3rd PLC Based Control Systems PBCS WORKSHOP

ICALEPCS 21 Conference

E. Blanco Viñuela, Brad Schofield J. Ortolá Vidal, B. Fernandez Adiego



ICALEPCS 2021



Create a **COLLABORATIVE space** where attendees exchange:

- return of experience
- best practices
- methods and tools

Identifying expertise among institutes which can foster collaborations

LINES LINES LINES STFC/RAL/ISIS USTC/NSRL EUXFEL Elettra INFN/LNL IHEP S7 attendees 28 Institutes JINR S2Innovation



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Technology trends

IEC 61499 standard and an industry implementation: **4DIAC**

Dr. Alois Zoitl

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IEC 61499



Function block

A domain-specific modeling language which provides realtime capabilities, determinism, decentralized architecture and dynamic reconfiguration.

> Function Blocks extended with event interface Pure **event-driven** execution model Data types based on **IEC 61131-3**



Graphics courtesy of A. Zoitl

Institutes presentations

ELETTRA (Italy)

IHEP CAS (China)

NCBJ (Poland)

ORNL (USA)

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(1) PLC Hardware upgrades

Challenges

- How can I determine whether my installation is reliable or not?
- How can estimate the service life?
- When should I migrate and why?
- What can I do to delay the end of life?

MIGRATION STRATEGY FACTORS

- Predicted product service life.
- Evaluation of the ability to repair
- Effort and cost in case of production downtime
- Dependencies and compatibly with extensions (evolution)
- Spare parts availability
- Successors availability and compatibility
- Service availability due to aging workforce.



(2) Quality assurance: CI/CD on PLCs

Software engineering paradigm brought to the PLC domain

Common approach for all PLC vendors: wrap API (S7, TIA or Unity) with a high-level gRPC service S7 Server VM
CI/CD Runner

Server (C#)
S7 gRPC Service

S7Lib
Build/Deploy Script

Siemens Simatic API
Siemens Simatic API

Automated testing (PLC interface by OPC-UA)

gRPC: open source universal RPC framework

[TUPV35]



(3) Quality assurance: PLCVerif



PLCVerif an open-source tool.

Application of formal methods to verify the PLC critical code (e.g. interlocks, safety instrumented systems, process control functions...)

[WEPV042]

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More information

Workshop page https://indico.cern.ch/e/PBCS-21



PBCS: PLC based control systems Workshop

15 October 2021 Shanghai (China) [Virtual] Europe/Zurich timezone

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Overview	This ICALEPCS 2021 conference workshop intends to create a collaborative space where attendees
Scientific Programme	will show and exchange their best practices, tools employed and return of experience when
Timetable	engineering PLC based control systems. Specific topics we would like to address are:
Contribution List	- Specifications - Software development under Standards and/or Frameworks
My Conference	- PLC Suppliers IDEs: Advanced software engineering features availability
My Contributions	- Novel paradigms: e.g. Automatic code generation, object orientation
Registration	- New technology trends: e.g. embedded OPC-UA, MQTT
Participant List	 Programming language choice and coding conventions: Best practices Application management: source version control & deployment service
Support	 Lesting and verification: Methodologies and tests (FAT, SAT), virtual commissioning, formal methods
ICALEPCS21-PBCS-W	- Upgrade and/or reengineering of applications
a +41754112804	- Documentation