IM124231 - Building Your First IoT Project Business Case

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Join the conversation #AU2017

AUTODESK
UNIVERSITY

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Key learning objectives

At the end of this class, you will:

- Identify your own readiness for a connected product business

- Learn how to articulate an internal IoT business plan to your organization

- Learn how to identify ROI opportunities on the way to your connected-product goals

- See examples of other companies IoT outcomes

About Me

- 15th Autodesk University

- This is Lucky 13 for speaking

- Haven't had a real job since 1999

  - Resellers

  - Oracle

  - Autodesk

- Last few years have been working on Go To Market and Business Strategy for Vault, Fusion Lifecycle and Fusion Connect
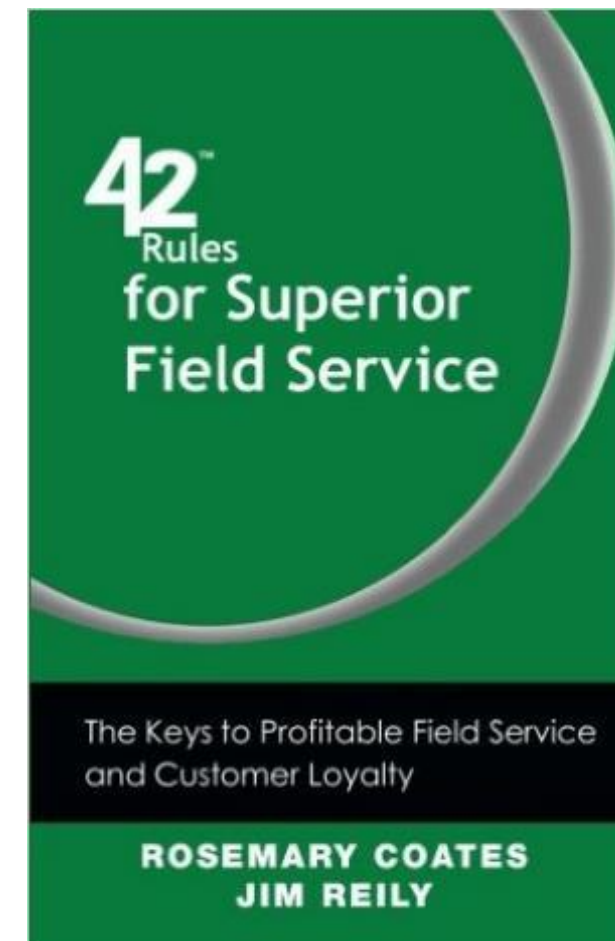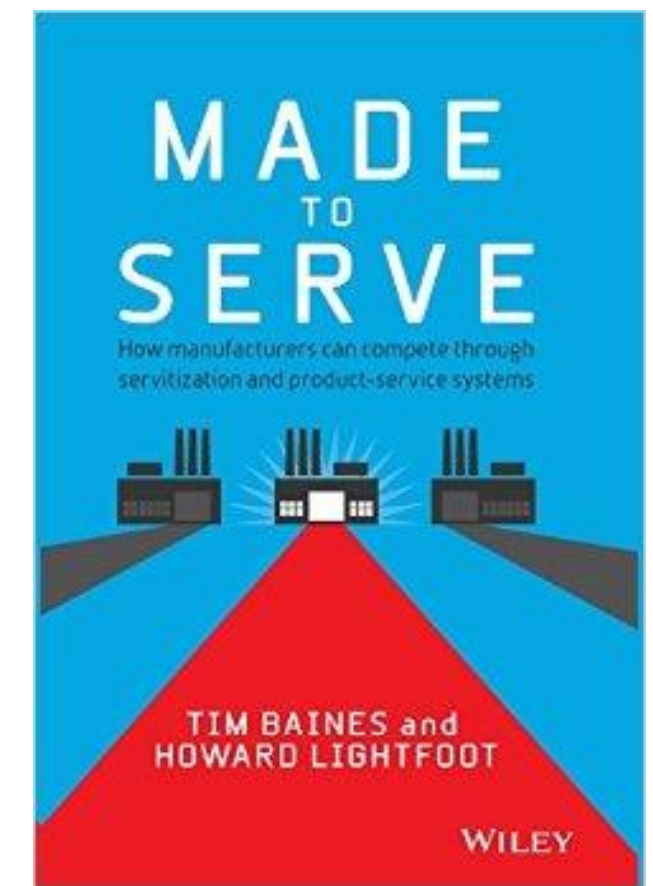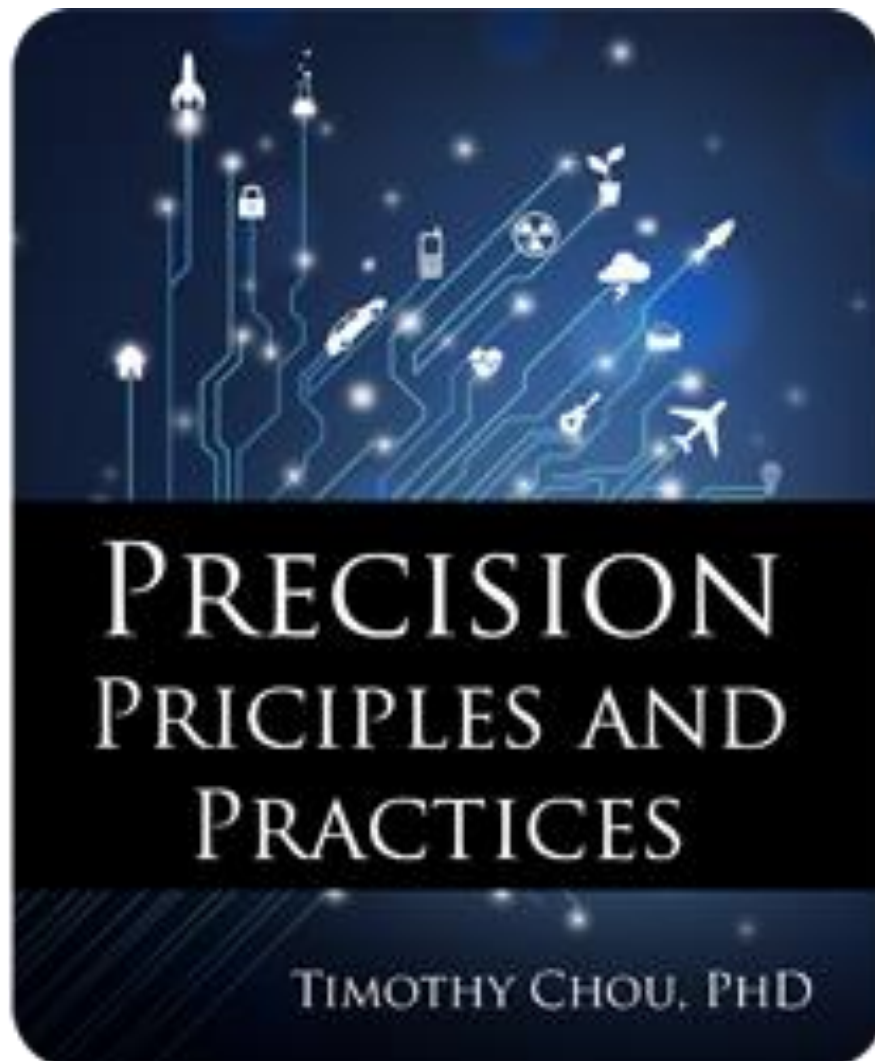
Lets Connect - www.linkedin.com/in/kevlink
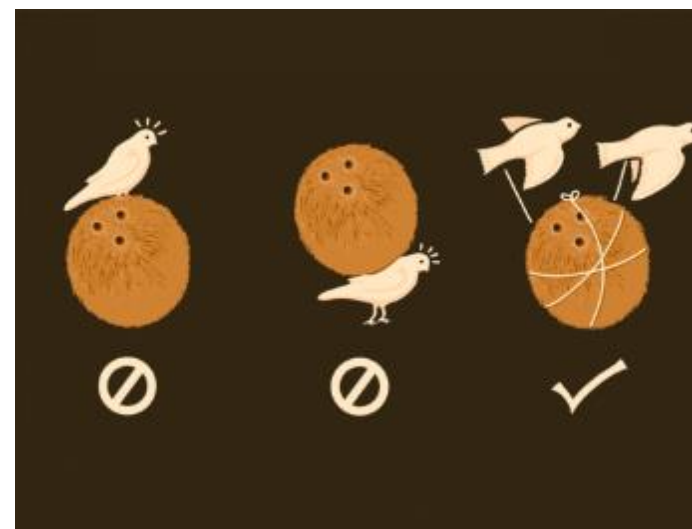
Session Outline

- Inspiration

- Business Drivers

- Creating your plan & project

- IoT Stack & Software example

- Customer Examples

- Wrap up & Call to action

Resources

Any sign manufacturing companies in the room?

Discussion topic Source : "Customer Success is key" and http://www.alltrafficsolutions.com/

The next wave of design …. Connected design

- Board Drafting ✓
  - Isometrics
  - Electronic Erasers

- 2d CAD ✓
  - Undo
  - Save As
  - Digitizers

- 3d CAD ✓
  - Rendering & Animations
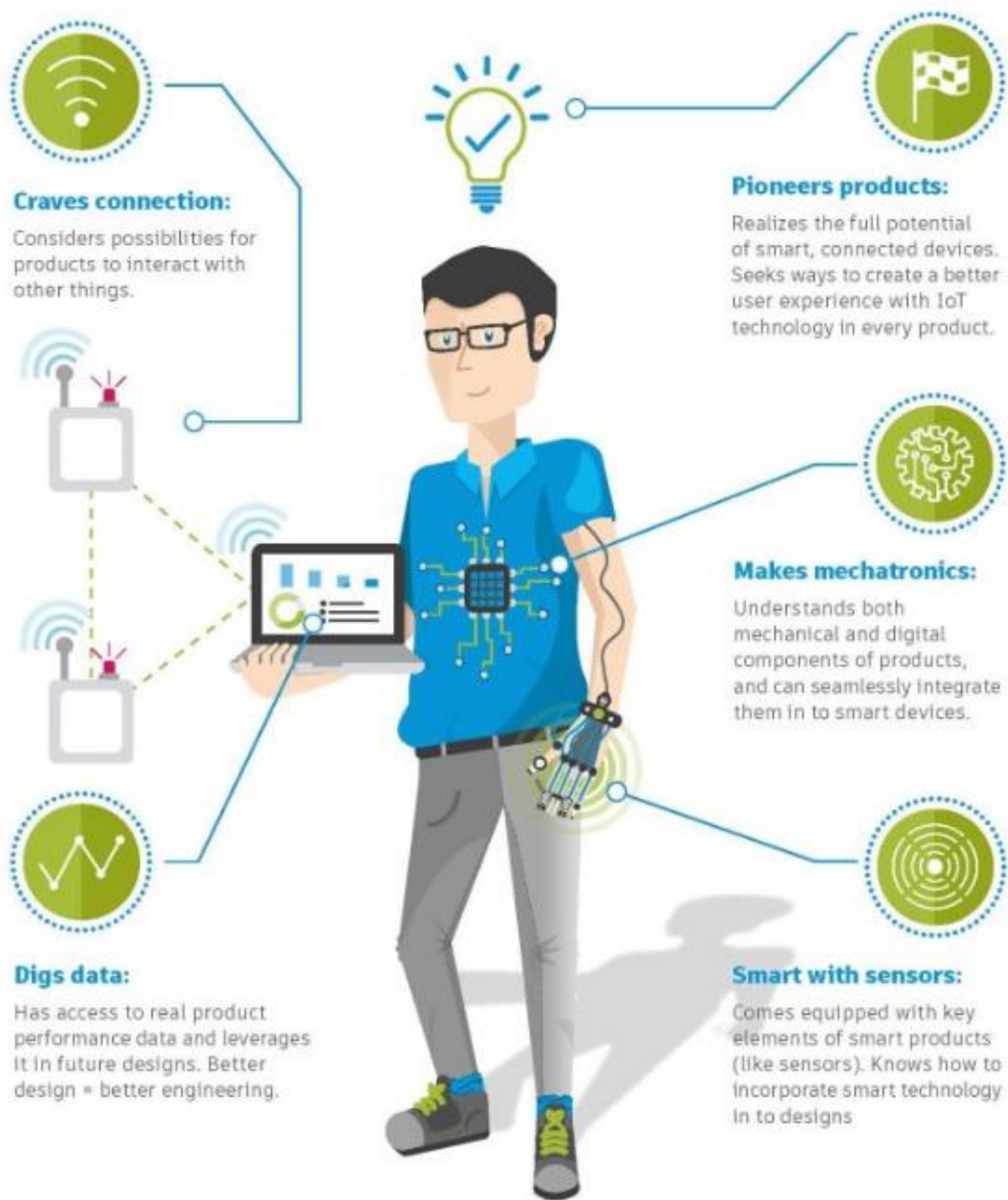 - Parametric
- Data Management ✓
- Simulation ✓
- PLM ✓
- **What's Next for you?**

Craves connection:
Considers possibilities for products to interact with other things.

Pioneers products:
Realizes the full potential of smart, connected devices. Seeks ways to create a better user experience with IoT technology in every product.

Makes mechatronics:
Understands both mechanical and digital components of products, and can seamlessly integrate them in to smart devices.

Digs data:
Has access to real product performance data and leverages it in future designs. Better design = better engineering.

Smart with sensors:
Comes equipped with key elements of smart products (like sensors). Knows how to incorporate smart technology in to designs

THE ESSENTIALS OF IoT FOR MODERN ENGINEERS

AUTODESK

THE
FUTURE
OF MAKING
THINGS

AGILE PRODUCT DEVELOPMENT

PaaS
Product as
a Service
=
=
Increased
Lifetime
Value

CONNECTED SERVICES
IOT & INDUSTRY 4.0

CUSTOMER EXPERIENCE
PERSONALIZED ENGAGEMENT

FLEXIBLE
ADDITIVE MANUFACTURING

COLLABORATIVE
VIRTUAL TEAMS

PERSONALIZED
CUSTOMIZATION

CONCEPT

DESIGN

PRODUCE

SELL

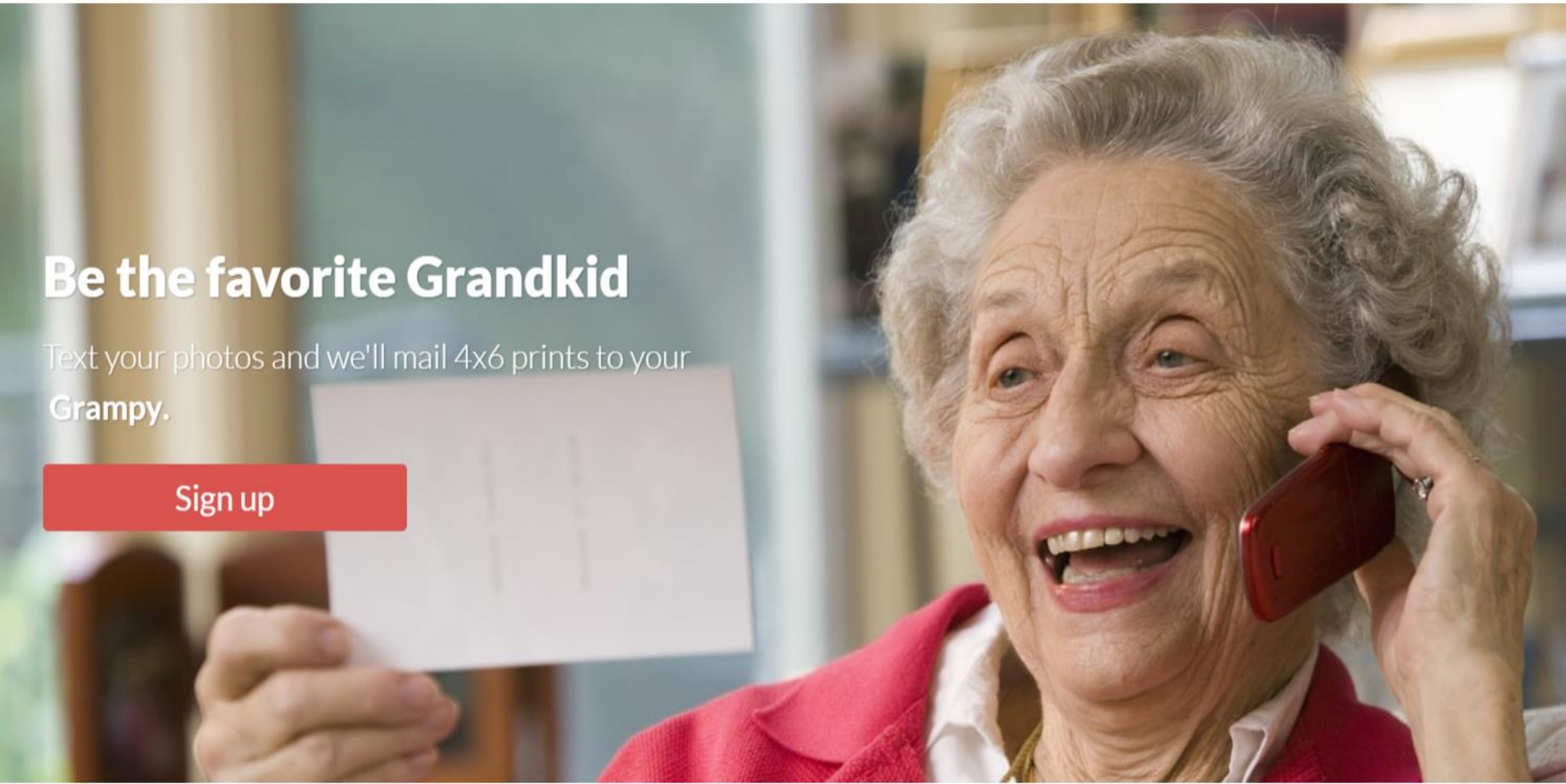OPERATE & RETIRE

TRADITIONAL PRODUCT LIFECYCLE

= Fixed
Product
Value
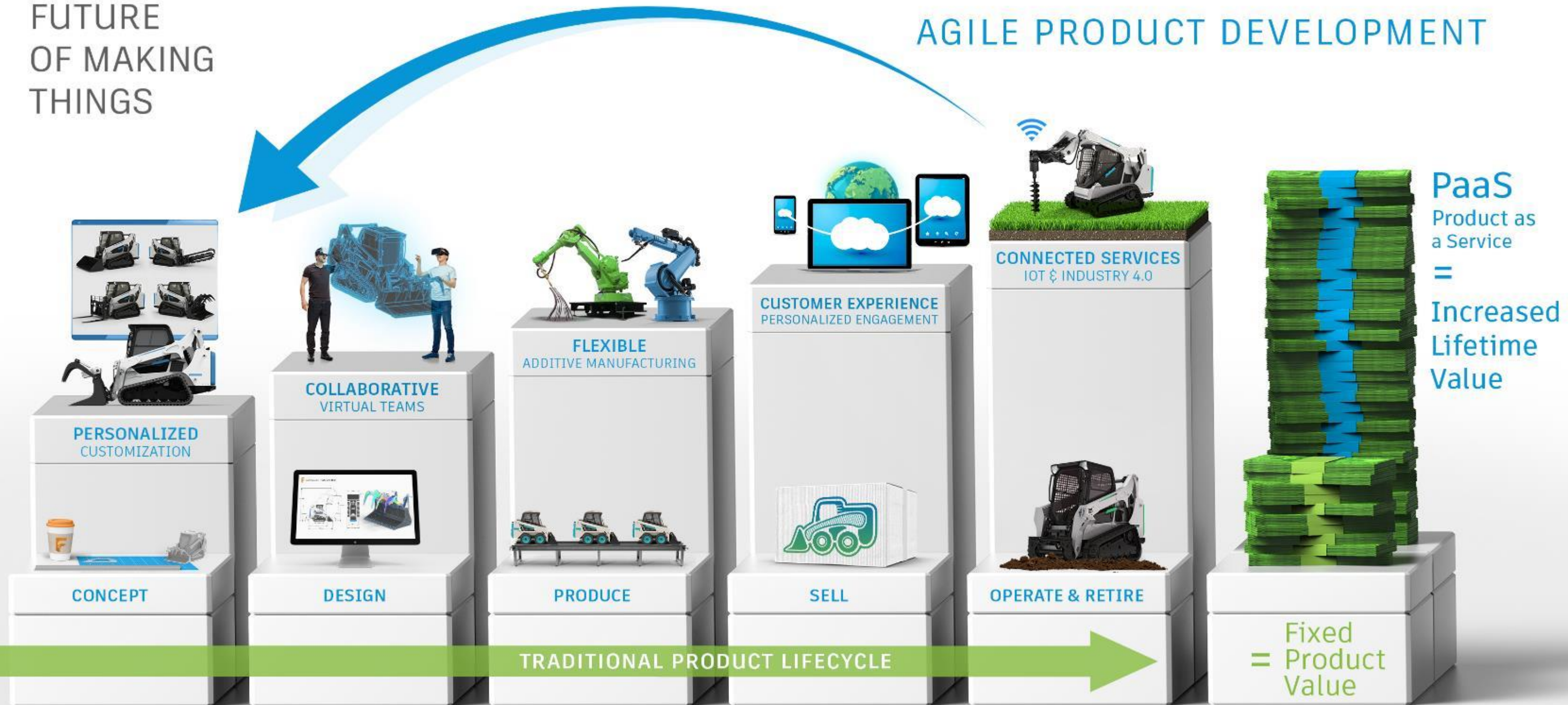
NanaGram

Be the favorite Grandkid

Text your photos and we'll mail 4x6 prints to your Grampy.

Sign up

Ladle Gate Type CS
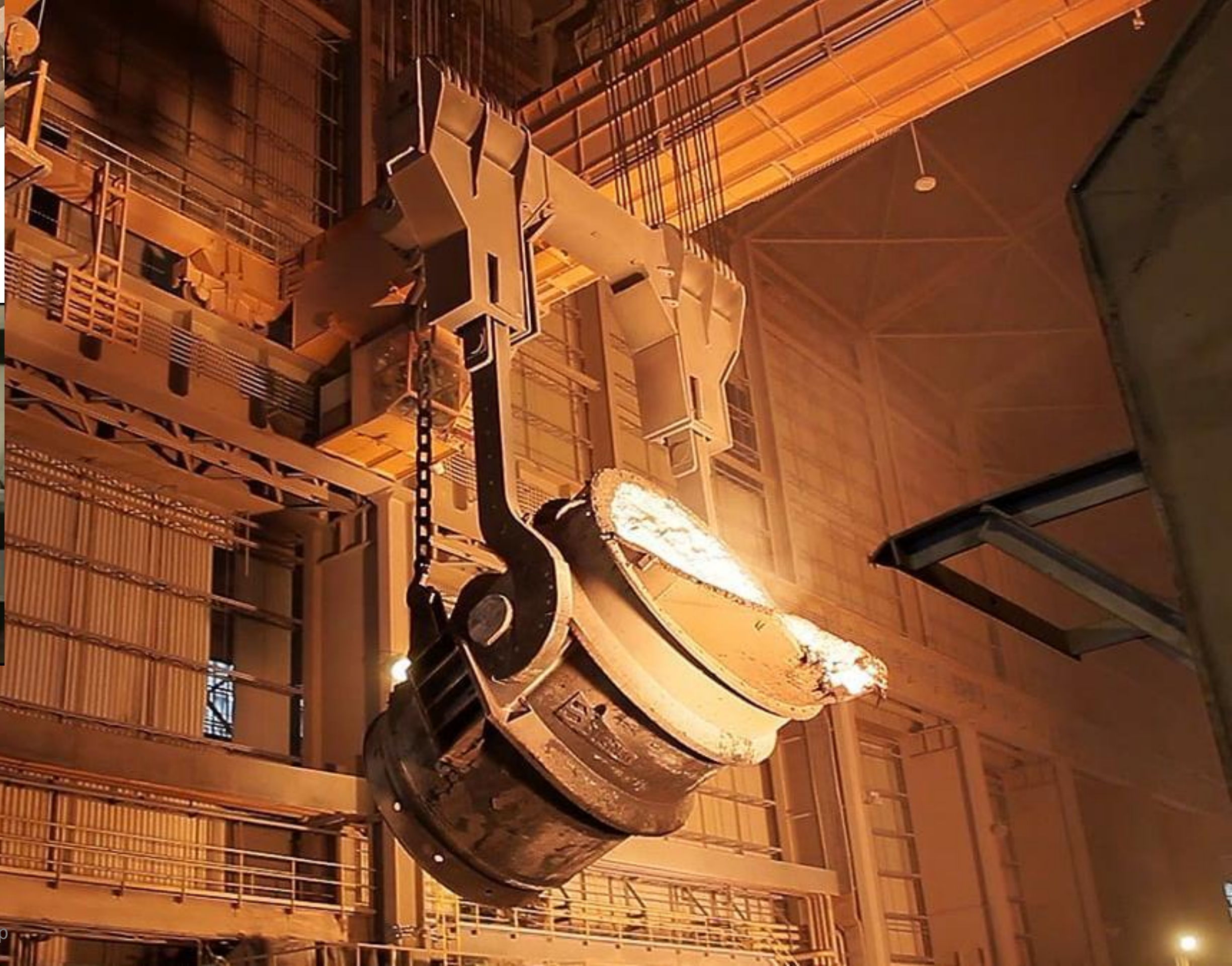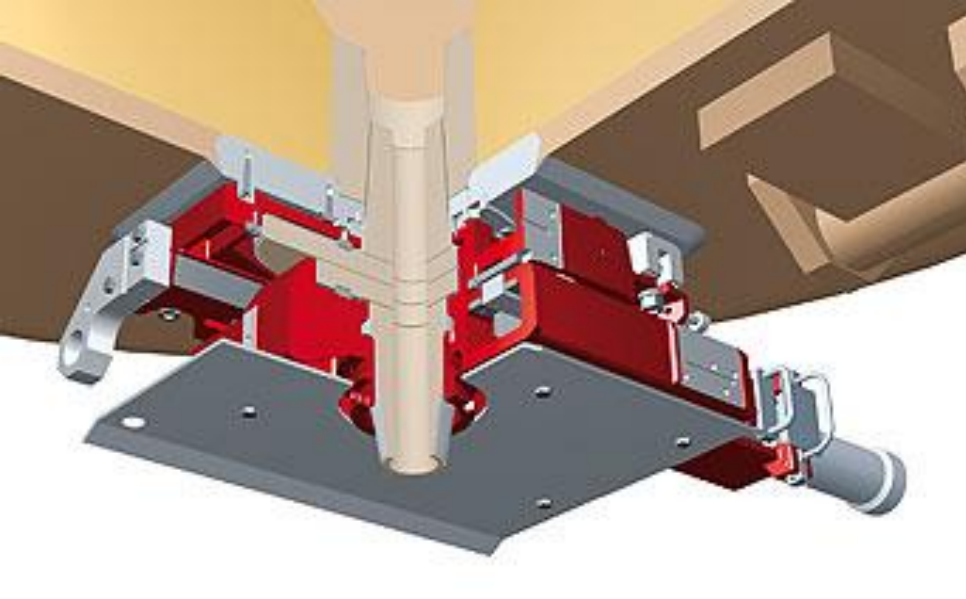
Anatomy of an IoT Project

Data Collection

- Custom Firmware & Onboard Data Science
- Security
- Storage
- Custom Real-Time OS & Device Drivers
- Embedded Hardware
- Sensor Package

Data Aggregation

- Custom Firmware & Onboard Data Science
- Security
- Storage
- Networking Drivers / SW
- Gateway Hardware

IoT Cloud Services

- App Builder (optional: charts, graphs, maps, business forms…)
- Mobile API
- Communication Protocol Handler & Security
- Messages
- Device Health & Inventory Management
- Application Logic & State Machines
- Alerting & Notifications
- Data Science Algorithms
- Complex Event Processor – Data Transformation
- Data API
- SQL Storage & Reporting
- Time Series Big Data Storage

Other Services

- Mobile Application
- FORGE Viewer
- Customer Visualization
- Enterprise Integrations
- Data Science Tools
- Long Term Data Warehouse

What's your IoT readiness score?   1 - 30

S D N A

C (k+p+p)

Start
Here

Connected Product Journey

Big Data

TRANSFORMED

ANALYZED

CONNECTED

REACTIVE

- Limited design feedback
- Break-fix service

- Usage data enables closed-loop design
- Push features out via internet
- Diagnose before service

- Timing for new product sale
- Predictive maintenance
- Shift to proactive service

- Sell subscriptions, leases, managed services
- Tailor to customer need
- Integrated, customer-driven business

Survey data from the room

- Question - Does your company have a smart connected product strategy?

17% Just Started

Yes 8%

No 75%

IoT Driven Business Transformation Areas

Operational Excellence	and/or	Market Differentiation

Assimilating and extending **best practices**

⬇

Moving to the **productivity methods**

Creating a **unique** competitive position

⬇

Doing things differently to **deliver distinct value**

Value of Pursuing IoT

	LOWER COST	INCREASE REVENUE
Connect *to smart machines* to improve service & repair operations	• Decrease field visits with remote access to operating data. • Reduce software update costs. • Reduce time-to-fix and downtime.	• Improve customer satisfaction for increased repeat business. • Enable premium SLA service contracts.
Analyze *IoT data* to improve product design, reliability, preventive actions	• Reduce warranty claims. • Reduce number of service calls. • Increase first-time fix rates. • Reduce inventory carrying costs	• Increase market share with superior, differentiated designs. • Improve quality; corporate and brand reputation. • Reduce R&D distractions for fewer new product delays.
Transform *your business* with new innovative products and services	• Reduce number and time of support calls. • Enable self-service support. • Improve enterprise productivity through IoT information sharing.	• Premium custom offering based on customer usage patterns. • New pay-per-usage service revenue models.

Show Me The Money!

24% of manufacturers with a smart connected strategy **have already realized incremental revenue.**

Early IoT Adopters Are Rewarded

27% say IoT has helped their company **create competitive differentiation.**

IoT disrupts design

Connected products deliver real time insight for improvement.

43% say feeding sensor data into design and product development is a top priority

49% are using IoT data to improve product quality

Source: Leveraging IoT Data. Survey of Early Adopters In Manufacturing Autodesk/Penton Research, August, 2017.
*Multiple selections were allowed.

IoT Data Is The New Gold

Manufacturers are leveraging IoT data for these top-five business use cases:

52%
Deliver remote services, such as diagnostics, and patch upgrades.

51%
Offer remote monitoring or predictive maintenance services.

49%
Improve product quality.

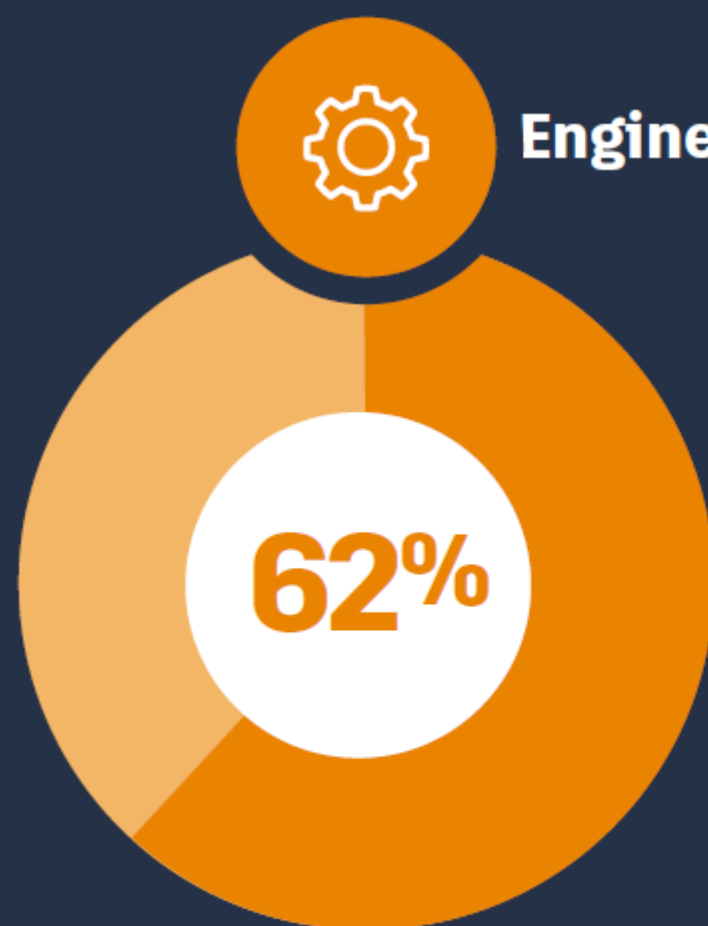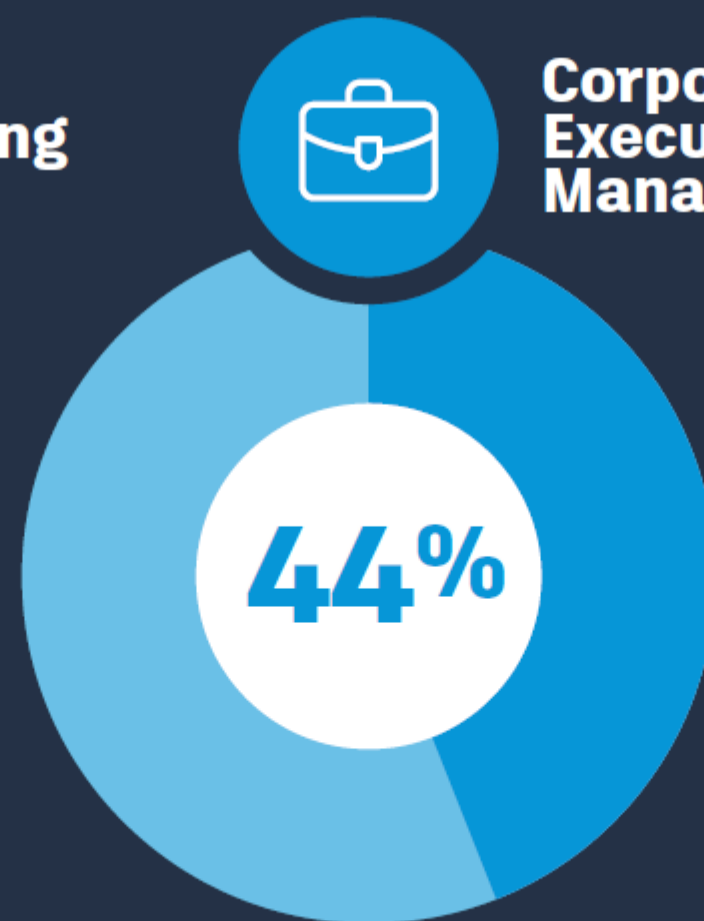**38%**
Extend product design capabilities and/or functionality.

38%
Gain a better understanding of how customers use our product(s).

Who is **the primary internal champion** for IoT?

Engineering

62%

Corporate/ Executive Management

44%

R&D

41%

Source: Leveraging IoT Data. Survey of Early Adopters In Manufacturing Autodesk/Penton Research, August, 2017.
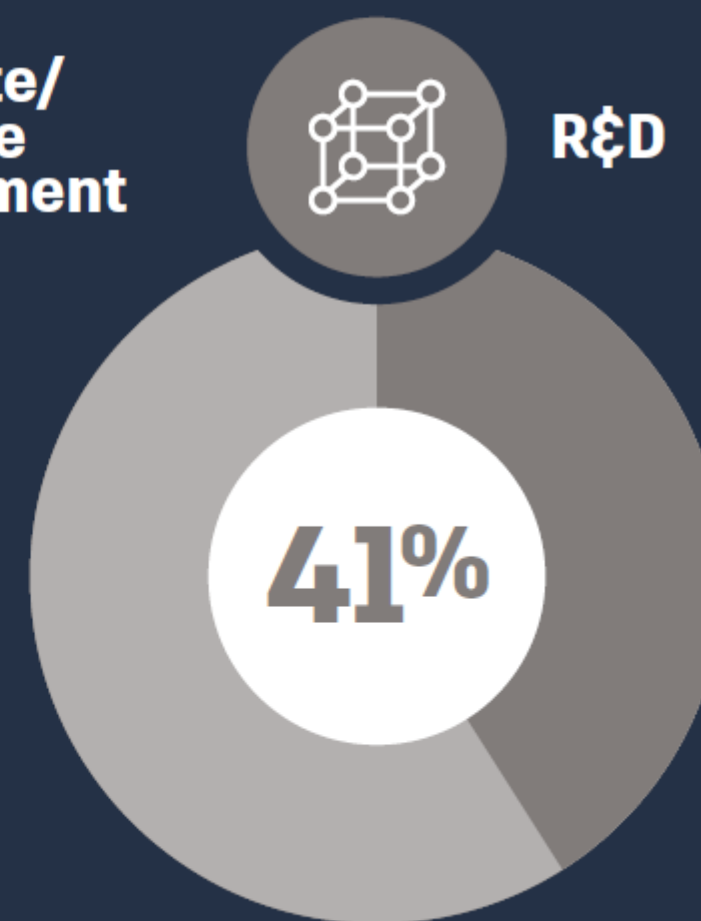*Multiple selections were allowed.

Example Customer for an IoT business case discussion

Eagle Crusher - http://www.eaglecrusher.com/ - Disclaimer, This is only being used as an example and does not reflect actual customer intentions or plans

SCREEN MACHINE INDUSTRIES

An American Manufacturer of Portable Crushing and Screening Equipment

5256T IMPACT CRUSHER

TEREX. | FINLAY

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I-140

Product Performance

Maintenance Needs

Safety

Upgrades & retrofits

Hours Running

Warranty

Location Tracking

Operation Ease of Use

Dealer Enablement

Eagle Crusher - http://www.eaglecrusher.com/ - Disclaimer, This is only being used as an example and does not reflect actual customer intentions or plans

Maintenance Examples…. What if….

☑ Check and maintain the engine fluid levels (oil, coolant, etc.). Check, clean or replace the engine air filter as necessary. Monitor and maintain the proper concentration of the Coolant Additive in your cooling system. Testing for normal levels is typically achieved by using a test kit obtained from the parts department at your local engine dealer.

☑ Check the oil level site glasses of the vibrating feeders and screens, if or where applicable. Drain and refill regularly per the recommendations in your Operator's Manual.

☑ Inspect the inside of the impactor on a daily basis. Look for worn or damaged blow bars and replace or turn if necessary. Look for worn, damaged or missing curtain and side liners. Replace as necessary. Assure that all blow-bar wedges and spindle pins are in place.

☑ Inspect V-belt drives for damaged belts or loose belt tension. Replace cracked, glazed, torn or separated belts. Maintain proper belt tension for optimum performance of your plant. Loose or worn belts and sheaves can affect the generator speed and result in low voltage supply to all electric-powered components. Low voltage can cause electric-motor and electric-panel component failures. Consult the manual for belt-tension calculation procedures.

☑ Check the plant for level. Side to side level is more critical to proper operation than front to back level. Adjust the hydraulic legs as necessary to bring the plant into a level position from side to side at both ends of the plant. Always insert the pins in the leg tubes so that the pins support the plant and not just the hydraulic cylinder itself. Allowing the plant to "lean" to one side causes incorrect oil levels in feeders and screens. This can cause oil to run into the center tubes of the feeders and can cause seal leaks to develop in both the feeders and screens. Allowing a plant to operate out of level also causes uneven wear patterns on the blow bars and curtains inside your impactor.

Chou's Precision Framework

IoT Framework

Things

Amps Phase A (ST_AMPS_A)
Amps Phase B (ST_AMPS_B)
Amps Phase C (ST_AMPS_C)
Apparent Power (ST_KVA)
Cellular Signal % (CELL_SIGNAL)
Check Genset (AL_CHK)
Common Alarm (AL_COMN)
Control Panel - Ignition Switch (ST_IGNIT_SW)
Control Switch (ST_CONTROL)
Device Type (ST_DEVICE)
Emergency Stop (AL_ESTOP)
Engine Coolant Temperature - Coolant Temperature (ST_COTE)
Engine Oil Pressure - Oil Pressure (ST_OIL_PR)
Engine On Time - Run Hours (ST_RUN_HS)
Engine RPM - Engine RPM (Actual) (ST_RPM)
Engine Shutdown Alarm (AL_SD_RUN)
Engine Starts (ST_START_CNT)
Engine Status
Frequency (ST_FREQ)
Fuel Level (FUEL_LEVEL)
Genset Supplying Load (ST_LOAD_GS)
Last Communication (COMM_TIME)
Last Data Collection Time (LAST_DATA)
Low Coolant Temperature (AL_COTE_LOLO)
Modbus Communication Failure (AL_MODBUS_FL)
Percent Amps A (ST_PCT_AMPS_A)
Percent Amps B (ST_PCT_AMPS_B)
Percent Amps C (ST_PCT_AMPS_C)
Power Factor (ST_POWER_FA)
Power in KVAR (ST_KVAR)
Total KW (ST_KW)
Total Percent kW (ST_KW_PCT)
Voltage Phase A-B (ST_VOLT_A)
Voltage Phase B-C (ST_VOLT_B)
Voltage Phase C-A (ST_VOLT_C)
Volts AB - Input Voltage Phase A (ST_VOLTS_A_IN)
Volts BC - Input Voltage Phase B (ST_VOLTS_B_IN)
Volts CA - Input Voltage Phase C (ST_VOLTS_C_IN)

Value of Pursuing IoT – where could we focus?

	$ LOWER COST	INCREASE REVENUE
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Stakeholders Impact

Engineering / R&D

IT

Product Management

Dealers / Dealer Service
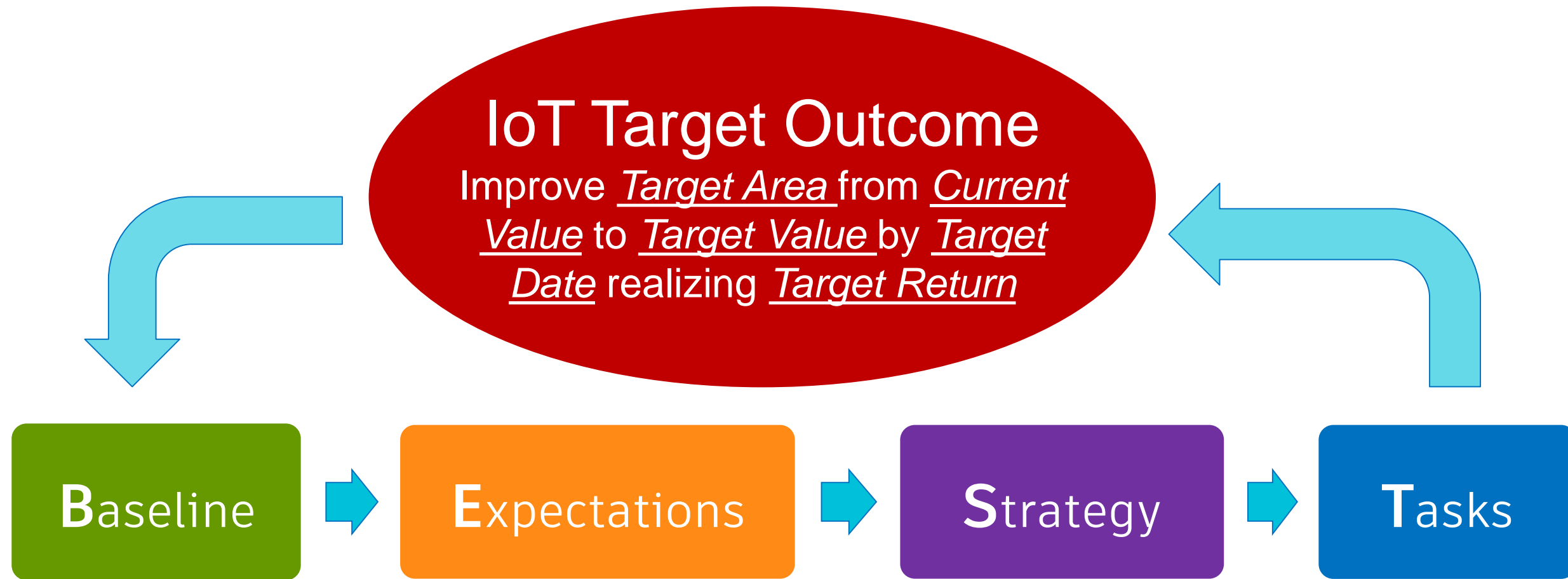

Operations

Sales

Customer Service / Field Service

Customer End Users of Product

"DO" Discovery and Internal discussion starters....

1. "What types of connected experiences do you think your customers would value?"

2. "How do you think a connected offering would impact our competitiveness or market position?"

3. "How do we collect and act on product feedback from customers?"

4. How do you obtain actual product performance data from the field?

5. "Can we diagnosis our machines remotely?"

6. "What are the conditions that create failure within our equipment?"

7. "What is the impact of equipment failure and downtime?" To our dealers? Our end customers contractors?

8. "How do our customers / dealers track or manage the suggested maintenance and operating procedures we provide?"

9. "How do our field services team know what to expected for a service call?"

10. "How are our First Fix rates for service calls?"

IoT Target Outcome
Improve *Target Area* from *Current Value* to *Target Value* by *Target Date* realizing *Target Return*

Baseline → **E**xpectations → **S**trategy → **T**asks

The Target Outcome is the vision for the IoT Project or the "Do Details"

- Specific and can be understood by all Stakeholders
- Focused on solving a key Business Problem
- Have a Storyboard showing the end state

Value of Pursuing IoT

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Target Outcome Example 1

- Improve Field Service First Fix rates

  - Currently at 75% >>>> 90%

  - By January 2019

  - Target Return Value areas:

    - Travel Costs

    - Total Service Hours for labor costs

    - Lost billable hours as opportunity costs

    - Projected Internal Costs Savings of $10k per month

    - Revenue Opportunity Growth per month of $50k per month

Operations

Customer Service / Field Service

Target Outcome Example 2

Operational Excellence and/or Market Differentiation

- Reduce Inventory Costs of replacement parts
  - Move to demand based vs. historical averages
  - Average monthly Inventory on hand value $250k
  - Inventory monthly creation costs $50k (raw, hours labor, equipment operation, etc)
  - By January 2019
  - Target Return Value areas:
    - Overtime Labor
    - Equipment Maintenance Frequency
    - Inventory costs
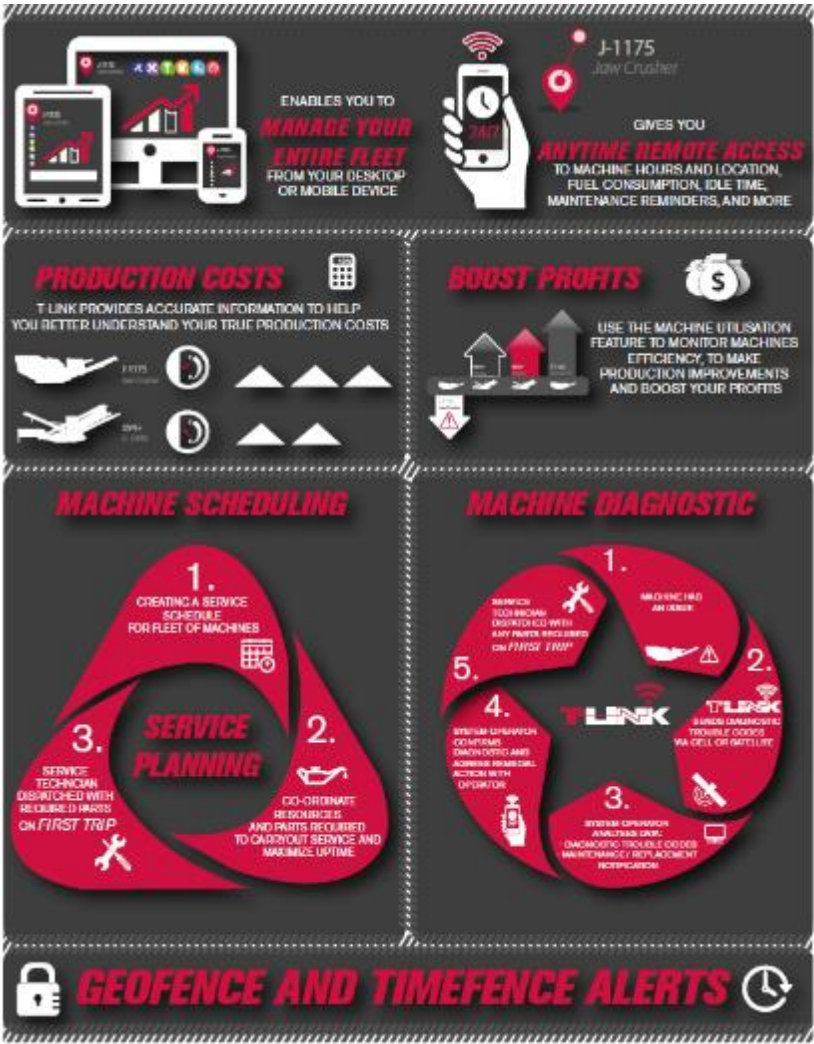
Operations

Shop

Vision and Storyboard Examples

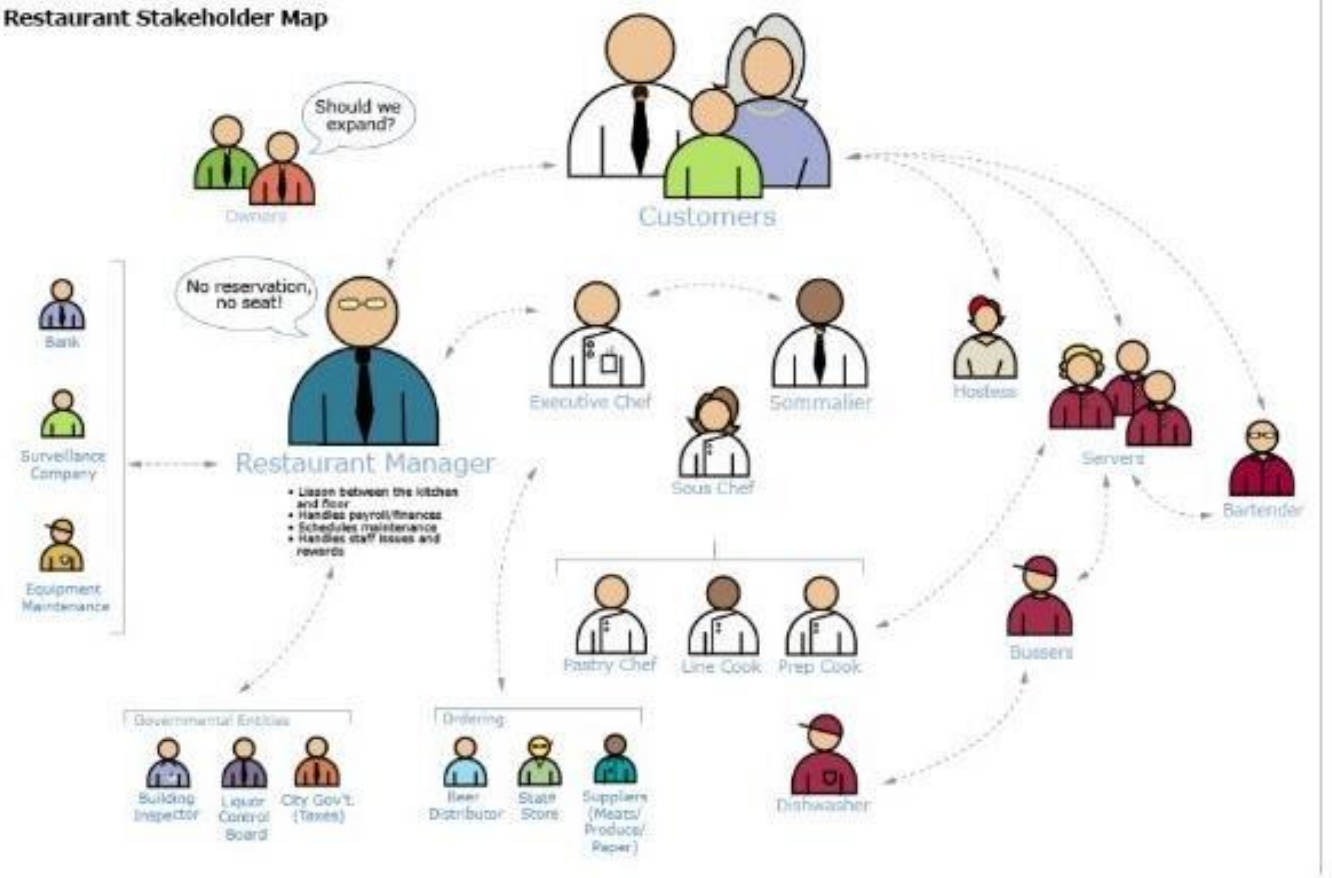**Operational Excellence** and/or **Market Differentiation**

PLAN, RUN AND MANAGE YOUR FLEET TO GROW YOUR BUSINESS

Restaurant Stakeholder Map

Example: Illustrative Relationship-based stakeholder Map. Graphic credit LUMA Institute
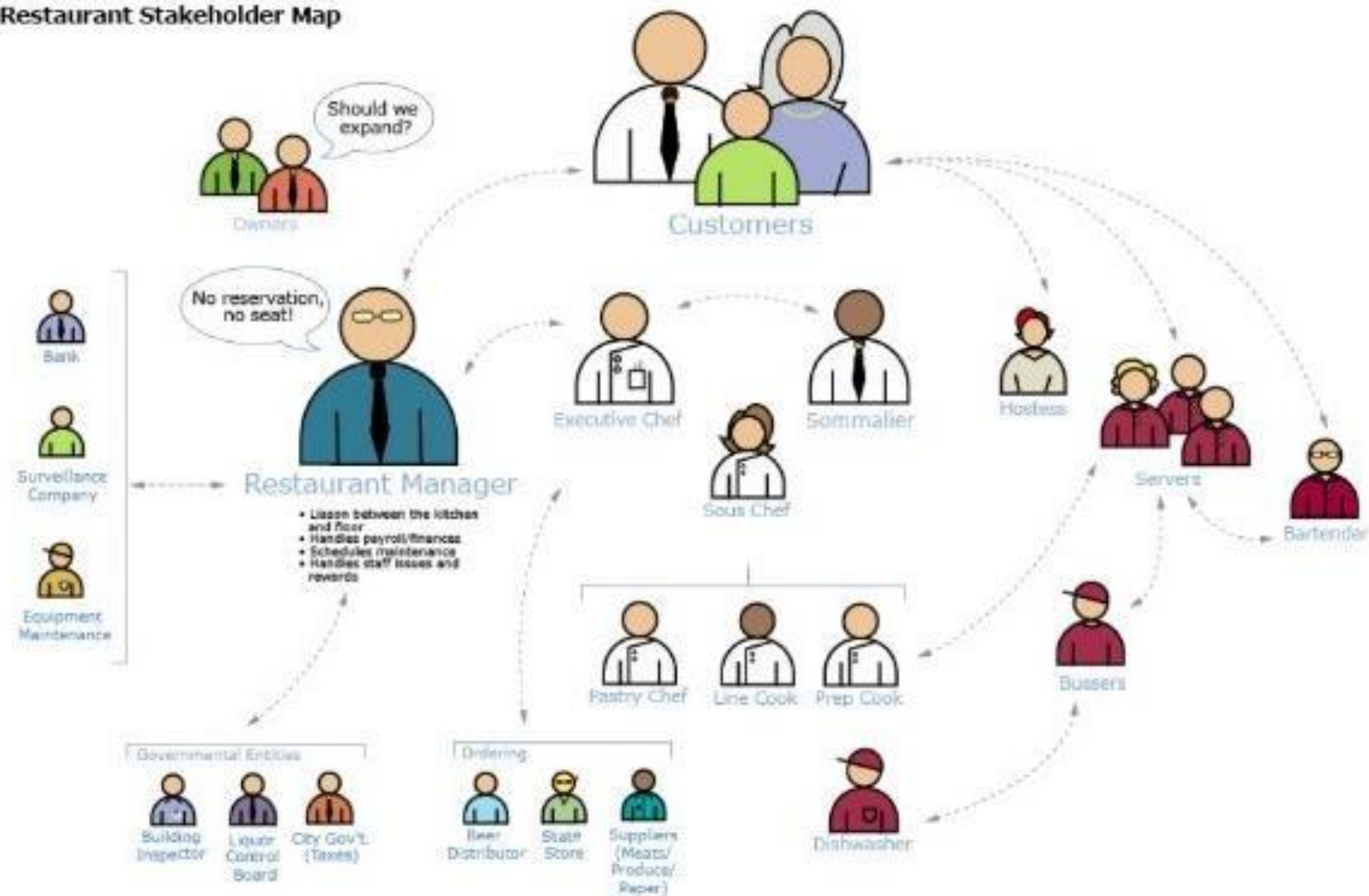
Sales

Product Management

Dealers / Dealer Service

Customer End Users of Product

Source: Terex Powerscreen T-link brochure and Luma Institute Class / Book – Innovating for People

Restaurant Stakeholder Map

Example: Illustrative Relationship-based stakeholder Map. Graphic credit LUMA Institute

Getting Started with your project

- Awareness, Research and Learning
- Brainstorm and socialized target outcome concepts and storyboards
- Project Approach Options

    1. PowerPoint Prototype

    2. Proof of Concept

        1. Emulated – Software only

        2. Live Data – Plus Hardware

    3. Funded – *Build out the B.E.S.T plan for your target outcomes*

The IoT Project Path

Idea / Interest → Learning / Awareness → Project / Business Concept Plan → Proof Of Concept → Internal Launch → Commercial Launch → Next Product / Rinse & Repeat

Customer Examples

Premier Deicers

Sluggish winter de-icing operations impacted departure times and profitability

- De-ice cycle accelerated **40%**
- More on-time departures
- Less fuel consumption
- New revenue streams/services
- Created competitive advantage

SOLUTION TIME
30 Days

AUTODESK® **FUSION CONNECT**

Griswold Water Systems

Traditional chemical treatment of water cooling towers was ineffective and toxic

Treat the water in cooling towers with electric fields & implement remote monitoring of bacteria levels with IoT

- Customers conserve 17% – 28% of total tower-water consumption (millions of gallons of water/year)
- Estimated 85% improvement in uptime
- Uptime reduces risk of deadly Legionnaires' disease which has no cure & 10% of those infected die
- Customers save an average $25K per year

SOLUTION TIME
One Week

AUTODESK® FUSION CONNECT

Our software approach

The Stack

7 Optimize Performance
(Purpose, People and Process)

6 Business Applications
(Analytics, Reporting, Control)

5 Cloud Servers
(Storage, Software, Redundancy)

4 Software Platform Services
(Security, Aggregation & Logic)

3 Network Connectivity
(Internet Access, M2M Wireless)

2 Gateways & Edge Computing
(Data Filtering/Analysis, Demarcation, Interface Protocols and Security)

1 Physical Sensors & Controllers
(The "Things" in IoT)

SOLUTIONS

Things

Sensors, Devices, Machines, Controllers,

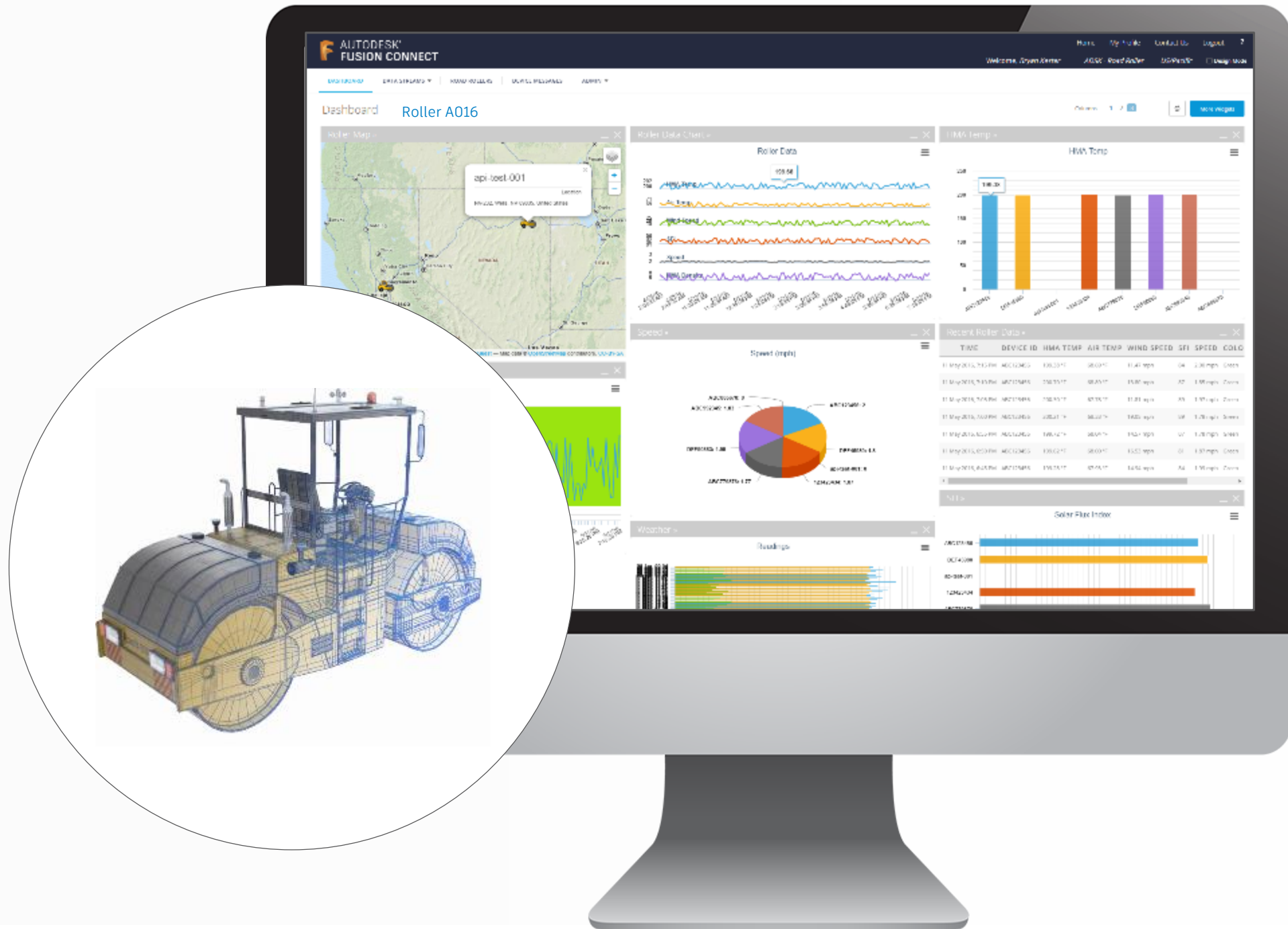S   <u>D</u>   N   A   C(k+p+p)

Start Here
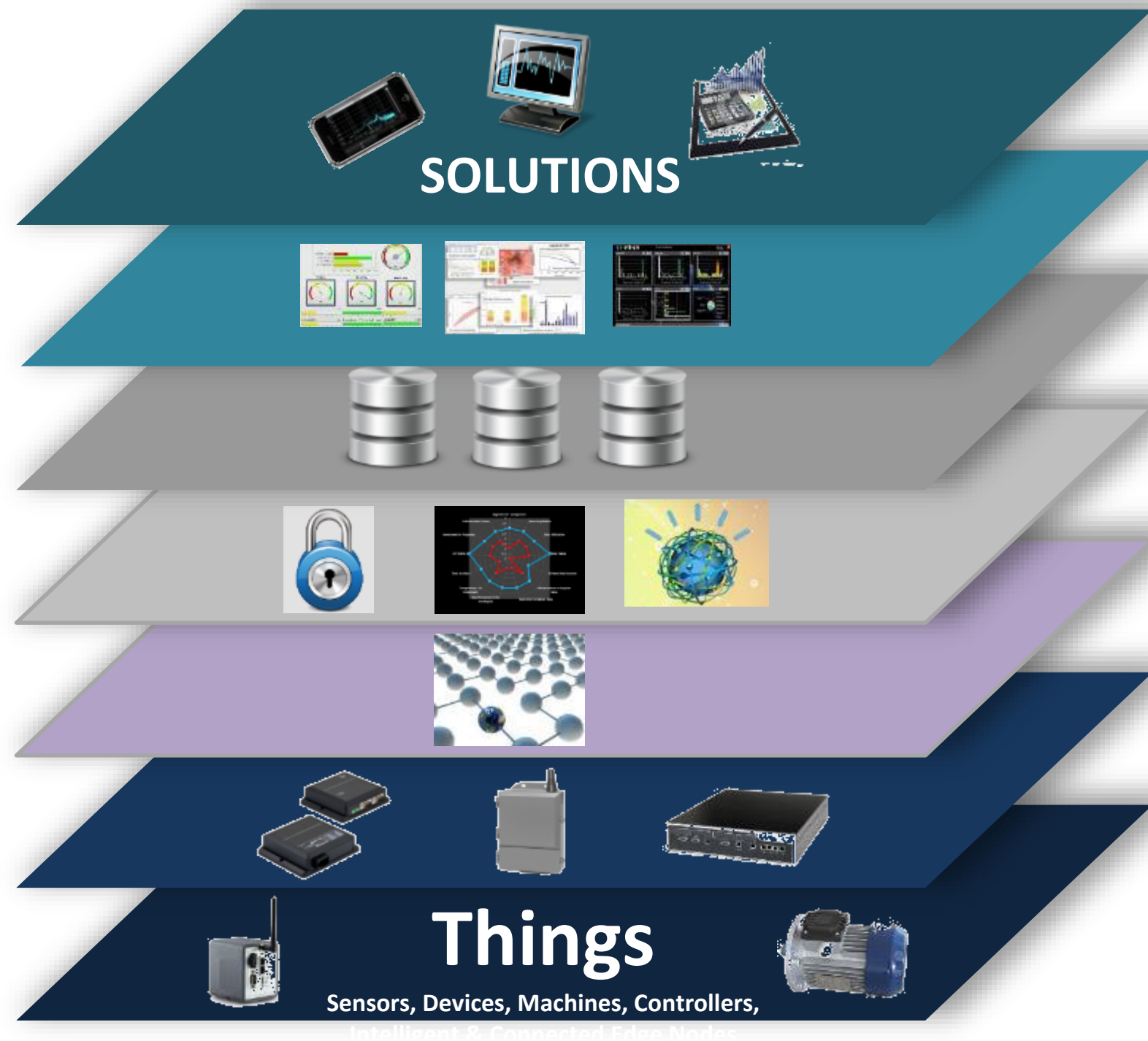
verizon✓

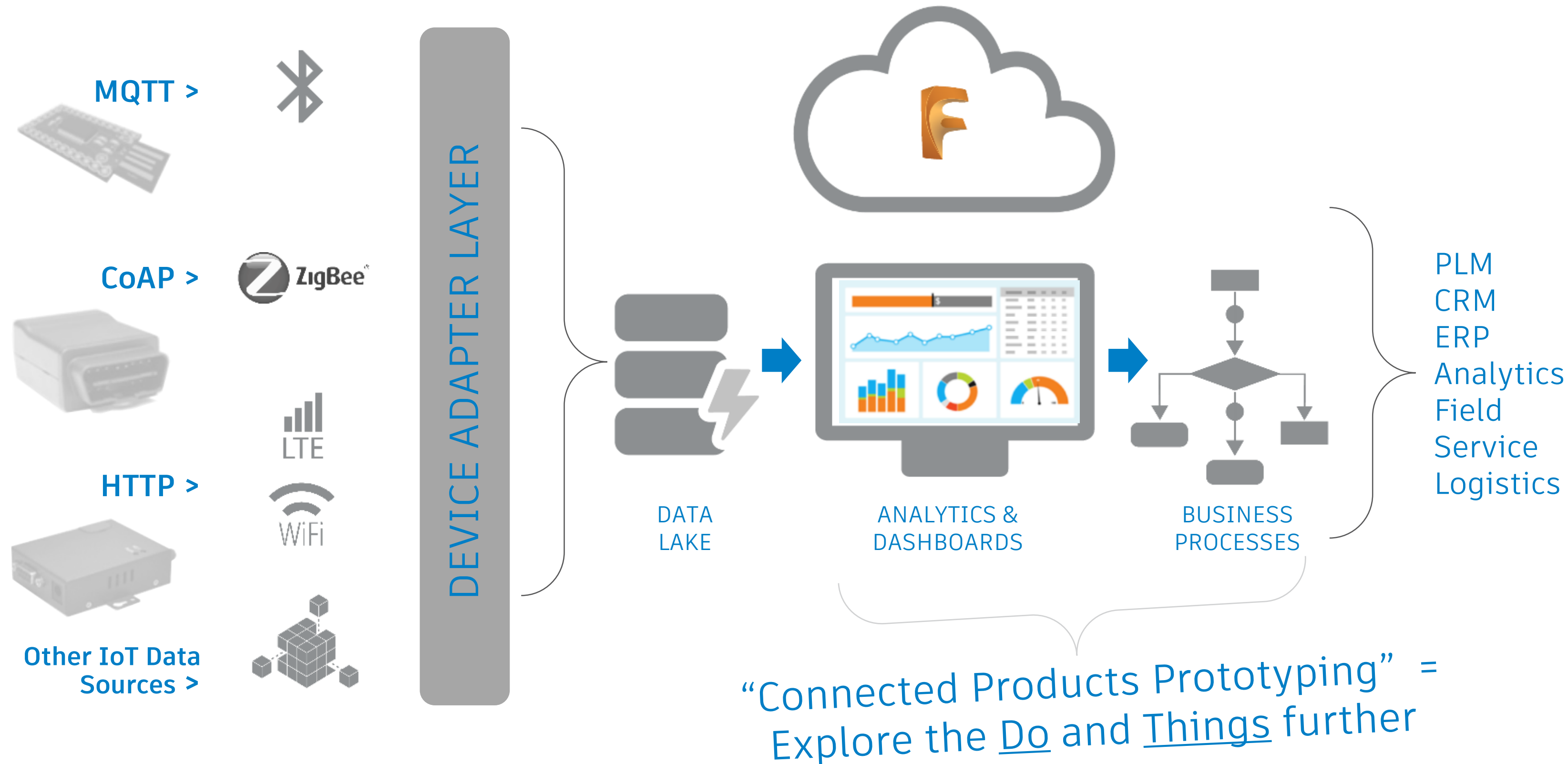**F** AUTODESK® **FUSION CONNECT**

Fusion Connect, Accelerate your IoT

- 100% no-coding IoT cloud service

- Hardware agnostic plus pre-integrated partners

- Emulate & test IoT concepts before acquiring expensive hardware

How Fusion Connect Works

MQTT >

CoAP >

HTTP >

Other IoT Data Sources >

DEVICE ADAPTER LAYER

DATA LAKE

ANALYTICS & DASHBOARDS

BUSINESS PROCESSES

PLM
CRM
ERP
Analytics
Field
Service
Logistics

"Connected Products Prototyping" =
Explore the <u>Do</u> and <u>Things</u> further

IoT Simplified: Fusion Connect

MQTT >

CoAP >

MODBUS >

OTHER IoT
DATA SOURCES >

DEVICE ADAPTER LAYER

Product Modeler
Builds Digital Twin

Analytics Transforms
Data From Raw
to Meaningful

SMS and Email
Notifications

Robust Data
Access Control

NATIVE

No Code Prototyping

API

Custom App
Built By Developers

Develop your IoT Solutions
with mobile support

**Partner Hardware & Networks
are pre-integrated**

Storage for device models, thing models and processed data

No Code Prototyping

Point-and-Click Analytics

Drag and Drop Web Page Building

100% No Coding Experience
Device Agnostic / Plug-n-Play

Secure | https://demo.dev.fusionconnect.autodesk.com/portal/dashboard.scn?n=e8a7a

Allan

AUTODESK
FUSION CONNECT

Home   My Profile   Contact Us   Logout   ?

Welcome, *Allan O'Leary*   1A - ADSK - Air Compressor   US/Pacific   ☐ Design Mode

DASHBOARD | ASSET MANAGEMENT ▾ | CHANNEL MANAGEMENT ▾ | SPARES MANAGEMENT | SERVICE MANAGEMENT ▾ | SHIFT MANAGEMENT ▾ | SHOPPING CART | ABOUT AUTODESK

Dashboard

Columns   1 **2** 3   **More Widgets**   ⟳

Compressor Status »   ─   ✕

SERIAL NUMBER	POWER STATUS	LOAD STATUS	DRYER RUN STATUS	LAST UPDATE	POWE
▮ 1000501203	▶ Running	▶ Running	⏹ Stopped	26 Jun 2017, 2:01 PM	1678.43 ⊦
▮ 1000501227	▶ Running	▶ Running	⏹ Stopped	22 Jun 2017, 5:25 PM	7993.92 ⊦
▮ 1000501224	▶ Running	▶ Running	⏹ Stopped	22 Jun 2017, 5:24 PM	8018.72 ⊦
▮ 1000501231	▶ Running	▶ Running	⏹ Stopped	22 Jun 2017, 5:24 PM	7966.51 ⊦
▮ 1000501229	▶ Running	▶ Running	⏹ Stopped	22 Jun 2017, 5:23 PM	8027.60 ⊦
▮ 1000501226	▶ Running	▶ Running	⏹ Stopped	22 Jun 2017, 5:23 PM	7967.12 ⊦
▮ 1000501213	▶ Running	▶ Running	⏹ Stopped	22 Jun 2017, 5:23 PM	7993.73 ⊦

Compressors by Site Col »   ─   ✕

Compressors - Count

☰

6

4

2

Sites »   ─   ✕

+
−

NORTH AMERICA ④   EUROPE ③   ASIA   NORTH AMERICA

ATLANTIC OCEAN   AFRICA   ②

PACIFIC OCEAN   INDIAN OCEAN   OCEANIA   PACIFIC OCEAN

OCEANIA   SOUTH AMERICA

SOUTHERN OCEAN

ANTARCTICA

© Mapzen, OpenStreetMap, and others | Leaflet

Assets »   ─   ✕

CUSTOMER	SERIAL NUMBER	MODEL	SALES CONTACT	RUNNING HOURS
Bold Manufacturing	1000501203	AD10-125-120-230	Dave Matthews	1086.08 h

Wrap Up & Call to Action

Other IoT classes for post AU review

From Monday

- ***Developing a mobile app with the Forge IoT***

Allan OLeary

From Tuesday

- ***An Introduction to Fusion Connect***

Allan O'Leary & Brian Sherman

- ***4 Peas in an IoT Pod–IoT Discovery***

Lona Dallessandro & Padma Duvvuri of Electric Imp

IoT Discovery Toolkit powered by Electric Imp

Purpose-built to empower manufacturing OEMs to:

Test Ideas

Test ideas on improving product design, predictive maintenance or streamlining service operations

Leverage Learnings

Take learnings & leverage them for commercial product launch with confidence & ease

At last, IoT is easy!

Manufacturers can now get a product connected & collecting data in 15 minutes
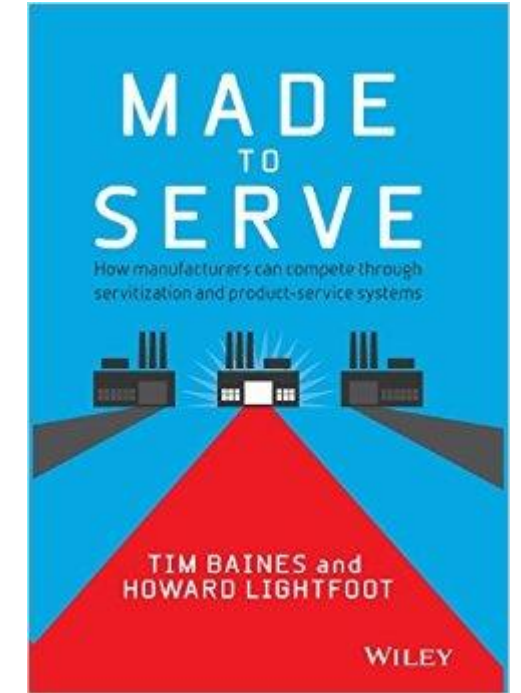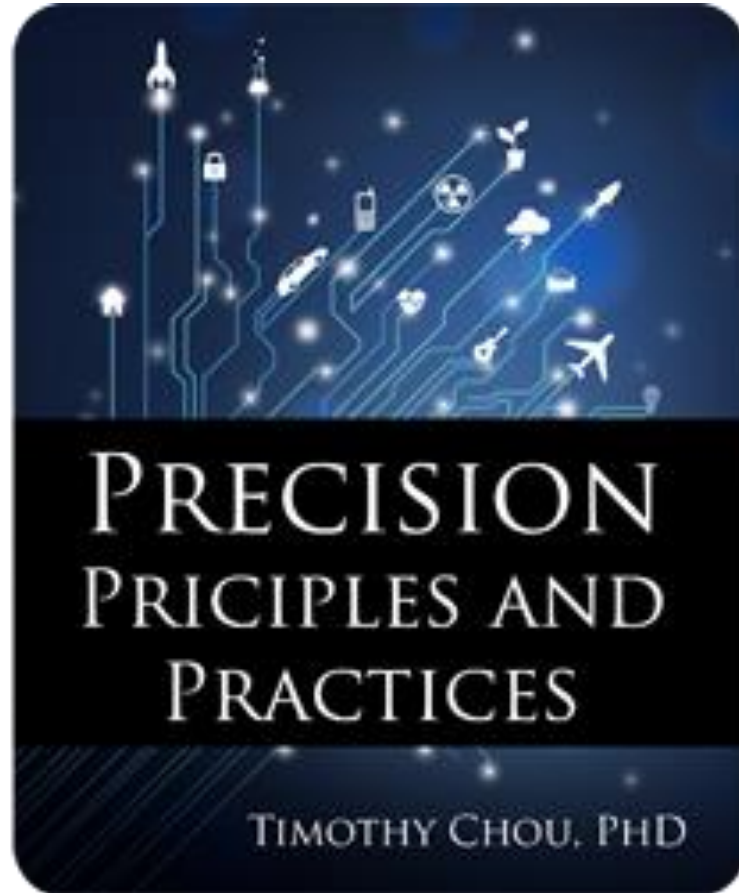
Apply for your kit today - https://autodeskfusionconnect.com/toolkit/

Apply for your kit today - https://autodeskfusionconnect.com/toolkit/

What's In the IoT Discovery Toolkit?

- Autodesk Fusion Connect Account with pre-defined business application template

- Electric Imp Developer Account with pre-defined IDE framework to easily create and manage device and cloud applications

- Wi-Fi enabled gateway

- Grove connector cable

- External grove temperature and humidity sensor adapter board

- Ports for industrial / PLC machine connectivity

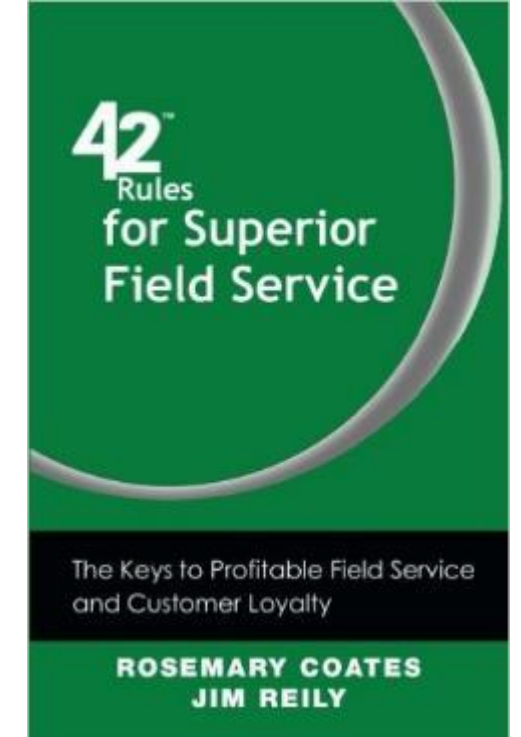- USB power supply and cable

- 5V-24V industrial power input

Resource Reminder

PRECISION PRICIPLES AND PRACTICES
TIMOTHY CHOU, PHD

This book will help you reach new Productivity Frontiers and create Competitive Advantage

IoTtransform™

IoTaudit™
IoTtransform™ IoTblueprint™
IoTdeploy™

The System that Drives Successful Business Transformation using the Internet of Things

Steve Grady CEO Enviro-Controls

Innovating for People
Handbook of Human-Centered Design Methods
LUMA INSTITUTE™

Customer Success Is Key

HOW A SMALL MANUFACTURER TRANSFORMED INTO AN INTERNET OF THINGS (IoT) SOLUTIONS PROVIDER AND UNLOCKED $2 MILLION IN SAAS REVENUE

MADE TO SERVE
How manufacturers can compete through servitization and product-service systems

TIM BAINES and HOWARD LIGHTFOOT

WILEY

42 Rules for Superior Field Service

The Keys to Profitable Field Service and Customer Loyalty

ROSEMARY COATES
JIM REILY

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