Machinery Information

How machines will be represented in the Internet-of-Things

Marketing Track

www.odva.org

Introduction

Exercise I:

- Everyone in row 1,3,5,7 …
  Try to exchange your business informationwith the person behind you in a electronic way!

Introduction

Analysis:

- From what APP did you take the info?
- What communication means (BT, WiFi)?
- What data format (VCF / Picture / QR)?

- To succeed, ALL factors must match

Introduction

Exercise II:

- Now try to share with everyone in the room!

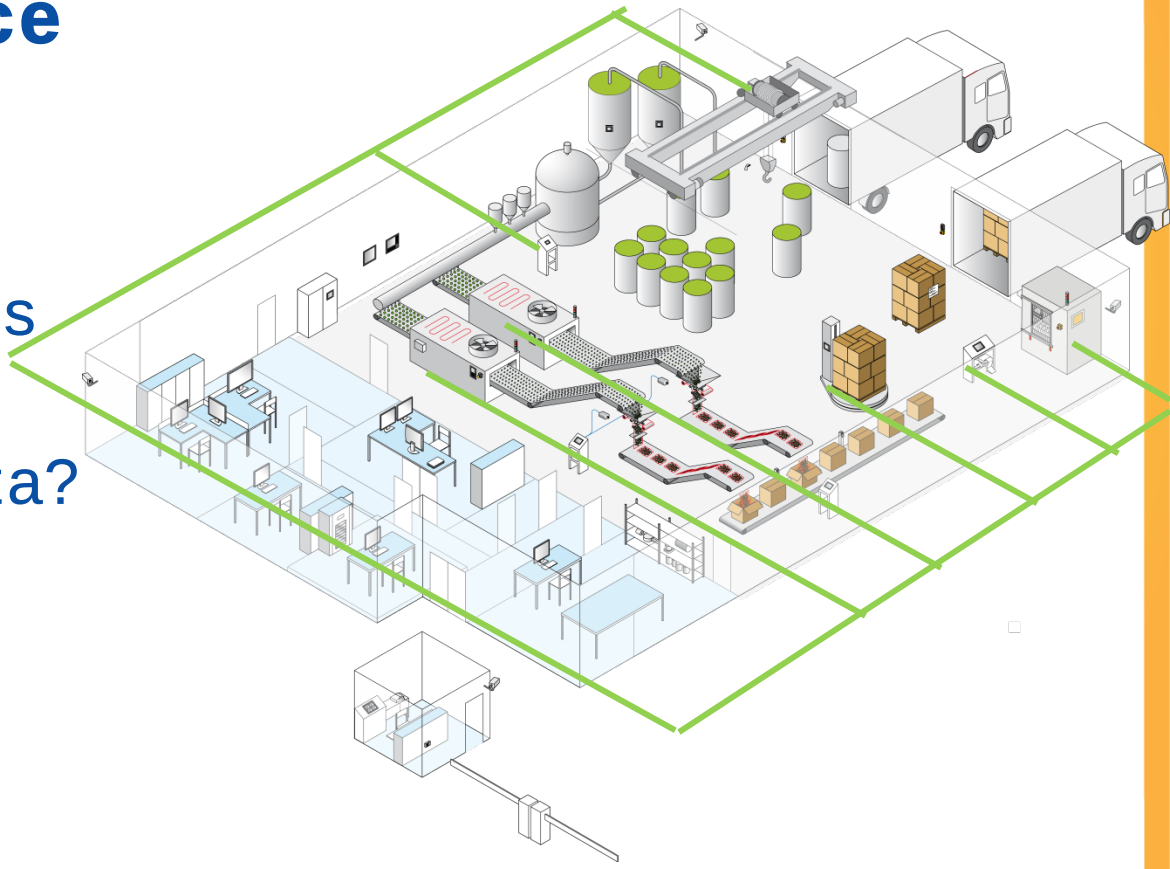
- Make a new database
- Standardize data
- ...
- Make it an APP
- ... make it common sense

facebook

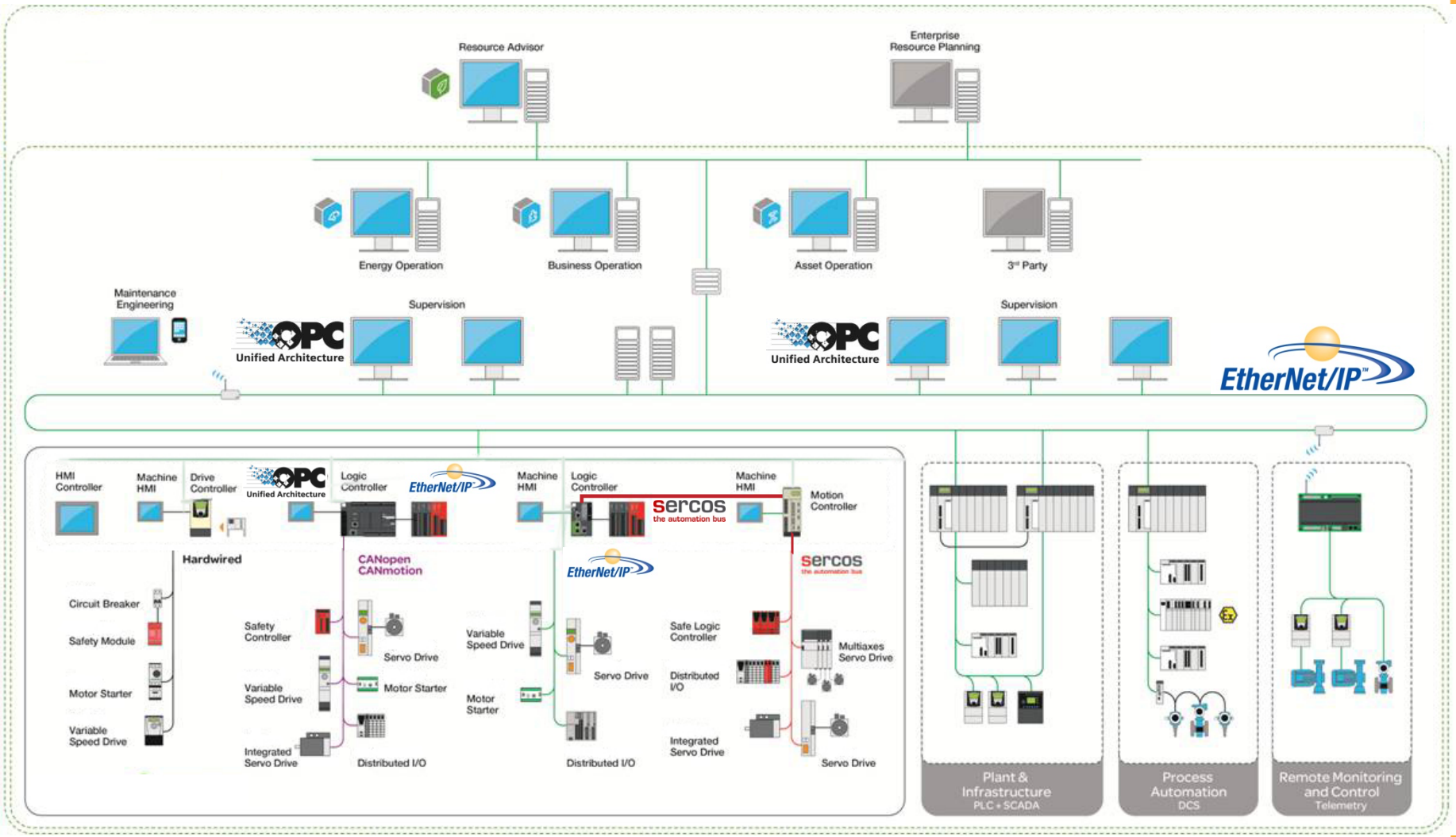
Challenges in our industry

Let‘s try to map this experience to machines

- How do machines communicate?
- What kind of data?
- Which format?

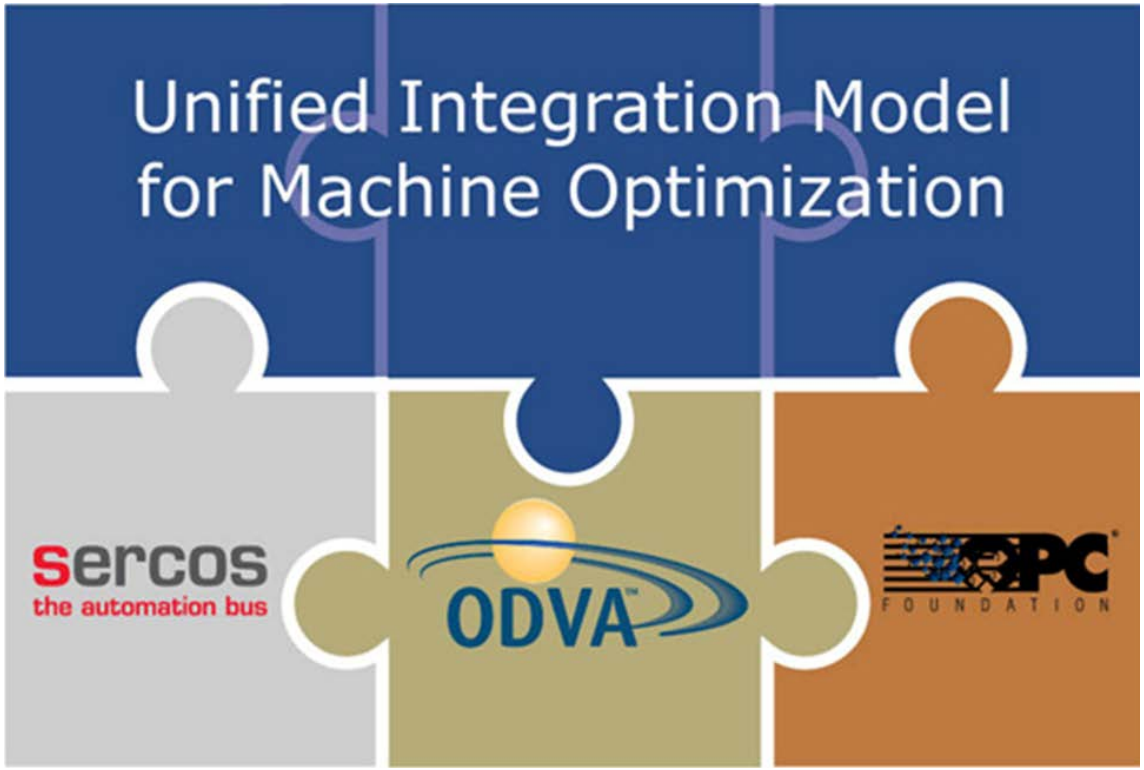


Definition of Architectural Scenarios



What has been done so far

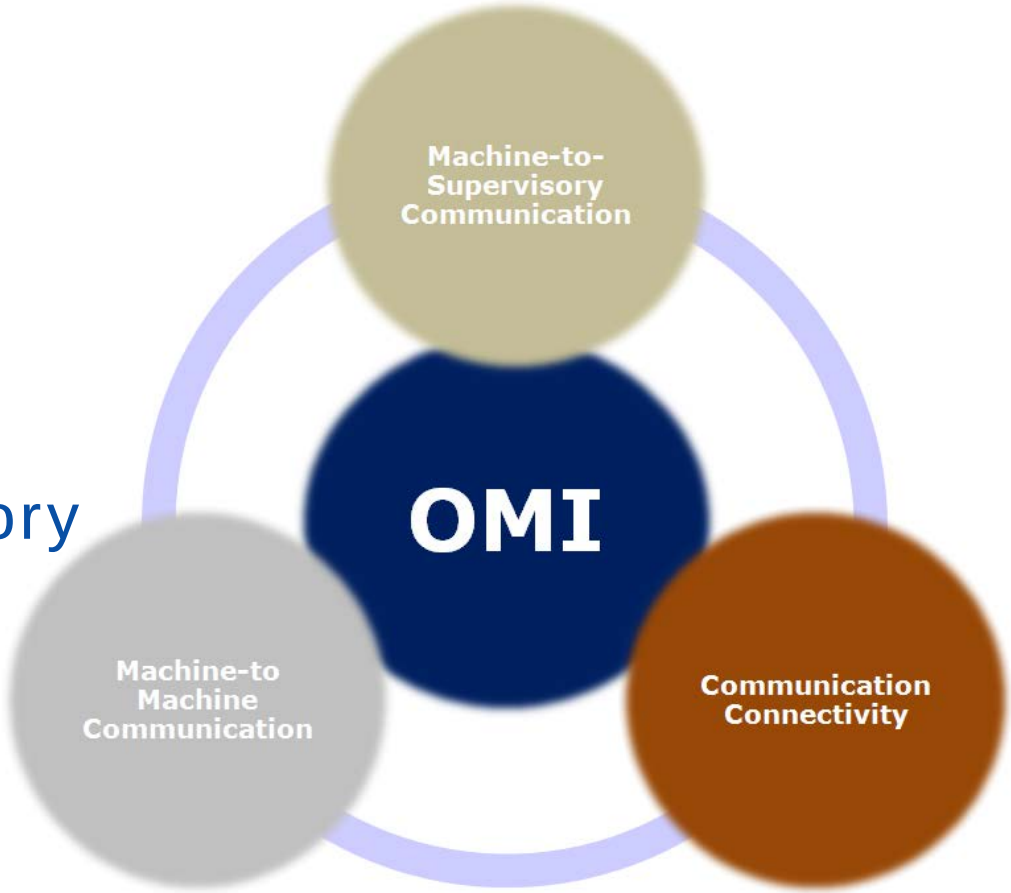
Multi-Organization Partnership established



What has been done so far

Typical Use Cases defined

- UC1:
  Machine-to-Machine Communication
- UC2:
  Machine-to-Supervisory Communication
- UC3:
  Communication Connectivity



What has been done so far

Special Interest Group formed in 2013

- Mission
  - The Special Interest Group for Machinery Information ("SIG") seeks to optimize the integration of manufacturing machines with the industrial ecosystem. To this end, the SIG seeks to develop standards for exchange of information between machines, and between machines and supervisory systems

- Main Players
  - Rockwell Automation
  - Bosch Rexroth
  - Cisco

(18 members)

- Omron
- Schneider Electric
- Sercos International
- OPC Foundation

What has been done so far

Foundation of the Machinery SIG

- Work plan is created
- Technical work is started
- Related machine types are defined
- Work started on focused data groups
  - Base machine states
  - Energy
  - Condition Monitoring

Food Product Machinery Manufacturing

Packaging Machinery Manufacturing

Plastics and Rubber Industry Machinery Manufacturing

Machine Tool (Metal Cutting Types) Manufacturing

Oil and Gas Field Machinery and Equipment Manufacturing

Engine, Turbine, and Power Transmission Equipment Manufacturing

Conveyor and Conveying Equipment Manufacturing

Paper Industry Machinery Manufacturing

Semiconductor Machinery Manufacturing

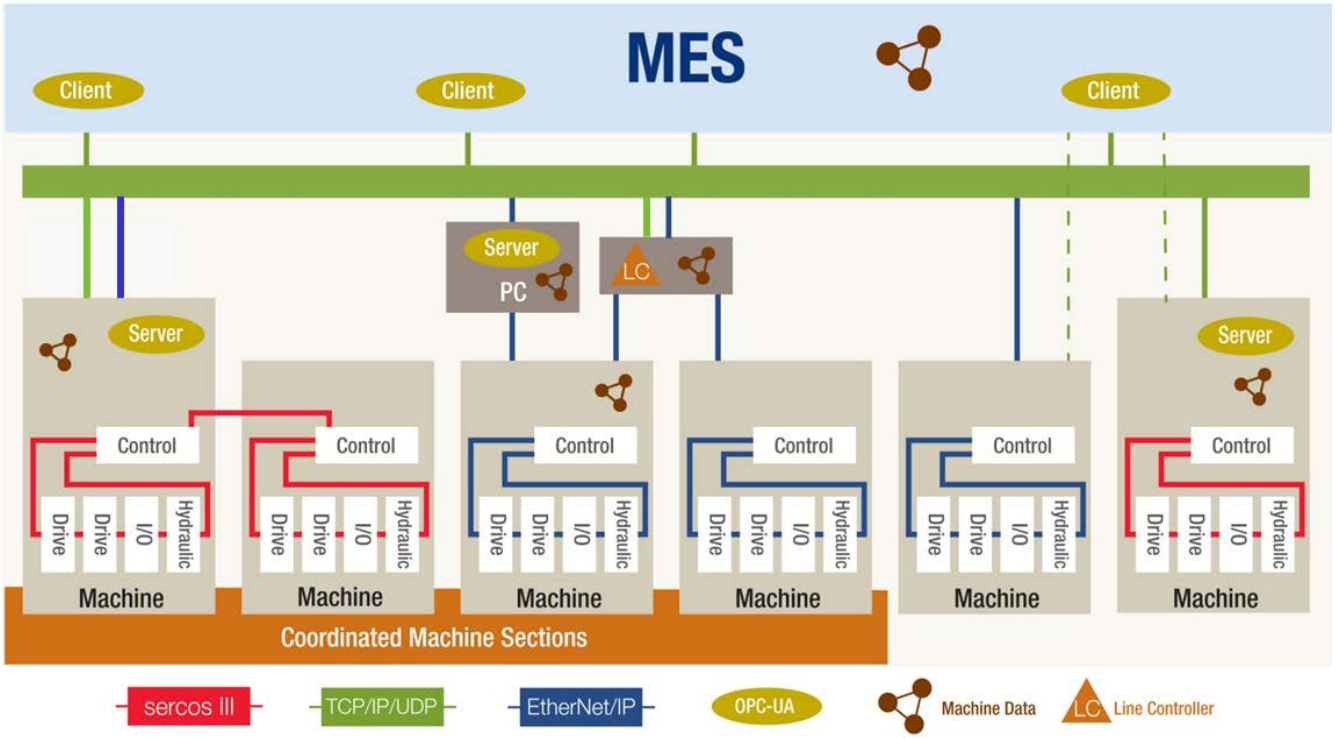
Mining Machinery and Equipment Manufacturing

Printing Machinery and Equipment Manufacturing

Materials handling equipment installation

What has been done so far

UC2: Definition of Architectural Scenarios

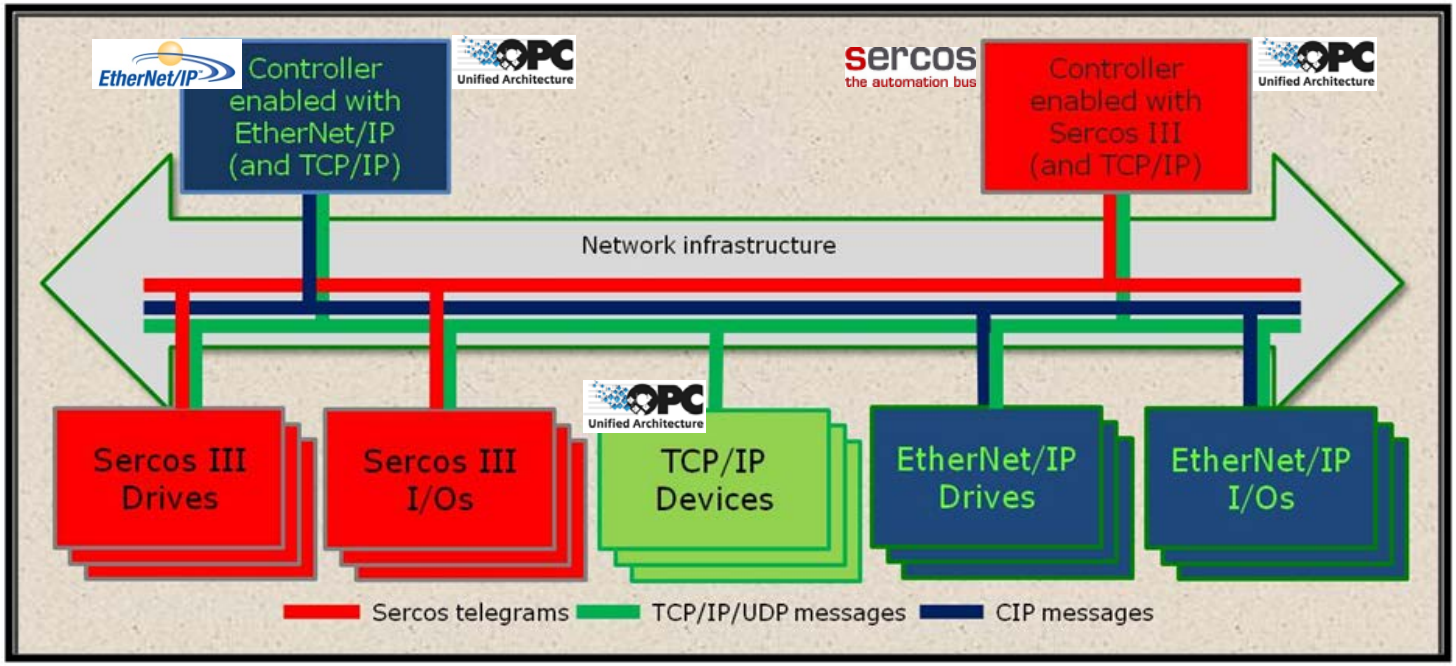


What has been done so far

UC3: Communication Connectivity

Definition of optional blended infrastructure for systems using EtherNet/IP and Sercos III

- Same cable
- Common profiles
- Different performance



What the SIG is working on now

Reviewing existing standards

- ISA S95 / S88
- IEC TR 62794
- OMAC / PackML
- MT Connect
- Others

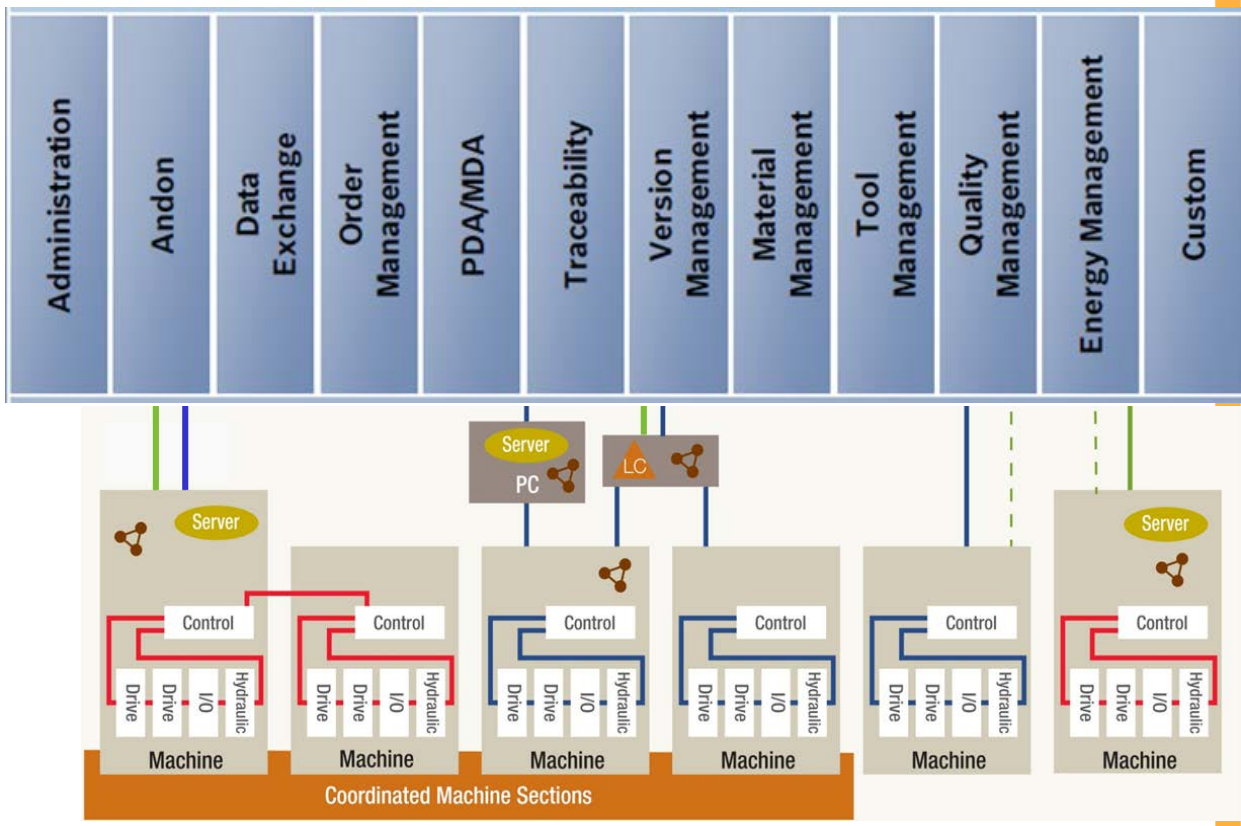
Looking for similarities

Building a flexible, expandable approach

What the SIG is working on now

Typical consumers of data

- SCADA
- LIMS
- Scheduler
- Energy Mgt.
- Asset Mgt.
- Line Control
- Condition Monitoring
- Recipe Mgt.
- Audit trail
- Alarming
- …



What the SIG is working on now

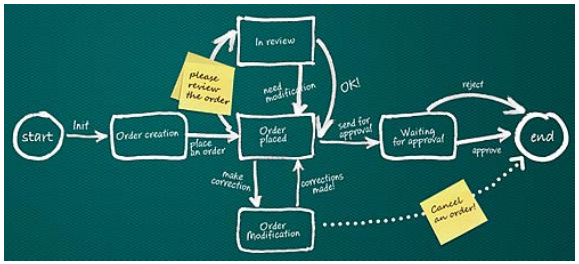
Types of information

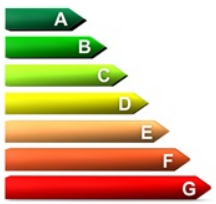
Machine related

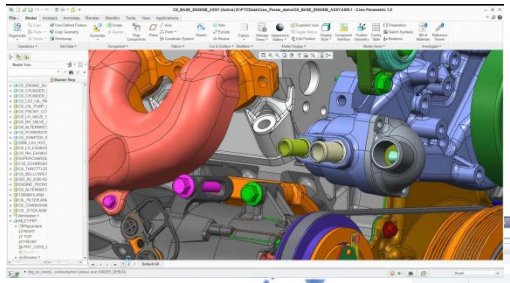
- Base machine states
- Energy
- Condition monitoring

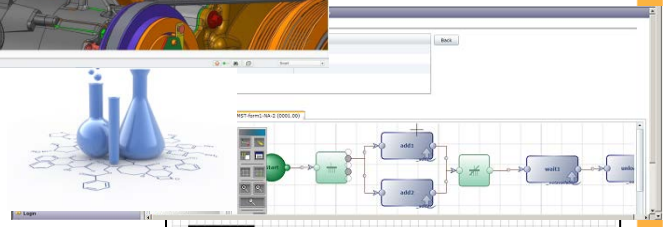
Process related

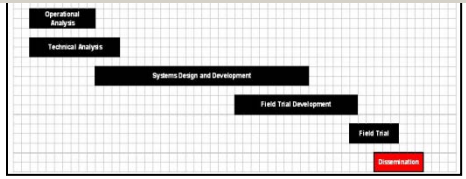
- Build profiles
- Recipes
- Schedules











“A day in the life of machinery data”

Jeff Smith

American Axle Manufacturing

ENTERPRISE LAYER

- Quality Information System
- Factory Information System (FIS)
- Provide Assembly Status to Packout & Shipping
- Reporting

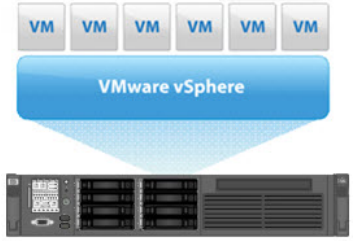
PLANT FLOOR – AGGREGATE LAYER

- Deliver Build Direction to Stations
- Store Build Results to Quality Systems
- Real-time Process Validation
- Identify Assemblies in station
- Provide FIS Data (OEE, Blocked, Starved, etc.)

PLANT FLOOR – STATION LAYER

- Build the Assembly
- Provide Build Results for devices not capable of Listen Only Connections (from Aggregate layer)

ENTERPRISE LAYER



TCP / IP

PLANT FLOOR – AGGREGATE LAYER

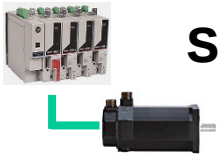
Supervisory
Line PLC

EtherNet / IP & OPC

Primary & Secondary
Database Servers

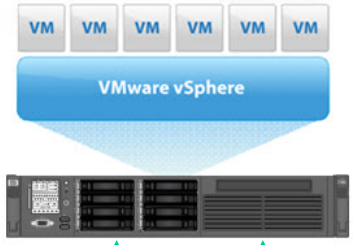
PLANT FLOOR – STATION LAYER

EtherNet / IP



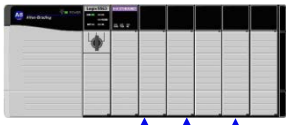
Sercos

ENTERPRISE LAYER



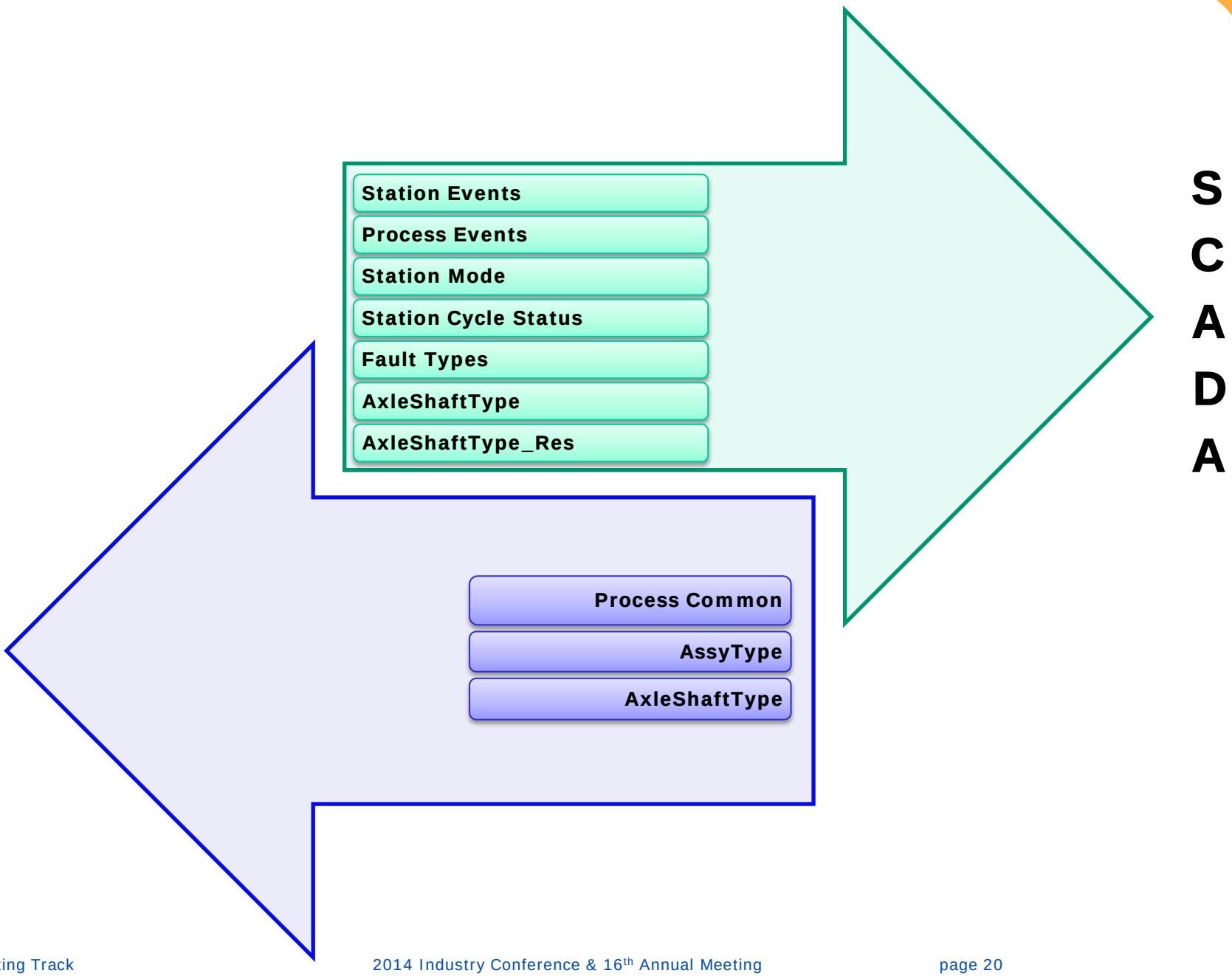
PLANT FLOOR – AGGREGATE LAYER

Supervisory
Line PLC

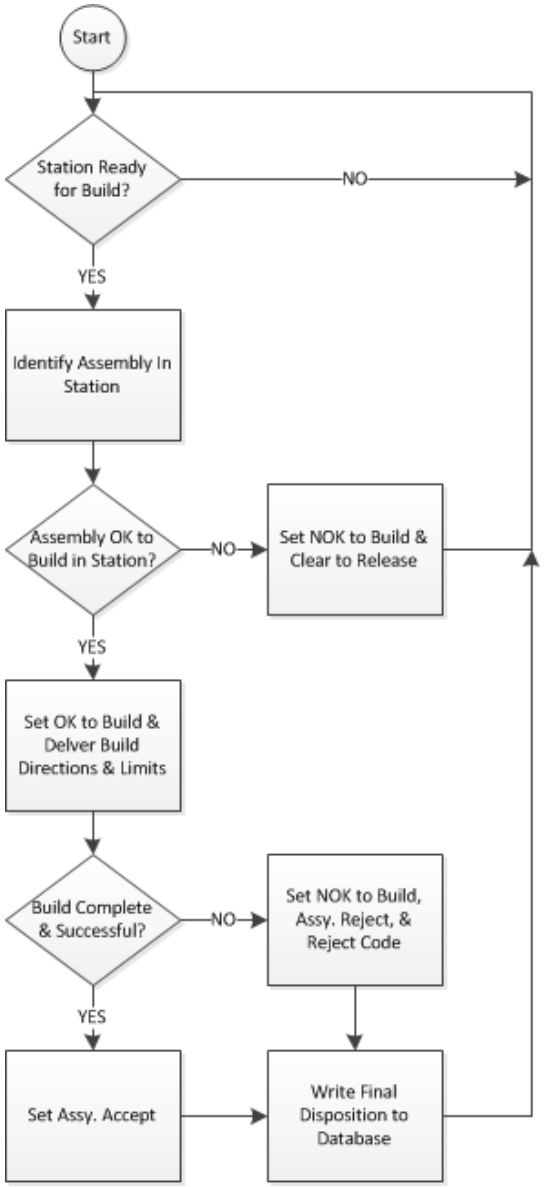


Primary & Secondary
Database Servers

PLANT FLOOR – STATION LAYER



A 30,000 foot view of the world from the Aggregate Layer (SCADA)



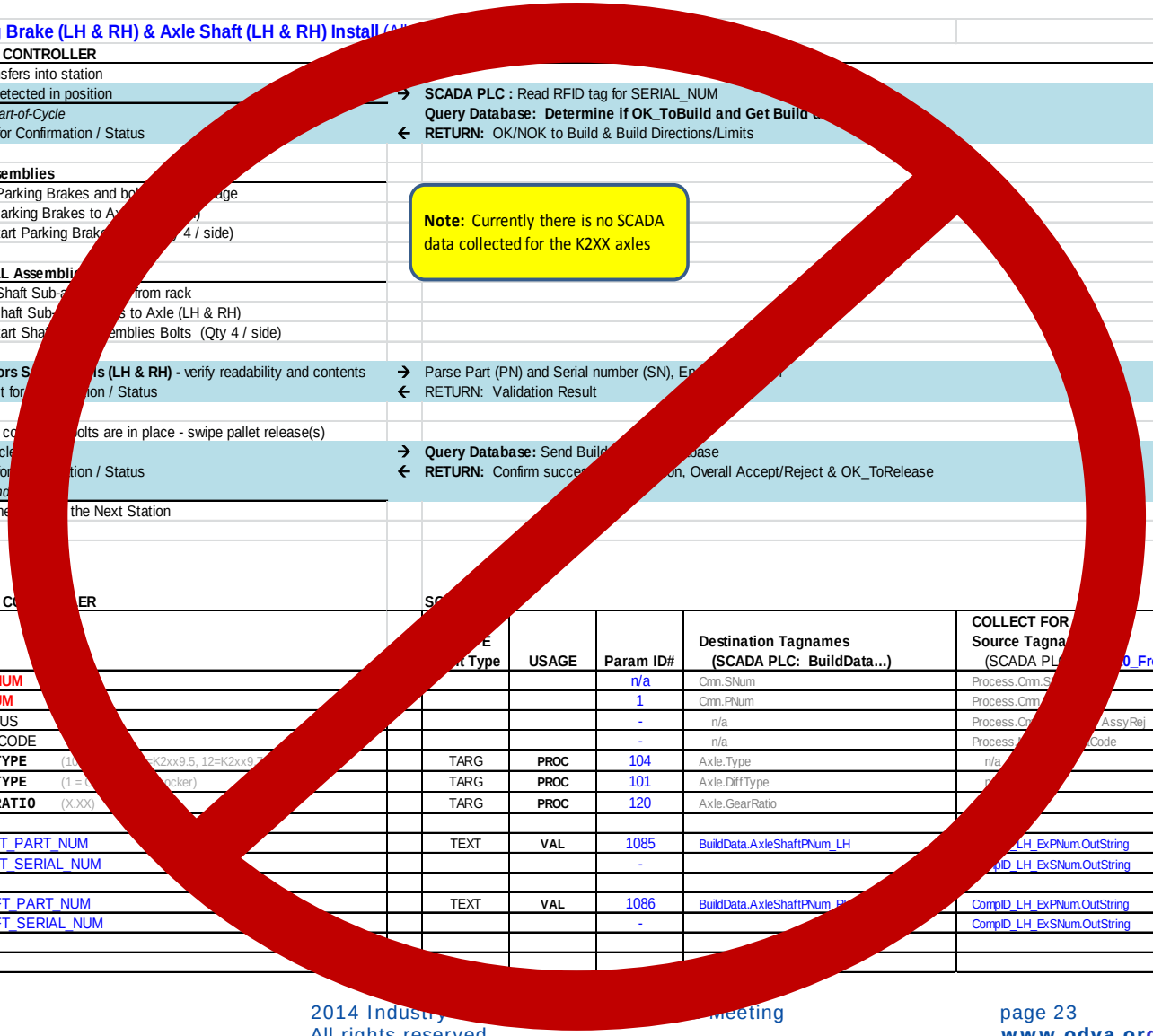
TYPE “C” MACHINE – Defined Process

OP20	**Parking Brake (LH & RH) & Axle Shaft (LH & RH) Install** (All Part Types)			*Zone #1*	
	STATION CONTROLLER		**SCADA**		
1	Pallet transfers into station				
2	Pallet is detected in position	→	**SCADA PLC :** Read RFID tag for SERIAL_NUM		AB RIFD
3	*FIS Start-of-Cycle*		**Query Database: Determine if OK_ToBuild and Get Build directions/limits**		(56RF-IPD22)
4	Wait for Confirmation / Status	←	**RETURN:** OK/NOK to Build & Build Directions/Limits		
5					
6	**K2XX Assemblies**				
7	Obtain Parking Brakes and bolts from dunnage				
8	Install Parking Brakes to Axle (LH & RH)				
9	Hand Start Parking Brake Bolts (Qty 4 / side)				
10					
11	**Nissan 61L Assemblies**				
12	Obtain Shaft Sub-assemblies from rack				
13	Install Shaft Sub-assemblies to Axle (LH & RH)				
14	Hand Start Shaft Sub-assemblies Bolts (Qty 4 / side)				
15					
16	**Operators Scan Labels (LH & RH) -** verify readability and contents	→	Parse Part (PN) and Serial number (SN), Enable validation		Cognex
17	Wait for Confirmation / Status	←	RETURN: Validation Result		(8100 HH)
18					
19	Operators confirm all bolts are in place - swipe pallet release(s)				
20	End of Cycle	→	**Query Database:** Send Build Data to Database		
21	Wait for Confirmation / Status	←	**RETURN:** Confirm successful transaction, Overall Accept/Reject & OK_ToRelease		
22	*FIS End-of-cycle*				
23	Release the Pallet to the Next Station				

Note: Currently there is no SCADA data collected for the K2XX axles

	STATION CONTROLLER		**SCADA**					
			RECIPE Limit Type	**USAGE**	**Param ID#**	**Destination Tagnames (SCADA PLC: BuildData...)**	**COLLECT FOR QIS Source Tagnames (SCADA PLC: cOP020_FromSta...)**	**Char ID#**
1	SERIAL NUM				n/a	Cmn.SNum	Process.Cmn.SNum	2
2	PART_NUM				1	Cmn.PNum	Process.Cmn.PNum	1
3	OP_STATUS				-	n/a	Process.Cmn.AssyAcc / AssyRej	n/a
4	REJECT_CODE				-	n/a	Process.Monitor.RejectCode	54
5	**AXLE_TYPE** (10=K2xx8.6, 11=K2xx9.5, 12=K2xx9.76, 100=Nissan)		TARG	**PROC**	104	Axle.Type	n/a	-
6	**DIFF_TYPE** (1 = Open/Std, 2 = Locker)		TARG	**PROC**	101	Axle.DiffType	n/a	-
7	**GEAR_RATIO** (X.XX)		TARG	**PROC**	120	Axle.GearRatio	n/a	-
8								
9	LH_SHAFT_PART_NUM		TEXT	**VAL**	1085	BuildData.AxleShaftPNum_LH	ComplD_LH_ExPNum.OutString	1085
10	LH_SHAFT_SERIAL_NUM				-		ComplD_LH_ExSNum.OutString	1083
11								
12	RH_SHAFT_PART_NUM		TEXT	**VAL**	1086	BuildData.AxleShaftPNum_RH	ComplD_LH_ExPNum.OutString	1086
13	RH_SHAFT_SERIAL_NUM				-		ComplD_LH_ExSNum.OutString	1084
14								
15								

TYPES “A” OR “B” MACHINE “OFF THE SHELF”



	OP20	**Parking Brake (LH & RH) & Axle Shaft (LH & RH) Install (A**		*Zone #1*	
		STATION CONTROLLER			
1		Pallet transfers into station			
2		Pallet is detected in position	→	**SCADA PLC :** Read RFID tag for SERIAL_NUM	AB RIFD
3		*FIS Start-of-Cycle*		**Query Database: Determine if OK_ToBuild and Get Build**	(56RF-IPD22)
4		Wait for Confirmation / Status	←	**RETURN:** OK/NOK to Build & Build Directions/Limits	
5					
6		**K2XX Assemblies**			
7		Obtain Parking Brakes and bo… …age			
8		Install Parking Brakes to A… …)			
9		Hand Start Parking Brak… …4 / side)			
10					
11		**Nissan 61L Assembli**			
12		Obtain Shaft Sub-… …from rack			
13		Install Shaft Sub… …s to Axle (LH & RH)			
14		Hand Start Sha… …emblies Bolts (Qty 4 / side)			
15					
16		**Operators S… …s (LH & RH) -** verify readability and contents	→	Parse Part (PN) and Serial number (SN), En…	Cognex
17		Wait for… …ion / Status	←	RETURN: Validation Result	(8100 HH)
18					
19		Operators co… …olts are in place - swipe pallet release(s)			
20		End of Cycle…	→	**Query Database:** Send Build… …base	
21		Wait for… …tion / Status	←	**RETURN:** Confirm succes… …on, Overall Accept/Reject & OK_ToRelease	
22		*FIS End…*			
23		Release the… …the Next Station			

Note: Currently there is no SCADA data collected for the K2XX axles

STATION C… …ER **SC…**

				…E …t Type	**USAGE**	**Param ID#**	**Destination Tagnames (SCADA PLC: BuildData…)**	**COLLECT FOR Source Tagna… (SCADA PL… …0_FromSta…)**	**Char ID#**
1	SERIAL NUM					n/a	Cmn.SNum	Process.Cmn.S…	2
2	PART_NUM					1	Cmn.PNum	Process.Cmn…	1
3	OP_STATUS					-	n/a	Process.Cr… …AssyRej	n/a
4	REJECT_CODE					-	n/a	Process… …Code	54
5	**AXLE_TYPE**	(10… …=K2xx9.5, 12=K2xx9…		TARG	**PROC**	104	Axle.Type	n/a	-
6	**DIFF_TYPE**	(1 = C… …ocker)		TARG	**PROC**	101	Axle.DiffType	…	-
7	**GEAR_RATIO**	(X.XX)		TARG	**PROC**	120	Axle.GearRatio		-
8									
9	LH_SHAFT_PART_NUM			TEXT	**VAL**	1085	BuildData.AxleShaftPNum_LH	…_LH_ExPNum.OutString	1085
10	LH_SHAFT_SERIAL_NUM					-		…D_LH_ExSNum.OutString	1083
11									
12	RH_SHAFT_PART_NUM			TEXT	**VAL**	1086	BuildData.AxleShaftPNum_R…	ComplD_LH_ExPNum.OutString	1086
13	RH_SHAFT_SERIAL_NUM					-		ComplD_LH_ExSNum.OutString	1084
14									
15									

$1,000,000 Question

OPC Foundation: Tom Burke

OPC Foundation: Who We Are

Community:

- The OPC Foundation is the world's leading community for interoperability solutions based on OPC specifications that deliver universal connectivity.

Collaboration:

- The mission of this community is to advance the development, adoption and certification of OPC based products through global collaborations.

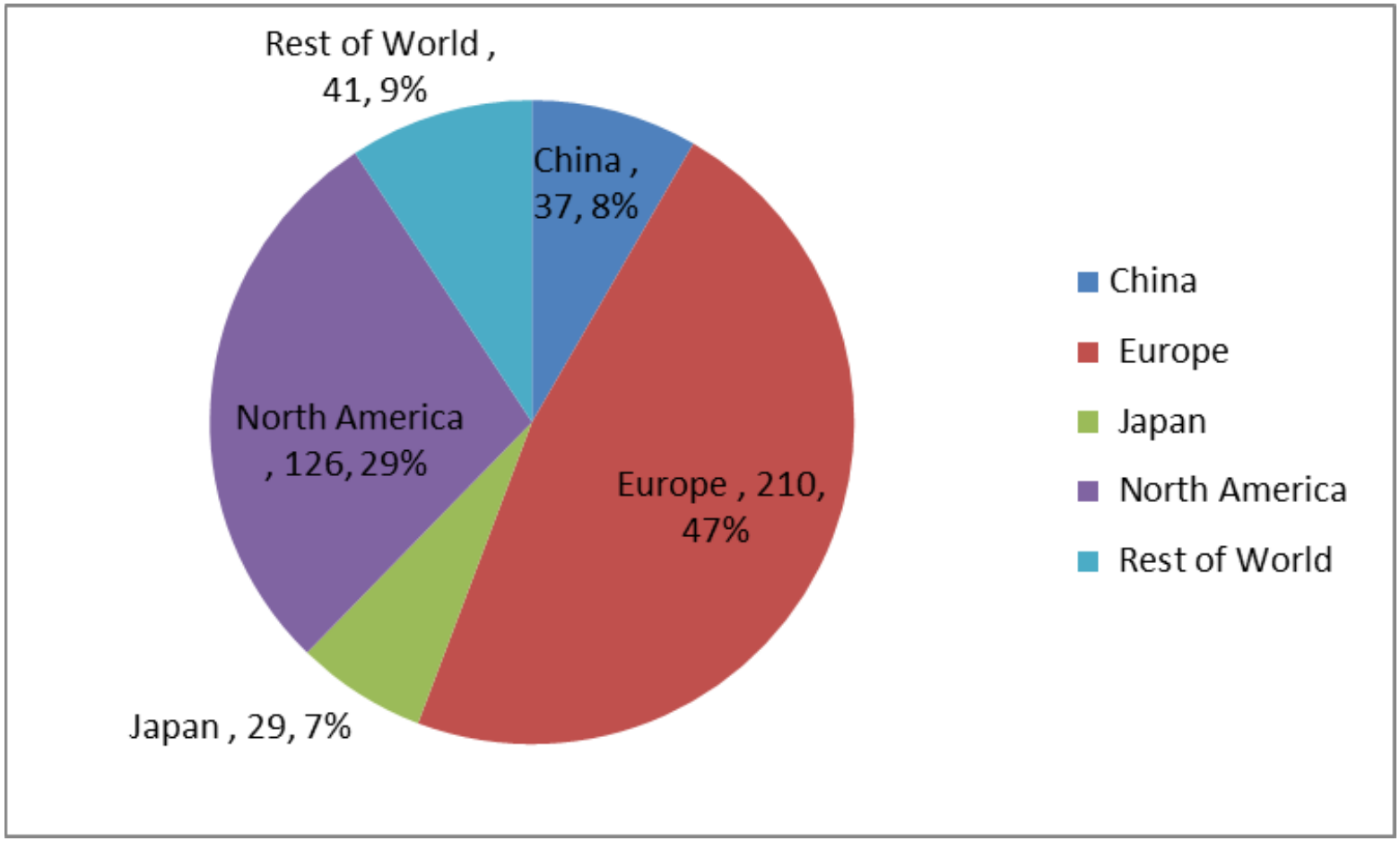
Compliance:

- The OPC Foundation is the official source for the OPC Certification Program, ensuring that OPC products plug-and-play in real-world application.

Board of Directors

Dr. Grant Wilson (Chairman)	• Emerson
Dave Eisner	• Honeywell
Russ Agrusa	• ICONICS
Thomas Burke	• OPC Foundation
Juergen Weinhofer	• Rockwell
Thomas Hahn	• Siemens
Nobuaki Konishi	• Yokogawa

2013 Membership by Region



President Summary

OPC Technology Adoption is Accelerating

Centralized Global Marketing

OPC Certification Program Recognition

IEC Standardization

New Market Opportunities

Collaboration & Partnerships

Continuous Improvement Process

Sercos International: Peter Lutz

sercos
the automation bus

Sercos: working together for open systems

ODVA (since Nov. 2006)

Adoption of CIP Safety as the safety protocol for Sercos

CIP Safety on Sercos Specification

FDT (since Nov. 2008)

Standardize the interface between field devices and engineering tools

Sercos Annex to the FDT specification

OSADL (since April 2009)

Cooperation in the field of Open Source Software

Integration of Sercos driver in mainline Linux

Machinery Initiative (since April 2011)

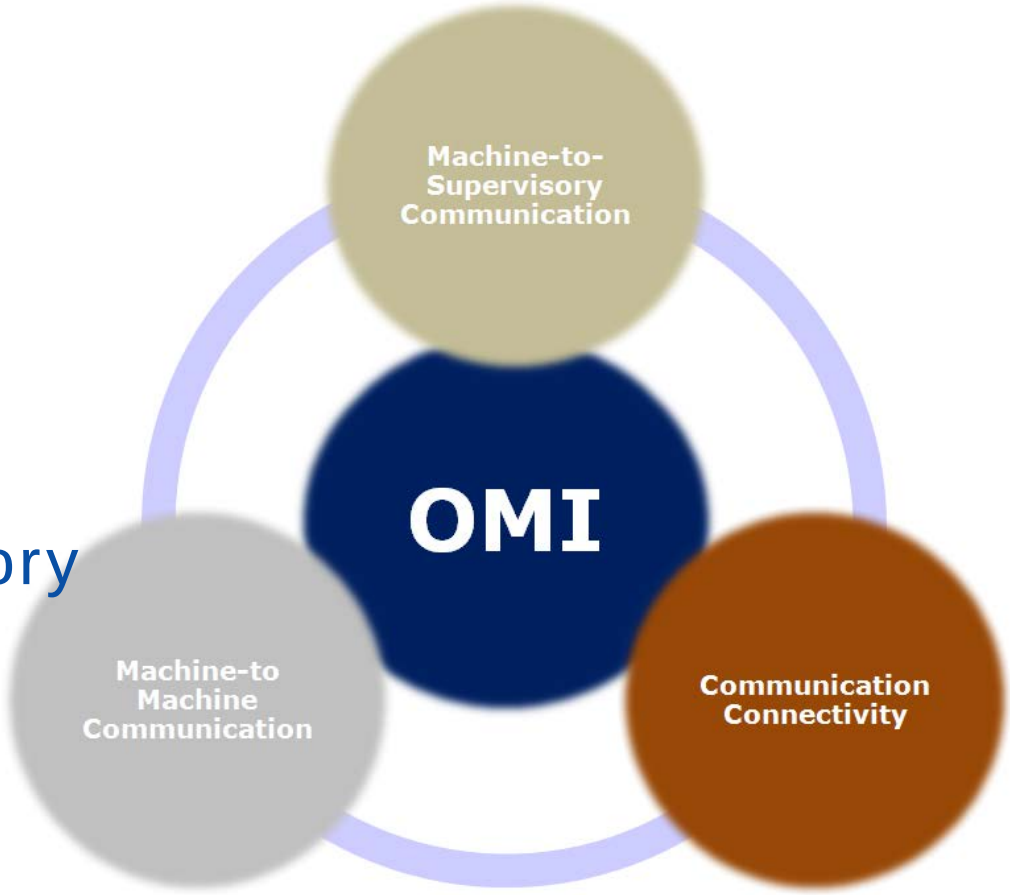
Optimization of Machine Integration **(OMI)**

Improve the machine integration

Machinery Initiative: Use Cases

Typical Use Cases defined

- UC1: Machine-to-Machine Communication
- UC2: Machine-to-Supervisory Communication
- UC3: Communication Connectivity



SIG priorities and next steps

- Define a clear and pragmatic description of different aspects of common machine information.
- Provide coherent syntax and semantics for a flexible, modular and expandable model that allows easy implementation on new and existing machines to simplify and standardize the access of machine information.

- Create common objects with data structure
- Map them to CIP and OPC UA
- Maintain the cooperation with Sercos International