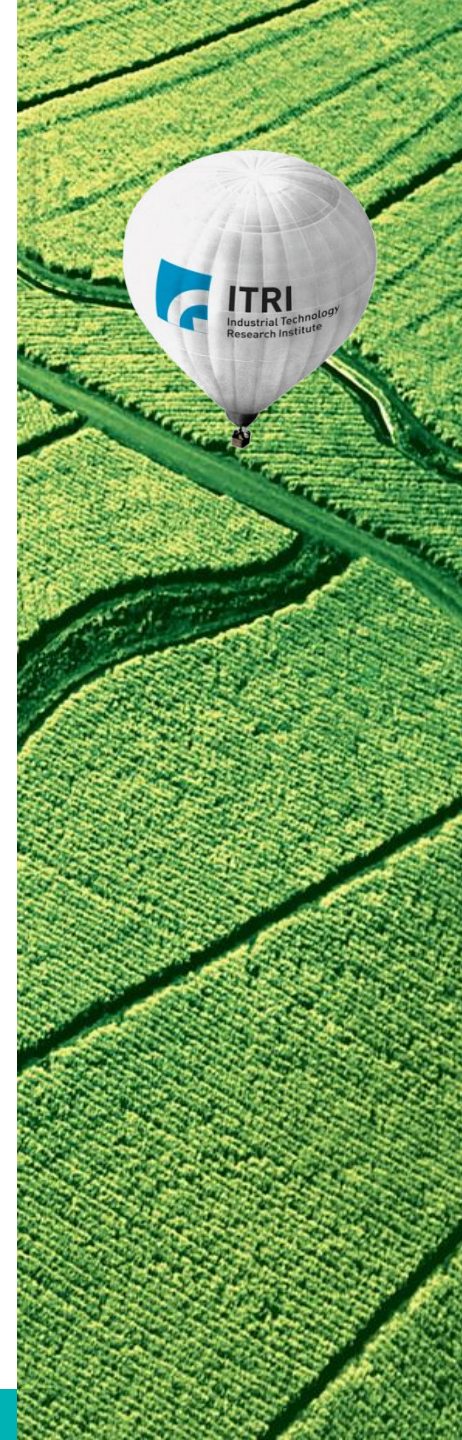


# 工業技術研究院

Industrial Technology  
Research Institute

## 智慧電網圖形交換之CIM應用

電網與自動化研究室  
電網與電力電子技術組  
綠能與環境研究所  
工業技術研究院



# Agenda

- 研究與實作成果
- IEC 61970-453
- CIM UML to Program Library
- Custom Format to Standard RDF
- 資料庫應用
- 可視化研究與實作

# 研究與實作成果

電力單線圖



Database

**CIM UML Model File**

(iec61970cim17v38\_iec61968  
cim13v13\_iec62325cim03v17  
a.eap)

Python

C#

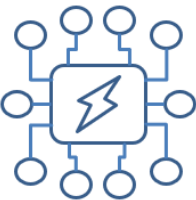
Java

Java  
Script

Custom Format

Standard RDF

電力單線圖

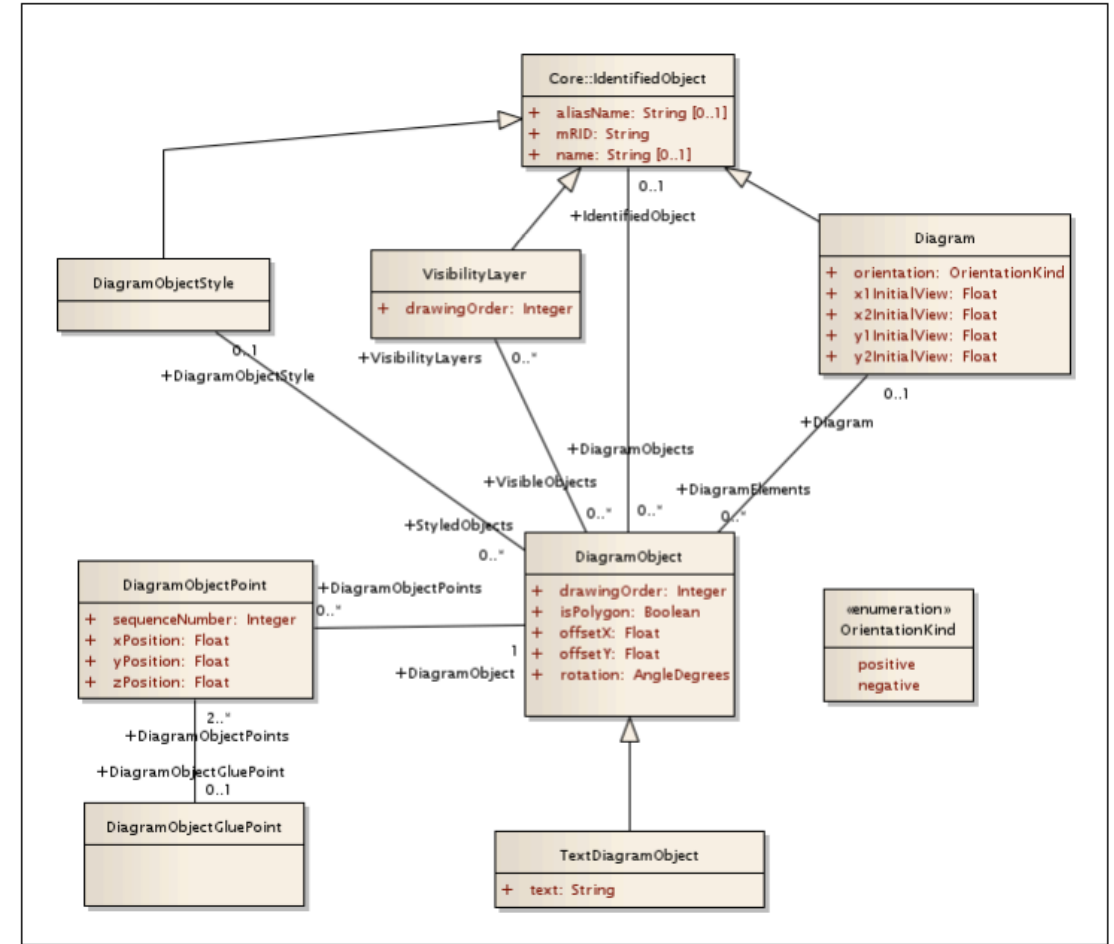


電力單線圖



# IEC 61970-453

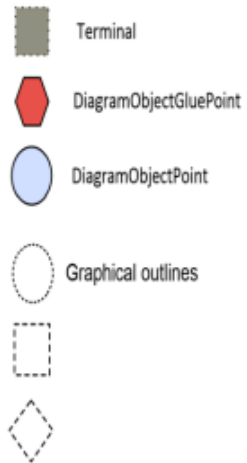
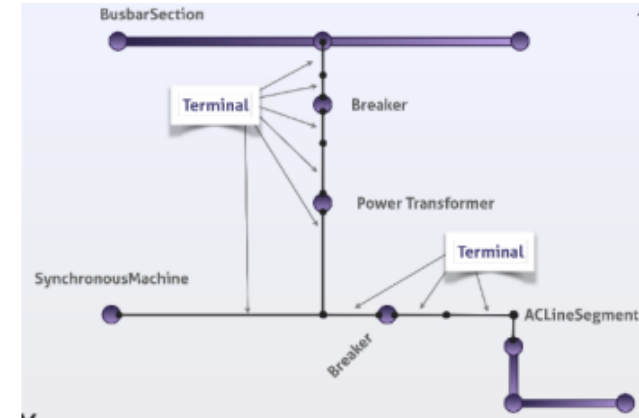
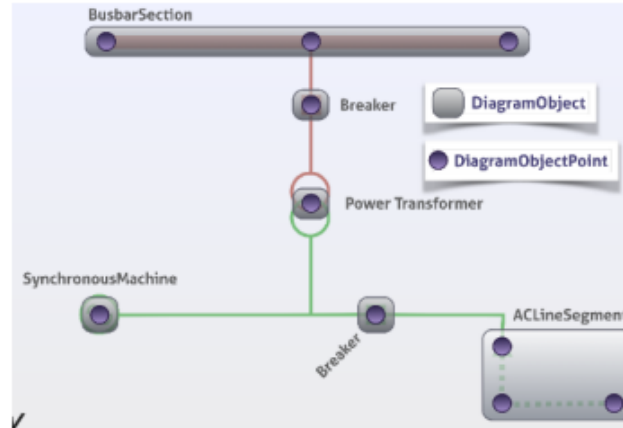
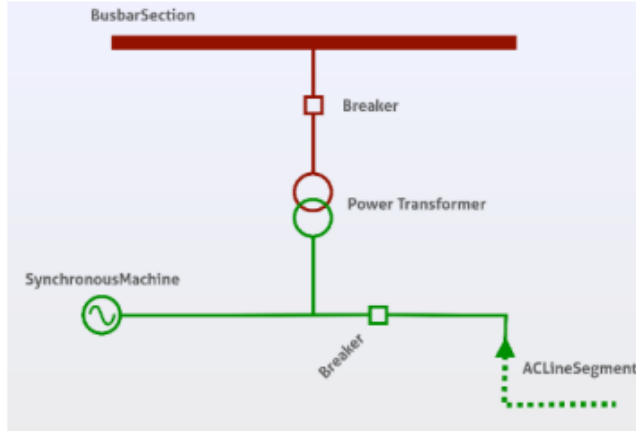
- IEC 61970 : EMS-API
- Part 453 : Diagram layout profile
  - A generic method for linking the diagram object to the domain data
  - Domain data and diagram layout data can be exchanged together with the domain data, or separately from each other
  - domain data modelled according to the IEC 61970-301 CIM that is exchanged in the IEC 61970-501 format
  - Allows the diagram to be used as the unit of exchange



IEC 0427/14

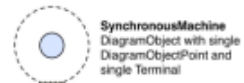
Figure 5 – Diagram layout information model

# IEC 61970-453



Association  
from DiagramObjectGluepoint to DiagramObject,  
or from DiagramObjectPoint to Terminal

"This is"



**SynchronousMachine**  
DiagramObject with single  
DiagramObjectPoint and  
single Terminal



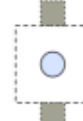
**EnergyConsumer**  
DiagramObject with single  
DiagramObjectPoint and  
single Terminal



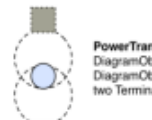
**Measurement**  
DiagramObject with single  
DiagramObjectPoint



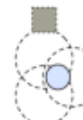
**Disconnecter**  
DiagramObject with single  
DiagramObjectPoint and  
two Terminals



**Breaker**  
DiagramObject with single  
DiagramObjectPoint and  
two Terminals

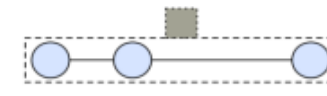


**PowerTransformer (Two Winding)**  
DiagramObject with single  
DiagramObjectPoint and  
two Terminals

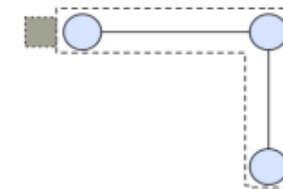


**PowerTransformer (Three Winding)**  
DiagramObject with single  
DiagramObjectPoint and  
two Terminals

IEC 61970-453



**BusbarSection**  
DiagramObject with three  
DiagramObjectPoints and  
single Terminal



**ACLineSegment**  
DiagramObject with four  
DiagramObjectPoints and  
two Terminals



**Terminal**  
DiagramObject with three  
DiagramObjectPoints

IEC 61970-453

# CIM UML to Program Library

CIM EA  
Project



iec61970cim17v  
38\_iec61968cim  
13v13\_iec62325  
cim03v17a.eap

Export XMI

-XML Metadata interchange  
-UML模型的交換格式

New Project

-Select Language to Generate  
-Import XMI

Generate  
Code

Include  
and Use

Compile

- .dll file

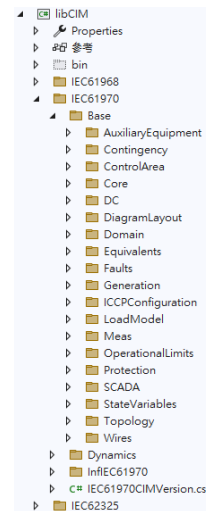
C# Library

-add code  
-Fix

```
public class Program
```

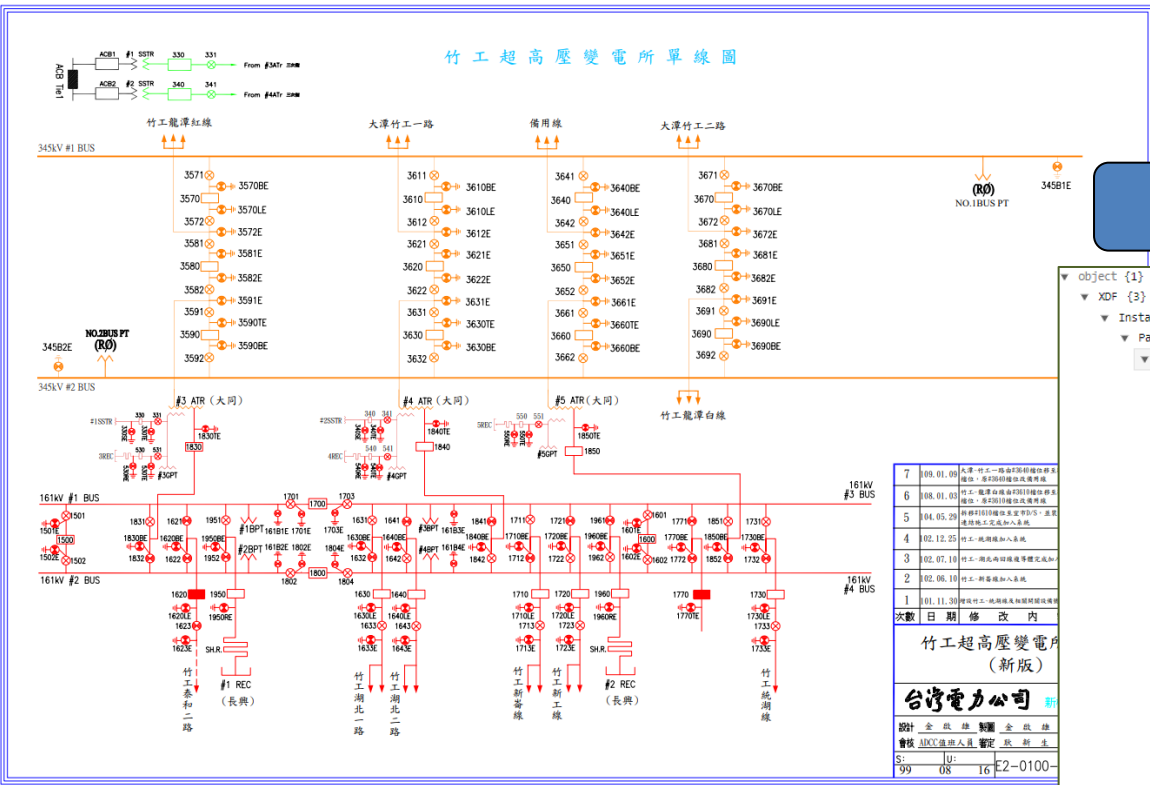
```
{
    0 個參考
    static void Main(string[] args)
    {
        TC57CIM.IEC61968.Metering.MeterReading meterreading = new TC57CIM.IEC61968.Metering.MeterReading();
        meterreading.mRID = "de381696-cfb7-44cc-9e80-2569145da715";

        TC57CIM.IEC61968.Customers.Customer customer = new TC57CIM.IEC61968.Customers.Customer();
        customer.aliasName = "cust_test";
    }
}
```



# Custom Format to Standard RDF

## • Spectrum 台電竹工單線圖



E05\_SLD.xml

```

object {1}
  XDF {3}
    Instances {1}
      Parent {3}
        Diagram {34}
          Link_DiagramHasADiagramStyle {3}
          SectionContainer {6}
          Symbol {906}
          TextDiagramObject {389}
          DiagramView {11}
          DiagramObjectGluePtContainer {4}
          VisibilityLayerContainer {4}
          Rectangle {2}
          _Name : E05
          _Guid : {49510ccc-14f6-4c2b-9f70-d5fa62f64583}
          _diagramProfileID : {value}
          _isModified : false
          _zoomFactor : 14999
          _y2InitialView : 40000
          _y1InitialView : 0
          _x2InitialView : 60000
          _x1InitialView : 0
          _viewWidth : 60000
          _viewHeight : 40000
          _profileListType : 3
          _orientation : 0
          _OBJName : E05
          _JOBID : 11937
          _gpsRef_GPSYCoord : 0
          _gpsRef_GPSXCoord : 0
          _gpsRef_GPSWidth : 0
  
```

E05\_Domaindata.xml

```

object {1}
  XDF {3}
    Instances {1}
      Parent {3}
        Substation {21}
          VoltageLevel {3}
          B2Block {17}
          PowerTransformer {9}
          Accumulator {18}
          Discrete {6}
          ControlCenterDataAccessRight {2}
          _Name : E05
          _Guid : {c45a826a-8a08-469e-85b7-fac4e39d0ee}
          _OBJName : E05
          _LogbookText : 中票cs
          _BlockType : 29
          _B1Number : 163
          _SCADAFlag : true
          _OMFlag : false
          _NAFlag : false
          _DMSFlag : true
          _DisplayOrder : {value}
          _AreaOfResponsibilityId : 1
          _GISID : {value}
          _Description : {value}
          _AliasName : {value}
          _Path : Network/Companies/TPC/HC
          _Guid : {cf10943a-5ee9-4e7d-bdccc31fe0287847}
          _xml:lang : EN
          _XdfTypesyntaxVersion : 2.0.00
  
```

Symbol.xml

```

svgData {1}
  __cdata : <?xml version="1.0" encoding="utf-8" ?>
  height : 600px
  urlns : http://www.w3.org/2000/svg
  width : 600px
  <!-- ... (XML content) ...
  _Name : sys_Clock
  _Guid : {8d95c021-bd85-4d4a-8753-4f8d0ce3ff51a}
  _SymbolID : 702
  
```

竹工超高壓變電所  
(新版)

台灣電力公司

設計	全檢	校對	審核	核准	製圖	校對	核准
S:	U:	U:	U:	U:	U:	U:	U:
99	08	16	E2	0100			

# Custom Format to Standard RDF

- RDF : Resource Description Framework
  - IEC 61970-552規範中，針對系統整合時的CIM XML訊息採用IEC 61970-501所定義的RDF格式

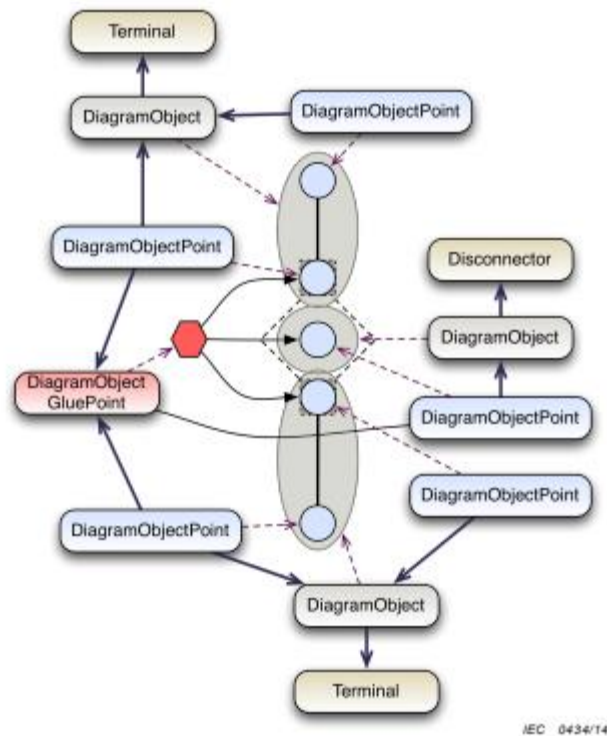


Figure 12 – Disconnector diagram object instantiation

```

<cim:DiagramObjectGluePoint rdf:ID="gp0">
</cim:DiagramObjectGluePoint>

<cim:Disconnector rdf:ID="discon0">
  <cim:IdentifiedObject.name>Disconnector</cim:IdentifiedObject.name>
</cim:Disconnector>
<cim:DiagramObject rdf:ID="disconDO">
  <cim:DiagramObject.IdentifiedObject rdf:resource="#discon0"/>
</cim:DiagramObject>
<cim:DiagramObjectPoint rdf:ID="disconDOP0">
  <cim:DiagramObjectPoint.xPosition>10</cim:DiagramObjectPoint.xPosition>
  <cim:DiagramObjectPoint.yPosition>10</cim:DiagramObjectPoint.yPosition>
  <cim:DiagramObjectPoint.DiagramObject rdf:resource="#disconDO"/>
  <cim:DiagramObject.GluePoint rdf:resource="#gp0"/>
</cim:DiagramObjectPoint>

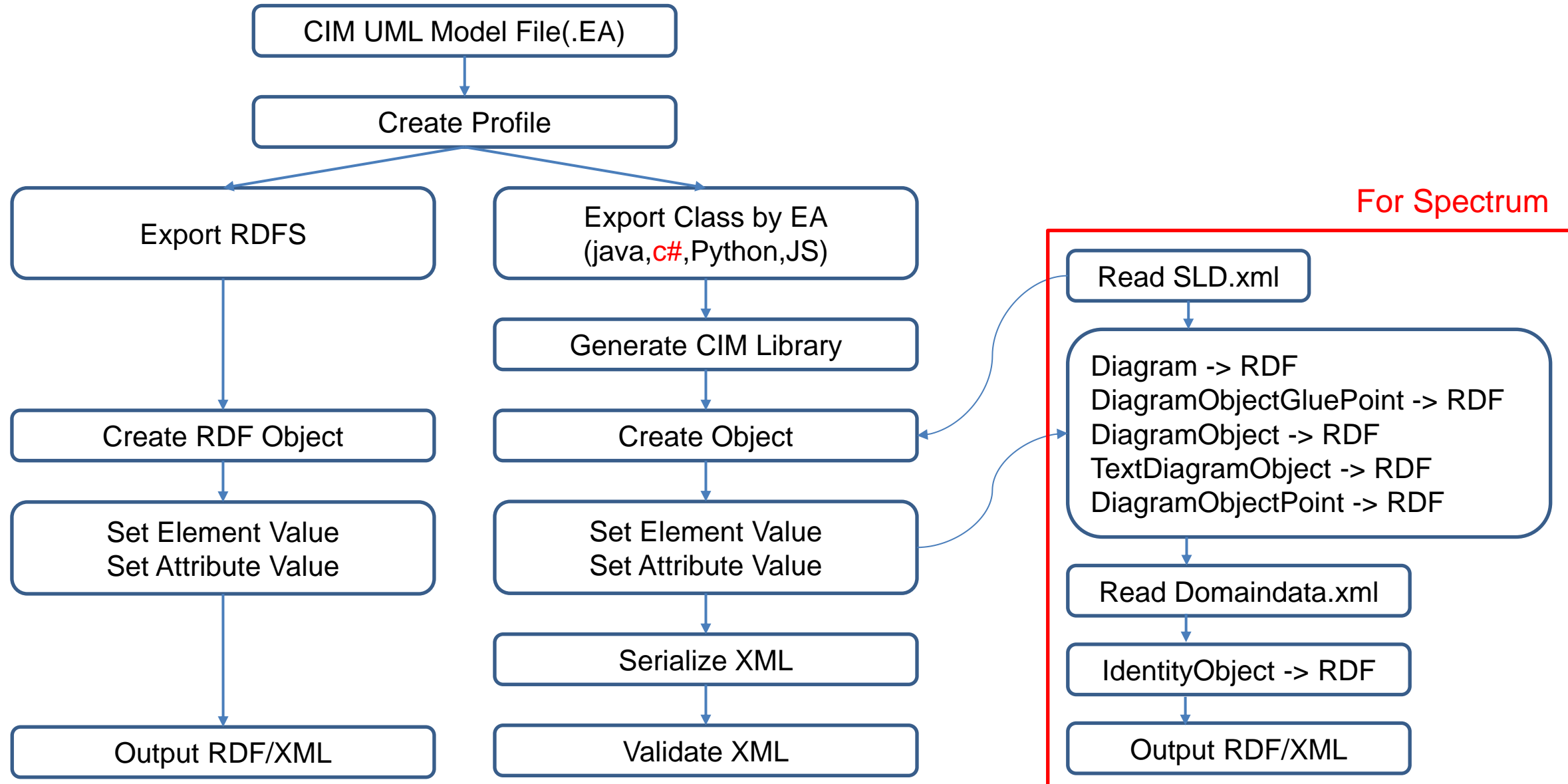
<cim:Terminal rdf:ID="t0">
  <cim:IdentifiedObject.name>Terminal 0</cim:IdentifiedObject.name>
  <cim:Terminal.ConductingEquipment rdf:resource="#discon0"/>
</cim:Terminal>
<cim:DiagramObject rdf:ID="t0DO">
  <cim:DiagramObject.IdentifiedObject rdf:resource="#t0"/>
</cim:DiagramObject>
<cim:DiagramObjectPoint rdf:ID="t0DOP0">
  <cim:DiagramObjectPoint.xPosition>10</cim:DiagramObjectPoint.xPosition>
  <cim:DiagramObjectPoint.yPosition>8</cim:DiagramObjectPoint.yPosition>
  <cim:DiagramObjectPoint.DiagramObject rdf:resource="#t0DO"/>
  <cim:DiagramObjectPoint.DiagramObjectGluePoint rdf:resource="#gp0"/>
</cim:DiagramObjectPoint>
<cim:DiagramObjectPoint rdf:ID="t0DOP1">
  <cim:DiagramObjectPoint.xPosition>10</cim:DiagramObjectPoint.xPosition>
  <cim:DiagramObjectPoint.yPosition>6</cim:DiagramObjectPoint.yPosition>
  <cim:DiagramObjectPoint.DiagramObject rdf:resource="#t0DO"/>
</cim:DiagramObjectPoint>

<cim:Terminal rdf:ID="t1">
  <cim:IdentifiedObject.name>Terminal 0</cim:IdentifiedObject.name>
  <cim:Terminal.ConductingEquipment rdf:resource="#discon0"/>
</cim:Terminal>
<cim:DiagramObject rdf:ID="t1DO">
  <cim:DiagramObject.IdentifiedObject rdf:resource="#t1"/>
</cim:DiagramObject>
<cim:DiagramObjectPoint rdf:ID="t1DOP0">
  <cim:DiagramObjectPoint.xPosition>10</cim:DiagramObjectPoint.xPosition>
  <cim:DiagramObjectPoint.yPosition>12</cim:DiagramObjectPoint.yPosition>
  <cim:DiagramObjectPoint.DiagramObject rdf:resource="#t1DO"/>
  <cim:DiagramObjectPoint.DiagramObjectGluePoint rdf:resource="#gp0"/>
</cim:DiagramObjectPoint>
<cim:DiagramObjectPoint rdf:ID="t1DOP1">
  <cim:DiagramObjectPoint.xPosition>10</cim:DiagramObjectPoint.xPosition>
  <cim:DiagramObjectPoint.yPosition>16</cim:DiagramObjectPoint.yPosition>
  <cim:DiagramObjectPoint.DiagramObject rdf:resource="#t1DO"/>
</cim:DiagramObjectPoint>
    
```

Figure 13 – IEC 61970-552 Encoding for disconnector diagram data



# Custom Format to Standard RDF



# Custom Format to Standard RDF

object ▶ XDF ▶ Instances ▶ Parent ▶ Diagram ▶

```

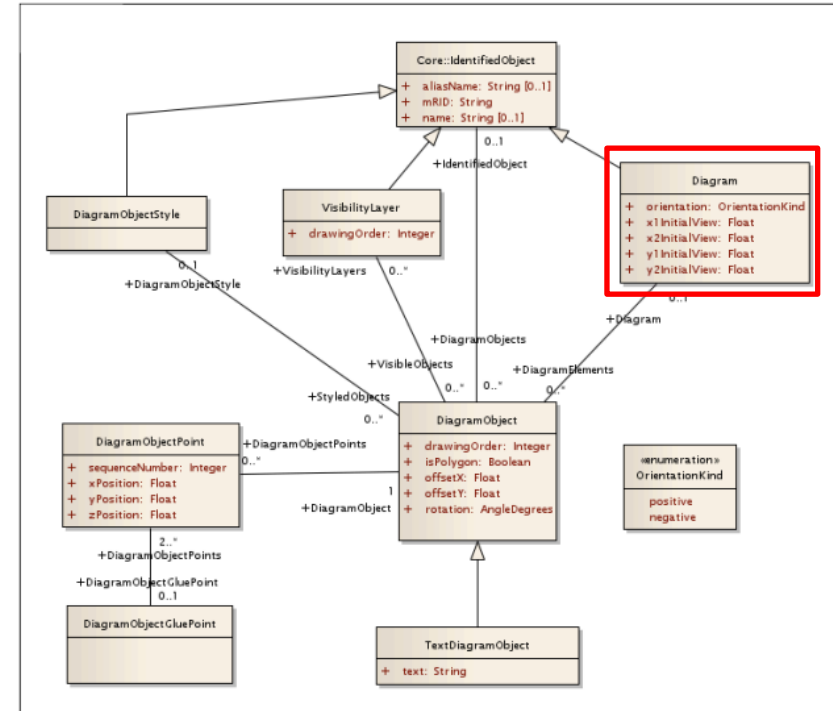
    ▼ object {1}
      ▼ XDF {3}
        ▼ Instances {1}
          ▼ Parent {3}
            ▼ Diagram {34}
              ▶ Link_DiagramHasADiagramStyle {3}
              ▶ SectionContainer {6}
              ▶ Symbol [906]
              ▶ TextDiagramObject [389]
              ▶ Path [257]
              ▶ DiagramView {11}
              ▶ DiagramObjectGluePtContainer {4}
              ▶ VisibilityLayerContainer {4}
              ▶ Rectangle [2]
                _Name : E05
                _Guid : {49510cc1-14f6-4c2b-9f70-d5fa62f64583}
                _diagramProfileID : [value]
                _isModified : false
                _zoomFactor : 14999
                _y2InitialView : 40000
                _y1InitialView : 0
                _x2InitialView : 60000
                _x1InitialView : 0
                _viewwidth : 60000
                _viewheight : 40000
                _profileListType : 3
                _orientation : 0
                _ODBName : E05
                _jobID : 11937
                _gpsRef_GPSYCoord : 0
                _gpsRef_GPSXCoord : 0
                _gpsRef_GPSWidth : 0
                _gpsRef_GPSHeight : 0
                _diagramID : 236
                _clusterZoomLevel : 3800
                _areaOfResponsibility : [value]
                _GISId : [value]
                _Description : [value]
                _aliasName : [value]
  
```

Diagram

DiagramObject

```

    DiagramObjectGluePtContainer {4}
      ▶ DiagramObjectGluePoint {2}
        _Name : .Glue Points
        _Guid : {c09e8d4a-a1bc-4196-b021-ce44fa2c8d2d}
        _description : [value]
  
```



## CIM RDF XML

```

<cim:Diagram rdf:ID="{49510cc1-14f6-4c2b-9f70-d5fa62f64583}">
  <cim:Diagram.aliasName></cim:Diagram.aliasName>
  <cim:Diagram.name>E05</cim:Diagram.name>
  <cim:Diagram.x1InitialView>0</cim:Diagram.x1InitialView>
  <cim:Diagram.x2InitialView>60000</cim:Diagram.x2InitialView>
  <cim:Diagram.y1InitialView>0</cim:Diagram.y1InitialView>
  <cim:Diagram.y2InitialView>40000</cim:Diagram.y2InitialView>
  <cim:Diagram.orientation>negative</cim:Diagram.orientation>
</cim:Diagram>
  
```

```

<cim:DiagramObjectGluePoint rdf:ID="{93b4e593-3a8b-48c2-af94-264df27e65e5}" />
  
```

# Custom Format to Standard RDF

## DiagramObject

Symbol {27}

- ▶ Link\_DiagramObjectHasAnAction {3}
  - ▶ Link\_DiagramObjectHasAStyleLogicRef {3}
  - ▶ Link\_SymbolHasASymbolLogicRef {3}
  - ▶ Link\_DiagramObjectRepresentsAnIdentifiedObject {3}
  - ▶ Link\_DiagramObjectSeenOnVisibilityLayer {3}
  - ▶ DiagramObjectPoint {11}
- ```

_Name : 330_GS_CE0
_Guid : {0d5c6e76-d86b-45b6-a480-90ceb5321cea}
_scaleFactor : 1
_color : {value}
_z : 0
_y : {value}
_width : 380
_rotation : 0
_offsetY : 0
_offsetX : 0
_jobID : {value}
_isPolygon : false
_height : 380
_drawingOrder : 3524068
_diagramObjectID : {value}
_depth : {value}
_x : {value}
_isConductingEquipment : false
_GISId : {value}
_Description : {value}
_aliasName : {value}
    
```

- ```

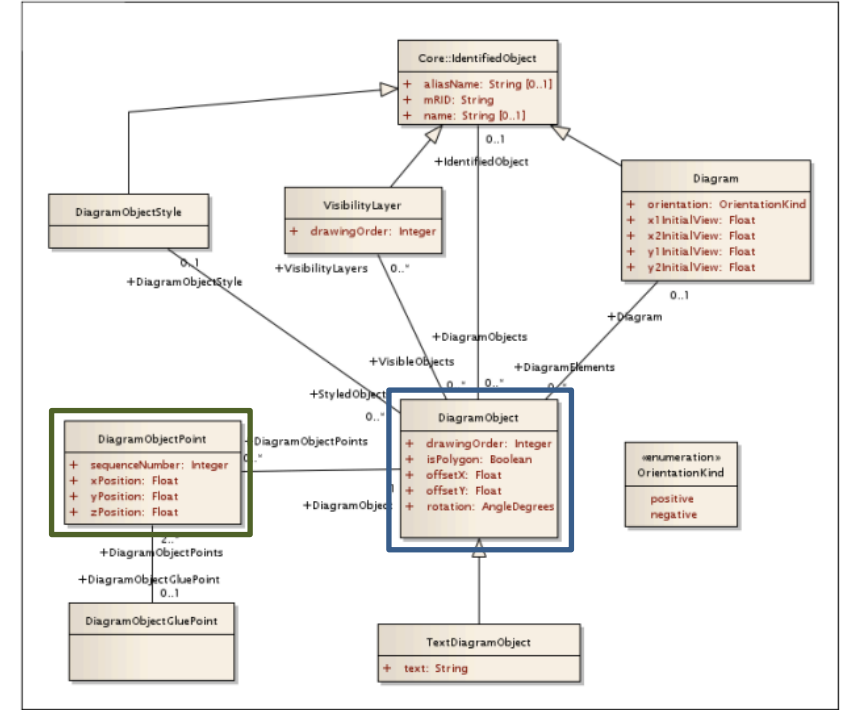
DiagramObjectPoint {11}
_Name : P0
_Guid : {897874c7-e4c8-41d7-83da-28ad7686a9b2}
_param4 : {value}
_param3 : {value}
_param2 : {value}
_param1 : {value}
_operation : 0
_zPosition : {value}
_yPosition : 16570.5
_xPosition : 23125
_sequenceNumber : 0

Link_DiagramObjectRepresentsAnIdentifiedObject {3}
_PathB : Network/Companies/TPC/HC/E05/33/330/CE0
_Guid : {4edd6963-1370-4496-a62a-473b14b80f86}
_LinkTypeID : {7e18cb16-897d-11d4-8202-00105a24673a}
    
```

- ```

Substation {21}
  VoltageLevel {3}
    (29)
      Link_VoltageLevelHasABaseVoltage {3}
      BusbarSection {5}
      ShuntCompensator {3}
      Bay {5}
        (22)
          ConnectivityNode {16}
          Discrete {3}
          GroundDisconnector {2}
            (36)
              Link_ConductingEquipmentHasTPStatusMeasurement {3}
              Terminal {0}
              Discrete {22}
                Name : CE0
                _Guid : {4edd6963-1370-4496-a62a-473b14b80f86}
                _FCLowAlarmMaximum : 0
                _FCLowAlarmMinimum : 0
            
```

Domaindata.xml



## CIM RDF XML

```

<cim:GroundDisconnector rdf:ID="{4edd6963-1370-4496-a62a-473b14b80f86}">
  <cim:IdentityObject.name>CE0</cim:IdentityObject.name>
</cim:GroundDisconnector>
<cim:DiagramObject rdf:ID="{0d5c6e76-d86b-45b6-a480-90ceb5321cea}">
  <cim:DiagramObject.IdentityObject rdf:resource="{4edd6963-1370-4496-a62a-473b14b80f86}" />
  <cim:DiagramObject.description></cim:DiagramObject.description>
  <cim:DiagramObject.aliasName></cim:DiagramObject.aliasName>
  <cim:DiagramObject.drawingOrder>3524068</cim:DiagramObject.drawingOrder>
  <cim:DiagramObject.isPolygon>False</cim:DiagramObject.isPolygon>
  <cim:DiagramObject.offsetX>0</cim:DiagramObject.offsetX>
  <cim:DiagramObject.offsetY>0</cim:DiagramObject.offsetY>
  <cim:DiagramObject.rotation>0</cim:DiagramObject.rotation>
</cim:DiagramObject>
<cim:DiagramObjectPoint rdf:ID="{897874c7-e4c8-41d7-83da-28ad7686a9b2}">
  <cim:DiagramObjectPoint.sequenceNumber>0</cim:DiagramObjectPoint.sequenceNumber>
  <cim:DiagramObjectPoint.xPosition>23125</cim:DiagramObjectPoint.xPosition>
  <cim:DiagramObjectPoint.yPosition>16570.5</cim:DiagramObjectPoint.yPosition>
  <cim:DiagramObjectPoint.zPosition>0</cim:DiagramObjectPoint.zPosition>
  <cim:DiagramObjectPoint.DiagramObject rdf:resource="{0d5c6e76-d86b-45b6-a480-90ceb5321cea}" />
</cim:DiagramObjectPoint>
    
```

IEC 0427/14

# Custom Format to Standard RDF

▼ TextDiagramObject [389]

## TextDiagramObject

▼ 0 {25}

- ▶ Link\_TextDiagramObjectHasABaseTextStyleRef {3}
- ▶ Link\_DiagramObjectSeenOnVisibilityLayer {3}
- ▶ DiagramObjectPoint {11}

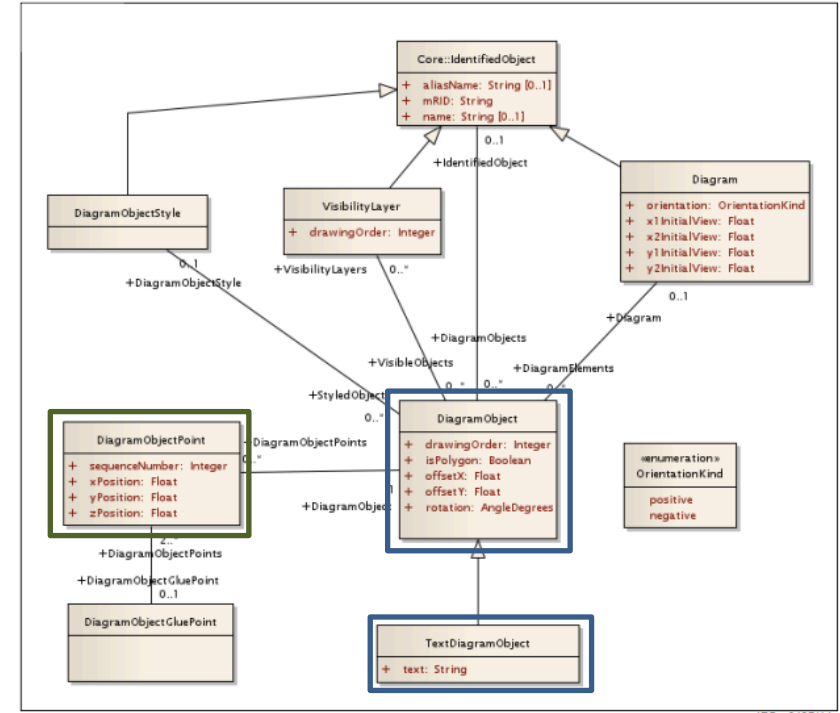
```

_Name : 3690_TXT_MW_UNIT
_Guid : {22aa7604-d48b-4243-8f18-98caedc6c683}
_length : {value}
_text : MW
_size : 115
_z : {value}
_y : {value}
_width : 196
_rotation : 0
_offsetY : {value}
_offsetX : 0
_jobID : {value}
_isPolygon : false
_height : 115
_drawingOrder : 3525980
_diagramObjectID : {value}
_depth : {value}
_x : {value}
_isConductingEquipment : false
_GISId : {value}
_Description : {value}
_aliasName : {value}
    
```

▼ DiagramObjectPoint {11}

```

_Name : P0
_Guid : {25c7ca94-3c82-4bf6-b65a-3d697b5336ee}
_param4 : {value}
_param3 : {value}
_param2 : {value}
_param1 : {value}
_operation : 0
_zPosition : 0
_yPosition : 16041.4075664
_xPosition : 33942.0485178
_sequenceNumber : 0
    
```



IEC 042714

## CIM RDF XML

```

<cim:TextDiagramObject rdf:ID="{22aa7604-d48b-4243-8f18-98caedc6c683}">
  <cim:TextDiagramObject.description></cim:TextDiagramObject.description>
  <cim:TextDiagramObject.aliasName></cim:TextDiagramObject.aliasName>
  <cim:TextDiagramObject.drawingOrder>3525980</cim:TextDiagramObject.drawingOrder>
  <cim:TextDiagramObject.isPolygon>false</cim:TextDiagramObject.isPolygon>
  <cim:TextDiagramObject.offsetX>0</cim:TextDiagramObject.offsetX>
  <cim:TextDiagramObject.offsetY>0</cim:TextDiagramObject.offsetY>
  <cim:TextDiagramObject.rotation>0</cim:TextDiagramObject.rotation>
  <cim:TextDiagramObject.text>MW</cim:TextDiagramObject.text>
</cim:TextDiagramObject>
<cim:DiagramObjectPoint rdf:ID="{25c7ca94-3c82-4bf6-b65a-3d697b5336ee}">
  <cim:DiagramObjectPoint.sequenceNumber>0</cim:DiagramObjectPoint.sequenceNumber>
  <cim:DiagramObjectPoint.xPosition>33942.05</cim:DiagramObjectPoint.xPosition>
  <cim:DiagramObjectPoint.yPosition>16041.41</cim:DiagramObjectPoint.yPosition>
  <cim:DiagramObjectPoint.zPosition>0</cim:DiagramObjectPoint.zPosition>
  <cim:DiagramObjectPoint.DiagramObject rdf:resource="{22aa7604-d48b-4243-8f18-98caedc6c683}" />
</cim:DiagramObjectPoint>
    
```

# Custom Format to Standard RDF

## DiagramObject

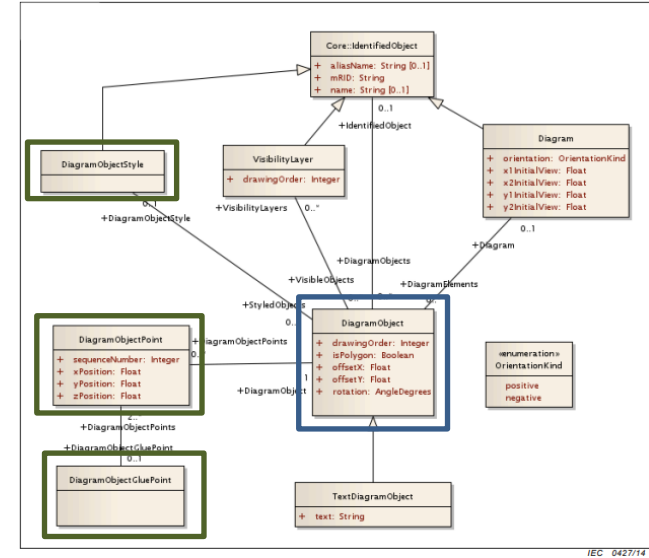
```

▼ Path {32}
  ▶ Link_DiagramObjectHasAStyleLogicRef {3}
  ▶ Link_DiagramObjectHasAnAction {3}
  ▶ Link_DiagramObjectRepresentsAnIdentifiedObject {3}
  ▶ Link_DiagramObjectSeenOnVisibilityLayer {3}
  ▶ DiagramObjectPoint [2]
    _Name : 3580_PL_T1_E1
    _Guid : {3e63cfd7-fecd-4d55-ad2e-d29a2eab603e}
    _terminalAligned : true
    _linePattern : {value}
    _transparent : false
    _linewidth : 3
    _lineStyle : 1
    _lineColor : #ffffff
    _fillStyle : 2
    fillColor : #ff00fff
    _z : {value}
    _y : {value}
    _width : {value}
    _rotation : 0
    _offsetY : {value}
    _offsetX : 0
    _jobID : {value}
    _isPolygon : false
    _height : {value}
    _drawingOrder : 350011
    _diagramObjectID : {value}
    _depth : {value}
    _x : {value}
    _isConductingEquipment : false
    GISId : {value}
    Description : {value}
    aliasName : {value}
  
```

## DiagramObjectStyle

```

▼ DiagramObjectPoint [2]
  ▼ 0 {12}
    ▼ Link_DiagramObjectPointHasADiagramObjectGluePoint {3}
      _PathB : Presentation/Diagrams/ADCC/SLD/E05/.Glue Points/C
      _Guid : {93b4e593-3a8b-48c2-af94-264df27e65e5}
      _LinkIdType : {f24a1794-f794-4f2c-9c30-d1a3caa5bb65}
      _Name : P1
      _Guid : {677acbd2-9354-4edd-90e1-0beedca379bb}
      _param4 : {value}
      _param3 : {value}
      _param2 : {value}
      _param1 : {value}
      _operation : 2
      _zPosition : 0
      _yPosition : 13505
      _xPosition : 26700
      _sequenceNumber : 1
    ▼ 1 {11}
      _Name : P0
      _Guid : {73257140-0385-41dd-84f2-669a33f669ec}
      _param4 : {value}
      _param3 : {value}
      _param2 : {value}
      _param1 : {value}
      _operation : 1
      _zPosition : 0
      _yPosition : 13505
      _xPosition : 26600
      _sequenceNumber : 0
  
```



## CIM RDF XML

```

<cim:DiagramObjectStyle rdf:ID="{75acd3ce-484c-43ea-913a-605aae3b4e3a}">
  <cim:DiagramObject.lineWidth>3</cim:DiagramObject.lineWidth>
  <cim:DiagramObject.lineStyle>1</cim:DiagramObject.lineStyle>
  <cim:DiagramObject.lineColor>#ffffff</cim:DiagramObject.lineColor>
  <cim:DiagramObject.fillStyle>2</cim:DiagramObject.fillStyle>
  <cim:DiagramObject.fillColor>#ff00fff</cim:DiagramObject.fillColor>
</cim:DiagramObjectStyle>
<cim:DiagramObject rdf:ID="{3e63cfd7-fecd-4d55-ad2e-d29a2eab603e}">
  <cim:DiagramObject.description></cim:DiagramObject.description>
  <cim:DiagramObject.aliasName></cim:DiagramObject.aliasName>
  <cim:DiagramObject.drawingOrder>350011</cim:DiagramObject.drawingOrder>
  <cim:DiagramObject.isPolygon>false</cim:DiagramObject.isPolygon>
  <cim:DiagramObject.offsetX>0</cim:DiagramObject.offsetX>
  <cim:DiagramObject.offsetY>0</cim:DiagramObject.offsetY>
  <cim:DiagramObject.rotation>0</cim:DiagramObject.rotation>
  <cim:DiagramObject.DiagramObjectStyle rdf:resource="{75acd3ce-484c-43ea-913a-605aae3b4e3a}" />
</cim:DiagramObject>
<cim:DiagramObjectPoint rdf:ID="{677acbd2-9354-4edd-90e1-0beedca379bb}">
  <cim:DiagramObjectPoint.sequenceNumber>1</cim:DiagramObjectPoint.sequenceNumber>
  <cim:DiagramObjectPoint.xPosition>26700</cim:DiagramObjectPoint.xPosition>
  <cim:DiagramObjectPoint.yPosition>13505</cim:DiagramObjectPoint.yPosition>
  <cim:DiagramObjectPoint.zPosition>0</cim:DiagramObjectPoint.zPosition>
  <cim:DiagramObjectPoint.DiagramObject rdf:resource="{3e63cfd7-fecd-4d55-ad2e-d29a2eab603e}" />
  <cim:DiagramObjectPoint.DiagramObjectGluePoint rdf:resource="{93b4e593-3a8b-48c2-af94-264df27e65e5}" />
</cim:DiagramObjectPoint>
<cim:DiagramObjectPoint rdf:ID="{73257140-0385-41dd-84f2-669a33f669ec}">
  <cim:DiagramObjectPoint.sequenceNumber>0</cim:DiagramObjectPoint.sequenceNumber>
  <cim:DiagramObjectPoint.xPosition>26600</cim:DiagramObjectPoint.xPosition>
  <cim:DiagramObjectPoint.yPosition>13505</cim:DiagramObjectPoint.yPosition>
  <cim:DiagramObjectPoint.zPosition>0</cim:DiagramObjectPoint.zPosition>
  <cim:DiagramObjectPoint.DiagramObject rdf:resource="{3e63cfd7-fecd-4d55-ad2e-d29a2eab603e}" />
</cim:DiagramObjectPoint>
  
```

# Custom Format to Standard RDF

```
▼ object {1}
  ▼ RDF {19}
    ▶ Diagram {9}
    ▶ DiagramObjectGluePoint {2}
    ▶ TextDiagramObject [389]
    ▶ DiagramObjectPoint [1857]
    ▶ Analog [75]
    ▶ DiagramObject [1163]
    ▶ GroundDisconnecter [86]
    ▶ Disconnecter [67]
    ▶ Discrete [25]
    ▶ Breaker [33]
    ▶ ConnectivityNode [13]
    ▶ Bay [31]
    ▶ ShuntCompensator [5]
    ▶ BusbarSection [7]
    ▶ TransformerWinding [9]
    ▶ DiagramObjectStyle [257]
    __xmlns:cim : http://iec.ch/TC57/2010/CIM-schema-cim15#
    __xmlns:rdf : http://www.w3.org/1999/02/22-rdf-syntax-ns#
    __prefix : rdf
```

# 資料庫應用-MS SQL Server

- Table Schema Design
- RDF Data to DB

DiagramObject

| Sys_ID | mRID                                   | IdentityObject | Identity... | DrawingOr... | isPolyq... | offsetX | offsetY | rotation | DiagramObject... | Diagram.mRID        | text   |
|--------|----------------------------------------|----------------|-------------|--------------|------------|---------|---------|----------|------------------|---------------------|--------|
| 13212  | {22aa7604-d48b-4243-8f18-98caedc6c683} | NULL           | NULL        | 3525980      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | MW     |
| 13213  | {2b77b550-ab5a-410c-8b14-251fbc9b2fa}  | NULL           | NULL        | 3525982      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 999.9  |
| 13214  | {54f05c4c-ec5c-41cc-be09-f72fb5511886} | NULL           | NULL        | 3525984      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 999.9  |
| 13215  | {8e7aa705-a1c5-448d-8a17-33084fdb2ff}  | NULL           | NULL        | 3525990      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | A      |
| 13216  | {26ed5955-bef7-458c-8670-87548bfa3426} | NULL           | NULL        | 3525992      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 999.9  |
| 13217  | {aca0a661-a7e4-4ec0-b3eb-ee2a8f042c2}  | NULL           | NULL        | 3525994      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | MVAR   |
| 13218  | {5106078f-da74-44ae-80df-d910c221ac3c} | NULL           | NULL        | 3526000      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 龍潭白蟻   |
| 13219  | {d99cc3f2-4078-4250-a740-7b1778895f5a} | NULL           | NULL        | 3525847      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 3691E  |
| 13220  | {c5a7063f-fc80-452c-940b-f6f92936e558} | NULL           | NULL        | 3525935      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 3691   |
| 13221  | {06f01e08-2a41-4142-9ccc-1737963ce3b2} | NULL           | NULL        | 3525933      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 3690   |
| 13222  | {92cec17e-4e5c-4fdb-8e2a-43acc23652cf} | NULL           | NULL        | 3525865      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 3682E  |
| 13223  | {b7aed1bc-6669-4ab3-a4bd-734c2fc0b307} | NULL           | NULL        | 3525877      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 3690TE |
| 13224  | {6e265386-0115-4c87-8e9b-565c9398afbc} | NULL           | NULL        | 3525879      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 3692   |
| 13225  | {f527d84c-2fe9-4b0b-bfaa-8628e5f4e237} | NULL           | NULL        | 3525883      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 3690BE |
| 13226  | {efc3700b-71be-4d92-a365-650360f085f}  | NULL           | NULL        | 3525905      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 3682   |
| 13227  | {569dfe4d-3cb9-43f0-886f-442df4211c8f} | NULL           | NULL        | 3524954      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | COIL-  |
| 13228  | {c4134d46-7d96-44a0-b827-2f6ccf53f9db} | NULL           | NULL        | 3524966      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 1961   |
| 13229  | {5e93c541-0dca-40ac-8b24-88e4b377a25}  | NULL           | NULL        | 3524972      | False      | 0       | 0       | 0        |                  | {49510cc1-14f6-4... | 391.4  |

DiagramObjectPoint

| Sys_ID | mRID                                   | IdentityObject | Identity... | DrawingOr...    | isPolyq... | offsetX          | offsetY        | rotation | DiagramObject... | Diagram.mRID                                | text |
|--------|----------------------------------------|----------------|-------------|-----------------|------------|------------------|----------------|----------|------------------|---------------------------------------------|------|
| 10213  | {25c7ca94-3c82-4bfe-b65a-3d697b5336ee} | NULL           | NULL        | 33942.05078125  | 0          | 33628.33984375   | 16041.41015625 | 0        |                  | {22aa7604-d48b-4243-8f18-98caedc6c683}      |      |
| 10214  | {f5ee959c-cfda-40a9-855a-497e7639df24} | NULL           | NULL        | 33628.33984375  | 0          | 16041.41015625   | 0              |          |                  | {2b77b550-ab5a-410c-8b14-251fbc9b2fa}       |      |
| 10215  | {2398de4c-b877-4c74-a1c9-33a4c411c41}  | NULL           | NULL        | 33628.33984375  | 0          | 16286.41015625   | 0              |          |                  | {54f05c4c-ec5c-41cc-be09-f72fb5511886}      |      |
| 10216  | {80dac8d9-ab0c-4e8f-8d50-183cf04e682}  | NULL           | NULL        | 33882.05078125  | 0          | 16286.41015625   | 0              |          |                  | {8e7aa705-a1c5-448d-8a17-33084fdb2ff}       |      |
| 10217  | {19187196-ecf4-451f-88d4-c598771b51fa} | NULL           | NULL        | 33628.33984375  | 0          | 16168.6298828... | 0              |          |                  | {26ed5955-bef7-458c-8670-87548bfa3426}      |      |
| 10218  | {7220fab-8eba-4c58-bd37-55730f0d00b}   | NULL           | NULL        | 34005.05078125  | 0          | 16172.25         | 0              |          |                  | {aca0a661-a7e4-4ec0-b3eb-ee2a8f042c2}       |      |
| 10219  | {56508338-f322-4e52-8dbc-242b9490b0a}  | NULL           | NULL        | 33628.33984375  | 0          | 15886.41015625   | 0              |          |                  | {5106078f-da74-44ae-80df-d910c221ac3c}      |      |
| 10220  | {120783bf-6e3a-4fa4-978c-79fd116d7048} | NULL           | NULL        | 30249.97009375  | 0          | 13690            | 0              |          |                  | {d99cc3f2-4078-4250-a740-7b1778895f5a}      |      |
| 10221  | {28466a95-6020-4311-9e50-a1a526f4ce00} | NULL           | NULL        | 29650.26953125  | 0          | 14195            | 0              |          |                  | {c5a7063f-fc80-452c-940b-f6f92936e558}      |      |
| 10222  | {431ee84b-8171-4675-90be-9080fca6e5c2} | NULL           | NULL        | 29628.26953125  | 0          | 14472            | 0              |          |                  | {06f01e08-2a41-4142-9ccc-1737963ce3b2}      |      |
| 10223  | {789b1391-2ccb-4a37-be1d-41a6270335ab} | NULL           | NULL        | 30249.97009375  | 0          | 13690            | 0              |          |                  | {92cec17e-4e5c-4fdb-8e2a-43acc23652cf}      |      |
| 10224  | {cf2cc997-636c-414f-85a7-07ca65d3d6af} | NULL           | NULL        | 30274.4609375   | 0          | 14230            | 0              |          |                  | {b7aed1bc-6669-4ab3-a4bd-734c2fc0b307}      |      |
| 10225  | {807e25a0-e572-420d-bc4b-887840316578} | NULL           | NULL        | 29650           | 0          | 14750            | 0              |          |                  | {6e265386-0115-4c87-8e9b-565c9398afbc}      |      |
| 10226  | {ea188dc-e5d7-4f01-bee9-0620756696b5}  | NULL           | NULL        | 30276.189453125 | 0          | 14513.9599609... | 0              |          |                  | {f527d84c-2fe9-4b0b-bfaa-8628e5f4e237}      |      |
| 10227  | {9cb4543c-96a7-4156-b01d-fb70944cb13d} | NULL           | NULL        | 29650.26953125  | 0          | 13925            | 0              |          |                  | {efc3700b-71be-4d92-a365-650360f085f}       |      |
| 10228  | {3c360c22-08dc-49f4-9103-12c788d26756} | NULL           | NULL        | 33190.03125     | 0          | 19775            | 0              |          |                  | {569dfe4d-3cb9-43f0-886f-442df4211c8f}      |      |
| 10229  | {e1fb5ee3-130b-49a2-9f76-4092d6d0c7a8} | NULL           | NULL        | 33462.53125     | 0          | 18196.599609375  | 0              |          |                  | {c4134d46-7d96-44a0-b827-2f6ccf53f9db}      |      |
| 10230  | {588e32cf-ec92-43fa-be99-51db3d6bd7d7} | NULL           | NULL        | 33512.53125     | 0          | 19775            | 0              |          |                  | {5e93c541-0dca-40ac-8b24-88e4b377a25}       |      |
| 10231  | {672bc79-9351-4775-b0c8-b1df9a76e4}    | NULL           | NULL        | 33556.12890625  | 0          | 19900            | 0              |          |                  | {e76f7217-cf82-42ef-9e44-14a0be728324}      |      |
| 10232  | {d0729b3f-327a-4d24-a955-3e0e45ee064a} | NULL           | NULL        | 33226.03125     | 0          | 19650            | 0              |          |                  | {8b9af3ae-2a9f-45b6-a2d8-58bd0902137}       |      |
| 10233  | {8bfcd9b9-3aee-4f81-a38d-f6dfa50da3f0} | NULL           | NULL        | 33512.53125     | 0          | 19650            | 0              |          |                  | {4755c6dc-1551-4676-8e36-64ad848b8b6f}      |      |
| 10234  | {34fbcc0a-327e-468a-b58f-e883349ca009} | NULL           | NULL        | 33684.4296875   | 0          | 18935            | 0              |          |                  | {cb42e2ae-a994-42a9-bb35-4d8dea47b57c}      |      |
| 10235  | {0a133228-8080-4425-9508-bd33ccf56a00} | NULL           | NULL        | 33312.53125     | 0          | 19525            | 0              |          |                  | {8458bd87-3cee-4415-93dc-47a38f31c216}      |      |
| 10236  | {c128feb4-46c7-48db-b6cc-4b187ecb5be7} | NULL           | NULL        | 33462.53125     | 0          | 18466.599609375  | 0              |          |                  | {f4ec2b13-226f-4cb6-b292-3437026f9e48}      |      |
| 10237  | {0b2fbc52-bc91-4291-b34e-e59e0ab36f7b} | NULL           | NULL        | 33060.3203125   | 0          | 18892.5          | 0              |          |                  | {cffedc21-1e3f-48f6-b4aa-5a907349938f}      |      |
| 10238  | {7c172f13-729f-4a78-ab95-9f7971e87e69} | NULL           | NULL        | 33151.23046875  | 0          | 19900            | 0              |          |                  | {457ab01e-b05e-41f6-b7a9-87a9-dcc669e1c8b7} |      |

# 資料庫應用-MS SQL Server

IdentifiedObject

| 資料行名稱       | 資料類型          |
|-------------|---------------|
| Sys_ID      | int           |
| aliasName   | nvarchar(100) |
| description | nvarchar(100) |
| mRID        | nvarchar(50)  |
| name        | nvarchar(100) |

DiagramLayout.Diagram

| 資料行名稱         | 資料類型         |
|---------------|--------------|
| Sys_ID        | int          |
| mRID          | nvarchar(50) |
| orientation   | int          |
| x1InitialView | float        |
| x2InitialView | float        |
| y1InitialView | float        |
| y2InitialView | float        |

DiagramObject

| 資料行名稱                           | 資料類型          |
|---------------------------------|---------------|
| Sys_ID                          | int           |
| mRID                            | nvarchar(50)  |
| IdentityObject                  | nvarchar(50)  |
| [IdentityObject.resource]       | nvarchar(50)  |
| drawingOrder                    | int           |
| isPolygon                       | bit           |
| offsetX                         | float         |
| offsetY                         | float         |
| [rotation.multiplier]           | nvarchar(20)  |
| [rotation.unit]                 | nvarchar(20)  |
| [rotation.value]                | float         |
| [VisibilityLayers.drawingOrder] | int           |
| [DiagramObjectStyle.mRID]       | nvarchar(50)  |
| [Diagram.mRID]                  | nvarchar(50)  |
| text                            | nvarchar(100) |

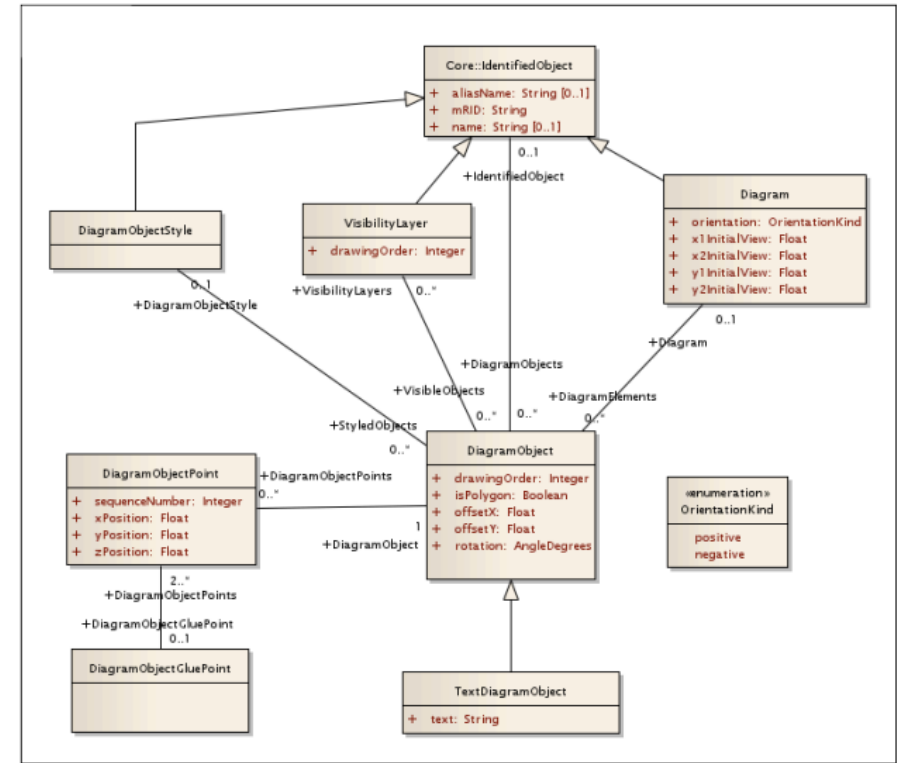
```
namespace ITC57CIM.IEC61970.Base.DiagramLayout {
    3 個參考
    public class VisibilityLayer : IdentifiedObject {
        public int drawingOrder;
    }
}
```

DiagramObjectPoint

| 資料行名稱                    | 資料類型         |
|--------------------------|--------------|
| Sys_ID                   | int          |
| mRID                     | nvarchar(50) |
| sequenceNumber           | int          |
| xPosition                | float        |
| yPosition                | float        |
| zPosition                | float        |
| [DiagramObject.mRID]     | nvarchar(50) |
| [DiagramObjectGluePo...] | nvarchar(50) |

DiagramObjectGluePoint

| 資料行名稱  | 資料類型         |
|--------|--------------|
| Sys_ID | int          |
| mRID   | nvarchar(50) |



DiagramObjectStyle

| 資料行名稱     | 資料類型         |
|-----------|--------------|
| Sys_ID    | int          |
| mRID      | nvarchar(50) |
| lineWidth | nvarchar(10) |
| lineStyle | nvarchar(10) |
| lineColor | nvarchar(10) |
| fillStyle | nvarchar(10) |
| fillColor | nvarchar(10) |

\*DiagramObject及TextDiagramObject共用此Table

IEC 0427/14



# 可視化研究與實作

- HTML + JavaScript + SVG + RDF

