Communication, Computing, & Technology

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Communication vs. Computation

- Interdependent technologies: Neither can exist without other

- Technologies/Products/Commerce developed (mostly) independently.
    - Early products based on clean abstractions of the other.
    - Later versions added other capability as afterthought.
    - Today products … deeply integrated.

- Deep theories: Well separated … and have stayed that way
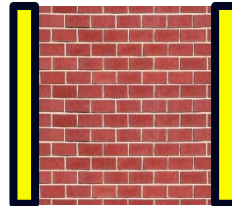
Turing '36   Shannon '48

Time for the theoretical wall to come down?

Consequences of the wall

- **Computing theory:**
  - Fundamental principle = Universality
  - You can program your computer to do whatever you want.
- **Communication principle:**
  - Centralized design (Encoder, Decoder, Compression, IPv4, TCP/IP).
  - You can NOT program your device!
- **Contradiction! But does it matter?**

Role of theory?

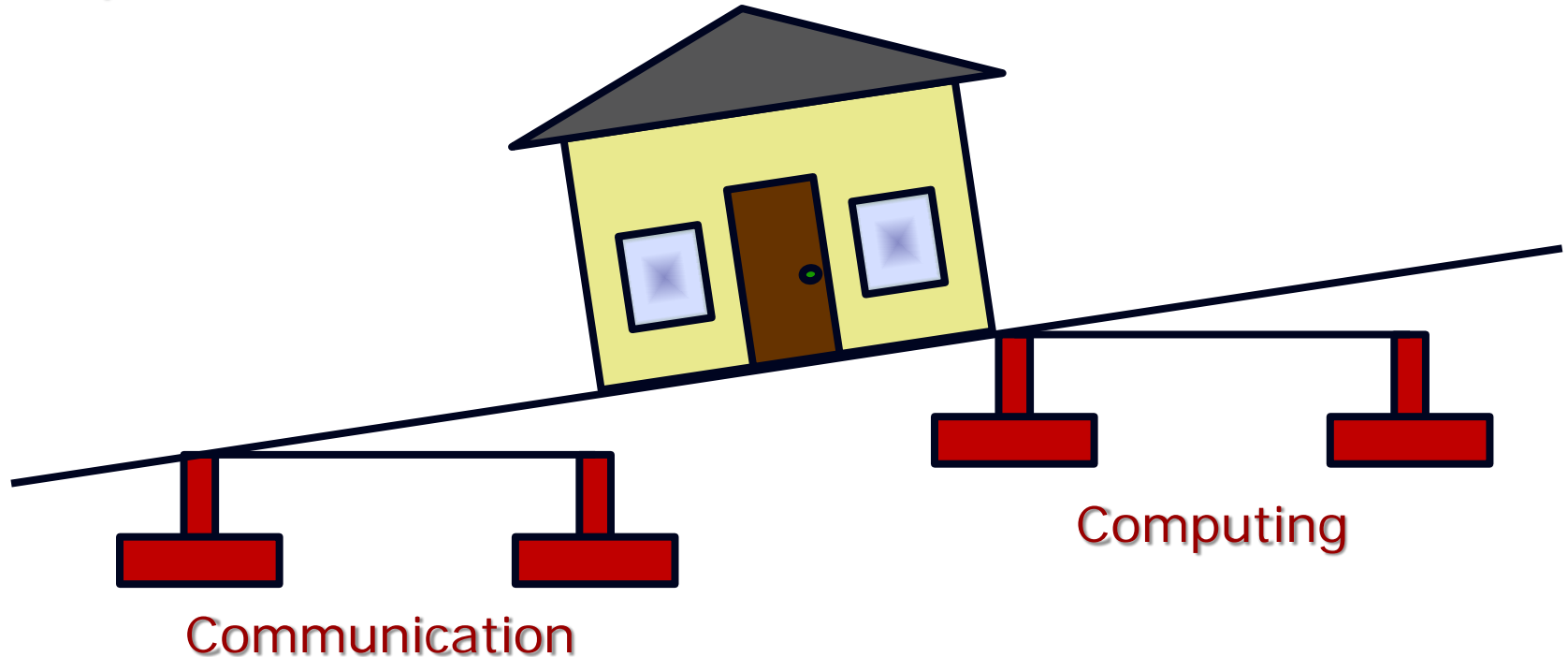- Ideally: Foundations of practice!
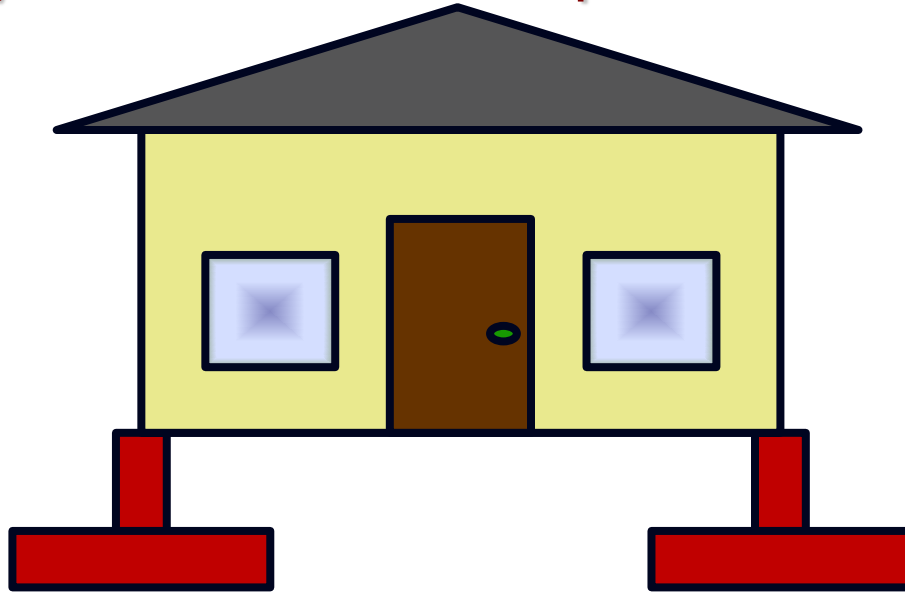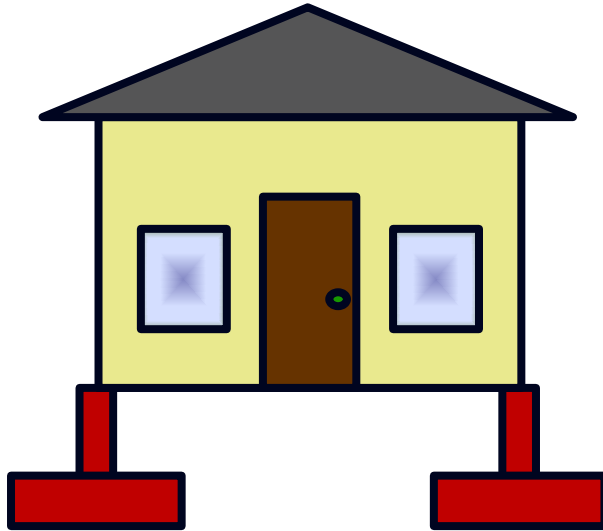
Application

Theory layer

Communication vs. Computing

■ Option 1

Computing

Communication

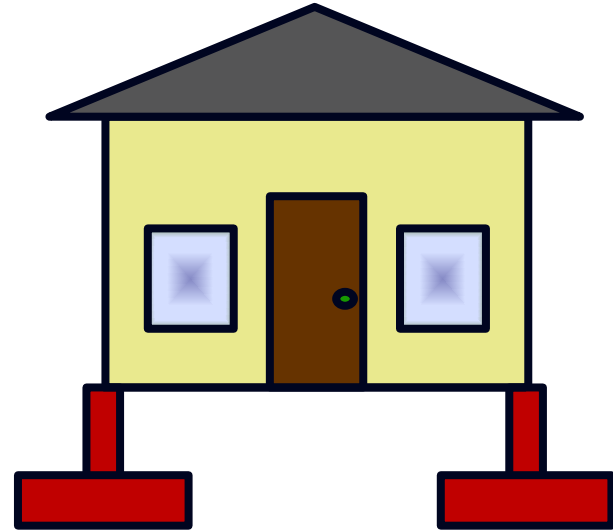# Communication vs. Computing

- Option 2

Communication

Computing

Communication vs. Computing

■ Option 3

Computing

Communication

Good News/ Bad News

- Good: We are mostly practicing option 2 or 3!

- Bad:
    - Lost opportunities.
    - Vulnerabilities.
    - Inefficiency.
    - Incompatibilities.

Sample problems:

- Digital library:
  - Data that lives forever (communication across time), while devices change!

- Projecting from your laptop:
  - Machines that learn to communicate, and learn to understand each other

A new theory?

Computing

Communication