Print Service Interface

Requirements

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Abstract:

The Print Service Interface is the set of interfaces and methods that enable a Client such as a Printer, a Mobile Device, Web Portal, or a service to set up and invoke a print job from a Print Service. The Print Service may be used to resolve and access the information to be printed.

Revision History

Revision	Date	Comments
0.02	October 9 2001	Initial Draft Proposal
0.03	October 31 2001	Changes suggested at F2F review
0.04	November 30 2001	Added Overview Section and Accounting Requirements
0.06	December 31	Added Acronyms Section
0.07	10 April 2002	Alignment with spec interface model vs. object model changes. Added use model 5.
0.071	19 April 2002	Review comments from Dennis Carney
0.8	30 July 2002	Changed Off-Ramp to Target Device and O2S to T2S
0.81	08 September	Fixed numbering in the Use Model 5 diagram

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1 Overview

In today's environment of ever increasing personal mobility combined with virtually unlimited and instantaneous access to information through the Internet, many problems have arisen trying to print this information. In the case of personal mobility, the nearest printer (also known as the "TargetDevice") is often one the user has never seen before and therefore one for which the user's computing device lacks appropriate printer drivers. And, with the wide variety of document formats available on the Internet, it is often impossible to load the desired document into a cell phone or PDA for either viewing or printing.

The latest print architectures have attempted to resolve some part of this problem by adopting a variation of XHTML (dubbed XHTML-Print) as a common page-description language to enable the printing of many simple web pages directly. However, this support is in its infancy and will not be widely deployed for many months or years. Therefore, to address the broadest set of mobile and Internet printing situations, a service needs to be available on the network that will take a document in one format, convert it to another format suitable for printing, and then deliver it to the desired TargetDevice. This delivery could be either directly from the printing service or through some proxy. The content could originate on the Internet or have been created by the client.

When a new problem presents itself, such as the one for mobile printing services, there will be some initial, proprietary, solutions and some early adopters. Experience, shows that standardizing certain critical components of the solution and making the standard freely available and assures interoperability among implementations. This ultimately results in the broadest, most competitive market for the new solution. Customer sentiment generally supports and reinforces this experience as long as the standardization effort is concluded in a timely manner and the standardization process yields widespread adoption and demonstrable interoperability.

Within this document, we will refer to "Client" and "Service," rather than "client device" and "service device," to avoid confusion related to the fact that computing devices such as PC's, PDA's, and printers can have multiple roles, operating as clients in some contexts and servers in others.

This document will specify the new interfaces and/or protocols necessary between:

1) The Client and the Service
2) The Service and the TargetDevice (or a proxy for the TargetDevice)

It will **not** specify the interfaces or protocols between:

1) The Service and the Internet
2) The Client and the Internet
3) The Client and the printer

2 Introduction

The purpose of this document is to specify the Scope and Requirements for Print Service Interface (PSI) Protocols.

Section 2 describes the Scope of the PSI specification.

Section 3 is intended as an informative section to describe some Use Models.

Section 4 describes the requirements for the interface between the Printer/Mobile device and the Print Service.

2.1 Terminology

Service -A *service* provides some desired functions and contains one or more interfaces used for communication. A Print Service is an example of a *service*.

Interface - An *interface* is a collection of *methods* that are exposed by the service. An example of an *interface* is the Print Service JobControl *Interface*.

Method – A method is an operation in an interface.

Protocol – A *protocol* is an agreed-upon method for transmitting information between two devices. The *protocol* determines the communication method. An example of a *protocol* is WSDL/SOAP over HTTP.

Client - A process that makes requests to a Print Service. The *Client* process may reside in a Printer, Mobile Device, Web Portal or other device. The role of a *Client* is separate from the overall role of a device.

Target-Device - The destination for the data created by a service. A printer is one example of a TargetDevice.

URL - Fully qualified Uniform Resource Locator. See RFC 2396.

Authentication - The process of identifying an individual usually based on a username and password. In security systems, *authentication* is distinct from authorization, which is the process of giving individuals access to system objects based on their identity. *Authentication* merely ensures that the

individual is who he or she claims to be, but says nothing about the access rights of the individual.

Authorization - This is the process of granting or denying access to a network resource. Most computer security systems are based on a two-step process. The first stage is authentication, which ensures that a user is who he or she claims to be. The second stage is *authorization*, which allows the user access to various resources based on the user's identity.

3 Scope Of The Print Service Interoperability Specification

The PSI defines the interfaces, methods, and communication protocols necessary to:

1. Discover capabilities of the Print Service and a TargetDevice.

2. Enable delivery of content to the Print Service

3. Enable delivery of transformed content from the Print Service to a TargetDevice.

4. Define the communication protocols between a Client and a Print Service (C2S) and between a TargetDevice Device and a Print Service (T2S).

5. Allows for existing authorization, authentication and privacy mechanisms to be employed.

6. Enables an extensibility mechanism by which a Client and discover additional functionality provided by the Print Service

Other interfaces needed to implement a Print Service may remain proprietary and are out of scope for the Print Service Interface specification.

It is not intended that the interfaces defined in the PSI specification support the requirements for a more fully functional Work Flow Engine. Rather a Work Flow Engine might utilize a service that exposes the PSI to perform one of its tasks.

Figure 1 shows an example deployment that illustrates use of the Print Service Interface (PSI) specification.

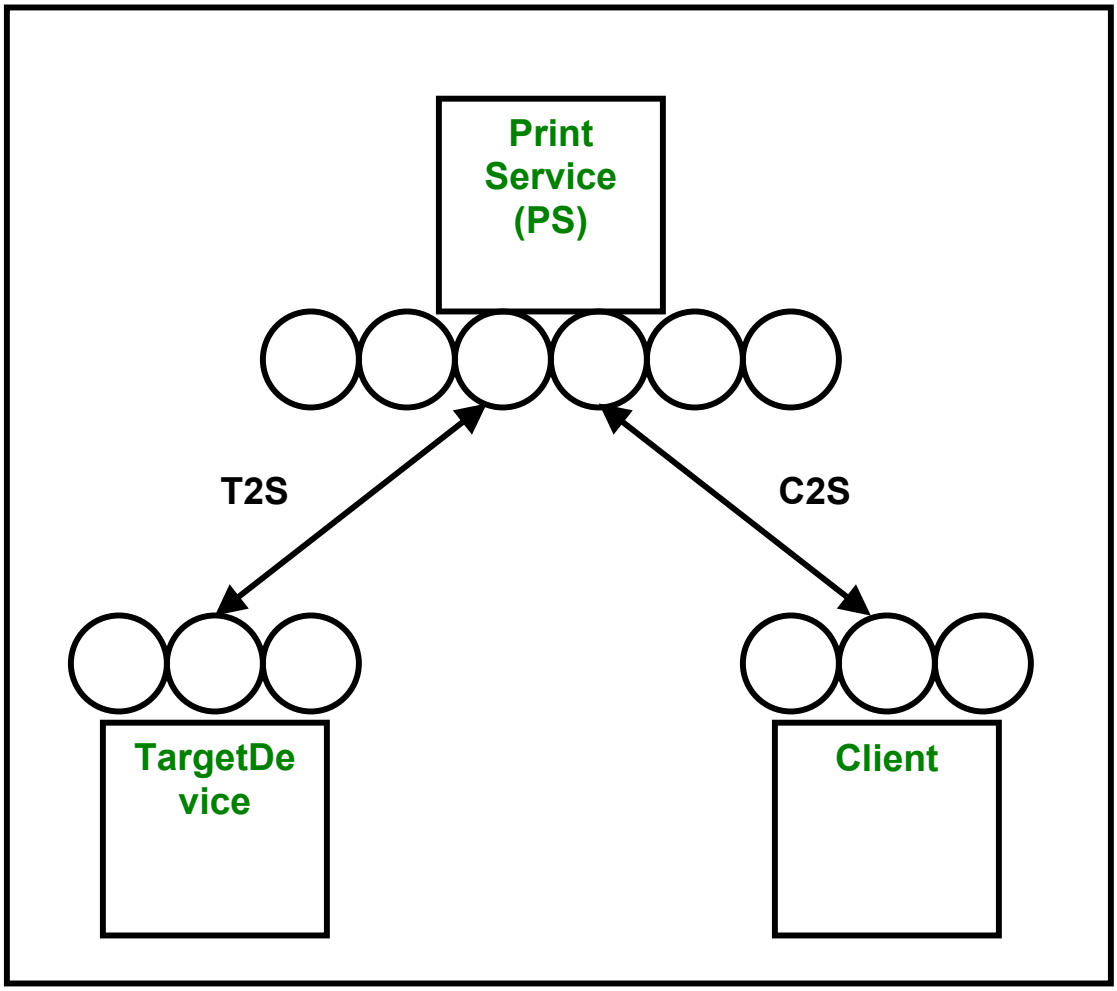


Figure 1- Example Print Service Interface Deployment

The circles in ***Figure 1*** ~~***Figure 1***~~ represent interfaces.

4 Print Service Interface Use Models (Informative)

A Print Service Interface will support a number of use models in order to serve the needs of a diverse set of clients and TargetDevices. This section describes some possible use models, along with more detailed information about the nature of the interactions required to support them. This should not be considered a complete list. The use models in the following sections focus on the reference and the data flow.

C2S is the Client to Service path.

T2S is the TargetDevice to Service path.

In all of the following diagrams the dashed lines are provided only as an aid to understanding. The data flows implied by the dashed lines are not defined by the PSI specification.

4.1 Use Model 1

The Printer requires a Print Service to format referenced data for printing.

At the new mall, Laurie sees the Digital still image camera of her dreams and it also has Bluetooth. The Camera Boutique is selling the camera at a price point Laurie finds compelling. From her previous research she remembers a different model and she wants to be sure this one has all of the same features. Laurie uses her mobile to inspect the web site of the other camera and wants to print out the detailed specifications. The Boutique has a new Particle Beam 2000 printer, which the Boutique allows their customers to use. Laurie sends the URL of the detailed specification to the printer, causing the desired camera specifications to printout. With the specifications in hand she observes that the competitors Camera only has 2 Mega Pixels and this new one offers 3 Mega Pixels. She leaves the store with camera in hand, confident she has done her homework.

Behind the Scenes: Laurie used her Cellular Access provider to surf the internet to retrieve the URL of the other camera. Note that Laurie could have saved this URL from a previous visit or typed it in or received as an e-mail promotion. Laurie sends this URL to the Boutique's printer using the store's Personal Area Network. The store may provide a secure access code for it's customers. The Particle Beam 2000 printer uses the Boutique's Print Service to accept the reference and fetch the content. The content is converted into a form acceptable to the Particle Beam 2000 printer. Laurie was not directly involved in the conversion process.

1. This Use Model starts with joining the stores Personal Area Network (PAN) and the discovery of the printer

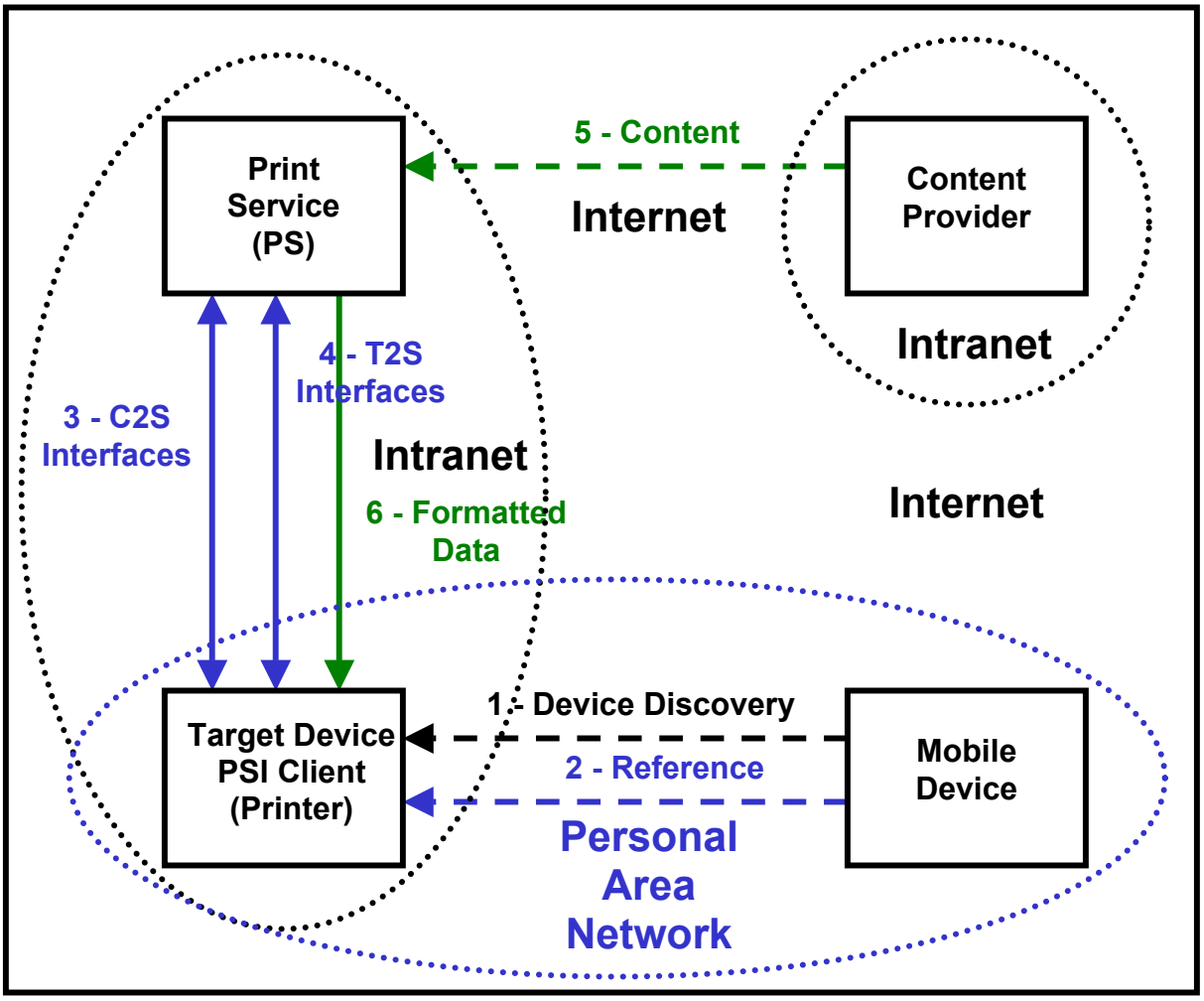
1.2. Next a ~~The Interaction starts with the creation of a~~ print job is initiated along with the ~~and~~ transfer of a reference from the Mobile Device to the Printer via any well-known method.

2.3. The reference refers to some information source on the network. The reference specifies the URL of the content and may include other information relating to the access of the reference. The creation of the print job may also include attributes such as color, duplex, n-up etc. The printer ~~is the~~ becomes a PSI client and ~~. It~~ ~~then~~ uses the PSI (C2S path) to setup and execute a Print Service request.

3.4. The Print Service may acquire information about the capabilities of the printer in order to process the request (T2S path).

4.5. The Print Service resolves the reference by retrieving the data and then converts it into a format that the Printer understands.

5.6. The formatted data is transferred to the TargetDevice.



4.1.1 Requirements

Printer needs to find or know about the Print Service

Printer needs to be able initiate a print job

Printer needs to be able to send a reference to the Print Service

Printer needs to tell the Print Service about what options are desired for the print job

Print Service needs to retrieve the content

Print Service needs to transform the content for the particular printer

Print Service needs to send the print job to the printer

4.2 Use Model 2

This use model provides for the streaming of print data from the Print Service through the Mobile Device to the Printer.

It is lunchtime at the Board of Directors meeting for the Society to Remedy the World Wild Agave Shortage. During this break Mary is using her handheld cellular network mobile device to receive quotes on her latest stock picks and she observes that her Don Juan Gold is up nearly 10 points. She would really like to get the detailed news reports that are also available. The conference room has a Bluetooth printer in the back that may be used by attendees. Mary selects the "print details" option for the Don Juan Gold stock. As the meeting continues Mary is reading the article and thinking of all the ways she can spend her new fortune.

Behind the Scenes: Mary's handheld doesn't have the detailed Don Juan Gold information, only current price information and an indication that detailed information is available. When Mary came into range of the Bluetooth printer, her handheld discovered the printer's capabilities. Alternately, the handheld could have discovered the printer in response to Mary's request for the details to be printed. The printer is not capable of print by reference since the printer does not have Internet access. Mary's handheld passes the printer capabilities and the reference to ~~a~~ her Print Service. When Mary subscribed to her ~~Mary did not even realize the~~ Chuck Smith Brokerage Company account she also chose to include Printe Services~~provides the Print Service as a service to its customers~~. The Print Service retrievs and convert~~sed~~ the content into a form that is acceptable to the printer. The Print Service sends the content back to Mary's handheld, which streams the data to the printer using the Bluetooth Printer protocol. Although the print job was by reference and used a Print Service, the printer is unaware of this fact. From the printer's point of view, it simply received a print job from a handheld.

1. The Mobile Device joins the conference PAN and discovers the printer using existing methods. The conference may have provided a secure access code for it's attendees.

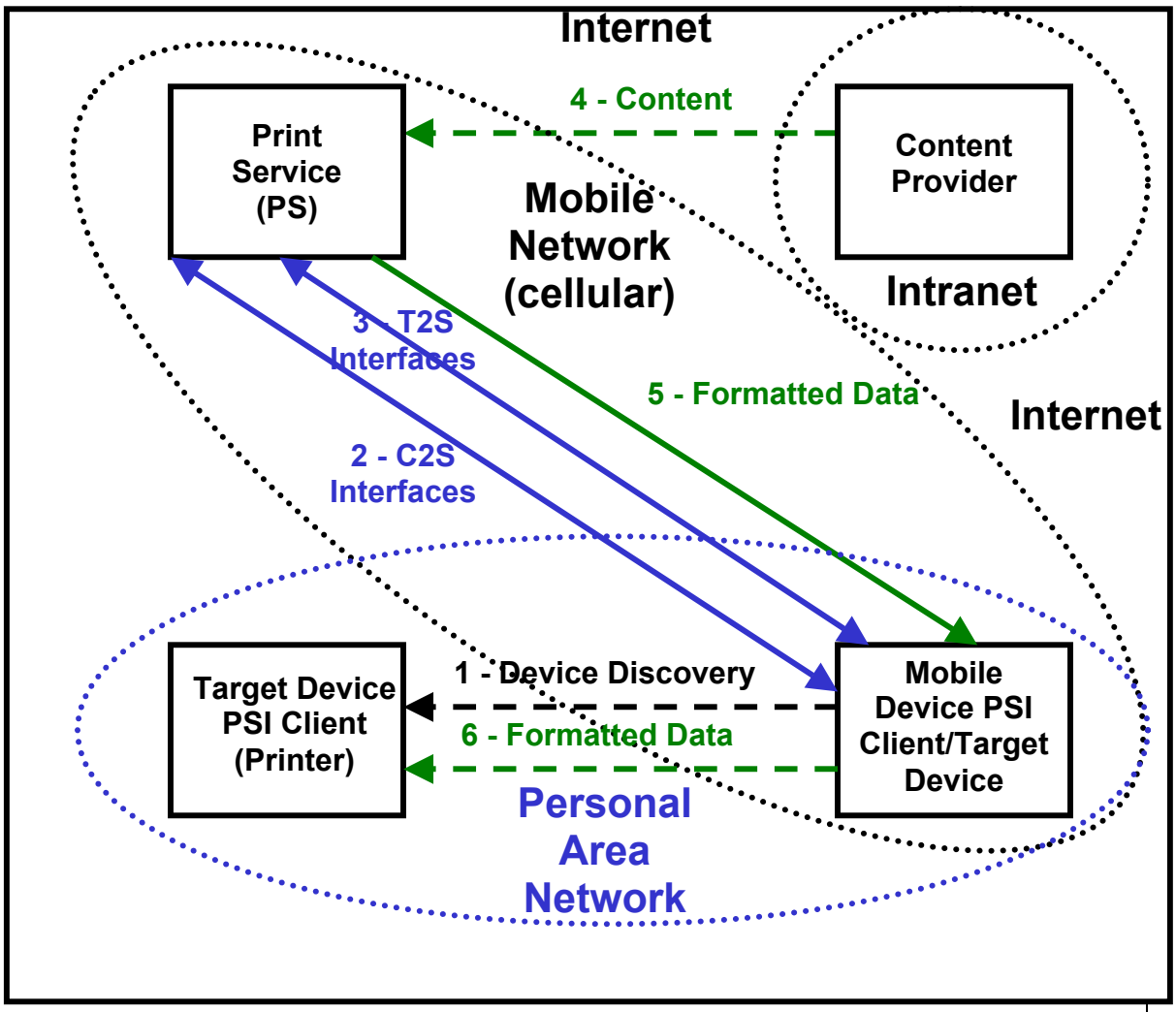
2. The Mobile Device sends the reference information to the Print Service via the C2S path.

3. The Print Service must acquire information about the capabilities of the printer from the mobile device in order to process the request. This information or the means to obtain it is sent via the T2S path.

4. The Print Service retrieves the data from the network.

5. The Mobile Device retrieves the converted data via the T2S path.

6. The print job is sent to the printer using existing methods.



4.2.1 Requirements

4.3 Use Model 3

This use model shows the Mobile Device initiating a print job by communicating directly with the Print Service.

Jim has just arrived at the Airport and he has arranged to meet his client at the Capitol Grill for a working dinner. He seems to have misplaced the address of the restaurant so he looks for it on the Internet. The Grill web page indicates that he can print out a map. He knows there is a Bluetooth printer on his way out of the Airport so he saves the URL of the map. When he gets to the end of the concourse he finds the printer and notices that it supports his cellular provider's Ggallop Network Print Service mobile cell phone print service. Using Ggallop he sends the captured URL to the print service and in no time his map and directions appear on the printer.

Behind the Scenes: Jim uses his mobile phone to access the Internet and to retrive the URL of a map to the restaurant. When his mobile device joins the airport's PAN and discovers the printer, it also discovers that the Printer is Internnet capable and specifically supports his Print Service. The applications that support printing in this scenario decide that the configuration supports printing directly for the Print Service to the Printer instead of streaming the data through the mobile device as in Use Model 2. The mobile device communicates directly with the Print Service and also relates the discovered printer's address. The Print service can then communicate directly with the printer to learn it's attributes and format the map accordingly. Finally the Print Service originates the print job.

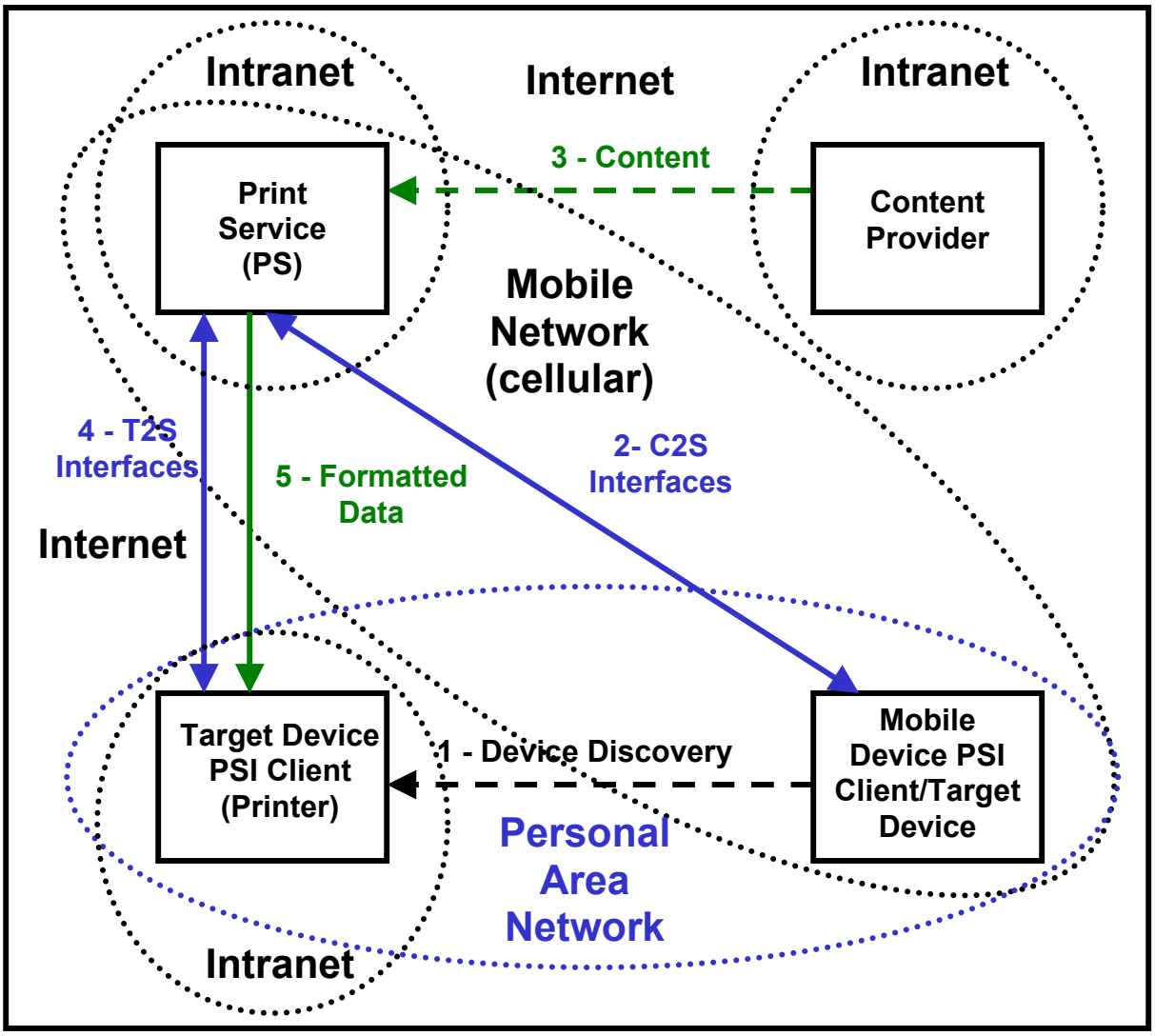
1. The Mobile Device discovers the printer using existing methods.

2. The Mobile Device acts as the PSI client. It sends the reference information to the Print Service, invokes the print job and indicates the desired TargetDevice device using the C2S path.

3. The Print Service retrieves the data from the network.

4. The Print Service must acquire information about the capabilities of the TargetDevice device in order to process the request. It communicates with the target TargetDevice using the T2S interface.

5. The Print Job data is communicated to the TargetDevice from the Print Service via the T2S path.



Issue: How does the mobile device know that it can use Model 3 instead of needing use model 2?

4.4 Use Model 4

This use model shows a Web Portal initiating a print job by communicating directly with the Print Service.

Fred has just arrived at the Intergalactic Big Iron Corporation to sign the final version of the contract he has been negotiating for several months. While waiting for his appointment he uses his laptop to surf the Internet via the lobby's wireless network that Big Iron allows its associates to use. He is thinking about dinner and discovers an interesting recipe for Chile Verde on a cooking web site. Fred selects the "print this" button next to the recipe and the recipe is printed out on Big Iron's printer in the lobby.

Behind the Scenes: Fred's laptop knows about several printers including the one it has discovered in the lobby. When he selected the "print this" function the portal communicated with the laptop to query for the printers that are available in Fred's current locale. The portal then communicated with a Print Service to originate a print job. The Print Service retrieved the recipe, translated the content according to Big Iron printer attributes, and sent the print Job to the printer.

1. A mobile Device finds content by browsing to a web portal.

2. The Mobile Device discovers the printer using existing methods.

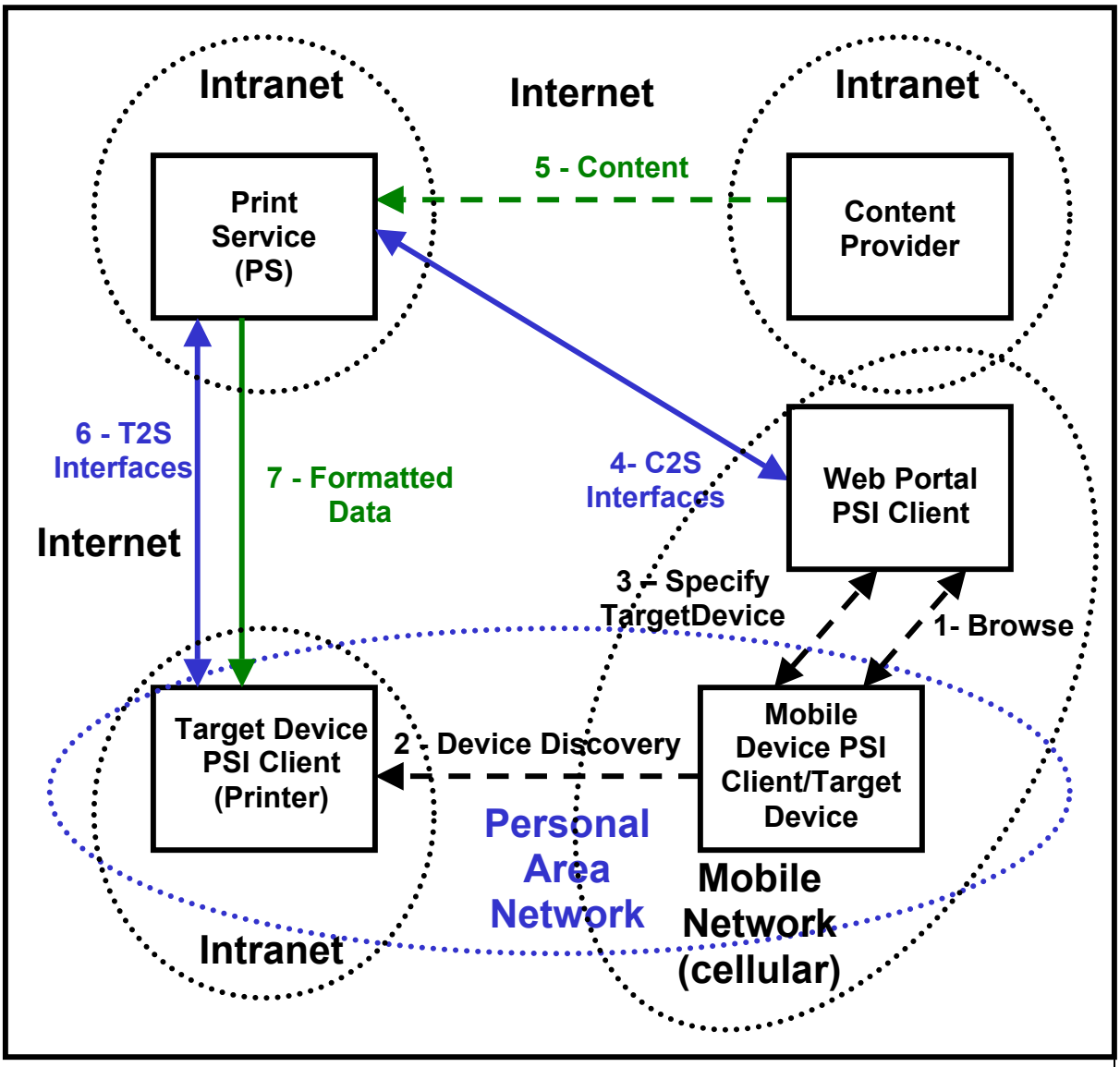
3. The Mobile Device tells the Web portal that it wants to print and includes the attributes and the name of the Printer.

4. The Web Portal acts as the PSI client, sends the reference information to the Print Service, invokes the job, and identifies the TargetDevice Device.

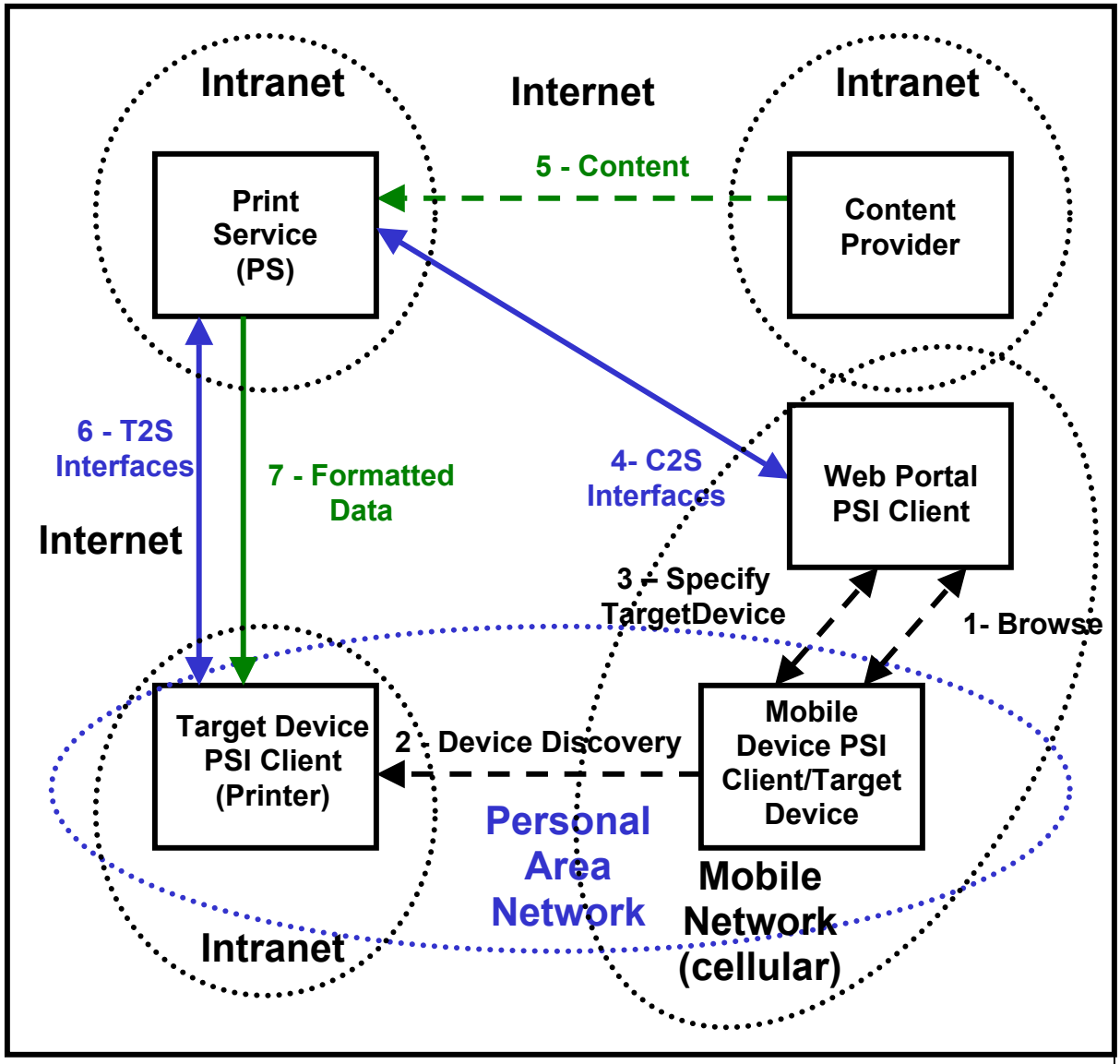
5. The Print Service retrieves the data from the network.

6. The Print Service must acquire information about the capabilities of the printer in order to process the request. The capabilities are communicated using the T2S path.

7. The Print Job data is communicated to the printer from the Print Service via the T2S path.



4.4.1 Requirements



4.5 Use Model 5

~~**Issue:** an alternative is for the web portal to discover the printer attributes and present these to the user.~~

This use model shows the Mobile Device sending a print job to the TargetDevice directly via some I/O technology.

It is strongly recommended that in this Use Model the Printer is pre configured to use a partclular Print Service. This will avoid issues with scaling and does not require the printer to attempt to discover a print service.

1. The Mobile Device discovers the printer using existing methods.

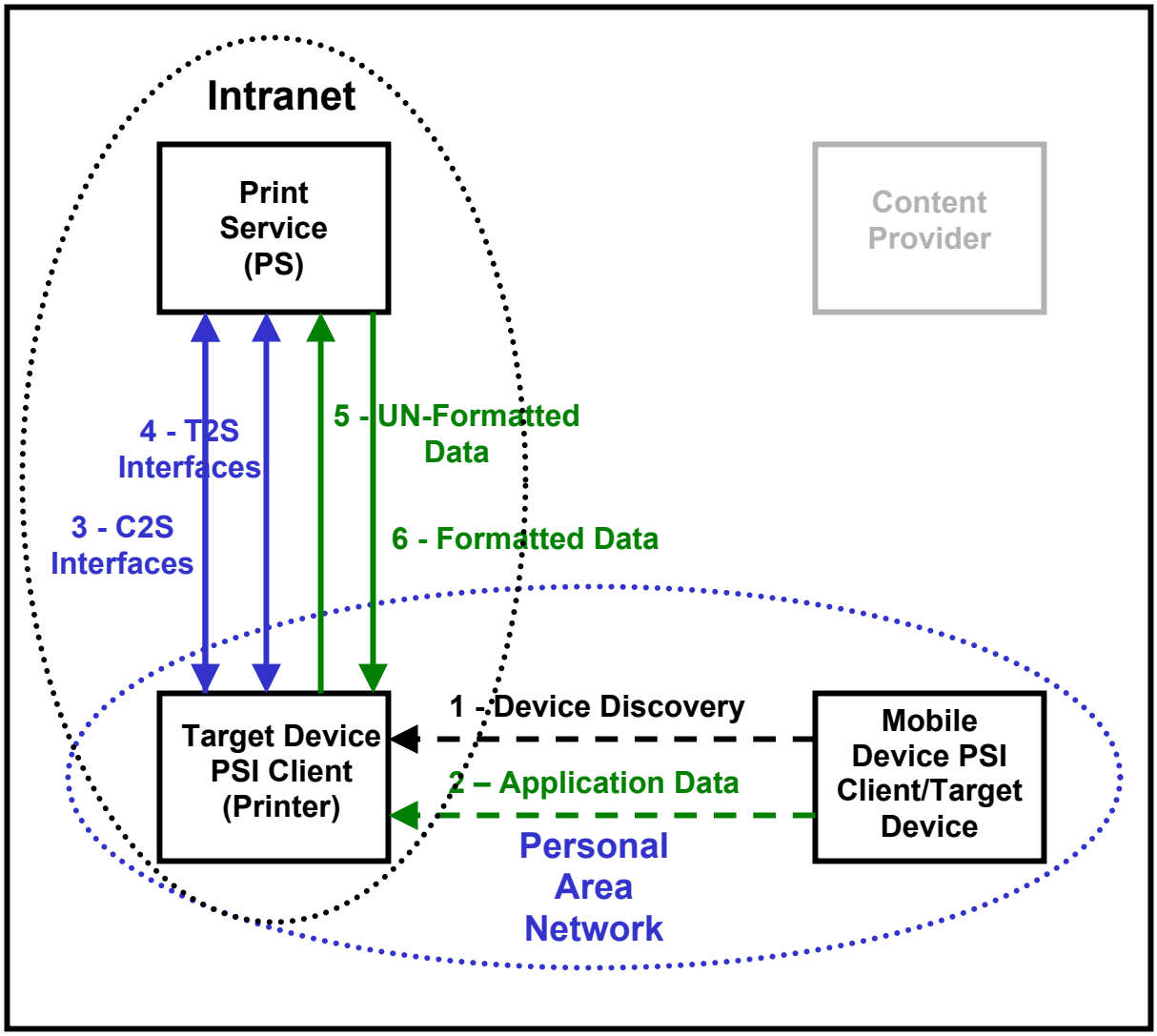
2. The Mobile Device sends a print job directly to the TargetDevice using some existing I/O technology.

3. The data format is one that the printer cannot translate. The TargetDevice uses the C2S interface to originate a print job.

4. The TargetDevice uses the T2S interface to initiate the data transfer to the PS.

5. The Print Job data is then transferred to the PS.

6. The transformed print job is sent back to the printer for printing.



4.5.1 Requirements

5 Print Service Interface Requirements

This section describes the general requirements of a Print Service Interface. These requirements will be based on the use models defined above along with the issues of Discovery, Print Job Control, Security and Billing.

5.1 Information Flow Requirements

The use models defined in section 4 can be supported with the following general requirements for the flow of information between the Printer or the Mobile Device using the Print Service interface.

1. The PSI shall support the ability for a client to send a reference and related print job attributes.

2. The PSI shall provide a method to allow printer ready information to be transferred to the TargetDevice.

5.2 Print Job Control

The PSI shall provide the means for a TargetDevice or Client to control, monitor and cancel a Print operation. This leads to the concept of a Print Job and may require an identification scheme to distinguish one print operation from another.

When a TargetDevice or Client initiates a Print request it shall have the option of setting attributes that determine the outcome of the Print operation. Extensions to this set must also be supported to allow for evolution and support of differentiated vertical markets. The initiation of a Print operation will result in the creation of a Print Job and an associated Job Identifier. All subsequent Print control operations will require a Job Identifier to link operations to a particular Print Job.

The PSI shall provide methods to communicate the capabilities of a Particular Printer in order to provide print ready information. The PSI shall provide the means for this information to be obtained before the processing of a Print request can begin.

Once a Print Job is underway the TargetDevice or Client must be able to query the status of the Print Job or to cancel the Print Job.

5.3 Security

The PSI may need to protect itself from unauthorized use. The PSI shall provide a mechanism for the Print Service to discover the identity of the client device (TargetDevice or Client) in order to enforce access control.

When processing a reference a Print Service may be challenged to provide credentials in order to access the information to be printed. The PSI may communicate access credentials in the following ways:

1. Access credentials may be included in the reference that was sent from the Mobile Device.

2. The Print Service may pass the challenge back to the client who must then re-submit the request with the correct security information included.

The PSI may optionally support privacy through the encryption of the information that travels across the T2S and C2S interfaces. This encryption can be imposed at the link level (e.g. HTTPS, IPSec) and established at connection set-up. Since this level of security occurs at the link level it has no bearing on the functionality of the Interface. Another approach is to have the information encrypted above the link level; however, this is out of scope for the PSI specification.

5.4 Accounting Metrics

The PSI shall support accounting metrics and attributes that could facilitate Print Service functions such as Billing. The PSI will not attempt to define any particular accounting or billing mechanisms.

Given the functions that a Print Service provides in the use models defined in section 4 it is clear that the Print Service will play a role in accounting related processing. The Print Services Interface must provide a means for accounting automata to acquire accounting related metrics generated by the Print Service. The Print Service is not required to integrate/inter-operate with any specific accounting package. Integration is assumed to be the responsibility of the accounting package/solution.

Requirements:

The Print Service Interface shall generate and capture a well defined set of accounting metrics (e.g. sheets delivered).

The accounting metrics defined by the Print Service Interface shall include metrics associated with specific "print job" transactions (e.g.,job level attributes such as the job id, impressions, sheets used, ...)

The accounting metrics defined by the Print Service Interface shall at a minimum include a user and job identifier.

The Print Service Interface shall provide a method that makes available the accounting metrics it has captured.

The Print Service Interface may provide accounting metrics beyond the well defined set specified above.

The Print Service Interface shall restrict access rights to the captured accounting metrics in a manner consistent with the overall Print Service.

The Print Service Interface should support the security requirements defined in the Security section of this requirements document.

6 Other Considerations

6.1 Print Service Discovery Requirements (Informative)

A client needs to locate a Print Service before it can be used. The PSI is not the mechanism used to locate a Print Service. There are a number of existing discovery models that can be used. A particular implementation or printing solution will make specific choices on how discovery should be done. The following provides a selection of options available. This should not be considered a complete list.

1. **Pre-configured**: The location of a Print Service may be pre-configured into a Printer or Mobile Device via a configuration interface.

2. **Service Registry**: The Print Service can be registered into a service registry. Printers and Mobile Devices can use the registry to locate a Print Service based on some set of search constraints. Registry infrastructures such as UDDI can be utilized for this purpose. The scope and use of a registry is outside the scope of this document.

Interop Stack	Universal Service Interop Protocols (these layers are not defined yet)
	Universal Discovery, Discription, Integration (UDDI)
	Simple Open Access Protocol (SOAP)
	Extended Markup Language (XML)
	Common Internet Protocols (HTTP, TCP/IP)

3. **Local Network Discovery**: A Print Service can be located via network discovery protocols. There are a number of protocols defined for IP based networks including SLP and SSDP. SSDP is used by UPNP based devices.

4. **Reference Based Location**: A Printer can discover which Print Service to use by processing a reference sent to it from a Mobile Device.

7 Acronyms

C2S	Client to Service
HTTPS	HyperText Transfer Protocol – Secure
IP	Internet Protocol
IPSec	Internet Protocol SECurity
T2S	TargetDevice to Service
PDA	Personal Digital Assistant
PS	Print Service
PSI	Print Services Interface
SLP	Service Location Protocol
SOAP	Simple Object Access Protocol
SSDP	Simple Service Discovery Protocol
SSL	Secure Sockets Layer
TLS	Transaction Layer Security
UDDI	Universal Description, Discovery and Integration
UPNP	Universal Plug and Play
URL	Universal Resource Locator (see RFC2396)
WSDL	Web Service Description Language
XHTML	eXtendable HyperText Markup Language