

Virtualization & realtime: Today's solution for future automation systems



Productie Proces Automatisering

25 januari 2024 | Van der Valk Hotel, Vianen

Even voorstellen:



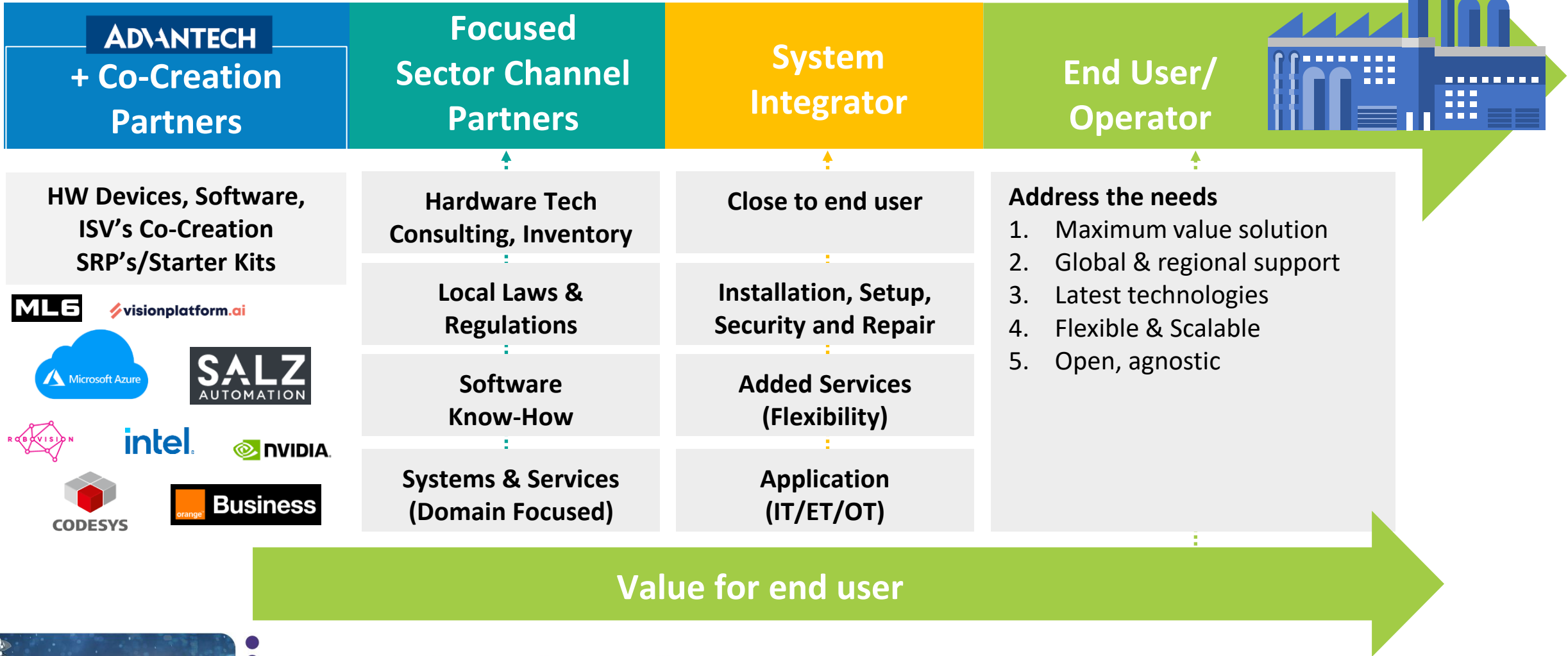
- Jim ten Broeke
- Business Development Manager
- Smart Manufacturing
- 37 years Industrial Automation
- jim.ten.Broeke@advantech.nl



- Dr. Thomas Holm
- Managing Director & CTO
- Industrial Automation expert
- Co-founder SALZ Automation
- thomas.holm@salz-automation.com



Ecosystem Market Development Strategy @ End User

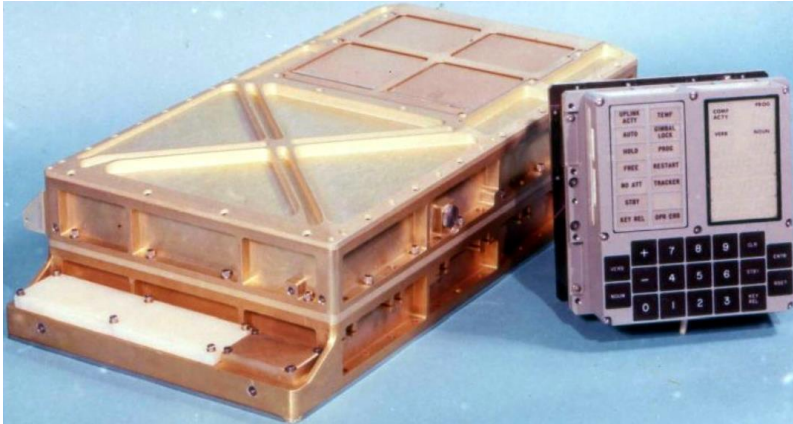


● Productie Proces Automatisering

"I think there is a world market for maybe 5 computers"

Thomas J. Watson 1943 (CEO IBM)





Apollo Guidance Computer (AGC) 1969

2048 words could be temporary stored = 32768 bits of RAM
72 KB Read Only Memory (ROM)

Apollo 11 flew to the moon with the
computing power of a today's toaster



Apollo 11 crew [NASA]

Productie Proces Automatisering

25 januari 2024 | Van der Valk Hotel, Vianen



● P
● 25 jan

2022: Osprey with 433 Qubits [IBM] **SALZ**
AUTOMATION

Fact 1 is:

Change Has Never Been This Fast.
It Will Never Be This Slow Again.



Fact 2 is:

No one can think ahead to all scenarios.

But we can discuss the basis for being safely prepared
for the future.



And what about Industrial Automation in the future?

We have no idea!

Or at least only a very vague one.



TH

How will industrial automation change in the next 10 years?



Industrial automation has been transforming the manufacturing industry for several decades, and it is expected to continue doing so in the next 10 years. Here are some potential ways industrial automation might change:



1. Increased use of robotics: With advances in robotics technology, robots are becoming more affordable and versatile, which could lead to an increase in their use in manufacturing. Robots can perform tasks that are repetitive, dangerous, or require high precision, freeing up human workers to focus on more complex tasks.
2. Integration of artificial intelligence (AI): AI can be integrated into manufacturing to help optimize production processes and make decisions based on real-time data. It can also be used to predict equipment failures and schedule maintenance before breakdowns occur.
3. Greater use of autonomous vehicles: Autonomous vehicles such as drones and self-driving trucks can be used to transport materials and products around manufacturing facilities and supply chains, reducing the need for human intervention.
4. Development of smart factories: Smart factories are highly automated facilities that use advanced sensors and data analytics to optimize production processes. They can also be used to monitor equipment performance, identify bottlenecks, and reduce waste.
5. Increase in collaborative robots: Collaborative robots, also known as cobots, can work alongside human workers to perform tasks that require a combination of human skills and machine precision. These robots are designed to be safe to work with and can improve productivity and quality in manufacturing.

Overall, the trend towards greater automation in manufacturing is likely to continue in the next 10 years, driven by advances in technology and the need for greater efficiency and productivity. However, there may also be challenges associated with this shift, including the potential for job losses and the need for workers.

Regenerate response



Productie Proces Automatisering

25 januari 2024 | Van der Valk Hotel, Vianen

TH

How should a control system be structured to follow these trends?



To structure a control system that follows the trends in industrial automation, there are a few key considerations to keep in mind:

1. Scalability: The system should be designed to accommodate changes in production demand and easily adapt to new technologies and processes.
2. Integration: The system should be able to integrate with different devices, machines, and software used in the manufacturing process. This will allow for the collection and analysis of data across the entire production line, leading to better insights and decision-making.
3. Reliability: The control system should be reliable and fault-tolerant to ensure that production processes are not interrupted by equipment failures or other issues.
4. Flexibility: The system should be flexible and customizable, allowing for the configuration of different processes and workflows to meet specific manufacturing requirements.
5. Security: As industrial automation relies on interconnected devices and systems, it is important to have strong security measures in place to protect against cyber-attacks and data breaches.

To achieve these goals, a control system can be designed using a modular approach that uses open standards and protocols to ensure interoperability between different components. This can be achieved by using technologies such as OPC UA, MQTT, and other IIoT protocols. Additionally, the system can incorporate advanced analytics and machine learning algorithms to optimize production processes, identify potential issues, and provide predictive maintenance.

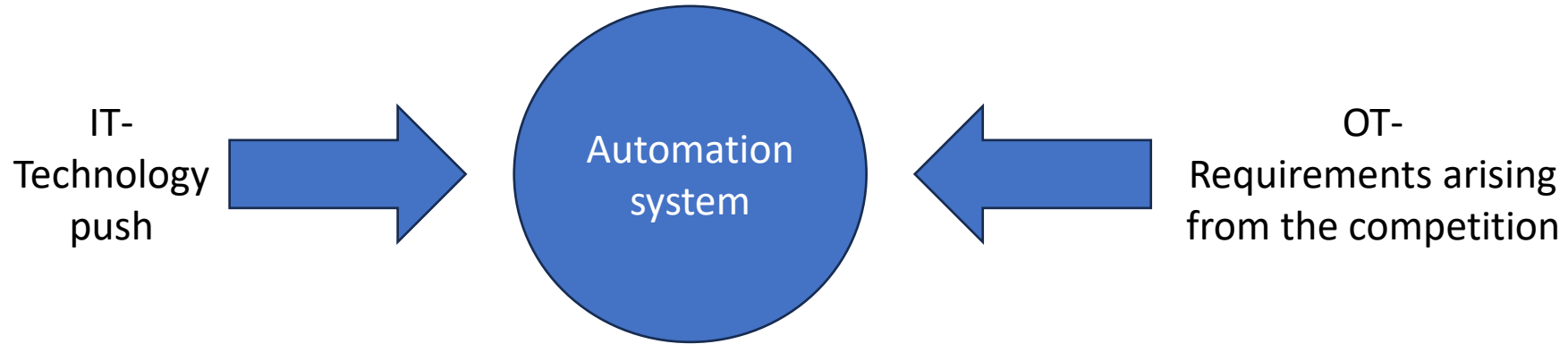
Overall, a well-designed control system that follows these trends can help to improve efficiency, reduce costs, and increase the competitiveness of the manufacturing process.



Productie Proces Automatisering

25 januari 2024 | Van der Valk Hotel, Vianen

What has an influence?

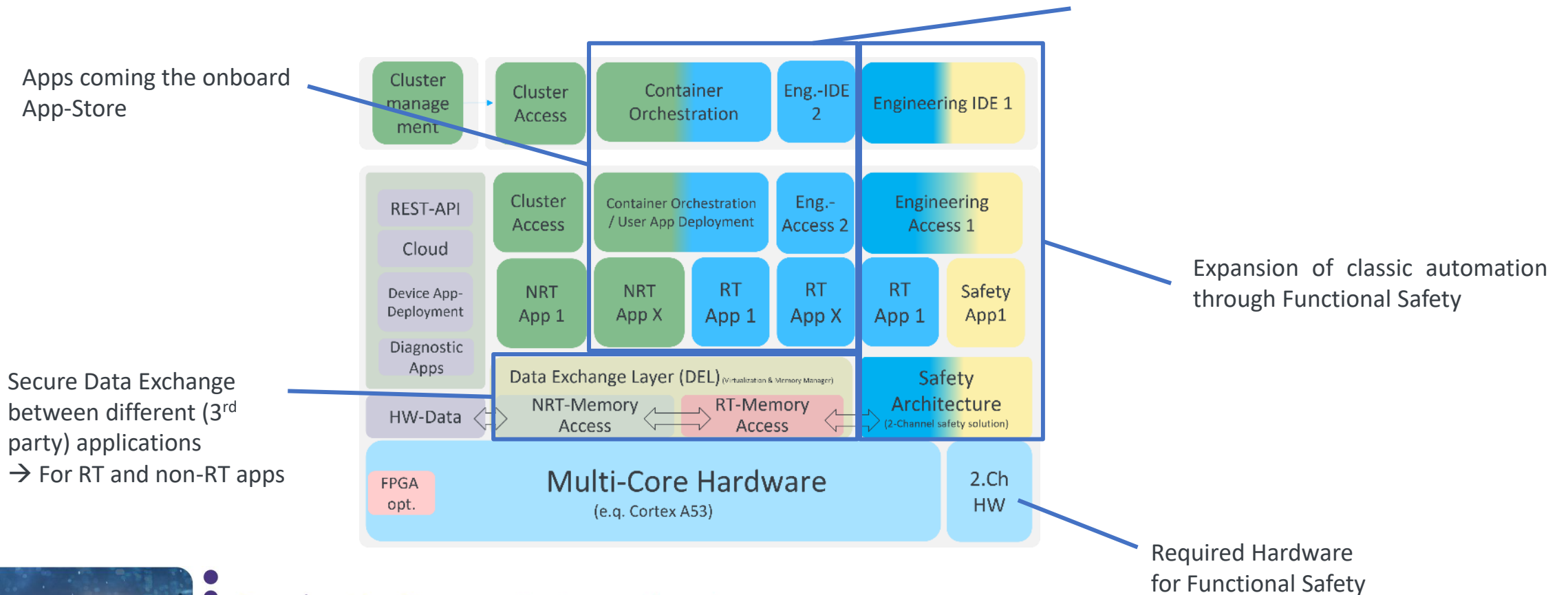


- There won't be THE automation system due to various requirements
- Automation systems will change during operation
- Virtualization / Container Technologies (Docker, CRI-O, Kubernetes, runC...)



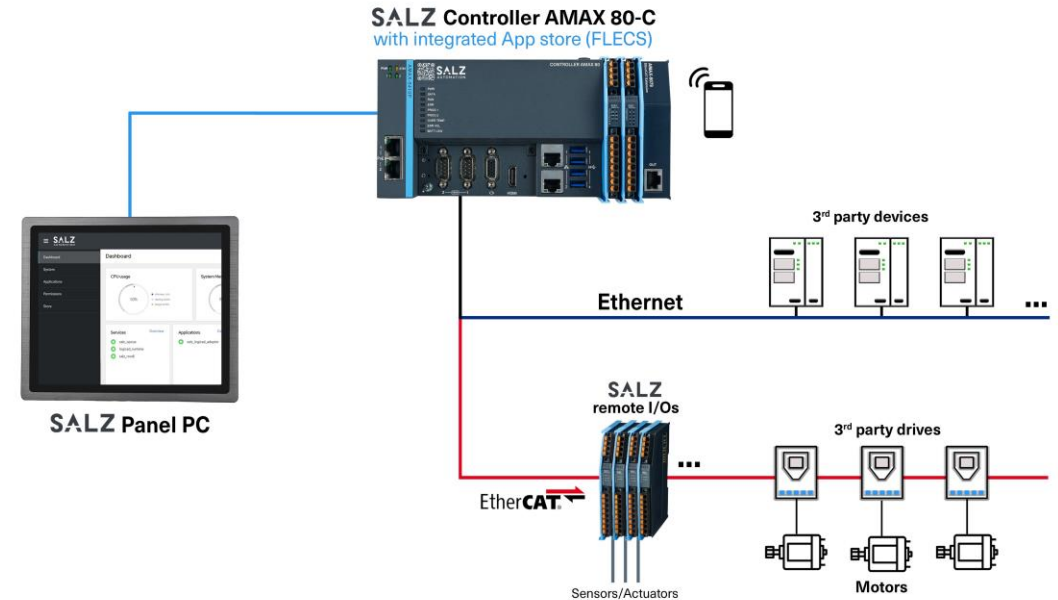
What can the architecture of a controller using virtualization look like?

Examples: CodeSys, Universal control, ROS, 4DIAC, OpenPLC, Matlab, ...



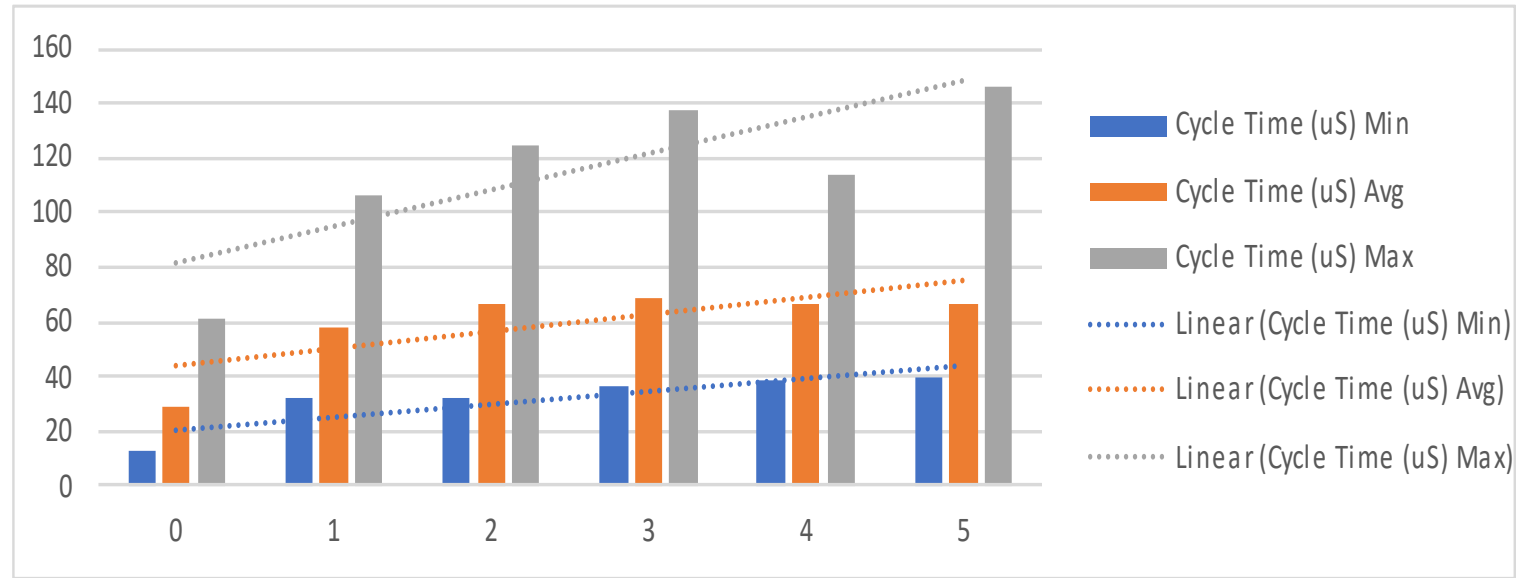
What about RT and Stability in Virtualization?

- Test scenario including:
 - Controller with RT Linux
 - Virtualized Runtime with EtherCAT Master
 - One to five motion controllers
 - Measuring Cycle Time & Jitter
 - Measuring with different cycle times
 - Behavior when running additional applications in parallel



What about RT and Stability in Virtualization - Results

1ms #Axis	Jitter (uS)		Cycle Time (uS)		
	Min	Max	Min	Avg	Max
0	117	120	13	29	61
1	135	128	32	58	106
2	130	130	32	67	125
3	119	126	36	69	137
4	249	269	39	66	114
5	187	261	40	67	146



What about RT and Stability in Virtualization - Results

250 uS	Jitter (uS)		Cycle Time (uS)		
#Axis	Min	Max	Min	Avg	Max
5	137	136	37	46	128

10 ms	Jitter (uS)		Cycle Time (uS)		
#Axis	Min	Max	Min	Avg	Max
5	150	150	76	83	170

Conclusion:

Motion application with Multi-Axis running
stable in virtualized environments.



What about RT and Stability in Virtualization - Results

1ms	Jitter (uS)		Cycle Time (uS)		
#Axis	Min	Max	Min	Avg	Max
5	270	270	40	68	161

- Running Nupano and Node Red without RT Context

1ms	Jitter (uS)		Cycle Time (uS)		
#Axis	Min	Max	Min	Avg	Max
5	253	268	41	68	148

- Running second CodeSys Application in RT Context
- Running Nupano and Node Red without RT Context



Virtualization & realtime: Today's solution for future automation systems



Jim ten Broeke

jim.ten.Broeke@advantech.nl



Dr. Thomas Holm

thomas.holm@salz-automation.com

Hartelijk dank



Productie Proces Automatisering

25 januari 2024 | Van der Valk Hotel, Vianen