International Roaming
Development until 2012

Munich, August 2005

solon
Summary

Mobile Industry
- Mobile penetration will continue to rise, mostly driven by Asia Pacific
- Declining ARPs will partly offset subscriber growth, resulting in a CAGR (Compound Annual Growth Rate) 2005-2012 for global mobile revenues of 3.8% p.a.
- GSM will extend its reach as the dominant standard with most international roaming taking place on GSM networks

Roaming
- Roaming traffic will show growth across all products and regions
- Roaming revenues will grow at 6.4% p.a. (CAGR 2005-2012) with strong growth in roaming traffic being partially offset by declining roaming prices (~ -9% p.a. 2005-2012)
- Growth will be driven by increasing subscriber numbers, rise in international travel, and declining roaming prices
- Asia Pacific, Eastern Europe and Middle East will show strong growth, but Western Europe will remain the dominant market for roaming in absolute terms
- Voice will remain the most important roaming product and account for 79% of total global roaming revenue in 2012 (2004: 89%)
- SMS roaming traffic will pick up speed and grow with a CAGR of 25% from 2005 to 2012
- Data roaming traffic will also grow strongly, but will still account for only 4% of overall roaming revenue in 2012

WLAN Roaming
- WLAN is a technology for wireless Internet access according to IEEE standards 802.11b and 802.11g
- WLAN roaming comprises the usage of multiple WLAN hotspots, run by different operators, by using one access ID and being billed by the “home” operator only (sole customer relationship)
- The WLAN Internet access market is expected to exceed € 1.7bn in 2008
- The Market for WLAN roaming is very limited, representing less than 2% of the overall WLAN Internet access revenues today. Given several alternative business models it is entirely unclear, whether significant volumes will ever be handled through WLAN roaming

Implications for Mobile Network Operators
- Participate in growing roaming revenues by further exploiting preferred network opportunities / roaming alliances
- Proactively address upcoming EU regulations and price pressure through new tariff structures
- Develop strategy to push new roaming tariffs in order to increase traffic
Mobile Roaming Development

WLAN Roaming Opportunities
International GSM roaming represents the major part of the roaming market

While there is some national roaming in large mobile markets (e.g. US, China, Germany), the bulk of roaming is international.

Most of this international roaming takes place under the GSM standard.

* Including 3G follow-up technologies

Source: Solon
Both volumes and prices will be analyzed in order to forecast mobile industry and roaming revenue development

- Mobile penetration will continue to grow throughout the world, albeit with slowing growth rates in Europe and North America.
- Roaming traffic will grow at significantly higher rates driven by:
  - increased prepaid roaming (through partial substitution of USSD by CAMEL standards)
  - rise in international travel
  - falling roaming prices
- "... Voice roaming traffic in Europe could grow by 15-20% p.a. ...“ Industry Expert

- Mobile ARPU will continue to fall, thus putting pressure on operators.
- Roaming prices for voice, SMS and data will also fall.
- “... The EU will definitely put regulation on roaming prices...” Industry Expert

Source: Solon
Global mobile and roaming revenues will grow with voice remaining the main revenue driver

**MOBILE AND ROAMING REVENUES**

**Global mobile revenues by region**

(€ bn)

<table>
<thead>
<tr>
<th>Year</th>
<th>North America</th>
<th>South America</th>
<th>Asia Pacific</th>
<th>Europe</th>
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</table>

**CAGR 05-12**

- Europe: 6.7%
- North America: 3.8%
- South America: 2.3%
- Asia Pacific: 0.7%
- Africa/Middle East: 0.7%

**Global roaming revenue by products**

(€ bn)

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<th>Data</th>
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<tr>
<td>2012</td>
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**CAGR 05-12**

- Voice: 6.4%
- SMS: 14.2%
- Data: 12.8%

- Even though the years of double-digit growth rates are over, total global mobile revenues are forecast to continue to grow.
- Expected declining roaming prices are more than compensated by increasing roaming traffic.

Source: Solon
Roaming prices will fall sharply until 2008 with further less significant decreases until 2012

Historically, roaming prices have been fairly stable. There are strong indications for this to change.

The European Commission is currently in the process of investigating roaming prices in Europe and is planning for regulation. This has caused MNOs to lower prices themselves (e.g. Vodafone is currently offering its subscribers roaming for a €0.75 flat fee on top of home network mobile tariffs).

In the light of recent price developments in the industry, roaming prices will fall significantly until 2012.
Voice will remain the dominant roaming product

Even though SMS and data roaming will show significant growth, voice roaming will remain the dominant product.

“…I am really bullish about the growth of roaming traffic, 20% should be reached…” Industry Expert
Global roaming traffic will continue to grow strongly – especially Asia Pacific and Eastern Europe are main areas of growth

... Eastern European countries will show strong growth in terms of volume and revenue...“Industry Expert

... The roll-out of GSM networks in the Americas will certainly boost international roaming traffic there ...“ Industry Expert

- Western Europe is today the most important region for roaming and will remain so in the future, with a CAGR 05-12 for voice roaming traffic of 13% and for SMS of 23%
- Eastern Europe will grow faster than Western Europe, with voice roaming growing with a CAGR 05-12 of 19% and SMS of 26%
- Asia Pacific will show strong growth in line with its economic development, CAGRs for voice and SMS roaming of 20% and 28% respectively
- Africa/Middle East will account for 9bn voice roaming minutes in 2012, less than any other region
- With the roll-out of GSM in North America, international roaming traffic will continue to grow
- Roaming traffic in South America is forecast to grow with a CAGR 05-12 of 16% for voice and 24% for SMS

REGIONAL OVERVIEW

Source: Solon
Among regions Asia Pacific and Eastern Europe clearly stand out in terms of growth in voice traffic

**REGIONAL VIEW**

Voice roaming traffic
(bn minutes)

- Eastern Europe shows strong growth rates due to economic and political development
- Voice roaming traffic in Asia Pacific will grow in line with subscriber growth
- Western Europe’s growth will be driven by falling prices (EU regulation)
- “… Voice roaming will always remain the bread and butter business …” Manager Interconnection and Roaming, Vodafone

![Graph showing voice roaming traffic growth by region from 2004 to 2012](image)

Source: Solon
SMS roaming will be a major driver of total roaming traffic in all regions

While total traffic remains below voice, SMS shows significantly higher growth rates

Western Europe will remain the most important region for SMS roaming, but Eastern Europe and Asia Pacific will catch up

SMS roaming traffic in North America will also take off, albeit from a low base

“... Voice will not grow that much in terms of traffic whereby we expect strong growth for SMS...” Roaming Manager, Sunrise

“... SMS roaming charges have been relatively stable in the past. This will change, and lower rates will result in growing SMS roaming traffic...” Industry Expert, Green Giraffe

Source: Solon
Data roaming is forecast to grow in all regions

**REGIONAL VIEW**

Data roaming traffic
(m MB)

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<thead>
<tr>
<th>Year</th>
<th>North America</th>
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<th>Western Europe</th>
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</tbody>
</table>

**CAGR 05-12**
- North America: 27.7%
- South America: 25.3%
- Asia Pacific: 25.4%
- Western Europe: 25.4%
- Eastern Europe: 24.9%
- Africa/Middle East: 26.1%

- Data roaming is clearly dominated by Western Europe and Asia Pacific
- Eastern Europe still holds potential for further growth
- “… We expect moderate growth for data albeit there are still major problems with quality…” Roaming Manager, Sunrise

Source: Solon
Mobile Roaming Development

WLAN Roaming Opportunities
A dominant business model based on technical standardization has not developed in WLAN

The short-range nature of WLAN, the lacking necessity for frequency licenses and low barriers to entry for hot spot operation lead to a highly fragmented WLAN market with a large number of WLAN operators

Source: Solon
The WLAN market is growing – however it is unclear whether WLAN roaming is going to happen

WLAN ROAMING

Is there a market for WLAN internet access?
- Still young market with many free-of-charge offers (restaurants)
- Growing momentum with entrance of large players (MNOs in Europe)
- 802.11g and WiMax will potentially bring further breakthrough
- Alliance of WLAN operators and VoIP (as Boingo and Skype) could further boost utilization

Does WLAN roaming happen?
- Roaming represents only very small share of WLAN access revenue (<2%)
- Fundamental difference to GSM: No standardization body, no regulating authority, highly fragmented market
- US aggregator model as predominant business model making roaming unnecessary
- Roaming agreements are currently being concluded in Europe (e.g. Vodafone and O2 in Germany), as individual one-on-one contracts
There are four plausible business models in the WLAN access market; only one will result in significant roaming revenues.

**WLAN BUSINESS MODELS**

- **Free commodity**
  - WLAN usage offered free of charge mainly by cafes or other venues in expectation of spill-over effects
  - Free-of-charge offers will continue

- **Lone Rider**
  - Individual WLAN operators cooperate with several alliances and offer direct billing via credit card
  - This model is predominant, especially in the US, but will lose relevance with market consolidation

- **Aggregator**
  - Aggregator holds customer relationships and handles AAA (Authentication, Authorization & Accounting)
  - Aggregators are most likely to win the US WLAN access market

- **Roaming**
  - Few hotspot operators with own customer base dominate market by allowing customers to roam in other operators’ networks
  - European market is likely to see more roaming business in the future

Source: Solon
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