Technology Adoption: From Standards to Products

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Grid-Interop 2012

Perspective

- Background and focus on development tools to insure
  - Conformance to standards
  - Interoperability of products
  - Security functionality and features
- Practical aspects of adopting a new technology
  - When is it ready to implement?
  - Maturity of technology
  - Maturity of adopting and vendor organizations

Contents

- Requirements for Technology Adoption
- Customers
- Technical Specifications
- Standard Engineering Tests
- Certifications Programs

- Customers that demand standard, interoperable products

- Technical Specification with minimal options and ambiguities

- Standard Conformance AND Interoperability Engineering tests

- Certifications that are integrated with development and test process

- Insist on standard, interoperable products and they get them: if not, well…
- Understand standards development and
  - Participate in standards work
  - Conduct own R&D to determine specific requirements and insure compliance
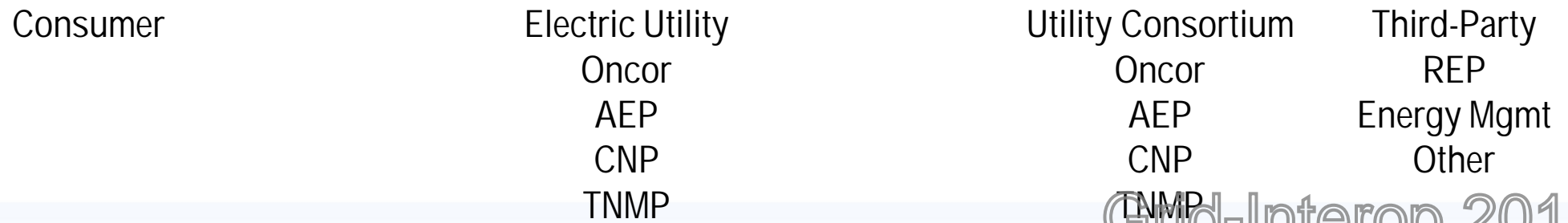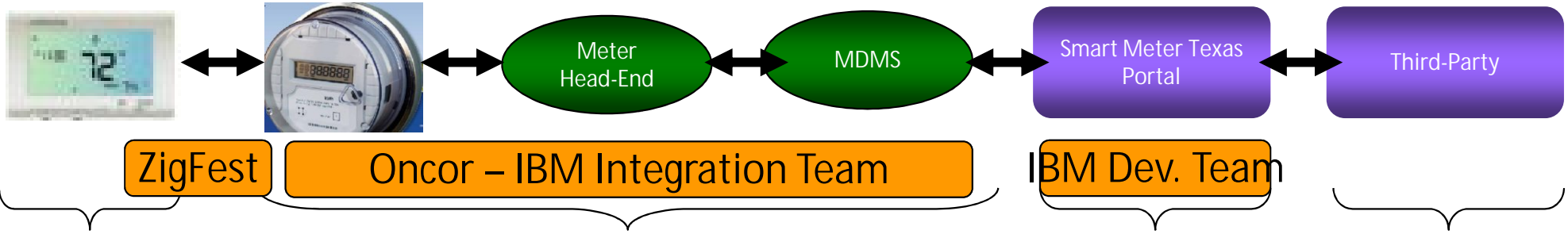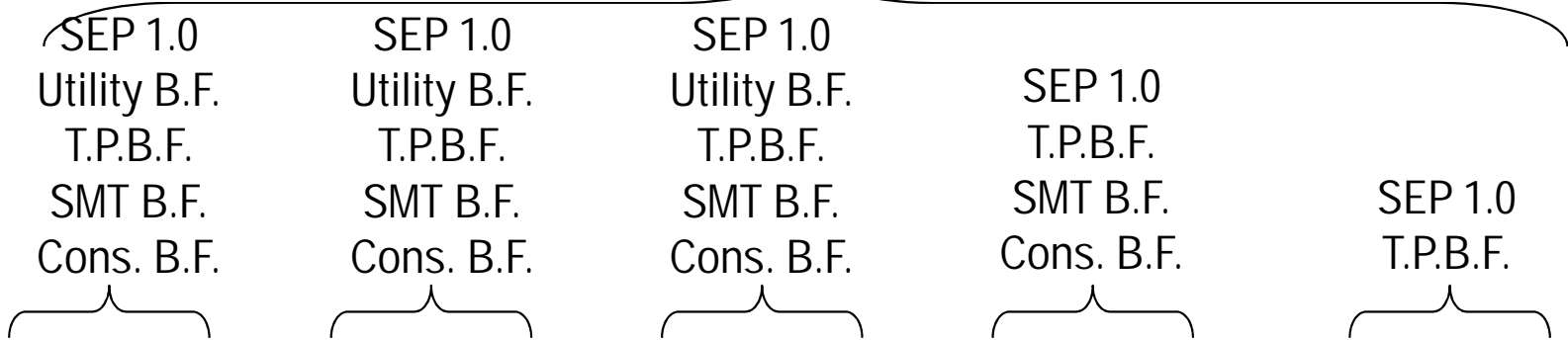
Customers Who...

- Do not assume that "certified" means products will integrate seamlessly together
- Are specific in RFPs on conformance and interoperability requirements
- Plan for independent assessment of conformance and interoperability of proposed products
- Monitor relevant standards to understand the state of the standards and certifications

R&D Example: Texas/Oncor

SEP 1.0
End-to-End Business Functions

| SEP 1.0 Utility B.F. T.P.B.F. SMT B.F. Cons. B.F. | SEP 1.0 Utility B.F. T.P.B.F. SMT B.F. Cons. B.F. | SEP 1.0 Utility B.F. T.P.B.F. SMT B.F. Cons. B.F. | SEP 1.0 T.P.B.F. SMT B.F. Cons. B.F. | SEP 1.0 T.P.B.F. |

| ANSI SEP 1.0 | ANSI (C12.xx) SEP 1.0 | ANSI (C12.xx) SEP 1.0 | UBP SEP 1.0 | SEP 1.0 | SEP 1.0 |

[Thermostat "72"] ⟷ [Smart Meter] ⟷ (Meter Head-End) ⟷ (MDMS) ⟷ [Smart Meter Texas Portal] ⟷ [Third-Party]

ZigFest | **Oncor – IBM Integration Team** | **IBM Dev. Team**

| Consumer | Electric Utility Oncor AEP CNP TNMP | Utility Consortium Oncor AEP CNP TNMP | Third-Party REP Energy Mgmt Other |

R&D Example: Texas/Oncor

<u>Smart Meter Texas</u>

- 404 Business Requirements to-date
- 1,544 Test Cases

<u>Oncor</u>

- 1,726   Business Requirements to-date
- 5 Test Environments (with multiple application components in each)
- 3,000 Test Cases (includes all AMS/LCIS cases to support AMS operations)
- 126 HAN specific Test Cases
- 12 software application components for AMS operations (complete stack)
- 150 distinct Espresso jobs

<u>Standards / Guidelines</u>

- ANSI (C12.xx), Zigbee, IEC (CIM), Multi-Speak, NAESB, NERC/CIP, NIST, Sarbanes Oxley, Texas Sate Privacy Laws, American Disabilities Act (ADA), ERCOT Market Rules, PUCT Rules etc.

Customer Example: KEPCO

- Advanced Substation Automation Project
- 715 Substations: intent to migrate to 61850
- 6 substations with 61850 (2010) in R&D project (station bus only)
- Vendors/IEDs developed and tested for 61850 conformance
- Created own test system for client testing
- Partner with KEMA for server certification test
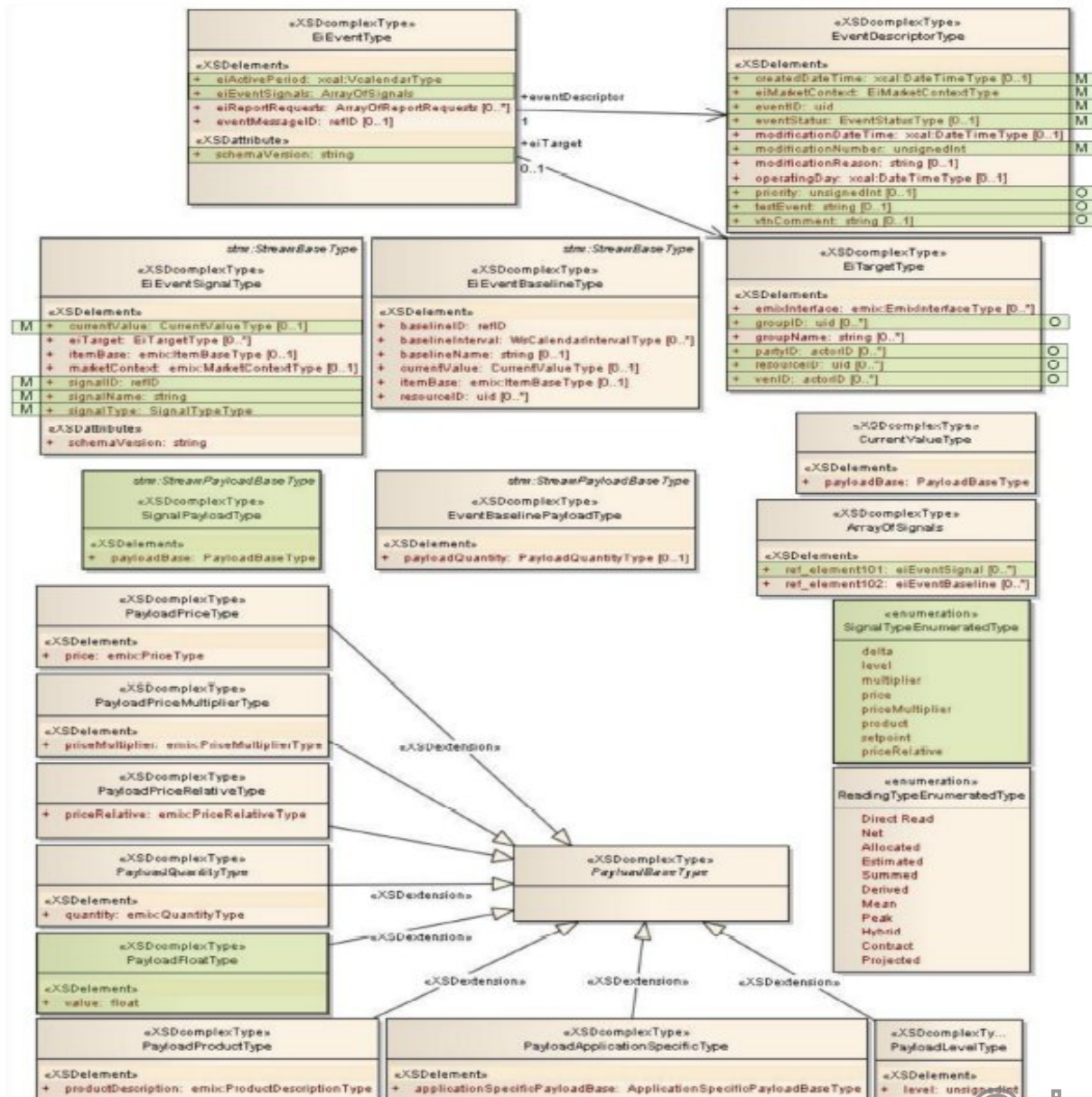
R&D Example: KEPCO Client Test System
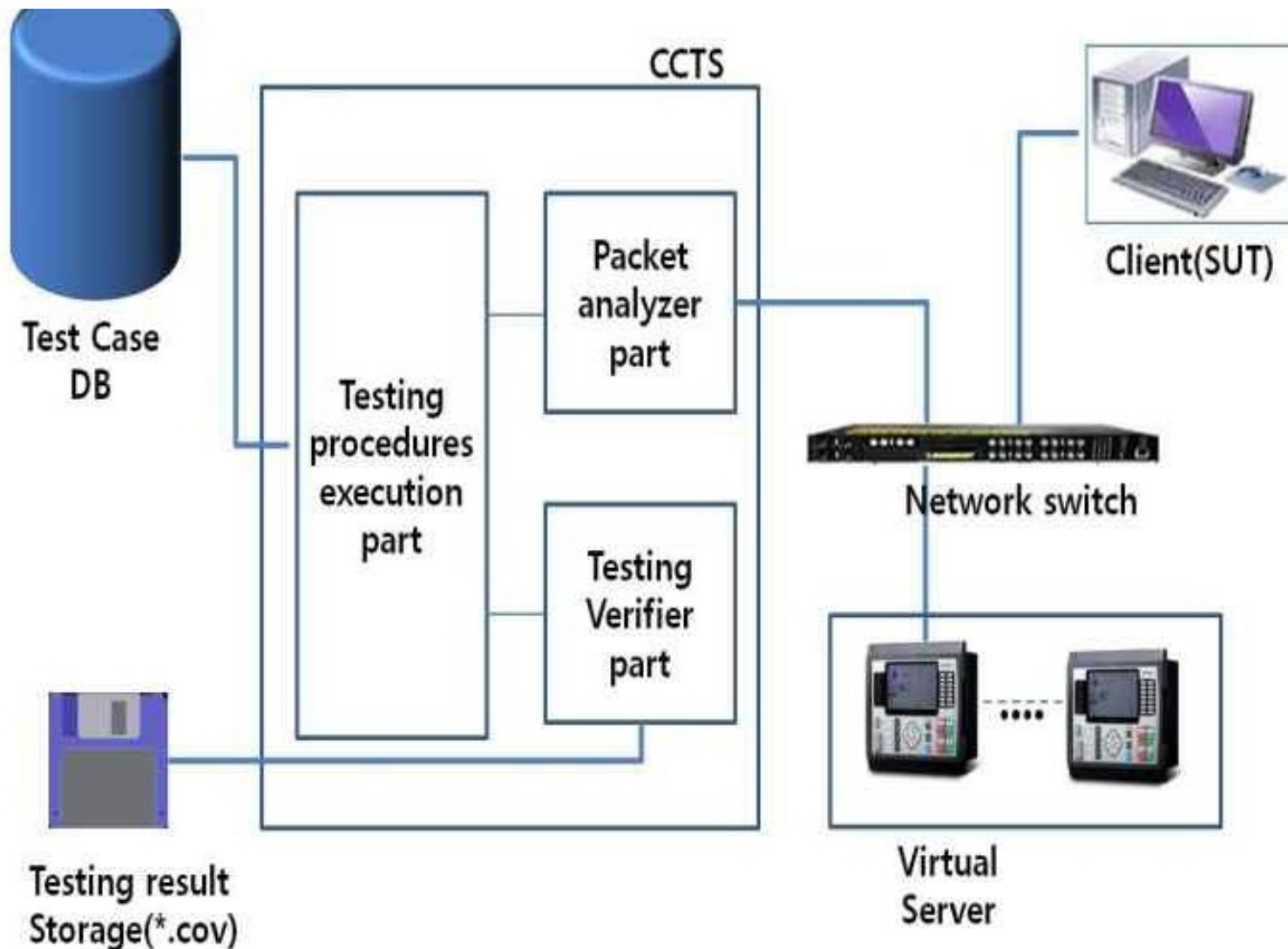
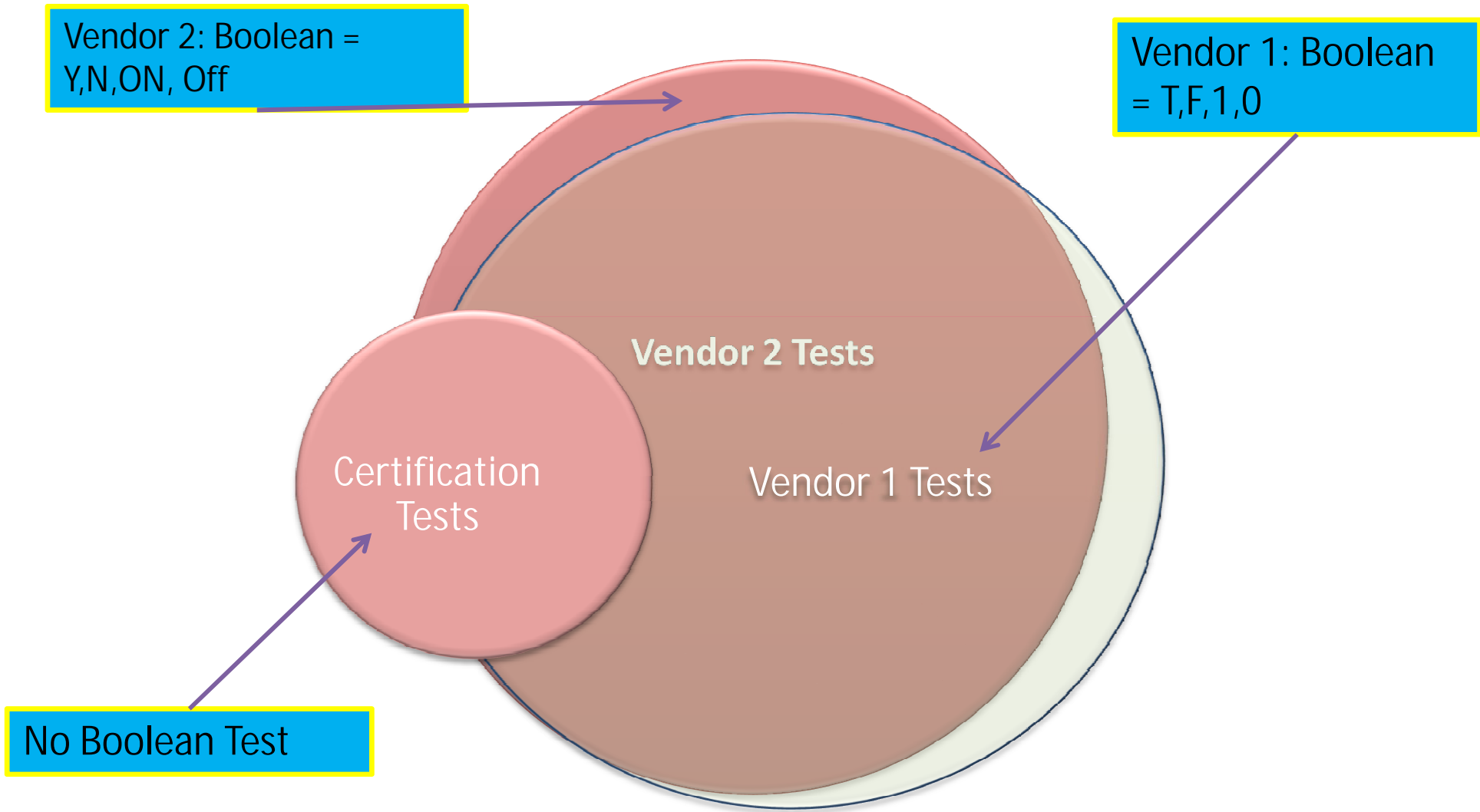Configuration of the KEPCO client conformance testing system

Unambiguous Specifications

- Options increase risks to interoperability:
  - SEP 2 currently defines 500 mandatory PICS requirements and 440 optional PICS requirements. How many optional requirements will be included in certification? (SEP 1.x only tested mandatory or 30% of possible functions)

- Ambiguities create risks to interoperability:
  - Boolean values are initialized to be values representing True or False. However, IEC 61850-6 is mute on the actual value that should be used. This means that values consisting of: T, F, Yes, No, Y, N, On, Off, and other permutations could all be argued to be valid.

- Different vendors can implement in conformant but differing ways

Why do Interoperability Problems Exist?

Vendor 2: Boolean = Y,N,ON, Off

Vendor 1: Boolean = T,F,1,0

Vendor 2 Tests

Certification Tests

Vendor 1 Tests

No Boolean Test

Implications

- If each vendor develops conformance tests for a standards-based product...
- Very likely to have different interpretations of ambiguous specifications
- Leading to interoperability problems
- PART of the SOLUTION
  - One official (industry-accepted) comprehensive set of conformance tests!
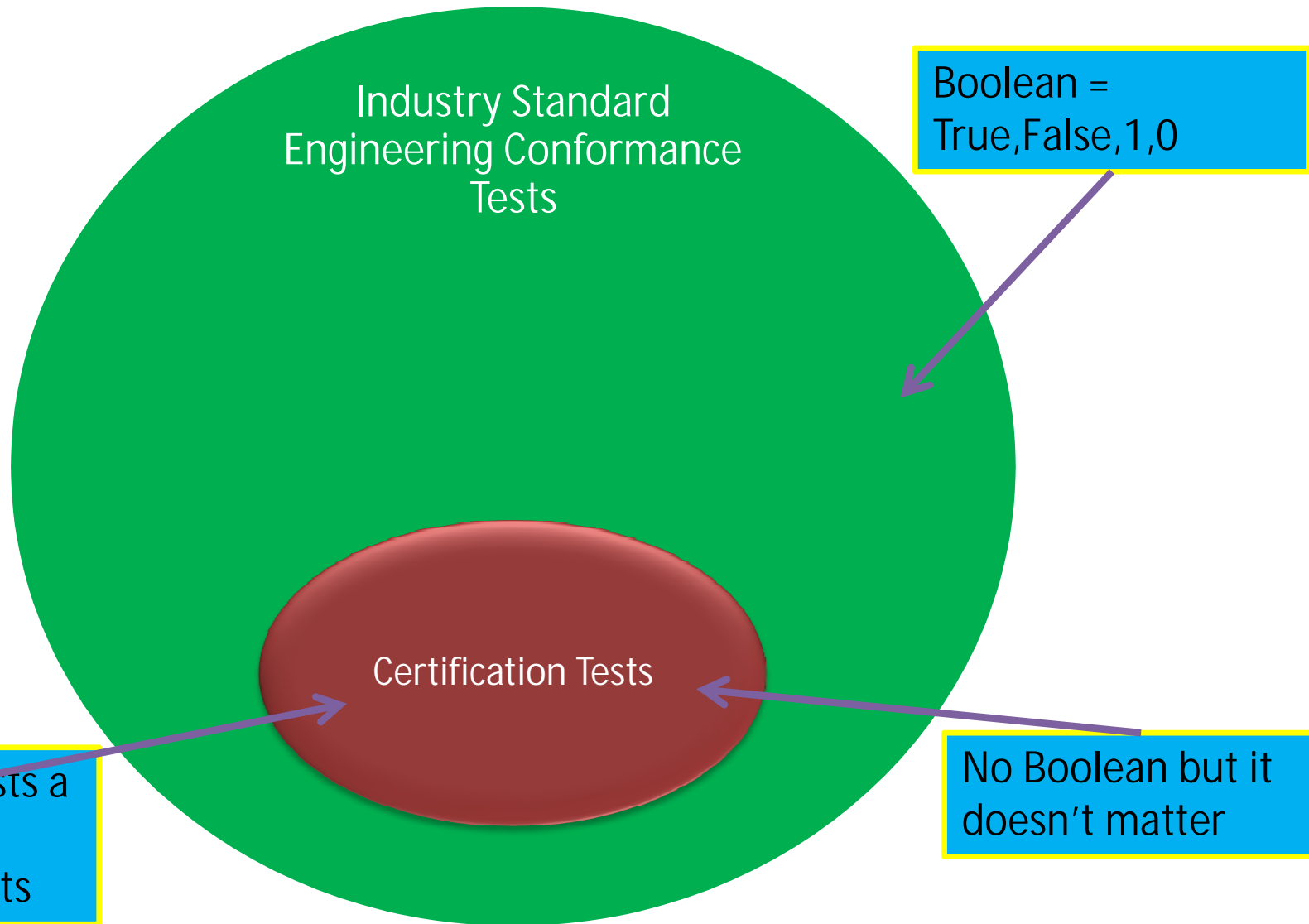
One Spec: One Test

- For each feature/function defined in a Standard Technical Specification...

- There should be a single set of "official" conformance tests

- Without such a model (one spec: one test) interoperability risks increase greatly

Integrated Conformance Testing & Certifications

Grid-Interop
Driving to Grid 2020

Industry Standard Engineering Conformance Tests

Boolean = True,False,1,0

Certification Tests

Certification Tests a Subset of Engineering Tests

No Boolean but it doesn't matter

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Benefits of Integrated Model

Improved efficiency and effectiveness of industry interoperability:

- Preparation for certification embedded in development process
- Streamline the certification process for vendors using standard conformance development test tools
    - Self-certification (with independent audit)
    - Preferential, accelerated certification
- Engineering feedback on certification tests will be earlier and broader, improving the certification tests rapidly

Combination of standardized engineering tests and certification tests accelerate and best insure interoperability of products

What Does Certification Mean?

- NOT ALL CERTIFICATIONS ARE CREATED EQUAL!
- Each ITCA (Interoperability Test and Certification Authority) decides what "certified" means for its standard
- Certifications are a great help but can mean different things for different standards – e.g.
    - Conformance subset vs broad conformance tests
    - Conformance vs interoperability tests
    - Specific function subset (Profile) vs single certification

Plugfests are Useful BUT

- ## Sporadic
  - 61850 Paris event first in 5 years

- ## Subset of certification tests
  - Which is a subset of comprehensive functional tests
  - Paris – 29 possible test cases vs 130+ Mandatory and 80+ Conditional Server tests in Certification

- ## Not all vendors participate with all products
  - Paris – 17 participants; 13 product vendors with 17 IEC 61850 conformant products

- What specific standard, version and conformance profile is the product certified against?
- Who conducted and issued the certification?
    - Is it current?
    - Does it apply to the specific proposed system or device?
- Is the system or device separately certified for interoperability?
- What specific standard profiles and devices is the certification applicable to?

Conclusions and Recommendations

- Customers that demand standard, interoperable products
- Technical Specification with minimal options and ambiguities
- Standard Conformance AND Interoperability Engineering tests
- Certifications that are integrated with development and test process