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Requirements Document

![The Printer Working Group logo — A Program of the IEEE-ISTO, pwg]

The Printer Working Group

Print Service Interface (PSI)
Requirements

Version 1.0

Status: Approved

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.

This document is a PWG Statement of Requirements. See:
ftp://ftp.pwg.org/pub/pwg/general/pwg-process20.pdf
This document is available electronically at:
ftp://ftp.pwg.org/pub/pwg/informational/req-psireq10-20040212.pdf, .doc, .rtf

About the IEEE-ISTO

The IEEE-ISTO is a not-for-profit corporation offering industry groups an innovative and flexible operational forum and support services. The IEEE Industry Standards and Technology Organization member organizations include printer manufacturers, print server developers, operating system providers, network operating systems providers, network connectivity vendors, and print management application developers. The IEEE-ISTO provides a forum not only to develop standards, but also to facilitate activities that support the implementation and acceptance of standards in the marketplace. The organization is affiliated with the IEEE (http://www.ieee.org/) and the IEEE Standards Association (http://standards.ieee.org/).

For additional information regarding the IEEE-ISTO and its industry programs visit:

http://www.ieee-isto.org.

About the Printer Working Group

The Printer Working Group (or PWG) is a Program of the IEEE-ISTO. All references to the PWG in this document implicitly mean "The Printer Working Group, a Program of the IEEE ISTO." The PWG is chartered to make printers and the applications and operating systems supporting them work together better. In order to meet this objective, the PWG will document the results of their work as open standards that define print related protocols, interfaces, data models, procedures and conventions. Printer manufacturers and vendors of printer related software would benefit from the interoperability provided by voluntary conformance to these standards.

In general, a PWG standard is a specification that is stable, well understood, and is technically competent, has multiple, independent and interoperable implementations with substantial operational experience, and enjoys significant public support.

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Instructions for subscribing to the PSI mailing list can be found at the following link:

http://www.pwg.org/mailhelp.html

Members of the PWG and interested parties are encouraged to join the PWG and PSI WG mailing lists in order to participate in discussions, clarifications and review of the WG product.

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 2003	Fixed numbering in the Use Model 5 diagram
0.86	2 September 2003	Enhance Use Model Diagrams to show the network domains
0.87	24 September 2003	Added a Requirements section to each Use Model
0.89	21 October 2003	Changes based on Input from 10/07/2003 F2F review

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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 "Target Device") 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 Target Device. 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 Target Device (or a proxy for the Target Device)

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 3 describes the Scope of the PSI specification.

Section 4 describes the Use Models which will be used to derive the requirements for the Print Service Interface specification.

Section 5 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 Job Control *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 Target Device.

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 Target Device.

2. Enable delivery of content to the Print Service

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

4. Define the communication protocols between a Client and a Print Service (C2S) and between a Target 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.
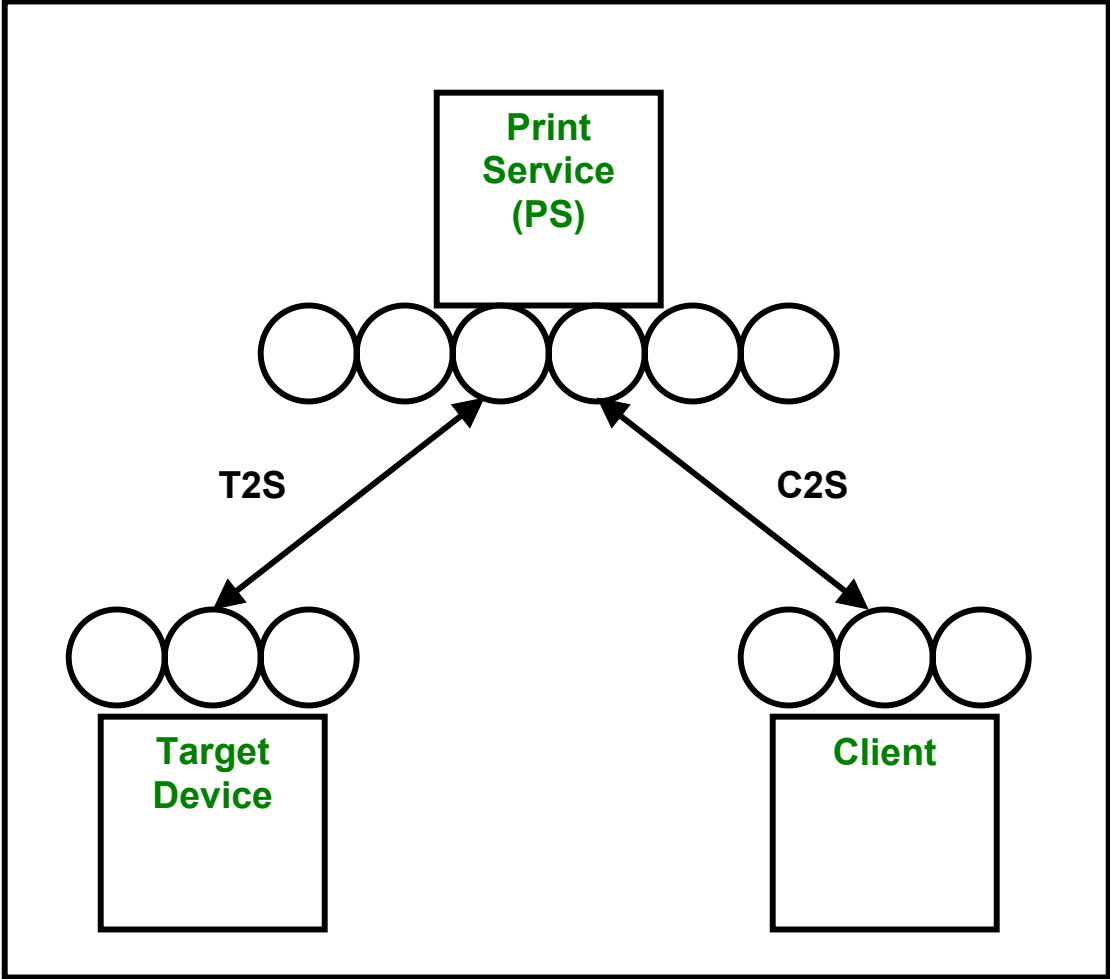
Figure 1- Example Print Service Interface Deployment

The circles in *Figure 1* represent interfaces.

4 Print Service Interface Use Models

A Print Service Interface will support a number of use models in order to serve the needs of a diverse set of clients and Target Devices. 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 Target Device to Service path.

In all of the following diagrams:

The solid lines indicate protocols that are defined by the Print Service Interface specification.

The dashed lines indicate protocols that are not defined by the Print Service Interface specification.

The dashed circles or ovals indicate administrative domains such as LANS, PANS, Intranets or Internets.

The term "reference" indicates a URL that could have been obtained in a number of different ways. The URL could be manually entered, previously stored, e-mailed, or even spoken into the mobile device.

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 Target Device

2. Next a print job is initiated along with the transfer of a reference from the Mobile Device to the Target Device via any well-known method.

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 Target Device becomes a PSI client and it uses the PSI (C2S path) to setup and execute a Print Service request.

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

5. The Print Service resolves the reference by retrieving the data and then converts it into a format that the Target Device understands.

6. The formatted data is transferred to the Target Device.
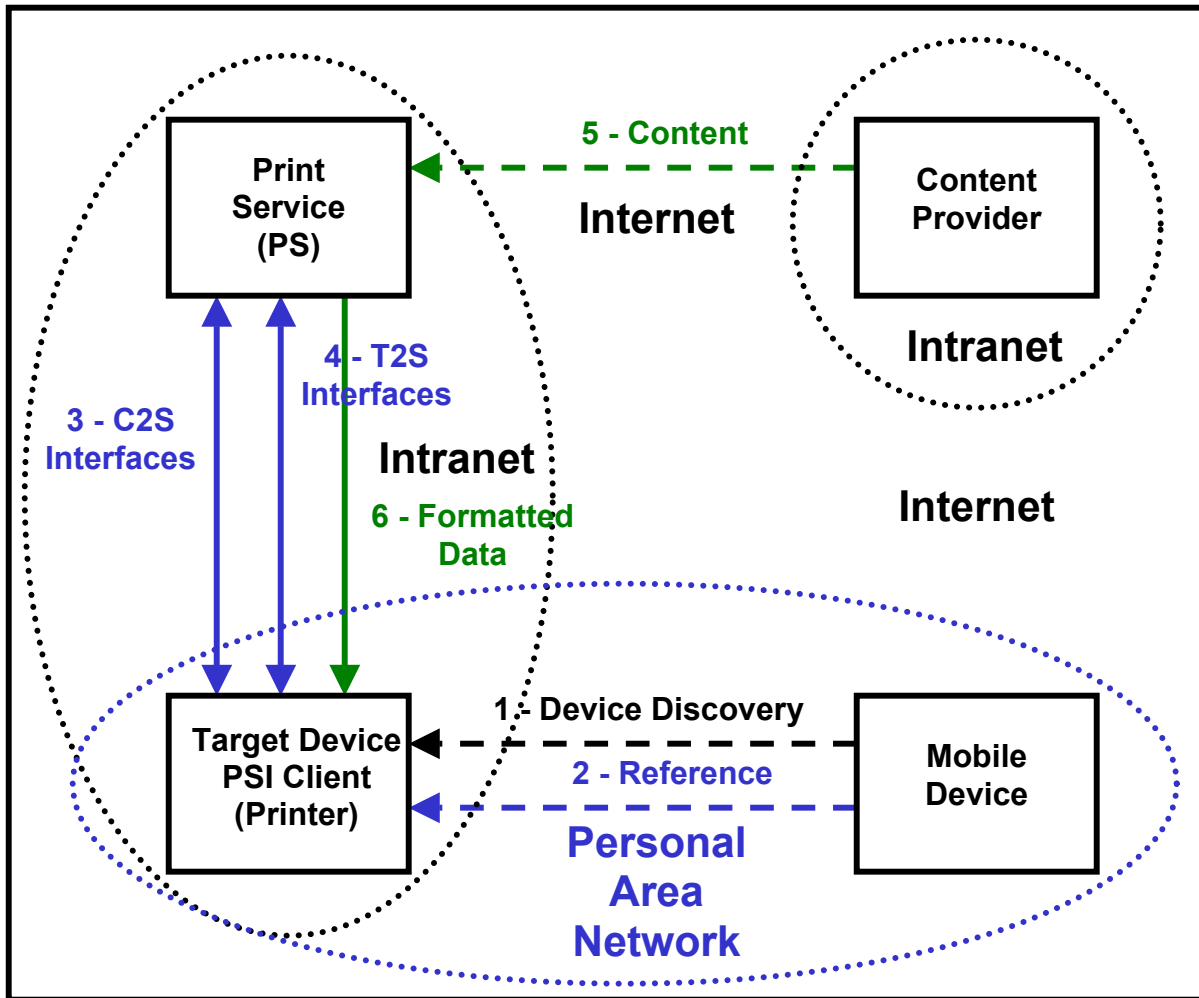
4.1.1 Requirements

The PSI specification must support:

1. Target Device configuration or discovery of Print Service.

2. Target Device initiation of a print job using a reference.

3. Target Device determination of the capabilities of the Print Service.

4. Target Device communication to the Print Service of the options desired for the print job.

5. Target Device communication to the Print Service for what Target Device to use.

6. Print Service retrieval of the original application data.

7. Print Service transformation of the original application data to a format supported by the Target Device.

8. Print Service transfer of the print job to the Target Device or Target Device retrieves the print job.

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 Target Device.

It is lunchtime at the Board of Directors meeting for the Society to Remedy the World Wide 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 her Print Service. When Mary subscribed to her Chuck Smith Brokerage Company account she also chose to include Print Services. The Print Service retrieves and converts 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 Target Device 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 Target Device 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 Target Device using existing methods.
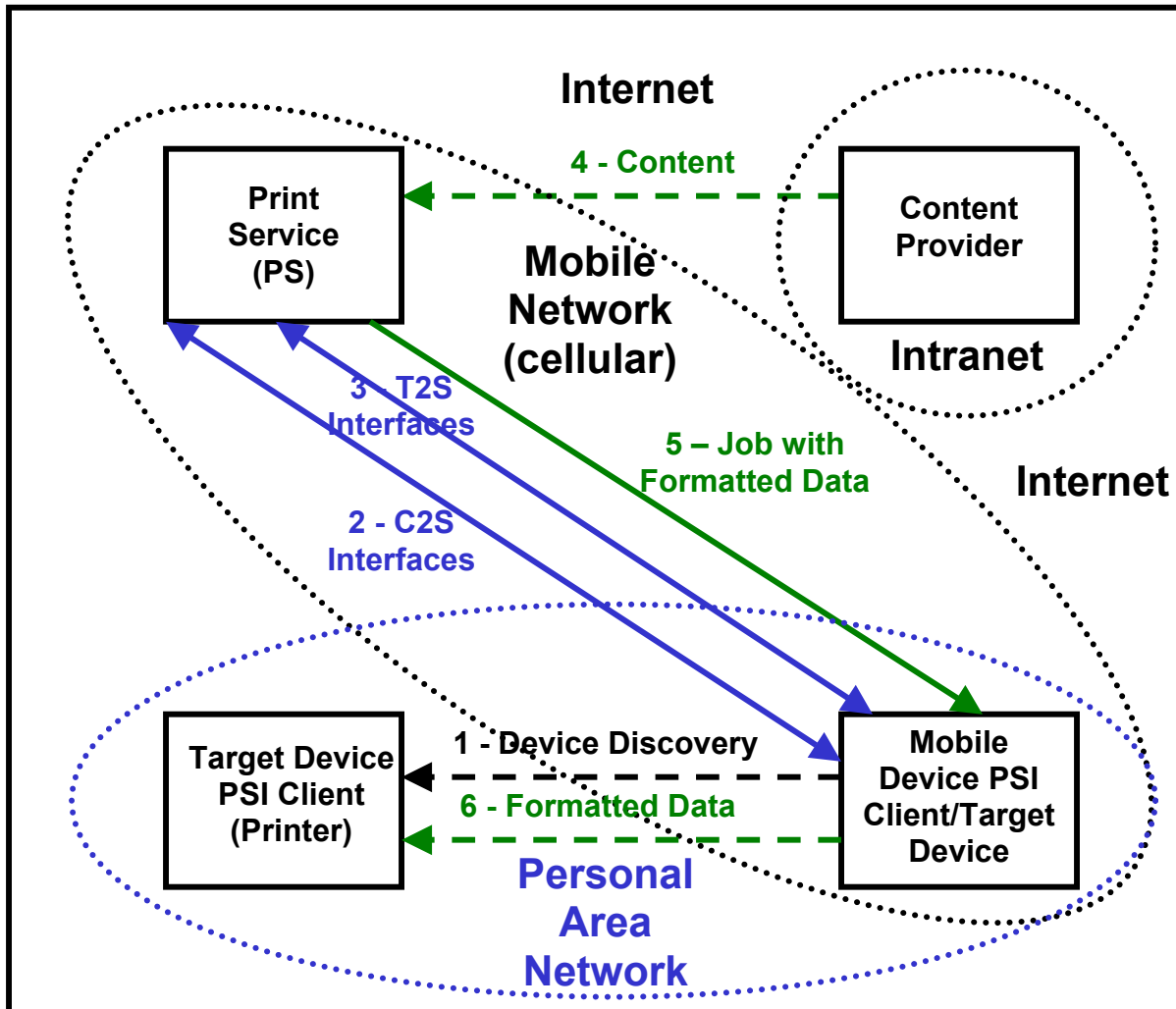
4.2.1 Requirements

The PSI specification must support:

1. Mobile Device configuration or discovery of Print Service.

2. Mobile Device initiation of a print job using a reference.

3. Mobile Device determination of the capabilities of the Print Service.

4. Mobile Device determination of the capabilities of the Target Device.

5. Mobile Device communication to the Print Service of the options desired for the print job.

6. Print Service retrieval of the original application data.

7. Print Service transformation of the original application data to a format supported by the Target Device.

8. Print Service transfer of the print job to the Mobile Device or Mobile Device retrieves the print job.

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 Gallop Network Print Service. Using Gallop 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 retrieve the URL of a map to the restaurant. When his mobile device joins the airport's PAN and discovers the Target Device, it also discovers that the Target Device is Internet capable and specifically supports his Print Service. The applications that support printing in this scenario decide via capabilities discovery that the configuration supports printing directly from the Print Service to the Target Device, 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 Target Device's address. The Print service can then communicate directly with the Target Device to learn it's attributes and format the map accordingly. Finally the Print Service originates the print job.

1. The Mobile Device discovers the Target Device 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 Target 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 Target Device in order to process the request. It communicates with the target Target Device using the T2S interface.

5. The Print Job data is communicated to the Target Device from the Print Service via the T2S path.
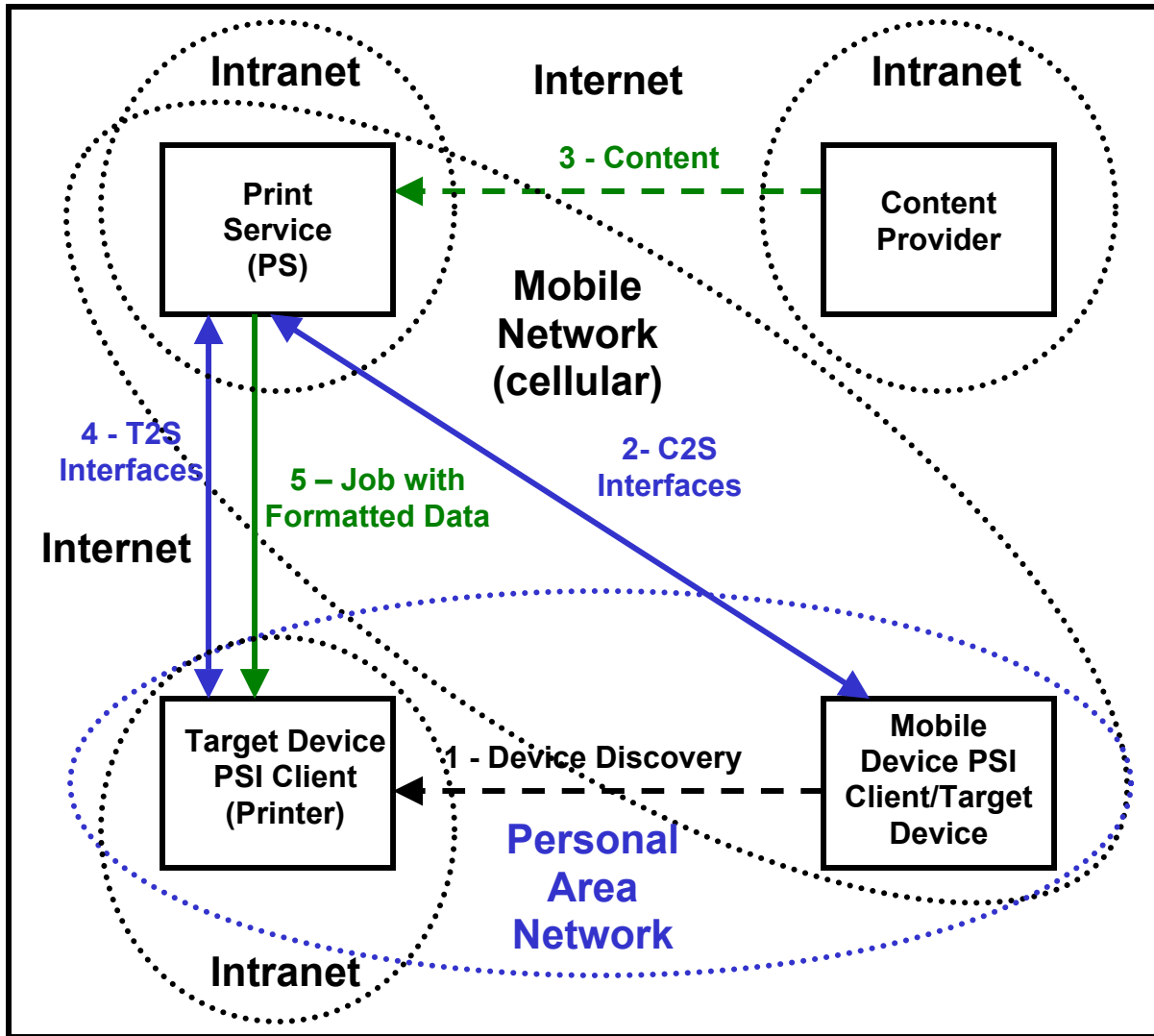
4.3.1 Requirements

The PSI specification must support:

1. Mobile Device configuration or discovery of Print Service.

2. Mobile Device initiation of a print job using a reference.

3. Mobile Device determination of the capabilities of the Target Device .

4. Mobile Device determination of the capabilities of the Print Service.

5. Mobile Device communication to the Print Service of the options desired for the print job.

6. Mobile Device communication to the Print Service of the Target Device to use

7. Print Service retrieval of the original application data.

8. Print Service transformation of the original application data to a format supported by the Target Device.

9. Print Service transfer of the print job to the Target Device or Target Device retrieves the print job.

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 Target Devices 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 Target Devices 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 Target Device attributes, and sent the print Job to the Target Device.

1. The Mobile Device finds content by browsing to a web portal.

2. The Mobile Device discovers the Target Device using non PSI methods.

3. The Mobile Device determines the capabilities of the Target Device using non PSI methods.

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

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

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

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

8. The Print Job data is communicated to the Target Device from the Print Service via the T2S path.
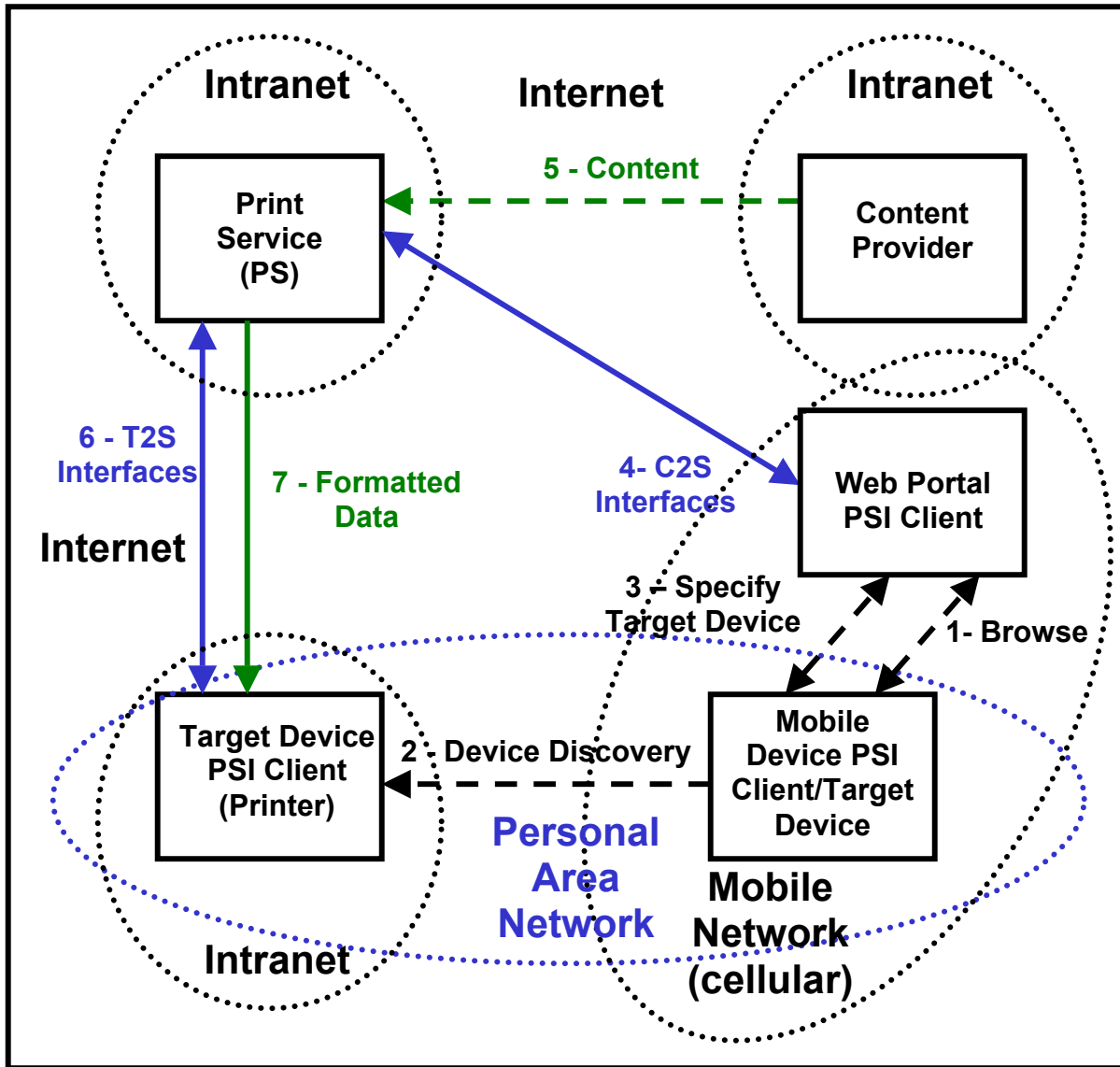
4.4.1 Requirements

The PSI specification must support:

1. Mobile Device configuration or discovery of Print Service.

2. Mobile Device initiation of a print job using a reference.

3. Mobile Device determination of the capabilities of the Print Service.

4. Mobile Device communication to the Print Service of the options desired for the print job.

5. Mobile Device communication to the Print Service of what Target Device to use.

6. Print Service retrieval of the original application data.

7. Print Service transformation of the original application data to a format supported by the Target Device.

8. Print Service transfer of the print job to the Target Device.

4.5 Use Model 5

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

It is strongly recommended that in this Use Model the Target Device is pre-configured to use a particular Print Service. This will avoid issues with scaling and does not require the Target Device to attempt to discover a Print Service.

Bob returns to his hotel room after a grueling day of bumping into people, while navigating the floor of his favorite trade show and developers conference. During the day he has gleaned some new information that causes him to change his Slide Wizard presentation, which he will deliver the next day. He makes the changes and really wants a hard copy to study during his long taxi ride in the morning. He finds that the printer in the hotel rooms shows up as a new wireless printing device that he can use. He chooses that device to print his Slide Wizard presentation. Since he has a business class, room and is a frequent traveler the cost of printing is built into his room rate.

Behind the Scenes: The printer in the hotel room uses a discovery protocol that announces itself to wireless devices within range. Since Bob has a predilection for printing while he is on the road, his lap top preferences have been configured to accept invitations from Printers. The Printer in the hotel room does not really understand Slide Wizard, however, it is pre-configured to use a Print Service that supports all of the most popular applications. The Printer accepts the Slide Wizard application data and forwards this data to the Print Service. The Print Service has previously acquired the capabilities of this Printer and translates the Slide Wizard data into a format that the Printer understands. Finally it sends the formatted data to the Printer.

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

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

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

4. The Target Device 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 Target Device for printing.
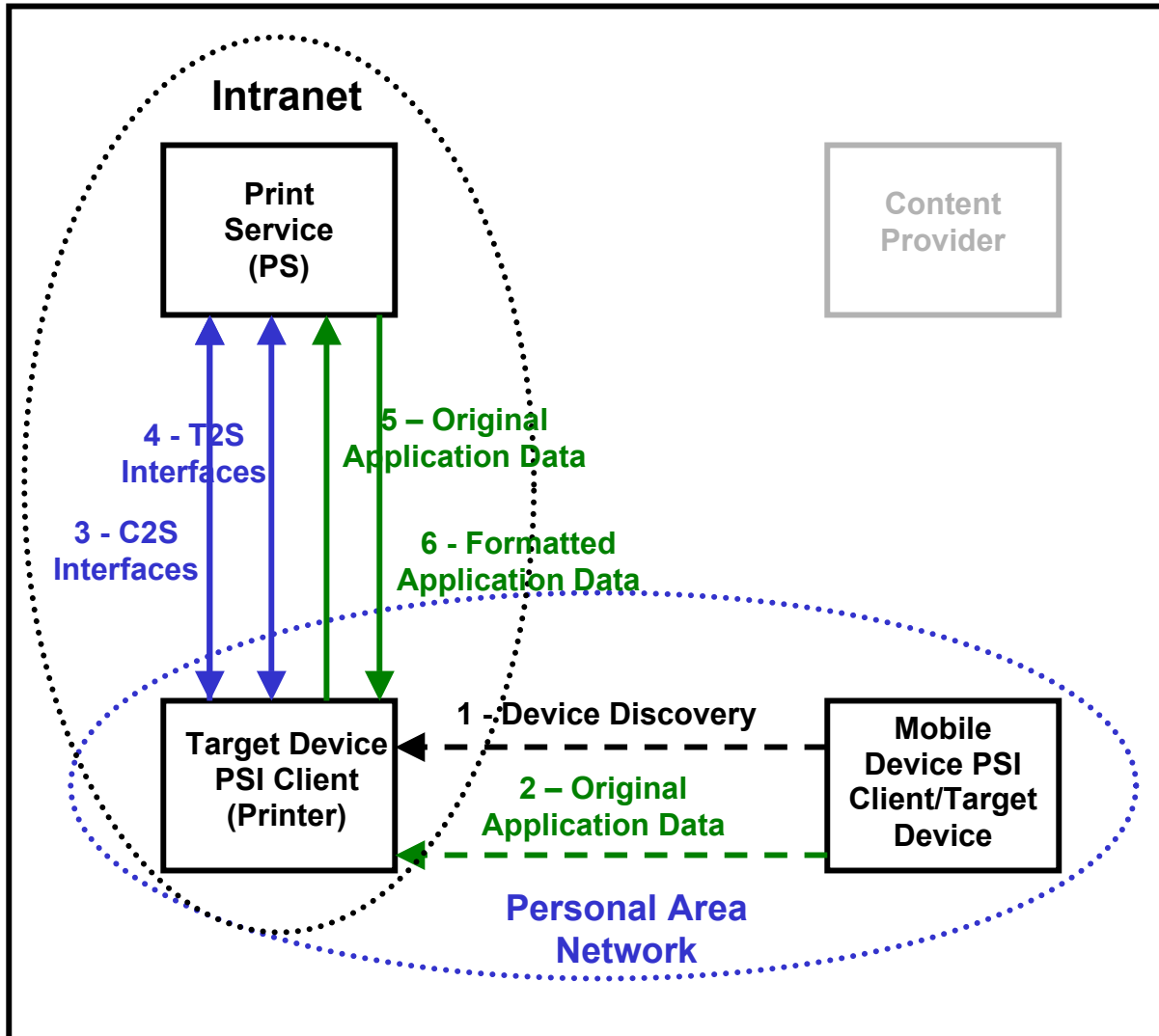
4.5.1 Requirements

The PSI specification must support:

1. Mobile Device configuration or discovery of Target Device.

2. Mobile Device initiation of a print job sending original application data to the Target Device.

3. Target Device configured for a Print Service.

4. Target Device communication to the Print Service of the options desired for the print job.

5. Target Device transfer of the original application data to the Print Service.

6. Print Service transformation of the original application data to a format supported by the Target Device.

7. Print Service transferal of the print job to the Target Device.

5 Print Service Interface Requirements

5.1 Summary of Requirements Described in Use Models

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 requirements of Discovery, Print Job Control, Security and Accounting.

1. Target Device configuration or discovery of Print Service.

2. Target Device initiation of a print job using a reference.

3. Target Device determination of the capabilities of the Print Service.

4. Target Device communication to the Print Service of the options desired for the print job.

5. Target Device communication to the Print Service for what Target Device to use.

6. Print Service retrieval of the original application data.

7. Print Service transformation of the original application data to a format supported by the Target Device.

8. Print Service transfer of the print job to the Target Device or Target Device retrieves the print job.

9. Mobile Device configuration or discovery of Print Service.

10. Mobile Device initiation of a print job using a reference.

11. Mobile Device determination of the capabilities of the Print Service.

12. Mobile Device determination of the capabilities of the Target Device.

13. Mobile Device communication to the Print Service of the options desired for the print job.

14. Mobile Device communication to the Print Service of the Target Device to use

15. Mobile Device initiation of a print job sending original application data to the Target Device.

16. Target Device configured for a Print Service.

5.2 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 Target Device or the Mobile Device using the Print Service interface.

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

2. The PSI shall provide a method to allow transformed application data to be transferred from the Print Service to the Target Device.

3. The PSI shall provide the ability to send application data from the client to a Target Device by value.

5.3 Security

The PSI shall select one or more existing standard end-to-end security protocols. The selected PSI security protocol(s) shall be specified as optional to use for all PSI implementations, but mandatory to support for all PSI implementations. The selected PSI security protocol(s) shall support:

(1) Client Authentication - protection from PSI service access by any unauthenticated client system or process.

(2) Server Authentication - protection from PSI service offering by any unauthenticated server system or process.

(3) Data Integrity - protection from PSI message insertion, message deletion, or message modification by any intermediate system.

(4) Data Privacy - protection from PSI message content disclosure to any intermediate system.

The PSI shall NOT specify or encourage the use of any hop-by-hop (link or network layer) security protocols, because they do not offer any end-to-end (application, session, or transport layer) security.

5.4 Accounting Attributes

The PSI shall support accounting attributes as defined in a named version of the PWG Semantic model.

5.5 Discovery

The PSI should select and recommend one or more existing standard discovery protocols. The selected PSI discovery protocol(s) should support:

(1) Service advertising

(2) Service type discovery

(3) Service capabilities discovery

(4) Device advertising

(5) Device type discovery

(6) Device capabilities discovery

6 Acronyms

C2S	Client to Service
HTTPS	HyperText Transfer Protocol – Secure
IP	Internet Protocol
IPSec	Internet Protocol SECurity
T2S	Target Device to Service
PAN	Personal Area Network – short range is typical
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