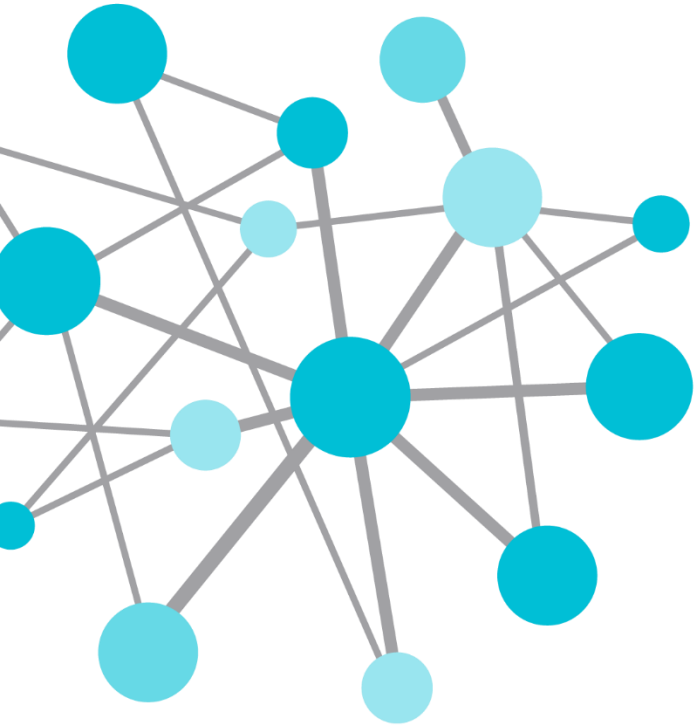


LINKING GOVERNMENT, INDUSTRY AND ACADEMIA

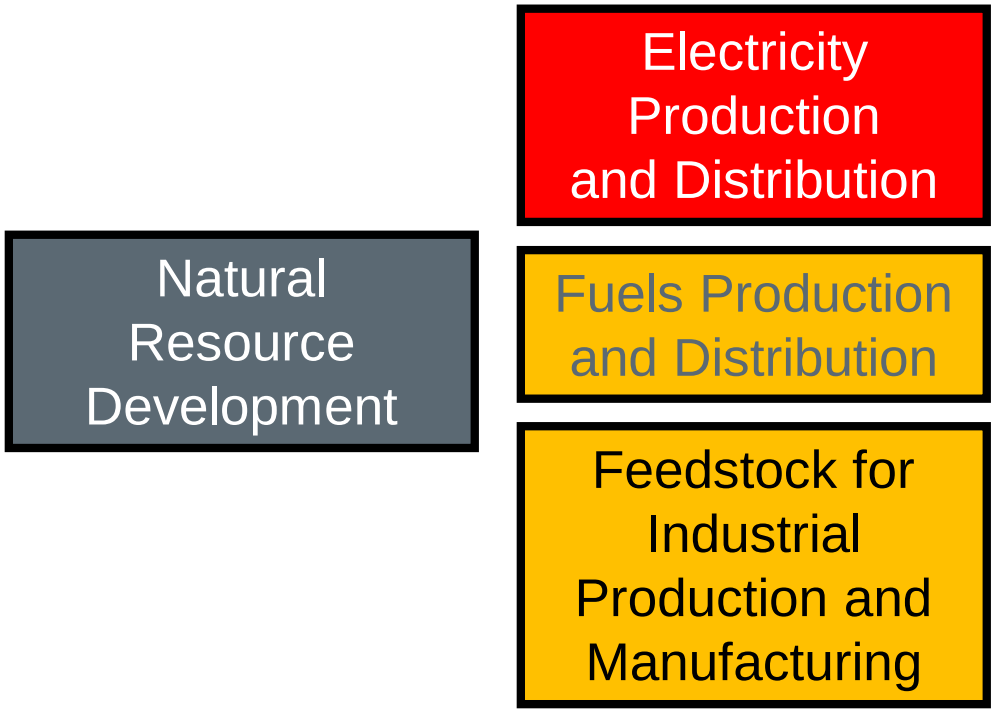
Presented by **Prof. Donald L. Paul**

University of Southern California

Themes

- The Intelligent Energy System
- Linkage and Research
- USC Energy Program Linkages
- Summary

The energy system



The energy system

Scale
Capital intensity
Asset longevity
Complexity and connectivity

Technology
+
Business
+
Government
+
Society

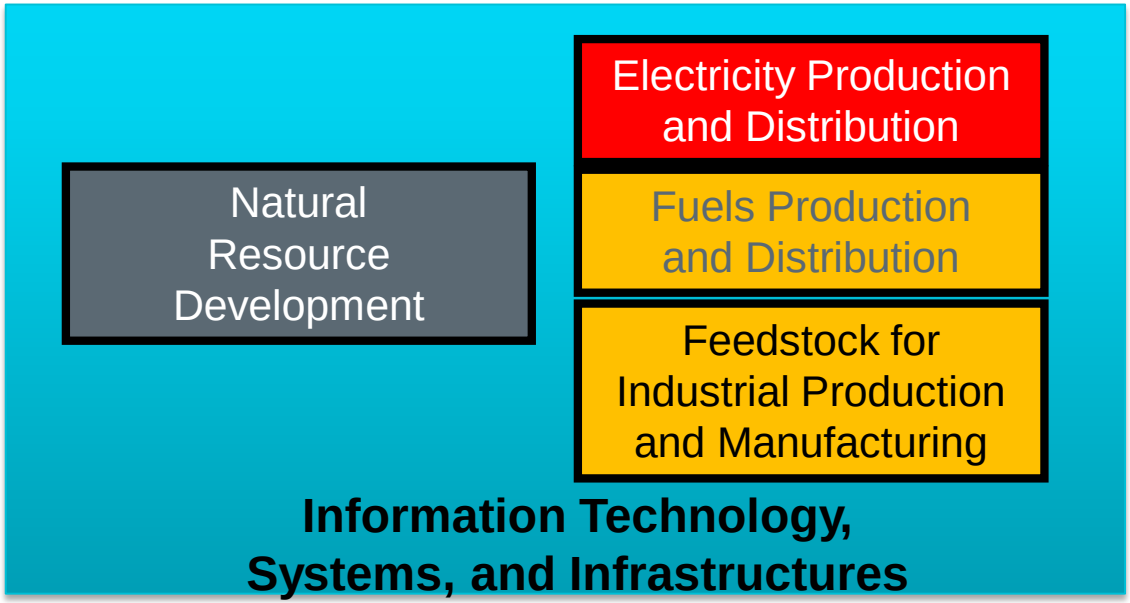
Natural Resource Development

Electricity Production and Distribution

Fuels Production and Distribution

Feedstock for Industrial Production and Manufacturing

Intelligent Energy:
the intersection, integration, and co-evolution of the information and energy systems



Energy trends

- U.S. energy resource boom - from scarcity to abundance
- Diversification / distribution of sources and storage
- Aging infrastructures
- Efficiency and carbon management
- Evolving “automobility”

IT trends

- Universal sensing, connectivity, and computing
- Moore’s Law continues
- Consumerization of IT
- “Big Data” and analytics
- Security
- Real-world robotics

Intelligent Energy: linkage opportunities for research and education

- Next-generation resource development technologies
- Balancing economic, environmental, and societal impacts of large-scale resource development
- Integrated management of the energy and transport systems
- Mega-scale complex systems science, including “Big Data” and analytics development
- Cyber-physical security systems for energy infrastructures
- Impacts of human / societal behaviors

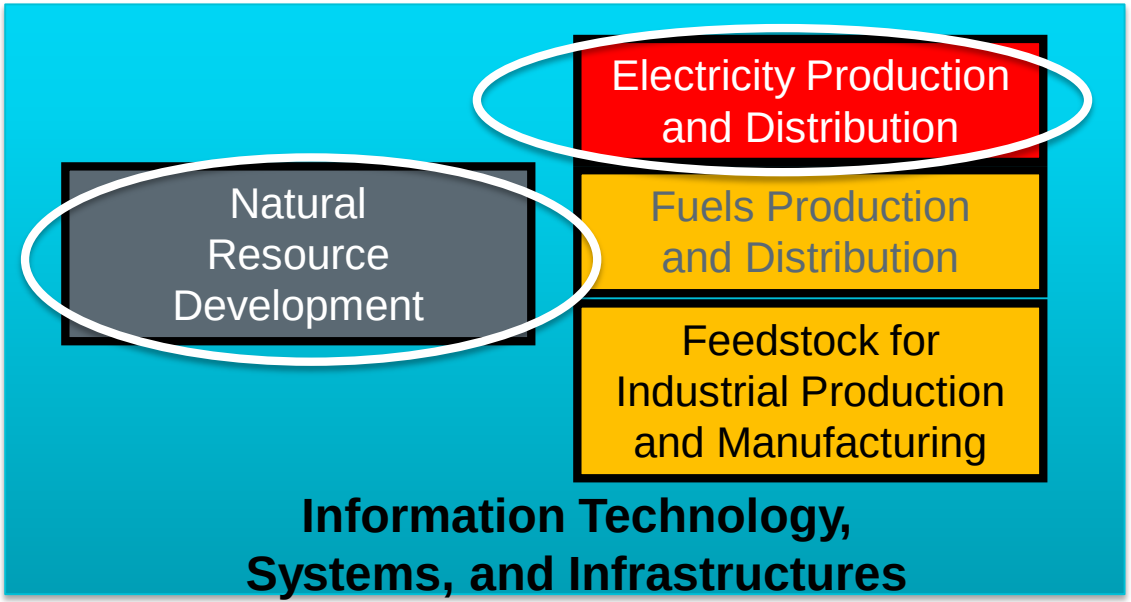
Chevron – USC Partnership

Center for Interactive Smart Oilfield Technologies
(Established Dec. 2003)

- Operates with a joint venture structure: Chevron / USC co-management
- Integrated Chevron / USC R&D programs
- Field demonstrations and deployment programs
- Graduate Petroleum Engineering degree specializations

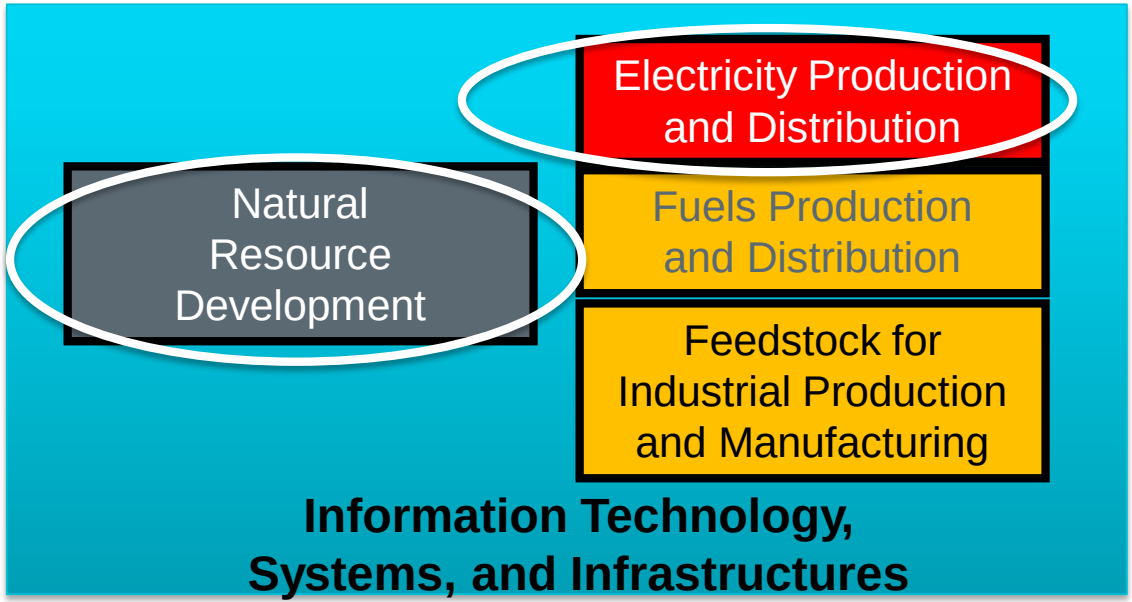
USC Energy Institute:
Intelligent Energy Programs

- ***System research programs integrating petroleum engineering / power engineering, and diverse information technologies***
- ***Strategic partnerships with major energy operators and technology companies***
- ***Experimental infrastructures and operational demonstrations programs at scale***
- ***Graduate degree specializations***



USC Energy Institute:
Intelligent Energy Programs

- ***CiSoft:*** **Center for Smart, Interactive Oilfield Technologies**
- **USC Smart Grid Living Laboratory**
- **Cyber-physical Security for Oil and Gas Infrastructures and Operations**

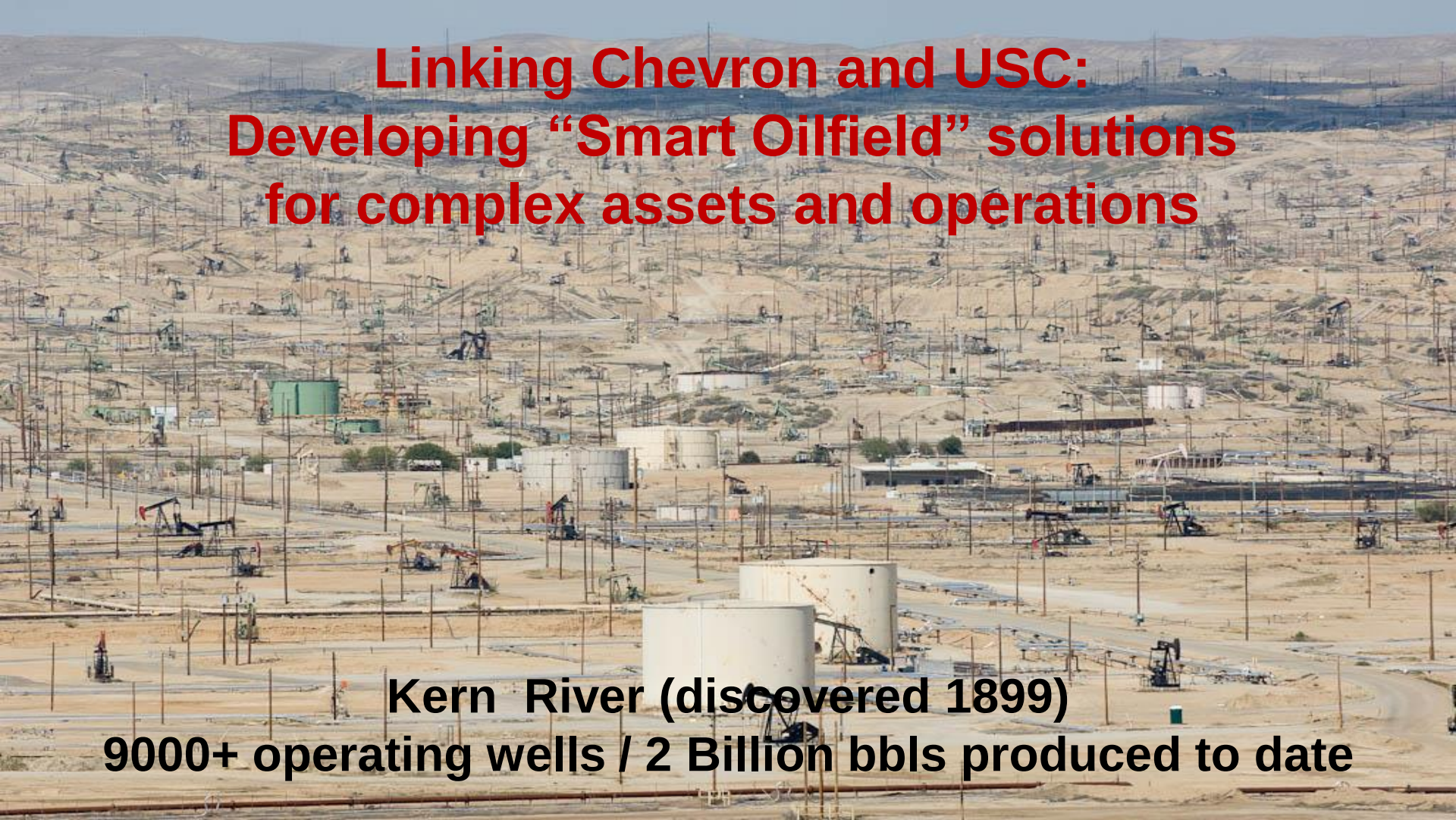


CiSoft directed R&D program areas

- Real-time Integrated Asset Management
- Well drilling and productivity improvement
- Reservoir performance management
- Informatics, analytics, and data management
- Robotics and artificial intelligence
- Embedded and networked systems
- Immersive visualization
- Applied virtualization technologies

Multi-disciplinary Teams:

- Petroleum Engineering Programs
- Reservoir Monitoring Consortium
- Center for Energy Infomatics
- Interactive Media Science Center
- Institute for Creative Technologies
- Industrial and Systems Engineering



Linking Chevron and USC: Developing "Smart Oilfield" solutions for complex assets and operations

Kern River (discovered 1899)

9000+ operating wells / 2 Billion bbls produced to date

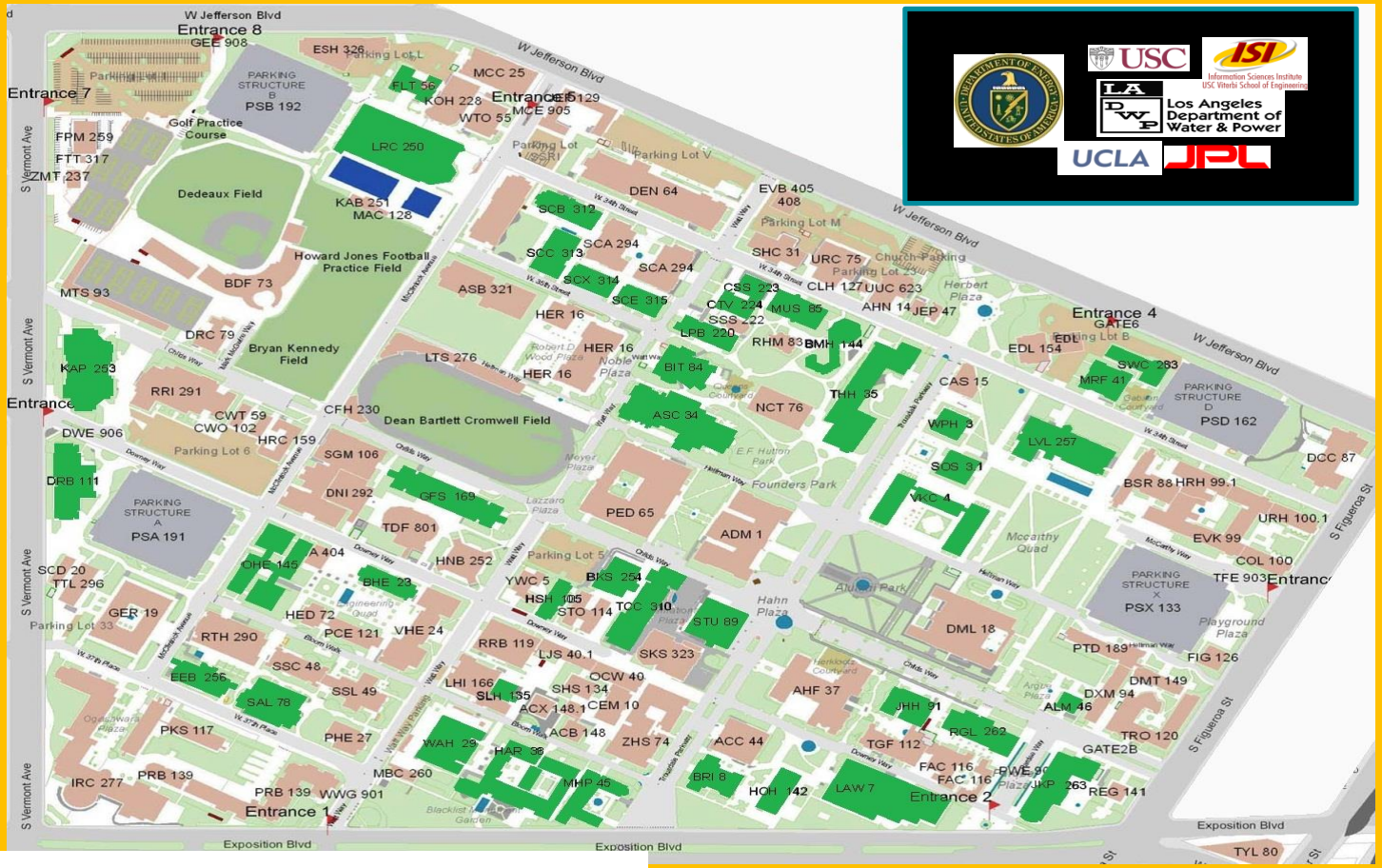
Linking industry and academia to educate today's Petroleum Engineer:

Science and Technology +

Business and Economics +

Geopolitics and Regulation +

Society and Environment



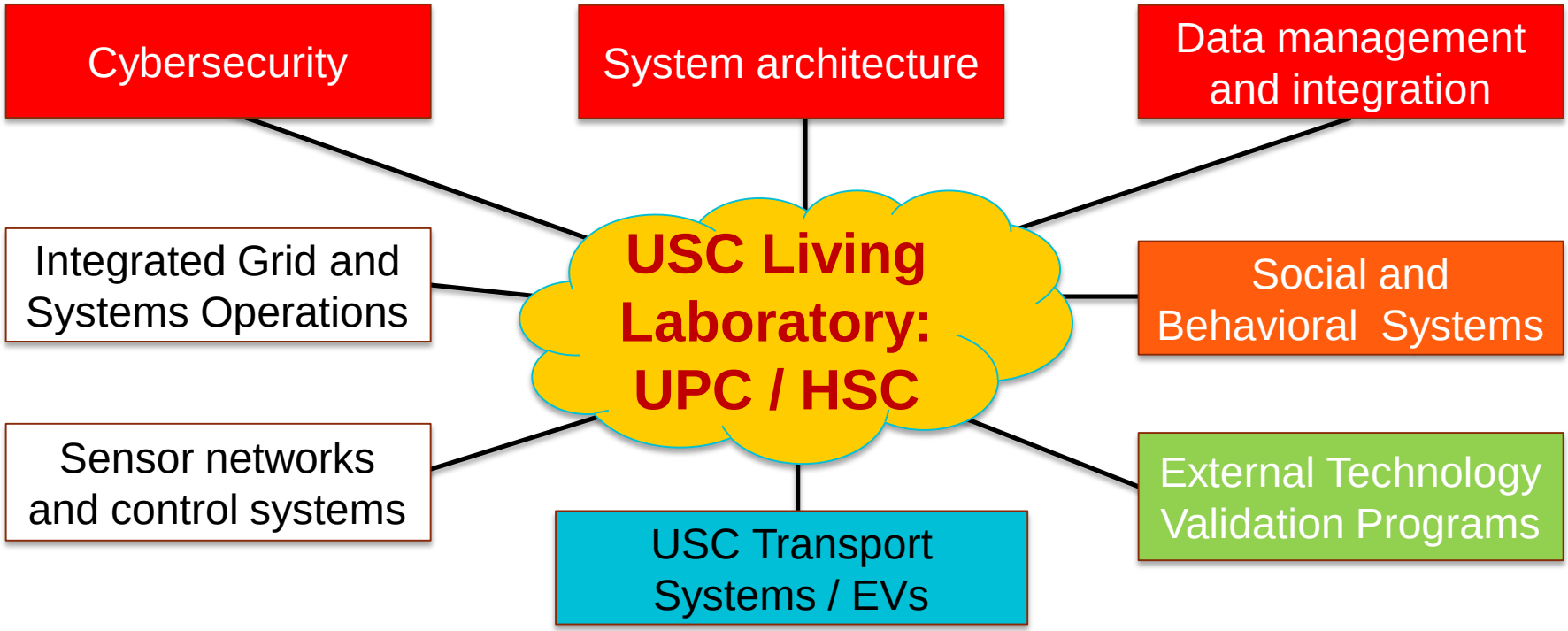
USC SmartGrid

Living Laboratory

The “USC Smart Grid Living Laboratory”

- Utilizes USC as a 50,000 person mini-city to establish an experimental and demonstration facility at scale
- Utilizes USC’s centrally-controlled energy and transport infrastructure
- Leverages USC’s energy system capital investments, freedom of operation, and diverse customer base
- Creates a controlled environment to test and validate system architectures, operational scenarios, and behavioral characteristics in support of deployment to utility-scale Smart Grids
- Creates a new demonstration and commercialization platform for current / future university research and education
- Enables unique partnerships with technology companies, utilities, and communities by providing calibrated testing at scale for 3rd party technologies

USC Smart Grid Living Laboratory: experimental test beds and system components



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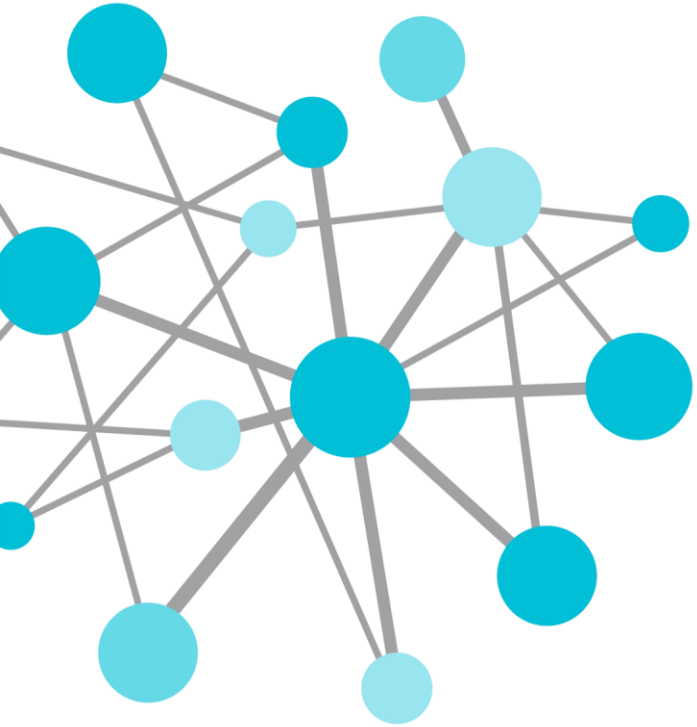

THANK YOU

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