Voice-based mobile services for social development

VOICES

ICT services will play a major role in social and economic progress in developing countries. Mobile telephony has shown a massive uptake in the developing world, and this opens up great opportunities. On the other hand, the World Wide Web with its immense amount of useful information is still inaccessible for many people in developing countries. Communication in the Sahel region in West Africa, for example, is voice-based – many people can't read or write – and in many different local languages.
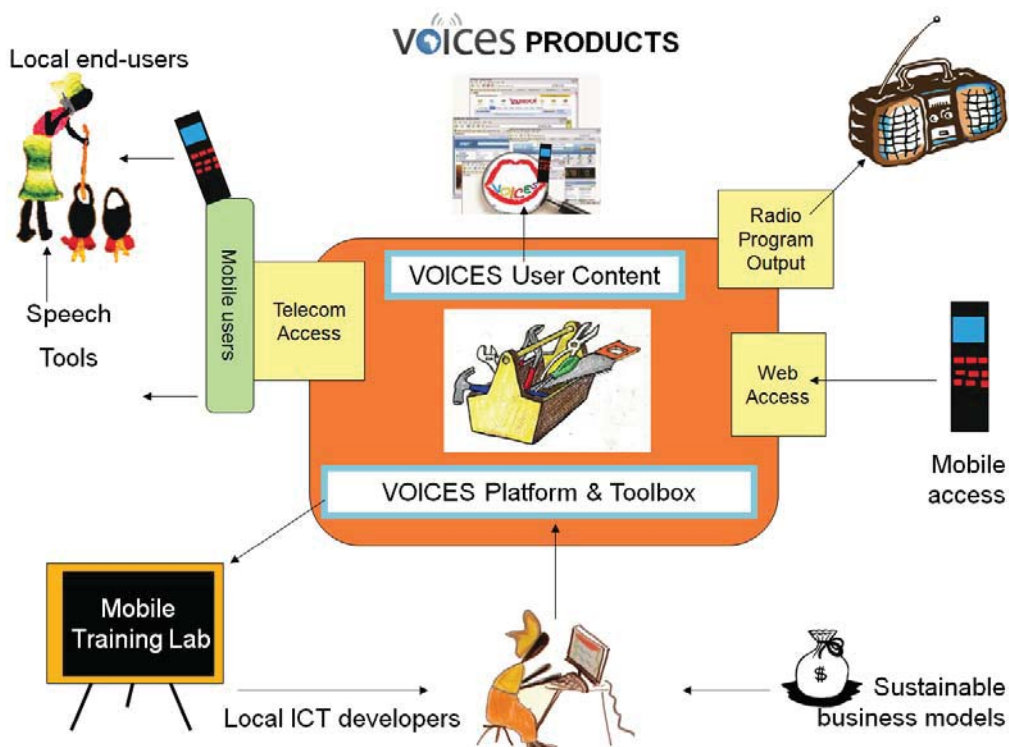
The VOICES project removes some of the current access barriers to the Web and its content, related to communication channels, access infrastructure, literacy, and languages. VOICES does so in a novel way by coupling Web facilities to mobile telephony and community radio, and gluing all this together by voice services. VOICES thus supports rural villages and remote communities in creating "spoken Web content" and sharing the created information across big distances. This represents a major step forward in realizing the potential of mobile ICT services for social and economic development, particularly in the African context.

Results of VOICES

1. Open and wider access: VOICES improves voice-based mobile ICT services and access to information content by a toolbox for the development of innovative voice services.

2. The VOICES services integrate local community radio, mobile telephony, voice ICT technologies and the World Wide Web.

3. VOICES has made an important step forward in speech technologies, by tool support and methodologies for under-researched and under-resourced African languages.

4. The VOICES services have been field deployed in Mali (agricultural knowledge sharing) and Senegal (health information services) and tested with a variety of African partners, paving the way for local adoption and long-term sustainability of new voice-based Web services.

5. VOICES furthermore facilitates uptake through its mobile training lab that offers capacity building for local partners.

W3C
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CSIR our future through science
CRS4 IDEAS BECOME LIFE
TNO
Ecole Supérieure Multinationale des Télécommunications
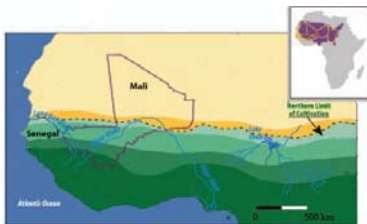FONDATION MÉRIEUX
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Voice-based Web mobile services for social development

voices

The Web connects us all. We use it to exchange information with friends, share knowledge with colleagues and business partners, improving our lives. This need for communication and knowledge sharing is global and not limited to the industrialized world.

In Sub-Saharan Africa for example, climate change and soil degradation threaten the lives of rural families. Innovation and collaboration by farmers can reverse these trends and increase food security. Sharing information amongst farmers, across villages, regions and countries is the key to success.

But how? Often, there is a lack of computers, internet connections and electricity. Moreover, the many spoken languages and low literacy restrict the use of the traditional 'written' web.
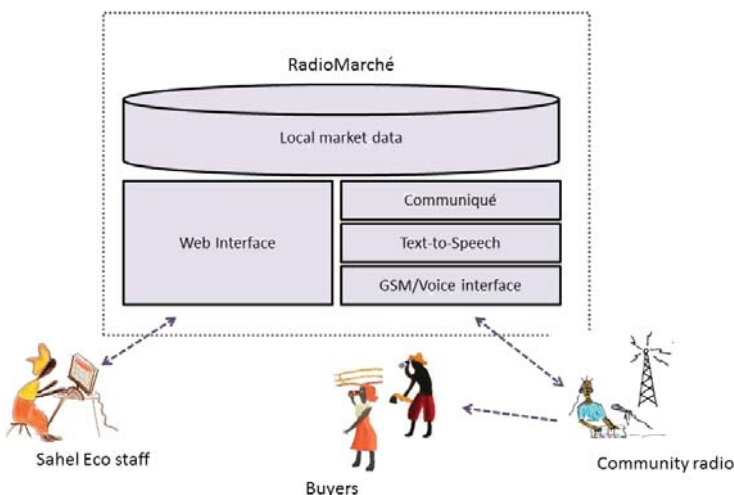
The wide availability of mobile phones in Africa -in combination with the many local community radio stations- provides an excellent opportunity for information sharing. By combining voice and web technologies we can improve information exchange in a way that it fits the local context and oral traditions.

A platform for voice-based mobile communication

Emerginov is a platform that can host voice-based mobile services. It enables local ICT entrepreneurs and web developers to create new knowledge sharing solutions or to develop content in fields such as health, agriculture or trade. It enables development of voice-based applications using web or mobile phone. Emerginov is Open Source software, and has been produced by Orange Labs.

Local language support

Illiteracy and language can be barriers to communication and knowledge sharing. To make our services relevant for local stakeholders, we developed specific language packs for Bambara and Bomu, enabling voice-based services for these two languages.

In addition, a methodology has been developed to create language packs for other African languages. This enables deployment of voice-based services for other regions of Africa, in a cost-effective way. On request of the local communities, our current services use familiar local voices, that were recorded in the region.

RadioMarché

Local market data

Web Interface

Communiqué

Text-to-Speech

GSM/Voice interface

Sahel Eco staff

Buyers

Community radio

RadioMarché

RadioMarché is a mobile voice Service for Market Information (MIS) supporting farmers in Tominian region in Mali. RadioMarché was developed in close collaboration with local farmers and is designed to serve local needs. RadioMarché can be accessed via voice or web, using either simple mobile phone or internet. It interacts with community radio stations that broadcast the farmer's product offerings.

Currently, RadioMarché distributes market information in three languages: French, Bambara and Bomu. Text-to-speech (TTS) technologies were developed to this end by the project partners. The service uses locally recorded Malian voices.

Foroba Blon

'Foroba Blon' in Bambara means a space where everyone has the right to speak, and the truth must be told respectfully. For people in rural Africa Community Radio is an essential, and often exclusive, source of information. Radio stations serve as information hubs, relay news, and share knowledge in the community.

The Foroba Blon system -winner of the 2011 IPI News Contest- shares technologies with Radio-Marché. In this system, the voice platform is used to improve radio journalism in Mali. It allows radio staff as well as citizen journalists to call in and leave spoken reports from the field for the radio stations. The reports can then be accessed, broadcast and shared through both a web- and a voice-based interface.

Tabale

Tabale in Mali is the King's drum beaten by a messenger to gather people for important occasions in the village. Our Tabale service is also used for gatherings. If Sahel Eco wants to organize a meeting, participants are notified by the Tabale voice message about the event, its time and venue. Each person receives the message in his or her own language. The service is very efficient and saves a lot of work and time.

Tabale can be used to send group messages to 50 phone numbers simultaneously. It enables the participants to reply and leave a voice message, that is stored and can be accessed later.
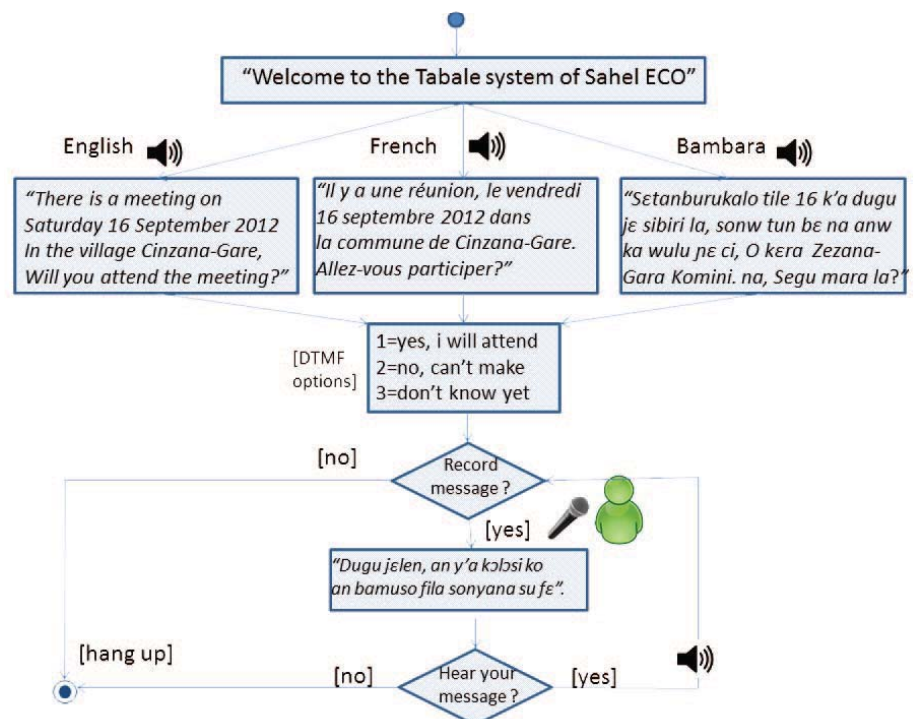
Local Language Support

Information sharing using Text-to-speech systems

Information, such as market prices of agricultural products, is often available in text format. Even though most farmers in Mali use mobile phones they can't access sms-based services because of illiteracy. VOICES developed several voice-based systems to enable farmers accessing information. For such information to be useful in voice services, the text must be "read out" as speech. Text-to-speech (TTS) systems are used for this purpose. However, the development of a full-fledged TTS system is an expensive and resource-intensive process. Thus, there are generally no TTS options available in African languages such as Bambara and Bomu.

To address this issue, we have developed a "slot-and-filler" approach to the creation of TTS systems. This approach can only be used in limited domains, and sacrifices generality for ease of development. It has enabled us to develop market-price readers in Bambara, Bomu and West-African French. Usability studies have shown that first-language speakers find the systems easy to understand and acceptably natural.

Developing a speech-recognition system

When using a voice service, it is natural for users to provide information by speech. Automatic speech recognition (ASR) is used to perform the speech-understanding task. But there are no ASR systems for the languages in Mali, which is why we have created our own system, using open-source tools along with speech data and other resources that were collected in Mali.

The collection of speech data from several speakers is a crucial and logistically complicated aspect of ASR development, especially in places without internet access. We have therefore developed a crowd-sourcing platform that can be used to guide the entire data-collection process. With data collected using this platform, we created a speaker-independent ASR system in Bambara, for use in the *Tabale* system in Mali. It is used to recognise whether invitees are planning to attend a Tabale-organized meeting; in this small-vocabulary task, the ASR system was found to be more than 90% accurate in recognizing the speech of respondents.

Language resources and open-source tools

Several language resources were created during the development of the TTS and ASR systems. These include:

1. single-speaker speech corpora in Bomu and Bambara;

2. a multi-speaker speech corpus in Bambara;

3. electronic grammars and pronunciation dictionaries and similar elements.

All the resources are being released into the public domain with Creative Commons licensing; similarly, the software tools that we created are freely available under non-restrictive open-source licenses.
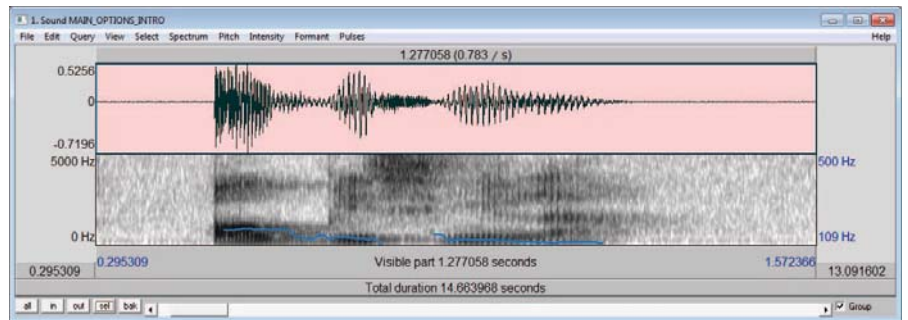
Waveform and spectrogram of a Bambara word
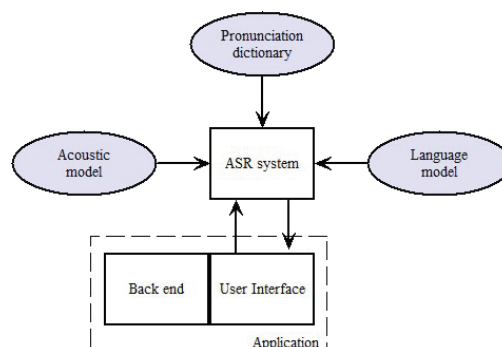
Block diagram of an application using ASR, showing the language-specific components

voices

Business models for voice-based services in Mali

A farmer in Mali may be interested in a mobile voice-based messaging service that provides her with market information. However, she will only pay for the service when it creates real value for her. Similarly, an enterprise such as a radio station may be interested in participating in the commercial delivery of such a voice service. However, the profitability of the service for the radio station is not evident at first sight. For the radio station to embark on such an enterprise, it must have an idea about the business sustainability of the service.

The e3value networked business model to explore sustainability

To assess the commercial feasibility of such multi-actor services, we have used the e3value modeling method (www.e3value.com) for networked value constellations, and applied it to voice-based applications that were field-piloted. The e3value approach considers the network of business relationships from the customer's needs, and it visualizes and calculates the value exchanges for all actors in the value web. Actors can be enterprises or individuals, customers, market segments or (service) providers. Thus, one can systematically model and calculate different strategic business model scenarios for a new service and find out whether a new business model idea is economically sustainable.

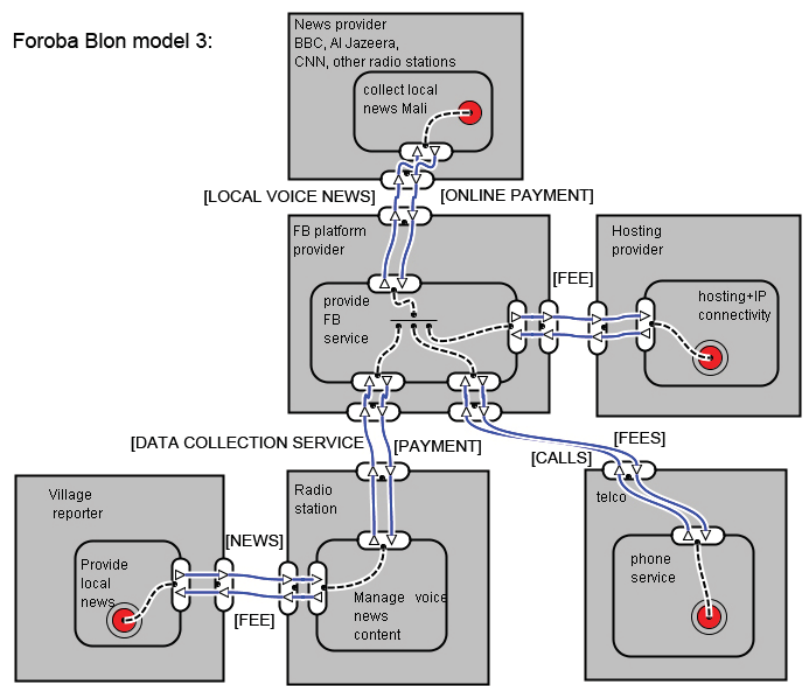## A sustainable business model for village reporting

As an example, we have applied this approach to the rural radio platform we developed called Foroba Blon. It won the News Innovation contest (a 250,000 US$ award) of the International Press Institute. Foroba Blon offers a mobile voice service for village reporting and citizen journalism. The business model studies we have carried out demonstrate, also in quantitative detail, that there is a significant window of opportunity to make and keep such a service economically sustainable. Upon its deployment in Mali, Al Jazeera expressed its interest to use it. The Foroba Blon service has been employed by Al Jazeera to monitor the presidential elections in Ghana in December 2012 and in Kenya in 2013.

Foroba Blon model 3:

The "Web of VOICES"

Zakary Diarra – farmer, beekeeper and honey producer from the village Bokuy-Mankoina in Mali:

"I now sell 200 liters of honey. With RadioMarché, after the broadcast on the radio, I was able to sell all of my honey."

"I am now able to pay schooling for my four children and I could even buy a cart and a donkey, last year."

Naomi Dembelé, producer of shea butter from the village Sira, Mali:

"Thanks to this system we, the women who produce shea butter, are known throughout the country, and whenever there is a demand for shea nuts people will come to me. I am proud that I am known across the country."

Adama Tessougué, journalist of Radio Sikidolo in Konobougou:

"People from 39 communes listen to our programs. We trained correspondents who are able to phone in directly from their remote villages to leave (radio) reports. Now that the Foroba Blon service is here, I can tell you: if there's anything we would have wished for, it's really Foroba Blon."

Alou Dolo, developer at the ICT enterprise Yeleman in Bamako, about the VOICES service Tabale:

"When is the system free and available for everybody? I can see possibilities not only for organizations in rural areas, but also for organizations in urban settings."

Sir Tim Berners-Lee, inventor of the World Wide Web:

"Our success will be measured by how well we foster the creativity of our children. Whether future scientists have the tools to cure diseases. Whether people, in developed and developing economies alike, can distinguish reliable information from propaganda or commercial chaff. Whether the next generation will build systems that support democracy and accountable debate. I hope that you will join this global effort to advance the Web to empower people."

Design: Marian Hamilton - www.hamiltondesign.nl
Photos: Bruno van Moerkerken & Anna Bon

New Scientist, 25 April 2013:
Voice-based web access helps illiterate get online. A new internet system is giving a voice to people in Africa who cannot read or write or who lack a computer.

International Press Institute
IPI News Innovation Contest
www.ipinews.contest.org>News

Foroba Blon:
Shaping a New Way to Inform Communities
(Mali, 19 July 2012)

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