Building Scalable and Distributed Voice Forums in the Developing World

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Joint work with Bill Thies
Voice Remains Primary Interface for Mobile Subscribers in India

• Most subscribers lack smart phones
  - Smart Phone: < 5%
  - Feature Phone: 50-70%
  - Basic Phone: 30-50%
    (e.g., music player)

• Text interfaces hindered by:
  – Low literacy (33% of adults in India are non-literate)
  – Language diversity (font support for tribal language?)
Interactive Voice Response in India

• Interactive Voice Response (IVR) allows humans to interact with computers by placing a voice call

• In 2010: $750M from value-added IVR services
  – Expected to grow to $3 billion by 2020

• Examples:
  – Ringtones, music, jokes, astrology
  – Booking movie tickets, travel, mobile commerce
  – Tata’s Behtar Zindagi program: information for farmers with over 10,000 voice prompts
  – Screening for Kaun Banega Crorepati
Voice Forums for “Development”

Citizen News Journalism
Mudliar et al. ICTD 2012

Community Radio
Koradia et al. ICTD 2012

Viral Entertainment Platform
Raza et al. ICTD 2012

Feedback on School Meals
Grover et al. DEV 2012

Content Creation and Dissemination by Rural users
Agarwal et al. ICTD 2009

Avaaj Otalo: Agriculture Discussion Forum
Patel et al. CHI 2010

Community driven Intelligent Maps
Kumar et al. ICTD 2009

(Phone Broadcasting System for Sex Workers)
Sambasivan et al. CHI 2011

(Healthline: Access to Health Information)
Sherwani et al. ICTD 2007
Example: CGNet Swara
A Voice Forum for Citizen Journalism

• Anyone can report news, issues, etc. in local language
• Submissions are reviewed by moderators over the Web
• Appropriate submissions are published:
  – For playback on audio channel
  – For browsing on Web
  – Some submissions seed stories for posting on CGNet site + list
How to Build a Voice Forum?

• Option 1: Leverage a hosting provider
  - Limited availability; can be expensive

• Option 2: Build and host it yourself
How to Build a Voice Forum?

Limitations of Existing Tools
(Freedom Fone, FreeSWITCH, Asterisk)

| Host your own website for content moderation and distribution |
| Runs on Linux |
| Ad-hoc implementation, tied to single infrastructure |
| Centralized server implies long-distance calls |

A new open-source system that combines other free and commercial tools into an integrated platform to facilitate creation of Distributed and Scalable voice forums.
# How to Build a Voice Forum?

**Limitations of Existing Tools** *(Freedom Fone, FreeSWITCH, Asterisk)*

<table>
<thead>
<tr>
<th>Feature</th>
<th>IVR Junction Offers</th>
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</thead>
<tbody>
<tr>
<td>Host your own website for content moderation and distribution</td>
<td><strong>Easier setup</strong> and <strong>Cost-effective</strong>, <strong>Distributed access points</strong></td>
</tr>
<tr>
<td>Runs on Linux</td>
<td><strong>Runs on Windows</strong></td>
</tr>
<tr>
<td>Ad-hoc implementation, tied to single infrastructure</td>
<td><strong>Standardized code (VoiceXML)</strong>, portable across infrastructures</td>
</tr>
<tr>
<td>Centralized server implies long-distance calls</td>
<td><strong>Distributed servers</strong> enable local calls</td>
</tr>
</tbody>
</table>
A person calls voice application

Recorded message is stored in Laptop
A person calls voice application

Recorded message is stored in Laptop

IVR Service Users or Listeners in Delhi

Other callers

IVR Junction uploads this message on YouTube
IVR Service Users or Listeners in Delhi

A person calls voice application

Recorded message is stored in Laptop

Moderator either approve or reject the post

IVR Junction uploads this message on YouTube
How IVR Junction Works

A person calls voice application

Recorded message is stored in Laptop

IVR Service Users or Listeners in Delhi

Moderator either approve or reject the post

IVR Junction uploads this message on YouTube

Approved posts are
- accessible at YouTube for Internet audience
- uploaded at SkyDrive or Dropbox
- can be posted at Facebook
- Available for listening to callers of IVR service
**Implementation**

- Key functionality: Synchronize content across different platforms and to present a unified interface to the user

<table>
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<th>Feature</th>
<th>LOC</th>
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<tr>
<td>Caller Interface</td>
<td>700 of ASP.NET, VoiceXML and C#</td>
</tr>
<tr>
<td>Admin Interface</td>
<td>1500 of ASP.NET</td>
</tr>
<tr>
<td>Synchronization with Moderators</td>
<td>3100 of C#</td>
</tr>
<tr>
<td>Synchronization with other branches</td>
<td>1300 of C#</td>
</tr>
</tbody>
</table>

- Implemented
- Various deployments are in progress
- Expected to be released this summer
Setting Up “Your” Voice Service

• Laptop
• GSM or Fixed line modem
• SIP and VXML interpreter software
  – Voxeo Prophecy 11
• IVR Junction and Application code
  – Free and Open source
  – Utilizes free Microsoft components like IIS Express, MS SQL Server Express, .NET framework 4 etc.
• YouTube account (free)
• SkyDrive or Dropbox account (free)
• Facebook page
is Easy to Set Up
Supports Parallel Lines

You can have as many parallel lines you want

- **1 line set up**: Modem - Laptop running Prophecy and IVR Junction - 1 port
- **2 line set up**: Modem - Laptop running Prophecy and IVR Junction - 2 port
- **4 line set up**: Modem - Laptop running Prophecy and IVR Junction - 4 port
- **4 line set up**: Single modem which supports 4 lines - Laptop running Prophecy and IVR Junction - 4 port
Power Applications

• Voice forums similar to CGNet Swara and Avaaj Otalo
• Phone Broadcasting System utilizing distributed architecture for lower outgoing call rates
• Any voice forum connecting users in different countries
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Future of Scalable Voice Forums

• Moderating content at scale
• Managing call costs at scale
Moderating Content at Scale

• Run a call center of content moderators
  – Like Just Dial
  – Challenge: difficult to maintain consistent judgment, quality and accountability across all moderators

• Community Moderation
  – Analogous to reddit, Digg, Slashdot, Quora, Stackoverflow
  – Easy to penalize those who try to game the system as phone number is unique identity
  – Challenge: taxing to listen to long voice posts
    • Hybrid model: transcribe audio posts on web using crowdsourcing. Moderators can moderate a voice forum by reading text rather than by listening to posts
  – Challenge: how to protect anonymity of participants of a sensitive voice forum before community moderation
    • Voice anonymizer can be used to distort the recording enough to prevent recognition of speaker
Managing Call Cost at Scale

• Use Distributed Architecture
• Deliver audio over data rather than voice
  – Streaming download from Web
  – Use “content caching” mobile application
    • Can also offer meta-data, search, that reduces traffic
  – Limitation: require users to have access to and familiarity with feature or smart phone
• Leveraging offline, peer to peer dissemination
  – Limitation: applicable only for those voice applications whose users are motivated to share the content with peers, have Bluetooth enabled cell phones and knowledge to send files via Bluetooth
Conclusion

• IVR systems can provide innovative information services to mobile subscribers in the developing world
• Complexity in setting up IVR systems, and challenges in moderating content and managing call costs limits impact
• IVR Junction
  – is a new and open-source system built on Windows platform
  – simplifies installation and configuration
  – enables interplay between Internet users and phone users
  – utilizes a distributed architecture for affordable sharing of audio content across different locations
• There are further opportunities to manage content and call costs at scale
Thanks!
Seeking Users!
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