Ubiquitous Internet & WiMAX open standard

Nir Cohen

Sep 2007
WiMAX Forum is leading the way
The IP behavior of mobile WiMAX networks
WiMAX profiles and their role in open architecture
Current rollout plan
About Alvarion
Summary
WiMAX Forum is leading the way
WiMAX Industry Ecosystem

Content Providers / Ecosystem (28%)

Service Providers (33%)

System Vendors (22%)

Chip/ Component Suppliers (17%)

WiMAX Forum
More than 400 Members
Global Representation
More than 30 WiMAX Forum Certified Products

2006
Portable WiMAX Certified Devices for Portable Services

2007
Customer premise WiMAX Certified Devices for Fixed Services

2008
WiMAX handsets and entertainment Devices

Consumer market demand drives WiMAX devices availability
WiMAX Forum Work Groups

Shankar, at&t
Tom Tofigh, at&t
Howard Liu, Disney
Prakash, Intel
TWG: Wonil Roh– Samsung
Vladimir Yanover- Alvarion
Ed Agis, Intel
Tim Hewitt, British Telecom
Mo Shakuri, Alvarion
Hyung Kim, Mary Clark
WiMAX Forum enables equipment certification

- Developing system profiles
- Building certification labs
- Performing un-official Plugfests
- Conducting interoperability tests

A system profile is

- A subset list of 802.16 features
- Each feature can be mandatory or not
- Narrow enough for real-life economical implementation

Band classes are usually defined by:

- Frequency, Duplexing Method (TDD, FDD, HD-FDD), Channel Bandwidth

Certification is conducted for profiles and band classes that are supported by at least 3 manufacturers
The IP behavior of mobile WiMAX networks
All IP Converged Networks

Access Service Network

Aggregation Network
MPLS, Ethernet, IP

Intelligent Edge

Scalable Backbone

Wireline

WiMAX

GPON

Aggregation Node (ASN-GW)

Aggregation Node (ASN-GW)

Aggregation Node (ASN-GW)

BRAS

ASG-NW

SCE

MPLS PE

L2/3 Edge

Core Network
IP / MPLS

HA
## E2E Integrative WiMAX Solution

<table>
<thead>
<tr>
<th>End users</th>
<th>Base Station</th>
<th>Transmission</th>
<th>Aggregation</th>
<th>Multi-service Core</th>
<th>Services OSS/BSS</th>
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</thead>
<tbody>
<tr>
<td>SME Indoor &amp; Outdoor</td>
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<tr>
<td>Residential Indoor &amp; Outdoor</td>
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<td>Nomadic User</td>
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<td>Portable</td>
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<tr>
<td>WiMAX</td>
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</tbody>
</table>

### Transmission
- **Metro Ethernet**
- **Microwave**
- **SDH/SONET (Ethernet)**

### Aggregation
- **ASN GW**
- **MIP HA**
- **PE**
- **IP/MPLS**

### Multi-service Core
- **PE**
- **ISP**
- **Internet**

### Services OSS/BSS
- **AAA**
- **DHCP**
- **DNS**
- **NMS**
- **VOD**
- **VoIP**
- **Broadcast**

- **PSTN**
- **PSTN Interworking**
- **SEF Policy Framework**

### Key Components
- **ASN**
- **CSN**
- **RAN Edge**
- **RAN Core**
- **L3 IP/MPLS Core**

### Internet On-net Services
- **Operator provided services**
Mobile WiMAX – Key Technology Attributes

Scalable PHY from 1.25-20 MHz channel BW, Fractional frequency reuse, All-IP End-to-End Network

Deployment Flexibility

5 ms Frame with low overhead, Adaptive Modulation, advanced FEC, H-ARQ, MIMO with Spatial Multiplexing & STC, spectral-efficient TDD

High Channel Throughput

Fast DL & UL scheduling, Adaptive Modulation & Coding, H-ARQ for added robustness

QoS support for Value-added Services

Optimized hard handover (up to 120 km/hr), Power Saving sleep and Idle Mode for reduced power consumption

Mobility Management

Best in class security features with: Privacy & Key Management Protocol Version 2, EAP Authentication, Encryption with AES-CCM Traffic encryption

Secure Communication
Low latency is the key for video and VoIP real-time services.
WEB 2.0 application support

- Real broadband – DSL like performance in mobile environment
- Flexible upstream/downstream - supports more symmetrical services
- Better end-to-end QoS and real time application support
- Air time mapping and prioritization for real time applications support over the air
- Fast switching for service continuity
WiMAX profiles and their role in open architecture
The Telecom rules of the game are changing

WiMAX All-IP open architecture removes barriers to entry both large and small can enjoy

Promote an Open eco-system all can enjoy and benefit

Follow successful IP network eco-system model

Create an offering to a diverse world of needs limited only by the imagination (and market demand…)
OPEN WiMAX delivers **Operator Centric Approach**
**Freedom to CHOOSE your network strategy**
**Open architecture guarantees interoperability among vendors**
Comparing WiMAX Profiles

OPEN™ WiMAX (Profile C)

Profile B

Profile A

Clearly define separation between radio (BTS) & Networking/IP (ASN-GW) Functions

“Black Box” unknown separation between Radio (BTS) & Networking/IP (ASN-GW) Functions

Radio (BTS) functionality implemented in ASN-GW (Networking) -> Performance degradation

OPEN™ WiMAX (Profile C)

Profile B

Profile A

Removed from WiMAX Forum Specifications (June ’07)
Eco-system is the key for mass market deployment

Leverage current successful IP network world

Open architecture allows:

- Low entry barrier for new vendors
- Though competition on cost and features
- Vendors to easily leverage on their core ingenuity
- Global network support

All Will Be Affected – All Can Benefit
Current rollout plans
WiMAX 802.16e is Already Here

2G - 3.5G

Market Demand
- OFDM
- All IP
- MIMO
- Smart Antenna

WiMAX 802.16e-2005

LTE
<table>
<thead>
<tr>
<th>Wave</th>
<th>Freq</th>
<th>Expected Certification Start Date</th>
<th>Expected Certification of Alvarion’s product Date</th>
<th>Alvarion 4Motion Release</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wave 1 - Phase 1</td>
<td>2.3GHz</td>
<td>ongoing</td>
<td>Oct ‘07</td>
<td></td>
<td>Only WiBRO 8.75Mhz channel</td>
</tr>
<tr>
<td>Wave 1 - Phase 2</td>
<td>TBD, depends on the availability of products</td>
<td>TBD</td>
<td>TBD</td>
<td>RII R2.5 (TBD)</td>
<td>Alvarion plans to participate once there will be such a certification. WF is saying Wave 1 certification will start in Jan’08</td>
</tr>
<tr>
<td>Wave 2 - Phase 1</td>
<td>2.5,</td>
<td>Aug ‘07</td>
<td>Dec ‘07 - Q1 08</td>
<td>2.0; 2.5 w MIMO</td>
<td>Alvarion will be in the first or second batch of those certifying to this wave. 4M certification will include MIMO, but will be commercially available only with 4M release 2.0</td>
</tr>
<tr>
<td>Wave 2 - Phase 2</td>
<td>2.5, 2.3, 3.5</td>
<td>Aug ‘08 (planned)</td>
<td>TBD</td>
<td>2.5</td>
<td></td>
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</table>
Pure-Play End-to-End WiMAX Solution Leader

Top Tier Supplier

- 350+ WiMAX Deployments
- 200+ Countries
- Run Rate $203.5m
- No Debt
- Over $120m Cash
- 1,000+ Employees
- 500+ WiMAX Engineers
- 10,000+ WiMAX Sectors Deployed
- 100,000+ WiMAX CPES Deployed
- 25+ Local Offices Worldwide
- $190 Million+ WiMAX Revenues
- 200+ Channel Partners
- 1,000+ Potential Open WiMAX Partners
- 3 Million+ Units Deployed
- $1 Billion+ Broadband Wireless Deployed
- 350+ WiMAX Deployments
- 100+ Countries

Standards Leadership
Global Partner
Global Deployments
WiMAX Deployments
Top Tier Supplier
Pure-Play End-to-End WiMAX Solution Leader
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25+ Local Offices Worldwide
$190 Million+ WiMAX Revenues
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10,000+ WiMAX Sectors Deployed
Run Rate $203.5m
No Debt
Over $120m Cash
350+ WiMAX Deployments
200+ Countries
The animation on this slide requires PowerPoint 2003 - the final ball sizes, positioning and layout is still being tweaked.

jonnyu, 28/01/2007
WiMAX Market Share Q1-07

802.16d Certified / 802.16e Compliant

Market Size Last 4 quarters $206m

- Airspan: 27%
- Others: 10%
- Alvarion: 41%
- Proximi Wireless: 16%
- Siemens: 14%

Market Size Q1/07 $51m

- Others (Adaptec, Adept, AirSpan, Alcatel, Apero, Fujitsu, Motorola, Nortel, NEC, Nokia, Siemens, ZTE, Zyxel): 51%
- Alvarion: 49%

Certified 16d Radios include Certified 16d radios as well as those waiting for certification. Certified 16d radios that have 16e dual mode ability are included in both the 16d and 16e-based categories to highlight the shift from 16d to 16e.

Includes radios based on the Forum’s 16e specifications. Radios must be shipping with at least Wave 1 ready software and hardware. There may be some overlap with the certified 16d radio category as the market shifts from 16d to 16e vendors offer dual mode radios.
Why Alvarion?

- OPEN™ WiMAX
- Top Tier Supplier
- Best of Breed Partners
- Thought Leader
Summary
WiMAX has built-in capabilities to support WEB 2.0 applications.

WiMAX forum lead the way to WiMAX open architecture.

Profile C enables OPEN WiMAX.

Best of breed eco-system allows operators to built the right combination of vendors.

Alvarion leads OPEN WiMAX and develop the eco-system to support it.