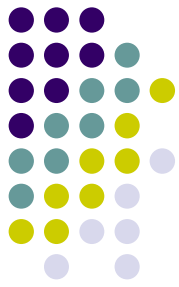


WiMAX



● **Worldwide Interoperability
for Microwave Access**

● **Wi-Max Protocol**

● **Network Architecture**

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Objectives

- Understand the basic of Wi-Max standards
- Know the features, applications and advantages of Wi-Fi



What is WiMax?

- WiMax is a radio technology that promises to deliver two-way Internet access at speeds of up to 75 Mbps at long range.
- WiMax can transmit data up to 30 miles between broadcast towers and can cover areas more than a mile in radius with bandwidth that exceeds current DSL and cable broadband capabilities.
- So, some believe that it could cut the cost of bringing broadband to remote areas.

WiMax (Cont'd)



- WiMax, short for Worldwide Interoperability for Microwave Access, is the latest of the wireless "last mile" broadband technologies.
- ISPs see WiMax as a means of connecting rural or remote areas with broadband service, something that would be technically, physically or economically difficult to do by burying wire for DSL or cable connections.
- Laying wires is especially difficult in hilly areas like Susquehanna.

WiMax (Cont'd)



- In congested cities, WiMax products could shift traffic to help relieve heavy demand on broadband networks.
- WiMax will work with other shorter-range wireless standards, including Wi-Fi, which has taken off as an easy way to provide Internet access throughout a home or business.
- Eventually, advocates hope to see the standard evolve into a mobile wireless Internet service similar to cellular data technologies. It may not ever be as wide-area as cellular but will offer higher data rates.

WiMax Protocols



- The protocols that govern WiMax have been standardized. They are collectively referred to as 802.16.
- Like Wi-Fi = 802.11, WiMax = 802.16.
- Overall vision for 802.16 is that carriers (e.g., ISP) would set up base stations connected to a public (wired) network. This is like cellular.
- Each base station would support hundreds of fixed subscriber stations. Fixed means that subscriber stations do not move. Plans to expand the standard to include mobile stations is in the working.



More on WiMax

- Base stations will use the 802.16 protocols to dynamically allocated uplink/downlink bandwidth to subscriber stations based on their demand.
- 802.16 has been developed for several frequency bands (various licensed frequencies in 10-66 GHz, also licensed and unlicensed frequencies in 2-11 GHz).
- In the unlicensed bands, 802.16 can be used as a backhaul for wi-fi systems or a longer-range alternative, i.e., replacing hotspots with hotzones.

Some Technical Specs on WiMax



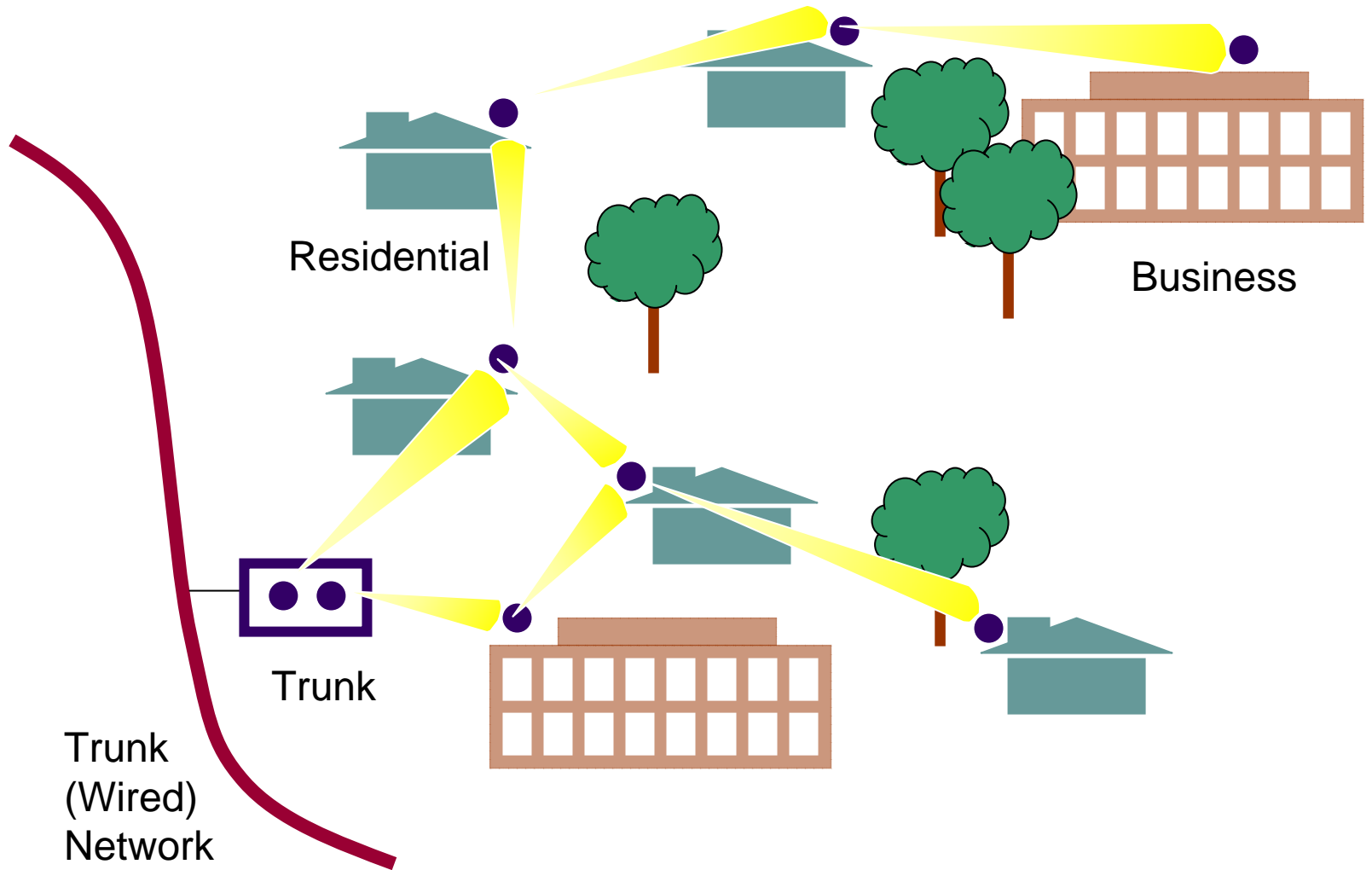
- The radio technology is based on OFDM.
- 802.16 standards incorporate use of adaptive antenna arrays, which can be used to create dynamic beams in desired directions.
- Standards offer option for a mesh mode network topology.



Mesh Networking in WiMax

- When a subscriber unit is not in line of sight with the base station (does not have a good signal strength), then it may be able to make a peer-to-peer connection to a neighbor, i.e., hop to a neighbor's subscriber unit.
- The neighbor's unit may be in line of sight with the base station, in which case this neighbor would serve as a relay station (a repeater).
- If the neighbor's unit is not in line-of-sight then another hop can be made.

Mesh Mode



WiMAX Technology



WiMax is...

The next generation of WiFi, or Wireless networking technology that will connect you to the Internet at faster speeds and from much longer ranges than current wireless technology allows.

WiMax Promises...

- ▶ Up to a ten (10) mile range without wires
- ▶ Broadband speeds without cable or T1
- ▶ Handles "last mile" access in remote areas
- ▶ Licencing and equipment due in 2005
- ▶ Affordable technology

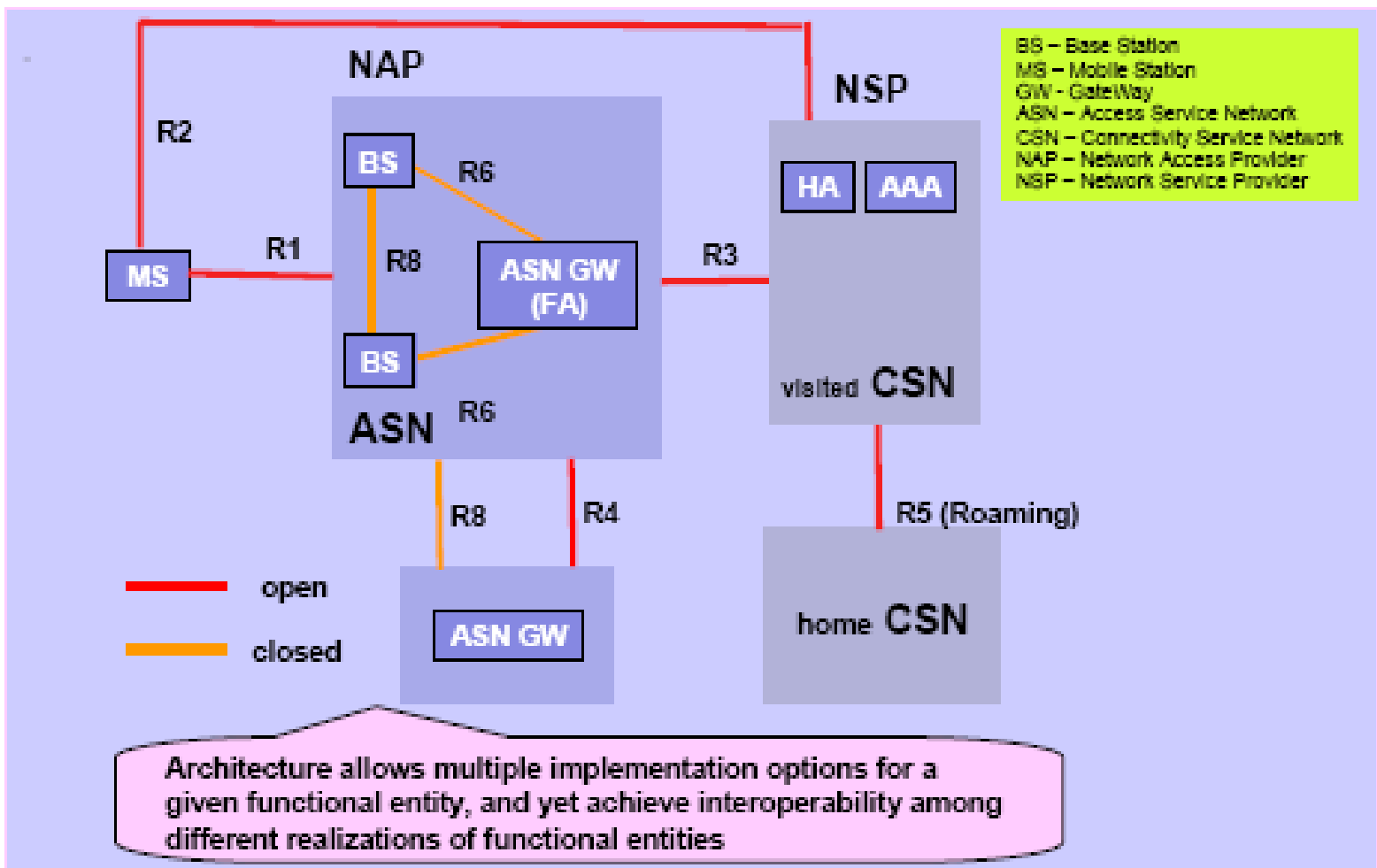


Benefits over Satellite



- In rural areas, the real competition to WiMax would be satellite data services.
- The benefit that WiMax offers over satellite is that satellite offers limited uplink bandwidth (upload data rates are not as high as download data rates).
- Further, satellite suffers with high latency.

Network Reference Architecture





Network Reference Architecture

- The WiMAX Forum has defined an architecture that defines how a WiMAX network connects with other networks, and a variety of other aspects of operating such a network, including address allocation, authentication, etc. An overview of the architecture is given in the illustration. This defines the following components:
 - SS/MS: the Subscriber Station/Mobile Station
 - ASN: Access Service Network
 - BS: Base station, part of the ASN
 - ASN-GW: the ASN Gateway, part of the ASN
 - CSN: the Connectivity Service Network
 - HA: Home Agent, part of the CSN

Network Reference Architecture



- AAA: AAA Server, part of the CSN
- NAP: a Network Access Provider
- NSP: a Network Service Provider
- plus a number of interconnections (or reference points) between these, labeled R1 to R5 and R8.
- It's important to note that the functional architecture can be designed into various hardware configurations rather than fixed configurations. For example, the architecture is flexible enough to allow remote/mobile stations of varying scale and functionality and Base Stations of varying size



WiMAX vs. 3G, pros and cons

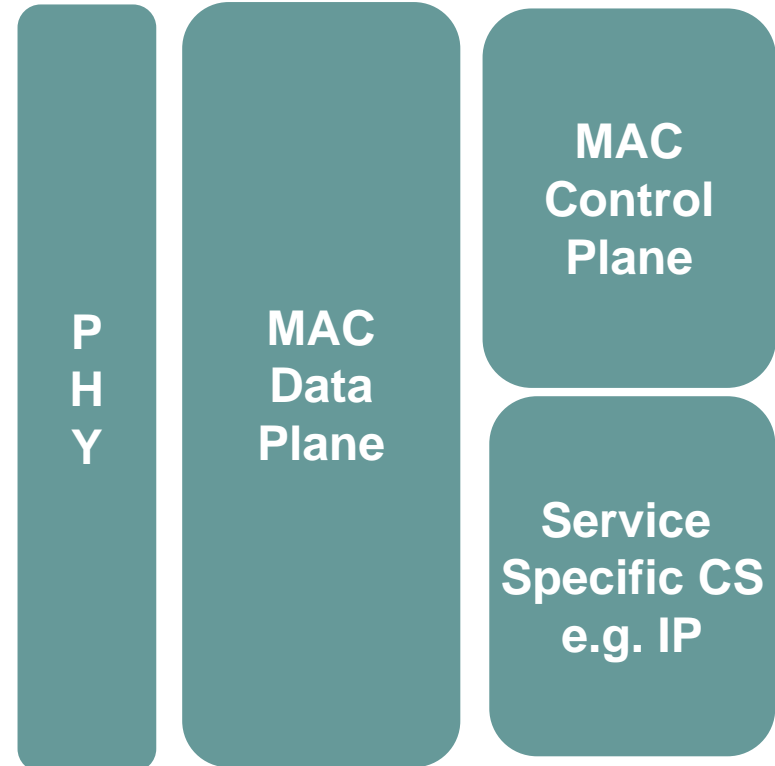
- **Cost**
 - Lower equipment cost for WiMAX due to certified products (compare with WiFi)
 - WiMAX require new infrastructure while HSPA rides on UMTS
- **Coverage**
 - Roughly the same coverage (average ~5 km)
- **Performance**
 - Roughly the same performance (average ~2 Mb/s per user)
- **Market window**

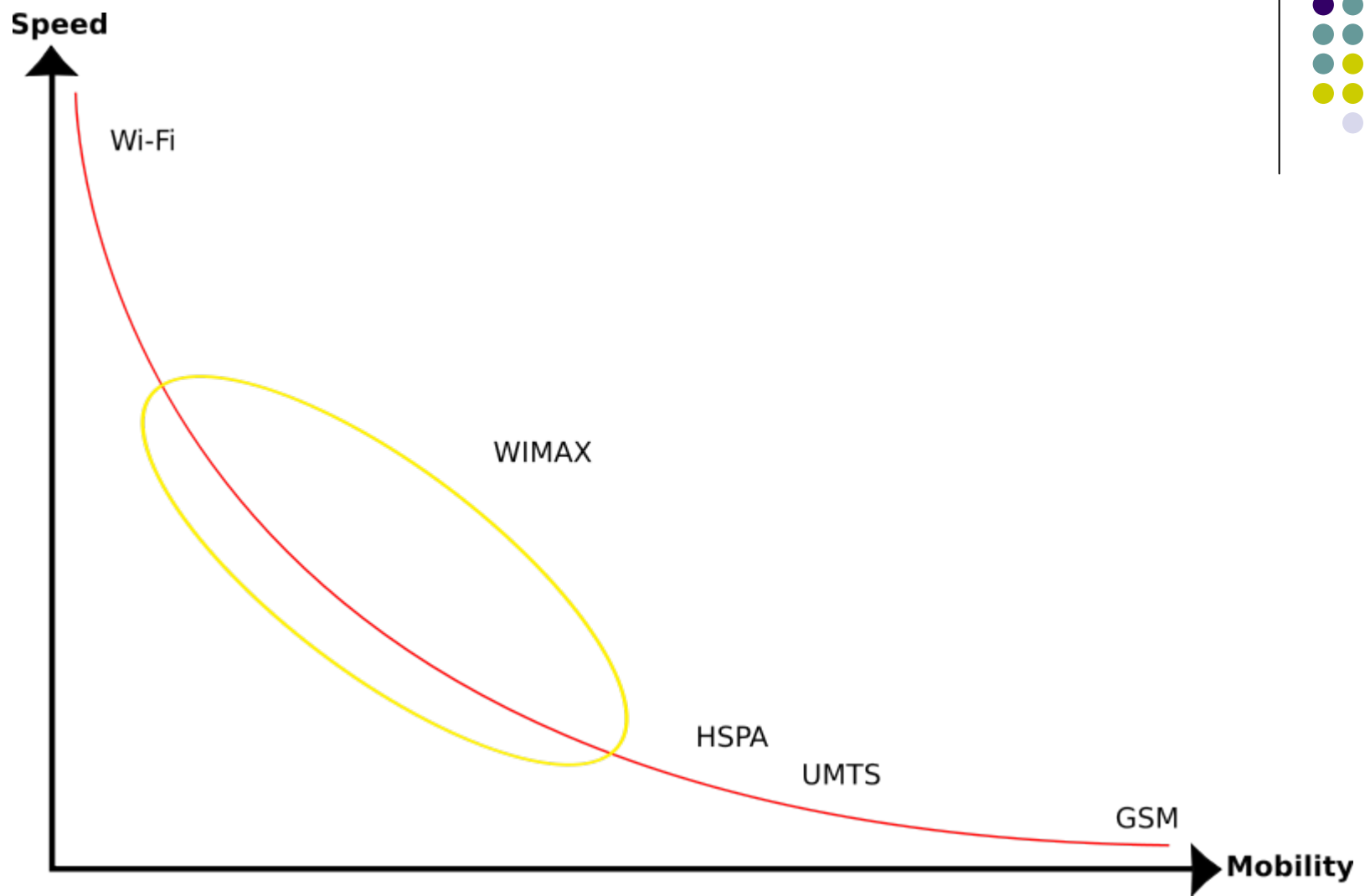
WiMAX standard set end of 2005 -> first products in 2007
- **Acceptance**
 - HSPA has a higher acceptance with mobile operator

WiMAX BS architecture



- OFDM
 - Modulation technique, spread spectrum
 - Used in e.g DSL, WLAN, WiMAX
- MAC, control plane, user plane
 - Manage resources on the air interface
 - QoS
 - ARQ
 - Mobility Management
 - Radio Resource Management
 - Location
- PHY
 - OFDM
 - MIMO
 - Modulation





Q & A ?

