EEE Savings Estimates

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IEEE 802 Plenary Meeting — San Francisco

July 18, 2007

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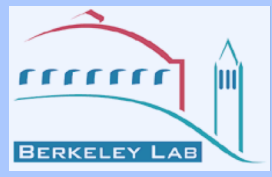
Outline

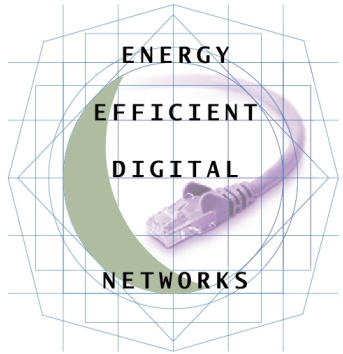


- Estimating energy consumption and savings
- "Potential" savings

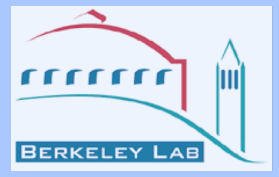
- Stocks
- Usage
- Power levels

- Energy price

- Key outstanding questions



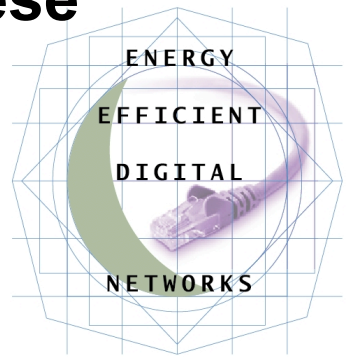
Estimating energy consumption and savings



Energy estimates driven by

- Stocks
  - How many devices exist
- Power levels
  - How much power consumed in each major operating mode
- Usage
  - How much time in each mode

Savings can occur by changing any or all of these

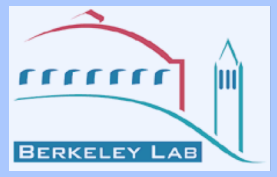


"Potential" savings

- Forecasts of expected savings necessarily uncertain
- Focusing on what not known a distraction
- Best to present what do know:
  Universe of 'potential' savings
  - –Can later apply penetration factors
  - –Provides magnitude of actual savings

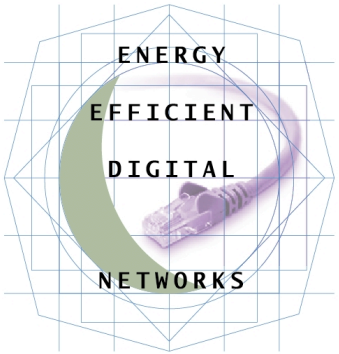
- Key uncertainties for EEE savings
  - –10 G copper NIC stocks
  - –1G and 10 G power savings at reduced rate
  - –Balance of system and non-system savings

Stocks

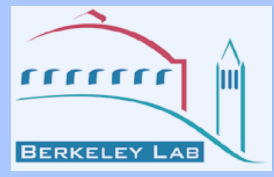


- 1 G NICs
  - Product populations in residential and commercial buildings
  - Presence and utilization of Ethernet

- 10 G (copper) NICs
  - Assume prime driver is servers (blade and non-blade)
  - Redundant links - total: 2/volume, 4/midrange, 8/high-end
    ⇑ Is this reasonable?
  - How many servers?
  - What fraction will use 10G copper? Estimating energy consumption and savings



Usage

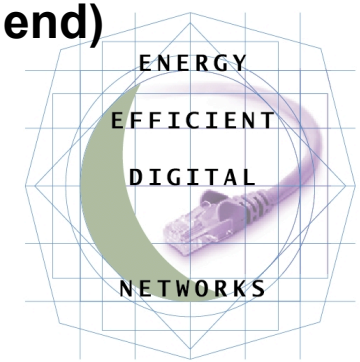


Usage: Time with EEE link that will be low rate when otherwise would have been high rate

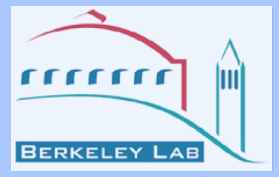
- **Shipped NICs may not be used**
- **NICs in use may in low rate if device is already asleep or off**
- ***(one end of link may not support higher rate at all)***

- **1 G**
  - **Varying assumptions based on product type**
- **10 G**
  - **90% low link rate time (80% and 60% for mid and high end)**

Not a great source of uncertainty



Power levels

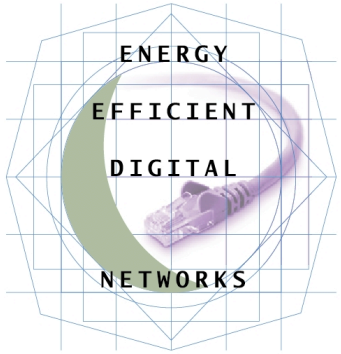


All power levels what results at AC input to system

1 G

- **Measured data: 1-2 W per NIC**
- **For estimate, used 1 W**
  - **While PHY power may drop below 1 W, other parts of system may also save power**
  - **Easily scalable to other assumptions**

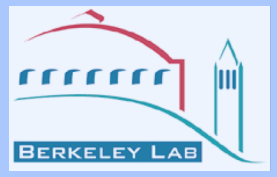
- **10 G**
  - **Measured data (unsurprisingly) absent**
  - **Fiber 10 G NICs 10-20 W**
  - **Used 8 W savings (4 W for backplane)**
  - **Need a consensus view from industry**



Energy price

- GWh/year or TWh/year not intuitive to many — $ are
- Recent average prices from DOE / EIA
  (Dept. of Energy / Energy Information Admin.)
  - –Industrial: 6+ cents/kWh
  - –Residential / Commercial: 9 cents/kWh
  - –Europe: nearly 20 cents/kWh
- Past estimates presented to IEEE used 8 cents/kWh
  - –Consistency has value
- 10 cents/kWh easily roundable / scalable
  - –More relevant to rest of world
- So — 8 or 10 cents/kWh ?

Key Outstanding Questions



- **Should balance-of-system and non-system savings be accounted for?**
  - **If so, what factors for 1 G devices? servers? switches?**
- **What year to create estimate for?**
- **How many 10 G copper NICs should we expect?**
- **What power levels are most appropriate:**

  (entire product at AC plug)
  - **1 G?**
  - **10 G? (BASE-T and backplane)**
- **Is this sufficient for IEEE needs?**