Software Development Process

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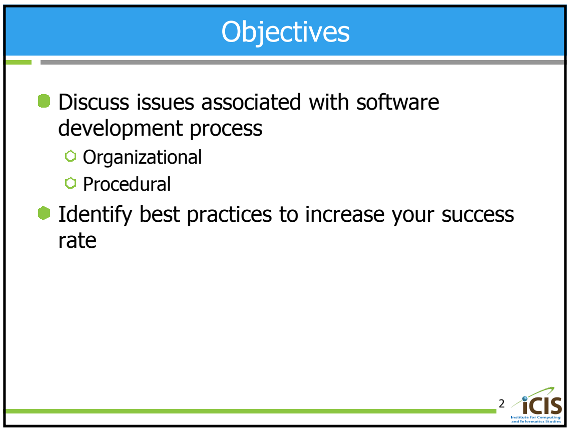
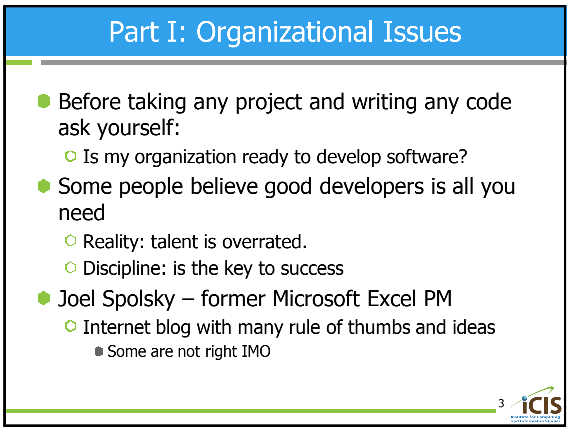


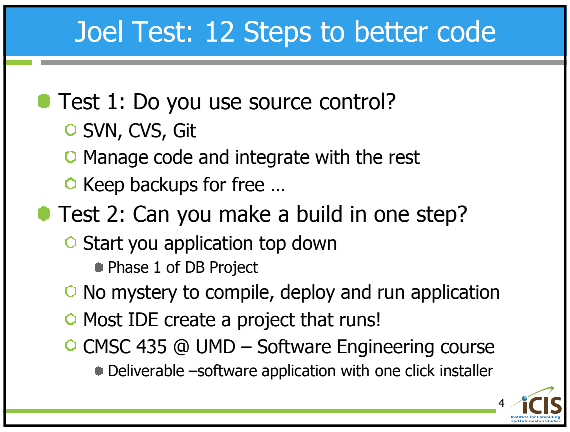
Objectives

- Discuss issues associated with software development process
  - Organizational
  - Procedural
- Identify best practices to increase your success rate



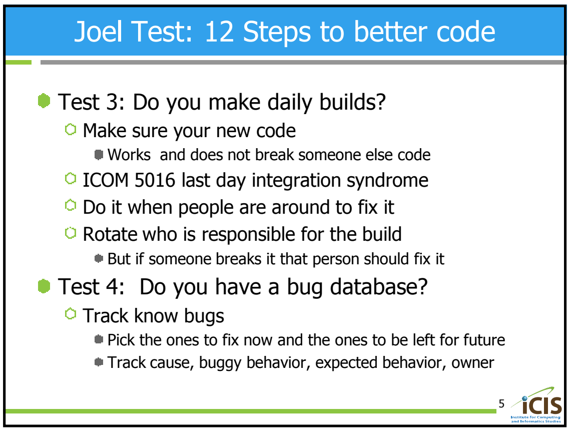
Part I: Organizational Issues

- Before taking any project and writing any code ask yourself:
  - Is my organization ready to develop software?
- Some people believe good developers is all you need
  - Reality: talent is overrated.
  - Discipline: is the key to success
- Joel Spolsky – former Microsoft Excel PM
  - Internet blog with many rule of thumbs and ideas
    - Some are not right IMO



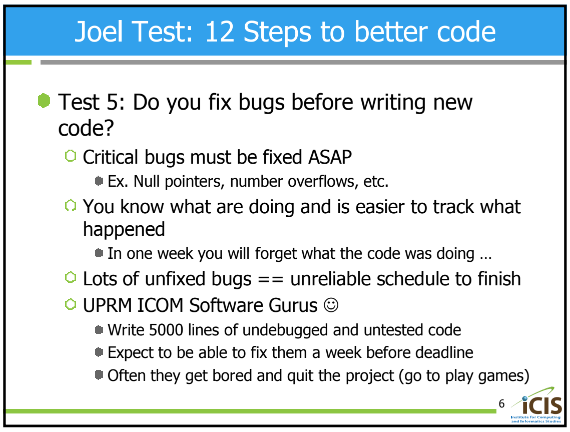
Joel Test: 12 Steps to better code

- Test 1: Do you use source control?
  - SVN, CVS, Git
  - Manage code and integrate with the rest
  - Keep backups for free …
- Test 2: Can you make a build in one step?
  - Start you application top down
    - Phase 1 of DB Project
  - No mystery to compile, deploy and run application
  - Most IDE create a project that runs!
  - CMSC 435 @ UMD – Software Engineering course
    - Deliverable –software application with one click installer



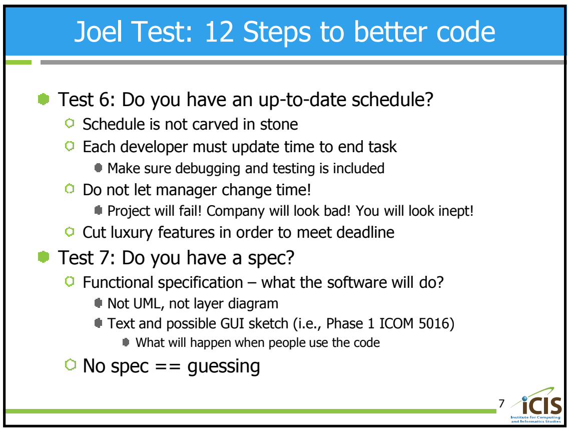
Joel Test: 12 Steps to better code

- Test 3: Do you make daily builds?
  - Make sure your new code
    - Works and does not break someone else code
  - ICOM 5016 last day integration syndrome
  - Do it when people are around to fix it
  - Rotate who is responsible for the build
    - But if someone breaks it that person should fix it
- Test 4: Do you have a bug database?
  - Track know bugs
    - Pick the ones to fix now and the ones to be left for future
    - Track cause, buggy behavior, expected behavior, owner



Joel Test: 12 Steps to better code

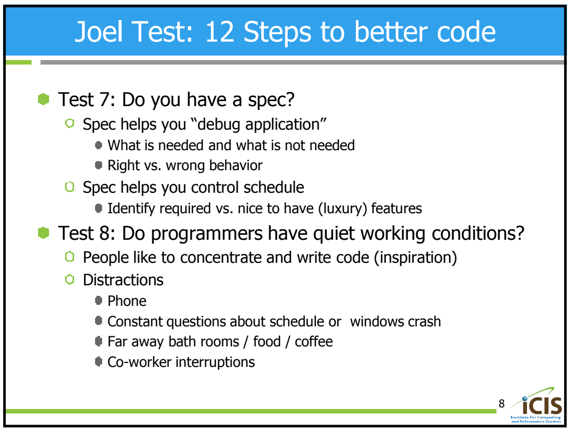
- Test 5: Do you fix bugs before writing new code?
  - Critical bugs must be fixed ASAP
    - Ex. Null pointers, number overflows, etc.
  - You know what are doing and is easier to track what happened
    - In one week you will forget what the code was doing …
  - Lots of unfixed bugs == unreliable schedule to finish
  - UPRM ICOM Software Gurus ☺
    - Write 5000 lines of undebugged and untested code
    - Expect to be able to fix them a week before deadline
    - Often they get bored and quit the project (go to play games)



Joel Test: 12 Steps to better code

- Test 6: Do you have an up-to-date schedule?
  - Schedule is not carved in stone
  - Each developer must update time to end task
    - Make sure debugging and testing is included
  - Do not let manager change time!
    - Project will fail! Company will look bad! You will look inept!
  - Cut luxury features in order to meet deadline
- Test 7: Do you have a spec?
  - Functional specification – what the software will do?
    - Not UML, not layer diagram
    - Text and possible GUI sketch (i.e., Phase 1 ICOM 5016)
      - What will happen when people use the code
  - No spec == guessing

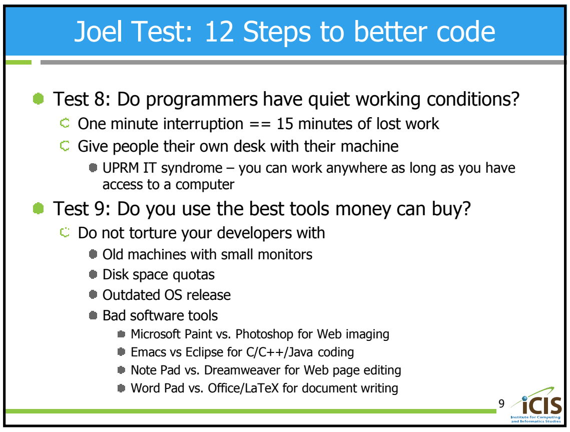
7



Joel Test: 12 Steps to better code

- Test 7: Do you have a spec?
  - Spec helps you "debug application"
    - What is needed and what is not needed
    - Right vs. wrong behavior
  - Spec helps you control schedule
    - Identify required vs. nice to have (luxury) features
- Test 8: Do programmers have quiet working conditions?
  - People like to concentrate and write code (inspiration)
  - Distractions
    - Phone
    - Constant questions about schedule or windows crash
    - Far away bath rooms / food / coffee
    - Co-worker interruptions

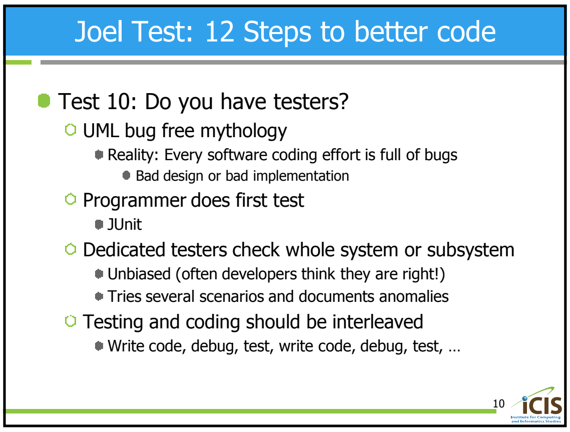
8



Joel Test: 12 Steps to better code

- Test 8: Do programmers have quiet working conditions?
  - One minute interruption == 15 minutes of lost work
  - Give people their own desk with their machine
    - UPRM IT syndrome – you can work anywhere as long as you have access to a computer
- Test 9: Do you use the best tools money can buy?
  - Do not torture your developers with
    - Old machines with small monitors
    - Disk space quotas
    - Outdated OS release
    - Bad software tools
      - Microsoft Paint vs. Photoshop for Web imaging
      - Emacs vs Eclipse for C/C++/Java coding
      - Note Pad vs. Dreamweaver for Web page editing
      - Word Pad vs. Office/LaTeX for document writing

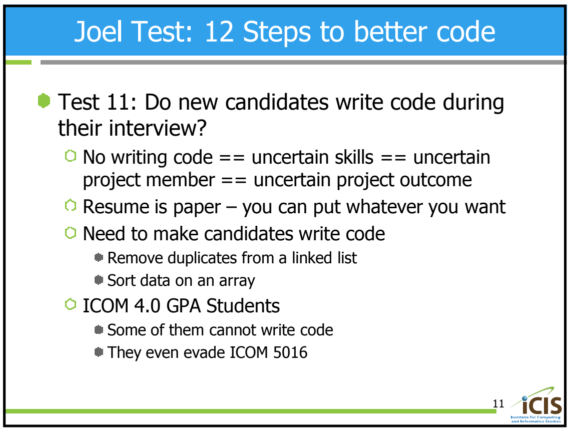
9



Joel Test: 12 Steps to better code

- Test 10: Do you have testers?
  - UML bug free mythology
    - Reality: Every software coding effort is full of bugs
      - Bad design or bad implementation
  - Programmer does first test
    - JUnit
  - Dedicated testers check whole system or subsystem
    - Unbiased (often developers think they are right!)
    - Tries several scenarios and documents anomalies
  - Testing and coding should be interleaved
    - Write code, debug, test, write code, debug, test, …

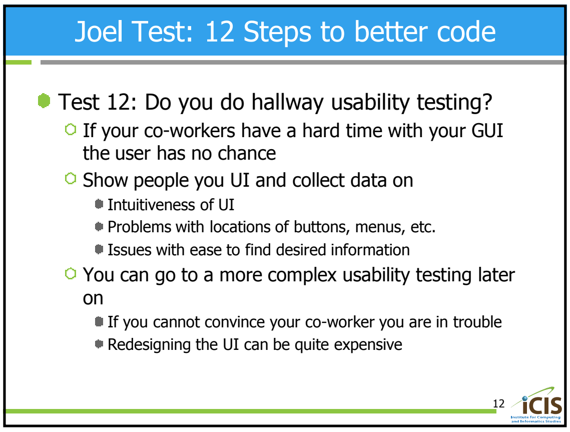
10



Joel Test: 12 Steps to better code

- Test 11: Do new candidates write code during their interview?
  - No writing code == uncertain skills == uncertain project member == uncertain project outcome
  - Resume is paper – you can put whatever you want
  - Need to make candidates write code
    - Remove duplicates from a linked list
    - Sort data on an array
  - ICOM 4.0 GPA Students
    - Some of them cannot write code
    - They even evade ICOM 5016

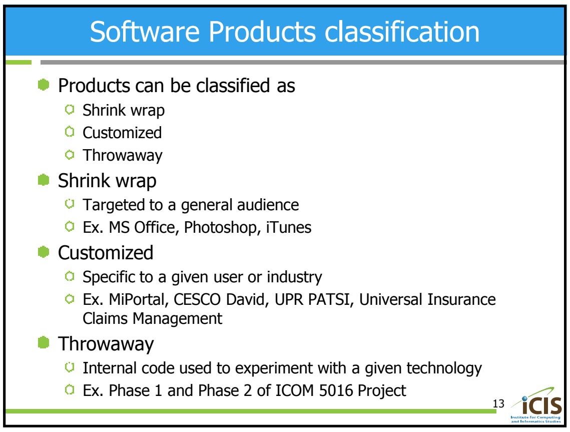
11



Joel Test: 12 Steps to better code

- Test 12: Do you do hallway usability testing?
  - If your co-workers have a hard time with your GUI the user has no chance
  - Show people you UI and collect data on
    - Intuitiveness of UI
    - Problems with locations of buttons, menus, etc.
    - Issues with ease to find desired information
  - You can go to a more complex usability testing later on
    - If you cannot convince your co-worker you are in trouble
    - Redesigning the UI can be quite expensive

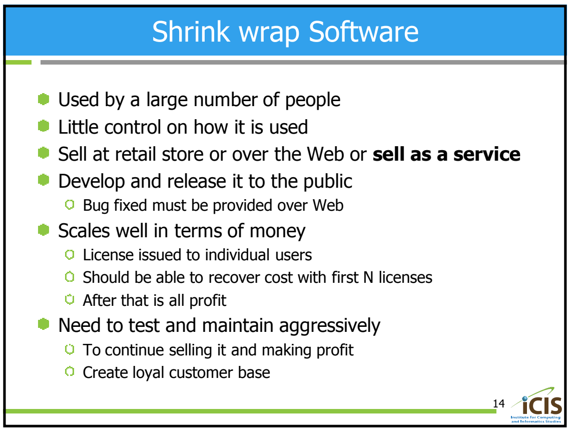
12



Software Products classification

- Products can be classified as
  - Shrink wrap
  - Customized
  - Throwaway
- Shrink wrap
  - Targeted to a general audience
  - Ex. MS Office, Photoshop, iTunes
- Customized
  - Specific to a given user or industry
  - Ex. MiPortal, CESCO David, UPR PATSI, Universal Insurance Claims Management
- Throwaway
  - Internal code used to experiment with a given technology
  - Ex. Phase 1 and Phase 2 of ICOM 5016 Project

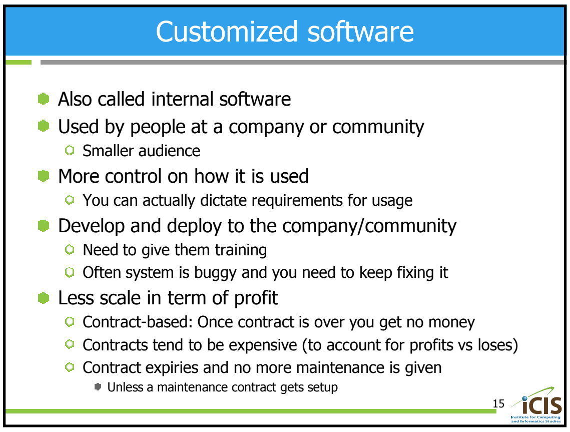
13



Shrink wrap Software

- Used by a large number of people
- Little control on how it is used
- Sell at retail store or over the Web or **sell as a service**
- Develop and release it to the public
  - Bug fixed must be provided over Web
- Scales well in terms of money
  - License issued to individual users
  - Should be able to recover cost with first N licenses
  - After that is all profit
- Need to test and maintain aggressively
  - To continue selling it and making profit
  - Create loyal customer base

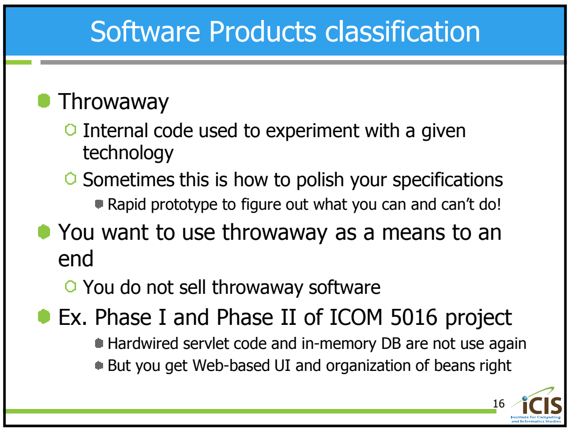
14



Customized software

- Also called internal software
- Used by people at a company or community
  - Smaller audience
- More control on how it is used
  - You can actually dictate requirements for usage
- Develop and deploy to the company/community
  - Need to give them training
  - Often system is buggy and you need to keep fixing it
- Less scale in term of profit
  - Contract-based: Once contract is over you get no money
  - Contracts tend to be expensive (to account for profits vs loses)
  - Contract expiries and no more maintenance is given
    - Unless a maintenance contract gets setup

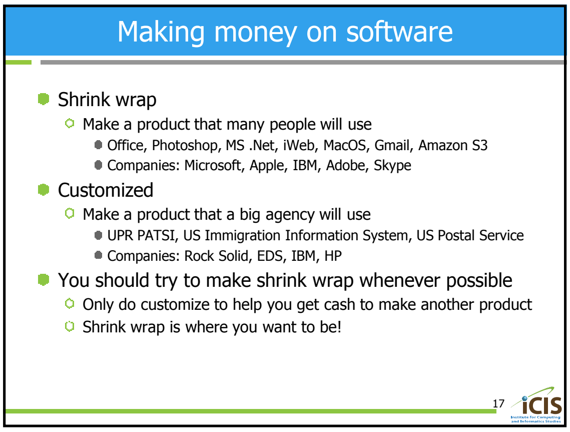
15



Software Products classification

- Throwaway
  - Internal code used to experiment with a given technology
  - Sometimes this is how to polish your specifications
    - Rapid prototype to figure out what you can and can't do!
- You want to use throwaway as a means to an end
  - You do not sell throwaway software
- Ex. Phase I and Phase II of ICOM 5016 project
    - Hardwired servlet code and in-memory DB are not use again
    - But you get Web-based UI and organization of beans right

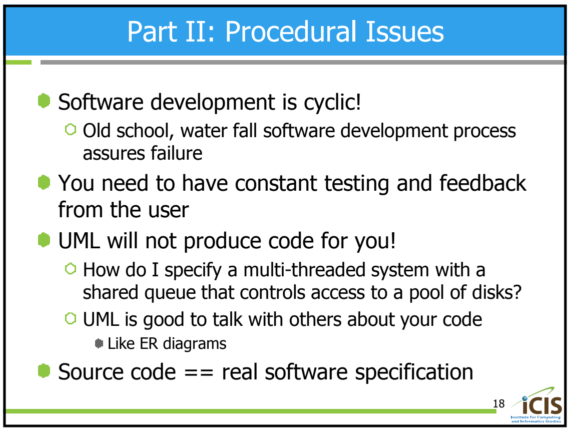
16



Making money on software

- Shrink wrap
  - Make a product that many people will use
    - Office, Photoshop, MS .Net, iWeb, MacOS, Gmail, Amazon S3
    - Companies: Microsoft, Apple, IBM, Adobe, Skype
- Customized
  - Make a product that a big agency will use
    - UPR PATSI, US Immigration Information System, US Postal Service
    - Companies: Rock Solid, EDS, IBM, HP
- You should try to make shrink wrap whenever possible
  - Only do customize to help you get cash to make another product
  - Shrink wrap is where you want to be!

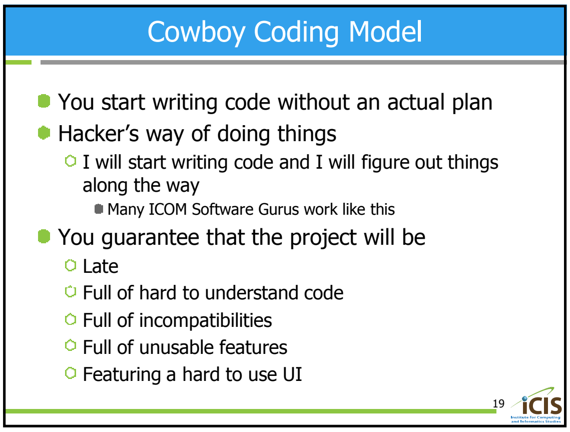
17



Part II: Procedural Issues

- Software development is cyclic!
  - Old school, water fall software development process assures failure
- You need to have constant testing and feedback from the user
- UML will not produce code for you!
  - How do I specify a multi-threaded system with a shared queue that controls access to a pool of disks?
  - UML is good to talk with others about your code
    - Like ER diagrams
- Source code == real software specification

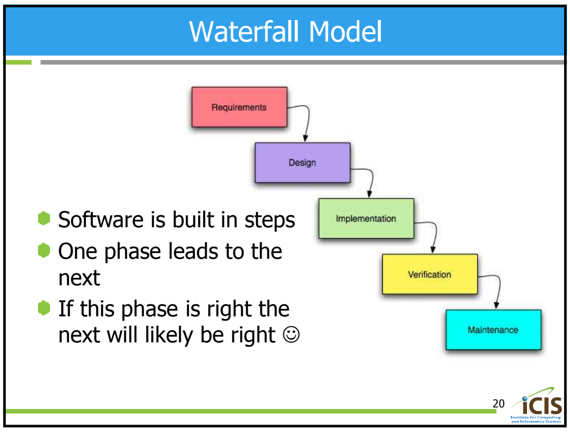
18



Cowboy Coding Model

- You start writing code without an actual plan
- Hacker's way of doing things
  - I will start writing code and I will figure out things along the way
    - Many ICOM Software Gurus work like this
- You guarantee that the project will be
  - Late
  - Full of hard to understand code
  - Full of incompatibilities
  - Full of unusable features
  - Featuring a hard to use UI

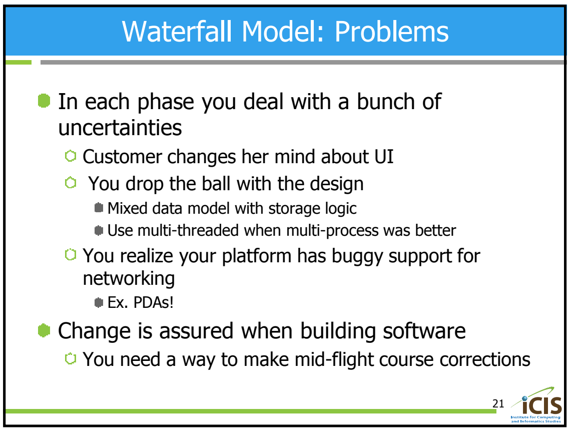
19



Waterfall Model

- Software is built in steps
- One phase leads to the next
- If this phase is right the next will likely be right ☺

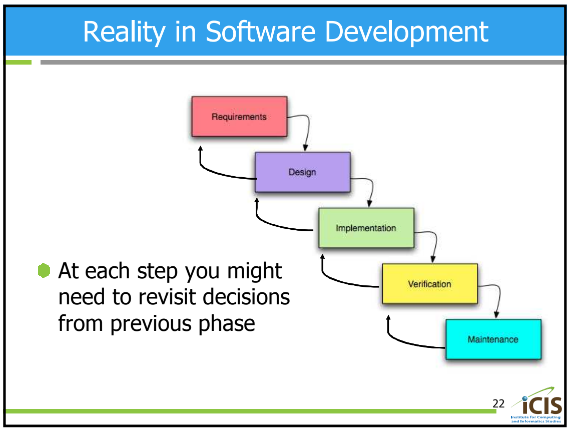
20



Waterfall Model: Problems

- In each phase you deal with a bunch of uncertainties
  - Customer changes her mind about UI
  - You drop the ball with the design
    - Mixed data model with storage logic
    - Use multi-threaded when multi-process was better
  - You realize your platform has buggy support for networking
    - Ex. PDAs!
- Change is assured when building software
  - You need a way to make mid-flight course corrections

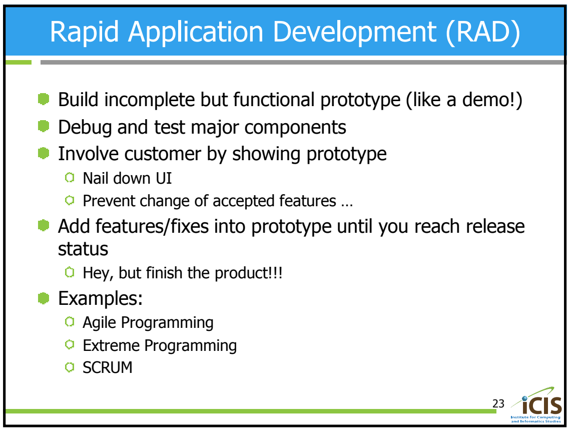
21



Reality in Software Development

- At each step you might need to revisit decisions from previous phase

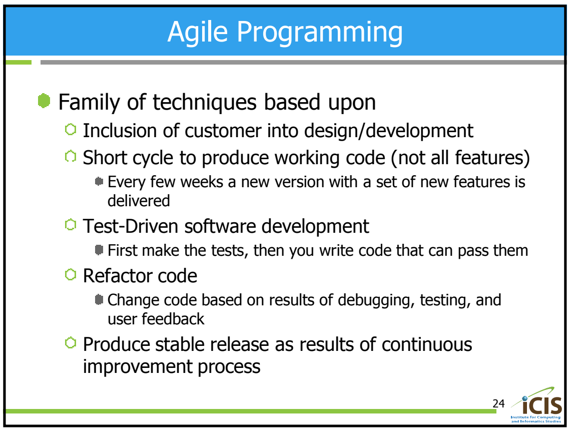
22



Rapid Application Development (RAD)

- Build incomplete but functional prototype (like a demo!)
- Debug and test major components
- Involve customer by showing prototype
  - Nail down UI
  - Prevent change of accepted features …
- Add features/fixes into prototype until you reach release status
  - Hey, but finish the product!!!
- Examples:
  - Agile Programming
  - Extreme Programming
  - SCRUM

23



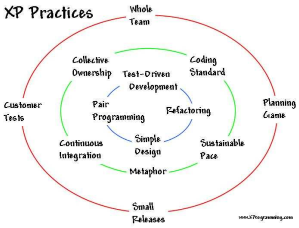
Agile Programming

- Family of techniques based upon
  - Inclusion of customer into design/development
  - Short cycle to produce working code (not all features)
    - Every few weeks a new version with a set of new features is delivered
  - Test-Driven software development
    - First make the tests, then you write code that can pass them
  - Refactor code
    - Change code based on results of debugging, testing, and user feedback
  - Produce stable release as results of continuous improvement process

24

Extreme Programming

- Based on daily practices and team values
- Customer and business people are part of the team
- Always deliver a new working version ASAP
- Communicate effectively with all team members



XP Values

- Simplicity
  - Write code that is simple, clean and straightforward
- Communication
  - Keep direct communication between customers, developers, business people and managers
- Feedback
  - Always comment on each other code, features, and issues
    - E.g., code reviews
- Courage
  - Write the code! If you mess up just refactor
    - Avoid getting stuck in perfect implementation issues

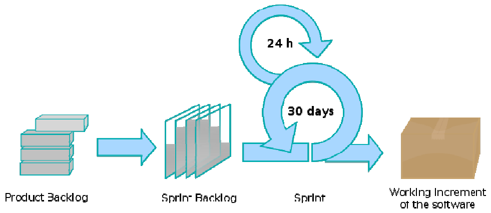
XP Activities

- Simple Design
  - Start with a simple system that works
  - Add new working features
- Pair Programming
  - 2 programmers work side by side on the same machine (like Spartan kings)
  - Faster, better code plus you have redundancy
- Test-Driven Development
  - Unit test and full system tests as new features are added
- Design Improvement
  - Refactoring – fix the design as you write code
  - You only know you are wrong when you see it

SCRUM

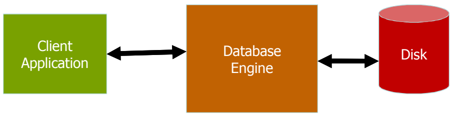
- XP can be chaotic
- Scrum is controlled chaos
- The Team:
  - Scrum master
    - PM
  - Product Owner
    - Customer and business people
  - Developers
- Team works in sprints or burst of one month
  - Design, code, test and demo software
  - Next sprint adds features to previous release
  - Backlog of the sprint list the features to do in each sprint

SCRUM Process



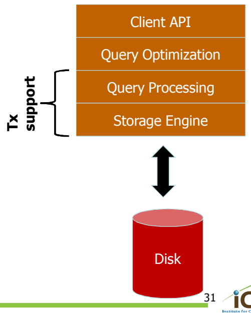
Software System Architecture

- Start out by giving high level system organization
  - Boxes and arrows



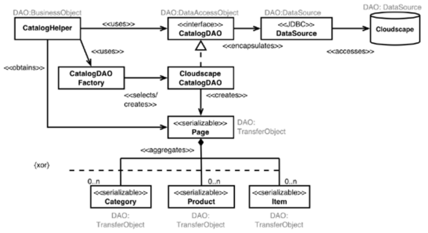
Layered Software Design

- Break down software model into layers
- Each layer is one or more libraries with specific role
  - i.e. – a Java package



Each Layer is Simple

- At this level you can lay down the classes
  - UML can help you illustrate structures and relations



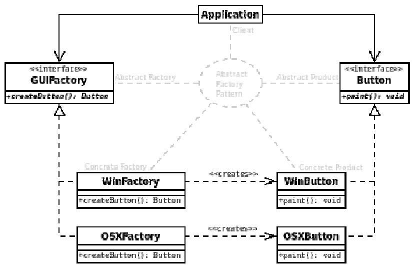
Design Patterns

- Well understood and documented recipes to build software
  - Reusable code
- Idea borrowed from architecture
  - Archetypes
  - Columns, arcs, etc.
- Smalltalk had them for GUI
- Gang of Four Book (GoF) popularized design patterns for CS
- You should build your libraries around them

Example: Abstract Factory

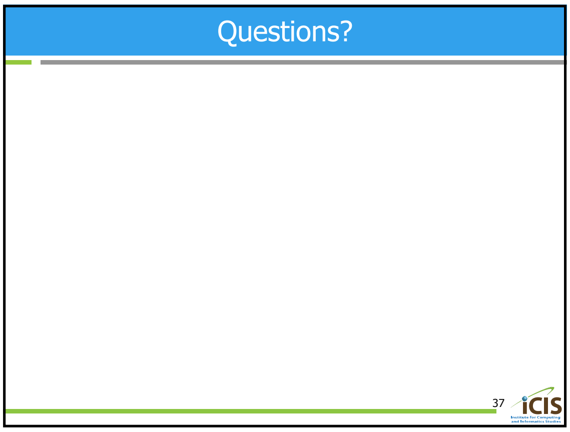
- You need to write an email client
- Must run in
  - Windows XP and Vista
  - MacOS X
  - Ubuntu
- Each one has a different look and feel
- You do not want to write 3 different programs
- Instead you want to share as much code as possible
  - Only differentiate in how UI elements are created

Example: Abstract Factory



Summary

- Discussed issues associated with software development process
  - Organizational
    - Joel 12 steps test
  - Procedural
    - Agile, XP, SCRUM
    - Change is assure in software development
- Identify best practices to increase your success rate
- Sell shrink wrap software or service



Questions?

37