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Energy Use in Buildings Enabling Technologies

Title
California Demand Response Business Network (DRBizNet) Field Simulation Workshop

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Publication Date
2006

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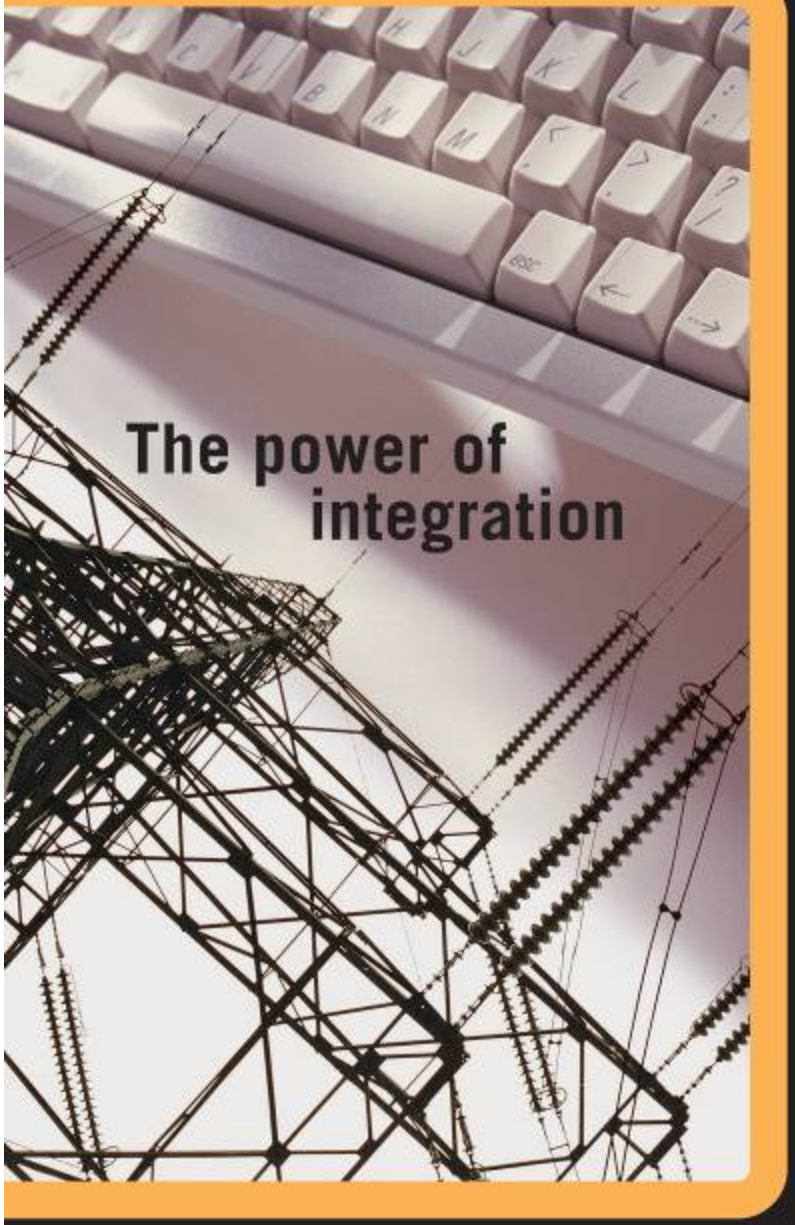


DRBizNet

Demand Response Business Network

Gaymond Yee
CIEE

August 11, 2006

Agenda

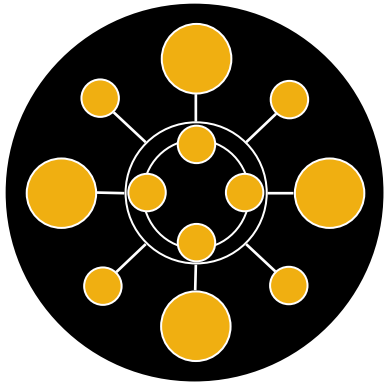
10:00 am	**Introduction to Workshop** Mark Rawson, CEC
10:05 am	**Demand Response Business Network (DRBizNet) Project** Gaymond Yee, DR ETD Project Manager
10:15 am	**The Need for DR in California** Jim McIntosh, Director of Grid Operations, CAISO
10:30 pm	**Description of DRBizNet and Field Simulation Set up** Ali Vojdani, DRBizNet Project Manager, UISOL
11:30 pm	**Lunch Break** (Not provided by the Workshop)
1:00 pm	**Field Simulation of DRBizNet** Live Demonstration by Nine (9) Stakeholders
2:30 pm	**Panel Session: Lessons Learned from Filed Simulation** Panelists: CAISO, PG&E, SCE, SDG&E, Infotility, UISOL
3:00 pm	**Adjourn**

Demand Response Business Network Project (DRBizNet)

- **Funded by the Demand Response (DR) Enabling Technologies Development Project**
  - Public Interest Energy Research (PIER) Program of the California Energy Commission (CEC)
- **Managed and Administered by the California Institute for Energy and Environment (CIEE)**
  - Part of the Office of the President, University of California (UCOP)
- **Guided by CAISO, PG&E, SCE, SDG&E and Industry Advisors**
- **Multidisciplinary Collaborate Team**
  - UISOL (Prime Contractor)
  - Dynamic Networks
  - Menlo Energy Economics
  - Michigan Group
  - NEXANT
  - SAVVION
  - TIBCO

Project Mission

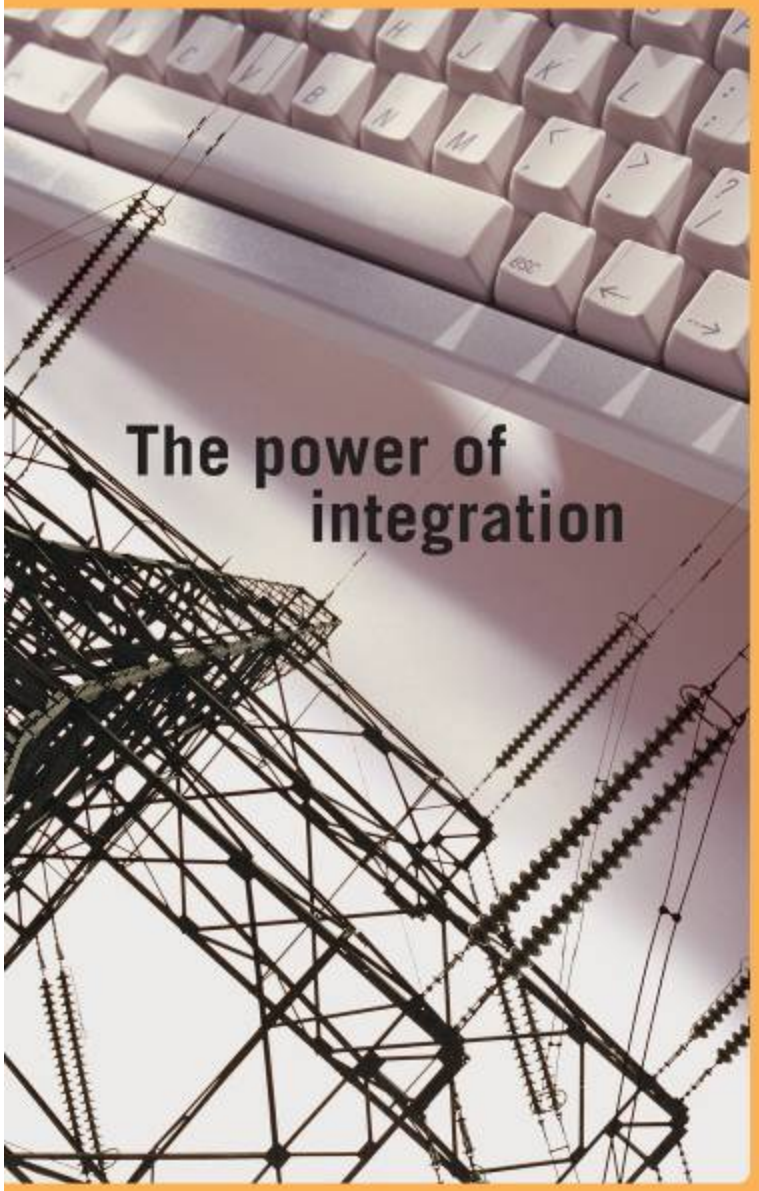
Design and demonstrate an integrated infrastructure for DR that can reduce costs by factor of 10 and increase speed and functionality by factor of 10



DRBizNet

Demand Response Business Network

Dynamic Networks



Our Challenge
The Need for Demand Response Programs in California

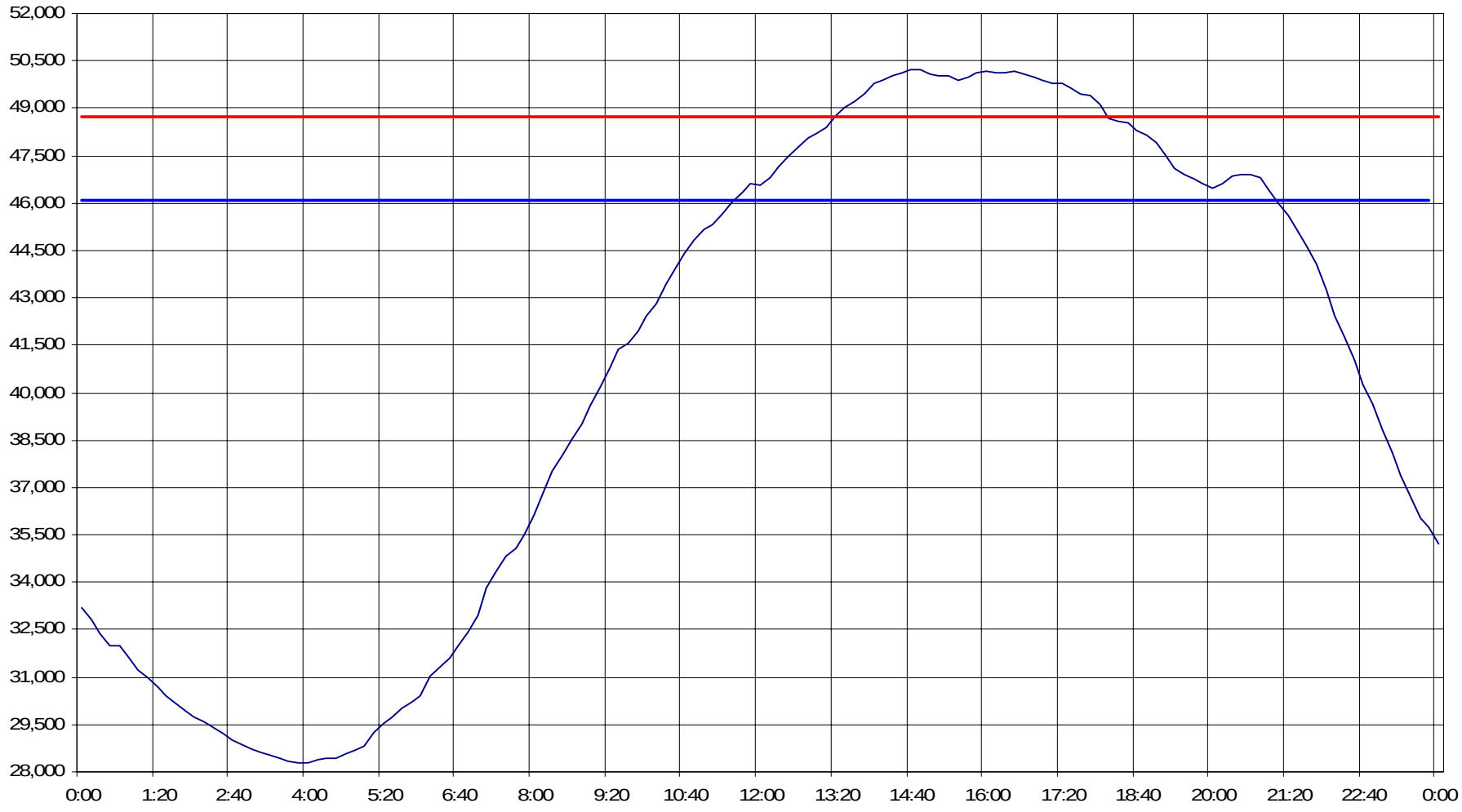
Jim McIntosh
Director of Grid Operation
California ISO

August 11, 2006

Challenges

- We are behind where we need to be
- Demand is outpacing supply
- It is costly to develop new generation resources and associated transmission requirements
- The ISO needs more quick start generation, more interruptible loads, and more demand response
- Peak Loads
  - DR only required for a small percentage of the time, at or near the peak system load
  - Large percentage of peaks are due to commercial and residential AC loads
  - During California Energy Crisis, small controlled reduction of load could have avoided rolling blackouts
  - DR is an excellent tool for grid operators when faced with system challenges, more is needed

CAISO Load Curve July 24, 2006

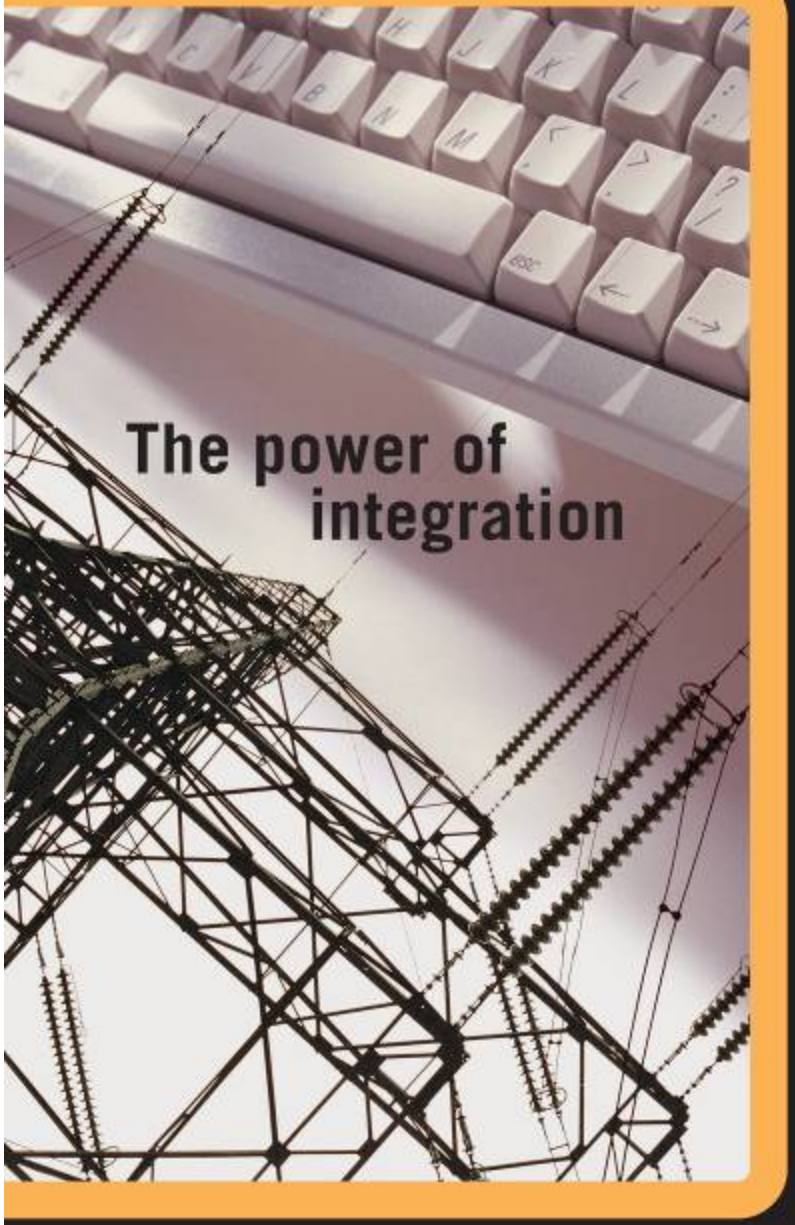


Current Landscape

- Significant research show DR programs support grid reliability
  - CAISO Participating Load Program allows Market Participants to bid non-spin in the Ancillary Service Market
  - Work is on going to change the WECC requirements to allow load to be considered spin and possibly regulation
- CAISO experience with interruptible programs, pump load and DR Programs is positive, “they work”
- California needs a “safety net” due to the number of large generation and transmission contingencies, DR provides a portion of the “safety net”
- More focus on coordinated statewide programs is essential

New Customer Challenges

- Research identifies customer barriers
  - Too many programs
  - Too complicated
  - Pricing not correct
  - Technology too expensive
- Experience shows success when the customer is provided with
  - Information about the program
  - A simple method to join a program
  - Advanced notice of when a curtailment will occur
  - The ability to gauge performance



DRBizNet

Demand Response Business Network

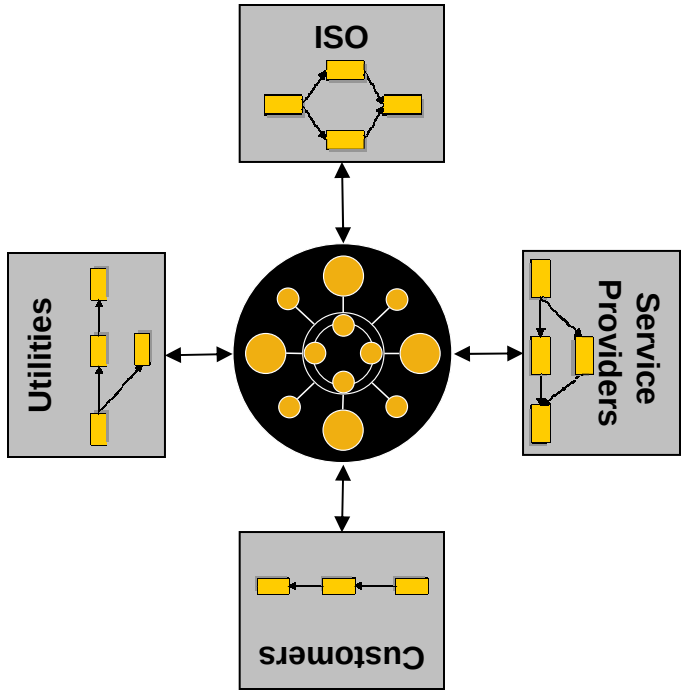
Ali Vojdani
Scott Neumann
Hannu Huhdanpaa

UISOL

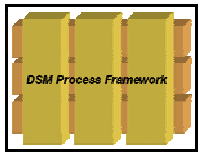
August 11, 2006

Workshop Objectives

1. Present proof-of-concept (POC) of ***DRBizNet*** as a ***DR enabling technology*** to efficiently execute DR processes such as:
   - Create new DR programs
   - Update existing DR programs
   - Register for DR
   - Enroll in DR programs
   - Process DR applications
   - Query how much DR is available
   - Invoke DR programs
   - Notify DR participants
   - Automatically respond to DR requests



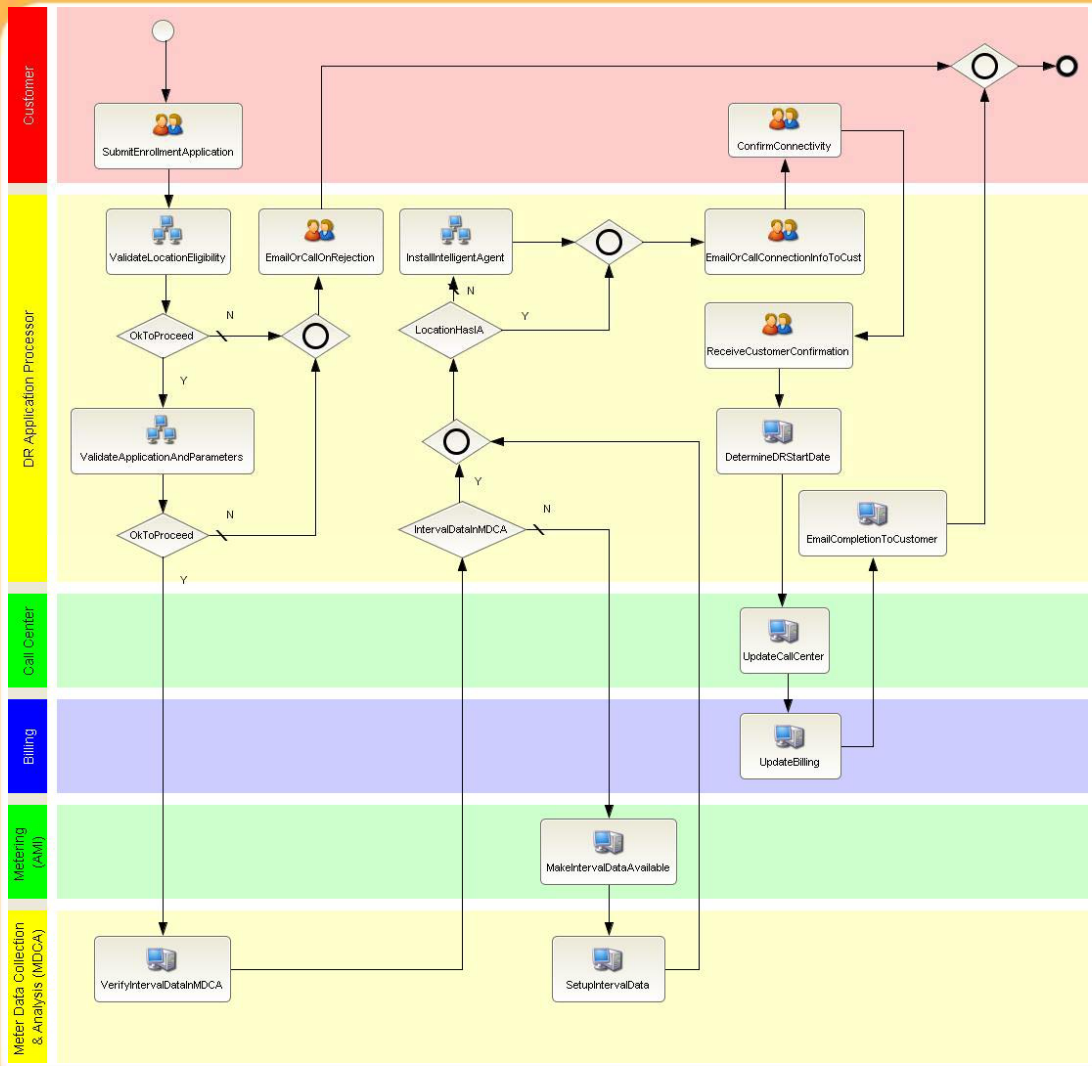
2. Motivate the need for a ***DR process framework*** for optimizing DR processes and demonstrate supporting technologies



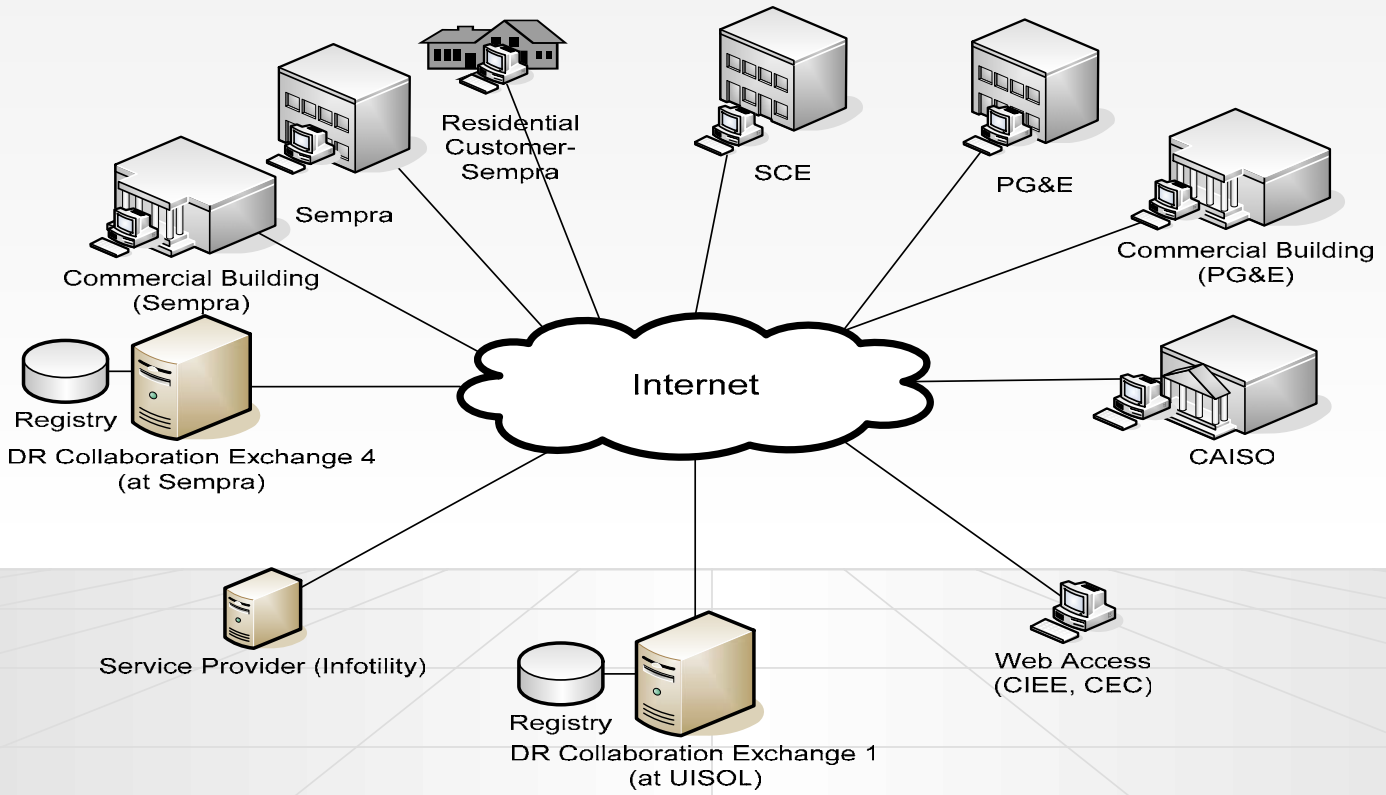
To make good food, you need good cooks (***people***), good recipes (***process***), and good kitchens (***technology***).

Example of a DR Process

DR Enrollment

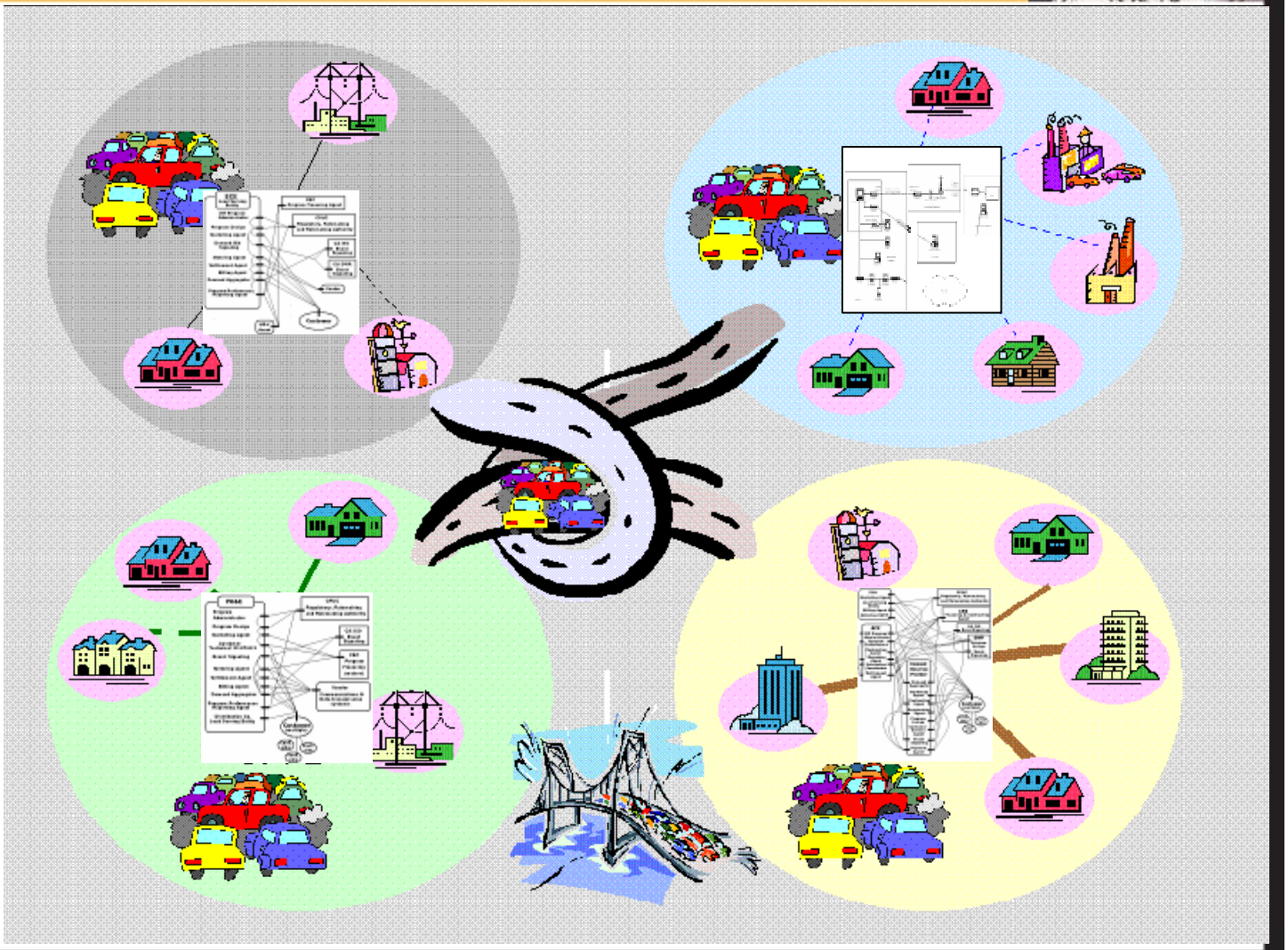


DRBizNet Field Simulation



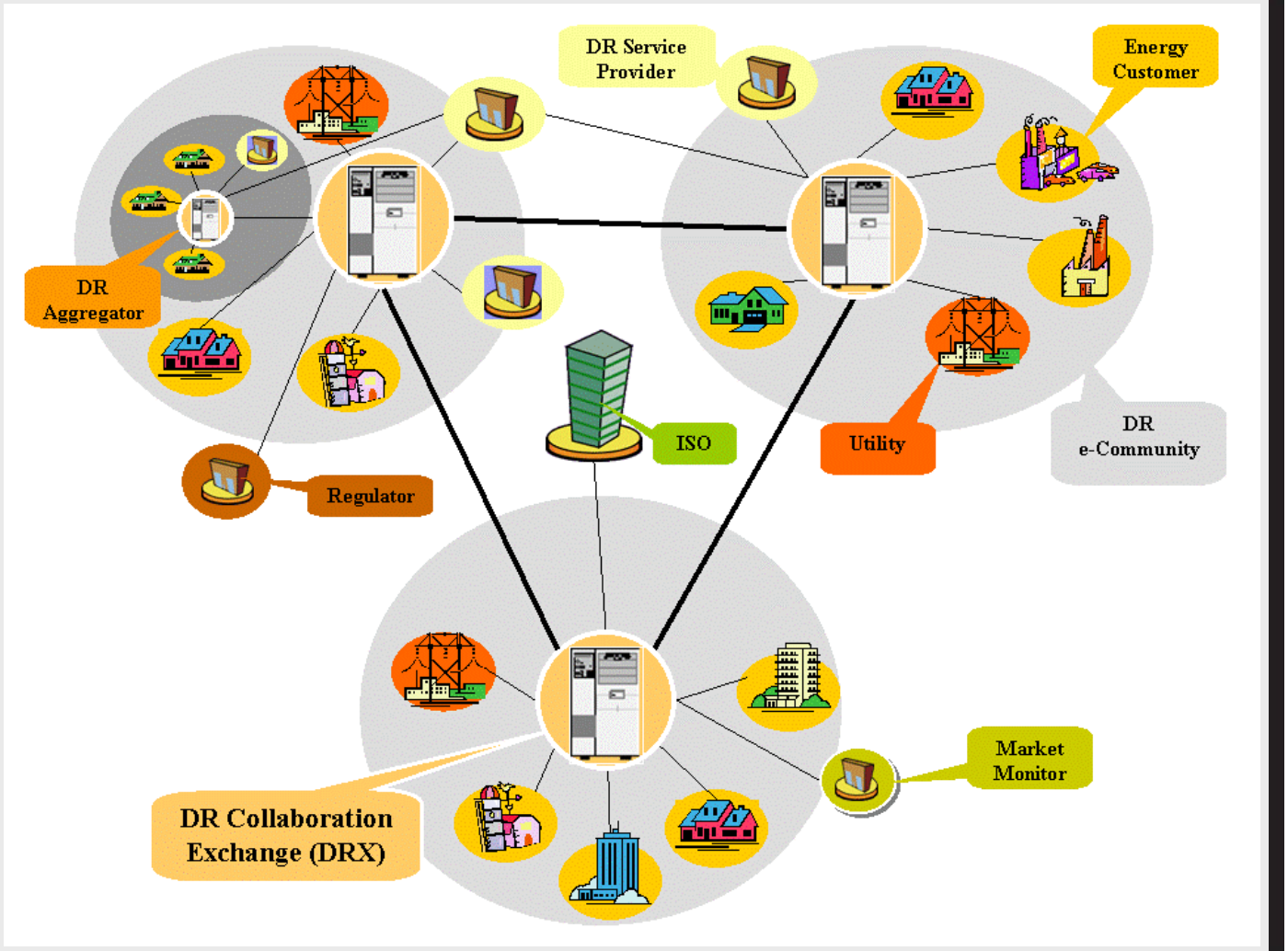
The Current California DR Landscape
An Analogy

- No unifying architecture
- Manual DR processes that are inefficient, slow, and error prone
- Inflexible to change & evolve
- Difficult to leverage investments/ reuse
- Costly for everyone
- Cannot support growth

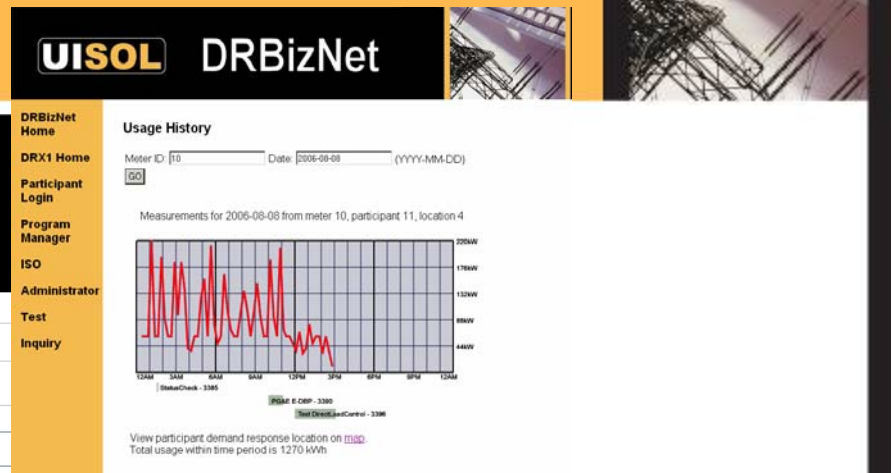


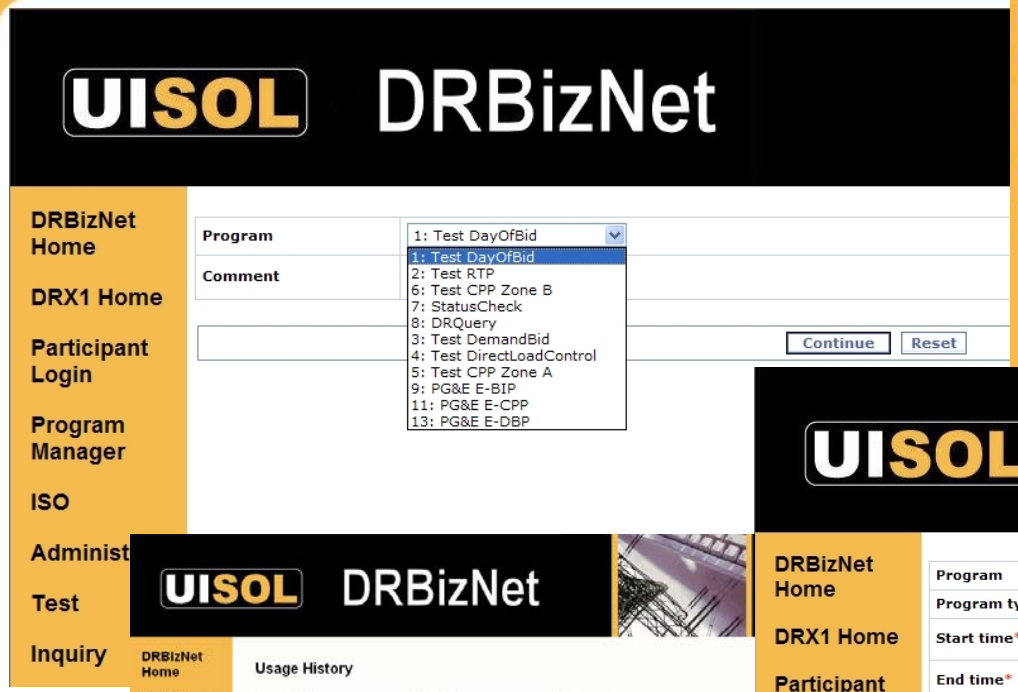
DRBizNet: A distributed business network ("eCommunity") designed to facilitate communications and business transactions among a large number of DR stakeholders

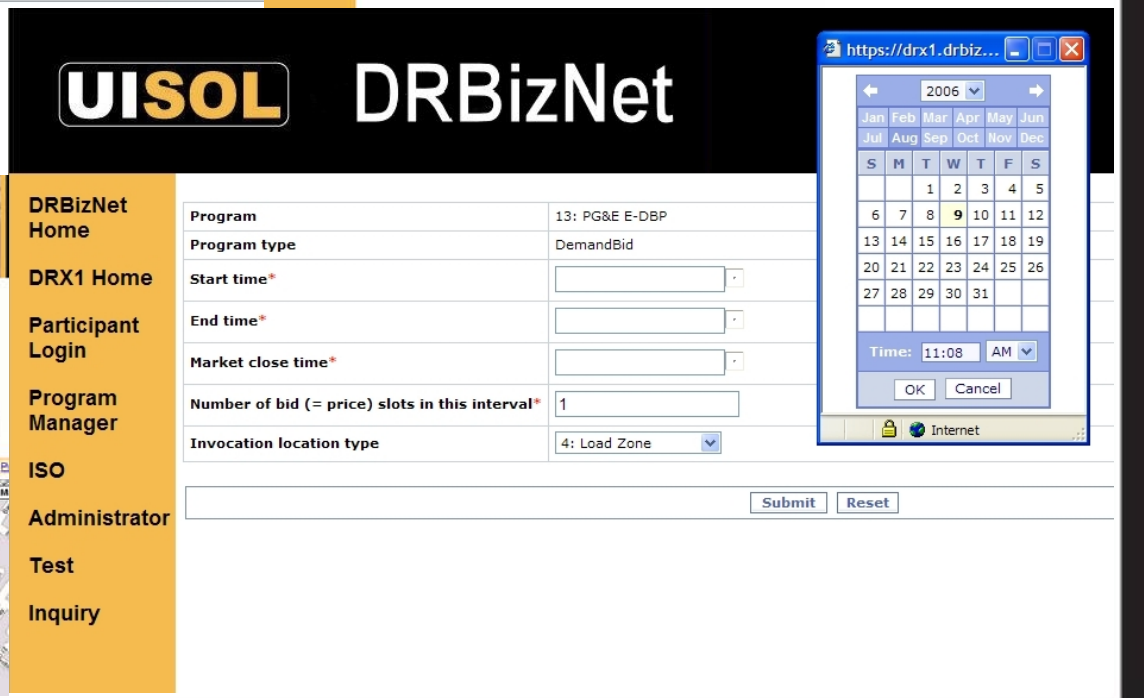
- Efficient management of DR processes
- Unified & open architecture
- Plug and play services
- Highly automated/Fast
- Secure Communications
- Full audit trail/ Visibility
- Enables DR process excellence
- Flexible/Easy to change
- Scalable to residential customers
- Protects investments
- Lowers costs/Benefits all stakeholders

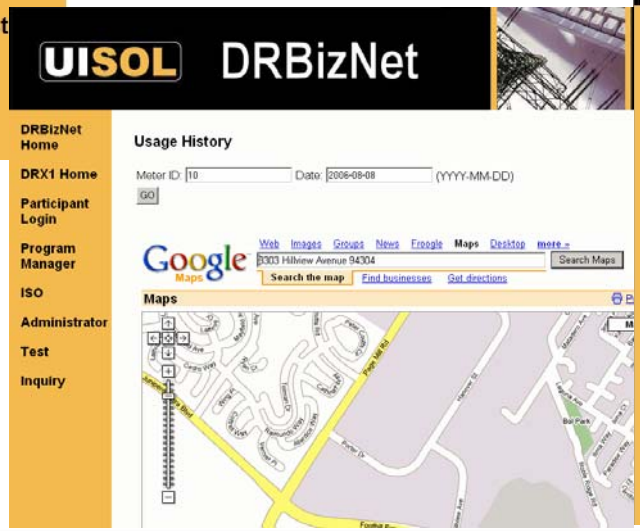


Field Simulation SW

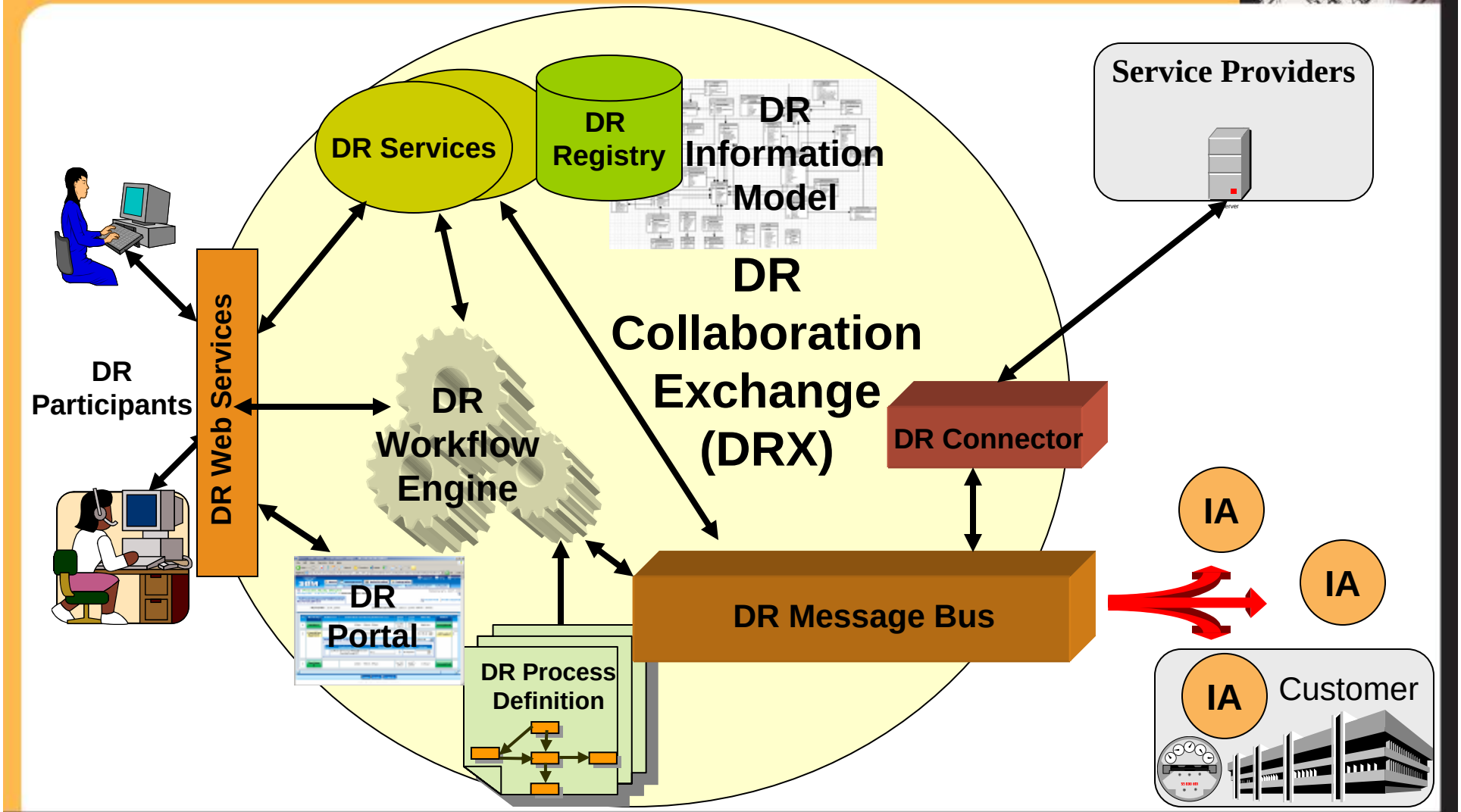




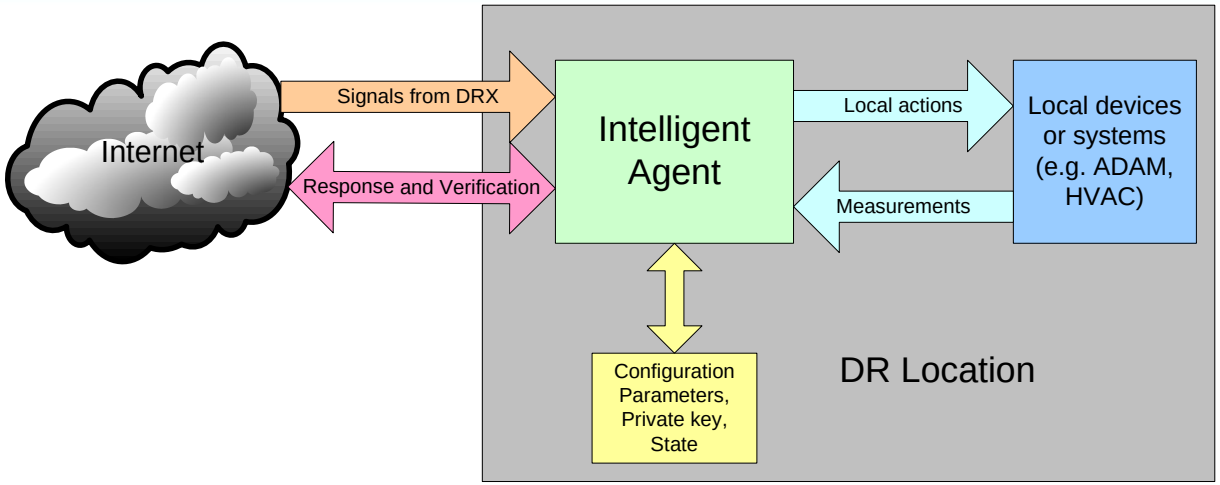




DR Collaboration Exchange (DRX)

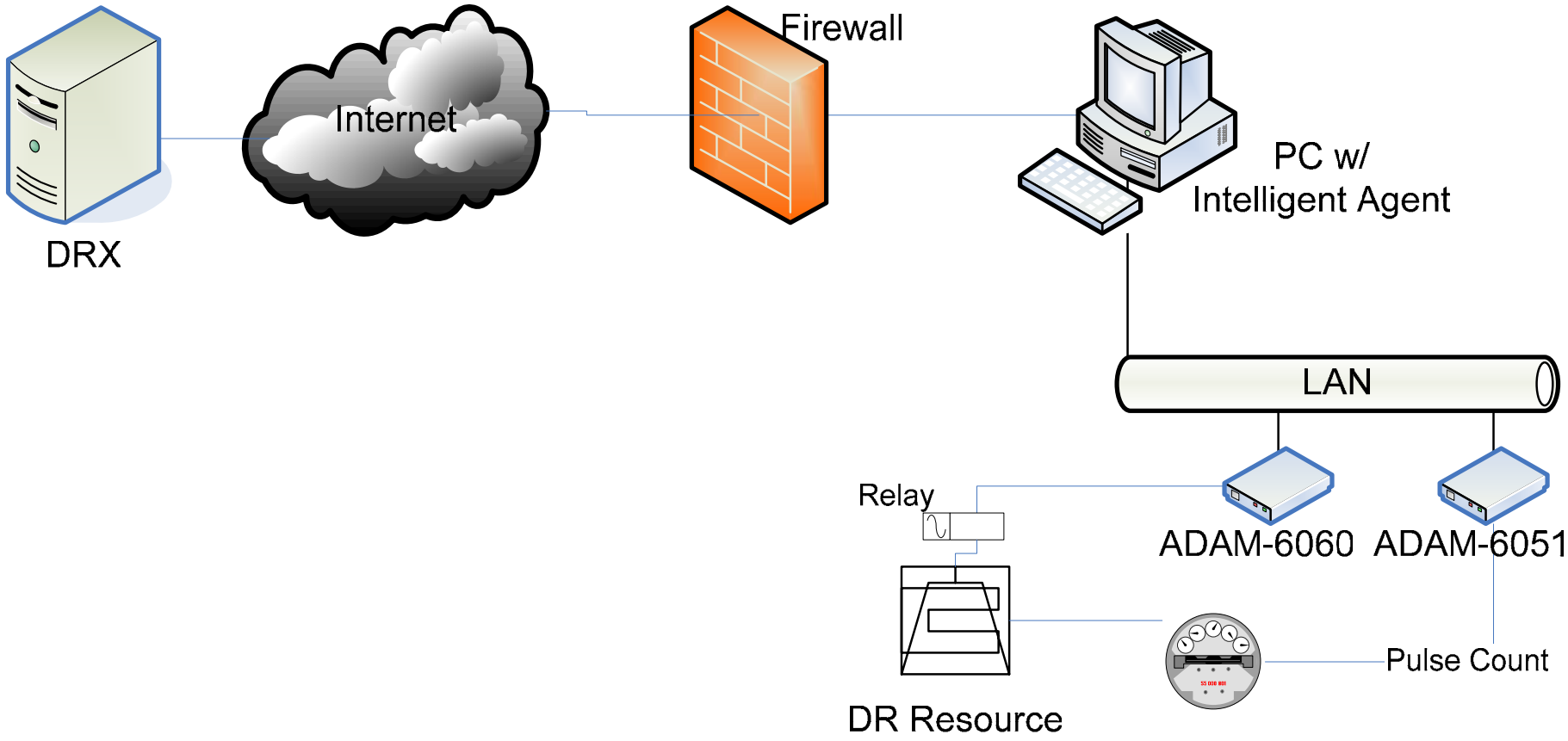


Intelligent Agent (IA)



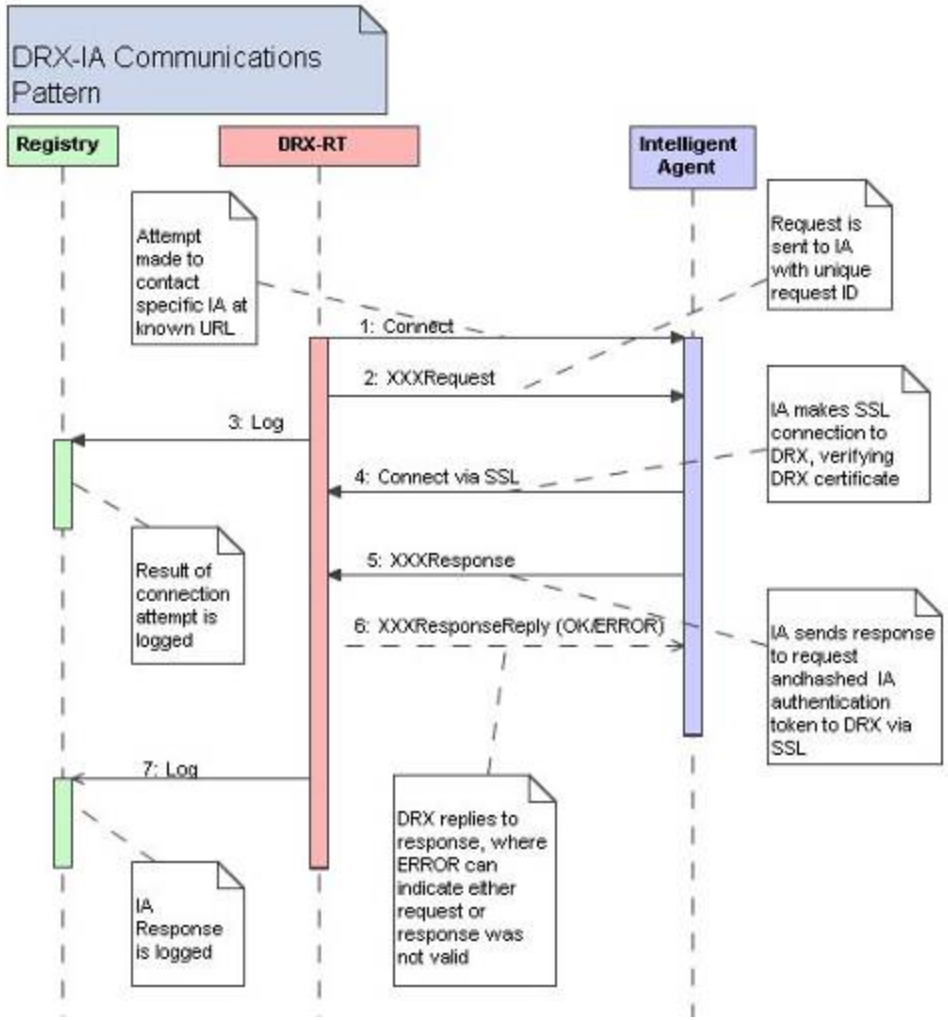
- Intelligent Agents: *Programs used extensively on the Internet that automate repetitive tasks, such as retrieving and delivering information*
- Key to any specific IA implementation is the support of DRBizNet messages and related security mechanisms
- Local DR resources (e.g. HVAC, pumps, …) can be integrated using DLLs, Modbus TCP, OPC or other interface mechanisms as appropriate
- UISOL has implemented a PC-based Reference IA that integrates with ADAM-6000 distributed I/O modules using Modbus TCP protocol
- IA interface and logic could be integrated within low cost devices

IA Integration



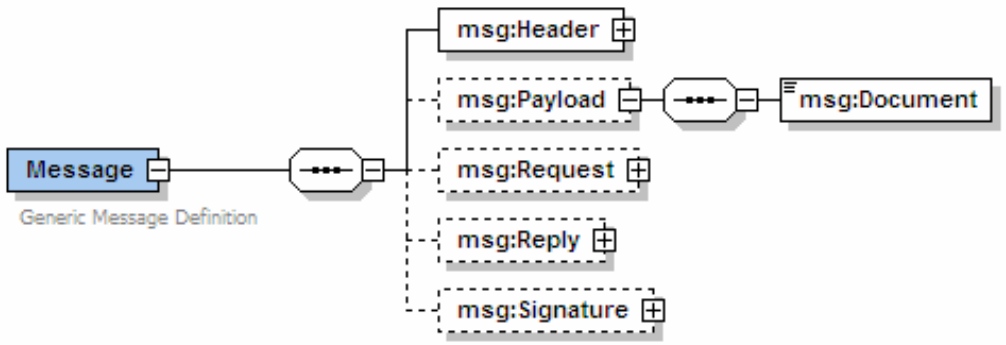
Security

- IA can be configured for listening or polling communication patterns
- IA authenticates requests by reconfirming with DRX
- DRX authenticates IA using PKI
- IA to DRX communications use SSL encryption
- Messages from IA are signed using XML Signatures
- DRX logs signed messages (transactions) from IAs with current public key, providing non-repudiation



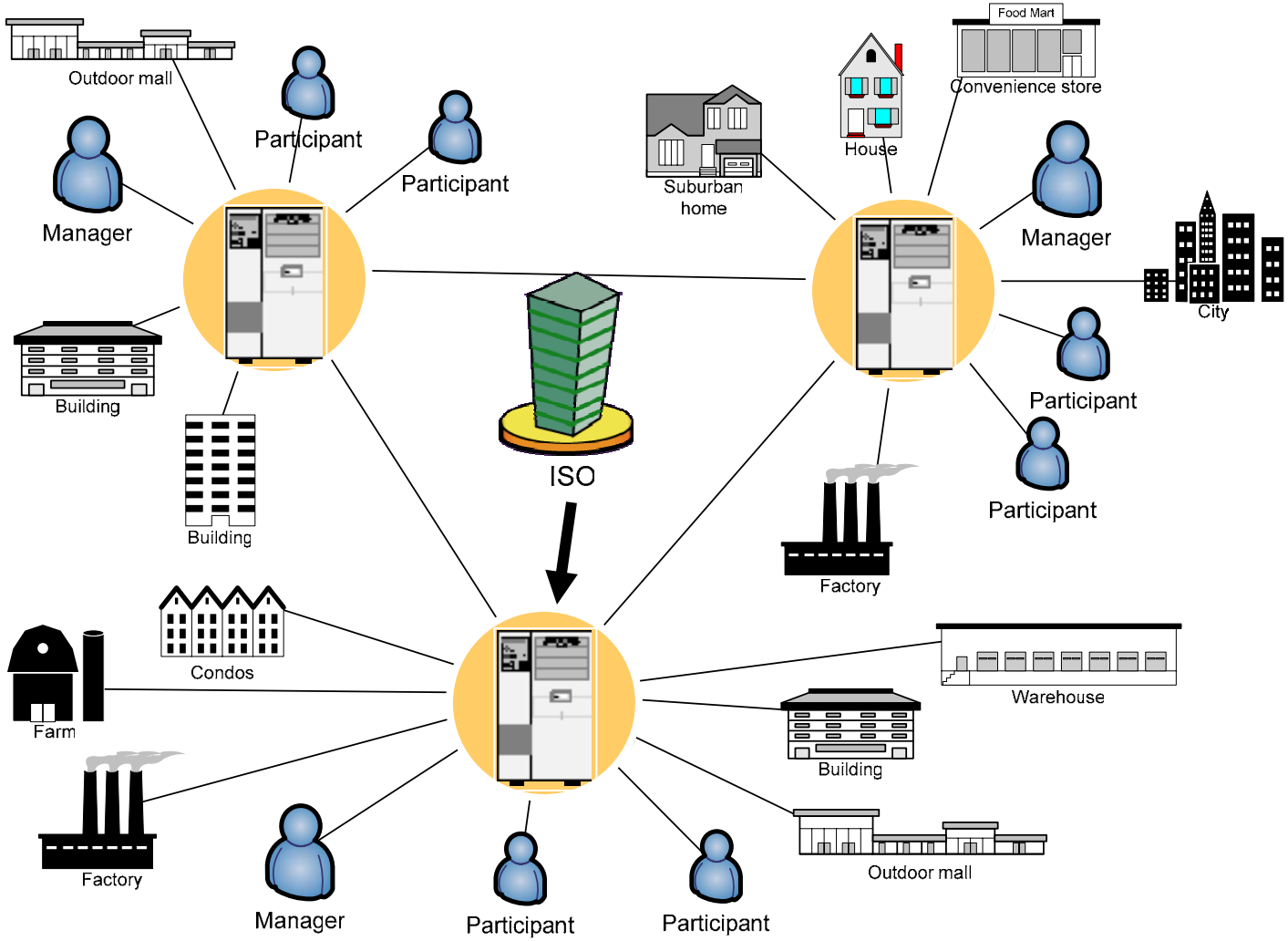
Interface Standards

- Web Services
- CIM
- IEC 61968-1
- IEC 61968-9 (draft)
- XML Signature
- SSL/TLS

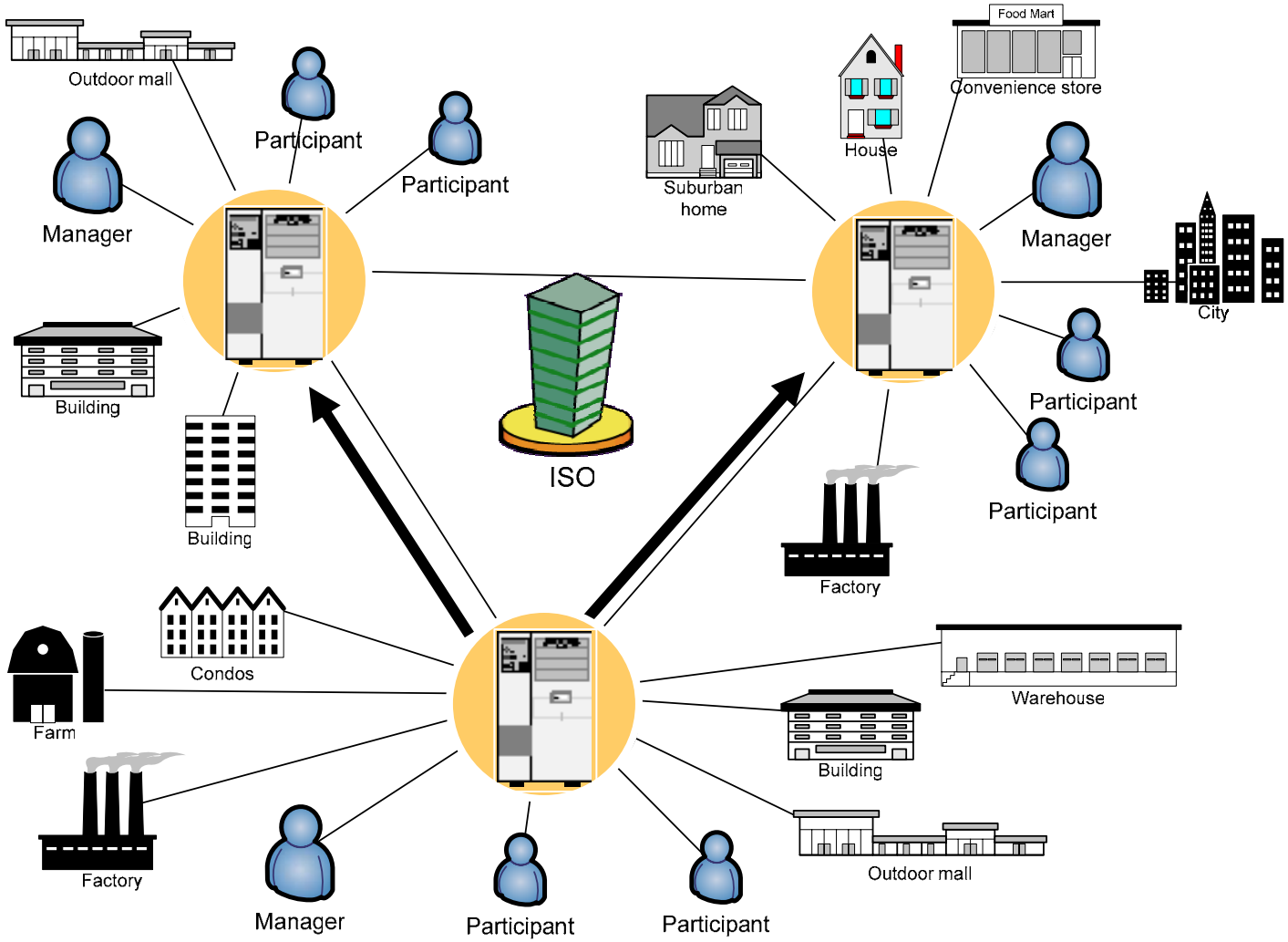


- XML
- XML Schema
- XPath
- SOAP
- WSDL
- HTTP
- XSLT
- SQL
- JDBC

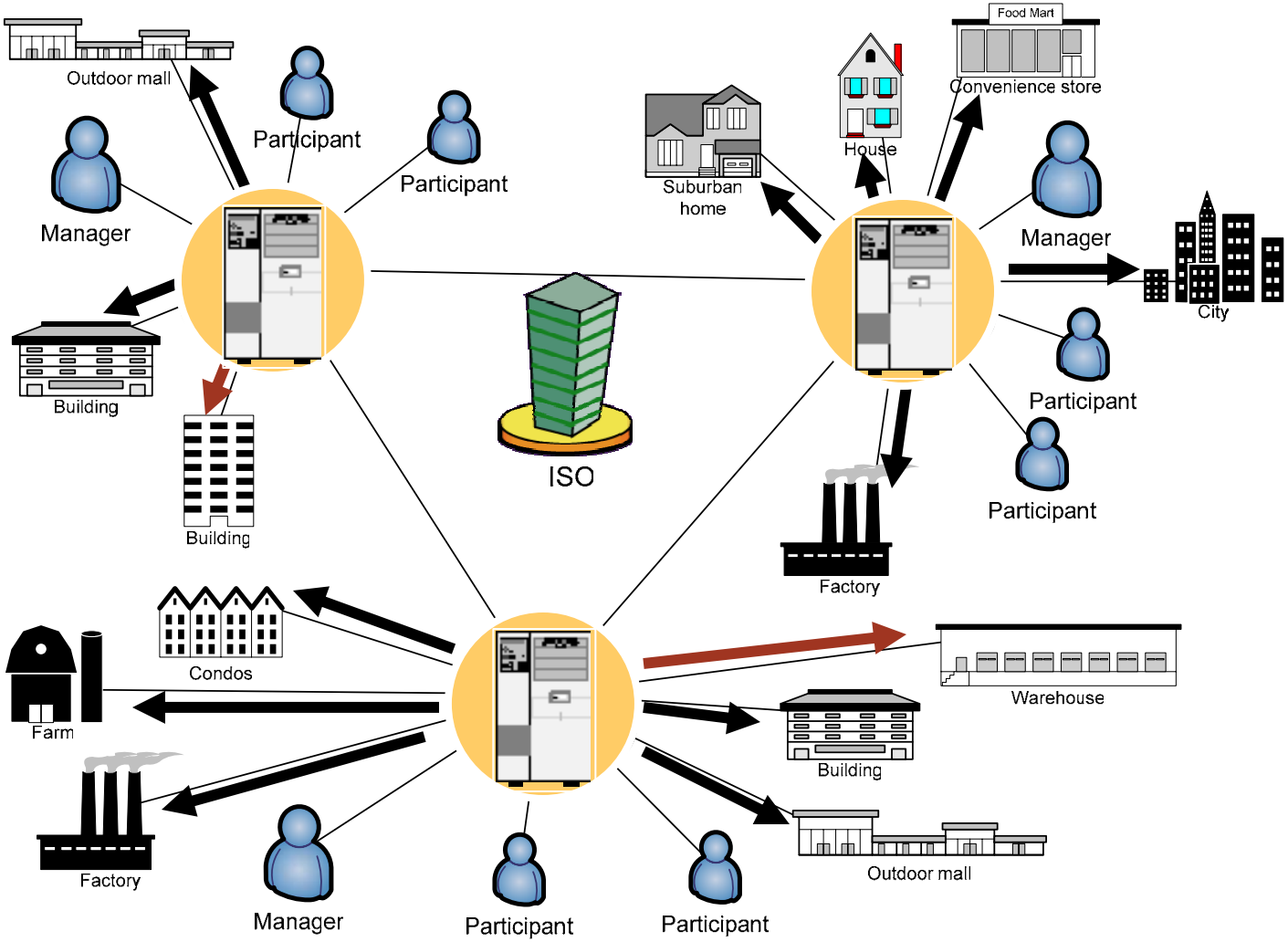
Example: Market Signal from ISO



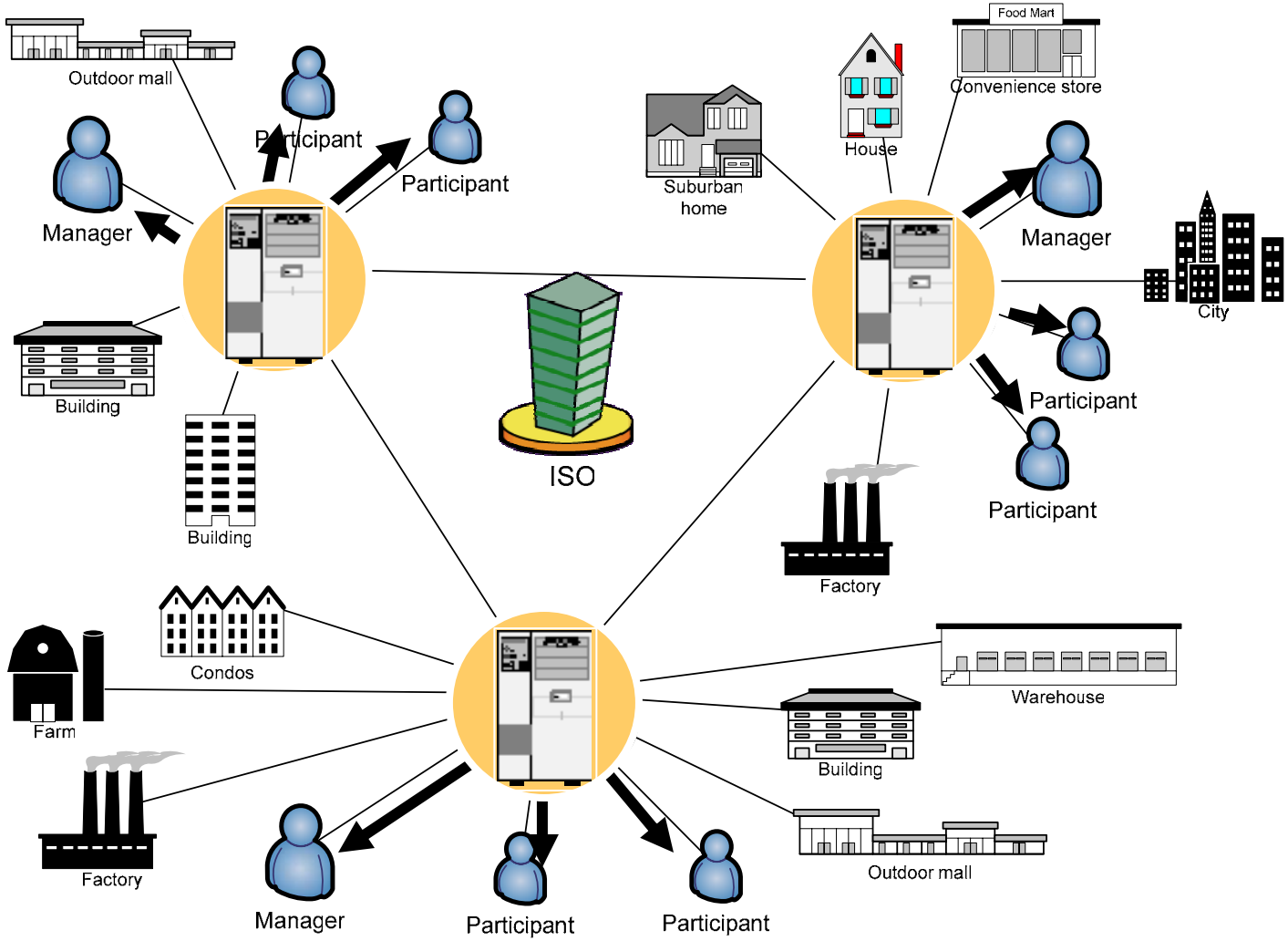
Example: Federation of Market Signal



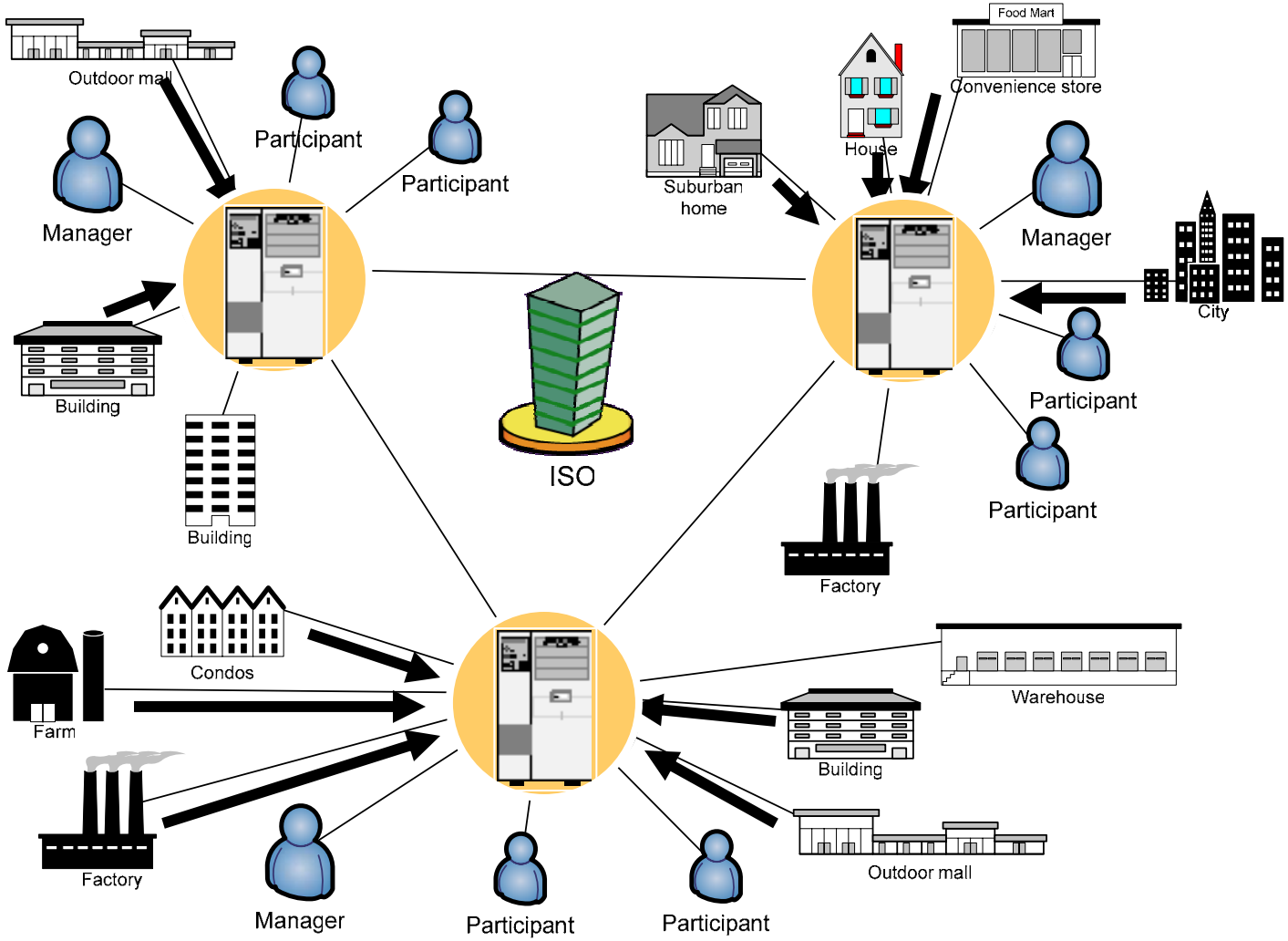
Example: DR Requests Sent to IAs



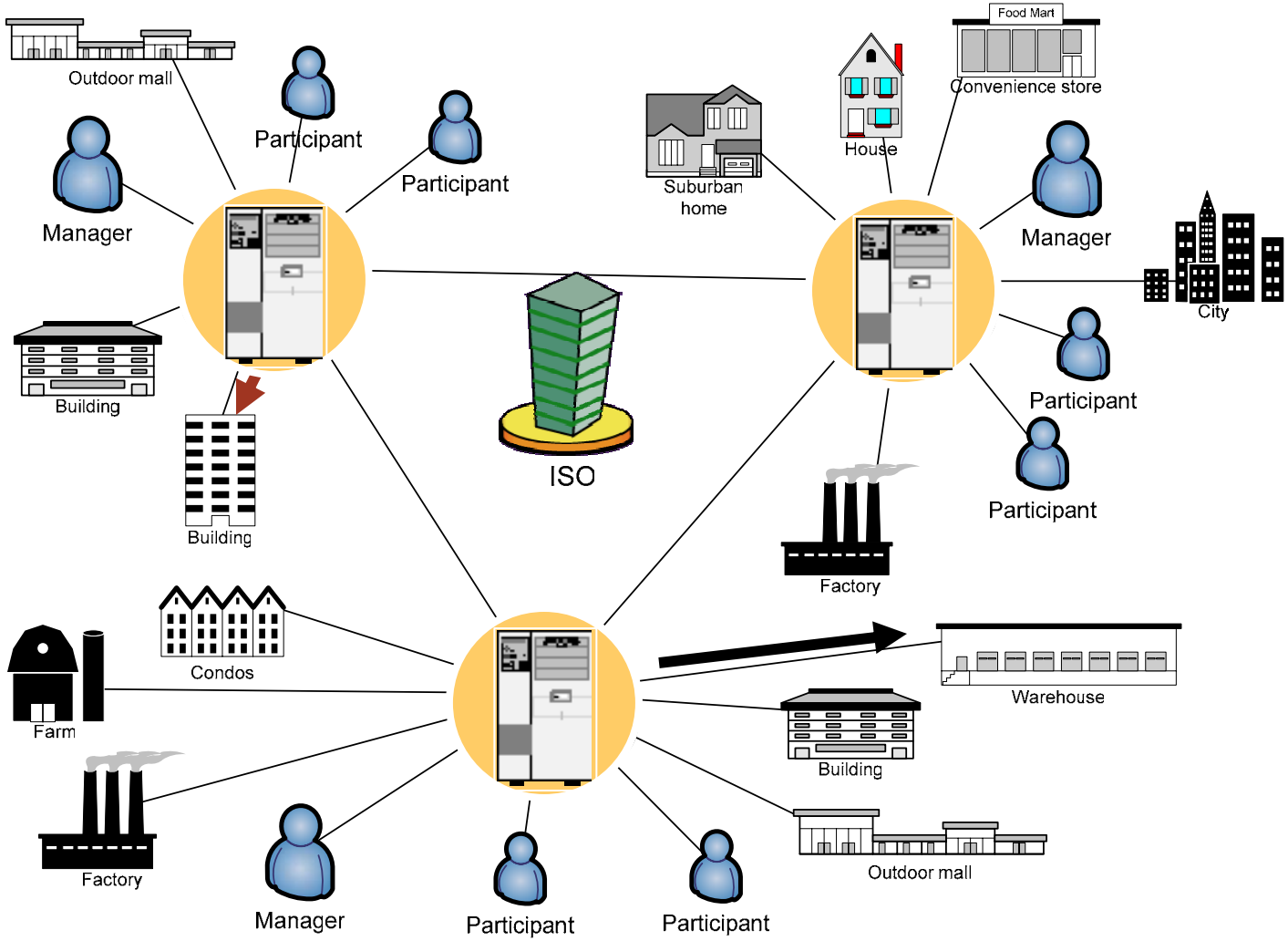
Example: Notifications to Contacts



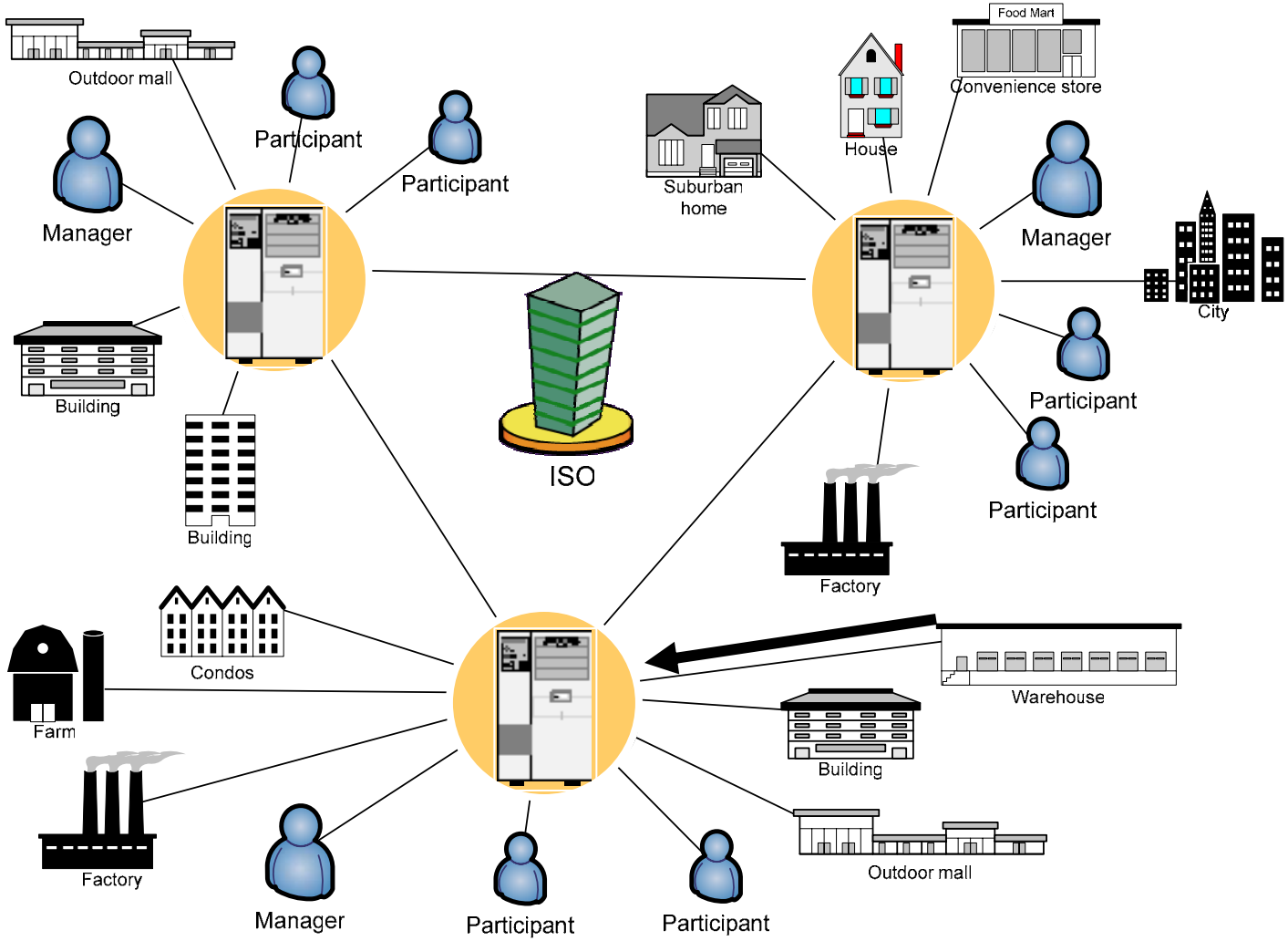
Example: IA Response and Verification



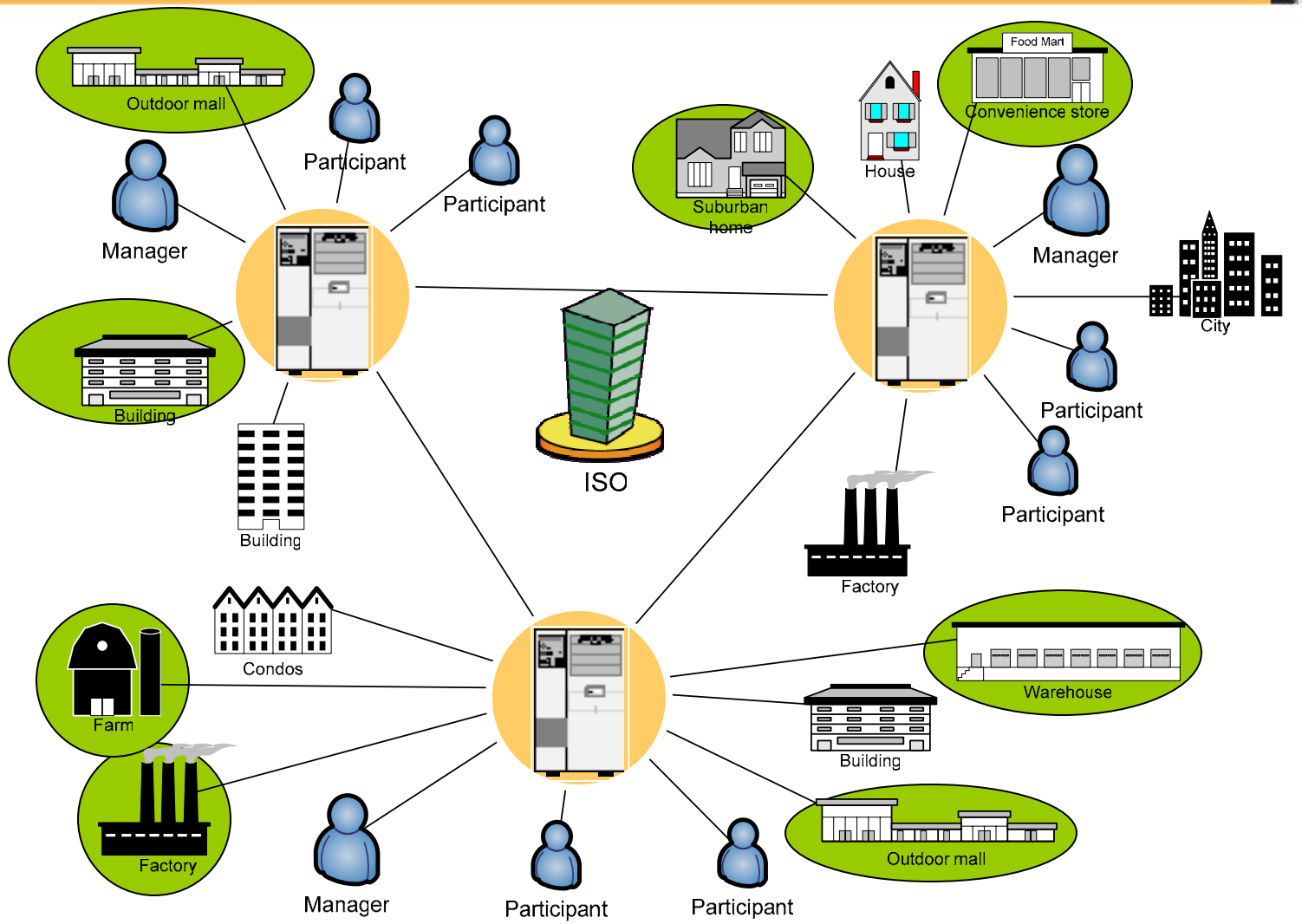
Example: Retry Processing



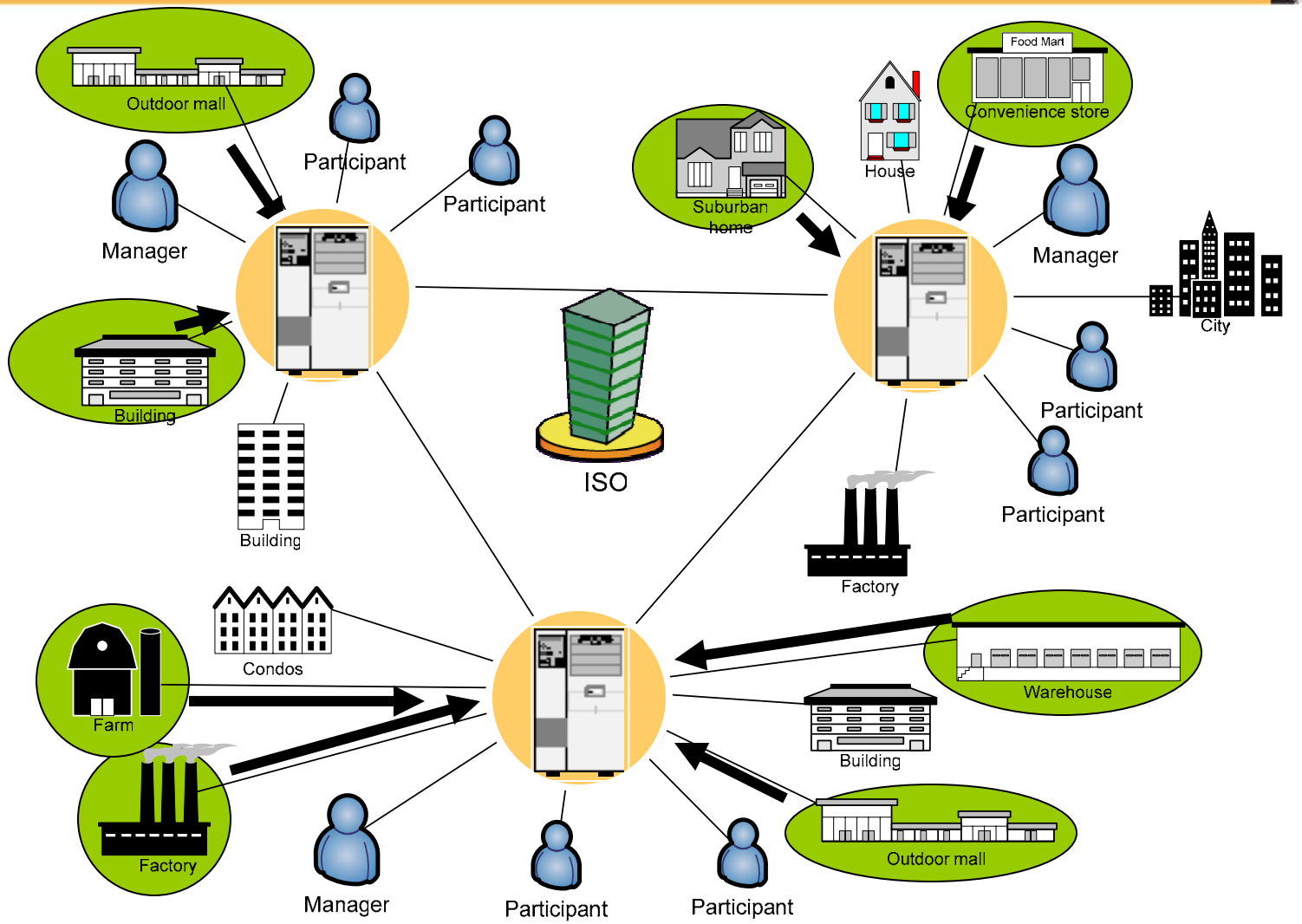
Example: Retry Processing



Example: Delivery Action



Example: Confirm Delivery Action



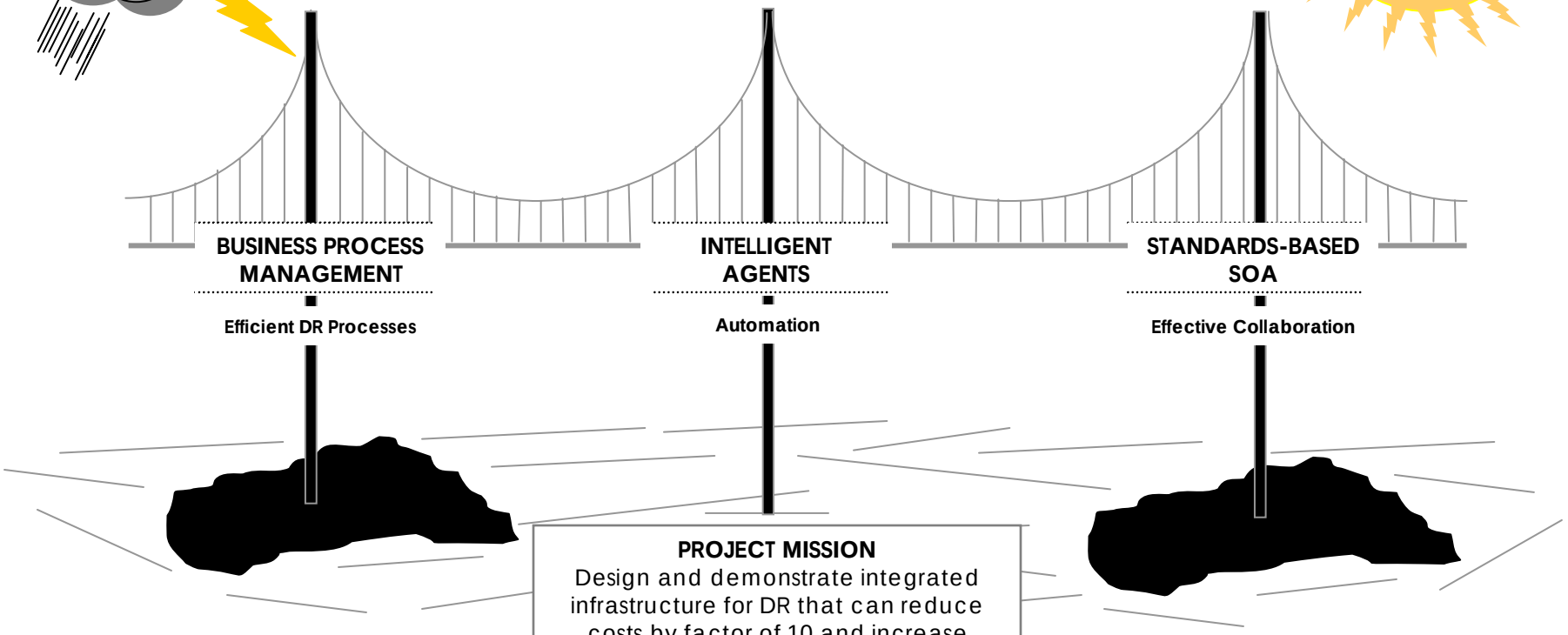
D R B i z N e t

Demand Response Business Network

DRBizNet is a distributed business network ("eCommunity") designed to facilitate communications and business transactions among a large number of DR stakeholders

AS-IS STATE
Inefficient, error-prone slow, inflexible, and non-scalable.

TO-BE STATE
Efficient, error-free, fast, flexible, and scalable.



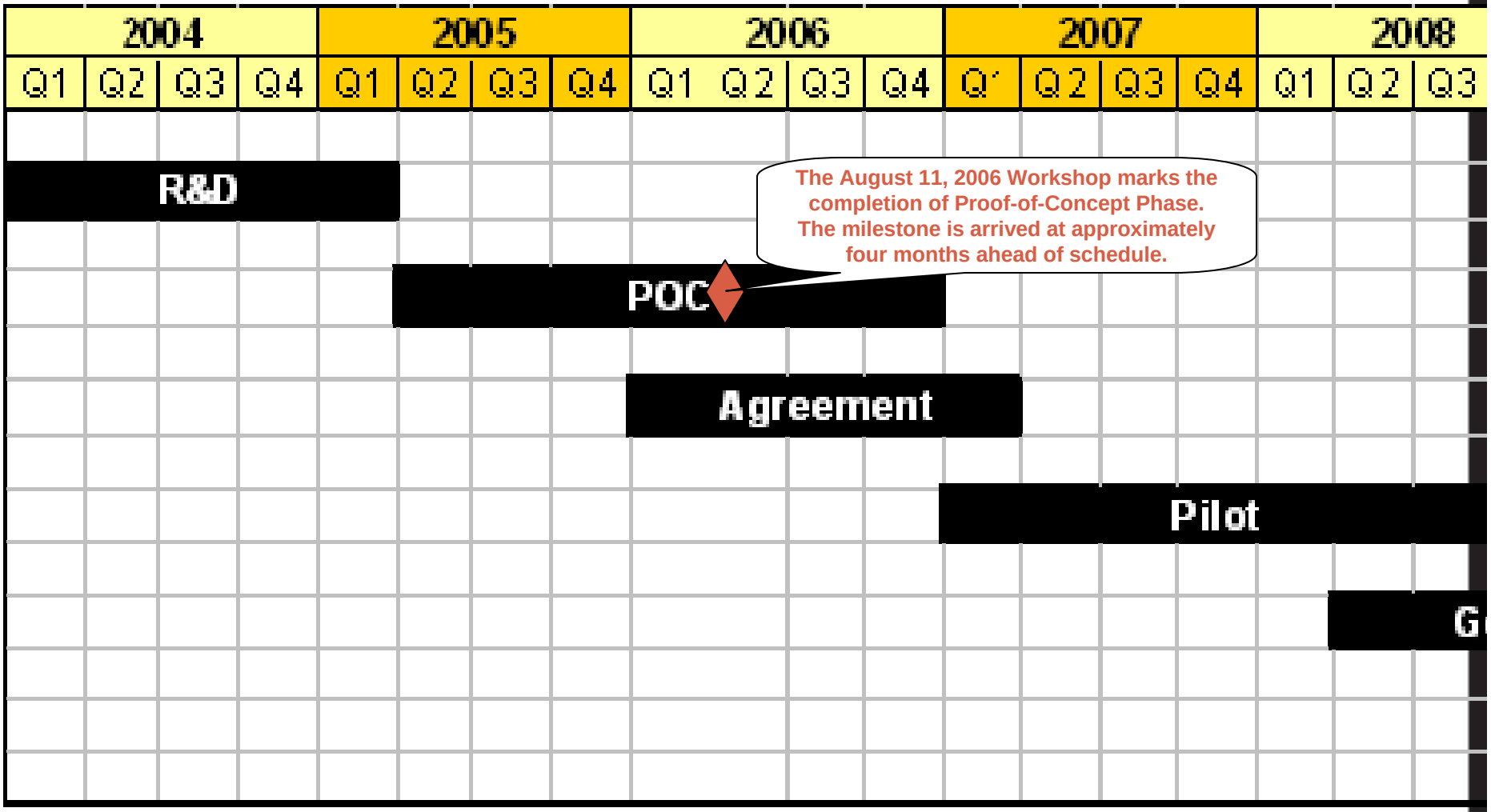
PROJECT MISSION
Design and demonstrate integrated infrastructure for DR that can reduce costs by factor of 10 and increase speed and functionality by factor of 10

UISOL TIBCO The Power of Now SAVVION Nexant Southern California Edison SDGE Sempra Energy PG&E pier CIEE

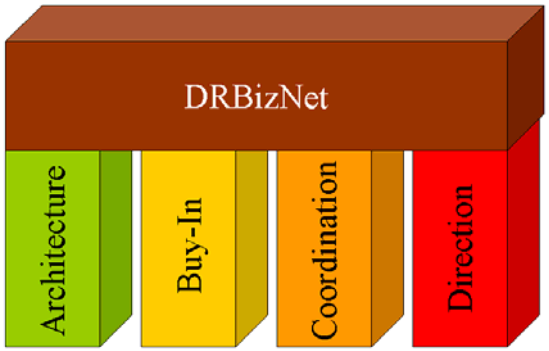
Dynamic Networks

Infotility California ISO Your Link to Power

DRBizNet Implementation Roadmap



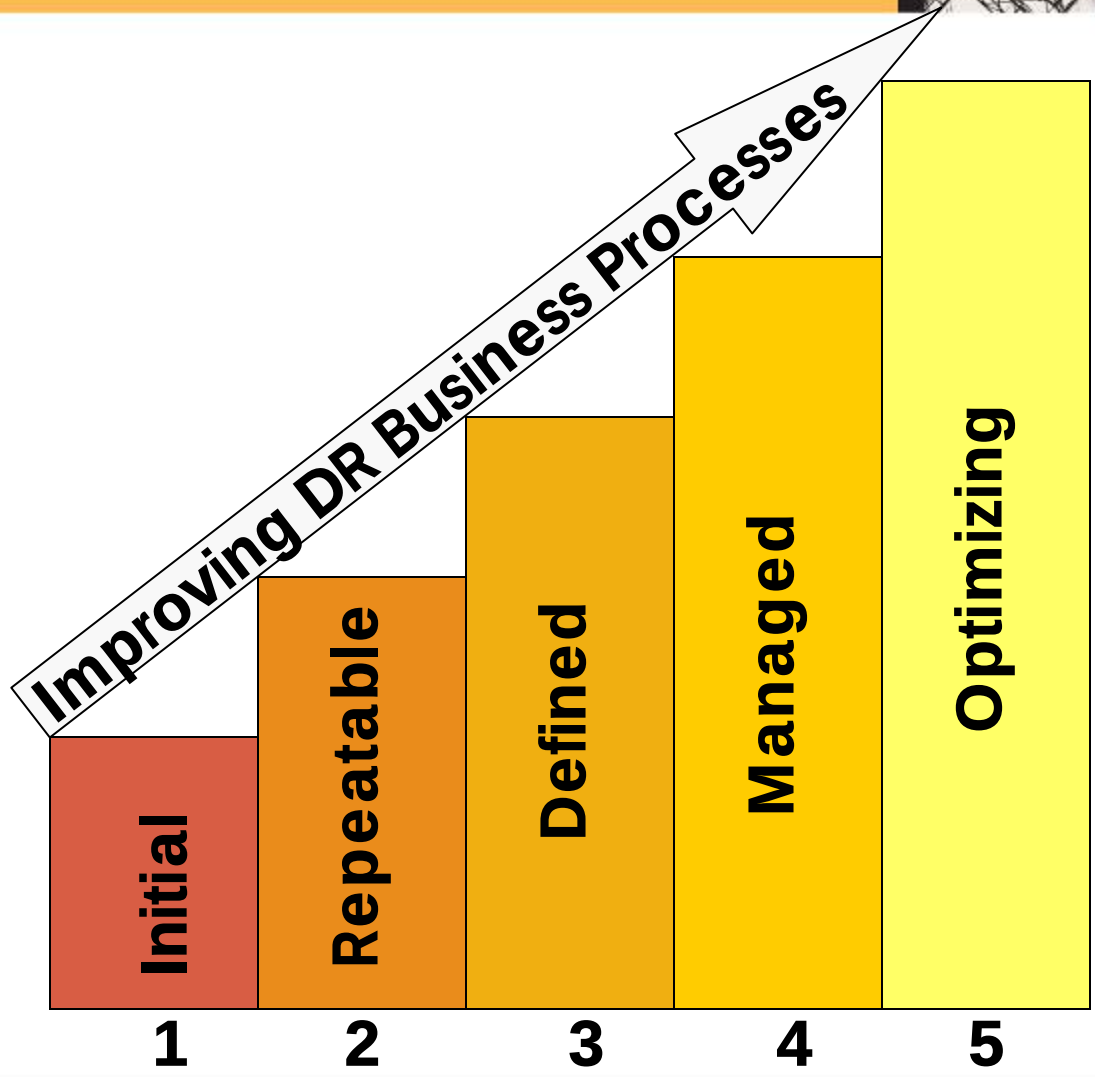
Supporting DRBizNet



DRBizNet Committees	Support Services
Steering Committee	Direction, goals, and priorities
	Sponsoring/Advocating DRBizNet Build Out
Management Committee	DRBizNet User Group Formation and Operation
	Organizational Policies and Procedures
Marketing Committee	Membership
	Communication, Marketing, and Promotion
	DRBizNet User Website
	Newsletter
	List of Compliant Products
Technical Committee	Technical Maintenance of DRBizNet Architecture, Information Model, Message Definitions, Services Design
	Technical Publications
	DRBizNet Helpdesk
	Resolution of Technical Issues
	Training Events, Workshops, Conferences
	Facilitation of Electronic Forum for Technical Discussions
	Integration and Conformance Testing Support
	Product Certifications
	Statistics/Reporting/Monitoring
	Liaison with Standards Organizations

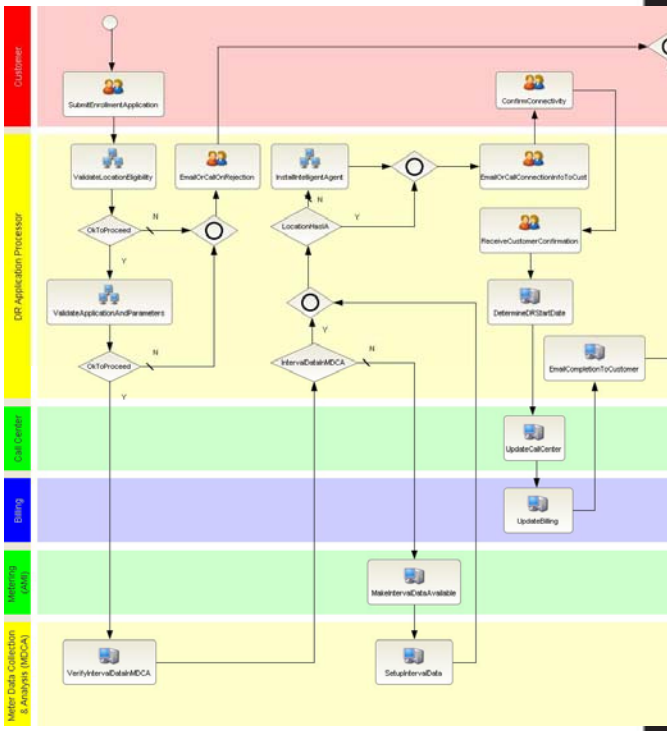
Enabling DR Process Excellence

Improving DR performance by defining, standardizing, managing, measuring, and continuously improving DR business processes



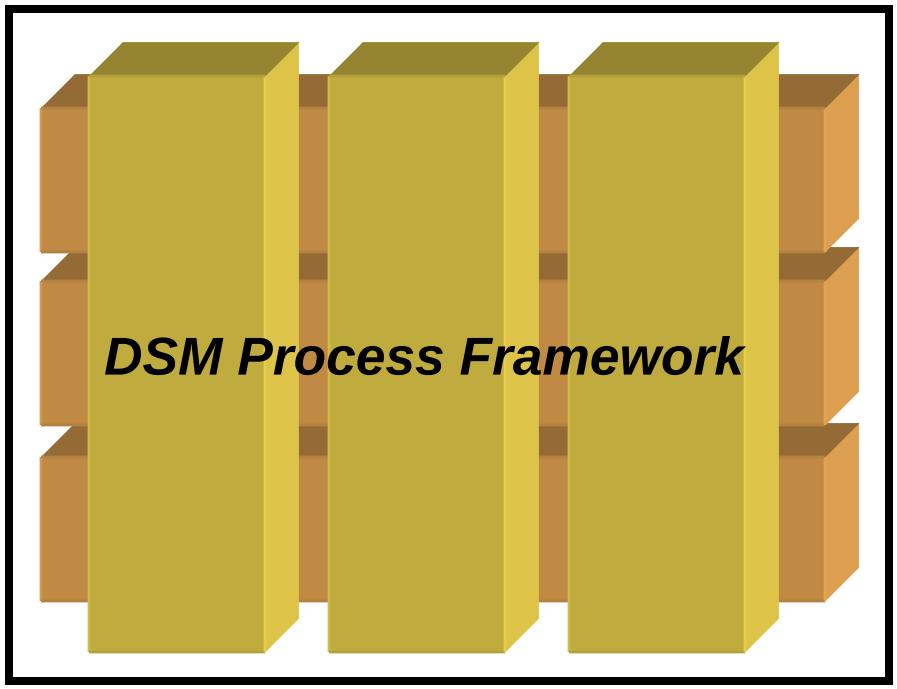
Motivation

- Are your DR business processes:
  - Easy to Execute/Efficient?
  - Consistent/Repeatable?
  - Well Documented/Auditable?
  - Compliant with Tariff Rules/Regulations?
  - Instrumented to Easily Monitor/Measure/Manage?
  - Easy to Learn?
  - Easy to Change/Improve/Optimize?
  - Seamlessly Integrate with Your other Processes/Systems (e.g., CIS, ERP)?

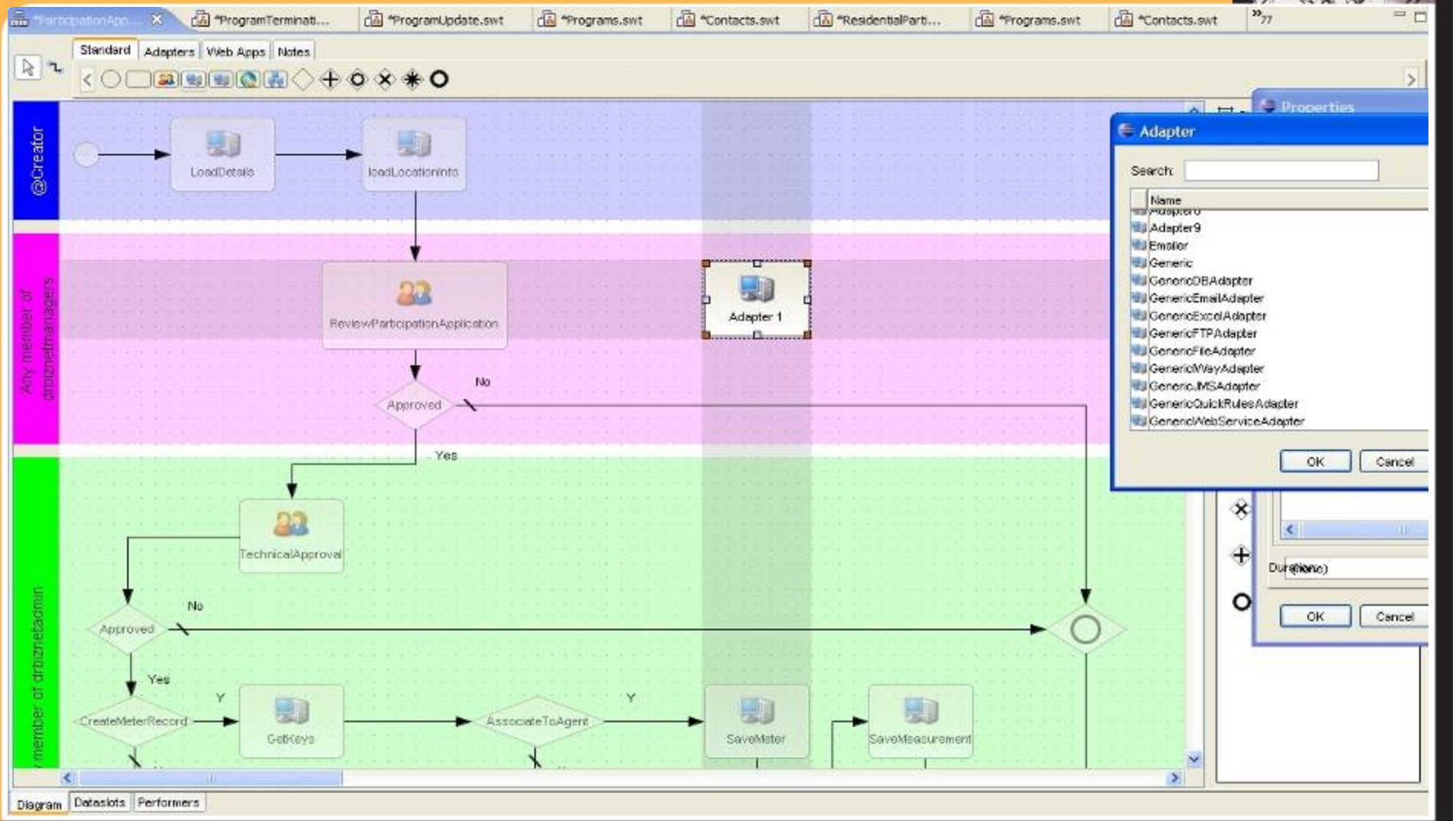


The Need for a DSM Process Framework

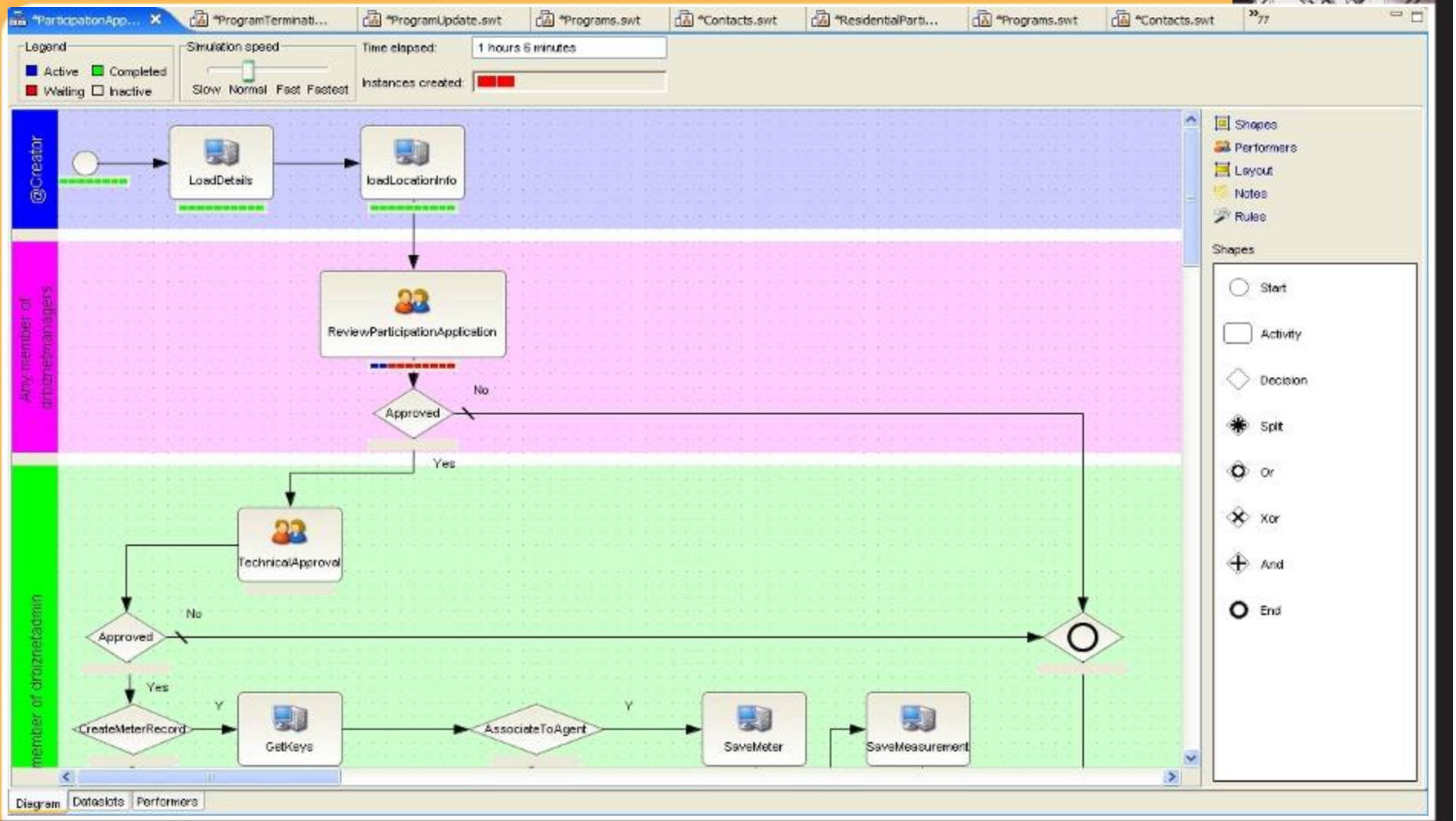
www.DRBizNet.org



Modeling & Flexibility



Simulation


*ParticipationApp...
*ProgramTerminati...
*ProgramUpdate.swt
*Programs.swt
*Contacts.swt
*ResidentialParti...
*Programs.swt
*Contacts.swt
Legend
Active
Completed
Waiting
Inactive
Simulation speed
Slow
Normal
Fast
Fastest
Time elapsed:
1 hours 6 minutes
Instances created:
@Creator
Any member of droiznetmanagers
member of droiznetadmin
LoadDetails
loadLocationInfo
ReviewParticipationApplication
Approved
No
Yes
TechnicalApproval
Approved
No
Yes
CreateMeterRecord
Y
GetKeys
AssociateToAgent
Y
SaveMeter
SaveMeasurement
Shapes
Performers
Layout
Notes
Rules
Shapes
Start
Activity
Decision
Split
Or
Xor
And
End
Diagram
Dataslots
Performers

What-If Scenario Analysis

Scenario Comparison for ParticipationApproval

Simulation
Create Charts

Activity Time and Cost

Activity	ReviewParticipationApplication					
Scenario	Occurs	Waiting Time	Total Time	Avg. Time	Cost	Avg. Cost
Scenario 1	50	1075.4833	1175.3833	23.5075	$25,057.50	$501.15
Scenario 2	50	352.4333	455.75	9.115	$25,911.68	$518.23

Activity	TechnicalApproval					
Scenario	Occurs	Waiting Time	Total Time	Avg. Time	Cost	Avg. Cost
Scenario 1	25	0	50	2	$9,750.00	$390.00
Scenario 2	25	357.8333	407.8333	16.3133	$0.00	$0.00

Activity	ActivateParticipationEntry					
Scenario	Occurs	Waiting Time	Total Time	Avg. Time	Cost	Avg. Cost
Scenario 1	12	0	0	0	$0.00	$0.00
Scenario 2	17	0	0	0	$0.00	$0.00

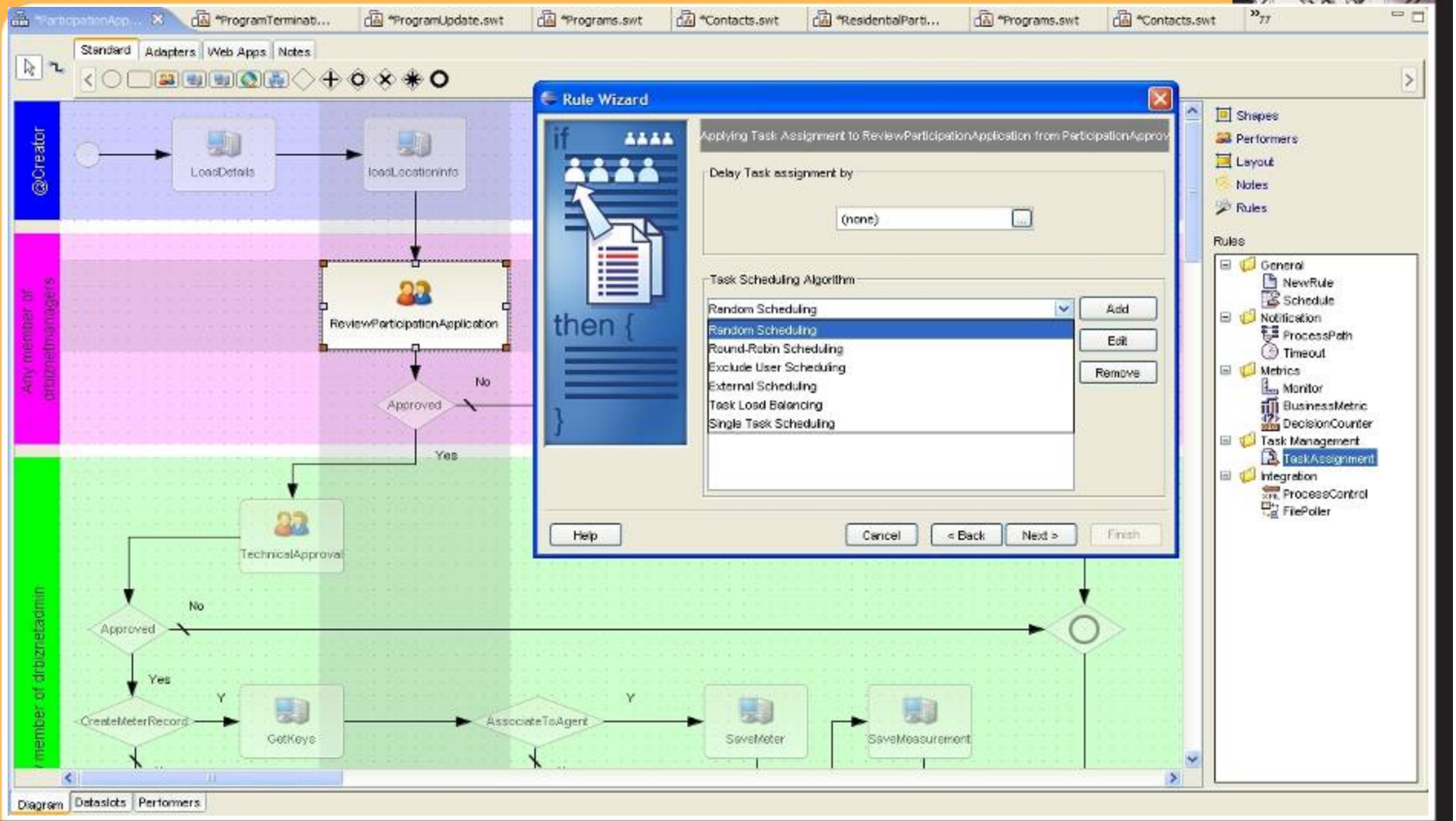
Activity	DeleteParticipationEntry					
Scenario	Occurs	Waiting Time	Total Time	Avg. Time	Cost	Avg. Cost
Scenario 1	38	0	0	0	$0.00	$0.00
Scenario 2	33	0	0	0	$0.00	$0.00

Activity	EmailApproval					
Scenario	Occurs	Waiting Time	Total Time	Avg. Time	Cost	Avg. Cost
Scenario 1	6	0	0.1	0.0167	$0.00	$0.00
Scenario 2	10	0	0.1667	0.0167	$0.00	$0.00

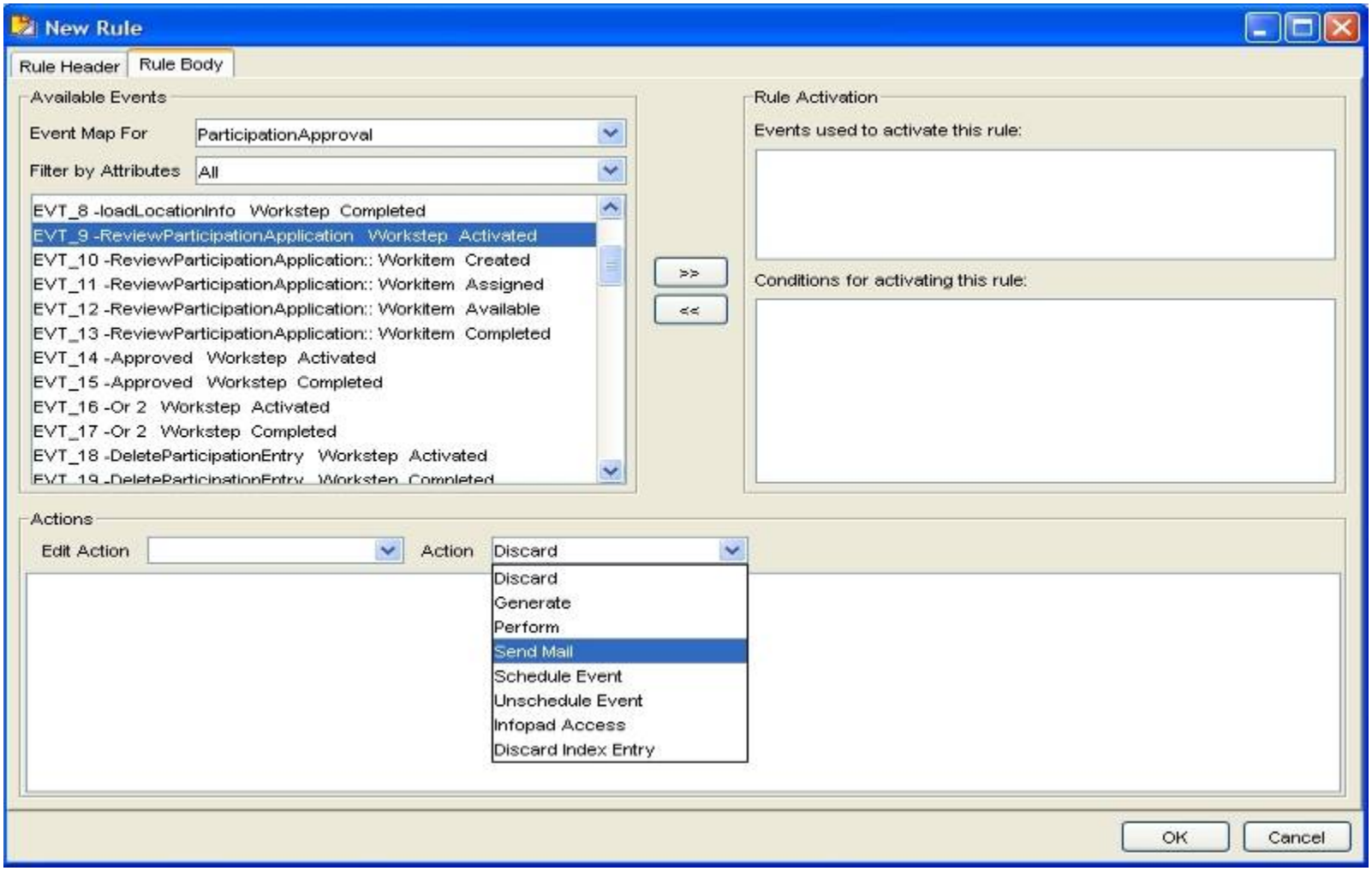
Activity	EmailRejection					
Scenario	Occurs	Waiting Time	Total Time	Avg. Time	Cost	Avg. Cost
Scenario 1	19	0	0.3167	0.0167	$0.00	$0.00
Scenario 2	19	0	0.3167	0.0167	$0.00	$0.00

Activity	GetKeys					
Scenario	Occurs	Waiting Time	Total Time	Avg. Time	Cost	Avg. Cost
Scenario 1	6	0	0	0	$0.00	$0.00
Scenario 2	8	0	0	0	$0.00	$0.00

Pre-Defined Business Rules

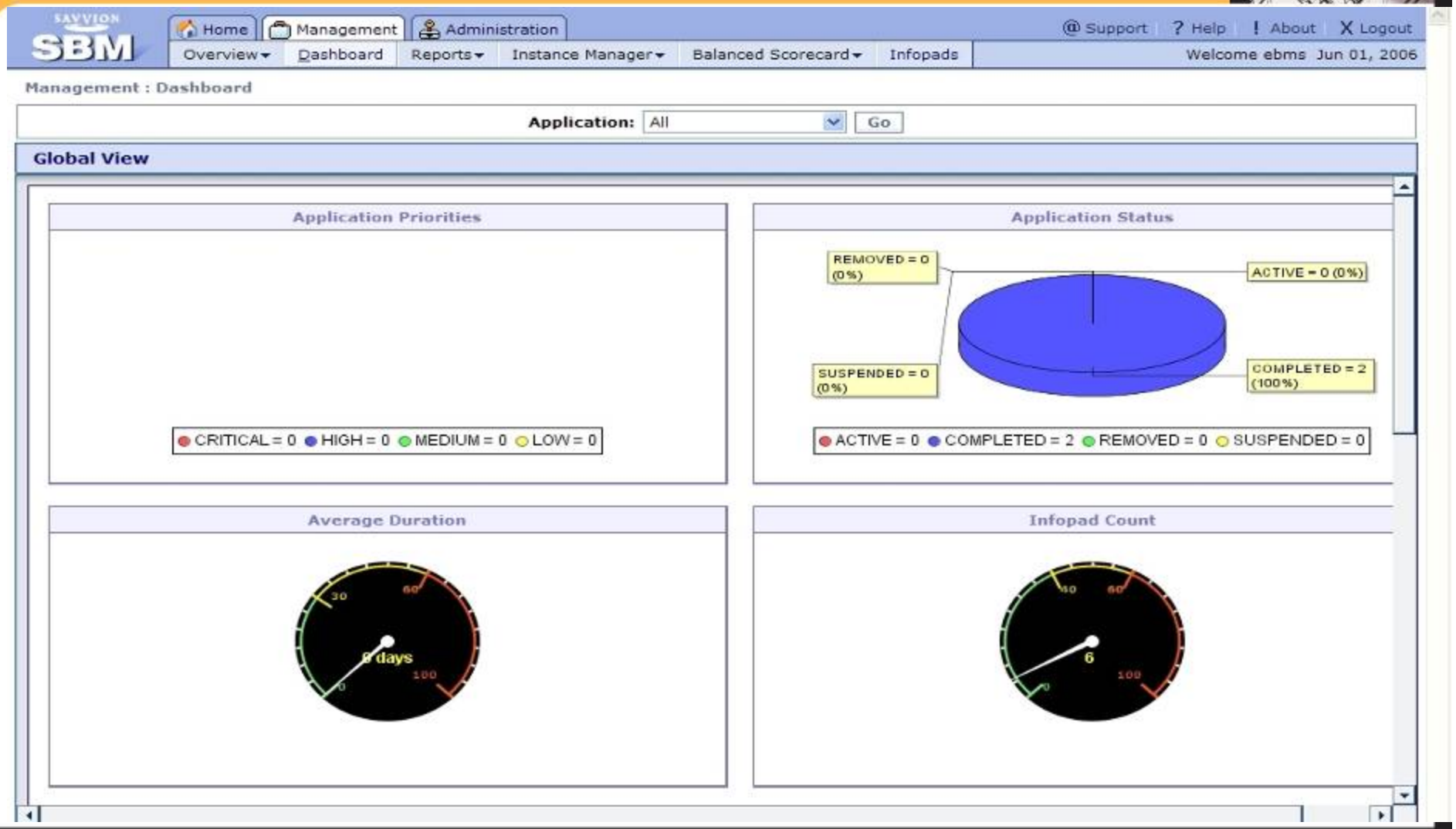


Configuring Custom Business Rules

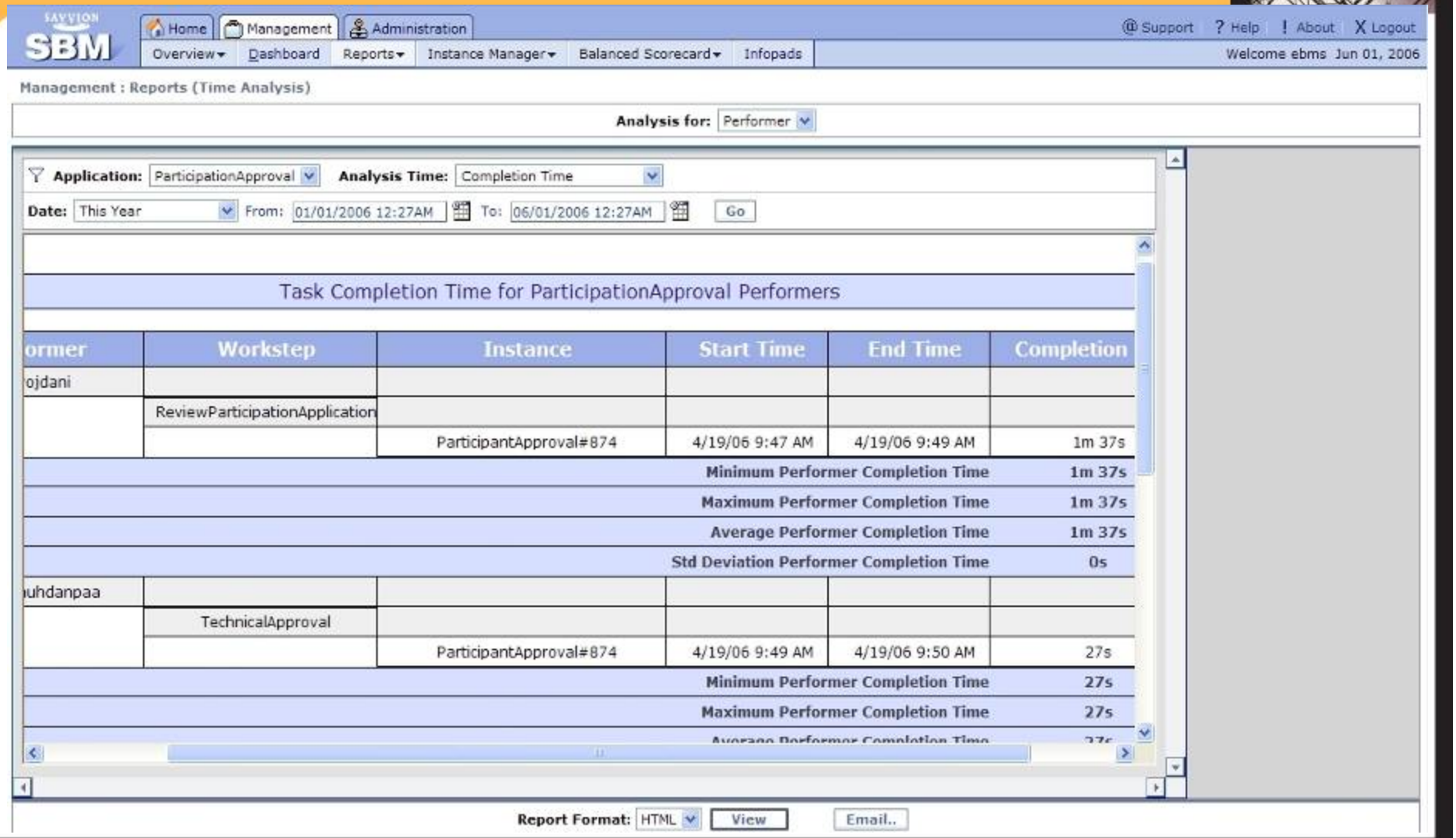


Measuring DR Processes

DR Process Metrics Dashboard

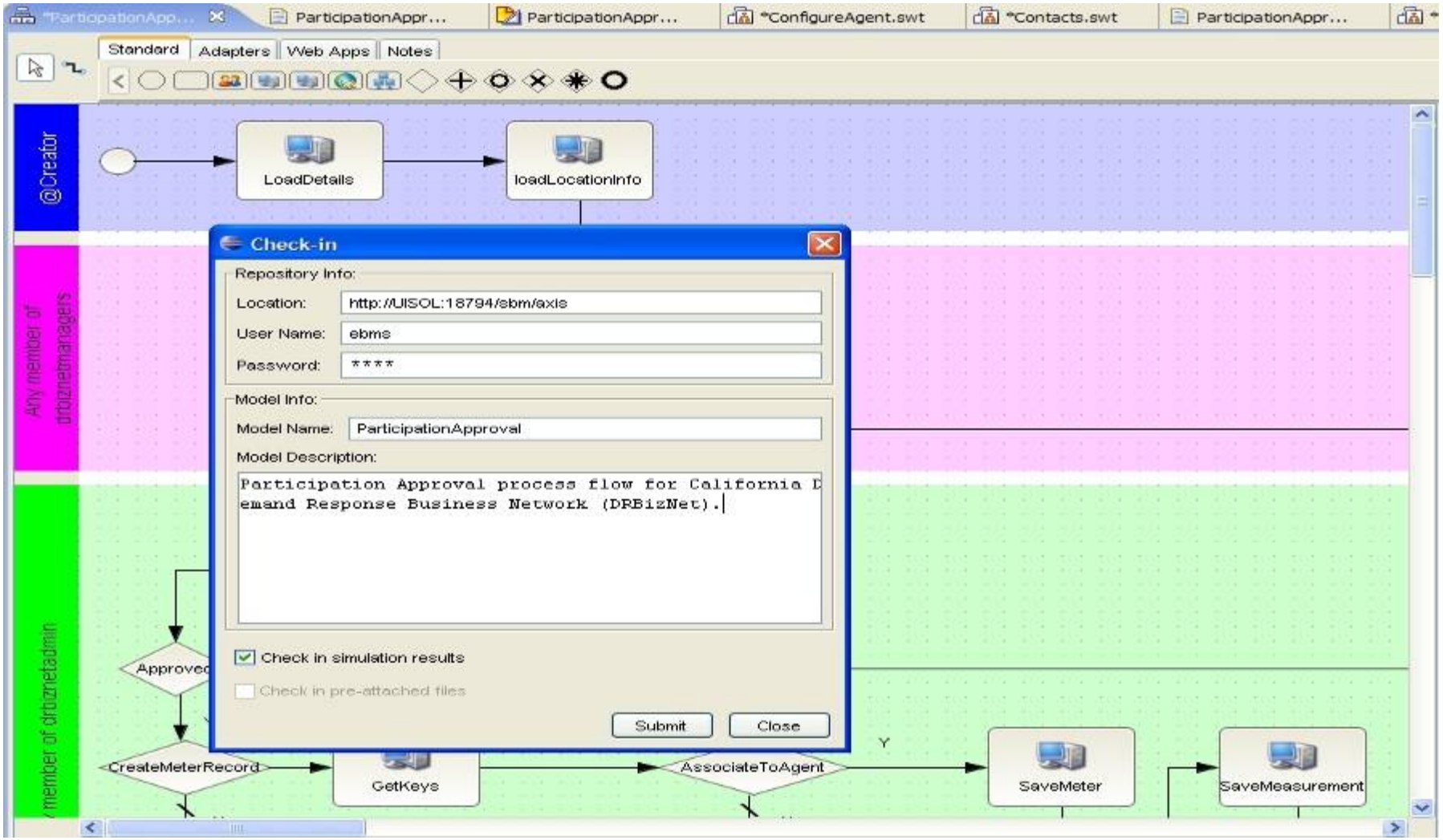


Complete Visibility & Auditability of DR Processes



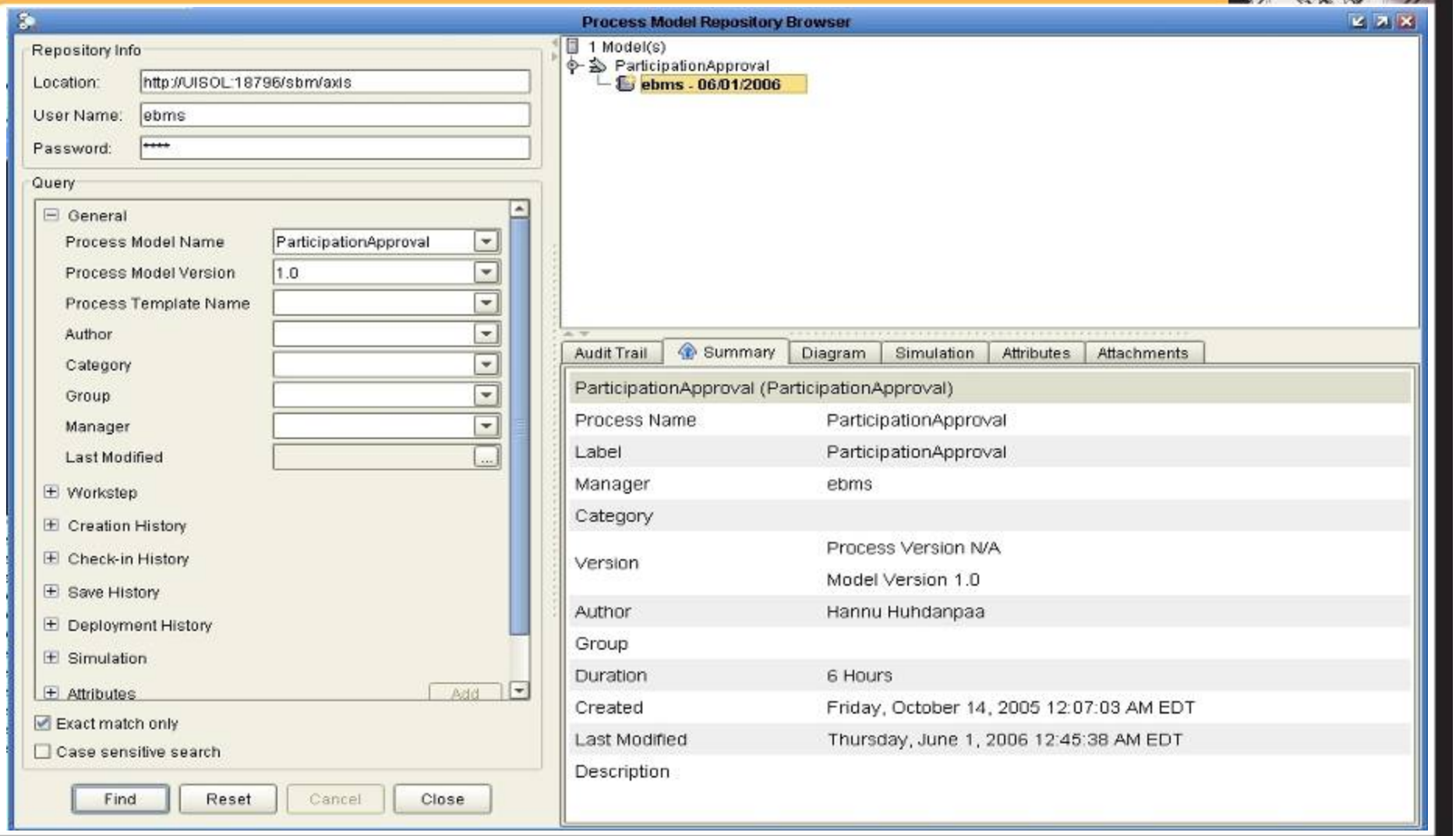
DR Process Repository

Check in



Searching for Best Practices

Process Repository Browser



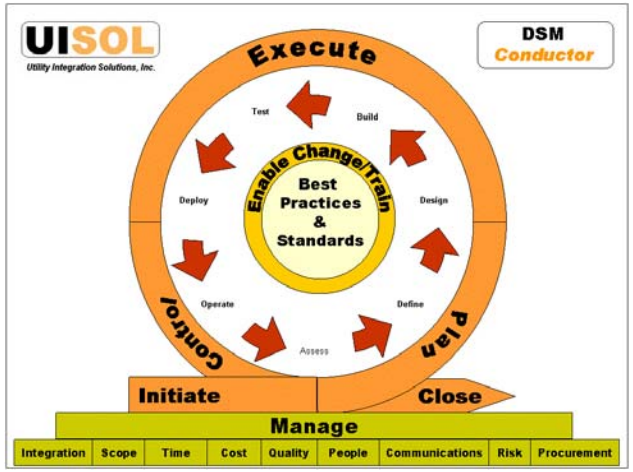
DSM Conductor

A Knowledgebase for Accelerating Utility Business Integration

TEST
- Testing Strategy
- Test Plans
- Test Script Templates
- Defect Tracking Templates
- Test Metrics
- Test Reports
- Checklists

BUILD
- Process Simulation Tools
- Adapters
- Rapid Prototyping Tools
- Reusable Components
- Checklists

DEPLOY
- Migration Plans
- Contingency Plans
- Checklists



DESIGN
- SOA
- Design Templates
- Information Model
- Database Designs
- Portal Views
- Vocabulary Translation Maps
- Sizing Templates
- Best Practice References
- Checklists

OPERATE
- ITIL Processes
- Policies
- Procedures
- Roles & Responsibilities
- Service Level Agreements
- Metrics

DEFINE
- Standard Glossary
- Prioritization Templates
- Use Case Library
- Process Repository
- Process Maps
- Metrics/KPI
- Requirements Templates
- Best Practice References
- Checklists

TRAIN/ENABLE CHANGE
- Change Management Plan
- Statement of Urgency
- Vision Statements
- Communications Plan
- Training Plan
- ARCI Matrices
- Policy Manuals
- Implementation Guides
- Job Roles/Descriptions
- Job Aids Templates
- Presentations
- Best Practice Papers
- Checklists

MANAGE
- PMO Procedures
- Project Charters & Scope Statements
- Roadmaps
- Project WBS & Schedules
- Resource Requirements/Organization
- Implementation Cost Estimation
- Case Studies & Selling Papers
- Risk Assessment Templates
- Communications Plan
- Estimation tools
- Vendor Selection Tools
- Checklists

ASSESS
- Assessment Templates
- Benchmarking Tools
- Best Practices References
- Checklists

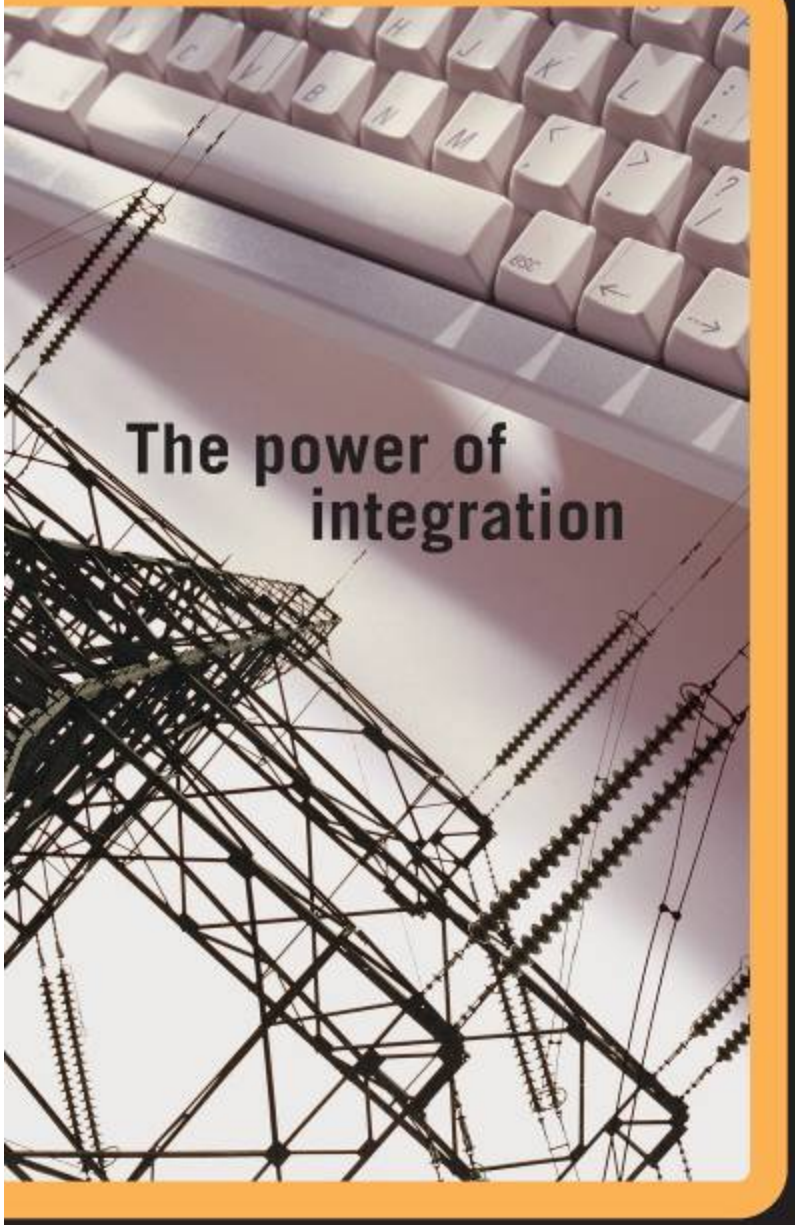
UISOL
Utility Integration Solutions, Inc.

Proprietary

DRBizNet Benefits

10x10 Improvements in DR Performance

- Efficient building blocks for an open and efficient DR e-Community
- Real-time communication and visibility
- Complete documentation/audit trail for all transactions
- Comprehensive platform for efficient and consistent end-to-end DR process management/collaboration
  - Electronic workflow mgt with powerful features (e.g., portal inboxes, deadline monitoring, escalation, substitution, e-mail notifications)
- Drastically reduces manual steps and errors
- Reduces need for training of process actors
- DR process optimization tools
  - DR process repository, DR process metrics/management dashboards, process simulation & forecasting, process bottleneck detection, what if analysis)
- Eliminates need for multiple systems for managing different DR programs
- Easy DR program creation
- Easy interface with other corporate systems through standard adaptors
- Easy, standards-based, interface with external parties
- Secure communications with DR resources
- Option for automating customer response through Intelligent Agents
- Dramatically reduces cost of making process changes through graphical process editors, integrated business rules engine, and rapid prototyping tools.
- Reduced O&M cost by replacing coding with configuration & empowerment of business users



DRBizNet

Demand Response Business Network

Steve De Backer
Pacific Gas and Electric

August 11, 2006

As-Is State

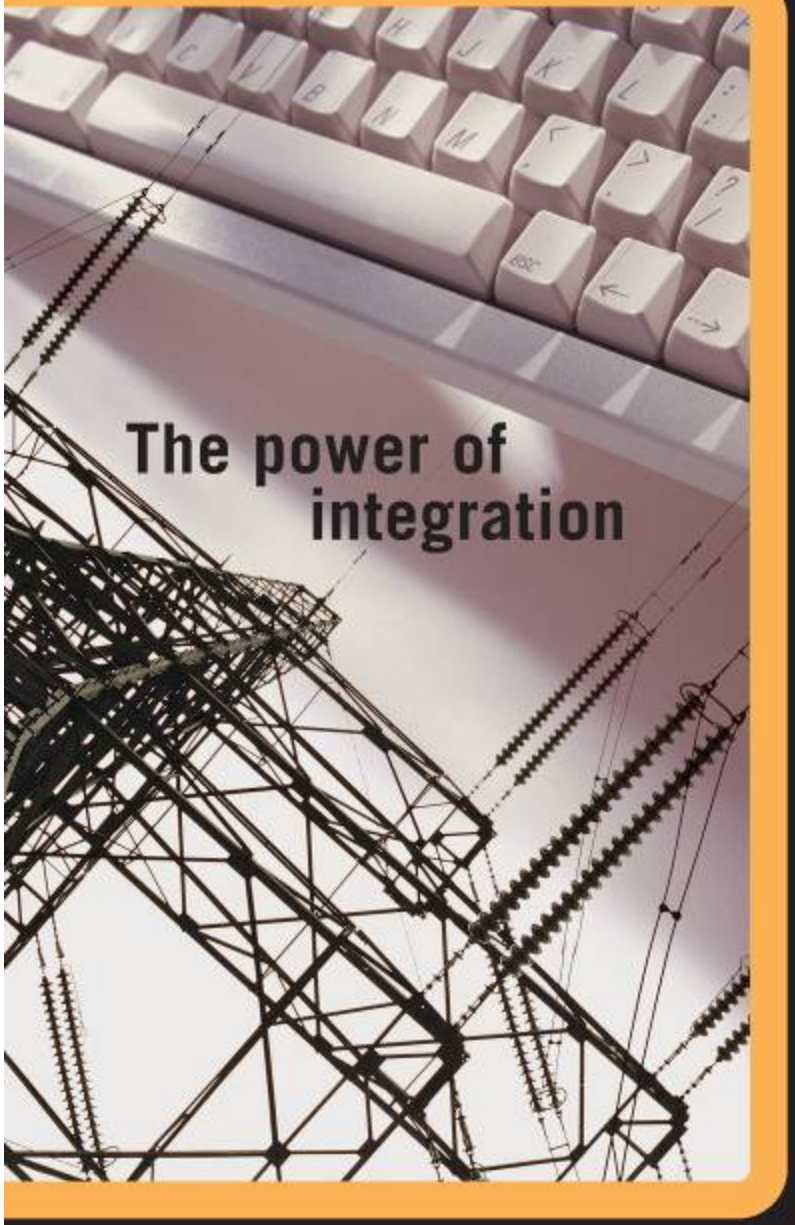
- Completely manual process
  - Person to person hand off as tasks are completed.
  - Users check other data stores to needed information.
  - Users must enter status into a computer system as tasks are completed.
  - Insufficient reporting systems.
  - Process changes are difficult to implement.

To Be State

- Workflow engine coordinates tasks for both manual and automated tasks.
- Workflow engine enters status for automated tasks.
- Users enter status updates for only manual tasks.
- Task reports are an inherent component of the workflow engine.
- Process changes are easy to implement using a graphical user interface.

Lessons Learned & Recommendations

- An existing manual process may not be optimized for automation.
- Some computer systems do not support automation.
  - This functionality should be highly considered when developing and purchasing software.
- The transition to full automation will be performed in phases.
  - Initially seek 100 percent automation but continue with manual processes when determined necessary.
  - Phase 1 should automate the “happy path” if possible.



DRBizNet

Demand Response Business Network

John Goodin
California ISO

August 11, 2006

As-Is State

Access to Load Reduction Programs

- Beneficial, however CAISO flying blind
  - Contact IOUs Day-of for “available” demand response
  - No visibility to load enrolled in such programs

- Key info: resource availability & response time
  - Planning for emergencies and system contingencies
  - Weave different response times into system operations

As-Is State

Triggering Load Reduction Programs

- Physical call made at stage 2 emergency
  - For invocation or cancellation
- No visibility by CAISO to response
  - Follow-up reporting occurs the day after
- Response not as localized as may be necessary to resolve transmission emergency
- Advantages of DRBizNet approach:
  - Targeted response
  - Automated process
  - Timely invocation

To Be State

Economic & Reliability Based DR Programs

- Integrated into CAISO markets & operations
  - Day-Ahead and/or Day-of participation
  - Price responsive
- Simple, understandable & beneficial to participant
  - Minimal hassle and imposition

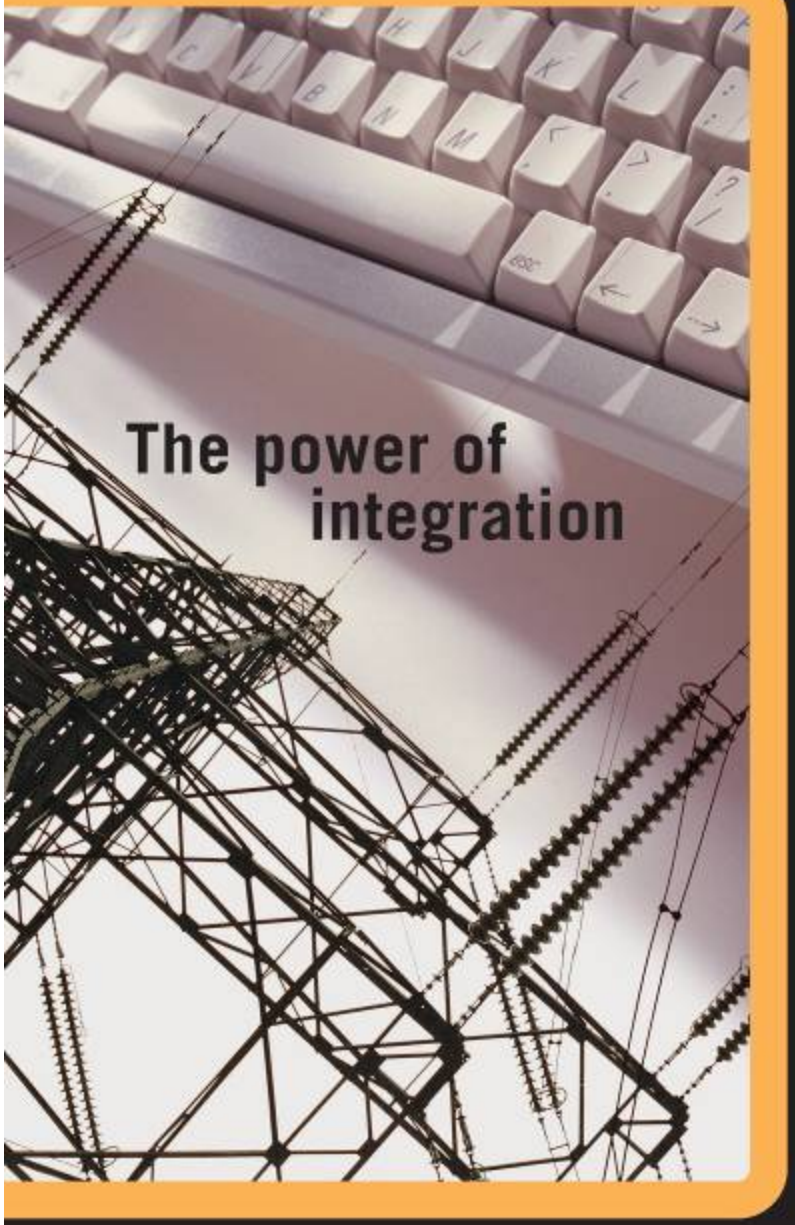
Reliability Tool for Grid Operators

- Transparent, dependable, verifiable
- Available when & where needed
- Automated dispatch process
- Provides imbalance energy, operating reserves and regulation

Lessons Learned & Recommendations

Bottom line…we need:

- **More demand response**
  - Greater participation from diverse load types
  - Additional reliability tool for grid operators that is woven into existing market structures
- **Simple & straightforward interfaces/programs**
- **DR backbone with simple interconnect**
  - Break down barrier linking customer response to the utility/grid operator
- **Further innovation & acceptance**
  - Minimal imposition on participant
  - Aggregated DR easily tied into DR infrastructure
  - Addressable- know where DR is coming from
  - Responsive products- available in 10- 20 minutes or less
  - Accepted as operating reserve- both spin & non-spin



DRBizNet

Demand Response Business Network

Austen D'Lima
San Diego Gas & Electric

August 11, 2006

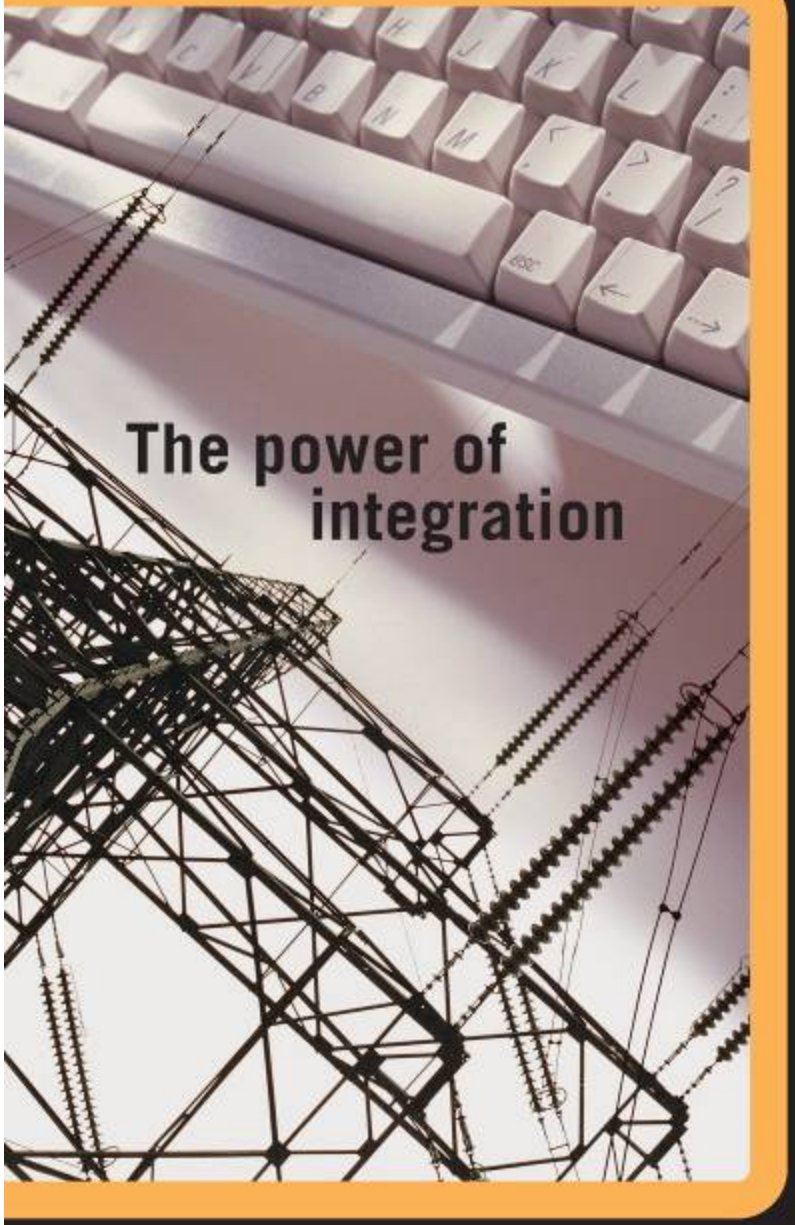
As-Is State

- DR Program Triggers
  - CA ISO notification (stage 1, 2, 3 or emergency) or
  - SDG&E grid ops notification
- DR Program Implementation
  - Customer Notification
    - Pager, e-mail, telephone, etc.
  - Customer action
    - Automated load sheds or
    - Manual load shed

To Be State

- Communication with end load or facility's EMCS
  - Little/no customer action required
  - Instantaneous DR

- Easier DR program Implementation
  - Increased efficiency in DR management
  - More reliable DR
  - Enables implementation flexibility (by load, zone, service area, etc.)



DRBizNet

Demand Response Business Network

Robert Dodier
Infotility, Inc.

August 11, 2006

As-Is State (as Infotility sees it)

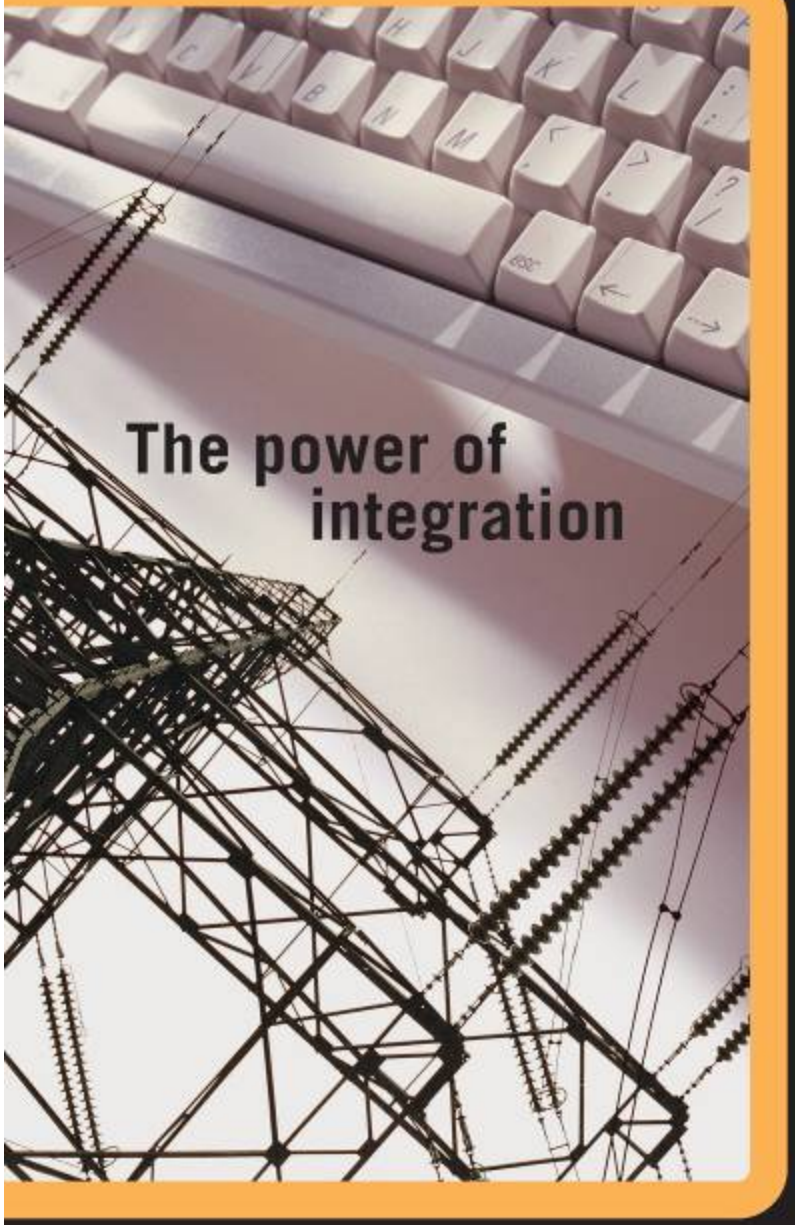
- Infotility functionality is implemented by software agents
- Infotility agents communicate via agent-specific protocol (JADE, FIPA)
- Creates a cozy environment, but difficult for outsiders to interact

To Be State

- Outside agents (i.e., non-Infotility) interact seamlessly with Infotility agents
- Point of contact is the web service
- Web service framework (Tomcat) mediates between Infotility agents and non-Infotility
- On each side, agents can be happy in their own little worlds

Lessons Learned & Recommendations

- Fairly burdensome to translate between agent systems; need Infotility → non-Infotility mapping and vice versa
- Furthermore, a separate mapping or interface is needed for each pair of interacting systems
- What to do?
  1. Same agent system everywhere (impractical, not recommended)
  2. "Widely accepted integration standards" (recommended, but needs to emerge)



DRBizNet

Demand Response Business Network

Mark S. Martinez
Manager, Demand Response
Program Development
Southern California Edison

August 11, 2006

As-Is State at SCE

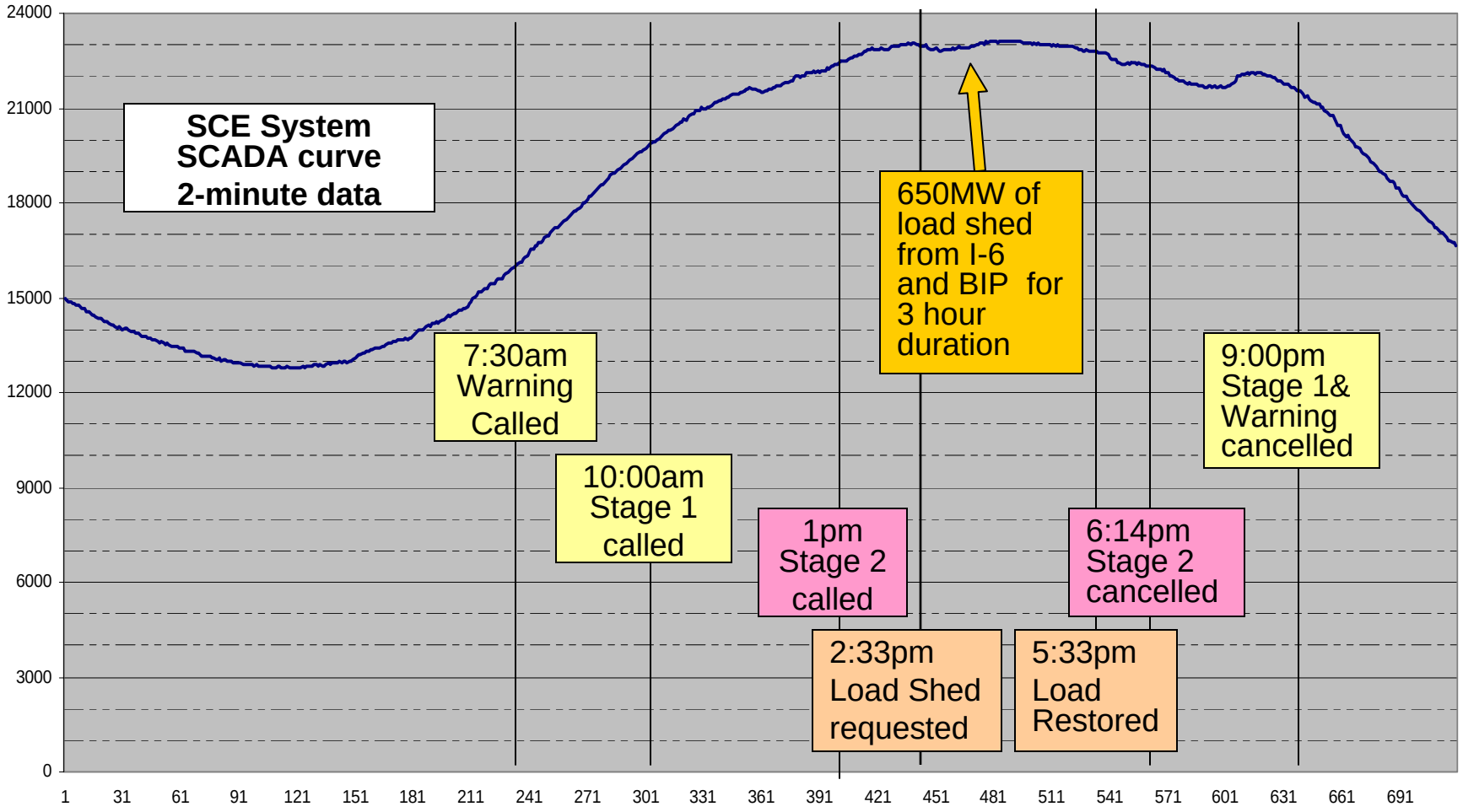
- SCE Large Customer DR Portfolio (reported as of July 1, 2006):
  - 586.6 MW I-6
  - 78.1 MW BIP (I-6 block)
  - 1.7 MW CPP
  - 14.8 MW DBP

(the above numbers are based on actual performance)

As-Is State at SCE

- I-6 and BIP programs are dispatched when ISO calls for firm load reduction, usually during Stage 2 emergencies.
  - Last one called was July 24, 2006
- DBP is dispatched a day-ahead when ISO forecasted load for CA is greater than 43,000 MW or when an ISO Alert is called.
- CPP program is triggered on LA temp forecast and ISO alerts

July 24, 2006 Stage 2 event



Potential Future State

- DRBizNet can be used to enable DR day-ahead customers if CA day-ahead forecasted load is provided.
- DRBizNet can be used to enhance customer notification of Base Interruptible Program event start/end times.
- Faster notifications would enable great demand response from customers

Lessons Learned & Recommendations

- Manual processes for notifications have too many “off-ramp” failure loops to ensure high reliability
- Automation of DR program notifications can be accomplished using DRBizNet.
- DRBizNet enhances ISO – IOU - customer communications when load drop is requested.
- Intelligent agents can enable more DR that is dependable and consistent