# An Instrumentation/Controls Perspective on Industry 4.0

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Spring 2020

BTG
A Voith company

# Agenda

- Digital Overview
- Capstone/BTG History
- Tools of the future
- Remote Reliability

# Digital

is happening now

Connectivity

Data

Computing power

**3**

**trends**

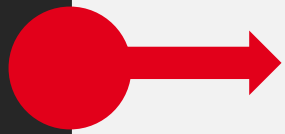
The amount of data produced is increasing exponentially.

**Dozens**
of data sources

**100,000's**
of tags

**1,000,000's**
of records

Speed & Ability to Collect, Present, Analyze & Interpret



Drives Decision Making & Performance

Focus on the Biggest & Highest Value Opportunities

# Digital =

Recombinant innovation




# Digital

has very different use cases across sectors


Consumer Products
(digital marketing)

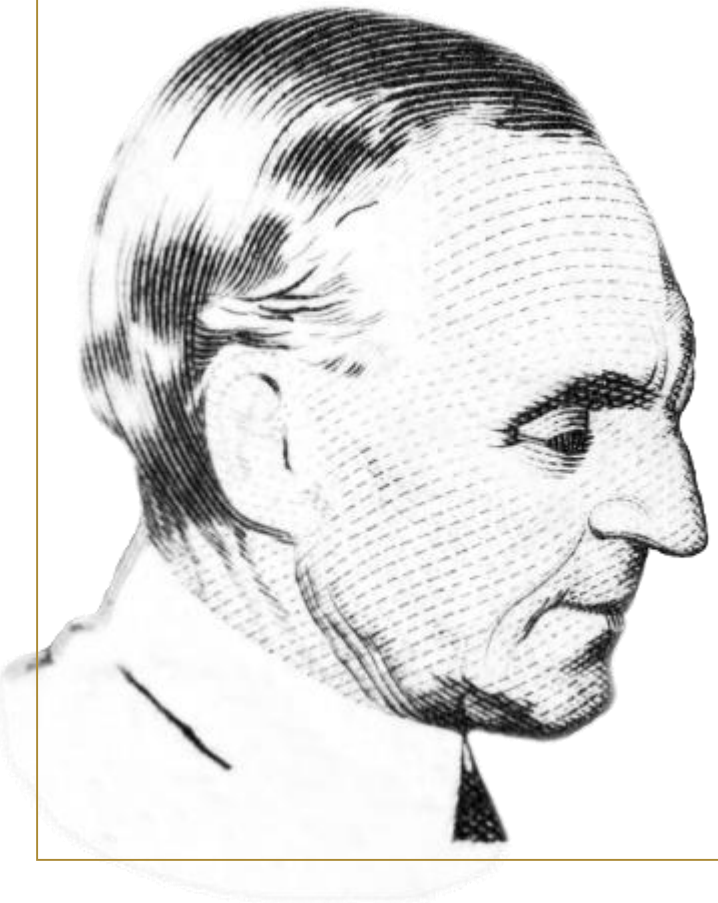
Construction
(virtualized sites)

Medtech
(robotic surgery)

Manufacturing
(3D printing)

**1000s**

**of applications**



“If I had asked people what they wanted, they would have said **faster horses**”

Henry Ford

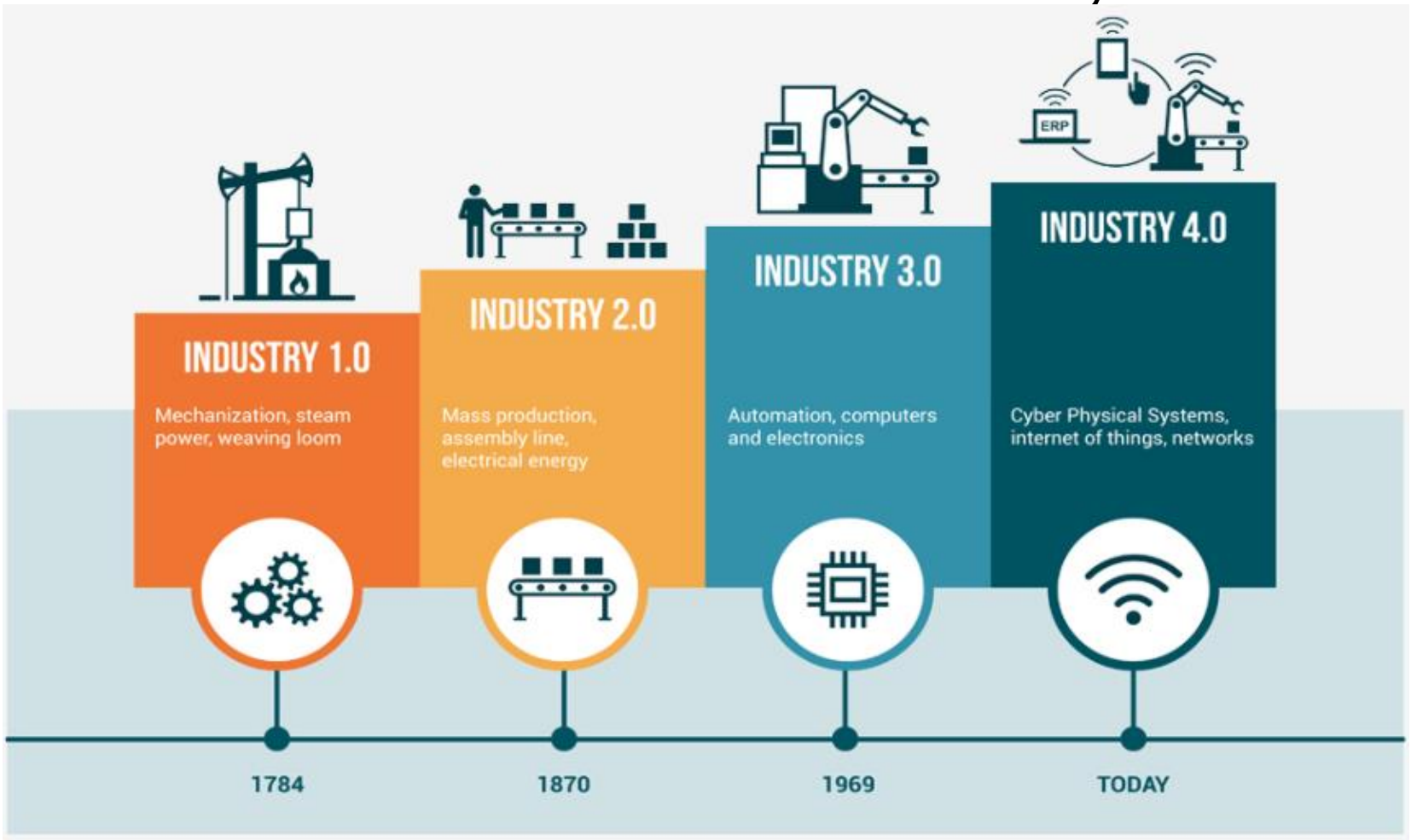
Every single business needs to **simultaneously build**

**a cheaper, better, faster horse**

**& imagine the car**

# What is Industry 4.0

It eliminates distance and uses data in a timely fashion




(Seekmomentum.com)

# History of Capstone/BTG

1997 – Founded by a Team of Chemical Engineers

2000 – Integration of Model Predictive Control (MACS)

2001 – Development of Plant Information Systems (dataPARC)

2016 – Acquired by Spectris PLC

2020 – Acquired by Voith

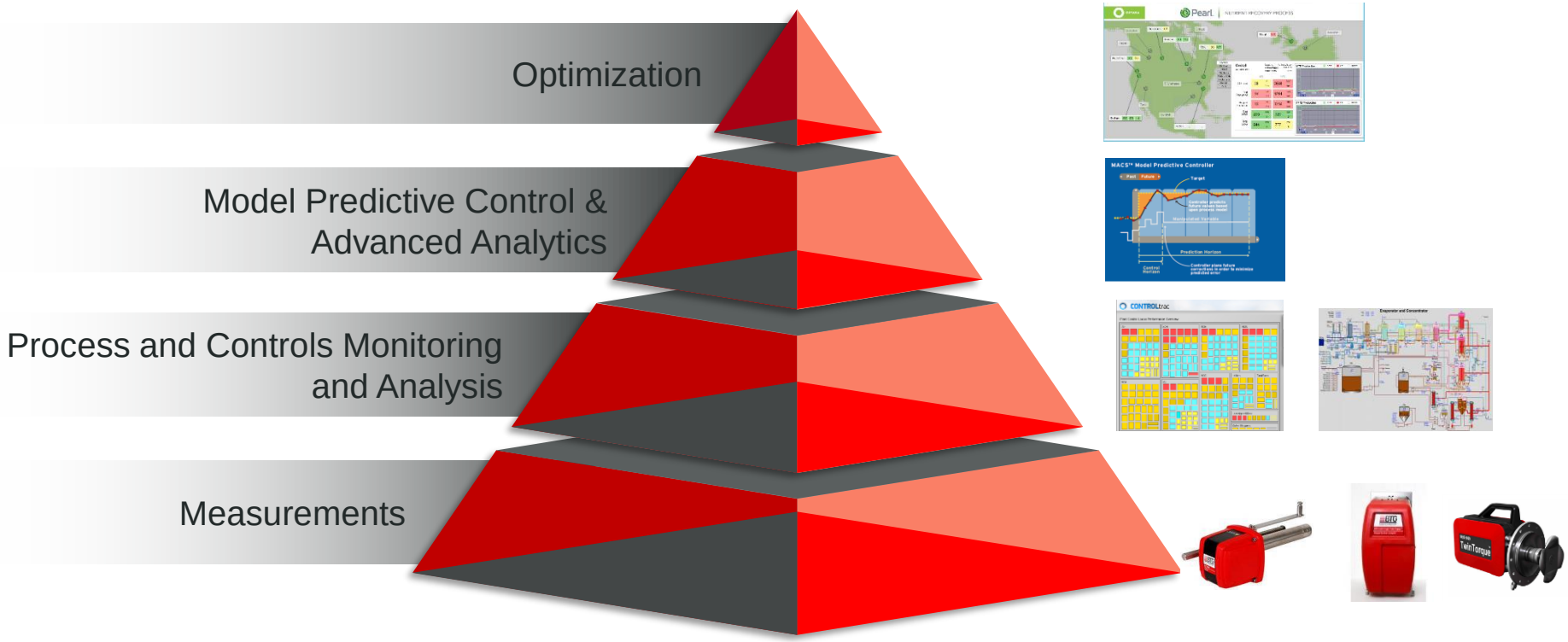

dataPARC

- Data Visualization Tools
- Data Historian
- Industry Solutions

MACS

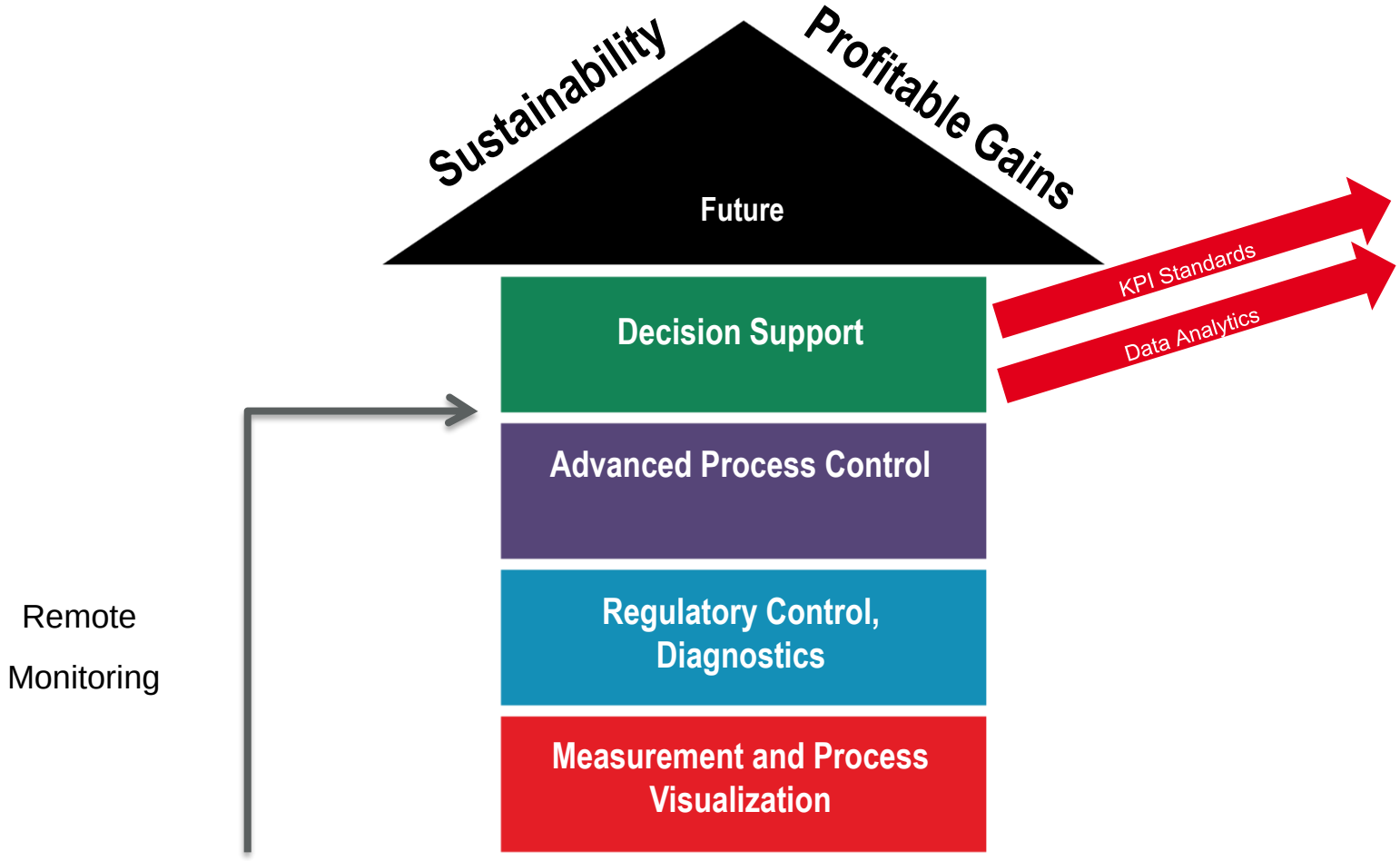
- Advanced Control Tools
- Loop Performance Tools
- Batch Monitoring & Control

# BTG Digital


Optimization
Model Predictive Control &
Advanced Analytics
Process and Controls Monitoring
and Analysis
Measurements
Pearl
MACS™ Model Predictive Controller
CONTROLtrac
TwinTorque

# Tools of the Future

- Deliver actionable information to all levels of the workforce in time to make critical business decisions
- Speed, Aggregation, Display Techniques
  - How information is displayed can be the difference between the right and wrong decision
- Integration of Data Sources with Context
- Consistent KPI's & Metrics
- Tools that can keep up with the speed of thought
- Ease of Use, data transformation


Sustainability
Profitable Gains
Future
KPI Standards
Data Analytics
Decision Support
Advanced Process Control
Regulatory Control, Diagnostics
Measurement and Process Visualization
Remote Monitoring

# The Need for Remote Reliability

- Increasing number of higher dependence on measurements for advanced controls at mills
- Enhanced sense of urgency for responses to sensor issues due to importance within control schemes
- Demand for remote troubleshooting of instruments rather than the traditional approach involving site visit by tech
- Economic impact of APC platforms can be compromised when sensors are offline or not trusted

# The Value of Remote Reliability

- Better Accuracy
  - Permanently maintained system
  - Sensor details available
  - Variation analysis of signals
  - Sensor comparison over process
- Higher availability
  - Shorter downtimes
  - Predictive maintenance and services
- Early/Immediate information on non-conformity
  - Alerts to service engineers (email, text, etc.)
  - Alerts to customer (email, text, etc)

# The Value of Remote Reliability

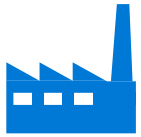
- Having a regular update on health of equipment
- Regularly inform customer about calibration quality and the need for any update
- Ability to quickly keep measurements online for APC support
- Quick analysis of instruments failures without a service engineer site visit
- Shift from break/fix to reliability focused maintenance
- Lower total service costs due to less travel and time requirements

# Digital Overview

## Business Insights

1. Supplier has access to advanced, real-time analytics for install-base
2. Better understand how products are being used
3. Better understand performance of products

## Manufacturing Efficiencies



1. Supplier fed real-time data on defects & durability
2. Update manufacturing process - avoid warranty costs
3. Instrument design improvements informed by live field data

## Service

Service

1. Predictive maintenance capability enables higher customer satisfaction

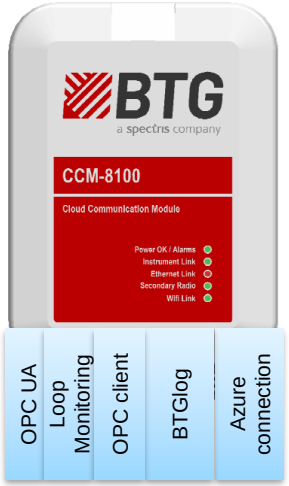
## New Features

Customer

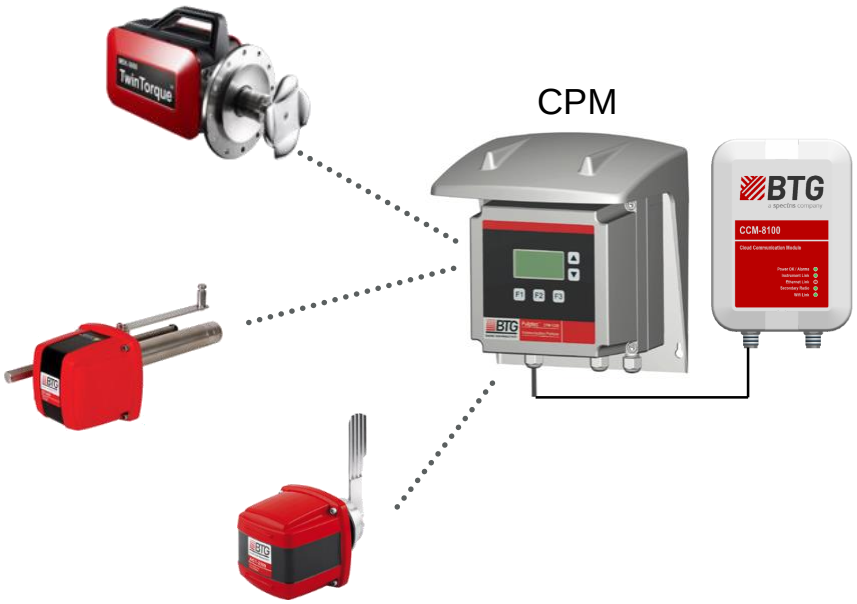
1. **b**Connect/SMART Monitoring – sensor monitoring, fault detection, troubleshooting
2. ControlSuite – Cloud deployment for loop performance monitoring

# Digital Connectivity Platform

- **b**Connect
  - Add-on upgrade for any CPM-based instrument
  - OPC-UA Server - next generation communication standard
  - Integrated OPC-UA data historian
  - Secure access control
  - Integrates with dataPARC 7.0 architecture and other data historians
  - Potential for wireless instrument installation -> reduced cost



# Communication Options




Today:

Common Communication Platform (CPM)

- 4-20 mA
- Hart & Profibus

**b**Connect Add-On:

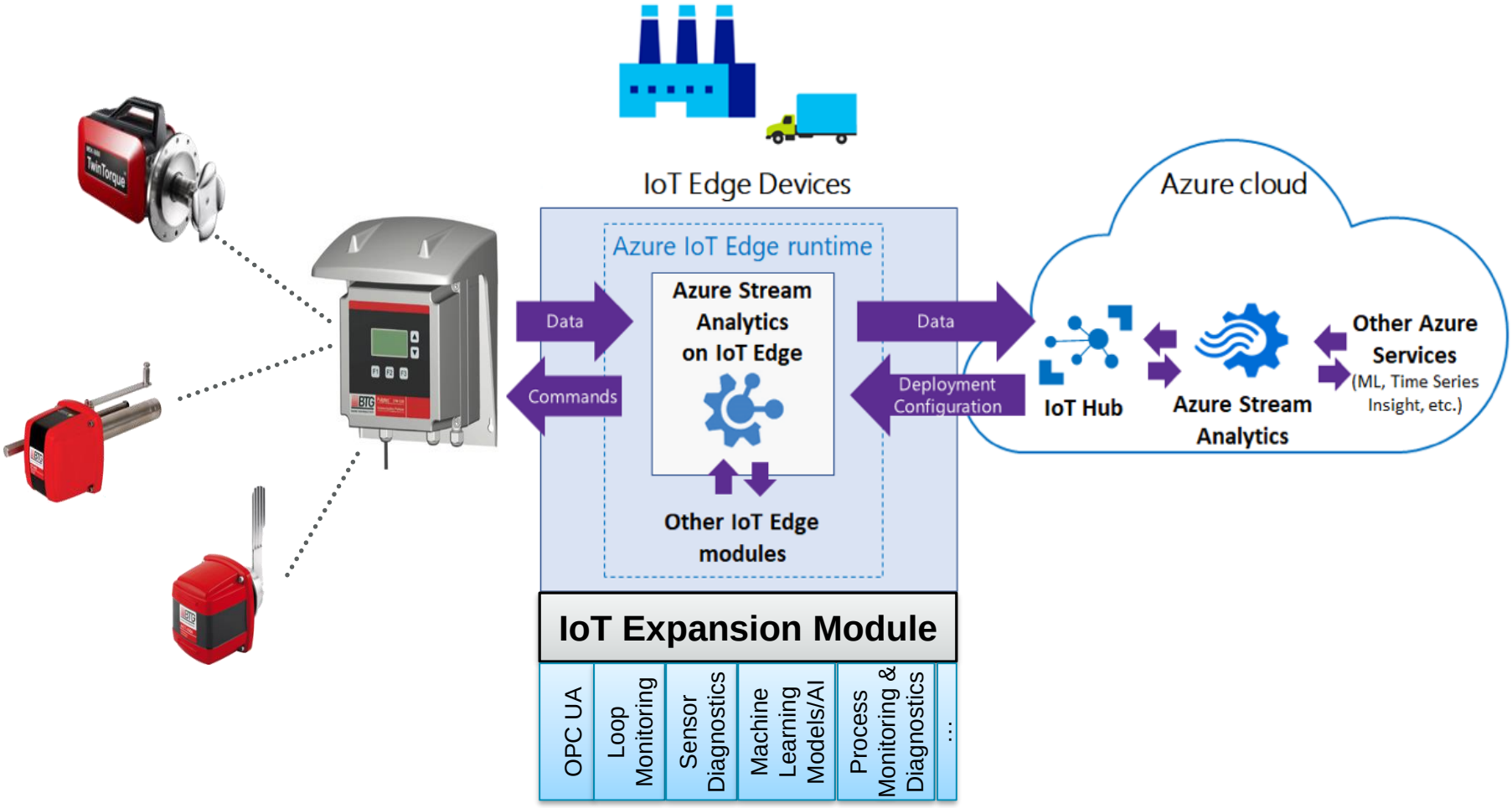
Industry 4.0 Interfaces

- Ethernet
- WiFi
- LTE/Cellular
- Backward compatible with installed instrumentation

Software Interfaces

- OPC UA Server/Client
- OPC DA Client

# Instrument – Azure/Cloud Integration



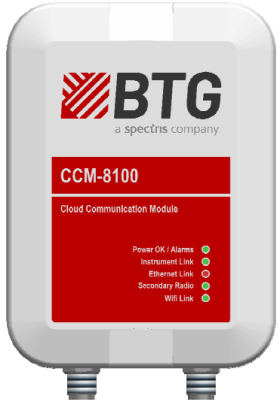
# Digital Connectivity Platform: Full Instrument Data Access

## Kappa

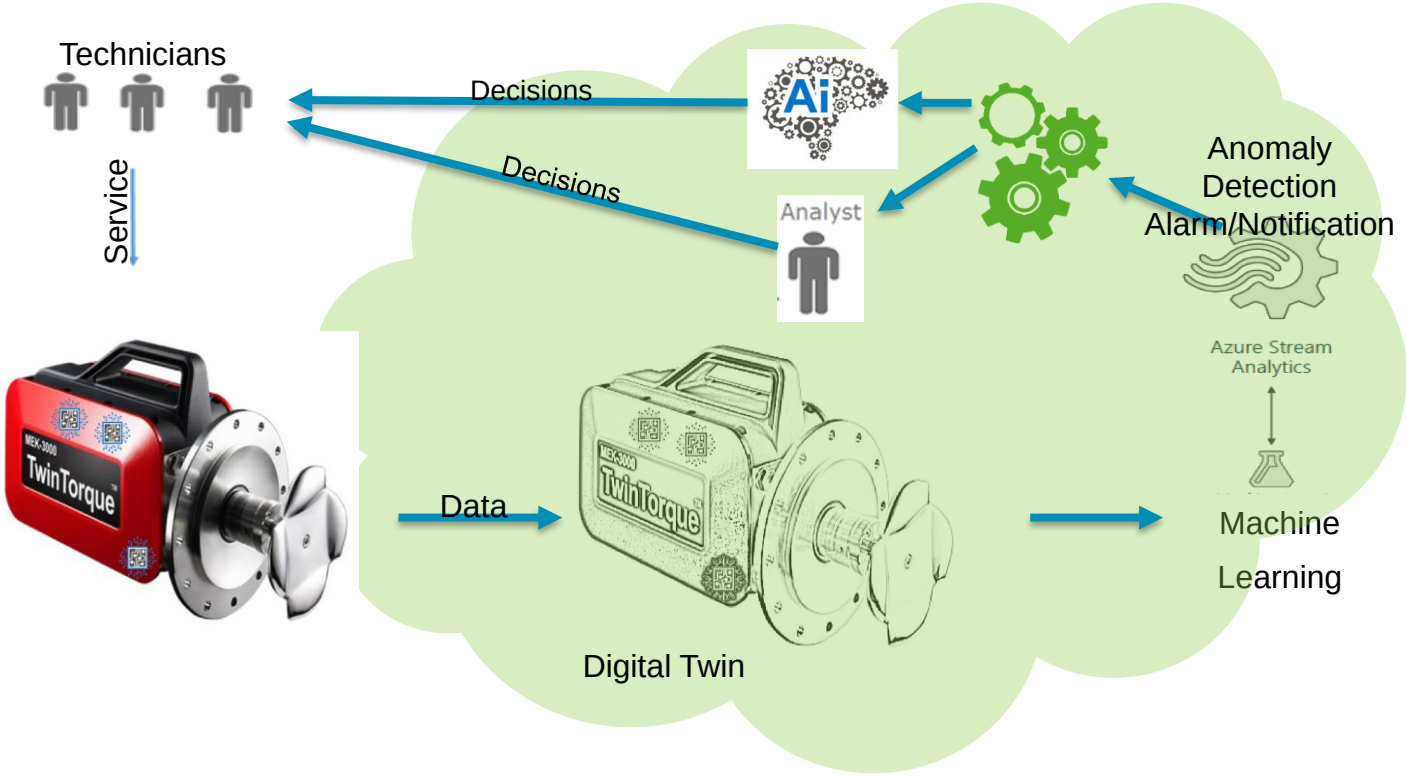
| | | | |
|---|---|---|---|
| DateTime | [yyyy-mm-dd hh.mm.ss] | DateTime | [yyyy-mm-dd hh.mm.ss] |
| CalibSet | [1 to 4] | CalibSet | [1 to 4] |
| CalcStatus | [0 to 255] | CalcStatus | [0 to 255] |
| **Kappa** | [0 to 100.] | Kappa | [0.0 to 100] |
| KappaUnfilt | [0 to 100.] | Abs | [0.0 to 100] |
| Abs | [0 to 100.] | Beta | [0.0 to 100] |
| AbsMin | [0 to 100.] | RmsZ | [0 to 1.65 V] |
| AbsMax | [0 to 100.] | Z | [0 to 1.65 V] |
| AbsMaxFilt | [0 to 100.] | T | [0 to 1.65 V] |
| Z | [0 to 1.65 V] | AnaIn | [0 to 22.00 mA] |
| T | [0 to 1.65 V] | MvrI_Z | [-8388608 to 8388607] |
| CwZ | [0 to 1.65 V] | MvrQ_Z | [-8388608 to 8388607] |
| CwT | [0 to 1.65 V] | MvrI_T | [-8388608 to 8388607] |
| DkZ | [0 to 1.65 V] | MvrQ_T | [-8388608 to 8388607] |
| DkT | [0 to 1.65 V] | MvrRmsZ | [-8388608 to 8388607] |
| FirstIndex | [0 to 29] | Bandwidth | [0 to 65535] |
| LastIndex | [0 to 29] | Frequency | [0 to 65535] |
| K0 | [0 to 1.] | Amplitude | [0 to 65535] |
| K1 | [0 to 1.] | Offset | [0 to 65535] |
| K2 | [0 to 1.] | OpticsTem | [0 to 100. °C] |
| RmsZ | [0 to 1.65 V] | OpticsHum | [0 to 100. %Rh] |
| SamplerExtendTi | [0 to 10. s] | | |
| SamplerRetractT | [0 to 10. s] | | |
| SamplerExtendC | [0 to 12] | | |
| SamplerRetractC | [0 to 12] | | |
| SamplerStrokes | [1 to 12] | | |
| SamplerStrokesF | [0 to 12] | | |
| CardTemp | [0 to 100. °C] | | |
| OpticsTemp | [0 to 100. °C] | | |
| OpticsHumidity | [0 to 100. %Rh] | | |
| SamplerTemp | [0 to 150. °C] | | |
| TempCompOptZ | [0 to 2.] | | |
| TempCompOptT | [0 to 2.] | | |
| TempCompDetec | [0 to 2.] | | |
| TempCompOptK | [0 to 2.] | | |
| DcAdc1 | [-1000 to 1000] | | |
| DcAdc2 | [-1000 to 1000] | | |
| MvrI_Z_Dark | [-8388608 to 8388607] | | |
| MvrQ_Z_Dark | [-8388608 to 8388607] | | |
| MvrI_T_Dark | [-8388608 to 8388607] | | |
| MvrQ_T_Dark | [-8388608 to 8388607] | | |

## Consistency

| | |
|---|---|
| DateTime | [yyyy-mm-dd hh.mm.ss, NoKey |
| **Consistency** | [0.0 to 50000 g/l, %Cs or mg/l] |
| CalibSet | [1 to 4] |
| AnaIn | [0 to 22.00 mA] |
| TempPcb | [0 to 150.0 °C] |
| TempExt | [0 to 150.0 °C] |
| AngleErr | [-900 to 900 m°] |
| AngleStdDev | [0 to 1000 m°] |
| Speed | [0 to 800.0 rpm] |
| PropellerCurrent | [0 to 10.0 A] |
| SensorCurrent | [0 to 16.0 A] |
| TorqueNmm | [0.0 to 2000 Nmm] |
| TorqueKpmm | [0.0 to 204 kpmm] |
| Feedback | [0.0 to 102 %] |
| RawCons | [0.0 to 50000 g/l, %Cs or mg/l] |
| MeasNum | [0 to 65535] |
| OutputLocked | [0 to 1] |
| NewDataAvailable | [0 to 3] |



# Remote Reliability Service



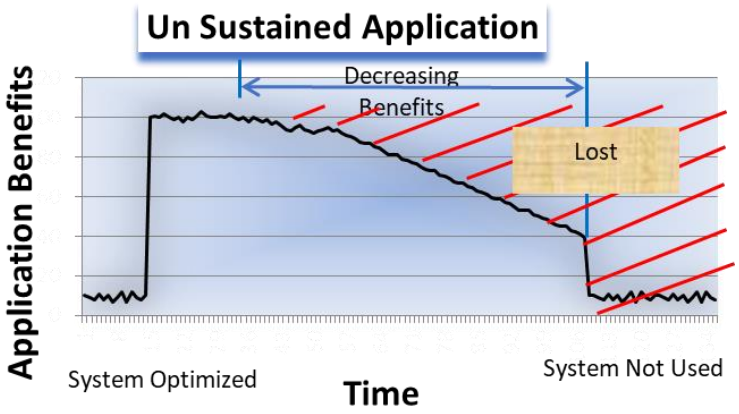
# Remote Reliability Reporting

- Periodic (monthly, quarterly, annually) reporting on instrumentation health:
  - Analyzer/Sensor conditions and availabillity for controls
  - Internal sensor diagnostics for health monitoring and maintenance assessments
  - Calibration review (assuming lab values will be entered in CPM)
- Emergency info and support based on alarms and error messages

# Sustaining the Benefits

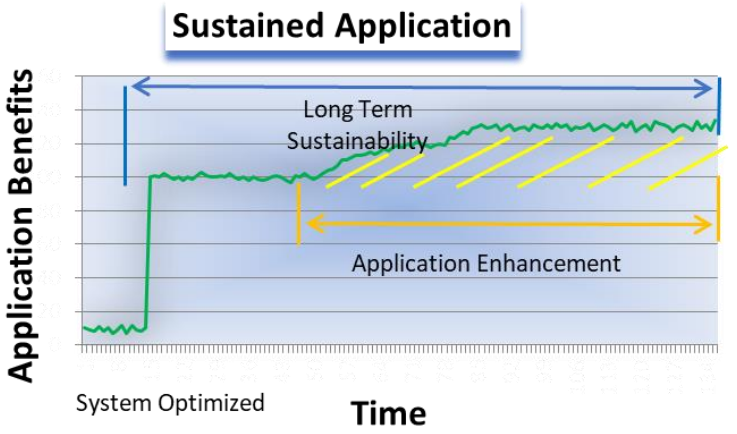
**Historical State of the Industry**

- Low Uptime
- Reduced or Lost Benefits
- Low Operator Acceptance
- Equipment/Measurement Issues
- Repetitive Process



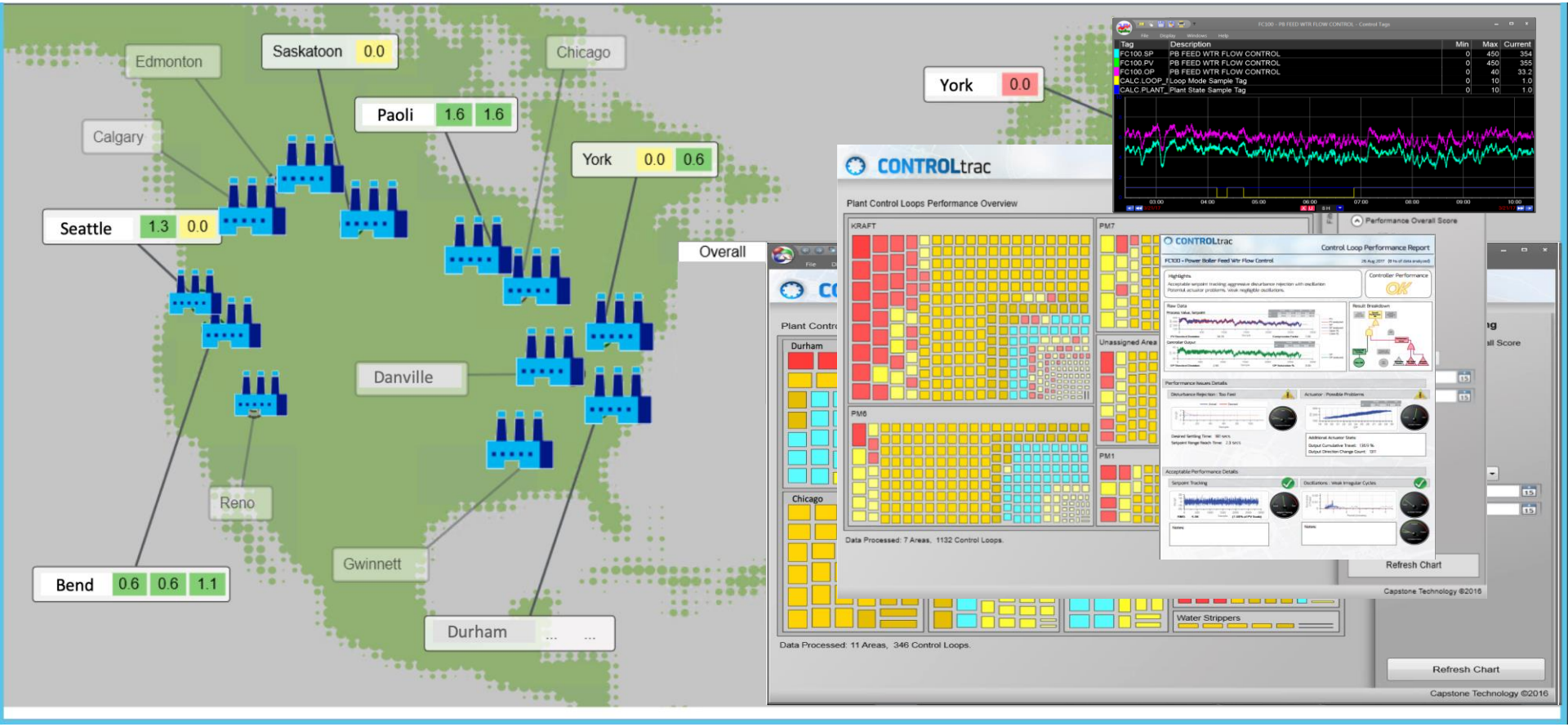

**Keys to Sustainability**

- Comprehensive System Support
- Automated System Reporting/Monitoring
- Operations Support
- Operator Training
- Continuous Improvement
- Current Technology




BTG Digitalisation Zellcheming 2019 /John Schulz, Roland Berger

# Enterprise Loop Monitoring – Cloud Deployed



# Conclusions

- Digitalization is happening now
- Suppliers R&D processes are changing
  - Continuous monitoring, Machine learning, etc.
- Customer service is changing
  - Less travel requirements for technical support
  - Better remote support and reliability of your equipment

# Thank You

BTG
A Voith company