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Hellaphone: Replacing the Java in Android

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Biography

- Computer engineer by training (RIT)
- Been interested in operating systems since high school
- · Work for Sandia National Labs, California
 - High performance computing
 - Mobile

Hellaphone

Introduction

- Security
- · I like open source and Sandia is down with that
- Goal: open up as much of my work as possible

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Smartphones

- Totally ruling the world
- A computer in my pocket? Awesome!
 - It can make phone calls too?
- Nifty sensors: camera, GPS, accelerometer
- Read email, browse the web, take pictures, get driving directions, play games
- Manage your passwords, 2 factor auth, Google Wallet



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memo

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Why smartphones kinda suck

- Blackberry, iPhone, Windows: all closed-source
- RIM will decrypt your messages for the government [6][5]
- iPhone
 - Tracks your movements [1]
 - DoS attack via SMS [2]
- Windows
 - Nobody has one!
 - DoS'd via SMS [7]
- CarrierIQ [3]

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Introduction

Android Inferno

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But Android is still cool, right?

- Linux-based
- Open-source
- Tons of devices (phones, tablets, laptops)
- Write your own applications-no developer fees, no market fees!
- You can hack the OS if you want
- · Big community of developers and OS hackers

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Android kinda sucks too

- I have to program in WHAT?
- · Vendors have no incentive to update the OS
 - How much do you trust Joe Random's ICS Rom?
- Security ain't so hot
 - DEF CON 19: fake OTA updates
 - CarrierIQ
 - Malicious apps [4]
- About 15 million lines of code, not including Linux.
 - Not very documented-hope you like digging!
- 1.2 GHz processor, 512 MB of RAM, runs like a dog



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Android as a Linux platform

- Android is unattractive for hacking, sure
- Really just a thick layer of Java spread on top of a thin Linux cracker
- Mostly standard Linux underneath
- · Comes with a little busybox environment
 - Cyanogenmod ships a rather nice environment with bash etc.
- · Let's scrape away the Java and build on Linux
- Bonus: we'll get tons of compatible hardware with all the drivers already written



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Inferno

- Open-source operating system from Bell Labs, now owned by Vita Nuova
- Implements the Dis virtual machine
- Runs natively or hosted on Linux/Windows/OS X/Plan 9
- Inspired by Plan 9
- Compiles fast, launches fast
 - Runs in a few megabytes
 - About 1 million LOC total
 - This includes the applications and code for native booting (which we don't use)
- Why not run it on top of Android's Linux?
 - We get all the hardware drivers (binary blobs, yay!)
 - Makes updating Inferno easy-no flashing ROMs



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Inferno

Android - Java = Linux

- Bibliography
- The first thing we do, let's kill all the Java
- Every Java process spawns from "zygote"
- Eliminate it from /init.rc
- But / is reset every boot!
- You can build your own custom ROM
- Or use our script to grab the running boot image, modify it, and reflash

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Android + Inferno = Hellaphone

- Adapt Inferno to build for Android
- Use AGCC script to build Inferno with Android compilers and libs
- Most of the Linux code is suitable
- Some tweaks were needed in bits of assembly or C
- Had to create support for various bits of hardware
 - Framebuffer adapted from OLPC code
 - Mouse code to parse touchscreen inputs
 - Convert /dev/input events to text and make it available
- Hack the window manager to make it suitable for a phone.

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The old Inferno window manager

	200
% ps grep Charon back stop 209 209 michael 382 382 michael	next http://www.vitanuova.com/inferno/index.html
Acne Newcol Kill Putall Dump Exit /appl	
New Cut Paste Snarf Sort Zerox Delcol /appl/cmd/bind.b Del Snarf Limbo Look	New Cut Paste Snarf Sort Z /usr/michael/ Del Snarf Glevelopment acros
<pre> } flags := sys->MREPL; arg=:nit(args); while((0 := arg->opt0) != 0)</pre>	Idemo/ demo2/ im.b architectures im.b im.b im.b im.b im.b im.b im.b im.b im.b im.b im.b im.b im.b im.c im.b im.c im.b im.c im.b im.c im.b im.c im.b im.c im.c im.c
arg = nil; /appl/cmd/auth/ Del Snarf Get Look khangelogin.b logind.b countersigner.b mKille createsignerkey.b passwd.b keyfs.b signer.b keysrv.b verify.b	auxi/ auxi/ bit2git.b brt2git.b broke.b broke.b cat.b cat.b cat.bl

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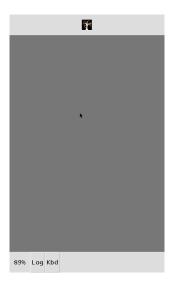
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The new phone-friendly window manager



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The drop-down menu

× 8	8				
Files	Edit				
Charon	Manua1				
Shell	Dialer				
SMS	->System				
->Misc	->Games				
89% Log Kbd					

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It has a browser too

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Phone-specific stuff

- devphone talks to the radio
 - Presents a file system interface
 - To make a phone call: echo 'dial 15551234567' > /phone/phone
 - To receive incoming calls, read from /phone/phone
 - Read will block until a call is incoming
 - Similar interface for SMS
- Nobody wants to make phone calls like that
- So we wrote a dialer app and an SMS app
- Also made early drafts at WiFi and audio drivers (both semi-functional)

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Dialing application

Dialer							
15551122331							
1	2	3					
4	5	6					
7	8	9					
*	0	#					
Dial							
Hang up							
Speaker							
Status: inactive ()							

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SMS application

Send message Back We: This string can be replaced in the client by the sender's name if desired, later.									ın	
Them: The client used to send messages should prepend "Me: " to messages it sends, then add them to this file.										
I am typing a message to send Send									nd	
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Neat things to try

- Inferno sandboxing one instance of OS per app
- Security hacks
 - If accelerometer reads > 10G, wipe the SD card
- Fun with 9P

Hellaphone

Inferno

- Easy to access your files at home
- Easy to share files with nearby phones
- Use 9P to export your phone's devices and control them from your PC
 - Anti-theft programs are now easy
 - Just import your phone's GPS device and camera
 - (Thief is probably pretty perplexed anyway)

Conclusion

- It's not that hard to strip down Android for your own purposes
- With a bit more work, Inferno could be a viable smartphone OS
 - It's fast

Hellaphone

Inferno

- It's light
- It's easy to work on
- It already comes with a bunch of software and infrastructure, you're not going from scratch
- No app store, but if you didn't write it yourself, you can't trust it anyway, right?

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Android

Inferno Ribliografi

Get in!



Code at http://bitbucket.org/floren/inferno

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