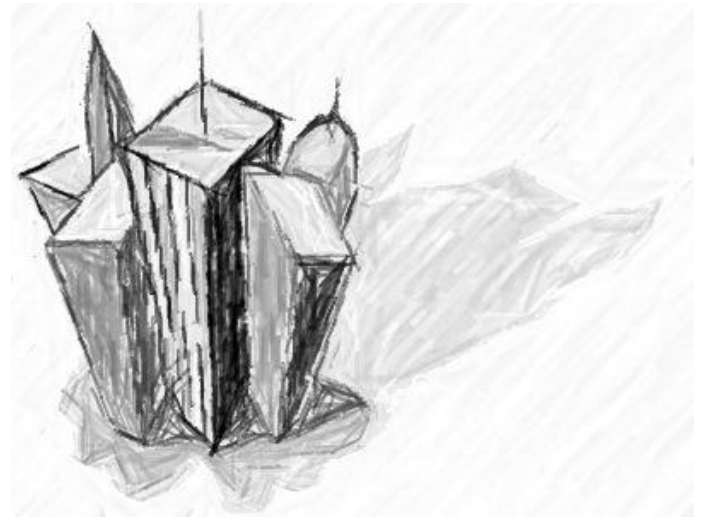


# Mobile Apps: It's Time to Move Up to ConDOS

*ConDOS: the Context Dataflow OS*



david chu• aman kansal• jie liu• feng zhao♦  
microsoft research redmond• microsoft research asia♦

# APPS



How *Might* New Apps Use New Sensors?

camera

microphone (x2)

microphone

magnetometer

barometer

GPS

camera (x2)

accelerometers

light sensors

NFC

infrared camera

health sensors

gyroscopes

thermometer

# SENSORS

# *OfficeFit* app

- › contextual fitness reminders in the office
  - › “Don’t slouch while sitting.”
  - › “You’ve been at your desk for too long.”
  - › “Take the stairs instead of the elevator.”
- › how it works
  - › motion from IMU + sound from mic → various fitness activities
  - › do this continuously



# context data from sensors

- › key pieces are ready

- › sensor hardware
- › application scenarios
- › algorithms (high accuracy inference, signal processing, db, etc.)

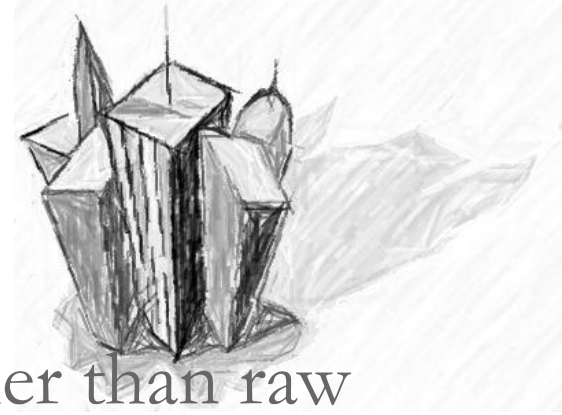


- › where is the context?

- › who is responsible for context?

- › individual apps
  - › ... but mobile OSs limit apps to foreground
  - › ... or apps can run anything in the background(!)
- › the cloud
  - › ... but energy cost of TX/RX is high
- › the mobile OS

# ConDOS design proposal



- › export *Context Data Units (CDUs)* rather than raw sensor data
  - › higher-level abstraction than bytes
  - › apps query or subscribe to CDUs
- › each CDU is defined by a **CDU Generator**: a graph of processing components
  - › combine Generators into composite context dataflow (like packet dataflow [kohler '00])
  - › provide a base CDU vocabulary (that is extensible)

Logical Location

*home, office, mall*

Motion State

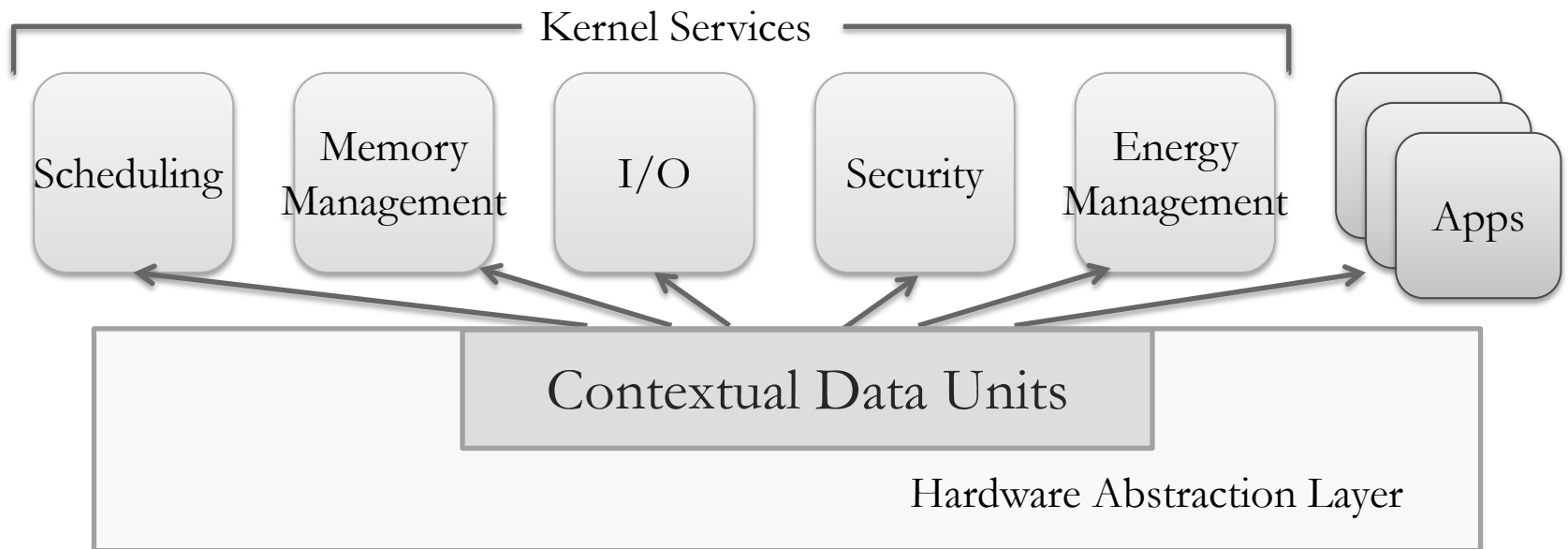
*sitting, walking, running*

Interruptible

*yes, no*

# benefits of OS-managed context

## 1. System services can use context



# system services can use context

## › memory management

- › preload calendar, email when *in the office*

Context	Preload Action
<i>in the office</i>	Email, Calendar
<i>at a party</i>	Twitter, Facebook

Memory  
Management

## › I/O

- › ring volume adjusted based on *conversation*
- › networking params dictated by *movement* [Balakrishnan '10]

I/O

# system services can use context

## › security

- › auto password unlock when at *home*
- › lend your phone to others easily [liu '09]

Security

## › energy management

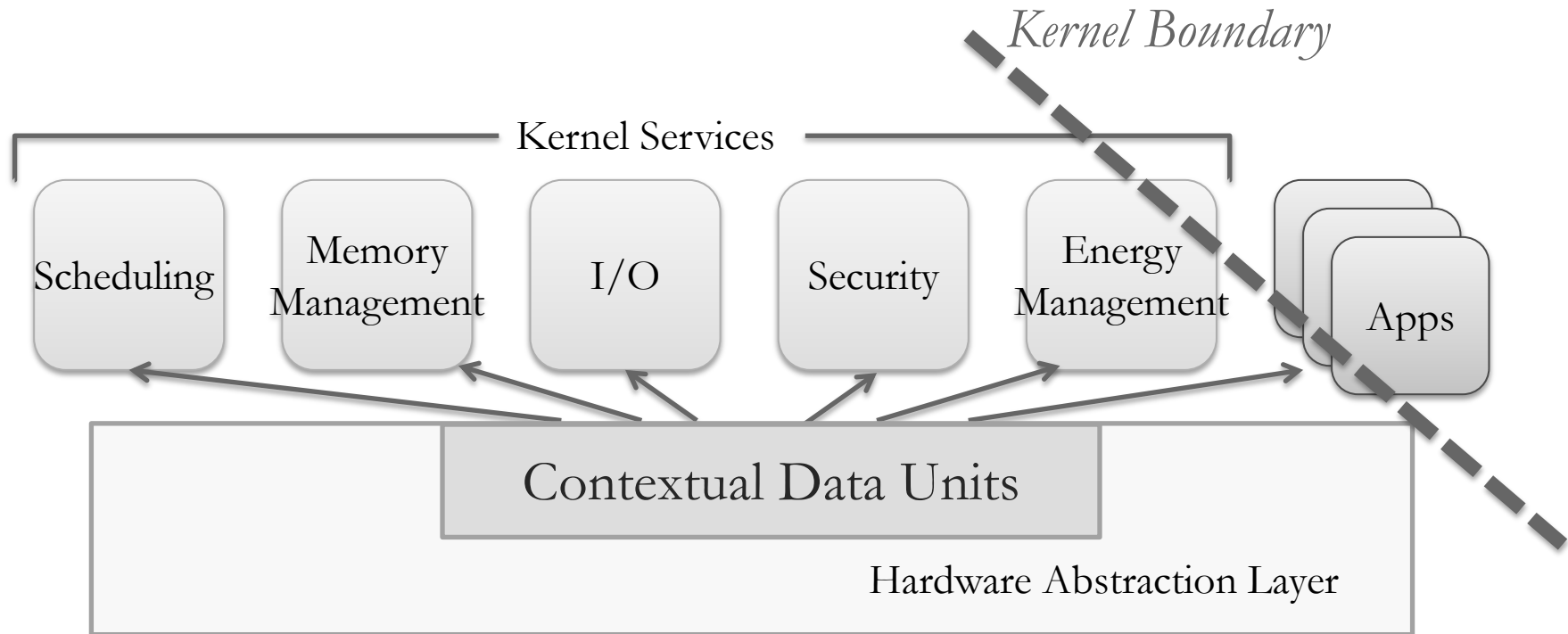
- › predict time-to-recharge based on context

Energy  
Management



# benefits of OS-managed context

## 2. Privacy enforced by OS protection

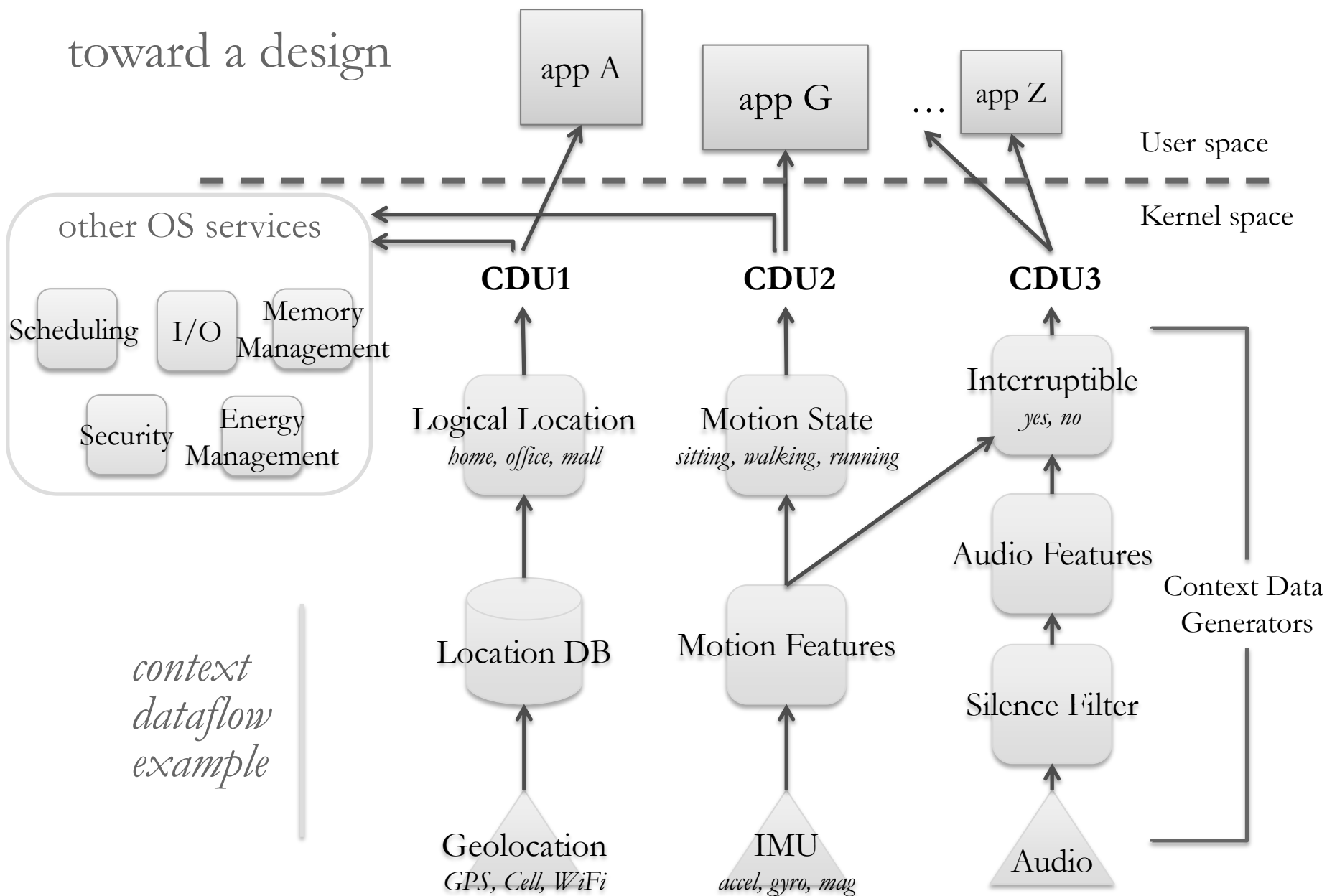


# better sensor privacy

- › mobile privacy is under attack [1]
  - › protecting raw sensor data is “true”
  - › 2/3 of popular apps use your data
  - › no idea what your raw data might do
- › OS-managed context lets us do
  - › app install time: per CDU type access control
    - › ... vs. per sensor type access control
  - › app run time: visual inspection of context
    - › ... vs. no comprehension of what is being used
  - › enforcement is low overhead



toward a design



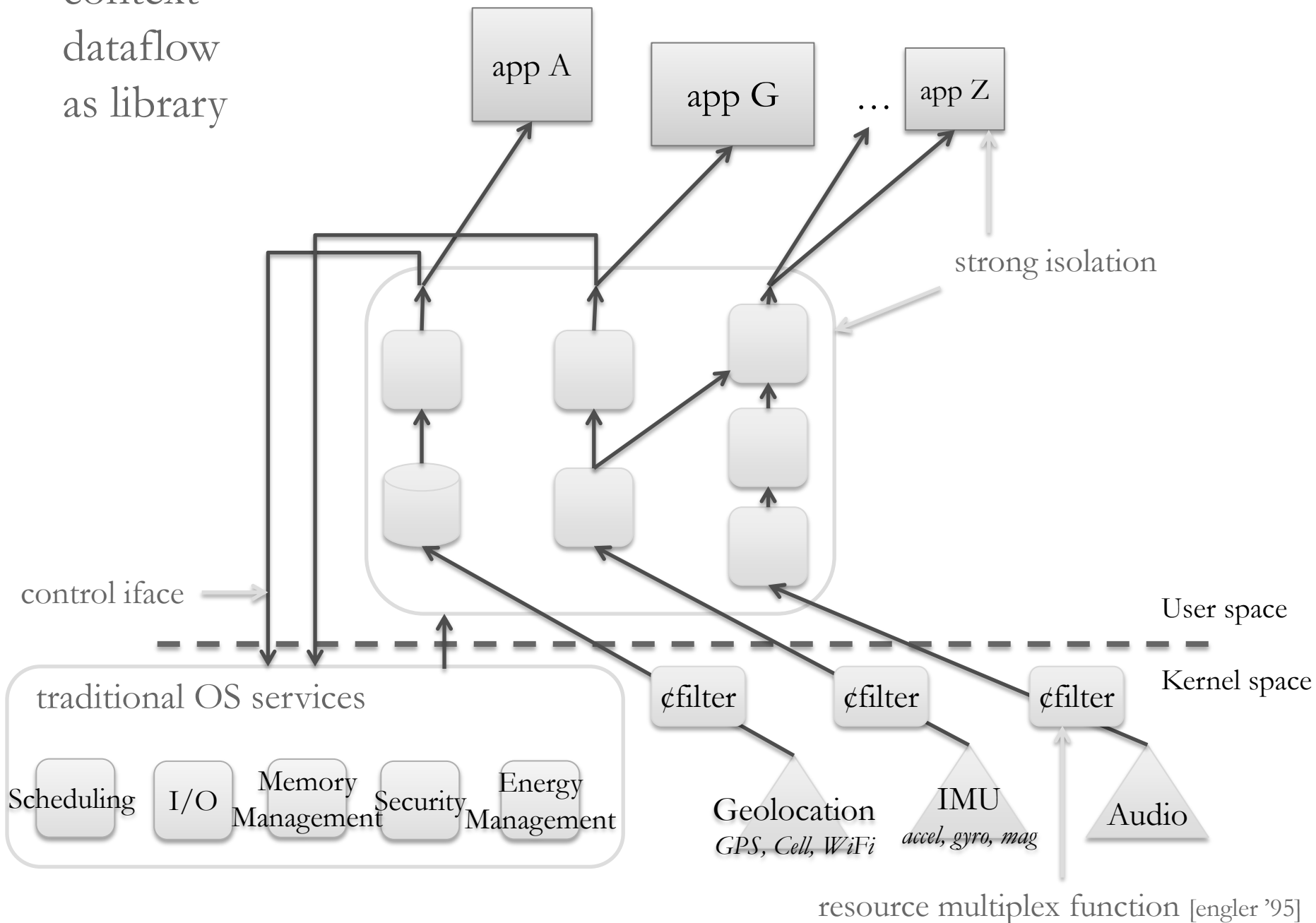


- › mobile OSs that don't *make* sense make *no* sense
- › *ConDOS* offers context as a primary app-OS interface
- › apps, OS services and User Privacy may all benefit

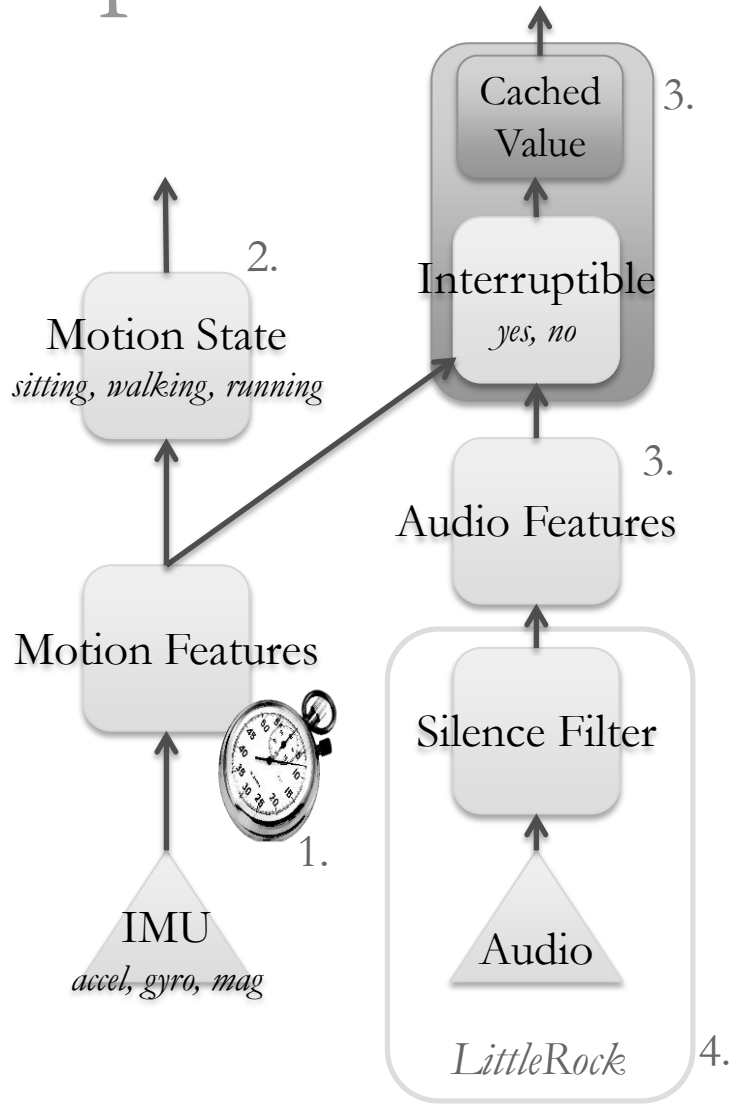
*thank you! questions?*

*backup slides follow*

context  
dataflow  
as library



# potential dataflow benefits



1. predictable execution [lee '87]
2. shared flow processing
3. principled flow degradation
4. flow-to-hardware mapping