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Speech Development, Processing, and Recognition

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Contents

About This Book

Overview

Most applications, usually written using the transaction state machine (TSM) script-level language or C language, involve some form of speech. For example, playing recorded phrases, recognizing speech input, recording spoken phrases, or playing synthesized speech to name a few. An application may use one, some, or all forms of speech the system has to offer.

This book offers detailed information about the features available for developing speech.

Intended Audiences

The primary audience for *UCS 1000 R4.2 Speech Development, Processing, and Recognition*, 585-313-212, is as follows:

- End customer developers

  This group is responsible for creating and maintaining applications in the system environment.

- Custom application developers

  This group is responsible for creating applications to be used in the system environment for end-user customers. This audience includes any Lucent Technologies custom application developers.

How This Book Is Organized

This book is contains the following sections:

- Chapter 1, Overview of Speech — Provides an overview of speech on the server, information about the speech file system and a discussion of all of the speech-related features available for the development of voice response applications.
- Chapter 2, Developing Speech — Describes the procedures involved in producing speech, from determining the transaction and planning the script to recording and encoding the speech.
- Chapter 3, Recognizing WholeWord Speech Input on the SSP — Discusses the concepts behind WholeWord speech recognition and includes sections on creating WholeWord vocabularies and improving the accuracy of speech recognition as it pertains to the SSP circuit card.
- Chapter 4, Recognizing FlexWord™ Speech Input on the SSP — Includes a detailed discussion of FlexWord speech recognition and its features as it pertains to the SSP circuit card.
- Chapter 5, Recognizing Dial Pulse Input — Discusses the recognition of dial pulses on rotary or push button telephones using the SSP circuit card.

- Chapter 6, Putting It Together for the SSP — Discusses how to make the various speech-related features and work well together in a voice response application using the SSP circuit card.
- Chapter 7, Recognizing WholeWord Speech Input on the LSPS II — Discusses the concepts behind WholeWord speech recognition and includes sections on creating WholeWord vocabularies and improving the accuracy of speech recognition using the LSPS II circuit card.
- Chapter 8, Recognizing FlexWord Speech Input on the LSPS II — Includes a detailed discussion of FlexWord speech recognition and its features using the LSPS II circuit card.
- Chapter 9, Putting It Together for the LSPS II — Discusses how to make the various speech-related features and work well together in a voice response application using the LSPS II circuit card.
- Appendix A, Speech File Formats — Includes information about speech files and speech file formats, including pulse code modulation (PCM) and adaptive differential pulse code modulation (ADPCM).
- Appendix B, Advanced Text-to-Speech Features — Discusses how to customize synthesized speech by using escape sequences to add silence delays, change the speaking rate, select the speaking voice gender, and mark text as belonging to a specific text category.
- Glossary — Defines the terms, abbreviations, and acronyms used in system documentation.
- Index — Alphabetically lists the principal subjects covered in the book.

Conventions Used in This Book

Note: Any screens shown in this book are examples only. The screens you see on your machine will be similar, but not exactly the same.

Terminology

- The word "type" means to press the key or sequence of keys specified. For example, an instruction to type the letter "y" is shown as

  Type **y** to continue.

- The word "type" means to type a value and then press the **ENTER** key on the keyboard. For example, an instruction to type the letter "y" and press **ENTER** is shown as

  Type **y** to continue.

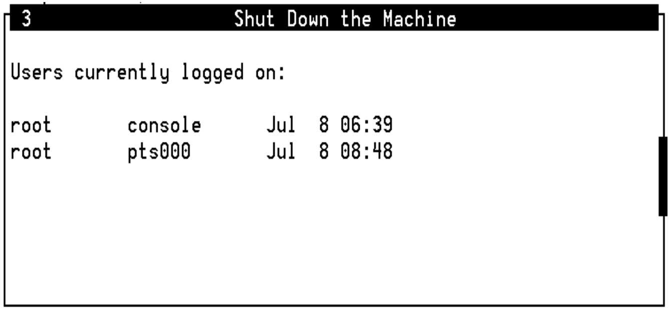
- The word "select" means to move the cursor to the desired menu item and then press **ENTER**. For example, an instruction to move the cursor to the start test option on the Network Loop-Around Test screen and then press **ENTER** is shown as

  Select **Start Test.**

- The system displays *windows, screens, and menus* (Figure 1 on page xxvii through Figure 4 on page xxix). Windows and screens both show and request system information. Menus (Figure 5 on page xxx) present options from which you can choose to view another menu, or a screen or window

Example of a Window Showing Information

Figure 1. Windows Showing Information



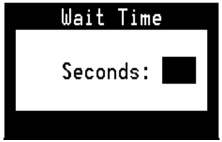
Example of a Window Showing Information

Figure 2. Window Showing Information

```
UnixWare Installation         Primary Hard Disk Partitioning

In order to install LINCS, you should reserve a UNIX system
partition (a portion of your hard disk’s space) containing
100% of the space on your primary hard disk. After you press
’ENTER’ you will be shown a screen that will allow you to
create new partitions, delete existing partitions or change
the active partition of your primary hard disk (the partition
that your computer will boot from).

WARNING: All files in any partition(s) you delete will be
destroyed. If you wish to attempt to preserve any files from
an existing UNIX system, do not delete its partitions(s).

The UNIX system partition that you intend to use on the
primary hard disk must be at lease 4200 MBs and labeled
"ACTIVE."

Press ’ENTER’ to continue
```

Example of a Window Requesting Information

Figure 3. Window Requesting Information



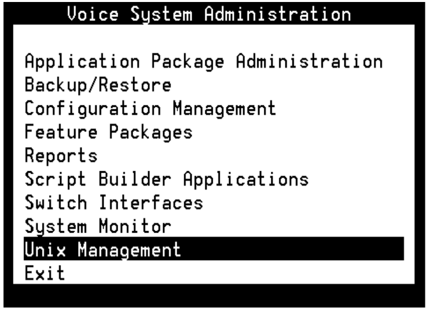
Example of a Screen Requesting Information

Figure 4. Screen Requesting Information

```
UNIX System Installation                              Set Slice Sizes

Please select whether you would like the recommended slice
sizes or would like to customize the slice sizes.

Your choices are:
1. Recommended Slice Sizes
2. Customize Slice Sizes

Press '1' or '2' followed by 'ENTER': 1
```

Example of a Menu Showing Information

Figure 5. Example of a Menu



Example of Terminal Keys

- Keys that you press on your terminal or PC are represented as small, capitalized **BOLD** text. For example, an instruction to press the enter key is shown as

  Press **ENTER**.

- Two or three keys that you press at the same time on your terminal or PC (that is, you hold down the first key while pressing the second and/or third key) are represented as a series of small **capitalized** text separated by the + sign. For example, an instruction to press and hold **ALT** while typing the letter "d" is shown as

  Press **ALT+D**.

- Function keys on your terminal, PC, or system screens, also known as soft keys, are represented as small **capitalized** text followed by the function or value of that key enclosed in parentheses. For example, an instruction to press function key 3 is shown as

  Press **F3** (Choices).

- Keys that you press on your telephone keypad are represented as **bold proportional** text. For example, an instruction to press the first key on your telephone keypad is shown as

  Press **1** to record a message.

Screen Displays

- System messages, field names, and prompts that appear on the screen are shown in `type-writer text`, as shown in the following examples:
  - ~ Enter the number of ports to be dedicated to outbound traffic in the `Maximum Simultaneous Ports` field.
  - ~ Enter **y** in the `Message Transfer?` field.
  - ~ The system displays the following message:

    `Installation in progress.`
- The sequence of menu options that you must select to display a specific screen or submenu appears in a series of boxes.

- The sequence of menu options that you must select to display a specific screen or submenu is shown as follows:

  Start at the Voice System Administration menu and select:

```
> Reports
    > Message Log Report
```

  In this example, you would access the Voice System Administration menu and select the Reports menu. From the Reports menu, you would then select the Message Log Report window.

Some Screen Simulations

Text in a simulated screen display appears in `type-writer text`.

Example:

```
            QuickStart - Data Recovery Rescue
Copyright(c) 1997-1999 by Enhanced Software Technologies, Inc.
      Serial# 8200-999                         Version: 1.3.13

   Backup     Verify     Recover    Duplicate    Configure     Exit
   System     System     System     Diskette     QuickStart    and Reboot
```

Items That May or May Not Appear

Grayed-out type represents optional items that may or may not appear in a given display.

Example:

> Once the backup is complete, the system displays a message similar to the following:
>
> `The Differential UNIX backup is now complete. Please remove the tape and label it as "Differential UNIX Backup, created` **April 30, 1999**`."`

Cross References and Hypertext

Blue, underlined type indicates a cross reference or hypertext link that will take you to another location in the document when you click on it.

Other Typography

Command Text

- Literal values, commands and text you type in or enter, appear in **bold type**, as in the following examples:

  Example 1: Enter **eqn_attach** at the `Enter command:` prompt.

  Example 2: Type **high** or **low** in the `Speed:` field.

- Command variables are shown in ***bold proportional italic*** type when they are part of what you must type in, and in italics when they are not part of the command line, for example:

  Enter **pkgadd -d cdrom1 *package_name***, where *package_name* is the name of the call delivery machine you just created.

- Command options are shown inside square brackets, for example:

  Enter **connect *switchname* [-c] [-b | -w]**

Safety and Security Alert Labels

This book uses the following symbols to call your attention to potential problems that could cause personal injury, damage to equipment, loss of data, service interruptions, or breaches of toll fraud security:

CAUTION:
Indicates the presence of a hazard that if not avoided *can* or *will* cause minor personal injury or property damage, including loss of data.

WARNING:
Indicates the presence of a hazard that if not avoided *can* cause death or severe personal injury.

DANGER:
Indicates the presence of a hazard that if not avoided *will* cause death or severe personal injury.

SECURITY ALERT:
Indicates the presence of a toll fraud security hazard. Toll fraud is the unauthorized use of a telecommunications system by an unauthorized party.

Related Resources

Documentation

Updates to the Product

The following Web site displays any updates or exceptions to the product that have occurred after the publication of this document: **http://glsdocs.lucent.com**

System Description

A detailed description of all books included in the UCS 1000 R4.2 documentation set is available in *UCS 1000 R4.2 System Description*, 585-313-209. Always refer to the appropriate book for specific information on planning, installing, administering, or maintaining a UCS 1000 R4.2.

Additional Suggested Documentation

It is suggested that you also obtain and use the following book for information on security and toll fraud issues:

- *GBCS Products Security Handbook*, 555-025-600

Training

For information on UCS 1000 R4.2 training, check the Lucent Message Institute Web site at: *http://www.octel.com/octelu/index.html*

Using the CD–ROM Documentation

Lucent Technologies ships the documentation in electronic form. Using the Adobe® Acrobat® Reader application, you can read these documents on a Windows PC, on a Sun Solaris workstation, or on an HP-UX workstation. Acrobat Reader displays high-quality, print-like graphics on both UNIX and Windows platforms. It provides scrolling, zoom, and extensive search capabilities, along with online help. A copy of Acrobat Reader is included with the documents.

Note: If viewing documents online, it is recommended that you use a separate platform and not the UCS 1000 R4.2.

Setting the Default Magnification

You can set your default magnification by selecting **File | Preferences | General**. We recommend the **Fit Page** option.

Adjusting the Window Size

On HP and Sun workstations, you can control the size of the reader window by using the **-geometry** argument. For example, the command string **acroread -geometry 900x900 mainmenu.pdf** opens the main menu with a window size of 900 pixels square.

Hiding and Displaying Bookmarks

By default, the document appears with bookmarks displayed on the left side of the screen. The bookmarks serve as a hypertext table of contents for the chapter you are viewing. You can control the appearance of bookmarks by selecting **View | Page Only** or **View | Bookmarks and Page.**

Using the Button Bar

The button bar can take you to the book's Index, table of contents, main menu, and glossary. It also lets you update your documents. Click the corresponding button to jump to the section you want to read.

Using Hypertext Links

Hypertext-linked text appears in blue, italics, and underlined. These links are shortcuts to other sections or books.

Navigating with Double Arrow Keys

The double right and double left arrows (◀◀ and ▶▶**)** at the top of the Acrobat Reader window are the go-back and go-forward functions. The go-back button takes you to the last page you visited prior to the current page. Typically, you use ◀◀ to jump back to the main text from a cross reference or illustration.

Searching for Topics

Acrobat has a sophisticated search capability. From the main menu, select **Tools | Search.** Then choose the **Master Index.**

Displaying Figures

If lines in figures appear broken or absent, increase the magnification. You might also want to print a paper copy of the figure for better resolution.

Printing the Documentation

If you would like to read the documentation in paper form rather than on a computer monitor, you can print all or portions of the online screens.

You can also order the printed documents by calling 1-888-582-3688 or visiting the Customer Information Center (CIC) Web site at: *http://www.lucentdocs.com/cgi-bin/CIC_store.cgi*

Printing an Entire Document

To print an entire document, do the following:

1. From the documentation main menu screen, select one of the print-optimized documents. Print-optimized documents print two-screens to a side, both sides of the sheet on 8.5x11-in or A4 paper.
2. Select **File | Print**.
3. Enter the page range you want to print, or select **All**. Note that the print page range is different from the page numbers on the documents (they print two to a page).
4. The document prints.
5. Close the file. Do not leave this file open while viewing the electronic documents.

Printing Part of a Document

To print a single page or a short section, you can print directly from the online version of the document.

1. Select **File | Print**.
2. Enter the page range you want to print, or select **Current**.

   The document prints, one screen per side, two sides per sheet.

How to Comment on This Book

We are interested in your suggestions for improving this book. Please complete and return the reader comment card that is located behind the title page.

If the reader comment card has been removed, send your comments to:

Lucent Technologies
GLS Information Development Division
Room 22-2H15
11900 North Pecos Street
Denver, Colorado 80234

You may also fax your comments to the attention of the Lucent Technologies UCS 1000 R4.2 writing team at (303) 538-1741.

Please mention the name and order number of this book, *UCS 1000 R4.2 Speech Development, Processing, and Recognition*, 585-313-212.

1 Overview of Speech

Overview

This chapter provides:

- Information about the speech file system
- Information about speech terminology
- An overview of the features available for speech development

This chapter is also designed to ensure that you:

- Understand the software features available for speech and ways in which they can be used
- Recognize speech hardware
- Are familiar with setting up speech file systems

The Speech File System

All speech to be played as part of an application resides as UnixWare files in a mounted UnixWare file system. By default, speech file systems reside in **/voice1**, which is linked to **/home2**. These two file systems can be used interchangeably. With the server, you can define where in **/voice1** or **/home2** speech files are stored.

Speech Encoding and Storage

Each speech phrase requires a minimum of 8 Kbytes of space. Depending on the encoding rate, an 8-Kbyte block holds different amounts of speech. See Table 1 to estimate how much speech is in each speech phrase block for the SSP circuit card.

Table 1. SSP Encoding Rates and Speech Phrase Blocks

Coding Rate	Seconds of Speech per 8-Kbyte Block
SBC16	4.0
SBC24	2.6
ADPCM32	2.0
ADPCM64	1.0
CELP16	4.0

See Table 2 to estimate how much speech is in each speech phrase block for the LSPS II circuit card.

Table 2. LSPS II Encoding Rates and Speech Phrase Blocks

Coding Rate	Seconds of Speech per 8-Kbyte Block
OKI ADPCM32	2.0
MuLaw	1.0

See Appendix A, Speech File Formats for detailed information about coding rates. For information about the encoding methods and capacities, see “Speech Storage Capacities” and “Speech Administration Capacities” in Chapter 4, “Features,” of *UCS 1000 R4.2 System Description*, 585-313-209.

Default Speech Directory

The default speech directory is designated as **/voice1/vfs/talkfiles**, which is a UnixWare directory for storing speech. It is organized into 8-Kbyte blocks, which allows for quick and efficient retrieval of speech files.

Specifying a Speech Directory Procedure

Use the following procedure to change the directory in which speech files are stored from the default (**/voice1/vfs/talkfiles**):

1 Stop the voice system.

For the procedure to do so, see “Common System Procedures” in *UCS 1000 R4.2 System Reference*, 585-313-210.

2 Access the ***/vs/data/irAPI.rc*** file.

3 Add the following entry:

SPEECHDIR=*directory*

where *directory* is the full path of the new directory where you want to store speech files.

The SPEECHDIR variable specifies the new directory and contains default coding style for all speech.

4 For LSPS II, add one of the following entries as a global play and record default:

SPEECH_ALGO=IRA_MULAW
SPEECH_ALGO=IRA_OKIPCM32

5 Restart the voice system.

The speech administration tools (for example, **list**, **add**, **copy**, **erase**, and **vdf**) are available for use only with speech files stored in the speech directory defined by the SPEECHDIR variable in the **irAPI.rc** file.

Saving and Restoring Speech Files

Speech files are backed up when a **mkimage** system backup is performed. The **spsav** (save) and **spres** (restore) commands are also available for backing up speech. See *UCS 1000 R4.2 Administration*, 585-313-507, for information about these commands.

CAUTION:
Use the **spsav** command to copy all speech after you make any changes. This allows you to restore the speech disk(s) during a recovery process with the **spres** command rather than from a **mkimage** tape, which takes longer and may not restore all speech.

Adding a Second Speech Disk

If you require speech-intensive applications, or if your system has 72 or more channels (telephone network connections), it is recommended that you add a second disk specifically for storing speech.

For instructions to do so, see ”Adding a Hard Disk Drive for Speech” in “Replacing the Hard Disk Drive Assembly” in *UCS 1000 R4.2 Maintenance*, 585-313-126. The second disk in the system is used to store speech file systems that reside in **/home3**.

Recovering from a Corrupted Speech Disk

For information on recovering from a corrupted speech disk, see “Replacing a Hard Disk Drive” in *UCS 1000 R4.2 Maintenance*, 585-313-126.

Defining Phrases

A phrase is a unit of speech, such as letter, number, word, sentence, or paragraph, that a speech application script speaks to a caller. Examples of phrases include a welcome message, a bank balance, or the name of a month. The application speaks a phrase to callers by referencing either TSM phrase number, TSM filename, or an irAPI filename. See Defining TSM Phrase Numbers on page 6 for more information.

Defining TSM Phrase Numbers

A phrase number is a number that identifies the contents of a phrase used by an application script. A script speaks a phrase to callers by referencing the phrase number. A phrase number is assigned to a phrase when you add the phrase to an application. See *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214, for more information.

Defining Talkfiles

A talkfile is a directory. Talkfiles, also called phrase lists (.pl files), are stored under the directory **/speech/talk**. The first line in the file shows the talkfile number. The rest of the file displays the phrases (as they were entered in the application) preceded by their phrase numbers. The actual phrases are located in the speech file system.

Each talkfile can contain as many as 65,535 phrases. The system can have up to 16,384 talkfiles, although the system is limited by the size of the hard disk. The talkfile number and phrase tag or phrase number together uniquely identify a phrase.

Defining Speech Files

A speech file is a file containing an encoded speech phrase. Speech files can be stored anywhere, although the default speech file system is located in the **/voice1/vfs/talkfiles** directory.

Defining the Speech File System

A speech file system is a mounted UnixWare file system where speech resides and is defined in the **irAPI.rc** file. Only one speech file system can be active at a given time. See the various topics under The Speech File System on page 2 for more information.

Speech Development Features

Nearly all applications involve playing speech to a caller. The irAPI application development tool is available to use for the creation, editing, recognition, and inclusion of speech in an application.

Note: See *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214, for further details on the irAPI application development tool.

The following speech development features are available for the creation, editing, recognition, and inclusion of speech in an application.

- Features
  - ~ Text-to-Speech
  - ~ WholeWord Speech Recognition
  - ~ FlexWord™ Speech Recognition
  - ~ Dial Pulse Recognition (SSP only)

irAPI Applications

See *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214 for more information.

Note: The LSPS II circuit card supports no more than 64 calls to irSay(3IRAPI) or irPlay(3IRAPI) functions. The application must call the irEnd(3IRAPI) after 64 irSay(3IRAPI) or irPlay(3IRAPI) calls, or unexpected results can occur.

Text-to-Speech

The Text-to-Speech (TTS) feature allows you to include speech in an application by providing text as input and allowing the speech and signal processing (SSP) circuit card or the Lucent Speech Processing Solutions (LSPS II) circuit card to produce synthesized speech. Currently TTS is available for US English only. The default gender for the speaking voice is male, although a female voice can be specified.

Text that TTS speaks can either be typed at the keyboard or obtained from a file or database.

The conversion of text to speech involves many steps, in which TTS does the following:

- Filters the text to identify sentence and phrase boundaries
- Identifies words as a parts of speech (noun, verb, preposition, etc.)
- Expands conventional abbreviations appropriate to the context (for example, “Dr.” can be expanded to “doctor” or “drive,” depending on the context)
- Identifies proper names and addresses for special handling
- Adjusts for inappropriate punctuation (for example, “Dr.” with or without a period is interpreted in the same way)
- Translates non-alphabetic characters (for example, $5 is spoken as “five dollars”)
- Analyzes the text to determine pronunciation, emphasis, timing, and pitch

The synthesized voice can be made more natural sounding in several ways:

- Punctuation marks such as commas, colons, and periods can be used to insert natural pauses in the synthesized voice as well as changes in voice intonation.
- Advanced TTS features can be used to alter the rate of speech and to add intervals of silence that provide emphasis and help increase listener comprehension (see Appendix B, Advanced Text-to-Speech Features).

Accuracy of the TTS conversion can be increased through the use of advanced TTS features to mark text as belonging to a specific class, such as address, proper name, telephone number, or fraction. Class detectors can then resolve the ambiguity that some text presents (Dr., for example, would be spoken “doctor” in a proper name field, but “drive” in an address field).

TTS can be used to produce text for prompts in an application. Use of TTS during the development of prototype applications eliminates the need to record custom phrases until the application is perfected. But TTS is most often used to speak text that changes frequently, for example:

- Fields from large databases of customer data, such as names, addresses, and order information
- Dynamic text, such as electronic mail

Requirements

The TTS feature requires:

- Text-to-Speech feature software package
- An SSP or LSPS II circuit card with TTS functionality assigned

References for use with the SSP Circuit Card

- To use TTS with TAS applications, see Appendix B, "Summary of TAS Script Instructions," in *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214.
- To install the TTS feature software for use with the SSP circuit card, see "Installing the Text-to-Speech Package" in Chapter 7, "Installing the Optional Feature Software" in *UCS 1000 R4.2 Maintenance*, 585-313-126.
- For information on SSP circuit card functions, see SSP Circuit Card on page 17.

References for use with the LSPS II Circuit Card

- To use TTS with TAS applications, see Appendix B, “Summary of TAS Script Instructions,” in *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214.
- The TTS software package for the LSPS II circuit card is included in the LSPSset software package. See Chapter 9, "Installing LSPS II Optional Software Packages," of *UCS 1000 R4.2 Maintenance*, 585-313-126.
- For information on the LSPS II circuit card functions, see LSPS II Circuit Card on page 19

Speech Recognition

Speech recognition is a feature that allows the system to recognize and respond to spoken voice responses from the caller. The system offers both WholeWord and FlexWord speech recognition.

WholeWord speech recognition and FlexWord speech recognition can be added on a per-channel basis.

WholeWord Speech Recognition

WholeWord speech recognition recognizes entire words, not phonemes or parts of words. However, WholeWord speech recognition is not restricted to recognizing single words. For example, “calling card” can be recognized as a whole word.

WholeWord speech recognition is currently available in the US English language.

Standard Versus Custom Vocabulary

Lucent Technologies provides a standard WholeWord speech recognition vocabulary that includes:

- The digits 0–9 (and their commonly used synonyms)
- The words “yes” and “no”

The standard WholeWord recognition vocabulary also provides connected-digit recognition.

The standard speech vocabulary is best suited for applications that require callers to respond with “yes” or “no” (such as a survey application) or for number-intensive applications (such as a banking application that requires callers to enter account numbers).

You can purchase a custom vocabulary if the standard WholeWord speech recognition vocabulary does not meet your needs.

Requirements

WholeWord speech recognition requires:

- WholeWord speech recognition base package and one or two language package(s) for use with the SSP circuit card.

Note: For use with the LSPS II circuit card, WholeWord speech recognition (asrenna) is included with the LSPSset software package.

- WholeWord functionality assigned to either SSP *or* LSPS II circuit cards, not both.

Note: If your system is equipped with SSP and LSPS II circuit cards, assign the functionality to either the SSP *or* the LSPS II circuit cards, not to both.

References

- To install the WholeWord feature software for use with the SSP circuit card, see “Installing the WholeWord Recognition Packages” in “Installing Optional Feature System Software” in *UCS 1000 R4.2 Maintenance*, 585-313-126.
- To install the WholeWord feature software (part of asrenna in the LSPSset) for use with the LSPS II circuit card, see Chapter 9, "Installing the LSPS II Optional Software Packages," in *UCS 1000 R4.2 Maintenance*, 585-313-126.
- For information on:
  - ~ Using the FlexWord toolkit for use on the SSP circuit card to create words, wordlists, and vocabularies, see Chapter 4, Recognizing FlexWord™ Speech Input on the SSP.
  - ~ SSP circuit card functions, see SSP Circuit Card on page 17
  - ~ LSPS II circuit card functions, see LSPS II Circuit Card on page 19

FlexWord Speech Recognition

FlexWord speech recognition recognizes phonemes or parts of words. It is available for use in the US English language

Because FlexWord recognition provides a cost-effective way of designing large, customized vocabularies and menu options, it is ideal for word-intensive or phrase-intensive applications. For example, a name dialer, an application that allows employees to speak the name of another employee instead of dialing a telephone extension, could be designed using FlexWord speech recognition. The names can be built from existing phoneme models, sparing the expense of custom whole-word data collection processes.

FlexWord Toolkit

The optional FlexWord toolkit, available only with the SSP circuit card, allows you to:

- Create FlexWord wordlists and vocabularies
- Add and delete words and wordlists in an existing vocabulary
- Change the phonetic structure of words in an existing vocabulary
- Hear audible playback of the phonemic representation of a word (US English only)

Requirements

FlexWord speech recognition requires:

- FlexWord speech recognition base package and one language package
- SSP circuit card with FlexWord functionality assigned

Note: The FlexWord Toolkit is only available for use with the SSP circuit card.

- Mouse (for the FlexWord toolkit)
- Video controller circuit card configured for the correct number of colors (for editing of wordlist entries in the FlexWord toolkit)

References

- To install the FlexWord feature software, see “Installing the FlexWord Speech Recognition Package” in “Installing Optional Feature System Software” in *UCS 1000 R4.2 Maintenance*, 585-313-126.
- To administer the mouse, see “Initializing the Mouse” in “Installing Base System Software” in *UCS 1000 R4.2 Maintenance*, 585-313-126.
- To configure the video controller circuit card, see “Setting Up the Monitor” in “Installing Base System Software” in *UCS 1000 R4.2 Maintenance*, 585-313-126.
- For information on SSP circuit card functions, see SSP Circuit Card on page 17.

- To use the FlexWord toolkit to create words, wordlists, and vocabularies, see Chapter 4, Recognizing FlexWord™ Speech Input on the SSP .

Dial Pulse Recognition

Dial pulse recognition (DPR) allows users with rotary telephones or push-button telephones that generate dial pulses to respond to the system. DPR converts the “pops” and “clicks” on the line to dial pulses. DPR supports digits 0-9 on analog and digital interfaces.

Note: DPR is available only with the SSP circuit card. See Chapter 5, Recognizing Dial Pulse Input for more information on DPR.

Requirements

DPR requires:

- Dial Pulse Recognition software package
- SSP circuit card

References

- To install the DPR feature software, see “Installing the Dial Pulse Recognition Package” in “Installing the Optional Feature Software” in *UCS 1000 R4.2 Maintenance*, 585-313-126.
- For information on SSP circuit card functions, see SSP Circuit Card on page 17.

SSP Circuit Card

Description

The speech and signal processor (SSP) circuit card is a high-performance signal processor circuit card capable of simultaneous support for various speech technologies. A single SSP circuit card can run Text-to-Speech, WholeWord speech recognition, FlexWord speech recognition, FAX, voice code and play back, and full call classification analysis (CCA) simultaneously.

Capacity

Table 3 lists the SSP speech channel capacities.

Channel counts assume that the entire SSP circuit card is dedicated to the specified feature. For SSP circuit card channel capacities for features other than those listed here, see “Optional System Hardware” in Chapter 2, “Hardware,” in *UCS 1000 R4.2 System Description*, 585-313-209.

Table 3. SSP Circuit Card Channel Capacities

Feature	Simultaneous Transactions Supported
DPR	60
Echo cancellation	60
FAX	90
	1 of 2

Table 3. SSP Circuit Card Channel Capacities

Feature	Simultaneous Transactions Supported
FlexWord speech recognition, without barge-in*	15
FlexWord speech recognition, with play and barge-in*	12
TTS	60
Playback/record in 16-Kbps CELP	120/60
Playback/record in 64-Kbps PCM (Mu-law)	120/120
Playback/record in 16- or 32-Kbps ADPCM	120/60
WholeWord speech recognition, without barge-in*	15
WholeWord speech recognition, with play and barge-in*	12
	2 of 2

* Echo cancellation is required for barge-in

References

- To install an SSP circuit card, see “Installing or Replacing Circuit Cards” in *UCS 1000 R4.2 Maintenance*, 585-313-126.
- To assign SSP functionality to an SSP circuit card, see Chapter 3, “Voice System Administration” in *UCS 1000 R4.2 Administration*, 585-313-507.

LSPS II Circuit Card

Description

The Lucent Speech Processing Solutions (LSPSII) circuit card is a high-performance signal processor circuit card capable of simultaneous support for various speech technologies. A single LSPS II circuit card can run Text-to-Speech, WholeWord speech recognition, FlexWord speech recognition, echo cancellation, and voice code and play back.

Note: On the LSPS II circuit card, echo cancellation and coding cannot both be turned on at the same time. If echo cancellation is on while coding, only silence is recorded.

Capacity

Table 4 on page 20 lists the LSPS II speech channel capacities.

Channel counts assume that the entire LSPS II circuit card is dedicated to the specified feature. For LSPS II circuit card channel capacities for features other than those listed here, see “Speech and Signal Processor Card” in Chapter 2, “Hardware,” in *UCS 1000 R4.2 System Description*, 585-313-209.

Table 4. LSPS II Circuit Card Channel Capacities

Feature	Simultaneous Transactions Supported
Echo cancellation	64
FlexWord speech recognition	24
FlexWord speech recognition with Text-to-Speech	14
TTS	64
TTS with FlexWord and/or WholeWord	20
WholeWord speech recognition	30
WholeWord speech recognition with Text-to-Speech	18
Playback/record in 64-Kbps PCM (Mu-law)	64/64
Playback/record in 32-Kbps OKI ADPCM	64/64

References

- To install an LSPS II circuit card, see “Installing or Replacing Circuit Cards” in *UCS 1000 R4.2 Maintenance*, 585-313-126.
- To assign LSPS II functionality to an LSPS II circuit card, see Chapter 3, “Voice System Administration” in *UCS 1000 R4.2 Administration*, 585-313-507.

Commands for SSP Only

The commands listed here are designed only for speech data used with the SSP circuit card; although some of the commands may work with the LSPS II circuit card, the commands are intended for use only with the SSP circuit card: **add, addhdr, codetype, list, copy, decode, encode, erase, spres, spsav, striphdr,** and **vusage**.

2 Developing Speech

Overview

Speech processing begins with the creation of encoded and digitized speech files for disk storage. The content of each speech file is a single speech phrase that is spoken at some point in an application dialog.

A *speech phrase* can consist of any of the following elements:

- A complete sentence
- A single word
- A silence period of specified duration
- Music
- A tone (for example, a “beep”)

Speech phrases are typically specific to a single application. You determine the speech phrase content based on the application requirements. However, some speech phrases, such as generic greetings or prompts, may be used in multiple applications.

During a call, the individual speech phrases specified in the application are downloaded by the system from a hard disk drive to either a speech and signal processor (SSP) circuit card or the Lucent Speech Processing Solutions (LSPSII) circuit card. The circuit card actually plays the speech.

This chapter provides background information necessary to complete the process of creating speech on the system. Topics covered include:

- Determining the Transaction on page 24
- Planning the Voice Script on page 25
- Writing the Voice Script on page 27
- Selecting a Speech Development Method on page 31
- Recording Speech on page 36
- Encoding Speech Phrases on page 41
- Installing Speech on page 41

Determining the Transaction

Background

The application provides the automated version of the communication between the caller and the agent. The *transaction* is one component of the application that involves the actual exchanges between the caller and the agent. The transaction is also referred to as the *call flow*.

Before you can begin speech development, you must determine the transaction for the application. It is also a good idea to develop an outline of the application, as well as a general idea of what speech phrases and prompts are necessary. For example, you must decide what type of service you are going to provide, as well as the language and the gender in which the speech will be recorded.

References

For information on:

- Planning a voice response application, see *Application Design Guidelines*, 585-310-670 in the language translation of your choice
- Developing an application using Intuity Response Application Programming Interface (IRAPI), the Transaction State Machine (TSM) process script level language, or C language, see *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214
- LSPS II circuit card applications, print the LSPS Software Development Kit resident on the system by moving the file **/usr/lsps/doc/pdf/sdk.pdf** from the system to a location that can be accessed by acrobat reader.

Planning the Voice Script

The *voice script* includes the exact phrases to be recorded, based on the transaction you determine. The following are suggestions to consider while writing the voice script:

- Track the contents of the voice script by using phrase numbers. Number each phrase in the written voice script.
- Write out every word you expect to be spoken. Edit the voice script to change any poorly written or repetitive phrases. The voice script should be as clear as possible so that a speakers can use it to record phrases.
- Ensure that changes are written into the voice script if changes are made during recording.
- Make all commands short and easy to understand. Users tend to remember only the ends of phrases, so place the needed caller action at the end of a phrase, for example, “For account information, press one.”
- Make prompts clear, but courteous. Remember to welcome users to your company and the system. Thank them at the end.
- Use vocabulary that is understandable and not beyond the scope of your users. For example, do not use computer or programming terminology unless it is familiar to all your users.

- Use the following types of phrases in your voice script:
  - ~ Long phrases that stand alone, for example,

    “Welcome to the LINCS Server order entry system.”

    Long phrases are easier to speak for a recording because they stand alone.
  - ~ Short phrases that you plan to concatenate, for example,

    “Your balance is “
    “Press 1”

    Typically short phrases include phrases that will be used over and over again.
- Anticipate the environment in which the phrases will be used — that is, whether the phrase will be used at the beginning, in the middle, or at the end of a sentence. The following example shows each use of the word “enter.”

  “*Enter* the pound key.” (phrase at the beginning of the sentence)

  “You need to *enter* the pound key.” (phrase in the middle of the sentence)

  “Please press *enter*.” (phrase at the end of the sentence)

You may plan to use the word "enter" as one phrase, but you need three recordings of this phrase — one phrase with rising inflection, one with medial inflection, and one with falling inflection. Recording words with the proper emphasis is discussed below in Writing the Voice Script on page 27.

- Avoid a long string of adjectives. The following is an example of a poorly designed instruction:
  - ~ "Check the 5-digit class schedule number, listed to the left of the specific course, in the course offering schedule book."
- Review the voice script to see if the prompts and responses make sense.

Writing the Voice Script

In writing the voice script, when using a professional speaker, prepare a document that produces the best recordings possible. Mark the target phrases in a way that is easy for the speaker to recognize. Placing quotation marks around the important phrases is helpful. This is called *framing*.

Using Framing in Voice Scripts

Human speech is a continuous, uninterrupted signal. It should not be assumed that you can remove a word from one phrase and place that same word in another phrase that is being recorded for a different use. Individual words that you plan to concatenate must be carefully recorded with the proper inflections and sounds framing them.

To achieve a better recording of short words and phrases, use quotation marks to frame those words you want to emphasize. For example, to achieve accurate recordings of the word “enter,” use quotation marks in your voice script as follows so that the speaker concentrates on the word “enter:”

> “Enter” the pound sign.
>
> Please press “enter.”

The following is an example of a well-prepared voice script that uses framing. The information in quotation marks is the information that the professional speaker should focus on, while the remaining information is the framework.

> “Welcome to our telephone information service.”
>
> “To learn more about our investment opportunities, press the star key.”
>
> “This amount represents” the total balance.
>
> “Please enter” two oh one.
>
> You have “a balance of” two hundred dollars.
>
> You can deposit “up to” five hundred dollars.

Analyzing Speech Inflections

Three types of inflection exist with speech phrases:

- Rising inflection

  Rising inflection is usually used in questions and at the beginning of some words. For example, when you ask, “Can I help you?”, the word “you” is spoken with rising inflection.

- Medial inflection

  Medial inflection is usually used in the middle of a word or statement. For example, when you speak the number “302” (as “three oh two”), the “0” is spoken with medial inflection.

- Falling inflection

  Falling inflection is usually used at the end of a word or statement. For example, when you speak “2.0”, the “0” is spoken with falling inflection.

Placing Frame Words

Place words or phrases before and after the word or phrase that you need recorded, if possible. These phrases should be familiar phrases that guide the speaker into speaking the word or phrase with the correct inflection. For example, if you want an accurate recording of the word “and” with medial inflection, you could record the word “and” in both of the following frames:

Installing “and” verifying
Cutting “and” pasting

You can remove the words that frame “and” later since they are not needed. These frame words are important, though, because the frame words enable a speaker to speak the word “and” in the context necessary to ensure it is concatenated properly when used in a phrase.

Selecting Speech Sounds for Framing

Words that end with the *r* or *l* sounds do not make good framing words because those sounds carry over to the next word. In this example,

December “eighth”

“December” is not a good frame word because it ends in an *r* sound, which affects the vowel quality of “eighth.” A better frame word is “August,” as follows:

August “eighth”

Including Voiceless Speech Sounds

By contrast, placing a voiceless stop before and after your target word will help achieve an accurate recording. Voiceless stops are sounds like *p*, *t*, and *k*. When a voiceless stop is spoken, the stream of air is blocked and the vocal cords do not vibrate, resulting in a momentary silence. In the example above, the final *t* of “August” provides a silence that makes it easy to isolate “eighth.”

Other voiceless sounds useful to end or begin a frame or space are *f* and *s*.

Selecting a Speech Development Method

As an application developer, you have several options from which to choose for including speech in your application.

Options that require you to record speech are:

- Hiring a Professional Speaker on page 32
- Purchasing a Lucent Technologies Custom Speech Package on page 33

Options that do not require you to record speech are:

- Using TTS (Text-to-Speech) on page 34

Hiring a Professional Speaker

Hiring a professional speaker, such as an actor or an announcer, gives you recorded speech of high quality. An additional advantage of using a professional speaker is that you may be able to obtain more control and faster response when adding new speech phrases. Consider the following guidelines when choosing a professional speaker:

- Have all phrases prepared for the speaker to read in advance of the recording session. See Planning the Voice Script on page 25 and Writing the Voice Script on page 27 for guidelines.
- Audition several speakers of both sexes. Record and digitize their voices to evaluate the encoded quality. You may want to listen to several male and female voices to compare the digitized quality.
- Ensure that the speaker is able to maintain the following:
  - ~ Constant speaking rhythm and general intonation throughout the recording session (this ensures that phrases spoken early in the session result in normal-sounding speech when they are concatenated with phrases spoken later in the session)
  - ~ Constant acceptable level of volume
  - ~ Clear pronunciation
  - ~ Constant orientation and distance from the microphone

- Ensure that alphabetic and numeric characters that are to be recorded with rising, medial, and falling inflections are spoken with appropriate inflection.
- Use the same speaker for all speech associated with a specific application.

If you hire a professional speaker, you can edit the speech phrases for the application script.

See Recording Speech on page 36 below for information on setting up a recording session with a professional speaker.

Purchasing a Lucent Technologies Custom Speech Package

For use with the SSP circuit card, you can purchase a professionally recorded custom speech package from Lucent Technologies. You write out the script and Lucent Technologies records and digitizes the speech. Custom speech packages are available with both male and female voices. Custom speech contains phrases designed specifically for the application you are developing. For example, “Thank you for calling Lucent Technologies,” is a custom speech phrase.

Note: Contact your Lucent Technologies service representative if you are interested in purchasing a custom speech package.

Using TTS (Text-to-Speech)

Using the TTS (Text-to-Speech) package is an option that eliminates the need for recording speech. You enter the phrases to be spoken, and TTS synthesizes the speech. The default speaking voice is male.

Note: TTS is available in US English only.

TTS converts text to speech in the following manner:

1. The text is filtered to identify the sentence and phrase boundaries, expand conventional abbreviations, and translate nonalphabetic characters (for example, $5 is translated to “five dollars”).
2. Each word is labeled according to part of speech it is (noun, verb, preposition, etc).
3. The text is analyzed to determine pronunciation and emphasis.
4. The text is further analyzed to determine timing and pitch, which is then associated with the pronunciation analysis.
5. The analyzed text is synthesized into speech.

TTS constructs speech by concatenating units of speech. When constructing speech from these units, the TTS feature adjusts parameters, such as pitch and duration, to make the outcome sound natural. Text filtering is critical because it:

- Expands abbreviations appropriate to the context (for example, “Dr.” may be expanded to “doctor” or “drive,” depending on the context)

- Adjusts for inappropriate punctuation (for example, "Dr" with or without a period is interpreted in the same way)
- Identifies names and addresses for special handling (standard post office abbreviations apply)

TTS functionality is supported through TSM script instruction. The talkoff function and other system features for voice response work with TTS as they work with other speech files.

TTS and prerecorded phrases can be used in the same application.

With some TTS applications, you may need to further customize the use of synthesized speech — for example, by adding silence delays, changing the speaking rate, or marking text as members of a more specific text category. See Appendix B, Advanced Text-to-Speech Features, for examples of these methods of customizing.

Reference

- For information on using TTS in a TAS application, see Appendix B, "Summary of TAS Script Instructions," in *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214.

Recording Speech

The following methods are available to obtain recorded speech for an application:

- Working with a Professional Speaker on page 36
- Working with Lucent Technologies to Develop a Custom Speech Package on page 40

Working with a Professional Speaker

Numerous technical considerations are involved in planning a recording session with a professional speaker and recording the speech on magnetic tape.

- Environmental Conditions on page 37
- Equipment Specifications on page 37
- Recording Spoken Phrases on Magnetic Tape on page 38
- Recording Natural Sounding Speech on page 38
- Recording Sets of Related Words on page 39
- Recording Alphabetic and Numeric Characters with Inflections on page 39

Environmental Conditions

A studio specifically designed for recording sessions is necessary when using a professional speaker. It should be noise-free and environmentally-controlled. Arrange for the recording environment to be quiet and acoustically “neutral.” The room should also have soft walls (drapes, carpet, etc.) and carpeted floors.

Equipment Specifications

The recommended equipment includes a reel-to-reel tape recorder or high-quality cassette player and amplifier. The reel-to-reel tape should be recorded at 7½ inches/second (19 centimeters/second). Post-processing such as filtering is not required. A VCR (video cassette recorder) with a digital audio processor also produces a high-quality recording.

The recording apparatus and medium should provide the following:

- Dynamic range of at least 50 dB
- Bandwidth from 100 to 8000 Hz
- Flat frequency response in bandwidth
- Low noise insertion

Recording Spoken Phrases on Magnetic Tape

After the recording session has been planned and the voice script has been created, the professional speaker records the speech on magnetic tape. See Planning the Voice Script on page 25 and Writing the Voice Script on page 27 above for tips and information on planning and writing your voice script prior to the recording stages.

Recording Natural Sounding Speech

The speaker uses the script to record entire sentences on tape so that the speech sounds natural. For example, for a temperature service, the following sentence can be recorded, although only parts of this sentence will be used:

> “The current temperature is” sixty-seven “degrees Fahrenheit.”

When this sentence is encoded, the phrase “The current temperature is” can be encoded as one phrase and “degrees Fahrenheit” can be encoded as a second phrase. The speech phrase “sixty-seven” should be removed because “sixty-seven” is a combination of two phrases that are recorded separately and concatenated later (numbers and alphabetic characters are recorded as separate phrases). See Recording Alphabetic and Numeric Characters with Inflections on page 39 below for tips to record alphabetic and numeric characters.

A stock service might use a sentence similar to the following:

> “The Dow was” “up” “two” “at the close of trading.”

This entire sentence is recorded, but the sentence can be encoded as three separate speech files that are concatenated later. Each of the separately-encoded phrases is shown in quotation marks (“ ”) above.

Recording Sets of Related Words

When recording sets of related words, such as the days of the week, ordinal numbers, or the months of the year, use a frame sentence in a typical context. A frame sentence for the days of the week might be as follows:

> The movie for “[the name of day]” is ____.

During speech editing, the frame words before and after the day of the week are deleted and only the phrase that is inserted in place of “[the name of day]” is saved as a phrase.

The speaker, the studio manager, and a coordinator are usually present at the recording session. The customer for whom the speech is recorded may also be present. During the recording session, these individuals can provide feedback about the necessary inflections for words and phrases and the overall quality of the speech.

Recording Alphabetic and Numeric Characters with Inflections

Record alphabetic and numeric characters with frame words that separate instances of initial, medial, and rising inflections for each letter and number.

Monitor the speaker during this phase of the recording session to ensure that proper inflection is used and that volume and rhythm are constant.

Working with Lucent Technologies to Develop a Custom Speech Package

Lucent Technologies can provide you with professionally recorded custom speech through its speech recording service. Lucent Technologies needs the following items to record custom speech phrases:

- A list of phrase tags that need to be recorded
- A list of the complete text of all the phrases that need to be recorded

Note: Phrases must be written the exact way they are to be spoken.

- A clear indication of the phrase tags that corresponds to each phrase
- Specifications of what type of speech encoding should be used

Note: The choice of formats depends in part on the amount of speech necessary for the applications on the system. Some coding rates requires more storage space than others. See Table 1 on page 2 in Chapter 1, Overview of Speech for a comparison of the storage requirements for various coding rates.

- Indication of whether each phrase is to be recorded in a male or female voice

Contact the Speech Coordinator for the UCS 1000 R4.2 at the following number for additional information on the custom speech recording service: 614-860-2260.

Encoding Speech Phrases

Recorded speech phrases are input from a reel-to-reel tape recorder, from a person over a telephone line, or from an amplifier and microphone. Once the speech phrases are recorded, the speech must be digitized. Speech is digitized by encoding it in an acceptable format. Once the speech phrases are digitized, they are stored as digital data.

If you want Lucent Technologies to digitize the speech, contact your Lucent Technologies representative for information.

Installing Speech

After the speech has been digitized, it must installed onto the system.

Installing Speech in an IRAPI Application

If your application was created using C language, use the following procedure to install speech:

1. Insert a diskette containing the speech files into the diskette drive.
2. Go to the appropriate speech filesystem.

   For example, if you are using the default speech filesystem, enter **cd /voice1/vfs/talkfiles**

3 Making sure to use a talkfile number not already in use, enter **mkdir *talkfile#***

where *talkfile#* is the talkfile number.

For example, if you are using talkfile100, enter **mkdir 100**

4 Copy the speech phrases to the directory specified above.

When the system prompt is displayed, the speech is loaded onto the hard disk and can be accessed by applications.

Note: If you are adding speech to an existing application, be aware that the system overwrites any existing speech files that have the same name as a file being added.

With an IRAPI application, you can put speech anywhere on your system. For information on accessing speech files in an IRAPI application, see Chapter 5, “IRAPI Programming,” in *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214.

3 Recognizing WholeWord Speech Input on the SSP

Overview

Note: Information in this chapter pertains to the feature working only on the SSP circuit card.

WholeWord speech recognition is available as an optional installable package on the system. WholeWord speech recognition allows you to write applications that prompt for and understand spoken input from callers. This feature supports a standard vocabulary that includes:

- The numbers “zero” through “nine” and their commonly used synonyms
- The words “yes” and “no”

This chapter describes the capabilities of WholeWord speech recognition and the factors that influence the accuracy of recognition. This background information is necessary to use the WholeWord speech recognition package for optimal accuracy. Topics covered include:

- Languages supported
- Standard vocabulary
- Speech recognition types

- Barge-in
- Positive and negative influences on speech recognition accuracy
- The process by which WholeWord speech recognition works

WholeWord Speech Recognition

WholeWord Hardware and Software

- For a list of the required software and hardware, see WholeWord Speech Recognition in Chapter 1, Overview of Speech.
- For the procedure to install the WholeWord software, see “Installing the WholeWord Recognition Package” in ”Installing Optional Feature System Software” in *UCS 1000 R4.2 Maintenance*, 585-313-126.

Languages Supported

WholeWord speech recognition provides standard vocabulary support for the US English language.

For additional information about global support, contact your Lucent Technologies representative.

Standard Vocabulary

Table 5 lists the standard vocabulary supported for the US English language in WholeWord speech recognition.

Table 5. Standard Vocabulary for WholeWord Speech Recognition

Caller Input Field	US English
0	zero, oh
1	one
2	two
3	three
4	four
5	five
6	six
7	seven
8	eight
9	nine
	1 of 2

Table 5. Standard Vocabulary for WholeWord Speech Recognition

Caller Input Field	US English
yes	yes
no	no
	2 of 2

Standard WholeWord Speech Recognition Types

Description

Recognition types allow you to indicate which keyword or words are possible selections for each prompt. All of the recognition types and words used by an application constitute that application's vocabulary. A complete recognition type includes:

- Mathematical models of the words, see Models and Speaker Independence on page 47.
- A grammar, see Grammars on page 47.
- Specifications of maximum and minimum numbers of digits, see Keyword Recognition Types on page 48.
- A recognition data interface process (DIP) — optional (discussed below) The standard WholeWord speech recognition package provides several commonly used recognition types. See Recognition DIPs on page 51.

Models and Speaker Independence

Each word of the system's vocabulary is represented by one or more mathematical models that contain the speech signal characteristics of the word. The speech recognition process compares a person's voice to the set of predeveloped speech models. Each model is constructed from thousands of samples of the spoken word. Regional accents and dialects associated with a particular language are incorporated into each model, as well as a mix of male and female speakers so that the system recognizes callers of either gender speaking in any of those dialects with any of those accents. The recognition type determines which models the incoming speech is compared to.

Grammars

A grammar, which is selected by a recognition type, is a set of rules that specifies allowable vocabulary words and vocabulary word combinations at any one point in the script (for example, "four," "five," "six," "no"). While collecting spoken input, the speech recognition algorithm uses models and grammars to generate a list of candidates that most closely resemble this spoken input. The algorithm returns the most likely match to the script or, if no match fits, rejects the input. When input is rejected, the algorithm returns a "?" or an empty string to the script. This return message is the same for all of the languages supported. All grammars provided in the speech recognition package share the same set of models for words that are common to their package's vocabulary.

Keyword Recognition Types

Keyword recognition types are used for isolated word recognition, that is, responses of a single word or digit. Table 6 shows the standard WholeWord speech recognition types for US English, which are used when prompting the caller to speak a response of one word or digit. The US_1_3 recognition type, for example, means that callers are expected to say a single word, either “one,” “two,” or “three.” A prompt that might use the 1_3 digit grammar type could be structured as follows: “For checking account balance, say ‘one’. For savings account balance, say ‘two’. For interest rates, say ‘three’.”

Table 6. US English Standard WholeWord Speech Recognition Types

Prompt	Recognition Type
"Yes" or "No"	US_YN
One digit 1_3	US_1_3
One digit 1_3 or "No"	US_1_3N
One digit 1_5	US_1_5
One digit 1_5 or "No"	US_1_5N
One digit 0_9 or "Oh"	US_DIG

Connected-Digit Recognition Types

Connected-digit recognition types are used for connected-word recognition, that is, responses of more than one word or more than one digit string. The spoken string can be fixed in length from 1 to 10 digits, or it can be of a variable length. Grammars are provided for the 1- to 10-digit fixed-length and the 1- to 24-digit variable-length strings. Table 6 on page 48 lists the connected-digit recognition types.

Note: With US English, the recognition type is US_DIG and use of a custom grammar is recommended.

For better accuracy, you must specify the desired string length when selecting the recognition type for a fixed-length string. A US area code (614, for example), consists of three words; therefore, the minimum and maximum values are “3.” If a variable-length string (US English *only)* of one to four words is required, “1” is the minimum value and “4” is the maximum value.

Connected-Digit Recognition

Connected digits are strings of naturally spoken digits, which may or may not include a pause. All packages recognize spoken digit strings. Connected-digit recognition packages allow you to collect input by specifying a fixed-length (1–10 digits) or, for US English only, a variable-length (1–24 digits). Number entry is an essential component if you want callers to input numbers with more than one digit, (for example, “1, 3, 5” or “2, 4, 6, 8”). Recognition is better for fixed-length strings than for variable-length strings.

Fixed-Length versus Variable-Length Connected Digits

The capability to recognize fixed-length strings of 1–10 digits is provided with WholeWord speech recognition packages (see Table 6 on page 48). A fixed-length string is a string of digits that is always made up of the same number of digits. For example, a US social security number is a fixed-length number, since it always consists of nine digits. By contrast, a variable-length string indicates a string of digits that varies. For example, a street address is a variable-length string.

Note: The variable-length string is available for US English only.

Accuracy is best when you use fixed-length strings. Whenever possible, try to specify the length of the string to increase recognition accuracy. For strings longer than 10 digits, use of a custom grammar is recommended (see Custom Grammars on page 58). Using the provided variable-length grammar as an alternative results in decreased accuracy. If your application must accept a variable-length digit string, you may be able to increase recognition accuracy by using a two-step entry process. First prompt the caller for the number of digits, and then prompt for the digits. For example:

> "How many digits are in the next code?"
> "Please say the three-digit code now."

The script can then select a fixed-length recognition type for the appropriate number of digits.

Recognition DIPs

A recognition data interface process (DIP) is used to help increase an application's accuracy. For example, certain digit strings, such as credit card numbers, have check digits built into them. Verifying a check digit is done most efficiently through a DIP. However, a DIP is not necessary for many recognition types. If there is no further information to consider for a string other than what is in the grammar, a DIP is not needed. Specifically, none of the standard WholeWord speech recognition types, such as "yes" and "no," needs a DIP.

For some recognition types, there may be tradeoffs that determine how much of the structure of the input is built into the grammar and how much should be left for the DIP. For more information about custom DIPs, see "Writing the DIP" in Chapter 4, "Data Interface Processes," in *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214. Also see Custom DIPs on page 60.

Word Spotting

WholeWord speech recognition supports word spotting. Word spotting is the ability of the system to ignore extraneous speech during speech recognition. For example, if a caller says, “I want number five, please,” the system recognizes the word “five” as a valid response and ignores the rest of the input. In other words, callers do not have to speak the key word, which in this case, is “five” in isolation. The caller can speak other words, and the system can distinguish the key word from the extraneous words.

This means that the caller’s input is not limited to the words in the system vocabulary. For example, in the phrase “Uh, yes please,” the vocabulary word “yes” is recognized if the system is using the standard vocabulary.

However, to maintain good recognition accuracy it is advisable to structure the application to prompt the caller for the required information only. Applications should encourage the caller to speak only what is required.

Phrase Screening

Phrase screening is the ability of the system to determine whether or not a candidate key word is a close enough match to be declared a valid key word. For example, if the prompt states, “Please respond with ‘yes’ or ‘no’,” and the caller speaks the word “what,” the system informs the caller that the response is invalid. It could then replay the prompt, “Please respond with ‘yes’ or ‘no’.”

However, to maintain good recognition accuracy it is advisable to structure the application to prompt the caller for the required information only. Applications should encourage the caller to speak only what is required.

Recognition Confirmation

Recognition confirmation is the ability of the system to repeat the caller’s spoken response back to the customer for confirmation. For example, a script prompts a caller, “Please say your area code,” and the caller says, “Six, one, four.” Using recognition confirmation, the system repeats what it recognizes the caller’s response to be and then prompts, “If this is correct, say ‘yes’, if not say ‘no’.” The caller then confirms whether the system recognized the spoken input properly.

Barge-In

Description

Barge-in, also called "recognize during prompt," is the ability of the system to allow callers to interrupt or barge in during voice playback by speaking a vocabulary word. Speech recognition accepts either speech or touchtone input in response to a prompt. Barge-in operates for speech much like the talkoff option does for touch-tone input, where a caller can interrupt the prompt by pressing a touch tone. See Dual Tone Multifrequency (DTMF) Support on page 57 for more information on interrupts.

Experienced callers appreciate being able to shorten the transaction time by not being required to listen completely to each prompt. You can enable or disable barge-in for any of the prompts in your application.

Note: The system is able to detect touch tones immediately; however, it does take a few seconds longer to detect valid speech, as opposed to a cough, sneeze, etc. You should expect a slight delay when using barge-in.

For isolated word recognition, the prompt does not stop until the system recognizes a valid vocabulary word. Once the prompt completes playback, the initial timeout field eventually ends the recognition if no valid input is received.

For packages that support connected-digit recognition, the playback of the prompt stops between the recognition of the first and last word of the input, when the system decides that valid input has started.

Enabling or Disabling Barge-In

At the beginning of an application, after the answer instruction, you can place an instruction to enable barge-in using the **sr_talkoff** (TAS instruction). If a barge-in resource is available, it is reserved for this call. Otherwise the return code is negative, and barge-in will not be available. For more information see Appendix B, "Summary of TAS Script Instructions," in *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214.

Discouraging Barge-In

The following example includes short pauses that tell the caller that the system is waiting for a response. The caller answers at the time of the short pause.

> "For sales say, 'one'.'" (pause
> "For service, say, 'two'." (pause)
> "To speak with a representative, say 'three'."

The following example does not include pauses. The caller waits until the prompt is completed before answering.

> "You can order up to five copies. Please say how may copies you want."

If there is silence at the end of a prompt, the caller may speak but the system may not be prepared to listen. Make sure that there is no silence at the end of your recorded phrases when barge-in is disabled.

Encouraging Barge-In

The following prompts are designed to encourage callers to barge in when barge-in is enabled. Note that the pauses are longer than in the examples in Discouraging Barge-In on page 55 above, so callers are encouraged to respond after hearing the desired option and the word “now.”

“For sales say, ‘one’ now.”	(pause of 1-1.5 seconds)
“For service, say, ‘two’ now.”	(pause of 1-1.5 second)
“For a representative, say ‘three’ now.”	(pause of 1-1.5 seconds)

System Response for Barge-In

For an application using speech recognition with barge-in, callers who choose to talk over the prompt message will not experience barge-in until most of the digit string is spoken. The distinction in response is as follows:

- When a fixed-length digit recognition type is used on the SSP circuit card, the prompt can be interrupted after ***N***-2 (N minus 2) digits are spoken plus a system delay of 0.75 second, where ***N*** is the total number of digits to be collected. For example, for the US_9DIG recognition type, the prompt can be interrupted after seven digits.
- When short prompts are used, callers may not detect delays in the barge-in point because the prompt will frequently complete before the caller has spoken much input.

Dual Tone Multifrequency (DTMF) Support

Even with WholeWord speech recognition installed, callers still have the option of responding to prompts with touch tones rather than speaking. Speech recognition accepts either speech or touchtone input in response to a prompt. Talkoff is the ability of the system to allow callers to interrupt during voice playback by pressing a DTMF touch tone. Talkoff operates for touch tones much like barge-in does for speech, where a caller can interrupt a prompt by speaking.

Often the response time for talkoff is faster than for barge-in. This is because touch tones were designed to be recognized by machines and are rarely confused with other sound or voice input. However, WholeWord speech recognition must perform the more complex task of separating the desired input from other sound or voice input that may simultaneously be present. The system does not terminate a prompt until it processes enough input to ensure with relatively high confidence that the input is valid. For a prompt requiring single-digit input, talkoff and barge-in may appear equally fast since the input is completed with a single touch tone or a single spoken digit. Prompts for multidigit input reveal the difference between the response times for talkoff and barge-in. See Barge-In on page 54 for information comparing and contrasting talkoff and barge-in.

Custom Grammars

The system uses the recognition type to select a speech recognition grammar to be used. Certain digit strings and custom vocabulary words may require custom recognition types and associated custom grammars for acceptable recognition accuracy. Examples include a credit card number or a merchant number. These digit strings have specific limitations on the position of certain digits within the string. For example, a telephone area code in North America requires a number 2 through 9 for the first digit, 0 through 9 for the second digit, and 0 through 9 for the third digit.

Custom recognition types help limit the recognition possibilities for the SSP (speech and signal processing) circuit card, which results in better accuracy. For the SSP circuit card, there is no restriction on the number of grammars that can fit on one card on any system.

For more information, contact your Lucent Technologies representative.

Custom Vocabulary

Lucent Technologies can create a custom vocabulary to supply your application with speech recognition software for words not included in the standard package. For example, the vocabulary might include the words “checking” and “savings.” With a custom vocabulary, the application could prompt the following:

> “For your checking account balance, say ‘checking’ or to hear your savings account balance, say ‘savings’.”

A custom vocabulary requires application analysis by Lucent Technologies, speech data collection, model creation, and custom grammar work. You may want to consider FlexWord™ speech recognition as a more practical alternative. See Chapter 4, Recognizing FlexWord™ Speech Input on the SSP .

For more information, contact your Lucent Technologies representative.

Custom DIPs

You can improve recognition accuracy by using an application with a DIP. DIPs, which are typically written in the C programming language, interact with your script to help access external information. Once a request is received from a transaction state machine (TSM) script, for example, the DIP processes the message and returns the results to the corresponding script. DIPs usually work based on knowledge that is unavailable to the SSP circuit card.

WholeWord Speech Recognition Accuracy

Overview

The accuracy of WholeWord speech recognition depends not only on the recognition algorithms, but also on the models, grammars, DIPs, prompt structure, calling environment, user behavior, and the recognized data itself. Each of these factors can impact recognition accuracy positively or negatively. Also, measures of accuracy must be based across the entire calling population. Therefore, any attempt to measure accuracy must include a statistically representative sample of the calling population.

Positive Influences on WholeWord Speech Recognition Accuracy

The items described below have a positive impact on WholeWord speech recognition accuracy.

Isolated Word Recognition

Isolated word recognition is very high. The smaller the number of choices in an isolated word recognition type, the better the accuracy. For example, US_1_3 is more accurate than US_1_5, which in turn is more accurate than using US_DIG with length 1.

Fixed-Length Digit String

For connected-digit recognition, a fixed-length recognition type provides better accuracy than a variable-length recognition type. If possible, avoid the use of variable-length strings in WholeWord speech recognition applications.

Validation of Data

Try to verify the recognized result against a database or a host field. This helps improve the overall accuracy of an application, especially when a longer string is input.

Reprompt

If the keyword is not spoken, and the system does not misinterpret extraneous words for a keyword, the system can reprompt the caller. If the accuracy measurement is based on either a WholeWord or FlexWord speech recognition application with a confirmation and reprompt step, the accuracy increases.

Prompt Structure

The prompt structure can greatly affect accuracy by promoting a clearly articulated response, helping the caller to barge in at the appropriate time or to wait until the prompt is complete before talking (when barge-in is disabled), and providing consistent instructions on what the caller should say to get the desired result.

- Menu prompts

  For best results, build menu prompts with the following structure:

  <desired result> <action required>

  Examples:

  "To hear your checking account balance, say 1."
  "To hear your savings account balance, say 2."

  By speaking the action required at the end of the prompt, the caller does not have to remember what is required of him or her through the description of the desired result. In addition, if you want to encourage your callers to barge in when they hear their desired result, you can add a small pause after the action-required phrase.

- Yes and no prompts

  Structure yes and no prompts as yes and no questions. For example:

  "Would you like to hear your order again?"

If the caller does not respond to the prompt, the follow-up prompt could be as follows:

> “Would you like to hear your order again? Please say ‘yes’ or ‘no’.”

This wording is more natural than the following:

> “To hear your order again, say ‘yes’. Otherwise, say ‘no’.”

To encourage the use of barge-in, add a small pause (about 1.5 seconds) following the action required phrase. For example:

> “Would you like to hear your order again? (pause)
> Please say ‘yes’ or ‘no’.”

Calling Experience and Informative Prompts

In an application where the calling population is closed and callers are experienced or trained to use the application, recognition accuracy improves.

Lengthy prompts that provide detailed instructions on how to respond may improve accuracy, but are generally unacceptable unless the application has infrequent users. Users who interact with system prompts infrequently (for example, once or twice a year) are more willing to listen to a lengthy prompt than those who do so frequently.

Custom Grammars and DIPS

Custom grammars improve the recognizer's ability to "score" the candidate by selectively limiting the recognition possibilities. The recognizer assigns a score to each input based on closeness of match to the models for the selected grammar. Custom DIPS help further process the recognition result with information unavailable to the recognizer.

Negative Influences on WholeWord Speech Recognition Accuracy

The items described below have a negative impact on WholeWord speech recognition accuracy.

Environment

A very noisy environment, such as an airport or train station, can cause recognition accuracy problems. In certain cases, speech data can be collected to build custom word models based on the noisy environment to improve recognition accuracy.

Extraneous Words Within Responses

The system can sometimes misinterpret extra words spoken alongside the keyword if they have the same characteristics as the key word.

Information Type

Attempting to recognize data not normally spoken in the form of the digits “0” through “9” adversely affect accuracy. For example, dollar amounts and days of the month are not usually spoken in digit form “0” through “9”. To speak the date December 15, the caller would have to say “1-2-1-5.” Training callers to speak information in this format can increase application accuracy. However, if callers speak natural numbers, such as “fifteen,” speech recognition will not work.

Regional and National Accents and Dialects

Although WholeWord speech recognition is based on thousands of speech samples per word, the system can still misinterpret strong regional or national accents or dialects.

Connected-Digit String Length

Connected-digit string recognition can be thought of as a sequence of single-digit recognitions performed as one operation. For example, assume that the per-digit accuracy is X% and that a digit string of one digit will be correct X% of the time. Taking into consideration that this is a probabilistic, exponential model, when longer digit strings are used the overall expected accuracy will be X^n%. Therefore, a 2-digit string will have an overall expected accuracy of X^2% and a 10-digit string will have an overall accuracy of X^{10}%. As a result, string accuracies are affected by the length of the string. Shorter string lengths are more accurate than longer string lengths. In addition, individual digit accuracies, as well as overall string accuracies, vary according to the language and noise conditions of different national networks.

Connected-digit string accuracy can be maximized in various ways:

- Accuracy is always better for shorter strings than longer strings.
- Fixed-length strings are more accurate than variable length since the recognizer knows to look for “X” number of digits.
- With custom programming, it is possible to further improve accuracy of an application by having the recognizer return a list of possible strings. When these can be validated against external information such as comparing potential account number strings against a database of valid account numbers, the correct string can frequently be chosen.
- The recognizer can also be given a custom digit string grammar that can guide the recognizer when the digit string must conform to specific digit sequence rules. To obtain custom grammars, contact your Lucent Technologies representative.

For a WholeWord speech recognition string of digits, the per-digit accuracy is comparable to isolated word recognition. However, the accuracy of the whole string is lower than the per-digit accuracy, and steadily decreases as more digits are added.

Application-Related Limitations

The capability of the system and WholeWord speech recognition is application dependent. If the system is under-engineered for a particular application, it may not perform satisfactorily. Several application-related factors can affect the number of channels available for speech recognition.

Specific application-related factors that affect the number of supported WholeWord speech recognition channels include:

- The percentage of time spent recognizing speech input
- The percentage of callers who use touch-tone entries, which require far fewer hardware and software resources
- The number of simultaneous speech recognition calls expected
- The use of the barge-in with WholeWord speech recognition, which increases the hardware and software resources required to process each transaction

How WholeWord Speech Recognition Works

Overview

Processing involved during WholeWord speech recognition on the system includes a caller response, the action of the recognizer, and processing.

Caller Response

During a prompt and collect action, the system prompts the caller for a response. If the prompt and collect action allows for voice input, the system locates and reserves a free recognizer resource. If the caller responds using touch tones, resources of the SSP circuit card are not required for this particular prompt and the resource is freed. If the caller responds using voice input, the input is sampled at 8000 samples per second, digitized, and then transferred to the SSP circuit card via the H.110 bus. The H.110 bus provides a communication link between the SSP circuit card and the telephone interface cards (E1/T1) and also allows SSP circuit card resources to be shared across all incoming voice channels. This makes available more channels of recognition, since there is no need to dedicate certain incoming channels to only WholeWord speech recognition when accepting both touch tone and voice input. Thus channels can share resources.

The Recognizer

Note: If your system is equipped with both the LSPS II and the SSP circuit cards, assign the function to either the SSP or LSPS II circuit card, not both.

The SSP circuit card is loaded with the WholeWord speech recognition software, also called the *recognizer*. The recognizer compares the incoming speech sample to the word models indicated by the recognition type chosen in the prompt and collect action. The recognizer computes a score for each of the models. The score represents the likelihood that the incoming speech matches a word model indicated by the recognition type.

See *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214 for more information.

Computational Processing

A single SSP circuit card has the ability to run Text-to-Speech (TTS), speech recognition, dial pulse recognition (DPR), FAX, voice code and playback, and full call classification analysis (CCA) simultaneously.

The SSP circuit card uses only 19 watts per circuit card. For more information on the SSP channel capacities, see SSP Circuit Card on page 17 in Chapter 1, Overview of Speech.

4 Recognizing FlexWord™ Speech Input on the SSP

Introduction

Note: Information in this chapter pertains to the feature working only on the SSP circuit card.

This chapter provides the information necessary to create FlexWord wordlists and use them in applications. It includes:

- Background information about the capabilities of FlexWord speech recognition
- Guidelines for designing FlexWord wordlists for use in applications
- Procedures for creating, modifying, installing, activating, and deactivating FlexWord wordlists
- Information on positive and negative influences on the accuracy of FlexWord speech recognition

Description

The FlexWord speech recognition package can be used to recognize specific words spoken by callers from a vocabulary that you define to suit your application.

- A word is any phrase that can be recognized with FlexWord speech recognition. A word must be associated with a wordlist.
- A vocabulary is a set of wordlists associated with a particular FlexWord speech recognition application.

Languages Supported

The US English language is the language supported by FlexWord speech recognition.

Either the speech and signal processor (SSP) circuit card or the Lucent Speech Processing Solutions (LSPSII) circuit card is required for all languages.

Phonemes

FlexWord speech recognition uses sub-word technology. Sub-word technology relies on phonemic recognition for analyzing and recognizing words.

Phonemes are units of sound that form recognizable words when strung together in a particular order. The English language contains 40 phonemes that represent all basic sounds used in the language. The word "sales," for example, consists of four phonemes: s-A-l-z. Other languages use different phonemes.

Illustrated in Figure 6 are FlexWord speech recognition phonemes for the SSP circuit card in the US English language. A word accompanies each phoneme to illustrate its sound.

Figure 6. US English Phonemes for the SSP Circuit Card

E heed	A hay	p pick	T thin
i hid	I hide	t tick	D then
e head	O hoe	k kick	s sip
a had	Y boy	b bit	S ship
o cot	R her	d dot	C chip
u hook	W how	g got	J jip
U rue	r rip	m met	z zip
> saw	l lip	n net	Z measure
^ cup	w we	N ring	f fit
& data	y yes	v vet	h hit

FlexWord Capacity

Every entry in a wordlist is counted as a distinct and separate word. The maximum number of words that can be loaded onto the FlexWord speech recognizer is 2000. (FlexWord speech recognition supports up to 200 wordlists and 500 words per wordlist, as shown in Table 7.) For example, if the word "help" appears as an entry in 10 of your wordlists, "help" is counted as 10 separate words. Phrases such as "loan information" count as only one word. Each wordlist must be given a name tag consisting of 1–14 uppercase characters. For definitions of word, wordlist, or vocabulary terms, see the Glossary at back of this book.

Table 7. FlexWord Maximum Capacity

	SSP Capacities
Wordlist entries (words or phrases)	2000
Wordlists	200
Words per wordlist	500
Characters per wordlist name tag	64
Phonetic transcription length	64

FlexWord Toolkit

FlexWord supports fast, low-cost delivery of speech recognition vocabularies on a custom basis through the use of the FlexWord toolkit. The FlexWord toolkit is an optional package that supports unique or dynamic applications such as name dialing, menu selection by words, command words, and entry of client or department names. This option gives you a point-and-click graphical environment for adding, deleting, or changing words on new or existing wordlists. You can use these wordlists in your application immediately after they are created. The FlexWord toolkit supports all available languages.

Vocabularies

A FlexWord speech recognition vocabulary can include a maximum of 2000 words or phrases per system, allowing up to 200 wordlists. Each wordlist can include up to 500 words. (For an application that requires more than 2000 words, contact your Lucent Technologies representative.)

The following are a few possibilities for creating the 2000 words:

- 4 wordlists with 500 words each for a total of 2000 words
- 50 wordlists with 40 words each for a total of 2000 words

A word can be used in more than one wordlist. Each prompt in a FlexWord speech recognition script requires a wordlist, which is a list of valid words with which the caller could respond. For example, for a script to play a prompt that asks, “Would you like information on your checking account or savings account?”, a wordlist including the entries “checking” and “savings” is required.

Keyword Spotting

The FlexWord speech recognition standard vocabulary package can recognize or spot a keyword within a spoken phrase. The system filters out extraneous speech or noises (such as a cough) during recognition. The caller's input is not limited to the words in the system vocabulary. For example, if one of the words in your wordlist is “checking,” then the system can recognize the word “checking” when a caller says “checking account please”. However, to maintain high recognition accuracy it is advisable to structure the application to prompt the caller for the required information only. Applications should encourage the caller to speak only what is required.

Phrase Screening

You can program the FlexWord speech recognition package to alert and reprompt the caller if the system does not recognize the spoken response. For example, if the prompt states, “Please respond with ‘checking’ or ‘savings’,” and the caller speaks the word “banking”, the application can be designed to inform the caller that the response is invalid and to replay the prompt.

Barge-in

FlexWord speech recognition does not support barge-in. Callers must wait until the system is completely finished prompting for information before they can speak their response.

Designing a FlexWord Speech Recognition Application

Preparing a FlexWord speech recognition application entails defining wordlists and using the wordlists in scripts.

Defining Wordlists

The first step in designing a wordlist is to define the words you want the system to recognize and group these words into wordlists. As Figure 7 on page 78 shows, each prompt should have its own wordlist. The first menu prompt looks to the “INFORMATION” wordlist to verify the caller’s first request. The second menu prompt looks to the “LOAN” wordlist to verify the caller’s second request. The wordlists in both Figure 7 on page 78 and Figure 8 on page 79 contain groups of possible words from which callers can choose. All of the wordlists for all of your applications constitute the vocabulary.

Using Wordlists in Scripts

Each application can use several wordlists. You must specify the name of the wordlist to be used for a prompt. FlexWord speech recognition looks to the wordlist that you designate.

The directory **/att/asr/wordlists/active** on the system is the directory for all active wordlists. The content of each wordlist file includes the spelling and phonetic breakdown of all of the words on the specific wordlist. The words “account information,” “mortgage information,” and “loan information,” for example, are included in the “LOAN” wordlist file in the **active** directory.

FlexWord speech recognition supports word spotting, that is, it has the ability to search past extraneous speech during a recognition and scan for specified words. For example, if callers are given the menu choice “account” and they specify “account please,” FlexWord speech recognition recognizes and accepts the word “account” and ignores “please.” After receiving spoken input, the FlexWord speech recognition algorithm scans the appropriate wordlist and generates a group of candidates that most closely resembles the caller’s response. The algorithm returns the most likely match to the script. Defining the wordlist appropriately is essential for the success of an application.

For more information on how to create effective wordlists, see Positive Influences on FlexWord Speech Recognition Accuracy on page 99.

Figure 7. FlexWord Speech Application Example Using Menu Prompts

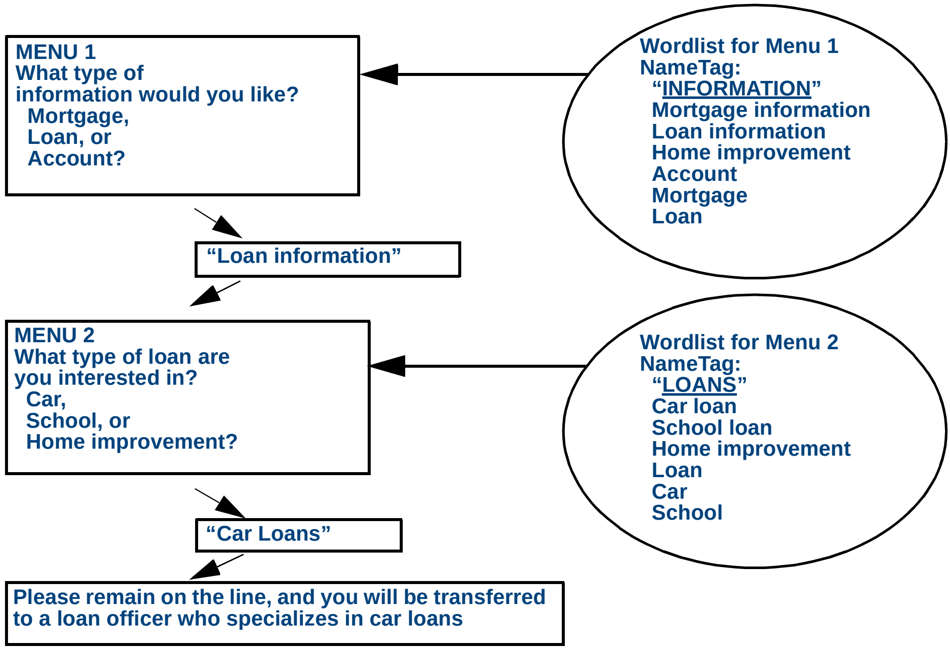
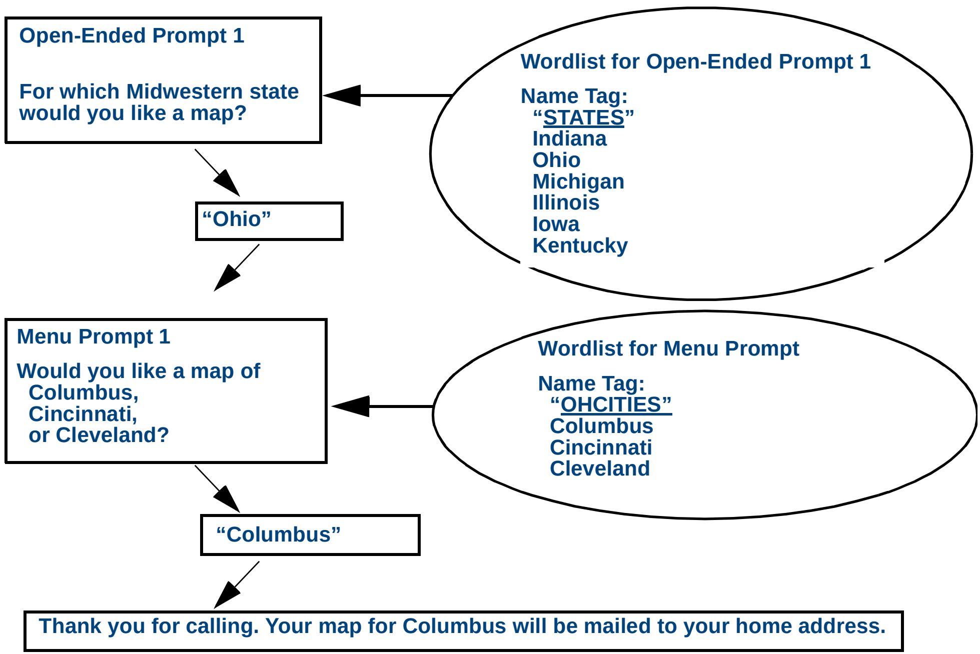


Figure 8. FlexWord Speech Application Example Using Open-Ended and Menu Prompts



Using the FlexWord Toolkit to Create Wordlists

The FlexWord toolkit allows you to construct words and phrases by stringing phonemes together. The toolkit includes a standard dictionary corresponding to the language chosen, as well as three commands for creating and modifying wordlists. The correct software and hardware are both necessary, and the hardware must be properly configured before you can create, edit, and delete wordlists.

FlexWord Software and Hardware

- For a list of the required software and hardware, see FlexWord Speech Recognition on page 14 in Chapter 1, Overview of Speech.
- To install the FlexWord feature software, see “Installing the FlexWord Speech Recognition Package” in ”Installing Optional Feature System Software” in *UCS 1000 R4.2 Maintenance*, 585-313-126.
- To configure the video controller circuit card, see “Setting Up the Monitor” in “Installing Base System Software” in *UCS 1000 R4.2 Maintenance*, 585-313-126.
- To initialize the mouse, see “Initializing the Mouse,” in “Installing Base System Software” in *UCS 1000 R4.2 Maintenance*, 585-313-126. The mouse connects to the mouse connection on the single board computing (SBC) portion of the CPU Complex. To locate the mouse connection point, see “CPU Complex” in Chapter 3, “Making Cable Connections” of *UCS 1000 R4.2 New System Installation*, 585-313-127.

Configuring the SSP Circuit Card

Once configured for TTS, the SSP circuit card generates the phonetic pronunciation from within the FlexWord editor. TTS is available for US English only.

Note: The FlexWord function should only be assigned to the SSP circuit card when at least one wordlist is currently activated. If the FlexWord function is assigned when no wordlists are activated, when the SSP circuit card is restored, the card will go to a BROKEN state.

Configuring the SSP circuit card for TTS functionality involves several steps. First, you must determine whether to assign the function to an SSP circuit card. Then you must determine which SSP circuit card should be assigned TTS functionality. Use the following procedure to make the determination.

1. Enter **display card sp**

   The system displays output in the format shown in Figure 9 on page 82.

2. Make a note of the card number.

3. Assign the TTS function to the chosen circuit card number.

   See “Assign SSP Functions” in Chapter 3, “Voice System Administration” in *UCS 1000 R4.2 Administration*, 585-313-507.

Figure 9. Output from the Display Card Command After Assigning TTS Functionality

```
CARD 12 STATE:Inserv CLASS: Signal_Processor (SSP)O.S.INDEX:12
        NAME: CWB1   OPTIONS: slave,tdm1
        FUNCTION: cca+code+echocan+play+text2speech+wholeword
```

Note: Before you begin using the FlexWord toolkit, verify that all the circuit cards needed are in service by repeating step 1.

FlexWord Commands

The following commands are used in the procedures to create wordlists, modify wordlists by adding and deleting entries, make phonetic changes in a wordlist., copy wordlists to diskette, and activate wordlists. For information on these commands, see *UCS 1000 R4.2 Administration*, 585-313-507.

- **wl_init**
- **wl_edit**
- **wl_copy**
- **wl_install**
- **wl_gen**

Note: You do not have to stop the voice system to run any of the commands associated with the FlexWord feature.

Using the Mouse

The left mouse button is used to select items from the menu bar on the FlexWord editor window as well as to move the marker so that you can type in the `Phonemes` and `String to Add` boxes.

Note: You can also select items from menu bar by typing the letter indicated with an underscore. For example, entering **f** at the keyboard while the FlexWord editor window is displayed accesses the File menu.

Creating a FlexWord Wordlist

Use the following procedure to create a FlexWord wordlist:

1 Log in as **root**.

2 Select a working directory.

You may want to create a directory with a name similar to the wordlist you will create.

3 Using vi (or other editor), create a file in the working directory that contains an entry for each word or phrase you want to recognize in an application.

~ The filename must be uppercase, alphanumeric, and 14 characters or less in length. (The filenames must be uppercase for the **wl_gen** command to execute.)

~ Each entry must be on a separate line.

- White space is not allowed. Separate multiple words in an entry with an underscore (_). For example, in a list of cities, Grove_City would be written with the underscore as shown.
- For guidelines on including out-of-vocabulary (OOV) entries, see Including Out-of-Vocabulary Terms on page 100.
- The maximum number of words in a wordlist must not exceed 2000 (see Table 7 on page 73).

4 Enter **wl_init *filename* [*language*]**

where:

- ***filename*** is the name of the wordlist file.
- ***language*** is the language for the wordlist.

The system adds a phonetic transcription for each entry in the wordlist according to the language you specify (English is the default), and then displays the following message:

`File` **<*filename*>** `now contains initial phonetic breakdown Enter` **cat <*filename*>** `to view the phonetic spelling of each word/phrase in your file.`

You can use vi (or other editor) to view the phonetic transcriptions the **wl_init** command has added. Figure 10 on page 85 shows an example of the command output. (You can also view the phonetic transcription once you open the wordlist in the FlexWord editor by clicking on a wordlist entry and looking in the Phonemes window.)

Figure 10. Example of an SSP Wordlist File with Phonetic Spelling For US English

```
speech                          sp"EC
database                        d"At&b.As
phone_number                    f"On_n"AmbR
address                         &dr"es
script                          skr"ipt
```

Modifying Entries in a FlexWord Wordlist

The FlexWord editor can be used to change wordlist entries to reflect alternative pronunciations, for example regional dialects. You may want to include two or more versions of the same entry to account for alternative pronunciations. You can also use it to correct pronunciations for items for nonstandard pronunciation. For example, a street named Lahser may commonly be pronounced as “Lasher,” despite the spelling.

For US English, you can use TTS to hear the pronunciation of the wordlist entries as an aid to decide whether entries need to be modified. For other languages, you may be able to make the modifications based on the list of phonemes displayed in the FlexWord editor.

When using only the SSP circuit card, use the following procedure to modify the phonetic transcription of entries in a FlexWord wordlist:

1 Log in as **root**.

2 Enter **wl_edit [-l *chan#*] [-s *ssp#*] [-D *dirname*] [-O] [-L *language*]**

   where:

   ~ ***chan#*** is the number of the Tip/Ring channel to be used for speech playback. If you do not specify this parameter, playback defaults to channel 0.

   ~ ***ssp#*** specifies which SSP circuit card to use for speech playback.

   ~ ***dirname*** is the directory in which the FlexWord editor looks for word list files.

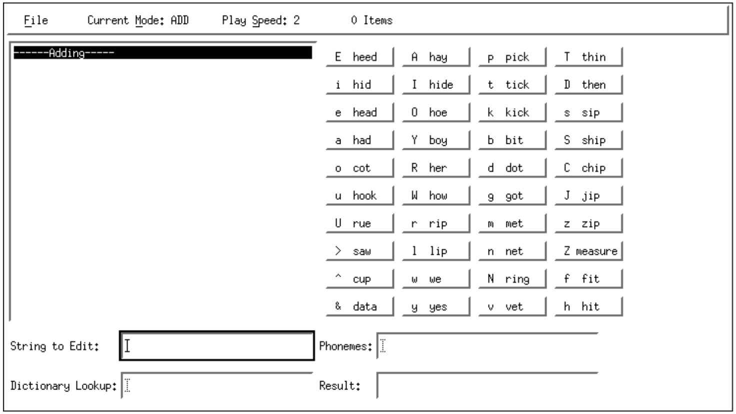
   ~ ***-O*** gives the maximum messaging output to the screen.

   ~ ***language*** specifies the language output that appears on the screen (Brazilian, English, French, German, Japanese, or Spanish).

Note: Error messages are written to a small window at the bottom of the screen. Messages are also logged to the file **/usr/tmp/wledit.output**.

The system displays the FlexWord editor window, Figure 11 on page 87. The editor displays phonemes for the language you selected.

Figure 11. FlexWord Editor Window



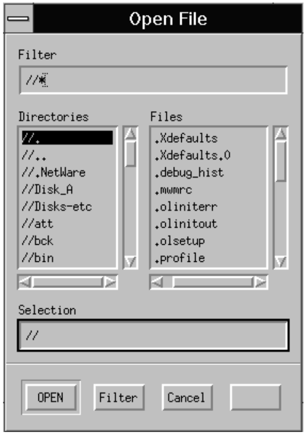
3 Select **File** from the menu bar at the top of the FlexWord editor.

The system displays the File menu.

4 Select **Open**.

The system displays the Open File window, Figure 12 on page 88.

Figure 12. Open File Window in the FlexWord Editor on the SSP



5 From the list of files, select the wordlist to be edited.

Note: The directory that is displayed is the last directory accessed before the FlexWord editor was invoked. It may not be the directory containing your wordlist. You may need to select the correct directory.

6 Select the **Open** button.

The FlexWord editor opens the wordlist file.

TTS pronounces the first entry in the wordlist. If you have not selected US English as your language, TTS will attempt to pronounce the first entry based on English phonemes. Phonemes that are not contained in the set for US English may not be pronounced correctly.

Note: The instruction in step 7 is for US English only.

7 Listen to the phonetic pronunciation of each entry by selecting it in the wordlist.

You can adjust the play speed by selecting `Play Speed` from the menu bar at the top of the FlexWord editor and then selecting the rate (1 through 4) from the Play Speed menu.

8 Type any necessary changes to the phonetic transcription of a selected wordlist entry in the `Phonemes` box on the FlexWord editor.

~ Use the phonemes shown in Figure 6 on page 72.

~ To add emphasis, use the following characters:

- (quote) " — Indicates primary emphasis and must go before a vowel sound.
- (period) . — Indicates secondary emphasis and must go before a vowel sound.

If TTS is enabled (US English only), you can listen to the pronunciation of each phoneme displayed in the FlexWord editor by clicking on it. Otherwise you can use the word displayed along with each phoneme to judge the sound of the phoneme.

9 Select **File** from the menu bar at the top of the FlexWord editor.

10 Select **Save**

Note: The system displays the Save File window, Figure 13 on page 91.

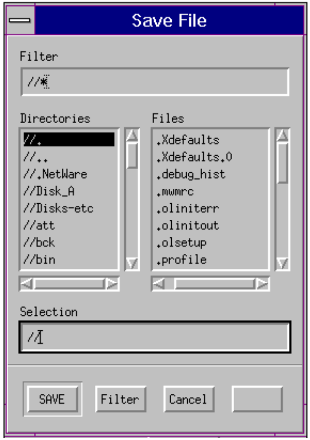
11 Select the correct file to save.

12 Select the **Save** button on the Save File window.

The system saves the wordlist, including any changes you made to the phonetic transcriptions.

13 Select **Quit** from the File menu at the top of the FlexWord editor to exit the editor.

Figure 13. Save File Window in the FlexWord Editor



Adding Entries to a Wordlist

Once a wordlist has been created, you can use the FlexWord editor to add entries to it. Use the following procedure to add entries to a wordlist:

1 Open the wordlist by completing step 1 through step 6 of the procedure in Modifying Entries in a FlexWord Wordlist on page 85.

2 Decide where you want the new entry to be placed in the wordlist.

   The new entry will be added below the currently selected entry.

3 Select **Current Mode** from the menu bar at the top of the FlexWord editor, Figure 11 on page 87.

4 Select **Add**.

The FlexWord editor displays a `String to Add` box.

5 In the `String to Add` box, type the entry to be added and press **ENTER**.

The FlexWord editor adds the new entry and its phonetic transcription. TTS pronounces the entry. If you have not selected US English as your language, TTS will attempt to pronounce the entry based on English phonemes. Phonemes that are not contained in the set for US English may not be pronounced correctly.

Note: TTS pronounces the entry according to what the dictionary tells TTS. If the entry is pronounced incorrectly, you can change the phoneme string so that TTS pronounces it correctly. However, upon subsequent lookups of the entry, TTS will still pronounce it according to the dictionary lookup. You must manually adjust the pronunciation by using the Phonemes box to make the change permanent.

6 Type any necessary changes to the phonetic transcription of the entry in the Phonemes box on the FlexWord editor. Follow the guidelines in step 8 of Modifying Entries in a FlexWord Wordlist on page 85.

7 Press **ENTER** to add the entry to the wordlist.

8 Repeat step 4 through step 7 to add another entry to the wordlist.

Deleting Entries from a Wordlist

Use this procedure to delete an entry from a wordlist.

1. Open the wordlist by completing step 1 through step 6 of the procedure in Modifying Entries in a FlexWord Wordlist on page 85.

   The system displays the Current Mode menu.

2. Select **Current Mode** from the menu bar at the top of the FlexWord editor, Figure 11 on page 87.

3. Select **Edit**.

4. Select the word or wordlist you want to delete.

5. Select **Delete** from the Current Mode menu.

   The system removes the selected entry from the wordlist.

Note: You must select **Edit** before selecting **Delete**. If you try to delete an entry while in the Add mode, the system displays the message, `Cannot DELETE while in ADD mode!`

6. Repeat step 2 through step 5 to delete another entry.

FlexWord Recognition Vocabulary Administration

Vocabulary administration involves installing wordlists and moving them between the **active** and **inactive** directories. Also, the FlexWord function may need to be assigned to or unassigned from the SSP circuit card.

Copying Wordlists

Use this procedure to copy a wordlists to diskette in preparation for installing them on a target machine loaded with the FlexWord speech recognition software.

Note: If the FlexWord software is installed on the same system where the wordlists reside, do not use this procedure. Instead copy the wordlists to the **inactive** directory (**/att/asr/wordlists/inactive**) with a standard UnixWare command.

1. Go to the directory where the wordlists are located.
2. Insert a diskette into the diskette drive.
3. Enter **wl_copy *filename1 filename2...filenameN***

   where *filename1 filename2...filenameN* are the names of wordlists.

Note: Filenames must be relative, not absolute pathnames, since they will be used to load the wordlists onto a FlexWord recognition system.

The system copies the files or directories specified to diskette. If any of the names are directory names, the contents of the directories are also copied to diskette.

Installing and Activating Wordlists from Diskette

Use the following procedure to install wordlists on the system from diskette and activate them.

1. Enter **wl_install**

2. Insert the diskette containing the wordlists (made in the procedure in Copying Wordlists on page 94) into the diskette drive when prompted.

   The system copies the wordlists to the **inactive** directory (**/att/asr/wordlists/inactive)** and prompts as to whether any of the wordlists should be activated and the **wl_gen** command run.

3. Designate, if appropriate, the wordlists that should be activated.

   The system copies the designated wordlists to the **/att/asr/wordlists/active** directory and creates the data files needed for FlexWord recognition.

Note: The **active** directory should contain only wordlists. The system does a format check when the data files are generated, and if files other than wordlists are in that directory, the system generates an error message.

Activating Wordlists Resident on the System

Activating a wordlist means creating all of the data files necessary to perform FlexWord speech recognition. Use the following procedure to activate a wordlist when the wordlist file already resides on the target voice system.

Note: Do not use this procedure if you have already activated the wordlists through the **wl_install** command. See Installing and Activating Wordlists from Diskette on page 95.

1 If there are no wordlists currently activated, make sure the FlexWord function is *not* assigned to the SSP circuit card.

2 Make sure the wordlist you want to activate is currently in the **inactive** directory (**/att/asr/wordlists/inactive**)

3 From the **inactive** directory, enter **ln *filename* /att/asr/wordlists/active** where *filename* is the name of the wordlist you want to activate.

   The system creates a hard link between the file in the **inactive** directory and the **active** directory.

4 Enter **wl_gen *language***

   where *language* is Brazilian, English, French, German, Japanese, or Spanish.

   The **wl_gen** command verifies the format of all active wordlists and creates the data files needed for FlexWord speech recognition. If the command finds more than 38 phonemes, including the underscore (_), within any entry in a wordlist, you receive an error message. Once **wl_gen** finds an error in a wordlist, it quits looking at that wordlist, and the wordlist containing the error is not used when generating the FlexWord recognition data files. Therefore, if you receive an error message, you may have to run **wl_gen** several times to locate each error.

5 Enter **diagnose card** to diagnose the FlexWord speech recognition SSP circuit card after activating your wordlists.

See *UCS 1000 R4.2 Administration*, 585-313-507, for more information about the **diagnose card** command.

6 Assign the FlexWord function to the SSP circuit card.

For the procedure, see Chapter 3, “Voice System Administration” in *UCS 1000 R4.2 Administration*, 585-313-507.

Deactivating Wordlists

Deactivating a wordlist means removing all data files associated with the wordlist. Use the following procedure to deactivate a wordlist.

1 If deactivating this wordlist will leave no wordlists activated on the system, make sure FlexWord function is *not* assigned to the SSP circuit card.

For more information, see Chapter 3, “Voice System Administration” in *UCS 1000 R4.2 Administration*, 585-313-507.

2 Make sure you are in the **/att/asr/wordlists/active** directory.

3 Remove the wordlist from the **/att/asr/wordlists/active** directory.

For example, enter **rm *filename*** where *filename* is the name of the wordlist that you want to deactivate.

Removing the wordlist destroys the link created by the **ln** command when the wordlist was activated.

4 Enter **wl_gen *language*** where ***language*** is Brazilian, English, French, German, Japanese, or Spanish.

The system removes the data files associated with the wordlist you deactivated. If there are no more active wordlists, the system displays a message to that effect.

Removing Wordlists

Removing a wordlist involves deleting both the data files and wordlists from the system. Use the following procedure to remove a wordlist.

1 Deactivate the wordlist.

See Deactivating Wordlists on page 97 for the procedure.

2 Go to the **/att/asr/wordlists/inactive** directory.

3 Remove the wordlist from **/att/asr/wordlist/inactive**.

For example, enter **rm *filename*** where *filename* is the name of the wordlist to be deleted.

FlexWord Speech Recognition Accuracy

FlexWord speech recognition accuracy depends not only on the recognition algorithms, but also on prompts, calling populations, the words to be recognized, and application designs. Given the variance in human speech among speaker and the statistical properties of recognition algorithms, the speech recognizer will make occasional errors. But the errors can be minimized and recognition can be enhanced with careful planning.

Positive Influences on FlexWord Speech Recognition Accuracy

Factors that positively affect accuracy rates include:

- Effective construction of wordlists and prompts
- Inclusion of an out-of-vocabulary (OOV) list
- Experienced calling populations
- Prompts with good structure and design

See also Chapter 6, Putting It Together for the SSP for information about getting the most out of a FlexWord speech recognition application.

Effective Wordlists

Choose words for your wordlist that have different sounds and are of medium length to help increase recognition accuracy. For example, using the last name and the first name on wordlists of a name dialer application (application that allows employees to speak a colleague's name rather than dial an extension number) increases recognition accuracy. In other types of applications, syllabic and vowel similarities may impair recognition. For example, “women’s wear” and “men’s clothing” are more effective wordlist entries than “women’s clothing” and “men’s clothing.” The latter pair sound too much alike. Both have “men” embedded in the word and both share the word “clothing.”

Note the words your customers actually use when they ask for a service. If you are automating an existing transaction that has previously taken place between a customer and an agent, use the agent as a resource and try to mimic the words of the customer requests.

Including Out-of-Vocabulary Terms

Note words your customers may use that are outside of your vocabulary wordlist. If you place these out-of-vocabulary (OOV) words in the wordlist preceded by two dashes, the recognizer classifies them as being OOV. As a result of the nature of the words in the OOV list, spoken words that are in neither list can often map to words in the OOV list. These spoken words will then be properly classified and handled by the FlexWord speech recognition application, even when they are not accurately recognized. A sample OOV wordlist is delivered with each FlexWord speech recognition language:

/vs/asp/flexword/*language*.oov

This list contains some of the words most frequently used by callers interacting with a voice response system. Append this wordlist and any custom OOV terms to each of your regular vocabulary wordlists.

Experienced Calling Population

Recognition accuracy improves for applications in which the calling populations are closed and callers are experienced or trained to interact with the application.

Prompt with Structure and Good Design

Prompts offered in calm, clear voices greatly affect recognition accuracy, as does the structure of the prompts. Prompts should guide the caller to say desired words or phrases.

For best results, menu prompts should be built with the structure of ***desired_result action_required*** and dissuade callers from attempting to speak before the prompt is finished, for example:

> "To hear your checking account balance, say 'checking'."
> "To hear your savings account balance, say 'savings'."

By placing the required action at the end of the prompt, the caller is better able to remember it. Do not list the action required before the desired result. For example, the following prompt, encourages the caller to forget the specific action required, since the last thing heard is the desired result.

> "Say 'one' for a description of the upcoming gallery events."

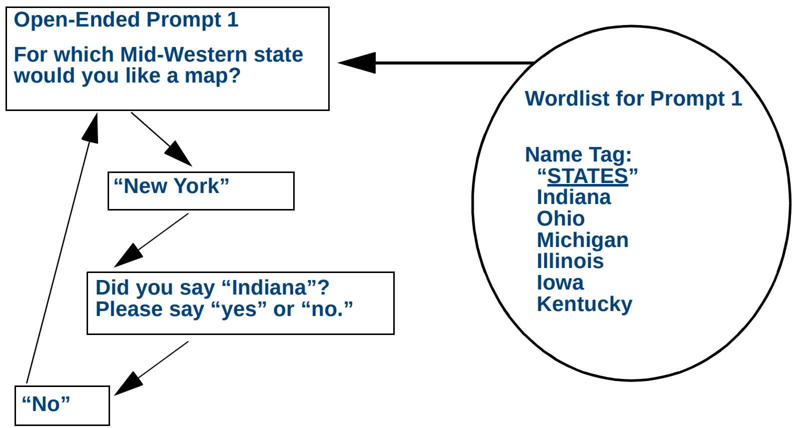
Confirmation and Reprompt Steps

Overall recognition accuracy can be increased if the application includes confirmation and reprompt steps. It is always a good idea to verify the recognized result before continuing with the application, for example:

> "You said 'spring registration'. Is this correct? Please say 'yes' or 'no'."

With this prompt structure, callers can make sure their words match the recognized response. Figure 14 provides an illustration of a confirmation reprompt.

Figure 14. Example of a Reprompt in a FlexWord Application



Informative Prompts

Lengthy prompts providing detailed response instructions may improve recognition accuracy. However, experienced users often find lengthy prompts, since they must to listen to the complete prompt before responding. One solution may be to provide more informative prompts for first-time callers only. However, for applications with infrequent users, lengthy prompts may be more acceptable and help improve the accuracy.

Negative Influences on FlexWord Speech Recognition Accuracy

Low recognition accuracy rates are usually due to:

- Inexperienced callers
- Environmental factors
- Ineffective wordlists

Inexperienced Callers

Inexperienced callers may speak extraneous phrases or speak before a prompt is finished.

Note: FlexWord speech recognition *does not* support barge-in capabilities. Thus, prompts should include some sort of time reference so that callers know when to respond.

The following examples illustrate effective and ineffective prompts. The effective prompt shows how recognition accuracy can be increased by including a time reference. This prompt encourages the caller to wait until the prompt is finished before responding. The ineffective prompt does not have the time reference “now.” Without the “now” at the end of the sentence, the caller is more likely to attempt to speak before FlexWord recognition is ready

Effective: "Please say the name of the agent with whom you wish to speak, now. "

Ineffective: "Please say the name of the agent with whom you wish to speak. "

Environment

Noisy environments, such as an airport or a train station, or an unclear telephone connection may contribute to recognition accuracy problems.

Ineffective wordlists

Ineffective wordlists cause lower recognition accuracy. In general, the larger the wordlist, the lower the expected recognition accuracy. Wordlists that contain short words and rhyming words also decrease accuracy:

- Wordlist size — As the size of wordlists increase, accuracy decreases. The best accuracy results can be achieved by structuring an application to make use of several smaller wordlists rather than one large wordlist.
- Rhyming words — Wordlists that include words with similar rhyming vowel sounds can cause a decrease in recognition accuracy.
- Short words — One-syllable words that have the same vowel sounds are difficult to recognize. For example, “on” and “off” both share the short “o” sound. (Long “o” vowel sounds appear in words like “oh” and “no”—words in which you can hear the letter “o.”) Short words should be used in moderation.

5 Recognizing Dial Pulse Input

Overview

Note: The information and procedures in this chapter pertain only to the SSP circuit card.

Dial Pulse Recognition (DPR) allows a user with a rotary or a push-button telephone that generates only dial pulses to respond to the UCS 1000 R4.2. Dial pulse telephones are commonly used in many countries throughout the world. DPR supports digits "0" (zero) through "9" on analog and digital interfaces.

This chapter explains the following topics for DPR:

- Components and functionality
- Simultaneous dial pulse capabilities
- Standard dial pulse recognition types
- The accuracy of DPR
- Grammars
- Recognition confirmation

- Barge-in
- Troubleshooting guidelines

Hardware

DPR is available on the:

- Speech and signal processor (SSP) circuit card

Note: If you are using a digital line interface circuit card, you must use the SSP circuit card for DPR.

Simultaneous Dial Pulse Capabilities

DPR can work simultaneously with either dual-tone multi-frequency (DTMF), WholeWord speech recognition, or FlexWord™ speech recognition. WholeWord and FlexWord recognizers can independently work with the dial pulse recognizer. Combining DPR with a speech recognizer gives the caller the choice of either keying in the number with dial pulse or touchtone, or of using spoken input.

Dial Pulse Recognition Types

Certain digit strings may require custom recognition types as a technique used to obtain acceptable recognition accuracy. Examples include a credit card number, a merchant number, and a 10-digit telephone number. These digit strings have specific limitations on the position of certain digits within the string (for example, a credit card whose first number must be 3 or 5, and whose second number must be 1 or 7).

Table 8 shows the standard dial pulse recognition types.

Table 8. Standard Dial Pulse Recognition Types

Digit Lengths and Digits Allowed	Recognition Type
Single digit 1 - 3	DP1_3
Single digit 1 - 5	DP1_5
Single digit 2, 5, or 8	DP258
Single digit 1, 4, 7, or 0	DP1470
Any digits 1 - 9 and 0	DP1_10
Any digits 2 - 9 and 0	DP2_10
Any digits 3 - 9 and 0	DP3_10

Grammars

A grammar is a set of rules that specifies allowable vocabulary words, vocabulary word combinations, or pulses at any one point. Grammars are built into a recognition type and increase recognition accuracy or limit expected input. After collecting dial pulse input, the DPR algorithm uses grammars to generate a list of candidates that most closely resemble this input. The algorithm returns the most likely match to the script or, if no match fits, rejects the input.

Grammars for DPR are modeled after grammars for speech recognition. DPR currently uses grammars only to do input restriction such as “ignore digit one” and pulse-to-digit mapping.

Recognition Confirmation

Recognition confirmation is the ability of the system to repeat the caller's dial pulse response back to the system for confirmation. For example, an application prompts a caller to "Please enter your area code," and the caller dials **6 1 4** or speaks "614." The Prompt and Collect action can be structured using the DP258 recognition type, thereby restricting the expected input to only 2, 5, or 8. Using recognition confirmation, the system repeats what it recognized the caller's response to be and then requests, "If this is correct, enter 2, if incorrect enter 5." The caller then confirms whether the system recognized the input properly.

When an application requires a long string of numbers such as an account number from a caller, these can be requested and confirmed one digit at a time. Although time consuming, this process establishes higher accuracy and decreases the likelihood of the system accepting a faulty account number.

Barge-In

Barge-in (also called recognize during prompt) is the ability of the system to allow callers to interrupt during prompts by entering DPR digits.

Note: Currently barge-in is not supported for use with DPR.

How Dial Pulse Recognition Works

Dial-pulse digits that a user enters are collected by the algorithm on the SSP circuit card and processed according to the selected recognition type. A maximum of 60 channels are available per SSP circuit card.

For DPR to run on the SSP circuit card, it must be assigned through the cvis_menu screens. For information on assigning SSP functionality, see Chapter 3, See “Assign SSP Functions” in Chapter 3, “Voice System Administration” in *UCS 1000 R4.2 Administration*, 585-313-507.

The Recognizer

The SSP circuit card is loaded with the DPR software package, also called the *recognizer*. The recognition type is defined in the `Recog:` field on the page 2 of the Define Prompt & Collect screen.

For a prompt of “2, 5, 8,” the application developer selects the DP258 recognition type, which is used for a response consisting of “2,” “5,” or “8.” The caller's response to the prompt is compared to the numbers 2, 5, or 8. The number of pulses that most closely matches the input determines the recognized result. A value of 2, 5, or 8 is returned in $CI_VALUE. The application decides what to do next, based on the value of $CI_VALUE.

Recognition Accuracy

False recognition can occur if the caller is in a noisy environment or on a noisy telephone line. For example, an electrical disturbance that causes a “pop” sound on the telephone line can be recognized as a dial pulse digit. Speaker phones can aggravate this condition since they amplify room noise. False recognition is reduced once training has been completed.

Training

Training is the ability of the system to learn the characteristics of each telephone. Training occurs when a caller first accesses the system. The application should ask the caller to enter a number greater than 5 for training to converge. This process increases accuracy of the system while decreasing false recognition due to extraneous noises.

For example, your first prompt may be, “Please enter ‘8’ followed by your account number.” When validating the user input, you should ignore the initial digit in the string. It is not necessary to create a separate input sequence just for training. At this point, the system has learned about the caller’s telephone characteristics.

Training is an option that can be turned on or off. When turned on, training is automatic in that it shuts off after the caller has entered the number greater than 5.

Limitations

In integrations with the DEFINITY® G3 switch, unexpected behavior from the dial-pulse recognizer may occur. DEFINITY G3 converts dial pulse digits to DTMF tones only when the input telephone is directly connected to the DEFINITY switch. This eliminates the need for DPR since the system always responds to DTMF tones.

Some central office (CO) switches may not pass dial pulse digits through once a call has been established. The caller's local switch (in the CO) may see the loss of loop current as a hangup or a register recall and disconnect the caller. Although the problem is not common, there is nothing the system's DPR can do in this situation.

Note: DPR applications cannot receive the pound sign (#), asterisk (*), or the letters "a" through "d," all of which are available on DTMF telephones. Applications using DPR must be redesigned accordingly.

DPR Troubleshooting

Use Table 9 to troubleshoot problems with DPR.

Table 9. DPR Troubleshooting

Problem	Action
DPR does not appear to be working.	A path is provided in the **feature_tst** script delivered with the system. Load this package by selecting DPR as a test path. Make sure DPR is assigned to the appropriate circuit card and is in service. The test asks you to dial any four dials pulse digits and speaks the result back to you.
	1 of 2

Table 9. DPR Troubleshooting

Problem	Action
DPR does not recognize digits.	A number of problems could cause DPR not to work. • Ensure all administration and assignments for DPR are correct. • Use the **feature_tst** script to determine if it is an application or system issue. • Check the system error logs and take appropriate corrective action. If these actions do not reveal the problem, contact your Support Hotline 1-303-538-8748.
DPR mis-recognizes digits.	If digits are consistently mis-recognized from multiple callers, some local tuning may be necessary. Contact your Support Hotline 1-303-538-8748.
	2 of 2

Common Failure Modes

DPR failure is usually a result of either noise on the line or missing (or extra) pulses.

Noise on the Line

Recognition failure due to noise on the line can most often this occurs with the digit “1” and sometimes with the digit “2”. If you have application control over the requested user input, you can avoid the use of these digits.

Missing or Extra Pulse

When the recognizer incorrectly recognizes, it is usually off by one digit. Application validation can decide to accept this and continue. For example, if the caller is asked to enter an account number and personal identification number (PIN), you may decide to accept the input even though the PIN is off by one digit.

There are standard recognition types for single-digit prompts requiring four or fewer choices that provide good recognition accuracy. This is accomplished by separating the valid choices by three pulses and mapping all invalid choices to their closest neighbor.

6 Putting It Together for the SSP

Overview

Note: Information in this chapter pertains to the features working only on the SSP circuit card.

This chapter describes the following considerations for using speech-related features with optimal effectiveness in applications:

- How to get the most out of speech-related features in applications
- Why certain features work well together
- When you can use speech-related features together

Recognition types, including FlexWord™ speech recognition, Whole Word speech recognition, and dial pulse recognition (DPR only on SSP) are discussed, as well as the TTS (Text-to-Speech) feature.

Note: In order for barge in to work, recognition and echo cancellation must be assigned on the same card. Otherwise a non-barge in prompt is displayed.

Using WholeWord Recognition and Dial Pulse Recognition Together

WholeWord speech recognition can be used to recognize a limited set of words, as discussed in Chapter 3, Recognizing WholeWord Speech Input on the SSP . However, WholeWord speech recognition is most successful when you use it to augment a touch-tone application to handle callers who do not have or for some reason do not want to use touch-tone telephones.

WholeWord speech recognition and DPR are the only practical ways to provide connected-digit recognition. If your application requires recognition of strings of digits, you can use either recognition type.

For more information on how to incorporate WholeWord speech recognition into a touch-tone application, see *Application Design Guidelines*, 585-310-670.

Getting the Most Out of FlexWord Speech Recognition

As discussed in Chapter 4, Recognizing FlexWord™ Speech Input on the SSP , FlexWord speech recognition recognizes the caller speaking words from a vocabulary that you define and is therefore specifically tailored to your application. Allowing the caller to speak the option wanted rather than speaking a number assigned to the option can make the interaction more natural and easy to use. Included below are guidelines for getting the most out of FlexWord speech recognition.

Choosing a FlexWord Speech Recognition Vocabulary

Since FlexWord speech recognition offers you the freedom to specify your own custom vocabularies, you have the advantage of making sure your custom vocabularies are easy to use with your application. How you set up your wordlists contributes greatly to the success of your application.

FlexWord speech recognition vocabulary items can be single words or phrases, which are all referred to as “words.” The words must be divided into groups called wordlists. A wordlist includes all of the words that can be spoken at a particular prompt. Each application has its own vocabulary, or set of wordlists. At any prompt, only one wordlist can be active at a time. This means that only one wordlist can be under consideration by the recognizer at any one time. The words in each wordlist must be distinct enough from each other to allow the recognizer to work effectively. If your vocabulary contains two or more words that are very similar, each of those words should be on a separate wordlist. The following sections discuss factors to consider when creating your wordlists.

Caller Error

If you find that callers tend to respond with unacceptable words or phrases during a prompt, you can add these words to the wordlist. In your application, you can handle these words as caller errors and reprompt the caller. For example, if your wordlist contains account names and the valid account names are “checking” and “savings,” but you find that callers are responding with “loan” you could add “loan” to the wordlist. If the recognizer recognizes that a caller says “loan,” you can design your application to say “Sorry. We did not recognize your response. Please choose ‘checking’ or ‘savings’. “

Word Length

Words with more than one syllable are recognized more reliably than shorter words. For example, the phrase “add entry” would be better to use than the word “add.” Phrases can be fairly long, although the longer the phrase, the greater the chance of callers forgetting it or making mistakes while speaking.

Word Choice

Choose words and phrases that would occur naturally to your typical caller. One way to determine this is to survey some representative callers and ask what words or phrases they would use for actions in your script. Do not rely on just your knowledge, because your impressions may be different than those of your callers.

Prompting for Input

Because FlexWord speech recognition does not support barge-in, structure your prompts to encourage callers to wait until the end of the prompt before speaking. For example enter, “Please say the department name, now,” as opposed to “Now say the department name, please.”

Word Sounds

Use words in your wordlists that do not have a similar sound. To the recognizer, vowels are more important than consonants. Avoid using words with similar vowel sounds. Words that differ in only one or two consonants are difficult for the recognizer to distinguish between. For example, the words “connect” and “comment” sound similar to the recognizer.

Synonyms

If you find that callers often use more than one word for the same thing, you may want to add both words to your list.

Examples of FlexWord Speech Recognition Applications

Two examples of applications suited to FlexWord speech recognition are described below.

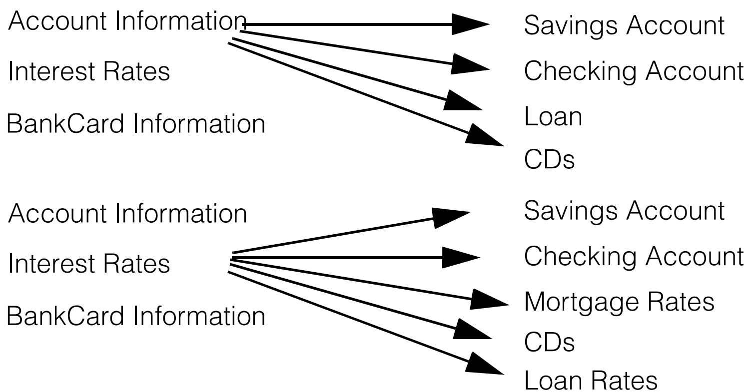
Applications Requiring Large Wordlists

Applications that require large custom wordlists can benefit from FlexWord speech recognition. In this type of application, the voice prompt cannot enumerate all of the valid responses. As a result, the application must provide sufficient guidance to the caller to facilitate an appropriate response. An example of this type of application would be a name dialer, or automatic call router. By speaking a name, the caller is transferred to the extension of that person.

Menu-Based Applications

Menu-based applications that use words and phrases native to your business environment are suggested for use with FlexWord speech recognition. Your application flows more smoothly if it uses the same words that would occur naturally in an interaction between an agent and the customer. Figure 15 on page 122 shows an example of a menu-based application.

Figure 15. Example of Menu-Based Application



Getting the Most out of Text-to-Speech

The following tips can help you use TTS most effectively in prompts and announcements.

- When TTS prompts are used with touch-tone input, callers can interrupt the prompt just as they can when the prompt is prerecorded.
- Callers can also interrupt TTS prompts with WholeWord speech recognition input. However, when using TTS prompts with FlexWord speech recognition input, barge-in is not available. Therefore, when accepting FlexWord speech recognition input, structure your TTS prompts so that they encourage callers to wait until the end before responding.

Note: TTS is available for US English only.

Using FlexWord Speech Recognition and Text-to-Speech Together

Since FlexWord speech recognition provides the ability to recognize up to 2000 words, your FlexWord speech recognition application needs a way to organize the recognized responses. This can be done by recording all the words in your wordlist, and speaking them back after the database completes a lookup.

However, TTS allows the transaction to provide a more flexible way of speaking the wordlist. TTS allows you to speak the contents of $CI_VALUE (the recognized word on the wordlist) easily. Also, if the wordlist changes, TTS still works— possibly without changes to your application. If you use prerecorded speech to speak the wordlist, you will have to record each time the wordlist changes.

Note: TTS is available for US English only.

Using WholeWord and FlexWord Speech Recognition Together

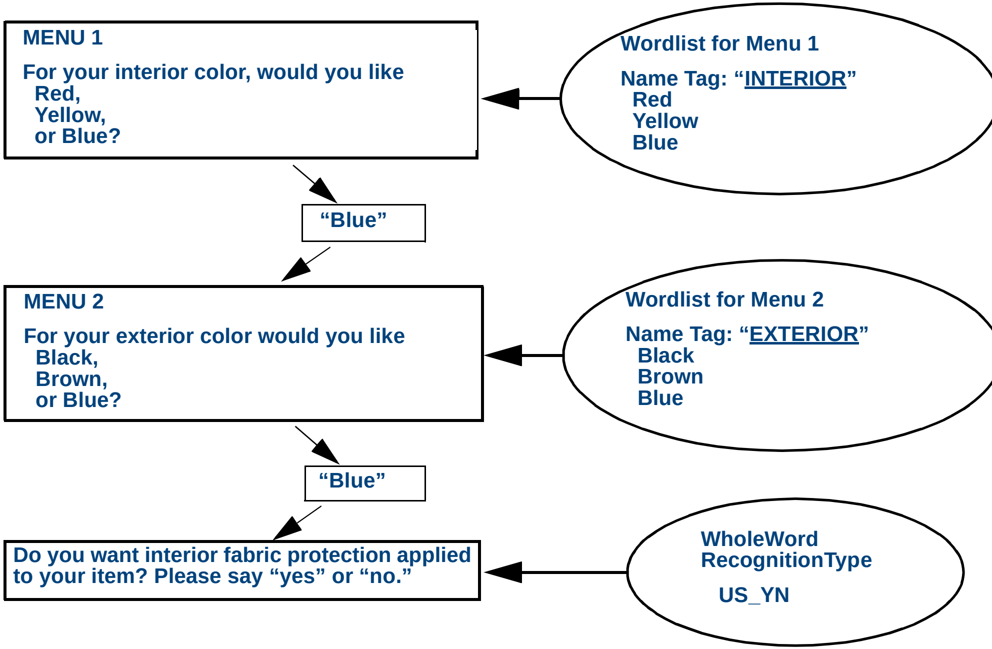
WholeWord and FlexWord speech recognition are used in either a TAS or irAPI script. See *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214 for TAS and irAPI information.

- If you want callers to say “yes” or “no,” a series of digits, or a single digit, choose a WholeWord speech recognition.
- If you want callers to speak a word or phrase from your custom vocabulary, choose a FlexWord speech recognition.

Note: Both recognizers cannot be used in the same prompt.

The example in Figure 16 on page 126 shows a model of a retail application that combines FlexWord wordlists and the WholeWord “yes and no” speech recognition feature. In the example, the word “blue” must appear on both the “INTERIOR” wordlist and the “EXTERIOR” wordlist. Since the word “blue” appears on two wordlists, it counts as two words. If the word “blue” is not on the “INTERIOR” wordlist, this feature will not look to the “EXTERIOR” wordlist to find it. The feature returns the word in the wordlist that it thinks is the most suitable match. Since the feature can only look at one wordlist prompt, each wordlist must contain *all* possible choices for a single prompt.

Figure 16. Illustration of the Use of FlexWord and WholeWord Speech Recognition in a Single Application Script



WholeWord Speech Recognition Versus FlexWord Speech Recognition Accuracy

For most applications, the accuracy of Whole Word recognition is higher than for FlexWord recognition. The following list shows the accuracy rates, arranged in order from highest to lowest:

1. WholeWord speech recognition isolated digit
2. WholeWord speech recognition connected digit
3. FlexWord speech recognition isolated word

Comparison of Recognition Types

Table 10 summarizes the similarities and differences between WholeWord speech recognition, FlexWord speech recognition, and DPR when assigned to an SSP circuit card.

Table 10. Comparison of Speech Recognition Types on an SSP Circuit Card

WholeWord Recognition	FlexWord Recognition	Dial Pulse Recognition
Word-based	Phoneme-based	Pulse-based
Requires data collection in model building for vocabulary words other than digits “zero” through “nine,” common synonyms for those words, and the words “yes” and “no”	No data collection required in model building	No data collection required in model building
Connected digits	Single word or phrase	Connected digits
Standard and custom grammars	Customized wordlists	Standard grammars
		1 of 2

Table 10. Comparison of Speech Recognition Types on an SSP Circuit Card

WholeWord Recognition	FlexWord Recognition	Dial Pulse Recognition
Barge-in supported	Barge-in not supported	Barge-in not supported
Phrase screening supported	Phrase screening supported	Phrase screening supported
Limited vocabulary	2000-word vocabulary	Limited vocabulary
Word spotting supported	Word spotting supported	Word spotting not supported
		2 of 2

7 Recognizing WholeWord Speech Input on the LSPS II

Overview

Note: Information in this chapter pertains to the feature working only on the LSPS II circuit card.

WholeWord speech recognition is part of the *LSPSset* installable software package. See Chapter 9, "Installing LSPS II Optional Software Packages," in *UCS 1000 R4.2 Maintenance*, 585-313-126 for procedures to install the *LSPSset* software package.

WholeWord speech recognition allows you to write applications that prompt for and understand spoken input from callers. This feature supports a standard vocabulary that includes:

- The numbers “zero” through “nine” and their commonly used synonyms
- The words “yes” and “no”

This chapter describes the capabilities of WholeWord speech recognition and the factors that influence the accuracy of recognition. This background information is necessary to use the WholeWord speech recognition package for optimal accuracy. Topics covered include:

- Languages supported

- Standard vocabulary
- Speech recognition types
- Barge-in
- Positive and negative influences on speech recognition accuracy
- The process by which WholeWord speech recognition works

WholeWord Speech Recognition

WholeWord Hardware and Software

- For a list of the required software and hardware, see WholeWord Speech Recognition in Chapter 1, Overview of Speech.
- For the procedure to install the LSPSset software package, see Chapter 9, ”Installing LSPS II Optional Software Packages” in *UCS 1000 R4.2 Maintenance*, 585-313-126.

Languages Supported

WholeWord speech recognition provides standard vocabulary support for the US English language.

For additional information about global support, contact your Lucent Technologies representative.

Standard Vocabulary

Table 11 lists the standard vocabulary supported for the US English language in WholeWord speech recognition.

Table 11. Standard Vocabulary for WholeWord Speech Recognition

Caller Input Field	US English
0	zero, oh
1	one
2	two
3	three
4	four
5	five
6	six
7	seven
8	eight
9	nine
	1 of 2

Table 11. Standard Vocabulary for WholeWord Speech Recognition

Caller Input Field	US English
yes	yes
no	no
	2 of 2

Standard WholeWord Speech Recognition Types

Description

Recognition types allow you to indicate which keyword or words are possible selections for each prompt. All of the recognition types and words used by an application constitute that application's vocabulary. A complete recognition type includes:

- Mathematical models of the words, see Models and Speaker Independence on page 134.
- A grammar, see Grammars on page 134.
- Specifications of maximum and minimum numbers of digits, see Keyword Recognition Types on page 135
- A recognition data interface process (DIP) — optional (discussed below). The standard WholeWord speech recognition package provides several commonly used recognition types. See Recognition DIPs on page 138

Models and Speaker Independence

Each word of the system's vocabulary is represented by one or more mathematical models that contain the speech signal characteristics of the word. The speech recognition process compares a person's voice to the set of predeveloped speech models. Each model is constructed from thousands of samples of the spoken word. Regional accents and dialects associated with a particular language are incorporated into each model, as well as a mix of male and female speakers so that the system recognizes callers of either gender speaking in any of those dialects with any of those accents. The recognition type determines which models the incoming speech is compared to.

Grammars

A grammar, which is selected by a recognition type, is a set of rules that specifies allowable vocabulary words and vocabulary word combinations at any one point in the script (for example, "one," "two," "three"). While collecting spoken input, the speech recognition algorithm uses models and grammars to generate a list of candidates that most closely resemble this spoken input. The algorithm returns the most likely match to the script or, if no match fits, rejects the input. When input is rejected, the algorithm returns an empty string to the script. This return message is the same for all of the languages supported. All grammars provided in the speech recognition package share the same set of models for words that are common to their package's vocabulary.

Keyword Recognition Types

Keyword recognition types are used for isolated word recognition, that is, responses of a single word or digit. Table 12 shows the standard WholeWord speech recognition types for US English, which are used when prompting the caller to speak a response of one word or digit.

Table 12. US English Standard WholeWord Speech Recognition Types

Prompt	Recognition Type
"Yes" or "No"	IW_YESNO
Connected digits: telephone numbers	CD_PHONE; CD_PHONE+
Connected digits:14-digit authorization code	CD_AUTH14
Natural numbers: dollar amounts	NN_DOLLAR
Natural numbers: dates	NN_DATE
Natural numbers: telephone numbers	NN_PHONE+
	1 of 2

Table 12. US English Standard WholeWord Speech Recognition Types

Prompt	Recognition Type
Natural numbers: time	NN_TIME
Connected digits: known length	CD_1 through CD_16
Connected digits: unknown length	CD_UNKNOWN
	2 of 2

Connected-Digit Recognition Types

Connected-digit recognition types are used for connected-word recognition, that is, responses of more than one word or more than one digit string. The spoken string can be fixed in length from 1 to 16 digits, or it can be of a variable length. Grammars are provided for the 1- to 16-digit fixed-length while CD_UNKNOWN provides the variable-length strings. Table 12 on page 135 lists the connected-digit recognition types.

For better accuracy, you must specify the desired string length when selecting the recognition type for a fixed-length string. A US area code (614, for example), consists of three words; therefore, the minimum and maximum values are “3.” If a variable-length string (US English *only)* of one to four words is required, “1” is the minimum value and “4” is the maximum value.

Connected-Digit Recognition

Connected digits are strings of naturally spoken digits, which may or may not include a pause. All packages recognize spoken digit strings. Connected-digit recognition packages allow you to collect input by specifying a fixed-length (1–16 digits) or, for US English only, a variable-length (1–24 digits). Number entry is an essential component if you want callers to input numbers with more than one digit, (for example, if using code CD_1, the system looks for numbers 0 through 9; if using CD-3 it looks for numbers 000 through 999). Recognition is better for fixed-length strings than for variable-length strings.

Fixed-Length versus Variable-Length Connected Digits

The capability to recognize fixed-length strings of 1–16 digits is provided with WholeWord speech recognition packages (see Table 12 on page 135). A fixed-length string is a string of digits that is always made up of the same number of digits. For example, a US social security number is a fixed-length number, since it always consists of nine digits. By contrast, a variable-length string indicates a string of digits that varies. For example, a street address is a variable-length string.

Accuracy is best when you use fixed-length strings. Whenever possible, try to specify the length of the string to increase recognition accuracy. For strings longer than 16 digits, use of a custom grammar is recommended (see Custom Grammars on page 144 below). Using the provided variable-length grammar as an alternative results in decreased accuracy. If your application must accept a variable-length digit string, you may be able to increase recognition accuracy by using a two-step entry process. First prompt the caller for the number of digits, and then prompt for the digits.

For example:

“How many digits are in the next code?”
“Please say the three-digit code now.”

The script can then select a fixed-length recognition type for the appropriate number of digits.

Recognition DIPs

A recognition data interface process (DIP) is used to help increase an application’s accuracy. For example, certain digit strings, such as credit card numbers, have check digits built into them. Verifying a check digit is done most efficiently through a DIP. However, a DIP is not necessary for many recognition types. If there is no further information to consider for a string other than what is in the grammar, a DIP is not needed. Specifically, none of the standard WholeWord speech recognition types, such as “yes” and “no,” needs a DIP.

For some recognition types, there may be tradeoffs that determine how much of the structure of the input is built into the grammar and how much should be left for the DIP. For more information about custom DIPs, see “Writing the DIP” in Chapter 4, “Data Interface Processes,” in *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214. Also see Custom DIPs on page 144.

Word Spotting

WholeWord speech recognition supports word spotting. Word spotting is the ability of the system to ignore extraneous speech during speech recognition. For example, if a caller says, “I want number five, please,” the system recognizes the word “five” as a valid response and ignores the rest of the input. In other words, callers do not have to speak the key word, which in this case, is “five” in isolation. The caller can speak other words, and the system can distinguish the key word from the extraneous words.

This means that the caller’s input is not limited to the words in the system vocabulary. For example, in the phrase “Uh, yes please,” the vocabulary word “yes” is recognized if the system is using the standard vocabulary.

However, to maintain good recognition accuracy it is advisable to structure the application to prompt the caller for the required information only. Applications should encourage the caller to speak only what is required.

Recognition Confirmation

Recognition confirmation is the ability of the system to repeat the caller’s spoken response back to the customer for confirmation. For example, a script prompts a caller, “Please say your area code,” and the caller says, “Six, one, four.” Using recognition confirmation, the system repeats what it recognizes the caller’s response to be and then prompts, “If this is correct, say ‘yes’, if not say ‘no’.” The caller then confirms whether the system recognized the spoken input properly.

Barge-In

Description

Barge-in, also called "recognize during prompt," is the ability of the system to allow callers to interrupt or barge in during voice playback by speaking a vocabulary word. Speech recognition accepts either speech or touchtone input in response to a prompt. Barge-in operates for speech much like the talkoff option does for touch-tone input, where a caller can interrupt the prompt by pressing a touch tone. See Dual LSPS Tone Multifrequency (DTMF) Support on page 143 for more information on interrupts.

Experienced callers appreciate being able to shorten the transaction time by not being required to listen completely to each prompt. You can enable or disable barge-in for any of the prompts in your application.

Note: The system is able to detect touch tones immediately; however, it does take a few seconds longer to detect valid speech, as opposed to a cough, sneeze, etc. You should expect a slight delay when using barge-in.

For isolated word recognition, the prompt does not stop until the system recognizes a valid vocabulary word. Once the prompt completes playback, the initial timeout field eventually ends the recognition if no valid input is received.

For packages that support connected-digit recognition, the playback of the prompt stops between the recognition of the first and last word of the input, when the system decides that valid input has started.

Enabling or Disabling Barge-In

At the beginning of an application, after the answer instruction, you can place an instruction to enable barge-in using the **sr_talkoff** (TAS instruction). If a barge-in resource is available, it is reserved for this call. Otherwise the return code is negative, and barge-in will not be available. For more information see Appendix B, "Summary of TAS Script Instructions," in *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214.

Discouraging Barge-In

The following example includes short pauses that tell the caller that the system is waiting for a response. The caller answers at the time of the short pause.

> "For sales say, 'one'.'" (pause
> "For service, say, 'two'." (pause)
> "To speak with a representative, say 'three'."

The following example does not include pauses. The caller waits until the prompt is completed before answering.

> "You can order up to five copies. Please say how may copies you want."

If there is silence at the end of a prompt, the caller may speak but the system may not be prepared to listen. Make sure that there is no silence at the end of your recorded phrases when barge-in is disabled.

Encouraging Barge-In

The following prompts are designed to encourage callers to barge in when barge-in is enabled. Note that the pauses are longer than in the examples in Discouraging Barge-In on page 141 above, so callers are encouraged to respond after hearing the desired option and the word “now.”

“For sales say, ‘one’ now.”	(pause of 1-1.5 seconds)
“For service, say, ‘two’ now.”	(pause of 1-1.5 second)
“For a representative, say ‘three’ now.”	(pause of 1-1.5 seconds)

System Response for Barge-In

For an application using speech recognition with barge-in, callers who choose to talk over the prompt message will not experience barge-in until most of the digit string is spoken. The distinction in response is as follows:

- When a fixed-length digit recognition type is used on the LSPS II circuit card, the prompt can be interrupted after ***N***-2 (N minus 2) digits are spoken plus a system delay of 0.75 second, where ***N*** is the total number of digits to be collected. For example, for the US_9DIG recognition type, the prompt can be interrupted after seven digits.
- When short prompts are used, callers may not detect delays in the barge-in point because the prompt will frequently complete before the caller has spoken much input.

Dual LSPS Tone Multifrequency (DTMF) Support

Even with WholeWord speech recognition installed, callers still have the option of responding to prompts with touch tones rather than speaking. Speech recognition accepts either speech or touchtone input in response to a prompt. Talkoff is the ability of the system to allow callers to interrupt during voice playback by pressing a DTMF touch tone. Talkoff operates for touch tones much like barge-in does for speech, where a caller can interrupt a prompt by speaking.

Often the response time for talkoff is faster than for barge-in. This is because touch tones were designed to be recognized by machines and are rarely confused with other sound or voice input. However, WholeWord speech recognition must perform the more complex task of separating the desired input from other sound or voice input that may simultaneously be present. The system does not terminate a prompt until it processes enough input to ensure with relatively high confidence that the input is valid. For a prompt requiring single-digit input, talkoff and barge-in may appear equally fast since the input is completed with a single touch tone or a single spoken digit. Prompts for multidigit input reveal the difference between the response times for talkoff and barge-in. See Barge-In on page 140 above for information comparing and contrasting talkoff and barge-in.

Custom Grammars

The system uses the recognition type to select a speech recognition grammar to be used. Certain digit strings and custom vocabulary words may require custom recognition types and associated custom grammars for acceptable recognition accuracy. Examples include a credit card number or a merchant number. These digit strings have specific limitations on the position of certain digits within the string. For example, a telephone area code in North America requires a number 2 through 9 for the first digit, 0 through 9 for the second digit, and 0 through 9 for the third digit.

Custom recognition types help limit the recognition possibilities for the LSPS II circuit card, which results in better accuracy.

For more information, contact your Lucent Technologies representative.

Custom DIPs

You can improve recognition accuracy by using an application with a DIP. DIPs, which are typically written in the C programming language, interact with your script to help access external information. Once a request is received from a transaction state machine (TSM) script, for example, the DIP processes the message and returns the results to the corresponding script. DIPs usually work based on knowledge that is unavailable to the LSPS II circuit card.

WholeWord Speech Recognition Accuracy

Overview

The accuracy of WholeWord speech recognition depends not only on the recognition algorithms, but also on the models, grammars, DIPs, prompt structure, calling environment, user behavior, and the recognized data itself. Each of these factors can impact recognition accuracy positively or negatively. Also, measures of accuracy must be based across the entire calling population. Therefore, any attempt to measure accuracy must include a statistically representative sample of the calling population.

Positive Influences on WholeWord Speech Recognition Accuracy

The items described below have a positive impact on WholeWord speech recognition accuracy.

Note: For more information on WholeWord Speech Recognition using the LSPS II circuit card, print the LSPS Software Development Kit resident on the system by moving the file **/usr/lsps/doc/pdf/sdk.pdf** from the system to a location that can be accessed by acrobat reader

Isolated Word Recognition

Isolated word recognition is very high. The smaller the number of choices in an isolated word recognition type, the better the accuracy. For example, IW_YES_NO is either yes or no.

Fixed-Length Digit String

For connected-digit recognition, a fixed-length recognition type provides better accuracy than a variable-length recognition type. If possible, avoid the use of variable-length strings in WholeWord speech recognition applications.

Validation of Data

Try to verify the recognized result against a database or a host field. This helps improve the overall accuracy of an application, especially when a longer string is input. The system uses a series of "prompt and collect" TAS instructions. The system responds with its "best guess" of what the user said to the TAS instructions below:

- talk or say set of instructions (play or TTS)
- **recog_start** and **getinput**

Note: See Appendix B, "Summary of TAS Script Instruction," in *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214 for more information on the **recog_start** and **getinput** instructions.

Reprompt

If the keyword is not spoken, and the system does not misinterpret extraneous words for a keyword, the system can reprompt the caller. If the accuracy measurement is based on either a WholeWord or FlexWord speech recognition application with a confirmation and reprompt step, the accuracy increases.

Prompt Structure

The prompt structure can greatly affect accuracy by promoting a clearly articulated response, helping the caller to barge in at the appropriate time or to wait until the prompt is complete before talking (when barge-in is disabled), and providing consistent instructions on what the caller should say to get the desired result.

- Menu prompts

  For best results, build menu prompts with the following structure:

  <desired result> <action required>

  Examples:

  "To hear your checking account balance, say 1."
  "To hear your savings account balance, say 2."

  By speaking the action required at the end of the prompt, the caller does not have to remember what is required of him or her through the description of the desired result. In addition, if you want to encourage your callers to barge in when they hear their desired result, you can add a small pause after the action-required phrase.

- Yes and no prompts

  Structure yes and no prompts as yes and no questions. For example:

  "Would you like to hear your order again?"

If the caller does not respond to the prompt, the follow-up prompt could be as follows:

> “Would you like to hear your order again? Please say ‘yes’ or ‘no’.”

This wording is more natural than the following:

> “To hear your order again, say ‘yes’. Otherwise, say ‘no’.”

To encourage the use of barge-in, add a small pause (about 1.5 seconds) following the action required phrase. For example:

> “Would you like to hear your order again? (pause)
> Please say ‘yes’ or ‘no’.”

Calling Experience and Informative Prompts

In an application where the calling population is closed and callers are experienced or trained to use the application, recognition accuracy improves.

Lengthy prompts that provide detailed instructions on how to respond may improve accuracy, but are generally unacceptable unless the application has infrequent users. Users who interact with system prompts infrequently (for example, once or twice a year) are more willing to listen to a lengthy prompt than those who do so frequently.

Custom Grammars and DIPS

Custom grammars improve the recognizer's ability to "score" the candidate by selectively limiting the recognition possibilities. The recognizer assigns a score to each input based on closeness of match to the models for the selected grammar. Custom DIPS help further process the recognition result with information unavailable to the recognizer.

Negative Influences on WholeWord Speech Recognition Accuracy

The items described below have a negative impact on WholeWord speech recognition accuracy.

Environment

A very noisy environment, such as an airport or train station, can cause recognition accuracy problems. In certain cases, speech data can be collected to build custom word models based on the noisy environment to improve recognition accuracy.

Extraneous Words Within Responses

The system can sometimes misinterpret extra words spoken alongside the keyword if they have the same characteristics as the key word.

Information Type

Attempting to recognize data not normally spoken in the form of the digits “0” through “9” adversely affect accuracy. For example, dollar amounts and days of the month are not usually spoken in digit form “0” through “9”. To speak the date December 15, the caller would have to say “1-2-1-5.” Training callers to speak information in this format can increase application accuracy. However, if callers speak natural numbers, such as “fifteen,” speech recognition will not work.

Regional and National Accents and Dialects

Although WholeWord speech recognition is based on thousands of speech samples per word, the system can still misinterpret strong regional or national accents or dialects.

Connected-Digit String Length

Connected-digit string recognition can be thought of as a sequence of single-digit recognitions performed as one operation. For example, assume that the per-digit accuracy is X% and that a digit string of one digit will be correct X% of the time. Taking into consideration that this is a probabilistic, exponential model, when longer digit strings are used the overall expected accuracy will be X^n%. Therefore, a 2-digit string will have an overall expected accuracy of X^2% and a 10-digit string will have an overall accuracy of X^{10}%. As a result, string accuracies are affected by the length of the string. Shorter string lengths are more accurate than longer string lengths. In addition, individual digit accuracies, as well as overall string accuracies, vary according to the language and noise conditions of different national networks.

Connected-digit string accuracy can be maximized in various ways:

- Accuracy is always better for shorter strings than longer strings.
- Fixed-length strings are more accurate than variable length since the recognizer knows to look for "X" number of digits.
- With custom programming, it is possible to further improve accuracy of an application by having the recognizer return a list of possible strings. When these can be validated against external information such as comparing potential account number strings against a database of valid account numbers, the correct string can frequently be chosen.
- The recognizer can also be given a custom digit string grammar that can guide the recognizer when the digit string must conform to specific digit sequence rules. To obtain custom grammars, contact your Lucent Technologies representative.

For a WholeWord speech recognition string of digits, the per-digit accuracy is comparable to isolated word recognition. However, the accuracy of the whole string is lower than the per-digit accuracy, and steadily decreases as more digits are added.

Application-Related Limitations

The capability of the system and WholeWord speech recognition is application dependent. If the system is under-engineered for a particular application, it may not perform satisfactorily. Several application-related factors can affect the number of channels available for speech recognition.

Specific application-related factors that affect the number of supported WholeWord speech recognition channels include:

- The percentage of time spent recognizing speech input
- The percentage of callers who use touch-tone entries, which require far fewer hardware and software resources
- The number of simultaneous speech recognition calls expected
- The use of the barge-in with WholeWord speech recognition, which increases the hardware and software resources required to process each transaction

How WholeWord Speech Recognition Works

Overview

Processing involved during WholeWord speech recognition on the system includes a caller response, the action of the recognizer, and processing.

Caller Response

During a prompt and collect action, the system prompts the caller for a response. If the prompt and collect action allows for voice input, the system locates and reserves a free recognizer resource. If the caller responds using touch tones, resources of the LSPS II circuit card are not required for this particular prompt and the resource is freed. If the caller responds using voice input, the input is sampled at 8000 samples per second, digitized, and then transferred to the LSPS II circuit card via the H.110 bus.

The H.110 bus provides a communication link between the LSPS II circuit card and the telephone interface cards (E1/T1) and also allows LSPS II circuit card resources to be shared across all incoming voice channels. This makes available more channels of recognition, since there is no need to dedicate certain incoming channels to only WholeWord speech recognition when accepting both touch tone and voice input. Thus channels can share resources.

The Recognizer

Note: If your system is equipped with both the LSPS II and the SSP circuit cards, assign the function to either the SSP or LSPS II circuit card, not both.

The LSPS II circuit card is loaded with the WholeWord speech recognition software, also called the *recognizer*. The recognizer compares the incoming speech sample to the word models indicated by the recognition type chosen in the Prompt and Collect action. The recognizer computes a score for each of the models. The score represents the likelihood that the incoming speech matches a word model indicated by the recognition type.

See *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214 for more information.

Computational Processing

A single LSPS II circuit card has the ability to run Text-to-Speech (TTS), speech recognition, voice code and playback, and echo cancellation, simultaneously.

The LSPS II circuit card uses approximately 25 watts per circuit card. For more information on the LSPS II channel capacities, see LSPS II Circuit Card on page 19 in Chapter 1, Overview of Speech .

8 Recognizing FlexWord Speech Input on the LSPS II

Introduction

Note: Information in this chapter pertains to the feature working only on the LSPS II circuit card.

This chapter provides the information necessary to create grammars and use them in applications. It includes:

- Background information about the capabilities of FlexWord speech recognition
- Guidelines for designing FlexWord wordlists for use in applications
- Procedures for creating, modifying, installing, activating, and deactivating FlexWord wordlists
- Information on positive and negative influences on the accuracy of FlexWord speech recognition

Note: For more information on Grammar Recognition using the LSPS II circuit card, print the LSPS Software Development Kit resident on the system by moving the file **/usr/lsps/doc/pdf/sdk.pdf** from the system to a location that can be accessed by acrobat reader.

Description

The FlexWord speech recognition package can be used to recognize specific words spoken by callers from a vocabulary that you define to suit your application. Throughout this chapter, FlexWord is the grammar-based ASR that is installed with the LSPSset optional software package.

- A word is any phrase that can be recognized with FlexWord speech recognition. A word must be associated with a wordlist.
- A vocabulary is a set of wordlists associated with a particular FlexWord speech recognition application.

Languages Supported

The US English language is the language supported by FlexWord speech recognition.

If assigning FlexWord to the Lucent Speech Processing Solutions (LSPSII) circuit card you can not assign FlexWord to the SSP circuit card.

Phonemes

FlexWord speech recognition uses sub-word technology. Sub-word technology relies on phonemic recognition for analyzing and recognizing words.

Phonemes are units of sound that form recognizable words when strung together in a particular order. The English language contains 40 phonemes that represent all basic sounds used in the language. The word “sales,” for example, consists of four phonemes: s-A-l-z. Other languages use different phonemes.

Illustrated in Table 13 are FlexWord speech recognition phonemes for the LSPS II circuit card in the US English language. A word accompanies each phoneme to illustrate its sound.

Table 13. US English Phonemes for the LSPS II Circuit Card

Phoneme	Word Example	Phoneme	Word Example
a	f*a*ther	l	*l*ed
@	b*a*t	m	*m*om
^	b*u*t	n	*n*o
c	b*ou*ght	G	sin*g*
W	b*ou*gh	o	b*oa*t
x	*a*gain	O	b*o*y
Y	b*i*te	p	*p*op
b	*b*ob	r	*r*ed
C	*ch*urch	s	*s*is
d	*d*ad	S	*sh*oe
D	*th*ey	t	*t*ot
			1 of 2

Table 13. US English Phonemes for the LSPS II Circuit Card

Phoneme	Word Example	Phoneme	Word Example
E	b*e*t	T	*th*ief
R	b*i*rd	U	b*oo*k
e	b*ai*t	u	b*oo*t
f	*f*ief	v	*v*ery
g	*g*ag	w	*w*et
h	*h*ag	y	*y*et
I	b*i*t	z	*z*oo
i	b*ea*t	Z	mea*s*ure
J	*j*udge	#	silence
k	*k*ick		
			2 of 2

FlexWord Capacity

Every grammar entry in a wordlist is counted as a distinct and separate word. When using the LSPS II circuit card, the maximum number of words that can be loaded onto your system is 10,000.

Creating a Grammar

FlexWord supports fast, low-cost delivery of speech recognition vocabularies on a custom basis.

Vocabularies

A FlexWord speech recognition vocabulary can include a maximum of 10,000 words or phrases per system.This is true whether you have one or more LSPS II circuit card installed. However, your system could become degraded if you use only one LSPS II circuit card and the maximum number of words. (For an application that requires more than 10,000 words, contact your Lucent Technologies representative.)

Keyword Spotting

The FlexWord speech recognition standard vocabulary package can recognize or spot a keyword within a spoken phrase. The system filters out extraneous speech or noises (such as a cough) during recognition. The caller's input is not limited to the words in the system vocabulary. For example, if one of the words in your wordlist is “checking,” then the system can recognize the word “checking” when a caller says “checking account please”. However, to maintain high recognition accuracy it is advisable to structure the application to prompt the caller for the required information only. Applications should encourage the caller to speak only what is required.

Designing a Grammar

The LSPS II circuit card allows you to construct words and phrases by stringing phonemes together. The correct software and hardware are both necessary, and the hardware must be properly configured before you can create, edit, and delete wordlists.

FlexWord Software and Hardware

- For a list of the required software and hardware, see FlexWord Speech Recognition on page 14 in Chapter 1, Overview of Speech.
- To install FlexWord (LSPSset software), see ”Installing LSPS II Optional Software Packages” in *UCS 1000 R4.2 Maintenance*, 585-313-126.

  Note: If you reinstall the LSPS Set (specifically, the LSPS II Integration package (cslsps)), it is possible that you will have to recreate your assignments for the following grammar files:

- ~ CS_BASIC_FLEX-6UB5
- ~ CS_BASIC_ASR_FLEX-6UB5
- ~ CS_BASIC_ASR_FLEX_TTS-6UB5
- ~ CS_BASIC_FLEX_TTS-6UB5

Currently, if you reinstall the cslsps package, the above files are saved as o.*filename* (such as o.CS_BASIC_FLEX-6UB5). These files can be used as a record of the previous grammar assignments.

- To configure the video controller circuit card, see “Setting Up the Monitor” in “Installing Base System Software” in *UCS 1000 R4.2 Maintenance*, 585-313-126.

Configuring the LSPS II Circuit Card

Once configured for TTS, the LSPS II circuit card generates the phonetic pronunciation. TTS is available for US English only.

Configuring the LSPS II circuit card for FlexWord functionality involves several steps. First, you must determine that you want to assign the function to an LSPS II circuit card. Then you must determine which LSPS II circuit card, if there is more than one, should be assigned FlexWord functionality. Use the following procedure to make the determination.

1 Enter **display card sp**

The system displays output in the format shown in Figure 17 on page 162.

2 Make a note of the card number.

3 Assign the TTS function to the chosen circuit card number.

See “Assign LSPS Functions” in Chapter 3, “Voice System Administration” in *UCS 1000 R4.2 Administration*, 585-313-507.

Figure 17. Output from the Display Card Command After Assigning TTS Functionality

```
CARD 12 STATE:Inserv CLASS: Signal_Processor (LSPS)O.S.INDEX:12
       NAME: 6UB5   OPTIONS: slave,tdm1
       FUNCTION: code+echocan+play+text2speech+flexword
```

Preparing a grammar-based application entails several steps and using the wordlists in scripts:

1 Writing the Grammar on page 162

2 Compiling the Grammar on page 163

3 Assigning the Basic Flex to the LSPS II Circuit Card on page 164

Writing the Grammar

The first step in designing a wordlist is to create, or write the grammar file. The grammar file is a ***variablename*** and should reflect the contents of the wordlist, i.e., *biglist*. Create the wordlist file in directory **/vs/cslsps/asr/grammars/<GC_*variablename*>.g**

The following is the template for a typical .g file:

```
(
<word or phrase>
:<word or phrase>
).
```

An example of the contents for a .g file is the following:

```
(
calling card
:operator
:collect
).
```

Compiling the Grammar

The next step is to run the **gc_make <*variablename*>** command. The grammar compiler converts the contents of the file into a graph that is used by the LSPS II ASR resource. This script uses programs to expand macros, convert region markers into grammar tags, and invokes the complier to compile the grammar.

Running the gc_make command creates two more files, one file with a *.mv* extension and one file with a *.lex* extension. Following this step, you should see three files:

- ***<variablename>*.g**
- ***<variablename>*.mv**
- ***<variablename>*.lex**

There are four files you must edit so that any combination that uses FlexWord the system will recognize the associated grammars. The files are the following and must be updated each time new grammars are added:

- CS_BASIC_FLEX-6UB5. This file includes the play and code functionality and all FlexWord grammars on the system. See Assigning the Basic Flex to the LSPS II Circuit Card on page 164.
- CS_BASIC_ASR_FLEX-6UB5. This file includes the play and code functionality and all FlexWord and WholeWord grammars on the system. See Assigning the Basic ASR Grammar with Flex on page 174.
- CS_BASIC_ASR_FLEX_TTS-6UB5. This file includes the play and code functionality and all FlexWord, WholeWord, and TTS grammars on the system. See Assigning the Basic ASR Grammar with Flex and TTS on page 185.
- CS_BASIC_FLEX_TTS-6UB5. This file includes the play and code functionality and all FlexWord and TTS grammars on the system. See Assigning Basic Flex and TTS on page 195.

Assigning the Basic Flex to the LSPS II Circuit Card

Following is an example for assigning the basic flex grammar to the LSPS II circuit card:

1. Enter **mkboardtype -f -t CS_BASIC_FLEX-6UB5**

   The system displays the following message:

```
Board Model Count Description
1) Off AYC51 or BYC51 Model Boards
2) Off 9UD3 Model Boards
3) Off 6UB5 Model Boards

Select 1-3, or Next?
```

2 Enter **3**

The system displays the following message:

```
Board Model Count Description
1) Off AYC51 or BYC51 Model Boards
2) Off 9UD3 Model Boards
3) Off 6UB5 Model Boards

Select 1-3, or Next?
```

3 Enter **n**

The system displays the following message:

```
Base Configuration (Select only one) Count Description
1) Off Basic configuration for the 6UB5
2) Off ASR configuration for the 6UB5
3) Off TTS configuration for the 6UB5
4) Off Combined ASR & TTS configuration for the 6UB
Select 1-4, or Next?
```

4 Enter **2**

The system displays the following message:

```
Base Configuration (Select only one) Count Description
1) Off Basic configuration for the 6UB5
2) Off ASR configuration for the 6UB5
3) Off TTS configuration for the 6UB5
4) Off MLTTS configuration for the 6UB
Select 1-4, or Next?
```

5 Enter **n**

The system displays the following message:

```
ASR Configuration for the 6UB5 Count Description
1) 64 Play Module
2) 64 Record Module
3) 64 Dtmf DetectionModule
4) 64 Connect TimeslotModule
5) 64 TDD DetectionModule
6) 64 Tone Generation Module
7) 64 Call Progress Detection Module
8) 64 Translate coded speech Module
9) 364 ASR Module (select ONLY the quantity that is
      required!)
Select 1-9, or Next?
```

6 Enter **n**

The system displays the following message:

```
ASR Language Options (Select a max of 4)Count Description
1) Off North American English ASR Models

Select 1 or Next?
```

7 Enter **1**

The system displays the following message:

```
ASR Language Options (Select a max of 4)Count Description
1) On North American English ASR Models
Select 1 or Next?
```

8 Enter **n**

The system displays the following message:

```
ASR North American English Options Count Description
1) On English Connected Digits
2) Off English Natural Digits
3) Off English Name Training
4) Off English Custom Grammar ASR
Select 1-4, or Next?
```

9 Enter **2**

The system displays the following message:

```
ASR North American English Options Count Description
1) On English Connected Digits
2) On English Natural Digits
3) Off English Name Training
4) Off English Custom Grammar ASR
Select 1-4, or Next?
```

10 Enter **1**

The system displays the following message:

```
ASR North American English Options Count Description
1) OFF English Connected Digits
2) On English Natural Digits
3) Off English Name Training
4) Off English Custom Grammar ASR
Select 1-4, or Next?
```

11 Enter **4**

The system displays the following message:

```
ASR North American English Options Count Description
1) OFF English Connected Digits
2) On English Natural Digits
3) Off English Name Training
4) Off English Custom Grammar ASR
Select 1-4, or Next?
```

12 Enter **n**

The system displays the following message:

```
ASR North American English Natural Number Options Count
Description
1) Off English Natural Date Recognition
2) Off English Natural Dollar Recognition
3) Off English Natural Phone Number Recognition
4) Off English Natural Time Recognition
5) Off English Natural Credit Card Number Recognition
6) Off English Natural Credit Card Expiration Recognition
Select 1-4, or Next?
```

13 Enter **1**

The system displays the following message:

```
ASR North American English Natural Number Options Count
Description
1) On English Natural Date Recognition
2) Off English Natural Dollar Recognition
3) Off English Natural Phone Number Recognition
4) Off English Natural Time Recognition
5) Off English Natural Credit Card Number Recognition
6) Off English Natural Credit Card Expiration Recognition
Select 1-4, or Next?
```

14 Repeat step 13 for each Natural Number Options listed.

After entering **6**, the system displays the following message:

```
ASR North American English Natural Number Options
Count Description
1) On English Natural Date Recognition
2) On English Natural Dollar Recognition
3) On English Natural Phone Number Recognition
4) On English Natural Time Recognition
5) On English Natural Credit Card Number Recognition
6) On English Natural Credit Card Expiration Recognition
Select 1-4, or Next?
```

15 Enter **n**

The system displays the following message:

```
ASR North American English Custom Grammar Options
Count Description
1) Off English Custom Grammar 1
2) Off English Custom Grammar 2
3) Off English Custom Grammar 3
4) Off English Custom Grammar 4
5) Off English Custom Grammar 5
6) Off English Custom Grammar 6
7) Off English Custom Grammar 7
8) Off English Custom Grammar 8
9) Off English Custom Grammar 9
10) Off English Custom Grammar 10
11) Off English Custom Grammar 11
12) Off English Custom Grammar 12
13) Off English Custom Grammar 13
14) Off English Custom Grammar 14
15) Off English Custom Grammar 15
16) Off English Custom Grammar 16
17) Off English Custom Grammar 17
18) Off English Custom Grammar 18
19) Off English Custom Grammar 19
Select 1-19, or Next?
```

16 Enter **1**

The system displays the following message:

```
Custom Base Grammar Specification
Enter Custom ASR Type Identifier (such as GC_MYGRAM1)?
```

17 Enter the **GC_*variablename*** identified earlier.

The system displays the following message:

```
Enter Grammar Name (ie. GC_TEST1)?
```

18 Enter the **GC_*variablename*** identified earlier.

The system displays the following message:

```
Enter Grammar Type (either gc, or namelist?)?
```

19 Enter **gc**

The system displays the following message:

```
Enter .lex Filename?
```

20 Enter **/vs/cslsps/asr/grammars/GC_*variablename*/*variablename*.lex**

The system displays the following message:

```
Enter .mv Filename?
```

21 Enter **/vs/cslsps/asr/grammars/GC_*variablename*/*variablename*.mv**

The system displays the following message:

```
Name: GC_variablename
Type: gc
.lex: /vs/cslsps/asr/grammars/GC_variablename/variablename.lex
.mv: /vs/cslsps/asr/grammars/GC_variablename/variablename.mv
Is this correct (y/n)?
```

22 Enter **y**

The system displays the following message:

```
Would you like to add a sub grammar (y/n)?
```

23 Enter **n**

The system displays the following message:

```
ASR North American English Custom Grammar Options Count
Description
1) On English Custom Grammar 1
2) Off English Custom Grammar 2
3) Off English Custom Grammar 3
4) Off English Custom Grammar 4
5) Off English Custom Grammar 5
6) Off English Custom Grammar 6
7) Off English Custom Grammar 7
```

```
8) Off English Custom Grammar 8
9) Off English Custom Grammar 9
10) Off English Custom Grammar 10
11) Off English Custom Grammar 11
12) Off English Custom Grammar 12
13) Off English Custom Grammar 13
14) Off English Custom Grammar 14
15) Off English Custom Grammar 15
16) Off English Custom Grammar 16
17) Off English Custom Grammar 17
18) Off English Custom Grammar 18
19) Off English Custom Grammar 19
Select 1-19, or Next?
```

24 Enter **n**

The system displays the system prompt.

Assigning the Basic ASR Grammar with Flex

1 Enter **mkboardtype -f -t CS_BASIC_ASR_FLEX-6UB5**

The system displays the following message:

```
Board Model Count Description
1)  Off    AYC51 or BYC51 Model Boards
2)  Off    9UD3 Model Boards
3)  Off    6UB5 Model Boards

Select 1-3, or Next?
```

2 Enter **3**

The system displays the following message:

```
Board Model Count Description
1)  Off   AYC51 or BYC51 Model Boards
2)  Off   9UD3 Model Boards
3)  On    6UB5 Model Boards

Select 1-3, or Next?
```

3 Enter **n**

The system displays the following message:

```
Base Configuration (Select only one) Count Description
1)  Off   Basic configuration for the 6UB5
2)  Off   ASR configuration for the 6UB5
3)  Off   TTS configuration for the 6UB5
4)  Off   Combined ASR & TTS configuration for the 6UB5

Select 1-4, or Next?
```

4 Enter **2**

The system displays the following message:

```
Base Configuration (Select only one) Count Description
1)  Off   Basic configuration for the 6UB5
2)  On    ASR configuration for the 6UB5
3)  Off   TTS configuration for the 6UB5
4)  Off   Combined ASR & TTS configuration for the 6UB5

Select 1-4, or Next?
```

5 Enter **n**

The system displays the following message:

```
ASR configuration for the 6UB5 Count Description
1)  64    Play Module
2)  64    Record Module
3)  64    Dtmf Detection Module
4)  64    Connect Timeslot Module
5)  64    TDD Detection Module
6)  64    Tone Generation Module
7)  64    Call Progress Detection Module
8)  64    Translate coded speech Module
9)  36    ASR Module (Select ONLY the quantity that is
          required!)

Select 1-9, or Next?
```

6 Enter **n**

The system displays the following message:

```
ASR Language Options (Select a max of 4) Count Description
1)  Off   North American English ASR Models

Select 1, or Next?
```

7 Enter **1**

The system displays the following message:

```
ASR Language Options (Select a max of 4) Count Description
1)  On    North American English ASR Models

Select 1, or Next?
```

8 Enter **n**

The system displays the following message:

```
ASR North American English Options Count Description
1)  On    English Connected Digits
2)  Off   English Natural Numbers
3)  Off   English Name Training
4)  Off   English Custom Grammar ASR

Select 1-4, or Next?
```

9 Enter **2**

The system displays the following message:

```
ASR North American English Options Count Description
1)  On    English Connected Digits
2)  On    English Natural Numbers
3)  Off   English Name Training
4)  Off   English Custom Grammar ASR

Select 1-4, or Next?
```

10 Enter **4**

The system displays the following message:

```
ASR North American English Options Count Description
1)  On    English Connected Digits
2)  On    English Natural Numbers
3)  Off   English Name Training
4)  On    English Custom Grammar ASR

Select 1-4, or Next?
```

11 Enter **n**

The system displays the following message:

```
ASR North American English Connected Digit Options Count
Description
1)  On     English Isolated Digits
2)  On     English Connected Digits of known length 2
3)  On     English Connected Digits of known length 3
4)  On     English Connected Digits of known length 4
5)  On     English Connected Digits of known length 5
6)  On     English Connected Digits of known length 6
7)  On     English Connected Digits of known length 7
8)  On     English Connected Digits of known length 8
9)  On     English Connected Digits of known length 9
10) On     English Connected Digits of known length 10
11) On     English Connected Digits of known length 11
12) On     English Connected Digits of known length 12
13) On     English Connected Digits of known length 13
14) On     English Connected Digits of known length 14
15) On     English Connected Digits of known length 15
16) On     English Connected Digits of known length 16
17) On     English Connected Digits of known length PHONE
18) On     English Connected Digits of known length PHONE+
19) On     English Connected Digits of unknown length
20) On     English Yes/No Keywords

Select 1-20, or Next?
```

12 Enter **n**

The system displays the following message:

```
ASR North American English Natural Number Options Count
Description
1)  Off   English Natural Date Recognition
2)  Off   English Natural Dollar Recognition
3)  Off   English Natural Phone Number Recognition
4)  Off   English Natural Time Recognition
5)  Off   English Natural Credit Card Number Recognition
6)  Off   English Natural Credit Card Expiration Recognition

Select 1-6, or Next?
```

13 Enter **1**

The system displays the following message:

```
ASR North American English Natural Number Options Count
Description
1)  On    English Natural Date Recognition
2)  Off   English Natural Dollar Recognition
3)  Off   English Natural Phone Number Recognition
4)  Off   English Natural Time Recognition
5)  Off   English Natural Credit Card Number Recognition
6)  Off   English Natural Credit Card Expiration Recognition

Select 1-6, or Next?
```

14 Repeat step 13 for each Natural Number Options listed.

After entering **6**, the system displays the following message:

```
ASR North American English Natural Number Options Count
Description
1)  On     English Natural Date Recognition
2)  On     English Natural Dollar Recognition
3)  On     English Natural Phone Number Recognition
4)  On     English Natural Time Recognition
5)  On     English Natural Credit Card Number Recognition
6)  On     English Natural Credit Card Expiration Recognition
Select 1-6, or Next?
```

15 Enter **n**

The system displays the following message:

```
ASR North American English Custom Grammar Options Count
Description
1)  Off    English Custom Grammar 1
2)  Off    English Custom Grammar 2
3)  Off    English Custom Grammar 3
4)  Off    English Custom Grammar 4
5)  Off    English Custom Grammar 5
6)  Off    English Custom Grammar 6
7)  Off    English Custom Grammar 7
8)  Off    English Custom Grammar 8
9)  Off    English Custom Grammar 9
```

```
10) Off    English Custom Grammar 10
11) Off    English Custom Grammar 11
12) Off    English Custom Grammar 12
13) Off    English Custom Grammar 13
14) Off    English Custom Grammar 14
15) Off    English Custom Grammar 15
16) Off    English Custom Grammar 16
17) Off    English Custom Grammar 17
18) Off    English Custom Grammar 18
19) Off    English Custom Grammar 19

Select 1-19, or Next?
```

16 Enter **1**

The system displays the following message:

```
Custom Base Grammar Specification
Enter Custom ASR Name Identifier (such as GC_MYGRAM1)?
```

17 Enter the **GC_*variablename*** identified earlier.

The system displays the following message:

```
Enter Grammar reference name (ie. GC_LIST_O_NAMES)?
```

18 Enter the **GC_*variablename*** identified earlier.

The system displays the following message:

```
Enter Grammar Type (either gc, or namelist)?
```

19 Enter **gc**

The system displays the following message:

```
Enter .lex Filename?
```

20 Enter ***/vs/cslsps/asr/grammars/GC_variablename/variablename*.lex**

The system displays the following message:

```
Enter .mv Filename?
```

21 Enter ***/vs/cslsps/asr/grammars/GC_variablename/variablename*.mv**

The system displays the following message:

```
Name: GC_variablename
Type: gc
.lex: /vs/cslsps/asr/grammars/GC_variablename/variablename.lex
.mv : /vs/cslsps/asr/grammars/GC_variablename/variablename.mv
Is this correct (y/n)?
```

22 Enter **y**

The system displays the following message:

```
Would you like to add a sub grammar (y/n)?
```

23 Enter **n**

The system displays the following message:

```
ASR North American English Custom Grammar Options Count
Description
1)  On     English Custom Grammar 1
2)  Off    English Custom Grammar 2
3)  Off    English Custom Grammar 3
4)  Off    English Custom Grammar 4
5)  Off    English Custom Grammar 5
6)  Off    English Custom Grammar 6
7)  Off    English Custom Grammar 7
8)  Off    English Custom Grammar 8
9)  Off    English Custom Grammar 9
10) Off    English Custom Grammar 10
11) Off    English Custom Grammar 11
12) Off    English Custom Grammar 12
13) Off    English Custom Grammar 13
14) Off    English Custom Grammar 14
15) Off    English Custom Grammar 15
16) Off    English Custom Grammar 16
17) Off    English Custom Grammar 17
18) Off    English Custom Grammar 18
19) Off    English Custom Grammar 19
Select 1-19, or Next?
```

24 Enter **n**

The system displays the system prompt.

Assigning the Basic ASR Grammar with Flex and TTS

1 Enter **mkboardtype -f -t CS_BASIC_ASR_FLEX_TTS-6UB5**

The system displays the following message:

```
Board Model Count Description
1)  Off    AYC51 or BYC51 Model Boards
2)  Off    9UD3 Model Boards
3)  Off    6UB5 Model Boards

Select 1-3, or Next?
```

2 Enter **3**

The system displays the following message:

```
Board Model Count Description
1)  Off    AYC51 or BYC51 Model Boards
2)  Off    9UD3 Model Boards
3)  On     6UB5 Model Boards

Select 1-3, or Next?
```

3 Enter **n**

The system displays the following message:

```
Base Configuration (Select only one) Count Description
1)  Off    Basic configuration for the 6UB5
2)  Off    ASR configuration for the 6UB5
3)  Off    TTS configuration for the 6UB5
4)  Off    Combined ASR & TTS configuration for the 6UB5

Select 1-4, or Next?
```

4 Enter **4**

The system displays the following message:

```
Base Configuration (Select only one) Count Description
1)  Off    Basic configuration for the 6UB5
2)  Off    ASR configuration for the 6UB5
3)  Off    TTS configuration for the 6UB5
4)  On     Combined ASR & TTS configuration for the 6UB5

Select 1-4, or Next?
```

5 Enter **n**

The system displays the following message:

```
Combines ASR & TTS configuration for the 6UB5 Count
Description
1)  64     Play Module
2)  64     Record Module
3)  64     Dtmf Detection Module
4)  64     Connect Timeslot Module
5)  64     TDD Detection Module
6)  64     Tone Generation Module
7)  64     Call Progress Detection Module
8)  64     Translate coded speech Module
9)  30     Text to Speech Module
10) 24     ASR Module (Select ONLY the quantity that is
           required!)
Select 1-10, or Next?
```

6 Enter **n**

The system displays the following message:

```
ASR Language Options (Select a max of 4) Count Description
1)  Off   North American English ASR Models

Select 1, or Next?
```

7 Enter **1**

The system displays the following message:

```
ASR Language Options (Select a max of 4) Count Description
1)  On    North American English ASR Models

Select 1, or Next?
```

8 Enter **n**

The system displays the following message:

```
ASR North American English Options Count Description
1)  On    English Connected Digits
2)  Off   English Natural Numbers
3)  Off   English Name Training
4)  Off   English Custom Grammar ASR

Select 1-4, or Next?
```

9 Enter **2**

The system displays the following message:

```
ASR North American English Options Count Description
1)  On    English Connected Digits
2)  On    English Natural Numbers
3)  Off   English Name Training
4)  Off   English Custom Grammar ASR

Select 1-4, or Next?
```

10 Enter **4**

The system displays the following message:

```
ASR North American English Options Count Description
1)  On    English Connected Digits
2)  On    English Natural Numbers
3)  Off   English Name Training
4)  On    English Custom Grammar ASR

Select 1-4, or Next?
```

11 Enter **n**

The system displays the following message:

```
ASR North American English Connected Digit Options Count
Description
1)  On     English Isolated Digits
2)  On     English Connected Digits of known length 2
3)  On     English Connected Digits of known length 3
4)  On     English Connected Digits of known length 4
5)  On     English Connected Digits of known length 5
6)  On     English Connected Digits of known length 6
7)  On     English Connected Digits of known length 7
8)  On     English Connected Digits of known length 8
9)  On     English Connected Digits of known length 9
10) On     English Connected Digits of known length 10
11) On     English Connected Digits of known length 11
12) On     English Connected Digits of known length 12
13) On     English Connected Digits of known length 13
14) On     English Connected Digits of known length 14
15) On     English Connected Digits of known length 15
16) On     English Connected Digits of known length 16
17) On     English Connected Digits of known length PHONE
18) On     English Connected Digits of known length PHONE+
19) On     English Connected Digits of unknown length
20) On     English Yes/No Keywords

Select 1-20, or Next?
```

12 Enter **n**

The system displays the following message:

```
ASR North American English Natural Number Options Count
Description
1)  Off   English Natural Date Recognition
2)  Off   English Natural Dollar Recognition
3)  Off   English Natural Phone Number Recognition
4)  Off   English Natural Time Recognition
5)  Off   English Natural Credit Card Number Recognition
6)  Off   English Natural Credit Card Expiration Recognition

Select 1-6, or Next?
```

13 Enter **1**

The system displays the following message:

```
ASR North American English Natural Number Options Count
Description
1)  On    English Natural Date Recognition
2)  Off   English Natural Dollar Recognition
3)  Off   English Natural Phone Number Recognition
4)  Off   English Natural Time Recognition
5)  Off   English Natural Credit Card Number Recognition
6)  Off   English Natural Credit Card Expiration Recognition

Select 1-6, or Next?
```

14 Repeat step 13 for each Natural Number Options listed.

After entering **6**, the system displays the following message:

```
ASR North American English Natural Number Options Count
Description
1)  On     English Natural Date Recognition
2)  On     English Natural Dollar Recognition
3)  On     English Natural Phone Number Recognition
4)  On     English Natural Time Recognition
5)  On     English Natural Credit Card Number Recognition
6)  On     English Natural Credit Card Expiration Recognition
Select 1-6, or Next?
```

15 Enter **n**

The system displays the following message:

```
ASR North American English Custom Grammar Options Count
Description
1)  Off    English Custom Grammar 1
2)  Off    English Custom Grammar 2
3)  Off    English Custom Grammar 3
4)  Off    English Custom Grammar 4
5)  Off    English Custom Grammar 5
6)  Off    English Custom Grammar 6
7)  Off    English Custom Grammar 7
8)  Off    English Custom Grammar 8
9)  Off    English Custom Grammar 9
```

```
10) Off    English Custom Grammar 10
11) Off    English Custom Grammar 11
12) Off    English Custom Grammar 12
13) Off    English Custom Grammar 13
14) Off    English Custom Grammar 14
15) Off    English Custom Grammar 15
16) Off    English Custom Grammar 16
17) Off    English Custom Grammar 17
18) Off    English Custom Grammar 18
19) Off    English Custom Grammar 19

Select 1-19, or Next?
```

16 Enter **1**

The system displays the following message:

```
Custom Base Grammar Specification
Enter Custom ASR Name Identifier (such as GC_MYGRAM1)?
```

17 Enter the **GC_*variablename*** identified earlier.

The system displays the following message:

```
Enter Grammar reference name (ie. GC_LIST_O_NAMES)?
```

18 Enter the **GC_*variablename*** identified earlier.

The system displays the following message:

```
Enter Grammar Type (either gc, or namelist)?
```

19 Enter **gc**

The system displays the following message:

```
Enter .lex Filename?
```

20 Enter ***/vs/cslsps/asr/grammars/GC_*variablename/variablename*.lex**

The system displays the following message:

```
Enter .mv Filename?
```

21 Enter ***/vs/cslsps/asr/grammars/GC_*variablename/variablename*.mv**

The system displays the following message:

```
Name: GC_variablename
Type: gc
.lex: /vs/cslsps/asr/grammars/GC_variablename/variablename.lex
.mv : /vs/cslsps/asr/grammars/GC_variablename/variablename.mv
Is this correct (y/n)?
```

22 Enter **y**

The system displays the following message:

```
Would you like to add a sub grammar (y/n)?
```

23 Enter **n**

The system displays the following message:

```
ASR North American English Custom Grammar Options Count
Description
1)  On     English Custom Grammar 1
2)  Off    English Custom Grammar 2
3)  Off    English Custom Grammar 3
4)  Off    English Custom Grammar 4
5)  Off    English Custom Grammar 5
6)  Off    English Custom Grammar 6
7)  Off    English Custom Grammar 7
8)  Off    English Custom Grammar 8
9)  Off    English Custom Grammar 9
10) Off    English Custom Grammar 10
11) Off    English Custom Grammar 11
12) Off    English Custom Grammar 12
13) Off    English Custom Grammar 13
14) Off    English Custom Grammar 14
15) Off    English Custom Grammar 15
16) Off    English Custom Grammar 16
17) Off    English Custom Grammar 17
18) Off    English Custom Grammar 18
19) Off    English Custom Grammar 19
Select 1-19, or Next?
```

24 Enter **n**

The system displays the system prompt.

Assigning Basic Flex and TTS

1 Enter **mkboardtype -f -t CS_BASIC_FLEX_TTS-6UB5**

The system displays the following message:

```
Board Model Count Description
1) Off    AYC51 or BYC51 Model Boards
2) Off    9UD3 Model Boards
3) Off    6UB5 Model Boards

Select 1-3, or Next?
```

2 Enter **3**

The system displays the following message:

```
Board Model Count Description
1)  Off   AYC51 or BYC51 Model Boards
2)  Off   9UD3 Model Boards
3)  On    6UB5 Model Boards

Select 1-3, or Next?
```

3 Enter **n**

The system displays the following message:

```
Base Configuration (Select only one) Count Description
1)  Off   Basic configuration for the 6UB5
2)  Off   ASR configuration for the 6UB5
3)  Off   TTS configuration for the 6UB5
4)  Off   Combined ASR & TTS configuration for the 6UB5

Select 1-4, or Next?
```

4 Enter **4**

The system displays the following message:

```
Base Configuration (Select only one) Count Description
1) Off    Basic configuration for the 6UB5
2) Off    ASR configuration for the 6UB5
3) Off    TTS configuration for the 6UB5
4) On     Combined ASR & TTS configuration for the 6UB5

Select 1-4, or Next?
```

5 Enter **n**

The system displays the following message:

```
Combines ASR & TTS configuration for the 6UB5 Count
Description
1)  64     Play Module
2)  64     Record Module
3)  64     Dtmf Detection Module
4)  64     Connect Timeslot Module
5)  64     TDD Detection Module
6)  64     Tone Generation Module
7)  64     Call Progress Detection Module
8)  64     Translate coded speech Module
9)  30     Text to Speech Module
10) 24     ASR Module (Select ONLY the quantity that is
           required!)

Select 1-10, or Next?
```

6 Enter **n**

The system displays the following message:

```
ASR Language Options (Select a max of 4) Count Description
1)  Off   North American English ASR Models

Select 1, or Next?
```

7 Enter **1**

The system displays the following message:

```
ASR Language Options (Select a max of 4) Count Description
1)  On    North American English ASR Models

Select 1, or Next?
```

8 Enter **n**

The system displays the following message:

```
ASR North American English Options Count Description
1)  On    English Connected Digits
2)  Off   English Natural Numbers
3)  Off   English Name Training
4)  Off   English Custom Grammar ASR

Select 1-4, or Next?
```

9 Enter **1**

The system displays the following message:

```
ASR North American English Options Count Description
1) Off    English Connected Digits
2) Off    English Natural Numbers
3) Off    English Name Training
4) Off    English Custom Grammar ASR

Select 1-4, or Next?
```

10 Enter **2**

The system displays the following message:

```
ASR North American English Options Count Description
1) Off    English Connected Digits
2) On     English Natural Numbers
3) Off    English Name Training
4) Off    English Custom Grammar ASR

Select 1-4, or Next?
```

11 Enter **4**

The system displays the following message:

```
ASR North American English Options Count Description
1)  Off   English Connected Digits
2)  On    English Natural Numbers
3)  Off   English Name Training
4)  On    English Custom Grammar ASR

Select 1-4, or Next?
```

12 Enter **n**

The system displays the following message:

```
ASR North American English Natural Number Options Count
Description
1)  Off   English Natural Date Recognition
2)  Off   English Natural Dollar Recognition
3)  Off   English Natural Phone Number Recognition
4)  Off   English Natural Time Recognition
5)  Off   English Natural Credit Card Number Recognition
6)  Off   English Natural Credit Card Expiration Recognition

Select 1-6, or Next?
```

13 Enter **1**

The system displays the following message:

```
ASR North American English Natural Number Options Count
Description
1)  On    English Natural Date Recognition
2)  Off   English Natural Dollar Recognition
3)  Off   English Natural Phone Number Recognition
4)  Off   English Natural Time Recognition
5)  Off   English Natural Credit Card Number Recognition
6)  Off   English Natural Credit Card Expiration Recognition

Select 1-6, or Next?
```

14 Repeat step 13 for each Natural Number Options listed.

After entering **6**, the system displays the following message:

```
ASR North American English Natural Number Options Count
Description
1) On     English Natural Date Recognition
2) On     English Natural Dollar Recognition
3) On     English Natural Phone Number Recognition
4) On     English Natural Time Recognition
5) On     English Natural Credit Card Number Recognition
6) On     English Natural Credit Card Expiration Recognition
Select 1-6, or Next?
```

15 Enter **n**

The system displays the following message:

```
ASR North American English Custom Grammar Options Count
Description
1)  Off    English Custom Grammar 1
2)  Off    English Custom Grammar 2
3)  Off    English Custom Grammar 3
4)  Off    English Custom Grammar 4
5)  Off    English Custom Grammar 5
6)  Off    English Custom Grammar 6
7)  Off    English Custom Grammar 7
8)  Off    English Custom Grammar 8
9)  Off    English Custom Grammar 9
10) Off    English Custom Grammar 10
11) Off    English Custom Grammar 11
12) Off    English Custom Grammar 12
13) Off    English Custom Grammar 13
14) Off    English Custom Grammar 14
15) Off    English Custom Grammar 15
16) Off    English Custom Grammar 16
17) Off    English Custom Grammar 17
18) Off    English Custom Grammar 18
19) Off    English Custom Grammar 19

Select 1-19, or Next?
```

16 Enter **1**

The system displays the following message:

```
Custom Base Grammar Specification
Enter Custom ASR Name Identifier (such as GC_MYGRAM1)?
```

17 Enter the **GC_*variablename*** identified earlier.

The system displays the following message:

```
Enter Grammar reference name (ie. GC_LIST_O_NAMES)?
```

18 Enter the **GC_*variablename*** identified earlier.

The system displays the following message:

```
Enter Grammar Type (either gc, or namelist)?
```

19 Enter **gc**

The system displays the following message:

```
Enter .lex Filename?
```

20 Enter **/vs/cslsps/asr/grammars/GC_*variablename/variablename*.lex**

The system displays the following message:

```
Enter .mv Filename?
```

21 Enter ***/vs/cslsps/asr/grammars/GC_variablename/variablename*.mv**

The system displays the following message:

```
Name: GC_variablename
Type: gc
.lex: /vs/cslsps/asr/grammars/GC_variablename/variablename.lex
.mv : /vs/cslsps/asr/grammars/GC_variablename/variablename.mv
Is this correct (y/n)?
```

22 Enter **y**

The system displays the following message:

```
Would you like to add a sub grammar (y/n)?
```

23 Enter **n**

The system displays the following message:

```
ASR North American English Custom Grammar Options Count
Description
1)  On     English Custom Grammar 1
2)  Off    English Custom Grammar 2
3)  Off    English Custom Grammar 3
4)  Off    English Custom Grammar 4
5)  Off    English Custom Grammar 5
6)  Off    English Custom Grammar 6
7)  Off    English Custom Grammar 7
8)  Off    English Custom Grammar 8
9)  Off    English Custom Grammar 9
```

```
10) Off    English Custom Grammar 10
11) Off    English Custom Grammar 11
12) Off    English Custom Grammar 12
13) Off    English Custom Grammar 13
14) Off    English Custom Grammar 14
15) Off    English Custom Grammar 15
16) Off    English Custom Grammar 16
17) Off    English Custom Grammar 17
18) Off    English Custom Grammar 18
19) Off    English Custom Grammar 19
Select 1-19, or Next?
```

24 Enter **n**

The system displays the system prompt.

LSPS Usage Data Files

The Resource Manager (RM) uses data to determine resource usage requirements for functions that can be assigned to the LSPS II circuit card. Normally, data contained in the usage files do not require any changes because of applications being used by the LSPS II circuit card.

However, there are possible exceptions that require changing the usage data file contents. Possible exceptions are:

- Custom Flex grammar required more resource that the default value. This could occur if large vocabulary grammars are used. In this instance, Usage0 should be changed to a value that represents the portion of the LSPS CPU capacity that is consumed. If different sizes of grammars are used, the usage data should be set based on the capacity of the most expensive grammar.
- Measured occupancy of the LSPS II circuit card shows significant difference from the TM view of the board load.

Usage Data Files That are Changeable

Table 14 on page 207 contains the fields in the LSPS II usage data files that can be changed, when necessary, and their meanings:

Table 14. LSPS II Changeable Usage Data Fields

Field*	Definition
MAX_CONCURRENT	Indicates the maximum number of times this function can be allocated on any LSPS II circuit card.
MAX_WITH_TTS	Applies only to ASR functions and is used to indicate when the TTS function is also assigned to this card.
MAX_WITH_ASR	Applies only to the TTS function and is used to indicate a lower MAX_CONCURRENT capacity for this TTS function when an ASR function is also assigned to this card.
USAGE0	Indicated the portion of the total board CPU and memory capacity that is consumed for each occurrence of the functions. The total board capacity is 10,000 so a value of 100 represents 1% of the board's capacity.
	1 of 2

Table 14. LSPS II Changeable Usage Data Fields

Field*	Definition
USAGE1	Indicates the portion of the Input (coding) I/O capacity that is consumed for each occurrence of the function. A value such as 312 for the code function implies that 1/21 of the board capacity is used.
USAGE2	Indicates the portion of the Output (Play) I/O capacity that is consumed for each occurrence of the function. A value such as 312 for the play function implies that 1/32 of the board capacity is used.
USAGE3	Indicates the portion of the PCI I/O capacity that is consumed for each occurrence of the function. A value of 100 implies that 1/100 of the board capacity is used.
	2 of 2

* Fields not listed in this table must not be changed.

Editing a Usage Data File

Default values for the LSPS II capacities can be found in Chapter 2, "Hardware," in *UCS 1000 R4.2 System Description*, 585-313-209. A limited listing is also located in LSPS II Circuit Card on page 19.

The data usage is found in ***/vs/cslsps/usage/function*** where ***function*** may be one of the following:

- play
- code
- wholeword
- flexword
- text2speech
- LSPS_DATA_COLLECT
- BUS_DIAG

Example

Note: The cslsps software package *will* erase any changes to a data usage file if cslsps is reinstalled after modifications are made. Ensure that the data usage file is updated properly after any reinstallation of the cslsps software package.

For example, a user may decide that it is necessary to modify data in the flexword data usage file. A few circumstances for this modification are:

- Using small grammars, connected digits and less than 50 word grammars, means that one can increase the LSPS II channel capacity.
- Using large or very large vocabulary grammars, the channel capacity must be reduced.

Continuing with the example, to modify the flexword file to accommodate very large grammars (those over 2000 words), do the following:

1 Edit the file **/vs/cslsps/usage/flexword**

2 Change the following lines:

```
MAX_CONCURRENT=6
MAX_WITH_TTS=4
USAGE0=1666
```

3 Write and exit the file.

In the above example, very large wordlists are accommodated but the channel capacity of the LSPS II circuit is changed to 6 channels for FlexWord speech recognition or 4 channels for FlexWord speech recognition with Text-to-Speech assigned to the same card.

Table 15 on page 211 contains some suggested starting values for various size flexword grammars:

Table 15. Suggested Start Values for FlexWord Grammars

Function	MAX_CURRENT	MAX_WITH_TTS	USAGE0
Default	24	14	416
FlexWord with connected digit or less than 50 word grammars	30	18	333
FlexWord with 50 to 2000 word grammars	15	8	666
FlexWord with over 2000 word grammars	6	4	1666

Note: Application developers are responsible for choosing the appropriate values and validating them as part of using a custom grammar. For further information, print the LSPS Software Development Kit resident on the system by moving the file **/usr/lsps/doc/pdf/sdk.pdf** from the system to a location that can be accessed by acrobat reader.

9 Putting It Together for the LSPS II

Overview

Note: Information in this chapter pertains to the features working only on the LSPS II circuit card.

This chapter describes the following considerations for using speech-related features with optimal effectiveness in applications:

- How to get the most out of speech-related features in applications
- Why certain features work well together
- When you can use speech-related features together

Recognition types, including FlexWord™ speech recognition, Whole Word speech recognition are discussed, as well as the TTS (Text-to-Speech) feature.

Note: In order for barge in to work, recognition and echo cancellation must be assigned on the same card.

Using WholeWord Recognition

WholeWord speech recognition can be used to recognize a limited set of words, as discussed in Chapter 7, Recognizing WholeWord Speech Input on the LSPS II. However, WholeWord speech recognition is most successful when you use it to augment a touch-tone application to handle callers who do not have or for some reason do not want to use touch-tone telephones.

For more information on how to incorporate WholeWord speech recognition into a touch-tone application, see *Application Design Guidelines*, 585-310-670.

Getting the Most Out of FlexWord Speech Recognition

As discussed in Chapter 8, Recognizing FlexWord Speech Input on the LSPS II, FlexWord speech recognition recognizes the caller speaking words from a vocabulary that you define and is therefore specifically tailored to your application. Allowing the caller to speak the option wanted rather than speaking a number assigned to the option can make the interaction more natural and easy to use. Included below are guidelines for getting the most out of FlexWord speech recognition.

Choosing a FlexWord Speech Recognition Vocabulary

Since FlexWord speech recognition offers you the freedom to specify your own custom vocabularies, you have the advantage of making sure your custom vocabularies are easy to use with your application. How you set up your wordlists contributes greatly to the success of your application.

FlexWord speech recognition vocabulary items can be single words or phrases, which are all referred to as “words.” The words must be divided into groups called wordlists. A wordlist includes all of the words that can be spoken at a particular prompt. Each application has its own vocabulary, or set of wordlists. At any prompt, only one wordlist can be active at a time. This means that only one wordlist can be under consideration by the recognizer at any one time. The words in each wordlist must be distinct enough from each other to allow the recognizer to work effectively. If your vocabulary contains two or more words that are very similar, each of those words should be on a separate wordlist. The following sections discuss factors to consider when creating your wordlists.

Caller Error

If you find that callers tend to respond with unacceptable words or phrases during a prompt, you can add these words to the wordlist. In your application, you can handle these words as caller errors and reprompt the caller. For example, if your wordlist contains account names and the valid account names are “checking” and “savings,” but you find that callers are responding with “loan” you could add “loan” to the wordlist. If the recognizer recognizes that a caller says “loan,” you can design your application to say “Sorry. We did not recognize your response. Please choose ‘checking’ or ‘savings’. “

Word Length

Words with more than one syllable are recognized more reliably than shorter words. For example, the phrase “add entry” would be better to use than the word “add.” Phrases can be fairly long, although the longer the phrase, the greater the chance of callers forgetting it or making mistakes while speaking.

Word Choice

Choose words and phrases that would occur naturally to your typical caller. One way to determine this is to survey some representative callers and ask what words or phrases they would use for actions in your script. Do not rely on just your knowledge, because your impressions may be different than those of your callers.

Prompting for Input

Even though FlexWord speech recognition does support barge-in on the LSPS II circuit card, it is wise to structure your prompts to encourage callers to wait until the end of the prompt before speaking. For example enter, “Please say the department name, now,” as opposed to “Now say the department name, please.”

Word Sounds

Use words in your wordlists that do not have a similar sound. To the recognizer, vowels are more important than consonants. Avoid using words with similar vowel sounds. Words that differ in only one or two consonants are difficult for the recognizer to distinguish between. For example, the words “connect” and “comment” sound similar to the recognizer.

Synonyms

If you find that callers often use more than one word for the same thing, you may want to add both words to your list.

Examples of FlexWord Speech Recognition Applications

Two examples of applications suited to FlexWord speech recognition are described below.

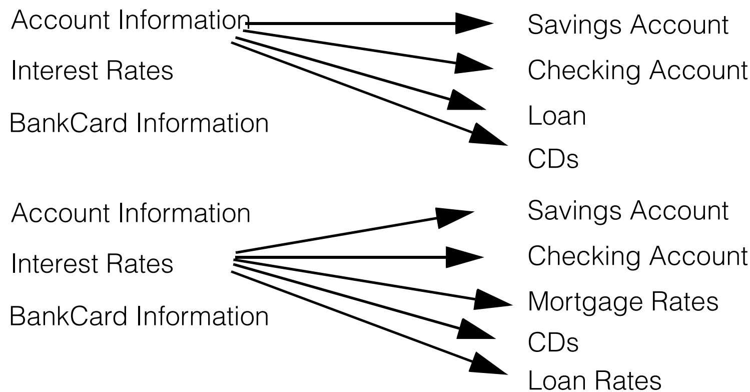
Applications Requiring Large Wordlists

Applications that require large custom wordlists can benefit from FlexWord speech recognition. In this type of application, the voice prompt cannot enumerate all of the valid responses. As a result, the application must provide sufficient guidance to the caller to facilitate an appropriate response. An example of this type of application would be a name dialer, or automatic call router. By speaking a name, the caller is transferred to the extension of that person.

Menu-Based Applications

Menu-based applications that use words and phrases native to your business environment are suggested for use with FlexWord speech recognition. Your application flows more smoothly if it uses the same words that would occur naturally in an interaction between an agent and the customer. Figure 18 on page 217 shows an example of a menu-based application.

Figure 18. Example of Menu-Based Application



Getting the Most out of Text-to-Speech

The following tips can help you use TTS most effectively in prompts and announcements.

- When TTS prompts are used with touch-tone input, callers can interrupt the prompt just as they can when the prompt is prerecorded.
- Callers can also interrupt TTS prompts with WholeWord speech recognition input. When using TTS prompts with FlexWord speech recognition input, barge-in is activated.

Note: TTS is available for US English only.

Using FlexWord Speech Recognition and Text-to-Speech Together

Since FlexWord speech recognition provides the ability to recognize up to 10,000 words, your FlexWord speech recognition application needs a way to organize the recognized responses. This can be done by recording all the words in your wordlist, and speaking them back after the database completes a lookup.

However, TTS allows the transaction to provide a more flexible way of speaking the wordlist. TTS allows you to speak the contents of $CI_VALUE (the recognized word on the wordlist) easily. Also, if the wordlist changes, TTS still works— possibly without changes to your application. If you use prerecorded speech to speak the wordlist, you will have to record each time the wordlist changes.

Note: TTS is available for US English only.

Using WholeWord and FlexWord Speech Recognition Together

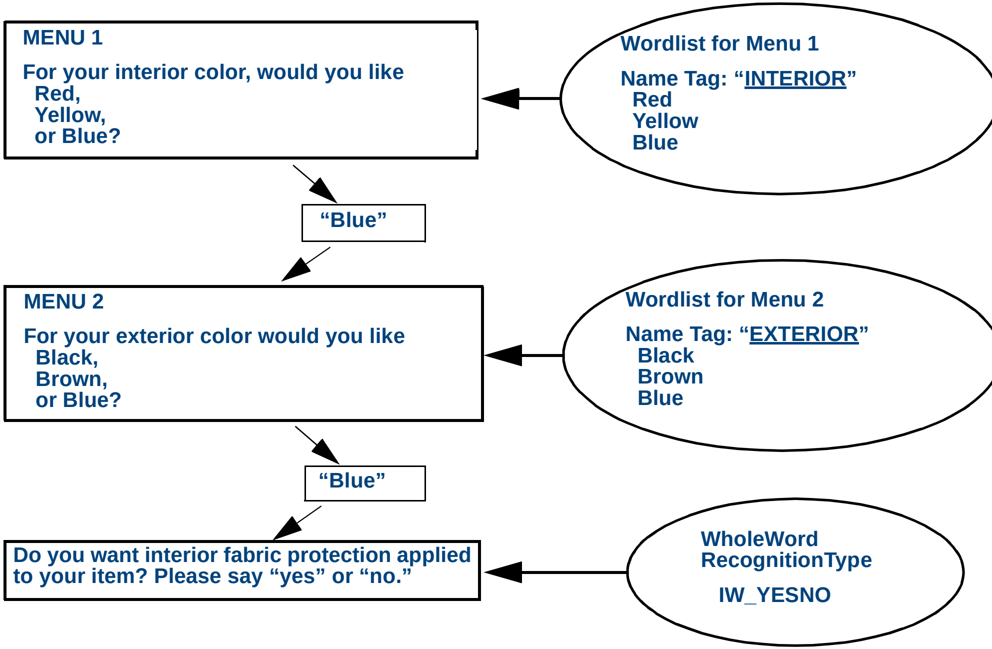
WholeWord and FlexWord speech recognition are used in either a TAS or irAPI script. See *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214 for TAS and irAPI information.

- If you want callers to say “yes” or “no,” a series of digits, or a single digit, choose a WholeWord speech recognition.
- If you want callers to speak a word or phrase from your custom vocabulary, choose a FlexWord speech recognition.

Note: Both recognizers cannot be used in the same prompt.

The example in Figure 19 on page 221 shows a model of a retail application that combines FlexWord wordlists and the WholeWord “yes and no” speech recognition feature. In the example, the word “blue” must appear on both the “INTERIOR” wordlist and the “EXTERIOR” wordlist. Since the word “blue” appears on two wordlists, it counts as two words. If the word “blue” is not on the “INTERIOR” wordlist, this feature will not look to the “EXTERIOR” wordlist to find it. The feature returns the word in the wordlist that it thinks is the most suitable match. Since the feature can only look at one wordlist prompt, each wordlist must contain *all* possible choices for a single prompt.

Figure 19. Illustration of the Use of FlexWord and WholeWord Speech Recognition in a Single Application Script



WholeWord Speech Recognition Versus FlexWord Speech Recognition Accuracy

For most applications, the accuracy of Whole Word recognition is higher than for FlexWord recognition. The following list shows the accuracy rates, arranged in order from highest to lowest:

1. WholeWord speech recognition isolated digit
2. WholeWord speech recognition connected digit
3. FlexWord speech recognition isolated word

Comparison of Recognition Types

Table 16 summarizes the similarities and differences between WholeWord speech recognition and FlexWord speech recognition when assigned to an LSPS II circuit card.

Table 16. Comparison of Speech Recognition Types on an LSPS II Circuit Card

WholeWord Recognition	FlexWord Recognition
Word-based	Phoneme-based
Requires data collection in model building for vocabulary words other than digits “zero” through “nine,” common synonyms for those words, and the words “yes” and “no”	No data collection required in model building
Connected digits	Single word or phrase
Standard and custom grammars	Customized wordlists
Barge-in supported	Barge-in supported
Phrase screening not supported	Phrase screening not supported
Limited vocabulary	Approximately 10,000 but can vary
Word spotting supported	Word spotting supported

A Speech File Formats

Overview

This appendix describes the encoding formats for speech files.

The purpose of this appendix is to ensure that you

- Are aware that the speech phrases must be in a supported format
- Understand and can apply a supported format

Speech File Formats

Before the speech phrases are digitized and then stored, the speech phrases must be in a supported format. This is the process of encoding speech. The UCS 1000 R4.2 supports the following encoding formats for speech phrases:

- PCM64 (pulse code modulation at 64 kbps in Mu-law encoding format)
- ADPCM32 (adaptive differential pulse code modulation at 32 kbps)
- ADPCM16 (adaptive differential pulse code modulation at 16 kbps — not commonly used in applications)
- CELP16 (code excited linear prediction at 16 kbps)
- SBC24 (sub-band coding at 24 kbps — not commonly used in applications)
- SBC16 (sub -and coding at 16 kbps — not commonly used in applications)
- OKI_ADPCM32 (adaptive differential pulse code modulation at 32 kbps and used by the LSPS II circuit card)

PCM Encoding Formats

In a PCM speech file, speech is sampled at 8000 times a second. Each sample is digitally coded into an 8-bit pattern (allowing 256 levels), resulting in 64,000 bits per second of speech. The header, which is used only by SSP circuit cards and has the values `0xAA 0xFF 0x34 0x00`, is repeated at least 10 times for every second of speech (every 800 bytes). If the value `0xAA 0xFF` occurs anywhere within the speech portion of the file, it is changed to `0xAA 0xFE`. The speech data consists of contiguous 8-bit patterns representing sampled speech. One type of PCM format is available, Mu-law. In the Mu-law PCM format, PCM coding uses predefined quasi-logarithmic steps for speech levels, encoding more steps when the speech level is low.

Note: Speech that is recorded and/or played on an SSP circuit card is not transferable to an LSPS II circuit card, and vice versa.

ADPCM Encoding Formats

ADPCM speech encoding is based on the principle that it is possible to reduce the amount of information needed to transmit speech between the sender and the receiver by using appropriate mathematical algorithms. The following types of ADPCM speech file formats are available, both of which follow similar compression algorithms:

- ADPCM32
- ADPCM16

Given that natural speech follows specific patterns (as opposed to random noise), the encoder (or the sender) predicts the present speech level by using a predefined algorithm and considering the past speech history. This predicted value is compared to the actual present speech level and the difference is encoded into digital format. The difference between the actual and the predicted values can be made as small as possible by using suitably defined predictor algorithms.

Thus, it is possible to encode the difference between the predicted and the actual speech into digital samples of either 4 bits (16 levels) or 2 bits (4 levels). At the decoder (receiver) end, the process is reversed. The decoder uses an equivalent algorithm to predict the present speech level from the past history, and makes the correction based on the received information from the sender to get the actual speech level. The accuracy and performance of the speech encoding and decoding depends on the type of algorithm used as well as the number of bits used for digital encoding of the difference between predicted and actual speech.

- In the ADPCM32 speech file, the header, which has the values `0xAA 0xFF 0x32 0x00`, is repeated at least five times for every second of speech data.
- In the ADPCM16 speech file, the header, which has the values `0xAA 0xFF 0x30 0x00`, is repeated at least five times for every second of speech data.

If the value `0xAA 0xFF` occurs anywhere within the speech portion of the file, it is changed to `0xAA 0xFE`. This makes a small but imperceptible change to the speech.

Processing of speech data for an application can be accomplished concurrently with application development. The only requirement is that the digitized speech must be loaded on the system before the application can be assembled.

Speech Files

Speech files are comprised of two parts:

- A header section, used by the SSP circuit card, of the format shown in Figure 20 that is present at the beginning of the file and repeated at periodic intervals within the body of the file
- Encoded digital data representing speech

Figure 20. Speech File Header Section

```
0xAA    0xFF     N     L
```

The following rules describe the header section that is used only by the SSP circuit card:

- `0xAA` and `0xFF` are the 2 bytes of data with bit patterns `10011001` and `11111111`.
- `N` is a unique identifier code representing the speech encoding format, as shown in Table 17 on page 230.
- `L` (mandatory field) represents the length of a control field that follows the header bytes. The control field is optional. If it is absent, `L` is set to `0x00`. For the PCM and ADPCM type speech files, it is set to 0x00 (no control field is specified).

The following rules apply to the data section:

- Use an even number of bytes.
- Use no more than 500 bytes between headers.
- Use only CELP 16 for the pattern `0xAA 0xFF`.

The length field `L` identifies the number of words (2 bytes each) that follow that include user defined information.

Note: Coding and playback of CELP16 works properly only on the hardware the SSP circuit card. If coding or playback is performed on an unsupported circuit card, the result is silence or noise.

- When CELP16 is played on a circuit card that does not support CELP16, the result is silence or noise, depending on the phrase.

- When a circuit card that does not accept CELP16 is asked to code CELP16, it either runs a default mode or stays in the current mode and the coding circuit card fails to return a phrase.

Table 17. Identifier Codes in Speech Encoding

N	Value	Channel Capacity (Playback/Coding) Per SSP Circuit Card
PCM Mu-law	0 x 34	120/120
ADPCM 32	0 x 32	120/120
ADPCM 16	0 x 30	120/120
SBC 24	0 x 21	100/100
SBC 16	0 x 20	100/100
CELP 16	0 x 40	120/60
		Channel Capacity (Playback/coding) Per LSPS II Circuit Card
PCM Mu-Law	N/A	64/64
OKI_ADPCM32	N/A	64/64

Note: Header bytes used by the SSP circuit card are inserted into the speech file so that the header appears at least five times for every second of speech. The headers are aligned on even byte boundaries.

B Advanced Text-to-Speech Features

Overview

For some Text-to-Speech (TTS) applications, you may need to customize the way TTS speaks to improve understandability or comprehension. Methods of customization include using escape sequences to do the following:

- Insert silent pauses or delays at the beginning, middle, or end of phrases
- Change the gender (male or female) of the synthesized voice
- Change the speaking rate of the synthesized voice
- Mark text as a member of a text class and specify a detector type that determines how certain words are spoken

Note: TTS is available for US English only.

Escape Sequences Used by the SSP

Customization of TTS involves using strings of characters called escape sequences that reset the TTS default parameters. The exact method of changing the defaults depends on the parameter and the application development tool. See *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214.

Inserting Silent Delays and Pauses

Inclusion of silent delays or pauses in an application helps make the speech more natural sounding and may help increase listener comprehension. Table 18 on page 233 lists the escape sequences used to insert TTS silences into synthesized speech.

Table 18. TTS Escape Sequence for Silence on the SSP

Sequence	Description
\!si***n*** (initial)	• Specifies *n* centiseconds of silence at the beginning of the current text phrase, where 1< *n* < 100 • Must be placed at the beginning of a text phrase and therefore cannot be used in the same phrase as a final silence (\!sf*n*)
\!sf***n*** (final)	• Specifies *n* centiseconds of silence at the beginning of the current text phrase, where 1< *n* < 100 • Must be placed at the beginning of a text phrase and therefore cannot be used in the same phrase as a final silence (\!sf*n*)
\!(*[***n***])	Specifies *n* centiseconds of silence within the current phrase, where 1< *n* < 60. Can be placed anywhere within a text phrase and can be used in the same phrase with either an initial silence (\!si*n*) or a final silence (\!sf*n*). **Note:** When typed in text or a variable, these sequences must be followed by one blank space.

CAUTION:
Using values outside the limits could cause problems in your application.

Examples for Silence— Using Text

The following examples illustrate use of escape sequences in text to add silent pauses and delays in an application.

- In the following example of a TAS script for the SSP circuit card, silence of 0.5 seconds occurs before “Hello” is spoken. The delay helps secure the listeners’ attention.

```
Say: ("Welcome")
Say: ("\!si50 Hello!”)
Say: (“Welcome to your Home Shopping Line!”)
```

- In the following example of a TAS script for the SSP circuit card, silence of 0.7 seconds is added after the phrase “Welcome to the Home Shopping Line!”. There is no silence between the word “Hello!” and the text that follows. The silence helps emphasize the end of the announcement.

```
Say: ("Welcome")
Say: (“\!si50 Hello!”)
Say: (“\!sf70 Welcome to your Home Shopping Line!”)
```

Note: The end punctuation (exclamation point) after the first phrase (“Hello!”) is necessary for TTS to speak the 0.7-second silence at the end of the second phrase (“Welcome to your Home Shopping Line!”). Without end punctuation in the first phrase, this escape sequence would be ignored.

- In the following example of a TAS script for the SSP circuit card, text phrase contains two silences— a 0.5-second silence at the beginning of the phrase and a 0.7-second silence between the words “Hello” and “and.” The placement of these silences helps make the synthesized speech more natural sounding.

```
Say: ("Welcome")
Say: (\!si50 Hello \!(*[70]) and welcome to your”)
Say: (“Home Shopping Line!”)
```

Examples for Silence— Using a Variable

- The following example from a TAS script for the SSP circuit card shows a silence delay defined as a variable called Silence_70 and used in an Announce action step. A silence of 0.7 seconds occurs between the first and second phrase.

```
Answer Phone
Set Field Value
  Field: Silence_70 = “\!si70 “
Announce
  Speak With Interrupt
    Text: “Welcome to your Home Shopping Line!”
    Field: Silence_70 As A
    Text: “To place an order, please have your”
    Text: ”account number ready.”
```

Changing the Gender of the Speaking Voice

TTS permits speech in both male and female voices. The default is male voice. Female voice provides the same capabilities and features as male voice. Voices can be switched by use of the escape sequences used by the SSP circuit card shown in Table 19.

Table 19. TTS Escape Sequences for Speech Gender Selection

Sequence	Description
\!uSm	Male voice (default)
\!uSf	Female voice
	Note: When typed in text or a variable, these sequences must be followed by one blank space.

The voice selection stays in effect until an event occurs that removes speech inhibition. At that point, speech reverts to the default (male) voice. Therefore, to create an entire application in female voice, you must reset the voice repeatedly.

See *UCS 1000 R4.2 Application Development with Advanced Methods*, 585-313-214 for examples to change voice gender.

Changing the Rate of Speech

Slowing the rate of speech for important words can provide emphasis and increase listener comprehension in an application. Table 20 shows escape sequences used to control the rate of speech for TTS.

Note: The escape sequences in Table 20 are used for TTS on the speech and signal processor (SSP) circuit card only.

Table 20. TTS Escape Sequences for Speaking Rate for SSP Circuit Card

Sequence	Description
\!rfastest \!rfast \!rnormal \!rslow \!rslowest	The default rate is “normal” (\!rnormal). Each rate is effective until the end of a sentence, indicated by punctuation such as a period, question mark, or exclamation mark. In text, to change the rate before the end of a sentence, insert a different escape sequence.
	Note: When typed in text or a variable, these sequences must be followed by one blank space.

Setting Text Classes and Detectors

Background

In an application, you can designate the format of a field to be spoken by TTS.

Classes

To solve this sort of problem, TTS allows you to explicitly assign text to any of the following four classes:

- Telephone number
- Proper name
- Address
- Fraction

Class Detector Modes

For TTS to speak text assigned to these classes, you must use an escape sequence of the following class detector modes:

- Off
- Conservative mode (default)
- Risky mode

Note: Initially all detectors are set to conservative mode.

The detector mode determines how TTS speaks ambiguous text.

- Risky mode sets a priority for the designated class to resolve ambiguity about how the information is to be classified. The setting of risky mode will be the highest priority at the time for the field to be spoken. TTS will then know, for example, that “22587” in the problem described above is part of an address.
- Conservative mode requires more contextual information to resolve ambiguous text.

Table 21 on page 240 shows the escape sequences used for class detector modes.

Guidelines

Observe the following guidelines when using class detectors:

- As a general rule, do not use risky mode unless in tests of your application TTS fails to pronounce words or phrases correctly or the text is known to be a member of the specified text class (for example, telephone numbers) or contains ambiguous abbreviations. Otherwise, always try conservative mode first (that is, do not explicitly set a class detector).
- More than one class detector can be activated at the same time, though results may be unpredictable.

- After using risky mode, reset detectors to conservative mode if special detection is not needed.
- Do not set a detector mode to off unless conservative mode is causing an undesirable effect.

Table 21. TTS Escape Sequences for Class Detectors for the SSP Circuit Card

Sequence	Description
Telephone number `\!npo` (off) `\!npr` (risky mode) `\!npc` (conservative mode)	In conservative mode TTS speaks telephone numbers as individual digits, except for 800 in area code position, which is spoken “eight hundred”. For example, 555 1365 is spoken “five five five (pause) one three six five,” not “five million (pause) five hundred fifty-one thousand (pause) three hundred sixty-five.” Risky mode also ensures that “vanity” telephone numbers, such as 1 800 SHOPPER, are spelled out.
	1 of 3

Table 21. TTS Escape Sequences for Class Detectors for the SSP Circuit Card

Sequence	Description
Proper name `\!nno` (off) `\!nnr` (risky mode) `\!nnc` (conservative mode)	Risky mode is needed only when the data may contain name-related abbreviations or titles. Otherwise, use conservative mode. In risky mode, titles such as “Mr.” and ambiguous abbreviations such as “Dr.” are spoken correctly. Abbreviations such as “Sr.” (as in “John Doe Sr.”) and “Jr.” expand correctly in either risky or conservative mode because there is only one possible interpretation of the abbreviations. **Note:** TTS speaks a proper name like “John Paul III” with three I’s. For TTS to pronounce this field successfully, you can enter either “John Paul third” or “John Paul 3rd”. This can be done in either conservative or risky mode because the “3rd” and “third” cannot be misinterpreted.
	2 of 3

Table 21. TTS Escape Sequences for Class Detectors for the SSP Circuit Card

Sequence	Description
Address `\!nao` (off) `\!nar` (risky mode) `\!nac` (conservative mode)	Use risky mode to detect partial addresses and to speak ambiguous address abbreviations correctly, such as “drive” for “Dr.“ (not “doctor”) and “street” for “St.” not “saint”). Standard post office abbreviations apply.
Fraction `\!nfo` (off) `\!nfr` (risky mode) `\!nfc` (conservative mode	Use risky mode so that, for example, “1/4” is spoken as “one fourth” and not “one slash four.” (To have TTS speak “1/4” as a date, use conservative date mode.)
	3 of 3

Escape Sequences Used by the LSPS II

The LSPS II has several types of embedded escape sequences such as:

- Changing Text Class Detection Mode on page 243
- Switching to Special Translation Mode on page 245
- Changing Text Expansion Modes on page 246
- Operating on User Dictionaries on page 247
- Using Other Escape Sequences on page 247

Note: The information in this section provides listings for some of the escape sequences that can be used by the LSPS II circuit card. For more information on escape sequencing, see the LSPS Software Development Kit resident on the system at **/usr/lsps/doc/pdf/sdk.pdf**

Changing Text Class Detection Mode

\!n*cm* is the general escape sequence format where ***c*** is the text class detector and ***m*** is the modes to which the detector is set. Table 22 on page 244 lists the function for the command variables.

Table 22. Text Class Detection Mode Variable Definitions

Text Class Detector (*c*)	**Function**
a	used for address class
d	used for date class
f	used for fraction class
i	used for measurement class
m	used for money class
n	used for proper names class
o	used for ordinal numbers class
p	used for telephone numbers class
t	used for time class
Class Detector Setting (*m*)	**Function**
o	turn the class detector off
c	set class detector to conservative mode (default)
r	set class detector to risky mode

Note: For example, to switch off the telephone numbers detector, enter **\!npo**

Switching to Special Translation Mode

Table 23 lists the escape sequences available to switch to special translation mode.

Table 23. Switch to Special Translation Mode Escape Sequences

Escape Sequence	Function
\!sb	spell mode begin
\!se	spell mode end
\!mb	math mode begin
\!me	math mode end
\!rb	raw mode begin
\!rb	raw mode end
\!pb	proofread mode begin
\!pe	proofread mode end

Changing Text Expansion Modes

Table 24 lists the escape sequences available to change text expansion modes.

Table 24. Change Text Expansion Modes Escape Sequences

Escape Sequence	Function
\!ab	begin acronym spell mode (default)
\!ae	end acronym spell mode
\!eb	begin abbreviation expansion mode (default)
\!ee	end abbreviation expansion mode
\!hnv	set numerical hyphen verbose mode (default)
\!hnt	set numerical hyphen terse mode
\!hav	set alphabetic hyphen verbose mode
\!hate	set alphabetic hyphen terse mode (default)

Operating on User Dictionaries

The cache file, residing at **/usr/lsps/tts/data** contains entries that are read in when an LSPS II circuit card is booted with a board type of TTS. The related sequences are the following:

- **\[ai/*abbrev/expansion*/\]** - add ***abbrev*** to the abbreviation dictionary
- **\[ad/*abbrev*//\]** - delete abbrev from the dictionary

Using Other Escape Sequences

Table 25 lists remaining escape sequences and their functions.

Table 25. Other Escape Sequences

Escape Sequence	Function
\!br	force end of sentence regardless of punctuation
\!cb	switch to case significant mode (default)
\!ce	switch to case insignificant mode
\!de	set all text class detection modes and text expansion modes to default
\!pn	following word is marked as proper noun (may alter pronunciation)
	1 of 2

Table 25. Other Escape Sequences

Escape Sequence	Function
\!I*n*	set index marker *n* (0-32000) to signal application of when the marked text is actually spoken by the board
\!lt	load external text class detection rules from the default file *ftspec.b*
\!lt*file*	load external text class detection rules from *file*
	2 of 2

Illustrated in Table 26 on page 249 are TTS recognition phonemes for the LSPS II circuit card in the US English language. A word accompanies each phoneme to illustrate its sound.

Table 26. US English Phonemes for the LSPS II Circuit Card

Phoneme	Word Example	Phoneme	Word Example
a	had	l	lid or hall*
@	father	m	moo or ham*
A	hay	n	nip or span*
^	cup	N	hang
W	how	o	hot
?	ohoh	O	hoe
Y	boy	p	pick or spit*
b	bit	r	rat or tar*
C	chip	s	sick
d	dip	S	ship
D	this	t	tip or stick*
E	heed	T	thick
R	her	U	rue
e	head	u	hook
			1 of 2

Table 26. US English Phonemes for the LSPS II Circuit Card

Phoneme	Word Example	Phoneme	Word Example
f	fool	v	voice
g	got	w	we
h	hit	y	yes
I	hide	z	zap
i	hid	Z	measure
J	judge	~	little
k	kick or skip*	&	data
>	saw		
			2 of 2

* How used depends on the transcription.

Numerics

23B+D

23 bearer (communication) and 1 data (signaling) channel on a T1 PRI circuit card.

30B+D

30 bearer (communication) and 1 data (signaling) channel (plus framing channel 0) on an E1 PRI circuit card.

47B+D

47 bearer (communication) and 1 data (signaling) channel on two T1 PRI circuit cards.

4ESS®

A large Lucent central office switch used to route calls through the telephone network.

5ESS®

A Lucent electronic switching machine used to route calls through the telephone network or private branch exchange.

A

AC

alternating current

ACD

automatic call distributor

AD

application dispatch

AD-API

application dispatch application programming interface

adaptive differential pulse code modulation

A means of encoding analog voice signals into digital signals by adaptively predicting future encoded voice signals. This adaptive modulation method reduces the number of bits required to encode voice. See also pulse code modulation.

adjunct products

Products (for example, the Adjunct/Switch Application Interface) that the system administers via cut-through access to the inherent management capabilities of the product itself; this is in opposition to the ability of the system to administer the switch directly.

ADPCM

adaptive differential pulse code modulation

ADU

asynchronous data unit

advanced speech recognition

A speech recognition ability that allows the system to understand WholeWord and FlexWord™ inputs from callers.

affiliate

A business organization that Lucent controls or with which Lucent is in partnership.

AGL

application generation language

ALERT

System alerter process

alerter

A system process that responds to patterns of events logged by the “logdaemon” process.

American Standard Code for Information Interchange

A standard code for data representation that represents alphanumeric characters as binary numbers. The code includes 128 upper- and lowercase letters, numerals, and special characters. Each alphanumeric and special character has an ASCII code (binary) equivalent that is 1 byte long.

analog

An analog signal, such as voice or music, that varies in a continuous manner. An analog signal may be contrasted with a digital signal, which represents only discrete states.

ANI

automatic number identification

announcement

A message the system plays to the caller to provide information. The caller is not asked to give a response. Compare to prompt.

API

Application programming interface

application

The automated transaction (interactions) among the caller, the voice response system, and any databases or host computers required for your business.

application administration

The component of the system that provides access to the applications currently available on your system and helps you to manage and administer them.

application verification

A process in which the system verifies that all the components needed by an application are complete.

ASCII

American Standard Code for Information Interchange

ASI

analog switch integration

ASR

advanced speech recognition

asynchronous communication

A method of data transmission in which bits or characters are sent at irregular intervals and spaced by start and stop bits rather than by time. Compare to synchronous communication.

asynchronous data unit

An electronic communications device that allows computer systems to communicate over asynchronous lines more than 50 feet (15 m) in length.

automatic call distributor

That part of a telephone system that recognizes and answers incoming calls and completes these calls based on a set of instructions contained in a database. The ACD can send the call to an operator or group of operators as soon as the operator has completed a previous call or after the system has played a message to the caller.

automatic number identification

A method of identifying the calling party by automatically receiving a string of digits that identifies the calling station of a particular customer.

B

back up

The preservation of the information in a file in a different location, so that the data is not lost in the event of hardware or system failure.

backing up an application

Using a utility that makes an archive copy of a completed application or an interim copy of an application in progress. The back-up copy can be restored to the system if the on-line version is damaged, or if you make revisions and want to go back to the previous version.

barge-in

A capability provided by WholeWord speech recognition and Dial Pulse Recognition (DPR) that allows callers to speak or enter their responses during the prompt and have those responses recognized (similar to the Speak with Interrupt capability). See also echo cancellation.

batch file

A file containing one or more lines, each of which is a command executable by the UNIX shell.

BB

bulletin board

blind transfer protocol

A protocol in which a call is completed as soon as the extension is dialed, without having to wait to see if the telephone is busy or if the caller answered.

bps

bits per second

BRDG

call bridging process

bridging

The process of connecting one telephone network connection to another over the system TDM bus. Bridging decreases the processing load on the system since an active bridge does not require speech processing, database access, host activity, etc., for the transaction.

bundle

In the context of the Enhanced File Transfer package, this term is used to denote a single file, a group of files (package), or a combination of both.

byte

A unit of storage in the computer. On many systems, a byte is 8 bits (binary digits), which is the equivalent of one character of text.

C

call classification analysis

A process that enables application designers to use information available within the system to classify the disposition of originated and transferred calls. Intelligent CCA is provided with the system. Full CCA is an optional feature package.

call data event

A parameter that specifies a list of variables that are appended to a call data record at the end of each call.

call data handler process

A software process that accumulates generic call statistics and application events.

called party number

The number dialed by the person making a telephone call. Telephone switching equipment can use this number to selectively route an incoming call to a particular department or agent.

caller

The party who calls for a service, gets connected to the system, and interacts with it. As the system can also make outbound calls for service, the caller can also be the person who responds to those outbound calls.

call flow

See transaction.

call progress tones

Standard telephony sounds that indicate the status of the call. These sounds include busy, fast busy, ringback, reorder, etc.

card cage

An area within a hardware platform that contains and secures all of the standard and optional circuit cards used in the system.

cartridge tape drive

A high-capacity data storage/retrieval device that can be used to transfer large amounts of information onto high-density magnetic cartridge tape based on a predetermined format. This tape can be removed from the system and stored as a backup, or used on another system.

CAS

channel associated signalling

caution

An admonishment or advisory statement used in the system documentation to alert the user to the possibility of a service interruption or a loss of data.

CCA

call classification analysis

CDH

call data handler process

CELP

code excited linear prediction

central office

An office or location in which large telecommunication devices such as telephone switches and network access facilities are maintained. These locations follow strict installation and operation requirements.

central processing unit

See processor.

CGEN

Voice system general message class

channel

See port.

channel associated signaling

A type of signaling that can be used on E1 circuit cards. It occurs on channel 16.

CICS

Customer Information Control System

circuit card upgrade

A new circuit card that replaces an existing card in the platform. Usually the replacement is an updated version of the original circuit card to replace technology made obsolete by industry trends or a new system release.

cluster controller

A bisynchronous interface that provides a means of handling remote communication processing.

CO

central office

code excited linear prediction

A means of encoding analog voice signals into digital signals that provides excellent quality with use of minimum disk space.

command

An instruction or request the user issues to the system software to make the system perform a particular function. An entire command consists of the command name and options.

configuration

The arrangement of the software and hardware of a computer system or network. The system configuration includes either a standard or custom processor, peripheral equipment (for example, printers and modems), and software applications. Configuration also refers to the way the switch network is set up; that is, the types of products that are in the network and how those products communicate.

configuration management

The component of the system that allows you to manage the current configuration of voice channels, host sessions, and database connections, assign scripts to run on specific voice channels or host sessions, assign functionality to SSP and E1/T1 circuit cards, and perform various maintenance functions.

connect and disconnect (C and D) tones

DTMF tones that inform the system when the attendant has been connected (C) and when the caller has been disconnected (D).

connected digits

A sequence of digits that the system can process as a group, rather than requiring the caller to enter the digits one at a time.

controller circuit card

A circuit card used on a computer system that controls its basic functionality and makes the system operational. These circuit cards are used to control magnetic peripherals, video monitors, and basic system communications.

copying an application

A utility in which information from a source application is directed into the destination application.

coresidency

The ability of two products or services to operate and interact with each other on a single hardware platform.

CPE

customer provided equipment or customer premise equipment

CPN

called party number

CPT

call progress tones

CPU

central processing unit

CPU Complex

The processor for the UCS 1000 R4.2 consisting of a single-board computing circuit card and an I/O companion board (SBC/IOB). The CPU complex is also used in other compactPCI platforms.

crash

An interactive utility for examining the operating system core and for determining if system parameters are being exceeded.

CSU

channel service unit

custom speech

Unique words or phrases to be used in system voice prompts that Lucent Technologies custom records on a per-customer basis.

custom vocabulary

A specialized package of unique words or phrases created on a per-customer basis and used by WholeWord or FlexWord speech recognition.

Customer Information Control System

Part of the operating system that manages resources for running applications (for example, IND$FILE).

CVS

converse vector step

D

danger

An admonishment or advisory statement used in system documentation to alert the user to the possibility of personal injury or death.

data interface process

A software process that communicates with Script Builder applications.

database

A structured set of files, records, or tables.

database field

A field used to extract values from a local database and form the structure upon which a database is built.

database record

The information in a database for a person, product, event, etc. The database record is made up of individual fields for each information item.

database table

A structure, made up of columns and rows, that holds information in a database. Database tables provide a means of storing information that changes too often to “hard-code,” or store permanently, in the transaction outline.

dB

decibel

DB

database

DBC

database checking process

DBMS

database management system

DC

direct current

DCE

data communications equipment

DCP

digital communications protocol

debug

The process of locating and correcting errors in computer programs; also referred to as troubleshooting.

default

The way a computer performs a task in the absence of other instructions.

default owner

The owner of a channel when no process takes ownership of that channel. The default owner holds all idle, in-service channels. In terms of the IRAPI, this is typically the Application Dispatch process.

diagnose

The process of performing diagnostics on a bus or on Tip/Ring, E1/T1, or SSP circuit cards.

dial ahead

The ability to collect and process touch-tone inputs in sequence, even when they are received before the prompts.

dial pulse recognition

A method of recognizing caller pulse inputs from a rotary telephone.

dialed number identification service

A service that allows incoming calls to contain information about the telephone number for which it is destined.

dial through

A capability provided by touch-tone and dial pulse recognition that allows callers to enter their responses during the prompt and have those responses recognized (similar to the Speak with Interrupt capability). See also barge-in and echo cancellation.

DIO

disk input and output process

DIP

data interface process

directory

A type of file used to group and organize other files or directories.

display errdata

A command that displays system errors sent to the logger.

DMA

direct memory address

DNIS

dialed number identification service

DPR

dial pulse recognition

DSP

digital signal processor

DTE

data terminal equipment

DTMF

dual tone multi-frequency

DTR

data terminal ready

dual tone multi-frequency

A touch-tone sound that is an audio signal including two different frequencies. *DTMF feedback* is the process of the "switch" providing this information to the system. *DTMF muting* is the process of ignoring these tones (which might be simulated by human speech) when they are not needed for the application.

dump space

An area of the disk that is fixed in size and should equal the amount of RAM on the system. The operating system "dumps" an image of core memory when the system crashes. The dump can be fetched after rebooting to help in analyzing the cause of the crash.

E

E&M

Ear and Mouth

E1 / T1

Digital telephony interfaces, commonly called *trunks*. E1 is an international standard at 2.048 Mbps. T1 is a North American standard at 1.544 Mbps.

Ear and Mouth

A common T1 trunking protocol for connection between two “switches.”

EBCDIC

Extended Binary Coded Decimal Interexchange Code

echo cancellation

The process of making the channel quiet enough so that the system can hear and recognize WholeWord and dial pulse inputs during the prompt. See also barge-in.

editor system

A system that allows speech phrases to be displayed and edited by a user.

EIA

Electronic Industries Association

EISA

Extended Industry Standard Architecture

EMI

electromagnetic interference

Enhanced Basic Speech

Pre-recorded speech available from Lucent Technologies in several languages. Sometimes called standard speech.

error message

A message on the screen indicating that something is wrong with a possible suggestion of how to correct it.

ESD

electrostatic discharge

ESS

electronic switching system

EST

Enhanced Software Technologies, Inc.

ET

error tracker

Ethernet

A name for a local area network that uses 10BASE5 or 10BASE2 coaxial cable and InterLAN signaling techniques.

event

The notification given to an application when some condition occurs that is generally not encountered in normal operation.

EXTA

external alarms feature message class

external actions

Specific predefined system tasks that Script Builder can call or *invoke* to interact with other products or services. When an external action is invoked, the systems displays a form that provides choices in each field for the application developer to select. Examples are Call_Bridge, Make_Call, SP_Allocate, SR_Prompt, etc. In Voice@Work, external actions are treated as external functions.

external functions

Specific predefined (or customer-created) system tasks that Voice@Work or Script Builder can call or *invoke* to interact with other products or services. The function allows the application developer to enter the argument(s) for the function to act on. Examples are concat, getarg, length, substring, etc. See also external actions.

F

FCC

Federal Communications Commission

FDD

floppy disk drive

feature

A function or capability of a product or an application within the system.

feature package

An optional package that may contain both hardware and software resources to provide additional functionality to a standard system.

feature_tst script package

A standard system software program that allows a user to perform self-tests of critical hardware and software functionality.

FEP

front end processor

field

See database field.

FIFO

first-in-first-out processing order

file

A collection of data treated as a basic unit of storage.

file transfer

An option that allows you to transfer files interactively or directly to and from UNIX using the file transfer system (FTS).

filename

Alphabetic characters used to identify a particular file.

FlexWord™ speech recognition

A type of speech recognition based on subword technology that recognizes phonemes or parts of words in a specific language. See also subword technology.

foos

facility out-of-service state

FTS

file transfer process message class

function key

A key, labeled F1 through F8, on your keyboard to which the system software gives special properties for manipulating the user interface.

G

GEN

PRISM logger and alerter general message class

grammar

The inputs that a recognizer can match (identify) from a caller.

GUI

graphical user interface

H

hard disk drive

A high-capacity data storage/retrieval device that is located inside a computer platform. A hard disk drive stores data on nonremovable high-density magnetic media based on a predetermined format for retrieval by the system at a later date.

hardware

The physical components of a computer system. The central processing unit, disks, tape, and floppy drives, etc., are all hardware.

hardware upgrade

Replacement of one or more fundamental platform hardware components (for example, the CPU or hard disk drive), while the existing platform and other existing optional circuit cards remain.

HDD

hard disk drive

hwoos

hardware out-of-service state

Hz

Hertz

I

IBM

International Business Machines

iCk or ICK

The system integrity checking process.

ID

identification

IDE

integrated disk electronics

idle channel

A channel that either has no owner or is owned by its default owner and is onhook.

IE

information element

IEEE

Institute of Electrical and Electronic Engineers

IND$FILE

The standard SNA file transfer utility that runs as an application under CICS, TSO, and CMS. IND$FILE is independent of link-level protocols such as BISYNC and SDLC.

independent software vendor

A company that has an agreement with Lucent Technologies to develop software to work with the system to provide additional features required by customers.

indexed table

A table that, unlike a nonindexed table, can be searched via a field name that has been indexed.

industry standard architecture

A PC bus standard that allows processors and other circuit cards to communicate with each other.

INIT

voice system initialization message class

initialize

To start up the system for the first time.

inserv

in-service state

Integrated Services Digital Network

A network that provides end-to-end digital connectivity to support a wide range of voice and data services.

intelligent CCA

Monitoring the line after dialing is complete to determine whether a busy, reorder (fast busy), or other failure has been encountered. It also recognizes when the extension is answered or if the extension is not answered after a specified number of rings. The monitoring capabilities are dependent on the network interface circuit card and protocol used

interface

The access point of a system. With respect to the system, the interface is designed to provide you with easy access to the software capabilities.

interrupt

The termination of voice and/or telephony functions when some condition occurs.

Intuity Response Application Programming Interface

A library of commands that provide a standard development interface for voice-telephony applications.

IOB

I/O companion card to the SBC. This is part of the CPU Complex.

IPC

interprocess communication

IPC

intelligent ports card (IPC-900)

IRAPI

Intuity Response Application Programming Interface

IRQ

interrupt request

ISA

industry standard architecture

ISDN

Integrated Services Digital Network

ISV

independent software vendor

ITAC

International Technical Assistance Center

K

Kbps

kilobytes per second

Kbyte

kilobyte

keyboard mapping

In emulation mode, this feature enables the keyboard to send 3270 keyboard codes to the host according to a configuration table set up during installation.

keyword spotting

A capability provided by WholeWord speech recognition that allows the system to recognize a single word in the middle of an entire phrase spoken by a caller in response to a prompt.

L

LAN

local area network

LDB

local database

LED

light-emitting diode

library states

The state information about channel activities maintained by the IRAPI.

LIFO

last-in-first-out processing order

line side E1

A digital method of interfacing a system to a PBX or “switch” using E1-related hardware and software.

line side T1

A digital method of interfacing a system to a PBX or “switch” using T1-related hardware and software.

listfile

An ASCII catalog that lists the contents of one or more talkfiles. Each application script is typically associated with a separate listfile. The listfile maps speech phrase strings used by application scripts into speech phrase numbers.

local area network

A data communications network in a limited geographical area. The LAN provides communications between computers and peripherals.

local database

A database residing on the system.

LOG

System logger process message class

logical unit

A type of SNA Network Addressable Unit.

logdaemon

A UNIX system information and error logging process.

logger

See logdaemon.

logging on/off

Entering or exiting the system software.

LSE1

line side E1

LST1

line side T1

LU

logical unit

M

magnetic peripherals

Data storage devices that use magnetic media to store information. Such devices include hard disk drives, floppy disk drives, and cartridge tape drives.

main screen

The system screen from which you are able to enter either the System Administration or Voice System Administration menu.

maintenance process

A software process that runs temporary diagnostics and maintains the state of circuit cards and channels.

manoos

manually out-of-service state

masked event

An event that an application can ignore (that is, the application can request not to be informed of the event).

master

A circuit card that provides clock information to the TDM bus.

Mbps

megabits per second

MByte

megabyte

megabyte

A unit of memory equal to 1,048,576 bytes (1024 x 1024). It is often rounded to one million.

menu

Options presented to a user on a computer screen or with voice prompts.

MF

multifrequency

MHz

megahertz

ms

millisecond

msec

millisecond

MS-DOS

A personal computer disk operating system developed by the Microsoft Corporation.

MTC

maintenance process

multifrequency

Dual tone digit signalling (similar to DTMF), used for trunk addressing between network switches or by network operators.

multithreaded application

A single process/application that controls several channels. Each thread of the application is managed explicitly. Typically this means state information for each thread is maintained and the state of the application on each channel is tracked.

N

NCP

Network Control Program

NEBS

Network Equipment Building Standards

NEMA

National Electrical Manufacturers Association

netoos

network out-of-service state

NFAS

non-facility associated signalling

NFS

network file sharing

NM-API

Network Management - Application Programming Interface

NMVT

network management vector transport

nonex

nonexistent state

nonindexed table

A table that can be searched only in a sequential manner and not via a field name.

nonmasked event

An event that must be sent to the application. Generally, an event is nonmaskable if the application would likely encounter state transition errors by trying to it.

null value

An entry containing no value. A field containing a null value is normally displayed as blank and is different from a field containing a value of zero.

O

OEM

original equipment manufacturer

on-line help

Messages or information that appear on the user's screen when a "function key" (F1 through F8) is pressed.

option

An argument used in a command line to modify program output by modifying the execution of a command. When you do not specify any options, the command executes according to its default options.

ORACLE

A company that produces relational database management software. It is also used as a generic term that identifies a database residing on a local or remote system that is created and maintained using an ORACLE RDBMS product.

P

PBX

private branch exchange

PC

personal computer

PCB

printed circuit board

PCI

peripheral component interconnect

PCI Mezzanine Card

A PCI module, such as a LAN or RAID controller, that connects to the CPU Complex IOB companion card.

PCM

pulse code modulation

PEC

price element code

peripheral (device)

Equipment such as printers or terminals that is in addition to the basic processor.

peripheral component interconnect

A newer, higher speed PC bus that is gradually displacing ISA for many components.

permanent process

A process that starts and initializes itself before it is needed by a caller.

phoneme

A single basic sound of a particular spoken language. For example, the English language contains 40 phonemes that represent all basic sounds used with the language. The English word “one” can be represented with three phonemes, “w” - “uh” - “n.” Phonemes vary between languages because of guttural and nasal inflections and syllable constructs.

phrase filtering (screening)

The rejection of unrecognized speech. The WholeWord and FlexWord speech recognition packages can be programmed to reprompt the caller if the system does not recognize a spoken response.

phrase tag

A string of up to 50 characters that identifies the contents of a speech phrase used by an application script.

platform migration

See platform upgrade.

platform upgrade

The process of replacing the existing platform with a new platform.

pluggable

A term usually used with speech technologies, in particular standard speech, to indicate that a basic algorithmic technique has been implemented to accept one or more sets of parameters that tailors the algorithm to perform in one or more languages.

PMC

PCI Mezzanine Card

poll

A message sent from a central controller to an individual station on a multipoint network inviting that station to send if it has any traffic.

polling

A network arrangement whereby a central computer asks each remote location whether it wants to send information. This arrangement enables each user or remote data terminal to transmit and receive information on shared facilities.

port

A connection or link between two devices that allows information to travel to a desired location. See telephone network connection.

PRI

Primary Rate Interface

Primary Rate Interface

An ISDN term for connections over E1 or T1 facilities that are usually treated as trunks.

private branch exchange

A private switching system, either manual or automatic, usually serving an organization, such as a business or government agency, and usually located on the customer's premises.

processor

In system documentation, the computer on which UnixWare and system software runs. In general, the part of the computer system that processes the data. Also known as the central processing unit.

prompt

A message played to a caller that gives the caller a choice of selections in a menu and asks for a response. Compare to announcement.

pseudo driver

A driver that does not control any hardware.

PSTN

public switch telephone network

pulse code modulation

A digital modulation method of encoding voice signals into digital signals. See also adaptive differential pulse code modulation.

R

RAID

redundant array of independent disks

RAID Array

An assembly of disk drives configured to provide some level of RAID functionality

RAM

random access memory

RDMBS

ORACLE relational database management system

RECOG

speech recognition feature message class

recognition type

The type of input the recognizer can understand. Available types include touch-tone, dial pulse, and Advanced Speech Recognition (ASR), which includes WholeWord and FlexWord speech recognition.

recognizer

The part of the system that compares caller input to a grammar in order to correctly match (identify) the caller input.

record

See database record.

recovery

The process of using copies of the system software to reconstruct files that have been lost or damaged. See also restore.

remote database

Information stored on a system other than your current system that can be accessed by your current system.

REN

ringer equivalence number

reports administration

The component of a system that provides access to system reports, including call classification, call data detail, call data summary, message log, and traffic reports.

restore

The process of recovering lost or damaged files by retrieving them from available back-up tapes or from another disk device. See also “recovery.”

restore application

A utility that replaces a damaged application or restores an older version of an application.

reuse

The concept of using a component from a source system in a target system after a software upgrade or platform migration.

RFS

remote file sharing

RM

resource manager

roll back

To cancel changes to a database since the point at which changes were last committed.

rollback segment

A portion of the database that records actions that should be undone under certain circumstances. Rollback segments are used to provide transaction rollback, read consistency, and recovery.

RTS

request to send

S

SCA

single connector architecture

SBC

A single-board computing circuit card used in the UCS 1000 R4.2. It is part of the CPU complex.

screen pop

A method of delivering a screen of information to a telephone operator at the same time a telephone call is delivered. This is accomplished by a complex chain of tasks that include identifying the calling party number, using that information to access a local or remote ORACLE database, and pulling a “form” full of information from the database using an ORACLE database utility package.

script

The set of instructions for the system to follow during a transaction.

Script Builder

An optional software package that provides a menu-oriented interface designed to assist in the development of custom voice response applications on the system (see also Voice@Work).

SCSI

small computer system interface

SDN

software defined network

shared database table

A database table that is used in more than one application.

shared speech

Speech that is a part of more than one application.

shared speech pools

A parameter that allows the user of a voice application to share speech components with other applications.

SID

station identification

single-threaded application

An application that runs on a single voice channel.

slave

A circuit card that depends on the TDM bus for clock information.

SLIP

serial line interface protocol

small computer system interface

A disk drive control technology in which a single SCSI adapter circuit card plugged into a PC slot is capable of controlling as many as seven different hard disks, optical disks, tape drives, etc.

SNA

systems network architecture

SNMP

simple network management protocol

software

The set or sets of programs that instruct the computer hardware to perform a task or series of tasks — for example, UnixWare software and the system software.

software upgrade

The installation of a new version of software in which the existing platform and circuit cards are retained.

source system

The system from which you are upgrading (that is, your system as it exists *before* you upgrade).

speech and signal processor circuit card (CWB1)

The high-performance signal processing circuit card capable of simultaneous support for various speech technologies.

speech energy

The amount of energy in an audio signal. Literally translated, it is the output level of the sound in every phonetic utterance.

speech envelope

The linear representation of voltage on a line. It reflects the sound wave amplitude at different intervals of time. This envelope can be plotted on a graph to represent the oscillation of an audio signal between the positive and negative extremes.

speech file

A file containing an encoded speech phrase.

speech filesystem

A collection of several talkfiles. The filesystem is organized into 16-Kbyte blocks for efficient management and retrieval of talkfiles.

speech modeling

The process of creating WholeWord speech recognition algorithms by collecting thousands of different speech samples of a single word and comparing them all to obtain a statistical average of the word. This average is then used by a WholeWord speech recognition program to recognize a single spoken word.

speech space

An area that contains all digitized speech used for playback in the applications loaded on the system.

speech phrase

A continuous speech segment encoded into a digital string.

speech recognition

The ability of the system to understand input from callers.

SPIP

signal processor interface process

SPPLIB

speech processing library

SQL

structured query language

SR

speech recognition

SSP

speech and signal processor circuit card (CWB1)

standard speech

The speech package available in several languages containing simple words and phrases produced by Lucent Technologies for use with the system. This package includes digits, numbers, days of the week, and months, each spoken with initial, medial, and falling inflection. The speech is in digitized files stored on the hard disk to be used in voice prompts and messages to the caller. This feature is also called Enhanced Basic Speech.

standard vocabulary

A standard package of simple word speech models provided by Lucent Technologies and used for WholeWord speech recognition. These phrases include the digits “zero” through “nine,” “yes,” “no,” and “oh,” or the equivalent words in a specific local language.

string

A contiguous sequence of characters treated as a unit. Strings are normally bounded by white spaces, tabs, or a character designated as a separator. A string value is a specified group of characters symbolized by a variable.

structured query language

A standard data programming language used with data storage and data query applications.

subword technology

A method of speech recognition used in FlexWord recognition that recognizes phonemes or parts of words. Compare to WholeWord speech recognition.

switch

A software and hardware device that controls and directs voice and data traffic. A customer-based switch is known as a private branch exchange.

switch hook

The device at the top of most telephones that is depressed when the handset is resting in the cradle (in other words, is *on hook*). The device is raised when the handset is picked up (in other words, when the telephone is *off hook*).

switch hook flash

A signaling technique in which the signal is originated by momentarily depressing the "switch hook."

switch interface administration

The component of the system that enables you to define the interaction between the system and switches by allowing you to establish and modify switch interface parameters and protocol options for both analog and digital interfaces.

switch network

Two or more interconnected telephone switching systems.

synchronous communication

A method of data transmission in which bits or characters are sent at regular time intervals, rather than being spaced by start and stop bits. Compare to asynchronous communication.

SYS

UNIX system calls message class

sysgen

system generation

system administrator

The person assigned the responsibility of monitoring all system software processing, performing daily system operations and preventive maintenance, and troubleshooting errors as required.

system architecture

The manner in which the system software is structured.

system message

An event or alarm generated by either the system or end-user process.

system monitor

A component of the system that tests to verify that each incoming telephone line and its associated Tip/Ring or T1 circuit card is functional. Through the "System Monitor" component, you are able to see displays of the Voice Channel and Host Session Monitors.

T

T1

A digital transmission link with a capacity of 1.544 Mbps.

table

See database table.

talkfile

An ASCII file that contains the speech phrase tags and phrase tag numbers for all the phrases of a specific application. The speech phrases are organized and stored in groups. Each talkfile can contain up to 65,535 phrases, and the speech filesystem can contain multiple talkfiles.

talkoff

The process of a caller interrupting a prompt, so the prompt message stops playing.

TAM

telecom alarm module

target system

The system to which you are upgrading (that is, your system as you expect it to exist *after* you upgrade).

TAS

transaction assembler script

TCP/IP

transmission control protocol/internet protocol

TDM

time division multiplexing

telecom alarm module

An intelligent alarm module that provides critical, major, and minor alarm indicators.

telephone network connection

The point at which a telephone network connection terminates on a system. Supported telephone connections are Tip/Ring, T1, and E1.

Text-to-Speech

An optional feature that allows an application to play US English speech directly from ASCII text by converting that text to synthesized speech. The text can be used for prompts or for text retrieved from a database or host, and can be spoken in an application with prerecorded speech. Text-to-Speech application development is supported through Voice@Work and Script Builder.

ThickNet

A 10-mm (10BASE5) coaxial cable used to provide interLAN communications.

ThinNet

A 5-mm (10BASE2) coaxial cable used to provide interLAN communications.

time-division multiplex

A method of serving a number of simultaneous channels over a common transmission path by assigning the transmission path sequentially to the channels, with each assignment being for a discrete time interval.

Tip/Ring

Analog telecommunications using four-wire media.

token ring

A ring type of local area network that allows any station in the network to communicate with any other station.

trace

A command that can be used to monitor the execution of a script.

traffic

The flow of information or messages through a communications network for voice, data, or audio services.

transaction

The interactions (exchanges) between the caller and the voice response system. A transaction can involve one or more telephone network connections and voice responses from the system. It can also involve one or more of the system optional features, such as speech recognition, 3270 host interface, FAX Actions, etc.

transaction assembler script

The computer program code that controls the application operating on the voice response system. The code can be produced from Voice@Work, Script Builder, or by writing directly in TAS code.

transaction state machine process

A multi-channel IRAPI application that runs applications controlled by TAS script code.

transient process

A process that is created dynamically only when needed.

troubleshooting

The process of locating and correcting errors in computer programs. This process is also referred to as debugging.

TSO

time share operation

TSM

transaction state machine process

TTS

Text-to-Speech

TWIP

T1 interface process

U

UCS

Unified Communications Server

UK

United Kingdom

US

United States of America

UNIX Operating System

A multiuser, multitasking computer operating system originally developed by Lucent Technologies.

UNIX shell

The command language that provides a user interface to the UNIX operating system.

upgrade scenario

The particular combination of current hardware, software, application and target hardware, software, applications, etc.

usability

A measurement of how easy an application is for callers to use. The measurement is made by making observations and by asking questions. An application should have high usability to be successful.

USOC

universal service ordering code

UVL

unified voice library

V

VDC

video display controller

vi editor

A screen editor used to create and change electronic files.

virtual channel

A channel that is not associated with an interface to the telephone network (Tip/Ring, T1, LSE1/LST1, or PRI). Virtual channels are intended to run “data-only” applications which do not interact with callers but may interact with DIPs. Voice or network functions (for example, coding or playing speech, call answer, origination, or transfer) will not work on a virtual channel. Virtual channel applications can be initiated only by a “virtual seizure” request to TSM from a DIP.

vocabulary

A collection of words that the system is able to recognize using either WholeWord or FlexWord speech recognition.

vocabulary activation

The set of active vocabularies that define the words and wordlists known to the FlexWord recognizer.

vocabulary loading

The process of copying the vocabulary from the system where it was developed and adding it to the target system.

Voice@Work

An optional software package that provides a graphical interface to assist in development of voice response applications on the system (see also Script Builder).

voice channel

A channel that is associated with an interface to the telephone network (T1, E1, or PRI). Any system application can run on a voice channel. Voice channel applications can be initiated by being assigned to particular voice channels or dialed numbers to handle incoming calls or by a “soft seizure” request to TSM from a DIP or the **soft_szr** command.

voice processing co-marketer

A company licensed to purchase voice processing equipment to market and sell based on their own marketing strategies.

voice response output process

A software process that transfers digitized speech between system hardware (for example, Tip/Ring and SSP circuit cards) and data storage devices (for example, hard disk, etc.)

voice response unit

A computer connected to a telephone network that can play messages to callers, recognize caller inputs, access and update a databases, and transfer and monitor calls.

voice system administration

The means by which you are able to administer both voice- and nonvoice-related aspects of the system.

VPC

voice processing co-marketer

VROP

voice response output process

VRU

voice response unit

W

warning

An admonishment or advisory statement used in system documentation to alert the user to the possibility of equipment damage.

watchdog timer

An timer that activates a TAM alarm when CPU activity is not received within the 30-second threshold.

WholeWord speech recognition

An optional feature, available in several languages, based on whole-word technology that can recognize the numbers one through zero, “yes”, and “no” (the key words). This feature is reliable, regardless of the individual speaker. This feature can identify the key words when spoken in phrases with other words. A string of key words, called *connected digits*, can be recognized. During the prompt announcement, the caller can speak or use touch tones (or dial pulses, if available). See also whole-word technology.

whole-word technology

The ability to recognize an entire word, rather than just the phoneme or a part of a word. Compare to “subword technology.”

wink signal

An interruption of current to a busy lamp indicating that there is a line on hold.

word

A unique utterance understood by the recognizer.

wordlist

A set of words available for FlexWord recognition by an application during a Prompt & Collect action step.

word spotting

The ability to search through extraneous speech during a recognition.

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