1. FBM Study Group Example – ESA1

The following is a real project document provided to ISO from European Space Agency files that has kindly agreed to distribute to SC32 WG2 for use in the mapping exercise from FBM into 19763-12.

Section 1 of the document contains the FBM graphical specification and the accompanying textual specification.

Section 2 of the document contains the Logical (relational mapping) model as derived from the FBM Model.

I am seeking help from WG2 members and invite WG2 to provide mappings into 19763-12 for the graphical specification and textual specification from Section 1. , i.e. fully populate all the FBM conceptual model textual requirements in Part 12. Note that the textual specification is a derivative of the graphical specification, and includes FBM constraints that accompany or are derived from FBM constructs.

I was only able to map Section 2---the Logical model---into Part 12. Note that the Section 2 as shown is a pared down version that does not necessarily fully portray all the constraints declared in the FBM model.
1 FACT BASED Conceptual Modelling

1.1 Container

1.1.1 Introduction

1.1.2 Graphical specification

1.1.3 Textual specification

1) Container has container name.
   a) Each container has exactly one container name.
   b) For each container name, exactly one container has that container name.

2) Container has container type.
   a) Each container has exactly one container type.
   b) It is possible that some container type is of more than one container.
   c) The possible values of container type are 'model', 'module', 'sub-system', 'element'.

3) Container
   a) For each container, exactly one of the following holds:
      that container is some model;
      that container is some module;
      that container is some subsystem;
      that container is some element.

4) Model
   a) *Each model is some container that has some container type where the possible value of that container type is 'model'.

5) Module
   a) *Each module is some container that has some container type where the possible value of that container type is 'module'.

6) Subsystem
   a) *Each subsystem is some container that has some container type where the possible value of that container type is 'sub-system'.

('model', 'module', 'subsystem', 'element')
7) **Element**
   a) *Each element is some container that has some container type where the possible value of that container type is 'element'.

1.2 **Nature of container**

1.2.1 Introduction

1.2.2 Graphical specification

1.2.3 **Textual specification**

1) **Container has nature.**
   a) Each container has exactly one nature.
   b) It is possible that some nature is of more than one container.

2) **Specified container**
   a) *Each specified container is some container that has some nature where the possible value of that nature is 'specification'.

3) **Realised container**
   a) *Each realised container is some container that has some nature where the possible value of that nature is 'realisation'.

![Diagram of ContainerNature](image-url)
1.3 Specification and realisation

1.3.1 Introduction

1.3.2 Graphical specification

1.3.3 Textual specification

1) Specified model
   a) *Each specified model is some container that is some specified container and is some model.

2) Specified module
   a) *Each specified module is some container that is some specified container and is some module.

3) Specified subsystem
   a) *Each specified subsystem is some container that is some specified container and is some subsystem.

4) Specified element
   a) *Each specified element is some container that is some specified container and is some element.

5) Realised model
   a) *Each realised model is some container that is some realised container and is some model.

6) Realised module
   a) *Each realised module is some container that is some realised container and is some module.

7) Realised subsystem
   a) *Each realised subsystem is some container that is some realised container and is some subsystem.

8) Realised element
   a) *Each realised element is some container that is some realised container and is some element.
1.4  Physical instantiation

1.4.1  Introduction

1.4.2  Graphical specification

1.4.3  Textual specification

1) Specified container specifies realised container.
   a) Each realised container Realises at most one Specified container.
   b) It is possible that some Specified container specifies more than one realised container.

2) Valid specification of realised container
   a) *Specified container is valid specification of realised container if and only if
      that specified container is some specified model that specifies some realised model
      that is that realised container
      or that specified container is some specified module that specifies some realised
      module that is that realised container
      or that specified container is some specified subsystem that specifies some realised
      subsystem that is that realised container
      or that specified container is some specified element that specifies some realised
      element that is that realised container.
   b) If some specified container specifies some realised container then that specified
      container is valid specification of that realised container.

3) Specification of realised model
   a) *Specified model specifies realised model if and only if
      that specified model is some specified container that specifies some realised
      container that is that realised model.
b) Each realised model realises exactly one specified model.
c) It is possible that some specified model specifies more than one realised model.

4) Specification of realised module
a) *Specified module specifies realised module if and only if that specified module is some specified container that specifies some realised container that is that realised module.
b) Each realised module realises exactly one specified module.
c) It is possible that some specified module specifies more than one realised module.

5) Specification of realised subsystem
a) *Specified subsystem specifies realised subsystem if and only if that specified subsystem is some specified container that specifies some realised container that is that realised subsystem.
b) Each realised subsystem realises exactly one specified subsystem.
c) It is possible that some specified subsystem specifies more than one realised subsystem.

6) Specification of realised element
a) *Specified element specifies realised element if and only if that specified element is some specified container that specifies some realised container that is that realised element.
b) Each realised element realises exactly one specified element.
c) It is possible that some specified element specifies more than one realised element.

1.5 Logical instantiation

1.5.1 Introduction

1.5.2 Graphical specification

1.5.3 Textual specification

1) Container contains logical instances of container.
a) **It is possible that some** container contains logical instances of **more than one** container and that **some** container logical instances belong to **more than one** container.

b) **In each population of** container contains logical instances of container, **each** container, container **combination occurs at most once**.

2) **Valid logical instantiations**

a) *Container, contains valid logical instances of container, if and only if that container, is some model that contains some logical instantiated-module, that is that container, or that container, is some module, that contains some logical instantiated-subsystem, that is that container, or that container, is some subsystem, that contains some logical-instantiated element that is that container.*

b) **If some** container, contains logical instances of some container, then that container, contains valid logical instances of that container.

3) **Module logical instances**

a) *Model logical instances belong to module if and only if that model is some container, that contains logical instances of some container, that is that module.*

4) **Subsystem logical instances**

a) *Module contains logical instances of subsystem if and only if that module is some container, that contains logical instances of some container, that is that subsystem.*

5) **Element logical instances**

a) *Subsystem contains logical instances of element if and only if that subsystem is some container, that contains logical instances of some container, that is that element.*

1.6 **Item**

1.6.1 **Graphical specification**

![Graphical representation of Container and Item relationships]

1.6.2 **Textual specification**

1) **Container contains item**

   a) Each item belongs to **exactly one** container.

   b) **It is possible that some** container contains **more than one** item.
1.7 **Accessibility**

1.7.1 **Introduction**

1.7.2 **Graphical specification**

1.7.3 **Textual specification**

1) **Container is property of community**
   a) **Each** container is property of **exactly one** community.
   b) **It is possible that some** community owns **more than one** container.

2) **Container controlled access**
   a) **It is possible that** the accessibility of **some** container is limited to **more than one** community
       and that **some** community accesses **more than one** container that has controlled access.
   b) **In each population of** the accessibility of container is limited to community, each container, community **combination occurs at most once**.

3) **Container global accessibility**
   a) **Container is globally accessible** if and only if
       the accessibility of that container is limited to **no** community.

4) **Item is property of community**
   a) **Each** item is property of **exactly one** community.
   b) **It is possible that some** community owns **more than one** item.

5) **Item controlled access**
   a) **It is possible that** the accessibility of **some** item is limited to **more than one** community
       and that **some** community accesses **more than one** item that has controlled access.
   b) **In each population of** the accessibility of item is limited to community, each item, community **combination occurs at most once**.

6) **Item global accessibility**
   a) **Item is globally accessible** if and only if
       the accessibility of that item is limited to **no** community.
1.8 Community

1.8.1 Introduction

1.8.2 Graphical specification

1.8.3 Textual specification

1) **Community** has community name.
   a) Each community has exactly one community name.
   b) Each community name is of at most one community.

2) **Membership**
   a) It is possible that some community has more than one user and that some user is of more than one community.
   b) In each population of community has user, each community, user combination occurs at most once.
   c) Each community has some user.

3) **User** has username.
   a) Each user has exactly one username.
   b) Each username is of at most one user.

4) **User** is employed by **company**.
   a) Each user is employed by exactly one company.
   b) It is possible that some company employs more than one user.

5) **Company** has company name.
   a) Each company has exactly one company name.
   b) Each company name is of at most one company.
1.9 title

1.9.1 Introduction

1.9.2 Textual specification
2 Logical Modelling

2.1 Relational model (automatically generated from the FBM conceptual model)

2.1.1

2.1.2
2.1.3

Community

Columns
PK: community#: int
U1: communityName: varchar

Membership

Columns
PK, FK1: community#: int
PK, FK2: user#: int

User

Columns
PK: user#: int
FK1: company#: int
U1: username: varchar

Company

Columns
PK: company#: int
U1: companyName: varchar