AVAYA

4600 Series IP Telephones Application Programmer Interface (API) Guide

Release 2.2 for 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones
Release 2.5 for the 4625SW IP Telephone

16-300256
Issue 1
April 2005

API Support

This support is limited to the API. We cannot provide assistance with generic configuration, servers, other software, or network issues. See the Application Support Forum for more information.

How to Get Help

For additional support telephone numbers, go to the Avaya support Web site: http://www.avaya.com/support. If you are:

- Within the United States, click the *Escalation Contacts* link that is located under the *Support Tools* heading. Then click the appropriate link for the type of support that you need.
- Outside the United States, click the *Escalation Contacts* link that is located under the *Support Tools* heading. Then click the *International Services* link that includes telephone numbers for the international Centers of Excellence.

Providing Telecommunications Security

Telecommunications security (of voice, data, and/or video communications) is the prevention of any type of intrusion to (that is, either unauthorized or malicious access to or use of) your company's telecommunications equipment by some party.

Your company's “telecommunications equipment” includes both this Avaya product and any other voice/data/video equipment that could be accessed via this Avaya product (that is, “networked equipment”).

An “outside party” is anyone who is not a corporate employee, agent, subcontractor, or is not working on your company's behalf. Whereas, a “malicious party” is anyone (including someone who may be otherwise authorized) who accesses your telecommunications equipment with either malicious or mischievous intent.

Such intrusions may be either to/through synchronous (time-multiplexed and/or circuit-based) or asynchronous (character-, message-, or packet-based) equipment or interfaces for reasons of:

- Utilization (of capabilities special to the accessed equipment)
- Theft (such as, of intellectual property, financial assets, or toll facility access)
- Eavesdropping (privacy invasions to humans)
- Mischief (troubling, but apparently innocuous, tampering)
- Harm (such as harmful tampering, data loss or alteration, regardless of motive or intent)

Be aware that there may be a risk of unauthorized intrusions associated with your system and/or its networked equipment. Also realize that, if such an intrusion should occur, it could result in a variety of losses to your company (including but not limited to, human/data privacy, intellectual property, material assets, financial resources, labor costs, and/or legal costs).

Responsibility for Your Company’s Telecommunications Security

The final responsibility for securing both this system and its networked equipment rests with you - Avaya’s customer system administrator, your telecommunications peers, and your managers. Base the fulfillment of your responsibility on acquired knowledge and resources from a variety of sources including but not limited to:

- Installation documents
- System administration documents
- Security documents
- Hardware-/software-based security tools
- Shared information between you and your peers
- Telecommunications security experts

To prevent intrusions to your telecommunications equipment, you and your peers should carefully program and configure:

- Your Avaya-provided telecommunications systems and their interfaces
- Your Avaya-provided software applications, as well as their underlying hardware/software platforms and interfaces
- Any other equipment networked to your Avaya products

TCP/IP Facilities

Customers may experience differences in product performance, reliability and security depending upon network configurations/design and topologies, even when the product performs as warranted.

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For the most current versions of documentation, go to the Avaya support Web site: http://www.avaya.com/support.

Contents

About This Guide

About this Document

This document describes how to set up two optional Avaya application interfaces, the Web browser and the Push interface. Both interfaces apply only to the following Avaya IP Telephones:

- 4610SW
- 4620/4620SW
- 4621SW
- 4622SW
- 4625SW

This document applies to software Release 2.2 for the 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones, and to Release 2.5 for the 4625SW IP Telephone. This document covers only the behavior of the IP telephones specified. The performance and behavior of the application or application server(s) are not addressed.

Note:

The 4625SW has a significantly different display than the other IP telephones, and supports the display of both color and JPEG images. Differences between the 4625SW and the other IP telephones are noted throughout this document.

Intended Audience

This document is intended for the application developers and System Administrators who develop or implement Web- or Push-based applications for Avaya IP Telephones. Chapter 4: Push Administration is intended for System Administrators who need to enable the Push interface and set up Subscription Server Addresses on the TFTP server.

CAUTION:

Avaya does not support many of the products mentioned in this document. Take care to ensure that there is adequate technical support available for the TFTP, DHCP, HTTP, LDAP, and Web servers. If the servers are not functioning correctly, the Avaya IP Telephones might not operate correctly.

Document Organization

This guide contains the following chapters:

Chapter 1: IP Telephone Interfaces	Describes the available Avaya IP Telephone interfaces.
Chapter 2: Push Interface Overview	Provides an overview of the Push technology. This chapter describes the Push Message Flow process with diagrams, and gives an overview of Push features as applicable to 4610SW, 4620/4620SW, 4621SW, 4622SW, and 4625SW IP Telephones.
Chapter 3: Creating Push Messages	Describes the message types that can be sent (pushed) to an IP telephone in detail, and provides setup requirements and examples.
Chapter 4: Push Administration	Covers Push security features and recommendations, and server setup.
Chapter 5: Troubleshooting the Push Interface	Describes messages received during Push interface setup or processing, and provides suggested resolutions.
Chapter 6: About The Web Browser	Provides a general overview of the Web browser and application setup.
Chapter 7: Web Browser for 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones	Provides information about creating and customizing Web sites for viewing on the 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones. Also describes the current capabilities and limitations of the Web browser.
Chapter 8: Web Applications	Provides information on administering an LDAP directory for the 4610SW, 4620/4620SW, 4621SW, 4622SW, and 4625SW IP Telephones.
Chapter 9: Web Browser for the 4625SW IP Telephone	Provides information about creating and customizing Web sites for viewing on the 4625SW IP Telephone. Also describes the current capabilities and limitations of the Web browser.

Issue Date

April, 2005 is the first issue of this document, which combines and replaces two previously-issued documents:

- *Avaya IP Telephones Web Browser API* (Document Number 16-300313) and
- *Avaya IP Telephones Push Interface API* (Document Number 16-300314).

This issue also reflects updates for two 4600 IP Telephone Software Releases:

- Release 2.2 for the 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones, and
- Release 2.5 for the 4625SW IP Telephone.

How to Use This Document

This guide is organized to help you find topics in a logical manner. Read it from start to finish to get a thorough understanding of the interfaces or use the Table of Contents or Index to locate specific features.

Terms Used in This Document

Term	Description
ACM	*Avaya Communication Manager*, previously known as MultiVantage. A member of a family of Avaya PBX's providing advanced call features. Avaya IP Telephones register on or login to the ACM.
AIM	*Access Key Input Mode*. A new text entry mode that allows a user to access a particular URL by selecting a single dialpad key.
Alerts	An optional notification such as a series of ring pings to alert the user to an incoming Push Message.
Card	A WML card is similar to an HTML page, but WML delivers a set (deck) of closely related cards. The complete WML page comprises a collection of various cards, of which only one is visible on the browser at one time. As each of the cards is labeled by a name and ID, they can be linked together without difficulty. The WML card author determines the content of the card. The browser determines how this card will be displayed (rendered).

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Term	Description (continued)
CAPP	*Cross-APEX Process Platform*, the set of development processes used by most of the CES development organizations. CAPP is subject to ISO audits.
CDATA	Text, which can contain numeric or named character entities. CDATA, a DTD data type, is used only in attribute values.
CSS2	*Cascading Style Sheets Version 2*.
Deck	A deck can be described as a stack of cards. When the browser downloads a WML page, it really is downloading a deck of cards but only one card in the deck is visible at a time.
DTD	*Document Type Definition*. The DTD defines the names and contents of all elements that permissible on a WML page, the order in which the elements must appear, the contents of all elements, attributes and default values.
Elements	Elements are the essential components that make up a single WML document.
FLOW	The flow type represents “card-level” information. In general, flow is used anywhere general markup can be included.
Focus	A unique adaptation of WML is the idea of focusing on a particular line on the screen. This is known as “focus.” Since the phone has no mouse to navigate around the screen, the Feature buttons that are located on the left side of the screen can be used to select a particular line on the display, or “to bring that line into focus.” Focusing on a line is used to select a line for text entry or to select a line that contains a link to another URL (card). Additionally, new titles can (not always) be presented to the user on the Top Line as each line on the screen is individually brought “into focus” (selected by pressing the Feature buttons).
Frame	The area in which the Web page is displayed.
Full-Width Browser	The Full-Width browser has with 12 linkable buttons, 6 on each side and no fixed navigation buttons.
href	The `href` attribute refers to either a relative or an absolute Uniform Resource Locator.
HTML	*Hyper Text Markup Language* is a text-based way of describing data for transmission over the Internet HTML is usually used with larger, color displays.
HTTP	*Hyper Text Transfer Protocol*, used to request and transmit pages on the World Wide Web.
IP	*Internet Protocol* – a suite of information exchanged message sets widely used for data transmission and increasingly used for the transmission of voice.
Link	The URI that is used to chain cards together.
mode	Push Priority type – normal or barge – to distinguish between emergency messages and ideal messages.
NMTOKEN	*A name token*, containing any mixture of name characters, as defined by the XML.
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Term	Description (continued)
PBX	*Private Branch Exchange* – A generic name for a premise-based switch supporting telephony features owned by an enterprise.
PCDATA	*Parsed CDATA*. Text that can contain numeric or named character entities. This text can contain tags. PCDATA, a DTD data type, is used only in elements.
Push Agent or PA	The telephone software that is capable of receiving a Push Message from a server (Push Initiator).
Push Initiator or Push Server	A Web application that is capable of transmitting the Push Message to the Push Agent.
Push Content (PC)	A valid XML or a WML file that contains a <Response> tag as the root or a <WML> as the root. The file carries the actual information to be displayed or streamed on to an IP telephone.
Push Message (PM)	An XML message that contains a <Push> tag as the root. The Push Message uses a <go> tag to specify a URI to which the Push Agent can launch a request for Push Content.
Push State	When the telephone is in busy state such as an active phone call or user entering information in the Speed Dial Application.
Registration	The registration is a scheme of allowing an Avaya IP Telephone to authenticate itself with the Avaya Communication Manager. The Avaya Media Server switch supports registering and authenticating Avaya IP Telephones using the extension and password.
RTP Audio	An audio stream received from an application outside the context of a telephone call. The audio Push Message can be accompanied with an optional notification alert.
Standard Browser	The Standard Browser display has 6 linkable buttons on the left, plus 6 fixed navigation buttons on the right. The 4625SW IP Telephone supports both the Standard Browser and the Full-Width browser. Other IP telephones currently support the Standard Browser only.
SUBSCRIBELIST	The subscription list for potential pushed content contains zero or more fully qualified URLs, separated by commas without any intervening spaces, up to 255 ASCII characters, including commas. The default is “” (Null).
Subscription Servers	A server or a database that stores the information for a Push-enabled IP telephone such as IP Address, Extension, MAC Address, etc.
Topline	The topline is 18 pixels in height, including one black pixel at the bottom of the area, extending across the width of the display. The other 17 pixels of height are available for text, icons, etc.
TPSLIST	*List of Trusted Push Servers*, contains one or more domains and paths in DNS format, separated by commas without any intervening spaces, up to 255 ASCII characters, including commas. The default is “” (Null)
Trusted Push Server (TPS)	Application Server with a URI that conforms to the security settings as established by the TPSLIST parameter in the script file. The Trusted Push Server and the Push Initiator can be the same entity.

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Term	Description (continued)
Type	Type specifies a tag or attribute.
User Agent	Software that interprets WML, WMLscript, WTAI and other forms of codes.
VDATA	A DTD data type representing a string that can contain variable references. This type is only used in attribute values.
W3C	*World Wide Web Consortium*.
WAP	*Wireless Application Protocol*. An open global standard for wireless solutions that includes WML.
WBMP	WBMP is a bitmap graphic format that is required for the integration of graphics into WML pages.
WML	*Wireless Markup Language* is a subset of XML, used by Avaya IP Telephone's Web browser to communicate with WML Servers.
WML homedeck	The WML start page, derived from Homepage.
WML tags	WML cards/deck are composed of a number of elements. Each element begins with a descriptive tag. Tags are indicated by a pair of angled brackets that start with the < character and end with the > character. The first element inside the angled brackets is the tag name.
WMLscript	A scripting language specifically designed for programming mobile devices. It is based on ECMAScript, but has been optimized for low bandwidth communication and limited processing power and memory.
WTA	*Wireless Telephony Application(s)*. An extension of the WAE (Wireless Application Environment) that provides a set of interfaces to a mobile device's telephony functionality.
WTAI	*Wireless Telephony Application Interface* is a set of interfaces that extend the WAE (Wireless Application Environment) to include telephony applications.
x-Push-Status	The Push Agent HTTP extension header. This extension is used by the Push Agent to send the Push Message status to the Push Initiator.
XML	*eXtensible Markup Language*. W3C's standard for Internet Markup Languages. WML is one of these languages.
xml:lang	The **`xml:lang`** attribute specifies the natural or formal language of an element or its attributes. This is a DTD term.
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Conventions Used in This Document

This guide uses the following textual, symbolic, and typographic conventions to help you interpret information.

Symbolic Conventions

Note:

This symbol precedes additional information about a topic.

CAUTION:

This symbol is used to emphasize possible harm to software, possible loss of data, or possible service interruptions.

Typographic Conventions

This guide uses the following typographic conventions:

Document	Underlined type indicates a section or sub-section in this document containing additional information about a topic.
"Document"	Italic type enclosed in quotes indicates a reference to specific section or chapter of an external document.
italics	Italic type indicates the result of an action you take or a system response in step by step procedures.
Conference	In step by step procedures, words shown in bold represent a single telephone button that should be pressed/selected.
`message`	Words printed in this type are messages, prompts, code excerpts, code samples, and XML tags.

Online Documentation

The online documentation for this guide and related Avaya documentation is located at the following URL:

http://www.avaya.com/support

Related Documentation

Avaya Documents

- *4600 Series IP Telephone LAN Administrator Guide (Document Number 555-233-507)*

  This guide provides a description of Voice over IP, describes how to administer DHCP and TFTP servers, and how to set up Push parameters in the 46xxsettings.txt script file.
- *4600 Series IP Telephone WML Server Setup Guide (Document Number 16-300507)*

  This guide provides information on setting up a Web server.

Other Documents

- *The Unicode Consortium*, The Unicode Standard, Version 3.2, Addison Wesley, 2002
- *Extensible Markup Language (XML) 1.0 (Second Edition)*, W3C Recommendation 6 October 2000.

IETF Documents

The following documents provide information relevant to IP telephony and are available for free from the IETF Web site.

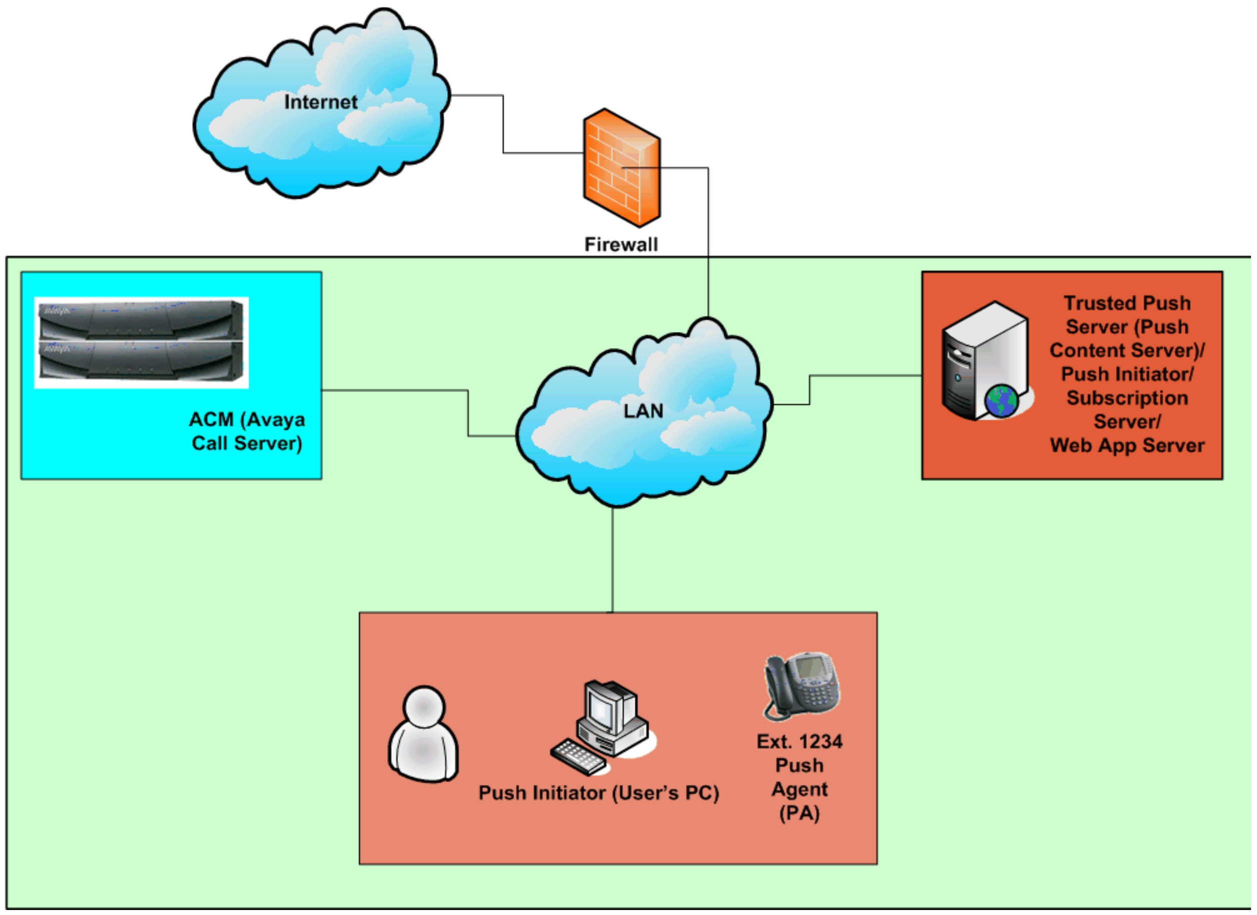
- IETF RFC 2616: http://www.ietf.org/rfc/rfc2616.txt?number=2616
- IETF 1945: http://www.ietf.org/rfc/rfc1945.txt?number=1945

Chapter 1: IP Telephone Interfaces

Overview

Figure 1 shows a typical system-wide network diagram that includes Avaya IP Telephones, Avaya Communication Manager Servers, and application servers. The application servers include Push Servers, Subscription Servers, and a Web Application Server.

Figure 1: Typical System-Wide Network Topolgy


Internet
Firewall
ACM (Avaya Call Server)
LAN
Trusted Push Server (Push Content Server)/ Push Initiator/ Subscription Server/ Web App Server
Push Initiator (User's PC)
Ext. 1234 Push Agent (PA)

With this picture in the current context, enabling a Web server or an application server for a particular enterprise is not an additional entity.

Example:

ABC Company currently has an intranet Web server that serves the company's intranet sites and other employee information. ABC has just deployed a company-wide Avaya IP Telephone system, which offers an optional Web browser application. To set up a Web server for the Avaya IP Telephones, ABC just has to add two MIME types to their existing intranet Web server. ABC does not require an additional server or entity to enable Web functionality on Avaya 4600 Series IP Telephones. Additionally, the same intranet server can be a Push Application server or a Trusted Push Server. Similarly, a subscription server can also be resident on ABC's existing intranet server.

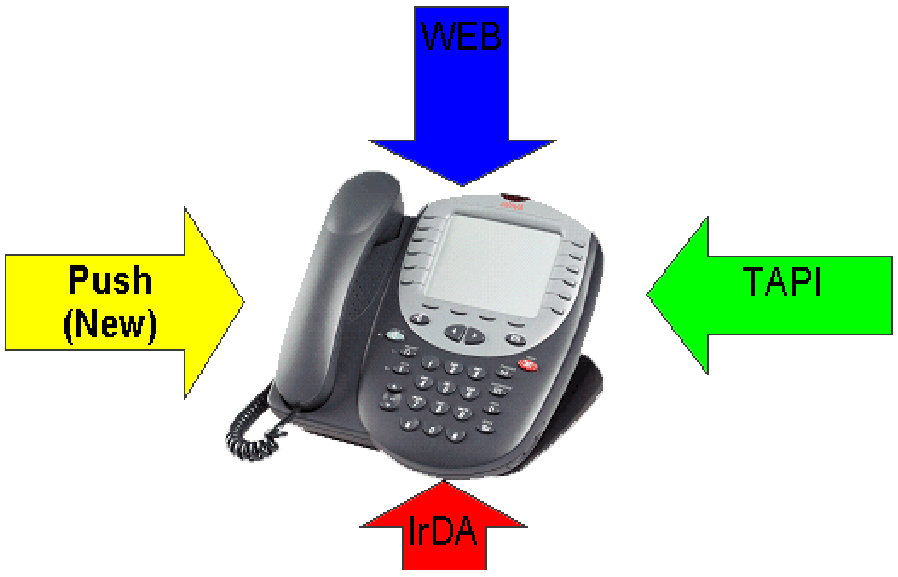
Note:

For more information on setting up MIME types or setting up a Web server, see the *WML Server Setup Guide* (Document Number16-300507), available for download at: http://www.avaya.com/support.

Existing Interfaces

Avaya IP Telephones accept the interfaces shown in Figure 2.

Figure 2: Avaya IP Telephone Interfaces



TAPI:

This is a Telephony Application Programmer’s Interface. TAPI is primarily used for call control applications such as NetMeeting or IP Softphone. This type of interface is not covered in this guide. Push does not require this type of interface.

irDA:

This is an infrared interface. Users can dial telephone numbers using the IR port from other IR devices such as PDAs. This type of interface is not covered in this guide. Push does not require this type of interface.

Web:

This is a Web browser Interface. Users can navigate Web applications and retrieve information about the company, news, or interactive applications such as a conference room scheduler and Company Directory lookup. For detailed information about the Web interface see:

- Chapter 6: About The Web Browser,
- Chapter 7: Web Browser for 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones,
- Chapter 8: Web Applications, and
- Chapter 9: Web Browser for the 4625SW IP Telephone

Push:

This interface allows an application to spontaneously Push Message to an IP telephone’s display without involving the user. See Chapter 2: Push Interface Overview, Chapter 3: Creating Push Messages, Chapter 4: Push Administration, and Chapter 5: Troubleshooting the Push Interface for information about the Push interface.

Chapter 2: Push Interface Overview

Introduction

Push is the ability for an application to send content to the Web browser, to the topline of the display, or to the audio transducers of 4610SW, 4620/4620SW, 4621SW, 4622SW, and 4625SW IP Telephones.

The Push interface was introduced in the 4600 Series IP Telephones' Release 2.1 software. Before that release, external applications interfaced with the IP telephone using the Web browser. The Web browser interface requires users to "Pull" the data from an application, for example, a user has to click a particular link or page to access the information.

With the Push interface, the application can spontaneously "push" the information to the telephone without the user having to click a link.

Some uses of the Push interface can be:

- Broadcasting company news
- Sending meeting reminders with conference bridge numbers, so that users don't have to search for the conference number
- Streaming music, such as wake-up alarms in hotel rooms
- Streaming audio announcements
- Sending critical stock news information
- Broadcasting critical weather alerts
- Building intelligent databases to target information to an individual or groups of phones

This chapter provides an overview of the Push interface. Chapter 3: Creating Push Messages and Chapter 4: Push Administration provide detailed information on setting up and initiating Push Messages.

Push Feature Description

The Push interface offers several features:

- Full screen pushes, called **Display** push types
- Single line top area text push, called **Topline** push types
- Audio streaming, called **Audio** push types
- Optional alerts
- Push priorities
- A Security mechanism
- A Subscription service

A message can be pushed to a properly configured Avaya IP Telephone as a single text line, a full screen, or an audio stream.

Avaya provides a security mechanism to assure that the content pushed to the phones is from a trusted source. Additionally, a subscription service allows the phones to provide necessary information to the application server such that pushes can be targeted to the individual user, a group of users, or to the enterprise. Push Messages have two priorities set by the application and can also be accompanied by an optional notification alert.

Push Architecture

The Push Flow Process

The Push interface uses the following terminology:

- **Push Initiator:** An application capable of transmitting the Push Message to the Push Agent.
- **Push Agent:** The telephone software resident on the Avaya IP Telephone that is capable of receiving the Push Message from the Push Initiator. The Push Agent processes the Push Message and requests the Push Content.
- **Trusted Push Server (TPS):** A Web server serving the Push Content that conforms to the security settings as established by the TPSLIST parameter in the script file. This can also be an existing Web server within the network, or the same server as the Push Initiator.

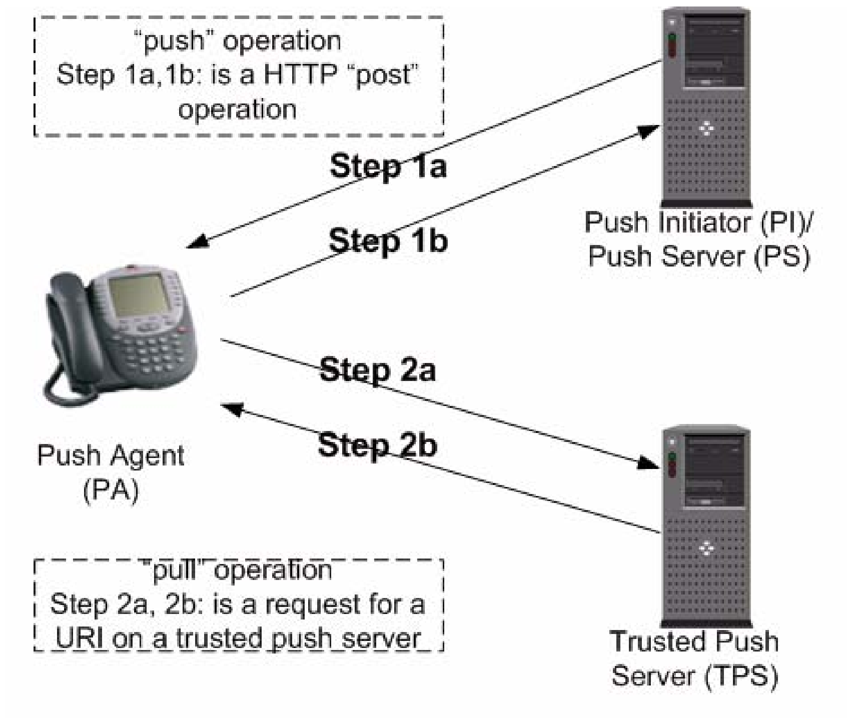
The Push/Pull Process – A Two-Step View

The Push framework is a two-step process - a “push” operation followed by a “pull” operation. See Figure 3 for a visual reference to the steps involved in the Push/Pull process.

Push operation (Step 1a and Step 1b)

The Push Initiator (PI), which is an application server, transmits a Push Message using the HTTP “POST” method to the phone’s Push Agent (PA).

Figure 3: Push/Pull Operation


“push” operation
Step 1a,1b: is a HTTP “post” operation
Step 1a
Step 1b
Push Initiator (PI)/ Push Server (PS)
Step 2a
Step 2b
Push Agent (PA)
“pull” operation
Step 2a, 2b: is a request for a URI on a trusted push server
Trusted Push Server (TPS)

Pull operation (Step 2a and Step 2b)

The phone requests the target URI of the Push Content from a Trusted Push Server. The Push Content can be any valid WML file or an XML file with tags that instruct the endpoint to do one or more of the following:

- Set up an RTP audio stream,
- Display a message on the topline,
- Display a full screen message with images and links, or
- Re-subscribe with the subscription server.

Push Message Flow

This section describes the step-by-step process to send a particular Push Message to an Avaya IP Telephone.Figure 4 illustrates this process.

Step 1 - XML File Push Message Sent

The first step of the Push process is to POST a Push Message to the telephone's Push Agent. The Push Message can only be sent using the HTTP POST method. The message contains an XML file with the <Push> tag and instructions for the telephone's Push Agent to request the Push Content from a Trusted Push Server.

Note:

For more information on creating Push Messages, see Chapter 3: Creating Push Messages.

Step 2 – Push Agent Responds

The Push Agent sends a response back to the Push Initiator with HTTP status codes. The response also contains an HTTP header extension called "x-Avaya-Push-Status" code. The x-Avaya-Push-Status indicates the outcome of a push request back to the Push Initiator. x-Avaya-Push-Status codes respond with errors such as Forbidden, Not in Push state, etc.

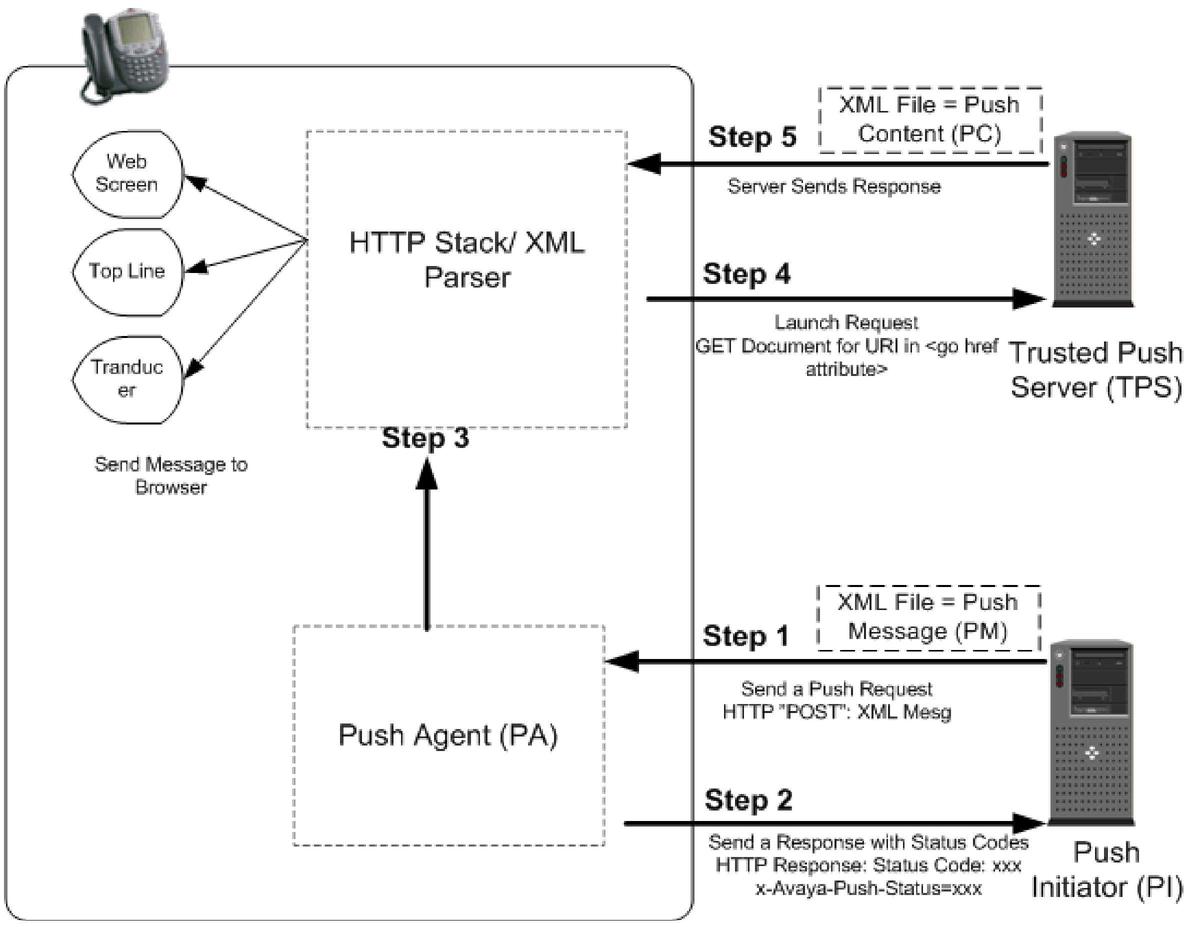
Note:

See Chapter 3: Creating Push Messages for more information on x-Avaya-Push-Status codes.

Step 3 – XML Message Parsing

The XML parser parses the Push Message and verifies that the Push Content URL is a Trusted Push Server. If the URL is not a Trusted Push Server, an `HTTP 403 - Forbidden` error message is sent back to the Push Initiator using Step 2 mechanisms.

Figure 4: Push Flow


Web Screen
Top Line
Tranduc er
Send Message to Browser
HTTP Stack/ XML Parser
Step 3
Push Agent (PA)
Step 5
XML File = Push Content (PC)
Server Sends Response
Step 4
Launch Request GET Document for URI in <go href attribute>
Trusted Push Server (TPS)
Step 1
XML File = Push Message (PM)
Send a Push Request HTTP "POST": XML Mesg
Step 2
Send a Response with Status Codes HTTP Response: Status Code: xxx x-Avaya-Push-Status=xxx
Push Initiator (PI)

Step 4 – Request Launched

Once the URL is verified as a Trusted Push Server, the Push Agent launches a request for the URL that is embedded in the <go> tag of the Push Message.

Step 5 – Push Content Server Responds

The Trusted Push Server sends a response back to the telephone with the proper Push Content. The Push Content consists of an XML file or a WML file, based on the Push type. This file is parsed by the XML Parser and the Push Content is extracted and prepared for display.

Step 6 – Message Sent to Telephone

Once the telephone's XML parser parses the XML file, depending on the Push type, the telephone either displays or streams the message.

About the Push Agent

The 4600 Series IP Telephones (4610SW, 4620/4620SW, 4621SW, 4622SW, and 4625SW) provide an HTTP server in addition to the HTTP client. This allows an application server to “push” a request for:

- The Web browser to get and display a particular Web page.
- The phone’s topline application to display a topline message.
- The phone to receive an audio stream from an application outside the context of a telephone call.

HTTP Server functionality is based on (or is provided by) the GoAhead Web Server 2.1, Copyright© 2004 GoAhead Software, Inc. All Rights Reserved.

HTTP Server

Note:

The Push Agent will activate the receive port 80 for the HTTP server if the phone is properly registered with a call server and if the TPSLIST contains at least one non-null value.

Avaya IP Telephones support an HTTP server as specified in the IETF Documents listed in Related Documentation for HTTP 1.0 and for an HTTP client. The HTTP server uses TCP as a transport-layer protocol, and supports only one connection (socket) at a time. The HTTP client uses TCP as a transport-layer protocol.

Note:

The Push Agent only listens to port 80 for all incoming requests.

Push Agent - HTTP POST Address

The HTTP POST address (URL) for the IP telephone where a Push request is sent to is:

http://<*IP_Address_of_the_telephone*>/forms/push

Where, <*IP_Address_of_the_telephone*> is the IP Address of the telephone where the push is to be sent in the dotted-decimal format.

The Push Agent will process all POST methods received by the phone's HTTP server that contain the above URL. All HTTP POST requests must be sent to this URL only.

All XML messages are sent in the HTTP POST pre-defined variable called "**XMLData**."

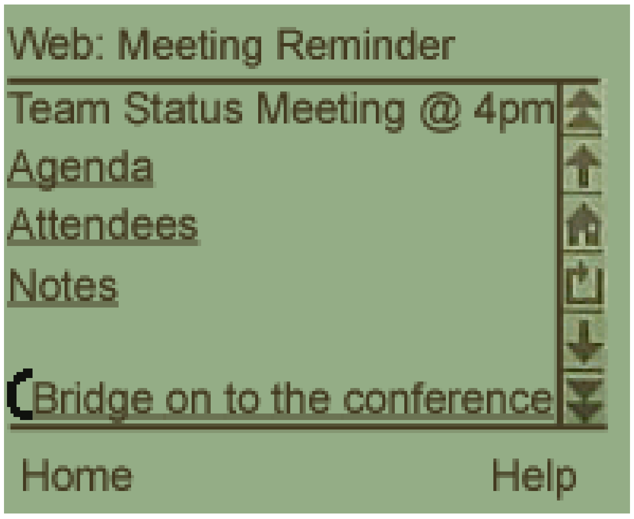
A `403 Forbidden` error message is sent in response to a POST with an invalid Request-URI.

Push Types

The 4610SW, 4620/4620SW, 4621SW, 4622SW, and 4625SW IP Telephones support the Push types described in this section.

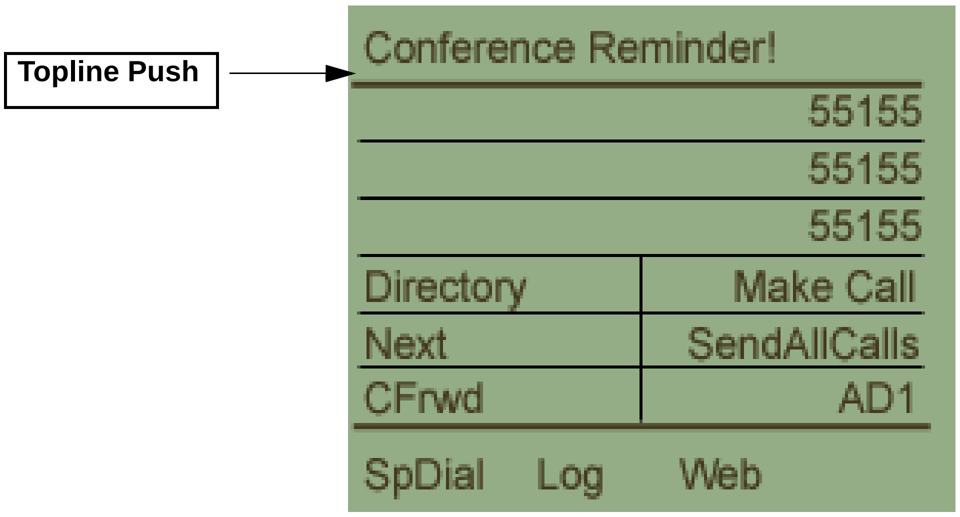
Display push type - Content can be pushed to the Web browser with an optional alert. The pushed page can access all Web browser features. See The Display Push Type on page 29 for more information about this type of push.

Figure 5: Full Screen (Display) Push


Web: Meeting Reminder
Team Status Meeting @ 4pm
Agenda
Attendees
Notes
Bridge on to the conference
Home
Help

Topline push type - Text can be pushed to the topline with an optional alert. Topline pushed messages and alerts can be displayed even when the Web browser is not in focus. For more information on a Topline push, see The Topline Push Type on page 37.

Figure 6: Topline Push



Audio push type - The phone can receive an audio stream from an application outside the context of a telephone call. The Audio Push Message can be accompanied with an optional alert. For more information on Audio push, see The Audio Push Type on page 46.

Subscribe push type - The Push Subscription Service allows the phones to re-subscribe to the subscription application server with the phone's IP Address, user's extension, Set ID and MAC ID. For more information on the Subscribe push, see The Subscribe Push Type on page 54 and Chapter 4: Push Administration on page 59.

All Push types can be delivered either with a **Normal** priority or with a **Barge** priority on an individual push basis. See the sections on each Push type in Chapter 3: Creating Push Messages for more information on priorities and states.

Chapter 3: Creating Push Messages

Introduction

This chapter covers the details involved in setting up Push Messages for each type of Push:

- Display (full screen) Push
- Topline (single line) Push
- Audio Push
- Subscribe Push

The Display Push Type

The Display push type is a full-screen Push. Details about this type of push are provided in the sections that follow.

Web Browser Features

When using the Display push type, you can use the entire range of features of a 4610SW, 4620/4620SW, 4621SW, 4622SW, and 4625SW IP Telephone's Web browser. Some of these features are:

- WBMP Images.
- Form controls such as Radio buttons, check boxes, etc.
- Input elements such as text boxes.
- Hyperlinks to a series of other pages with information.
- WTAI features such as click-to-dial and add-to-speed dial.
- Full use of 16 programmable soft keys.
- Capability to push an entire thin-client Web application.

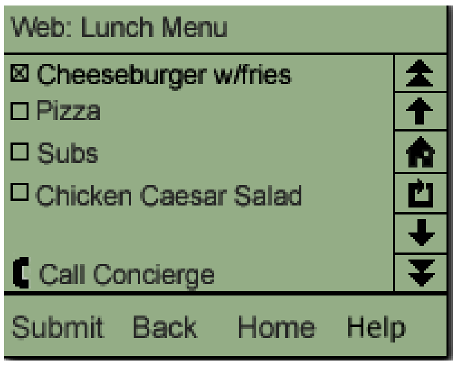
Alerts

A Display Push Message can be sent using alerts. Alerts are a number of ring pings sounded just prior to displaying the message on the screen. With the Display push type, an alert can be sounded with 1, 2, or 3 ring pings. If the **`alert`** attribute is not associated with the <Push> tag, then no alerts are sounded. Alternatively, if the **`alert`** attribute is set to "0" no alerts sound.

Display Push Example 1:

Following is an example of the Display push type. Assume that the Push Message (screen) in Figure 7 will be sent to a telephone in a hotel.

Figure 7: Hotel Application Example


Web: Lunch Menu

☒ Cheeseburger w/fries
☐ Pizza
☐ Subs
☐ Chicken Caesar Salad

Call Concierge

Submit Back Home Help

Priorities and States

Display Push Content is sent with one of two priorities: **normal** or **barge**. Normal priority push conditions are specified first, followed by barge priority push conditions.

Pushable vs. Non-Pushable States

The following are **non-pushable** states for Display pushes to an IP telephone:

- When the user is in text entry mode on a Web text entry screen or Speed Dial text entry screen (for **normal** priority only).
- When the telephone is in the process of restoring a retrieved backup file.
- When a Local Procedure has been initiated.

If a phone is not in one of the above states, it is considered to be in a **pushable** state, meaning the telephone will accept a pushed message.

Successful Push Response

If the phone is in a pushable state, the Push Agent sends the Push Initiator the following response for all Push request modes and all Push request types:

Parameter	Status Code	Response
HTTP Status Code	200	“OK”
x-Push-Status	200	“Push Message Accepted”

Normal Priority

When the **`mode`** attribute in the <Push> tag is set to **normal**, the telephone state for the Display push type is as follows:

- When the telephone is in any of the **non-pushable** states, the screen currently displayed continues to be displayed (i.e., the Display push is **rejected**).
- If the telephone is in the **pushable** state, the telephone **accepts** the Push Message and generates appropriate notification tone(s).

A normal push is accepted when the telephone is in text edit mode in applications other than the Web. If a non-Web application, such as Speed Dial, is in text-edit mode, then `x-Push-Status 204` “Not in Push State: Push Accepted” is sent:

Parameter	Status Code	Reason Phrase
HTTP Status Code	200	“OK”
x-Push-Status	204	“Not in Push State: Push Accepted”

Use Case Scenario:

Q. What happens when a user is editing or adding an entry on the Speed Dial screen and a **normal** priority Display push Message is sent?

A. If an alert is associated with this message, then the alert sounds first. The pushed content is loaded in the background. The message is not displayed until the user elects to view it by clicking the Web tab to launch the Web browser.

If the Web is in "text edit mode" a subsequent normal push is rejected and `x-Push-Status 205` "Not in Push State: Push Aborted" is sent. The Push Request does not proceed.

Parameter	Status Code	Reason Phrase
HTTP Status Code	200	"OK"
x-Push-Status	205	"Not in Push State: Push Aborted"

Note:

If a normal Display push is denied, then the entire Display push is denied, including the Web page's title. Hence, the application writer might choose to send two pushes - a Topline push, followed by a Display push. Sending two messages maximizes the chance of the user viewing at least one message.

Barge Priority

When the **`mode`** attribute in the <Push> tag is set to **barge**, the Display Push Content is accepted as a priority message, with two exceptions. A **barge** Display push is rejected only when the telephone is in either of these **non-pushable** states:

- When the telephone is in the process of restoring a retrieved backup file, or
- When a Local Procedure has been initiated. See the *4600 Series IP Telephone LAN Administrator Guide* on the http://www.avaya.com/support Web site for more details on Local maintenance procedures.

In either non-pushable state, the **barge** content, including any notification tones is discarded. In all other cases, the telephone must accept the **barge** request.

Use Case Scenario:

Q. What happens when a user is editing or adding an entry on the Speed Dial screen and a **barge** priority Display push message is sent?

A. If an alert is associated with this message, then the alert will first sound. Then the pushed message displays immediately. The user can leave the displayed Web page normally by pressing the telephone's **Phone/Exit** button.

When receiving Push Content with a barge priority, the state of the telephone is as if the user had selected the Web Access tab on the Phone Screen. For example, any incomplete task, such as FTP Setup, is considered as having been interrupted. Additionally, the user can leave the displayed Web page normally by pressing the **Phone/Exit** button.

Display Push XML Messages

This section describes how to send a Display push using XML messages.

Display Push Message (PM)

To send a Display push, an application must send an **HTTP POST** request to the Push Agent in the telephone.

The format of the XML Message (PM) sent from the Push Initiator to the Push Agent is as follows:

```
<?xml version="1.0"?>

<Push
   alert=“0|1|2|3”
   type=“display”
   mode=“normal|barge”

>
  <go href=“http://trusted_push_server/filename.wml” method=“get|post”>
     <postfield name=“name1” value=“value1”/>
     <postfield name=“name2” value=“value2”/>

</go>

</Push>
```

Using the <postfield> Tag

The IP telephones' Web browser interface supports the <postfield> tag. The <postfield> tag allows an application to set a name/value pair that can be sent to the source of the request. The name is set by the **`name`** attribute and must be a valid WML variable name. The value is set by the **`value`** attribute. A <go> element can contain one or more <postfield> tags. Postfield tags must be sent if HTTP POST method is used.

Note:

For more information on the <**`postfield`**> tag, see Chapter 7: Web Browser for 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones and Chapter 8: Web Applications.

Table 1: Description of Elements and Attributes used in the Display Push XML Message

Element or Tag	Attribute	Description
<Push>		Each Push Message must contain one valid root <Push> tag.
	`alert=0|1|2|3`	Optional notification alerts – number of ring pings.
	`type`	Push Content = **display**.
	`mode`	**normal** or **barge** priority.
	<**`go href=…/`**>	A fully qualified URL - to a valid WML file for Display pushes. Cannot exceed 1024 characters.
	`method`	HTTP **get** or **post** methods for Push Content.

Display Push Example 2:

Using our previous hotel example, the hotel is ready to serve lunch and wants to send the lunch menu directly to each room's telephone display screen, including sounding an alert to get the guest's attention. The XML payload sent as part of the Push Message is as follows:

```
<!– Following is the XML Push Request Message sent as a POST request embedded as part of form data -->
     XMLData = <?xml version="1.0"?>
     <Push alert="2" type="display" mode="normal">
       <go href="http://trusted_push_server/lunch_menu.wml"    method="get">
       </go>
     </Push>
     <!– The above message is part of the form data (XMLData) being sent in Step 1 request -->
```

Push Agent

Once a Push Message is received from the Push Initiator, the Push Agent first parses the XML file for validation and tags mismatch errors. Then the Push Agent verifies that the URL in the <go> tag is part of the Trusted Push Servers. Then the Push Agent requests the Push Content from the Trusted Push Server using the URL.

Note:

For more information on Trusted Push Servers, see Chapter 4: Push Administration.

Push Content (PC)

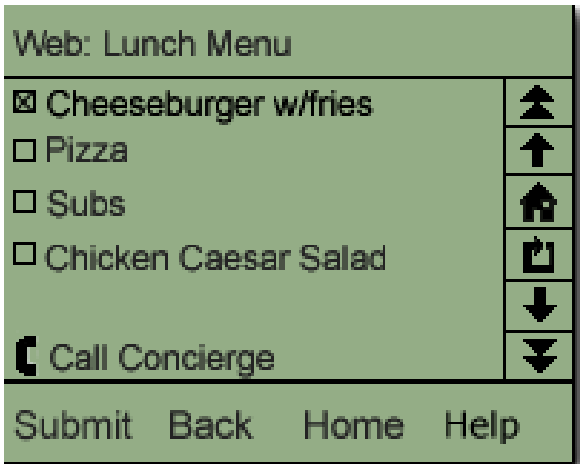
The Display push type's Push Content has to be a WML file. This WML file can contain any of the Web browser elements and features. See Chapter 7: Web Browser for 4610SW, 4620/ 4620SW, 4621SW, and 4622SW IP Telephones and Chapter 8: Web Applications for more details on elements and tags the Avaya IP Telephones support.

The outline of the "`lunch_menu.wml`" file (PC) from the Hotel example is as follows:

```
<!– Server Sends Response – Push Content (PC) - File in the <Push…<go href Url> -->
<?xml version="1.0"?>
<wml>
     <card id="lunch" title="Lunch Menu">
       <p>
          <select name="selection" multiple="true">
             <option value="cheeseburger">Cheeseburger w/fries</option>
             <option value="pizza">Pizza</option>
             <option value="sub">Sub</option>
             <option value="salad">Chicken Caesar Salad</option>
          </select>
          <a href="wtai://wp/mc;5551212">Call Concierge</a>
       </p>
       <do type="accept" name="submit" label="Submit">
          <go href="submit_form.php" method="get"/>
       </do>
       <do type="prev" label="Back">
          <prev/>
       </do>
       <do type="accept" name="home" label="Home">
          <go href="home.wml"/>
       </do>
       <do type="accept" name="help" label="Help">
          <go href="help.wml"/>
       </do>
     </card>
</wml>
```

The IP telephone's XML parser parses the WML file. Depending on the priorities and state of the telephone, the Push Content displays as shown in Figure 8, with an alert of two ring pings.

Figure 8: Hotel Lunch Menu Display



Web: Lunch Menu

☒ Cheeseburger w/fries
☐ Pizza
☐ Subs
☐ Chicken Caesar Salad

Call Concierge

Note:

Invalid WML Display push error messages are not displayed to the user.

The Topline Push Type

Use the Topline push when you only need to send a single-line text message.

Text Message Features

Some of the Topline push features are:

- A single-line, alternating text message.
- Message displays, even if Web browser is not in focus.
- Supports UTF-8[1], ISO-888991[1], and Latin1[1] character encodings.

Alerts

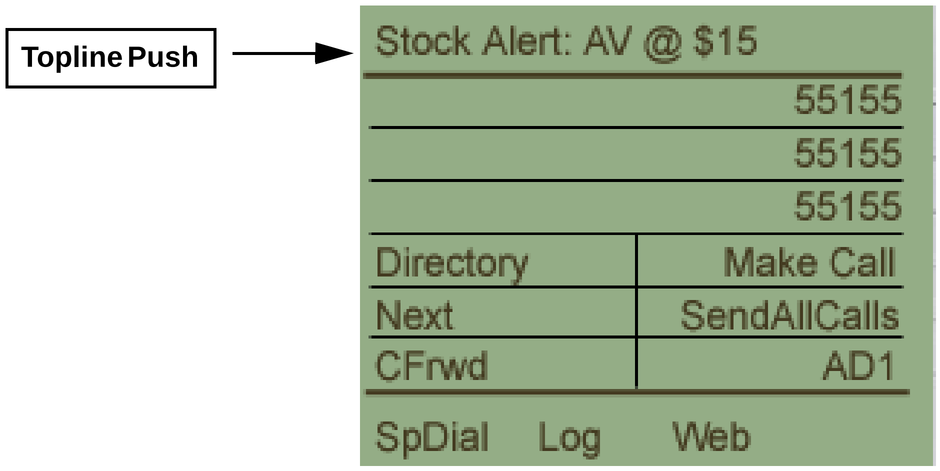
A Topline Push Message can be sent with alerts. Alerts are number of ring pings sounded just prior to displaying the message on the screen. For a Topline push type, an alert can be sounded with 1, 2, or 3 ring pings. If the **`alert`** attribute is not associated with the <Push> tag, then no alerts are sounded. Alternatively, if the **`alert`** attribute is set to "0" no alerts sound.

Topline Push Example 1:

The following Stock Alert Topline Push Message is sent to a telephone to alert the user when a stock, AV in this example, reaches $15 price target.

Figure 9 shows the pushed message that displays.

Figure 9: Stock Alert Example



Priorities and States

Topline Push Content is sent with one of two priorities: **normal** or **barge**. Normal priority push conditions are specified first, followed by barge priority push conditions.

Pushable vs. Non-Pushable States

The following are **non-pushable** states for Topline pushes to an IP telephone:

- When the telephone is in the process of restoring a retrieved backup file
- When a Local Procedure has been initiated. See the *4600 Series LAN Administrator Guide* on the http://www.avaya.com/support Web site for more details on Local maintenance procedures
- When the telephone is in any text entry mode (for normal priority)
- When any Call Appearance is in the Alerting (for normal priority)
- When the telephone is in Soft-Hold call state (for normal priority)

If a phone is not in one of the above states, it is considered to be in a **pushable** state, meaning the telephone will accept a Pushed Message.

Successful Push Response

If the phone is in a pushable state, the Push Agent sends the Push Initiator the following response for all Push request modes and all Push request types:

Parameter	Status Code	Reason Phrase
HTTP Status Code	200	“OK”
x-Push-Status	200	“Push Message Accepted”

Normal Priority

When the **mode** attribute in the <Push> tag is set to **normal**, the telephone state for the Topline push type is as follows:

- If the Topline is being used for system messages such as application help messages, then the text string is buffered until the higher-priority message is complete.
- If the phone is in a **non-pushable** state, meaning the Push Message cannot be displayed on the top display line, the Push Agent sends the Push Initiator the following responses for a **normal** priority Topline push request. The Push request does not proceed to request Push Content.

Parameter	Status Code	Reason Phrase
HTTP Status Code	200	“OK”
x-Push-Status	205	“Not In Push State: Push Aborted”

If a text string is pushed while the top display line is displaying an earlier pushed text string, then the new text string replaces the previous one as a **normal** priority.

Note:

The expiration time on all pushed text strings is 30 seconds. All Topline messages are discarded after 30 seconds.

Barge Priority

When the **mode** attribute in the <Push> tag is set to **barge**, the Topline Push Content is accepted as a priority message. However, a **barge** Topline push is rejected when the telephone is in one of these **non-pushable** states:

- When the telephone is in the process of restoring a retrieved backup file, or
- When a Local Procedure has been initiated. See the *4600 Series IP Telephone LAN Administrator Guide* on the Avaya support Web site for more details on Local maintenance procedures.

In either non-pushable state, the **barge** content, including any notification tones, is discarded. In all other cases, the telephone must accept the **barge** request and display the barge Topline message immediately.

Topline Push XML Messages

This section describes how to send a Topline push with XML messages. Use the Stock Alert Example in Figure 9 as a reference.

Topline Push Message (PM)

The first step in sending a Topline push is to send an HTTP POST request from the Push Initiator to the telephone's Push Agent. The XML Message (PM) sent from the Push Initiator to the Push Agent is as follows:

```
<?xml version="1.0"?>

<Push
  alert=“0|1|2|3”
  type=“topline”
  mode=“normal|barge”

>

<go href=“http://trusted_push_server/filename.xml” method=“get|post”>
  <postfield name=“name1” value=“value1”/>
  <postfield name=“name2” value=“value2”/>

</go>

</Push>
```

Using the <postfield> Tag

The IP telephones' Web browser interface supports the <postfield> tag. The <postfield> tag allows an application to set a name/value pair that can be sent to the source of the request. The name is set by the **`name`** attribute and must be a valid WML variable name. The value is set by the **`value`** attribute. A <go> element can contain one or more <postfield> tags. Postfield tags must be sent if HTTP POST method is used.

Note:

For more information on the **`<postfield>`** tag, see Chapter 7: Web Browser for 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones.

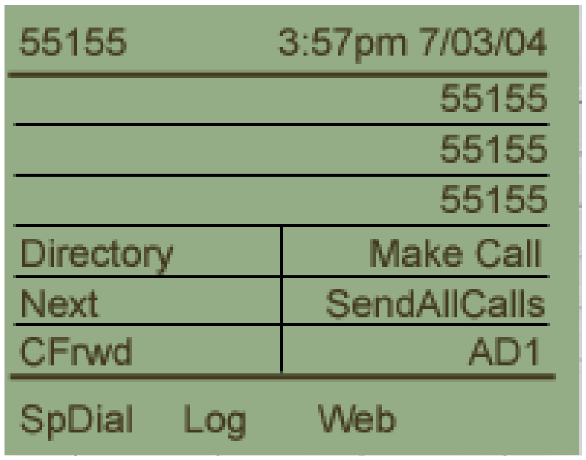
Table 2: Description of Elements and Attributes used in the Topline Push XML Message

Element or Tag	Attribute	Description
<**Push**>		Each Push Message must contain one valid root <Push> tag.
	`alert=0|1|2|3`	Optional notification alerts – number of ring pings.
	`type`	Push Content = **topline**.
	`mode`	**normal** or **barge** priority.
	<**`go href=…/`**>	A fully qualified URL - to a valid XML Push Content file for Topline pushes. Cannot exceed 1024 characters.
	`method`	HTTP **get** or **post** methods.

Topline Push Example 2:

Using our previous stock alert example, the price of the AV is reaching the $15 price target. Now, the stock broker's telephone display shows:

Figure 10: Telephone Display Prior to Receiving Stock Alert Message



The code excerpt associated with the Stock Alert example to be sent as part of the Push Message is as follows:

```
<!– Following is the XML Push Request Message sent as a POST request embedded as part of form data -->
     XMLData = <?xml version="1.0"?>
     <Push alert="3" type="topline" mode="normal">
        <go href="http://trusted_push_server/stock_alert.xml"      method="get">
        </go>
     </Push>
     <!– The above message is part of the form data (XMLData) being sent in Step 1 request -->
```

Push Agent

Once a Push Message is received from the Push Initiator, the Push Agent first parses the XML file for validation and tag mismatch errors. Then the Push Agent verifies that the URL in the <go> tag is part of the Trusted Push Servers.

Note:

For more information on Trusted Push Servers, see Chapter 4: Push Administration.

Then the Push Agent requests the Push Content from the Trusted Push Server using the URL.

Topline Push Content (PC)

The Topline push type's Push Content has to be an XML file.

The following is the code excerpt associated with the Stock Alert Topline Push Example 2: to be sent as part of the Push Content:

```
<!– Server Sends Response – Push Content (PC) - File in the <Push...<go href Url> -->
    <?xml version="1.0"?>
    <Response>
       <Topline>
              Stock Alert: AV @ $15
       </Topline>
     </Response>
```

Using the <Response> tag

The <Response> tag for the Topline push type must be the root element in the (PC) XML file.

Using the <Topline> tag

The <Topline> tag consists of the actual text message to display on the telephone's Top Line.

If the length of the message exceeds the given pixels, the entire message is divided. The message then fits on a single line, with the initial text and the remaining text alternating on the top display line.

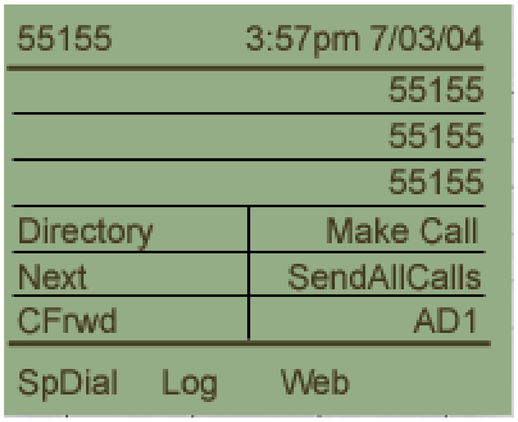
The Topline message can only be 56 characters long. If the text is longer than 56 characters, all characters beyond the 56th are ignored and not displayed.

The text within the <Topline> tag can consist of different character encodings such as UTF-8, ISO-888991, and Latin1. See the IETF Documents listed under Related Documentation for information on character encoding.

The telephone's XML parser parses the XML file. Depending on the priorities and state of the telephone, the Push Content displays as shown in Figure 11 with an alert ring ping of 3.

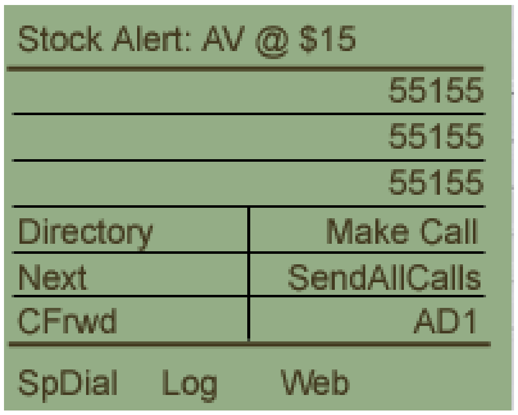
Figure 11: Stock Alert Message

Phone screen before the Topline Push



55155 3:57pm 7/03/04
55155
55155
55155
Directory Make Call
Next SendAllCalls
CFrwd AD1
SpDial Log Web

Phone screen after the Topline Push



Stock Alert: AV @ $15
55155
55155
55155
Directory Make Call
Next SendAllCalls
CFrwd AD1
SpDial Log Web

The Audio Push Type

Use an Audio push when you need to stream a particular audio message to the telephone. The Audio push is the ability to transmit RTP streams to the endpoint. This Push type provides additional capabilities such as start and stop to control audio streams. The RTP stream can also notify the phone that a stream has ended.

To the user, the telephone's handling of pushed audio content mirrors the telephone's handling of a call. The user can switch between Speaker, Handset, and Headset as desired, adjust volume, and view LED states as with a call.

The user can terminate the pushed audio stream by taking **one** of the following actions:

- By going on-hook, for example, picking up the handset or activating the headset,
- By pressing the telephone's **Speaker** button,
- By pressing the telephone's **Drop** button, or
- By selecting a Call Appearance button.

While the telephone is playing back pushed audio content, the call server can independently send messages that require the telephone to generate tones, for example, alert the user to an incoming call. The **Volume Up** and **Volume Down** buttons work normally if the user presses them while listening to pushed audio content.

Audio Push Features

The Audio push type provides the following features:

- Telephone connection to an incoming RTP stream
- A "pure" stream, not a telephone call
- Temporarily replacement of the active stream
- Audible alerts
- A built-in timer to display the stream for given period of time

Alerts

An Audio Push Message can be sent with accompanying alerts. Alerts are a number of ring pings sounded just prior to displaying the message on the screen. With an Audio push type, an alert can be sounded with 1, 2, or 3 ring pings. If the **`alert`** attribute is not associated with the <Push> tag, then no alerts are sounded. Alternatively, if the **`alert`** attribute is set to "0" no alerts sound.

Audio Push Example:

An Audio push example could be a hotel wake-up message a guest schedules from the room. The guest can schedule the alarm directly from an existing Web application loaded to the IP telephone. The next morning, the application sounds the alarm using RTP streaming directly to the telephone. As an added touch, a concurrent Display push can send the Hotel Breakfast menu so customer can order breakfast directly from the telephone.

Priorities and States

Audio Push Content is sent with one of two priorities: **normal** or **barge**. Normal priority push conditions are specified first, followed by barge priority push conditions.

Pushable vs. Non-Pushable States

The following are **non-pushable** states for an IP telephone with the Audio push type.

- Any Call Appearance is alerting. For example, the user is adjusting volume settings or the telephone is alerting the user to an incoming call.
- Any active Call Appearance, meaning the user is on a call.
- The telephone is restoring a retrieved backup file.
- When a Local Procedure has been initiated. See the *4600 Series LAN Administrator Guide* on the http://www.avaya.com/support Web site for more details on Local maintenance procedures.
- The telephone is already broadcasting pushed audio content

If a phone is not in one of the above states, it is considered to be in a **pushable** state, meaning the telephone will accept a Pushed Message.

Successful Push Response

If the phone is in a pushable state, the Push Agent sends the Push Initiator the following response for all Push request modes and all Push request types:

Parameter	Status Code	Reason Phrase
HTTP Status Code	200	“OK”
x-Push-Status	200	“Push Message Accepted”

Normal Priority

When the **`mode`** attribute in the <Push> tag is set to **normal**, the telephone state for the Audio push type must be **pushable**. If the telephone is in the **pushable** state, then the telephone accepts the Audio push and broadcasts the pushed audio stream through the Speaker. Once the pushed audio stream is transmitted to the user, the user can redirect it, terminate it, etc.

An Audio push with a normal priority will not stream if the phone is in a **non-pushable** state. When the telephone is in a **non-pushable** state, any current audio activity continues without interruption or user notification and the Audio push stream is rejected. Error message 208 is sent and the Push Request does not proceed.

Parameter	Status Code	Reason Phrase
HTTP Status Code	200	“OK”
x-Push-Status	208	“Not in Audio Push State: Push Aborted”

Barge Priority

When the **`mode`** attribute in the <Push> tag is set to **barge**, the Audio Push Content is accepted as a priority message. However, a **barge** Audio push is rejected when the telephone is in one of these non-pushable states:

- When the telephone is in the process of restoring a retrieved backup file,
- When a Local Procedure has been initiated (Refer to the “*LAN Administrator Guide*” on support.avaya.com Web site for more details on Local maintenance procedures).

In either non-pushable case, the **barge** audio content, including any notification tones, is discarded and the RTP socket is closed. In all other cases the telephone accepts the barge audio request regardless of any user activity.

Use Case Scenario:

Q. What happens when a user is on the call and a **barge** Audio Push Message is sent?

A. If a user is on the call and a barge Audio Push Message is sent, the current active call is placed on Hold, and the audio is streamed immediately. If the call is still on Hold when the pushed audio stream ends, the user can select the appropriate Call Appearance button to continue the original call. Note that the far-end party does not get any indication that the current call is being placed on hold.

Audio Push XML Messages

This section describes how to send an Audio push with XML messages.

Audio Push Message (PM)

The first step in sending an Audio push is to send an HTTP POST request from the Push Initiator to the telephone's Push Agent. Following is the XML Message (PM) format sent from the Push Initiator to the Push Agent:

```
<?xml version="1.0"?>
<Push
    alert="0|1|2|3"
    type="audio"
    mode="normal|barge"
>
   <go href="http://trusted_push_server/filename.xml"   method="get|post">
    <postfield name="name1" value="value1"/>
    <postfield name="name2" value="value2"/>
</go>
</Push>
```

Using the <postfield> Tag

The IP telephones' Web browser interface supports the <postfield> tag. The <postfield> tag allows an application to set a name/value pair that can be sent to the source of the request. The name is set by the **name** attribute and must be a valid WML variable name. The value is set by the **value** attribute. A <go> element can contain one or more <postfield> tags. Postfield tags must be sent if the HTTP POST method is used.

Note:
For more information on the <**postfield**> tag, see Chapter 7: Web Browser for 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones.

Table 3: Description of Elements and Attributes used in the Audio Push XML Message:

Element or Tag	Attribute	Description
<**Push**>		Each Push Message must contain one valid root <Push> tag.
	`alert=0|1|2|3`	Optional notification alerts – number of ring pings.
	`type`	Push Content = **audio**.
	`mode`	**normal** or **barge** priority.
	<`go href=…/`>	A fully qualified URL - to a valid XML file for Audio push Content. Cannot exceed 1024 characters.
	`method`	HTTP **get** or **post** methods.

RTP Port

An RTP port is needed to stream audio to the telephone. The Push Agent sends the port information to the Trusted Push Server in the GET string. The GET string contains the variable “rtpLPort”, the telephone’s local port to be used for audio streaming.

The Push Agent responds to the server with:

Push Message Type	Syntax
“**audio**”	GET|POST `http://server_IP_address?rtpLPort=`***xxxx***

The RTP Local port information sent by the Push Agent to the Push Initiator from the GET request is as follows:

GET Parameter	Description
rtpLPort	RTP Local port that will be used for streaming.

Note:

The rtpLPort is generated dynamically and might be different for every new Audio Stream Push session. The telephone will play the audio stream only on this specified port.

The code excerpt associated with Audio Push Example: (the hotel wake-up message), which will be sent as part of the Push Message, is as follows:

```
<!– Following is the XML Push Request Message sent as a POST request embedded as part of form data -->
    XMLData = <?xml version="1.0"?>
        <Push alert=“3” type=“audio” mode=“barge”>
        <go href=“http://trusted_push_server/wake_up.xml” method=“get”>
        </go>
    </Push>
<!– The above message is part of the form data (XMLData) being sent in Step 1 request -->
```

Push Agent

Once a Push Message is received from the Push Initiator, the Push Agent first parses the XML file for validation and tag mismatch errors. Then the Push Agent verifies that the URL in the <go> tag is part of the Trusted Push Servers. Then the Push Agent requests the Push Content from the Trusted Push Server using the URL.

Note:

For more information on Trusted Push Servers, see Security on page 59.

Audio Push Content (PC)

A special XML file for RTP streaming must initiate Audio push.

```
<?xml version="1.0"?>
  <Response>
          <Audio
                  packetsize=”10|20|30|40|50|60”
                  codec = “PCMU | PCMA”
>
    <AudioTimer value="30"/>
    <Url href=”RTPRx://rtpserver_ip_address:rtpLPort”>

    </Audio>
  </Response>
```

Each <Response> can contain only one <Audio> tag with the following attributes:

Attribute	Value	Description
`codec`	**PCMU | PCMA**	Silence suppression on. G.711 Annex A (no CID frames) µ-law | A-law Default is PCMU.
`packetsize`	**10|20|30|40|50|60** (milliseconds)	Default is 40 milliseconds.

Each <Audio> tag can contain <AudioTimer> and <Url> tags. The <AudioTimer> tag is used as an inter-packet timer. This timer is set every time a packet is received. After an administrable duration where no packets are received the RTP stream is terminated. This tag has the following attributes:

Attribute	Value	Description
`value`	*X (seconds)*	Default is 20 seconds. The range is 5 to 30 seconds.

Each <Url> tag consists of information for the RTP streaming server and the local receive port of the telephone. The <Url> tag has the following attributes:

Attribute	Value	Description
`href`	*string*	RTP Streaming URI Format.

RTP Streaming URI Format	IP Address	Port
RTPRx denotes “Receive” by the phone	rtpserver_ip_address is the IP Address of the RTP streaming server.	Port Number separated by a colon. This is the receive port number or rtpLPort value from the GET request.

The following reserved URIs can be used in the **`href`** attribute to control an audio stream:

Reserved URIs	Description
RTPRx://STOP	Can be used to stop an audio streaming on the receive end. To be successful, all Push requests that result in sending the RTPRx://STOP must have a **barge** priority.

Note:

For example, if an audio stream originator wanted to explicitly stop an audio stream the following would be sent in new Push Content:

```
<!– Following is the XML Push Request Message sent as a POST request embedded as part of form data -->
     XMLData = <?xml version="1.0"?>
     <Push type=“audio” mode=“barge”>
         <go href=“http://trusted_push_server/stop_audio.xml” method=“get”>
         </go>
     </Push>

<!–The message below is from the Push Content file called “stop_audio.xml” from above go href URI -->
     <?xml version="1.0"?>
       <Response>
          <Audio>
            <Url href=”RTPRx://STOP”>
             </Audio> <
     </Response>
```

Audio quality depends on the streaming source providing the audio at an appropriate pace. The pace depends on the packet size. If you are using 40ms packets, then the packets should be separated by 40ms.

Transmitting the packets too slowly results in odd silences when the telephone has no audio to play out its Speaker. Transmitting the packets too quickly results in broken sound, as the telephone is forced to drop packets it cannot maintain in its buffer.

The error in the pace measured at the telephone is called jitter. If the jitter stays below the size of one packet, then jitter does not impact the audio quality. Note that a +2ms jitter on one packet cancels out a -2ms jitter on the next. However, 40ms packets, each separated by 38ms, means that the jitter grows +2ms with each packet. After 3 seconds, the jitter would be +150ms, and the telephone would need to drop audio to maintain its buffers.

The Subscribe Push Type

The Subscribe push is used as a subscription service for the IP telephones. The subscription service allows an intelligent application to get the telephone’s information from an external database without having to query for the target telephone.

Subscribe Push Features

The features associated with the Subscribe push type are:

- Sends re-subscription requests when the Push type is Subscribe.
- No user interface is involved, since the subscription service is launched in the background.
- This feature is recommended to build databases of IP telephones.

The telephone provides the following information while subscribing to a particular subscription server:

- User’s Telephone Extension
- IP Address of the telephone
- MAC Address of the telephone
- Set ID, an eight character model number which is fixed and does not change
  - For a 4610SW IP Telephone, the Set ID is **4610D01A**
  - For a 4620 IP Telephone, the Set ID is **4620D01A**
  - For a 4620SW IP Telephone, the Set ID is **4620D01B**
  - For a 4621SW IP Telephone, the Set ID is **4621D01A**
  - For a 4622SW IP Telephone, the Set ID is **4622D01A**
  - For a 4625SW IP Telephone, the Set ID is **4625D01A**

Alerts

Alerts are not applicable to the Subscribe push type, as there is no user interaction.

Priorities and States

Normal and barge priorities are not applicable to the Subscribe push type.

The Subscription service is initialized during registration or the IP telephone boot-up process. Once the telephone is properly registered (logged in) with the media server, the telephone subscribes to the server listed in the **SUBSCRIBELIST** parameter.

Note:

For more information on **SUBSCRIBELIST** and boot-time subscription service, see Chapter 4: Push Administration.

Successful Push Response

If the phone is in a pushable state, the Push Agent sends the Push Initiator the following response for all Push request modes and all Push request types:

Parameter	Status Code	Reason Phrase
HTTP Status Code	200	“OK”
x-Push-Status	200	“Push Message Accepted”

Subscribe XML Messages

The following sections describe how to send a re-subscription Push request.

Subscribe Push Message (PM)

The first step in sending a Subscribe push is to send an HTTP POST request from the Push Initiator to the Push Agent in the telephone. Following is the format of the XML Message (PM) sent from the Push Initiator to the Push Agent:

```
<?xml version="1.0"?>
<Push type=“subscribe”>
   <go href=“http://subscription_server/filename.xml”   method=“get|post”>
    <postfield name=“name1” value=“value1”/>
    <postfield name=“name2” value=“value2”/>
</go>
</Push>
```

Using the <postfield> Tag

The IP telephone's Web browser interface supports the <postfield> tag. The <postfield> tag allows an application to set a name/value pair that can be sent to the source of the request. The name is set by the **`name`** attribute and must be a valid WML variable name. The value is set by the **`value`** attribute. A <go> element can contain one or more <postfield> tags.

Note:

For more information on the <**`postfield`**> tag, see Chapter 7: Web Browser for 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones.

Note:

Postfield tags must be sent if HTTP POST method is used.

Table 4: Description of Elements/Attributes used in the Subscribe Push XML Message:

Element or Tag	Attribute	Value	Description
<**Push**>			Each Push Message must contain one valid root <Push> tag.
	`type`	**`subscribe`**	For the Subscribe push type, set type to `subscribe`.
	<**`go href=…/`**>	<**`Url`**>	A fully qualified URL - to an XML file with <Response> and the associated embedded <Subscribe> tag.
	`method`	**`get|post`**	HTTP **get** or **post** methods.

Push Agent

Once a Push Message is received from the Push Initiator, the Push Agent first parses the XML file for validation and tag mismatch errors. The Push Agent verifies that the URL in the <go> tag is part of the Trusted Push Servers. The Push Agent then requests the Push Content from the Trusted Push Server using the URL.

Note:

For more information on Trusted Push Servers, see Security in Chapter 4: Push Administration.

Subscribe Push Content (PC)

The Push Content for the Subscribe push type must be an XML file. This XML file contains the URL for the subscription server and the type of subscription request made.

Using the <Response> Tag

The <Response> tag for the Subscribe push type must be the root element in the (PC) XML file.

Using the <Subscribe> Tag

Following is the syntax for the Subscribe XML file:

```
<?xml version="1.0"?>
  <Response>
      <Subscribe type=”all|me”>
       <Url href= ”Subscription_Server_Url” />
    </Subscribe>
  </Response >
```

Each < Response> can contain only one <Subscribe> tag with the following attributes:

Attribute	Value	Description
type	“**all**”	Instructs the endpoint to re-subscribe to all servers in the SUBSCRIBELIST.
	“**me**”	Instructs the endpoint to re-subscribe to the server in the **href** attribute of the <Url> tag. This url string must exactly match one of the subscription server list servers in the SUBSCRIBELIST variable for this type of subscription to proceed. If the matching fails the subscription request is aborted.

The <Url> tag has the following attributes:

Attribute	Value	Description
href	*string*	Contains the URL of the subscription server for which the endpoint must subscribe. Maximum length cannot exceed 1024 characters.

An exact string-based comparison matches the subscription URIs against the SUBSCRIBELIST values. If the subscription server URI does not exactly match the values in the SUBSCRIBELIST, the subscription request is aborted.

Note:

See Subscription Service in Chapter 4: Push Administration for more information.

Chapter 4: Push Administration

Introduction

This chapter covers the administrative actions required for the Push interface to work properly.

Note:

Consult your System Administrator if appropriate to modify push-related settings. Also, see the *4600 Series IP Telephone LAN Administrator's Guide* on the http://www.avaya.com/support Web site for more information.

Requirements

To enable the Push interface, the non-null parameter TPSLIST (Trusted Push Server List) must be administered in the 46xxsettings.txt script file on the TFTP server.

Use the SUBSCRIBELIST parameter to define the list of subscription servers to which all the telephones will subscribe. The SUBSCRIBELIST parameter is not required to send Push Messages. The remaining sections in this chapter discuss these two topics in more detail.

Security

Push security is validated by a domain-based authentication algorithm. If the Push Content URL is not part of the Trusted Push Server, the Push Message is denied.

Trusted Push Server List (TPSLIST)

Depending upon the TPSLIST setting in the script file, the Push Message is either accepted for additional processing or denied.

An administrator can set the security level using the following domain-based security values for the TPSLIST parameter in the 46xxsettings.txt script file.

System Value Name	Application Software Default	Usage (Value Range; References)
TPSLIST	“” (Null)	List of Trusted Push Servers. Contains zero or more domain/path strings, separated by commas without any intervening spaces. Up to 255 ASCII characters, including commas are allowed.

Specifically, the List of Trusted Push Servers contains one or more domains and paths in a DNS format or an IP Address in dotted-decimal format, separated by commas.

1. The administrator sets the TPSLIST values in the 46xxsettings.txt script file on the TFTP server. See the *4600 Series IP Telephone LAN Administrator’s Guide* on the http://www.avaya.com/support Web site for more details.
2. If the value of TPSLIST is null, Push Messages cannot be received and the Push interface is disabled.
3. If the value of TPSLIST contains only a forward slash character (/), then all Push Messages are accepted, meaning any Push server is considered a Trusted Push Server.
4. Wild cards such as asterisks are not allowed for URL strings in the TPSLIST.

If the pushed URI string (the value of the Push Request’s **`href`** attribute in the <go> tag does not begin with the proper HTTP schema, **http://**, the URI string is rejected and the response back to the Push Initiator contains the following parameters:

Parameter	Status Code	Reason Phrase
HTTP Status Code	403	“Forbidden”
x-Push-Status	402	“Push security failure”

To validate a particular pushed URI string, a string-based comparison is done against the values of the TPSLIST administered in the 46xxsettings.txt script file.

Validation Scenarios

Table 5: URI Examples

Validation String **(Validation string Interpreted as)**	**Pushed URI string** **'X'** means **failure** and **'OK'** means **success**.			
/ = domain/path separator	**Example 1** **http://www.company.com/**	**Example 2** **http://support.company.com/**	**Example 3** **http://www.company.com/push/**	**Example 4** **http://www.hacker.com/**
"company" ("company /")	X	X	X	X
"company.com" ("company.com/")	OK	OK	OK	X
"support.company.com" ("support.company.com/")	X	OK	X	X
"company.com/push" ("company.com/push")	X	X	OK	X
"/push" ("/push")	X	X	OK	X (OK for "http://www.hacker.com/push")
"company.com/xy/push"\ ("company.com/xy/push")	X	X	X	X
"http://www.company.com" ("http://www.company.com/")	OK	X	OK	X
"http://support.company.com" ("http://support.company.com/")	X	OK	X	X
"http://support.company.com/push" ("http://support.company.com/push")	X	X	X	X
"http://www.company.com/push" ("http://www.company.com/push")	X	X	OK	X
"/" ("/")	OK	OK	OK	OK

Recommendations:

If the domain from Table 5: URI Examples is “**associate.hacker.com**” and the TPS string is “**company.com**”, then the domain “**hackercompany.com**” will also match the TPS string and pass the security validation. For example, if the TPS string is “**company.com**” & the URLs are:

http://www.company.com - this URL is acceptable.
http://associate.company.com - this URL is acceptable.
http://www.hackercompany.com - this URL is acceptable.

In this case “**hackercompany**” also passes the security validation.

To avoid such security issues, the administrator must set the TPS string to “**.company.com**” (where there is a “**dot**” before “**company**”).

For example, if the TPS string is “**.company.com**” and the URLs are:

http://www.company.com - this URL is acceptable.
http://associate.company.com - this URL is acceptable.
http://www.hackercompany.com - this URL is not acceptable.

In this case “**hackercompany**” fails the security validation.

Subscription Service

The phone provides a set of values such as the IP Address and user telephone number to subscription servers when the telephones register with the media server. An explicit subscription message can also be sent to the phone using <Push type=”**subscribe**”… /> to re-subscribe the phones.

Note:

See Chapter 3: Creating Push Messages for more details on sending a re-subscribe Push Request to the telephone.

Applications must maintain their own database of information for each phone. Databases can be built with respect to a group of telephones or an individual phone.

A typical example in a corporate work environment is to have distribution lists according to specific teams. An application can only target pushes to that team such as “team meeting reminders” with conference bridge numbers, etc.

Once an application builds a database that has the required information of all of the telephones in the network, it can target Push Content or an audio stream to a specific phone or a group of phones. Additionally, Push Initiator Servers can poll the phone to update its database.

Note:

A phone in a logoff state does not unsubscribe from the Subscription server.

Subscriber Service

Using the Push Subscription Service, the phone makes the following values known to the trusted subscription service server:

- IP Address of the Phone
- User’s Extension
- MAC Address
- Set ID, an eight-character model number which is fixed and does not change
    - For a 4610SW IP Telephone, the Set ID is **4610D01A**
    - For a 4620 IP Telephone, the Set ID is **4620D01A**
    - For a 4620SW IP Telephone, the Set ID is **4620D01B**
    - For a 4621SW IP Telephone, the Set ID is **4621D01A**
    - For a 4622SW IP Telephone, the Set ID is **4622D01A**
    - For a 4625SW IP Telephone, the Set ID is **4625D01A**

The HTTP Push Subscription Message Syntax is as follows:

```
GET:http//<subscription_server>/<script_name>?MAC=xxx+Extn=xxx+ip=xxx+
SetID=xxx
```

Upon log on to the call server, the Push Subscription service updates all values. No unsubscribe event is sent upon user logoff.

Subscription List (SUBSCRIBELIST)

This list specifies the Push administrative requirements for setting a new system value for the subscription-trusted list of servers. Specifically, the Subscription list contains one or more fully qualified URLs, separated by commas.

An administrator can set the subscription server addresses using the following domain-based values for the SUBSCRIBELIST parameter in the 46xxsettings.txt script file.

System Value Name	Application Software Default	Usage (Value Range; References)
SUBSCRIBELIST	“” (Null)	List of Trusted Subscription Servers, contains zero or more domain/path strings, separated by commas without any intervening spaces. Can be up to 255 ASCII characters, including commas.

Specifically, the List of Trusted Subscription Servers contains one or more fully qualified URLs of the subscription servers, separated by commas.

The values for SUBSCRIBELIST are set by the administrator in the 46xxsettings.txt script file on the TFTP server. See the *4600 Series IP Telephone LAN Administrator’s Guide* on the http://www.avaya.com/support Web site for more details.

Note that the Subscription Servers specified in the SUBSCRIBELIST parameter are considered to be Trusted Push Server. Hence, no additional security validation is done for the subscription server URIs.

The syntax of the Trusted Subscription List is a series of fully qualified URIs of the form:

```
<scheme>://<host>:<port>/<url-path>
```

If http://10.0.1.101/subscribe.asp, http://company.com/subscribe/, and http://abc.company.com:8000/cgi/subscribe are lists of the three subscription servers, then use the following syntax in the 46xxsettings.txt script file to administer these URLs as the subscription servers:

```
SET SUBSCRIBELIST http://10.0.1.101/subscribe.asp,http://
company.com/subscribe/, http://abc.company.com:8000/cgi/subscribe
```

Subscription Update

Use the Subscribe push type to make an asynchronous request to a phone to re-subscribe and update all the values defined in the syntax examples above.

Note:

See Chapter 3: Creating Push Messages for more details on sending a Subscribe Push Request to the telephone.

An exact string-based comparison is done to match the subscription URIs against the values in the SUBSCRIBELIST. If the subscription server URI does not exactly match the values in the SUBSCRIBELIST, the subscription request is aborted.

Retry Timer

If the subscription server is unresponsive to the initial subscription message from the phone at boot up and does not return a Message 200 (OK), then the subscription service retry timer will send subscription messages to the subscription server every 20 minutes, up to five times.

The retry timer does not apply to a subscription update from the subscription server.

Denial of Service Timer

The Denial of Service Subscription Timer limits the number of subscription updates requested by the trusted subscription service. The Push Agent following a successful subscription will accept only one subscription request per minute. This implies that the Push Agent in the telephone can handle one subscription request per minute.

The denial of service timer starts following a Push Request for Subscribe. No Subscribe request is accepted for the next minute. If another Subscribe request is received within that time, the response is as follows:

Parameter	Status Code	Reason Phrase
HTTP Status Code	200	“OK”
x-Push-Status	503	“Service Unavailable”

Chapter 5: Troubleshooting the Push Interface

Avaya HTTP Header Extensions (x-Push-Status Codes)

The Push Agent sends a response back to the Push Initiator with HTTP status codes.

Note:

See Push Message Flow and Figure 4 in Chapter 2: Push Interface Overview for an overview of the Push process.

In addition to the HTTP response codes, an additional HTTP header extension called “x-Push-Status” is sent.

The x-Push-Status header is used to indicate the outcome of a Push Request back to the Push Initiator. The header is included in all responses to the Push Initiator for Push Requests. General guidelines for error codes for x-Push-Status are as follows:

- Status-Code 200-299: Push Service Response and Rejection codes, Push State codes
- Status-Code 300-399: XML parsing codes
- Status-Code 400-499: Trusted Domain Security codes
- Status-Code 500-599: General rejection reasons

Table 6: x-Avaya-Push-Code Responses

x-Push-Status code	Reason Phrase (Description)	Resolution (“N/A”: Avaya IP Telephones never send the status code)
200	“Push Message Accepted”	This reports that the telephone has successfully accepted the push.
201	“Push Services Disabled”	Ask your system administrator to administer the TPSLIST value on the TFTP Server. See Push Administration for more information.
202	“Internal Error: Push Aborted”	There was a problem processing your request. Re-send the Push request.
204	“Not in Push State: Push Accepted”	The Push Message was accepted but the user’s telephone is busy, for example, in text-edit mode. The Push Message is loaded in the background. Once the user launches the Web browser on the phone, the user will be able to view the Push Message. Try sending a “barge” priority message instead if you want the user to view the message immediately.

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Table 6: x-Avaya-Push-Code Responses (continued)

x-Push-Status code	Reason Phrase (Description)	Resolution ("N/A": Avaya IP Telephones never send the status code)
205	"Not In Push State: Push Aborted"	The Push Message was rejected because the phone is in a non-pushable state. Try sending a "barge" priority message instead. See Chapter 3: Creating Push Messages for more information.
208	"Not in Audio Push State: Push Aborted"	The audio stream was rejected because the user is currently on the call or busy. Try sending a "barge" priority message instead. See The Audio Push Type on page 46for more information.
301	"XML document not valid"	Check the proper XML schema as described in this API. See Chapter 3: Creating Push Messages for more information.
302	"XML document not well-formed"	Make sure that all the XML tags are properly formed. See Chapter 3: Creating Push Messages for more information.
303	"No element found"	Make sure that all the XML tags are properly formed. See Chapter 3: Creating Push Messages for more information.
304	"Unknown encoding"	Make sure that all the XML tags are properly formed. See Chapter 3: Creating Push Messages for more information.
305	"Invalid root element"	Make sure that all the XML tags are properly formed. See Chapter 3: Creating Push Messages for more information.
306	"Empty Post Content"	If you are using the HTTP POST method in the Push Message, include postfield tags with the message.
307	"Push Content too large"	The XML file is larger than 5Kb. Send an XML file less than 5K bytes.
402	"Push security failure"	The security service failed to validate the Trusted Push Server.
501	"Invalid Push URI"	Recheck the URI included in the <go href…/> request for fully qualified URL string. Also, make sure the length of the URI is no longer than 1024 characters.
503	"Subscription Service Unavailable"	Ask your system administrator to administer the SUBSCRIBELIST value on the TFTP Server. See Chapter 4: Push Administration for more information.
		2 of 2

HTTP Error Messages

The following standard HTTP Error Messages will be supported. Status codes starting with “4” indicate a client error in which the request contains bad syntax or cannot be fulfilled. Status codes starting with “5” indicate a server error in which the server failed to fulfill an apparently valid request.

Table 7: HTTP Error Messages

Status Code	Cause of Failure	Failure Message Displayed to the User/Resolution (“N/A”: Avaya IP Phone will never send the status code)
400	Bad Request	Due to incorrect syntax the server could not understand the request.
401	Unauthorized	The request requires user authentication.
402	Payment Required	N/A
403	Forbidden	The server has indicated it will not respond to your query.
404	Not Found	The server has not found anything matching the request.
405	Method Not Allowed	N/A
406	Not Acceptable	N/A
407	Proxy Authentication Required	The request requires user authentication.
408	Request Time-out	N/A
409	Conflict	The request could not be completed due to a conflict with the current state of the resource.
410	Gone	The requested resource is no longer available.
411	Length Required	The server refuses to accept the request.
412	Precondition Failed	N/A
413	Request Entity Too Large	The server refuses to accept the request because the request entity is too large.
414	Request-URI Too Large	The request-URI is longer than the server can interpret.

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Table 7: HTTP Error Messages (continued)

Status Code	Cause of Failure	Failure Message Displayed to the User/Resolution ("N/A": Avaya IP Phone will never send the status code)
415	Unsupported Media Type	The server refuses to accept the request because it's in an unsupported format.
416	Requested range not satisfiable	N/A
417	Expectation Failed	N/A
500	Internal Server Error	The server encountered an unexpected condition that prevented it from fulfilling the request.
501	Not Implemented	N/A
502	Bad Gateway	The server, while acting as a gateway or proxy, received an invalid response from the upstream server it accessed in attempting to fulfill the request.
503	Service Unavailable	The server is currently unable to handle the request due to a temporary overloading or maintenance of the server.
504	Gateway Time-out	The server, while acting as a gateway or proxy, did not receive a timely response from the upstream server specified.
505	HTTP Version not supported	The server does not support, or refuses to support, the HTTP protocol version that was used in the request message.
		2 of 2

Chapter 6: About The Web Browser

Introduction

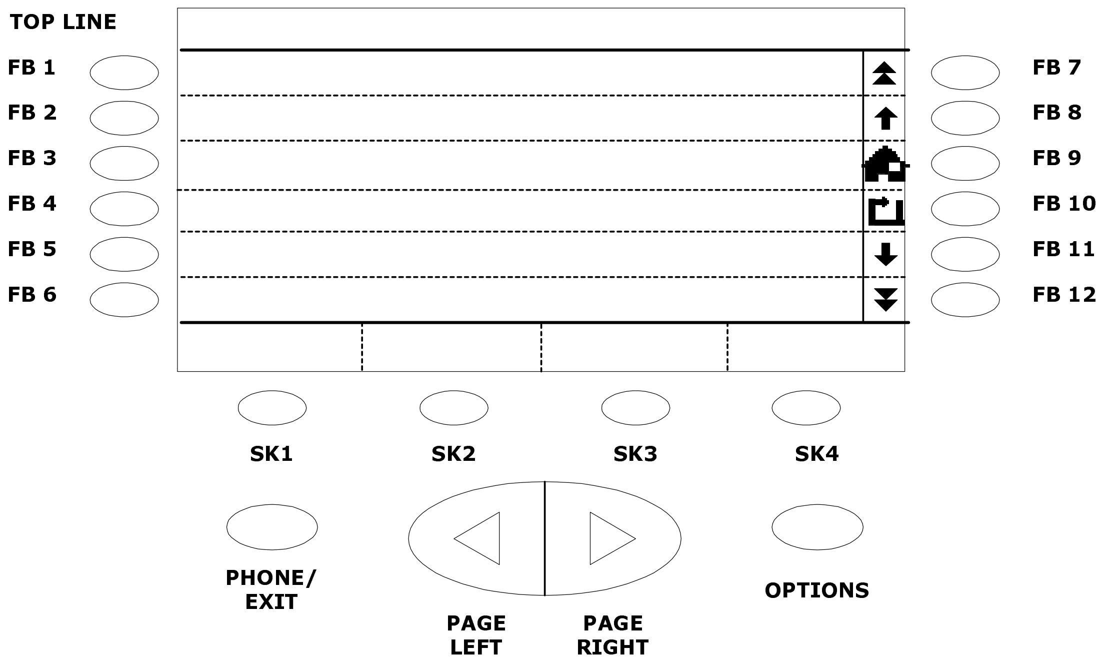
This chapter provides general information about and requirements for developing Web browser applications. The information covered applies to all IP telephones to which Web application development applies, specifically:

- 4610SW
- 4620/4620SW
- 4621SW
- 4622SW
- 4625SW

The 4625SW IP Telephone differs from the others listed in that it has a significantly different display that supports color and JPEG images. However, basic browser principles apply to all telephones capable of maintaining a Web browser. This chapter describes those common characteristics. For specific information about Web application development for the 4625SW, see Chapter 9: Web Browser for the 4625SW IP Telephone. For specific information about Web application development for the other 4600 Series IP Telephones to which Web application development applies, see Chapter 7: Web Browser for 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones.

Figure 12 provides a schematic view of the standard Web browser display for the 4620/4620SW, 4621SW, 4622SW, and 4625SW IP Telephones and the key fixed buttons associated with the display. The abbreviations “FB” and “SK” stand for “Feature button” and “Softkey” respectively.

Figure 12: Schematic View of the Standard Web Browser Display and Key Fixed Buttons



Note:

Figure 12 does not apply to the 4610SW IP Telephone, which has only has six Feature buttons. However, the fixed buttons and softkeys shown do apply to the 4610SW.

Physical Attributes

The IP telephones that support the Web browser have these characteristics:

- Twelve Feature buttons are available for Web applications, except for the 4610SW, which has six Feature buttons.
- The top display line is reserved for messages, text entry prompts, and page titles.
- The bottom display line presents the available softkey selections. Four softkeys can be displayed at one time. For the 4625SW, the bottom display line cannot be overwritten.
- **Page Left** and **Page Right** hard buttons to navigate back to a previous page and forward to another page, if one exists.

The browser uses an HTTP client to communicate with Web servers. WML 1.3 (WML June 2000) is supported. See wapforum.org for more information about WML 1.3.

The Web browser renders pages with spaces before the XML prolog. The strict rules of XML specify that pages with any characters before the XML prolog, including spaces, are invalid and should be rejected. However, many WML pages available on the World Wide Web contain such spaces. To facilitate compatibility with existing content, this constraint is relaxed in the Web browser.

The frame in which a Web page displays sits flush with both the left and right sides of the display. Pixel 319 is the last horizontally addressable pixel, and pixel 239 is the last vertically addressable pixel.

The Web browser uses the right side of the display for navigation controls. These controls do not appear in any other IP telephone application.

A maximum number of 96 lines per card is supported. A line corresponds to text rendered on the screen that spans the row between the left and right side Feature buttons.

For deck storage, 6.5 Mbytes of memory is allocated to the Web browser.

Web Browser Navigation

Web screen navigation is accomplished as follows:

- Use the Feature buttons to the left of the display to select items/lines on the screen.
- Use the Feature buttons to the right of the screen for navigation.
- One link is permitted per line. To activate a link, press the left Feature button associated with a particular display line.
- Use Feature buttons to select an option.
- Use Feature buttons to focus on a text entry box, to allow entry of text.
- Use the softkeys on the bottom of display for navigation as appropriate.
- Also use the hard **Page Left** and **Page Right** buttons for navigation. The **Page Left** button takes the user to the previous card. The **Page Right** button takes the user to the next card only if it is available in the history stack.
- Horizontal scrolling is not supported for any line other than the top display line.

See Icons for Navigation Control for additional information about establishing navigation controls.

Icons for Navigation Control

Icons associated with (default) Feature buttons **7** through **12** appear on the right side of the display. On each line of pixels corresponding to the Call Appearance/Application Areas for the Feature buttons (i.e., not for the Top Area or the Softkey Label Area) the pixel array is as follows:

- pixel 242 is white,
- pixel 293 is black, and
- pixel 294 is white, resulting in a vertical line down pixel 293.
- Icons are up to 25 pixels wide and 25 pixels high, and display in horizontal pixels 295-319.

Note:

Horizontal and vertical pixel numbering starts with 0 in the upper-left corner.

Figure 13 shows the Standard Browser Feature button icons that appear on the right side of the display.

Figure 13: Standard Browser Navigation Feature Buttons

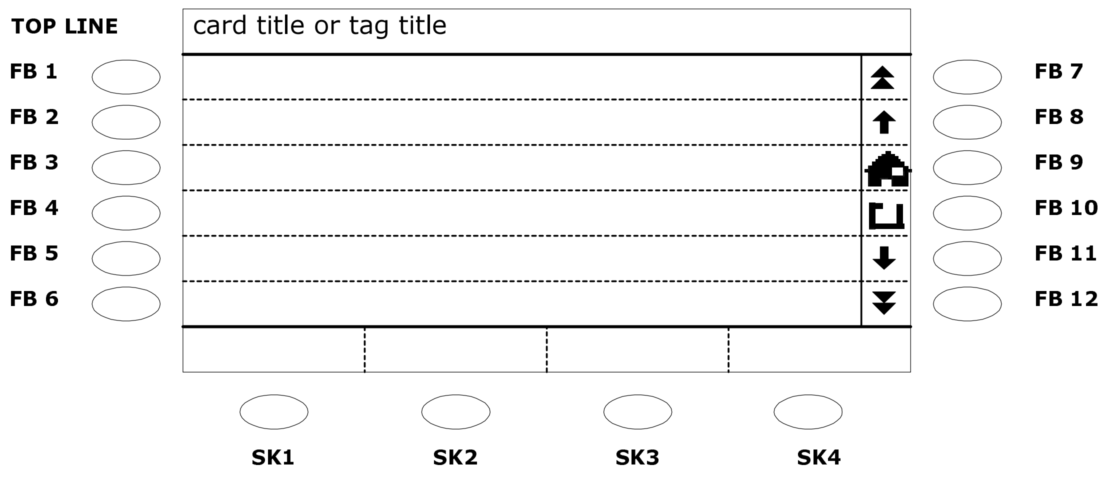


Table 8 describes the Standard Browser Feature buttons on the right side of the display. The navigation icons for the 4625SW differ from those for the other applicable IP telephones because only the 4625SW supports a color display.

Table 8: Navigation Control Icons

4625SW	All Other Phones	Explanation
⏫	⏫	**Page Up**. If more text exists than can be currently viewed on the display's six lines, moves up an entire screen and displays the previous six lines of text. No line on the new page displays in focus and the Top Line displays the card title. The double arrows display in black when there are additional text lines that do not fit on the display. The double arrows display in the lightest shade of gray when there are no additional text lines. When any page other than the first has no line in focus and a user selects Page Up, the previous page displays with no line in focus. If a line is in focus, the same line displays in focus on the new page. When Page Up is selected on the first page, the focus moves to the first line on that page.
⏬	⏬	**Page Down**. If more text exists than can be currently viewed on the six lines of the screen, moves down to line 7 and displays up to the next six lines of text. No line on the new page displays in focus and the Top Line displays the card title. The double arrows display in black when there are additional lines of text that do not fit on the display. The double arrows display in the lightest shade of gray when there are no additional text lines. When any page other than the first has no line in focus and a user selects Page Down, the next page displays with no line in focus. If a line is in focus, the same line displays in focus on the new page. When Page Down is selected on the last page, the focus moves to the last line on that page.
▲	⬆	**Focus Up**. Moves the focus up the page by one line, up to the Top Line. The single arrow displays in black when there are additional lines of text that do not fit on the display. If the first line of the first page is in focus, pressing Focus Up removes the focus entirely. The single arrow displays in the lightest shade of gray when there is no additional text.
▼	⬇	**Focus Down**. Moves the focus down the page by one line. If Focus Down is selected when no line on the current page is in focus, the first line on the current page is placed in focus. When the last line of the initial six lines is in focus, selecting this icon causes the screen to scroll down one line and the focus to shift to that line. The single arrow displays in black when there are additional lines of text. The single arrow displays in the lightest shade of gray when there is no additional text.
🏠	🏠	**HOME** icon. Returns to the original card, the URL of the home card for the Web application. When a page first loads, the **Home** icon displays in the lightest gray shade to indicate that Feature button is not available.
⟳	⟳	**REFRESH** icon. Refreshes the screen, unless the user is trying to refresh an expired card.

Use the **Focus Up** and **Focus Down** Feature buttons (single Up and Down arrows next to Feature buttons **8** and **11**, respectively) to move the focus up and down one line at a time. This is not scrolling in a conventional sense. The Up and Down arrows allow a user (in addition to directly selecting the associated left Feature button), to reach a text entry area or to focus on a line and see the associated title information displayed on the Top Line of the screen.

Use the **Page Up** and **Page Down** Feature buttons (double up and down arrows next to Feature buttons **7** and **12** respectively) to navigate up and down to text that is not initially visible on the display.

Note:

The navigation arrow controls do not have an auto-repeat capability. This means that the user must press and release the Feature button associated with the navigation icon each time the user wants to view additional display lines.

Multiple Paging Indicators

When the screen displayed is one of multiple “pages” in the Web history stack, the paging indicator displays on the screen. The paging indicator is one or a pair of directional arrows centered on the solid black line between the Call Appearance/Application Area 6 and the Softkey Label Area. The presence of one or both arrows tells the user that pressing the telephone’s **Page Left** and **Page Right** buttons have a visible effect. The independent **Page Left** and **Page Right** indicators let users know they can move back and forth in the Web history stack. The **Left Arrow** indicator appears when a previously viewed page is available in the history stack. The **Right Arrow** indicator appears when the user can travel forward to see the next page in the history stack. If a user attempts to go back or forward using the **Page Left** and **Page Right** buttons when there are no cards in the history stack, an error tone sounds.

Moving Up and Down a Card

Table 8 shows that the right Feature buttons allow the user to move up and down the lines currently displayed, or move down to additional lines of text that are not currently visible on the screen.

The user moves up and down the lines currently displayed because different title information shows on the Top Line depending on which of the six currently displayed lines is brought into focus. Each time a new line is brought into focus, a new title can display on the Top Line, if the title is included in the tag coding. When you code a tag without a title, the Top Line shows the default associated with that tag. The chart of Tags with Titles and Corresponding Top Line Defaults: on page 78 provides Top Line default titles. Chapter 7: Web Browser for 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones and Chapter 9: Web Browser for the 4625SW IP Telephone provide tag-specific information.

Users can move up and down, bringing displayed text into focus as they choose. This is a unique WML feature that allows additional information about a line of text to be presented to the user. Moreover, the user can move to additional text lines that do not fit on the current screen, to view all the text lines contained in one card. It appears to the users as if they are navigating to the next page of text, but they are really descending down six more lines of text on the currently displayed card.

Example:

Table 9 shows the relationship between moving up and down one line at a time on the current lines displayed, what appears in the Top Line, and what line is considered in focus. This example shows what happens as the user moves down the card one line at a time. The table shows the title displayed in the Top Line when its corresponding tag is in focus. In this table, for example, when line 1 is in focus, its corresponding title displays on the Top Line. When the tag associated with a line does not have a specific title, a default title displays. If the line is only text and has no actionable tags, the card title displays.

Table 9: Relationship between Line/Page Movement, Focus, and Top Line Display

Top Line displays:	**Card Title**	**Line 1 Tag Title**	**Line 2 Tag Title**	**Line 3 Tag Title**	**Line 4 Tag Title**
Line	1	1	1	1	1
that is	2	2	2	2	2
in focus	3	3	3	3	3
	4	4	4	4	4
	5	5	5	5	5
	6	6	6	6	6
Action	Ø	Ø	Ø	Ø	Ø
Top Line displays:	**Line 5 Tag Title**	**Line 6 Tag Title**	**Line 7 Tag Title**	**Line 8 Tag Title**	**Line 9 Tag Title**
Line	1	1	2	3	4
that is	2	2	3	4	5
in focus	3	3	4	5	6
	4	4	5	6	7
	5	5	6	7	8
	6	6	7	8	9
Action	Ø	Ø	Ø	Ø	Ø

Tags with Titles and Corresponding Top Line Defaults:

Tag	Attribute	Top Line Default Values
<card>	`Title`	New Card
<anchor>	`Title`	Use button to select
<a>	`Title`	Use button to select
<input>	`Title`	Enter text between brackets
<select>	`Title`	Use button to select
<img>	`Alt`	Web:

All Top Line messages are not prepended with the word **Web:** followed by a space.

The card title displays on the Top Line when the page is first displayed. The card title also appears on the Top Line when the user scrolls down the screen and comes across a text element (<p> tag or <br/> tag). When pages are downloading, **Loading ….** displays on the Top Line for the 4625SW IP Telephone only.

Note:

Phone calls can be made or received while in the Web browser. The Phone application can overwrite Top Line tag titles.

Truncation Rules and Links

Truncating Lines and Words

- Each link associated with <a> and <anchor> WML tags can take up the width of one display line. If the link would display wider than the frame width, the link is truncated at the point where it no longer fits in the frame. Links are not wrapped around to the next display line.
- The browser breaks long lines of text into multiple lines. This is equivalent to setting the <p> mode = wrap. The default is to wrap the text.
- Long words that don’t fit on an entire line are hyphenated.
- URLs cannot be broken into multiple lines.

Links

Rules for links within a page are simplified for development purposes:

- A maximum of one link can be displayed per display line.
- Regular text will not be displayed on the same line as a link.
- A link causes an automatic line break to occur both before and after the link.

Enabling Text Entry

Use these guidelines to enable standard text entry. See Access Key Input Mode (AIM) in Chapter 7 for information about an alternate text entry method using access keys. AIM applies only to the 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones. AIM does not apply to the 4625SW IP Telephone.

1. When a card displays, a set of square brackets containing the prompt **Enter text here** indicates a text entry area.
2. To start text entry, the user either presses the left Feature button associated with the text line/field, or uses the **Up Arrow** or **Down Arrow** key(s) to bring the line/field into focus. Either action causes a cursor that indicates where to begin text entry to replace the text entry prompt.
3. Text editing softkeys display at the bottom of the screen to assist the user with text entry.
4. Pixels 0 to 153 are addressable.
5. The user exits Standard Text Entry mode by:
   - Pressing the Feature button associated with the line on which text entry occurred to de-focus the line,
   - Pressing any other Feature button, or
   - Pressing a **Done** softkey at the bottom of the screen.
6. To re-enter text entry mode, the user presses the Feature button associated with the text line/field. Text entry can proceed when a cursor appears to the right of the existing text. The **Bksp** (Back Space) softkey is used to delete existing text, as appropriate.
7. A page author can customize bracketed text to assist a user in text entry. For example, the author can prompt “Enter name here,” “Enter phone number here,” or “Enter email address here.”

8. On-hook keypad dialing to make a phone call is not allowed when in Text Entry mode. If the user is already off-hook, text entry is allowed. When the phone is again placed on-hook, text entry can be re-enabled at the point at which it was disabled. When text entry is active, the user can be active on a call or receive a call, but cannot use the keypad to dial a number or for interactive voice recognition (IVR) prompts. In this case, the user must disable text entry prior to using the keypad to dial a call or for IVR prompts.

Text Entry Example:

An <input> tag used for a text entry box has these attributes:

- **`<title>`** - The title is sent to the Top Line.
- **`<value>`** - A value displays in the text entry box rather than the standard “Enter text here” prompt. When the user selects the line or brings the line in focus, the cursor displays at the end of the value. When the value field is empty, focusing in erases the “Enter text here” prompt and places the cursor at the beginning of the entry field. The **`<value>`** attribute takes precedence over an **`<ivalue>`** attribute, as explained in the examples that follow.

Note:

See Chapter 7: Web Browser for 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones and Chapter 9: Web Browser for the 4625SW IP Telephone for specific information on the <input>, <title>, <value>, and <ivalue> tags.

Here is how the user experiences a value versus a non-value during standard text entry:

For the tag <input title=”Hello there”/> - The text box displays **[Enter text here]** as a default. No value is present, meaning the user has not entered text in the text box. Upon text entry, the value equals the typed-in text, and the “Enter Text here” prompt no longer displays.

For the tag <input title=Hello there” value=”Fill in the blanks”/> - The text box displays **[Fill in the blanks]**. The cursor is positioned after the “s” in “blanks.” In this example, “Fill in the blanks” always appears at the beginning of the text box, regardless of what the user enters. This is contrary to the situation above where no value was specified in the <input title> string and the prompt [Enter text here] no longer displays after the user types the first character.

If a new attribute value is defined, the attribute takes precedence over ivalue. For the tag <input title=”Hello there” ivalue=”Enter name here”/> - the text box displays **[Enter name here]** and the attribute value takes precedence over ivalue. When the user enters text, the value now equals the typed-in text. The prompt “Enter name here” no longer displays and the text the user entered remains in the text box.

Text Editing Modes

When a text entry area is enabled, these softkey labels display centered above the actual softkeys:

Done	**Bksp**	**Space**	**alpha**

The labels appear at the bottom of the display and are activated by pressing the Softkey buttons directly below them.

The **Done** softkey exits text entry mode. When **Done** is pressed, several actions occur:

- *the line containing the text entry area no longer displays as in focus*,
- *the cursor no longer displays, and*
- *the previous softkey labels and operation are restored*.

The **Bksp** softkey is used for destructive backspacing during text entry. Pressing this softkey deletes text that is backspaced over. This softkey can only be used if there is a character to the left of the cursor. Text to the right of the cursor moves left with the cursor.

The **Space** softkey advances the cursor forward, leaving a space. Since there is no "cursor back" ability, the cursor cannot have characters to its right.

The rightmost softkey always displays the name of the current input mode. The Top Line prompts **Press <*mode*> to change mode** where <*mode*> is the name of the current input mode. When the user presses the rightmost "alpha" softkey for the first time, all four softkeys change to:

ALPHA	**alpha**	**Num**	**Symbol**

After selecting one softkey, the softkeys then change back to "Done | Bksp | Space | <mode>" where <*mode*> is the mode just selected. When the **Symbol** mode is selected, the Top Line Area displays **Select desired symbol**.

Input Modes

ALPHA	alpha	Num	Symbol

The default entry mode is **alpha** (lower case alphanumeric). Once the user brings a text entry area into focus with the appropriate Feature button, text entry displays lower-case alphanumeric text. The user can switch between **ALPHA** (all capital letters), **alpha** (lower case alphanumeric), **Num** (Numeric. Numbers only) and **Symbol** text entry modes at any time by using the softkeys.

ALPHA - This mode works just like **alpha** mode, except all alphabetic characters entered display in upper case letters.

Num - This text entry mode allows the entry of numeric characters.

Symbol - Pressing this softkey displays the first of three screens containing symbols for text entry. To select a symbol for entry, the user presses the Feature button with which the symbol is associated.

Figure 14: Text Editing Symbol Screen One

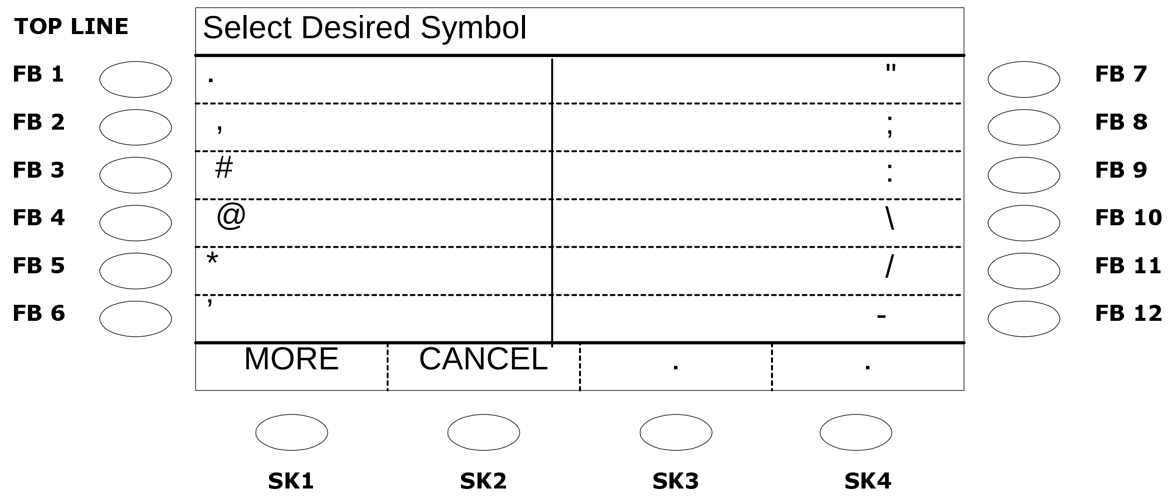


Figure 15: Text Editing Symbol Screen Two

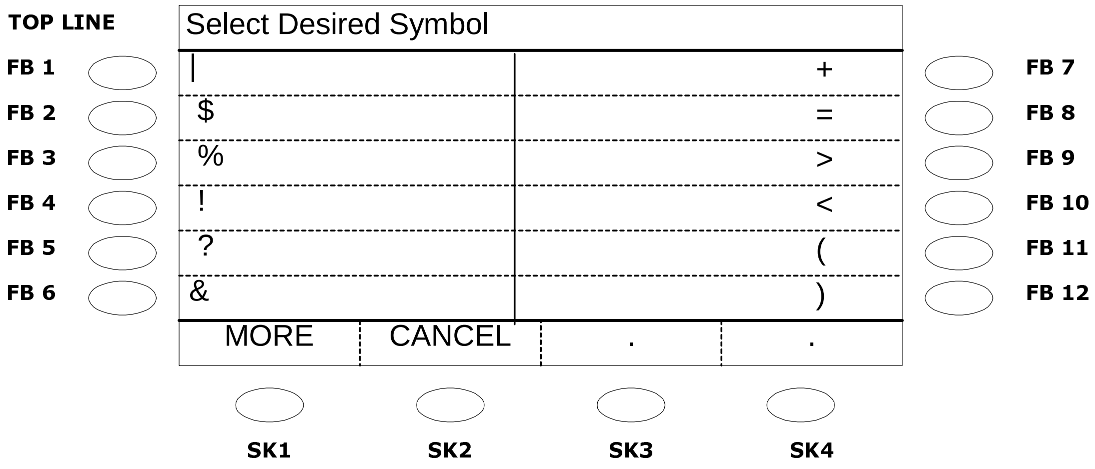
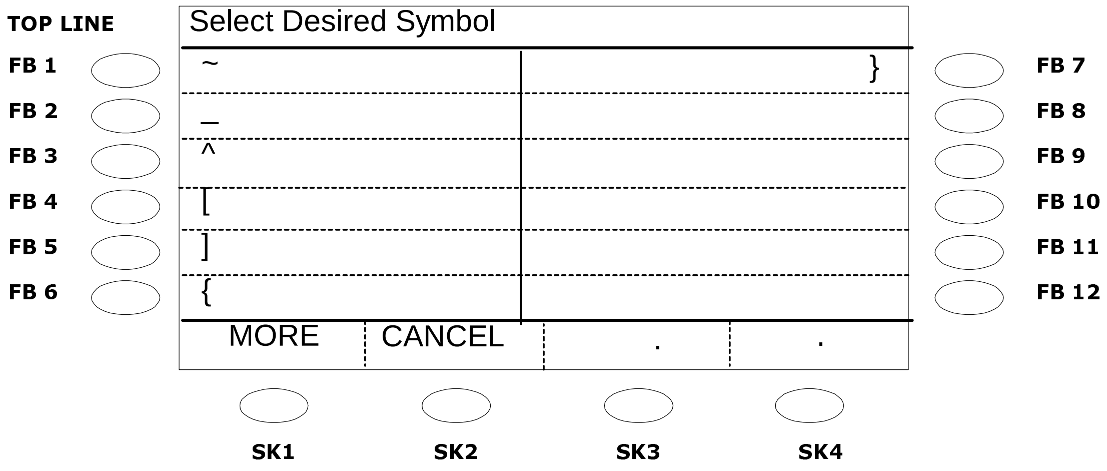


Figure 16: Text Editing Symbol Screen Three



Use the Feature button associated with the desired symbol to place that symbol at the cursor position in the text entry area. Use either the **MORE** softkey or the **Page Left** and **Page Right** hard buttons to view the next page of symbols. There are three pages of symbol choices. When the user is on the last page of symbol selections, pressing the **MORE** softkey takes the user back to the first page of symbol selections. After selecting a symbol, the text entry screen redisplays in alpha mode. The selected symbol appears in the text entry area and the cursor advances to the next position. The default entry mode (alpha) displays.

Note:

The ***** and **#** dial pad keys can be used to enter the * and # characters in any text mode. The cursor automatically advances after one of these characters is entered.

Character Set Support

Character set support differs depending on the IP telephone model. The Web browser supports ISO-8859-1 (Latin 1) encoded WML for any languages available on each specific telephone model. For example, the 4625SW does not support the Chinese and Japanese (Han and Katakana) languages.

Web History

The Web history is a list of URLs and starts from the point the user initiates the browser session for the first time. Up to 100 URLs can be stored in memory. Any URLs exceeding the allowable maximum are deleted in the order stored in memory, meaning the first URLs stored are the first URLs deleted.

Display Colors

Any line that is considered in focus displays in the reverse colors used for foreground and background.

Note:

The 4625SW supports a color display and JPEG images. See Chapter 9: Web Browser for the 4625SW IP Telephone for specific information regarding color.

Call Interaction

The user can make and receive calls when in a Web browser session.

When users re-enter the Web browser application, they are returned to the same point at which they left. If the user is entering text and leaves the Web browser using the **Phone/Exit** button, the user returns to the same state of text entry upon reentering the Web application.

No dialing is supported when in text entry mode. On-hook keypad dialing to make a phone call is not allowed when the user is entering text. Text entry is allowed while the user is off-hook. When the phone is placed once again on-hook, text entry can be re-enabled at the point where it was disabled.

When text editing is active, the user can be active on a call or receive a call, but cannot use the keypad to dial a phone number or for interactive voice recognition (IVR) prompts. The user must disable text entry prior to using keypad dialing to make a call or for IVR prompts.

Requirements for Deck/Card Elements

Valid WML elements include the following:

Type of Elements	Element
Deck/card elements	wml, card, template, head, access, meta
Event elements	do, ontimer, onenterforward, onenterbackward, onpick, onevent, postfield
Tasks	go, prev, refresh, noop
Variables	setvar
User input	input, select, option, optgroup, fieldset
Anchors, Images, Timers, Variables	a, anchor, img, setvar, timer

Unsupported tags (not well-formed) cause the error message **Page cannot be rendered** to appear in the Top Line. The error message **Page contains invalid tags** displays on the Top Line if the XML parser fails.

The attributes **`xml:lang`**, **`class`**, and **`id`** are universal attributes associated with every wml element. The Web browser supports these tags as follows:

Attribute	Support	Comments
`xml:lang`	No - will not be used	Currently only English is supported.
`class`	No - will not be used	Only half of the phone browsers support this attribute.
`id`	Yes - will be used	

The three universal tags are not repeated in requirements for other tags.The Summary Of WML Tags and Attributes on page 99 is a complete list of all supported tags and attributes.

Wireless Telephony Applications (WTA)

Wireless Telephony Applications (WTA) are those applications designed to interact with the telephony-related functions present in a phone. The Web browser supports:

- Originating a call - **Click to Dial**
- Adding entries to the phonebook - **Add to Speed Dial entries**

The Web browser supports the WTA application “click to dial” any link on the screen. A telephone handset icon displays to the left of a “click to dial” link when the link first display.

The **Add to Phonebook WTAI** function “wtai://wp/ap;” adds a Name and Number to the telephone’s Speed Dial application. A Speed Dial icon displays to the left of an “add to phonebook” link. The wtai syntax is supported as an **`href`** attribute. As such, any tags supporting the **`href`** attribute can use the “add to speed dial” function. These tags are <a>, <anchor>, <img>, <do>, <onevent>, <select>, <option>, and <optgroup>.

When a user activates the **add to speed dial** function, the Web transfers the name and number to the Speed Dial application. The user can edit the entry according to the current Speed Dial functionality.

The WTAI URI scheme is as follows:

```
wtai://<library>/<function> (; <parameter>)* [! <result>]
```

Scheme Definition:	
< >	Indicates an enumerated operator.
[ ]	Indicates an optional section.
I	Indicates a pair of mutually exclusive options.
( )*	Repeat none or multiple items.
*( )	Repeat one or multiple items.
library	Name that identifies the library type, WTA Public uses library “wp.”
function	Function within a library, for example, “mc” for function “make call” in “wp” library.
parameter	Zero or more parameters sent to a function. Delineated by a semicolon “;”.
result	Start of result defined by “!”. Optional.

Syntax Implementation

Click to Dial Functionality

To enable the click to dial functionality, use the following syntax:

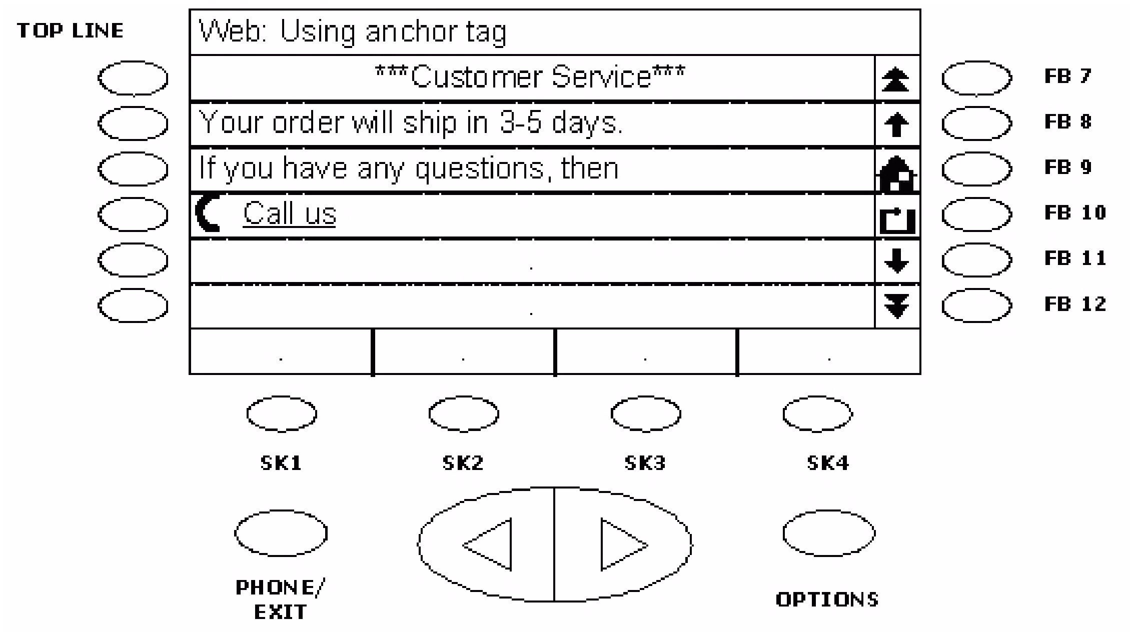
`wtai://wp/mc;`***number***

You can embed this code into any valid WML tag that implements href or a hyperlink by associating these tags with a <go> tag. Examples of tags you can associate with the <go> tag are the <a> tag, <anchor>, <do>, <option>, or <onevent> tags.

Click-to-dial using <a> tag:

```
        <?xml version="1.0"?>
        <!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.3//EN"
                  "http://www.wapforum.org/DTD/wml13.dtd">
        <wml>
        <card id="callid1" title="Click-to-Dial Demo">
        <p>
        Click on the link below to originate a call
        <a href="wtai://wp/mc;5551212">Call 5551212</a>
        </p>
        </card>
    </wml>
```

The generated code is rendered as the following diagram:



The code shows a hyperlink as **Call 5551212** on the Web screen of an Avaya 4620 IP Telephone. A phone icon precedes this hyperlink, indicating the hyperlink is a "click-to-dial" number. When a user selects this link, the phone dials the string "5551212" or any phone number that follows a semicolon in the WTAI code.

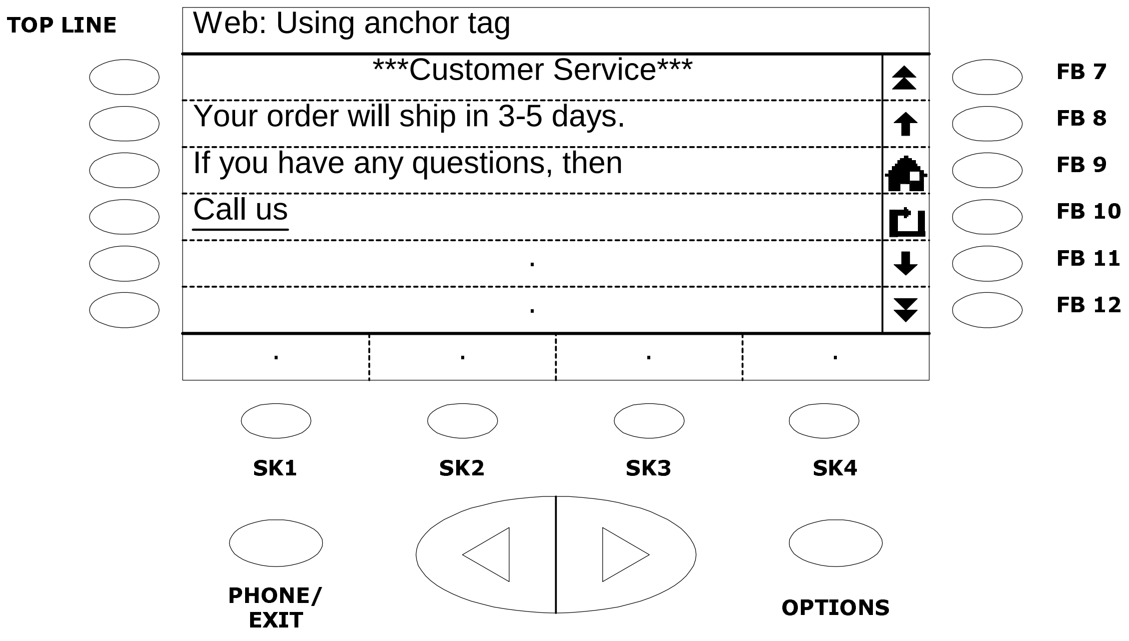
Note:

A phone icon is generated only when an <a> tag or <anchor> tag is used.

Click-to-dial using <anchor> tag:

```
<?xml version=”1.0”?>
<!DOCTYPE wml PUBLIC “-//WAPFORUM//DTD WML 1.3//EN”
             “http://www.wapforum.org/DTD/wml13.dtd”>
<wml>
   <card id=”callid2” title=”Using anchor tag”>
   <p>
   <p align=”center”>***Customer Service***</p>
   Your order will ship in 3-5 days.
   If you have any questions, then
   <anchor>Call us
   <go href=”wtai://wp/mc;5551212”/>
   </anchor>
   </p>
   </card>
</wml>
```

The generated code is rendered as the following diagram:

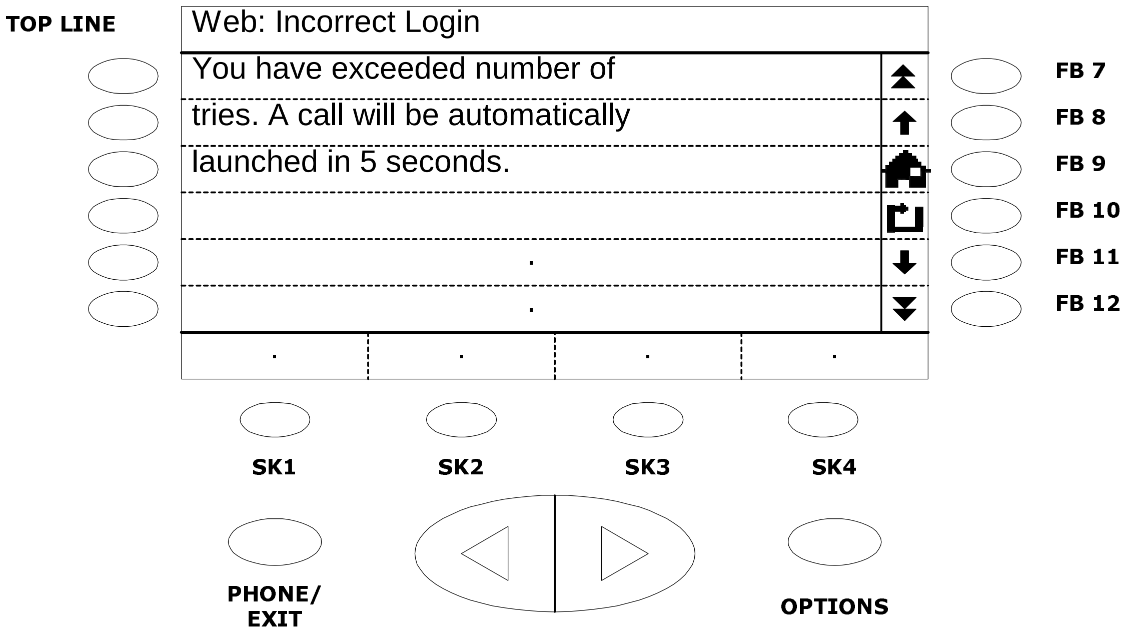


The code shows a hyperlink as **Call Us** on the Web page. When a user selects this link, the phone dials the string “5551212” or any number that follows a semicolon in the WTAI code.

Click-to-dial using <onevent> tag:

```
<?xml version=”1.0”?>

<!DOCTYPE wml PUBLIC “-//WAPFORUM//DTD WML 1.3//EN”

             “http://www.wapforum.org/DTD/wml13.dtd”>

<wml>
   <card id=”callid3” title=”Incorrect Login”>
   <onevent type=”ontimer”>
   <timer value=”50”/>
   <go href=”wtai://wp/mc;+1888 555 1212"/>
   </onevent>
   <p>
 You have exceeded number of tries.

   A call will be automatically launched in 5 seconds.

   </p>

</card>
 </wml>
```

The generated code is rendered as the following diagram:

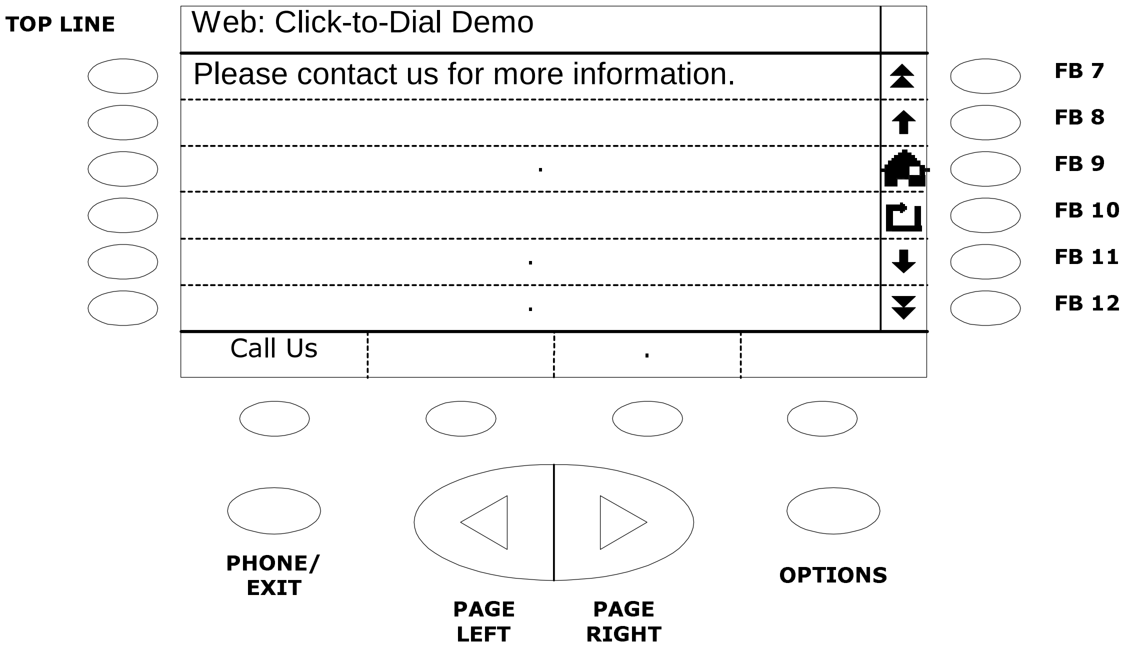


The code automatically dials the number “1888 555 1212" after 5 seconds, once the Web page loads.

Click-to-dial using <do> tag (softkey):

```
<?xml version=”1.0”?>
<!DOCTYPE wml PUBLIC “-//WAPFORUM//DTD WML 1.3//EN”
             “http://www.wapforum.org/DTD/wml13.dtd”>
<wml>
   <card id=”callid4” title=”Click-to-Dial Demo”>
   <p>
   Please contact us for more information.
   </p>
   <do type=”accept” label=”Call Us” name=”dotag1”>
   <go href=”wtai://wp/mc;+18005552525”/>
   </do>
   </card>
</wml>
```

The generated code is rendered as the following diagram:



The code is implemented as a **Call Us** softkey, indicating the softkey is a “click-to-dial” number. When the user selects this link, the phone dials the string “18005552525” or any number that follows a semicolon in the WTAI code.

Add to Speed Dial Functionality

Add to Speed Dial is referred to as Add to Phone Book by WTAI. When a user clicks **Add** to Speed Dial, the Web transfers the name and number to the telephone's speed dial application. The speed dial application allows the user to edit and save the entry to their speed dial list.

To enable the add to speed dial functionality, use the following syntax:

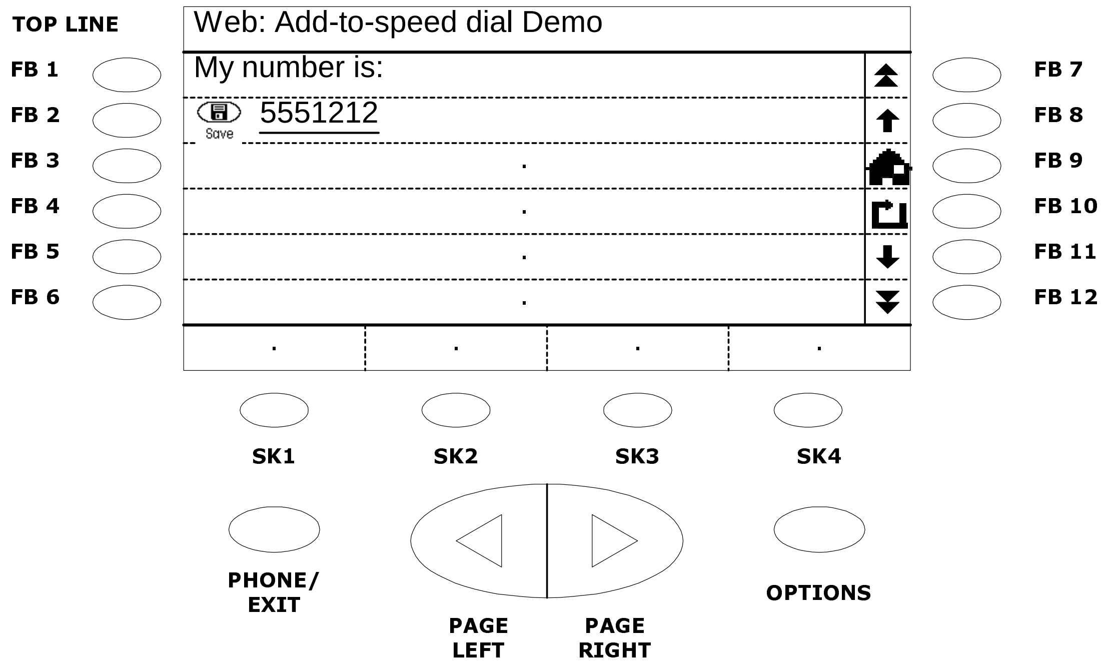
wtai://wp/ap;number;name

This code can be embedded into any valid WML tag that implements href or a hyperlink by associating these tags with a <go> tag. Examples of tags you can associate with the <go> tag are the <a> tag, <anchor>, <do>, <option>, or <onevent> tags.

Add to Speed Dial using <a> tag:

```
<?xml version=”1.0”?>
<!DOCTYPE wml PUBLIC “-//WAPFORUM//DTD WML 1.3//EN”
             “http://www.wapforum.org/DTD/wml13.dtd”>
<wml>
   <card id=”addap1” title=”Add to speed dial Demo”>
   <p>
   My number is:
           <a href=”wtai://wp/ap;5551212;My   Company”>5551212</a>
   </p>
    </card>
  </wml>
```

The generated code is rendered as the following diagram:



The code adds the entry to the speed dial group with the name “My Company” on the telephone’s speed dial screen. A **Save** icon precedes this hyperlink, indicating the hyperlink is an “add to speed dial” number. When the user selects this link, the Web transfers the name and number, for example, “My Company” and “5551212,” to the telephone’s speed dial application. Users can then edit and save the entry to their speed dial list.

Note:

A **Save** icon is generated only when an <a> tag or an <anchor> tag is used.

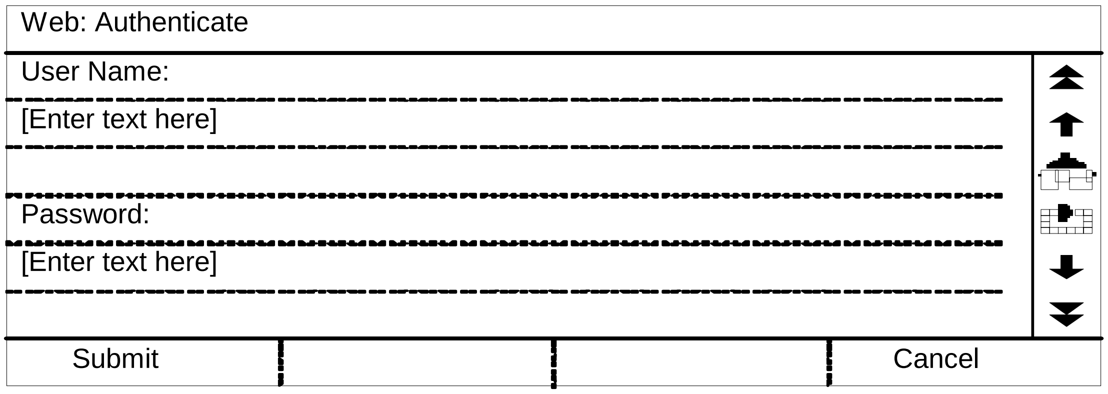
Support for HTTP Authentication

An authentication input screen displays when a response code of 401 (Unauthorized Response) or a response code of 407 (Proxy Authentication Required) is received. The authentication input screen has a text entry area for the user to enter a name and password, and two softkeys labeled **Submit** and **Cancel**. The word **Authenticate** appears on the Top Line.

The **Submit** softkey is enabled whenever there is at least one character in one of the input fields. If the **Submit** softkey is selected, the original HTTP request is reissued and contents of the user-input fields used to generate the appropriate authentication header.

The **Cancel** softkey is always enabled. If **Cancel** is selected, the contents of the user input controls are discarded, and the previous screen redisplays.

The authentication screen is as follows:


Web: Authenticate
User Name:
[Enter text here]
Password:
[Enter text here]
Submit
Cancel

Page Loading

When a page is loading, any additional button presses are not honored and the user receives an error tone. If a user tries to reach another link before a page is loaded, the page will continue to load and the user cannot go to another link until the page is loaded.

Error Tones

Error tones are consistent with other applications. When a labeled button is pressed but the button's function is not specified for the current state of the browser, an error tone sounds. Presses of unlabeled Feature buttons or softkeys are ignored. When users press a Feature button or softkey inappropriately, they receive an error tone.

HTTP Protocol

The Web browser uses an HTTP client to communicate with Web servers.

HTTP Header

User Agent

The User-Agent request-header field contains the Web browser's signature. This is for:

- tracking requests,
- statistical purposes,
- tracing protocol violations, and
- automated user agent recognition to tailor responses to avoid particular user agent limitations.

User agents should include the User-Agent request-header field with requests. The field can contain multiple product tokens and comments identifying the agent (browser) and any sub-products that form a significant part of the user agent. By convention, the product tokens are listed in order of their significance in identifying the application.

User-Agent = "User-Agent" ":" 1*(product | comment)

Example: User-Agent: CERN-LineMode/2.15 libwww/2.17b3

The User-Agent header is included in all HTTP messages initiated by the browser, formatted as specified below for the appropriate IP telephone.

User-Agent Header String (4610SW IP Telephones)

Identify the 4610 WML Web browser using the following user-agent string:

```
"AVAYA/IGEN/v2.2+(4610x)/0.0"
Where:
Avaya : Company Name
IGEN : Product Family Name
V2.2 : Firmware version no
4610 : Set Type
x : Reserved Extensions
0.0 : Minor Version Number
2.5
```

User-Agent Header String (4620/4620SW, 4621SW, 4622SW IP Telephones)

Identify the 4620/4620SW, 4621SW and 4622SW WML Web browsers using the following user-agent string:

Note:

The 4620SW, 4621SW, and 4622SW are aliased as 4620 IP Telephones, and therefore use the same header as that phone.

```
"AVAYA/IGEN/v2.2+(4620x)/0.0"
Where:
Avaya : Company Name
IGEN : Product Family Name
V2.2 : Firmware version no
4620 : Set Type
x : Reserved Extensions
0.0 : Minor Version Number
```

User-Agent Header String (4625SW IP Telephones)

Identify the 4625SW Web browser using the following User-Agent string:

```
"AVAYA/IGEN/v2.5+(4625)/0.0"
Where:
Avaya : Company Name
IGEN : Product Family Name
V2.5 : Firmware version no
4625 : Set Type
x : Reserved Extensions
0.0 : Minor Version Number
```

Error Messages

The Web browser supports the following HTTP standard Error Messages. The 4xx Status Codes indicate a client error in which the request contains bad syntax or cannot be fulfilled. The 5xx status codes indicate a server error in which the server failed to fulfill an apparently valid request.

Table 10: HTTP Error Messages

Status Code	Failure Message	Meaning
400	Bad Request	The request could not be understood by the server due to incorrect syntax.
401	Unauthorized	The request requires user authentication.
402	Payment Required	
403	Forbidden	The server has indicated it will not respond to your query.
404	Not Found	The server has not found anything matching the request.
405	Method Not Allowed	
406	Not Acceptable	
407	Proxy Authentication Required	The request requires user authentication.
408	Request Time-out	

1 of 2

Table 10: HTTP Error Messages (continued)

Status Code	Failure Message	Meaning
409	Conflict	The request could not be completed due to a conflict with the current state of the resource.
410	Gone	The requested resource is no longer available.
411	Length Required	The server refuses to accept the request.
412	Precondition Failed	
413	Request Entity Too Large	The server refuses to accept the request because the request entity is too large.
414	Request-URI Too Large	The request-URI is longer than the server can interpret.
415	Unsupported Media Type	The server refuses to accept the request because it is in an unsupported format.
416	Requested range not satisfiable	
417	Expectation Failed	
500	Internal Server Error	The server encountered an unexpected condition that prevented it from fulfilling the request.
501	Not Implemented	
502	Bad Gateway	The server, while acting as a gateway or proxy, received an invalid response from the upstream server it accessed.
503	Service Unavailable	The server is currently unable to handle the request due to a temporary overloading or maintenance of the server.
504	Gateway Time-out	The server, while acting as a gateway or proxy, did not receive a timely response from the upstream server specified.
505	HTTP Version not supported	The server does not support, or refuses to support, the HTTP protocol version used in the request message.
		2 of 2

When the client server receives a Status Code 431, it safely assumes there was something wrong with its request and treats the response as if it had received a Status Code 400.

Summary Of WML Tags and Attributes

Table 11: Summary Of WML Tags And Attributes

Tag	Attribute	Supported?
<a>		Yes
	accesskey	Yes, except No for the 4625SW
	href	Yes
	title	Yes
<access>		No
<anchor>		Yes
	accesskey	Yes, except No for the 4625SW
	title	Yes
<b>		No
<big>		No
<br/>		Yes
<card>		Yes
	newcontext	No, except Yes for the 4625SW
	onenterbackward	Yes
	onenterforward	Yes
	ontimer	Yes
	ordered	No
	title	Yes
<do>		Yes
	label	Yes
	name	Yes
	optional	Yes
	type	Yes, except x-*
<em>		No
<fieldset>		No
<go>		Yes
	accept-charset	Yes
	href	Yes
	method	Yes
	sendreferer	Yes

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Table 11: Summary Of WML Tags And Attributes (continued)

Tag	Attribute	Supported?
<head>		No
<i>		No
<img>		Yes
	`align`	No
	`alt`	Yes
	`height`	No
	`hspace`	Yes
	`localsrc`	No
	`src`	Yes
	`vspace`	Yes
	`width`	No
<input>		Yes
	`accesskey`	No
	`ivalue`	Yes
	`emptyok`	Yes
	`format`	Yes
	`maxlength`	Yes
	`name`	No
	`size`	No
	`tabindex`	Yes
	`title`	Yes
	`type`	Yes
	`value`	
<meta>		No
<noop>		Yes
<onevent>		Yes
<optgroup>		Yes
	`title`	Yes
<option>		No
	`onpick`	Yes
	`title`	Yes
	`value`	Yes
<p>		Yes
	`align`	Yes
	`mode`	No

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Table 11: Summary Of WML Tags And Attributes (continued)

Tag	Attribute	Supported?
<postfield>		Yes
	`name`	Yes
	`value`	Yes
<prev>		Yes
<refresh>		Yes
<select>		Yes
	`ivalue`	Yes
	`multiple`	Yes
	`name`	Yes
	`tabindex`	No
	`title`	Yes
	`value`	Yes
<setvar>		Yes
	`name`	Yes
	`value`	Yes
<small>		No
<strong>		No
<table>		No
<td>		No
<template>		Yes
	`onenterbackward`	Yes
	`onenterforward`	Yes
	`ontimer`	Yes
<timer>		Yes
	`name`	Yes
	`value`	Yes
<tr>		No
<u>		No
<wml>		Yes
{Universal Attributes}	**`xml:lang`**	No
	`class`	No
	`id`	Yes

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Chapter 7: Web Browser for 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones

Introduction

This chapter describes the capabilities and limitations of the Web browser in the following 4600 Series IP Telephones:

- 4610SW
- 4620/4620SW
- 4621SW
- 4622SW

This chapter also provides suggestions to design Web sites for viewing on these telephones. This chapter is intended for IP telephone Web browser (Web page) designers, and assumes that readers are somewhat familiar with WML.

Note:

For information specific to Web development for the 4625SW IP Telephone, see Chapter 9: Web Browser for the 4625SW IP Telephone.

This chapter serves these functions:

- Presents the WML portions implemented in the 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephone Web Access applications. Any limitations or non-standard implementations are mentioned.
- Provides considerations to develop effective Web pages for browser viewing.

This chapter is not intended to provide technical details on setting up a Web server, nor does it provide information on Web server technologies. Finally, this document is not intended to provide an introduction to Web browser protocols or technologies.

Note:

Unless otherwise noted, all references in this chapter to the 4610SW or 4620 IP Telephone apply equally to the 4620SW, 4621SW, and 4622SW IP Telephones.

General Background

The 4620/4620SW IP Telephone has a 168 pixel-by-132 pixel four grayscale LCD display. The available WML Web page display area is 153 pixels across by 96 pixels in height, arranged in 6 rows each 16 pixels in height. In addition, the top row displays the Web page title, if any, and the bottom row presents up to four softkey labels at one time. Softkey labels are used for <do> tags, each a maximum of 6 characters. The only relevant difference between the 4620SW and the 4621SW/4622SW IP Telephones is that the latter have backlighted displays.

The 4610SW IP Telephone has a 168 pixel-by-80 pixel four grayscale LCD display. The available WML Web page display area is 153 pixels across by 44 pixels in height. In addition, the top row displays the Web page title, if any, and the bottom row presents up to four softkey labels at one time. Softkey labels are used for <do> tags, each a maximum of 6 characters. The 4610SW supports all the data types, features, tags, etc. that the 4620 supports. The only difference is the size of the display.

Unless otherwise indicated, all subsequent references to the 4620 IP Telephone and its Web application apply equally to the 4610SW, 4620SW, 4621SW, and 4622SW IP Telephones.

The data types and other features supported in this browser include:

- WML 1.3, June 2002
- HTTP 1.1

The Summary Of WML Tags and Attributes on page 99 summarizes the detailed tag-related information provided in each section in this chapter.

Note:

Unsupported WML 1.3 tags are not rendered, and do not cause the browser to fail. Unknown tags and misspelled tags generate error messages.

WML Tags and Attributes

WML Document Skeleton

Certain tags define the basic framework of a WML document. The tags listed below make up the basic skeleton of a WML document. The designated IP telephones support these tags unless otherwise indicated.

- Common tag attributes: **`xml:lang`**, **`class`**, and **`id`**.

  The attributes **`xml:lang`**, **`class`** and **`id`** are universal attributes associated with each WML element.

  The Web browser supports these tags:

Attribute	Comments
`xml:lang`	NOT SUPPORTED
`class`	NOT SUPPORTED
`id`	SUPPORTED

- <wml> tag - The <wml> tag defines a deck of cards and encloses all information about the deck. This tag is a required WML element and must contain at least one <card> tag.
- <head> tag - The <head> tag is an optional WML tag. This tag contains information that relates to the deck as a whole, including meta-data and access control elements. This tag is not supported.
- <meta> tag - The optional <meta> tag is contained between multiple <head> tags. This tag gives values for the parameters that describe the content of the deck. This tag is not supported.
- <card> tag - A single WML file can contain multiple cards, supporting the analogy of a “deck” of “cards” within a single WML file. A “card” is essentially the specification of one specific WML page. This is a mandatory tag.

The card element attributes supported by the Web browser are as follows (unsupported attributes are indicated as such in the Comments column):

Attribute	Value(s)	Description	Comments
`newcontext`	true false	Re-initializes the browser context. Default is “false.”	Clears out the current WML browser context, which entails emptying the navigation stack history and clearing out all variables. NOT SUPPORTED.
			1 of 2

Attribute	Value(s)	Description	Comments
`ordered`	true false	Specifies the order of card content. When ordered is set to “true” the browser displays the content in a fixed order. When ordered is set to “false” the users decide the order as they navigate between content. Default is “true.”	Optional. Sets a Boolean value that provides information on how the content of the current card is arranged. Used by the browser to organize the display presentation and layout. If set to true, content is organized in a linear sequence of elements - for example, a series of ordered or non-optional input elements. If set to false, content is in no natural order - for example, a series of unordered or optional input elements. The default is true. NOT SUPPORTED.
`title`	*cdata*	The title of the card.	Can be used for title displays. SUPPORTED.
`onenterbackward`	*url*	Occurs when the user navigates into a card by means of a “prev” task.	SUPPORTED.
`onenterforward`	*url*	Occurs when the user navigates into a card by means of a “go” task.	SUPPORTED.
`ontimer`	*url*	Occurs when a “timer” expires.	SUPPORTED.

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- <template> tag - The <template> tag defines a template for all the cards in a deck. The “code” in the <template> tag is added to each card in the deck. Only one <template> tag for each deck can be specified. This tag can only contain <do> and <onevent> tags.

The **template** tag attributes the Web browser supports are:

Attribute	Value(s)	Description	Comments
`onenterbackward`	*url*	Occurs when the user navigates into a card by means of a “prev” task.	SUPPORTED.
`onenterforward`	*url*	Occurs when the user navigates into a card by means of a “go” task.	SUPPORTED.
`ontimer`	*url*	Occurs when the “timer” expires.	SUPPORTED.

Note:

The implication for rendering WML pages is that the local environment always overrides a global template for <do> types with the same name and type. If there is a onevent in the template and a *local* onevent of the same type, the local onevent takes precedence over the global one.

- <access> - The <access> tag limits access within the deck to certain cards. This tag is not supported.

Text Elements

See Enabling Text Entry on page 79 and Text Editing Modes on page 81 for guidelines to enable standard text entry and facilitate text editing. See Access Key Input Mode (AIM) on page 119 for information about an alternate text entry method using access keys.

- <br/> tag - The <br/> tag tells the browser to add a line break to the text at the point the element is written.
- <p> tag - The <p> tag specifies a paragraph of text with alignment and line wrapping properties. All text data must be contained inside this tag. Only <do> tags, wml and card elements can exist outside the <p> tag. When rendered, this tag causes subsequent text to start on the next line.

Attribute	Value	Description	Comments
`align`	left right center	Aligns the paragraph. Default is “left.”	SUPPORTED.
`mode`	wrap nonwrap	Sets whether a paragraph wraps lines or not.	Since horizontal scrolling is not supported, all text lines wrap. WML pages with mode=nowrap are ignored, and the text wraps. If the align attribute is set to `center` or `right`, the mode attribute is set to `nowrap` for all tags except <img>. NOT SUPPORTED.

The following tags are not supported but the content inside the tags is rendered as normal text:

- <table> tag - The <table> tag specifies a table. This tag is not supported.
- <td> tag - The <td> tag defines individual cell contents in each row of a defined table. This tag is not supported.
- <tr> tag - The <tr> tag defines each row of a defined table. This tag is not supported.

Text Formatting Tags

The following tags are not supported but the content inside the tags is rendered as normal text:

- <b> tag - The <b> tag specifies bold text. This tag is not supported.
- <big> tag - The <big> tag specifies large font text. This tag is not supported.
- <em> tag - The <em> tag specifies emphasized text. This tag is not supported.
- <i> tag - The <i> tag specifies italicized text. This tag is not supported.
- <small> tag - The <small> tag specifies small font size text. This tag is not supported.
- <strong> tag - The <strong> tag specifies strongly emphasized text. This tag is not supported.
- <u> tag - The <u> tag specifies underlined text. For the 4620 Web Access application, only links appear underlined. This tag is not supported.

Anchor Elements

- <a> tag - <a> elements define <go> tasks that require a URL link specification. All <a> tags are rendered as underlined. All <a> nested tags like br and img are supported. One anchor is rendered per line. A maximum of six anchors can be rendered on the screen at one time. The user selects the link by pressing one of the Feature buttons associated with that display line.

Attribute	Value	Description	Comments
`href`	*url*	REQUIRED. Defines where to go when the user selects the link.	SUPPORTED.
`title`	*cdata*	Defines a text identifying the link.	SUPPORTED.
`accesskey`	1,2,3,4,5,6, 7,8,9,0,*,#	A keypad key the user can press as a shortcut to selecting a link.	SUPPORTED.

- <anchor> tag - <anchor> elements define <go> tasks that require a URL link specification. All anchors are rendered as underlined. All <anchor> nested tags (br, go, img, prev, and refresh) are supported. A maximum of six anchors can be rendered on the screen at one time. The user selects a link by pressing one of the Feature button associated with that display line. You cannot specify more than one <onevent> tag inside an <anchor> tag.

Attribute	Value	Description	Comments
`title`	*cdata*	Defines a text identifying the link.	SUPPORTED.
`accesskey`	1,2,3,4,5,6,7, 8,9,0,*,#	A keypad key the user can press as a shortcut to select a link.	SUPPORTED.

Image Elements

- <img> tag - Use the <img> tag to place an image in the text flow. The telephones (4610SW, 4620/4620SW, 4621SW, 4622SW) support black-and-white Wireless Bitmap (WBMP) image rendering, up to 152 pixels wide and 1536 pixels (96 lines of 16 pixels high each) high. Up to 3 Mbytes of volatile memory is available for display of all WBMP images. We do not recommend large images. Images can be part of a link and can be selectable. At most, each card can display 10 images.

Attribute	Value	Description	Comments
`align`	top middle bottom	Aligns the image.	NOT SUPPORTED.
`alt`	*cdata*	REQUIRED. Sets an alternate text to be displayed if the image is not displayed. If this is not supplied, either default text displays (if available) or the following message displays: "Image not displayed."	SUPPORTED.
`height`	*px (pixel)* *%*	Sets the height of the image.	NOT SUPPORTED. The true height parameters are determined by parsing the WBMP information.
`hspace`	*px* *%*	Sets white space to the left and right of the image.	SUPPORTED. The default is 1 pixel.
`localsrc`	*cdata*	Sets an alternate representation for the image.	NOT SUPPORTED.
`src`	*url*	REQUIRED. The path to the image. Must be a .wbmp file.	SUPPORTED.
`vspace`	*px* *%*	Sets white space above and below the image.	SUPPORTED. The default is 1 pixel.
`width`	*px* *%*	Sets the width of the image.	NOT SUPPORTED. The true width parameters are determined by parsing the WBMP/ JPEG information.

Event Elements

- <do> tag - The <do> tag is a card-level user interface. It serves as a general mechanism to activate a task, usually performed by the user clicking a word or phrase in the display. A task is performed in response to an event. There are four tasks in WML: **go**, **noop**, **prev**, and **refresh**.

The mandatory **`type`** attribute provides information about the intent of the element, helping to improve processing. If the Web browser does not recognize the specified type, the specified type is treated as unknown. For example, testing, experimental, and vendor specific types would be unknown. The browser only renders WML 1.2 tags. Any other tags cause an error and the user receives a "not a valid wml page" error statement.

Attribute	Value	Description	Comments
`type`	accept prev help reset options delete unknown x-* vnd.*	REQUIRED. Defines the type of the "do" element.	SUPPORTED.
`label`	*cdata*	Creates a label for the "do" element.	Optional. Creates a string label for the element. The telephone browser imposes a six character limit. SUPPORTED.
`name`	*mmtoken*	Defines a name for the "do" element.	SUPPORTED.
`optional`	true false	If set to true, the browser ignores this element. If set to false, the browser does not ignore this element. Default is "false."	Optional. SUPPORTED.

Type	Description	Comments
accept	Acknowledgement of acceptance.	SUPPORTED.
delete	Delete item.	SUPPORTED.
help	Request for help.	SUPPORTED.
options	Options or additional operations.	SUPPORTED.
prev	Backward navigation.	SUPPORTED.
reset	Clearing or reset.	SUPPORTED.
X-*n or x-*n	Experimental.	SUPPORTED, but treated as "unknown."

<do> tags are rendered as softkey labels on the bottom line of the display. <do> tags are specified per WML page and therefore are page context-sensitive. The eight “do” types are labeled either specifically in a WML page or by a browser-dependent label.

If no labels are given, then the “do” types have the following default labels:

Type	Default Label if no label specified
accept	ACCEPT
delete	DELETE
help	HELP
options	OPTIONS
prev	BACK
reset	RELOAD
X-*n or x-*n	UNKNOWN
Vnd* Any mix of upper or lower cases	AVAYA. Available for future use, but currently UNKNOWN.

If no <do> tags were specified, no softkeys display:

If one <do> tag was specified, these softkeys display:

1st DO

If multiple <do> tags are specified, display them as follows:

1st DO	2nd DO	3rd DO	MORE

Page 1 softkeys:

1st DO	2nd DO	3rd DO	MORE

Page 2 softkeys:

4th DO	5th DO	Etc.	MORE

Note:

If more than one page of softkey labels are specified, pressing the **MORE** softkey automatically presents the user with the next page of labels. If the last page displays and the user presses the **MORE** softkey, the first page of labels is then displayed. As implied in the examples, the Softkey buttons are labeled in sequential order of the <do> tags.

- <onevent> tag - The onevent tag serves as a container for code that you want executed automatically when one of the four intrinsic events occurs. The onevent element is said to bind (associate) the tasks (code) to the event for the element. You must specify the intrinsic event using the mandatory **`type`** attribute.

  For example, when a user presses the **BACK** softkey, instead of being routed to the previous screen, the user is directed to another specified page because this tag carries out an onevent backward event.

The intrinsic events are:

Event	Permitted Tags	Description
onenterbackward	card or template	Occurs when a <prev> navigates back onto a card. SUPPORTED.
onenterforward	card or template	Occurs when a <go> navigates into a card. SUPPORTED.
onpick	option	Occurs when a user selects/ deselects an item. SUPPORTED.
ontimer	card or template	Occurs when the time expires. SUPPORTED.

The template element creates code that is inserted into all cards in a single deck. The nested tags are: go, noop, prev, and refresh.

There are no visual implications for supporting the <onevent> tag.

Attribute	Value	Description	Comments
`type`	onenterbackward onenterforward onpick ontimer	REQUIRED. Specifies the type of the “onevent” element.	SUPPORTED.

- <postfield> tag - Use the postfield tag to set a name/value pair that can be transmitted during a URL request to an origin server, the request’s source. The **`name`** attribute sets the name, which must be a valid WML variable name. The **`value`** attribute sets the value. There are no visual rendering implications with this tag.

Attribute	Value	Description	Comments
`name`	*cdata*	REQUIRED. The name of the field.	SUPPORTED.
`value`	*cdata*	REQUIRED. The value of the field.	SUPPORTED.

Task Elements

- <go> tag - The go element can contain one or more postfield elements. If a go element's destination is a card within the same deck, all postfield elements are ignored. The go element can also contain one or more setvar elements. Unlike postfield elements, there are no destination limitations on passing information contained in the setvar elements. The <go> nested tags, postfield and setvar, are supported.

Attribute	Value	Description	Comments
`href`	*url*	REQUIRED	SUPPORTED.
`accept-charset`	Charset_list	A comma- or space-separated list of character encoding the server must be able to process. The default value is "unknown".	SUPPORTED.
`method`	post get	Sets how to send the data to the server. Default method is get. When method="get", the data is sent as a request with*?data* appended to the URL. A get can be used only for a limited amount of data, which is a disadvantage. If you send sensitive information it is displayed on the screen and saved in the Web server's logs. With method="post", the data is sent as a request with the data sent in the body of the request. This method has no limit, and sensitive information is not visible. The data sent in a get method is limited to ASCII characters. The data sent in a post method can include non-ASCII characters that are included as part of a **`value`** attribute in an <input>, <select>, or <option> tag that is part of the current WML page.	SUPPORTED.
`sendreferer`	true false	If set to true, the browser sends the URL of the current deck with the request, which allow servers to perform simple access control on decks, based on which decks are linking to them. Default is "false."	SUPPORTED.

- <noop> tag - The noop tag dictates that no operation should be done. This tag can be used on the card level to prevent an event that is specified on the deck level by the template element from occurring. This tag can only be contained in either a do or onevent element.

An example of noop is to use a <do> tag to add a “Back” link to the card. When users click the “Back” link, generally they should be taken back to the previous card. However, the <noop> tag prevents this operation. When the user clicks on the “Back” link nothing happens.

- <prev> tag - The prev tag specifies navigation to the previous URL in the history.
- <refresh> tag - The refresh tag specifies a refresh task whereby whatever card is being displayed is refreshed. This task specifies the need for an update of the user agent context as specified by the contained <setvar> elements.This tag can only be nested inside an anchor, do, or onevent element. Xml:lang is not an associated attribute. User-visible side effects of the update can occur during the processing of the <refresh>.

Input Elements

- <input> tag supported - The input tag specifies a point where the user is prompted to enter text.

Attribute	Value	Description	Comments
`accesskey`	1,2,3,4,5, 6,7,8,9,0, *,#	A Dialpad button used to access a link containing selections. If the element is a Radio button, pressing the access key is a shortcut for selecting the Radio button. If the element is a check box, pressing the access key is a shortcut to check or uncheck the box. If the element is a Submit or Reset button, pressing the access key is a shortcut for pressing that button. For example, pressing a Submit button’s access key submits the applicable form.	NOT SUPPORTED.
`name`	*nmtoken*	REQUIRED. The name of the variable that is set with the result of the user's input.	SUPPORTED.
`emptyok`	true false	Sets whether the user can leave the input field blank or not. Default is “true.”	SUPPORTED.
			1 of 2

Attribute	Value	Description	Comments
`format`		Sets the data format for the input field. Default is "M."	SUPPORTED.
	A	A = uppercase alphabetic or punctuation characters	
	a	a = lowercase alphabetic or punctuation characters	
	N	N = numeric characters	
	X	X = uppercase characters	
	x	x = lowercase characters	
	M	M = all characters	
	m	m = all characters	
	*f	*f = Any number of characters. Replace the f with one of the letters above to specify what characters the user can enter.	
	nf	nf = Replace the n with a number from 1 to 9 to specify the number of characters the user can enter. Replace the f with one of the letters above to specify what characters the user can enter. The user cannot exit the input box unless the correct number or type of characters is entered. The user does not receive an error message if incorrect data is entered.	
`ivalue`		The attribute **`value`** takes precedence over **`ivalue`**.	SUPPORTED.
`maxlength`	*number*	Sets the maximum number of characters the user can enter in the field.	SUPPORTED.
`size`	*number_ of_char*	Sets the width of the input field.	NOT SUPPORTED.
`tabindex`	*number*	Sets the tabbing position for the input field.	NOT SUPPORTED.
`title`	*cdata*	Sets a title for the input field.	SUPPORTED.
`type`	text password	Indicates the type of the input field. The default value is "text."	SUPPORTED.
`value`	*cdata*	Sets the default value of the variable in the **`name`** attribute.	SUPPORTED.

2 of 2

The 4620/4620SW, 4621SW, and 4622SW's six display lines associated with Feature buttons are available for input elements. The Top Line of the display cannot be used for input.

The input tag causes an automatic line break before and after input text.

Only one input tag can exist per display line.

When a user views a page with the input tag specified, the first thing that shows up in the Top Line is the card title, if specified. When the user scrolls to the first line containing input, the Top Line shows the input box title if specified, otherwise the card title is shown. The Top Line displays the card title for all non-input text.

When the input box is selected, a vertical line (the "cursor") appears at the left side of the input box.

The attribute **`type`** password should only be used when it is important to not display the user' s password on the screen. Asterisks are displayed instead. It is also important that the password not be cached.

The phrase **[enter text here]** appears for all input tags if the **`value`** attribute is null. If the author specifies a non-null content in the **`value`** attribute, that content displays between brackets for that input tag.

Only the correct size, type, and number of characters are accepted in to the input box. For example, if alpha text is specified and the user types in a symbol or numeric text, the user input is not accepted. The screen repaints and the user has to re-enter the text. If the wrong kind of text is typed, the user receives an error tone. If the "n" (number) value is specified and the user types in the incorrect number of characters, that input is rejected.

See Text Elements for other text entry guidelines.

- <fieldset> tag - The fieldset tag is used to group logically related elements in a card. This tag is not supported.
- <optgroup> tag - Sets of <optgroup> brackets can be put around <options> in a <select> list. The results in breaking a list into sublists.

Attribute	Value	Description	Comments
`title`	*cdata*	Sets a title for the optgroup element.	SUPPORTED.

- <option> tag - A set of option tags is needed to specify each individual item in a list. This tag must be used with the select tag.

Attribute	Value	Description	Comments
`onpick`	*url*	Sets what is going to happen when a user selects an item.	SUPPORTED.
`title`	*cdata*	Sets a title for the option	SUPPORTED.
`value`	*cdata*	Sets the value to use when setting the "name" variable in the select element.	SUPPORTED.

- <select> tag - The select tag allows for the definition of a list, embedded in a card. This tag allows the user to choose inputs from a list rather than having to type a value. The select tag must be used with the option tag.

Attribute	Value	Description	Comments
`name`	*nmtoken*	Names the variable that is set with the index result of the selection.	SUPPORTED.
`ivalue`	*cdata*	Sets the pre-selected option element. If none is specified, the first item in a list is automatically selected.	SUPPORTED.
`multiple`	true false	Sets whether multiple items can be selected. Default is “false”. False is used for a single selection.	SUPPORTED.
`tabindex`	*number*	Sets the tabbing position for the select element.	NOT SUPPORTED.
`title`	*cdata*	Sets a title for the list.	SUPPORTED.
`value`	*cdata*	Sets the default value of the variable in the **`name`** attribute.	SUPPORTED.

A single select is rendered with a small square containing a dot. A multiple select is rendered as multiple squares - blank if there is nothing in them, else a lowercase “x”.

Variable Elements

- <setvar> tag - There are no visual rendering implications with this tag.

Attribute	Value	Description	Comments
`name`	*cdata*	REQUIRED. Sets the name of the variable.	SUPPORTED.
`value`	*cdata*	REQUIRED. Sets the value of the variable.	SUPPORTED.

- <timer> tag - The timer tag sets a timer that starts counting. This tag must be used with <onevent type=”ontimer”> to be useful.

Attribute	Value	Description	Comments
`value`	*cdata*	REQUIRED. Sets the default value of the variable defined in the **`name`** attribute.	SUPPORTED.
`name`	*nmtoken*	Names the variable that is set with the value of the timer.	SUPPORTED.

Character Entities

As with any syntactic language, WML has certain characters that have special meaning. The two most obvious of these characters are the **<** and **>** symbols, which surround all tags. These characters cannot be typed in directly if the designer's intent is to display these characters. Thus, all characters that can be displayed in a Web browser have numeric values assigned to them. The numeric values are entered into the source Web page as **&#*nnn***; where ***nnn*** is a three-digit value. For example, the **<** symbol is entered as '&#060;'.

In addition, many of these characters also have names assigned. Name values are entered into the source Web page as **&*name***; where ***name*** is the WML name associated with this character. For example, the **<** symbol would be entered as '&lt;'. The set of characters defined by the World Wide Web Consortium are fully supported in the 4620 browser in conformance with the standard.

For convenience, here are a few of these key symbols:

Description	Symbol	Numeric Entity	Name Entity
double quotation	“	&#34;	&quot;
ampersand	&	&#38;	&amp;
apostrophe	‘	&#39;	&apos;
less than	<	&#60;	

Colors and Fonts

The 4610SW/4620/4620SW/4621SW/4622SW Browser supports a four grayscale display. Because of the telephone’s screen size, the browser has only a single font available for use, which is based on Latin-1. Only a normal font weight is supported. Bold, italic and different font sizes are not supported. The font the telephone uses defines characters to have at most six pixels in width.

Access Key Input Mode (AIM)

The Web browser considers cards that include the accesskey attribute and which require the user to enter text to be in a new Text Entry mode. That new mode is called Access Key Input Mode (AIM). Unlike standard Text Entry mode, AIM arbitrates dialpad use between the phone and Web applications that use accesskey attributes. When a Web page with one or more valid accesskey attributes loads completely, the Web page takes control of the dialpad.

With standard Text Entry, text entry is considered complete once a URL is launched and the Web relinquishes control of the dialpad. AIM works differently than standard text editing by maintaining control of the dialpad over the course of loading one or multiple new Web pages. AIM stays in effect until either:

- the user presses the **Phone/Exit** or **Options** button,
- the phone goes off-hook to make or receive a call, or
- a Web page without any valid accesskey attribute is completely loaded.

Support for Access Keys

The accesskey attribute assigns a particular key on the phone to an element. Its purpose is to allow the user to activate a particular element using a single key. For the IP telephone's Web browser, an access key is a single Dialpad button and the element is a URL. The access keys associated with the IP telephone Web browser are as follows:

Accesskey
1
2ABC
3DEF
4GHI
5JKL
6MNO
7PQRS
8TUV
9WXYZ
0
*
#

In Table 12 each of the Dialpad button access keys is mapped to a different URL. For example, when the “**2**” button on the dialpad is pressed, the example2.com URL is launched because it is mapped to the “**2ABC**“ button, as shown in the following code example:

```
<a href="http://example.2ABC.contents/wml" accesskey="2”>
```

Similarly, to inform the Web server that any of the Keypad buttons were pressed, the Table 12 example URLs would be launched for any of the 12-keypad buttons. Each button is assigned to a different access key and URL. Each button to be tracked must have a URL mapped to it in the page. If the page author wants to know whether any of the 12 possible Dialpad buttons are pressed, then the page must include access keys pointing to specific URLs.

Table 12: Dialpad/URL Mapping Example

Dialpad Button	Example
1	<a href=”http://URL1” accesskey=”1">1</a>
2ABC	<a href=”http://URL2” accesskey=”2">2</a>
3DEF	<a href=”http://URL3” accesskey=”3">3</a>
4GHI	<a href=”http://URL4” accesskey=”4">4</a>
5JKL	<a href=”http://URL5” accesskey=”5">5</a>
6MNO	<a href=”http://URL6” accesskey=”6">6</a>
7PQRS	<a href=”http://URL7” accesskey=”7">7</a>
8TUV	<a href=”http://URL8” accesskey=”8">8</a>
9WXYZ	<a href=”http://URL9” accesskey=”9">9</a>
0	<a href=”http://URL10” accesskey=”0">0</a>
*	<a href=”http://URL11” accesskey=”*">*</a>
#	<a href=”http://URL12” accesskey=”#">#</a>

Button presses do not distinguish among the characters a button represents. For example, if a user presses Dialpad button 2, it is impossible to distinguish anything other than the user pressed the second button. No refinement is made to inform the Web server that the user meant **2** or **A** or **B** or **C**.

An AIM application is one where the page currently being loaded contains <a> or <anchor> tags with access keys defined. The application developer has a choice of mapping every keypad entry to a URL or can opt to leave some unmapped keypad entries. The <a> or <anchor> tags support the accesskey attribute. The correct syntax is:

WML tag <a> or <anchor>	href=”URL”	accesskey=dialpad button

Note:

The <input> tag does not support the accesskey attribute because AIM and standard Text Entry cannot be mixed on one page.

Example:

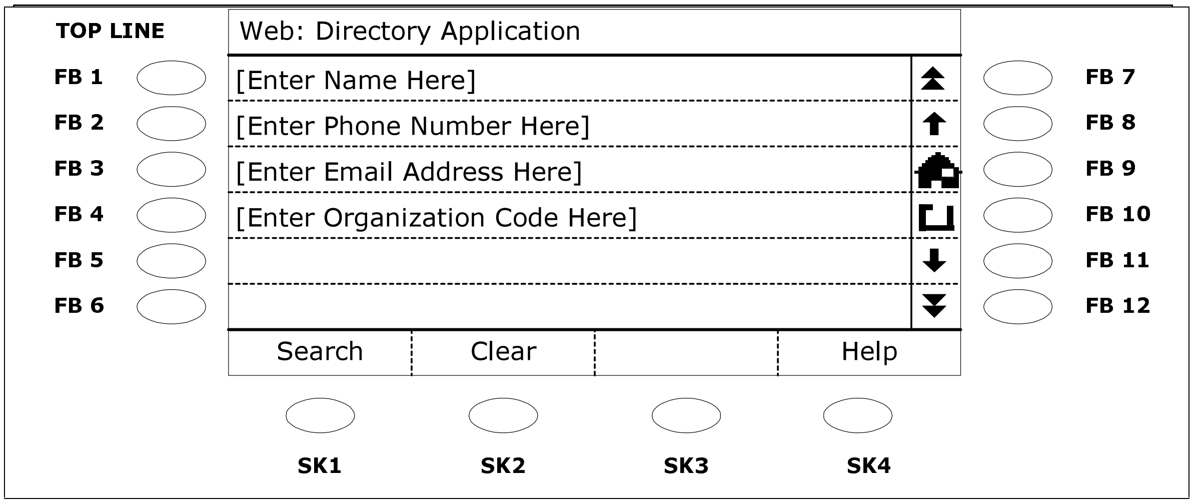
```
<a href="http://Example.2ABC.contents/wml" accesskey="2">
```

Example of Text Entry Using AIM:

The user wants to look up a person named Oscar in a Directory database. The user presses a Directory softkey on the Home page that initiates the AIM application. Figure 17 shows a sample starting page. The user presses the **6MNO** Dialpad button because it contains the first letter of the name to be found. In most cases, AIM avoids the user having to enter the entire first and/or last name. AIM also avoids multiple key presses to select letters, for example, pressing **6** four times to select the letter **O**.

The user then presses the dialpad number key that corresponds to the second letter in the name once, etc. There is no need to press a number key multiple times to select a letter. Figures 18 through 20 illustrate locating the name “Oscar” in the directory.

Figure 17: Starting Page


Web: Directory Application

[Enter Name Here]

[Enter Phone Number Here]

[Enter Email Address Here]

[Enter Organization Code Here]

Figure 18: User presses “6” one time for “O” and the closest match to “O” displays.

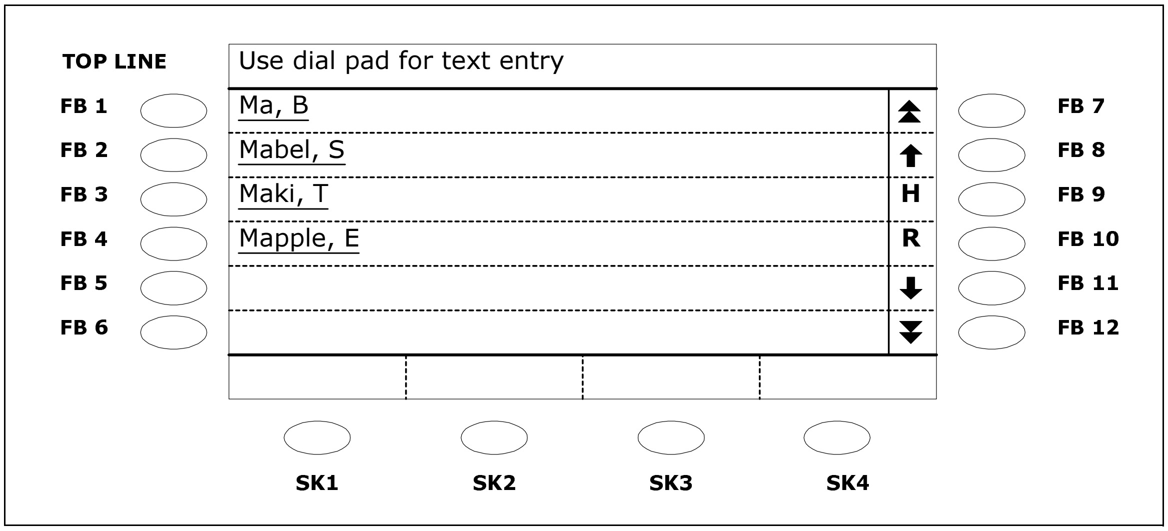


Figure 19: User presses “7” one time for “S,” narrowing the search.

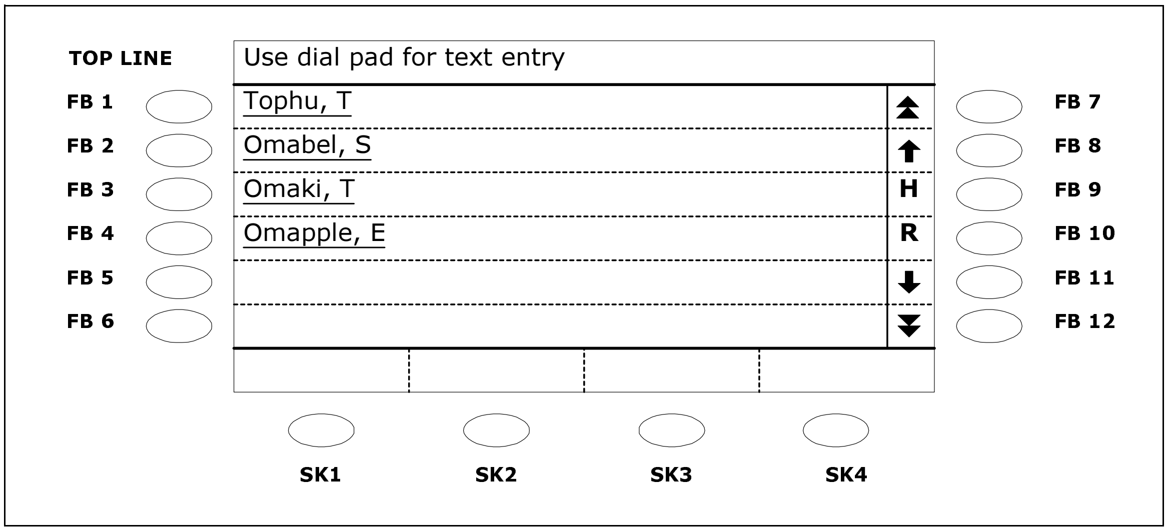
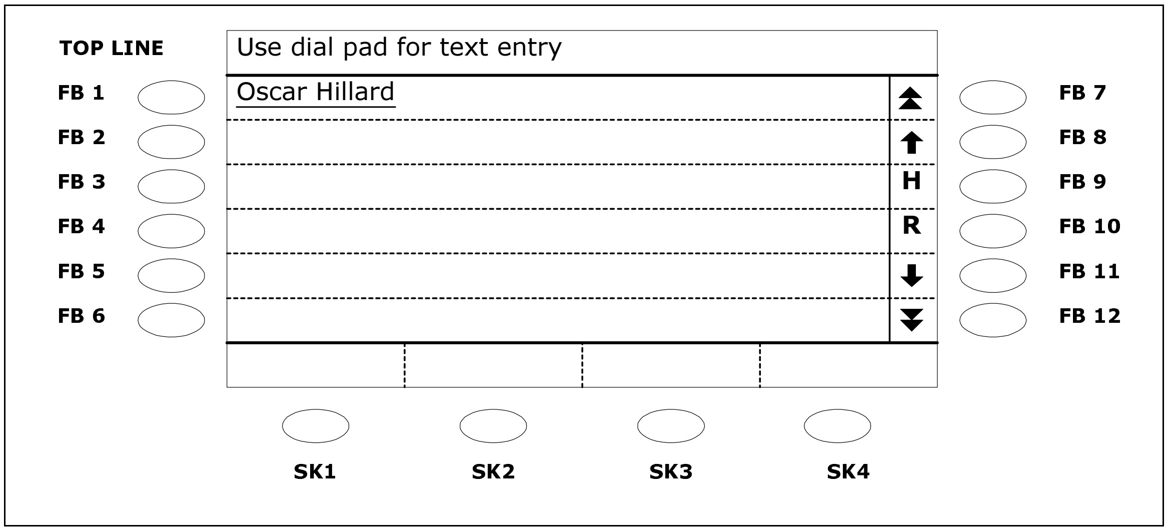


Figure 20: User presses “2” one time for “C” and the search result displays the desired result - Oscar Hillard.



AIM Considerations

AIM mode cannot be enabled when the browser is not in focus.

AIM maintains dialpad control while loading one, or multiple, new Web pages as long as the accesskey attribute is part of the page.

When a user presses a Dialpad button, or “access key,” the browser launches a URL without displaying any characters to the user. The button press information is sent to the URL and the Web page author returns subsequent screens. What the user views is up to the page author. Access key supplies the mechanism to capture button press information and send that information to a Web server.

The user is automatically in AIM when the page loads (attribute=accesskey) and can begin pressing Dialpad buttons to send button press information. As an example, you may want to have a link from your Home page to the AIM application or wherever else such a link makes sense.

When a user clicks a button that has not been mapped to a URL and the browser is in AIM mode, nothing happens.

Having a **Clear** softkey on the AIM page allows a user to clear previous search results and start a new search. The page author must set up a **Clear** softkey that loads the first AIM page to allow this action.

The Web pages resulting from Dialpad button presses are part of the history stack. This is normal browser behavior.

AIM is re-enabled when the phone goes back on-hook and the current Web page has valid access keys.

An error beep sounds if the user presses any Dialpad buttons while a new page is loading.

If the accesskey attribute is on the page, then:

- Text Entry/Editing (TE) softkeys do not appear when the user is in AIM. AIM does not have the default Text Editing softkeys such as **alpha**, **backwards**, etc.
- The Top Line help states “Use dial pad for text entry” when the user is in AIM mode. The message displays when the page first loads and when the user restarts AIM. When AIM is disabled the message no longer appears. When AIM is restarted, the message reappears.
- The <a> and <anchor> links that would normally appear on the screen are hidden.
- Normal text entry (<input> tags) is prohibited because it cannot co-exist with access keys. If, by error, regular Text Entry and access keys are on the same page, AIM rules take precedence. This means when the accesskey attribute appears on a page, the regular text entry (TE) softkeys do not appear.
- If the user enters the AIM Application, and there is an input field for TE, the field will not get focus. Focus does not occur, regardless of how many times the user selects the Feature button next to the TE input field. Since TE is prohibited when access keys are present on a page, TE does not get focus.
- The server must send back a resulting page with the access keys for each Dialpad button in the page. Doing so maintains AIM across pages and retains dialpad ownership. The URLs associated with each accesskey can differ from the starting page in case the proxy server caches Web pages.

For example, after the page with access keys loads and the user pushes Feature button **2**, the Web server launches the URL:

```
<a href="http://URL2" accesskey="2">2<\a>
```

In the resulting page, the page author can send a different URL to be associated with the same access key:

```
<a href="http://URL2a" accesskey="2">2<\a>
```

Terminating AIM

The user ends AIM by:

- Pressing the **Phone/Exit** button or **Options** button.
- Selecting (loading) a Web page that does not contain any valid accesskey attributes.

Pressing any of the navigation scroll Feature buttons does not terminate AIM. This is because the user might want to scroll to see results, then continue a search. AIM is re-enabled when the user goes back on hook and the current Web page has valid accesskeys.

Chapter 8: Web Applications

Introduction

If you have a corporate database that supports the Lightweight Directory Access Protocol (LDAP), Avaya's Thin Client Directory application can communicate with that database. IP telephone users can then use their phones to search for names, telephone numbers, or other information. Using search results, users can call a person directly, store a number on a Speed Dial button, and view more details about the person.

The Thin Client Directory application applies only to these IP telephone types:

- 4610SW
- 4620/4620SW
- 4621SW
- 4622SW

Note:

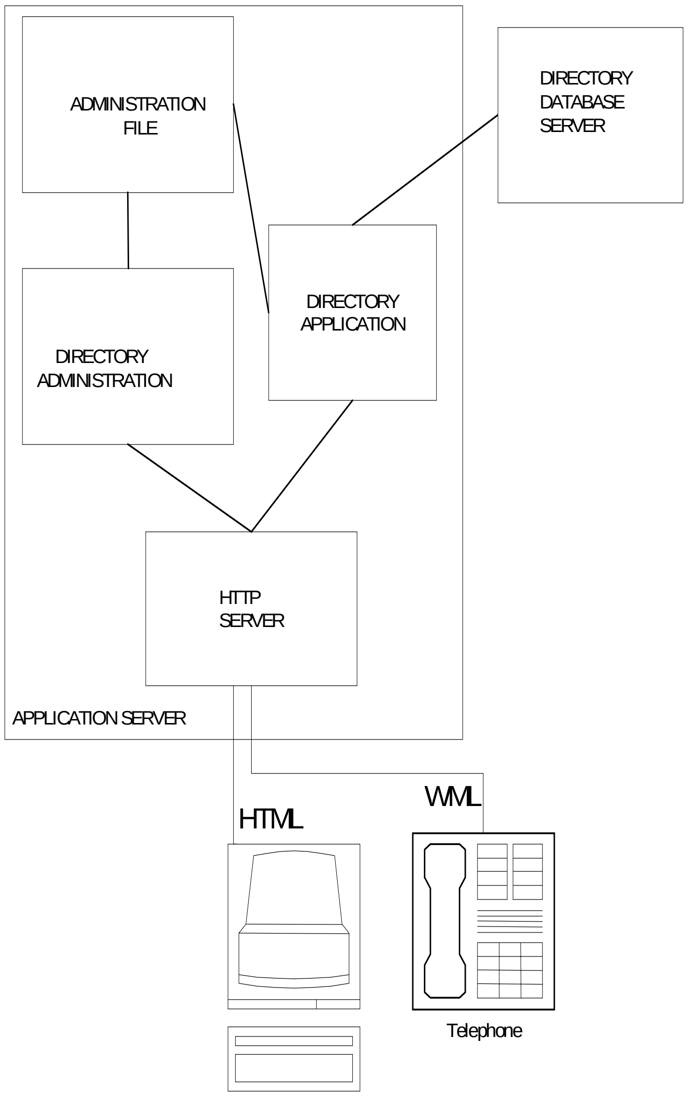
All subsequent references to the 4620 IP Telephone in this chapter apply equally to the 4610SW, 4620SW, 4621SW, and 4622SW IP Telephones.

This chapter provides the information you need to install and administer Avaya's Thin Client Directory. It has four primary sections:

- Application Platform Requirements - Describes the operating environment for the Thin Client Directory application.
- Installing the Thin Client Directory on the Server - Lists the Avaya-provided download files needed for installation, pre-installation requirements, and step-by-step installation instructions.
- Web Application User Interface - Describes and illustrates the Directory application screens with which IP telephone users perform Directory searches and review search results.
- Directory Database Administration Interface - Describes and illustrates the administration screens with which you define LDAP attributes and configure the user interface screens.

Figure 21: High-Level Thin Client Architecture on page 128 provides a high-level overview of the Thin Client architecture.

Figure 21: High-Level Thin Client Architecture



As Figure 21 shows, the Directory application and its administration are co-resident with an HTTP server. Administration screens allow all Directory application parameters like the directory database server's IP Address, allowable search fields, etc. to be set using a PC browser. The Web browser can be co-resident on the Directory application server.

When a 4620 IP Telephone user starts a directory search, the user's browser sends the search criteria to the Directory application. The Directory application sends a query based on administered parameters to the directory database, usually located on a separate server. The directory database server then returns search results to the Directory application. The Directory application formats the results in the appropriate markup language and sends the results back to the end user. The user then has several options regarding the search results.

Application Platform Requirements

The LAN Administrator or System Administrator must provide and configure the LDAP server and the operating environment on which to install the Thin Client Directory.

The recommended server configuration is Red Hat for Linux 8.0 or greater software. This version facilitates optimal, automatic Thin Client Directory application installation. Other configurations, not recommended by Avaya, require HTTP/Apache 2.0 and PHP Version 4.2.0, with PHP Version 4.2.4 preferred.

Installing the Thin Client Directory on the Server

Pre-Installation Requirements (Apache/PHP)

Before you install the Thin Client Directory application, you must install the PHP Apache module included with Red Hat 8.0. If necessary, you can download this module for free from the http://www.php.net/downloads.php Web site. Go to http://www.php.net for installation instructions. Otherwise, the distribution you download will contain its own set of installation instructions.

If you are not using Red Hat 8.0 or greater, Apache must be configured to accept PHP so the Web server recognizes it. This process differs depending on whether PHP is being installed on Linux or Windows. Further configuration variations depend on the Apache version installed.

Avaya-Provided Download Files

Two Thin Client Directory application versions are available from the Avaya Web site at:

http://avaya.com/support

The recommended download version (avayadir-1.0-1.0.i386.rpm) is for Red Hat Linux 8.0 or greater installations only. This download allows the Red Hat Package Manager to automatically install the required directories and associated files in the correct locations.

Note:

A README file containing Thin Client Directory application installation instructions is also available from the Avaya Web site, if needed.

The other application version available is a Winzip-readable file. This file is for those installations with Windows or any other operating system not using Red Hat for Linux 8.0 or greater. This version requires that you select specific files to download. You must also perform additional server/file customization to properly install the Thin Client Directory application.

The download contains these directories:

- **avayadiradmin** - Files needed for the HTML administration part of the LDAP application. Includes the PHP files needed for administration.
- **avayadirclient** - Files necessary for the telephone/user interface. These files perform the search query and return search results to the telephone’s display screen.
- **avayadir.ini** - Files containing settings that control the administration and client application. This is a protected directory that cannot be browsed. During the unzip process, it is placed in the same root as the other two sub-directories. If desired, you can move this directory outside the HTML path, providing the new path is PHP-accessible.
- **avaydirinclude** - Common files shared between the Directory administration and client (end user) interface.
- **avayadirerror** - Text files for search-related error message generation.
- **avayadirhelp** - Text files containing end user Directory assistance.

Installing the Thin Client Directory

Installations using Red Hat for Linux 8.0 (or greater):

1. Login at the root.
2. Copy this download file to the Linux system: **avayadir-1.0-1.0.i386.rpm**.
3. Run the following command from the command line to extract the files to the **/var/www/html/avayadir** directory: **rpm –ivh avayadir-1.0-1.0.i386.rpm**.
4. To enable password control for the Directory Administration application, create a directory entry in the **httpd.conf** file as follows:

   Note:
   The correct filename is ***httpd.conf, not http.conf.***

```
<Directory “/var/www/html/avayadir/avayadiradmin”>
AuthType Basic
AuthName “Password Required”
AuthUserFile “/var/www/password/avayadirpasswd”
Require user ldap
</Directory>
```

5. The default user/password combination is **ldap/ldap**. To change the password, run “**htpasswd/var/www/passwd/avayadirpasswd ldap**.”
6. Open the file **/etc/php.ini** for editing.
7. Set the option “**short_open_tag = On**” in php.ini.
8. Uncomment the line “**extension=ldap.so**” in php.ini.
9. To finish, restart the Web server by running “**/sbin/service httpd restart**.”
10. Now test everything out by pointing a browser at the newly created directory structure such as <http://yourserver/avayadir/avayadiradmin/index.htm>.

Installation for any other Unix-based operating system:

1. Download the winzip file and run: **unzip avayadir-1.0.zip**
2. Copy the entire tree that was created by running unzip under the documentRoot of the httpd server. For example, if your directory is /var/www/html, the directory created is /var/www/html/avayadir.
3. Use the command “**chown apache:apache /var/www/html/avayadir/avayadirini**” to change the user and group of the directory /var/www/html/avayadir/avayadirini to **user:apache, group:apache**.
4. Run “**chmod 755 /var/www/avayadir/avayadirini**” to change the permission of the /var/www/html/avayadir/avayadirini to **755**.
5. To enable password control for the Directory Administration application, create a directory entry in the httpd.conf file as follows:

   Note:

   The correct filename is ***httpd.conf, not http.conf.***

```
<Directory “/var/www/html/avayadir/avayadiradmin”>
AuthType Basic
AuthName “Password Required”
AuthUserFile “/var/www/password/avayadirpasswd”
Require user ldap
</Directory>
```

6. The default user/password combination is **ldap/ldap**. To change the password, run “**htpasswd /var/www/passwd/avayadirpasswd ldap**”.
7. Open the file **/etc/php.ini** for editing.
8. Set the option “**short_open_tag = On**” in php.ini.
9. Uncomment the line “**extension=ldap.so**” in php.ini.
10. To finish, restart the Web server by running “**/sbin/service httpd restart**.”
11. Now test everything out by pointing a browser at the newly created directory structure such as <http://yourserver/avayadir/avayadiradmin/index.htm>.

Installation for Windows with Apache:

1. Extract the file **avayadir-1.0.zip** to the documentRoot folder.

   Note:

   Making LDAP/PHP work with Apache is not necessarily easy. This procedure contains only the basics. For further information, you can download a free white paper available on the Avaya support Web site. After accessing the Avaya support Web site, make the following selections: **Telephone Devices & User Agents,** then **IP Telephones & User Agents**, then **4600 IP Telephones** and **SDK and Browser Information**.

   The documentRoot location varies based on Web server installation. This is the directory where the Web server originates the files it serves.

2. Go to www.php.net to determine how to install and configure PHP for your server.
3. Check your Web server's installation instructions to determine how to enable directory-level password control. We *strongly recommend* that you enable password protection for the directory administration folder **avayadiradmin**.
4. Open the file **php.ini** for editing. This file is typically located in the Windows folder **c:\windows**.
5. In php.ini, set the option "**short_open_tag = On**".
6. Uncomment the line "**extension=php_ldap.dll**"
7. Save the updated **php.ini** file.
8. To finish, restart the Web server.
9. Now test everything out by pointing a browser at the newly created directory structure such as: <http://yourserver/avayadir/avayadiradmin/index.htm>.

Web Application User Interface

This section describes the user interface screens required for the Directory application. The Directory application's phone screens are accessed using the 4620's Web Access application. Therefore, any Directory user interface screen you administer must use LDAP attributes only. Some examples are provided in Table 16: List of Drop-Down Attributes available for Search, Query and Details Administration Screens on page 149. Chapter 7: Web Browser for 4610SW, 4620/4620SW, 4621SW, and 4622SW IP Telephones provides detailed information about how Web pages/screens are rendered. Once you familiarize yourself with the user interface, see Directory Database Administration Interface for instructions on completing the associated administration screens.

Note:

Specific user instructions regarding the Directory application are not provided in the respective *4610SW, 4620/4620SW/4621SW*, *4622SW*, or *4625SW IP Telephone User Guides*. Each user guide has a “Using the Web Access Application” chapter that provides general information only for working with Web pages. We do not provide detailed information because the Directory user interface screens are considered part of a Web-based application that you can customize.

Generic User Interface Screen Characteristics

All Directory application phone screens have similar layouts with:

- A display area.
- Feature buttons down the left and right sides related to a text entry field or data item.
- Softkeys below the display that start screen-related actions, such as **Search** or **Call**.
- Web browser navigation buttons down the right side of the display, which allow the user to move forward, back and return to the Home page.

Note:

Standard softkey labels on text entry screens are translated into the user’s language. The Directory application itself, and associated help or error messages are in English only.

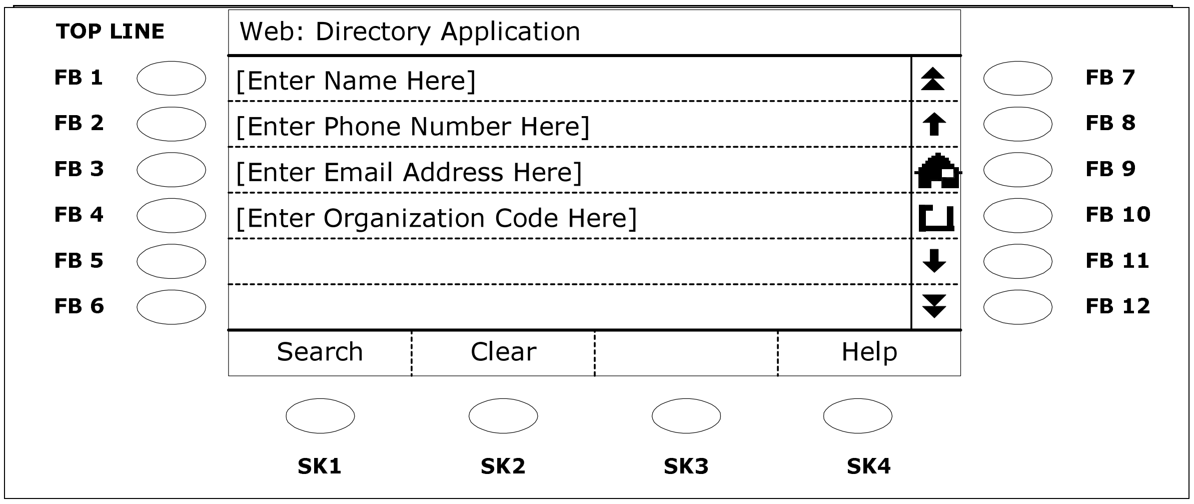
Web Application Search Screen

The Search screen displays upon user selection of the Directory application. At a minimum, administer these two user text entry fields:

- Enter Name Here
- Enter Phone Number Here

Either field provides basic search criteria. You can administer up to four additional text entry fields.

Figure 22: Sample Search Screen


TOP LINE
Web: Directory Application
FB 1
FB 2
FB 3
FB 4
FB 5
FB 6
[Enter Name Here]
[Enter Phone Number Here]
[Enter Email Address Here]
[Enter Organization Code Here]
FB 7
FB 8
FB 9
FB 10
FB 11
FB 12
Search
Clear
Help
SK1
SK2
SK3
SK4

The three softkeys at the bottom of the screen function as follows:

- **Search** - Sends user input to the Directory application to initiate a search.
- **Clear** - Discards user input.
- **Help** - Retrieves a Help page specific to the Search screen.

Search responses take one of two forms. A successful search, one returning at least one telephone number when a name was provided as search criteria, displays the Successful Search screen. This screen offers options to call the number found, add it to a Speed Dial button or review more detail. An unsuccessful search, for example, no name found, error report(s) and/or unintelligible responses, displays the Directory Trouble screen.

Note:

You complete the Search Administration screen to administer the [user interface] Search screen. See Configuring the Directory Application Search Administration Screen on page 144.

Web Application Successful Search Screen

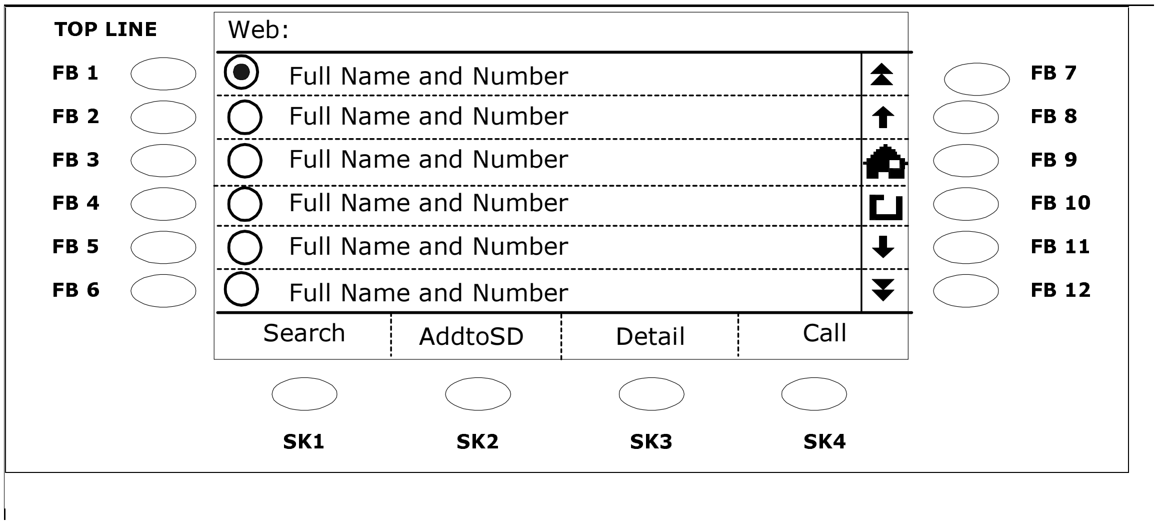
The Successful Search screen displays when at least one match results from a user-submitted search. The top display line provides one of these messages:

`X found. Select choice.` where ***X*** = the number of matches found, or

`More results - please try again and refine search.` to indicate more than 96 matches were found.

This screen's display area provides the name and phone number of up to 96 matches. If the search returns more than 96 matches, only the first 96 are shown and the rest are lost. The user can scroll through the matches using the Web browser navigation key to move forward one page. To select an entry, the user presses the Feature button to the left of that entry.

Figure 23: Sample Successful Search Screen



The four softkeys across the bottom of the display function as follows:

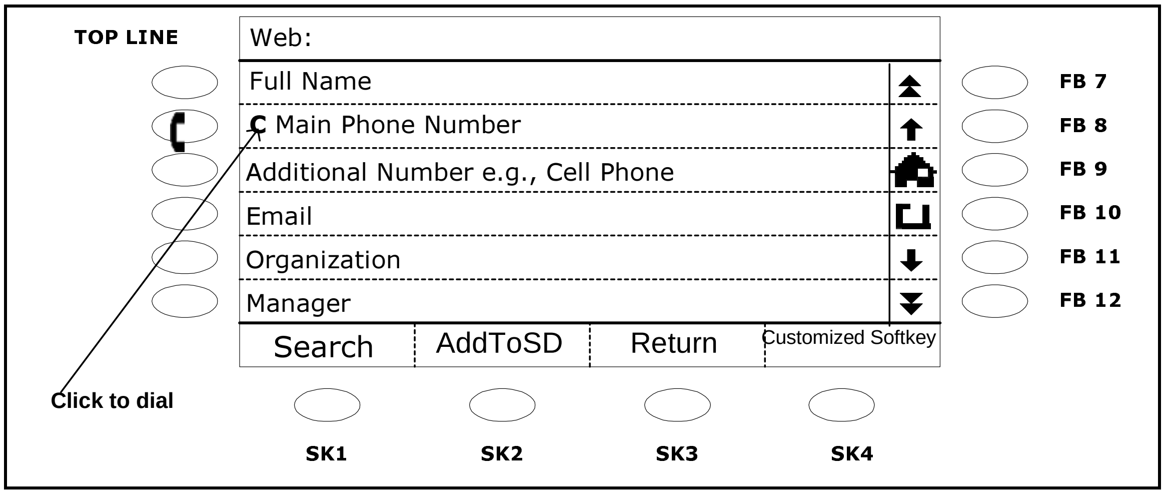
- **Search** - Displays the Search screen, to allow the user to enter new criteria and start another search.
- **Add to SD** - Allows the user to add a selected name and phone number to a Speed Dial button.
- **Detail** - Displays more directory information on the person selected, such as a department, secondary contact, manager, etc. (as administered). See Figure 24 for a sample Detail screen.
- **Call** - Allows the user to initiate a call to a person listed.

Web Application Detail Screen

The Detail screen displays when a user selects the **Detail** button on the Successful Search screen. Depending on how you administer it, this screen provides additional information about the person selected on the Successful Search screen. The selected person's Full Name and Main Telephone Number show on the first two lines as a default. You can administer the first two lines to show different data. You can administer four additional display lines to provide specific corporate or personal information about the person. Examples of data you can administer to appear as follows. (You can use any valid LDAP attribute in place of the sample data.)

- **Additional Phone Number** - a cell phone or other related telephone number.
- **E-mail** - the person's business e-mail address.
- **Organization** - the department or organization to which this person belongs.
- **Other** - any other pertinent information, such as the name of the person's manager or assistant.

Figure 24: Sample Detail Screen



A "click to dial" icon ( ) to the left of the Main Phone Number allows the user to call the person directly from the Detail screen. Using this icon instead of a **Call** softkey saves a softkey for your customization. Three softkeys are labeled as follows, the fourth softkey is available for your use:

- **Search** - Displays the Search screen, to allow the user to enter new criteria and start another search.
- **Add to SD** - Allows the user to add a selected name and phone number to a Speed Dial button.
- **Return** - Displays the Search screen, including the **Name** field entered by the user to start the most recent search.

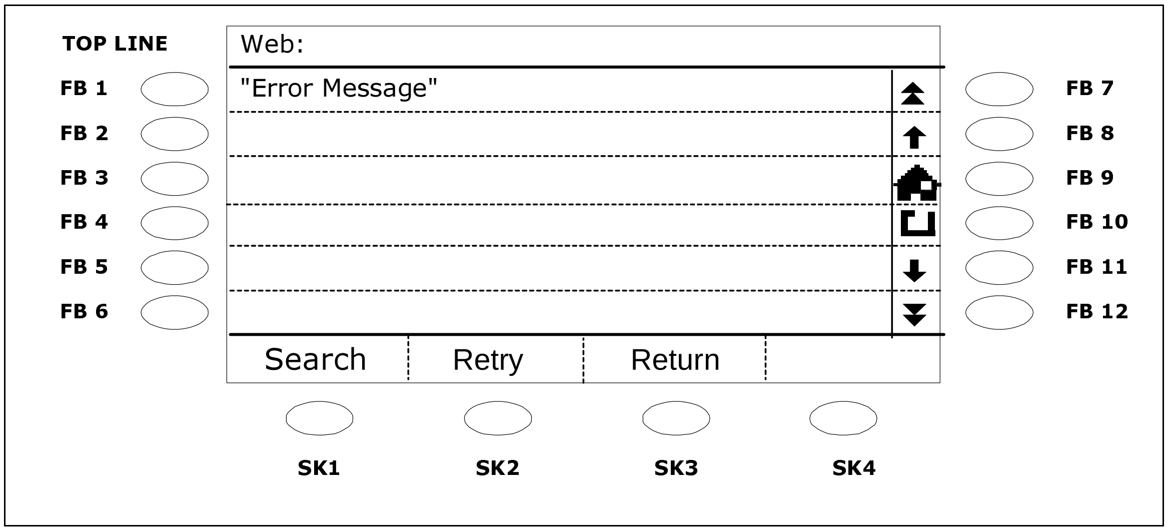
Note:

You administer the [user interface] Detail screen on the Details Administration screen. See Configuring the Directory Application Details Administration Screen on page 146.

Web Application Directory Trouble Screen

Unsuccessful Directory searches occur for several reasons. For example, an inability to connect to the server for a search or finding no Directory listings that match the search criteria produce unsuccessful searches. Any search-related problem displays as an error message on the Directory Trouble screen, shown in Figure 25.

Figure 25: Sample Directory Trouble Screen



The Trouble Screen's softkeys function as follows:

- **Search** - Displays the Search screen, to allow the user to enter new criteria and start another search.
- **Retry** - Allows the user to restart the search using the same search criteria.
- **Return** - Displays the Search screen, with the **Name** field the user entered to start the most recent search.

Possible reasons for search failure and the resulting messages displayed on the Trouble screen follow in Table 13.

Table 13: Search Failure Causes and Corresponding Trouble Screen Error Messages

Cause of Search Failure	LDAP Result Code	Trouble Screen Message
N/A. The corresponding LDAP Result Code represents a successful search.	0	No message displayed. The search was successful.
Operations/Protocol error.	1, 2	`Operations/ Protocol error.`
Server-generated timeout.	3	`Server timed out.`
More than 96 entries match the Search criteria.	4	`Size limit exceeded.`
Various unexpected errors. You should never receive these result codes.	5, 6, 10, 11, 12, 13, 14, 18, 19, 20, 21, 34, 36, 54, 64, 65, 66, 67, 68, 69, 71	`Invalid response.`
Authentication not accepted.	7, 8, 48, 49, 50, 53	`Authentication error.`
Telephone Number not recognized.	16, 17	`Telephone Number not recognized.`
Object not found.	32	`No results found.`
Server responds with “null” as data.	N/A	`No results found.`
Server not available.	51, 52	`Server not available.`
Other, unspecified failure.	80	`An unknown problem has occurred.`
If any of these system values are null (except **DIRUSERID** and **DIRSRVRPWD**, which are optional and might remain null), and the user tries to access the Directory application, the endpoint receives a Trouble Screen.	N/A	`Insufficient Administrative Information.`
The Directory server does not respond at all within an administrable amount of seconds. The default is 10 seconds.	N/A	`Unable to contact server.`

1 of 2

Table 13: Search Failure Causes and Corresponding Trouble Screen Error Messages (continued)

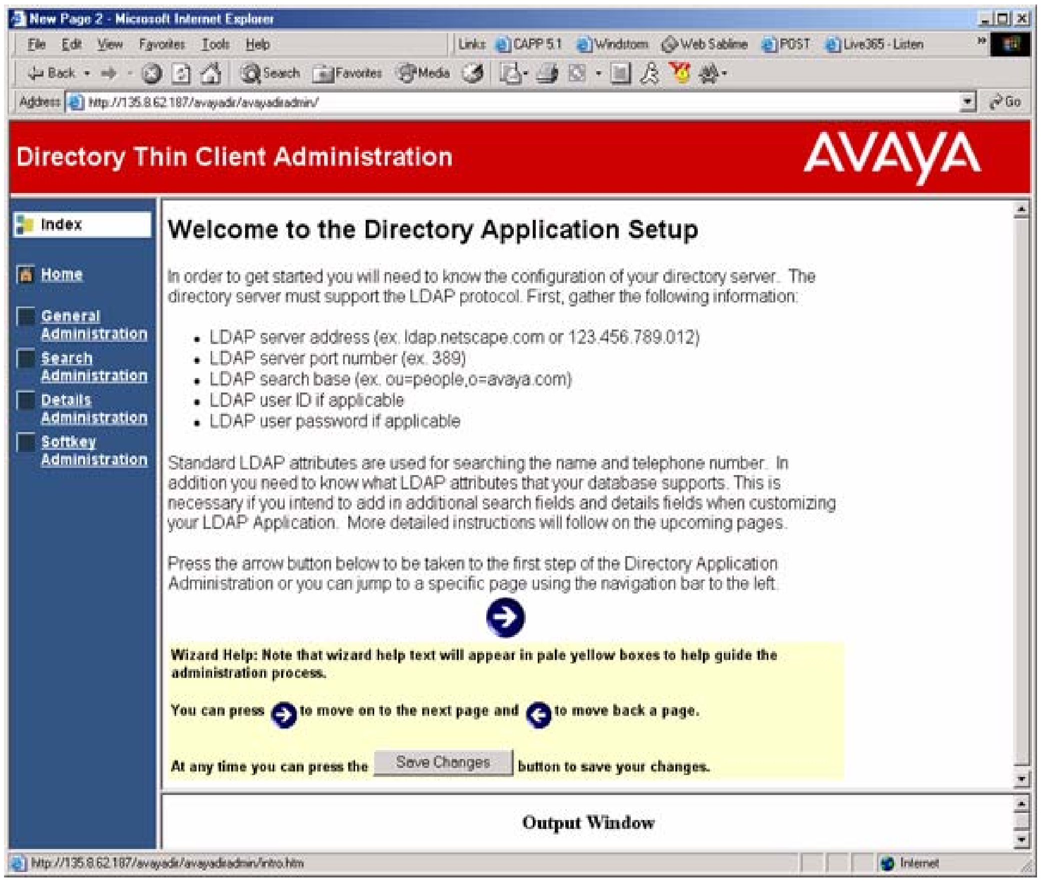
Cause of Search Failure	LDAP Result Code	Trouble Screen Message
When the Directory application receives a request for a Search screen, it sends a Search screen in response only if supplied with the minimum administrative information. Otherwise, the endpoint receives a Trouble Screen.	N/A	`Insufficient Administrative Information.`
When the Directory application receives a request for a search from an endpoint, it initiates a connection to the directory database server. If the connection succeeds, a query is formatted and sent to the database server based on the input received from the endpoint. If the input received from the endpoint is null, the endpoint receives a Trouble Screen.	N/A	`Insufficient Query Information.`
If a connection to the database server cannot be established, or if the connection fails before a response is received, the endpoint receives a Trouble Screen.	N/A	`Connection Failure.`
When the Directory application receives a successful response from the database server, the endpoint receives a Successful Result screen. If no matching database entries are returned, the endpoint receives a No Match Result screen. If the database returns an error, the endpoint receives a Trouble screen.	N/A	`No Match Result.`
Cannot be determined.	9, 22 - 31, 35, 37 - 47, 55 - 63, 70, 72 - 79, and 81 - 90	`Unknown Error.`
		2 of 2

Directory Database Administration Interface

The Directory application file you download from the Avaya Web site contains five primary screens on which you administer and customize the Thin Client Directory. Additionally, each administration screen has embedded Help to guide you through the administrative process. The primary screens are:

1. **Welcome screen** - The Home Page for administering your Directory application. This screen provides pre-administration requirements, basic administration information, links to all other administration screens, and a link to administrative Help.

Figure 26: Welcome Screen


New Page 2 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://135.8.62.187/avayadir/avayadiradmin/
Directory Thin Client Administration
AVAYA
Index
Home
General Administration
Search Administration
Details Administration
Softkey Administration
Save Changes
Output Window
http://135.8.62.187/avayadir/avayadiradmin/intro.htm
Internet

Welcome to the Directory Application Setup

In order to get started you will need to know the configuration of your directory server. The directory server must support the LDAP protocol. First, gather the following information:

- LDAP server address (ex. ldap.netscape.com or 123.456.789.012)
- LDAP server port number (ex. 389)
- LDAP search base (ex. ou=people,o=avaya.com)
- LDAP user ID if applicable
- LDAP user password if applicable

Standard LDAP attributes are used for searching the name and telephone number. In addition you need to know what LDAP attributes that your database supports. This is necessary if you intend to add in additional search fields and details fields when customizing your LDAP Application. More detailed instructions will follow on the upcoming pages.

Press the arrow button below to be taken to the first step of the Directory Application Administration or you can jump to a specific page using the navigation bar to the left.

Wizard Help: Note that wizard help text will appear in pale yellow boxes to help guide the administration process.

You can press to move on to the next page and to move back a page.

At any time you can press the Save Changes button to save your changes.

Note:

The Welcome screen (Home page) provides a checklist of the values required to set up general administration, such as the LDAP Server Address. Ensure that you have this required information before starting to configure the General Directory application Administration screen.

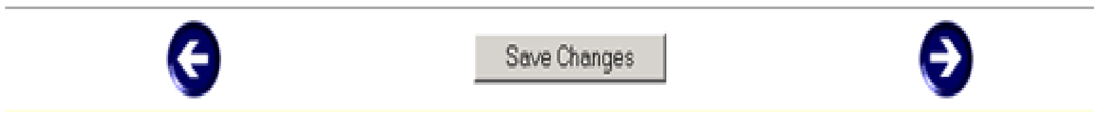
2. **General Directory Application Administration screen** - You provide general information about your Directory application, such as: the Application Title displayed at the top of the first user interface screen, the LDAP Server Address, the search root and port network identification, optional User ID and Password for accessing the application, and the amount of time to be allowed for a search.
3. **Directory Application Search Administration screens** - You specify required and optional LDAP search attributes that display on the [user interface] Search screen.
4. **Details Administration screen** - You specify the detail information the user sees on the [user interface] Detail screen, such as an e-mail address for a person found, etc.
5. **Softkey Administration screen** - Allows you to optionally specify additional softkeys, to appear below the [user interface] Detail screen's display area.

Note:

The Directory application administration interface is in the English language only.

Each screen has required and optional parameters. The input fields have a definition and/or explanation of what is required to their right in the yellow areas. There can also be yellow Help areas at the bottom of a screen to help you populate the screens correctly. You can select the **Home** option from the left side of any administration screen to return to the Welcome screen (Home page).

The bottom of each screen provides navigation and save options, as shown here:



After entering the screen values, press the **Save Changes** button to save your entries. Then use the **Right Arrow** or **Left Arrow** buttons to move from that screen to another. Pressing an arrow button without first saving what you entered or changed displays a dialog box. The dialog box allows you to:

- confirm that you do not want to retain your entries or any changes you've made to existing values, or
- allows you to select **Cancel** to return to the screen and save the data.

Configuring the required information in accordance with the instructions in this section allows the Thin Client Directory application to communicate properly with the LDAP server. After configuring and saving the required information, test the Directory application to ensure that:

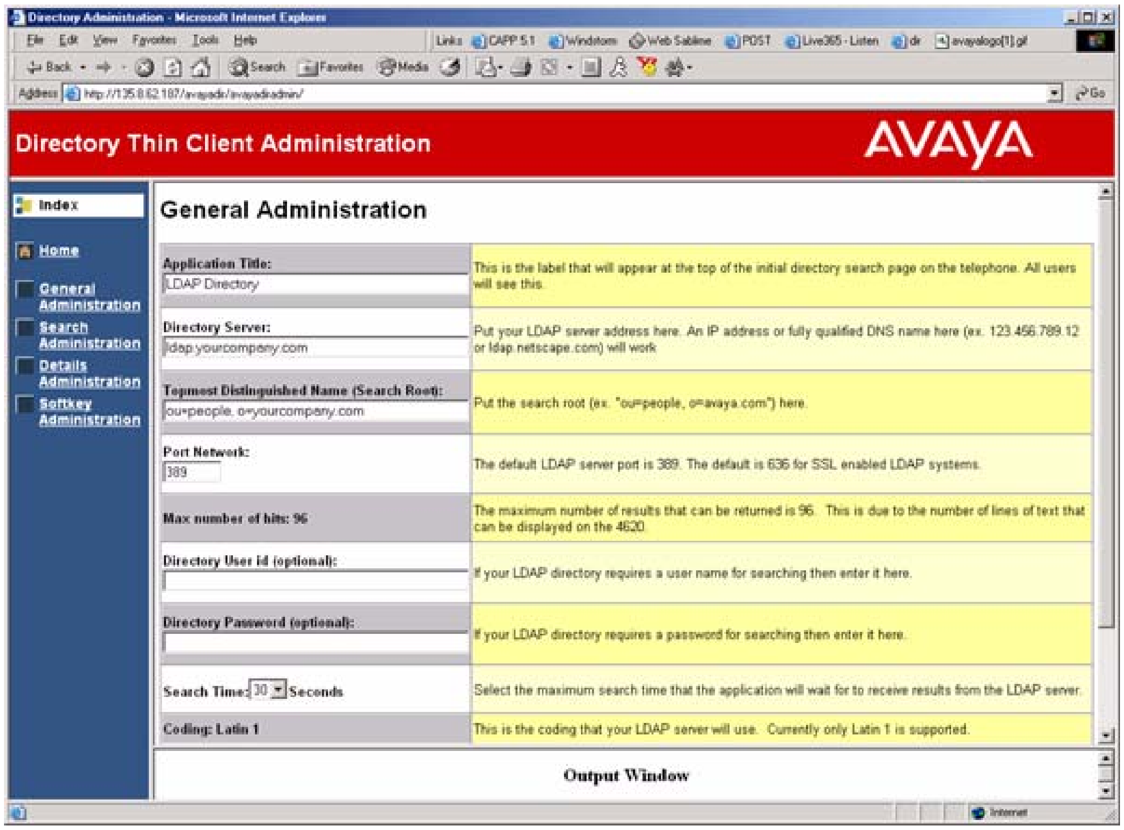
- the user interface screen values are correct,
- the application is interfacing properly with the LDAP server, and
- the Directory application server is interfacing properly with the end user's phone.

Configuring the General Directory Application Administration Screen

To configure the General Directory Application Administration screen:

1. From the Welcome screen, select the **General Administration** screen link. Alternately, select the **Right Arrow** icon at the bottom of the Welcome screen.

Figure 27: Directory Application Administration Screen


Directory Administration - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Links CAPP 5.1 Windstorm Web Sabline POST Live365 - Listen dr avayalogo[1].gif
Back Search Favorites Media
Address http://135.8.62.187/avayadir/avayadiradmin/
Go
Directory Thin Client Administration
AVAYA
Index
Home
General Administration
Search Administration
Details Administration
Softkey Administration
Internet

General Administration

Application Title: LDAP Directory	This is the label that will appear at the top of the initial directory search page on the telephone. All users will see this.
Directory Server: ldap.yourcompany.com	Put your LDAP server address here. An IP address or fully qualified DNS name here (ex. 123.456.789.12 or ldap.netscape.com) will work
Topmost Distinguished Name (Search Root): ou=people, o=yourcompany.com	Put the search root (ex. "ou=people, o=avaya.com") here.
Port Network: 389	The default LDAP server port is 389. The default is 636 for SSL enabled LDAP systems.
Max number of hits: 96	The maximum number of results that can be returned is 96. This is due to the number of lines of text that can be displayed on the 4620.
Directory User id (optional):	If your LDAP directory requires a user name for searching then enter it here.
Directory Password (optional):	If your LDAP directory requires a password for searching then enter it here.
Search Time: 30 Seconds	Select the maximum search time that the application will wait for to receive results from the LDAP server.
Coding: Latin 1	This is the coding that your LDAP server will use. Currently only Latin 1 is supported.

Output Window

2. All fields except **Directory User ID** and **Directory Password** are required. Table 14 shows the Administration screen fields, their associated key names, default values, and descriptions:

Table 14: Administration Screen Fields

Field Title	Key Name	Default	Description
Application Title	DIRSVRNAME	4620 Directory Application	Label appearing at top of the user interface's Directory Search screen.
Directory Server	DIRSRVR	Null	LDAP server address, IP Address or fully qualified DNS name.
Topmost Distinguished Name (Search Root)	DIRTOPDN	Null	The search root base, usually "ou=people" or o=company name. Note that spaces and other special characters might need to be treated as specified in RFC 2253, *Lightweight Directory Access Protocol (v3): UTF-8 String Representation of Distinguished Names*.
Port Network	DIRLDAPPORT	389 for LDAP 686 for SSI-enabled LDAP	Directory Server Port.
Max number of hits		96	The maximum number of result entries that can be displayed on the 4620.
Directory User ID	DIRUSERID	Optional	User name for authorized Directory search, if required.
Directory Password	DIRSRVRPWD	Optional	User's password for authorized Directory search, if required.
Directory Search Time	DIRSEARCHTIME	10 seconds	Maximum amount of time the application waits for search results (01 - 59 seconds).
Directory Coding	DIRCODING	Latin 1	No other option is currently available.

3. Press the **Save Changes** button as stated at the bottom of the screen to save the values entered. When you complete the final administration screen, you can review all values on all screens.

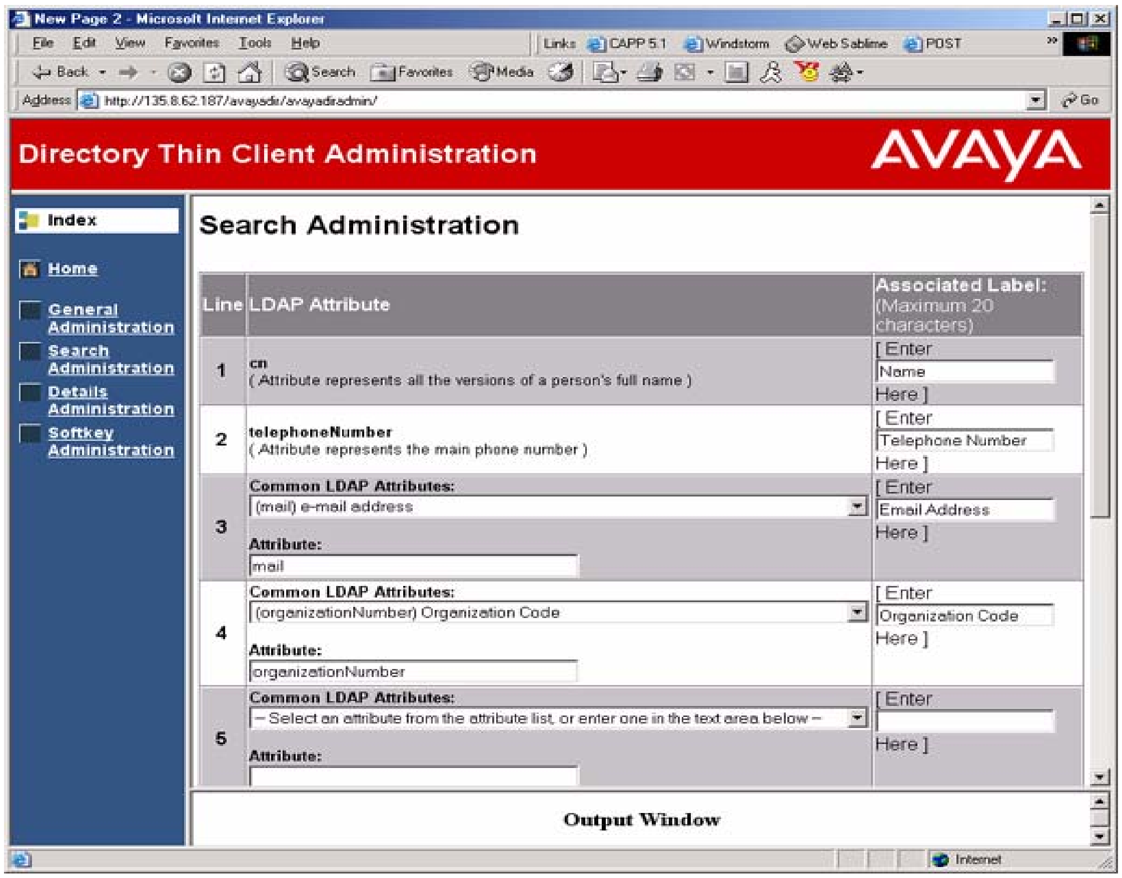
Configuring the Directory Application Search Administration Screen

The Search screen's administration requires that you provide labels for the LDAP attributes that appear on the user interface Search screen. These attributes are the labeled search fields the end user sees when the Search screen displays.

Any Customer-Defined Label you create populates the ***Label*** value of the **Enter *Label* Here** text entry box on the Search Administration screen. This label also displays as the text entry prompt on the user interface Search screen. See Figure 22: Sample Search Screen on page 134 for an illustration of the user interface Search screen

1. From the Welcome screen, select the **Search Administration** screen link. Alternately, select the **Right Arrow** icon at the bottom of the General Administration screen.

Figure 28: Search Administration Screen


New Page 2 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Links CAPP 5.1 Windstorm Web Sablime POST
Back Search Favorites Media
Address
Go
Directory Thin Client Administration
AVAYA
Index
Home
General Administration
Search Administration
Details Administration
Softkey Administration
Output Window
Internet

Address: http://135.8.62.187/avayadir/avayadiradmin/

Search Administration

Line	LDAP Attribute	Associated Label: (Maximum 20 characters)
1	cn (Attribute represents all the versions of a person's full name)	[Enter Name Here]
2	telephoneNumber (Attribute represents the main phone number)	[Enter Telephone Number Here]
3	Common LDAP Attributes: (mail) e-mail address Attribute: mail	[Enter Email Address Here]
4	Common LDAP Attributes: (organizationNumber) Organization Code Attribute: organizationNumber	[Enter Organization Code Here]
5	Common LDAP Attributes: -- Select an attribute from the attribute list, or enter one in the text area below -- Attribute:	[Enter Here]

2. Enter the ***search fields***, ***corresponding LDAP attribute names***, and associated ***labels*** by which your end users can search your corporate Directory. The Search Administration screen contains the fields shown in Table 15.

Table 15: Search Administration Screen Fields

Search Screen Line #	Search Field/ Search Object	LDAP Attribute Name	Associated (Customer-Defined) Label (20 characters maximum)
1	Name (fixed)	**`cn`**	Customer administrable.
2	Main Phone Number (fixed)	**`phoneNumber`**	Customer administrable.
3	E-mail (default)	**`mail`**	Customer administrable.
4	Customer administrable	**`Customer administrable`**	Customer administrable.
5	Customer administrable	**`Customer administrable`**	Customer administrable.
6	Customer administrable	**`Customer administrable`**	Customer administrable.

Example: Line 3 above shows a search field “E-mail” with the LDAP attribute “**`mail`**.” If you enter the Associated Label in column 4 as “E-mail Address” the end users’ Search screen third line prompts: “Enter E-mail Address Here.”

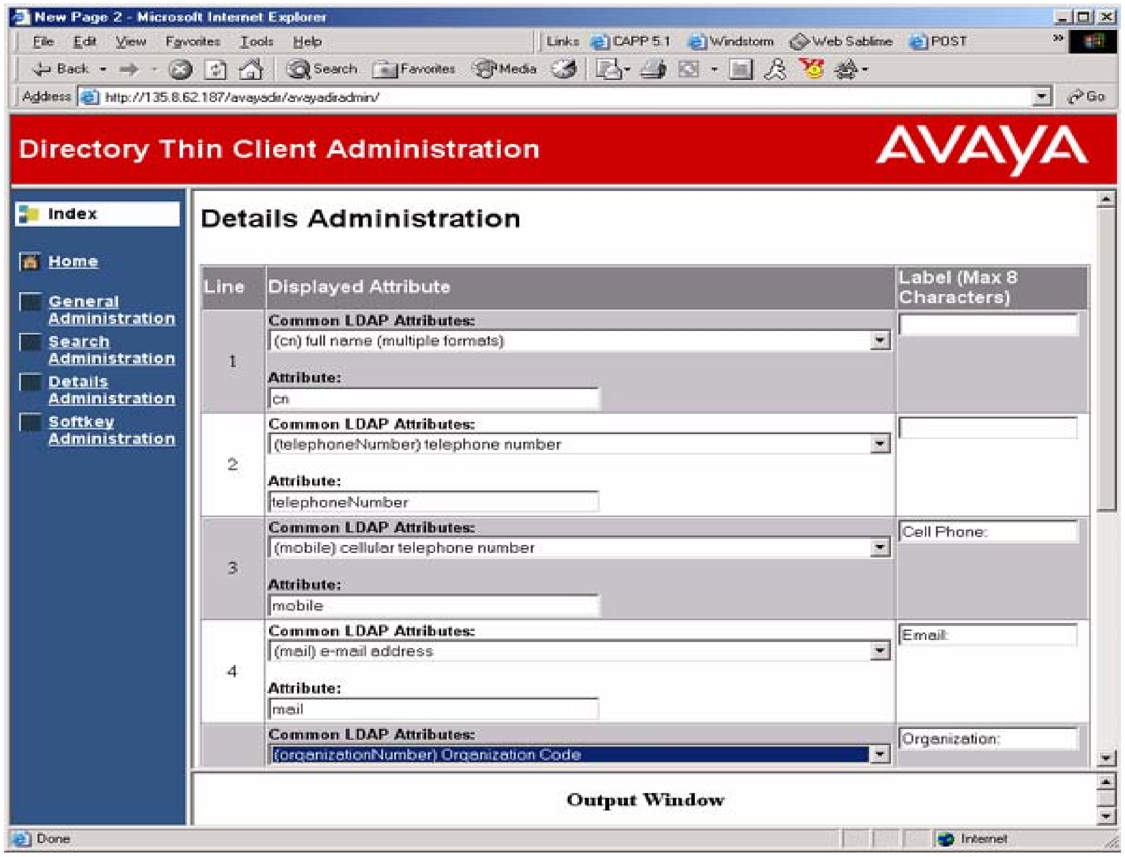
You can populate fields with well-known LDAP attributes from an Avaya-provided drop-down list. Table 16: List of Drop-Down Attributes available for Search, Query and Details Administration Screens on page 149 provides a list of allowable attributes you can use to label such fields.

Configuring the Directory Application Details Administration Screen

The Detail screen's administration requires you to provide the LDAP attributes to display on the user interface Details screen. These attributes are the details the end user sees about a selected person when the Details screen displays.

1. From the Welcome screen, select the **Details Administration** screen link. Alternately, select the **Right Arrow** icon at the bottom of the Search Administration screen.

Figure 29: Details Administration Screen


New Page 2 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Links CAPP 5.1 Windstorm Web Sablime POST
Back Search Favorites Media
Address http://135.8.62.187/avayadir/avayadiradmin/
Go
Directory Thin Client Administration
AVAYA
Index
Home
General Administration
Search Administration
Details Administration
Softkey Administration
Output Window
Done
Internet

Details Administration

Line	Displayed Attribute	Label (Max 8 Characters)
1	Common LDAP Attributes: (cn) full name (multiple formats) Attribute: cn	
2	Common LDAP Attributes: (telephoneNumber) telephone number Attribute: telephoneNumber	
3	Common LDAP Attributes: (mobile) cellular telephone number Attribute: mobile	Cell Phone:
4	Common LDAP Attributes: (mail) e-mail address Attribute: mail	Email:
	Common LDAP Attributes: (organizationNumber) Organization Code	Organization:

2. Enter the LDAP attribute names that represent the detail information you want to display about a person found by a search. These entries appear on the user interface Detail screen, as shown in the Web Application Detail Screen on page 136.

   Note:

   We assume that detail information has, at minimum, the name and telephone number. You can change these defaults and provide different attributes, if desired.

   To override an attribute that does not appear in a drop-down list, change the **Use Other** radio box next to the appropriate displayed attribute from "**Yes**" to "**No**." Then enter the custom attribute in the **Other** text entry field.

   Labels are not required because the detail attribute should be unique enough for end user identification. If the attribute does not provide a sufficient description, you can include a label of up to 8 or less characters. Doing so, however, reduces the number of characters in the text display area accordingly.

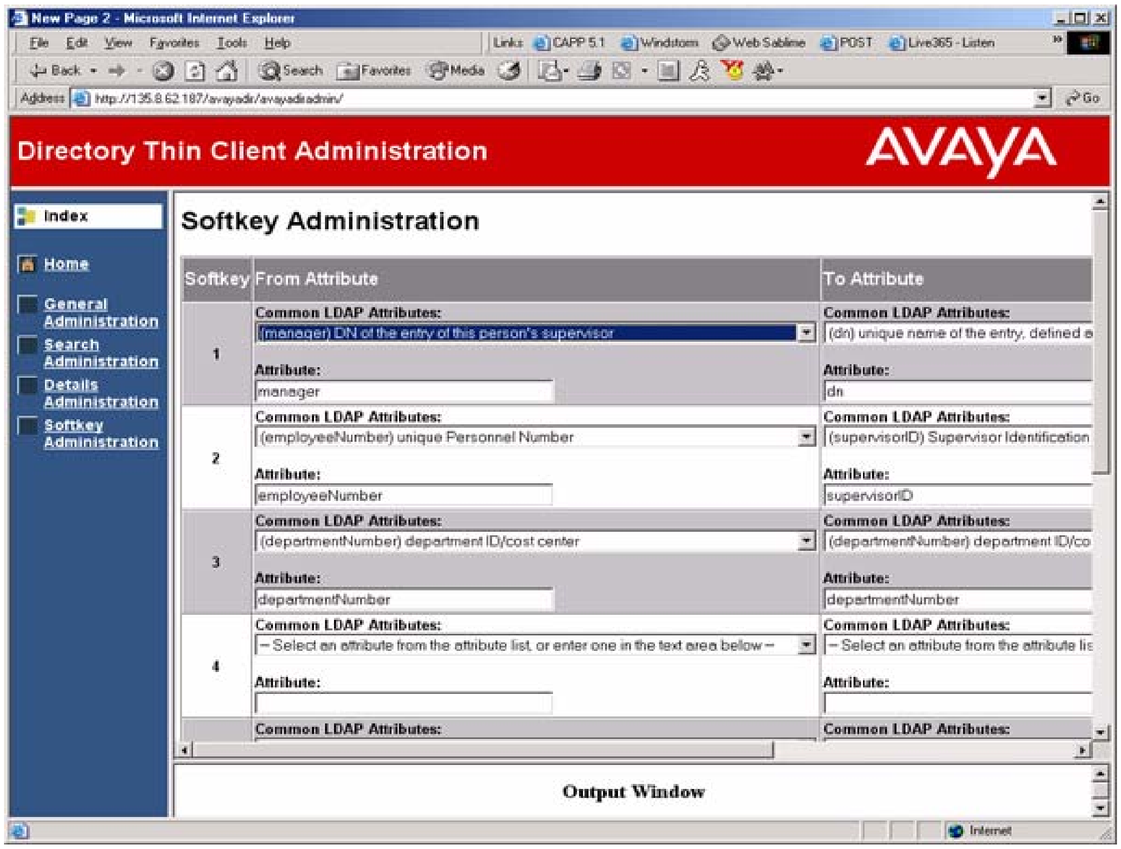
You can populate LDAP attributes from an Avaya-provided drop-down list. Table 16: List of Drop-Down Attributes available for Search, Query and Details Administration Screens on page 149 provides a list of allowable attributes you can use to label such fields.

Configuring the Directory Application Softkey Administration Screen

Avaya provides specific softkeys with specific functions on each user interface screen. Where space is available in the softkey area at the bottom of a [user interface] screen, you can optionally configure up to five additional softkeys. Then you can link them to specific Detail screen display fields. For example, you might have configured "Manager" as a detail screen attribute, which shows a [found] person's manager as part of the detail information. Linking a softkey to that field can provide a report/list of *any* person in the directory having that manager as part of his or her own detail information.

The Softkey Administration screen lists all attributes you previously defined on the Detail Administration screen as "From" attributes. You configure softkeys by providing a "To" attribute that establishes a link between the two attributes, and which is used as the softkey's label. You can populate LDAP "To" attributes with values from an Avaya-provided drop-down list. Find these values in Table 16: List of Drop-Down Attributes available for Search, Query and Details Administration Screens on page 149. You can also provide a specific label for the new softkey, using the minimum number of characters that display in the screen's softkey label area.

Figure 30: Softkey Administration Screen


New Page 2 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Links CAPP 5.1 Windstorm Web Sablime POST Live365 - Listen
Back Search Favorites Media
Address http://135.8.62.187/avayadir/avayadiradmin/
Go
Directory Thin Client Administration
AVAYA
Index
Home
General Administration
Search Administration
Details Administration
Softkey Administration
Output Window
Internet

Softkey Administration

Softkey	From Attribute	To Attribute
1	Common LDAP Attributes: (manager) DN of the entry of this person's supervisor Attribute: manager	Common LDAP Attributes: (dn) unique name of the entry, defined a Attribute: dn
2	Common LDAP Attributes: (employeeNumber) unique Personnel Number Attribute: employeeNumber	Common LDAP Attributes: (supervisorID) Supervisor Identification Attribute: supervisorID
3	Common LDAP Attributes: (departmentNumber) department ID/cost center Attribute: departmentNumber	Common LDAP Attributes: (departmentNumber) department ID/co Attribute: departmentNumber
4	Common LDAP Attributes: -- Select an attribute from the attribute list, or enter one in the text area below -- Attribute:	Common LDAP Attributes: -- Select an attribute from the attribute lis Attribute:
	Common LDAP Attributes:	Common LDAP Attributes:

Table 16: List of Drop-Down Attributes available for Search, Query and Details Administration Screens

Field	LDAP Attribute

person	`sn`
	`cn`
	`userPassword`
	`telephoneNumber`
	`description`

organizationalPerson	`title`
	`registered address`
	`telexNumber`
	`teletexTerminalIdentifier`
	`telephoneNumber`
	`internationalISDNNumber`
	`facsimileTelephoneNumber`
	`street`
	`postOfficeBox`
	`postalCode`
	`postalAddress`
	`physicalDelieveryOfficeName`
	`ou`
	`st`
	`l`

inetOrgPerson	`businessCategory`
	`carLicense`
	`departmentNumber`
	`employeeNumber`
	`employeeType`
	`givenName`
	`homePhone`
	`homePostalAddress`
	`initials`
	`labeledURL`
	`mail`
	`manager`
	`mobile`
	`pager`
	`roomNumber`
	`secretary`
	`uid`
	`userCertificate;binary`
	`x500uniqueIdentifier`

Chapter 9: Web Browser for the 4625SW IP Telephone

Introduction

This chapter describes the capabilities and limitations of the Web browser for the 4625SW IP Telephone. This chapter also provides suggestions to design Web sites for viewing on the 4625SW IP Telephone. The 4625SW has a significantly different display than other IP telephones and supports display of color and JPEG images.

This chapter serves these functions:

- Presents the WML portions implemented in the 4625SW IP Telephone Web browser applications. Any limitations or non-standard implementations are mentioned.
- Provides considerations to develop effective Web pages for browser viewing.

This chapter is intended for IP telephone Web browser [Web page] designers, and assumes that readers are somewhat familiar with WML. This chapter is not intended to provide technical details on setting up a Web server, nor does it provide information on Web server technologies. Finally, this document is not intended to provide an introduction to Web browser protocols or technologies.

General Background

The 4625SW has a 1/4-VGA 320 pixels wide by 240 pixels high backlighted display that supports 65K colors. The available WML Web page display area is 291 pixels across by 180 pixels in height. In addition, the top row displays the Web page title, if any. The bottom row presents up to four softkey labels at one time for <do> tags.

The 4625SW can display JPEG images as part of a WML page or for softkey labels. Softkey label images should at most be 79 pixels wide and 29 pixels high. If the <do> tag is only text, use up to 6 characters per tag.

The data types and other features supported in this browser include:

- WML 1.3, June 2002
- HTTP 1.1

The Summary Of WML Tags and Attributes on page 99 summarizes the detailed information provided in each tag-related section in this chapter.

Note:

Unsupported WML 1.3 tags are not rendered, and do not cause the browser to fail. Unknown tags and misspelled tags generate error messages.

WML Tags and Attributes

WML Document Skeleton

Certain tags define the basic framework of a WML document. The tags listed below make up the basic skeleton of a WML document. The 4625SW IP Telephone supports these tags unless otherwise indicated.

- Common tag attributes: **`xml:lang`**, **`class`**, and **`id`**.

  The attributes **`xml:lang`**, **`class`** and **`id`** are universal attributes associated with each WML element.

  The Web browser supports these tags:

Attribute	Comments
`xml:lang`	NOT SUPPORTED
`class`	NOT SUPPORTED
`id`	SUPPORTED

- <wml> tag - The <wml> tag defines a deck of cards and encloses all information about the deck. This tag is a required WML element and must contain at least one <card> tag. If a onevent attribute is defined for the <card> tag and one already exists for the <wml> tag, the <card> onevent attribute overwrites that of the <wml> tag, assuming they are the same type. If a <do> tag is defined for the <card> tag and one already exists for the <wml> tag, the <card> tag overwrites that of the <wml> tag, assuming they are the same type and name.

- <head> tag - The <head> tag is an optional WML tag. This tag contains information that relates to the deck as a whole, including meta-data and access control elements. This tag is not supported.
- <meta/> tag - The optional <meta> tag is contained between multiple <head> tags. This tag gives values for the parameters that describe the content of the deck. This tag is not supported.
- <card> tag - A single WML file can contain multiple cards, supporting the analogy of a “deck” of “cards” within a single WML file. A card is essentially the specification of one specific WML page. This is a mandatory tag.

The card element attributes supported by the Web browser are as follows (unsupported attributes are indicated as such in the Comments column):

Attribute	Value(s)	Description	Comments
`newcontext`	true false	Re-initializes the browser context. Default is “false.”	Clears out the current WML browser context, which entails emptying the navigation stack history and clearing out all variables. When set to “true” the browser clears its history buffer and captures and buffers the WML card title attribute of the WML card containing the newcontext tag. This buffered attribute is used as the title for every WML element having a null or missing title attribute, including top-level cards. SUPPORTED.
`ordered`	true false	Specifies the order of card content. When ordered is set to “true” the browser displays the content in a fixed order. When ordered is set to “false” the users decide the order as they navigate between content. Default is “true.”	Optional. Sets a Boolean value that provides information on how the content of the current card is arranged. Used by the browser to organize the display presentation and layout. If set to true, content is organized in a linear sequence of elements - for example, a series of ordered or non-optional input elements. If set to false, content is in no natural order - for example, a series of unordered or optional input elements. The default is true. NOT SUPPORTED.
`title`	*cdata*	The title of the card.	Can be used for title displays. SUPPORTED.
`onenterbackward`	*url*	Occurs when the user navigates into a card by means of a “prev” task.	SUPPORTED.

1 of 2

Attribute	Value(s)	Description	Comments
`onenterforward`	*url*	Occurs when the user navigates into a card by means of a "go" task.	SUPPORTED.
`ontimer`	*url*	Occurs when a "timer" expires.	SUPPORTED.

2 of 2

The seven display lines are used to render a card. If a onenterforward or onenterbackward attribute is defined for a <card> tag, and the <card> tag also has a <onevent> tag defined with a onenterforward or onenterbackward event type, the attribute defined in the <card> tag supersedes the onevent binding. If a onevent attribute is defined for the <card> tag and one already exists for the <wml> tag, the <card> onevent attribute overwrites that of the <wml> tag, assuming they are the same type. If a <do> tag is defined for the <card> tag and one already exists for the <wml> tag, the <card> tag overwrites that of the <wml> tag, assuming they are the same type and name.

- <template> tag - The <template> tag defines a template for all the cards in a deck. The "code" in the <template> tag is added to each card in the deck. Only one <template> tag for each deck can be specified. This tag can only contain <do> and <onevent> tags.

The **template** tag attributes the Web browser supports are:

Attribute	Value(s)	Description	Comments
`onenterbackward`	*url*	Occurs when the user navigates into a card by means of a "prev" task.	SUPPORTED.
`onenterforward`	*url*	Occurs when the user navigates into a card by means of a "go" task.	SUPPORTED.
`ontimer`	*url*	Occurs when the "timer" expires.	SUPPORTED.

Note:

The implication for rendering WML pages is that the local environment always overrides a global template for <do> types with the same name and type. If there is a onevent in the template and a *local* onevent of the same type, the local onevent takes precedence over the global one.

- <access> - The <access> tag limits access within the deck to certain cards. This tag is not supported.

Text Elements

See Enabling Text Entry in Chapter 6 for text entry guidelines.

- <br/> tag - The <br/> tag tells the browser to add a line break to the text at the point the element is written.
- <p> tag - The <p> tag specifies a paragraph of text with alignment and line wrapping properties. All text data must be contained inside this tag. Only <do> tags, wml and card elements can exist outside the <p> tag. When rendered, this tag causes subsequent text to start on the next line.

Attribute	Value	Description	Comments
`align`	left right center	Aligns the paragraph. Default is “left.”	SUPPORTED.
`mode`	wrap nowrap	Sets whether a paragraph wraps lines or not.	Since horizontal scrolling is not supported, all text lines wrap. WML pages with mode=nowrap are ignored, and the text wraps. If the “align” attribute is set to `center` or `right`, the mode attribute is set to `nowrap` for all tags except <img>. SUPPORTED.

The following tags are not supported but the content inside the tags is rendered as normal text:

- <table> tag - The <table> tag specifies a table. This tag is not supported.
- <td> tag - The <td> tag defines individual cell contents in each row of a defined table. This tag is not supported.
- <tr> tag - The <tr> tag defines each row of a defined table. This tag is not supported.

Text Formatting Tags

The following tags are not supported but the content inside the tags is rendered as normal text:

- <b> tag - The <b> tag specifies bold text. This tag is not supported.
- <big> tag - The <big> tag specifies large font text. This tag is not supported.
- <em> tag - The <em> tag specifies emphasized text. This tag is not supported.
- <i> tag - The <i> tag specifies italicized text. This tag is not supported.
- <small> tag - The <small> tag specifies small font size text. This tag is not supported.
- <strong> tag - The <strong> tag specifies strongly emphasized text. This tag is not supported.
- <u> tag - The <u> tag specifies underlined text. This tag is not supported.

Application developers can create a JPEG image with different font styles, since the browser does not support any of the text formatting tags listed.

Anchor Elements

- <a> tag - <a> elements define <go> tasks that require a URL link specification. All <a> tags are rendered as underlined. All <a> nested tags like br and img are supported. One anchor is rendered per line. A maximum of six anchors can be rendered on the screen at one time. The user selects the link by pressing one of the Feature buttons associated with that display line.

Attribute	Value	Description	Comments
`href`	*url*	REQUIRED. Defines where to go when the user selects the link.	SUPPORTED.
`title`	*cdata*	Defines a text identifying the link.	SUPPORTED.
`accesskey`	1,2,3,4, 5,6,7,8, 9,0,*,#	A keypad key the user can press as a shortcut to selecting a link.	NOT SUPPORTED.

- <anchor> tag - <anchor> elements define <go> tasks that require a URL link specification. All anchors are rendered as underlined. All <anchor> nested tags (br, go, img, prev, and refresh) are supported. A maximum of six anchors can be rendered on the screen at one time. The user selects a link by pressing one of the Feature button associated with that display line. You cannot specify more than one <onevent> tag inside an <anchor> tag.

Attribute	Value	Description	Comments
`title`	*cdata*	Defines a text identifying the link.	SUPPORTED.
`accesskey`	1,2,3,4, 5,6,7,8, 9,0,*,#	A keypad key the user can press as a shortcut to select a link.	NOT SUPPORTED.

Image Elements

The 4625SW display has a higher pixel density, and supports rendering of both grayscale WBMP images and color JPEG images. All images must be at most 291 pixels wide and at most 2880 pixels high, which corresponds to 96 rows of 30 pixels each. In addition, JPEG files can display in the softkey label area, with a maximum width of 79 pixels and a maximum height of 29 pixels.

- <img> tag - Use the <img> tag to place an image in the text flow. Either the monochrome wbmp (wireless bitmap) format or the color JPEG format is used to code display images. Up to 3 Mbytes of volatile memory is available for display of all WBMP and JPEG images. Avaya does not recommend large images. Images can be part of a link and can be selectable. At most, each card can display up to 16 images.

Attribute	Value	Description	Comments
align	top middle bottom left right center	Aligns the image.	Top, middle, bottom, right and center are NOT SUPPORTED. Left is SUPPORTED.
alt	*cdata*	REQUIRED. Sets an alternate text to be displayed if the image is not displayed. If this is not supplied, either default text displays (if available) or the following message displays: “Image not displayed.” If alternative text is available, that should be the default text. When an alt tag is not associated with an image, the Top Line should be empty.	SUPPORTED.
height	*px (pixel)* *%*	Sets the height of the image.	NOT SUPPORTED. The true height parameters are determined by parsing the WBMP/ JPEG information.
hspace	*px* *%*	Sets white space to the left and right of the image.	SUPPORTED. The default is 0 pixel.
localsrc	*cdata*	Sets an alternate representation for the image.	NOT SUPPORTED.
src	*url*	REQUIRED. The path to the image. Must be either a .wbmp or JPEG file.	SUPPORTED.

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Attribute	Value	Description	Comments
`vspace`	*px* *%*	Sets white space above and below the image.	SUPPORTED. The default is 0 pixel.
`width`	*px* *%*	Sets the width of the image.	NOT SUPPORTED. The true width parameters are determined by parsing the WBMP/ JPEG information.
			2 of 2

The 4625SW Web browser follows the WML 1.3 specifications, and images can be used as hyperlinks. The <img> element can be contained in the following elements: <a>, <anchor>, <b>, <big>, <em>, <fieldset>, <i>, <p>, <small>, <strong>, <td>, and <u>.

Event Elements

- <do> tag - The <do> tag is a card-level user interface. It serves as a general mechanism to activate a task, usually performed by the user clicking a word or phrase in the display. A task is performed in response to an event. There are four tasks in WML: go, noop, prev, and refresh.

The mandatory **`type`** attribute provides information about the intent of the element, helping to improve processing. If the Web browser does not recognize the specified type, the specified type is treated as unknown. For example, testing, experimental, and vendor specific types would be unknown. The browser only renders WML 1.2 tags. Any other tags cause an error and the user receives a “not a valid wml page” error statement.

Attribute	Value	Description	Comments
`type`	accept prev help reset options delete unknown x-* vnd.*	REQUIRED. Defines the type of the “do” element.	SUPPORTED.
`label`	*cdata*	Creates a label for the “do” element.	Optional. Creates a string label for the element. The telephone browser imposes a six character limit. SUPPORTED.
			1 of 2

Attribute	Value	Description	Comments
`name`	*mmtoken*	Defines a name for the “do” element.	SUPPORTED.
`optional`	true false	If set to true, the browser ignores this element. If set to false, the browser does not ignore this element. Default is “false.”	NOT SUPPORTED.
			2 of 2

Type	Description	Comments
accept	Acknowledgement of acceptance.	SUPPORTED.
delete	Delete item.	SUPPORTED.
help	Request for help.	SUPPORTED.
options	Options or additional operations.	SUPPORTED.
prev	Backward navigation.	SUPPORTED.
reset	Clearing or reset.	SUPPORTED.
X-*n or x-*n	Experimental.	NOT SUPPORTED.
Vnd - any mix of upper and lower cases	Vendor-specific (to be determined)	SUPPORTED.

<do> tags are rendered as softkey labels on the bottom line of the display. <do> tags are specified per WML page and therefore are page context-sensitive. The eight “do” types are labeled either specifically in a WML page or by a browser-dependent label. The softkeys default to mixed case, where the first letter is capitalized and the remaining letters are lower case unless the Web designer specifies otherwise.

If no labels are given, then the “do” types have the following default labels:

Type	Default Label if no label specified
accept	ACCEPT
delete	DELETE
help	HELP
options	OPTIONS
prev	BACK
reset	REFRESH
X-*n or x-*n	UNKNOWN
Vnd* Any mix of upper or lower cases	AVAYA. Available for future use, but currently UNKNOWN.

All <do> tags with the type attribute `X*` or `x*` (experimental) and any vendor-specific tags are treated as unknown types.Therefore, shadow rules apply where the last attribute overwrites the previous attribute when a <do> tag with the same type and name. In this case, a <do> tag with the same type and name at the card level, shadows or renders a <do> tag inactive at the deck level. A <do> tag with the <noop> tag embedded is not rendered on the Web browser. An unspecified name attribute for the <do> tag defaults to the <type> attribute value. If a <do> tag is defined for the <card> tag and one already exists for the <wml> tag, the <card> tag overwrites that of the <wml> tag, assuming they are the same type and name.

If no <do> tags were specified, no softkeys display:

If one <do> tag was specified, these softkeys display:

1st DO

If multiple <do> tags are specified, display them as follows:

1st DO	2nd DO	3rd DO	MORE

Page 1 softkeys:

1st DO	2nd DO	3rd DO	MORE

Page 2 softkeys:

4th DO	5th DO	Etc.	MORE

Note:

If more than one page of softkey labels are specified, pressing the **MORE** softkey automatically presents the user with the next page of labels. If the last page displays and the user presses the **MORE** softkey, the first page of labels is then displayed. As implied in the examples, the Softkey buttons are labeled in sequential order of the <do> tags.

To render JPEG or WBMP images in the softkey area, embed <img> tags in the <do> tag. For example, the syntax might be:

```
<do type="example-accept" label="SK1">
  <go href="example-#card2"/>
  <img src="x.jpg"/>
</do>
```

Note:

When an image tag existing inside a <do> tag results in a failed attempt to retrieve the image through http, the softkey label displays the do tag label.

- <onevent> tag - The onevent tag serves as a container for code that you want executed automatically when one of the four intrinsic events occurs. The onevent element is said to bind (associate) the tasks (code) to the event for the element. You must specify the intrinsic event using the mandatory **`type`** attribute.

  For example, when a user presses the **BACK** softkey, instead of being routed to the previous screen, the user is directed to another specified page because this tag carries out an onevent backward event.

The intrinsic events are:

Event	**Permitted Tags**	**Description**
onenterbackward	card or template	Occurs when a <prev> navigates back onto a card. SUPPORTED.
onenterforward	card or template	Occurs when a <go> navigates into a card. SUPPORTED.
onpick	option	Occurs when a user selects/ deselects an item. SUPPORTED.
ontimer	card or template	Occurs when the time expires. SUPPORTED.

The template element creates code that is inserted into all cards in a single deck. The nested tags are: **go**, **noop**, **prev**, and **refresh**.

There are no visual implications for supporting the <onevent> tag.

Attribute	Value	Description	Comments
`type`	onenterbackward onenterforward onpick ontimer	REQUIRED. Specifies the type of the "onevent" element. **onenterbackward** - triggered when a <prev> goes to a previous card. **onenterforward** - triggered when a <go> goes to a card. **onpick** - triggered when an item is selected or deselected. **ontimer** - triggered when a timer expires.	SUPPORTED.

If there is more than one <onevent> tag defined with the same type in a deck or card, only the last <onevent> is rendered. Specifying more than one <onevent> tag inside an <anchor> tag causes an error.

- <postfield> tag - Use the postfield tag to set a name/value pair that can be transmitted during a URL request to an origin server, the request's source. The **`name`** attribute sets the name, which must be a valid WML variable name. The **`value`** attribute sets the value. There are no visual rendering implications with this tag.

Attribute	Value	Description	Comments
`name`	*cdata*	REQUIRED. The name of the field.	SUPPORTED.
`value`	*cdata*	REQUIRED. The value of the field.	SUPPORTED.

Task Elements

- <go> tag - The go element can contain one or more postfield elements. If a go element's destination is a card within the same deck, all postfield elements are ignored. The go element can also contain one or more setvar elements. Unlike postfield elements, there are no destination limitations on passing information contained in the setvar elements. The <go> nested tags, postfield and setvar, are supported.

Attribute	Value	Description	Comments
`href`	*url*	REQUIRED	SUPPORTED.
`accept-charset`	Charset_list	A comma- or space-separated list of character encoding the server must be able to process. The default value is "unknown". Used by the server to specify which character sets it supports in POST data the client sends. This applies only to POST data, since the character set that can be used to encode data sent in a GET is specified by URL-encoding rules. The accept-charset header is: **`accept-charset: US-ASCII, ISO-8859-1, UTF-8:q=0.1`**	SUPPORTED.
`method`	post get	Sets how to send the data to the server. Default method is get. When method="get", the data is sent as a request with*?data* appended to the URL. A get can be used only for a limited amount of data, which is a disadvantage. If you send sensitive information it is displayed on the screen and saved in the Web server's logs. With method="post", the data is sent as a request with the data sent in the body of the request. This method has no limit, and sensitive information is not visible. The data sent in a get method is limited to ASCII characters. The data sent in a post method can include non-ASCII characters that are included as part of a **`value`** attribute in an <input>, <select>, or <option> tag that is part of the current WML page.	SUPPORTED.

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Attribute	Value	Description	Comments
`sendreferer`	true false	If set to true, the browser sends the URL of the current deck with the request, which allow servers to perform simple access control on decks, based on which decks are linking to them. Default is “false.”	SUPPORTED.
			2 of 2

- <noop> tag - The noop tag dictates that no operation should be done. This tag can be used on the card level to prevent an event that is specified on the deck level by the template element from occurring. This tag can only be contained in either a do or onevent element.

  An example of noop is to use a <do> tag to add a “Back” link to the card. When users click the “Back” link, generally they should be taken back to the previous card. However, the <noop> tag prevents this operation. When the user clicks on the “Back” link nothing happens.
- <prev> tag - The prev tag specifies navigation to the previous URL in the history. Xml:lang is not an associated attribute.
- <refresh> tag - The refresh tag specifies a refresh task whereby whatever card is being displayed is refreshed. This task specifies the need for an update of the user agent context as specified by the contained <setvar> elements.This tag can only be nested inside an anchor, do, or onevent element. Xml:lang is not an associated attribute. User-visible side effects of the update can occur during the processing of the <refresh>.

Input Elements

- <input> tag supported - The input tag specifies a point where the user is prompted to enter text.

Attribute	Value	Description	Comments
accesskey	1,2,3,4,5, 6,7,8,9,0, *,#	A keypad key the user can press as a shortcut to selecting the link by pressing the primary softkey. If the element is a Radio button, pressing the access key is a shortcut for selecting the Radio button. If the element is a check box, pressing the access key is a shortcut to check or uncheck the box. If the element is a Submit or Reset button, pressing the access key is a shortcut for pressing that button. For example, pressing a Submit button's access key submits the applicable form.	NOT SUPPORTED.
name	*nmtoken*	REQUIRED. The name of the variable that is set with the result of the user's input.	SUPPORTED.
emptyok	true false	Sets whether the user can leave the input field blank or not. The WML default is "false."	SUPPORTED.
format		Sets the data format for the input field. Default is "M"	SUPPORTED.
	A	A = uppercase alphabetic or punctuation characters	
	a	a = lowercase alphabetic or punctuation characters	
	N	N = numeric characters	
	X	X = uppercase characters	
	x	x = lowercase characters	
	M	M = all characters	
	m	m = all characters	
	*f	*f = Any number of characters. Replace the f with one of the letters above to specify what characters the user can enter.	
	nf	nf = Replace the n with a number from 1 to 9 to specify the number of characters the user can enter. Replace the f with one of the letters above to specify what characters the user can enter. The user cannot exit the input box unless the correct number or type of characters is entered. The user does not receive an error message if incorrect data is entered.	

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Attribute	Value	Description	Comments
`ivalue`		The attribute **`value`** takes precedence over **`ivalue`**.	SUPPORTED.
`maxlength`	*number*	Sets the maximum number of characters the user can enter in the field.	SUPPORTED.
`size`	*number_of_char*	Sets the width of the input field.	NOT SUPPORTED.
`tabindex`	*number*	Sets the tabbing position for the input field.	NOT SUPPORTED.
`title`	*cdata*	Sets a title for the input field.	SUPPORTED.
`type`	text password	Indicates the type of the input field. The default value is "text."	SUPPORTED.
`value`	*cdata*	Sets the default value of the variable in the **`name`** attribute.	SUPPORTED.

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The **`value`** attribute takes precedence over **`ivalue`**. For example, the tag syntax is as follows:

```
<input title="Hello there" ivalue="Enter name here" />
```

The text box displays **[Enter name here]** instead of the default **[Enter text here]**. The page author can supply any text to the ivalue. Once the user enters text, the **`value`** attribute now equals the typed-in text. The words "Enter name here" disappear and the user-entered text remains in the text box.

The optional empty **`OK`** attribute sets a Boolean value that specifies whether empty input can be accepted, even if the format attribute is set. The WML default is false, which forbids empty values, while a true WML browser default permits empty values. This means that if the user is in text entry mode and the page author sets the value as false, the user cannot leave text entry mode without entering some characters. At this point, the phone must display the following message **"Input field cannot be empty"** so the user can make an entry and leave text entry mode.

The six display lines/cells associated with the phone's Feature buttons are available for input elements. The Top Line of the display cannot be used for input.

The input tag causes an automatic line break before and after input text.

Only one input tag can exist per display line.

When a user views a page with the input tag specified, the card title displays first. When the user scrolls to the first line containing input, the Top Line shows the input box title if specified, otherwise the card title is shown. The TopLine displays the card title for all non-input text.

When the input box is selected a vertical line, or cursor, appears at the beginning of the input box.

When a given character is selected, that character is immediately replaced with an asterisk. For example, the user takes an action that moves the cursor to the right of the current character, such as pressing a different dial pad key or pressing an arrow softkey. If the user returns to that character, it continues being displayed as an asterisk.

Only the correct size, type, and number of characters are accepted in to the input box. For example, if alpha text is specified and the user types in a symbol or numeric text, the user input will not be accepted. If the user enters the wrong kind of text, an error beep sounds. If the “n” (number) value is specified and the user enters an incorrect number of characters, that input is not accepted. The user cannot exit the field if this invalid character exists. The Top Line will displays the error message: “Invalid character. Please check and try again.”

Only use the attribute **`type`** password when it is important not to display the user' s password on the screen. Asterisks display instead. It is also important that the password not be cached.

The phrase **[Enter text here]** appears for all input tags if the **`value`** attribute is null. If the author specifies a non-null content in the **`value`** attribute, that content displays between brackets for that input tag.

Only the correct size, type, and number of characters are accepted in to the input box. For example, if alpha text is specified and the user types in a symbol or numeric text, the user input is not accepted. The screen repaints and the user has to re-enter the text. If the wrong kind of text is typed, the user receives an error tone. If the “n” (number) value is specified and the user types in the incorrect number of characters, that input is rejected.

See Text Elements for other text entry guidelines.

- <fieldset> tag - The fieldset tag is used to group logically related elements in a card. This tag is not supported.
- <optgroup> tag - Sets of <optgroup> brackets can be put around <options> in a <select> list. The results in breaking a list into sublists.

Attribute	Value	Description	Comments
`title`	*cdata*	Sets a title for the optgroup element.	SUPPORTED.

- <option> tag - A set of option tags is needed to specify each individual item in a list. This tag must be used with the select tag.

Attribute	Value	Description	Comments
`onpick`	*url*	Sets what is going to happen when a user selects an item.	SUPPORTED.
`title`	*cdata*	Sets a title for the option.	SUPPORTED.
`value`	*cdata*	Sets the value to use when setting the “name” variable in the select element.	SUPPORTED.

The user makes a selection as follows:

If an **`onpick`** attribute is specified, the user simply presses the associated Feature button(s). If no onpick is specified, the user must make a choice and use the (Do tag) softkey to execute that choice.

A WML page cannot specify both a do type (select softkey) and onpick on the same page. Either the do type or onpick specifies the next card's URL.

Feature buttons toggle the state. When a Feature button is initially pressed a choice is selected. Pressing the same Feature button again deselects the choice.

If an **`onpick`** attribute is defined for an <option> tag and the <option> tag also has an <onevent> tag defined, the **`onpick`** attribute supersedes the onevent binding.

- <select> tag - The select tag allows for the definition of a list, embedded in a card. This tag allows the user to choose inputs from a list rather than having to type a value. The select tag must be used with the option tag.

Attribute	Value	Description	Comments
`name`	*nmtoken*	Names the variable that is set with the index result of the selection.	SUPPORTED.
`ivalue`	*cdata*	Sets the pre-selected option element. If none is specified, the first item in a list is automatically selected.	SUPPORTED.
`multiple`	true false	Sets whether multiple items can be selected. Default is "false." False is used for a single selection.	SUPPORTED.
`tabindex`	*number*	Sets the tabbing position for the select element.	NOT SUPPORTED.
`title`	*cdata*	Sets a title for the list.	SUPPORTED.
`value`	*cdata*	Sets the default value of the variable in the **`name`** attribute.	SUPPORTED.

The graphic template to render single and multiple choice selections is defined as follows:

Single selection - a modified Radio button is rendered for single selection of multiple choices. A complete empty circle indicates the user did not select the associated item, while a complete empty circle with a round black dot in the center indicates user selection.

Multiple selection - a check box is rendered for multiple selections of multiple choices. An empty check box indicates the user did not select the associated item, while a check box(es) with a centered **X** indicates user selection(s).

Variable Elements

- <setvar> tag - There are no visual rendering implications with this tag.

Attribute	Value	Description	Comments
`name`	*cdata*	REQUIRED. Sets the name of the variable.	SUPPORTED.
`value`	*cdata*	REQUIRED. Sets the value of the variable.	SUPPORTED.

- <timer> tag - The timer tag sets a timer that starts counting. This tag must be used with <onevent type=”ontimer”> to be useful. The Web browser sets the timer value to **10** or to the value set in the <timer> tag, whichever is greater. A minimum setting of 10 equates to a minimum timer setting of one second.

Attribute	Value	Description	Comments
`value`	*cdata*	REQUIRED. Sets the default value of the variable defined in the **`name`** attribute.	SUPPORTED.
`name`	*nmtoken*	Names the variable that is set with the value of the timer.	SUPPORTED.

Character Entities

As with any syntactic language, WML has certain characters that have special meaning. The two most obvious of these characters are the **<** and **>** symbols, which surround all tags. These characters cannot be typed in directly if the designer's intent is to display these characters. Thus, all characters that can be displayed in a Web browser have numeric values assigned to them. The numeric values are entered into the source Web page as **&#*nnn***; where ***nnn*** is a three-digit value. For example, the **<** symbol is entered as '&#060;'.

In addition, many of these characters also have names assigned. Name values are entered into the source Web page as **&*name***; where ***name*** is the WML name associated with this character. For example, the **<** symbol would be entered as '&lt;'. The set of characters defined by the World Wide Web Consortium are fully supported in the Web browser in conformance with the standard.

For convenience, here are a few of these key symbols:

Description	Symbol	Numeric Entity	Name Entity
double quotation	“	&#34;	&quot;
ampersand	&	&#38;	&amp;
apostrophe	‘	&#39;	&apos;
less than	<	&#60;	

Image Support

WBMP Images

The 4625SW Web browser supports rendering of Wireless Bitmap (WBMP) images. WBMP is a graphic format optimized for mobile computing devices. At present WBMP supports only a simple picture format that is restricted to bi-level (black and white pixel) images.

A WBMP image is identified using a TypeField value, which describes encoding information such as pixel and palette organization, compression, and animation. The TypeField value also determines image characteristics according to WAP documentation. An Image Type Identifier represents Type Field values. Currently, there is only one type of WBMP specified. The Image Type Identifier label for this is 0.

This image type has the following characteristics:

- No compression
- One bit color (white=1, black=0)
- One bit deep (monochrome)

The 4625SW Web browser does not support graphic animation.

WBMP is part of the Wireless Application Protocol, Wireless Application Environment Specification Version 1.1. The WBMP specification is available at:

http://www.wapforum.org/docs/technical1.1/.

Many utilities are available as shareware to convert other graphical file formats to the WBMP format.

JPEG Images

In addition to WBMP, the 4625SW's Web browser supports renderings of JPEG images. JPEG stands for the Joint Photographic Experts Group, and is a digital image file format designed for maximal image compression. JPEG uses "lossy" compression in such a way that, when the image is decompressed, the human eye does not find the loss too obvious. The amount of compression is variable and the extent to which an image may be compressed without too much degradation depends partly on the image and partly on its use. JPEG is designed for compressing either full-color or gray-scale images of natural, real-world scenes. It works well on photographs, naturalistic artwork, and similar material. JPEG does not work as well on lettering, simple cartoons, or line drawings. JPEG handles only still images.

Image Rendering

The mime type for the WBMP is image/vnd.wap.wbmp. The mime type for the JPEG image is as follows:

Extension	Mime Type
jpe	image/jpeg
jpeg	image/jpeg
jpg	image/jpeg

Without a mime type, the Web servers are not able to process JPEG files.

Due to the current browser implementation, no text is rendered on the same line as an image. If a page author attempts to include both text and image on the same line, the image is rendered first, followed by the text.

Scrolling Through Images

Users can scroll through an image using the current navigation schema as described in Web Browser Navigation in Chapter 6.

The **Page Up/Down** Feature buttons (double up and down arrows) navigate up and down to a portion of the image that is not initially visible on the display.

Icon	Explanation
⏫	If the image is larger than the six lines of the display, move up an entire screen and display the image's previous six lines.
⏬	If the image is larger than the six lines of the screen, move down to line 7 and display up to the next six lines of image.
▲	When the user focuses on the first line of an image and the image spans multiple lines on the screen, the following occurs when the user presses Feature button **11** (line down navigation softkey): The focus drops to the bottom line of the image if the entire image can fit on the screen. For example, assume the image spans lines 1 to 5, and line 1 is in focus. The user presses Feature button **11**, and the focus shifts to the bottom of the image on line 5. If the user focuses on line 2 (and so forth) and presses Feature button **11**, again the last line of the image on the screen is put in focus. If the image does not fit on the screen, pressing Feature button **11** causes the focus to drop to the last line on the screen. For example, if the image spans lines 1 to 6 and does not fit on the screen, the focus shifts to the bottom of the screen on line 6.
▼	When the user focuses on the last line of an image and the image spans multiple lines on the screen, the following occurs when the user presses Feature button **8** (line up navigation softkey): The focus goes to the first line of the image if the entire image can fit on the screen. For example, if the image spans lines 1 to 5, the user focuses on line 5 and presses Feature button **8**. The focus shifts to the first line of the image on line 1. If the user focuses on line 2 (and so forth) and presses line up, again the first line of the image on the screen will be in focus. If the image does not fit on the screen, pressing Feature button **8** causes the focus to go to the first line on the screen. For example, if the image spans lines 1 to 6 and does not fit on the screen, the focus shifts to the bottom of the screen on line 6.

As another example, an image takes up three of the six available display lines. The user presses a navigation Feature button next to any of the three lines displaying the image, and the entire three lines of the image are brought into focus. The image itself does not change color when in focus, but the screen area outside of the image changes color when in focus.

Images can be a part of a link and be selectable. An image inside an <a> or an <anchor> tag can be selected to activate a <go> task. For information see Anchor Elements.

The browser follows the WML 1.3 specs which allow images to be used as hyperlinks. The img element can be contained within the following elements: a, anchor, p and do tags for softkeys.

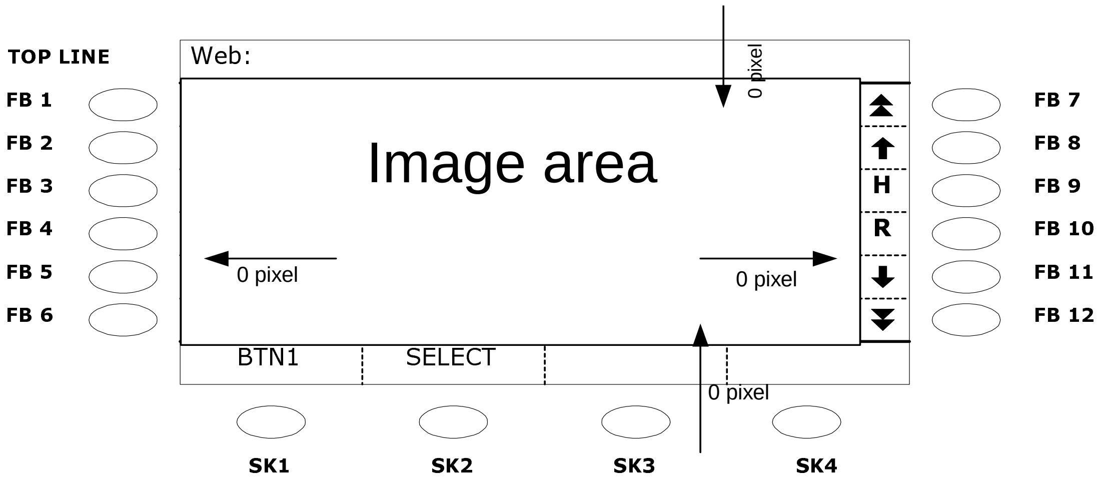
All supported images can have up to 3 Mbytes of volatile memory per WML file. Images cannot be partially parsed. If the memory size requirement is met and the size of the full image is less than 3 MB or the available memory, images larger than 96 lines are truncated by the graphic engine at the 96th line.

The browser processes images successfully as long as the upper limit of 3 Mbytes is not reached. The browser checks for sufficient memory as image processing starts. If sufficient memory to process the entire image is not found, the image's alternate text displays instead of the actual image. For example, there are ten images, the first four of which use 1.5 Kbytes. But the fifth image is 2.0 Mbytes, and the browser does not have sufficient memory to process that image. The browser will continue to process the next image if sufficient memory for that is available. The browser displays a page with first four images, then an image for which the alternate text is displayed, followed by the sixth image and so on. Alternate text is displayed only for those images where:

- the browser could not successfully parse the image file because of memory limitations,
- the image could not be found on the server (404 error), or
- the image file is corrupt.

When an image tag exists inside a <do> tag, and it results in a failed attempt to retrieve the image through http, the <do> tag's label attribute value (text) displays on the softkey label.

Image Justification



The Image Area is the screen area that is available for the browser to render that particular image. If an image overflows the image area, the graphic engine expands to the right and downward until the image completes or truncates the image at the image area’s border (screen glass). The **hspace** and **vspace** values define the Image Area.

Images line up with the left side Feature buttons as follows:

- A 0 (zero) pixel border on the left and right sides of all images displayed, as well as on top of any image displayed. The border area is empty.
- A 0 (zero) pixel border at the bottom.
- No 0 (zero) pixel border on the top of the remaining lines of images that span multiple lines.

Left-justified images begin at pixel 0. Center-justified images center at pixel 146. Right-justified images end at pixel 291.

The default values for hspace and vspace are 0 pixel. This default value is honored only if the authors have not specified their own hspace and vspace values.

Image Size

The maximum width of an image is 291 pixels. The maximum height is 30 pixels of height x 96 lines is 2880 pixels. Images greater than 291 X 1536 pixels are truncated. This is translated as the maximum image width being from pixel 1 to pixel 291. The maximum height is 96 lines. Images greater than the maximums are truncated.

Each Call Appearance/Application Area is 29 pixels in height, including one black pixel at the bottom of the area, making the maximum supported image height 96 lines x 30 pixels, or 2880 pixels.

To ensure the best image quality, use only images having an equal height and width. Odd width and/or height images will automatically be adjusted to even-sized images. For example, the right and/or bottom 1-pixel edge(s) will be removed.

JPEG images can appear in the softkey area. The softkey label area is 30 pixels in height, including one black pixel at the top of the area extending across the width of the display. Each softkey can be a maximum of 79 pixels in width and 29 pixels high.

Softkey #	Pixel Range
1	0 - 79
2	80 - 159
3	160 - 239
4	240 - 319

Scaling to reduce images to fit the screen is not supported. This means that if an image is bigger than the screen width/height, both the width and the height of the image will be truncated. WML is intended for small screens. Large images are not recommended.

Number of Images Supported

A maximum of 16 images can be displayed per card, in either the middle content area or softkey area. For any additional images that exceed this maximum number, the “alt” text is presented.

Support for Cascading Style Sheets

XHTML and **C**ascading **S**tyle **S**heets (CSS) are designed to separate content from its presentation. XHTML and WML tags were originally designed to define the content of a document. In this way, the same content can be rendered on diverse devices. Most XHTML elements are semantic elements, that is, they convey meaning about their content rather than information on how to display it. For example, the <em> element contains content that should be emphasized. It is up to the browser to figure out how to render the emphasis, with a different typeface, a louder voice, or in another way. Style sheets are a way to manage a Web page’s overall look such as the page background, background color or font color.

A style is a rule that tells the browser how to render a particular tag’s contents. Each tag has a number of style properties associated with it, whose values define how that tag is rendered by the browser. A rule defines a specific value for one or more tag properties. Style Sheets allow style information to be specified in many ways. The Web browser supports the inline style where a style attribute and tag along with a list of properties and their values are specified. The browser uses those style properties and values to render the tag’s contents.

The browser supports CSS2. CSS2 is compatible with both WML and XHTML and can be re-used if the browser evolves to XHTML. See http://www.w3.org/TR/CSS21/cascade.html for further details about CSS2.

Cascading Order

If more than one style is specified for a WML element, the multiple style definitions cascade into one style definition. Many factors affect the precedence of styles, including:

- The default style of the browser on the phone, that is, how elements are presented in the absence of presentation rules from a style sheet.
- Inheritance rules under which style rules are inherited by elements.
- A style rule that is more specific takes precedence over a less specific, conflicting rule. For example, a style rule applied to a class of elements takes precedence over a rule that applies to an element in general, and a rule that applies to an element ID takes precedence over both.
- In general, the most recent style rule in a document takes precedence over earlier style rules.
- If a style rule in a style sheet conflicts with a presentational attribute of a WML element, the style sheet takes precedence.

In lieu of a specific rule for a particular tag element, properties and their values for tags within tags are inherited from their parent tag. Thus, setting a property for the <wml> tag effectively applies that property to every tag in the body of the document, except for those that specifically override it. To make all the text in the page blue, code the following:

```
wml style="color:blue;"
```

rather than creating a rule for every tag used in the page.

This inheritance extends to any level. If the page author later creates a <p> tag with different color text. The style-conscious browser displays all the contents of <p> tag and all its included tags in that new color. When the <p> tag ends, the color reverts to that of the <wml> tag. For example, for WML:

- <card> tags inherit all <wml> tag properties.
- All <card> properties are inherited by <p>, <do>, <onevent>, <timer> tags.
- All <p> tag properties are inherited by other wml tags.

This inheritance is not restricted to its immediate child tags, but can cascade further down.

Also note that some inherited properties may not have any meaning in the scope of the child tag. For example, a background color defined for a <card> tag has no meaning for a <onevent> tag that has no visual rendering.

Table 17 shows which WML tags are parent and which tags inherit properties.

Table 17: WML Inheritance Table

Col1 No inheritance.	**Col2** Tag in column inherits from tag in column 1.	**Col3** Tag in column inherits from tag in column 1.	**Col4** Tag in column inherits from tag in column 1.	**Col5** Tag in column inherits from tag in column 1.	**Col6** Tag in column inherits from tag in column 1.	**Col7** Tag in column inherits from tag in column 1.	**Col8** Tag in column inherits from tag in column 1.	**Col9** Tag in column inherits from tag in column 1.	**Col10** Tag in column inherits from tag in column 1.
wml									
	card	do	go	postfield					
				setvar					
			noop						
			prev	setvar					
			refresh	setvar					
		onevent	go	postfield					
				setvar					
			noop						
			prev	setvar					
			refresh	setvar					
		timer							
		p		a	br				
					img				
				anchor	br				

1 of 4

Table 17: WML Inheritance Table (continued)

Col1 No inheritance.	Col2 Tag in column inherits from tag in column 1.	Col3 Tag in column inherits from tag in column 1.	Col4 Tag in column inherits from tag in column 1.	Col5 Tag in column inherits from tag in column 1.	Col6 Tag in column inherits from tag in column 1.	Col7 Tag in column inherits from tag in column 1.	Col8 Tag in column inherits from tag in column 1.	Col9 Tag in column inherits from tag in column 1.	Col10 Tag in column inherits from tag in column 1.
					go	postfield			
						setvar			
					img				
					prev	setvar			
					refresh	setvar			
				br					
				do	go	postfield			
						setvar			
					noop				
					prev	setvar			
					refresh	setvar			
				i					
				input					
				img					
				select					
					optgroup	optgroup			
						option	onevent	go	postfield

2 of 4

Table 17: WML Inheritance Table (continued)

Col1 No inheritance.	Col2 Tag in column inherits from tag in column 1.	Col3 Tag in column inherits from tag in column 1.	Col4 Tag in column inherits from tag in column 1.	Col5 Tag in column inherits from tag in column 1.	Col6 Tag in column inherits from tag in column 1.	Col7 Tag in column inherits from tag in column 1.	Col8 Tag in column inherits from tag in column 1.	Col9 Tag in column inherits from tag in column 1.	Col10 Tag in column inherits from tag in column 1.
									setvar
								noop	
								prev	setvar
								refresh	setvar
					option	onevent	go	postfield	
								setvar	
							noop		
							prev	setvar	
							refresh	setvar	
	head	access							
		meta							
	template	do	go	postfield					
				setvar					
			noop						
			prev	setvar					
			refresh	setvar					
		onevent	go	postfield					

3 of 4

Table 17: WML Inheritance Table (continued)

Col1	Col2	Col3	Col4	Col5	Col6	Col7	Col8	Col9	Col10
No inheritance.	Tag in column inherits from tag in column 1.	Tag in column inherits from tag in column 1.	Tag in column inherits from tag in column 1.	Tag in column inherits from tag in column 1.	Tag in column inherits from tag in column 1.	Tag in column inherits from tag in column 1.	Tag in column inherits from tag in column 1.	Tag in column inherits from tag in column 1.	Tag in column inherits from tag in column 1.
				setvar					
			noop						
			prev	setvar					
			refresh	setvar					

4 of 4

Table 18 provides a list of CSS2-affected WML tags. Applicable tags are indicated by a **Yes**. The Color column applies to the foreground color, while the Background Color column is the alternative used to set the background color.

Table 18: WML Tags to Which CSS2 Applies

WML Tag	CSS2 Property	
	Color	**Background Color**
wml	Yes	Yes
card	Yes	Yes
template	Yes	Yes
br/	Yes	Yes - see Note below
p	Yes	Yes
a	Yes	Yes
anchor	Yes	Yes
img	Yes	Yes
do	Yes	Yes
onevent		
postfield		
go		
noop		
prev		
refresh		
input	Yes	Yes
optgroup	Yes	Yes
option	Yes	Yes
select		
setvar		
timer		

Note:

The <br/> tag’s color setting needs to support color property so the inverse color shows when a line with this tag is in focus.

CSS2 Specifications

The browser supports Cascading Style Sheets Version 2 to render color backgrounds, text and images.

Syntax

The CSS2 syntax the browser uses is made up of three parts - a wml tag with a new attribute called style, a property, and a value:

```
WML tag style= “property: value”
```

The property is the attribute that will be changed, and each property can take a value. The property and value are separated by a colon and surrounded by quotes.

To specify more than one property, separate each property with a semi-colon:

```
style="property1:value1; property2: value2; ... ; propertyN:
  valueN"
```

The browser uses CSS2 with inline styles. The style attribute can be used with every WML tag. The style attribute can contain only the CSS properties. The code example that follows shows how to change the color:

```
    <p style="color: sienna">
    This is a paragraph
</p>
```

Another example is:

```
<wml> tag:
   <wml style= “|properties|”> .. </wml>
<card> tag:
   <card style= “|properties|” title=”Card Title”> .. </card>
<p> tag:
   <p style= “|properties|” mode=”wrap”> .. </p>
<a> tag:
   <a style= “|properties|” href=”…”>Link </a>
```

Note:

The browser does not support external stylesheet linking using <link> tags. For example, **<link rel=”stylesheet” type=”text/css” href=”phone.css”/>** is not supported.

CSS Background Properties

The Background properties control an element’s background color, set an image as the background, repeat a background image vertically or horizontally, and position an image on a page.

Property	Description	Value
background- color	Sets the background color. Used to paint the background color of the screen.	*color-rgb* *color-hex* *color-name* transparent

If a background color is set, set the foreground to a contrasting color, so that its content remains visible. The transparent value allows the parent element's color to show.

CSS Text Properties

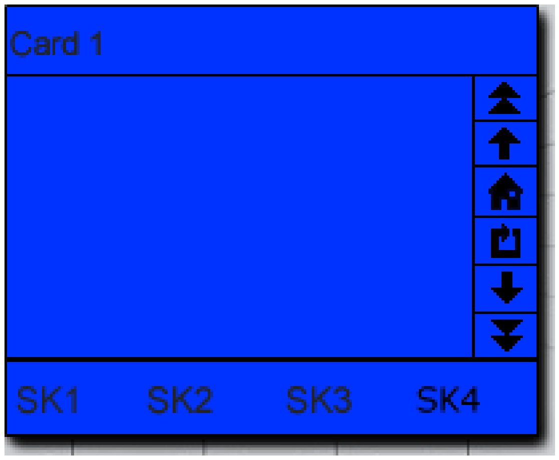
Text properties allow for control of the text appearance. It is possible to change the color of a text, increase or decrease the space between characters in a text, align a text, decorate a text, indent the first line in a text, and more.

Property	Description	Value
color	Sets the foreground color. Used to paint the icons (not including the navigation bar), brackets for text editing, text, numbers, symbols, horizontal line under the Top Line, horizontal line above the softkeys.	*color*

Code Examples

<wml> Example with the entire page blue

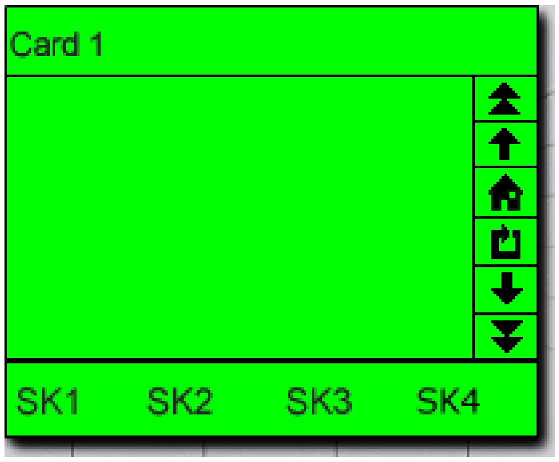
```
<wml style=”background-color:blue;”>
    <card>
    </card>
 </wml>
```

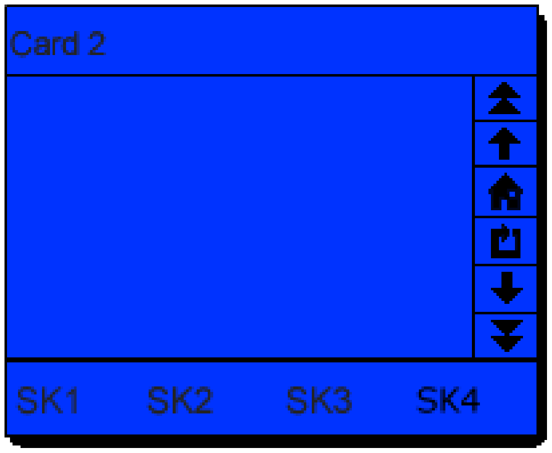


<card> Example

The <wml> tag and the first <card> tag have CSS2 style attributes defining background colors. The second card does not have a defined background attribute and therefore the second card inherits the color from the <wml> tag.

```
<wml style=”background-color:blue;”>
    <card style=”background-color:green;” title=”Card 1”>
    </card>
    <card title=”Card 2”>
    </card>
 </wml>
```

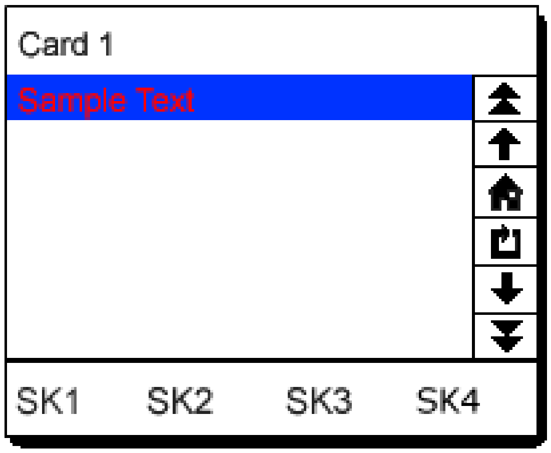




<p> tag Example

This example shows the background-color and color attribute specifying the font color. A second card does not have a defined background attribute and therefore would inherit the color from the <wml> tag.

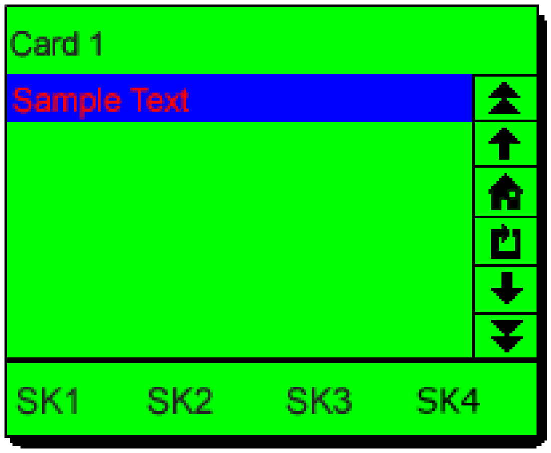
```
<wml>
    <card title=”Card 1”>
     <p style= ”background-color:blue; text:red;”>
          Sample Text
     </p>
    </card>
</wml>
```



Another <p> tag Example

This example illustrates using the background-color specified in the <card> tag for the whole page and a special color specification for the <p> tag.

```
<wml>
  <card style="background-color:green;" title="Card 1">
    <p style= "background-color:blue; text:red;">
       Sample Text
    </p>
  </card>
</wml>
```

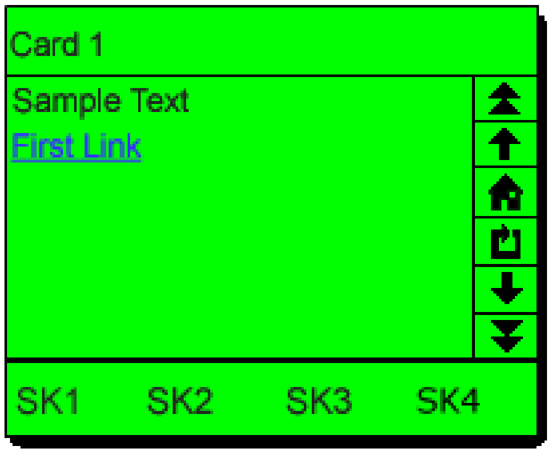

Card 1

Sample Text

First <a> tag Example

CSS2 properties for an <a> tag are inherited from its parent <p> tag. Properties can also be inherited from <p>'s parent tag <card> tag, etc. This example shows that the background-color is specified in the <card> tag for the whole page and a special color is specified for the <a> tag.

```
<wml>
    <card style=”background-color:green;” title=”Card 1”>
      <p>
        Sample Text
        <a href=”1.wml” style= ”background-color:green; text:medium blue;”>
         First Link
        </a>
      </p>
    </card>
    </wml>
```


Card 1

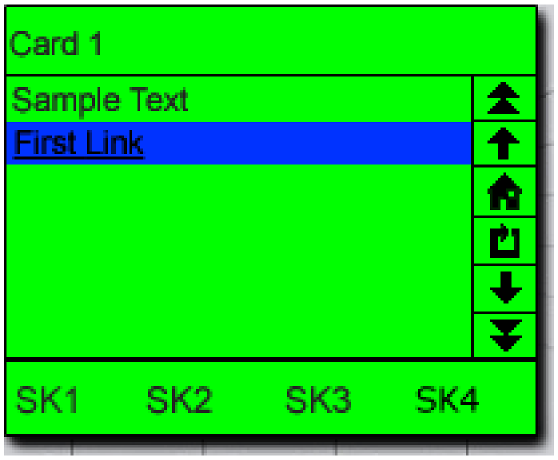
Sample Text

First Link

Second <a> tag Example

The CSS attributes for the <a> tag are inherited from its parent <p> tag. In the following example, the parent <p> tag defines the font color of the <a> tag, but the background-color of the <a> tag overrides the parent <p> tag.

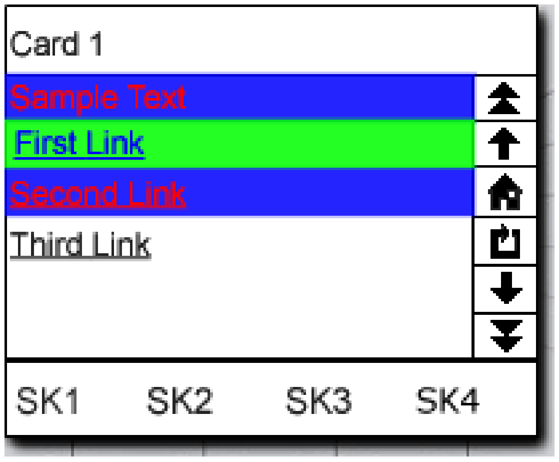
```
<wml>
  <card style=”background-color:green;” title=”Card 1”>
    <p>
       Sample Text
       <a href=”1.wml” style= ”background-color:blue;”>
          First Line
       <a>
    </p>
  </card>
</wml>
```


Card 1
Sample Text
First Link
SK1 SK2 SK3 SK4

Third <a> tag Example

In this example neither the <card> nor the <wml> tags has any style attributes, so there is nothing to which to default. The <p> tag has a style defined such that it gets a background color of blue and font color of red. The first link (<a> tag) has a background-color defined as green and font color in blue. However, the second link (<a> tag) does not have any style defined, so it inherits the color selection from the <p> tag. The third link, the <a> tag, has no properties defined nor does it have an immediate parent <p> tag. Since no style is defined, the link is rendered with the default background color and font color.

```
<wml>
    <card title="Card 1">
      <p style= "background-color:blue;color:red">
        Sample Text
        <a href="1.wml" style= "background-color:green;color:red">
          First Link
        </a>
        <a href="2.wml">
          Second Link
        </a>
      </p>
      <p>
        <a href="3.wml">
          Third Link
        </a>
      </p>
    </card>
</wml>
```


Card 1

Sample Text

First Link

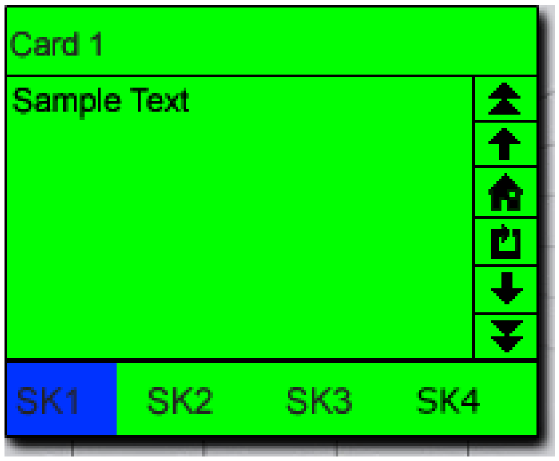
Second Link

Third Link

<do> tag Example

CSS2 properties for a <do> tag are inherited from its parent <card> tag. The CSS2 properties for a <card> tag are inherited from its parent <wml> tag This example shows that the <do> tags can define a separate background color for a softkey than from rest of the page.

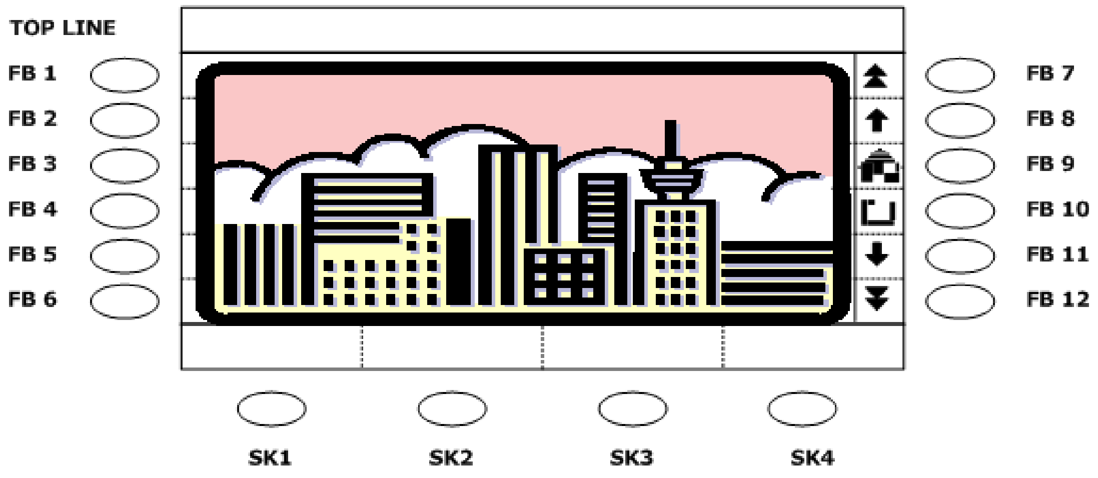
```
<wml>
    <card style=”background-color:green;” title=”Card 1”>
      <p>
        Sample Text
      </p>
      <do type= “accept” label= “SK1” style=”background-color:blue;”
        <go href=”1.wml”/>
      </do>
    </card>
</wml>
```



CSS2 Color Image Support Examples

In this example, the image spans across the browser's screen.

```
<wml>
  <card style="background-color:blue;" title="Card 1">
    <p>
       <img src="Avaya.jpeg" alt+"Avaya building"/>
    </p>
  </card>
</wml>
```

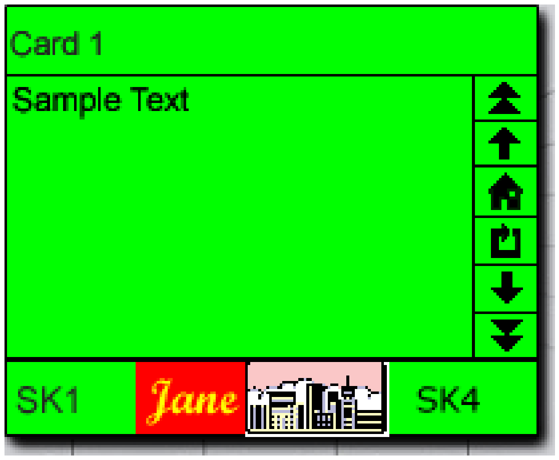


The image in the above diagram can be supported as either:

- A series of six individual images with the slices cut exactly to fit each line. This way the page author must send six images. When displayed on the browser, the six images look like one single image.
- A large image that is left justified on line 1 and expands to cover the screen exactly.

<do> tag image support for softkeys

To render JPEG or WBMP images in the softkey area, use the CSS2 property background-image with a <do> tag.



This example shows multiple <do> tags with images embedded in them. The first <do> tags have a background image and a label (SK1). Softkey 1's font color is inherited from the <card>. The second <do> tag shows the background image ("red.jpg") and a color ("yellow") as set by the style attribute. The third <do> tag has an image that does not completely fit in softkey 3. The user can see the background color where the image does not cover the softkey area.

The code example that follows embeds <img> tags in the <do> tags:

```
<wml>
  <card style=”background-color:blue;” title=”Card 1”>
    <p>
       Sample Text
    </p>
    <do type= “accept” label= “SK1”>
       <img src= “blue.jpg”/>
       <go href=”1.wml”/>
    </do>
    <do type= “accept” label= “SK2” style=”color:yellow;”>
       <img src= “red.jpg”/>
       <go href=”1.wml”/>
    </do>
    <do type= “accept”>
       <img src= “hotel.jpg”/>
       <go href=”1.wml”/>
    </do>
  </card>
</wml>
```

Colors Specification

Properties that set colors accept the standard 16 HTML 4.0 color keywords (color=”yellow”) or RGB values. RGB values can be specified in short hexadecimal format (color=”#FF0”), long hexadecimal format (color=”#FFFF00”).

If an invalid color name is specified, for example, bluu rather than blue, the default color is used. A card’s background color is extended to empty cells, empty lines, empty softkey areas, and the **MORE** softkey. For example, if a card’s background color is specified as blue, and the contents occupy only three lines, the background color extends to the remaining three empty lines. The Web Authentication screen, Text Entry softkey color, and Symbol Text Entry screen will take on the default Web background and text color. The Topline color will match the background and text color of the line or cell currently in focus.

For more information on specifying colors in style sheets, see Section 4.3.6, “Colors” in the *W3C CSS2 Specification* available at http://www.w3.org/TR/REC-CSS2.

Possible Value	Description
Color	The color value can be a color name (red) or a hex number (#ff0000). 16 bit colors are supported.
Transparent	The background color is transparent.

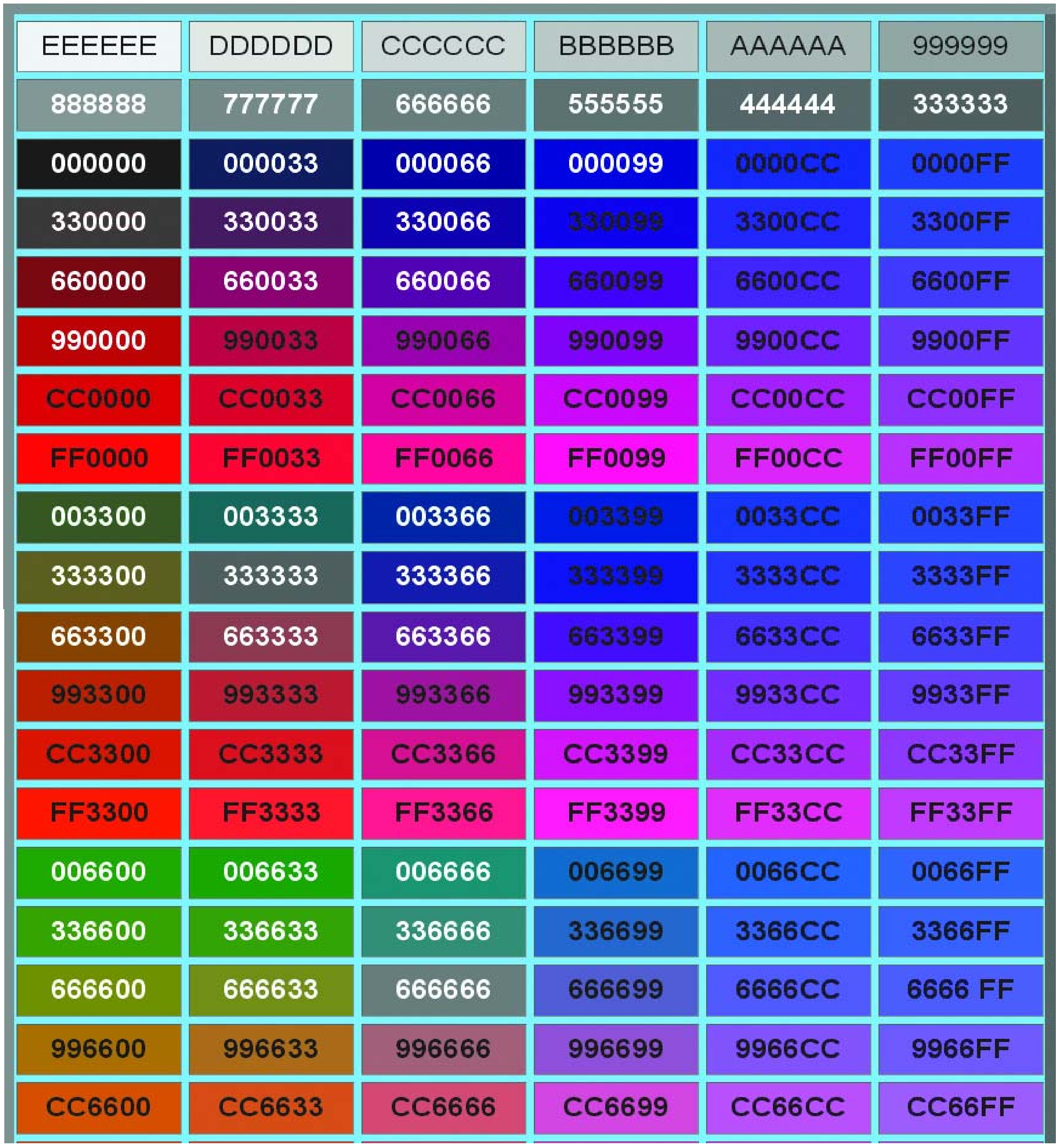
Colors and Fonts

The foreground color CSS2 property is used to paint the icons (not including the navigation bar) and brackets for text editing. The navigation bar, excluding the vertical line, remains the same color regardless of how the foreground color is set.

The 4625SW has a color browser that supports rendering of 256 colors. Properties that set colors accept the standard 16 HTML 4.0 color keywords (for example, color=”yellow”) as shown in Table 19 or RGB values as shown in Table 20. You can specify RGB values any of these ways:

- short hexadecimal format, for example, color=”#FF0”
- long hexadecimal format, for example, color=”FFFF00”

Table 19: Supported Colors and Corresponding Hexadecimal Coding



EEEEEE	DDDDDD	CCCCCC	BBBBBB	AAAAAA	999999
888888	777777	666666	555555	444444	333333
000000	000033	000066	000099	0000CC	0000FF
330000	330033	330066	330099	3300CC	3300FF
660000	660033	660066	660099	6600CC	6600FF
990000	990033	990066	990099	9900CC	9900FF
CC0000	CC0033	CC0066	CC0099	CC00CC	CC00FF
FF0000	FF0033	FF0066	FF0099	FF00CC	FF00FF
003300	003333	003366	003399	0033CC	0033FF
333300	333333	333366	333399	3333CC	3333FF
663300	663333	663366	663399	6633CC	6633FF
993300	993333	993366	993399	9933CC	9933FF
CC3300	CC3333	CC3366	CC3399	CC33CC	CC33FF
FF3300	FF3333	FF3366	FF3399	FF33CC	FF33FF
006600	006633	006666	006699	0066CC	0066FF
336600	336633	336666	336699	3366CC	3366FF
666600	666633	666666	666699	6666CC	6666 FF
996600	996633	996666	996699	9966CC	9966FF
CC6600	CC6633	CC6666	CC6699	CC66CC	CC66FF

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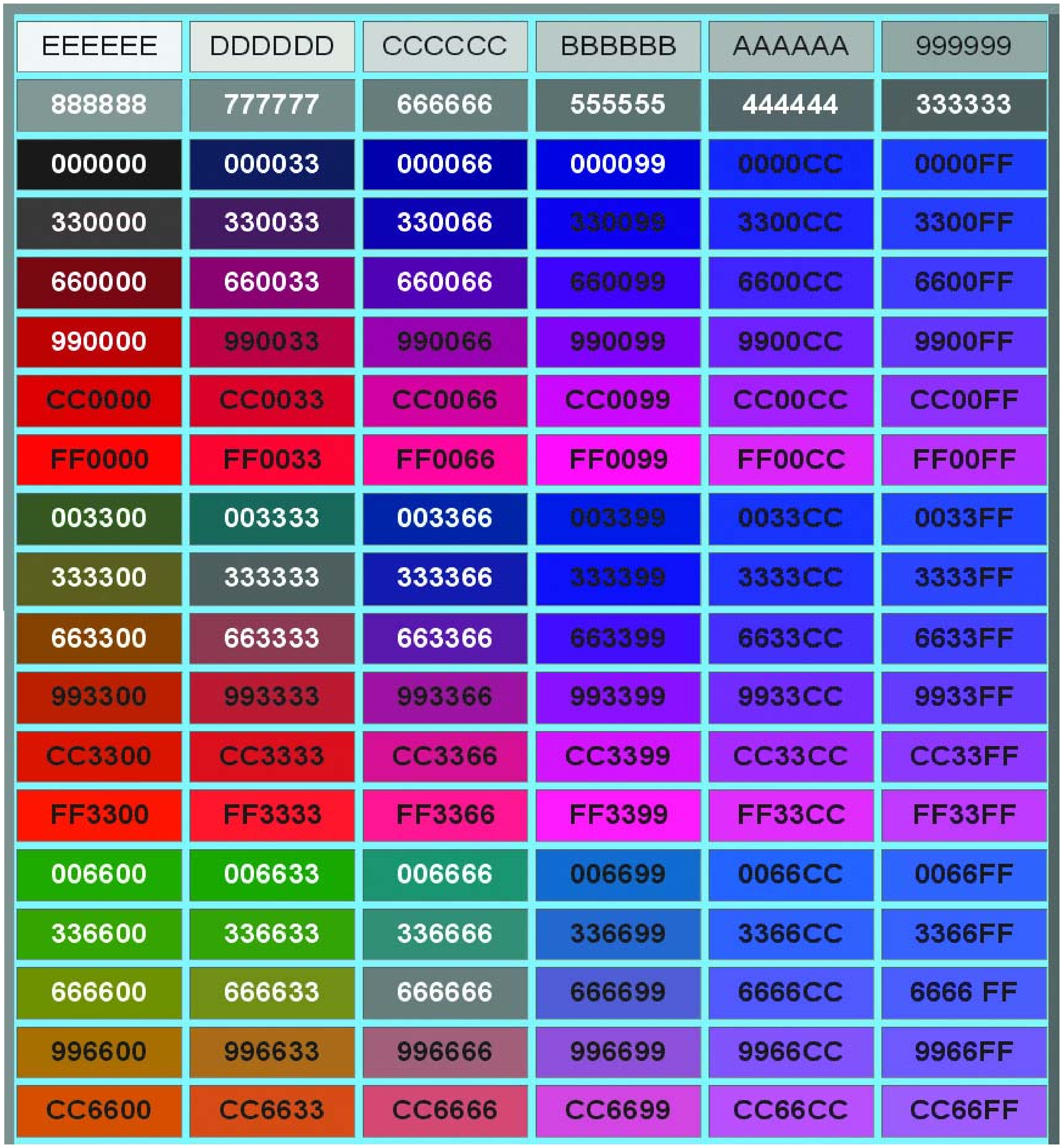
Table 19: Supported Colors and Corresponding Hexadecimal Coding (continued)



EEEEEE	DDDDDD	CCCCCC	BBBBBB	AAAAAA	999999
888888	777777	666666	555555	444444	333333
000000	000033	000066	000099	0000CC	0000FF
330000	330033	330066	330099	3300CC	3300FF
660000	660033	660066	660099	6600CC	6600FF
990000	990033	990066	990099	9900CC	9900FF
CC0000	CC0033	CC0066	CC0099	CC00CC	CC00FF
FF0000	FF0033	FF0066	FF0099	FF00CC	FF00FF
003300	003333	003366	003399	0033CC	0033FF
333300	333333	333366	333399	3333CC	3333FF
663300	663333	663366	663399	6633CC	6633FF
993300	993333	993366	993399	9933CC	9933FF
CC3300	CC3333	CC3366	CC3399	CC33CC	CC33FF
FF3300	FF3333	FF3366	FF3399	FF33CC	FF33FF
006600	006633	006666	006699	0066CC	0066FF
336600	336633	336666	336699	3366CC	3366FF
666600	666633	666666	666699	6666CC	6666 FF
996600	996633	996666	996699	9966CC	9966FF
CC6600	CC6633	CC6666	CC6699	CC66CC	CC66FF

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Table 20: Supported Colors by Name and Hex Coding

Aliceblue F0F8FF	Antiquewhite FAEBD7	Aqua 00FFFF
Aquamarine 7FFFD4	Azure F0FFFF	Beige F5F5DC
Bisque FFE4C4	Burlywood DEB887	Blanchedalmond FFEBCD
Blue 0000FF	Blueviolet 8A2BE2	Brown A52A2A
Black 000000	Cadetblue 5F9EA0	Chartreuse 7FFF00
Chocolate D2691E	Coral FF7F50	Cornflowerblue 6495ED
Cornsilk FFF8DC	Crimson DC143C	Cyan 00FFFF
Darkblue 00008B	Darkcyan 008B8B	Darkgoldenrod B8860B
Darkgray A9A9A9	Darkgreen 006400	Darkkhaki BDB76B
Darkmagenta 8B008B	Darkolivegreen 556B2F	Darkorange FF8C00
Darkorchid 9932CC	Darkred 8B0000	Darksalmon E9967A
Darkseagreen 8FBC8F	Darkslateblue 483D8B	Darkslategray 2F4F4F
Darkturquoise 00CED1	Darkviolet 9400D3	deeppink FF1493
Deepskyblue 00BFFF	Dimgray 696969	Dodgerblue 1E90FF

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Table 20: Supported Colors by Name and Hex Coding (continued)

Firebrick B22222	Floralwhite FFFAF0	Forestgreen 228B22
Fuchsia FF00FF	Gainsboro DCDCDC	Ghostwhite F8F8FF
Gold FFD700	Goldenrod DAA520	Gray 808080
Green 008000	Greenyellow ADFF2F	Honeydew F0FFF0
Hotpink FF69B4	Indianred CD5C5C	Indigo 4B0082
Ivory FFFFF0	Khaki F0E68C	Lavender E6E6FA
Lavenderblush FFF0F5	Lawngreen 7CFC00	Lemonchiffon FFFACD
Lightblue ADD8E6	Lightcoral F08080	Lightcyan E0FFFF
Lightgoldenrodyellow FAFAD2	Lightgreen 90EE90	Lightgrey D3D3D3
Lightpink FFB6C1	Lightsalmon FFA07A	Lightseagreen 20B2AA
Lightskyblue 87CEFA	Lightslategray 778899	Lightsteelblue B0C4DE
Lightyellow FFFFE0	Lime 00FF00	Limegreen 32CD32
Linen FAF0E6	Magenta FF00FF	Maroon 800000
Mediumauqamarine 66CDAA	Mediumblue 0000CD	Mediumorchid BA55D3

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Table 20: Supported Colors by Name and Hex Coding (continued)

Mediumpurple 9370D8	Mediumseagreen 3CB371	Mediumslateblue 7B68EE
Mediumspringgreen 00FA9A	Mediumturquoise 48D1CC	Mediumvioletred C71585
Midnightblue 191970	Mintcream F5FFFA	Mistyrose FFE4E1
Moccasin FFE4B5	Navajowhite FFDEAD	Navy 000080
Oldlace FDF5E6	Olive 808000	Olivedrab 688E23
Orange FFA500	Orangered FF4500	Orchid DA70D6
Palegoldenrod EEE8AA	Palegreen 98FB98	Paleturquoise AFEEEE
Palevioletred D87093	Papayawhip FFEFD5	Peachpuff FFDAB9
Peru CD853F	Pink FFC0CB	Plum DDA0DD
Powderblue B0E0E6	Purple 800080	Red FF0000
Rosybrown BC8F8F	Royalblue 4169E1	Saddlebrown 8B4513
Salmon FA8072	Sandybrown F4A460	Seagreen 2E8B57
Seashell FFF5EE	Sienna A0522D	Silver C0C0C0
Skyblue 87CEEB	Slateblue 6A5ACD	Slategray 708090

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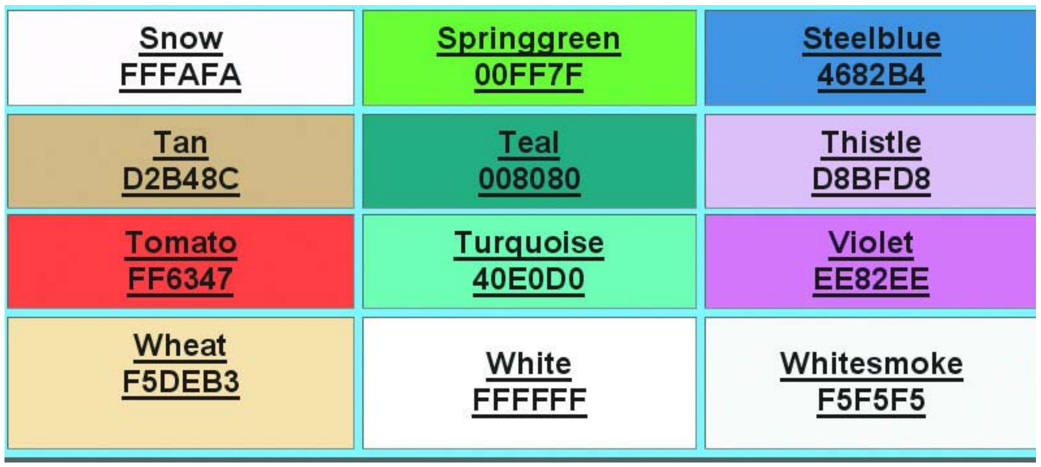
Table 20: Supported Colors by Name and Hex Coding (continued)



Snow FFFAFA	Springgreen 00FF7F	Steelblue 4682B4
Tan D2B48C	Teal 008080	Thistle D8BFD8
Tomato FF6347	Turquoise 40E0D0	Violet EE82EE
Wheat F5DEB3	White FFFFFF	Whitesmoke F5F5F5

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