International Technology Corporate Finance

Fixed Mobile Convergence

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Dr. Mehmet Unsoy

- Highly experienced telecommunications technology executive with 30 years experience in the data, IP and wireless industries
- Partner at Cartagena Capital, a global investment banking boutique, focused on telecom, specifically wireless companies
- Ex-CTO/ CIO, Vice President/ Chief Wireless Architect responsible for O2 (UK, Germany, Ireland and The Netherlands)
- Ex-VP Mobile Multimedia Architecture, British Telecom (UK)
- Former Director Wireless Internet, Nortel Networks – Asia/ Pacific, US and Global (US, Japan)
- Former R&D Director at Bell-Northern Research (Canada)
- Ph.D., University of Waterloo (Canada) and BSEE degree from METU in Ankara

Cartagena Capital

- Investment banking boutique http://www.cartagena-capital.com

- Headquartered in Munich, Germany, with partners in Munich, Paris, Helsinki and Dallas, Texas

- Focus on Telecom sector, with special emphasis on wireless market

- Key services: Mergers and Acquisitions (M&A) and Fundraising

- Several recent transactions:
  - Swapcom (mobile device management) sold to Swisscom subsidiary Sicap
  - Part of Openbit (mobile payment) sold to Packetvideo
  - Coronis (machine-to-machine) sold to Elster
  - Merger of Appium (SIP app server) with Aepona

- Working on a number of transactions in various areas:
  - FMC / Mobile VoIP
  - Mobile Video / TV
  - Mobile Security
  - WiMAX

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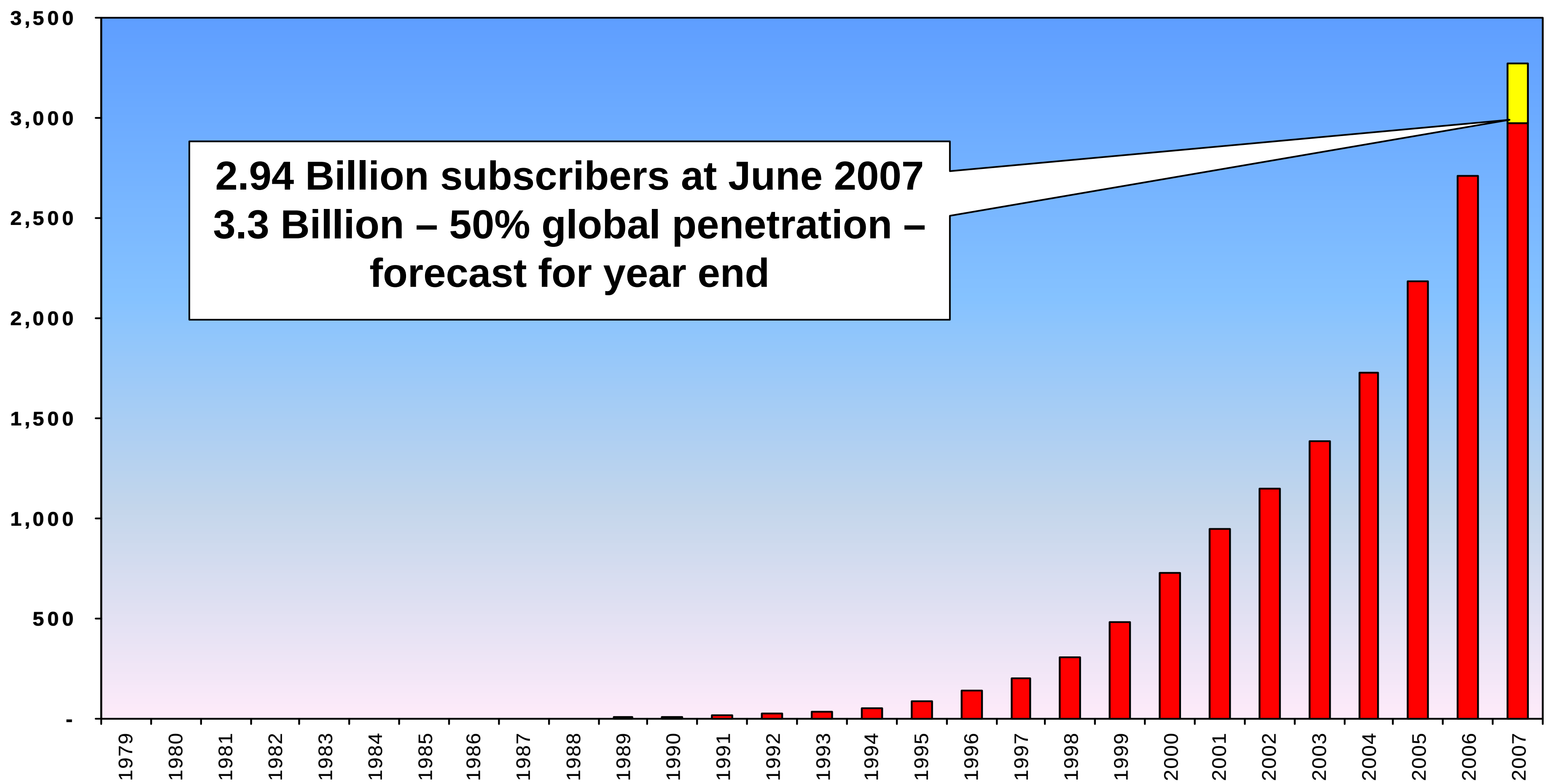
Outline

- FMC Market
- UMA Direction
- SIP / VCC Direction
- Femtocell Direction
- Recommendations

Global Mobile Market



Source: The Mobile World Database, September 2007

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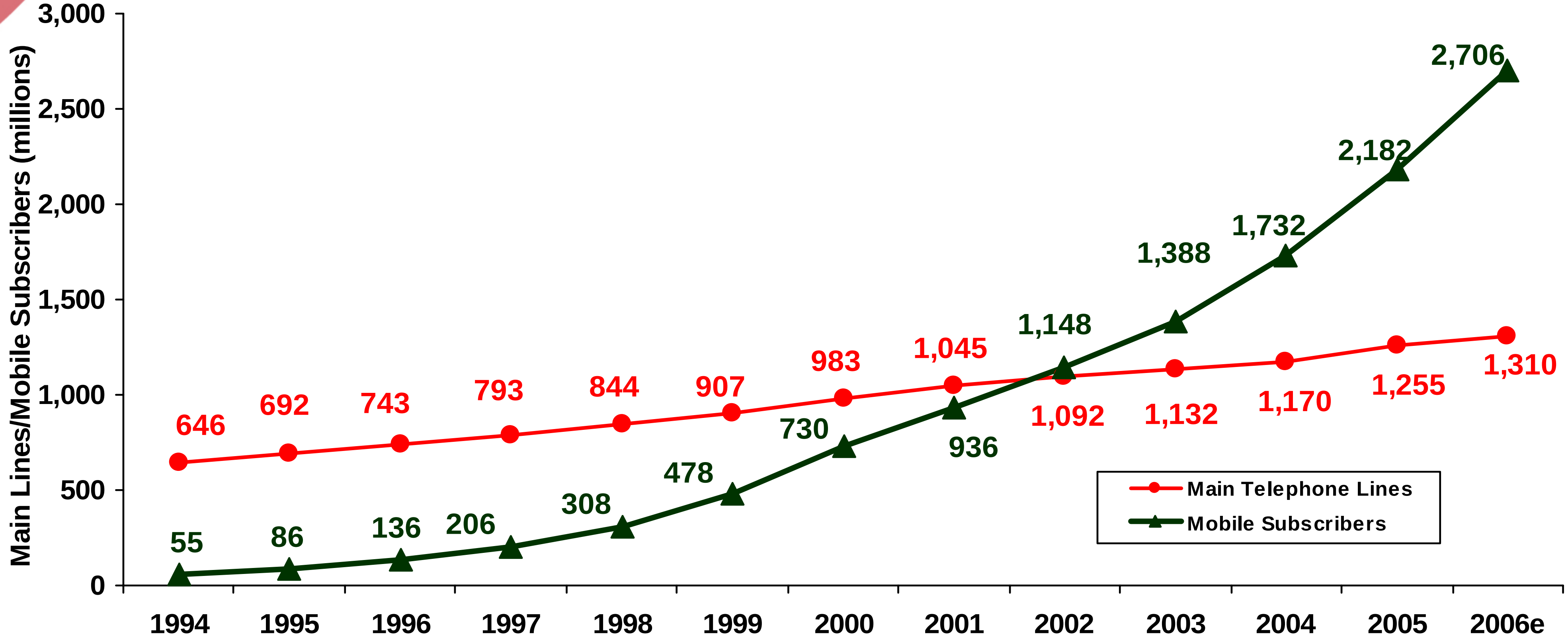
Fixed Lines vs. Mobile Subscribers



Sources: Main lines for 1994-2005 as reported in *World Telecommunications Development Report* and Successor Publications, International Telecommunication Union, Geneva, 1995-2007. Mobile Subscribers for 1994-2005 are industry consensus and for 2004 and following from *The World Database*. Landline estimate for 2006 is by The Shosteck Group. Values as of year-end. (5/6/07)

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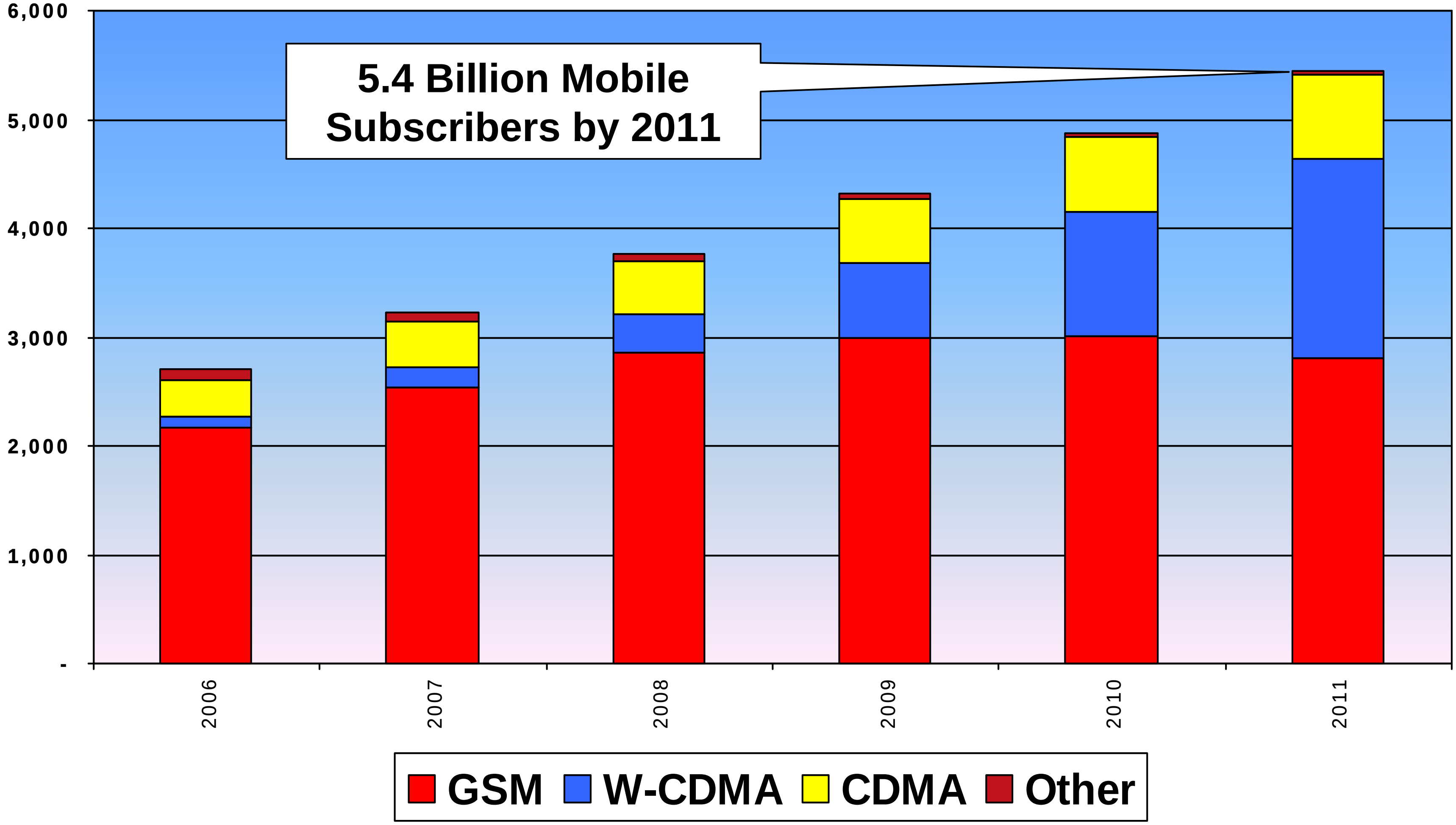
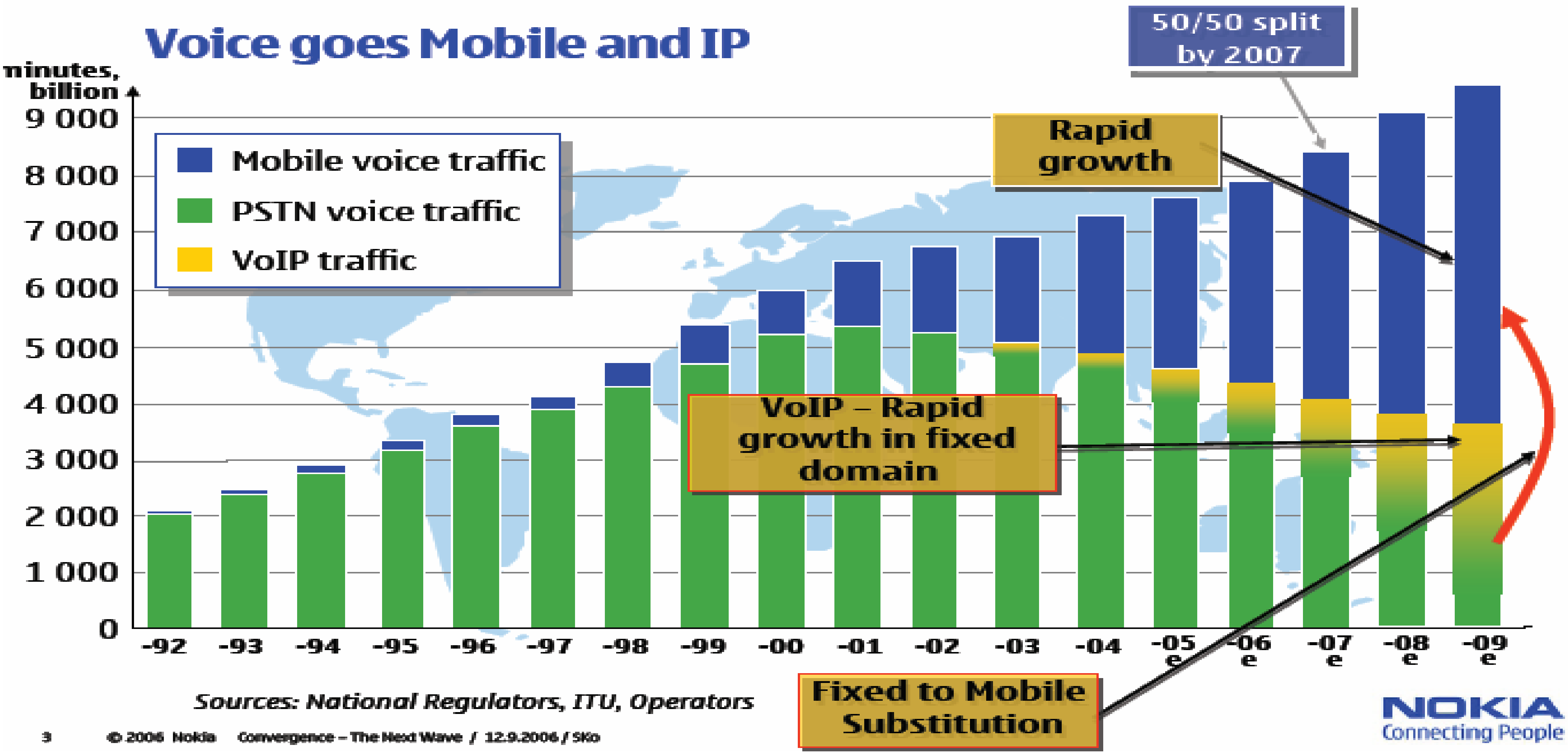
Forecast Mobile Market Growth



Source: The Mobile World Database,
September 2007

Voice Traffic Forecasts



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Fixed Mobile Convergence (FMC) vs. Fixed to Mobile Substitution (FMS)

Fixed to Mobile Substitution (FMS)	↔	**Fixed Mobile Convergence (FMC)**

- Tendency of consumers and businesses to increasingly substitute cellular telephones for fixed wired land-line communication
- Mobile operators have been successfully promoting FMS to grow their business, and will continue to do so

- A way to provide seamless connectivity between cellular network and fixed wired network
- Service to a handset irrespective of whether the user is on either network, and to switch between them seamless
- Fixed network operators have been the first to promote FMC

The Goal of Fixed to Mobile Convergence (FMC)

Converged Networks

Delivering Integrated Services on Any Device

One Bill

FMC enables customers to have “continuity of experience”.
Enterprise benefits = simplified, integrated communications.
Carrier benefits = incremental revenue and cost savings.

One Customer

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Benefits of FMC

End-Users

- Simple & single bill
- One operator for all services
- Same Look and feel,
- On any terminal (Mobile, PDA, PC,...)
- Over any access network (WLAN, DSL, GPRS, …)
- One contact address/number
- Service continuity

Service Provider Network Operator

- Richer and universal service offering
- Guaranteed interoperability
- Market differentiation
- Introduce new revenue generating services
- Enlarge customer base & loyalty
- Complete merger of Business Model
- Reduce OPEX

Equipment Vendors

- Common product development
- Synergies in development; reuse of SW/HW components
- Optimised R&D
- Market differentiation
- Larger addressable Market
- *Overall*: Better, richer and more cost effective products

Several Types of Convergence

Device Convergence

Multi-mode handsets, Smartphones, Music devices, Cameras, Game decks, PDAs

Service / App Convergence

VoIP, Digital Content, Messaging, Push-to-Talk, Interactive Gaming, Video Sharing, Web 2.0

Network Convergence

Fixed-Mobile, Multiple Access, Common Core Network

Fixed-Mobile Convergence

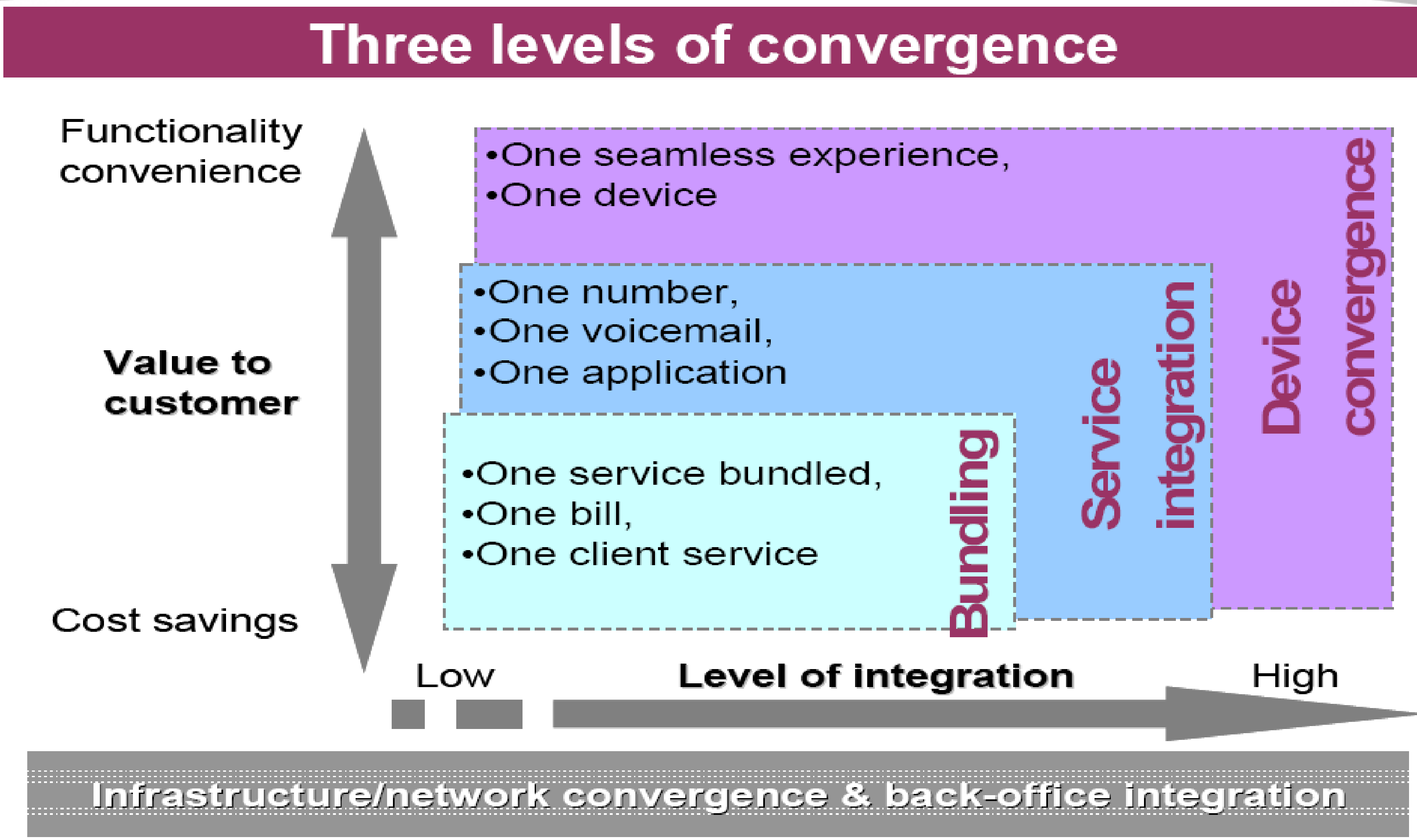
Industry Convergence

Fixed – Mobile

Telecom – Media / TV

Digital devices

Levels of Convergence



Source: Ovum (May 2006)

FMC Market Growth

- FMC market is forecasted to soar to $46.3 Billion by 2010 (*)
- Worldwide seamless FMC subscribers is expected to skyrocket from 188K in 2006 to 38.2 Million by 2010 (*)
- Multi-Access Convergence Gateways (MACGs) are expected to become the largest FMC equipment market
- Wi-Fi and MUNIs today will be complemented with WiMAX starting in 2008
- Femtocells will also be part of the FMC landscape, starting in 2008
- New entrants into the market, such as Apple, Google, Yahoo
- Dual-mode devices, Multi-mode devices and Portable devices

(*) Infonetics Research – October 2007.

Multi-mode Devices – Device Convergence

- Around 160 models of Wi-Fi & Cellular Dual-mode handsets today
- 105 Million Dual-mode handsets by 2009 forecasted
- Most are “seamless dual-modes” with seamless hand-off between Wi-Fi and Cellular
- However, there are also a lot of non-seamless dual-modes, such as iPhone
- Nokia N-series and E-series, Sony Ericsson, Motorola lead on cellular / Wi-Fi dual-mode phones
- But also, Blackberry, Samsung, HTC, Paragon Wireless, etc.
- WiMAX support to be added in 2008 / 2009

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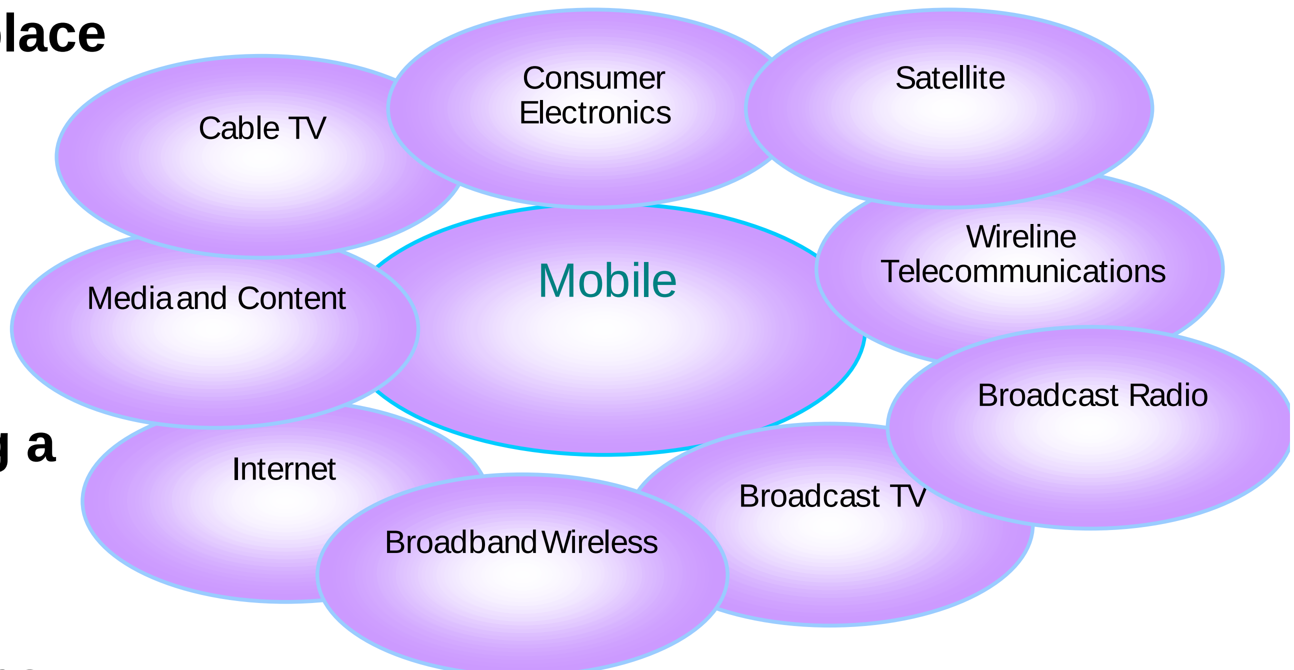
Multi-mode Device Revenues

Source: Infonetics Research, July 2005

- Dual mode Wi-Fi / cellular phone revenue will more than double year over year, through 2009
- Revenues by 2009 will reach $3.7 Billion
- Single mode Wi-Fi phones will be focused on enterprise market
- But real growth will be with Dual-Mode Wi-Fi / Cellular phones for mass market
- 91% of the revenues will be from dual phones vs. 9 % from single mode Wi-Fi phones by 2009
- EMEA will contribute much more of the dual mode phone revenues by 2009

Future of Convergence – is already here!

- **Convergence between different industries already taking place**
  - **iPhone, Google Android**
- **Innovation is eliminating borders**
  - **Start-up / young companies**
- **Mobile / wireless is playing a central role**
  - **Handset is personal device**
- **Cross-Industry partnerships and consolidations**



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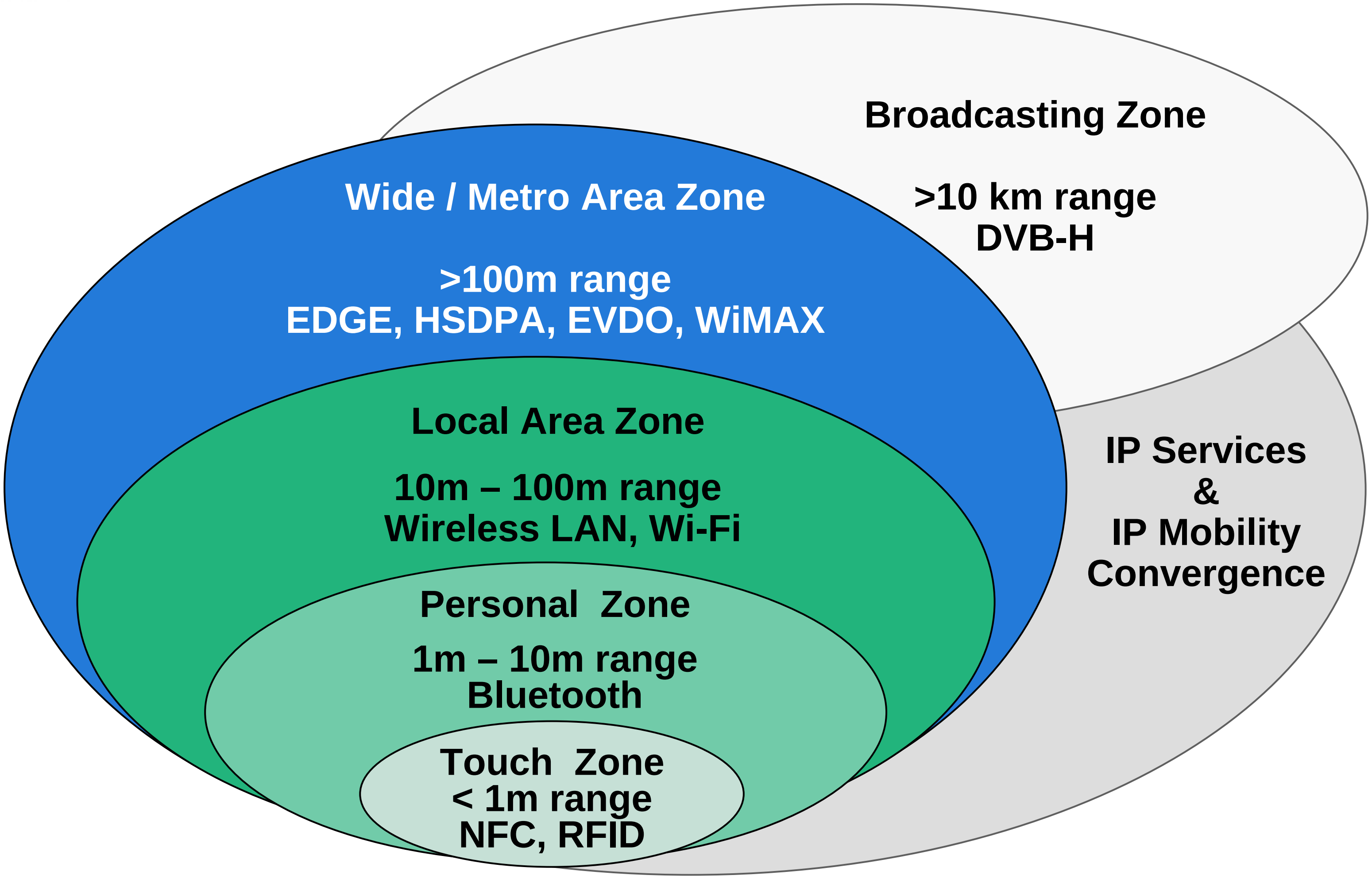
Connectivity Technologies & IP Convergence

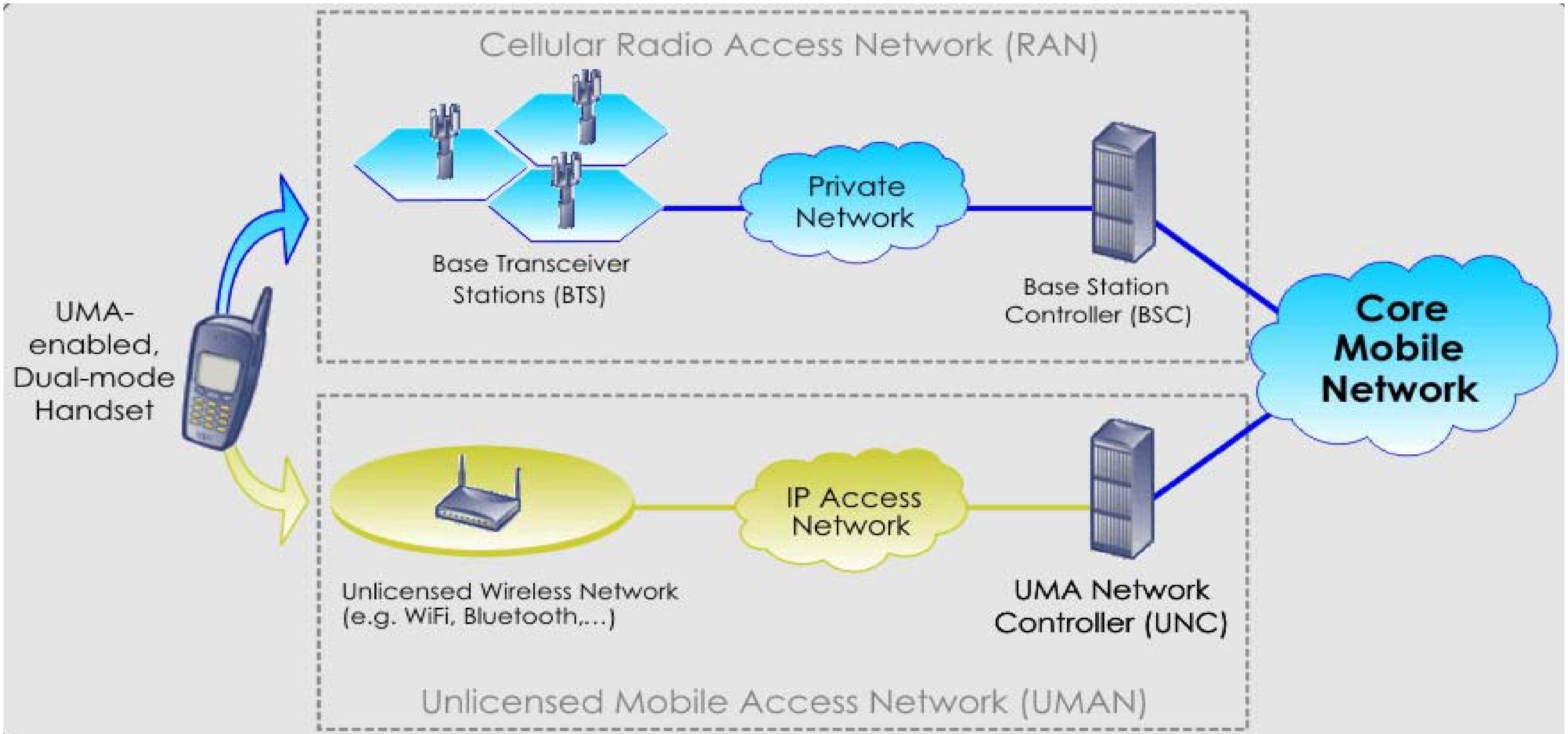


Technology Choices for FMC

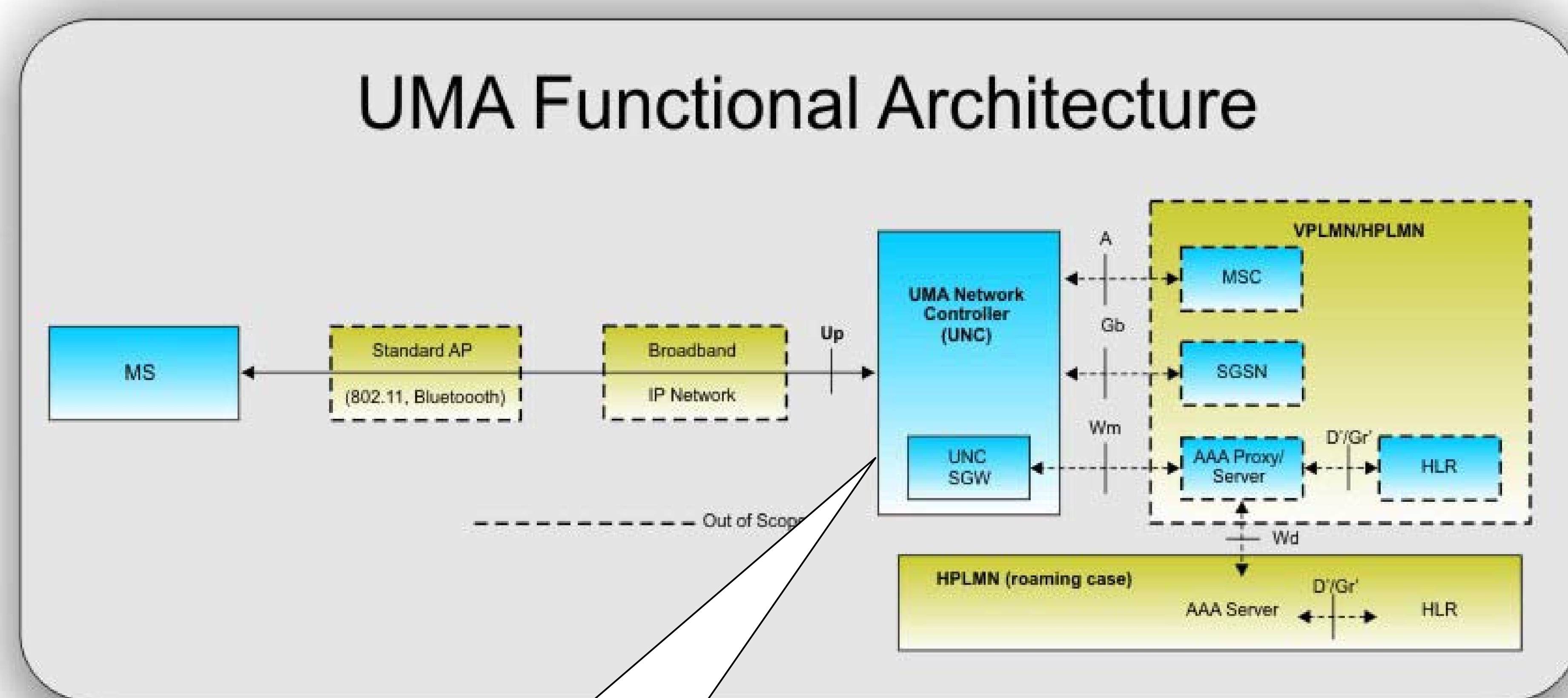
Three major technology choices:

1. **Unlicensed Mobile Access (UMA)**
2. **IP Multimedia Subsystem (IMS) with**
   - **Session Initiation Protocol (SIP) and**
   - **Voice Call Continuity (VCC)**
3. **Femtocells**

Unlicensed Mobile Access (UMA)



UMA Functional Architecture



Also being called RAN Gateway

UMA Technology

- Seamless delivery of mobile voice & data services over unlicensed wireless networks.
- Provides the same mobile identity on Cellular RAN and unlicensed wireless networks.
- Seamless transitions (roaming and handover) between Cellular RAN and unlicensed wireless networks.
- Preserves investment in existing / future mobile core network infrastructure
- Independent of underlying unlicensed spectrum technology (e.g. Wi-Fi, Bluetooth)
- Transparent to existing, standard CPE devices (e.g. access points, routers and modems)
- Utilizes standard “always on" broadband IP access networks (e.g. DSL, Cable, T1/E1, Broadband Wireless, FTTH…)
- Security equivalent to current GSM mobile networks
- No impact to operations of Cellular RAN (e.g. spectrum engineering, cell planning,…)

Where is UMA today?

- T-Mobile USA is the leader in UMA deployment;
- Also, Orange, BT and TeliaSonera in Europe have been deploying UMA service / handsets
- Target 1 Million dual-mode UMA handsets deployed by Year-end 2007
- Finally a decent number of handsets being deployed by Nokia, Samsung, Motorola, RIM/Blackberry, HP, Sagem, and SIM Tech
- Some rumors of SonyEricsson and HTC handsets in 2008
- UMA is finding new home and life in Femtocells, as default option for backhaul / integration with core network

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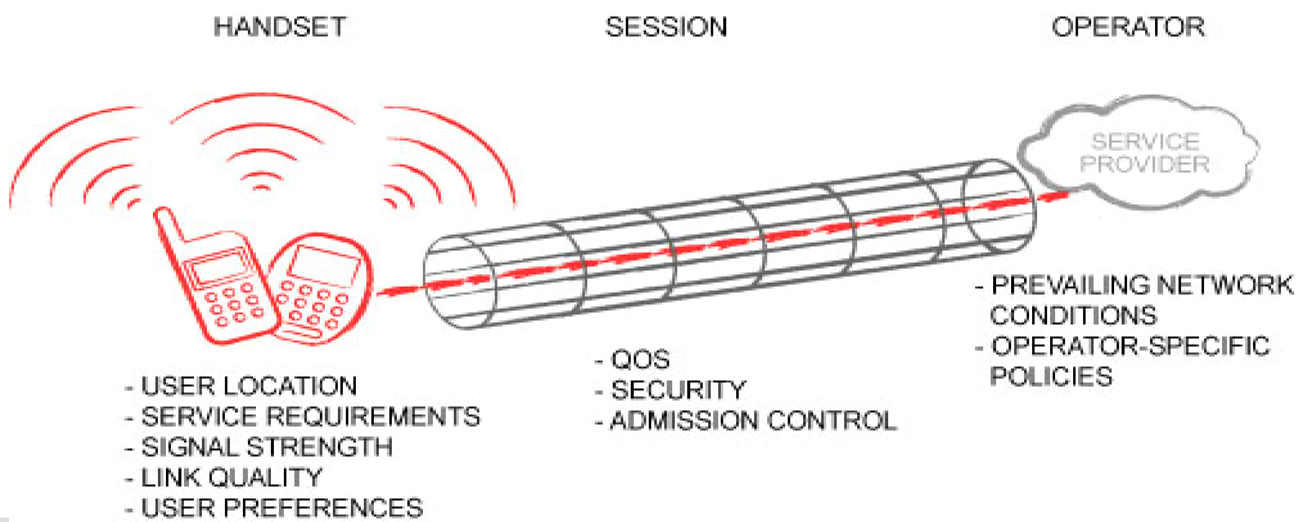
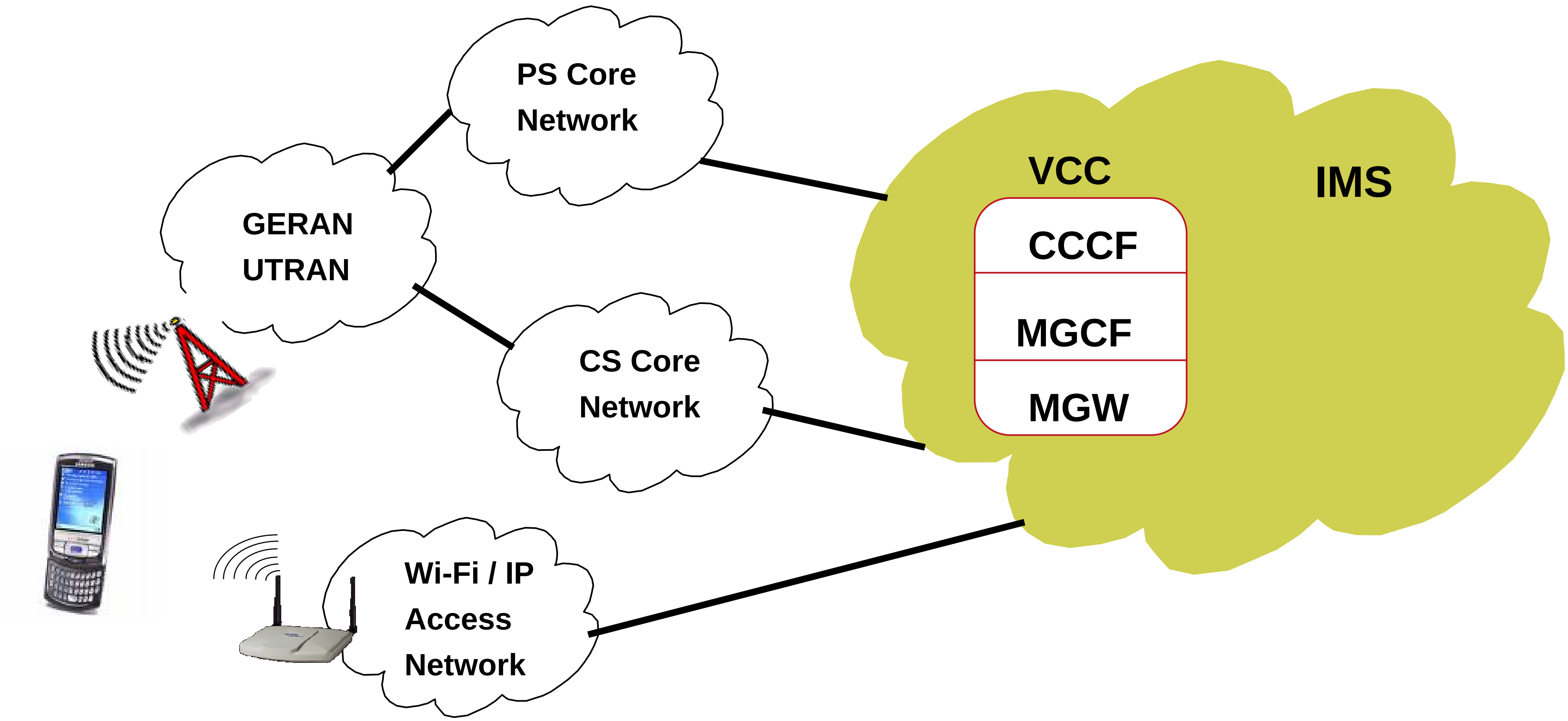
Voice Call Continuity (VCC)

- Objective of VCC is to seamless move an active voice session between an IP domain and circuit-switched cellular domain
- Session continuity across heterogeneous access domain is a critical step in FMC direction
- VCC is a critical part of IP Multimedia Subsystem (IMS)
- Not just Voice, but Multi-media session continuity must be supported
- Must ensure transparent support of supplementary services across heterogeneous domains

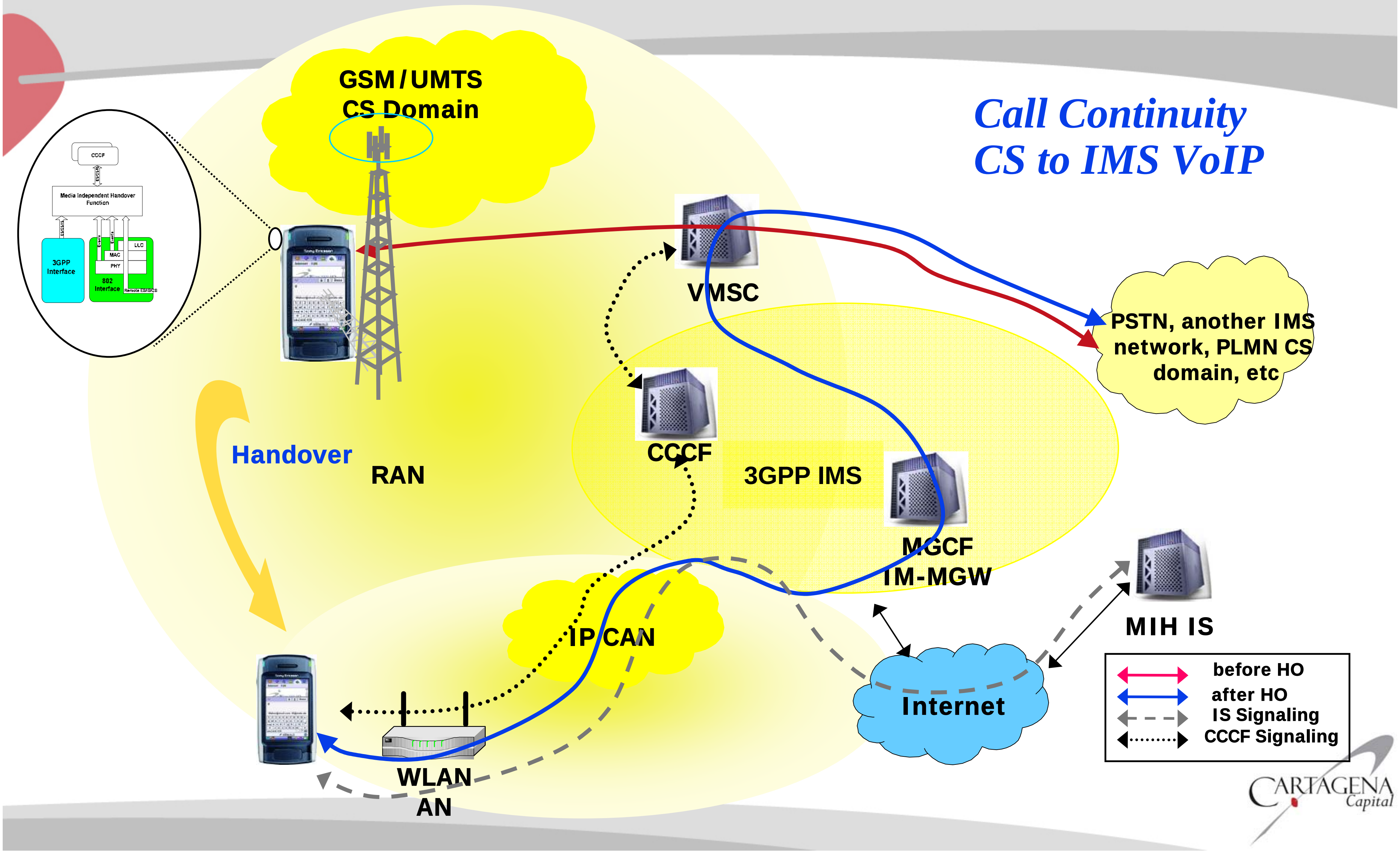
Roles of Handset vs. Operator



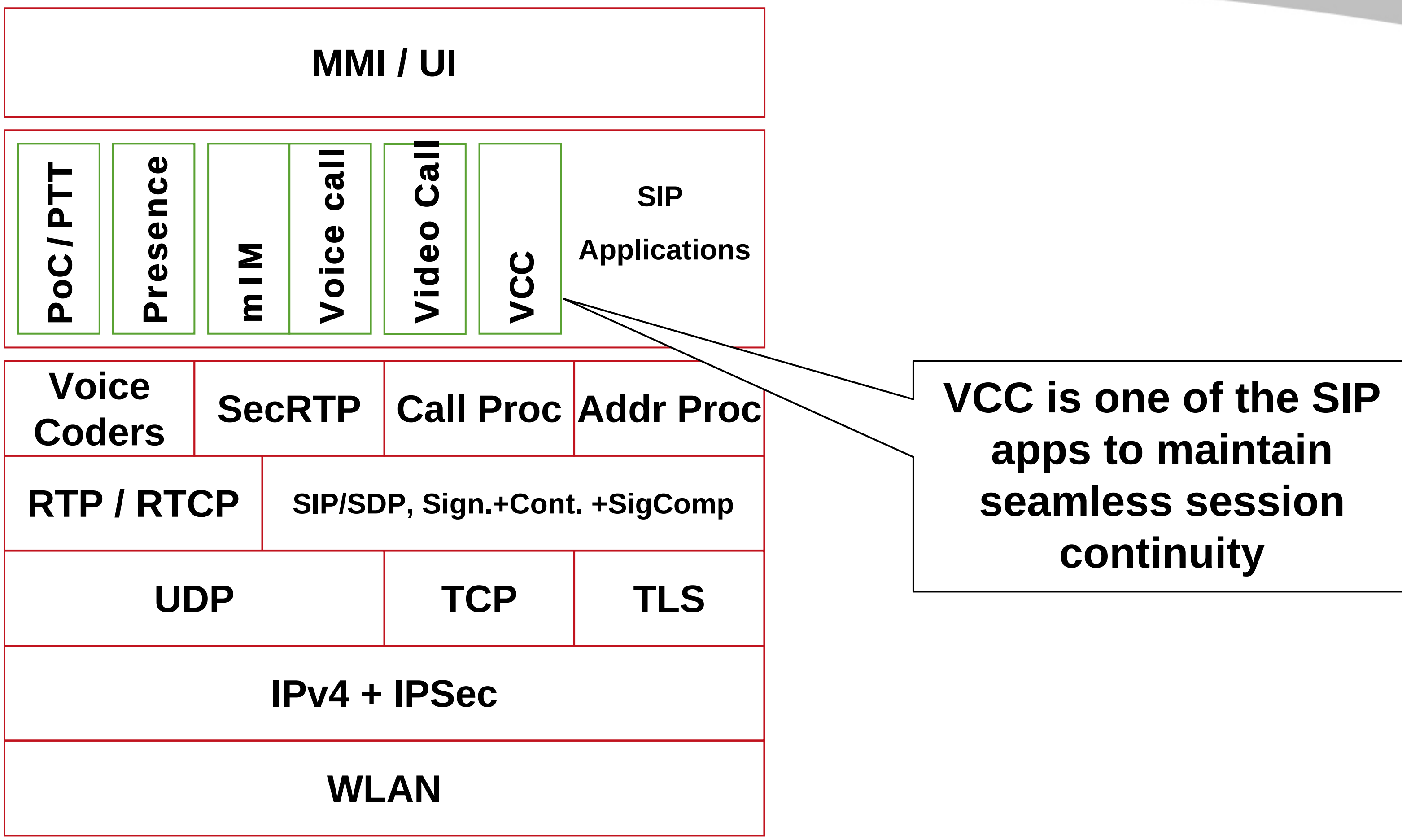
High Level VCC Network Architecture



Voice Call Continuity (VCC)



Mobile Phone Architecture



Next phase of FMS & FMC – Femtocells

- Originally called Access Point Base Stations,
- Offers scalable, multi-channel, two-way communication
- Includes
  - A base station (Node B in WCDMA),
  - A base station controller (RNC in WCDMA), or parts of it
  - Ethernet or Broadband connection
- Major benefits
  - Ultra low cost
  - Scalable deployment
  - Major reduction in OPEX and CAPEX for mobile operators
  - Much better in-building coverage
  - Use of existing handsets, as oppose to multi-mode handsets
  - Better and cost effective Home Zone tariffs for operators

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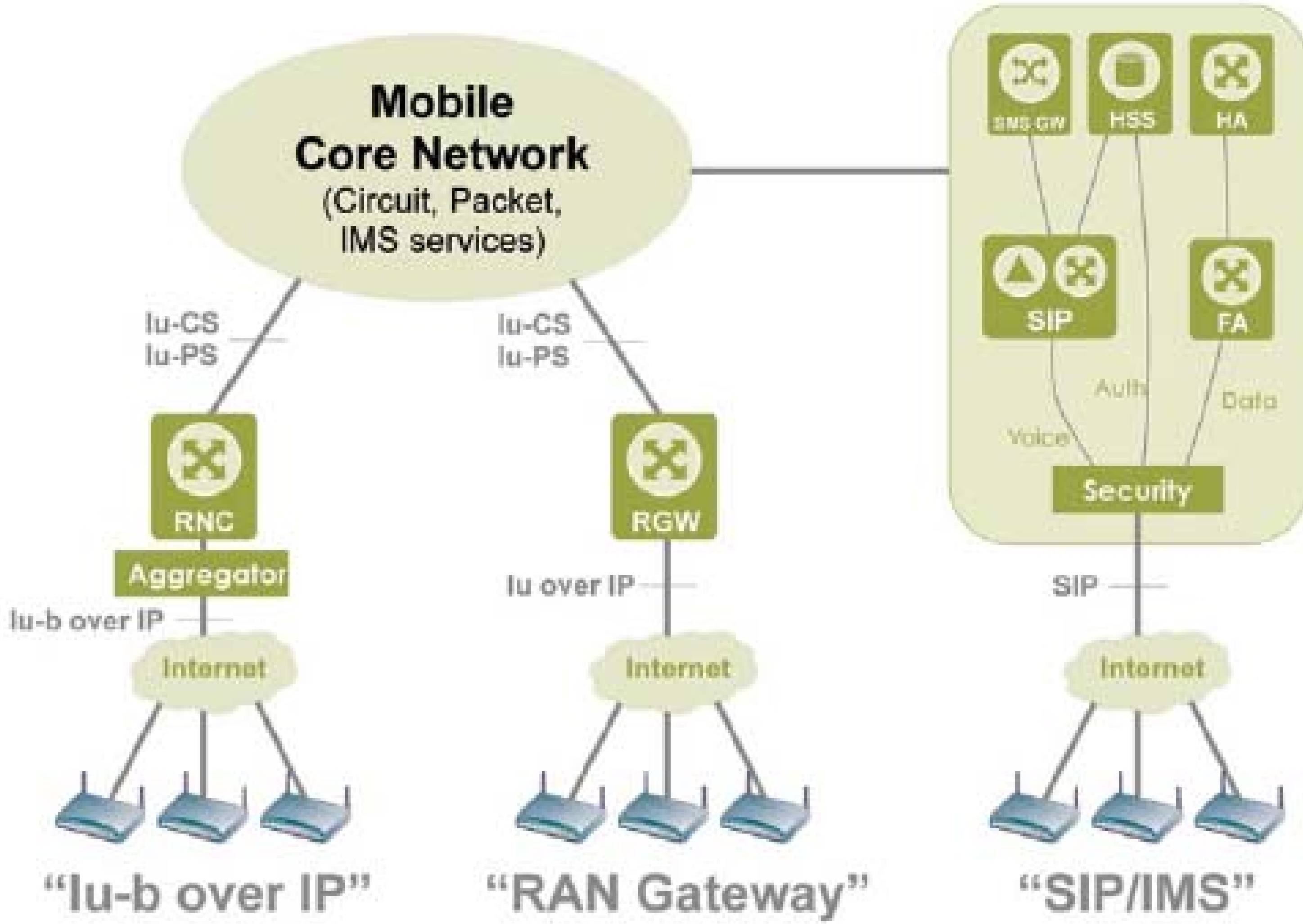
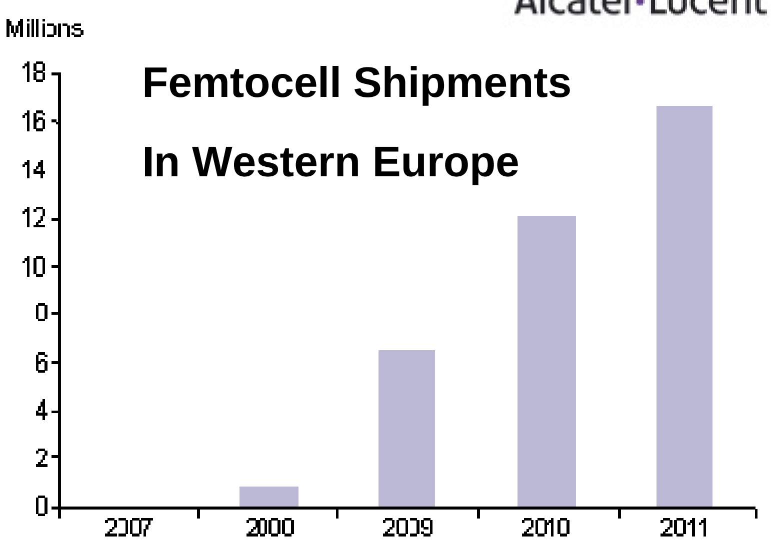
Femtocell Backhaul Architectures



Femtocell Deployments

- **First demonstrations in 2007, trial announcements and start of a handful of trials (e.g. Sprint Nextel trial with CDMA Femtocell in Denver)**
- **Major RFIs / RFQs from mobile operators during 2007**



ABI Research forecast that, by 2012, there will be 150 million users of Femtocell products, on 36 million access points worldwide.

Stuart Carlaw,
Principal Analyst
ABI Research,

"We forecast 17million residential Femtocells in Western Europe in 2011"

Vincent Poulbere
June 2007

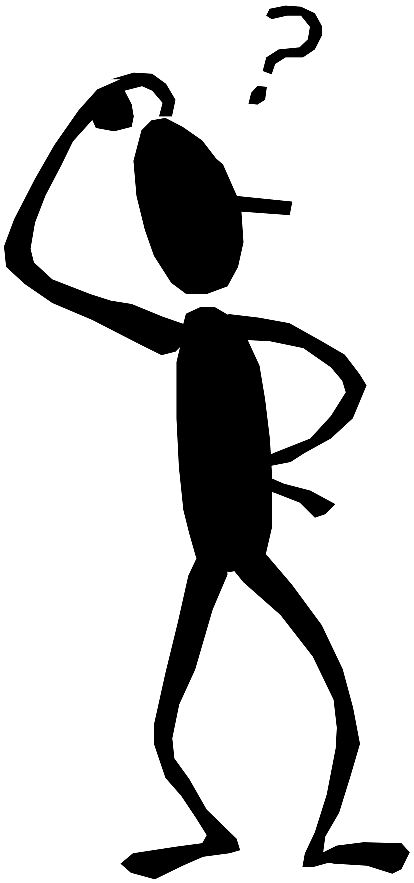
Femtocell Challenges

- Interference – with macro network, and with other Femtocells
- Licensed spectrum – license requirements compliance
- Network integration – connection millions of Femtocells back to core network
- Price – currently around $200, needs to around or below $100
- Access control and privacy
- Emergency call / 911 and Lawful Intercept regulatory requirements
- Handoff between macro network and the correct Femtocell
- Remote management of Femtocells!

Recommendations

- **Watch the developments at Mobile devices / handsets and portables**
  - **Smarter, multi-modal, new user-experiences, and key to convergence**
- **UMA needs to be re-examined by those who has ignored it in the past**
  - **Valuable field experience, and good positioning in Femtocell eco-system**
- **SIP / VCC is the industry-wide agreed direction**
  - **Not just for voice but multi-media hand-offs; VCC clients are as important if not more important than the network infrastructure**
- **Femtocells, despite early challenges, will have major implications**
  - **Need to establish how to position and benefit from it**
- **Fixed Mobile Convergence will be one of the major telecom trends for the next 5-10 years**
  - **Expect to see huge growth in FMC subscribers and revenues**

Questions?



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