IPP Bake-Off Results Summary

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1 Revision Log

10/19/98 pjz Initial release. Missing tabulated data from P5, P11, and P15. Log files missing from P7.

2 Overview

The IPP Interoperability Test (i.e. Bake-off) was held in September 1998 from the 23rd to the 25th. The event was hosted by Microsoft. The following 16 companies participated companies participated.

Auco	Epson	Fuji Xerox	Hewlett Packard
IBM	i-data International	Japan Computer Industry	Lexmark
Microsoft	Novell	Osmicom	Ricoh
Sun Microsystems	Tektronix	TR Computing Solutions	Xerox

These companies provided 16 IPP Printer implementations and 8 IPP Client implementations. The overall result of the first Bake-off was an unqualified success. All participating Clients attempted to send simple print jobs to every participating Printer. See table 2.1 for details. Some 20 issues were uncovered and captured. The various Test Suites were given a thorough shake down. The cooperative spirit of about 40 IPP experts assisting each other in clarifying and resolving implementation issues was arguably the biggest benefit.

The First day of the Bake-off was for setup. This was accomplished in less than half a day. Some time was spent discussing methodology and prioritizing objectives. The IPP Test Plan was used as the basis for Bake-off testing. The URL for the Test Plan is "ftp://ftp.pwg.org/pub/pwg/ipp/new_TES/IPP-Test-Plan-980916.pdf"
The first objective was to try to print from every IPP Client to every IPP Printer. All available clients, printers and test suites were assigned a designation. All results and discussion will use these designations to provide some level of anonymity. The next objective was to run the three Test Suites against the IPP Printer implementations. The trace files generated were uploaded to a server. The results were tabulated in the Test Plan by each Printer implementation and uploaded to the server. These files were available to any Bake-off participant. The individual results were collected and issued in the long version of this document. Only Bake-off participants receive the long version of this document. An abridged version of this document showing only the summary information is available to the IPP community at large.

An attribute, group or operation is considered tested when two independent implementations are able to interoperate. For the purposes of the Bake-off, that means at least two IPP Printers and two IPP Clients understand the attribute, group or operation. Partial successes are listed giving the number of printers and clients that interoperate. A value of 'No' in the 'Tested' column indicates that no printer supported the operation, attribute or group.

3 Summary Tables

3.1 Print Submission Interoperability Matrix

This matrix shows the results of submitting a simple print job from IPP Clients to IPP Servers. The participants of the Bake-Off agreed on rules of anonymity. One of the rules was to use designations to identify implementations. In the following table IPP Clients are on the horizontal and IPP Printers are on the vertical. A key at the bottom of the table is provided to interpret the results.

	C1	C2	C3	C4	C5	C6	C7	TS2	S/F
P1	SP	SP	S	SP	SP	SP	SP	SP	8/0
P2	SP	SP	SP	SP	SP	SP	SP	SP	8/0
P3	S	S	S	S	S	S	S	S	8/0
P4	S	S	S	S	S	S	S	S	8/0
P5	SP	S	S	S	SP	SP	SP	SP	8/0
P6	SP	SP	SP	SP	SP	S	SP	SP	8/0
P7	S	S	S	S	S	S	S	S	8/0
P8	S	SP	SP	SP	SP	F	SP	SP	7/1
P9	S	S	S	S	S	S	S	S	8/0
P10	SP	SP	SP	SP	SP	SP	SP	SP	8/0
P11	SP	SP	SP	S	SP	SP	S	SP	8/0
P12	SP	SP	SP	SP	SP	SP	SP	SP	8/0
P13	SP	F	SP	SP	FP	SP	SP	SP	6/2
P14	SP	S	S	S	S	SP	SP	SP	8/0
P15	S	S	S	S	F	S	S	S	7/1
P16	S	SP	SP	SP	SP	SP	SP	S	8/0
S/F	16/0	15/1	16/0	16/0	14/2	15/1	16/0	16/0	**124/4**

S = Success
F = Failure
P = Paper came out

3.2 Operation Coverage

ID	Operation	Mandatory	Tested
OC01	print-job	Yes	Yes
OC04	validate-job	Yes	Yes
OC05	get-printer-attributes	Yes	Yes
OC06	get-jobs	Yes	Yes
OC07	get-job-attributes	Yes	Yes
OC08	cancel-job	Yes	Yes
OC09	print-uri	No	1Printer 2 clients
OC10	create-job	No	1Printer 2 clients
OC11	send-document	No	1Printer 2 clients
OC12	send-uri	No	1Printer 2 clients
OC13	hold-job	No	Yes
OC14	release-job	No	Yes

ID	Operation	Mandatory	Tested
OC15	pause-printer	No	Yes
OC16	resume-printer	No	Yes
OC17	purge-printer	No	Yes
OC18	restart-job	No	No

3.3 Operational Attributes Coverage

Operational Attribute Coverage					
ID	**Operational Attribute**	**Group**	**Comment**	**Mandatory**	**Tested**
OA01		job-attribute	Tested by get-jobs	Yes	Yes
OA02		printer-attribute	Tested by get-printer-attributes	Yes	Yes
OA03		unsupported-attributes	Tested by print-job with unsupported attributes	Yes	Yes
OA04		operational-attribute	See OA08 to OA30	Yes	Yes
OA05	version-number	preamble	Test with any operation	Yes	Yes
OA06	operation-id	preamble		Yes	Yes
OA07	request-id	preamble	Test with any operation	Yes	Yes
OA08	attributes-charset	operational-attribute	Must support utf-8	Yes	Yes
OA09	attributes-natural-language	operational-attribute	Test imposes en-us requirement	Yes	Yes
OA10	printer-uri	operational-attribute	This or OA11 must be 3rd attribute	Conditional	Yes
OA11	job-uri	operational-attribute	This or OA10 must be 3rd attribute	Conditional	1Printer 1Client
OA12	job-id	operational-attribute	This must be 4th attribute	Conditional	Yes
OA13	job-name	operational-attribute	Only for print & validate operations	Optional	Yes
OA14	requesting-user-name	operational-attribute		Optional	Yes
OA15	document-uri	operational-attribute	Only for print-uri	Conditional	Yes
OA16	last-document	operational-attribute	Only for send-uri and send-document	Conditional	No

Operational Attribute Coverage					
ID	**Operational Attribute**	**Group**	**Comment**	**Mandatory**	**Tested**
OA17	status code	preamble	Test with any response	Yes	Yes
OA18	status-message	operational-attribute	Test with any response	Optional	Yes
OA19	compression	operational-attribute	Only for print & validate operations	Optional	No
OA20	document-natural-language	operational-attribute	Only for print & validate operations	Optional	No
OA21	ipp-attribute-fidelity	operational-attribute	Only for print & validate operations	Optional	Yes
OA22	job-impressions	operational-attribute	Only for print & validate operations	Optional	No
OA23	job-k-octets	operational-attribute	Only for print & validate operations	Optional	No
OA24	job-media-sheets	operational-attribute	Only for print & validate operations	Optional	No
OA25	limit	operational-attribute	Only for get-jobs operations	Optional	Yes
OA26	message	operational-attribute	Only for cancel operations	Optional	No
OA27	my-jobs	operational-attribute	Only for get-jobs operations	Optional	Yes
OA28	requested-attributes	operational-attribute	Only for get-* operations	Optional	Yes
OA29	Document-format	operational-attribute	Only for print operations	Optional	Yes
OA30	which-jobs	operational-attribute	Only for get-jobs operations	Optional	Yes

3.4 Attribute Coverage

3.4.1 Printer Description

Printer Description				
ID	**Attribute**	**Syntax**	**Mandatory**	**Tested**
PD01	printer-uri-supported	uri	Yes	Yes
PD02	uri-security-supported	1setOf type2 keyword	Yes	Yes
PD03	printer-name	name	Yes	Yes
PD04	printer-state	type1 enum	Yes	Yes
PD05	operations-supported	1setOf type2 enum	Yes	Yes

Printer Description				
ID	**Attribute**	**Syntax**	**Mandatory**	**Tested**
PD06	charset-configured	charset	Yes	Yes
PD07	charset-supported	1setOf charset	Yes	Yes
PD08	natural-language-configured	naturalLanguage	Yes	Yes
PD09	generated-natural-language-supported	1setOf naturalLanguage	Yes	Yes
PD10	printer-is-accepting-jobs	boolean	Yes	Yes
PD11	pdl-override-supported	type2 keyword	Yes	Yes
PD12	printer-up-time	integer	Yes	Yes
PD13	printer-location	text	No	1 Printer 2 Client
PD14	printer-info	text	No	Yes
PD15	printer-more-info	uri	No	Yes
PD16	printer-driver-installer	uri	No	1 Printer 2 Client
PD17	printer-make-and-model	text	No	Yes
PD18	printer-more-info-manufacturer	uri	No	Yes
PD19	printer-state-reasons	1setOf type2 keyword	No	Yes
PD20	printer-state-message	text	No	Yes
PD21	document-format-default	mimeMediaType	Yes	Yes
PD22	document-format-supported	1setOf mimeMediaType	Yes	Yes
PD23	queued-job-count	integer	No	Yes
PD24	printer-message-from-operator	text	No	1 Printer 1 Client
PD25	color-supported	boolean	No	Yes
PD26	reference-uri-schemes-supported	1setOf uriScheme	No	1 Printer 2 Client
PD27	printer-current-time	dateTime	No	2 Printers 1 Client
PD28	multiple-operation-time-out	integer	No	1 Printer 2 Client
PD29	compression-supported	1setOf type3 keyword	No	Yes
PD30	job-k-octets-supported	rangeOfInteger	No	1 Printer 2 Client
PD31	job-impressions-supported	rangeOfInteger	No	1 Printer 2 Client
PD32	job-media-sheets-supported	rangeOfInteger	No	1 Printer 2 Client

3.4.2 Job Template

Job Template				
ID	**Attribute**	**Syntax**	**Mandatory**	**Tested**
JT01	job-priority	integer	No	Yes

Job Template				
ID	**Attribute**	**Syntax**	**Mandatory**	**Tested**
JT02	job-priority-default	integer	No	Yes
JT03	job-priority-supported	integer	No	Yes
JT04	job-hold-until	type4 keyword | name	No	Yes
JT05	job-hold-until-default	type4 keyword | name	No	Yes
JT06	job-hold-until-supported	1setOf type4 keyword | name	No	Yes
JT07	job-sheets	type4 keyword | name	No	Yes
JT08	job-sheets-default	type4 keyword | name	No	Yes
JT09	job-sheets-supported	1setOf type4 keyword | name	No	Yes
JT10	multiple-document-handling	type2 keyword	No	Yes
JT11	multiple-document-handling-default	type2 keyword	No	Yes
JT12	multiple-document-handling-supported	1setOf type2 keyword	No	Yes
JT13	copies	integer	No	Yes
JT14	copies-default	integer	No	Yes
JT15	copies-supported	integer	No	Yes
JT16	finishings	1setOf type2 enum	No	Yes
JT17	finishings-default	1setOf type2 enum	No	Yes
JT18	finishings-supported	1setOf type2 enum	No	Yes
JT19	page-ranges	1setOf rangeOfInteger	No	1 Printer 1 Client
JT20	page-ranges-supported	boolean	No	Yes
JT21	sides	type2 keyword	No	Yes
JT22	sides-default	type2 keyword	No	Yes
JT23	sides-supported	1setOf type2 keyword	No	Yes
JT24	number-up	integer	No	Yes
JT25	number-up-default	integer	No	Yes
JT26	number-up-supported	1setOf integer | rangeOfInteger	No	Yes
JT27	orientation-requested	type2	No	Yes
JT28	orientation-requested-default	type2	No	Yes
JT29	orientation-requested-supported	1setOf type2	No	Yes
JT30	media	type4 keyword | name	No	Yes
JT31	media-default	type4 keyword | name	No	Yes
JT32	media-supported	1setOf type4 keyword | name	No	Yes
JT33	media-ready	1setOf type4 keyword | name	No	1 Printer 2 Client

Job Template				
ID	**Attribute**	**Syntax**	**Mandatory**	**Tested**
JT34	printer-resolution	resolution	No	1 Printer 2 Client
JT35	printer-resolution-default	resolution	No	1 Printer 2 Client
JT36	printer-resolution-supported	1setOf resolution	No	1 Printer 2 Client
JT37	print-quality	type2 enum	No	1 Printer 2 Client
JT38	print-quality-default	type2 enum	No	1 Printer 2 Client
JT39	print-quality-supported	1setOf type2 enum	No	1 Printer 2 Client

3.4.3 Job Description

Job Description				
ID	**Attribute**	**Syntax**	**Mandatory**	**Tested**
JD01	job-uri	uri	Yes	Yes
JD02	job-id	integer	Yes	Yes
JD03	job-printer-uri	uri	Yes	Yes
JD04	job-name	name	Yes	Yes
JD05	job-originating-user-name	name	Yes	Yes
JD06	job-state	type1 enum	Yes	Yes
JD07	attributes-charset	charset	Yes	Yes
JD08	attributes-natural-language	naturalLanguage	Yes	Yes
JD09	job-more-info	uri	No	1 Printer 1 Client
JD10	job-state-reasons	1setOf type2 keyword	No	2 Printer 1 Client
JD11	job-state-message	text	No	1 Printer 1 Client
JD12	number-of-documents	integer	No	Yes
JD13	output-device-assigned	name	No	1 Printer 1 Client
JD14	time-at-creation	integer	No	Yes
JD15	time-at-processing	integer	No	Yes
JD16	time-at-completed	integer	No	Yes
JD17	number-of-intervening-jobs	integer	No	Yes
JD18	job-message-from-operator	text	No	1 Printer 1 Client
JD19	job-k-octets	integer	No	Yes
JD20	job-impressions	integer	No	No
JD21	job-media-sheets	integer	No	1 Printer 2 Client
JD22	job-k-octets-processed	integer	No	Yes
JD23	job-impressions-completed	integer	No	1 Printer 2 Client
JD24	job-media-sheets-completed	integer	No	Yes

3.5 Syntax Coverage

Syntax Coverage				
ID	**Syntax**	**Attribute**	**Mandatory**	**Tested**
SC01	text	printer-state-message	No	Yes
SC02	textWithLanguage			No
SC03	name	printer-name	Yes	Yes
SC04	nameWithLanguage			No
SC05	keyword	pdl-override-supported	Yes	Yes
SC06	enum	printer-state	Yes	Yes
SC07	uri	printer-uri-supported	Yes	Yes
SC08	UriScheme (1 setOf)	reference-uri-schemes-supported	No	1 Printer 2 Client
SC09	charset	charset-configured	Yes	Yes
SC10	naturalLanguage	natural-language-configured	Yes	Yes
SC11	mimeMediaType	document-format-default	No	Yes
SC12	octetString			No
SC13	boolean	printer-is-accepting-jobs	Yes	Yes
SC14	integer	printer-up-time	Yes	Yes
SC15	rangeOfInteger	job-k-octets-supported	No	1 Printer 2 Client
SC16	dateTime	printer-current-time	No	2 Printer 1 Client
SC17	resolution	printer-resolution	No	1 Printer 2 Client
SC18	1setOf X (1setOf type2 enum)	operations-supported	Yes	Yes

4 Issues

- Check on case sensitiveness in URLs. Characters from "http://" to the first "/" are case insensitive, any characters after that are case sensitive.
- Should we allow IPP over HTTP 1.0? In clients, servers, both? C3 currently sends HTTP 1.0.
- Should the PWG make a recommendation about HTTP "Get" method for printer URLs? Many vendors already return some information (some static only, others static and dynamic) if the Printer URL is entered in a web browser.
- Some implementations do not send back an HTTP response to the Cancel-Job operation.
- Implementations react differently to "Cancel-Job". What is correct response when job is already completed? Should cancel result in deletion of job history?
- Should we make the printer description attribute "queued-job-count" a required attribute?
- If a client does not have any job template attributes to send (or does not support ANY job template attributes), does it still have to send the empty group for job template attributes?
- Fragmentation of HTTP requests and responses does not always work.
- The IPP-PRO document sometimes describes behavior which is loosely defined in HTTP 1.1.
- Does it make sense for IPP trying to further refine HTTP behavior?
- Inconsistent wording in the Model & Semantics document about whether you must return unsupported attributes in Get-Printer-Attributes, Get-Job-Attributes, and Get-Jobs.

- What character set should a server use for the value when returning the value of an unknown or badly formed attribute? Suggested solution is to always use UTF-8, or in worst case the server's default character set.
- TS1 generates HTTP Connection Header with value "keep-alive", while IPP-PRO requires "close". This is an HTTP 1.0 vs. HTTP 1.1 issue.
- Unclear whether you can cancel a job which is already completed, spec is inconsistent.
- IPP-MOD says that resolution should be two bytes. This is wrong, see syntax.
- Although IPP-MOD says that target (Job-URI, Print-URI plus Job-Id or Printer-URI) should be the 3rd operation attribute, several implementations do not have it in that place or not at all. Can we relax that requirement or should it be strictly enforced?
- In the Get-Printer-Attributes operation, if e.g. you do not have any job template attributes to send back, why do you have to send an empty printer group in the "requested attributes' test case 2.8 with TS1?
- Test cases 2.6-2.7 and 2.9 in TS1 seems to expect a response before all the data has been sent. This results in a deadlock situation with some printers which are still waiting for all the data to first be delivered.
- TS1 is saying that the job attributes job-uri and job-id should be returned in the response to a Get-Jobs operation with requested-attributes of <job-template>, but job-uri and job-id are not in the job-template group.
- Is it required to return a status of 01 when a bogus attribute is included as one of requested attributes of a Get-Jobs operation? Technically, this situation is not covered by the definition of status x0001. The first part of the definition says 'some attributes were ignored". The attribute being "requested-attributes" was not ignored. What was ignored is one of the bvalues (bogus-attribute) of the attribute. The second half of the definition is "unsupported values were substituted with supported values". this wasn't done either, since the unsupported value was ignored. So this status code does not apply. Recommended that the definition gets beefed up to include something like "or unsupported values were ignored".
- Some implementations still have problems with chunking.