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Towards Secure Deletion on Smartphones

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Agenda

- Introduction
- Background: Wear Leveling
- Towards Secure Deletion on Symbian OS
- Conclusion & Future Work

Introduction I

- smartphones are increasingly used as „mobile office“
- they are more frequently equipped with GPS for navigation purposes
- => smartphones store a lot of sensitive data

Introduction II

- the second market (e.g. eBay) for smartphones is increasing
- many manufacturers simply replace the phone with a refurbished one if it malfunctions
- => the deletion of data becomes more and more important

Obstacles

- smartphones offer only a limited user-interface
- the user’s activities are often restricted to interaction with preinstalled tools
- mobile devices typically use flash chips to store data and these components use a technique called „wear leveling“

Wear Leveling I

- the content of flash chips can only be changed a limited number of times
- afterwards so much voltage or time is required to write on the cell that it becomes impractical to use it any further
- => wear leveling provides a method to distribute the access at times when it is detected that they are receiving significantly uneven use

Wear Leveling II

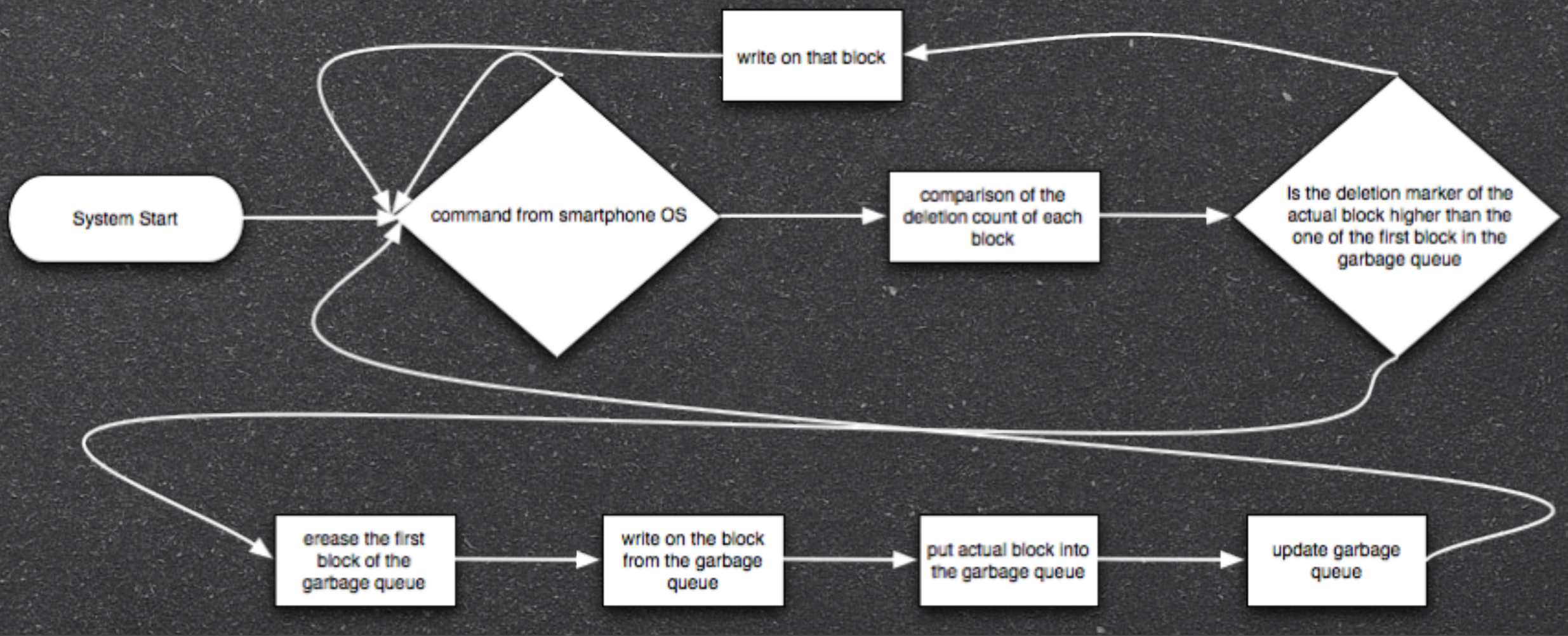
Only 200 blocks are reused: $\frac{\text{10,000 cycles x 200 blocks}}{\text{50 blocks per file x 6 files per hour x 24 hours per day}}$ = ~278 days or <1 year

All 4,096 blocks are evenly used: $\frac{\text{10,000 cycles x 4,096 blocks}}{\text{50 blocks per file x 6 files per hour x 24 hours per day}}$ = ~5,689 days or >15 years

Wear Leveling III

- the intention of this process is even wear of the storage space
- according to Symbian[6] and Samsung[5], Nokia uses in its current device series Samsung OneNAND storage
- this storage has a special modification of the known wear leveling techniques [2]

Wear Leveling Process



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Deletion on Symbian Smartphones

- we developed a tool that helps to securely delete data on Symbian driven smartphones
- the tool is named „SecDel“ and is written in Python

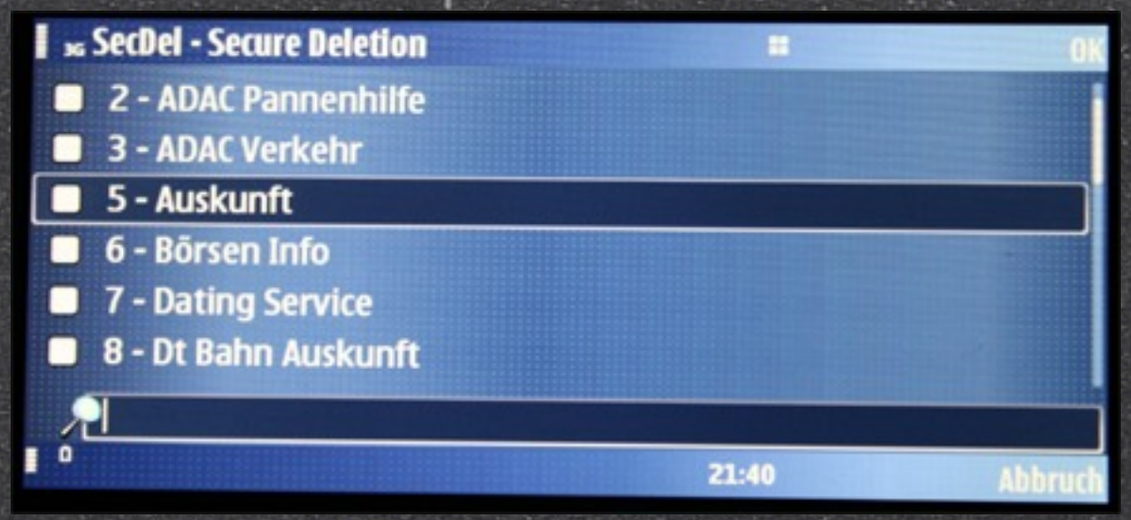
Overview of the Tool

- SecDel currently possesses the ability to delete SMS messages, telephone directories, as well as calendar entries
- it contains an update-function, which allows the user to load modules via the Internet
- we have included a remote service function to run the deletion process remotely

The Deletion Process

- a list of all entries in the telephone directory is created
- the user can choose the entry he wants to delete
- SecDel overwrites every part of this entry with a maximum amount of „X“
- SecDel deletes this entry with the help of a system API call

Some Impressions



Evaluation I

- all operations and testings have been realized on a Nokia E90 with Symbian 9.2 and a Nokia N70 with Symbian 8.1
- flasher-tools like Twister Box will not work
- for verification only a few technical possibilities exist

The Software Agent I

The Software Agent II

- fast and easy to use
- is based on system API calls
- automated process
- offers analysis on a higher level

Desoldering the Chip

- high technical knowledge and equipment is needed
- time-consuming
- offers in depth analysis of the flash chip

Evaluation II

- => due to the fact that we did not have the technical possibilities to desolder the flash chip, we chose the software agent for verification

Evaluation III

- we used the software agents MIAT[1][4] and Panoptes[7]

- => as a result these tools are not able to restore any deleted data

- => the most perfect solution for the verification would be the desoldering of the flash storage chip and the subsequent direct analysis of this element

Conclusion

- we presented a tool which tries to delete personal data in a more secure way
- the tool first overwrites the data with garbage and deletes this garbage afterwards
- unfortunately we were not able to thoroughly verify the deletion
- we could prove with the help of tools like Panoptes[7] and MIAT[1][4]

Future Work

- optimization of the evaluation procedures (e.g. desoldering of the flash chip)
- transferring SecDel to Android OS
- forensic analysis of the Android OS and Android file system (YAFFS2)

Thank you very much for your Attention

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References I

- [1] Alessandro Distefano and Gianluigi Me. An overall assessment of Mobile Internal AcquisitionTool. Digital Investigation, 5:121–127, 2008
- [2] Flash Software Group. XSR1.5 WEAR LEVELING. Technical report, Samsung Electronics Co., Ltd, 2007
- [3] Karl MJ Lofgren, Robert D Norman, Gregory B Thelin, and Anil Gupta. Wear Leveling techniques for flash EEPROM systems. United States Patent, April 2008

References II

- [4] Pontjho M. Mokhonoana and Martin S. Olivier. Acquisition of a Symbian Smart phone's Content with an On-Phone Forensic Tool. Technical report, Information and Computer Security Architectures Research Group, 2007
- [5] SAMSUNG OneNAND, September 2009
- [6] Symbian Press. Plattform Security & OS Internals
- [7] Michael Spreitzenbarth. Mobile Phone Forensics. Diploma Thesis, University of Mannheim, 2009.