Who we are

- Telkom SA Limited is one of the largest companies registered in the Republic of South Africa and is the largest telecommunications services provider on the African continent based on operating revenue and assets
- Listed on the JSE Securities Exchange South Africa and the New York Stock Exchange
- An integrated communications group, Telkom offers fixed-line and mobile services through a 50% shareholding in a mobile operator Vodacom, while also leveraging the synergies between the two
Overview

- Broadband – The South African Challenge
  - Cost, Timeline, Market Opportunity
- Broadband capable NGN
- Wireless Broadband Market Segmentation
- Present Broadband Wireless Offerings
- Network Evolution
  - FMC, WiMAX, CDMA 2000
- WiMAX Trial
- Network Management
- Final Comments

... is this your current BWA scenario?
Existing Rural Coverage and Service Provisioning

Broadband – The South African Challenge

Definitions:
- **Rural Area** – Low teledensity and economic activity
- **Broadband high density area** – high teledensity and economic activity

![Map of South Africa with regions colored to indicate rural and broadband high density areas]
The Rural Puzzle – challenges in service provisioning

Technology
- Wireline vs. Wireless
- Topographical profile
- Maturity of technology vs. standardization
- TDD vs. FDD
- Frequency availability e.g. CDMA limitations in South Africa

Commercial Viability
- Will the business case fly in the ‘rural’ and/or urban area?
- Customer profile e.g. gated community vs. informal developments in same ‘rural’ area
- Emerging vs. developed market
- Affordability

Regulatory
- Appropriate spectrum assignment
- Tariff
- Social responsibility
- Licensing conditions e.g. service obligations

… Broadband Wireless Access is more than just technology

The importance of a broadband capable Next Generation Network…
...the model

Evolutionary approach tailored to operator uniqueness is key

... 5 critical focus areas of technology strategy

“Going for Gold” - Move to all IP Network
**Wireless Broadband Market Segmentation**

- **Primary Capability**
  - Data: 802.11x and 802.16x
  - Voice: 3G (W-CDMA, EV-DO, HSxPA)

<table>
<thead>
<tr>
<th>Device Type</th>
<th>Primary Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable</td>
<td>• High speed processors</td>
</tr>
<tr>
<td>Portable</td>
<td>• Large, high resolution display</td>
</tr>
<tr>
<td>PDA</td>
<td>• Long battery life</td>
</tr>
<tr>
<td>Smartphone</td>
<td>• Low processor speed</td>
</tr>
<tr>
<td>Cell Phone</td>
<td>• Smaller, lower resolution display</td>
</tr>
<tr>
<td></td>
<td>• Short battery life</td>
</tr>
</tbody>
</table>

**Wireless Platform Capability**

- **High speed processors**
- **Large, high resolution display**
- **Long battery life**

- **Low processor speed**
- **Smaller, lower resolution display**
- **Short battery life**
What Do Customers Ultimately Want?

- Personal Broadband
- Knowledge workers
- Portable and mobility demand on the increase
- Services evolution
  - Content
  - Quad play
  - Always Best Connected
- Goal – Enhancement to Telkom’s Value Proposition
  - Backward and forward integration with key business and solution partners
  - Integrating value-added services into the product mix
  - Technology selection determined by access to appropriate spectrum

Present Broadband Wireless Offering
Present PTMP FWA Systems

- Applications
  - Always-On Fast Internet / Corporate access (<512kbps)
    - eMGW
  - Toll quality telephony
  - Voice band data (56kbps)
    - MGW

- Market Position
  - Residential
  - Small business

WLAN (WiFi)
WLAN - WiFi

- Targeting enterprise, business traveler, knowledge worker
  - Convention Centers, Business parks
  - Hotel chains, Franchises
- Products must be WiFi Alliance certified
  - IEEE 802.11b – 11Mbps
  - IEEE 802.11g – 54 Mbps
- Technology development being monitored
  - MIMO (802.11n)
  - Security (802.11i)
  - QoS (802.11e)
  - WiFi Alliance WMM™ (WMM – WiFi Multimedia)
  - WMM Power Save™
  - WPA2 Enterprise and WPA2 Personal
  - IETF CAPWAP (Control and Provisioning of Access Points)
  - IEEE 802.11r – Fast Inter AP Roaming
  - IEEE 802.11u – Inter-working with external networks
  - Enterprise mobility
- Not suitable as an WAN technology
- Enterprise Mobility
  - Need for WLAN switches

Satellite (VSAT)
Telkom’s Satellite Offerings

- SSO, SSE, 5 User packages
  - Intended for periodic use of e-mail, newsgroups, file transfers, Internet chat, instant messaging, and Web-browsing. Also has plain old telephone service in the case of SSO
  - It is not suited for extensive Virtual Private Network (VPN) usage, video and voice over IP, remote access, gaming, hosting web or ftp servers, or applications with heavy upload traffic

Satellite

- VSAT (GEO)
  - Stagnant growth, new products need to be developed (broadcasting e.g. IPTV)
  - Better suited for niche market applications
  - Deployments in Ku (South Africa) and C (Africa) bands
  - Move to “meshed” PTP space segment from Point-to-Multipoint space segment – single hop required, thereby reducing latency

- Present satellite challenges and future demand
  - Real-time applications
  - Service management
  - QoS
  - Prioritisation
  - Dynamic bandwidth on demand
  - Future Ka developments (small VSAT terminals)
  - Higher bandwidth
Broadband Considerations

Broadband Wireless Access and Satellite Considerations

- Use standards based technologies
  - Economies of scale
  - Support and Integration
  - Interoperability
  - Reduced learning curve effects
  - Reduced technology dissonance (you need harmony)

- Fixed WiMAX
  - Outdoor and indoor antennas for fixed deployment
  - IAD/CPG based communications for voice and data
  - Services – Voice, Fax, WiFi, Internet…

- Mobile WiMAX
  - Fixed, Nomadic, Portability, Mobility

- WLAN Hotspots
  - Present focus on single AP hotspots, hotels to full Enterprise solutions
  - New opportunities in Corporate and Enterprise mobility
    - Roaming with enterprises and branch offices
    - IP PBX, Enterprise WLAN Switches, GSM roaming
Broadband Wireless Access and Satellite Considerations (2)

- Technology Convergence
  - Reduction in the points of failure

- All access infrastructure is supported by
  - Backhauling technologies
  - Must be included in business case consideration

- Synchronization

- Core and services infrastructure
  - Move to IP centric technologies such as IMS and VCC
  - Softswitch (VoIP and PSTN interconnectivity)
  - Standards (e.g. SOAP, XML, AAA)
  - Economies of scale
  - Outsourcing service development e.g. Billing, payment gateways, AAA, RADIUS

Fixed Mobile Convergence
Drivers for Telkom’s Involvement in FMC

- Defensive strategy
  - Revenue protection

- Offensive Strategy
  - Improved value proposition for all customers
  - Cost reduction

- Enable the delivery of customer-centric ubiquitous services
- Increase customer loyalty
- Exploit new revenue streams
- Tighter integration with next generation IP and SIP based communications
- Closer alignment with corporate/enterprise requirements
- Convergence of voice and high speed data capabilities over IP
- Ensure capital expenditure (CAPEX) and operating expenditure (OPEX) cost reduction through a migration to IP

Fixed Mobile Convergence
FMC Network Challenges

- IEEE 802.21
  - Media Independent Handover
- The fundamental point to remember is that 802.21 and IMS are key enablers for VCC and data session continuity
- Value Proposition of IEEE 802.21 (MIH)
  - Maintain connectivity
  - Lower power
  - Anytime, Always, Best Connected
- Optimize Handovers
  - WiFi – WiMax - Cellular
    - Network Discovery & Selection
    - Session and Service continuity
    - Device to Network co-operation
- Key work items for FMC
  - Link layer triggers
  - Information Service
  - Handover Commands
  - Media Independent Handover Function

Wireless Access Technologies – enhancing access capability
WiMAX 802.16-2004 and 802.16-2005

Implementation Driver - CAPACITY

Implementation Driver - COVERAGE

Table:

<table>
<thead>
<tr>
<th>Service</th>
<th>Frequency</th>
<th>Bandwidth</th>
<th>Number of Subcarriers</th>
<th>Maximum Data Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIXED</td>
<td>3.5 GHz FDD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOMADIC</td>
<td>3.5 GHz FDD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PORTABLE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOBILE</td>
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</table>

ITU/BDT Region Seminar
Yaoundé (Cameroon)
September 2006

Telkom SA WiMAX trial – overview
Telkom SA WiMAX trial objectives...

- **Air Interface Prioritization**: Voice, BbDo with QoS/SLA, Ethernet
- **Wireless Backhaul**: Between WiMAX Towers, Hotspot Backhaul
- **Gateway**: Customer premise gateway with integrated voice, WiFi Access gateway
- **Network Management and Planning**: Network management, Performance management, RF Planning tool functionality
- **Technology Capabilities**: LOS/NLOS capabilities, Distance/Bandwidth/Speed
- **Integration Issues**: Voice/PSTN/VOIP integration, ATM interworking, IP interworking

### Test Focus: Throughput and Coverage
- **Results**:
  - 190m antenna
  - LOS capability verified
  - 90° sector coverage verified
  - Reach capability verified
  - Throughput capability verified
  - Planning tool verification for LOS scenarios
  - Backhaul between WiMAX towers verified (CSIR)
  - Remote CPE software upgrades demonstrated e.g. versions, changes
  - VoIP with Unsolicited Grant Services (UGS)

### Test Focus: WiMAX Backhaul
- **Results**:
  - 50m Antenna
  - Backhaul between WiMAX towers verified (PJV)
  - LOS capability verified
  - Throughput capability verified

### Test Focus: NLOS and Micro Cells
- **Results**:
  - 85m Antenna
  - NLOS capability verified
  - Omni coverage verified
  - Micro base station tested
  - Planning tool verification for NLOS scenarios with digital terrain map functionality

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**Telkom SA WiMAX trial – setup and results**

**Lukasrand (PJV)**
- **Test Focus**: Throughput and coverage
- **Results**:
  - 190m antenna
  - LOS capability verified
  - 90° sector coverage verified
  - Reach capability verified
  - Throughput capability verified
  - Planning tool verification for LOS scenarios
  - Backhaul between WiMAX towers verified (CSIR)
  - Remote CPE software upgrades demonstrated e.g. versions, changes
  - VoIP with Unsolicited Grant Services (UGS)

**Kool**
- **Test Focus**: NLOS and micro cells
- **Results**:
  - 85m Antenna
  - NLOS capability verified
  - Omni coverage verified
  - Micro base station tested
  - Planning tool verification for NLOS scenarios with digital terrain map functionality

**CSIR**
- **Test Focus**: WiMAX Backhaul
- **Results**:
  - 50m Antenna
  - Backhaul between WiMAX towers verified (PJV)
  - LOS capability verified
  - Throughput capability verified
Telkom SA WiMAX trial – results …

- Reach capability demonstrated
- PJV to Bronkhorstspruit
- 54.7km distance
- Simultaneous VoIP (UGS) and 512kbit/s Internet (BE)

… effective radio planning is critical …

… effectiveness is dependent on availability of accurate terrain information
• Fully understanding the implications of portability and mobility
  → Marketing requirements
  → Technical requirements
  → Network and frequency planning
WiMAX Network Deployment Guidelines

- **Dense urban areas**
  - Cell sizes < 3km radius
  - Based on data centric usage
  - Indoor, fixed outdoor and nomadic CPE
  - Self-install CPE

- **Urban and peri-urban areas**
  - Cell sizes < 10km radius
  - Deployment is data centric
  - Indoor, fixed outdoor and nomadic CPE
  - Self-install CPE

- **Rural areas**
  - Cell sizes < 30km radius
  - Voice centric deployment
  - Outdoor fixed CPE with higher antenna gain preferred
  - FDD systems preferred
  - Voice and data services offered (WLL)

WiMAX Backhaul
- Cell sizes < 50km radius
- Not considered to be the optimal solution in Urban areas

WiMAX Implementation Considerations

- Need for extended planned coverage prior to deployment
- Consider
  - Certification and technology delays
  - Physical layer certification not enough… QoS recommended for deployment
  - First Office Application recommended to aid in Product Development / Engineering / Operational Readiness
  - Core network and backbone roll-out
  - OSS / BSS availability
  - Network management
- Mobile WiMAX can be used for fixed installations
- Fixed, nomadic, portable and mobile deployments could be considered using 802.16-2005
- MIMO and AAS should be supported directly by the vendor
CDMA 2000 1x with EVDO

- Proof of Concept done with two major Chinese vendors
- Lower frequencies – major competitive advantage
- Language, not technology proved to be the major challenge
- PoC conducted at Thabazimbi (Rural)
  - Mixture of CPE (hand-held, data cards, fixed)
  - Single base station
- Recommend wait for IP centric releases
- Very competitive technology

Inhibitors
- Spectrum availability
- Lack of handsets in 450 MHz and bands other than A and C
Network Management

Generic Management Requirements

- Vendor and operators – need to negotiate / develop joint requirements
- Standard MIBs
- Operations and Support and Business Systems (OSS, BSS)
  - Service/Device Provisioning
- Monitoring Events, Statistics
  - Notification, Triggers, Logging
- Managing Connections
  - Admission control and QoS Mapping, Managing Device States & Resources
  - Managing Broadcast and Multicast Services
- Managing AAA and Security Functions
  - AAA Guidelines, Security Context and Key Management
- Mobility and Handover Management and Procedures
- Physical Layer Management
  - Radio Measurement and Reporting & Power Control Management
Final Comments

- Achieve a service focused evolution
  - Focus on convergence on all layers (Application, Network, Service)
- A cautionary approach towards technology choices and implementation is advised – be sure of:
  - Spectrum availability
  - Regulatory environment
  - Understanding the service requirement
  - Technology Maturity
  - Technology partners
- Monitor Sub-1GHz developments
- Make your business model work
  - Scenario planning is crucial to determine successful network deployment

Thank You... See You in 2010