Effective Teamwork and Practical Integration: Software Configuration Management in Context

September 20, 2004

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DEVELOP YOUR EXPERTISE

Agenda

- Introductions
- Background
  - SCM and The Development Process.
  - Patterns and SCM Pattern Languages.
  - Software Configuration Management Concepts.
- SCM Patterns
- Questions

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About Me

- Software Developer, Architect, Consultant
- Startup and established company experience
- Author
- Systems ranging from Travel Web sites, to enterprise systems, to space science systems.
- Agile and Iterative Development.

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Who Are You?
Why are you here?

- Name
- Role in your organization
- What you hope to walk out of this session with.

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Part I: Background/Foundation

Common Problems

- Code Freezes.
- “Builds for me…”
- “Works for me!”
- Long integration times at end of project.

What is *Agile SCM?*

- *Individuals and Interactions* over Processes and Tools
  - SCM Tools should support the way that you work, not the other way around.
- *Working Software* over Comprehensive Documentation
  - SCM can automate development policies & processes: Executable Knowledge over Documented Knowledge.

…What is *Agile SCM*?

- *Customer Collaboration* over Contract Negotiation.
  - SCM should facilitate communication among stakeholders and help manage expectations.
- *Responding to Change* over Following a Plan.
  - SCM is about facilitating change, not preventing it.

Traditional View of SCM

- Configuration Identification
- Configuration Control
- Status Accounting
- Audit & Review
- Build Management
- Process Management, etc

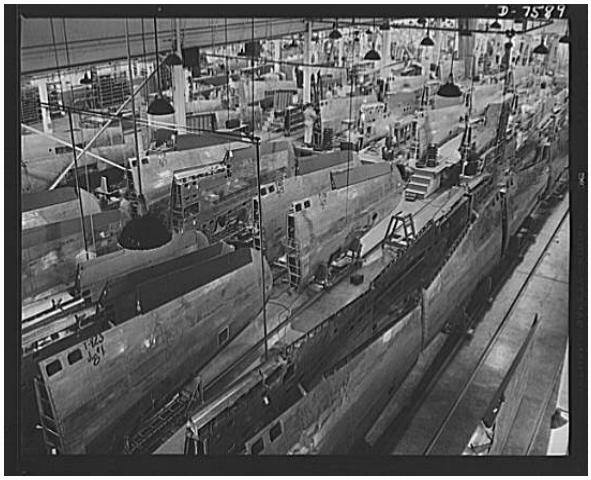
Effective SCM

- Who?
- What?
- When?
- Where?
- Why?
- How?

SCM as an Enabling Tool

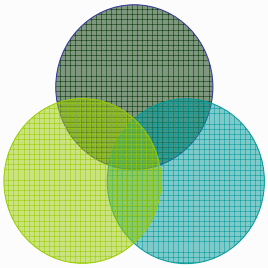
- SCM Enables:
  - Increased productivity
  - Enhanced responsiveness to customers
  - Increased quality

SCM Concepts



Part of the Puzzle

- Architecture
- Software Configuration Management
- Culture/Organization



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What SCM Does for You

- Reproducibility
- Integrity
- Consistency
- Coordination

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SCM Done Badly Can:

- Slow down development
- Frustrate developers
- Limit customer options

Alternate Definition of SCM

- SCM is a set of structures and actions that enable you to build systems in repeatable, agile fashion while improving quality and helping your customers feel more confident.
- SCM facilitates frequent feedback on build quality and product suitability.

Core SCM Practices

- Frequent feedback on build quality, and product suitability
- Version Management
- Release Management
- Build Management
- Unit & Regression Testing

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SCM Concepts & Definitions

- Codeline/Branch
- Versioning Concepts
  - Configuration
  - Version
  - Revision
  - Label
- Workspace

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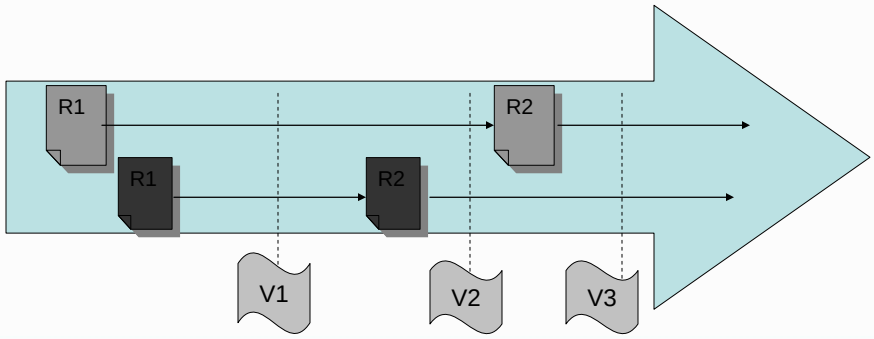
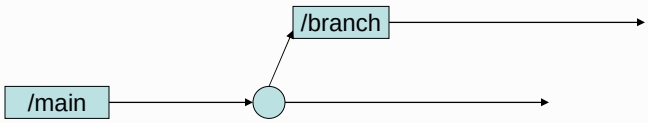
Codeline

- A **codeline** contains every version of every artifact over one evolutionary path.



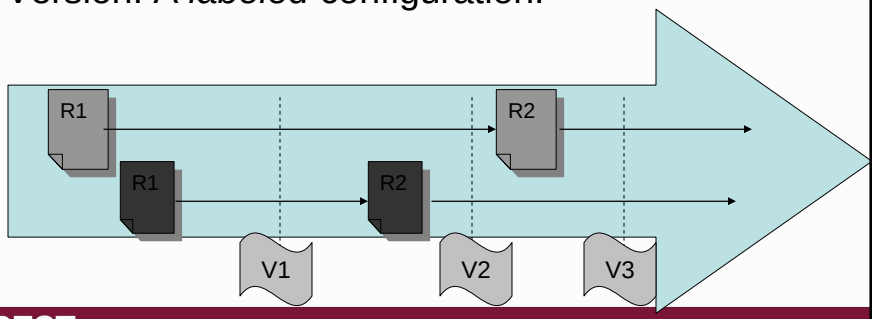
Branching

- **Branch**: A *codeline* that contains work that derives (and diverges) from another codeline.
- **Branch** of a file: A revision of a file that uses the trunk revision as a starting point.



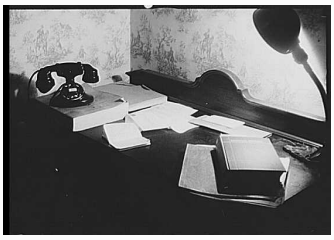
Versions, Revisions and Labels

- Revision: An element at a point in time.
- Configuration: A snapshot of the codeline at a point in time.
- Version: A *labeled* configuration.

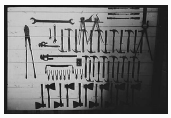


Workspace

- Everything you need to build an application:
  - Code
  - Scripts
  - Database resources, etc

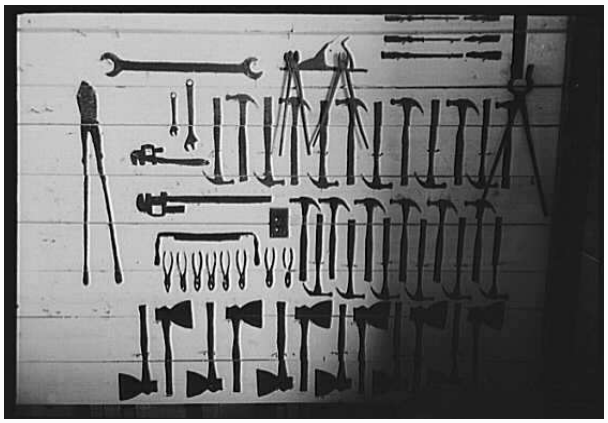


What are *Patterns* and Pattern Languages?

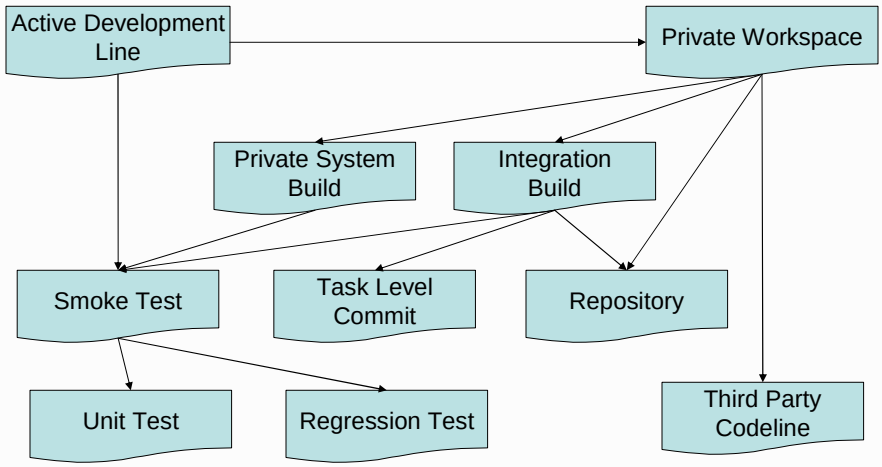


- A *pattern* is a solution to a problem in a context.
- Patterns capture common knowledge.
- Pattern *languages* guide you in the process of building something using patterns. Each pattern is applied in the correct way at the correct time.

Part II: The Patterns



Workspace Patterns



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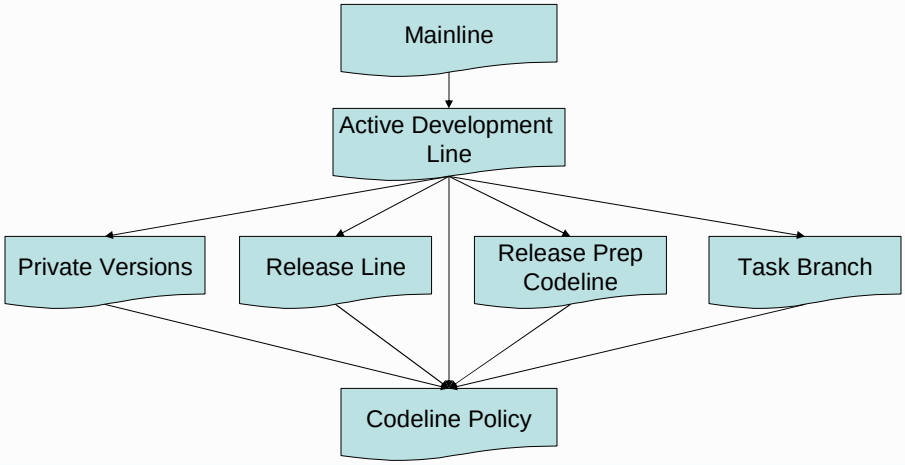
Codeline Patterns



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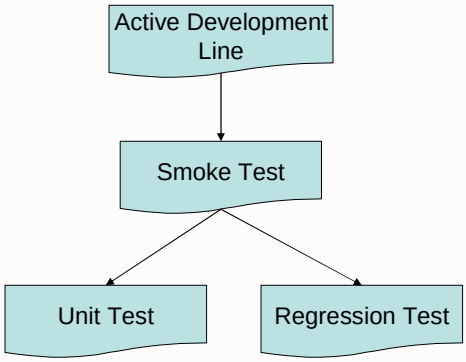
A Word about Context



- *Smoke Test* "completes" *Active Development Line.*
- *Smoke Test* applies in the context of *Active Development Line.*
- Arrows point from context to the "next" pattern.

Effective Codeline Structures

- How many codelines should you be working from?
- What should the rules be for check-ins?
- Codelines are the integration point for everyone's work.
- Codeline structure determines the rhythm of the project.

Mainline

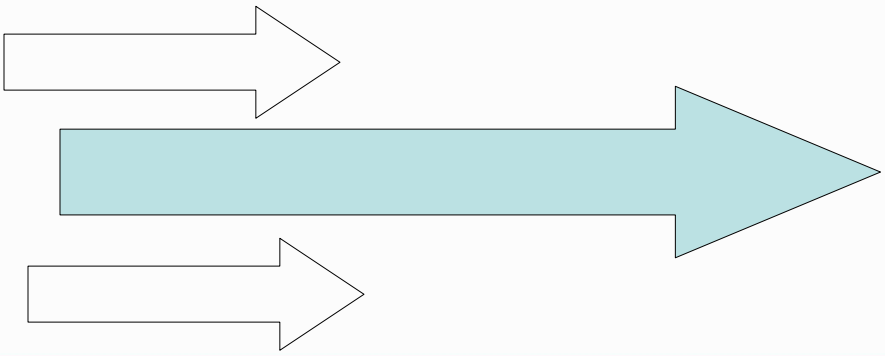
- You want to simplify your codeline structure.
- **How do you keep the number of codelines manageable (and minimize merging)?**

Mainline (Forces & Tradeoffs)

- A Branch is a useful tool for isolating yourself from change.
- Branching can require merging, which can be difficult.
- Separate codelines seem like a logical way to organize work.
- You will need to integrate all of the work together.
- You want to maximize concurrency while minimizing problems cause by deferred integration.

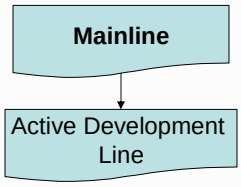
Mainline (Solution)

- When in doubt, do all of your work off of a single *Mainline*.



Mainline (Unresolved)

- Simplicity with speed and *enough* stability: *Active Development Line*.



Active Development Line

- You are developing on a *Mainline*.
- **How do you keep a rapidly evolving codeline stable enough to be useful (but not impede progress)?**

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Active Development Line (Forces & Tradeoffs)

- A Mainline is a synchronization point.
- More frequent check-ins are good.
- A bad check-in affects everyone.
- If testing takes too long: Fewer check-ins:
  - Human Nature
  - Time
- Fewer check-ins slow project's pulse.

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Active Development Line (Solution)

- Use an *Active Development Line*.
- Have check-in policies suitable for a “good enough” codeline.

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Active Development Line (Unresolved)

- Doing development: *Private Workspace*
- Keeping the codeline stable: *Smoke Test*
- Managing maintenance versions: *Release Line.*
- Dealing with potentially tricky changes: *Task Branch.*
- Avoiding code freeze: *Release Prep Codeline.*

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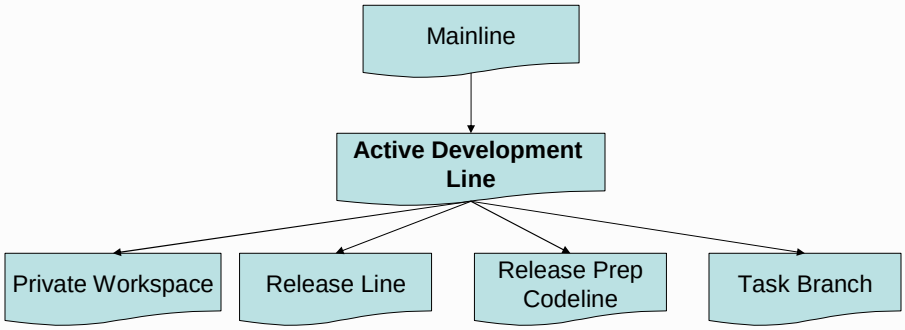
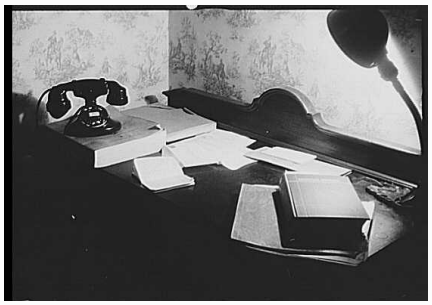
Active Development Line Context



Private Workspace

- You want to support an *Active Development Line.*
- **How do you keep current with a dynamic codeline and also make progress without being distracted by your environment changing from beneath you?**



Private Workspace (Forces & Tradeoffs)

- Frequent integration avoids working with old code.
- People work in discrete steps: Integration can never be “continuous.”
- Sometimes you need different code.
- Too much isolation makes life difficult for all.

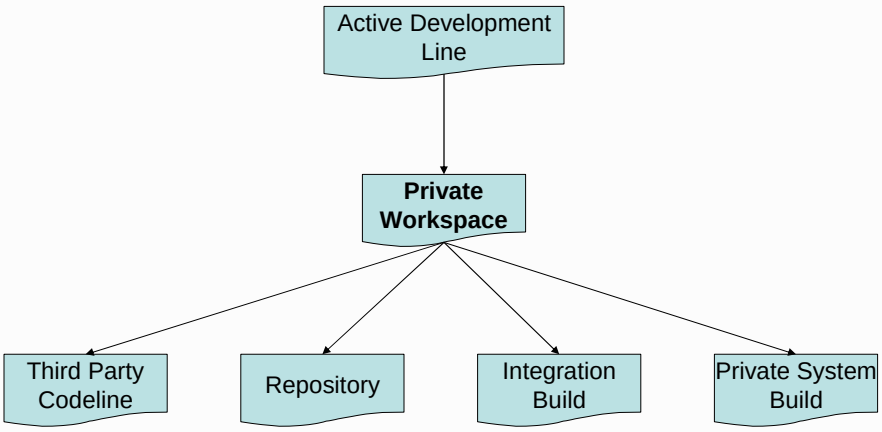
Private Workspace (Solution)

- Create a *Private Workspace* that contains everything you need to build a working system. You control when you get updates.
- Before integrating your changes:
  - Update
  - Build
  - Test

Private Workspace (Unresolved)

- Populate the workspace: *Repository.*
- Manage external code: *Third Party Codeline.*
- Build and test your code: *Private System Build.*
- Integrate your changes with others: *Integration Build.*

Private Workspace Context



Repository

- *Private Workspace* and *Integration Build* need components.
- **How do you get the right versions of the right components into a new workspace?**

Repository (Forces & Tradeoffs)

- Many things make up a workspace: code, libraries, scripts.
- You want to be able to easily build a workspace from nothing.
- These components could come from a variety of sources (3rd Parties, other groups, etc).

Repository (Solution)

- Have a single point of access for everything.
- Have a mechanism to support easily getting things from the *Repository*.

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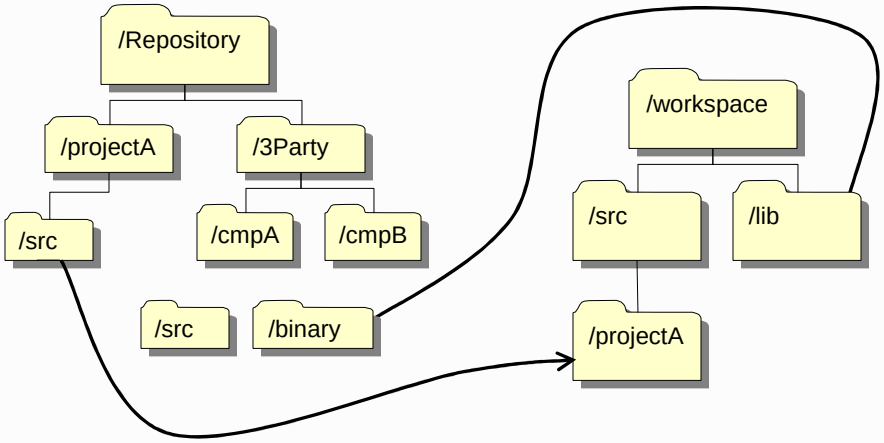
Mapping from Repository to Workspace



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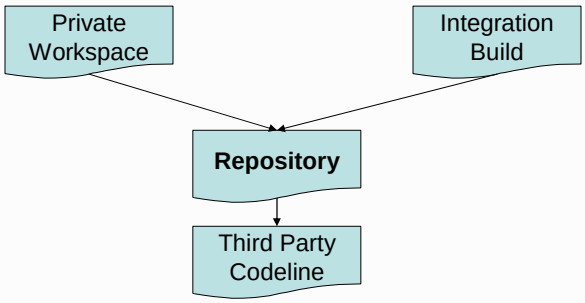
Repository (Unresolved)

- Manage external components: *Third Party Codeline*



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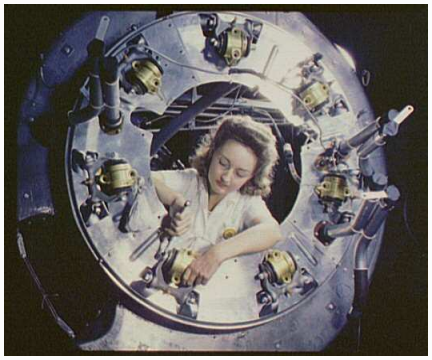
Private System Build

- You need to build to test what is in your *Private Workspace*.
- **How do you verify that your changes do not break the system before you commit them to the *Repository*?**



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Private System Build (Forces & Tradeoffs)

- Developer Workspaces have different requirements than the system integration workspace.
- The system build can be complicated.
- Checking things in that break the *Integration Build* is bad.

DEVELOP YOUR EXPERTISE

Private System Build (Solution)

- Build the system using the same mechanisms as the central integration build, a *Private System Build*.
- This mechanism should match the integration build.
- Do this before checking in changes!
- Update to the codeline head before a build.

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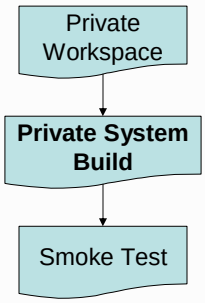
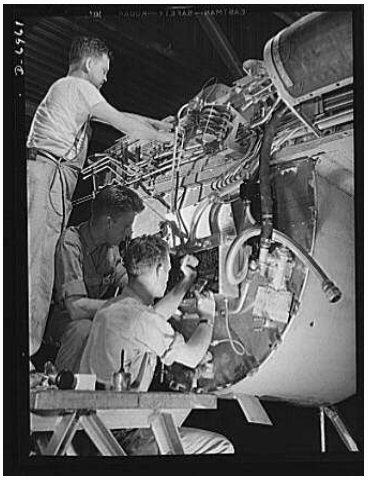
Private System Build (Unresolved)

- Testing what you built: *Smoke Test.*



Integration Build

- What is done in a *Private Workspace* must be shared with the world.
- **How do you make sure that the code base always builds reliably?**



Integration Build (Forces & Tradeoffs)

- People do work independently.
- *Private System Build*s are a way to check the build.
- Building everything may take a long time.
- You want to ensure that what is checked-in works.

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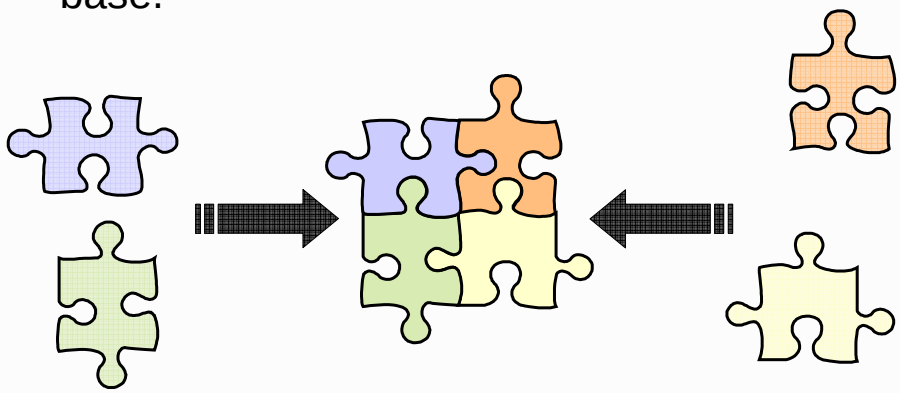
Integration Build (Solution)

- Do a centralized build for the entire code base.



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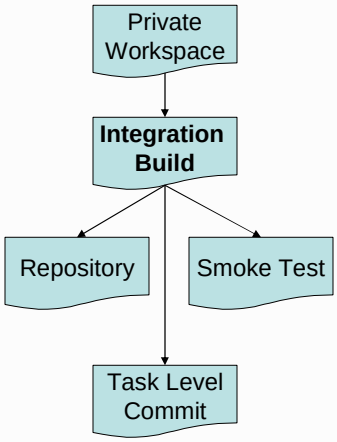
Integration Build (Unresolved)

- Testing that the product of the build still works: *Smoke Test*.
- Build products may need to be available for clients to check out.
- Figure out what broke a build: *Task Level Commit.*



Third Party Codeline

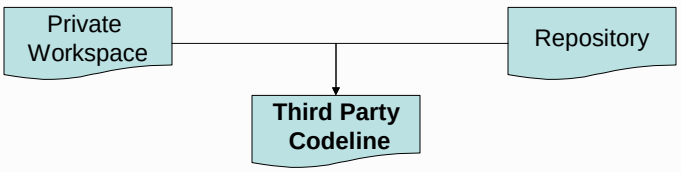
- *Private Workspaces* and the *Repository* need the right versions of external components.
- **How do you coordinate versions of external components with your versions?**

Third Party Codeline (Forces & Tradeoffs)

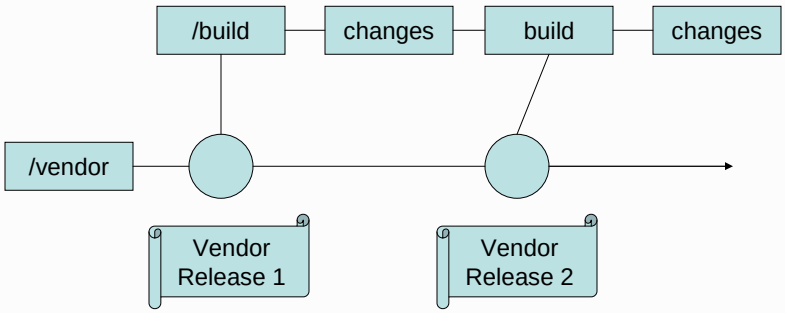
- Vendor releases do not match your releases.
- Sometimes you alter external code (open source, etc) or apply patches.

Third Party Codeline (Solution)

- Use the same mechanisms as you do for your code to create a *Third Party Codeline*.
- Label the codeline to associate snapshots with your versions.

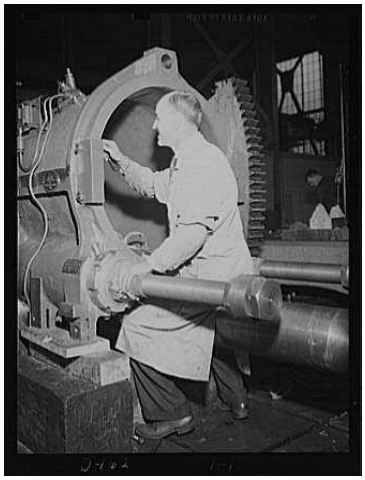


Third Party Codeline (Structure)



Task Level Commit

- You need to associate changes with an *Integration Build*.
- **How much work should you do before checking in files?**



Task Level Commit (Forces & Tradeoffs)

- The smaller the task, the easier it is to roll back.
- A check-in requires some work.
- It is tempting to make many small changes per check-in.
- You may have an issue tracking system that identifies units of work.

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Task Level Commit (Solution)

- Do one commit per small-grained task.

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Codeline Policy

- *Active Development Line* and *Release Line* (etc) need to have different rules.
- **How do developers know how and when to use each codeline?**

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Codeline Policy (Forces & Tradeoffs)

- Different codelines have different needs, and different rules.
- You need documentation. (But how much?)
- How do you explain a policy?

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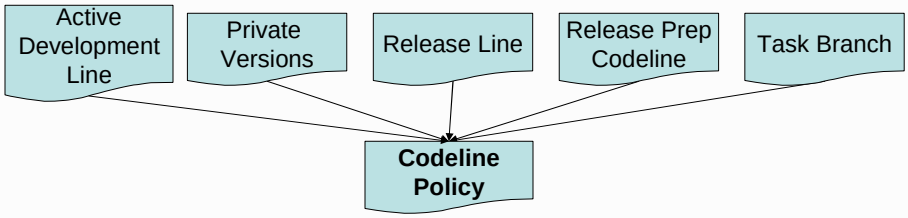
Codeline Policy (Solution)

- Define the rules for each codeline as a *Codeline Policy*. The policy should be concise and auditable.
- Consider tools to enforce the policy.



Smoke Test

- You need to verify an *Integration Build* or a *Private System Build* so that you can maintain an *Active Development Line.*
- **How do you verify that the system still works after a change?**

Smoke Test (Forces & Tradeoffs)

- Exhaustive testing is best for ensuring quality.
- The longer the test, the longer the check-in, resulting in:
  - Less frequent check-ins.
  - Baseline more likely to have moved forward.

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Smoke Test (Solution)

- Subject each build to a *Smoke Test* that verifies that the application has not broken in an obvious way.

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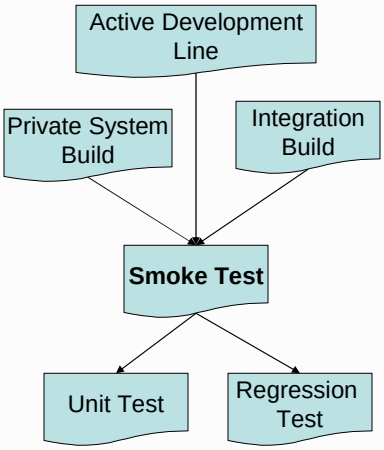
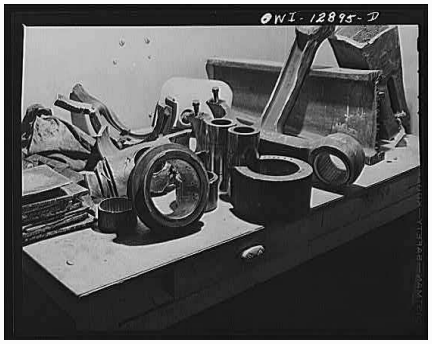
Smoke Test (Unresolved)

- A *Smoke Test* is not comprehensive. You will need to find:
  - Problems you think are fixed: *Regression Test*
  - Low level accuracy of interfaces: *Unit Test*



Unit Test

- A *Smoke Test* is not enough to verify that a module works at a low level.
- **How do you test whether a module still works after you make a change?**



Unit Test (Forces & Tradeoffs)

- Integration identifies problems, but makes it harder to isolate problems.
- Low level testing is time consuming.
- When you make a change to a module you want to check to see if the module still works before integration so that you can isolate the problems.

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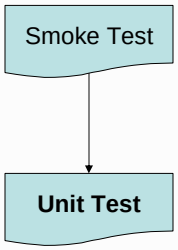
Unit Test (Solution)

- Develop and run *Unit Tests*
- *Unit Tests* should be:
  - Automatic/Self-evaluating
  - Fine-grained
  - Isolated
  - Simple to run



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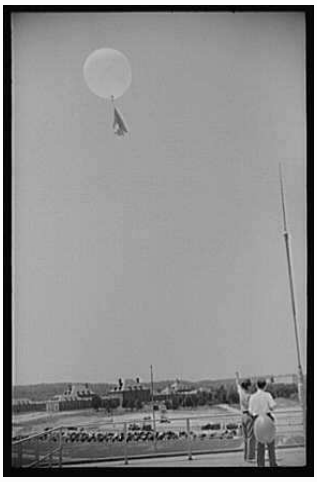
Regression Test

- A *Smoke Test* is good but not comprehensive.
- **How do you ensure that existing code does not get worse after you make changes?**

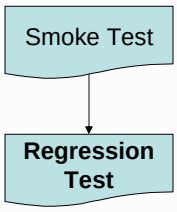


Regression Test (Forces & Tradeoffs)

- Comprehensive testing takes time.
- It is good practice to add a test whenever you find a problem.
- When an old problem recurs, you want to be able to identify when this happened.

Regression Test (Solution)

- Develop *Regression Tests* based on test cases that the system has failed in the past.
- Run *Regression Tests* whenever you want to validate the system.



Private Versions

- An *Active Development Line* will break if people check in half-finished tasks.
- **How can you experiment with complex changes and still get the benefits of version management?**

Private Versions (Forces & Tradeoffs)

- Sometimes you may want to checkpoint an intermediate step of a long, complex change.
- Your version management system provides the facilities for checkpointing.
- You don't want to publish intermediate steps.

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Private Versions (Solution)

- Provide developers with a mechanism for checkpointing changes using a simple interface.
- Implement as:
  - Private History
  - A Private Repository
  - A Private Branch
- [*Compare with* Task Branch *for long lived /joint efforts.*]

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Release Line

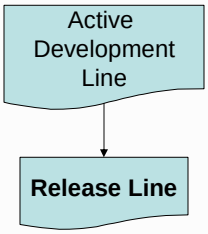
- You want to maintain an *Active Development Line*.
- **How do you do maintenance on a released version without interfering with current work?**

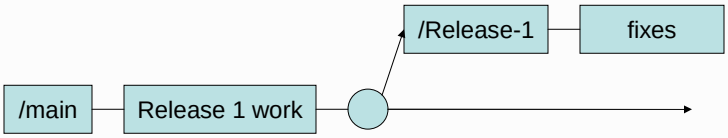
Release Line (Forces & Tradeoffs)

- A codeline for a released version needs a *Codeline Policy* that enforces stability.
- Day-to-day development will move too slowly if you are trying to always be ready to ship.

Release Line (Solution)

- Split maintenance/release activity from the *Active Development Line* and into a *Release Line*.
- Allow the line to progress on its own for fixes.





DEVELOP YOUR EXPERTISE

Release Prep Codeline

- You want to maintain an *Active Development Line*.
- **How do you stabilize a codeline for an imminent release while allowing new work to continue on an active codeline?**

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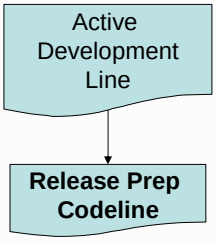
Release-Prep Codeline (Forces & Tradeoffs)

- You want to stabilize a codeline so you can ship it.
- A code freeze slows things down too much.
- Branches have overhead.

DEVELOP YOUR EXPERTISE

Release Prep Codeline (Solution)

- Branch instead of freeze. Create a *Release Prep Codeline* (a branch) when code is approaching release quality.
- Leave the *Mainline* for active development.
- The *Release Prep Codeline* becomes the *Release Line* (with a stricter policy)
- Note: If only a few people are doing work on the next release, consider a *Task Branch* instead.



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Task Branch

- Some tasks have intermediate steps that would disrupt an *Active Development Line*.
- **How can your team make multiple, long-term, overlapping changes to a codeline without compromising its integrity?**

DEVELOP YOUR EXPERTISE

Task Branch (Forces & Tradeoffs)

- Version Management is a communication mechanism.
- Sometimes only part of a team is working on a task.
- Some changes have many steps.
- Branching has overhead.

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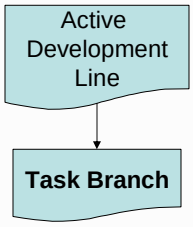
Task Branch (Solution)

- Create a *Task Branch* off of the *Mainline* for each activity that has significant changes for a codeline.
- Integrate this codeline back into the *Mainline* when done.
- Be sure to integrate changes from the *Mainline* into this codeline as you go.
- [*Compare with* Private Versions.]



DEVELOP YOUR EXPERTISE

Wrap Up

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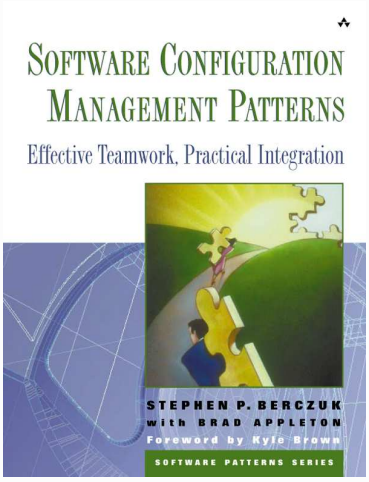
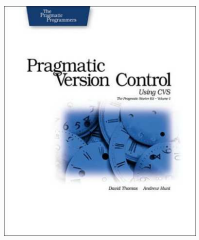
The SCM Patterns Book



- Pub Nov 2002 By Addison-Wesley Professional.
- ISBN: 0201741172

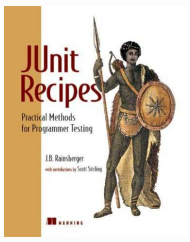
DEVELOP YOUR EXPERTISE

Other Books of Interest



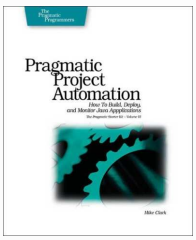
Pragmatic Version Control

by Andy Hunt & Dave Thomas



JUnit Recipies

by J. B. Rainsberger



Pragmatic Project Automation

by Mike Clark

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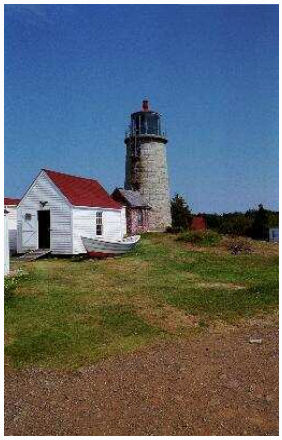
Other Pointers

- www.scmpatterns.com
- acme.bradapp.net
- www.berczuk.com
- www.cmcrossroads.com

- steve@berczuk.com



DEVELOP YOUR EXPERTISE

Questions?

- ?

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