Setting the context of Digital Transformation in Control and Automation

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- *Anthony Loy – Smart Factory Program Leader, Global Supply Chain*

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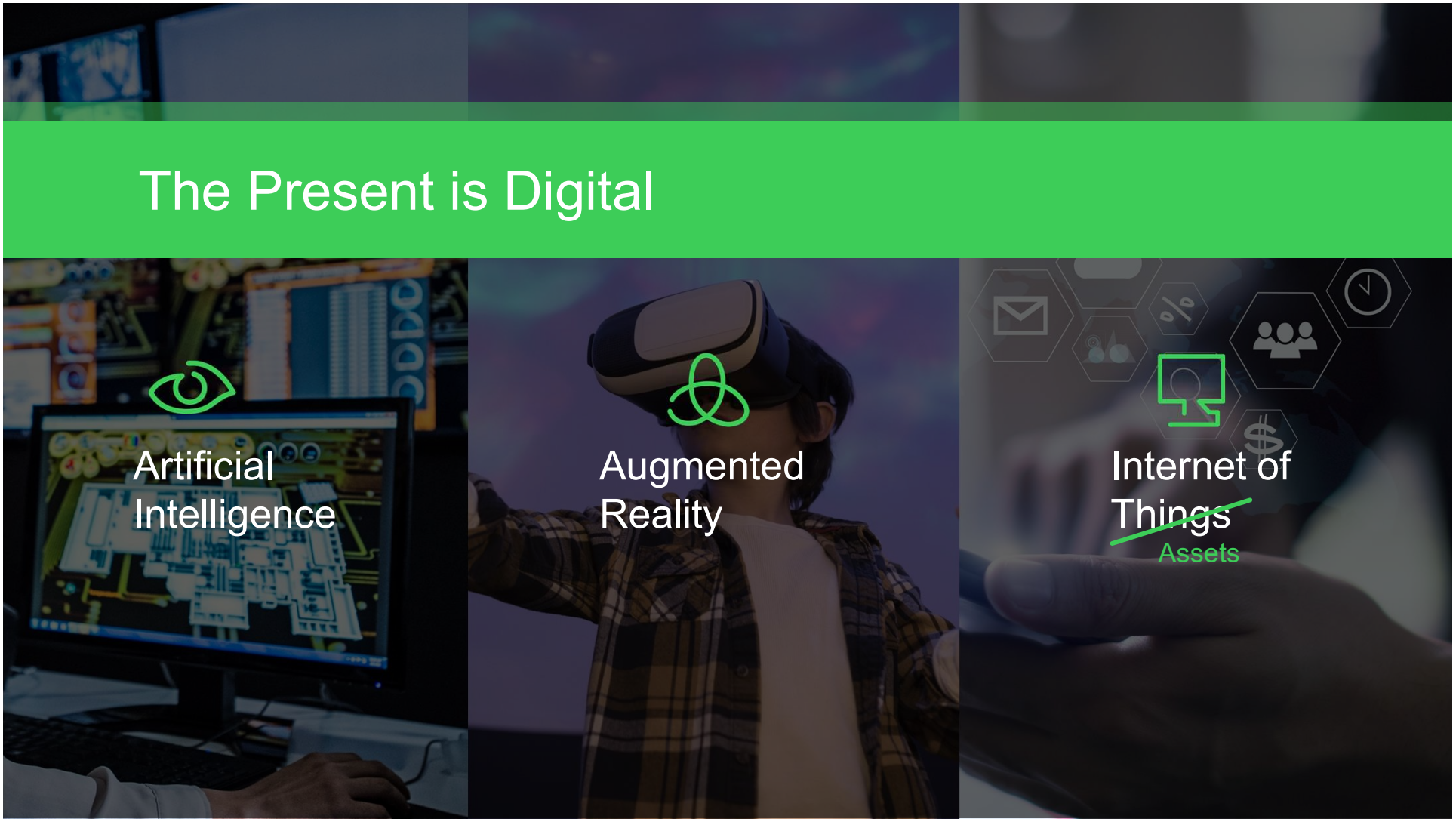
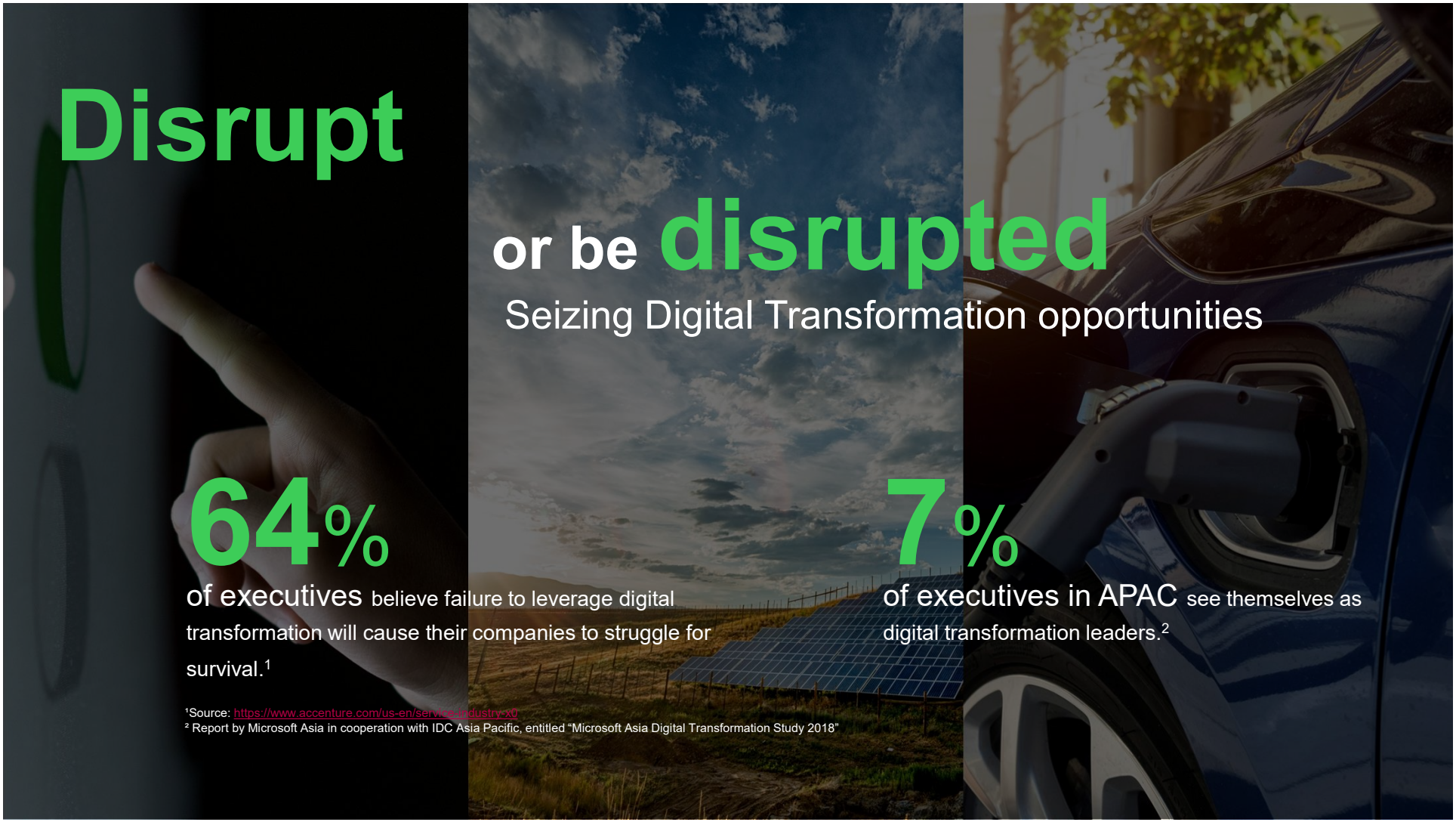
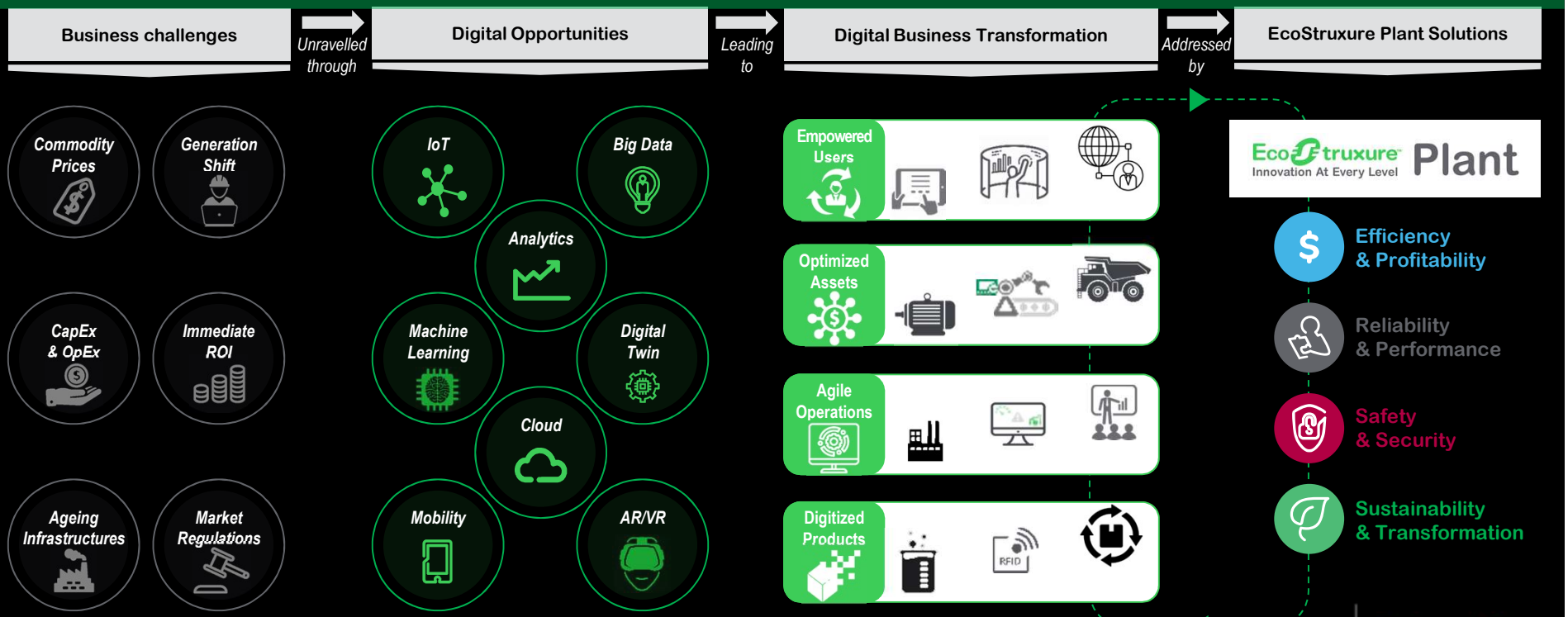
The Present is Digital




Disrupt
or be disrupted
Seizing Digital Transformation opportunities
64%
of executives believe failure to leverage digital transformation will cause their companies to struggle for survival.[1]
7%
of executives in APAC see themselves as digital transformation leaders.[2]
[1]Source: https://www.accenture.com/us-en/service-industry-x0
[2] Report by Microsoft Asia in cooperation with IDC Asia Pacific, entitled "Microsoft Asia Digital Transformation Study 2018"

Digital technologies open unprecedented opportunities to increase productivity and efficiency



Digital Transformation in Control & Automation context

A complete paradigm shift…..

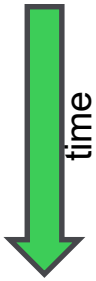
Introduction

- *Process control*: to keep a process safe and operating to design to produce economic value for the asset owners…
- …has been with us since the earliest days of the industrial revolution…and…
- …will always persist…and will never go away.
- *How* we solve/address those challenges – the platform on which the control is executed – ie the "*automation*"…
- …has changed over time…and will radically change in the future.
- The "intelligence" to achieve this objective is being pushed further and further "down" the architecture, and the traditional process control "Levels" are being compressed over time closer to the valve and the sensor…and to the process itself.
- There will ALWAYS be the conversion process itself…*and its process equipment*: pipes, vessels, pumps, reactors, concrete, steel, catalysts, etc., but how to *control* that process has – and will continue – to dramatically shift over time.

State-of-the-Art Industrial Control System – *for Four Decades!*

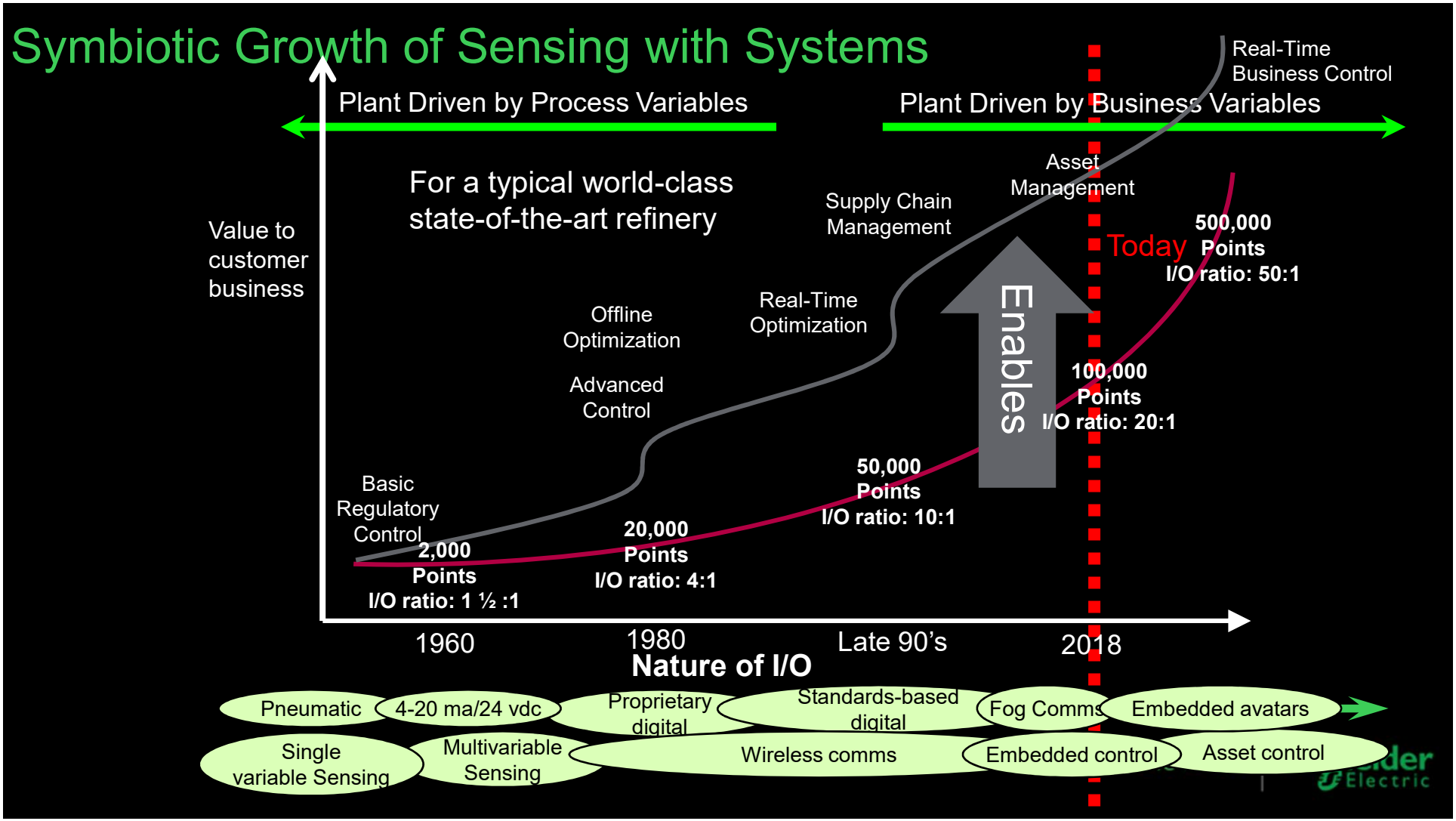
The predicament we're in:

2. We were severely limited in their scope by the technologies available:
   a) Manual/direct human manipulation/intervention in the process
   b) Mechanical control (e.g. spinning ball governors, siphon level control)
   c) Pneumatic (huge benefit: *intrinsically safe*)
   d) Electronic
   e) Digital computing and microprocessors



3. Forced control to be applied *on* the process, as an add-on or an appendage to the process

4. New technologies will bring the ability to shift that century-old paradigm so that control will be performed *in* the process, *in-situ*, in the actual process devices/ equipment, not "stuck-on".
5. It will become embedded and autonomous similar to a human body: ***the process controls itself***, it is NOT "stuck-on".


Symbiotic Growth of Sensing with Systems
Plant Driven by Process Variables
Plant Driven by Business Variables
Real-Time Business Control
For a typical world-class state-of-the-art refinery
Value to customer business
Asset Management
Supply Chain Management
Real-Time Optimization
Offline Optimization
Advanced Control
Basic Regulatory Control
Today
500,000 Points I/O ratio: 50:1
100,000 Points I/O ratio: 20:1
50,000 Points I/O ratio: 10:1
20,000 Points I/O ratio: 4:1
2,000 Points I/O ratio: 1 ½ :1
Enables
1960
1980
Late 90's
2018
Nature of I/O
Pneumatic
4-20 ma/24 vdc
Proprietary digital
Standards-based digital
Fog Comms
Embedded avatars
Single variable Sensing
Multivariable Sensing
Wireless comms
Embedded control
Asset control

State Sensing v. Property *Measuring*

About growth of outputs:

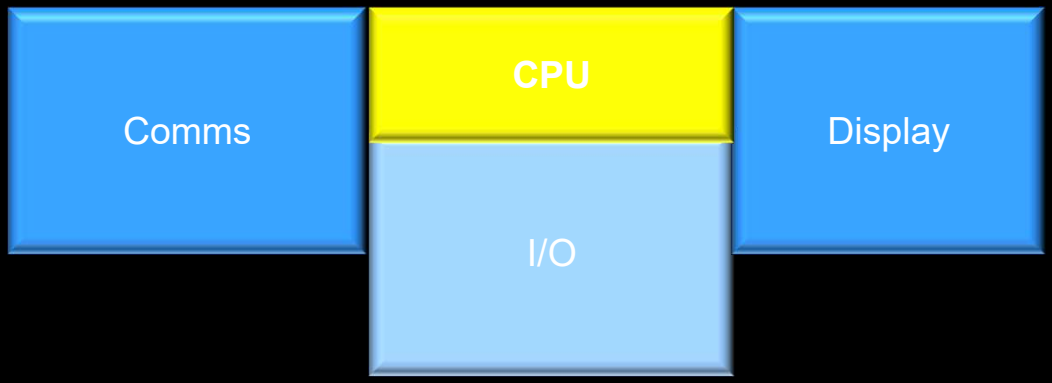
- Increased linearly over time/with scope of control
- Will remain a relatively constant ratio of driven devices: valves, actuators, and motors (pumps, fans, dampers, machinery, etc.)

About growth of inputs:

- *State* sensing – measuring state of the process like temp, press, flow, pH, etc. – *utilized for control* – will have growth rates similar to outputs
- Exponential growth in *measured* inputs *to support applications needs - only a few of which are involved in control – i.e.* "monitoring" v. "control"
- As move from *process efficiency improvements* to *business performance improvements* will shift the growth from *state sensing* of the underlying process to more and more *property measurement of the product being made and the assets and business associated with it:*
  - Product quality
  - Asset reliability
  - Profitability
  - Safety levels
  - Environmental compliance
  - Etc.

Growth in measurement largely bypasses the controllers

The Common Core Functionality (CCF)



The “controller” of any brand of DCS today…*and for the past 40 years*

Has been utilized for decades to architect control systems

But Technologies available today can now…

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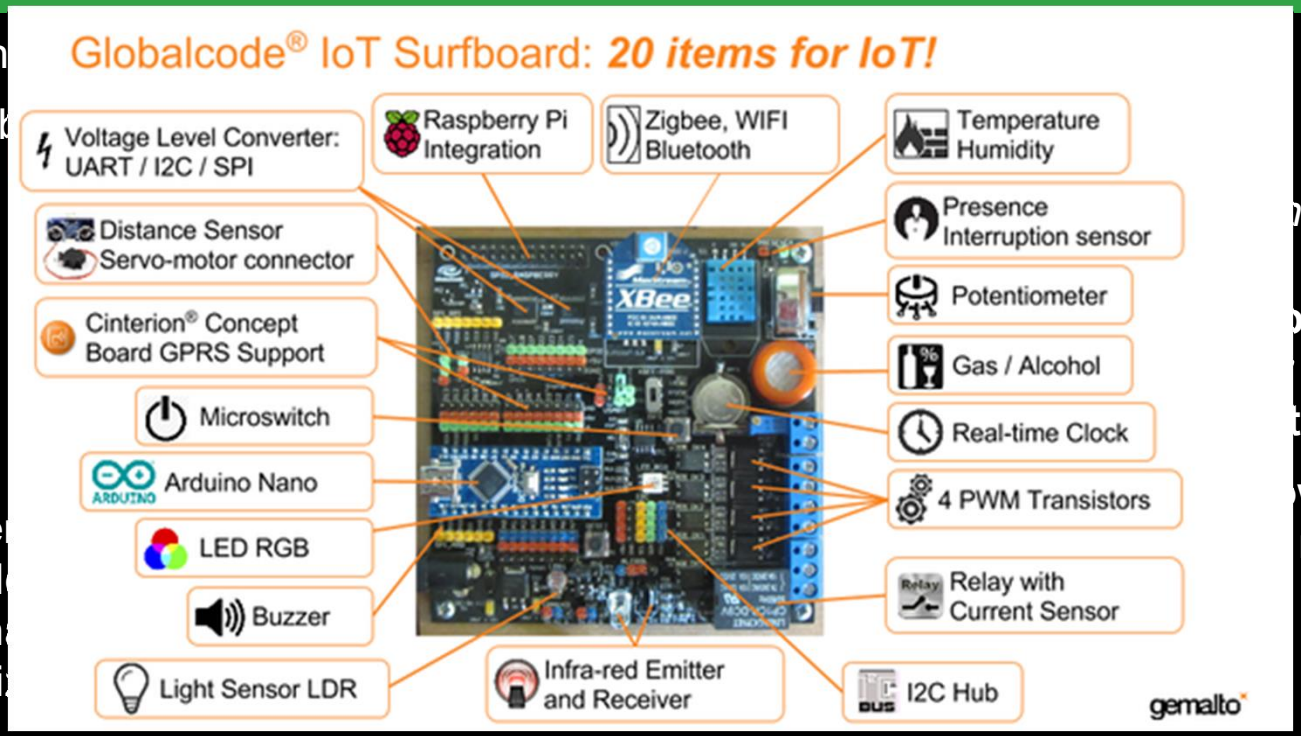

…s (CIF)

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… roots…

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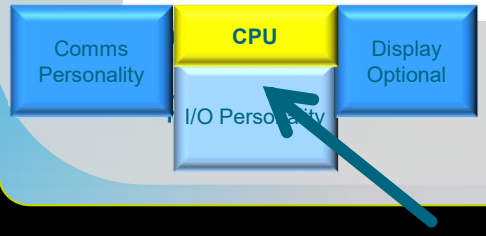
Imagine Instead…

1. Reduce CCF to the granularity of one, $3, and size of postage stamp: CPS

High-Speed Control & I/O Network

2. Low-level "fog" of communications "clinging" to the equipment via meshing (e.g. NFC)
Intrinsically secure/immune to hacking by distance



3. Uses power harvested from surroundings

4. Control now occurs *at the asset*

"Cyber Physical System" (CPS)

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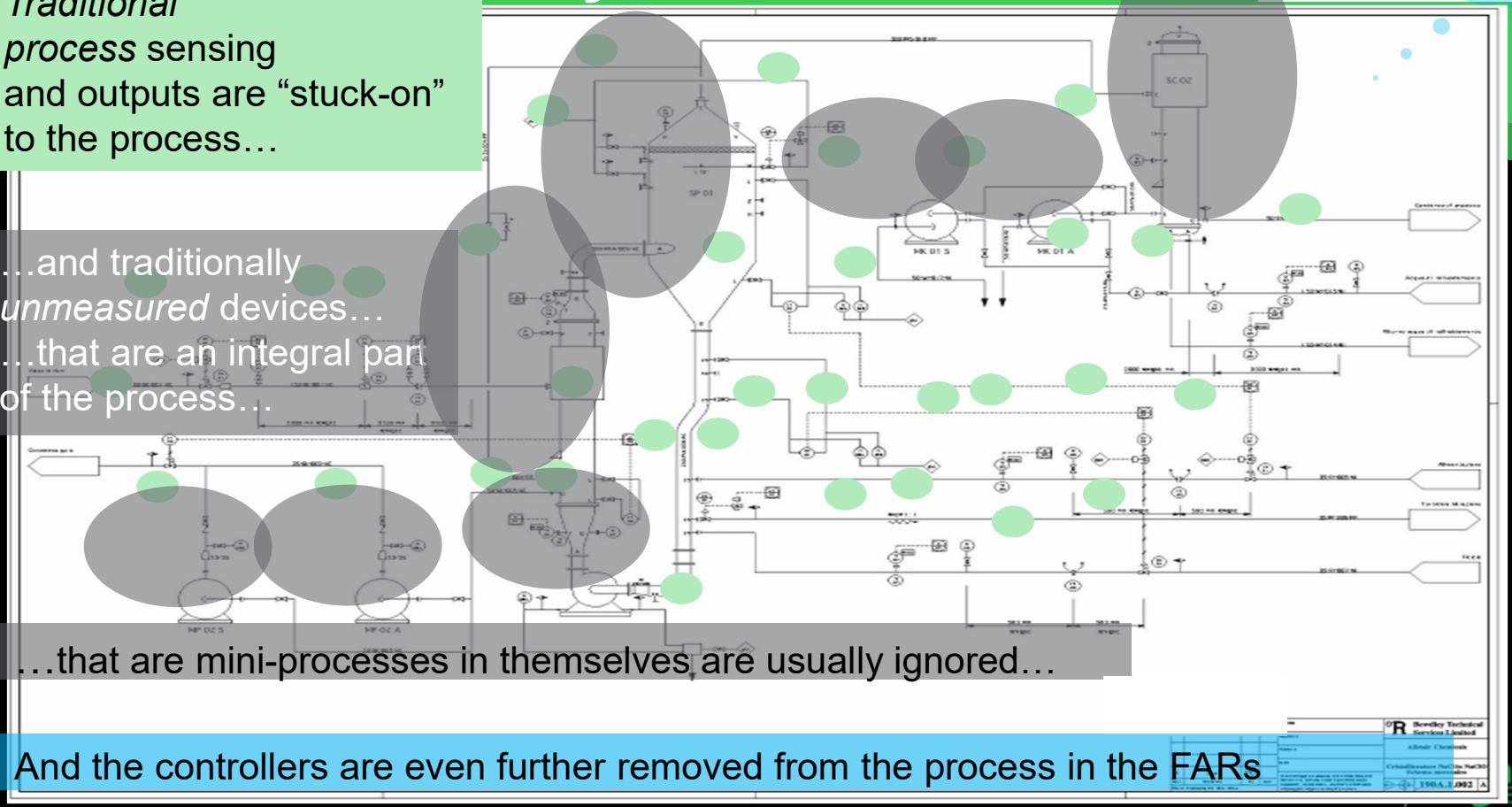
Now in a Plant Today…

= traditional process sensors & outputs/valves

= process equipment: e.g. pumps, reactors, etc.

Traditional *process* sensing and outputs are “stuck-on” to the process…

…and traditionally *unmeasured* devices… …that are an integral part of the process…



…that are mini-processes in themselves are usually ignored…

And the controllers are even further removed from the process in the FARs

How Asset Centric Control Will Change This…

For Traditional Process Sensing and Outputs…

Put measurement/control/comms CCF/CPS *inside* conventional sensors & valves…

…communicating via the secure *highly localized* communications fog

Charte[illegible]d to:

Autonomous

…andling routine process control – most usually with *nearest neighbors*

…as well as asset performance management - *avatars*

…aware of environment – self configuring (ie modeling). No need to keep models

As defined by the device vendor

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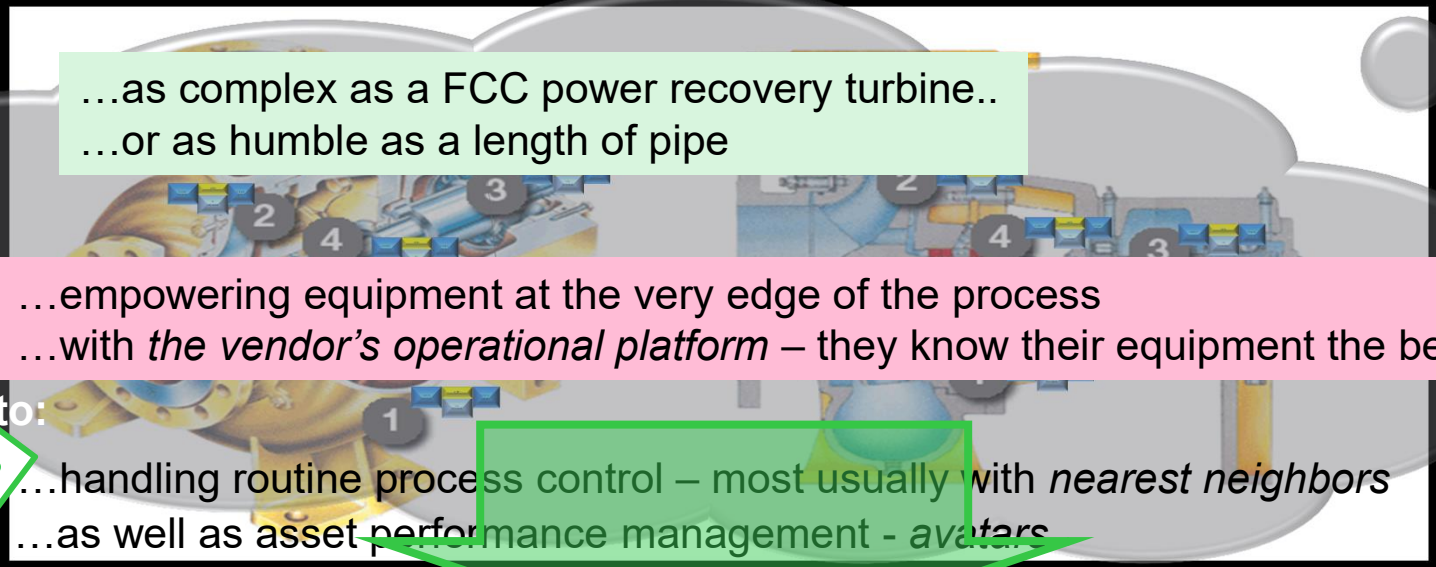
The Same Can Be Done For Traditionally Unmeasured Devices…and Equipment

Put measurement/control/comms CCF/CPS *inside* the asset…

… communicating via the secure *highly localized fog of* communications



…as complex as a FCC power recovery turbine..
…or as humble as a length of pipe

…empowering equipment at the very edge of the process
…with *the vendor's operational platform* – they know their equipment the best

Chartered to:

…handling routine process control – most usually with *nearest neighbors*
…as well as asset performance management - *avatars*

Autonomous

aware of environment – self configuring (ie modeling). No need to keep models

As defined by the <u>equipment</u> vendor

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So Now Our Plant Looks Like

- Totally and truly “distributed control”
- Self identifying, self configurable and autonomous
- Built-in security
- “Control” is sold with the equipment itself, not “stuck-on”
- Provides inherent asset performance intelligence

The “Internet of Things” as it applies to automation

Summary

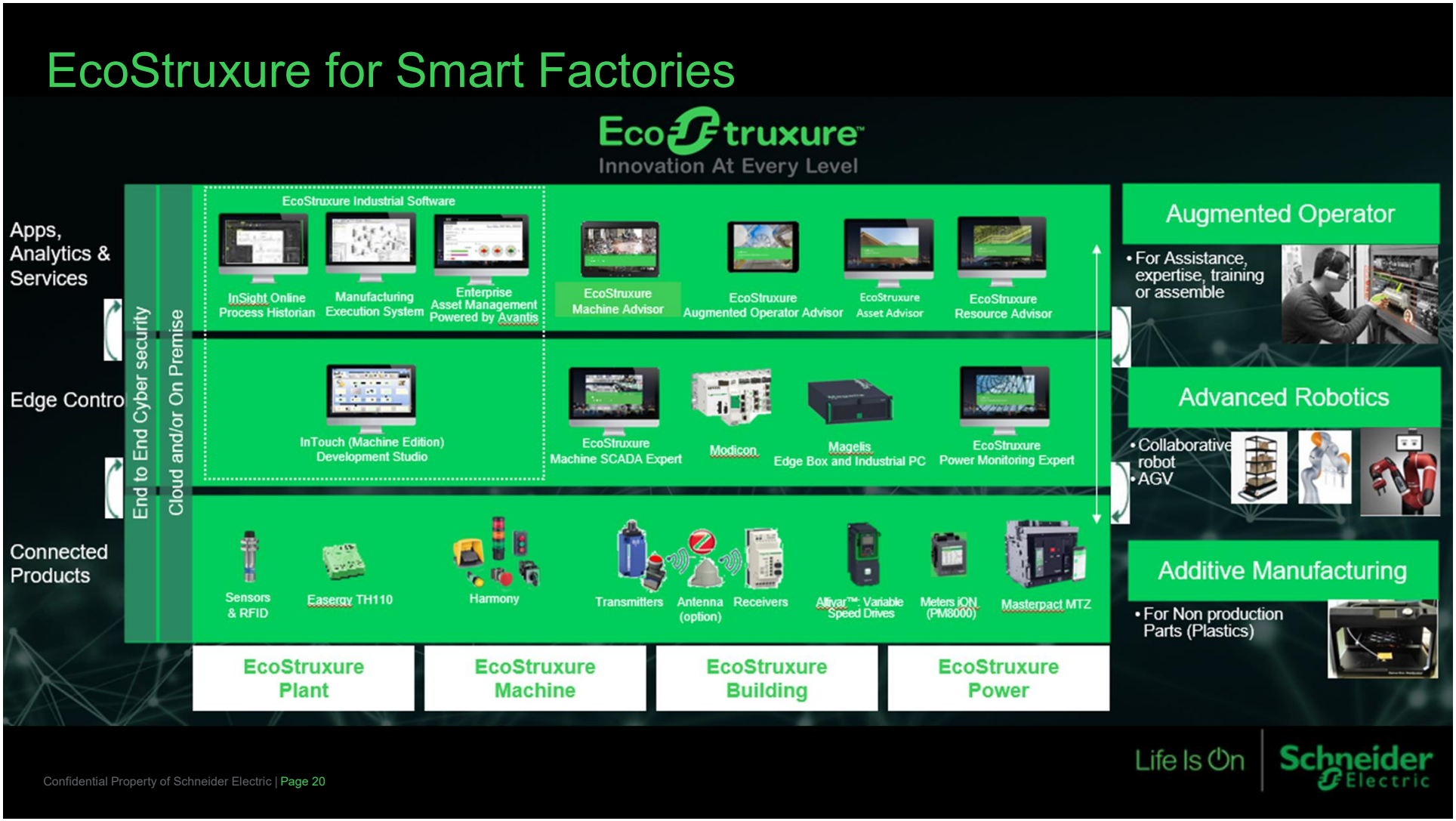
- Sensing needs will grow faster than output needs. Will occur at the extremities of the process: at the edge many a times bypassing the controller
- Sensing and Control is no longer “stuck on” – it is *in situ – embedded on the device/ equipment itself*, autonomous
- Emphasis will shift towards measurement and control of business variables rather than process or state variables
- Maximum security, reliability and resiliency at lowest possible cost
- Asset centric control systems will help “close the business control loop” in real time
- Everyone understands how their actions impact business profitability

This is Digital Transformation as applied to industrial process control

Smart Factory in our supply chain

An example of Digital Transformation in action

EcoStruxure for Smart Factories



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Performance & Operations Management

Wonderware MES

Efficiency Equipment Advisor

Augmented Operator

Predictive Maintenance

Vibration

Temperature

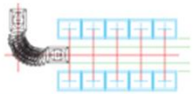
Acoustique

Le Vaudreuil

Automatic product assembly

Smart Factory initiative

Automatic Guided Vehicle



Energy Management

3D printing

Collaboration is key for Digital Transformation

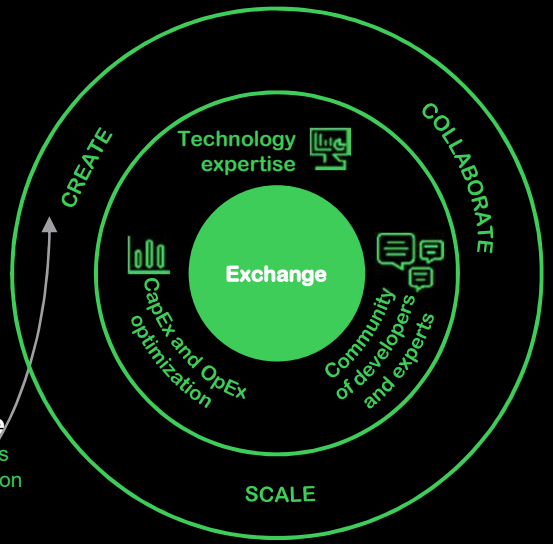
Use Case – Collaboratively solving a business challenge

Stephane Muethon - Maintenance manager @ Schneider Electric
Le Vaudreuil Plant
France
« How do I minimize unplanned downtime of my machines ? »

#1 Post Challenge & Discover
- Structured problem statements
- Verified providers & solutions
- AI powered communities

#2 Test & Select
- Setup private space with candidate
- Access and expose datasets
- Proof of value trials and demos
- Benchmarking tools and assistance

Outcome
Proof of Concept decided with
AI startup Senseye on data from one machine
Scalable Predictive Maintenance



#3 Solve Problem
- Workspace and SDK
- APIs, Analytics, Data Sets
- Advanced IIoT Program

Outcome
Solution by combining
- Senseye techno
- Schneider IIoT box
- AVEVA cloud SW

#4 Transact & Build
- Private and secured workspace
- On line payment tools
- No / Low code application design

Outcome
Application deployed
ROI < 3 months

#5 Operate & Scale
- Live data hosting / access
- Analytics / User Application
- Scalable business model

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