Analysis and Improvement of the Alignment between Business and Information System for Telecom Services

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Abstract - The main aim of Enterprise Architecture (EA) is to master the development and the evolutions of Information Systems (IS). The EA process consists of designing the IS target architecture from several views, according to the company strategy. The business view represents the target organization of the particular company. The functional view focuses on the target functional architecture of that company’s IS. In this paper, we propose a new formal solution to analyze and to improve the consistency between the target functional view and the target business view of telecom services. This solution is based on the definition of a strategic alignment of the target functional view with the target business view. Alignment is validated with a real case study implemented and deployed at Orange--France Telecom on their messaging service. An alignment measure completing this analysis provides an estimation of the gap between a target functional view and a target business view.

Keywords - information system, enterprise architecture, business view, functional view, alignment, measure, function typing.

I. INTRODUCTION

A. Context and Motivation

Enterprise Architecture (EA) aims to simplify the Information Systems (IS) of a company, and to reduce the cost of IS development and evolution. This simplification of IS should be driven by the strategy of the company. For telecommunication service providers, the strategy mainly consists of providing new services (designed by marketing to fit user’s needs) that rely as much as possible on existing infrastructures [1].

EA frameworks (such as that of Zachman [2]) define various points of view (business, system, technology, etc.) in order to take into account all the aspects of these strategic objectives. This paper relies on the four classic EA views (as defined in [3]): the business view defining ‘why’, the functional view defining ‘what’, the technical view defining ‘with what’, and the applicative view defining ‘how’. The relationships between the functional view, the technical view, and the applicative view are deduced from the iterative development cycle, which relies on the Unified Process (UP) [4]. The business view should be an input for both the functional and the technical views.

This paper is focused on the strategic alignment of a company’s functional view with its business view. A good alignment highlights the consistency within the organization of the company and its IS [5] and indicates that the business strategy and the IS strategy are synchronized.

The target business architecture and the target functional architecture must both fulfill the strategy of a company. However, the strategy guiding the business organization (business view) and that of the IS functions (functional view) are different and are not defined by the same people. Business and functional views evolve independently, following the business and the marketing evolutions. Moreover, the evolution of a company’s organization is seldom synchronous with the evolution of its IS.

We therefore propose an innovative formal approach that allows a functional Enterprise Architecture to analyze the misalignment between the target functional architecture and the target business architecture. We also propose a metric for this alignment. The objective is to define an assessment in order to improve the alignment between the functional view and the business view.

B. Outline

This paper is organized as follows. Section II depicts the state of the art and Section III introduces the EA process and defines what is meant by the alignment of the functional view with the business view. Section IV describes the alignment measure of the functional view with that of the business view. The examples in Section III and in Section IV is based on an Orange messaging service. Section V describes a solution to improve the alignment measure of the functional view in comparison with the business view, by typing functions according to business processes. Section VI depicts the first experimentation of the alignment measure at the Orange laboratories.
II. RELATED WORK

In practice, most telecommunication companies directly map their business view with their IS applicative, aiming for an alignment between their core business and their IS. A company may decide that a given email platform (for example, Microsoft Exchange server) will manage the entire service business process of communicating by email. For telecom services, this method has one major shortcoming: it implies a tight coupling between the business view and the applicative view. The business analysis is then distorted by applicative considerations. For example, the messaging business may evolve so that it is driven by the evolutions of the selected platform, and no longer by the company strategy. The specification of a target business architecture that differs from the current applicative view may become virtually impossible.

In the literature, the alignment problem involving EA is mainly considered to be between the business view of a company and its IS [6]. Alignment may also be considered between the business view of a company and its objectives, as in the Business Motivation Model [7], or between an analysis model and a design model of the functional view of a telecom service [8]. The parameters related to the quality of the alignment are specific for each company [9]. For this type of alignment, heuristics may be defined to provide warnings in case of misalignment [5]. A measurement method would allow the evaluation of architectures in business terms (cost, benefit, risk). However, the measures relevant to business terms do not take IS concepts into account.

One significant contribution of this paper is a method to take into account the effects of a company’s strategy on its functional view. The alignment perspective between the business and functional views is shown in Figure 1.

![Figure 1](image1.png)

Figure 1. Alignment perspective between the target business view deduced from a business strategy and the IS target functional view deduced from an IS strategy [6].

The functional view choice is justified because an IS functional view is easier to align with than a business view. Functional, meaning comprehensible and practical, is indeed helpful to match business description. Moreover, the IS applicative view is largely the facet that implements the functional view. Alignment of the applicative view with the business view is thus dependent on the alignment of the functional view with the business view.

Moreover, many object-oriented measures exist outside the scope of EA. To estimate model alignment, coupling measures [10] are the most appropriate means, since relationships between models are the main characteristics of the solution proposed in this paper.

III. ALIGNMENT OF THE FUNCTIONAL VIEW WITH THE BUSINESS VIEW DEFINITION

We focus here on the alignment—or the misalignment of the functional view with the business view. As demonstrated in the previous section, this topic has not been studied in much detail.

A. Alignment Definition Home Domain Analogy

Let us introduce the alignment definition with a “home domain” analogy. In a “home domain”, the house customer is responsible for the “home processes” of a home domain business view. One is the Have a meal at home process and its activities Cooking at home and Eating at home. The house occupant defines that Eating at home comes after Cooking at home. “Home IS” is designed by house architects, who define models of homes based on the home domain functional view. House architects design models of homes from “home functions”. Three components composed of “home functions” and their dependencies support the Have a meal at home process. The so-restricted “Home IS” is represented by a home model in a Unified Modelling Language (UML) [11] component diagram given in Figure 2. Figure 2 illustrates three dependencies between “home functions”: Have breakfast on Cook at home, Have dinner on Cook at home and Have lunch on Cook at home.

![Figure 2](image2.png)

Figure 2. “Home domain” analogy with “Home IS”, which owns two functional components: Eating management and Cooking management.

Alignment of the functional view with the business view is easily illustrated with this “home domain”:

- **Have breakfast, Have dinner, Have lunch** are “home functions” aligned with an *Eating at home* “home activity”;
- **Cook at home and Get food** are “home functions” aligned with a *Cooking at home* “home activity”;

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• Have breakfast on Cook at home, Have diner on Cook at home and Have lunch on Cook at home are dependencies between “home functions" aligned with Cook at home, and come before any Eating at home activity succession.

With this home analogy, we can highlight that there is a reversal between the dependency and the succession relationships. The eating-on-cooking dependency means that cooking must come before eating.

B. EA and Target Architecture

The EA process has two main goals:
• to depict existing IT architecture, in order to describe what functions are implemented on each IT system, how each IT system is deployed and which process is supported by each IT system; and
• to design several target architecture views to separate the concerns of the various stakeholders in the enterprise.

Even if the company strategy is constant during the design of all the target architectures of these views, the required skills are different: on one side, the company’s core business experts elaborate the business view; on the other side, enterprising functional architects design the functional view. This independency is particularly significant for the evolution of each view because their lifecycles are different. A complete synchronization of a company’s organization evolutions and IS evolutions is very difficult to achieve for a large company. This is especially true for telecom service operators whose markets and technologies are very dynamic.

A company usually elaborates its target business architecture following a process analysis, which provides for descriptions of the business processes that belong to the core business of a company. The business view has the activity as its main concept, which is a part of a business process and which is under the responsibility of an organizational role. Concepts are modelled with UML [11]. A UML activity diagram can be used to capture a procedure designed in the target business architecture. Within Orange–France Telecom, the usage of telecom services is specified with approximately 10 roles and several tens of activities.

For illustration, let us consider a messaging service, limited to the message receipt. When a new requirement appears in the telecom operator strategy, such as the need to protect children from inappropriate electronic messages, the access control must evolve. In this example, the operator chooses to implement its strategy by creating a new Child protection provider role. Furthermore, the Messaging service provider role will depend on the new Child protection provider role in the new target organizational infrastructure. So, to achieve the messaging receipt activity, the Messaging service provider role needs the intervention of the Child protection provider role.

The procedure deduced from the messaging service process is therefore easily captured using an activity diagram such as the one in Figure 3.

The IS target functional architecture contains functional elements implemented by IS systems. Functional architectures design the target functional architecture according to the company strategy. The main concept of the functional view meta-model holds that the function defines the functional component. Functional view concepts such as "Functional component" and "Dependency between functional components" are also close to UML concepts. The target functional view may be represented by a component diagram. The target functional view of our messaging illustration is represented by the component diagram in Figure 4.
resolve this complexity, our approach is based on the
dynamic perspective because it allows functional reusability,
a useful improvement. This reusability involves service
components called enablers, as defined by the OMA (Open
Mobile Alliance) [13]. Moreover, the alignment between
business data and functional data can be deduced from the
alignment between business activities and functions, as
business data are produced by business activities and
functional data by functions.

The business view, as illustrated in Figure 3, instantiates
dynamic concepts. A procedure is indeed described by an
activity sequence instead of a business data model.
Concerning the functional view, the design of an interaction
sequence carrying out a telecom service usage scenario does
precede the data modelling. This chaining is feasible because
each data is produced or used by a function during a
scenario. With this dynamic approach, a dependency
between functional components corresponds to an interaction
between two functional component instances. The
equivalence between an interaction sequence and a telecom
service usage scenario denotes the dynamic aspect of this
approach (see Figure 5).

A "request" type dependency of the functional view is
therefore an information request. A functional dependency
has a "resource" type if it represents an answer to an
information request.

The association completing the alignment criterion is
between a succession relationship of two business activities
and a dependency between functions. We define the
following links:
- Succession relationships are between two business
  activities if the end of one precedes the beginning of
  the other in a UML activity diagram capturing a
  business process (for example, in Figure 3, the
  succession relationship is the one from the business
  activity Message receipt to the business activity
  Message filtering);
- Dependency between two functions occurs
  - if they are associated to two interactions
    between functional components, which
    have either the "request" type or the
    "resource" type,
  - and if the end of one of these interactions
    precedes the beginning of the other
    interaction in a UML sequence diagram
    (an example in Figure 5 is the dependency between
    the function Filter a message from the message
    sender on the function Create message filtering
    rule).

The alignment of the functional view with the business view
can thus be defined from these alignment criteria:
- a function is aligned with the business view
  - if the function has a common meaning
    with at least one activity of the business
    view,
  - and if each business activity aligned with
    the function has at least one succession
    relationship with another business activity
    aligned with the function; and

C. Alignment of the Functional View with the Business
View Definition

Alignment criteria are required to define the alignment
between models. Our innovative criterion is based on the
associations between concepts of the business view and of
the functional view. Enterprise Architecture chooses
business view concepts consistent with functional view
concepts, while taking the alignment definition into account.
The consistency between these concepts is known as the
alignment value between a business model and a functional
model.

We have considered two relevant types of possible
associations:
- associations between business data manipulated by
  business activities and functional data manipulated
  by functions; and
- associations between business activities and
  functions.

An approach based on the first type (business data and
functional data) can be viewed as static because it does not
take into account the evolution of the states of data.

We have therefore chosen an innovative approach by
considering the second type (business activities and
functions). We have qualified this approach as dynamic,
because it relies on the UML dynamic diagrams (activity
diagram, sequence diagram) that show the live comportment
of a system.

The idea of a dynamic approach (as opposed to an
approach based on data) is to base the alignment on service
usage scenarios instead of basing it on data models. For
development methods in relation to the entity relationship
model [12], the methodological complexity is a consequence
of the simultaneous modelling of data and treatments. To

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- a function is aligned with the business view
  - if the function has a common meaning
    with at least one activity of the business
    view,
• a dependency between two functions F1 and F2, such as F1 depends on F2, is aligned with the business view if there is at least one business activity A1 aligned with F1, if there is at least one business activity A2 aligned with F2, and if A1 follows A2 in an activity diagram (succession relationship).

The alignment definitions are illustrated in Figure 3 for the business activity and the activity succession relationship concepts, in Figure 4 for the function concept, and in Figure 5 for the function dependency concept:

- Receive a message function is aligned with
  o Message receipt business activity;

- Filter a message from the message sender and Filter a message from the message object functions are aligned with
  o Message filtering business activity; and

- the dependency relationship from Filter a message from the message sender function on Receive a message function is aligned with
  o the succession relationship from the Message receipt business activity to the Message filtering business activity.

In Figure 5, the Create message filtering rule function and the dependency relationship of the Filter a message from the message sender function on the Create message filtering rule function are not aligned with the business view. No business activity in Figure 3 has a meaning in common with Create message filtering rule function.

IV. ALIGNMENT MEASURE OF THE FUNCTIONAL VIEW WITH THE BUSINESS VIEW

Axiomatization allows the intuitive properties of the alignment of a functional view to be specified in comparison to a business view description [14]. We propose an alignment measure according to these axioms.

A. Alignment Measure Home Domain Analogy

Alignment measure could be illustrated with a "home domain" analogy. We assume in this section that "home function" Get food is offered by the Cooking management component. This "home function" is added to our "Home IS" designed in Section III. Figure 6 represents our new "Home IS" with a UML component diagram.

This new "home function" Get food is not aligned with the "home activity" of Eating at home process because no activity of "Home processes" restricted to Have a meal at home shares a sense with food management, which is the closest repository management activity. We can say that the alignment of the new "Home IS" with "Home process" is worse than the alignment of the "Home IS" designed in Section III with "Home process".
B. Alignment of the Functional View with the Business View Axiomatization

An axiom is an expected and understandable property of an alignment measurement that has also a meaning in the mathematical model. The following BFA axioms define this intuitive behaviour. Axioms are parameterized by functional view concepts affected by the alignment.

**BFA1 – Function addition.** The alignment resulting from the addition of a function in the functional view is either:

- worse than or identical to the previous alignment if the function has no business meaning in common with at least one activity of the business view,
- better than the previous alignment if the function has a business meaning in common with at least one activity of the business view.

**BFA2 – Function dependency addition.** The alignment resulting from the addition of a dependency between functions in the functional view is either:

- worse than or identical to the previous alignment if there is no business activity time succession of the business view that is aligned with the function dependency,
- better than the previous alignment if there is at least one business activity time succession of the business view that is aligned with the function dependency.

**BFA3 – Function deletion.** The alignment resulting from the deletion of a function in the functional view is either:

- worse than the previous alignment if the function shares a common business meaning with at least one activity of the business view,
- better than or identical to the previous alignment if the function has no common business meaning with even one activity of the business view.

**BFA4 – Function dependency deletion.** The alignment resulting from the deletion of a dependency between functions in the functional view is either:

- worse than the previous alignment if there is at least one business activity time succession of the business view that is aligned with the function dependency,
- better than or identical to the previous alignment if there is no business activity time succession of the business view aligned with the function dependency.

C. Alignment of the Functional View with the Business View Measure

An alignment measure depends on the alignment concepts defined in Section III. The number of relationships captured in a diagram is a well-known parameter for data model estimation [15]. The dependencies from the target functional view are the parameters of a proposed alignment measure, named BFAM, of the functional view with the business view. These dependencies, which are or are not aligned with the business view, enable estimation of the alignment of the functional view with the business view.

\[
BFAM(FV) = \frac{N_f(FV) - N_{naf}(FV)}{N_f(FV)} \times \left( \frac{N_d(FV) - N_{nad}(FV)}{N_d(FV)} \right)
\]

(1)

where, for a functional view FV:

- \(N_f(FV)\) is the number of functions,
- \(N_{naf}(FV)\) is the number of functions that are not aligned with business activities,
- \(N_d(FV)\) is the number of dependencies between functions,
- \(N_{nad}(FV)\) is the number of dependencies between functions that are not aligned with a business activity time succession of the business view.

The BFAM value is a real number which value is between 0 (no function and no dependency relationship between functions are aligned with the business view) and 1 for a perfect alignment (all functions and all dependency relationships between functions are aligned with the business view).

BFAM measures complies with axioms **BFA1**, **BFA2**, **BFA3**, **BFA4** (see Section IV) of the alignment of the functional view with the business view.

The compliance for the BFAM axiom is detailed as follows:

- Let \(F\) a function added to the functional view FV,

\[
BFAM(FV \cup \{F\}) = \left( \frac{N_f(FV \cup \{F\}) - N_{naf}(FV \cup \{F\})}{N_f(FV \cup \{F\})} \right) \times \left( \frac{N_d(FV \cup \{F\}) - N_{nad}(FV \cup \{F\})}{N_d(FV \cup \{F\})} \right)
\]

- Let \(F\) a function added to the functional view FV,

\[
BFAM(FV \cup \{F\}) = \left( \frac{N_f(FV) + 1 - N_{naf}(FV) + N_{naf}(\{F\})}{N_f(FV) + 1} \right) \times \left( \frac{N_d(FV) - N_{nad}(FV)}{N_d(FV)} \right)
\]

because the number of dependency relationships between functions is unchanged. And then
If F has no common meaning with at least one business activity, then
\[ N \cdot \{naf\}(F) = 1 \]

\[ BFAM(F \cup \{F\}) - BFAM(F) = \]
\[ \left( 1 - \frac{N \cdot \{naf\}(F) + N \cdot \{nad\}(F)}{N \cdot f(F) + 1} \right) \]
\[ \left( 1 - \frac{N \cdot \{naf\}(F)}{N \cdot f(F)} \right) \]
\[ \left( \frac{N \cdot d(F) - N \cdot \{nad\}(F)}{N \cdot d(F)} \right) \]

\[ \frac{N \cdot \{naf\}(F) - N \cdot f(F)}{N \cdot \{naf\}(F) + N \cdot \{nad\}(F)} \]

and so,
\[ BFAM(F \cup \{F\}) \leq BFAM(F) \]

because the number of misaligned functions is lower than or identical to the complete number of functions.

The BFAM measure is identical to the previous alignment measure when
\[ N \cdot f(F) = N \cdot \{naf\}(F) \]
i.e., when no function of the functional view F is aligned with the business view.

If F has a common meaning with at least one activity of the business view, then
\[ N \cdot \{naf\}(F) = 0 \]
A new dependency of \textit{Cook at home} on \textit{Get food} allows an alignment with the activity succession (\textit{Taking out food from the freezer} activity comes before \textit{Cooking at home} activity).

Alignment improvement is the result of functional dependency design, which is consistent with activity succession. In the following section, we propose rules, named \textbf{BFRs}, that provide for alignment improvement from functional views in comparison with business views.

\section*{B. Typing of functions in relation to the Business View}

The principle of typing functions comes from the architectural layer concept from the OSI model (Open Systems Interconnect) [16]. Typing each element allows to locate it on a specific layer. This principle is applied to the design of functions and of functions' dependencies.

A function owns types, which distinguishes it from the business activities aligned with it. The following types are consistent with a networking system [17]:

- \textbf{Command}, if this function is aligned with a business activity, then it has a life duration depending on the instances of business processes containing it (for example, \textit{Give a telecommunication service order} function is aligned with a business activity, which has a life duration depending on the \textit{Order capture} process (defined in [18])),

- \textbf{Data}, if this function is aligned with a business activity, then it has life duration that is independent of the instances of business processes containing it (for example, \textit{Have access to telecommunication service catalogue} function is aligned with business activity, which has a life duration independent of the \textit{Order capture} or \textit{Billing} processes containing catalogue management activity).

Let $F$ be the set of functions and $T$ be the set of function types, then a type $t$ of function $f$ is the power set of $T$:

$$t : F \rightarrow P(T)$$

$$f \mapsto t : t \subseteq P\{\{\text{Command}, \text{Data}\}\}$$

(2)

So, a function can be of type \{\text{command, data}\} if it is aligned with two activities, such as life duration depending on the processes containing it and life duration independent of the processes containing it.

The functional architecture represented in Figure 4 shows four functions:

- \textbf{Create message filtering rule} function, which is of both \textit{Command} and \textit{Data} types. An alignment improvement would identify business activities that share a sense in common with this rule creation function. Two activities must be inserted in the messaging telecom service use process: \textit{Filtering rule creation} and \textit{Filtering rule consultation}. On the one hand, \textit{Filtering rule creation} activity has a life duration, which depends on the use process, while \textit{Filtering rule consultation} does not depend on it. We may indeed consult a filtering rule, while other messaging telecom service use process instances do not;

- \textbf{Filter a message from the message sender} and \textbf{Filter a message from the message object} functions own \textit{Command} type. Their life duration depends on messaging telecom service process instances; and

- \textbf{Receive a message} function owns \textit{Command} type for the same reason.

From definition (2), the typing can be expressed as:

$$t(\text{Create message filtering rule}) = \{\text{Command, Data}\}$$

$$t(\text{Filter a message from the message sender}) = \{\text{Command}\}$$

$$t(\text{Filter a message from the message object}) = \{\text{Command}\}$$

$$t(\text{Receive a message}) = \{\text{Command}\}$$

In our messaging telecom service, the \textit{Create message filtering rule} function has both \textit{Command} and \textit{Data} types. To improve alignment with the business view, function typing should associate each function to only one type (\textit{Command} or \textit{Data}). These functions, \textit{Create message filtering rule} and \textit{Consult message filtering rule}, are illustrated in a UML sequence diagram in Figure 8.

Figure 7. New “Home IS”, which owns a new “home function dependency: Cook at home on Get food.”

Figure 8. The diagram illustrates the alignment improvement in two processes, \textit{Order capture} and \textit{Billing}, with the \textit{Filtering rule creation} and \textit{Filtering rule consultation} activities.
We propose then the first two rules, **BFR1** and **BFR2**, for improved alignment with the business view:

**BFR1 – Multi-typed function splitting.** Multi-type functions must be split in sub-functions so that each sub-function is only of one type.

BFR1 improves alignment because activities are under the responsibility of specific roles. Activities with life durations dependent on processes are indeed under the responsibility of the enterprise’s front-office, and activities with life durations independent of processes are mainly under the responsibility of an enterprise’s back-office.

On one hand, the *Filtering rule creation* activity is under the responsibility of the *Child protection provider*, which is a telecom service back-office role. On the other hand, *Filtering rule consultation*, *Filter a message from the message sender* and *Filter a message from the message object* are activities under the responsibility of the *Messaging service provider* role, which is a telecom service front-office role.

Type pattern [19] may complete function typing, defining relationships between mono-typed functions. This pattern must be consistent with type definitions in relation to the business view. Pattern motivation enables alignment improvement of the functional view with the business view. A pattern may, for example, be associated with types as defined in (2). The UML class diagram in Figure 9 illustrates that a *Command* function depends on the *Data* function. An activity, which has life duration dependent on the instance of a business process, comes before an activity that has life duration independent of the instances of business processes.

**BFR2 – Multi-typed function sub-functions model.** Sub-functions deduced from one multi-type function must satisfy a type pattern. Considering the $t$ function defined in (2), the type pattern motivated in Figure 9 is applied to sub-functions in Figure 10.

Alignment of the functional view with the business view may be improved because of type pattern consistency in relation to business view design.

**C. Typing of Functional Component Dependency in relation to the Business View**

Type pattern consistency with the business view may also be applied to function dependency.

**BFR3 – Mono-typed functions model.** A dependency between two mono-typed functions must respect type pattern for dependency existence and dependency orientation.
To decide the orientation of this dependency, let us note that each process has to be supported first by a command-typed function.

Messaging dynamic illustrations in Figures 5, 8 and 11 all show that message receipt process is supported by Filter a message from message sender, which is a Command typed function. A dependency of the Consult message filtering rule on the Create message filtering rule is designed in the messaging sequence diagram. This dependency does not satisfy BFR3 because the Consult message filtering rule is a Data typed function and the Create message filtering rule is a Command typed function. The business interpretation of this dependency is that one activity of message rule consulting is not useful in message rule creation.

This dependency can, moreover, be analyzed at the data production level and with a data access security point of view. A command-typed function’s need for a data-typed function to enable a process to be achieved is illustrated by the dependency of data characterizing the reception of an email, such as its reception date, toward data characterizing a filtering rule. This data dependency provides the opportunity to secure data produced by data-typed function. It is then possible to realize a data-typed function with high security requirements (in the present example: access control depending on the data and on the role of the user: administrator or developer of the mail service), but the realization of the command-typed block is associated with weaker security requirements (in the example: user authentication in the mail service).

VI. CASE STUDY

The alignment measure of the functional view with the business view is a tool for functional architects to compare the business alignment of various functional domains (messaging, IPTV, telephony, etc.) and so to prioritize their actions and improve the alignment. Such action can be guided by an assessment of the alignment. A case study with telecom messaging functions was conducted within the Orange Labs. This domain contains 8 functional components, 12 functions, and 16 function dependencies between functional components for six scenarios. The associated business view contains three activities and two activity time successions.

The alignment measure, BFAM, of the messaging domain functional view with the business view of telecom service usage is estimated (see formula (1)):

\[ BFAM (\text{Messaging}) = \frac{7}{8} \]

Let us illustrate with a simple case how to improve the alignment. The assessment for messaging is the following: the alignment of the functional view of the Messaging domain with the business process of message sending would be perfect (i.e., with a measure estimated as 1) if the dependency relationship

- from the Transmit a message function defining Message exchange functional component
- on the Store a message function defining Message storage functional component

could be reversed (see Figure 12).
To maintain the aligned dependency from Send a message on Store a message, this reversal should require the Message exchange functional component to be split as follows into two:

- **Message sending** functional component defined by the Send a message function, and
- **Message transmission** functional component defined by the Transmit a message function.

From definition (2), typing can be expressed as:

\[
\tau(\text{Send a message}) = \{\text{Command}\} \\
\tau(\text{Transmit a message}) = \{\text{Data}\} \\
\tau(\text{Store a message}) = \{\text{Command}\}
\]

**Message transmission** is indeed a network function within the telecommunication services IS. This function has a life duration independent of the instances of telecommunication service processes. Moreover, Send a message and Store a message are dependent on the telecommunication service process because the telecommunication service user has an access to data provided by these two functions (message sending date and message storage date, for example).

A dependency relationship of the **Message transmission** functional component on the **Message storage** results from the previous target functional architecture.

One dependency relationship represented in Figure 13 is consistent with the type pattern in Figure 9:

- a dependency relationship of the **Message storage** functional component on **Message transmission**, which improves the alignment.

Another dependency relationship represented in Figure 13 is consistent with the type pattern in Figure 10:

- a dependency relationship of the **Message sending** functional component on **Message transmission**, deduced from the Message exchange splitting.

Using type patterns thus provides a perfect alignment:

\[
BFAM(\text{Messaging}) = 1 \text{ (see (1))}
\]

Functional architects may use this assessment as a tool to improve the business alignment, by checking if the suggested modifications conform to the enterprise strategy.

**VII. CONCLUSION**

The modelling process described in this paper enables a representation of the alignment of an IS functional view with the business view of the IS company. The alignment definition is consistent with the meta-modelling used to instantiate both the business and the functional models. An alignment measure is proposed, which provides estimation of the synchronization of a company's strategic integration of business and functional views.

Finally, a good alignment of the target functional view with the business target view induces a good alignment of the applicative view, which in turn implements the target functional view with the target business view. We illustrate this applicative alignment in Figure 14 with our “home domain”. An applicative view that implements the functional view is represented in Figure 7.

**Figure 14. “Home IS” applicative view implementing the Eat at home “Home process”**

Functional dependency is implemented in the applicative view by only one call from the “Home bus”. Function dependency implementation is deployed on the doors between rooms. “Home bus” traffic is thereby lowered. This
property, deduced from the alignment improvement of the functional view in compared to the business view, may be significant in Service Oriented Architecture (SOA) [21] design.

The applicative view may contain several hundred applications, which can hardly be directly mapped with the company business processes. In our approach, the target functional view is used as a link between the business and applicative views. This indirect mapping allows an efficient tool to govern IT evolution according to company strategy.

REFERENCES


