Designing the Accountability of Enterprise Architectures

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Abstract: Designing enterprise architectures for accountability is to reason about options. Instead of taking enterprise architectures as products, the paper seeks to comprehend how they are produced. Considering enterprise architecture as an entangled category of sociological, political and democratic challenges provide an opportunity to determine the political *topos* of enterprise architectures.

Keywords: Design for Accountability, Enterprise Architecture, Actor Network Theory, Circulating System of Scientific Objects, Located Accountabilities.

1 Introduction

In information engineering, a model is a guide for writing the code of applications. It is used as a protocol for the exchange of specifics among engineers. For enterprise architects, instead, a model gives guidance in visualizing the overall organizational activity [Zachman 1987]. Previously, different models coexisted in enterprises, and each model had its application. A model for the development of a software application would be devised using MS Visio, for example. A model for product development would be developed using CAD. A blueprint would be the model of the organization. And a model of business processes would be constructed using a business process modelling (BPM) application. Today, enterprise architects envisage the use of a single information platform (the 'enterprise architecture') to model all organizational activities: product, processes, human resources and information systems. This phenomenon can be interpreted as the radical modernization, or 'reflexive modernization' [Beck 1994], of enterprise systems (where 'enterprise systems' means the overall family of enterprise modelling tools). The radical modernization of enterprise systems represented by enterprise architectures (EA) has two distinctive features:

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1. EA are turning from applications on single functions - like expert systems or business process automation - into systems to control overall organizational action;
2. EA is not about introducing a new technology into organizations where there is none; it is about introducing a new technology on top of existing ones.

These features make 'enterprise architecture' a category that must be reconfigured both in political terms and from the point of view of sociological analysis. Moreover, the radical or reflexive modernization of the domain of enterprise systems [Beck 1994] informs public debate on reform of the control systems of democratic institutions.

In this paper we will use the term 'enterprise architecture' to denote the modelling platform (the enterprise architecture modelling tool) as well as the enterprise model produced from it. The question that we shall seek to answer is this: what would a design for the accountability of enterprise architectures look like?

The paper is structured as follows. First we describe enterprise architecture as an entangled category of sociological, political and democratic challenges. We then review the current literature on accountability in the information system field. The limitations of the current literature are presented. Thereafter, we develop our own proposal of design for accountability based on actor-network theory. The empirical part of the paper is devoted to the case of an enterprise architecture modelling platform observed in a Scandinavian software company. The role of enterprise architectures (EA) in the context of US regulations on financial reporting is presented. In particular, we present how EA facilitate fulfilment of templates required by the Office of Management and Budget for allowing investments of public money on IT. We will underline how the dimension of financial reporting is related to the work of modellers and how the work of modellers is related to the scientific acceptance of a modelling approach. We will also present the relation between the scientific acceptance and the way modeller gather user requirement. Drawing on interviews and ethnographies of modellers gathering requirements, we witness a series of attempts to foster connections through which to gain access to the organization to be modelled and then immediately afterwards, to cut them, nullify them, obliterate them. Our interest for accountability raises from this observed trend. The data will be structured and analyzed according to the theoretical framework proposed. Discussion and final remarks conclude the paper.

2 Enterprise Architecture as an Entangled Category of Sociological, Political and Democratic Challenges

2.1 The Superseding of the Political System

In the case of EA, the material to be modernized is not material provided by a political representation. What is to be replaced by the introduction of computer-based technology is not labour and its union representatives. The modernization concerns a previous modernization process that has already dealt with the problem of reference. In industrial society, the problem of reference was a problem of accuracy

and precision. In today's risk society, the problem of reference is one of trust, election, obedience. In industrial society the formula was 'technology replaces labour': an object took the place of subjective performance. In the risk society, technology supersedes technology: objectivity applies to itself [Beck 1994].

2.2 The Elusion of the Sociological Analysis

It is not only the political system that has been superseded. The sociological analysis is also eluded. The category of 'accountability' in its sociological version cannot be used to make enterprise architectures 'visible and reportable'. Accountability is a category of ethnomethodology conceived by Alfred Schutz [Schutz 1953/1971], developed by Garfinkel [Garfinkel 1967], Sacks [Sacks 1966-7,1992] and Cicourel [Cicourel 1974] and applied in organizational studies by Bittner [Bittner 1965], Silverman and Jones [Silverman and Jones 1976] and Boden [Boden 1994]. This tradition postulates that accountability is the main bond of human interaction. Accountability is considered to be a 'members concern'. It doesn't seem to be explained in what are the relations between different accounting rules, which suggests an implicit naturalism [Lynch and Bogen 1994]. We still consider accountability to be a bond, but we extend the notion to non-human interactions as well. What is specific to accountability in technology production is its 'dismemberment' [Beck 2005] from the social setting taken as a gathering of humans with some kind of shared membership. What we have in mind in developing the concept of accountability is not a social community but a still-to-be-organized number of human and non-human actors jointly implicated by an issue [Marres 2005].

2.3 The Debate on Reform of the Control Systems of Democratic Institutions as an Integral Part of EA Analysis

The debate on reform of the control systems of Western democratic institutions is an integral part of enterprise architecture analysis. The regulations of the US Congress contain provisions on a 'sound and integrated information architecture technology' [CCA 1996] and 'graphical representations' [SOA 2002] that governmental agencies and corporations have to provide on the investment of public money and the reliability of their disclosures.

This represents a shift from the idea of the 'state manager' – with the capabilities and the instruments to intervene directly in the market – to the idea of a 'regulatory state' [La Spina and Majone 2000] which delegates regulation of the markets for both private and public goods to private actors. The state oversees this shift via specific regulatory authorities, which supervise the action of private actors, considered valuable for a community by implementing regulations.

Because these regulations establish internal control procedures in the form of monitoring techniques, they help create what in anthropology has been termed an 'audit culture' [Strathern 2002].

Technology plays a key role. Michael Power, a leading scholar of audit studies, states that a distinctive feature of an audit culture is the switch to system accountability [Power 1994]. Technology is said to ensure a more 'neutral' system of control. Enterprise architecture has been advocated as one such control system by the 'Information Technology Reform Act' [CCA 1996] of the US Congress and by the more recent 'Sarbanes Oxley Act' of 2002 [SOA 2002].

Studying enterprise architecture as an entangled category of sociological political and democratic challenges provides an opportunity to determine the locus of the conditions of possibility within which we want to live, this being the political *topos* of enterprise architectures. Designing enterprise architectures for accountability is to reason about options [Mol 1999:80]. Instead of taking enterprise architecture as a product, we want to comprehend how it is produced.

3 Design for Accountability

Accountability is on the list of desiderata of system developers [Leven 1995, Paulk et al. 1993]. However, the expression 'design for accountability' is a more recent coinage by Sara Eriksen [Eriksen 2002]. In her paper, citing the ethnomethodological definition of accountability – 'visibly-rational-and-reportable-for-all-practical-purposes' [Garfinkel 1967:vii] – Eriksén remarks that design methodologies lack an understanding of accountability 'from a user perspective'.

The scholars that Eriksen considers in regard to the concept of 'design for accountability' are Paul Dourish [Dourish 1993, 2001], Harold Garfinkel [Garfinkel 1967] and Lucy Suchman [Suchman 1994,2000]. Although Eriksén acknowledges that all these authors have influenced her work, the most influential of them is certainly Lucy Suchman.

Suchman can be indeed considered a pioneer in the study of accountability in design practices. In 1993 she published 'Technologies of Accountability' [Suchman 1993] on the work of air traffic controllers, in 1994 'Working Relations in Technology Production and Use' [Suchman 1994], and drawing on the former paper, in 2000 she issued a work in progress entitled 'Located Accountabilities in Technology Production' [Suchman 2000]. Suchman distinguishes three design practices on a scale of increasing accountability:

1. 'design from nowhere', where the designer is only concerned with system accountability, that is, how the system feeds back on the function assigned to it by the developer;
2. 'detached intimacy', which is when the circuit of accountability is limited to the community to which the engineer belongs; and
3. 'located accountability', when the designer makes him/herself politically accountable for his actions to a public wider than the community of system engineers.

The notable aspect of the notion of 'located accountability' is that it goes beyond Garfinkel's idea of accountability as a member concern. Suchman instead adopts a deliberately political stance. As also noted by Eriksén [Eriksen 2002], the concept of 'located accountability' implies reflexivity and awareness of our personal

participation in various communities and of the possible benefits to be derived from 'boundary-crossing networking' [Eriksen 2002:182]. Each of us must be accountable for our actions in a wider and 'commonal' sense [Eriksen 2002:182]. The design and use of technologies are collective attainments for which each of us is, in some way, responsible.

The notion of 'located accountability' gives a broader and civic meaning to designer responsibilities. The question to bear in mind in technology production is, Suchman writes, 'Who is doing what to whom?' [Suchman 2000:5]. We would point out that, although we too adopt Suchman's stance, we do not maintain that designers inscribe their will in objects and that objects serve them. We instead distinguish between a 'substantive' view of design and a 'propositional' one. Developing a propositional view of design means seeing 'design' not as a noun but as a verb. <requirement>, <design> and <user> are not separate terms in a list, but instead form a proposition. On the substantive view of design, the political *topos* – where a decision is made – is always deferred to an elsewhere. 'Design' is determined by 'requirement', and 'requirement' is motivated by 'design', so that the decision defers to a matter of fact, making impossible to track the trajectory of accountability. On a propositional view of design, a chain of inscription between human and non-human actors takes the place of the dichotomy between matters of fact and designer decisions.

4 Actor-Network Theory

The notion of 'located accountabilities' has a drawback. It gives no indication as to the 'broad sense' in which the designer must take responsibility for his/her actions. Even when referring to Suchman's writings on accountability in design practices [Suchman 1993,1994], it is not easy to garner clarification of the 'wider and 'commonal' sense' in which the designer must take responsibility for his/her actions. A similar criticism of this aspect to the concept of 'located accountabilities' is made by Neyland and Woolgar [Neyland and Woolgar 2002], when they write:

> across the wide range of ethnomethodological studies of accountability, the analytic status of the 'public', that is, the nature and identity of those for whom practical actions are 'publicly observable' varies considerably. The nature of the 'public observation' also varies. [Neyland and Woolgar 2002:263]

In order to determine the 'nature and identity' and the 'ontological status' of the 'public observation' that makes an action accountable in the ethnomethodological version of accountability, we may resort to actor-network theory. Actor-network theory has never been codified into a full fledged theory; it is better described as an interpretative approach and a literary genre. Its two sources of theoretical inspiration are actant theory [Greimas and Courtes 1982] and the notion of translation [Callon 1975]. We make use here of actant theory, a version of structuralist analysis introduced by the French semiologist Algirdas Greimas [Greimas and Cortes 1982], who propounded the notion of 'narrative program': a change of state produced by any subject affecting any other subject. Greimas speaks of grammatical subjects,

which may or may not reveal themselves as persons. He accordingly replaces the term 'character' with the term 'actant', "that which accomplishes or undergoes an act" [Greimas and Cortes 1982], because it applies not only to human beings but also to animals, objects and concepts. Narrative programs are chained together in a logical sequence to form a narrative trajectory. The circulating system of scientific facts [Latour 1999:70] used to structure field data is an adaptation of Greimas's narrative trajectory to description of the making of technological objects. In our proposed design for accountability, the circulating system of scientific and technological facts assigns analytical status to the public observation that makes designer actions accountable, thus filling the analytical gap in the ethnomethodological version of accountability. The use of actor-network theory [Callon and Latour 1981] in a proposed design for enterprise system accountability focuses attention on the carefully arranged sequence of steps and movements that involve actors (models and enterprises, referents and modellers) in negotiations and associations.

Moreover, actor-network theory provides a topology for accountability design that allows us to do away with the 'requirement', 'design' and 'user' triad. We can thus study the multiplicity of enterprise architecture accounts and how this multiplicity produces the modelling platform in relation. Multiplicity is different from plurality. In plurality there are mutually exclusive, discrete perspectives existing side by side in a transparent space, while at the centre the object of attention is singular, intangible, untouched. In multiplicity, reality is performed and enacted rather than observed. Instead of being seen by diverse watching eyes while remaining untouched in the centre, reality is manipulated by various tools used by diverse practices [Mol 1999:77].

5 Empirical Study

5.1 Data Source

We report a field study carried out at the production site of an enterprise architecture tool – which we call 'EPISTEME'. EPISTEME is delivered by a software company headquartered in Scandinavia. We gained access to the software company as a result of longstanding collaboration between the Information Engineering Laboratory of the University of Trento and the software company producing EPISTEME. Preparation for the fieldwork started in January 2004 with preliminary interviews, and the fieldwork itself was conducted at the EPISTEME production site from September to December 2004 using ethnographic methods. The data were obtained by means of regular weekly interviews with the managers of the company's Product Business Unit and Research & Development Business Unit (BU), and with developers working in its R&D BU. In progress at the same time as the field study was an EU research project – let us call it MINERVA. We were able to discuss the MINERVA requirements, at their various stages of modelling, with the developers working on them. Further data were collected from the minutes of meetings held by the modellers with one industrial project partner and from the MINERVA

deliverable documents. Other sources of data were the scientific papers published by the manager of the Research & Development Business Unit (BU). The company has a branch in North America, and data on EPISTEME's American market were gathered from mail exchanges between the North American branch manager and the Product Business Unit manager at the headquarters in Scandinavia. Finally, marketing materials were analyzed and compared with the on-line marketing materials of competitor companies in North America.

5.2 Data Structure

The data are structured according to the scheme known as the 'circulatory system of scientific facts' [Latour 1999:98]. Obtaining requirements from users (mobilization) is the first of a number of loops that must be measured in order to calculate a model's accountability. Together with 'mobilization', the model is then translated into scientific text to convince the enterprise architects' audience of its autonomy from competing approaches (autonomization). Third, the model is sold on the market. (alliances). Finally, Enterprise Architectures reaches the public controversy of financial reporting (public).

5.3 Data Presentation

The role of EPISTEME in the context of US regulations on financial reporting has been investigated. We quote an excerpt from an article by BW, the manager of the company's North American branch. 'Clinger Cohen Fulfilled? Agency Officials are Taking Enterprise Architecture and Capital Planning Seriously'. In this article BW relates success in compliance with the regulations to success in selling EPISTEME to governmental public agencies. He writes:

> Cohen might be gratified by the sophistication of agencies' compliance with the act..1

This sentence comes exactly one year after Government Accountability Office reports 1% of governmental agencies applying Enterprise Architectures following the criteria of the OMB provision of 20022. He adds:

> For more than a year some agencies [...] have been developing prototype models for a single line of business that could be duplicated department wide.

The gratification derives from the fact that if the EPISTEME application is applied to one single line of business, it will be 'duplicated' (without variations) to the scale of the entire organization. Since it is used by 1% of agencies, it will be soon used by the remaining 99%. In addition, the article furnishes an example of the 'sophistication' with which agencies use enterprise architectures. The example is 'the marriage' with 'capital planning' and 'investment control':

> An example is the marriage of the capital planning and investment control process – the financial rationale behind funding requests – with the enterprise

architecture model that officials must incorporate into agency business cases contained in the OMB Exhibit 300s.

OMB Exhibit 300 is the format for IT investment proposals that agencies submit to OMB in order to obtain a 'Delegation of Procurement Authority' (DPA). A DPA is approval for IT investment issued by OMB. EPISTEME is presented as a product able to speed up and facilitate fulfilment of the Exhibit 300 by generating them dynamically.

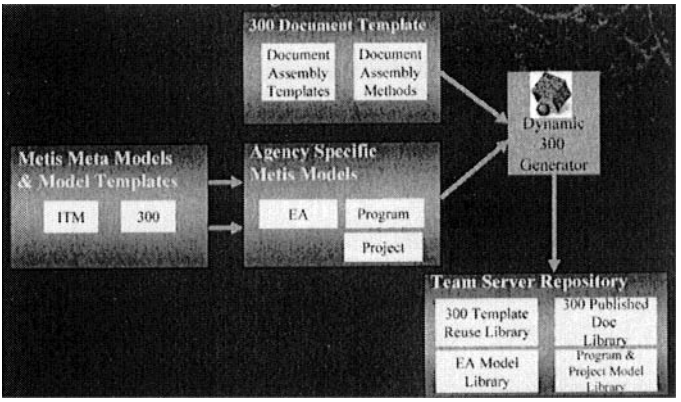

Fig. 1. The dynamic 300 generator

Here EPISTEME performs the highly specific role of dynamically generating the format to obtain funding. The general name for this function is 'Capital Asset Planning', which is the key factor in the marriage between enterprise architecture and financial reporting.

In fig.1 a very simple diagram depicts what EPISTEME does. A number of square shapes, represent causes and consequences in a line. Our analysis did not stop to this frame. Our ethnography has been driven by the following question: what do we find if we expand the diagram a bit more? Where an imaginary arrow pointing to the box 'EPISTEME Meta Model & Model Templates' departs from? The answer can be found drawing on other sources of data analyzed. Namely we had: scientific papers published by the R&D department of the Company and by observation of meeting modellers had with users in the MINERVA project. We will be fast stepping through these other sources of data, for our aim is to make our point on accountability. The element framed out from the dynamic Exhibit 300 generator is the work of modellers developing EPISTEME. To understand modellers' work we have to go back to the 'scientific foundations' of the modelling approach used to build EPISTEME. The scientific foundations of the modelling approach, to its turn, involve the discourse on the empirical base, that is, the way in which the requirements are collected. The empirical base is populated by 'referents' and by their knowledge about the organization. The knowledge of the organization's referent providing the empirical base is defined by a modeller in the following way:

> I enter a company and I have a contact with a referent that gives me the data. The referent has a *limited knowledge* that is *unstructured*. It is *tacit*.[3]

6 Data Analysis

The modeller first credits the data gathering process with the presence of a referent ('I have a contact with a referent that gives me the data'). Then s/he quickly discredits it, ascribing to that referent 'limited', 'tacit' and 'unstructured' knowledge of his/her daily work practice. On following the itinerary of the 'data' step by step from the data collection site to that of their elaboration in EPISTEME, we witnessed a series of attempts to foster connections through which to gain access to the organization to be modelled and then immediately afterwards, to cut them, nullify them, obliterate them. First memory of the passages accomplished is impaired. Later there is a quest for the model appearing on the computer screen to be an accurate representation of the organization where the data come from.

This reconstruction prompted us to enquire as to the reason why this question about accuracy is asked. According to our empirical findings, the reason was to obtain a perfectly defined product from EPISTEME. It is only by defining the referent's know-how as unstructured knowledge that the call for a different kind of knowledge can be sustained. Only by opposing two different kinds of knowledge can structured knowledge be preferred instead of unstructured know-how. And finally, only by leaving out of the scene the dependency of one form of knowledge (straight and scientific) on the other (clever and crooked) that a perfectly defined product can be obtained.

We can extend this argument to analysis of the role of EPISTEME in the context of US regulations on financial reporting. Analysis of SOA provisions shows the know-how of independent auditors as inadequate because of a conflict of interests. Enactment of this inadequacy produces an image of enterprise architecture as know-how free from conflicts of interest. As a consequence a last relation is made: that of the public with the private. The felicity condition of the financial reporting triangle [Cullinan 2004], where the resolution of urgent financial controversies in real time is secured by the presence of a heterogeneous and odd system of actors (independent auditor, CEO, internal audit committee), is represented by enterprise architecture software firms as places where the intervention of a 'built-in system' with no need for consultation is beneficial and resolutive. It is now that the technical problem becomes totally political. It is not a system clash but an interest clash that the technology must prevent. What is now required by a piece of technology is accountability, election and obedience. No longer accuracy.

7 Discussion

The foregoing description of EPISTEME using the circulatory system of scientific facts [Latour 1999:98] has shown that the interests that lie behind technology are significant and diverse. For this reason, requiring all these interests to fit together without any clash is problematic. To make EPISTEME a system that prevents interest clashes, without any additional warranty, is to erase what makes EPISTEME a secure system: the visibility of its interest clashes. If EPISTEME is maintained as something neutral that supplies decisive knowledge, something is created that is

precisely what is to be avoided: a thousand times bigger interest clash between technology and politics. Because financial reporting is subject to regulations, it can be shaped as a 'public' discourse. According to Dewey [Dewey 1927], 'public' is a place deprived of the option of decisive knowledge. In the 'public' dimension, decision making have to be made in 'real-time' under the constraints of 'number, priority and urgency' [Latour 1999:263]. There is no alternative or substitutive decision-making procedure under these conditions. Why, then, is EPISTEME deemed to be a more neutral system of control? What EPISTEME can do in this frame is constantly to enrol new elements, increase the list of entities that must be taken into account.

Continuous backward references instead turn EPISTEME into a structured scientific method, so that it becomes insecure and decision making by the financial reporting system becomes impossible.

For this to be avoided, it is necessary to make apparent all the connections among the loops in the EPISTEME circulatory system.

8 Conclusion

Finally: what would a design for the accountability of enterprise systems look like? We outline some features. First, enterprise models should be represented as different from independent objects, perhaps as *assemblies*. The visual metaphor must be replaced by an *industrial metaphor* taking account of each intermediary in the circulatory system of technological facts. Moreover, the work of modellers, and the role played by the referents of the organizations that give them the data, together with their *bodies* and their *voices*, must be better represented, all the way down to the model's production line. Finally, new strategies and new media for the *distribution of responsibilities* in engineering must be identified and developed. These various aspects warrant further investigation.

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