SMART MANUFACTURING MODELS WITH SUSTAINABLE ROI

How the IIoT Provides a Scalable Platform for Continuous Improvement

Tom Craven, VP of Product Strategy, RRAMAC Connected Systems

RRAMAC
CONNECTED SYSTEMS

Some simple definitions

Industrial Internet of Things (IIoT)

Industrial sensors, controllers, etc., connected over the internet

Smart Manufacturing

Making manufacturing processes smarter thru data, analytics, machine learning etc.

Industry 4.0

Could be loosely defined as the combination of IIoT and Smart Manufacturing

RRAMAC
CONNECTED SYSTEMS

What Can Hinder Sustainable ROI?

IIoT without Smart Manufacturing

- Internet enabled devices that only support text, email, tweets, or simple dashboards
- Web published Operator Interface Screens

Don't invest in the Industrial *Dumb* Internet of Things (IDIOT)

Smart Manufacturing without IIoT

- Hinders data flow between software systems and limits timely access to critical information
- Leveraging existing cloud computing infrastructure can potentially deliver faster ROI

Trying to do everything at once

- Huge upfront costs and lengthy implementation may cause financial stakeholders to lose interest

RRAMAC
CONNECTED SYSTEMS

Lessons from the Consumer Market

- Amazon, Google Maps, Apple Pay
- Start with a relatively simple yet valuable concept
- Use AI to become smarter and increase value over time
- User Interface matters

	Amazon	Google Maps	Apple Pay/Restaurant Apps
Simple Concept	Buy books online	Navigate with your phone	Use your phone as a credit card
Use AI learning to increase value over time	Recommnedations based on previous purchases	Traffic feedback from other Google Map users	Bypass the line
	Other people also purchased…	Push notifications to tell you its time to leave (based on traffic)	Remembers what you like to order to simplify ordering
	Anticipatory Shipping	Uses your travel history to anticipate your destination	Time your order with travel time to the restaurant

"The best way to predict the future is to invent it" – Alan Kay, Motivational Speaker

RRAMAC
CONNECTED SYSTEMS

Can you afford to shut down your equipment because you ran out of raw material?

1. Text or Email alerts
- Reduce reaction time
- Increase revenue

2. Live web dashboards
- Monitor current chemical levels
- Reduce service cost

3. ERP Connectivity
- Automatic reordering
- Reduce downtime, reduce inventory

4. Historical Usage Report
- Predict when you will run out
- Reduce downtime, reduce inventory

5. Weather data
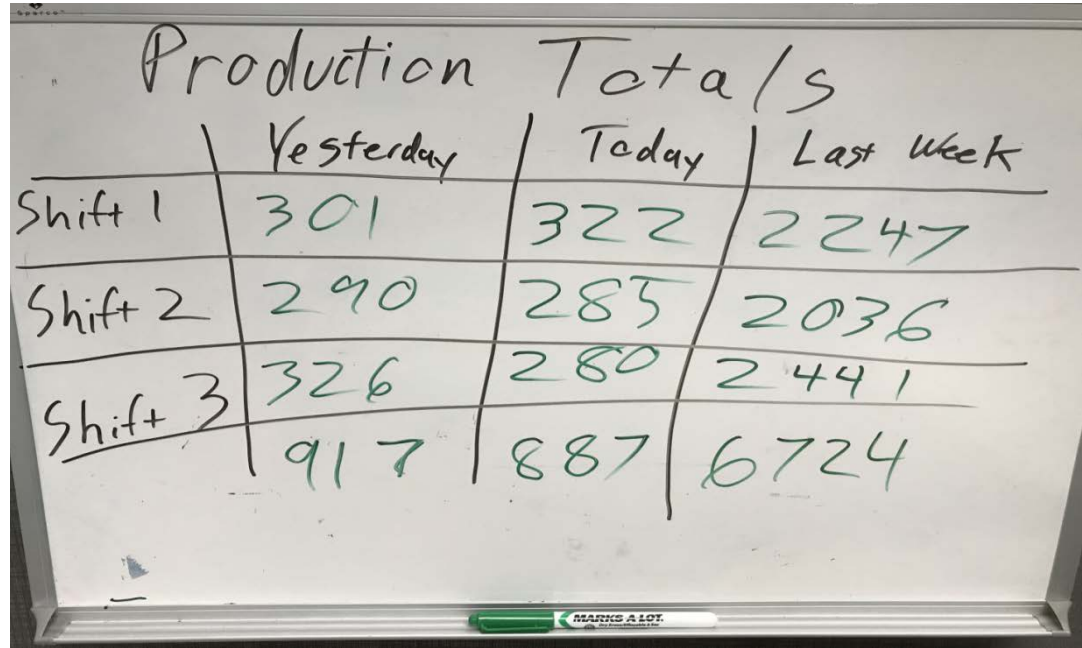- Increase accuracy of predictions

Car Wash Example

Continuous Improvement

"Measurement is the first step that leads to control and eventually to improvement. If you can't measure something, you can't understand it. If you can't understand it, you can't control it. If you can't control it, you can't improve it."

— H. James Harrington

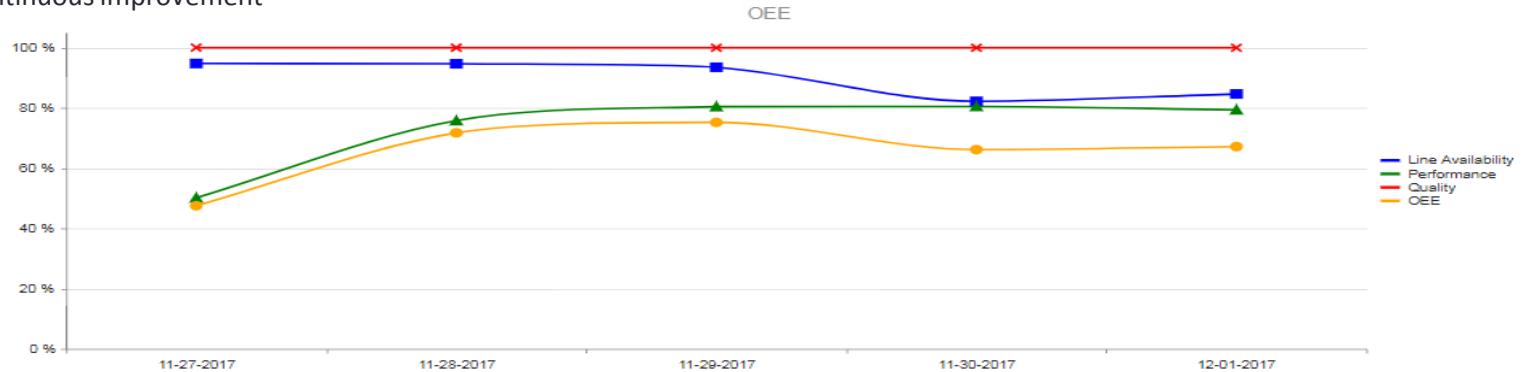Quality Guru

Overall Equipment Effectiveness

OEE: The gold standard for continuous improvement

OEE Benchmarks

85% - World Class

60% - fairly typical

40% - common for companies just starting to measure OEE.

OEE

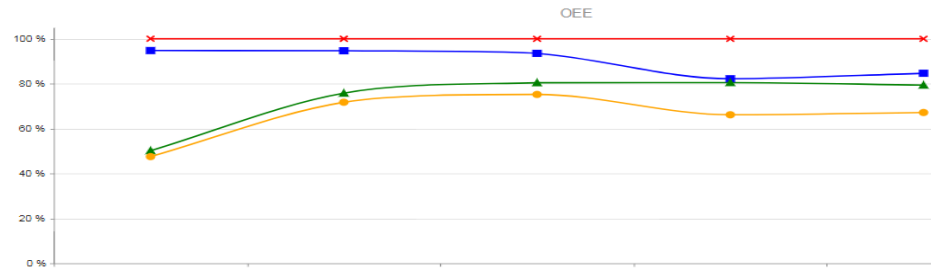|	Hourly Line Availability	Hourly Performance	Hourly Quality	Hourly OEE	Production Units Actual	Time In Hours
11-27-2017	94.75 %	50.17 %	100.00 %	47.53 %	1,276.00	14.76
11-28-2017	94.66 %	75.78 %	100.00 %	71.73 %	2,027.00	20.68
11-29-2017	93.50 %	80.43 %	100.00 %	75.21 %	2,001.00	19.26
11-30-2017	82.19 %	80.49 %	100.00 %	66.15 %	1,907.00	18.27
12-01-2017	84.64 %	79.36 %	100.00 %	67.17 %	2,051.00	19.91
Summary	89.95 %	73.25 %	100.00 %	65.56 %	9,262.00	92.89

RRAMAC
CONNECTED SYSTEMS

Continuous Improvement

Traditional OEE

- Document OEE Requirements
- $50K - $100K SW Licenses, plus renewal
- $50K - $100K Server Hardware
- SW development training
- SW installation
- Application Configuration
- Timeline of many months
- Ongoing SW support
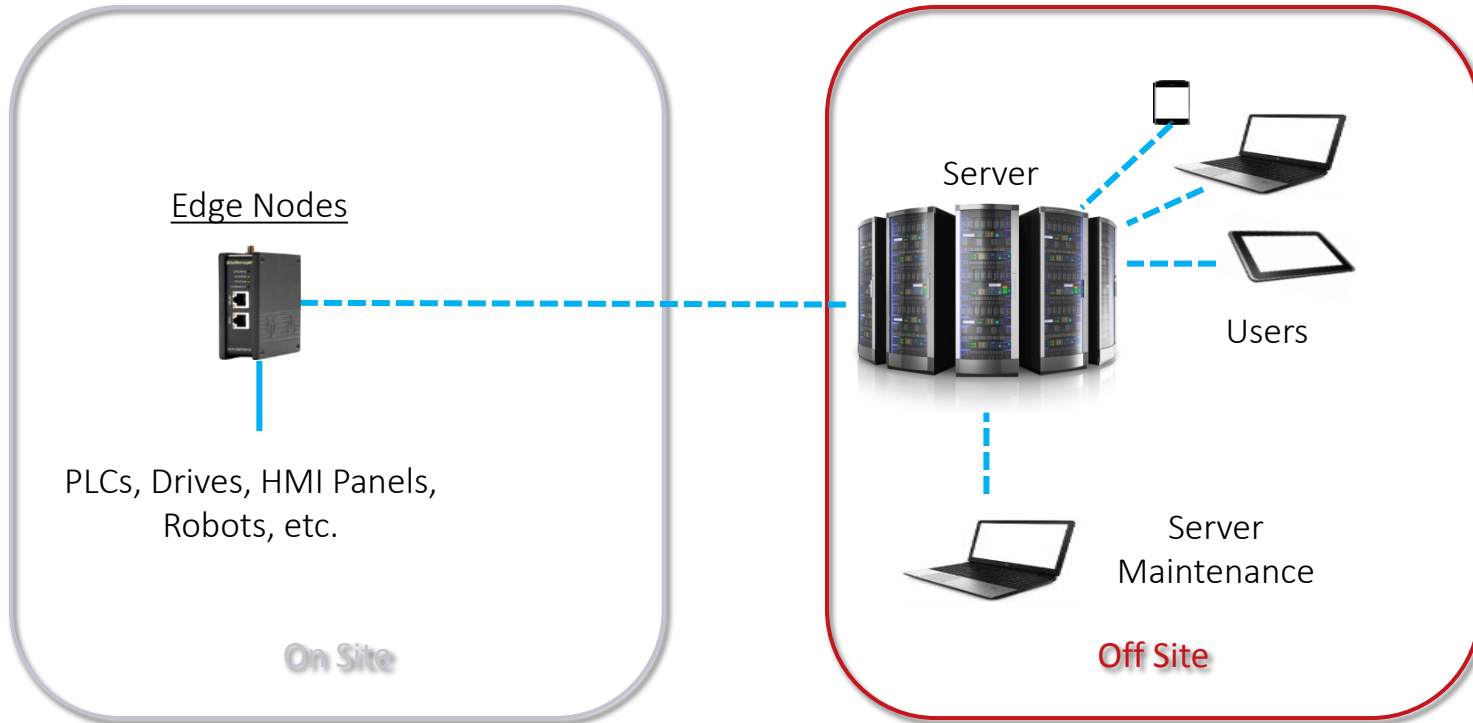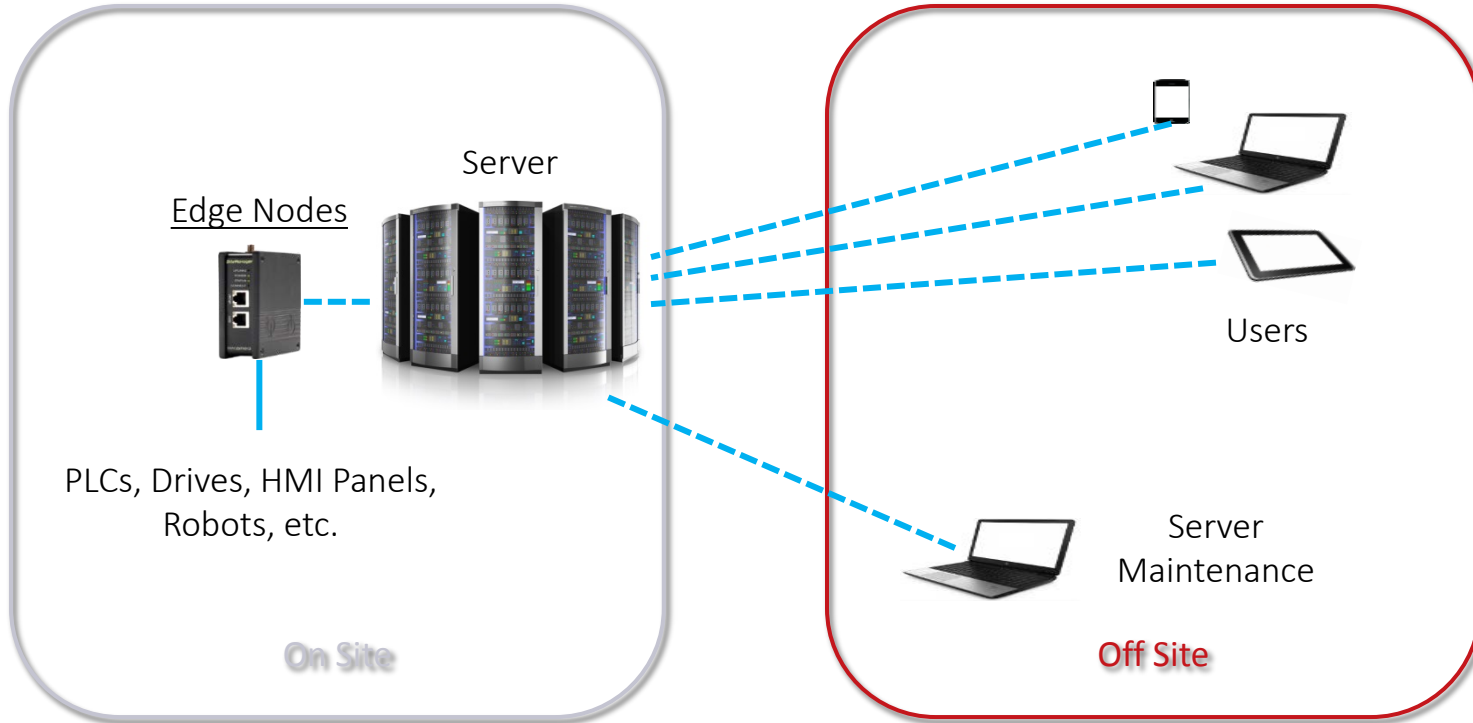- OS and SW upgrades
- Troubleshooting

Hosted OEE

- Document OEE Requirements
- Low Configuration Fee
- Install Edgenode
- Timeline of a few weeks
- Ongoing hosting fee

Cloud Hosted Architecture

Edge Nodes

PLCs, Drives, HMI Panels, Robots, etc.

On Site

Server

Users

Server Maintenance

Off Site

RRAMAC
CONNECTED SYSTEMS

On-Premise Hosted Architecture

Server

Edge Nodes

PLCs, Drives, HMI Panels, Robots, etc.

On Site

Users

Server Maintenance

Off Site

rramac.com | info@rramac.com

Machine Learning

Applications
- Accurate Predictions
- Process Optimization
- Variable Correlation

ML Platforms
- Amazon Machine Learning
- IBM Watson
- Cortana Intelligence Suite
- Industry Specific Experts

Recommendations

- Brainstorm ways to save money or increase revenue through Smart Manufacturing and IIoT
  - Reduce cost of service trips, order entry, inventory, etc.
  - Increase revenue thru production efficiency
  - Increase revenue by providing a better user experience
- Identify phase 1 targets –
  - Simple improvements
  - Tangible ROI
  - Typically text or email alerts, dashboards, condition monitoring, etc.

RRAMAC
CONNECTED SYSTEMS

Recommendations

- Select a provider to meet short term and long term needs
  - Obtain proposals from multiple providers for phase I
  - Obtain budgetary estimates for one or more future projects
- Calculate ROI for Phase I
  - Up front costs (internal and external)
  - Ongoing costs (internal and external)
  - Timeline for results
  - Cost savings or revenue once results are achieved
  - Document projected results for year 1, 2, and 3
- Implement Phase I (consider collecting additional data for phase II)
- Measure Results

Recommendations

- Identify next phase
  - ERP connectivity?
  - Downtime or OEE analytics?
  - Predictive Maintenance?
  - Machine Learning?
- Get quotes and calculate ROI
- Use ROI from previous phase to fund and cost justify next phase
- Repeat the previous three steps on this slide

The IIoT Roadmap

Asset Monitoring

Asset Intelligence
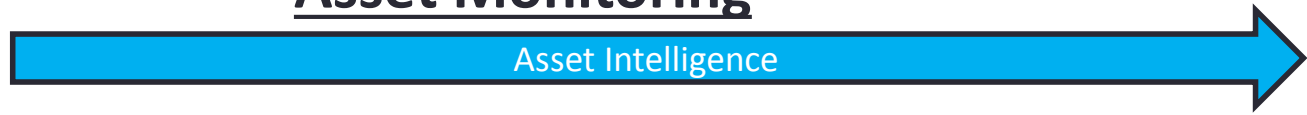
| Alarm Monitor |
| Maintenance Dashboard |
| Production Line Status |
| Temp/Hum Monitor |
| Tank Level Monitor |
| Pump Station Monitor |

| Alarm History |
| Downtime Summary |
| Production Totals |
| Condition Monitoring |
| Root Cause Analysis |

| Predictive Maintenance |
| Overall Equip Effectiveness |
| Reorder Consumables |
| Product Genealogy |

| Machine Learning |
| Prescriptive Maintenance |

RRAMAC
CONNECTED SYSTEMS

FOR MORE INFORMATION...

Tom Craven

VP of Product Strategy

RRAMAC Connected Systems

www.rramac.com

info@rramac.com

(844) 477-2622

RRAMAC
CONNECTED SYSTEMS