Low Cost TV Based Messaging for Remote Desert Communities

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***Abstract*—In recent years telecommunications services in remote Australia have received considerable attention, with services for indigenous desert communities a key focus. This project, known as Desert Interactive Remote Television (DIRT), uses existing community rebroadcast TV infrastructure to provide low cost multimedia messaging services for remote desert communities. The system architecture, key applications, and field trial outcomes are described**

Keywords-remote communications, community re-broadcast TV

I. INTRODUCTION

The Australian Government has devoted significant resources to improving telecommunications services in remote Australia. The 2002 Regional Telecommunications Inquiry [1] reported significant improvements in regional and remote telecommunications services, with services for indigenous communities a key exception. The Telecommunications Action Plan for Remote Indigenous Communities (TAPRIC) was formed as a response, with improved payphone access a major focus. Following this, a new program, known as "Backing Indigenous Ability" is now starting, with around $90M for indigenous broadcast and telecommunications services [2].

Motivated by this need for improved remote indigenous telecommunications, the Desert Interactive Remote Television (DIRT) Project, part of the Desert Knowledge Cooperative Research Centre (DK-CRC), has developed and tested a low cost Internet based messaging system, which uses community re-broadcast TV infrastructure as a delivery platform.

The DIRT project team combines technical development capabilities (University of Wollongong) with expertise in Interactive TV design and evaluation and experience with indigenous community dynamics (Murdoch). It is our view that, for remote indigenous communities, studies of the social implications of new telecommunications technologies must proceed in tandem with technical developments. In particular, testing communications services in remote communities requires an understanding of the unique dynamics of these places. Past work in this area by DIRT team members is outlined in [3].

The DIRT messaging application developed in the project is known as "GoDot". Following consultations with stakeholders, four basic GoDot message types have emerged, as follows:

- Emergency Messages: These messages would be generated by emergency management organisations (Bureau of Meteorology; fire service; police; etc) to alert remote communities of potentially dangerous situations (e.g. severe storms ; bush fires).

- Agency Messages: These messages would originate from government agencies (e.g. Dept. of Health and Community Services), or other organisations registered with the 'GoDot' system (e.g. community support NGOs or commercial organisations). They would relate to the delivery of services to particular communities (e.g. providing details re a forthcoming visit by health workers or legal case managers; etc).

- Sports and Culture Messages: These messages may come from sporting associations (e.g. re an up-coming football carnival) or could be generated by a community group wishing to advise others about a cultural or other type of community event (e.g. concert; 'sorry' business).

- Targeted Advertisements: These could be government advertising messages (e.g. health promotions), ideally community (or language group) specific - using appropriate language and featuring people and places familiar to the community. The impact is further improved if the community participants are involved in the creation of these messages.

Further details of potential messages, as well as our approach to remote community engagement are in [4], along with survey results of remote indigenous TV viewing patterns.

This paper outlines the messaging system which has evolved following our field trials. Section II outlines TV reception methods for remote communities. Section III describes our proposed system, with implementation details in Section IV. Section V discusses some of the outcomes from our field trials. Section VI concludes the paper.

II. BACKGROUND

Remote desert communities receive television in three ways. The first is Direct to Home (DTH), sent over the Optus Aurora platform and received via individual satellite dishes and Set Top Boxes (STBs). DTH is used in very small communities, e.g. eight houses or less. The second method is community re-broadcast (CRB), used in larger communities. Here satellite TV programs are received at one central satellite dish, then re-broadcast over analog channels by low power

transmitters. Community re-broadcast viewers use analog receivers, and hence cannot access interactive content (in the usual way). The third method is satellite pay TV, which provides pay TV (Austar or Foxtel) programming. For this project, our key focus has been community rebroadcast, as it is by far the most common delivery method for remote indigenous community TV. Figure 1 shows the DTH and community rebroadcast architectures

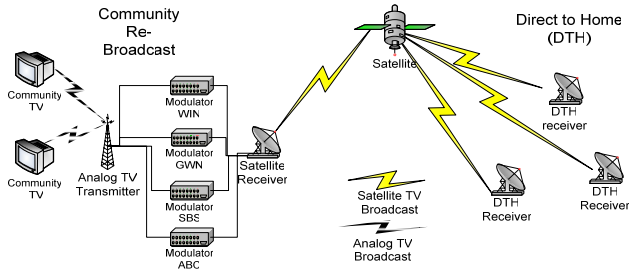

Figure 1. Community Rebroadcast and DTH architectures

III. SYSTEM OVERVIEW

Interactive TV (iTV) generally assumes digital reception. This allows a given program to have multiple components, which are presented selectively, under the control of the iTV application. Clearly this type of interactivity is not possible with a CRB (analog) TV situation. Given the high cost of conversion to digital television in very remote areas, it is unlikely to happen for many years. Hence we have chosen a two simpler approaches, which we have named "Call to Action" and "Targeted Advertisements".

The "Call to Action" approach has two key elements:

- an incoming message alert system, comprising transparent icons (or "bugs", similar to station IDs) overlaid on to the broadcast channels. The format and timing of these icons will be controlled by the DIRT system.

- a separate local analog channel, which carries the actual messages, in a continuous loop. The overlaid icons alert viewers to new messages in this loop.

To view the messages, users switch to the separate messaging channel, wait until the desired message has been played, before returning to the previously viewed channel. This provides a basic level of interactivity, where the users view messages due to prompting from the overlaid icons on the broadcast channel. The audio/video content of these messages is a big improvement on text only messaging, as many Aboriginal people understand spoken English much better than written. Audio can also be in the local language. A set of 4 or 5 main languages should cover the majority of people in the central Australian region, although there are many more local languages (at least 15). However most people are multi-lingual, at least to some extent. The dynamics of this type of iTV use was a key part of the pilot study evaluation.

The ability to combine icons and other message alerts, delivered via the Internet, with off-air satellite TV broadcast, is not provided by standard TV broadcast equipment. Hence custom infrastructure to do this was designed and built, as part of the project work. The key component of this equipment is the Hauppauge Nexus satellite receiver card, which provides the required reception, conditional access, MPEG decoding and TV signal generation capabilities, as outlined in section IV. These cards fit with standard Linux based PC infrastructure, allowing a relatively low cost implementation.

Within a community rebroadcast context, however, the overlay of icons on to existing broadcast channels raises significant licensing issues, as the community rebroadcast license (currently) specifically prohibits changes to content. Hence we have also developed a simpler approach, where messages are seen on the Indigenous Community TV (ICTV) channel only. This channel is covered by a community license, which allows this local message insertion. The timing of message insertion is determined by the communities, not the ICTV broadcaster. The proposal is that the ICTV broadcast is delayed locally (i.e. stored in a similar manner to a Personal Video Recorder) while messages are played out, resuming after the messages are finished. As a result, viewers do not miss ICTV content. There would be a once per day correction to the local ICTV broadcast, done when viewers are unlikely to be affected (e.g. 3 am), to return the receiver to real time reception.

We have named this second system "Targeted advertisements", as the messages (nominally of similar length to TV ads) can be targeted to or created by individual communities.

The infrastructure required for this ICTV single channel approach is shown in Figure 2. The DIRT message server/ICTV receiver is located with the other community rebroadcast infrastructure, as shown in the figure. This device receives the satellite ICTV broadcast, and passes the resulting video to the local analog TV transmitter, similar to the other channels. The device also sends the message video to the transmitter at predetermined intervals, interrupting the ICTV broadcast to do so. The device is also connected to the local data network, and can hence be reached via the Internet. This allows messages to be delivered to the server, either from computers within the community or in other locations (e.g. Alice Springs, neighbouring communities). As shown in the figure, received messages must be authorized, over a separate interface, before local transmission occurs.

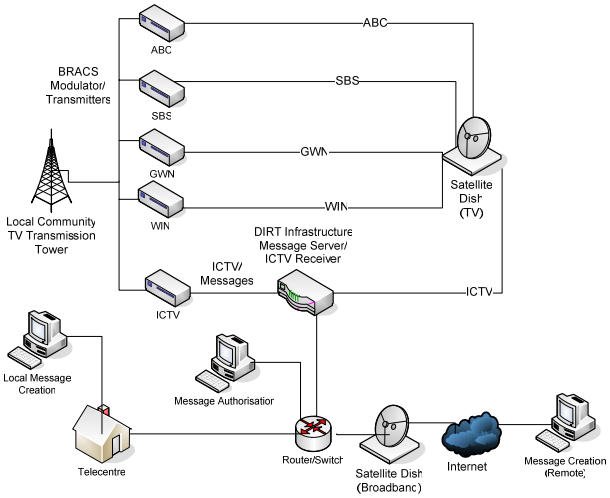

Figure 2. DIRT System Architecture

The timing of message playout in this system is controlled by the device, and is not synchronised to the ICTV broadcast. As mentioned, the proposal is that individual communities control the timing of message playout, through a Web based interface to be developed as part of the system. This allows a simpler (and cheaper) implementation, as no changes to the broadcast stream are needed, as would be required for precise alignment of locally stored messages to program breaks. The downside is that message insertion may occur at bad times (e.g. at a critical stage of a football broadcast). However, this system is intended for ICTV (in the first instance), where the current programming appears to be more amenable to interruptions from the proposed messages.

A. Message Creation

A fundamental system requirement is easy message creation, without assistance from skilled technical staff. Hence a simple web based message creation application is proposed, and is currently under development. This application will allow messages to be created locally, or by remote service agencies, e.g. in Alice Springs. In the latter case, messages would delivered by satellite or terrestrial broadband.

Bandwidth for satellite broadband is currently a limited resource in remote communities, with 1 Gbyte a common monthly download limit. MPEG video message delivery via satellite broadband would severely impact this monthly quota, which, for example, could be exhausted by about an hour of messages (depending on the type of compression used). Hence we propose that the standard message type be audio, which is played out with a locally stored video segment identifying the message originator (e.g. Dept of Health, the Community Coordinator, a local elder). Delivery of audio messages via satellite broadband would have minimal impact on download quotas.

The Web based application for creating messages must produce audio which is suitable for broadcast, i.e. without long silence intervals before the initial speech, minimal background noise, and at a volume level suitable for broadcast. A java based application to do this has been developed at the University of Wollongong. Message creation also includes specifying message playout intervals. This information, along with the message author details and the audio are then sent to the server located with the CRB infrastructure, as shown in figure 2. This server incorporates the messages into the local broadcast stream.

The proposed system includes an authorisation phase before messages are played out. Here messages are viewed by a community leader (or designated agent), who then allows/forbids broadcast. This also provides an audit trial.

B. Billing

The DIRT system is designed to be owned, operated and controlled by local communities, as part of their CRB infrastructure. In particular, a given community will determine which externally generated messages it wishes to view, and from whom messages may be received.

Given local ownership of the DIRT system, we propose that external agencies should pay communities directly for message broadcasts. This model contrasts with the existing one, where broadcasters are paid for delivering TV ads. This local billing would, for example, fund staff time for system maintenance. Clearly bills would need to be aggregated, e.g. all Ngaanyatjarra communities sending a single bill to the Department of Health for broadcasting advertisements targeting healthy eating.

IV. IMPLEMENTATION

The Dirt prototype infrastructure comprises three components, a combined satellite TV receiver/message server, a web based interface for controlling the server, and a java based audio message recoding application. Details of these components are as follows:

A. Satellite Receiver/Server

This system comprises a 3U rackmounted case, housing a Linux server. The server is fitted with 2 Hauppage WinTV Nexus-S PCI DVB-S receiver cards, allowing overlays to be placed on to two channels. Each receiver card has an external Conditional Access Module (CAM), and a hardware MPEG stream decoder, providing composite audio/video as well as S-Video outputs. The server also has an AGP video card, which, with the built in audio, provides a separate messaging channel output, as required for the “Call to Action” system. The server has a large hard drive for content storage.

The satellite cards support a basic programmable on-screen display interface, which allow an overlay to be placed over part of the screen. The on-screen-display is stored in video memory on the MPEG decoder, with a limited palette of 256 colours. However, it is possible to alpha-blend the overlay image with the television picture in the PCI card hardware, allowing control over on-screen display appearance. In particular, position, size, and transparency can be controlled via the external interface.

B. Server Interface

A Web based PHP interface has been developed to compose and transfer overlays to the server, as well as video segments. Overlays may comprise text and/or logo images, which are combined into a single image for the on-screen display. This image may be scaled via the interface, along with its location on the TV screen. In addition, a brief recorded segment of the resulting video at the server may be returned to the interface, to ensure that the composite broadcast video and overlay are satisfactory.

C. Message Creation Application

A java application has been developed to input audio messages via a simple graphical user interface, using a USB headset. The recorded audio message is processed to remove initial silence periods, background noise, and to ensure a volume level suitable for broadcast.

V. Field Trials

The DIRT project has devoted significant effort to building relationships with remote indigenous communities, to gain insight into potential applications, and to trial prototype messaging platforms. The communities of Irrunytjy and Kanpa, in the Ngaanyatjarra Lands in Western Australia have hosted multiple visits from the DIRT project team. Daniel Featherstone, the media coordinator for the Ngaanyatjarra Lands, has been the key facilitator for these visits.

These field trips have had two main objectives. The first, to determine potential messaging applications and patterns of indigenous TV viewing, has been detailed in [4]. The second objective has been to trial a prototype of the messaging system outlined in the previous section.

Our prototype equipment allowed both the Call to Action and Targeted Advertisement systems to be tested. Due to the relatively short time spent in the communities, a detailed understanding of the system impact could not be obtained However, we were able to see that the TV messaging could have a significant effect on community dynamics

A more detailed examination of community interactions resulting from DIRT system use will form the next phase of this project. To do this, extended field trials in Ngaanyatjarra Lands communities are currently being planned.

VI. Conclusions

A system for delivering multimedia messages to TV screens in remote indigenous communities has been described. This system combines existing community rebroadcast equipment with new DIRT project infrastructure, to send messages to specific remote communities, relating specifically to their needs, e.g. health, cultural business. A prototype system has been built and tested in the Ngaanyatjarra Lands, in Western Australia.

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