Securing the Electric Grid with Common Cyber Security Services

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TCIPG Seminar

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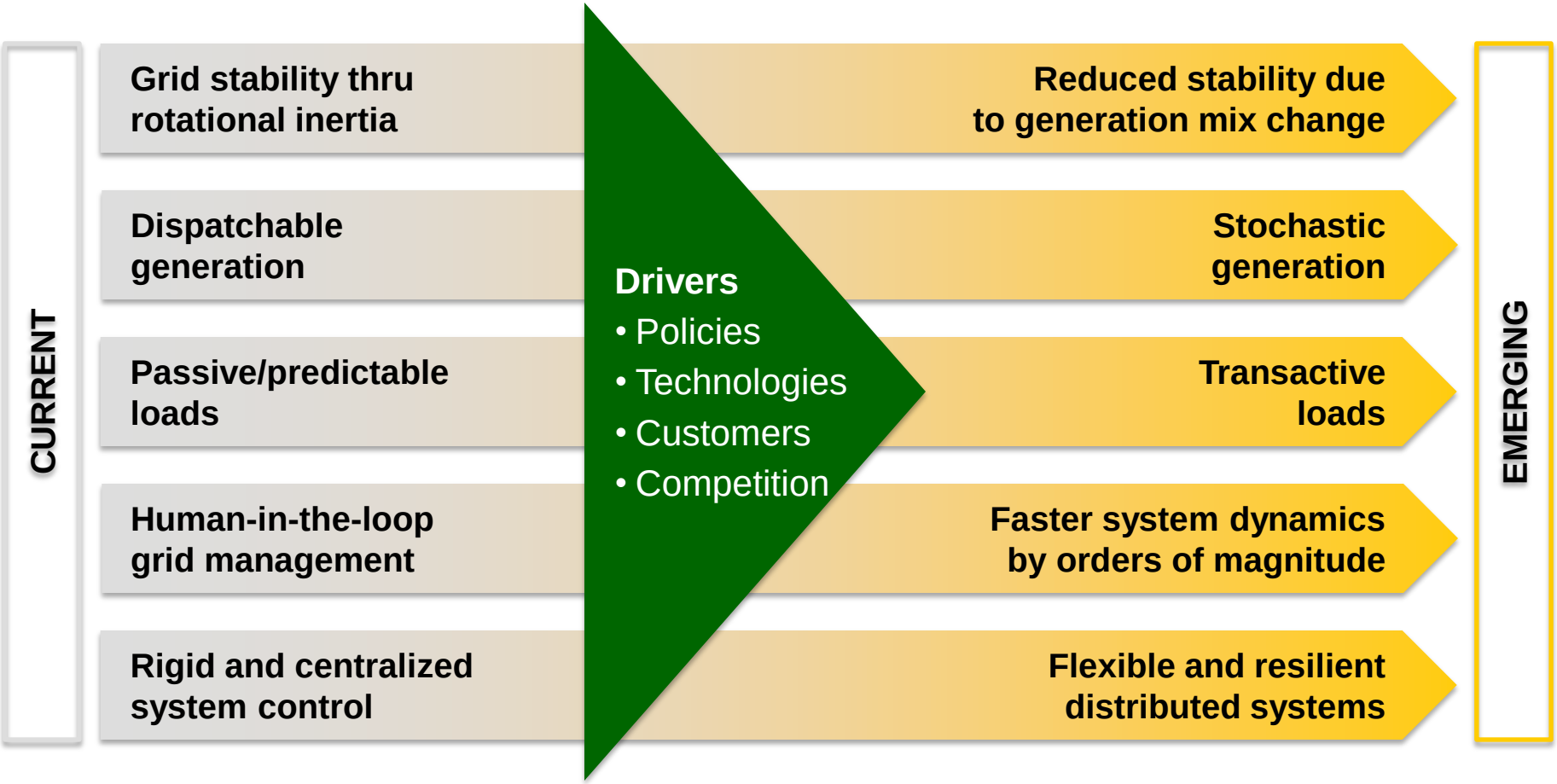
Southern California Edison (SCE) is committed to safely providing reliable and affordable electricity to its customers

On an average day SCE provides power to:

- Nearly 14 million people
- 180 cities in 50,000 square miles of service area, encompassing 11 counties in central, coastal and Southern California
- Commercial industrial and nonprofit customers, including:
  - 5,000 large businesses
  - 280,000 small businesses

The electric utility system is facing fundamental changes



System stability through technology

Basic capability

Advanced capabilities

Mechanical controls

Fly by wire

Stability through physics

Stability through technology

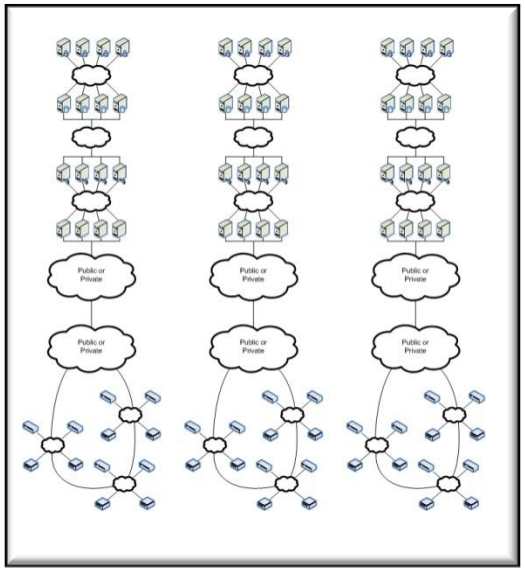
Smart grid design goals

- ***More*** – increased capabilities
  - More capabilities at the edge and enterprise, pervasive automation
- ***Better*** – faster, more reliable & secure
  - The electric grid is more resilient
  - Dynamic control of all security elements allows the system to adapt to evolving threats
- ***Easier*** – usability (convergence, unified control, visualization, information on demand)
  - Tens of Millions of nodes are manageable
  - Situational awareness
  - Common Services allow for easier integration of new capabilities and technologies

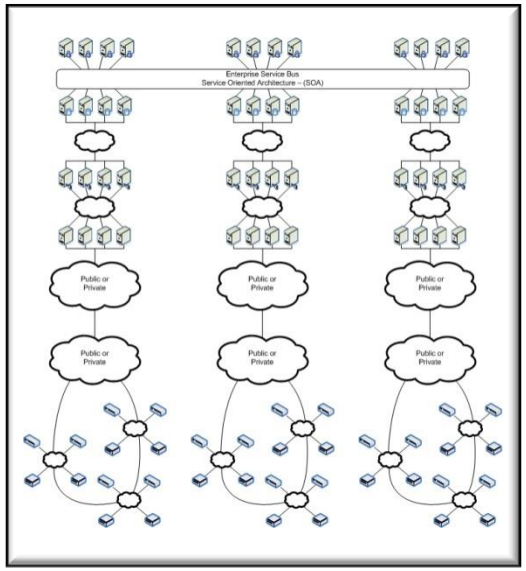
Smart Grid System of Systems (SoS) Research

Four evolutions of Smart Grid SoS Architectures

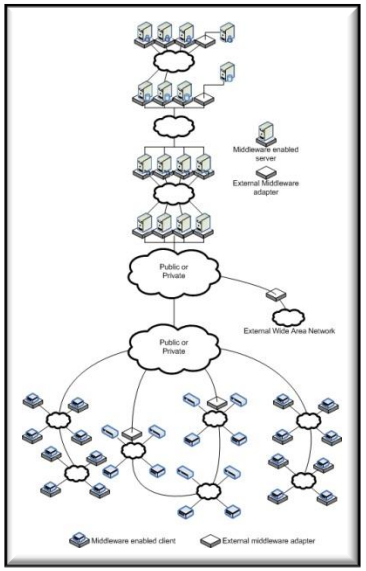
Silos



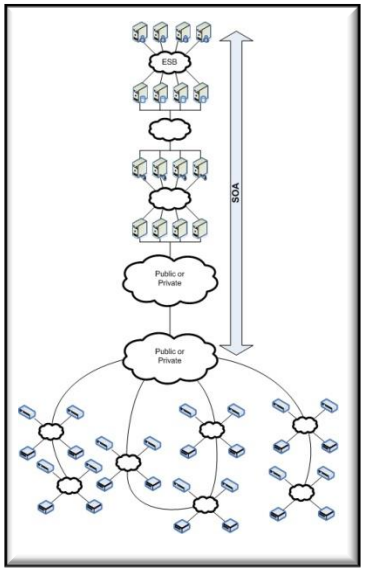
ESB



Adapter-based



Common

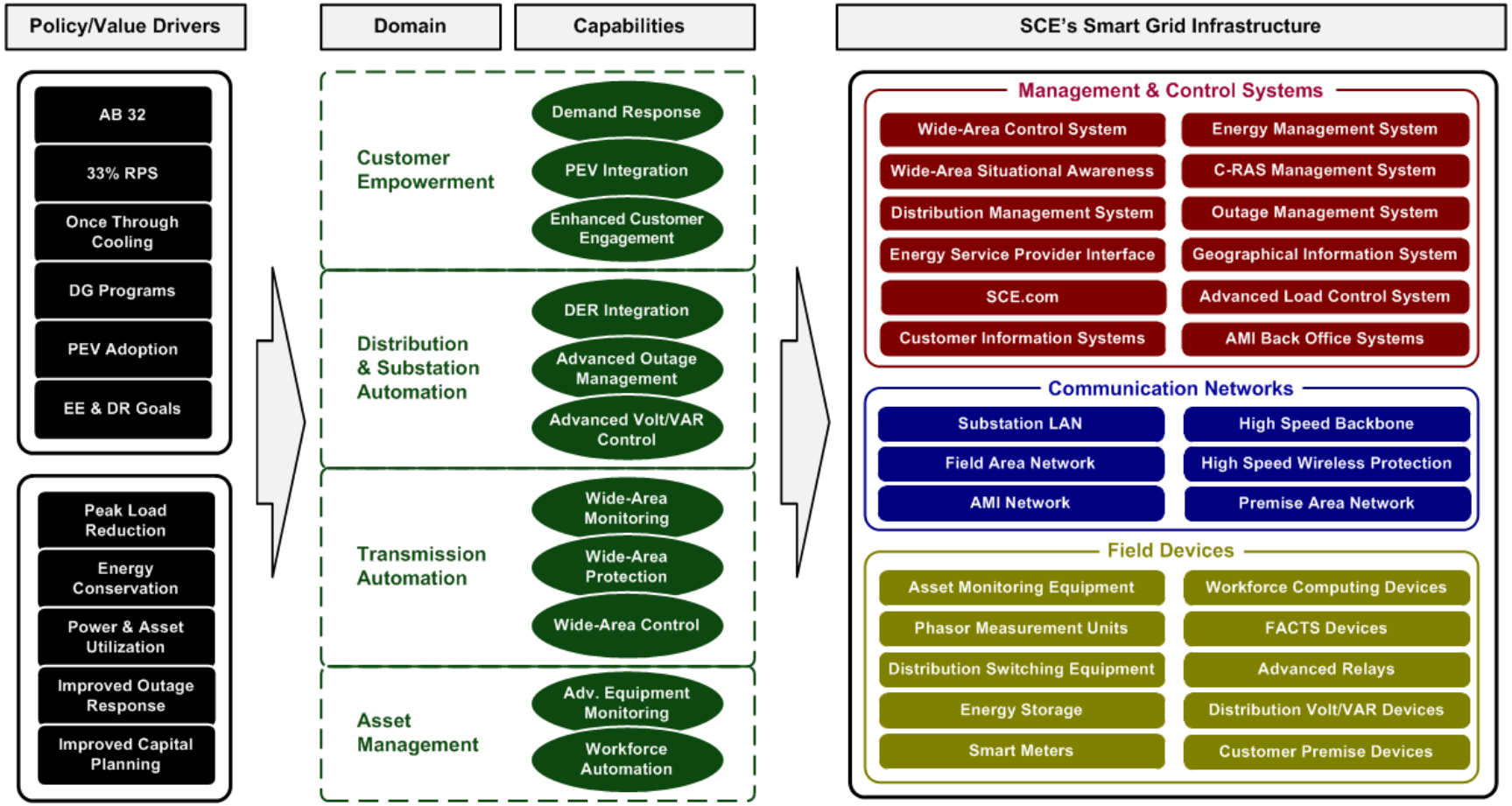


1	2	3	4
Current-state	Typical SI Approach	DoD-style approach	Standards –based Internet-style

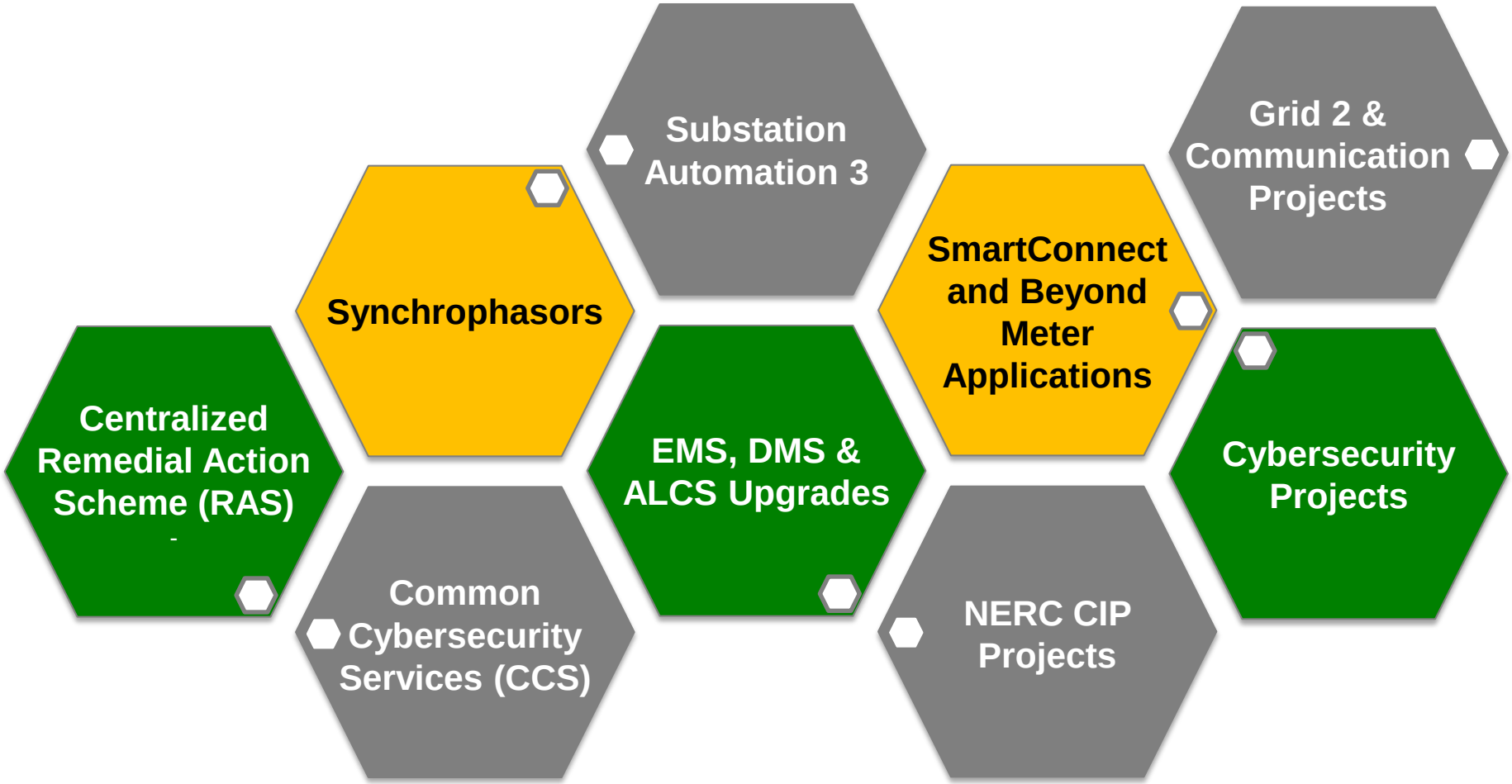
A holistic strategy is needed to serve customers better

- Inform policy
- Manage operational costs
- Serve customers through improved operations and services
- Mitigate reliability impact of variable energy resources
- Mitigate risk of technology obsolescence and stranded assets
- Secure our system from cybersecurity threats
- Integrate and adapt to disruptive technologies

SCE developed a structured approach for modernization strategies and technologies



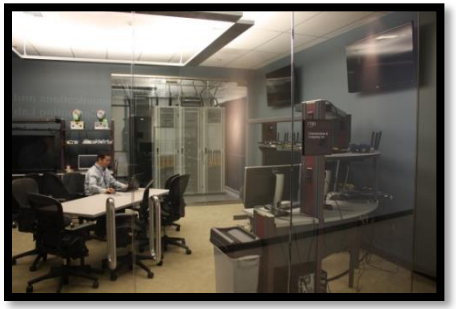
There are already a number of smart grid projects in flight to meet policy and changing customer needs



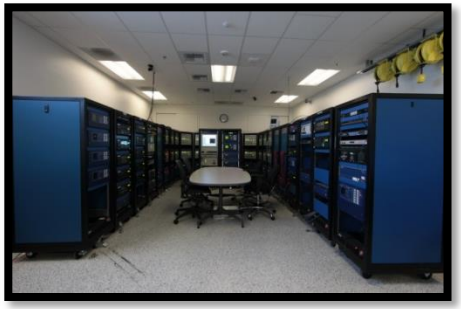
SCE evaluates the safety and operability of new technologies in a controlled environment first

Situational Awareness Lab

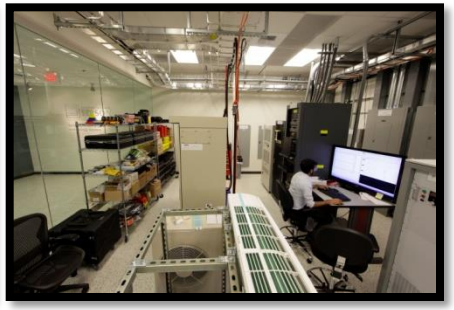
Communications & Computing Lab



Power Systems Lab



Distributed Energy Resources Lab

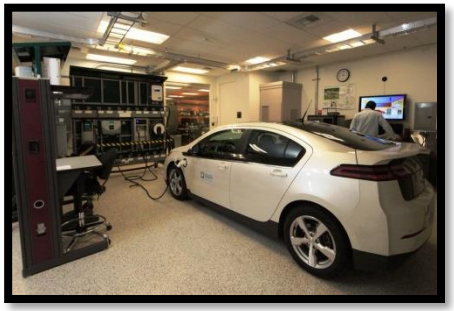


Substation Automation Lab

Distribution Automation Lab

Home Area Network Lab

Garage of the Future Lab



Integrated platform for evaluating the safety and operability of smart grid technologies in a controlled environment before being deployed on the grid.

Goals of Information Security

Goals:

Make data visible
Make data accessible
Enable data to be understandable
Enable data to be trusted
Enable data interoperability

To make the right decisions at the right time

Actions:

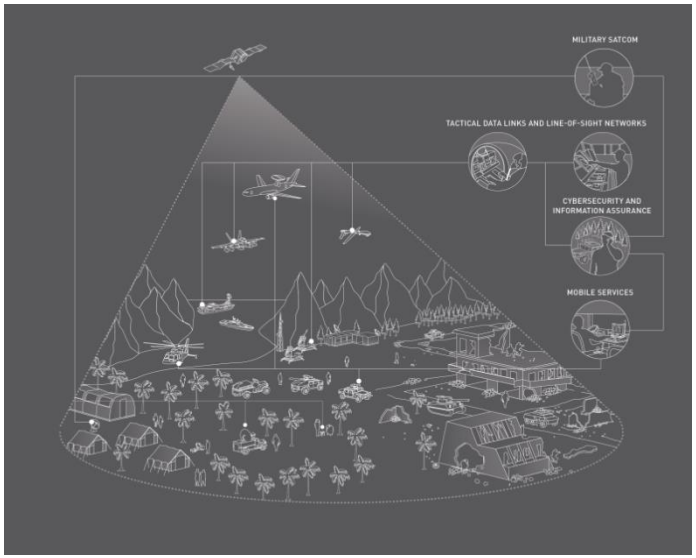
- **Secure data assets to ensure reliable operations through:**
  - Authentication
  - Authorization
  - Accounting
  - Peer to Peer
  - Quality-of-Trust
  - Dynamic security posture awareness
- **Make system data and processes available to the Enterprise by protecting:**
  - Availability
  - Integrity
  - Confidentiality

Courtesy DOD office of CIO

High Assurance Capability

Using DoD cybersecurity methods to enhance system resiliency

Networked Battlefield



Networked Utility Operations

CIP owners/operators facing transition that DoD started 10+ years ago

Common Cyber Security Services (CCS)

- **An advanced security system for the energy sector**
  - Next generation utility technologies
  - DoD technology transfer
  - Best practices from many sectors
  - Modern SOA style architecture

- **A standards compliant security system**
  - NERC CIP Version X
  - All Federal Processing Standards (DHS, FIPS)
  - NIST Compliant (NISTIR, SP)

- **An extremely scalable and dynamic security system**
  - Supports Grid Applications (control & monitoring)
  - Supports current and next generation networking (MPLS)
  - Supports major protocols used on the Grid (61850-90-5, DNP3, etc)

- **"Build-to" specifications supports multi-vendor adoption**

Cybersecurity System Capabilities

Authentication	•Integrated Operational Public Key Infrastructure (PKI), Identity Management
Authorization	•Role and Group Based Access Control (RBAC)
Accounting	•Security Information and Event Management (SIEM)
Peer to Peer	•Authenticated communication •Defense in Depth
Quality-of-Trust	•Continuous device to device trust monitoring •Cyber & Physical alerts, device health, operator actions
Integrity	•Trusted Boot, Trusted Network Connect •Device Bill-of-Health
Dynamic Scalable GUI	•Central operations security visualization GUI accessed via web browser •Multi-Tier Security Operations Capability •Large scale System Planning and Test Capabilities

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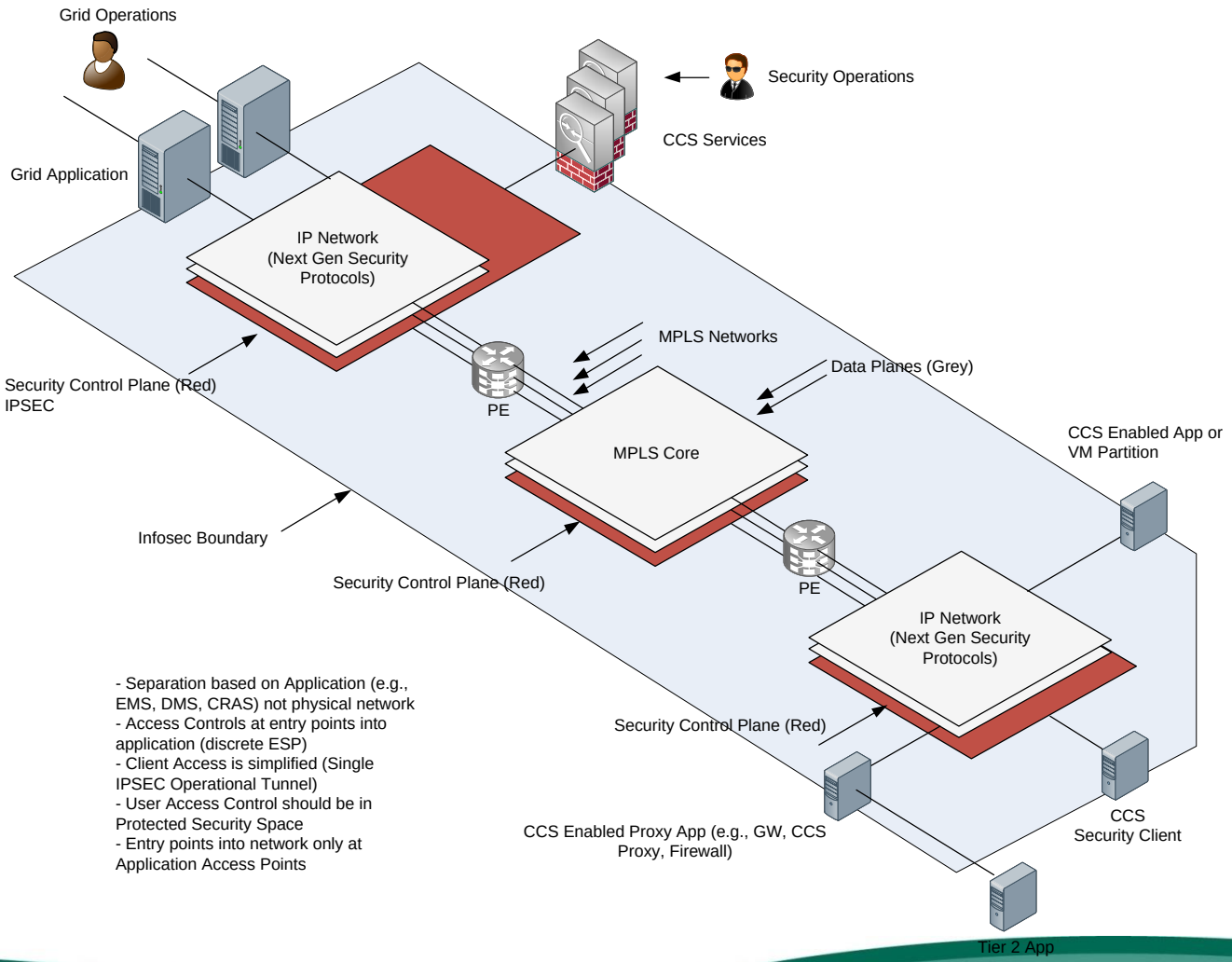
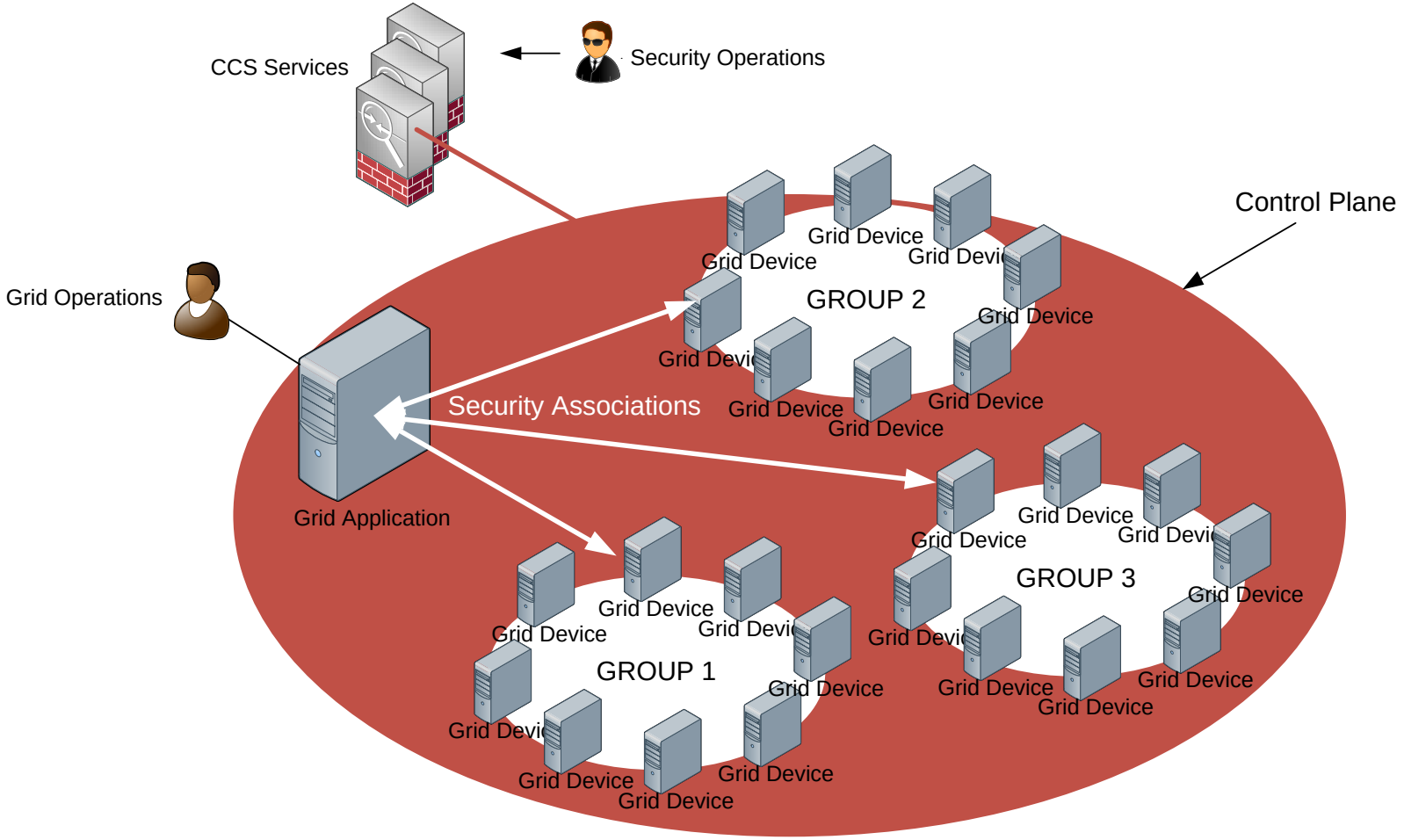
CCS Enabled ESP

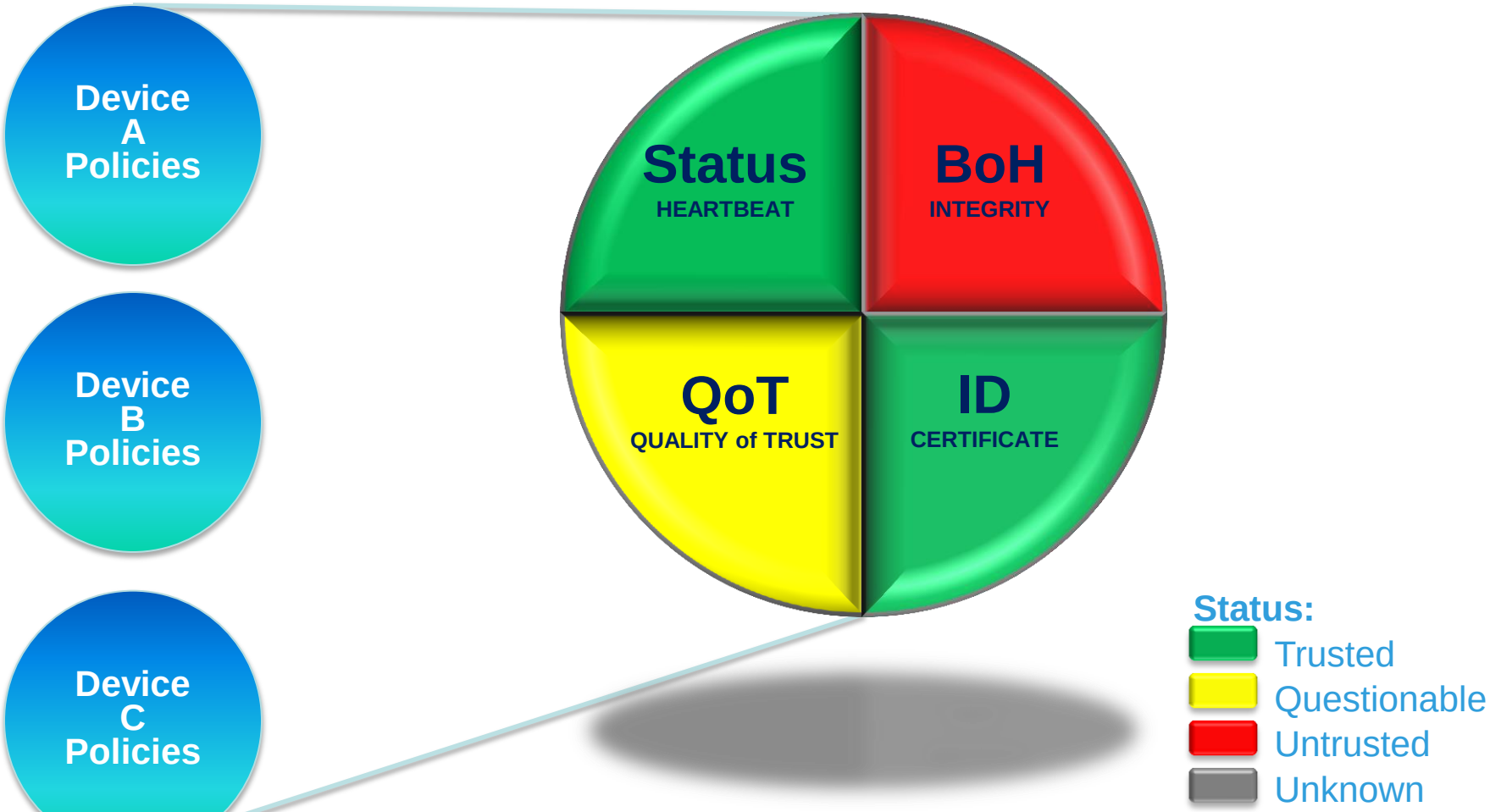


COI (Key Group Management)

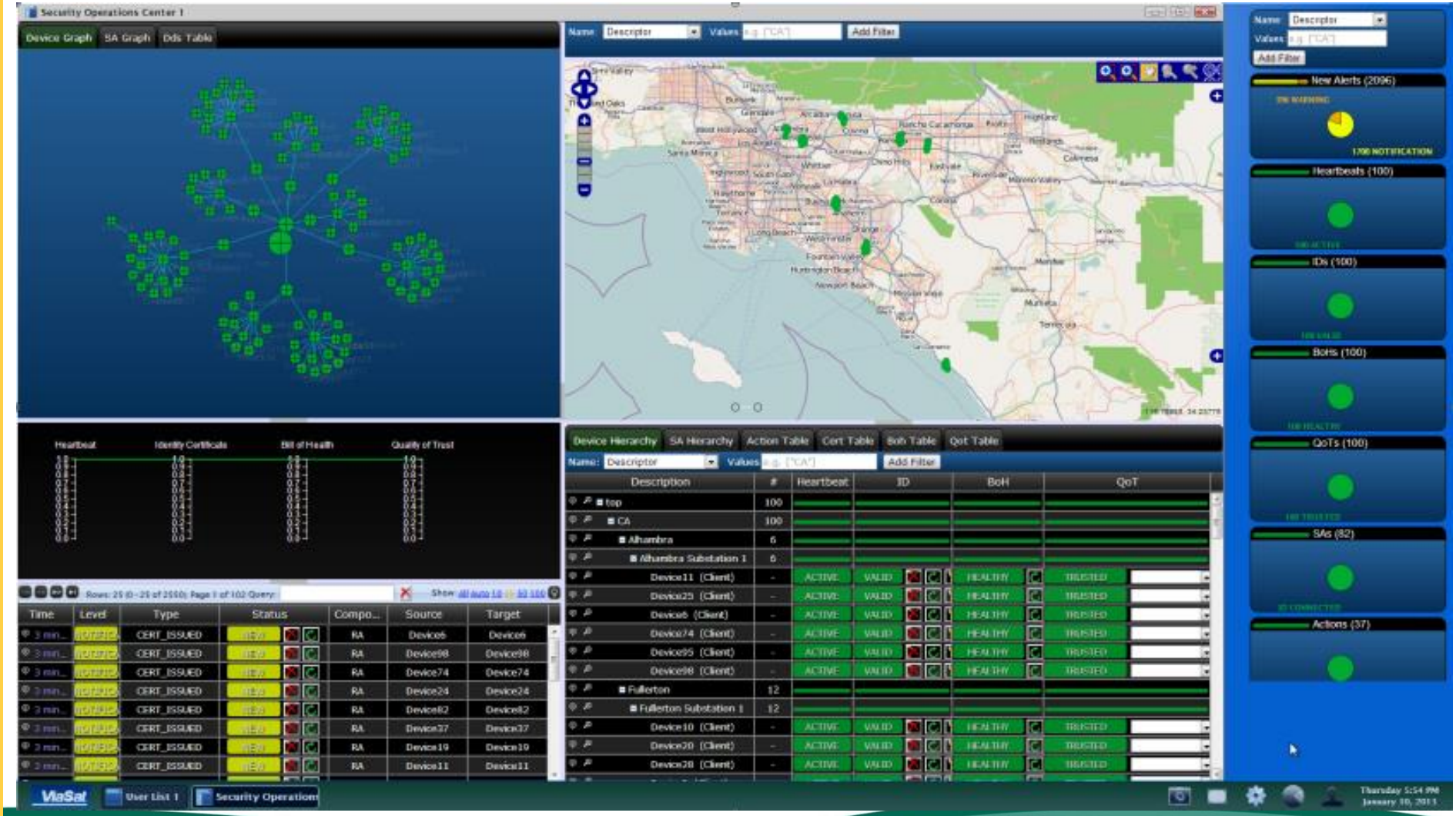


Common Cybersecurity Service Concept

Security Policy Enforcement & Status based on device and function

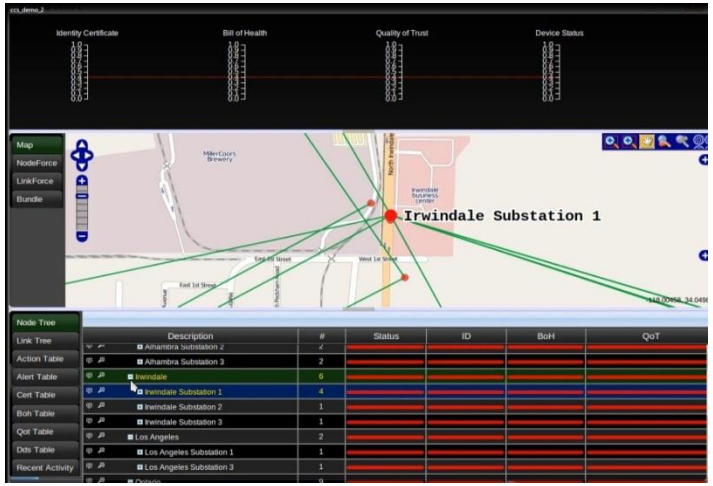


Real-time Operational Grid Security Posture



Common Cyber Security Services (CCS)

- CCS operational in production environment since mid-2013.
- Various federal and state agencies are supportive of CCS and are open to supporting a variety of industry adoption acceleration approaches.
- Key vendors such as GE and others have developed and delivered CCS enabled clients
- SCE has installed CCS in the McArthur substation and is working to scale up to BES subs over the next several years
- CCS Specifications are available under NDA upon request



Questions?

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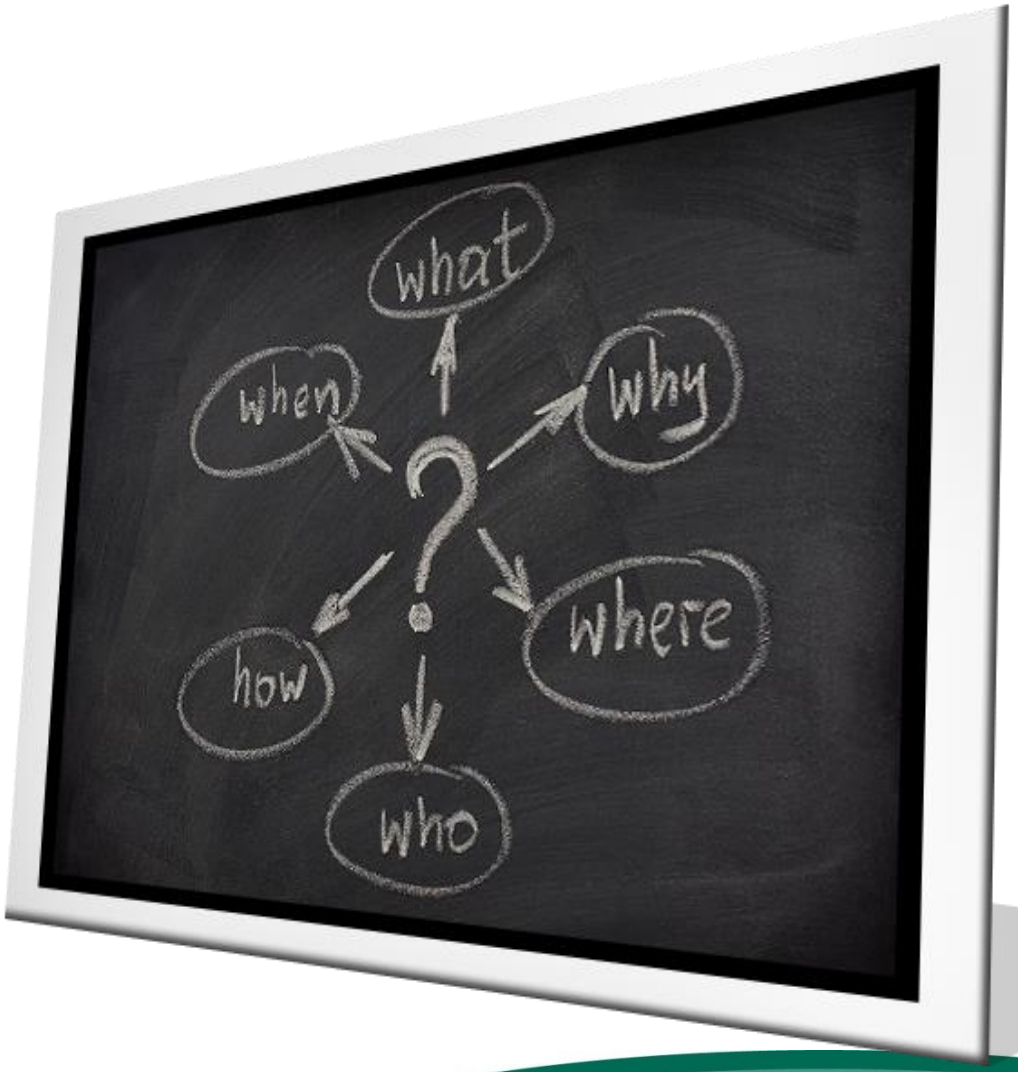

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