[Initial Input for 802.16m project Goals]

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[Response to call for initial input regarding P82.16m Project.]

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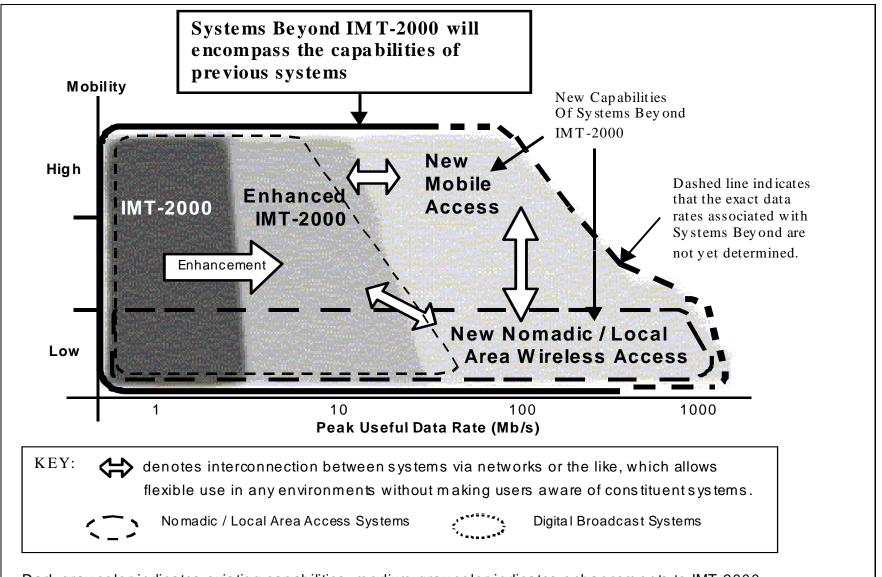
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Outline

- 16m Goals
- Envisioned 16m Usage/Services
- Envisioned Requirements
 - Rate
 - Coverage
 - Flexibility/Adaptability
 - Geographic Considerations
 - Deployment Scenario

ITU-R Vision on Next Generation Wireless Communications



Dark gray color indicates existing capabilities, medium gray color indicates enhancements to IMT-2000, and the lighter gray color indicates new capabilities of Systems Beyond IMT-2000.

The degree of mobility as used in this figure is described as follows: Low mobility covers pedestrian speed, and high mobility covers high speed on highways or fast trains (60 km/h, or more).

Goals of 802.16m

- Support broadband multimedia services
 - Maintain minimum latency to support conversational type applications (voice)
- Improved data rate
- Improved spectral efficiency and reuse
 - 5 25 b/s/Hz required to offer new high rate services
- Flexible and adaptive
 - Allow trade-off between rate/complexity/performance
- Compatibility with OFDMA TDD frame structure

802.16m Usage

- Personal Use
 - Mobile Internet
 - New high bandwidth content (YouTube, MySpace,...)
 - Mobile entertainment
 - Access to digital content: music, video
 - Mobile Gaming
- Business Use
 - Mobile Office: Video conferencing, collaboration (application sharing)
 - Supply chain management
- Others
 - ???

It is expected that applications run on 16m will be similar to those on future wired networks (DSL/Cable/FTTH/Office) and therefore users will expect to be able to use existing applications and receive comparable performance from the 16m system

Application Environment

- Stationary
 - Fixed wireless access
- Pedestrian
 - -5 km/hr
- Vehicular
 - $-30 300 \, \text{km/hr}$

Services

Data Rate

- Higher is better → support current and future applications
 - 1 Gb/s (peak) for stationary users
 - 100 Mb/s (peak) for highly mobile users
 - Peak data rate should scale linearly with spectrum allocation

QoS

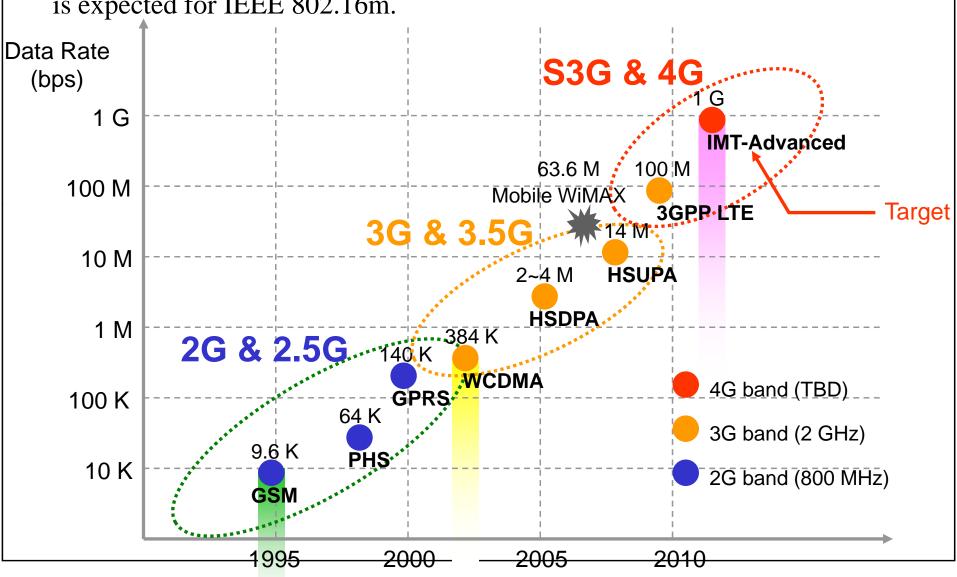
 Support multiple classes of traffic with widely differing latency, error rate tolerance, ...

802.16m Peak Data rate and QoS

cor	Internet	Mobile entertainment	Mobile Gaming	Mobile Office/Video Conferencing
Stationary	•10 – 100 Mb/s •interactive	•10 – 100 Mb/s •Streaming/interactive	•10 - 100 Mb/s •Streaming/interactive	•10 – 100 Mb/s •Conversational
Pedestrian	•10 – 100 Mb/s •interactive	•10 – 100 Mb/s •Streaming/interactive	•10 - 100 Mb/s •Streaming/interactive	•10 – 100 Mb/s •Conversational
Vehicular	•1-10 Mb/s •interactive	•10 Mb/s – 20 Mb/s •Streaming/interactive	•10 Mb/s – 20 Mb/s •Streaming/interactive	•10 Mb/s •Conversational

Rate Requirements

• In order to fulfill the scope of IMT-Advanced, more than <u>1Gbps</u> peak data rate is expected for IEEE 802.16m.

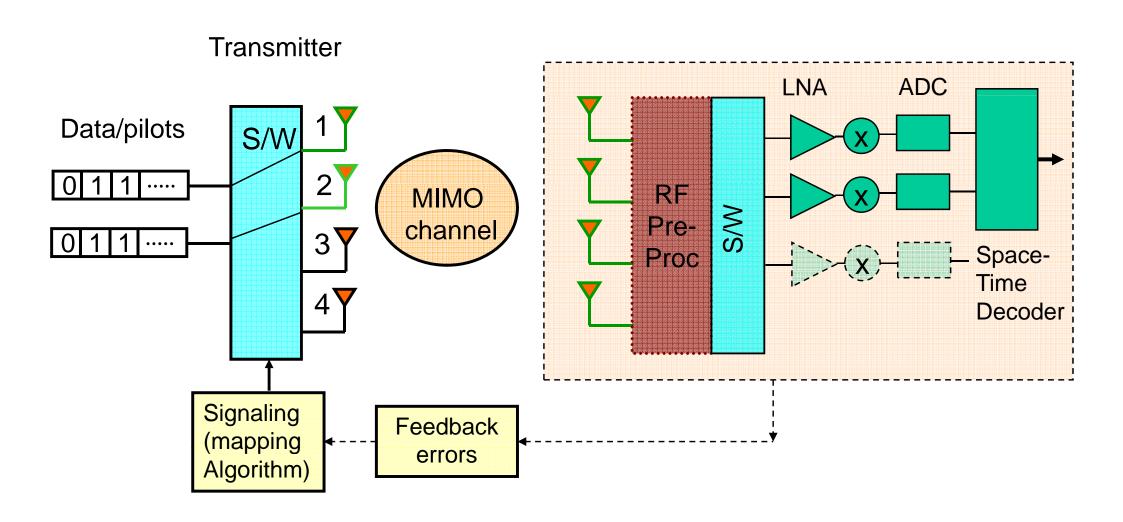


Flexibility/Adaptability

- System will serve a variety of users with different end device capabilities
- PHY/MAC should enable a variety of hardware platforms with different cost/performance/complexity requirements
 - Cellphone → few antenna elements, strict power/battery requirements
 - High end PDA/Laptop
 - More antenna elements, larger display, ...
- Adapt bitrate based on target device
 - Provide date to higher layers regarding channel condition and end device type

Hardware complexity MIMO/AS

Reduced RF Chains/Complexity



Coverage

- Subscribers need service regardless of location.
 - ubiquitous coverage 99% of area in specified service areas
 - Rural → Multihop/relay for range extension
 - Urban (high subscriber density)
 - → Greater Spectral efficiency
 - MIMO
 - Beam Forming
 - InterferenceManagement/Avoidance





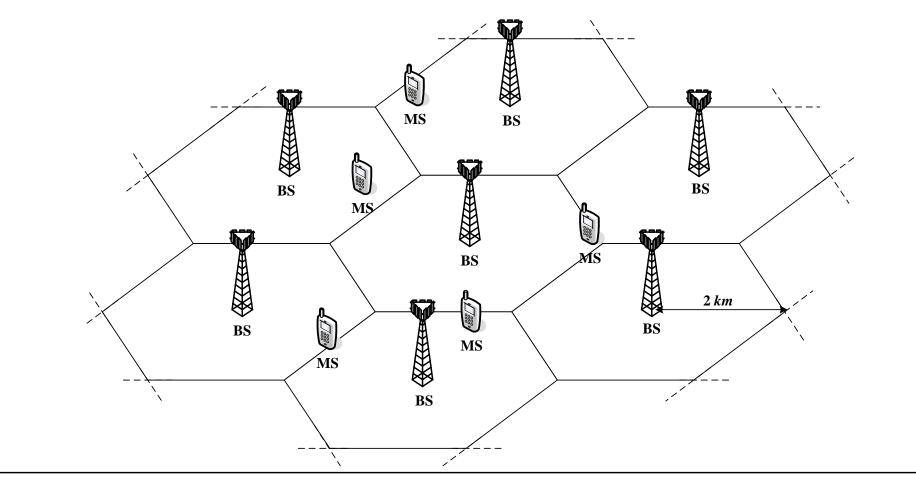
Geographic Considerations

 Improve cell edge bit rate – rate delivered to subscribers far from the base station

	Cell Size	Aggregate DL/UL
Rural	5-30 km	100 - 1 Gb/s / 50 - 100 Mb/s
Urban	1 – 5 km	100 - 1 Gb/s / 50 - 100 Mb/s
Dense Urban	300m – 1km	100 - 1 Gb/s / 50 - 100 Mb/s

Geographic Considerations

- In IEEE 802.16e system, 10W/200mW transmit power can support around 2 km cell coverage both DL and UL respectively.
 - Maximum allowable path-loss as 133dB/133.7dB for UL and DL [1]
 - Consider IEEE 802.16 Type C path-loss model [2] for this example

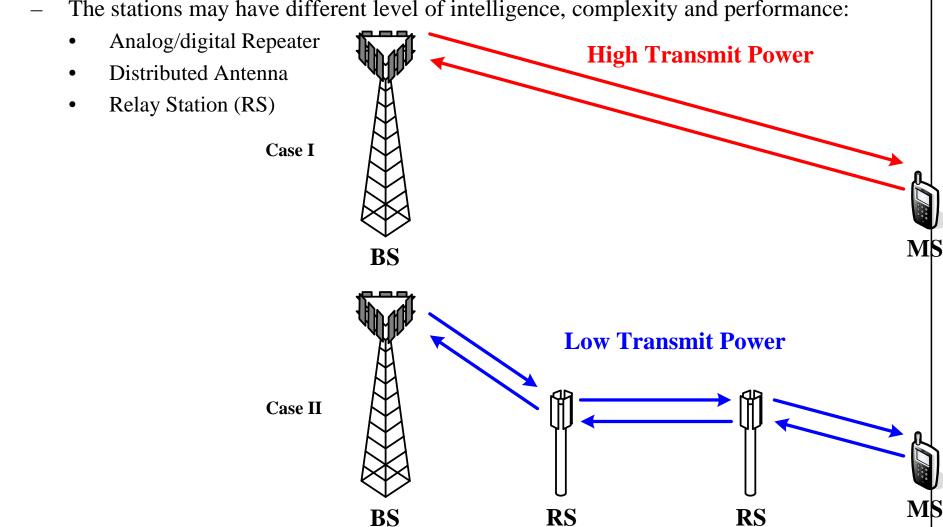


Geographic Considerations

- In order to perform 10~100 times data rate (i.e. 100M~1Gbps) higher than existing IEEE 802.16e system, over 10~100 times max. transmit power may be required to maintain the same received E_b/N₀ and the same cell coverage if we use the same cell deployment scenario as previous page.
 - Take the example in previous page, that means over <u>100~1,000W</u> transmit power and over <u>2~20W</u> transmit power may be required <u>for BS and MS</u> <u>respectively</u>.
 - This may be a very critical challenge for BS and MS hardware development
 - High transmit power will severely shorten the battery life of MS
 - The requirement may be even higher when taking the interference increment into consideration

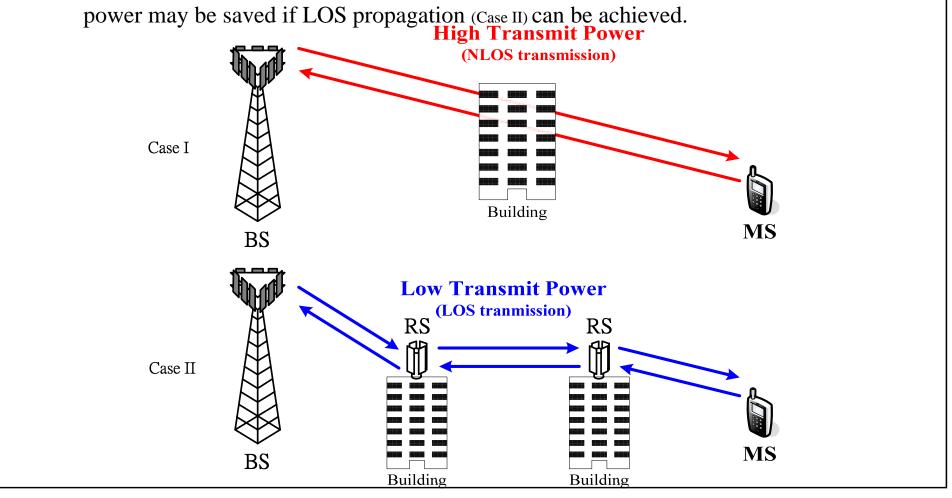
Deployment Scenario

- Instead of substantially increase the transmit power (case I), an alternative (case II) is deploying additional stations for power boosting between BS and MS.
 - The stations may have different level of intelligence, complexity and performance:



Deployment Scenario

- In addition, deploying additional stations between BS and MS can lead to higher flexibility to explore better propagation condition:
 - Compare with NLOS (Non Line-Of-Sight) propagation (Case I), more than 20 dB transmit



Deployment Scenario

- Extending high data rate to users at the cell edge.
 - Consider cooperative techniques among base stations to improve reception near cell boundaries]

