COSC345
Software Architecture
Tuesday 2015-04-14
Software Architecture

• “the high level structure of a .. system”
  - the architecture a system has
• “the discipline of making such structures”
  - what software architects do
• “the documentation of such structures”
  - what an architecture looks like

What’s the point?

- Documentation (overview)
- Design (planning work)
- **Reasoning** (criticism)
Let’s have an example
Criticism: completeness

- What have we left out?
- What else have we left out?
- This is a system architecture, where’s the software?
Questions to ask

• What is the user doing?
• What software runs on the watch?
• What software runs on the phone?
• What on the web server?
• What on the main data base &c?
Criticism: one vs many

• Any time there is one thing on a diagram, ask if it’s exactly one, or possibly more.
• Could there be more than one watch?
• Could there be more than one phone?
• Could there be more than one web server?
• Could there be more than one back end?
Data rates 1

- We can ask about **storage** capacity
- and about **transmission rates**.
- People: about 100 words per minute by speech or typing, call it 20 bits / second.
- ASCII (Teletype) coding: 110 bits/second.
Data rates 2

- Bluetooth 2.1 Mbit/s
- 3G mobile phone 2 Mbit/s (stationary)
  384 kbit/s (moving vehicle)
- Broadband internet 25 Mbit/s download or 3 Mbit/s upload.
- Web server↔host very fast
Capacities

- Watch: 10s of MiB
- Phone: 100s of MiB in RAM to low GiB on SD card
- Web server: low GiB of Ram to 100s of GiB on disc/SSD
- Main data server: low TiB and up
So what?

• We can see where there is room to put information, and how fast we can move it around.

• We can tell if a proposed scheme will work.

• With prices, we can tell if a scheme that could work is too expensive.
Boxes and lines

- Architectural diagrams are made of variously shaped boxes, representing “things”, like users, phones, modules.
- And of variously decorated lines, representing connections or communications between things.
- Capacities on boxes, rates on lines.
Information

• We ask what information is **stored** at boxes (some boxes holding none)

• and what information is **sent** from one box to another over a line

• Some lines represent control (do this!) and some represent data (here’s your receipt)
Integrity

• We do not want data to be lost or changed
• Watch lost or broken: what happens?
• Phone lost or broken: what happens?
• Web server goes down, or hacked?
• Encryption or authentication keys lost?
Integrity 2

- Only protection against loss/breakage of device is to **replicate** data.
- What about loss/corruption during transmission due to transmission errors and congestion (running out of buffers)?
- Look up “The end-to-end principle”
Security

• Information may be changed or copied without our permission.

• “Smart watches” are often used for gathering health/fitness data.

• Health data are particularly sensitive.

• Consider privacy laws.
Security 2.

• Data in storage: how could this be copied?
• What if a device is lost or stolen?
• Data in movement: could this be interfered with? could it be copied? could a transmission be played back?
Security: Authentication

- When box A sends a message to box B,
  - How does box A find box B?
  - How does box A know it’s box B that it has found? (Spoofing, DNS attacks)
  - How does box B know box A is who it says it is? (Authentication)
  - Man-in-the-middle attack?
Authentication 2

• Identification can be
  • Something you **know** (password)
  • Something you **have** (key, dongle)
  • Something you **are** (biometrics)
• Beware of record/playback
Security: snooping

- Audio input/output easy to eavesdrop
- Bluetooth easy to eavesdrop
- 3G eavesdropping kits on market
- If you don’t want eavesdroppers, you have to use encryption
- OpenSSL has problems of its own...