



Vestec Automatic Speech Recognition Engine  
Standard Edition  
Version 1.1.1

## **Installation Guide**



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## Standard Edition

### Version 1.1.1

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*145 Columbia Street West, Suite 1, Waterloo, Ontario, Canada N2L 3L2*

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## About This Document

Vestec's Automatic Speech Recognition Engine (VASRE) is a speaker-independent speech recognition engine that supports a distributed architecture of servers and clients. VASRE works for Windows, GNU/Linux, and Open Solaris platforms to process an audio file or stream from external sources, such as telephone systems. The grammar can be built simply, with a list of keywords or pronunciations to be recognized, or with a more sophisticated industry standard.

This guide describes the step-by-step installation and verification process of VASRE for GNU/Linux and Windows.

## Audience

This guide is intended for speech application developers who are installing VASRE.

## Organization

This guide is organized as follows:

- Section 1 presents the hardware and software requirements for VASRE installation.
- Section 2 lists the documents regarding VASRE.
- Section 3 describes the installation and verification process of VASRE for GNU/Linux platforms.
- Section 4 describes the installation and verification process of VASRE for Windows platforms.

## Conventions

Guides for VASRE use the following conventions:

- **Bold Arial** represents user utterances, recognized strings, and semantic results.
- `Courier New` represents file names, directory names, command line strings, and file contents.
- *Italic text* represents types, tokens, keywords, variables, and functions.
- Underlined text represents menu strings or texts in graphical user interface.
- *Italic Courier New* represents values replaced by you. For example, *YYYY-MM-DD* may represent a date in the year-month-day format.
- A paragraph starting with **N.B.** represents critical information or warning.
- For abbreviated terms, both singular and plural are spelled the same. For example, RM represents both resource manager and resource managers.

# 1 System Requirements

For both GNU/Linux and Windows, Vestec recommends the hardware and software specifications described in this section as the minimum system requirements for VASRE.

## 1.1 Hardware Requirements

To launch the Resource Manager (RM) with four recognition servers, VASRE should be installed on a computer with

- Intel 1 GHz Pentium 4 or better processor,
- 512MB or more RAM,
- 100MB or more of free hard disk space for installation and verification,
- and network connections.

The actual memory usage and CPU power consumption are roughly proportional to the number of server ports. To illustrate this, we performed a resource requirement test using a PC with AMD Athlon 64-X2 Dual Core Processor 5600+ 2.9 GHz and 3GB RAM. With a grammar containing 500 keywords, the server ran on the PC, processing an audio input 1.6 seconds in length, issuing from clients at a rate of one every fourteen seconds. The relationship between the number of ports and the corresponding memory usage and CPU usage is listed in the following table:

# Ports	Memory Usage (MB)	CPU Usage (%)
0	1	0
1	55	1.74
2	101	3.45
4	193	6.45
8	378	13.11

Use the above data to choose the hardware specification that fits your recognition needs. Proper operation of VASRE is not guaranteed unless the minimum hardware requirement is fulfilled.

## 1.2 Software Requirements

VASRE supports the following operating systems:

- GNU/Linux: Debian, Ubuntu, OpenSUSE, SUSE Linux Enterprise, Fedora Core, CentOS, RedHat Enterprise (all for 32 bit and 64 bit)
- Unix: Open Solaris
- Windows: Windows XP 32 bit, Windows Vista 32 bit and 64 bit, and Windows 7 32 bit and 64 bit

You should have C or C++ compilers to build sample client applications and develop your own client programs.

Note also that you should install Asterisk, Open Source PBX, if you would like to use VASRE in conjunction with Asterisk.

## 2 Documentation

Six guides are included in VASRE Standard Edition (sorted in alphabetical order):

- Administration Guide (`Admin_Guide_version.pdf`): describes the usage of executable and script files developed to compile text grammars and control Resource Manager (RM) and recognition servers.
- Application Developer's Guide (`App_Dev_Guide_version.pdf`): explains C data structure and Application Programming Interface (API) functions that can be used to develop client applications.
- Asterisk Integration Guide (`Ast_Int_Guide_version.pdf`): explains how to install and use the VASRE plug-in for Asterisk.
- Grammar Developer's Guide (`Gram_Dev_Guide_version.pdf`): reviews the syntax of VASRE text grammars, which is based on Speech Recognition Grammar Specification (SRSG) version 1.0 and Semantic Interpretation for Speech Recognition (SISR) version 1.0.
- Installation Guide (`Install_Guide_version.pdf`): describes a step-by-step installation and verification process of VASRE for GNU/Linux and Windows (this document).
- Introduction (`Introduction_version.pdf`): introduces the main components and distributed architecture of VASRE.

Upon successful installation, the guides are available in:

- `/usr/share/doc/VestecASRE/` for GNU/Linux
- `\VestecASRE\Doc\` for Windows.

## 3 Installing VASRE on GNU/Linux

### 3.1 Installation Procedures

For GNU/Linux, VASRE Standard Edition provides the installation packages in two formats: `.deb` and `.rpm`. For each format, two files are available; one for the recognition engine itself and the other for Asterisk plug-in (connector).

To install the `.deb` package of the recognition engine on the 32 bit platform, open a shell terminal and enter the following command:

```
dpkg -i vasre-se-version-arch.deb
```

where *version* and *arch* represent engine version and platform architecture, respectively. For example, to install VASRE SE 1.1.1 for Centos 5 and i386 architecture, run:

```
dpkg -i vasre-se-1.1.1~Centos_5-i386.deb
```

To install the recognition engine on the 64 bit platform, use `gdebi` command instead of `dpkg -i` as follows:

```
gdebi vasre-se-version-arch.deb
```

This will ensure some prerequisite libraries to VASRE are installed on the 64 bit platform.

If you are going to use VASRE with Asterisk, install `.deb` package for the plug-in using the following command:

```
dpkg -i vasre-se-ast_astver-plugin-version-arch.deb
```

where *astver* and *version* represent Asterisk version and plug-in version. You don't need to use `gdebi` command for the plug-in.

To install the `.rpm` package of the engine, enter the following command:

```
rpm -i vasre-se-version-arch.rpm
```

To install `.rpm` package of the plug-in, enter the following command:

```
rpm -i vasre-se-ast_astver-plugin-version-arch.rpm
```

Upon successful installation of both packages, you should have new directories listed in the following table (sorted in the alphabetical order of names). The files and directories generated by the plug-in package are highlighted in a light blue colour.

Directory	Contents
/etc/init.d/	two script files to start, stop, restart, and check status of RM and recognition servers, <code>vasreRM</code> and <code>vasreSRVs</code>
/etc/VestecASRE/	configuration files <code>vasre.conf</code> and <code>vasre-ast.conf</code> for recognition servers and Asterisk plug-in
/opt/VestecASRE/bin/	three binary files used for grammar compiler and recognition servers
/opt/VestecASRE/License/	one or more license files
/opt/VestecASRE/Samples/ConsoleApp/	the source code and executable file of a client application example that adds a grammar and processes an audio file
/opt/VestecASRE/Samples/Dialplan/	a sample Dialplan for Asterisk. This directory will be created only when you install the Asterisk plug-in
/opt/VestecASRE/Samples/Grammars/	eight sample text grammar files
/opt/VestecASRE/Samples/SAP/	the source code and executable file of another client application, which simulates processing of streamed audio
/usr/bin/	five executable files for RM, servers, grammar compiler, and pronunciation generator, <code>RM</code> , <code>StartSRVs</code> , <code>StopSRVs</code> , <code>GramGen</code> , and <code>Pron</code>
/usr/include/VestecASRE/	the header file of VASRE API, <code>VasrLib.h</code>
/usr/lib/	two library files of VASRE API, <code>libvasrlib.a</code> and <code>libVasrLib.so</code>
/usr/lib/asterisk/modules/	the shared object file for Asterisk <code>res_speech_vasre.so</code> . This directory will be created only when you install the Asterisk plug-in
/usr/share/doc/VestecASRE/	manuals and guides of VASRE Standard Edition including this guide
/usr/share/doc/VestecASRE/Api_reference/	VASRE API programmer's reference in html format
/var/log/VestecASRE/	log files of RM, servers, and server controller

Contact the distributor of VASRE to get the license file(s). Copy the license file(s) to `/opt/VestecASRE/License/` and change the folder's permission to be readable by the RM.

### 3.2 Test Procedures

The RM should be started first. Open a shell terminal and run the script `vasreRM` by entering the following command:

```
/etc/init.d/vasreRM start
```

In a few seconds, you will see the following message indicating the RM is running:

```
Starting resource manager: Done
```

Now, run the script `vasreSRVs` by entering the following:

```
/etc/init.d/vasreSRVs start
```

Running this script will take more time as it starts the servers, which should load the acoustic model and dictionary. If the following message appears, all the servers are ready to go.

```
Starting Vestec ASR Engine: Done
```

The simplest way to test the operation of the RM and servers is to run the sample client application named `ConsoleApp`. Change the current directory to `/opt/VestecASRE/Samples/ConsoleApp/` and enter `./ConsoleApp`. Then, you will see the following messages and an XML file `Result.xml` will be generated under `/opt/VestecASRE/Samples/ConsoleApp/`.

```
Opening port ...
  Connected to 10500.
  Done

Adding "Date.grm" ...
  Done

Processing "Apr-13-2009.wav" ...
  Found 1 n-best alternative(s) (cpu seconds: 1.261)
  [1] =====
      grammar matched: Date.grm
      raw text: april thirteenth two thousand nine
      score: 901 1000 861 684 495 (avg: 788)
      logical parse: [$Date[$Month[april,{out = "Apr...
      semantic result:
        Date (Object)
          Month (String): Apr
          Day (String): 13
          Year (String): 2009

  Done

Closing port ...
  Done
```

The operation of `ConsoleApp` comprises four steps:

1. **Opening port:** `ConsoleApp` communicates with the RM to get the location of an idle server and establishes a communication channel to the server. If this fails, you will see the associated error message and `ConsoleApp` will stop. Otherwise, you will see the following messages:

```
Opening port ...
  Connected to SRV_PORT
  Done
```

where `SRV_PORT` represents the port number of the server connected.

2. **Adding grammar:** `ConsoleApp` adds the sample grammar file `Date.grm` to the server. `Date.grm` matches a date in `MONTH-DAY-YEAR` format from Jan 1, 2001 to Dec 31, 2020.
3. **Processing audio:** `ConsoleApp` has the server process the audio file `Apr-13-2009.wav`, which plays the TTS voice saying **April thirteenth two thousand nine**. The output message comprises multiple lines:

- The first line shows the number of n-best alternatives and CPU seconds taken to process

the audio file.

- The second line, starting with [ 1 ], indicates the following lines are subject to the first n-best alternative. If multiple n-best alternatives were found, ConsoleApp would output more blocks starting with [ 2 ], [ 3 ], and so on.
- The third line outputs the name of the grammar matched to the audio.
- The fourth line shows the raw text recognized.
- The fifth line outputs confidence score of each word.
- The sixth line shows the first 32 characters of the logical parsing.
- From the seventh line, the hierarchy of the semantic result is described.

If ConsoleApp has permission to create a file in the current directory, ConsoleApp can also generate an XML file describing the recognition output, called `Result.xml`.

4. Closing port: ConsoleApp releases the connection to the server.

You may also try the other sample client application, SAP, which stands for Streamed Audio Processor. Go to `/opt/VestecASRE/Samples/SAP/` and run `./SAP`.

SAP simulates a situation where audio is being streamed from an external source. The server should detect voice segments therein and return the associated recognition result. SAP loads the streamed audio input of 19.02 seconds contained in `sa_digits.raw`. The streamed audio plays four 5-digit numbers, **11019**, **19749**, **59746**, and **85553**, intermittently. As soon as the server detects the end of each 5-digit number, it outputs the recognized results as follows:

```
Opening port ...
  Connected to 10500.
  Done

Adding "Digit5.gout" ...
  Done

Processing audio stream ...
  Found 1 n-best alternative(s) (cpu seconds: 0.352)
  [1] =====
      grammar matched: Digit5.gout
      raw text: one one zero one nine
      score: 363 299 459 567 984 (avg: 534)
      logical parse: [$Digit5[{out = ""};,$Digit[one...
      semantic result:
          Digit5 (String): 11019
  Found 1 n-best alternative(s) (cpu seconds: 0.352)
  [1] =====
      grammar matched: Digit5.gout
      raw text: one nine seven four nine
      score: 436 568 327 903 989 (avg: 644)
      logical parse: [$Digit5[{out = ""};,$Digit[one...
      semantic result:
          Digit5 (String): 19749
  Found 1 n-best alternative(s) (cpu seconds: 0.352)
  [1] =====
      grammar matched: Digit5.gout
      raw text: five nine seven four six
      score: 659 598 451 989 997 (avg: 738)
      logical parse: [$Digit5[{out = ""};,$Digit[fiv...
      semantic result:
          Digit5 (String): 59746
  Found 1 n-best alternative(s) (cpu seconds: 0.355)
  [1] =====
      grammar matched: Digit5.gout
      raw text: eight five five five three
      score: 609 701 705 536 948 (avg: 699)
      logical parse: [$Digit5[{out = ""};,$Digit[eig...
      semantic result:
          Digit5 (String): 85553
  Done

Closing port ...
  Done
```

The successful execution of ConsoleApp or SAP verifies that VASRE has been successfully installed and that the RM and servers are in operation.

For further details on client application development, refer to the Application Developer's Guide or the source code of these two sample client applications.

## 4 Installing VASRE on Windows

### 4.1 Installation Procedures

The file name of the VASRE installation package for Windows is:

`VestecASRE_version_arch.exe`

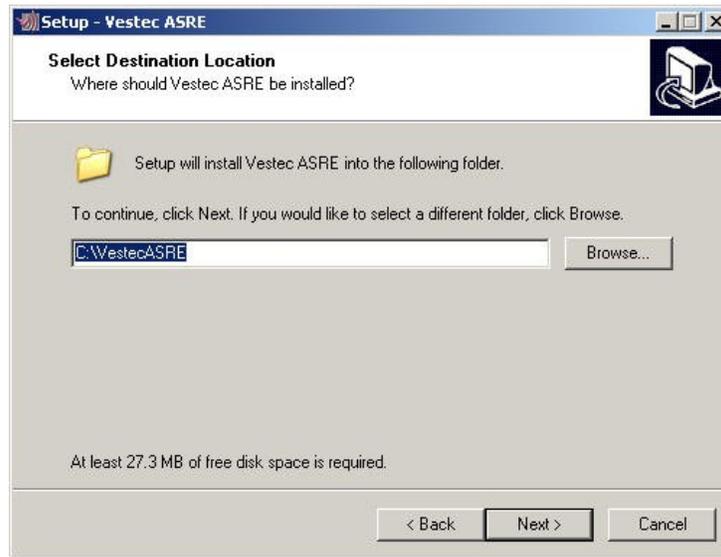
where *version* and *arch* represent engine version and platform architecture. For example, the Windows installation package of VASRE SE 1.1.1 for x86 platform is named:

`VestecASRE_1.1.1_x86.exe`

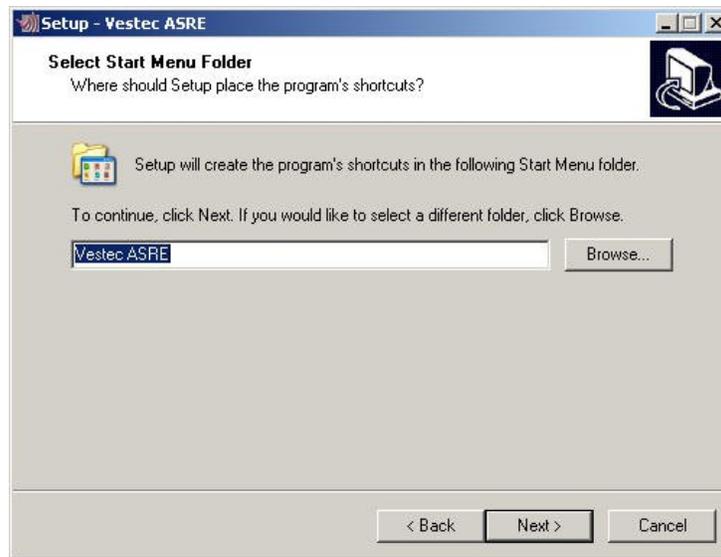
To install the package, run the executable file and you will see the following dialogue box (The screen shot was taken from Window XP; for Window Vista and 7, a similar dialogue box will appear). Click Next >:



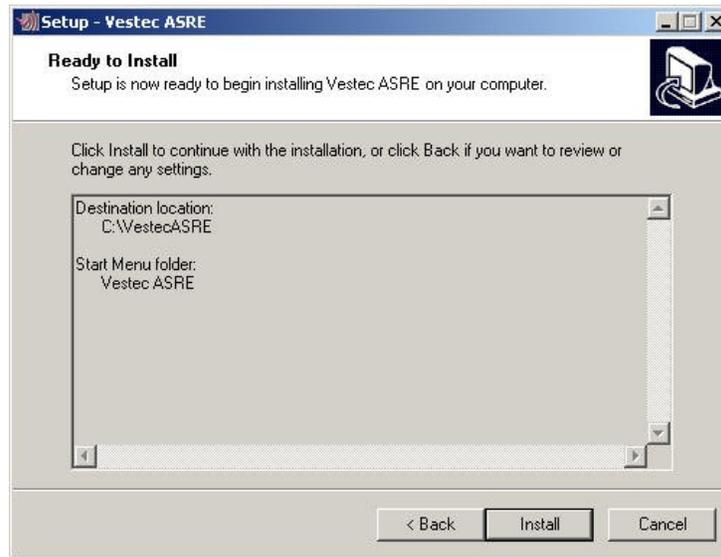
The next pane will ask you where VASRE should be installed as shown below. The default location is `C:\VestecASRE`. Click Next > when ready to continue.



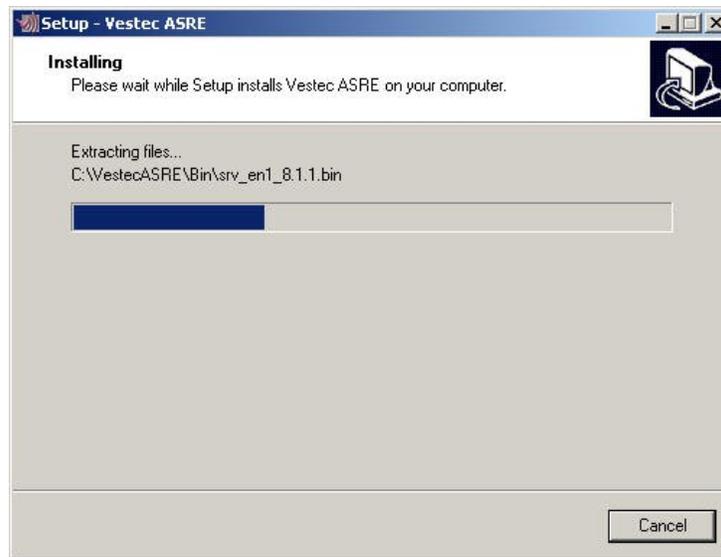
You will be prompted to name the start menu folder; the default is Vestec ASRE. Click Next >.



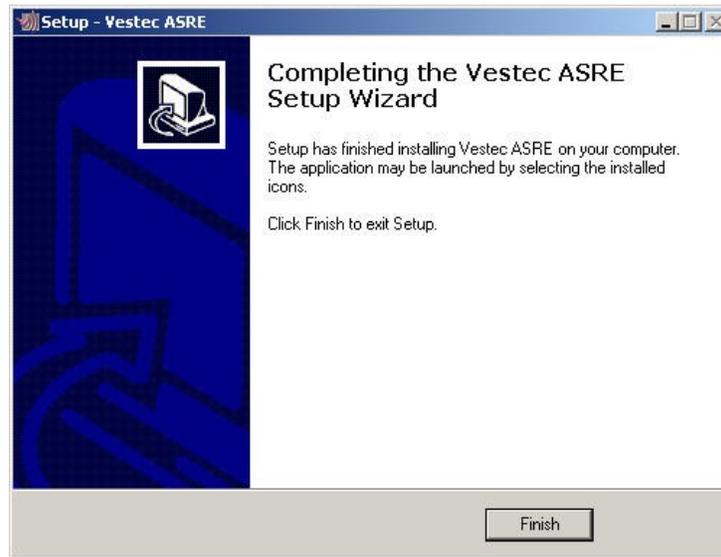
You are now ready to install the package. Click Install.



The package will be installed shortly.



After the installation is done, the following pane will appear. Click Finish.



In the root folder of VASRE, you should now have the following seven sub-folders:

1. `Bin` contains the executable files and data files required for the RM, server controller, server, grammar compiler, and pronunciation generator.
2. `Doc` contains the six guides and API reference.
3. `Include` contains the API header file.
4. `Lib` contains the API library files.
5. `License` will contain license files. This folder is empty initially.
6. `Log` contains log files for the RM, server controller, and servers.
7. `Samples` contains some sample grammars and client applications to test VASRE.

The root folder also contains five files:

1. `StartRM.bat`: The batch file creating and starting the NT service for the RM
2. `StartSRVs.bat`: The batch file creating and starting the NT service for the server controller
3. `StopServices.bat`: The batch file stopping and deleting the NT services for the RM and server controller if any
4. `unins000.exe` and `unins000.dat`: The files required for uninstallation.

Note that the NT services for the RM and server controller are created and started upon successful installation of VASRE. That is, whenever you restart the computer after VASRE installation, the service control manager of Windows will start the RM and servers automatically.

To remove the VASRE SE from your system, run Start > Programs > Vestec ASRE > Uninstall Vestec ASRE. All the files except newly generated ones will be removed and NT services will be stopped and deleted.

Just after the installation is done, the RM and servers won't start because no license file exists under `\VestecASRE\license\`. To start the RM and servers, (i) obtain valid license files, (ii) copy them to `\VestecASRE\License\`, and (iii) restart the NT services by performing either of the followings:

- Restart the computer
- Run `StopServices.bat`, `StartRM.bat`, and `StartSRVs.bat` under `\VestecASRE\` in this order.

**N.B.** To run the NT-service-related batch files under Windows Vista and 7, you need administrator's privilege. If you run the batch files from the **Vestec ASRE** menu, right-click on the menu item to select **Run as administrator**. If you run the batch files from the command-line window, start the command-line window with administrator's privilege: Right-click on the command-line window icon and select **Run as administrator**.

## 4.2 Test Procedures

To verify whether the RM and servers are running, run Windows Task Manager by typing `Ctrl+Alt+Del` and select **Processes** tab. For Windows Vista and 7, click the button named **Show process from all users**. Make sure the following three processes exist:

1. `RM.exe`: The process of the RM
2. `VasreSRVs.exe`: The process of the server controller
3. `Vasre.exe`: The process of the server

If one or more processes are missing, check the corresponding log files under `\VestecASRE\Log` and fix the problem:

1. `RM-YYYY-MM-DD.log`: The log file of the RM
2. `SRVs-YYYY-MM-DD.log`: The log file of the server controller
3. `Port-PORT_YYYY-MM-DD.log`: The log file of the server running at `PORT`

To see whether the recognition server is actually in operation, run `Start > Run...` and enter `cmd` to open a command line window. Go to `\VestecASRE\Samples\ConsoleApp` and enter `ConsoleApp.exe`. Then, you will see the output message shown in Section 3.2. You may also try the other sample client application, `SAP`, by changing the current directory to `\VestecASRE\Samples\SAP` and run `SAP.exe`. For further details on the output messages of these two sample applications, See Section 3.2. The successful execution of the sample applications verifies that VASRE has been successfully installed and the RM and servers are in operation.