Bringing Clean Code to Large Scale Legacy C++ Applications

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"What do you mean?"

Legacy C++ Applications

Quote

"Legacy code" is a term often used derogatorily to characterize code that is written in a language or style that

(1) ...the speaker/writer consider outdated and/or
(2) ...is competing with something sold/promoted by the speaker/writer.

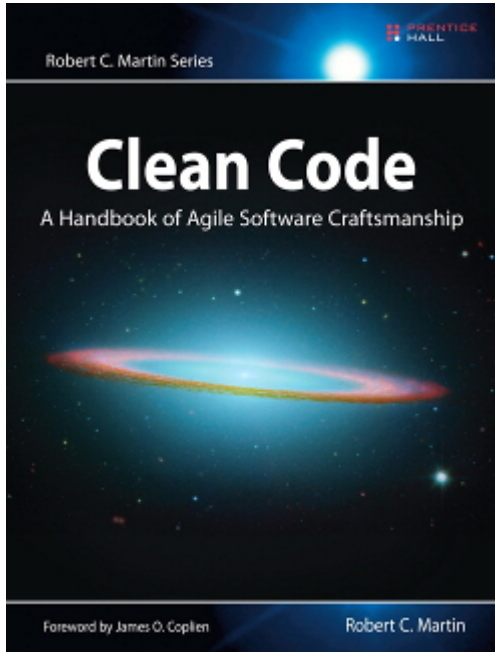
"Legacy code" often differs from its suggested alternative by actually working and scaling.

Bjarne Stroustrup

Large Scale Legacy C++ Applications

Clean Code

Clean Code


Robert C. Martin Series
Clean Code
A Handbook of Agile Software Craftsmanship
Foreword by James O. Coplien
Robert C. Martin

Clean Code

C++ Applications

Clean Code C++ Applications

"I've read the book, but there is not much in it that we can use for C++."

Basic principles are language independent

- KISS
- S.O.L.I.D.
- DRY

Make use of C++ features that make the code more readable and safer

For example:

- range based for
- references vs. pointers
- typedefs
- smart pointers

"But performance!"

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Performance is important.

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Performance is important.

But that does not mean we have to optimize every little piece of code.

Before you manually optimize...

- ... use the right data structures and algorithms.

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- ... trust the optimizer.

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- ... use the right data structures and algorithms.
- ... trust the optimizer.
- ... find the actual bottleneck.

Use. A. Profiler.

</OptimizationRant>

Bringing Clean Code to Large Scale Legacy C++ Applications

Means fighting for maintainability and against code rot in a sea of old C++ code, usually while simultaneously fixing bugs and adding new features.

It's a team game

You can't fight the dragon alone

When we have legacy code now, it's because we let it happen in the past

Make it a team decision

"Legacy knowledge"

Practice

Build awareness for code and habits

Meeting resistance

"That's MY Code!"

Legacy processes and estimates

Refactoring

Refactoring ist the process of restructuring existing computer code without changing its external behavior.

Good refactoring is the key to legacy code

Planned refactoring: Where?

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Determine the "hot spots" of the codebase

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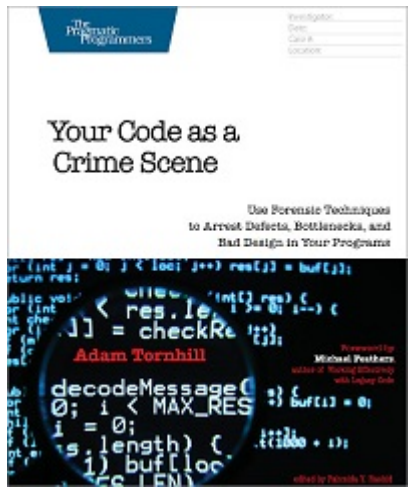
Determine the "hot spots" of the codebase

Adam Tornhill: *Your code as a crime scene*



Planned refactoring: Pick a goal

There is *still* more than enough to do. Pick a goal and work towards it.

- Determine main pain points
- No cosmetic refactoring
- No sidetracking
- Timebox or narrow down the goal

Possible goals

- Automated testing

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- Less bugs

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- Faster development

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- Automated testing
- Less bugs
- Faster development
- Faster onboarding
- Shorter compile times
- Scaling architecture

Separate refactoring from daily maintenance

Safe refactoring

- Safe refactoring needs test coverage
- Unit tests need modularization
- Modularization is achieved through refactoring

Small, provably correct steps

Integration and system tests

Start with large scale decoupling

1. Bring a larger part of code under test
2. Refactor for decoupling using small steps
3. Repeat with finer granularity

Refactoring historically grown spaghetti code

The legacy codebase may have grown without refactoring the architecture

- High coupling
- Original architecture is only present as misleading names

Make the mess complete

- If there are no modules, don't pretend to have them
- Remove misleading namespace borders
- Take apart collections of functionality that is not related
- Disassemble before reassembling the parts

Reassemble

- *Consciously* design a new architecture
- Fit the previously decoupled classes into that architecture
- Grow core(s) around which the new architecture can be evolved

Rewriting instead of refactoring

Rewriting can be an option for smaller components.

Consider having old and new components in parallel until all references are migrated.

Cons

- Errors that had been removed in the old version can be committed again
- Double maintenance while the old component is in place
- Complete decoupling of the component needed first

Pros

- Can start with clean code practices from scratch
- No legacy design to cope with, only the interface matters
- Can use other techniques (e.g. DSLs)

Tooling

- Builtin IDE tooling
- Static analyzers
- Refactoring aides

Problem: Tools may not be present for older compilers/IDEs.

Consider using a newer IDE and compiler

Apart from the tooling they also support modern C++ standards


ONE DOES NOT SIMPLY
SWITCH TO ANOTHER COMPILER

Switching the compiler

- A refactoring goal on its own
- Usually smaller refactorings

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- A refactoring goal on its own
- Usually smaller refactorings
- ... unless you have to get rid of proprietary frameworks

Get help from the compiler

- E.g. when renaming functions and variables
- override & final
- "Strong typedefs"
- Warnings

```
shared_ptr<Node> createTree(TreeData const& data)
{
  auto rootData = data.root();
  auto newNode = make_shared<Node>();
  newNode->configure(rootData);
  for (auto&& subTreeData : data.children()) {
    newNode->add(createTree(subTreeData);
  }
  return newNode;
}
```

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shared_ptr<Node> createTree(TreeData const& data) {
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    auto rootData = data.root();
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```

```
shared_ptr<Node> createTree(TreeData const& data) {
  auto createNode = [&](){
    auto rootData = data.root();
    auto newNode = make_shared<Node>();
    newNode->configure(rootData);
    return newNode;
  };
  auto newNode = createNode();
  for (auto&& subTreeData : data.children()) {
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shared_ptr<Node> createTree(TreeData const& data) {
  auto createNode = [](TreeData const& data){
    auto rootData = data.root();
    auto newNode = make_shared<Node>();
    newNode->configure(rootData);
    return newNode;
  };
  auto newNode = createNode(data);
  for (auto&& subTreeData : data.children()) {
    newNode->add(createTree(subTreeData);
  }
  return newNode;
}
```

```
auto createNode(TreeData const& data) {
  auto rootData = data.root();
  auto newNode = make_shared<Node>();
  newNode->configure(rootData);
  return newNode;
}

shared_ptr<Node> createTree(TreeData const& data) {
  auto newNode = createNode(data);
  for (auto&& subTreeData : data.children()) {
    newNode->add(createTree(subTreeData);
  }
  return newNode;
}
```

```
auto createNode(NodeData const& data) {
  auto newNode = make_shared<Node>();
  newNode->configure(data);
  return newNode;
}

shared_ptr<Node> createTree(TreeData const& data) {
  auto newNode = createNode(data.root());
  for (auto&& subTreeData : data.children()) {
    newNode->add(createTree(subTreeData);
  }
  return newNode;
}
```

Wrap up

- Costly and long term
- Tests are important
- Team is even more important

Questions?

Thank you!

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