

## **The challenges of Interoperability in E-government: Towards a conceptual refinement**

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### **1 Introduction**

There are great expectations on advanced e-government solutions coming from politicians, public administrators and citizens. The modern state should be as modern as the rest of the society with its advanced on-line opportunities. Consumers meet daily a vast commercial supply of goods, services and information when surfing the internet. In their roles as citizens, they do not however meet the same vast supply of government services.

Huge efforts are made in order to create public e-services to citizens. National and trans-national programmes are established as a basis for e-service development. The pace of introduction of new services seems however not to come up to the given expectations. There is a high complexity in public administration which renders a high complexity in realising e-government solutions.

A well-known model of e-government development is the Layne & Lee (2001) model of four e-government stages. Although disputable<sup>1</sup> this model points to some important features of advanced e-government solutions. Their most advanced stage in e-government development is the level of integrated e-services. This fourth level comprises horizontal integration of public agencies and their information systems (IS). The communication between different agencies' IS will be a core issue in advanced e-government. In other terms this can be labelled *IS interoperability*; i.e. how different information systems can operate and function together.

I would claim that e-government interoperability is perhaps the most important issue of e-government today. In order to create advanced solutions with integrated e-services and one stop government there will be high demands on e-government interoperability. There are great initiatives (both national and trans-national) to create frameworks and architectures for e-government interoperability; confer EC (2003; 2004) and SOU (2007) for some examples and Guijarro (2006) for an overview. In my own research on e-service development in local governments<sup>2</sup> I have identified e-government interoperability as the most challenging task. In this short paper I will focus on e-government interoperability and especially analyse different interoperability layers. There is a great need for research efforts in this area due to lack of in-depth understanding of these complex issues. Scholl & Klischewski (2007, p 890) write about the challenges of e-government interoperability: "the complex nature or the exact extent of these challenges and constraints regarding integration and interoperability are not well

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<sup>1</sup> Confer critique in Goldkuhl & Person (2006) and Andersen & Henriksen (2006).

<sup>2</sup> Confer e.g. Goldkuhl (2007; 2008).

understood, neither in practice nor in theory”. My specific contribution in this paper is to make further clarifications of the notion of e-government interoperability.

## 2 Layers of e-government interoperability

Several scholars have declared the importance of e-government interoperability; e.g. Cava & Guijarro (2003), Benamou et al (2004), Klischewski (2004), Bekkers (2005), Klischewski & Scholl (2006). There seems to be a consensus that the interoperation of egov IS should not simply be seen as a technical problem. There are other aspects which need to be conceptualised as well. The European Commission has developed a “European Interoperability Framework” (EC, 2004) consisting of three layers: Organisational, semantic and technical interoperability. These layers seem to be “containers” of different aspects concerning interoperating egov systems. Organisational interoperability is defined as: “This aspect of interoperability is concerned with *defining* business goals, *modelling* business processes and *bringing* about the collaboration of administrations that wish to exchange information and may have different internal structures and processes” (ibid p 16; my emphasis). This means that interoperability is about *what people do* in order to obtain interoperating egov systems. This is also obvious when looking at the definition of semantic interoperability: “This aspect of interoperability is concerned with *ensuring* that the precise meaning of exchanged information is understandable by any other application that was not initially developed for this purpose” (ibid; my emphasis). This way of defining interoperability as activities seems to be conceptually confusing and I will return to this issue below.

These three layers seem however in the government context to be insufficient. In SOU (2007), a Swedish government official inquiry on IT standardization, a fourth level was introduced: Judicial (or legal) interoperability. Incompatible regulations and unclear legal status are examples of inhibitors of judicial interoperability. The notion of legal interoperability is also described by Bekkers (2005). The description of this kind of interoperability (as well as other kinds) is however most concerned with what hinders interoperation.

## 3 Interoperability in e-government: Towards a conceptual clarification

There seems to be needs for conceptual clarifications and developments of the notion of e-government interoperability. First, the concepts of *integration* and *interoperability* need to be conceptually distinguished<sup>1</sup>. Integration (as a more abstract concept) could mean to bring some parts together and make them a coherent whole. Such integration could mean that different information systems are integrated into one system. Integration could however also mean that the parts remain as separate entities but that they work together in a well-functioning manner (as federated systems). Interoperable systems are systems that can work together, but they still remain as separate systems. They are linked together through some exchange of data.

Further, there is a need to clarify the *scope* of ‘interoperability’. Is it something that is concerned with an information system (an IT artefact) or an organisation? The described layers above (organisational and judicial interoperability) imply that its scope can comprise the organisation. I think it is important to conceptually distinguish between organisational and IS interoperation. Organisational interoperation is a broader notion and it comprises both

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<sup>1</sup> Scholl & Klischewski (2007, p 897) discuss these concepts in a similar vein.

interaction 1) between humans (as organisational agents)<sup>1</sup> and 2) between information systems. Information systems' interoperability is thus seen as a special case of organisations' interoperability. It is however important to clarify if the discussion of e-government interoperability is concerned with the super-class interoperability between organisations or the sub-class interoperability between information systems.

It is obvious that the layers of technical and semantic interoperability is concerned with IS interoperability. How about the other layers? Judicial and organisational layers? Can they also be seen as properties concerned with IS interoperability? I introduce figure 1 to clarify the discussion. This figure depicts two public agencies (one State agency and one Municipal agency) which interact through their information systems/technical agents (T) and also between their employees/human agents (H). The T interaction is part of a broader human-via system-to human communication (HT-T-HT).

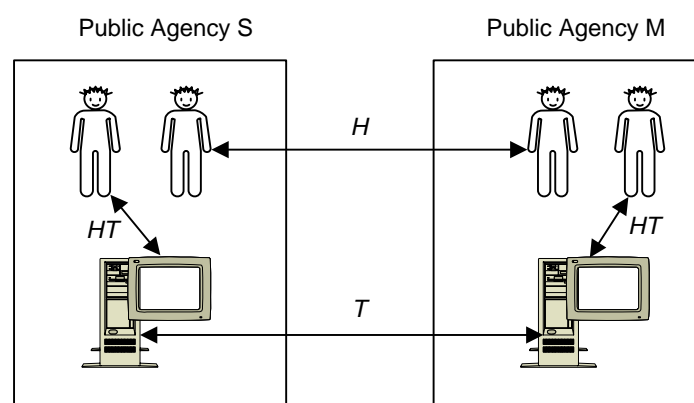


Figure 1: E-government interoperability in context

There may be organisational and judicial issues concerning the human-to-human communication (H). Such communication is a case of organisational interoperability (and not IS interoperability). I claim that organisational and judicial aspects also can concern IS interoperability. This will be discussed further below. First, I need to make some *linguistic clarification* of the notion of interoperability. What kind of concept is this? What kind of phenomena is abstracted through this concept? And what related words/concepts are there?

Interoperability is a noun, but is interoperability some kind of separate entity? The philosopher Ludwig Wittgenstein (1958) has warned for an extensive use of nouns. He says: "We are up against one of the great sources of philosophical bewilderment: a substantive makes us look for a thing that corresponds to it." (ibid p 1). Many concepts are often given a substantival form instead of an original adjective or verb form. Falling in the traps of such a noun disease, scholars often search for the essential thing behind the concept.

The concept of interoperability should be compared with other similar word forms<sup>2</sup>. Besides 'interoperability' (as a noun) there are 'interoperate' (as a verb) and 'interoperable' (as an adjective). Interoperate designates, as a verb, activities; i.e. the activities of agents interoperating. The noun 'interoperation' is a substantival derivation from this verb of 'interoperate'. Interoperable designates properties of entities; properties that makes agents

<sup>1</sup> Organisations are seen as actors (Ahrne, 1994; Taylor & van Every, 2000) and their actions are conducted by their agents (humans or artefacts) that act on behalf of the organisation (Goldkuhl & Röstlinger, 2003).

<sup>2</sup> This analysis follows the principles of conceptual determination of language use (Goldkuhl, 2002).

capable of interoperating. The noun ‘interoperability’ is a substantival derivation from this adjective of ‘interoperable’. Interoperability is thus an *attributive concept*. E-government interoperability is a set of *relational properties* between different egov systems. Interoperability is a property of systems<sup>1</sup> that make them function together. When we talk about interoperability, we designate the particular properties of such systems that make them interact properly. Interoperability is a relational property, since it expresses how properties of two (or more) entities are related to each other. Peristeras & Tarabanis (2006) have gone through several definitions of IS interoperability and one main common thread is the *ability* of two or more systems to exchange information and use this exchanged information.

Since information systems embed organisational institutions as norms, routines, language and other inter-subjective phenomena (Goldkuhl & Lyytinen, 1982; Orlikowski, 1992), there may be different types of interoperability. The systems inherit organisational features and thus become carriers of organisational functions and properties.

This means that there might be other issues than semantic and technical issues that affects the IS interoperation. As I pointed out above, some descriptions of interoperability seem to be occupied of what obstructs interoperation and not what enables it. Following the clarification above, that interoperability is different features that make information systems possible to work properly together, means that instead of inhibitors<sup>2</sup> we should look for positive features. The notion of *congruence* seems to be a key concept when clarifying interoperability. Two or more systems should have congruent properties. I have used this notion of congruence when clarifying the different layers of e-government interoperability in table 1 below. As indicated above, I was not content with describing interoperability as preparatory activities for achieving interoperable systems. We must distinguish between such preparatory activities (as defining, modelling etc) and the achieved properties of such systems.

*Table 1: Different layers of e-government interoperability*

<b>Different layers of interoperability</b>	<b>Meaning</b>
Judicial interoperability	Congruence between different laws/regulations
Organisational interoperability	Congruence in goals and work processes
- Axiological interoperability	Congruence in values and goals
- Cognitive interoperability	Congruence in thought and perceptions
- Intra-processual interoperability	Congruence between internal work processes
- Interactional interoperability	Congruence in interactions
Semantic interoperability	Congruence in used language (concepts/terminology)
Technical interoperability	Congruence in technical equipment

Judicial interoperability is defined as congruence between different laws/regulations. This means that it is necessary that legal preconditions for the IS interoperation are congruent. There may be specific laws regulating the behaviour of one public agency. These laws should be congruent with other laws/regulations governing the other public agency. These different laws/regulations will affect the different information systems and some parts of them (rules,

<sup>1</sup> Properties of interoperability can however also belong to entities in the IS context. This will be further commented below when discussing judicial interoperability.

<sup>2</sup> It is of course of great interest to look for inhibitors that obstruct interoperation. However, it is conceptually necessary to distinguish between inhibiting and enabling properties; and there are the enabling properties that constitute interoperability.

concepts) may also be implemented in the systems. The laws and regulations must however be seen as something external to the system, although it may be a carrier of some parts as mentioned above. Judicial interoperability of information systems are thus concerned with judicial preconditions for such systems. Partially it is concerned with legal rules enacted in the system. One conclusion from this discussion is that IS interoperability properties can be external to the system itself. A further refinement of the concept of e-government interoperability is that it is properties of systems or properties of external preconditions that makes the systems work together in proper ways. E-government interoperability are thus 1) intrinsic properties of information systems and 2) properties belonging to external preconditions of the information systems.

In table 1, I have especially tried to clarify the notion of organisational interoperability, since it seems to be a rather diffuse residual category. Organisational interoperability is briefly defined as “congruence in goals and work processes”. This is further refined in four types: 1) axiological that is concerned with values and goals, 2) cognitive that is concerned human actors’ way of thinking, 3) intra-processual that is concerned with how work processes are organised and structured within each organisation, and 4) interactional that is concerned with how the interaction between the different organisations are structured (how different interacts are related).

#### **4 Conclusions**

The development of e-government encounters several challenges. There are many researchers and practitioners who acknowledge e-government interoperability as a major challenge. In order to master this kind of challenge there is a need for useful conceptualisations. Important contributions have been made earlier; as dividing interoperability into different layers. The existing body of knowledge is, however, in parts conceptually confusing. E-government interoperability is for example described as activities and inhibitors. I have tried to take steps away from this conceptual quagmire and made some conceptual refinements of the notion of e-government interoperability. This work has so far been mainly conceptual. I have however been inspired by my on-going research on e-government development and the next step is to let the emerging concepts meet empirical data from these studies.

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