Global mobile network traffic – a summary of recent trends

29 June 2011

1 Introduction

Spectrum requirements for International Mobile Telecommunications (IMT) were considered in detail by the ITU at the World Radio Conference (WRC) in 2007.

In preparation for WRC-07, a detailed assessment of world mobile telecoms market trends was undertaken, and forecasts of future traffic growth up to the year 2020 were developed and published in ITU-R Report M.2072, *World mobile telecoms market forecast*. At the time that report was published, mobile broadband services were in their infancy, and the report provided a series of forecasts for how services might grow in different world regions. In those forecasts, voice traffic was expected to remain the dominant service in many countries until approximately 2015.

In reality, the take-up and use of mobile broadband services have increased significantly in many countries around the world since around 2008, as a result of the growing use of data-intensive devices such as smartphones and tablet PCs in some regions. This has led to data traffic exceeding voice traffic on many mobile networks over the past year – five years ahead of the ITU's forecast.

In this paper, we describe how mobile data traffic levels have evolved in recent years, compared to the forecasts in M.2072, and we assess the implications in terms of further growth in mobile data traffic beyond 2011.

2 Summary of past forecasts

In M.2072, the ITU provided total world usage forecasts for mobile voice and data services for the period from 2003 to 2020. The forecasts were based on a series of hypotheses concerning the penetration and usage of mobile services in six country categories (further subdivided into three environments: dense urban, urban and rural) for 2003, 2006, 2010 and 2020 (see Figure 1).

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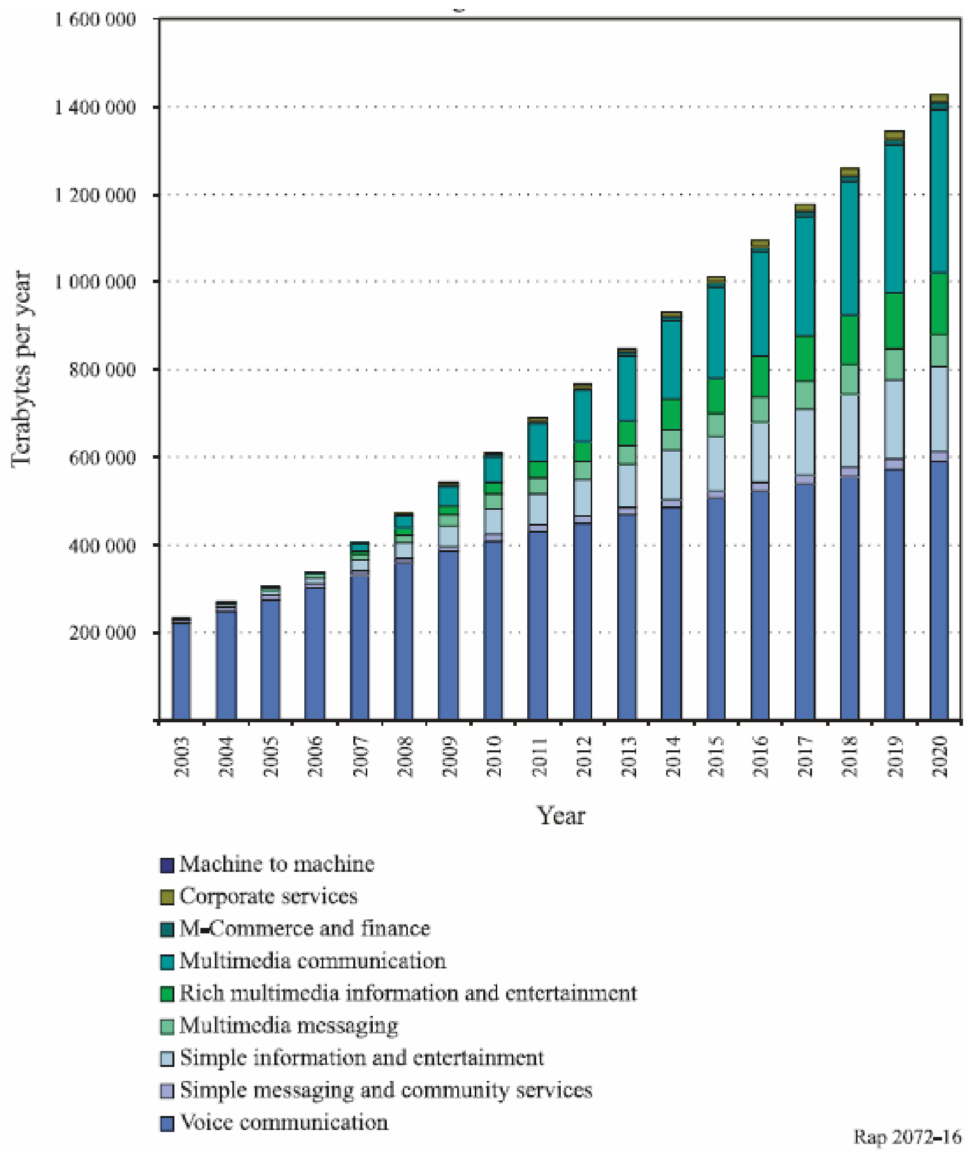

Figure 1: *Worldwide usage forecast per mobile service category [Source: ITU-R M.2072]*

The ITU forecasts in M.2072 predicted that:

- total traffic would grow from around 450 Petabytes (PB) in 2008 to around 1000 PB in 2015 (a compound annual growth rate (CAGR) of 12%)
- voice would decline from around 75% of total traffic in 2008 to approximately 50% of total traffic in 2015.

3 Trends in mobile data use

Since WRC-07, the demand for mobile data services has grown significantly, with a reported 140% increase in total worldwide mobile data traffic between 2008 and 2010[1]. This is placing

1 Analysys Mason, 2011.

increasing pressure on mobile networks to accommodate the continued growth in demand for services.

Mobile traffic volumes in 2008 were four times higher than those forecast by the ITU in M.2072, according to Analysys Mason's historical data[2]. By 2010, the figure was seven times higher (see Figure 2).

Between 2008 and 2010, M.2072 forecast that traffic would grow at a CAGR of 16%. In reality, according to Analysys Mason historical data, mobile traffic grew at a CAGR of 54%.

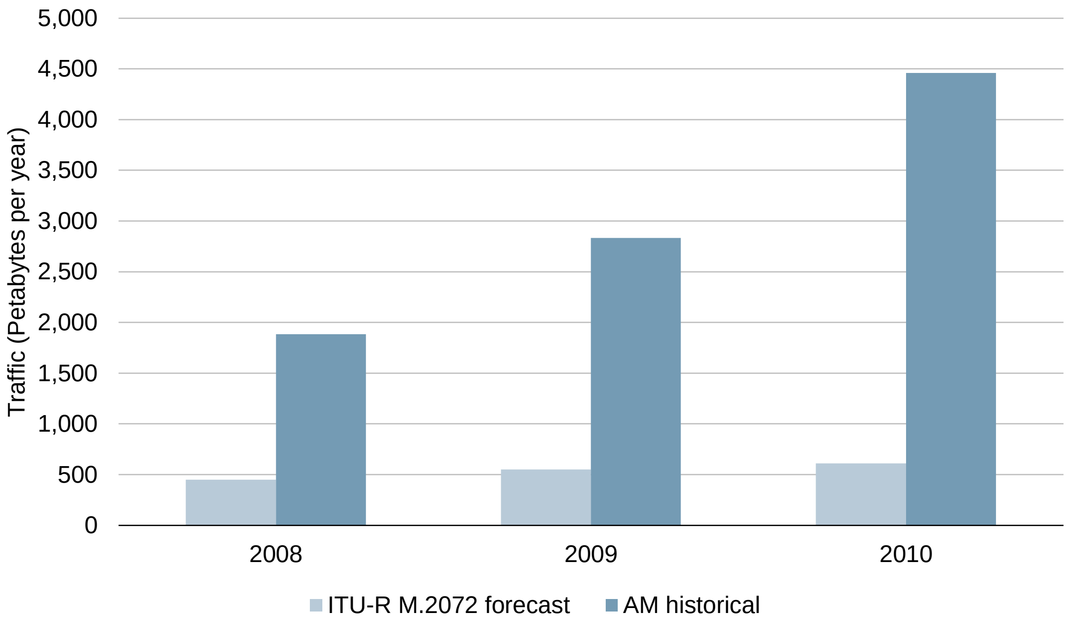

Figure 2: Comparison between ITU forecasts and Analysys Mason historical data, 2008–2010 [Source: ITU, Analysys Mason]

M.2072 anticipated that in 2008 there would be a 75:25 split between mobile voice and data traffic, which is aligned with our historical data.

However, the ITU forecasts were unable to anticipate the pace at which mobile data would grow. M.2072 forecast that the proportion of traffic from mobile data would exceed the traffic generated from mobile voice in 2015**. In reality, the proportion of traffic from mobile data exceeded mobile voice in 2009** (see Figure 3).

[2] Analysys Mason historical data (2008–2010) is based on iterative updates to historical forecasts as new input data becomes available. This data includes GSM, UMTS, LTE, CDMA and Wi-Fi (traffic generated from mobile devices only).

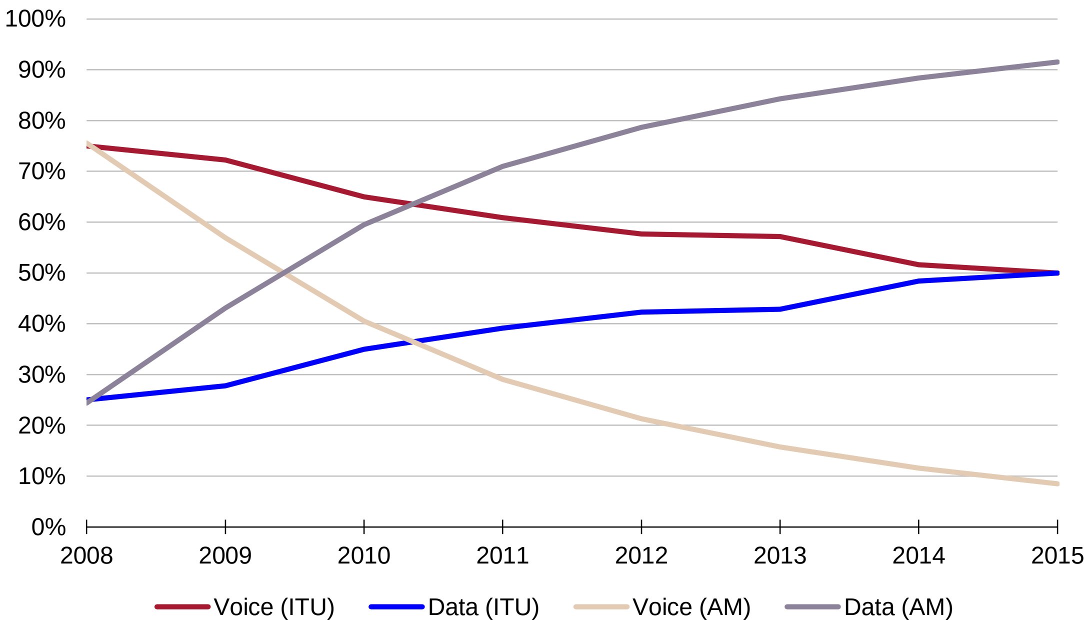

Figure 3: Comparison of traffic split between voice and data [Source: ITU, Analysys Mason]

Regional split of traffic

The ITU forecast in M.2072 presents a regional split of traffic according to levels of mobile penetration. Countries with telecoms (fixed-plus-mobile) penetration above or equal to 17% in 2002 were included in categories A, B and C (with countries in category A having the highest levels of mobile penetration). Countries with a telecoms penetration of less than 17% were included in categories D, E and F. According to the ITU forecasts, countries in categories A to C were expected to generate 88% of total traffic in 2008, declining to 85% of total traffic by 2015.

Taking a somewhat different approach, Analysys Mason breaks its traffic data down by region as follows:

- ‘developed’: Western Europe, Central and Eastern Europe, North America and developed Asia–Pacific
- ‘emerging’: Central and Latin America, Middle East and North Africa, Sub-Saharan Africa and emerging Asia–Pacific.

Because of the different methodologies employed, Analysys Mason data is not directly comparable with the ITU data. However, for the purposes of a high-level comparison, we have considered countries included by the ITU in categories A to C as ‘developed’ and countries in categories D to F as ‘emerging’.

According to the ITU forecasts, ‘emerging’ countries would represent 13% of mobile traffic in 2008, rising to 15% by 2015.

According to our historical data, mobile traffic generated in emerging markets accounted for 60% of total mobile traffic in 2008. While our historical data presented in Figure 2 shows a strong growth in data traffic in emerging markets in the period to 2015 (from 1132 PB per year in 2008 to 14 839 PB per year in 2015), unlike the ITU, we expect that mobile data traffic as a proportion of total mobile traffic in emerging markets will fall slightly, to 53% (see Figure 4)[3].

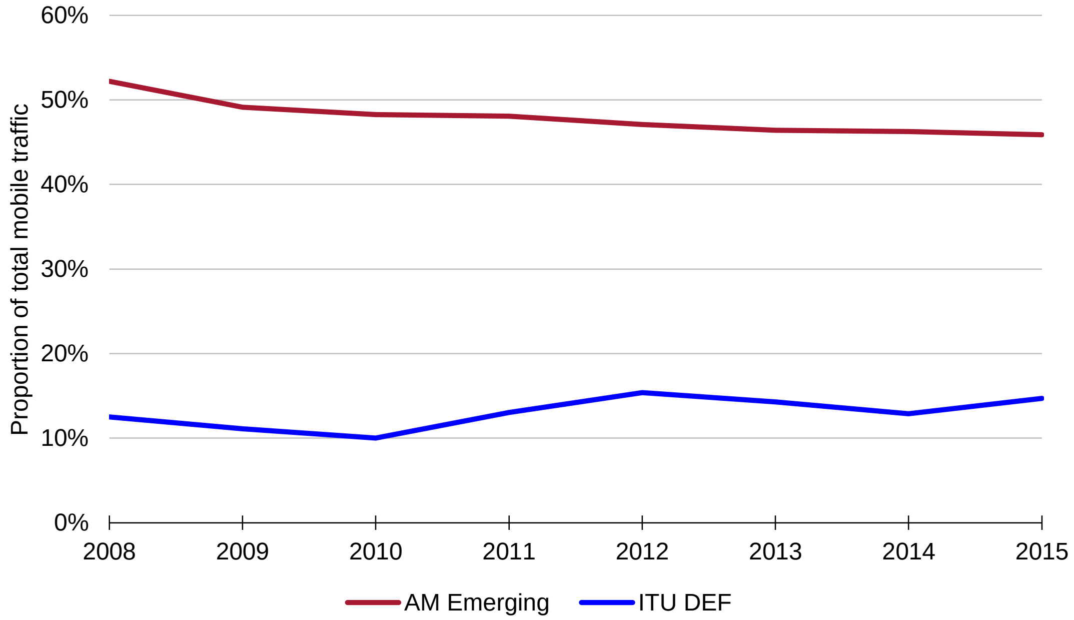

Figure 4: Comparison of mobile traffic split by region [Source: ITU, Analysys Mason]

In Analysys Mason's forecast of mobile traffic split across six regions[4], EMAP is the region with the highest proportion of total traffic throughout the period from 2008 to 2015, followed by NAM and WE. The countries included within our regional definitions are contained in Annex A.

3 Analysys Mason historical data (2008–2010).

4 SSA (Sub-Saharan Africa); MENA (Middle East and North Africa); EMAP (Emerging Asia–Pacific); CALA (Central and Latin America); CEE (Central and Eastern Europe); DVAP (Developed Asia Pacific); NAM (North America); WE (Western Europe).

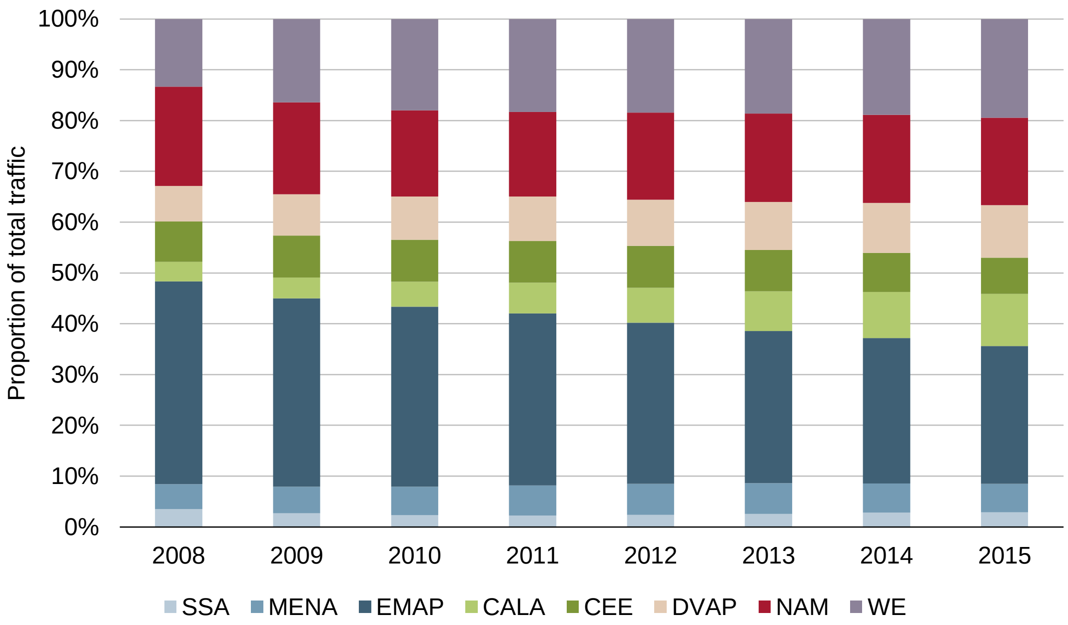

Figure 5: Forecast split of total mobile traffic by region [Source: Analysys Mason, 2011]

3.2 Improvements in cellular devices were a key driver of service usage and wireless network traffic in the period 2008–2010

A wide range of enhanced devices that incorporate cellular connectivity have entered the market during the past two to three years, including smartphones, USB dongles, tablets, e-book readers and gaming consoles. Some of these complement basic mobile phones, while others provide a substitute. These devices offer improved screen sizes and resolution, and hence increase data consumption per image and encourage the use of traffic-intensive applications such as video calling. As a result, these devices have been a key driver of wireless service usage and traffic.

In 2008, basic mobile voice phones accounted for 70% of total traffic (1319 PB per year). By 2010, this proportion had fallen to just 35%, despite an increase in total traffic to 1570 PB per year, with laptops and smartphones accounting for a significant proportion of new growth (see Figure 6).

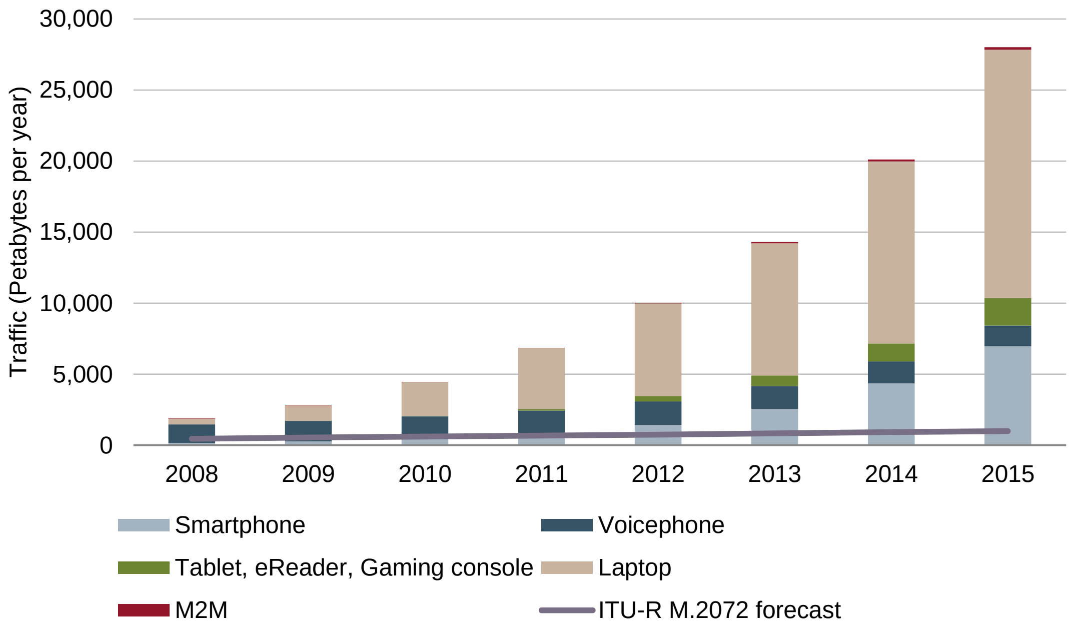

Figure 6: Mobile traffic (PB per year) by device type, 2008–2015 [Source: ITU, Analysys Mason]

Smartphones

Touch-screen smartphones (launched from around 2007) have been a key driver of mobile data traffic growth, offering users the ability to browse standard websites on their mobile device for the first time. The volume of smartphone data routed over cellular networks is growing very rapidly, driven predominantly by increases in device penetration, but also by increases in average usage[5]. In developed markets, a smartphone generates about 50 times more data per month than a basic phone[6]. This includes all data generated and consumed by the device – including that offloaded onto a Wi-Fi network. For example, in Western Europe a smartphone generates 73MB of data traffic per month, compared to an average of 1.22MB per month for a basic phone, which equates to a ratio of 60:1 for the two device types.

In absolute terms the volume of traffic generated by smartphones remains small compared with that of large-screen mobile broadband. One notable development will be 3D displays, which we anticipate will have become well established on smartphones by 2013 and we estimate these 3D smartphones could generate up to 1000 times more traffic than established user applications.

Connected devices

A wide range of new, connected devices, including tablets, e-readers and gaming devices, have emerged in the last two to three years and are already beginning to have an impact on mobile

5 A significant proportion of smartphone traffic is generated indoors; accordingly, we estimate that between 80% and 90% of this traffic is routed over Wi-Fi and fixed broadband networks (included here in the data supplied).

6 Analysys Mason (UK, 2010).

traffic volumes. A tablet PC generates 500 times as much data traffic as a basic mobile phone[7]. For example, in Western Europe a tablet PC generates a total of 740MB per month compared to 1.22MB per month for a basic phone.

Other device developments

Figure 7 provides an overview of other technology developments that are set to increase user demand for mobile data:

Development	*Comment*
Virtualisation	Could enable users to partition one mobile phone into two separate devices – for example, to create a virtual business phone on a personal smartphone (or vice versa). This could reduce the cost of smartphone ownership by negating the need to purchase secondary devices, and thus drive take-up
Multitasking	The ability to run multiple applications concurrently, which encourages multiple bandwidth usage
Introduction of GPUs	The introduction of graphical processing units (GPUs) by chipset vendors such as ARM, Texas Instruments and Qualcomm, will enhance the performance of video applications and thus promote mobile video consumption. The overall user experience of such applications will still be limited by network capacity
Introduction of MPUs	The introduction of multiprocessor units (MPUs) will replace standalone GPUs and, along with virtualisation, will reduce handset costs and allow smartphone technology to be available on a device costing less than USD100.

Figure 7: Technology developments that are set to increase user demand for mobile data [Source: Analysys Mason, 2011]

4 Implications for future traffic growth

The ITU forecast (produced in 2005) assumed that mobile traffic would increase from around 610 PB per year in 2010 to around 1450 PB per year in 2020, a CAGR of approximately 9%. In Figure 8, we apply the CAGR forecast by the ITU to 2010 historical data, which results in a forecast of total mobile traffic for 2010 that is eight times higher than that forecast in M.2072.

7 Ibid.

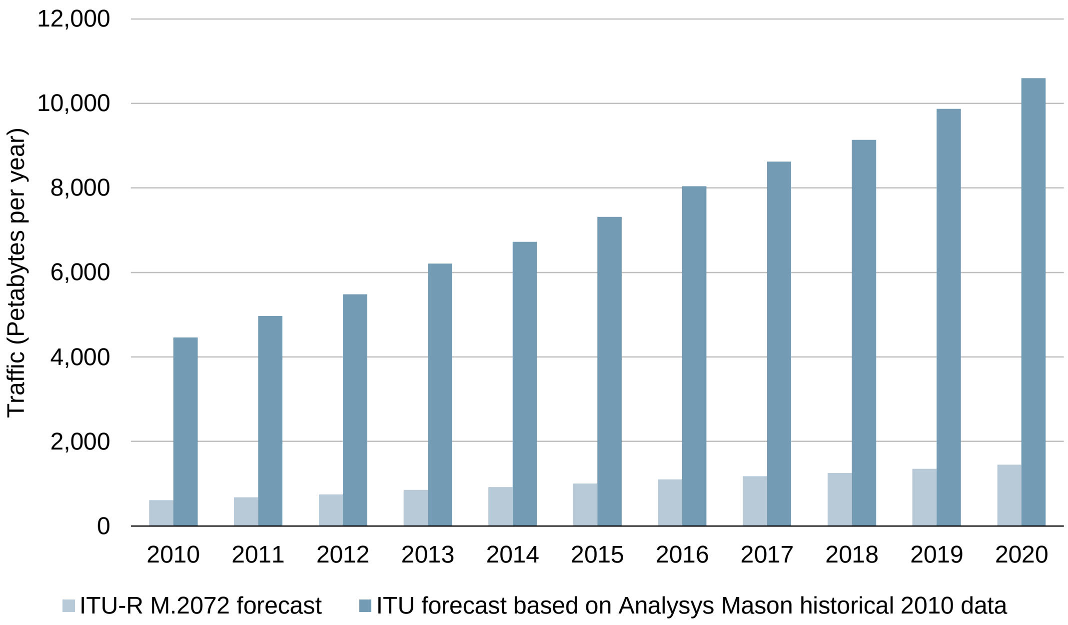

Figure 8: *Mobile traffic forecasts, 2010–2020 [Source: ITU, Analysys Mason]*

Based on the growth observed between 2008 and 2010, Analysys Mason expects more aggressive growth in total mobile traffic during the period to 2015 than has been observed in previous years, but our forecast rate of growth is still more conservative than other vendors and analyst houses. Analysys Mason revised its forecasts upwards in May 2011 (see Figure 9). **On the basis of recent forecasts , we estimate that mobile traffic will grow at a CAGR of 42% to reach 28 000 PB per year in 2015**.

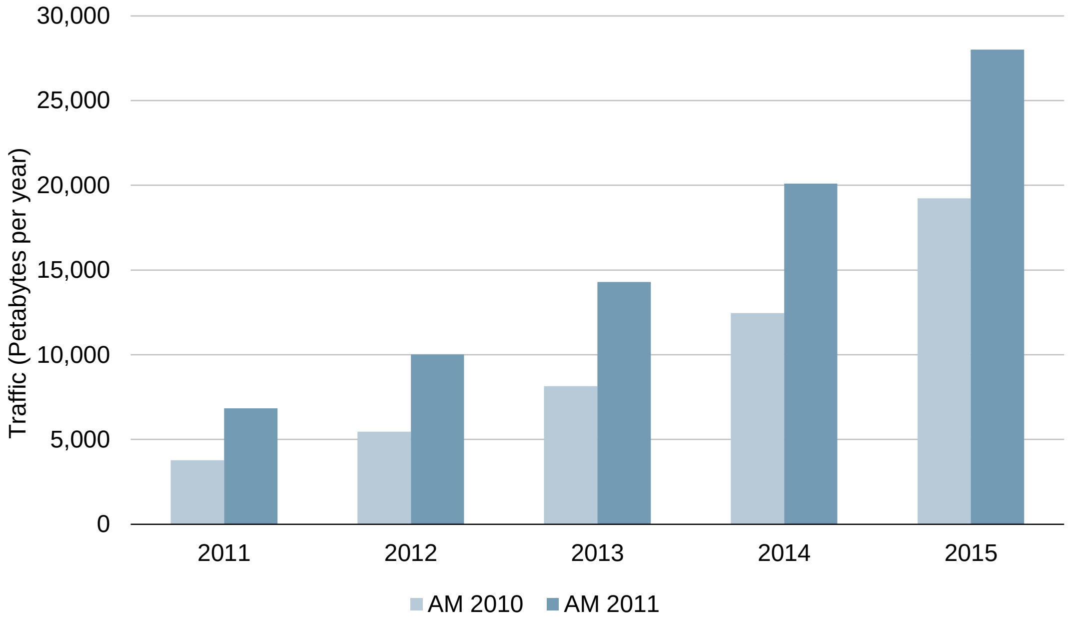

Figure 9: *Comparison between total mobile traffic forecasts produced in 2010 and 2011 [Source: Analysys Mason, 2011]*

As discussed in the following subsections, we expect the key drivers of mobile traffic growth beyond 2011 to include:

- increasing mobile connections in emerging markets
- new services
- affordable pricing and bundling
- improved network architecture and delivery mechanisms.

4.1 Increasing mobile connections in emerging markets

Dramatic growth in the number of mobile broadband connections has driven the first wave of wireless traffic growth. Developed markets are now largely saturated and so Analysys Mason forecasts that take-up of secondary devices will account for most of the marginal growth in the number of connections, which we forecast will increase from 1.66 billion in 2011 to 2.04 billion in 2016.

By contrast, Analysys Mason forecasts that increasing mobile penetration will drive significant growth in emerging markets, where the number of connections will increase from 3.36 billion in 2011 to 4.99 billion in 2016. The BRIC[8] countries in particular will have a major impact on traffic growth during the next five years, with the sheer size of the addressable market in those countries offering favourable conditions for the adoption of mobile broadband services.

4.2 New mobile services

A wealth of new mobile applications and services are finding traction among consumers and enterprise customers, and some of these will generate substantial amounts of data traffic. Figure 10 provides an overview:

Applications/services	*Comment*
Cloud services	The trend towards storage of content such as photos and videos in 'the cloud' will drive growth in uplink traffic from handsets
Content sharing	Users could share content between handsets using a mobile network for connectivity, in place of short-range solutions such as Bluetooth
Mobile applications development	Applications fall into two categories: those that do not lead to further downloads (such as e-books and simple games) and those that do (such as newspapers and links to websites – particularly shopping). Applications that encourage further downloads can generate a significant amount of traffic. Many data-intensive mobile TV applications, such as BBC iPlayer, are experiencing strong growth in take-up and usage
Social networking	Social networking is a relatively low-bandwidth pursuit, but when combined with other applications (such as cloud storage or video on demand (VoD)) it has the potential to drive significant levels of traffic. Social networking is becoming increasingly popular on mobile devices. Facebook reported in June 2011 that more than 250 million active users access its service via mobile devices, up from 200 million six months earlier. It is estimated that Twitter has more than 25 million

8 Brazil, Russia, India, China; the four largest high-growth emerging economies.

Applications/services	*Comment*
	active users, and that 50% of them use a mobile device to access the service, compared to 25% a year ago
Music streaming	Music streaming is a background service, and so can have long usage times per user and high bandwidth requirements, even though the required data throughput levels can be low on a bits-per-second basis
Video on demand	Consumption of VoD traffic is likely to grow very quickly, unless constrained by pricing. In addition, more and more TV network operators are introducing on-demand or 'catch-up' versions of their programming output
Videotelephony	Many new handsets include a forward-facing camera, which will drive usage of videotelephony – a service that depends on high bandwidth, low jitter and low latency

Figure 10: Examples of applications and services that will generate substantial amounts of data traffic [Source: Analysys Mason, 2011]

In particular, it is widely acknowledged that video streaming is a major consumer of wireless bandwidth. Industry estimates now place video streaming as making up about 60% of wireless network data traffic (with Google and YouTube clips estimated to account for half of video streaming traffic). We expect the number of mobile requests for video content to increase, keeping pace with enhanced technology deployments (LTE and LTE-Advanced) and device improvements (including processing power, screen resolution and size).

4.3 Affordable bundling and pricing

Since their introduction in 2008, low-cost 'all you can eat' data tariffs for smartphones and USB modems have encouraged growth in the take-up of data services – particularly those that are traffic-intensive. More recently, however, many operators are eliminating such plans in favour of those with data limits. Most operators cap their services at a few gigabytes per month, and are likely to move away from fixed-price tariffs towards tiered pricing. This might have an impact on the growth of some mobile data services in future, depending on how tariffs are set.

4.4 Improved network architecture and delivery mechanisms

Operators worldwide are still deploying 3G networks, which provide greater capacity than 2G networks and enable a broader range of services to be offered. Operators with established 3G networks are also deploying enhancements, such as HSPA and HSPA+, and improving backhaul from base-station sites in order to increase capacity and reduce capex and opex per megabyte.

By the end of the first quarter of 2011, MNOs worldwide had launched HSPA+ services on more than 125 UMTS networks, and on CDMA networks a total of 122 EV-DO Rev. A services and 3 Rev. B services were available[9].

9 Analysys Mason (UK, 2011), *Wireless Networks Tracker*.

LTE offers a further range of significant performance improvements, and the growth in data traffic during the last three years is driving interest from MNOs to launch LTE services. LTE networks were already operational on 23 networks worldwide at the time of writing in June 2011[10].

5 Conclusion

Looking back to 2005 when the ITU prepared M.2072, expectations about how the volume and composition of mobile traffic would evolve were vastly different from the reality six years on.

The vast range of devices using cellular connections that have entered the market since 2007, coupled with the rapid development of attractive and relevant mobile data services was a reality that could not have been imagined in 2005.

Mobile traffic will continue to experience strong growth worldwide due to a combination of increasing device penetration in emerging regions and take-up of secondary devices in developed regions. This growth represents a challenge to operators who need to adapt their existing network to meet the new capacity requirements.

10 Ibid.

Annex

A1 Countries per region

Central and Eastern Europe	Central and Latin America		Developed Asia–Pacific	Emerging Asia–Pacific		The Middle East and North Africa	Sub-Saharan Africa		Western Europe
Albania	Anguilla	Guyana	Australia	Afghanistan	Malaysia	Algeria	Angola	Malawi	Andorra
Belarus	Antigua and Barbuda	Haiti	Hong Kong	American Samoa	Maldives	Bahrain	Benin	Mali	Austria
Bosnia-Herzegovina	Antilles	Honduras	Japan	Armenia	Marshall Islands	Egypt	Botswana	Mauritania	Belgium
Bulgaria	Argentina	Jamaica	Macau	Azerbaijan	Micronesia	Iran	Burkina Faso	Mauritius	Cyprus
Croatia	Aruba	Mexico	New Zealand	Bangladesh	Mongolia	Iraq	Burundi	Mayotte	Denmark
Czech Republic	Bahamas	Montserrat	Singapore	Bhutan	Myanmar	Israel	Cameroon	Mozambique	Finland
Estonia	Barbados	Nicaragua	South Korea	Brunei Darussalam	Nauru	Jordan	Cape Verde	Namibia	France
Hungary	Belize	Panama	Taiwan	Cambodia	Nepal	Kuwait	Central African Republic	Niger	Germany
Latvia	Bermuda	Paraguay		China	New Caledonia	Lebanon		Nigeria	Greece
Lithuania	Bolivia	Peru		Cook Islands	Niue	Libya	Chad	Réunion	Iceland
Macedonia	Brazil	Puerto Rico		Fiji	North Korea	Morocco	Comoros	Rwanda	Ireland
Moldova	Cayman Islands	St Kitts and Nevis		French Polynesia	Northern Marianas	Oman	Congo	São Tomé and Principe	Italy
Montenegro	Chile	St Lucia		Georgia	Pakistan	Palestine	Côte d'Ivoire		Liechtenstein
Poland	Colombia	St Vincent and the Grenadines		Guam	Palau	Qatar	Democratic Republic of Congo	Senegal	Luxembourg
Romania	Costa Rica			India	Philippines	Saudi Arabia		Seychelles	Malta
Russia	Cuba	Trinidad and Tobago		Indonesia	Sri Lanka	Syria	Djibouti	Sierra Leone	Monaco
Serbia	Dominica	Turks and Caicos Islands		Kazakhstan	Tadzhikistan	Tunisia	Equatorial Guinea	Somalia	Netherlands
Slovakia	Dominican Republic			Kiribati	Thailand	United Arab Emirates	Eritrea	South Africa	Norway
Slovenia	Ecuador	Uruguay		Kyrgyzstan	Turkmenistan	Yemen	Ethiopia	St Helena	Portugal
Turkey	El Salvador	Venezuela		Laos	Uzbekistan		Gabon	Sudan	San Marino
Ukraine	Grenada	Virgin Islands (UK)			Vietnam		Gambia	Swaziland	Spain
	Guatemala	Virgin Islands (USA)					Ghana	Tanzania	Sweden
						North America	Guinea	Togo	Switzerland
							Guinea-Bissau	Uganda	UK
						Canada	Kenya	Zambia	
						USA	Lesotho	Zimbabwe	
							Liberia		
							Madagascar		

Figure 11: Countries considered across each of the regions [Source: Analysys Mason, 2011]

A2 Mobile traffic split per region

Region	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
SSA	3%	3%	2%	2%	2%	3%	3%	3%
MENA	5%	5%	6%	6%	6%	6%	6%	7%
EMAP	40%	38%	35%	34%	33%	30%	28%	27%
CALA	4%	4%	5%	6%	7%	8%	9%	10%
CEE	8%	8%	8%	8%	8%	8%	8%	7%
DVAP	7%	8%	9%	9%	9%	9%	10%	10%
NAM	20%	18%	17%	17%	17%	17%	17%	17%
WE	13%	16%	18%	18%	18%	19%	19%	19%

Figure 12: Mobile traffic split per region [Source: Analysys Mason, 2011]

A3 Mobile traffic split per device

Device	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
Smartphone	155	270	460	794	1418	2542	4349	6957
Voicephone	1319	1453	1570	1646	1662	1626	1557	1477
Tablet, e-reader, gaming console	0	4	24	120	367	757	1257	1933
Laptop	407	1103	2397	4259	6529	9292	12 820	17 463
M2M	1	3	8	20	46	81	123	173

Figure 13: Mobile traffic (Petabyte) split by device [Source: Analysys Mason, 2011]

A4 Connections per device type

Device	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
Smartphone	272	385	544	769	1072	1429	1806	2176
Voicephone	3186	3484	3775	3953	3995	3922	3779	3608
Tablet, e-reader, gaming console	0	1	5	21	47	76	104	132
Laptop	52	93	152	211	269	331	396	457
M2M	23	32	47	67	90	131	192	273

Figure 14: Connections (million) per device type [Source: Analysys Mason, 2011]

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