How the IoT and Data Analytics Will Drive the Future of the Supply Chain

Presented by:

Dan Romary
VP, Data Analytics
Getting beyond the “Buzz” in Supply Chain
Agenda

- Notes and Terms
- The Smart Warehouse
- Measurable success
- Tools and roadmap
- Looking Ahead
Notes and Terms

The **Internet of things** is the internetworking of physical devices, **vehicles** (also referred to as "connected devices" and "smart devices"), buildings, and other items, embedded with electronics, software, sensors, actuators, and network connectivity that **enable these objects to collect and exchange data**.

The **Internet of things** is the interconnection via the Internet of computing devices **embedded in everyday objects**, enabling them to **send and receive data**.

**Telematics** is the area of technology that deals with sending digital information over long distances using wireless forms of communication:

In vehicles, telematics can be used to monitor **hours used and miles driven**, each of which can be recorded in real time.
Three basic components make a “thing” part of the IoT
  – Sensors track and measure activity
  – Internet connectivity contained in the object
  – Processors enable the object to have computing power

It is estimated there are approximately 6.4B IoT devices
  – Excludes smartphones, tablets, computers

Gartner, Inc.
The “Fourth Industrial Revolution”

The IoT will add $4T to $11T in potential economic impact by 2025

*McKinsey Global Institute*

<table>
<thead>
<tr>
<th>Nine settings where value may accrue</th>
<th>Size in 2025, $ trillion¹</th>
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</thead>
<tbody>
<tr>
<td><strong>Factories</strong>—eg, operations management, predictive maintenance</td>
<td>Low estimate</td>
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<tr>
<td><strong>Cities</strong>—eg, public safety and health, traffic control, resource management</td>
<td>0.9–1.7</td>
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<tr>
<td><strong>Human</strong>—eg, monitoring and managing illness, improving wellness</td>
<td>0.2–1.6</td>
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<td><strong>Retail</strong>—eg, self-checkout, layout optimization, smart customer-relationship management</td>
<td>0.4–1.2</td>
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<td><strong>Outside</strong>—eg, logistics routing, autonomous (self-driving) vehicles, navigation</td>
<td>0.6–0.9</td>
</tr>
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<td><strong>Work sites</strong>—eg, operations management, equipment maintenance, health and safety</td>
<td>0.2–0.9</td>
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<td><strong>Vehicles</strong>—eg, condition-based maintenance, reduced insurance</td>
<td>0.2–0.7</td>
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<td><strong>Homes</strong>—eg, energy management, safety and security, chore automation</td>
<td>0.2–0.3</td>
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<tr>
<td><strong>Offices</strong>—eg, organizational redesign and worker monitoring, augmented reality for training</td>
<td>0.1–0.2</td>
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**Total** $4 trillion–$11 trillion
Data storage prices have dropped dramatically from more than $10,000 to less than $0.10 per GB over the decades.

Examples of data collected every one minute:

- 350,000 tweets
- 300 hours of video
- 171 million emails
- 330 gigabytes

Jet engine sensor data
The Smart Warehouse: Roadmap

- Fleet Management
- Materials Tracking
- Warehouse Management System
- Data Integration and Reporting
- Advanced Analytics
- Looking ahead
The Smart Warehouse: *Driven by IoT, Analytics*

- **Automated**
  - Eliminate manual processes of labor and input (costs)
  - Increase accuracy, speed
  - Savings generally exceed costs 2:1 within 24 months

- **Nimble**
  - Flexibly adapt, manage staffing, software, environment

- **Scalable**
  - Handle changes in demand, seasonality

- **Real-time**
  - Fully integrated, fully transparent, real-time by task

- **Customer-centric**
  - Real-time web access, enabled by a robust WMS
The Smart Warehouse: Measurable Success

- Operator efficiency, productivity
- Asset optimization
- Warehouse space optimization
- Safety improvement
- Overall visibility increased
- Foster data-driven culture
Fleet Management: VMS

✓ **Standard VMS features, including:**
  - OEM inclusive
  - Access control – by group, asset, location
  - Checklists/compliance
  - Text messaging
  - Current status, speed, warnings
  - Driver productivity
  - Lift weight
  - Location within facility

✓ **Wireless:**
  - Wi-Fi (enterprise mode) standard
  - Cellular (optional)

*Connected cars and vehicles will generate nearly 300k Exabytes of data by 2020
1 EB = 1 million terabytes = 1 billion gigabytes (more than doubling annually)*

Business Insider
Fleet Management: *Measurable Success*

- Operator efficiency, productivity
- Asset optimization
- Visibility, route optimization
- Safety improvement
Fleet Management:  Efficiency, Productivity

- Automated OSHA checklists
- Operator efficiency by vehicle
  - Time, distance required to perform work
  - Motion vs login time ratio
- Operational profiling
  - By OEM, vehicle type, conditions, facility
- Identify opportunities for automation
- Monitor vehicle abuse, wear and tear by operator
## Fleet Management: Efficiency, Productivity

### Vehicle Usage Dashboard

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<thead>
<tr>
<th>Vehicles</th>
<th>Make</th>
<th>Ent Avg M v L %</th>
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<tbody>
<tr>
<td>1k Sum</td>
<td>Raymond</td>
<td>33 Maximum</td>
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#### Motion vs Login Hrs Pct by Site

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<th>Site</th>
<th>Motion vs Login Hrs Pct</th>
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<tr>
<td>Demarest</td>
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#### Vehicles Used by Site

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Fleet Management: Efficiency, Productivity

- Fleet Management
- Advanced Analytics
- Integration, Reporting
- Materials Tracking
- Measurable Success
- The Smart Warehouse
- IoT, Data Analytics
- Meeting Agenda
- Notes and Terms
- Looking Ahead
- In Summary
Fleet Management: Asset Optimization

- Balance fleet size based on usage, demand
- Manage leases by meter, usage and forecast
- Right-size fleet based on max usage and demand
- Predictive maintenance
- Reduce asset downtime
Fleet Management: Asset Optimization

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Fleet Management: Route Optimization

- GPS, beacons, wi-fi (location-based)
- Integration with public maps, floor plans
- Visibility, tracking, replay
- Identify bottlenecks
- Optimize movement of vehicles, materials
Fleet Management: Safety Improvement

✓ Vehicle access control
✓ Speed control
✓ Zone access control
✓ Impact sensing
✓ OSHA checklists and reporting

OSHA statistics from 2013 report that there are approximately 85 forklift fatalities and 34,900 serious injuries yearly.
The average direct cost to a company is $38,000 with $150,000 in indirect costs related to a single forklift incident.

*National Safety Council*
Fleet Management: Safety Improvement

An OSHA safety fine can cost a company up to $7,000 for “minor” infractions, and up to $70,000 for repeat offenders.

OSHA
Materials Tracking: **Tools and Technology**

Handheld devices, scanners, barcodes

GPS and RFID technologies: *The “backbone” of the IIoT*

- Provide identity, location and other tracking information
- Tracking from manufacturer to retailer
- Automates shipping, delivery, accurately predicts time of arrival
- Monitors details like temperature control, which impact quality
Materials Tracking: **Applications**

Placed on pallets

- Bring in traffic, weather, driver-specific data (average speed, pattern)
- Brings together real-time sensor data with environmental data
- Identify traffic jams in advance
Materials Tracking: **Applications**

Key Benefits:

- Proactive replenishment
- Reduce asset loss
- Save fuel costs
- Monitor the cold chain
  - About one third of food perishes in transit every year
    *United Nations Food and Agriculture Organization*
- Manage warehouse stock
- Create fleet efficiencies

Deadhead miles account for up to 10% of truck miles and 28% of truck miles for private fleets

*National Private Truck Council*
Integration, Reporting: **Key Benefits**

- **Greater efficiency**
  - Singular, consolidated, consistent reporting

- **Context and Filters**
  - Leverage definitions across platforms

- **Comprehensive analysis**
  - Merge metrics from disparate systems to create a holistic picture

- **Enterprise analysis**
  - Evaluate performance across the entire enterprise, by site, group, operator, etc.
Integration, Reporting: Sources

- VMS
- WMS / ERP
- Maintenance System
- Location Tracking
- EIS / DSS
- Battery Management
- Timecard

Integrated Reporting

**Tools and Roadmap**

- Fleet Management
- Materials Tracking

**The Smart Warehouse**

- Measurable Success

**IoT, Data Analytics**

- Meeting Agenda
- Notes and Terms

**Integration, Reporting**

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Integration, Reporting: *Examples*

- **Dual-axis**
  - Pallets
  - Impacts

**Scorecards**
- Vehicle Utilization
- Pallets
- Impacts
Integration, Reporting: *Examples*

Rank sites performance by:
- **X-axis:** Pallets moved (WMS)
- **Y-axis:** Motion vs Login Ratio (VMS), or
- **Y-axis:** Motion vs Hours Ratio (VMS / Timecard)
Integration, Reporting: **Examples**

**Heatmaps**
- Timecard
- Vehicle utilization
- Pallets
- Impacts

- Daily Heatmap
- Hourly Heatmap
- 15-Minute Heatmap
**Advanced Analytics**

✓ Leverage AI, Machine Learning
  - Utilize vast amounts of data from sensors, business systems

✓ Action – beyond insights
  - Recommended course of action based on numerous variables
  - Descriptive > Diagnostic > Predictive > Prescriptive Analytics

✓ Simulation
  - Model affects based on changes
  - Develop intelligent workplans based on numerous variables

✓ Prediction
  - Forecast demand, maintenance, work performed

✓ Variation analysis
  - Characterize typical operations
  - Develop profile “fingerprint” for every operational variable
    • Operator, vehicle, OEM, tasks, environment, demand
Advanced Analytics:  Examples

Fleet Optimization
- Optimal fleet size based on simultaneous usage
Looking Ahead: **The Digital Supply Chain**

- Beyond the warehouse
- Sensors / End-to-end visibility
- Smart Infrastructure
- Real-time
- Machine Learning and prediction
- Optimization / Ongoing adjustments
- Automation

In Summary
## In Summary

<table>
<thead>
<tr>
<th>Widely Used</th>
<th>Becoming the Standard</th>
<th>Looking Ahead</th>
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</thead>
<tbody>
<tr>
<td>Vehicle Management Systems</td>
<td>Smart Warehouse</td>
<td>The Digital Supply Chain</td>
</tr>
<tr>
<td>Warehouse Management Systems</td>
<td>Automation</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td>RF-Id and Scanners</td>
<td>Robotics</td>
<td>Machine Learning</td>
</tr>
<tr>
<td>Automated Checklists</td>
<td>Data-driven accountability</td>
<td>Ongoing Optimization</td>
</tr>
<tr>
<td>Basic Reporting and Analytics</td>
<td>Advanced and Predictive Analytics</td>
<td>Prescriptive Analytics</td>
</tr>
</tbody>
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80% surveyed believe the Digital Supply Chain will be the predominate model within the next five years

16% saying it’s happening today

*2017 MHI Annual Industry Report*
For More Information:

Speaker email: DRomary@id-systems.com
Website: www.id-systems.com

Or visit MODEX Booth #4021