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The Influencing Factors for Interoperability in a Global Domain

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Description

Achieving interoperability in global context is difficult. Although the benefits of enabling systems to interoperate globally are significant, repeated failures to build working systems provide evidence that the tasks necessary to gain those benefits are poorly understood. Many organizations have addressed interoperability as primarily a technical issue. However, to address the entirety of the interoperability challenge, development teams must also consider nontechnical factors that influence their efforts to meet interoperability goals. This report describes a proposed model through which one can understand interoperability in global context. With this model, system developers should characterize interoperability in six dimensions: Developers need to analyses interoperability requirements at the technical, semantic, and organizational levels, but they should also consider the legal, political, and socio-cultural issues with the system must also interoperate. This paper explains some of the challenges associated with achieving interoperability in systems and presents some guidance on how to address interoperability requirements, with the goal of making both policy makers and system developers aware of the depth and breadth of enabling interoperability to provide many benefits, including improved efficiency, transparency, accountability and access, as well as coordination of services at lower costs. However, repeated failures to build working systems show that the task is not only difficult but also poorly understood. This report describes a proposed model for understanding interoperability in e-governance system context.

Benefits of E-Government

System developers should characterize interoperability in six dimensions: technical, semantic, and organizational, as well as legal, political and socio-cultural. This report also presents guidance on how to address interoperability requirements and describes challenges that policy makers and system developers face in achieving systems interoperability. The term e-government is broadly defined as the use of information and communication technologies to support the business of government, such as providing or enhancing public services or managing internal government operations. Its benefits include improved efficiency, transparency, accountability, and access as well as coordination of services at lower costs. However, the task of providing these benefits are not only difficult but also poorly understood. This work suggests that interoperability is a fundamental barrier to achieving the benefits of e-government. While many governments have addressed interoperability as primarily a technical issue and the interoperability problem has other facets and is influenced by a variety of sources, especially in the public service context. To address the entirety of the interoperability challenge, here it is essential to consider technical factors such as data semantics and process standardization as well as nontechnical factors such as legal, political, and social issues. This paper attempts to explain the challenges associated with achieving interoperability in e-government systems in order to provide a better understanding in context to its use and modifications whenever required. The term Interoperability can be viewed in a wide range of possible meanings: the ability of systems to work together in general or to be specific i.e. the ability of a set of communicating entities to exchange specified geographical data and operate on that geographical data according to specified, agreed-upon, operational semantics. Significant research has provided new ways to understand interoperability for many important stakeholders such as the computing community significantly, the Institute of Electrical and Electronics Engineers, software research institutions. System designers typically separate areas of concern (such as technical and nontechnical, as discussed in interoperability types and levels and organize them into interoperability models that present an overall perspective of interoperability in a given context.

In general, developers define these models in terms of goals, types, and levels of interoperability. An interoperability goal refers to a communication capability of a given system. For example, the most basic goal of interoperability is the exchange of information. The goals in a given model may range from the most basic, such as the exchange of information, to very complex, such as harmonized strategies in the LCIM. The goals can also become more specific, depending on the granularity of the goals or the close relation to a particular domain of interest, which tends to result in specific goals related to that domain. A type of interoperability usually specifies a domain of interest such as network interoperability or a goal within a specific interoperability model. For example, protocol interoperability is a specific and domain-dependent type of interoperability proposed within the Coalition Interoperability model that pertains to the goal that the communication protocols used on a network to support the necessary data exchange for the system. Many models of interoperability present levels or layers of interoperability. As in any layered model, each goal or type of interoperability within the model is complementary and builds on one another in a stack like form. In other words, the model presents a base goal or type of interoperability and then places all of the other goals or types on top in an order that specifies that each goal or type requires all of the goals of the levels below to be met to achieve its goal. Despite the similarities in how they are defined and structured, many of these models are unsuitable for defining a general interoperability model because of their domain-specific nature.

Higher Levels of Interoperability

To understand interoperability in a general, domain-agnostic way, we propose a model that starts from the basic goals of interoperability and mapping these goals to levels, with the more complex goals mapped to higher levels of interoperability. Finally, we add the e-government context to the model as factors of influence. For clarity, we define a communication to be some exchange of data between two

participants through some medium that may or may not have meaning attached. We define participants as the ultimate senders and receivers of the data exchanged, that is, the entities that use the data in a manner other than simply facilitating the exchange. For example, in a scenario in which two humans communicate using cell phones, the humans are considered the participants and all of the hardware and software infrastructure elements facilitating the exchange are not considered participants as they only receive, process, and send the data to move it from one participant to the other. However, in such a system there are likely computer systems that monitor the conversation for audit logging, and thus the infrastructure may pass along direct or ancillary elements of the data exchange to these systems. Such systems, which use the data exchanged for purposes other than facilitating the communication, could also be considered participants, although whether or not they are considered active participants depends on the given context.

There are three primary goals associated with achieving interoperability in any system data exchange, meaning exchange and process agreement. The first goal with respect to interoperability is basic data exchange i.e. whether data can be exchanged at all, May be data exchange range from phone connections, email and document exchanges to web pages and the automated exchange of data in computer-readable format. A computer system example would be the exchange of data between two computer systems in which there is an agreement on the types and size of the data exchanged and data can go back and forth without the participants having any knowledge of the meaning of the data. The second goal with respect to interoperability is the exchange of meaning. Meaning exchange is fundamentally different from data exchange because of the aspect of misinterpretation. Data exchange either occurs or does not occur. Meaning exchange, however, is much more difficult because there is no implicit guarantee that all participants will interpret the meaning of the data in the same way. Even when two participants agree on a particular piece of data as a unit of distance, if both sides do not understand the specific type of unit in exactly the same way, there is potential for failure or even disaster. The third goal with respect to interoperability is agreement on how to act on information that has been exchanged. Process agreement is a fundamentally different type of interoperability goal from data exchange and meaning exchange, because its focus shifts from the information exchanged to the actions taken by the participants once the information exchange has occurred. Here, all participants must agree in advance about what to do with the data they receive in the exchange. Process agreements are often complex and represent many of the problems that e-government efforts attempt to address. Lack of process agreement often manifests as a need for the consumer to provide the same information to multiple government services in response to a single event. The interoperability levels explain how interoperability goals can be built on each other to achieve various goals. Technical interoperability maps to the goal of data exchange. Here, technical interoperability is placed at the base level because the exchange of data is at the root of all communication. In some of the more technically based interoperability models, this level is divided into sublevels that map to specific modes of communication and separate the data from the communication channel. The approach taken in existing government interoperability models is to abstract the details of the communication.