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INTELLIGENT BUILDINGS

CONFERENCE

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Open Automated Demand Response Infrastructure

Ed Koch

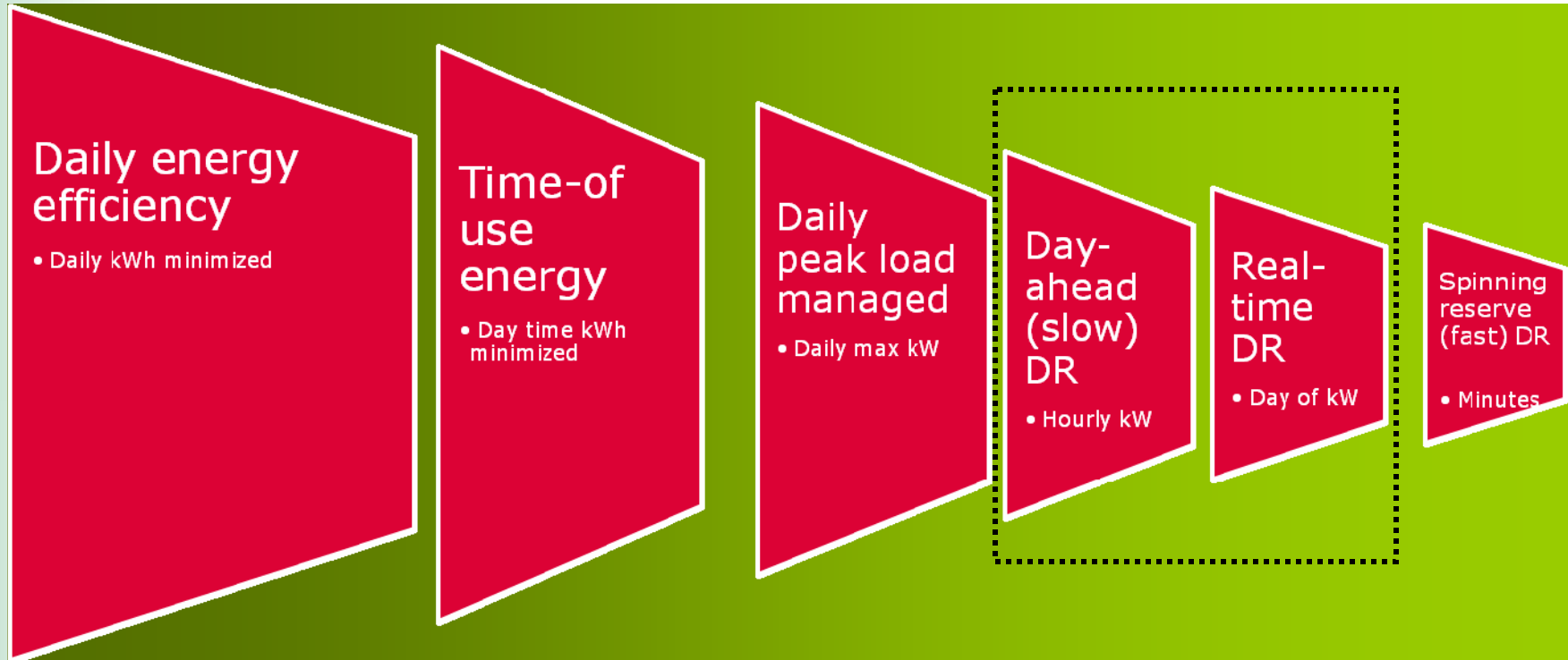
CTO Akuacom

ed@akuacom.com

415-256-2583



Time Scales of Building/Grid Optimization – Automated DR Future



Service Levels Optimized

Service Levels Temporarily Reduced

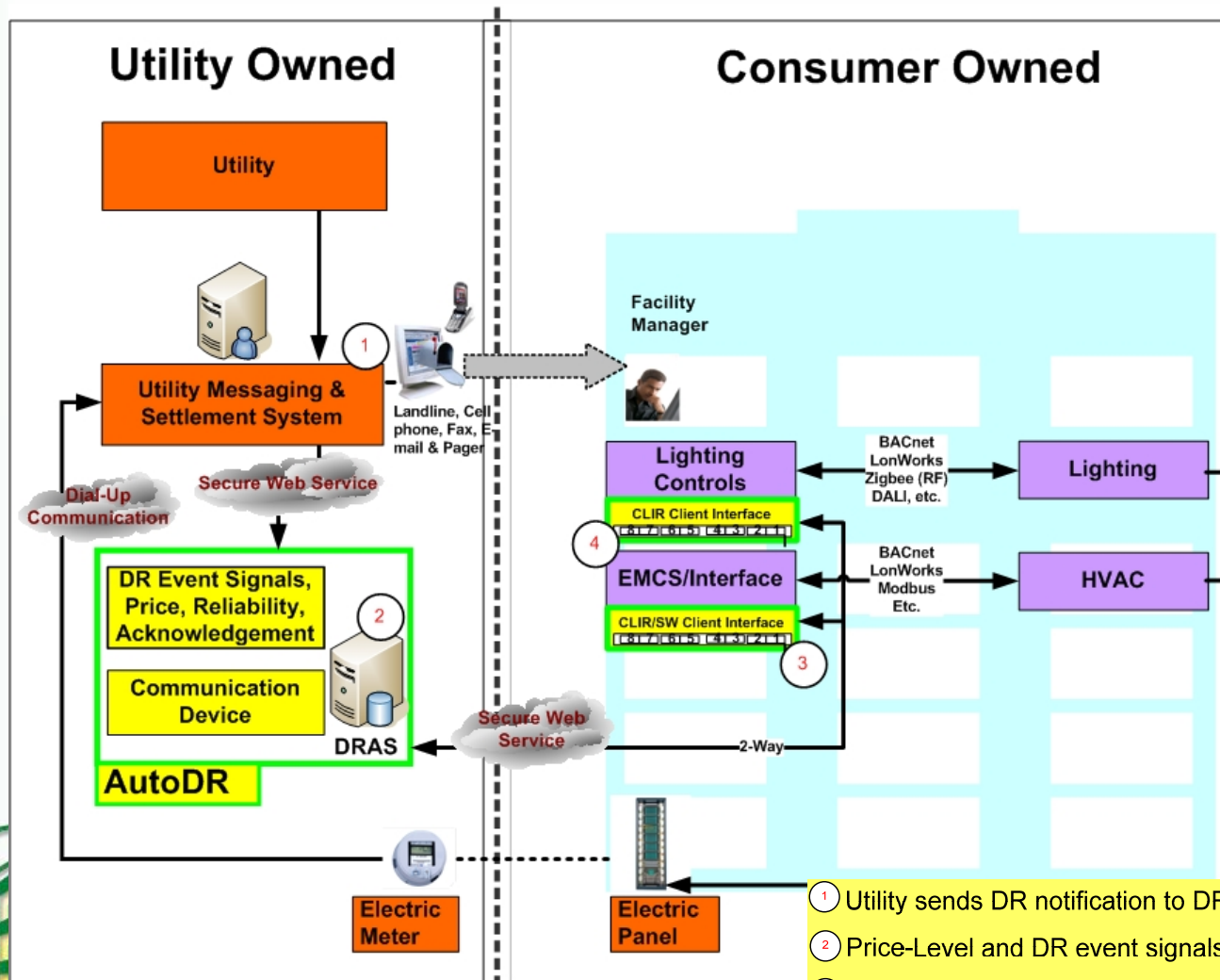


History

- 2002 - Research begun at LBNL Demand Response Research Center (DRRC) into automated DR, sponsored by California Energy Commission
- 2003 – Initial development at DRRC using XML exchange of information with limited field trials.
- 2004 – Use of internet relays in field trials to support automation with simple EMCS, scaled up field tests.
- 2005 – Development of DRAS concept. Collaboration with PG&E’s CPP DR program.
- 2006 – Expanded field trials and use in PG&E’s Pilot DR programs. Development of CLIR box for use as Simple DRAS Client.
- 2007 – Commercialization and use of DRAS in PG&E, SCE, and SDG&E DR programs.



DR Automation Server w/ DRAS Client



- DRAS Clients –**
1. Software only (Smart)
 2. Software & Hardware (Simple)



- 1 Utility sends DR notification to DRAS
- 2 Price-Level and DR event signals sent on DRAS
- 3 Polling clients request price level and event data every minute
- 4 Energy Management Control System (EMCS) and other systems carry out shed based on pre-programmed strategies.

Demand Response Automation Server (DRAS)

- Designed in conjunction with the LBNL's Demand Response Research Center (DRRC)
- Uses a Service Oriented Architecture and leverages industry standard Web Services infrastructure
- Since going live in 2005, the DRAS has exceeded its availability requirement of 99.99%.
- Core design is scalable to 100,000+ clients
- The DRAS can be easily customized to support new programs
- DRAS is secured using the same technology used to secure banking transactions



Improving DR capability in Buildings – present to future

- Improved levels of granularity/modular control
- Improved intelligence of building modes – lighting, HVAC, other
- Improved end-use metering, service level performance metrics
- Multivariate optimization trade off with other criteria

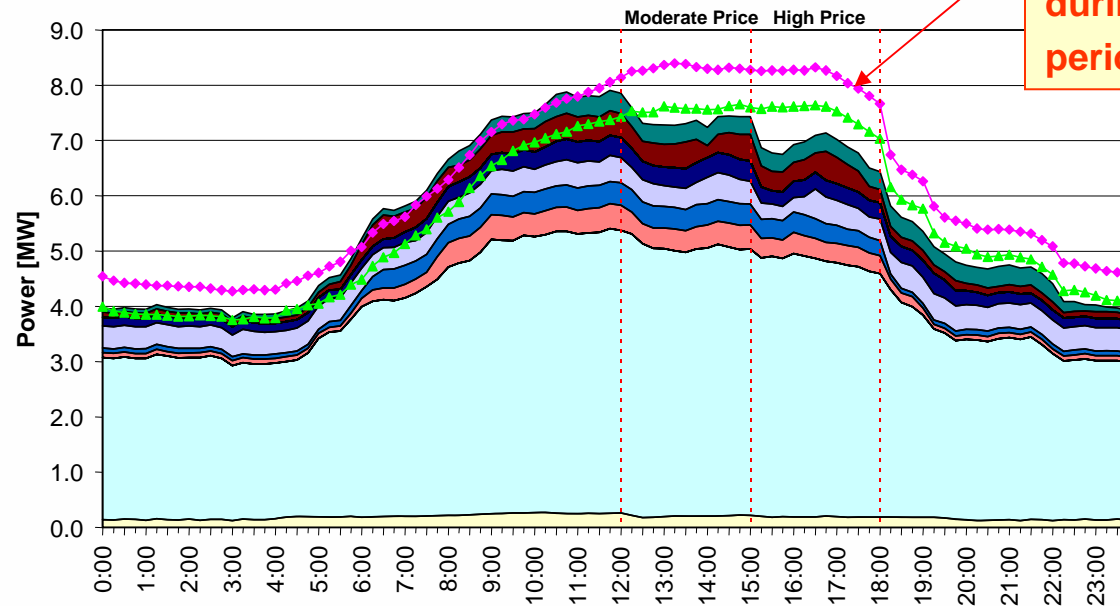
Global Temperature Reset Migrating to California Energy Code

	Building use	HVAC										Lighting				Other		
		Global temp. adjustment	Duct static pres. Increase	SAT Increase	Fan VFD limit	CHW temp. Increase	Fan qty. reduction	Pre-cooling	Cooling valve limit	Boiler lockout	Slow recovery	Extended shed period	Common area light dim	Office area light dim	Turn off light	Dimmable ballast	Bi-level switching	Non-critical process shed
ACWD	Office, lab	X	X	X		X			X	X		X						
B of A	Office, data center		X	X	X	X			X									
Chabot	Museum	X						X										
2530 Arnold	Office	X									X							
50 Douglas	Office	X									X							
MDF	Detention facility	X																
Echelon	Hi-tech office	X	X	X			X					X	X	X	X			
Centerville	Junior Highschool	X						X										
Irvington	Highschool	X						X										
Gilead 300	Office				X													
Gilead 342	Office, Lab	X		X														
Gilead 357	Office, Lab	X		X														
IKEA EPaloAlto	Furniture retail	X																
IKEA Emeryville	Furniture retail	X																
IKEA WSacto	Furniture retail	X																
Oracle Rocklin	Office	X	X															
Safeway Stockton	Supermarket																	X
Solectron	Office, Manufacture	X												X				
Svenhard's	Bakery																	X
Sybase	Hi-tech office													X				
Target Antioch	Retail	X					X											
Target Bakersfield	Retail	X					X											
Target Hayward	Retail	X					X					X						X
Walmart Fresno	Retail	X																X

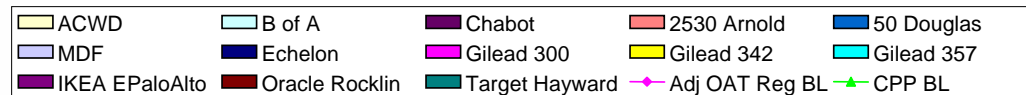


AutoDR Results – June 26, 2006

Aggregated Demand, 6/26/2006 (OAT: 89 ° F) - Zone 2, 8 sites



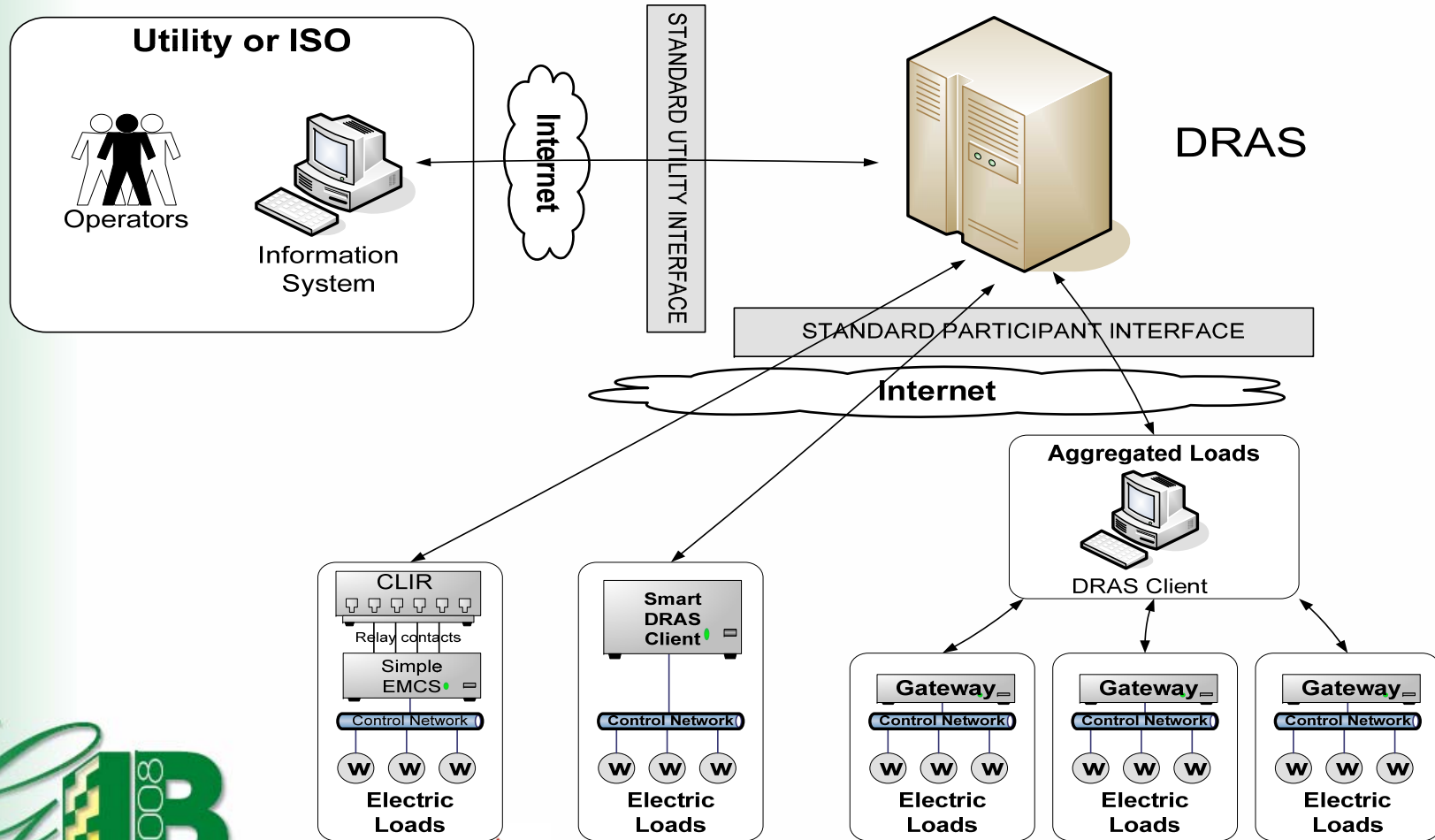
1.3 MW reduction during high price period



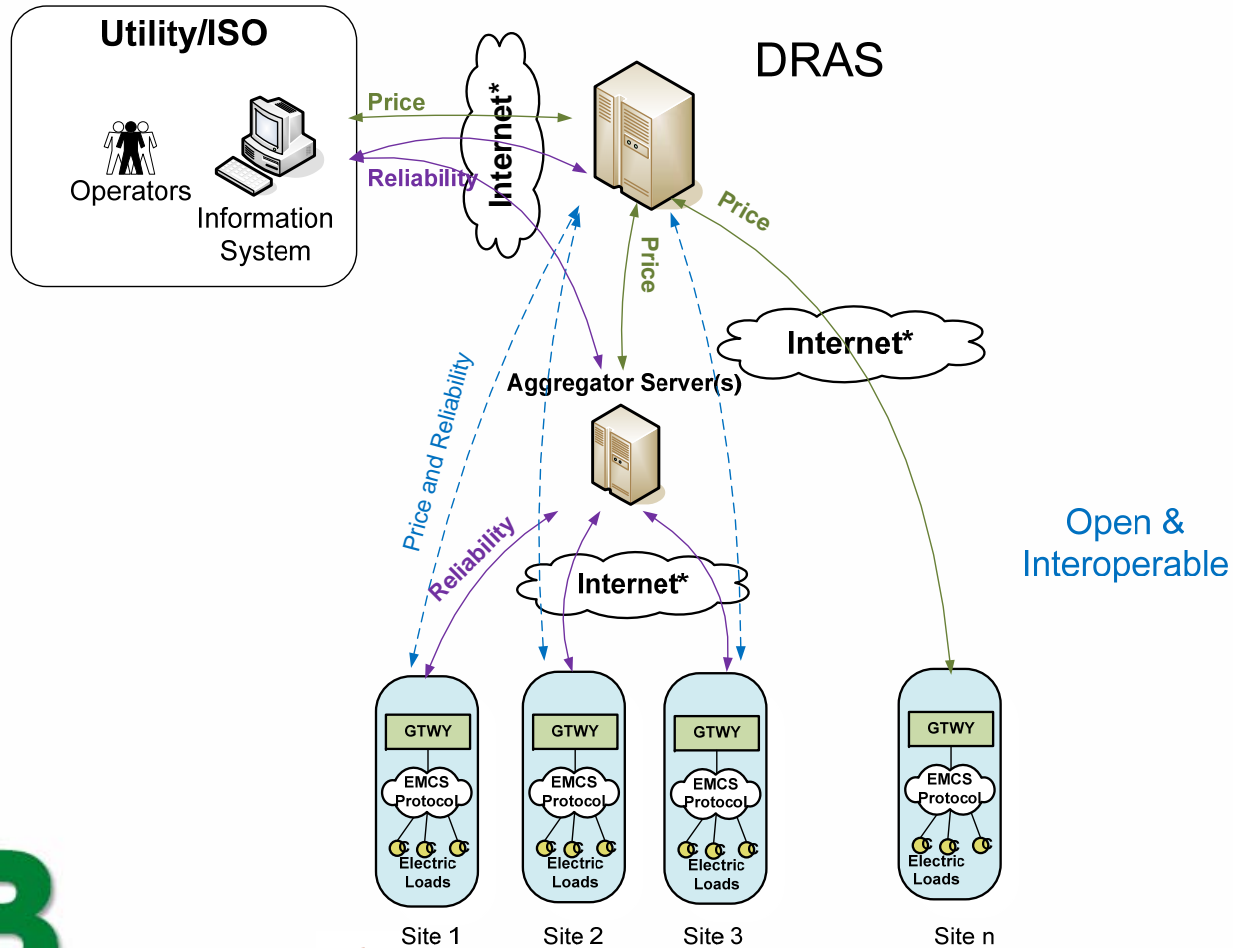
	Average kW		Average %		Average W/ft ²	
	Moderate	High	Moderate	High	Moderate	High
ACWD	78	91	28%	32%	1.53	1.78
B of A	478	604	9%	12%	0.67	0.85
2530 Arnold	102	140	20%	29%	0.78	1.07
50 Douglas	57	94	13%	22%	0.63	1.04
MDF	90	155	17%	30%	0.52	0.90
Echelon	-2	80	0%	22%	-0.02	1.07
Oracle Rocklin	85	60	17%	14%	0.85	0.60
Target Hayward	59	56	15%	15%	0.45	0.43
Aggregated	946	1281	11%	16%	0.65	0.88



Automated Demand Response Concept



Aggregators and DRAS



Encourage Standard Approach

Benefits Include –

- Interoperability, Low Costs, Innovation
- Improved Quality of Service (QoS)
- Improved Business Practice
- Impact Reliability of Price & Reliability DR
- Impact Pricing & Financial Planning
 - CORNERSTONE of technology development is to enable DR with dynamic tariffs



Pacific Gas and Electric Company®



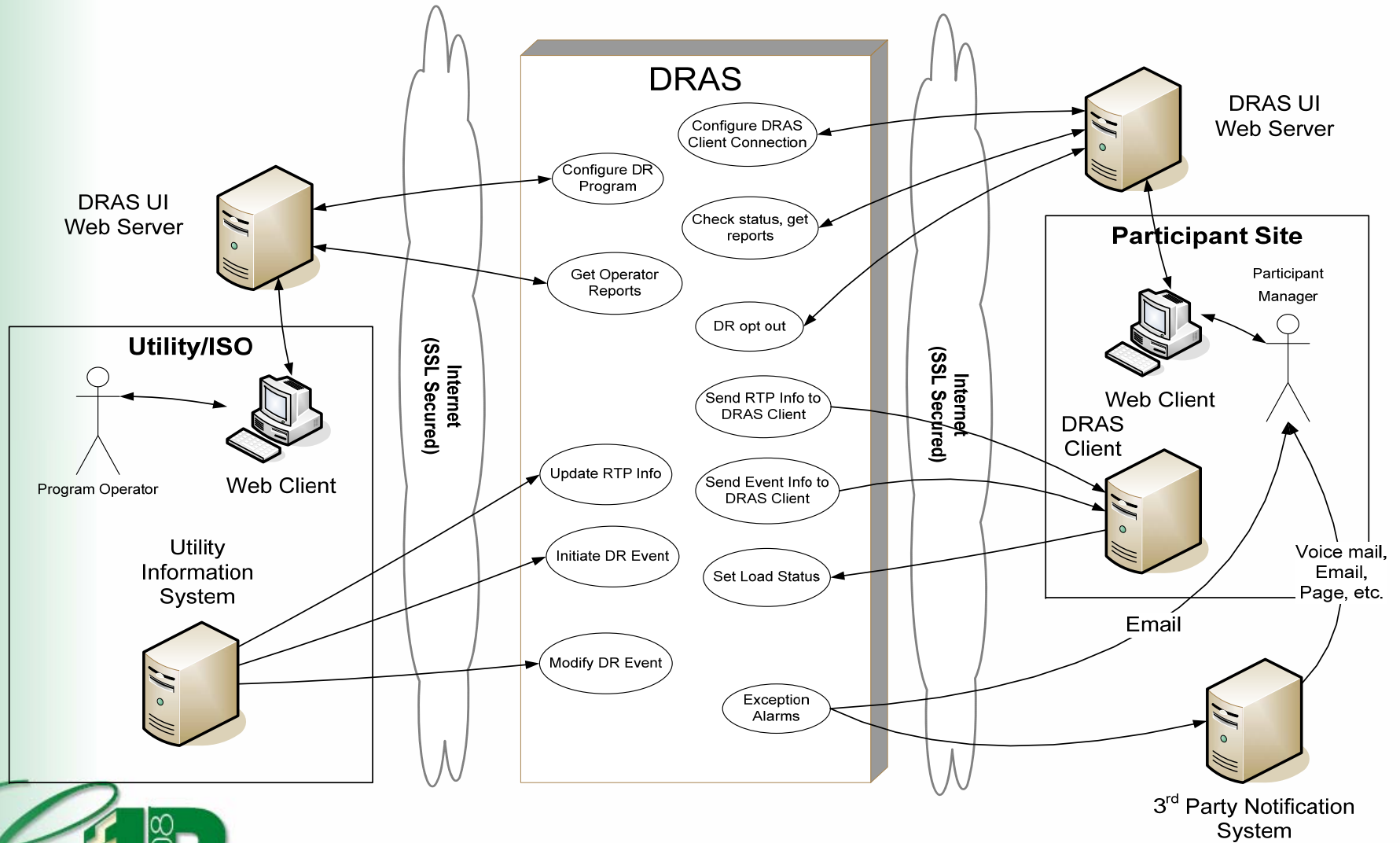
Participants 2006	13 CPP			0	0
Peak Load Reduction (MW)	1.1			0	0
Peak Load Reduction (%)	13%			--	--
2007 Peak Reduction Goal	15MW			5MW	0
Participants 2007	29 CPP	52 DBP	8 CPP	62 CBP	
Peak Load Reduction (MW)	2	21	2	2	
Peak Load Reduction (%)	14%	35%	49%	50%	
2007 Peak Reduction (MW)	23			2	2

Note: Includes in-production and estimated impacts of in-process sites

TAG Member Affiliations: LBNL, CA utilities and ISO, CEC/PIER, UCB – PCT, CIEE, NIST, EPRI, BACnet, Gridwise, OpenAMI, OpenHAN, Gridnet, Enernex



DRAS Event Architecture



What is Being Standardized?

- Interfaces used by Utilities/ISO and their DR Participants.
- Automatic DR Event Notification including support for RTP.
 - Smart DRAS Clients
 - Simple DRAS Clients
- Automatic bid submission by Participants



Future Directions

- **Deployment**
 - Scale up AutoDR participation
 - Inform / educate industry of potential
 - Deploy concept outside of CA
- **DRAS Standards**
 - Have first draft ready in May 2008.
- **Research**
 - Embed in controls – consider Building Codes in 2011
 - Improve and test tools to estimate peak savings
 - Improve economic feedback

