Voice Over IP for Rural Telecommunication Provision

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INTRODUCTION

With the continual convergence of analogue technologies with those either simulated or implemented in digital based equivalents, future benefits usually involve better reliability and lower costs. As current technical limitations are removed, the literature does not show any large scale assessment of the legal and security implications of the removal of cables in this digital world or the effect of a move toward wireless transmission in this context. Neither Voice Over Internet Protocol (VoIP) nor IEEE 802.11b is new technology, but the combination of these services to provide a primary telephone network for small regional centres is an innovative solution to rural telecommunication problems.

There are many companies, especially in the context in rural Australia, currently developing satellite communication networks for regional communities to access broadband equivalent internet access, generally where this type of bandwidth is usually unavailable. Reasons for insufficient access primarily are due to lack of infrastructure and this can be directly attributed to either the remoteness, or to the effect of a low level of population some areas which generally equates to the lack of potential return on investment for telecommunication companies wishing to establish infrastructure out to these regions.

The cost of implementing a traditional wired infrastructure to reach these lowly populated regions offers no great reward to the companies providing the service and therefore they usually discount such an expansion or explore other means to provide the minimum service required by the Australian legislation to every household.

Australia's primary telecommunications company, Telstra, who has a majority owner in the Australian government, is required to meet service supply standards to all Australian households—no matter the geographical location. Service levels to regional and remote regions of Australia are similar in quality to that of highly populated metropolitan areas but traditionally limited in the services they are required to provide. While current telephone coverage is of an acceptable level, the growth of internet access, among other forecasted future technologies requiring data like infrstructure (IP), has caused great bottlenecks within current solutions and network providers such as Telstra are exploring ways to overcome this. Simply stated, the infrastructure available was implemented with limited foresight and will not scale to accommodate these new and emerging services.

Satellite usage, among other networking technologies, is now being tested and implemented to allow for the delivery of large volumes of IP traffic to regions which are not covered within the major telecommunications network infrastructure. Most of these technologies being explored take the form of wireless. Included benefits of wireless such as the substantial cost reduction achieved with the avoidance of installing long distances of cable and infrastructure. Satellite, particularly with the use of KA band services, allows for clients to connect in a bidirectional fashion with very small aperture terminals (VSAT), transmitting via satellite hub locations to apertures in similar trip times to that of wired infrastructure.

The principle of satellite, and other technologies, is packet switched based usually on the underlying infrastructure of digital transfer as compared to analogue transfer used within the current circuit switched networks. While this provides significant increases in the amount and types of traffic which can be transferred simultaneously, it requires the translation of current analogue technologies, such as telephone and fax, to digital equivalence and back again to analogue to simulate current models. As with most of the services proposed to be offered, and in VoIP in particular, the timing and delivery model are of the upmost importance to ensure the quality of service for all users. Substantial fluctuations in the time for the delivery of digital packets can confuse the protocols and participants, making the phone call seem unnatural in comparison to current phone usage.

VoIP, as a standard, attempts to simulate the current analogue telephone call but utilises the advantages of digital networks with its ability to generate, route and receive phone calls. Of major concern is the efficiency of the network, along with quality of service (QoS), integra-

tion with plain old telephone systems (POTS) and last mile connections. Small companies hope to address some of these issues by offering clients access to metropolitan like services in regional Australia using the benefits of wireless communications not only for the major distance (satellite) but also at the last mile with wireless local loops in the form of 802.11b to connect to this service.

WHAT IS VoIP (VOICE OVER INTERNET PROTOCOL)?

This suggests traditional telephony, which is a circuit-switched technology, can be adapted or interact with an IP network (Marjalaakso, 2003). One may pose the question of why the traditional phone systems must be updated or complemented while it appears to be satisfying current requirements?

BENEFITS OF VoIP

Not only are the merging of voice and data traffic down an individual stream financially beneficial to users, but possible services provided are greatly increased with the ability for scalable updates over time, a characteristic not associated with the traditional analogue telephone network.

Financial Benefit

McPherson reports the financial benefits alone are not enough to entice a large scale of take up of VoIP (McPherson, 2003). Although it is known the cost of a packet switched network for VoIP is approximately half the cost than that of a circuit switched network, an end user will not be aware of these costs other than the monthly subscriber bill. Thus, the financial benefit will be the greatest selling point of the technology to customers and it must be highlighted and marketed openly.

How these vast financial benefits are achieved is due to the architecture of IP networks, and the ability for intelligent navigation (routing) to occur. This gives the appearance that the VoIP solution determines the cheapest method to place the call, when in fact it is predetermined by routing tables within the network. The private network is intelligent and directs the phone call to enter the PSTN where a local call charge will be incurred rather than that of a long distance call. The financial benefit is appealing but IP networks are not always reliable—particularly with time sensitive information.

Other benefits can include no external bills generated by internal calls, even if geographically separated. If a phone call is routed the entire distance via the IP network and never enters the PSTN, no third party bill will charge for that call, as compared to a leased line solution. An example of this is a company with many offices interconnected via broadband links into the internet using VPN connections to secure communications.

Service Benefit

The integration of two networks into one provides maintenance benefits, but is the convergence of voice and data a good relationship? Marjalaakso (2003) predicts the VoIP will compliment the already existing Internet based services such as web, email and newer technologies like net meeting and instant messaging.

SECURITY VULNERABILITIES OF VoIP

As with all technologies it is essential to examine whether customers confidentiality, integrity and availability to their conversations, data and service are preserved. Marjalaakso (2003) discusses the inbuilt security of standards such as SIP, but summarises that these are not valid as they are flawed and knowledge is widespread about such vulnerabilities. While this is true and valid, the level of encryption and secrecy on telephone services for domestic users and the current level of secrecy on circuit based networks must be determined.

Other risks associated with VoIP implementations are categorised below, using the traditional security goals of confidentiality, integrity and availability.

Confidentiality

Confidentiality concerns one's ability to remain anonymous to outsiders while being able to disclose information for authorisation and billing. Issues in confidentiality include eaves dropping and tapped. The Australian Telecommunications Act allows for a call entering a public network to be "tapped". In 2001-2002, 2,500 authorised phone tapping warrants were issued to authorities, with prosecutions from the information gathered from authorised tapping rising 48% proving this to be a valuable weapon for law enforcement. Thus it is an essential requirement for VoIP to be able to provide a similar or better attribute than current networks.

While current telephone networks offer no encryption on transport it is an attribute that is required for VoIP as it merges into accessible networks and makes the task of