



The Printer Working Group

~~January 29, 2020~~  
Best Practice Draft

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## Job Accounting with IPP v1.0

Status: Interim

Abstract: This document discusses how to perform different kinds of job accounting with IPP and how to address privacy and consent issues associated with accounting information.

This is a PWG Best Practice. For a definition of a "PWG Best Practice", see:

<https://ftp.pwg.org/pub/pwg/general/pwg-process30.pdf>

This best practice is available electronically at:

<https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippaccounting10-20200129.docx>

<https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippaccounting10-20200129.pdf>

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2 Title: *Job Accounting with IPP v1.0*

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## 64 1. Introduction

65 This document discusses how to perform different kinds of job accounting with IPP, including  
66 auditing of content and usage, billing, supply and service management, and diagnostics and  
67 debugging. In addition, this document provides guidance on the privacy and consent issues  
68 associated with the collection, storage, and processing of accounting information

## 69 2. Terminology

### 70 2.1 Conformance Terminology

71 Capitalized terms, such as MUST, MUST NOT, RECOMMENDED, REQUIRED, SHOULD,  
72 SHOULD NOT, MAY, and OPTIONAL, have special meaning relating to conformance as  
73 defined in Key words for use in RFCs to Indicate Requirement Levels [BCP14]. The term  
74 CONDITIONALLY REQUIRED is additionally defined for a conformance requirement that  
75 applies when a specified condition is true.

76 The term DEPRECATED is used for previously defined and approved protocol elements that  
77 SHOULD NOT be used or implemented. The term OBSOLETE is used for previously defined  
78 and approved protocol elements that MUST NOT be used or implemented.

### 79 2.2 Printing Terminology

80 Normative definitions and semantics of printing terms are imported from the Internet Printing  
81 Protocol/1.1 [STD92].

82 *Administrator*: An End User who is also authorized to manage all aspects of an Output  
83 Device or Printer, including creating the printer instances and controlling the authorization  
84 of other End Users and Operators [RFC2567].

85 *Client Supplied Metadata*: All Job/Document Template and operation attributes supplied in  
86 a Job or Document Creation request.

87 *Document*: An object created and managed by a Printer that contains the description,  
88 processing, and status information. A Document object may have attached data and is  
89 bound to a single Job.

90 *End User*: A person or software process that is authorized to perform basic printing functions,  
91 including finding/locating a printer, creating a local instance of a printer, viewing printer  
92 status, viewing printer capabilities, submitting a print job, viewing print job status, and  
93 altering the attributes of a print job [RFC2567].

94 *Job*: An object created and managed by a Printer that contains description, processing, and  
95 status information. The Job also contains zero or more Document objects.

96 *Job Accounting*: Collection of Metadata to audit, bill, or otherwise report on the origin,  
97 processing, and disposition of Jobs and Documents.

98 *Logical Device*: a print server, software service, or gateway that processes jobs and either  
99 forwards or stores the processed job or uses one or more Physical Devices to render output.

100 *Metadata*: Information about a Job or Document such as name, originator, owner, format,  
101 state, counters, dates and times, content, and template attributes.

102 *Operator*: An End User that also has special rights on the Output Device or Printer. The  
103 Operator typically monitors the status of the Printer and manages and controls the Jobs at  
104 the Output Device [RFC2567]. The Operator is allowed to query and control the Printer,  
105 Jobs, and Documents based on site policy.

106 *Output Device*: a single Logical or Physical Device

107 *Personal Data*: Information related to a person that can be used to identify the person such  
108 as a name, email address, government-issued identification, medical information, and so  
109 forth. [IPPPRIVACY]

110 *Physical Device*: a hardware implementation of a endpoint device, e.g., a marking engine, a  
111 fax modem, etc.

112 *Printer Generated Metadata*: All Job and Document Status attributes generated by Printer.

### 113 **2.3 Protocol Role Terminology**

114 The following protocol roles are defined to specify unambiguous conformance requirements:

115 *Client*: Initiator of outgoing connections and sender of outgoing operation requests  
116 (Hypertext Transfer Protocol -- HTTP/1.1 [RFC7230] User Agent).

117 *Printer*: Listener for incoming connections and receiver of incoming operation requests  
118 (Hypertext Transfer Protocol -- HTTP/1.1 [RFC7230] Server) that represents one or more  
119 Physical Devices or a Logical Device.

### 120 **2.4 Acronyms and Organizations**

121 *IANA*: Internet Assigned Numbers Authority, <http://www.iana.org/>

122 *IETF*: Internet Engineering Task Force, <http://www.ietf.org/>

123 *ISO*: International Organization for Standardization, <http://www.iso.org/>

124 *PWG*: Printer Working Group, <http://www.pwg.org/>

125 *UI*: [User Interface](#)



## 127 3. Rationale

### 128 3.1 Use Cases

#### 129 3.1.1 Auditing of Printing Usage

130 Jane manages a shared office multifunction device and wants to know who prints, what kinds  
131 of Jobs are printed, how are those Jobs are submitted, and where are they printed. She  
132 configures a Job Accounting service on her network for use with the Printer so that all Jobs  
133 are routed through the service and she can then generate reports showing the information  
134 she is interested in.

#### 135 3.1.2 Auditing of Print Content

136 Bob is concerned that the students in his computer lab are printing inappropriate content on  
137 the school's color printer. He configures a server on his network to act as a print server that  
138 stores copies of every Job so that he can periodically review what is being printed.

#### 139 3.1.3 Billing

140 Kate is the owner of a managed print service company that supplies printers and print  
141 servers to businesses. She collects information about each Job that is printed including  
142 whether the Job is printed in color, how many sheets are printed on, how many sides are  
143 printed on, and what finishing options (if any) are used. She uses the collected information  
144 to bill each business for their usage and to plan customer visits to perform maintenance or  
145 supply additional media, ink, and/or toner based on their usage.

#### 146 3.1.4 Diagnostics and Debugging

147 Joe is a support technician at Kate's managed print service company. He uses the  
148 accounting data to reproduce problems specific to a particular Job or Client application.

#### 149 3.1.5 Supplying Required Information

150 Some of Kate's larger customers need to be able to track their printing expenses based on  
151 their own contract numbers. Kate configures the print server to require the Client to supply  
152 a ~~user ID and~~ contract number with every new Job, and then includes ~~the user ID and~~  
153 contract number in the billing reports ~~sent~~ to those customers.

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#### 154 3.1.6 Supplying Optional Information

155 Some of Kate's customers want to know what applications their End Users are printing from.  
156 Kate configures the printer server to request the application name from the Client with every  
157 Job, and then includes a separate informational report to her customers showing the amount  
158 of printing that has occurred for each application.



### 3.1.7 Authenticating End Users

Bob uses authentication to both identify and authorize End Users that submit Print Jobs.

### 3.1.8 Authenticating Print Services

Bob configures his Client computers to require the Print Services they communicate with to have an X.509 certificate using their company root certificate.

### 3.1.9 Reconfiguring a Print Service

One of Kate's customers wants to change the information that is tracked for printing. After she makes the configuration changes, each Client computer detects the changes and shows the explicit consent UI the next time an End User submits a Print Job.

## 3.2 Exceptions

In addition to the exceptions in the following sub-sections, the standard Internet Printing Protocol/1.1 [STD92] access control, authorization, and role exceptions apply to the use cases defined in section 3.2.

### 3.2.1 Opt-Out of Mandatory Data Collection

Mary selects a Printer in her Client application for a report she is printing. Her Client application queries the Printer and presents a dialog showing the mandatory data that is required to submit a Job to this Printer. She decides she does not want to send that data and cancels the print request for that Printer. The Client application does not submit a Job to the Printer.

### 3.2.2 Opt-Out of Optional Data Collection

John selects a Printer in his Client application for a report he is printing. His Client application queries the Printer and presents a dialog showing the optional data that is requested when submitting a Job to this Printer. He decides he does not want to send that data and indicates his preference using the supplied UI before activating the print action. The Client application submits the Job to the Printer without the requested data.

## 3.3 Out of Scope

The following are considered out of scope for this document:

1. Definition of authentication methods and requirements;
2. Definition of user account configuration and requirements; and
3. Definition of TLS security requirements.

### 191 3.4 Design Requirements

192 The design requirements for this document are:

- 193 1. Define requirements for the authentication of the Client, Printer, and/or End  
194 User;
- 195 2. Define best practices for the collection of (potentially required) metadata from  
196 the Client;
- 197 3. Define best practices for the generation of metadata by the Printer;
- 198 4. Define requirements for explicit privacy and data collection policies that are  
199 accessible to/discoverable by Client;
- 200 5. Define requirements for explicit consent for all metadata that is sent from the  
201 Client to the Printer;
- 202 6. Define best practices for audit logging;
- 203 7. Define requirements for data protection;
- 204 8. Define best practices for the validation of all metadata; and
- 205 9. Define best practices for interoperability.

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## 206 4. Job Accounting with IPP

### 207 4.1 Client Supplied Metadata

208 Clients supply attributes in Job or Document Creation requests to specify both print intent  
209 and informational metadata, including the Job name ("job-name") and Document name  
210 ("document-name"). Two additional Job Template attributes, "job-accounting-user-id" and  
211 "job-account-id" [PWG5100.7], can be supplied to specify End User and billing identifiers for  
212 the Job Accounting system separate from the authenticated user. While these values are  
213 not authenticated, they can often be validated against the authenticated user. These  
214 attributes are sometimes used together to specify a logical user for a given organizational  
215 account.

### 216 4.2 Printer Generated Metadata

217 Printers generate attributes and values for Job and Document objects based on the  
218 processing they perform. Per the Internet Printing Protocol/1.1 [STD92], the "job-originating-  
219 user-name" and "job-originating-user-uri" Job Status attributes contain the most  
220 authenticated identity of the Job owner.

221 The "job-impressions", "job-impressions-col", "job-k-octets", "job-media-sheets", "job-  
222 media-sheets-col", "job-pages", and "job-pages-col" attributes can be provided by a Client  
223 in a Job Creation request but are best generated by the Printer after inspection of the  
224 Document data. Similarly, the "impressions", "impressions-col", "k-octets", "media-sheets",  
225 "media-sheets-col", "pages", and "pages-col" attributes can be provided by a Client in a  
226 Document Creation request but are best generated by the Printer after inspection of the  
227 Document data.

229 Printers provide a receipt of values use for each Job and Document Template attribute in  
230 the corresponding "xxx-actual" Job and Document Status attributes. For example, the actual  
231 media used for a Job is reported in the "media-col-actual" Job Status attribute.

232 **4.3 Job Creation Requests and Recommended/Required Attributes**

Deleted: Requiring Attributes in

233 The "printer-mandatory-job-attributes (1setOf keyword)" Printer Description attribute  
234 [PWG5100.13] is used by a Printer to list the operation and Job Template attributes that a  
235 Client MUST supply in a Job Creation Request. Clients MUST support this attribute and  
236 Printers MUST supply this attribute if specific attributes are needed for Job Accounting.

237 The "printer-requested-job-attributes (1setOf keyword)" Printer Description attribute (section  
238 5.1.1) is used by a Printer to list the operation and Job Template attributes that a Client  
239 SHOULD supply in a Job Creation Request. Clients SHOULD support this attribute and  
240 Printers MUST supply this attribute if specific attributes are used but not required for Job  
241 Accounting.

242 These attributes are typically configured by an Administrator, either using the Set-Printer-  
243 Attributes [RFC3380] operation or some out-of-band mechanism.

244 **4.4 Explicit Consent**

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245 In any Job Accounting system, certain information is necessary, such as a billing account  
246 number, while other information is "nice to have", such as the Client's operating system  
247 name and version. Clients MUST provide End Users with the ability to control whether  
248 necessary and "nice to have" attributes that are not associated with other UI controls  
249 (authenticated user, media settings, etc.) are provided in Job Creation requests. Figure 1  
250 shows one possible UI.

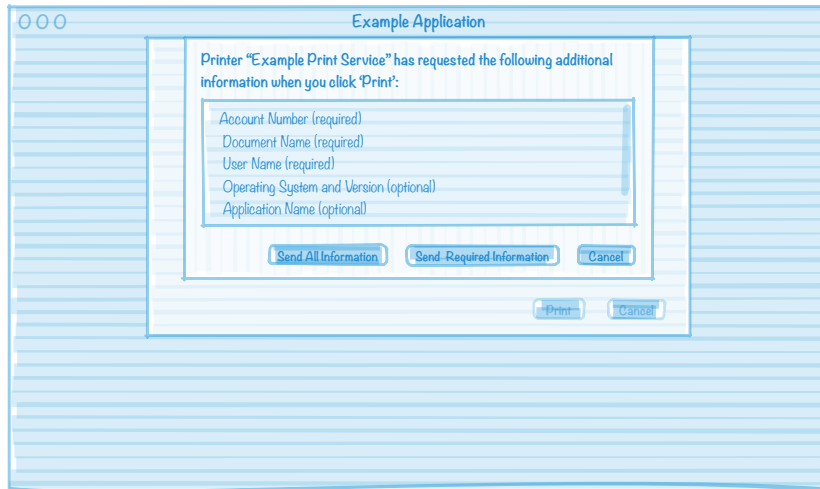


Figure 1 - Example **Explicit Consent Dialog**

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254

## 255 4.5 Privacy and Data Retention Policies

256 The IPP Privacy Attributes [IPP-PRIVACY] provide a framework for a Printer to report its  
257 privacy and data retention policies to the Client, which can then be presented to the End  
258 User. Printers and Clients conforming to this document MUST also conform to the IPP  
259 Privacy Attributes.

## 260 5. New Attributes

### 261 5.1 Printer Description Attributes

#### 262 5.1.1 printer-requested-job-attributes (1setOf keyword)

263 This RECOMMENDED attribute lists the attributes the Printer wants but does not need in  
264 order to support Job Accounting. Member attributes of collections are specified by  
265 concatenating attribute names delimited by the period (".") character, e.g., the "document-  
266 source-application-name" member attribute of the "document-format-details" operation  
267 attribute [PWG5100.7] would be requested using the keyword value 'document-format-  
268 details.document-source-application-name'. If supported, Clients MUST allow the End User  
269 to explicitly consent to the sending of any attributes or values that are not explicitly chosen  
270 by the End User.

272 For example, a Printer can list the 'media' and 'media-col' keywords in "printer-requested-  
273 job-attributes". If the Client application provides a UI control for selecting a media size, no  
274 additional consent is needed since the UI allows the User to select which value is sent.

275 However, if a Printer lists the "document-format-details.document-source-application-name"  
276 keyword in "printer-requested-job-attributes", it is unlikely that the Client application will  
277 provide a UI control for selecting the application name that is sent to the Printer. In this case,  
278 the Client MUST provide a UI that allows the End User to opt out of sending the requested  
279 information. If the End User opts out of sending the requested information, the Client MUST  
280 NOT send it.

## 281 6. Internationalization Considerations

282 For interoperability and basic support for multiple languages, conforming implementations  
283 support:

- 284 1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8)  
285 [STD63] encoding of Unicode [UNICODE] [ISO10646]; and
- 286 2. The Unicode Format for Network Interchange [RFC5198] which requires  
287 transmission of well-formed UTF-8 strings and recommends transmission of  
288 normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

289 Unicode NFC is defined as the result of performing Canonical Decomposition (into base  
290 characters and combining marks) followed by Canonical Composition (into canonical  
291 composed characters wherever Unicode has assigned them).

## 292 7. Security Considerations

293 The IPP extensions defined in this document require the same security considerations as  
294 defined in the [Internet Printing Protocol/1.1 \[STD92\]](#), including the [TLS considerations in the](#)  
295 [Opportunistic Security: Some Protection Most of the Time \[RFC7435\]](#) and  
296 [Recommendations for Secure Use of Transport Layer Security \(TLS\) and Datagram](#)  
297 [Transport Layer Security \(DTLS\) \[RFC7525\]](#). The following subsections provide  
298 considerations specific to this document.

### 299 7.1 Client Considerations

300 Clients MUST:

- 301 1. Allow the End User to examine a Printer's privacy and data handling policies;
- 302 2. Allow the End User to opt out of sending requested attributes in Job or  
303 Document Creation requests;
- 304 3. Allow the End User to cancel a Job submission if the End User does not wish to  
305 supply mandatory attributes in Job or Document Creation requests;

Deleted: IPP/1.1: Model and Semantics

Deleted: RFC8011

- 308 4. Provide confidentiality of data in transit using TLS encryption [RFC5246] of
- 309 Printer connections;
- 310 5. Authenticate their connections to Printers, such as by validating the Printer's
- 311 X.509 certificate or using other in-band mutual authentication protocols; and
- 312 6. Support authentication of End Users using HTTP authentication methods.

## 313 7.2 Printer Considerations

314 Printers MUST:

- 315 1. Provide information on configured privacy and data handling policies;
- 316 2. Provide lists of optional (requested) and mandatory attributes for Job and
- 317 Document Creation requests;
- 318 3. Validate the HTTP Host request header in order to protect against DNS
- 319 rebinding attacks;
- 320 4. Provide confidentiality of data in transit using TLS encryption [RFC5246] of
- 321 Client connections;
- 322 5. Support authentication of Clients using X.509 certificate validation, HTTP
- 323 authentication methods, and/or other mechanisms;
- 324 6. Support authentication of End Users using HTTP authentication methods; and
- 325 7. Provide confidentiality of Document and Job data at rest.

## 326 7.3 Privacy and Data Collection

327 Printers SHOULD consider all Job and Document attributes as potentially containing

328 Personal Data. The following attributes explicitly contain Personal Data:

329 "document-metadata": Contains author information

330 "job-originating-user-name" and "job-originating-user-uri": The most authenticated

331 Job owner

332 The following attributes can be used to identify individuals or Client devices:

333 "document-format-details": Contains application and operating system information

## 334 7.4 Data Protection

335 TBD

## 336 7.5 Data Validation

337 TPM mechanisms to provide signed information?

338 Using Client/Printer/User authentication as a source of trust?

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392 Ira McDonald - High North  
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394 **10. Change History**

395 **10.1 January 29, 2020**

- 396 • Added discussion of user and printer authentication in use cases
- 397 • Added discussion of changing consent requirements in new use case
- 398 • Section 3.1.5: Added user ID
- 399 • Section 3.3: Added definition of user account configuration/requirements
- 400 • Section 4.3: Updated title, added reference to RFC 3380
- 401 • Global: Use "explicit consent" throughout
- 402 • Section 4.4: Clarify that only information not entered through UI controls needs
- 403 explicit consent
- 404 • Sections 7 and 8: Added references to RFC 7435 and 7525
- 405 • Section 8: Add reference to RFC 3380

406 **10.2 October 22, 2019**

- 407 • Status: Interim
- 408 • Section 2: Added some terms and acronyms that were missing.
- 409 • Section 3: Cleaned up use cases, out of scope, and design requirements.
- 410 • Section 3.2: Added exceptions.
- 411 • Section 4: Added discussion of informed consent, notion of required and requested
- 412 attributes/values for accounting.
- 413 • New Section 5: "printer-requested-job-attributes"
- 414 • Section 7.1: Added explicit informed consent
- 415 • Section 7.2: Added printer-requested-job-attributes
- 416 • Updated references.

417 **10.3 April 18, 2019**

418 Initial revision.