

# Mobile Operating Systems: The impact of open source and importance of user experience

©2009 Informa UK Ltd.

All rights reserved.

The contents of this publication are protected by international copyright laws, database rights and other intellectual property rights. The owner of these rights is Informa UK Ltd, our affiliates or other third party licensors. All product and company names and logos contained within or appearing on this publication are the trade marks, service marks or trading names of their respective owners, including Informa UK Ltd. This publication may not be:-

- (a) copied or reproduced; or
- (b) lent, resold, hired out or otherwise circulated in any way or form without the prior permission of Informa UK Ltd.

Whilst reasonable efforts have been made to ensure that the information and content of this publication was correct as at the date of first publication, neither Informa UK Ltd nor any person engaged or employed by Informa UK Ltd accepts any liability for any errors, omissions or other inaccuracies. Readers should independently verify any facts and figures as no liability can be accepted in this regard - readers assume full responsibility and risk accordingly for their use of such information and content.

Any views and/or opinions expressed in this publication by individual authors or contributors are their personal views and/or opinions and do not necessarily reflect the views and/or opinions of Informa UK Ltd.

#### AUTHOR

Gavin Byrne  
David McQueen  
Malik Kamal-Saadi

#### FORECASTERS

Gareth Sims  
Nidhir Maudgalya

#### REPORT STAFF

Olivia Gibney, *Reports Managing Editor*  
Maria Mithchell, *Reports Production Manager*  
Shalia Mughal, *Reports Production Editor*

#### HEAD OFFICE

Mortimer House  
37-41 Mortimer Street  
London W1T 3JH  
Web site: [www.informamedia.com](http://www.informamedia.com)

#### SALES & CUSTOMER SERVICE

##### **UK/Europe**

Phone: (44) 20 7017 5533  
Fax: (44) 20 7017 4783  
Email: [telecoms.enquiries@informa.com](mailto:telecoms.enquiries@informa.com)

##### **North America**

Phone: (1) 978 258 2500  
Fax: (1) 20 978 258 2500  
Email: [colleen.barron@informa.com](mailto:colleen.barron@informa.com)

*Published in May 2009*

ISBN: 978 1843 118 220

## About the Authors



**Gavin** is a Research Analyst within Informa Telecoms & Media's Industry Research team. As a member of the Handsets & Devices team he examines developments within the mobile handset value chain, including hardware and software components, vendor strategy and segmentation, business models, technology and feature forecasts. His research also includes the nascent market of mobile broadband devices (attachments, handsets, smartphones, MIDs, UMPCs and notebooks offering high speed WWAN and WMAN connectivity).

As lead author of this report, Gavin has examined the area of mobile handset software, particularly focusing on advanced OS and open source software. The growth in handsets using advanced OS is being driven by mobile network operator requirements to reduce platform fragmentation in their handset portfolio while also increasing data revenues. At the same time many leading handset vendors are also seeking to diversify into the applications space. Importantly, open source is a game changing software development method that offers new means to achieve these goals, possibly at lower cost.

Gavin has over six years' experience in research, competitive intelligence and benchmarking within the telecoms and IT sectors, he provides comment to industry leading publications and contributes to a number of analytical newsletters and research.



**David** is a Principal Analyst at Informa Telecoms & Media with a key focus on mobile device developments and vendor strategies worldwide.

David is responsible for Informa Telecoms & Media's thought leadership in the handsets and devices space, from both a hardware and software perspective, with a slant towards new application convergence. He has been either lead or contributing author to a number of Informa's strategic reports, including *Mobile Broadband Devices*, *Future Mobile Handsets*, *Mobile Broadcast TV*, *Multimedia Handsets and Devices* and *Mobile Application Platforms & Operating Systems*.

David has considerable experience in the telecoms research and consulting sector and has gained first-hand experience in the handset markets' needs and requirements. He is a frequent speaker and chair at international conferences and has made many presentations on current trends and future development of mobile handsets and devices. He also provides timely analysis and comment on the devices market, and is often quoted in the global business press.

David holds a Masters degree in marketing and an honours degree in econometrics and mathematical economics.

## About the Authors (continued)



**Malik** is a Principal Analyst at Informa Telecoms & Media. He is a thought leader covering several different sectors of the global telecommunications industry including devices, networks and infrastructure and multimedia services.

Malik has planned, authored and co-authored many of Informa Telecoms & Media strategic reports including *Future Mobile Handsets*, *Mobile Applications Platforms & Operating Systems*, *Mobile Broadband Networks*, *Mobile Access at Home*, *Mobile VoIP*, *Open Source in Mobile*, *IP Multimedia Systems (IMS)*, *Mobile Converged Devices*, *Mobile Computing Devices*, and *Metropolitan Area Networks and Switching Technologies*. He has also contributed in planning the content of many of Informa events and workshops and was involved in the Telecoms Academy's Mini MBA program.

Malik is a frequent speaker at international conferences on mobile telecommunications. He has over 13 years' experience in the telecommunications industry as a technology expert and analyst following different technologies from inception to maturity. He has also played a key role in a number of European and government projects.

Malik has a PhD degree from Groupe d'Etude des Semiconducteurs (GES, France), specializing in Semiconductor Devices and Materials, Design and Engineering.

# Contents

<b>CHAPTER 1</b>	
<b>EXECUTIVE SUMMARY</b> .....	1
The importance of handset software .....	1
<i>Figure 1.1: Global mobile handset sales, new vs. old forecasts, 2008-2013.</i> .....	1
Open source .....	2
<i>Figure 1.2: Main open software licenses as a function of the degree of freedom they offer.</i> .....	3
Operating systems .....	5
<i>Figure 1.3: Segmentation of mobile OS market</i> .....	6
Vendor strategies .....	6
Mobile OS market .....	7
<i>Figure 1.4: Global smartphone sales, 2007-2013</i> .....	9
Device service ecosystems .....	10
<b>CHAPTER 2</b>	
<b>HANDSET MARKET TRENDS</b> .....	13
<i>Figure 2.1: Global mobile handset sales, new vs. old forecasts, 2008-2013.</i> .....	13
<b>Differentiation</b> .....	15
Introduction .....	15
<i>Figure 2.2: Competitive advantage, strategic options.</i> .....	15
Cost leadership .....	15
Differentiation .....	16
Handset hardware .....	17
<i>Figure 2.3: Penetration of selected hardware features in new Nokia handsets.</i> .....	18
Handset software .....	18
<b>User experience</b> .....	20
<i>Figure 2.4: Selected factors that can influence mobile user experience.</i> .....	20
Mobile handset .....	20
External factors .....	21
Conclusion .....	22
<b>Access to other markets</b> .....	22
<b>CHAPTER 3</b>	
<b>OPEN SOURCE IN MOBILE</b> .....	25
<b>The business perspective</b> .....	25
Open source approach .....	25
<i>Figure 3.1: The main steps of open source history.</i> .....	25
The philosophy .....	26
<i>Figure 3.2: The 10 criteria of OSS as defined by OSI v1.9.</i> .....	26
The business case .....	27
The main misconceptions of open source .....	28
It is not a product with no revenue model. ....	28
It is not free of cost. ....	29
It is not a free resource of volunteer developers .....	30
It is not a viral threat to intellectual property .....	30
<b>Licensing models</b> .....	30
<i>Figure 3.3: Different approaches of licensing open source software</i> .....	31

<i>Figure 3.4: Main open software licenses as a function of the degree of freedom they offer.</i> . . . . .	32
Legal characteristics . . . . .	32
Disparities between different licenses . . . . .	32
GPL and GPLv2 . . . . .	34
<i>Figure 3.5: Main characteristics of different open source licenses</i> . . . . .	35
Changes in the third version of GPL . . . . .	37
<i>Figure 3.6: Compatibility of GPLv3 with other open source licenses</i> . . . . .	38
Lesser GPL (LGPL) . . . . .	38
Apache License (APL) . . . . .	38
Eclipse Public License (EPL) . . . . .	39
Mozilla Public License (MPL) . . . . .	41
<b>Governance models</b> . . . . .	41
The balance between the 'Cathedral' and the 'Bazaar' approaches . . . . .	42
<i>Figure 3.7: Three key governance models</i> . . . . .	42
Cathedral model – central control . . . . .	42
Bazaar model – a decentralized approach . . . . .	44
Key factors needed to create a strong governance model . . . . .	45
<b>Business models</b> . . . . .	47
Advantages of open source-based business models . . . . .	47
Pitfalls of open source-based business models . . . . .	48
Choosing an open source business model . . . . .	50
Is open source a disruption to the mobile industry? . . . . .	51
<b>Open source in mobile case studies</b> . . . . .	52
WebKit phenomena and development paths . . . . .	53
Different implementations and forks . . . . .	53
WebKit for Nokia's S60 browser . . . . .	53
<i>Figure 3.8: Nokia S60 web browser architecture</i> . . . . .	54
WebKit for Nokia's S40 browser . . . . .	54
Industry impact of WebKit . . . . .	55
Linux in the mobile market . . . . .	56
Benefits and challenges of mobile Linux . . . . .	57
<i>Figure 3.9: Advantages and benefits of Linux in the mobile market.</i> . . . . .	58
Google in open source and mobile markets: the Android story . . . . .	60
<i>Figure 3.10: Android architecture</i> . . . . .	61
The rationale behind releasing Android SDK under APL . . . . .	61
Purple Labs . . . . .	62
Open source and Java: what happened to Java ME? . . . . .	64
Java open source: future outlook . . . . .	64
Open source Java ME components . . . . .	65
<i>Figure 3.11: Main components of phoneME Feature and Advanced projects</i> . . . . .	66
Licensing and intellectual property constraints . . . . .	67
<i>Figure 3.12: Comparative analysis of Sun's Java ME platform implementations under commercial and open source licenses</i> . . . . .	68
Java ME open source: impact on the mobile industry . . . . .	70
The case of Motorola's MIDP3 project . . . . .	72
Nokia's experience with open source . . . . .	74
Major projects sponsored by Nokia . . . . .	74
<i>Figure 3.13: Nokia: major open source projects by licensing model (as of January 2009)</i> . . . . .	75
The case of the Maemo platform . . . . .	76

Figure 3.14: Maemo platform architecture diagram . . . . .	77
The reasons behind the acquisition of Symbian by Nokia . . . . .	77
Figure 3.15: Symbian performance, 2001-2008 . . . . .	78
The rationale behind taking Symbian and S60 to open source . . . . .	79

## CHAPTER 4

<b>MOBILE OPERATING SYSTEMS</b> . . . . .	83
<b>Role and architecture</b> . . . . .	83
Figure 4.1: Simplified view of the OS role . . . . .	83
Figure 4.2: Typical dual platform architecture functions . . . . .	84
Figure 4.3: Selected applications OS platform components . . . . .	84
<b>Mobile OS market segments</b> . . . . .	85
Figure 4.4: Segmentation of mobile OS market . . . . .	86
<b>Proprietary OS</b> . . . . .	87
<b>Open architecture OS</b> . . . . .	88
Symbian . . . . .	90
Overview . . . . .	90
Figure 4.5: Global Symbian OS unit shipments, 2003-1H08 and 2007 shipments by UI platform . . . . .	90
Symbian: higher volume and lower cost . . . . .	91
Figure 4.6: Symbian roadmap v9.1 – v9.5 . . . . .	92
Development . . . . .	94
Conclusion . . . . .	95
Microsoft Windows Mobile (WM) . . . . .	96
Overview . . . . .	96
Figure 4.7: Global Microsoft Windows Mobile phone-enabled device shipments, 2005-2008 . . . . .	96
OS, application and services development . . . . .	97
Figure 4.8: Microsoft Windows Mobile roadmap 5.0-6.5 . . . . .	97
Mobile phone market strategy and confronting open source . . . . .	99
webOS . . . . .	101
BlackBerry OS . . . . .	102
Figure 4.9: BlackBerry OS major releases, Dec-99 to Nov-08 . . . . .	103
Apple OS X iPhone . . . . .	105
Figure 4.10: iPhone and iPod Touch OS releases, Jun-07 to Jan-09 . . . . .	106
<b>Open source OS</b> . . . . .	107
Standards bodies . . . . .	108
Figure 4.11: Main members of the LiMo Foundation, the OHA and the Symbian Foundation, as at end Feb-09 . . . . .	109
LiMo Foundation . . . . .	110
Open Handset Alliance . . . . .	112
Android . . . . .	112
Figure 4.12: Android architecture . . . . .	113
Symbian Foundation . . . . .	114
Figure 4.13: Symbian Foundation timeline . . . . .	115
Figure 4.14: Symbian Foundation Platform . . . . .	116
<b>Commercialization and OS</b> . . . . .	117
Linux . . . . .	117
The business case for mobile Linux . . . . .	118
Figure 4.15: Pros and cons of a Linux-based OS as an open source OS for mobile handsets . . . . .	119
Figure 4.16: Market segmentation of Linux offerings . . . . .	120

Leading Linux OS developers .....	120
MontaVista .....	120
Wind River .....	121

<b>CHAPTER 5</b>	
<b>VENDOR STRATEGIES .....</b>	<b>123</b>
<b>Nokia .....</b>	<b>124</b>
Company overview .....	124
<i>Figure 5.1: Nokia: company structure .....</i>	<i>124</i>
Operating system support and segmentation .....	127
Other software support (UI and browsers) .....	129
Conclusions .....	130
<b>Samsung .....</b>	<b>131</b>
Company overview .....	131
Operating system support and segmentation .....	132
Other software support (UI and browsers) .....	133
Conclusions .....	134
<b>LG .....</b>	<b>135</b>
Company overview .....	135
Operating system support and segmentation .....	136
Other software support (UI and browsers) .....	137
Conclusions .....	138
<b>Motorola .....</b>	<b>138</b>
Company overview .....	138
Operating system support and segmentation .....	139
Other software support (UI and browsers) .....	141
Conclusions .....	142
<b>Sony Ericsson .....</b>	<b>143</b>
Company overview .....	143
Operating system support and segmentation .....	143
Other software support (UI and browsers) .....	145
Conclusions .....	146
<b>Apple .....</b>	<b>146</b>
Company overview .....	146
Operating system support and segmentation .....	147
Other software support (UI and browsers) .....	148
Conclusions .....	149
<b>High Tech Computer Corporation (HTC) .....</b>	<b>149</b>
Company overview .....	149
Operating system support and segmentation .....	150
Other software support (UI and browsers) .....	151
Conclusions .....	152
<b>Research In Motion (RIM) .....</b>	<b>153</b>
Company overview .....	153
Operating system support and segmentation .....	154
Other software support (UI and browsers) .....	155
Conclusions .....	155

<b>CHAPTER 6</b>	
<b>MOBILE OS MARKET</b>	157
<b>Mobile operating system landscape</b>	157
OS market segmentation	157
<i>Figure 6.1: Segmentation of mobile OS market</i>	158
<i>Figure 6.2: Market segmentation of OSs for mobile devices</i>	162
OS drivers and trends	162
<b>Global mobile OS handset market forecasts</b>	166
Total handset sales by OS type	166
<i>Figure 6.3: Global smartphone sales, 2007-2013</i>	168
<i>Figure 6.4: Global smartphone sales, by region, 2007-2013</i>	169
<i>Figure 6.5: Global smartphone penetration of sales, by region, 2007-2013</i>	170
Total smartphone sales by smartphone OS type	170
<i>Figure 6.6: Operating systems defined by platform type</i>	170
<i>Figure 6.7: Global smartphone sales, by OS and segment, 2007-2013</i>	173
<i>Figure 6.8: Global smartphone sales, OS segment share, by region, 2008, 2010 and 2013</i>	174
Total smartphone sales by smartphone OS	174
<i>Figure 6.9: Global open OS handset sales, by OS type, 2007-2013</i>	177
<i>Figure 6.10: Global smartphone sales volume, by OS and region, 2008, 2010 and 2013</i>	179
<i>Figure 6.11: Global smartphone market shares, by OS and region, 2008, 2010 and 2013</i>	180
<b>Conclusions</b>	181
<i>Figure 6.12: Key OS platform landscape for the leading handset vendors</i>	182
<b>CHAPTER 7</b>	
<b>DEVICE SERVICE ECOSYSTEMS</b>	185
<b>Application store phenomenon and device service ecosystem</b>	185
Industry dynamics	185
<i>Figure 7.1: Key non-operator mobile application stores: addressable market and revenue models</i>	186
What it means for handset vendors	187
What it means for ISPs and software solution providers	187
What it means for mobile operators	188
What it means for application developers	189
Profile: Nokia Ovi	190
Profile: Apple's App Store	192
<b>Enhanced UE through mobile application runtime</b>	193
Trends towards open application runtime	193
Different flavors of application runtime environment and fragmentation	196
The marketplace and roadmap of Qualcomm's BREW ecosystem	197
Market drivers and business model	197
BREW technology and roadmap	198
<i>Figure 7.2: BREW software platform roadmap</i>	199
<i>Figure 7.3: The main differences between next and current generations of BREW</i>	200
Adobe Flash	201
Adoption level and changes in the business model	201
Flash technology and roadmap	203
<i>Figure 7.4: Flash Lite platform roadmap</i>	204
Nokia S60: increased support for Web services	205
<i>Figure 7.5: Nokia S60 evolution and compatibilities across different generations</i>	206

<b>Evolution towards MRIsAs and mobile MWRT</b> .....	209
The business case .....	209
<i>Figure 7.6: Mobile telecoms ecosystem in three dimensions</i> .....	209
<i>Figure 7.7: Evolution towards mobile Web runtime (MWRT) and mobile rich Internet applications (MRLAs)</i> .....	210
Three criteria in choosing MWRT .....	211
<i>Figure 7.8: Mobile Web user experience: community-triggered ecosystem</i> .....	211
<i>Figure 7.9: Schematic picture of cross-platform and seamless web experience</i> .....	212
Different flavors of MWRT platforms .....	212
<i>Figure 7.10: Main MWRT solutions and their development environment</i> .....	214
Microsoft's Silverlight .....	214
Adobe's AIR .....	215
Google's Gears .....	216
Sun's JavaFx and ODP .....	216
Qualcomm's Plaza .....	217
Fragmentation issues and the role of standard bodies .....	217
Main issues in the mass market .....	218
Main issues for high-end handsets and smartphones .....	219
Standardization trends .....	219
<b>Mobile operators rationalizing on terminal platforms</b> .....	220
Advantages of rationalization .....	221
Operator choices .....	222
<i>Figure 7.11: Key terminal software platforms supported by the leading operators</i> .....	223