NIST Cyber Physical Systems Public Working Group

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Information Technology Laboratory
NIST

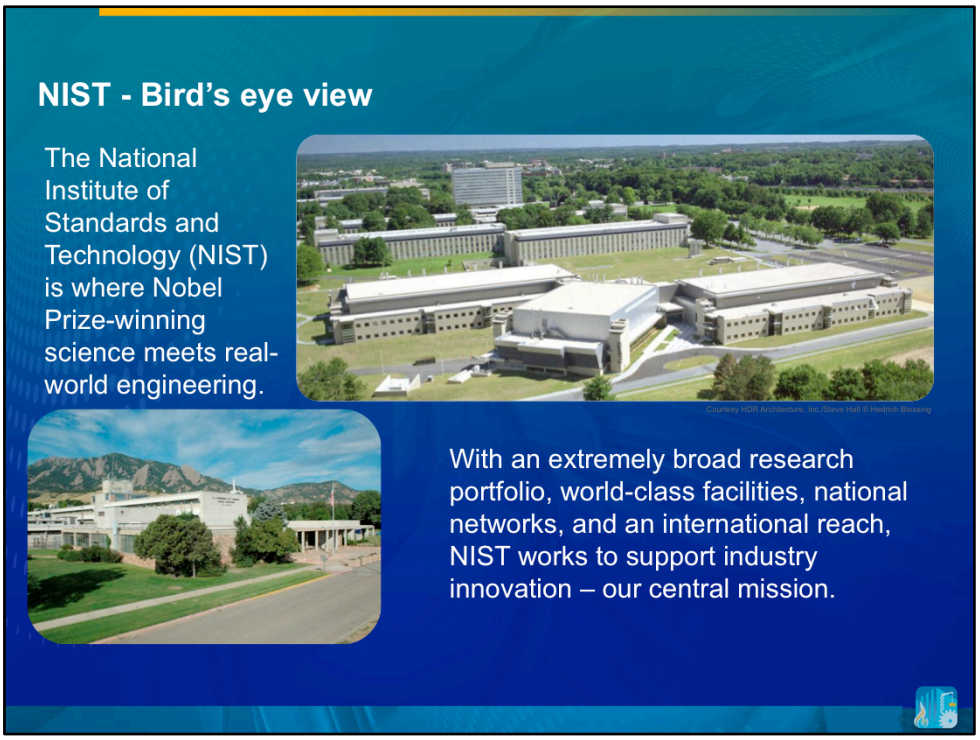
NIST Cyber Physical Systems Public Working Group

Outline

- Overview of NIST
- NIST FY15 Budget Request – CPS Initiative
- Examples of Current and Previous Working Groups
- CPS Public Working Group

NIST's 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



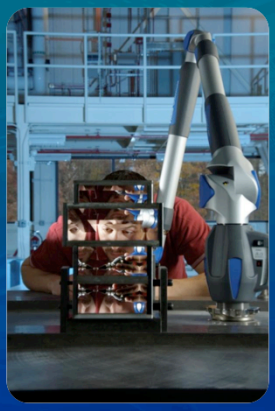
The United States' national measurement laboratory, NIST is where Nobel Prize-winning science meets real-world engineering.

Established in 1901, NIST is among the nation's first physical science laboratories.

With an extremely broad research portfolio, world-class facilities, national networks, and an international reach, NIST works to support industry innovation – our central mission.

NIST: Basic Stats and Facts

- Major assets
  - ~ 3,000 employees
  - ~ 2,800 associates and facilities users
  - ~ 1,300 field staff in partner organizations
  - Two main locations: Gaithersburg, Md., and Boulder, Colo.
  - Four external collaborative institutes: basic physics, biotech, quantum, and marine science
  - Nobel Prize Winners: 1997, 2001, 2005, 2007, 2013



FY 2015 Budget Request $900 M

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NIST FY2015 Budget Request

6 Initiatives:

- Cyber-Physical Systems
- Synthetic Biology
- Lab-to-Market
- Advanced Materials
- Measurement Science and Standards for Forensic Science Infrastructure

NIST FY2015 Budget Request

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FY15 Request: CPS Initiative

3 Components:

- Methods for scalable CPS design and engineering
  - Consensus architectures and language
  - Formal methods for models/simulations
  - Tools, platforms, test beds
- CPS performance prediction, measurement, and management
  - Performance metrics
  - Security and Privacy
  - Sustainability and energy use
  - Resilience
- CPS Alliance
  - Academia/Industry/Government forum for communication and collaboration

FY15 Request: CPS Initiative

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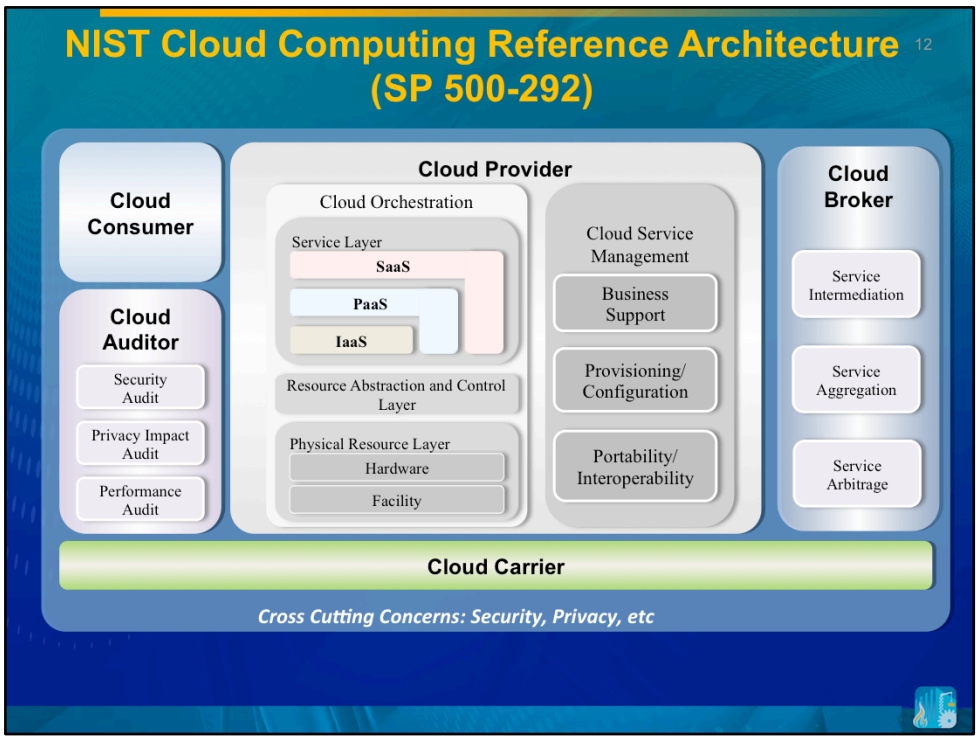
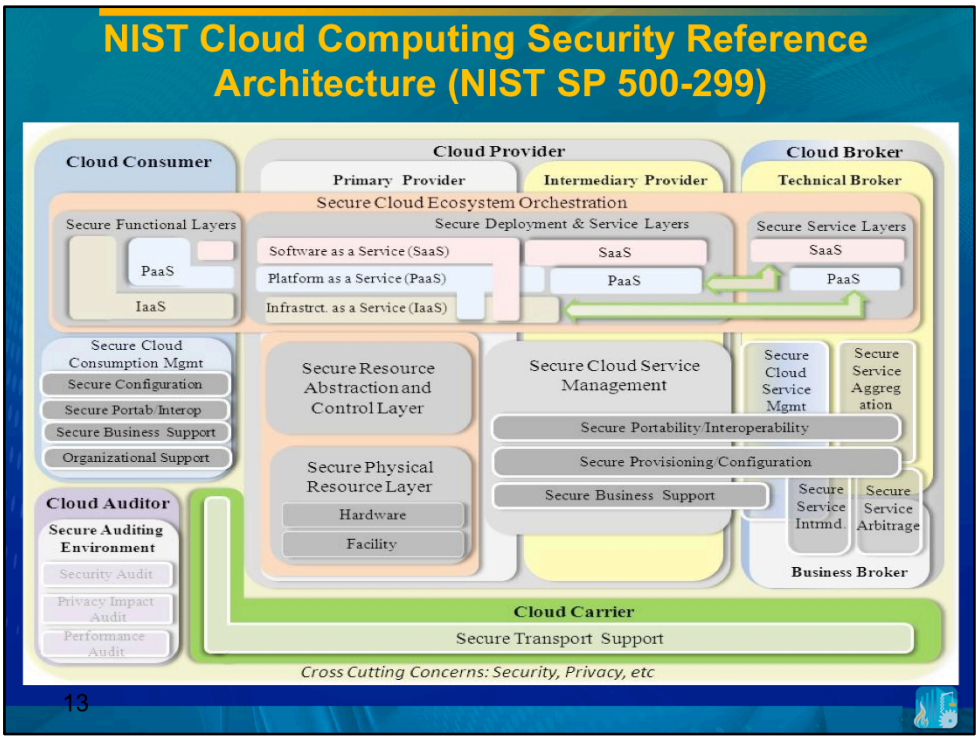


NIST SP 500-292. This body of work brought together the various stakeholders to develop the taxonomy to communicate the components and offerings of cloud computing in a vendor-neutral way. It does not seek to stifle innovation by defining a prescribed technical solution. Actor/Role-based model and the necessary architectural components for managing and providing cloud services such as service deployment, service orchestration, cloud service management, security and privacy.

- A **Cloud Consumer** is an individual or organization that acquires and uses cloud products and services.
- The purveyor of products and services is the **Cloud Provider**.
- The **Cloud Broker** acts as the intermediate between consumer and provider and will help consumers through the complexity of cloud service offerings and may also create value-added cloud services as well.
- The **Cloud Auditor** provides a valuable inherent function for the government by conducting the independent performance and security monitoring of cloud services.
- The **Cloud Carrier** is the organization who has the responsibility of transferring the data akin to the power distributor for the electric grid.

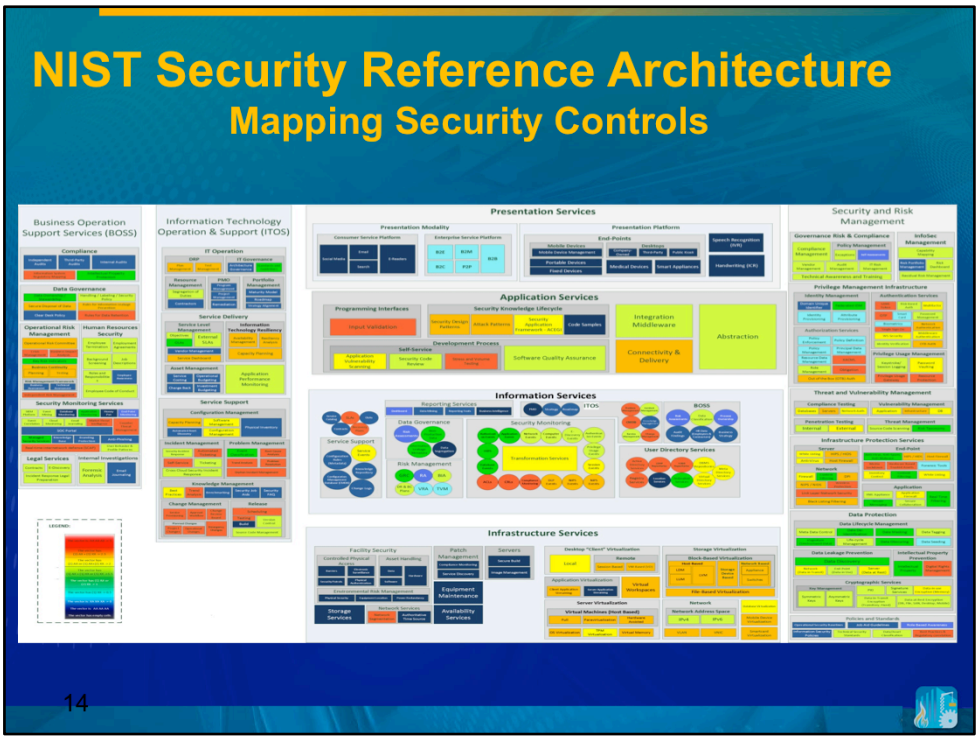


The NCC-SRA provides a formal model, a set of security components and a methodology of using this information to orchestrate a secure cloud Ecosystem. By describing a common core-set of *security components* for each instance of the cloud Ecosystem and by defining a formal model agnostic of the deployment mode or service type with a set of *architectural components* to which the *security components* are mapped to, we aim to aid an organization that elects to migrate one or more of their services to the Cloud in architecting and securing their cloud Ecosystem and identifying each cloud *Actor*'s responsibilities in implementing the necessary *security components* and associated security controls.

In a layered representation, the cloud Actors on the background and the security *architectural components* defined for each Actor, in the foreground with the *architectural components* and sub-components stretched across multiple Actors when Actors could satisfy similar or identical functions.

We found it necessary to elaborate on the definitions of the Cloud Provider (+intermediate) and the Cloud Broker (+ technical). <<elaborate on the Intermediate Provider and Technical Broker later>> overlay NIST architecture…

a Technical Broker interacts with the Consumer's operational processes, cloud



We generate an overall heat map that identifies, in a unified view, the *security components* that require special attention for a particular cloud deployment model(public), regardless of the service type elected by Consumer. Such a heat map highlights the *security components* that are under Consumer's responsibility versus the ones that can only be addressed by the Provider and/or Broker when applicable. Such a heat map represents in "hot" colors the *security components* where the cloud Consumer loses the ability to manage the security controls for the component. The "warm" colors are used to represent the *security components* where both, Consumer and Provider share responsibility (depending on the service type). The "cool" colors represent the *security components* where the Consumer keeps control of (and is responsible for) implementing the security mechanisms in the cloud Ecosystem.

NIST Big Data Public Working Group & Standardization Activities

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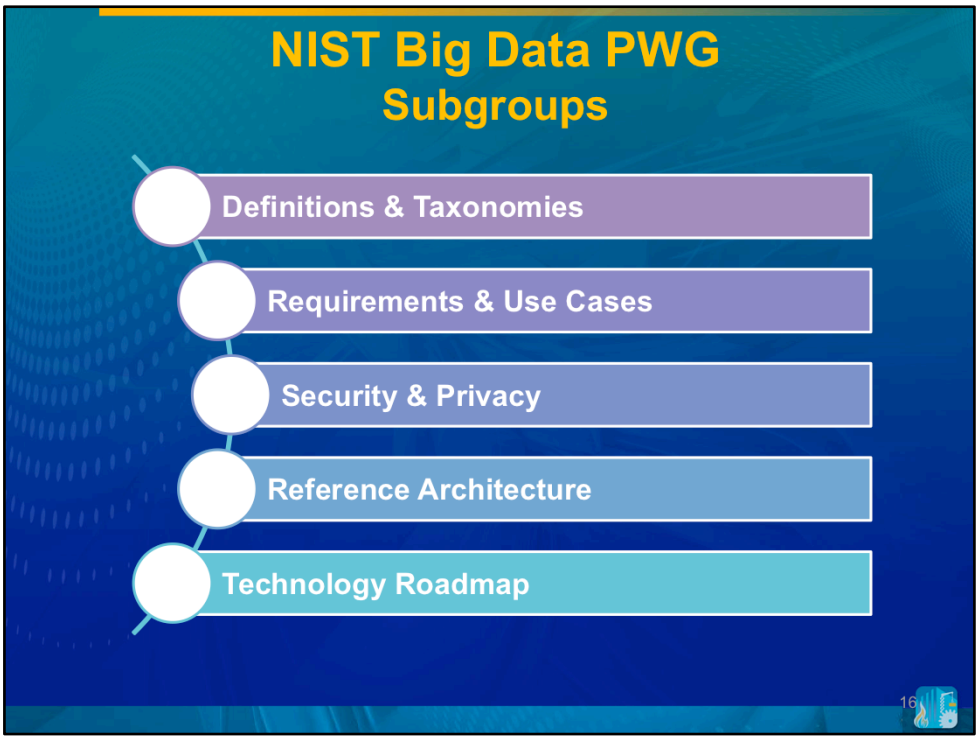
Robert Marcus, ET-Strategies
Chaitanya Baru, UC San Diego
http://bigdatawg.nist.gov


NIST Big Data PWG
Subgroups
Definitions & Taxonomies
Requirements & Use Cases
Security & Privacy
Reference Architecture
Technology Roadmap

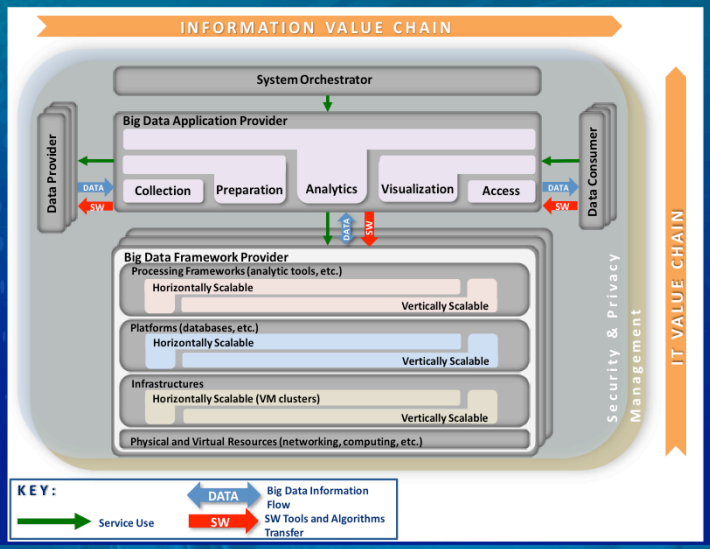
NIST Big Data PWG
Working Timeline, Jun. – Sept. 2013

NIST Big Data Public Working Group and Subgroups Work Plan

Week	Def. & Tax.	Requirements	Sec. & Privacy	Ref. Arch	Tech. Roadmap
June 26	NBD-PWG (13:00PM – 15:00PM) Kick-off Meeting				
July 3	NBD-PWG (13:00PM – 15:00PM) Establish Subgroups with Co-Chairs, Subgroups Charter, Overall OWG direction				
July 8 - 12	Mondays 10:00AM – 12:00PM	Tuesdays 10:00AM – 12:00PM	Wednesdays 10:00AM – 12:00PM	Thursdays 10:00AM – 12:00PM	Fridays 10:00AM – 12:00PM
July 15 – 19	Definitions & Characteristics	Collect general use cases, identify requirements	Collect security and privacy use cases,	Analyze use cases from Reqs. & Sec. subgroups	Vision Characteristics & Def.
July 22 – 26	Tax.: Roles, activities, components & subcomp.	Categorize reqs., Identify missing reqs.	Identify requirements	Create conceptual model, identify actors,	Taxonomies Roles & Activities
July 24	NBD-WG (13:00PM – 15:00PM) **Subgroups report: Sharing and brainstorming results**				
July 29 – Aug. 2				Identify usage scenarios, iden. Implement. Scenarios	Use cases & scenarios Ref. Architecture
Aug 5 – 9				Create ref. architecture	Standards & Activities Gap Analysis
Aug 12 – 16					Standardization Priorities ??? Strategy of Adoption
Aug 19 – 23					Strategy of Implement. Resourcing
Aug. 21	NBD-WG (13:00PM – 15:00PM) **Subgroups report: Present and Discuss Working Draft Outline**				
Aug. 26 - 30					Recommendations
Sept. 2 – 6					
Sept. 4	NBD-WG (13:00PM – 15:00PM) **Subgroups report: Present and Discuss Rough Draft**				
Sep 9 – 13					
Sep 16 - 20					
Sep 23 – 27					
Sep 25	NBD-WG (13:00PM – 15:00PM) **Subgroups report: Present and Discuss Final Draft**				
Sep 30	Big Data Workshop, NIST **- Deliverables Presentation & Discussion - Breakout Sessions by Subgroups - Announcement for Next Steps**				

2013 Big Data World Congress, NIST/ITL, Wo Chang, Dec. 3, 2013

NIST Big Data PWG
Initial Draft, Reference Architecture



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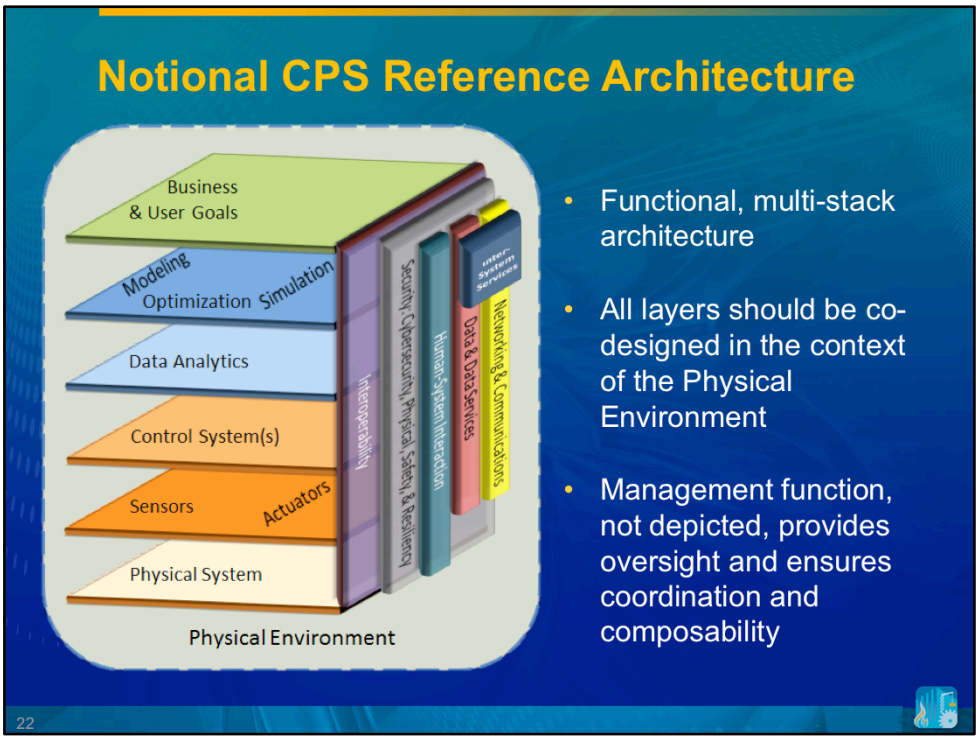
Need for Consensus CPS Definition and Reference Architecture

- Provide a common lexicon and taxonomy that can apply across CPS
- Show a common architectural vision to help facilitate interoperability between components and systems
- Enable creation of reusable CPS components and tools to measure and evaluate their performance
- Promote communication across diverse stakeholder community

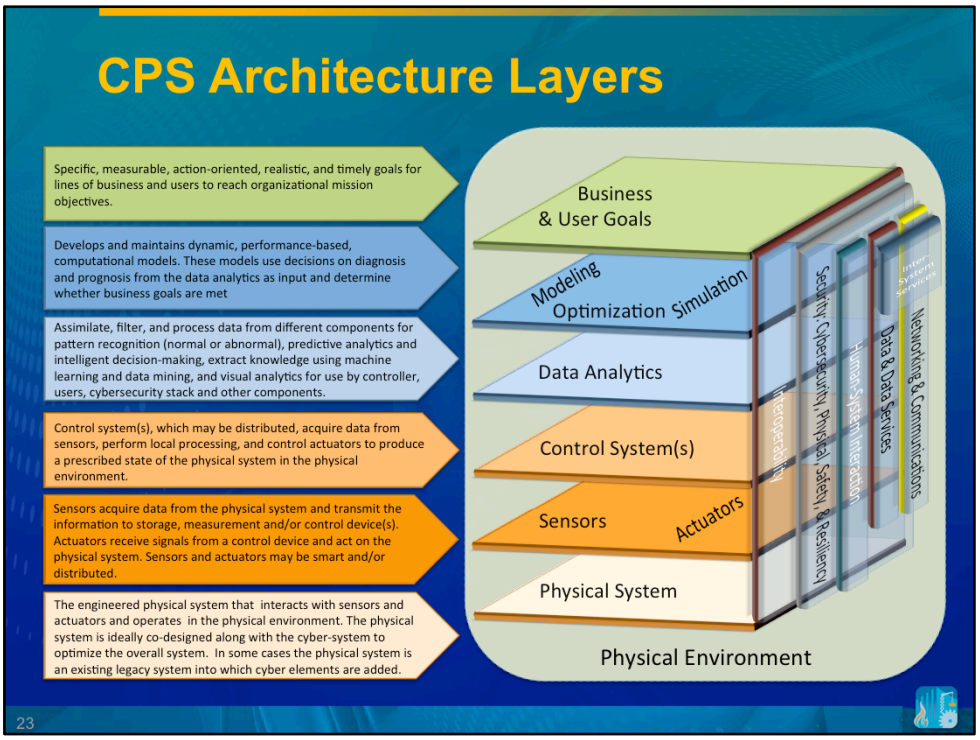
Cyber-Physical Systems – Notional Definition

- Integrated, hybrid networks of cyber and engineered physical elements
- Co-designed and co-engineered to create adaptive and predictive systems
- Respond in real time to enhance performance*

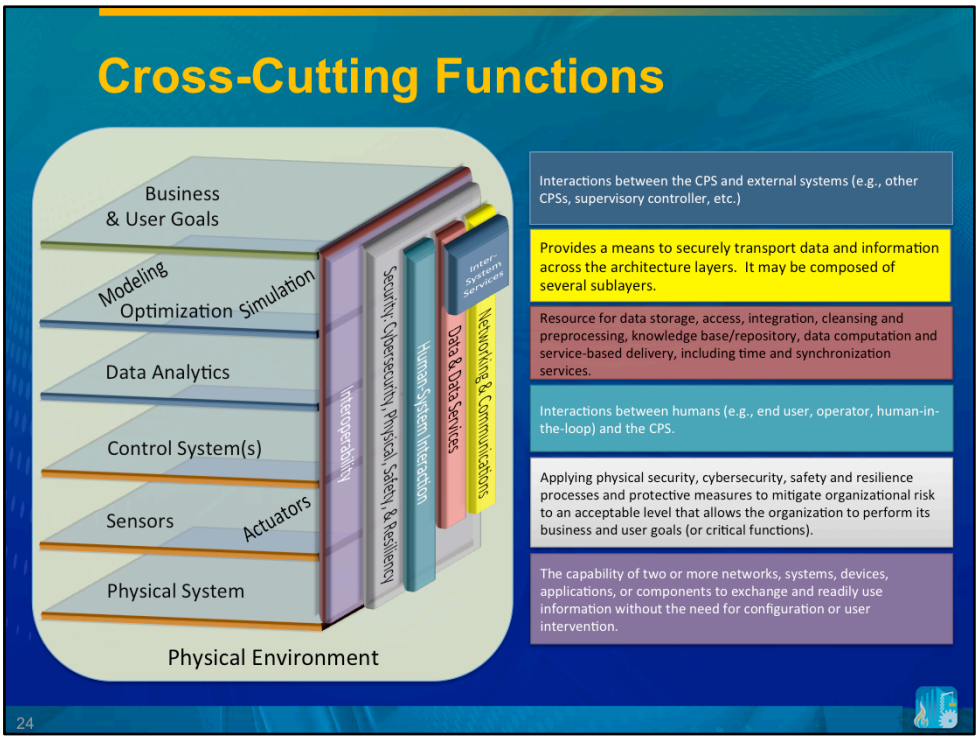
* Key metrics include: efficiency and sustainability, agility and flexibility, reliability and resilience, safety and security



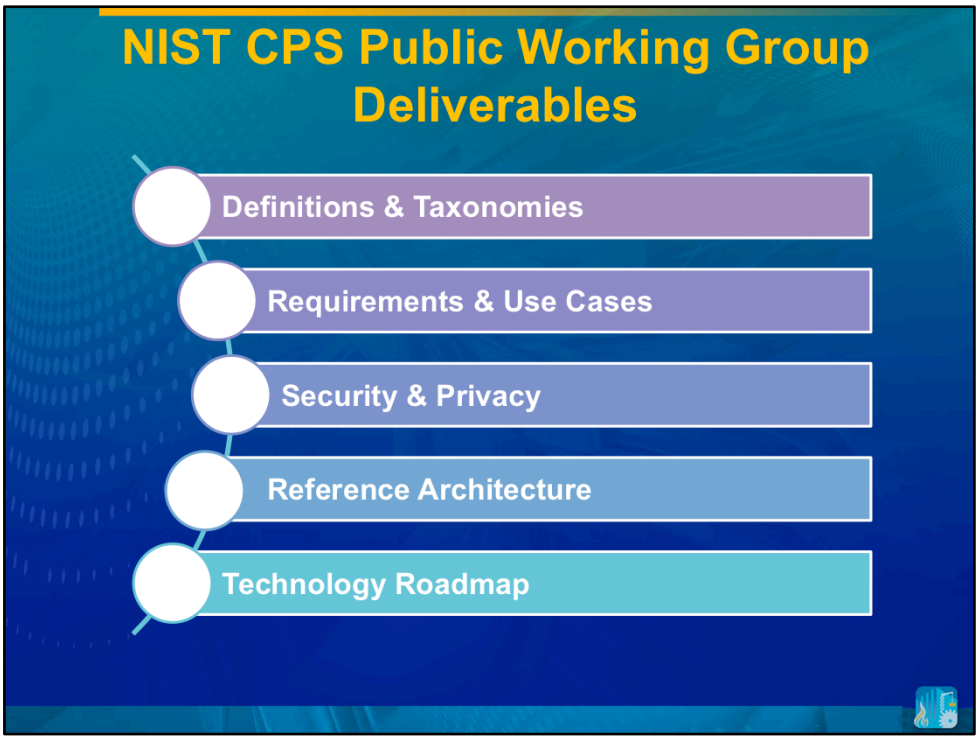
- The Physical Environment encompasses the aggregate surrounding environmental conditions, influences or surroundings. All layers, including the architecture layers and cross-cutting functions, should be co-designed in the context of the Physical Environment.
- The horizontal layers of the stack depict a hierarchy of functions, but does not imply that communication is limited to adjacent layers only.
- Each layer and cross-cutting function of the stack may be composed of sub-layers, which are not shown.
- The vertical cross-cutting functions show the critical elements that connect the architecture layers
    - These cross-cutting functions are essential to ensure that each of the architecture layers can share and act on data from other layers effectively and securely.
- The management function allows the ability to oversee complexity across the CPS system(s) and ensures that each of the layers, cross-cutting functions, and potential solutions in hardware and software are co-designed in the context of the physical environment.
- The current architecture does not capture the the spatial and temporal scales over which CPS can extend.



- The architecture layers depicted start as tangible, physical systems at the bottom layer and transition to abstract concepts and goals at the top layer.
- The organization of these architecture layers provides a grouping of key components of CPS, both physically and conceptually, and demonstrates a hierarchy of functions, which are ultimately driven by the business and user goals at the top of the stack.
- Communication between the architecture layers is not limited to adjacent layers. Each of the layers is described in the following sections.



- The cross-cutting functions are the means and methods to securely and reliably transport data and information across the architecture layers.


NIST CPS Public Working Group Deliverables
Definitions & Taxonomies
Requirements & Use Cases
Security & Privacy
Reference Architecture
Technology Roadmap

NIST CPS Public Working Group
Subgroups

Co-Chairs	Definition, Reference Architecture	Use Cases	Cyber Security	Timing (Coordinated Effort with Boulder Group)
NIST	Abdella Battou	✓	✓	Marc Weiss
Academia	Janos Sztipanovitz	John Baras	✓	(Steering
Industry	✓	✓	✓	Group)

NIST CPS Public Working Group Anticipated Timeline

- Inaugural Virtual Meeting:
  - Spring 2014
- First Draft Documents from Subgroups:
  - Fall 2014
- Second Draft, Integrated Subgroup Inputs
  - Winter 2015
- Publication of Results
  - Spring 2015

To Receive Information on the Launch of the Public Working Group:

Contact:

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