ISO 19141:
Schema for moving features

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Moving Features

- The standard ISO 19141 defines a conceptual schema for representing features whose locations change over time
- The standards OGC 14-083r2 and 14-084r2 define an XML/GML and a CSV encoding for the conceptual schema from ISO 19141 restricted to moving points
- The conceptual schema allows for describing the motion (translation and rotation) of features (rigid bodies). Deformations are not addressed.
- The motion follows a planned route, but can deviate. The motion can be affected by physical forces (e.g. gravitation) and can affect or be affected by other features (e.g. the moving feature changes the planned route at a waypoint).

Source: ISO 19141

Concept

- Basis of the conceptual schema for moving features is the concept of a **one parameter set of geometries**, which is decribed by:

  Function f from an interval $t \in [a, b]$ such that $f(t)$ is a geometry and for each point $P \in f(a)$ there is a one parameter set of points (called the trajectory of P) $P(t)$: $[a, b] \rightarrow P(t)$ such that $P(t) \in f(t)$

- Parameters can e.g. be a point in time, a temperature or a pressure

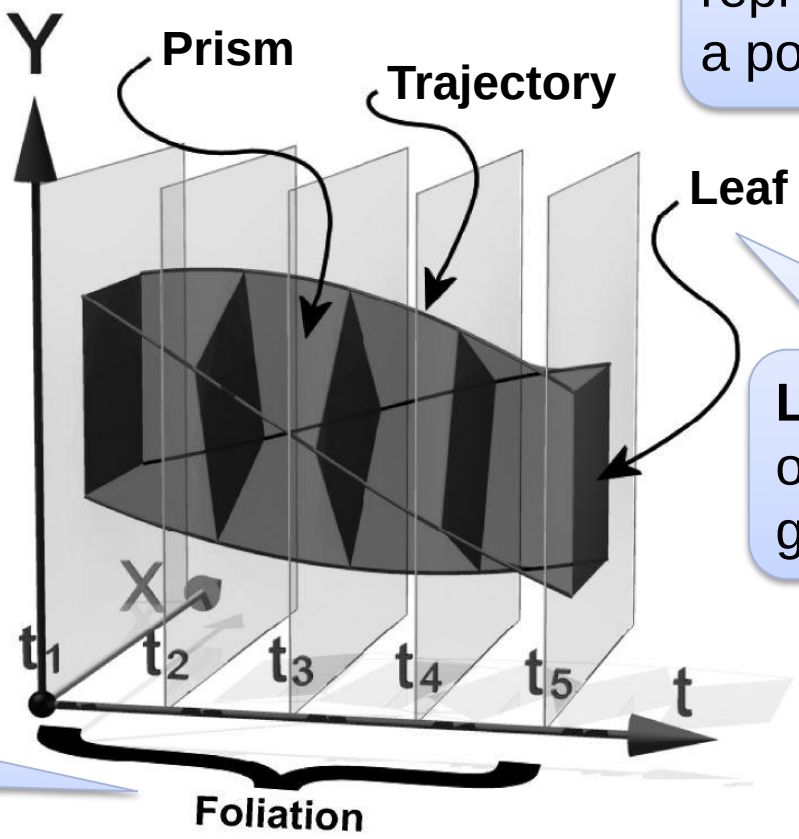
Source: ISO 19141

Concept

- The figure shows a moving and rotating 2D polygon

Prism = the set of points existing in all leafs and trajectories

Trajectory = a curve representing the path of a point in the polygon



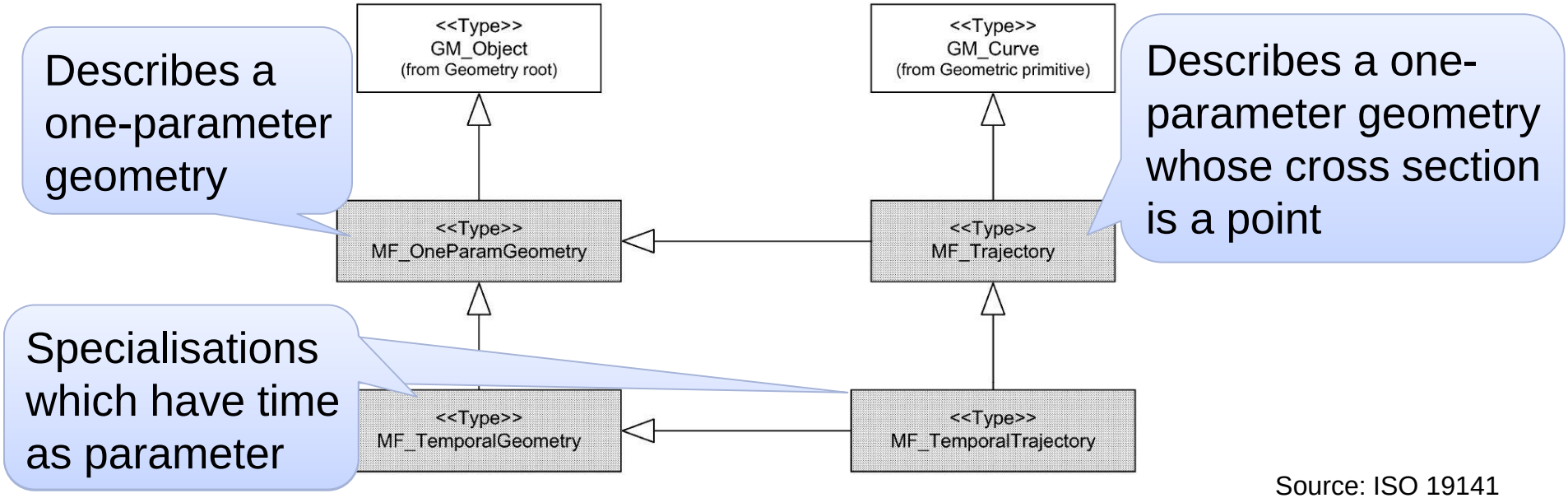
Leaf = representation of the polygon at a given point in time

Foliation = the set of leafs

Source: ISO 19141

Conceptual schema

- Two UML packages
  - Geometry Types: Defines one parameter geometry types
  - Prism Geometry: Defines types to describe the prism of a moving feature
- The one parameter geometry types are based on ISO 19107 which allows using them as feature attributes according to the General Feature Model of ISO 19109



Source: ISO 19141

XML/GML Encoding

```
<mf:MovingFeatures … gml:id="MFC_0001">
   <mf:sTBoundedBy>…defines the spatio-temporal bound…</mf:sTBoundedBy>
   <mf:member>
      <mf:MovingFeature gml:id="a">
         <gml:name>Joe Blow</gml:name>
      </mf:MovingFeature>
   </mf:member>
   <mf:header>
      <mf:VaryingAttrDefs>
         <mf:attrDef>
            <xsd:simpleType name="state">
               <xsd:restriction base="xsd:string">
                  <xsd:enumeration value="walking"/>
                  <xsd:enumeration value="staying"/>
                  <xsd:enumeration value="running"/>
               </xsd:restriction>
            </xsd:simpleType>
         </mf:attrDef>
         …
```

The elements MovingFeatures and MovingFeature extend gml:AbstractFeature

Here, attributes are defined which are used in the foliation

Source: OGC 14-083r2

XML/GML Encoding

```
…       <mf:attrDef>
            <xsd:simpleType name="km_per_hour">
                <xsd:restriction base="xsd:positiveInteger">
                    <xsd:minInclusive value="0"/>
                    <xsd:maxInclusive value="5"/>
                </xsd:restriction>
            </xsd:simpleType>
        </mf:attrDef>
    </mf:VaryingAttrDefs>
</mf:header>
<mf:foliation>
    <mf:LinearTrajectory gml:id="LT0001" mfIdRef="a" start="10" end="150">
        <gml:posList>11.0 2.0 12.0 3.0</gml:posList>
        <mf:Attr>walking,1</mf:Attr>
    </mf:LinearTrajectory>
    <mf:LinearTrajectory gml:id="LT0003" mfIdRef="a" start="150" end="190">
        <gml:posList>12.0 3.0 10.0 3.0</gml:posList>
        <mf:Attr>walking,2</mf:Attr>
    </mf:LinearTrajectory>
</mf:foliation>
</mf:MovingFeatures>
```

- The folation element contains the moving geometries
- Only changes of state (e.g. moving-speed, direction) are encoded
- The LinearTrajectory element consists of a single segment with linear interpolation

Source: OGC 14-083r2