FRAM Model Visualiser (FMV) – Data Format   May 2019

The FMV application is used to create and visualise FRAM models and stores all of the data in a text file with a '.xfmv' file extension, using a standard XML format.

The data files can be viewed using a text editor or imported by any program that reads XML data.

Structure

The XML structure has four hierarchical levels:

1. The 'root' level sits within an <FM> tag.
2. The second level contains the following ten sections:
   <Functions>
   <Controls>
   <Inputs>
   <Outputs>
   <Preconditions>
   <Resources>
   <Times>
   <Aspects>
   <Playbacks>
   <Groups>
3. Each of the ten sections above can contain any number of tags that represent the elements of that section. For example, Functions in the FMV model are nested within the <Functions> tags, each having its own <Function> tag at the third level. The next six sections are for the FMV model's six Aspect types. Each <Input> tag is nested within the <Inputs> tag, and so on.
   <Aspects> is used to save additional data about specific couplings, such as the location of a label that has been moved manually.
   <Playbacks> saves information for the Playback animation functionality.
   <Groups> saves information about Functions that have been combined in a Group.
4. The fourth level contains data specific to the elements within each section.

(In the example below there are two Functions shown within the <Functions> tag and two Inputs shown within the <Inputs> tag. Each of the other sections only has one element.)

<Function>

For each Function there are five data fields:

<IDNr>   An index number for the Function. Sequential, beginning with zero.

<FunctionType>   The type of Function as determined by the application. Valid values are:

	0 (Foreground)
	1 (Foreground Variable)
	2 (Background)
`<IDName>`	The name of the Function as entered
`<Description>`	The description of the Function as entered
`<metadata>`	This tag can contain any number of child tags generated by the user for storing additional information about a function. The metadata can be used and edited by other applications without affecting the functionality of the FMV application.

The <Function> tag also has 8 attributes used to store data specific to the visualisation of the FRAM model (attributes sit inside tags as shown in the example file):

`fnStyle`	Indicates the model rendering style:
	0 (Traditional)
	1 (Modern)
`style`	The selected pre-set colour of the Function:
	white, blue, green, grey, red, yellow, purple, custom
`color`	If the style is 'custom' then this is used to store the custom colour value.
`fnType`	The variability type. Valid values are:
	0 (undefined)
	1 (Technological)
	2 (Human)
	3 (Organisational)
`x, y`	These are the x and y coordinates for positioning the Function within the model space
`Tp`	The potential output variability with respect to time:
	-1 (not set)
	0 (Too early)
	1 (On time)
	2 (Too late)
	3 (Not at all)
`Pp`	The potential output variability with respect to precision:
	-1 (not set)
	0 (Precise)
	1 (Acceptable)
	2 (Imprecise)
`Ts`	The selected output variability with respect to time:
	-1 (not set)
	0 (Too early)
	1 (On time)

<div style="margin-left: 35%;">

2 (Too late)

3 (Not at all)

4 (Forced neutral)

</div>

Ps   The selected output variability with respect to precision:

<div style="margin-left: 35%;">

-1 (not set)

0 (Precise)

1 (Acceptable)

2 (Imprecise)

</div>

<Control>, <Input>, <Output>, <Precondition>, <Resource>, <Time>

For each of the next six sections that contain Aspect information there are three data fields:

<IDNr>   An index number. Sequential within each section starting at 1.

<IDName>   The name as entered

<FunctionIDNr>   The index number (IDNr) of the Function that this Aspect is a child of. For example, an Output with <FunctionIDNr> = 0 will be an output of the Function that has <IDNr> = 0. If another Function has a different Aspect with the same <IDName>, then the two will be shown linked in the FMV as a 'potential coupling'.

These six tags also each have one attribute used to store data specific to the visualisation of the FRAM model:

orphan   ="true" if the aspect name does not match any other aspect in the model to create a potential coupling

<Aspect>

An Aspect tag is only added when the default rendering of potential couplings between aspects is overridden by manually moving an aspect label:

<Name>   A sequence of 4 items delimited by a vertical bar, that identifies the coupling. For the <Aspect> tag shown in the example;

<Name>4|Loading|1|R</Name>

The coupling and label comes from the Output of Function 4, is named 'Loading', joins to Function 1, at its 'R' Resource aspect.

The attributes contain information on where to position the label relative to the default position:

directionX   ="from" if the label is moved horizontally closer to the Output Function

="to" if the label is moved horizontally closer to the other Aspect Function

directionY   ="from" if the label is moved vertically closer to the Output Function

	="to" if the label is moved vertically closer to the other Aspect Function
x	The fraction away from the default position, horizontally
y	The fraction away from the default position, vertically

<Group>

A Group tag stores information needed to display Function Groups:

<FunctionIDNr>	The ID number (<IDNr>) of the Parent Function.
<CHILD>	A sequence of ID numbers delimited by a vertical bar, that lists the remaining Child Functions in the Group

The attribute contains information on how to display the Group:

active	="true" if the Group is currently condensed. Otherwise it is assumed that it is expanded

Example file:

```
<?xml version="1.0" standalone="yes"?>
<FM Version="0,0,4,0">
  <Functions>
    <Function fnStyle="0" Tp="1" Pp="0" x="50" y="200" style="white"
color="16777215" Tp="-1" Pp="-1" fnType="2" Ts="0" Ps="">
      <IDNr>0</IDNr>
      <FunctionType>0</FunctionType>
      <IDName>Function Name</IDName>
      <Description>Description</Description>
    </Function>
    <Function fnStyle="0" Tp="-1" Pp="-1" fnType="2" x="200"
y="200">
      <IDNr>1</IDNr>
      <FunctionType>2</FunctionType>
    </Function>
  </Functions>
  <Aspects/>
  <Controls>
    <Control>
      <IDNr>1</IDNr>
      <IDName>Control</IDName>
      <FunctionIDNr>0</FunctionIDNr>
    </Control>
  </Controls>
  <Inputs>
    <Input>
      <IDNr>1</IDNr>
      <IDName>Input</IDName>
      <FunctionIDNr>0</FunctionIDNr>
    </Input>
    <Input>
      <IDNr>2</IDNr>
      <IDName>Output</IDName>
      <FunctionIDNr>1</FunctionIDNr>
    </Input>
```

```xml
      </Inputs>
      <Outputs>
        <Output>
          <IDNr>1</IDNr>
          <IDName>Output</IDName>
          <FunctionIDNr>0</FunctionIDNr>
        </Output>
      </Outputs>
      <Preconditions>
        <Precondition>
          <IDNr>1</IDNr>
          <IDName>Precondition</IDName>
          <FunctionIDNr>0</FunctionIDNr>
        </Precondition>
      </Preconditions>
      <Resources>
        <Resource>
          <IDNr>1</IDNr>
          <IDName>Resource</IDName>
          <FunctionIDNr>0</FunctionIDNr>
        </Resource>
      </Resources>
      <Times>
        <Time>
          <IDNr>1</IDNr>
          <IDName>Time</IDName>
          <FunctionIDNr>0</FunctionIDNr>
        </Time>
      </Times>
      <Aspects>
        <Aspect x="0.554" y="0.935" directionX="from" directionY="from">
          <Name>4|Loading Officer|1|R</Name>
        </Aspect>
      </Aspects>
      <Groups>
        <Group active="true">
          <FunctionIDNr>7</FunctionIDNr>
          <CHILD>8|9</CHILD>
        </Group>
      </Groups>
  </FM>
```