

EVANGELOS
POURNARAS

Multi-level Reconfigurable
Self-organization in Overlay Services

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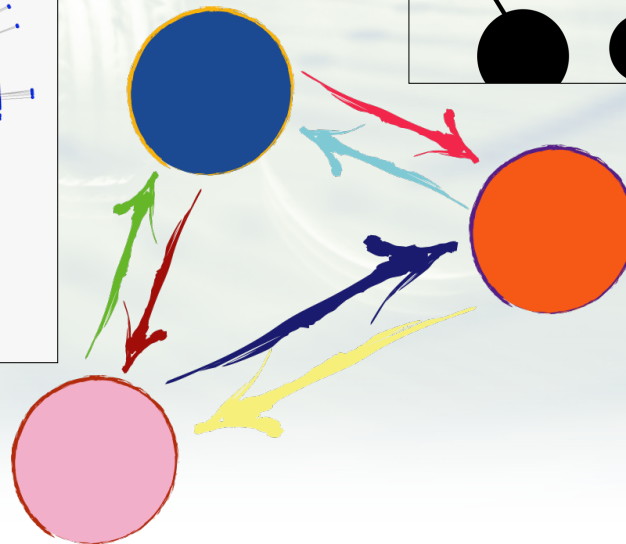
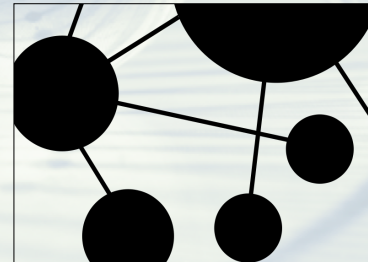
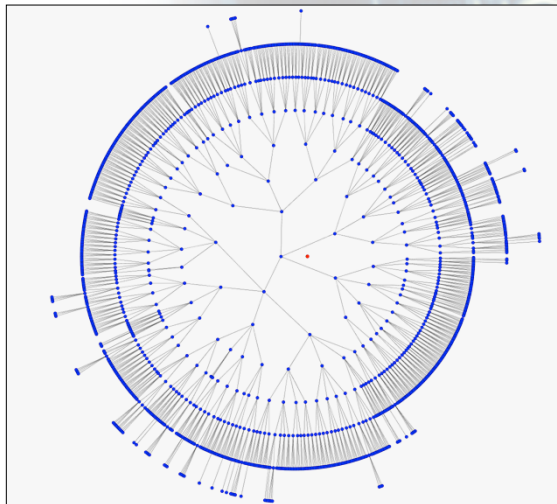
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Research Scope

2,102,400

Large-scale, decentralized, networked computing systems



```
151 public DIAS(String id, int Tdias, int numOffenses, int sampling, int sampleSize, AggregationStrategy.Strategy strategy,
152             this.IDias);
153 this.Tdias=Tdias;
154 this.numOffenses=numOffenses;
155 this.sampling=sampling;
156 this.sampleSize=sampleSize;
157 this.strategy=new AggregationStrategy(strategy, unexploitedDias,
158             this.bloomFilterParam=BloomFilterParam);
159 this.active=false;
160 }
161 /**
162  * Initializes the DIAS peerlet
163  * @param peer the local peer
164  */
165 @Override
166 public void init(Peer peer){
167     super.init(peer);
168     this.getId=getPeer().getIdentifer().toString();
169 }
170 /**
171  * Starts the DIAS peerlet by sending the epoch measurements
172  */
173 @Override
174 public void start(){
175     this.scheduleMeasurements();
176 }
177 /**
178  * Stops the DIAS peerlet
179  */
180 @Override
181 public void stop(){
182 }
183 /**
184  * Accesses the application that requests aggregation
185  * @return the application instance
186  */
187 private DIASApplicationInterface getApplication(){
188     return (DIASApplicationInterface)this.getPeer().getPeerletOfType(DIASApplicationInterface);
189 }
190 /**
191  * Accesses the peer sampling service
```


Decentralized Computing Systems

Scalability

Fault-tolerance

Performance

Lower economic cost

Openness

Privacy preservance

File sharing

Multimedia multicasting

Sensor networks

Social networks

Distributed databases

Recommender systems

The collage features several news articles and website screenshots. At the top, a CNN banner asks if the user wants to make the International Edition their default. Below it, a headline reads "Activists creating decentralized mesh networks that can't be blocked, filtered or silenced". Another article from VICE.COM is titled "Movement aims to decentralize the Internet". A BBC News article discusses "Peer-to-peer (P2P) networks are here to stay, and are on the verge of being exploited by commercial media firms, says a panel of industry experts". An MIT news article is titled "Guaranteed delivery — in ad hoc networks". A diagram shows a network of nodes connected by lines, with a caption "GRAPHIC: CHRISTINE DANILOFF/NEWS OFFICE". Other articles include "Making cloud computing more efficient" and "Practicing medicine at the nanoscale".

Smart Power Grid

Infrastructural costs

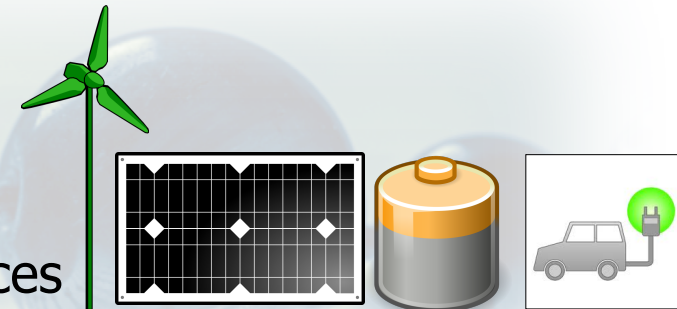
ICT vs power control systems

Decentralized energy resources

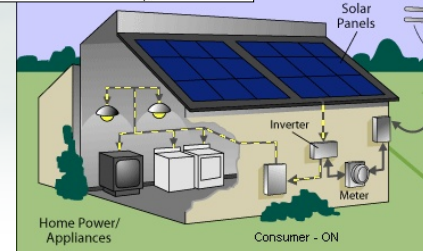
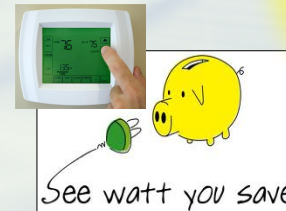
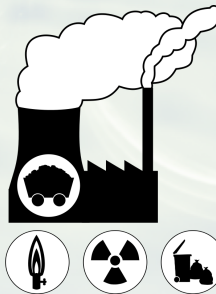
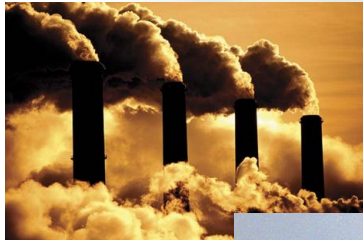
Renewables, micro-generation and storage, electrical vehicles

Decentralized Markets

Prosumers, real-time participation



Production-side vs **Demand-side**



LG introduces its first Smart Grid-Ready Refrigerator the DIOS

Category: Environment Household

Available Technologies

Grid Friendly Appliance™ Controller

Battelle Number(s): 12782-E, 13536-D
Patent(s) issued
Available for licensing in all fields

Summary

The Grid Friendly Appliance controller developed at PNNL senses grid conditions by monitoring the frequency of the system and provides automatic demand response in times of disruption.

Within the North American power grid a disturbance of 60-Hz frequency is an indicator of serious

(click on image for full size)

A coin-sized integrated circuit developed by researchers at Pacific Northwest National Laboratory may help solve the nation's overworked electricity grid. Called The Grid Friendly™ Appliance Controller, the circuit board would turn normal household appliances into ones that would better regulate energy usage and help prevent local and national blackouts.

Research Question

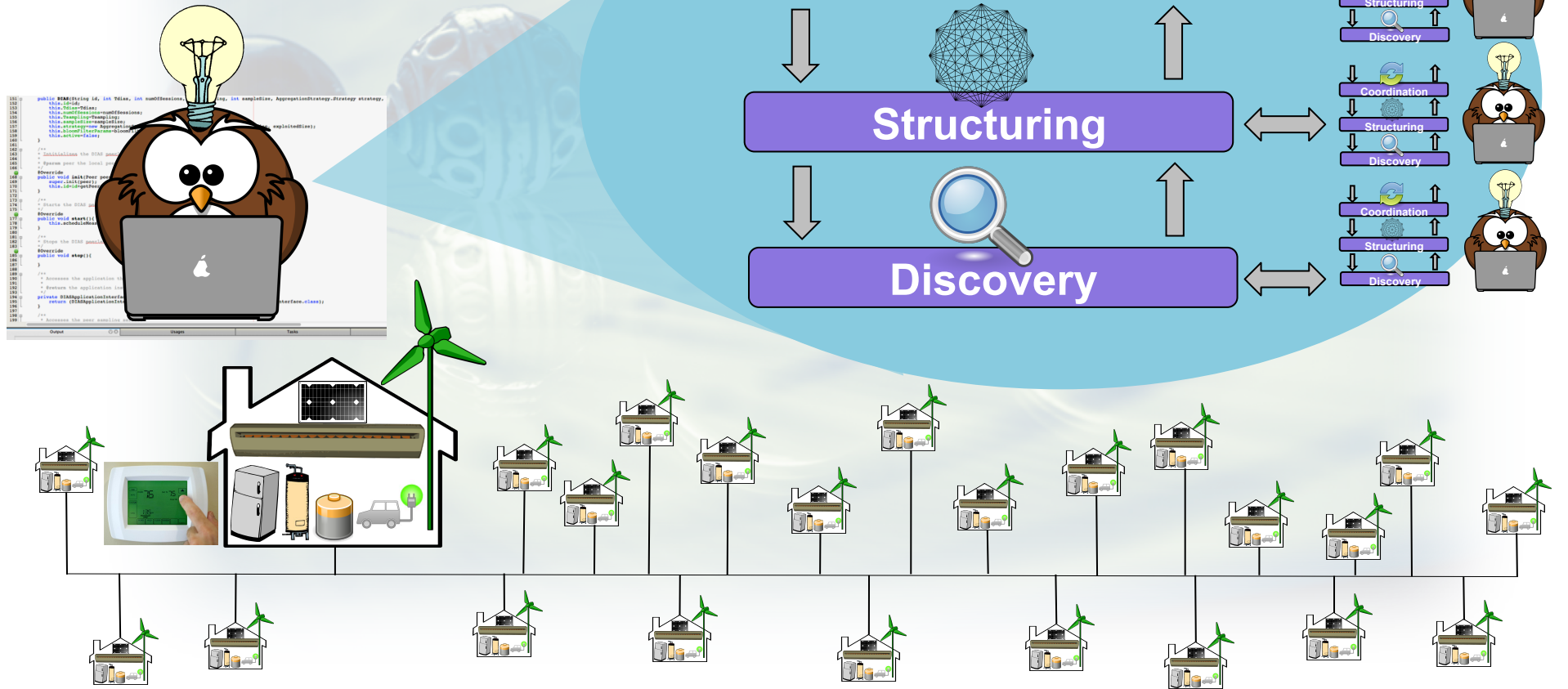
Can **large-scale decentralized networked systems** be designed to provide **modular and reconfigurable overlay services**,
e.g. **in demand-side energy management**

Minimizing/reversing power peaks

Increasing/decreasing demand

Architectural Approach

Software agent



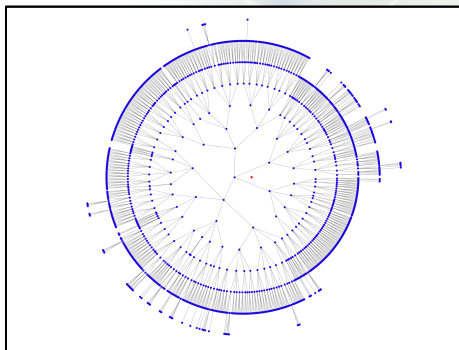
1. Stabilization of Energy Consumption

Minimizing & reversing power peaks

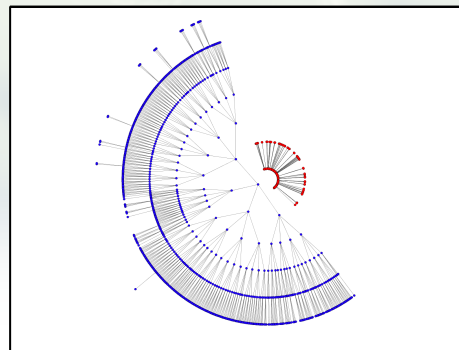
Agents **generate, combine, select & execute** energy consumption plans

Communication & decision-making over **self-organizing** tree topologies

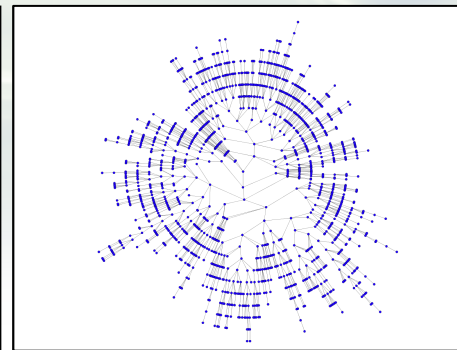
Top-down strategy



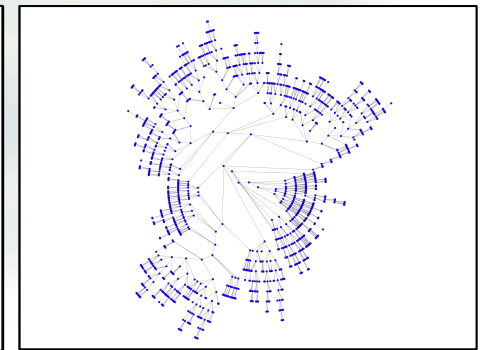
Top strategy



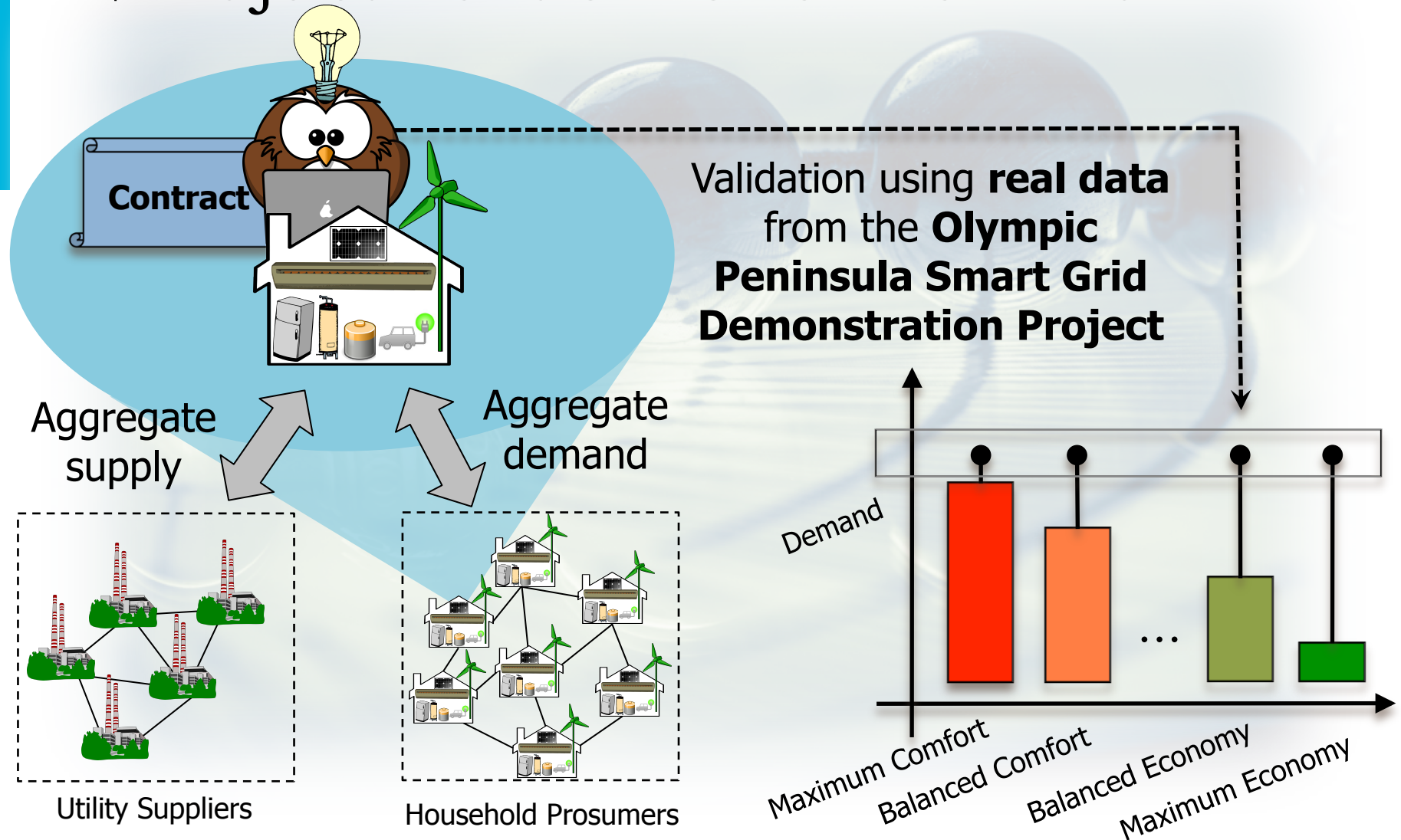
Bottom-up strategy



Humble strategy



2. Adjustment of Power Demand



Conclusions

Large-scale decentralized computing systems in Smart Power Grids

Modular and **reconfigurable** overlay services

Self-stabilization & **self-adjustment** of energy consumption

Black-out prevention, lower costs, cleaner energy resources

*Foundations towards sustainable development and a resource-based economy
in future societies*

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