Language-based software security

Course summary

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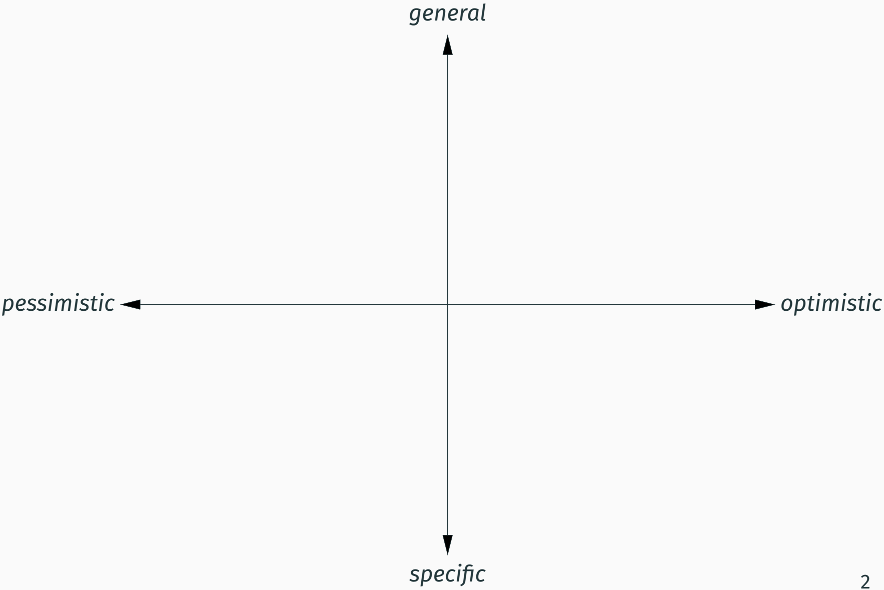
Four attitudes towards computer security



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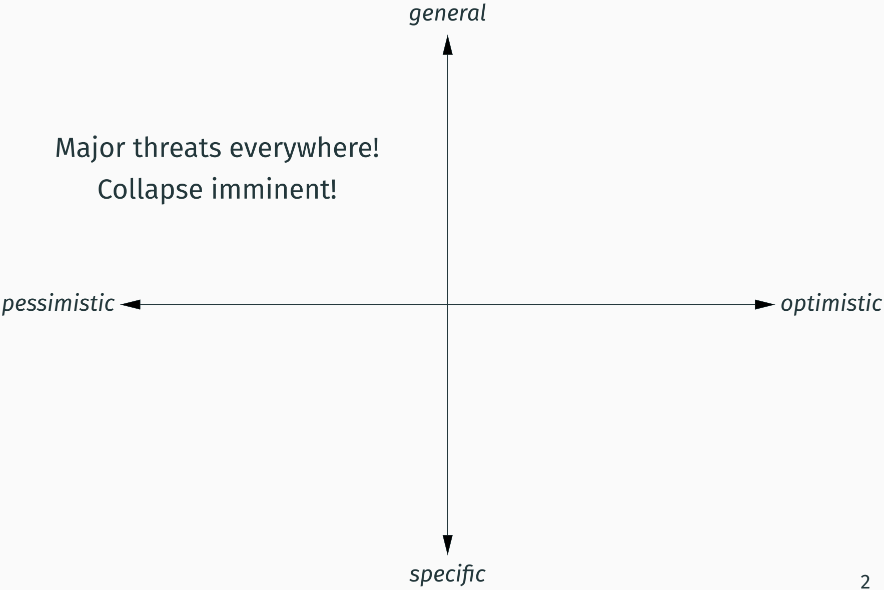

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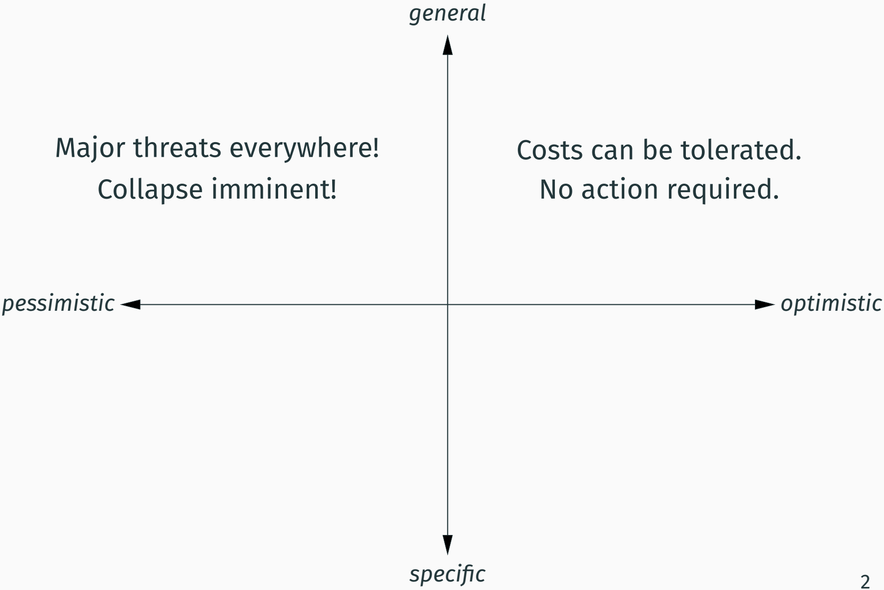
Collapse imminent!

Four attitudes towards computer security



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Costs can be tolerated.
No action required.

pessimistic

optimistic

specific

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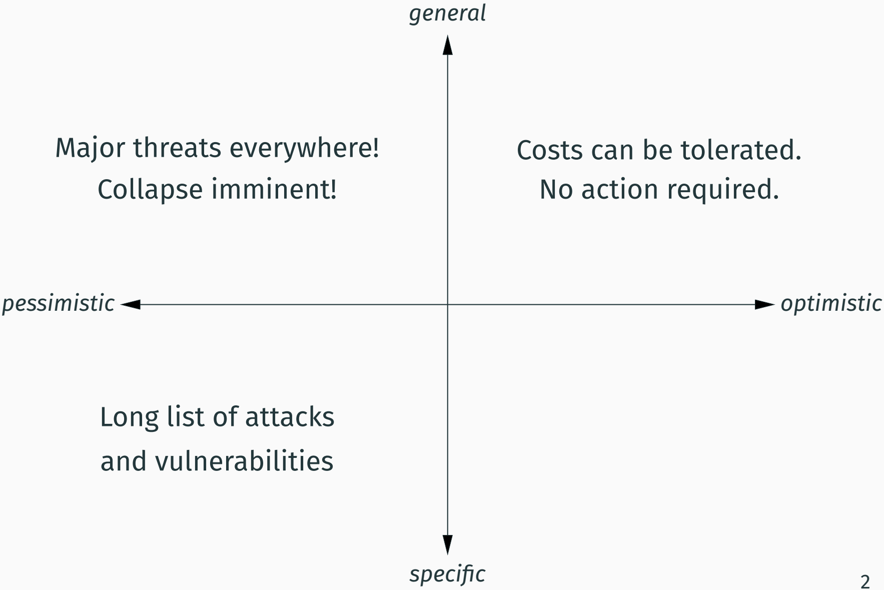

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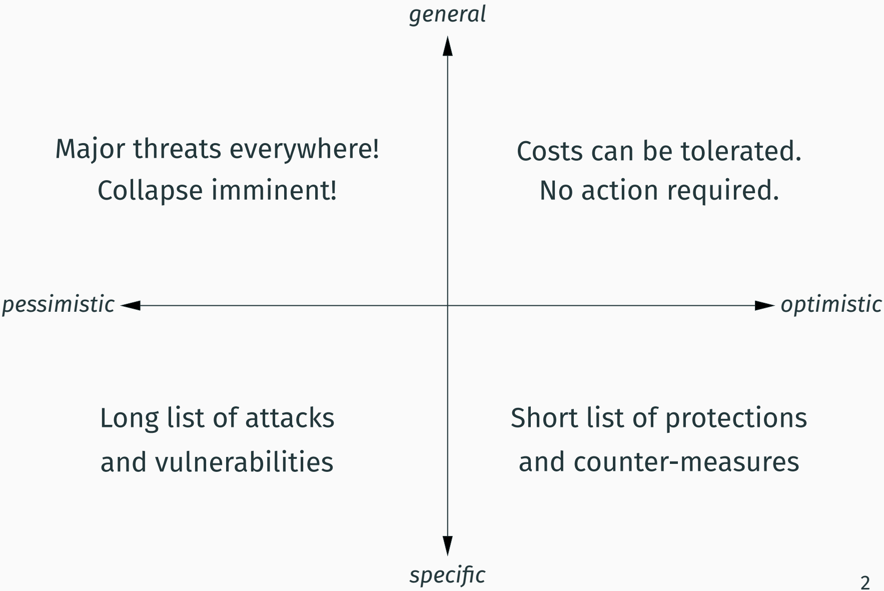

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optimistic

Long list of attacks
and vulnerabilities

Short list of protections
and counter-measures

specific

The components of computer security

Users

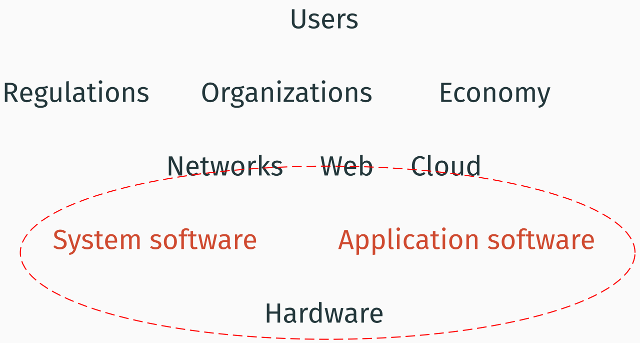
Regulations Organizations Economy

Networks Web Cloud

System software Application software

Hardware

The components of computer security



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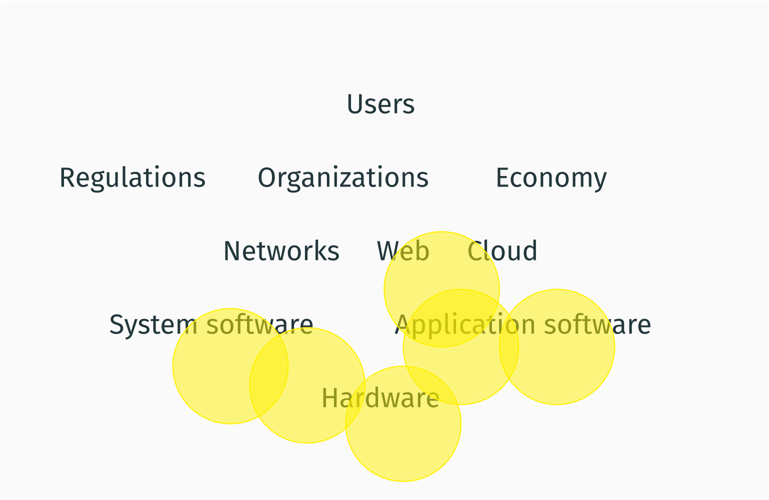

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What role for programming languages and tools?

An essential role:

- Run-time safety, to guarantee the integrity of data structures and control flow.

Some specific contributions to security, such as

- Controlling information flow (lecture 2)
- Software fault isolation (lecture 3)
- “Constant-time” programming (lecture 4)
- Mobile code verification; proof-carrying code (lecture 5)
- Protections against microarchitectural attacks (lecture 6)

Security: a challenge for programming

Poor programming practices that make it harder to write secure software.

- Performance does not trump security.
- Testing does not suffice to avoid vulnerabilities.

Programming Satan's computer
(Ross Anderson)

It is difficult to formally reason beyond functional correctness:

- confidentiality, privacy;
- availability, resilience;
- hardware faults and information leaks.

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