# Business implications of mobile technology developments

**Stanley Chia**
**Group Research and Development**
**Vodafone**

**April 2006**

# Structure

- Competitive landscape
- Access technologies
- Impact of IP
- Impact of storage
- Broadcasting technologies
- Conclusions

# Key business indicators

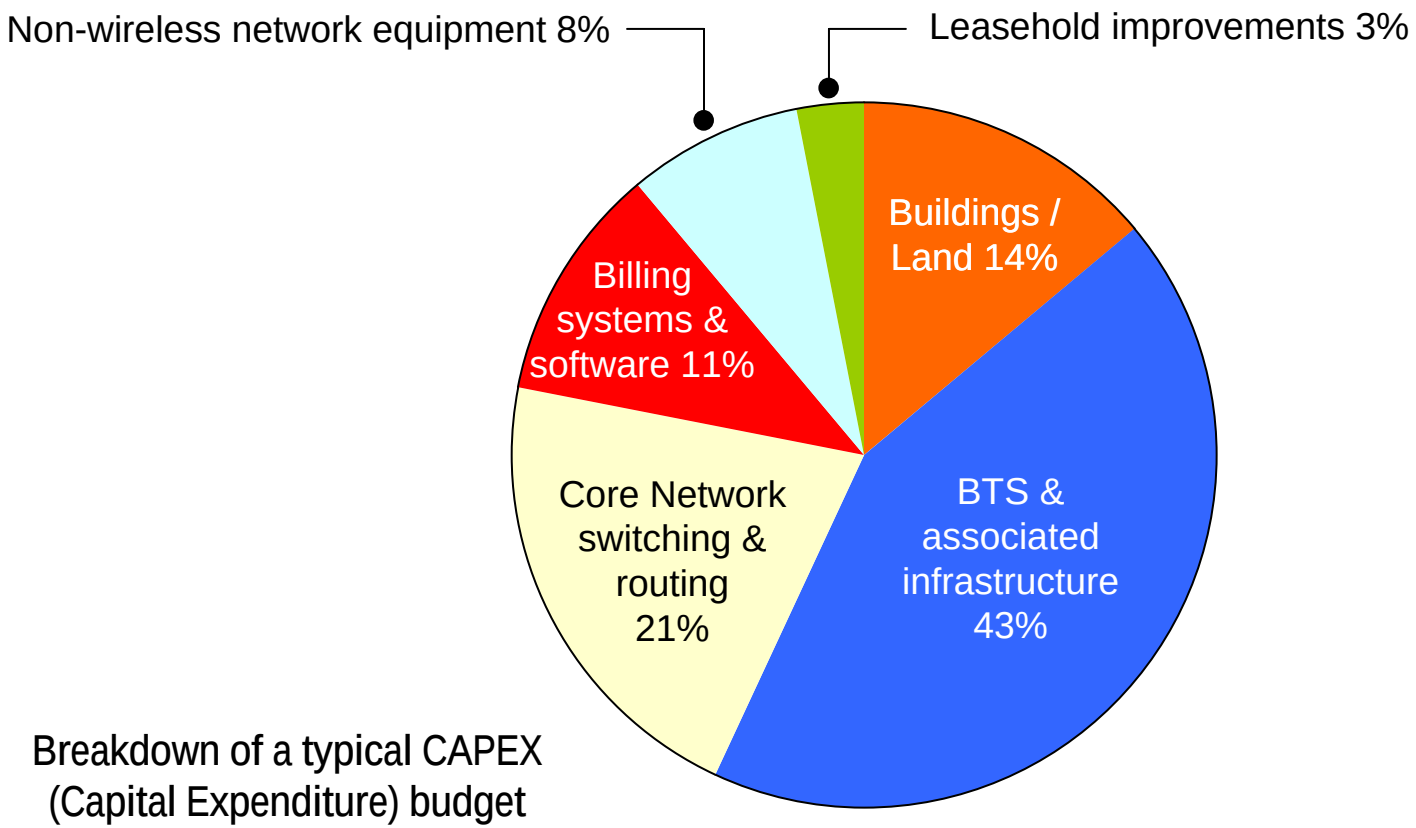
| | Subscription penetration, % | User penetration, % | ARPU US$ / month | Traffic MOU / user |
|---|---|---|---|---|
| W Europe | 102.0 | 79.5 | 44.2 | 212.4 |
| C/E Europe | 76.2 | 63.1 | 14.3 | 131.7 |
| N. America | 71.8 | 62.6 | 57.3 | 763.4 |
| CALA | 42.6 | 38.9 | 15.1 | 105.8 |
| Asia Pacific | 23.0 | 18.7 | 22.2 | 315.0 |
| Mid East, Africa | 21.5 | 18.9 | 20.5 | 166.4 |
| Worldwide | 34.8 | 29.0 | 28.5 | 287.2 |

CALA = Caribbean and Latin America

Source: Strategy Analytics 2006

**Minutes of Use (MOU) for selected countries:**
UK contract: 207 minutes / month (Strategy Analytics 2006)
UK prepaid: 57
Spain contract: 188
Spain prepaid: 37
Germany contract: 103
Germany prepaid: 23
China: 311 (China Mobile 1H 2005)
India: 367 (TRAI 3Q 2005)
Japan: 150 (Japan Telecom Ministry)
US: 760 (Vodafone data)

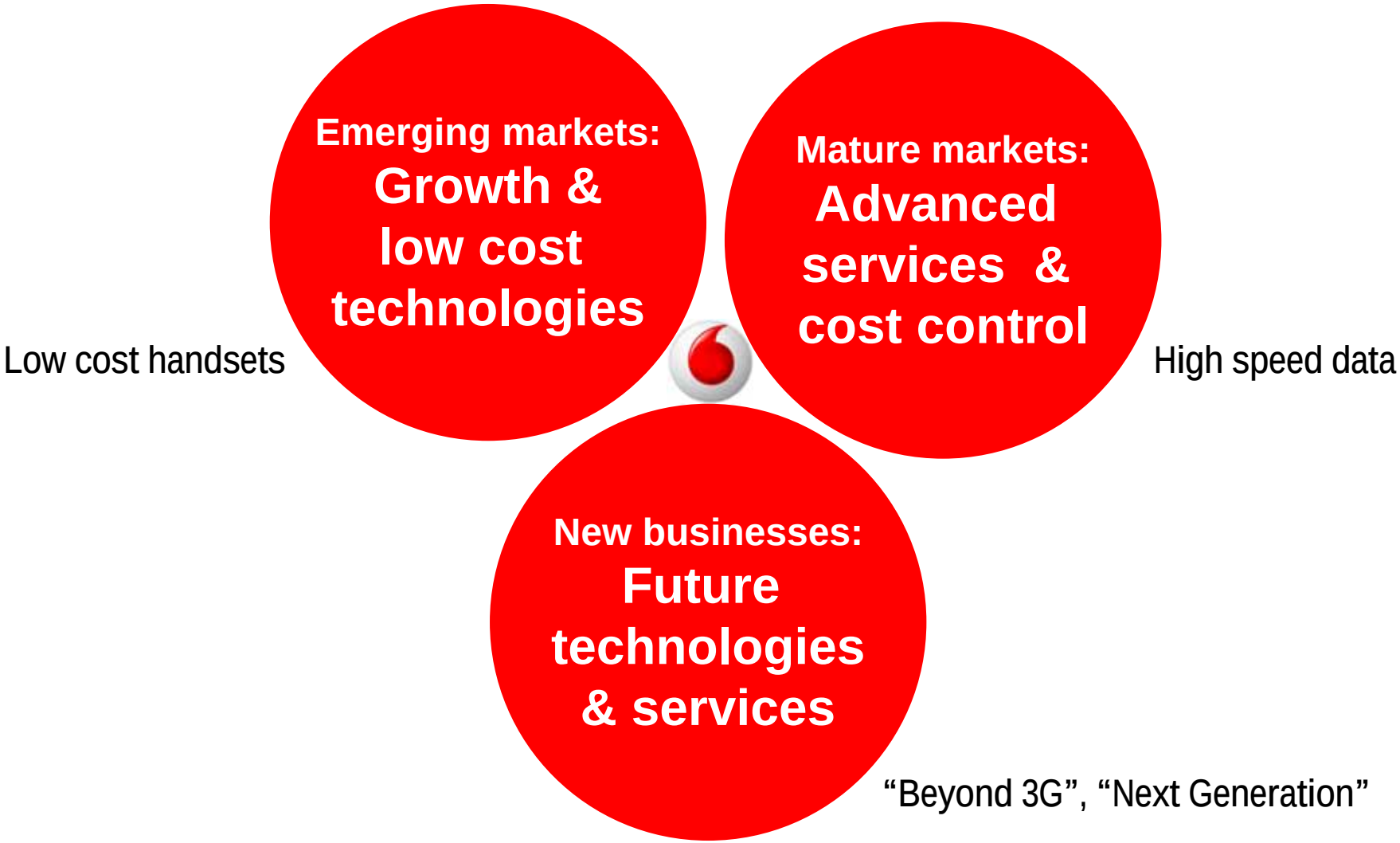
# Barrier to market entry - CAPEX



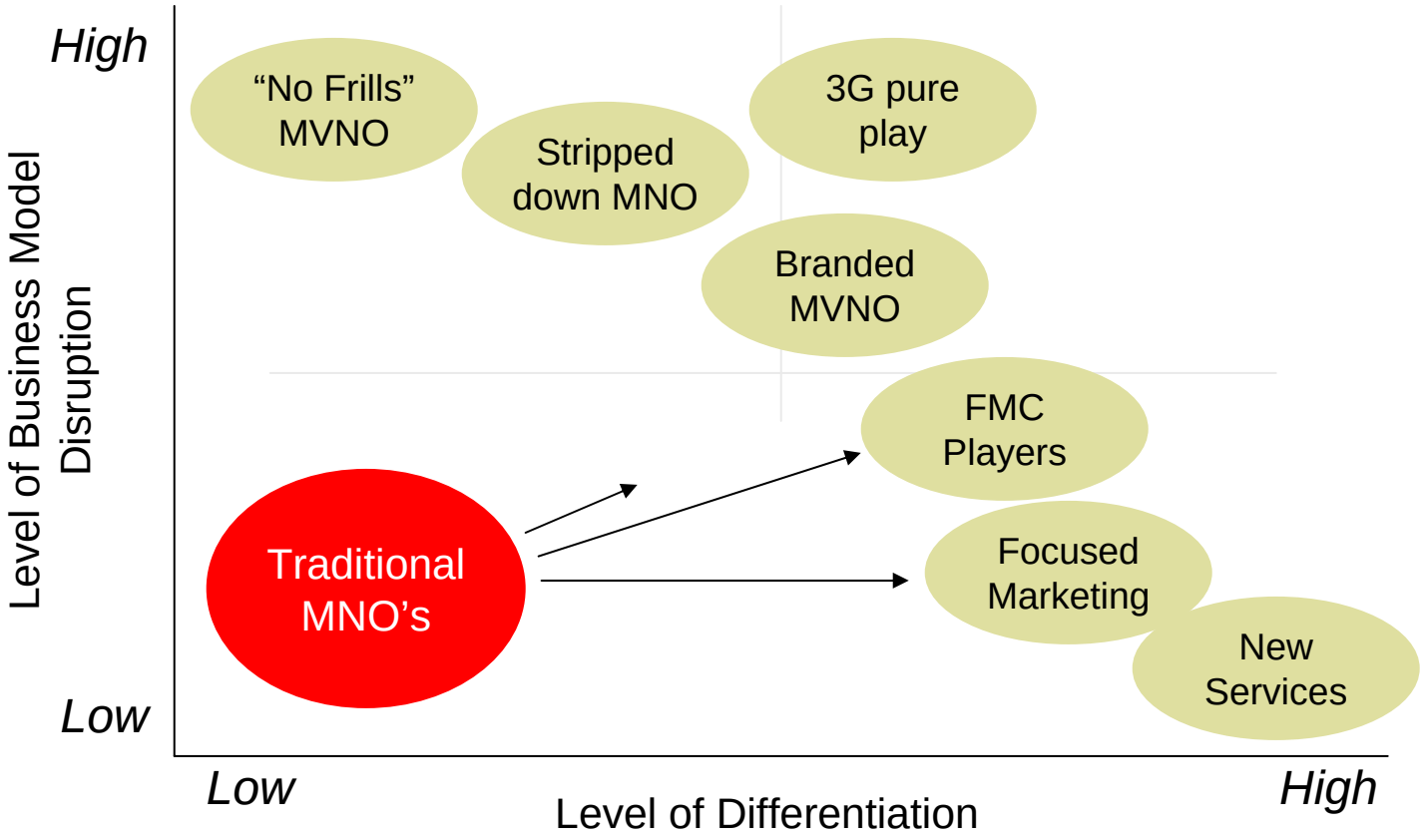

Breakdown of a typical CAPEX (Capital Expenditure) budget

Source: Stephens Inc. estimates, Wireless Week November 1, 2005

# Market maturity and technologies



# Evolving competitive landscape




MNO = mobile network operator
MVNO = mobile virtual network operator
FMC = fixed mobile convergence

# Access technologies

- “3G” Evolution
- WiFi
- WiMAX

# WCDMA roadmap

**HSDPA evolution**

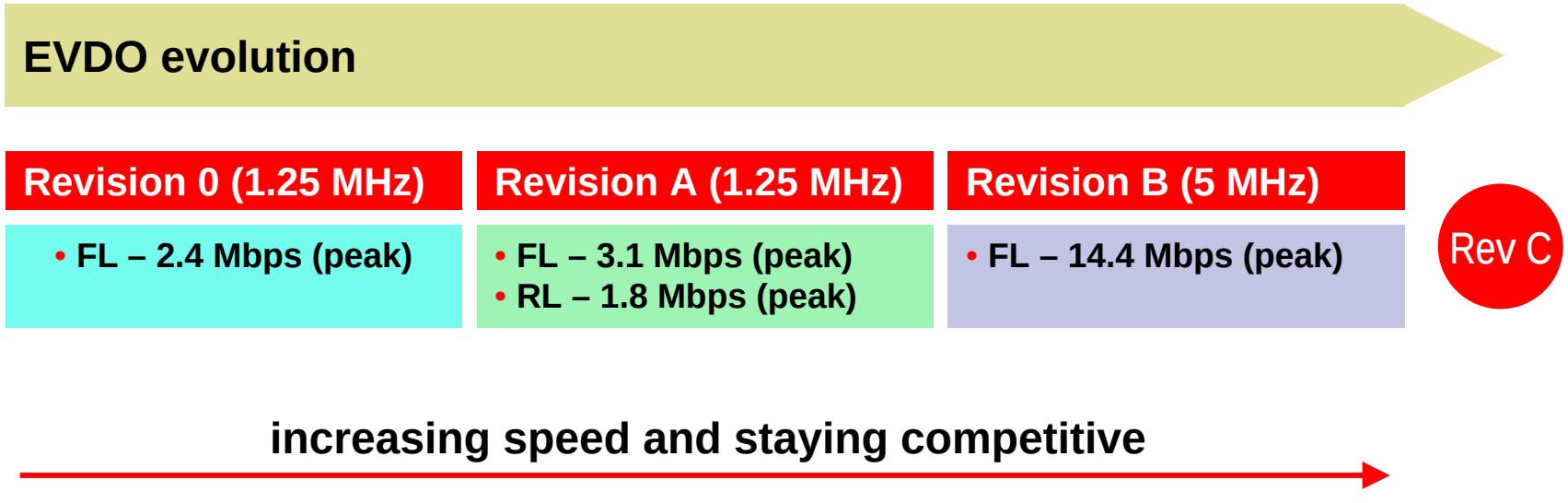
| Release 5 | Release 6 | Release 7 |
|---|---|---|
| • HSDPA – 3.6 Mbps (peak) | • HSDPA – 7.2 Mbps (peak)<br>• HSUPA introduction | • HSDPA – 14.4 Mbps (peak) |

**LTE**

**increasing speed & reducing production cost**

HSDPA = high speed downlink packet access
HSUPA = high speed uplink packet access
WCDMA = wideband code division multiple access
LTE = Long term evolution

# CDMA roadmap



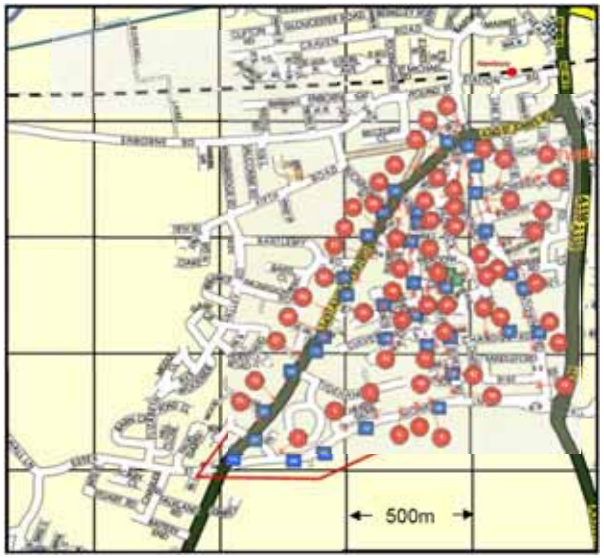

EV-DO = Evolution Data Optimize
FL = Forward link
RL = Reverse link

# WiFi – Different forms of availability

- In office / home
- Hotspot
- Mesh networks
- Unlicensed Mobile Access (UMA)

# WiFi mesh network trial - performance

- Peer-to-peer and User Terminal (“UT”) to Access Point (“AP”)
- Individual & simultaneous throughput
- Varying numbers of active UT’s
- **Throughput results:**
  - Unloaded*, 80% of users to AP < 200kbps
  - Loaded**, 80% of users to AP < 120kbps
  - Unloaded, 80% P-2-P user < 130kbps
  - Loaded, 80% P-2-P users < 45kbps
- **Packet delay results:**
  - Unloaded 20% of users to AP > 120 ms
  - Unloaded 10% saw delays of > 300 ms
  - Up to 7 fold increase for loaded network




*Source: Vodafone*

*All nodes can relay, but not all nodes generating traffic

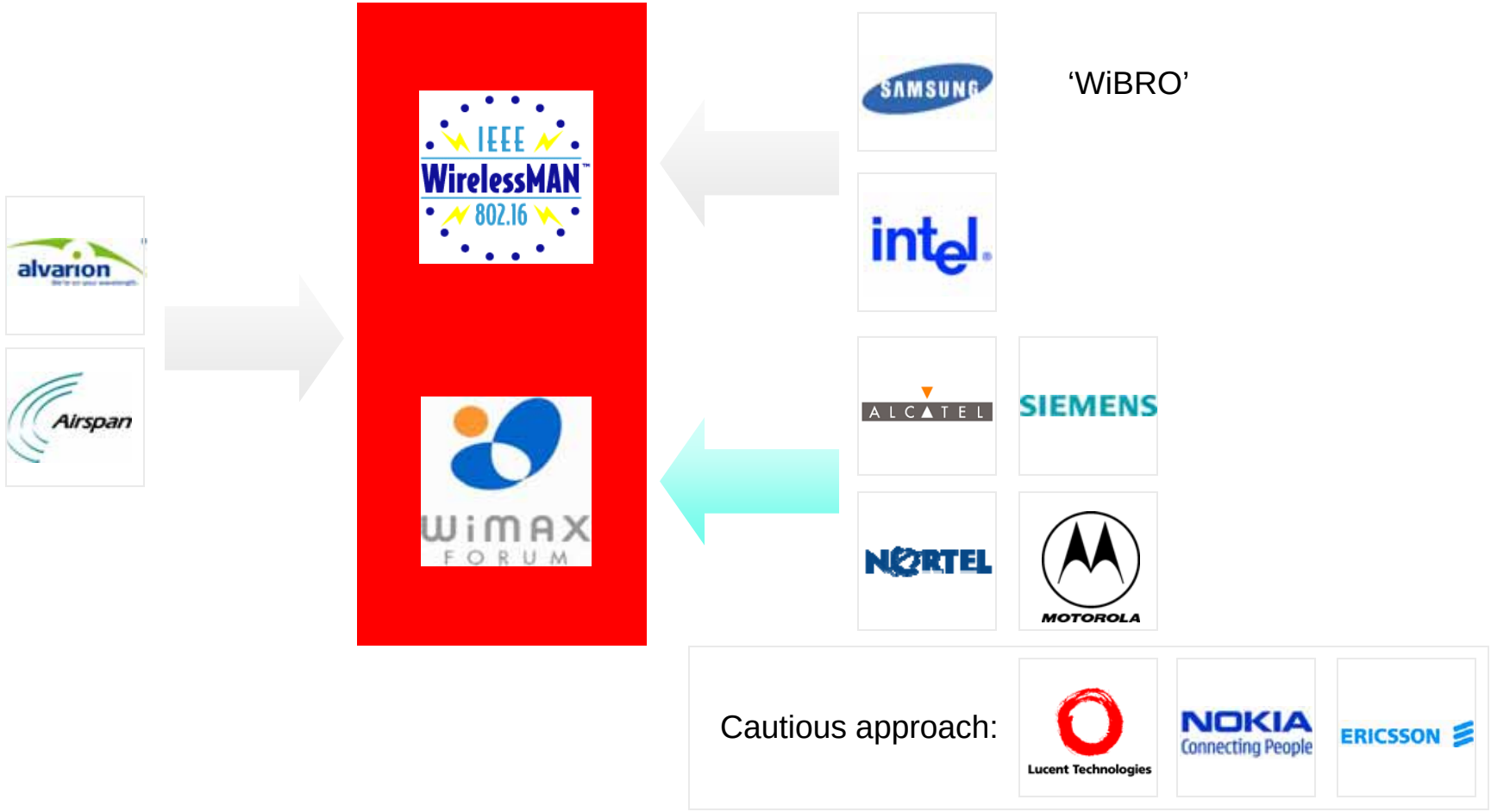
** All nodes can relay and all generating traffic

# WiMAX players

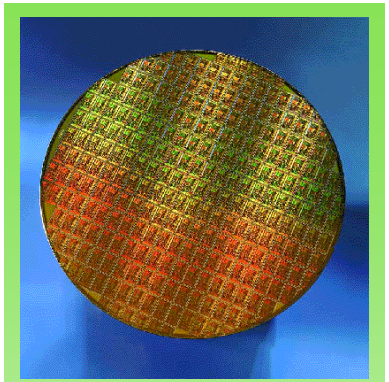
Both fixed wireless access and mobile wireless access players are involved

FIXED Wireless Access

MOBILE Wireless Access



# WiMAX commercial status

| 04 | 06 | 08 | 09 |
|---|---|---|---|
|  |  |  |  |
| **Fixed Pre-WiMAX:** FWA Pre-WiMAX kit based on 802.16-2004 and proprietary solution | **Fixed Nomadic WiMAX:** FWA to outdoor and indoor CPE using 802.16-2004. Nomadic hot-zone coverage also possible | **Mobile WiMAX:** Metropolitan zone coverage using 802.16e to laptops | **Mobile WiMAX:** 802.16e in handsets ?? |

*Source: Vodafone, Siemens, Intel, Broadcom*

FWA = fixed wireless access
CPE = customer premises equipment

# ‘Mobile’ WiMAX coverage example

- WiMAX has no magic solution
- The cell ranges for ‘mobile WiMAX’ will be similar to 3G cell ranges as they are both targeting indoor coverage to portable users

| Environment | Cell range |
|---|---|
| Dense Urban | 300 m |
| Urban | 500 m |
| Sub-urban | 1-2 km |
| Rural | 4-7 km |

**Assumptions:**

2.1 GHz

95% coverage

Uplink 128 kbps @ cell edge

*Source: Alcatel: Assumes adaptive antenna system, 3dB turbo coding gain, using 3G frequencies*

# Lex: WiMAX

FT.com FINANCIAL TIMES



Subscription page

Sunday Feb 26 2006 . All times are London time.

Home
World
Companies
Markets
Market data
Managed funds
Lex
About Lex
Lex tools
Investment navigator
Best of Lex
Lex by email
Your comments
Number in the news
Comment & analysis
Technology
Business life
Business education
Your money

Lex

**Lex: Wimax**

Published: February 1 2006 13:41 | Last updated: February 1 2006 20:08

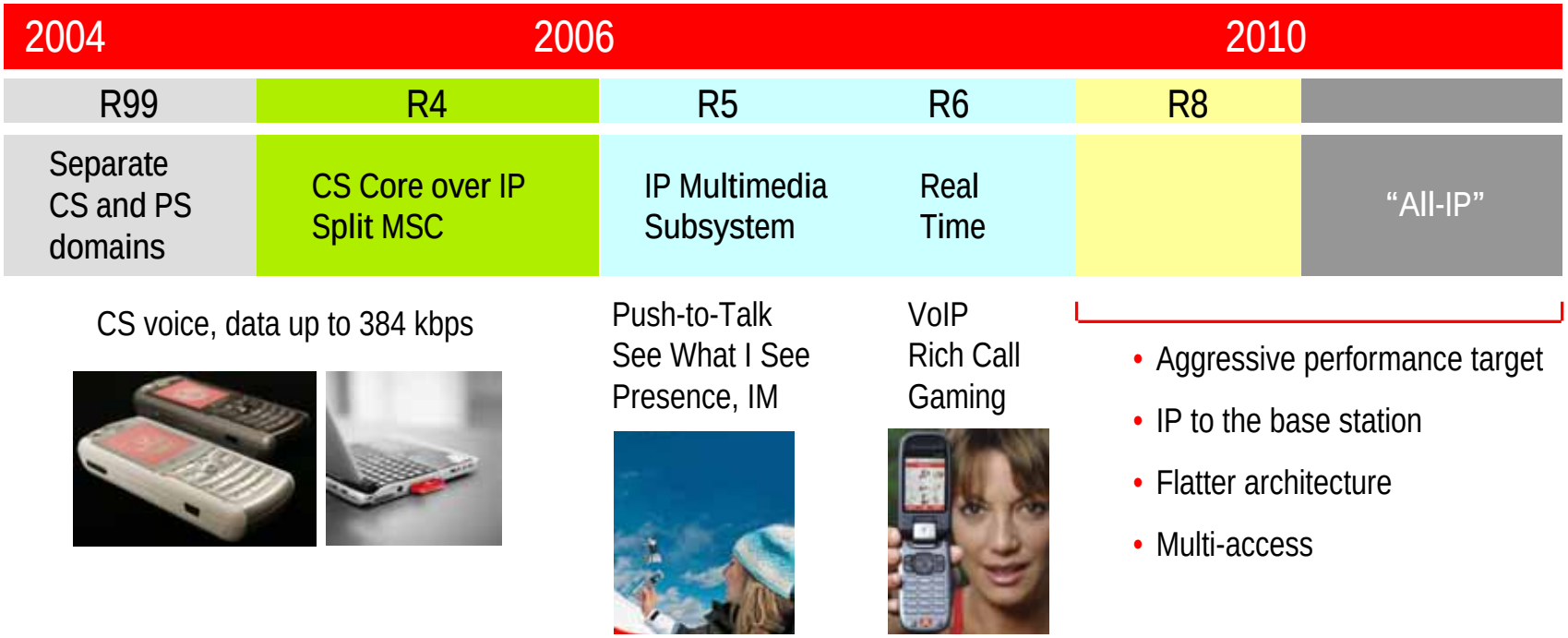
Having broken investors' hearts and mobile companies' balance sheets, has 3G been in vain? An alternative technology known as Wimax is gradually making progress.

Wimax comes in two flavours. This week the first equipment set was certified for the fixed flavour known inelegantly, as 802.16-2004. Fixed Wimax will mainly be used as an alternative to the local loop. The real excitement is over the wireless flavour, 802.16e. Unlike Wifi, the hotspot technology used in coffee shops worldwide, mobile Wimax has a range measured in miles, not feet, and much faster speeds. Large trials have taken place in Korea, using a sister technology called Wibro. Intel, which is backing Wimax as its path into the broadband wireless market, should have chips available by 2008.

- Is mobile WiMAX a credible substitute for 3G? Probably not…
  - Most 3G network are already upgrading to an adequate speed
  - Spectrum is a problem
  - Regional licenses
  - Building a ubiquitous network would be far more expensive than buying wholesale 3G access
- Can mobile WiMAX be giant hotspots? This threat cannot be totally ignored…
  - Dual mode handsets are being developed
  - 3G's potential inadequacies is evident by Qualcomm buying Flarion

The basic strategy of most mobile operators of being married to 3G, but being open mined about flings with other technologies, thus looks correct

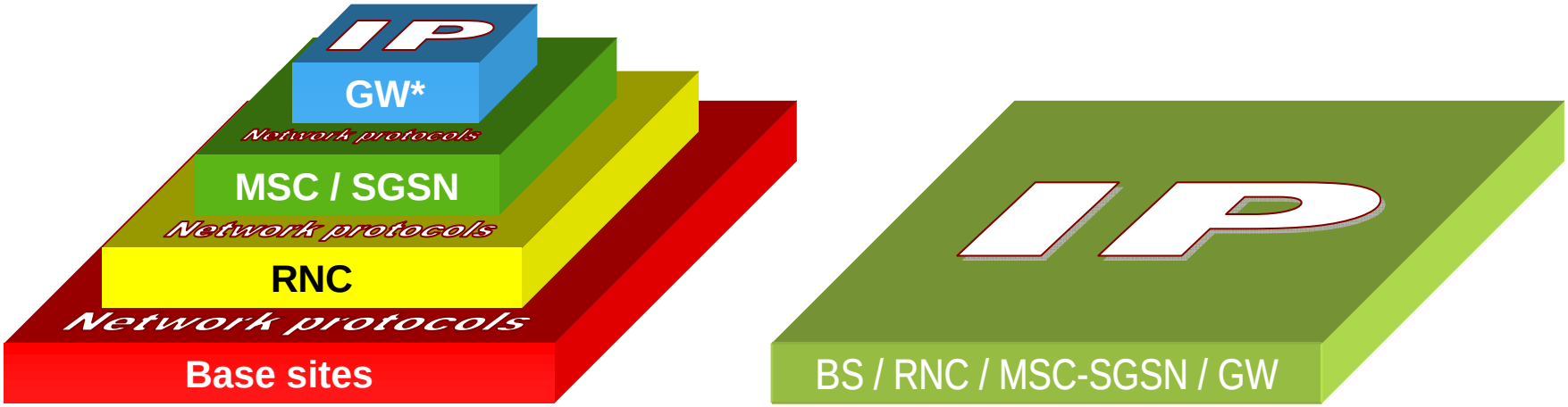
# Moving towards “all IP”




- Benefits of moving to a standard architecture built around IP
  - Standard equipment – lowers cost for carrying traffic
  - New set of vendors – alters competitive dynamics reducing costs
  - New set of service functionality including lower maintenance

CS = circuit switched, PS = packet switched, VoIP = voice over Internet protocol, IM = instant messaging, IP = Internet protocol

# Evolving to a flat core network architecture




| Hierarchical | | Flat |
|---|---|---|
| 😐 | Incremental capacity scaling of central nodes | ☺ |
| ☹ | Cross technology interworking | ☺ |
| ☹ | Routing of user IP flows | ☺ |
| ☹ | Mapping of QoS | ☺ |
| ☺ | High speed handoff / soft handoff | ☹ |
| ☺ | Global radio resource management | ☹ |
| 😐 | Capital and recurring cost | 😐 |

*GW = Gateway Node, e.g. PDSN, GGSN

BS=base stations, RNC=radio network controller, MSC=mobile switching center, SGSN=Serving GPRS Service Node, GGSN = GPRS Gateway Service Node, PDSN=Packet Data Service Node

# Impact of VoIP

Important differences exist across telecoms:

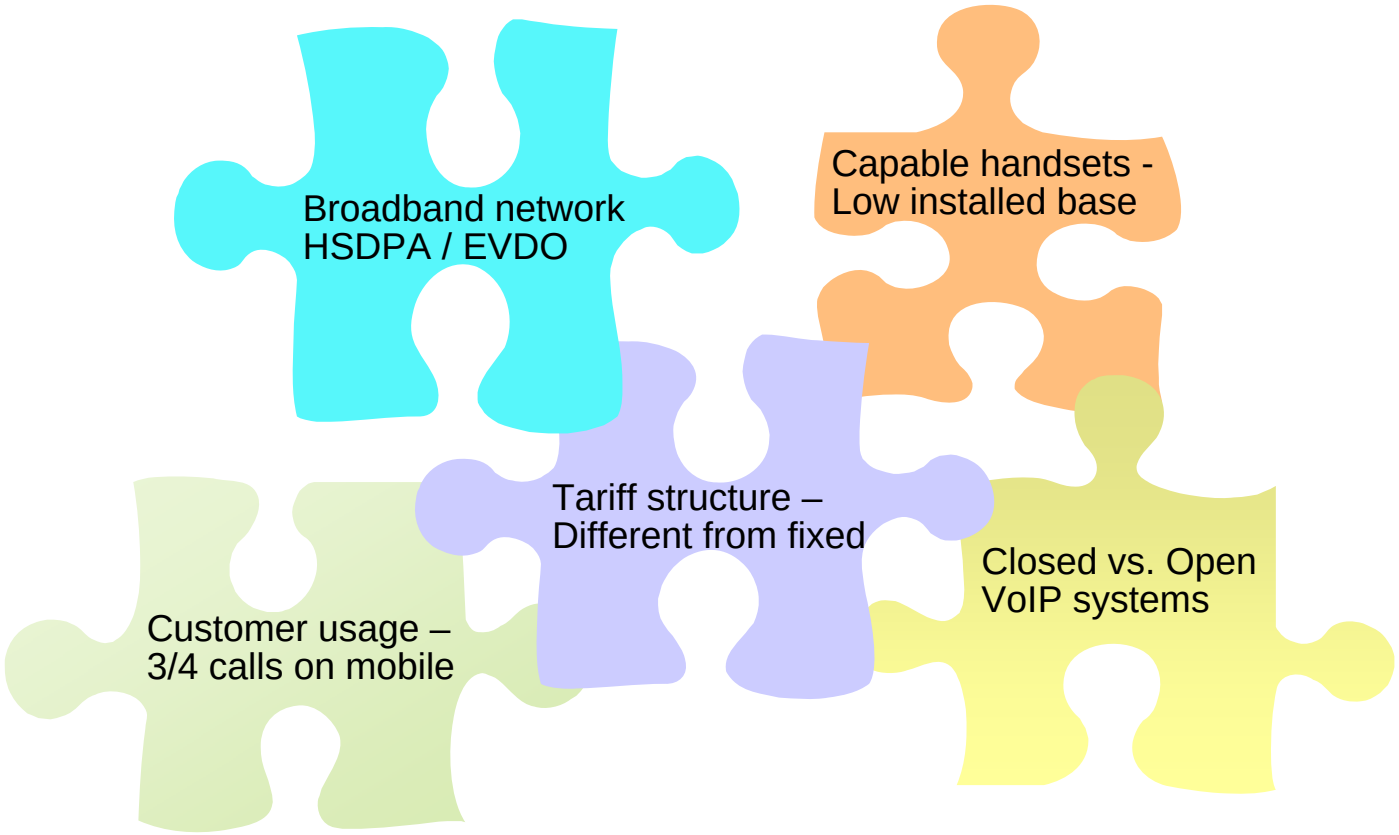
- VoIP in fixed market


- VoIP in mobile enterprise market


- Mass-market consumer VoIP on mobiles

?

# Mass-market consumer mobile VoIP




Severely limited for at least 2 to 3 years

Customer proposition is key – not about technology

Operator can exploit advantages as new services / cost efficiencies become available

# Media storage

- Storage technology is advancing rapidly in both performance and cost
- Fundamental to many new mobile services such as FTMD
- Also enables “non-networked mobility” business models such as iPod or PSP
- HDD currently higher capacity and cheaper/Mb than removable storage, but memory card is more convenient and cost/Mb is improving quickly


Memory card

*Source: Vodafone*

1-inch HDD & Compact Flash microdrive

*Source: Seagate*

FTMD = Full Track Music Download
PSP = play station portable
HDD = high density drive

# Handset memory devices

- Driving multimedia revolution of handsets
- Many challenges
  - High capacities / densities
  - Small form factor
  - High read/write speed
  - Low power consumption
  - High reliability
  - Embedded or removable
  - Mechanical or solid state access
  - Low cost

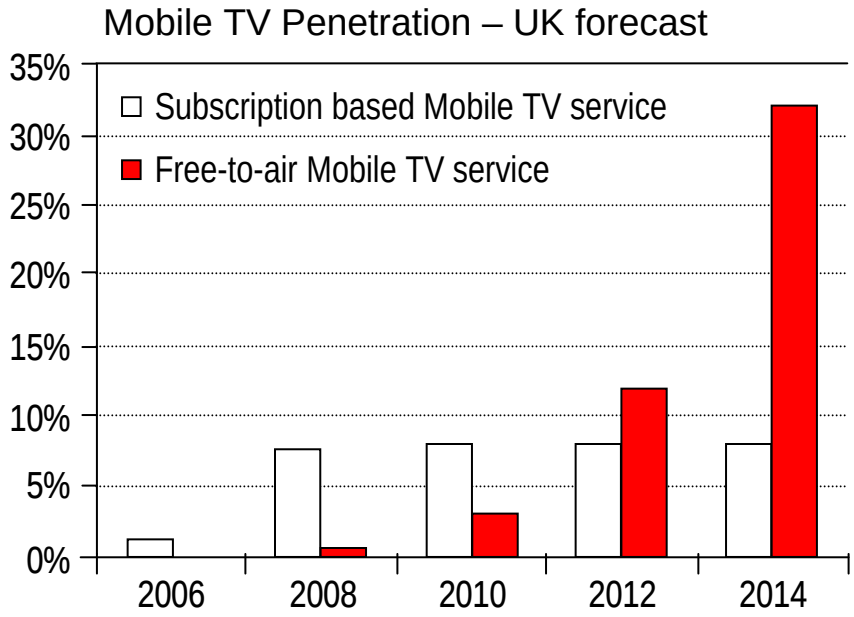

*Source: Vodafone, Sandisk*

# Mobile broadcasting

Source: Siemens

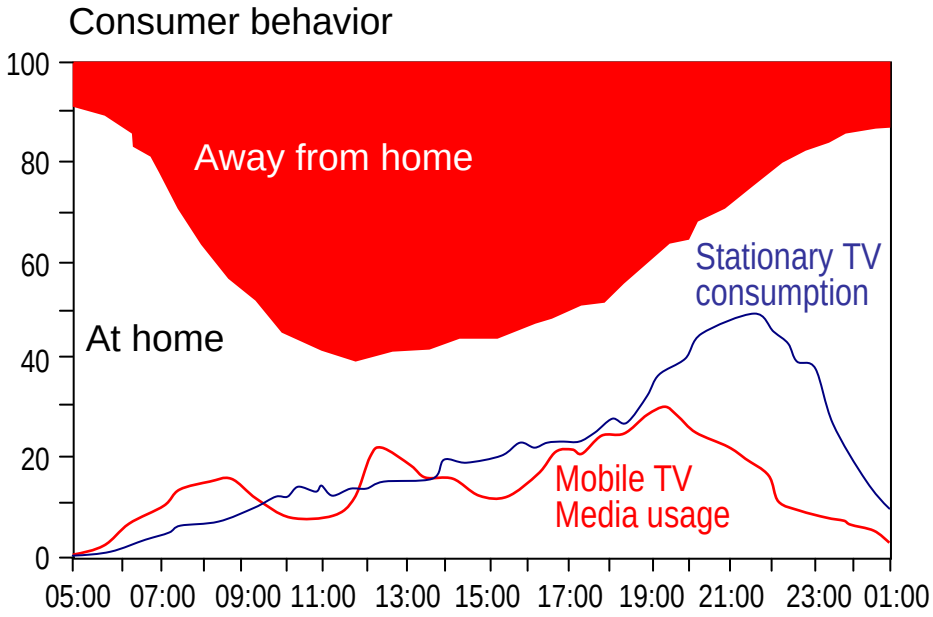
- Video streaming on WCDMA
- Drive for DVB-H in Europe
- MBMS, satellite, DMB, MediaFLO, TDTV as alternative broadcast approaches

**Forecast suggest mobile TV to hit penetration levels of 30% in the next 10 years**




*Source: Enders Analysis, Mobile TV Report, Sept 2005*

**Mobile TV usage patterns will differ from traditional TV**




*Source: Strategic Analytics, Sept 2005*

MBMS = Multimedia broadcast multicast service, DMB = Digital mobile broadcast, DVB-H = Digital video broadcast – handheld, FLO = Forward link only

# Summary

- HSPA / EVDO – here in 2006 and developing quickly
- WiFi – good private system but not for public-wide area service
- WiMAX – probably too little, too late to be cost effective
- Coverage – frequency bands still critical to cost of network
- VoIP – coming slowly to mass market mobile
- Media storage – a major agent of change
- Mobile broadcasting – fragmented format battle or multi-format chip solutions


vodafone