ETH zürich

Making sharing economies more sustainable

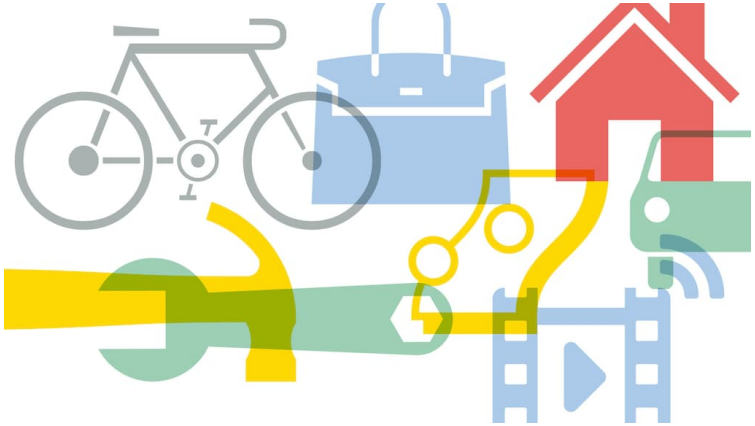
Science in & art out of decentralized computational intelligence

Evangelos Pournaras & Marinos Koutsomichalis

airbnb

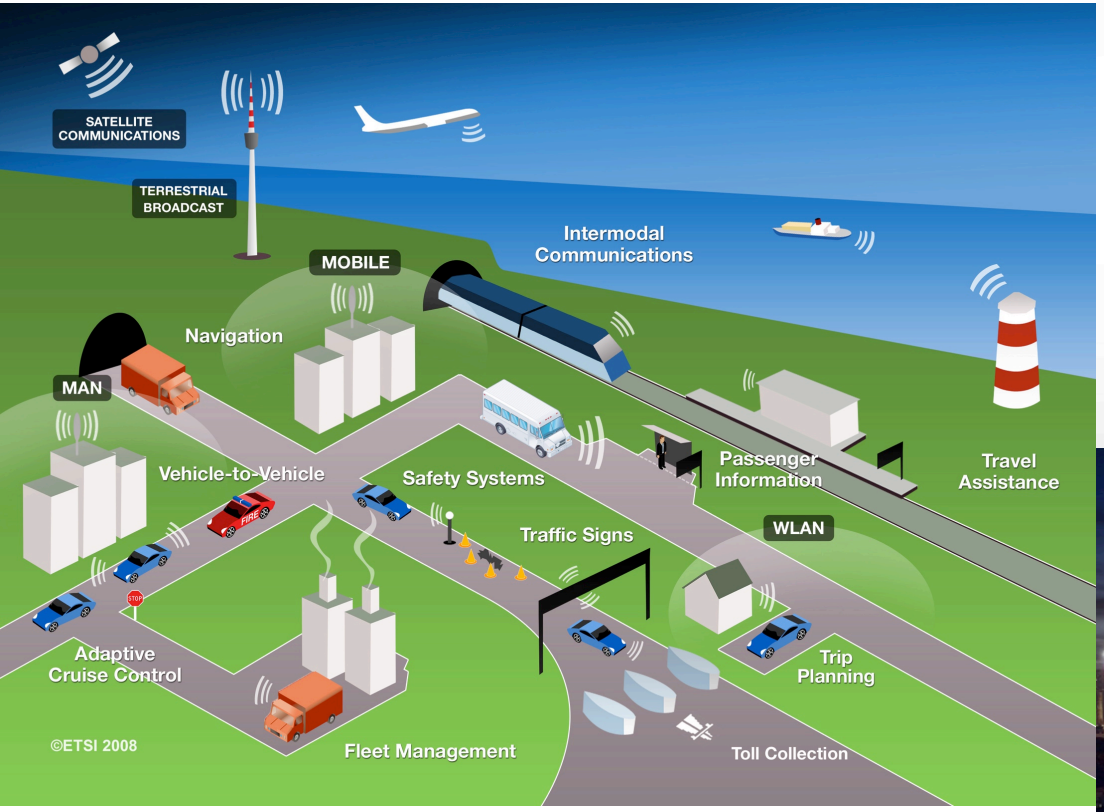
Sharing resources & services in the **Internet of Things** era

Online, participatory, bottom-up, decentralized

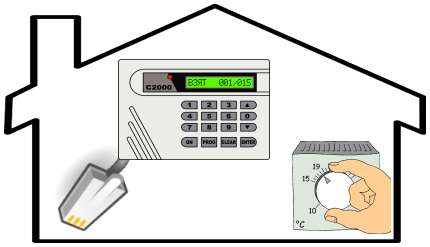


Smart Grids

Smart Cities

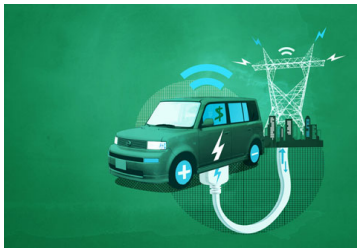


Smart Grids: Local-to-global Objectives

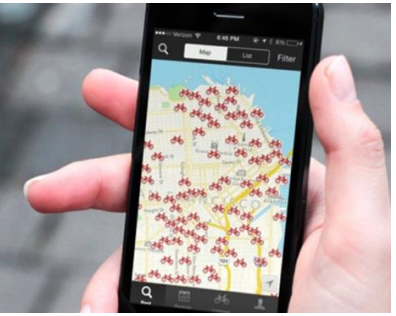


Local: make a shower, cook, laundry, charge EV

Global: prevent a blackout,
minimize production costs,
maximize use of renewables



Smart Cities: Local-to-global Objectives



Local: station to pick or leave a bicycle

Global: prevent overload/underload of bicycle stations
minimize manual bicycle relocations
minimize operational costs
minimize investment costs

Questions

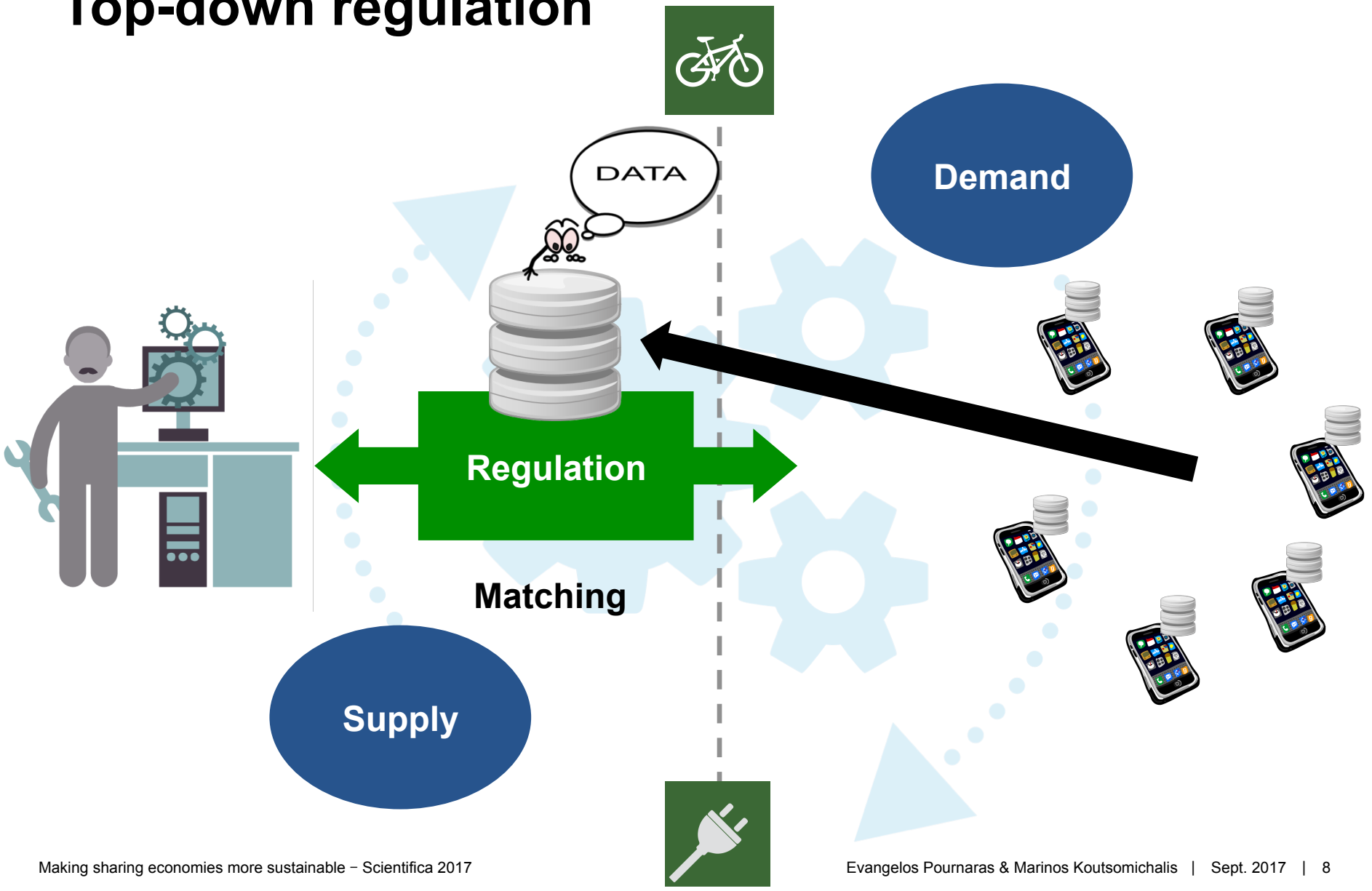
How truly decentralized is regulation of sharing economies?

Can centralized computations & data collection undermine sharing economies?

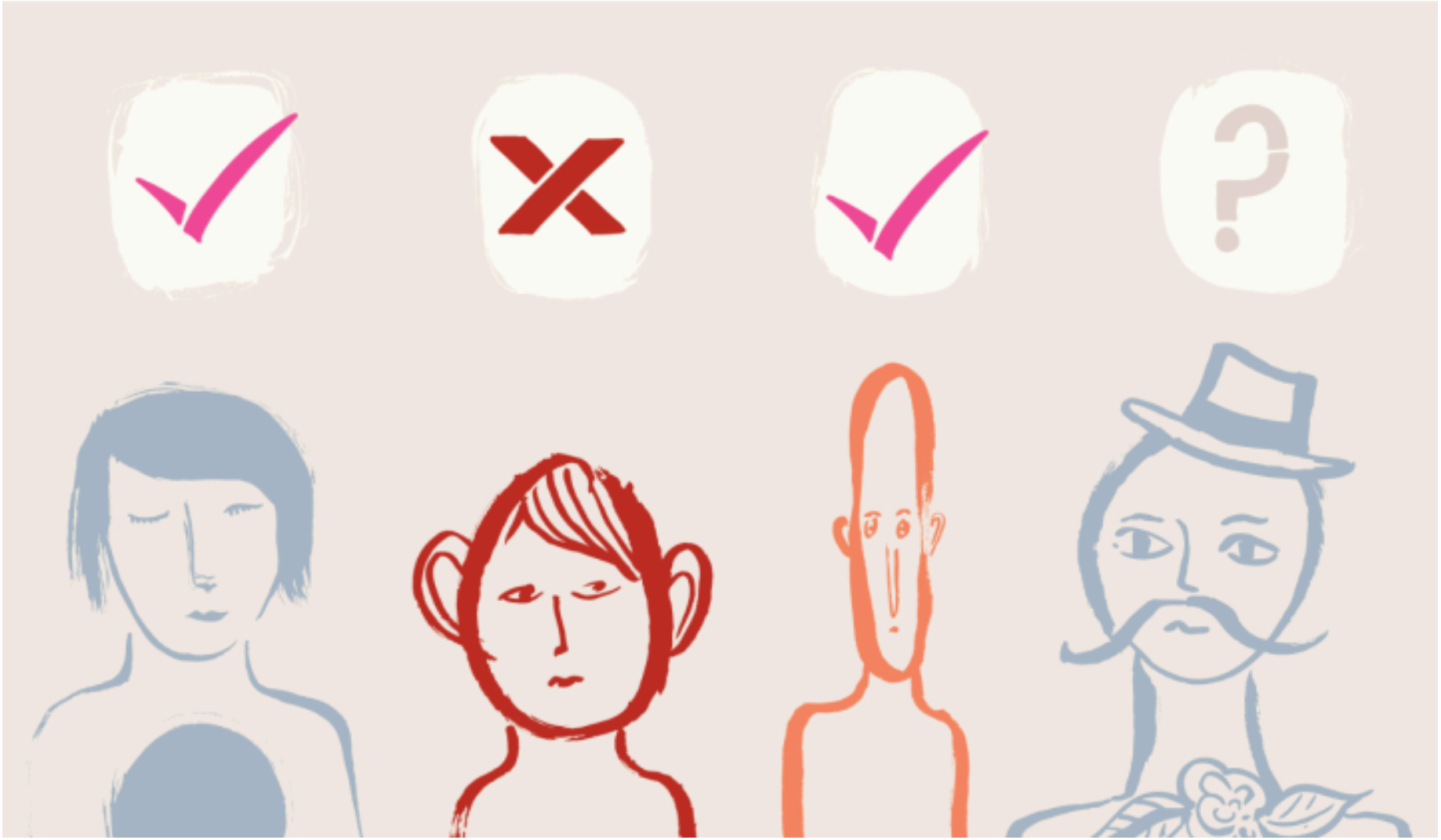
Is decentralized & participatory self-regulation a feasible alternative?

Can scientists use art as the means to establish a dialogue with general public?

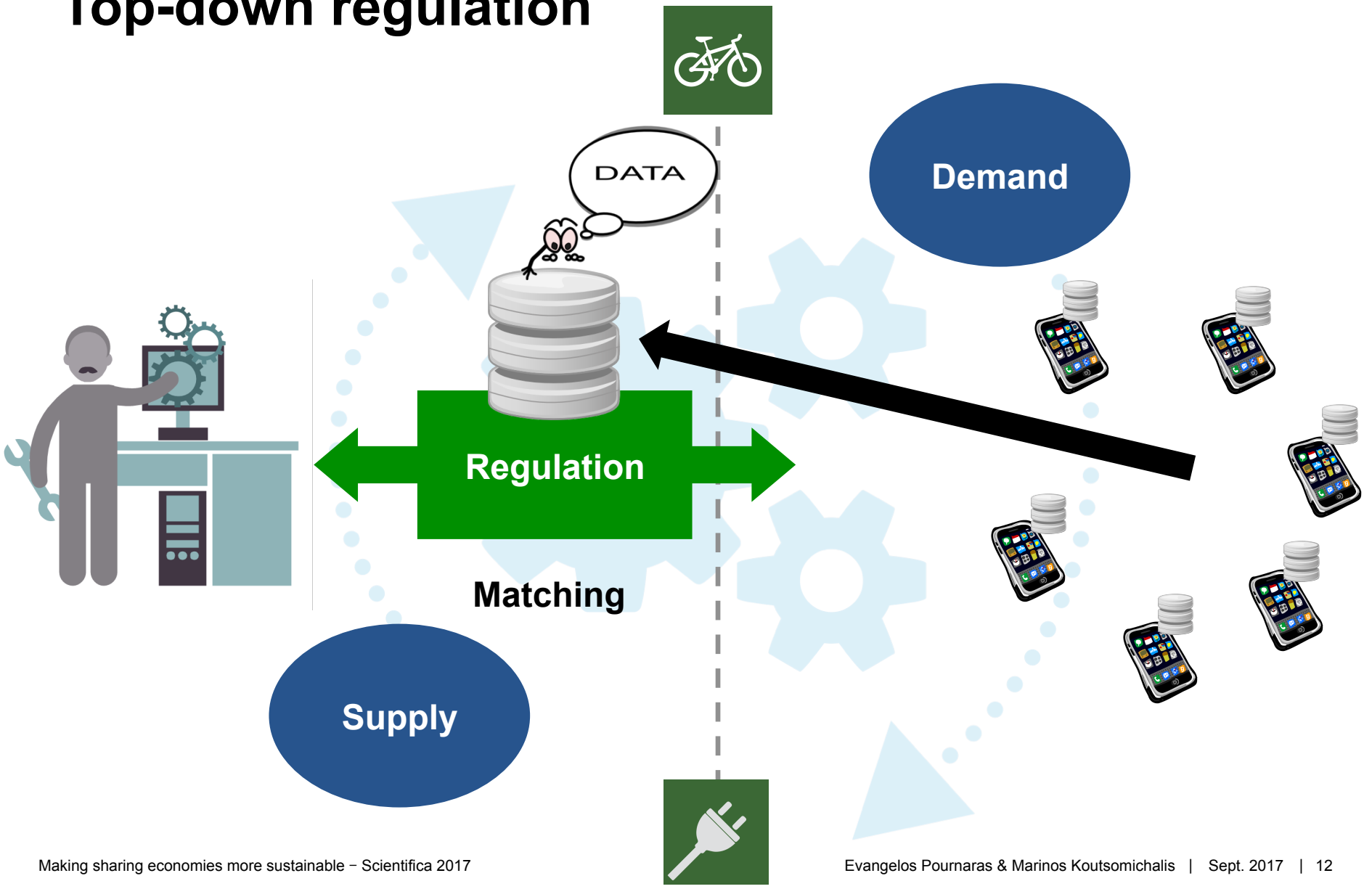
Top-down regulation



Profiling & Discrimination



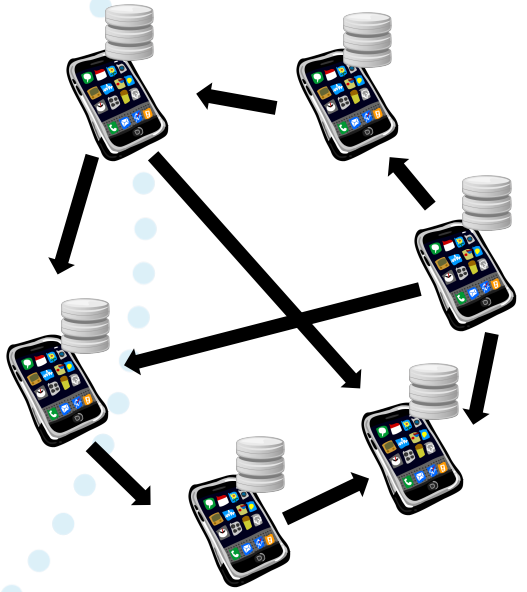
Top-down regulation



Self-regulation

Demand

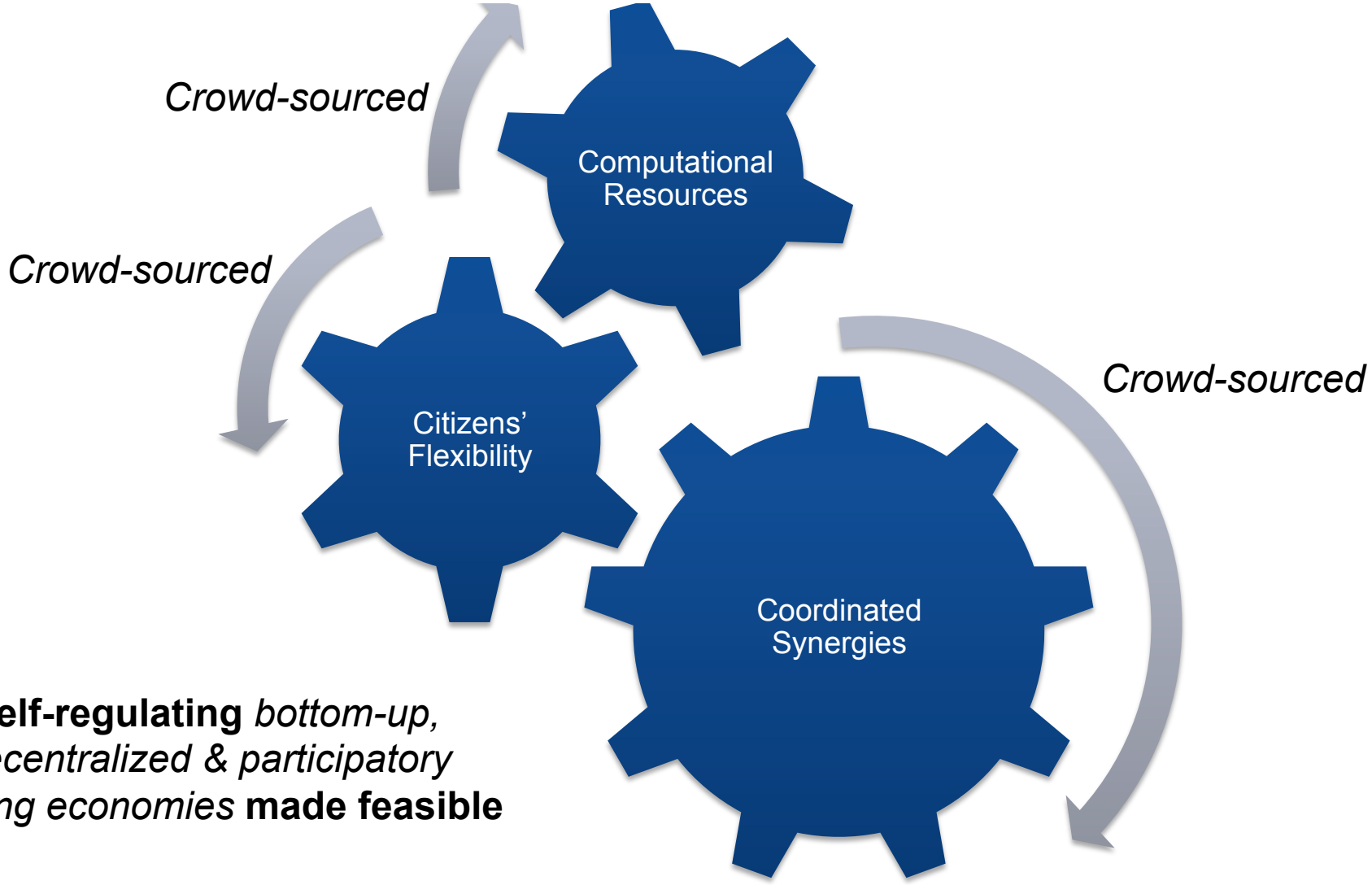
Self-regulation



Supply

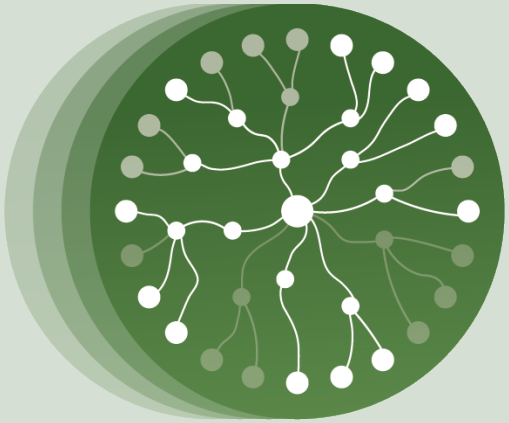
Collective Matching

Crowd-sourced Self-Regulation



Self-regulating *bottom-up, decentralized & participatory sharing economies* **made feasible**

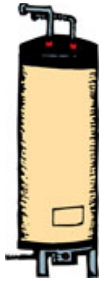
I-EPOS
Iterative
Economic
Planning &
Optimized
Selections



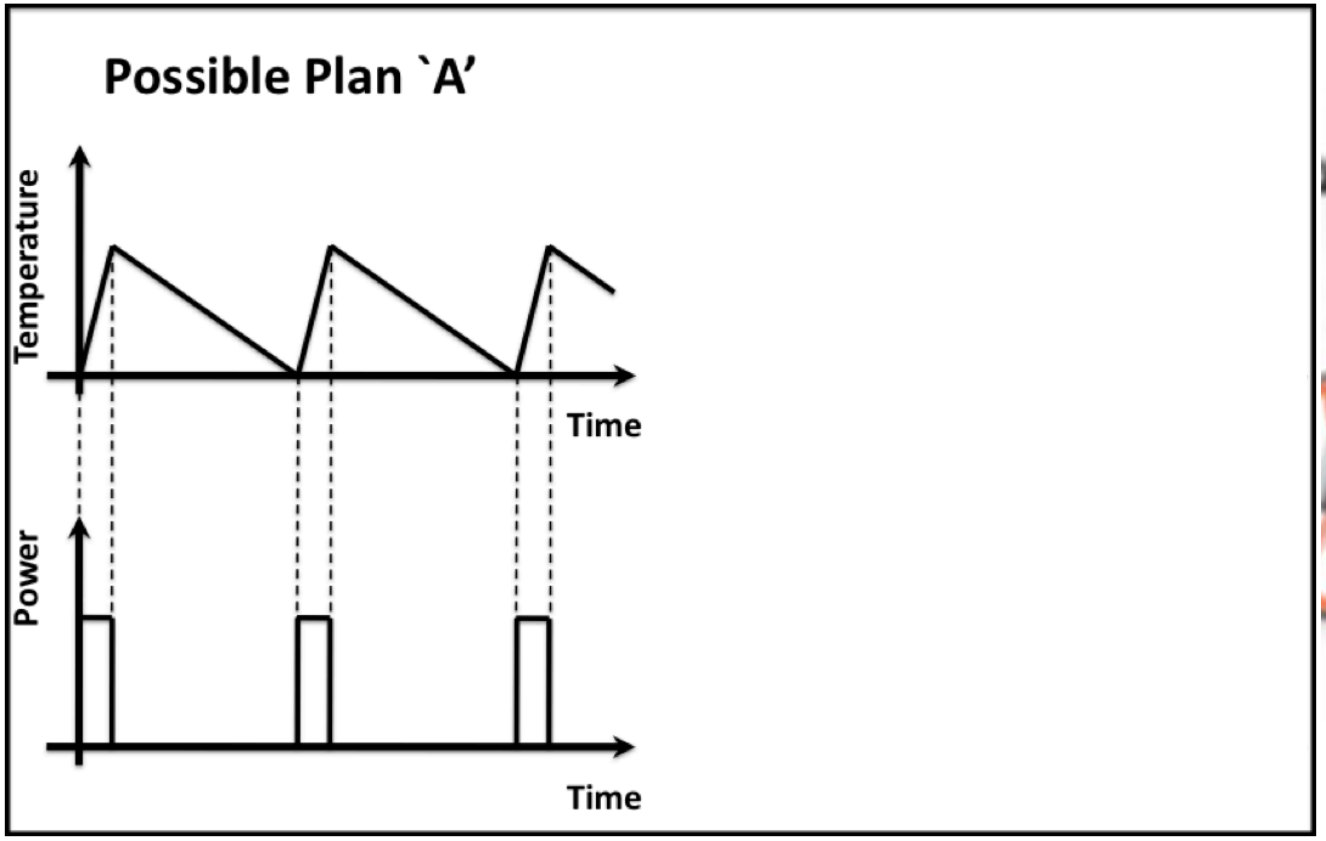
EPOS

epos-net.org

Participation Model



Self-determination of flexibility: planning of (alternative) citizens' options



LG introduces its first Smart Grid-Ready Refrigerator the DIOS

Category: Environment Household - *Tags:* Household, Lg, Lge, Smart Adapt, Smart Grid, Wi-fi, Wifi

+1 0

Barely 24 hours Samsung's Smart Grid Ready fridge, LG is now announcing its very own connected Smart Grid-Ready DIOS Fridge in Korea. The new smart refrigerator offers updates and information that can be accessed via smartphones and tablets. It offers three powerful smart savings options: late night saving, preferable time saving and the Smart Grid-ready.

The smart fridge also comes with Smart Adapt, which allows owners to keep their refrigerator software up-to-date with the latest upgrades, features and options. The smart fridge is also a source of useful information as it keeps track of daily schedules and dispenses regular weather reports. And instead of having to jot notes on sticky memos, family members can turn the fridge's LCD screen into a note pad to leave messages for each another.

Via LGE

4 Comments

Tweet 21 Like 5 Category ENVIRONMENT HOUSEHOLD

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.

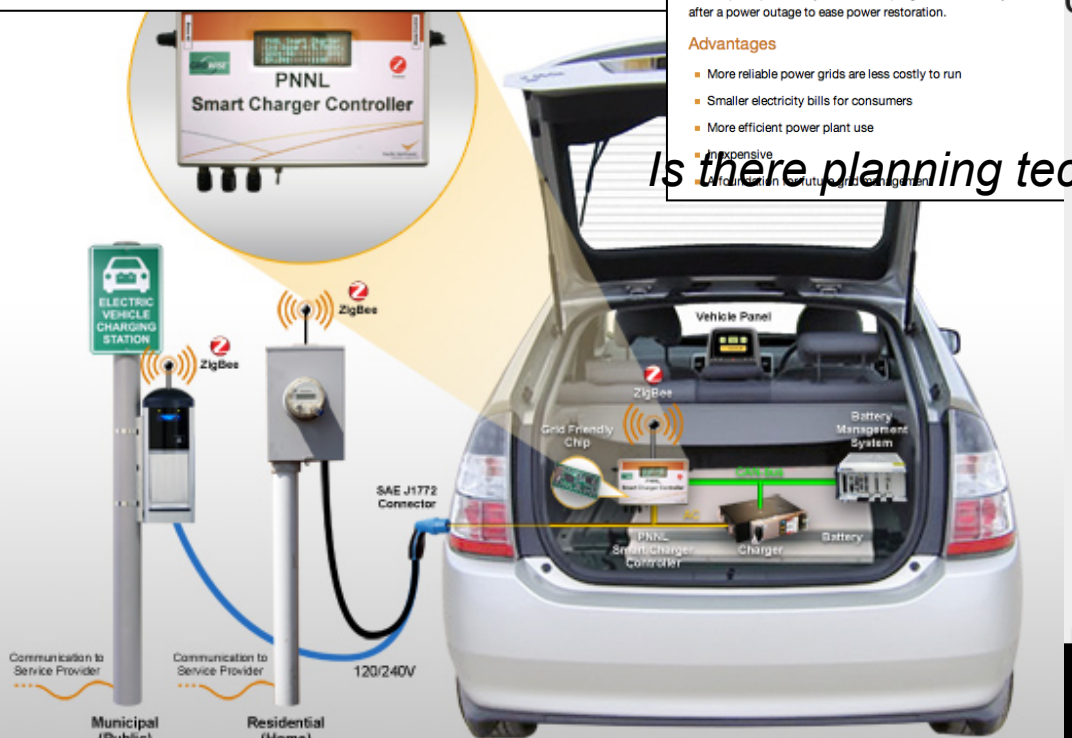
(click on image for full size)

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 one that would better regulate energy usage and help prevent local and national blackouts.

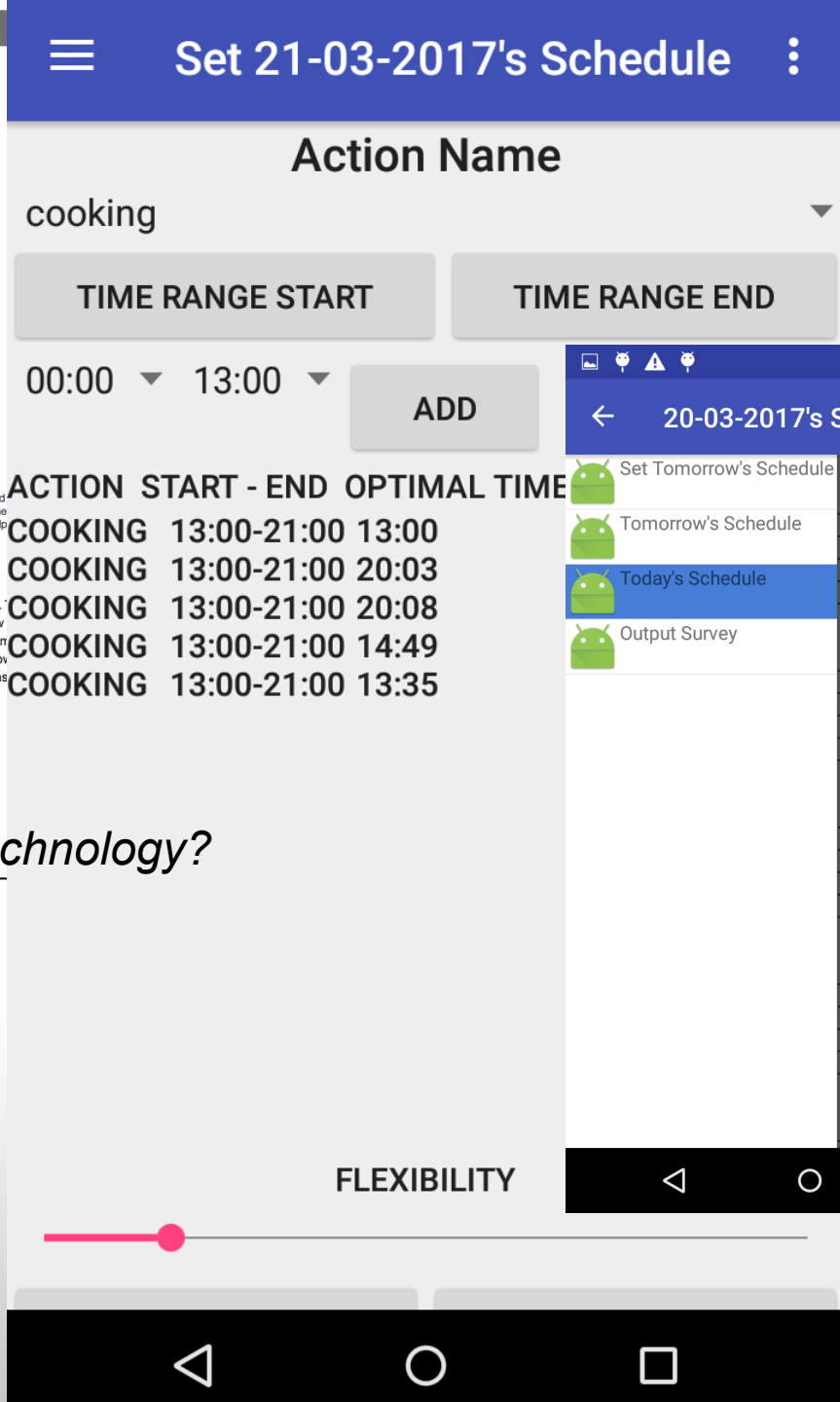
Within the North American power grid a disturbance of 60-Hz frequency is an indicator of serious imbalance between supply and demand that, if unarrested, leads to a blackout. can be installed in household appliances and turn them off for a few seconds to allow the grid to stabilize. The controllers can be program in fractions of a second when a disturbance is detected, whereas pov come up to speed. They can even be programmed to delay restart ins after a power outage to ease power restoration.

Advantages

- More reliable power grids are less costly to run
- Smaller electricity bills for consumers
- More efficient power plant use
- Inexpensive
- Information for future grid management



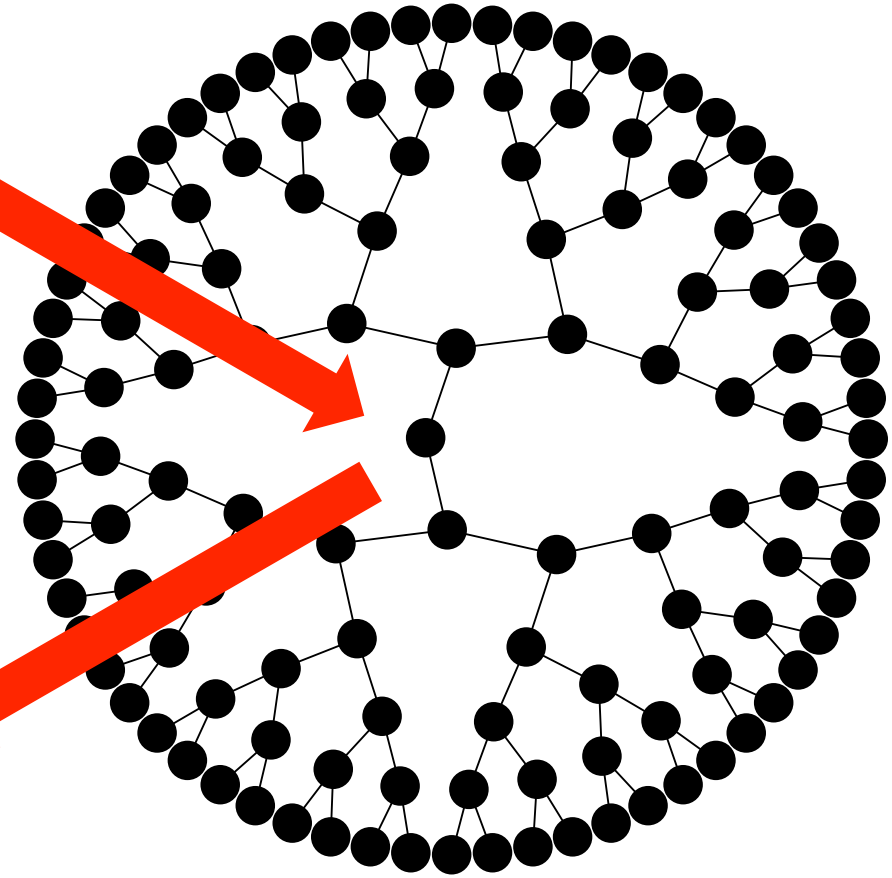
Is there planning technology?



Decentalized Collective Decision-making

Bottom-up phase:
leaves to root

Initial selections



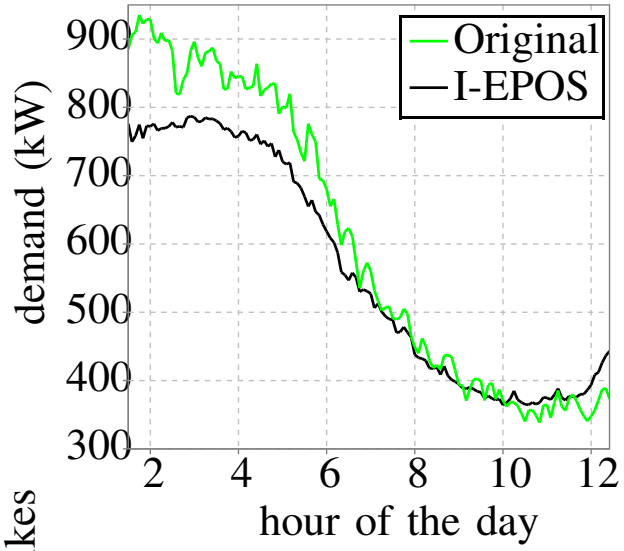
Top-down phase:
root to leaves

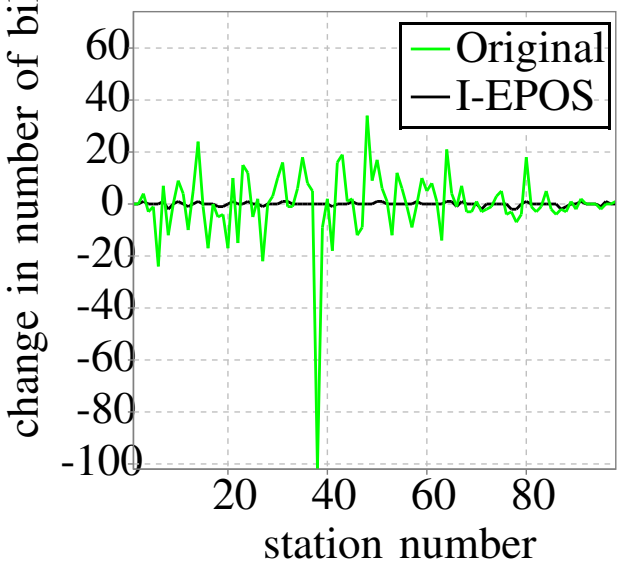
Final selections

EPOS functionality

1 bottom-up + 1 top-down phase = 1 learning iteration

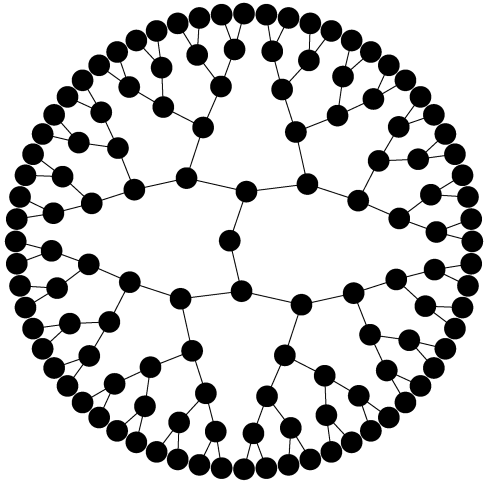
Proof-of-concept

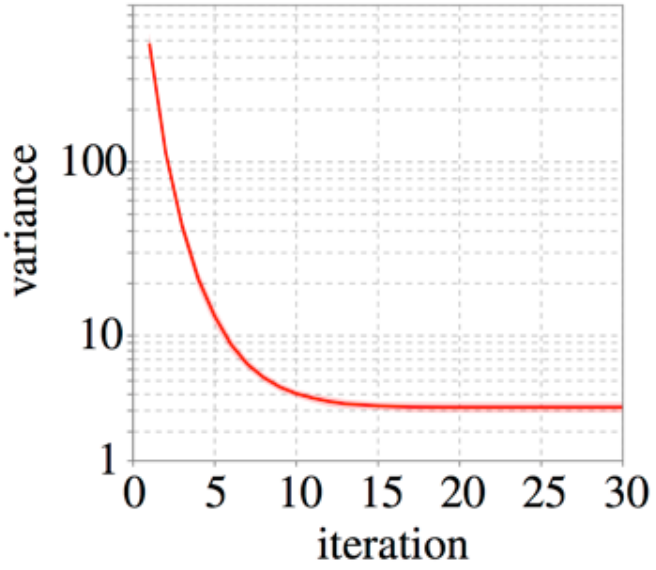




Pacific Northwest SMART GRID DEMONSTRATION PROJECT

Power peak-shaving

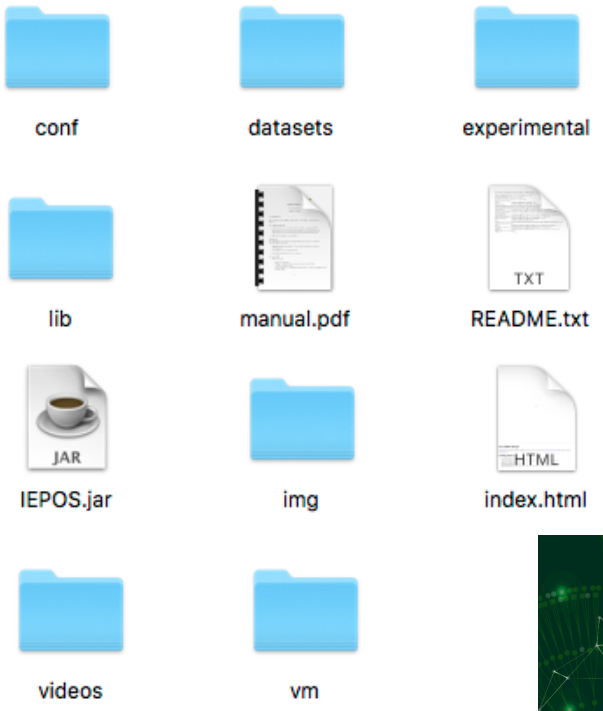


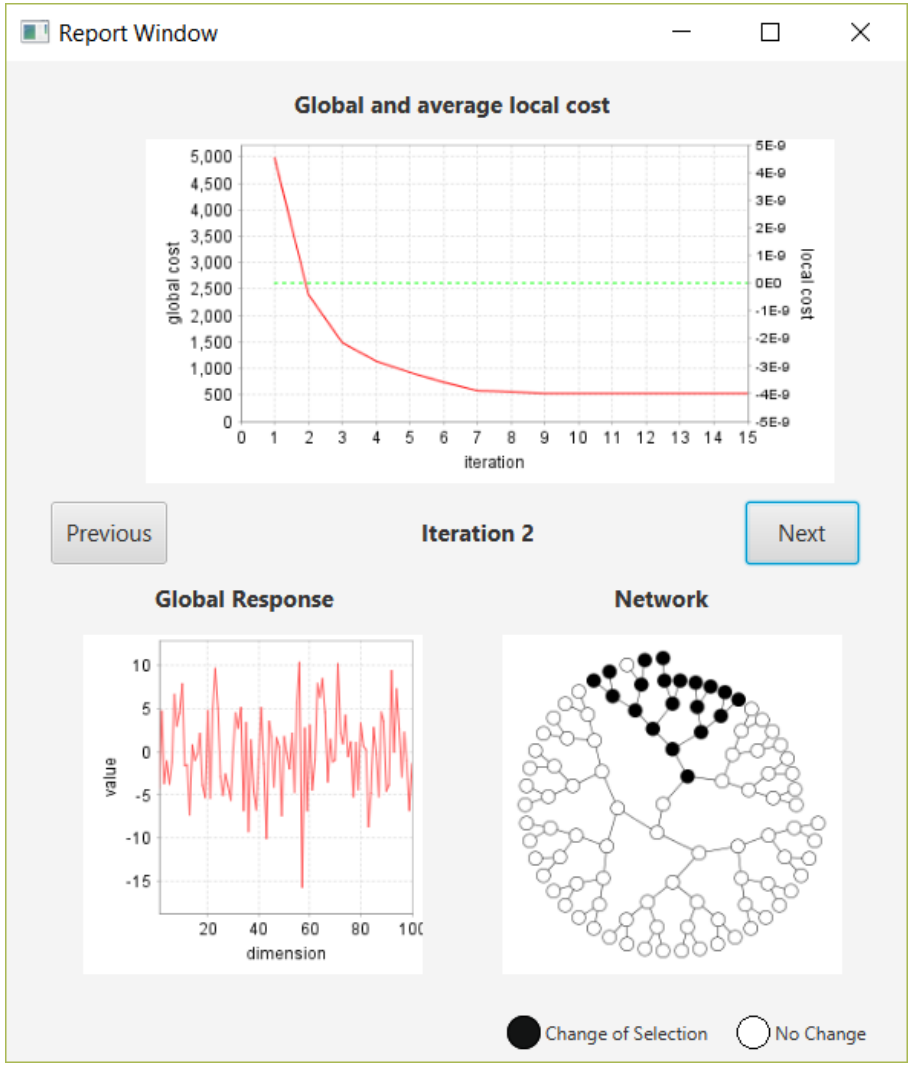


Stations load-balancing

Hubway Data Visualization Challenge

Download it Today!





Download the software exemplar (2.7 GB)
http://epos-net.org/shared/I-EPOS.zip

Follow the instructions: index.html

Open source: https://github.com/epournaras/EPOS/

The Aesthetics of Computational Intelligence

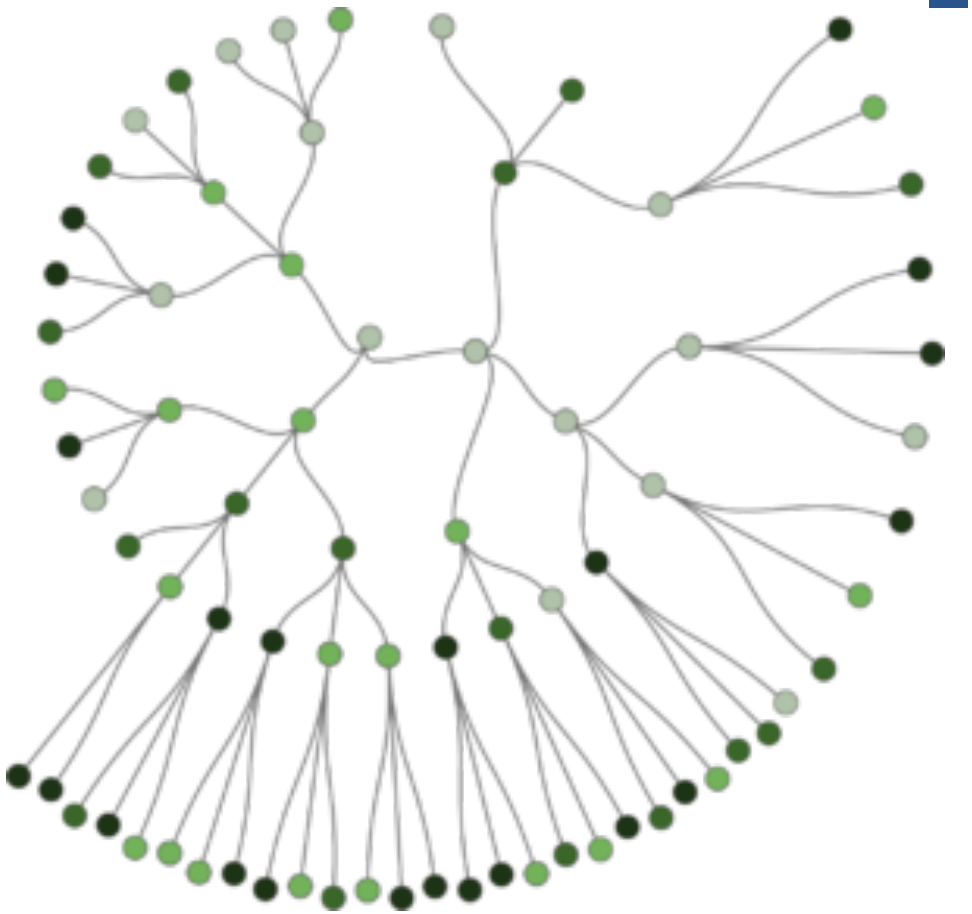
Desoundralization

The Sound of Decentralization

Sonifying Computational Intelligence in Sharing Economies

Sonification

`desoundralization' concerns the sonification of complex data that exhibit decentralized computational intelligence



Objectives

display

sonify systems that are too complex or non-intuitive for mainstream thinking, so that they become more 'meaningful' for general public?

compare

demonstrate alternative design patterns for computational intelligence in data-intensive decentralized systems

speculate

probe datasets whose meaning is largely unknown or too complex to be known

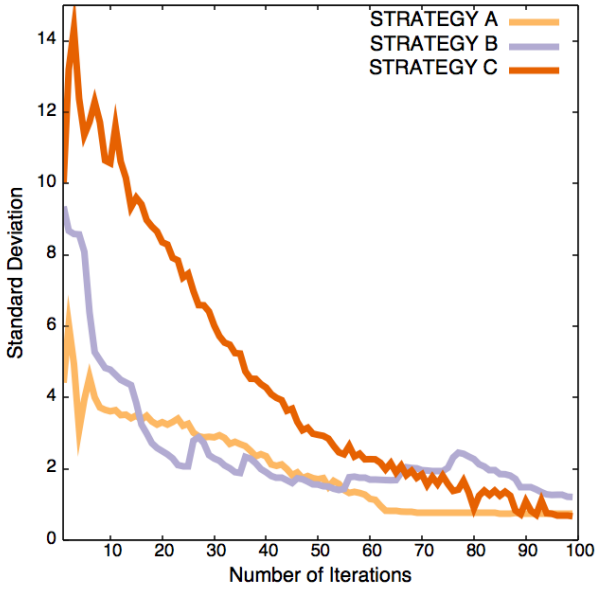
foreground

aestheticize relevant attributes of intelligent decentralized systems, e.g.: robustness, scalability, privacy-by-design, fault-tolerance, fairness)

Sonified Data

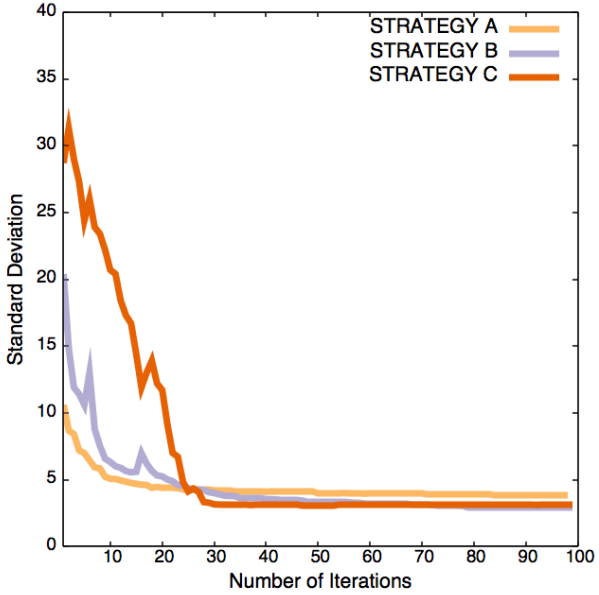
Hubway Data Visualization Challenge

concerning trips from 1000 extracted unique users recorded for the Hubway bicycle sharing system in Paris and showing the available bicycle stations at a two-hour morning time slot (08:00-10:00)



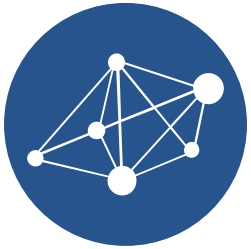
Pacific Northwest SMART GRID DEMONSTRATION PROJECT

concerning the energy consumption in a series of Pacific Northwest states for the period 23.07.2014, 01:00-12:00, from 493 households with 4 generated plans per agent to choose from



Demonstration

Results



aestheticize

we can delineate the complexities of decentralized systems as manifested both microscopically and macroscopically, bring forth the most important micro-modulations at play, speculate on the importance of certain attributes and present our findings in a very straightforward phenomenological fashion that also holds artistic merit

probe

employing ratios and other mathematical formulas owe can both sustain the complex nexi of micro-modulations that give rise to certain phenomena, as well as to examine particular properties and how they interrelate with macroscopic attributes of the system under scrutiny

understand

it may be impossible for non-specialists to fully understand the deeper implications of such systems, yet, it is becomes possible for both experts and the general public to appreciate the various processes at play in their proper granularity and, to immediately perceive how the overall convergence of the system translates to microscopic modulations in the locally-generated data and vice-versa

Questions?

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References

[1] Peter Pilgerstorfer and Evangelos Pournaras, Self-adaptive Learning in Decentralized Combinatorial Optimization-A Design Paradigm for Sharing Economies, in the Proceedings of the 12th International Symposium on Software Engineering for Adaptive and Self-managing Systems-SEAMS-2017, Buenos Aires, May 2017 © IEEE

[2] Marinos Koutsomichalis and Evangelos Pournaras, The Sound of Decentralization-Sonifying Computational Intelligence in Sharing Economies, in the proceedings of the 23rd International Symposium on Electronic Art-ISEA-2017, Manizales, Colombia, June 2017