



Bonjour Printing Specification



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Abstract

Bonjour, also known as zero-configuration networking, enables automatic discovery of computers, devices, and services on 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.

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1. Introduction

Setting up a network-enabled printer has never been easier thanks to Bonjour printing support in Mac OS X 10.2 and later. This document explains what printer vendors must do in order to create Bonjour compatible printers that work seamlessly with Mac OS X . 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/darwin/projects/bonjour/>

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/mkt/swl/agreements.html#bonjour>

2. Conventions and Terminology Used in this Document

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 described in "Key words for use in RFCs to Indicate Requirement Levels" [RFC 2119].

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 Web Server._http._tcp.local.
```

In this example, "Marc's Web Server" is the service name, "_http._tcp" is the service type, and "local." is the domain.

This document 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 [RFC 1918], all of which may be forwarded via routers.

3. Zero Configuration

Bonjour consists of IPv4 Link-Local Addressing, Multicast DNS, and DNS Service Discovery. 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 [v4LL] as described in the following document.

<http://files.zeroconf.org/draft-ietf-zeroconf-ipv4-linklocal.txt>

The printer MUST assign itself a link-local IP address in the absence of a DHCP server [RFC 2131], and it MUST automatically resolve link-local address conflicts.

5. Multicast DNS

The printer MUST implement Multicast DNS [mDNS] as described in the following document.

<http://files.multicastdns.org/draft-cheshire-dnsext-multicastdns.txt>

The printer MUST assign itself a link-local host name, and it MUST automatically resolve link-local host name conflicts.

6. DNS Service Discovery

The printer MUST implement DNS Service Discovery [DNS-SD] as described in the following document.

<http://files.dns-sd.org/draft-cheshire-dnsext-dns-sd.txt>

The printer MUST assign itself a service name which is used to advertise the printing protocols it supports, and the printer MUST automatically resolve service name conflicts.

7. Bonjour Printing Support

Every Bonjour compatible device must implement v4LL, mDNS and DNS-SD, however, in order to provide the customer with the best possible user experience and to ensure optimal compatibility with Mac OS X, a printer should 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 [RFC 2279]. An example default service name is

```
Apple LaserWriter 8500
```

Some printer vendors prefer to append a unique identifier to the default service name, so you **MAY** choose to append the last three bytes of the printer’s hardware MAC address as shown below.

```
Apple LaserWriter 8500 (e8:44:b4)
```

The printer also needs a link-local host name but this name is restricted to the rules for DNS host names as described in RFC 1034. 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
```

Some printer vendors prefer to append a unique identifier to the default host name, so you **MAY** choose to append the last three bytes of the printer’s hardware MAC address as shown below.

```
LaserWriter8500-e844b4
```

Many networked printers support Dynamic DNS Update [RFC 2136] 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.apple.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) [RFC 2132]. 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 name.

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 vice 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 [RFC 1157].

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. Printer Setup Utility relies 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, LPR, IPP, Port 9100, 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” service type.

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

7.6 Flagship Naming

As described in “DNS-Based Service Discovery” [DNS-SD], LPR is the “flagship” protocol for printing. Therefore, the printer **MUST** defend its service name for the LPR service type (“_printer._tcp”). For example, if the printer supports LPR and IPP, it should register both service types, but if the printer only supports IPP, it should register the IPP service type and then assert that LPR is not supported. 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 RFC 2782. 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 LPR [RFC 1179], IPP [RFC 2567], and Socket (Port 9100). The following table maps printing protocols to their corresponding DNS-SD service types.

Protocol	Service Type
LPR	_printer._tcp
IPP	_ipp._tcp
AppSocket PhaserPort JetDirect Port 9100	_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 always deemed inferior and less reliable than that available via these other means.

These key/value pairs are intended to serve two purposes. One, they provide important information about the printer for protocols such as LPR, that have no other way to provide this information. Second, these pairs are intended to 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:  0A 6E 61 6D 65 3D 76 61 6C 75 65 1A 70 64 6C 3D | .name=value.pdl=  
16:  61 70 70 6C 69 63 61 74 69 6F 6E 2F 70 6F 73 74 | application/post  
32:  73 63 72 69 70 74 | 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. 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.

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 following keys SHOULD be 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.

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 LPR, 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 SHOULD NOT appear in TXT records for Port 9100 . If the “rp” key is present in a Port 9100 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 in Printer Setup Utility when browsing. For example:

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

The user SHOULD 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 LPR queues on port 515, the printer would register three LPR TXT records, and each TXT record would contain

```
qtotal=3
```

This key MUST be present in every TXT record, even when there's 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's only one TXT record for that protocol, and all other TXT records for that protocol SHOULD be ignored.

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 Printer Setup Utility, the priorities for all printing protocols will be evaluated and the protocol and queue with the highest priority 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" will be assumed. In Mac OS X, if all TXT records have equal "priority" values, IPP will be the preferred protocol, followed by Port 9100 and then LPR.

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 PPD (including the parentheses). Printer Setup Utility will use this key when selecting the PPD. 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’s highly RECOMMENDED that you register one with IANA. Currently, the Mac OS X printing system uses the “pdl” value to determine if 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 path. 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 could 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 Setup Utility. 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" key to find the corresponding driver. If the printer has a 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" key to find the corresponding driver. If the printer has a IEEE 1284 Device ID, a value for this key MUST be specified, even if the printer doesn't support USB.

9.3 Printer Protocol 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. 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

9.4 Printer Feature TXT Record Keys

The following keys MAY be included in the TXT record when registering a print service so that a browsing application can discover the printer's supported features. The current version of Mac OS X does not check for these keys, so usage of these keys is completely OPTIONAL. 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.

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

Key	Usage	Possible Values	Default
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"
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"
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"
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", "2", "3", "4", "U"	"U"
PaperMax	The value of this key defines the maximum paper size supported by the printer. Only four possible values exist for this key. The value "<legal-A4" indicates that the device can only print on paper sizes smaller than legal-A4. "legal-A4" specifies that the printer can handle media up to legal and A4 sizes. "isoC-A2" indicates that the device can handle paper up to the ISO-C and A2 sizes. The ">isoC-A2" indicates that the printer can handle sizes larger than ISO-C and A2.	"<legal-A4", "legal-A4", "isoC-A2", ">isoC-A2"	"legal-A4"

9.5 Example Printing TXT Record

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

```
0: 09 74 78 74 76 65 72 73 3D 31 07 72 70 3D 61 75 | .txtvers=1.rp=au
16: 74 6F 08 71 74 6F 74 61 6C 3D 31 0B 70 72 69 6F | to.qtotal=1.prio
32: 72 69 74 79 3D 32 35 19 74 79 3D 41 70 70 6C 65 | rity=25.ty=Apple
48: 20 4C 61 73 65 72 57 72 69 74 65 72 20 38 35 30 | LaserWriter 850
64: 30 05 6E 6F 74 65 3D 3A 61 64 6D 69 6E 75 72 6C | 0.note=:adminurl
80: 3D 68 74 74 70 3A 2F 2F 4C 61 73 65 72 57 72 69 | =http://LaserWri
96: 74 65 72 38 35 30 2E 6C 6F 63 61 6C 2E 2F 72 | ter8500.local./r
112: 65 6E 64 65 7A 76 6F 75 73 70 61 67 65 2E 68 74 | endezvouspage.ht
128: 6D 6C 1A 70 72 6F 64 75 63 74 3D 28 4C 61 73 65 | ml.product=(Lase
144: 72 57 72 69 74 65 72 20 38 35 30 30 29 1A 70 64 | rWriter 8500).pd
160: 6C 3D 61 70 70 6C 69 63 61 74 69 6F 6E 2F 70 6F | l=application/po
176: 73 74 73 63 72 69 70 74 07 43 6F 6C 6F 72 3D 46 | stscript.Color=F
192: 08 43 6F 70 69 65 73 3D 54 08 44 75 70 6C 65 78 | .Copies=T.Duplex
208: 3D 54 0D 50 61 70 65 72 43 75 73 74 6F 6D 3D 54 | =T.PaperCustom=T
224: 08 42 69 6E 61 72 79 3D 54 0D 54 72 61 6E 73 70 | .Binary=T.Transp
240: 61 72 65 6E 74 3D 54 06 54 42 43 50 3D 54 06 42 | arent=T.TBCP=T.B
256: 69 6E 64 3D 54 09 43 6F 6C 6C 61 74 65 3D 54 06 | ind=T.Collate=T.
272: 53 6F 72 74 3D 54 08 53 74 61 70 6C 65 3D 46 07 | Sort=T.Staple=F.
288: 50 75 6E 63 68 3D 33 11 50 61 70 65 72 4D 61 78 | Punch=3.PaperMax
304: 3D 6C 65 67 61 6C 2D 41 34 | =legal-A4
```

9.6 Advertising Multiple Queues

For protocols like LPR that are capable of providing multiple queues, the printer MAY register one TXT record per queue and use the “rp” key to specify the queue name. For example, if a printer has four LPR 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()`.

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. Normative References

- [RFC 1034] Mockapetris, P., "Domain Names - Concepts and Facilities", STD 13, RFC 1034, November 1987.
- [RFC 1157] Case, J., Fedor, M., Schoffstall, M. and J. Davin, "Simple Network Management Protocol", STD 15, RFC 1157, May 1990.
- [RFC 1179] McLaughlin, L., "Line Printer Daemon Protocol" RFC 1179, August 1990.
- [RFC 1918] Y. Rekhter et.al., "Address Allocation for Private Internets", RFC 1918, February 1996.
- [RFC 2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", RFC 2119, March 1997.
- [RFC 2131] R. Droms, "Dynamic Host Configuration Protocol", RFC 2131, March 1997.
- [RFC 2132] Alexander, S., and Droms, R., "DHCP Options and BOOTP Vendor Extensions", RFC 2132, March 1997.
- [RFC 2136] Vixie, P., et al., "Dynamic Updates in the Domain Name System (DNS UPDATE)", RFC 2136, April 1997.
- [RFC 2279] Yergeau, F., "UTF-8, a transformation format of ISO 10646", RFC 2279, January 1998.
- [RFC 2567] Wright, D., "Design Goals for an Internet Printing Protocol", RFC 2567, April 1999.
- [RFC 2782] Gulbrandsen, A., et al., "A DNS RR for specifying the location of services (DNS SRV)", RFC 2782, February 2000.
- [IEEE 1284] "IEEE Std.1284-1994 Standard Signaling Method for a Bi-directional Parallel Peripheral Interface for Personal Computers", 1994.

11. Informative References

- [v4LL] Cheshire, S., B. Aboba, and E. Guttman, "Dynamic Configuration of IPv4 Link-Local Addresses", Internet-Draft (work in progress), draft-ietf-zeroconf-ipv4-linklocal-17.txt, July 2004.
- [mDNS] Cheshire, S. and M. Krochmal, "Performing DNS queries via IP Multicast", Internet-Draft (work in progress), draft-cheshire-dnsext-multicastdns-04.txt, February 2004.
- [DNS-SD] Cheshire, S. and M. Krochmal, "DNS-Based Service Discovery", Internet-Draft (work in progress), draft-cheshire-dnsext-dns-sd-02.txt, February 2004.

Appendix A. Bonjour Printing History

A.1 Mac OS X 10.2

First release with Bonjour printing support. To browse for printers in Print Center, select “Directory Services” from the pop-up menu. In this release, every service type supported by the printer is displayed, meaning that the same printer name will show up multiple times. The “Configure” button only activates when using an IPP print queue.

A.2 Mac OS X 10.2.1

Print Center now looks at all TXT records in cases where the printer advertises a protocol that has multiple print queues. Also, when browsing for printers in Print Center, the print protocol is now appended to the name. For example, a printer named “Bonjour Printer” that supports all IP printing protocols will show up in Print Center three times like so

```
Bonjour Printer.ipp  
Bonjour Printer.lpd  
Bonjour Printer.socket
```

A.3 Mac OS X 10.2.2

To browse for Bonjour printers, select “Rendezvous” from the Print Center pop-up menu. In this release, the printer name is only displayed once, and the “priority” key from the TXT record is consulted to determine which protocol to use when printing. Also, the protocol suffix is no longer appended to the printer’s name.

A.4 Mac OS X 10.2.3

Clicking the “Configure” button in Print Center now works for all printing protocols, and Print Center uses the “adminurl” value to determine the URL for the configuration page. Also, the printing system now resolves the printer’s service name each time the user prints, which means printing will continue to work even if the printer’s IP address changes. Additionally, you can now browse for Bonjour printers directly from the standard print dialog.

A.5 Mac OS X 10.2.4

First release to support non-PostScript Bonjour printers.

A.6 Mac OS X 10.3

The “Print Center” application is now called “Printer Setup Utility”. Inside Printer Setup Utility, the “Configure” button is renamed to “Utility”. Also, the “IP Printing” section in Printer Setup Utility allows you to pick a particular queue for printers that advertise multiple queues for a protocol.

Appendix B. Known Issues with Bonjour Printing in Mac OS X

Radar 3151461. If the printer's Bonjour service name contains a dot (".") or a backslash ("\"), the "Configure" button in Print Center will not be usable. **This was fixed in Mac OS X 10.3.**

Radar 3182751. When adding a non-PostScript printer from the print dialog, Port 9100 is always chosen as the printing protocol, regardless of which protocol is the highest priority as specified by the TXT record. If the printer doesn't support Port 9100, the printer can't be added from the print dialog and must be added from Print Center. **This was fixed in Mac OS X 10.3.**

Radar 3271549. When a printer advertises multiple TXT records for a protocol like LPR, and the combined sum total of all LPR TXT records is larger than 1500 bytes, Print Center will fail to receive the TXT records. The result is that Print Center will fail to choose the corresponding protocol, even when it's the highest priority. **This was fixed in Mac OS X 10.4.**

Radar 3272924. Bonjour service names are capable of being full UTF-8, however, because of a bug, if the printer uses a service name that contains Unicode characters beyond the standard ASCII range of 0x00 - 0x7F, then the "Configure" button in Print Center will not be usable. **This was fixed in Mac OS X 10.3.**

Radar 3272933. The official DNS-SD TXT record spec says that key names are case insensitive, however, Print Center requires that the key names match the case as described in this document. **This was fixed in Mac OS X 10.3.**

Appendix C. 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.