Bitcoin2Go: Secure Offline and Fast Payments with Bitcoins

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Motivation
- Bitcoin thrives to be the most successful crypto currency
- Transaction verification in Bitcoin requires online access and time
- Not applicable in offline payment scenarios (e.g., PoS, vending machines, etc.)
- Fast payments with Bitcoins are vulnerable to double spending attacks

Related Work
- Covers security, privacy and economical aspects of Bitcoin online payments
- No attempts to adapt to offline scenarios

Challenges of Offline Payments
- Double-spending prevention and detection of forged coins in offline settings

System Architecture

Features
- Compatible to Bitcoin system
- Designed for resource constraint wallets
- Can be used by PCs and smartphone-based clients

Security Mechanisms
- Secure, but resource constraint wallet
  - Prevents double spending in offline phase
  - Resource constraints raise challenge to verify pre-loading transactions
- Time-based transaction confirmation
  - Restricts standard Bitcoin transaction confirmation generation by max. time
  - Probability to produce valid confirmation is high for the Bitcoin network, but low for an attacker
- Limited transaction amounts
  - Attack costs become higher than benefits

Prototype Implementation
- Host platform: Galaxy S3 with Android 4.0.4
- Wallet:
  - Secure element in microSD card
  - JavaCard 2.2.2, JCOP 2.4.1
  - 81 Kb EEPROM, 20 Kb code, 1 Kb RAM footprint

Risk Analysis

<table>
<thead>
<tr>
<th></th>
<th>Set 1</th>
<th>Set 2</th>
<th>Set 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attacker’s hashrate, %</td>
<td>10</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Min. length of the trans. conf., blocks</td>
<td>6</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Max. time for generation of a single block, sec.</td>
<td>1000</td>
<td>1200</td>
<td>1200</td>
</tr>
<tr>
<td>Attack probability, %</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Attack costs per block, EUR</td>
<td>560</td>
<td>560</td>
<td>560</td>
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</tbody>
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