



Research Opportunity Notices and How to Submit Proposals

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What are RON's

Research Opportunity Notice

- ◆ **Mechanism to solicit proposals**
- ◆ **State general objectives to stimulate research ideas for proposals**
- ◆ **Presented at DR ETD Workshops**
- ◆ **Full text available on-line**
- ◆ **Not an RFP**
 - ◆ Non-competitive
 - ◆ No deadlines

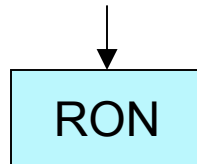


Proposals

- ◆ **Mix and match RON objectives**
 - ◆ One RON
 - ◆ Part of one RON
 - ◆ Combine RONs
 - ◆ Combine pieces of different RONs
- ◆ **DR relevance**
- ◆ **Collaborative and multidisciplinary**
- ◆ **Leverage funding (DOD, DOE, NSF, industry)**
- ◆ **Start with R&D design phase (<\$250 K)**
- ◆ **Reviewed by the TAC**



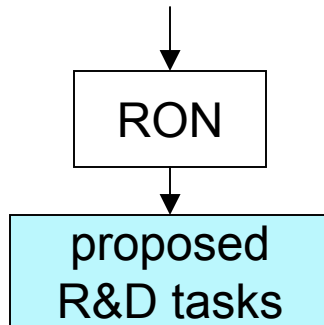
Research Opportunity Notice (RON)



- ◆ **RONs are posted at CIEE website in PDF file format and presented at DRETD workshops**
- ◆ **10-12 weeks to get through funding process from receipt of proposed tasks**



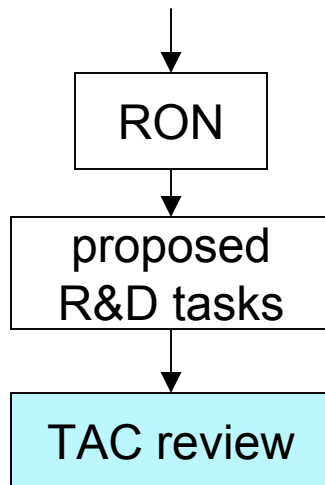
Proposed R&D Tasks



- ◆ **R&D tasks should be informal proposals**
 - ◆ ~ 7 written pages with
 - ◆ Budget
 - ◆ Schedule
 - ◆ Milestones
- ◆ **Discuss R&D ideas with Gaymond Yee (and Ron Hofmann) before submitting**



Technical Advisory Committee (TAC) Review



◆ Key review elements

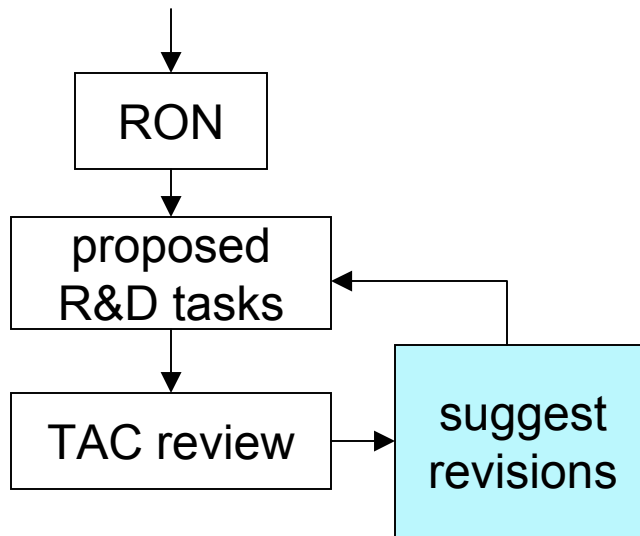
- ◆ DR relevance
- ◆ Enabling technology
- ◆ Collaboration
- ◆ Multi-disciplinary

◆ 3 possible outcomes

- ◆ Recommend
- ◆ Suggest changes
- ◆ Reject



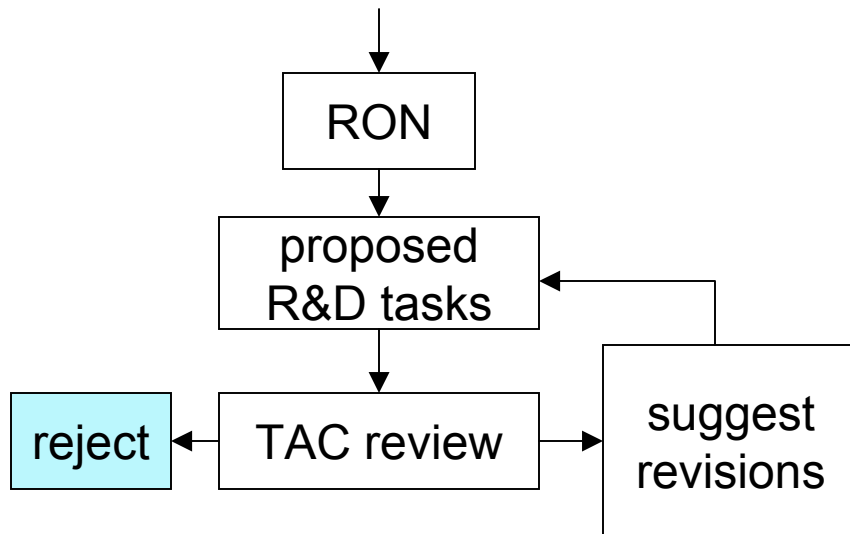
Suggest Revisions



- ◆ **Proposal is returned to submitter**
- ◆ **Suggested revisions are made and proposal is re-submitted**



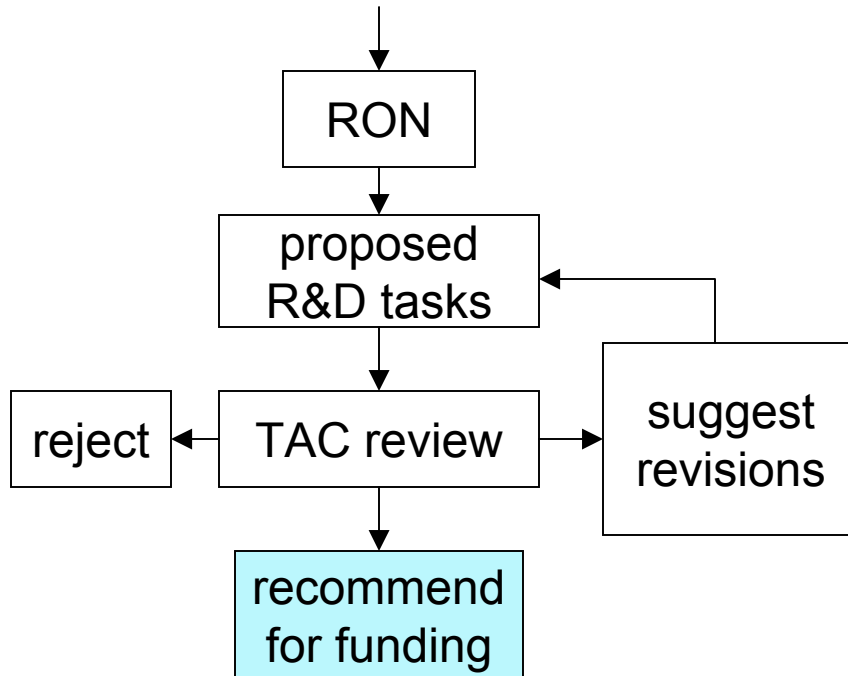
Reject



- ◆ **Failed key element(s)**
 - ◆ DR relevance
 - ◆ Enabling technology
 - ◆ Collaboration
 - ◆ Multi-disciplinary
- ◆ **Can resubmit new proposed R&D tasks after discussions and failed elements are corrected**



Recommend For Funding



Meeting to Discuss TAC's Funding Recommendation

◆ CIEE

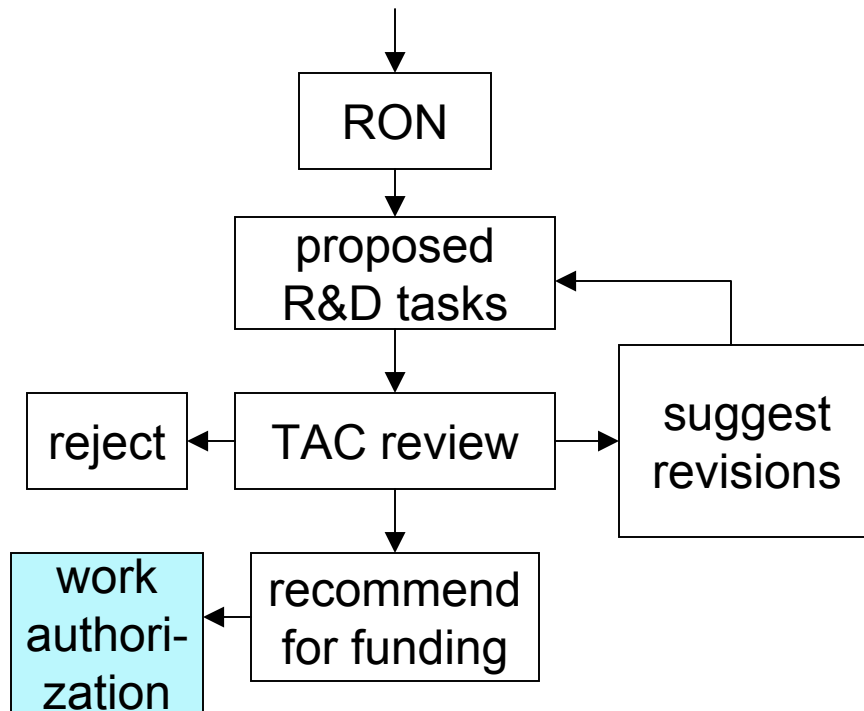
- ◆ Gaymond Yee

◆ CEC

- ◆ David Michel
- ◆ Laurie ten Hope



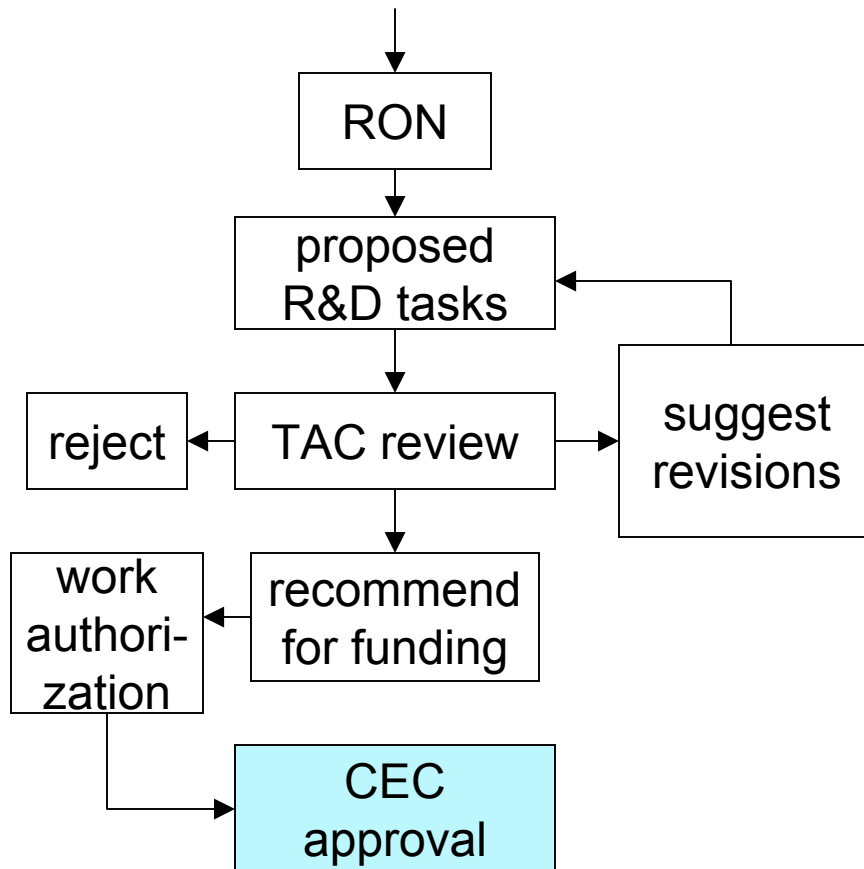
Work Authorization



- ◆ **Maureen Barnato**
(DR ETD funding and development manager)
- ◆ **Prepares and submits work authorization package for formal CEC approval**



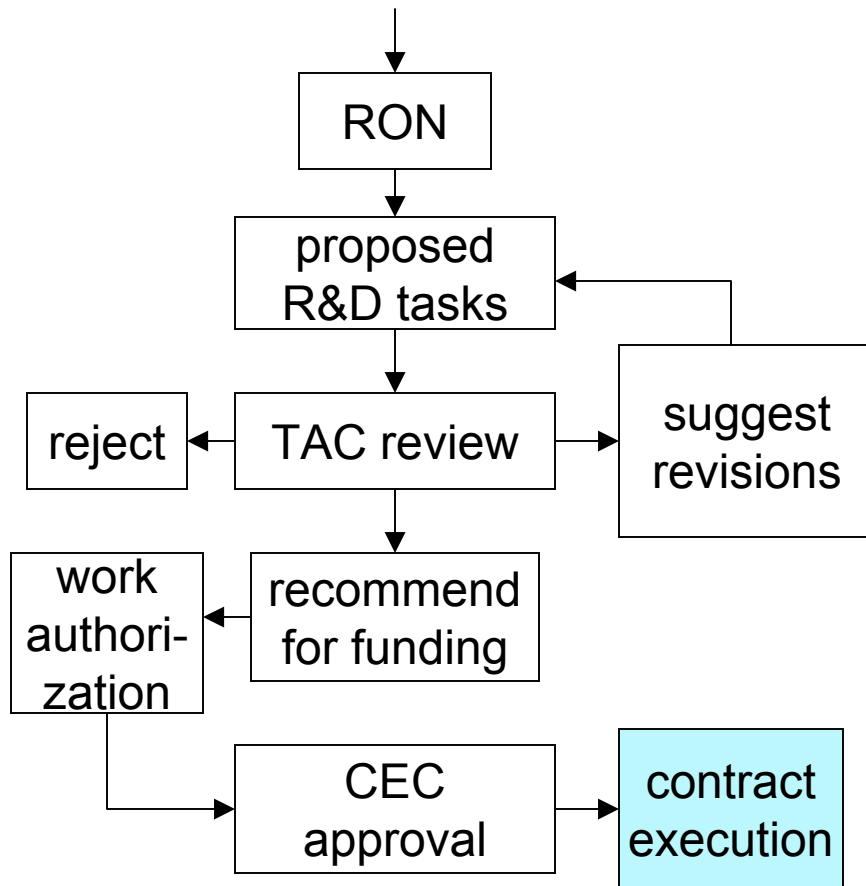
CEC Approval



◆ **David Michel**
(CEC Contract Manager)



Contract Execution



- ◆ **John Snyder (DR ETD subcontract administrator)**
- ◆ **Prepares contract for execution**



CIEE - DR ETD Team

- ◆ **Project management**
 - ◆ Gaymond Yee
- ◆ **Funding and development administration**
 - ◆ Maureen Barnato
- ◆ **Subcontract administration**
 - ◆ John Snyder
 - ◆ Supported by Brad Niess and Steve Cunningham
- ◆ **Project website**
 - ◆ <http://ciee.ucop.edu/dretd/>



Current RON's

1. **Revenue Energy Metering**
2. **Temperature Measurement**
3. **Network Management**
4. **System Integration**
5. **Control and Communications Integration**

Posted on <http://ciece.ucop.edu/drted/>



Research Opportunity Notice

Revenue Energy Metering

Today's Electric Meters





Goals of the **NewMeter**

- ◆ **Installed costs of <\$50**
- ◆ **Flexible communications capability**
 - ◆ Cannot be “stranded”
 - ◆ Compatible with water and gas metering
- ◆ **Support for dynamic tariffs and DR**
- ◆ **System Platform capable of supporting**
 - ◆ Sensors
 - ◆ Actuators
 - ◆ Communications Links



Additional Goals

- ◆ **Easy installation at residence entry or on individual appliances**
- ◆ **Communications range 10-300M with a very efficient wireless network**
- ◆ **Scavenge ambient energy**
- ◆ **Revenue quality measurements of Instantaneous volts and amps over long life**
- ◆ **Perform computations of power factor, power quality, etc.**
- ◆ **Store measured and computed data**



NewMeter

◆ Platform

- ◆ Hardware/Firmware reconfigurable remotely (fail-safe)
- ◆ Allows new features and tariffs to be added remotely
- ◆ Collects, stores, communicates
 - Revenue quality measurements

◆ Sensors (voltage/current)

- ◆ Integrated on a chip for low cost, “smart” calibration
- ◆ Passive, non-intrusive sensors allow easy installation
 - At utility pole
 - At building without socket
 - At individual loads



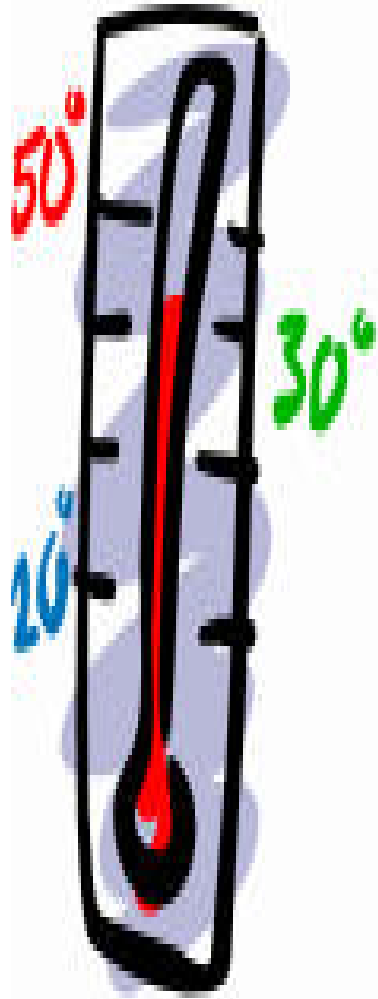
NewMeter

◆ Power Supply

- ◆ Energy scavenged from line being measured
- ◆ Internal energy storage allows 15 minutes communications after power has failed

◆ Communications

- ◆ Maximize digital components
- ◆ Integrated “smart” antenna
- ◆ Reconfigurable for frequency band, modulation, and protocol - cannot be stranded
- ◆ WAN to the outside world
- ◆ LAN to sensors, actuators



Research Opportunity Notice

Temperature Measurement



Today's Thermostats





Goals of the **NewStat**

- ◆ **Installed cost <\$30**
- ◆ **Communications range 10-300M, efficient wireless network**
- ◆ **Easy installation (no new wires)**
- ◆ **Scavenge energy for operation**
- ◆ **Support for dynamic tariffs and DR**
- ◆ **Increased functionality, humidity, comfort, etc.**
- ◆ **Clear and intuitive user interface**



Goals of the TempNode

- ◆ **Installed cost <\$10**
- ◆ **Communications range 10-50M, efficient wireless network**
- ◆ **Easy installation in self-organizing networks**
- ◆ **Scavenge energy for operation**
- ◆ **Support for dynamic tariffs and DR**
- ◆ **Measure additional environmental parameters**



NewStat

◆ Platform

- ◆ Hardware/Firmware reconfigurable remotely and fail-safe
- ◆ Allows new features and tariffs to be added remotely
- ◆ Computes “comfort” and adjusts setpoints accordingly
- ◆ Automatically responds to price signals – based on user-preferences

◆ Sensors

- ◆ Integrated on a chip for low cost, “smart” calibration
- ◆ Measures temperature and humidity



NewStat

◆ Power Supply

- ◆ Energy scavenged from environment or load
- ◆ Sources include vibration, illumination, heat, or the circuits being controlled

◆ Communications

- ◆ Remotely configurable for new capabilities
- ◆ Integrated “smart” antenna
- ◆ WAN to the outside world
- ◆ LAN to **TempNodes**, **NewMeter** or sensors/actuators



NewStat & TempNode

- ◆ **User Interface - clear and intuitive**
 - ◆ May be radically different than existing text/button interfaces
 - ◆ Allows user input to price signal actions
 - ◆ Displays status of all parameters and decisions
 - ◆ Avoids “flashing VCR clock syndrome”
- ◆ **TempNode - NewStat capabilities, without**
 - ◆ User Interface
 - ◆ Actuators
 - ◆ WAN support



Research Opportunity Notice

Network Management



Current AMR Communications Deficiencies

- ◆ **Most are one-way only**
- ◆ **Some require walk-by or drive-by to read meters**
- ◆ **Not scalable to very large deployments**
- ◆ **Difficult to add/remove nodes in the network**
- ◆ **Cannot multicast/broadcast**
- ◆ **Long latencies - inbound, outbound, or both**
- ◆ **Little or no redundancy**
- ◆ **Some fixed networks have become stranded**

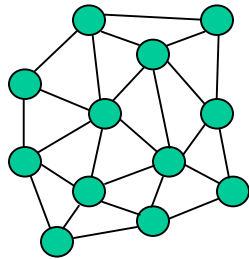


Objectives

Network Architecture/Management Technologies

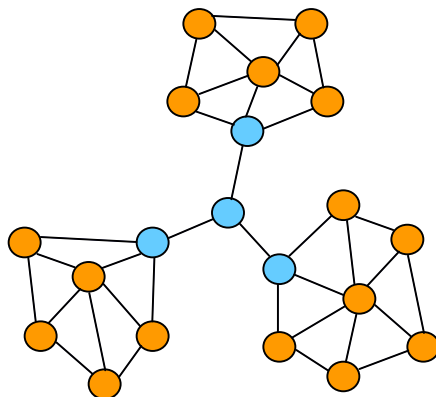
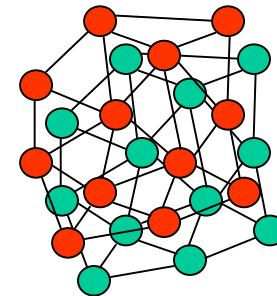
- ◆ **Support for dynamic tariffs and DR strategies**
- ◆ **Support for 2-way communications**
- ◆ **Broadcast and multicast capabilities**
- ◆ **Secured communications**
- ◆ **Minimal latencies**
- ◆ **High level of redundancy**
- ◆ **Scalable to very large deployments**

Candidate Concepts for Network Topology



⇐ **Mesh Networks**
(Self-organizing, self-healing)

**Interacting, Overlapping
Mesh Networks**



⇐ **Hybrid Networks**



Candidate Enabling Technologies

- ◆ **Ad-hoc self-organizing networks**
- ◆ **Distributed network management**
- ◆ **Message routing and management**
- ◆ **Adaptive protocols/channel agility**
- ◆ **Other technologies that address:**
 - **Broadcast/multicast capability**
 - **Scalability**
 - **Security**
 - **Survivability and Redundancy**



Research Opportunity Notice

System Integration

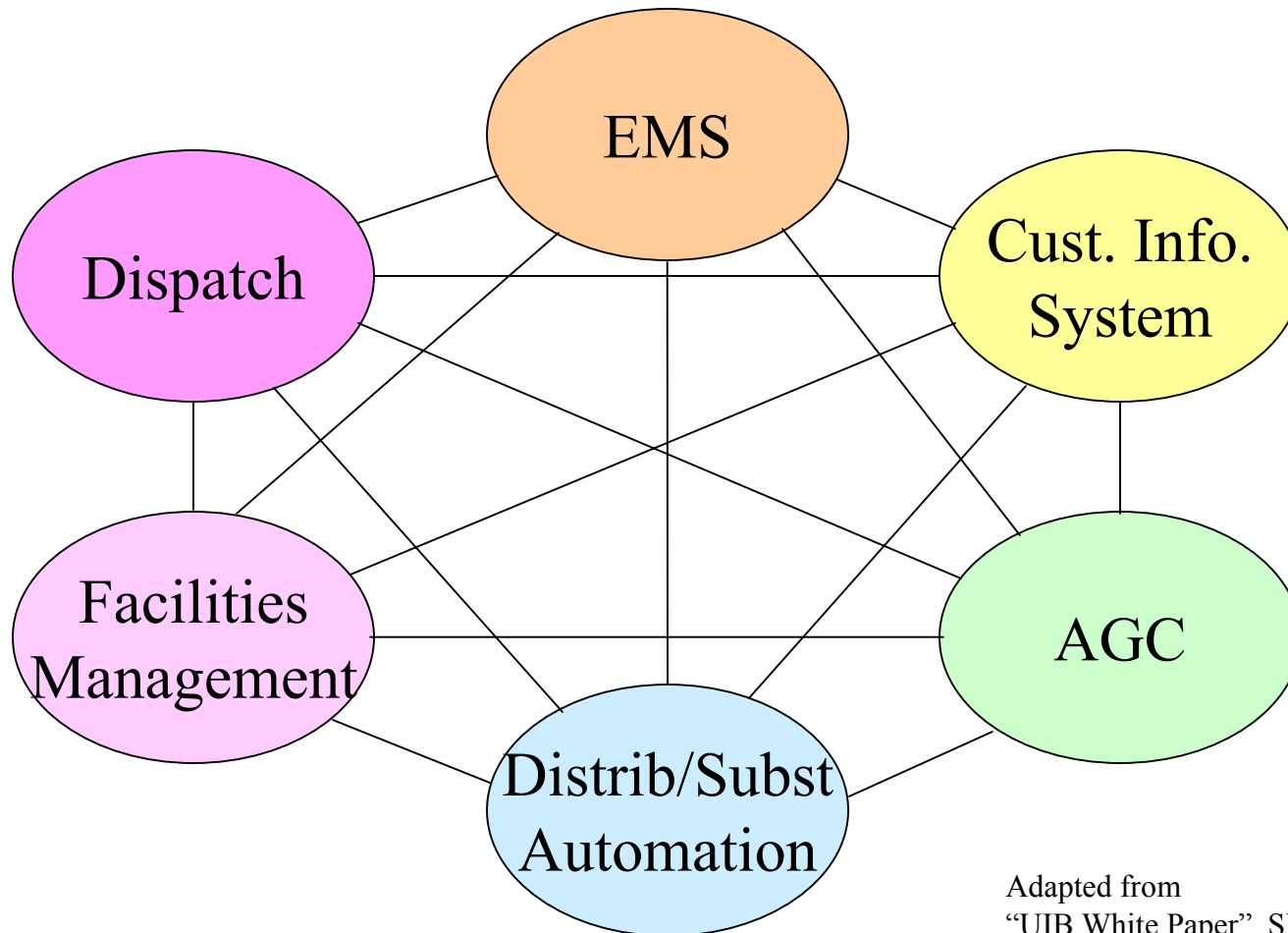


Utility Business and Engineering Systems

- ◆ **Many computing hardware platforms**
- ◆ **Many different operating systems**
- ◆ **Different mainframes / client-server / web-based systems**
- ◆ **Different databases**
- ◆ **Many component technologies**
 - CORBA (Common Object Request Broker Architecture - Open)**
 - DCOM (Distributed Component Object Model – Microsoft)**
 - EJB (Enterprise JavaBeans – Sun Microsystems)**



Islands of Information



Adapted from
"UIB White Paper", SISCO, 1999.



Drawbacks

- ◆ **Duplicate entries for the same data in multiple databases**
- ◆ **Each duplicate data entry may not be synchronized**
- ◆ **Data from one system requires entry by hand onto another system**
- ◆ **Non-critical data are rarely updated**
- ◆ **Locked into legacy proprietary systems**
- ◆ **Difficult to introduce new systems/applications**



Objectives

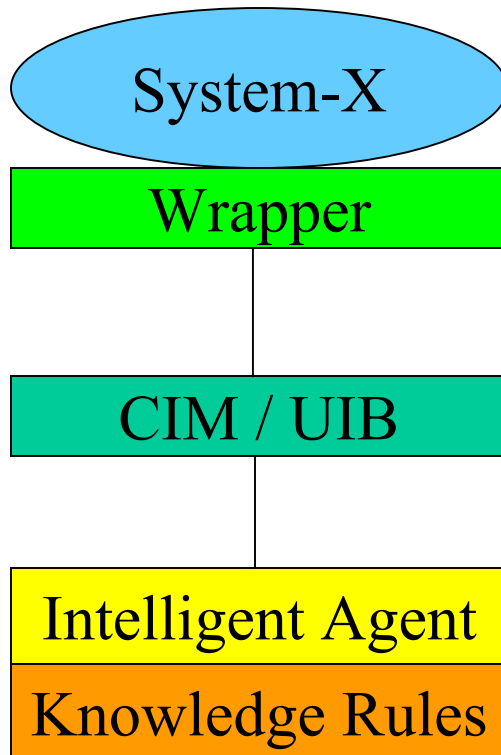
Develop System Integration Enabling Technologies in Support of DR

◆ **Technologies need to support:**

- The concept of measured once, used many times
- Sharing of stored data within all systems
- Legacy systems and pathways to future systems
- Common methods of sending/receiving data
- Automated initiation of new and innovative utility business processes



Candidate Technologies



- ◆ **Software wrappers or applications interfaces**
- ◆ **Additions and/or enhancements to the Common Information Model (CIM) and Utility Integration Bus (UIB)**
- ◆ **Intelligent Agents**
- ◆ **Knowledge rules (ontologies)**



Research Opportunity Notice

Control and Communications Integration



Background

◆ **Multitude of separate information networks**

- ◆ Transmission grid
- ◆ Distribution grid
- ◆ Substations
- ◆ Automatic Meter Reading (AMR)
- ◆ Resource aggregation
- ◆ Other energy services



Background

- ◆ **Networks are owned/operated by**
 - ◆ CAISO
 - ◆ IOUs (PG&E, SCE, and SDG&E)
 - ◆ Municipal Utilities (SMUD, SVP)
 - ◆ Load Serving Entities (LSE)
 - ◆ Energy Service Providers (ESP)

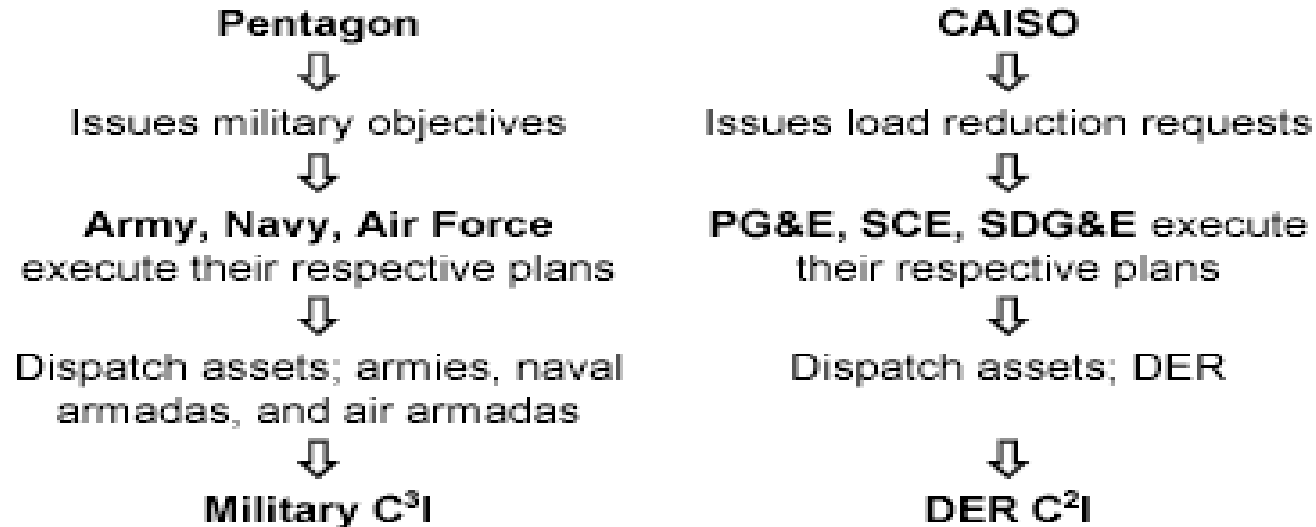


What Can Be Done?

- ◆ **Control and Communications Integration (C²I) Strategy**
 - ◆ **Orchestrate the various networks**
 - ◆ **This strategy has similarities to military C³I (Command, control, and communications integration)**



C³I and C²I Parallels



- Real-time collection of data and information dissemination
- Sharing of data and information
- Integrated communications systems
- Simplified coordination between operating entities



Candidate Research Topics

- ◆ **Using a military (or another) C³I system as a model**
 - Adapt it to conceptually deal with C²I electricity applications such as dispatching DER.
 - Compare and contrast the chosen C³I model with the requirements for implementing a C²I strategy for integrating utility information and communications systems.
 - Are there analogies that indicate CAISO or an UDC can operate in a similar fashion? If not, what are the gaps that need to be filled and is it feasible to fill the gaps?
- ◆ **How would the CAISO or an UDC operate its control centers in a military (or another) C³I style?**
 - With C²I ability to control all available assets, given a particular operational scenario, how would a plan to address the scenario be executed using C³I-based strategies?