



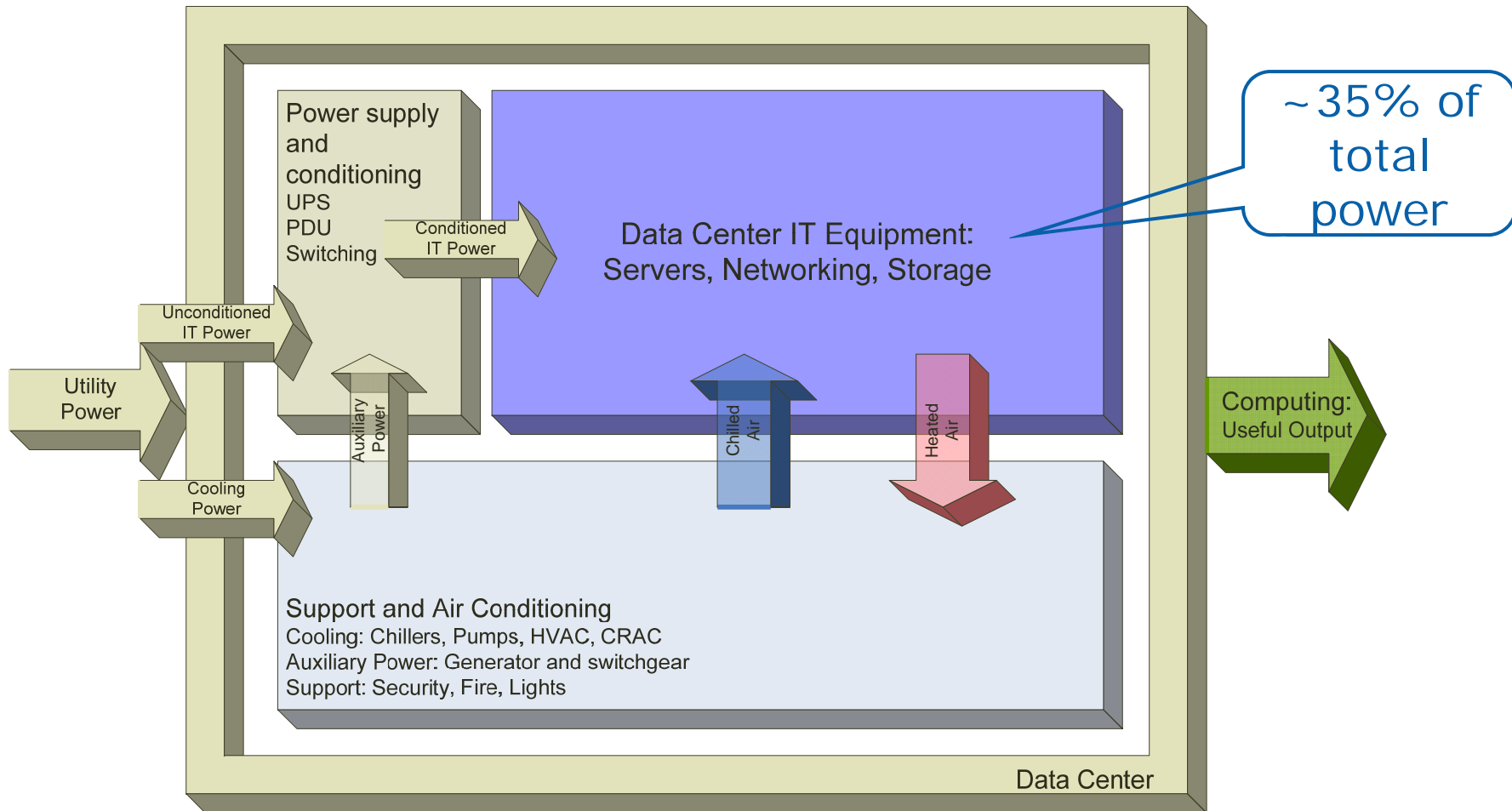
“Green IT”: Data-Center Power and Thermals Challenge and Autonomic Opportunity

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Data-Center Power Challenge

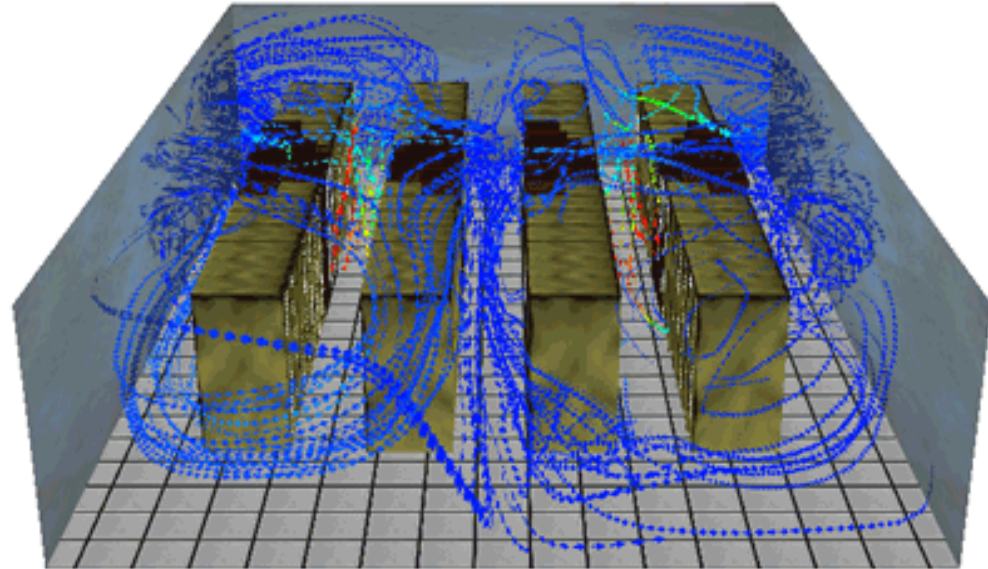
- IT Industry is a significant consumer of power
 - EPA 2007 estimates 1.5% of total US electricity consumption is by servers and data centers, equivalent to approx 5.8 M average US households
 - Consumption doubled from 2000 to 2006, growing rapidly
- Data centers not managed for power efficiency
 - IT measured on performance and uptime, not power consumption
 - Applications, workload have no sense of power impact
 - Should be a first-order managed resource, just like processor and memory
 - Environment, applications not instrumented for power and thermals
 - Thermal sensors common but unused, power sensors in the pipeline
 - No connection with cooling automation systems
 - Account for more than 50% of data-center power

Data-Center Power and Cooling

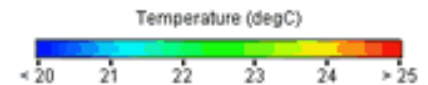


DCPT Opportunity, Call to Action

1. Instrument and visualize
 - Real-time temp, power sensing
 - Measure so you can control
 - Data-center rt “weather map”
2. Integrate with ecosystem
 - Management consoles
 - Interface with facilities mgmt
 - More sensors, location
3. Automation: policies, models
 - Thermally-aware load placement, rebalancing, group and DC levels
 - Operate at optimal power points, unused capacity in sleep
 - Minimize temperature variance (reduce cooling costs)



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Use autonomies to self-organize and manage power for/with heterogeneous data-center infrastructure

Elements of the Challenge

- Collaboration of autonomic agents
 - Node level
 - Group level, e.g. rack-level PDU level
 - Data-center level
 - Heterogeneous, cross-vendor
 - Needs standards, agreements on data and controls, formats
- Integration with facilities control
 - Other industry, standards, “we need to talk”
- Collaboration of distinct tools, throughout life-cycle
 - Application infrastructure needs and expectations, “design intent”
 - Infrastructure state and capabilities, configurability, load
 - Workload allocators, performance monitors optimize along all that...