DEMAND RESPONSE AUTOMATION SERVER

Functional Description

Description: The LBNL DR Automation Server (DRAS) (previously called price server) is at the heart of the controls and communications architecture for Automated Demand Response tests conducted by the Lawrence Berkeley National Lab in 2003, 04, 05 & 06.

The DRAS enables utilities, grid system operators and other entities to remotely initiate preplanned automated sheds of electric loads in commercial and industrial facilities. The automated sheds can be initiated based on economic or contingency based grid conditions. The DR signals are transmitted using the existing public Internet and private wide area networks (WANs). Facilities can be connected to the DRAS using either software or hardware based gateways or other interface devices.

Once a shed event is initiated by the appropriate decision-makers, the DRAS automatically manages all communications, time buffering, and on-site connections to enable demand reductions for the pre-planned duration using pre-planned strategies. Unless a facility manager "opts-out" using their personalized website, sheds will occur without human intervention.

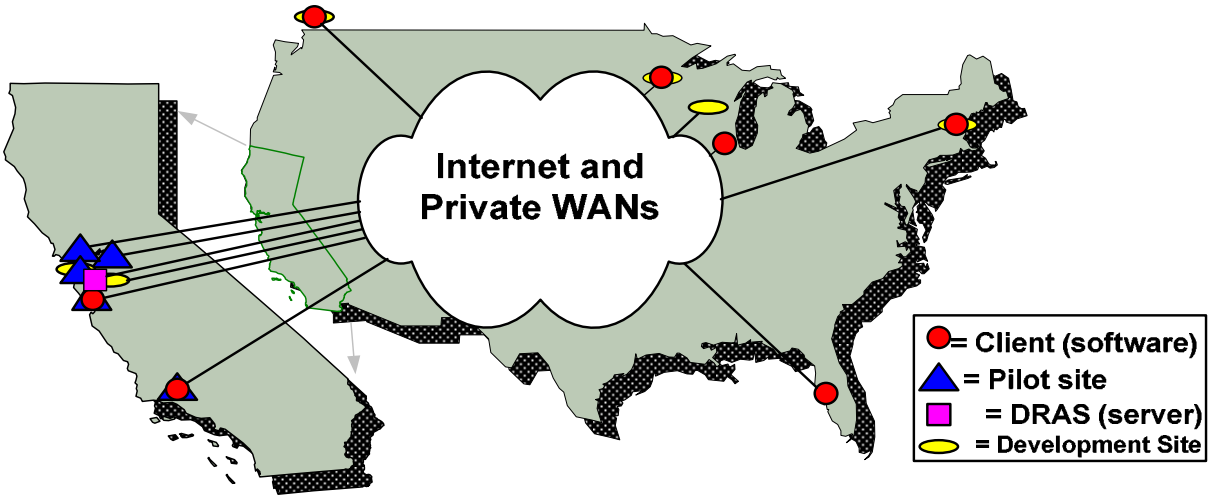

Figure 1. Geographic location of pilot sites and other DRAS components.

Background:
Version 1.0 was designed and used as a research tool in 2003 and 2004. Version 2.0 was pilot production tool designed and used as the automation "engine" of PG&E's Auto-CPP program in 2005.

Version 2.0 was built from scratch to meet the high standards required for financial transactions using Internet technology. The version 2.0 server successfully met the requirements for the 2005 tests including: 1) Flexibility – The system was customized to interface with PG&E's existing CPP processes and Itron's Interact system. 2) High availability/reliability – The system successfully processed every PG&E initiated Auto-CPP event. Since coming online, DRAS has maintained it's availability target of 99.99%. (four nines) 3) Scalability – Tests show that the 2.0 framework was more than adequate for the ~ 20 sites in the 2005 pilot. Scalability tests indicate that the current system could support approximately 30,000 "sites" per server with an end-to-end latency averaging less than ½ second. Modular software is designed to enable support of millions of sites by simply adding servers and other standard IT equipment. 4) Security - The DRAS architecture was designed so as to be secure enough to meet current industry standards for financially binding transactions. It is of utmost importance that Auto-DR tests are secure. A security breech could become a major public relationship setback to the industry.

Figure 2 shows the control and communication architecture used by the DRAS in 2006. Communications occur in the following sequence:

1) Utility defines the start time and duration of the Auto-DR event

2) Auto-DR event info published on DR Automation Server

3) Polling clients check event status and signal EMCS when to enter shed mode(s)

4) EMCS carries out pre-determined shed strategies

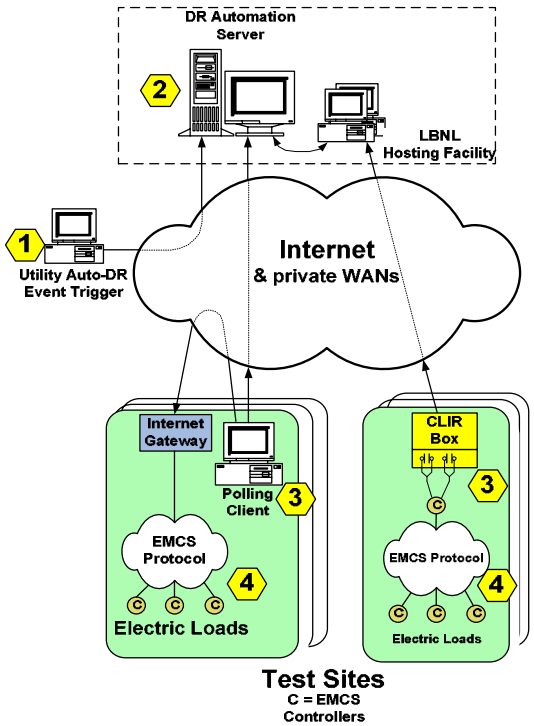

Figure 2. Control and communication architecture.

The DRAS was defined and created as part of the larger DRRC effort to remove impediments to demand response in commercial facilities. Solutions and some areas requiring more research are shown in table 1.

Barrier to DR	**Cost effective solution**
HVAC strategies complicated and ineffective	Global Temperature Adjustment (GTA) strategy. Proven to be simple, effective and minimally objectionable to occupants. GTA software feature is in process of being added to Title 24 for 2008. This effort is led by the DRRC. The GTA feature will enable DR in commercial building at no additional cost.
Too labor intensive	Automated DR with pre-planned strategies
Auto-DR signal transmission infrastructure too expensive.	DRAS leverages existing Internet and WAN connections in commercial buildings.
Internet signals not standardized	DRRC is working with NIST and BACnet toward signal standardization in the DRRC DR Automation Server (DRAS).
Internet signals and protocols too complicated to transfer into existing EMCS	Internet relays are easily read by all existing EMCS. Can be used for direct load control as well.
Internet relays are difficult to configure and are inherently insecure.	DRRC developed self configuring, secure Internet relay device; CLIR Box (Client, Logic, w/ Integrated Relay). CLIR box prototyped in 2005, pilot production in 2006.
Lighting has huge potential for DR, yet remains largely unavailable due to lack of centralized control systems.	Further research required. Leveraging existing title 24 mandated bi-level switching, wireless controls and other concepts in research.
Leased office space owners unable to participate.	Further research required. Working with BOMA to revise lease language so as to allow temperature devastations based on CAISO alert levels under consideration.

Table 1. Existing Barriers and Solutions to Automated DR

The DR Automation Server (DRAS) 2006

LBNL is currently working to enhance the DRAS based on feedback from utilities, installation contractors and other stakeholders. The overall Auto-DR project for 2006 has several major themes. These themes, along with technical lessons learned from previous years will drive many of the features and other enhancements of the DR Automation Server for 2006:

1) Process turnover. Researchers at LBNL plan to further define and document DR processes and turn over more tasks to others (utilities and other 3rd parties).
2) Provision of secure, reliable, customized interfaces to multiple utility partners.
3) Sharing of real-time, system-level, non-sensitive DR information with the CEC, CAISO and other parties.
4) Continued enhancements in performance and usability.
5) Cost optimization.

The aforementioned overall project themes and lessons learned from previous years drive the need for the following categories of enhancements to the DR Automation Server for 2006:

1) Support for event "trigger" signals from multiple sources (e.g., from different utility systems).
2) Support for additional password protected user types. (e.g., users of the system with various roles have access to various parts of the system).
3) Enhanced the design and manufacturing process for the hardware interface devices to each participating site. Client Logic w/ Integrated Relay (CLIR) Box.
4) Enhance reliability and reduce maintenance requirements.
5) Enable the DR Automation Server for 2006 to be hosted at the LBNL managed hosting co-lo or at a utilities network operations center or both.
6) Improved operator tools for status display and log visualization.
7) Continued attention to security and scalability.

Input from utilities and CAISO will be encouraged during the development phase of the DR Automation Server 2006. In addition, their involvement with this project will hopefully help them in the future to create their own systems and/or help in the design of future revisions of the LBNL DR Automation Server.

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