Recommendations for smartphone project success

David Wood
EVP Research, Symbian

Understand what’s different about smartphones

Warnings from smartphone project failures
Preamble:
Why smartphones are interesting

David Wood
EVP Research, Symbian

The smartphone opportunity

And what is a smartphone?
Global installed base at end of 2006

- Mobile phones: 2.7B
- TVs: 1.5B
- Credit cards: 1.4B
- Fixed telephones: 1.3B
- Internet: 1.1B
- Misc. CE: 870m
- PCs: 850m
- Cars: 800m

“Misc. CE” include: PDAs, mp3 players, PVRs, camcorders, game consoles and digital cameras

Source: Communities Dominate Brands – Tomi Ahonen & Alan Moore
Three waves of mobile phones

Voice centric
~2000

Feature phones
~2005

Smartphones
The best is still to come

Phone functionality

• Great communications
  • Voice (& text)
  • Pocketability
  • Size
  • Weight
  • Battery life
  • Robustness
  • Reliability

• Graphics display
  • Colour
  • Camera
  • Audio: Ringtones+
  • Video
  • Memory
  • Information
  • Personalisation

• Rich programmability
  • Virtuous cycle
  • Innovation
  • Applications & services
  • Personal productivity
  • Business productivity
  • Mobile commerce
  • Customisability
The smartphone market open virtuous cycle

Advanced open mobile OS

Consumers & corporates

Mobile services, content & applications

Developers

Open standards

Handset manufacturers

Fast 3G & 3.5G networks (WiFi plus cellular)

Network operators

Large volumes of advanced open programmable mobile phones
“Open” means

• Programmable
• Interchangeable
• Collaborative
• Open-minded
• Free-flowing

Opportunities build on openness

“Closed” means

• Fixed functionality
• Non-standard add-ons
• Overly competitive
• “Divine right” attitude
• Bottlenecks and chokes

Risks threaten a resurgence of closure
The smartphone market open virtuous cycle

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Symbian smartphone shipments

Quarterly phone sales

Units shipped (millions)

2000 2001 2002 2003 2004 2005 2006

2.0m 6.7m 14.4m 34.0m 51.7m

14.6m Q4 06

110 million cumulative units shipped at the end of Q406
Regional smartphone sales breakdown (Q4 06)

Source: Canalys

Total Q4 2006 smartphone sales: 20,217,920
Sustained smartphone market share

Source: Canalys

<table>
<thead>
<tr>
<th></th>
<th>Q4 05</th>
<th>Q1 06</th>
<th>Q2 06</th>
<th>Q3 06</th>
<th>Q4 06</th>
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</thead>
<tbody>
<tr>
<td>Symbian</td>
<td>69.3%</td>
<td>69.9%</td>
<td>69.7%</td>
<td>72.8%</td>
<td>72.5%</td>
</tr>
<tr>
<td>RIM</td>
<td>22.0%</td>
<td>20.5%</td>
<td>19.4%</td>
<td>16.7%</td>
<td>16.9%</td>
</tr>
<tr>
<td>Linux</td>
<td></td>
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<tr>
<td>Microsoft</td>
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<tr>
<td>PalmSource</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>2.8%</td>
<td>2.5%</td>
<td>4.9%</td>
<td>5.6%</td>
<td>4.6%</td>
</tr>
</tbody>
</table>
Smartphone Bill Of Materials cost decline

Notional threshold BOM

BOM Cost ($)

2002 2003 2004 2005 2006 2007 2008 2009

153 134 119 106 97 88 81 75

Software
Manufacturing
Accessories
Mechanical
PCB
Camera
Battery
Display
Other semiconductor
Bluetooth
CPU
DBB
ABB + GSM
RAM
ROM
Total
Mobile phone market: sales per annum (M)

- All mobile phones
But just because something’s technically possible, it doesn’t mean it will happen!
Technology adoption life-cycle

Can accept poor usability

Innovators, technology enthusiasts

Early adopters, visionaries

THE CHASM

Early majority

Late majority

Won’t accept poor usability

Laggards, sceptics

Customers want technology and features

Customers want complete solutions, reliability, and convenience

(source: Geoffrey Moore)
Smartphones will cross the chasm if:

• They allow users to build on & do more of the things that caused users to buy phones in the first place
  …Communication (and messaging)
  …Safety & connection (timely info in context)
  …Fashion & fun (personalisation)

• AND they allow users to do these things simply & swiftly
  …(Even though the phones themselves are increasingly complex)

• AND on that basis, provide additional functionality of genuine value to users

  …For example, becoming people’s preferred personal mobile gateway into the digital universe…
Mobile gateway into the digital universe
Accessing the digital world, while mobile

- Improved bandwidth – faster wireless networks
- Improved display technology
  - More pixels, higher resolution, more colours, sharper screens
- Enhanced UIs, keyboards, HWR, auto-complete
  - Easier for users to enter data
- Predictable, flat-rate data charging systems
  - Removing users’ fear of unexpectedly large phone bills
- Intelligent web browser software!
  - Page re-layout, intelligent proxies, incremental redrawing…
- Intelligent non-browser software!
  - Dedicated native applications…
Mobile gateway into the digital universe
Mobile gateway into the digital universe

Collective

Intelligence
Convergence: Novelty via unexpected convergence
Smartphones as pocket melting pots

Health monitor  Games console  Newspapers
To-do list  Diary  Alarm clock  Tickets
Vouchers  Keys  Camera  Camcorder
Wallet  PDA  Radio  Dictionary
Map  TV  Books  BlackBerry
Watch  Calculator  Web tablet  Music player

Smartphones everywhere
Vision: Analysts’ forecasts

• Andrew Brown, mobile devices specialist at IDC
  … Cumulative sales of smartphones will reach over 1 billion units by 2011
  … The smartphone segment of the handset market is seeing strong annual growth and is expected to rise from 57 million units in 2005 to around 250 million units by the end of 2010
  … The advent of single chip designs will attract a growing number of licensees and drive greater penetration into the mid-market

• Stuart Robinson, Director, Strategy Analytics
  … Cumulative sales of smartphones will reach 1 billion units by the first quarter of 2011
  … The smartphone segment of the handset market is expected to rise from 45 million units in 2005 to around 300 million units by the end of 2010

• Nick Spencer, Analyst, Canalys
  … Global shipments of smartphones will reach 1 billion by 2012
  … We are still at an early stage of market development, with businesses & consumers only scratching the surface of what is and will be possible with such devices
Smartphone project economics

David Wood
EVP Research, Symbian
The increasing value of software

2000

- Closed Software
  - 1-2Mb
  - Personalisation & programming
  - More complex phone technology
  - More software applications
  - Better user experience
  - Standardization of components

2005 onwards

- Operator Customisation
- Open Software
  - 10-20Mb
  - Hardware
- Hardware
- Standardization of components
- More software applications
- Better user experience
- More complex phone technology
- Personalisation & programming

Effort required to build phone

complexity
Symbian ecosystem technology growth

Ecosystem added value – indicative products

No. of Symbian Ecosystem Partners with embedded software

- Jun 02
- Sep 03
- Aug 06
What is the cost of smartphone project delays?

- Model: assume product lifetime sales of 500,000 units
  … If the smartphone meets its target market opportunity
- Assume the development takes 9 months (if on time)
- Assume product lifetime to be 12 months
  … If it meets its target market opportunity
- Product lifetime sales will reduce if late to market
  … This takes into account the effect from competition from other products
- Estimated sales units in any month is the maximum of:
  … The sales possible from the production ramp-up
  … The sales possible from the declining market window
Cost of smartphone project delays (2)

Sales profile (thousands of units monthly)
Cost of smartphone project delays (2)

Sales profile (thousands of units monthly)
Cost of smartphone project delays (2)

Sales profile (thousands of units monthly)
Cost of smartphone project delays (3)

- Assume bill of materials of phone is USD 150
- Assume target selling price of USD 300
  
  ... (Fee paid by operator to the phone manufacturer)

- However, the possible selling price declines over time
  
  ... Due to the effect of market competition
Cost of smartphone project delays (4)

- Assume development effort ramps up during the project, to a maximum of 120 heads working on the project. After launch, there is still some development effort (maintenance)

  ...Assume average fully loaded cost of person per year is USD 150,000

- The commercially most significant effect of project delays is not the additional development cost, but rather the reduced market window

<table>
<thead>
<tr>
<th>Number of months delay</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total development cost</td>
<td>12,825,000</td>
<td>14,250,000</td>
<td>15,675,000</td>
<td>17,025,000</td>
<td>18,375,000</td>
<td>19,725,000</td>
</tr>
<tr>
<td>Number of units sold</td>
<td>500,000</td>
<td>434,211</td>
<td>368,421</td>
<td>309,211</td>
<td>250,000</td>
<td>197,368</td>
</tr>
<tr>
<td>Total earnings from sales</td>
<td>52,697,368</td>
<td>42,828,947</td>
<td>33,355,263</td>
<td>25,460,526</td>
<td>18,453,947</td>
<td>12,927,632</td>
</tr>
<tr>
<td>Net profit</td>
<td>39,872,368</td>
<td>28,578,947</td>
<td>17,680,263</td>
<td>8,435,526</td>
<td>78,947</td>
<td>-6,797,368</td>
</tr>
</tbody>
</table>

c. $10M loss of profits per month delay!?
Causes of project delays – Symbian review

- Under-strength licensee team or organisation: 16.9%
- Sub-optimal processes (e.g., build configuration): 6.3%
- Project impact by slips in earlier projects by licensee: 15.8%
- Licensee major re-planning of roadmap or resource: 6.7%
- Commercial discussions with 3rd parties not closed: 12.0%
- Licensee has 3rd party software problems: 6.3%
- Lack of operator interest to drive project completion: 10.8%
- Delay in meeting lead operator requirements: 6.3%

(These are “proximate causes” not “root causes”)
Should you focus on reduced time-to-market?

- IBM discovered 20 years ago that projects that focused on attaining the shortest schedules had high frequencies of cost and schedule overruns
- Projects that focused on achieving low defect counts had the best schedules and the highest productivities
- Source: Steve McConnell, 1999, “After the goldrush”

… Subtitle, “Creating a true profession of software engineering”

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**The more haste, the less speed**

Focus on quality, not reduced TTM

*Learn & apply best principles of large-scale software development*
Ten steps to smartphone project success

David Wood
EVP Research, Symbian
Ten steps to smartphone project success

Smartphone project success

Bone deep comfort with Symbian OS

Symbian OS
Deep comfort with Symbian idioms

- **Robustness**
  - Cleanup stack
  - … Error handling matters: Expect things to go wrong

- **Openness**
  - Active objects, ECOM
  - … Expect the software to change or new modules to be added

- **Performance**
  - Descriptors
  - … Expect the hardware to be under-powered

- **Efficiency**
  - Asynchronous
  - … Expect the user to be in a hurry

- **Security**
  - Capabilities, Signing
  - … Expect to have to earn trust

Understand the “why” as well as the “how”
Ten steps to smartphone project success

Smartphone project success

Bone deep comfort with Symbian OS

Symbian OS

Intense market awareness
The value of intense market awareness

% Allocation of effort

Project-led activity

- Operation succeeded, but the patient died

Market-led activity

- Includes research, modelling, prototypes

Do (quite a lot of) the wrong thing

Do the right thing
Ten steps to smartphone project success

Smartphone project success

Bone deep comfort with Symbian OS
Ruthless drive to simplify
Intense market awareness

Symbian OS
Ruthlessly simplify

- **Software inevitably tends towards greater complexity**
  - ... This is the second law of thermodynamics for software
  - ... (The first law is that software inevitably tends to grow in bulk)
- **Complexity has n-squared effects**
  - ... Many more relations to understand
- **Keep seeking to simplify the design**
  - ... Well-defined classes
  - ... Expose fewer APIs rather than many APIs
  - ... Avoid long inheritance trees; Avoid using inheritance for “cleverness”
  - ... Re-factor designs on a regular basis, wherever possible
- **Keep seeking to simplify the development process**
  - ... Re-factor the development process on a regular basis
- **Note – make things as simple as possible, but no simpler**

Especially when constrained
Ten steps to smartphone project success

Smartphone project success

v2 product: re-use not re-invent

v2 people: experienced team

Bone deep comfort with Symbian OS
Ruthless drive to simplify
Intense market awareness

Symbian OS
Take the platform viewpoint, not a product one

Return on investment

The subsequent return on Platform investment is huge

The first project can be hard

Extend product lifetime; Allow reduced manufacturing costs

Time
The ‘Open Platform Savings Effect’ for operators: Implementing a set of applications & services

Source – Northstream / Nokia research 2005 – ‘How open platform based phones reduce operator costs’
Ten steps to smartphone project success

Smartphone project success

Strong, capable, dedicated leader

Strong integration, testing, & gate-keeping

v2 product: re-use not re-invent

v2 people: experienced team

Bone deep comfort with Symbian OS

Ruthless drive to simplify

Intense market awareness

Symbian OS
The big picture of a Symbian OS development project

Symbian OS + Symbian OS components
Silicon
Hardware design
Wireless stack
Multimedia
UI framework + apps from UI framework
Third party apps & middleware

Processes
Customisation + Integration + Innovation
Consultancy + Training + Documentation + Tools
Testing + Optimisation + Localisation

Revenues
Certification + Approvals

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Revenues
Certification + Approvals
Practise iterative development

- If you don’t know for sure what you’re doing, don’t do it on a large scale
- Integrate “little and often”
  - Integrating too much at once makes quality dip so far it takes a month to recover
  - so that no-one has a recent build to work with because recent builds are worse quality than earlier ones
  - so engineers are forced/encouraged to develop/debug against out-of-date software
  - so their work will not integrate well into the Mainline
- Practice rigorous “gatekeeper discipline”
### Ten steps to smartphone project success

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*Bone deep comfort with Symbian OS* | *Ruthless drive to simplify* | *Intense market awareness*
Appoint a “tools champion” in your team

- Understand all the software tools used by the team
  
  ... Ensure that team members receive suitable training on how to get the best out of the available tools
- Understand and prioritise all the potential software tools that could be used by the project
  
  ... Evaluate the tools offering available from third-party vendors
- Foresee possible problems with tools as the project proceeds – and plan ahead to forestall these problems
  
  ... Extra code bulk, more people on the project, etc
- Consider special sub-projects to “productise” tools that have been developed internally
  
  ... Invest effort to maintain tools
Tools that you should know and love

- Debugger
- Emulator
- Profilers and loggers
- Static code analyser
- Prototyping tools
- Build system
- Distribution system
- Porting tools
- Interface management tools
- Automated testing tools

*Know how to use these tools – AND know their limitations*
Ten steps to smartphone project success

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<tr>
<td>Mastery of ecosystem relationships</td>
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Symbian OS

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Invest in consultancy

• Skilled technical consultants in Symbian OS can make a huge difference to the project success
  … Timeliness and quality
  … Don’t think of this as an “optional expenditure”

• This is the testimony from many previous projects

• Expert advice available on
  … Tools
  … Troubleshooting
  … Optimisation
  … Architecture
  … Defect triage
  … Risk management
  … Project setup
  … Connections into Symbian and into third parties, etc

A good software engineer can be 10 times as productive as an average one
A good technical consultant can make parts of your project go 10 times faster
Cultivate rich network of Symbian-savvy contacts

• The very best developers are surrounded virtually by other very good developers
• You can never know everything by yourself
  … You can never always know where to look for information
• You need a wide variety of highly-knowledgeable contacts
  … Within your team
  … Within your company
  … + outside your company
• Know the most useful newsgroups and web forums
• Share information, to receive information
  … “In order to have a friend, you need to be a friend”
• Maintain your trustworthiness – don’t bluff
Ten steps to smartphone project success

- **Smartphone project success**
- **Mastery of ecosystem relationships**
- **Make great use of tools**
- **Strong, capable, dedicated leader**
- **Strong integration, testing, & gate-keeping**
- **v2 product: re-use not re-invent**
- **v2 people: experienced team**
  - Bone deep comfort with Symbian OS
  - Ruthless drive to simplify
  - Intense market awareness
- **Symbian OS**
Pick the right project leader – someone with:

• The ability to drive completion of the project as a whole
  … The ability to drive completion of contractual issues
  … Single-minded focus on project issues, not just the technical issues

• The ability to “manage up”
  … To gain the necessary organisation support from higher managers

• The ability to motivate & focus all the different players in the team
  … Prevent team members from just working on what interests them

• The ability to communicate clearly
  … With all the parties involved in the project
  … Chief collaborator

• A deep understanding of smartphones and their ecosystem

• A deep understanding of complex software systems
  … An understanding of agility and dynamic planning
Dynamic methods – agile planning

• Design for change – Expect the unexpected
  … APIs may not work as expected
  … Phone performance may be different than expected
  … Networks may not behave as expected
  … Users may not behave as expected
  … The competitive landscape may change
  … Phone model popularity may change (phones delayed or accelerated)

• Don’t try to plan everything to the last degree

• Delivering value is more important than sticking firmly to the original spec and plan

• Deliver little and often – and check the feedback carefully
  … Practice incremental development
What the project plan needs to cover

• Failing to plan means planning to fail
• BUT it’s impractical and unnecessary for a plan to cover every detail
• SO you must identify the “critical chains” for the project
  … These are the parts of the work that determine the end date
  … They contain “essential” functionality
  … So the project cannot ship without them completing
• You have to carefully plan the critical chains
  … End to end – including the features that have to happen afterwards
• You have to ensure adequate coverage for the critical chains
  … Adequate resourcing, time for good design, optimisation, testing
• Gradually construct the rest of the plan around the critical chains
  … Make sure you have identified the right critical chains!
Aside on “best practice” ("process")

- Quality
- Creative chaos
- Senseless bureaucracy
- Mindless chaos

Source: Steve McConnell
Further reading: “Symbian for software leaders”

- **Principles of highly successful smartphone development projects**
  - 23 chapters and 3 appendices
- **Part I – Symbian in context**
  - At the heart of the smartphone revolution. Why smartphones will win
- **Part II – Thriving on scale**
  - Streamlining the management of smartphone project groupware, defects, configurations, integration, interfaces, testing, tools, plans and change, and uncertainty
- **Part III – Symbian’s design philosophy**
  - Designing for efficiency, robustness, usability, longevity, and commercial success with smartphones.
- **Part IV – Human aspects of smartphone projects**
  - The roles of the project manager, the support network, and renewal