A Unified and Efficient Approach to Energy Management across the Network

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Agenda

- Problem Statement
- Energy Management Monitoring Use Case
  - Different Views into Information Model
- Energy Management Data Model
- Competing Protocol Limitations
- Energy Management Collection Interface
  - IPDR/SP Overview
- Energy Management Application Framework
- Conclusion

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Problem Statement

- The U.S. Department of Energy has issued a Docket on RFI for Energy Conservation Standard for Set Top Boxes and Network Equipment
  - 76 FR 32325, December 16, 2011
  - http://www.gpo.gov/fdsys/pkg/FR-2011-12-16/html/2011-32325.htm
- Device manufacturers are now beginning to address energy efficiency in their network equipment
- But what about the back office? What about energy management monitoring? We need back office tools…based on state of the art technology and design approaches

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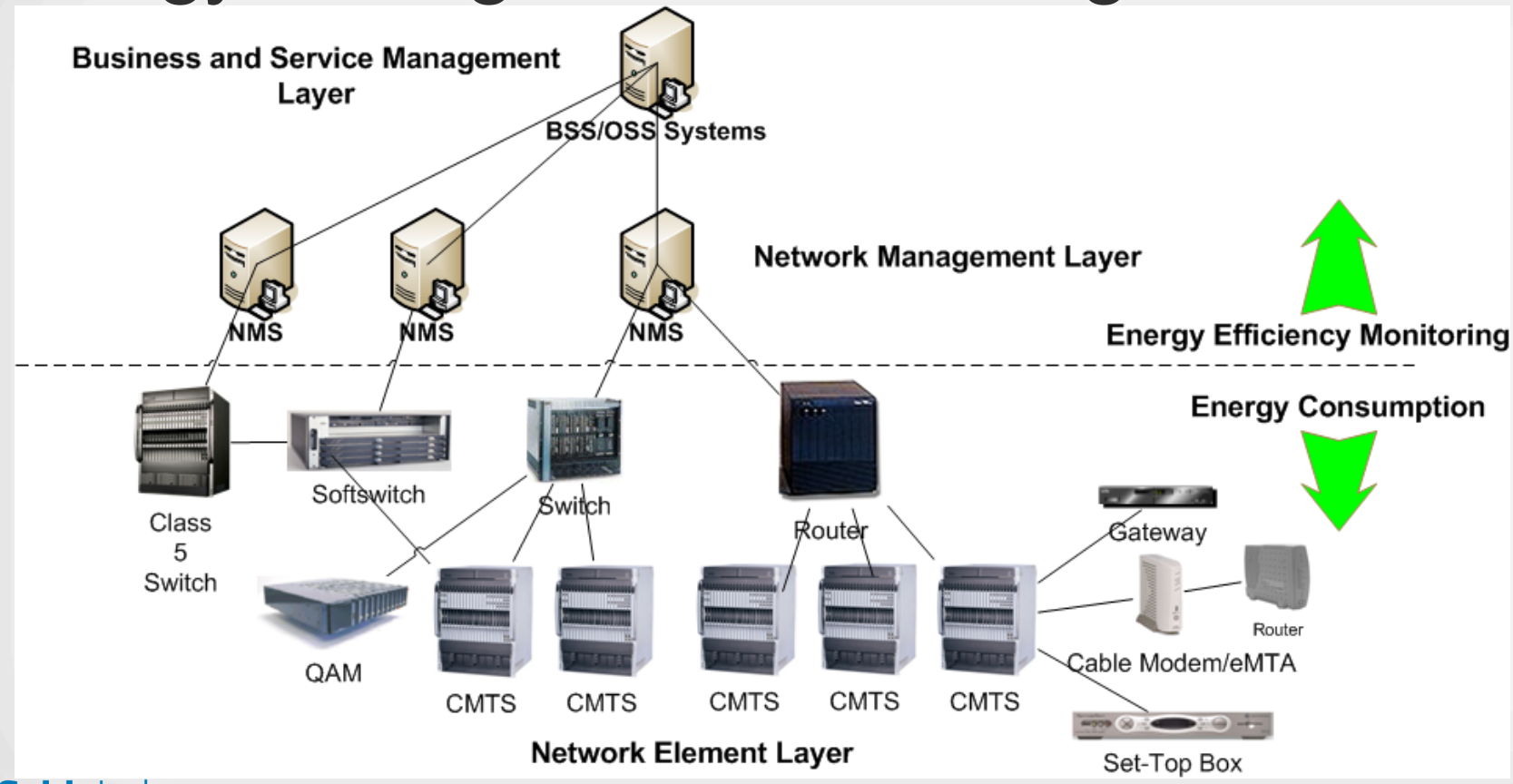
Energy Management Monitoring Use Case



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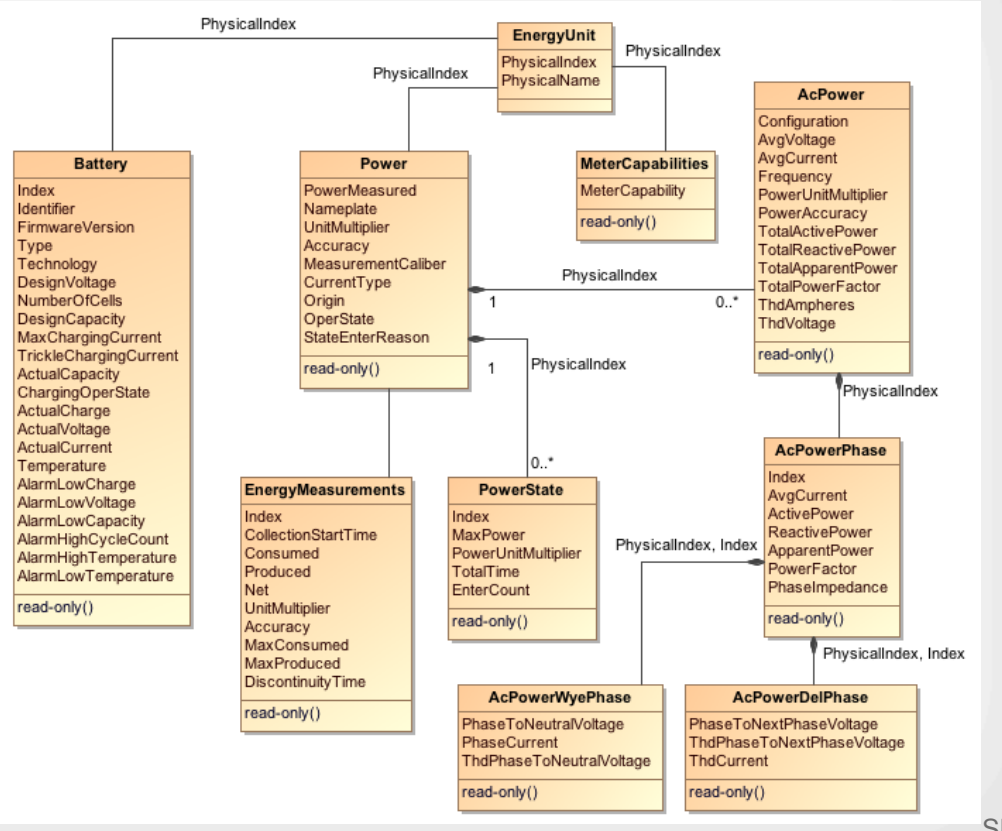
Energy Management Information Model

- Defines the protocol-agnostic Information Models (in UML Class Diagram syntax) for the Energy Management Monitoring Use Case
- Defines the common Energy Management Information Model
- **Model shown based on IETF eman WG attributes



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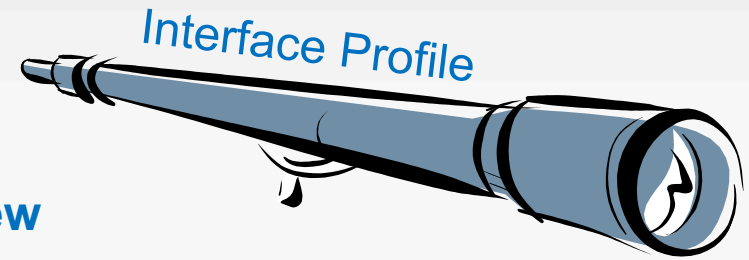
Different Views into Information Model

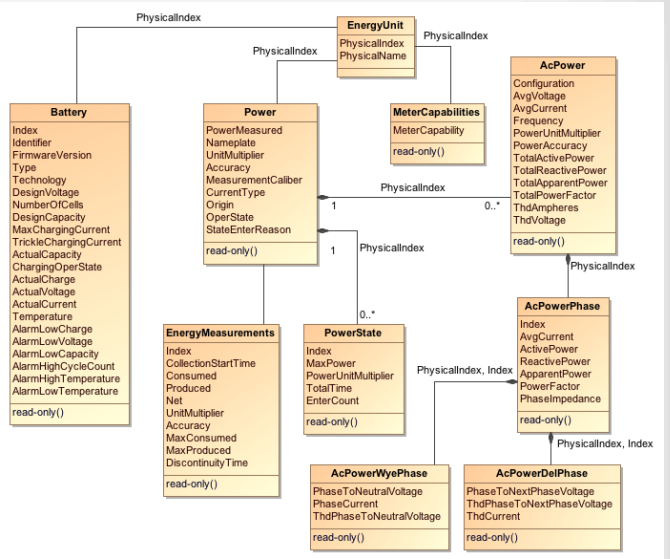
Core Network Component View



Headend Network Component View

CPE Network Component View

Interface Profiles: Define access to a specific set of Information



Common Energy Management Information Model

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Energy Management Data Model

- Defines the protocol-specific implementation data models for the Energy Management Monitoring Use Case
- Translate Information Model into Data Model for implementation in network devices
- Many types, based on management protocols
  - IPDR Service Definitions (XML Schemas)
    - Transport uses IPDR/SP protocol, payload based on XML
  - NETCONF YANG Modules
    - Transport uses NETCONF protocol, payload based on XML
  - TR-069 Data Models (XML Files/Schemas)
    - Transport uses TR-069 protocol, payload based on XML
  - SNMP MIBs (SMI)
    - Transport uses SNMP protocol, payload based on ASN.1

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SNMP MIB Data Model Limitations

- Syntax is too constraining, complex and static
- Language is not extensible
- Cannot define complex structures
  - For example, tables embedded in tables not supported
  - Not well defined for hierarchical tree structures which more mimic device configurations
- No support for operations
- Limited support for versioning/revisions
  - No method for advertising module and versions supported

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SNMP Protocol Limitations

- Lack of support for
  - Atomic transactions
    - Providing a full config at boot time
    - Providing backup and restore capabilities
    - Validation of cfg data set prior to activation
  - Connection-oriented management sessions
    - Limited to connectionless transport which can generate more traffic (e.g., inefficient for configuring complex devices)
  - Multiple configuration data stores
- Limited set of protocol operations (Get, Set, etc)
- Not scalable
- Using SNMPv3 for secure connections is complex and difficult to deploy

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NETCONF/TR-069 Protocol Limitations

- NETCONF and TR-069 protocols were designed for configuration management functions, not data collection
- Both protocols transport uncompressed XML
  - Leads to 10x the data size
  - Increased bandwidth
  - Increased processing time

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Energy Management Collection Interface
IPDR/SP Protocol

- Under the TeleManagement Forum's Interface Framework resides the IPDR/SP standard
  - Internet Protocol Detail Record/Streaming Protocol
  - A Data record streaming protocol
  - http://www.tmforum.org/DocumentLibrary/IPDRTechnicalSpecifications/47351/article.html
- Service Definitions define the data record (information model) format via XML Schema
  - Guidelines for data model definitions maintained

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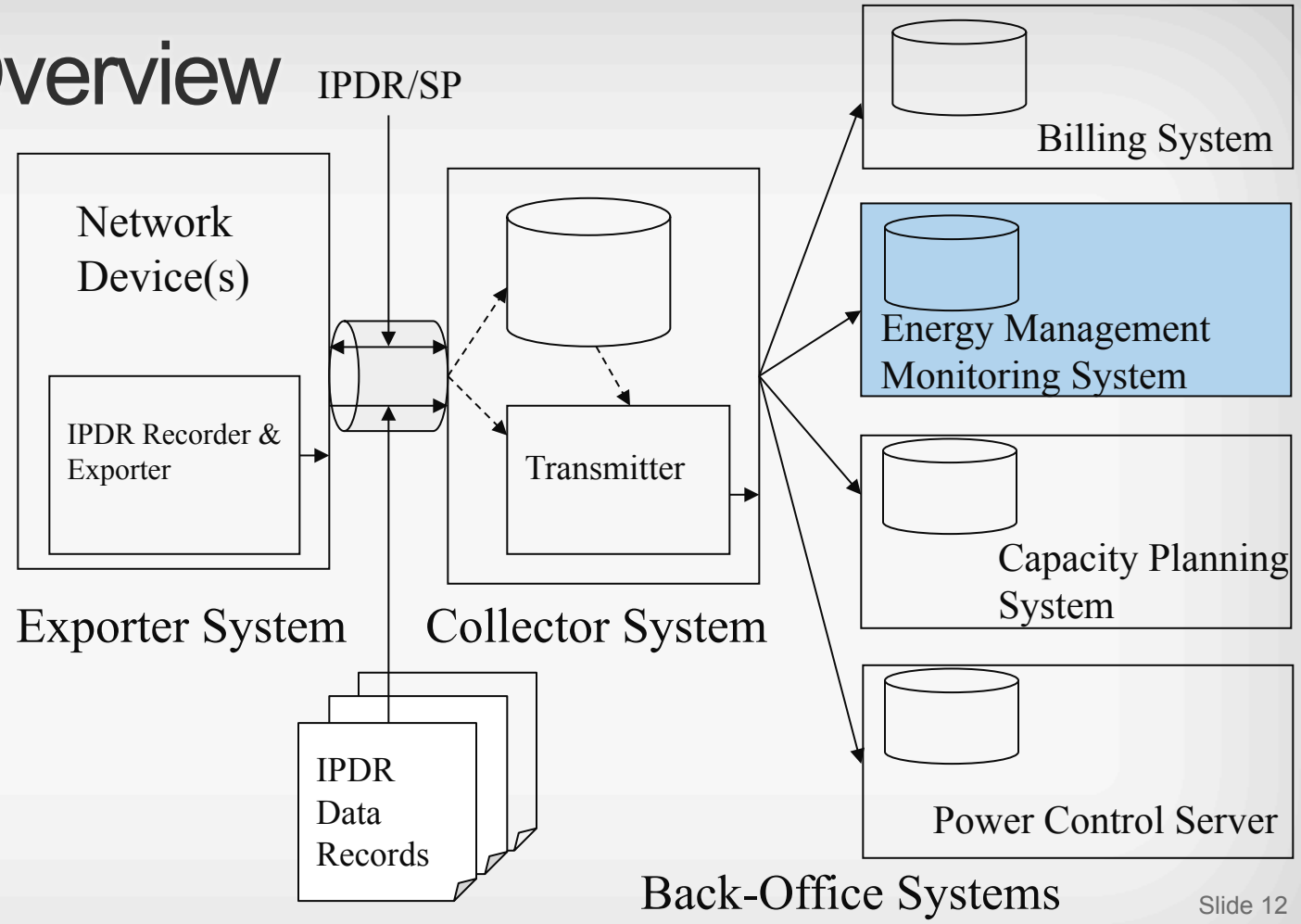
IPDR/SP Overview

- Network Device implements the IPDR/SP Exporter function and streams the metrics to the Collector



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Efficiency Gained with IPDR/SP

- Eliminates redundant information
- Different collection methods
  - Time Interval, Event Based and Ad-hoc Sessions
- Reduces management bandwidth on network
- XDR binary serialization encoding creates compact data records
- Minimizes computational encoding/decoding processing for resources
- IPDR provides negotiated “Push” vs. incremental “Pull”
- TCP-based: connection oriented transport reliability
- Provision for a redundant Collector for automated fail-over

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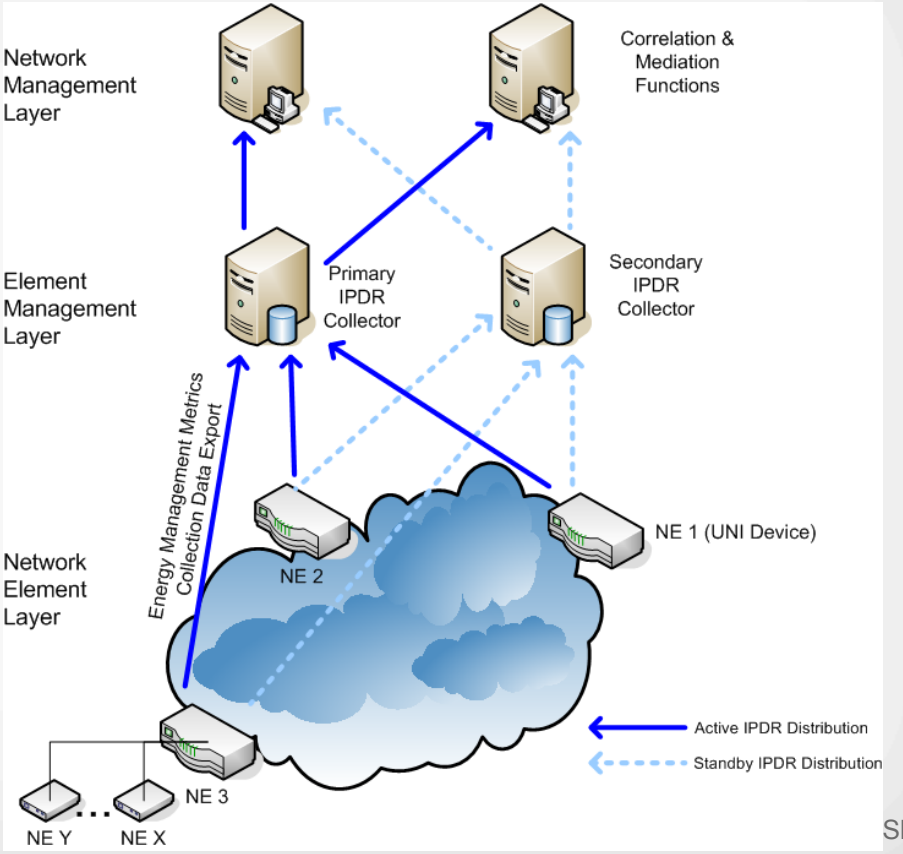
Energy Management Application Framework

- Network Element Layer ➔ Eelement Management Layer uses IPDR/SP Collection Method
- New generation protocol provides
  - High Availability & Redundancy
  - Massive Scalability
  - Efficiency
  - Standardized Data Models
    - XML Schemas



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Conclusions

- New Energy Management Back Office OSS Framework is needed to address the trends of lowering the energy consumption in the network
- New tools are just the beginning
  - We have protocols today to address efficient and scalable collection of metrics from the network
- Need to drive the standardization of common Information Models and data models based on the collection methods for network devices
  - Design the data models using information modeling concepts from UML and publish the information models
- These approaches can enable a SOA based framework for monitoring energy parameters within the network
- The Cable use case presented can be applied to any Communications Service Provider example

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Q & A

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