



Grand Challenge:
Green Computing Everywhere
aka
UbiGreen

Participants:

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UbiGreen

- ❖ **Mission: Growing computation and communication with environmental responsibility**

UbiGreen

- ❖ **Metrics: Reduce total-lifecycle annual per capita computer & communications environmental impacts**
 - **Material and energy consumption by 10x**
 - **Non-recycled material and non-renewed energy consumption by 100x**
 - **Toxic and harmful byproducts by 1000x**

Technical Challenges

- ❖ **Change physical computers and devices**
 - **Edible and biodegradable devices**
 - **Findable**
 - **Recyclable**
 - **Responsibly disposable devices**
 - **Smart garbage**

Technical Challenges

- ❖ **Change the hardware and software design**
 - **Incrementally upgradeable mini-components and assembly-by-feature (and OS support for them)**
 - **Easy component upgradeability (different rates of obsolescence)**
 - **Software radios**
 - **True backward compatibility**
 - **Smarter energy management and alternative energy sources (ambient, solar, human footfalls, keystroke and mouse energy, ...)**
 - **Network-based services vs P2P (SETI/Proteomics)**
 - **New metrics and design criteria**
 - **New formal models and design methodologies**

Technical Challenges

- ❖ **Change the way we use computers**
 - **Make resource consumption and toxic byproducts visible to end users**
 - **EnergyStar -> NonToxicStar**
 - **Time-shifting usage patterns**
 - **Incentives for sharing, recycling and properly disposing of devices**
 - **Enable repurposing of devices (including personal context transfer)**

Spinoffs and Barriers

❖ **Spinoffs**

- **Make B24B more viable**
- **Appliances, manufacturing and recycling in general**

❖ **Social barriers to acceptance**

- **Consumers generally receptive**
 - **except vehement opposition in some quarters ...**
- **Manufacturers and vendors of devices and software may be opposed**
 - **Unable to externalize costs**
- **No professional incentives for R&D in this area**