

# Performance Evaluation in Wireless Networks and Technologies from 2.5 G, 3G, LTE to 4G and Beyond

**ICIW 2008, AICT 2008**

Athens, June , 2008

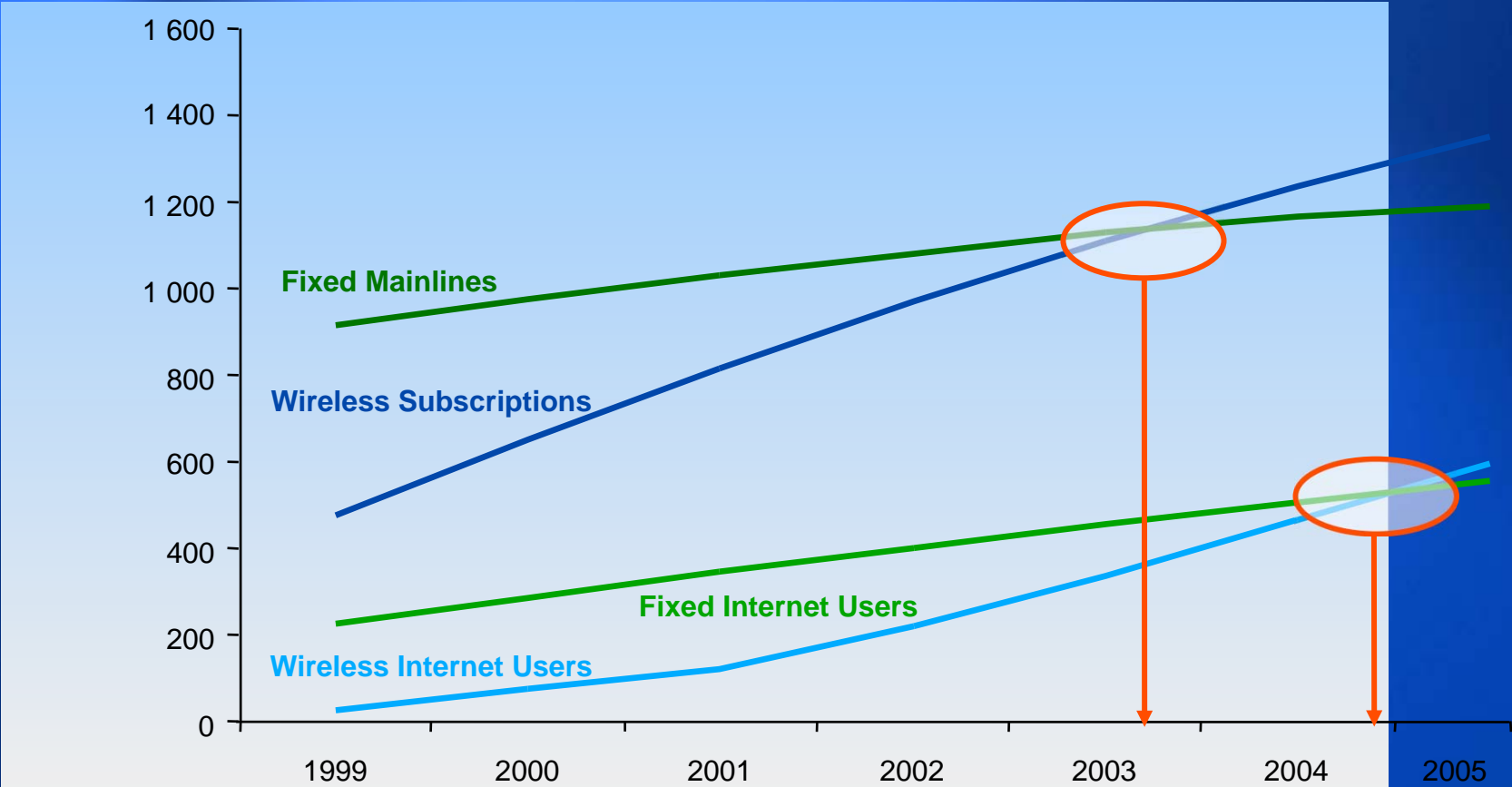
**Dr. Reda**

**Innovation Communication Technologies**

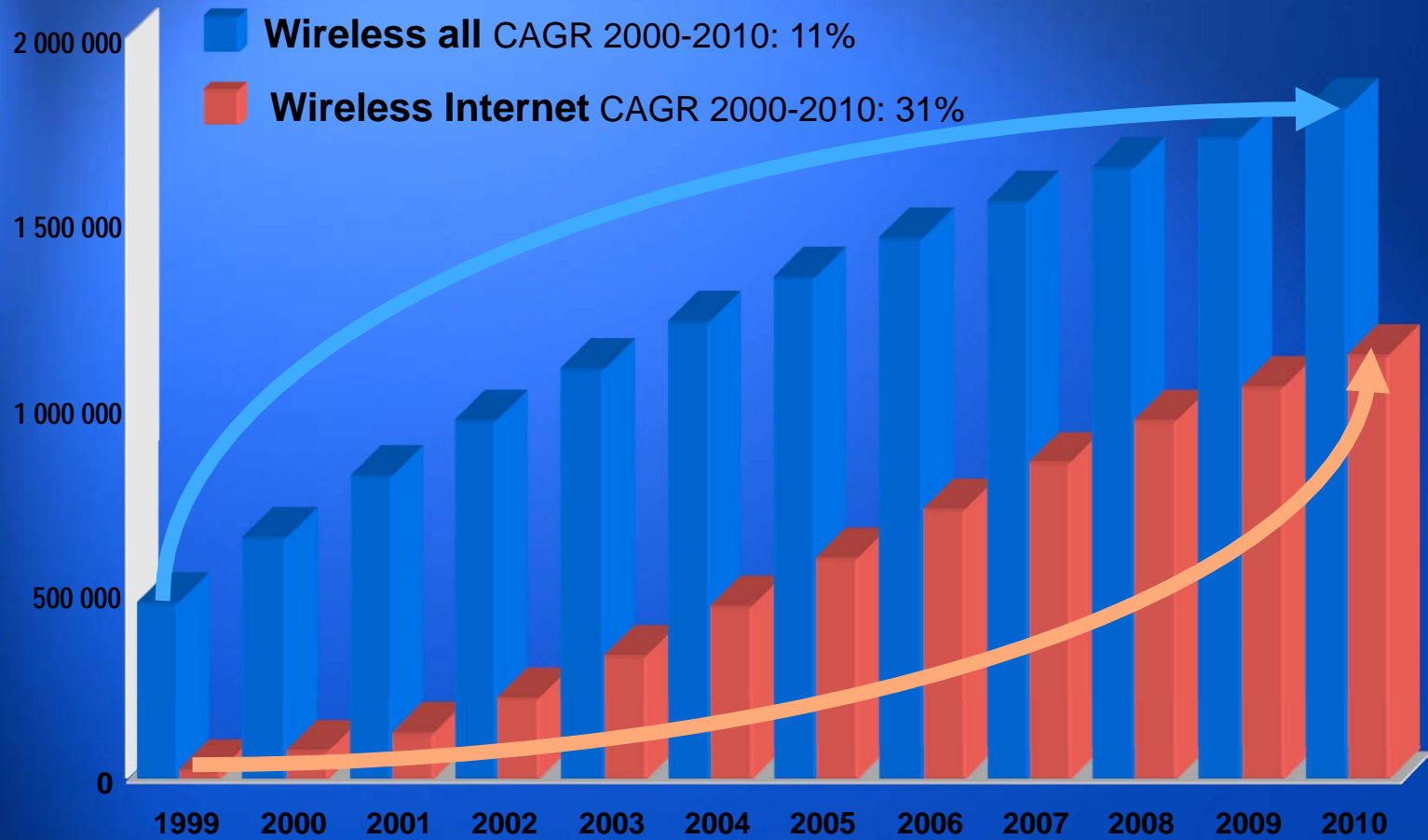
**Munich / Vienna**

# Mobility.... Mobile Wireless...

# Mobile Network Subscribers vs. Fixed Network Subscribers



# Wireless Internet Access



# Wireles Generations at a Glance

**0 G:**

**Mobile Radio Telephone, USA, Areas  
outside Cities**

# Wireles Generations at a Glance

**1 G:**

**1980**

**Cell phones**

**Aanalog cell phone**

**150MHz**

# Wireles Generations at a Glance

## 2 G:

**Digital Signal**

**Signalling**

**Devided to:**

**TDMA-based standards (Time Division Multiplexed Access) and  
CDMA-based standards (Code Division Multiple Access)  
depending on the type of multiplexing used.**

# Wireles Generations at a Glance

## 2 G:

### Main Standards

- GSM 900, 1800
- GPRS :56 up to 114 kbit/s
- EDGE Enhanced Data rates for GSM Evolution , Enhanced GPRS (EGPRS) ,473.6 kbit/s for 8 timeslots)



# Wireless Generations at a Glance

## 2.5 G:

- 2.5G is a stepping stone between 2G and 3G cellular wireless technologies
- P+S

## Wireles Generations at a Glance

### 3 G:

**UMTS: Universal Mobile Telecommunications System** is one of the third-generation (3G) cell phone technologies, which is also being developed into a 4G technology. Currently, the most common form of UMTS uses W-CDMA as the underlying air interface. **Mobile Radio Telephone, USA, Areas outside Cities**

## Wireles Generations at a Glance

### 3 G:

**UMTS: Universal Mobile Telecommunications System** is one of the **third-generation (3G)** cell phone technologies, which is also being developed into a **4G** technology. Currently, the most common form of UMTS uses **W-CDMA** as the underlying air interface. **Mobile Radio Telephone, USA, Areas outside Cities**

## Wireles Generations at a Glance

### 3 G:

**HSPA:High-Speed Packet Access is a collection of mobile telephony protocols that extend and improve the performance of existing UMTS protocols. Three standards, HSDPA, HSUPA and HSOPA, were established**

**HSUPA provides improved up-link performance of up to 5.76 Mbit/s theoretically. In Singapore, Starhub announced a 1.9 Mbit/s HSUPA Service as part of its new MaxMobile plan in 1 Aug 2007 [1]. In Finland, Elisa announced on 30.8.2007 1.4 Mbit/s HSUPA to most large cities with plans to add the service to its whole 3G network within months**

## Wireles Generations at a Glance

### 3 G:

**HSDPA High Speed Downlink Packet Access provides improved theoretical down-link performance of up to 14.4 Mbit/s. Existing deployments provide up to 7.2 Mbit/s in down-link. Up-link performance is a maximum of 384 kbit/s.**

## Wireles Generations at a Glance

### 3 G:

**UMTS: Universal Mobile Telecommunications System** is one of the third-generation (3G) cell phone technologies, which is also being developed into a 4G technology. Currently, the most common form of UMTS uses W-CDMA as the underlying air interface. Mobile Radio Telephone, USA, Areas outside Cities

## Wireles Generations at a Glance

### 3 G:

**WiMAX, the Worldwide Interoperability for Microwave Access, is a telecommunications technology standards aimed at providing wireless data over long distances in a variety of ways, from point-to-point links to full mobile cellular type access. It is based on the IEEE 802.16 standard, which is also called WirelessMAN.**

# Wireles Generations at a Glance

## **LTE:**

- improve the UMTS mobile phone standard
- improving efficiency, lowering costs, improving services, making use of new spectrum opportunities
- ALLROUNDER !!
- LTE: All-IP-Networks
- MS, SDE !!



## Wireles Generations at a Glance

### 4 G:

**Traditional definition:**

**Fourth-Generation Communications System (also known as Beyond 3G), is a term used to describe the next step in wireless communications. A 4G system will be able to provide a comprehensive IP solution where voice, data and streamed multimedia can be given to users on an "Anytime, Anywhere" basis, and at higher data rates than previous generations. There is no formal definition for what 4G is; however, there are certain objectives that are projected for 4G .**

# Wireles Generations at a Glance

## 4 G:

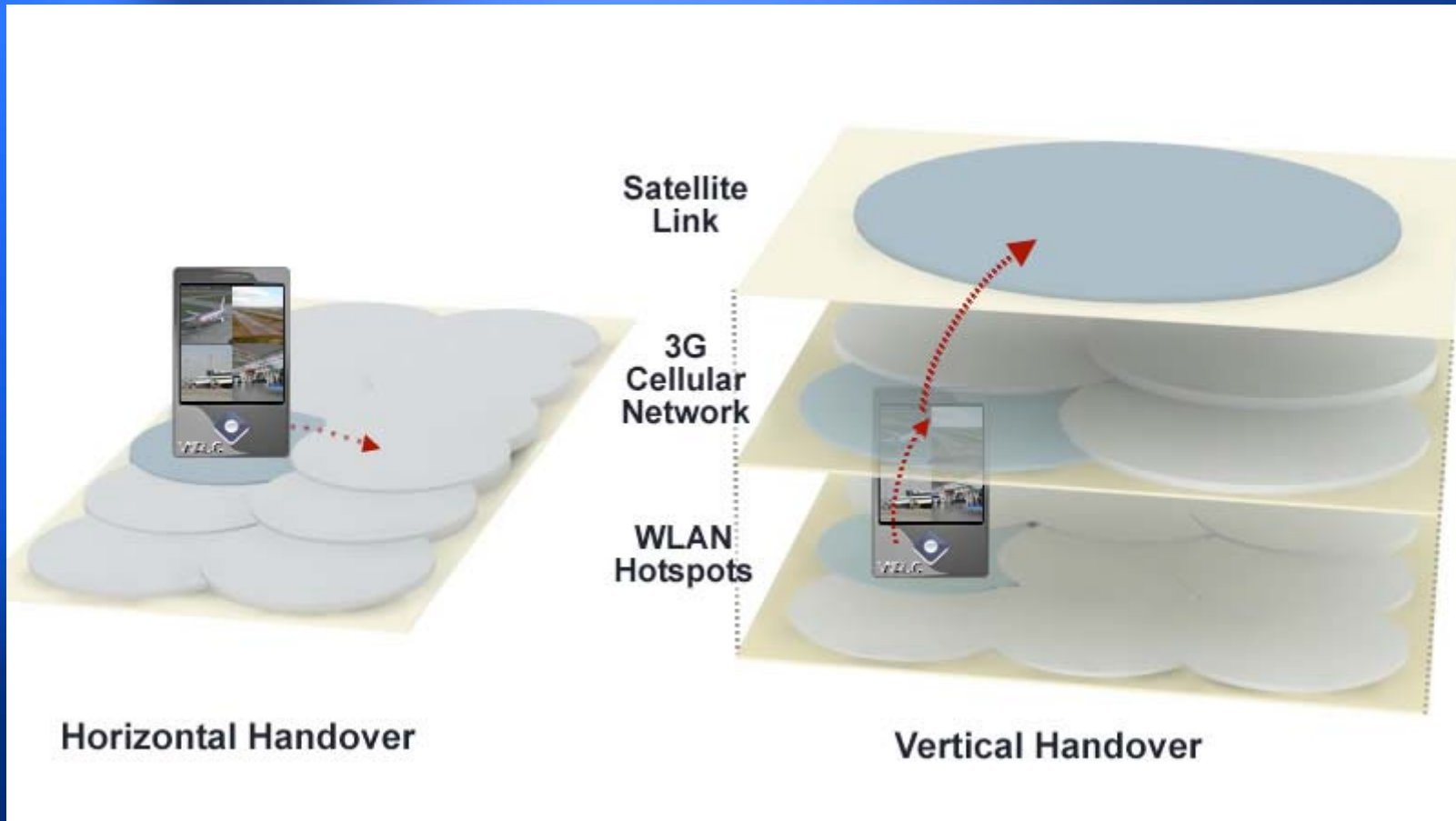
**Traditional definition:**

**Fourth-Generation Communications System (also known as Beyond 3G), is a term used to describe the next step in wireless communications. A 4G system will be able to provide a comprehensive IP solution where voice, data and streamed multimedia can be given to users on an "Anytime, Anywhere" basis, and at higher data rates than previous generations. There is no formal definition for what 4G is; however, there are certain objectives that are projected for 4G .**

**IS THIS TRUE !!!!**

# The Big Q.?

4G ....why??



## Comparing Key Parameters of 4G with 3G

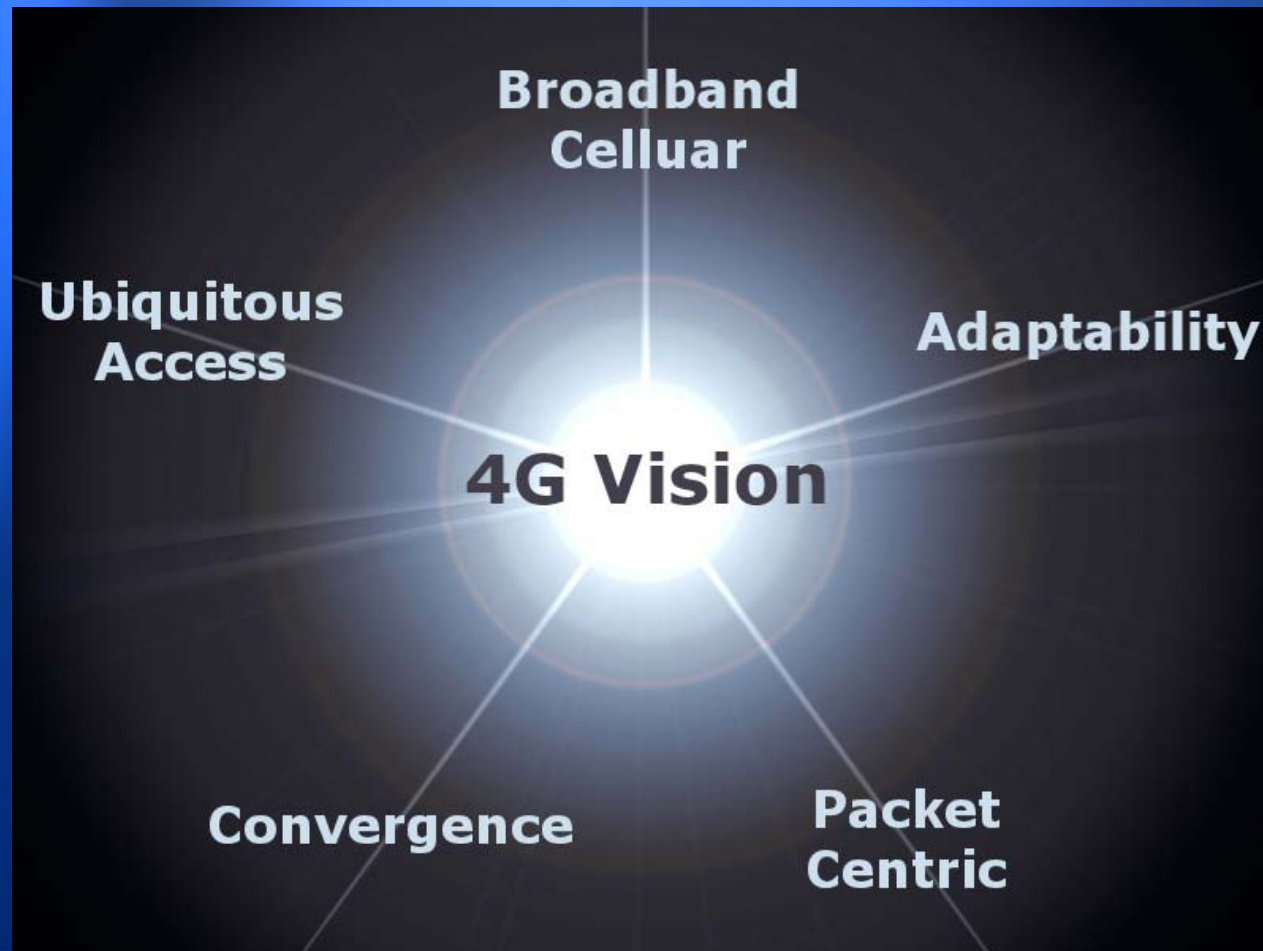
	3G	4G requirements
	voice driven, data was always add on	Converged data and voice over IP
Network Architecture	Wide area cell-based	Hybrid - Integration of short range technologies (WLAN, Bluetooth) and wide area
Transmission speeds	384 Kbps to 2 Mbps	20 to 100 Mbps in mobile mode
Frequency Band	1800-2400 MHz Dependent on country or continent	2-8 GHz
Switching Design Basis	Circuit and Packet	All digital with packetized voice
Radio Technologies	W-CDMA, EDGE	OFDM and MC-CDMA (Multi Carrier CDMA) Ultra Wide Band (UWB)
Component Design	Optimized antenna design, multi-band adapters	Smarter Antennas, software multiband and wideband radios

# Bandwidth Rqmnt. to Reach Excellent Quality

## Bandwidth requirements



## Vision of the 4G



# The Big A.?

S 3

S 4

S 5