eMGW™ Solutions
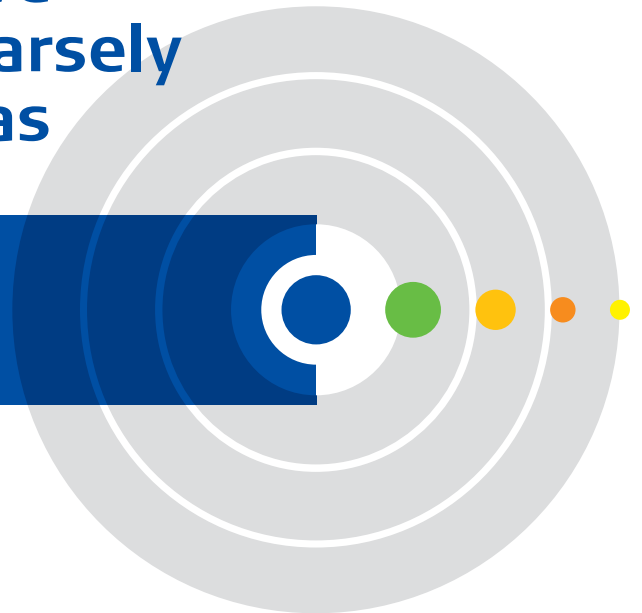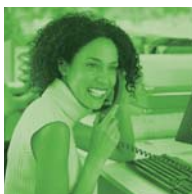
Enabling Operators to Provide Cost Effective Voice Services to Sparsely Populated Rural Areas

White paper

Introduction

A growing number of operators, mainly those focusing on service provision to developing countries, face an increasing demand to provide voice services to rural regions. A common challenge faced by those operators is to find a solution that will be cost-effective, despite the low number of potential subscribers, while still providing toll-quality voice services. To offer a system that answers that business model challenge, Alvarion has introduced enhancements and improvements in its eMGW product line, especially designed for the low density, rural applications, thereby bringing to market a highly cost-effective, high quality solution for voice and broadband data services.

This paper will describe these features and improvements of the Alvarion eMGW in detail and how they can be implemented in rural applications. Following this section will be an explanation of how the operator's business case is improved significantly when incorporating these enhanced features and hardware improvements, equalizing the deployments of a few dozens of users to the same cost-effectiveness of large deployments of hundreds of users.

eMGW Solutions for Rural Regions

In eMGW version 4.0 Alvarion will release several significant feature enhancements and hardware improvements, especially designed to improve the operator's business case in the sparsely populated rural regions.

The eRPR – Remote Radio Unit

The eRPR, which was released in version 2.5, is a remote outdoor radio port unit, functioning in the same way as the eRPC, the base station radio, but designed to remotely connect to the base station controller unit (eRPCU) over standard transmission infrastructure, such as point-to-point microwave. The solution also efficiently extends the coverage range into areas without line of sight.

Low-density remote cells can be covered using one common controller (eRPCU) and many eRPRs connected over standard transmission links: PDH or SDH (1xE1 per eRPR). Thereby, reducing the cost per line to the minimum by reducing the number of base stations required.

The eMGW product family

Self-backhauling Solution

In the cases of low-density population, a point-to-point, self-backhaul solution can be used for connecting the eRPR to the eRPCU, thereby eliminating the need for a third party, point-to-point, microwave link and reducing the bottom price per line. The solution enables the operator to cost effectively provide a variety of TDM voice services, including fax and modem to subscribers within sparsely populated regions. Operators can also take advantage of common management of both the access and the self-backhaul through the IMS, avoiding the burden of managing through two separate management systems.

The self backhaul and eRPR solutions may function together in one network, operating in either the same or in different frequency bands.
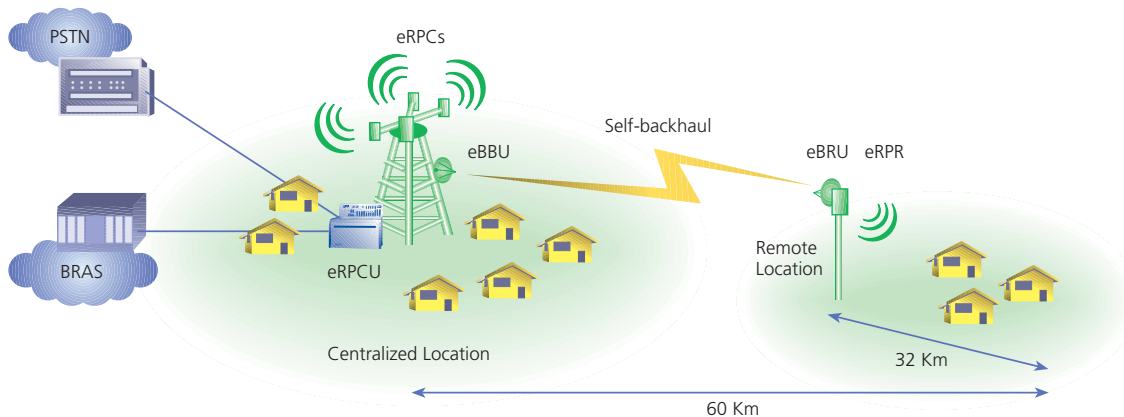

Figure 1: Self-backhauling architecture

The self-backhauling solution is a point-to-point link that is comprised of three basic components:

- **eBBU (Backhaul Base Unit)** – collocated with eRPCs in the base station
- **eBRU (Backhaul Remote Unit)** – collocated with the eRPR in the remote cell
- **BCM (Backhaul Controller Module)** - A dedicated module in the eRPCU

Typical configuration

Figure 1 illustrates the typical configuration in which a single eRPR is connected to the base station over a single leg, self-backhaul. Coverage is in a vicinity of 60km from where the eRPCU is enabled; assuming line of sight is maintained between the eBBU and the eBRU.

Solution's capacity

The self-backhaul link can reach up to 32Km in the 3.57 GHz band and theoretically extends the coverage of the eMGW base station up to 64Km. The self-backhaul provides voice capacity of up to 4.5 Erlangs, allowing the eRPR connected over this backhaul to serve about 90 subscribers, using traffic of 50mE each at 1% GOS.

One eRPCU can accommodate up to 8 eRPC or eRPR. Each eRPR can be connected either over a third party backhaul or over a self-backhaul that is also managed by the same eRPCU. Any mix of eRPCs and eRPRs may be deployed.

The eFAU-4 – Multi-User CPE

In striving to improve the operator's business case, Alvarion introduces the eFAU-4, a multi-POTS CPE in eMGW version 4.0. Sharing a single CPE by several telephone lines can drop the cost per line dramatically, enabling the operator to expand its network to regions and subscribers over distances previously not cost effective to cover. The eFAU-4 solution is ideal for providing quality voice and data services for small businesses in urban and suburban areas and improves the eMGW offering for low-density rural regions.

Alvarion offers two models of eFAU-4:

- **eFAU-4 (voice only):** includes 4 POTS ports with fax/modem support and payphone signaling
- **eFAU-4E (voice and data):** includes 4 POTS ports and a single Ethernet port which supports up to 8 data users. Also supports fax/modem and payphone signaling

The eFAU-4 and eFAU-4E can be powered separately using up to 4 different ePCUs. This capability is applicable in multi-tenant deployment, where the eFAU is shared among independent subscribers. Each subscriber independently powers the common eFAU, which means that when one tenant disconnects the main power source, the voice services will be blocked for this specific tenant. The relatively low power consumption of the eFAU-4 and eFAU-4E units are enabled to power the units by using a solar panel.
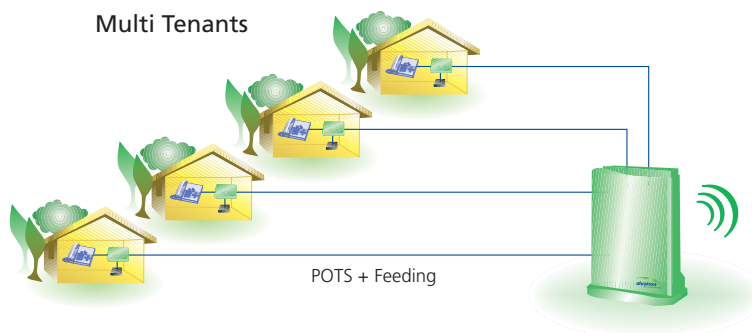
Multi Tenants

POTS + Feeding

Figure 2: Multi-tenants application with eFAU-4

Business Case Analysis

How can the operator benefit from using eRPR with self-backhauling?

The following analysis will demonstrate how the operator can benefit from using the eRPR together with the self-backhauling solution.

The cost effectiveness of the eMGW system in a scenario of 500 subscribers per cell has been proven in numerous field installations. The following analysis will show that even in areas with as few as 50 subscribers, the price per line reaches the same level as with 500 subscribers per cell.

Model's assumptions (all costs are in $USD):
- Only voice users
- eFAU installation: $50
- ARPU (Annual Revenue per User): $30/month
- OPEX (Operational expenses): 10% of ARPU

Benefit of using eRPR with 3rd party MW link

In the case where the number of users located in the cell is 500, the operator is required to deploy a base station with a single eRPCU and three eRPCs. Using the assumptions above, the operator will reach the breakeven point (the point in time where the CAPEX+OPEX equal the revenues) very rapidly, after only 19 months from the beginning of providing the service.

If the operator wishes to provide services to a low-density populated area, e.g. 50 users per cell, the results in this case are entirely different. If eRPR and self-backhaul are not used, the operator will be required to deploy an eRPCU with a single eRPC, resulting in a relatively higher price per line. In this case, the breakeven point will be delayed and be reached only after 34 months (a year longer than in the case of 500 users). Obviously, this result undermines the cost-effectiveness of the entire solution. Nonetheless, the operator will be able to improve the cost-effectiveness by covering the low-density region with an eRPR and a 3rd party microwave link. In this configuration the remote cell shares a common infrastructure with the central base station resulting in a lower price per line and the breakeven point will be reached only after 28 months, an improvement of 6 months from the last case.

Benefit of using eRPR with self-backhauling link

The results can be further improved if the operator will deploy a self-backhaul instead of the third party microwave link as described in the previous scenario. This configuration saves on the cost of the third party microwave, improves the price per line significantly and shortens the time to reach breakeven to only to 23 months, almost the same as in the case of 500 users.

eRPR

eBBU

eBRU

No. of users per site	eRPCU+eRPC per site	eRPCU+eRPR + 3rd party microwave backhaul	Common eRPCU+eRPR + self-backhaul
20	56	41	27
50	32	26	21
100	25	22	20
500	19	19	18

Table 2: Breakeven point (in months) in different deployment scenarios

No. of months to reach breakeven point

eRPCU+eRPC per site

Common eRPCU+eRPR + 3rd party microwave backhaul
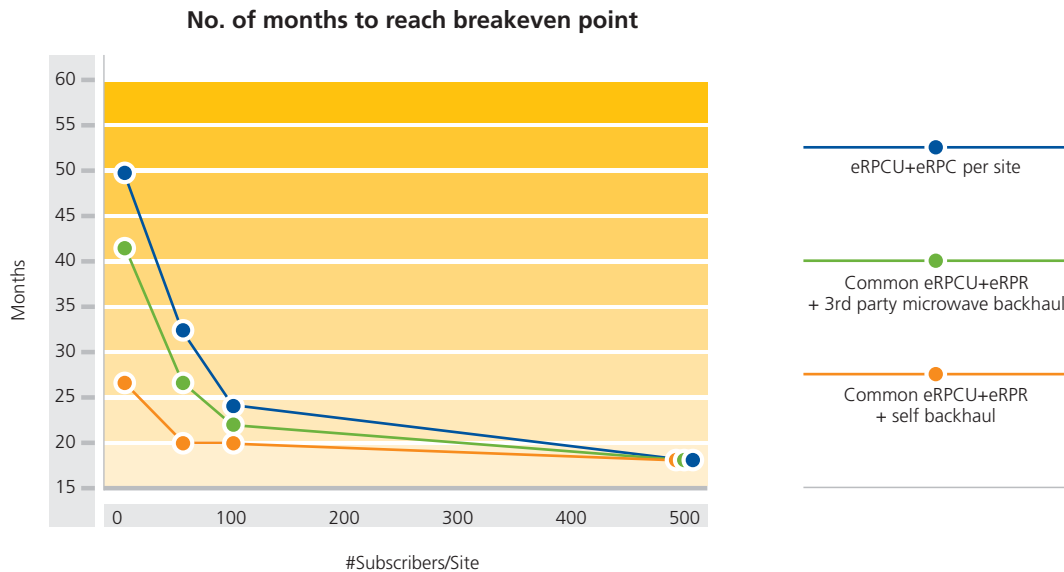
Common eRPCU+eRPR + self backhaul

Figure 3: Breakeven point versus subscribers number per site in different scenarios

Benefits of the eFAU-4

By using the eFAU-4 as a multi-tenant CPE, the operator can cut the price per line dramatically. To demonstrate this cost reduction, we will take the case of 50 users connecting to the eMGW system via eRPR and self-backhauling. According to the above analysis, when each user connects to a single eFAU-1, the breakeven point will be reached in 21 months from service launch (see Table-1). When an eFAU-4 is used for connecting every four users, the price per line drops dramatically bringing the breakeven point to only 11 months after the service launch.

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Alvarion's eMGW

Alvarion's eMGW is a highly cost-effective, point-to-multi-point, fixed wireless access system tailor-made for SOHO and residential users. eMGW provides fast Internet access, corporate access and carrier-class telephony in a single system and its innovative 'hybrid-switching' architecture uses circuit switching for toll quality voice and packet switching enabling broadband data services to maximize spectrum and equipment utilization. Operating in a wide range of frequencies (1.5GHz - 5.7GHz), the MGW/eMGW product family has been successfully installed in over 60 countries.

About Alvarion

With more than 2 million units deployed in 130 countries, Alvarion is the worldwide leader in wireless broadband providing systems to carriers, ISPs and private network operators, and also in extending coverage of GSM and CDMA mobile networks to developing countries and other hard to serve areas. Leading the WiMAX revolution, Alvarion has the most extensive deployments and proven product portfolio in the industry covering the full range of frequency bands with both fixed and mobile solutions. Alvarion's products enable the delivery of business and residential broadband access, corporate VPNs, toll quality telephony, mobile base station feeding, hotspot coverage extension, community interconnection, public safety communications, and mobile voice and data. Alvarion works with several global OEM providers and more than 200 local partners to support its diverse global customer base in solving their last-mile challenges.

As a wireless broadband pioneer, Alvarion has been driving and delivering innovations for more than ten years from core technology developments to creating and promoting industry standards. Leveraging its key roles in the IEEE and HiperMAN standards committees and experience in deploying OFDM-based systems, the Company's prominent work in the WiMAX Forum is focused on increasing widespread adoption of standards-based products in the wireless broadband market and leading the entire industry to mobile WiMAX solutions.

For more information, visit
Alvarion's World Wide Web site at
www.alvarion.com

Specifications

eFAU-4/4E

Parameter	Value
Voice services (eFAU-4 and eFAU-4E)	POTS, Fax (G3)/Modem(V.92), payphone signaling
Voice performance	Identical to eFAU - 1 & 2
Maximum DC loop	600 OHM
Data (eFAU-4E only)	Always-on up to 512bps full duplex (symmetrical), up to 8 IP addresses.

Radio Interface

Frequency band	3.425 - 3.575GHz (other bands can be provided upon demand)
Transmission performance	Identical to eFAU - 1 & 2

Power Requirements

Power consumption	12W maximum
Input voltage	55.5 ±1.5 VDC
	Input for one to 4 ePCU
ePCU to eFAU range	eFAU-4E: 100m @ 0.5mm
	eFAU-4: 350m @ 0.5mm

Physical Characteristics

Dimension (H x W x D)	25x18x9cm
Weight	2.5kg

Environmental

Temperature	-40°C to +60°C
Relative humidity	Up to 95%
	Rain proof (according to IEC 68-2-18)

Specifications

Self Backhauling

Feature	Value
Service supported	Voice, FAX, Modem
Voice Capacity of a single eRPR (when using self-backhauling)	4.5E per link (90 subscribers @50mE, 1% GOS)
Range	32km @LOS
Power Requirements	eBBU - fed by eRPCU's LIM module
	eBRU - fed locally: -42 to -56VDC
Operating bands (self backhaul)	3.57 band: 3.425 - 3.575 GHz
Environmental Temperature (eBBU, eBRU)	-40°C to +60°C
	Up to 95%
	Rain proof (according to IEC 68-2-18)
Power consumption	eBBU - less than 18w
	eBRU - less then 10W
Self backhauling capacity	Each eRPCU (BCM) supports up to 8 self-backhauls.
Interfaces	eBBU-eRPCU: E1 interface
	eBRU-eRPR: E1 interface
Physical Characteristics Dimensions (HxWxD)	eBBU: 33x21x14 cm
	eBRU: 25x18x9 cm

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