

Visualizing Sensor Network Data with PowerTron

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<http://powernet.stanford.edu>

Problem

Electricity powers our everyday computing, yet we have no visibility into how this energy is consumed.

Detailed power and utilization data can improve how we design, select, manage, and use our computing devices and infrastructure.

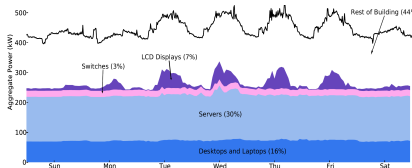
Solution

Build a hybrid distributed measurement infrastructure that collects the necessary data from a large variety of computing systems, at a high time granularity.

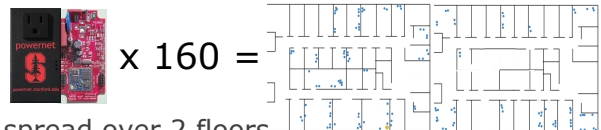
Analyze the collected data to increase the energy efficiency of enterprise computing.

PowerNet

is a platform for collecting, viewing, and analyzing plug-level power data collected from over 200 meters and 25 of software monitors in Gates Hall, the Stanford CS building.



Sample CTP Deployment



spread over 2 floors
active 10+ months
160 wireless nodes
2 base stations
data packets once every ~10 seconds
CTP diagnostics once every 5 minutes

Questions We've Answered

How much do computing systems contribute to the building's monthly electricity bill?

Is our networking infrastructure energy-proportional? Is it energy-efficient?

Can simple, one-time settings changes produce energy savings?

What is the impact of policy changes and purchasing decisions?

How does the energy picture change if we use laptops? or VM migration? or thin clients?

What would a clean-slate approach to enterprise computing look like?

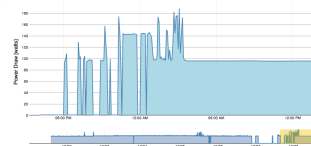
Lots of data and lots of questions! Now what?

Demo

PowerTron is an *interactive, real-time visualization* of both wireless network properties & application-level power data.

Use it to:

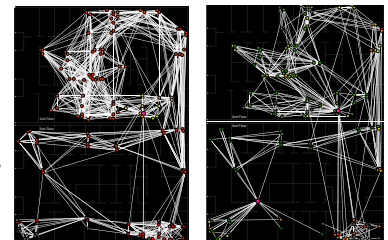
- see network performance at a glance
- compare energy use of devices and people
- identify energy waste
- find aberrant behavior of equipment
- and many more



sample desktop power draw



real-time power data



CTP network topology, before and after adding a second base station; node color shows delivery from 0% (red) to 100% (green)

Going Forward

- evaluate alternatives to traditional computing
- design green computing infrastructures
- bring data and insights to the public
- expand PowerTron so other deployments can use it

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