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Information technology — Office equipment — Guidelines for the development of an ontology (vocabulary, components and relationships) for office equipment

Technologies de l'information — Équipement de bureau — Lignes directrices pour l'élaboration d'une ontologie (vocabulaire, composantes et relations) pour l'équipement de bureau

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Foreword

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 28, *Office equipment*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

The aim of this document is to provide an overview of the current status of 'office equipment', to identify likely future directions and to show how standardisation of terminology in the form of an ontology could provide a strong framework for office automation.

Historically 'office equipment' was more clearly defined than it is today. The concept of what constitutes 'the office' is changing and people no longer have to go to a particular place to perform tasks traditionally associated with the office. These tasks include activities such as creating or copying documents, reading reference books and preparing presentation materials can now be carried out in many different environments as shown in Figure 1.

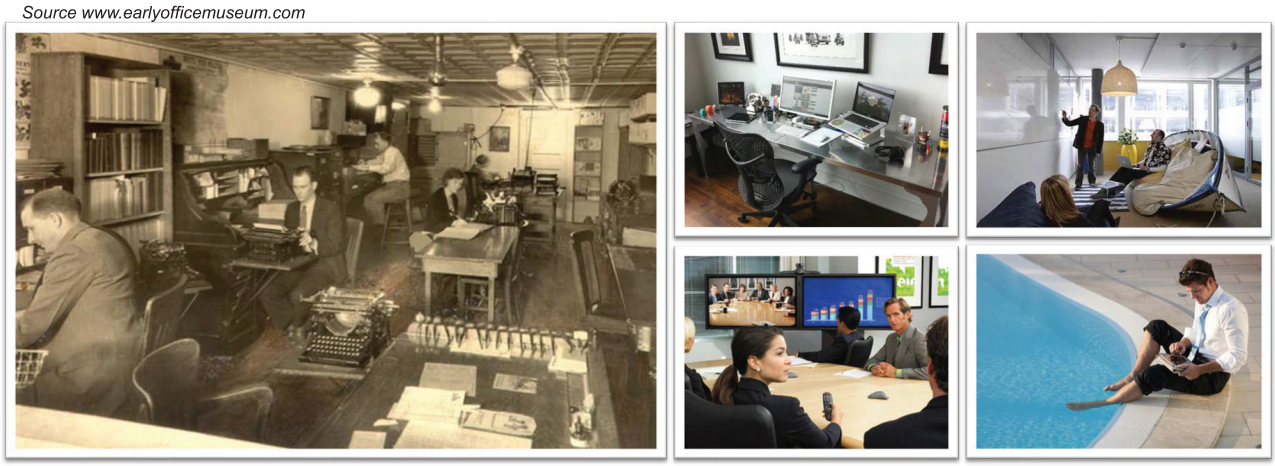


Figure 1 — Ideas of what constitutes an office are changing rapidly

The set of tools and equipment traditionally available to office users has also expanded and now includes on-line document creation and sharing, high quality colour displays, digital projection equipment, video communication and so on. Indeed there seems to be a new class of equipment, used to enable tasks traditionally associated with 'the office', introduced each year.

Consequently, there is no longer a clear boundary between office, personal, industrial and commercial documents as many of the same design tools and reproduction equipment are used across all of these sectors. For example, Microsoft Publisher, Adobe InDesign and Microsoft Word are used to create company brochures, personal documents and product handbooks.

With the advent of high-speed internet, there is no longer a need for 'office workers' to be in the same location and, in many cases, companies operate a virtual office with members working from many different locations. To support this, documents are made available in a central repository, for example using a document management system, and can be viewed, modified and printed at any location as long as the user has the required rights.

When considering requirements for future office standards it is important to consider these recent developments and also to think about what users will expect to be able to do in future. Given the fact that the same range of systems and supporting software are used for several different purposes, the scope of these standards should also be considered. One option would be to focus on the set of tools used to communicate business ideas, particularly the creation, display, printing, copying, distribution and archival of documents.

In a Scientific American article in May 2001[4], Tim Berners-Lee proposed a concept that he referred to as 'the Semantic Web'. He envisaged the development of the internet in such a way that information could be identified by structured metadata, for example its type, creator, intended use and so on. In this article the authors observe that three of the important technologies are already in place: eXtensible Markup Language (XML)[26], the Resource Description Framework (RDF)[5] and Uniform

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Resource Indicators (URIs)[27]. In its simplest form, XML allows the creation of tags such as <name> and <country> and associated values such as <John Smith> and <China> and these data names and values can be used to annotate web pages. While in some cases these can be understood by a person reading these pages, the meaning cannot generally be understood by a machine. The meaning, however, can be expressed using RDF which provides a mechanism to allow properties of particular things to be described in a way whereby they can be parsed unambiguously by machines. For example <name> <is a resident of> <country>, has a structure rather like the subject, verb and object of an elementary sentence. The subject and object can be defined precisely using URIs and with care URIs can also be used to define the relationship (the verb) between the subject and object. The authors observed that this model can be used to allow web data to be interpreted by machines. This is a very powerful concept and with only minor modifications is one of the basic principles for the Internet (or web) of Things (IoT).

The basic concept of the IoT is that all internet objects have a unique identifier such as an IP address, URL, URI, barcode or RFID tag. 'Things' include any kind of uniquely identifiable object including both physical and abstract objects such as a device, web page, communications link or an item with an RFID tag or barcode. Where suitable infrastructure and authentication exists, devices can communicate directly with other devices, for example a home security system can detect an intruder and pass this information to a mobile telephone to alert the home owner (device-to-device). Similarly, devices can obtain data from web pages, for example a mobile phone can find the weather forecast in Tokyo or a list of books published by Springer on colour management. Thinking about the needs for accurate colour reproduction, a digital printer can find a suitable ICC profile for its current configuration (paper, ink set, resolution etc.). This document uses identification of a suitable ICC profile as a practical example.

Ensuring that equipment used in the office of the future can communicate effectively with minimal user intervention is one of the goals of manufacturers of all such equipment. An important prerequisite to this kind of communication is the ability to be able to identify internet resources clearly using some form of standardised vocabulary or ontology[10].

One of the mechanisms proposed for the development of ontologies is RDF, the latest version of which was published by W3C on 25th February 2014[5]. Details of RDF and the way in which it is supported is complex and Annex A provides an overview of the principles. Further research is needed, particularly to investigate details of registration of standard predicates.

One benefit of RDF-enabled documents is that search engines can provide more useful search results as they can discover web resources of particular types and order these in a way that is useful to someone who wishes to browse the set.

In addition to the basic RDF syntax there is a need to standardise the types of things and the relationships between them. The W3C recommends the use of Web Ontology Language (OWL)[27] which provides the framework to define basic classes, properties, individuals, and data values which can be used in conjunction with RDF for a given domain. More recently (July 2017) W3C introduced the Shapes Constraints Language (SHACL) which provides constraints necessary for data validation. OWL is designed for classification tasks (inferencing in an 'open world'), while SHACL covers data validation (in a 'closed world') in a similar way to that of traditional schema languages.

Perhaps it is easiest to understand how an ontology can be defined by looking at an example. Here, the ontology of BBC programmes[17] has been selected and a very high-level overview of this is shown in Figure 2.

The first observation is that this ontology is built on a number of others:

— The Music Ontology[18] provides main concepts and properties for describing music (i.e. artists, albums and tracks) in terms of, for example a 'Composition','MusicArtist', 'AudioFile' and so on. This ontology was developed independently and is widely used by other ontologies.

— FOAF (an acronym of Friend Of A Friend)[19] is a machine-readable ontology describing people, their activities and their relations to other people and objects.

— SKOS (Simple Knowledge Organisation System) is used to define some of the more abstract concepts such as topics of a program.

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— Event ontology describes where and when the event was held and who the participants were.

These ontologies in turn build on other ontologies. The BBC ontology is part of a large web of connected ontologies which can be explored from the Linked Open Vocabularies website[15]. The BBC Programmes ontology defines specific classes such as 'Broadcast', 'FM', 'Format', 'Genre' and so on.

Image from http://www.bbc.co.uk/blogs/radiolabs/2008/03/whats_that_star_on_the_wall.shtml

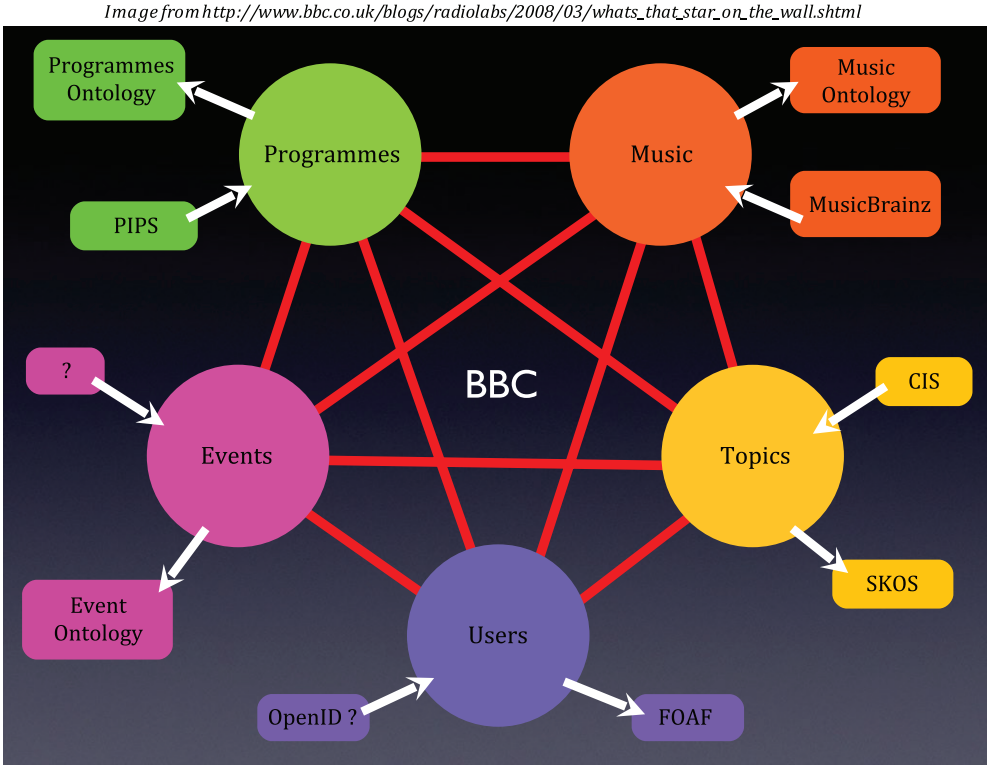


Figure 2 — An example of an ontology

In a similar way, it would be possible to build an ontology for office equipment, office documents, internet resources and so on. In order to provide a concrete example, the task of automatically identifying ICC profiles has been selected. This example addresses only one aspect of office devices (that of achieving colour fidelity) but is sufficiently complex to show how standardised metadata can be used in practice.

For all of these solutions to be useful, some kind of domain-specific ontology is needed. An example of the identification of ICC profiles is used in this document but this should be seen as part of a broader ontology, for example an imaging and print ontology or an office actors, tools and resources ontology. There are aspects of ICC profile metadata that are common to other areas, for example identification of colour imaging devices, print substrates, printing inks and other more abstract metadata such as identification of the copyright holder, creator and owner. This is an important consideration and where such metadata is already well defined, this should be incorporated by reference and not redefined by any new ontology. There are a number of groups closely related to that of office equipment and any work done should be coordinated with these other groups.

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Information technology — Office equipment — Guidelines for the development of an ontology (vocabulary, components and relationships) for office equipment

1 Scope

This document provides background information and guidelines for the development of an ontology for office equipment.

An example of how such a standard can be used to automate the identification of resources for colour is provided.

NOTE Often the terms vocabulary and ontology are used with the same meaning.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
office actor
person or machine conducting a specific role related to an office function

3.2
ontology
specification of concrete or abstract things, and the relationships among them, in a prescribed domain of knowledge

[SOURCE: ISO/IEC TR 19763-9:2015,3.1.3 modified — Note 1 to entry has been deleted.]

4 Key concepts and current activities

4.1 General

There are several important concepts that are emerging and seem likely to become important for future business technologies. Together these enable direct peer-to-peer communication and form the basis of emerging concepts such as smart cities, smart homes, smart cars, smart office and many others. These future models assume that many devices will be used, and these devices will communicate with each other directly rather than requiring a central control as is currently required. Such a central control becomes impractical when the number of devices increases to the extent envisaged.

Key concepts include virtualisation of physical objects and processes, big data, artificial intelligence, peer-to-peer communication, digital rights management, identification and authentication. The main topic of this document is the role played by an ontology but some context for this may be helpful.

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