Generic or specific?

Making sensible software design decisions

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Let's meet

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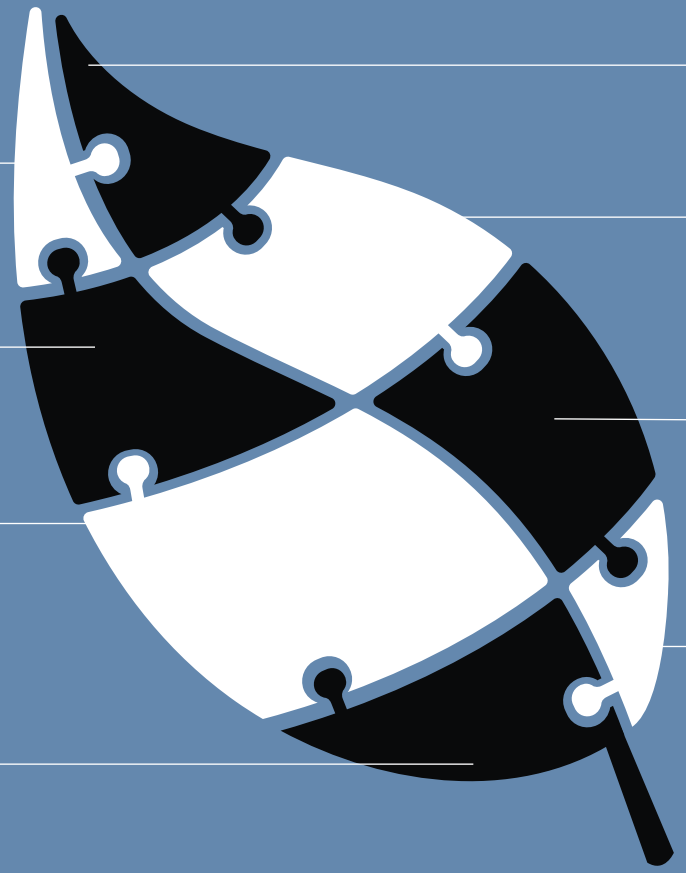
What's next?

Outline

- Definitions
- Flexibility in software
- Levels of generic vs specific
- Tools to help decide



- The cost of generic
- When & why to go generic
- Sharing code in an organization
- Conclusion

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What is software design?

Specific solution (or design)

- Tailor made for use in a single place
- Tailored to a specific problem or scenario
- May not be easily adaptable to other situations

Generic solution (or design)

- More flexible and reusable solution
- Solution can be applied to a wide range of problems or scenarios
- Generified solution that can be used in more than 1 place

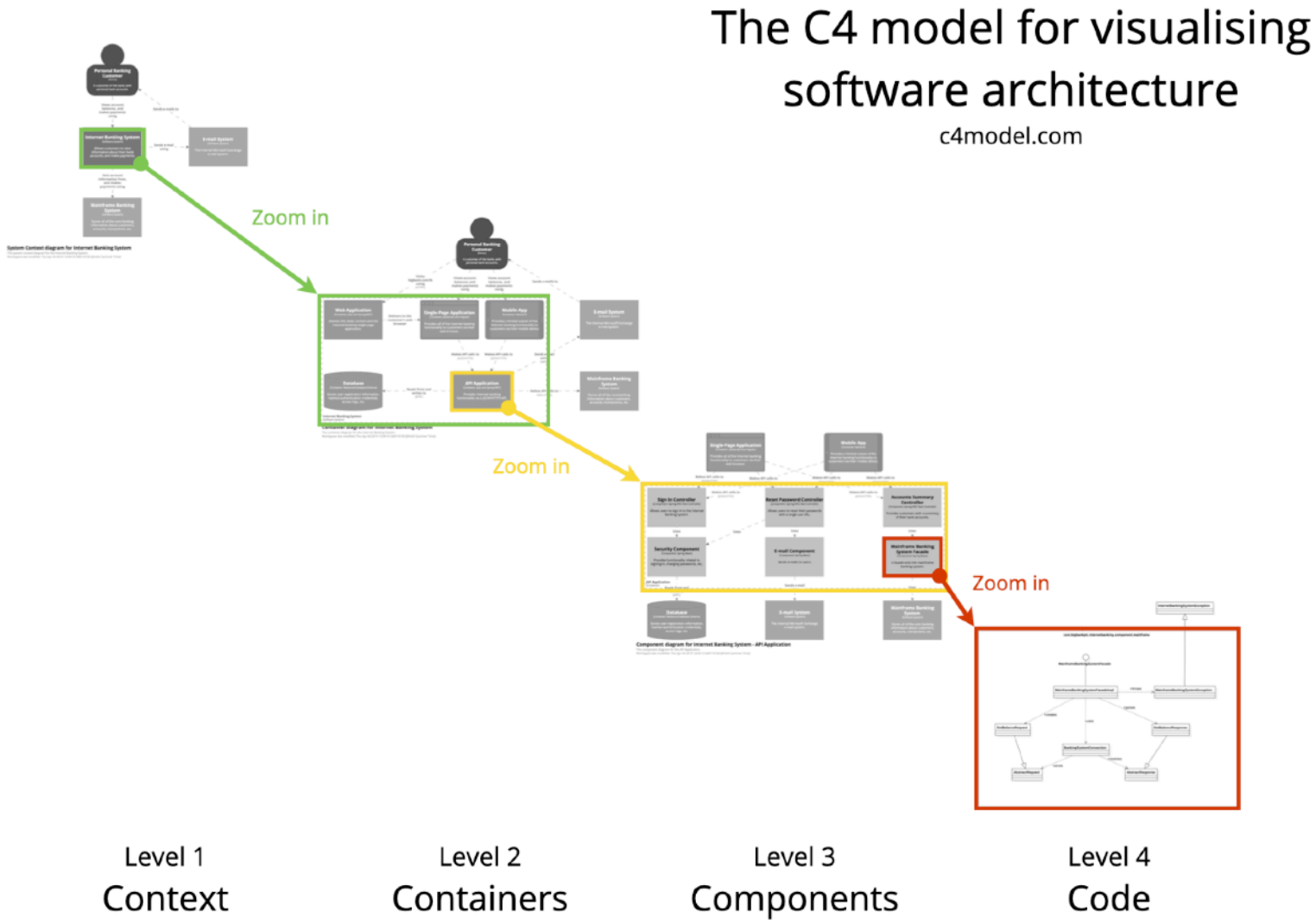
Background source: https://filmquarterly.org/2012/07/02/i-robot-what-do-robots-dream-of/

Hierarchical decomposition

- Breaking a system or problem into smaller parts that are easier to understand
- Example: Google search

Background source: DALL·E

Hierarchical decomposition



Source: https://c4model.com

Coupling

- Kind and degree of interdependence between building blocks of software
- Measure of how closely connected two components are
- Usually contrasted with cohesion (low coupling -> high cohesion)

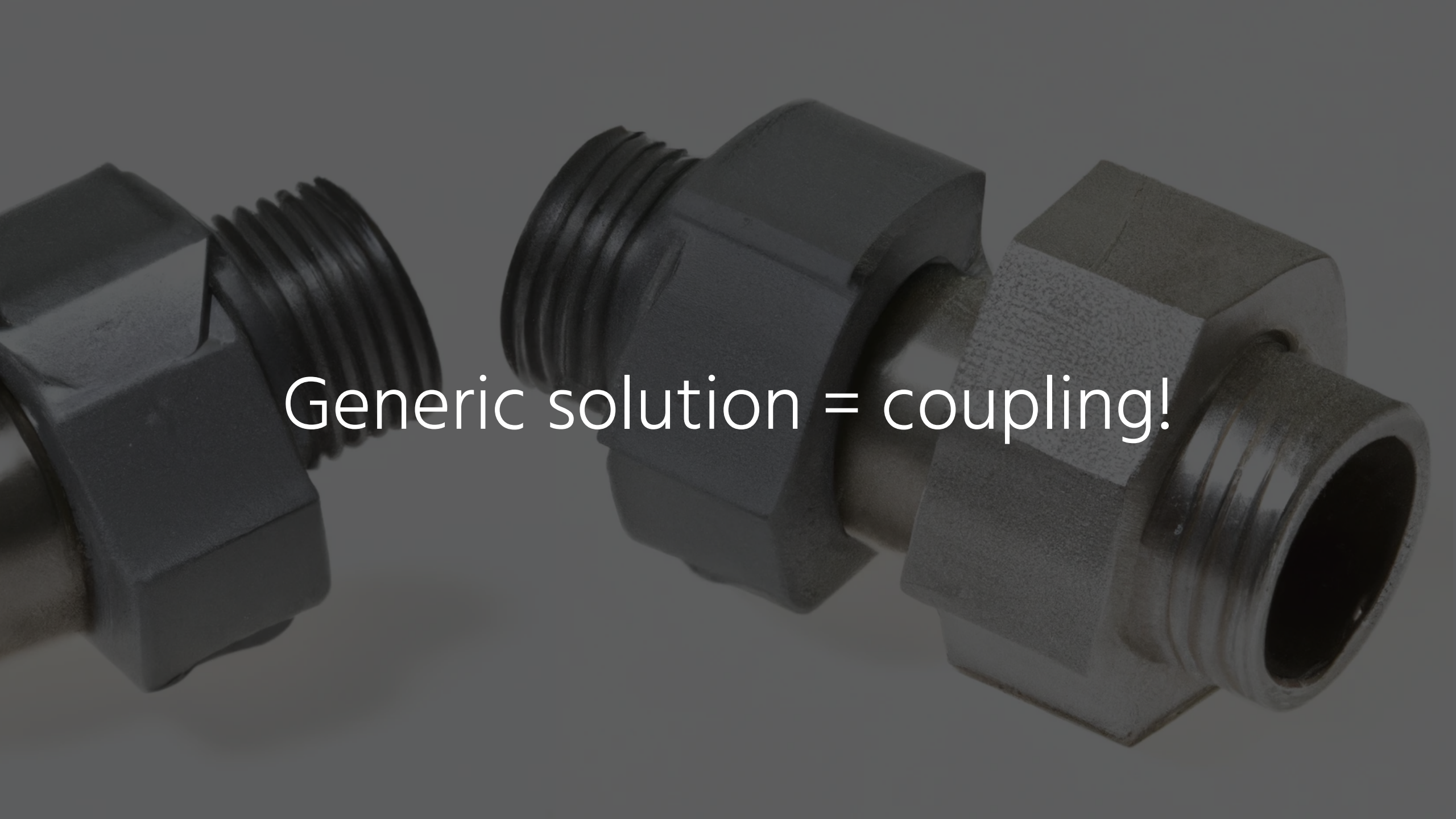
Background source: DALL·E

Types of coupling

- Inheritance
- Messages or events
- Temporal
- Data types
- Data
- Code / API (binary or source)

Background source: DALL·E


Be careful with coupling!



Generic solution = coupling!

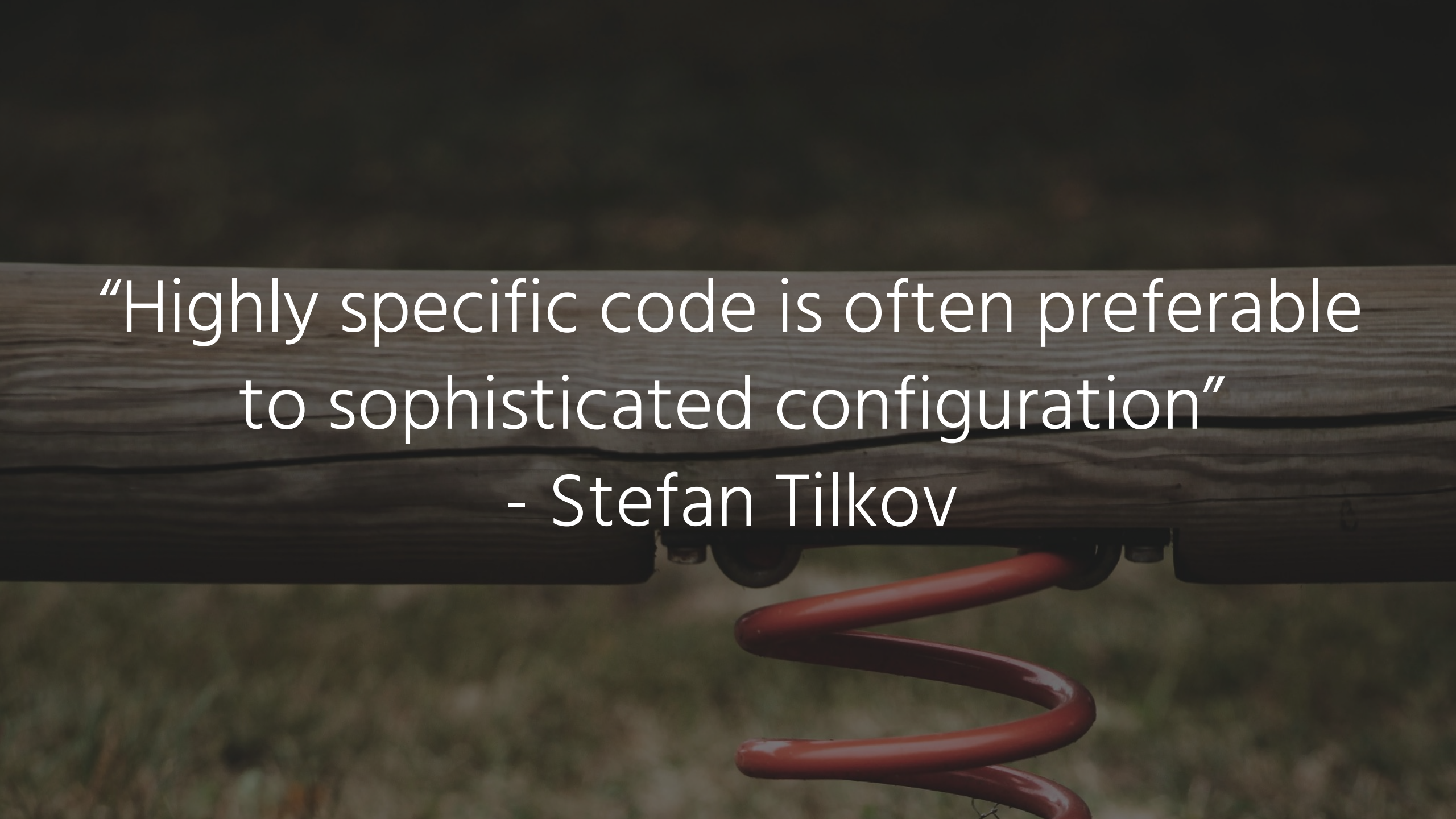
The risk of DRY

“Future proof” design

- Should we be prepared for future changes?
- Design should be structured to accommodate change
- Risk management: risk of wrong decision

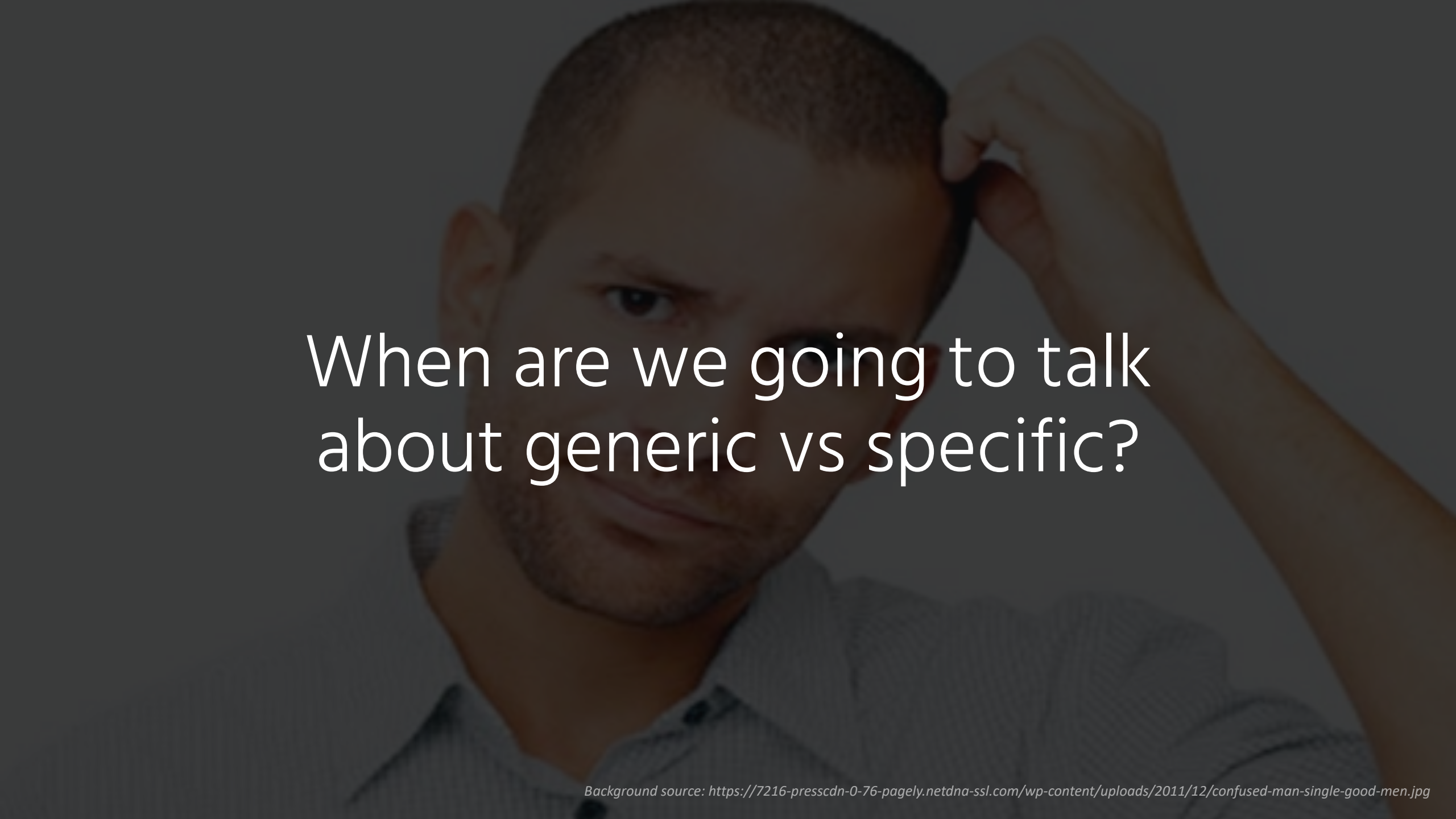
Background source: DALL·E

About flexibility in software…



“Highly specific code is often preferable to sophisticated configuration”

- Stefan Tilkov



When are we going to talk about generic vs specific?

Background source: https://7216-presscdn-0-76-pagely.netdna-ssl.com/wp-content/uploads/2011/12/confused-man-single-good-men.jpg

Generic vs specific: levels

- Code / class level
- Library level
- Data level
- (Micro)service level
- Organisation level

Background source: DALL·E

Generic or specific?

Tools to help decide

- Do we really need this now? (YAGNI)
- Time/effort for generic vs specific
- Myth of “first time right”
- Complexity and scope
- Future needs and evolution
- The rule of three

The rule of three

- When reusing code, copy it once, and only abstract the third time
  - Avoid writing the wrong abstraction
  - It’s easier to make a good abstraction from duplicated code than to refactor the wrong abstraction
- "Three strikes and you refactor"

Background source: https://learntalk.org/en/blog/where-did-the-saying-third-times-the-charm-come-from

The rule of three

- First case: Just build it, don’t genericise at all. Solve the problem in front of you (YAGNI)
- Second case: Duplicate the original, redesign and extract common behaviour while you change
- Third case: examine the lessons from the first two passes, design a generic solution that will make it easy to add your third case

Background source: https://learntalk.org/en/blog/where-did-the-saying-third-times-the-charm-come-from

Design heuristics

- Pass 1: YAGNI / rule of three: as simple and specific as possible
- Pass 2: based on solution domain knowledge:
  is a generic solution less work?
- Pass 3: based on problem domain knowledge:
  is the easiest solution actually correct?
- Pass 4: looking at customer behaviour or other non technical considerations, does this change your decision?

Background source: DALL·E

Strategic design

- Concept from Domain Driven Design
- Tool to help decide for generic vs specific
- But more about building yourself or not
- Subdomains:
  - Core domain
  - Supporting subdomain
  - Generic subdomain

Background source: GR Stocks on Unsplash

Conway's law

- Organizations design systems that mirror their own communication structure
- Don't force a solution that goes against the organisation structure
- Be careful to go generic when teams don't want to work together

Background source: DALL·E

Conway’s law in action

Background source: DALL·E

The cost of a generic solution

- Going generic may save time in the long run, but at which price?
- Another rule of three: building reusable components is 3x as difficult as single use
- The price you pay is coupling
  - Both on code level and people/team level (communication overhead)

Background source: DALL·E


What if you get it wrong?
Photo: Dave Lehl

The cost of abstractions

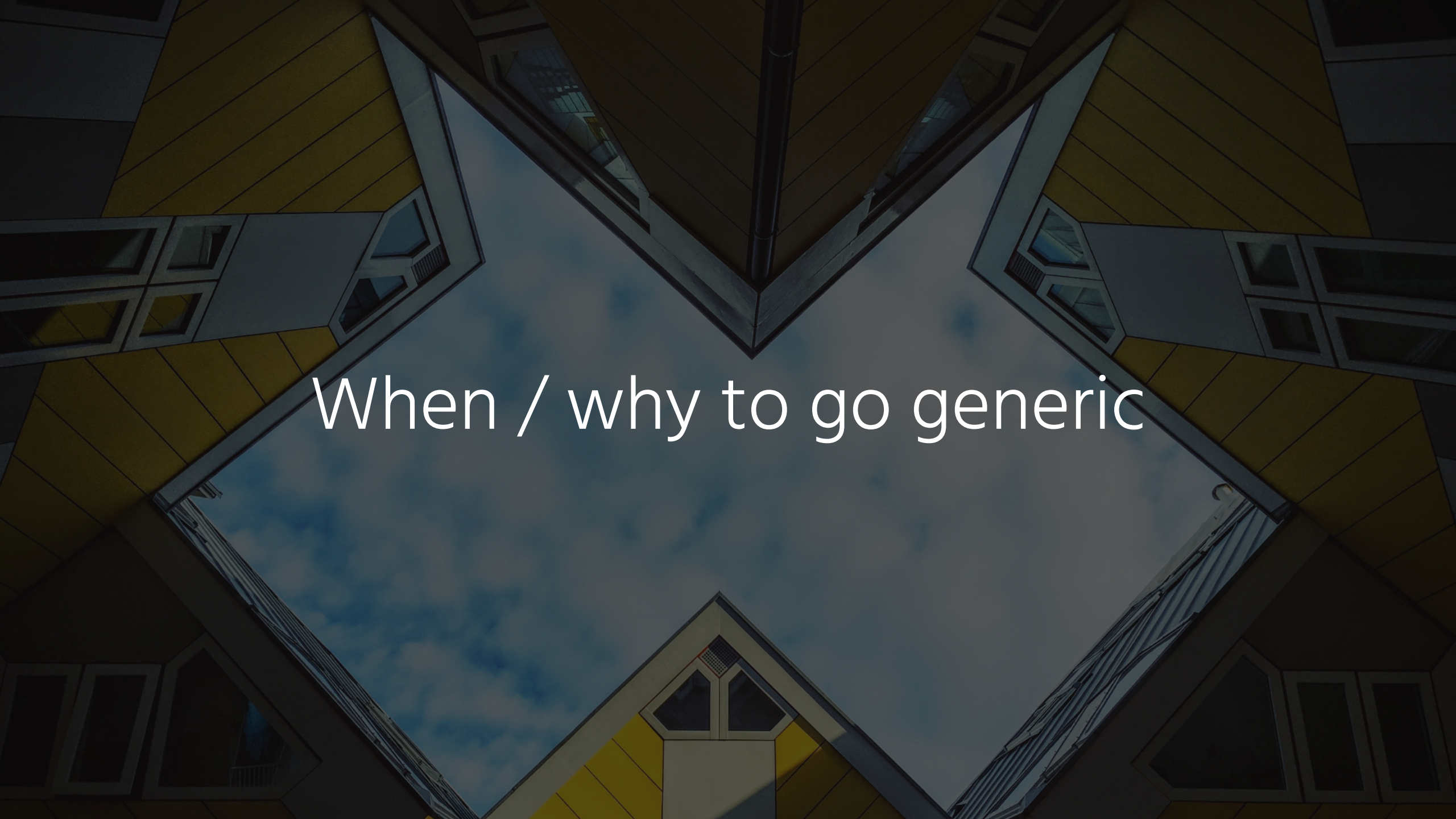
- There are no zero cost abstractions
- Efficiency gains of a generic solution are typically clear, but how about:
  - Onboarding new people
  - Readability
  - Coupling

Background source: Héctor J. Rivas on Unsplash

The cost of abstractions

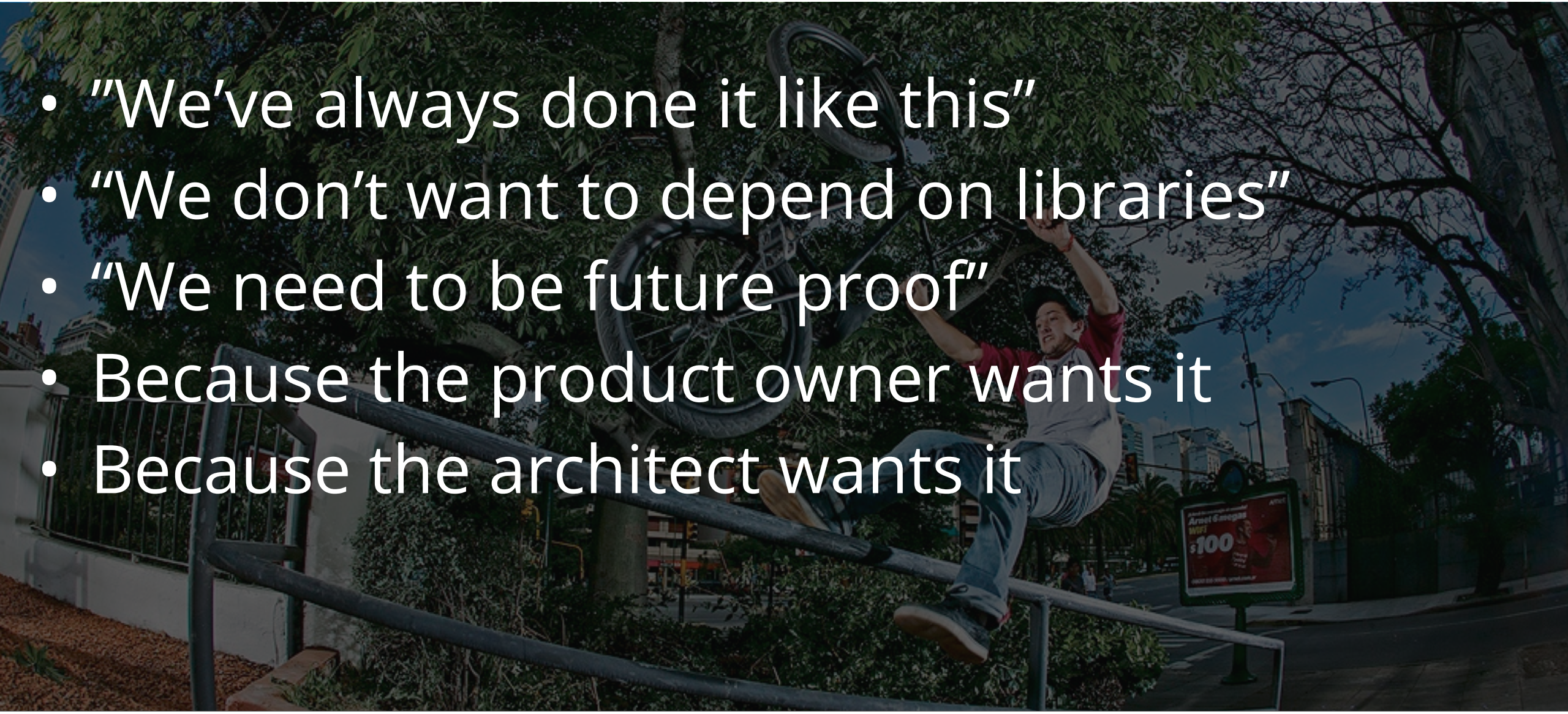
- Writing bad abstractions
  - Writing unnecessary reusable code
  - Introducing unnecessary coupling
- Maintaining bad abstractions
  - Hard to see
  - Hard to understand
  - Hard to extend

Background source: Héctor J. Rivas on Unsplash



When / why to go generic

Bad reasons to go generic



- ”We’ve always done it like this”
- “We don’t want to depend on libraries”
- “We need to be future proof”
- Because the product owner wants it
- Because the architect wants it

Valid reasons to go generic

- Rule of three checks out
- You're pretty sure you're going to need it almost everywhere
- A library that lots of teams will use
- Complex logic or skills that only a couple of people have
- Gains are bigger than cost

Generic vs specific in different scopes

- Think back about the layers in hierarchical decomposition of a system
- Code vs component vs service
- Are the considerations for generic vs specific the same on every level?
- Risk when getting it wrong is higher when the level is higher
- Don’t confuse generification with standardization!

Background source: Fernando Gomez on Unsplash

Why specific is often faster

Code golf

Advent of code

--- Day 5: Supply Stacks ---

The expedition can depart as soon as the final supplies have been unloaded from the ships. Supplies are stored in stacks of marked **crates**, but because the needed supplies are buried under many other crates, the crates need to be rearranged.

The ship has a **giant cargo crane** capable of moving crates between stacks. To ensure none of the crates get crushed or fall over, the crane operator will rearrange them in a series of carefully-planned steps. After the crates are rearranged, the desired crates will be at the top of each stack.

The Elves don't want to interrupt the crane operator during this delicate procedure, but they forgot to ask her **which** crate will end up where, and they want to be ready to unload them as soon as possible so they can embark.

They do, however, have a drawing of the starting stacks of crates **and** the rearrangement procedure (your puzzle input). For example:

```
    [D]
[N] [C]
[Z] [M] [P]
 1   2   3

move 1 from 2 to 1
move 3 from 1 to 3
move 2 from 2 to 1
move 1 from 1 to 2
```

```
[Q] [J]                         [H]
[G] [S] [Q]     [Z]             [P]
[P] [F] [M]     [F]     [F]     [S]
[R] [R] [P] [F] [V]     [D]     [L]
[L] [W] [W] [D] [W] [S] [V]     [G]
[C] [H] [H] [T] [D] [L] [M] [B] [B]
[T] [Q] [B] [S] [L] [C] [B] [J] [N]
[F] [N] [F] [V] [Q] [Z] [Z] [T] [Q]
 1   2   3   4   5   6   7   8   9

move 1 from 8 to 1
move 1 from 6 to 1
move 3 from 7 to 4
move 3 from 2 to 9
move 11 from 9 to 3
move 1 from 6 to 9
move 15 from 3 to 9
move 5 from 2 to 3
move 3 from 7 to 5
move 6 from 9 to 3
move 6 from 1 to 6
move 2 from 3 to 7
```

```java
Scanner scanner = new Scanner(input);
List<String> lines = new ArrayList<>();
List<String> instructions = new ArrayList<>();

// determine initial matrix width/height dimensions
int maxLineLength = 0, initialMatrixHeight = 0;
while (scanner.hasNextLine()) {
    String line = scanner.nextLine();
    lines.add(line);
    if (line.contains("[")) { initialMatrixHeight++; }
    if (line.endsWith("]") && line.length() > maxLineLength) { maxLineLength = line.length(); }
}
int initialMatrixWidth = (maxLineLength + 1) / 4;
Matrix matrix = new Matrix(initialMatrixWidth, initialMatrixHeight);

// init matrix and instruction
int y = 0;
for (String line: lines) {
    if (line.contains("[")) { // matrix line
        y++;
        for (int x=1; x<initialMatrixWidth+1; x++) {
            matrix.put(x, y: initialMatrixHeight-y+1, line.charAt(4*(x-1)+1));
        }
    } else if (line.startsWith("move")) { instructions.add(line); }
}
```

```java
ArrayList<String> stack1 = new ArrayList<>(Arrays.asList("F", "D","B", "Z","T", "J","R","N"));
ArrayList<String> stack2 = new ArrayList<>(Arrays.asList("R", "S", "N", "J","H"));
ArrayList<String> stack3 = new ArrayList<>(Arrays.asList("C", "R","N", "J","G", "Z","F", "Q"));
ArrayList<String> stack4 = new ArrayList<>(Arrays.asList("F", "V", "N", "G", "R", "T", "Q"));
ArrayList<String> stack5 = new ArrayList<>(Arrays.asList("L", "T", "Q", "F"));
ArrayList<String> stack6 = new ArrayList<>(Arrays.asList("Q", "C","W", "Z","B", "R","G", "N"));
ArrayList<String> stack7 = new ArrayList<>(Arrays.asList("F", "C","L", "S","N", "H","M"));
ArrayList<String> stack8 = new ArrayList<>(Arrays.asList("D", "N", "Q", "M","T", "J"));
ArrayList<String> stack9 = new ArrayList<>(Arrays.asList("P", "G","S"));
```

Generic solutions on organization level

Sharing code within an organization

- Sharing code efficiently at scale is hard
- Sharing code at scale means:
  - Multiple modules that share code
  - Multiple team members
  - High rate of change
  - Little to no loss of individual productivity

Source: https://medium.com/@jeffwhelpley/the-problem-with-shared-code-124a20fc3d3b

Sharing code within an organization

- Challenges:
  - Refactoring
  - Versioning
  - Reviewing
  - Builds and codebase size - monorepo?

Source: https://medium.com/@jeffwhelpley/the-problem-with-shared-code-124a20fc3d3b

Monorepositories

- Monorepo: 1 large repository for a group of projects (possible all projects)
- Good: easy to make changes across projects
- Bad: dependencies & build times

Background source: DALL·E

Considerations on sharing code in an org

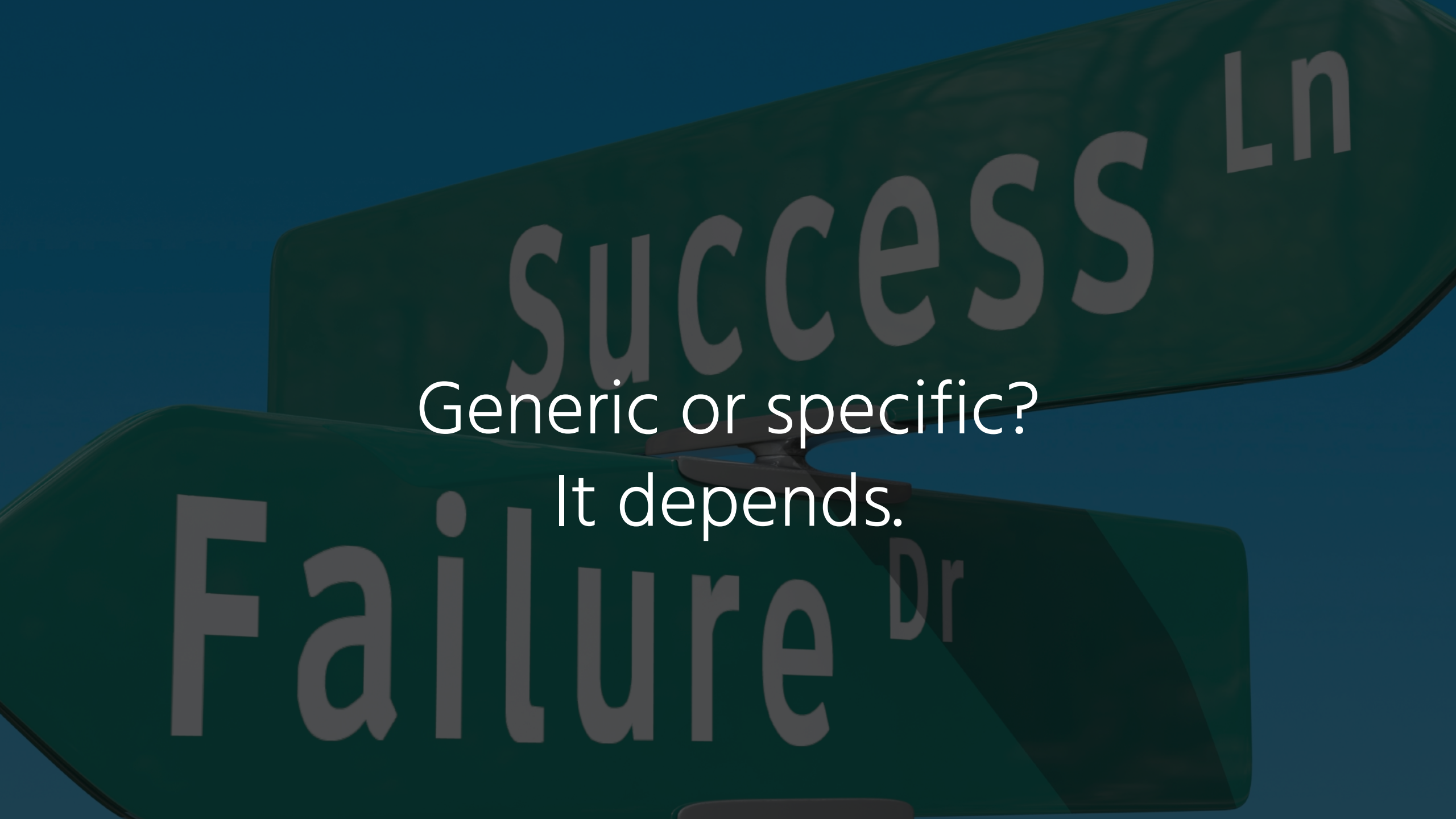
- Discovery: what code / libraries exist?
- Distribution: binary or source dependency?
- Import: well defined API's or chaos?
- Versioning, upgrades and lifecycle management
- Who maintains it?
- Possible approach: inner source culture

Source: https://medium.com/@jeffwhelpley/the-problem-with-shared-code-124a20fc3d3b, background source: Klara Kulikova on Unsplash

Summary

Generic or specific?

- Consider:
  - YAGNI / Rule of three
  - Cost of generic
  - Scope / level
  - Conway's law
  - Organization



Generic or specific?
It depends.

Source: https://images.unsplash.com/photo-1515611926865-4fcb1c2ce28d?ixlib=rb-4.0.3&dl=kelly-sikkema-kxtB2TFBF2g-unsplash.jpg&q=80&fm=jpg&crop=entropy&cs=tinysrgb

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Questions?
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