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

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

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]

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

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

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

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

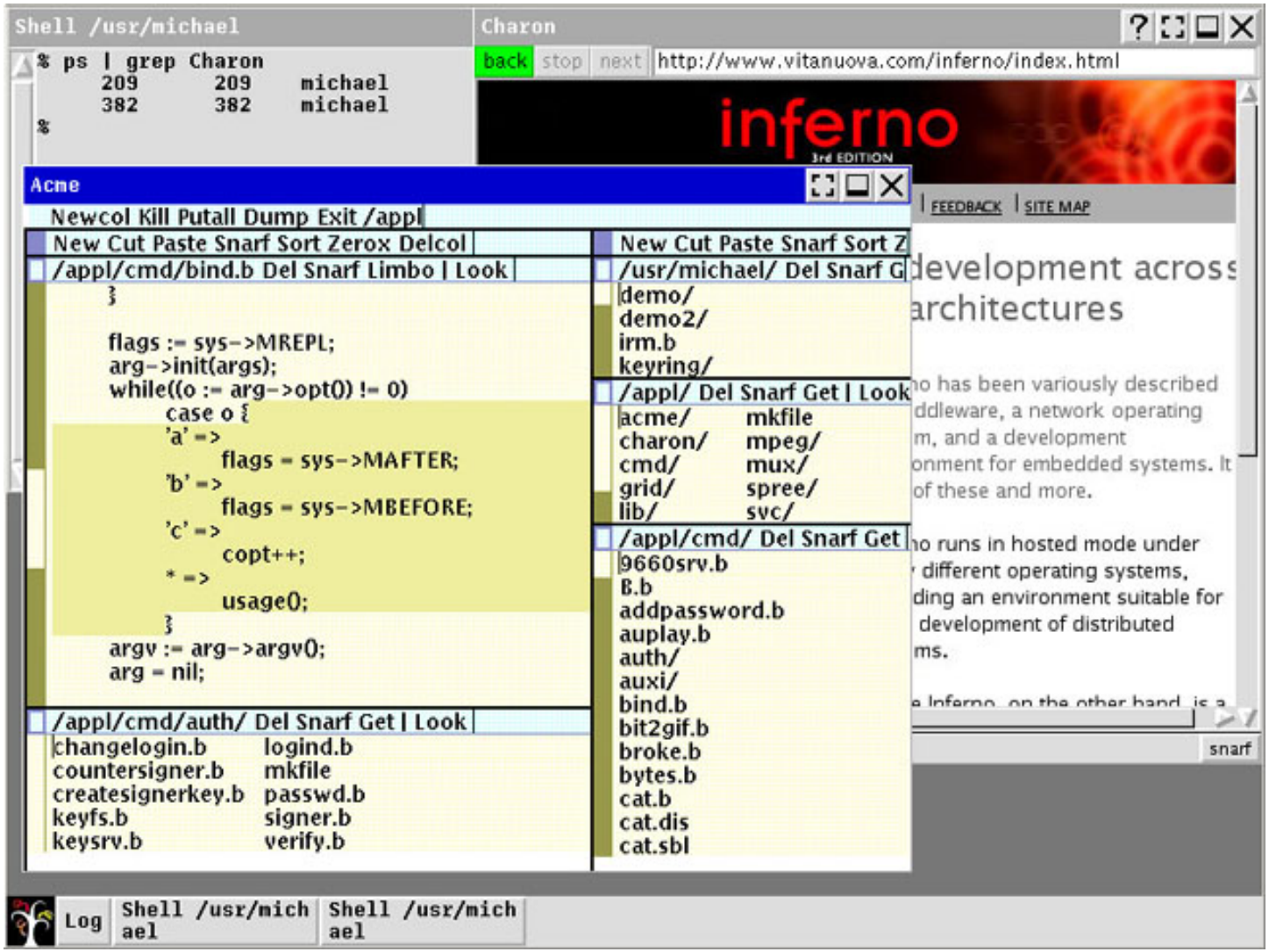
Android - Java = Linux

- 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

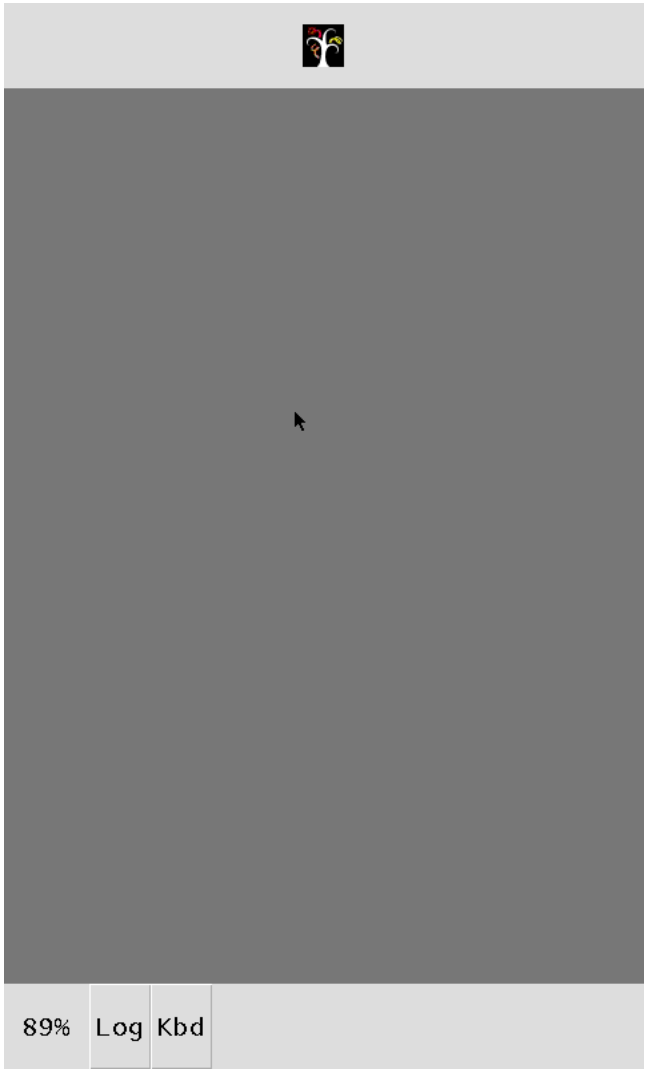
Android + Inferno = Hellaphone

- 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.

The old Inferno window manager

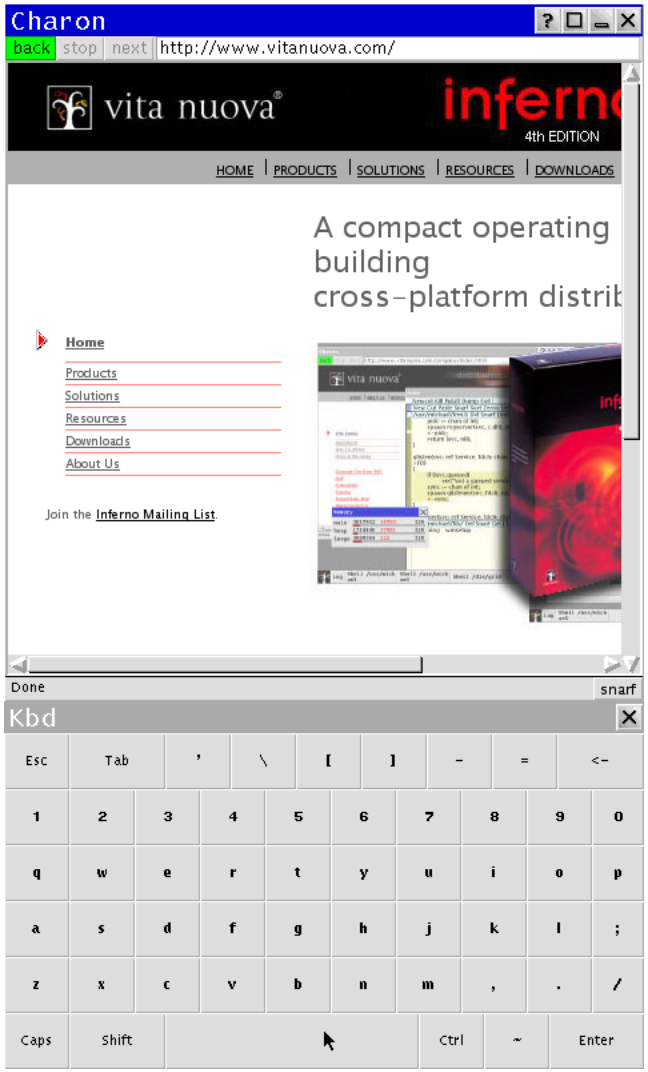


The new phone-friendly window manager



The drop-down menu

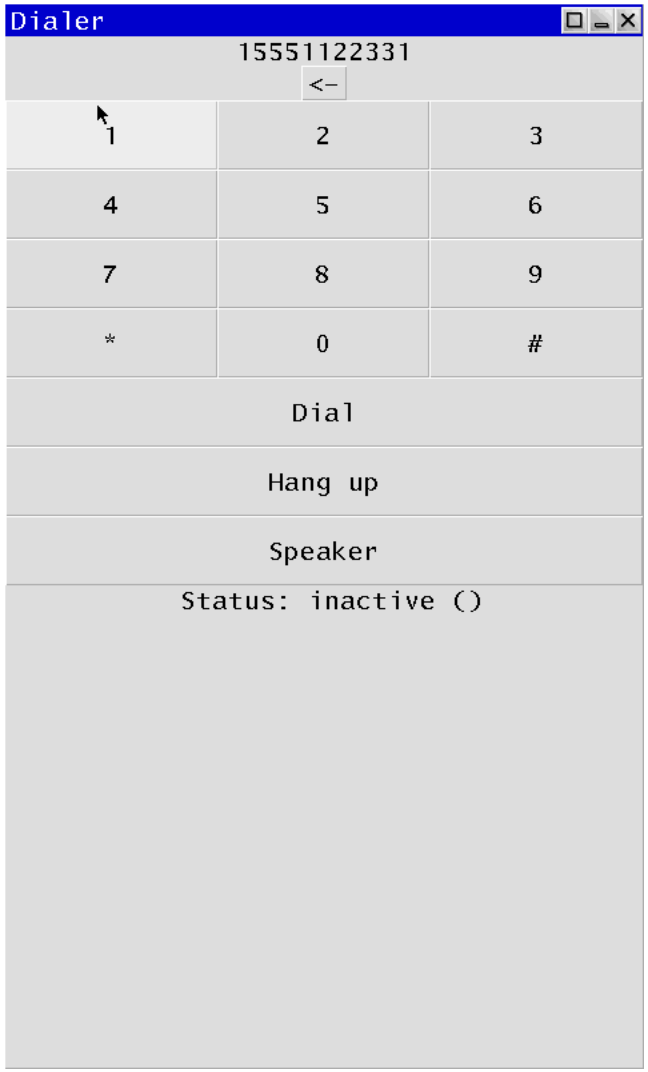
It has a browser too



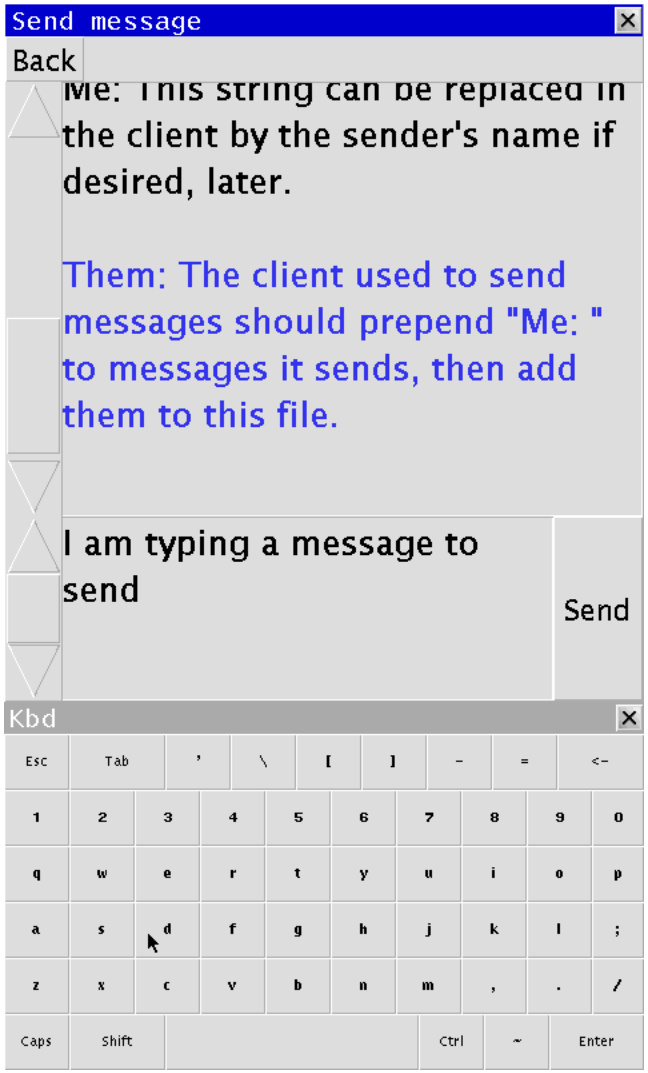
Phone-specific stuff

- 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)

Dialing application



SMS application



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
  - 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
  - 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?

Get in!

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

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