

There (3) issues in this document, each beginning 'ISSUE\_n:'.

Internet Printing Protocol Working Group  
INTERNET DRAFT  
Expires 7 January 2001

Tom Hastings  
Xerox  
Ira McDonald  
High North  
7 July 2000

**Internet Printing Protocol (IPP):  
Resource Objects and Get Resource Operations**  
<[draft-ietf-ipp-get-resource-00.txt](#)>

Copyright (C) The Internet Society (2000). All Rights Reserved.

Status of this Memo

This document is an Internet-Draft and is in full conformance with all provisions of [Section 10 of RFC2026](#). Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at  
<http://www.ietf.org/ietf/1id-abstracts.txt>

The list of Internet-Draft Shadow Directories can be accessed at  
<http://www.ietf.org/shadow.html>.

Abstract

This document is a submission to the Internet Printing Protocol Working Group of the Internet Engineering Task Force (IETF). Comments should be submitted to the [ipp@pwg.org](mailto:ipp@pwg.org) mailing list.

This IPP Get Resource document specifies an extension to IPP/1.0 [[RFC-2565](#)] [[RFC-2566](#)] and IPP/1.1 [[IPP-MOD](#)] [[IPP-PRO](#)]. This document extends the current closed IPP object model with a passive polymorphic object that is intended to satisfy most needs for new object types in the long-term evolution of IPP via an extensible object framework.

This document defines: Resource object (passive polymorphic object); Resource get operations (e.g., Get-Resource-Attributes); Resource attributes (e.g., "resource-name"); new Printer attributes (e.g.,

"resource-type-supported"); Resource type of Driver (a morph of the Resource object); methods for supporting 'driver download' to IPP Client systems.

## Table of Contents

<a href="#">1.</a>	<a href="#">Introduction .....</a>	<a href="#">4</a>
<a href="#">2.</a>	<a href="#">IPP Model for Resources .....</a>	<a href="#">5</a>
<a href="#">2.1.</a>	<a href="#">Resource Object .....</a>	<a href="#">5</a>
<a href="#">3.</a>	<a href="#">Terminology .....</a>	<a href="#">6</a>
<a href="#">3.1.</a>	<a href="#">Conformance Terminology .....</a>	<a href="#">6</a>
<a href="#">3.2.</a>	<a href="#">Model Terminology .....</a>	<a href="#">6</a>
<a href="#">4.</a>	<a href="#">Resource Operations .....</a>	<a href="#">7</a>
<a href="#">4.1.</a>	<a href="#">Get-Resource-Attributes Operation .....</a>	<a href="#">7</a>
<a href="#">4.1.1.</a>	<a href="#">Get-Resource-Attributes Request .....</a>	<a href="#">8</a>
<a href="#">4.1.2.</a>	<a href="#">Get-Resource-Attributes Response .....</a>	<a href="#">9</a>
<a href="#">4.2.</a>	<a href="#">Get-Resource-Data Operation .....</a>	<a href="#">10</a>
<a href="#">4.2.1.</a>	<a href="#">Get-Resource-Data Request .....</a>	<a href="#">10</a>
<a href="#">4.2.2.</a>	<a href="#">Get-Resource-Data Response .....</a>	<a href="#">10</a>
<a href="#">4.3.</a>	<a href="#">Get-Resources Operation .....</a>	<a href="#">11</a>
<a href="#">4.3.1.</a>	<a href="#">Get-Resources Request .....</a>	<a href="#">11</a>
<a href="#">4.3.2.</a>	<a href="#">Get-Resources Response .....</a>	<a href="#">12</a>
<a href="#">4.4.</a>	<a href="#">Resource Operation Response Status Codes .....</a>	<a href="#">13</a>
<a href="#">5.</a>	<a href="#">Resource Attributes .....</a>	<a href="#">14</a>
<a href="#">5.1.</a>	<a href="#">Table of Required Resource Attributes .....</a>	<a href="#">14</a>
<a href="#">5.2.</a>	<a href="#">Table of Optional Resource Attributes .....</a>	<a href="#">15</a>
<a href="#">5.3.</a>	<a href="#">Resource Template Attributes .....</a>	<a href="#">16</a>
<a href="#">5.3.1.</a>	<a href="#">resource-info (text(127)) .....</a>	<a href="#">16</a>
<a href="#">5.3.2.</a>	<a href="#">resource-charset (charset) .....</a>	<a href="#">16</a>
<a href="#">5.3.3.</a>	<a href="#">resource-natural-language (naturalLanguage) .....</a>	<a href="#">16</a>
<a href="#">5.3.4.</a>	<a href="#">resource-document-formats (1setOf mimeType) ...</a>	<a href="#">17</a>
<a href="#">5.3.5.</a>	<a href="#">resource-os-types (1setOf type2 keyword) .....</a>	<a href="#">17</a>
<a href="#">5.3.6.</a>	<a href="#">resource-data-present (boolean) .....</a>	<a href="#">17</a>
<a href="#">5.3.7.</a>	<a href="#">resource-data-uri (1setOf uri) .....</a>	<a href="#">18</a>
<a href="#">5.3.8.</a>	<a href="#">resource-data-k-octets (integer(0:MAX)) .....</a>	<a href="#">18</a>
<a href="#">5.3.9.</a>	<a href="#">resource-data-compression (type3 keyword) .....</a>	<a href="#">18</a>
<a href="#">5.3.10.</a>	<a href="#">resource-create-date-time (dateTime) .....</a>	<a href="#">19</a>
<a href="#">5.3.11.</a>	<a href="#">resource-duration (integer(0:MAX)) .....</a>	<a href="#">19</a>
<a href="#">5.3.12.</a>	<a href="#">resource-persistence (boolean) .....</a>	<a href="#">19</a>
<a href="#">5.4.</a>	<a href="#">Resource Description Attributes .....</a>	<a href="#">20</a>
<a href="#">5.4.1.</a>	<a href="#">resource-type (type2 keyword) .....</a>	<a href="#">20</a>
<a href="#">5.4.2.</a>	<a href="#">resource-name (name(127)) .....</a>	<a href="#">20</a>
<a href="#">5.4.3.</a>	<a href="#">resource-id (integer(1:MAX)) .....</a>	<a href="#">20</a>
<a href="#">5.4.4.</a>	<a href="#">resource-printer-uri (uri) .....</a>	<a href="#">21</a>
<a href="#">5.4.5.</a>	<a href="#">resource-create-user-name (name(MAX)) .....</a>	<a href="#">21</a>
<a href="#">5.4.6.</a>	<a href="#">resource-create-time (integer(0:MAX)) .....</a>	<a href="#">21</a>
<a href="#">5.4.7.</a>	<a href="#">resource-change-time (integer(0:MAX)) .....</a>	<a href="#">22</a>
<a href="#">5.4.8.</a>	<a href="#">resource-refresh-time (integer(0:MAX)) .....</a>	<a href="#">22</a>
<a href="#">5.4.9.</a>	<a href="#">resource-expiration-time (integer(0:MAX)) .....</a>	<a href="#">22</a>
<a href="#">6.</a>	<a href="#">Driver Resource Type .....</a>	<a href="#">23</a>
<a href="#">6.1.</a>	<a href="#">Table of Required Driver Resource Attributes .....</a>	<a href="#">23</a>
<a href="#">6.2.</a>	<a href="#">Table of Optional Driver Resource Attributes .....</a>	<a href="#">23</a>
<a href="#">6.3.</a>	<a href="#">Driver Resource Template Attributes .....</a>	<a href="#">24</a>

<a href="#">6.3.1.</a>	driver-charset (1setOf charset) .....	<a href="#">24</a>
<a href="#">6.3.2.</a>	driver-natural-language (1setOf naturalLanguage) ...	<a href="#">24</a>

<a href="#">6.3.3.</a>	driver-file-type (type2 keyword) .....	<a href="#">24</a>
<a href="#">6.3.4.</a>	driver-file-name (name(MAX)) .....	<a href="#">25</a>
<a href="#">7.</a>	Conformance Requirements .....	<a href="#">26</a>
<a href="#">7.1.</a>	IPP Client Conformance Requirements .....	<a href="#">26</a>
<a href="#">7.2.</a>	IPP Printer Conformance Requirements .....	<a href="#">26</a>
<a href="#">7.2.1.</a>	Resource Operations .....	<a href="#">26</a>
<a href="#">7.2.2.</a>	Resource Attributes .....	<a href="#">27</a>
<a href="#">7.2.3.</a>	Driver Resource Attributes .....	<a href="#">27</a>
<a href="#">8.</a>	IANA Considerations .....	<a href="#">28</a>
<a href="#">9.</a>	Internationalization Considerations .....	<a href="#">28</a>
<a href="#">10.</a>	Security Considerations .....	<a href="#">28</a>
<a href="#">11.</a>	Encodings of Additional Resource Tags .....	<a href="#">28</a>
<a href="#">12.</a>	References .....	<a href="#">28</a>
<a href="#">13.</a>	Authors' Addresses .....	<a href="#">29</a>
<a href="#">14.</a>	<a href="#">Appendix A</a> - Change History .....	<a href="#">30</a>
<a href="#">14.1.</a>	7 July 2000 - <a href="#">draft-ietf-ipp-get-resource-00.txt</a> .....	<a href="#">30</a>
<a href="#">15.</a>	Full Copyright Statement .....	<a href="#">30</a>



## **1. Introduction**

See [section 1](#) 'Introduction' in [[IPP-MOD](#)] for a full description of the IPP document set and overview information about IPP.

This document is a submission to the Internet Printing Protocol Working Group of the Internet Engineering Task Force (IETF). Comments should be submitted to the [ipp@pwg.org](mailto:ipp@pwg.org) mailing list.

This IPP Get Resource document specifies an extension to IPP/1.0 [[RFC-2565](#)] [[RFC-2566](#)] and IPP/1.1 [[IPP-MOD](#)] [[IPP-PRO](#)]. This document extends the current closed IPP object model with a passive polymorphic object which is intended to satisfy most growth needs for new object types in the long-term evolution of IPP via an extensible object framework.

This document defines: Resource object (passive polymorphic object); Resource get operations (e.g., Get-Resource-Attributes); Resource attributes (e.g., "resource-name"); new Printer attributes (e.g., "resource-type-supported"); Resource type of Driver (a morph of the Resource object); methods for supporting 'driver download' to IPP Client systems.

This document does not specify other possible Resource operations (e.g., 'Create-Resource') or Resource types (e.g., 'font'). A future document may specify a complete set of system admin operations for Resource objects.

This document is laid out as follows:

- [Section 2](#) adds the Resource object to the IPP object model.
- [Section 3](#) is the terminology used throughout the document.
- [Section 4](#) specifies the operations on Resource objects, including new status codes for Resource operations.
- [Section 5](#) specifies the attributes common to all Resource objects.
- [Section 6](#) specifies the Driver Resource type and its additional attributes - to allow client print support (e.g., driver) download (all or part of an IPP Client) from an IPP Printer.
- [Section 7](#) specifies the conformance requirements for this document.
- [Section 8](#), 9, and 10 specify IANA, internationalization, and security considerations.
- [Section 11](#) allocates new protocol encoding values for this

document.

Hastings, McDonald

Expires 7 January 2001

[Page 4]



- Sections [12](#), [13](#), [14](#), and [15](#) list references, authors' addresses, change history, and full IETF copyright statement.

## **[2.](#) IPP Model for Resources**

See [section 2](#) 'IPP Objects' in [[IPP-MOD](#)] for a full description of the IPP object model and terminology.

### 2.1. Resource Object

IPP Resource objects are used to model installed features or capabilities of IPP Printers (e.g., 'font'). All Resource object instances contain a common set of base Resource object attributes.

Resource object instances MAY have an additional set of attributes, according to their "resource-type" and IPP Printer implementation.

Resource objects instances MAY also have associated data, according to their "resource-type" and IPP Printer implementation. Resource data (if any) is available by reference in "resource-data-uri" or by value if "resource-data-present" is 'true' (i.e., a local copy of the Resource data is available on the IPP Printer).

[Section 4](#) describes each of the Resource operations in detail.



### **3. Terminology**

This specification document uses the terminology defined in this section.

#### **3.1. Conformance Terminology**

The terms "MUST", "MUST NOT", "REQUIRED", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC-2119](#)]. These terms are used to specify conformance requirements which apply if this specification is implemented (in addition to IPP/1.0 or higher).

#### **3.2. Model Terminology**

See [section 12.2](#) 'Model Terminology' in [[IPP-MOD](#)].



#### **4. Resource Operations**

The common semantics of all IPP Resource operations are the ones defined for all IPP operations in [[IPP-MOD](#)], e.g., "operation-id", "status-code", "attributes-charset", etc.

See [section 3.1](#) 'Common Semantics' in [[IPP-MOD](#)].

The following three Resource operations are REQUIRED for all IPP Printers to implement, if they implement Resource objects.

##### **4.1. Get-Resource-Attributes Operation**

REQUIRED - for IPP Printers to implement.

This operation allows an IPP Client to request the values of attributes of a Resource object instance and is similar to the Get-Job-Attributes operation (see section 3.2.5 in [[IPP-MOD](#)]). The only differences are that the operation is directed at a Resource object instance rather than a Job object instance, there is a "resource-type" operation attribute required when querying a Resource object, and the returned attribute group is a set of Resource object attributes rather than a set of Job object attributes.

For Resources, the possible names of attribute groups are:

- 'resource-template': the subset of the Resource Template attributes that the implementation supports for Resource objects.
- 'resource-description': the subset of the Resource Description attributes that the implementation supports for Resource objects.
- 'all': the special group 'all' that includes all attributes that the implementation supports for Resource objects.

Since an IPP Client MAY request specific attributes or named groups, there is a potential that there is some overlap. For example, if an IPP Client requests 'resource-create-time' and 'resource-description', the IPP Client is actually requesting the "resource-create-time" attribute once by naming it explicitly, and once by inclusion in the 'resource-description' group. In such cases, the IPP Printer object NEED NOT return the attribute only once in the response even if it is requested multiple times. The IPP Client SHOULD NOT request the same attribute in multiple ways.

It is NOT REQUIRED that a Resource object instance support all attributes belonging to a group (since some attributes are OPTIONAL).

However it is REQUIRED that each Resource object instance support all

group names.

#### 4.1.1. Get-Resource-Attributes Request

The following groups of attributes are part of the Get-Resource-Attributes Request when the request is directed at a Resource object:

##### Group 1: Operation Attributes

###### Natural Language and Character Set:

The "attributes-charset" and "attributes-natural-language" attributes as described in section 3.1.4.1 in [[IPP-MOD](#)].

###### Target:

The "printer-uri" (uri) operation attribute which is the target for this operation as described in section 3.1.5 in [[IPP-MOD](#)].

ISSUE\_1: The target of all IPP Resource operations is always simply "printer-uri" and separate required operation attributes are used to specify resource type and name or ID. This is like IPP Subscription objects but unlike the earlier IPP Job objects. Should we continue to follow the IPP Subscription object model?

###### Resource Type:

The "resource-type (type2 keyword)" attribute as described in [section 5.2.1](#) in this document.

###### Resource Name or ID:

The "resource-name (name(127))" attribute as described in [section 5.2.2](#) in this document OR  
the "resource-id (integer(1:MAX))" attribute as described in [section 5.2.3](#) in this document.

###### Requesting User Name:

The "requesting-user-name" (name(MAX)) attribute SHOULD be supplied by the IPP Client as described in section 8.3 in [[IPP-MOD](#)].

###### "requested-attributes" (1setOf keyword):

The IPP Client OPTIONALLY supplies this attribute. The IPP Printer MUST support this attribute. It is a set of attribute names and/or attribute group names in whose values the requester is interested. If the IPP Client omits this attribute, the IPP Printer MUST respond as if this attribute had been supplied with a value of 'all'.





#### 4.1.2. Get-Resource-Attributes Response

The Printer object returns the following sets of attributes as part of the Get-Resource-Attributes Response:

##### Group 1: Operation Attributes

###### Status Message:

In addition to the REQUIRED status code returned in every response, the response OPTIONALLY includes a "status-message" (text(255)) and/or a "detailed-status-message" (text(MAX)) operation attribute as described in sections [13](#) and [3.1.6](#) in [[IPP-MOD](#)].

###### Natural Language and Character Set:

The "attributes-charset" and "attributes-natural-language" attributes as described in section 3.1.4.2 in [[IPP-MOD](#)]. The "attributes-natural-language" MAY be the natural language of the Resource object, rather than the one requested.

##### Group 2: Unsupported Attributes

See section 3.1.7 in [[IPP-MOD](#)] for details on returning Unsupported Attributes.

The response NEED NOT contain the "requested-attributes" operation attribute with any supplied values (attribute keywords) that were requested by the IPP Client but are not supported by the IPP Printer. If the Printer object does include unsupported attributes referenced in "requested-attributes" and such attributes include group names, such as 'all', the unsupported attributes MUST NOT include attributes described in this document but not supported by the implementation.

##### Group 3: Resource Object Attributes

This is the set of requested attributes and their current values. The IPP Printer ignores (does not respond with) any requested attribute or value which is not supported or which is restricted by the security policy in force, including whether the requesting user is the user that created the Resource. However, the IPP Printer MUST respond with the 'unknown' value for any supported attribute (including all REQUIRED attributes) for which the IPP Printer does not know the value, unless it would violate the security policy. See the description of the "out-of-band" values in the beginning of Section 4.1 in [[IPP-MOD](#)].



## 4.2. Get-Resource-Data Operation

REQUIRED - for IPP Printers to implement.

This operation allows an IPP Client to request the values of attributes of a Resource object instance AND the value of associated Resource data (i.e., this operation is like 'Print-Job'). This operation is a strict superset of the Get-Resource-Attributes operation above. The only difference is that the operation returns Resource data in addition to Resource attributes. This operation is only legal for certain values of "resource-type".

Note: This operation is defined (rather than overloading the 'Get-Resource-Attributes' operation above) to simplify access control policies. Note that many possible future Resource types (e.g, 'font') have copyright and intellectual property considerations with respect to IPP Clients reading their associated data.

### 4.2.1. Get-Resource-Data Request

See [section 4.1.1](#) 'Get-Resource-Attributes Request' in this document.

The following groups of attributes are part of the Get-Resources request:

#### Group 1: Operation Attributes

See 'Group 1: Operation Attributes' in [section 4.1.1](#) 'Get-Resource-Attributes Request'.

### 4.2.2. Get-Resource-Data Response

See [section 4.1.2](#) 'Get-Resource-Attributes Response' in this document.

#### Group 1: Operation Attributes

See 'Group 1: Operation Attributes' in [section 4.1.2](#) 'Get-Resource-Attributes Response'.

#### Group 2: Unsupported Attributes



See 'Group 2: Unsupported Attributes' in [section 4.1.2](#) 'Get-Resource-Attributes Response'.

#### Group 3: Resource Object Attributes

See 'Group 3: Resource Object Attributes' in [section 4.1.2](#) 'Get-Resource-Attributes Response'.

#### Group 4: Resource Data Content

See [section 5.3.6](#) 'resource-data-present' in this document.

See [section 3.2.1.1](#) 'Print-Job Request' in [[IPP-MOD](#)].

The IPP Printer MUST return the Resource data content (if any) to the IPP Client, within the constraints of administratively configured access control policies and any applicable copyright or other intellectual property considerations.

### 4.3. Get-Resources Operation

REQUIRED - for IPP Printers to implement.

This operation allows an IPP Client to retrieve the list of Resource object instances (of a specified resource type) belonging to the target Printer object. The IPP Client may also supply a list of Resource attribute names and/or attribute group names. A group of Resource object attributes will be returned for each Resource object instance that is returned.

This operation is similar to the Get-Resource-Attributes operation, except that this Get-Resources operation returns attributes from possibly more than one object.

See [section 3.2.6](#) 'Get-Jobs Operation' in [[IPP-MOD](#)].

#### 4.3.1. Get-Resources Request

The IPP Client submits the Get-Resources request to an IPP Printer object.

The following groups of attributes are part of the Get-Resources request:

#### Group 1: Operation Attributes



See 'Group 1: Operation Attributes' in [section 4.1.1](#)  
'Get-Resource-Attributes Request'.

Resource Name or ID:  
[omitted]

"limit" (integer(1:MAX)):  
[added]

The IPP Client OPTIONALLY supplies this attribute. The IPP Printer MUST support this attribute. It is an integer value that determines the maximum number of resources that an IPP Client will receive from the IPP Printer.

Groups 2 to N: Resource Filter Attributes  
[added]

See 'Group 3: Resource Object Attributes' in [section 4.1.2](#)  
'Get-Resource-Attributes Response'.

This is the set of filter attributes and their filter values. The IPP Printer ignores Resources which do not satisfy the specified filter. A multi-valued filter attribute matches if the corresponding Resource object instance attribute contains all of the one or more values of the multi-valued filter attribute.

The filter criteria in each Resource Filter Attribute group MUST all be true for a match (logical AND within the set). But only ONE Resource Filter Group need be true for a match (logical OR across the sets).

#### 4.3.2. Get-Resources Response

The Printer object returns all of the Resource object instances, up to the number specified by the "limit" attribute, that match the criteria as defined by the filter attribute values supplied by the IPP Client in the request. It is possible that no Resource objects are returned since there may literally be none at the Printer, or there may be no Resource objects that match the criteria supplied by the IPP Client. If the IPP Client requests any Resource attributes at all, there is a set of Resource Object Attributes returned for each Resource object instance.

It is not an error for the IPP Printer to return 0 Resources. If the response returns 0 Resources because there are no Resources matching the criteria, and the request would have returned 1 or more Resources with a status code of 'successful-ok' if there had been Resources

matching the criteria, then the status code for 0 Resources MUST be

Hastings, McDonald

Expires 7 January 2001

[Page 12]



'successful-ok'.

#### Group 1: Operation Attributes

See 'Group 1: Operation Attributes' in [section 4.3.1](#)  
'Get-Resources Request'.

#### Group 2: Unsupported Attributes

See 'Group 2: Unsupported Attributes' in [section 4.1.2](#)  
'Get-Resource-Attributes Response'.

#### Groups 3 to N: Resource Object Attributes

See 'Group 3: Resource Object Attributes' in [section 4.1.2](#)  
'Get-Resource-Attributes Response'.

Resource object instances are returned sorted by "resource-id".

ISSUE\_2: Resource object instances are always returned sorted by  
"resource-id" and not by "resource-name" (more user-friendly).  
Should we add an operation attribute to control the sort order?

#### 4.4. Resource Operation Response Status Codes

client-error-not-authenticated  
client-error-not-authorized  
client-error-resource-type-not-supported  
client-error-resource-data-not-supported  
client-error-resource-data-not-present



## 5. Resource Attributes

### 5.1. Table of Required Resource Attributes

All IPP Printers that support Resource objects MUST implement the following REQUIRED attributes defined in this specification (on the Resource object or the Printer object):

Resource Attribute Operation or Resource Group Printer Attribute	Resource Attribute Type Printer Attribute Type
-----	-----
resource-type	(type2 keyword)
resource-type	[Operation group]
resource-type-supported	(1setOf type2 keyword)
resource-name	(name(127))
resource-name	[Operation group]
[none]	
resource-id	(integer(1:MAX))
resource-id	[Operation group]
max-resources-supported	(integer(0:MAX))
resource-printer-uri	(uri)
printer-uri	[Operation group]
printer-uri-supported	(1setOf uri)
resource-charset	(charset)
attributes-charset	[Operation group]
charset-configured	(charset)
charset-supported	(1setOf charset)
resource-natural-language	(naturalLanguage)
attributes-natural-language	[Operation group]
natural-language-configured	(naturalLanguage)
generated-natural-language-supported	(1setOf naturalLanguage)
resource-data-present	(boolean)
resource-data-present	[Resource group]
resource-data-present-supported	(1setOf boolean)
resource-data-uri	(1setOf uri)
resource-data-uri	[Resource group]
resource-data-schemes-supported	(1setOf uri)

resource-data-k-octets

(integer(0:MAX))

Hastings, McDonald

Expires 7 January 2001

[Page 14]

resource-data-k-octets	[Resource group]
resource-data-k-octets-supported	(rangeOfInteger (0:MAX))
resource-data-compression	(type3 keyword)
resource-data-compression	[Resource group]
compression-supported	(1setOf type3 keyword)
resource-create-user-name	(name(MAX))
requesting-user-name	[Operation group]
[none]	
resource-create-date-time	(dateTime)
resource-create-date-time	[Resource group]
[none]	
resource-create-time	(integer(0:MAX))
[none]	
printer-current-time	(integer(0:MAX))
resource-expiration-time	(integer(0:MAX))
[none]	
[printer-current-time + duration]	
resource-duration	(integer(0:MAX))
resource-duration	[Resource group]
resource-duration-default	(integer(0:MAX))
resource-duration-supported	(rangeOfInteger(0:MAX))
resource-persistence	(boolean)
resource-persistence	[Resource group]
resource-persistence-supported	(boolean)

## 5.2. Table of Optional Resource Attributes

All IPP Printers that support Resource objects MAY implement the following OPTIONAL attributes defined in this specification (on the Resource object or the Printer object):

Resource Attribute	Resource Attribute Type
Operation or Resource Group	
Printer Attribute	Printer Attribute Type
-----	-----
resource-info	(text(127))
resource-info	[Resource group]
[none]	
resource-document-formats	(1setOf mimeType)
document-format-default	(mimeType)
document-format-supported	(1setOf mimeType)

resource-os-types

(1setOf type2 keyword)

Hastings, McDonald

Expires 7 January 2001

[Page 15]

resource-os-types-default	(1setOf type2 keyword)
resource-os-types-supported	(1setOf type2 keyword)
resource-change-time	(integer(0:MAX))
[none]	
[none]	
resource-refresh-time	(integer(0:MAX))
[none]	
[none]	

### 5.3. Resource Template Attributes

#### 5.3.1. resource-info (text(127))

OPTIONAL - for IPP Printers to implement.

This attribute specifies descriptive information about this Resource object. This may include manufacturer, version, copyright, etc.

See [section 4.4.6](#) 'printer-info' and [section 4.4.9](#) 'printer-make-and-model' in [[IPP-MOD](#)].

#### 5.3.2. resource-charset (charset)

REQUIRED - for IPP Printers to implement.

This attribute specifies the charset of 'text' and 'name' attributes of the Resource and of textual data in the associated Resource data (if any).

#### 5.3.3. resource-natural-language (naturalLanguage)

REQUIRED - for IPP Printers to implement.

This attribute specifies the natural language of 'text' and 'name' attributes of the Resource and of textual data in the associated Resource data (if any).





#### 5.3.4. resource-document-formats (1setOf mimeType)

OPTIONAL - for IPP Printers to implement.

This attribute specifies the list of document formats supported by the Resource.

#### 5.3.5. resource-os-types (1setOf type2 keyword)

OPTIONAL - for IPP Printers to implement.

This attribute specifies the list of target operating system types of the Resource.

See IANA registry of operating system names at [[OS-TYPE](#)].

#### 5.3.6. resource-data-present (boolean)

REQUIRED - for IPP Printers to implement.

The attribute indicates whether or not a local copy of the Resource data is present at the IPP Printer.

When "resource-data-present" is 'true' on a Resource object instance, it indicates that the IPP Printer has stored a local copy of the Resource data or has fetched a local copy of the Resource data that was specified by reference in "resource-data-uri".

When "resource-data-present" is 'false' on a Resource object instance and "resource-data-uri" is empty, it indicates that there is no Resource data.

When "resource-data-present" is 'false' on a Resource object instance and "resource-data-uri" is non-empty, it indicates that the IPP Printer has NOT yet fetched a local copy of the Resource data that was specified by reference and the value of "resource-data-k-octets" is unverified.

See [section 5.3.7](#) "resource-data-uri" in this document.

See [section 5.3.8](#) "resource-data-k-octets" in this document.



#### 5.3.7. resource-data-uri (1setOf uri)

REQUIRED - for IPP Printers to implement.

This attribute contains the URI of associated Resource data (if any) as a reference.

Lazy Refresh:

An IPP Printer NEED NOT immediately fetch a local copy of the Resource data specified by reference in "resource-data-uri", but MUST set "resource-data-present" to 'false' until a local copy is fetched.

When an IPP Printer does fetch a local copy of the Resource data, it MUST set (REQUIRED) "resource-data-present" to 'true', set (REQUIRED) "resource-data-k-octets" to the actual size, and update the timestamp in the (OPTIONAL) "resource-refresh-time" attribute.

ISSUE\_3: This 'lazy refresh' behavior may have performance and 'stale data' consequences for IPP Clients. Because the manufacturer may also be slow to inform installed IPP Printers of a new version of a Resource (for update by means outside of this specification) the 'stale data' problem may also apply to IPP Printers. Should we add an operation attribute to prevent this 'lazy refresh' behavior?

See [section 5.3.6](#) "resource-data-present" in this document.

See [section 4.4.27](#) 'reference-uri-schemes-supported' in [[IPP-MOD](#)].

See [section 3.2.2](#) 'Print-URI' in [[IPP-MOD](#)].

#### 5.3.8. resource-data-k-octets (integer(0:MAX))

REQUIRED - for IPP Printers to implement.

This attribute contains the size of associated Resource data (if any).

See 'Lazy Refresh' in [section 5.3.7](#) 'resource-data-uri' for IPP Printer behavior with respect to "resource-data-k-octets".

See [section 5.3.6](#) "resource-data-present" in this document.

#### 5.3.9. resource-data-compression (type3 keyword)

REQUIRED - for IPP Printers to implement.

This attribute identifies the compression of the associated Resource



data (if any).

See [section 4.4.32](#) 'compression-supported' in [[IPP-MOD](#)] for standard keyword values.

#### 5.3.10. resource-create-date-time (dateTime)

REQUIRED - for IPP Printers to implement.

This attribute indicates the date and time at which the Resource object instance was created.

Note: This time SHOULD reflect the actual 'build date' of the Resource data rather than simply the 'install date' on the IPP Printer, because this is more informative for the end user.

See [section 4.4.30](#) 'printer-current-time' in [[IPP-MOD](#)].

See [section 4.3.14.5](#) 'date-time-at-creation' in [[IPP-MOD](#)].

#### 5.3.11. resource-duration (integer(0:MAX))

REQUIRED - for IPP Printers to implement.

This attribute indicates length of the Resource object instance lease in seconds.

See [section 5.4.6](#) "resource-create-time" in this document.

See [section 5.4.9](#) "resource-expiration-time" in this document.

#### 5.3.12. resource-persistence (boolean)

REQUIRED - for IPP Printers to implement.

This attribute indicates whether or not this Resource object instance is persistent (preserved by the IPP Printer across power cycles).

A 'true' value specifies an infinite lease and supersedes "resource-duration" and "resource-expiration-time". A 'false' value specifies a finite lease and selects use of "resource-duration" and "resource-expiration-time".

See [section 5.3.11](#) "resource-duration" in this document.

See [section 5.4.9](#) "resource-expiration-time" in this document.



## 5.4. Resource Description Attributes

### 5.4.1. resource-type (type2 keyword)

REQUIRED - for IPP Printers to implement.

This attribute identifies the type of this Resource object instance which determines additional Resource attributes specific to the named type.

The following standard keyword values are defined:

'driver': The Resource contains client print support files (e.g., a driver) for an IPP Client (see [section 6](#) 'Driver Resource Type' in this document) for this IPP Printer.

### 5.4.2. resource-name (name(127))

REQUIRED - for IPP Printers to implement.

This attribute is the human-readable name of the Resource. This name is more user-friendly than the integer "resource-id" attribute.

This name MUST be unique among Resources of the SAME "resource-type". IPP Printers MUST not allow Resource object instances of the SAME "resource-type" with duplicate "resource-name" values.

Note: This attribute has been specified as REQUIRED (unlike "job-name") in the interests of ease-of-use. IPP Printers are expected to implement large numbers of Resource objects and the guaranteed presence of the user-friendly name will benefit ease-of-use.

See [section 4.3.5](#) 'job-name' in [[IPP-MOD](#)].

### 5.4.3. resource-id (integer(1:MAX))

REQUIRED - for IPP Printers to implement.

This attribute contains the locally unique ID of the Resource. The IPP Printer, on creation of a new Resource (by means outside of this specification), generates an ID which identifies the new Resource on that Printer (but not globally). The zero '0' value is not included





to allow for compatibility with SNMP index values which also cannot be zero '0'.

See [section 4.3.2](#) 'job-id' in [[IPP-MOD](#)].

#### 5.4.4. resource-printer-uri (uri)

REQUIRED - for IPP Printers to implement.

This attribute identifies the IPP Printer that hosts this Resource object instance.

See [section 4.3.3](#) 'job-printer-uri' in [[IPP-MOD](#)].

#### 5.4.5. resource-create-user-name (name(MAX))

REQUIRED - for IPP Printers to implement.

This attribute contains the name of the end user that created this Resource object instance.

For factory-installed resources, "resource-create-user-name" MUST be set to the empty string to prevent namespace conflicts in end user networks.

See [section 4.3.6](#) 'job-originating-user-name' in [[IPP-MOD](#)].

#### 5.4.6. resource-create-time (integer(0:MAX))

REQUIRED - for IPP Printers to implement.

This attribute indicates the time at which the Resource object instance was created.

Note: This time SHOULD reflect the actual 'build time' of the Resource data rather than simply the 'install time' on the IPP Printer, because this is more informative for the end user.

See [section 4.4.29](#) 'printer-up-time' in [[IPP-MOD](#)].

See [section 4.3.14.1](#) 'time-at-creation' in [[IPP-MOD](#)].



#### 5.4.7. resource-change-time (integer(0:MAX))

REQUIRED - for IPP Printers to implement.

This attribute indicates the time at which the Resource object instance was last changed.

See [section 5.4.6](#) "resource-create-time" in this document.

See [section 4.4.29](#) 'printer-up-time' in [[IPP-MOD](#)].

#### 5.4.8. resource-refresh-time (integer(0:MAX))

REQUIRED - for IPP Printers to implement.

This attribute indicates the time at which the Resource object instance was last refreshed (i.e., a local copy of the Resource data was made).

See [section 5.4.6](#) "resource-create-time" in this document.

See [section 4.4.29](#) 'printer-up-time' in [[IPP-MOD](#)].

#### 5.4.9. resource-expiration-time (integer(0:MAX))

REQUIRED - for IPP Printers to implement.

This attribute indicates the time at which the Resource object instance lease will expire.

See [section 5.4.6](#) "resource-create-time" in this document.

See [section 5.3.11](#) "resource-duration" in this document.

See [section 4.4.29](#) 'printer-up-time' in [[IPP-MOD](#)].

See [section 4.3.14.5](#) 'date-time-at-creation' in [[IPP-MOD](#)].



## 6. Driver Resource Type

### 6.1. Table of Required Driver Resource Attributes

All IPP Printers that support Driver Resource objects MUST implement the following REQUIRED attributes defined in this specification (on the Driver Resource object or the Printer object):

Driver Resource Attribute Operation or Resource Group Printer Attribute	Driver Attribute Type Printer Attribute Type
-----	-----
driver-file-type	(type2 keyword)
driver-file-type	[Resource group]
driver-file-type-default	(type2 keyword)
driver-file-type-supported	(1setOf type2 keyword)
driver-file-name	(name(MAX))
driver-file-name	[Resource group]
[none]	

### 6.2. Table of Optional Driver Resource Attributes

All IPP Printers that support Driver Resource objects MAY implement the following OPTIONAL attributes defined in this specification (on the Driver Resource object or the Printer object):

Driver Resource Attribute Operation or Resource Group Printer Attribute	Driver Attribute Type Printer Attribute Type
-----	-----
driver-charset	(1setOf charset)
driver-charset	[Resource group]
charset-configured	(charset)
charset-supported	(1setOf charset)
driver-natural-language	(1setOf naturalLanguage)
driver-natural-language	[Resource group]
natural-language-configured	(naturalLanguage)
generated-natural-language-configured	(1setOf naturalLanguage)



### 6.3. Driver Resource Template Attributes

#### 6.3.1. driver-charset (1setOf charset)

OPTIONAL - for IPP Printers to implement.

This attribute specifies the list of client charsets supported by the Driver Resource (when installed on the client system).

#### 6.3.2. driver-natural-language (1setOf naturalLanguage)

OPTIONAL - for IPP Printers to implement.

This attribute specifies the list of client natural languages supported by the Driver Resource (when installed on the client system).

#### 6.3.3. driver-file-type (type2 keyword)

REQUIRED - for IPP Printers to implement.

This attribute specifies the client file type of this Driver Resource (when installed on the client system).

The following standard keyword values are defined:

'none': The Driver Resource contains client print support files in unspecified (opaque) format.

'exec': The Driver Resource contains client print support files in native executable format of the operating system(s) specified in "resource-os-types" attribute, for example '.exe' on Microsoft systems.

'gpd': The Driver Resource contains client print support files in Microsoft GPD format.

'java': The Driver Resource contains client print support files in Java format.

'ppd': The Driver Resource contains client print support files in Adobe PPD format.

'printcap': The Driver Resource contains client print support files in the UNIX 'printcap' format.





'script': The Driver Resource contains client print support files native script format of the operating system(s) specified in the "resource-os-types" attribute, for example Bourne shell on UNIX s  
Note: This type may be ambiguous on some target operating system

'updf': The Driver Resource contains client print support files i (work-in-progress) PWG UPDF format.

#### 6.3.4. driver-file-name (name(MAX))

REQUIRED - for IPP Printers to implement.

This attribute specifies the client file name of this Driver Resource (when installed on the client system) or the empty string (if none configured).  
If this Driver Resource contains multiple client print support files, then "driver-file-name" SHOULD specify an 'install directory path'.



## **7. Conformance Requirements**

### **7.1. IPP Client Conformance Requirements**

IPP Clients **MUST** supply the required operation attributes in Resource operations.

### **7.2. IPP Printer Conformance Requirements**

#### **7.2.1. Resource Operations**

All IPP Printers that support Resource objects **MUST** implement the following **REQUIRED** operations defined in this specification:

Resource Operation

-----

Get-Resources

Get-Resource-Attributes

Get-Resource-Data



#### 7.2.2. Resource Attributes

See [section 5.1](#) 'Table of Required Resource Attributes' and [section 5.2](#) 'Table of Optional Resource Attributes'.

#### 7.2.3. Driver Resource Attributes

See [section 6.1](#) 'Table of Required Driver Resource Attributes' and [section 6.2](#) 'Table of Optional Driver Resource Attributes'.

## **8. IANA Considerations**

See [section 6](#) 'IANA Considerations' in [[IPP-MOD](#)].

## **9. Internationalization Considerations**

This IPP Resource Objects and Get Resource Operations specification continues support for the internationalization in [[IPP-MOD](#)] attributes containing text strings and names.

See [section 7](#) 'Internationalization Considerations' in [[IPP-MOD](#)].

## **10. Security Considerations**

This IPP Resource Objects and Get Resource Operations specification inherits the same security considerations for Resources as are specified for Jobs in [[IPP-MOD](#)].

See [section 8](#) 'Security Considerations' in [[IPP-MOD](#)].

## **11. Encodings of Additional Resource Tags**

The section assigns values to new protocol tags as extensions to the encoding defined in [[IPP-PRO](#)].

The resource-attributes-tag delimits Resource Template Attributes Groups in requests and Resource Attributes Groups in responses.

Tag Value (Hex)	Tag Meaning
-----	-----
0x08	resource-attributes-tag
0x1E	Get-Resource-Attributes operation
0x1F	Get-Resource-Data operation
0x20	Get-Resources operation

## **12. References**

See [section 9](#) 'References' in [[IPP-MOD](#)].

[[IPP-MOD](#)] R. deBry, T. Hastings, R. Herriot, S. Isaacson, P. Powell.



IPP/1.1 Model and Semantics, <[draft-ietf-ipp-model-v11-07.txt](#)>, May 2000 (adopted by IESG as Proposed Standard in June 2000).

[IPP-NOT] S. Isaacson, J. Martin, R. deBry, T. Hastings, M. Shepherd, R. Bergman. IPP Event Notification Specification, <[draft-ietf-ipp-not-spec-02.txt](#)> (work-in-progress), March 2000.

[OS-TYPE] IANA Registry of Operating System Names at <ftp://ftp.isi.edu/in-notes/iana/assignments/operating-system-names>.

### **13. Authors' Addresses**

Tom Hastings  
Xerox Corporation  
701 S Aviation Blvd, MS 834-03E  
El Segundo, CA 90245

Phone: +1 310-333-6413  
Email: [hastings@cp10.es.xerox.com](mailto:hastings@cp10.es.xerox.com)

Ira McDonald  
High North Inc  
221 Ridge Ave  
Grand Marais, MI 49839

Phone: +1 906-494-2434 or +1 906-494-2697  
Email: [imcdonald@sharpplabs.com](mailto:imcdonald@sharpplabs.com)  
Email: [imcdonal@sdsp.mc.xerox.com](mailto:imcdonal@sdsp.mc.xerox.com)





#### **14. [Appendix A](#) - Change History**

[To be deleted before RFC publication]

14.1. 7 July 2000 - [draft-ietf-ipp-get-resource-00.txt](#)

initial version

#### **15. Full Copyright Statement**

Copyright (C) The Internet Society (2000). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

