

Setting the Standard for Automation™

ISA-95 for MES More then an interface standard

Standards Certification Education & Training Publishing Conferences & Exhibits

March 27, 2014 Marc Blekkink



ISA-Belgium Section

- Part of EMEA organization ISA (known as District 12)
- www.isa-belgium.org
- Adress:
 - Kasteelhoekstraat 1 1820 Perk 02-254 02 59
- Board:

Kris Adriaenssens Wim Tindemans Marc Blekkink kris.adriaenssens@isa-belgium.org wim.tindemans@isa-belgium.org marc.blekkink@isa-belgium.org





Enterprise-Control System Integration



What is ISA-95?

- International standard (ANSI. IEC)
- Structuring activities at production management level
- Structuring information flow between production
 management and other systems
- Universal language



Structuring Activities



Object Definitions



ISA

Manufacturing 2.0





"The use of one common ISA 95 based ODS ensures the integration of the MOM activities"



Design of a Lean Manufacturing Execution Framework

University Gent

Dr. Johannes Cottyn

June 2012

Normalized Systems

n and engineer information

Normalized Systems is a theory to design and engineer information systems exhibiting proven evolvability.

Originally established at the University of Antwerp, at the department Management Information Systems of the faculty Applied Economics.

It aims at re-creating information technology based on laws for software evolvability.





The Business Challenge

• The Agile Organization

- Continually scans its ecosystem
- Reacts quickly to opportunities and is innovative
- Has 2 Characteristics
 - Complexity
 - Multi-channel vs. single channel
 - Diversify offerings/Additional services
 - Change/Evolvability/Flexibility
 - "These things are changing so fast it's invention in the hands of the owner." (Hansen et al., 2007)



The Law of Increasing Complexity Manny Lehman

"As an evolving program is continually changed, its complexity, reflecting deteriorating structure, increases unless work is done to maintain or reduce it."

Proceedings of the IEEE, vol. 68, nr. 9, september 1980, pp. 1068.



Reference Frame

- Common ground between enterprises and IT is the structure or modularity
- Combination of modularity and change means
 → EVOLVABLE MODULARITY
- Enterprises need to be architected, engineered, and designed
- Combination of design and change means
 → DESIGN FOR CHANGE

The Theories – part 1



Stability in System Dynamics:

- In systems theory, the dynamic evolution of a system is studied based on a differential or difference equation
- A system is stable if and only if:
 - a bounded input results in a bounded output
 - it has poles in the left plane or inside the unit circle:
- For a first order model, stability $\leftarrow \rightarrow a < 0$:
 - $dy(t)/dt = x(t) + ay(t) \leftrightarrow Y(s)/X(s) = 1/(s-a)$
 - $y[k+1]-y[k] = x[k] + ay[k] \leftrightarrow Y(z)/X(z) = 1/(z-(1+a))$
- This means that the increase cannot have a positive contribution from the size of the system



• The effort to include an additional component may or may not vary with the system size



Source: http://nl.wikipedia.org/wiki/Enterprise_Service_Bus

The Theories – part 2

ISA

Entropy in Thermodynamics:

- The dynamic evolution of a system is represented by its entropy, a *measure for how (dis)organized a system is*
- An isolated system will always increase its entropy, which basically represents the *irreversibility in nature*
- In statistical thermodynamics, Boltzmann entropy is the number of possible microstates for a given macrostate, e.g.:
 - a number of coins with or without partitions
 - gas container with or without partitions
- In information theory, Shannon defined entropy in a similar way as the expected value of uncertainty, i.e. inversely related to *the amount of information* we have:

 $-\sum_{i} p(x_i) \log(p(x_i))$



Example: Workflow controller

• The effort to debug a system after adding another component may or may not increase



Entropy/Uncertainty = 4

Entropy/Uncertainty = 1

A necessary condition: Fine-grained Modular Structure

و ۵ ورز من ۵ ورز می ۵ ورز می ۵ ورز می ۵ ورز می ۵ ود ور ۵ ورز ۲	و کارور هی کارور میں کارور میں کارور میں کارور روں کارور پر	وں کے بین جو ا ہیں جی کے روں میں کے روں میں کے رود روں ڈیروں	ارور کا برن هو از برن هی کروی هم کرور هی کرون برن کرد.
ور و من کور میں کور میں کور میں کور من کور مو کو سے کور کو	و کری مو گرور سرو کورو هو کری مو گرور سو گود وو گروز و	روکی منها اور می کوی میڈوی می کور مولایہ کے اور	ارور کارور هوا اور های کورو می کور هو کور هو کوه وو کور
pad tagad tagad tagad tagad tagad tagad t		tend tendent tendent tendent tendent tendent tendent ten	
	والمستحج للمحادث ومحادي المحاد والمحاد والمحاد والمحاد والمحاد والمحاد والمحاد		
	0 502 02 02 02 02 02 0		
			2 5 5 5 5 5 6
والمراجع المراجع البور في الواجع البور عبر البواج والوا	والمرجع المرتجع المرتجع المرتج المرتج البواج والمراج	ويتحاد والمراجع للمواجع للمراجع للمراجع المراجع والمراجع	استا بير حج البير في البير في البير في ابي في ابي ا
pad tagaal tagaal tagaal tagaal tagaal tagaal ta		and testing te	
الرواب موالا ويرامي الروي في الرواب والرواب الموالي وما يوالي الرواب	والمستجوبة والمحاد والمحاد والمحاد والمحاد والمحاد ومناجع المحاد	يور ال يور حج ال يو الي اليو ا	الي الا يبير حجو الربين حجو الربيب حجو الربيب حجو الربيب الربيب الربيب
	1 - 2 - 5 - 5 - 5 - 5 - 5 - 5 - 5		- 2-5 -5 -5 -5 -5 -1
a a a a a a a a a a a a a a a a a a a	a a a a a a a a a a a a a a a a a a a		
			sectors may a subject and a subject may be a subject
		+	~5~2~2~2~2~2~2~2~
President renter			
hofofofofofofofofo		$\left[\begin{array}{c} - \frac{1}{2} - \frac{1}$	
			$\left \left(\left\{ $

Building NS Applications



IS/

Summary NS

Current	Step 1: Principles	Step 2: Elements	Step 3: Meet-in- The-Middle
Lehman	Fine-grained	Expansion	Aggregate Reusable And Evolvable Building Blocks → DETERMINISM !





ISA

ISA-95 based approach towards MES/MOM

				Materialen WOUTERS KM	es/es 1	16 jan 11 9:02	XA
Productie order nr.	Code	Beschrijving	Bewerking	Aantal	Herhaling	Start	rage
M11/00200	303590031	MMI-U-T-SA DWG 46118	STANSEN MATERIALEN	65,000	1,000	07-01-2011 09:36	\sim
M11/00149	303390000	MMI-U-W-SA RAM PLAN 59304377 INDICE E	STANSEN MATERIALEN	65,000	1,000	10-01-2011 08:22	
M11/00063	303529332	SF-3.5-GCE SHEET	VERPAKKEN MATERIALEN	1,000	1,000	12-01-2011 08:01	
M11/00001	303540028	SF-U 0.5 SA SHEET	STANSEN MATERIALEN	1,000	3,000	14-01-2011 07:33	\checkmark
Geplande Productie	Orders						
Productie order nr.	Code	Beschrijving	Bewerking	Aantal	Herhaling	Start	
11-403529202-00014	403529202	SF-3.0-SS6M 8"×17.5"	VERPAKKEN MATERIALEN	50,000	1,000	14-01-2011 00:18	
11-303590010-00014	303590010	MMI-U-SA DWG 45795	STANSEN MATERIALEN	7,000	4,000	14-01-2011 10:18	
11-303517892-00014	303517892	ME-PP-120 DWG 46289-8	VERPAKKEN MATERIALEN	2.000,000	5,000	14-01-2011 10:48	
11-303516077-00021	303516077	MF-116 PLAN 61039912-003 REV.C	VERPAKKEN MATERIALEN	1,000	6,000	14-01-2011 12:18	$\mathbf{\mathbf{v}}$





ISA



Thank you.

For more information please contact us at:

ISA Belgium VZW Kasteelhoekstraat 1 1820 PERK Tel. 02-254 02 59

isa-belgium.org marc.blekkink@isa-belgium.org



Marc Blekkink is Managing Partner of Inxites.

Inxites provides practical SAP solutions based on ISA-95.

Inxites provides a services based OIS providing all ISA-95 objects embedded in SAP MII to connect your existing infrastructure.

The solution is known as Veri95.

