

TECHNOLOGY RECOMMENDATIONS MAMA BANGLADESH

August 2012

This publication was produced for review by the United States Agency for International Development. It was prepared by Pamela Riley for the Strengthening Health Outcomes through the Private Sector (SHOPS) project.



Recommended Citation:
Riley, Pamela, 2012, *Technology Recommendations MAMA Bangladesh,* Bethesda, MD: Strengthening Health Outcomes through the Private Sector Project, Abt Associates Inc.

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Cooperative Agreement: GPO-A-00-09-00007-00

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ACRONYMS

API	Application Protocol Interface
BDT	Bangladesh taka
BTRC	Bangladesh Telecommunications Regulatory Commission
ISP	Internet Service Providers
IVR	Interactive Voice Response
RFP	Request for Proposals
SIP	Session Initiation Protocol
SMS	Short Message Service
USAID	United States Agency for International Development
VAS	Value Added Service
VoIP	Voice over Internet Protocol

ACKNOWLEDGMENTS

As a technical advisor to MAMA Bangladesh Secretariat Dnet, SHOPS worked in close collaboration with Dnet staff in identifying priorities, assessing technology options, and weighing pros and cons of various technology strategies to support the Aponjon service. Although the recommendations in this report are those of the SHOPS project, this report was based on inputs from Dnet reflecting their many hours of research, negotiation, analysis and evaluation to determine optimum technical design. The recommendations in this report reflect the strategy Dnet has embraced for the evolution of the Aponjon platform. Under the leadership of Executive Director Ananya Raihan, Dnet provided SHOPS regular communications about its in-country activities and challenges, and access to its talented technology team Shamarukh Alum and Imran Ahmed. Ananya's technical expertise and collaborative approach is gratefully acknowledged.

Guidance over all aspects of MAMA Bangladesh has been provided by Sandhya Rao, Senior Advisor for Private Sector Partnerships at USAID. Sandhya's supported the development of this report through facilitation of meetings between InSTEDD and Dnet and provided ongoing direction to Dnet regarding USAID priorities and policies.

Substantial input to this report was provided by Eduardo Jezierski of InSTEDD, who provided the basic vision for an alternative voice platform, and offered many of the insights and ideas for addressing current barriers to scaling voice-based information services. Eduardo worked transparently with all the MAMA Bangladesh partners including SSD-Tech and Dnet, and contributed much to the recommendations proposed.

EXECUTIVE SUMMARY

Problem Statement: New Models Are Needed to Support Scalable Voice Services Such as Aponjon

Aponjon's innovative mobile health information service offers subscribers a choice of either interactive voice response (IVR) or short message service (SMS) formats, and Bangladesh customers overwhelmingly prefer audio over text message format. Based on business plan projections, Aponjon requires a high capacity voice platform that can serve up to 3 million subscribers with twice weekly recorded messages of one minute duration.

When Aponjon design phase began in 2010, proprietary customized IVR systems were the only options available that met requirements of mobile operators. Software companies with telephony expertise have made large investments in integrated IVR platforms using high-end hardware programmed to accommodate each mobile operator's specifications. These systems require large development investments; those costs are recouped through "turn-key" service license fees that bundle application development, maintenance, hosting and operations. New IVR models are needed to address to dramatically lower operating costs and promote scalable services. As a first-in-class national service, Aponjon is positioned to drive these changes.

Aponjon's Existing Platform Provided y SSD-Tech

SSD-Tech, a mobile software company in Bangladesh, was selected in 2010 through a competitive bidding process to deliver a software solution for the Aponjon service. To expedite time to market, contract for pilot period was based upon rental model in which Aponjon would use servers and hardware owned by SSD and shared with other clients. Negotiations on scope of work were lengthier than anticipated, due in part to decision to connect to the three largest mobile operators (Grameenphone, Banglalink, Robi) and unanticipated complexities of their billing systems. Negotiations were also drawn out over scope of web-based registration, which delayed pilot launch. Pilot launched in October 2011.

While the SSD-Tech platform worked well technically during the pilot, the leap to national scale service is a large one. Based on SSD-Tech's initial proposal and Dnet's projected subscriber growth, costs for Aponjon to rent SSD-Tech platform would increase from $150,000 in Year 1 (July 2012 – June 2013) to well over $3m in Year 3. Much consideration was given to the pros and cons of continuing with SSD-Tech for national launch for a single year, which was determined to be the best option: to meet established timeframe for national launch, to preserve limited Dnet resources needed to address many other program facets, and the need to limit cash flow during early years of service. Dnet staff is currently negotiating a final contract terms with SSD-Tech for the Year 1, including lower monthly rates. The continuation of the rental model for one year would give Dnet time to explore emerging IVR alternatives (described below) and to investigate the timeframe, costs, and technical infrastructure and training needed.

Role of Mobile Operators

Mobile operators are critical to the success of Aponjon as the service requires local mobile networks to deliver the messages to their subscribers. During early partnership-building period in 2010, MAMA Bangladesh assumed that it would be more cost efficient to test the platform with a single operator, but this approach was dropped when it became clear that technical variations among the six networks regarding billing requirements required design input from each. To maintain maximum flexibility, reduce dependence on SSD designed configuration, and better understand limitations of charging gateways for each operator, Dnet initiated and was encouraged to seek agreements from each operator to support connectivity through SSD platform.

Dnet has been meeting regularly with teams from three largest networks (Grameenphone, Robi, and Banglalink) over the past year, both to seek favorable financial terms for mobile charges, and to execute connectivity agreements. These negotiations proceeded slowly. Two issues were particularly problematic in instituting Aponjon service with similar features across all networks: per call charging for calls received by subscribers, and providing free calls to a portion of Aponjon subscribers qualifying for subsidies.

In a series of negotiations facilitated by Secretary of Health, BTRC, and Policy Advisor of Prime Minister Office in May and June, 2012, agreement between Dnet and all six mobile operators has been reached on a number of fronts including revenue sharing terms, waivers for registration charges, unrestricted choice of networks for family member, and both billing issues described above.

These outcomes demonstrate the fluidity of technical barriers to scale. Mobile operators may initially oppose new service approaches, but may be amenable to making changes if there are financial or regulatory incentives to do so. With support from policymakers and alignment with business strategies, mobile operators may be interested in exploring new IVR options to expand the use of recorded voice services. In this case, Aponjon can serve as an anchor client to justify investments in system changes to support a more scaleable voice model.

Addressing the Limitations of Existing IVR Platforms: InSTEDD's Proposed Approach

There are a number of current technology trends that suggest promising opportunities for new IVR solutions with direct relevance to Aponjon's requirements. These include the growth in cloud-based services, the emergence of lower-end software switches, and the expansion of voice over internet protocol (VoIP), all of which reduce dependence on high cost hardware-based systems. At the same time, there is growing demand in markets across the world for applications with similar functionality that would simplify design of voice message services.

As the IVR industry moves toward greater reliance on standards-based programs using more efficient internet channels, a number of benefits will result. These include an ease of porting applications, a cadre of trained application programming specialists, protection from reliance on a single vendor, and in time, availability of "off the shelf" voice applications.

InSTEDD, a technology NGO, developed a prototype web-based IVR platform, called Verboice, which is designed to offer a scalable open architecture alternative to proprietary IVR systems. The Verboice architecture combines cloud services with standards-based Application Protocol Interfaces (APIs), designed to allow non-technical staff to define applications and track their

usage. The goal is to reduce development resources needed to develop applications by providing an automated portable solution which can interface with any telephone system. Verboice allows for online community support and maintenance, and is currently being deployed at small pilots in US, Ghana, India and Kenya.

Based upon its unique organizational mission, and approach for a modular open source IVR solution, SHOPS awarded InSTEDD a sole source contract in January 2011 to flesh out its solution for possible deployment in Bangladesh and other USAID programs. In December, 2011, Dnet, InSTEDD, and USAID began negotiations to refine and deploy Verboice platform for Aponjon. These negotiations did not progress for several reasons:

- Only SSD-Tech could guarantee successful integration with the mobile operator networks, and those negotiations were not yet finalized for the rapidly approaching launch date. InSTEDD negotiations posed risk of distraction.
- Dnet lacked clarity about whether USAID supported the investment of Verboice platform, and whether such funds were appropriately categorized as research and development in addition to, or as a replacement for, the SSD-Tech budget.

While Dnet remains committed to exploring feasibility of alternative open source platform such as Verboice, its current priority is to ensure successful transition to national service.

Recommendations and Next Steps

1. A clear vision for Aponjon technology platform is needed that incorporates the lessons from the past year to guide future contracts.
2. Dnet funds should be allocated for the next 12 months specifically for research & development of a web-based IVR solution.
3. Dnet should execute a contract with InSTEDD's Verboice "test-ready" solution to inform future technology strategy, or issue new RFP for web-based IVR platform.
4. Dnet should integrate Verboice platform testing with internet service provider(s) to identify technical and operational challenges for deployment of voice-over-internet-protocol (VoIP) solutions with mobile operators.
5. Roles and responsibilities should be clarified for supporting open source platform
6. Direct negotiations between Dnet and mobile operators should continue without reliance on third party aggregators or platform developers.

BACKGROUND AND PURPOSE OF REPORT

In July 2012, Mobile Alliance for Maternal Action (MAMA) Bangladesh is launching Aponjon, a national scale mobile health information service to achieve sustained improvements in maternal child health knowledge, behaviors and outcomes. With catalytic funding and strategic support from global MAMA, the Aponjon service was developed by the MAMA Bangladesh coalition, a public private partnership overseen by Health Advisory Board chaired by the Secretary of Health, and coordinated by Dnet, a Bangladesh NGO. The Aponjon service provides both audio and text health messages to pregnant women, new mothers and their families, tied to a woman's due date or date of baby's birth. The messages offer evidence-based maternal child health and family planning content about such topics as antenatal care, skilled attendants at delivery, immunizations, exclusive breast-feeding, and health spacing of births. A pilot of the service was conducted with 2000 women in 13 locations from October 2011 to July 2012.

The Strengthening Health Outcomes through the Private Sector (SHOPS) project provided technical assistance to MAMA Bangladesh from July 1, 2011 through June 30, 2012 through field support from USAID Bangladesh Mission. During this period, SHOPS has worked closely with MAMA Bangladesh Secretariat Dnet to assess best technology platform options to support Aponjon. This report summarizes the key activities, findings, lessons and recommendations from that effort. The audience for this report includes USAID implementing partners facing challenges similar to those faced by MAMA Bangladesh in designing a cost-effective mobile information service with the widest possible reach.

Problem Statement

During Aponjon's initial design phase, current technology options for high capacity voice services were limited to commercial country-specific proprietary systems. MAMA Bangladesh selected experienced local company to ensure it could get Aponjon service to market quickly and reliably, but high prices with built-in licensing fees undermine long-term sustainability. Investment is needed in alternatives tailored to development sector to lower the cost of ownership and innovation with voice applications.

Aponjon Requires High Capacity Voice Platform

Bangladesh customers overwhelmingly prefer voice-based messages over text. Aponjon offers subscribers a choice of either interactive voice response (IVR) or short message service (SMS). During the pilot phase, more than 90% opted for the IVR format. This preference may be due to low literacy skills, unfamiliarity with texting on their phones, phones without ability to use Bangla characters, novelty of drama-format recordings, or other reasons.

Aponjon's business plan projects that it will serve a cumulative total of 2.9 million subscribers over the three year period from July 2012 – June 2015. This includes both the primary target audience (pregnant women and mothers with babies under one year) and the secondary audience of caregivers (such as spouses and mothers-in-law) who influence the health seeking behaviors of the target beneficiates. It is assumed that 90% of Aponjon subscribers will continue to select audio format service, with subscriber growth escalating rapidly beginning in Year 3.

High Cost Proprietary IVR Systems Have Been the Only Options Available for Voice Applications

More extensive network resources are needed to transmit audio signals compared to text or data, which can be compressed into very efficient packets for transmission. Mobile networks manage thousands of simultaneous voice calls through complex engineering algorithms to provide call handling and signaling protocols, and track through complex billing software. Third-party IVR providers have developed “carrier grade” systems using high end hardware and switches that are programmed to meet the specifications of each operator’s network.

Software companies with telephony expertise have made large investments in these integrated IVR platforms. They configure these systems from the ground up, using proprietary designs that works on top of high-end hardware which also utilize unique designs and impose license fees. To recoup those large upfront development investments, IVR providers offer bundled “turn-key” services to clients that include their development, maintenance, hosting and operation costs into service agreements that include perpetual license fees. Even if local clients had the skills and resources to duplicate the underlying system, there is limited ability to reuse in other countries because these platforms do not rely on open, standards-based architectures.

New IVR Models Are to Address the Gap in Scalable Voice Service Platforms

As set forth below, Dnet is exploring emerging IVR options that provide more modular, standards-based, community-supported platforms that can dramatically lower the costs for voice information services. This objective was balanced against the need for rapid market entry with an existing platform that could meet aggressive timelines for designing, testing and scaling the service during initial phases. Parallel activities are needed to rapidly identify alternative solutions for long-term sustainability

> **Recommendation**: Dnet funds should be allocated for the next 12 months specifically for research & development of a web-based IVR solution. A clear vision for Aponjon technology platform is needed that incorporates the lessons from the past year to guide future design.

EXISTING APONJON PLATFORM

Selection of SSD-Tech

In the fall of 2010, USAID through the SHOPS project conducted a competitive solicitation process and sought bids from experienced mobile software companies able to design, build, test, adapt, and maintain a platform to provide audio and text mobile phone messages to subscribers at national scale. Bidders were invited to propose most cost-effective and appropriate solutions available, including dial-in IVR model, “push” IVR services that automatically send messages to subscribers without subscriber initiation, and voice SMS options.

Design parameters for the IVR proposals included requirements that the proposed solution be able to handle call volumes for up to 500,000 subscribers, and be based on open source software with unrestricted licensing to promote global replicability. Eight vendors responded with proposals, and in-depth interviews were conducted with seven to fully evaluate their approaches, clarify pricing structure and flexibility, and explore open source options. All vendors interviewed acknowledged that while the code for Aponjon “top layer” application would be open source, the underlying IVR platform that enables Aponjon to work would be proprietary, thus limiting its usefulness outside of Bangladesh.

In collaboration with implementing partner Dnet, SHOPS selected SSD-Tech as the technology provider, pursuant to the selection criteria. SSD is a mobile solutions market leader with extensive experience developing and providing customized mobile applications to medium and large enterprises in Bangladesh. It offered existing IVR and SMS value added services to all six licensed mobile phone network operators. SSD-Tech had established a track record of establishing high volume consumer-facing IVR services with its platform for BBC Janala service, providing mobile-delivered audio English language lessons to more than 23 million Bangladesh consumers. SSD-Tech proposal included realistic estimates of design, testing and maintenance of the platform.

SSD-Tech Contract Phases

Initial pilot contract

SHOPS contract to SSD-Tech was finalized in March 2011 for pilot phase only, which was originally scheduled for June 2011 launch. Contract terms included delivery of a prototype software solution to host and route messages according to a schedule set by subscriber’s expected delivery date or date of baby’s birth, and access for reporting and analysis. SSD budget was based upon a rental model in which Aponjon would use servers and hardware owned by SSD and shared with other clients. The contract was a fixed price agreement, with the potential for Change Request Addendums to reflect requirements outside of the agreed scope of work.

Negotiations between Dnet and SSD-Tech on scope of work extended for months due to 1) decision that platform needed to be tested with multiple operators requiring individual negotiations with each, and 2) unanticipated complexities related to billing system support needed to provide variable charges, and both per call and weekly subscription format. To

maintain maximum flexibility, reduce dependence on SSD designed configuration, and better understand limitations of billing services for each operator, Dnet initiated and was encouraged to seek agreements from each operator to support connectivity through SSD platform.

Negotiations were also drawn out over scope of web-based registration, including location-based information, length of registration form, subscriber qualification for free service, public access to SSD-Tech servers, number of pilot subscribers and multi-language options. Lessons learned during the requirements development process for the initial IVR platform include bringing more partners (donors, mobile operators, technical advisors) to the table during requirements sign-off discussions to clarify agreements reached. Given the number of issues that emerged during negotiations on System Requirements Specifications, a minimum timeline of eight weeks should have been scheduled, and in fact twelve were needed for the initial contract.

Pilot contract addendums

The SHOPS contract had assumed that the largest operator in Bangladesh, Grameenphone, would serve as the exclusive design/test partner. The assumption was that this would expedite time to market by limiting negotiations to a single operator, and provide incentives for financial contributions. Given the insights gained early on during negotiations about the need for a national platform that could work with dissimilar billing and charging policies, Dnet provided an addendum contract for SSD-Tech to connect to the second and third largest networks, Robi and Banglalink. Changes were also made to reflect pilot timeline, which extended from October 2011 through July 2012.

National launch Year 1

SSD-Tech platform performed well during the pilot, with successful call delivery on schedule provided (subscribers were able to choose time of day to receive the messages). The leap from pilot to national scale is a large one. Aponjon will expand service from a 13-location pilot phase with 2000 subscribers, to national coverage with a target of 300,000 total subscribers at the end of 12 months, up to 2.9m by the mid-2015. Based on SSD-Tech's initial proposal and Dnet's projected subscriber growth, costs to rent SSD-Tech platform would increase from $150,000 in Year 1 to well over $3m in Year 3.

Much consideration was given to the pros and cons of continuing with SSD-Tech for the first year of national launch, and whether to transition to build/own model. For a number of reasons, a one year contract utilizing the existing SSD platform was determined to be the best option.

- Given the widespread demands on Dnet senior staff resources during first year of national launch (rolling out media campaign, expanding outreach partner training, handling increased demands on customer service, soliciting new sponsorships, and managing knowledge dissemination), and the protracted time needed to reach agreement with SSD-Tech for the pilot contract, it was agreed that continuing with the current platform would be an expedient and practical choice in meeting program goals. The prototype has been tested and refined, and continuing through the transition would help Aponjon meet its July timeframe for national launch.
- The continuation of the rental model for one year would give Dnet time to explore emerging IVR alternatives (described below) and to investigate the timeframe, costs, and technical infrastructure and training needed.
- In budget estimates supplied by SSD-Tech, total technology costs would be lower in the long run for Dnet to purchase, configure and maintain its own system rather than

continue to rent SSD-Tech's existing platform and pay per minute charges. However, in the short-term, the rental model would be cheaper than investing in the capital expenditures needed for an independent system. During the decision period, there were many uncertainties about the source and level of additional funding from USAID and other MAMA partners to help Aponjon achieve long-term financial viability. Given this certainty about cash flow in Year 1, it was important to keep costs as low as possible until funding could be secured, thus supporting the rental approach.

Dnet staff is currently negotiating a contract with SSD-Tech that extends support for Aponjon through its existing network and operating system architectures for a one year period. Terms will include connectivity for the three remaining mobile operators (AirTel, Teletalk, CityCell) subject to their needs and requirements. Initial negotiations have focused on shifting from a flat price for projected annual subscribers to one that charges Dnet based on actual clients served per month. This will significantly lower costs in the early months and protect cash flow. Terms are also being discussed for reducing proposed monthly rates and Change Request charges.

ROLE OF MOBILE OPERATORS

Mobile operators are critical to the success of Aponjon as the service requires local mobile networks to deliver the messages to their subscribers. IVR and SMS services such as Aponjon are called Value Added Services (VAS), and providers must negotiate connectivity contracts with operators in order for their services to be accessible. In the case of Aponjon, Dnet owns service content and the “short code” telephone number for subscribers to access the service. Service providers often use mobile service aggregators such as SSD-Tech to conduct mobile operator negotiations, but others prefer to do so directly.

Standard contract terms for connectivity include terms related to permission to access interface software to their content servers, liability protection for mobile operators for content provided, technical parameters for service formatting and testing, protocols for service activation and deactivation, information security requirements, and other requirements to protect operator networks. For fee-based services such as Aponjon, mobile operators “charging gateways” are needed to bill, collect and transfer revenues to service providers from subscribers. These technical issues are separate from financial issues related to service pricing, revenue sharing, marketing promotion, corporate social responsibility financial support, and waivers of taxes and fees.

Ensuring Connectivity to all Mobile Operators

During early partnership-building period in 2010, MAMA Bangladesh intended to work with the largest operator, Grameenphone, exclusively during the pilot phase to ease time to market and optimize their support, with the expectation of opening service to all operators within a year. This approach assumed that it would be more cost efficient to test the platform with a single operator, and that an exclusive partnership would provide the strongest incentives for an operator to support and promote the service. Aponjon shifted this approach during the pilot when it became clear that 1) technical variations among the six networks required design input from each for platform to accommodate dissimilar requirements, 2) subscriber targets in several pilot locations would not be met working with a single carrier, and 3) exclusivity offer during pilot phase did not result in significant financial support.

Mobile Operator Negotiation Challenges

Dnet has been meeting regularly with teams from three largest networks (Grameenphone, Robi, and Banglalink) over the past year, both to seek favorable financial terms for mobile charges, and to execute connectivity agreements. These negotiations proceeded slowly. Two issues were particularly problematic in instituting Aponjon service with similar features across all networks.

Per-call charging

Aponjon subscribers prefer the “push IVR” option which enables subscribers to schedule a time for audio messages to be delivered to their phone, and to have their accounts charged when answering the call. Two of the network operators had no capability for “mobile termination” charges, providing only the more traditional “calling party pays” model. The only option for subscriber payment for these calls was for Aponjon to set a monthly subscription service,

docking subscriber accounts in advance of call delivery. But this model was not amenable to subscribers with low monthly balances, and imposed extra monitoring and accounting costs.

Differential charging

To promote equity in service access, Aponjon has set a target of 20% of lowest income subscribers to receive free service while all other subscribers pay the initial Aponjon charge of BDT 2 messages. In initial negotiations with the operators, they were unable to set different charges (free versus BDT 2) for the same service, again citing limitations of their billing systems. The work-around available to Aponjon was to manually top-up free subscribers with airtime to cover the standard charge, which would be a prohibitive undertaking at scale.

Government assistance in resolving contract terms

In negotiations conducted in May and June, 2012, Dnet reached agreement with six mobile operators on key terms of service. These negotiations were facilitated by Secretary of Health, BTRC, and Policy Advisor of Prime Minister Office who brought the operators together in several joint sessions. Agreement was reached on a number of fronts including revenue sharing terms, waivers for registration charges, unrestricted choice of networks for family member, and both billing issues described above. Through significant support and push from Aponjon government partners, mobile operators agreed to reconfigure their billing systems to differentiate Aponjon customers eligible for free service with “zero rate” and other Aponjon customers. The operators previously unable to offer mobile termination charges agreed to implement the changes necessary in their billing systems, fueled by competitive pressures and the needs of the Aponjon coalition.

These outcomes demonstrate the fluidity of technical barriers to scale. Mobile operators may initially oppose new approaches, but may be amenable to making changes if there are financial or regulatory incentives to do so. With support from policymakers and alignment with business strategies, mobile operators may be interested in exploring new IVR options to expand the use of recorded voice services. In this case, Aponjon can serve as an anchor client to justify investments in system changes to support web-based voice model.

> **Recommendation**: Dnet should continue its direct negotiations with mobile operators without reliance on third party platform developers (including SSD-Tech and InSTEDD). Given the considerable variation in mobile operator capabilities and competitive strategies, the investment in time to build these relationships will best serve Aponjon development.

ADDRESSING LIMITATIONS OF IVR PLATFORMS

Promising Technology Trends

There are a number of current technology trends that suggest a promising direction for emerging IVR solutions. With the expansion of computing power, hardware-based systems are evolving toward lower cost, more modular and powerful virtual systems. These trends include:

The growth of web-based voice applications

A number of web-based application programming interface (APIs) for voice services have emerged over the past few years. These applications reflect the introduction and growing use of standard IVR programming code (called VoiceXML and CCXML) that facilitate speech recognition by computers, and allow for easier developing and porting of applications[1]. Three examples of commercial applications are Tropo, Ribbit, and Twilio. These proprietary cloud services have been introduced for enterprise applications, based upon the owners' business model. Although they provide scalable options for certain markets, however, they are not designed to be customized at a local level to accommodate lower scale innovations, and may not integrate with local mobile operator hardware in all countries.

The emergence of software switches

Several voice-based switching platforms have emerged through open source communities. Two examples are Freeswitch and Asterisk. These platforms are designed for lower cost, community- supported voice applications, and provide alternatives to traditional high end hardware switches. Some projects, such as Freedomfone, have built on top of these low level switches but access to phone lines and servers are still needed, which limits scalability. These platforms require some programming skills to configure, set-up and maintain, and have not been integrated across mobile networks or tested at national scale

Voice-over Internet protocol (VoIP) is expanding

Supported by the growth of third generation (3G) mobile networks and the expansion of bandwidth available, VoIP has been growing globally. The ability to deliver voice traffic over the internet has been controversial, but regulations previously in place to protect revenues of local telephone companies are falling in the face of market pressures. Eighteen internet service providers were awarded VoIP licenses in Bangladesh in 2010, and costs are coming down. As more infrastructure becomes VoIP-based, there are new options emerging for lower cost IVR services with less dependence on specialized hardware and customized interfaces to mobile operators' data centers.

VoIP changes IVR architecture in several ways, each lowering costs. First, through a standard interface called Session Initiation Protocol (SIP), incoming and outgoing calls can utilize data

[1] Interact Incorporated Software Systems, *Four Trends Changing the IVR Landscape Whitepaper*, Lincoln, NE (downloaded July 2012 from http://www.iivip.com/ivr/spot-media-platform/).

channels rather than the more the more restrictive T1 lines, which are the trunks of traditional IVR. Second, VoIP allows the use of standard servers (computers), unlike traditional IVR which use complex “telephony cards” which require multiple computers to support fixed numbers of call channels, reduce system capacity. A layer called a “media gateway” translates or maps the call routing language of the internet with the language of existing telephone networks. The result is a set-up that replaces special purpose hardware with software that can run on standard personal computers[2].

Global Demand for off-the-Shelf IVR Features

With the rapid proliferation and penetration of mobile phones in developing countries, program implementers across the world have common needs for utilizing voice services in meeting development objectives. There is demand for services that could simplify the design of IVR applications that can adapted at a local level on platforms that can scale up to national levels, without the need for high cost intermediaries. Each program may have unique user cases and call flow requirements, but many operational elements are common. These include providing a simple interface for uploading sound files, easy-to-manipulate voice menus and sub-menus in multiple languages, reverse billing capability, and expandable and searchable mailbox storage.

InSTEDD’s Proposed Approach

InSTEDD is a technology NGO, founded by Google.org, whose mission is to make technological innovations accessible to humanitarian and public health organizations for more coordinated, effective solutions to development challenges. InSTEDD has developed a prototype web-based IVR platform, called Verboice, which is designed to offer a scalable open architecture alternative to proprietary IVR systems. The objective is to create a global platform that will allow users to share voice applications, in multiple languages, across mobile and internet infrastructure.

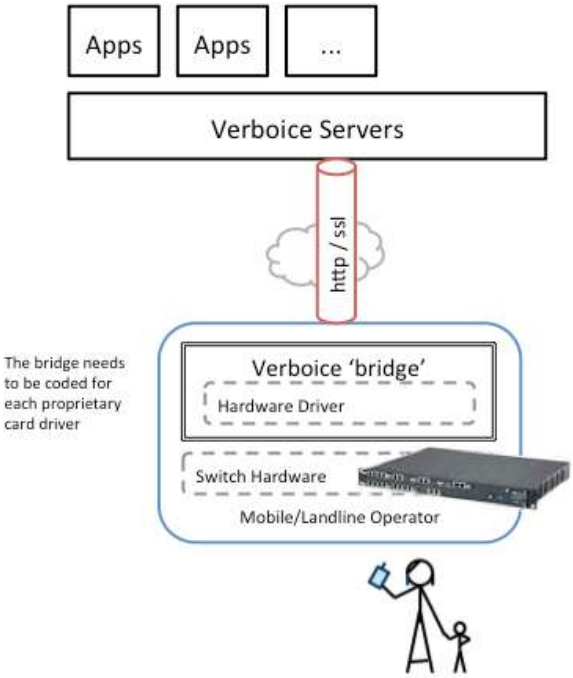
Overview of Verboice platform

The Verboice architecture combines cloud services with standards-based Application Protocol Interfaces (APIs). Verboice is a set of subsystems that include a call flow designer (directing when, how often and to whom messages should go), adapter layers for connectivity (to bridge the application to call delivery channels), and reporting functionality. The platform provides a set of commands that can work with multiple IVR content management systems, to simplify future development applications, increasing portability and decrease time to market .

Verboice is designed to support complex call workflows, without the need for coding skills that enables non-technical staff to define applications and track their usage. Organizations can host themselves or use cloud hosting. As an open source platform, Verboice can support multiple programming languages to promote easy local customization, and allow for community support and maintenance.

[2] Interact Whitepaper, 7.

FIGURE 1: OVERVIEW OF VERBOICE PLATFORM



One subsystem supports the top layer application through a content management system, web-interface for subscriber registration, and dashboard for data analysis. A second subsystem serves as bridge between the top layer applications and the call transport function of various magnitudes. The bridge layer enables its integration with any switch platform, from the proprietary hardware drivers and switches of national mobile operators and large aggregators, to the software platforms of smaller gateways, modems or VoIP providers. It serves as the glue that enables direct connections with simultaneous channels, with no need for additional gateways to route the call, simplifying contracting and promoting scalability.

Current use cases of Verboice

Verboice completed a proof of concept for American Red Cross in 2010 with funding from Google.org and Cisco. In that use case, an application was designed to activate volunteers with calls linked to their location, skills, schedules and the severity of the event. This cloud-hosted instance of Verboice demonstrated adequacy of bandwidth, processing power (which affects voice quality), and security.

Additional projects integrating Verboice include iLab in SE Asia, and Baby Monitor in Kenya. Through the open source community, other health projects not involved with InSTEDD are actively using the Verboice code in India and Ghana, and contributing solutions to address new use cases. These deployments support the possibility of identifying a number of cost share partners to develop Verboice including Gates Foundation and Rockefeller Foundation.

History of InSDTEDD engagement with MAMA Bangladesh

In response to SHOPS Requests for Proposals in October 2010, InSTEDD joined in the proposal of a Bangladesh software company, Inforev. SHOPS awarded the contract to SSD-Tech but entered into separate negotiations with InSTEDD to develop a strategy to incorporate its proposed open source IVR platform using MAMA Bangladesh as a test case. Based upon its

unique mission, expertise in IVR, and approach for a modular open source IVR solution, SHOPS awarded InSTEDD a sole source contract in January 2011 to flesh out its solution for possible deployment in Bangladesh and other USAID programs.

Throughout 2011, InSTEDD and Dnet conferred, and met with SSD-Tech, to examine how the Aponjon pilot platform might be unlayered to integrate with the Verboice bridge. Through these discussions it became clear that testing of Verboice on SSD-Tech's platform would require access to mobile operator hardware, but that access was restricted. During this same period, Dnet entered discussions with MetroNet, an internet service provider (ISP) who expressed interest in testing Verboice with their VoIP service. Testing of Verboice with either the VoIP or SSD platform would require the cooperation of one or more mobile operators.

In December, 2011, Dnet, InSTEDD, and USAID agreed to move ahead with contract between Dnet and InSTEDD to deploy and refine Verboice platform for Aponjon, with the intent of further exploring feasibility of replacing SSD-Tech platform. A tentative budget was prepared to implement and test Verboice at increasing scale with Bangladesh mobile operators during 2012. A separate InSTEDD- Dnet contract was discussed to improve the Aponjon web interface and reporting functionality. With support from SHOPS, these Dnet/InSTEDD contract negotiations extended for months during first half 2012, and were postponed without execution for a number of reasons.

- Only SSD-Tech could guarantee successful integration with the mobile operator networks for Year 1 of national service. With national launch scheduled for July 2012, resolving protracted negotiations with SSD-Tech to transition from pilot to national service was a higher priority, and these terms are still being finalized. Dnet resources were needed to focus on SSD-Tech terms for transition to insure no service disruptions for national launch.
- Mobile operator negotiations for connection to SSD-Tech platform were also drawn out throughout first half 2012, and are still being finalized. There was concern that introducing new elements in the discussion for Verboice integration through VoIP could further delay initial connectivity with the operators. By first launching through the SSD-Tech established platform, access across operators would be expedited.
- The discussions between USAID and Dnet regarding total budget and budget allocation for the technology platform for Year 1 were taking place simultaneously. Dnet lacked clarity about whether USAID supported the investment of Verboice platform, and whether such funds were appropriately categorized as research and development in addition to, or as a replacement for, the SSD-Tech budget. Ultimately, the contract discussions were discontinued due to uncertainty about platform feasibility and who should bear the risk for failure. Both InSTEDD and Dnet recognized that Verboice could fail to be accepted by mobile operators. Given Dnet's obligation to guarantee reliable message delivery for Aponjon subscribers, it declined to move ahead with the InSTEDD contract in the absence of explicit direction from USAID that it wanted to assume the risk.
- Additional unresolved issues included how ownership and support for the open source license would work, delineation between Aponjon reporting capabilities and call handing capacities, and scheduling of deliverables within tight timelines.

In summary, there is commitment to exploring feasibility of alternative open source platform such as Verboice for Aponjon. Due to time and resource constraints, Dnet staff managing the technology and mobile operator negotiations needed to focus first on the successful expansion

of the current SSD-Tech network to ensure successful transition to national launch. Once national service is in place, attention can turn to securing more cost effective options.

> **Recommendation**: It is SHOPS assessment that InSTEDD's Verboice platform provides a "test-ready" application which should be implemented early in the first year of national launch. Current deployments of the Verboice platform in other markets provide potential for cost-share partners to create new iterations with expanded functionality.

SUMMARY RECOMMENDATIONS

A Vision for Aponjon Platform Evolution Is Needed

USAID and Dnet should jointly develop agreed-upon characteristics for Aponjon solution that can guide future contracts for the program. Elements of the vision should include:

- Preference for Dnet ownership to reduce long-term dependence on third party providers
- Commitment to Dnet capacity-building as needed to ensure cost-effective maintenance and adaptation of Aponjon service
- Maximum ability to export, reuse, build upon and leverage Aponjon technology investments
- Adoption of internet-based IVR design to reduce hardware-dependent costs

Dnet Research and Development Funds should Be Allocated for Web-Based IVR Solution

Aponjon is well-positioned to drive innovation in IVR platforms that are less hardware-dependent and tied to proprietary third party systems. By making this investment during first year of Aponjon launch, key questions about feasibility can be addressed early and better decisions made about platform design and budget. Risks of IVR innovation investments through an “incubator” model should be explicitly acknowledged as appropriate to realize future benefits.

Dnet should Enter Contract to Test Verboice Platform to Inform Future Technology Options

Verboice architecture enables Dnet to improve and innovate Aponjon design more easily than through costly Change Request process with SSD-Tech, with potential for much lower infrastructure costs. Rapid testing and demonstrations should be required to test scalability of Verboice with network operators and internet service providers, with frequent stakeholder meetings to re-evaluate progress. InSTEDD software engineers can be contracted to design solutions in parallel with Dnet technical staff so that future support is sustained locally and through the open source community.

Alternatively, Dnet can solicit bids through a competitive RFP process, to explore whether better alternatives exist, to confirm assumptions in this report. Such an approach is consistent with USAID procurement policies and may uncover innovative solutions not previously identified in this fast changing industry. An open bid may result in enhancements to design of Aponjon application features, and allow comparison of independent aspects of Verboice option including cost and functionality of gateway interface. The trade-off is potential that time and effort is expended fruitlessly prior to understanding mobile operator constraints which can be documented with quick testing of Verboice.

Dnet should Integrate Verboice Platform Testing with Internet Service Provider

In parallel with InSTEDD agreement, or other standards-based IVR software program, Dnet should enter agreement with local ISP to support rapid integration and testing of VoIP service. This will expedite identification of technical and operational challenges to deploying VoIP solutions. Issues to be resolved include potential local operator requirements limiting efficiencies of VoIP. Dnet should also explore relative cost benefits of outsourcing hosting of Aponjon by ISPs who may provide lower overhead costs, greater reliability and ease in scaling than self-hosting options.

Agreement Is Needed to Clarify Roles and Responsibilities for Supporting Open Source Platform

Verboice is open source and IT programmers are using and contributing to it. To optimize this process, organizational support from InSTEDD or others should be specified. This will include responsibility for creating documentation and training materials, providing online technical assistance, quality assurance and oversight of outputs, and a mechanism to manage the community of developers and users.

Direct Negotiations between Dnet and Mobile Operators should Continue without Reliance on Third-Party Aggregators or Platform Developers.

In order to understand what is possible, face-to-face negotiations between Aponjon owner Dnet and mobile operators is essential. As demonstrated in the past two years, operators vary considerably in their network infrastructure, billing systems, willingness to innovate, business priorities, geographic coverage, relationship with regulators, and competitive position. Some may be more willing than others to pilot a new IVR approach, and differentiate themselves in a highly competitive environment. The evolution of Aponjon is likely proceed with innovations amendable to one but not all operators, providing valuable experience with novel technical approaches. There may be new network investments needed that could be deployed on a cost-share basis, or other workarounds which could be devised to ensure successful operations. Critical questions to be answered during rapid pilot and testing include:

- What barriers and challenges will mobile operators have in connecting to a new IVR platform and what can be done to address operator concerns?
- What business incentives are needed for mobile operators to support new IVR models?
- How can charging gateways be configured to accommodate billing interface requirements and complexities such as variable pricing?