

Topic: **IIR Transport Networks for Mobile Operators 2008 in Amsterdam:**

The trends, trials and triumphs of migrating the mobile backhaul network

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Transition in Step With The Market

The IIR Transport Networks for Mobile Operators conference in Amsterdam was in its 10th year, but has matured rather than aged, changing with the times. Those in attendance a few years ago will remember it being a conference with significant focus on optimization of the next-gen mobile core network. With the migration to IP/MPLS in the core having been widespread and largely completed, the focus of this event has increasingly transitioned toward mobile backhaul.

Consensus and Controversy

Along with that new focus on backhaul comes strong agreement on the tremendous challenges that operators face in this part of the network. Most operators seem resigned to flat rate pricing for mobile data (though often are quite worried about it), and see flat or falling ARPU on voice. Most are counting on mobile data and video as the services with the potential to drive their future revenue growth. But they do so based on the assumption and understanding that these new service revenue opportunities are going to require significantly reducing costs in the backhaul network if they are to be rolled out commercially in a way that is cost effective, manageable, and profitable.

Near universal consensus has been achieved regarding the need to achieve a lower TCO model for the backhaul network, and that Ethernet will play a significant role in making that happen. But that is where much of the consensus ends, and much of the controversy starts. Because solving the mobile backhaul dilemma is one of the most complex problems in networking, and is about a great deal more than simply scaling the network in reaction to the bandwidth demands imposed by new mobile data and video services. Mobile backhaul is also about optimizing bandwidth utilization, not simply scaling bandwidth capacity – because there is simply no sense in scaling inefficiency. And it is about embracing new cellular radio technologies and WiMAX, while supporting the installed base.

Complexity and Challenges

The consensus on mobile backhaul generally ends with the challenges, however. Because Mobile backhaul is a complex topic, one that encompasses selecting the right access technologies, dealing with legacy radio protocols and transport interfaces, understanding how peak and average traffic load is changing, providing for efficient aggregation of traffic onto converged facilities and achieving port consolidation, deciding when to offload data traffic to a more efficient network, providing the QoS required for internal performance objectives for service now and in future, and selecting the right solution for different classes of cell sites in the same network. It is also about operators making use of existing network assets, planning optimal timing of investment in new infrastructure to assure an optimal degree of service competitiveness in terms of price and the service experience offered, while deciding how to optimize the network for the rapidly changing mix of traffic, new applications, and bandwidth demand that mobile data and video services will impose in the future.

That planning and analysis would be complex enough, even if it did not have to happen within the constraints necessarily imposed by capital availability, installed base, revenue requirements, and the need not only to build a network that will reduce backhaul costs for WiMAX or 2G and 3G networks today, but also remain viable as cellular 2G and 3G networks are complemented by and begin to transition to LTE.

Add all this complexity to the vastly different starting points from which operators begin in terms of capitalization, installed base of various access and transport technologies and protocols, and assumptions about future mobile data service marketability, pricing, differentiation, resiliency, security, and billing requirements, and what do you get? What Mobile Backhaul has already become: a highly fractured, fast evolving market with high risks and rewards, plenty of room for differentiation, and strong competition for market mindshare.

The complexity and varying opportunities that operators are faced with is presenting opportunity for vendors – because operators need their expertise and professional services for design of optimized mobile backhaul networks. Mobile backhaul potentially touches on networking issues, technologies, protocols, and on systems ranging from DSL, PON, EFM, legacy and packet microwave, DWDM, SDH, ATM switches, MSPPs, Carrier Ethernet, pseudowire gateways, packet rings, IP/MPLS routers. There is no wonder why the market has not ramped more quickly: the learning curve for mobile operators that were concentrated primarily on voice and SMS for revenues not long ago, is understandably quite steep.

The “Brave New World” of Mobile Networks in the Future

But overcoming the challenges are worth it. The market is fast leaving behind the era of selling bandwidth, and is increasingly going to be focused on the sale of applications and content, with competitive advantages awaiting those operators coming not only from offering the right service mix, but also from those demonstrating the ability to provide differentiated QoS and quality of experience to the subscriber at lowest cost, and the ability to successfully commercialize services based on applications and content which they may not necessarily own themselves. Surviving and thriving in this new world is going to require operators with vision, creativity, and real marketing savvy, marketing on a level and of a type rarely seen or required in this industry in the past. And this fundamental change has the potential to “re-level” the playing field and the “balance of power” between mobile and fixed/mobile operators in future.

In the short-term, due to wanting to prove in the revenue and profitability potential of new services, deployment trends of mobile operators on average market-wide have tended toward the timid. But that is about to change, led by the innovations of a few key operators that understand that the business model not only will change, but fundamentally *must* change. “Leading edge” can sometimes equate to “bleeding edge.” But when it comes to learning how to successfully transition to a new business model in which bandwidth is increasingly commoditized, it may well be those mobile operators on the “trailing edge” of transport optimization and innovative new service commercialization techniques that will experience the most “bleeding.”

The Ultimate Impact of Topics Discussed

The transitions in mobile networks that have begun to occur and will ramp significantly in 2009 are not only sweeping, they will also be prolonged by the uptake and evolution of new services and mobile radio technologies for the next 5 to 6 years. What is at stake ultimately is which mobile and fixed/mobile operators will best optimize the competitiveness of new services and their resulting profitability. So in the long-term perspective, the transition underway in the design of mobile transport networks is an exciting topic – one that goes beyond transport optimization to encompass operator profitability and the future of mobile services. So although some outsiders might have thought this to be another conference on technical topics, it was actually in many respects a discussion about the future of our industry, how optimization of backhaul networks will enable mobile services to further positively impact mobile communication and the information-intensive lifestyle we will all enjoy in the future, and what vendors and operators need to do to make that happen, and how they can make money by doing so.

Who Came, Who Saw, Who Conquered

Operators presenting at the conference this year included BT, Intracom, Mobilkom Austria, MTN, Orange (and Orange Labs), Swisscom, Telecom Italia, Vodafone (Vodafone Germany, Vodafone Italy), and Wana. **Vendors** making presentations included ADTRAN, Alcatel-Lucent, Axerra, Celtro, Ciena, Harris-Stratex, Memotec, NEC, Semtech, and Tellabs. The **IP/MPLS Forum** and the **Metro Ethernet Forum** also addressed the attendees.

Having first attended this conference four years ago, it seems that every year the “cross-pollination” between operators in Eastern Europe, the Middle East, Africa, and Western Europe and the U.K. increases.

BT discussed its installed base, the speed with which CN 21 is being rolled out, and how it is also able to leverage the CN 21 network for operators’ mobile backhaul requirements. **Mobilkom Austria** discussed expectations of seeing 20 – 60 Mbps of bandwidth required per cell site, and how operators can save money with the “Concept of Y” – replacing multi-hop microwave daisy-chains with a higher speed access link over which traffic from three sites is multiplexed and carried, then using a single microwave hop to get to the other two cell sites.

Orange discussed analysis of the potential to complement microwave backhaul with bonded copper solutions such as 2-BaseTL or 10-PassTL versus DSL, for needs at microcells as well as a potential supplement to backhaul bandwidth at macrocells – and predicted greater use of metro WDM in mobile backhaul is a trend that will continue. **Orange Labs** analyzed the need for one RAN IP transport backhaul solution that will be designed for 3GPP R99, R4, R5, on through HSPA+ and LTE requirements, considered the relative benefits of L2 vs L3 VPNs – and indicated that its analysis indicates that L2 VPNs offer the advantage of simultaneously providing that integrated solution for their own needs and a solution for providing wholesale offers as well.

Vodafone Germany talked about how the peak to average traffic load at cell sites is changing, cited the need to keep the backhaul network as simple as possible, and that while legacy microwave might be able to cope with initial data traffic requirements in the short-term, there is already a need for new microwave Ethernet radios for feeder links – and how the spectrum efficiency of adaptive modulation helps make for efficient microwave backhaul, the need for next gen microwave solutions to support at least 4 levels of QoS, and why they believe that switching functions for packet microwave will remain at L2 (NodeB routing using 802.1Q VLAN-ID, QoS management using 802.1P bits, and Q in Q VLAN stacking)..

Swisscom predicted a 10x increase in capacity requirements in two years, and the need to support 80-160 Mbps of backhaul bandwidth after 2010. Swisscom also discussed its planned migration to the IP RAN, but and predicted that this will be a multiyear effort. They also

pointed out that for most operators, there may not be a “one size fits all” solution for all cell sites, and that it may be common for individual operators to have multiple backhaul solutions in place for a number of years – phasing in new technologies when and where bandwidth requirements, capital availability and operations resources make sense.

VIPnet discussed the need to optimize backhaul in order to support migration to 14.4 Mbps HSDPA, a PWE3 trial using ATM encapsulation over PW, and how key factors it will use to analyze the success of the technology will include performance, alarming and OAM functions, and provisioning and simplicity.

Telecom Italia discussed how PWE3 is an enabler for supporting multiple generations of radio technology, making it a realistic technology for transitioning toward an all-IP/Ethernet solution in the long-term...and how transport convergence is required to achieve transport optimization. They also discussed their UMTS backhauling over Metro Ethernet in their network, including use of PWE3 access gateways at the network edge to collect NxE1 traffic, map the ATM traffic into MPLS/Ethernet using PWE3, and collocating PWE3 backbone gateways with the RNC...and how they have solved end-to-end latency and synchronization issues.

Interesting trends and highlights:

Bandwidth optimization has become every bit as important a topic as **bandwidth scalability**. Talk about how much capacity the average cell site needs has evolved to a more intelligent discussion about how much capacity various classes of high and low density urban versus suburban and rural cell sites will need – and when.

There is no race to build out bandwidth – this is not another psychological bubble, this one is for real...but operators cannot afford to move faster than their ability to prove in a solid business case. Mobile operators need a blueprint for achieving cost effective scalability and efficient consolidation of backhaul traffic over time, not an invoice for overbuilding network capacity in the short-term.

TDM backhaul will remain part of the mix. The real problem operators face is how to profitably scale for the huge expected increase in mobile data and video traffic once flat rate pricing occurs. Voice traffic in emerging markets may not necessarily scale enough to prove in packet solutions in the short-term. In more established markets, backhaul is growing not due to subscriber growth as in emerging markets, but as operators look to increase service availability and quality to reduce churn, and are faced with greater demand for higher speed 3G data services.

In microwave, **Adaptive modulation** and **integration of Ethernet switching and digital cross connects** into packet microwave will be key trends driving new microwave sales – but the sheer size of the installed base of microwave is going to make the transition from the installed base PDH/SDH radios to packet microwave a gradual process. With an installed base of several million cell towers worldwide, with approximately 60% of that served by microwave including SDH radio access rings and single or multiple hop microwave drops off of that common in EMEA and parts of Asia Pac, this is a huge opportunity. Vendors like Nokia Siemens Networks are partnering to private label cutting edge microwave systems developed by companies like. And incumbent microwave vendors like Ericsson and Alcatel-Lucent are putting a lot of development focus into their own portfolios. NEC, the worldwide leader in microwave, has stepped up its marketing presence with microwave recently as well. Dreams of point-to-multipoint access technologies have largely evaporated in the face of operational complexity – with the spectrum efficiency of licensing point-to-point links to cell towers typically providing significant bandwidth where required. What may change over time is whether repeated microwave shots, particularly backhaul from aggregation points, may face increasing challenges from other technologies – as fiber deployment and metro WDM play a greater role. Microwave may also face increasing challenges as a backbone technology in emerging markets as capacity requirements increase.

Cell sites are proliferating, getting smaller, and getting closer to the subscriber – with more operators exploiting small access platform footprint to leverage street cabinet infrastructure – placing smaller micro-sites and antennas in more locations to improve coverage and reduce power effective radiated power requirements in established markets. Small footprint and hardening for access platforms is becoming increasingly critical as a result.

Offload of mobile data traffic onto DSL continues to be a strong trend, with the use of ADSL or VDSL providing asynchronous downlink/uplink speeds that fit current mobile data traffic patterns with HSDPA – but potentially representing a short-term transition-oriented solution as HSUPA is implemented, and as traffic patterns transition increasingly to a peer-to-peer model over time. G.SHDSL.bis in bonded copper solutions are being pushed as an EFM –based solution to providing synchronous backhaul bandwidth that might support more peer to peer traffic.

Bonded copper solutions provide another backhaul alternative, one that is increasingly being looked at as a solution for parts of the network by more operators as the bandwidth capabilities increase. The installed base of DSL is quite serviceable for the current mobile data requirements, which tend to be download-centric...but future synchronous mobile data standards make G.SHDSL.bis solutions of growing potential interest for a number of operators.

PWE3 has been a key enabling technology for some of the hybrid data offload implementations going on, providing very strong legacy support and flexibility – but also potentially introducing some overhead inefficiencies and additional cost if deployed all the way out to the cell site.

The introduction of Ethernet interfaces for the lub for the installed base of 3G, and for a fraction of the 2G installed base has been held out as something that some network infrastructure vendors with cellular-radio capabilities felt was going to eclipse the pseudowire access and aggregation gateway market in traditional cellular operators.

We think the PWE3 gateway vendors have a very good window of opportunity in the short-term. Overhead issues may have some importance on constrained microwave access links, potentially leading some operators to implement PWE3 only at the first aggregation point...but others will find employing PW at the cell site will allow for efficient consolidation of multiple generations of traffic. But of course, operators are also looking at the impact on synchronization, and the total delay budget.

TDM as part of **hybrid offload solutions** appear to have hit a sweet spot in the market, as they are addressing the short-term requirements for finding a more cost effective way to transport fast growing best effort data traffic, while preserving the tried-and-true synchronization techniques of the past. These will likely be part of a transition for many operators – but it is not necessarily going to be as rapid a transition as some vendors would like.

4G is on the horizon! But how close? Discussions with operators in some sideline conversations indicated that many seem very fully engaged in trying to get their hands around the opportunities presented by 3G. And given how long 3G has been available, it is important to note how long it can take to roll out and sell new technologies. There is some “4G preparatory” spending going on, and some planned early deployment.

Where Controversy Remains King

IP/MPLS to the cell site and the full meshed access network remains very controversial for now – with proponents citing that QoS, security, and resiliency needs of future mobile data applications will require this, and detractors saying the cost will never be justified by service revenues.

What kind of rate limiting can operators expect to sustain on flat rate mobile data services? Flat rate pricing with download restrictions may not have the same effect on demand that flat rate pricing without similar restrictions did for fixed broadband access. But flat rate pricing for mobile is a scary proposition for operators, when you factor in the cell site, tower, radio infrastructure, and spectrum costs in addition to the remaining transport and management costs. Flat rate pricing may open up opportunity for operators, but also a lot of challenges.

Does PWE3 have a long-term role in the network, or is this a short-term transition technology? The availability of Ethernet interfaces for 3G and 2G radios will grow significantly in 2009 – but is it better to buy these now, or to implement a pseudowire gateway that may cost a bit more, but which would not necessitate the Ethernet interface investment and potentially provides legacy support for data services as well?

How quickly will operators roll out packet microwave? And will future capacity requirements lead to their changing the architecture of the microwave access network in any way? Will enhanced modulation techniques give microwave enough capacity for the future, or will it become increasingly suited to lower bandwidth requirements and less likely to be used for mobile cores in emerging countries or even for aggregation point backhaul?

Is there an investment in packet synchronization today that will meet current requirements and prepare operators for the future of 4G as well? Or is it too early to predict what requirements future deployment options chosen for 4G may impose?

Can mobile video be successfully commercialized profitably on a wide scale in the short-term, and will it be done using 3G spectrum with MBMS, or will it require separate network infrastructure using DVB-H? Is there a “best method” for packet synchronization? How quickly will 4G be rolled out, and how long will it take?

Will operators strongly embrace upgrading the 3G and 2G infrastructure with Ethernet interfaces in the coming year, or will they invest that money in other technologies that will allow them to integrate traffic onto converged backhaul facilities instead?

These were some of the topics that generated far in presentations and conversations at the Transport Networks for Mobile Operators 2008 conference – issues to be resolved in future and undoubtedly topics for future events.

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Future Networking Opportunities at IIR Conferences

Upcoming IIR events of potential interest for the Mobile Networks community include:

Mobile Broadband World

September 16 – 19, 2008 - Amsterdam

Info on this conference available at: <http://www.iir-events.com/IIR-Conf/page.aspx?id=12821>



Optimising and Evolving 3G Networks

June 16 – 19, 2008 - Prague

Info on this conference available at: <http://www.iir-events.com/IIR-Conf/page.aspx?id=12824>



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