[MS-WPRN-Diff]:

Web Point-and-Print Protocol

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Revision Summary

Date	Revision History	Revision Class	Comments
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4/3/2007	1.1	Minor	Version 1.1 release
5/11/2007	1.2	Minor	Version 1.2 release
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Table of Contents

1 Introduction

This is a specification of the Web Point-and-Print Protocol. It is based on the Hypertext Transfer Protocol (HTTP) [RFC2616].

The Web Point-and-Print Protocol provides a way for a client to download printer driver software, from a server in the client network, from a website, or directly by a print device. This supports the distribution of printer drivers using standard web technologies.

This protocol references commonly used data types as defined in [MS-DTYP].

Sections 1.5, 1.8, 1.9, 2, and 3 of this specification are normative. All other sections and examples in this specification are informative.

1.1 Glossary

This document uses the following terms:

ASCII: The American Standard Code for Information Interchange (ASCII) is an 8-bit character-encoding scheme based on the English alphabet. ASCII codes represent text in computers, communications equipment, and other devices that work with text. ASCII refers to a single 8-bit ASCII character or an array of 8-bit ASCII characters with the high bit of each character set to zero.

big-endian: Multiple-byte values that are byte-ordered with the most significant byte stored in the memory location with the lowest address.

CAB file: See cabinet file.

cabinet file: A file that has the suffix .cab and that acts as a container for other files. It serves as a compressed archive for a group of files. For more information, including the format of CAB files, see [MSDN-CAB].

device driver: The software that the system uses to communicate with a device such as a display, printer, mouse, or communications adapter. An abstraction layer that restricts access of applications to various hardware devices on a given computer system. It is often referred to simply as a "driver".

driver package: A collection of the files needed to successfully load a driver. This includes the device information (.inf) file, the catalog file, and all of the binaries that are copied by the .inf file. Multiple drivers packaged together for deployment purposes.

fully qualified domain name (FQDN): An unambiguous domain name ~~(2)~~ that gives an absolute location in the Domain Name System's (DNS) hierarchy tree, as defined in [RFC1035] section 3.1 and [RFC2181] section 11.

Hypertext Transfer Protocol (HTTP): An application-level protocol for distributed, collaborative, hypermedia information systems (text, graphic images, sound, video, and other multimedia files) on the World Wide Web.

Hypertext Transfer Protocol Secure (HTTPS): An extension of HTTP that securely encrypts and decrypts web page requests. In some older protocols, "Hypertext Transfer Protocol over Secure Sockets Layer" is still used (Secure Sockets Layer has been deprecated). For more information, see [SSL3] and [RFC5246].

INF file: A file providing ~~Windows~~ Setup with the information required to set up a device, such as a list of valid logical configurations for the device and the names of driver files associated with the device.

Internet Printing Protocol (IPP): A standard protocol for printing and for the management of print jobs and printer settings over the Internet. It is built on the Hypertext Transfer Protocol (HTTP).

Internet Protocol version 4 (IPv4): An Internet protocol that has 32-bit source and destination addresses. IPv4 is the predecessor of IPv6.

little-endian: Multiple-byte values that are byte-ordered with the least significant byte stored in the memory location with the lowest address.

NetBIOS: A particular network transport that is part of the LAN Manager protocol suite. NetBIOS uses a broadcast communication style that was applicable to early segmented local area networks. ~~The LAN Manager protocols were the default in Windows NT operating system environments prior to Windows 2000 operating system.~~ A protocol family including name resolution, datagram, and connection services. For more information, see [RFC1001] and [RFC1002].

print server: A machine that hosts the print system and all its different components.

printer driver: The interface component between the operating system and the printer device. It is responsible for processing the application data into a page description language (PDL) that can be interpreted by the printer device.

proxy: A network node that accepts network traffic originating from one network agent and transmits it to another network agent.

registry: A local system-defined database in which applications and system components store and retrieve configuration data. It is a hierarchical data store with lightly typed elements that are logically stored in tree format. Applications use the registry API to retrieve, modify, or delete registry data. The data stored in the registry varies according to the version of ~~Windows~~the operating system.

Unicode: A character encoding standard developed by the Unicode Consortium that represents almost all of the written languages of the world. The Unicode standard [UNICODE5.0.0/2007] provides three forms (UTF-8, UTF-16, and UTF-32) and seven schemes (UTF-8, UTF-16, UTF-16 BE, UTF-16 LE, UTF-32, UTF-32 LE, and UTF-32 BE).

Uniform Resource Locator (URL): A string of characters in a standardized format that identifies a document or resource on the World Wide Web. The format is as specified in [RFC1738].

Universal Naming Convention (UNC): A string format that specifies the location of a resource. For more information, see [MS-DTYP] section 2.2.57.

UTF-16LE: The Unicode Transformation Format - 16-bit, Little Endian encoding scheme. It is used to encode Unicode characters as a sequence of 16-bit codes, each encoded as two 8-bit bytes with the least-significant byte first.

web server: A server computer that hosts websites and responds to requests from applications.

MAY, SHOULD, MUST, SHOULD NOT, MUST NOT: These terms (in all caps) are used as defined in [RFC2119]. All statements of optional behavior use either MAY, SHOULD, or SHOULD NOT.

1.2 References

Links to a document in the Microsoft Open Specifications library point to the correct section in the most recently published version of the referenced document. However, because individual documents in the library are not updated at the same time, the section numbers in the documents may not match. You can confirm the correct section numbering by checking the Errata.

1.2.1 Normative References

We conduct frequent surveys of the normative references to assure their continued availability. If you have any issue with finding a normative reference, please contact dochelp@microsoft.com. We will assist you in finding the relevant information.

[MS-DTYP] Microsoft Corporation, "Windows Data Types".

[MS-RPRN] Microsoft Corporation, "Print System Remote Protocol".

[MS-RRP] Microsoft Corporation, "Windows Remote Registry Protocol".

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997, http://www.rfc-editor.org/rfc/rfc2119.txt

[RFC2396] Berners-Lee, T., Fielding, R., and Masinter, L., "Uniform Resource Identifiers (URI): Generic Syntax", RFC 2396, August 1998, http://www.rfc-editor.org/rfc/rfc2396.txt

[RFC2616] Fielding, R., Gettys, J., Mogul, J., et al., "Hypertext Transfer Protocol -- HTTP/1.1", RFC 2616, June 1999, http://www.rfc-editor.org/rfc/rfc2616.txt

[RFC2617] Franks, J., Hallam-Baker, P., Hostetler, J., et al., "HTTP Authentication: Basic and Digest Access Authentication", RFC 2617, June 1999, http://www.rfc-editor.org/rfc/rfc2617.txt

[RFC2818] Rescorla, E., "HTTP Over TLS", RFC 2818, May 2000, http://www.rfc-editor.org/rfc/rfc2818.txt

[RFC793] Postel, J., Ed., "Transmission Control Protocol: DARPA Internet Program Protocol Specification", RFC 793, September 1981, http://www.rfc-editor.org/rfc/rfc793.txt

1.2.2 Informative References

[MSDN-CAB] Microsoft Corporation, "Microsoft Cabinet Format", March 1997, http://msdn.microsoft.com/en-us/library/bb417343.aspx

[MSDN-INF] Microsoft Corporation, "About INF Files", http://msdn.microsoft.com/en-us/library/aa376858.aspx

[MSDN-PRNINF] Microsoft Corporation, "Printer INF Files", ~~http~~https://msdn.microsoft.com/en-us/~~library/aa506008.aspx~~windows/hardware/drivers/print/printer-inf-files

[MSDN-RTV] Microsoft Corporation, "Registry Value Types", http://msdn.microsoft.com/en-us/library/ms724884.aspx

[RFC2781] Hoffman, P., and Yergeau, F., "UTF-16, an encoding of ISO 10646", RFC 2781, February 2000, http://www.rfc-editor.org/rfc/rfc2781.txt

[RFC2910] Herriot, R., Ed., Butler, S., and Moore, P., "Internet Printing Protocol/1.1: Encoding and Transport", RFC 2910, September 2000, http://www.ietf.org/rfc/rfc2910.txt

[RFC2911] Hastings, T., Ed., Herriot, R., deBry, R., et al., "Internet Printing Protocol/1.1: Model and Semantics", RFC 2911, September 2000, http://www.ietf.org/rfc/rfc2911.txt

1.3 Overview

The Web Point-and-Print Protocol provides a mechanism for clients to download printer driver software from a server in the client network or from a website, or directly by print devices. <1>

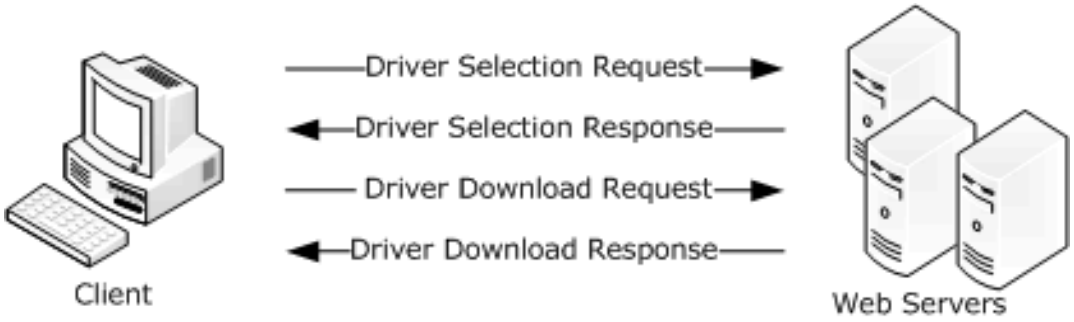


Figure 1: Client selection and download of printer driver

A Web Point-and-Print Protocol web server maintains a list of printer drivers. A client makes a Driver Selection Request (section 2.2.4) to obtain a printer driver of a particular type and for a particular client configuration. If the server locates a printer driver that matches these requirements, the server redirects the client to the location of the printer driver through the Driver Selection Response (section 2.2.5).

After a suitable printer driver has been found, the client downloads it by issuing a Driver Download Request (section 2.2.6). The driver is supplied in a Driver Download Response (section 2.2.7).

1.4 Relationship to Other Protocols

The Web Point-and-Print Protocol is dependent on HTTP specifications [RFC2616] and [RFC2617], and on TCP/IP specification [RFC793]. There are no protocols that are dependent on the Web Point-and-Print Protocol.

1.5 Prerequisites/Preconditions

The Web Point-and-Print Protocol is built on HTTP and therefore has the prerequisites specified in [RFC2616] that are common to HTTP communications.

It is a requirement that, before the protocol is invoked, a Web Point-and-Print Protocol client has obtained both the name of a server that supports the Web Point-and-Print Protocol and the name of a printer. How a client obtains these names is not addressed in this specification.

1.6 Applicability Statement

The Web Point-and-Print Protocol is applicable in environments that require distribution of printer driver software where other mechanisms (such as the Print System Remote Protocol; for more information, see [MS-RPRN]) are not available.

1.7 Versioning and Capability Negotiation

The Web Point-and-Print Protocol does not have versioning and does not contain locale-dependent information.

1.8 Vendor-Extensible Fields

The Web Point-and-Print Protocol does not support vendor-extensible fields.

1.9 Standards Assignments

The Web Point-and-Print Protocol uses the following default assignments.

Parameter	Value	Reference
TCP/IP port for Hypertext Transfer Protocol (HTTP)	80	As specified in [RFC2616] section 3.2.2.
TCP/IP port for Hypertext Transfer Protocol over Secure Socket Layer (HTTPS)	443	As specified in [RFC2818] section 2.3.

2 Messages

2.1 Transport

The Web Point-and-Print Protocol uses the following transports for HTTP sequences:

- HTTP over TCP/IP
- HTTPS over TCP/IP

2.2 Message Syntax

The Web Point-and-Print Protocol issues its requests from the client via Uniform Resource Locators (URLs) in an HTTP GET request and the associated query qualifier. The server returns a response via an HTTP response message, which returns either a Location header in a 302 (redirect) response or an HTTP error 500 if the original HTTP GET request cannot be processed by the server. For HTTP, see [RFC2616].

2.2.1 Common Data Types

Unless otherwise noted, the following statements apply to this specification:

- All strings that are defined in this protocol MUST consist of characters that are encoded in Unicode UTF-16LE and MUST be null-terminated. Each code point in a string, including null terminators, MUST occupy 16 bits. For more information, see [RFC2781] section 2.1.
- A list of strings is referred to as a **MULTI_SZ** ([MS-DTYP] section 2.3.8) in this protocol. In a **MULTI_SZ**, the characters that make up the string N+1 MUST directly follow the terminating null character of string N. The last string in a **MULTI_SZ** MUST be terminated by two null characters.
- All parameters or members that specify the number of characters in a string or **MULTI_SZ** MUST specify the number of characters in the string, including the terminating null characters.
- All constraints that specify the maximum number of characters in a string or **MULTI_SZ** MUST specify the number of characters in the string, including the terminating null characters.
- All parameters or members that specify the number of bytes in buffers that contain a string or **MULTI_SZ** MUST specify the number of bytes in the buffer, including the terminating null characters.

2.2.2 ClientInfo Value

There are four parameters encoded in a ClientInfo value:

- The major version number of the client operating system.
- The minor version number of the client operating system.
- A value specifying the type of client platform.
- A value specifying the client processor architecture.

Each parameter is an 8-bit unsigned value. For transmission on the wire, these values are packed into 32-bits to form a ClientInfo value, according to the following equation:

```
ClientInfo = (major version) * (2^24) + (minor version) * (2^16) + (client platform) * (2^8)
+ (client processor architecture)
```

The major version number of the client operating system is dependent on the platform on which the client is running.<2>

The minor version number of the client operating system is dependent on the platform on which the client is running.<3>

The client platform value is dependent on the platform on which the client is running.<4>

The client processor architecture value MUST be one of the following.<5>

Value	Client processor architecture
0x00	Intel x86
0x01	MIPS
0x02	ALPHA
0x03	PPC
0x06	Itanium-based
0x09	AMD64 or Intel x64
0x05	ARM

2.2.3 Registry Type Values

The following table specifies valid registry type values for use in the **dwType** field of the PrnDataRoot structure (section 2.2.7.1.2).

Registry type name/value	Description
REG_NONE 0x00000000	No value type is defined.
REG_SZ 0x00000001	A string.
REG_EXPAND_SZ 0x00000002	A string that can contain unexpanded references to environment variables, for example, "%PATH%".
REG_BINARY 0x00000003	Binary data in any form.
REG_DWORD 0x00000004	A 32-bit number.
REG_DWORD_LITTLE_ENDIAN 0x00000004	A 32-bit number in little-endian format; equivalent to REG_DWORD.
REG_DWORD_BIG_ENDIAN 0x00000005	A 32-bit number in big-endian format.

Registry type name/value	Description
REG_LINK 0x00000006	Symbolic link to a registry key.
REG_MULTI_SZ 0x00000007	A **REG_MULTI_SZ** structure ([MS-RRP] section 2.2.6).
REG_RESOURCE_LIST 0x00000008	A device driver resource list.
REG_QWORD 0x0000000B	A 64-bit number.
REG_QWORD_LITTLE_ENDIAN 0x0000000B	A 64-bit number in little-endian format; equivalent to REG_QWORD.

2.2.4 Driver Selection Request

The Driver Selection Request sends the printer driver selection criteria to the server. The message is a standard HTTP GET request, as specified in [RFC2616] section 9.3. The format of the HTTP request URL is specified by the grammar rule for **PrinterDriverQuery**, as follows:

```
PrinterDriverQuery = [PRINT_SERVER] PRINTER_RESOURCE "?" DRIVER_QUERY
PRINT_SERVER       = "http:" "//" host [":" port]
PRINTER_RESOURCE   = abs_path
DRIVER_QUERY       = "createexe" "&" CLIENT_INFO
CLIENT_INFO        = 1*DIGIT
```

Here, "1*DIGIT" indicates "one or more occurrences of DIGIT". For the definitions of **host**, **port**, **abs_path**, and **DIGIT**, see [RFC2616] sections 2.2 and 3.2, and [RFC2396] sections 3.2.2 and 3.3.

How the client determines the **host**, **port**, and **abs_path** is not specified by this protocol. Typically, the port is either the HTTP default port "80" or another port that is configured by an administrator.

DRIVER_QUERY: Forms the HTTP query component, as specified in [RFC2396] section 3.4, which constrains the selection of printer driver instances for the printer resource.

PRINT_SERVER: Specifies the address of the Web Point-and-Print Protocol server, whether or not the request is to be routed through a proxy.

PRINTER_RESOURCE: Specifies the name of the printer resource.

CLIENT_INFO: Contains the environmental information on the client that is making the request, constructed as a **ClientInfo** value and formatted as the ASCII representation of a decimal integer. Additionally, it MUST be computed as specified in section 2.2.2.

2.2.5 Driver Selection Response

The Driver Selection Response packet is a standard HTTP redirect response, in the HTTP **Location** field, to the URL of a file that contains the printer driver software and the information necessary to install the printer driver on the client. Specifically, the response MUST be a **Redirection 302** response, as defined in [RFC2616] section 10.3.3, and the HTTP **Location** field MUST point to the printer driver file.

2.2.6 Driver Download Request

This MUST be a standard HTTP GET request to the URL specified in the Location header received in the Driver Selection Response. For more information, see [RFC2616] section 10.3.3.

2.2.7 Driver Download Response

This MUST be a standard HTTP response, as specified in [RFC2616]. It MUST be returned in response to the driver download HTTP GET request. If the response return code is 200 (success), the response entity body MUST contain the requested driver.

The HTTP redirect is to a URL with content-type set to application/octet-stream, which specifies a cabinet file (for more information, see [MSDN-CAB]) that MUST have a .webpnp extension. The cabinet file includes the following:

- Printer driver software files.
- An INF file that is used during installation of the driver software. For more information, see [MSDN-INF].
- A BIN file that provides the information needed to access printer setup/configuration data. For the structure of this file, see section 2.2.7.1.
- A DAT file that provides additional print server and printer setup/configuration data. For the structure of this file, see section 2.2.7.2.

2.2.7.1 BIN File Format

A BIN file contains the information needed to access printer setup and configuration data. The format of that information is shown below. All fields are in little-endian format.

File Header:

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0x00000001																															
cItems																															
UserDevMode (variable)																															
...																															
PrnDataRoot (variable)																															
...																															

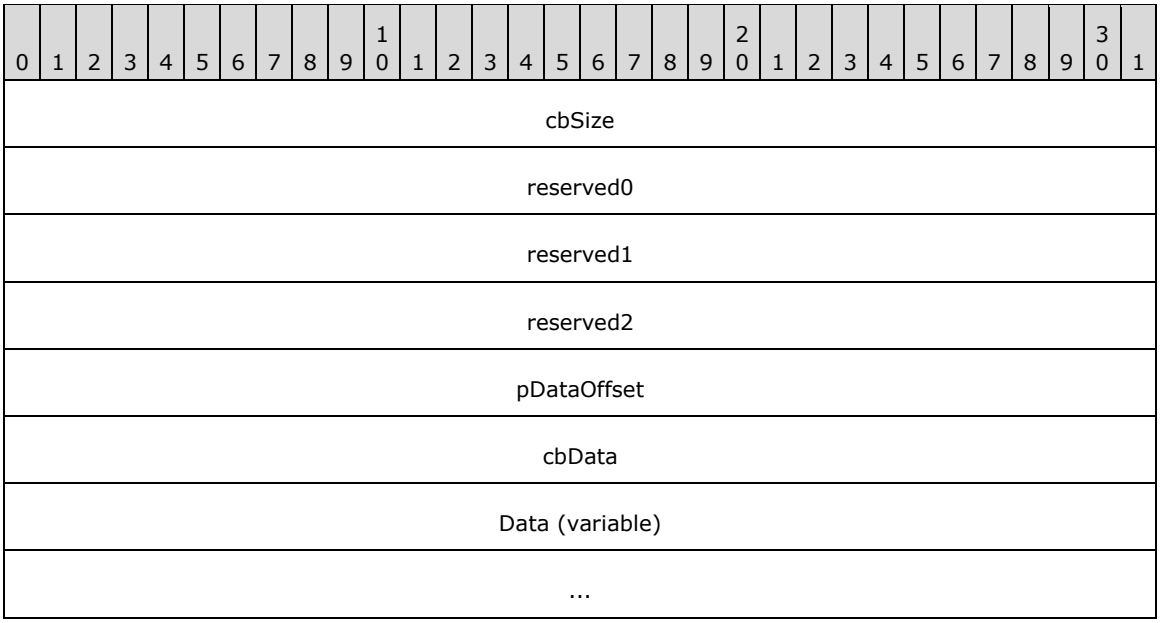
cItems (4 bytes): The number of PrnDataRoot (section 2.2.7.1.2) structures contained in the BIN file. This value can be zero.

UserDevMode (variable): A UserDevMode (section 2.2.7.1.1) structure.

PrnDataRoot (variable): A PrnDataRoot structure, which is repeated **cItems** times in this field.

2.2.7.1.1 UserDevMode Structure

The UserDevMode structure is used for general printer information.



cbSize (4 bytes): Total number of bytes in this UserDevMode structure.

reserved0 (4 bytes): MUST be set to zero when sent and MUST be ignored on receipt by the server.

reserved1 (4 bytes): MUST be set to zero when sent and MUST be ignored on receipt by the server.

reserved2 (4 bytes): MUST be set to zero when sent and MUST be ignored on receipt by the server.

pDataOffset (4 bytes): A 32-bit unsigned integer that MUST specify the number of bytes from the start of the UserDevMode structure to the **Data** field.

cbData (4 bytes): Number of bytes in the **Data** field.

Data (variable): A printer device settings structure; for details, see the _DEVMODE structure in [MS-RPRN] section 2.2.2.1.

This field MUST be padded to the next 64-bit boundary.

2.2.7.1.2 PrnDataRoot Structure

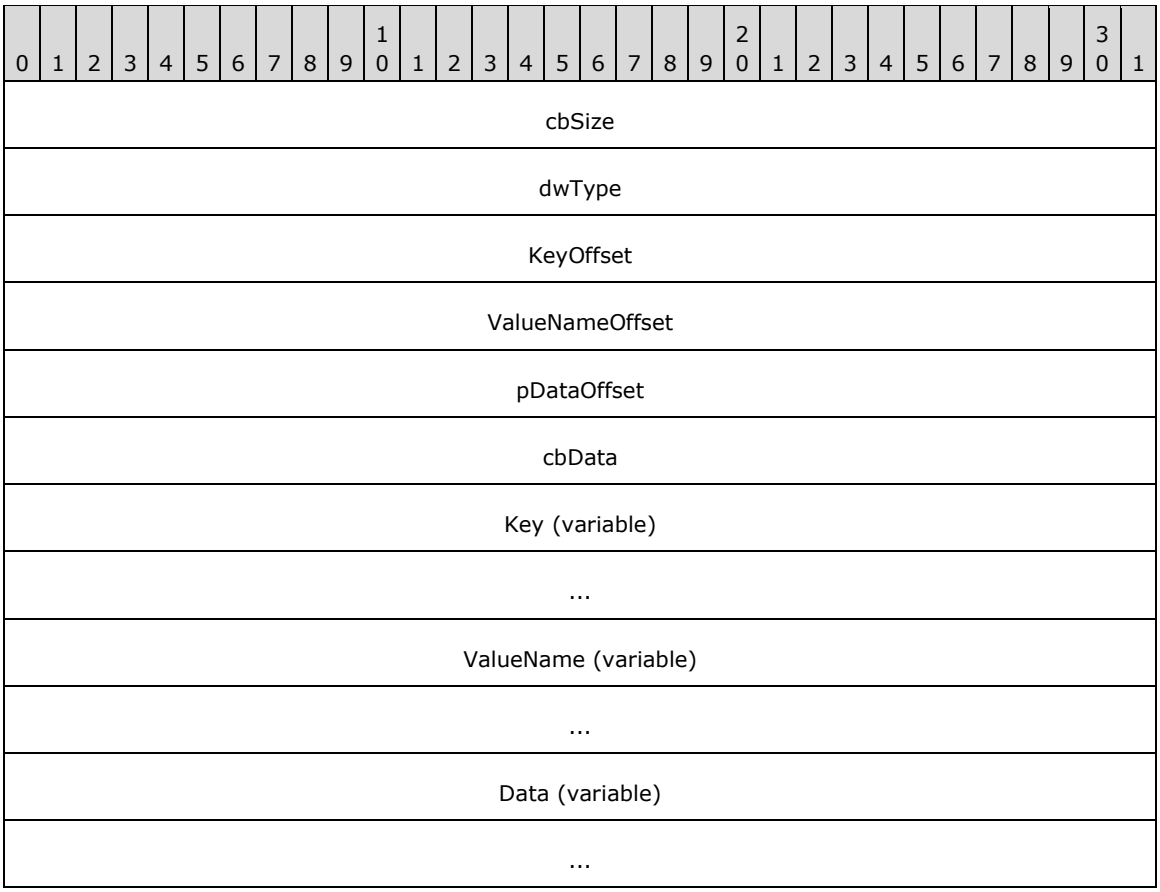
The PrnDataRoot structure describes a printer configuration value in the registry structure used by a printer driver that is associated with a printer. This structure is repeated for a count specified by the **cItems** member of the BIN file (section 2.2.7.1) header.

Printer configuration values control the behavior of the printer driver in a printer driver-specific way. A printer driver can define an arbitrary number of printer configuration values.

Printer configuration values are uniquely identified by the following attributes:

Key: An arbitrary string defined by the printer driver associated with a printer.

ValueName: A string that contains the name of the printer configuration value.



cbSize (4 bytes): Total number of bytes in this PrnDataRoot structure.

dwType (4 bytes): A value that specifies a registry type value (section 2.2.3). For additional information about registry types, see [MSDN-RTV].

KeyOffset (4 bytes): A 32-bit unsigned integer that specifies the number of bytes from the start of the PrnDataRoot structure to the **Key** field.

ValueNameOffset (4 bytes): A 32-bit unsigned integer that specifies the number of bytes from the start of the PrnDataRoot structure to the **ValueName** field.

pDataOffset (4 bytes): A 32-bit unsigned integer that specifies the number of bytes from the start of the PrnDataRoot structure to the **Data** field.

cbData (4 bytes): The number of bytes in the **Data** field.

Key (variable): A string that contains the name of the key that corresponds to the printer configuration value identified by **ValueName**. This field MUST be padded to the next 64-bit boundary.

ValueName (variable): A string that contains the name of a printer configuration value for the printer driver. This field MUST be padded to the next 64-bit boundary.

Data (variable): A field containing data for the printer configuration value identified by **ValueName**. The data contained in this field MUST be interpreted according to the registry value type that is specified by the **dwType** field. This field MUST be padded to the next 64-bit boundary.

2.2.7.2 DAT File Format

A DAT file contains options for installing a printer driver on the client machine. The following restrictions apply to DAT files:

- The name of the DAT file MUST be "cab_ipp.dat".
- The DAT file MUST be a text file, in Unicode UTF-16LE character encoding.

DAT file options are specified as follows:

```
/if
/x
/Q<PackageList>
/b<PrinterBaseName>
/f<InfName>
/r<PrinterPortName>
/m<DriverName>
/n<UncName>
/a<BinName>
/q
```

Note These options are presented in the form of a list for readability. This is not to specify that a newline character is required to separate each option in a DAT file.

Option parameters are defined as follows:

PackageList: A list of CAB file names containing driver packages included in the **.webpnp** file. The individual CAB file names are separated by ";".

PrinterBaseName: "\\http://<ServerName>\<PrinterName>", if the HTTP transport is being used; or "\\https://<ServerName>\<PrinterName>", if the HTTPS transport is being used.

ServerName: The NetBIOS name, fully qualified domain name (FQDN), or IPv4 address.

PrinterName: The name of the printer.

InfName: The name of the INF file that is included in the **.webpnp** file.

PrinterPortName: The URL of the printer.

DriverName: The name of the printer driver.

UncName: The Universal Naming Convention (UNC) path of the server.

BinName: The name of the BIN file that is included in the **.webpnp** file.

The following syntax rules apply to DAT file options and parameters:

- The individual options can appear in any order.
- All options MUST be specified, except "/x", "/q" and "/Q".
- The individual options MUST be separated by white space, which includes the UTF-16LE character codes 0x0020, 0x000D, and 0x000A, and combinations thereof.
- White space between the switch of an option (for example, "/r") and its parameter (for example, the **PrinterPortName**) MUST be accepted.
- A parameter MUST be surrounded by quotes if it contains white space.
- Quotes around a parameter that does not contain white space MUST be accepted.

- The absence of quotes around a parameter that does not contain white space MUST be accepted.
- The option "/if" conveys no meaning in the protocol.

The following syntax rules apply to the "/x", "/q" and "/Q" options specifically:

- Either the two options "/x" and "/q" together, or the single option "/Q", MUST be specified.
- If "/x" and "/q" are specified "/Q" MUST NOT be specified.
- If "/Q" is specified "/x" and "/q" MUST NOT be specified.
- The options "/x" and "/q" together indicate the installation of a printer driver. The name and location of the printer driver MUST be specified with the parameters of other options.
- The option "/Q" specifies the installation of a driver package.
- "/Q" MUST NOT be specified if the major version parameter of the ClientInfo value (section 2.2.2) in the request is less than 6.

3 Protocol Details

3.1 Client Details

3.1.1 Abstract Data Model

None.

3.1.2 Timers

None.

3.1.3 Initialization

None.

3.1.4 Higher-Layer Triggered Events

A client invocation is the result of local client application activity. The client application specifies the driver selection parameters. The syntax and semantics of these parameters are specified in section 2.2.4. No other higher-layer triggered events are defined.

3.1.5 Message Processing Events and Sequencing Rules

As specified in section 1.5, the client MUST be preconfigured with the URL of a Web Point-and-Print Protocol server. To initiate the Web Point-and-Print Protocol, the client MUST send a Driver Selection Request (section 2.2.4) message to the web server with which it has been configured.

If the server returns an HTTP status other than 302 (found), the client MUST NOT process any Location header in the HTTP response, and it MUST return an error code to the client application.

If the server returns an HTTP redirect (indicated by an HTTP status code of 302), the client MUST parse the received HTTP response to retrieve the Location header. If a Location header is not found in the response, the client MUST return an error to the invoking application. Otherwise, the client MUST send a Driver Download Request (section 2.2.6) to the server identified in the Location header of the received HTTP response.

If the HTTP response returned to the client has a status of 200 (success), the entity body received in the HTTP response MUST be returned to the invoking application as the printer driver package. If the HTTP response is anything other than success, the client MUST return an error to the invoking client application.

3.1.6 Timer Events

None.

3.1.7 Other Local Events

No additional local events are used on the client beyond the events maintained in the underlying HTTP.

3.2 Server Details

3.2.1 Abstract Data Model

This section describes a conceptual model of a possible data organization that an implementation might need to maintain to participate in this protocol. The organization described in this section is provided to facilitate the explanation of how the protocol behaves. This specification does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this specification.

The Web Point-and-Print Protocol depends on an abstract data model that maintains printers. The print server MUST behave as if it hosted the following objects in the specified hierarchy.

List of Printers: Each printer represents a physical print device or a number of homogeneous physical devices that are installed on the print server. Each printer object MUST maintain the following data elements:

- A name that uniquely identifies the printer.
- A reference to a printer driver object for the printer.
- Per-user printer device settings; for details, see the _DEVMODE structure in [MS-RPRN] section 2.2.2.1.

List of Drivers: Each printer driver represents the software component responsible for converting print content submitted by applications into device-specific commands. Each printer driver object MUST maintain the following data elements:

- A name that uniquely identifies the printer driver.
- A list of well-known modules (that is, rendering module, configuration module, and data module).
- Additionally, each printer driver object SHOULD maintain the following optional data elements:
  - A list of dependent files.
  - Information on the printer driver manufacturer, printer driver time stamp, and version.

The abstract data model MUST be able to relate each printer to a single printer driver. For more information, see [MS-RPRN] section 3.1.1.

3.2.2 Timers

None.

3.2.3 Initialization

The server MUST listen for HTTP and HTTPS requests.

3.2.4 Higher-Layer Triggered Events

None.

3.2.5 Message Processing Events and Sequencing Rules

The client initiates the Web Point-and-Print Protocol by sending a Driver Selection Request (section 2.2.4) message to the server. On receiving this message, the server MUST validate parameters as follows:

- The **PRINTER_RESOURCE** parameter MUST be a valid absolute path of a printer resource.
- The **CLIENT_INFO** section of the URL MUST be a supported ClientInfo (section 2.2.2) value.

If parameter validation fails, the server MUST fail the operation immediately, returning HTTP error 500 (Internal Server Error). If parameter validation succeeds, the server MUST compose a response to the client as follows:

- The server MUST use the received **CLIENT_INFO** parameter to determine the location of the appropriate printer driver. The mechanism is implementation specific. If a matching driver is found, the server MUST create a Driver Selection Response (section 2.2.5), replying to the client with an HTTP 302 redirect.<6>
- If a matching driver cannot be found, the server MUST fail the operation, replying to the client with HTTP error 500 (Internal Server Error).

Processing of a Driver Download Request MUST follow the rules specified for GET processing, as specified in [RFC2616] section 9.3. The format of the data returned in the response is specified in section 2.2.7.

3.2.6 Timer Events

None.

3.2.7 Other Local Events

No additional local events are used on the client beyond the events maintained in the underlying HTTP.

4 Protocol Examples

4.1 Client/Server Interaction

The following diagram illustrates the interaction sequence to obtain a printer driver using the Web Point-and-Print Protocol.

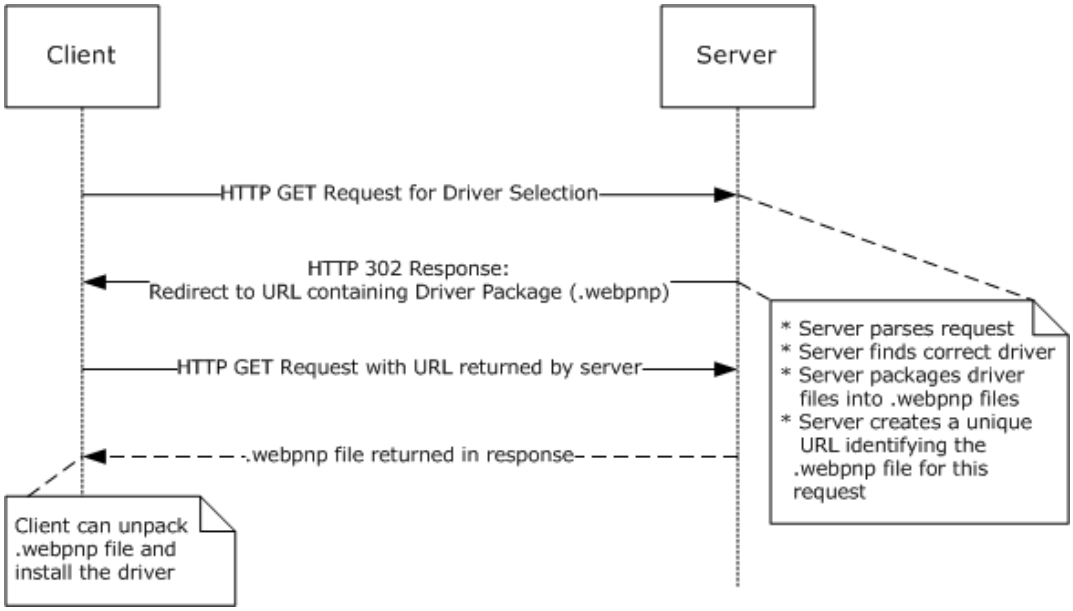


Figure 2: Obtaining a printer driver

4.2 Client/Server Messages

4.2.1 Client

The following text is a sample client Driver Selection Request, depicted in the figure of section 4.1. An HTTP **GET** request is used for sending printer driver selection criteria to the server. For more information, see section 2.2.4.

```
GET /printers/printerModelXXX/.printer?createexe&83952128
```

4.2.2 Server

The following text is a sample server Driver Selection Response to a client Driver Selection Request, as depicted in the figure of section 4.1. The server performs an HTTP **Redirection 302** response to the URL of a file that contains the requested printer driver and installation software. For more information, see section 2.2.5.

```
HTTP/1.1 302 Object Moved
Content-Length: 176
Content-Type: text/html
Location: http://1.1.1.2/printers/PrtCabs/85CCX862.webpnp
Server: Microsoft-IIS/6.0
```

```
X-Powered-By: ASP.NET
Date: Wed, 12 Jul 2006 21:44:42 GMT
Connection: close
<head><title>Document Moved</title></head>
<body><h1>Object Moved</h1>This document may be found
   <a HREF="http://1.1.1.2/printers/PrtCabs/85CCX862.webpnp">here</a>
</body>
<END OF ENTITY>
```

5 Security

5.1 Security Considerations for Implementers

The Web Point-and-Print Protocol does not provide any facilities for mutual authentication, so server identities cannot be verified.

5.2 Index of Security Parameters

There are no security parameters in the Web Point-and-Print Protocol.

6 Appendix A: Product Behavior

The information in this specification is applicable to the following Microsoft products or supplemental software. References to product versions include released service packs.

- Windows 2000 operating system
- Windows 2000 Server operating system
- Windows XP operating system
- Windows Server 2003 operating system
- Windows Vista operating system
- Windows Server 2008 operating system
- Windows 7 operating system
- Windows Server 2008 R2 operating system
- Windows 8 operating system
- Windows Server 2012 operating system
- Windows 8.1 operating system
- Windows Server 2012 R2 operating system
- Windows 10 operating system
- Windows Server 2016 operating system

Exceptions, if any, are noted below. If a service pack or Quick Fix Engineering (QFE) number appears with the product version, behavior changed in that service pack or QFE. The new behavior also applies to subsequent service packs of the product unless otherwise specified. If a product edition appears with the product version, behavior is different in that product edition.

Unless otherwise specified, any statement of optional behavior in this specification that is prescribed using the terms "SHOULD" or "SHOULD NOT" implies product behavior in accordance with the SHOULD or SHOULD NOT prescription. Unless otherwise specified, the term "MAY" implies that the product does not follow the prescription.

<1> Section 1.3: The Web Point-and-Print Protocol is used when the Print System Remote Protocol (for more information, see [MS-RPRN]) is not available due to policy restrictions, policy restrictions on the use of RPC, or other restrictions on printing. When the Web Point-and-Print Protocol is used to install the printer drivers, the print spooler uses the Internet Printing Protocol (IPP) (for more information, see [RFC2910] and [RFC2911]) to communicate with the actual print device.

<2> Section 2.2.2: Windows clients use one of the following major version values.

Value	Major version
0x05	Windows 2000 Server, Windows XP, or Windows Server 2003
0x06	Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, or Windows Server 2016

<3> Section 2.2.2: Windows clients use one of the following minor version values.

Value	Minor version
0x00	Windows 2000 Server, Windows Vista, or Windows Server 2008
0x01	Windows XP, Windows 7, or Windows Server 2008 R2
0x02	Windows Server 2003, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, or Windows Server 2016

<4> Section 2.2.2: Windows clients use one of the following client platform values.

Value	Client platform
0x01	Windows 95 operating system, ~~Microsoft~~ Windows 98 operating system, or Windows Millennium Edition operating system.
0x02	Windows 2000, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, or Windows Server 2016

Windows Vista, and Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 :

- A "client platform" value of 0x01 is invalid.
- All other "client platform" values are treated as 0x02.

Windows 2000, Windows 2000 Server, Windows XP, and Windows Server 2003:

- All "client platform" values different from 0x01 or 0x02 are treated as 0x02.
- If "client platform" is 0x01, the "client processor architecture" value will be ignored and will always be treated as "Intel x86".

<5> Section 2.2.2: Windows client processor architecture values:

Not supported on Windows 2000 or Windows 2000 Server:

- AMD64

Not supported on Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, or Windows Server 2016:

- MIPS
- ALPHA
- PPC

Not supported on Windows 2000, Windows 2000 Server, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, or Windows Server 2008 R2 operating system:

- ARM

<6> Section 3.2.5: The Windows implementation extracts information from printer driver INF files to determine the appropriate drivers to return to the client. For information on printer driver INF files, see [MSDN-PRNINF].

7 Change Tracking

No table of changes is available. The document is either new or has had no changes since its last release.

8 Index

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