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

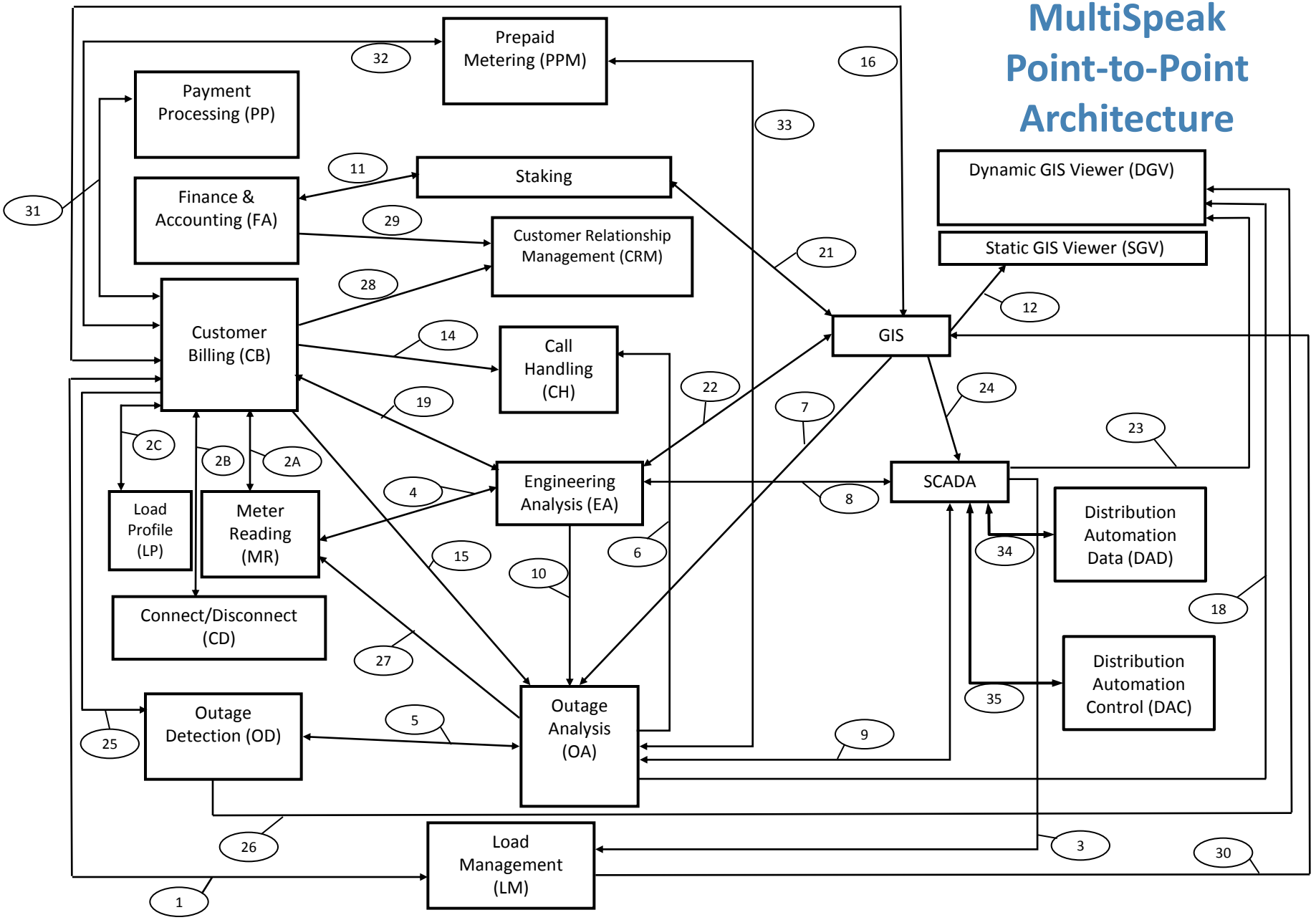
- Developed by NRECA in collaboration with key industry vendors
- Covers applications of interest to distribution utilities; currently doesn't include power scheduling or generation
- Standard is mature, but scope is continuing to grow
- In use at over 200 utilities
- Mature interoperability testing 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

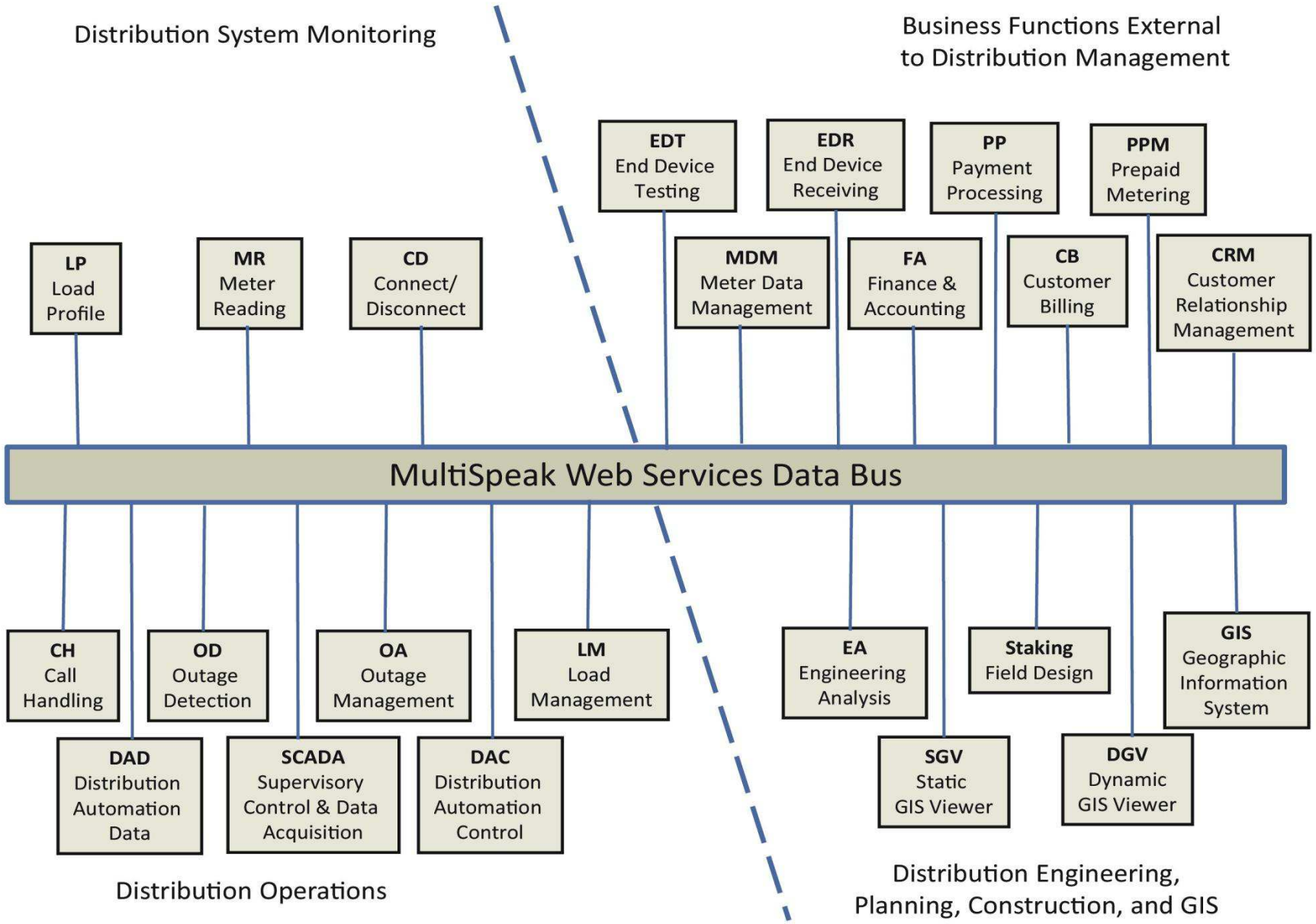
CIM with Distribution Extensions

- 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

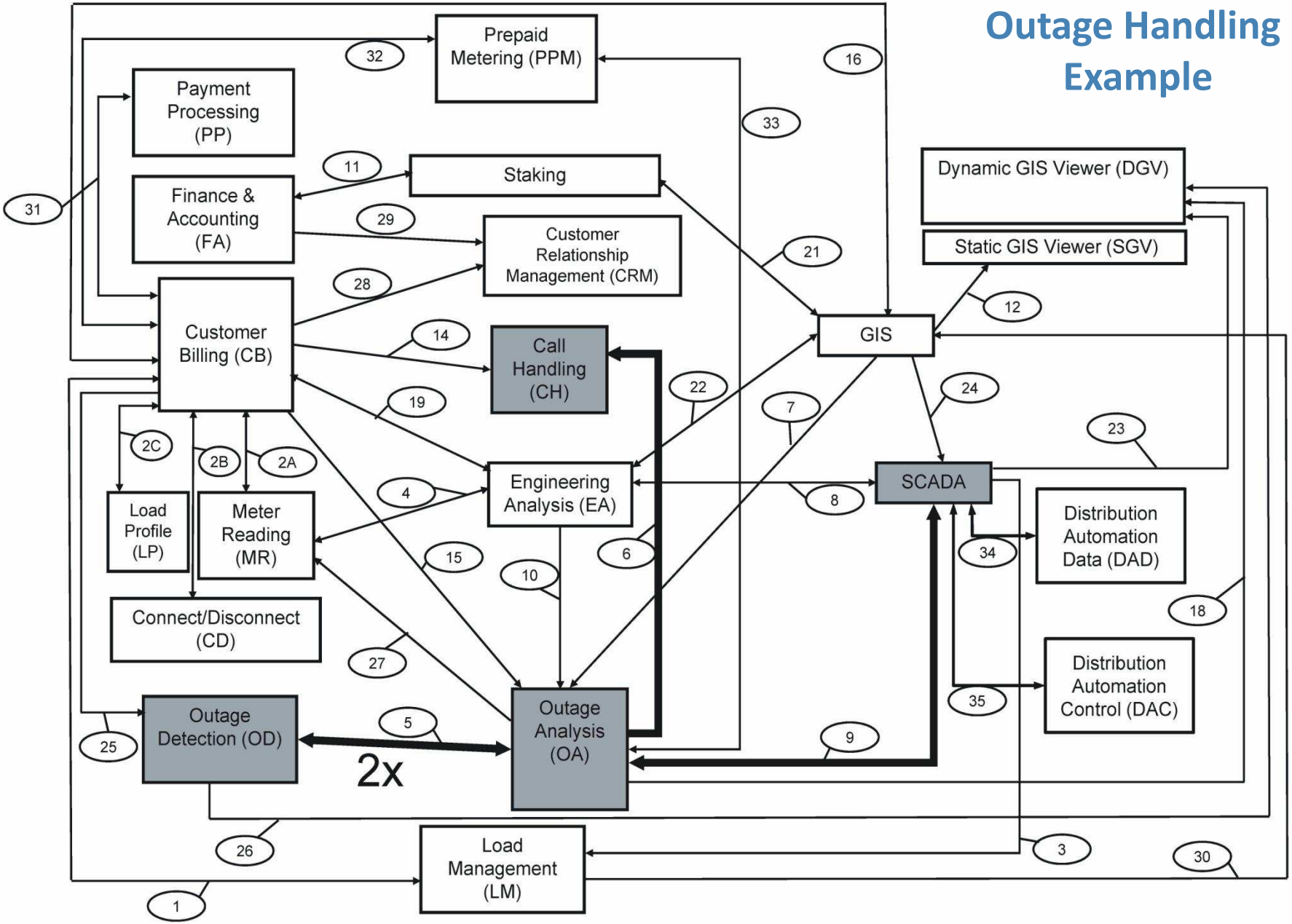
MultiSpeak Point-to-Point Architecture



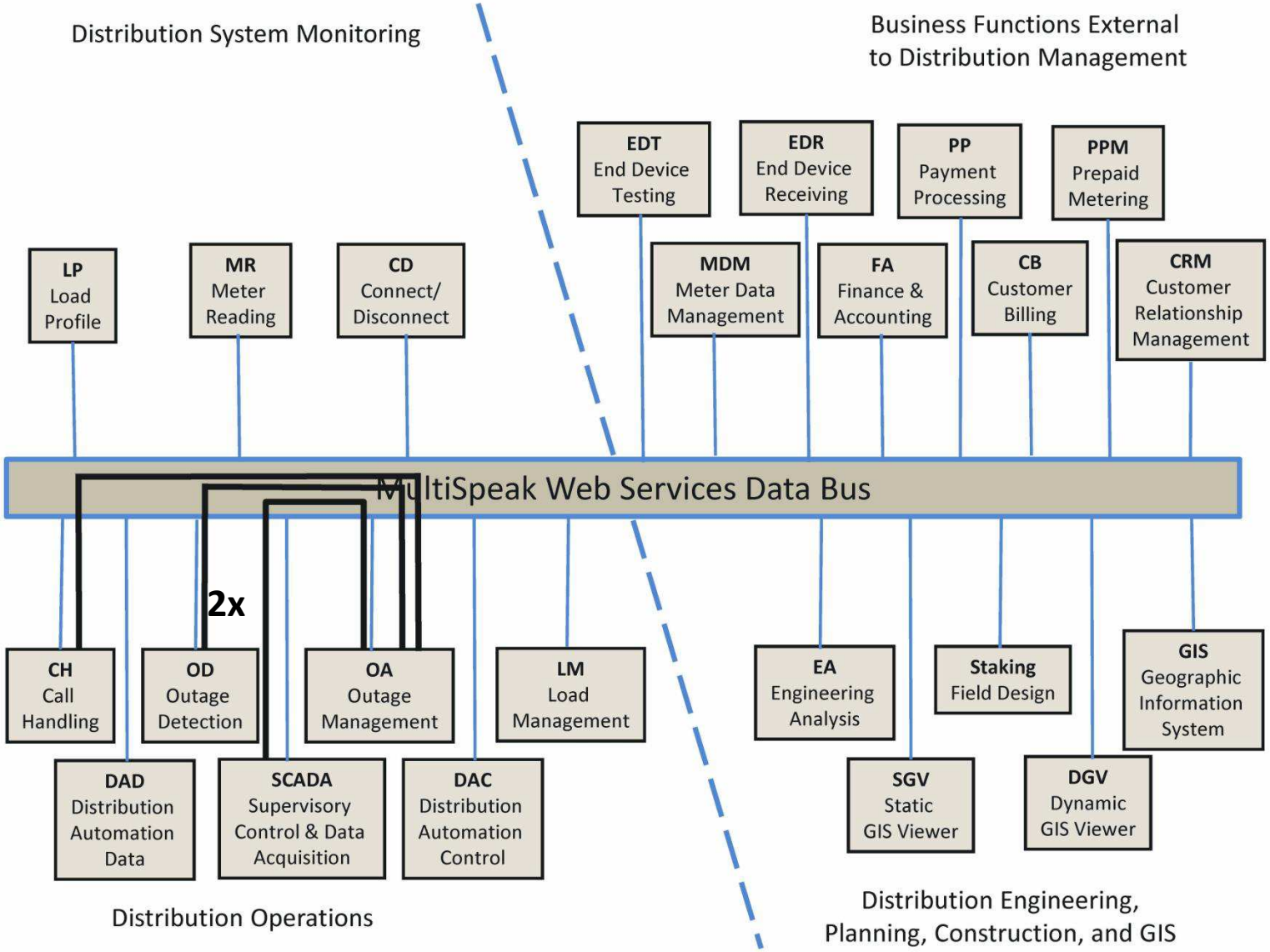
MultiSpeak Services Bus Architecture



Point-to-Point Outage Handling Example



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.
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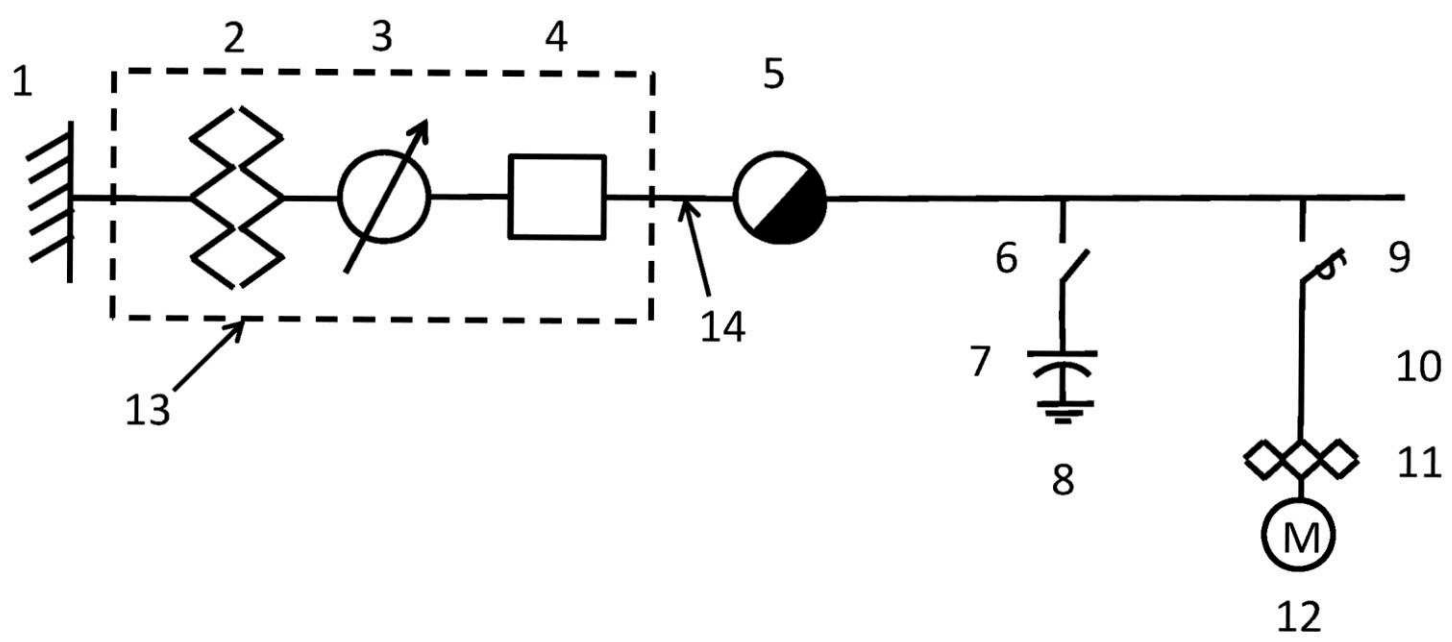
Harmonization Example

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.	**ACLineSegment**
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 **ACLineSegment**s (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).
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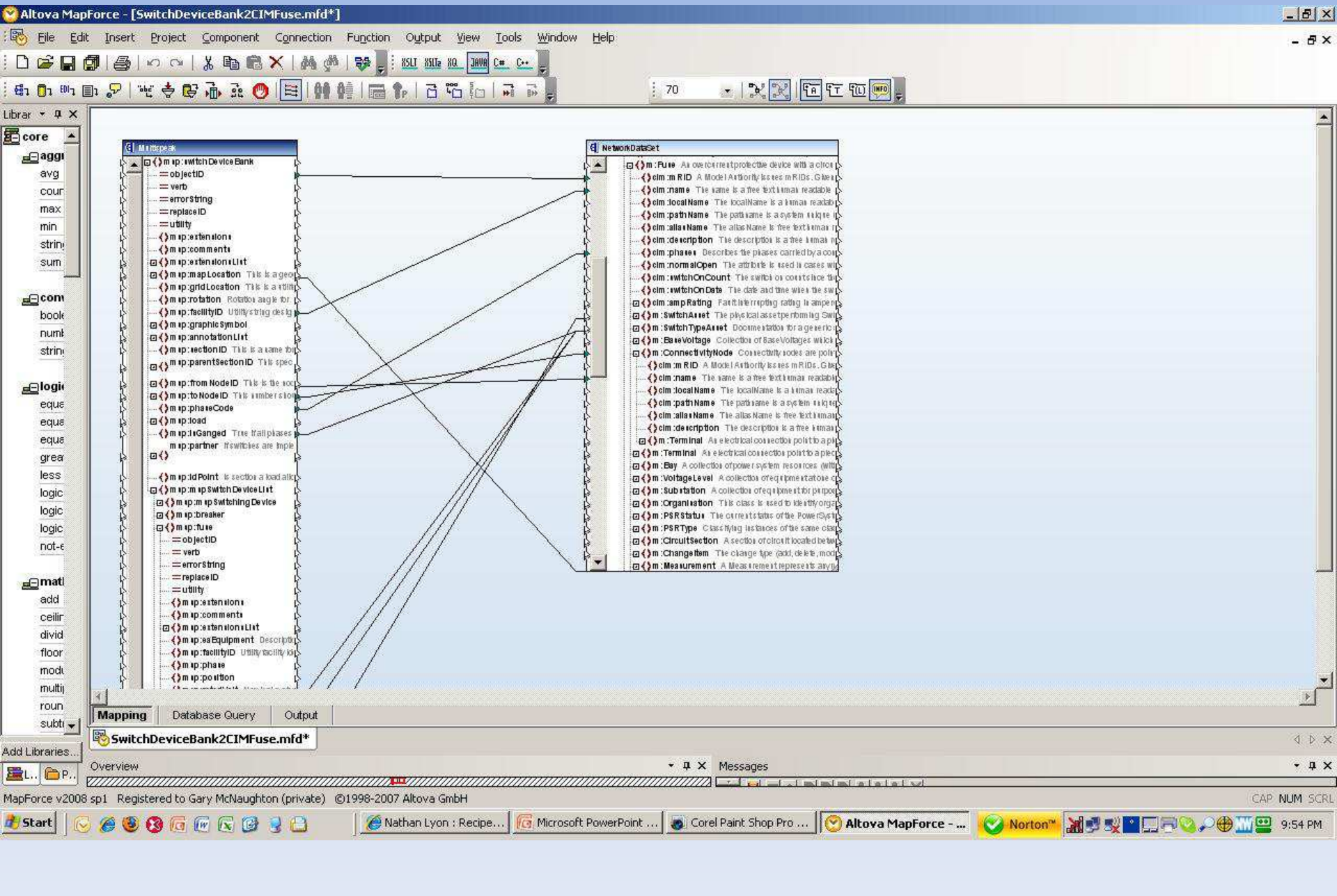
3. Create electronic data payload transformation.
4. Create adapter layer to handle data transformation and messaging conversion.


Altova MapForce - [SwitchDeviceBank2CIMFuse.mfd*]
File Edit Insert Project Component Connection Function Output View Tools Window Help
Multispeak
mp:switchDeviceBank
objectID
verb
errorString
replaceID
utility
mp:extension
mp:comments
mp:extensionList
mp:mapLocation
mp:gridLocation
mp:rotation
mp:facilityID
mp:graphicSymbol
mp:annotationList
mp:sectionID
mp:parentSectionID
mp:fromNodeID
mp:toNodeID
mp:phaseCode
mp:load
mp:isGanged
mp:partner
mp:idPoint
mp:mpSwitchDeviceList
mp:mpSwitchingDevice
mp:breaker
mp:fuse
objectID
verb
errorString
replaceID
utility
mp:extension
mp:comments
mp:extensionList
mp:aEquipment
mp:facilityID
mp:phase
mp:position
NetworkDataSet
m:Fuse
cim:mRID
cim:name
cim:localName
cim:pathName
cim:aliasName
cim:description
cim:phases
cim:normalOpen
cim:switchOnCount
cim:switchOnDate
cim:ampRating
m:SwitchAsset
m:SwitchTypeAsset
m:BaseVoltage
m:ConnectivityNode
cim:mRID
cim:name
cim:localName
cim:pathName
cim:aliasName
cim:description
m:Terminal
m:Terminal
m:Bay
m:VoltageLevel
m:Substation
m:Organisation
m:PSRStatus
m:PSRType
m:CircuitSection
m:ChangeItem
m:Measurement
Mapping
Database Query
Output
SwitchDeviceBank2CIMFuse.mfd*
Overview
Messages
MapForce v2008 sp1 Registered to Gary McNaughton (private) ©1998-2007 Altova GmbH
CAP NUM SCRL
Start
Nathan Lyon : Recipe...
Microsoft PowerPoint ...
Corel Paint Shop Pro ...
Altova MapForce - ...
Norton™
9:54 PM

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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