Karlsruher Institut für Technologie

Common Information model (CIM)

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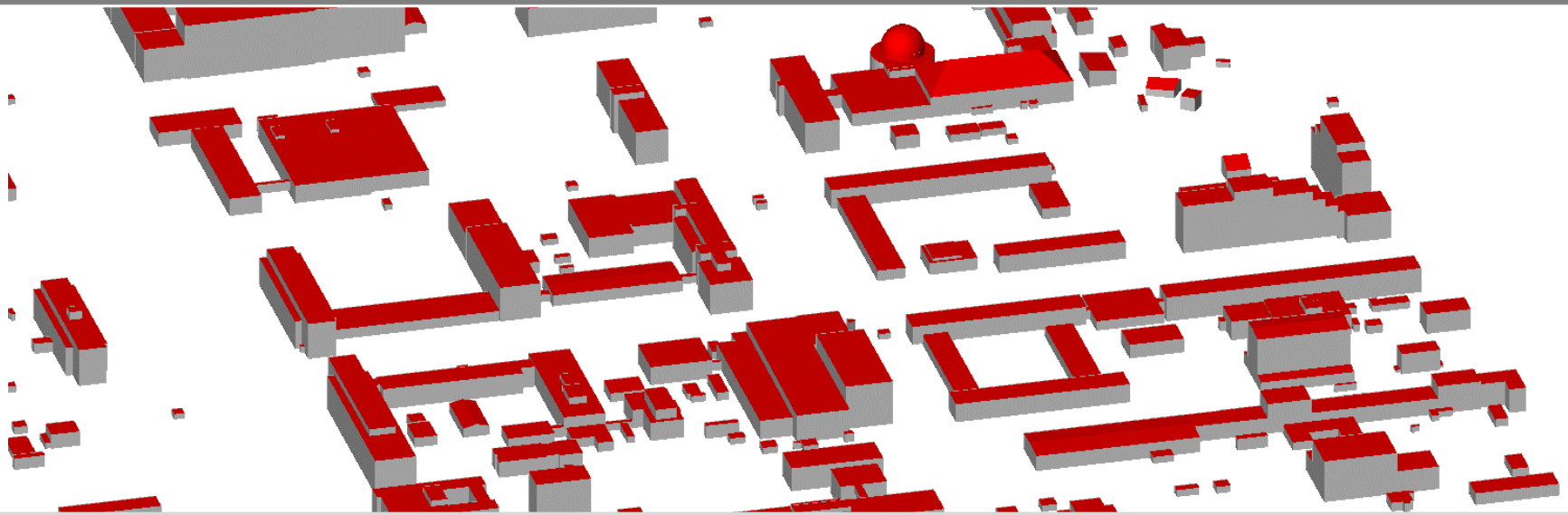


Agenda

- Overview, general characteristics
- Model overview and model structure
  - Class hierarchy
  - Conducting elements
  - Wires
- Topology concept
- Spatial relationship
- Summary

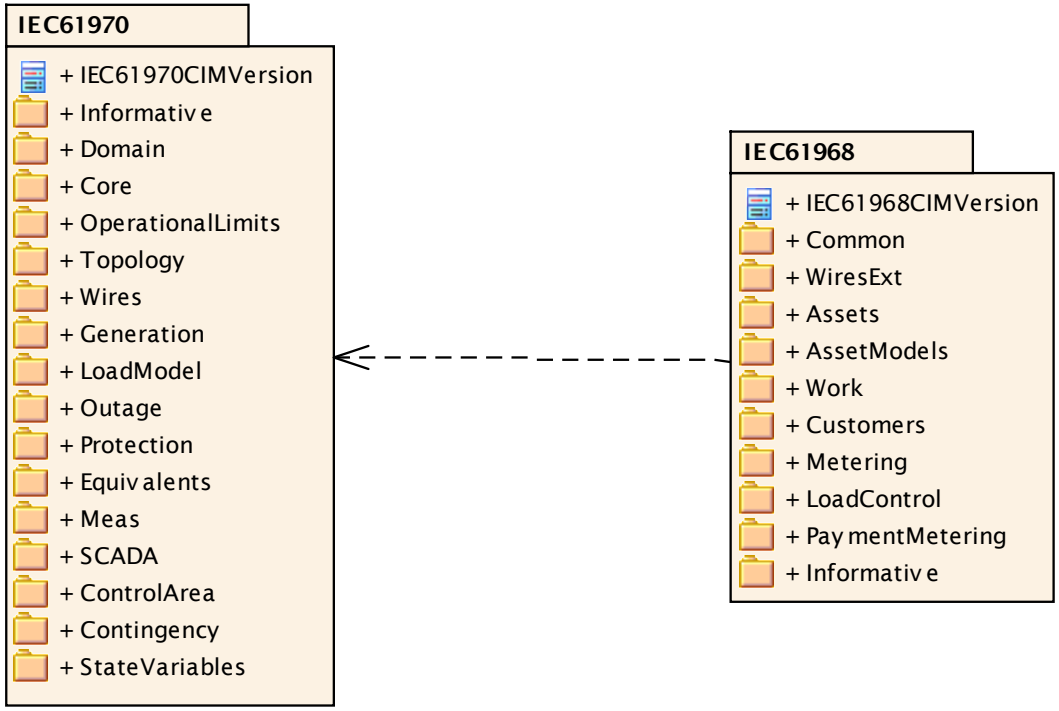
Overview CIM– 1

- Model type
  - Conceptual data model represented in UML
  - An encoding of the complete model does not exist
- Application range
  - Modeling of electricity networks, including information on power system components and their relations, Energy Management Systems (EMS), Supervisory Control and Data Acquisition (SCADA) systems, planning and optimization, asset management, work schedules, payment metering, customer information systems and enterprise resource planning
- Responsible organization
  - International Electrotechnical Commission (IEC), TC57, WG14
    - IEC 61970-301 (Base package)
    - IEC 61968-11 (Extension)
  - Adopted by European und German National standards

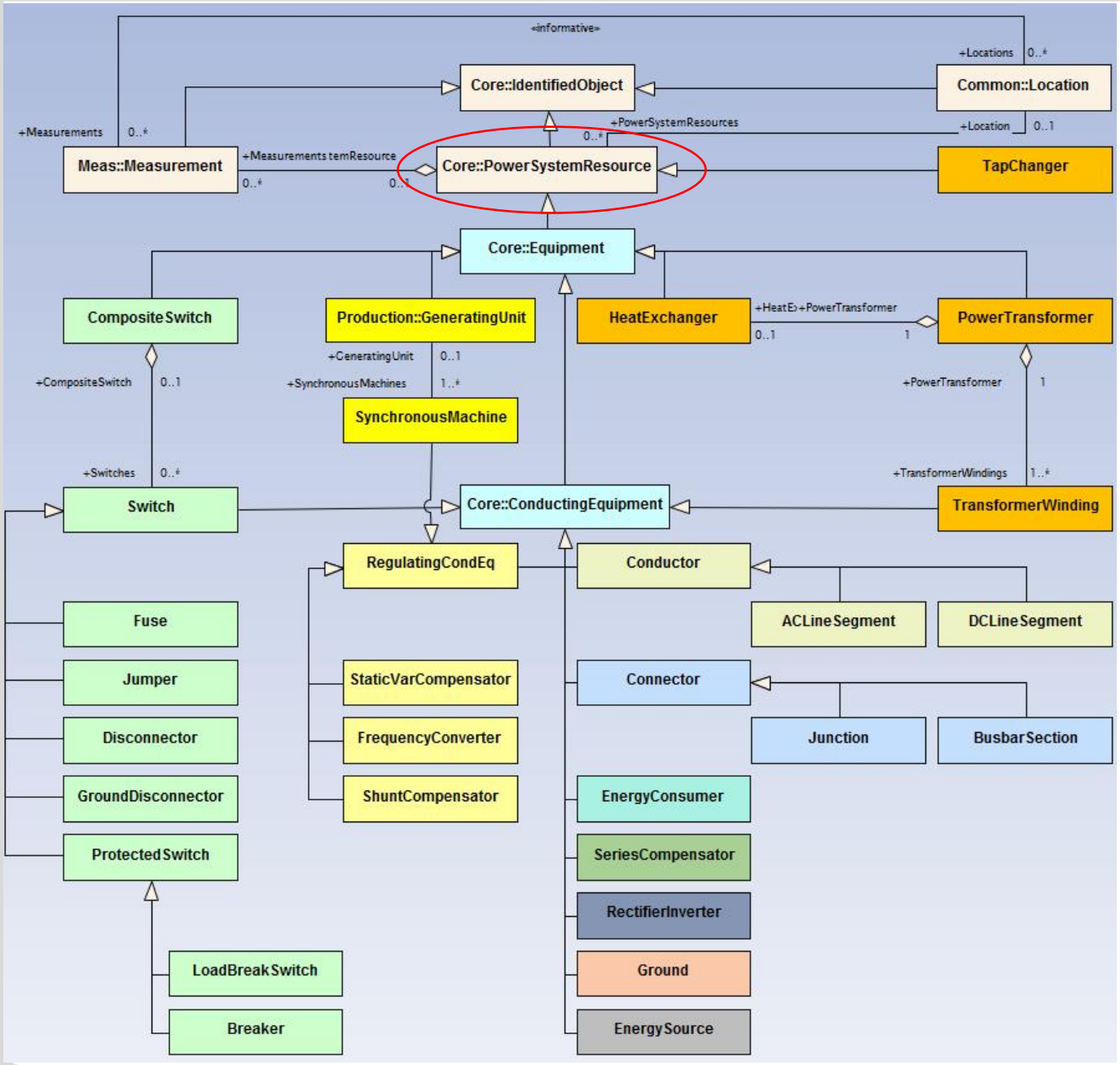
Overview CIM – 2

- CIM profiles
  - CIM normally is not used and encoded as a whole.
  - Specific profiles, targeted to certain application ranges, have been defined
    - IEC 61970-452 (USA, electricity transmission)
    - ENTSO-E (Europe, electricity transmission)
    - IEC 61968-13 (Europe, electricity distribution)
    - …
  - Different types of encodings are used (RDF, XML-Schema)
  - Users can generate own encodings, which is supported by freely available EA-Tools
- Documentation
  - Integrated into the UML model
  - Lots of books, documents, reports, internet resources …
  - CIM primer (Technical report EPRI)

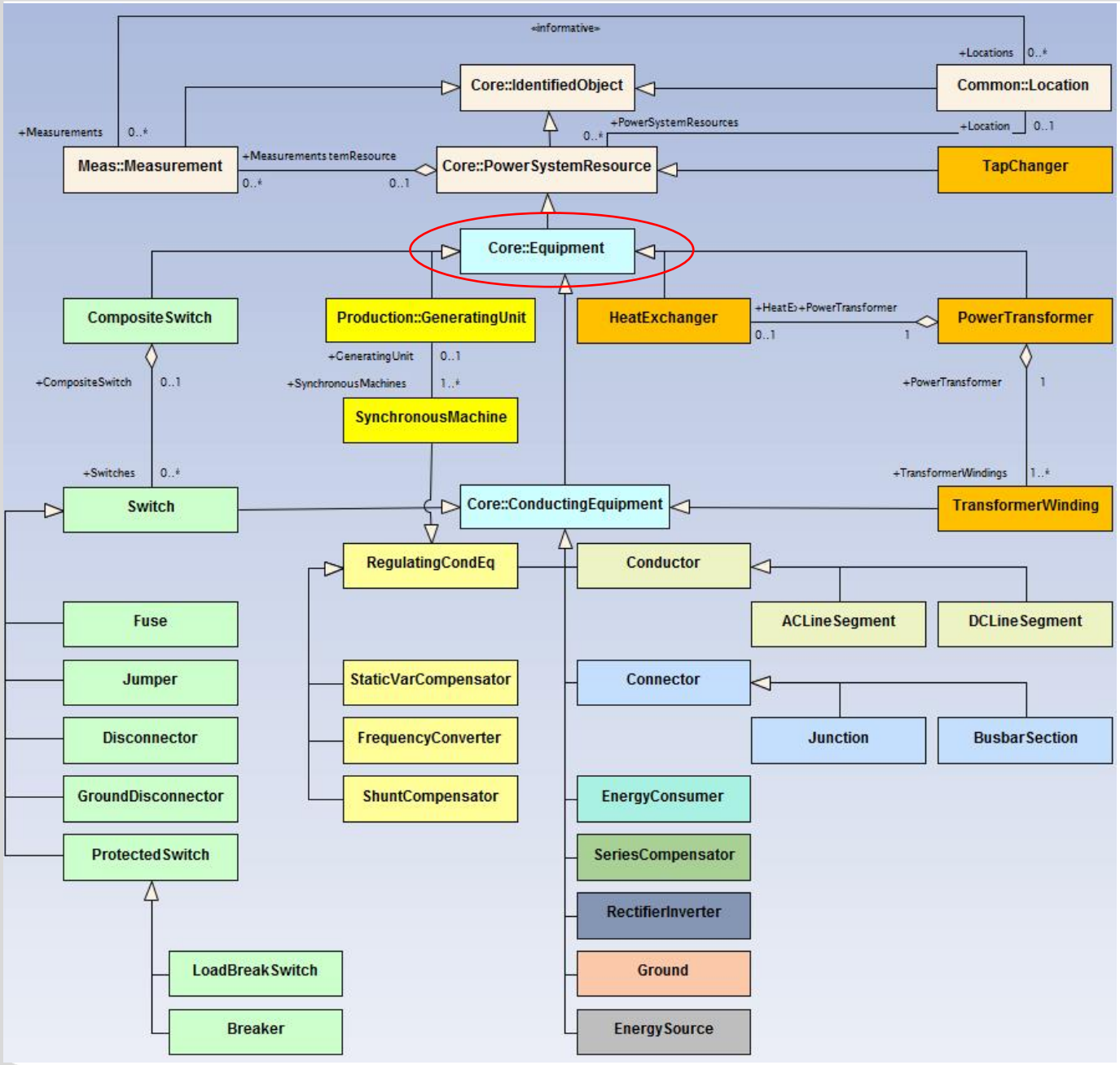
Model overview



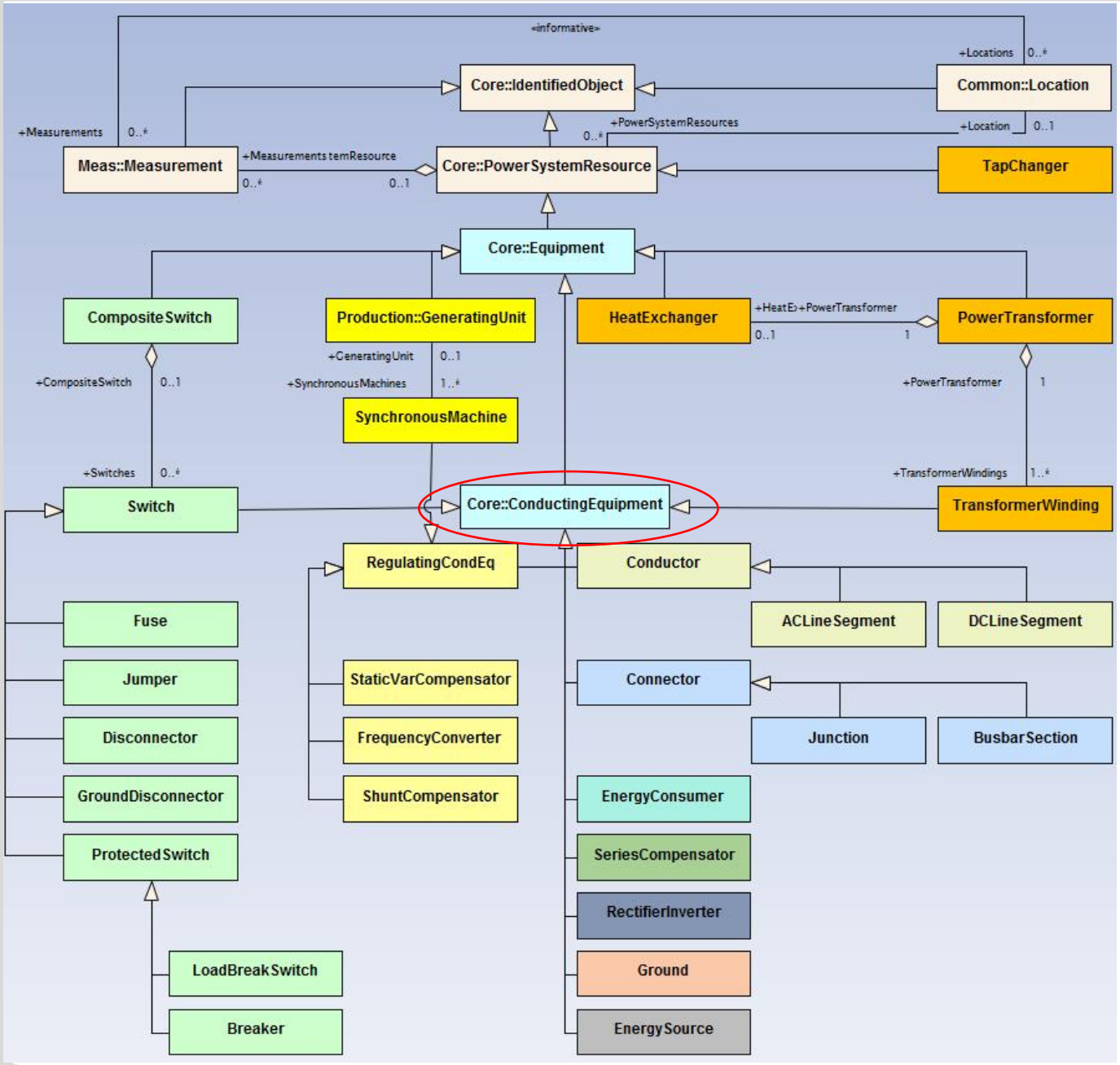
716 UML Elements (including „informative“ packages)



A power system resource can be an item of equipment such as a Switch, an EquipmentContainer containing many individual items of equipment such as a Substation, or an organisational entity such as Company or SubControlArea.

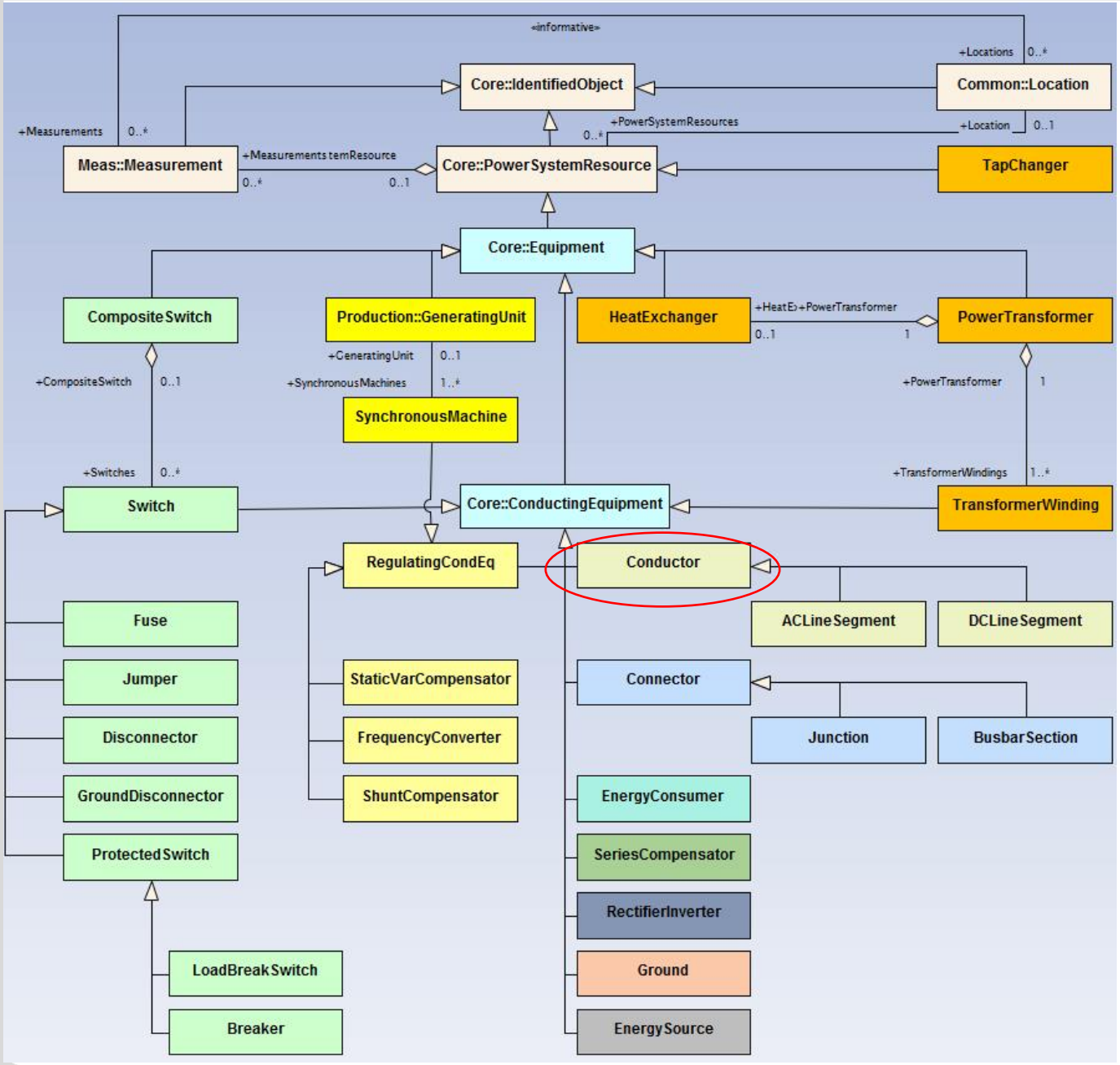


The parts of a power system that are physical devices, electronic or mechanical

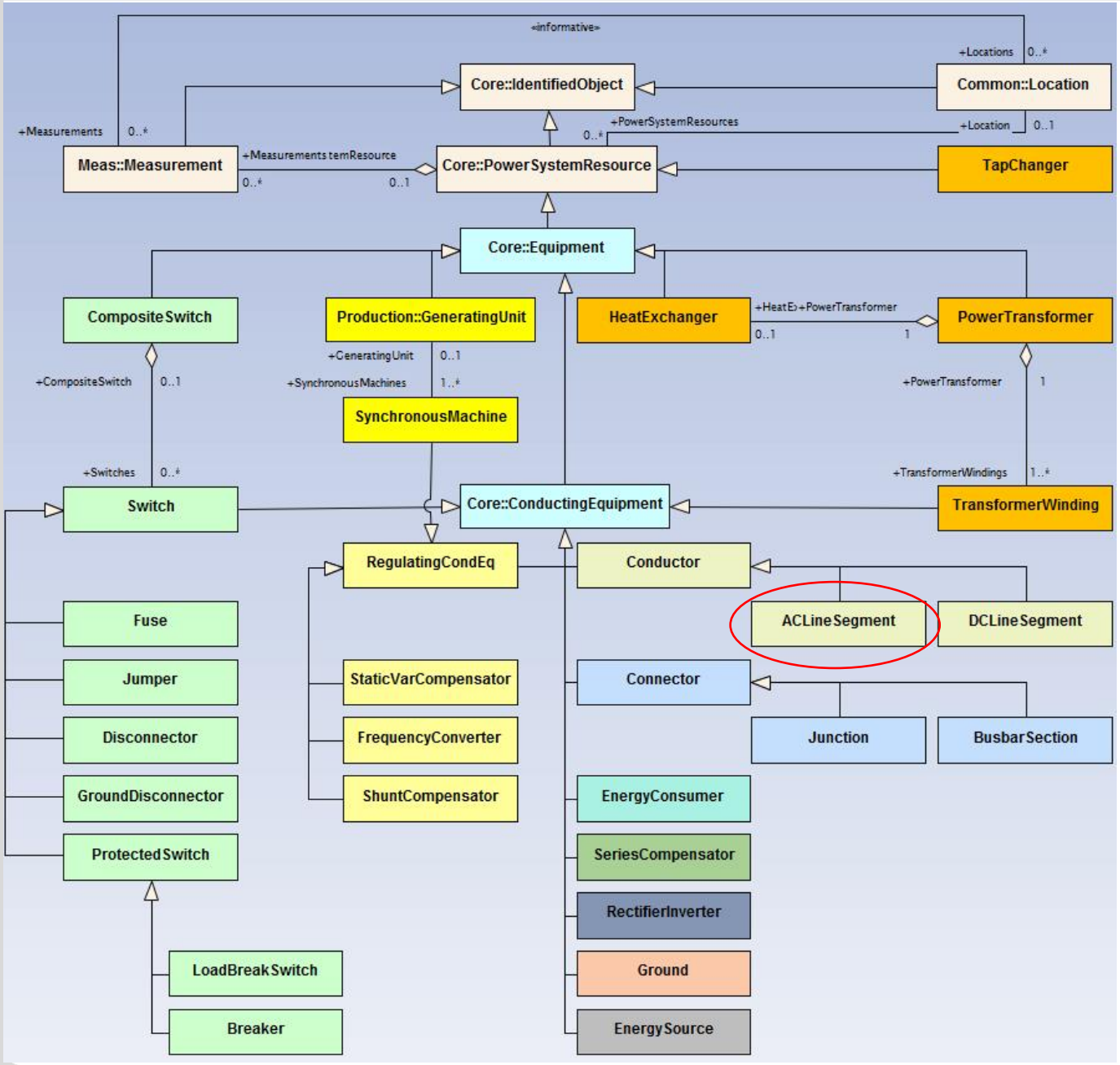


The parts of the power system that are designed to carry current or that are conductively connected therewith. ConductingEquipment is contained within an EquipmentContainer that may be a Substation, or a VoltageLevel or a Bay within a Substation.

Name	Type
cim:IdentifiedObject.mRID [0..1]	String
cim:IdentifiedObject.name [0..1]	String
cim:IdentifiedObject.localName [0..1]	String
cim:IdentifiedObject.pathName [0..1]	String
cim:IdentifiedObject.aliasName [0..1]	String
cim:IdentifiedObject.description [0..1]	String
cim:IdentifiedObject.ModelingAuthoritySet [0..1]	ModelingAuthoritySet
cim:PowerSystemResource.OperatingShare [0..*]	OperatingShare
cim:PowerSystemResource.PsrLists [0..*]	PsrList
cim:PowerSystemResource.PSRType [0..1]	PSRType
cim:PowerSystemResource.OutageSchedule [0..1]	OutageSchedule
cim:PowerSystemResource.Measurements [0..*]	Measurement
cim:PowerSystemResource.ReportingGroup [0..*]	ReportingGroup
cim:PowerSystemResource.PSREvent [0..*]	PSREvent
cim:PowerSystemResource.SafetyDocuments [0..*]	SafetyDocument
cim:PowerSystemResource.ChangeItems [0..*]	ChangeItem
cim:PowerSystemResource.CircuitSections [0..*]	CircuitSection
cim:PowerSystemResource.ScheduleSteps [0..*]	SwitchingStep
cim:PowerSystemResource.NetworkDataSets [0..*]	NetworkDataSet
cim:PowerSystemResource.ErpOrganisationRoles [0..*]	OrgPsrRole
cim:PowerSystemResource.DocumentRoles [0..*]	DocPsrRole
cim:PowerSystemResource.Assets [0..*]	Asset
cim:PowerSystemResource.Location [0..1]	Location
cim:Equipment.normallyInService [0..1]	Boolean
cim:Equipment.aggregate [0..1]	Boolean
cim:Equipment.EquipmentContainer [0..1]	EquipmentContainer
cim:Equipment.OperationalLimitSet [0..*]	OperationalLimitSet
cim:Equipment.ContingencyEquipment [0..*]	ContingencyEquipment
cim:Equipment.CustomerAgreements [0..*]	CustomerAgreement
cim:ConductingEquipment.phases [0..1]	PhaseCode
cim:ConductingEquipment.BaseVoltage [0..1]	BaseVoltage
cim:ConductingEquipment.Terminals [0..*]	Terminal
cim:ConductingEquipment.ProtectionEquipments [0..*]	ProtectionEquipment
cim:ConductingEquipment.ClearanceTags [0..*]	ClearanceTag
cim:ConductingEquipment.SvStatus [0..1]	SvStatus
cim:ConductingEquipment.ElectricalAssets [0..*]	ElectricalAsset
cim:ConductingEquipment.OutageStepRoles [0..*]	OutageStepPsrRole



Combination of conducting material with consistent electrical characteristics, building a single electrical system, used to carry current between points in the power system

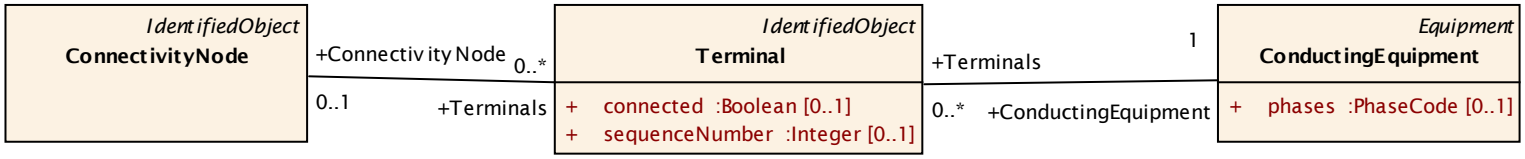


A wire or combination of wires, with consistent electrical characteristics, building a single electrical system, used to carry alternating current between points in the power system.

ACLineSegment properties

cim:Conductor.length [0..1]	Length
cim:ACLineSegment.b0ch [0..1]	Susceptance
cim:ACLineSegment.bch [0..1]	Susceptance
cim:ACLineSegment.g0ch [0..1]	Conductance
cim:ACLineSegment.gch [0..1]	Conductance
cim:ACLineSegment.r [0..1]	Resistance
cim:ACLineSegment.r0 [0..1]	Resistance
cim:ACLineSegment.x [0..1]	Reactance
cim:ACLineSegment.x0 [0..1]	Reactance

Network topology



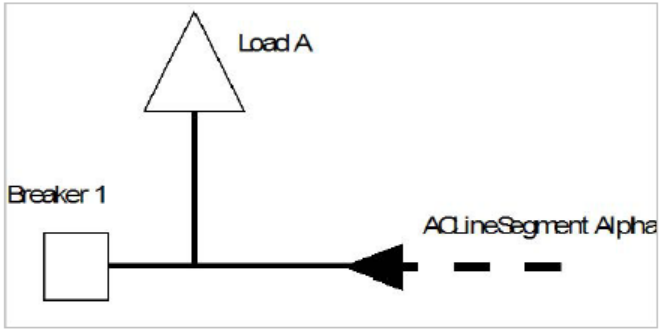


Figure 5-5
Connectivity Example Circuit

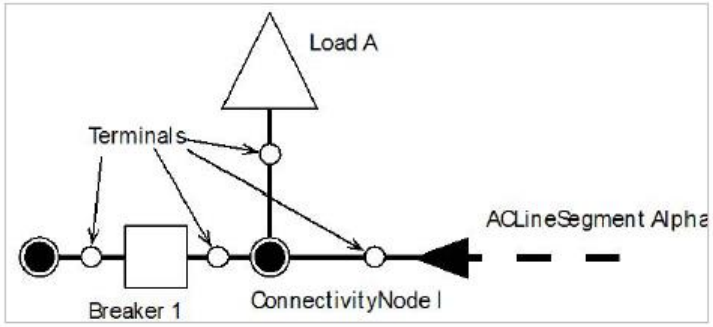
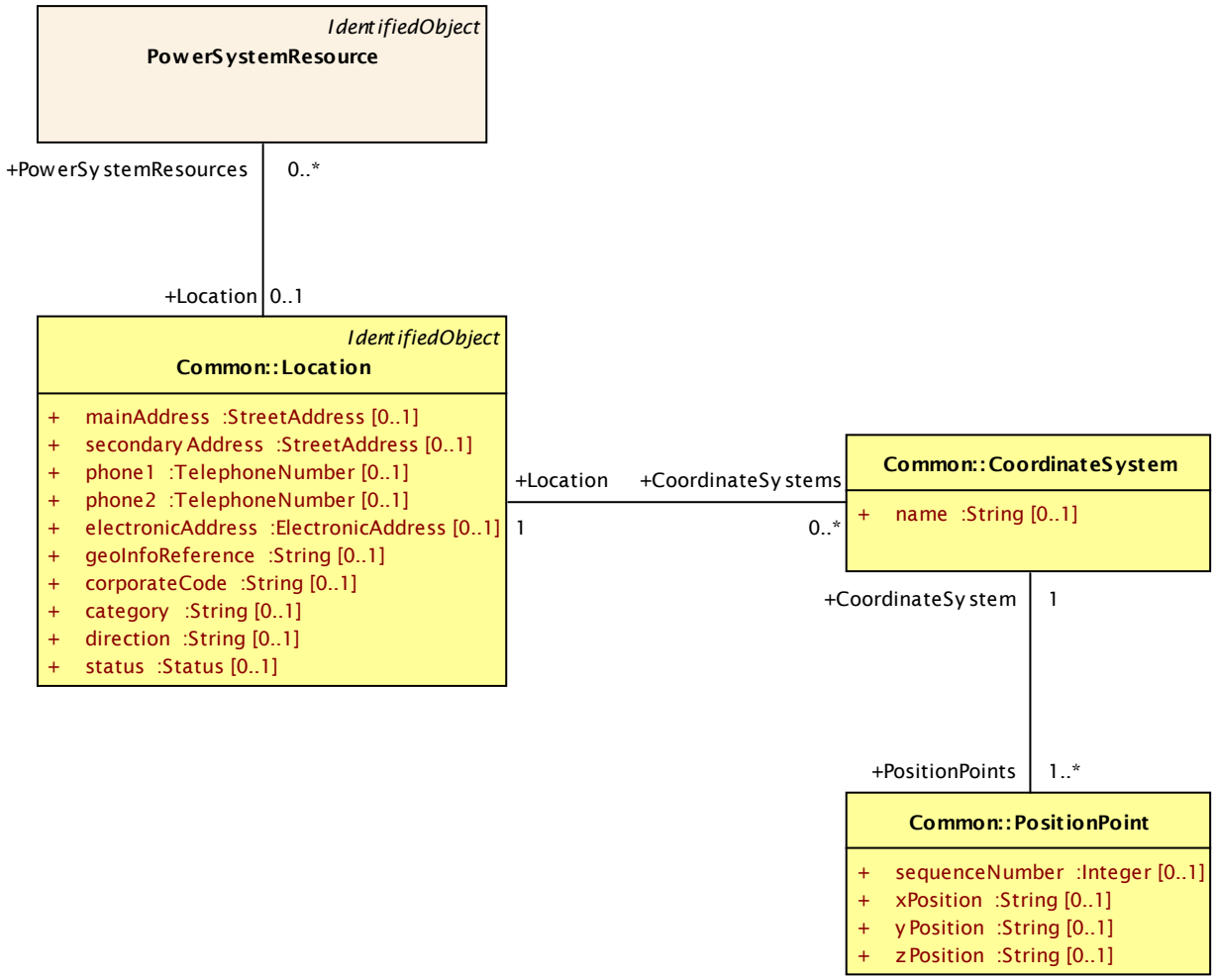


Figure 5-10
Connectivity Example Circuit with Additional Breaker Terminal

from: EPRI Common Information Model Primer, Third Edition

Georeference, geometric representations



Summary

- CIM is a very comprehensive data model dealing with all aspects of electric power systems, including electricity networks
- CIM (at least at the moment) is not suited for other types of energy networks like, e.g. gas or district heating networks
- CIM is used in form of various profiles, for which dedicated software tools exist
- The model explicitly represents a lot of electrical devices with numerous physical and non-physical properties
- A powerful concept for representing the network topology, similar to IFC, is provided
- The spatial representation of the components is very simple and restricted to point and line geometry