Pacific Northwest
National Laboratory
Operated by Battelle for the
U.S. Department of Energy

GridLAB-D™

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EPRI Workshop on Active Distribution Management for Integration of Distributed Resources

Nice, France

09 DEC 2008

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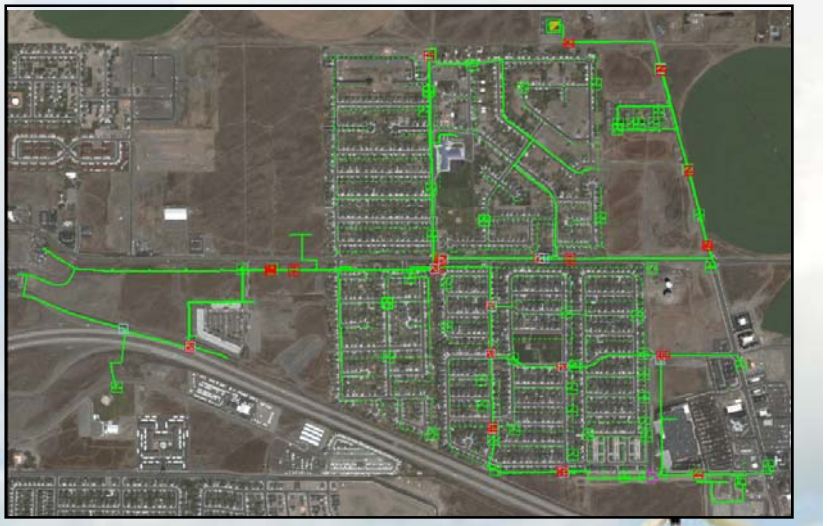
GridLAB-D: Simulating the Smart Grid Technologies and Benefits



- Time-series, life-cycle simulation of smart grid operations
- Many technologies: demand response, distributed generation & storage, feeder reconfiguration, islanding
- Simultaneous solution of power flow & entire populations of voltage-dependent end-use loads
- Prototypical feeders, U.S. weighting factors
- Open source, modular environment for collaboration (module contributions can be used to develop commercial products)
- Commercial modules can be linked, kept private

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Why Simulate the Smart Grid?

- *Evaluate the potential* of new technologies and operational strategies to save capital costs, improve reliability, provide other benefits
- *Craft and refine* the characteristics of technologies and operational strategies for maximum benefit at lowest cost
- *Understand and quantify the synergies* of deploying a broad range of smart grid technologies
- *Avoid unintended consequences* that can result from utilizing distributed control systems
- *Predict and evaluate* results from deployment projects
- *Extrapolate* regional/national impacts

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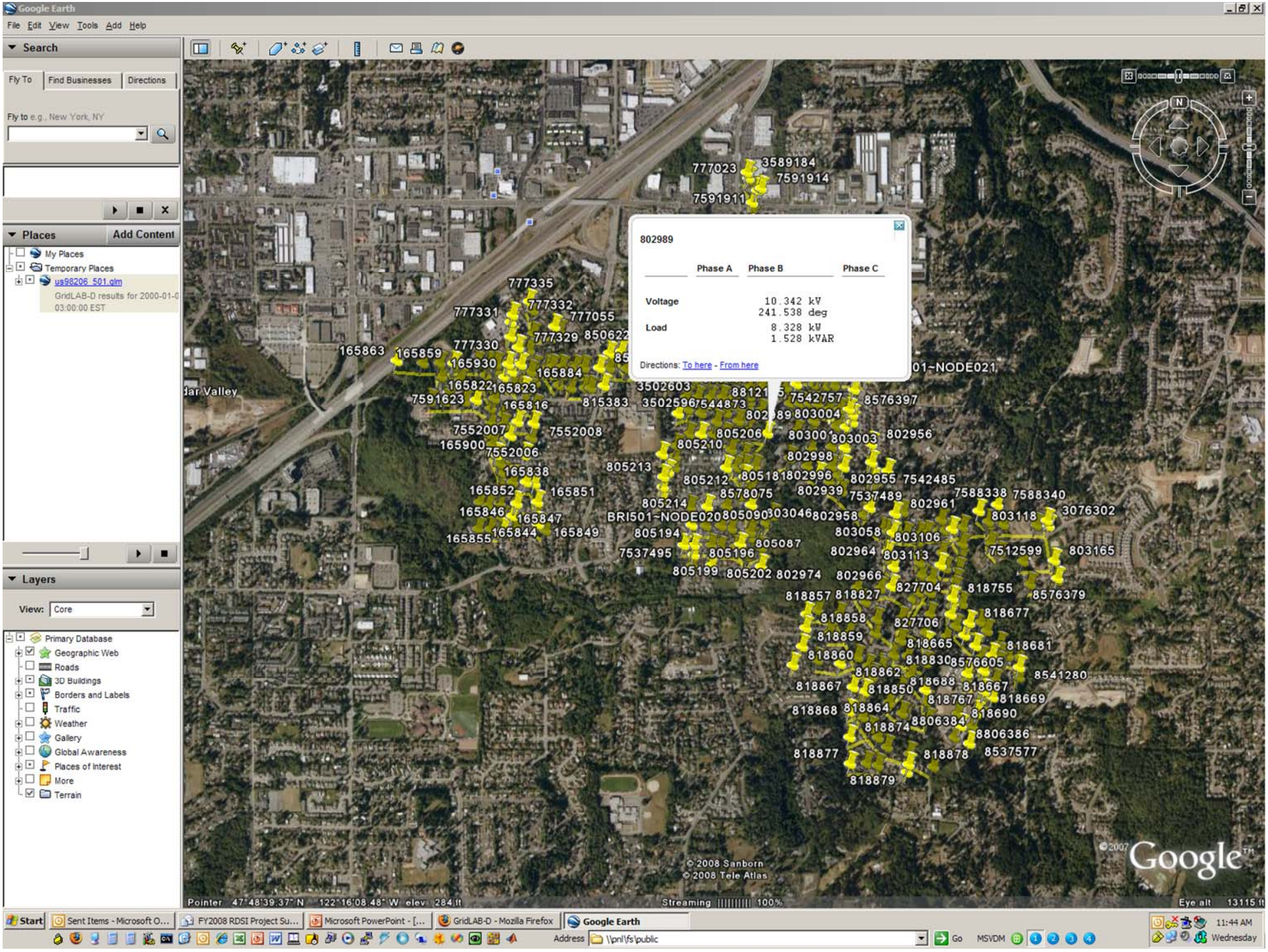
Key Characteristics

- Time scales from sub-cycle to decades
  - quasi-steady state solutions (initially)
  - ~1-sec to 1-hr time steps (variable, event-driven, user-specified)
- Tracks capacity expansion costs, market operations, customer billing revenues
- Off-line analysis tool, not engineering or real-time control but … open-source modules can be used in commercial products
- Open architecture consists of a system core that manages and synchronizes ‘plug-in’ modules
  - *modules* are independently compiled, contain all technical content
  - *core* manages time steps, variable sharing, convergence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Search
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Fly to e.g., New York, NY
Places
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GridLAB-D results for 2000-01-0
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Layers
View: Core
Primary Database
Geographic Web
Roads
3D Buildings
Borders and Labels
Traffic
Weather
Gallery
Global Awareness
Places of Interest
More
Terrain
802989
Phase A
Phase B
Phase C
Voltage
10.342 kV
241.538 deg
Load
8.328 kW
1.528 kVAR
Directions: To here - From here
777023
3589184
7591914
7591911
777335
777332
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165863
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818879
NODE021
dar Valley
© 2008 Sanborn
© 2008 Tele Atlas
©2007 Google™
Pointer 47°48'39.37" N 122°16'08.48" W elev 284 ft
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Eye alt 13115 ft
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Sent Items - Microsoft O...
FY2008 RDSI Project Su...
Microsoft PowerPoint - [...
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Wednesday

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Modules Completed

- Residential (single-family homes, washer/dryer, dishwasher, lights, refrigerator, microwave/range, occupancy, plugs, water heater)
- Commercial (single-zone office buildings)
- Climate (handles weather data)
- Power flow (3 phase unbalanced distribution power flow)
- Network (transmission power flow; HPC version by UNC Charlotte)
- Generators (battery, diesel, PV, wind; w/WSU & Stanford students)
- Markets (double auction, transaction journals)
- PLC (controllers, network comms)
- Reliability (events, metrics)
- Tapes (players, recorders, shapers, collectors, plotting, ODBC, Matlab, Excel)

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Active/Planned Partners

- UNC Charlotte (IBM Cell port)
- Iowa State (bulk power markets)
- IBM TJ Watson (ICS implementation)
- Enernex (EPRI DSS and Multispeak)
- Others (inactive, newcomers or incommunicato)
  - Humbolt State University
  - Old Dominion
  - Several foreign downloads & inquiries
- New prospects in the works