RHIZOMATICA

Redes por la Diversidad, Equidad y Sustentabilidad A.C.

Community cellular telephony and broadband networks

Summary

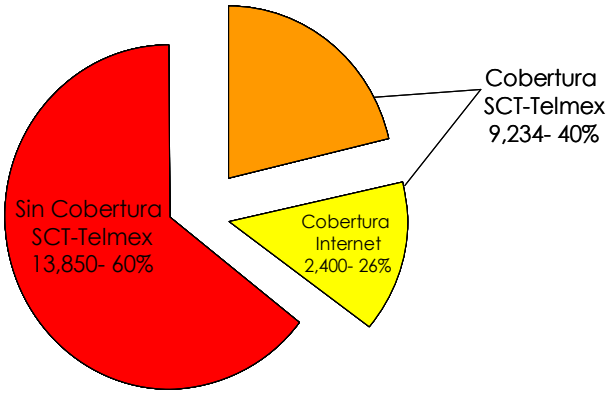
The project consists in implementing a new system for fostering the provision of rural broadband services through community cellular networks, facilitating the availability of frequencies for this type of communication and facilitating funding for the purchase of equipment, together with a system of training and technical support based on the training of community technicians and a rural support network. Schemes for the provision of service in rural communities encounter the following problems: high costs for the operator and the need for government subsidies; a high incidence of faults and long waiting times to have them repaired, coupled with high costs that make this unaffordable. In its recommendations on public policy for rural areas and indigenous communities, published in the Connect a School initiative, ITU highlights the importance of fostering the development of companies based on economies of scale which enable the provision of local services. The project will assist Mexico and other countries that do not currently have such a programme to develop one, thereby enabling communities, through the use of available technology, to have cellular telephony and data transmission services at affordable prices, operated by community enterprises. In line with ITU's recommendations, the project seeks to establish an appropriate regulatory format and obtain the necessary frequencies, seed financing and technical support for the development of those enterprises.

Current situation

According to ITU, two to three billion people worldwide lack affordable mobile telephony services which enable vital communications and access to information. Owing to saturation of the market in developing countries and economic disincentives in the developing world, especially in rural areas, the proliferation of mobile telephony coverage is slowing drastically worldwide.

Within this context, Mexico's indigenous localities present a major coverage problem. This is how their situation looked in 2006:

Cobertura de servicios de telecomunicaciones en localidades indígenas



Causes

- The subsistence economy of such localities discourages operators from providing service
- Their inaccessibility and remoteness adds to the cost of network maintenance and generates a high fault rate (up to 70 per cent) with repair work taking up to six months
- Where services are provided, their cost is high and sometimes unaffordable.

Obstacles

- Some telecommunication regulations and policies do not favour the provision of local rural communication services, limiting the opportunities for telecommunication micro-enterprises to prosper in such areas.
- The business model and technology used by traditional providers have for the most part proved incapable of resolving the rural communication problem in many parts of the world.

Legal framework and public policy

- ITU recommendations on rural communication highlight the importance of creating conditions conducive to the flourishing of ICT industries, based on economies of scale.
- The Mexican Constitution requires the creation of conditions whereby indigenous peoples are able to acquire, administer and operate communication media.

Solutions

Thanks to numerous open-source efforts developed in recent years, it is technologically and economically feasible for a community, acting as an operator, to provide cellular service to thousands of individuals.

Our method

Combining identification of the opportunities available under the existing regulatory framework, service provision based on economies of scale, community involvement and the application of new technologies for connecting individuals and communities to telecommunication services.

Proposal

- Implement a new system for fostering the provision of rural broadband services through community cellular networks
- Facilitate the availability of frequencies for this type of communication
- Facilitate funding for the purchase of equipment and for training

Business model (pilot)

- Private community network or VMO
- Access through a PTN licensee
- Support centers and related services
- Local operator with essential network operation and maintenance capacities
- Node population centers for deployment of the system

Requirements for project implementation

- Access to frequencies
- Funds for equipment purchase
- Access to training

Technology options

1. sysmoBTS – Sysmocom (OpenBSC) - Germany

OpenBSC concepts

- OpenBSC is an open-source software project for the creation of autonomous GSM networks
- OpenBSC includes the functionality of GSM network components:
  - BSC (base station controller)
  - MSC (mobile switching centre)
  - HLR (home location register)
  - AuC (authentication centre)
  - VLR (visitor location register)
  - EIR (equipment identity register)

Sysmocom, a project from the main creators of OpenBSC, based in Germany, offers an open hardware option (sysmoBTS) which operates with the OpenBSC software.

sysmoBTS data sheet

sysmocom
systems for mobile communications GmbH

Mechanical / Electrical specification

Dimensions of enclosure (W x H x D)	200 x 138 x 34 mm (indoor / table-top enclosure)
Dimensions of PCB assembly	120 x 160 x 20 mm
Weight	< 1 kg (with metal enclosure), < 500 g (PCB assembly)
RF Input (SMA)	• GSM 850/900/1800/1900 quad-band uplink band • Sensitivity: –95 dBm (exceeding 3GPP TS 05.05 pico BTS requirements)
RF Output (SMA)	• GSM 850/900/1800/1900 downlink band • Max output power: (850/900): 22 dBm GMSK, 18 dBm 8PSK (1800/1900): 25 dBm GMSK, 20 dBm 8PSK
CPU / SoC	TI Davinci (ARM + DSP), 600 MHz
Input Voltage	5 V (DC), max. total power consumption: 13W
Cooling	passive cooling (via metal enclosure), active cooling optionally available depending on customer-specific enclosure or temperature requirements
Internal Memory	128 Mbyte Flash, 128 Mbyte RAM
Communications Interface	RJ45 Ethernet (100-Base-Tx)

Software / Logical specification

Number of Transceievers	1 TRX / 8 timeslots
Supported timeslot configurations	CCCH, CCCH+SDCCH/4, SDCCH/8, TCH/F, TCH/H
Back-haul (Signalling)	A-bis according to TS 08.58 and TS 12.21, encapsulated over TCP/IP
Back-haul (voice)	RTP/UDP/IP with FR/EFR/AMR payload according to IETF and ETSI specs
Ciphering	A5/1 and A5/2, A5/3 software upgrade option
GPRS/EDGE	Hardware and L1 API only. No RLC/MAC, PCU and Gb interface until customer demand / funding
Max. concurrent calls	14 (TCH/H on 7 timeslots)
Max. simultaneous SMS	60 (7*SDCCH/8 + 1*SDCCH/4)
Operating System	Embedded Linux (Poky based)

Available Options / Configurations

Hardware Options

- Internal uSD Card slot for extended memory
- Clocking: VCTCXO / OCXO / GPS disciplined
- Integrated Antenna Duplexer
- 2W downlink PA and uplink LNA kit
- Outdoor enclosure (pole mount type)
- Wall-mount enclosure
- PoE power splitter (802.3af compatible)
- G.SHDSL modem for 2-wire copper back-haul

Software Options

- BTS-only (A-bis/IP interface)
- integrated BSC (A/IP interface)
- NITB: Fully autonomous GSM PBX
- GPRS/EDGE PCU with Gb interface (Q4/2012)
- SDK for customer-specific applications on BTS

Costs

sysmoBTS + AMP = USD 2 500

2. OpenBTS 5150 - Range Networks, California, USA

Concepts

- OpenBTS is GSM and VoIP, simplified
  - OpenBTS software in Linux with a VoIP switch (Asterisk)
  - Software-defined radio, GSM850, 900, etc.
- Based on Internet protocols such as SIP and HTTP/S , replacing traditional architecture such as SS7
- Standard 2G interface
- Goal: networks with monthly operating expenses lower than USD 250

Equipment with multiple ARFCN

- Power: 50 watts
- Range: 2 - 35 km
- Capacity: 5 AFRCN, 35 simultaneous calls
- Cost: USD 20 000

Cost model

- The cost model is to be defined on a case-by-case basis, although with the following standard:
- 300 users each paying a monthly contribution of USD 5.00
- Operating cost USD 700.00 (covering electricity, staff and connectivity charge)
- USD 800.00 by way of monthly amortization

Pilot project (objectives)

- Define the model for frequency access and for the legal framework to be implemented
- Establish a system of local technical support
- Identify different business models according to locality characteristics
- Identify the behaviour of different technologies

- Define a long-term promotion programme

Prospects

- A market option that could increase coverage exponentially
- Establishment of a win-win arrangement for all operators
- Establishment of node communities with trained staff to provide technical support for broadband deployment in rural areas

Budget

BUDGET	**Unit cost**	**No. units**	**Total** (USD)
Phase 1			
Coordination	650	18	11 700.00
Training		1	6 000.00
Subsistence (Oaxaca-Mexico City)	175	6	1 050.00
Programme proposal and regulatory aspects	9500	1	17 000.00
Monitoring and evaluation	2000	5	10 000.00
Reporting and dissemination			1 000.00
Subsistence (20 visits)	175	20	3 500.00
Programme evaluation			20 000.00
INSTALLATIONS			
Tlahuitoltepec			28 125.00
Mazatlan			19 500.00
Mexico 3			18 750.00
Mexico 4			19 600.00
Mexico 5			24 175.00
EQUIPMENT AND MATERIALS			8 600.00
Phase 2			
FUND FOR SEED PROJECTS			500 000.00
TOTAL (USD)			**689 000.00**