IoT ENABLED INTELLIGENT FLEET MANAGEMENT

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SMART LOGISTICS – PART OF INDUSTRY 4.0

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Smart Products

Smart Mobility

Smart Logistics

Smart Grids

Smart Buildings
LOGISTICS 4.0 FOR LIFT TRUCK INDUSTRY

**Intelligent trucks**
- Truck equipped with electronic control unit
- Increased efficiency also from driver assistance systems

**Fleet data management**
- Fleet data services connect trucks with management tool
- Optimise truck fleet usage
- Financial and safety benefits

**Automated trucks**
- Full range of automated series trucks
- Enable automation of the entire material flow

**System solutions**
- Customised integrated intralogistics solutions
- Automated trucks combined with further hard- and software

- Safety – fewer accidents
- Flexibility, esp. in handling complex material flows
- Increasing precision and reliability

No “Industry 4.0” without “Intralogistics 4.0”

Source: KION Group AG - 2015
IoT BUSINESS OPPORTUNITIES

5 Ways IoT Will Create New Opportunities

New business models
The IoT will help companies create new value streams for customers, speed, time to market and respond more rapidly to customer needs

Real-time information on mission-critical systems
Enterprises can capture more data about processes and products, more quickly and radically improve market agility

Diversification of revenue streams
The IoT can help companies monetize additional services on top of traditional lines of businesses

Global visibility
The IoT will make it easier for enterprises to see inside the business, including tracking from one end of the supply chain to other, which will lower the cost of doing business in far-flung locales

Efficient, intelligent operations
Access to information from autonomous endpoints will allow organizations to make on-the-fly decisions on pricing, logistics and sales and support deployment

Source: IDC
MAJOR COMPONENTS OF FLEET MANAGEMENT

Operational Fleet Monitoring and Management
Real-time equipment tracking, KPI management per truck, fleet and location

Equipment dispatching
Assigning equipment to customers

Technician scheduling
Location, skill requirement, shift of work based crew scheduling

Asset tracking
Linked to overall fleet management, allows the tracking of all goods and physical items allocated to fleet operations

Condition based, predictive maintenance
Remotely view and manage equipment servicing

Security and safety
Equipment and driver security during operation or while stopped, recovery of stolen vehicles
FLEET MAINTENANCE

Corrective Maintenance
Performed to identify, isolate, and rectify a fault so that the failed equipment, machine, or system can be restored to an operational condition.

Preventive Maintenance
Schedule of planned maintenance actions aimed at the prevention of breakdowns and failures. Preserve and enhance equipment reliability.

Predictive Maintenance
Techniques that help determine the condition of in-service equipment in order to predict when maintenance should be performed. Minimize disruption of normal operations, while allowing right time repairs.
Your equipment tells you precisely what kind of service it needs, where, why, and what its estimated life time will be without that service.

**Sense**
Raw data is collected from hundred or thousands of sensors, locally processed or transmitted wireless to remote monitoring.

**Decide**
Analyse the data, take decisions locally or through remote analytical services. Private and public data are combined using cloud-based services.

**Act**
Adapt and optimize the performance of the process locally or take actions to replace the part causing problems.

**Predictive, condition-based Maintenance**
Allocate and plan maintenance tasks according to the anticipated, measured or calculated condition of a component, device or system.
INTELLIGENT SPARE PARTS

Predictive Maintenance
Self diagnostics identify failing components resulting in automated parts ordering

Embedded sensors
Real time, condition based monitoring
Part identification and direct ordering
Classical or additive manufacturing

Reference #
Ref. #
Digital design

Spare parts supplier
OEM Manufacturer
3D printing factory
TECHNOLOGIES DRIVING INDUSTRY 4.0

- Mobile
- Autonomous robots
- Cloud Computing
- Augmented reality
- 3D Printing
- Big Data
- Internet Of Things
- IoT
- Analytics
- Artificial intelligence
- Big & Fast data
SMART PRODUCTS

Physical Components
Mechanical and Electrical Parts

Smart Components
Sensors, chips, storage, software, embedded operating system...

Connectivity Components
Ports, antennae, protocols, wired or wireless connections
CYBER-PHYSICAL WORLD

- Vehicle, asset, person & pet monitoring & controlling
- Agriculture automation
- Energy consumption
- Security & surveillance
- Building management
- Embedded Mobile
- M2M & wireless sensor network
- Everyday things
- Smart homes & cities
- Telemedicine & healthcare

MERGING THE REAL AND VIRTUAL WORLDS
DIGITAL TWINS

SENSORS

DATA

ANALYTICS

VIRTUAL MODEL FOR PHYSICAL PRODUCTS
DESIGN – BUILD - OPERATE

Design 3D CAD twin
Simulate First born digital twin
Monitor Physical asset twin
In past 6 months, my number of cold starts is 4, my number of warm starts is 8, my number of hot starts is 39. The number of start/stop cycles has increased by 27.5%.
IMMERSION INTO THE VIRTUAL WORLD

AR / Mixed Reality Headset
- Physical world is augmented with some “virtual items”
- Real controls etc.

Traditional Simulator:
- Virtual world etc.
- Real controls etc.

VR Headset & Camera
- Virtual mach. & env.
- Real controls etc.
- Virtual world is augmented with some “physical items”

VR Headset
- Virtual mach. & env.
- Real controls (not visible) or virtual controls.

Level of “reality”

0%

100%

Physical world

Virtual world

? The future ?

Source: Mevea Ltd.
MAJOR BENEFITS

- Ecosystems - Collaborative product development
- Asset performance - Analytics-based performance optimization
- New digital business models
HOW TO BUILD DIGITAL TWINS?

- Integrate smart components such as sensors, software, computing power, or data storage into new or existing products.

- Connect the product to a central location where you can capture sensor data and enrich that sensor data with business and contextual data.

- Analyze that data on an ongoing basis to identify opportunities for product improvements, new products, or even new business models.

- Leverage these digital insights to transform your company — for example, by reducing costs through proactive avoidance of business interruptions, or by creating new business opportunities.
SMART LIFT TRUCKS

- GPS
- Engine data
- Fuel
- Temperature
- Tyre pressure
- Oil condition
- Battery
- Mast Tilt Angle
- Load presence
- Proximity sensor
- Heavy load position
- Speed & Accelerometer
- Camera
- Mast & steering sensor
Making the Lift Truck Smarter

Putting more intelligence on existing machines

Safety & Security

Weight-sensing fork blade assembly for engaging pallets in different alternative directions of approach

Usage Monitoring
Impact sensing

Battery Monitoring

Battery Management

Sensors for Lift Trucks

Access control

Access
Measure, Manage, Maximize

EMROL
Batteries & Chargers
SECURITY – IMPACT SENSING
The *Value* comes from the *Information* that’s hardest to manage.

IoT *generates large quantities of data* that need to be processed and analyzed in real time.

Data aggregation and processing *at the Edge*. Relevant data is forwarded to central site for additional processing.

In *Maintenance Mode* a lift truck generates more than 3 MB / min through CAN-bus.

The *massive scale* and *highly dynamic* nature of the IoT, the huge amounts of data streamed from the physical world, and new communication patterns demand novel programming, content delivery, and network management.
FAST DATA

- Fix Trade & Market Data
- Sensors
- Mobile
- Logs
- Real-time News
- Twitter

BIG DATA

- STREAMING ANALYTICS
- HADOOP

EVENT SERVER

- 2:00 PM: Buy 10K IBM
- 2:01 PM: Sell 10K IBM

POTENTIAL FRAUD
MOVING TOWARDS ADVANCED ANALYTICS

BI & Reporting
- Descriptive
  - What is happening?
    - Business Reporting
    - Dashboards
    - Metrics
    - Scorecards
    - Mobile BI

Information Portal
- BI Specialist

Business Analytics
- Diagnostic
  - Why did it happen?
    - Data discovery
    - OLAP
    - Ad-hoc query
    - Location analytics
    - Basic predicative modelling

Analytics Workbench
- Information Analyst

Advanced Analytics
- Predictive
  - What will happen?
    - Predictive analytics
    - Support for BigData
    - Advanced data access
    - Experimentation

Data Science Laboratory
- Data Scientist
  - What should we do?
    - Decision modelling
    - Expert systems
    - Simulation
    - Optimization
    - Innovation
IoT & PREDICTIVE ANALYTICS

- **Raw Data Collection**
- **Edge Data Filtering**
- **Real-Time Data Analysis**
- **Signal Analysis**
  - Sensor value distribution analysis
  - Linear regression ...

- **Event Analysis**
  - Event Tracking & Filtering
  - Event Correlation
  - Event Aggregations ...

- **Root Cause Analysis**
- **Predictive Modelling**
- **Integrate into Operations**

**Exploratory Data Analysis**

**PREDICTIVE ENGINE**
PREDICTIVE MAINTENANCE COST SAVING

**IBM**
- Reduction in maintenance costs: 25-30%
- Elimination of breakdown: 70-35%
- Reduction of downtime: 35-45%
- Increase in production: 35-45%

**Gartner**
- Average cost reduction moving from preventive to predictive maintenance: 10-20%

**Source:** IBM – Published on Oct 27, 2016
**Source:** Gartner – Published on Oct 17, 2016

By 2022, IoT will save consumers and businesses $1 trillion a year in maintenance, services and consumables.

**Source:** Volvo Construction Equipment 2016
NEXT GENERATION SERVICE ENGINEERING

COMBINING HUMAN AND ARTIFICIAL INTELLIGENCE

AUGMENTED REALITY

SMART GLOVES

NATURAL LANGUAGE PROCESSING

CHAT BOTS

ADVANCED TECHNICAL SUPPORT

ARTIFICIAL INTELLIGENCE

IMAGE RECOGNITION

PARTPİC

SMART GLOVES
MAJOR BENEFITS

Moving from Two-Step to One-Step Maintenance

Increasing the availability of equipment, optimize the usage and reduce the operational cost

Empowering Equipment Maintenance
Combining Human Intelligence with Machine Learning

Allowing the development of a new business model
Offering Lifting Capacity as a Service

Improve driver safety and promote responsible driving
NEW BUSINESS MODEL

MOVING FROM PRODUCT TO SERVICE

Lifting capacity as a service

Reducing downtime
Extending asset life

Measuring the residual value

Pay-per-usage

Detecting and avoiding overloading

OEM’s will not sell equipment alone, but a solution including maintenance and insurance
CONNECTED EQUIPMENT ECOSYSTEM

ORIGINAL EQUIPMENT MANUFACTURER (OEM)

- Real-time alerts
- Consolidated view
- Improvement proposals
- Technical specifications
- Maintenance procedures
- Digital twin API

CUSTOMER

- Real-time alerts
- Maintenance and service issues
- Data produced by equipment
- Real-time alerts & updates
- Maintenance services
- Improved user experience
Digital Transformation is much more than just implementation of technology. It requires a top-down organizational and cultural change. Senior leaders need to lead by example showing people that the old way is no longer good enough.

Big Data, Fast Data, Advanced Analytics, Data Science. Technology is not enough. Unless your organization truly values data, these are nothing but buzzwords.

Building a Mixed Team of Business and IT Data Specialists with a Culture of Analytic Agility is a good way to go.
The Internet of Things is about the transformation of physical objects into digital data products. It is radically changing the way businesses operate and people interact with the physical world.

The benefits of Predictive Maintenance are significant. Its implementation requires more than just technological choices. It has impact on the organizational structure and culture.

New digital business models require ecosystems of people, businesses and technologies that must scale beyond the enterprise.
Thank You