ABB Underground mining
Mobile Integration
Integrated Mine automation and electrification

Mine Operation Center

Communication network
- Wired & wireless Supervision
- IP Telephony, video
- Asset & people tracking

Mine ventilation

Mobile assets
- Remote monitoring
- Production reporting
- Work order mgmt.

Substations GIS Substations Transformer E-Houses MCC & Drives

Stockyard management

Hoisting systems

Water handling
- Drainage system
- Water pumps

Crushing and conveying
- Loading pockets
- Crushers
- Feeders
- Conveyors

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Electrical integration means integrating **Process Automation** and **Power Automation** into the same plant control system.
Integrated Mine automation and electrification
Mine operation center

- Production management
- Fleet management
- Asset & personnel tracking
- Video and voice
- Communication network

- Energy management
- Asset Management
- Process control
- Tele-remote control
- Access control
Integrated Mine automation and electrification
Communication networks

Mine Production control

APPLICATION

POSITIONING

COMMUNICATION NETWORK

Mine Safety

Tele-remote control

Fleet Management

Video

Process control

IP Telephony & messaging
Integrated Mine automation and electrification

Communication networks

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Integrated Mine automation and electrification
Communication networks - Positioning
ABB Mine Location Intelligence – powered by Mobilaris

- Automated positioning of personnel
- Automated verification of machine work position – right machine at the right face...
- Real-time location tracking of assets
- Data and voice communication

Positioning of machines and people...

Process control
- Better visualization of the mine in 3D
- Increase productivity by knowing where your assets are and optimizing your logistics, stop searching for things!
- Increase the collaboration between your personnel
- Increased decision support
- Trace ore and other materials
- Analysis of traffic patterns
- Save energy in combination with ABB Smart ventilation integration

Safety
- Increase safety by knowing where your people are in emergency situations
- Rescue operation with simulationindustrial.mobilaris.se:8888/admin/protected/moc/moc.jsf
- Rescue chamber optimization based on actual resource locations
- Automatically warning system by create Geofences

...positioning is a service for other services.
Integrated Mine automation and electrification
Communication networks - Applications

- **Mine Safety**
  ABB Mine Location Intelligence provides real-time location tracking of assets and personnel in underground mines.

- **IP Telephony & messaging**
  Integrated IP telephones from Ascom. Provides voice communication with push-talk telephone calls as messaging and alarm functionality.

- **Video**
  Integrated video system from VideoNet and Indigo Vision. Provides video surveillance and remote control capabilities.

- **AutoMine system**
  Autonomous loaders controlled remotely via WLAN, the operator can be in a control room to remote control the loading and unloading. Transporting between loading and unloading autonomous with ability to operate during blasting.
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Source: ABB 2020 Project Team
ABB MineInsight™
Mine production and control system

MineInsight™

Execution manager

- Scheduling
- Production execution
- Material tracking
- Production performance reporting

Fleet manager

- Dispatch & work order management
- On-board machine reporting
- Remote monitoring
- Equipment performance reporting

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Typical problems

- The MTBF figures of mining machines are low. Can be as low as 8h.
- Reactive and time-based maintenance are dominating maintenance strategies.
- Hard to perform root-cause analysis and understand why machines break-down

- Utilization rate of mobile mining machines are low, can be as low as 20-25% of available working time
- Utilization of open faces are low. Can be as low as 20-30% of the available working time.
- High degree of unplanned activities and low plan compliance.
Value proposition

- Maximize equipment availability by moving from reactive to predictive maintenance.
- Achieve production targets and produce to plan by reducing variability and improving responsiveness to unplanned activities and disturbances.
- Maximize production flow from face, through blast cycle activities and crushing and haulage to surface.
- Track and control ore inventory for maximal flow and optimal grade.
- Increase operation awareness for all personnel of the current mine status.

"Estimated to increase production capacity with 10-20% with same resources"
The ore factory
Execute optimized plans and monitor on-line

Decision layer
- Design
- Production
- Assets
- Work
- Material
- People
- Finance

Operation layer
- Production plan
- Asset availability
- KPI report & visualization
- Status on-line

Capability layer
- Work orders
- Production status
- Machine status
- Machine position

Development → Production drilling → Load & haul → Truck haulage → Crushing → Hoisting → Stockyard management → Mineral Processing

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ABBS MineInsight™
Logical structure

Mine engineer

Machine operator

3:rd party mine planning server

Minelnsight™ Server

Scheduling & dispatch client

Vehicle data logger

Vehicle client

Shift manager client

Shift manager

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ABB MineInsight™
System layout - overview

3:rd party systems

Minelnsight™
Web clients

Minelnsight™
Servers

System 800xA
Servers

Mine operator workplace
Minelnsight™ clients
Scheduling & dispatch
Remote monitoring
Process control

Production network

Process control network

Process control network / Production network

3:rd party
Remote monitoring

Machine operator workplace

Machine operator workplace

Machine operator workplace
On-board Vehicle data logger

Shift manager workplace

Process control
Fixed/semi mobile equipment

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**Gantt scheduler**

- Import of mine production plan from long- and medium mine planning system
- Short-term planning of blasts for both development and production.
- Scheduling of tasks for related to each blast with support for standardized blast cycles
- Scheduling of task related to maintenance of machines, media and electrical installations at different locations
- Auto push to adjust plan according to actual time
- Printing of shift work orders / tasks

**Production execution**

- Automatic export of Operation requests / scheduled tasks to MineInsight™ Fleet manager
- Automatic import Operations responses containing:
  - Status of tasks
  - Production data
  - Disturbances
MineInsight™
Key functionality – Execution manager

Material tracking
- Tracking of material movements
- Tracking ore qualities
- Keeping inventory balances

Production performance reporting
- Actual operation status
- Reporting of operation results (daily, weekly, monthly)
- Reporting of operation performance according to planned
- Analytics of utilization of production resources
- Analytics and drill-down of production disturbances
Dispatch & work order management

- Production status overviews
- Production reporting for each task
- Disturbance and stop reporting for each task
- Check and approval of production reporting for shift handover
- Production and equipment status shift reports
- Supervision of vehicle clients and shift manager clients
- Robust communication services, support for different levels of communications over different infrastructures. High data integrity is built-in to secure that no data is lost independent of infrastructure.

On-board machine reporting

Vehicle clients and Shift manager clients

- Easy-to-use user interface specially adopted for vehicles.
- Work order / task management
- Production reporting
- Disturbance and stop reporting
- Operator notes
- Pre-operation check list & post production reporting
- Robust communication services, have the possibility to act as data carrier for other clients which enables data from one client to be transferred to second client. When the second client come in contact with the network, data is synchronized with the server.
Remote monitoring
- System 800xA provides the real-time platform where the fleet of vehicles and mobile machines are managed together with fixed equipment
- Vendor independent remote monitoring of vehicles and mobile machines. Support for IREDES standard.
- Interface to 3:rd party remote monitoring systems servers
- On-board vehicle data logger module supporting standard interfaces like CAN, Modbus, RS232, I/O or other standard fieldbus protocol.

Equipment performance reporting
- Analytics and web reporting is provided through ABB Decathlon Services information platform
- Dashboard for monitoring of overall equipment efficiency and key performance indices
- Drill-down analysis of stop and disturbance data
MineInsight™
integration of 3:rd party Remote Monitoring System

Machines and Monitoring Solution

800xA Control System
MineInsight™ integration of 3:rd party Remote Monitoring System
MineInsight™
integration of 3:rd party Remote Monitoring System

- Asset Optimization
- Actual operation status
- Reporting of operation results (daily, weekly, monthly)
- Reporting of operation performance according to planned
- Reporting energy consumption
- Integrated access to documentation
- Material tracking
- …
MineInsight™
integration of 3:rd party Remote Monitoring System
Mobile machine Objects

Typical Aspects
ABB MineInsight™
Supported processes

- Execution manager
  - Generic base module
  - Load & Haul module
  - Drilling process
  - Safe charging module
  - Scaling & rock reinforcement module

- Fleet manager
**Load & Haul module**

- Scheduling and execution of draw plans
- Specific Load & Haul vehicle client HMI’s
  - Loader vehicle client
  - Truck vehicle client
- On-board location tracking via passive RFID technology or WiFi
- On-board vehicle data interface to loader or truck scale.
- Automatic production tracking of mucked and transported material
- Analysis of complete load & haul operations cycle including disturbance reporting and production performance.
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