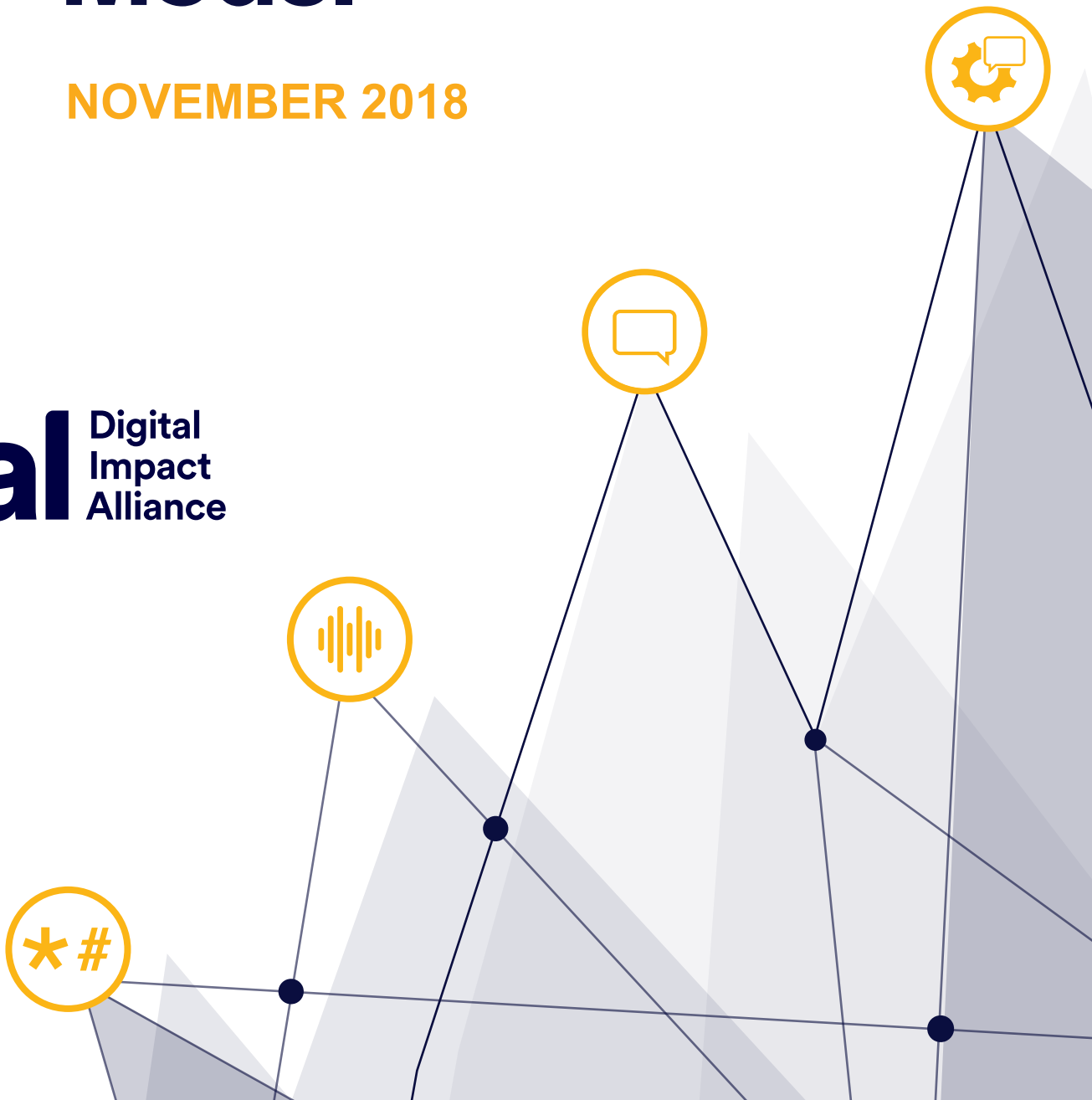# Mobile Capability Model

NOVEMBER 2018

dial Digital Impact Alliance

Introduction to Core Mobile Services for NGOs

Introduction

Due to the ubiquity of mobile phones in emerging markets, development programs are increasingly designing services for the underserved that leverage the reach of mobile technology. Often, the path toward achieving national scale involves using the mobile channel because no other communication channel is as well understood and prevalent. But while understanding of core mobile channels (e.g., SMS, USSD) is fairly universal, the nuances of each channel's capabilities and how they can be used specifically within the development and humanitarian sector are less well known, outside of a relatively small community of technically oriented specialists in the NGO sector.

Without a fuller understanding and appreciation of the opportunities and challenges of using these channels, as well as a common understanding of product requirements, implementation of mobile development projects can suffer from expensive delays and cost overruns. These problems can potentially be avoided by having open and honest discussions with the aggregator or mobile network operator about the tradeoffs between requirements, feasibility and affordability.

Audience

This guide is designed as an introduction for nontechnical professionals working in the development and humanitarian space who are considering implementing mobile-enabled services targeting the underserved. For those who have not selected a technology provider, this guide will help support an informed discussion about requirements that are appropriate, feasible and affordable for their service or program. For those who already have a technology partner, this guide will help prompt the right questions when problems arise or when the time comes to scale the project to the national level.

What's covered

This guide will only cover the three most commonly used mobile channels by NGOs, i.e., SMS (short message service), USSD (unstructured supplementary structured data) and voice, along with provisioning services that associates a dial code to these channels.

We have chosen these as they are available in all places where there is mobile coverage. For the purposes of this guide, we have left out mobile services that are increasingly important but not yet ubiquitous across all geographies, but we plan to include discussions of these channels in future guides.

Mobile internet: While the use of mobile internet is certainly rising, particularly with the popularity of messenger platforms such as WhatsApp, smartphone penetration is still relatively limited in many emerging markets. DIAL has conducted research about the emergence of internet-enabed messenger platforms for the underserved, which you can see here.

Mobile money: The increasing use of mobile money in emerging markets as a major contributor to financial inclusion is well documented. However, like mobile internet, it is not yet ubiquitous, so we have left it out as a core mobile service. We encourage you to explore resources on mobile money from the GSMA and CGAP's guide to digital finance.

Short Message Service (SMS)

SMS allows users to send and receive personal text messages directly from each other and from service providers. Each message can be up to 160 characters long (when using the default character set) and can be sent to and from users of different operator networks.

Recently, mobile manufacturers have started offering special reading layouts for SMS inspired by instant messengers. The threaded message or conversation-style layout displays the incoming and outgoing messages between two participants in a single pane ordered chronologically. This enhancement reflects the prevalent use of SMS as a type of instant messaging, much like chatting on a computer.

Because of its reliance on text, the SMS channel is ideal for countries with a relatively high literacy rate and national operator penetration. As SMS information can be stored on devices and retrieved whenever it is needed, it is also ideal for delivering reference content that can be reused and shared, such as health and agricultural information.

One of the key considerations in using SMS and designing services and content for SMS is the number of characters each message can hold, which is also affected by language:

Language, Characters	GSM Set	No. of Characters (1 Set)
All Latin-based characters	Basic A – Z, 0 – 9 and some special characters	160
Extended characters	^, {, }, \, [,], ~, "" and €	Treated as 2 characters
Basic Arabic, simplified Chinese, Russian, Thai	ISO-8859-6, ANY UTF-16	70

Key limitations:

1. Character length

2. Does not support rich media content

3. Cost can be high in some markets and varies by volume

4. Does not cover users who are not literate

Core capabilities

These are capabilities that are core to any NGO service and form the basis of any SMS-based service that we have come across.

One way

This is used to send an SMS from a service to a user's mobile device. Among mobile providers, it is also known as a mobile terminated (MT) or outbound message. A

one-way SMS sent to a large group of users is typically referred to as a "bulk SMS" or "SMS blast" by mobile providers. It is typically used by mobile providers to raise awareness about new services and provide information on airtime balance.

The most common use case for NGOs for one-way SMS is in promoting their services and the number used to access the service (the short code). Typically, this would involve an arrangement for the mobile provider to send an SMS blast to all its users or a segment of users with a promotional message about the service. A variant of this is to attach the promotion to some other service-related SMS so the user doesn't receive more SMS messages than necessary. This is particularly relevant in countries with strict anti-spam regulations on SMS.

It is unusual for a service to rely solely on one-way SMS, except in the case of one-off emergency messaging to entire populations (e.g., during natural disasters).

Two way

This is used for interactive communication between a user and a service via SMS. The mobile user should be able to send an SMS to a number (the short code) and receive an SMS response message from the same short code. In mobile terminology, this is actually a combination of inbound (mobile originated or MO) and outbound (mobile terminated or MT) SMS text messaging services, initiated by a user or application with an option to respond to the user or application

Two-way SMS is used when there is a need for interaction, such as collecting information from the user, and then using that information to send targeted content to the user as part of a behavior change or communication campaign. Information collected can range from profiling data (e.g., a mother's pregnancy stage or baby's birth date for a maternal and child health tips service), consent (e.g., confirmation of a subscription for a service), or topic (e.g., baby nutrition, feeding tips). Information can then be tailored and sent to the user.

An adaptation of this approach could be to present the information in a quiz or game format that can add an entertainment element to the information.

The other major usage of two-way SMS is for surveys, which is an important component for development agencies to assess the impact of their programs.

Delivery reporting

These are records maintained by mobile providers of successful and unsuccessful deliveries of SMS messages. They are not used by end users but are useful for implementers to track whether messages have been successfully delivered. When an implementer is not working directly with a mobile provider but rather with a mobile aggregator that works with multiple mobile providers, it is important to differentiate delivery reports between a service provider and the aggregator, and those between the aggregator and the mobile providers when troubleshooting problems with timely delivery.

These reports are critical in ensuring quality of service and for reconciliation when settling payments.

Reverse billing/zero rating

Particularly for NGO services, it is important to have a way to make a service cheaper (or free) to the end user. Reverse billing, like an 800 number, lets the service provider (e.g., the NGO sending maternal health information) pay for both the messages sent and the messages received by beneficiaries. With zero rating, no one is charged. Typically, the mobile operator absorbs the cost when there is an agreement in place.

Advanced capabilities

These are more advanced capabilities that either build on core capability or add administrative convenience in implementation.

Hosted flows

A more advanced implementation of two-way SMS is an automated interaction that flows more like a conversation rather than a question and answer session. Some providers and tools, including RapidPro, Viamo, engageSpark and FrontlineSMS, allow an implementer to define a flow of messages and responses to carry on a conversation and capture responses along the way, which promotes engagement and encourages users to stay on, as well as to come back for more.

Message counter

Individual SMS messages are limited to 160 Latin characters or 70 non-Latin characters. However, modern phones can send and receive much longer messages. Behind the scenes, these messages are sliced up into several individual messages of 160 or 70 characters long and reconstructed into a longer message on the recipient's phone.

The problem with this is that the mobile operator charges for each message, so charges may add up if this is not adequately planned for. A message counter feature lets the platform or app user see how many individual messages will be sent for a given block of text, so they can decide if they want to pay for it.

Automatic character substitution

With this service, the communications provider will remove non-Latin special characters from a message to prevent the character limit from dropping to 70 instead of 160. This is a helpful feature when content is being pasted from a Word document and includes special characters, such as a quotation mark, that are not really needed.

Maximum spend limits

It is not always clear upfront how much a communication will cost. For example, one may have designed a service that sends out SMSs in bulk, but to a list of names that may change dynamically. A maximum spend limit tells the communications provider to only perform an action up to a maximum cost. So even if the list is really long, the provider will stop sending messages when the maximum spend is reached.

Send re-attempt

Occasionally, when a message is sent by the service, one of the technical partners downstream (such as the mobile operator or mobile aggregator) might be down. This capability allows for messages to be sent repeatedly until there is confirmation that the message is sent.

EXAMPLES

Below are links to case studies describing services where SMS is a core component:

- TobangKO, a service for social and behavior change communication (SBCC) campaigns implemented by MercyCorps in the Philipines, involves SMS-based quizzes that are used to gauge the impact of their campaigns on the community over time. -- link

- Chipatala Cha Pa Foni (CCPF), implemented by VillageReach in Malawi, is a service where SMS and voice is used in tandem to first collect information and then to distribute health information on maternal and newborn child health. -- link

- SMSBunda, implemented by Expanding Maternal and Neonatal Survival (EMAS) and funded by the GE Foundation in Semarang, Indonesia, is an SMS-based service that sends updates to mothers providing information about what to expect as their pregnancy progresses. (Luntungan, 2016) -- link

Unstructured Supplementary Structured Data (USSD)

USSD allows users to receive and respond to messages using a menu-driven interface provided by the mobile operator or service provider. A USSD interaction is similar to SMS, but unlike SMS, where each message is treated and charged individually, multiple USSD messages can occur during a single session that terminates after 60 seconds or as configured by the operator. From a service design perspective, this means that a registration process that requires nine or 10 SMS messages to complete may only require a single USSD session. While responsiveness to USSD may be higher than for SMS, as everything happens within the session, the tendency of a USSD to disconnect mid-session can make the interaction less than ideal. Each message can be up to 180 characters long (when using the default character set) and can be sent to and from users of different operator networks.

Like SMS, the USSD channel is ideal for countries with a relatively high literacy rate and stable network coverage.

An important distinction is that during a USSD session, information is not stored on devices but captured by the application, which means there is no way for someone to retrieve the information later.

Limitations:

1. Messages are not stored on the device (This can also be a benefit, as messages do not use up the limited memory of some very low-end phones.)

2. Does not support media content

3. Sessions expire within a short time

4. Limited character length (180 for default characters and 80 for special characters)

Core capabilities

These are capabilities that are core to any NGO service and form the basis of any USSD-based service that we have come across.

One way

This is used to send a USSD message from a service to a user's mobile device.

One-way USSD is used in much the same way as one-way SMS, as a means to distribute messages to large groups of users. It is a relatively cheap way (compared to SMS) to raise awareness of new services, as well as to notify large populations of things such as weather or health emergencies. From a marketing perspective, it is more effective because the user has to interact with it to remove the message. However, this can potentially be perceived as intrusive and annoy the user. As these messages are not meant to be stored, they are best used in situations where messages are only relevant for a specific period of time and do not need to be referred to again.

Two way

This is used for interactive communication between a user and a service via USSD. Upon typing in a short code, such as *1234#, the user is presented with a list of numbered options and sub-menus to choose and open up until the desired outcome is reached. In mobile terminology, this is actually a combination of an outbound (mobile terminated or MT) and inbound (mobile originated or MO) USSD session, initiated by an application or user with an option to respond to the user or application.

Two-way USSD is very similar to SMS in operation, and like SMS, it can be used in almost all applications that require a series of interactions between a user and a service within a short time period. It is not ideal in cases where connectivity is sporadic. One of the major criticisms of USSD is the tendency for sessions to drop, particularly in rural areas with poor connectivity, which causes frustration among users when they are forced to restart the USSD session multiple times.

Session reporting

These are records of USSD sessions showing whether they were initiated, dropped or completed successfully. Unlike with SMS, it can be easier to spot problems in delivery, since one can see exactly where the session failed. Similar to SMS, when working with mobile aggregators it is important to understand the nature of the report and whether they represent the relationship between the service and the aggregator, or the aggregator and the mobile provider.

Unlike SMS, there is immediate feedback as to whether or not a USSD session has reached its mark. If a USSD session fails, it fails completely and is not "queued" as an SMS might be. These reports are used to ensure quality of service and for reconciliation when settling payments.

Reverse billing/zero rating

Reverse billing is an alternative charging model, where a party other than the requester of the service pays for the service. With zero rating, no one is charged. Typically, the mobile operator absorbs the cost when there is an agreement in place.

There is, however, an important distinction between SMS and USSD in terms of how they are billed. Charging for USSD is by session, while SMS is charged by message. As a result, far fewer USSD sessions would be needed than SMS messages to achieve the same result.

Additional capabilities

These are more advanced capabilities that either build on core capability or add administrative convenience in implementation.

Hosted flows

See the description of SMS hosted flows above. The process is the same for USSD.

EXAMPLES

Below are links to several case studies describing services where USSD is a core component. However, it is common for messaging services to feature both USSD and SMS.

- mAgri, by Brastorne in Botswana, is a service where farmers can access information such as agricultural tips and weather using USSD. It also features an automated interactive voice call-back (discussed more in the Voice section below). -- Link

- Climate Information & Early Warning Systems Communications Toolkit by UNDP for Africa is a service where USSD flash messages are distributed for climate information and early warning channels along with other recommended channels. (Benchwick, 2016) -- Link Pg. 52

- MomConnect, implemented by the Ministry of Health in South Africa, is a service that provides maternal and newborn care information and support to mothers across the country. USSD is used to collect information during registration as well as to provide a survey after registration so users can provide further information about themselves and feedback on the service. -- Link

Voice

Voice is used in a number of contexts by NGOs. For the purposes of this guide, we will leave out the procurement of voice packages for NGO staff or field agents for interpersonal, work-based communication. Instead, we will focus on the use of interactive voice response (IVR) systems that are a popular way to introduce automated voice-based interactivity in services. IVR is an automated telephony system that initiates calls to a user and allows the user to respond to questions during the call. It is one of the most popular methods of communication for NGOs, as it does not assume literacy on the part of the user and, therefore, has a much larger reach than text-based services. However, it is also relatively more expensive than text-based solutions.

Limitations:

1. Messages could be too long, leading to information overload
2. In countries where there are multiple languages or dialects, it can be costly to offer voice communication in multiple languages
3. Implementation can also be costly in terms of length of call
4. Voice recording quality can be variable

Core capabilities

These are capabilities that are core to any NGO service and form the basis of any IVR-based service that we have come across.

Inbound calling

This is the most familiar use case for an IVR system, where a user calls a number and reaches the automated system. The mobile user is able to respond by talking back or pressing defined keys as responses. During an inbound call, the system should be able to capture all responses from the caller, whether it is spoken feedback or buttons pressed. Some systems are also able to transcribe speech to text, although this may be error-laden in practice depending on the quality of the call and the sophistication of speech recognition.

The system can pass the call onwards to a live hotline agent or be fully automated and provide relevant information based on the responses provided by the caller.

It is typically used as a triage system to screen calls before connecting the call to a call center, for information dissemination (e.g., to provide information based on topics chosen by the caller), or for information collection (e.g., conducting surveys in areas with low literacy to measure the impact of a project for that area).

Outbound calling

It may be necessary sometimes for the system to be more proactive and reach out to users. This is particularly relevant for NGO services, which might need to contact the user in order to assure them that the call is paid for. One way in which this is done is the "flash call," where a user can call a number, let it ring a number of times, and then end the call. The system then recognizes this as a request for a call and calls the user back, bearing the charges. This is used when reverse billing (see below) is difficult because of technical reasons.

Call queue/forwarding

If the IVR system is used as a frontend for a call center, callers are placed in a queue until they can speak to a live agent after completing initial IVR prompts. Thereafter, the IVR system dynamically forwards calls to a live agent's phone number, based on call load, network availability and location. Forwarding can be based on "not answered," "busy," "failed to pick up in time" or any other condition required. The timing and corresponding phone numbers can be customized depending on the caller's issue.

Call detail records (CDR)

Call detail records contain data captured by telecommunication operators of subscriber telephony utilization, including voice calls made, voice calls received, time spent on calls and status of a specific call (e.g., connected when dialled). These records are not only used to bill subscribers, but also to assess the quality of the network by analyzing the successful connection of dialed numbers. Technology partners and digital service providers use CDRs to reconcile mobile operator invoices prior to paying for the services.

Reverse billing/zero rating

Reverse billing is an alternative charging model where a party other than the requester of the service pays for the service. With zero rating (commonly known as a toll-free number), no one is charged. Typically, the mobile operator absorbs the cost when there is an agreement in place.

Additional capabilities

These are more advanced capabilities that either build on core capability or add administrative convenience in implementation.

Hosted flows

Just like with SMS, it is helpful to be able to design an entire automated conversation on a platform rather than having to define the tree and having to code the IVR application from scratch. Organizations such as EngageSpark offer applications that allow a nontechnical user to define what the system says when someone calls, what keys to listen for, what to do next when people hit keys, and so on. Another benefit of having hosted IVR is that audio files used for the IVR are stored by the communications provider rather than making a server request a file when needed.

EXAMPLES

- Chipatala cha pa foni (CCPF), implemented by VillageReach in Malawi, is an example of a toll-free hotline that uses IVR to provide callers with automated information and advice on a wide range of health topics and refers callers displaying danger signs for further care at a village clinic, health center or hospital. It also redirects callers to live agents when the automated information is not adequate for the caller. - http://www.villagereach.org/impact/ccpf/

- Mobile Vaani, a literacy initiative implemented by UNESCO providing access to public resources, is an example of outbound/flash calling. After calling the number, the caller is disconnected after three rings, and the system returns the call so the user is not charged for engaging the platform. (UNESCO, 2017) - Link Pg. 8

- Ebola IVR mLearning Course for Health Workers, implemented by the CDC, is an example of an IVR service used as an educational tool specifically for health care workers. The service pushes information and conducts tests on Ebola prevention, diagnosis and care. (Tulenko, 2014) -- Link

- Vulnerability Analysis and Mapping (mVAM), implemented by World Food Program in Somalia, uses IVR to collect and disseminate information regarding food security.-- Link

Provisioning

The combination of digits users dial in order to reach a service, whether it's to access an SMS- or USSD-based service, or for an IVR service, is referred to as either a short code or long code. Long codes contain the same number of digits used within the country for regular calling. However, in the context of user services, short codes (five to six digits) are always preferred, as they are easier to remember and market. Provisioning is the process where short and long codes are configured by the operator in their network and the service provider in their application to ensure messaging or voice traffic is channelled through the specific codes allocated and approved by the country regulatory board and operator.

The process of applying for and getting approval for the use of specific codes can vary from country to country and depends on who administers the use of codes in that country and what use the code is being provisioned for. It can be difficult to navigate, and sometimes can take longer than the process of developing a service. In some countries, there is no documented process. It is highly advisable to ask the mobile provider how this will be done, what the expected timelines are and, most importantly, any external dependencies (e.g., reliance on obtaining approvals from a regulatory body) before setting up a service. It may also be worth understanding how flexible the requirement is for a specific memorable code.

Comparisons:

	Short Codes	Long Codes
Format	5 to 6 digits	10 to 15 digits
Coverage	National usage and accessibility	International usage and accessibility
Throughput	Higher transactions per second (TPS) e.g. 100 TPS	1 transaction per second
Set Up	Requires 2 to 5 days to configure on the mobile provider end, but code allocation itself can take a variable length of time	Instant
Regulatory	Requires regulatory approvals; use case is vetted at application for a short code by both operators and the relevant regulatory agency	Closely monitored by operators and regulation; they are subject to heavy filtering and immediate suspension due to misuse or high volume of transactions
Costs	Expensive to acquire (although this varies)	Cheaper to acquire (also varies)
Capabilities	SMS traffic	SMS and voice traffic

Core capabilities

Dedicated vs shared short codes

One of the ways NGOs get around the lengthy, complex and expensive process of getting a short code which is dedicated to the service, is to use a shared short code. Many mobile providers have shared short codes which are already pre-approved and in use for other services, and which do not need to go through the lengthy approval processes described above. The price to set up and maintain such a short code is divided between many customers and services, so is also (typically) much lower.

However, the downside is that users will typically need to type in a standard keyword as a prefix in every text communication so the system knows who to send the message to, which may make for a poor user experience. There are also overall performance considerations, in terms of speed and throughput, as well as other system-dependent limitations which the NGO will have to discuss with the mobile provider. In any case, it remains an interesting option that should be explored, particularly if there are budgetary or time constraints associated with getting a dedicated short code.

Standard vs premium short codes

More often than not, the NGO would like to use a short code that is easy to remember (e.g. 12345) or spells something meaningful on the dial pad (e.g. 435763 which spells "HELPME"). These are premium short codes. Premium short codes are specific, memorable short codes that are priced differently for use by service providers. The more memorable the number, the more costly it will be to provision.

Reverse billing

The reverse billing capability (described above in the context of mobile channel capabilities) has to be configured with respect to specific short or long codes so the user does not bear the cost of using the voice or messaging service. The service provider is charged for all traffic usage.

Acknowledgements

We would like to thank the following persons and organizations whose advice and input has been invaluable to the content within this document:

Simon DeHaan, Praekelt

Murat Knect, EngageSpark

Luke Kyohere, Beyonic

Sherrie Simms, WorldVision

Evan Wheeler, UNICEF

David Waithaka, Cellulant

Sam Gikandi, Africa's Talking

Boaz Yaya, SynqAfrica

Noka Fahimi, Airtel

Benjamin Makai, Safaricom