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POURNARAS

Multi-level Reconfigurable
Self-organization in Overlay Services

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Self-organization in
Overlay Services
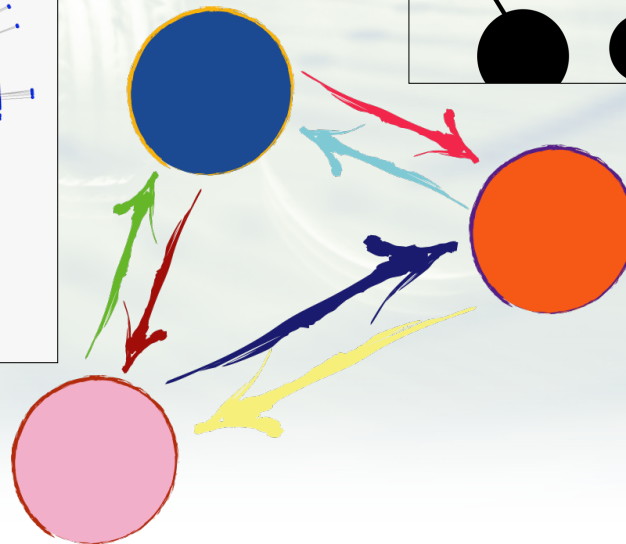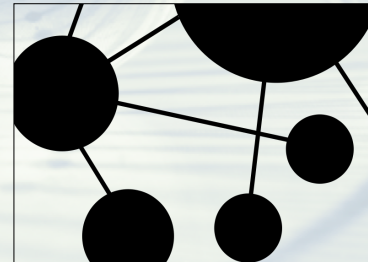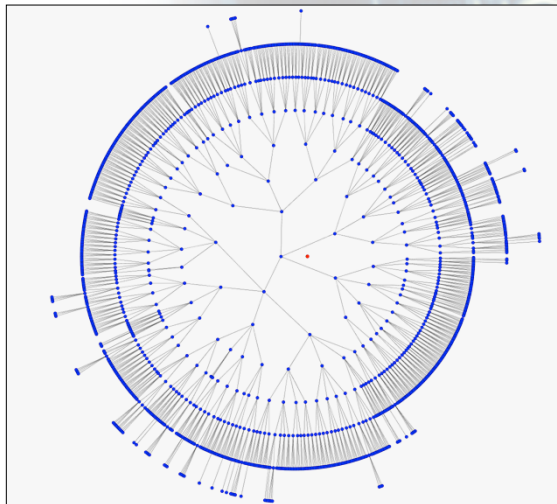
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T U Delft

Research Scope

2,102,400

Large-scale, decentralized, networked computing systems

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
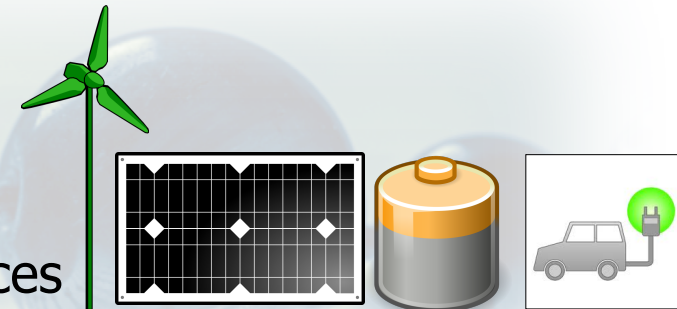
Smart Power Grid

Infrastructural costs

    ICT vs power control systems

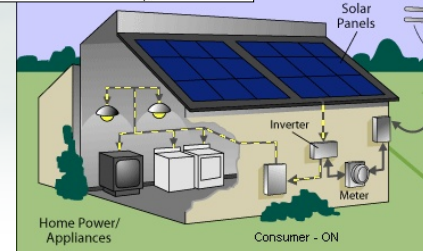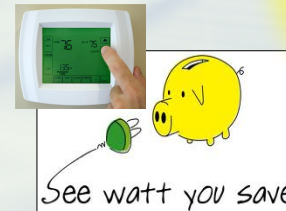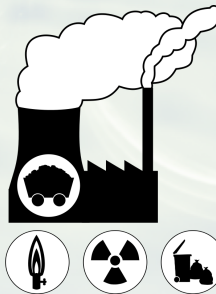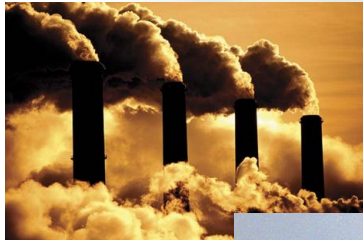**Decentralized energy resources**

    Renewables, micro-generation and storage, electrical vehicles

Decentralized Markets

    Prosumers, real-time participation

Production-side vs Demand-side

See watt you save

LG introduces its first Smart Grid-Ready Refrigerator the DIOS

Available Technologies

Grid Friendly Appliance™ Controller

Battelle Number(s): 12782-E, 13538-B
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

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.

Solar Panels

Inverter

Meter

Home Power/Appliances

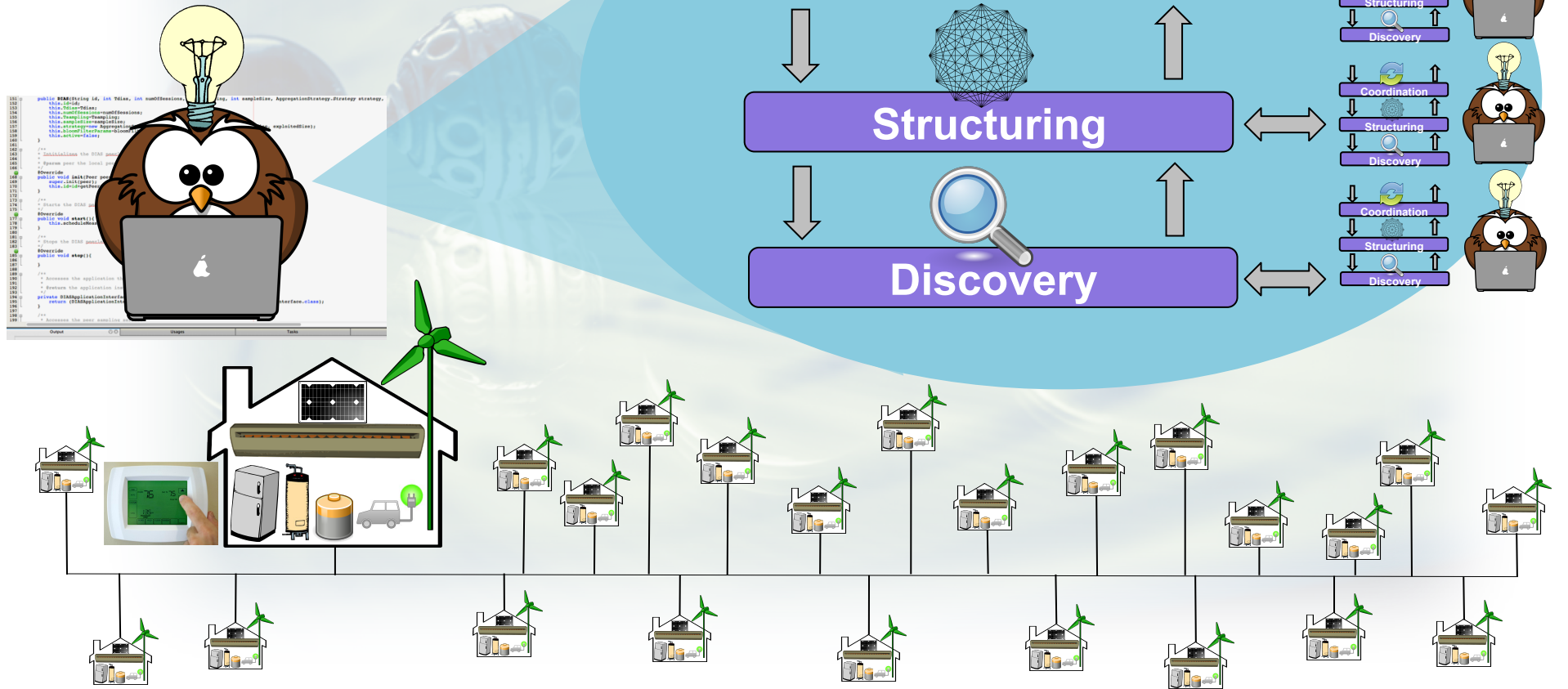Consumer - ON

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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
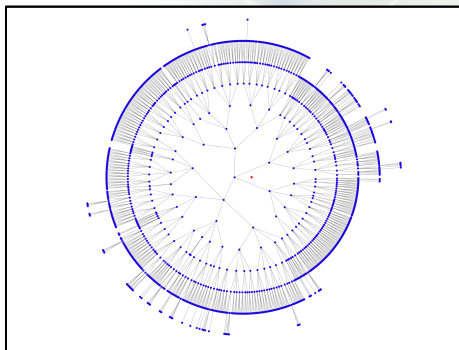
Coordination

Structuring

Discovery

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1. Stabilization of Energy Consumption

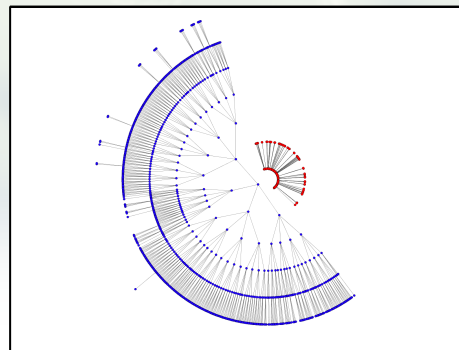**Minimizing** & **reversing** power peaks

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

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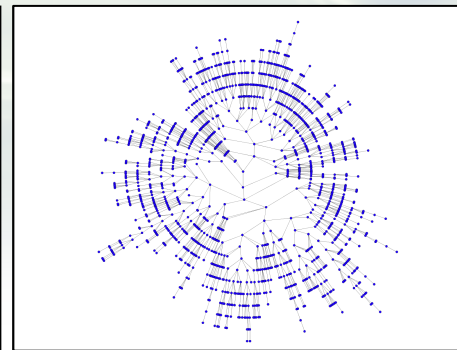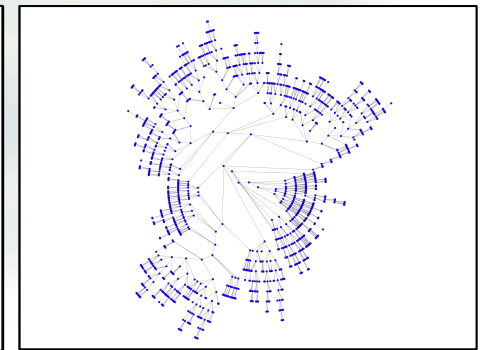
2. Adjustment of Power Demand

Contract

Aggregate supply

Aggregate demand

Utility Suppliers

Household Prosumers

Validation using **real data** from the **Olympic Peninsula Smart Grid Demonstration Project**

Demand

Maximum Comfort

Balanced Comfort

Balanced Economy

Maximum Economy

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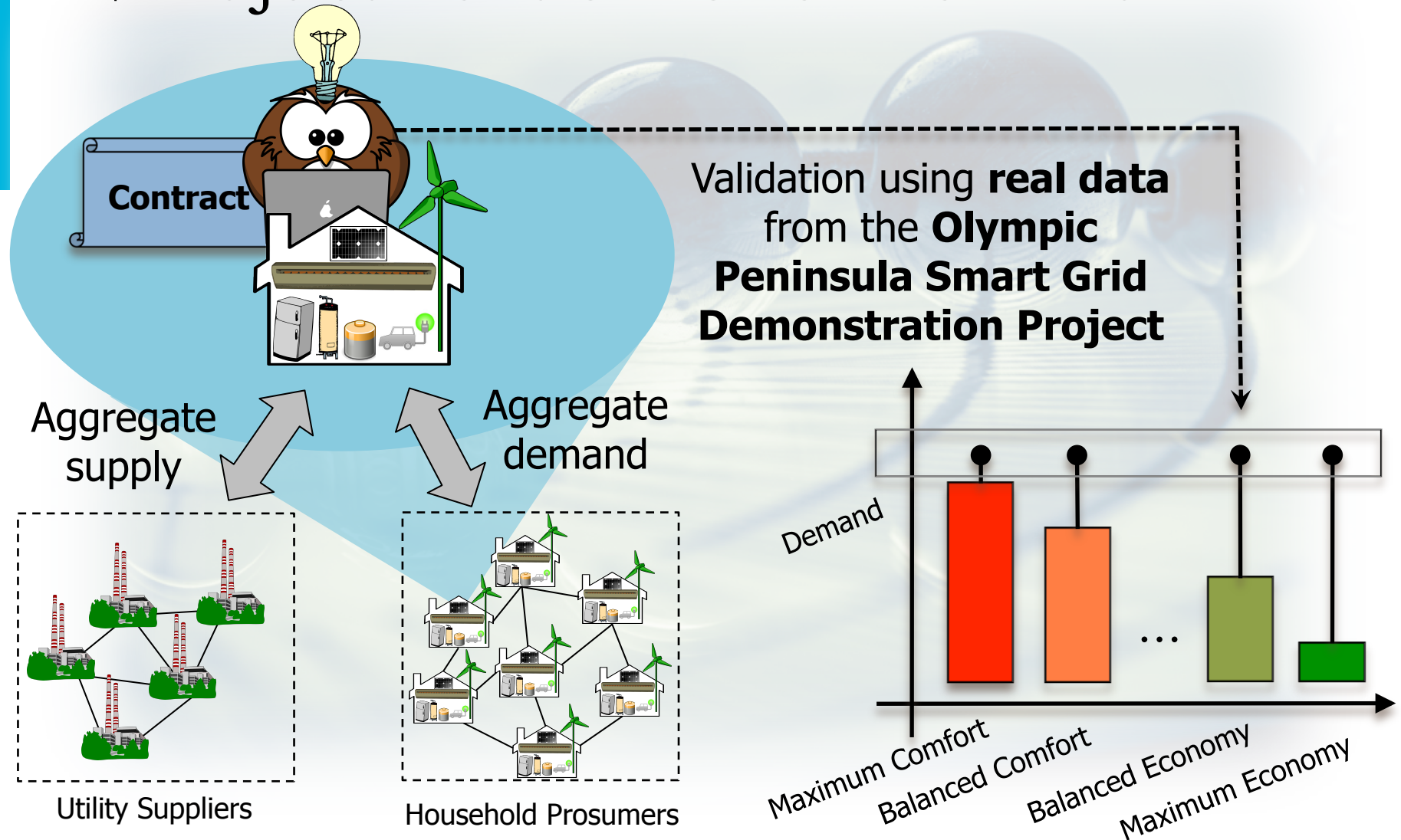
Conclusions

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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