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Utility Experience Developing a Smart Grid Roadmap

July, 2008

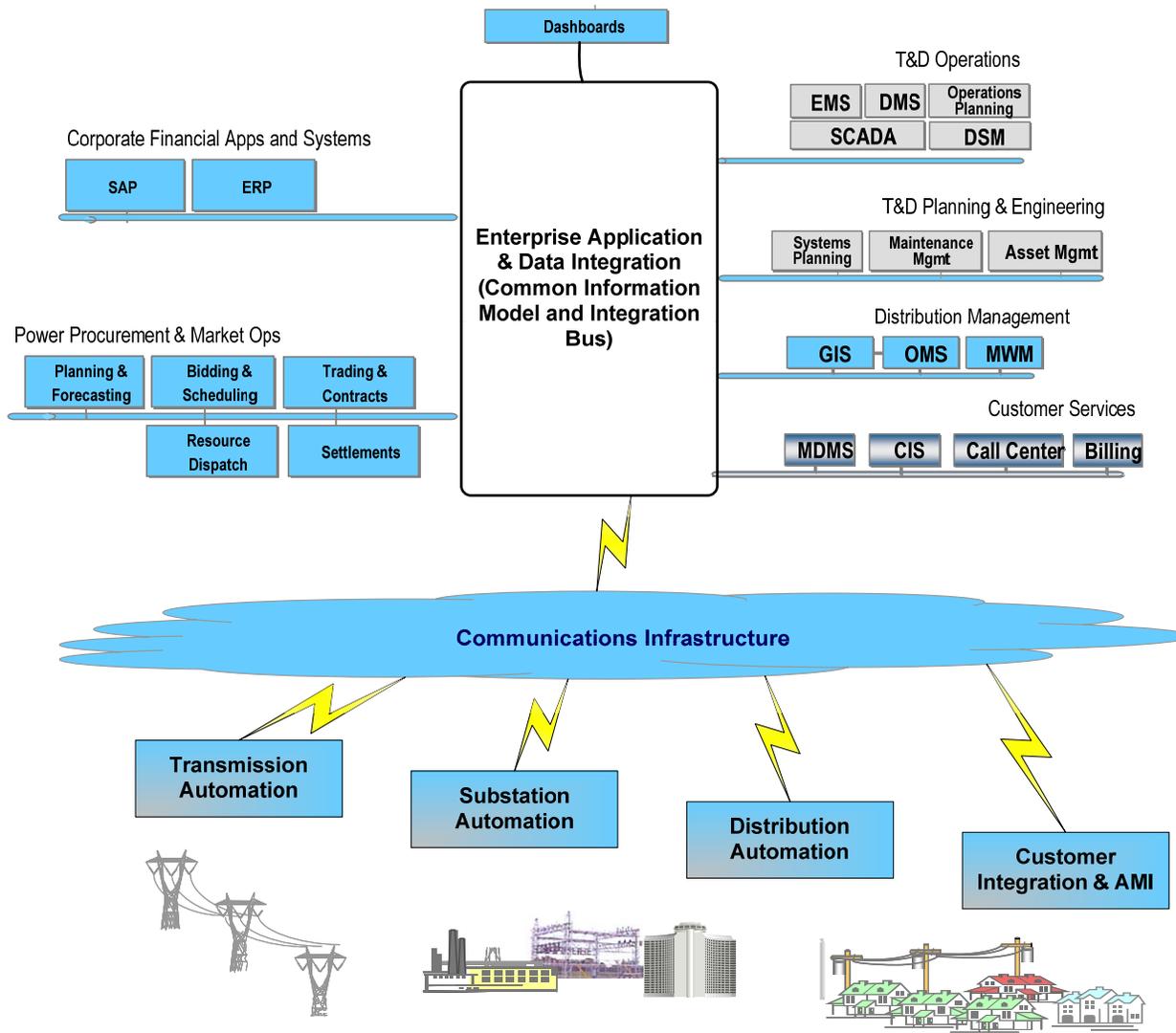**IEEE PES**

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The Smart Grid is about the Infrastructure (Communications and Information)

Dashboards

Corporate Financial Apps and Systems
- SAP
- ERP

Enterprise Application & Data Integration (Common Information Model and Integration Bus)

Power Procurement & Market Ops
- Planning & Forecasting
- Bidding & Scheduling
- Trading & Contracts
- Resource Dispatch
- Settlements

T&D Operations
- EMS
- DMS
- Operations Planning
- SCADA
- DSM

T&D Planning & Engineering
- Systems Planning
- Maintenance Mgmt
- Asset Mgmt

Distribution Management
- GIS
- OMS
- MWM

Customer Services
- MDMS
- CIS
- Call Center
- Billing

Communications Infrastructure

- Transmission Automation
- Substation Automation
- Distribution Automation
- Customer Integration & AMI
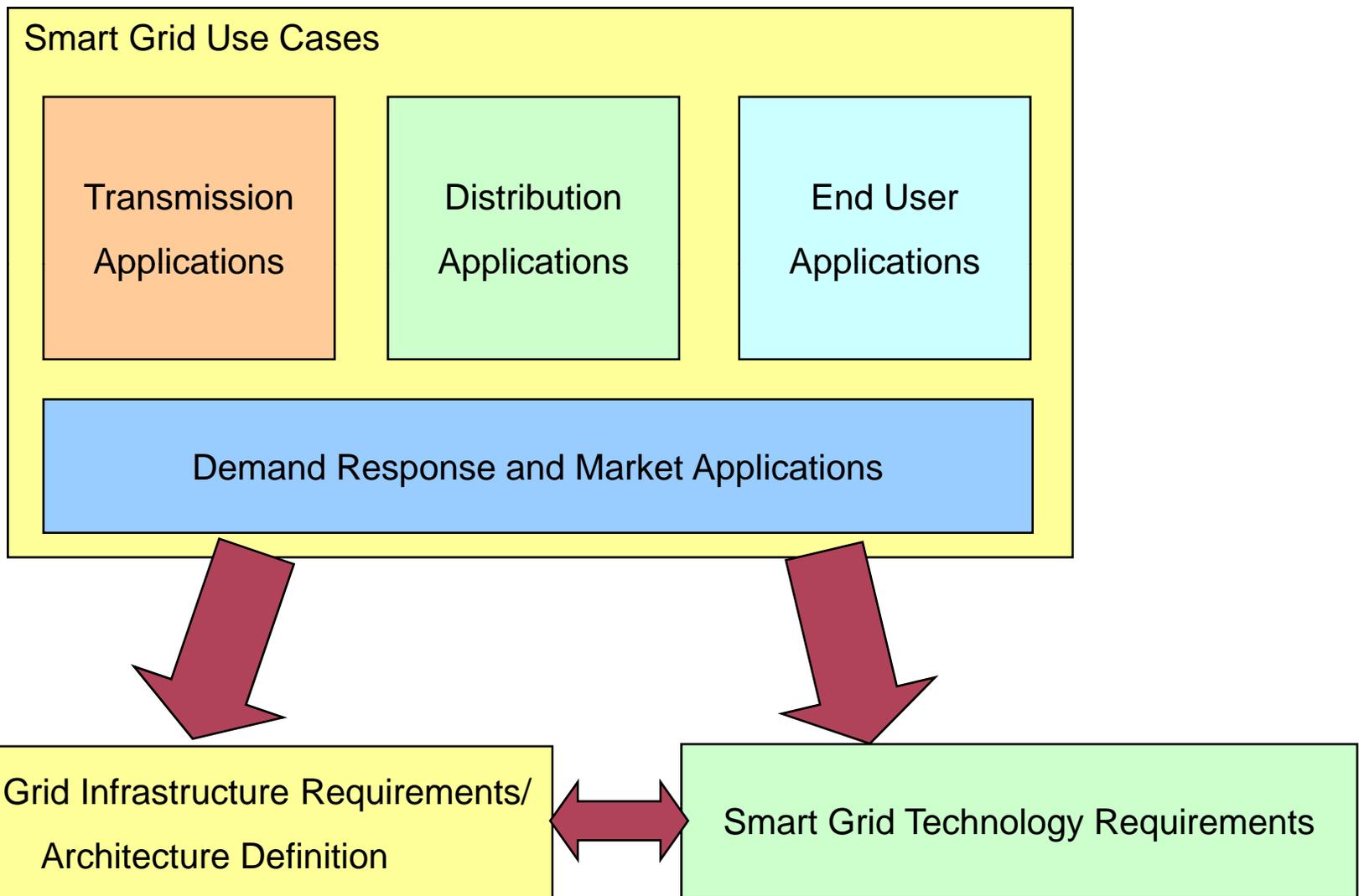
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The benefits of the smart grid derive from the applications

- Reliability
- Efficiency
- Demand Management
- Managing the utility infrastructure investment
- New Energy Services

Key new drivers:

- **Integration of renewables (intermittent resources)**

- **Distributed resources, microgrids**

- **Facilitating customer participation in markets**

- **New technologies (PHEV, storage, smart loads)**

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Developing Use Cases and Deriving Requirements

Smart Grid Use Cases

Transmission Applications

Distribution Applications

End User Applications

Demand Response and Market Applications

Smart Grid Infrastructure Requirements/ Architecture Definition

Smart Grid Technology Requirements

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Examples of Use Cases for Deriving Requirements
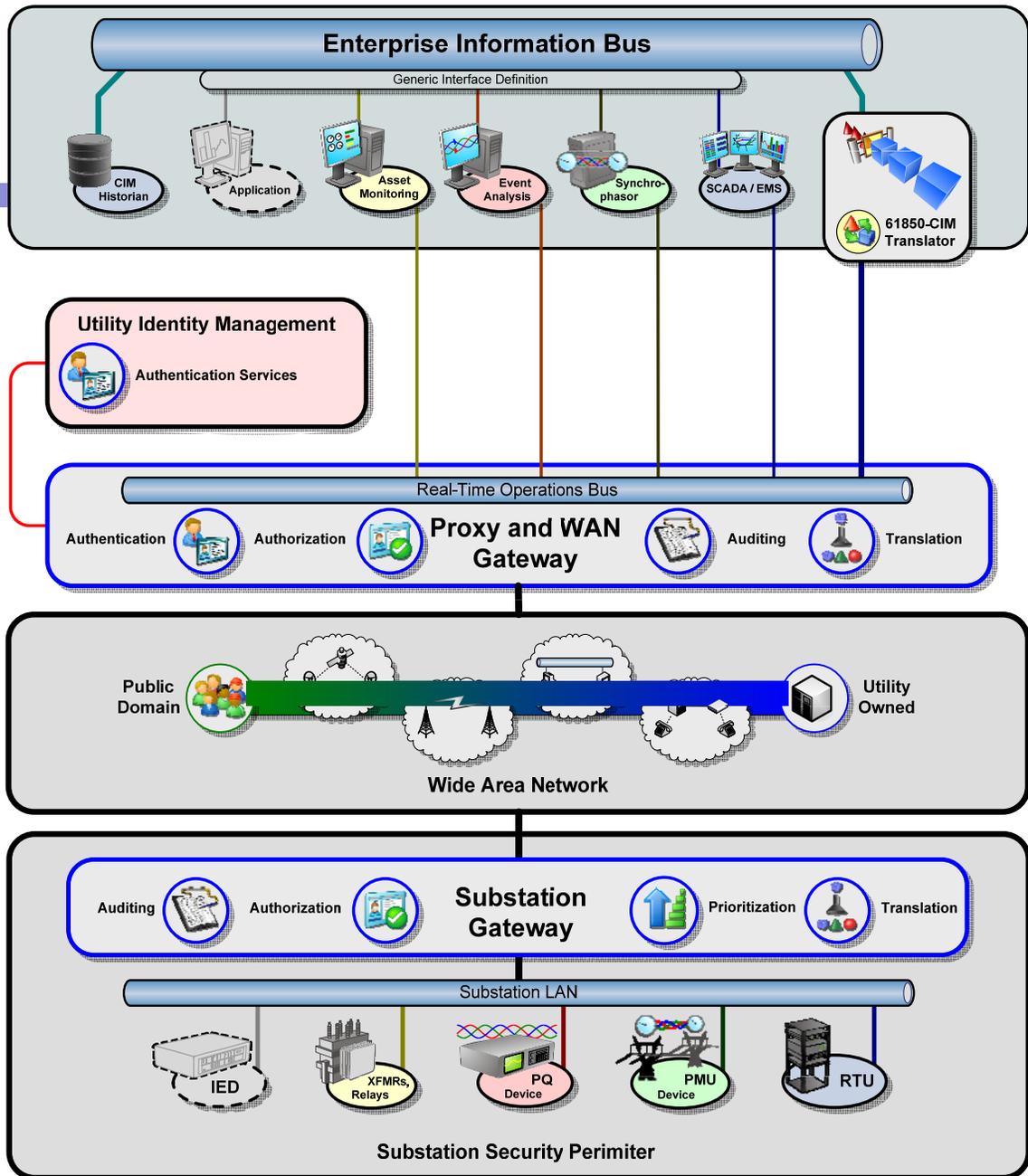
Transmission	1. Transmission Fault Location
	2. PMU Data Collection and Management
	3. System-Wide PQ Monitoring, Integration with Asset Management
	4. Asset Condition Monitoring (Advanced Sensors)
	5. Real Time State Estimation
Distribution	6. Distribution Fault Location
	7. Distribution System Management with automated reconfiguration
	8. Distribution State Estimation (performance optimization)
Customer Integration	9. Web-Based Energy Use Information for Customers
	10. Real Time Pricing Information for Customers
	11. Monitoring and Management of Distributed Resources

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Use a consistent methodology

IEC
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IEC/PAS 62559
Edition 1.0   2008-01

PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

IntelliGrid Methodology for Developing Requirements for Energy Systems

WORKSHOPS

Requirements Document

Architecture Document

Requirements and Tech Selection

Use Cases

steps
actors
requirements
business values
scenarios

Message Sequence Diagrams — messages → Interface Diagram ← actors — Global Actor List
Requirements Database
Security Analysis

scenarios
messages
interfaces
actors
candidate standards
vendor input
requirements
security requirements

Message Matrix

Use Case Activity Diagrams
Standards Catalog and Mapping
Component Architecture
Distilled Requirements
Capability Frameworks

Data Model   Performance Analysis   Technology Choices   Structural Choices   Device Choices   Communications with Vendors

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Documenting interfaces

Transmission Interface Diagram

Enterprise — NASPI/TVA Super Data Concentrator, Stability Assessment Application, EMS Phasor Application, PMU Data Concentrator, Operator Visualization Tools, Enhanced State Estimator, Video System, EMS, Maintenance Server (Information Security), Engineers/Operators, EMS Equipment Dynamic Ratings, Maintenance Database, Fault Information Database, Fault Analysis Application, Central Monitoring System, CMMS, Power Quality Data Management System, Operations Database, Lightning Detection System, Geographical Information System, Central Monitoring Database

Transmission Interface Diagram — External Relay, Video & Infrared Cameras, Communications Infrastructure, Substation Data Manager, SCADA/GUI, Equipment Monitor

Substation — IEDs: Phasor Measurement Unit, PQ Monitor, Relay, Fault Recorder; Equipment Monitor

UC1 – Automated Transmission Fault Location
UC2 – PMU Data Collection
UC3 – Systemwide PQ Monitoring
UC4 – Asset Condition Monitoring
UC5 – Real Time State Estimation

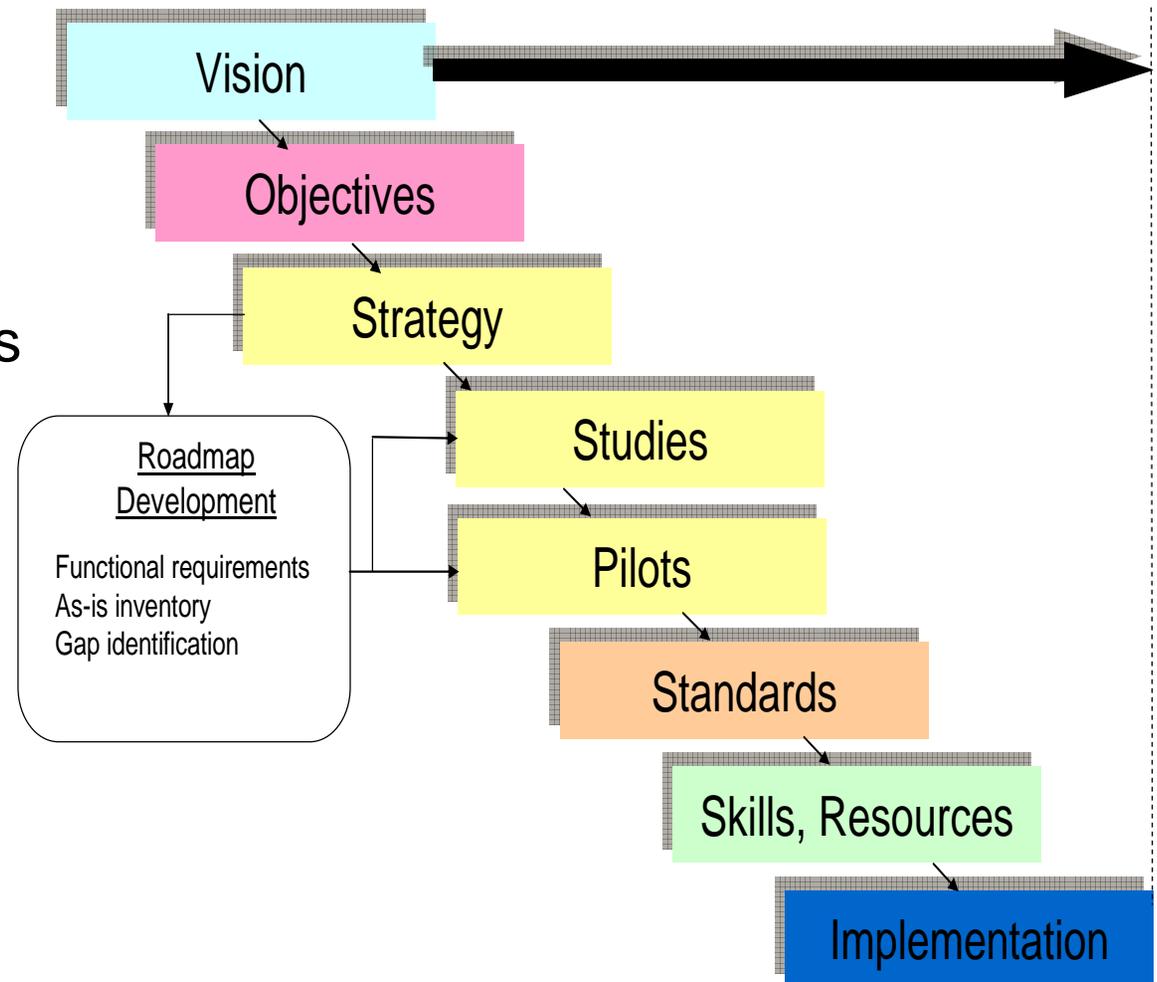EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Develop the architecture specifications based on the requirements (including security)
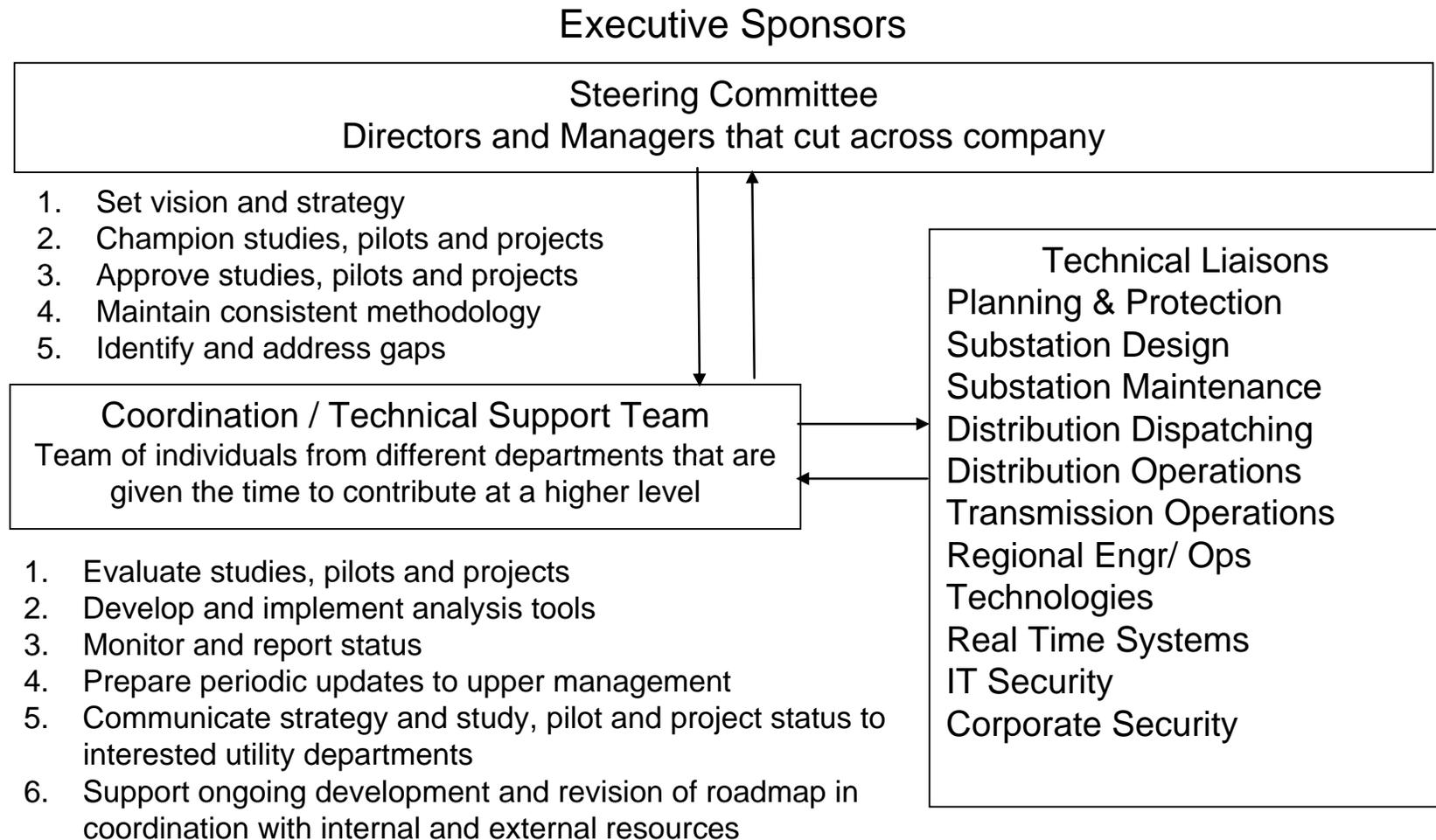
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Utility Specific Smart Grid Roadmaps

- Every utility will take a unique path in creating their smart grid

- Recommends technology investments to be made over time

- Projects underway with:
  – FirstEnergy
  – Salt River Project
  – Duke
  – Southern Company
  – TVA/TVPPA

Vision

Objectives

Strategy

Studies

Pilots

Roadmap Development

Functional requirements
As-is inventory
Gap identification

Standards

Skills, Resources

Implementation

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Organization for Smart Grid Roadmap Development

Executive Sponsors

Steering Committee
Directors and Managers that cut across company

1. Set vision and strategy
2. Champion studies, pilots and projects
3. Approve studies, pilots and projects
4. Maintain consistent methodology
5. Identify and address gaps

Coordination / Technical Support Team
Team of individuals from different departments that are given the time to contribute at a higher level

1. Evaluate studies, pilots and projects
2. Develop and implement analysis tools
3. Monitor and report status
4. Prepare periodic updates to upper management
5. Communicate strategy and study, pilot and project status to interested utility departments
6. Support ongoing development and revision of roadmap in coordination with internal and external resources

Technical Liaisons
Planning & Protection
Substation Design
Substation Maintenance
Distribution Dispatching
Distribution Operations
Transmission Operations
Regional Engr/ Ops
Technologies
Real Time Systems
IT Security
Corporate Security

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Host of First Smart Grid Roadmap Workshop

Roadmap Development Process

June 5, 2008

Smart Grid Roadmap Workshop Participants

- FirstEnergy
- Duke Energy
- Con Edison
- Orange & Rockland
- Southern Company (Alabama Power and Georgia Power
- AEP
- Southern Company
- Exelon (PECO)

- Kansas City Power & Light
- Detroit Edison
- BPA
- Entergy
- Long Island Power Authority
- We Energies
- Consumers Energy

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Workshop Results

- Attendees shared information about
  - Smart Grid Organization
  - Smart Grid Roadmaps
  - Smart Grid Technologies, Demonstrations, etc.
- Sharepoint site created for initial information sharing
  - http://sharepoint.smartgridroadmap.com/
  - Username: smartgriduser
  - Password: sgrm101

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Different groups developing Use Cases

- EPRI Intelligrid and Smart Grid Demonstrations
- Other parts of EPRI (e.g. EPRI Transportation for PHEV)
- DOE
- Gridwise Alliance and Gridwise Architecture Council
- IEC TC 57 (CIM and 61850)
- UCA Users Group
  – Utility AMI
  – CIM
  – IEC 61850
- Individual utilities and vendors as part of smart grid roadmaps and other activities

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IEEE Intelligent Grid Coordinating Committee

- Smart Grid Information Resource Center
  - Background references and links
  - Business cases
  - Use cases
  - Projects

- http://listserv.enernex.com/cgi/wa.exe?SUBED1=IEEE-PES-IGCC

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