INTERNET OF THINGS IN LOGISTICS
WHAT IS IOT?

Source: Cisco
Joint report with Cisco on the implications for IoT in warehousing, transport and last-mile operations. Report launched at the Tech. Conference and took approx. 10 weeks to produce.

Source: DHL Trend Research [www.dhl.com/iot]
## WHY IOT IN LOGISTICS?

IoT is “sensing and sense making” in the world of logistics

<table>
<thead>
<tr>
<th>Technology Push</th>
<th>Need for Logistics Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mobile computing</strong> growing steadily with more mobile phones expected in 2020 than people in the world</td>
<td>High need for transparency and integrity control (\text{(right products, at the right time, place, quantity, condition and at the right cost) along the supply chain} )</td>
</tr>
<tr>
<td>Due to the consumerization of IT, sensor technology has become more mature and affordable to be used for industry purposes in logistics</td>
<td>End-consumers are asking for detailed shipment tracking to have transparency in real time</td>
</tr>
<tr>
<td>With the move towards 5G, wireless communication will reach a new level of maturity connecting everything anytime</td>
<td>Business-Customers asking for integrity control especially for sensitive goods</td>
</tr>
<tr>
<td><strong>Cloud computing and big data</strong> technologies will enable new data based services</td>
<td>Logistics companies need transparency of networks and assets being used for ongoing optimization of efficiency and network utilization</td>
</tr>
</tbody>
</table>

Source: DHL Trend Research
DHL’s has already started its IoT journey

Maturity of IoT Technology

- Passive RFID
- Semi-active Sensors
- Real-time Solutions
- Sensor-Network

Source: DHL Trend Research

New data driven Services/Big Data
1. IoT in Warehousing
## USE CASES:

<table>
<thead>
<tr>
<th>1). Smart Inventory Management</th>
<th>2). Optimal Asset Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensors tags on pallets and items transmit data on location, condition (e.g. temperature) to enable real-time visibility into inventory levels and increase quality of warehousing operations</td>
<td>By connecting machinery and vehicles to a central system, managers can monitor all aspects of an asset in real-time such as productivity, speed and location to optimize asset management (See Swisslog)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers can connect via smartphones and wearables to monitor health and fatigue and to identify areas where process paths can be optimized and potential collision risks with vehicles</td>
<td>Lighting costs which account for up to 70% of energy use in a warehouse could be optimized by combining intelligent LED lights with data from the warehouse floor to dim areas where there is no activity</td>
</tr>
</tbody>
</table>
2. IoT in Transportation

- **Shipment ID:** HS800243
  **Location:** HHDE_7F240
  **Temperature:** 15°C
  **Humidity:** 53%
  **Light:** container opened for customs
  **Shock:** no shock events detected

- **Engine sensor:** 9R003
  **Status:** serious malfunction detected
  **Action:** maintenance team alerted

- **Shipment ID:** CR55024
  **Location:** HHDE 50331
  **Speed:** 70km/H
  **ETA:** 20:30 04/05/15
  **Material damage likely**
  **Maintenance check scheduled**

- **Shipment ID:** DE235104
  **Location:** HHDE002-45-8
  **Temperature:** OK

- **Driver fatigue detected**
  **Pull over at next stop**
USE CASES:

1). Location & Condition Monitoring
Tagged items enable more accurate and faster track & trace and condition monitoring of all shipments across various modes of transportation, improving integrity control and decision making in the supply chain.

3). Predictive Maintenance
Sensors in key areas of the truck identify and transmit data on material degradation or damages. Analytics can predict asset failures and automatically schedule maintenance checks when needed (See MoDE).

2). Fleet & Asset Management
Sensors monitor and transmit data on asset utilization, location, and spare capacity to improve fleet management and enable dynamic consolidation on routes. This includes assets such as trucks, ULDs and containers.

4). End-to-end SC Risk Management
Central platform integrates data from all assets as well as data from external sources such as weather and traffic data on key trade lanes to intelligently conduct risk assessment and trigger corrective action real-time.
3. IoT in Last-mile Delivery

Automatic order placed for:
- Product BRA03252AB x 200
- Product TRA24989 x 350

Notification: delivery of your parcel scheduled for 13:30 this afternoon. Re-route delivery to your neighbor?

Notification: Groceries have been delivered
- Temperature 1°C

Pick-up of clothes (1.5kg) requested
- Address: 5a Clovelly Road
- Payment: complete
- Bring back to parcel center for packaging and processing

Transmit data on:
- Road condition
- Traffic
- CO2 emissions
- Noise pollution

Automatic order placed for:
- Fridge: milk, eggs, fresh fruits
- Goods: cat food, diapers, washing powder
### USE CASES:

<table>
<thead>
<tr>
<th><strong>1). Optimized Mail/Parcel collection</strong></th>
<th><strong>2). Automatic Replenishment</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensors in official and private post boxes can notify the customer whether a package has been delivered and to the logistics provider whether a collection needs to take place.</td>
<td>Intelligent products and home appliances as well as shelves at retailers automatically schedule an order when a product is running low on stock. This reduces lead time and avoids costly stock out situations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>3). Flexible Delivery and Pick-up</strong></th>
<th><strong>4). Next-generation Visibility</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart homes detect whether the recipient is home or not and can allow secure remote access for the delivery man. Logistics providers can also connect with surrounding homes to provide ad hoc pick-up services (see shyp).</td>
<td>Proliferation of printed smart labels that track temperature and humidity will enable consumers to monitor the integrity of potentially all perishable and temperature sensitive goods in the future</td>
</tr>
</tbody>
</table>

Pictures: LG, Shyp, Diageo
**CASE STUDY: DHL PHARMA EXPRESS**

**Who?**  DHL Express Spain

**Goal?**  Shipment level temperature monitoring

**Devices?**  DHL SmartSensor RFID, USB RFID Readers, Data Export interface

**How?**  Shipment temperature derived from vehicle and sorting center temperature monitoring

---

**Temp. Monitoring location**
- Pickup vehicle
- Origin sorting
- Line haul vehicle
- Destin. Sorting
- Delivery vehicle

**Temp. monitoring device**
- Sample parcel with SmartSensor RFID
- Fixed installed 3rd party device
- Sample parcel with SmartSensor RFID
- Fixed installed 3rd party device
- Sample parcel with SmartSensor RFID

**Data transmission**
- Data read out performed upon arrival at sorting center
- Network data transmission
- Data read out performed upon arrival at sorting center
- Network data transmission
- Data read out performed upon arrival at sorting center

**Online customer data portal**
CASE STUDY: DHL OCEAN SECURE

Combined container and shipment level monitoring

**At container level**
- Primary unit to maintain integrity of entire container
- Active checks of container location and conditions
- In-transit alarms in case of predefined exceptions

Outer surveillance layer to spot any developing exceptions before they can affect the shipment.

**SHIPS SAME**

**At shipment level**
- Completely redundant data loggers inside container
- Pharma-validated temperature and humidity records
- Granular monitoring down to single cargo items

Core surveillance layer to verify nominal cargo conditions were maintained from door to door.
## Challenges Facing IoT in Logistics

1. Logistics is still a **fragmented industry** so end-to-end solutions often require cooperation of various logistics player along the Supply Chain.

2. Being such a **networked business**, implementing new solutions requires adjustments for entire networks resulting in high investment needs.

3. **Willingness to invest** in new solutions for integrity control is still low and limited to niche markets such as Life Science or High Value Goods.

4. **Regulations** (e.g. Aircraft) and lack of network availability (e.g. remote locations on Oceans) limit the full usage of real time tracking.

Source: DHL Trend Research
### KEY SUCCESS FACTORS FOR IOT IN LOGISTICS

<table>
<thead>
<tr>
<th></th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clear and <strong>standardized</strong> approach for the use of unique identifiers for various types of assets among different industries on a global scale</td>
</tr>
<tr>
<td>2</td>
<td>Seamless <strong>interoperability</strong> for exchanging sensor information in heterogeneous environments</td>
</tr>
<tr>
<td>3</td>
<td>Establishment of trust and ownership of <strong>data and overcoming privacy</strong> issues in the supply chain</td>
</tr>
<tr>
<td>4</td>
<td>Clear focus on <strong>reference architecture</strong> for the IoT</td>
</tr>
<tr>
<td>5</td>
<td>Change in <strong>business mindset</strong> to embrace the full potential of IoT in logistics</td>
</tr>
</tbody>
</table>

Source: DHL Trend Research