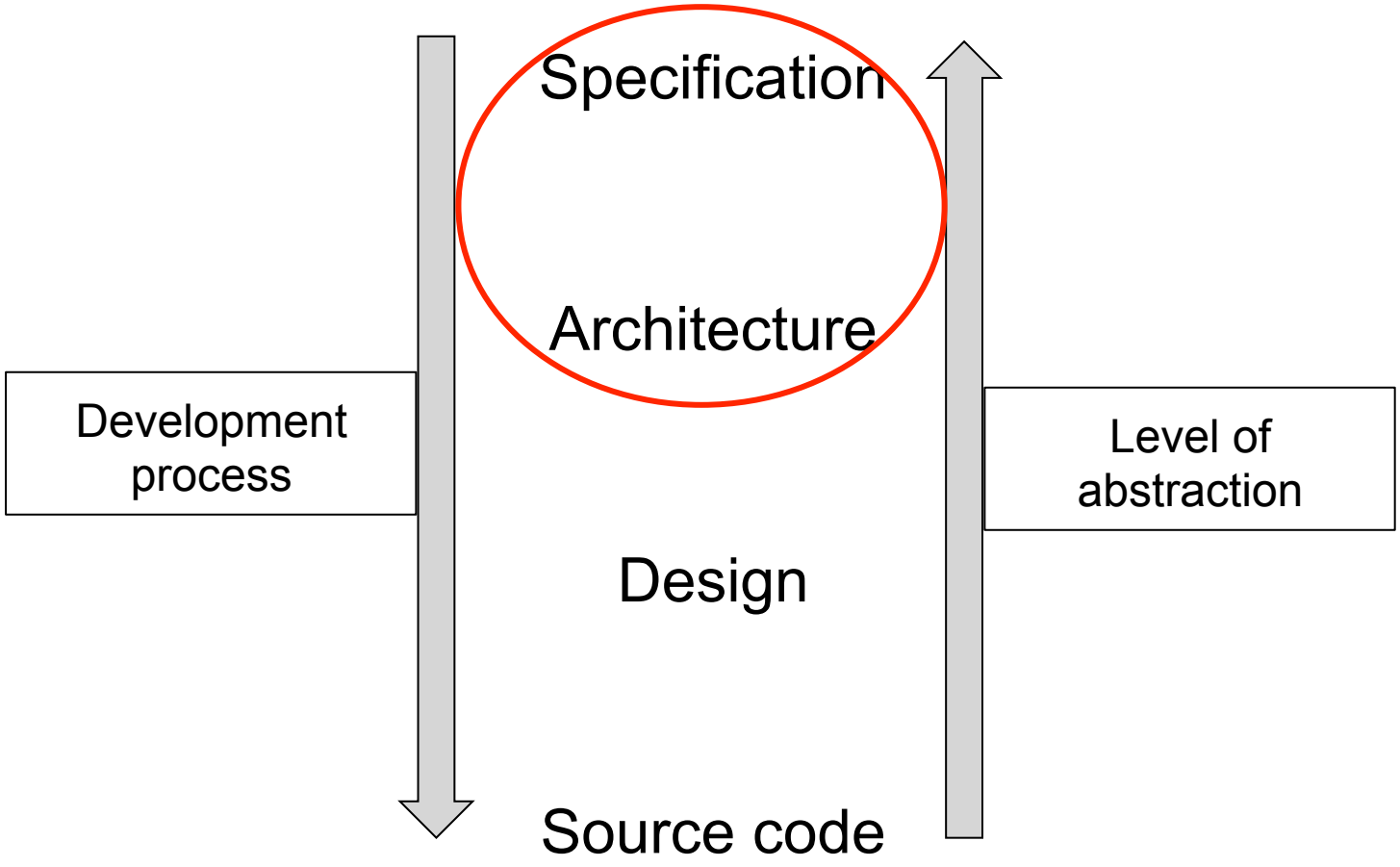
CS 520

Theory and Practice of Software Engineering
Fall 2021

Best and worst software development practices

September 9, 2021

Recap: Software requirements and architecture



Recap: Stakeholders

“individuals and organizations who are actively involved in the project, or whose interests may be positively or negatively affected as a result of project execution or successful project completion”

[Project Management Institute (PMI®), 1996]

Recap: US online banking app example

Recap: Two key types of requirements

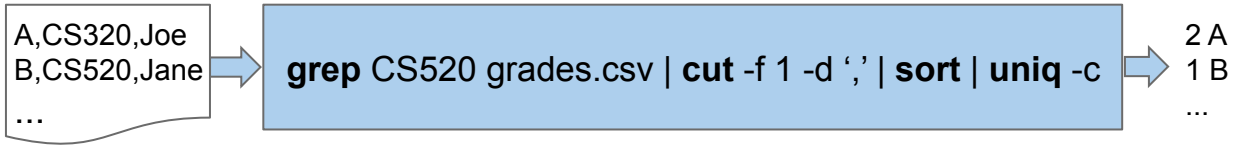
Non-functional requirement: A quality constraint on the software application (often called the 'ilities'), e.g., understandability

Functional requirement: An intended (or unintended) behavior of the software application, e.g., Initially, the electronic gradebook needs to allow registered users to login to it.

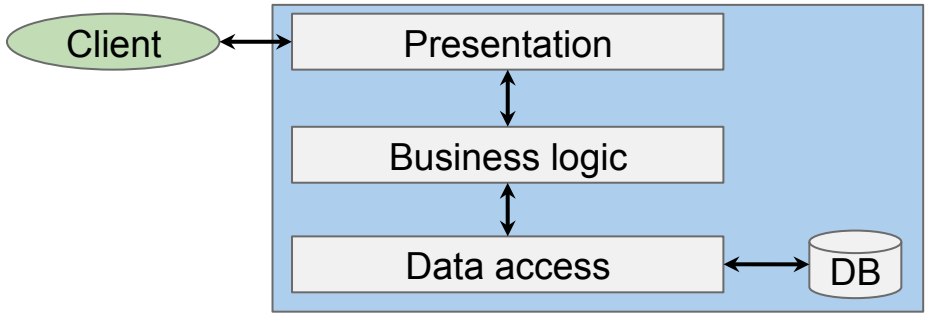
NOTE) There are other types of requirements to describe assumptions, features, and usage scenarios (e.g., UML use cases).

Recap: software architecture examples

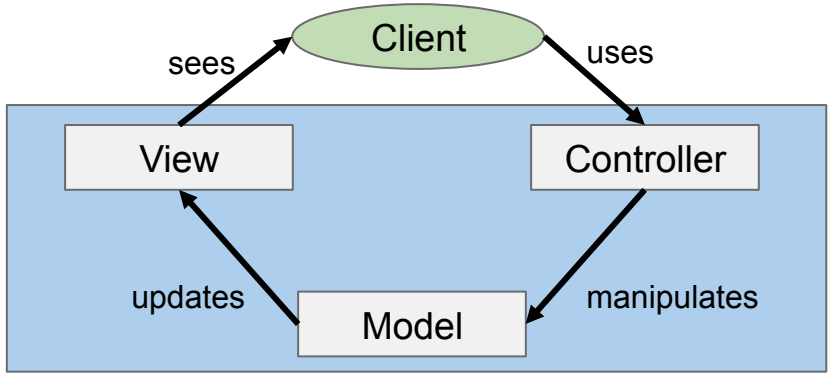
- **Pipe and filter**



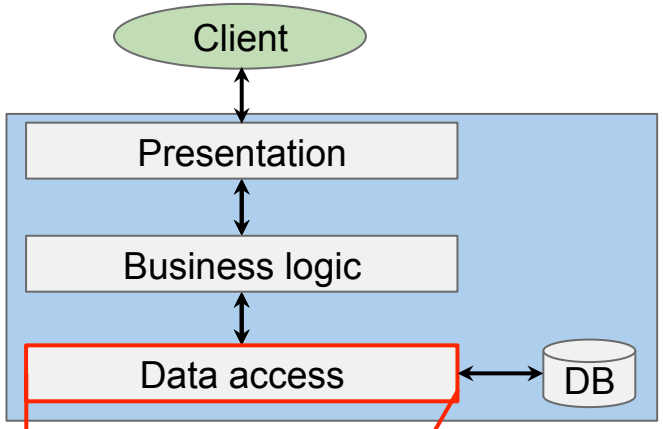
- **N-tier / Client-Server**

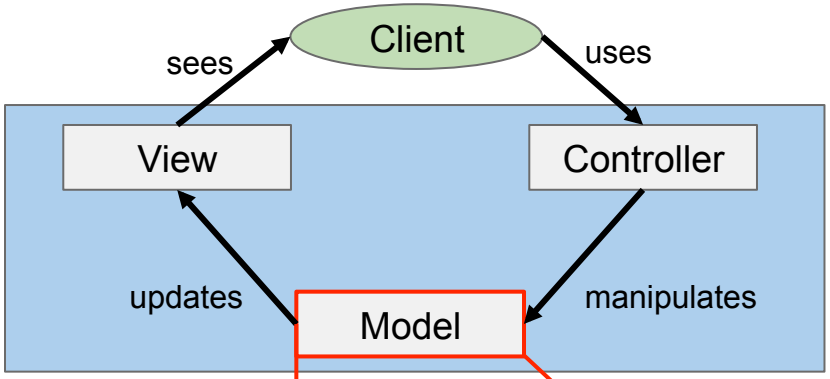


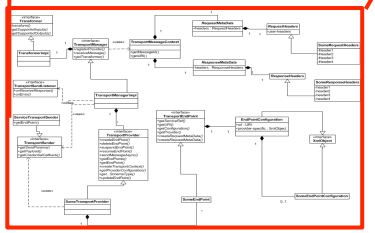
- **MVC (Model-View-Controller)**

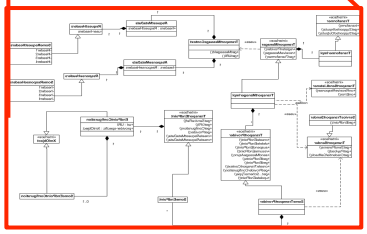


Recap: software architecture and design goals







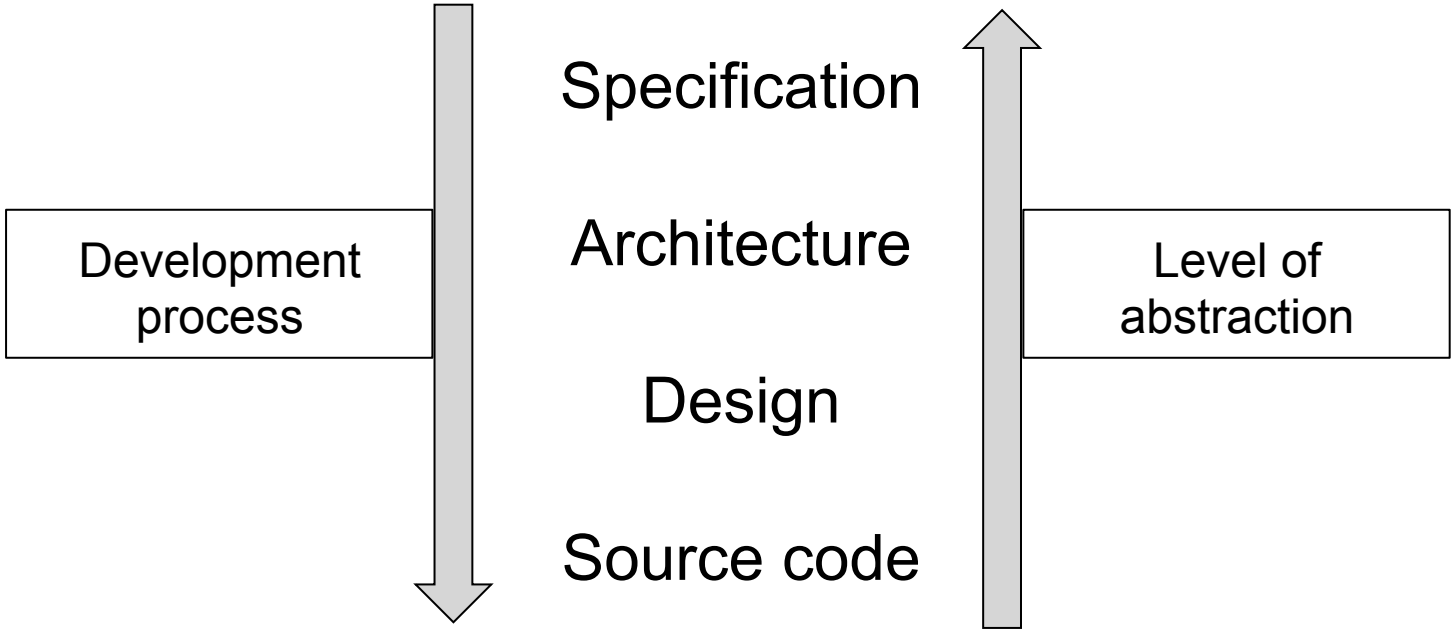


Architecture and design goals

- Lower complexity: separation of concerns, well defined interfaces
- Simplify communication
- Allow effort estimation and progress monitoring

Today

- An in-class discussion on best and worst software development practices.



Setup and goals

- 4- or 5- person teams
- Examples
- 2 rounds
  - **First phase**
    - For each of 4 examples, decide whether it represents good or bad practice.
    - **Goal:** discuss and reach consensus on good or bad practice.
  - **Second phase** (known solutions)
    - For each example, try to understand why it is good or bad practice.
    - **Goal:** come up with one or more explanations or a counter argument.

  and then repeat with 4 more examples

Round 1: Good or bad?

Example 1.1: good or bad?

src/Model-exp.java
src/Model-old.java
src/Model.java
src/View.java
src/GraphicalView.java
src/GraphicalView-opt.java
src/TextualView.java

Example 1.2: good or bad?

src/build.xml
src/Model.java
src/View.java
src/GraphicalView.java
src/TextualView.java
src/README.txt

Example 1.3: good or bad?

```
public enum PaymentType {DEBIT, CREDIT}

public void doTransaction(double amount, PaymentType payType) {
  switch (payType) {
    case DEBIT:
       … // process debit card
       break;
    case CREDIT:
       … // process credit card
       break;
    default:
       throw new IllegalArgumentException("Unexpected payment type");
   }
}
```

Snippet 1.4: good or bad?


```
public File[] getAllLogs(Directory dir) {
   if (dir == null || !dir.exists() || dir.isEmpty()) {
      return null;
   } else {
      int numLogs = … // determine number of log files
      File[] allLogs = new File[numLogs];
      for (int i=0; i<numLogs; ++i) {
         allLogs[i] = … // populate the array
      }
      return allLogs;
   }
}
```

Round 1: why is it good or bad?

Example 1.1: this is bad! why?

src/Model-exp.java
src/Model-old.java
src/Model.java
src/View.java
src/GraphicalView.java
src/GraphicalView-opt.java
src/TextualView.java

Example 1.2: this is good! why?

```
src/build.xml
src/Model.java
src/View.java
src/GraphicalView.java
src/TextualView.java
src/README.txt
```

Snippet 1.3: this is good, but why?

```
public enum PaymentType {DEBIT, CREDIT}

public void doTransaction(double amount, PaymentType payType) {
  switch (payType) {
    case DEBIT:
       … // process debit card
       break;
    case CREDIT:
       … // process credit card
       break;
    default:
       throw new IllegalArgumentException("Unexpected payment ty");
   }
}
```

Snippet 1.4: this is bad! why?

```
public File[] getAllLogs(Directory dir) {
   if (dir == null || !dir.exists() || dir.isEmpty()) {
      return null;
   } else {
      int numLogs = … // determine number of log files
      File[] allLogs = new File[numLogs];
      for (int i=0; i<numLogs; ++i) {
         allLogs[i] = … // populate the array
      }
      return allLogs;
   }
}
```

Round 2: Good or bad?

Example 2.1: good or bad?

src/Mod.java
src/View.java
src/GView.java
src/TView.java

Example 2.2: good or bad?

```
/**
 * Sets the width of this rectangle to the given positive number.
 *
 * @param width The new width
 *
 * @throws IllegalArgumentException when the width is a negative number
 */
public void setWidth(int width) { … }
```

Snippet 2.3: good or bad?

```
public BitSet(int size, boolean initialValue) {
  this.bitSet = new boolean[size];

  for (int i = 0; i < this.bitSet.length; i++) {
    this.bitSet[i] = initialValue;
  }
}
```

Example 2.4: good or bad?


```
public void addStudent(Student student, String course) {
   if (course.equals("CS520")) {
      cs520Students.add(student);
   }
   allStudents.add(student)
}
```

Solutions

- Example 2.1:
- Example 2.2:
- Example 2.3:
- Example 2.4:

Round 2: why is it good or bad?

Example 2.1: this is bad! why?

src/Mod.java
src/View.java
src/GView.java
src/TView.java

Example 2.2: good or bad?

```
/**
 * Sets the width of this rectangle to the given positive number.
 *
 * @param width The new width
 *
 * @throws IllegalArgumentException when the width is a negative number
 */
public void setWidth(int width) { … }
```

Snippet 2.3: this is bad! huh?

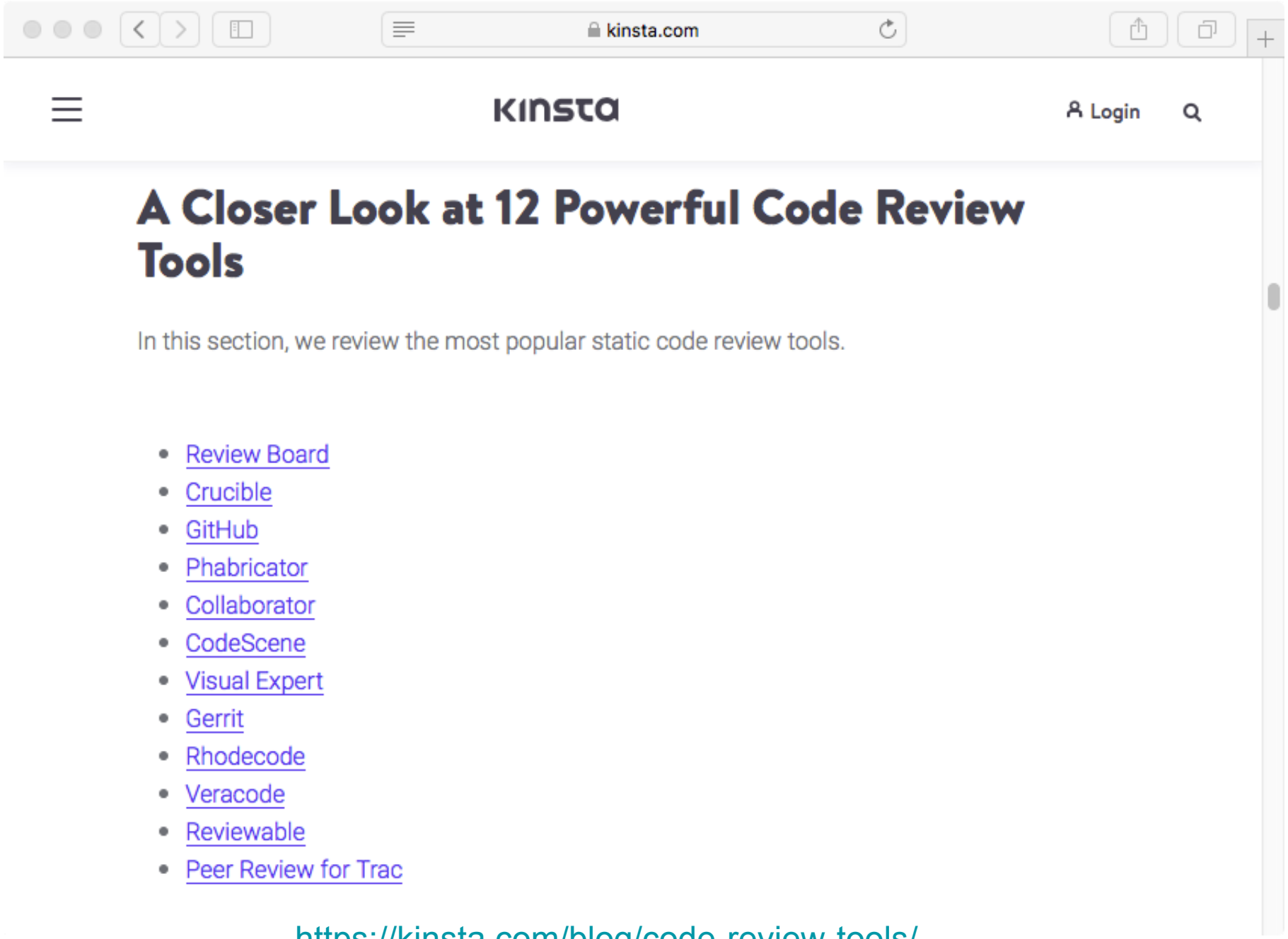
```
public BitSet(int size, boolean initialValue) {
  this.bitSet = new boolean[size];

  for (int i = 0; i < this.bitSet.length; i++) {
    this.bitSet[i] = initialValue;
  }
}
```

Snippet 2.4: short but also bad! why?

```
public void addStudent(Student student, String course) {
   if (course.equals("CS520")) {
      cs520Students.add(student);
   }
   allStudents.add(student)
}
```

Code reviewing



https://kinsta.com/blog/code-review-tools/

Final project description

- Each team of 4 will carry out **one** of the following projects:
  - MSR Mining Challenge
  - Replication Study (e.g., Automated Program Repair)
  - ML Development Toolkits (e.g., Weights & Biases)
  - EleNa: Elevation-based Navigation
- The key phases of the project are: topic selection, mid-point presentation, final presentation (and submission)
- More details available here:

https://people.cs.umass.edu/~hconboy/class/2021Fall/CS520/finalProject.pdf