

WTL Space Agency project gives boost to VoIP over satellite!

Introduction

World Telecom Labs NV (WTL), a Brussels-based pioneer in VoIP equipment for telecom operators has recently completed a development contract with the European Space Agency (ESA). The contract, under ESA's Artes 4 program, provided joint funding for a series of developments designed to make WTL equipment perform an even better job for telecom operators wishing to use emerging low cost satellite services. WTL already has an excellent track record in providing equipment for voice services using satellite trunking. A key benefit in this area has always been the superior bandwidth saving capability of WTL's patented NOP (Network Optimisation Protocol). One focus of the ESA project was to modify NOP to operate efficiently over DVB-RCS services. The lower price point of DVB-RCS equipment and space segment means that this will be of great interest to operators particularly in the developing world.

One of the main results of the project was to prove, using an independent voice quality laboratory, that WTL equipment matches or outperforms regular SIP and H323 gear whilst using half the satellite bandwidth!

This is believed to be the first project that ESA has funded in the area of VoIP and indicates a firm belief in VoIP as a suitable technology for use over satellite and in WTL equipment as a good platform for this.

Project Objectives:

The project addressed the difficulties of carrying VoIP (Voice over IP) traffic over shared satellite services (especially DVB-RCS) and has resulted in a range of WTL products which allow telecom operators to deploy a range of satellite-based commercial services.

The platform for the development was WTL's existing IPNx, SoIP and PVx switches which are already successfully used by terrestrial telecoms operators all over the world. In order to make the products more suitable for satcom operators WTL's patented NOP (Network Optimisation Protocol) was adapted. NOP is currently used to improve the bandwidth utilisation of VoIP traffic within a telephone network. The resultant products are now suitable for use with VSAT or other low cost satellite services. The project included an extensive beta test in a live network trialling the use of DVB-RCS links for VoIP.

The project was divided into 2 phases:

Phase 1 built a DVB-RCS reference network and used emulation tools to characterise the issues currently affecting the quality of VoIP over satellite.

Phase 2 implemented the improvements identified in Phase 1 and culminated in a Beta Test installation using VoIP over DVB-RCS with a live telecom operator.

Features

1. VoIP over DVB-RCS: New algorithms were created for the ways in which IP voice packets are processed after they have been encoded from normal analogue speech and before they are transmitted over the IP network. This made the voice traffic more resilient to the greater packet loss, delay and jitter that are typically found on these links.
2. WTL Equipment Management over Satellite: Current management tools have been extended to ensure that all operations can be carried out as effectively remotely as they can locally. The objective was that remote management should consume a minimum of the satellite link capacity leaving as much as possible for revenue-earning voice calls.
3. IP-based IVR ("Soft IVR"): An IP-based Interactive Voice Response (IVR) system for Pre-Paid customers was developed to reside in the WTL switch at the remote site. This had 2 benefits; a) the cost of equipment in the remote location is dramatically reduced (dedicated DSP-based hardware is replaced with a software-only solution), b) decentralising the caller authorisation function means less delay for the user and reduces the need for the operator to use satellite bandwidth for this stage of the call.
4. Independent Laboratory Testing: The improvements made to the WTL products were verified by a respected voice testing laboratory.

Predicted Benefits

The ability to use optimised VoIP over DVB-RCS gives long distance telecom operators many new opportunities. Wholesale operators will make major savings carrying bulk traffic in and out of destinations in Africa and Asia. The Retail segment of the telecom market will enjoy the bandwidth savings but also the use of Soft IVR to deliver a low cost Pre-Paid service locally is a breakthrough in cost terms. The lower cost of infrastructure and space segment is likely to be particularly appealing to less developed countries where telecom provision is still sparse and significantly lowers the barriers to entry for new operators.

Key Issues

The key issues encountered were:

- a) The achievement of high audio quality whilst using very low amounts of satellite bandwidth (10 calls in 64K bps).
- b) Jitter (delay variation) tolerance.
- c) Resilience to packet loss (up to 5%) without serious degradation.
- d) Packet prioritisation of real time (voice) traffic.
- e) The effect of Bandwidth on Demand
- f) Remote management of the equipment whilst using very little link capacity

- g) The design of an algorithm for the software detection of DTMF digits in a VoIP stream
- h) Design of a method for playing constant tones during a VoIP call (to match the tones normally played to the user by a standard telephone network)
- i) Resource management of multiple simultaneous IP streams playing tones or messages to many concurrent users
- j) Use of an independent test laboratory for objective MOS voice quality scores.
- k) Management of a successful live customer trial.

Results

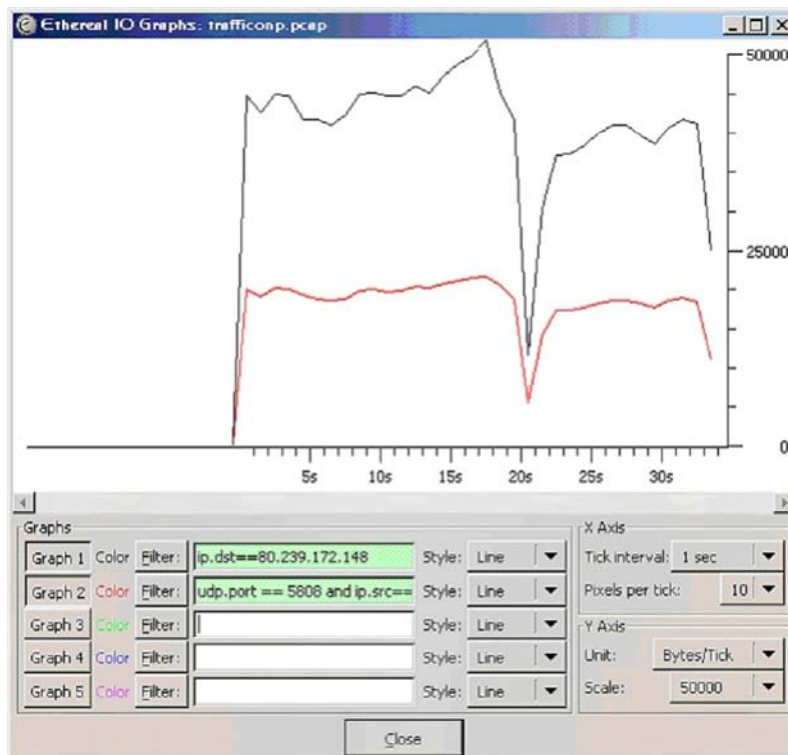
The key result was proof that NOP can save operators half the cost of their satellite bandwidth for carrying VoIP calls. At the same time there will be no loss of quality (in some cases there are even improvements!) This benefit holds true even in poor network conditions.

Codec	UNLOADED NETWORK			LOADED NETWORK		
	NOP	SIP / H.323	Diff. %	NOP	SIP / H.323	Diff. %
G.723.1	3.8	3.8	0%	2.6	2.5	+4%
G.729	3.8	3.8	0%	2.8	2.9	-3%

The following graph uses data from the live customer Beta Test. It shows 18 simultaneous calls to/from Gambia using a mix of G723 and G729 traffic. It can clearly be seen that the bandwidth usage of NOP is half that of H.323 (around 20K bps compared to over 50K).

Case Study... Case Study... Case Study...

Changing the Way the World Communicates



--- = NOP

--- = H.323

Table 2: Bandwidth Usage NOP v. SIP/H323

The following results also emerged from our beta testing:

- The new software delivered the various enhancements with a very high degree of **reliability**.
- **Voice quality** of calls which involved the new NOP enhancements was acceptable for commercial use.
- High **network traffic load** had no greater detrimental effect on NOP-based calls than on RTP-based calls. Voice quality was maintained within acceptable boundaries.
- Typical **jitter and packet loss** experienced on customer satellite link did not seriously affect call quality.
- The **Soft IVR** system proved totally reliable, and should give major cost-efficiency benefits.
- **Remote management** consumes less than 500bps in passive mode but can burst up to 10Kbps when major updates or status enquiries are active.
- The customer was highly satisfied with the **remote management** capabilities of the WTL equipment.