Bonjour Printing Specification
Version 1.2

Abstract

Bonjour, also known as zero-configuration networking, enables automatic discovery of computers, devices, and services on Internet Protocol (IP) networks. Bonjour uses industry standard IP protocols to allow devices to automatically discover each other without the need to enter IP addresses or configure DNS servers. This document describes the procedure for adding Bonjour support to a network-enabled printer.

Minimum Implementation Requirements

· IPv4 + IPv6

· Multicast DNS

· DNS Service Discovery

· Line Printer Daemon protocol

Bonjour Printing Specification, Version 1.2

Copyright © 2003-2013 Apple Inc. All Rights Reserved.

Table Of Contents

1 Introduction

Discovering a network-enabled printer has never been easier thanks to Bonjour support in Mac OS X and iOS. This document explains what printer vendors must do in order to create Bonjour compatible printers. Parts of this document refer to functions specific to the mDNSCore source code provided in Darwin. Although using mDNSCore isn't required, Apple highly encourages you to take advantage of this code to make your job easier. The latest version of the mDNSCore source code can be downloaded from

> http://developer.apple.com/bonjour/

1.1 Conformance Requirements

In order to use the Bonjour logo, your printer must also pass the Bonjour automated conformance test. Information about licensing the Bonjour logo can be found at

> http://developer.apple.com/softwarelicensing/agreements/bonjour.html

Printers claiming support for the Internet Printing Protocol (IPP) MUST also pass the ipptool automated conformance tests appropriate for the version of IPP supported by the printer which are available at:

> http://www.cups.org/software.php

Instructions for running the ipptool automated conformance tests are provided with the ipptool software.

2 Terminology

2.1 Conformance Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as defined in Key words for use in RFCs to Indicate Requirement Levels [RFC2119].

2.2 Network Terminology

DNS Service Discovery "Service Instance Names" are of the form:

Service Instance Name = <instance> . <service> . <domain>

This document refers to the "instance" portion as the "service name", while the "service" portion is referred to as the "service type". An example Service Instance Name is:

Marc's LaserWriter 8500._http._tcp,_printer.local.

In this example, "Marc's LaserWriter 8500" is the service name, "_http._tcp,_printer" is the service type, and "local." is the domain.

This document also uses the term "routable address" to refer to all unicast addresses outside the 169.254/16 prefix, including global addresses and private addresses such as Net 10/8 defined in Address Allocation for Private Internets [RFC1918], all of which may be forwarded via routers.

3 Zero Configuration

Bonjour consists of IPv4 and IPv6 Link-Local Addressing, Multicast DNS (mDNS), and DNS-Based Service Discovery (DNS-SD). In order to provide a true zero-configuration experience, the printer MUST have Bonjour enabled by default.

Ideally, it SHOULD NOT be possible to disable any part of Bonjour. This safeguards the user from accidentally configuring the printer in such a way that they can no longer communicate with it. If you insist on providing a means of disabling Bonjour, the printer MUST have a clearly-labeled physical reset button or similar mechanism to restore it to the factory-default state so that Bonjour is re-enabled. If no reset mechanism exists, the printer MUST NOT allow Bonjour to be disabled.

4 Link-Local Addresses

The printer MUST implement IPv4 Link-Local Addressing as described in Dynamic Configuration of IPv4 Link-Local Addresses [RFC3927]. The printer MUST assign itself a link-local IP address in the absence of a Dynamic Host Configuration Protocol (DHCP) [RFC2131] server, and it MUST automatically resolve link-local address conflicts.

The printer MUST ALSO implement IPv6 link-local addressing.

5 Multicast DNS

The printer MUST implement Multicast DNS [RFC6762], MUST assign itself a link-local host name, and MUST automatically resolve link-local host name conflicts.

9

6 DNS Service Discovery

The printer MUST implement DNS-Based Service Discovery [RFC6763], MUST assign itself a service name which is used to advertise the printing protocols it supports, and MUST automatically resolve service name conflicts.

7 Bonjour Printing Support

Every Bonjour compatible device MUST implement IPv6, IPv4 Link Local Addressing, mDNS, and DNS-SD. However, in order to provide the customer with the best possible user experience and to ensure optimal compatibility with OS X, a printer MUST implement the printing-specific functionality as described in the remainder of this document.

7.1 Naming Conventions

The printer MUST, by default, assign itself a "user-friendly" service name that sufficiently describes the printer's manufacturer name and model number. The service name can be up to 63 bytes of UTF-8 [STD63] and MUST NOT contain a unique identifier by default. An example default service name is:

    Apple LaserWriter 8500

The printer also needs a link-local host name but this name is restricted to the rules for DNS host names as described in Domain Names - Concepts and Facilities [STD13]. That means it must only contain letters, digits, and hyphens, and must begin and end with a letter or digit. An example host name label is:

    LaserWriter8500

Many networked printers support Dynamic Updates in the Domain Name System (DNS UPDATE) [RFC2136] which allows the user to configure a printer's host name locally and have it automatically register that host name with a DNS server. In order to simplify configuration, the printer SHOULD use the first label of its global host name to create its link-local host name. For example, if the printer's global host name is "salesprinter.example.com.", then its link-local host name should be "salesprinter.local."

One exception to this is if the printer automatically configures its global host name using the DHCP "Host Name" option (option code 12) as defined in DHCP Options and BOOTP Vendor Extensions [RFC2132]. In that case, the printer SHOULD NOT use the global host name as its link-local host name because the link-local host name SHOULD remain unchanged when the printer is moved between different networks. Using a stable link-local host name is valuable when connecting to the printer using networking software in situations where you don't know the printer's IP address or its DHCP assigned host name.

7.2 Handling Name Conflicts

If a printer name conflict occurs, the printer MUST automatically assign itself a new name until the name conflict is resolved. If a service name conflict occurs for any one of the advertised services, the printer MUST un-register all services and then re-register all services using the new name.

The printer SHOULD handle a host name or service name conflict by appending a number to the name. If any further name conflicts occur, the printer SHOULD increment the appended number with each additional conflict.

For example, if the printer's service name is "Apple LaserWriter 8500", after the first name collision, the service name SHOULD change to "Apple LaserWriter 8500 (2)". After the second name collision, the service name SHOULD change to "Apple LaserWriter 8500 (3)", and so on.

If the printer's host name is "LaserWriter8500", after the first name collision, the host name SHOULD change to "LaserWriter8500-2". After the second name collision, the host name SHOULD change to "LaserWriter8500-3", and so on.

Alternately, you MAY choose to handle name collisions by appending a unique identifier such as a partial MAC address or serial number to the end of the names, for example:

> Apple LaserWriter 8500 (e8:44:b4)
> LaserWriter8500-e844b4

7.3 Name Stability

Since the host name and service name are used as the primary identifiers for the printer, steps must be taken to ensure that these names remain stable.

If a host name conflict occurs, the printer MUST choose a new host name, but MUST NOT choose a new service name unless a service name conflict occurred as well, and vise versa.

If a service name or host name conflict occurs and the printer chooses a new name, it MUST permanently store the new name in memory so that the next time the printer is powered on, it continues to use the new name.

7.4 Configurable Names

The printer's service name and host name MUST be user configurable so that when multiple printers exist on the network, each printer can be uniquely identified. The user MUST be given complete control over the printer name that gets advertised on the network. When the user changes the service name, the printer MUST un-register all services and then re-register all services using the new name.

The printer SHOULD include a built-in web server that allows the user to configure these names along with other printer settings. The printer MAY provide additional ways of configuring these names, for example, by using SNMP as defined in A Simple Network Management Protocol (SNMP) [RFC1157].

The printer's user interface SHOULD refer to the service name as the "Bonjour Printer Name". The link-local host name SHOULD be referred to as the "Local Hostname" or simply "Hostname" in cases where the printer shares the same name for both its link-local host name and its global host name. If the user interface is arranged such that these names are located in a Bonjour specific section, the word "Bonjour" MAY be omitted from the front of "Bonjour Printer Name".

7.5 Advertising Services

You can use the mDNSCore function mDNS_RegisterService() to register a service. You will need to specify the port number that each service is running on so that the Mac OS X printing system knows which port to use when communicating with the printer. For example, the Apple LaserWriter 8500 would register the following services:

```
Apple LaserWriter 8500._printer._tcp.local.        Port 515
Apple LaserWriter 8500._ipp._tcp.local.            Port 631
Apple LaserWriter 8500._pdl-datastream._tcp.local.  Port 9100
```

The printer MUST advertise all services using the same service name. In OS X, Add Printer and the nearby printers UI rely on this in order to filter out multiple instances of the printer when the printer advertises more than one printing protocol.

The printer SHOULD advertise every open port that's running a service, such as HTTP, FTP, Telnet, SSH, LPD, IPP, Socket, and so on. Advertising the printer's built-in web server is especially important so that Bonjour enabled web browsers can discover it. In order to advertise a built-in web server, the printer would register a service with the "_http._tcp,_printer" service type:

```
Apple LaserWriter 8500._http._tcp,_printer.local.   Port 80
```

7.6 Flagship Naming

As described in DNS-Based Service Discovery [RFC6763], LPD is the "flagship" proto-col for printing. Therefore, the printer MUST defend its service name for the LPD service type ("_printer._tcp"). For example, if the printer supports LPD and IPP it MUST register both service types. If the printer only supports IPP it MUST register the IPP service type and then assert that LPD is not supported by registering the LPD service type with a port number of 0. This will prevent other Bonjour printers from using that service name.

The printer SHOULD defend its service name for all the printing service types. You can use the mDNS_RegisterNoSuchService() function to assert that a service is disabled or not supported.

7.7 Link Changes

When a network "Link Change" occurs, for example, when the Ethernet cable is plugged-in, the printer MUST perform the initial probing process to verify that its host name and service names are unique, and after verifying uniqueness, it MUST re-advertise its services. This can be done by calling mDNSCoreMachineSleep(m, false).

7.8 Mixed-Network Interoperability

The printer MUST be able to route to the link-local address range in situations where the printer contains a routable address but the computer has a link-local address. You can implement this by adding a network address of 169.254/16 to the printer's routing table.

The printer MUST be able to communicate with a routable address in situations where the printer has a self-assigned link-local address, but the computer, which is located on the local-link, contains a routable address. This can be accomplished by ARP-ing for the destination address and then sending the packet directly to the routable address.

8 Service Types

DNS Service Discovery uses the same format for service types that was established in A DNS RR for specifying the location of services (DNS SRV) [RFC2782]. Service types are of the form "_applicationprotocol._transportprotocol". Currently, "_transportprotocol" MUST be either "_tcp" or "_udp". The "_applicationprotocol" MUST be a protocol name registered with IANA and appearing in the list of registered IANA protocol names and port numbers. The full list of protocol names can be viewed at

http://www.iana.org/assignments/port-numbers

8.1 Printing Service Types

Bonjour printing currently supports the Line Printer Daemon Protocol (LPD) [RFC1179], Internet Printing Protocol/1.1: Model and Semantics (IPP) [RFC2911], IPP Version 2.0 Second Edition [PWG 5100.12], and Socket (AppSocket/PhaserPort/JetDirect/Port 9100). Table 1, "Printing Service Types", maps printing protocols to their corresponding DNS-SD service types. IPPS is IPP over HTTPS using TLS 1.2 or higher.

Table 1 - Printing Service Types

Protocol	Service Type
LPD	_printer._tcp
IPP	_ipp._tcp
IPPS	_ipps._tcp
Socket	_pdl-datastream._tcp

9 TXT Records

DNS Service Discovery provides a means for supplying additional information when advertising a service. This information is stored in a DNS TXT record as a set of strings that can be parsed into a series of key/value pairs. The TXT record is not intended to replace the superior capability descriptions available from some printing protocols, such as IPP, available from some web services, such as SOAP, or available from data files such as PPDs. The information supplied by the TXT record is intended to provide basic access, identity, and capability information and is less complete than that available via these other means.

These key/value pairs are intended to serve two purposes. First, they provide important information about the printer for protocols such as LPD that have no other way to provide this information. Second, these pairs provide information useful to a printer browsing user interface. Such an interface should be able to quickly provide a list of devices that fall into broad categories such as being capable of color or duplex printing.

9.1 TXT Record Format

The following rdata hex dump is from a TXT record which contains two key/value pairs:

```
 0: 0A6E616D653D76616C75651A70646C3D | .name=value.pdl=
16: 6170706C69636174696F6E2F706F7374 | application/post
32: 736372697074                     | script
```

Each key/value pair consists of a length byte, followed by up to 255 bytes of data. The length byte contains the count of the number of data bytes. From the above example, the "name" will be replaced by one of the key names defined later in this document. Case is ignored when interpreting a key name, so "Name=value", "NAME=value" and "name=value" are all identical. Everything after the first '=' to the end of the string is the value. The value can contain any eight- bit values, including '='. Leading or trailing spaces are part of the value; don't include them unless you intend the value to have leading or trailing spaces. Any quotation marks around the value are also considered part of the value.

Although the maximum size of a TXT record is 65535 bytes as defined in the DNS-SD specification, the RECOMMENDED maximum size of a TXT record is 512 bytes. Printers MUST place Printer Description TXT Keys (Section 9.2) prior to any Printer Capability TXT Keys (Section 9.3). If the contents of a TXT record is potentially going to be larger than 512 bytes, you SHOULD remove any optional keys in order to reduce its size to 512 bytes or less. Despite this maximum size recommendation, the printer MUST gracefully handle receiving a resource record which is larger than 512 bytes.

The TXT record is named by the service instance name of the associated service. Each service advertisement MUST include a corresponding TXT record, even if the TXT record is empty, so that clients are not left waiting forever looking for a nonexistent record. The TXT record SHOULD contain some of the key/value pairs defined later in this document.

Copyright © 2003-2013 Apple Inc. All rights reserved.

If the TXT record information changes and needs to be updated after the initial registration, you can use the function mDNS_Update() to update the current TXT record(s). Alternatively, it may be easier to completely un-register the service by calling mDNS_DeregisterService() and then re-register it with the new TXT record information.

9.2 Printer Description TXT Record Keys

The keys defined in Table 2 are included in the TXT record when registering a print service in order to supply useful information about the printer and queue. If a key from the TXT record has a value that is identical to the default value for that key, you MAY choose to omit that key/value pair in order to save space on the wire. All keys are treated as ASCII, and all values are interpreted as UTF-8.

Table 2 - Printer Description TXT Record Keys

Key	Usage	Default
adminurl †	The URL to access the printer's embedded web interface.	""
air	The type of authentication information required by the printer. *IPP/IPPS only.*	"none"
note	The textual location of the printer as a UTF-8 string.	""
pdl	A comma-delimited list of MIME media types supported by the printer.	"application/postscript"
priority †	The priority of the service compared to other print protocols from "0" (highest) to "100" (lowest).	"50"
product †	The PostScript product string, including parenthesis.	"()"
qtotal †	The number of different queues for this service. *LPD only.*	"1"
rp	The queue name or resource path for the print service	""
TLS	The highest TLS encryption standard supported by the printer. *IPP/IPPS only.*	""
txtvers †	The TXT key version number.	"1"
ty †	The printer make and model string.	""
usb_CMD †	The IEEE-1284 Device ID COMMAND SET/CMD string.	""
usb_MDL †	The IEEE-1284 Device ID MODEL/MDL string.	""
usb_MFG †	The IEEE-1284 Device ID MANUFACTURER/MFG string.	""
UUID	The Universally-Unique IDentifier (UUID) for the print service.	""

† Deprecated for IPP and IPPS, optional for LPD and Socket

9.2.1 txtvers

This key defines the TXT record version number for printing, for example:

```
txtvers=1
```

In the future, if the meaning of any of the TXT record keys is changed, the txtvers value will be incremented. The current value of this key is "1", and if this key does not exist in the TXT record, the default value of "1" is assumed. The txtvers SHOULD be the first key/value pair in the TXT record.

9.2.2 rp

This key is used to specify the queue name. This is NOT the name displayed to the user. This is the queue name that is passed by the printing software when it sends data using a protocol like LPD, in the case where the printer supports multiple logical queues, for example:

```
rp=auto
```

When used in an IPP TXT record, this value indicates the full path of the IPP URL for a particular print queue. The value MUST NOT begin with a slash ("/"). For example, if "rp=queue123" is present, the resulting URL for that print queue would be:

ipp://<hostname>:<port>/queue123

If your printer requires the word "printers" in the URL path, then simply advertise "rp=printers/queue123" and the resulting URL will be:

ipp://<hostname>:<port>/printers/queue123

This key MUST NOT appear in TXT records for Socket. If the "rp" key is present in a Socket TXT record, the key/value MUST be ignored.

9.2.3 note

The value is a user readable location of the printer which shows up when browsing, for example:

```
note=3rd Floor Copy Room
```

The user MUST be able to specify the location of the printer using the printer's configuration user interface. If no location information is available, the value of this key SHOULD be empty.

9.2.4 qtotal

The value of this key MUST be the total number of queues and hence the total number of TXT records registered for a protocol on a specific port. For example, if there are three LPD queues on port 515, the printer would register three LPD TXT records, and each TXT record would contain:

```
qtotal=3
```

This key MUST be present in every TXT record, even when there is only one queue. When a protocol registers multiple TXT records, each TXT record MUST contain the same "qtotal" value. If the "qtotal" key is missing from a TXT record, then the client MUST assume that there is only one TXT record for that protocol, and all other TXT records for that protocol SHOULD be ignored.

Printers MUST NOT register multiple TXT records for the same physical printer, but instead MUST register each physical printer using its own unique service name. Support for multiple queues is only intended for LPD print servers that support multiple logical printers. IPP and Socket TXT records MUST use the default value of 1 for the "qtotal" key.

9.2.5 priority

This key allows the printer vendor to specify which printing protocol and queue is used by default, for example:

```
priority=20
```

When adding a Bonjour printer in Add Printer or from the nearby printers menu in OS X, the priorities for all printing protocols are evaluated and the protocol and queue with the highest priority (lowest value) will be chosen. The value must be between 0 – 99. Lower numbers indicate higher priority. If the priority is not specified, a default value of "50" is assumed. When adding printers using vendor drivers on OS X, if all TXT records have equal "priority" values Socket is the preferred protocol followed by IPP and then LPD.

9.2.6 ty

The value of this key provides a user readable description of the make and model of the printer which is suitable for display in a user interface when describing the printer, for example:

```
ty=Apple LaserWriter Pro 630
```

9.2.7 product

For PostScript printers and non-PostScript printers that use a CUPS driver, the value for this key SHOULD match the value of the "Product" stored in the driver's PPD file (including the parentheses), for example:

```
product=(LaserWriter 12/640 PS)
```

Otherwise, the value for this key SHOULD be an open parenthesis (0x28), followed by the manufacturer name (MFG), followed by a space (0x20), followed by the model name (MDL), followed by a closed parenthesis (0x29). This value will be used as a fallback to find the corresponding driver in the event that the "usb_MFG" and "usb_MDL" keys are missing.

9.2.8 pdl

The value of this key SHOULD contain comma-separated MIME types of the page description languages supported by the given protocol or queue, for example:

```
pdl=application/postscript,application/vnd.hp-PCL
```

The value MUST NOT end with a comma. If the pdl key is omitted, the default value "application/postscript" will be assumed. A full list of application MIME Types can be found at:

http://www.iana.org/assignments/media-types/

If your language doesn't have a registered MIME type, it is highly RECOMMENDED that you register one with IANA. Currently the Mac OS X printing system uses the "pdl" value to determine whether the printer supports PostScript. If "application/postscript" is not one of the supported MIME types, Mac OS X will attempt to find a raster driver for the printer.

9.2.9 adminurl

This key specifies the associated configuration URL for a given printer or print queue, for example:

```
adminurl=http://printer.local./path/configpage.html
```

where "printer.local." is the domain name which SHOULD be the same as the Target Host in the SRV record. The ending "." indicates an absolute host name. If a port number is not specified, port 80 is assumed. The "/path/configpage.html" is a full path to the desired web page for that particular protocol or queue. Alternatively, the URL MAY point to a Bonjour-specific configuration page that allows the user to change the printer's service name, host name, and location.

The user will be taken to this URL when clicking the "Utility" button in Printer Proxy or the Print & Fax system preferences. If the user changes the printer's host name, the printer MUST update the adminurl values in all registered TXT records since they probably contain the old host name.

9.2.10 usb_MFG

The value of this key MUST be the value of the MANUFACTURER (MFG) from the printer's 1284 device ID, for example:

```
usb_MFG=Apple
```

For non-PostScript printers, this key will be used in combination with the "usb_MDL" and "usb_CMD" keys to find the corresponding driver. If the printer has an IEEE 1284 Device ID, a value for this key MUST be specified, even if the printer doesn't support USB.

9.2.11 usb_MDL

The value of this key MUST be the value of the MODEL (MDL) from the printer's 1284 device ID, for example:

```
usb_MDL=LaserWriter 12/640 PS
```

For non-PostScript printers, this key will be used in combination with the "usb_MFG" and "usb_CMD" keys to find the corresponding driver. If the printer has an IEEE 1284 Device ID, a value for this key MUST be specified, even if the printer doesn't support USB.

9.2.12 usb_CMD

The value of this key MUST be the value of the COMMAND SET (CMD) from the printer's 1284 device ID, for example:

```
usb_CMD=PS,PDF17,PCL
```

For non-PostScript printers, this key will be used in combination with the "usb_MFG" and "usb_MDL" keys to find the corresponding driver. If the printer has an IEEE 1284 device ID, a value for this key MUST be specified, even if the printer doesn't support USB.

9.2.13 air

The value specifies the type of authentication required for the service and MUST be one of the following:

- "none"; No authentication is required.
- "certificate"; The service uses the Client's TLS certificate for authentication.
- "username,password"; The service requires Basic or Digest authentication with a username and password.
- "negotiate"; The service requires Negotiate authentication with Kerberos credentials.

The default value is "none". This key only has meaning for printers that support IPP and MUST NOT be included in TXT records for LPD or Socket queues.

9.2.14 TLS

The value MUST be set to "1.2" if the service supports the HTTP Upgrade [RFC2817] protocol for upgrading to TLS 1.2 encryption and omitted otherwise. The default value is "". This key only has meaning for printers that support IPP and MUST NOT be included in TXT records for LPD or Socket queues.

9.2.15 UUID

The value is a unique identifying string conforming to A Universally Unique IDentifier (UUID) URN Namespace [RFC4122] that identified the print service, for example:

```
UUID=40989ed5-65f4-3977-52f4-89a7528bd637
```

The default value is the empty string.

9.3 Printer Capability TXT Record Keys

The following keys SHOULD be included in the TXT record when registering a print service in order to provide useful information about the protocol used by that queue. If a key from the TXT record has a value that is identical to the default value for that key, you SHOULD omit that key/value pair in order to save space on the wire. All keys are treated as ASCII, and all values are interpreted as UTF-8. Setting the value to "T" indicates "True", while a value of "F" indicates false.

9.3.1 Transparent

The value SHOULD be set to "T" if the queue is capable of accepting character codes 00-1F, for example:

```
Transparent=T
```

If this key is missing, a value of "F" is assumed.

9.3.2 Binary

The value SHOULD be set to "T" if the print queue is capable of accepting character codes 80-FF. This key can be used with the Transparent key to indicate 8-bit binary, for example:

```
Binary=T
```

If this key is missing, a value of "F" is assumed.

9.3.3 TBCP

The value SHOULD be set to "T" if the print queue is capable of accepting Tagged Binary Communication Protocol data, for example:

```
TBCP=T
```

If this key is missing, a value of "F" is assumed. For information regarding TBCP, please see:

http://partners.adobe.com/public/developer/en/ps/5009.Comm_Spec.pdf

9.3.4 kind

This key lists keywords, separated by commas, describing the kinds of printing supported by the Printer. The supported keywords are:

- 'disc'; the Printer supports printing on optical discs such as printable CD-Rs and DVD-Rs

- 'document'; the Printer supports standard document printing on standard cut sheet media such as US Letter, US Legal, US Tabloid, ISO A4, and ISO A3

- 'envelope'; the Printer supports printing on envelopes

- 'label'; the Printer supports printing on cut labels

- 'large-format'; the Printer supports printing on cut sheet sizes and roll media larger than ISO A3

- 'photo'; the Printer supports printing with photographic print quality

- 'postcard'; the Printer supports printing on postcards

- 'receipt'; the Printer supports printing receipts on continuous rolls

- 'roll'; the Printer supports printing documents or photos on continuous rolls, typically on (but not limited to) large-format media

9.4 Printer Feature TXT Record Keys

Table 3, "Printer Feature Keys", lists the keys that SHOULD be included in the TXT record when registering a print service so that a browsing application can discover the printer's supported features. If a key from the printer's TXT record has a value that is identical to the default value for that key, you SHOULD omit that key/value pair from the TXT record in order to save space on the wire. All keys are treated as ASCII, and all values are interpreted as UTF-8.

Table 3 - Printer Feature TXT Record Keys

Key	Usage	Possible Values	Default
Bind †	Set value to "T" if the printer is capable of binding its output.	"T", "F", "U"	"U"
Collate †	Set value to "T" if the printer is capable of generating collated copies.	"T", "F", "U"	"U"
Color	Set value to "T" if the printer is capable of generating color output.	"T", "F", "U"	"U"
Copies †	Set value to "T" if the printer is capable of generating fast copies	"T", "F", "U"	"U"
Duplex	Set value to "T" if the printer is capable of generating two sided output.	"T", "F", "U"	"U"
PaperCustom †	Set value to "T" if the printer can handle custom paper sizes.	"T", "F", "U"	"U"

Key	Usage	Possible Values	Default
PaperMax	The value of this key defines the maximum paper size supported by the printer. Only five possible values exist for this key. The value "<legal-A4" indicates that the device can only print on paper sizes smaller than 9x14 inches and rolls smaller than 9 inches wide. "legal-A4" specifies that the printer can handle media up to 9x14 inches and rolls up to 9 inches wide. "tabloid-A3" specifies that the printer can handle media up to 13x19 inches and/or rolls up to 13 inches wide. "isoC-A2" indicates that the device can handle paper up to 18x24 inches and rolls up to 18 inches wide. The ">isoC-A2" indicates that the printer can handle sizes larger than 18x24 inches and rolls wider than 18 inches.	"<legal-A4", "legal-A4", "tabloid-A3", "isoC-A2", ">isoC-A2"	"legal-A4"
Punch †	Set value to the number of holes of the hole puncher supported by the printer. A value of "0" means that the printer does not support hole punch.	"0", "1", "2", "3", "4", "U"	"U"
Scan †	Set value to "T" if the printer is capable of scanning.	"T", "F"	"F"
Sort †	Set value to "T" if the printer is capable of sorting its output.	"T", "F", "U"	"U"
Staple	Set value to "T" if the printer is capable of stapling output.	"T", "F", "U"	"U"

"T" stands for "True", "F" stands for "False", and "U" stands for "Unknown".

† Deprecated for IPP and IPPS, optional for LPD and Socket

9.5 Example Printer TXT Record

The following rdata hex dump is from an LPD TXT record for a PostScript printer:

```
  0: 09747874766572733D310772703D6175  | .txtvers=1.rp=au
 16: 746F0871746F74616C3D310B7072696F  | to.qtotal=1.prio
 32: 726974793D32351974793D4170706C65  | rity=25.ty=Apple
 48: 204C6173657257726974657220383530  |  LaserWriter 850
 64: 30056E6F74653D3A61646D696E75726C  | 0.note=:adminurl
 80: 3D687474703A2F2F4C61736572577269  | =http://LaserWri
 96: 7465723835303002E6C6F63616C2E2F72  | ter8500.local./r
112: 656E64657A766F7573706167652E6874  | endezvouspage.ht
128: 6D6C1A70726F647563743D284C617365  | ml.product=(Lase
144: 72577269746572203835303029.1A7064  | rWriter 8500).pd
160: 6C3D6170706C69636174696F6E2F706F  | l=application/po
176: 7374736372697074407436F6C6F723D46  | stscript.Color=F
192: 08436F706965733D54084475706C6578  | .Copies=T.Duplex
208: 3D540D5061706572437573746F6D3D54  | =T.PaperCustom=T
```

```
224:  0842696E6172793D540D5472616E7370    |  .Binary=T.Transp
240:  6172656E743D5406544243503D540642    |  arent=T.TBCP=T.B
256:  696E643D5409436F6C6C6174653D5406    |  ind=T.Collate=T.
272:  536F72743D5408537461706C653D4607    |  Sort=T.Staple=F.
288:  50756E63683D333115061706574D6178    |  Punch=3.PaperMax
304:  3D6C6567616C2D4134                  |  =legal-A4
```

9.6 Advertising Multiple Queues

For protocols like LPD that are capable of providing multiple queues, the printer MAY register a single service instance name with one TXT record per queue and use the "rp" key to specify the queue name. For example, if a printer has four LPD queues, it might register four separate TXT records under the same service instance name and each TXT record MUST contain a key/value pair of "qtotal=4". Also, each TXT record SHOULD use the "priority" key to indicate the preferred queue.

Because each additional TXT record takes up extra space in the packet, printer vendors are not required to advertise every single queue. Only print queues that provide significant value to the end user SHOULD be registered. You can add TXT records to the initial registration by using the function mDNS_AddRecordToService().

Printers MUST NOT register multiple queues with the same service name for different physical printers. Instead, printers MUST register each physical printer using a unique service name.

9.7 Keys for Other Protocols

This document defines TXT record key/value pairs for the printing specific protocols. If the printer advertises other protocols such as HTTP, FTP, or Telnet, it will most likely not need to provide any information in the corresponding TXT records. Most information required to connect using these protocols is available without the need for TXT record data. In the future, if key/value pairs are defined for other network protocols, you can learn about them at

http://www.dns-sd.org/ServiceTypes.html

10 References

10.1 Normative References

[IEEE1284]   "IEEE Std.1284-1994 Standard Signaling Method for a Bi-directional Parallel Peripheral Interface for Personal Computers", 1994.

[PWG5100.12]   R. Bergman, H. Lewis, I. McDonald, M. Sweet, "Internet Printing Protocol Version 2.0 Second Edition (IPP/2.0 SE)", PWG 5100.12-2011, February 2011

[RFC1157]   Case, J., Fedor, M., Schoffstall, M. and J. Davin, "Simple Network Management Protocol", STD 15, RFC 1157, May 1990.

[RFC1179]   McLaughlin, L., "Line Printer Daemon Protocol" RFC 1179, August 1990.

[RFC1918]   Y. Rekhter et.al., "Address Allocation for Private Internets", RFC 1918, February 1996.

[RFC2119]   Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", RFC 2119, March 1997.

[RFC2131]   R. Droms, "Dynamic Host Configuration Protocol", RFC 2131, March 1997.

[RFC2132]   Alexander, S., and Droms, R., "DHCP Options and BOOTP Vendor Extensions", RFC 2132, March 1997.

[RFC2136]   Vixie, P., et al., "Dynamic Updates in the Domain Name System (DNS UPDATE)", RFC 2136, April 1997.

[RFC2782]   Gulbrandsen, A., et al., "A DNS RR for specifying the location of services (DNS SRV)", RFC 2782, February 2000.

[RFC2911]   Hastings, T., Herriot, R., deBry, R., Isaacson, S., and Powell, P., "Internet Printing Protocol/1.1: Model and Semantics", RFC 2911, September 2000.

[RFC3927]   Cheshire, S., B. Aboba, and E. Guttman, "Dynamic Configuration of IPv4 Link- Local Addresses", RFC 3927, May 2005.

[RFC4122]   P. Leach, M. Mealling, R. Salz, "A Universally Unique IDentifier (UUID) URN Namespace", RFC 4122, July 2005.

[RFC6762]   S. Cheshire, M. Krocmal, "Multicast DNS", RFC 6762, February 2013

[RFC6763]   S. Cheshire, M. Krocmal, "DNS-Based Service Discovery", RFC 6763, February 2013

[STD13]   Mockapetris, P., "Domain Names - Concepts and Facilities", STD 13, RFC 1034, November 1987.

[STD63]   F. Yergeau, "UTF-8, a transformation format of ISO 10646", STD 63, RFC 3629

A Document Revision History

Date	Notes
June 20, 2003	First Release.
Nov 15, 2003	Minor changes to "Naming Conventions" and updated "Known Issues" and "Printing History" sections.
Apr 12, 2005	Changed "Rendezvous" to "Bonjour". Improved description of "rp" key when used in IPP TXT record.
October 29, 2010	Updated all specification references. Added IPv6 content. Added "air", "Scan", "TLS", and "UUID" keys. Added IPP+TLS service type definition. Added requirement for IPP conformance in order to advertise IPP support. Added ",_printer" subtype information for web interfaces. References to LPR were corrected to LPD. Changed the recommendations for service and host names to favor names without unique identifiers unless a collision occurs. Removed the history and known Mac OS X issues appendices which were out of date.
July 10, 2013	Added new "air" value. Added new "PaperMax" value. Added new "kind" key/value pair. Updated all document references (new DNS-SD and mDNS RFCs, updated UTF-8 RFC, updated IPP/2.0 specification) Deprecated several TXT record keys.