Software Development Best Practices

Part I

Best Practices

- Describe best practices in rapid development
- Result of 20 years or more experience from many developers
- Common sense to less obvious
- Excluded
  - Fundamental development practices
  - Best philosophy but not best practice
  - Best practice, maybe, but not for development speed
  - Insufficient evidence

Ratings

- Efficacy
  - Potential reduction from nominal schedule
    - None = 0%
    - Fair = 0-10%
    - Good = 10-20%
    - Very Good = 20-30%
    - Excellent = 30%+
  - Improvement in progress visibility
    - None = 0%
    - Fair = 0-25%
    - Good = 25-50%
    - Very Good = 50-75%
    - Excellent = 75%+

Ratings

- Efficacy
  - Effect on schedule risk
    - Decreased
    - No effect
    - Increased
  - Chance of first-time and long-term success
    - Poor = 0-20%
    - Fair = 20-40%
    - Good = 40-60%
    - Very Good = 60-80%
    - Excellent = 80%+

Change Board

- Approach to controlling changes in the product
  - Brings together representatives from all parties
    - Development, QA, Doc, Customer support, Marketing, etc.
  - Gives representatives authority for accepting or rejecting proposed changes
  - Raises visibility of feature creep, reduces number of uncontrolled changes, keeps all parties involved

Change Board

- Efficacy
  - Potential reduction from nominal schedule: Fair
  - Improvement in progress visibility: Fair
  - Effect on schedule risk: Decreased Risk
  - Chance of first-time success: Very Good
  - Chance of long-term success: Excellent
- Major Risks
  - Approving too few or too many changes

Daily Build and Smoke Test

- A process where the product is completely built every day and put through some basic tests to see if it “smokes” when turned on
- On a typical project there are many developers that must integrate their code
  - “Build” means the product is compiled ,linked, and combined into an executable at the end of each day
  - Test is a simple one that exercises basic functionality

Time Savings of Daily Build

- Minimized integration risk
  - Integrating code from team members one of the greatest risks
  - Daily build keeps integration errors small and manageable
- Reduces risk of low quality
  - Minimal smoke testing every day helps keep quality problems from taking over
- Easier defect diagnosis
  - Easier to pinpoint why something is broken on any given day; changes since last day; incremental development
- Supports progress monitoring
  - Obvious what features are present and missing
- Improves morale
  - Boost in morale to see the product work and progress made
  - Also applies to customer relations

Using the Daily Build and Smoke Test

- Build daily
  - Or at regular intervals
  - “Heartbeat” of the project; keeps developers synchronized
  - Use automated build tools; e.g. make
- Check for broken builds
  - Fixing broken builds is top priority
  - Failure to pass smoke test is a broken build
- Smoke test daily
  - Exercise entire system end to end but not exhaustive
  - Grows from “hello world” to complex system that may even take hours to run

Using the Daily Build and Smoke Test

- Developers should smoke test before adding to the build
- Use version control tools to know what might have broken the build and be able to revert
- Create a penalty for breaking the build
  - $$?
  - Beeper?
  - Sucker?
  - Responsibility for build until fixed?

Risks of Daily Build

- Tendency toward premature release
  - Developers might focus on the build and skip materials needed for the final product like documentation
  - Developers might put in hacks to fix the build

Daily Build Summary

- Efficacy
  - Potential reduction from nominal schedule: Good
  - Improvement in progress visibility: Good
  - Effect on schedule risk: Decreased Risk
  - Chance of first-time success: Very Good
  - Chance of long-term success: Excellent
- Major Risks
  - Pressure to release interim versions of a program too frequently
- Major Interactions
  - Especially effective with miniature milestones

Designing for Change

- Broad practice that encompasses many practices to plan for change. Must be employed early in the lifecycle.
  - Identifying likely changes
  - Develop a change plan
  - Hide design decisions to avoid rippling through the project

Using Designing for Change

- Identify Areas Likely to Change
  - List design decisions likely to change
  - Great designers able to anticipate more kinds of possible change than average designers
  - Frequent sources:
    - Hardware dependencies
    - File formats
    - Nonstandard language features
    - Difficult design areas
    - Specific data structures
    - Business rules
    - Requirements barely excluded
    - Features for next version

Using Designing for Change

- Use Information Hiding
  - Plenty has been said about this already
  - Hide design decisions inside modules
  - One of the few theoretical techniques proven useful in practice

Using Designing for Change

- Develop a Change Plan
  - Examples:
    - Use late-binding strategies for types or data structures that may change (e.g. allocate dynamically based on sizes)
    - Use named constants instead of hard-coded literals
    - Data-driven techniques where data dictates how the program will operate instead of hard-coding

Designing for Change Summary

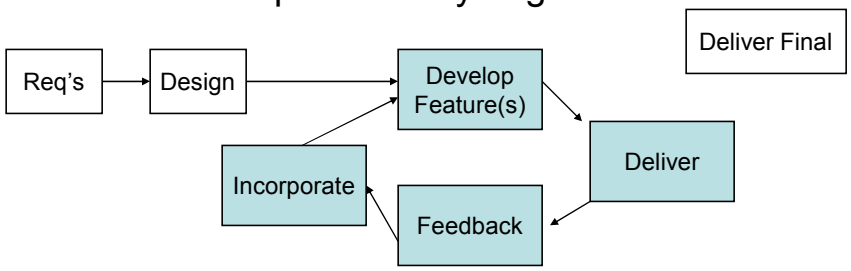
- Efficacy
  - Potential reduction from nominal schedule: Fair
  - Improvement in progress visibility: None
  - Effect on schedule risk: Decreased Risk
  - Chance of first-time success: Good
  - Chance of long-term success: Excellent
- Major Risks
  - Over-reliance on programming languages to solve design problems rather than on change-oriented design practices

Evolutionary Delivery

- Lifecycle model using the ideas of evolutionary prototyping. Delivers selected portions of the software earlier than would otherwise be possible, but does not necessarily deliver the final product any faster.
- Can lead to improved quality, even distribution of development and testing

Evolutionary Delivery Approach

- Going grocery shopping
  - Waterfall model: complete list for next week
  - Prototyping: no list, get what looks good
  - Evolutionary delivery: in between, start with a list them improvise as you go



Evolutionary Delivery Benefits

- Reduces risk of delivering a product the customer doesn't want
- Makes progress visible by early and often delivery
- Reduces risk of integration by integrating early and often
- Improves morale as the project evolves in power

Evolutionary Delivery Summary

- Efficacy
  - Potential reduction from nominal schedule: Good
  - Improvement in progress visibility: Excellent
  - Effect on schedule risk: Decreased Risk
  - Chance of first-time success: Very Good
  - Chance of long-term success: Excellent
- Major Risks
  - Feature creep, diminished project control, unrealistic schedule, inefficient use of development time

Goal Setting

- Human motivation is the single, strongest contributor to productivity
  - A manager simply tells developers what is expected
  - Developers will generally work hard to achieve a goal of “shortest schedule”
  - Primary obstacle to success is an unwillingness to define a small, clear set of goals and commit to them for an entire project

Goal Setting: Goal of Shortest Schedule

- Efficacy
  - Potential reduction from nominal schedule: Very Good
  - Improvement in progress visibility: None
  - Effect on schedule risk: Increased Risk
  - Chance of first-time success: Good
  - Chance of long-term success: Very Good
- Major Risks
  - Significant loss of motivation if goals are changed

Goal Setting: Goal of Least Risk

- Efficacy
  - Potential reduction from nominal schedule: None
  - Improvement in progress visibility: Good
  - Effect on schedule risk: Decreased Risk
  - Chance of first-time success: Good
  - Chance of long-term success: Very Good
- Major Risks
  - Significant loss of motivation if goals are changed

Goal Setting: Goal of Maximum Visibility

- Efficacy
  - Potential reduction from nominal schedule: None
  - Improvement in progress visibility: Excellent
  - Effect on schedule risk: Decreased Risk
  - Chance of first-time success: Good
  - Chance of long-term success: Very Good
- Major Risks
  - Significant loss of motivation if goals are changed

Inspections

- Formal technical review
  - Participants inspect review materials before the review meeting to stimulate discovery of defects
  - Participants have roles of moderator, scribe, participant
  - Can find errors before going to testing, studies have found it more effective in total defects found and time spent per defect
  - Good tool for tracking progress

Inspections Summary

- Efficacy
  - Potential reduction from nominal schedule: Very Good
  - Improvement in progress visibility: Fair
  - Effect on schedule risk: Decreased Risk
  - Chance of first-time success: Good
  - Chance of long-term success: Excellent
- Major Risks
  - None

Lifecycle Model Selection

- Product development styles vary tremendously among different kinds of projects
- Choice of the wrong lifecycle model can result in missing tasks and inappropriate task ordering, which undercuts planning and efficiency
- Choose the appropriate lifecycle

Lifecycle Selection Summary

- Efficacy
  - Potential reduction from nominal schedule: Fair
  - Improvement in progress visibility: Fair
  - Effect on schedule risk: Decreased Risk
  - Chance of first-time success: Very Good
  - Chance of long-term success: Excellent
- Major Risks
  - Specific lifecycle models may contain certain risks

Measurement

- Quantitative measurement of project progress
  - Dozens of techniques, we will discuss in more detail later
    - Size, lines of code, defect rate, hours spent debugging, hours spent designing, developer or customer satisfaction surveys
  - Provides complementary information to adjust estimates, schedules, track progress
- Can have short-term motivational benefits and long-term cost, quality, and schedule benefits

Measurement Benefits

- Provides status visibility
  - Helps you and others know what your status is
- Focuses people's activities
  - Feedback on measurement can motivate and get people to respond; e.g. reduce defect rate
  - What gets measured gets optimized
- Improves morale
  - Properly implemented, measurement can improve morale by bringing attention to problem areas
- Help set realistic expectations
  - Provides historic baseline over long-term
  - Sets stage for process improvement

What to Measure

- Cost and resource data
  - Effort by activity, phase, personnel type
  - Computer resources
  - Time
- Change and defect data
  - Defects by classification
  - Problem report status
  - Defect detection method
  - Effort to detect and correct defects
- Process data
  - Process definition, process conformance
  - Estimated time to completion
  - Milestone progress
  - Requirement changes
- Product data
  - Size, functions
  - Development milestones
  - Total effort

Measurement Risks

- Over-reliance on statistics, data accuracy
- Over-optimization of a single factor
  - If measure LOC, developers may become more verbose but decrease quality
  - If only measure defects, development might drop in favor of testing/fixing
- Measurements misused for employee evaluations
  - Lots of defects does not necessarily mean a bad developer

Measurement Summary

- Efficacy
  - Potential reduction from nominal schedule: Very Good
  - Improvement in progress visibility: Good
  - Effect on schedule risk: Decreased Risk
  - Chance of first-time success: Good
  - Chance of long-term success: Excellent
- Major Risks
  - Over-optimization of single-factor measurements
  - Misuse of measurements for employee evaluations
  - Misleading information from LOC measurements

Miniature Milestones

- Fine-grain approach to project tracking and control
  - Provides good visibility into a project's status
  - Keys to success include
    - Overcoming resistance of people whose work will be managed with the practice, may feel like micromanagement
    - Staying true to the "miniature" nature

Miniature Milestones

- Driving to the lower 48
  - Major milestones: cities along the way
    - Might be hundreds of miles apart
  - Mini milestones: stops and landmarks much closer, perhaps 25 miles apart
    - Move to mini milestone, then make a reading to the next mini milestone, etc.
- Define set of targets
  - Targets should be met on a daily or near daily basis
  - If milestones are not met, you know the schedule isn't realistic and will find out early on

Miniature Milestone Benefits

- Improves status visibility
  - Avoid letting developers “go dark”
    - “How’s everything going?” “OK”
    - “How’s everything going?” “Late by 6 months.”
- Can help keep people on track
  - Easy to lose sight of the big picture without short-term milestones
- Improved motivation
  - Achievement happens regularly
- Reduced schedule risk
  - Breaks large, poorly defined schedule into smaller more well-defined ones
  - Requires more planning work on behalf of manager

Using Mini Milestones

- Initiate early or in response to a crisis
  - If set up at other times, manager runs the risk of appearing draconian and over-controlling
- Have developers create their own mini milestones
  - Allows developers to remain in control and not feel micro-managed
- Keep milestones miniature
  - Achievable in 1-2 days
  - Important to be able to catch up quickly of a milestone is missed
  - Reduces number of places for unforeseen problems to hide
- Make milestones binary
  - Done or not done

Using Mini Milestones

- Make the set of milestones exhaustive
  - Must cover every task needed to release the product
  - Do not allow developers to keep list of “cleanup” tasks in their heads, easily lost
- Use for short-term but not long-term planning
- Regularly assess progress and recalibrate or replan
  - Since mini milestones are short term they need re-alignment often, can’t plan ahead too far

Mini Milestone Side Effects

- Requires detailed, active management
- Demands additional time and effort from both management and developers
  - Tradeoff with increased visibility and control of the planning process
- Successful use prevents a project leader from losing touch with the project
  - In regular contact with each person whenever a milestone is to be done
  - Lots of incidental communication that helps with risk management, motivation, personnel issues, and other management activities

Mini Milestones Summary

- Efficacy
  - Potential reduction from nominal schedule: Fair
  - Improvement in progress visibility: Very Good
  - Effect on schedule risk: Decreased Risk
  - Chance of first-time success: Good
  - Chance of long-term success: Excellent
- Major Risks
  - Developer opposition to micro-management
- Major Interactions
  - Especially well-suited to project recovery
  - Works well with daily build and smoke test practice