

BreezeCOM and Floware unite



A positive business case for Broadband Wireless Access

A paper for cellular operators, ILECs and full service operators



1 The end of the gold rush

The late 1990s scramble for market share in the last mile resembled the California Goldrush of the mid nineteenth century: being fastest, whatever the cost, to stake a claim on part of this lucrative market was seen as the primary measure of success. Carriers old and new, wired and wireless, rushed headlong into the market in a drive to acquire the critical mass of customers that could pave the way to a rapid IPO.

In this headlong rush were sown the seeds of industry downturn. Few business models were robust. Few thought about the customer mix required to achieve profitability. And even fewer thought about the services that customers would actually pay for. The result was that in 2000, available capital evaporated and share prices fell off a cliff. The whole industry - service providers, equipment vendors, investors and customers - was forced to contemplate a new economic landscape, one in which the fool's gold of the previous few years was no longer convertible currency. Everyone was forced to accept a stubborn truth: gold only comes from robust, flexible business models that balance investment with revenues.

Throughout Europe (and the US) the financial difficulties prompted even carriers with a strong financial position to tighten their belts and slow new infrastructure roll out. Those with weaker financial positions met with disaster. Even in Latin America and Asia, where the competitive pressures were less intense and outlooks more promising, the malaise slowed new investments.

Operators found themselves asking key questions about investment in the last mile:

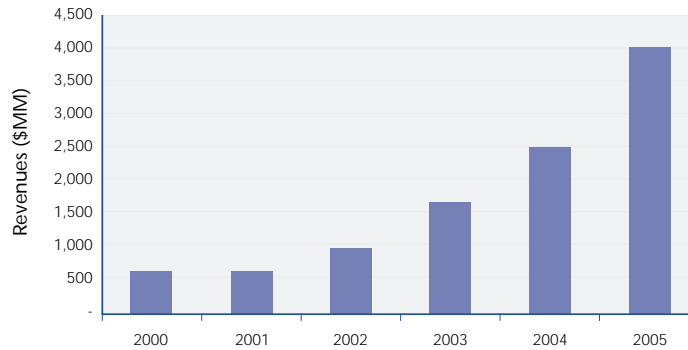
- Which **end user segments** generate the most attractive revenues in relation to the initial investment?
- What revenues can be expected and what **services** will generate these revenues?
- How can we **leverage existing infrastructure** and experience?
- What **level of investment** is realistic?
- How can we create stable and **increasing revenues**?
- How soon can we be **profitable** (and not merely EBITDA positive)?
- How quickly can we generate **positive cash flows**?

This document examines how operators can deploy BWA in the last mile to make money. It looks at the business case for BWA, particularly for ILECs, established carriers and cellular operators, and examines which end user segments can be most profitable. It identifies the capital costs involved in building a BWA network and assesses the operational expenditures required to run the network and make it cost effective. It makes the case that a BWA solution allows carriers to attack multiple end users customer segments simultaneously with a wide portfolio of voice and data services.

Alvarion is the clear global leader in BWA deployment and our analysis shows that:

- Revenues for BWA equipment will grow to more than \$4 billion by 2005. (Source: Dell'Oro, CSFB, Aug. 2001)
- Half of these equipment sales will come from established carriers and ILECs and the rest from cellular operators
- BWA will be deployed by at least one established carrier operator in each major geographical market. In Asia Pacific, Latin America and Eastern Europe, BWA penetration will be significantly higher than in other regions due to the relative poor infrastructure and limited alternatives for broadband services.

US\$ Mil



BWA Global Equipment Revenues 2000 - 2005 according to Dell'Oro, CSFB, Aug. 2001

2 Which operators can take advantage of BWA technology?

The simple answer to this question is: established carriers of three broad types, present in just about every market around the world:

- Incumbent local exchange carriers (AT&T, Telefonica, BT, France Telecom, OTE, etc)
- Full service operators within national markets (Novis, Alestra...)
- Cellular operators (Bell South, Orange, etc...)

These three groups share some common characteristics.

Typically they are all strong financially. They have been investing in infrastructure for some time - sometimes decades - and have a large and established multi-segment customer base. This relationship with the end customer - either consumer or business - is what insulates the strongest carriers from their weaker counterparts.

They have also developed the business and operation support systems (BSS/OSS) to ensure circuit provisioning, billing, network management and maintenance as well as sales and marketing. And they nearly all have experience of building wireless networks and running voice and data services. They are full-scale carriers in every sense.

ILECs/Full service Operators

While ILECs and full service operators share many characteristics, there is one major difference between them. The ILECs are invariably recently privatised national champion firms that own upwards of sixty percent (sometimes much more) of the customers in any market, despite deregulation.

The full service operators are precisely that: companies that were set up immediately after deregulation to offer the stiffest competition to the ILECs in large national markets. Often they are subsidiaries of large international companies seeking to expand overseas and with the resources to compete over the long term.

Both groups tend to offer integrated service offerings - combining long-distance and local services, Internet access, and data traffic - from a wholly owned fixed line and wireless network. Invariably these companies operate in multiple markets.



In Europe and the US, such companies face similar challenges with voice revenues under severe threat (as deregulation takes hold) and rising capital expenditures as they install new backbone fiber networks and broadband access solutions to handle exploding data traffic.

In Latin America and Asia (including Japan), access to capital is more stable for ILECs and full service operators because competition is less intense. For those few full service operators in these markets with sufficient funding, the potential is enormous.

Cellular operators

Established cellular operators around the world also share some common characteristics: they are usually solid in financial terms and have most of the required backbone infrastructure in place, having built it for previous cellular generations. They have an already significant customer base and like ILECs and full service operators have the management tools to provide good levels of customer service.

3 Why is the business case for BWA so positive?

The answer here lies in three main areas:

- The revenues that can be expected by the different established carrier groups compared to the costs - both capex and opex - that are necessary to deliver new services
- The attractiveness of BWA generated services to a range of customer segments
- The future development of BWA solutions

Let us look first at why BWA is attractive in broad terms.

In the mid-to-late 1990s as deregulation opened up the last mile, speed to market was seen as the key success factor. Speed to profit was largely ignored. As weaker service providers consolidated, ILECs, full service operators and cellular operators were forced to look in forensic detail at the business case before investing in new last mile technologies.

For cellular operators facing a three-to-four year gap before 3G revenues come on stream, BWA looks attractive for a number of reasons. First, if they are the dominant cellular operator in their market, they will probably have market penetration of close to sixty per cent. This is close to saturation point, reflected in downward price pressures on this largely voice-centric business.

They need to stimulate growth and profits with investments in new areas. BWA can deliver these with limited risk. Taking market share from the ILEC is an elegant and relatively easy way to resume growth, especially when they can focus on the most lucrative segment - business customers. Long experience in building and running wireless infrastructures is a clear advantage in relation to BWA deployment.

For ILECs and full service operators the case for BWA is similarly strong. There are clear benefits in an xDSL/BWA complementary strategy. BWA allows the delivery of broadband services in remote areas where it is either impossible to deliver xDSL services cost effectively or where fiber is simply not an option. And, once again, because they already have an amortized infrastructure, BWA can deliver these benefits at low cost.

BWA offers the means to:

- Create a stable, predictable and increasing revenue stream in multiple customer segments
- Focus the investment on specific geographies according the business plan
- Link infrastructure investment to customer profiles as defined in the business plan
- Add profitable services quickly, (not only EBITDA positive) over a few months
- Become cash flow positive comparatively quickly
- Build a network that can be expanded easily and cost effectively in line with market penetration
- Deliver the full mix of voice and data services, included value added services.

Revenues and segments

Operator revenues are the direct results of what the customer is willing to pay for that service, the alternative offered by the competition and the ability of the service provider to create positive business models from this revenue (assuming a certain penetration rate). In this discussion, the flavor of last mile technology chosen is not in itself the main determinant of revenues. In markets where there is a high degree of competition, the goal must be to deploy BWA technology and solutions to create competitive business models. In less competitive areas, BWA provides a solution in environments where no other technology is viable. In both areas, what the customer is prepared to pay for specific services also has an effect on deployment choices.

Table 1 sets out the type of services that can be offered to three target segments - SOHO, small business and medium business - along with the expected revenues that can be forecast on a monthly basis. In deregulating markets where prices are falling, value added services - virtual private networks, ASP services, service level guarantees, integrated voice and data - become the central differentiation platform. Without them, price is the only point of difference.

End Customer	Service	Expected Revenue per month
SOHO / High end Residential (64kbps, 1- 2 voice lines)	Best Effort Data	\$30-40 and up to \$100/SOHO
	Data + Centrex voice	\$60-100 and up to \$200/SOHO
Small Business (256-512kbps, 8-16 voice lines)	Data 256-512k	\$150-250
	Advanced Data Services including Service Level Agreement	\$400-500
	Data + Voice	\$400-600
	Full Service (VPN,ASP)	\$750-1000
Medium Business (1.5-2Mbps, 30 lines)	Data 1.5 - 2M	\$400-500
	Advanced Data Services including Service Level Agreement	\$750-850
	Data + Voice	\$800-1200
	Full Service (VPN, ASP)	\$1500-2000

Table 1: Service and revenue expectations

There are two main sources of revenue for operators here: the monthly revenues paid for the services themselves and the cost paid for equipment installation. Table 2 adds detail to Table 1 and outlines some sample revenues for each target segment for some typical BWA-based services and installation costs.



Generally speaking the cost of the installation and commissioning is reflected in the down payment required by the operator to its customer according to the specific segment.

Market Segment	SOHO/High Res		SE			ME
	Data Only	Data + 1-2 POTS	Data Only	Data + 4 POTS	Data + 8 POTS	Data and E1
Typical Service examples						
CIR (Committed Information Rate)	64k	128k	128k	128k	256k	256
MIR(maximum Information Rate)	1M	1M	2M	2M	2M	8M
Internet Access Services.	Eth	Eth	Eth	Eth	Eth	Eth or FR
LAN to LAN services	No	No	Yes	Yes	Yes	Yes
Total average revenue/months	\$100	\$200	\$250	\$500	\$750	\$3,200
Installation cost	\$200	\$200	\$250	\$250	\$400	\$600
Upfront Installation	\$150	\$200	\$250	\$250	\$300	\$500
Operator Revenue after 6 months	\$600	\$1,200	\$1,500	\$3,000	\$4,500	>\$5,000

Table 2: Detailed Revenues for different Segements

Telecel S.A., the largest cellular operator in Paraguay, has purchased Alvarion subscriber units to connect customers to Telecel's broadband wireless access network in the licensed 3.5 GHz frequency band.

With around 700,000 cellular subscribers, Telecel owns a 60% share of the cellular market in Paraguay. In 2000, Telecel leveraged its positioning and assets - including its customer base, marketing and support organization, rooftop rights, and other real estate - to launch Telesurf Wireless, a high-speed Internet access network. Requiring only the mounting of Alvarion base station equipment on Telecel's existing cellular base stations, time-to-launch of the advanced network was particularly rapid.

The service quickly reached critical mass. Telecel has connected more than 3,000 subscribers - from Paraguay's largest businesses to residential customers in affluent neighborhoods, to residential and business users in isolated agricultural communities - via Alvarion products. For large businesses, the BWA network offers high-speed Virtual Private Networks (VPNs) with guaranteed Quality of Service (QoS) as needed to support automatic teller machines and distributed Point-of-Sale networks. In remote areas, the wireless network reaches areas where wireline infrastructure fails, bringing always-on Internet access to villages and agricultural businesses.

The Costs

(i) Capex and Opex

Looking at Capex first (as shown in Table 3), for those established cellular and wireline operators, BWA represents a powerfully attractive last mile option.

Cellular players have no need to spend the time and resources acquiring rooftop rights or doing the work required: BWA base stations can sit beside their existing cellular equipment.

Nor will they require supplementary investment in switching or routing equipment or technology to connect the BWA network nodes to the backbone network since these already exist as part of their cellular systems. Moreover, billing and management systems are also present in the existing network. The savings here are considerable: in a typical greenfield BWA network built from scratch these investments can make up a substantial percentage share of overall Capex. For ILECs and alternative operators, the capex benefits of BWA are also very significant. They can take advantage of their technical and human infrastructure, reusing as much of their already deployed network.

However, there is clearly a need to acquire rooftop rights and accomplish the installation and commissioning work for these rooftops. But the additional incremental capex required to offer the service remain relatively low.

Types of Capex investments required	Established Operator/ILEC	Cellular
CPE investments	Yes	Yes
Civil work& installation and commissioning Base	Yes	Partial
Installation and commissioning CPE	Yes	Yes
Roof site acquisition and construction	Yes	No
Switch/router	Yes	Yes
PMP base stations	Yes	Yes
Backhaul connectivity	No	No
Access concentrators†	No	No
Regional concentrators	No	No
Radio Planning	Yes	Partial
Customer care and billing	No	No
Network management and NOC	No	No

Table 3: The major capital expenditure components of BWA

When we look at operational expenditures (as shown in Table 4), a similar picture emerges. Both groups will already be amortizing the running costs of their existing owned backbone connectivity, routing/switching assets and network operations and management systems. Introducing a new BWA network can be incorporated easily by these systems with no upgrade requirement. There are Opex elements for those carriers without existing rooftop rights.

Operating Expenditures per annum required	Established operator/ILEC	Cellular operator
Roofsites operation	Yes	No
PTP base station operation	No	No
access concentrators	No	No
regional concentrators	No	No
Leased line rental	No	No
Spectrum fees	Yes	Possibly (The spectrum could already be used for feeding BSTs **)
Maintenance	Yes	Yes
General Network Opex		
Network management and NOC	No	No
Personnel expenses	No	No
Customer care and billing	No	No
Office rent	No	No

Table 4: The major operational expenditure components of BWA

** See Alvarion's white paper on cellular feeding application using PMP



(ii)The Positive Business Model

Based on the aforementioned revenue and cost analysis, it is possible to identify market segments where the BWA business model is very attractive. To provide quantification of the size of the opportunity, Alvarion has analyzed different examples of established operators that have successfully deployed BWA in different regions of the world. By extrapolating the experience of these operators, we can describe the most successful business cases with BWA defined as one where operators reach a return on investment in less than three-to-four quarters and profitable business in one year.

According to our experience, we can estimate that the Customer Premises Equipment CAPEX and its installation cost, represents in general more than 2/3rds of the last mile investment to acquire and connect a customer to a Broadband Wireless Network.

Market Segment	SOHO/High Res		SE			ME
	Data Only	Data + 1-2 POTS	Data Only	Data + 4 POTS	Data + 8 POTS	Data and E1
Typical Service examples						
Total average revenue/months	\$100	\$200	\$250	\$500	\$750	\$3,200
Installation charge	\$150	\$200	\$250	\$250	\$300	\$300
Installation cost	\$200	\$200	\$250	\$250	\$300	\$300
Budget for CPE price for 6 months ROI	\$550	\$1,200	\$1,500	\$3,000	\$4,500	>\$5,000

Table 5: CAPEX expenditures

We can clearly see that the CAPEX for the CPE can be covered within 6 months of operations. As has been shown previously, other investments can be reduced by providing solutions that enable carriers to leverage on their existing infrastructure, by offering add-on systems delivering bundled services.

For example:

- Diversified CPEs offered for various customer and application types
- Possibility of re-use of radio-sites, core networks etc.
- Interfaces to existing billing, OSS, customers DB, etc.

The additional incremental investment remains relatively low and shortens the time of ROI by a maximum of 3 additional months, which brings ROI in less than 9 months and profitable business in less than one year.

(iii)The multi-segment opportunity

As Table 6 shows, operators can, with a similar investment, choose either to focus on a narrowly defined segment with a limited range of services or address a much wider business opportunity with a broad range of services.

The table outlines a simplified business case of three operators, each targeting a specific market segment with a particular offering.

	Operator A	Operator B	Operator C
Target Customers	High End Residential, SOHO	Small businesses	Medium sized businesses & feeding
Service Offered	Internet + 1-2 POTS	Internet, VPN + 8 POTS	Internet, VPN and E1
Monthly revenue*	Data: \$50 Voice: \$100 Total: \$150	Data: \$250 Voice: \$400 Total: \$650	Data: \$700 Voice: \$2,500 Total: \$3,200
Number of Customers in targeted cell	10,000	5,000	3,000
Penetration rate	20%	10%	10%
Monthly Revenue from Data Services	2,000 X \$50=\$100,000	500 X \$250=\$125,000	300 X \$700=\$210,000
Monthly Revenues from Voice Services	1,000 X \$100=\$100,000 (assuming that 50% are also using voice services)	250 X \$400=\$100,000 (assuming that 50% are also using voice services)	100 X \$2,500=\$250,000 (assuming that 1/3 are also using voice services)
Total Monthly Revenues	\$200,000	\$225,000	\$460,000

Table 6: Three types of simplified operators' business cases

*Average revenues taken from different examples worldwide

Table 7 highlights the simplified business case of an operator that is taking advantage of its infrastructure (comprising backbone, network operations center, billing infrastructure, roof sites, operations, sales and marketing investments) to address all three markets simultaneously.

Target Customers	High End Residential, SOHO	Small businesses	Medium sized businesses & Feeding
Service Offered	Internet + 1-2 POTS	Internet, VPN + 8 POTS	Internet, VPN and E1
Average revenues taken from different examples worldwide	Data: \$50 Voice: \$100 Total: \$150	Data: \$250 Voice: \$400 Total: \$650	Data: \$700 Voice: \$2,500 Total: \$3,200
Customers targeted cell	10,000	5,000	3,000
Penetration rate	20%	10%	10%
Monthly Revenue from Data Services	1,500 X \$50 = \$100,000	500 X \$250=\$125,000	300 X \$700=\$210,000
Monthly Revenues from Voice Services	1,000 X \$100 =\$100,000 (assuming that 50% are also using voice services)	250 X \$400=\$100,000 (assuming that 50% are also using voice services)	100 X \$2,500 =\$250,000 (assuming that 1/3 are also using voice services)
Total Monthly Revenues	\$200,000	\$225,000	\$460,000
Total Monthly Revenues from the entire market	\$885,000		

Table 7: Integrated operators' simplified business case



The illustrations above show that by incorporating BWA into a single infrastructure, established operators (including cellular operators) can widen their target market, application and service offering, thereby increasing revenues without significantly increasing capital or operational expenses.

Some lessons for operators from this analysis

For ILECS and established operators, it is clear that:

- In most developed markets, broadband data services offered to a strictly residential market are being delivered at prices above \$40/month. In such cases, operators use BWA solutions mainly for SOHO and SME customers and will be willing to serve other residential segments only if they already have coverage in a cell.
- If monthly revenues from the residential segment can be superior to \$60/month for data services, then the residential segment can represent a reasonable payback.
- BWA offers reasonable payback for the SOHO and SME segments already when offering data services only.
- Operators get a strong return from the SOHO and SME market when offering a combination of voice and data

For cellular operators it is clear that:

- There is strong payback for cellular operators who invest in BWA, targeting all markets, including the residential market, assuming that revenues for this service is more than \$40/month.
- The business case is also fully proven when using BWA to deliver residential data-only service, assuming that revenues for this service is more than \$40/month.
- Successful cellular operators are targeting a mix of residential MDU, SOHO & SME and are willing to serve other market segments providing they already have coverage in a cell. The deployment is completed with residential users either in MDU or in the same cell
- There is high sensitivity to the price of BWA customer premises equipment because it is so highly tied to capital investment costs of network deployment.

4 Alvarion's benefits

According to industry analyst DAIN RAUSCHER WESSELS, operators have several clear objectives that must be met before deploying point-to-multipoint solutions. They require:

- " Low cost with simple installation/deployment procedures (i.e., requires consumer installable for the residential) and scalable deployment architectures."
- " Efficient coverage capabilities (potentially including in-building coverage)"
- " Spectrally efficient delivery of high data rates and overall throughput (relative to the frequency bandwidth available)"
- " Low-cost continuation support and management."

Alvarion addresses each of these requirements.

Cost - Alvarion has the highest installed base of any BWA equipment vendor with over 500,000 CPEs deployed worldwide in the last three years. Alvarion understands how to drive down equipment cost without compromising the quality requirement of a carrier class access product. Our new SU-R BreezeACCESS product, for example, permits very simple installation, in the majority of cases either indoors or in other non-roof-based locations.

Alvarion also offers economies in installation and deployment. By utilizing breakthrough in new technologies like OFDM, Alvarion is able to offer benefits in terms of non-line-of-site deployment. Alvarion has pioneered the introduction of OFDM technology, introduced commercially in January 2002 based on industry standards.

Coverage - Alvarion focuses on offering very high coverage and scalable solutions.

Successful BWA business models depend ultimately on the coverage capacity of the base station.

Alvarion's technology aims to both increase base station capacity (the number of users per base station) as well as base station coverage (the area served by the base station). Our planned future investments in further developing OFDM technology and development of smart antennas will increase our advantage in these areas.

In addition, Alvarion offers its carrier customers what we call "bi-dimensional scalability". On the one hand this reflects a "pay as you grow" philosophy regarding base stations that allows carriers to invest in new infrastructure only as they bring on new customers. On the other hand, Alvarion also offers a range of different CPE equipment aimed at different market segments that all work with a single base station. This allows operators to address multiple markets from a single, fully integrated infrastructure and that is flexible enough to react cost effectively to shifts in customer profiles and service offerings. This approach optimizes capex and opex requirements. (Please refer to Alvarion's AlvariBase Integrated Base Station White Paper).

Spectral efficiency and throughput - BWA systems deliver more bandwidth to end users than any other last mile access technology (except fiber). Alvarion's solutions, for example, deliver up to 36Mbps throughput for a single customer. This is more than any variant of xDSL (ADSL, SDSL, G.SHDSL etc.) or cable modem can offer to a single subscriber.

At low frequency ranges like 3.5GHz, Alvarion has overcome any perceived spectrum availability problems. Offering spectral efficiency of more than 2.5Bit/s/HZ is achieved by advanced modem technology over channels of 1.75/3.5MHz and is more than answering operator demand. In addition, BWA systems combine this high spectral efficiency with the ability to offer the full range of differentiated services like LAN-to-LAN services (VLAN, VPN etc.) voice etc.

Customer support - No one else in the BWA market is as committed to the market and well positioned to lead the industry into the future. Alvarion is the strongest independent BWA company and has sufficient resources to ensure it can continue to invest for the long term, unfazed by cyclical changes in market conditions. In addition, our partnerships with Siemens, Alcatel and others permit us to offer a full range of solutions to customer requirements.



5 Alas, a proven BWA market

The BWA field in 2002 is a real and profitable market for carriers and service providers. Based on its experience, Alvarion has identified that established carriers can leverage on their existing infrastructure, minimize their investment to offer BWA services and reach a positive business case within a few quarters. Already many operators have proved it and significant established carriers have recognized the opportunity of the BWA market and entered it. **

Alvarion has developed special expertise, tools and complete solutions and is working very closely with carriers and operators all around the world in order to maximize their business case.

Alvarion understands the BWA business best and invests in the future to assure successful BWA business today and tomorrow.

**see also Alvarion's customer stories



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