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Information technology — Framework for specifying a common access profile (CAP) of needs and capabilities of users, systems, and their environments

Technologies de l'information — Cadre de définition d'un profil d'accès commun (CAP) des besoins et capacités des utilisateurs, des systèmes et de leurs environnements

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Foreword

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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 24756 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 35, *User interfaces*.

Introduction

Users of various systems in various environments can experience temporary or permanent accessibility difficulties. Potential users of systems need to evaluate whether the systems will be accessible to them in the intended environments in which they will be used. Where accessibility can be insufficient, either due to environmental barriers or poor design, these users can wish to resort to assistive technologies (ATs) to provide the required level of accessibility. Currently, there is no common framework for describing accessibility needs or abilities. This requires each potential user to develop their own evaluation method, and then to investigate and evaluate various systems and ATs using this method. However, due to the lack of an existing method, there might also be a lack of suitable information on the abilities of different systems and ATs, leading to inefficiency, confusion, frustration and a general lack of satisfaction by the user.

A variety of difficulties can be encountered when trying to identify suitable ATs to improve accessibility. Accessibility issues being encountered by potential users can inhibit them from obtaining the required information to identify possible ATs that could help improve their accessibility. Lack of experience with ATs can also affect information technology support staff who attempt to assist these potential users.

The need for accessibility extends to all systems that a proposed user can access. The ability for information gathered regarding accessibility issues and solutions for individual users to be portable across systems and environments is essential. This International Standard introduces a model of accessibility as a basis for understanding access issues with the interactions between users and systems in various environments.

Accessibility is multi-dimensional; existing at multiple levels. The model shows that users and systems must share capabilities of communicating. This International Standard provides a framework to specify a profile of common access capabilities (the CAP) of interactive systems, users, and their environment that are necessary for accessibility to be possible.

The CAP is specified in a top-down manner that provides extensibility to be able to include capabilities at increasingly detailed levels.

Information technology — Framework for specifying a common access profile (CAP) of needs and capabilities of users, systems, and their environments

1 Scope

This International Standard defines a framework for specifying a common access profile (CAP) of needs and capabilities of users, computing systems, and their environments, including access that is supported by assistive technologies. It provides a basis for identifying and dealing with accessibility issues in a standardised manner across multiple platforms. It can be used to evaluate the accessibility of existing systems in particular environments for particular users.

2 Conformance

Specifications for systems and/or system components, including assistive technologies, conform to ISO/IEC 24756 if they conform to Clauses 6 and 7 of this International Standard.

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 639-3, *Codes for the representation of names of languages — Part 3: Alpha-3 code for comprehensive coverage of languages*

ISO 15924, *Information and documentation — Codes for the representation of names of scripts*

ISO 80000 (all parts), *Quantities and units*

4 Terms and definitions

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

4.1
accessibility
usability of a product, service, environment or facility by people with the widest range of capabilities

NOTE 1 The concept of accessibility addresses the full range of user capabilities and is not limited to users who are formally recognised as having a disability.

NOTE 2 The usability-orientated concept of accessibility aims to achieve levels of effectiveness, efficiency and satisfaction that are as high as possible considering the specified context of use, while paying particular attention to the full range of capabilities within the user population.

[ISO 9241-171:2008, definition 3.2]

4.2
usability
extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use

[ISO 9241-11:1998, definition 3.1]

4.3
assistive technology
AT
hardware or software that is added to or incorporated within a system that increases accessibility for an individual

EXAMPLE Braille displays, screen readers, screen magnification software and eye tracking devices are assistive technologies.

[ISO 9241-171:2008, definition 3.5]

4.4
context of use
users, tasks, equipment (hardware, software, and materials), and the physical and social environments in which a product is used

[ISO 9241-11:1998, definition 3.5]

4.5
handicap
anything that might interfere with the accessibility of interactions between users and systems

5 A model of accessibility

Accessibility involves usable interaction between a user and a system. This interaction takes place within a context of use that includes the system, the user, the user's tasks, and the environment. Figure 1 illustrates the environment in which this interaction takes place. Handicaps are anything that might interfere with the accessibility of interactions between users and systems. A handicap can have one or many sources among the system, user, interaction, and/or environment. This model is "blame-free," since resolving any handicap to the interaction is more important than attributing blame to the source of the handicap.

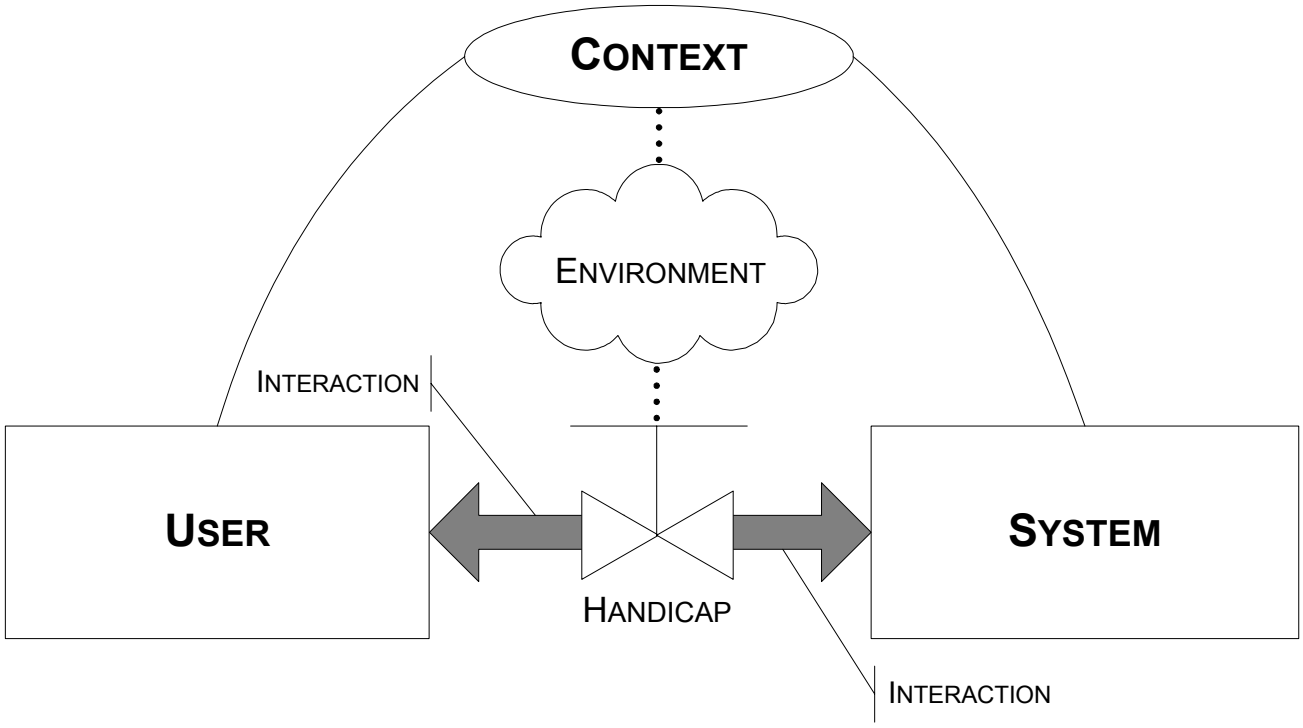

Figure 1 — A model of the User-System interaction

The figure uses a pipe metaphor to illustrate the flow of interactions between the user and the system and a valve metaphor to illustrate various levels of handicaps to the interaction(s). The shaded flow between user and system illustrates the possibility of multiple communications occurring in either direction. A fully open valve represents the absence of a handicap to the interaction. A fully closed valve represents an interaction being fully handicapped. Any other setting of the valve represents an interaction being partially handicapped.

While universal design features can reduce handicaps to interactions, it cannot eliminate all handicaps of the interactions in all situations. An assistive technology (AT) is a means of reducing such handicaps. While a consumer of an AT might not have a disability, there can be some component of the interaction that is "handicapping" them. For example, one could attend a lecture where the speaker uses a language unknown to the listener. Since most people know at least one language, the listener might eventually come to know the language the presentation is given in, but the interaction between speaker and listener is currently handicapped by one not knowing the language used by the other at the present time. The listener's task of following the details of the presentation would not be possible without the use of a translator to bridge the interaction between the listener and the speaker. In this sense, the translator would be an AT.

Computer related ATs can be realised through: alternative input devices (e.g., trackball, left-handed mouse, sip/puff systems), alternative output devices (e.g., voice, Braille display), accessible software (e.g., screen magnification software), and "universal design" (i.e., barrier-free design). Since the interaction is what is being handicapped, an accessible computing experience is realised by a reduction of this handicap.

ATs can be modelled as a means of opening the valve between systems and users, as shown in Figure 2.

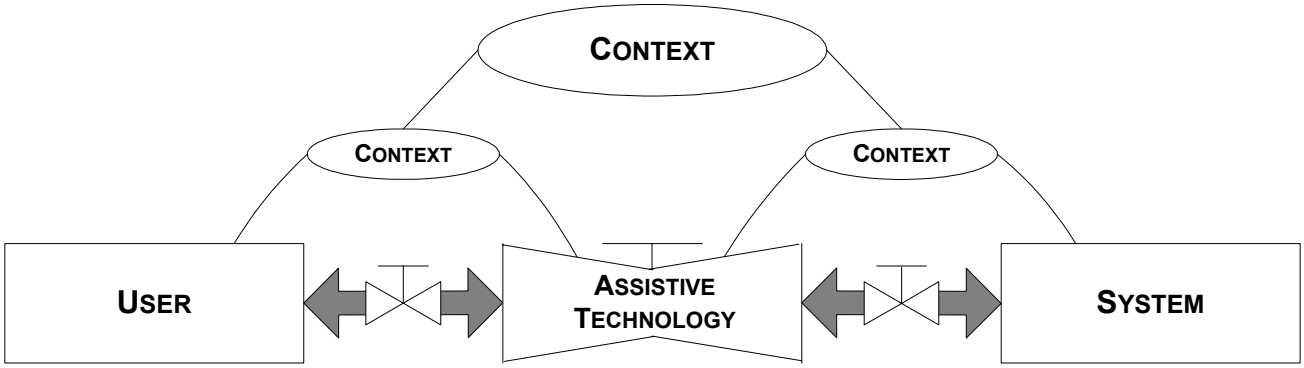

Figure 2 — Assistive Technology in the User-System interaction

Accessibility relies on users and systems using compatible interfaces for interaction. The inclusion of an AT allows translation between two incompatible interfaces as illustrated in Figure 3. To evaluate current and proposed future accessibility, there is a need for a standard method to describe both user-system accessibility and user-AT-system accessibility across all users and systems.

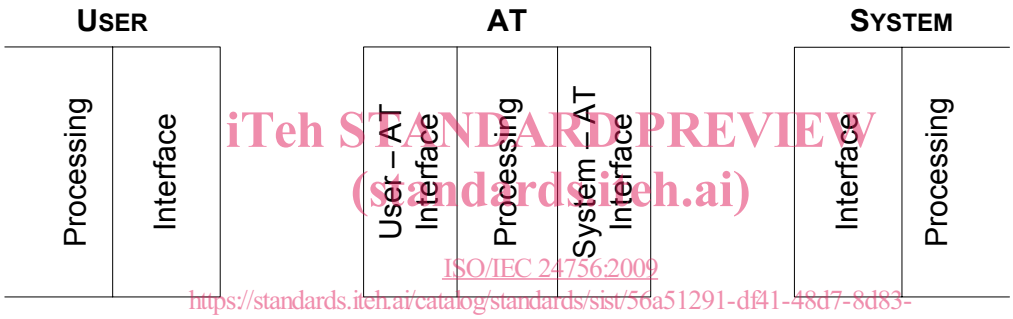

Figure 3 — Interfacing between components

The goal of accessibility is to make systems accessible to users. However, different situations call for different packaging(s) of systems. Where the user's goal is to interact with a particular application package, the user can choose the operating system, computer, peripherals, and other ATs that make the application the most accessible. ATs might be required for accessibility purposes where the user's goal is to interact with an application package that is part of an existing hardware/software system.

The model presented in Figure 3 holds in all situations regardless of the different possible locations of system boundaries. In this model, ATs can be considered anything that is added to the basic system to make it accessible to users. There is a very wide range of objects that can act as ATs, including: special purpose assistive technologies, universal remote consoles, intelligent agents, and even components that are specifically chosen to meet the accessibility needs of a particular user. Multiple ATs can be used in sequence and/or in parallel to support access.

Figure 4 illustrates the paths between the User and their ultimate goal, the application (A1, A2, A3) the user wants to use. Multiple communications can occur in either direction along the connecting lines between components. The applications being used must be accessible to the user. To this end, software-based Assistive Technology (SAT), software which may be part of the operating system or software that is added to the system to increase accessibility for an individual user, might be needed. Examples of SATs include add-on or built-in screen readers.

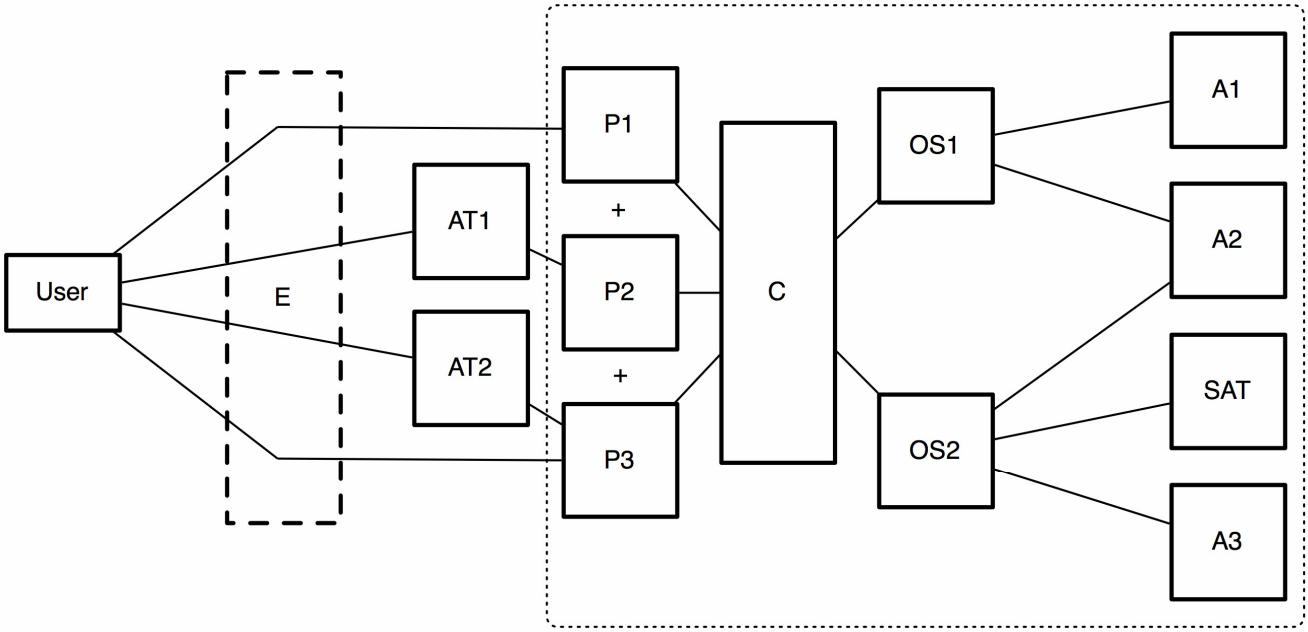

Figure 4 — Components of accessibility

Although not traditionally considered assistive technology, each of the layers (Operating System, Hardware, Peripherals, Assistive Technology, and Environment) between the user and the application has the same effect as an AT in either increasing or decreasing access. The choice of operating system (OS1, OS2) to use with the application can limit or increase the user's access to the application. It can limit access where it does not support certain forms of interaction between the user and the application. It might increase access where it supports transformations of interactions between the user and the application from one form of interaction to another. The computer (C) with which the operating system interacts might limit the user's experience still further. Users are also limited by the capabilities of peripherals (P1, P2, P3) available with the computer.

The user might perceive the combination of application, operating system, computer, and peripherals as a single system, as is indicated by a dotted box in the figure. When considering accessibility, these components can be modelled separately or as a single system.

Assistive Technologies (AT1, AT2) can be used to transform interactions of peripherals to make them more accessible. Environmental conditions (E) can further degrade the accessibility of certain interactions.

To the user, the total experience with all of these components might be perceived as a total system. It is the total system that needs to be specified to evaluate accessibility for the user.

6 A format for identifying access potential

6.1 Introduction to the Common Access Profile

Communications are transmitted (by systems, users, or ATs through channels and environments) to their intended receptors (systems, users, or ATs). This involves flows of information from the system to the user and from the user to the system. The characteristics of these flows are not necessarily the same (e.g., the system might provide spoken output which the user can hear however, if the user has a speech disability, they might choose to use a keyboard to input information to the system). Access exists when the receptor is able to receive and understand the message as transmitted. In this International Standard, systems, users, ATs, environments, and channels will be considered Interacting Components (ICs). Individual communications can be modelled in terms of the receptors, channels, and transmitters used to accomplish the communication. Interaction involves many sets of communications going in either direction between the ICs in the interaction.

An access framework modelling all of the sets of transmitters, channels, and receptors involved in the set of possible interactions between a particular user and a particular system can be used to evaluate the accessibility of a system in a given environment to a particular user.

This access framework involves multiple sets of:

{ Interactions each of which is composed of one or more sets of { receptor, channel, transmitter } }

Rather than deal with each interaction, it is possible to model the set of potential interactions based on an understanding of the compatibility of transmitters, receptors, and channel characteristics of the ICs.

6.2 Common Access Profile

An overall Common Access Profile (CAP_O) is composed of the CAP_{IC} of each different Interacting Component (IC), including those of: users (CAP_{USE}), systems (CAP_{SYS}), assistive technologies (CAP_{AT}), and environments (CAP_{ENV}).

$$(CAP_O) = \Sigma\,(CAP_{IC}) = \text{any}\,(CAP_{USE}) \cup \text{any}\,(CAP_{SYS}) \cup \text{any}\,(CAP_{AT}) \cup \text{any}\,(CAP_{ENV})$$

NOTE 1 The union operation (∪) is used to indicate a composition (collection) of lower-level CAPs pertaining to a CAP. Such compositions are further referenced as “Lower-CAP Linkages” for a specific CAP in this International Standard (see Tables 2 and 3).

The CAP_{IC} of each IC (user, system, AT, environment) is in turn composed of the CAP(s) of each of its Component Features (CAP_{CF}) that provide specifics of various directional communications and processes, these include: the CAP_{IR} of each Input Receptor (IR), the CAP_{OT} of each Output Transmitter (OT), and the CAP_{PF} of each Processing Function (PF) involved in the IC. Describing PFs is optional for users and systems, but is required for ATs.

$$(CAP_{IC}) = \Sigma\,(CAP_{CF}) = \text{any}\,(CAP_{IR}) \cup \text{any}\,(CAP_{OT}) \cup \text{any}\,(CAP_{PF}) \cup$$

ICs can make use of one or more OTs and/or IRs. Where multiple OTs or IRs are required they will be ANDed within the CAP specification. Where substitutions of OTs or IRs are possible, they will be ORed within the CAP specification.

NOTE 2 (IR1 AND IR2) is equivalent to (IR1, IR2).

EXAMPLE (IR1 AND (IR2 OR IR3)) requires that input receptor IR1 always be used and that either input receptor IR2 or input receptor IR3 be used.

Systems are intended to help users to perform tasks. Systems might or might not be directly accessible by users. The CAP of a system provides the starting point for evaluating and improving the accessibility of the system for a user in a given environment. The Environment can reduce the accessibility of a system. ATs might be used to increase the accessibility of a system. Thus, an evaluation of access involves analysing the CAP(s) of a set of systems, users, environments, and ATs.

Figure 5 depicts the structure of the CAP. This four-level structure places CF Type-Specific Information [i.e., modality (CAP_M), capability (CAP_C), and processing (CAP_P)] within their own specific tables. Only those records that are applicable will be coded, leading to simplification and space saving.

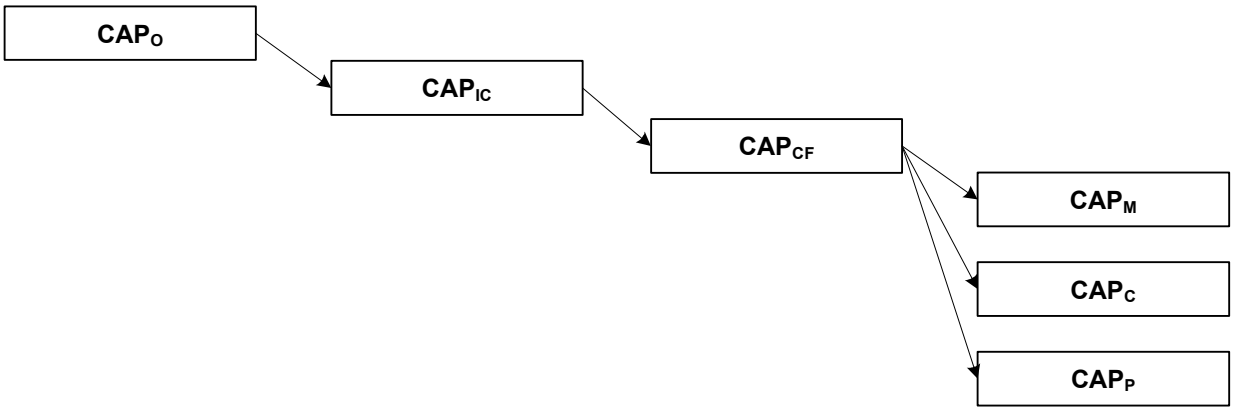

Figure 5 — The CAP structure

6.3 Describing Overall CAPs

The overall CAP$_O$ of a group of ICs shall be specified as outlined in Table 1. Every CAP$_O$ specification has an Identification Information section containing information such as the unique *Name* of the CAP$_O$, its *Type* (i.e., CAP$_O$), and a *Qualifier*. It might also contain an unstructured narrative description. Narrative *Descriptions* can be used to record preliminary information and/or provide an easy to read introduction to the structured details of all CAP specifications. All useful CAP$_O$ specifications have linkages to one or more CAP$_{IC}$(s) and can have linkages to other CAP$_O$(s).

	Description	*Possible Values*
Identification		
Type	The record type.	CAP$_O$
Name	An identifier of, or a commonly known name for, the CAP$_O$.	any (must be unique within CAP)
Qualifier	A unary operator that qualifies this record as being required, optional, or excluded.	one of {SHALL MAY NOT}
Description	A narrative description to record preliminary information and / or optional comments further describing the object.	any
Linkages		
Peer-CAP$_O$	Peers to this CAP$_O$.	{<*cap-o-name*, *linkage-type*>, <*cap-o-name*, *linkage-type*>, …}
Lower-CAP$_{IC}$	The ICs used by this CAP$_O$.	{<*cap-ic-name*, *linkage-type*>, <*cap-ic-name*, *linkage-type*>, …}

Table 1 — High level CAP$_O$ structure

Linkages are described as <*cap-name, linkage-type*> pairs. The *cap-name* field is the name of the target CAP. The *linkage-type* field describes the applicable binary operator this link implies (i.e. AND, OR, XOR), but if left blank will imply the default linkage type for the given IC type (i.e. AND in the case of CAP$_{SYS}$/CAP$_{AT}$/CAP$_{ENV}$, OR in the case of CAP$_{USE}$). See 7.3 for more information.

6.4 Describing Interacting Components

Each CAP_{IC} shall be specified as outlined in Table 2. Every CAP_{IC} specification has an Identification Information section with the unique *Name* of the CAP_{IC} and the *Type* (i.e., CAP_{USE}, CAP_{SYS}, CAP_{AT}, or CAP_{ENV} of the IC specification as well as an unstructured narrative *Description* and a *Qualifier*. All CAP_{IC} specifications have linkages to one or more IR/OT/PF Component Feature specifications as well as to the CAP_{O}(s) to whom it belongs.

	Description	*Possible Values*
Identification		
Type	The record type.	one of {CAP_{USE} CAP_{SYS} CAP_{AT} CAP_{ENV} }
Name	An identifier of, or a commonly known name for, the IC.	any (must be unique within CAP)
Qualifier	A unary operator that qualifies this record as being required, optional, or excluded.	one of {SHALL MAY NOT}
Description	A narrative description to record preliminary information and / or optional comments further describing the object.	any
Linkages		
Higher-CAP_{O}	The CAP_{O} to whom this IC belongs.	{<*cap-o-name*, *linkage-type*>, <*cap-o-name*, *linkage-type*>, …}
Peer-CAP_{IC}	Peers to this IC. Linkages to Channel ICs, indicate the number of channel connections to this IC.	{<*cap-ic-name*, *linkage-type*>, <*cap-ic-name*, *linkage-type*>, …}
Lower-CAP_{IR}	The IRs used by this IC.	{<*cap-ir-name*, *linkage-type*>, <*cap-ir-name*, *linkage-type*>, …}
Lower-CAP_{PF}	The PFs used by this IC.	{<*cap-pf-name*, *linkage-type*>, <*cap-pf-name*, *linkage-type*>, …}
Lower-CAP_{OT}	The OTs used by this IC.	{<*cap-ot-name*, *linkage-type*>, <*cap-ot-name*, *linkage-type*>, …}

Table 2 — Interacting Component CAP_{IC} structure

6.5 Describing IC Component Features

Communication is only possible where there are corresponding IRs for the OTs being used. Thus a common format is used to describe both IRs and OTs. Environments can be modelled as components with their own IR and OT and with processing that potentially inhibits access. Processing transforms communications between inputs and outputs and thus is represented by a pair of input and output formats along with a rule to describe the transformation. User and system processing is usually outside the bounds of evaluation. Environmental processing only affects the usability of the communication. AT processing effects the communication by transforming its characteristics.

Each CAP_{IR}, CAP_{OT}, or CAP_{PF} shall be specified as outlined in Table 3. IC Component Feature (CF) specification has an Identification Information section containing information such as the unique *Name* of the CF and the *Type* (i.e., CAP_{IR}, CAP_{OT}, or CAP_{PF}) of CAP_{CF} specification. It might also contain an unstructured narrative *Description* and a *Qualifier*.

	Description	*Possible Values*
Identification		
Type	The record type.	one of {CAP_{IR} CAP_{PF} CAP_{OT}}
Name	An identifier of, or a commonly known name for, the CF.	any (must be unique within CAP)
Qualifier	A unary operator that qualifies this record as being required, optional, or excluded.	one of {SHALL MAY NOT}
Description	A narrative description to record preliminary information and / or optional comments further describing the object.	any
Linkages		
Higher-CAP_{IC}	The IC(s) to whom this CF belongs.	{<*cap-ic-name*, *linkage-type*>, <*cap-ic-name*, *linkage-type*>, …}
Peer-CAP_{IR}	The IRs used by this CF.	{<*cap-ir-name*, *linkage-type*>, <*cap-ir-name*, *linkage-type*>, …}
Peer-CAP_{PF}	The PFs used by this CF.	{<*cap-pf-name*, *linkage-type*>, <*cap-pf-name*, *linkage-type*>, …}
Peer-CAP_{OT}	The OTs used by this CF.	{<*cap-ot-name*, *linkage-type*>, <*cap-ot-name*, *linkage-type*>, …}
Lower-CAP_{M}	The modality specifications of this CF.	{<*cap-m-name*, *linkage-type*>, <*cap-m-name*, *linkage-type*>, …}
Lower-CAP_{C}	The capabilities of this CF.	{<*cap-c-name*, *linkage-type*>, <*cap-c-name*, *linkage-type*>, …}
Lower-CAP_{P}	The processing specifications of this CF.	{<*cap-p-name*, *linkage-type*>, <*cap-p-name*, *linkage-type*>, …}
Connectivity		
Channel capacity	The maximum number of channels the CF can accept.	one of {1 any other specific integer N}
Sharing capability	The need for a CF to have a dedicated channel	one of {SHARABLE DEDICATED POSSIBLE}
CF operations	The amount of time that a CF requires the use of a channel.	one of {INTERMITTENT CONTINUOUS}
Priority	The priority of this CF when using a shared channel	one of {LOW MEDIUM HIGH URGENT}

Table 3 — IC Component Feature CAP_{CF} general format