Managing OO Projects

- Introduction
- The Waterfall Model
- OO and the Iterative Model
- Metrics and Management

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Introduction

- How Software goes bad.
- OO Improves the Quality of a Software Product

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How Software goes bad.

- Interdependencies between modules increase with time.
- Traditional Software Methods Promote Fragile Dependency Structures.

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Interdependencies between modules increase with time.

- Maintainability is lost
- Flexibility is lost
- Reusability is lost

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Traditional Software Methods Promote Fragile Dependency Structures.

- Abstractions depend upon Details
- Data are not encapsulated
- Interfaces are fat

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OO Improves the Quality of a Software Product

- OO provides tools for Managing Dependencies

- OO Promotes Dependency Inversion.

- Strategically Inverting Dependencies improves Software Quality

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OO provides tools for Managing Dependencies

- Polymorphism
- Abstract Interfaces

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OO Promotes Dependency Inversion.

- Details depend upon Abstractions.
- Data are encapsulated.
- Interfaces are narrow and abstract.

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Strategically Inverting Dependencies improves Software Quality

- Firewalls are constructed between modules.

- Increased Maintainability.

- Increased Flexibility

- Increased Reusability

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The Waterfall Model

- Waterfall: The original idea.

- Waterfall: As implemented today.

- In small - medium projects (10KLOC - 50KLOC) this works well.

- The larger the project, the worse Waterfall becomes.

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Waterfall: The original idea.

- Separate project into phases.
- Phases run concurrently, output of one feeds input of next
- Feedback from downstream phases cause rework in upstream phases.

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Waterfall: As implemented today.

- Separate project into phases: Analysis, Design, Implementation, Test.

- Prior to start, have software team commit to dates for each phase.

- Downstream phases begin only after upstream phases conclude.

- Workers have "Throw it over the wall" mentality.

- No part of the project works until the end when it all comes together.

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In small - medium projects (10KLOC - 50KLOC) this works well.

- Estimates can be reasonably accurate.

- Slush can be built in to the project time.

- An X% overrun seems worse on a large project than on a small one.

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The larger the project, the worse Waterfall becomes.

- Analysis and design are not binary Deliverables.

- Estimates get more inaccurate as time proceeds

- Analysis and Design get more inaccurate as time proceeds.

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Analysis and design are not binary Deliverables.

- There is no way to tell when they are done, so they are always done on time.

- They are built without feedback, so there is no way to tell if they are correct.

- Often the producers of the documents carry little responsibility for them.

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Estimates get more inaccurate as time proceeds

- Because Analysis and Design are always done on time, schedule inaccuracies are not seen until too late.

- Implementation is a binary deliverable, so it is always where the debt accrued by analysis and design is paid.

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Analysis and Design get more inaccurate as time proceeds.

- The lack of feedback means the analysis and design are wrong.

- The hard schedule dates mean that there is no time for the analysis and design documents to be fixed.

- At the end, the project is very late, and does not look much like its analysis and design.

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OO and the Iterative Model

- The Most Important Output of the OO Process is the Dependency Structure of the Software.

- Dependency Structures Evolve as the Software is Built.

- The Waterfall Model is Incompatible with the Goals of OO

- The Iterative Model Supports the Goals of OO.

- What is the Iterative Model?

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The Most Important Output of the OO Process is the Dependency Structure of the Software.

- It is this structure that must be managed if the software is to be:
  - Maintainable
  - Robust
  - Flexible
  - Reusable

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Dependency Structures Evolve as the Software is Built.

- The dependencies shift and jitter as more features are added to the system.

- This "jitter" must always be monitored and managed.

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The Waterfall Model is Incompatible with the Goals of OO

- There is no way to anticipate all the dependencies up front.

- There is no feedback to fix the interdependencies once they start to proliferate.

- Projects decrease in quality, flexibility, maintainability and reusability as the Waterfall proceeds.

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The Iterative Model Supports the Goals of OO.

- It allows the software to evolve without being completely planned.

- There are Feedback Loops that

- Estimates and Design information get more accurate as time passes.

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What is the Iterative Model?

- The iterative model is begun with a very small amount of up-front analysis and design.

- Project is then divided into "slices".

- The most complex slice is chosen.

- The slice is analyzed and designed by a miniature waterfall, with the feedback loops in place.

- Completion of the slice provides important data.

- You can apply this data to the rest of the slices.

- As knowledge increases, earlier slices will need rework.

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Project is then divided into "slices".

- These slices are small, yet they must be demonstrable.

- They may be based upon feature sets, or on architectural entities.

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The most complex slice is chosen.

- The importance of this should not be underestimated. This step <u>calibrates</u> the rest of the process.

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The slice is analyzed and designed by a miniature waterfall, with the feedback loops in place.

- No dates are placed upon the completion of analysis and design of a slice.

- Analysis and Design of the slice will probably be concurrent and will also probably overlap with the implementation.

- The Slice is implemented and then demonstrated.

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Completion of the slice provides important data.

- Some part of the software is working.
- How long it took to get it working.

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You can apply this data to the rest of the slices.

- With every slice, the timing data gets more accurate.

- With every slice the analysis and design get more accurate.

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As knowledge increases, earlier slices will need rework.

- This is a cost of the technique.

- However, rework occurs in Waterfall too, but outside of the analysis and design.

- In the iterative technique, rework becomes part of subsequent slices.

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Metrics and Management

- Tom Demarco: You can't manage what you can't control, you cant control what you don't measure.

- The Iterative method "cries out" for measurement.

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Tom Demarco: You can't manage what you can't control, you cant control what you don't measure.

- Without data, all managers can do is "Motivate", and cross their fingers.

- When "Motivation" fails, "Mandation" often follows. With little effect.

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The Iterative method "cries out" for measurement.

- Slices can be measured.

- Those measurements are valid when applied to subsequent slices.

- They may also be valid when applied to other projects.

- A repository of such measurements will provide management with data for use in future projections.

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Slices can be measured.

- Time to completion.
- Number of changes.
- Number of bugs
- Design quality metrics.

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