PROCESS TOWARDS AN EXECUTABLE ENGINE COMPLIANT WITH THE INTEROPERABLE TEST AND OPERATION PROCEDURE LANGUAGE 70-32

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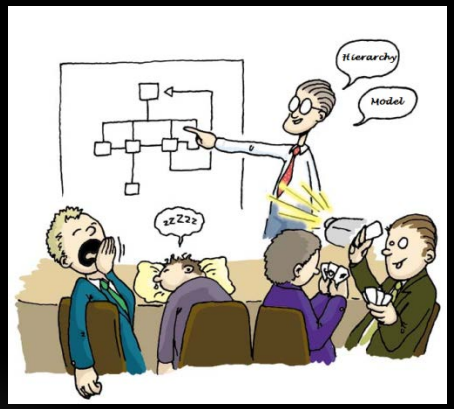
AGENDA

- ISSUES
- CONCEPTUALIZATION
  - DATA
  - PROCESS
- VALIDATION
- DEVELOPMENT
  - EDITORS
  - SCALABILITY
  - UNIQUE ENGINE
- RE-USE OF METHODOLOGY
- CONCLUSSIONS

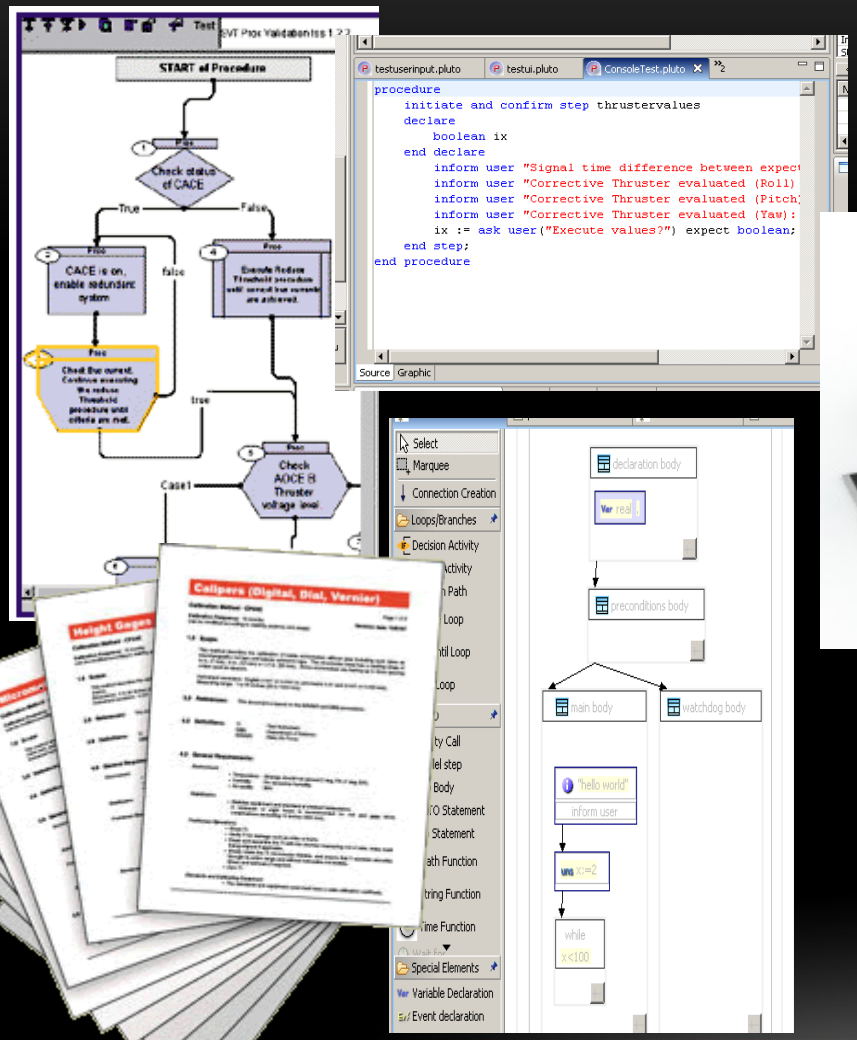


ISSUES IN PROCEDURE INTEROPERABILITY (I)

Let's cook…

…or better not

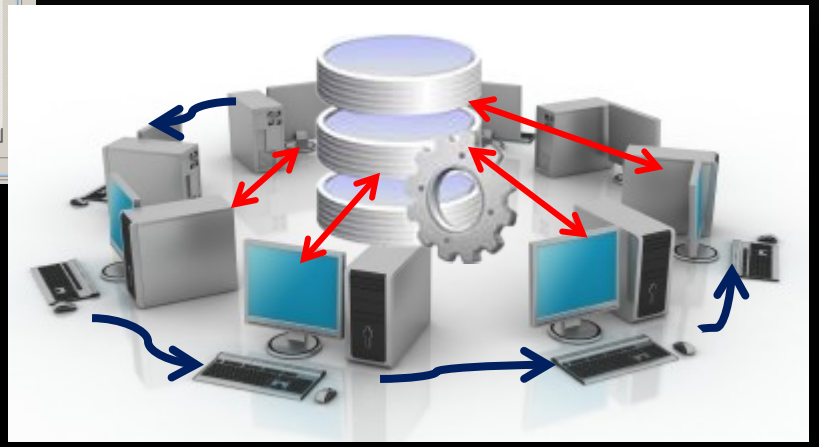
ISSUES IN PROCEDURE INTEROPERABILITY (II)



PLUTO

MOIS

OTX



OBCP

TOPE

FCP

JAVA

EGS-CC AP LANGUAGE

ECSS-E-ST-70-32 CONCEPTUALIZATION

- Requirements
  - From the standard
  - From experience
  - From other implementations
- A Procedure specifies:
  - Data to be handled
  - Process to be performed with the specified data
  - Format to specify the information

Formalize:

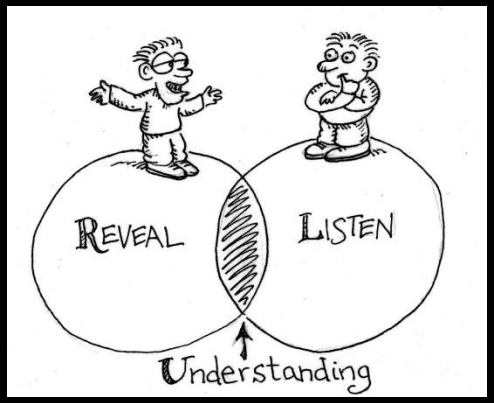
- Compare
- Unify
- Add missing info.

- Data
- Process

CONCEPTUALIZATION: DATA (I)

- The standard defines a complete set of information and structures to be handled.
- Exchanging procedures → semantics have to be shared between parties.

SEMANTICs



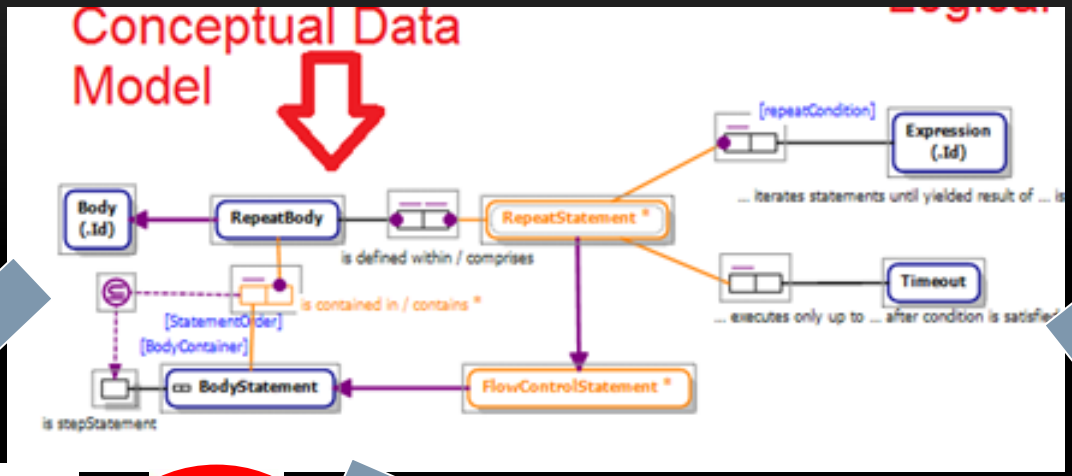
- Shared semantics
  - Shared Process Engine
  - Translations
  - Decoupling editors
  - Shared Persistence Model

CONCEPTUALIZATION: DATA (II)

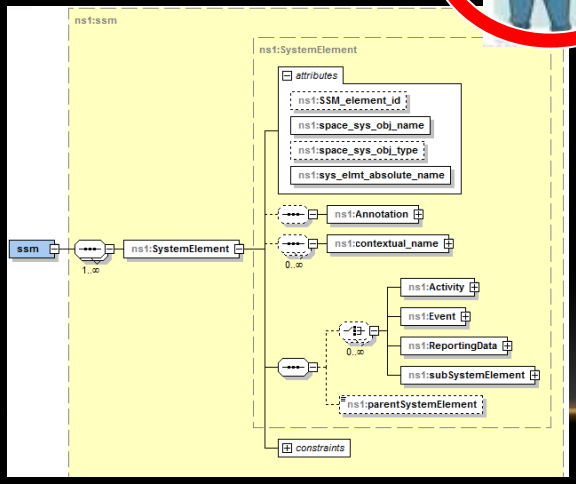
- Process for conceptualization:
  - Define the structure of the language
  - For each structure
    - Get the data concepts required
    - Get the relationships within the structure (cardinalities)
    - Define the constraints applicable per structure
  - Verify all structures are reachable and complete
  - Add missing structures.

Complete Conceptual Model

CONCEPTUALIZATION: DATA (III)



20130611-70-32 Formal.MySQL.sql
20130611-70-32 Formal.Oracle.sql
20130611-70-32 Formal.PostgreSQL.sql

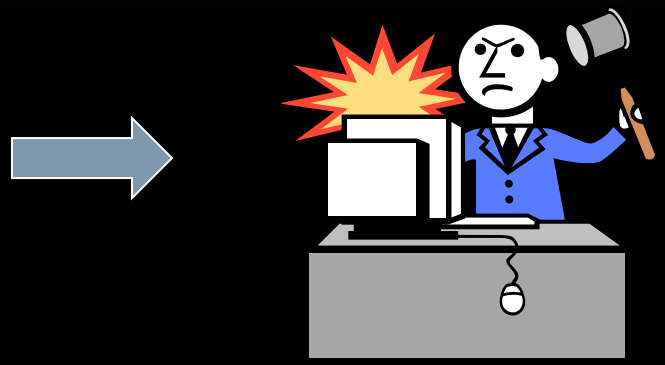


BodyStatement is stepStatement.
In each population of BodyStatement is stepStatement, **each** BodyStatement **occurs at most once.**
RepeatBody contains BodyStatement.
Each RepeatBody contains **some** BodyStatement.
Each BodyStatement is contained in **at most one** RepeatBody.
It is possible that some RepeatBody contains **more than one** BodyStatement.
Derivation Note: *Fully derived from the entries in the repeatBody.*
If some BodyStatement is contained in **some** RepeatBody **then that** BodyStatement is stepStatement.
Body **is an entity type.**
Reference Scheme: Body has Body_Id.
Reference Mode: .Id.

Standard	Conceptual Model
26 Mandatory Pages	137 Mandatory Pages
88 Informative Pages	>400 static data requirements
	>60 Change Requests

CONCEPTUALIZATION: DATA (IV)

- After conceptualization, users can exchange procedures in:
  - Database Sets (e.g. SQL)
  - XML
  - ORM formats



- Editors are needed.
  - Define edition formats (i.e. grammars) to create procedures

CONCEPTUALIZATION: PROCESS (IV)

- Procedure Goal → Execute
- Each data structure → Specific behavior
- Behaviors need to be modelled → Interfaced
  - Require the definition data
  - Implies the creation of dynamic information (instances)
  - Follow a set of interactions between elements
  - Have to handle user/system inputs

DEVELOPMENT: EDITORS

procedure2.pluto | proced.plutoL

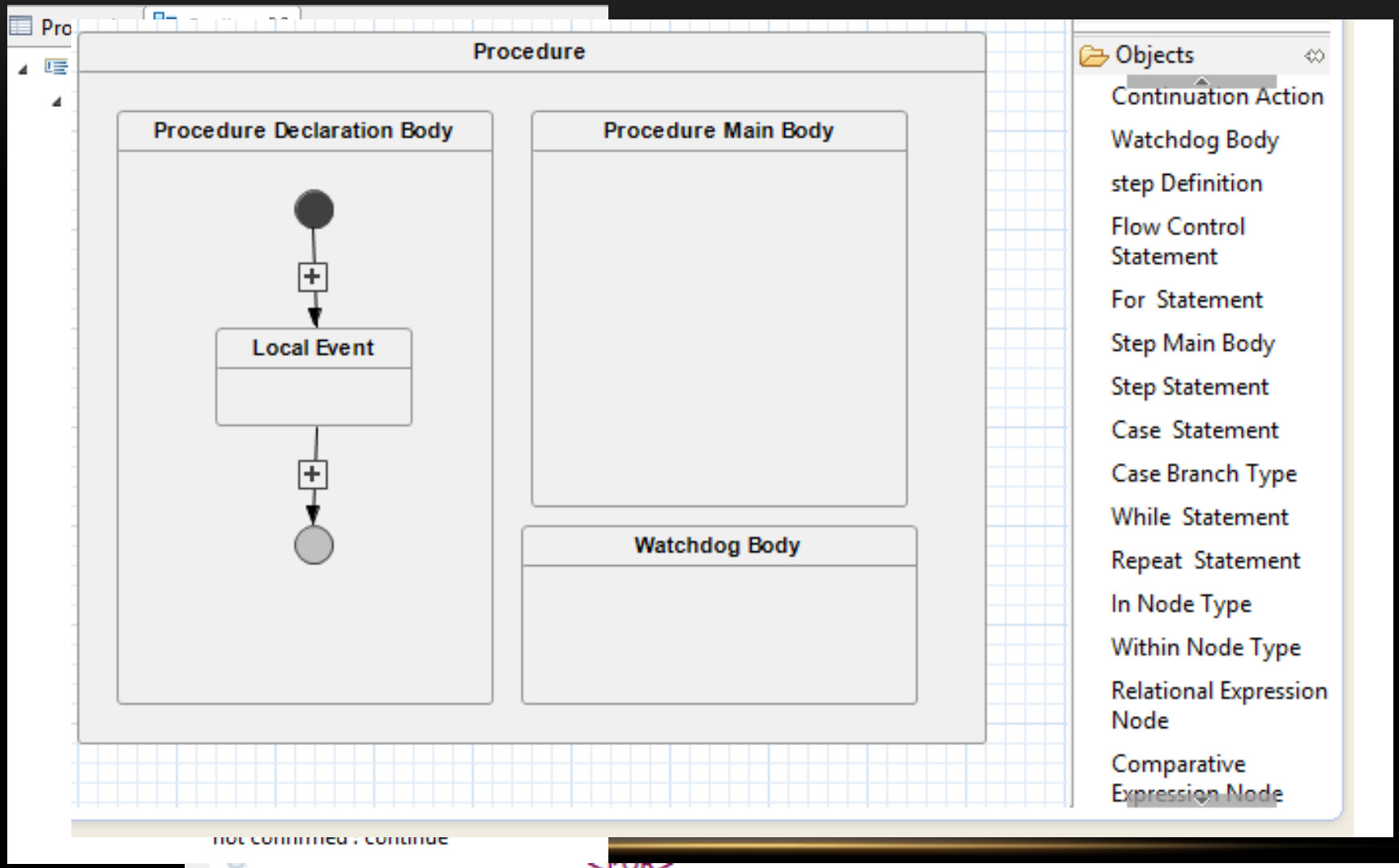
```
Procedure{
    declare{
        event ad described by "asb";
        event ab ;
    }end declare
    main{
        initiate{
            sys1.sys2.Procedure2
        }end initiate;
        initiate and confirm{
            sys1.sys2.Procedure2
            refer by "asda"in case{
                aborted:abort;
                confirmed:restart timeout{
                    12
                }end timeout;
            }end case
        }end initiate and confirm;
        initiate and confirm step{
            step ad {
                main{
                    wait{
                        for event ad
                    }end wait;

                }end main
            }end step
        }end initiate and confirm;
        inform user{
            43;
        };

    }end main
}
```

Properties | AND | procedure2.pluto

```
<PROCEDURE>
    <MAIN>
        <LOG>
            <EXPRESSION><REL_EXPRESSION>
                <TERM>
                    <PRODUCT>
                        <FACTOR>
                            <CONSTANT>"embedded Executed"</CONSTANT>
                        </FACTOR>
                    </PRODUCT>
                </TERM>
            </REL_EXPRESSION></EXPRESSION>
            <EXPRESSION><REL_EXPRESSION>
                <TERM>
                    <PRODUCT>
                        <FACTOR>
                            <REQUEST>
                            <PROPERTY> "completion time" </PROPERTY>
                            <VALUE_OF> sys1.sys2.Procedure2</VALUE_OF></REQUEST>
                        </FACTOR>
                    </PRODUCT>
                </TERM>
            </REL_EXPRESSION></EXPRESSION>
        </LOG>
    </MAIN>
</PROCEDURE>
```

```
Timeout returns Timeout:
    '<TIMEOUT>' expression=Expression ('<RAISE_EVENT>' event =[LocalEvent] '</RAISE_EVENT>')? '</TIMEOUT>'
;
```

DEVELOPMENT: EDITORS



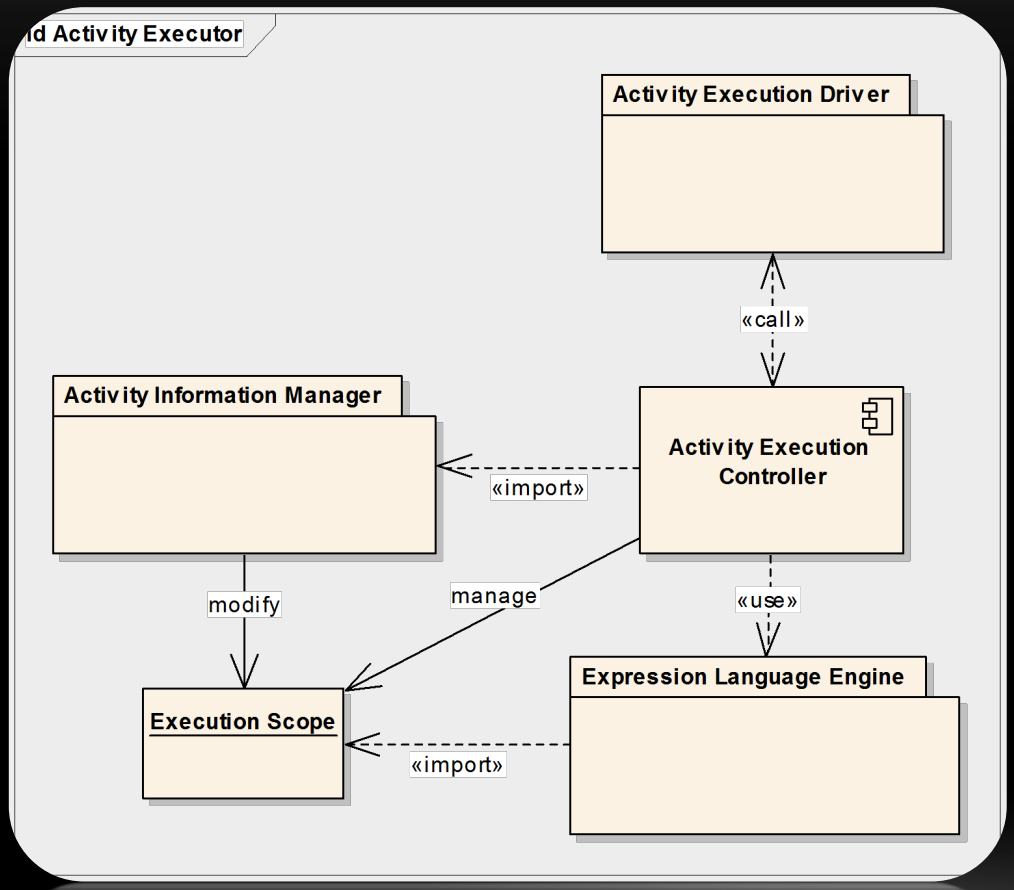
DEVELOPMENT: SCALABILITY

- Global constants
- Augment the possible data types with:
  - Byte Fields
  - Arrays (Simple or complex)
  - Record: Set of complex values which can mix both simple values and complex ones.
- Allow the explicit raising of events during the execution.
- Assign a criticality to the declared events
- Mathematical exceptions handling (i.e. arithmetic and class cast exceptions)
- Transactional bodies

<2 weeks

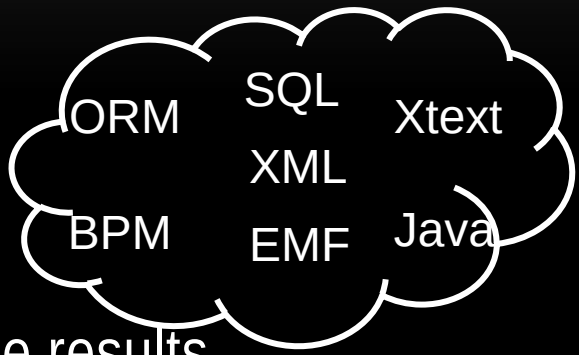
- Editor
- Validation
- Transformation
- Execution

DEVELOPMENT: UNIQUE ENGINE



VALIDATION

- Verification & Validation Techniques
  - Validation of the methodologies used



  - Experts in the standard have assessed the results
  - Existing procedures have been assessed with the created editors.
  - Interoperability among different formats have been empirically proven during compilation and execution.

METHODOLOGY-REUSE

- Application in EGS-CC environment
  - The AP Execution Language:
    - Definition of structures/behaviors/interfaces
    - Definition of DSL languages and transformations into AP Format.
  - The CDM Definitions:
    - Definition of several MCM browsers/editors through the formalization of the data model.
- The HMI Project (ongoing):
  - Definition of the data model
  - Integration between graphical and textual procedure editors.
- Technical Knowledge
  - Use of OSGI Services
  - Application and integration of EMF/Xtext/GMF Libraries

CONCLUSIONS

- Having common meta-model and execution engine:
  - Only new front-ends have to be developed
  - Expand the range of activities where space standards can be used.
  - Reduce updates/modifications impact
- Conceptualization of requirements
  - Ensure completeness and validity of requirements
  - Help design and development stages

Any Question?