7th UCAAT User Conference on Advanced Automated Testing

ETSI

TESTING COMMUNICATION IN VIRTUAL POWER PLANTS ENVIRONMENT WITH STANDARDIZED TEST APPROACH TTCN-3

Presented by Steffen Lüdtke

Fraunhofer FOKUS

Agenda

- Introduction
- Involved Standards
- Test Specification
- Technical Realization
- Summary and Outlook

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INTRODUCTION

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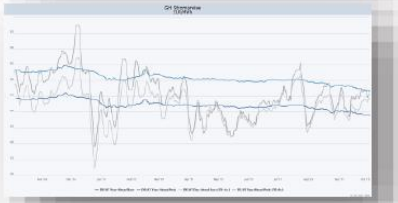
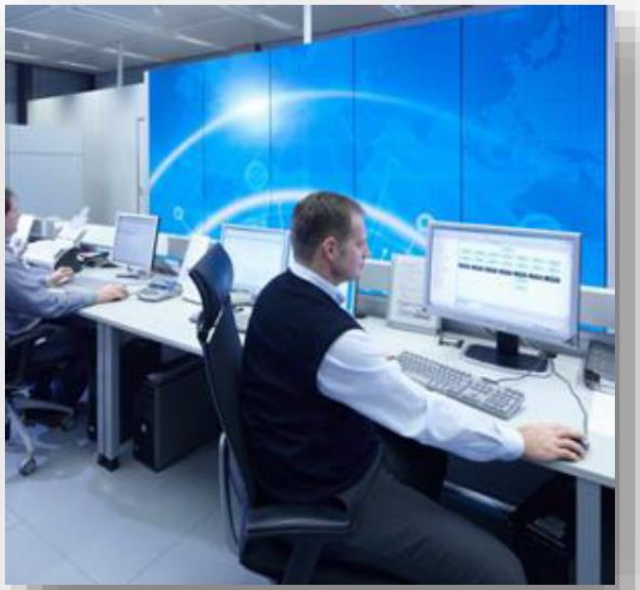
Introduction





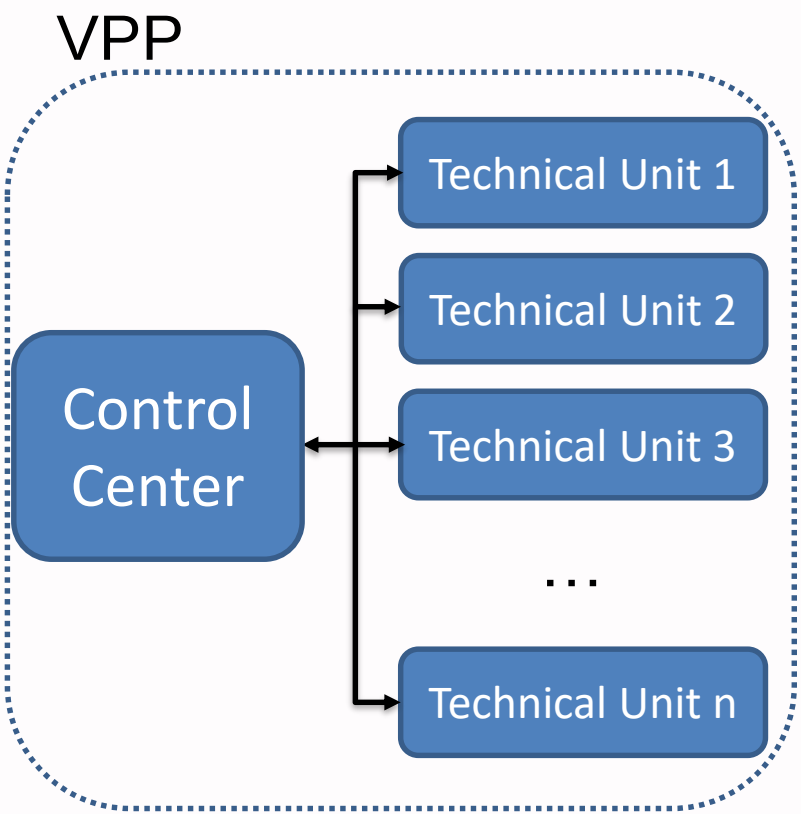
VHPready

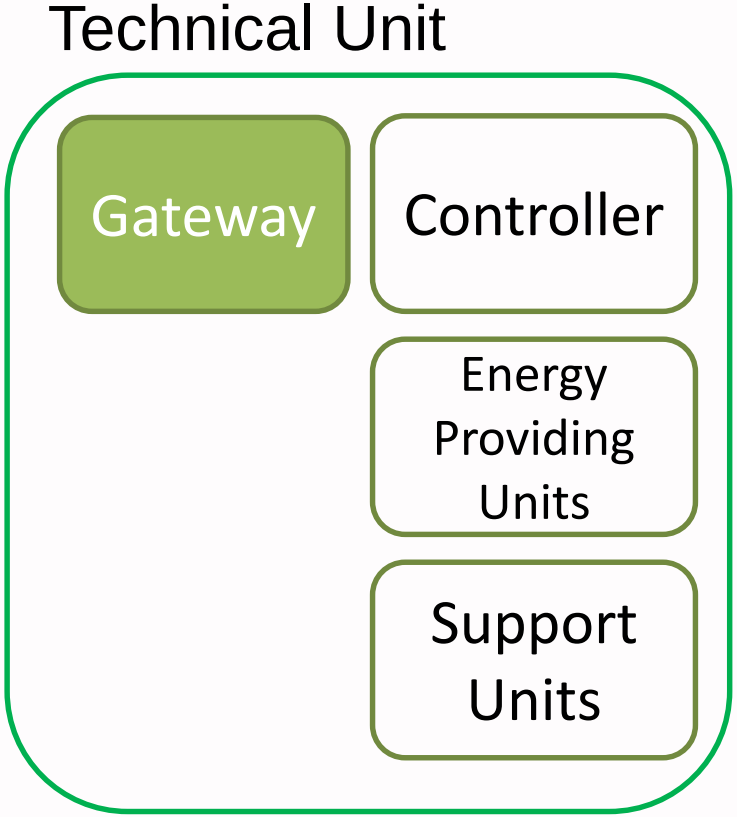
VHP READY Virtual Heat & Power

Scope – Version 4.0

- Published by: Industry Alliance VHPready e.V., https://www.vhpready.de/de/home/
- Communication: Control Room ⇔ Technical Unit(s)
- Critical Infrastructure
  - Reliability
  - Resilience
  - Affordability
- Utilization
  - System reserve (primary control~, secondary control~, minute~)
  - Accumulate DER (distributed energy resources) → market access

VHPready Entitys





INVOLVED STANDARDS

Involved Standards

VPP ⇔ Gateway

- IEC 60870
- IEC 61850
- TCP/IP
- TLS
- VPN
- (S)NTP

Gateway ⇔ Controller

- Profibus
- ModBus
- …

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TEST SPECIFICATION

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Functional Test Requirements: Communication

- Device Under Test Initialization
- Send / Receive Sequence Number handling
- Disturbed message order handling
- Timeout Protection
- Loss of Connection handling
- Request confirmation
- Data transfer
- Clock Synchronization

And more…

Functional Test Requirements: Information Security

- Device Under Test Secure Initialization
- Secure Connection handling
- VPN handling
- Functioning features to support patch management
- Certificate distribution / revocation

And more…

Test Requirements

- 32 Test puposes specified
  - Conformance (17)
  - Negative (5)
  - Security (7)
  - Clock Sync (2)
  - Documentation (1)

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TECHNICAL REALIZATION

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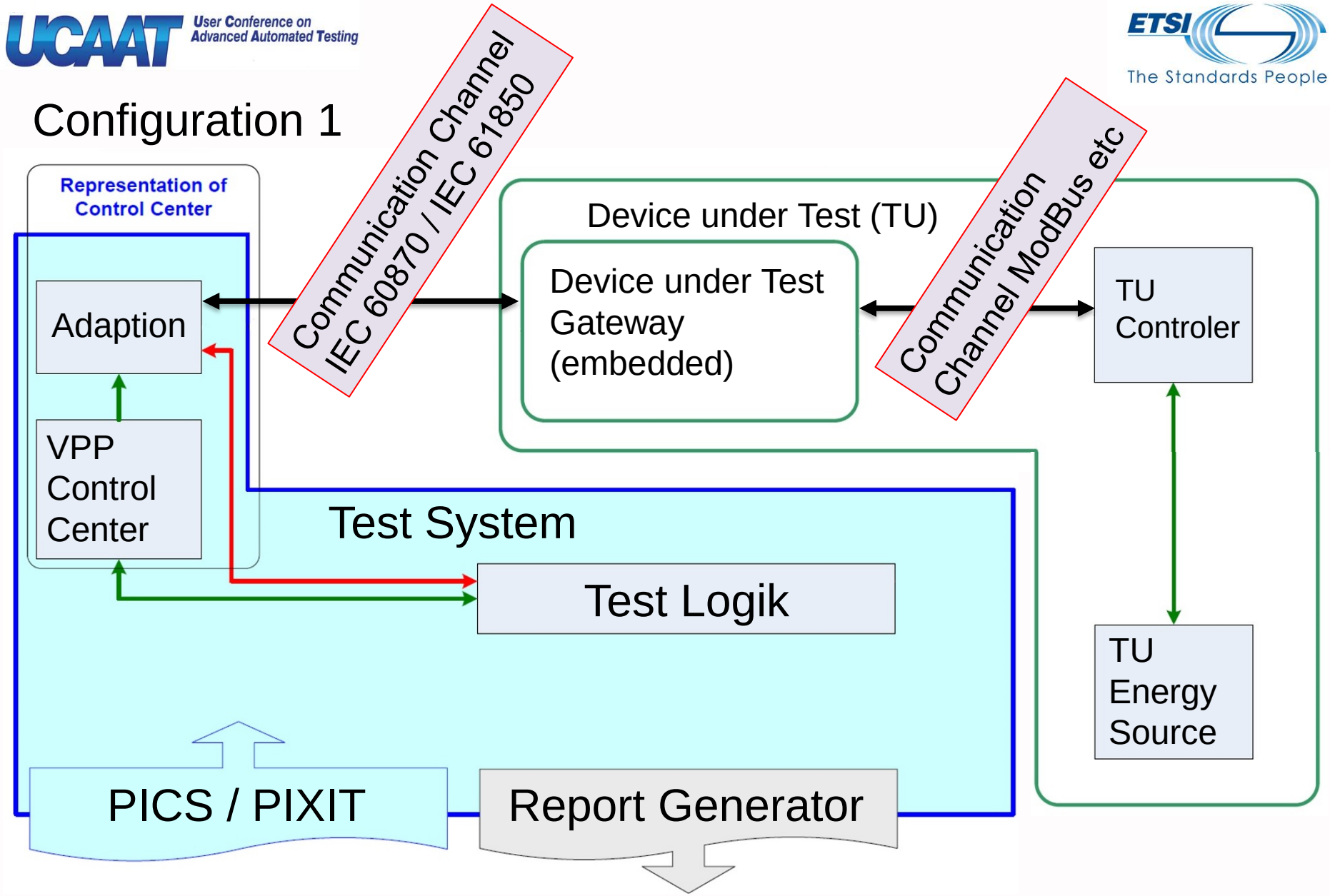
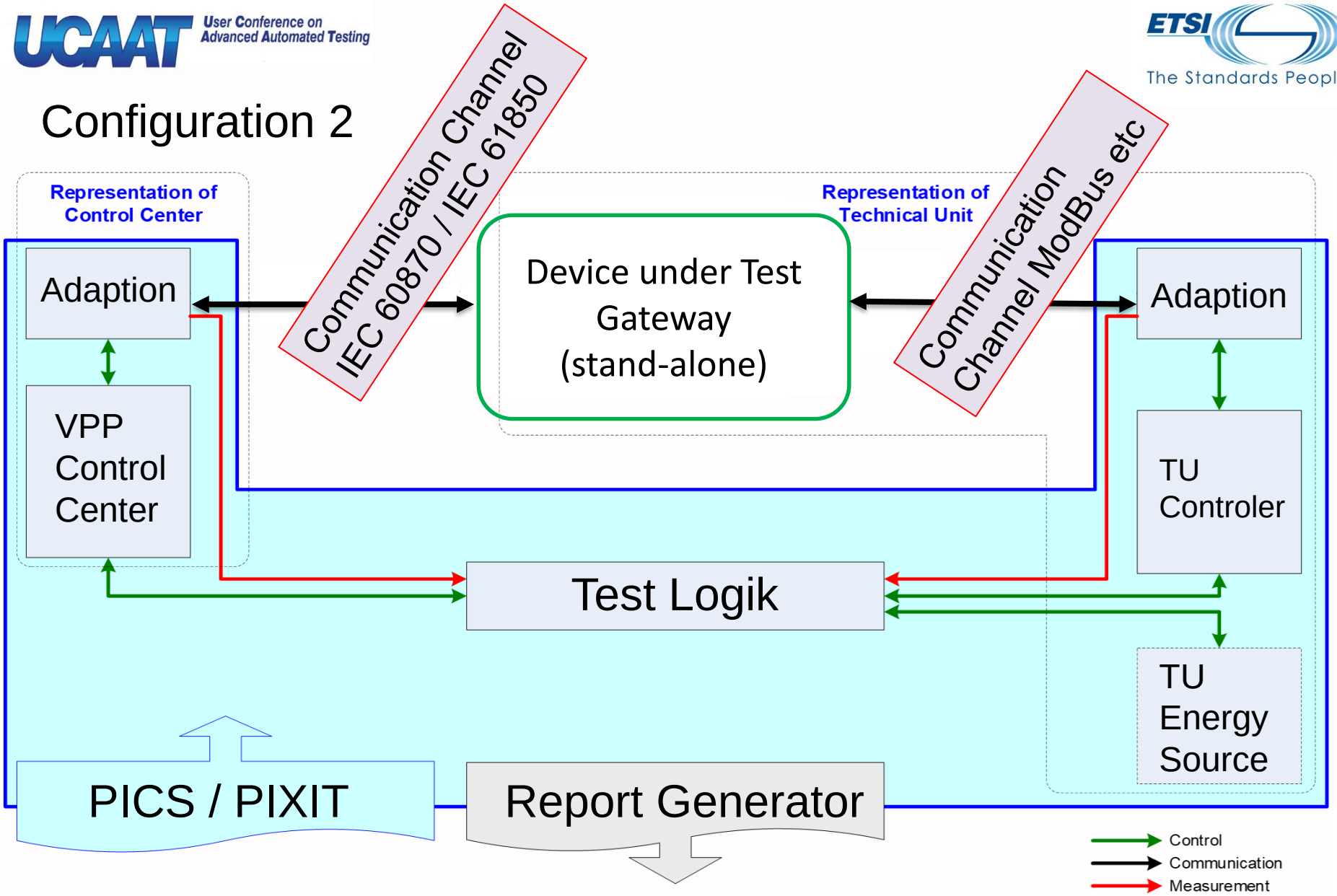
Configuration 1

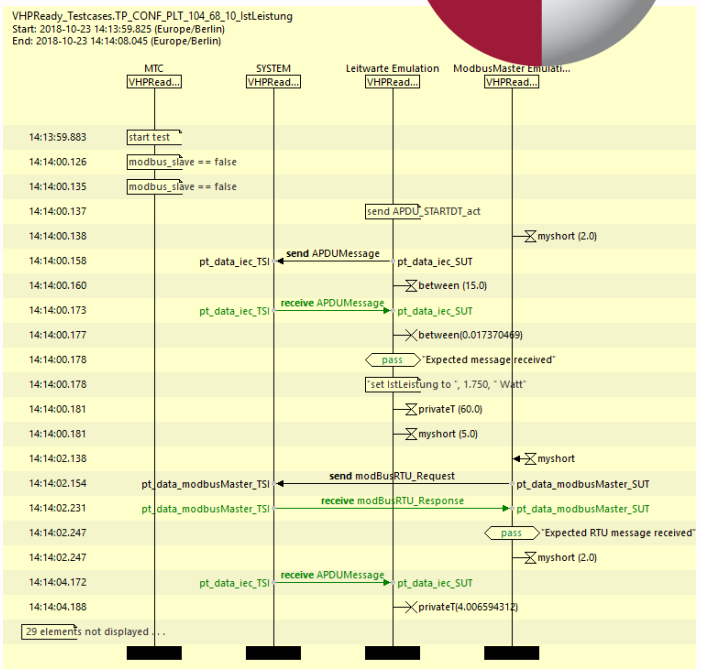


Configuration 2



Language and Tooling

- **TTCN-3**
  - Internationally standardized testing language for formally defining test scenarios by ETSI
- **TTworkbench** *(by Spirent)*
  - IDE for TTCN-3 testcase development end execution
  - Java-based Adaption Layer
- openVPN



Technical Realisation

- **Adaptors:**
  - IEC 60870
  - Modbus RTU
  - Modbus TCP (prepared)
  - Network Time Protocol (NTP) Server
- **Out of scope:**
  - *IEC 61850*
  - *Profibus*

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SUMMARY AND OUTLOOK

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Research Project VHPready

- 4 Project Partners, 2 years running time
- Artefacts:
  - VHPready complient Gateway Prototype (Hard- and Software)
  - VHPready complient Gateway alternativ layout
  - Control Center Emulation Software
  - Test Specifications
  - 2 different Test Systems

Research Project VHPready

- *Test System development:*
  - Around 2 PM developing (TTCN-3 Testcases and Adaptors)
- *Test System Benefits:*
  - Findings and Discussion about ambivalences and gaps in VHPready 4.0 Standard
  - Corrections in RefBox implementation
  - Re-usabilty of Adaptors
  - Simple Extensibility (e.g. IEC 61850)
- Future:
  - Using Test System in Certification Process
  - Follow-up project planned

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THANK YOU FOR YOUR ATTENTION

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