

IFC Parametric Product Type Example

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This example is for IKEA kitchen cabinets sold in the U.S. found here:

<http://www.ikea.com/us/en/catalog/categories/departments/kitchen/12317/>

This example demonstrates various parametric capabilities, including geometric formulas, configuration tables, bounding box sizing, repetitive placement patterns, and parametric aggregation. The same principals may be applied to any type definition in IFC (e.g. beams, walls, MEP fixtures, piping, ductwork, lighting, etc.).

The approach used is compatible with the simple parametric behaviors found in Sketchup, yet also supports more advanced parametric capabilities such as lookup tables supported at most manufacturer websites (e.g. Wayfair, IKEA, Lowes, Home Depot).

The approach proposed herein allows any product manufacturer or BIM application vendor to define parametric behaviors on product types as they see fit, and any other application can leverage this information to change the product occurrences after-the-fact, even if they did not create the parametric behavior originally. As parametric behavior is fully described on product types, application software can support parametric design generically without having any specific knowledge of particular product types, configurations, or algorithms.

This line of cabinetry is comprised of interchangeable parts, each of which have various configurations.

At the outermost level are sections which are aggregated into cabinets along an axis path, along with countertop(s) and baseboards.

Each cabinet is aggregated into five parts: Frame, Front(s), Inserts, Hardware, and Legs.

- + Sections
 - + Cabinets
 - Frames
 - Fronts
 - Inserts
 - Hardware
 - Legs
 - + Countertops
 - + Baseboards

Frame

<http://www.ikea.com/us/en/catalog/products/74382110/>



The frame type has two configurable parameters: Size and Color, where articles correspond to combinations of these.

Each size corresponds to geometry defined parametrically, where the actual size is slightly less than the nominal size.

Size	Length
12"	11.875
15"	14.875
18"	17.875
21"	20.875
24"	23.875
30"	29.975
36"	35.875

Each color corresponds to a texture defined parametrically for visualization.

Color	Texture
birch effect	http://www.ikea.com/us/en/images/products/perfekt-orsa-cover-panel-for-base-cabinet__0183273_PE334435_S4.JPG
white	http://www.ikea.com/us/en/images/products/perfekt-cover-panel-for-base-cabinet__0084008_PE210282_S4.JPG

Each article number identifies a product type with a SKU, relating size and color, price, and image preview:

Article	Color	Size	Price	Image
543.817.10	white	12"	\$28.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__35804_PE126721_S4.jpg
343.818.10	white	15"	\$30.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__35807_PE126724_S4.jpg
132.819.10	white	18"	\$31.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__35867_PE126797_S4.jpg
943.820.10	white	21"	\$33.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__35805_PE126722_S4.jpg
743.821.10	white	24"	\$36.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__35806_PE126723_S4.jpg
543.822.10	white	30"	\$41.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__32620_PE122645_S4.jpg
343.823.10	white	36"	\$45.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__32620_PE122645_S4.jpg
700.493.43	birch effect	12"	\$28.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__35800_PE126717_S4.jpg
500.492.44	birch effect	15"	\$30.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__35801_PE126718_S4.jpg
200.493.45	birch effect	18"	\$31.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__34357_PE124290_S4.jpg
000.493.46	birch effect	21"	\$33.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__35802_PE126719_S4.jpg
800.493.47	birch effect	24"	\$36.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__35803_PE126720_S4.jpg
600.493.48	birch effect	30"	\$41.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__35803_PE126720_S4.jpg
400.493.49	birch effect	36"	\$45.00	http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__35803_PE126720_S4.jpg

Geometry is defined in IFC using rectangular blocks, where the origin is at the lower left front edge of the block, the X axis points to the right when facing the cabinet, the Y axis points towards the back of the cabinet, and the Z axis points up. While other geometry such as BREP or extruded solids could be used instead, IfcBlock is used to better illustrate. The positioning of each piece is defined as follows for the 24" configuration.

Part	Position X	Position Y	Position Z	Length X	Length Y	Length Z	Anchors
Left plate	0	0	0	0.75	24	30.375	-X
Right plate	23.25	0	0	0.75	24	30.375	+X
Bottom plate	0.75	0	0	22.5	24	0.75	-X, +X
Top front beam	0.75	0	29.625	22.5	3	0.75	-X, +X
Top back beam	0.75	21	29.625	22.5	3	0.75	-X, +X
Back covering	0	24	0	24	0.125	30.375	-X, +X

To define the geometry parametrically, formulas may be defined to correspond to anchors.

Part	Position X	Position Y	Position Z	Length X	Length Y	Length Z	Anchors
Left plate	0	0	0	0.75	24	30.375	-X
Right plate	Size-0.75	0	0	0.75	24	30.375	+X
Bottom plate	0.75	0	0	Size-1.5	24	0.75	-X, +X
Top front beam	0.75	0	29.625	Size-1.5	3	0.75	-X, +X
Top back beam	0.75	21	29.625	Size-1.5	3	0.75	-X, +X
Back covering	0	24	0	Size	0.125	30.375	-X, +X

In IFC, the product type is defined the same as any other type object, but has parametric behaviors added. This approach provides backward compatibility and enables non-parametric implementations to support geometry consistently.

```

<IfcSystemFurnitureElementType GlobalId="{1}" Name="AKURUM" Description="Base cabinet frame">
  <RepresentationMaps> <!-- static geometry defined here --> </RepresentationMaps>
  <HasAssociations><IfcRelAssociatesConstraint> <!-- parametric behaviors defined here --> </IfcRelAssociatesConstraint></HasAssociations>
</IfcSystemFurnitureElementType>

<IfcRepresentationMap>
  <MappedRepresentation>
    <IfcShapeRepresentation RepresentationIdentifier="Body" RepresentationType="CSG">
      <Items>
        <IfcBlock XLength="0.75" YLength="24.125" ZLength="30.375"> <!-- Left plate -->
          <Position><IfcAxis2Placement3D><Location><IfcCartesianPoint Points="0,0,0"/></Location></IfcAxis2Placement3D></Position>
        </Block>
        <IfcBlock XLength="0.75" YLength="24.125" ZLength="30.375"> <!-- Right plate -->
          <Position><IfcAxis2Placement3D><Location><IfcCartesianPoint Points="11.25,0,0"/></Location></IfcAxis2Placement3D></Position>
        </Block>
        <IfcBlock XLength="22.5" YLength="24.125" ZLength="0.75"> <!-- Bottom plate -->
          <Position><IfcAxis2Placement3D><Location><IfcCartesianPoint Points="0.75,0,0"/></Location></IfcAxis2Placement3D></Position>
        </Block>
        <IfcBlock XLength="22.5" YLength="3" ZLength="0.75"> <!-- Top front beam -->
          <Position><IfcAxis2Placement3D><Location><IfcCartesianPoint Points="0.75,0,29.625"/></Location></IfcAxis2Placement3D></Position>
        </Block>
        <IfcBlock XLength="22.5" YLength="3" ZLength="0.75"> <!-- Top back beam -->
          <Position><IfcAxis2Placement3D><Location><IfcCartesianPoint Points="0.75,0,29.625"/></Location></IfcAxis2Placement3D></Position>
        </Block>
        <IfcBlock XLength="24" YLength="0.125" ZLength="30.375"> <!-- Back covering -->
          <Position><IfcAxis2Placement3D><Location><IfcCartesianPoint Points="0,0,0"/></Location></IfcAxis2Placement3D></Position>
        </Block>
      </Items>
    </IfcShapeRepresentation>
  </MappedRepresentation>
</IfcRepresentationMap>

```

To support parametric sizing, defining a Bounding Box representation provides dimensional reference for defining placement and sizes of geometric items. It also provides implementations a mechanism to allow users to resize objects according to their rectangular boundary, with dimensions snapping to the nearest available configuration, and defines a default size to use when initially adding an occurrence to a project.

For defining sizes parametrically, 1D linear elements (e.g. beams, walls) should use the 'Axis' representation; 2D area-based elements (e.g. floor coverings) should use the 'FootPrint' representation; 3D volume-based elements such as cabinetry should use the 'BoundingBox' representation as described here. All of these representations are defined in IFC documentation.

```
<IfcRepresentationMap>
  <MappedRepresentation>
    <IfcShapeRepresentation RepresentationIdentifier="Body" RepresentationType="CSG">
      <Items>
        <IfcBoundingBox XDim="24" YDim="24" ZDim="30.375"/>
      </Items>
    </IfcShapeRepresentation>
  </MappedRepresentation>
</IfcRepresentationMap>
```

To support parametric behaviors, parameters and formulas are defined using constraints. Such constraints work the same as any other constraint in IFC, where they may be evaluated as passing or failing. However, by marking the ObjectiveQualifier to "Parameter", it indicates that if any constraint fails then the application should automatically update values to match backing formulas such that the constraint then passes.

```
<IfcObjective Name="Parameters" ObjectiveQualifier="parameter" LogicalAggregator="logicaland">
```

A metric is defined for the size of the cabinet providing a table of sizes with labels and corresponding dimensions. The ReferencePath is set to null, which indicates that the metric is configurable on occurrences and should be displayed in an application's user interface using the name of the metric ("Size"). Applications may display cells of all columns or just the first column when prompting the user for selection. By convention, the first column should provide a user-identifiable label of the configuration, as would normally be done in any schedule or spreadsheet.

Each column corresponding to an attribute that should be set has IfcTableColumn.ReferencePath defined. Each column that may be referenced by other constraints has its Identification set.

```
<IfcMetric Name="Size">
  <DataValue>
    <IfcTable>
      <Columns>
        <IfcTableColumn Name="Size" Identification="FrameSize"/>
        <IfcTableColumn Name="Length">
          <Reference><IfcReference>RepresentationMaps.MappedRepresentation['BoundingBox'].Items[1].XDim</IfcReference></Reference>
        </IfcTableColumn>
      </Columns>
      <Rows>
        <IfcTableRow><RowCells><IfcLabel Value="12"/><IfcPositiveLengthMeasure Value="11.875"/></RowCells></IfcTableRow>
        <IfcTableRow><RowCells><IfcLabel Value="15"/><IfcPositiveLengthMeasure Value="14.875"/></RowCells></IfcTableRow>
        <IfcTableRow><RowCells><IfcLabel Value="18"/><IfcPositiveLengthMeasure Value="17.875"/></RowCells></IfcTableRow>
        <IfcTableRow><RowCells><IfcLabel Value="21"/><IfcPositiveLengthMeasure Value="20.875"/></RowCells></IfcTableRow>
        <IfcTableRow><RowCells><IfcLabel Value="24"/><IfcPositiveLengthMeasure Value="23.875"/></RowCells></IfcTableRow>
        <IfcTableRow><RowCells><IfcLabel Value="30"/><IfcPositiveLengthMeasure Value="29.875"/></RowCells></IfcTableRow>
        <IfcTableRow><RowCells><IfcLabel Value="36"/><IfcPositiveLengthMeasure Value="35.875"/></RowCells></IfcTableRow>
      </Rows>
    </IfcTable>
  </DataValue>
</IfcMetric>
```

Metrics are also defined for each geometric attribute, using a formula of referenced parameters. The IfcMetric.ReferencePath identifies the attribute that is set to a formula. With this attribute set, then applications know to calculate this value and not display the metric to the user as configurable (hence, no need for metric names).

Applications may also recognize certain metrics by their formulas to provide higher-level user interfaces such as anchors, where geometry can be anchored to near side, far side, or both sides of each axis of the bounding box.

```
<IfcMetric>
  <ReferencePath><IfcReference>RepresentationMap.MappedRepresentation['Body'].Items[2].Position.Location.Points[1]</IfcReference></ReferencePath>
  <DataValue>
    <IfcAppliedValue ArithmeticOperator="subtract">
      <Components>
        <IfcAppliedValue><AppliedValue><IfcReference>RepresentationMaps.MappedRepresentation['BoundingBox'].Items[1].XDim</IfcReference></IfcAppliedValue>
        <IfcAppliedValue><AppliedValue><IfcLengthMeasure>.75</IfcLengthMeasure></AppliedValue></IfcAppliedValue>
      </Components>
    </IfcAppliedValue>
  </DataValue>
</IfcMetric>

<IfcMetric>
  <ReferencePath><IfcReference>RepresentationMap.MappedRepresentation['Body'].Items[3].XLength</IfcReference></ReferencePath>
  <DataValue>
    <IfcAppliedValue ArithmeticOperator="subtract">
      <Components>
        <IfcAppliedValue><AppliedValue><IfcReference>RepresentationMaps.MappedRepresentation['BoundingBox'].Items[1].XDim</IfcReference></IfcAppliedValue>
        <IfcAppliedValue><AppliedValue><IfcLengthMeasure>1.5</IfcLengthMeasure></AppliedValue></IfcAppliedValue>
      </Components>
    </IfcAppliedValue>
  </DataValue>
</IfcMetric>

<IfcMetric>
  <ReferencePath><IfcReference>RepresentationMap.MappedRepresentation['Body'].Items[4].XLength</IfcReference></ReferencePath>
  <DataValue>
    <IfcAppliedValue ArithmeticOperator="subtract">
      <Components>
        <IfcAppliedValue><AppliedValue><IfcReference>RepresentationMaps.MappedRepresentation['BoundingBox'].Items[1].XDim</IfcReference></IfcAppliedValue>
        <IfcAppliedValue><AppliedValue><IfcLengthMeasure>1.5</IfcLengthMeasure></AppliedValue></IfcAppliedValue>
      </Components>
    </IfcAppliedValue>
  </DataValue>
</IfcMetric>

<IfcMetric>
  <ReferencePath><IfcReference>RepresentationMap.MappedRepresentation['Body'].Items[5].XLength</IfcReference></ReferencePath>
  <DataValue>
    <IfcAppliedValue ArithmeticOperator="subtract">
      <Components>
        <IfcAppliedValue><AppliedValue><IfcReference>RepresentationMaps.MappedRepresentation['BoundingBox'].Items[1].XDim</IfcReference></IfcAppliedValue>
        <IfcAppliedValue><AppliedValue><IfcLengthMeasure>1.5</IfcLengthMeasure></AppliedValue></IfcAppliedValue>
      </Components>
    </IfcAppliedValue>
  </DataValue>
</IfcMetric>

<IfcMetric>
  <ReferencePath><IfcReference>RepresentationMap.MappedRepresentation['Body'].Items[6].LengthX</IfcReference></ReferencePath>
  <DataValue>
    <IfcAppliedValue>
      <AppliedValue><IfcReference>RepresentationMaps.MappedRepresentation['BoundingBox'].Items[1].XDim</IfcReference></AppliedValue>
    </IfcAppliedValue>
  </DataValue>
</IfcMetric>
```

Similar to size, a metric is also defined for Color, also named and having ReferencePath set to null. A texture file is referenced for each row. Applications may display such textures in the user interface for picking such colors by detecting the ReferencePath corresponding to IfcImageTexture.UrlReference.

```
<IfcMetric Name="Color">
  <DataValue>
    <IfcTable>
      <Columns>
        <IfcTableColumn Name="Color" Identification="FrameColor"/>
        <IfcTableColumn Name="Texture">
          <ReferencePath><IfcReference>RepresentationMaps.MappedRepresentation['Body'].Items[*].StyledByItem.Styles\IfcSurfaceStyle.Styles\IfcSurfaceStyleWithTextures
          .Textures\IfcImageTexture.UrlReference</IfcReference></ReferencePath>
        </IfcTableColumn>
      </Columns>
      <Rows>
        <IfcTableRow><RowCells><IfcLabel Value="white"/><IfcUrlReference Value="http://www.ikea.com/us/en/images/products/perfekt-cover-panel-for-base-
cabinet__0084008_PE210282_S4.JPG"/></RowCells></IfcTableRow>
        <IfcTableRow><RowCells><IfcLabel Value="birch effect"/><IfcUrlReference Value="http://www.ikea.com/us/en/images/products/perfekt-orsa-cover-panel-for-
base-cabinet__0183273_PE334435_S4.JPG:/></RowCells></IfcTableRow>
      </Rows>
    </IfcTable>
  </DataValue>
</IfcMetric>
```

Finally, a metric is also defined for Article, which brings together sizes and colors into specific articles (having SKUs) that may be purchased. While it would also be possible to have the Article table define all the data for sizes and colors directly (rather than having separate tables), separating them eliminates redundancy and enables applications to provide user interfaces for configuring each parameter separately.

For this table, IfcTableColumn.Identification identifies another IfcTableColumn within another IfcMetric by name (FrameColor and FrameSize). The price is mapped to IfcCostItem, which enables any assigned costs to be automatically updated if the occurrence should change to use a different article. An image file is provided for each referenced article, where applications may present in user interfaces by detecting the well-known ReferencePath pointing to a document reference (using same icon convention established in IFC Product Library Model View). Only the first row is shown in this example, for brevity.

```
<IfcMetric Name="Article">
  <ReferencePath><IfcReference>Tag</IfcReference></ReferencePath>
  <DataValue>
    <IfcTable>
      <Columns>
        <IfcTableColumn Name="Article"/>
        <IfcTableColumn Name="Color" Identification="FrameColor"/>
        <IfcTableColumn Name="Size" Identification="FrameSize"/>
        <IfcTableColumn Name="Price" > <ReferencePath><IfcReference>
Types[*].RelatedObjects[*]\IfcProduct.HasAssignments\IfcRelAssignsToControl.RelatingControl\IfcCostItem.CostValues['MSRP'].AppliedValue\IfcMonetaryMeasure
        </IfcReference></ReferencePath></IfcTableColumn>
        <IfcTableColumn Name="Image"> <ReferencePath><IfcReference>
Types[*].RelatedObjects[*].HasAssociations['Icon']\IfcRelAssociatesDocument.RelatingDocument\IfcDocumentInformation.Location\IfcUriReference
        </ReferencePath></ReferencePath>
      </IfcTableColumn>
    </Columns>
    <Rows>
      <IfcTableRow>
        <RowCells>
          <IfcIdentifier>543.817.10</IfcIdentifier>
          <IfcLabel>white</IfcLabel>
          <IfcPositiveLengthMeasure>12</IfcPositiveLengthMeasure>
          <IfcMonetaryMeasure>28</IfcMonetaryMeasure>
          <IfcUrlReference>http://www.ikea.com/us/en/images/products/akurum-base-cabinet-frame__35804_PE126721_S4.jpg</IfcUrlReference>
        </IfcTableRow>
      ...
    </Rows>
  </IfcTable>
</DataValue>
</IfcMetric>
```

This then marks the end of the product type definition.

```
</IfcObjective>
</IfcRelAssociatesConstraint>
</HasAssociations>
</IfcSystemFurnitureElementType>
```

Upon instantiating occurrences of such types, the configuration of each occurrence is defined by constraints indicating parameter values. The rationale for using constraints as opposed to other attributes or property sets is to prevent non-constraint-aware applications or users from modifying such data, leading to inconsistencies.

```
<IfcSystemFurnitureElement Name="BaseCabinetFrame1">
  <HasAssociations>
    <IfcRelAssociatesConstraint>
      <IfcObjective Name="Parameters" ObjectiveQualifier="parameter" >
        <IfcMetric Name="Article"><DataValue><IfcIdentifier>743.821.10</IfcIdentifier></DataValue></IfcMetric>
        <IfcMetric Name="Size"><DataValue><IfcPositiveLengthMeasure>24</IfcPositiveLengthMeasure ></DataValue></IfcMetric>
        <IfcMetric Name="Color"><DataValue><IfcLabel>white</IfcLabel></DataValue></IfcMetric>
      </IfcObjective>
    </IfcRelAssociatesConstraint>
  </HasAssociations>
</IfcSystemFurnitureElement>
```

This completes the first example of defining cabinet frames parametrically. While it would be possible to use such frames directly as occurrences, it is much more powerful to define parameters at a higher level, specifically for each Cabinet, which contains one Frame, one or more Fronts (for doors, drawers, or fixed panels), and other objects.

Wall Cabinet Frame

Wall cabinet frames are defined similarly to base cabinet frames, but have slightly different geometry – instead of beams at the top to hold a countertop, the frame is fully enclosed.



Each size corresponds to geometry defined parametrically, where the actual size is slightly less than the nominal size.

Size	Width	Height
12x30	12	30
12x39	12	39
15x30	15	30
15x39	15	39
18x30	18	30
18x39	18	39
21x30	21	30
21x39	21	39
24x18	24	18
24x24	24	24
24x30	24	30
24x39	24	39
30x15	30	15
30x18	30	18
30x24	30	24
30x30	30	30
30x39	30	39
36x15	36	15
36x18	36	18
36x24	36	24
36x30	36	30
36x39	36	39

Each color corresponds to a texture defined parametrically for visualization.

Color	Texture
birch effect	http://www.ikea.com/us/en/images/products/perfekt-orsa-cover-panel-for-base-cabinet__0183273_PE334435_S4.JPG
white	http://www.ikea.com/us/en/images/products/perfekt-cover-panel-for-base-cabinet__0084008_PE210282_S4.JPG

Each article number identifies a product type with a SKU, relating size and color, price, and image preview:

Article	Color	Size	Price	Image
900.494.03	Birch effect	12x30	21	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35851_PE126781_S4.jpg
700.494.04	Birch effect	12x39	26	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35855_PE126785_S4.jpg
400.494.05	Birch effect	15x30	22	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34373_PE124306_S4.jpg
200.494.06	Birch effect	15x39	27	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34374_PE124307_S4.jpg
000.494.07	Birch effect	18x30	23	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35852_PE126782_S4.jpg
600.494.09	Birch effect	18x39	29	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35856_PE126786_S4.jpg
200.494.11	Birch effect	21x30	25	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35861_PE126791_S4.jpg
000.494.12	Birch effect	21x39	31	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35863_PE126793_S4.jpg
800.494.13	Birch effect	24x18	24	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34386_PE124321_S4.jpg
600.494.14	Birch effect	24x24	25	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34377_PE124310_S4.jpg
300.494.15	Birch effect	24x30	26	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34380_PE124315_S4.jpg
100.494.16	Birch effect	24x39	32	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35852_PE126782_S4.jpg
900.494.17	Birch effect	30x15	22	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35922_PE126812_S4.jpg
700.494.18	Birch effect	30x18	23	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34384_PE124319_S4.jpg
500.494.19	Birch effect	30x24	27	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35916_PE126809_S4.jpg
300.494.20	Birch effect	30x30	29	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35859_PE126789_S4.jpg
100.494.21	Birch effect	30x39	35	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35864_PE126794_S4.jpg
900.494.22	Birch effect	36x15	25	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35922_PE126812_S4.jpg
700.494.23	Birch effect	36x18	28	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34384_PE124319_S4.jpg
500.494.24	Birch effect	36x24	31	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35916_PE126809_S4.jpg
200.494.25	Birch effect	36x30	34	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34386_PE124321_S4.jpg
000.494.26	Birch effect	36x39	41	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35908_PE126804_S4.jpg
343.837.10	White	12x30	21	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35853_PE126783_S4.jpg
943.976.10	White	12x39	26	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35857_PE126787_S4.jpg
143.838.10	White	15x30	22	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35858_PE126788_S4.jpg
443.832.10	White	15x39	27	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34376_PE124309_S4.jpg
943.839.10	White	18x30	23	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35854_PE126784_S4.jpg
243.833.10	White	18x39	29	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35858_PE126788_S4.jpg
043.834.10	White	21x30	25	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35862_PE126792_S4.jpg
743.977.10	White	21x39	31	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35865_PE126795_S4.jpg
643.826.10	White	24x18	24	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34387_PE124322_S4.jpg
743.840.10	White	24x24	25	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34379_PE124314_S4.jpg
743.835.10	White	24x30	26	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34381_PE124316_S4.jpg
742.690.10	White	24x39	32	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34383_PE124318_S4.jpg
143.843.10	White	30x15	22	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35923_PE126813_S4.jpg
443.827.10	White	30x18	23	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34385_PE124320_S4.jpg
543.841.10	White	30x24	27	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35914_PE126808_S4.jpg
543.836.10	White	30x30	29	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35860_PE126790_S4.jpg
043.829.10	White	30x39	35	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35866_PE126796_S4.jpg
943.844.10	White	36x15	25	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35923_PE126813_S4.jpg
243.828.10	White	36x18	28	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34385_PE124320_S4.jpg
343.842.10	White	36x24	31	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35914_PE126808_S4.jpg
643.831.10	White	36x30	34	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__34387_PE124322_S4.jpg
843.830.10	White	36x39	41	http://www.ikea.com/us/en/images/products/akurum-wall-cabinet-frame__35919_PE126810_S4.jpg

High Cabinet Frames

High cabinet frames use the shape of wall cabinet frames but have the placement of base cabinet frames.



Each size corresponds to geometry defined parametrically, where the actual size is slightly less than the nominal size.

Size	Width	Height
15x80	15	80
15x88	15	88
24x80	24	80
24x88	24	88
30x80	30	80
30x88	30	88

Each color corresponds to a texture defined parametrically for visualization.

Color	Texture
birch effect	http://www.ikea.com/us/en/images/products/perfekt-orsa-cover-panel-for-base-cabinet__0183273_PE334435_S4.JPG
white	http://www.ikea.com/us/en/images/products/perfekt-cover-panel-for-base-cabinet__0084008_PE210282_S4.JPG

Each article number identifies a product type with a SKU, relating size and color, price, and image preview.

Article	Color	Size	Price	Image
200.493.50	Birch effect	15x80	70	http://www.ikea.com/us/en/images/products/akurum-high-cabinet-frame__34358_PE124291_S4.jpg
800.493.52	Birch effect	15x88	77	http://www.ikea.com/us/en/images/products/akurum-high-cabinet-frame__34361_PE124294_S4.jpg
600.493.53	Birch effect	24x80	82	http://www.ikea.com/us/en/images/products/akurum-high-cabinet-frame__35834_PE126757_S4.jpg
100.493.55	Birch effect	24x88	89	http://www.ikea.com/us/en/images/products/akurum-high-cabinet-frame__35833_PE126756_S4.jpg
900.493.56	Birch effect	30x80	92	http://www.ikea.com/us/en/images/products/akurum-high-cabinet-frame__35834_PE126757_S4.jpg
700.493.57	Birch effect	30x88	99	http://www.ikea.com/us/en/images/products/akurum-high-cabinet-frame__35835_PE126758_S4.jpg
843.811.10	White	15x80	70	http://www.ikea.com/us/en/images/products/akurum-high-cabinet-frame__34359_PE124292_S4.jpg
243.814.10	White	15x88	77	http://www.ikea.com/us/en/images/products/akurum-high-cabinet-frame__34362_PE124295_S4.jpg
643.812.10	White	24x80	82	http://www.ikea.com/us/en/images/products/akurum-high-cabinet-frame__35868_PE126798_S4.jpg
943.815.10	White	24x88	89	http://www.ikea.com/us/en/images/products/akurum-high-cabinet-frame__35836_PE126759_S4.jpg
244.960.10	White	30x80	92	http://www.ikea.com/us/en/images/products/akurum-high-cabinet-frame__35868_PE126798_S4.jpg
044.961.10	White	30x88	99	http://www.ikea.com/us/en/images/products/akurum-high-cabinet-frame__35837_PE126760_S4.jpg

Fronts

Fronts are defined similarly to frames, but have three parameters: Color, Width, and Height. Some pieces are sold as articles individually, while others are sold in partial or full combinations.

<http://www.ikea.com/us/en/catalog/products/40231206>



Color	Texture
Abstrakt high gloss cream	http://www.ikea.com/us/en/images/products/abstrakt-drawer-front-set-of-_0154491_PE312749_S4.JPG
Abstrakt high gloss gray	http://www.ikea.com/us/en/images/products/abstrakt-drawer-front-set-of-_0154487_PE312745_S4.JPG
Abstrakt high gloss white	http://www.ikea.com/us/en/images/products/abstrakt-drawer-front-set-of-_0154490_PE312748_S4.JPG
Adel medium brown	
Adel off-white	
Applad white	
Gnosjo wood effect black	http://www.ikea.com/us/en/images/products/gnosjo-drawer-front-set-of-_0145566_PE304890_S4.JPG
Harlig white	
Lidi grey	http://www.ikea.com/us/en/images/products/lidingo-drawer-front-set-of-_0151567_PE309610_S4.JPG
Lidi white	
Lixtorp brown	http://www.ikea.com/us/en/images/products/lixtorp-drawer-front-set-of-_0162809_PE318062_S4.JPG
Orsa birch	http://www.ikea.com/us/en/images/products/orsa-drawer-front-set-of-_0183399_PE334444_S4.JPG
Ramsjo black-brown	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front-set-of-_0154498_PE312756_S4.JPG
Ramsjo red-brown	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front-set-of-_0124705_PE281634_S4.JPG
Ramsjo white	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front-set-of-_0154499_PE312757_S4.JPG
Rockhammer wood effect brown	http://www.ikea.com/us/en/images/products/rockhammar-drawer-front-set-of-_0145737_PE304935_S4.JPG
Sofielund walnut effect light grey	12x30
Stat white	

Panel
Flat
Raised
Glass

Article	Color	W	H	Panel	\$	Image
302.311.79	Lixtorp	12	24	Raised	37	http://www.ikea.com/us/en/images/products/lixtorp-door_0162783_PE318059_S4.JPG
102.311.80	Lixtorp	12	30	Raised	42	http://www.ikea.com/us/en/images/products/lixtorp-door_0162783_PE318059_S4.JPG
902.311.81	Lixtorp	12	39	Raised	57	http://www.ikea.com/us/en/images/products/lixtorp-door_0162783_PE318059_S4.JPG
002.311.85	Lixtorp	15	24	Raised	44	http://www.ikea.com/us/en/images/products/lixtorp-door_0162783_PE318059_S4.JPG
802.311.86	Lixtorp	15	30	Raised	56	http://www.ikea.com/us/en/images/products/lixtorp-door_0162783_PE318059_S4.JPG
102.312.22	Lixtorp	15	30	Glass	74	http://www.ikea.com/us/en/images/products/lixtorp-glass-door_0162878_PE318069_S4.JPG
602.311.87	Lixtorp	15	39	Raised	73	http://www.ikea.com/us/en/images/products/lixtorp-door_0162783_PE318059_S4.JPG
902.312.23	Lixtorp	15	39	Glass	98	http://www.ikea.com/us/en/images/products/lixtorp-glass-door_0162878_PE318069_S4.JPG
402.311.88	Lixtorp	15	64	Raised	112	http://www.ikea.com/us/en/images/products/lixtorp-door_0162762_PE318052_S4.JPG
202.312.12	Lixtorp	15	6	Flat	18	http://www.ikea.com/us/en/images/products/lixtorp-drawer-front_0162846_PE318066_S4.JPG
902.312.04	Lixtorp	15	30	Raised	66	http://www.ikea.com/us/en/images/products/lixtorp-deep-drawer-front-set-of-_0162815_PE318063_S4.JPG
102.312.17	Lixtorp	15	30	Flat	69	http://www.ikea.com/us/en/images/products/lixtorp-drawer-front-set-of-_0162852_PE318067_S4.JPG
802.311.91	Lixtorp	18	24	Raised	51	http://www.ikea.com/us/en/images/products/lixtorp-door_0162783_PE318059_S4.JPG
602.311.92	Lixtorp	18	30	Raised	65	http://www.ikea.com/us/en/images/products/lixtorp-door_0162783_PE318059_S4.JPG
702.312.24	Lixtorp	18	30	Glass	98	http://www.ikea.com/us/en/images/products/lixtorp-glass-door_0162878_PE318069_S4.JPG
402.311.93	Lixtorp	18	39	Raised	88	http://www.ikea.com/us/en/images/products/lixtorp-door_0162783_PE318059_S4.JPG
402.312.25	Lixtorp	18	39	Glass	101	http://www.ikea.com/us/en/images/products/lixtorp-glass-door_0162878_PE318069_S4.JPG
002.312.13	Lixtorp	18	6	Flat	19	http://www.ikea.com/us/en/images/products/lixtorp-drawer-front_0162846_PE318066_S4.JPG
602.312.05	Lixtorp	18	30	Raised	78	http://www.ikea.com/us/en/images/products/lixtorp-deep-drawer-front-set-of-_0162815_PE318063_S4.JPG
902.312.18	Lixtorp	18	30	Flat	80	http://www.ikea.com/us/en/images/products/lixtorp-drawer-front-set-of-_0162852_PE318067_S4.JPG
202.311.94	Lixtorp	21	24	Raised	61	http://www.ikea.com/us/en/images/products/lixtorp-door_0162783_PE318059_S4.JPG
902.311.95	Lixtorp	21	30	Raised	73	http://www.ikea.com/us/en/images/products/lixtorp-door_0162783_PE318059_S4.JPG
702.311.96	Lixtorp	21	39	Raised	98	http://www.ikea.com/us/en/images/products/lixtorp-door_0162783_PE318059_S4.JPG
802.312.14	Lixtorp	21	6	Flat	23	http://www.ikea.com/us/en/images/products/lixtorp-drawer-front_0162846_PE318066_S4.JPG

102.311.99	Lixtorp	24	24	Raised	61	http://www.ikea.com/us/en/images/products/lixtorp-door__0162783_PE318059_S4.JPG
702.312.00	Lixtorp	24	30	Raised	76	http://www.ikea.com/us/en/images/products/lixtorp-door__0162783_PE318059_S4.JPG
502.312.01	Lixtorp	24	39	Raised	100	http://www.ikea.com/us/en/images/products/lixtorp-door__0162783_PE318059_S4.JPG
302.312.02	Lixtorp	24	64	Raised	161	http://www.ikea.com/us/en/images/products/lixtorp-door__0162762_PE318052_S4.JPG
502.312.15	Lixtorp	24	6	Flat	24	http://www.ikea.com/us/en/images/products/lixtorp-drawer-front__0162846_PE318066_S4.JPG
102.312.03	Lixtorp	24	24	Raised	72	http://www.ikea.com/us/en/images/products/lixtorp-drawer-front-set-of__0162809_PE318062_S4.JPG
402.312.06	Lixtorp	30	30	Raised	134	http://www.ikea.com/us/en/images/products/lixtorp-drawer-front-set-of__0162817_PE318064_S4.JPG
202.312.07	Lixtorp	36	30	Raised	129	http://www.ikea.com/us/en/images/products/lixtorp-drawer-front-set-of__0162817_PE318064_S4.JPG
001.532.67	Ramsjo black-brown	12	24	Raised	44	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
801.532.68	Ramsjo black-brown	12	30	Raised	54	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
601.532.69	Ramsjo black-brown	12	39	Raised	66	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
001.532.72	Ramsjo black-brown	15	24	Raised	51	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
801.532.73	Ramsjo black-brown	15	30	Raised	64	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
101.533.37	Ramsjo black-brown	15	30	Glass	70	http://www.ikea.com/us/en/images/products/ramsjo-glass-door__0113265_PE275637_S4.JPG
601.532.74	Ramsjo black-brown	15	39	Raised	81	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
901.533.38	Ramsjo black-brown	15	39	Glass	88	http://www.ikea.com/us/en/images/products/ramsjo-glass-door__0113265_PE275637_S4.JPG
301.532.75	Ramsjo black-brown	15	64	Raised	131	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
501.533.21	Ramsjo black-brown	15	6	Flat	19	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front__0113262_PE265330_S4.JPG
201.533.13	Ramsjo black-brown	15	30	Deep	78	http://www.ikea.com/us/en/images/products/ramsjo-deep-drawer-front-set-of__0121510_PE278162_S4.JPG
	Ramsjo black-brown	15	30	Flat		
701.532.78	Ramsjo black-brown	18	24	Raised	61	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
501.532.79	Ramsjo black-brown	18	30	Raised	74	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
701.533.39	Ramsjo black-brown	18	30	Glass	79	http://www.ikea.com/us/en/images/products/ramsjo-glass-door__0113265_PE275637_S4.JPG
301.532.80	Ramsjo black-brown	18	39	Raised	95	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
501.533.40	Ramsjo black-brown	18	39	Glass	103	http://www.ikea.com/us/en/images/products/ramsjo-glass-door__0113265_PE275637_S4.JPG
301.533.22	Ramsjo black-brown	18	6	Flat	20	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front__0113262_PE265330_S4.JPG
001.533.14	Ramsjo black-brown	18	30	Deep	88	http://www.ikea.com/us/en/images/products/ramsjo-deep-drawer-front-set-of__0121510_PE278162_S4.JPG
	Ramsjo black-brown	18	30	Flat		
101.532.81	Ramsjo black-brown	21	24	Raised	69	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
901.532.82	Ramsjo black-brown	21	30	Raised	86	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
701.532.83	Ramsjo black-brown	21	39	Raised	108	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
101.533.23	Ramsjo black-brown	21	6	Flat	24	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front__0113262_PE265330_S4.JPG
001.532.86	Ramsjo black-brown	24	24	Raised	75	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
801.532.87	Ramsjo black-brown	24	30	Raised	91	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
601.532.88	Ramsjo black-brown	24	39	Raised	114	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
401.532.89	Ramsjo black-brown	24	64	Raised	208	http://www.ikea.com/us/en/images/products/ramsjo-door__0109862_PE259643_S4.JPG
901.533.24	Ramsjo black-brown	24	6	Flat	27	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front__0113262_PE265330_S4.JPG
201.533.08	Ramsjo black-brown	24	24	Deep	86	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front-set-of__0154498_PE312756_S4.JPG
701.533.15	Ramsjo black-brown	30	30	Deep	138	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front-set-of__0143125_PE302720_S4.JPG
501.533.16	Ramsjo black-brown	36	30	Deep	136	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front-set-of__0143125_PE302720_S4.JPG
	Ramsjo red-brown	12	24	Raised		
	Ramsjo red-brown	12	30	Raised		
	Ramsjo red-brown	12	39	Raised		
	Ramsjo red-brown	15	24	Raised		
	Ramsjo red-brown	15	30	Raised		
	Ramsjo red-brown	15	30	Glass		
	Ramsjo red-brown	15	39	Raised		
	Ramsjo red-brown	15	39	Glass		
	Ramsjo red-brown	15	64	Raised		
	Ramsjo red-brown	15	6	Flat		
202.106.34	Ramsjo red-brown	15	30	Deep	66	http://www.ikea.com/us/en/images/products/ramsjo-deep-drawer-front-set-of__0124706_PE281635_S4.JPG
	Ramsjo red-brown	15	30	Flat		
	Ramsjo red-brown	18	24	Raised		
	Ramsjo red-brown	18	30	Raised		
	Ramsjo red-brown	18	30	Glass		
	Ramsjo red-brown	18	39	Raised		
	Ramsjo red-brown	18	39	Glass		
	Ramsjo red-brown	18	6	Flat		
902.106.35	Ramsjo red-brown	18	30	Deep	78	http://www.ikea.com/us/en/images/products/ramsjo-deep-drawer-front-set-of__0124706_PE281635_S4.JPG
	Ramsjo red-brown	18	30	Flat		
	Ramsjo red-brown	21	24	Raised		
	Ramsjo red-brown	21	30	Raised		
	Ramsjo red-brown	21	39	Raised		
	Ramsjo red-brown	21	6	Flat		
	Ramsjo red-brown	24	24	Raised		
	Ramsjo red-brown	24	30	Raised		
	Ramsjo red-brown	24	39	Raised		
	Ramsjo red-brown	24	64	Raised		
	Ramsjo red-brown	24	6	Flat		
402.106.33	Ramsjo red-brown	24	24	Deep	72	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front-set-of__0124705_PE281634_S4.JPG
701.533.15	Ramsjo red-brown	30	30	Deep	134	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front-set-of__0124707_PE281636_S4.JPG
502.106.37	Ramsjo red-brown	36	30	Deep	129	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front-set-of__0124707_PE281636_S4.JPG

	Ramsjo white	12	24	Raised		
	Ramsjo white	12	30	Raised		
	Ramsjo white	12	39	Raised		
	Ramsjo white	15	24	Raised		
	Ramsjo white	15	30	Raised		
	Ramsjo white	15	30	Glass		
	Ramsjo white	15	39	Raised		
	Ramsjo white	15	39	Glass		
	Ramsjo white	15	64	Raised		
	Ramsjo white	15	6	Flat		
501.584.89	Ramsjo white	15	30	Deep	78	http://www.ikea.com/us/en/images/products/ramsjo-deep-drawer-front-set-of-_0121503_PE278161_S4.JPG
	Ramsjo white	15	30	Flat		
	Ramsjo white	18	24	Raised		
	Ramsjo white	18	30	Raised		
	Ramsjo white	18	30	Glass		
	Ramsjo white	18	39	Raised		
	Ramsjo white	18	39	Glass		
	Ramsjo white	18	6	Flat		
301.584.90	Ramsjo white	18	30	Deep	88	http://www.ikea.com/us/en/images/products/ramsjo-deep-drawer-front-set-of-_0121503_PE278161_S4.JPG
	Ramsjo white	18	30	Flat		
	Ramsjo white	21	24	Raised		
	Ramsjo white	21	30	Raised		
	Ramsjo white	21	39	Raised		
	Ramsjo white	21	6	Flat		
	Ramsjo white	24	24	Raised		
	Ramsjo white	24	30	Raised		
	Ramsjo white	24	39	Raised		
	Ramsjo white	24	64	Raised		
	Ramsjo white	24	6	Flat		
301.584.85	Ramsjo white	24	24	Deep	86	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front-set-of-_0154499_PE312757_S4.JPG
101.584.91	Ramsjo white	30	30	Deep	138	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front-set-of-_0143126_PE302721_S4.JPG
901.584.92	Ramsjo white	36	30	Deep	161	http://www.ikea.com/us/en/images/products/ramsjo-drawer-front-set-of-_0143126_PE302721_S4.JPG

Layout	Description
Full	One panel takes up entire space
Horizontal	Two panels split horizontally (e.g. doors), taking up entire vertical space
Vertical	Top panel separate from lower panel ()
Vertical-Horizontal	Top panel separate from lower panels split horizontally (doors)
Vertical-Vertical	Top panel separate from lower panels split vertically (drawers)

Configuration	Frame Size	Layout	Upper Width	Lower Width	Door Size	Door Count
12-Door1	12				12	1
15-Door1	15				15	1
15-Drawers	15		15	15		
18-Door1	18					
18-Drawers	18		18	18		
21-Door1	21					
24-Door1	24					
24-Door2	24		24		12	2
24-Drawers	24		24	24		
30-Door2	30		15		15	2
30-Drawers	30		15	30		
36-Door2	36		18		18	2
36-Drawers	36		18	36		

Legs

Legs are defined similarly to frames, and have two parameters: Color and Size, however in this case, multiple sizes are only available for the stainless steel legs (4", 6", 8").

<http://www.ikea.com/us/en/catalog/products/20049538>



Assemblies

Parametric assemblies allow combinations of object types to be defined. Such assemblies do not have article numbers themselves, as they refer to configurations of articles. Combining into a single assembly allows users to easily modify an object by selecting particular parameters, rather than constructing from scratch.

The cabinet assembly is decomposed into aggregation relationships, where each part linked to the corresponding type (as defined earlier in this document).

Upon instantiating the Cabinet type into occurrences, the occurrence object also has part occurrences instantiated, where each part occurrence is linked to the corresponding type part using IfcRelDefinesByObject as defined in IFC4 documentation.

```
<IfcElementAssemblyType Name="IKEA Cabinet">

<IsDecomposedBy>
  <IfcSystemFurnitureElement Name="Frame">
    <IsTypedBy><IfcSystemFurnitureElementType ref="{1}" /></IsTypedBy>
  </IfcSystemFurnitureElement>
  <IfcSystemFurnitureElement Name="Drawers">
    <IsTypedBy><IfcSystemFurnitureElementType ref="{2}" /></IsTypedBy>
  </IfcSystemFurnitureElement>
  <IfcSystemFurnitureElement Name="Doors">
    <IsTypedBy><IfcSystemFurnitureElementType ref="{2}" /></IsTypedBy>
    <ObjectPlacement></ObjectPlacement>
  </IfcSystemFurnitureElement>
  <IfcSystemFurnitureElement Name="Legs">
    <IsTypedBy><IfcSystemFurnitureElementType ref="{3}" /></IsTypedBy>
  </IfcSystemFurnitureElement>
</IsDecomposedBy>
```

The cabinet assembly has a table of configurations – such configurations do not correspond to anything that can be ordered specifically, and may or may not be defined by the manufacturer. The assemblies below were derived by navigating the IKEA website.

Part	Placement	Anchor-X	Anchor-Y	Anchor-Z
Frame		Span	Max	+LegHeight
Front Lower		Span	Min	
Front Upper		Span	Min	
Legs		Span		Min

Layout	Frame Size	Front Layout	Upper Front Size	Lower Front Size
12-1	12	1		12x30
15-1	15	1		15x30
15-2	15	2	15x6	15x24
18-1	18	1		18x30
18-2	18	2	18x6	18x24
21-1	21	1		21x30
21-2	21	2	21x6	21x30
24-1	24	1		24x30
24-2	24	2	24x6	24x24
24-3	24	3	24x6	24x24
30-2	30	2	15x6	15x24
30-3	30	3		30x30
36-2	36	2	18x6	18x24
36-3	36	3		36x30

Parameter	
Frame Size	36"
Frame Color	Birch effect
Front Layout	3
Front Color	Lixtorp brown
Leg Size	4
Leg Color	Stainless steel

A table metric is defined, similar to the previous examples, but columns are mapped to other constraints found in aggregated occurrences by `IfcTableColumn.Identification`.

The Door Count parameter indicates multiple placement for the same item, where the particular part is identified by name (corresponding to the part aggregated at the type object). While separate `IfcProduct`-based parts could be elaborated for each part (and would also be valid), such approach could potentially result in much larger files, particularly for repetitive elements such as floor tile or rebar. This example uses `IfcMappedItem` for multiple pattern placement (as documented in IFC4 such as for rebar).

```
<HasAssociations>
<IfcRelAssociatesConstraint>
  <IfcObjective Name="Parameters" ObjectiveQualifier="parameter" >
    <IfcMetric Name="Assembly">
      <DataValue>
        <IfcTable>
          <IfcTableColumn Name="Assembly" />
          <IfcTableColumn Name="Frame Size" Identification="FrameSize"/>
          <IfcTableColumn Name="Drawer Width" Identification="FrontWidth"/>
          <IfcTableColumn Name="Drawer Height" Identification="FrontHeight"/>
          <IfcTableColumn Name="Door Count">
            <ReferencePath>
Types[*].RelatedObjects[*]\IfcElementAssembly.IsDecomposedBy[*].RelatedObjects['Doors']\IfcSystemFurnitureElement.HasRepresentation.Representations['Body']
.Items[]\IfcMappedItem
            </ReferencePath>
          </IfcTableColumn>
          <IfcTableColumn Name="Door Width"/>
        </IfcTable>
      </DataValue>
    </IfcMetric>
```

A metric is also defined to indicate placement of multiple geometry instances. A formula is defined for each mapped item, where the placement offset is defined as the instance number multiplied by the X dimension of the bounding box of the doors.

```

    <IfcMetric>
      <ReferencePath>
Types[*].RelatedObjects[*]\IfcElementAssembly.IsDecomposedBy[*].RelatedObjects['Doors']\IfcSystemFurnitureElement.HasRepresentation.Representations['Body']
.Items[]\IfcMappedItem.MappingTarget.LocalOrigin.Points[1]
      </ReferencePath>
      <DataValue>
<IfcAppliedValue ArithmeticOperator="multiply">
      <Components>
      <IfcAppliedValue><AppliedValue><DataValue><IfcReference>
Types[*].RelatedObjects[*]\IfcElementAssembly.IsDecomposedBy[*].RelatedObjects['Doors']\IfcSystemFurnitureElement.HasRepresentation.Representations['Body']
.Items[#]</IfcReference></DataValue></IfcAppliedValue>
      <IfcAppliedValue><AppliedValue><DataValue><IfcReference>
Types[*].RelatedObjects[*]\IfcElementAssembly.IsDecomposedBy[*].RelatedObjects['Doors']\IfcSystemFurnitureElement.HasRepresentation.Representations['Bound
ingBox'].Items[0]\IfcBoundingBox.LengthX</IfcReference></DataValue></IfcAppliedValue>
      </Components>
    </IfcAppliedValue>
    </DataValue>
  </IfcMetric>

```

Metrics are also redefined for aggregated parts that should be exposed externally at a higher level, such as Size, Frame Color, Front Color, and Leg Color. IfcMetric.ValueSource identifies the corresponding IfcTableColumn by identifier.

```

<IfcMetric Name="Size" ValueSource="FrameSize"/>
<IfcMetric Name="Frame Color" ValueSource="FrameColor"/>
<IfcMetric Name="Fronts" ValueSource="FrontColor"/>
<IfcMetric Name="Leg Color" ValueSource="LegColor"/>
<IfcMetric Name="Leg Size" ValueSource="LegSize"/>

    </IfcObjective>
  </IfcRelAssociatesConstraint>
</HasAssociations>

</IfcElementAssemblyType>

```

This completes the Cabinet type definition.

Upon instantiating occurrences of the Cabinet type, the configuration of each occurrence is defined by constraints indicating parameter values, the same as done in previous examples. However, constraints of aggregated objects may also be rolled up as defined on the Cabinet type object – this enables defining settings that apply to multiple aggregated objects such as multiple drawer fronts of the same cabinet using the same color.

```
<IfcSystemFurnitureElement Name="BaseCabinet1">
  <IsDecomposedBy>
    <IfcSystemFurnitureElement Name="Frame">
      <IsTypedBy><IfcSystemFurnitureElementType ref="{1}" /></IsTypedBy>
    </IfcSystemFurnitureElement>
    <IfcSystemFurnitureElement Name="Drawers">
      <IsTypedBy><IfcSystemFurnitureElementType ref="{2}" /></IsTypedBy>
    </IfcSystemFurnitureElement>
    <IfcSystemFurnitureElement Name="Doors">
      <IsTypedBy><IfcSystemFurnitureElementType ref="{2}" /></IsTypedBy>
      <ObjectPlacement></ObjectPlacement>
    </IfcSystemFurnitureElement>
    <IfcSystemFurnitureElement Name="Legs">
      <IsTypedBy><IfcSystemFurnitureElementType ref="{3}" /></IsTypedBy>
    </IfcSystemFurnitureElement>
  </IsDecomposedBy>
  <HasAssociations>
    <IfcRelAssociatesConstraint>
      <IfcObjective Name="Parameters" ObjectiveQualifier="parameter" >
        <IfcMetric Name="Frame Size"><DataValue><IfcPositiveLengthMeasure>24</IfcPositiveLengthMeasure></DataValue></IfcMetric>
        <IfcMetric Name="Frame Color"><DataValue><IfcLabel>white</IfcLabel></DataValue></IfcMetric>
        <IfcMetric Name="Front Color"><DataValue><IfcLabel>lixtorp brown</IfcLabel></DataValue></IfcMetric>
        <IfcMetric Name="Leg Color"><DataValue><IfcLabel>stainless steel</IfcLabel></DataValue></IfcMetric>
        <IfcMetric Name="Leg Size"><DataValue><IfcPositiveLengthMeasure>4</IfcPositiveLengthMeasure></DataValue></IfcMetric>
      </IfcObjective>
    </IfcRelAssociatesConstraint>
  </HasAssociations>
</IfcSystemFurnitureElement>
```

This completes the first example of defining cabinet frames parametrically. While it would be possible to use such frames directly as occurrences, it is much more powerful to define parameters at a higher level, specifically for each Cabinet, which contains one Frame, one or more Fronts (for doors, drawers, or fixed panels), and other objects.

Sections



The next step is to define a parametric Cabinet Section, which allows definitions of connected cabinets where placement can be done parametrically and styles can be used consistently throughout. This also ties in countertops, backsplashes, and baseboards.

Parametric Model View Definitions

While parametric modelling may be performed generically, model view definitions may be defined to standardize usage in general, as well as specific to particular product types. For example, a general-purpose Parametric Product Library model view would define the basic mechanism for expressing parametric behaviors along with several parameters that may apply to all product types such as Article, Price, and Image. Then, specific configurations may be defined for specific product types.

This example above could be standardized within an MVD, such that all cabinets must follow a similar approach. As different vendors will likely offer different configuration options, parameters will likely vary, however sharing the most common parameters may assist users in becoming familiar with commonalities.

The approach proposed herein allows any product manufacturer or BIM application vendor to define constraints as they see fit, and any other application to leverage such constraints to change the model after-the-fact, even if they did not create the parametric behavior originally. As parametric behavior is fully described on product types, application software can support constraints generically without having any specific knowledge of particular product types, configurations, or algorithms.