Delivering Smartphone Capabilities to the Battlefield

Josh Dixon, Capt./USMC
Naval Postgraduate School
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Outline

- Overview of the Environment, Industry, and Technology
- Proposed Concepts
  - Handset
  - Service
  - Infrastructure
- Cost Savings
Handheld Solutions

COTS vs. GOTS

Motorola i1
(MIL-STD 810F)

Blackberry
(Curve 8900)

General Dynamics
(Sectera Edge)

No military security specifications built into design

$150 - $4900 - $4000

Josh Dixon, Capt/USMC
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jsdixon@nps.edu

*Images from vendors website
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<table>
<thead>
<tr>
<th>Component</th>
<th>Manufacturer</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseband Processor</td>
<td>Qualcomm</td>
<td>1GHz CPU, 600MHz Digital Signal Processor</td>
<td>$30.50</td>
</tr>
<tr>
<td>RF Transceiver</td>
<td>Qualcomm</td>
<td>RF Transceiver (ZIF, Quad-Band GSM/EDGE, Tri-Band WCDMA/HSDPA)</td>
<td>$2.50</td>
</tr>
<tr>
<td>Display</td>
<td>Samsung</td>
<td>Mobile Display (3.7&quot; AM-OLED)</td>
<td>$23.50</td>
</tr>
<tr>
<td>Touchscreen</td>
<td>Synaptics</td>
<td>Touchscreen Assembly (Capacitive Multitouch)</td>
<td>$17.50</td>
</tr>
<tr>
<td>Memory</td>
<td>Samsung</td>
<td>Multichip Package (4Gbit NAND Flash + 4Gbit Mobile Double Data Rate (DDR) DRAM)</td>
<td>$20.40</td>
</tr>
<tr>
<td>Power Management IC</td>
<td>Qualcomm</td>
<td>Power Management IC (w/ integrated USB transceiver)</td>
<td>$2.50</td>
</tr>
<tr>
<td>Power Management IC &amp; Li-Ion Charger</td>
<td>Texas Instruments</td>
<td>Integrated Power Management IC &amp; Li-Ion Charger</td>
<td>$1.20</td>
</tr>
<tr>
<td>Power Amplifier Modules</td>
<td>Skyworks &amp; Others</td>
<td>4 Power Amplifier Modules</td>
<td>$2.20</td>
</tr>
<tr>
<td>Bluetooth/WLAN/FM Transmitter/Receiver</td>
<td>Broadcom</td>
<td>Bluetooth/WLAN/FM Transmitter/Receiver (802.11a/b/g/n, Bluetooth V2.1+EDR, 65nm)</td>
<td>$8.20</td>
</tr>
<tr>
<td>Electrical</td>
<td></td>
<td>Misc. Electrical Components (Small IC’s, Discrete Semiconductors, Passives, etc.)</td>
<td>$16.30</td>
</tr>
<tr>
<td>Camera</td>
<td></td>
<td>Camera (5.0 MP Auto focus)</td>
<td>$12.50</td>
</tr>
<tr>
<td>MicroSD Card</td>
<td>MicroSD Card (4GB)</td>
<td></td>
<td>$8.50</td>
</tr>
<tr>
<td>Mechanical</td>
<td></td>
<td>Misc. Electronmechanical Components, PCB’s</td>
<td>$14.10</td>
</tr>
<tr>
<td>Mechanical</td>
<td></td>
<td>Misc. Mechanical Components</td>
<td>$6.20</td>
</tr>
<tr>
<td>Battery</td>
<td></td>
<td>Battery (1400mAh, 3.7V)</td>
<td>$5.25</td>
</tr>
<tr>
<td>Mechanical</td>
<td></td>
<td>Main Enclosure Housing (Machined Aluminum Unibody)</td>
<td>$2.80</td>
</tr>
</tbody>
</table>

Avg. wholesale*: $323.07  
Avg. retail (2 year plan)*: $179.00

*images from www.ifixit.com  
*cost figures from www.isuppli.com  
**according to ABI Research Firm (as of June 2010)
Limitations
- Virtualization delays
  - Mitigated through multiple processors
  - Hardware virtualization vice software
- Added cost

Advantages
- Higher level of assurances
- Run multiple instances of COTS Operating Systems
- Separate OS from hardware
- Trusted applications receive dedicated resources
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DoD Wireless Procurements

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Army AAFBPA Total</th>
<th>NMCI EDS Total</th>
<th>FISC NDWC Total</th>
<th>% of Carrier Rev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY2005*</td>
<td>$25,000,000</td>
<td>$5,000,000</td>
<td>$19,473,117</td>
<td>0.032%</td>
</tr>
<tr>
<td>FY2006*</td>
<td>$40,000,000</td>
<td>$10,000,000</td>
<td>$38,053,130</td>
<td>0.042%</td>
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<tr>
<td>FY2007</td>
<td>$64,253,383</td>
<td>$14,699,780</td>
<td>$46,823,658</td>
<td>0.046%</td>
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<tr>
<td>FY2008</td>
<td>$97,407,712</td>
<td>$26,876,967</td>
<td>$56,997,334</td>
<td>0.065%</td>
</tr>
<tr>
<td>FY2009</td>
<td>$119,566,667</td>
<td>$37,769,191</td>
<td>$59,517,776</td>
<td>0.076%</td>
</tr>
</tbody>
</table>

- FY2005-06 – AAFPA and NMCI data estimates based on trends
-commercial market trend line referencing carriers combine revenue as reported on annual financial records
-procurement data derived from the federal procurement data system (public access)
• DoD (domestic) voice cost (calculate per minute rate)

  Average: $0.06 per minute

  Std. Dev.: $0.03 (majority of plans range $0.03 – $0.09 per min.)

• Carriers cost

  Roaming Cost (FCC 2009 Report): $0.03 per minute
DoD Cost per Region FY09

**Legend:**
- Red: Top 75 - 100%
- Orange: Top 50 - 74%
- Yellow: Middle 25 - 49%
- Blue: Bottom 4 - 24%
- Green: Bottom 0 - 3%

- Arlington, VA (17%)
- Washington, DC (3%)
- Anacostia Annex (2%)
- Washington Naval Yard (1%)
- Fort Bragg, NC (2%)
- Millington, TN (2%)
- Redstone Arsenal, AL (2%)
- Atlanta, GA (3%)

*Data derived from the federal procurement data system (public access)*

Josh Dixon, Capt/USMC
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Spectrum Trade-off

Sell-Off Spectrum and Lease Back

Cost to government

- Cost to lease spectrum
- Loss of dedicated spectrum
  - Lower capacity (smaller channels)

Maintain Spectrum

Cost to government

- No fiscal expenses
- Opportunity Cost (Gov’t)
  - revenue from selling spectrum
  - commercial industry builds around spectrum
  - shared R&D burden
  - standards built around spectrum

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* DoD UCR 2008/2010 Section 6.1 (Unique Deployed Requirement)
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Tethered Solutions

Requirement - Integrate MILS Separation Kernel

USB Dongle

- Limitations
  - USB Host
  - Limited Mobility
  - Power Inefficiencies

- Advantages
  - No commercial signal emissions
  - Low Cost
  - Shorter procurement timeline

Sleeve

- Limitations
  - Added hardware to handset
  - Procure sleeve hardware for each handset (customized per phone model)

- Advantages
  - Transmit across military signals
  - Potential for Type 1 encryption module or Suite B client
  - Low Cost in comparison

Lockheed Martin (MONAX)

*Images from vendors website

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Wireless Solutions

Requirement - Integrate MILS Separation Kernel

Secure (Encryption) WiFi

- Limitations
  - Added hardware
  - Not LPD/LPI/LPE signal

- Advantages
  - Operates on a non-licensed band
  - Provides suite B link encryption

- Cost ($6-8K per squad)

Commercial cellular (fixed cites)

- Limitations
  - High opportunity cost for concentrated areas
  - Coverage gaps
  - Reoccurring usage cost
  - Not LPD/LPI/LPE signal

- Advantages
  - Preexisting network (no setup, maintenance/support)
  - Shared cost burden with commercial market

Cost (avg. monthly service cost $25 - $30 per user)*

*Current cost ($60 - $70 per user)

Josh Dixon, Capt/USMC
Naval Postgraduate School
jsdxon@nps.edu
Wireless Solutions

Mobile Base Stations (Tactical design)

- Limitations
  - Higher Cost (limited market)
  - Scalability
  - Not LPD/LPI/LPE signal

- Advantages
  - Ruggedized
  - All-in-one Solutions

- Cost
  - Equipment: $15K – $250K+ (6 – 80 simultaneous users)
  - Frequency lease: $5K – $6K

Modified Tactical Radio (host cellular signal)

- Limitations
  - High Cost
  - Not LPD/LPI/LPE signal
  - Modifications not on roadmap

- Advantages
  - No added hardware for infrastructure
Infrastructure Security Trade-off

SIZE = LEVEL OF SECURITY

Cost (Millions)

Time (Years)

USB

Sleeve

WiFi

Mobile BS

Cellular

Tactical Radios
Overview of the Environment, Industry, and Technology

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Estimated Current Cost

Secure Comms Cost

- Service
  - 1500 x $70 x 12 = $1.25 Million

- Handset
  - 1500 x $3000 = $4.5 Million

- Infrastructure
  - $750 Thousand

- R&D
  - $50 Million

Total: $56.5 Million annually

Unsecure Comms

- Service
  - 280K x $70 x 12 mo = $240 Million

- Handset/Data Cards
  - $600 Thousand

Total: $240.6 Million annually

$2.56B NPV (rough estimate 10 yrs)
Proposed Savings

- Spectrum
  - $165 \times $5000 \times 12 = 10 \text{ Million}

- Leased / Owned Infrastructure
  - $165 \times 50 \text{ K} = 50 \text{ Million}

- Handset
  - $450\text{K} \times $300 = 135 \text{ Million}
    (hardware and software cost)

- Service
  - $140\text{K} \times $30 \times 12 \text{ mo} = 50 \text{ Million}

- R&D
  - $25 \text{ Million}

Current Cost
- $2.56 \text{ B (280K users)}

Proposed Cost
- $2.16 \text{ B (450K users)}

Savings: $400\text{MM (across 10 yrs)}
Increased Coverage
Increased Capability

Total: $270 \text{ Million annually}
Questions

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Josh Dixon, Capt/USMC
Naval Postgraduate School
Military Wireless Communications (research group)
Email: jsdixon@nps.edu