



The Printer Working Group

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Best Practice Draft

## 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](#)

126

## 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.

#### 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.



### 159 **3.1.7 Authenticating End Users**

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

### 161 **3.1.8 Authenticating Print Services**

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

### 164 **3.1.9 Reconfiguring a Print Service**

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

## 168 **3.2 Exceptions**

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

### 172 **3.2.1 Opt-Out of Mandatory Data Collection**

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

### 178 **3.2.2 Opt-Out of Optional Data Collection**

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

## 184 **3.3 Out of Scope**

185 The following are considered out of scope for this document:

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

### 189 **3.4 Design Requirements**

190 The design requirements for this document are:

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

## 204 **4. Job Accounting with IPP**

### 205 **4.1 Client Supplied Metadata**

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

### 214 **4.2 Printer Generated Metadata**

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

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

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

### 229 **4.3 Job Creation Requests and Recommended/Required Attributes**

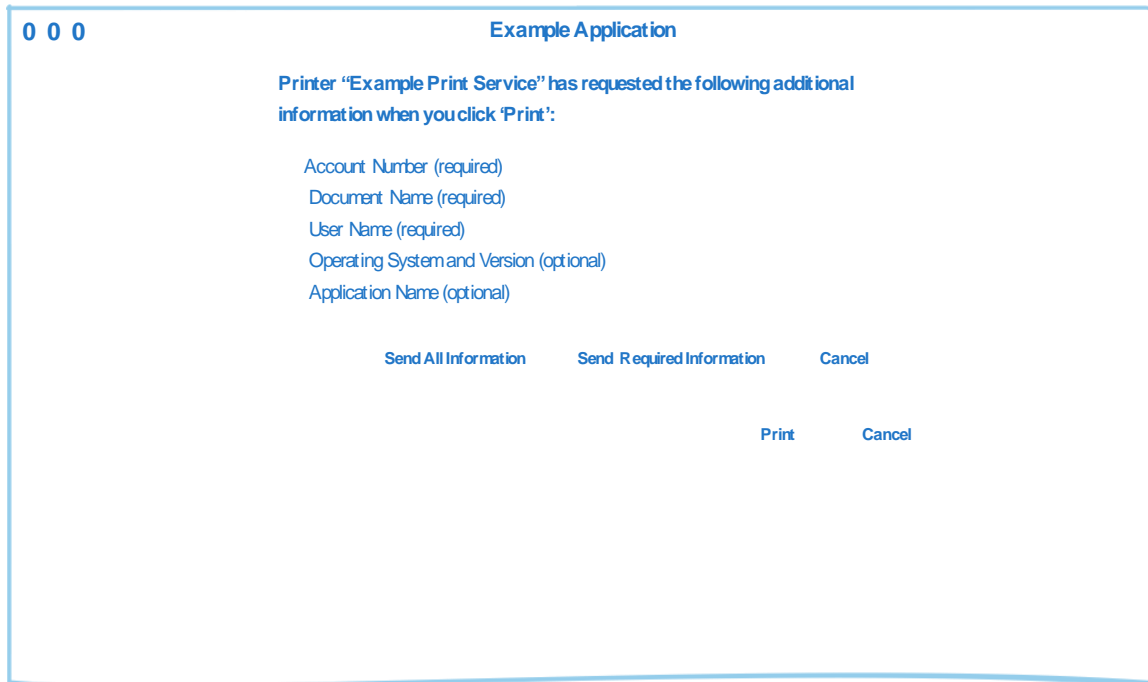
230 The "printer-mandatory-job-attributes (1setOf keyword)" Printer Description attribute  
231 [PWG5100.13] is used by a Printer to list the operation and Job Template attributes that a  
232 Client MUST supply in a Job Creation Request. Clients MUST support this attribute and  
233 Printers MUST supply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

234 The "printer-requested-job-attributes (1setOf keyword)" Printer Description attribute (section  
235 5.1.1) is used by a Printer to list the operation and Job Template attributes that a Client  
236 SHOULD supply in a Job Creation Request. Clients SHOULD support this attribute and  
237 Printers MUST supply this attribute if specific attributes are used but not required for Job  
238 Accounting.

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

### 241 **4.4 Explicit Consent**

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



248

249

**Figure 1 - Example Explicit Consent Dialog**

## 250 4.5 Privacy and Data Retention Policies

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

## 255 5. New Attributes

### 256 5.1 Printer Description Attributes

#### 257 5.1.1 printer-requested-job-attributes (1setOf keyword)

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

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

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

## 275 **6. Internationalization Considerations**

276 For interoperability and basic support for multiple languages, conforming implementations  
277 support:

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

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

## 286 **7. Security Considerations**

287 The IPP extensions defined in this document require the same security considerations as  
288 defined in the Internet Printing Protocol/1.1 [STD92], including the TLS considerations in the  
289 Opportunistic Security: Some Protection Most of the Time [RFC7435] and  
290 Recommendations for Secure Use of Transport Layer Security (TLS) and Datagram  
291 Transport Layer Security (DTLS) [RFC7525]. The following subsections provide  
292 considerations specific to this document.

### 293 **7.1 Client Considerations**

294 Clients MUST:

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

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

## 305 7.2 Printer Considerations

306 Printers MUST:

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

## 318 7.3 Privacy and Data Collection

319 Printers SHOULD consider all Job and Document attributes as potentially containing  
320 Personal Data. The following attributes explicitly contain Personal Data:

321 "document-metadata": Contains author information

322 "job-originating-user-name" and "job-originating-user-uri": The most authenticated  
323 Job owner

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

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

## 326 7.4 Data Protection

327 TBD

## 328 7.5 Data Validation

329 TPM mechanisms to provide signed information?

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

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## 386 **10. Change History**

### 387 **10.1 January 29, 2020**

- 388 • Added discussion of user and printer authentication in use cases
- 389 • Added discussion of changing consent requirements in new use case
- 390 • Section 3.1.5: Added user ID
- 391 • Section 3.3: Added definition of user account configuration/requirements
- 392 • Section 4.3: Updated title, added reference to RFC 3380
- 393 • Global: Use "explicit consent" throughout
- 394 • Section 4.4: Clarify that only information not entered through UI controls needs  
395 explicit consent
- 396 • Sections 7 and 8: Added references to RFC 7435 and 7525
- 397 • Section 8: Add reference to RFC 3380

### 398 **10.2 October 22, 2019**

- 399 • Status: Interim
- 400 • Section 2: Added some terms and acronyms that were missing.
- 401 • Section 3: Cleaned up use cases, out of scope, and design requirements.
- 402 • Section 3.2: Added exceptions.
- 403 • Section 4: Added discussion of informed consent, notion of required and requested  
404 attributes/values for accounting.
- 405 • New Section 5: "printer-requested-job-attributes"
- 406 • Section 7.1: Added explicit informed consent
- 407 • Section 7.2: Added printer-requested-job-attributes
- 408 • Updated references.

409 **10.3 April 18, 2019**

410 Initial revision.