Wireless Printing

White Paper

Introduction

Overview

Industry Analysts predict an explosive growth in pervasive computing market, as an increasing number of solutions and offerings are being developed. Pervasive computing means having information and application access anywhere as needed. Some of the characteristics and trends of pervasive computing are:

- Increased user mobility
- Increase in availability of Information appliances
- Computing is spread throughout the environment
- Communication will become easier

International Data Corporation predict that by 2003 over 6 Billion pervasive computing devices will be in use, divided into 300 million PDA's and 2 Billion electronic devices (e.g. mobile phones, pagers and set top devices) and 5 Billion internet connected domestic devices. Many similar industry reports concur with this information.

Pervasive computing will be made possible using a combination of technologies, including wireless computing, home networks, Bluetooth, appliance servers, thin servers, peer computing.

Pervasive computing will provide many new applications and requirements for printing, specifically the increased deployment of wireless technologies will create new demands to be met by printing devices in order to match this rapidly emerging environment.

This document describes the positioning of i-data's solutions for wireless printing support. It describes some of the usage scenarios for wireless printing, the challenges for wireless printing and a number of wireless printing scenarios.

Evolving Printing Demands

Print Requirements

The needs for printing will increase with the expansion of information and the availability of information from hand-held and other portable computing devices.

The information described here are examples of the types of information that will be printed.

Local PDA printing or personal printing

- Screen print outs
- Print out of calendar and appointments
- To-do lists
- Message or email printout
- Printout of address books and business cards

Public Information

Information collected from external sources, i.e. from internet.
- Printing of internet information (HTML pages)
- Flight schedules and current or active information
- Confirmation of transactions, reservations

Commercial Information

- Printing of data sheets, draft and final contracts.
- Invoices and order confirmations
- Service instructions and work orders

Possible print scenarios

A number of different printing scenarios are envisioned to satisfy the above printing needs.

Walk-up printing

Service kiosks could provide a number of services for information access, and for servicing requests from mobile devices, PDA's and WAP devices. An example could be able to walk into a kiosk and print a book published via the internet without any staffing requirements or intervention.

Home Printing

Printing at home from WAP device or PDA.

e-commerce

Printing of invoices, order confirmation when shopping via the internet using WAP devices.

At the Office

The ability to walk-up to any printer and receive print outs of information that is needed real-time/on-demand.

In-Transit

Airport terminals and other transportation facilities, accommodation (hotels, conferences), public locations (libraries) for printing actual information received from the internet. Part of this process could contain automated billing capabilities for printing and other services, based upon user authentication and security.

Challenges

Challenges

The use of a Wireless Network for printing creates a number of new challenges to the way in which printing is performed, and the methods used to communicate between the wireless device and a printer.

Wireless Network Characteristics

When considering requirements for printing, the characteristics of wireless networks do not meet the typical characteristics of existing LAN networks. Some of the challenges are:
- Low Bandwidth networks
- Unreliable connections
- Use of disconnected operation
- Suspend/resume session operation

Wireless Application Protocol Characteristics

Wireless Application protocols have been designed to meet the characteristics of Wireless Networks. These design criteria are not typical of existing LAN networks, and are focused upon bandwidth optimization, interrupted networking, and presentation of information that suits a wide range of devices with simple user interfaces.

Bandwidth Requirements for Printing

The quality and presentation of output is expected to be unaltered with the use of a wireless network. The present volume of data used to print documents and information will far exceed the bandwidth capacity of current Wireless Application Networks.

Application Requirements for Printing

Support of wireless devices would imply that application protocols used in Wireless Application Protocol will also need to be supported in printer devices, or be converted using a WAP server or other transcoding technologies.

Information protection

Use of a wireless network can add additional security exposures during the transmission of information. Similar exposures also exist when printing from a Wireless Device to a printer.
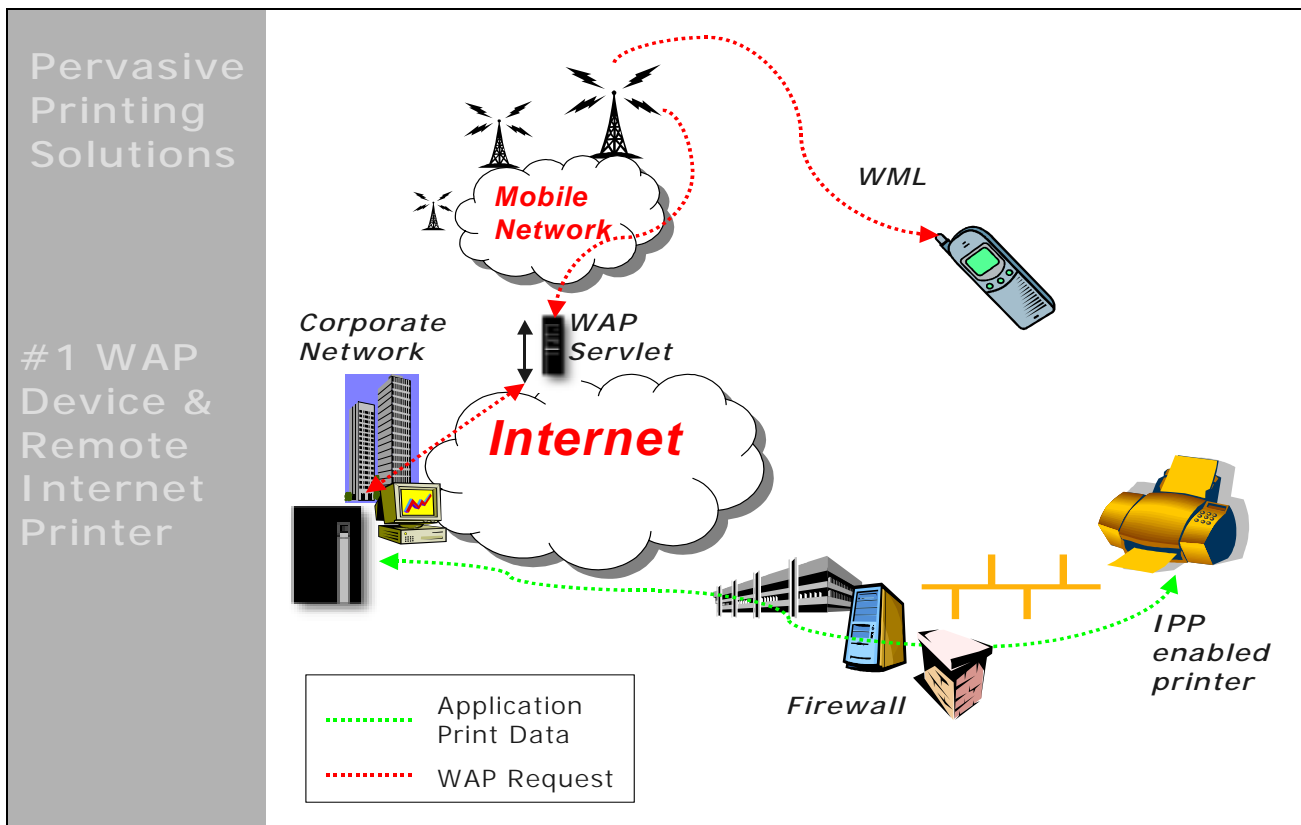
Solution Alternatives

Solutions

This section describes four separate implementation scenarios that are designed to meet wireless printing requirements for pervasive computing. It should be noted that this paper only discusses wireless connections using Bluetooth. A number of other wireless protocols exists, (e.g. infrared, 802.11, Home RF), however the primary focus is upon the use of Bluetooth.

Scenario #1

WAP device and conventional printer with Internet Printing (IPP) capability. The WAP client is not Bluetooth enabled.
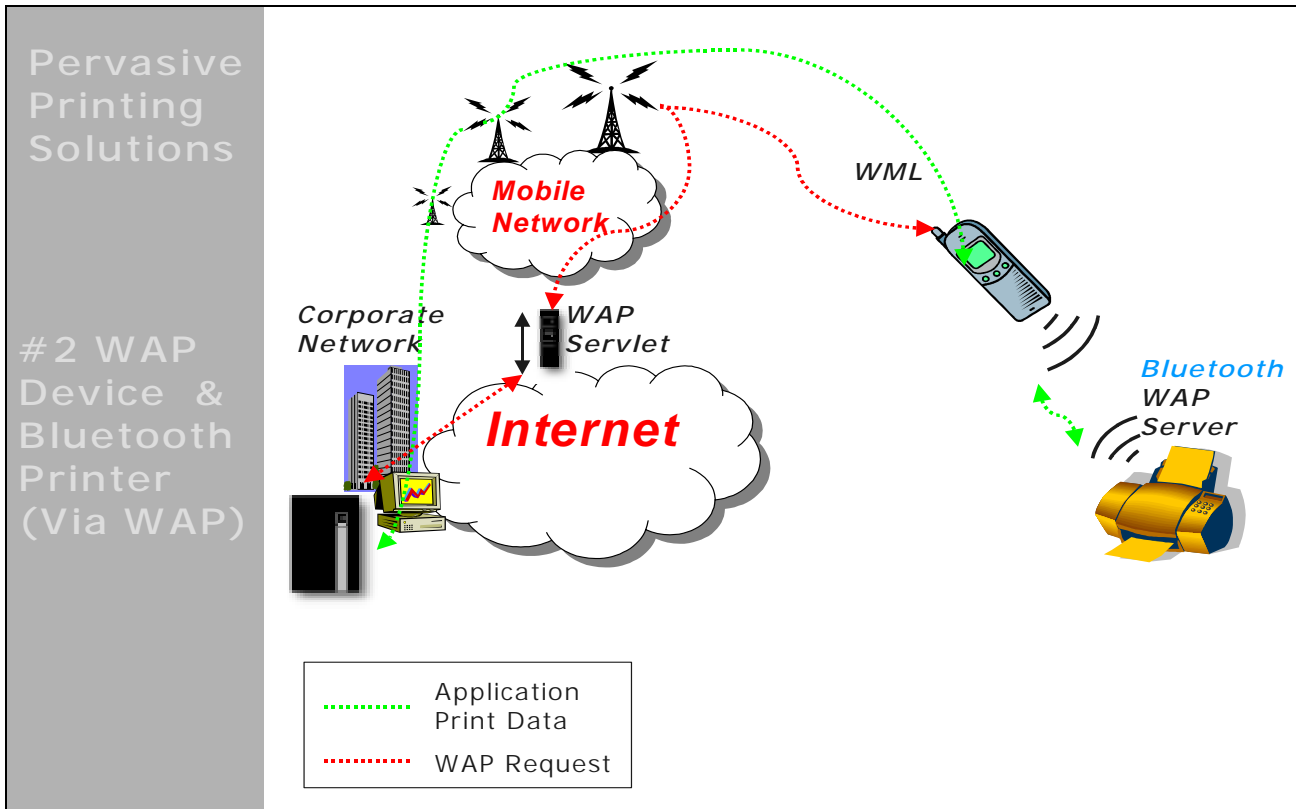
Description of Print Process	• Printer Selection A manual discovery process is used to locate the printing device. This could rely upon identification of printer name, or other method of identifying the name of the printer that is accessible from the Internet. • Local printing (from WAP client) All local printing requests from the WAP handheld device are performed by sending the print data to the Internet via the WAP application (i.e. pass-thru mode). The local print request is translated into a IPP print request for the target printer specified by the user. • WAP client printing requests Printing from the WAP enabled print sources are converted to IPP printing requests to the target printer device.
Capabilities and features	Support of WAP initiated print can be performed using any printer device.
Accessibility and usability	This solution relies upon manual process for printer selection, and requires use of an internet attached printer.
Security and authentication	Have to be administered by the WAP serving application.
Bandwidth	• Local Data Limitations are restricted by the mobile network bandwidth. • Internet Data Bandwidth is restricted by the printer interface to the internet.
Cost Considerations	No special investments are required, as this solution can be supported using standard WAP devices and existing LAN printer devices.
Advantages	• No specific printer features required to perform printing (i.e. standard printer that is IPP enabled). • No additional wireless bandwidth requirements for printing • No additional WAP client device processing power/hardware required for printing.
Disadvantages	• No discovery of printer devices. • Indirect printing via the Internet • Potential complications in printing process due to the increased complexity. • Supports WAP clients only.

| Scenario #2 | WAP device and Bluetooth enabled printer. Communication between the WAP Client and the Printer using Bluetooth & application protocols. Printing from WAP client only. |

Pervasive Printing Solutions

#2 WAP Device & Bluetooth Printer (Via WAP)

Description of Print Process	• Printer Selection (walk-up printing). Discovery of printer devices is performed using the Bluetooth protocol suite, and negotiation of printing capabilities. The printer needs to meet the service requirements of the WAP client, e.g. built-in WAP server. • Local printing (from WAP client) All local printing requests from the WAP client device are performed by sending the print data directly to the printer using Bluetooth. • WAP client printing requests Printing from the WAP enabled print sources requires that printing is relayed from the source to the target device, and then directed to the printer.
Capabilities and features	Support of WAP client printing requires a printer with Bluetooth and ability to permit printing (e.g. using additional application layer components).
Accessibility and usability	The Bluetooth capability is required in both the WAP client and the printer device.
Security and authentication	The printer will need to provide security and authentication services, e.g. billing information, password and pin protection.

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Bandwidth	• Local Data Limitations are restricted by the Bluetooth protocol. • Internet Data Bandwidth is restricted by the mobile network bandwidth.
Cost Considerations	Bluetooth support is required in the WAP client and the printer device.
Advantages	• Discovery of local printers (ease of use) • Direct printing of information from WAP device • Direct printing of downloaded/internet information from WAP device • Walk by printing (control of print process). • Supports PDA and WAP clients.
Disadvantages	• Specific printer features required to perform printing (i.e. standard printer that is IPP enabled). • Additional wireless bandwidth requirements from WAP server to client • Additional WAP client device requirements for printing software application, and local wireless interface.

Scenario #3	*WAP device and Bluetooth enabled printer with Internet Printing (IPP) capability. Communication between the WAP Client and the Printer using Bluetooth & application protocols. Printing from WAP client for local information, and internet for remote information.*
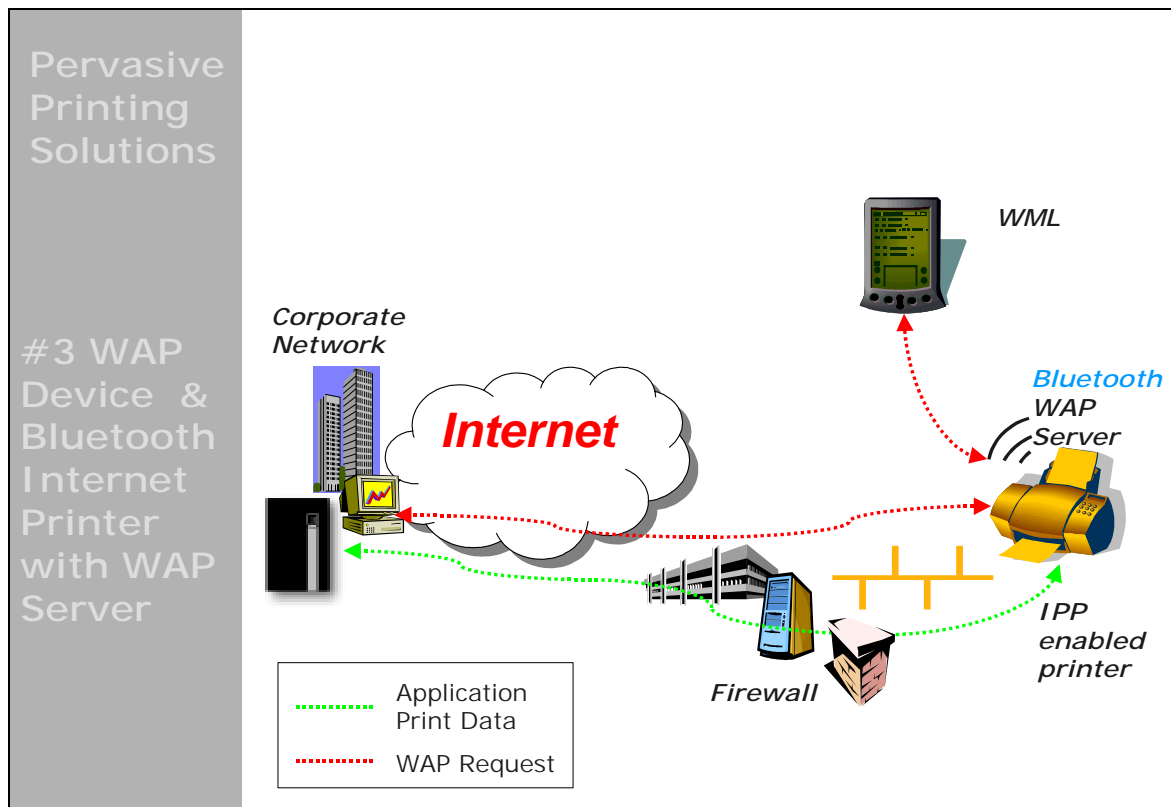
Description of Print Process

- Printer Selection
  Discovery of printer devices is performed using the Bluetooth protocol suite, and negotiation of printing capabilities.
- Local printing (from WAP client)
  All local printing requests from the WAP client device are performed by sending the print data directly to the printer using Bluetooth.
- WAP client printing requests
  Printing from the WAP enabled print sources requires that printing is relayed from the source via internet (IPP) to the target device. All "high-volume" printing is performed via the internet (e.g. IPP printing via URI reference).

Capabilities and features

Support of WAP client printing requires a printer with Bluetooth and ability to permit printing (e.g. using additional application layer components).

Accessibility and Usability

The Bluetooth capability is required in both the WAP client and the printer device. In addition, the printer device will also require Internet capability, e.g. using another device for Internet access.

Security and authentication	The printer will need to provide security and authentication services, e.g. billing information, password and pin protection.
Bandwidth	- Local Data Limitations are restricted by the Bluetooth protocol. - Internet Data Bandwidth is restricted by the internet connection limitations.
Cost Considerations	Bluetooth support is required in the WAP client and the printer device. Internet (LAN capability) is required for in the printer.
Advantages	- Discovery of local printers (ease of use) - Direct printing of local information from WAP device - No major additional hardware/software WAP client requirements - Printing of downloaded/internet information via internet - Walk by printing (control of print process). - Supports PDA and WAP clients.
Disadvantages	Specific printer features required to perform printing (i.e. standard printer that is IPP enabled).

Scenario #4	*WAP device and Bluetooth enabled printer with Internet Printing (IPP) capability. Communication between the WAP Client and the Printer using Bluetooth & application protocols. Printing via Bluetooth for WAP local output and internet for remote information.*
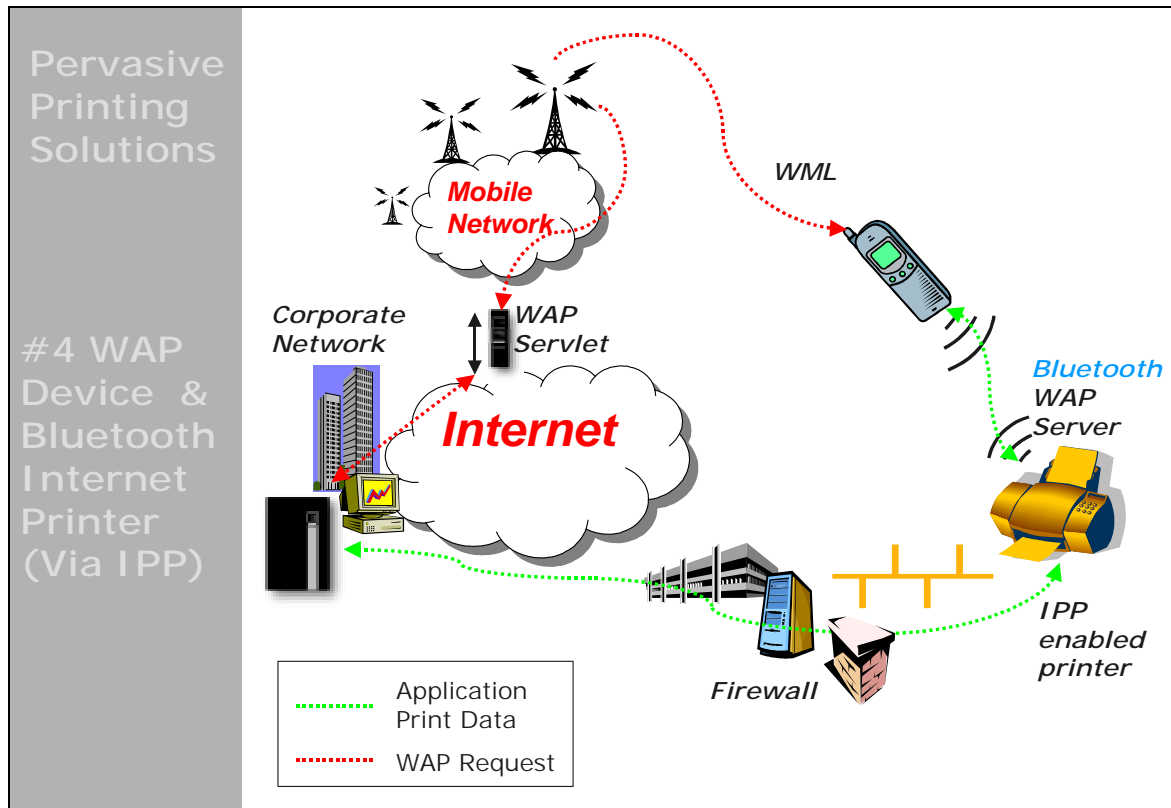
Description of Print Process	• Printer Selection Discovery of printer devices is performed using the Bluetooth protocol suite, and negotiation of printing capabilities. • Local printing (from WAP client) All local printing requests from the WAP client device are performed by sending the print data via the WAP Server via Internet to the printer. • WAP client printing requests Printing from the WAP enabled print sources requires that printing is relayed from the source to the target device, and then directed to the printer.
Capabilities and features	Support of WAP client printing requires a printer with Bluetooth and ability to permit printing (e.g. using additional application layer components).
Accessibility and usability	The Bluetooth capability is required in both the WAP client and the printer device. Internet (LAN) capability is required in the printer device.
Security and authentication	

Bandwidth
- Local Data
  Limitations are restricted by the Bluetooth protocol.
- Internet Data
  Bandwidth is restricted by the internet connection limitations.

Cost Considerations   Bluetooth support is required in the WAP client and the printer device.
Internet (LAN capability) is required for in the printer.

Advantages
- Discovery of local printers (ease of use)
- Direct printing of information from WAP device
- Direct printing of downloaded/internet information from WAP device
- Walk by printing (control of print process).

Disadvantages
- Specific printer features required to perform printing (i.e. standard printer that is IPP enabled).