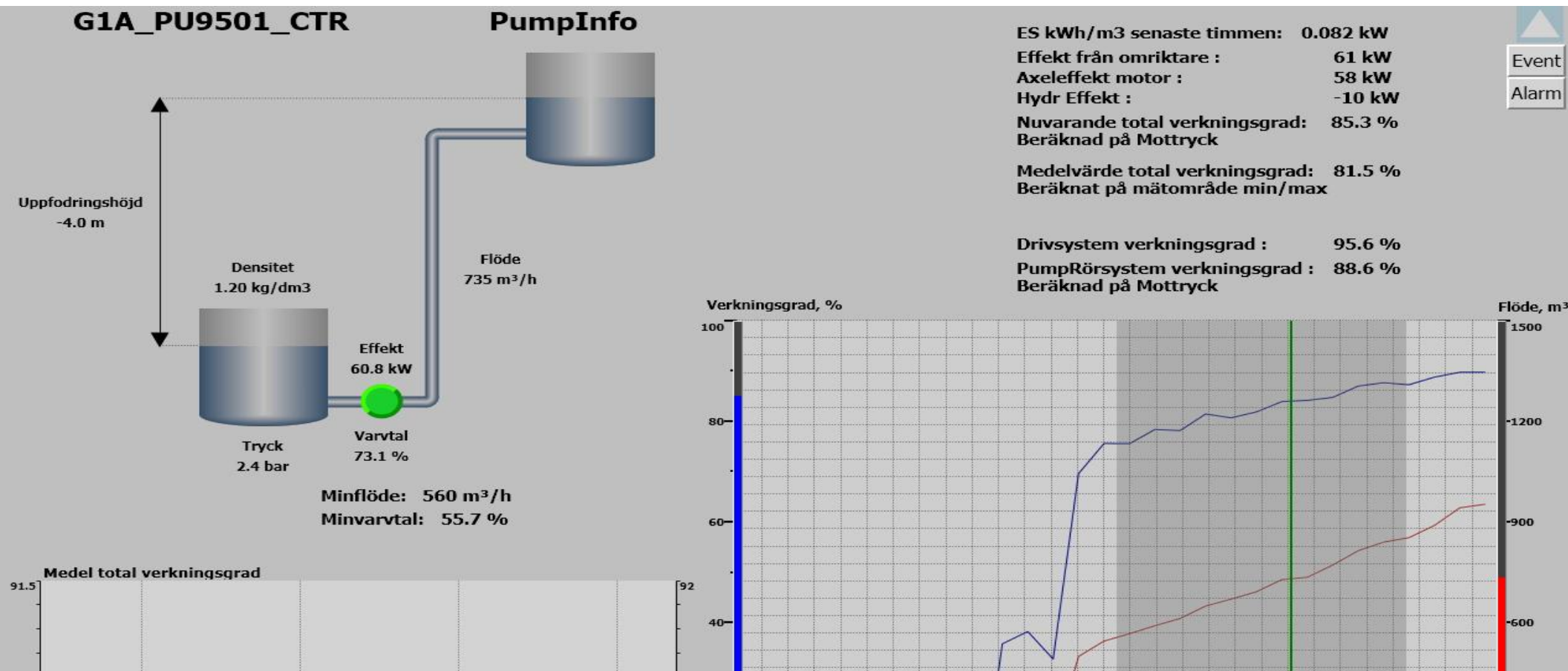
S20A3_C3_S

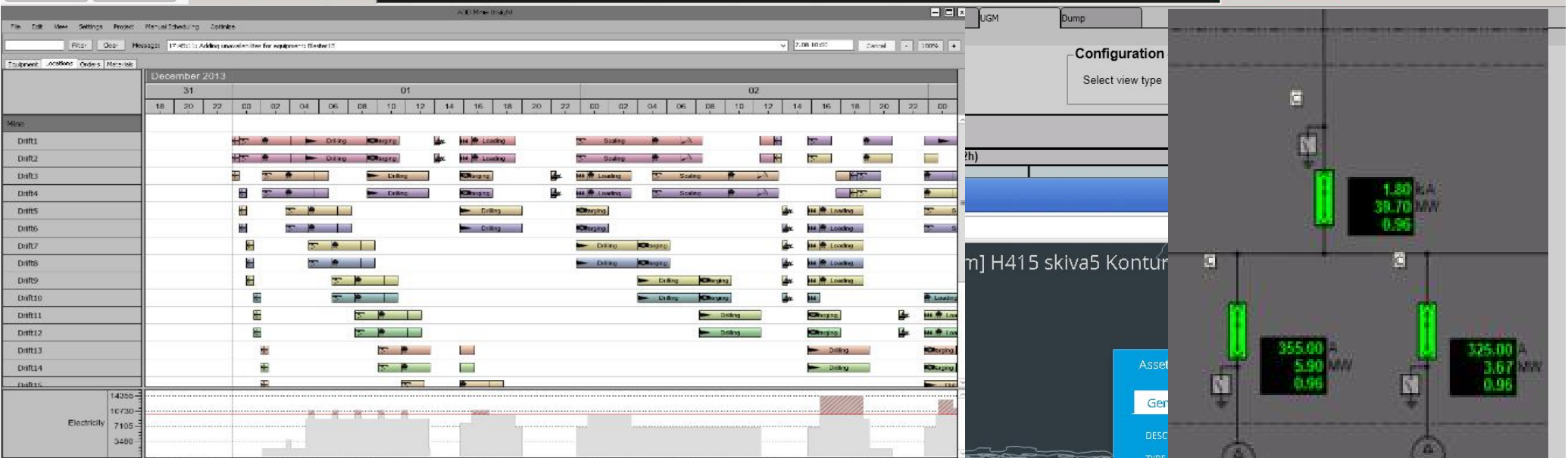
S20M4_C1_

S20M4_C2_

S20M4_C3_S

Process control





Atlas E2 | C 31 14 fot : Faceplate

Atlas E2 | C 31 14 fot
1.0.5393

Base Control

Activities

Drill / Salvborning

N542_1614

Table view

Current activity

Salvborning

N542_1614

Plan start

2015-5-16

Plan end

2015-5-16

16:12

22:12

Planned time

6h

Next activity

Salvborning

testgavelPEK1

Plan start

2015-5-16

Plan end

2015-5-16

16:12

22:12

Planned time

6h

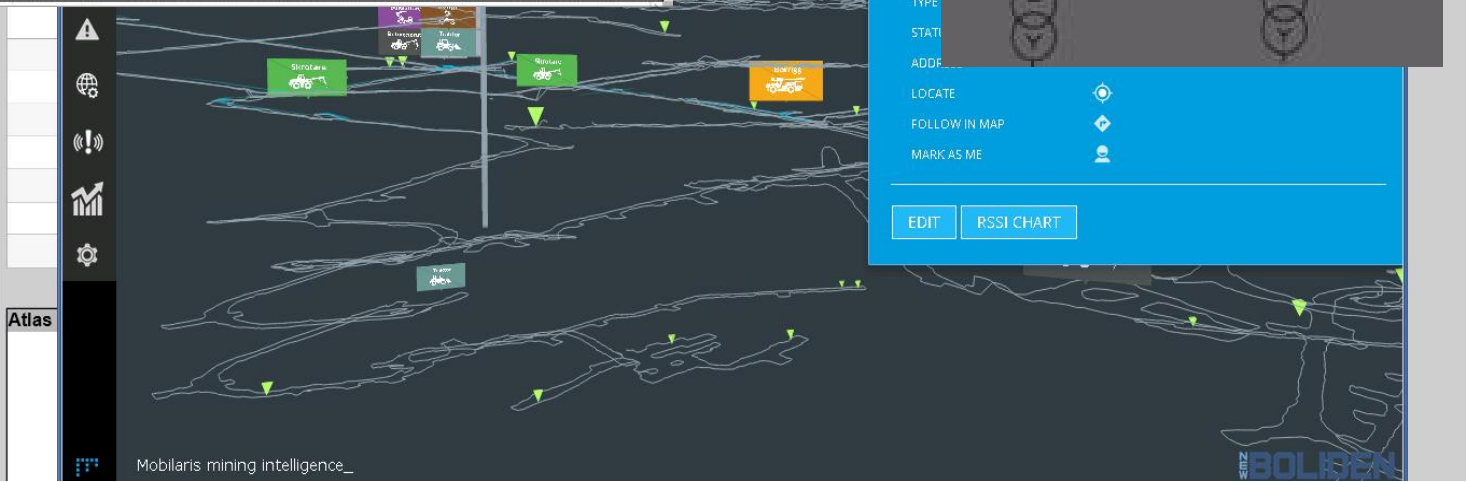


ABB Ability – Colloborative services Portfolio

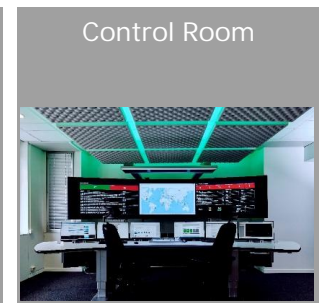
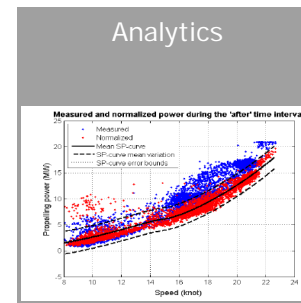
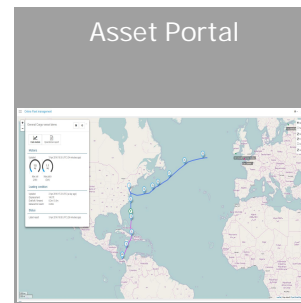
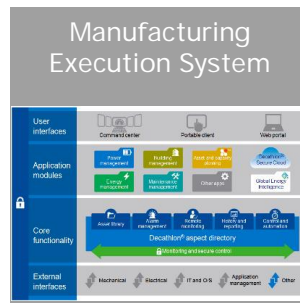
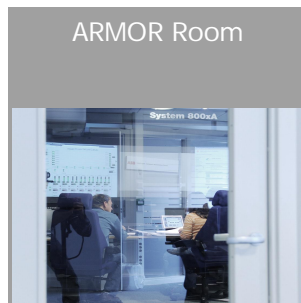
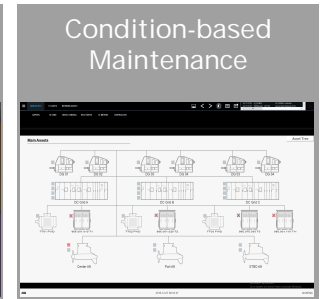
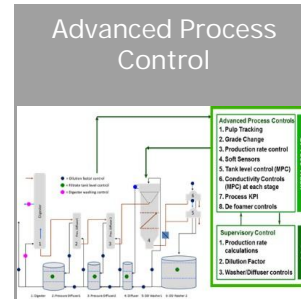
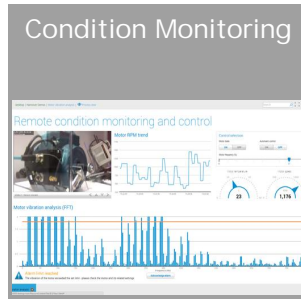
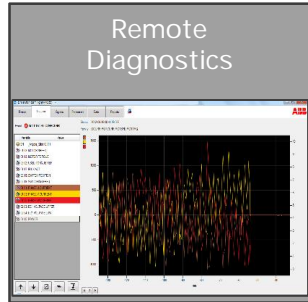


ABB Ability – Collaborative services

Performance Analytics

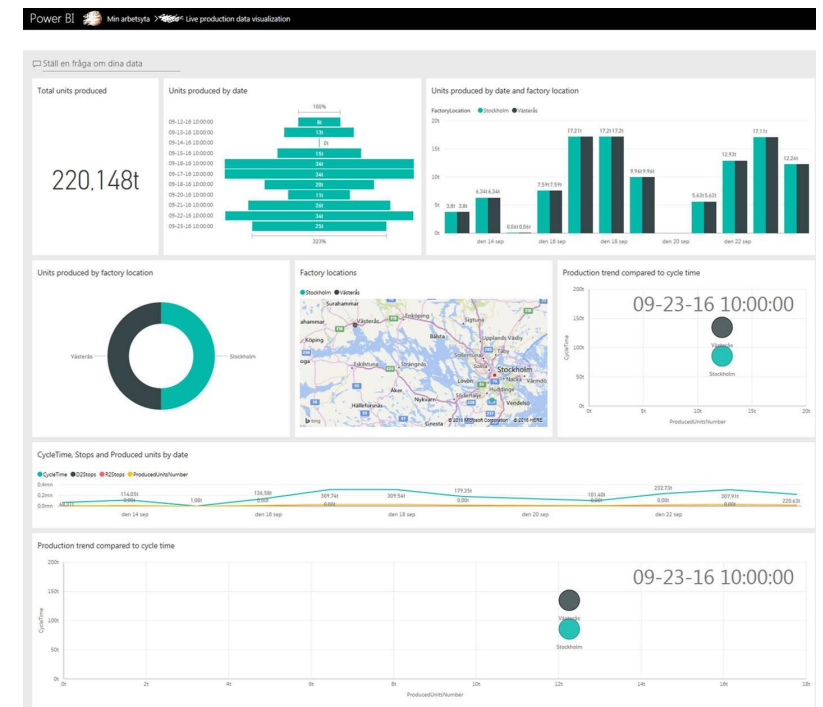
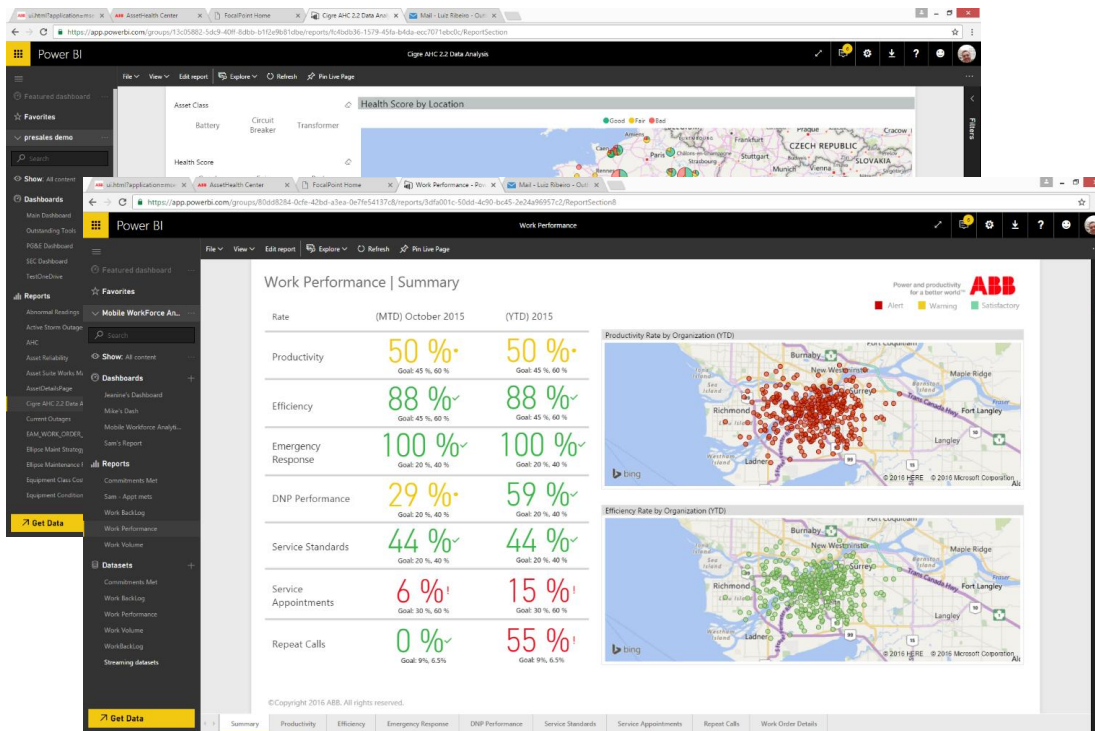


ABB Ability – Mine ventilation control

Function as a service

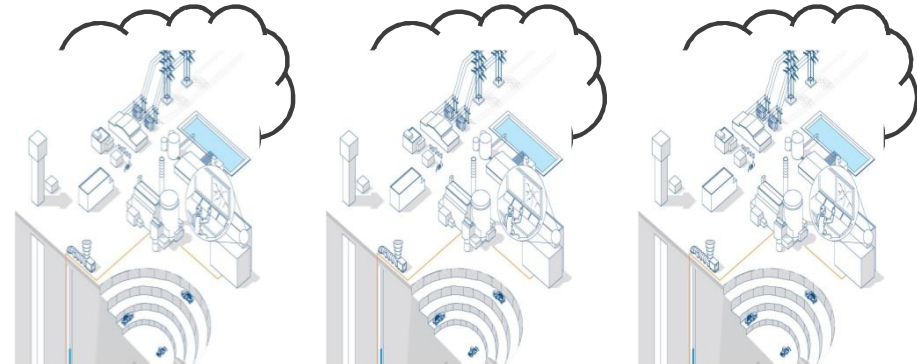
Basic services

- The service is managed from a central location by specialist on control
- Flexibility to modify and improve needed models to maintain efficiency
- Customers use the service as needed
- Monitoring of performance
- Faster deployment

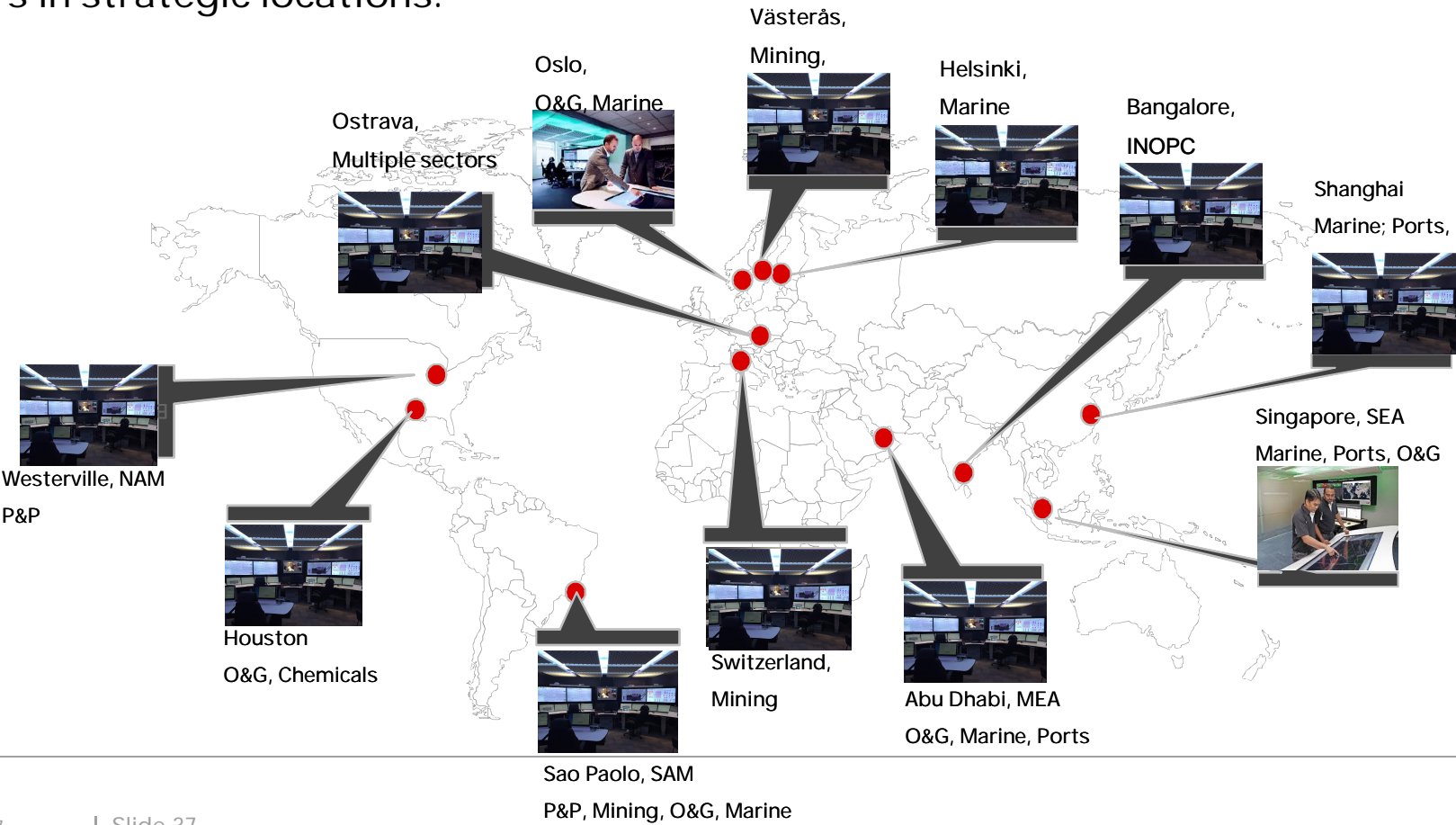


Extended services

- Monitor ventilation data from across different mine sites
- Visualization of ventilation-related data to assist decision makings, e.g., historical data, real-time data, and KPI tracking, etc.
- Increased information sharing and decision support with coordinated and integrated mine operation services in the value chain
- i.e Low energy operation as a service from ABB through or CO Centres

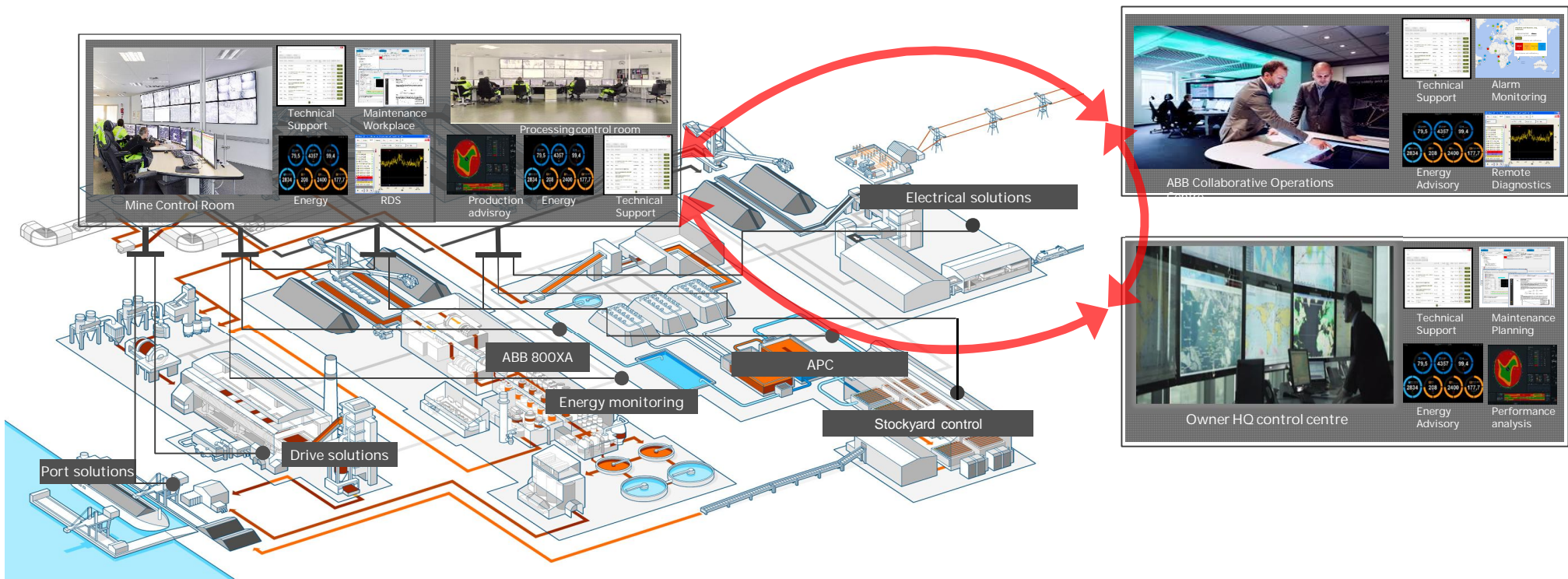


Collaborative Operations within ABB
Centers in strategic locations.



Collaborative operations

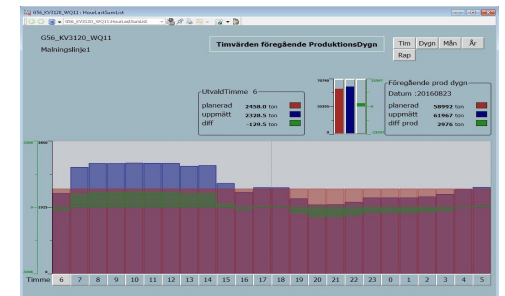
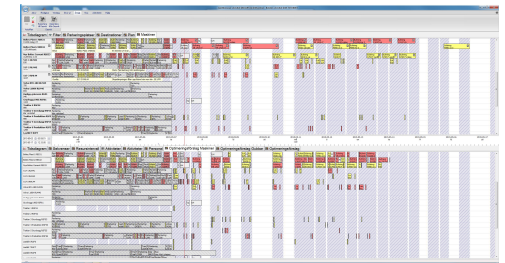
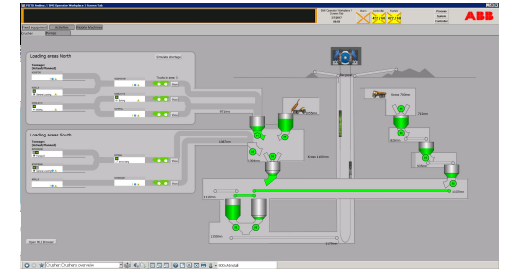
Closing the loop



Ore Factory

Benefits

- Increased production through fast replanning, 10-20% increase in weekly blasting
- Measurement based identification of bottlenecks
- Real-time measurement and logging of process activity variability
- Balanced production between activities on shift-, week/month and value chain
- Adjust production to resource constraints as electricity, water etc
- On-line reporting of disturbances creating event alarm.
- Real-time visualization for current status over the value chain



Q&A and Contact information

If you have questions, please contact me further

Speakers

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ABB