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Information technology for learning, education and training — Language accessibility and human interface equivalencies (HIEs) in e-learning applications —

Part 1: Framework and reference model for semantic interoperability

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Technologies de l'information pour l'apprentissage, l'éducation et la formation — Accessibilité au langage et équivalences d'interface humaines (HIEs) dans les application d'apprentissage électronique —

Partie 1: Cadre et modèle de référence pour l'interopérabilité sémantique

Reference number
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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 20016-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 36, *Information technology for learning, education and training*.

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ISO/IEC 20016 consists of the following parts, under the general title *Information technology for learning, education and training — Language accessibility and human interface equivalencies (HIEs) in e-learning applications*:

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— *Part 1: Framework and reference model for semantic interoperability*

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Introduction

0 Introduction

0.1 Purpose and overview

In an “Access for All” (AfA) approach, a key missing component in the development of ITLET standards, in support of culture, language, and individual needs is one which focuses on the (intended) meaning and use of the contents of the recorded information being interchanged among, on the one hand, (1) an individual as a learner, and, on the other, (2) other Persons in an ITLET context. This requires the assurance of the development and availability of contents, (e.g. as Human Interface Equivalents (HIEs), in any ITLET application which support individual accessibility requirements in the form of language accessibility.

The primary purpose of this multipart standard is to ensure that “individual accessibility” rights are supported from a “content” and semantic interoperability requirements perspective, both:

1) within the IT system(s) of an organization, and/or public administration; and,

2) Open-edi interchanges of the IT system(s) of that organization and/or public administrations with any individual.

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It is also recognized that there already exist international standards (ISO, ISO/IEC and/or ITU) which need to be integrated and/or taken into account in the development of this Part of ISO/IEC 20016 “*Framework and Reference Model*”.

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Further, it is recognized that localization requirements of a cultural adaptability and multilingual requirements nature need to be capable of being supported in this multipart standard.

In addition, this standard is based on the principle of maximizing use of applicable / relevant international standards.

The *UN Convention of the Rights of Persons with Disabilities* (2006) provides a unifying basis for legal and regulatory requirements of jurisdictional domains as external constraints pertaining to language accessibility and the provision of human interface equivalents in support of semantic interoperability.

A primary purpose of ISO/IEC 20016-1 Framework and Reference Model is to make organizations and public administrations aware, that where they are content providers to develop content, (e.g., as sets of recorded information (SRIs)) for use by individuals that such SRIs meet applicable language accessibility requirements from an individual accessibility requirements needs perspective, i.e., as applicable in that jurisdictional domain doing so through the parallel development of required human interface equivalents for these SRIs.

As such, the development of any SRI requires the assurance of the development and availability of its contents in any learning, education and training (LET) application in a manner that supports individual accessibility requirements. This requires the development and preparation in a non-temporal manner of all the HIEs (from both content and presentation perspectives) as are required in the accordance with the requirements of individual accessibility the applicable jurisdictional domain (at whatever level) for use in a LET context.

The language(s) used in a learning, education and training (LET) context is determined by four key factors; namely:

1) the language of the learner (apart from the learner wanting to learn another language);
2) language of instruction (LOI);

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3) the needs of the learner with disabilities and anyone in a disabling context (this includes providing the semantics of the contents in the form of a Human Interface Equivalents (HIEs) and doing so in a systematic and IT-facilitated manner)[1];
4) the fact that the language of instruction (LOI), and thus the development of LET related products and services is often governed by: (a) general rules governing the use of an official language (or de facto language) of the jurisdictional domain in which the LET activity takes place; (b) a particular law or regulation of a jurisdictional domain which pertains to the use of a language for LET purposes, i.e., as a "legally recognized language (LRL)".

Jurisdictional domains have also instituted policies or legislation that require the ability to provide access to education in one or more languages and to do so increasingly in support of cultural diversity within a single country as a jurisdictional domain. Examples include: (1) Gaelic and Welsh in addition to English in the UK; (2) aboriginal and native languages in addition to English and/or French in Canada; and (3) multiple official languages in the states of South Africa, India, Nigeria and many other countries. In addition, the EU as a jurisdictional domain has multilingual Human Interface Equivalency requirements within itself as a single (supra) jurisdictional domain.

This multipart standard recognizes that jurisdictional domains have also instituted policies, legislation, regulations, etc., that require LET provides to (1) have the ability from both ICT and content semantic perspectives to provide learning, education, and/or training in one or more languages; and, (2) to do so in support of not only its cultural diversity but more importantly in support of any "LET language (LET-L). This work integrates regulatory requirements from both "accessibility" and "language" requirements of jurisdictional domains.

In addition to the three strategic directions of ISO/IEC JTC1 standards development work, i.e. (1) portability, (2) interoperability, and, (3) cultural adaptability, this standard also adds individual accessibility[2] requirements (as stated in the "*UN Convention on the Rights of Persons with Disabilities*). {See further below Annex B} As such, linguistic adaptability and use of language are of importance.

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The ISO/IEC 20016 multipart standard, and in particular ISO/IEC 20016-1 *Framework and Reference Model for Semantic Interoperability*, has been developed and structured in a manner to be able to support and facilitate legal and regulatory requirements governing the application and use of ITLET standards and solutions.

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0.2 Benefits to implementers of this multipart ISO/IEC 20016 standard

There are several benefits from taking an integrated approach: First, this standard provides for a systematic, cost-efficient and effective approach to the creation of robust, (re-)useable and accessible contents components for individual users, i.e., human interface equivalents (HIEs) at any level of granularity from that of simple (atomic) data element to that of a "book" or a law or regulation, the contents of a whole Website, etc. Without this standards development work, it will be very difficult to achieve workable solutions to providing language accessibility alternatives to individuals in their use of information technologies (IT) in support of learning, education, and training (LET) as provided by organizations and public administrations.

---

1 There already exist both different forms of written representations of a language as well as in the form of symbols, glyphs, oral, pictorial, etc. We also have other forms of recorded information of a language including audio, visual, transforms, (e.g., Braille, etc.).

2 While "individual accessibility" here is a right of individuals in support of any individual being informed, provided recorded information at a level of unambiguity to be able to support "decision-taking" and/or commitment-making", the more generic requirement here in support of the same among individuals, organizations and/or public administrations is that of "semantic interoperability".

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Second, this multipart standard will provide cost savings to those organizations and public administrations, individual users and LET providers of LET-based products and services, ("LET providers"). In addition, it will provide the benefits of semantic interoperability, re-usability and accessibility (access) for all (AfA). It will do so from a multilingual requirements[3] perspective and in support of cultural adaptability and diversity.

Third, having a common IT-facilitated approach will: (1) benefit individual users world-wide (doing so in respect and support of cultural diversity); (b) ensure that requirements of jurisdictional domains (at whatever level) can be supported in a very cost-effective and efficient manner; and, (2) also benefit LET providers of LET focused products.

Fourth, essential to interoperability are elements for making e-learning accessible to all. Without this work, solutions to providing language accessibility alternatives in the use of information technologies in support of learning, education, training (LET): (1) will not be integrated across IT platforms and organizations; (2) will be unnecessarily re-invented in every organization and public administration involving added large costs; (3) will exacerbate current lack of interoperability; (4) lead to waste of potential accessibility gains for individuals unable to identify and access e-learning systems and content in their language of use; and, (5) increase loss of usability and re-usability gains and benefits for everyone.

The present (and potential) world of use of IT systems in support of LET is gradually establishing networks and cooperative approaches which include multiple jurisdictional domains, implement accessibility alternatives, etc. Here and elsewhere, there is a requirement for metadata to support the ability to specify language accessibility and human interface equivalency in the provision of content and services. As such, this ISO/IEC 20016 multipart standard serves to further enable this developmental process.

The concept of semantic collaboration space (SCS), introduced in Clause 7 below, with respect to language accessibility and human interface equivalents (HIE) aspects of semantic interoperability requirements is directed at supporting the implementation of the *UN Convention on the Rights of Persons with Disabilities* in an ITLET context.

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However, this multipart ISO/IEC 20016 standard, while developed in an ITLET context, like the multipart ISO/IEC 24751 standard, has many aspects which are not ITLET specific. The ISO/IEC 24751 multipart standard is being used by many Persons, (organizations and public administrations), for implementation in domains which are not ITLET specific. This ISO/IEC 20016-1 *Framework and Reference Model for Semantic Interoperability* standard supports a similar "Access for All" (AfA) approach.

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0.3 Primary sources of requirements

The evolution of information communication technologies has created the ability to be able to support any and all language accessibility and provide human interface equivalents (HIEs) representations for any set of recorded information (SRI) in support of:

1) individual accessibility requirements; and,

2) to do so at whatever level of unambiguity and granularity required.

There are therefore no information or communication technology (ICT) barriers to the ability to support individual accessibility requirements for sets of recorded information (SRIs) within the IT systems of organizations and public administrations.

[3] Multilingual communications (whatever the supporting IT platform used including the Internet) is already supported by existing technologies. Many ISO/IEC and ISO standards already exist (or are under development) whose contents can and will be used as building blocks for the integration of this new LET standard.

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The primary source of requirements governing the development of this multipart standard and in particular underline this Part of ISO/IEC 20016 is the "*UN Convention on the rights of persons*[4] *with disabilities*".[5]

This UN Convention represents a common (global) high level integration of applicable laws and regulations of UN member states as jurisdictional domains who are signatories to this UN Convention. It is understood that the actual implementation and use of this Part of ISO/IEC 20016 "*Framework and Reference Model*" and subsequent Parts 2+) in any jurisdictional domain will be conditioned by the applicable laws and regulations of that jurisdictional domain.

Figure 1 provides an integrated view of these requirements[6].

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[4] The majority of JTC1/SC36 P-members if not ISO/IEC JTC1 members are either already signatories of this UN Convention (or have already put in place national legislation of an equivalent nature). {See further ISO/IEC 24751-1:2007 *Annex C (informative) "Accessibility policies and legislation/Politiques et legislation en matières d'accessibilité.}*

[5] It is understood and this standard is based on the assumption that "person" here = an "individual" (and not an "organization" or "public administration", i.e., a legal or artificial person).

[6] The arrangement of the 'boxes' in illustrative Figure 1 is as follows:

a) the left-hand side represents different levels and categories of legal & regulatory requirements which this standard must be able to support;

b) the right hand-side represents the key aspects of the approach which SC36/WG7 has already decided to take in the development of this standard;

c) In addition, placing the UN Convention at the top recognizes and supports the key SC36/WG7 decision that this multipart standard shall be 'architected and structured'' to fully support the UN Convention and its requirements as applicable;

d) the use of the thick black line of "box" for "Laws & Regs of UN member States…" denotes the fact that while this UN Convention provides a global requirements perspective, there are laws and regulations of UN member states which give effect to individual accessibility right and enforce them; and,

d) the two boxes at the bottom reflect the fact that the Sources of requirements are summarized in the 11 Principles (Clause 6) and that Box at the bottom provide the link to this multipart standard.

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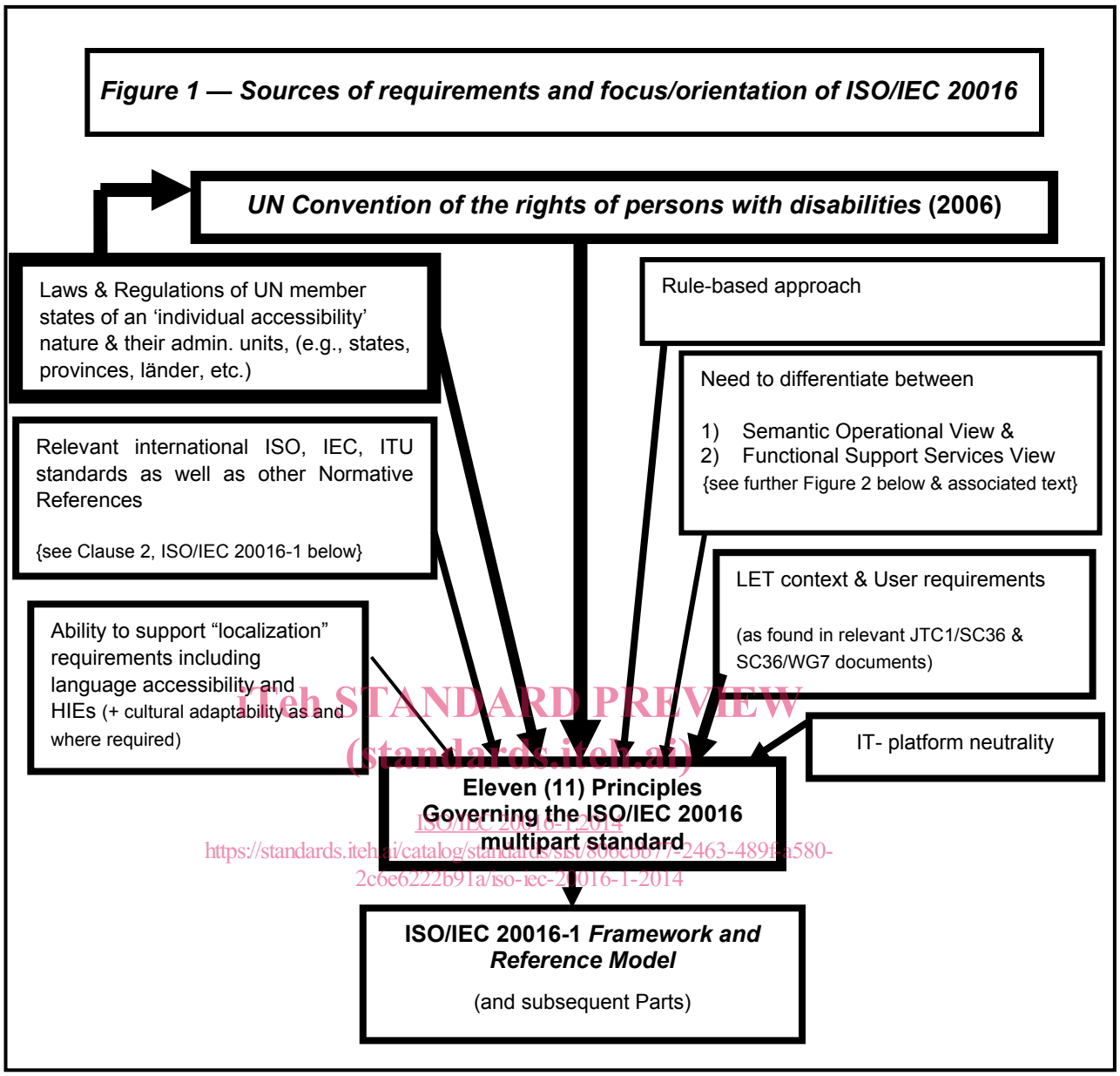

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Figure 1—Sources of requirements and focus/orientation of ISO/IEC 20016

The development of ISO/IEC 20016-1 integrates these sources of requirements and serves as the basis for the eleven (11) principles provided in Clause 6 below.

0.4 Key concept of "individual accessibility"

A key unifying concept of this *Framework and Reference Model* is that of "individual accessibility".

"Individual accessibility" is a right of an individual (which is modelled as an "external constraint". Closely related rights here of an individual include "consumer protection" and "privacy protection". Collectively, these rights of individuals are known as "public policy' requirements. {See further below Clause 8 "*Public policy requirements of jurisdictional domains*"}

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0.5 Holistic approach

This *Framework and Reference Model* for ISO/IEC 20016 takes a holistic approach (based on the fundamental principles and assumptions as stated in Clause 6 below). In addition, it is based on a key, if not primary, requirement of the "*UN Convention of persons with disabilities"*, which is that individuals be provided with unambiguous semantics of the recorded information at the level required for informed consent for the making of decisions, and/or in the making of commitments, i.e., an individual with disabilities has the same and equal rights as any other individual. In support of these universal rights of an individual, {See further (normative) Annex B below}, this multipart ISO/IEC 20016 standard in ISO/IEC 20016-1 "*Framework and Reference Model*" differentiates between those aspects which are:

1) content related, i.e., the provision of recorded information at a level of unambiguity required for the purpose and use of such recorded information from a language accessibility and Human Interface equivalent(s) (HIEs) perspective. One can label this as the "Semantic Operational View" (SOV). The SOV focuses on standards which address perspectives and requirements limited to those aspects regarding the provision of recorded information as unambiguous semantics to individuals so that they are fully informed, able to make decisions, able to make commitments; and,

2) non-content related, i.e., the provision of functional support services of an ICT nature capable of supporting any individual accessibility requirement in support of those of a language accessibility and HIE nature with respect to the provision and presentation of such existing contents, i.e. sets of recorded information, capable of being made available at the human interface level through as any combination of ICTS. One can label this as the "Functional Accessibility Services View" (FASV). Many of the standardization requirements of this nature are already being addressed via the multipart ISO/IEC 24751 standard.

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Here it is noted that the need to: (1) ensure unambiguity in the provision of recorded information in order for any Person to be able to participate in a commitment exchange of whatever nature, (commonly known as a "business transaction" or in an ITLET context as a "learning transaction"); and, (2) differentiate these requirements from those of the supporting ITC infrastructures and services, has been already recognized as a fundamental principle in the development of the "Open-edi" family of international standards. Here the common framework or reference model supported by the ISO, IEC, ITU, ISO/IEC JTC1, UN/EDIFACT (as well as other organizations such as OASIS) is that of the ISO/IEC 14662 "*Open-edi Reference Model*" - (a freely available ISO.IEC standard, first introduced in 1997 and one which has basically remained unchanged and now is in its 3rd 2010 edition. {See further below Annex M}

ISO/IEC 20016-1:2014
https://standards.iteh.ai/catalog/standards/sist/806e9b77-2461-4804-a580-2e6e6222b91a/iso-iec-20016-1-2014

The approach to need to differentiate between:

1) the content-related and associated operational view; and,

2) the non-content related functional support services view

is based on the ISO/IEC 14662 *Open-edi Reference Model* (a widely used and freely available ISO/IEC standard new in its 3rd edition. {See further Annex L below for a summary overview of the |*Open-edi Reference Model"*.

Adopting the Open-edi Reference Model in an ITLET context in support of individual accessibility requirements yields the following Figure 2.

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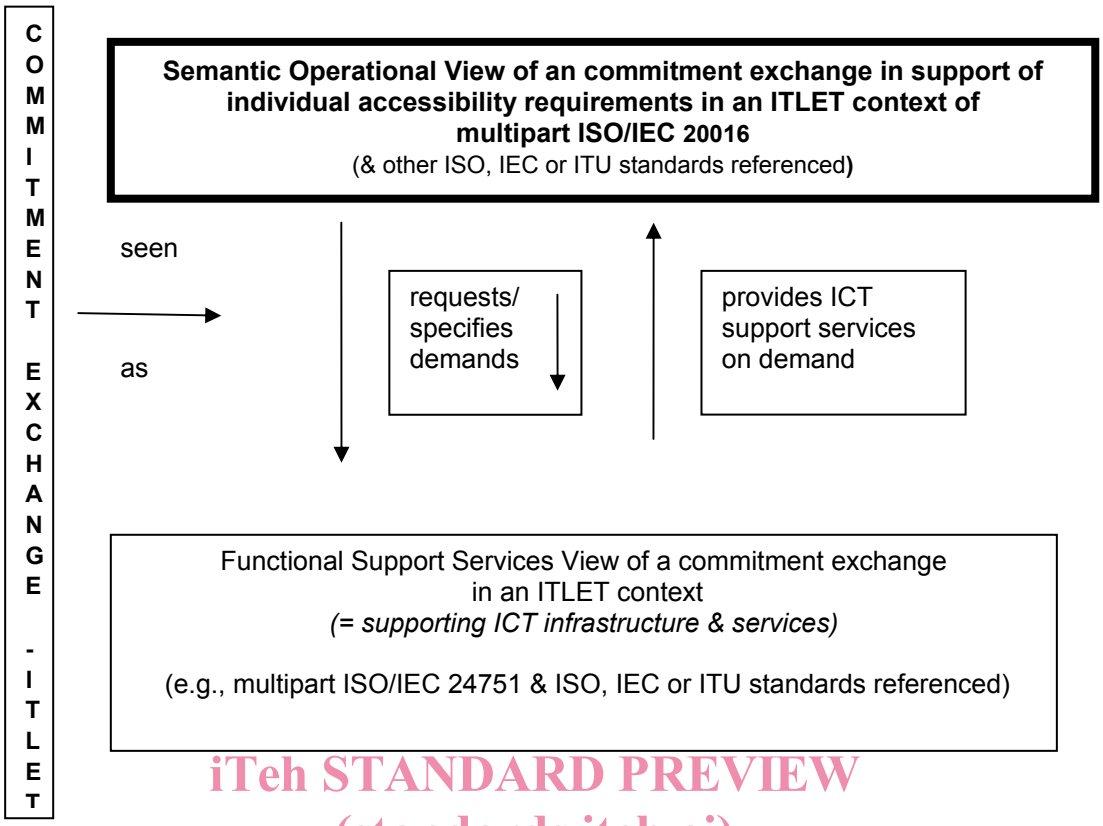

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Figure 2 — Commitment exchange involving an 'individual' in a (potential) commitment exchange with an organization or a public administration in an ITLET context

ISO/IEC 20016-1:2014
https://standards.iteh.ai/catalog/standards/sist/806cbb77-2463-489f-a580-2c6e6222b91a/iso-iec-20016-1-2014

The focus of the development of ISO/IEC 20016 is on the development of the "Semantic Operational View[7]" in an 'individual accessibility" requirements context, i.e., with "individual accessibility" as a set of external constraints.

Figure 3 provides an overview of key components for ISO/IEC 20016-1 "individual accessibility "*Framework and Reference Model*". The key components of this *Framework and Reference Model* include:

1) the sources of requirements (as summarized in Clause 0.3 above and associated Figure 1)

2) the individual accessibility model (IAM) {See further Annex D (normative) and Figure D-3}

3) Semantic interoperability levels (SIEL) {See further Clause 7 and Table 1}

4) semantic collaboration space (SCS) {See further Clause 9 and Figure 6}

5) Human interface equivalency model (HIEM) {See further Clause 12 and Figure 9}

6) degrees of linguistic equivalence {See Clause 11 and Table 4}

7 The multipart ISO/IEC 24751 standard focuses on the "("non-content") functional support services view as do other existing or under development ISO/IEC, ISO, IEC or ITU international standards.

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