IEEE Conformity Assessment Program

IEEE Standards Association (IEEE-SA)

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TCBC Workshop
Baltimore, MD

IEEE:
World's Largest Professional Association Advancing Technology for Humanity

Our Global Reach

430,000+
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45
Technical Societies

160
Countries

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- Computer
- Computational Intelligence
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- Council on Electronic Design Automation
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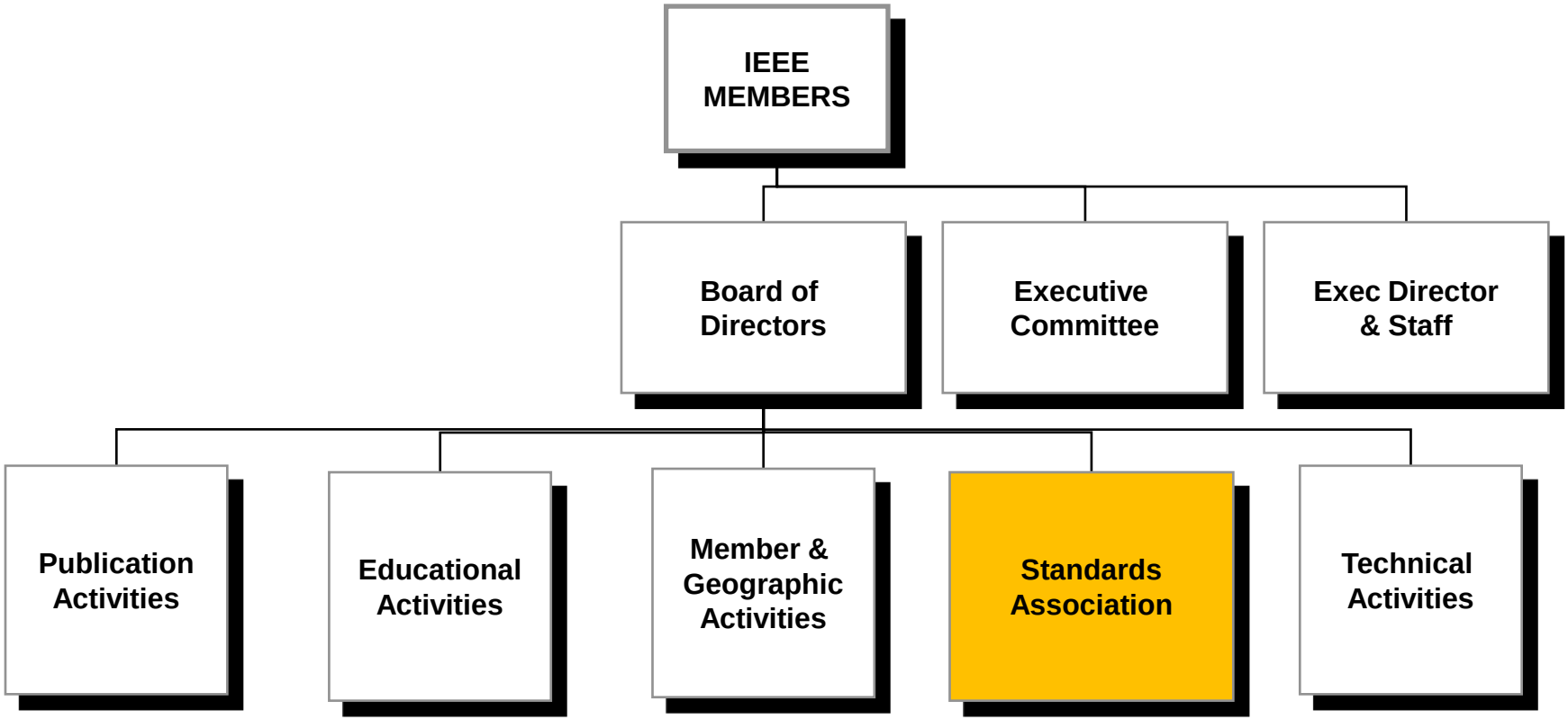
- Solid-State Circuits
- Systems Council
- Systems, Man, & Cybernetics
- Technology Management Council
- Ultrasonics, Ferroelectrics, & Frequency Control
- Vehicular Technology

How IEEE-SA Fits Within the IEEE



IEEE Standards Association (IEEE-SA)

- Globally recognized standards
- Over 900 active standards
- More than 500 standards under development
- 7,000 individual members
- 200 corporate members
- Over 20,000 standards developers worldwide

IEEE-SA Standards Drive Markets

Evolution of traditional country-based models for standards development to **market-driven models**

Open Process	Consensus-based	eTools	Global Community
• Open membership • Open participation	• Based on WTO core principles • Collaboration	• Facilitate remote participation, lessening travel costs	• Participation from around the world

Standardization is borderless:

Global standards sustain products and services for implementation and use by customers in a globalized world

IEEE-SA Builds Strong Global Collaboration

TTA

KATS Ministry of Knowledge Economy
Korean Agency for Technology and Standards

KEA

国家电网公司
STATE GRID
CORPORATION OF CHINA

TTC Telecommunication Technology Committee

KEA Korea Electronics Association

KSAE The Korean Society of Automotive Engineers

Asia

Europe

SAE International®

ETSI World Class Standards

Middle East

Africa

ISO International Organization for Standardization

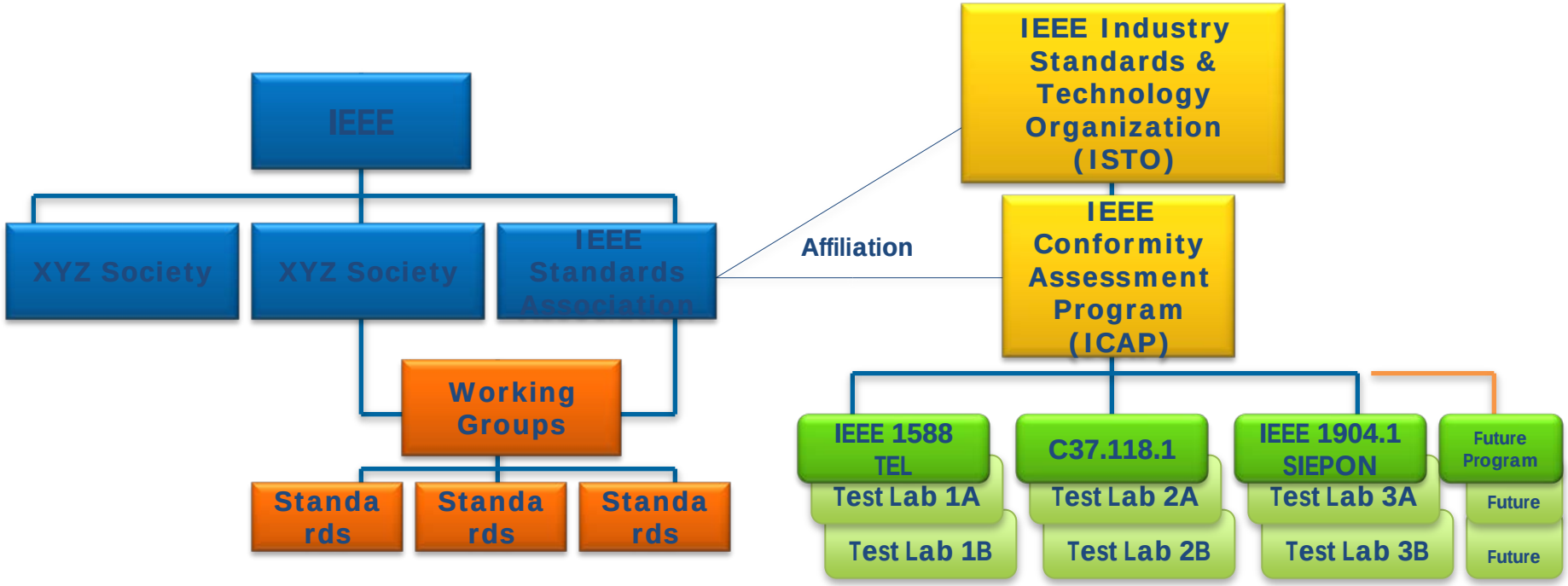
ITU

IEC Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

ICAP Completes the IEEE-SA Business/Standards Lifecycle

ICAP is a Program of IEEE-ISTO Supported by IEEE-SA

ICAP Introduction



ICAP: Provides programs and industry support and an operational structure that help bridge those standards development activities with the conformity assessment activities that accelerate market acceptance and enablement of new products and technologies in support of IEEE Standards.

Understanding Conformity Assessment

Standards are developed to ease adoption / use of products and solutions

What is Conformity Assessment?

- Conformity Assessment is the mechanism to verify and ensure conformance of a product or solution with the applicable standards
- Provides assurance and confidence a product or service meets requirements
- Key to consistent interpretation of results
- Empowers the user to make better purchasing decisions

Conformity Assessment Activities Include:

- Conformance, Interoperability, Inspection, Accreditation
- "Catch-all" term to address range of test-related activities

Demand Driver for successful implementation

- User should require IEEE certified products or implementations

Types of Conformity Assessment

1st Party / Suppliers Declaration of Conformity (SDOC)

- Self Declaration ; Companies conduct their own testing

2nd Party Conformity Assessment

- Conformity assessment conducted by the end purchaser of products (e.g., Service Providers) to ensure purchased products are deemed compliant or interoperable

3rd Party Conformity Assessment

- Conformity assessment being determined by an independent body

Related International Standards

Accreditation Bodies – ISO/IEC 17011

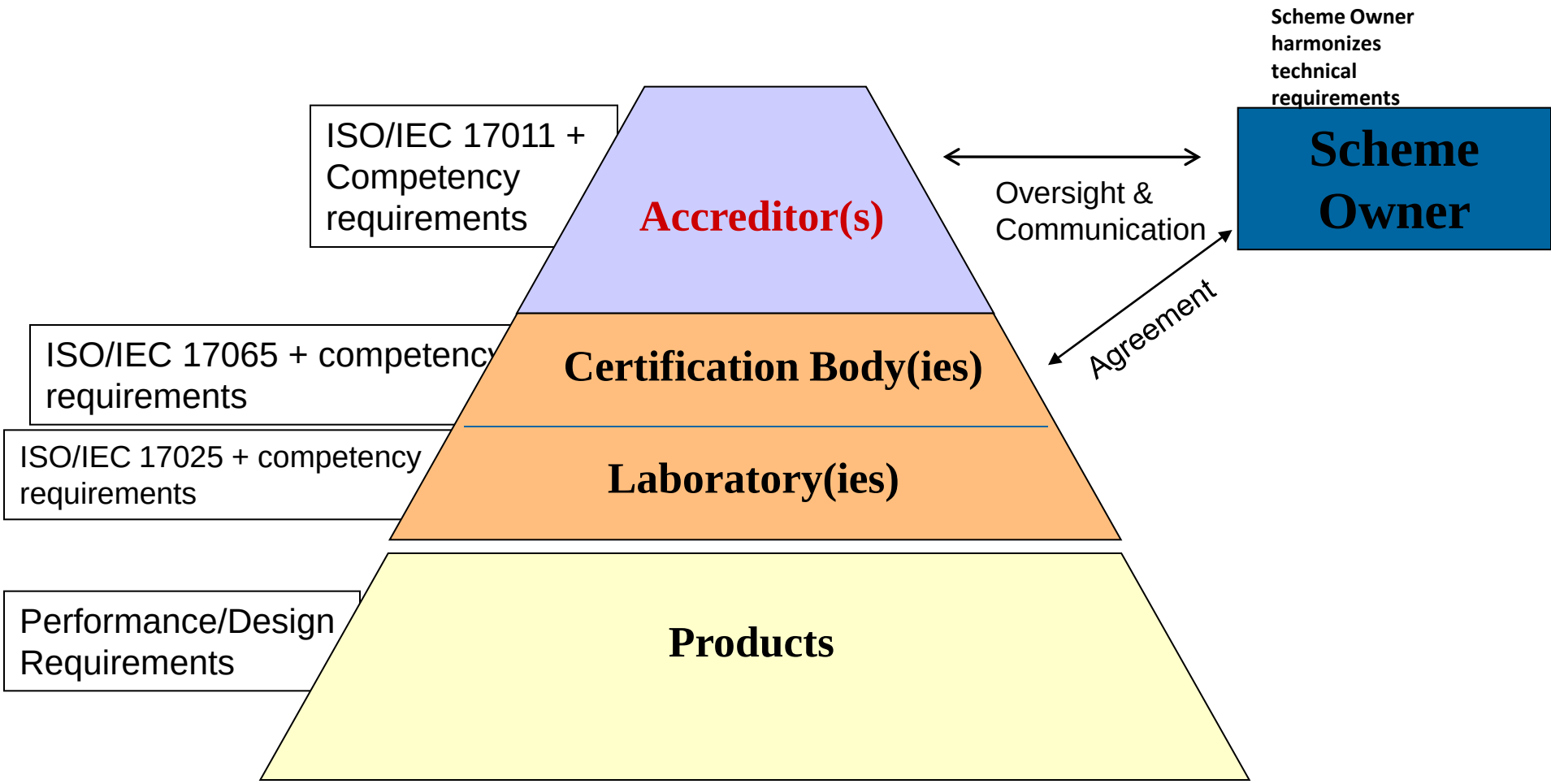
Certification Bodies - ISO/IEC 17065

Test Labs – ISO/IEC 17025

Benefits of Implementing a Conformity Assessment Program

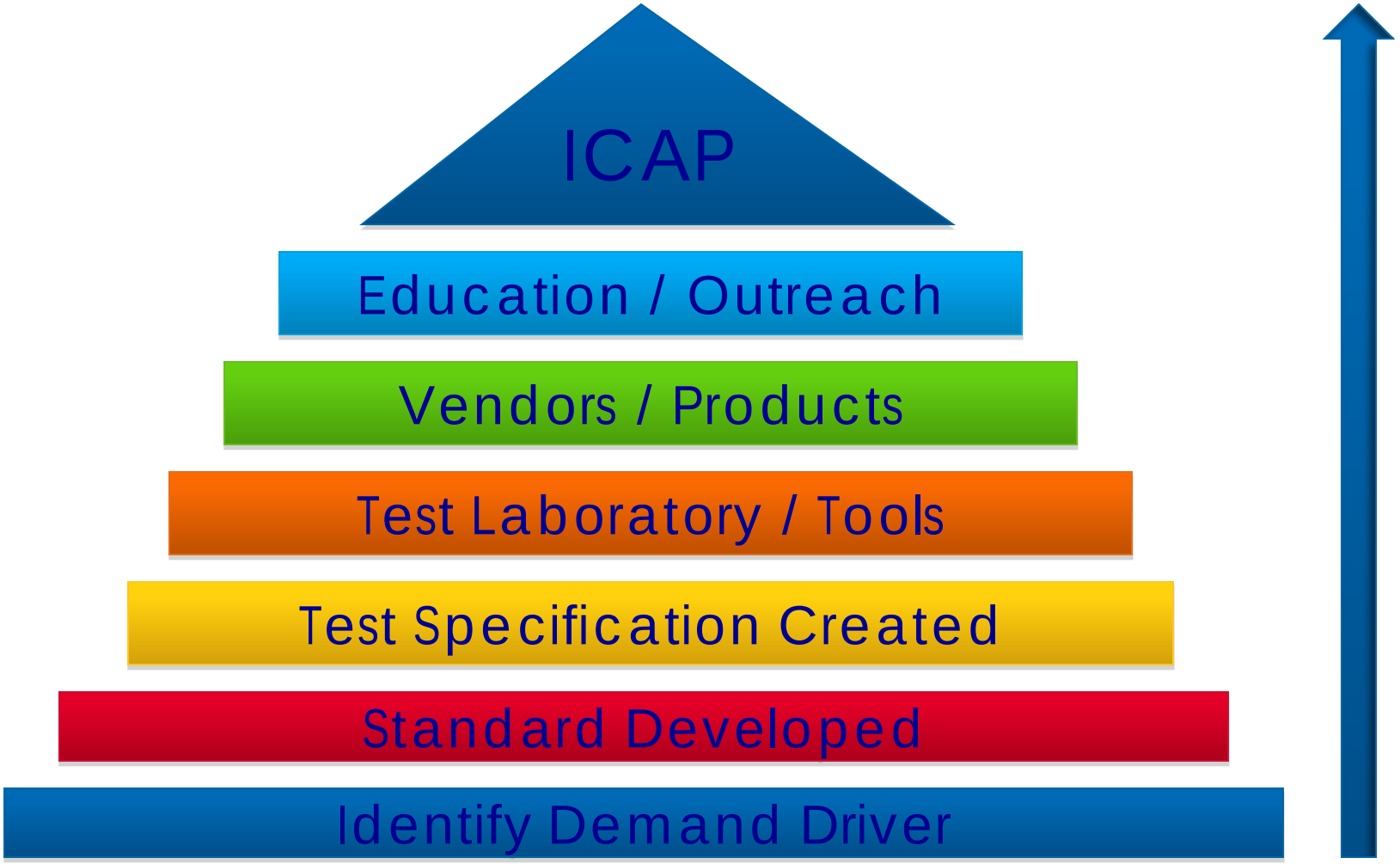
- Benefits of conformance test before deployment implementation
  - Early identification of non-conformances
  - Exact functionality of the protocol is identified
  - Multi-vendor solutions will have interoperability issues – helps identify such issues
  - New offerings will have bugs – helps to catch them
- Reduces the vendor's cost / need for re-tests for different end-users
- Establishes a baseline for performance expectation
- Eases interoperability
- Transparency based on common implementation / Test Authority

Conformity Assessment Certification Scheme – Single Scheme



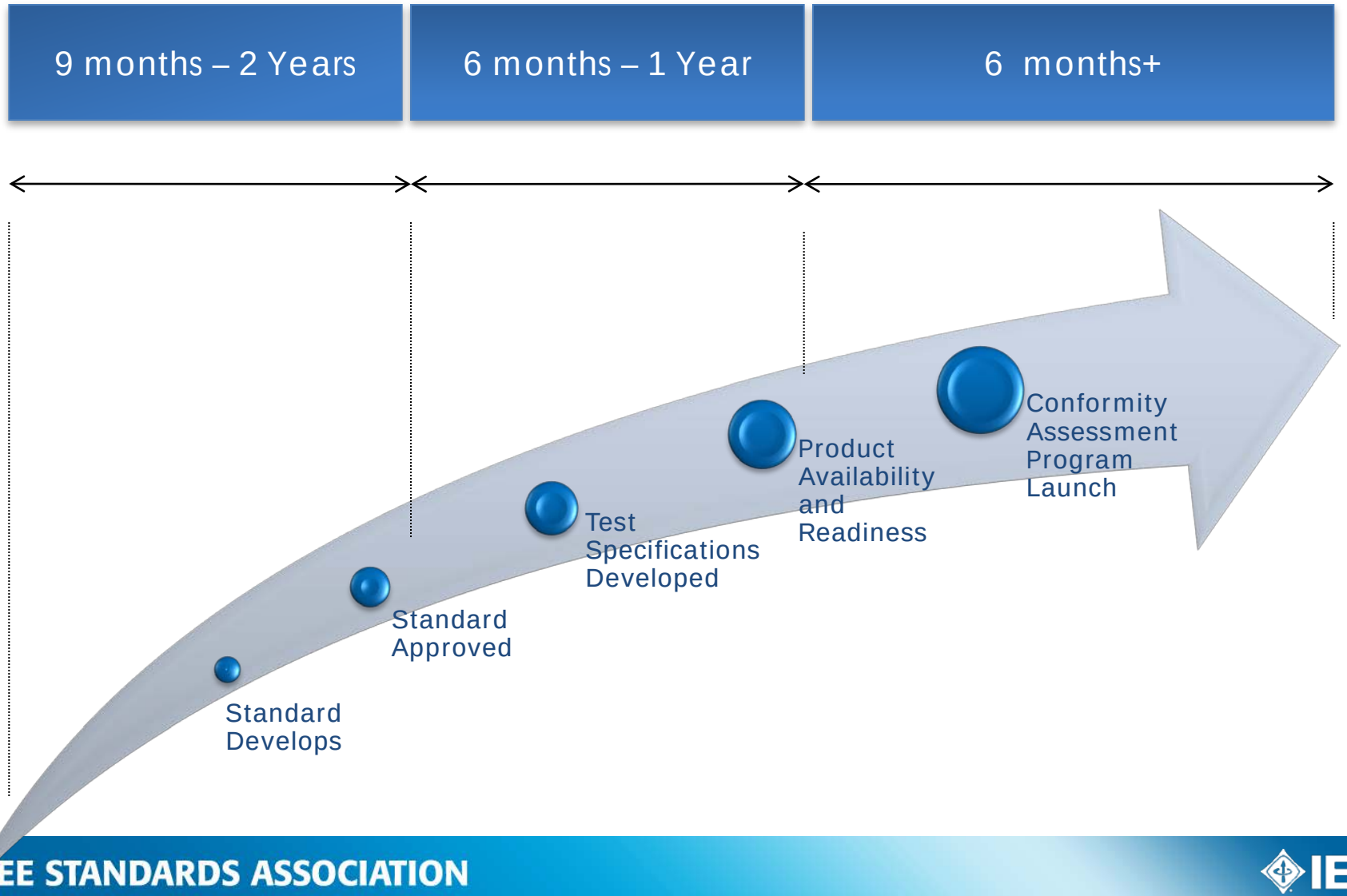
Courtesy of G.Gillerman @ NIST

ICAP Certification Framework



Certification Program Development Timeline

Standard – > Test Specs - > Program Launch



ICAP Business Models

WORKING GROUP CERTIFICATION PROCESS

1 IEEE Std. completed

2 Test Specification submitted to ICAP

3 ICAP distributes test spec to selected labs

4 Vendor submits equipment to one of the selected labs for testing

5 Lab submits test report to ICAP

6 ICAP issues a certificate, grants logo usage rights, and adds device to a registry

Perspective of Key Stakeholder – End-User

- Levels the playing field
  - The end-user (i.e. utilities, telecom carriers, etc) know what to expect
  - The manufacturers know what is expected of them
- Requiring a Certified Product from a vendor means:
  - Vendor makes the investment as a qualification cost
  - Early discovery of problems avoids dealing with unexpected behaviors during installation and over project life cycle
  - Vendor and User save dollars and time in Operation & Maintenance
- In the absence of an industry level Conformance Assessment program, an end-user has to establish its own internal program
  - Example, PG&E Proof-of-Concept (POC) Facility for Synchrophasor systems
    - Significant cost
    - Helped identify gaps and mature / develop industry Guides and Standards

Programs Under Active Development

Programs Under Active Development

IEEE 1588 Telecom (ITU G8265.1) (Launched)

- Standard that enables precise synchronization of clocks in measurement and control systems implemented with technologies such as network communication, local computing and distributed objects

Synchrophasor (IEEE C37.118.1)

- Key components include GPS Satellite synchronized clock, phasor measurement units (PMUs) & phasor data concentrator (PDC)

SIEPON (IEEE 1904.1)

- Service Interoperability in Ethernet Passive Optical Networks (SIEPON)addresses the need for global passive optical network devices to interoperate – plug & play interoperability
- Target market – passive optical networks, fiber-to-the-home (FTTH)

IEEE 1588 Power (IEEE C37.238)

- Standard specifies a common profile for the use of IEEE 1588 Precision Time Protocol (PTP) in power system protection, control, automation, and data communication applications utilizing an Ethernet communications architecture

Camera Phone Image Quality (CPIQ – IEEE P1858)

- This standard defines a standardized suite of objectives and subjective test methods for measuring camera phone image quality attributes , and it specifics tools and test methods to facilitate standards-based communication

IEEE 1588 Telecommunications Certification Program

Mission

- The IEEE 1588 Conformity Program currently focuses on providing the **telecommunication & power industries** with a timing & sync product certification mark
- The goal is to provide Industry a forum to develop IEEE 1588 certification tests and testing-related profiles
- Market demand will dictate the next vertical in the IEEE 1588 space that ICAP will support

Model

- **Build program around Standard's applications**
- Driven by Industry as well as several IEEE working group members
- **Industry recognized - Committee of Experts** provides additional level of integrity to test specs, documents and overall certification
- Develop test requirement documents, test case templates, test setup documents
- Formal review processes to ensure highest integrity of test suite
- End goal: Certification, Marking & Marketing of conforming products

Members

Participating Members

Committee of Experts

SIEPON – IEEE P1904.1

- What is IEEE P1904.1 (SIEPON)
  - Service Interoperability in Ethernet Passive Optical Networks (SIEPON)addresses the need for global passive optical network devices to interoperate – plug & play interoperability
  - Target market – passive optical networks, fiber-to-the-home (FTTH)
- WG developing Conformance Test Procedures in parallel with completion of Standard
- Market-leading, fiber-access technology, with worldwide deployments supporting more than 60 million subscribers today, and an anticipated subscriber base of more than 100 million by the end of 2013.
- Business and residential services, including IPTV, VoIP, commercial-grade data services, and cellular backhaul.

SIEPON – IEEE P1904.1

Mission

- The IEEE SIEPON Working Group currently focuses on developing the standard as well as the test procedure
- The goal is to provide Industry a developed and recognized test that provides SIEPON certification globally
- Market demand will dictate the next set of geographical test labs to conduct tests

Model

- **Build test around the SIEPON standard**
- Driven by Industry through the IEEE working group
- **Marketing Committee –** provides marketing outreach, communication and market awareness
- **Industry recognized – Technical Experts** provide integrity to test spec development, documents and overall certification
- Develop test requirement documents, test case templates, test setup documents
- Formal review processes to ensure highest integrity of test suite
- ICAP Manages testing and certification, functioning both as the certification authority and process auditor to maintain test lab integrity

Drivers

Synchrophasor IEEE C37.118

Mission

- The SCASC currently focuses on developing the test suite specification and the certification program
- The goal is to provide Industry a developed and recognized certification program that provides Synchrophasor certification globally
- Market demand will dictate the next set of geographical test labs to conduct tests

Model

- **Build test around the Synchrophasor standard**
- Driven by Industry through the IEEE working group
- **Marketing initiatives –** provides marketing outreach, communication and market awareness
- **Industry recognized – Technical Experts** provide integrity to test spec development, documents and overall certification
- Develop test requirement documents, test case templates, test setup documents
- Formal review processes to ensure highest integrity of test suite
- ICAP manages testing and certification, functioning both as the certification authority and process auditor to maintain test lab integrity

Participants

What are PMUs?

- Precise grid measurements (voltage, current & frequency) using GPS signals
- Taken at high speeds 30-120 observations per second compared to 1 every 4 seconds using conventional technology
- Better indication of grid stress
- 24 operational satellites currently in 2014
  - They are evenly spaced. At least 4 or more observable at any location on the earth
- PMU has evolved from being a piece of HW to a SW function
- Blackout in NW…..60 million lost power, phase angles were 2-3X the usual amounts and developed over minutes. Could have been prevented.

Conformance is necessary:

PMUs must work together in a big system!

- 21 or more PMU manufacturers
- More than 50 different models of PMU
- PMU functions included in “multifunction devices”:
  - protective relays
  - digital fault recorders
  - power quality meters
- PMUs will be used in almost every power transmission system worldwide.
- Each PMU has *18 or more* configurations of nominal frequency (F0), reporting rate (Fs), and class (M or P)

Documenting the need for PMU testing and certification

North American Synchrophasor Initiative (NASPI) Report of Task Force on Testing and Certification: https://www.naspi.org/File.aspx?fileID=1149

- *"The scope of synchrophasor technology reaches well beyond phasor measurement units (PMUs), so it would take a long time to cover the process for the entire system. It is recommended that the initial efforts should primarily focus on establishing a testing and certification process solely for PMU (performance IAW IEEE Std. C37.118.1-2011 and future amendments."*
- *"The guidance defined by the Testing and Certification Committee (TCC) of the Smart Grid Interoperability Panel (SGIP), summarized in this report, is highly recommended for the synchrophasor technology stakeholders to follow."*

NASPI Executive Summary

"It is recognized that synchrophasor technology is undergoing rapid changes and that both a PMU standard (IEEE Std. C37.118.1) and products will be undergoing changes in the near future; hence the testing and certification process is needed to make sure the new and existing products can be verified against the revised standard requirements."

"The need for testing and certification was revealed by published test results that existing products do not meet all the requirements specified in the existing standard. This creates a level of uncertainty as to how such products will perform when used for given applications. The testing and certification process has to provide comprehensive, multi-vendor results to allow users to assess PMU performance impact on applications."

"IEEE has initiated a PMU certification procedure for test laboratories. For IEEE to have a successful procedure and process in place, it created a Steering Committee to provide feedback from all the stakeholder groups. IEEE endeavors to adhere to the TCC recommendations for this process to succeed."

NASPI Recommendations

- *A PMU testing and certification program should be developed and managed by an industry-recognized and -approved body.*
- *PMUs placed into service should be tested by an accredited test organization and the test results be certified by an accredited certifying authority for compliance with the latest PMU standard.*
- *Products successfully completing testing and certification should be placed in an electronic database which references the product and the certification date.*
- *Vendors should strive to meet the latest PMU standards by submitting products with PMU functionality to approved test organizations for test and certification.*
- *Should a product undergo a change or system update that could impact the performance or functionality, the PMU should be retested for compliance.*
- *The initial goal of PMU testing and certification should be expanded to include other components of the synchrophasor system defined by existing standards.*
- *The eventual goal is to develop performance assessment procedures for testing and certifying system solutions used to implement given applications.*
- *The cost of testing and certification should be carefully evaluated by specifying differentiated test and certification requirements for different PMU applications.*

Steps being taken

IEEE Conformance Assessment Program (ICAP) is developing a conformance assessment program for PMUs.

NIST is developing a portable system to calibrate PMU calibrators that can be used as part of a PMU test laboratory assessment program.

Standards used by PMUs

IEEE Std. C37.118.1-2011 “Synchrophasor measurement”

- Amended by IEEE C37.118.1a

IEEE Std. C37.118.2-2011 “Synchrophasor communications”

IEEE Std. 754-1985 “Standard for Binary Floating Point Arithmetic”

Various communications standards (Ethernet, TCP, UDP, IEC 61850, etc.)

Various timing standards (GPS, IRIG Std. 200-04, Universal Time Coordinated (UTC), IEEE Std. 1588, etc.)

(future) IEEE PC37.240 “Standard for Cyber Security Requirements for Substation Automation, Protection and Control Systems.

IEEE ICAP PMU conformity assessment program is starting with IEEE C37.118.1-2011 “Synchrophasor measurements”

PMU Test Types

Type Testing (ICAP)

Manufacturing test

- determined by manufacturer

Commissioning tests

- determined by utilities

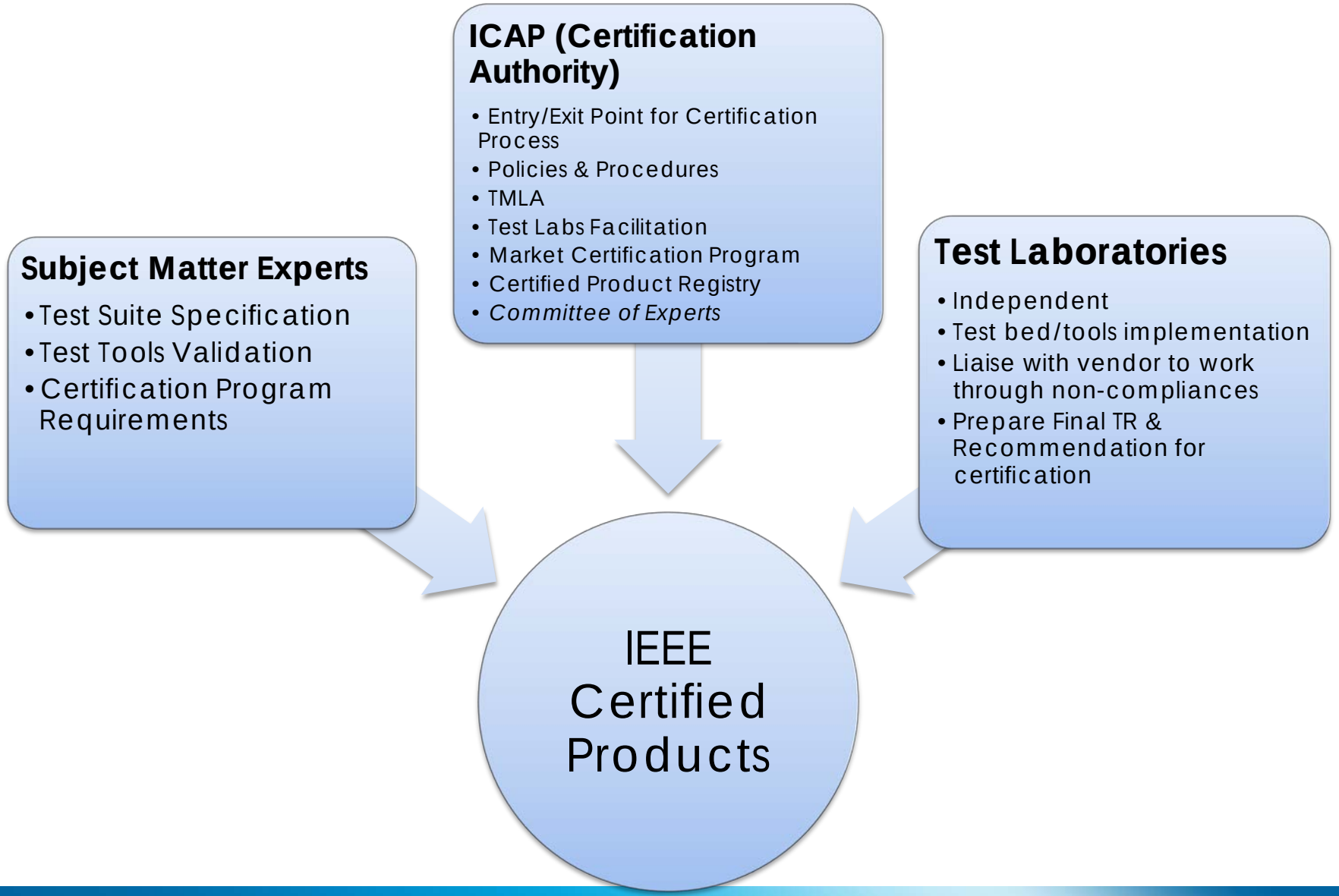
Periodic calibration

- recommended by manufacturer

Key elements of the Synchrophasor Conformity Assessment Program

- Synchrophasor Conformity Assessment Steering Committee (SCASC)
  - Comprised of stakeholders from utilities, vendors, academia and government
- PMU Certification Policy (Scheme) Document
  - Development underway by ICAP; being reviewed by the SCASC
- Test Suite Specification (TSS)
  - Based on IEEE C37.118.1 and in accordance with the Interoperability Process Reference Manual 2.0 (IPRM)
- Close ties with standards setting organizations
  - Many SCASC members are also leading members of IEEE PSRC and IEC synchrophasor standards working groups
- Test laboratories: Open invitation for PMU test laboratories to participate
- Test laboratory Authorization
  - ICAP assesses quality and technical competence of laboratories utilizing IEC/ISO 17025
  - NIST is developing a mobile calibration system for PMU calibrators

Roles of Entities



Synchrophasor Test Suite Specification (TSS)

Purpose / Scope	PMU Features	Test Equipment	Test Signals	Test Result Calculations	Test Plans (procedures)	Test Result Calculation	Test Reporting	Test System Calibration

- Purpose:
  - Procedures and requirements for test laboratories
  - In accordance with the IPRM
  - Unambiguous test plans
  - Sometimes more specific than the standard to resolve ambiguities

- Scope:
  - IEEE Std. C37.118.1-2011 and amendment PC37.118.1a
  - PMU Performance ONLY - limit the scope so can be completed within two (2) years
  - Data transmission protocol (IEEE C37.118.2) testing MAY be added after performance testing program is under way

Equipment needed to test PMUs

Timing reference (e.g. GPS Receiver)

Signal Source (3 phase Voltage and Current)

Signal Reference (synchrophasor, frequency and ROCOF of the sourced signal)

PMU Data receiver (TCP / UDP)

Means of comparing the PMU reports to the signal reference

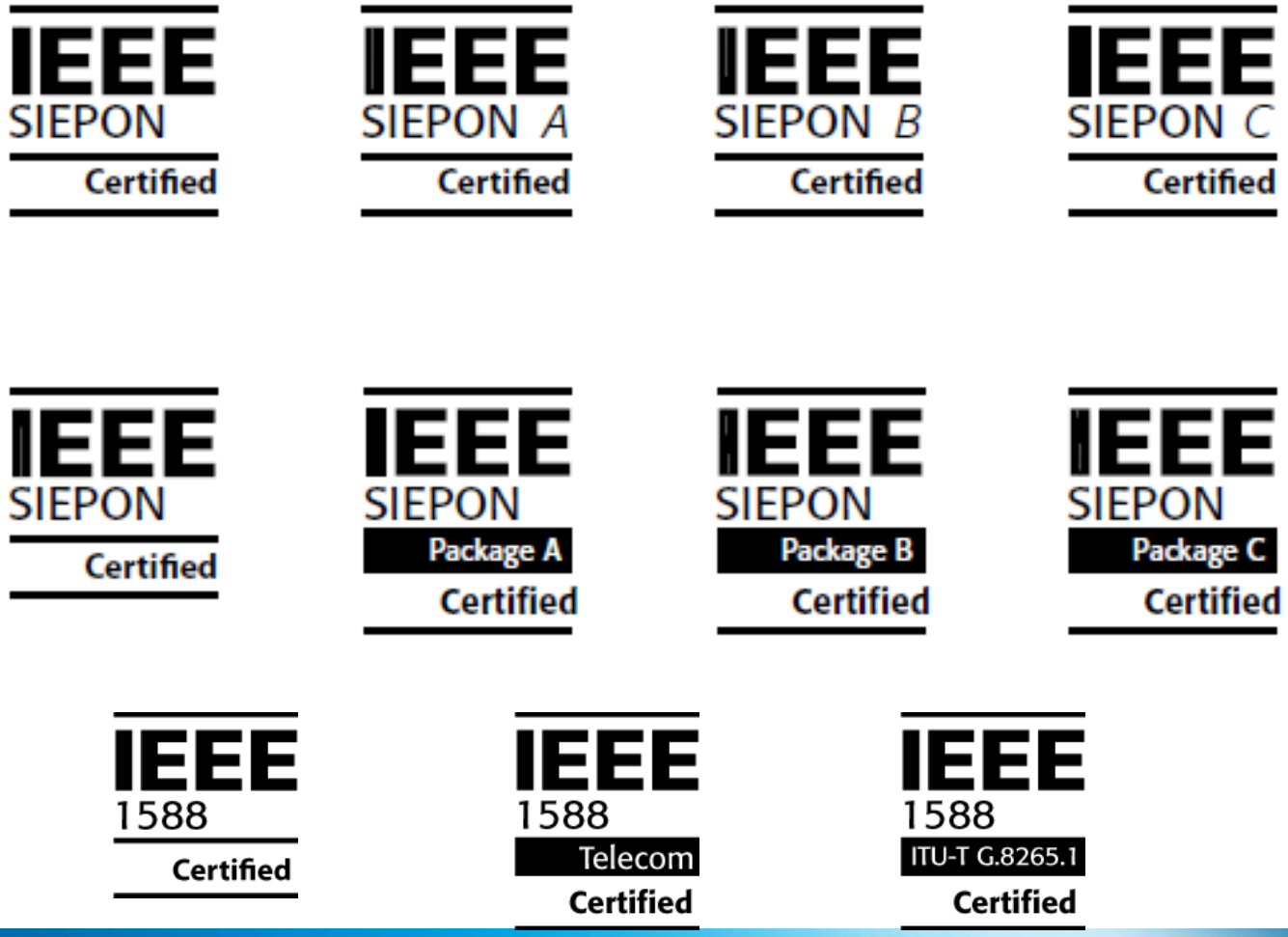
Means of publishing the results.

IEEE Certification Mark

Certification Mark Defined

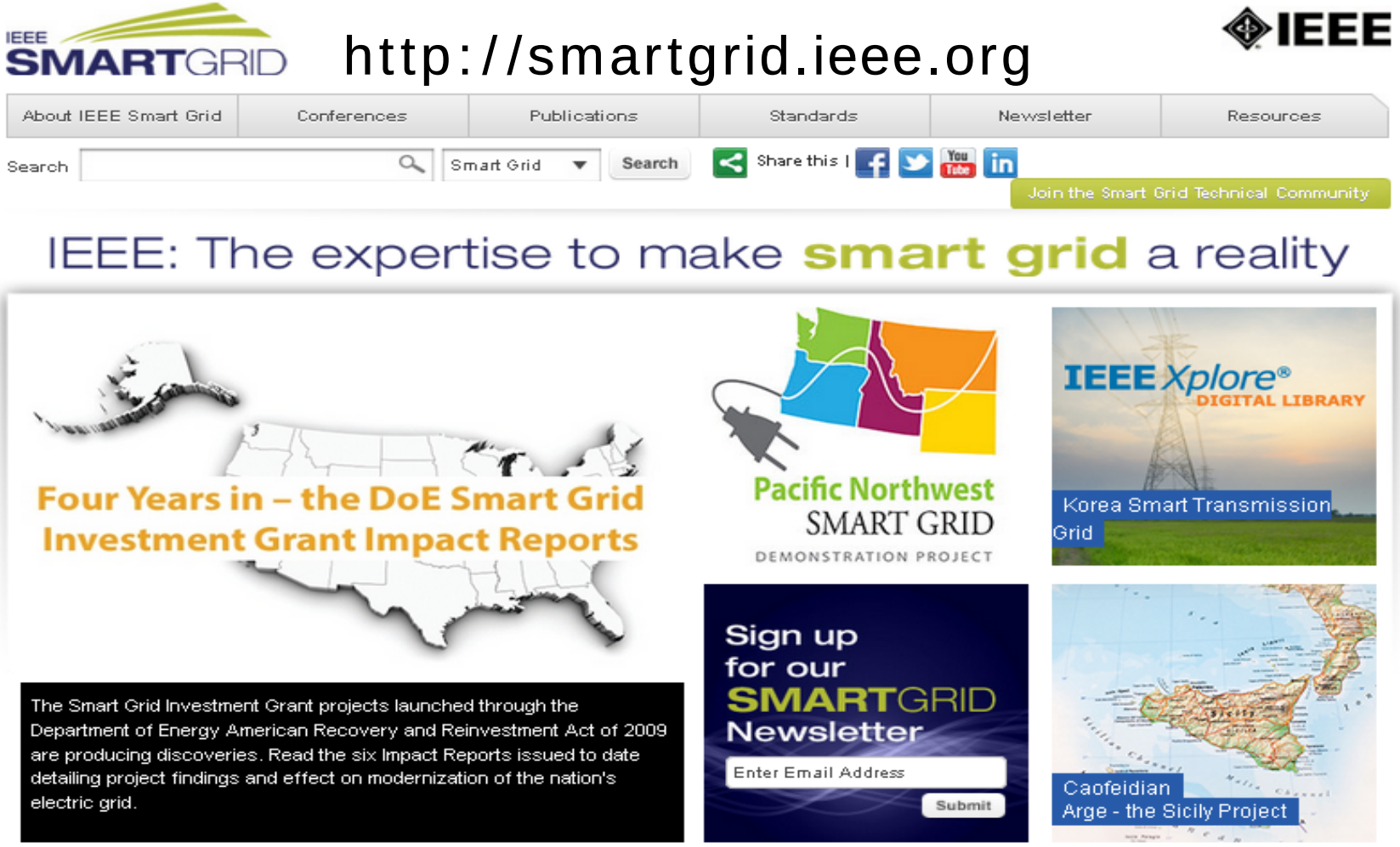
A certification mark is any **word, phrase, symbol or design**, or a combination thereof owned by one party who **certifies the goods and services of others when they meet certain standards.** The **owner of the mark exercises control** over the use of the mark; however, because the sole purpose of a certification mark is to indicate that certain standards have been met, **use of the mark is by others.**

The IEEE Certification Mark – (draft examples)



IEEE-SA Smart Grid Portal

- Single location to identify all IEEE Standards, publications, conferences IEEE resources associated with Smart Grid



Additional Information & Details

IEEE Standards Association:

- http://standards.ieee.org

Overview of IEEE-SA standards development:

- http://standards.ieee.org/develop/overview.html

ICAP

- http://www.ieee-isto.org/icap-program

Industry Connections:

- http://standards.ieee.org/prod-serv/indconn

IEEE Smart Grid standards:

- http://smartgrid.ieee.org/standards

IEEE Contacts

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