YANG Data Model for Energy Measurements in Streaming Devices

draft-neumann-green-streaming-yang

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Goal and design choices

Reporting of power consumption from streaming-capable devices; instantaneous and historical power measurements.

Identify sources and reasons of power consumption:

- Distinguish between global system power and component-level power
- Component-level power should allow to distinguish sources of power consumption:
  - network card, GPU, CPU, memory…?
- Provide relevant information to identify the type of device with respect to the video streaming workflow:
  - Encoder, router, cache, STB, TV…?
- Provide relevant streaming metrics needed for correlation and analysis

If some power measurements (e.g. global system power or component power) are not available, provide alternative metrics that may be used by the collecting entity to estimate power consumption.

Device Information and Measurement Capabilities

Device-id: opaque identifier

Device-type

- encoder, decoder, cdn-cache, router, switch, settop-box, tv, mobile-device…
- provide means to identify the type of device with respect to the video streaming workflow

⇒ probably requires defining a comprehensive list of device types

Measurement Capabilities

- supports-mains-power: Device can report total power draw
- supports-component-power: Device can report component-level power
- supports-component-usage: Device can report component-level usage

```
+--rw device-info
   +--rw device-id                    string
   +--rw device-type                  enumeration
   +--rw measurement-capabilities
      +--rw supports-mains-power?           boolean
      +--rw supports-component-power?       boolean
      +--rw supports-component-usage?       boolean
```

Power and Component Usage Readings

Timestamp: UTC timestamp of measurement.

- Required for correlation analysis across devices of video streaming workflow.

Main Power: Total power draw from mains providing system-level energy perspective.

Component Power: Individual component power drain.

- Allows analysis, identification of reason and sources of power usage.
- May enable estimating the system power if not available.

Component Usage: Individual component load/usage.

- Allows analysis, identification of reason and sources of power usage.
- May enable estimating the component and system power if not available.

⇒ probably requires defining a comprehensive list of components

```
+--ro power-readings
   +--ro timestamp                yang:timestamp
   +--ro mains-power
   |  +--ro watts?                decimal64
   +--ro component-power
   |  +--ro cpu-watts?            decimal64
   |  +--ro gpu-watts?            decimal64
   |  +--ro memory-watts?         decimal64
   |  +--ro network-watts?        decimal64
   +--ro component-usage
      +--ro cpu-usage?            decimal64
      +--ro gpu-usage?            decimal64
      +--ro memory-usage?         decimal64
      +--ro network-usage?        decimal64
```

Usage and streaming metrics

Streaming metrics

- enable correlation with power measurements to understand power consumption patterns in relation to actual streaming activities.

⇒ probably requires extension with comprehensive set of streaming metrics

```
+--ro streaming-metrics
   +--ro active-streams?             uint32
   +--ro total-bandwidth-mbps?       decimal64
   +--ro video-brightness?           uint8
   +--ro encoding-parameters?        string
   +--ro network-utilization?        decimal64
```