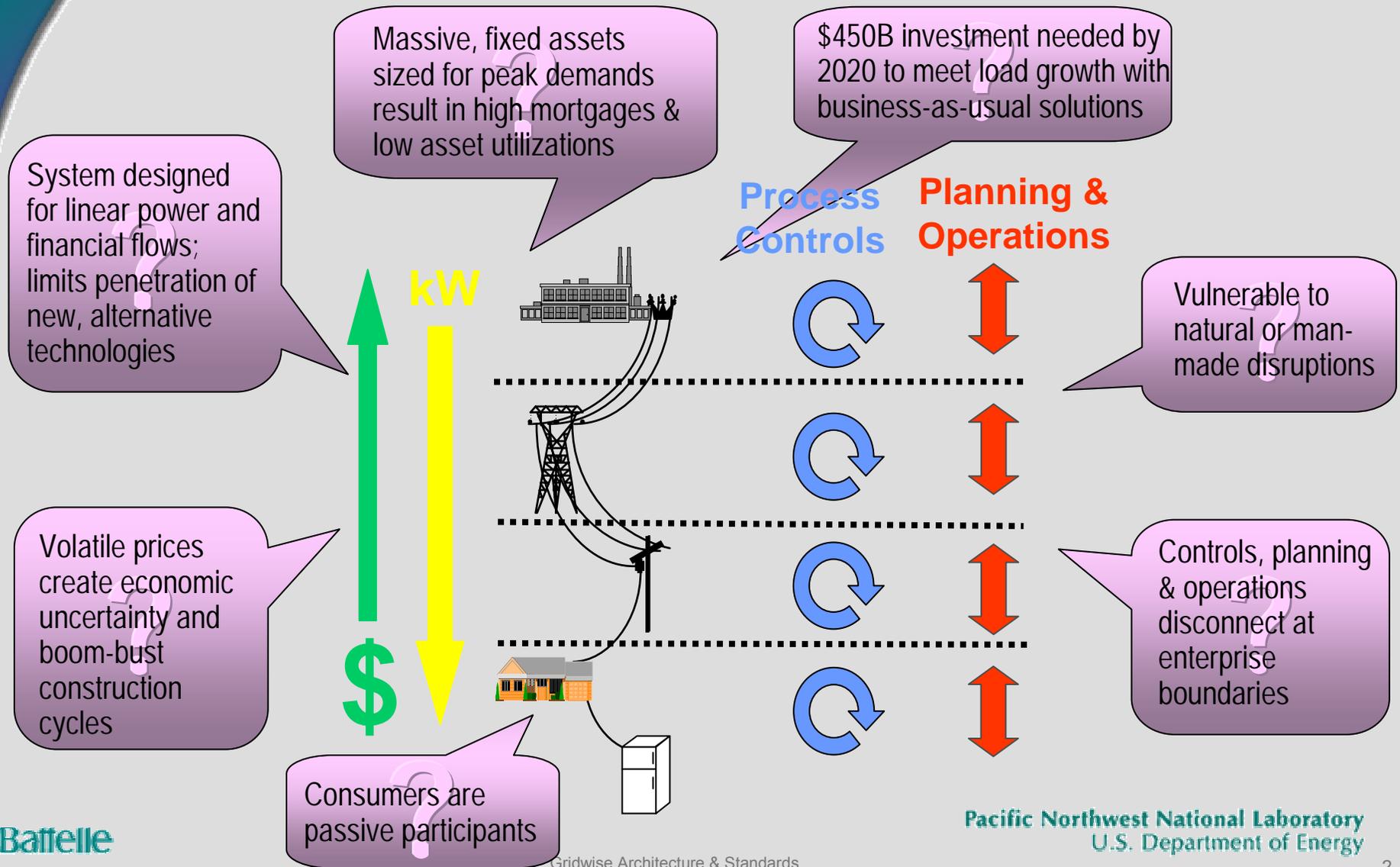


GridWise Architecture & Standards

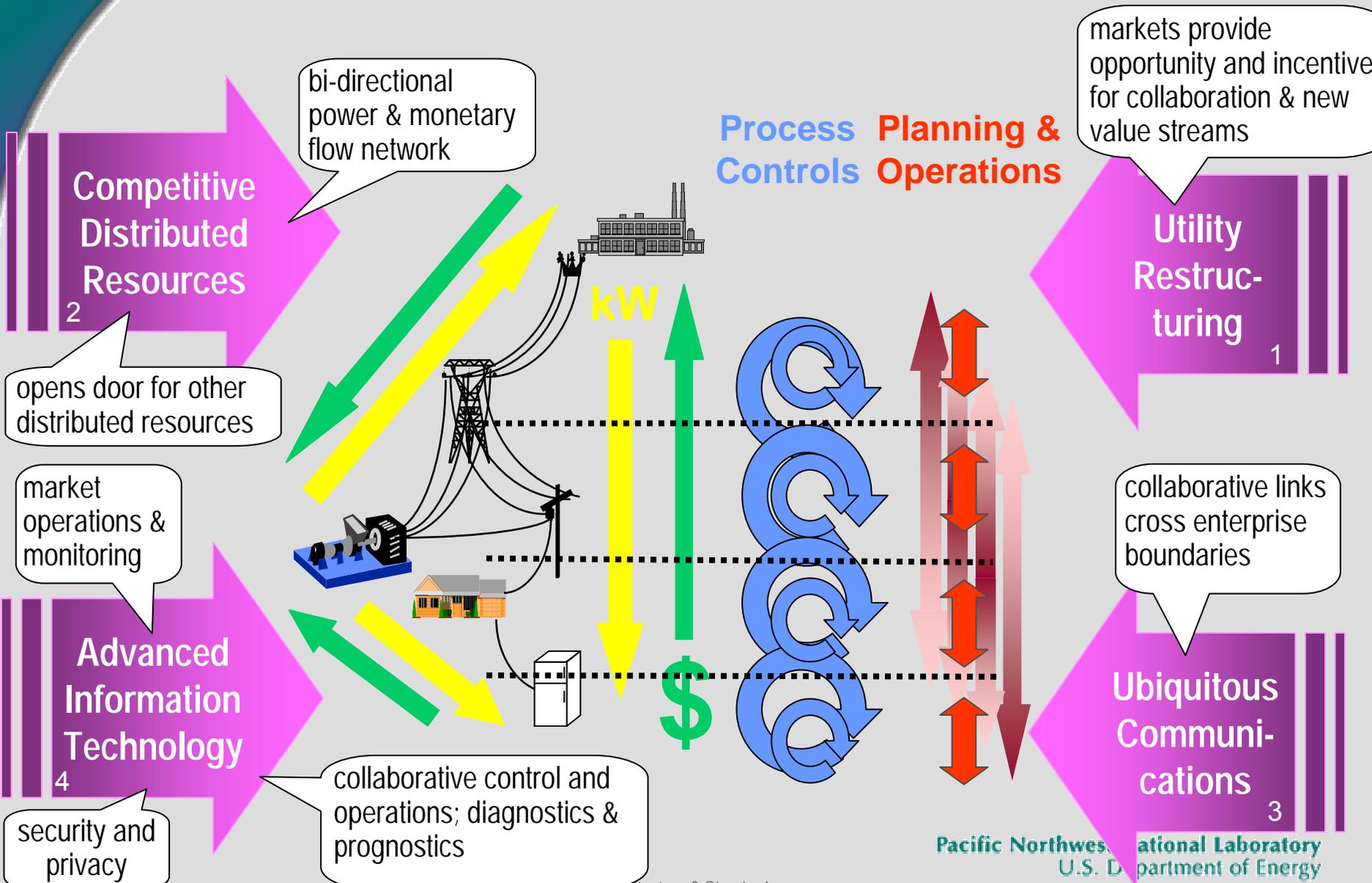
Electric Distribution Transformation Program Review FY04
Steve Widergren
Pacific Northwest National Laboratory

October 30, 2003
Coronado, CA

Issues & Uncertainties Surround Today's Energy Infrastructure



The Transformed Energy Infrastructure



Process Controls Planning & Operations

Competitive Distributed Resources

Utility Restructuring

Advanced Information Technology

Ubiquitous Communications

bi-directional power & monetary flow network

opens door for other distributed resources

market operations & monitoring

markets provide opportunity and incentive for collaboration & new value streams

collaborative links cross enterprise boundaries

collaborative control and operations; diagnostics & prognostics

security and privacy

The Result

- Real-time info, e-business, & market efficiencies minimize need for inventory & infrastructure, maximize productivity & asset utilization
- Loads & resources collaborate as a “society” with self-organizing & self-optimizing properties of free, fair markets
- Stability, security, crisis management capabilities enhanced
- Rapid, seamless penetration of DG, storage, & load management
- Efficiency & renewable programs competitive



Relevance

- ▶ Electric energy powers the economy
 - Ensure electricity is accessible, affordable, reliable
- ▶ Industry restructuring is transforming the energy business
 - New value streams & incentives
 - Distributed resources & environmental implications
 - Changing organizational entities
 - Reforming social responsibilities & regulations
- ▶ The information age is transforming the way energy is managed
 - Inexpensive, intelligent processing
 - Pervasive communications infrastructure
 - Interoperability trends that serve the mainstream economy

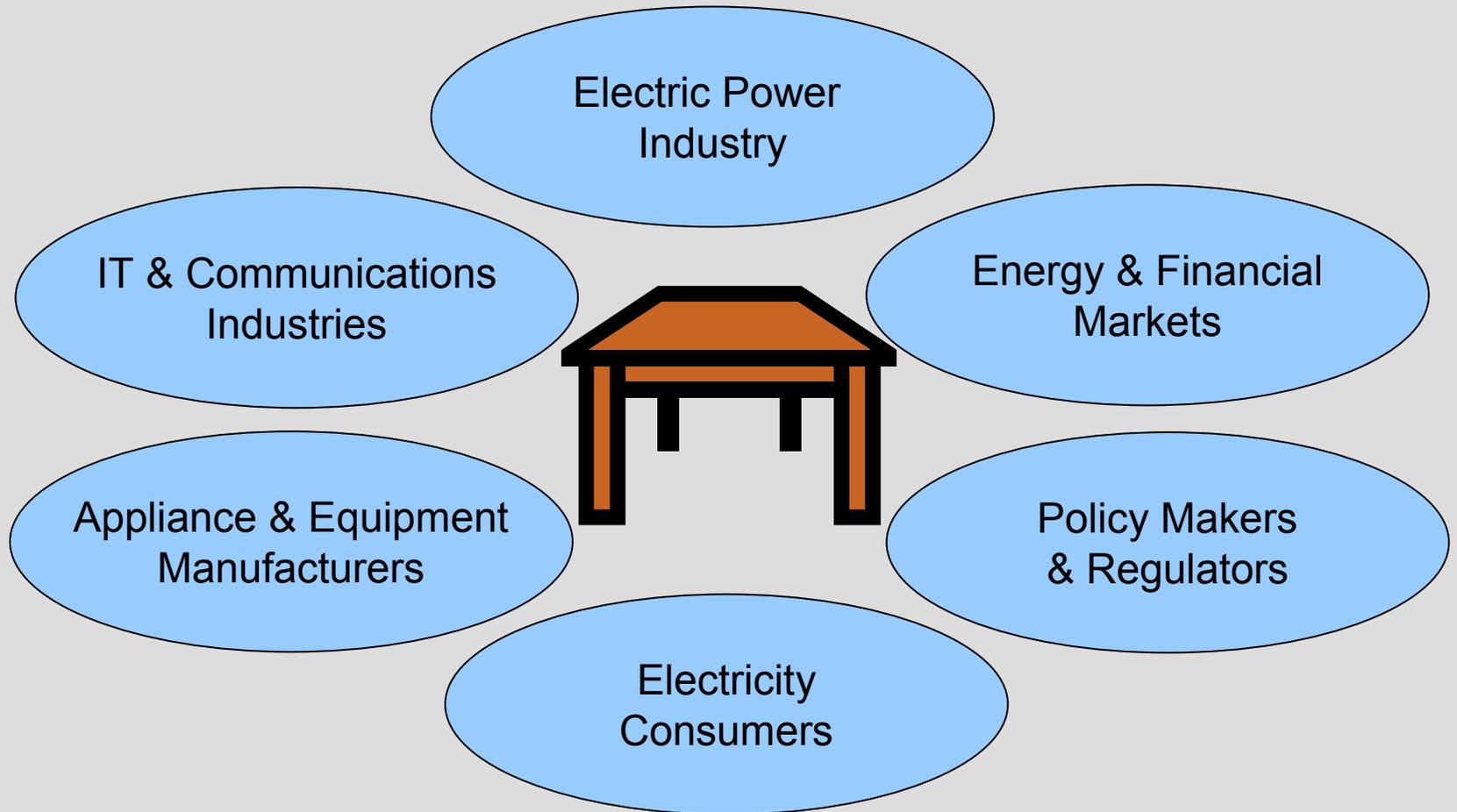
Challenges

- ▶ Enable access to new value streams
- ▶ Facilitate the integration of vast quantities of distributed resources (including load)
 - Economic synergy from multiple value streams
 - Systemic operational benefit v. detriment
 - Scalable approaches
- ▶ Be flexible to changing organizations roles & responsibilities
- ▶ Improve system performance & resilience
- ▶ Support fair market review & repudiation
- ▶ Respect the tensions between openness & privacy
 - open knowledge v. protected information for security
 - regulatory or investigative access v. privacy rights
- ▶ Ensure alignment with mainstream information technology trends that have widespread adoption in multiple business industries

Project Objectives

- ▶ Develop the principles & conceptual framework to facilitate multi-party, multi-device interoperability in a transformed energy system
- ▶ Align stakeholder mindshare behind these principles and framework
 - To ensure cross-industry adoption
 - Through participation in their creation & articulation
- ▶ Encourage standards development that promotes interoperation consistent with the principles and framework

Stakeholders

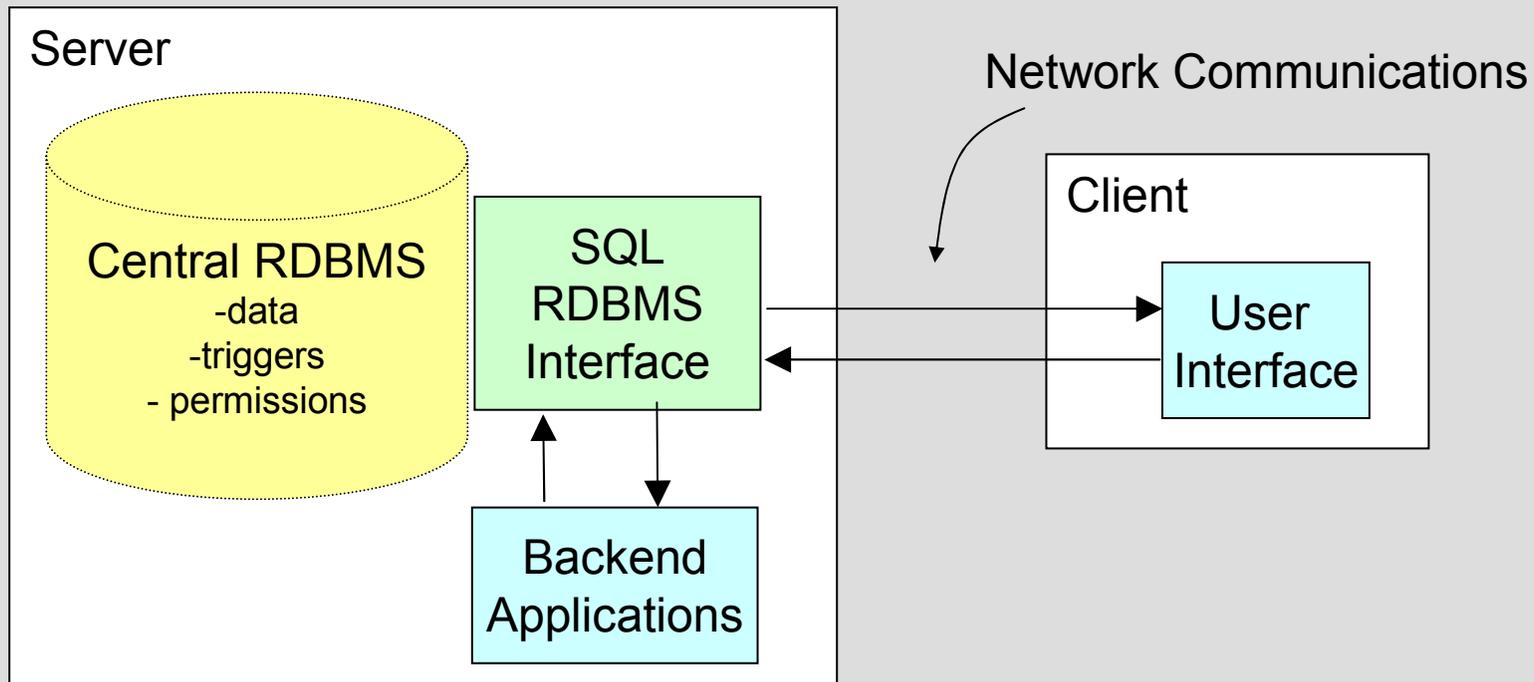


GridWise Architecture

- ▶ Architecture = principles & conceptual framework
- ▶ Architecture \neq design specification or prescribed implementation
 - Architecture inspires solutions consistent with the framework
- ▶ Architecture \neq a standard
 - Architecture helps reveal key interfaces between conceptual components that can benefit from standards

Example: Client / Server Architecture

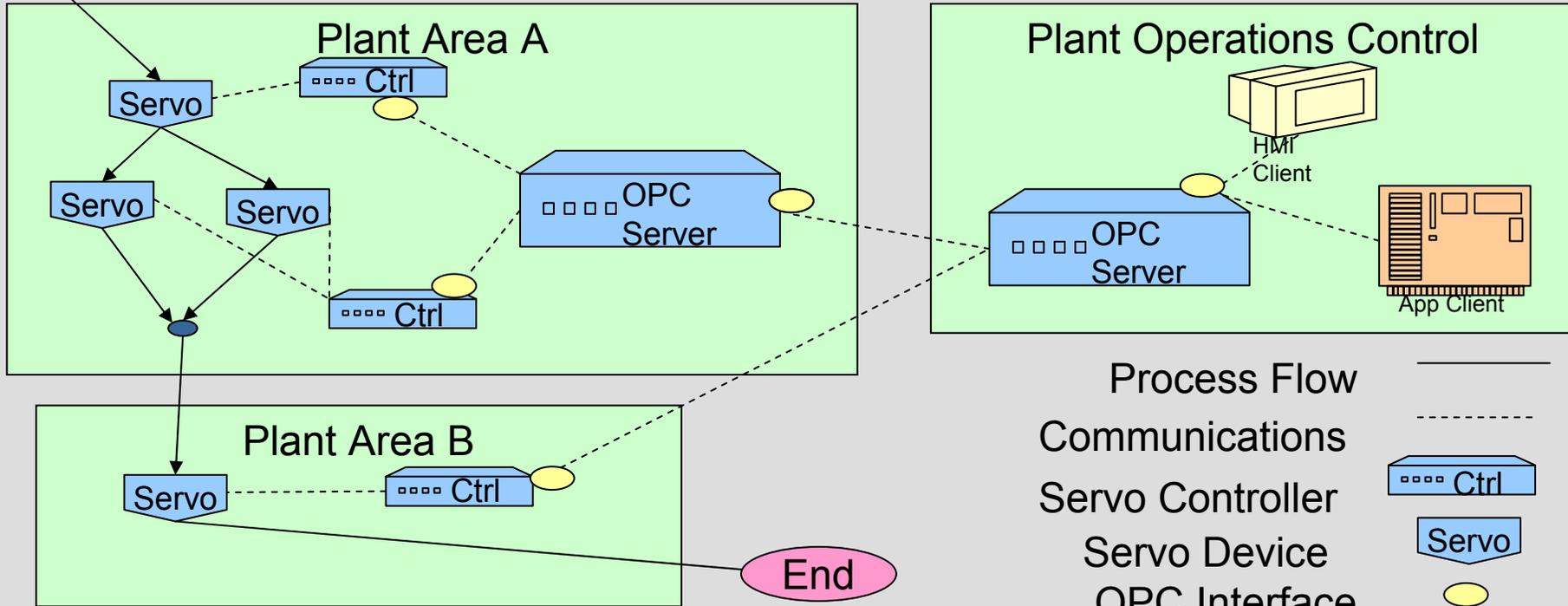
- ▶ Software system approach, generally relational database oriented
- ▶ Client UI requests served by a central information repository through applications and embedded database triggers
- ▶ Based on RDBMS standards & services, but with flexibility to customize user interface, applications, and communications



Example: OPC* Architecture

- ▶ Designed for industrial control SCADA application within a plant
- ▶ Initially based on DCOM distributed component integration mechanisms
- ▶ Supports interrogation of component server information
- ▶ Integrates servo measurements & actuators with plant controllers in a master/slave relationship

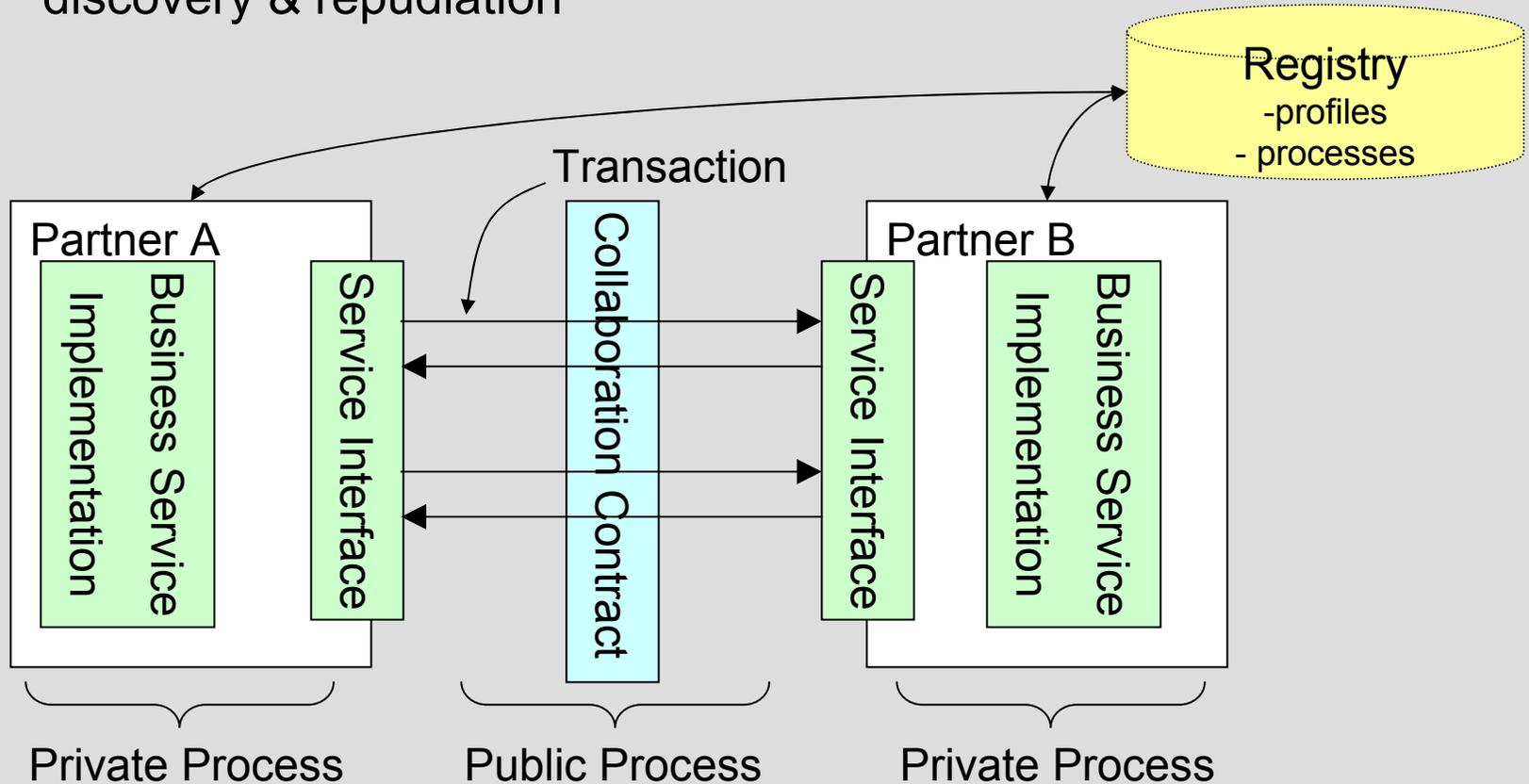
Start



* OPC – OLE for Process Control

Example: ebXML Architecture

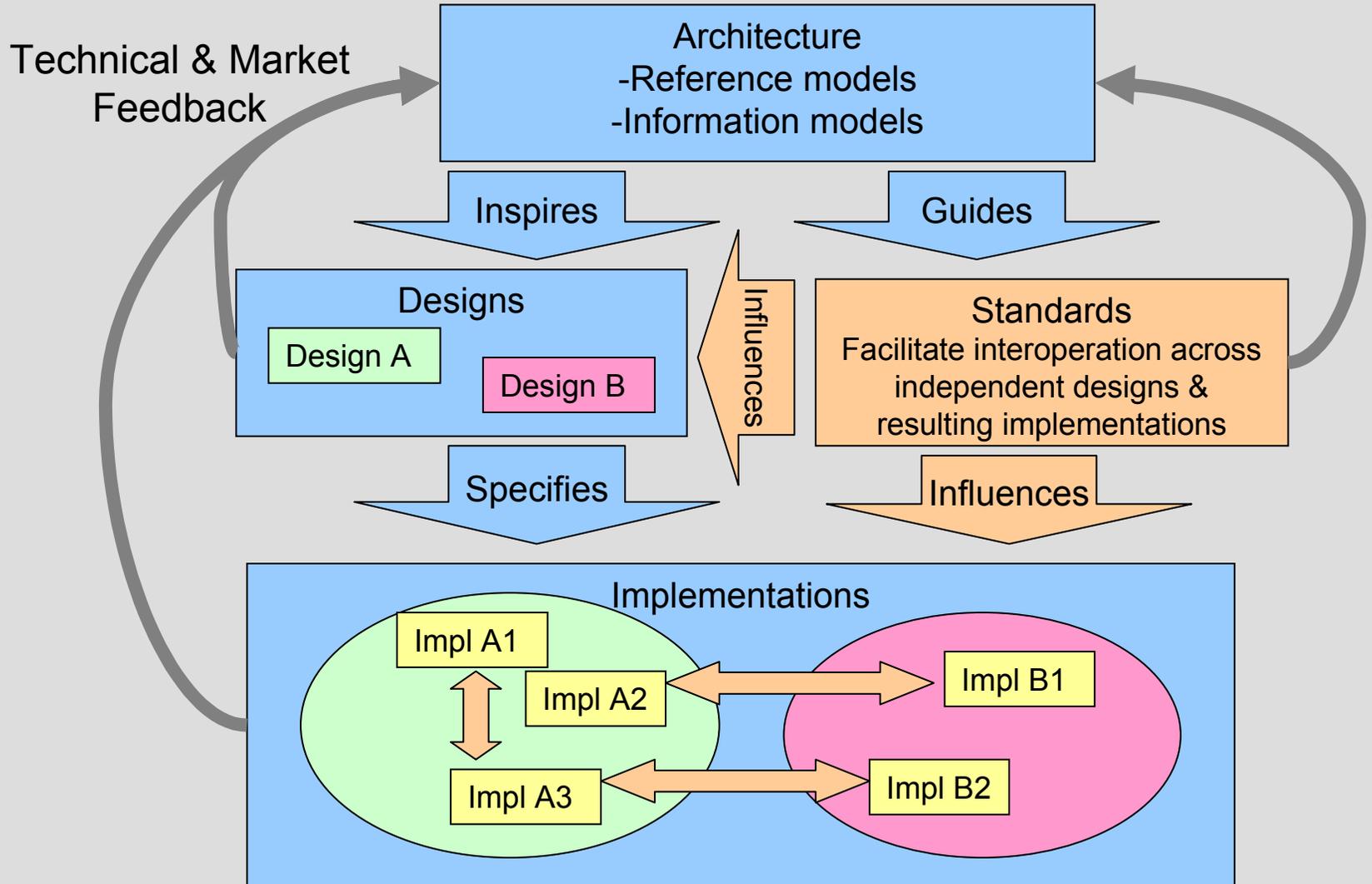
- ▶ Internet transaction based information exchange
- ▶ Based on standards & services, but with flexibility to customize
- ▶ Parties agree to collaboration contracts maintained in a registry for discovery & repudiation



From Gibb, Damodaran, ebXML Concepts and Application

Pacific Northwest National Laboratory
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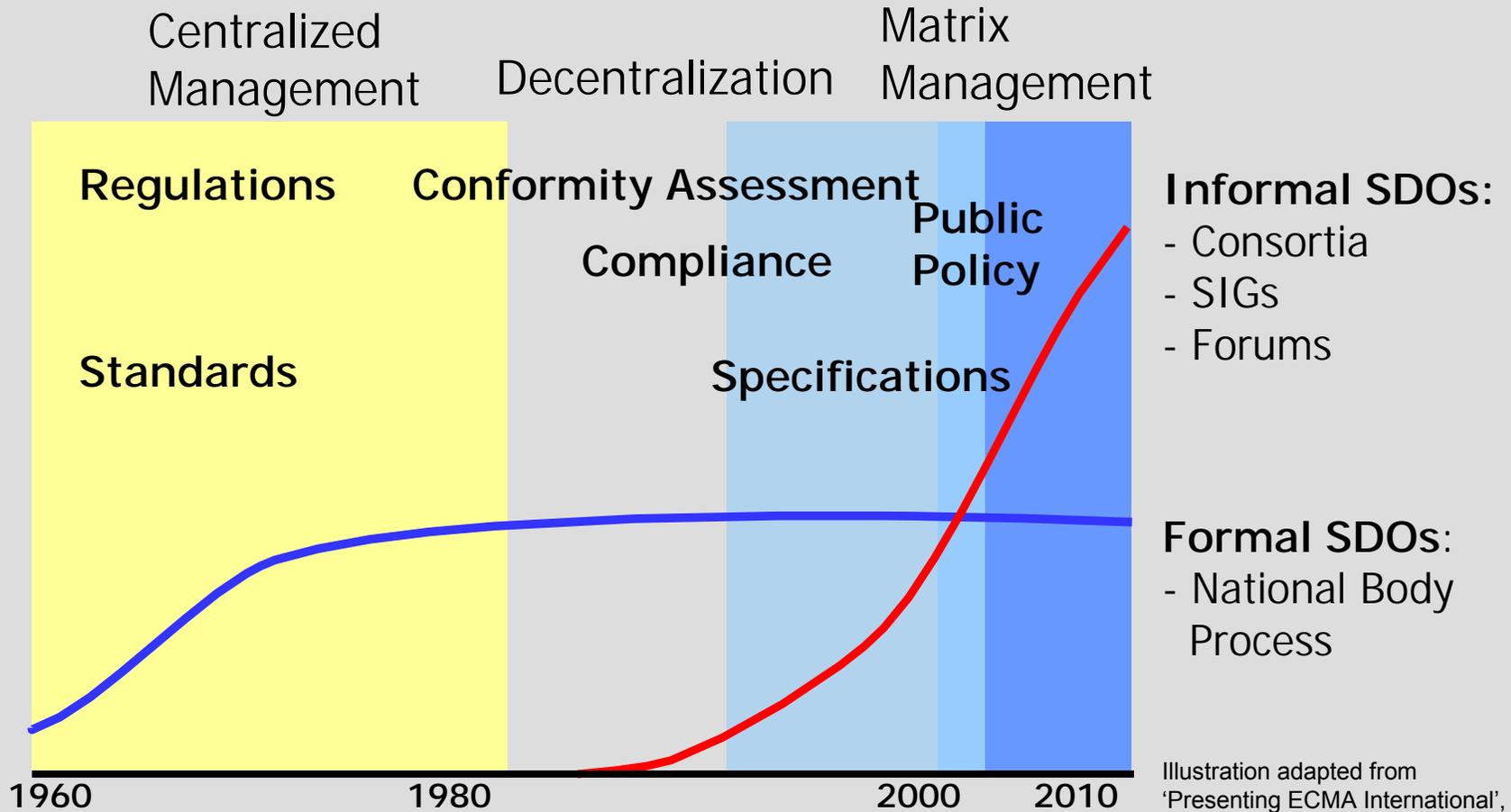
Architecture v Design v Standards



Standards

- ▶ Standards & standards organizations are plentiful
- ▶ Existing standards bodies are chartered to meet specific industry needs
 - E.g., power engineering, IT, internet, B2B
- ▶ Standards action requires a critical mass engagement
- ▶ Good standards yield the most interoperability for the least amount of agreement
 - They are focused to resolve shared issues of value
 - They respect simplicity & clarity
 - They are championed by industry leaders & are applied
 - E.g., electric plugs/communication jacks, http, XML

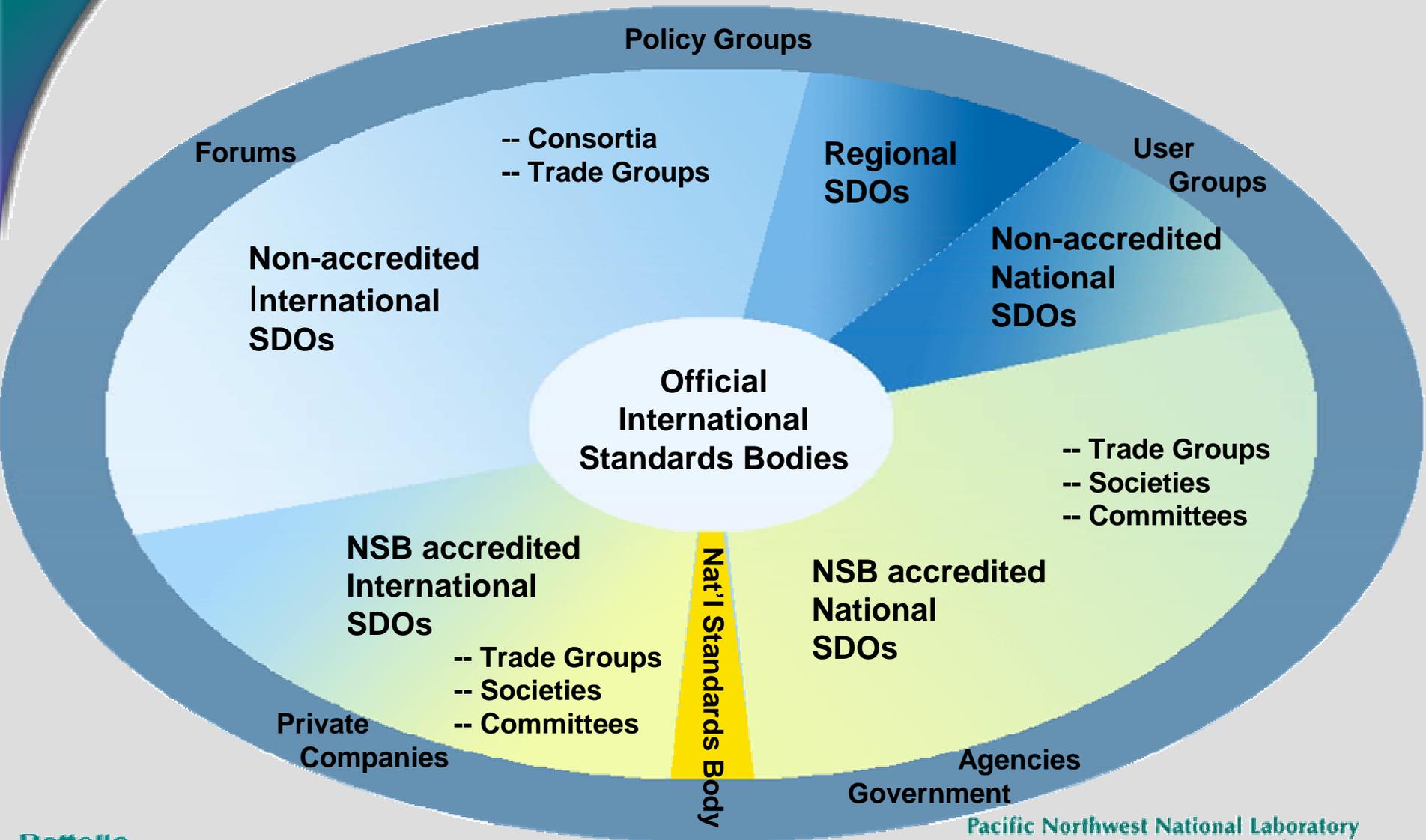
Standards Organizations Evolvemement



SDO = standards development organization

Illustration adapted from 'Presenting ECMA International', European Computer Manufacturers Association International website www.ecma-international.org. July 17, 2003, file author Martin Jacklin

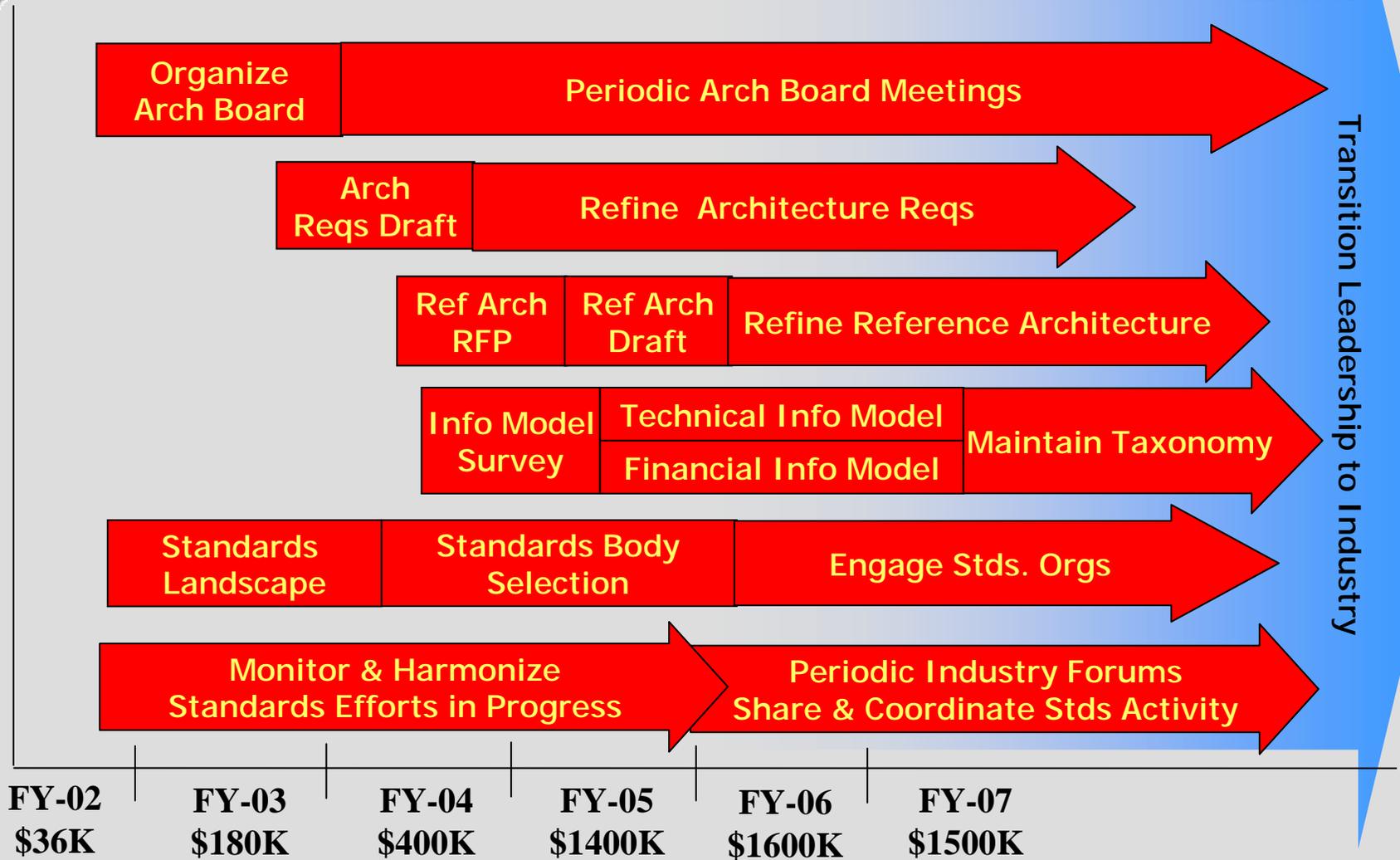
Standards-Related World



Approach

- ▶ Institute an architecture board
 - Charter: develop an architectural vision to align mindshare, articulate concepts, & inspire standards activity that promotes the GridWise vision
 - Broad industry representation
 - Recognized & respected thought leaders
- ▶ Communicate architectural principles & conceptual framework
- ▶ Identify relevant standards, as well as public and private industry activity from all stakeholder areas
- ▶ Target & engage existing or new standards work to facilitate interoperability consistent with principles & conceptual framework

Life-Cycle Project Timeline



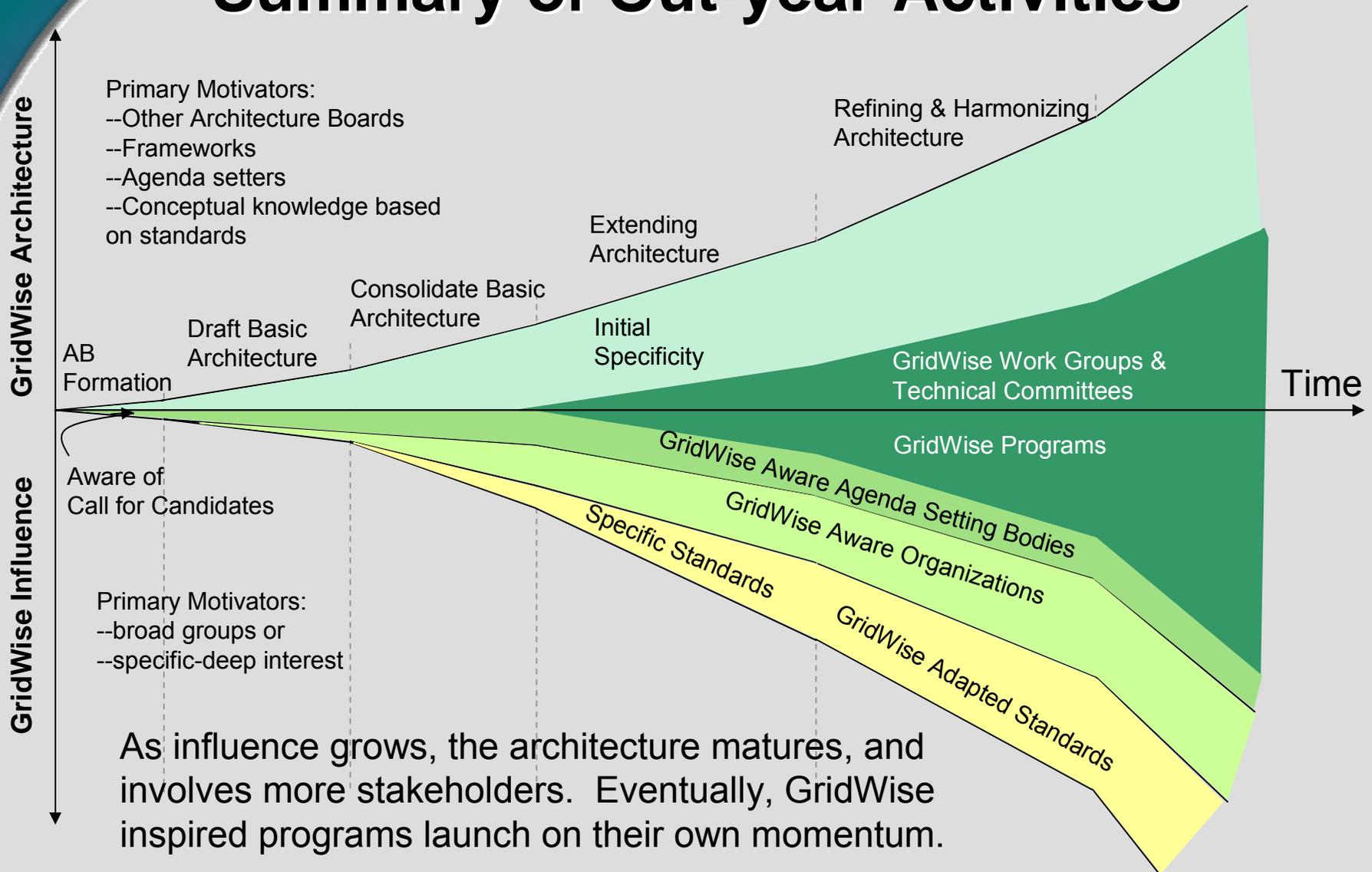
FY03 Progress and Accomplishments

- ▶ Articulated the purpose & structure for an architecture board
- ▶ Developed an architecture board formation process & drafted call-for-candidates literature & website
- ▶ Initiated the call-for-candidates process
- ▶ Drafted a description of the standards body landscape & relevant organizations
- ▶ Standards engagement
 - Active in the development of the IEEE SCC21 1547.3 Guide
 - Represented DOE on the CEIDS IECSA & DER/ADA projects

Planned Activities for FY04

- ▶ Launch architecture board call-for-candidates – Q1
- ▶ Refine standards landscape report – Q1
- ▶ Form Board & hold first meeting – Q2
- ▶ Draft architecture requirements – Q2
- ▶ Solicitation plan for reference model – Q3
- ▶ Second Board meeting – Q4
- ▶ Support 1547.3 & CEIDS projects – Q1-Q4
- ▶ Participate in related conferences/events – Q1-Q4

Summary of Out-year Activities



Interactions & Collaborations

- ▶ OETD Electric Distribution Transformation related projects
- ▶ Industry organizations, e.g.,
 - GridWise Alliance
 - EPRI & E2I CEIDS
 - Open Business Process Communities, e.g.,
 - UN/CEFACT, OASIS, The Open Group
- ▶ Relevant standards organizations, e.g.,
 - IEEE: e.g., SCC 1574.3
 - IEC: e.g., TC57
 - W3C
 - OMG

Contact Information

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Office of Electric Transmission & Distribution
Electric Distribution Transformation

For more information about the
GridWise Architecture Board
Call for Candidates, please see,
<http://www.pnl.gov/gridwise>