



White Paper

Accelerating Network Convergence with End-to-End Next Generation IP MW Solutions

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1. Executive Summary

The increasing demand for high-speed IP data services, enabled by HSPA+, mobile WiMAX and LTE technologies, poses significant constraints on the backhaul network and forces wireless broadband carriers to make new investments in order to:

- Evolve their transport networks toward an all-IP architecture
- Enable expansion of their customer base, achieve a fast ROI and increase revenue

Wireless carriers highly appreciate the value of advanced end-to-end Next Generation MW solutions enabling a smooth all-IP migration of their existing legacy backhaul networks. Simultaneously, they warmly welcome the possibility to flexibly configure any part of the network in an optimum and cost-effective manner.

2. The Challenge

Mobile networks, and especially the backhaul last-mile and aggregation segments, already cope with extreme data traffic volumes, as a result of heavy usage of smart handsets and IP applications. Market forecasts reveal that a traffic issue will explode, as smart handsets are about to overtake standard mobile phones by 2012.

In the exciting evolution of wireless broadband services, convergence of transport networks is the technical foundation for convergence as a whole. IP / ETH (Ethernet) is envisaged as the most appropriate underlying mechanism because it is future-proof and gives cost, capacity, and scalability advantages. All new wireless standards adopt IP / ETH as transport technology because mobile data is inherently IP-based.

The majority of operators are planning ahead to ensure capabilities for their current and future needs, and face the challenge of building end-to-end IP-based infrastructure to deal with the new demands.

Not surprisingly, a big portion of the huge installed base of MW backhaul equipment (since the early deployment of 2G networks) is outdated. In addition, a large number of MW links have already reached their end-of-life / end-of-support phase. The severe scalability limitations do not allow the upgrading of existing infrastructure.

The only option for the operators is replacing obsolete infrastructure with brand new native Ethernet MW equipment that will assure:

- Optimization of CapEx
- Traffic growth without OpEx dependency
- Guarantee of quality & availability of services
- Simplification of deployment with end-to-end backhaul solutions
- Smooth migration of legacy systems to target IP
- Facilitation of evolving requirements to cater for LTE networks
- Exploitation of synergies with existing IP/MPLS core backbone networks
- Powerful network management to handle all types of traffic flows

Operators seek for advanced end-to-end MW solutions that meet the aforementioned requirements and effectively address all current and future IP issues.

3. The INTRACOM TELECOM Response

INTRACOM TELECOM understands that the evolution path from existing TDM-based to all-IP MW backhaul requires seamless support of legacy services. This will allow a smooth modernization plan and will provide sufficient time to ensure that all technical challenges are met and that consumers' perception for service quality is not altered.

OmniBAS™, the INTRACOM TELECOM's response, is a highly-flexible native Ethernet PtP MW solution that spans all segments of a typical backhaul network. It can be configured for tree / repeater / ring topologies and can be incorporated into nodal aggregation, or edge backhaul sites, simply and effortlessly.





Built upon cutting-edge packet-based technology, this solution accommodates leading radio performance, native Ethernet capabilities and high capacities. It achieves traffic throughputs of up to 400 Mbit/s over a single link (or up to 800 Mbit/s with XPIC) with channelization up to 56 MHz, while incorporating highly-efficient mechanisms to assure carrier-class service delivery with the highest availability.

Backhaul of legacy services is carried out seamlessly through Pseudo-Wire Emulation functionality, with low end-to-end latency, and through the utilization of E1, STM-1 (VC-12/4), and Gigabit Ethernet network interfaces.

OmniBAS™ is an indoor – outdoor system that comprises:

- Indoor units (OmniBAS™-4W, OmniBAS™-2W) of small form factor (1RU) and modular architecture
- Complete family of outdoor radios (ODUs) covering a wide range of operating frequencies, from 6 GHz to 38 GHz
- Traffic aggregation and interworking units (OmniWAY™-12G, OmniWAY™-2G)

The following table gives the technical details for the aforementioned indoor equipment:

OmniBAS™-4W	OmniBAS™-2W	OmniWAY™-12G	OmniWAY™-2G
			
<ul style="list-style-type: none"> • Industry-leading modem density – up to four modems in 1RU • System configuration agility (1+0 / 2+0 / 3+0 / 4+0, 1+1 / 2+2 FD / SD / HSB) • 2 x GbE (optical or electrical) network interfaces • 16 x E1 interfaces 	<ul style="list-style-type: none"> • Economical variant of OmniBAS™-4W • Up to two modems • System configuration agility (1+0 / 2+0, 1+1 FD / SD / HSB) • Fits edge MW backhaul applications • 1 x GbE (optical or electrical) & 4 x FE network interfaces • 8 x E1 interfaces 	<ul style="list-style-type: none"> • Modular switch aggregation & interworking unit (3RU) • 12 x GbE (electrical) for traffic aggregation • 8 x GbE (four optical & four electrical) interfaces • 4 x STM-1 / VC-12 (optical 2+0 / 2+2) – interfaces also protected at card level • 2 x STM-1 / VC-4 (optical 2+0 / 2+2) – interfaces also protected at card level 	<ul style="list-style-type: none"> • Compact (1RU) aggregation & interworking unit • 4 x GbE (optical or electrical) for traffic aggregation • 4 x STM-1 / VC-12 (optical 2+0 / 2+2) • 2 x STM-1 / VC-4 (optical 2+0 / 2+2)

For high system reliability, various redundancy options (ODU, modem, GbE interfaces, etc.) are provided, while the implementation of protected Ethernet rings is supported (as per ITU-T G.8032). The efficient timing capabilities include traditional synchronization (based on G.703) and Ethernet synchronization based on Synchronous Ethernet standard.

The uni|MS™ Unified Management Suite fully exploits the OmniBAS™ capabilities being a state-of-the-art solution for deploying, supervising and managing contemporary telecommunication networks. It is a carrier-class Element, Network and Service management platform for all INTRACOM TELECOM products, wireless and wireline (access, transmission, aggregation), as well as for third-party products, upon request, through easy integration.

Based on OS-independent Java/J2EE technology, uni|MS™ requires no vendor lock in, or third-party license fees. uni|MS™ complies with the latest TMForum & ITU-T standards and allows flexible Client / Server configurations for great scalability and high network resiliency.

In addition, uni|MS™ provides convergent service activation & provisioning capabilities to address the need for automated service provisioning across multi-vendor networks and diverse IT environments.

4. Meeting the Challenge

The OmniBAS™ product line perfectly suits any revolutionary MW backhaul network and effectively addresses the IP design & deployment challenges that operators are facing:

No more capacity bottlenecks

With a 400 Mbit/s native Ethernet capacity per single link and a 1.6 Gbit/s total capacity from a single 1RU unit, OmniBAS™ can satisfy all current and future capacity needs.

Effective legacy traffic handling

Traditional circuit-based services are seamlessly emulated with Pseudo-Wire (PW) technology and are delivered with assured high quality.

Simplicity & deployment agility

Advanced Ethernet functionality allows deploying IP-ready MW links in the last mile. Network design is as simple as it gets requiring basic-only Ethernet background instead of complicated L3 expertise (which could be gradually gained over the years).

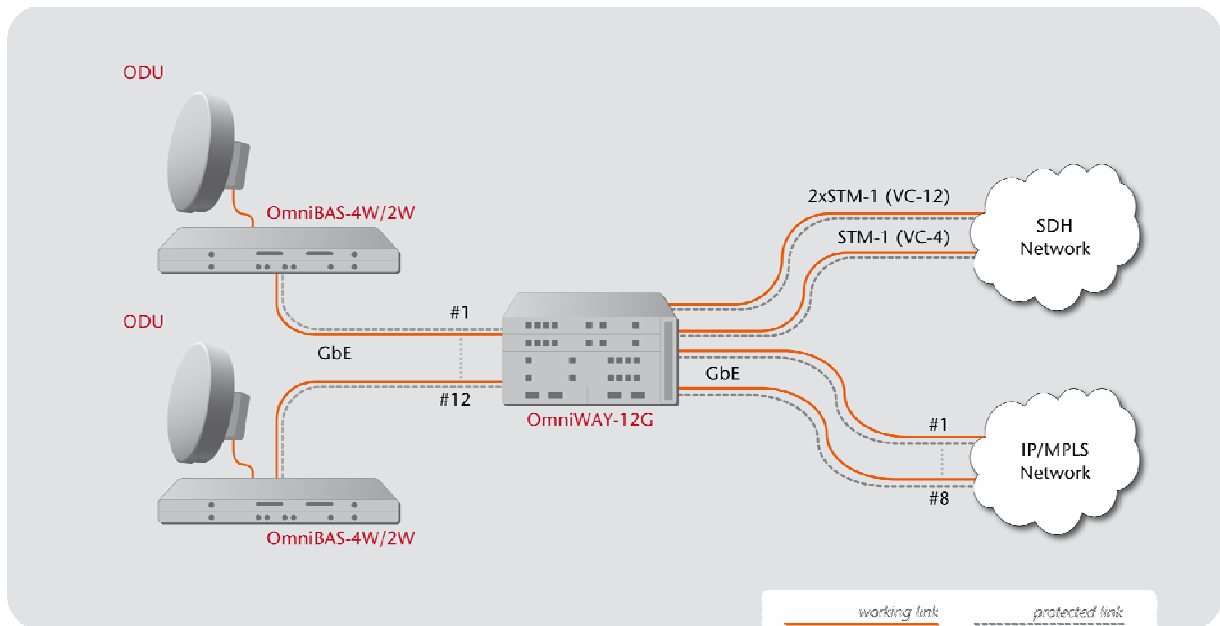
The OmniWAY™ traffic aggregation & interworking units complement the OmniBAS™ product line offering higher-order interfaces (STM-1 VC-12/4) for nodes requiring such connectivity.

In particular, the OmniWAY™-12G switch aggregation unit best fits highly-dense nodes also requiring high-level protection. With embedded Ethernet switch functionality, it aggregates packet-based traffic from multiple OmniBAS™ systems and forwards TDM traffic toward the SDH network and Ethernet traffic toward the IP/MPLS network [see Fig. 1].

OmniWAY™-2G is the compact (1RU) variant of OmniWAY™-12G for nodes requiring low traffic aggregation.

Finally, OmniBAS™-4W can accommodate up to four radio units to allow nodal configurations for aggregating traffic from multiple sites, thus increasing deployment flexibility.

Fig.1 The OmniWAY™-12G Switch Aggregation Unit Offers Advanced Interworking Capabilities



Efficient bandwidth utilization through advanced techniques

Statistical multiplexing best optimizes available link capacity, while hitless adaptive modulation – QPSK to 256QAM – increases service availability at all weather conditions.

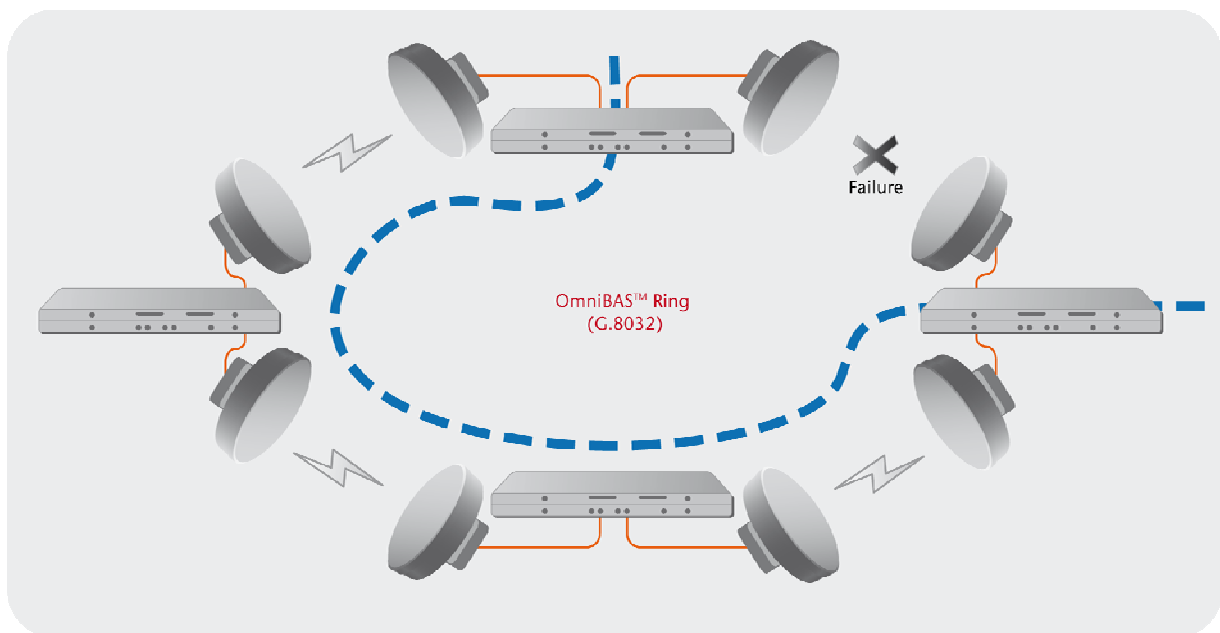
The OmniBAS™ advanced resource utilization techniques are derived from WiBAS™, INTRACOM TELECOM's market-leading PtMP product. WiBAS™ has been offering statistical multiplexing and hitless adaptive modulation for many years, before similar techniques were introduced to PtP networks.

Reliability & service assurance

Transmission network resiliency is ensured through protected system configurations (1+1/2+2, HSB & FD) and redundancy at card and interface level. In addition, the conformity with the ITU-T G.8032 standard allows implementing Ethernet rings that assure a protection recovery switching much lower than 50 ms [see Fig. 2].

The inherent L2 QoS capabilities support various classes of traffic to allow proper handling and prioritization of voice and IP traffic flows.

Fig.2 Protected Ethernet Ring Implementation According to ITU-T G.8032



Full control over managed network & services

The uni|MS™ Unified Management Suite enables effective end-to-end management – network deployment, provisioning, real-time monitoring, testing, etc. – all through a powerful set of features:

- Simplified end-to-end provisioning – service agnostic workflow (BPEL) and a design environment, for realizing rapid service provisioning
- Sub-network Connections Management – circuits creation with powerful user-friendly wizards, alarm correlation and impact analysis
- High availability & fault-tolerant operation
- Advanced security features – hardened operating system ensures compliance to strict NOC security guidelines with fine-grained users, roles & privileges

uni|MS™ facilitates the management of transition to IP, and ensures Quality of Service (QoS), as well as network availability.

Future-proof & revolutionary

With a 400 Mbit/s capacity per single link, LTE traffic requirements (~100 Mbit/s) are effortlessly met. In addition, the utilization of advanced XPIC technology allows link capacities to reach up to 800 Mbit/s. Through the continuous monitoring of industry developments and advancements, such as those relevant to MPLS-based transport and aggregation, and also the careful consideration of operator requests, INTRACOM TELECOM accordingly evolves its products to always remain at the cutting edge of technology.

Highly-flexible IP Migration

Addressing operators' approach to capitalize investments made on legacy and hybrid MW systems, OmniBAS™ facilitates a staged introduction of IP technologies in the backhaul networks and the gradual expansion of native Ethernet transmission, from the aggregation points toward the cell sites. Alternatively, operators may start deploying IP / ETH in the last mile, while utilizing legacy SDH systems in the aggregation part of the network.

In this smooth evolution process, OmniBAS™ maintains simplicity in the network design and operation, while encompassing future-proof IP concepts.

5. Conclusion

There is no doubt that the new wireless communication landscape will be exciting, especially for consumers that will enjoy high-speed multimedia applications on the go. The future will also be exciting and profitable for wireless carriers, provided that deployment and operational challenges are properly and timely addressed.

Of the utmost importance to a wireless carrier is to understand the necessity and the value of investing strategically in backhaul networks when evolving infrastructure to future-proof IP technologies. No single bottleneck in the network could be overlooked.

INTRACOM TELECOM is aware of all technical and operational challenges of the new wireless era and provides a complete MW solution, support and guidance to render the transition toward IP-based networks a smooth and enjoyable experience.

The OmniBAS™ product line provides excessive capacity, simplicity and deployment flexibility, advanced functionality and powerful management capabilities for end-to-end IP service control. It meets and exceeds operator requirements for backhaul networks convergence, while being a future-proof solution that sets a solid foundation for long-term efficient network operation and outstanding performance.

6. Glossary

ATM	Asynchronous Transfer Mode
FD	Frequency Diversity
HSB	Hot Stand By
HSPA	High Speed Packet Access
IP	Internet Protocol
L2	Layer 2
L3	Layer 3
LTE	Long Term Evolution
MPLS	Multi Protocol Label Switching
MW	Micro Wave
OS	Operating System
PtMP	Point-to-MultiPoint
PtP	Point-to-Point
QoS	Quality of Service
ROI	Return On Investment
SDH	Synchronous Digital Hierarchy
TDM	Time Division Multiplexing
WiMAX	Worldwide Interoperability for Microwave Access
XPIC	Cross Polarization Interference Cancellation