Requirements for Energy Management

draft-quittek-power-monitoring-requirements-02

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What is going on?

- reducing power consumption has become an important issue
  - buildings, transportation, datacenters ...
  - ... and also in the Internet
- global warming
  - goal: reduce carbon emissions
- significant increase in energy cost
  - goal: reduce operational cost

What is needed for a green Internet?

- low power electronics
- energy-saving protocols
  - e.g. energy efficient Ethernet (802.3az)
- energy-efficient device design
  - low-power and stand-by modes for each module in a device
- active power management
  - power down or switch off modules of devices that are not under heayv/any load
- monitoring power states and consumption

Why is monitoring desirable?

- monitoring does not directly save energy
  - it rather consumes additional energy
- however ...
  - it helps identifying possible savings
  - it is needed to evaluate effectiveness of saving measures
  - it can be used to quantify equipment‘s total cost of ownership (TCO)
  - it can be useful for dynamic power management

What needs to be monitored? (1)

wish list for power state monitoring

- actual power state
  - e.g. full power, low-power, stand-by/sleep, off
  - times spent in each state
  - duration of last time period in each state
  - number of transitions to each state
  - cause for last transition
- current power source (AC/battery)
  - times spent on each source
  - duration of last time period on each source

What needs to be monitored? (2)

wish list for energy consumption monitoring

- power (current energy consumption rate)
- energy consumption (accumulated)
  - in total and per power state
  - for which time intervals?

- it‘s easy to extend the list much more
  - power quality
  - battery status

Meta Information

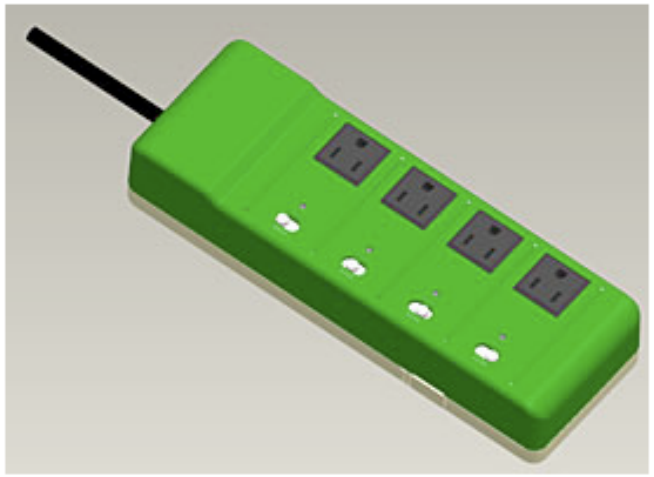
- accuracy of meter
- AC or DC
- power measurement interval
- real or apparent power
- reporting interval
- ...

What about control?

- It appears to be useful having means to set the power state of a device
  - set to sleep, wake up, etc.
- The eman charter covers control for the architecture, but not for the MIB modules.
- However, what would be needed is probably just a single writable object for the desired power state.

Remote Power Monitoring Examples I

- Power Distribution Units (PDUs) / power strips
  - switch on/off per socket
  - power/energy monitoring per socket



- Power over Ethernet (PoE) sourcing devices
  - PoE switches monitor and control power supply of attached devices
  - unfortunately: per-port power monitoring not supported by PoE MIB module

Remote Power Monitoring Examples II

- energy data collectors
  - data center / building / sensor network
  - often non-IP communication between probes and collectors
  - wired (powerline, field bus, non-standard) and wireless
  - in some cases intermittent connectivity
  - with just a single client device: protocol converter
- devices in examples act as mid-level managers
  - collecting power information
  - discovering and identifying, adding context to concerned devices
  - providing structured information to energy management system
- we need an **energy management framework**
  - defining role of mid-level manager
  - modeling relationship between mid-level manager and monitored devices (parent – child)
  - defining common terms and categories (power states, etc.)

History

- initial proposal presented at IETF 75
- requirements discussed at IETF 76
  - draft-quittek-power-monitoring-requirements-00
- four MIB modules submitted for discussion at IETF 77
- two further drafts at IETF 78
- IETF 79: EMAN WG, more drafts, vivid discussions on own mailing list

What do we have already?

- RFC 4268 (Entity State MIB)
  - standby status (hot, cold, providing service)
- RFC 3621 (Power Ethernet MIB)
  - good information on small devices powered with PoE
  - accessible at power sourcing equipment
- RFC 1628 (UPS MIB)
  - good information for UPS protected devices
- RFC 3433 (Entity Sensor MIB)
  - generic, can be used for power monitoring
- DMTF DSP 1027 (Power State Management Profile)
  - targeted at hosts, using Common Information Model (CIM)
  - rather device profile than actual monitoring
- ACPI (advanced configuration and power interface)
  - Power monitoring and control of PC motherboards
- and many more … but not all we need is already there

What is needed?

(The charter gives you already the answer.)

- reporting power, energy consumption, power states, statistics
- reporting power quality
- reporting battery status
- (setting power state)

- this sounds rather straightforward
  Isn't there any problem?

Big issue: identification

- identification of the energy consumer
  - for which device are these power values?
  - obvious for devices reporting on themselves
  - doable for PoE switches
    - they know IP and MAC address of the consumer
  - tricky for power strips
    - they know just the socket number
  - what is a good identifier?
    - SNMP engine ID?
    - IP address?
    - socket number? PoE port number?
    - something more general?
- requirements for identification still to be done.

Minor issues

- elaboration of information to be reported (information model)
  - number of power states
    - 3, 6, 12, many?
  - information per state
    - max power? average power?
    - energy per state? further state statistics?
  - regular energy reporting
    - absolute or delta values
  - . . .
- again: requirements still to be done.

Even more issues?

- probably yes.
- energy management is rather new and still to be fully explored
- let‘s see which challenge will come up next

- Any questions?