

UCAlug Testing Subcommittee Boot Camp



Agenda

- ▶ Introduction to 3 UCAlug groups
- ▶ Testing Overview
- ▶ Testing Details
- ▶ Development of a Testing Program

Introduction to UCAlug groups

- ▶ UCAlug – how did we get here?
 - MMS Forum - 1993
 - AEP Substation Initiative - 1996
 - UCA2 Users Group - 1999
 - UCA International Users Group – 2002
- ▶ Why did we get here
 - Share experiences
 - Promote adoption of underlying standards

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IEC 61850 Users Group

- ▶ This was the start of UCAlug
- ▶ Started as protocol with a substation
- ▶ Is now far more than a protocol, a way of life
- ▶ Based upon MMS, ISO, TCP/IP
- ▶ Defines conformance suites for various product
- ▶ Defines performance test for “GOOSE”
- ▶ Created QAP
- ▶ Has Certificate program without logo

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CIM Users Group

- ▶ Second group to join UCAIug
- ▶ Large user group
- ▶ Started as object database standard
- ▶ Now deals with object transport
- ▶ Based upon XML, TCP/IP
- ▶ Defines interoperability suites for various use cases
- ▶ Performs pre-standards tests (verifies standards BEFORE they are issued)
- ▶ Has no formal Certificate program

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Open Smart Grid Users Group

- ▶ This is most recent entry to UCAIug
- ▶ Has diverse user base
- ▶ Device and enterprise components
 - Device : bits and bytes, RF signal strength, etc.
 - Enterprise : XML like CIM
- ▶ Based upon ZigBee (SEP), XML, TCP/IP
- ▶ Will define conformance and IOP suites
- ▶ Has no programs complete at this time

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Testing Overview - Goals

- ▶ Why do we test?
 - Expose latent defects in system
 - Users expect error-free systems in their application
 - Vendors want independent validation
 - Sometimes: “Check the box”

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Testing Overview - Outcomes

- ▶ What do we expect from testing
 - Error-free report: no problems found (bad?)
 - Report showing areas needing improvement
 - Report showing failure of test (rarely issued)

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Testing Overview – Product types

- ▶ Can test products or services
 - Product: Identified unit with specific input/output relationship, typically at bits and bytes level
 - Service: Software with less well-defined inputs and outputs, generally holding state information
- ▶ Why testing differs
 - Product: stimulate UUT, verify response
 - Service: send context, verify response semantics

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Testing Overview – Test Cases

- ▶ What are test case sources?
 - Implicit standards: “... shall ...”
 - Explicit standards: tests specified by SDO
 - Industry Use Cases: “... Monitors system and issues ...”
 - User use cases: Specific ways user operates system
 - Vendor use cases: Regression testing

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Testing Overview – Test Steps

- ▶ Test procedures document: What will tester do?
 - Requirement for specific test step
 - Preconditions
 - Stimulus
 - Expected response (or range of responses)
 - Verdict definition

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Testing Details – Types of Tests

- ▶ Conformance – does device/system match spec
- ▶ Pair-wise IOP – does it work with a specific partner?
- ▶ Standards-vetting IOP – does the proposed spec mandate unique solutions?
- ▶ End-to-End IOP – does entire system work?
- ▶ Ad-hoc testing – for specific situations, does the system correctly perform its function?

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Testing Details – Test Reports

- ▶ What was tested
- ▶ How tested (environment, test equipment, etc.)
- ▶ Which tests executed
- ▶ Which tests not executed (and why)
- ▶ Tester comments
- ▶ Overall verdict: pass or fail or inconclusive

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Testing Details – Test Execution

- ▶ Level of test specification
 - Specify test procedure
 - Allows innovation in test scripting
 - Possible differences between testers
 - Define standardized test scripts
 - Requires specification of one test tool
 - Public tool requires much volunteer time to vet
- ▶ Control of tests – ideally voted by User Group
 - Reality – most users don't understand tests

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Testing Details – User Group/SDO

- ▶ SDOs may have national/political agendas
- ▶ Inherent struggle between groups
 - SDO wants stability – stable standards
 - UG wants flexibility – faster evolution
 - Both want appearance of stability for adoption
- ▶ Implication upon testing
 - Test groups must be flexible when interpreting a standard
 - Sometimes deliberately violate written spec

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Test Program Development

- ▶ Question before starting
 - What programs already exist/known to users?
 - What is funding model?
 - Test development
 - Test program maintenance
 - Test program administration
 - Logo / formal certificates?
 - What can vendors afford? Testers?
 - What problems are users seeing/testing needs

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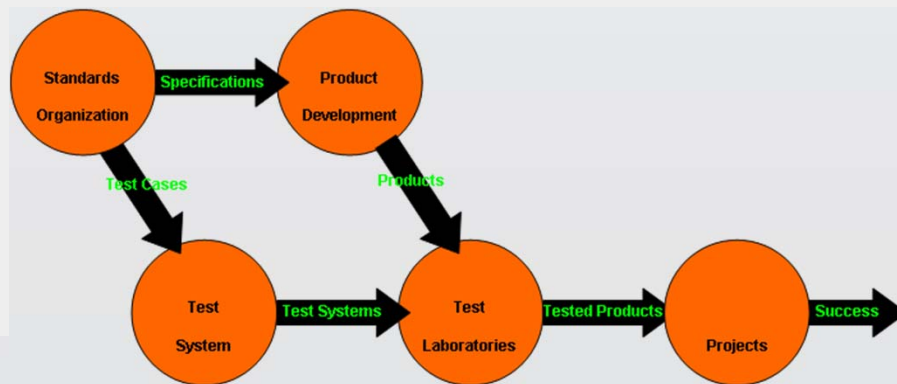
Quality Assurance Plan

- ▶ Need this as first step
 - Define how testing process functions
 - Defines defect feedback mechanisms
 - Defines quality systems needed by testers
 - Defines funding model for the testing process
 - Defines conformance vs. IOP testing or both
 - Defines whether UG will contract work
- ▶ This is the “business plan” for the testing group
- ▶ Get support from user group of this QAP
- ▶ Iterate until users agree to plan

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UCAlug QAP Process



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Forming Testing Group

- ▶ Seek volunteers
- ▶ Set realistic timetable, don't overwork volunteers
- ▶ Create real project plan, too easy to fall behind
- ▶ Avoid temptation of scope creep
 - Finish planned work unless completion makes no sense
- ▶ Continue to seek volunteers until 1/3 complete
- ▶ Add "unplanned" work at end

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Test Plan reviews

- ▶ Have user group periodically review test plan
 - Don't want a surprise after 6 months work
 - Be willing to change to meet user needs
 - Avoid temptation to satisfy minority of users
 - Ask question: "Is this what our industry needs?"
- ▶ Upon completion of test plan, real work begins

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Test Procedure Development

- ▶ Begin with highest-level of suite
 - Example: Connects, authenticates, basic data
- ▶ Break each of these into logical functions
 - Example: Joins network, creates peer matrix
- ▶ Break each function into individual tests
 - Example: Join network using only default credentials
 - Create both positive and negative tests
- ▶ Break tests into test steps with stimulus/response

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Practical Example – 61850

- ▶ Decided on lightweight process at start
- ▶ QAP:
 - Write test procedures
 - Accredited/monitor testers
 - Arbitrate disputes
 - Post tester-created certificates
- ▶ Results: industry acceptance, low-cost to users

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Practical Example – CIMug

- ▶ Decided on lightweight process at start
- ▶ QAP (informal):
 - Only perform IOP testing
 - IOP tests specific to each IOP
- ▶ Results:
 - IOPs have found errors in pre-IS IEC documents
 - CIM products are interoperable

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Testing Outcome

- ▶ All stakeholders agree on testing process
- ▶ Testing is meaningful to the industry
- ▶ Testing is cost-effective
 - Users view tested products as good “first step”
 - Vendors view testing as more than “check the box”

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Questions



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