

Comparison of MultiSpeak® Connectivity Model and the IEC CIM NetworkDataSet

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Outline

- Background on MultiSpeak® and CIM
- **Why** MultiSpeak and CIM should be harmonized
- **How** harmonization can occur
- MultiSpeak and CIM power system data models



Standards for Integration of Distribution Applications

MultiSpeak

- Developed by NRECA in collaboration with key industry vendors
- Covers applications of interest to distribution utilities; currently doesn't include power scheduling or generation
- Standard is mature, but scope is continuing to grow
- In use at over 200 utilities
- Mature interoperability testing program, applies to all interfaces
- Uses XML; web services and batch transport profiles defined
- More information and specification available at www.MultiSpeak.org



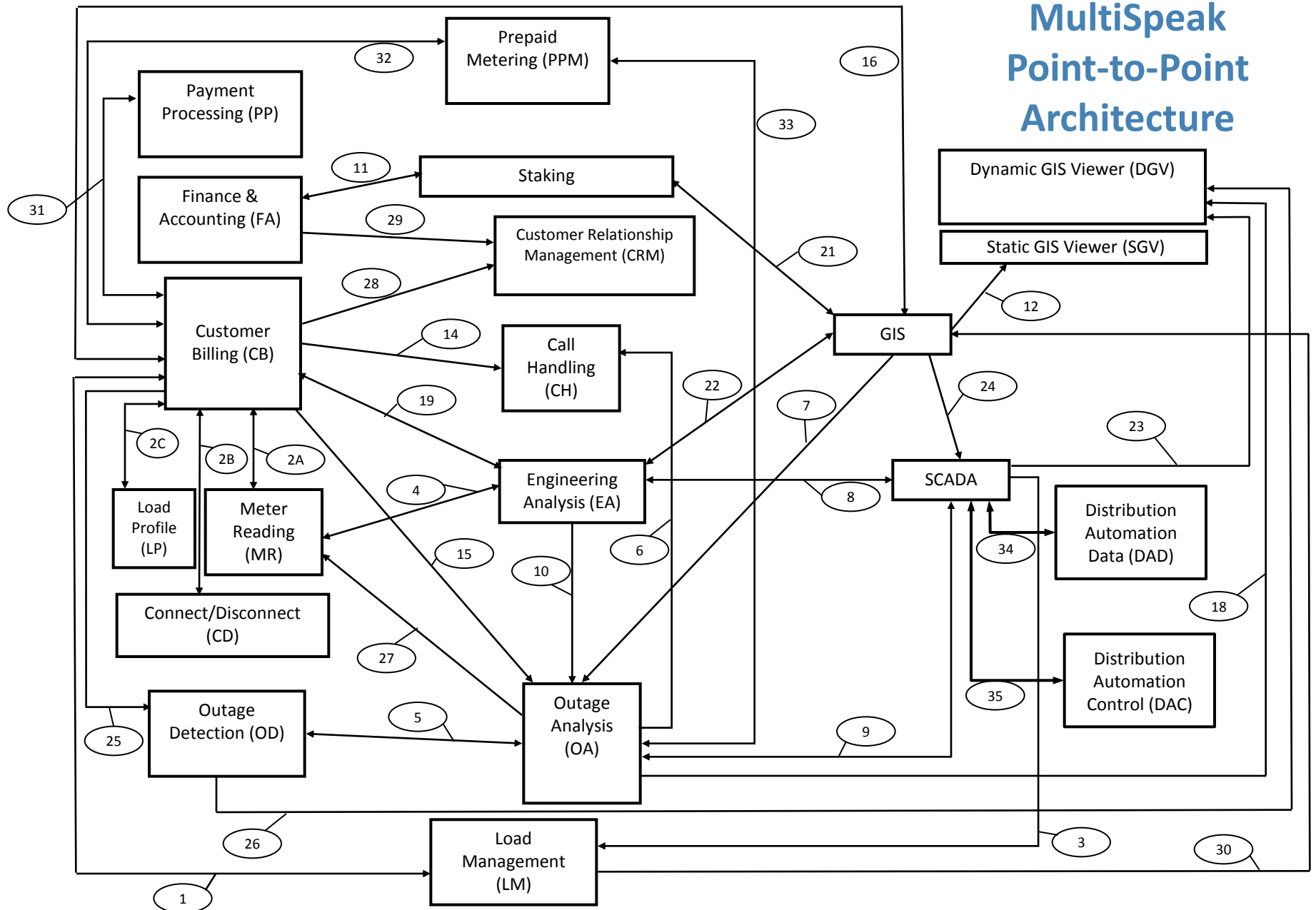
Standards for Integration of Distribution Applications

CIM with Distribution Extensions

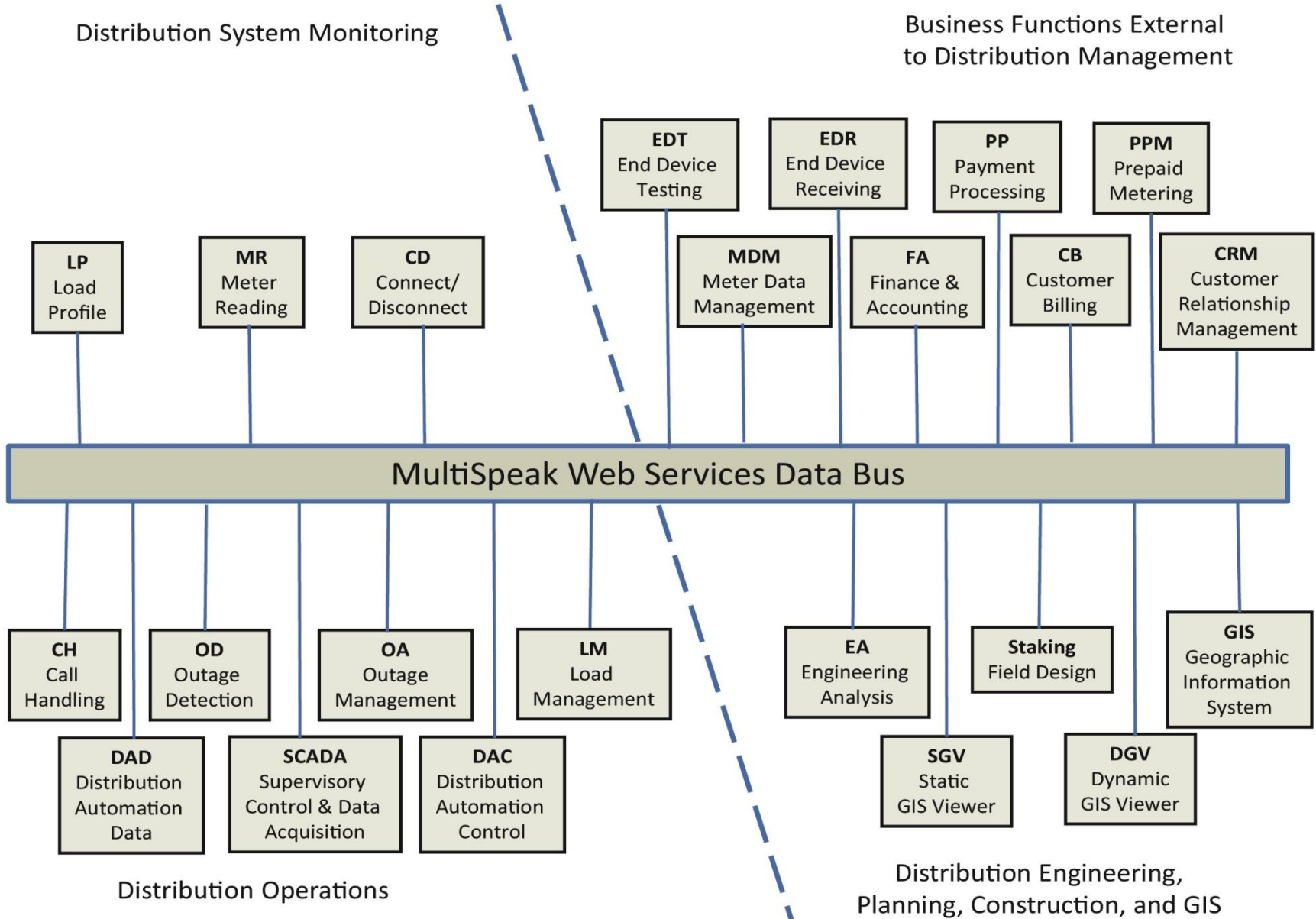
- Maintained by IEC Technical Committee 57
- Scope is larger than MultiSpeak, but is less mature
- Implementations based on CIM data model in place at dozens of utilities
- Implementation is messaging-based and transport agnostic, currently no transport profiles defined
- Interoperability testing is in place for two limited profiles (transmission and distribution power system model exchange)
- Core CIM in IEC 61970; distribution extensions in IEC 61968



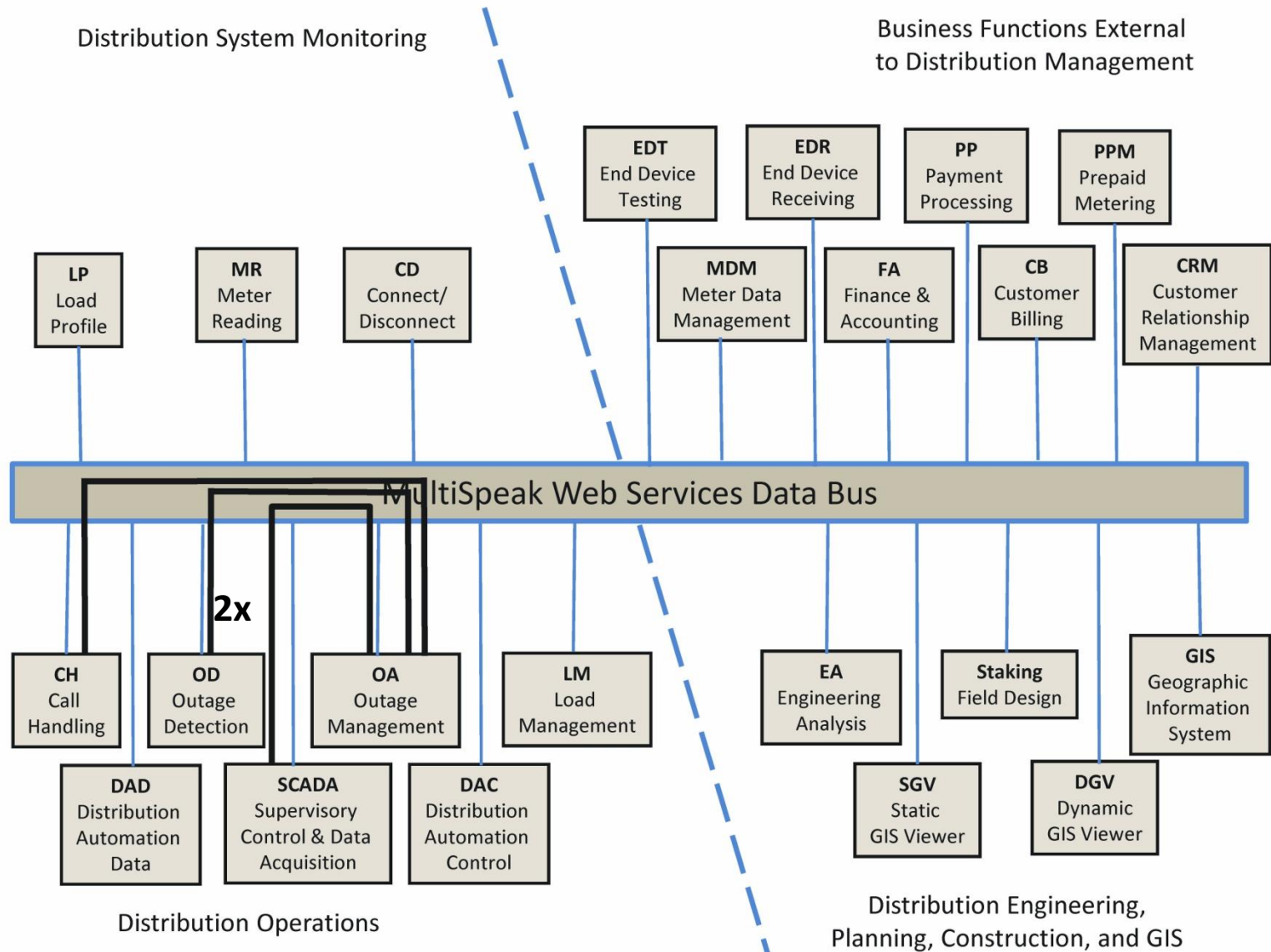
MultiSpeak Point-to-Point Architecture



MultiSpeak Services Bus Architecture



Outage Handling Example - Bus Architecture



Why Harmonize MultiSpeak and CIM?

- Both standards have value and likely will co-exist in market
- Both standards will undoubtedly be simultaneously implemented in some utilities
- Inter-company messaging will likely be required among companies using different standards



Steps in Harmonization

1. Map MultiSpeak web service **methods** to WG14 CIM **messages** (use case steps).
2. Compare WG14 and MultiSpeak data payloads for each use case step.
3. Create electronic data payload transformation.
4. Create adapter layer to handle data transformation and messaging conversion.



Harmonization Example

1. Map MultiSpeak web service **methods** to WG14 CIM **messages**. **Choose network connectivity**
2. Compare WG14 and MultiSpeak data payloads for each use case step.
3. Create electronic data payload transformation.
4. Create adapter layer to handle data transformation and messaging conversion.

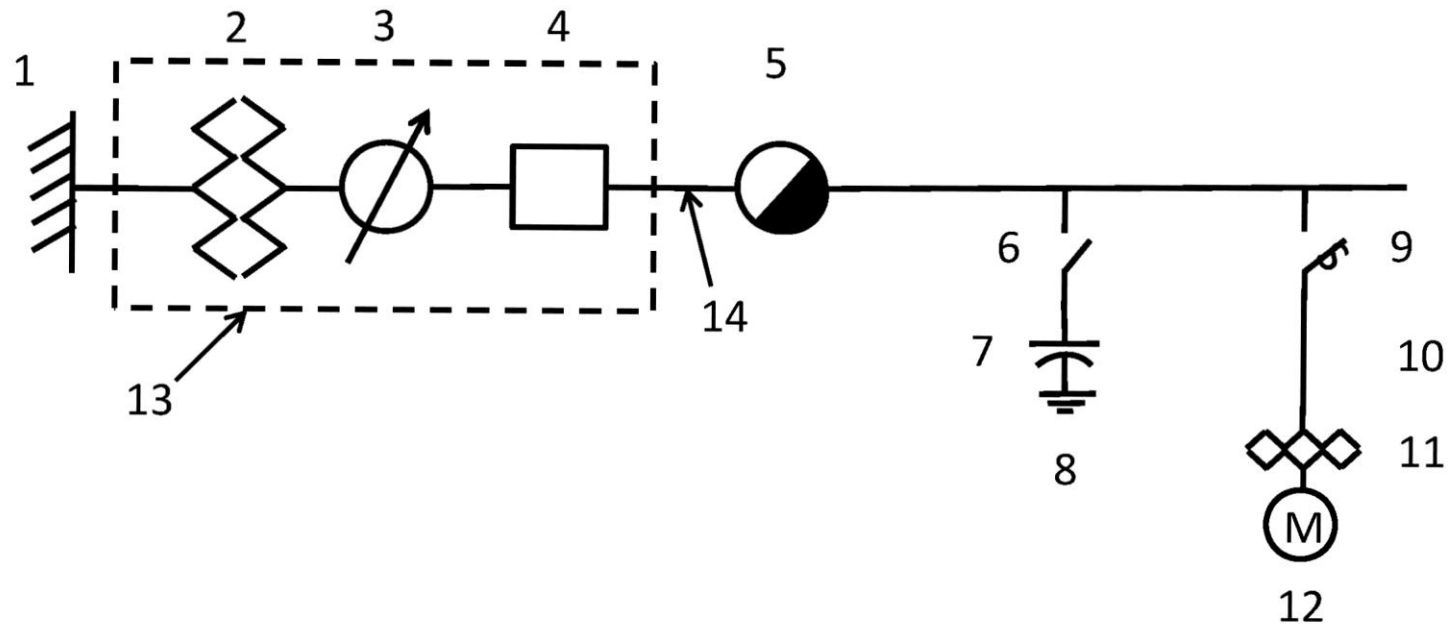


Harmonization Example

1. Map MultiSpeak web service methods to WG14 CIM messages.
2. Compare WG14 and MultiSpeak data payloads for each use case step. **Compare MultiSpeak Connectivity and CIM NetworkDataSet payloads**
3. Create electronic data payload transformation.
4. Create adapter layer to handle data transformation and messaging conversion.



Sample Distribution Circuit



Basic Differences

- MultiSpeak can handle section-oriented or node oriented models; CIM uses nodes.
- CIM can have terminals associated with nodes; MultiSpeak does not have terminals.
- MultiSpeak does not explicitly model ground.
 - One terminal devices have an implied ground.
 - Three terminal devices are modeled with two terminals and implied ground.



MultiSpeak and CIM Equivalence

Power System Element	MultiSpeak Object	NetworkDataSet Object
1) Equivalent source	Included in Substation object.	EnergySource
2) Power transformer	TransformerBank (containing one or more Transformer units)	PowerTransformer (containing two or more Windings)
3) Voltage regulator	Regulator	Modeled as a PowerTransformer with a TapChanger and RegulationSchedule .
4) Breaker	OvercurrentDeviceBank (containing breaker object(s))	Breaker
5) Recloser	Recloser	Modeled as a Breaker with RecloserProperties .
6) Switch	SwitchDeviceBank (containing Switch units).	Switch
7) Shunt capacitor bank	CapacitorBank	ShuntCompensator
8) Ground	Assumed to be part of CapacitorBank .	Ground
9) Fuse	OvercurrentDeviceBank with (Fuse objects)	Fuse
10) Single phase distribution line	ohPrimaryLine or ugPrimaryLine as appropriate.	ACLLineSegment
11) Distribution transformer	TransformerBank (containing one or more Transformer units).	PowerTransformer (containing two or more Windings)
12) Customer service location	ServiceLocation	ServiceDeliveryPoint
13) Substation	Substation	Substation
14) Three phase distribution feeder	FeederObject in substation. Upon leaving the substation, the line is modeled as a set of ohPrimaryLine or ugPrimayLine objects which model line sections between connectivity nodes.	Circuit in substation. Upon leaving the substation, the line is modeled as a set of ACLLineSegments (also called CircuitSections) between connectivity nodes.

Fuse Equivalence – Peeling the Onion

- 1. CIM Fuse contains more than MultiSpeak fuse**
 - Equivalent is MultiSpeak **overcurrentDeviceBank** containing **fuse** units.
- 2. MultiSpeak overcurrentDeviceBank contains more than a CIM Fuse**
 - Missing parts are in **SwitchProperties** child of the **Fuse**.
- 3. CIM Fuse w/ SwitchProperties has more than MultiSpeak OCD w/ fuses**
 - Missing parts are in **eaEquipment** catalog



Steps in Harmonization

1. Map MultiSpeak web service **methods** to WG14 CIM **messages** (use case steps).
2. Compare WG14 and MultiSpeak data payloads for each use case step.
3. **Create electronic data payload transformation.**
4. Create adapter layer to handle data transformation and messaging conversion.





- core
- aggr
 - avg
 - cour
 - max
 - min
 - strinv
 - sum
- com
 - book
 - numi
 - strinv
- logic
 - equa
 - equa
 - equa
 - grea
 - less
 - logic
 - logic
 - not-e
- mat
 - add
 - ceilir
 - divid
 - floor
 - modk
 - multij
 - roun
 - subti

M:SwitchDeviceBank

- objectID
- verb
- errorString
- replaceID
- utility
- m:extension
- m:comments
- m:extensionList
- m:mapLocation This is a geog
- m:gridLocation This is a stili
- m:rotation Rotation angle for
- m:facilityID Utility string des
- m:graphicSymbol
- m:annotationList
- m:sectionID This is a same thi
- m:parentSectionID This spec
- m:fromNodeID This is the vor
- m:toNodeID This is mber sion
- m:phaseCode
- m:load
- m:ganged True if all phases
- m:partner If switches are imple
- m:loadPoint is section a load all
- m:m:SwitchDeviceList
 - m:m:SwitchingDevice
 - m:breaker
 - m:fuse
 - objectID
 - verb
 - errorString
 - replaceID
 - utility
 - m:extension
 - m:comments
 - m:extensionList
 - m:equipment Description
 - m:facilityID Utility facility id
 - m:phase
 - m:position

NetworkDataSet

- Fuse As one circuit protective device with a circuit
- cim:RID A Model Authority issues m:RIDs. Glean
- cim:name The name is a free text (max readable
- cim:localName The localName is a (max readable
- cim:pathName The pathName is a system (single
- cim:aliasName The aliasName is the text (max r
- cim:description The description is a free (max r
- cim:phase Describes the phases carried by a con
- cim:normalOpen The attribute is used in cases wh
- cim:switchOnCount The switch on counts (the th
- cim:switchOnDate The date and time when the sw
- cim:ampRating Fault interrupting rating in amper
- SwitchAsset The physical asset performing Swa
- SwitchTypeAsset Documentation for a geotri
- BaseVoltage Collection of base voltages with
- ConnectivityNode Connectivity nodes are poin
- cim:RID A Model Authority issues m:RIDs. Glean
- cim:name The name is a free text (max readable
- cim:localName The localName is a (max readable
- cim:pathName The pathName is a system (single
- cim:aliasName The aliasName is the text (max r
- cim:description The description is a free (max r
- Terminal As electrical connection point to a p
- Terminal As electrical connection point to a p
- Bay A collection of power system resources (with
- VoltageLevel A collection of equipment at one c
- Substation A collection of equipment for purpo
- Organization This class is used to identify orga
- PSRStatus The current status of the PowerSyst
- PSRType Classifying instances of the same clas
- CircuitSection A section of circuit located betw
- ChangeItem The change type (add, delete, mod
- Measurement A Measurement represents any

Mapping Database Query Output

SwitchDeviceBank2CIMFuse.mfd*

Overview

Messages

Steps in Harmonization

1. Map MultiSpeak web service **methods** to WG14 CIM **messages** (use case steps).
2. Compare WG14 and MultiSpeak data payloads for each use case step.
3. Create style sheet data payload transformation.
4. Create adapter layer to handle data transformation and messaging conversion.



Conclusions

- CIM and MultiSpeak are both complete, consistent data models for distribution modeling
- There are stylistic differences reflecting the needs and perspectives of the modelers
- The models are symantically and topologically equivalent
- It is possible to electronically convert payloads between the data models
- The two data models can co-exist if desirable



For More Information

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