



Research Opportunity Notice

Network Management

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Network Management for DR

- ◆ **Includes applications such as Automatic Meter Reading (AMR) system**

- ◆ **Some fixed (single application) AMR networks have proven not cost effective and have become stranded**



Network Management for DR (cont.)

- ◆ **Network management capability over multiple public and private networks**
- ◆ **Concept similar to call routing from multi-mode cell phones operating in different network environments (Analog, CDMA, TDMA, PCS, GSM networks)**
- ◆ **For utility DR applications – AMR, SCADA, etc.**



Desirable Network Features for DR

- ◆ **2-way communications**
- ◆ **Broadcast/multicast capability**
- ◆ **Secured communications**
- ◆ **Minimal latencies**
- ◆ **High reliability with redundancies**
- ◆ **Scalable to very large deployments**



Current Utility Communications to the Electricity End-User

- ◆ **Customer Service**
 - Telephone system/Cellular phone system(s)
- ◆ **Public Service Broadcast**
 - Cable/broadcast television/AM/FM radio
 - Pager system(s)
- ◆ **Internet/e-mail**
 - Dial-up telephone
 - Cable television/DSL (Digital Subscriber Line)
- ◆ **Automatic Meter Reading (AMR) system**



AMR Communications

- ◆ Telephone system
- ◆ Cellular phone system
- ◆ Cable television
- ◆ 1-/2-way pager system
- ◆ Drive-/walk-by wireless
- ◆ Proprietary fixed wireless network
- ◆ Public fixed wireless network



Communications Deficiencies

- ◆ **One-way only**
- ◆ **Not scalable to very large deployments**
- ◆ **Requires walk-by or drive-by meter reader**
- ◆ **Difficult to add/remove nodes in the network**
- ◆ **Cannot multicast/broadcast**
- ◆ **Long latencies - inbound, outbound, or both**
- ◆ **Little or no redundancy**
- ◆ **Not all end-users subscribe to the service**



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**

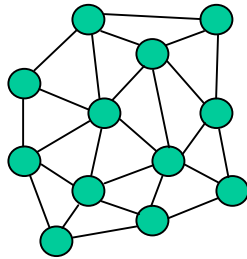


Scope and Constraints

- ◆ **P.G.&E. as an example utility**
 - Territory size
 - ~ 600 miles by 250 miles
 - Meters
 - ~ 4 million electric and ~ 3.5 million gas
 - Population densities
 - Rural to nation's 2nd densest major city – SF (17,000/sq.mi.)
- ◆ **Outbound message (from the utility)**
 - Frequency – hourly, but potentially every 15 minutes
 - Message size – tens of bytes
- ◆ **Inbound message (to the utility)**
 - Frequency – 15 minutes, hourly, daily, monthly
 - Message size – tens of bytes to hundreds of bytes

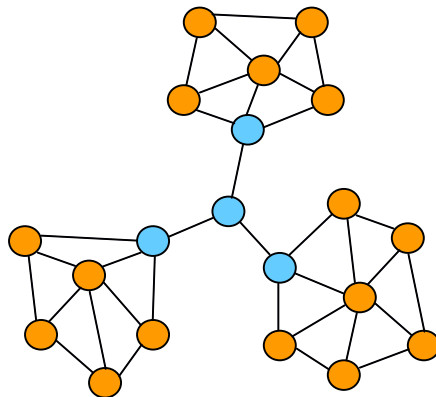
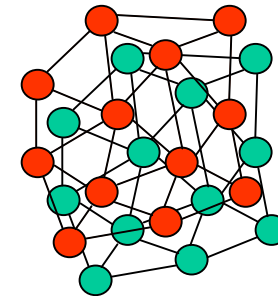


Candidate Concepts for Network Topology



⇐ **Mesh Networks**

**Interacting, Overlapping
Mesh Networks**



⇐ **Hybrid Networks**



Candidate Enabling Technologies

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



Summary

The purpose of this RON is to solicit proposals.

- ◆ **For R&D tasks that will develop enabling technologies for network management to support DR.**
- ◆ **NOT to produce a product.**
- ◆ **R&D shall address network management over multiple networks (cell phone analogy)**
- ◆ **Multi-phase proposals – initial phase < \$250K.**
- ◆ **Initial phase defines milestone for funding approval for remaining phases.**