Section outline

2. CRAMES: Compressed RAM for embedded systems
   - Introduction, motivation, and past work
   - CRAMES design
   - Compression algorithm design
   - Experimental evaluation
   - Commercialization

Problem background

RAM quantity limits application functionality

RAM price dropping but usage growing faster

Secure Internet access, email, music, and games

How much RAM?

- Functionality
- Cost
- Power consumption
- Size

Ideal hardware–software design process

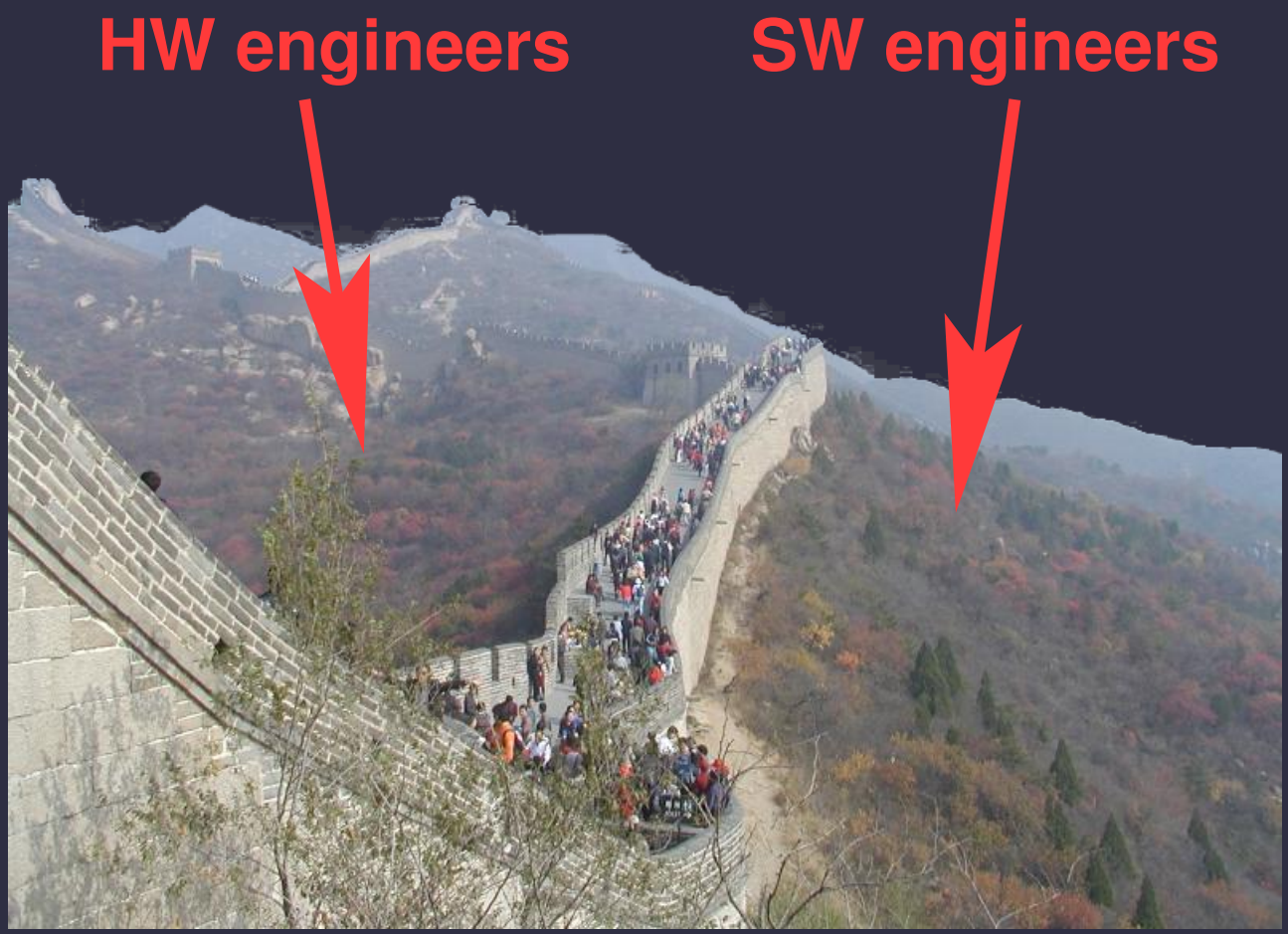
Ideal case

Hardware and software engineers collaborate on system-level design from start to finish

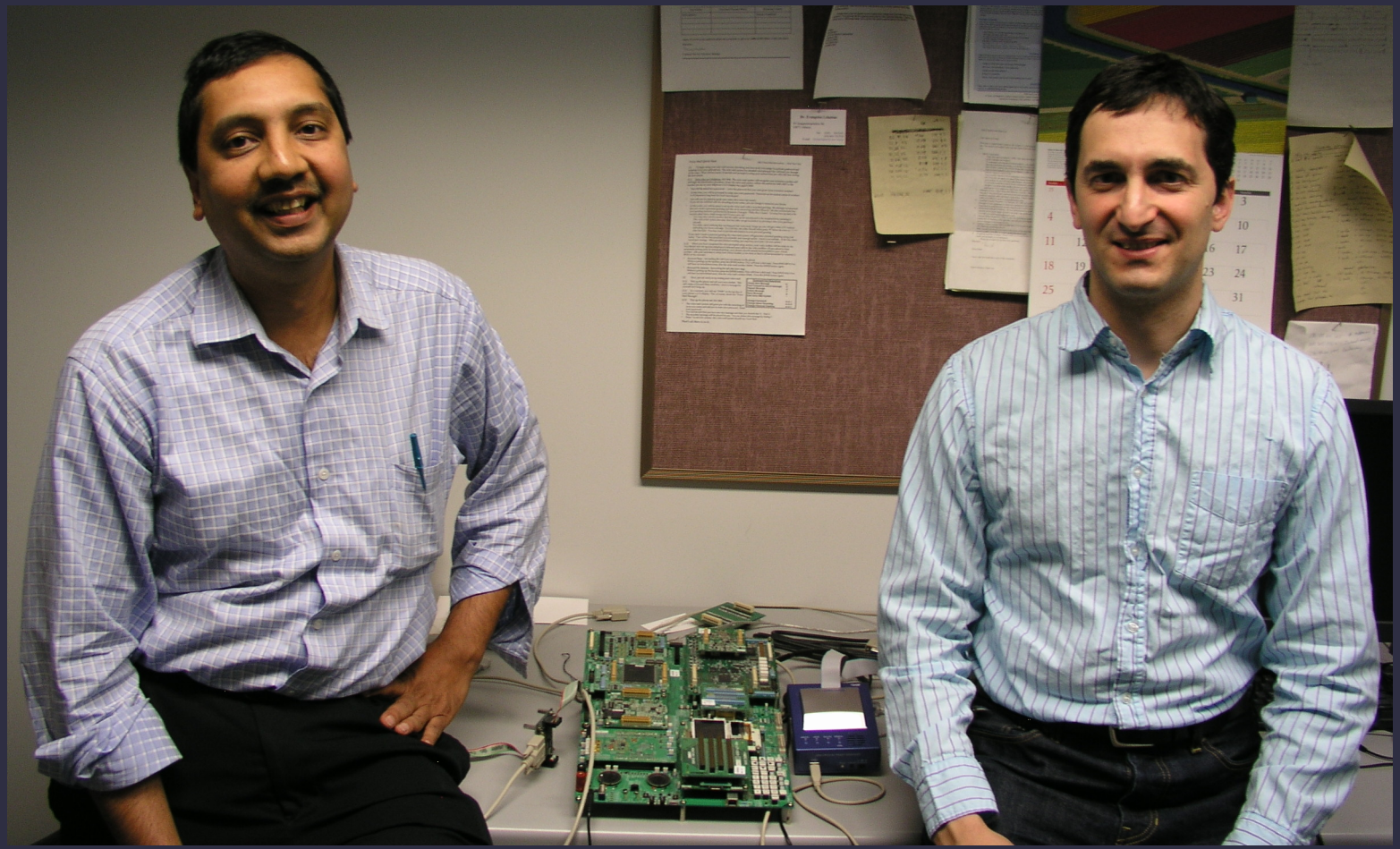
We teach the advantages of this in our classes

It doesn't always happen

Real hardware–software design process



NEC collaborators and cellphone prototype



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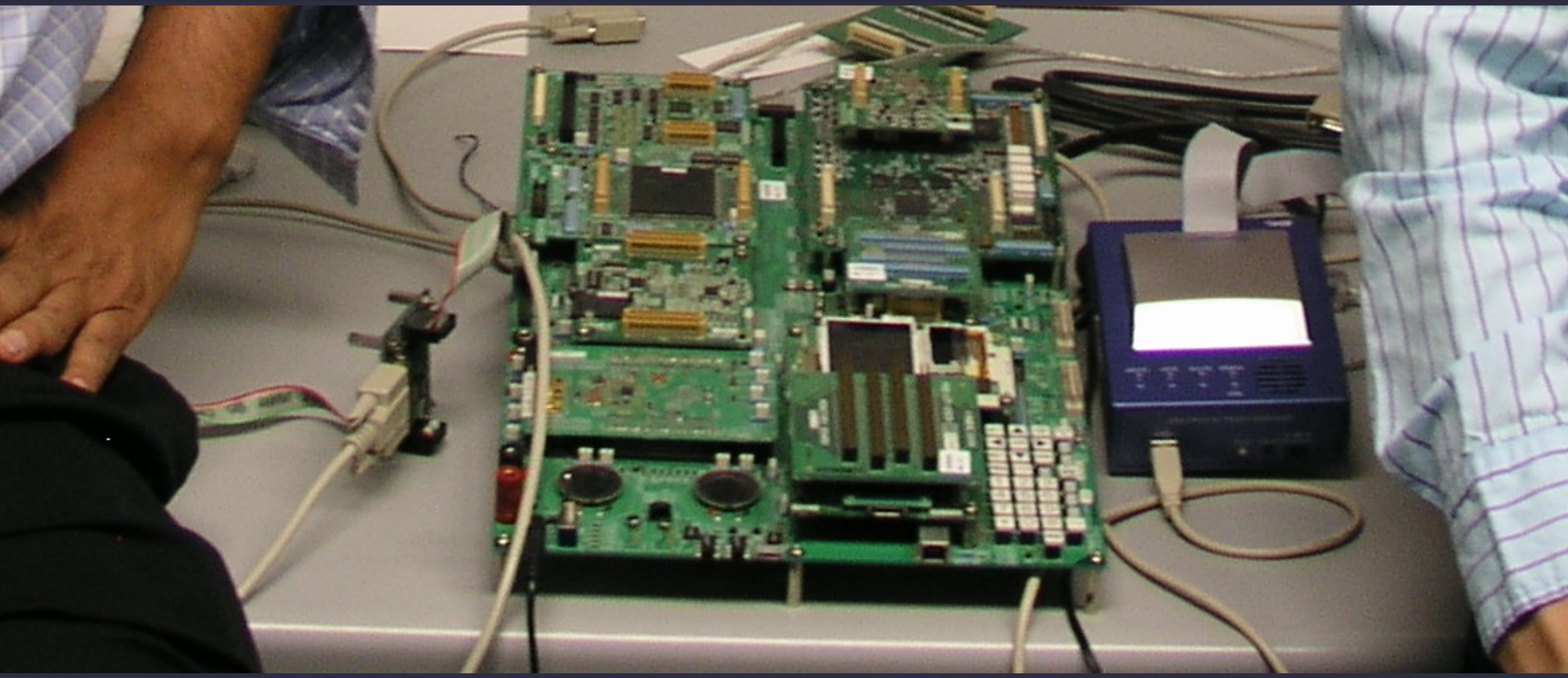

Options

Option 1: Add more memory

Implications: Hardware redesign, miss shipping target, get fired

Option 2: Rip out memory-hungry application features

Implications: Lose market to competitors, fail to recoup design and production costs, get fired

Option 3: Make it seem as if memory increased

- Do not change hardware
- Do not change applications
- Do not decrease performance
- Do not increase power

Nobody knew how to do this

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Goals

Allow application RAM requirements to overrun initial estimates even after hardware design

Reduce physical RAM, negligible performance and energy cost

Improve functionality or performance with same physical RAM