Aligning the conformance process in the SID and eTOM Frameworks

Metabula Limited, Dec 2005

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Metabula

Table of Contents

Table of Figures

Summary

Metabula have extended their conformance solution for the SID framework [6] to include cross referencing within the eTOM framework [8]. The conceptual architecture for this extended system is shown in Figure 1. This new solution uses the contract entity (defined in the TNA framework) as the vehicle to decompose third party applications into SIS-Process structures. These are matched against the SID/eTOM models held in Metabula's DataBridge system. This contract-based decomposition can then be validated against the SID-eTOM mappings as defined in the TMF framework.
The initial solution has focussed on the operations area in eTOM that has been mapped to ITL [12] and ITU(M3400) [13].

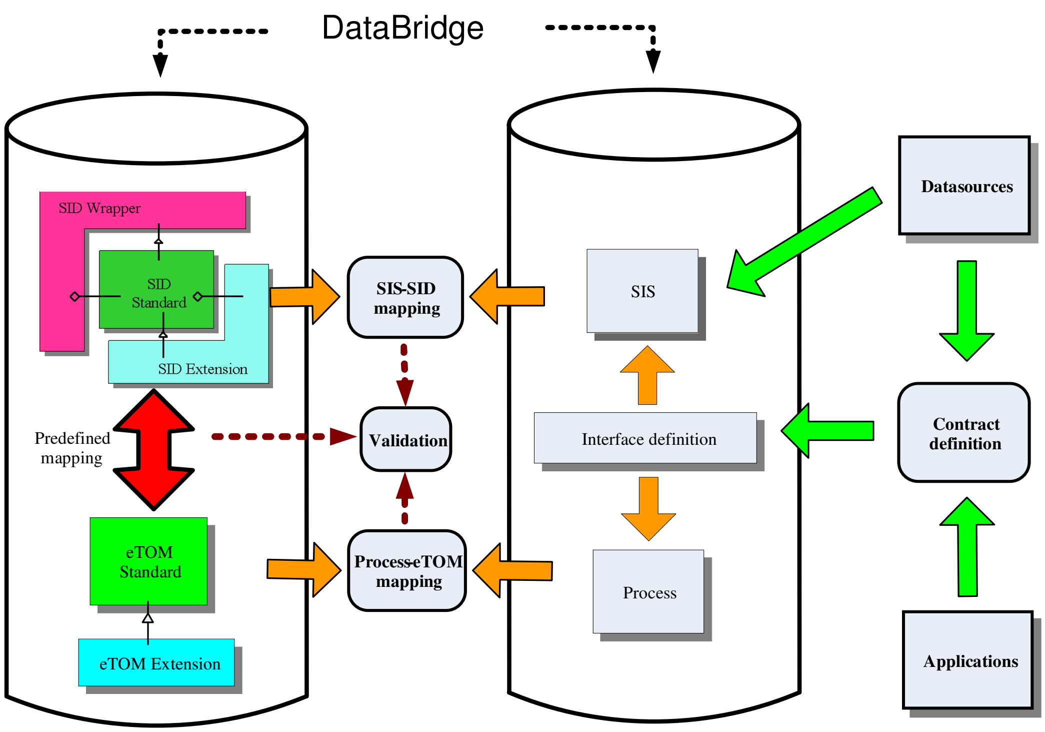


Figure 1 Logical architecture

The basic process implemented in this solution is:

1. Load eTOM/SID standard models into DataBridge
2. Identify key OSS use cases (i.e. configure the scope of a specific solution)
3. Analyse OSS to identify key datasources and applications that support the use cases
4. Generate contract structures that cover the use cases
5. Load contract structures into DataBridge (specifically the interface definitions)
6. Perform data centric and process-centric mappings
    a. SIS <-> SID (as supported by the existing Metabula solution)
    b. Process <-> eTOM (as described in this paper)
7. Extend eTOM/SID frameworks where appropriate to capture OSS-specific entities

8. Validate implicit linkage (as described by (5)) by cross referencing mapped eTOM-SID elements with predefined TMF mappings

Note that this is not a fully automated solution in that it requires contract interfaces to be synthesized from OSS processes and data entities before the matching process can be initiated. The requirement for a formal interface definition language (IDL) may seem onerous at first sight. However there is a lot of material with the framework documents that can facilitate the IDL production. This will be evaluated in the following sections.

Introduction

Metabula is a specialist provider of intelligent information management, integration and consolidation solutions. These solutions help to limit and reduce errors, promote consistency and increase efficiency thereby reducing project costs and times.

In particular, Metabula has specific competences in object-oriented representations, data modelling and mapping. This applies to standard and industry modelling techniques such as UML, ISO STEP representations and Application Protocol (AP)-models e.g. Oil / Gas, Telecoms, Shipping, Defence, Aerospace.

These capabilities have been applied to the telecoms industry where Metabula has focused upon the representation and management of the NGOSS Shared Information and Data Model (SID) model and comparison with client specific information models known as Shared Information Specifications (SIS) [1] [2]. This paper describes how this solution has been extended to support the comparison of Operations Support System (OSS) processes with elements defined in the Enhanced Telecom Operations Map® (eTOM) framework.

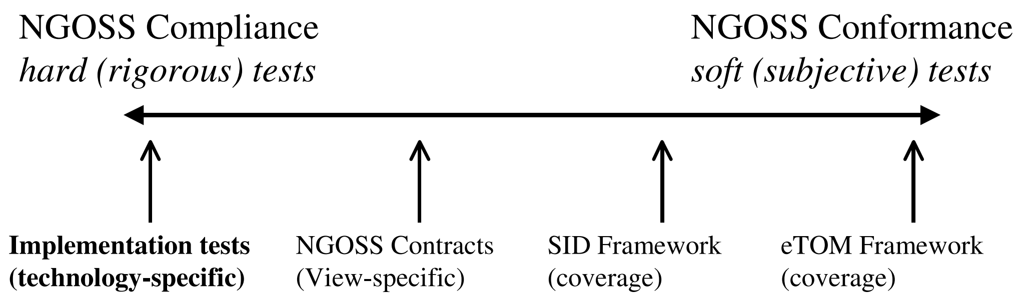
The paper is structured around three sections - analysis, process and deployment.

- The analysis section describes why the contract entity is the key artefact in the mapping process and how it can be extracted from OSS processes and data entities.
- The process section describes how these contract entities can be captured in a model driven architecture and processed using data consolidation techniques to produce match candidates in the SID and eTOM domains.
- The deployment section describes the product set that delivers the process.

Analysis

Coverage

The eTOM and SID conformance metrics lie in adjacent locations on the compliance-conformance continuum as defined in the NGOSS Compliance/Conformance Strategy document [3]. However there is no explicit linkage at present between the conformance activity in the eTOM and SID frameworks.



The NGOSS Assessment Continuum (with some indicative steps)

Conformance in this context is "coverage" as shown in Figure 2 i.e. the mapping of similar items in an OSS and the SID/eTOM frameworks.

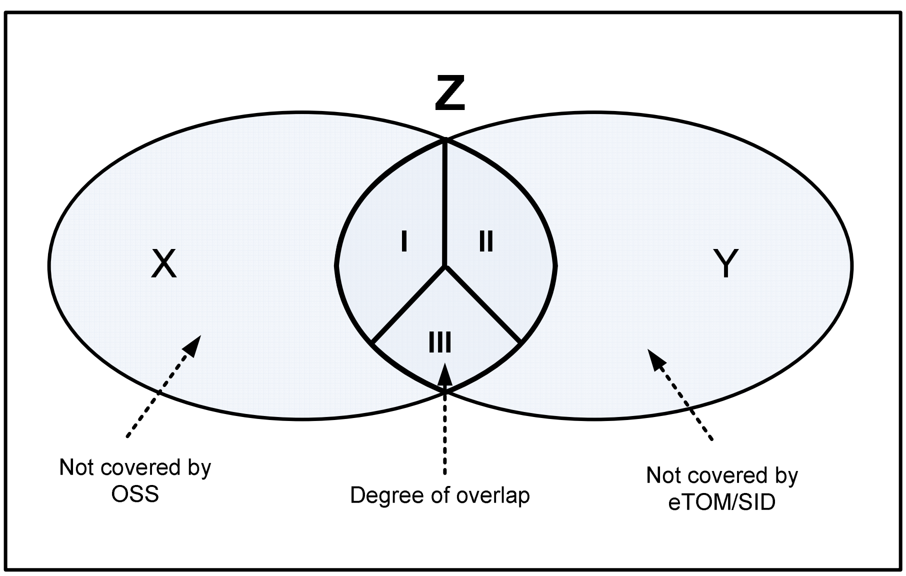


Figure 2 Categories of coverage

The entities of interest for comparing the OSS and SID/eTOM are sets Y and Z.

The items in Set Y can be handled fairly easily – they are those entities with no "overlap" between the TMF and OSS. In this case, an extension point must be defined in the framework to absorb the original OSS elements into the framework. These extension points must be constructed in such a way as to group OSS elements with similar "semantic" characteristics.

The items in Set Z are those which overlap to some extent and it is in this area of the overlap where there is the possibility or potential for "matching" entities from within the OSS and entities from within the SID/eTOM framework.

There are various degrees of overlap which can be identified in Set Z. An example in the case of SID entities is the following three categories:

I. Members match completely on class, attribute and relationship
II. Members match completely on class and attribute but not on relationship
III. Members match on class but not completely on attribute or relationship.

The equivalent case for eTOM entities would be:

I. Members match completely on name and share at least one vertical group
II. Members match completely on name
III. Members partially match on name

In this example, the eTOM case I group is using vertical group membership within the eTOM framework as an additional classification (this is further discussed in the "eTOM element representation" section).

SID-eTOM alignment

There are currently four frameworks in the TMF standard that can be characterized as follows:

- SID – data centric
- eTOM – process centric
- TNA – interface centric
- TAM – application centric[1]

At the highest level of abstraction, SID domains are consistent with eTOM level 0 processes as follows:

SID domain	**eTOM Level 0 process structure**
Market/Sales	}
Product	} Market, Product and Customer
Customer	}
Service	Service
Resource	Resource (Application, Computing and Network)
Supplier/Partner	Supplier / Partner
Enterprise	Enterprise

Mappings have also been specified for level 2 eTOM processes and level 1 SID Aggregate Business Entities in [6]. A key issue is explicating the interaction constructs that have produced these (de-facto) mappings. Once these have been made explicit then a similar mechanism can be applied to the problem of mapping OSS processes to SIS data entities.

[1] The Telecoms Application Map [16] does not define any linkage between eTOM and SID at the current time and does not form part of this solution

SID-eTOM alignment at lower levels (starting with SID Aggregate Business Entity (ABE) to eTOM Level 1 processes) is defined by the following interaction constructs in the UML [5]:

- Process flow diagrams – execution flow through a set of processes
- Activity diagrams – interchange of information between contracts
- Use case diagrams – user-application interaction
- State chart diagrams – entity policy finite state machines
- Sequence diagrams – part of the eTOM system view

An informal view of the relationship between use cases and activities is shown in Figure 3. This shows how both use case and activity entities can function as cross references between an eTOM process and a contract

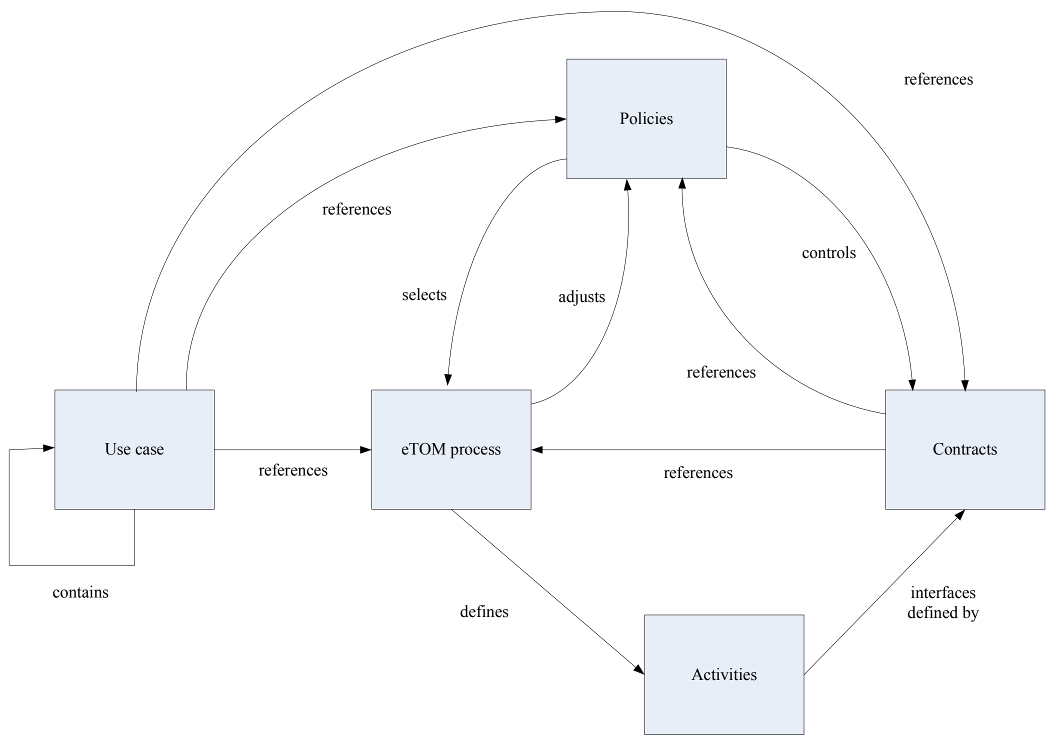
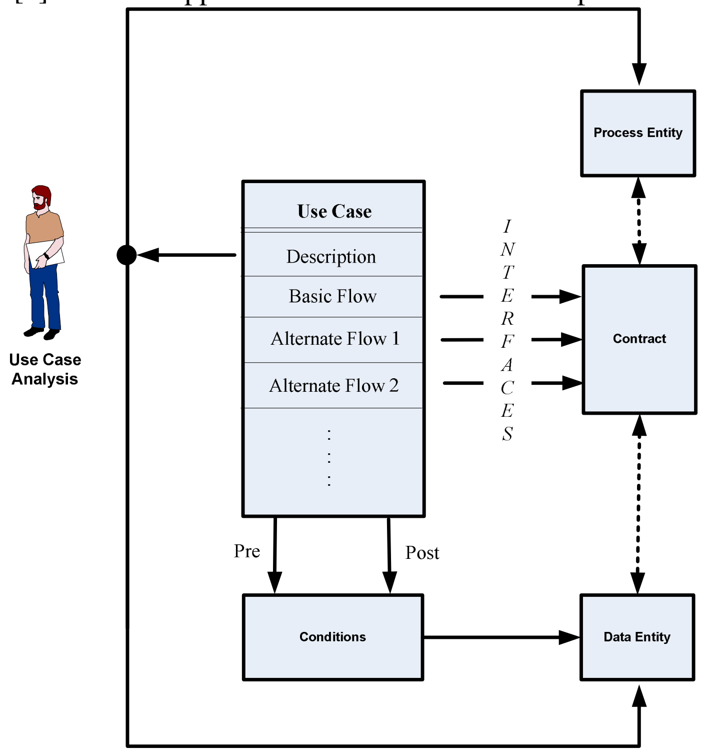


Figure 3 eTOM domain

Metabula's approach has been to apply use case analysis to identify mappings between OSS processes and data entities. Each mapping is synonymous to the contract entity defined in the TNA framework. The method of use case analysis described in [5] has been applied to extract candidate OSS processes and data entities



as shown in

Figure 4. Once a use case description has been captured against a standard template [15], a number of analysis paths are available:

- Description to data entity / process entity
- Condition set to data entity
- Flow descriptions to interfaces

The target result of this analysis is a set of contracts that encapsulates OSS processes and data entities. These entities are implicitly linked by virtue of being “owned” by a single contract.

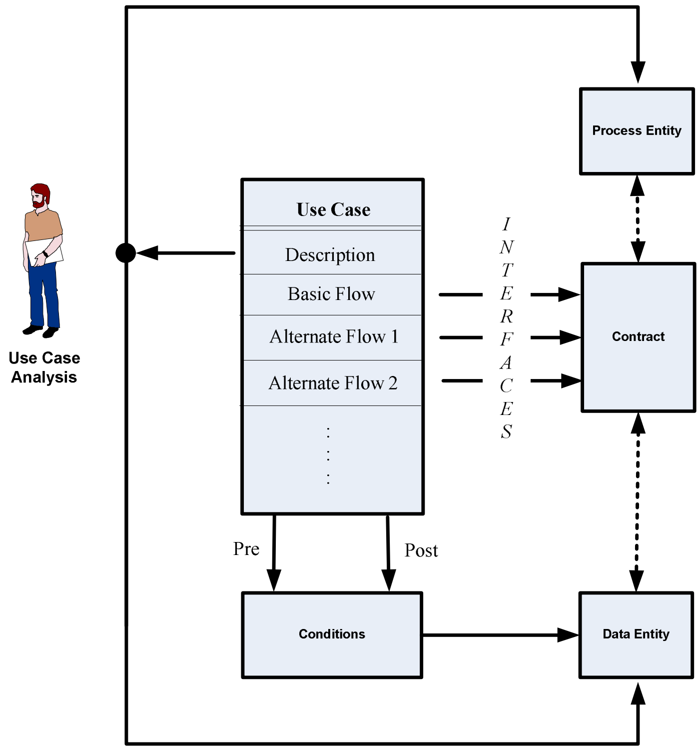


Figure 4 Use case analysis

Contracts

Contracts are a key part of TNA framework defined as the "fundamental unit of interoperability" within the TMF standard [4]. Contracts have a lifecycle that enables them to evolve through the different TMF views - business, system, implementation and deployment [14]. This work is focussed on the system and implementation views. So it is specifically interested in the interface characteristics associated with a contract.

The relationship between a contract, its interface(s) and the specialization hierarchy associated with an interface is shown in Figure 5. Note that the role played by specific interfaces depends on the type of the contract that supports the interface.

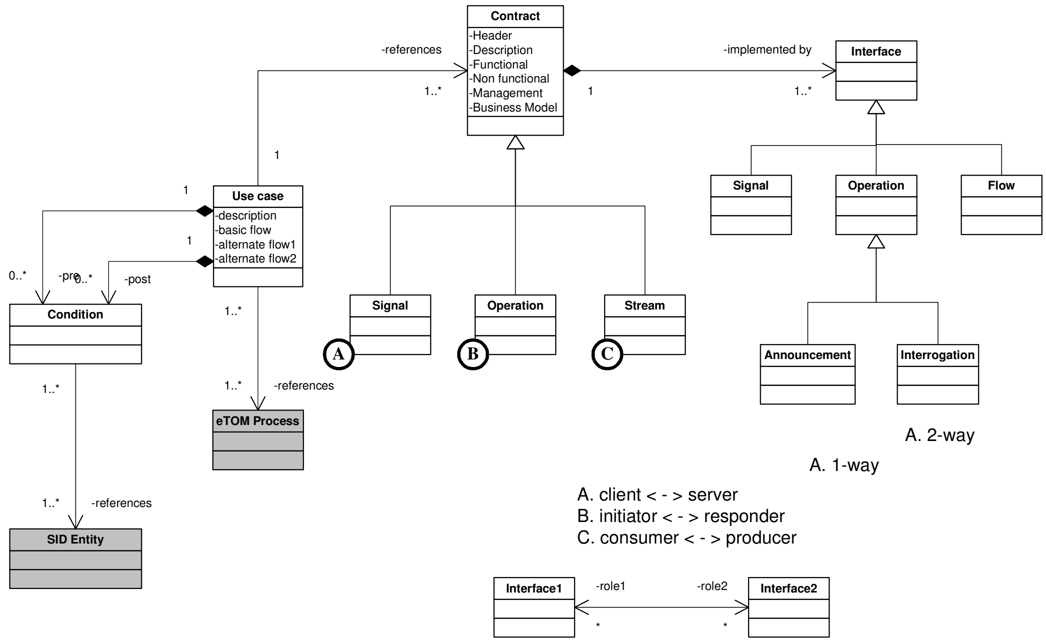


Figure 5 Contract-Interface class hierarchy

Note that this figure also shows a "soft" linkage between business use case and its supporting SID/eTOM/Contract framework entities.

An important design constraint in the implementation view of a contract is that [4]

"all data exchanged in a contract invocation are defined using the SID "

This gives us another route into the SID for each contract that is mapped into an OSS business process. In particular, all interface parameters of a complex type should map to SID entities as shown in

Figure 6. This analysis path is slightly "harder" than the use case path (shown in Figure 4) in that it requires a more formal interface definition.

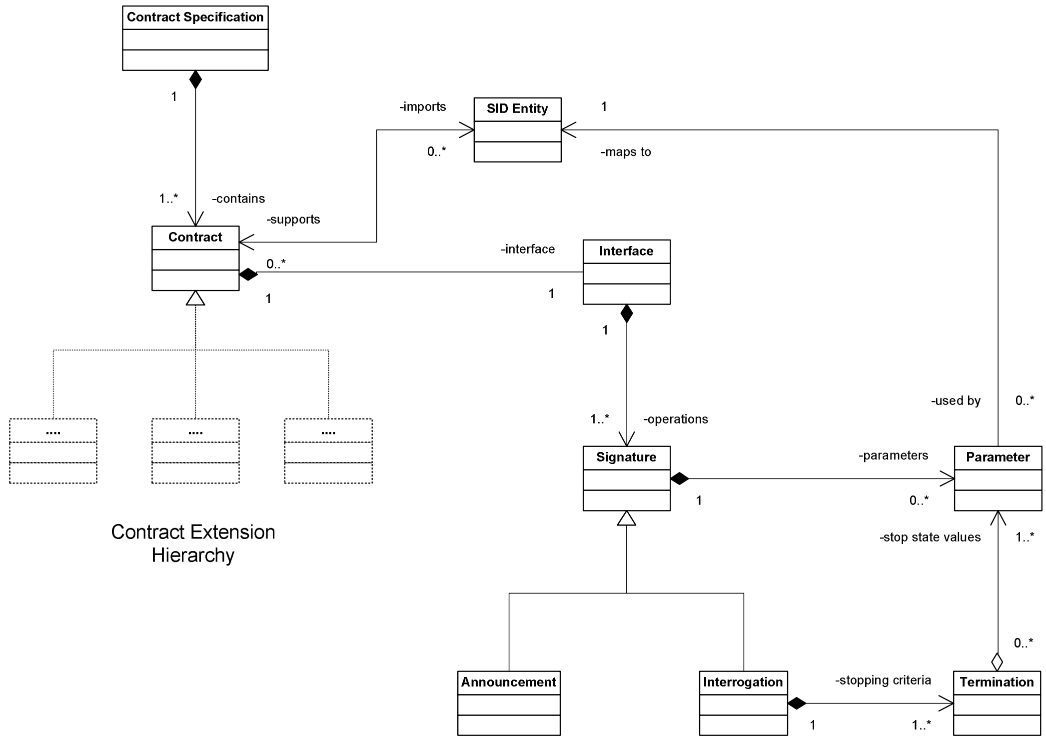


Figure 6 Interface-Signature parameterization

The NGOSS Compliance Testing Specification [7] also presents an information model that explicates a linkage between an OSS data entity ("SIS"), Contract and eTOM element (as shown in

Figure 7). Two paths can be followed to map an OSS to the NGOSS frameworks via the Contract entity:

1. A,B,C
2. I,I,III

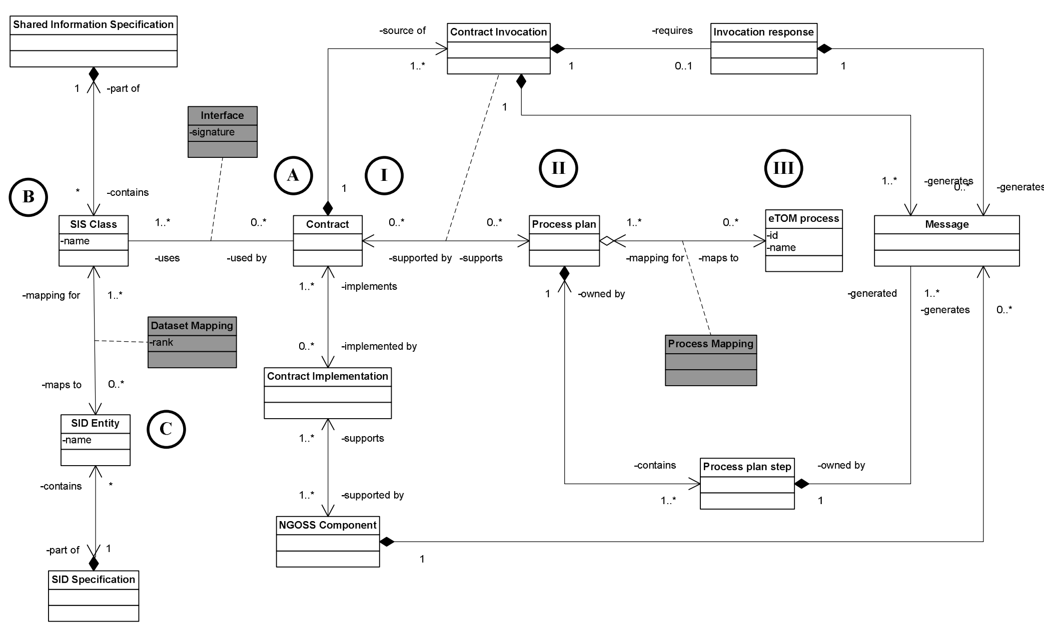


Figure 7 SIS-Contract conformance paths

The path from A, B, to C provides a measure of the Contract to SID conformance through the use of the SID compliance levels. The path from I, II, to III provides a measure of the Contract to eTOM conformance through process flows.

The three shaded elements in Figure 7 have been added by the author to highlight the elements utilized in Metabula's mapping process.

- The Interface association was discussed in the previous section.
- The Dataset Mapping association is described in [1] [2].
- The Process Mapping association between a Contract and eTOM process is mediated by a Process Plan which aggregates a series of Process Steps into a Process flow.

Process flows

Process flows link eTOM process elements together to fulfil specific business needs [10]. They have a strong relationship with the activity diagrams that form part of the SID/eTOM interaction model. Each process flow can be considered as a (dynamic) container (cf. the static SID ABE container) that defines a membership function on an eTOM (or OSS) process element. Process elements may participate in many process flows and this level of participation provides a ranking measure that may be used to evaluate match candidates. Hence membership of process flows must be incorporated into the representation of eTOM/OSS process elements if it is to be used as part of the matching process.

eTOM element representation

Any matching solution must be able to measure OSS-eTOM similarity across the eTOM process hierarchy as well as within a specific eTOM process. The representation of hierarchy is encoded within the identifier structure of each eTOM element.

eTOM elements are available at three levels in some areas of the standard. Level 2/3 is available [9] for the following level 1 operations:

- Customer Relationship Management (CRM) [TMF.1.OFAB.1..]
- Service Management and Operations (SM&O) [TMF.1.OFAB.2..]
- Resource Management and Operations (RM&O) [TMF.1.OFAB.3..]
- Supplier/Partner Relationship Management (S/PRM) [TMF.1.OFAB.4..]

These apply across the verticals of Operations, Fulfilment, Assurance and Billing.

The eTOM element identification [] is defined as follows:

aaaaaa	company id (use a descriptor to highlight extensions)
b	originator (1 implies TMF)
xxxx	verticals
c	level1.id
d	level2.id
e	level3.id

Using this encoding, the level 2 decomposition associated with CRM is as follows:

- CRM Support & Readiness [TMF.1.O.1.1.]

- Customer Interface Management [TMF.1.FAB.1.2.]
- Marketing Fulfilment Response [TMF.1.F.1.3.]
- Retention & Loyalty [TMF.1.FAB.1.9.]
- Selling [TMF.1.F.1.4.]
- Problem Handling [TMF.1.A.1.6.]
- Order handling [TMF.1.F.1.5.]
- Customer QoS/SLA Management [TMF.1.A.1.7.]
- Billings and Collections Management [TMF.1.A.1.8.]

The level 3 decomposition associated with Customer Interface Management is:

- Manage Contract [TMF.1.FAB.1.2.1]
- Manage Request (including self service) [TMF.1.FAB.1.2.2]
- Analyse and report on Customer [TMF.1.FAB.1.2.3]
- Mediate & orchestrate Customer interactions [TMF.1.FAB.1.2.4]

The Metabula mapping process (defined in the "Process" section) utilizes the vertical classifications associated with each element as additional match identifiers. This enables OSS elements to be positioned against eTOM elements as match candidates based on their business context as well as process context.

SID-eTOM mapping

A mapping between SID ABEs and eTOM level 2 processes has been defined in [6]. The example table below shows the mapping for the SID Customer domain.

SID ABE	Primary Mapping	Secondary Mapping	Comments
Customer	TMF.1.F.1.4	TMF.1.F.1.3 TMF.1.F.1.5	Implies ambiguity in the definition of Customer ABE.
	TMF.1.FAB.1.9	TMF.1.A.1.6 TMF.1.A.1.8	
Customer Interaction	TMF.1.FAB.1.2	TMF.1.F.1.4 TMF.1.A.1.6 TMF.1.A.1.8 TMF.1.A.1.9	
Customer Statistic	TMF.1.FAB.1.9	TMF.1.F.1.4 TMF.1.A.1.6 TMF.1.A.1.8	
Customer Problem	TMF.1.A.1.6	TMF.1.FAB.1.9	
Customer SLA	TMF.1.A.1.7	TMF.1.F.1.4 TMF.1.FAB.1.9	
Customer Order	TMF.1.F.1.5	TMF.1.FAB.1.9 TMF.1.F.2.2	
Customer Bill	TMF.1.A.1.8	TMF.1.FAB.1.9 TMF.1.B.2.5	
Applied Customer Billing Rates	TMF.1.B.2.5	TMF.1.FAB.1.9	
Customer Bill Collections	TMF.1.A.1.8	TMF.1.FAB.1.9 TMF.1.E.5.1	Note the additional vertical "Financial Management"

Customer Bill Inquiry	TMF.1.A.1.6	TMF.1.FAB.1.9 TMF.1.A.1.8	

This linkage has been defined between SID and eTOM as a mapping between ABEs and vertical processes (at level 1 and 2).

All SID–eTOM mappings are of two types:

1. Primary 1::1 or 1::2 (implies duality or ambiguity) (read-write)
2. Secondary 1::n (read only)

A Primary mapping implies the eTOM process can create instances of the SID entities. Therefore Primary mappings should be ranked higher when looking for match candidates between OSS processes and eTOM entities.

This predefined mapping can provide a feedback mechanism because OSS processes and SIS entities are implicitly linked via their Contract definitions. Therefore we would expect that SID/eTOM elements that have been mapped from these OSS entities would have some overlap with the linkage defined in [6]. If they do not then it suggests one or more of the following:

- the Contract (interface) has been poorly defined
- the SIS elements have been poorly matched
- the eTOM elements have been poorly matched
- the mapping in [6] is incomplete

Examples of mapping between the eTOM framework and third party processes are given in [12] and [13].

The coverage defined by such mappings can be characterized as:

- Coarse (source) 1::n (eTOM level2)
- Overlapping (source) n::1 (eTOM level2)
- Missing (source) 0::1 (eTOM level2 – vertical or horizontal)
- Orphaned (source) 1::0 (eTOM level2 – but may map at another inappropriate level)

The Metabula solution uses the same classification structure in its match process.

eTOM/SID extensions

After the mapping process, there will be a set of OSS process/data entities that have been mapped to eTOM/SID entities. This set can be validated (to a degree) by comparing it with the set that has been mapped in [6].

There will also be a set of OSS entities that have not been mapped. These need to be placed into an appropriate SID/eTOM extension structure. Extension structures are essentially containers for unmatched elements that are linked to parents (existing SID/eTOM elements) via a specialization relationship.

SID extension structures have been described in [1][2]. eTOM extension structures are based on Process Flow containerization. Where possible, extension elements are placed in an existing Process Flow container. Therefore eTOM extensions are dynamic in that they reflect the execution paths that their members participate in.

Process

Three different methods may be applied to generate a measure of conformance between an OSS system and the eTOM and SID frameworks:

A. OSS to eTOM process mapping

1. Start with an OSS business process
2. Break it into a set of OSS process flows - each process flow aggregates a set of process steps.
3. Try to match each step against an eTOM process element
    a. First check all entities within the standard framework
    b. Then consider extensions to that framework

B. OSS to SID dataset mapping

1. As currently defined in the Metabula papers [1] [2]

C. OSS to Contract mapping

1. Start with an OSS application or use case scenario
2. Generate the distinct Contract interfaces for the scenario
3. For each Contract, identify the signature and input/output parameters for the Contract.
4. For each signature do method A
5. For each parameter do method B

This solution implements method (C) as the following process:

1. Load eTOM/SID standard models into DataBridge
2. Identify key OSS use cases (i.e. configure the scope of a specific solution)
3. Analyse OSS to identify key datasources and applications that support the use cases
4. Generate Contract structures that cover the use cases
5. Load Contract structures into DataBridge (specifically the interface definitions)
    a. Add the OSS data entities (SIS) encapsulated within each Contract
    b. Add the OSS process entities encapsulated within each Contract
6. Perform data centric and process-centric mappings
    a. SIS <-> SID (as supported by existing Metabula solution [1] [2])
    b. Process <-> eTOM (as described below)
7. Classify match candidates according to the similarity in process (flows) and business domains
8. Tag matched entities between SID/eTOM and SIS/Process models to define a navigation path
9. Extend eTOM/SID frameworks where appropriate to capture OSS-specific entities
10. Validate implicit linkage (as described by (5)) by cross referencing mapped eTOM-SID elements with predefined TMF mappings

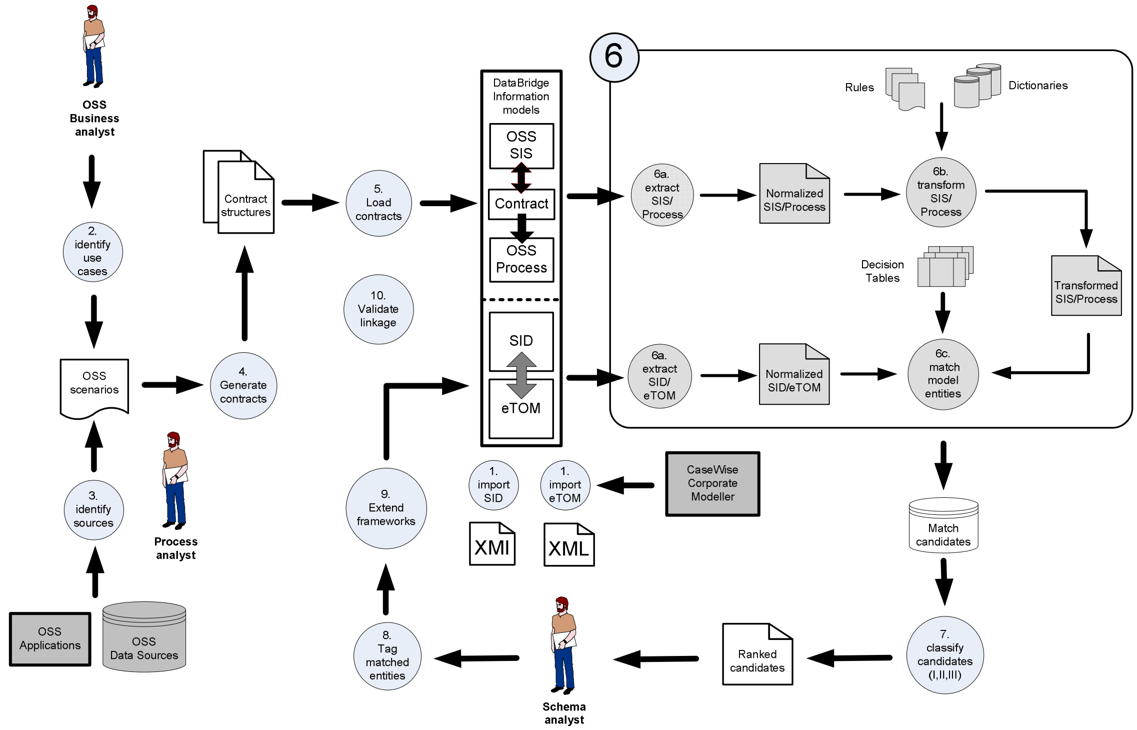


Figure 8 The top level process

The process is detailed in Figure 8 and the following sections:

1. Load eTOM/SID standard models

The first stage of the process is to import the SID Aggregate Business Entities (ABEs) into the DataBridge system using the Phase 5 XMI file. The eTOM v4.5 model is available in XML format when generated from CaseWise CorporateModeller. A subset of this model is loaded into the DataBridge system and linked to SID ABEs (according to the mapping defined in [6]).

2. Identify key OSS use cases

This is a manual process involving an OSS business analyst. See [5] for a useful description of techniques.

3. Identify supporting data sources and applications

This is a manual process involving a Metabula consultant.

4. Generate Contract structures

Each Contract captures one or interfaces which correspond to a "chunk" of functionality offered by the Contract. Initially generate one interface per Contract with multiple operations per interface. An informal definition of an operation is based on template of

status ***ProcedureName****(in* ***parameter1****, in* ***parameter2****, … out* ***parameterN****)*

where

parameterM *= type* ***AttributeName***[2]

[2] ***AttributeName*** may appear redundant but can be used to support the matching process.

and

type is a simple data type or a SIS entity

An example of a formal definition of an interface is as follows:

```
interface IDCDictionary : IDispatch
{
	HRESULT DCGetLogicalModel([in] IDCSessionContext* clientSession, [in]
				BSTR bstrConnection, [out, retval]  long *lIdSchema);

	HRESULT DCGetClassMetric([in] IDCSessionContext* clientSession, [in]
				BSTR bstrClsMetName, [out, retval] long *lIdClsMet);

	HRESULT DCGetFieldMetric([in] IDCSessionContext* clientSession, [in]
				BSTR bstrAttMetName, [out, retval] long *lIdAttMet);
}
```

5. Load Contract structures

This process is a standard XMI based load into the ContractInterface model of a DataBridge system. A new instance of a process element is created for each operation using the procedure name as an identifier. Each non simple data type is validated against the existing set of SIS entities. If not found then a new instance of an SIS entity is created using the type name as an identifier.

All processes / SIS entities created for an interface are associated together since they are linked via their common interface. Note that SIS entities are likely to be shared across several interfaces.

6. Perform independent mapping

Perform an automatic mapping process to generate match candidates between elements of the following models:

- OSS process – eTOM process
- OSS SIS entity – SID Business Entity

The basic process is documented in [1] [2] and summarized as

a) Normalizing TMF and OSS models to produce a “flattened” representation
b) Apply transformation “rules” and dictionary lookups to remove noise and standardize OSS entities to the TMF naming conventions
c) Generating a list of potential match candidates between TMF and OSS entities using decision tables based on different match categories.

7. Classify match candidates

The mapping process generates a series of match groups containing similar process or data entities based on the match categories defined in step (6). These match candidates are reviewed and candidates with required degree of matching confidence are paired as being synonymous in the OSS and TMF frameworks.

8. Tag matched candidates

Paired OSS – TMF candidates in the TMF and OSS models are tagged to provide a navigation path between process-eTOM elements and data-SID elements

9. Extend frameworks

Both SID and eTOM frameworks must be extended within the DataBridge system to capture key OSS elements that have failed the matching process. The SID framework is extended as described in [1] [2] to capture new OSS data elements as specializations or generalizations of existing SID business entities. The eTOM framework is extended by adding OSS processes as part of a level 4/5 decomposition. All new extensions to either framework must be placed in an appropriate model container.

10. Validate linkage

The entities that have been tagged in step (8) should be cross referenced against known relationships between the eTOM and SID frameworks. The validation path for this process is shown in Figure 9.

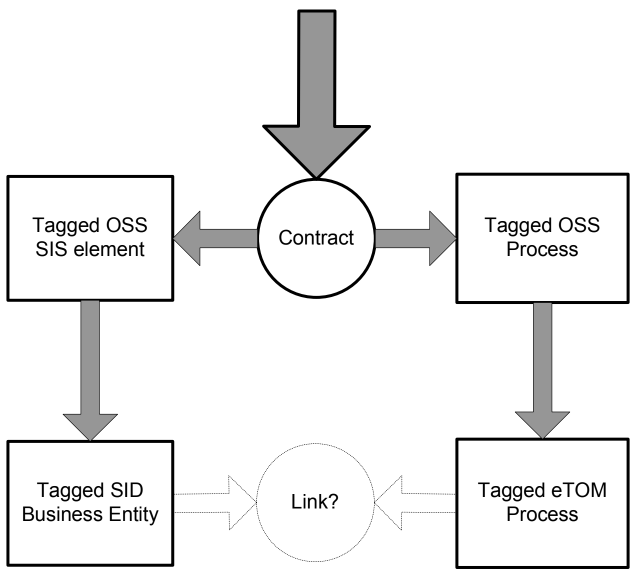


Figure 9 Process – data validation paths

Deployment

This Metabula solution utilises a variety of Metabula's products. The DataBridge product is used as the information model repository and is able to present the views on the SID, SIS, and SID extensions models. These views are then used by the dn:Clean and dn:Audit products to perform the overlap analysis and proposed matching with the results being loaded back into the DataBridge product.

DataBridge

DataBridge uses a meta-data driven approach that hooks the structure and layout of data in existing systems into a common frame of reference – in DataBridge terminology, this is known as the 'logical data model'. DataBridge can manage a catalogue of logical models, supporting different perspectives. The key product characteristics are that it

- delivers **unified data** from multiple sources, multiple systems and multiple structures
- delivers this unified data into **multiple structures** for different users and applications
- is **non-invasive**, driven by metadata, leaving the original data at source
- collects and processes data in **real-time** – integrated information **on-demand**
- provides a **single point of entry** for application interfacing according to whatever business model is required
- includes an intermediate **datastore** to allow the post-processing of source data after extraction and before delivery
- helps data sources and systems to be retired or replaced without affecting all the other systems. Systems are **insulated** from changes elsewhere
- can deliver **two-way** data transfer. Use DataBridge to populate multiple systems from a single source
- is **rapidly implemented**, fast, flexible, and scaleable

dn:Audit

dn:Audit offers a phased approach that focuses initially on profiling to enable user to gain a clear overview of her data from a neutral perspective. This generic view is then overlaid with specific analyses that help her understand the meaning of the data and quantify its quality from a business perspective. Feedback from this process is then used to drive the compliance process whereby owners of the data raise their standards of quality

dn:Audit is both a configurable and extensible product. Existing analysis rules are extensively parameterized to enable a user to configure them to specific data sources. New analysis rules can be added to existing libraries via

- third party reference sets
- User defined look-ups, patterns
- User extended rules & business logic
- Intelligent algorithms – phonetics, statistics, probability, information theory, inference

dn:Clean

dn: Clean provides a comprehensive library of processing modules, which the user can link and combine to solve their problems. These include the following common key areas: parsing, standardisation, validation, verification, enrichment and matching

- **Parsing** takes free-form, or loosely structured data and identifies its key elements. This is then delivered in a well-defined, structured format. This is particularly useful where data has been entered inconsistently in different fields within the record.
- **Standardisation** creates consistency of content. This may be based upon standard words and abbreviations, standard formats of patterns, structures of compound codes, or dealing with fixed length fields and leading characters.
- **Validation** tests and corrects data according to algorithms or business rules. These may be simple or complex, generic or application-specific.
- **Verification** tests and corrects data by reference to a trusted source. This may be another system or data source within the organisation, or may be third party reference data.
- **Enrichment** allows additional information to be added to existing records, for example lifestyle or demographic information for residential customers, geo-coding of locations, or the addition of business classifications.
- **Matching** works either within a single source, to identify duplicate or potentially duplicate records, or across multiple sources. The goal may be to reconcile and link disparate systems, or to create a single definitive source of data currently residing in multiple sources.

Conclusion

Metabula believes that the process described could provide significant benefit in the area of NGOSS conformance analysis. The ability to semi-automate and electronically document the process (as DataBridge models) is extremely powerful, but it also means that the resulting information models can be used to present OSS information according to the eTOM/SID frameworks as well as make the models available for use in other tools and subsequent phases.

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