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xMCF in Simcenter 3D

Implementation and feedback

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Agenda:

xMCF Standard in Simcenter 3D
xMCF Implementation Feedback
Future Vision of xMCF Standard
Conclusions

xMCF Standard in Simcenter 3D
Supported Universal Connections

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Spot Weld

```
<connection_group id="1">
  <connected_to>
    <assy index="1">
      <part pid="63325"/>
      <part pid="63326"/>
    </assy>
    <assy index="2">
      <part pid="63323"/>
      <part pid="63324"/>
    </assy>
  </connected_to>
  <connection_list>
    <connection_0d label="Spot Weld Connection(1)">
      <spotweld diameter="3.000000"/>
      <loc>-277.830391 -112.868713 30.000000</loc>
    </connection_0d>
  </connection_list>
</connection_group>

<connection_group id="2">
  <connected_to>
    <part index="1" pid="63325"/>
    <part index="2" pid="63323"/>
  </connected_to>
  <connection_list>
    <connection_0d label="Spot Weld Connection">
      <spotweld diameter="3.000000"/>
      <loc>-300.346464 -107.478095 30.000000</loc>
    </connection_0d>
  </connection_list>
</connection_group>
```

Seam Weld

```
<connection_group id="1">
  <connected_to>
    <assy index="1">
      <part pid="63325"/>
      <part pid="63326"/>
    </assy>
    <assy index="2">
      <part pid="63323"/>
      <part pid="63324"/>
    </assy>
  </connected_to>
  <connection_list>
    <connection_1d label="Seam Weld Connection(1)">
      <loc_list>
      <seamweld>
        <corner_weld base="1" technology="Arc">
          <sheet_parameter index="1"/>
          <sheet_parameter index="2"/>
        </corner_weld>
      </seamweld>
    </connection_1d>
  </connection_list>
</connection_group>

<connection_group id="2">
  <connected_to>
    <part index="1" pid="63325"/>
    <part index="2" pid="63323"/>
  </connected_to>
  <connection_list>
    <connection_1d label="Seam Weld Connection">
      <loc_list>
      <seamweld>
        <corner_weld base="1" technology="Arc">
          <sheet_parameter index="1"/>
          <sheet_parameter index="2"/>
        </corner_weld>
      </seamweld>
    </connection_1d>
  </connection_list>
</connection_group>
```

Bolt

```
<connection_group id="1">
  <connected_to>
    <assy index="1">
      <part pid="56292"/>
      <part pid="56294"/>
      <part pid="63323"/>
      <part pid="63325"/>
    </assy>
  </connected_to>
  <connection_list>
    <connection_0d label="Bolt Connection">
      <loc>-330.000000 -95.000000 30.000000</loc>
      <threaded_connection diameter="20.000000" head_diameter="32.000000" length="30.000000">
        <normal_direction x="-0.000000" y="-0.000000" z="-1.000000"/>
        <bolt>
          <nut diameter="32.000000"/>
        </bolt>
      </threaded_connection>
    </connection_0d>
    <connection_0d label="Bolt Connection">
      <loc>-280.000001 -95.000000 30.000000</loc>
      <threaded_connection diameter="20.000000" head_diameter="32.000000" length="30.000000">
        <normal_direction x="-0.000000" y="-0.000000" z="-1.000000"/>
        <bolt>
          <nut diameter="32.000000"/>
        </bolt>
      </threaded_connection>
    </connection_0d>
  </connection_list>
</connection_group>
```

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Interpretable explanation of connection_group concept

According to the image:

- The connection_group seems to contain only the Adhesive and Seam Weld (based on color criteria).
- What about the Spot Weld? Is there a single connection_group containing the Adhesive, Seam Weld and Spot Weld connections?

According to definition:

- connection_group1 connecting A with B through Seam Weld and Spot Weld connections.
- connection_group2 connecting A with C through Adhesive connection.

Alignment / correction ?

1) Part (or Assembly) A is joined to Part B by the seam weld 1 along the curve l_1 and the spot weld 1 at the position x_1 …
and
Part (or Assembly) A is connected to Part C by the adhesive AD_x in the area A_x, etc..

2) The seam weld 1 joins Part (or Assembly) A to Part B along the curve l_1
and
spot weld 1 connects Part (or Assembly) A to Part B at the position x_1 etc..

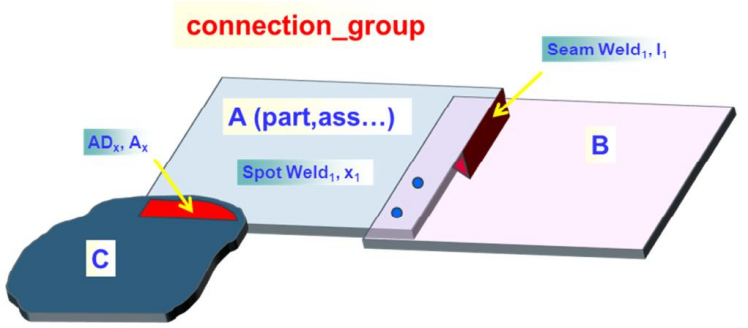

Figure 2: Topological Relations between Parts and Assemblies

The alternative 1) is adopted by xMCF. The description is mapped into XML by using an element tagged `<connection_group/>`. A `<connection_group/>` comprises all joints which connect the same parts (or assemblies). Details are referred to later chapters. Here one of the merits of employing XML becomes apparent.

xMCF Implementation Feedback

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Connections group implementation

A connection group contains all connections that connect the same components.

Simcenter 3D:

- Currently does not support this logic.

- Upon export each connection is owned by a distinctive connection group.

Which CAE software currently supports the correct logic?

```
<connection_group id="1">
  <connected_to>
    <assy index="1">
      <part pid="63325"/>
      <part pid="63326"/>
    </assy>
    <assy index="2">
      <part pid="63323"/>
      <part pid="63324"/>
    </assy>
  </connected_to>
  <connection_list>
    <connection_0d label="Spot Weld Connection(1)">
      <spotweld diameter="3.000000"/>
      <loc>-277.830391 -112.868713 30.000000</loc>
    </connection_0d>
  </connection_list>
</connection_group>

<connection_group id="2">
  <connected_to>
    <part index="1" pid="63325"/>
    <part index="2" pid="63323"/>
  </connected_to>
  <connection_list>
    <connection_0d label="Spot Weld Connection">
      <spotweld diameter="3.000000"/>
      <loc>-300.346464 -107.478095 30.000000</loc>
    </connection_0d>
  </connection_list>
</connection_group>

</xmcf>
```

xMCF Implementation Feedback

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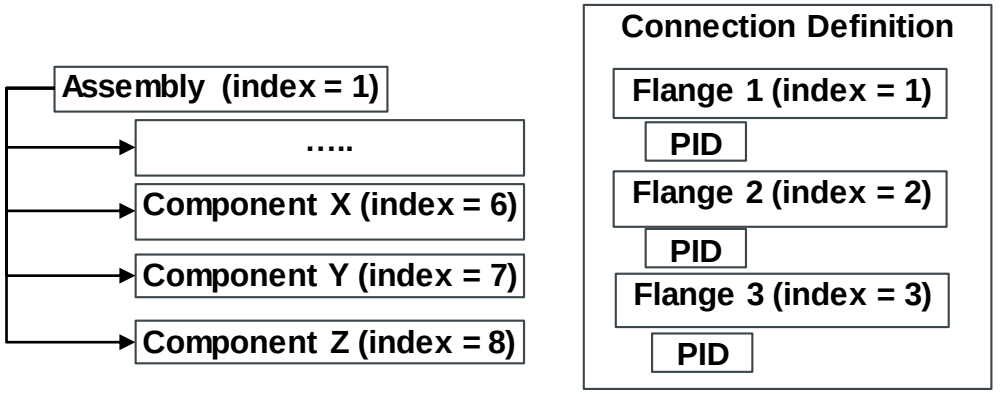
Index (<part index=“ x”/> , <assy index=“ x”/>)

Currently the concept of index is not clearly defined.

What does the index represent?

- The index of the component in the context of the assembly.
- The identification of the flange inside the connection definition.

Clarification of index attribute needed?




```
<connection_group id="2">
  <connected_to>
    <part index="1" pid="63325"/>
    <part index="2" pid="63323"/>
  </connected_to>
  <connection_list>
    <connection_0d label="Spot Weld Connection">
      <spotweld diameter="3.000000"/>
      <loc>-300.346464 -107.478095 30.000000</loc>
    </connection_0d>
  </connection_list>
</connection_group>

</xmcf>
```

xMCF Implementation Feedback

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Number of connected components compatibility

To <part> or not to <part> ? That is the question…

Adapted to Simcenter 3D and xMCF

Q: Which English writer is known for that question?

- Simcenter 3D allows to define in the bolt connection a high number of connected flanges.
- Other CAE software might allow to define only a limited number of connected flanges.

Answer: always use <assy> attribute for bolt connection to avoid incompatibility.

```
<connection_group id="1">
  <connected_to>
    <assy index="1">
      <part pid="56292"/>
      <part pid="56294"/>
      <part pid="63323"/>
      <part pid="63325"/>
    </assy>
  </connected_to>
  <connection_list>
    <connection_0d label="Bolt Connection">
      <loc>-330.000000 -95.000000 30.000000</loc>
      <threaded_connection diameter="20.000000" head_diameter="32.000000" length="30.000000">
        <normal_direction x="-0.000000" y="-0.000000" z="-1.000000"/>
        <bolt>
          <nut diameter="32.000000"/>
        </bolt>
      </threaded_connection>
    </connection_0d>
    <connection_0d label="Bolt Connection">
      <loc>-280.000001 -95.000000 30.000000</loc>
      <threaded_connection diameter="20.000000" head_diameter="32.000000" length="30.000000">
        <normal_direction x="-0.000000" y="-0.000000" z="-1.000000"/>
        <bolt>
          <nut diameter="32.000000"/>
        </bolt>
      </threaded_connection>
    </connection_0d>
  </connection_list>
</connection_group>
```

What is you view on this?

xMCF Future Vision

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Actions and benefits

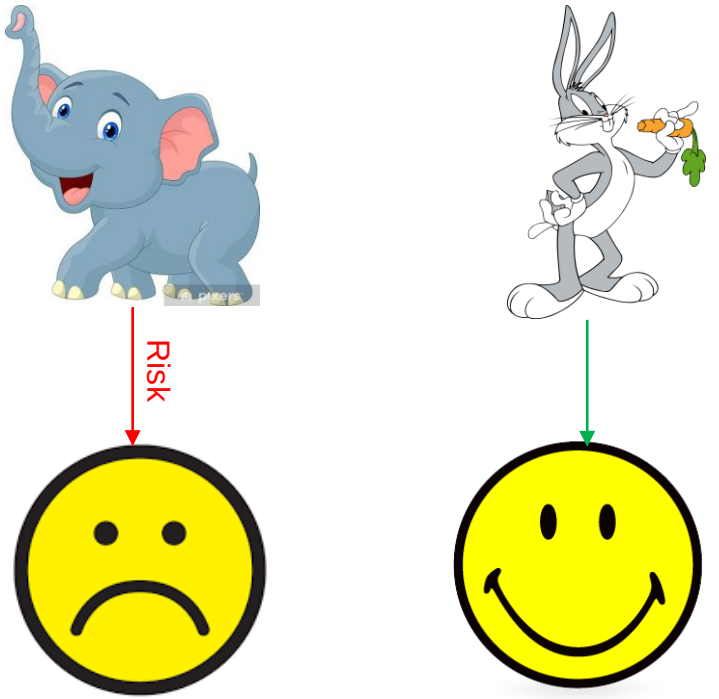
- Definition of a unique XML schema → Prevents misinterpretations of the standard | Reduces the development time | Allows fast deployment of xMCF in the industry.

- Provide in the standard, contact information of xMCF working group → Feedback collected quickly which allows fast evolution of the standard.

- "Agilization" of xMCF standard → Quick implementation of received feedback which allows fast evolution of the standard.

Questions to ponder?

- Is the standard appropriate for all CAE software, both multi-level and single level hierarchy assemblies?
- How do you see the collaboration between different CAE software to asses the universal character of the standard?



Conclusions

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- REMOVE AMBIGUITY
  - Correct unclear topics
- DEFINE THE VISION W.R.T FAST IMPLEMENTATION
  - Unique XML schema
- “AGILIZE” THE STANDARD
  - Provide contact info to reach workgroup with feedback
  - Increase frequency of working group meetings (online) depending on collected feedback

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Thank you.