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Information technology — Mobile item identification and management — Service broker for Mobile AIDC services

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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 29178 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

Introduction

Mobile AIDC is a version of the AIDC technology that is combined with mobile communications. A Mobile AIDC terminal is a mobile phone that has one or more types of embedded AIDC device functions. It accesses AIDC media (e.g., labels, tags, etc.) information in the same manner as existing AIDC devices. In a typical Mobile AIDC service architecture, Mobile AIDC terminal gets the location information of information content which is associated with Mobile Item Identifier (MII) stored in AIDC media through MII resolution process with Object Directory Service (ODS) directly. The information content provided by content provider may not be guaranteed to be adequate to the Mobile AIDC terminal in terms of capabilities of terminal or service policy of service provider. If the information content is not suitable to the Mobile AIDC terminal, the information content cannot be used in the Mobile AIDC terminal. For preventing this situation, a service broker can be applied optionally to a typical Mobile AIDC service architecture to enforce service policies on Mobile AIDC information content. By a service broker, MII recognition and resolution related functions are performed in a service broker, which improves the functionality and efficiency over a Mobile AIDC terminal that includes these functions. This International Standard specifies the functions of a service broker and the interface between Mobile AIDC terminals and a service broker.

There are alternative techniques to meet the use case addressed by this International Standard. One of those techniques is to use EPC and ONS. Further information on this technique can be obtained from GS1.

Information technology — Mobile item identification and management — Service broker for Mobile AIDC services

1 Scope

This International Standard defines the functions of a service broker supporting service control, MII recognition and MII resolution related functions in Mobile AIDC service architecture that uses MII (ISO/IEC 29174) as an identifier. For the use of a service broker by a Mobile AIDC terminal, definition is required of the interface between a terminal and a service broker. This International Standard describes that interface.

2 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/IEC 19762 (all parts), *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary*

ISO/IEC 18000-6, *Information technology — Radio frequency identification for item management — Part 6: Parameters for air interface communications at 860 MHz to 960 MHz*

ISO/IEC 29143, *Information technology — Automatic identification and data capture techniques – Air interface specification for Mobile RFID interrogators*

ISO/IEC 29168-1, *Information technology — Open systems interconnection — Object identifier resolution system (ORS)*

ISO/IEC 29172, *Information technology — Mobile item identification and management — Reference architecture for Mobile AIDC services*

ISO/IEC 29174 (all parts), *Information technology — UII scheme and encoding format for Mobile AIDC services*

ISO/IEC 29177, *Information technology — Automatic identification and data capture technique — Identifier resolution protocol for multimedia information access triggered by tag-based identification*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762, ISO/IEC 29168-1, ISO/IEC 29172, ISO/IEC 29174, ISO/IEC 29177, and the following apply.

3.1
MII recognition
process that recognizes the type of the MII stored in an RFID tag or in a bar code or two-dimensional symbol on a label

3.2
MII resolution
process of converting an MII into its associated information by means of Object Directory Service (ODS)

4 Symbols (and abbreviated terms)

AIDC Automatic Identification and Data Capture

DNS Domain Name System

DSFID Data Storage Format Identifier

FQDN Fully Qualified Domain Name

MII Mobile Item Identifier

NAPTR Naming Authority Pointer

ODS Object Directory Service

OID Object Identifier

ORM Optically Readable Media

ORS Object identifier Resolution System

URL Uniform Resource Locator

XML Extensible Markup Language

5 Overview of Mobile AIDC service architecture

5.1 Generic architecture

According to ISO/IEC 29172, generic service architecture can be illustrated as Figure 1. An RFID tag or ORM can be attached to a physical object and one or more Mobile AIDC device(s) are built into the Mobile AIDC terminal. A content provider maintains the information content associated with the object. ODS manages the access information to retrieve the information content identified by the MII where the access information is usually represented as a URI.

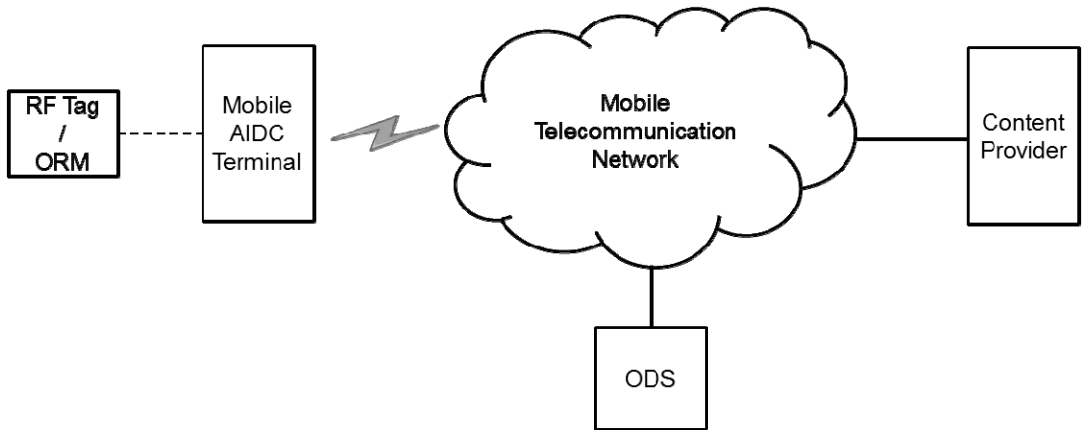

Figure 1 — Generic service architecture

Figure 2 shows the service procedures based on generic service architecture. The Mobile AIDC terminal reads the Mobile Item Identifier (MII) which is defined as ISO/IEC 29174 from the data carrier and performs MII recognition.

For the purposes of this document, the term MII is intended to mean the unique item identifier that appears on Memory Bank "01_2" of RFID tag conforming to ISO/IEC 29143 or ISO/IEC 18000-6C or encoded in optically readable media as a serialized item. The MII appears in an RFID tag as the content of Memory Bank "01_2" and in ORM traditionally shown with a data identifier of "25S".

Once the MII is recognized in the Mobile AIDC terminal, the Mobile AIDC terminal sends an MII resolution request to the Object Directory Service (ODS). The ODS performs MII resolution and returns an MII resolution result. MII resolution protocol is defined in ISO/IEC 29177 and the detailed MII resolution protocol follows ISO/IEC 29177. This MII resolution result includes the locations of the associated information of the MII that the Mobile AIDC terminal read from the data carrier. The Mobile AIDC terminal then chooses the associated information from the results.

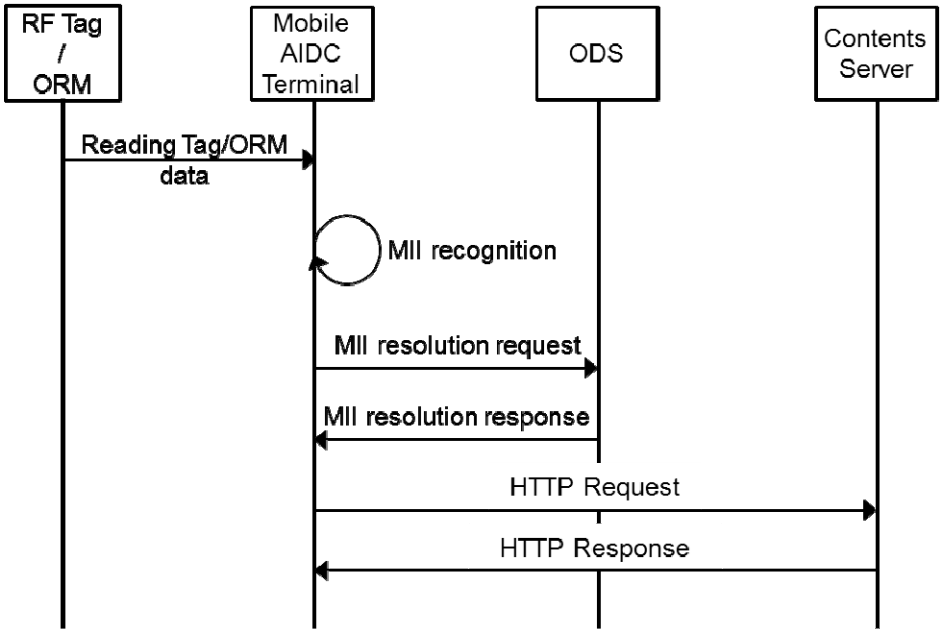

Figure 2 — Generic service procedure

In this service procedure, information content that Mobile AIDC terminal tries to access can be uncontrolled service. This means that the target content may not be adequate to the Mobile AIDC terminal in terms of capabilities of terminal or service policy of service provider. In that case, the Mobile AIDC terminal cannot use the chosen service.

5.2 Service broker-assisted architecture

As explained in 4.1, a Mobile AIDC terminal is required to send the MII resolution request directly to ODS and get MII resolution result from ODS. In this case, service control such as service filtering is not applied to information content because the Mobile AIDC terminal acquires the location of information content directly from ODS. For providing service control and simplicity of Mobile AIDC terminal's functions, MII recognition and MII resolution related functions are performed in a service broker. In a service broker-assisted architecture, the Mobile AIDC terminal has only to read the MII from the data carrier and pass the MII to a service broker. Then a service broker performs the MII recognition and the MII resolution. Figure 3 below depicts a service broker-assisted Mobile AIDC service architecture.

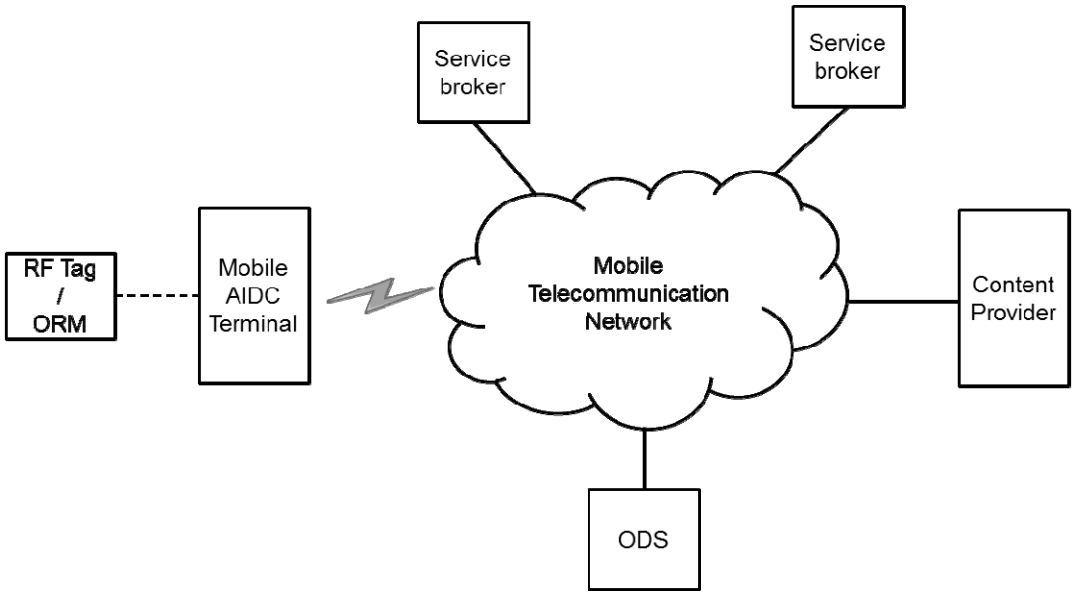

Figure 3 — Service broker-assisted architecture

In a service broker-assisted architecture, a Mobile AIDC terminal is connected to a service broker. A service broker processes the MII recognition and sends the MII resolution request to ODS. Multiple service brokers may exist and the selection of service broker depends on the user's preference.

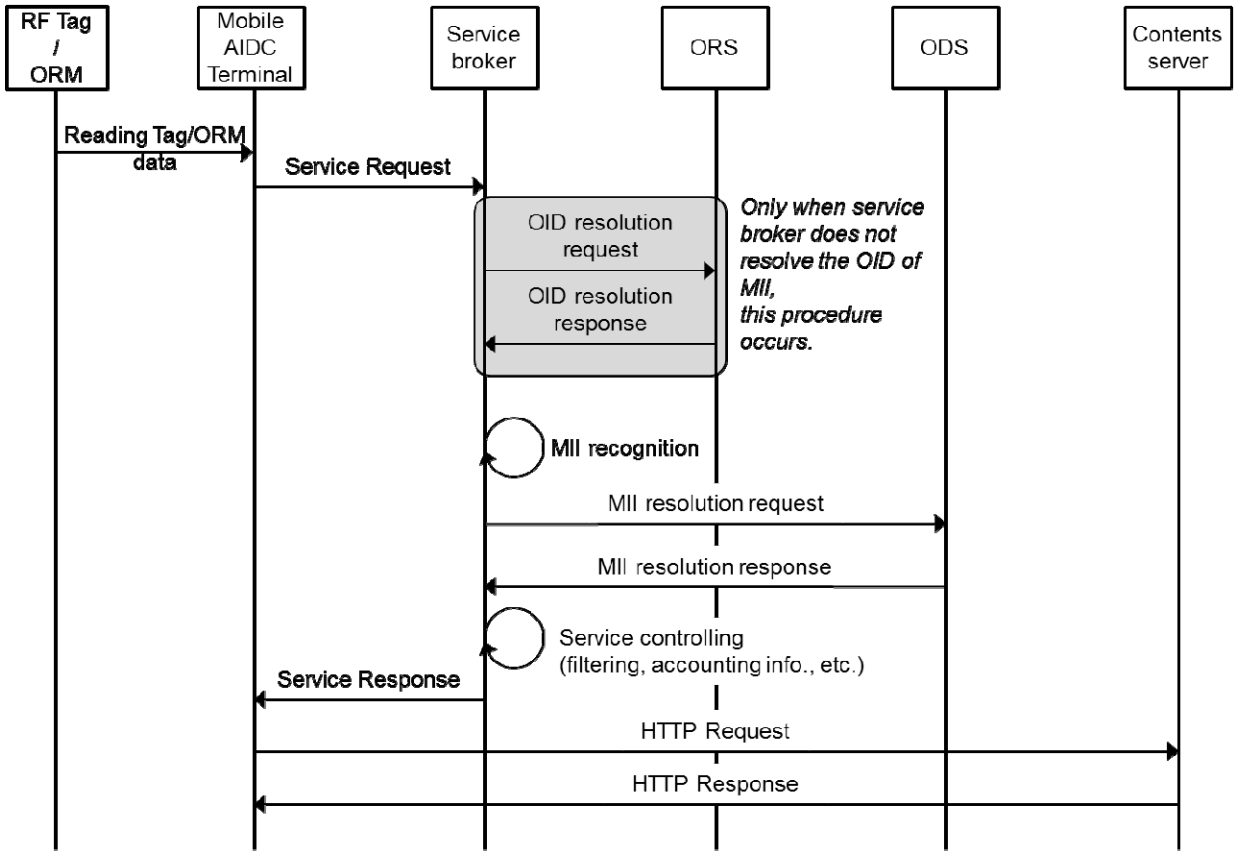

Figure 4 — Service broker-assisted service procedures (in case of HTTP as an access protocol to contents server)

In Figure 4, the Mobile AIDC terminal reads the MII from the data carrier and passes the MII to a service broker using the interface in clause 7.1.1. A service broker recognizes the MII and sends MII resolution request to ODS using the interface in clause 6.2.2. ODS performs the MII resolution process and returns the MII resolution result with the interface in clause 6.2.3. This MII resolution result includes the locations of the associated information of the MII including the access protocol to the locations.

However, if a service broker fails to recognize the OID for MII or OID for other identifier schemes, a service broker sends the OID resolution request to ORS using the interface in clause 7.3.1 for resolving the OID which is defined in ISO/IEC 29168-1.

ISO/IEC 29168-1 describes OID resolution process as follows:

> The general OID resolution process uses the DNS and DNS resource records. It involves an interaction between the application and an ORS client to retrieve information (specified by that application) from the DNS system. The general OID resolution process normally returns a URL for a document, a canonical OID-IRI or a DNS name, but there is no restriction on what could be returned. This is usually followed by an application-specific OID resolution process, where the application uses the information obtained from the general resolution process to obtain the final information required by the application.

A service broker can enforce service policy on resolution result such as filtering and modify the resolution result according to service policies. A service broker transfers the MII resolution result using the interface in clause 6.1.3 to the Mobile AIDC terminal.

6 Functions of service broker

6.1 MII recognition

A service broker recognizes the MII according to ISO/IEC 29174. This MII is delivered from the Mobile AIDC terminal using SERVICE-REQUEST interface. In case that a service broker fails to recognize the OID for MII or OID for other identifier schemes, a service broker cannot recognize the MII. In this case, a service broker sends the OID resolution request using interface defined in clause 7.3.1 to ORS which is defined in ISO/IEC 29168-1.

6.2 MII resolution

For MII resolution, a service broker creates the MII resolution request and sends the request to ODS using interface defined in clause 6.2.2. To create a MII resolution request, a service broker needs to transform the recognized MII into a specified form defined in ISO/IEC 29177. Once receiving MII resolution result from ODS using interface defined in clause 6.2.3, a service broker responses to the Mobile AIDC terminal using interface defined in clause 6.1.3.

6.3 Service control

A service broker may be provided by a mobile telecommunication service provider or by the third party in agreement with a mobile telecommunication service provider. A service broker maintains the service policies and the Mobile AIDC terminal's information. A service broker can perform service control over MII resolution procedures and determine whether information content listed in the MII resolution result from ODS is adequate to the Mobile AIDC terminal. Service control functions such as service filtering, authorization and accounting are dependent on the service provider, therefore this International Standard does not deal with service control in detail.

7 Interfaces for service broker

7.1 Mobile AIDC terminal – Service broker

7.1.1 General

Interfaces between a service broker and a Mobile AIDC terminal use HTTP.

7.1.2 SERVICE-REQUEST (from Mobile AIDC terminal to service broker)

SERVICE-REQUEST uses HTTP GET command. URL used in HTTP GET command using Augmented Backus-Naur form is as follows.

Table 1 — SERVICE-REQUEST

```
request_url = base_url "?" option ("&" tagtype":"datablock)
base_url = "http://" host [":" port] "/Services"
option = "P="doctype
doctype = word
tagtype = "O" / "R"
datablock = (base64block / safe_base64block)
base64block = *(4b64char) [(2b64char 2"=") / (3b64char "=")]
b64char = ALPHA / DIGIT / "+" / "/"
safe_base64block = *(4safe_b64char) [(2safe_b64char 2"=") / (3safe_b64char "=")]
safe_b64char = ALPHA / DIGIT / "-" / "_"
```

- **<option>**
  <option> indicates the way of processing SERVICE-REQUEST in service broker. Parameter for option is as below.

Table 2 — Parameter for option

Name	Value	Default value	Description
doctype	xml, xhtml, wml, mhtml, html	html	doctype indicates the type of return document in SEVICE-RESPONSE to Mobile AIDC terminal. This may be useful when web browser sends SERVICE-REQUEST and receives SERVICE-RESPONSE. Default value is html.

- **<tagtype>**
  <tagtype> indicates the type of Mobile AIDC media. “O” indicates Mobile ORM media type and “R” indicates Mobile RFID media type.

- **<datablock>**
  <datablock> holds DSFID and MII conforming to ISO/IEC 29174 represented by BASE64. Content of <datablock> depends on MII scheme and Mobile AIDC media. <datablock> for Mobile RFID holds DSFID, precursor, length of OID, OID, length of object and object, which are explained in detail in ISO/IEC 29174.MII for Mobile ORM is defined in ISO/IEC 29174.

<datablock> for Mobile ORM holds message header, format header, precursor, OID, object and message trailer, which are also explained in detail in ISO/IEC 29174.

Additional header information shall be included SERVICE-REQUEST, which are Accept, Accept-Charset and Accept-Language. If this information is missing, service broker can use default values and default values are left to implementers.

- **Accept**
  Accept indicates the possible service types that service broker can return as SERVICE-RESPONSE. General service types may be text/xml, text/html, application/xhtml+xml, text/vnd.wap.wml, text/vnd.sun.j2me.app-descriptor and application/pdf. Service broker shall not return service that is not included in service types.

- **Accept-Charset**
  Accept-Charset specifies the encoding of document to be returned. UTF8 is recommended.

- **Accept-Language**
  Accept-Language specifies the language of document to be returned.

When a service broker receives SERVICE-REQUEST from a Mobile AIDC terminal, a service broker recognizes the MII and sends MII resolution request using MII_RESOLUTION-REQUEST to ODS.

7.1.3 SERVICE-RESPONSE (from service broker to Mobile AIDC terminal)

SERVICE-RESPONSE follows HTTP response. Result code may be one of the following.

Table 3 — Result code of SERVICE-RESPONSE

200 OK	No error found
400 BAD REQUEST	The request could not be understood by the server due to malformed syntax
401 UNAUTHORIZED	The request requires user authentication
403 FORBIDDEN	The server understood the request, but is refusing to fulfill it
404 NOT FOUND	The server has not found anything matching the Request-URI
500 INTERNAL SERVER ERROR	The server encountered an unexpected condition which prevented it from fulfilling the request

Returned document should include MII resolution result as the indicated document type which is indicated in option filed SERVICE-REQUEST. Returnable document types are HTML, XML, WML, XHTML and MHTML. Returned document including MII resolution result can be expressed by the XML schema as follows.

Table 4 — XML schema

```
<?xml version="1.0" encoding="UTF-8" ?>

<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="ods:ietf:xml:service-1.0"
xmlns="ods:ietf:xml:service-1.0"
elementFormDefault="unqualified">

  <xs:simpleType name="mimeType">
    <xs:restriction base="xs:string">
      <xs:pattern value="\w+/(\w+)(.\w+)*"/>
    </xs:restriction>
  </xs:simpleType>


  <xs:complexType name="serviceType">
    <xs:sequence>
     <xs:element name="uri" type="xs:anyURI"/>
      <xs:element name="mime-type" type="mimeType"/>
      <xs:element name="name" type="xs:string" minOccurs="0"/>

     <xs:attribute name="language" type="xs:language" use="optional"/>
    </xs:sequence>
  </xs:complexType>

  <xs:element name="services">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="service" type="serviceType" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

</xs:schema>
```

A service broker can enforce service policies on SERVICE-RESPONSE when the information content listed in the MII_RESOLUTION-RESPONSE are not adequate to the Mobile AIDC terminal.

7.2 Service broker – ODS

7.2.1 General

ODS uses the DNS protocol and NAPTR Resource Record. Interface between service broker and ODS conforms to ISO/IEC 29177.

7.2.2 MII_RESOLUTION-REQUEST (from service broker to ODS)

When a service broker can recognize the MII, a service broker proceeds to perform MII resolution process. MII_RESOLUTION-REQUEST is sent to ODS using DNS protocol. MII is transformed to a FQDN in MII_RESOLUTION-REQUEST according to ISO/IEC 29177. Detailed procedures conform to ISO/IEC 29177.

7.2.3 MII_RESOLUTION-RESPONSE (from ODS to service broker)

As a result of MII_RESOLUTION-REQUEST, the result of MII resolution is sent to service broker from ODS. ODS returns the URI of the associated information with the MII. Detailed procedures conform to ISO/IEC 29177.

7.3 Service broker – ORS

7.3.1 General

If a service broker fails to recognize the OID for MII or OID for other identifier schemes, a service broker sends the OID resolution request to ORS for resolving the OID which is defined in ISO/IEC 29168-1.

ISO/IEC 29168-1 describes OID resolution process as follows:

> The general OID resolution process uses the DNS and DNS resource records. It involves an interaction between the application and an ORS client to retrieve information (specified by that application) from the DNS system. The general OID resolution process normally returns a URL for a document, a canonical OID-IRI or a DNS name, but there is no restriction on what could be returned. This is usually followed by an application-specific OID resolution process, where the application uses the information obtained from the general resolution process to obtain the final information required by the application.

With the OID resolution result, a service broker is able to resolve the OID and recognize the identifier.

Interface between service broker and ORS conforms to ISO/IEC 29168-1.

7.3.2 OID_RESOLUTION-REQUEST (from service broker to ORS)

OID_RESOLUTION-REQUEST is sent to ORS using DNS message format for a query. OID is transformed to a FQDN in OID_RESOLUTION-REQUEST according to ISO/IEC 29168-1.

7.3.3 OID_RESOLUTION-RESPONSE (from ORS to service broker)

As a result of OID_RESOLUTION-RESPONSE, ORS returns the access information for application-specific OID resolution system then a service broker request OID resolution to an application-specific OID resolution system. The result from the OID resolution system is delivered to service broker using NAPTR Resource Record in DNS message format for response.

Annex A
(informative)

Example of interfaces

Mobile AIDC terminal reads MII from the RFID tag and the MII is "0000190100000000000000259FD720E$_{HEX}$".

Also, the URI of the associated information of the above MII is http://www.sample.com/sample.html and NAPTR in MII-RESOLUTION-RESPONSE is

IN NAPTR 0 100 'u' 'C2U+mCS:web' '!^.*$!http://www.sample.com/sample.html!'.

A. Mobile AIDC terminal sends **SERVICE-REQUEST** to service broker**. SERVICE-REQUEST** requesting HTML document as SERVICE-RESPONSE may be explained as follows:

GET /Services?P=html&R=*XXXXXX, where XXXXXX is base64-encoded value of <datablock>,*

Accept: text/html

Accept-Charset: UTF-8

Accept-Language: en

B. Service broker sends **MII_RESOLUTION-REQUEST** to ODS. MII (0000190100000000000000259FD720E$_{HEX}$) is transformed to a FQDN format according to ISO/IEC 29177.

C. ODS returns **MII_REQOLUTION-RESPONSE** to service broker using according to ISO/IEC 29177. NAPTR in **MII_REQOLUTION-RESPONSE** is

IN NAPTR 0 100 'u' 'C2U+mCS:web' '!^.*$!http://www.sample.com/sample.html!'

D. Service broker produces XML document from the result of **MII_RESOLUTION-RESPONSE**.

```
<?xml version="1.0" encoding="UTF-8"?>
<services>
 <service>
  <uri>http://www.sample.com/sample.html</uri>
  <mime-type>text/html</mime-type>
  <name>C2U+mCS:web</name>
 </service>
</services>
```

Service broker produces HTML document from XML document and returns **SERVICE-RESPONSE** including HTML document to Mobile AIDC terminal. Following HTML document is a sample document of the XML document above.

```
<html>
<head>
<meta http-equiv=Content-Type content="text/html;charset=en">
<title>Mobile AIDC Service</title>
</head>
<body>
<img src="welcome.png">
Code is 3602.4.18.4660.
<ol>
<li>   <a   href="http://www.sample.com/sample.html">Link   :   SAMPLE.com
contents server</a> </li>
</ol>
</body>
</html>
```

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