Project	**IEEE 802.20 Working Group on Mobile Broadband Wireless Access** **<http://grouper.ieee.org/groups/802/mbwa>**	
Title	**802.20 PAR Analysis**	
Date Submitted	**2003-03-10**	
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Re:	MBWA ECSG Call for Contributions	
Abstract	This contribution takes a technical look at the 802.20 PAR, attempting to derive requirements that will govern the development of the 802.20 standard. Several open areas for further detailed definition are defined, with respect to air interface evaluation conditions, system modeling, and network oriented issues currently unspecified that may influence the air interface and MAC design. Related work in other standards bodies is also surveyed, since the PAR calls for significant improvement over these technologies.	
Purpose	To provide input to 802.20 on a number of issues requiring further definition and to recommend that a technical requirements phase should be planned for this standards project.	
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802.20 PAR Analysis

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PAR Analysis: Goals

- Technical Analysis of PAR
  - Identify Major Requirements so Far
  - Identify Issues for Clarification
  - Identify Areas For Further Specification
- Non-Technical Analysis of PAR
  - Identify Use Models
  - Identify Market Requirements
  - Identify Services to Support

PAR Scope – Item 12

- **Item 12 Text:**
  - *Specification of physical and medium access control layers of an air interface for interoperable mobile broadband wireless access systems, operating in licensed bands below 3.5 GHz, optimized for IP-data transport, with peak data rates per user in excess of 1 Mbps. It supports various vehicular mobility classes up to 250 Km/h in a MAN environment and targets spectral efficiencies, sustained user data rates and numbers of active users that are all significantly higher than achieved by existing mobile systems. (See also Item 18)*
- **Derived Requirements**
  - Interoperable MBWA Systems
  - Licensed Bands below 3.5 Ghz
  - IP Data Transport Optimized
  - Peak User Data Rates >1Mb/s
  - Robust Air Interface up to 250 Km/Hr
  - Spectral Efficiency >>Existing Mobile Systems
  - Sustained User Data Rates >> Existing Mobile Systems
  - Numbers of Active Users >> Existing Mobile Systems

Requirements and Questions

Requirement	Questions (Not an Exhaustive List!)
Interoperable MBWA	How is Interoperability Defined? Interoperable with 3G Systems? At What Level?
Licensed Bands Below 3.5 Ghz	What is the Co-Existence Approach with Already Licensed/Deployed Segments?
Optimized for IP Data Transport	Optimized in What Ways?
Peak User Data Rates > 1Mb/s	How is this defined? Channel Conditions Typically Vary the Peak Data Rates. Other Parameters Needed.
Robust for Vehicular Mobility up to 250 Km/hr	What are the Vehicular Conditions? Urban Canyon? Open Space? Freeways with Bridges? What about FER/BER?
Spectral Efficiency >> Existing Mobile Systems.	How is Spectral Efficiency Defined? Conditions Need Clarification.
Sustained User Data Rates>>Existing Mobile Systems	Sustained for how long? Under What Conditions? What is Significantly Greater Than Existing? What does the Application Require?
Numbers of Active Users >> Existing Mobile Systems	How are these users defined as active? Service Active? Transmitting users?

Item 18:Added Notes - 1

Characteristic	Target	Comments
Mobility	Veh. <250Km/Hr	Ref ITU-R M.1034-1
Spectral Efficiency (Sustained)	>1b/s/Hz/cell	How is this Measured? Under What Conditions, Loading, Positioning of Stations? Antenna Arrangements? MIMO?
Peak User Data Rate (DL)	>1 Mb/s	How to Measure? “Marketing” numbers or “Achievable” numbers?
Peak User Data Rate (UL)	>300 Kb/s	How to Measure? Peak Depends on Intervals, Statistics, Channel, Loading.
Peak Aggregate Data Rate/Cell (DL)	>4 Mb/s	Depends on Definition of a “Cell”. How to Measure? Compression on or Off? Traffic Types? Time Periods? Instantaneous?
Peak Aggregate Data Rate/Cell (UL)	>800 Kb/s	Depends on Definition of a “Cell”. How to Measure? 3 Sector Cell? What is Traffic Mix, PHY Conditions, Instantaneous
Airlink MAC Frame RTT	<10ms	Where in Stack is this Measured?? How? Is This Sufficient for ALL Anticipated Services?

Item 18 - Continued

Characteristic	Target	Comments
Bandwidth	1.25 Mhz, 5 Mhz	Spectral Masks are Key to Assure no Adjacent Channel Interference. Should Verify/Evaluate All Important Combinations
Cell Sizes	Capable of Cell-Site Reuse	No Questions.
Spectrum	<3.5 Ghz	What is the Coexistence Approach?
Frequency Arrangements	TDD and FDD	Spectrum Below 3Ghz is Allocated as FDD. TDD Introduces HUGE Co-Existence Issues with Other Licensed Technologies in these Bands.
Security Support	AES	How is AES Used?; Needs to Support Existing and Emerging Commercial Methods for Interoperability. Is this just Over the Air? How about Network Issues?

Project Purpose

- Text:
  - *The purpose of this project is to enable worldwide deployment of cost effective, spectrum efficient, ubiquitous, always-on and interoperable multi-vendor mobile broadband wireless access networks. It will provide an efficient packet based air interface optimized for IP. The standard will address end user markets that include access to Internet, intranet, and enterprise applications by mobile users as well as access to infotainment services.*

- **Derived Requirements**:
  - Multi-Vendor, Interoperable Networks
    - Implies Backward Compatibility with Existing Networks
    - May imply Extensions of Existing 3G Network Services (see later slides)
    - May Imply Basic Voice Services Continuity
  - Packet Based, Optimized for IP (See Scope Comments)
  - End User Markets
    - Internet Access
    - Enterprise Applications
    - Infotainment Services

Item 15: Similar Projects

- **Text:**
  - *ITU-R Working Party 8F is developing air interfaces for IMT-2000 for both mobile and fixed applications, and receives input from various external standards development organizations. 3GPP and 3GPP2 are partnership projects that develop the specifications among these organizations for evolving mobile data air-interface specifications. Their work targets an evolution of existing voice and circuit-switched architectures (in the case of 3GPP based on GSM and in the case of 3GPP2 based on IS-41), as compared to the MBWA project, which focuses on an air-interface optimized for IP data for a cost-effective, packet-switched mobile broadband wireless data solution. T1P1.4 has a project on WWINA which addresses standards related to the radio and netowrk aspects of systems optimized for internet data applications in low mobility environments (with handoff). The individual user data rates specified by this group range from 8 Kb/s to 2 Mb/s.*
- **Other Projects Not Mentioned**
  - **3GPP (HSDPA – IP Optimized - Baseline or Candidate?)**
  - **3GPP2 (1xEV/DO and 1xEV/DV – Baseline or Candidate?)**
  - **OMA – Open Mobile Alliance (Developing Future Applications)**
- **Important Question:**
  - **What Services Deployed and Anticipated by These Projects Must Be Supported on 802.20 MBWA??**
  - **Need to Determine Baselines for Help Evaluating Technology Contributions for MBWA**

Beyond the PAR

- While not Standardized in 802.20, Service "Continuity" with Existing Network Services May Influence the Air Interface Design
  - Examples:
    - **Voice Services** – Currently the Most Profitable Service
      - Service is Very Cost/Complexity Sensitive
      - May require Control Hooks in the Air Interface for Best Performance
      - Requires Minimal Delay, and Delay Variation
      - May Require Service Continuity Such As Soft Handoff to Meet Quality Requirements
    - **SMS Services**
      - Currently Implemented in a Very Efficient Manner
      - Huge Message Volume
      - Very Short Messages (<<<< Typical MSS)
    - **E911 Services**
      - Location Services
      - Priority Access
      - May Require Air Interface "Hooks"
    - **Other New Services**
      - Broadcast/Multicast, Push, MMS, Presence, etc…)

Summary and Conclusions

- Moving Forward from the PAR and 5C
  - 802.20 Should Develop a Consensus View in Many Areas Not Just MAC and PHY
  - 802.20 Would Do Well to Develop a High Level Requirements Document
  - 802.20 Should Develop Appropriate PHY and MAC Modeling Techniques
    - Not Just Data Link and PHY Layer
    - Need System Level Model to See Potentially Hidden Effects
    - Aids in Building Confidence that 802.20 Has Standardized the Best Technical Solution
  - Technical Evaluation Process Has Not Been Addressed and Should Be Before We Discuss Specifics

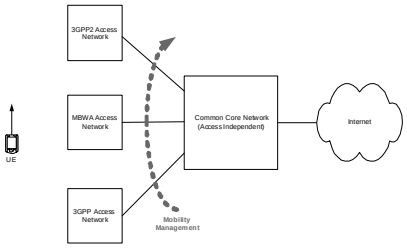
3G/MBWA Interworking

Interworking Scenarios

Six Possible scenarios:

1. Common billing and Customer care
   - No new specification work needed.
2. 3G system based access control and charging
   - IP access over MBWA for 3G subscribers
3. Access to 3G system PS based services
   - For example, Access to IMS, SMS, WAP, MMS from an Interworking WLAN
4. Service Continuity
   - Non transparent service maintenance across MBWA and 3G access networks
5. Seamless service provision
   - Transparent service maintenance across MBWA and 3G access
6. Access to 3G CS Services

Service Continuity



- Service continuity questions:
  - Same service invocation between 3G and MBWA?
  - Simultaneous connections?
  - Service level roaming?
  - Keep the same IP address?
  - Mobility Management role?