

IoT*fy*ing your Applications



A quick look at the trends and applied use cases, pain points and recommendations

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Agenda

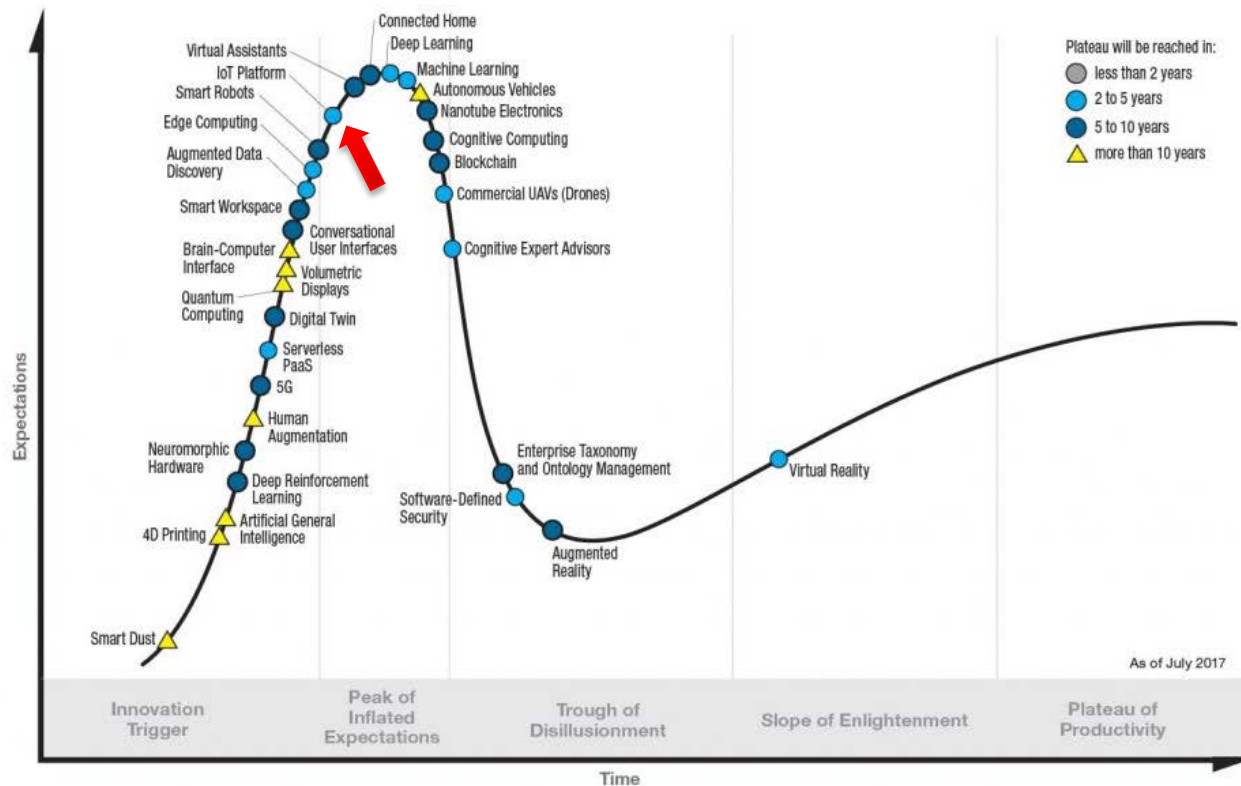
- **IoT Trends**
- **Use Cases**
- **Lessons Learned**
- **Recommendations**

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The Emerge of IoT is at Peak of Inflated Expectations and has significant Momentum to boost towards Productivity

Gartner Hype Cycle for Emerging Technologies, July 2017



- 61% of organizations with IoT projects believe they have barely begun to scratch the surface of what IoT can do for their business.
- 73% of organizations are using data from IoT projects to improve their business already:
 - Improved product quality or performance
 - Improved decision-making
 - Lowered operational costs
 - Improved or new customer interactions
 - Reduced maintenance or downtime

Source: Gartner, Cisco, Bosch

Current Status of IT and OT Relationship

Operational Technology



The
IT <--> OT
Gap

Information Technology



Product
Development



Planning



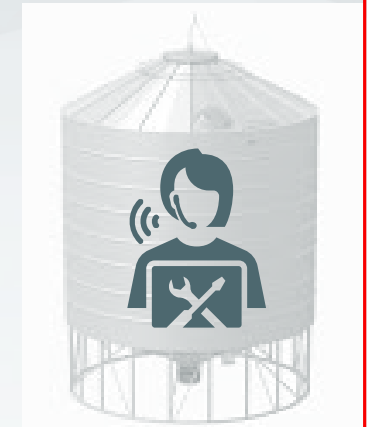
Manufacturing



Forecasting

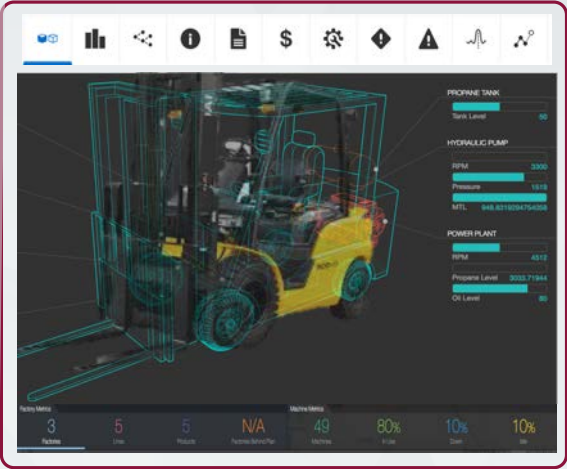
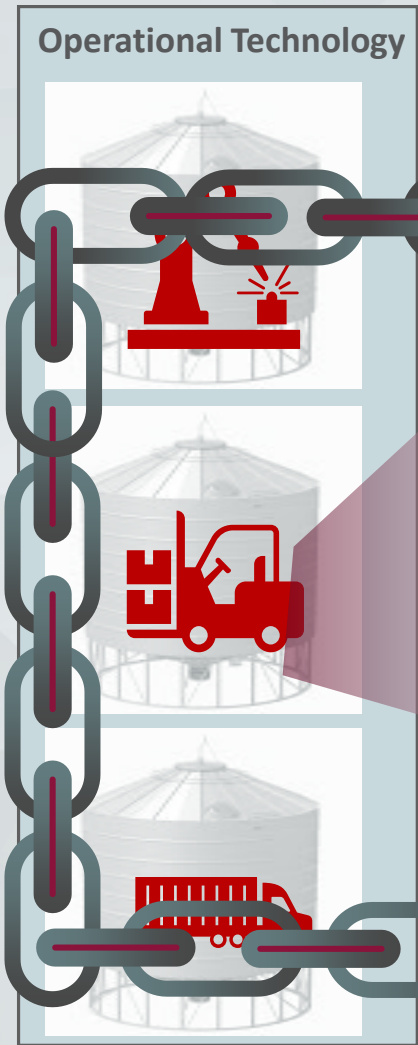


Inventory

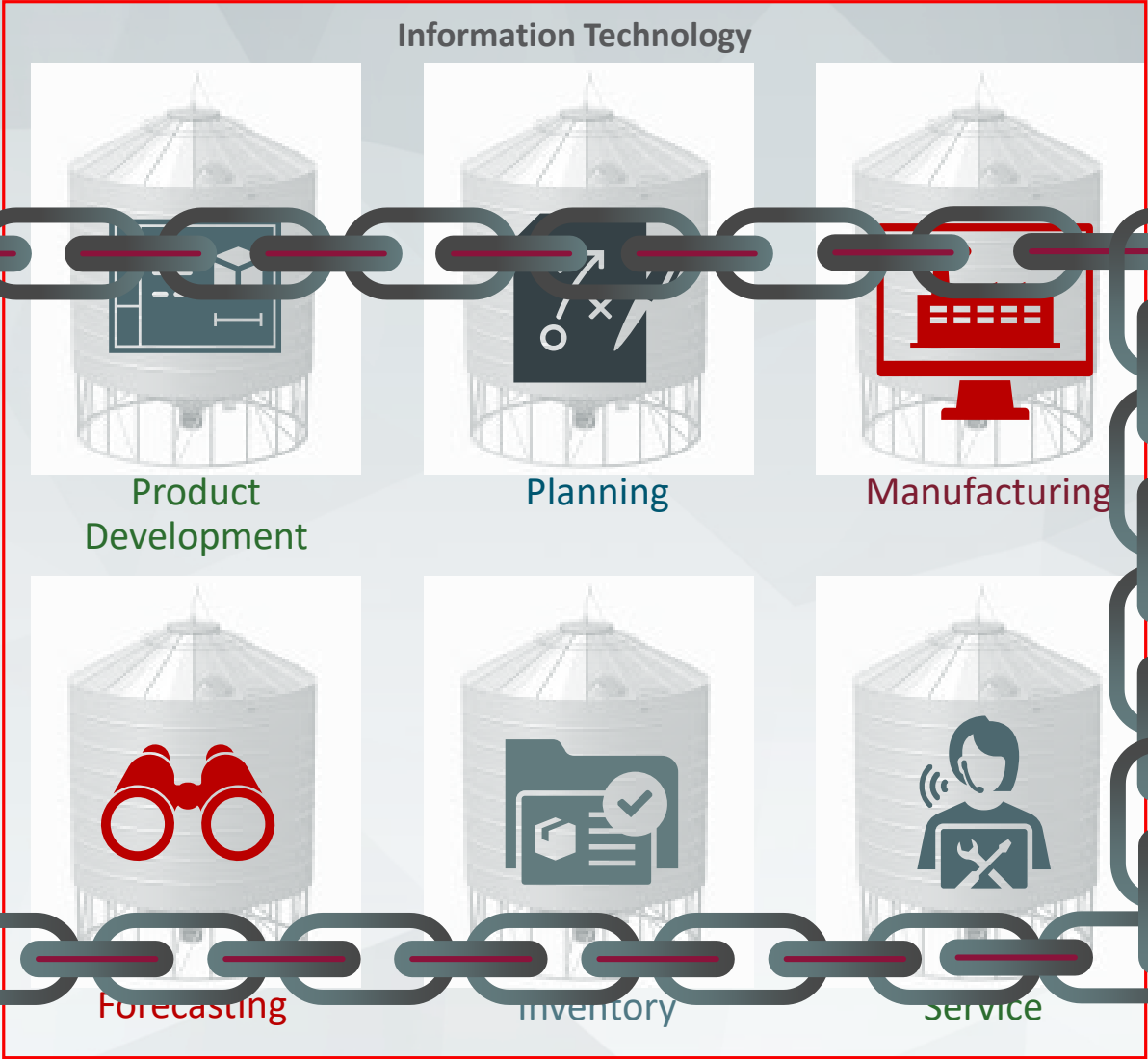


Service

Target Status Driven by IoT



- 1 Digital Twin
- 2 Artificial Intelligence
- Machine Learning
- and
- 3 Digital Thread



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Use Cases



Manufacturing

- Shop floor equipment monitoring
- Predictive Analytics for machine failures
- Integration with MES and ERP
- Real-time filtering and processing of events
- Proactive parts replacement
- Integration with CRM and Service Ticketing system



Asset Tracking

- Tracking of assets in conference center and warehouses
- Track utilization, dispatch/returns
- Integration with ERP for orders & invoicing



Inventory Monitoring

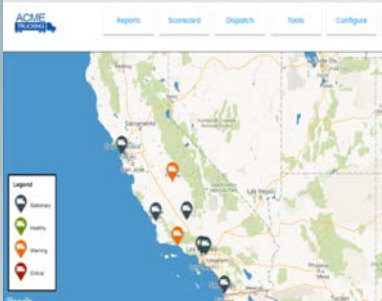
- Monitoring humidity, temperature of smart Freezers
- Monitoring load for inventory levels
- Integration with Mobile App, Inventory systems



Automotive

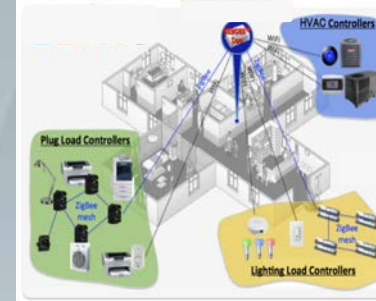
- Automobile monitoring for predicting maintenance needs
- Usage based insurance
- Just in time parts ordering driven by IoT events
- Integrated billing, subscription & marketing support
- Machine Learning & AR to analyze performance deviations

Use Cases



Fleet Management

- Connected Fleet solutions
- IOT to monitor fleet/cargo and reduce response time
- IOT and Big Data processing for Predictive maintenance
- IOT to deliver mobility as a service (city e-bikes and similar)



Facilities Management

- Next generation sensor-driven building automation
- Reduce the number of “truck rolls”
- Integration with Service Management and ERP systems
- Predictive maintenance of building assets (HVAC)



Smart Cities

- Insight into KPIs like energy efficiency, indoor air quality, etc
- Lower public utility and transport costs
- Smart traffic, parking
- Faster time to resolution of incidents
- High trust collection of video surveillance for criminal investigation



Communications

- Proximity sensing services
- Enabling M2M collaboration
- Physical and Environmental Protection of Telco sites

Use Cases



FSI

- Wearables – from contactless payment solutions to insurance premium/loyalty
- Mobile ATMs part of connected car story
- Fraud detection with Big Data
- Smart contracts with digital assets with help of Blockchain
- Beacons – secure entry to ATM lobbies during off hours, location based offers



Energy & Utilities

- Prescriptive maintenance
- Failure prediction and alert in the grid
- Energy conservation (smart lighting, thermostats, ...)
- Replacement of some expensive SCADA solutions

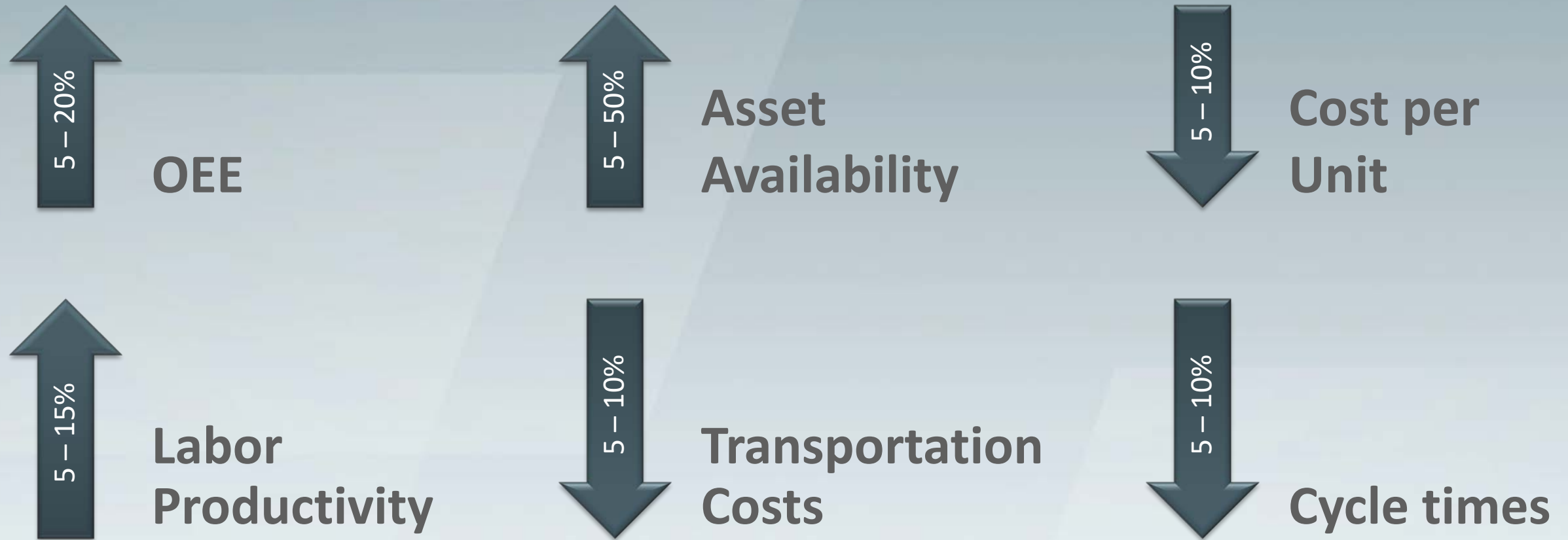
Key use case opportunities for International Trade:

- Maritime IoT Clouds for vessels, containers and related equipment for predictive maintenance, lower OpEx
- Dynamic product value assessment for new dimensions in trade financing
- Location based fund transactions with Smart Contracts
- IoT output data to track insured goods and enable real-time claim payments
- Pre-shipment financiers are also using IoT to verify the state of warehoused goods used as collateral

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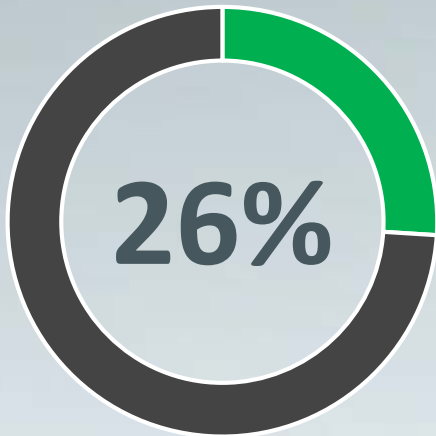
It is definitely worth exploring Opportunities with IoT to optimize organizational KPIs and realize Benefits



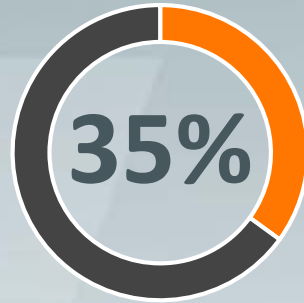
*OEE: Overall Equipment Effectiveness

However, success is not as easy as it seems

Only...



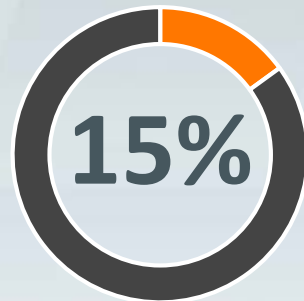
...of companies are successful with their IoT Initiatives.



of IT Executives think they were successful

Important factors:

- Technologies
- Organizational culture
- Expertise
- Vendors



of Business Executives think they were successful

Important factors:

- Strategy
- Business Cases
- Processes
- Milestones

Key Success Factors



Collaboration between IT and the Business



IoT expertise: internal & external partnerships



Technology focused culture

Source: Cisco Journey to IoT Value Survey, May 2017

Bottlenecks need to be identified and dealt with in advance for a successful outcome

Predictable impediments typically encountered

EARLY STAGE

Information challenges

- Trouble distinguishing meaningful and irrelevant information
- Trouble interpreting conflicting information
- Trouble identifying correct architecture

MIDDLE STAGE

People problems

- Competing priorities
- Different success criteria definitions
- Identifying correct skill set requirements
- Conflicting views on need for change
- Hidden concerns yet to be communicated

LATE STAGE

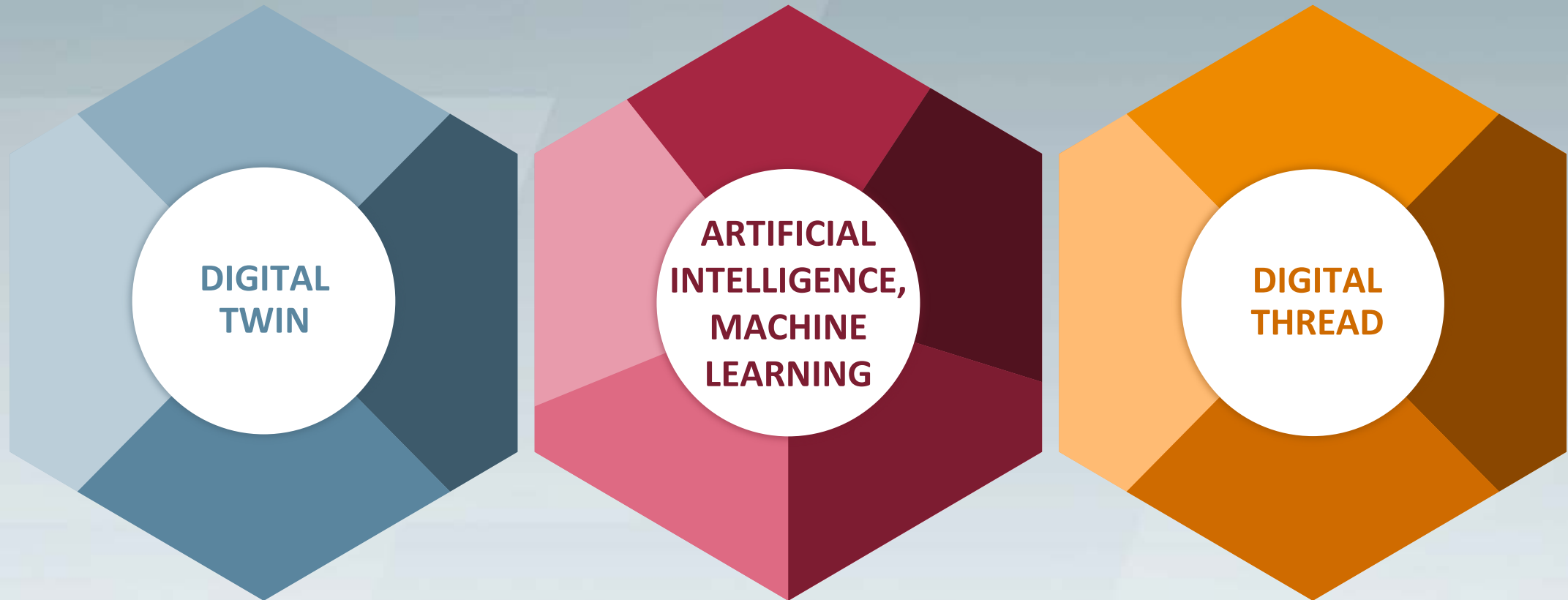
Options issues

- Having too many solution options is overwhelming (cloud, on-premise) → referring back to early stage architectural decisions and forcing changes
- Late introduction of new solution options creating confusion
- Unclear of implementation options

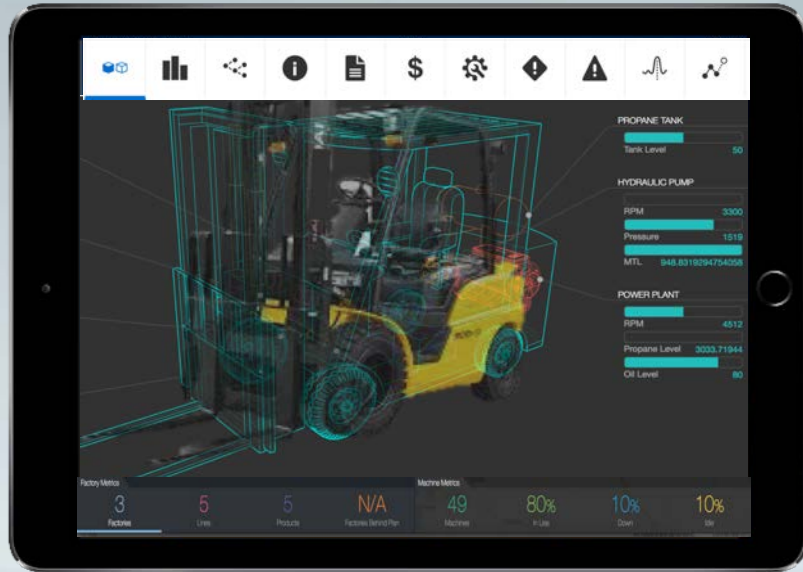
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The Future of IoT



Digital Twin



Visibility & Digital Interaction model

- Past, Current & Future view – metrics and device states
- Augmented Reality enabled



Single pane of glass – 360 degree view of assets

- KPIs
- Maintenance
- Incidents
- Financials



Business Context, Hierarchical, Relationships

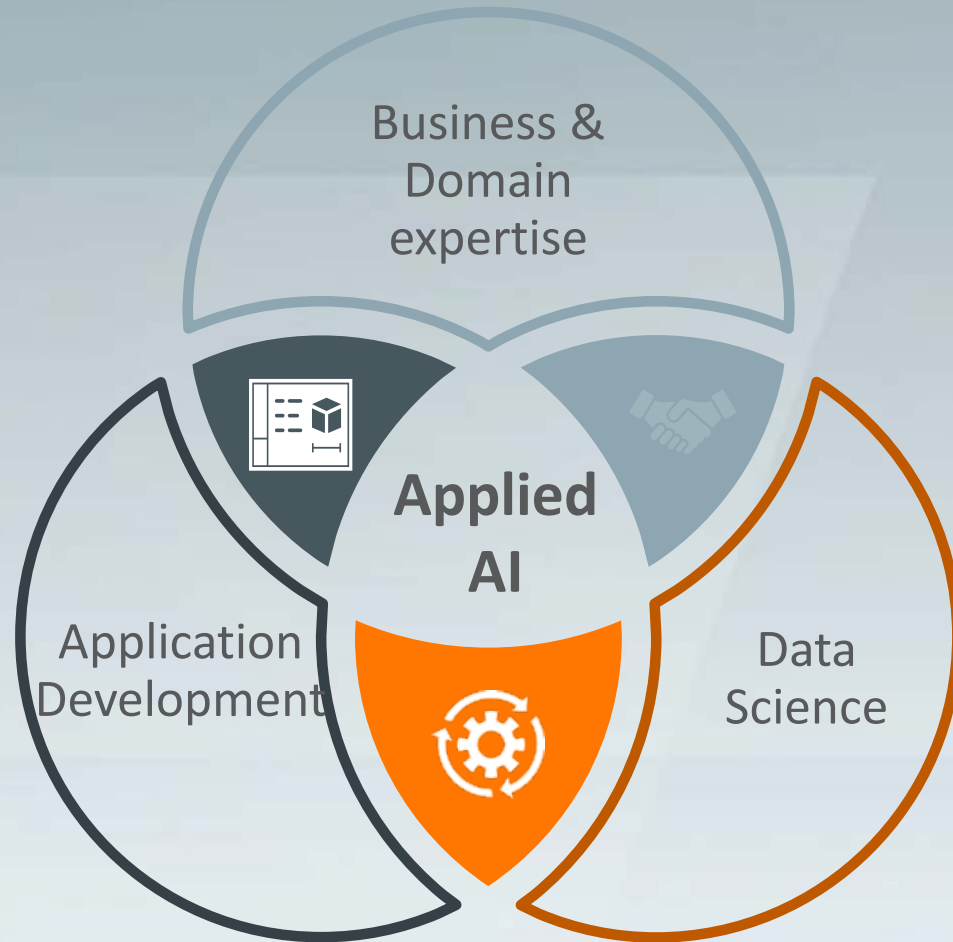
- View the asset in the context of the business processes, and relate it to other assets

What if?

What if simulations

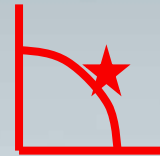
- Verify your business process by defining what-if-simulation scenarios

AI & ML



Prescriptive

- Recommendation on the best action



Optimality

- Optimization based on multiple simultaneous constraints



Demand Predictions

- Demand predictions based on multiple demand sensing signals

Digital Thread



Seamless Exchange of Asset Information

- Design → Manufacturing → Logistics → Transportation → Service



Integrate Organization Silos

- IT and OT, Logistics and Finance, Production and Design



Transformative Business Models

- Product as a Service, Dynamic planning based on demand signals

To make your applications IoT ready, you need to connect them to OT and evaluate solutions to cover 4 Aspects

Devices



Event Processing



If temperature is greater than 100, create an event



Business Metrics

Calculate my OEE (Overall Equipment Efficiency) based on Availability, Performance and Quality

Machine Learning

Alert me when the vibration of an equipment is anomalous.
Predict my OEE for next Tuesday



Artificial Intelligence

Example: Recommend an optimal course of action to deal with the predicted outage.



Business Apps



Manufacturing,



Supply Chain



Customer Relations



Service

Define the Algorithms you are going to need

Real Time

Anomaly
Detection

Time Series
Analytics

Data Processing

Classification and
Prediction Model
Evaluation

Batch

Forecasting

Pattern and Trend
Detection

Positioning
Algorithms

Clustering

Network Analysis

Recommender
System

Classification

Optimization

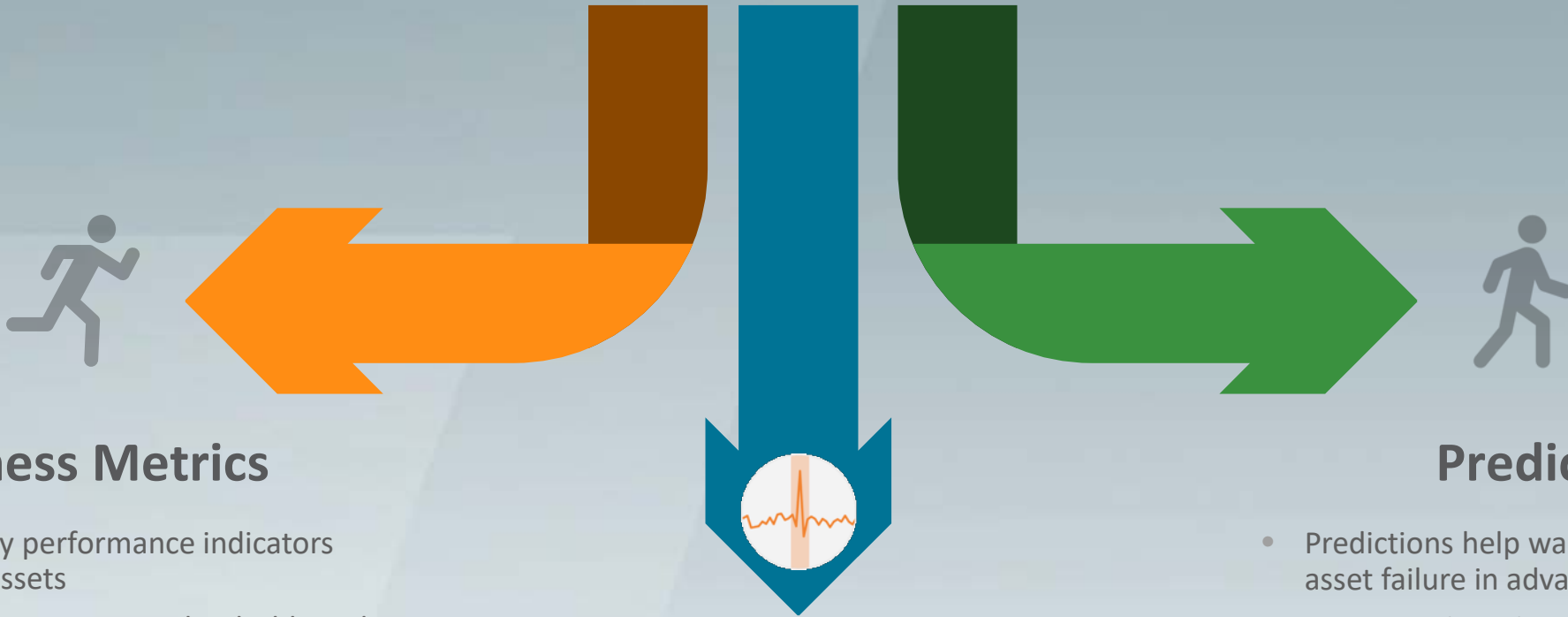
Feature
Engineering

Regression

Statistical Analysis

App Specific ML &
DL

Define your Metrics, Anomalies & Predictions



Business Metrics

- Cumulative key performance indicators (Metrics) for assets
- System Metrics appear on the dashboard by default
- Custom Metrics allow business users to track metrics relevant to business processes

Anomalies

- Anomalies detect deviations from normal asset behavior
- Point-in-time anomaly to look for deviations in a Metric value
- Pattern-based anomaly to look for telltale patterns in sensor data

Predictions

- Predictions help warn you of impending asset failure in advance
- Categorical Prediction help predict whether something will happen or not
- Predictions can be Anomalies intrinsically contribute to the predictions
- All data (sensor and contextual) split in training (80%) and testing (20%).
- Use training data for creating predictive models

Make sure IoT Applications apply smart data preparation techniques

MY DATA IS NOT NORMALIZED

e.g. Convert 3 machine states (running, idle, stopped) to binary (is running, is idle, is stopped)

MY DATA IS MISSING

e.g. Machine data lost due to connectivity issues

Perform missing value imputation



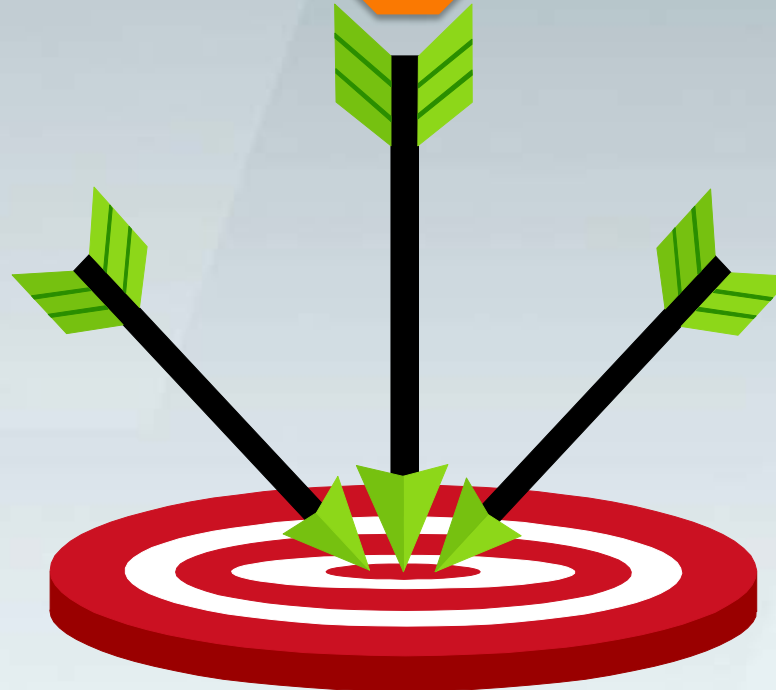
Perform 1HotEncoding



MY DATA ARRIVES IRREGULARLY

e.g. Temp data arrives every 30 mins, but vibration arrives every 10 mins

Perform time frequency matching



Summary

- Establish IoT skill set (partners, architects, data scientists or other resources needed internally or externally) and work on ideas
- Cloud is a good option for rapid prototyping your ideas and identify good use cases
- Once use cases are defined, analyze your applications and their integration needs to OT (APIs, gateways, interaction with other technologies like Blockchain, Big Data, ...)
- Refine the architecture: Consider OOTB solutions, cloud solutions
- Always check security needs for all solution possibilities
- Define success criteria early before PoC or PoV stages, gather executive sponsorship as well as IT-Business partnership

Thank You



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