EUROPEAN SPALLATION SOURCE

Proposal for a PLC Test Bench at ESS

Lessons to learn

Motivation

- What do we need a PLC Test Stand for?
  - Evaluate hardware from different vendors and support decisions.
  - Evaluate fieldbuses, communication protocols and network topologies.
  - Getting experience with IO modules for different types of signals and fast processing modules
  - Testing EPICS support & integration
  - Safety and Protection Systems: Tests Regarding Safety PLCs, Redundancy, Reliability, Availability, Self-Testing….
  - Motion Control
  - A platform for PLC Code Development and Verification
  - Helping to understand integration problems
  - Issue recommendations and support stakeholders when choosing PLC vendors, fieldbuses, communication protocols…
  - R&D
  - ???

Two stages deployment (first stage)

- First stage (now – 1Q 2014)
  - Procure basic equipment
  - Set up a development environment (workstation+ development software + version control….)
  - Evaluate and create expertise for some basic protocols and technologies (Modbus TCP, s7plc driver)
  - Gain knowledge and gather information of used PLCs and development environments.
  - Begin with the first use cases for PLCs (Safety & Protection, CF, Vacuum Test Stand, He loop Test Stand)
  - Basic EPICS integration (operator screen and short-term archiving).

Two stages deployment (first stage)

- Basic Tests
  - Modbus TCP/IP (speed, delay, load)
  - S7plc driver (speed, delay, load)
  - BACnet protocol and its EPICS support (speed, delay, load, well supported?)
  - ????

- What are the differences in terms of performance of these protocols? In terms of speed, delay, load? Are there any other considerations to be taken into account?
- What makes us choose Modbus TCP or S7plc driver connection?
- Is it worth to use more than one? or is it preferable to standardize one of them?

Two stages deployment

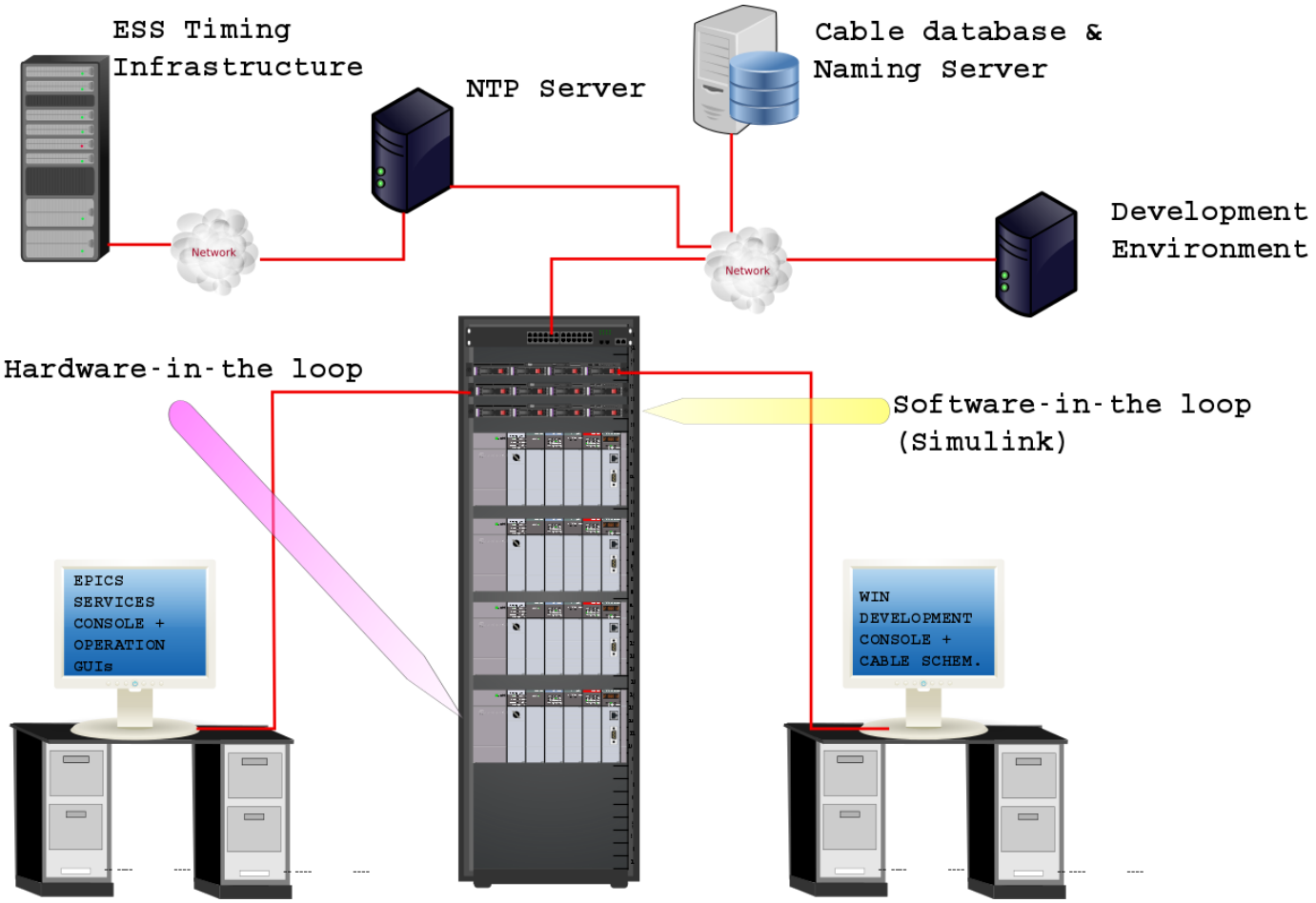
- Second Stage (2Q 2014 – 4Q 2014)
  - Synchronization with timing system (external clock)
  - PLC Framework and automatic code deployment
  - Reliability (Availability & Self-Testing functionality)
  - Incorporate more use cases and stakeholders specific issues.
  - Integration of EPICS

Alignment with other ESS policies

- Use standard tool for electrical schematics
- Use naming convention.
- Use configuration databases.
- Development Environment

- How do we maintain coherency between the drawings, cable database and configuration database?

Deployment


ESS Timing
Infrastructure
NTP Server
Cable database &
Naming Server
Network
Network
Development
Environment
Hardware-in-the loop
Software-in-the loop
(Simulink)
EPICS
SERVICES
CONSOLE +
OPERATION
GUIs
WIN
DEVELOPMENT
CONSOLE +
CABLE SCHEM.

How to measure a PLC performance?

Characteristic	Description
Processing Speed	
Memory	
Product ranges	Do we find the right product for each application?
Vendor support	

- Burden of dealing with multiple vendors?
- Burden of developing EPICS drivers?

USE CASES

- Initial users of the PLC Test Stand:
  - Slow Machine Protection System (MPS), *(A. Nordt)*
  - Conventional Facilities Integration, (J. Lundgren)
  - Vacuum Integration, *(P. Ladd)*
  - Target Integration, *(F. Plewinski)*

Safety & Protection Systems

- Intense testing/verification of code required before deployment
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-
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- Implications in code development?
- Systems simulation?
- Should safety classified systems be developed internally?

?}

Conventional Facilities

- Heterogeneous interface
  - ~35 systems (power, access, fire, cranes…).Most of them are PLC based
  - Interface to Person Safety and Machine protection {*Risk sessions ongoing*}
  - Integration sessions starting this fall
- In the PLC Test Stand:
  - Build prototypes for the interfaces
  - Test communication protocols
  - Special cases.

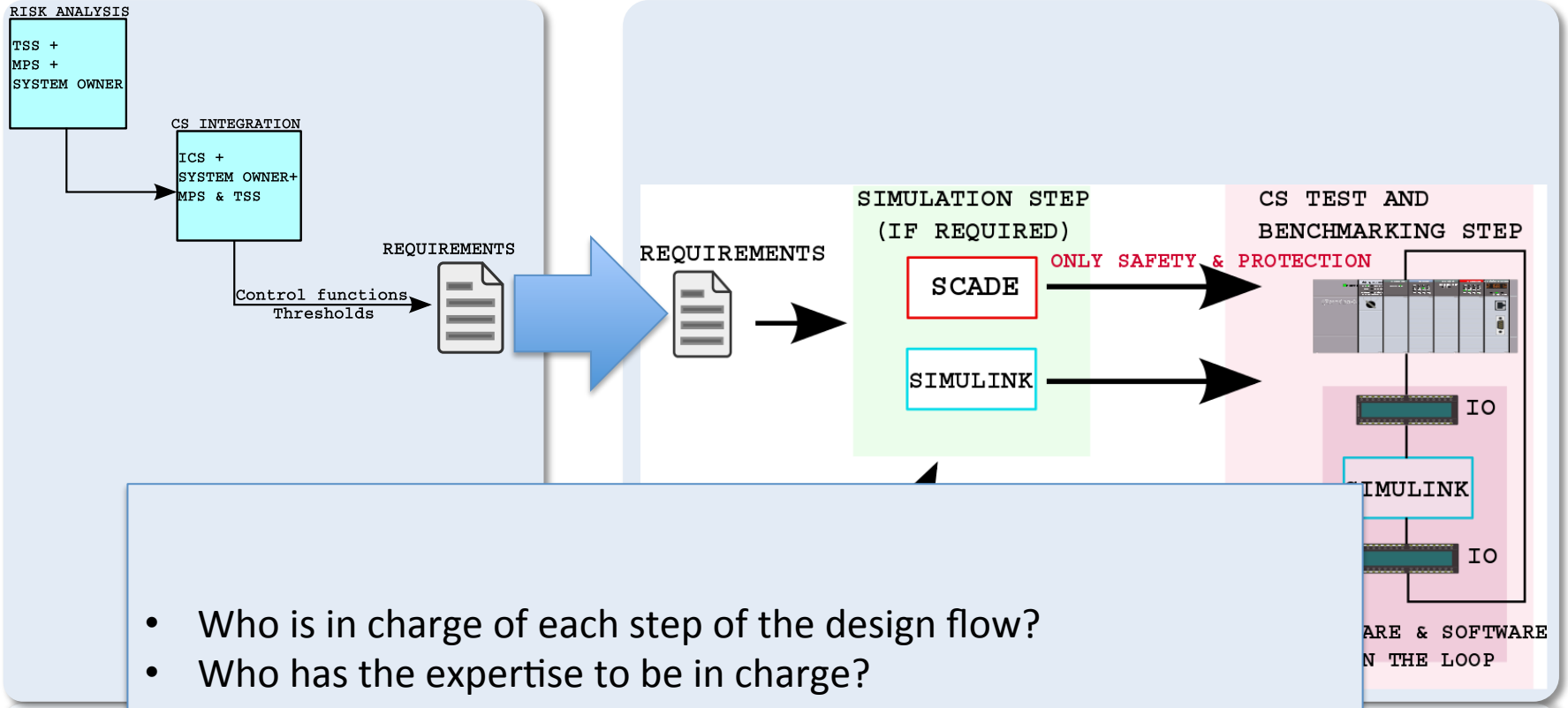
- BacnetIP/s7plc/Modbus TCP???

Vacuum

- Intensive use of fieldbuses
- Alarms
- Logging

- Is it worth to generate Vacuum devices information in the device configuration database for automatic PLC Configuration?

Target – He Loop Test Stand



- Who is in charge of each step of the design flow?
- Who has the expertise to be in charge?

Thank you for your attention!

Questions?