

MOBILE SPEECH SEARCH WHITE PAPER

Effective implementations of mobile speech search today.



1 Preface

This white paper is intended for wireless carriers and content providers interested in developing and launching applications that use mobile speech search technology.

The purpose of this white paper is to provide education on the benefits of mobile speech search and effective implementations of this technology, including examples of revenue generating applications on existing networks. This paper will show case applications that can be developed using V-ENABLE's mobile speech search technology to deliver faster and easier access to mobile content and information.

The white paper is based on V-ENABLE's current experience with over 8 commercial deployments of mobile speech search applications and expertise with all major wireless voice, data, and multimodal standards.

About the Author

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At V-ENABLE, Mr. Holmes is responsible for driving product marketing initiatives and working with partners to develop mobile speech search solutions. Mr. Holmes holds a Masters Degree in Marketing from San Diego State University and a B.S. from University of California, Riverside.

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The mobile user problem is...

The user issues associated with mobile data have been well documented and have proven significant hurdles to market adoption. Typing on a cellphone keypad is very painful and the screen is small making it very difficult to browse for content. Furthermore, the exploding amount of content and information available makes it more difficult to find over complicated tree-based mobile portals. Mobile users do not have the patience or time to navigate through complicated menus and input text over numbered keypads. According to a recent survey sponsored by Wacom Components, "76% of consumers claim mobile data is too hard to access." This problem is affecting not only mobile users, but also content providers and carriers who have had trouble managing the exploding amount of content available over multiple technologies. Furthermore, both carriers and content providers are losing millions of dollars in revenues from potential buyers who cannot find the content they really want.

SOLUTION: Mobile Speech Search

Mobile Speech Search technology transforms the current cumbersome, inconvenient wireless experience of mobile data, to one that is faster, easier, and more personalized. Mobile users can instantly access content by simply speaking keywords into their phone. No more complicated WAP menus or frustrating tap-text entry. Using mobile speech search is a natural fit and is

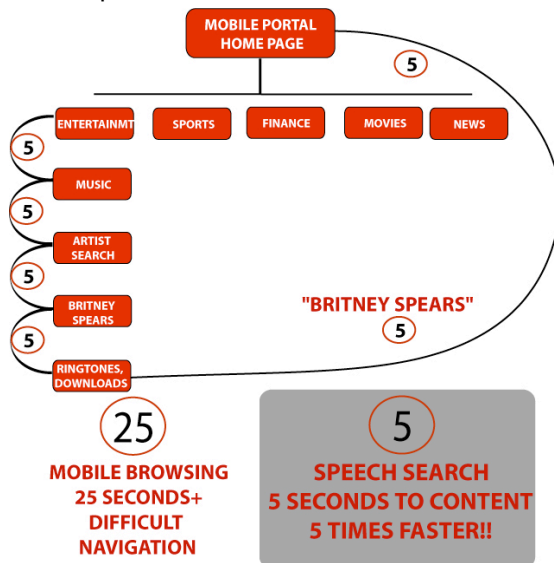


Exhibit 1. Mobile Speech Search offers an easier and faster way to access to mobile content/information.

revolutionizing the mobile user experience. Mobile speech search allows you to jump right to the content you want when you want it. Search for all types of mobile content and information including ringtones, wallpaper, games, movie information, sports, news, weather, and 411 information.

Speech Recognition Technology

Why is a client-server implementation required for effective mobile speech search?

Speech recognition technology has been implemented in many forms: Client-based (Voicemail), server-based (Directory Assistance, IVR), and client-server based (Mobile Speech Search).

CLIENT-BASED

Client-based systems have received slow adoption. Many of them are speaker dependent, requiring the user to "train" the system for proper recognition. This can be overwhelming as well as time consuming for many users. Furthermore, in order to provide a high level of performance and accuracy, speech recognition requires access to very fast processors that exceed device capabilities.

In addition, speech recognition clients are usually limited to searching across a few hundred entries with a fixed database that is limited to what is preloaded on the phone. However, mobile content is extremely dynamic, very large, and requires frequent updates to the database to add new content. That is nearly impossible to do in a client-only environment.

SERVER-BASED

Server-based IVR (Interactive Voice Response) systems have been implemented widely within both enterprises and carriers today. Companies have realized the cost benefits of serving customer support and directory assistance applications through these systems. Several wireless carriers have also implemented IVR-based systems that allow mobile users to dial in and get movie showtimes, weather, and more. However, adoption of this user interface has been very limited. One reason is because they are restricted to a voice-in and voice-out user interface. IVR systems typically require 100% attention to effectively navigate the application. This interface can be very difficult to use in a mobile environment because mobile users often get distracted.

CLIENT-SERVER BASED

The ideal interface for mobile users offers a voice-in and visual-out user interface, which can only effectively be done with a client-server implementation. This interface will allow the user to speak a keyword to search for mobile content/information and receive the result in a visual format right on their screen. In this implementation, the user will speak directly into their phone and it will be recorded and sent to a server for processing. This provides the speed and accuracy benefits that a server-based system can provide. This implementation

requires 4GHZ servers in order to maximize performance time and provides the capability to search across tens of thousands of entries. In addition, because it is server-based, it has the ability to search across a very dynamic database environment.

This will allow content providers and wireless carriers to easily keep up with the constant change of mobile content and information that occurs on a daily basis. Smaller codecs and an intelligent gateway server (combined with faster wireless network speeds) are required to reach response times of only 2-5 seconds.

SPEECH SEARCH PRESENT
Based on this analysis, V-ENABLE has developed a patent-pending technology that is client-server based and it serves three primary functions: SPEECH, SEARCH, and PRESENT.

Mobile speech search technology from V-ENABLE gives mobile users the ability to instantly find personalized mobile content and information with their phones while on the go. Here's how it works: (Refer to Exhibit 2.)

1. When prompted at the search screen, users begin by pressing the TALK key to record and speak a keyword (say an artist name).
2. The user's words are recorded, compressed, and sent to the veGATEWAY™.

3. The V-ENABLE servers use patent-pending technology to decompress the recording and eliminate background noise.
4. The audio recording is converted to text by our mobile speech engine that uses our finely-tuned phoneme index optimized for mobile content.
5. The keyword is then sent through our search algorithm, where it is matched against the content provider's catalog.
6. The Recommendation Engine will check the catalog for additional similar and relevant

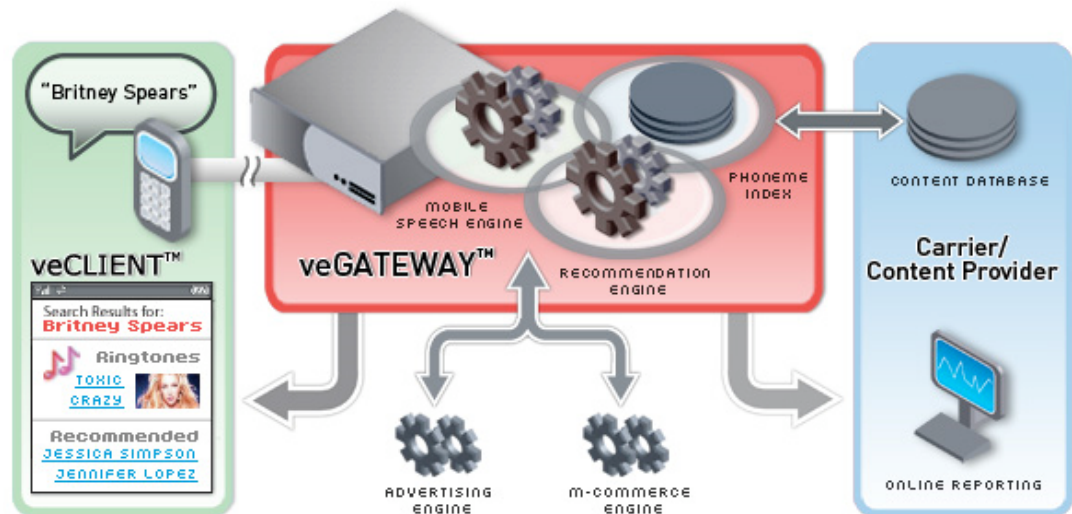


Exhibit 2 Mobile Speech Search Infrastructure

content and filter results according to device capabilities.

7. Additional services such as advertising and m-commerce can be integrated into search results for increased revenue opportunities.
8. Search results are ranked, sorted and presented to the user, all within 2-5 seconds!

COMPONENTS

veANYWAY™ – This is the combined software product that makes up V-ENABLE's client-server technology, comprised of the veCLIENT™ and the veGATEWAY™. The veCLIENT™ performs the recording using patent-pending technology and compresses the file to be sent over the wireless network to the veGATEWAY™. The veGATEWAY™ manages the mobile speech search process and its interaction with all the key components of the system.

PHONEME INDEX – The phoneme index contains a breakdown of all the relevant keywords contained within the content provider's catalog. Entries in this index are optimized and tuned to provide results with

a high level of accuracy in a speaker independent environment.

RECOMMENDATION ENGINE – Our recommendation engine uses data acquired from actual usage behavior for searches and downloads of mobile content derived from commercial applications. In addition, information is gathered from multiple sources to provide additional data for ranking content according to popularity and relevance. A popularity index is assigned to each piece of content and linked to other content based on previous usage behaviors (search and download).

REPORTING – All usage data and behavior is captured to provide the most comprehensive reporting available. Mobile speech search will provide the carrier/content provider with relevant information to determine which content mobile user's are most interested in. Reports will indicate what content is searched, downloaded, and what content is most requested and not available in the catalog. This will allow content providers to understand the value of each piece of their content to end users. V-ENABLE's system has an online interface for accessing reports in real-time either daily, weekly, or monthly.

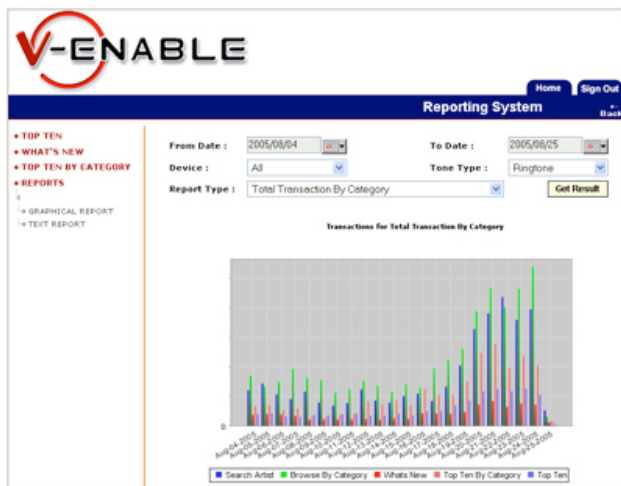


Exhibit 3. Live Online Reporting.

IMPLEMENTATIONS

Mobile speech search can be implemented either as individual search queries within a limited data set (i.e. Ringtone Search), or across an entire mobile platform (Portal Search).

Ringtone Search

Mobile speech search can provide an easy and fun way to search for ringtones. Mobile users can simply say the name of the artist they are looking for and within seconds, have access to preview and download ringtones. There have been several commercial applications of this to date. (Ex.Cricket Tones, Exhibit 4). Some effective statistics from these applications are:

- **30% of downloads are made using search.**
- **70% of searches are made using voice.**
- **Only 50% of typed searches were successful (due to typos) vs. 80% for Mobile Speech Searches)**

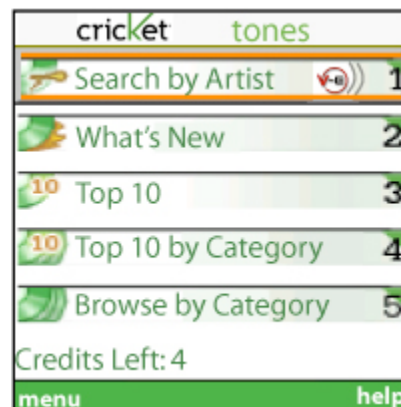


Exhibit 4 Cricket Tones featuring mobile speech search.

Since ringtones are typically limited to only the most popular artists, many searches are left with “no result”, a poor user experience for the mobile user. However, an effective search implementation will offer additional recommendations based on the artist requested. Instant access to both requested and recommended ringtones will result in greater overall ringtone sales.

Portal Search

Mobile speech search can be implemented to search across an entire mobile content catalog offering users easier access to mobile content and information. An effective portal search implementation will require a directed

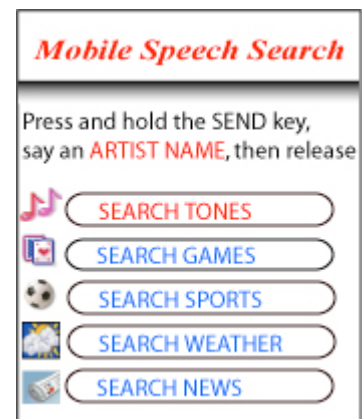
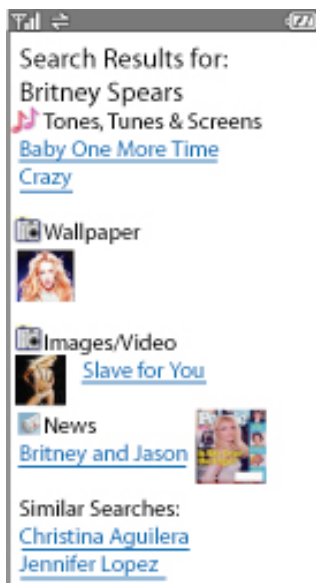


Exhibit 5. Directed Search.

search approach. With directed search, mobile users will first choose the type of content or information they are searching for (ringtones, sports, weather) and then perform the search. Directed search is required due to the limited screen size that mobile phones have. Mobile users do not have the patience to scroll through multiple results pages to find what they want. Instant access is vital.

With a directed search experience, users will get the desired result either on the first or second results page. Exhibit 5 offers an example of a directed search experience. Users will simply select the desired content, and then speak to execute their query and receive requested search results.

Directed search, however, does not mean that you are limited to only present the exact search results. An effective mobile search implementation will provide other similar and recommended content available for the user. When implementing across a



wide content catalog, like that of a wireless carrier, you should take advantage of the breadth of content and provide an experience for discovering other forms of content. For example, a ringtone query for Britney Spears may provide search results with many types of content (See Exhibit 6), including wallpapers, images, wallpaper, news. With V-ENABLE's mobile speech search, the results will be filtered based on the devices' capabilities.

BENEFITS:

Mobile speech search benefits everyone, from the mobile user all the way up to the content provider. By making it easier to access and purchase mobile content and information, everybody wins!

Mobile Users: With mobile speech search, mobile users now have instant access to content. Finding content is now fun and easy instead of frustrating and time-consuming. With mobile data, there is no

killer application. Mobile users each want something different at different times, making it difficult to easily access the information they want, when they want it. With easier access to mobile content, mobile users are downloading more content, accessing mobile data more often and they are more satisfied with the experience.

Carriers: Carriers can now benefit from implementing mobile speech search in four ways. Mobile speech search can provide an increased number of content downloads, an increased number of mobile data subscribers, an increase in satisfied customers (reduced churn), and have more satisfied mobile content providers. Carriers today are losing millions in revenues to lost customers who are too confused and frustrated with mobile data. It has been well documented that easier access (fewer clickthroughs) to mobile content = more content downloads (ringtones, wallpaper, and games). Furthermore, commercial implementations of mobile speech search have also verified that easier access to content leads to more content downloads. In addition, by providing easier access to mobile information, such as news, weather, and sports, mobile users can get the information they need quickly and move on to something else. This improved user experience will only lead to more users accessing mobile data by recognizing the benefits of quickly getting information on the go. Furthermore, due to these increased satisfaction levels, mobile users are less likely to change wireless providers, reducing churn for the carrier. Finally, carriers providing mobile speech search will address the complaints coming from so many wireless content providers that are frustrated with being buried on the WAP deck, often 10-20 clicks away from the main portal page.

Content Provider: ChangingWorlds, an Irish artificial intelligence company, and Swedish consultant firm Mobile Metrix recently found that 65 percent of mobile content and applications on WAP decks required more than 12 clicks for users to access-enough to keep most would-be buyers from completing transactions. (RCR Wireless, Aug, 2005). Content providers are also losing millions in revenues due to the standard tree-based design of wireless portals. Mobile speech search can address this issue by allowing users to easily discover their content using mobile speech search. With easier access to content, content providers will sell more content downloads and also retain regular customers.