Kasadaka: A Voice Service Development Platform to Bridge the Web's Digital Divide

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ABSTRACT

The World Wide Web is a crucial open public space for knowledge sharing, content creation and application service provisioning for billions on this planet. Although it has a global reach, still more than three billion people do not have access to the Web, the majority of whom live in the Global South, often in rural regions, under low-resource conditions and with poor infrastructure. However, the need for knowledge sharing, content creation and application service provisioning is no less on the other side of this Digital Divide. In this paper we describe the *Kasadaka* platform that supports easy creation of local-content and voice-based information services, targeted at currently 'unconnected' populations and matching the associated resource and infrastructural requirements. The Kasadaka platform and especially its Voice Service Development Kit supports the formation of an ecosystem of decentralized voice-based information services that serve local populations and communities. This is, in fact, very much analogous to the services and functionalities offered by the Web, but in regions where Internet and Web are absent and will continue to be for the foreseeable future.

KEYWORDS

digital divide, low literacy, sub-Saharan Africa, voice-based services, low-resource hardware, services development software kit

1 INTRODUCTION

The World Wide Web is a unique public space for knowledge sharing, content creation and application service provisioning for billions on this planet. Although it has a global reach, still more than three billion people do not have access to the Web: the 'Digital Divide' [2]. The majority lives in the Global South, often in remote rural regions, under low-resource conditions and with poor or even absent infrastructures.

However, needs for knowledge sharing, locally relevant content and application service provisioning are certainly no less beyond the current borders of the Web.

To overcome the Digital Divide, various policies are promoted to improve global access to Internet, Web and its vast arsenal of resources. A prominent one, for which quite large funds have been made available by donors such as the World Bank, is the attempt to roll out forms of "affordable internet" to currently unconnected regions.[1] Basically, the underlying idea is a form of relatively straight-forward technology transfer from advanced countries to developing and emerging regions [1, 3, 4].

Our research focuses on information exchange and knowledge sharing support for smallholder and family farmers in the African Sahel (including e.g. Mali, Burkina Faso, northern Ghana). In a country such as Mali, around 80% of the population depend for their livelihood on work in small susbsistence agriculture in remote rural regions where there is no Internet, very limited electricity, and high levels of low-literacy (around 50% on average, for women even significantly higher). Under these conditions it is highly unlikely that a technology transfer policy of internet roll-out to bridge the Digital Divide will come to fruition in some foreseeable future.

This does not imply that nothing can be done. The contribution of this paper is that one can, and that it is possible to develop and deliver web-reminescent services for information and knowledge exchange, but not in a one-size-fits-all technology transfer approach. It requires a thorough investigation *in the field* of conditions, requirements and local specificities. This leads to insights and technical directions that cannot be derived from advanced but far-away technology considerations alone.

2 KASADAKA TECHNICAL IMPLEMENTATION AND EVALUATION

The Kasadaka platform and especially its Voice Service Development Kit aims to facilitate the formation of an ecosystem of many

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[1]See: https://webfoundation.org/our-work/projects/alliance-for-affordable-internet/
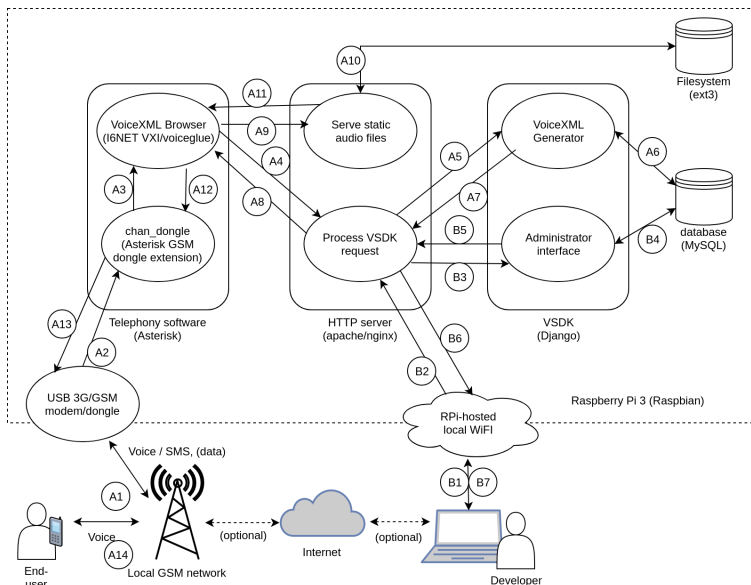
Figure 1: Overview of the Kasadaka system architecture

decentralized voice-based information services that serve local populations and communities. This is, in fact, very much analogous to the services and functionalities offered by the Web, but in regions where Internet and Web are and will continue to be absent for the foreseeable future.

The platform that we propose is called *Kasadaka* (*talking box* in a number of northern Ghanaian languages). The platform consists of a combination of hardware and accompanying software. The hardware forming the foundation of the KasaDaka platform is the Raspberry Pi, which is a low-resource computer based on an ARM processor (like found in many smartphones). The Raspberry Pi runs Raspbian, a Debian based Linux distribution. To provide the Raspberry Pi with connectivity to the local mobile phone network, a USB 3G modem is used. The total costs of the hardware is around EUR 60. The main software component that enables the development of voice services is called the *Voice Service Development Kit*, or VSDK in short. The VSDK allows for the development of voice service (prototypes) in a web-based development environment, by users without programming skills. The VSDK also generates the VoiceXML files that describe the interactions in a voice service. To serve these interactions in a phone call, the Kasadaka runs a stack of (mostly open-source) applications that provide the different functions that are required for voice-based interactions. Asterisk, an open-source telephony exchange application is used in conjunction with chan_dongle and VXI, to provide the voice-based interactions through the local GSM network.

The evaluation of the VSDK and the Kasadaka platform in general was structured in two phases: the first was an evaluation in the Netherlands with inexperienced users, that have developed voice services for several use cases from the west-African context. The second validation was a case study in Mali with a local radio station, that developed a citizen journalism application in the local language Bambara.

Both evaluations showed that the Kasadaka platform is suitable for the development of simple voice services, by users with minimal programming skills. For more complex voice services, the VSDK does not (yet) provide sufficient functionalities out-of-the box, and needs to be extended with data models and interactions that are specific to the use case. Despite this limitation, the platform clearly shows potential for the development of (financially) sustainable voice services in the development context.

3 CONCLUSION

The wider aim of the presented Kasadaka platform and its Voice Service Development Kit is to allow the populations on the other side of the Digital Divide to share knowledge and create content, analogous to the advantages that the Web provides. The platform is lightweight and is tailored to the harsh circumstances that are found in the Global South and takes into account the information needs of the local population. By enabling local voice service development and making custom voice services affordable for the world's rural poor, Kasadaka enables the formation of a network of decentralized voice services. Such a network has the potential to provide the benefits of the internet to the rural poor, reducing the gap of the Digital Divide and helping to improve the quality of life and well-being in the developing world.

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