

GPS Mobile Phones: The Privacy and Regulatory Issues

You Are Here



ARC CHART

S E C T O R R E P O R T

GPS Mobile Phones: the Privacy and Regulatory Issues

February 2008

Dr Tony Judge
Lead Analyst

Matt Lewis
Research Director

ARCchart Ltd
27 Holywell Row
London EC2A 4JB
United Kingdom

Tel: +44 20 7456 9669
Fax: +4420 7456 9660
Email: service@arcchart.com

ARCchart is an independent research and consulting firm focusing on all aspects of the wireless communications sector. Based in London, ARCchart's depth and breadth of analysis provides a global perspective on wireless technology and industry developments. Combining original thinking with exceptional knowledge and experience, ARCchart assists clients in making sound commercial decisions about technologies, market strategies and competitive positions. With strong roots in the tracking of M&A activity across the communications space, ARCchart's strategic advice covers all aspects of the wireless value-chain - ranging from semiconductors and WLANs to network operators, handsets and mobile applications. ARCchart is an affiliate of London-based investment bank ARC Associates.

This report draws upon research and analysis conducted by all the ARCchart information groups. Use of this report by any third party for whatever purpose should not, and does not, absolve such third party from using due diligence in verifying the report's contents. Any use which a third party makes of this document, or any reliance on it, or decisions to be made based on it, are the responsibility of such third party. ARCchart, its affiliates and representatives accept no duty of care or liability of any kind whatsoever to any such third party, and no responsibility for damages, if any, suffered by any third party as a result of decisions made, or not made, or actions taken, or not taken, based on this document. ARCchart does not make investment recommendations, in this report or otherwise, and nothing in this report should be interpreted as an opinion by ARCchart either on market forecasts or on the prospects of specific companies.

Executive Summary

GPS phone shipments are set to grow significantly over the period 2008-12. This is governed by a number of factors such as regulatory requirements for mobile service providers to give accurate location fixes for emergency callers, the decreasing costs of GPS phone chipsets, a migration of GPS functionality from high-end into mid-range and eventually low-end handsets, and a determination by handset manufacturers – particularly Nokia – to share in the projected rise in revenues from mobile location based services (LBS).

The number of users of mobile LBS is also expected to grow strongly from 2008-12. ARCchart predicts that by 2012 the worldwide installed base of GPS-enabled handsets will reach 891 million and the consequent growth in the availability of handset location information (LI) raises many questions about the degree to which users can be protected from potential abuses of their LI.

In this report ARCchart examines the market for GPS phones, location finding techniques, legal and regulatory implications of GPS phones and technologies available for managing location privacy. ARCchart's analysis of the emerging LBS market reveals that there is a potential for serious abuses of location privacy in cases where the use of location information has not been adequately regulated.

- Chapter A describes the positioning technologies that allow mobile handsets to be located, with particular emphasis on GPS, assisted GPS (A-GPS) and its use in conjunction with the most common cellular location technologies. It also samples some current GPS phone models and reviews handset and server side architectures for accessing LI.
- Chapter B reviews the main types of LBS applications, which includes personal security, navigation, education & gaming, enterprise, social networking, commerce and Government. Descriptions and examples are provided of each application, followed by our observations of the implications for location privacy. We also summarise the major threats arising from abuses of LI.
- Chapter C describes the legal, regulatory and technological mechanisms that are currently available for the protection of location privacy. We look in particular at the experiences in four representative markets: China, Japan, the UK and the US.
- Chapter D provides some key recommendations for regulators and LBS providers to ensure that LI is adequately protected in the markets where they operate.
- Chapter E presents ARCchart's world and regional market forecasts over the period 2008-12 for annual shipments of GPS phones, numbers of GPS phones in circulation and user numbers for the main types of LBS application.

ARCchart forecasts that worldwide shipments of GPS phones will increase from 234 million in 2008 (20% of all shipments) to 535 million in 2012 (37% of all shipments). GPS functionality will migrate from high-end smartphones into mid-range and low-end models during the forecast period. The total installed base of GPS-enabled handsets worldwide will increase from 343 million in 2008 to 891 million in 2012.

In parallel with the rapid growth in GPS phone ownership, the user base for key LBS applications accessed via these devices will also grow significantly. For example, ARCchart forecasts that users of location services aimed at personal security will increase from 14 million in 2008 to 45 million by 2012, while mobile subscribers using their handsets for navigation purposes will jump from 39 million in 2008 to 150 million in 2012.

ARCchart also presents important recommendations for regulators and LBS providers operating in nascent LBS markets. A key requirement is that regulators provide clear rules on the permissible use of LI for all players in the LBS value chain and not just for mobile service providers. Where the regulatory regime is incomplete, industry players should adopt a common code of practice for the use of LI within their market; this will safeguard their customers' location privacy and their own longer-term commercial interests.

Other recommendations aimed at LBS application providers highlight the need to introduce new techniques for protecting location privacy in ways which allow users to retain control of their privacy profile. Sales and marketing materials should stress safe modes of use for LBS; in particular for potentially high-risk services such as child-finders and location-aware dating services. Where services allow users to tag uploaded content (e.g. photos) with their location, the content should ideally be moderated before it is shared with other users.

Table of Contents

A. INTRODUCTION TO GPS PHONES	1
A.1 Introduction	1
A.2 Drivers for GPS phones	1
E911	1
E112 and eCall	2
Privacy	2
A.3 How GPS works	3
Technical features.....	3
GPS Ephemeris and Almanac.....	3
C/A code	4
P(Y) code	4
Navigation Message.....	4
Differential GPS (DGPS)	5
A.4 Future GPS developments	5
IIR-M and IIF.....	5
GPS III	5
A.5 Other GPS-type networks	6
Galileo.....	6
Galileo navigation systems.....	6
GLONASS (Global Navigation Satellite System)	7
QZSS - Japan	7
Compass - China	7
IRNSS - India.....	8
A.6 Cellular location technologies	8
A.7 Assisted GPS	10

A-GPS standards	11
Cellular/A-GPS hybrids	12
A.8 Other location techniques	12
Cell tower databases	12
Wi-Fi location finding.....	13
RFID and Bluetooth	13
A.9 GPS receiver design	13
Qualcomm gpsOne	14
Single chip GPS from TI	14
Global Locate and Infineon	14
GPS SIM from BlueSky Positioning	14
A.10 GPS phone examples	14
Examples of specialist GPS ‘phones’.....	15
A.11 Handset implementations of LBS	17
Java	17
Windows Mobile.....	17
Symbian.....	18
BREW	18
Browser.....	18
A.12 Network location platforms	18
Open Location Standards	18
Examples of location platform products	20
B. PRIVACY IMPLICATIONS FOR COMMON LBS APPLICATIONS	22
B.1 Market background for LBS	22
B.2 Active and passive services	23
B.3 Abuse of location information	23
B.4 Personal security	24
Roadside Assistance	24
Weather Warning.....	25
Child Finders.....	25
E 911 /E112.....	26

Healthcare	26
GeoFencing	26
B.5 Gaming/Education	27
Interactive Gaming.....	27
GeoCaching.....	28
B.6 Enterprise	28
Fleet Management/ Asset Monitoring	28
Personnel Productivity	29
Customer Service	30
Lone worker protection	30
B.7 Navigation	31
City Guides	31
Mobile Yellow Pages.....	31
Turn-by-turn navigation.....	32
Traffic reroute	32
B.8 Social networking	33
Buddy Groups.....	33
Dating	33
Geo-tagging and blogging.....	35
B.9 Commerce	35
Mobile Coupons.....	35
Location Based Billing.....	36
B.10 Government	36
Homeland Security.....	37
Military	37
B.11 Summary	38
C. MANAGING LOCATION PRIVACY	39
C.1 Legal and regulatory approaches	39
International regulation – OECD	39
EU directives.....	40
Extract From the Privacy and Electronic Communications Regulation 2003 EC Directive	42

National legislation and regulation	43
China.....	43
Japan	44
UK.....	44
US	45
C.2 National industry self-regulation	47
China.....	47
Japan	47
UK.....	47
Child location services.....	48
Adult/friend location services.....	49
Mobile games supported by location services.....	49
Corporate location services.....	50
Summary.....	50
US.....	50
CTIA Location Privacy Principles	50
C.3 Techniques for managing location privacy	52
Consent	52
Anonymization	53
Spatial cloaking.....	53
Temporal cloaking.....	54
Location perturbation	54
Pseudonyms	54
Information-minimizing.....	55
User privacy profiles	55
D. RECOMMENDATIONS	56
D.1 Regulation and self-regulation	56
Technology neutrality.....	56
Avoid piecemeal regulation.....	56
Emergency calling.....	57
Codes of practice.....	57

Passive services	57
D.2 Service Design	58
Privacy by design.....	58
Users in control.....	58
User interfaces.....	58
User education.....	58
Moderate UGC.....	59
E. MARKET FORECASTS	60
E.1 Forecasts for GPS phone volumes	60
E.2 Forecasts for selected location-enabled applications	62

List of Figures

Figure A-1: Constellation of 31 medium earth orbit GPS satellites	3
Figure A-2: Nokia N95 GPS phone	15
Figure A-3: Motorola/ Nextel i580 ruggedised GPS phone	15
Figure A-4: The MobiCare GPS phone and monitoring device from Argyll Telecom	16
Figure A-5: The MaxCare location and alerting device from Argyll Telecom	16
Figure A-6: LG Migo GPS phone aimed at young children	17
Figure A-7: Role of the GeoMobility Server	19
Figure A-8: Architecture of the GeoMobility Server	19
Figure A-9: Openwave Location Manager: Commercial Edition	20
Figure A-10: Openwave Location Manager: Emergency Edition (GSM)	20
Figure A-11: Xypoint Location Platform from TCS	21
Figure C-1: LBS anonymization function.....	53
Figure E-1: GPS phone shipments 2008-12 - worldwide	60
Figure E-2: GPS phone shipments 2008-12 - by region	61
Figure E-3: Total installed base of GPS phones in use 2008-12 - worldwide	61
Figure E-4: Total installed base of GPS phones in use 2008-12 - by region.....	62
Figure E-5: Users of location-enabled personal security applications 2008-12.....	63
Figure E-6: Users of location-enabled gaming applications 2008-12	63
Figure E-7: Users of location-enabled enterprise applications 2008-12.....	64
Figure E-8: Users of location-enabled navigation applications 2008-12	64
Figure E-9: Users of location-enabled social networking applications 2008-12	65
Figure E-10: Users of location-enabled commerce applications 2008-12	65

List of Tables

Table A-1: Summary of GPS frequency bands	4
Table A-2: GPS error sources.....	4
Table A-3: Comparison of mobile location methods.....	9
Table A-4: Comparison of GPS modes.....	11
Table A-5: GPS performance metrics for GSM and CDMA assisted GPS.....	12
Table B-1: Use of location information in different LBS applications.....	38
Table C-1: OECD guidelines on data privacy	40

ARCchart Ltd
27 Holywell Row
London EC2A 4JB
United Kingdom

Tel: +44 20 7456 9669
Fax: +4420 7456 9660
Email: service@arcchart.com