

Generalizing Meta-Data Elements: Global Scenario and Indian Perspective

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Abstract

Meta-data plays important role in the discovery and management of government resources. Meta-data is the key to interoperability. This paper aims to highlight the use of meta-data in e-Government and presents preliminary comparison of meta-data of different countries willing to share data interoperably and guide the new entrants into the same directions. This paper identifies elements and presents them in the Indian scenario as an example since the Indian government has planned for e-Government applications in NeGP. However no concrete initiative has been outlined in the NeGP about meta-data or GIF (Government Interoperability Framework). There is a need for meta-data standard for e-Government application in the Indian context.

Keywords: e-Government, Dublin Core, meta-data, xml Schema, Interoperability

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Introduction

US National Performance Review first coined the term ‘e-Government’ in 1993, (Alasem, 2009) and by early 2000s the term ‘e-Government’ became popular across the world including many developed countries for describing the reinvention and improvement of processes within government and interface with citizens through Information and communication technology (ICT) in general and the Internet in particular. The United Nations defines e-Government as “utilizing the Internet and the world-wide-web for delivering government information and services to citizens” (UN, 2001). To achieve excellence in governance and ensure sustainable growth in e-Government, various governments are in the process of creating their GIF (Government Interoperability Framework) and meta-data repositories for better integration and sharing of information. Many countries (Brazil, Canada, Denmark, Estonia, European Union, Germany, Hong Kong, Malaysia, Mauritius, New Zealand, Saudi Arabia, Sri Lanka, Thailand, United Kingdom, and the United States) have already developed standards for GIF (UNDP-APDIP, 2007). Other countries like Portugal are on the way to create their GIF (Microsoft, 2007).

Countries like India and the Philippines have also submitted their draft of a GIF based on the open standard for e-Governance. This is in order to accelerate the development of e-Government solutions so that seamless interoperability of various solutions developed by multiple government agencies - which are inherently distributed - can be achieved for long term accessibility to public documents and information (Government of India, 2008). Since e-Government is being adopted and there is lack of general meta-data elements which can be used as a rule of thumb and act as guidelines for implementation. As the e-Government implementation scales up in distributed environment over a period of time there is a strong need for a resource discovery mechanism and data interoperability across digitised data resources or electronic resources (i.e. Web-services, documents etc.) of various government departments felt. Well planned meta-data services in e-Government will be required to provide this facility. In e-Government applications it may be used, amongst other for the discovery and retrieval of government information.

Significance of Meta-data

Governments, being the largest producer and consumer of information, need to verify, validate and maintain a large number of documents and data which eventually become information. This information is geographically dispersed among many organizations across the state or country and needs to be shared and integrated during policy decisions and other day-to-day work. Organizational entities that manage data are autonomous in adopting the architecture, design and communication technology etc. which give them leverage to adopt any architecture/design suitable for holding the data across the organization. Government organizations are not only independent in adopting the architecture but also provide communication autonomy when the organization is willing to share data with different architectures, vendors or solutions. All information in organizations is expected to be shared over time with some other organization or with the citizens. Thus there is a need to have some framework in hand to organize the information resources.

Resource discovery is important in the government scenario where an enormous information flow is observed. Meta-data description of these resources not only helps in identification and discovery of resources but also gives information a semantic meaning. Meta-data is used to structure the information which makes its easier discovery and management (American Library Association, 1999). Various countries (UNDP-APDIP, 2007) have already developed the GIF

(Government Interoperability Framework) where meta-data is a part of this framework which caters to the need of interoperable information sharing.

To achieve excellence in governance and ensure sustainable growth in e-Government, initiatives have been taken by the Indian government to come up with a draft policy on open standards for e-Governance to accelerate the development of e-Government solutions. This is so that seamless interoperability of various solutions developed by multiple government agencies - which are inherently distributed - can be achieved for long term accessibility to public documents and information (Government of India, 2008). Existing draft policy is without any explicit interoperability standard as yet. Since e-Government is being adopted in India and e-Government applications are being developed across the country, as the e-Government implementation scales up in distributed environment over a period of time, there will arise a strong need for resource discovery mechanism and data interoperability across digitised data resources or electronic resources (i.e. Web-services, documents etc.) of various government departments. Well planned meta-data services in e-Government will be required to provide this facility.

In e-Government applications may be used, amongst others, for the discovery and retrieval of government information. Resource discovery mechanisms provide the sustainability of the application in long term. Meta-data is one element in the overall framework for the interoperability which itself is achieved in various ways and through various technologies at different level of solution. Identification of meta elements are useful in e-governance scenarios, like providing the consistent definition of terms, definition of objects, management of information resources, discovery of resources etc.. Meta-data also fills the semantic gaps. All information resources, for description, need the identification of a meta-data element, management of identified elements, search path for resource using a meta element. Identification of these meta elements boosts the e-Governance initiative.

Role of Meta-Data in e-Government

It is not possible to transfer information from one system to another or combine information from multiple systems without agreement on the format and meaning of data. Interoperation is easier when system designers reach consensus about the meta-data (National Research Council, 2002). Meta-data and interoperability among data sets and information systems is the problem that government frequently faces.

Meta-data is 'data about data' in its most basic form and used to describe digitized and non-digitized resources located in a distributed system in a network environment (Haynes, 2004). There are mainly three types of meta-data: (i) descriptive meta-data which describes the purpose of data resource and is frequently used for the resource discovery and identification; (ii) structural meta-data which describes how the compound resource/object is aggregated; and (iii) administrative meta-data which provides the information to help in managing the resource (NISO Press, 2004). Describing a resource with meta-data allows it to be understood by both humans and machines in way that promotes interoperability. Interoperability is considered the ability of multiple systems with different hardware and software platforms, data structures and interfaces to exchange data with minimal loss of content and functionality. Using defined meta-data schemas and crosswalks between schemas, the resources across the distributed environment can be accessed and searched seamlessly. Meta-data also acts as a tool for the management of information resource and it enables the management of the life cycle wherein the resources are created, modified and used. Furthermore, meta-data helps to determine the authenticity of data and hence, meta-data is the key to interoperability amongst applications (Haynes. 2004).

E-Government applications demand that data from divergent sources be built around different technologies from multiple vendors. This makes probability of errors and data duplication high. Many entities play roles and similarity is found among stored entities in different organizations because of the similar nature of the work that has been carried out in different contexts. The inherent distributed nature of data presents discrepancies in entities such as name conflicts - either the similar name is used for different entities or different names are used for the entities which are semantically similar. By using standardized meta-data and thus ensuring interoperability across different entities the sustainable e-government solutions can be developed providing reusability, extensibility and solution independence. In the terms of government information and services discovery “meta-data can facilitate the discovery of e-Government resources by identifying resources, bringing similar resources together, distinguishing similar resources, and giving location information”(Tambouris et al, 2007) and also by enabling users to search and locate electronic information without explicit details of government structure.

It is a common fact that governments are the biggest producers as well as users of information and manual interaction and sharing of data across departments is both difficult and costly. This has prompted governments to move towards e-Government. However the isolated development of e-Government applications without any standards at the meta-data level leads to inconsistent solutions, which will not integrate seamlessly when the need arises as the society moves towards an internet information society. By standardizing the way the information is exchanged the ease of access can be improved, costs reduced and public services become effective. In case of emergent situations and natural disasters the government needs to put together all the information in a time critical manner. Interoperability standards with meta-data service helps in unifying information from various sources (Australian Government Information Management Office, 2006).

The e-Government interoperability framework (e-GIF) defines the necessary policies and technical specifications governing information flow across government and the public sector. In e-GIF the focus is on the development of software independent interoperable applications that comply with existing government standards with a feature of extensibility and take care of the management and other data retrieval needs of the government for exchange of information among citizens, businesses, organisations and between the governments. Interoperability is categorised into three domains 1) technical; 2) informational; and 3) business process. At the government level, due to the multiple stakeholders and with multiple vendors having different standards for services, interoperability is a necessity to interchange the information from one area to another in a user-friendly manner. The ‘information interoperability’ domain will provide a common methodology, definition and structure of information, along with shared services for its retrieval.

Internationally, e-GIF has attracted considerable attention and is under consideration by the European Union Interchange of Data between Administrations program as basis for European standards. In the emerging e-Government applications, the business rules must be applied ‘on the fly’ as information from users interacts with agency databases to produce new services. Data sharing, exchange of information and resource discovery are more frequent in government services and these services need new standards for data exchange and sharing. Urgent need for interoperable applications for sustainability of services is in demand. New browser based solutions makes closer connections between an agency’s internal systems and the outside world, presenting new risks and demanding new tools and techniques for managing them. Democracy,

transparency, business, administration and economics are the areas where exchange of information and data sharing takes place. Access to the information is often for political purposes or citizens and businesses require the information for their decisions. Government administrations also need information for decision making and planning and for the use of scarce and distributed resources. Interoperability standards can assist nations in their efforts to make the best use of scarce resources and provide cost effective services to citizens (Pardo & Burke, 2008).

Present inherited organizational environments; often limit the capability of governments to share authority, to collaborate, and to jointly and strategically manage enterprise initiatives. To change this, administrators must understand the capability of governments to create the systems necessary to share information across boundaries. The transformation of government depends on these new capabilities: interoperability and information sharing across borders. Interoperability in tandem with meta-data service allows government managers to work at the same time, with the same information integrated from multiple sources. A post-tsunami lesson learned from a report released by the Government of Indonesia and the United Nations noted the many missed opportunities for coordinated response among national and international responders. The consequence of this was a myriad of coordination problems resulting in each responder providing what they could based on an internal setting of priorities rather than a shared understanding of needs (Pardo & Burke, 2008). Need for cross-departmental communication arises as more and more organizations become on-line and data verification among different departments contributes major data exchange across the departments, which also needs a resource discovery mechanism.

The need for an interoperability framework at many levels is imperative (Cabinet Office, 2004). It should provide government departments an underlying platform for decision making at the managerial level and the investment level. At the organizational level this framework may act as the resource/information sharing in common format using an XML like language for platform and solution interoperability. This enables the government to communicate faster than in a conventional system.

The framework is necessary at the development level where many vendors with multiple technologies, are working together. Interoperability software architecture development and implementation is complicated when the systems belong to different organizations. Joint interoperability, that is, interoperability between different services, is challenging. Sustained joint interoperability cuts across two dimensions: laterally between services and horizontally over time (Hamilton & Murtagh, 2008). Once two systems become interoperable, there is no guarantee that they will remain interoperable if they are upgraded asynchronously. To follow a common standard is imperative for government solutions for the long-term sustainability.

In technical terms the meta-data can be stored either with the object or it may be maintained separately. If it is stored with the object then it will prevent the problem of linking between data and meta-data and will ensure that the meta-data and object are updated together. If it is maintained separately, it will simplify the management of meta-data ensuring future scalability and sustainability of applications (NISO Press, 2004). Generally the data in enterprises is managed by a popular relational database management system (RDBMS) where the object and meta-data is rigidly fixed within the RDBMS automatically without giving much freedom to modify the same if the need arises. However in e-Government applications the scalability and reusability is of paramount importance because new applications need to be added keeping intact the existing

ones. Therefore there is need for maintaining meta-data separately and standards like Core Dublin (Table 1) are required.

Table 1. Simple Dublin Core Elements

S.No.	Element	Definition
1	Title	The name given to the resource
2	Contributor	An entity responsible for making contribution to the resources
3	Coverage	Jurisdiction under which the resource is relevant
4	Creator	Entity responsible for creating the resource
5	Date	Period i.e the time associated with the event in the life cycle of the resource
6	Description	An account of the resource
7	Format	The file format, physical medium, or dimension of the resource.
8	Identifier	An unambiguous reference to the resource within a given context.
9	Language	A language for the resource
10	Publisher	An entity responsible for making the resource available
11	Relation	A reference to the related resource
12	Rights	A legal constraints held in and over the resource
13	Source	A related resource from which the described resource is derived also shows its inheritance details.
14	Subject	Key phrases, keywords describe the coverage of the subject.
15	Type	Nature of the resource

Meta-Data Standard (Dublin Core)

The Dublin Core (DC) meta-data Initiative (DCMI) is the outcome of a joint workshop held in Dublin in 1995, by the On-line Computer Library Center (OCLC) and the National Center of Supercomputing Application (NCSA) of USA. DC is one of the most widely used meta-data standards recognized by the International Organization for Standardization (ISO 15836: 2003). The DC meta-data element set is a standard in the fields of library and computer science. It is intended to be used for cross-domain information resource description. It defines conventions for describing things online in ways that make them easy to find. DC is widely used to describe digital materials such as video, sound, image, text, and composite media like web pages. It is a simple and flexible meta-data standard, which can be used in almost all domains of networked electronic resources. “The applications of DC elements have been designed to cover not only the type of resources in traditional repositories of information, but also on the web. Each element is repeatable and can also have sub-types and sub-object relationships.” (Nair & Jeevan, 2004). Simple DC meta-data proposes a set of 15 elements, as shown in the Table 1.

Clearly defined policies and specifications for interoperability and information management are key to staying connected to the outside world and aligned to the global information revolution. The effective management and sharing of information across agency boundaries will result in information being used more efficiently and effectively. This will provide significant benefits including:

- 1) Reduction in data duplication and hence reduction in data entry effort.
- 2) Risk reduction through re-use of technical patterns and components.
- 3) Simplified system integration.
- 4) Reduced maintenance costs.

- 5) Reduced cost of data collection, management and processing.
- 6) Improvement in policy making and more integrated planning.
- 7) Increased information accuracy and timeliness.
- 8) added value for government through reusing existing information.

A cluster of organizations that use the same standards for information management and delivery, effectively deal with the dispersed information sharing and better reporting to deal with the situation and unified information delivery enhances the accountability of government to another level. DC international standard has been used by governments, such as those of the United Kingdom (UK), Australia, Ireland and Canada, as the basis for their own standard. Meta-data standards of other countries, such as those of New Zealand and the Netherlands, are based on national standards.

On reviewing the literature of e-Government meta-data development almost all the countries established a meta-data Working Group (MWG) with the key responsibility to identify the meta elements used across government agencies. The MWG should be formed with the public and private sector participation that can work together to support and develop standard for meta-data according the country's need. This first requires a decision as to what kind of national meta-data standard will be used throughout the government and their consistent definitions across the government agencies. Many good practices and guidelines are available for the development and implementation of meta-data standards (CabinetOffice, 2004). While developing the standards focus should be on the requirements of consumers and producers of government resources. As government agencies deal with different subject areas and have different policies and procedures, it can therefore be identified from these that what meta-data elements can meet their needs, within the context of a country's policies, laws and regulations as a whole.

Meta-data users (citizens, residents, businesses etc.) are very important in the process of developing meta-data, users' needs and skills should be kept in mind developing and implementing meta-data. This means that MWG identifies the government resources to be described by meta-data according to the requirements of both government resource providers and users. MWG will also have to study various government web sites to find whether they are following any standard or not. Major problems in the existing sites should be identified keeping the meta-data and interoperability context in mind. A tentative draft can be formulated which will include the key policy decision on the national meta-data standard that reflects the meta-data from the perspective of government and users. MWG has the three options to create meta-data standards 1) use commonly used standard like DC with little customization; 2) adopt appropriate national e-Government meta-data standard with customization; or 3) design and develop from scratch new elements for meta-data.

Overview of Existing Meta-Data Standards in Various Countries

Australia, Portugal, UK, New Zealand, the European Union and some other governments created standards for interoperability. The Australian Government Technical Framework addresses the technical domain and focuses on information and business process. The framework was developed by the Australian Interoperability Framework Working Group (IFWG). A group of technical people nominated by the chief information officers committee (CIOC) and Australian Government Information Management Office (AGIMO) supports the reviews. Independent advice and consultancy is provided by the Distributed System Technology (DSTC) (Steward, 2005). The whole framework is reviewed annually with the mission of interoperability of

exchange of data and services for improving business processes. Information Management and Strategic Committee (IMSC) categorize interoperability in three domains 1) Information; 2) technical; and 3) business process.

In this process various agencies agreed to collaborate within a federated model and framework based on open standards and also uses international standards wherever possible while keeping the security aspects in mind. The technical domain of this framework consists of interconnection, data exchange, discovery, presentation, meta-data for process, and data description and naming. To provide the security to the data during exchange various encryption/decryption standards are incorporated in the framework and work paralleled with previously mentioned elements. Various service description language and message transfer protocols are included in the interconnection layer. Apart from these LDAP standard, XML and other technologies and standards are included in the various layers of the framework.

Meta-data standard began in December 1997, with the AGLS version 1.0 meta-data standard published in 1998. Meta-data in the view of the Australian government is “structured information that is created specifically to describe another resource”. (AGIMO, 2004). It was designed to improve the usability, accessibility and interoperability of government information and services through the provision of standardized web-based resource description. The AGLS meta-data standard is also based on Dublin Core keeping the Australian context in mind and therefore customized according to the need and has four additional elements. Table 2 shows additional AGLS meta-data Element Set. Version 2.0(2006)

Table 2. Additional Elements in AGSL Meta-Data Element

Element	Definition
Availability	How the resource can be obtained or made available
Function	Refers to the business function of the organization to which the resource related
Audience	Audience for which the resource is made
Mandate	A specific warrant which requires the resource to be created or provided

The Portuguese government also took steps towards developing a framework for interoperability and meta-data standards. The Portuguese government created an interoperability framework to simplify citizen/government interaction (Microsoft, 2007). The Portuguese government's agency for modernization of public administration (AMA) worked with the leading leaders of software to develop interoperability framework for data interchange and data sharing. In 2005, the Innovation and Knowledge Society Unit e-government group, which is now part of AMA, put out a public tender for an interoperability solution. The project objectives were to design and implement an interoperability framework that addressed application integration, citizen authentication, and citizen privacy. The agency put no stipulations on the technology other than that the solution be deployed on both the Java and Microsoft®.NET platforms and use Web services as the medium for information exchange. The interoperable solution was developed by the united efforts of Microsoft, Siemens IT solutions and services, and Accenture. Focus was on the service integration, simplified identification, privacy and security, immutability of existing information system. The first use of the Common Services Framework was the Citizen’s Card, a universal citizenship identification card that was introduced in early 2007 and will be distributed to all Portuguese citizens.

UK's interoperability framework encompasses the e-GIF registry, which covers the e-Government meta-data Standard (e-GMS), Government Category List (GCL), the Government Data Standards Catalogue (GDSC), XML schemas, the Technical Standards Catalogue (TSC) (previously e-GIF Part 2: Technical policies and specifications) and the e-Services Development Framework (e-SDF). The e-GIF defines the minimum set of technical policies and specifications governing information flows across government and the public sector (Cabinet Office, 2004). These cover interconnectivity, data integration, content management, meta-data and e-services access. E-GIF as most of Interoperability standard, adopted XML as primary means of data integration. All connectivity and access of the services is browser based. Most of the elements adopted from the DC model (ISO 15836). Table 3 shows additional UK eGMS meta-data Element Set (eGMS) version 3.1 (2006).

Table 3. Additional elements in UK Meta Element Set

Element	Definition
Accessibility	Indicates the resource's availability and usability to specific groups.
Addressee	The person (or persons) to whom the resource is addressed.
Aggregation	The level or position in a hierarchy of the resource.
Audience	The category of user for whom the resource is intended.
Digital signature	To be decided.
Disposal	The retention and disposal instructions for the resource.
Location	The physical location of the resource.
Mandate	Legislative or other mandate under which the resource was produced.
Preservation	Information to support the long-term preservation of the resource.
Status	The position or state of the resource.

The New Zealand (NZ) government developed Locator Services (NZGLS) for discovery of resources and meta-data standard was recommended in 1998 by the NZ Discovery Level meta-data Standard Working Group (NZMSWG). The working group was established to suggest a common policy, standard and rules to be used across government agencies to improve the discovery of NZ government information and services. After consultation and testing, the NZMSWG recommended that the Australian Government Locator Service (AGLS) be used in the NZ e-Government initiative with some changes, such as element obligation, refinement and encoding schemes (Booth, K, 2002). Like the AGLS, the NZGLS has four additional elements: function, availability, audience and mandate. The NZGLS was issued in 2001. By May 2002, NZ agencies were required to create a core set of meta-data describing their information and services. (Booth, K, 2002). Table 4 shows additional NZGLS meta-data Element Set. Version 2.1 (2004).

Table 4. Additional Elements in NZGLS Meta-Data Element Set

Element	Definition
Function	The business function of the organization to which the resource relates
Availability	How the resource can be obtained or contact information for obtaining the resource
Audience	A class of entity for whom the resource is intended or is useful.
Mandate	A specific warrant which requires the resource to be created or provided.

The Hong Kong Government took steps to facilitate interoperability (HKSARG Interoperability framework, 2002). Almost all the countries among those that are focusing on the better exchange of information in interoperable way are adopting XML as data exchange language. So interoperability means a development of XML schema to facilitate sharing information within the

government. Government expects all vendors to use this framework for developing government-to-government and government-to-citizen solutions. Whole interoperability framework is reviewed after every six or twelve months. Hong Kong Interoperability standard did not create new technical standards but adopted de-facto standards after studying best practices adopted internationally. This Interoperability framework also describes the entire architecture that consists of GNA (Government network Architecture), DN (Departmental Network), CS (Central Services), GNET (Government Network).

Services are provided to users when the client of outside network is logged into the GNET. This framework specification also describes the area on which this framework can be applied. Areas covered under interoperability are: intra-government remote service description language, intra-government remote service delivery protocol, publication of intra-government remote services, speech, web page design, client side scripting, content publishing, mobile device content, document file types, presentation file types, spreadsheet file type, graphics, encoding schemes, system modelling, default document/ message formatting language and many other areas (HKSARG Interoperability framework, 2002). These areas covered almost every type of domain from networking to message transfer, from content to modelling. Various components of Government Network Architecture (GNA) ensure overall connectivity and service delivery to clients. This framework provides comprehensive XML schema design methodology to facilitate e-Government data standardization. A library of reusable common schemas has been developed and shared in a data standards registry for developing project schema for new government services.

Apart from this the Ireland Government meta-data Standard (IGMS) was also developed in 1999 by Web Publication Group (WPG) using the same superset of DC elements with two additional elements 1) service descriptor and 2) life event descriptor (WPG, 1999). A meta-data working group (MWG) was set up to decide meta-data that would suit the e-government of Ireland, the MWG proposed a meta-data standard in 2002. In a similar way the Government of Canada meta-data framework established a strategy for the development of meta-data within federal departments or agencies. The Government On-line meta-data Working Group was established to adopt a common meta-data standard to be used on the federal web. The group agreed on common look and feel meta-data standard (CLF), which is based on simple DC with two additional elements: audience for record management purposes, and keyword for resource discovery. This appeared in 2002 (GOMWG, 2005).

Meta-Data Development in the Indian Scenario and Proposed Meta-Data Elements

The Indian government approved the National e-Governance Plan (NeGP) for implementing various e-Government applications/projects, on May 18, 2006 with the vision of making service accessibility and to ensure reliability, transparency and efficiency with affordable cost. The Indian States have been given flexibility to identify the state specific projects which are relevant to the economic development of the state (www.mit.gov.in). E-Government is promoted as an initiative of the central government. Interoperability is also mentioned in it but an interoperability framework as well as a meta-data framework in the existing NeGP is missing in the general context. To ensure the sustainable growth and scalability of existing solutions, interoperability framework as well as identification of meta-data elements is the necessary requirement.

For the implementation of NeGP, Department of Information Technology (DIT) has been given the responsibility to create Infrastructure (National/State Wide Area Networks, National/State Data Centers, and Common Services Centers & Electronic Service Delivery Gateways) and make

suitable arrangements for monitoring and coordinating the implementation of NeGP under the direction of the competent authorities in this regard. Various committees like economic affairs (CCEA), National e-Governance advisory group, Apex Committee (NeGP) and Expenditure Finance Committee (EFC) have been formed for different purposes (Chauhan, 2009). However, NeGP is almost silent on meta-data and interoperability, though some work has been performed in the context of personal identification and land region codification (Government of India, 2009). This is just a mention of the work in the direction of meta-data identification which is focused on the particular area rather than being general in nature. Table 5 & 6 shows the description of the scheme of reference numbers developed (Government of India, 2009) for the easy and unambiguous references.

Table 5. Unique Reference Scheme

XX	XX	XX	XX
Domain	Data Element	Instances	Parts

Table 6. Unique Reference Scheme

XX	Domain	Domain, a number, which may be generic or specific to some area, here area, is person identification. Further customisation and generalisation of this attribute may be possible to include other domain also that is related to different area of governance.
XX	Data Element	A number, represents the name of data element which is identified as meta-data element
XX	Instances	A number, Represents the different instances of the same element e.g. for vehicle element, car, bus, two-wheeler are the different instances of the element vehicle.
XX	Parts	A number, Represents the parts of data elements e.g. in name, first name, middle name and last name are the parts of data elements. In date, day, month and year are the parts of data element.

Schema Development for General Meta-data Elements

XML has become the language of choice for data sharing and data interchange in interoperability. This is because of the inherent distributed nature of e-Government applications where scalability, reusability and interoperability are much desired. For that XML is best suited because it is platform independent, web-based and can manipulate data while keeping the coding separately; thus, keeping the scope for future extensibility and scalability. Also XML Schema supports many primitive data types that are found in programming languages as well as user-defined complex types which makes it powerful as compared with other contemporary technologies like DTD. XML Schema is a suitable way to define meta-data elements.

Table 7. Generalized Meta-data Elements

Generalized Meta-data	Description
Resource Name	Full name of the resource.
Creator	Refers to the name of individual or group or organization who creates the resource and to whom this resource originally belongs.
Contributor	Entity responsible for making the contribution to the content of resource. It should not be confused with creator. Contributors do not have the primary or overall responsibility of the contents.
Date of resource Creation	This refers to the date on which resource is created.
Description	Helps the users decide if the resource fits their contents.
Date of Last Updation	Refers to the Date on which resource's definition is last modified
Purpose	Refers to the role of resource is the application for which resource is originally designed and created.
Location	Physical location of the resource.
Accessibility	Refers to the list of groups who are authorised to use this resource. It enables those unable to use all information resources to limit the search to items meeting their requirements.
Audience	The category of user for whom the resource is intended.
Rights and use conditions for resource	Refers to how the resource can be used with the legal constraints.
Resource's scope and usability	Refers to the limits of resource.
Constrained with the resource	Refers to the constraints imposed on resource.
Version number of the resource	Version number is needed for the resource that is frequently updated. Since new releases may add some features related to current scenario.
Format	Refers to the file format, physical medium, or dimension of the resource.
Identifier	Refers to the reference number allocated for the resource for its easy retrieval.
Relation	Refers to the other related resource from which this resource belongs.

Conclusion

The role of meta-data is of paramount importance in e-Government applications. A few countries, mainly developed, are serious about meta-data framework. Dublin Core meta-data standard is most widely adopted by various governments after customization to the country specific needs. The Indian government has charted out a plan for e-Government applications (i.e. NEGP), but the concerns about meta-data are missing. This lacuna in the NeGP may lead to inconsistency in data resources when e-Government applications need to be integrated in future. To develop better

scalable and extensible solution in e-Government domain meta-data standards must be established first to facilitate interoperability in applications.

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