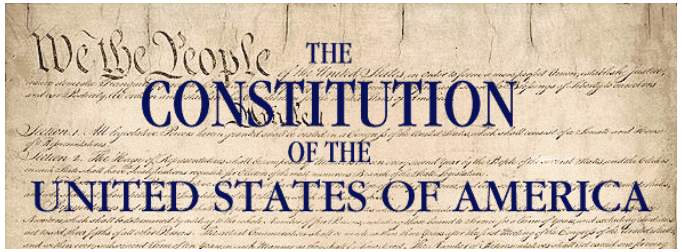
Consensus Safety Measurement Methodologies for ADS-Equipped Vehicles

June 25-26, 2019

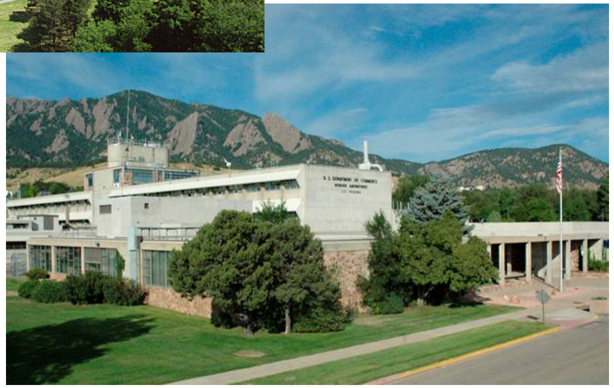
Chris Greer
chris.greer@nist.gov

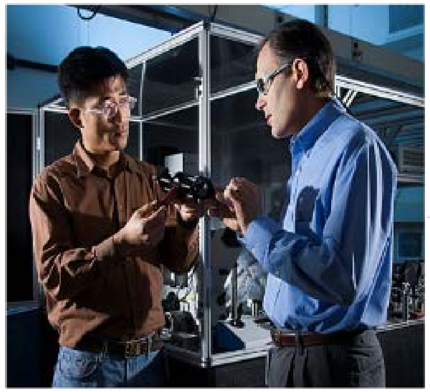


- Article I, Section 8: The Congress shall have the power to…*fix the standard of weights and measures*
- National Bureau of Standards established by Congress in 1901
- Renamed in the NIST Act of 1988

Gaithersburg, MD

Boulder, CO





People

Employees
& Associates

3400+ Federal Employees
(1800+ technical staff, 1000+ PhDs)
3800+ NIST Associates and Facilities Users

NIST Mission

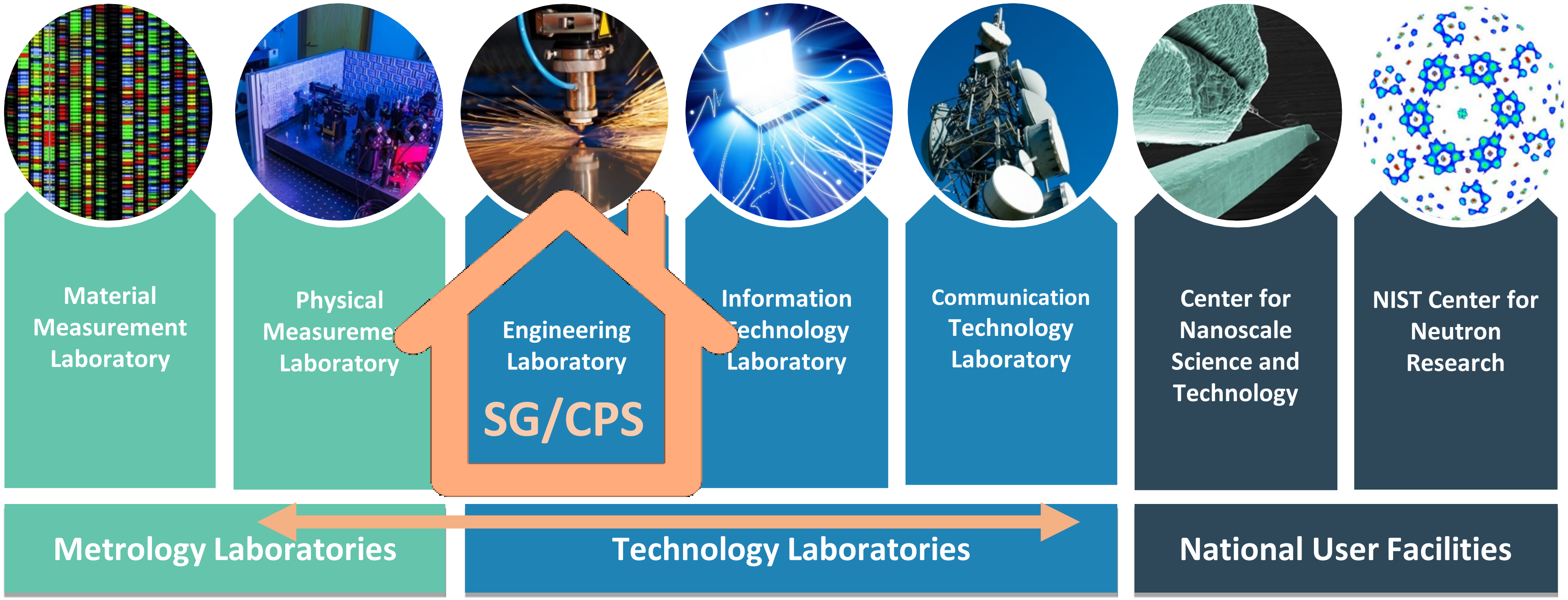
To promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life

Measurement Science – Creating the experimental and theoretical tools – methods, metrics, instruments, and data – that enable innovation

Standards – Disseminating physical standards, providing technical expertise to documentary standards that enable interoperability and

Technology – Driving innovation through knowledge dissemination and public-private partnerships to bridge gap between discovery & marketplace

NIST Laboratory Programs



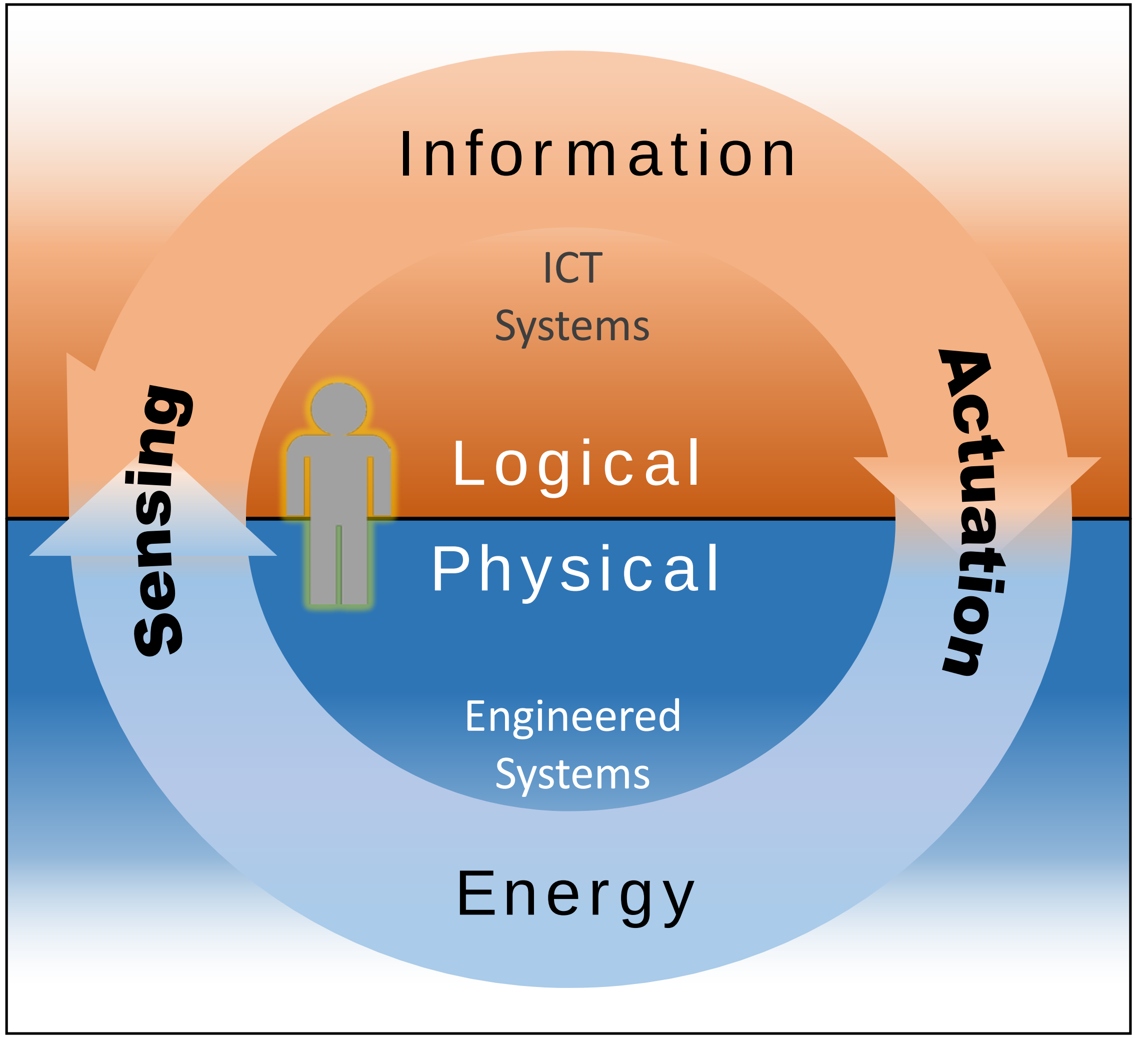
Driving innovation through Measurement Science and Standards

Accelerating the adoption and deployment of advanced technology solutions

Providing world class, unique, and cutting-edge research facilities

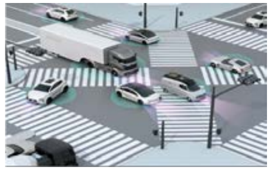
Cyber-Physical Systems and Internet of Things

Cyber-Physical Systems (CPS) and Internet of Things (IoT) comprise interacting digital, analog, physical, and human components engineered for function through integrated logic and physics.



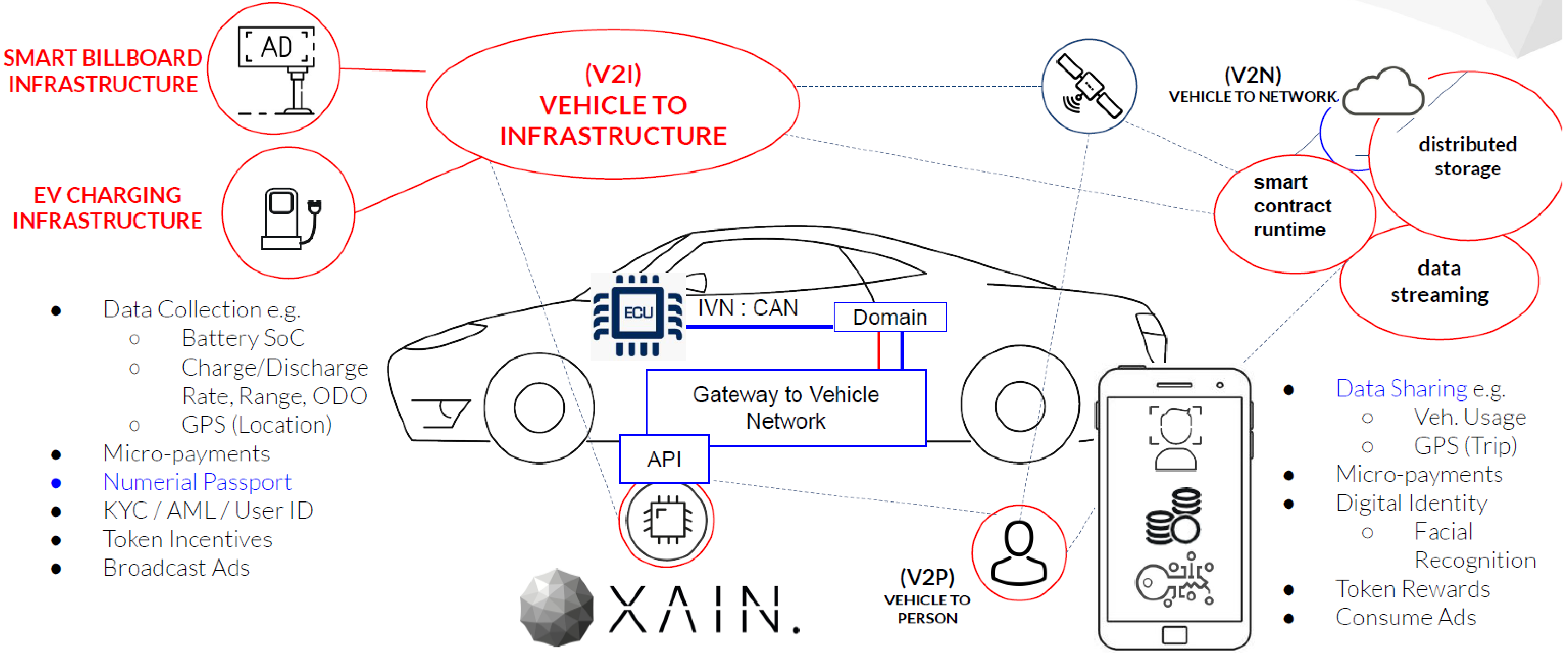
Smart Grid

Smart Cities



Smart
Transportation

Enabling Innovation



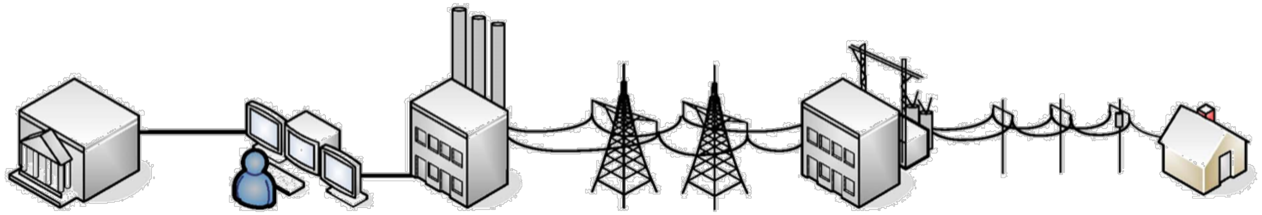
- Data Collection e.g.
  - Battery SoC
  - Charge/Discharge Rate, Range, ODO
  - GPS (Location)
- Micro-payments
- Numerial Passport
- KYC / AML / User ID
- Token Incentives
- Broadcast Ads

- Data Sharing e.g.
  - Veh. Usage
  - GPS (Trip)
- Micro-payments
- Digital Identity
  - Facial Recognition
- Token Rewards
- Consume Ads

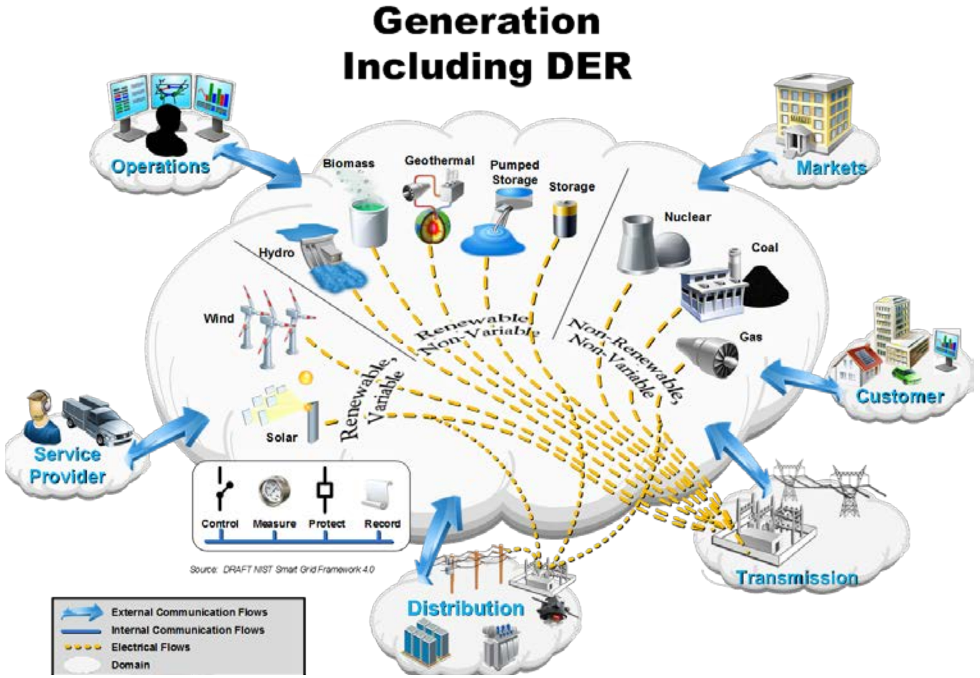
Source: Michael Huth, Imperial College London

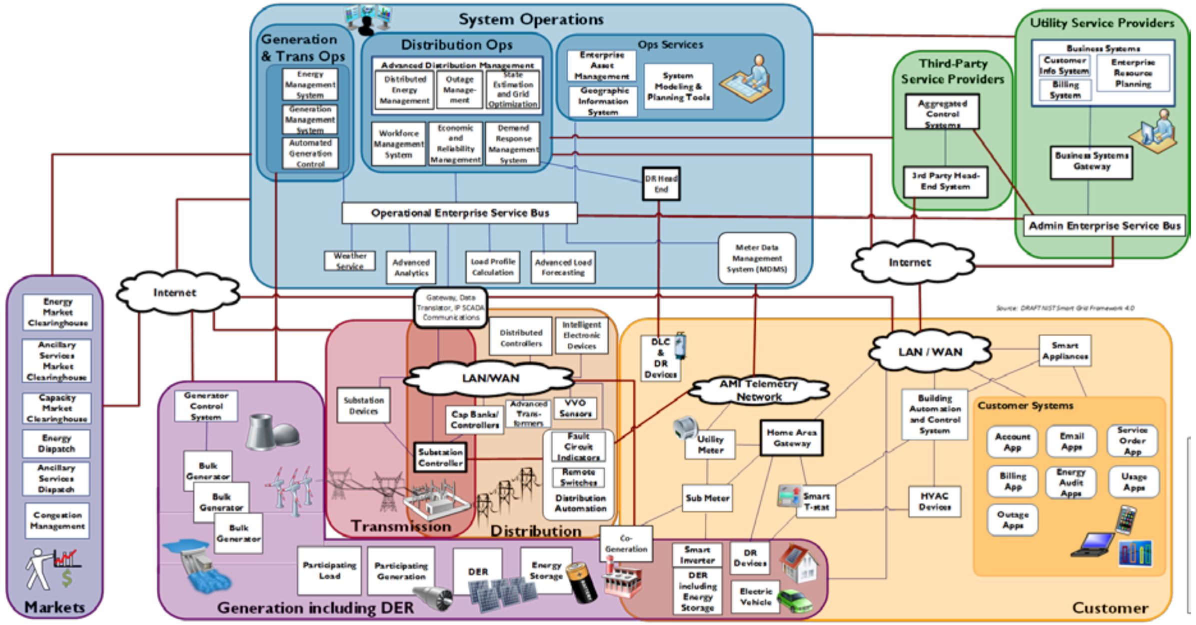
Electric Grid Transformation

Legacy Grid

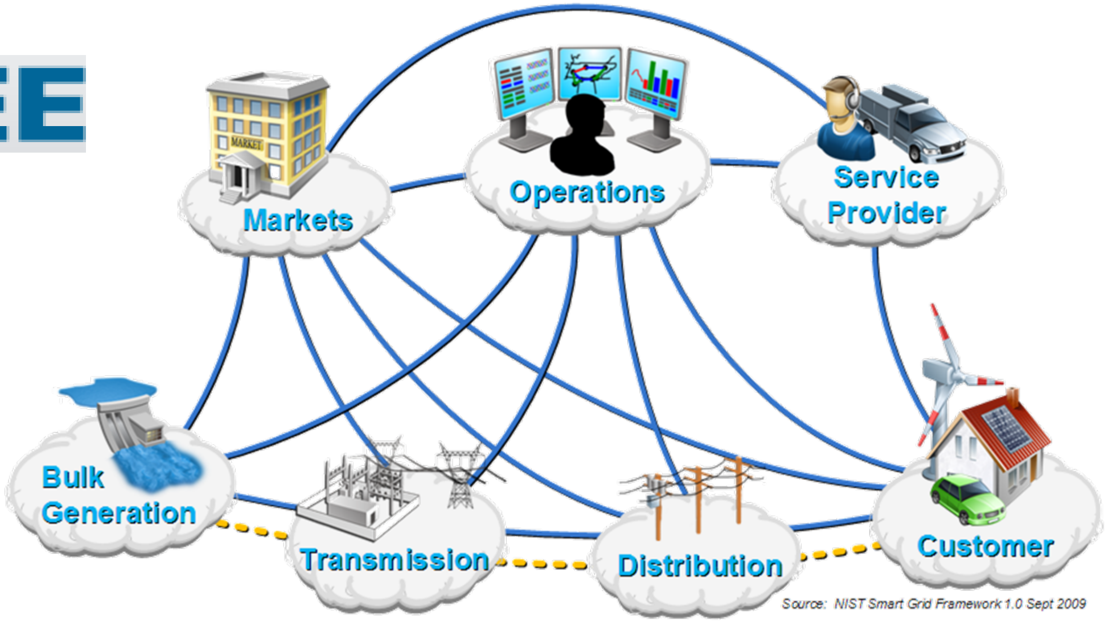


Smart Grid





Smart Grid Coordination



State Regulators
NARUC

NIST Special Publication 1108

NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0

NIST Special Publication 1108R2

NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 2.0

NIST Special Publication 1108r3

NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 3.0

NISTIR 7628 Revision 1

Guidelines for Smart Grid Cybersecurity

Volume 1 - Smart Grid Cybersecurity Strategy, Architecture, and High-Level Requirements

The Smart Grid Interoperability Panel – Smart Grid Cybersecurity Committee

http://dx.doi.org/10.6028/NIST.IR.7628r1

5236 IEEE TRANSACTIONS ON POWER SYSTEMS, VOL. 33, NO. 5, SEPTEMBER 2018

MMSE-Based Analytical Estimator for Uncertain Power System With Limited Number of Measurements

Hasnae Bilil, *Member, IEEE* and Hamid Gharavi, *Life Fellow, IEEE*

2882 IEEE TRANSACTIONS ON SMART GRID, VOL. 10, NO. 3, MAY 2019

A Fast Recursive Algorithm for Spectrum Tracking in Power Grid Systems

B. Hu, *Senior Member, IEEE*, and H. Gharavi, *Life Fellow, IEEE*

NIST Special Publication 1900-750

The Transactive Energy Abstract Component Model

Martin Burns
Eugene Song
David Holmberg

NIST Special Publication 1900-801

NIST Smart Grid Interoperability Test Tools

Dhananjay Anand
Kevin G. Brady Jr.
Eugene Song
Cuong Nguyen
Kang Lee
Gerald FitzPatrick
Allen Goldstein
Ya-Shian Li-Baboud

PAP	PAP Project	Standards Products
0	Meter Upgradeability Standard	•NEMA SG-AMI 1-2009: Requirements for Smart Meter Upgradeability
1	Role of IP in Smart Grid	•IETF RFC6272: Internet Protocols for the Smart Grid
3	Common Specification for Price and Product Definition	•OASIS EMIX: Energy Market Information eXchange
4	Common Schedule Communication Mechanism for Energy Transactions	•OASIS WS-Calendar: Web Services Calendar
5	Standard Meter Data Profiles	•AEIC Metering Guidelines V2.1
6	Translate ANSI C12.19 to and from a Common Semantic Model	•White Paper: Mapping of ANSI C12.19 End Device Tables to UML model
9	Standard DR and DER Signals	•OpenADR 2.0 Profile A •SEP 2.0
10	Standard Energy Usage Information	•NAESB REQ 18/WEQ 19: PAP10 Energy Usage Information
11	Common Object Models for Electric Transportation	•SAE J1772: Electrical Connector between PEV and EVSE •SAE J2836/1-3: Use Cases for PEV Interactions •SAE J2847/1-3: Communications for PEV Interactions
13	Harmonization of IEEE C37.118 with IEC 61850 and Precision Time Synchronization	•IEEE C37.238-2011: IEEE Standard Profile for Use of IEEE 1588 Precision Time Protocol •IEC 61850-90-5: Use of IEC 61850 to transmit synchrophasor information per IEEE C37.118
14	Transmission & Distribution Power Systems Model Mapping	•IEEE C37.239 COMFEDE •Relay Settings Guideline
15	Harmonize Power Line Carrier Standards for Appliance Communications in the Home	•NISTIR 7862 •IEEE 1901-2010 •ITU-T G.9960 •ITU-T G.9972 •ITU-T G.9961 •ITU-T G.9955 •ITU-T G.9956
18	SEP 1.x to SEP 2 Transition and Coexistence	•SGIP 2011-0008_1: SEP 1.x to SEP 2.0 Transition and Coexistence White Paper
19	Wholesale Demand Response Communication Protocol	•OpenADR 2.0 Profile B •Proposed Wholesale Demand Response Communication Protocol (WDRCP) extensions for the IEC Common Information Model

Framework Process

- Follow the community lead
- Leverage existing standards, guidelines, and best practices
- Convene in open, transparent processes
- Support technology-neutral, business model-neutral approaches
- Ensure the application of sound technical foundations
- Contribute to voluntary, open, consensus-based standards

Next Steps

NIST Special Publication 1500-201

Framework for Cyber-Physical Systems: Volume 1, Overview

Version 1.0

Cyber-Physical Systems Public Working Group
Smart Grid and Cyber-Physical Systems Program Office
Engineering Laboratory

This publication is available free of charge from:
https://doi.org/10.6028/NIST.SP.1500-201

National Institute of Standards and Technology
U.S. Department of Commerce

NIST Special Publication 1108r3

NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 3.0

Smart Grid and Cyber-Physical Systems Program Office
and Energy and Environment Division,
Engineering Laboratory

in collaboration with
Quantum Measurement Division,
Semiconductor and Dimensional Metrology Division,
and Electromagnetics Division,
Physical Measurement Laboratory
and
Advanced Network Technologies Division
and Computer Security Division,
Information Technology Laboratory

http://dx.doi.org/10.6028/NIST.SP.1108r3

National Institute of Standards and Technology
U.S. Department of Commerce

A Consensus Framework for Smart City Architectures

IES-City Framework
(Internet-of-Things-Enabled Smart City Framework) Release v1.0 20180930

This IES-City Framework is the product of an open, international public working group seeking to reduce the high cost of application integration through technical analyses of existing smart city applications and architectures. This Framework documents the findings of the authors and provides valuable tools that are based on the findings and that can lower barriers to an expanded smart city marketplace.

Currently, three primary barriers exist that inhibit widespread deployment of effective, powerful smart city solutions:

1. Inadequate information and knowledge transfer: Most smart city deployments are based on custom systems that cannot exchange information with other cities, and therefore, are neither extensible nor cost-effective.
2. Diverse standards: Current architectural standardization efforts have not yet converged. This creates uncertainty among stakeholders [1]. There is a lack of consensus on both a common language/taxonomy and smart city architectural principles [2]. The result is that the many groups with smart city interests are likely to generate standards and practices that are divergent, perhaps even contradictory, which would not optimally serve the global smart city community.
3. Poor scalability: A third barrier is the insufficient interoperability and scalability of underlying Internet of Things (IoT), and Cyber-Physical Systems (CPS) technologies that provide the foundation for many smart cities applications [3].

Additional barriers include lack of resources, lack of clear principles for prioritization, and limited access to the necessary technical expertise and experience.

To lower these barriers, NIST and its partners, below, convened this international public working group to compare and distill a consensus language, taxonomy, and framework of common architectural features to enable smart city solutions that meet the needs of modern communities.

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