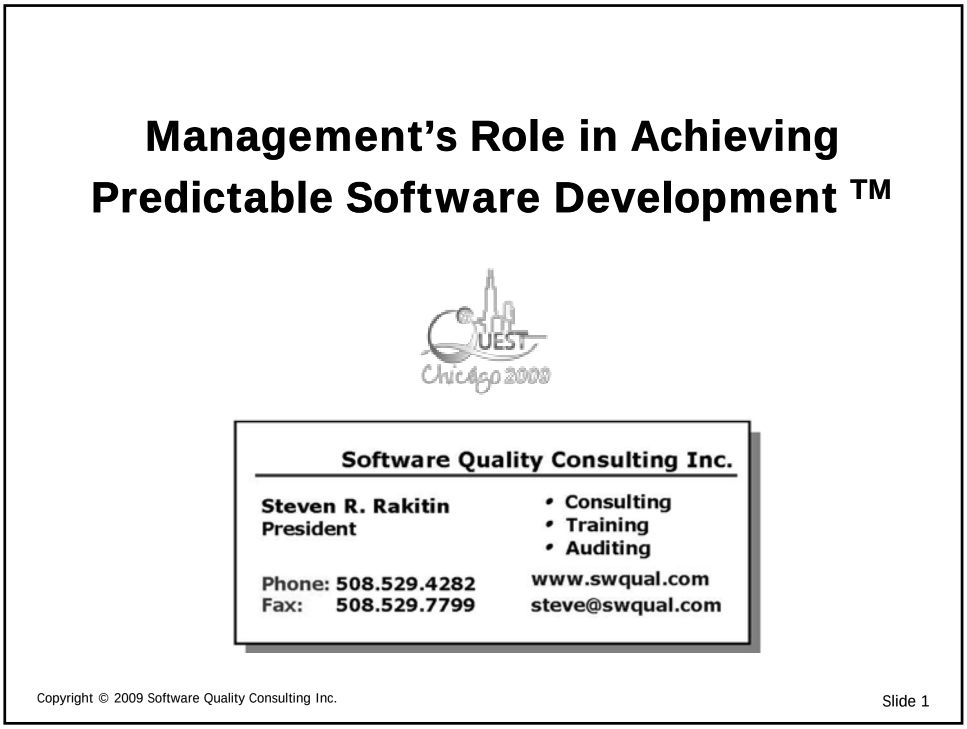

Management’s Role in Achieving Predictable Software Development ™

QUEST Chicago 2009

Software Quality Consulting Inc.

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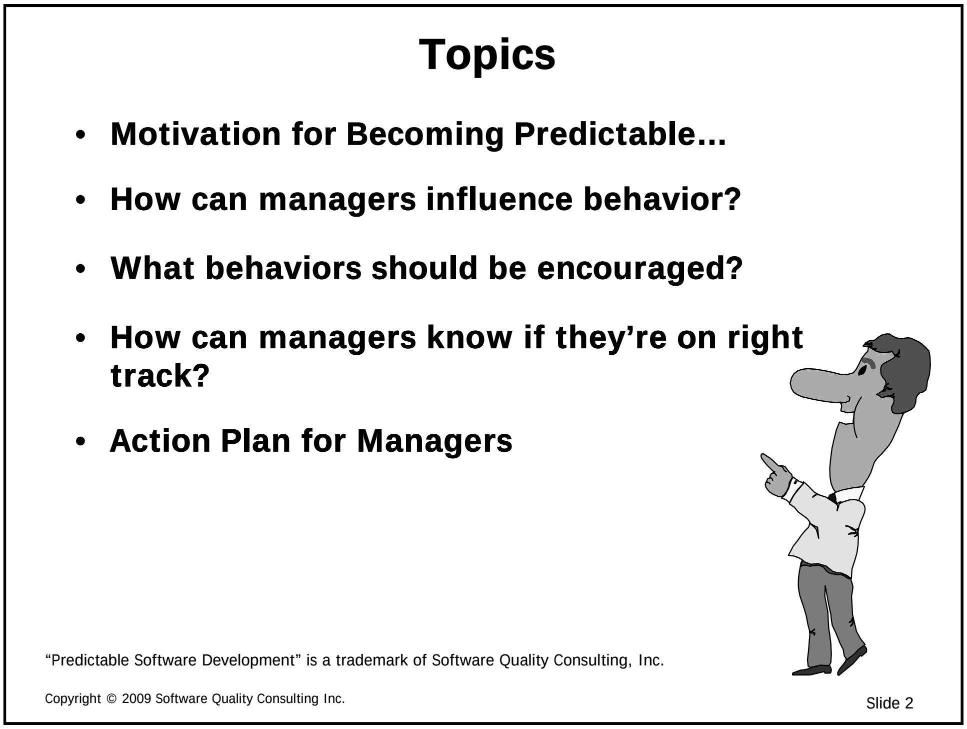
Slide 1



Topics

- Motivation for Becoming Predictable…
- How can managers influence behavior?
- What behaviors should be encouraged?
- How can managers know if they’re on right track?
- Action Plan for Managers

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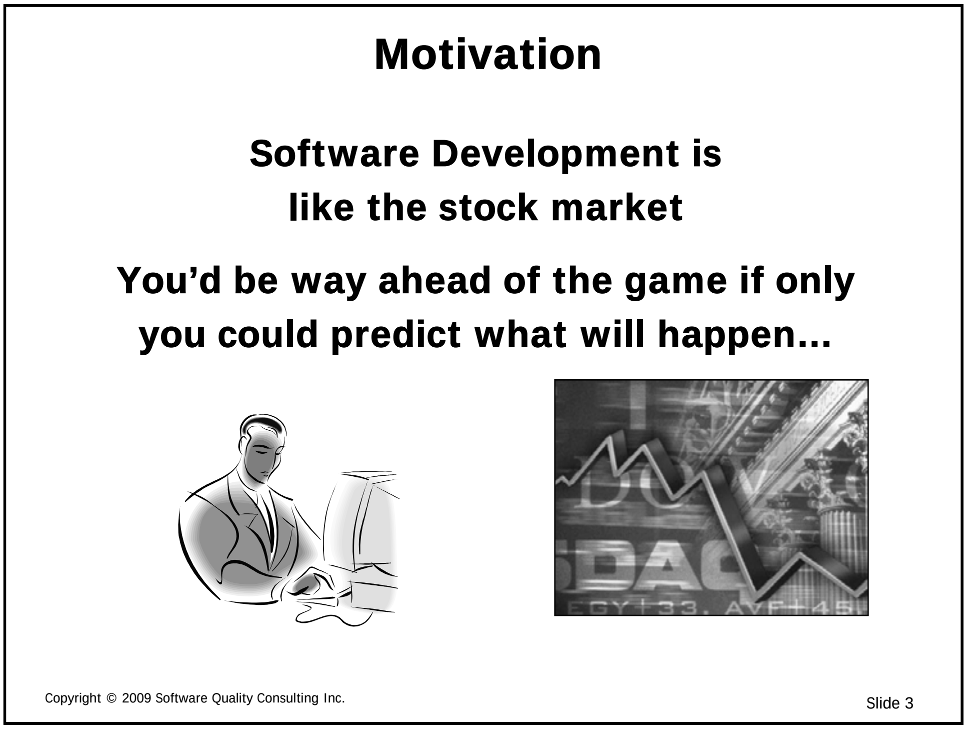
Slide 2

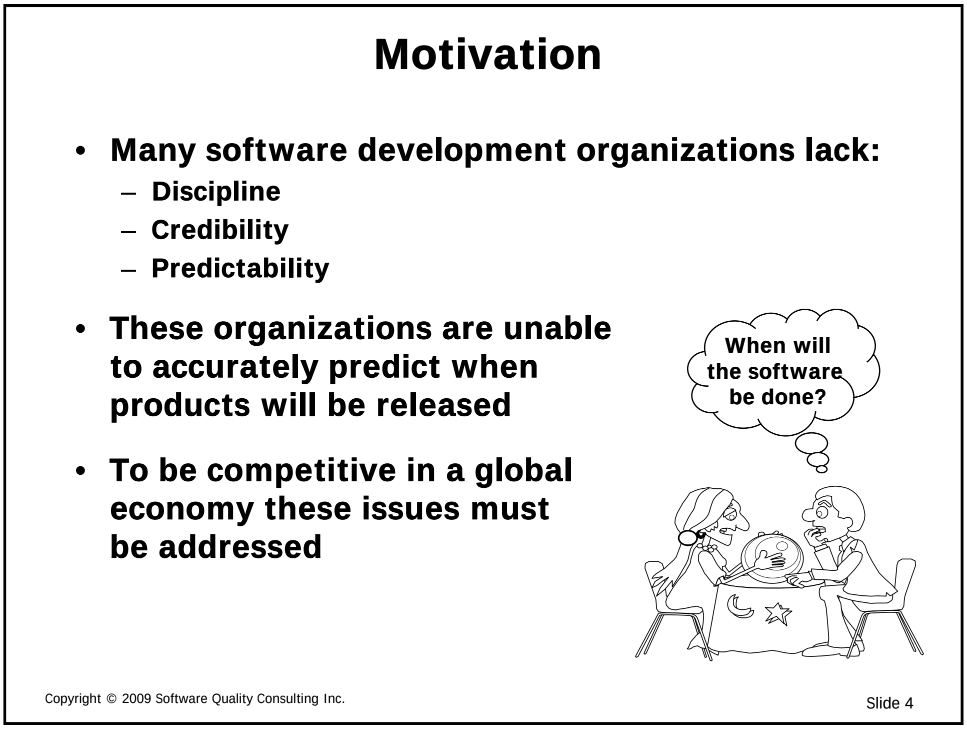


Motivation

Software Development is like the stock market

You’d be way ahead of the game if only you could predict what will happen...

Slide 3

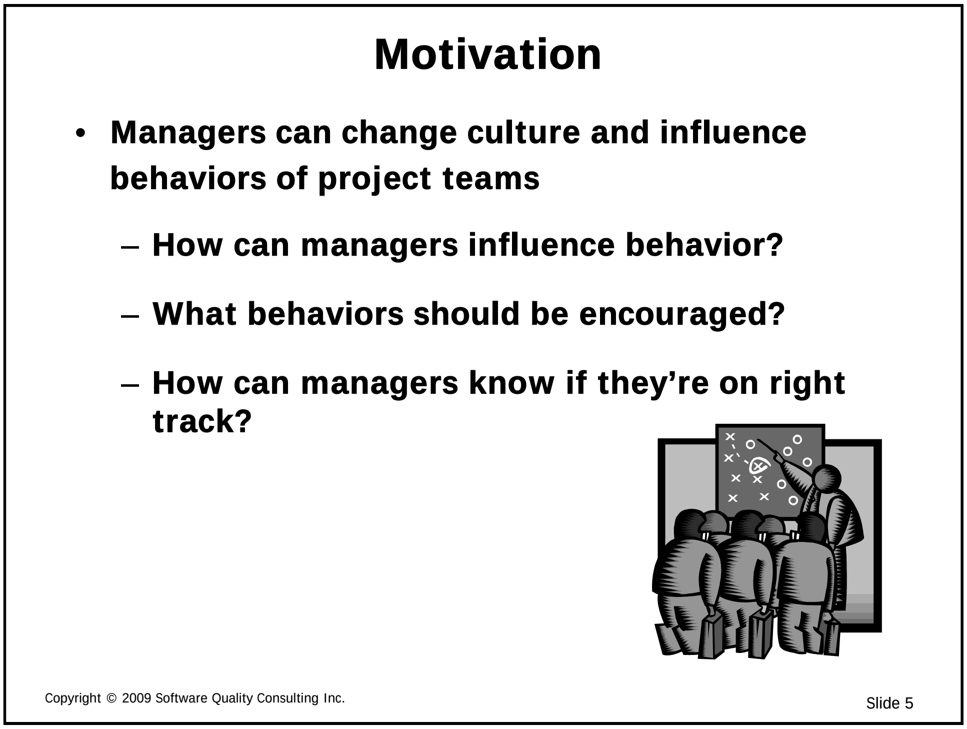


Motivation

- **Many software development organizations lack:**
  - **Discipline**
  - **Credibility**
  - **Predictability**
- **These organizations are unable to accurately predict when products will be released**
- **To be competitive in a global economy these issues must be addressed**

When will the software be done?

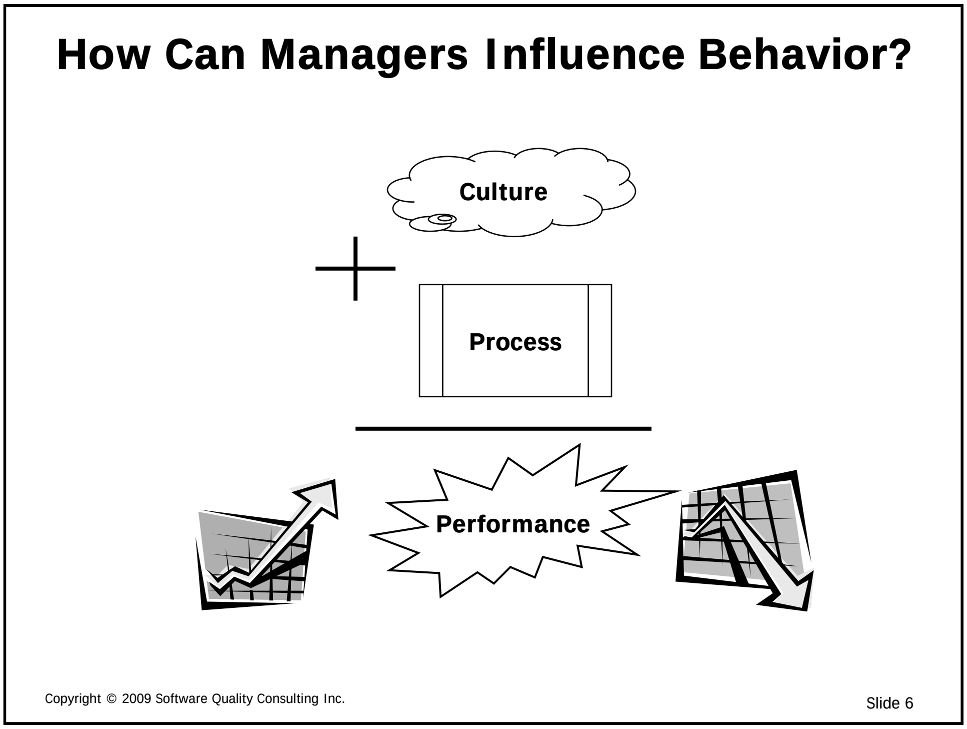
Slide 4



Motivation

- Managers can change culture and influence behaviors of project teams
  - How can managers influence behavior?
  - What behaviors should be encouraged?
  - How can managers know if they’re on right track?

Slide 5



How Can Managers Influence Behavior?

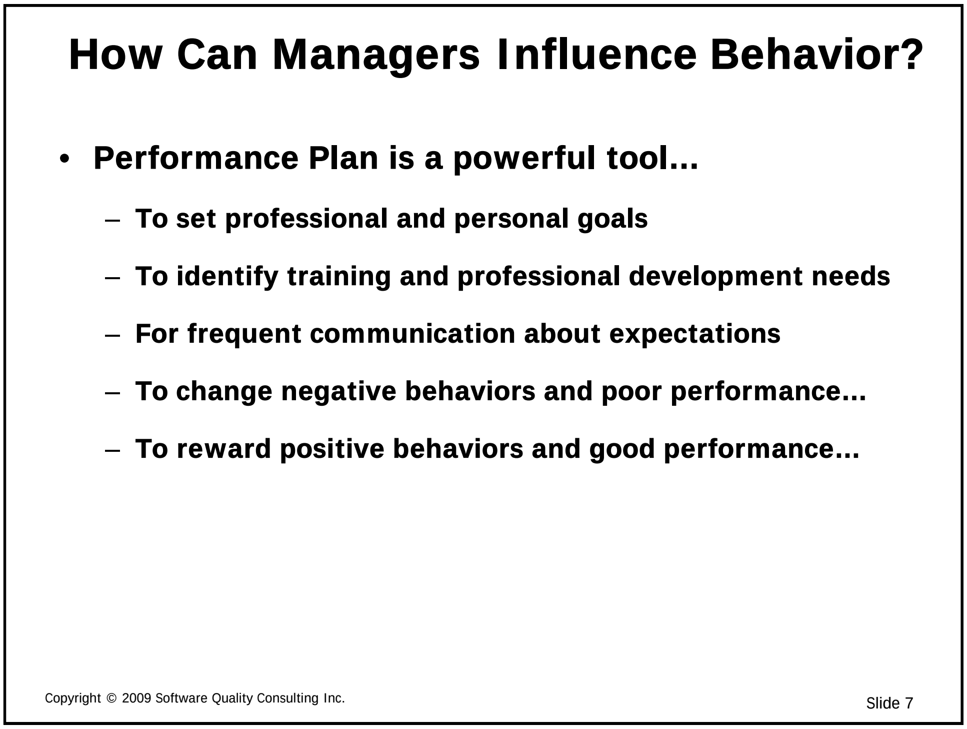
Culture

+

Process

Performance

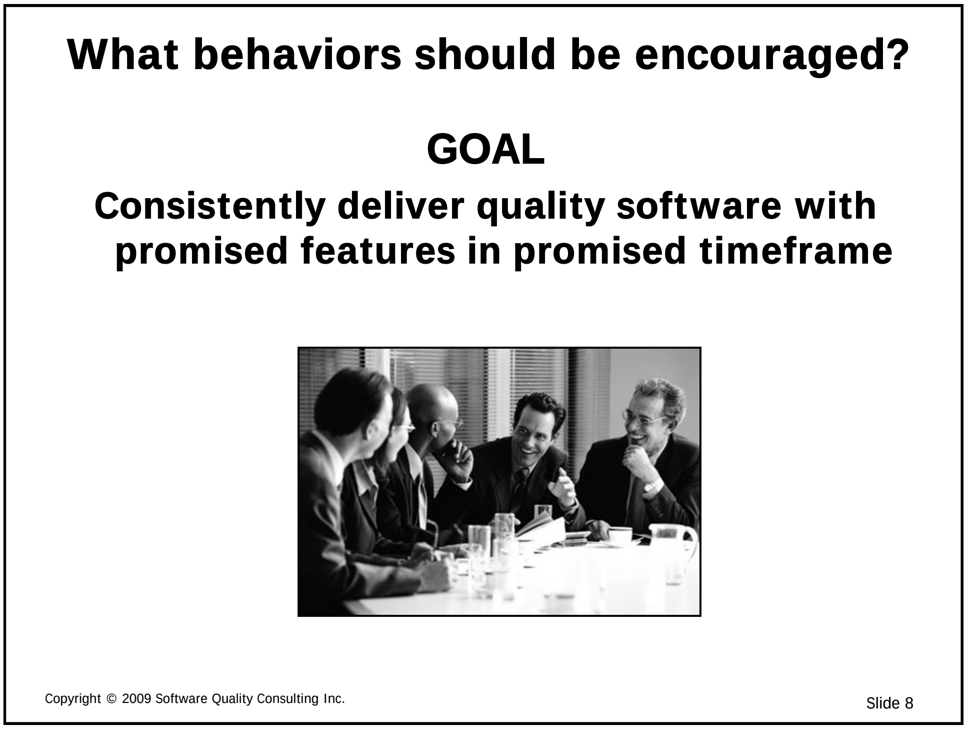
Slide 6



How Can Managers Influence Behavior?

- **Performance Plan is a powerful tool…**
  - **To set professional and personal goals**
  - **To identify training and professional development needs**
  - **For frequent communication about expectations**
  - **To change negative behaviors and poor performance…**
  - **To reward positive behaviors and good performance…**

Slide 7

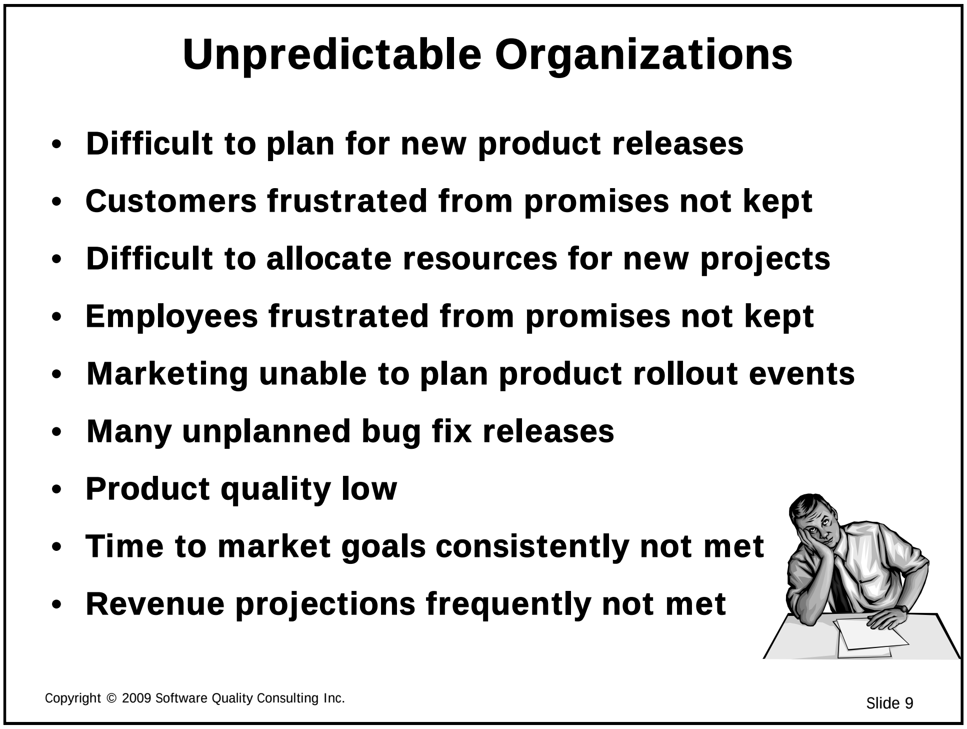


What behaviors should be encouraged?

GOAL

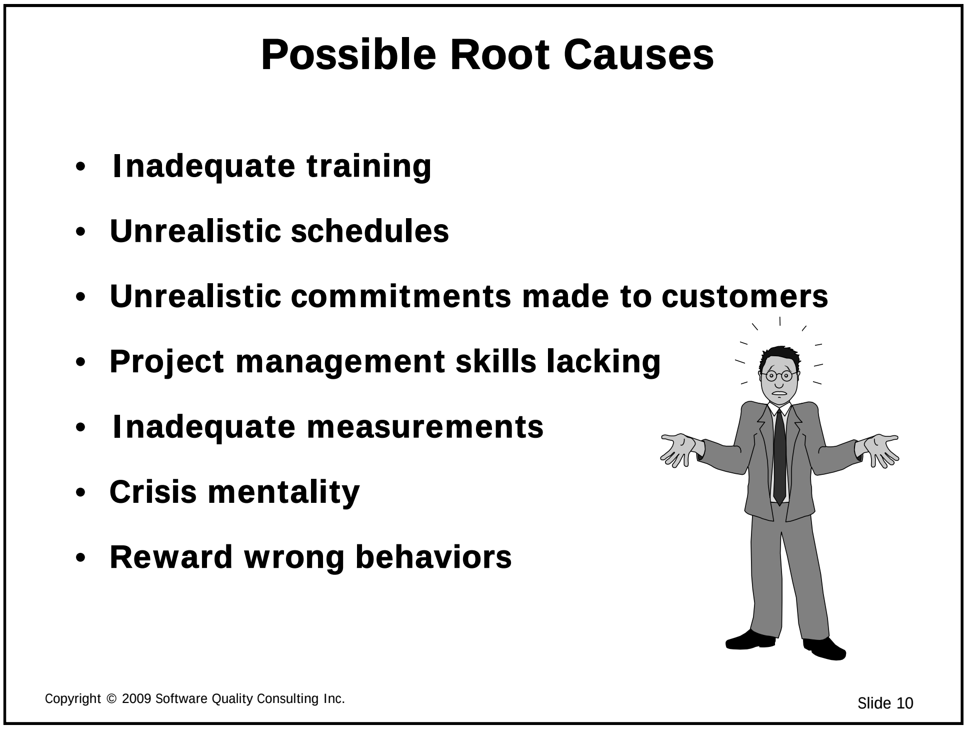
Consistently deliver quality software with promised features in promised timeframe

Slide 8



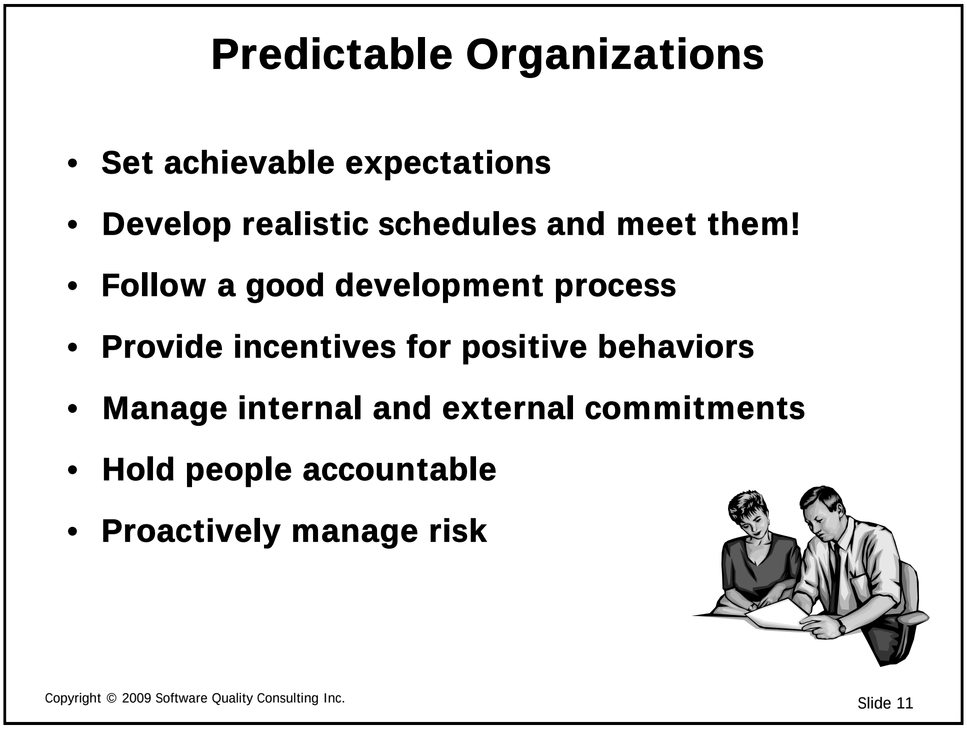
Unpredictable Organizations

- Difficult to plan for new product releases
- Customers frustrated from promises not kept
- Difficult to allocate resources for new projects
- Employees frustrated from promises not kept
- Marketing unable to plan product rollout events
- Many unplanned bug fix releases
- Product quality low
- Time to market goals consistently not met
- Revenue projections frequently not met



Possible Root Causes

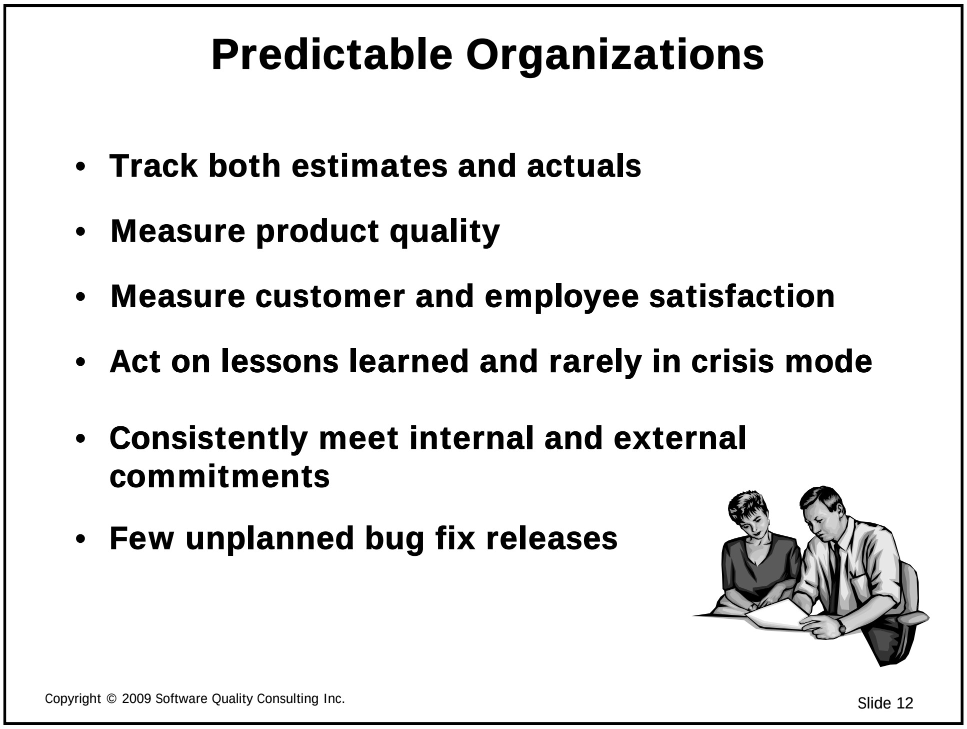
- Inadequate training
- Unrealistic schedules
- Unrealistic commitments made to customers
- Project management skills lacking
- Inadequate measurements
- Crisis mentality
- Reward wrong behaviors



Predictable Organizations

- Set achievable expectations
- Develop realistic schedules and meet them!
- Follow a good development process
- Provide incentives for positive behaviors
- Manage internal and external commitments
- Hold people accountable
- Proactively manage risk

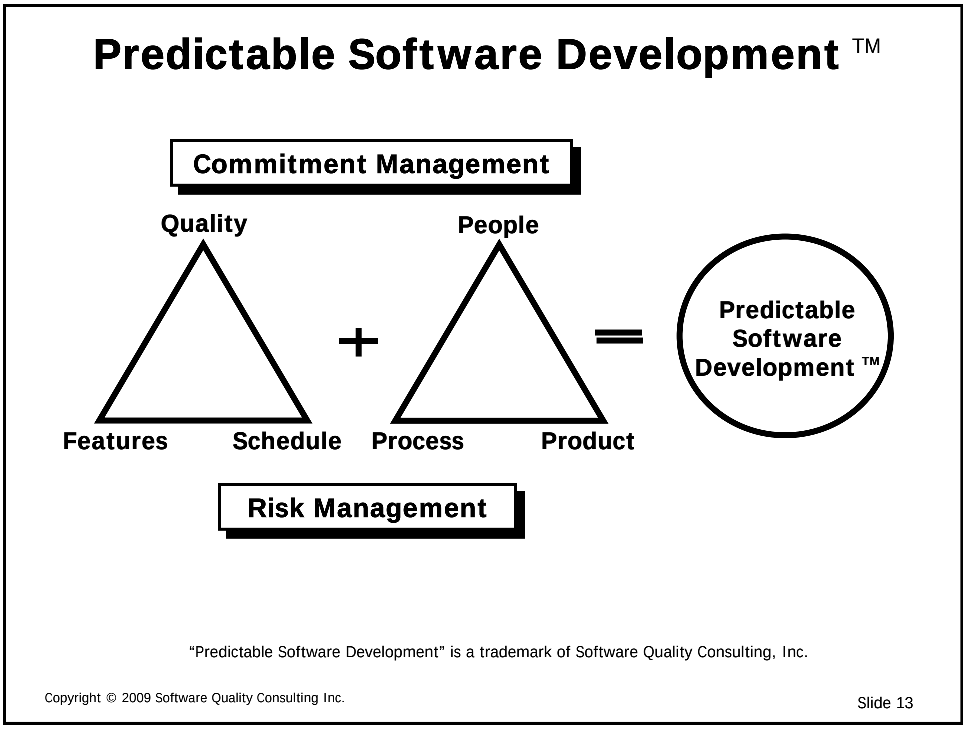
Slide 11



Predictable Organizations

- Track both estimates and actuals
- Measure product quality
- Measure customer and employee satisfaction
- Act on lessons learned and rarely in crisis mode
- Consistently meet internal and external commitments
- Few unplanned bug fix releases

Slide 12



Predictable Software Development ™

Commitment Management

Quality

Features

Schedule

+

People

Process

Product

=

Predictable Software Development ™

Risk Management

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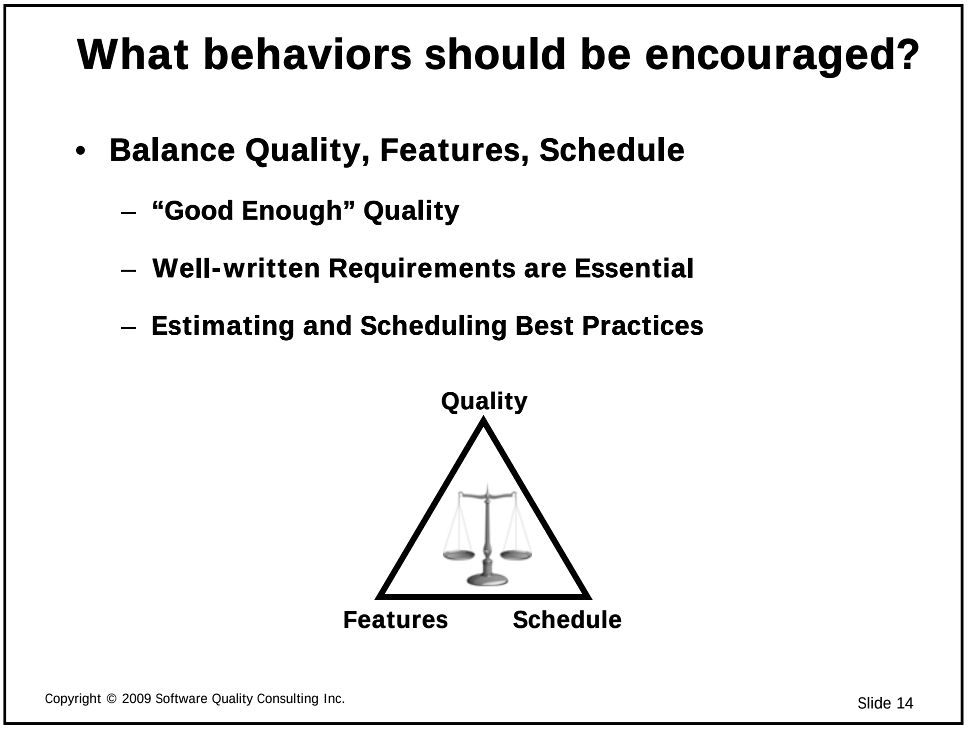
Slide 13



What behaviors should be encouraged?

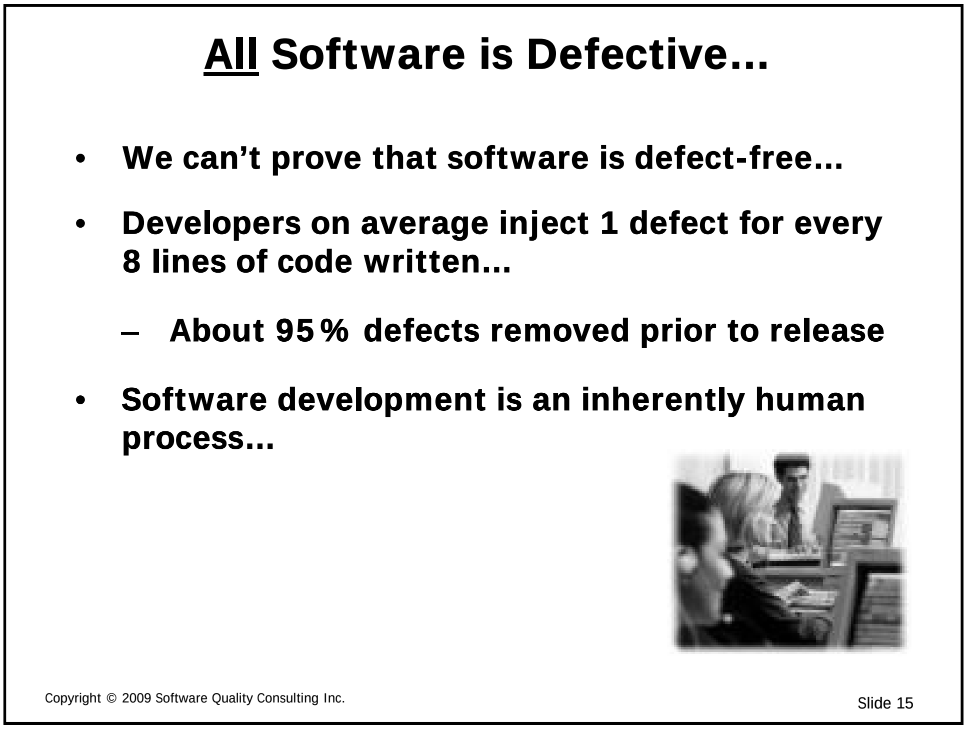
- **Balance Quality, Features, Schedule**
  - **"Good Enough" Quality**
  - **Well-written Requirements are Essential**
  - **Estimating and Scheduling Best Practices**

Quality

Features

Schedule

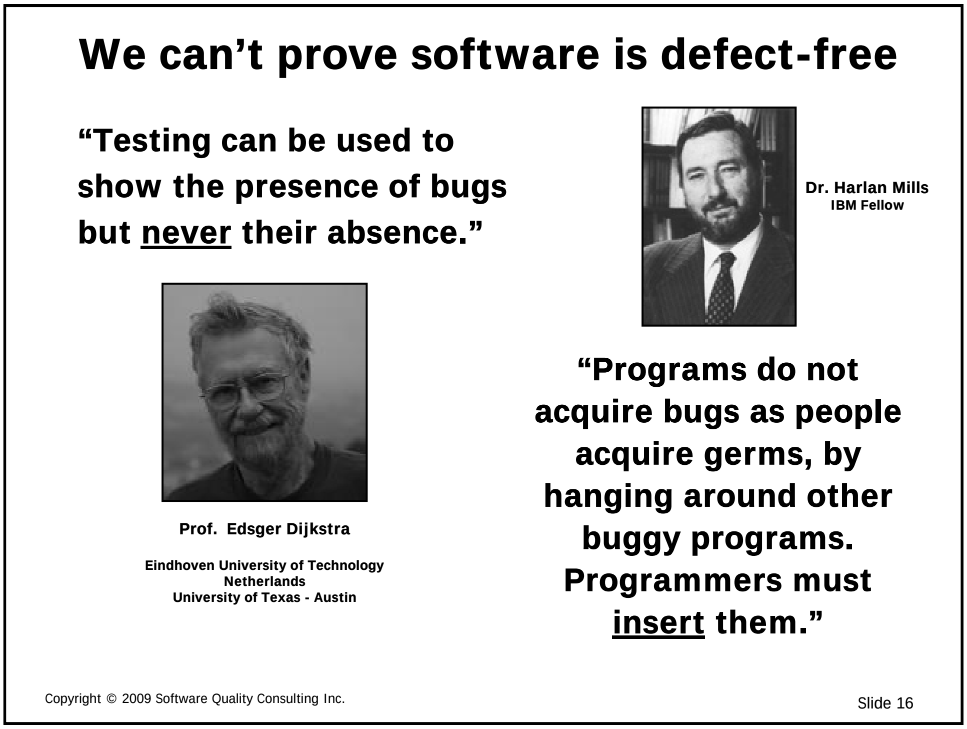
Slide 14



All Software is Defective…

- We can't prove that software is defect-free…
- Developers on average inject 1 defect for every 8 lines of code written…
  - About 95% defects removed prior to release
- Software development is an inherently human process…

Slide 15



We can't prove software is defect-free

"Testing can be used to show the presence of bugs but never their absence."

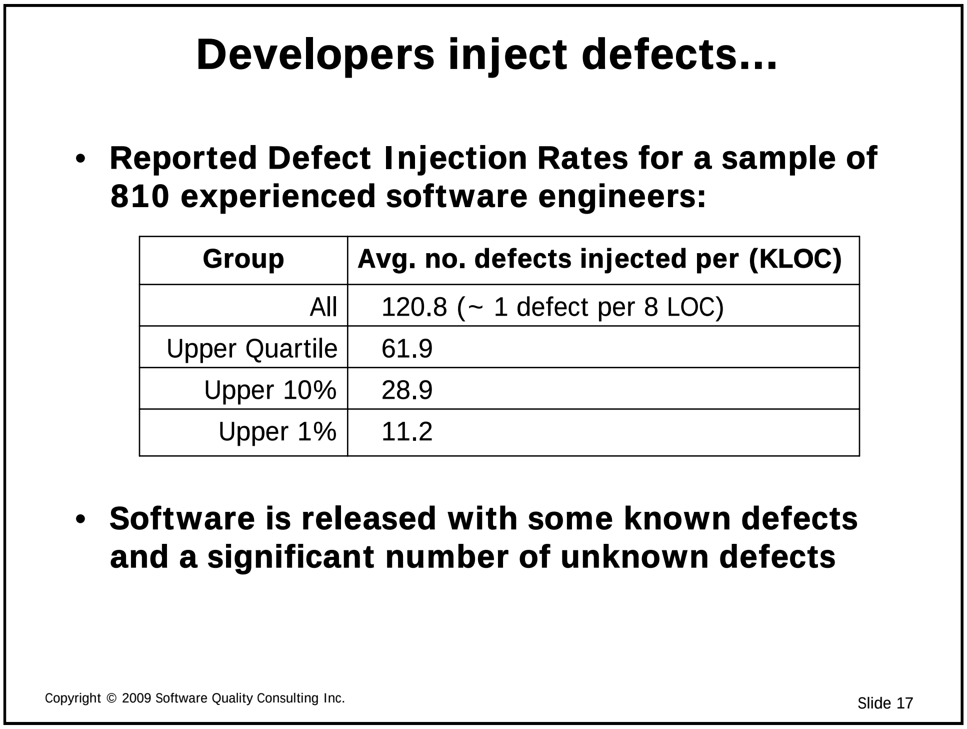
Prof. Edsger Dijkstra

Eindhoven University of Technology
Netherlands
University of Texas - Austin

Dr. Harlan Mills
IBM Fellow

"Programs do not acquire bugs as people acquire germs, by hanging around other buggy programs. Programmers must insert them."

Slide 16



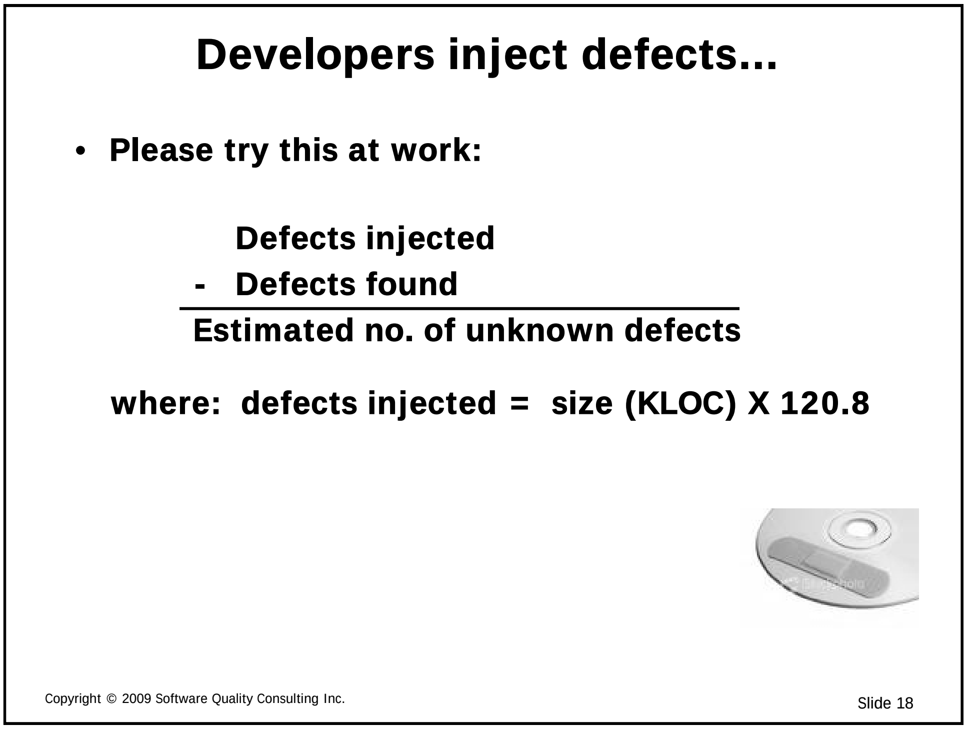
Developers inject defects...

- Reported Defect Injection Rates for a sample of 810 experienced software engineers:

Group	Avg. no. defects injected per (KLOC)
All	120.8 (~ 1 defect per 8 LOC)
Upper Quartile	61.9
Upper 10%	28.9
Upper 1%	11.2

- Software is released with some known defects and a significant number of unknown defects

Slide 17



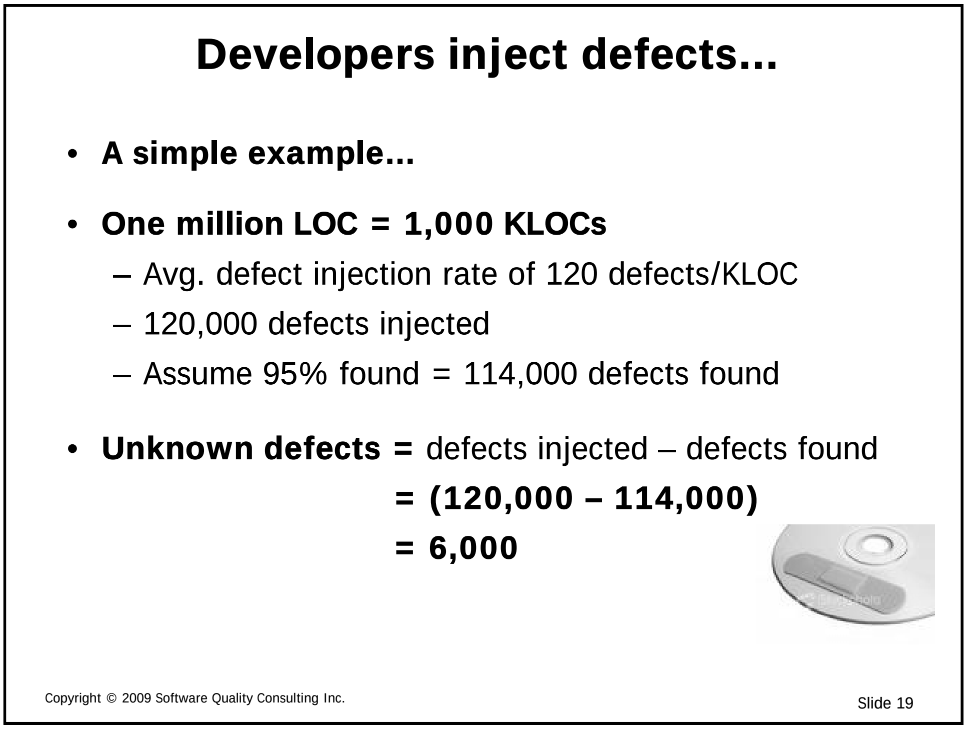
Developers inject defects...

- Please try this at work:

$$\begin{array}{rl} & \text{Defects injected} \\ - & \text{Defects found} \\ \hline & \text{Estimated no. of unknown defects} \end{array}$$

where: defects injected = size (KLOC) X 120.8

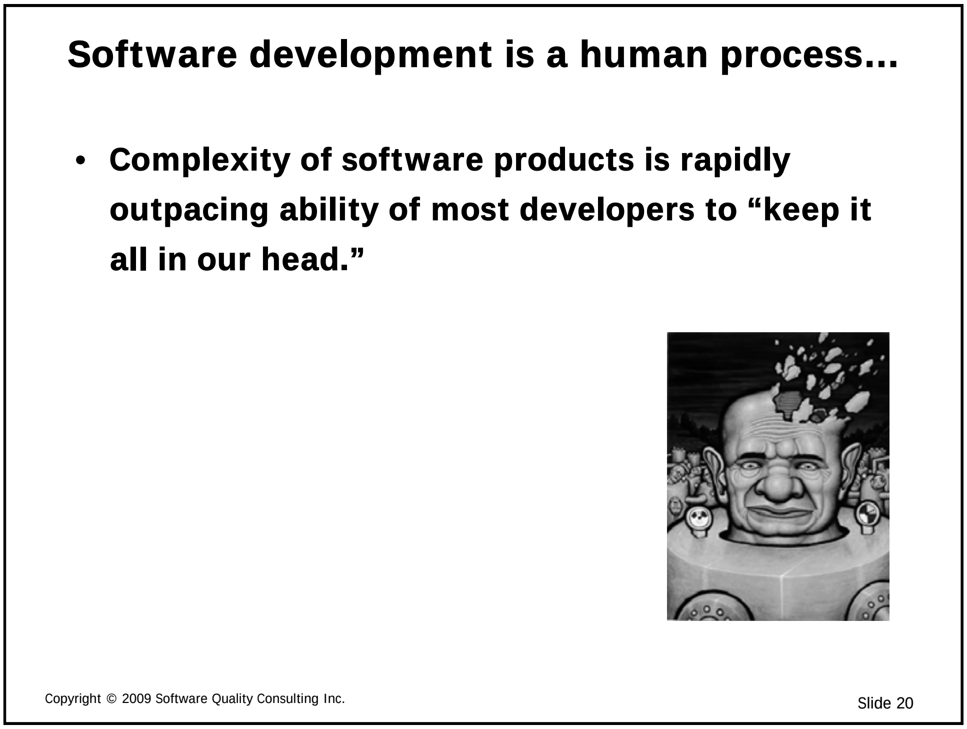
Slide 18



Developers inject defects...

- **A simple example...**
- **One million LOC = 1,000 KLOCs**
  – Avg. defect injection rate of 120 defects/KLOC
  – 120,000 defects injected
  – Assume 95% found = 114,000 defects found
- **Unknown defects =** defects injected – defects found
  = (120,000 – 114,000)
  = 6,000

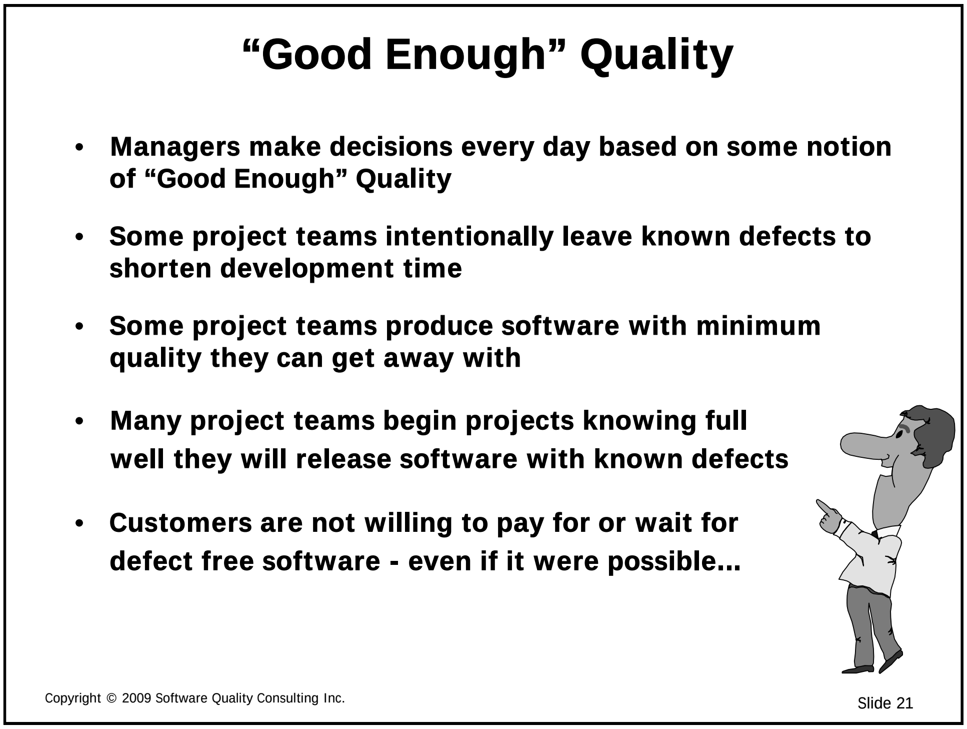
Slide 19



Software development is a human process...

- **Complexity of software products is rapidly outpacing ability of most developers to “keep it all in our head.”**

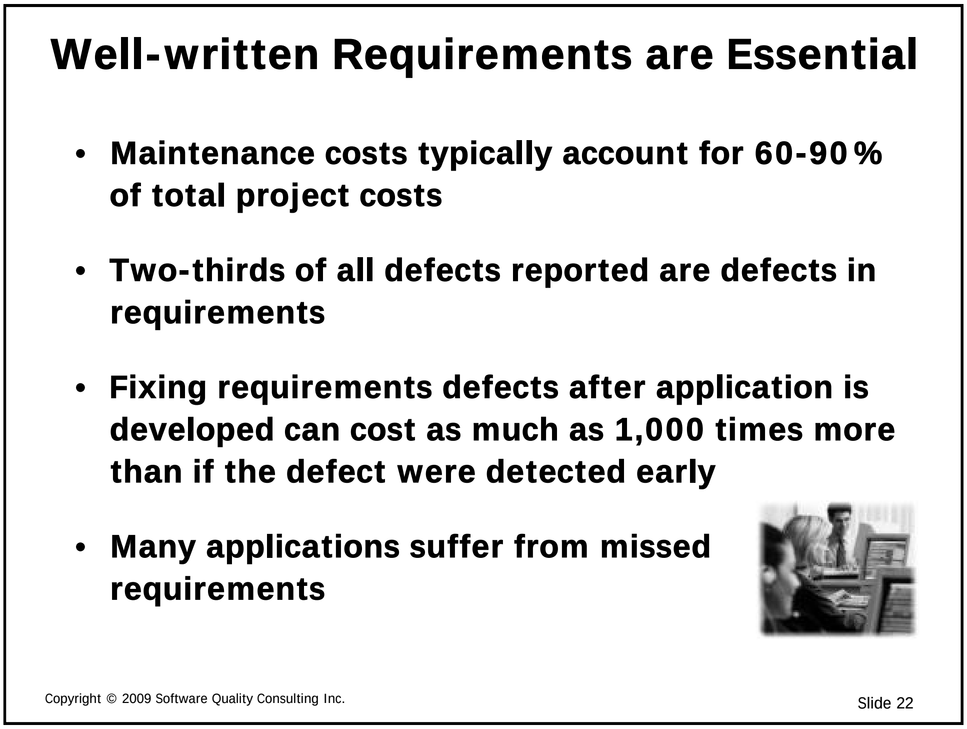
Slide 20



“Good Enough” Quality

- Managers make decisions every day based on some notion of “Good Enough” Quality
- Some project teams intentionally leave known defects to shorten development time
- Some project teams produce software with minimum quality they can get away with
- Many project teams begin projects knowing full well they will release software with known defects
- Customers are not willing to pay for or wait for defect free software - even if it were possible...

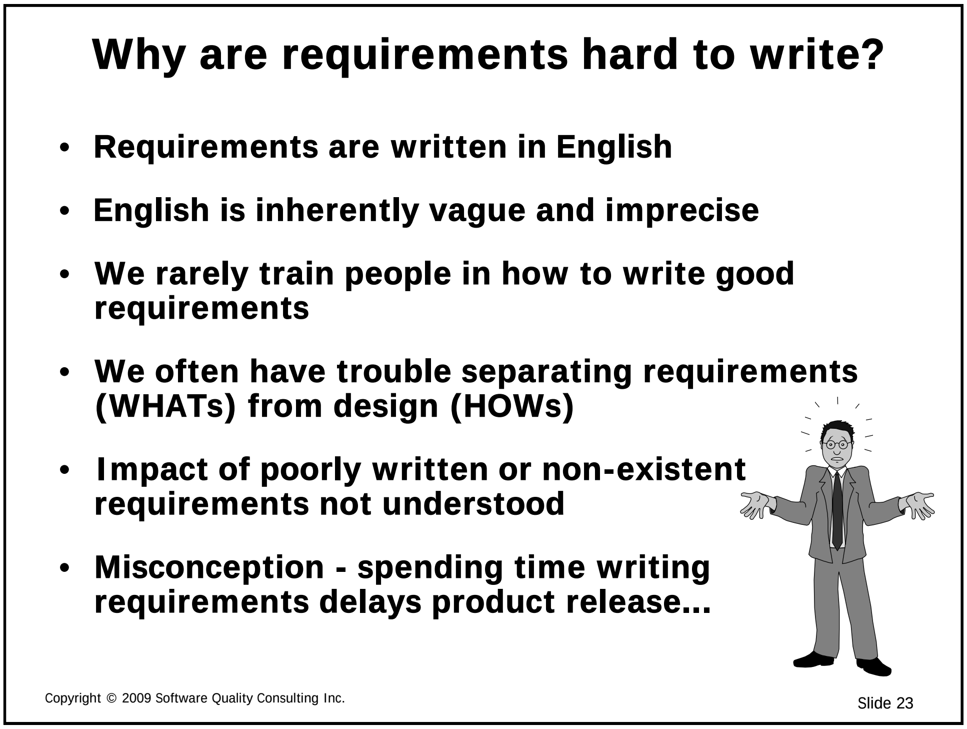
Slide 21



Well-written Requirements are Essential

- Maintenance costs typically account for 60-90% of total project costs
- Two-thirds of all defects reported are defects in requirements
- Fixing requirements defects after application is developed can cost as much as 1,000 times more than if the defect were detected early
- Many applications suffer from missed requirements

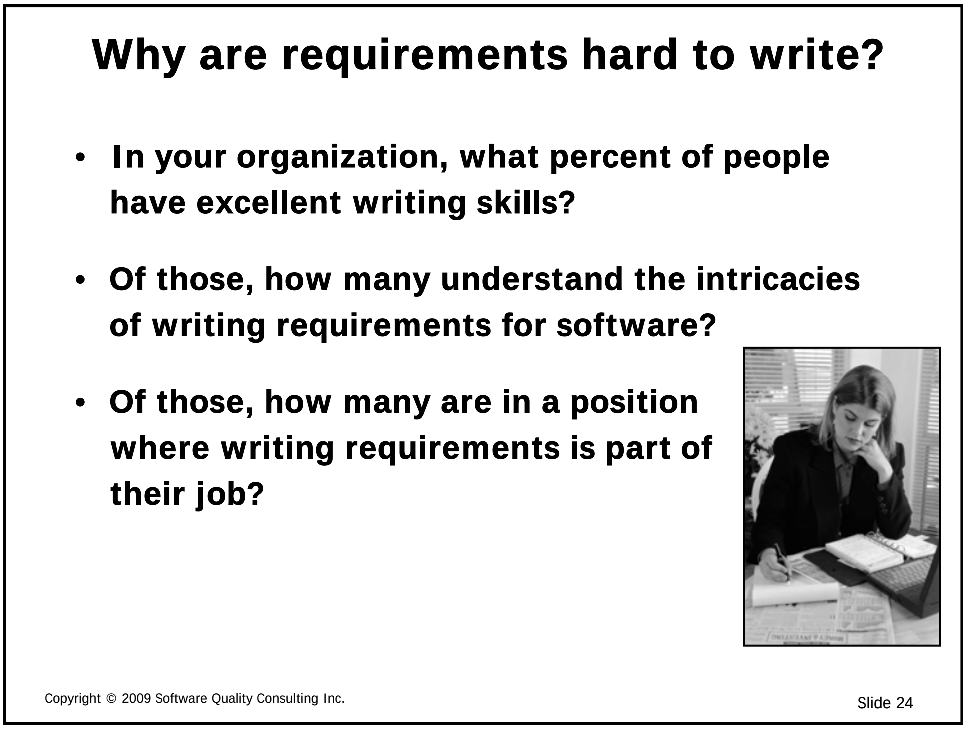
Slide 22



Why are requirements hard to write?

- Requirements are written in English
- English is inherently vague and imprecise
- We rarely train people in how to write good requirements
- We often have trouble separating requirements (WHATs) from design (HOWs)
- Impact of poorly written or non-existent requirements not understood
- Misconception - spending time writing requirements delays product release...

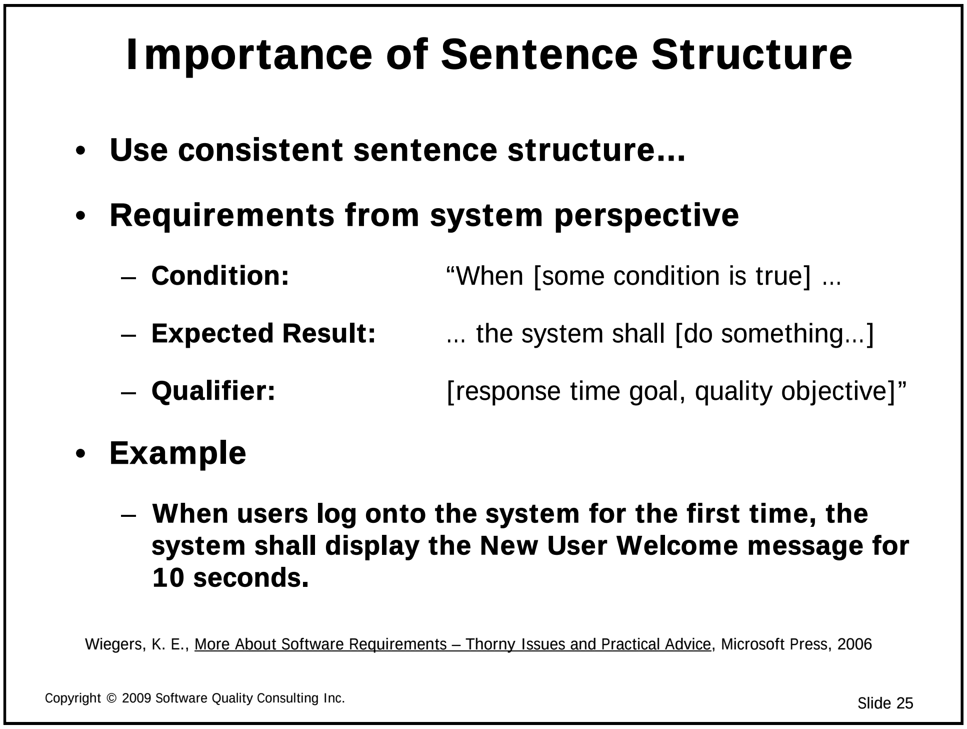
Slide 23



Why are requirements hard to write?

- In your organization, what percent of people have excellent writing skills?
- Of those, how many understand the intricacies of writing requirements for software?
- Of those, how many are in a position where writing requirements is part of their job?

Slide 24

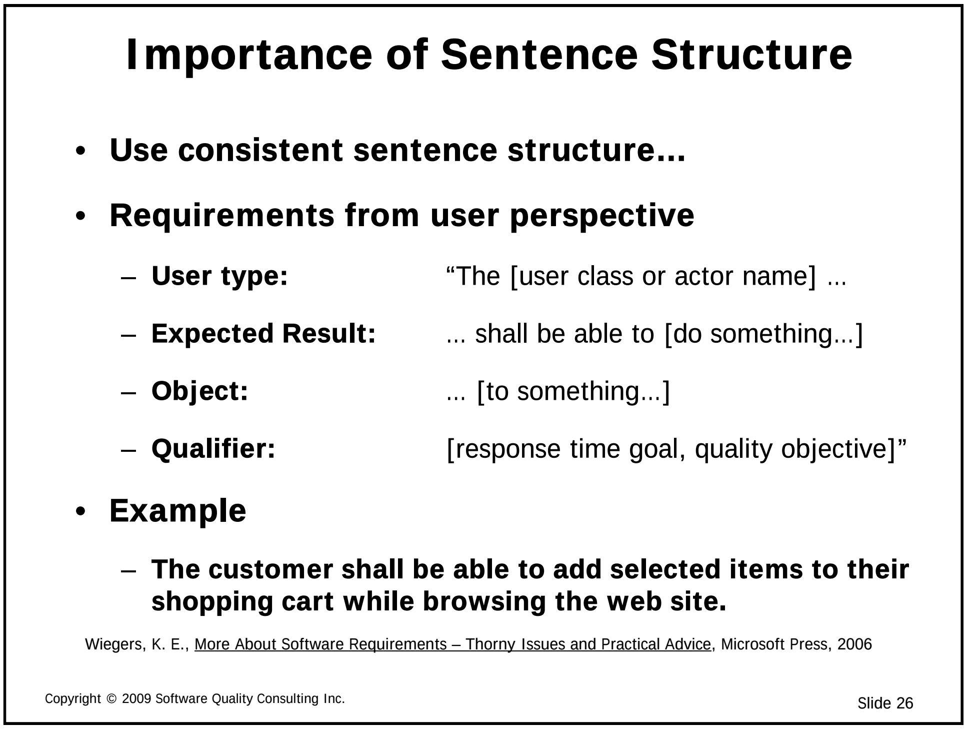


Importance of Sentence Structure

- **Use consistent sentence structure…**
- **Requirements from system perspective**
  - **Condition:** “When [some condition is true] …
  - **Expected Result:** … the system shall [do something...]
  - **Qualifier:** [response time goal, quality objective]”
- **Example**
  - **When users log onto the system for the first time, the system shall display the New User Welcome message for 10 seconds.**

Wiegers, K. E., More About Software Requirements – Thorny Issues and Practical Advice, Microsoft Press, 2006

Slide 25



Importance of Sentence Structure

- **Use consistent sentence structure…**
- **Requirements from user perspective**
  - **User type:** “The [user class or actor name] …
  - **Expected Result:** … shall be able to [do something...]
  - **Object:** … [to something...]
  - **Qualifier:** [response time goal, quality objective]”
- **Example**
  - **The customer shall be able to add selected items to their shopping cart while browsing the web site.**

Wiegers, K. E., More About Software Requirements – Thorny Issues and Practical Advice, Microsoft Press, 2006

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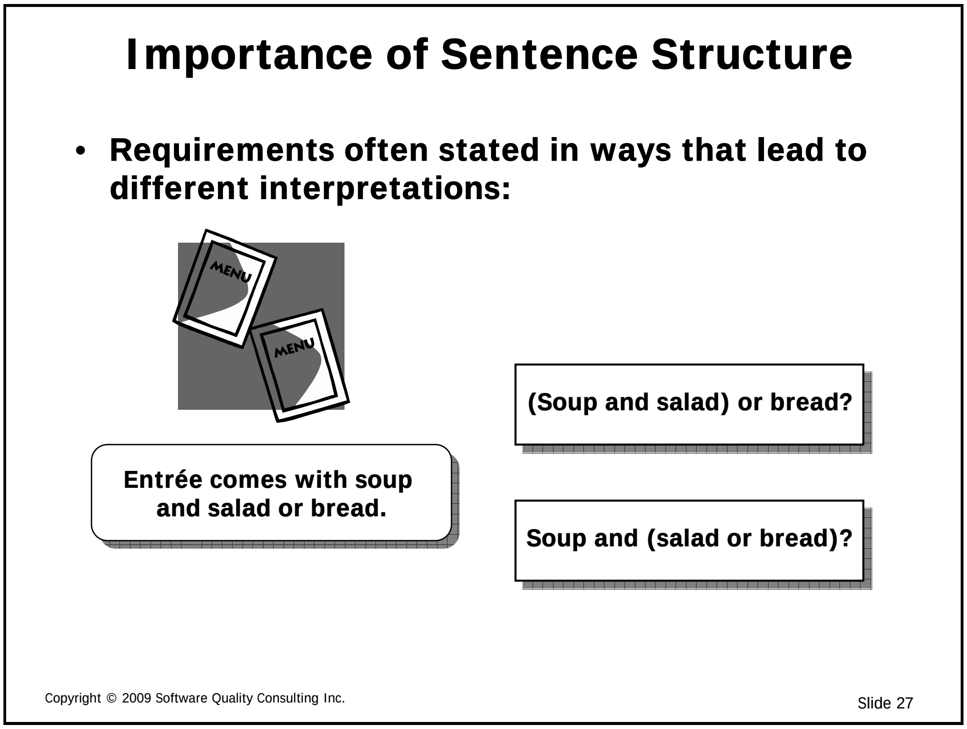


Importance of Sentence Structure

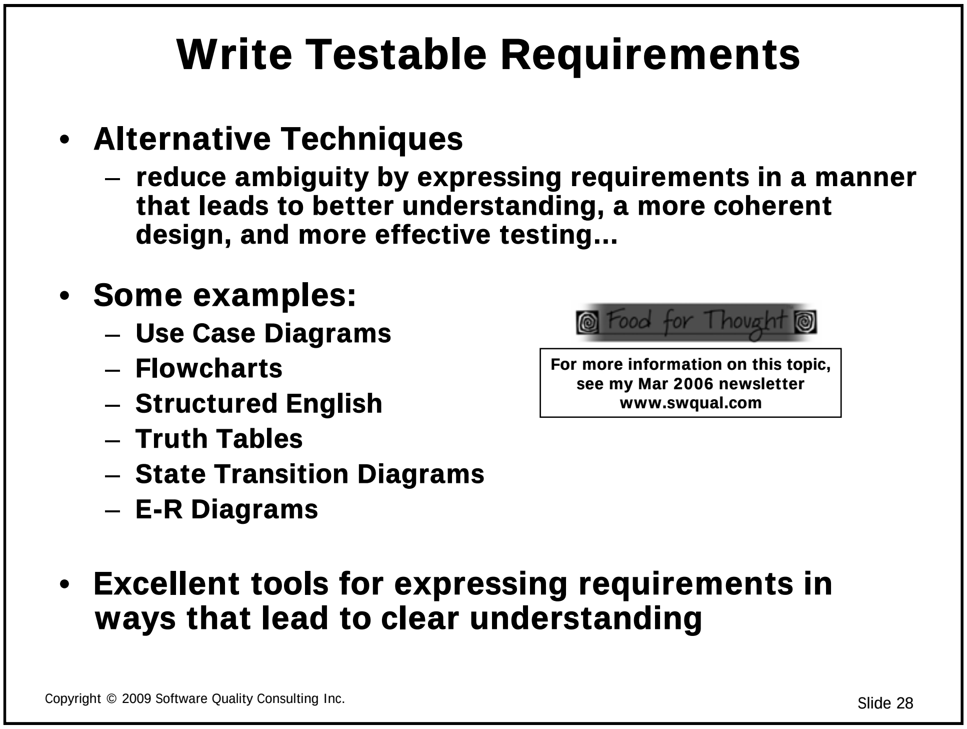
- Requirements often stated in ways that lead to different interpretations:

Entrée comes with soup and salad or bread.

(Soup and salad) or bread?

Soup and (salad or bread)?

Slide 27



Write Testable Requirements

- Alternative Techniques
  - reduce ambiguity by expressing requirements in a manner that leads to better understanding, a more coherent design, and more effective testing…
- Some examples:
  - Use Case Diagrams
  - Flowcharts
  - Structured English
  - Truth Tables
  - State Transition Diagrams
  - E-R Diagrams
- Excellent tools for expressing requirements in ways that lead to clear understanding

Food for Thought

For more information on this topic, see my Mar 2006 newsletter
www.swqual.com

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Estimating and Scheduling Best Practices

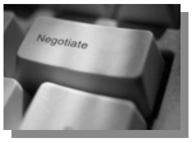
- **Estimates**
  - A **tentative evaluation** or **rough calculation**
  - Determined from experience doing similar tasks
  - Estimates are never negotiable…
  - Good estimates can only come from good requirements
- “A good estimate [...] provides a clear enough view of the project to allow the project leadership to make good decisions about how to control a project in order to hit its targets.”

McConnell, S., Software Estimation – Demystifying the Black Art, Microsoft Press, 2006

Slide 29

Estimating and Scheduling Best Practices

- **Targets**
  - Descriptions of desirable business objectives…
  - Determined by making business decisions…
  - Are internal to the business…
  - Targets are always negotiable…

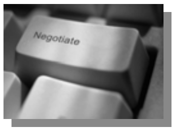


McConnell, S., Software Estimation – Demystifying the Black Art, Microsoft Press, 2006

Slide 30

Estimating and Scheduling Best Practices

- **Commitments**
  - Promises to deliver defined functionality at a specific level of quality by a specific date…
  - Promises made specifically to customers (internal or external)
  - Commitments are always negotiable…

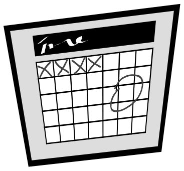


McConnell, S., Software Estimation – Demystifying the Black Art, Microsoft Press, 2006

Slide 31

Estimating and Scheduling Best Practices

- **Schedules**
  - A schedule consists of a list of a project's terminal elements with intended start and finish dates
  - Terminal elements are items that are estimated in terms of resource requirements, budget and duration, linked by dependencies and scheduled
  - Schedules are always negotiable…
  - Good schedules can only come from good estimates…



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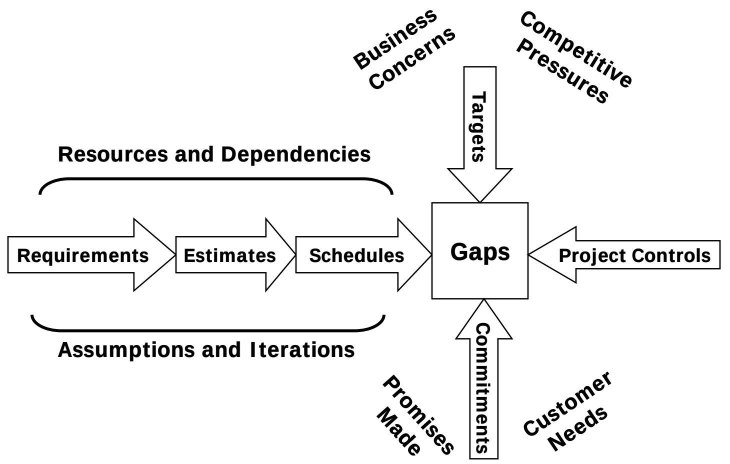
Estimates, Targets, Commitments, and Schedules



Business Concerns

Competitive Pressures

Targets

Resources and Dependencies

Requirements

Estimates

Schedules

Gaps

Project Controls

Assumptions and Iterations

Commitments

Promises Made

Customer Needs

McConnell, S., Software Estimation – Demystifying the Black Art, Microsoft Press, 2006

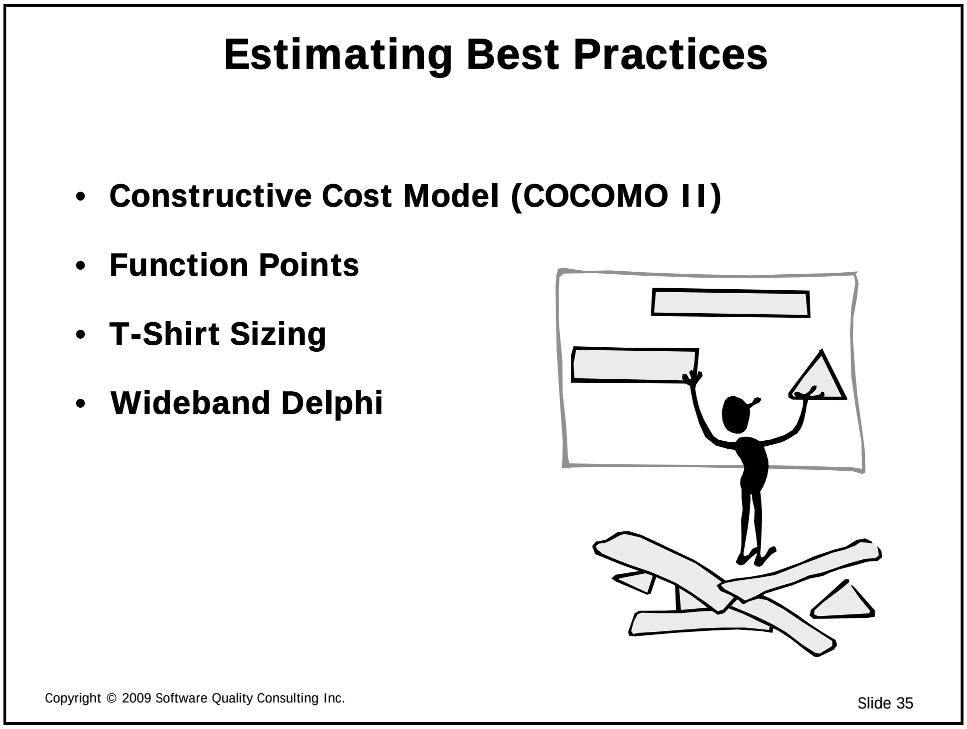
Slide 33

Estimates, Targets, Commitments, and Schedules

- **Some Problems**
  - **When Managers asks for estimates often interested in something else…**
  - **Characteristics of many estimates:**
    - **Derived using “gut feel”, “finger in the wind” methods**
    - **Not supported by data or factual information**
    - **Answer boss wants to hear**
  - **“It is difficult to make a vigorous, plausible, and job-risking defense of an estimate that is derived by no quantitative method, supported by little data, and certified chiefly by the hunches of managers”.**

Brooks, F., The Mythical Man-Month, 25th Anniversary Edition, Addison-Wesley, 1995

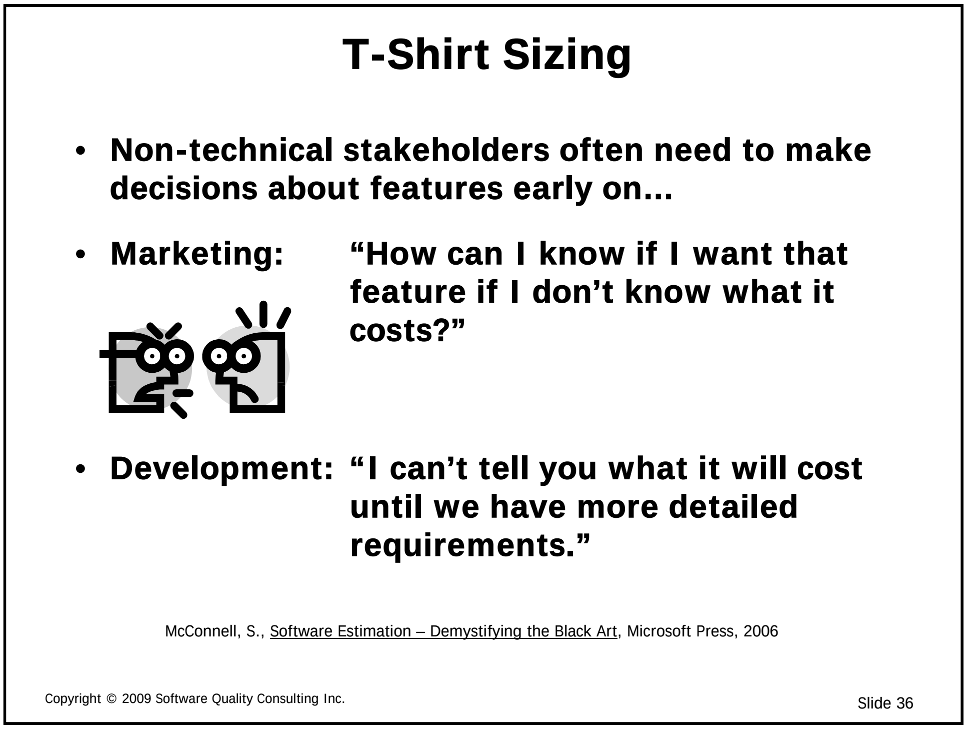
Slide 34



Estimating Best Practices

- Constructive Cost Model (COCOMO II)
- Function Points
- T-Shirt Sizing
- Wideband Delphi

Slide 35

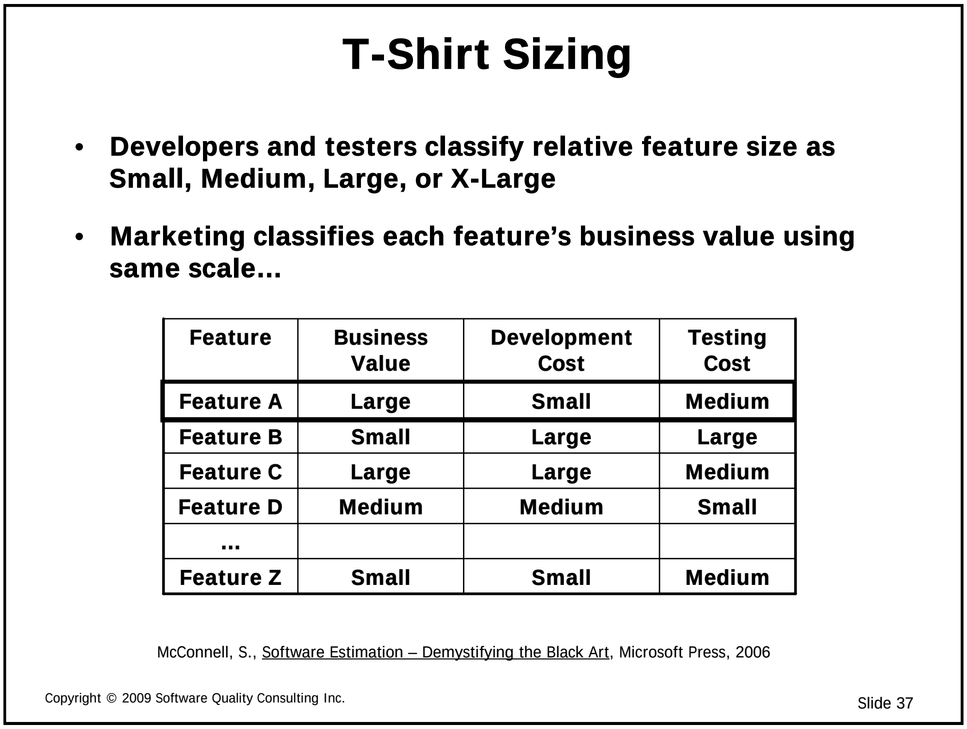


T-Shirt Sizing

- Non-technical stakeholders often need to make decisions about features early on…
- Marketing: “How can I know if I want that feature if I don’t know what it costs?”
- Development: “I can’t tell you what it will cost until we have more detailed requirements.”

McConnell, S., Software Estimation – Demystifying the Black Art, Microsoft Press, 2006

Slide 36



T-Shirt Sizing

- Developers and testers classify relative feature size as Small, Medium, Large, or X-Large
- Marketing classifies each feature's business value using same scale...

Feature	Business Value	Development Cost	Testing Cost
Feature A	Large	Small	Medium
Feature B	Small	Large	Large
Feature C	Large	Large	Medium
Feature D	Medium	Medium	Small
...			
Feature Z	Small	Small	Medium

McConnell, S., Software Estimation – Demystifying the Black Art, Microsoft Press, 2006

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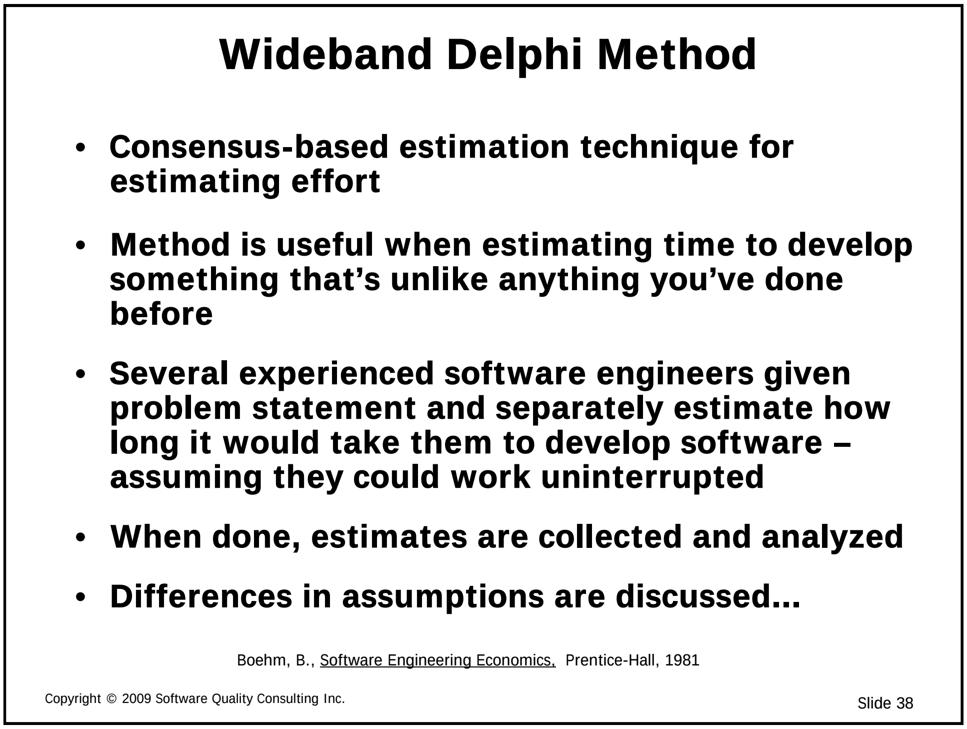
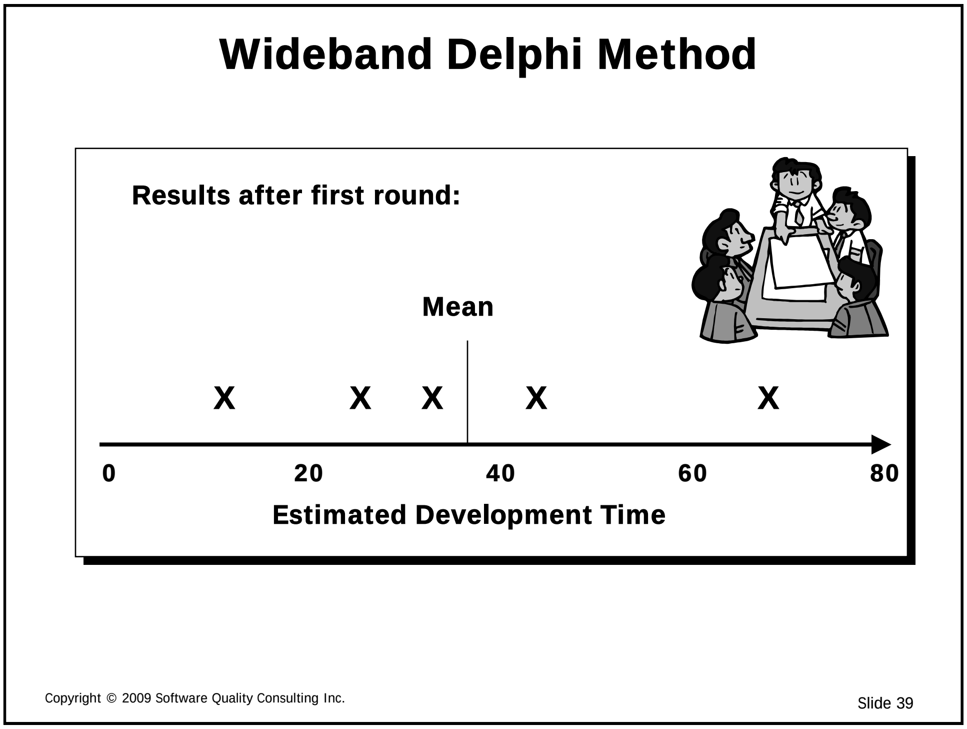


Wideband Delphi Method

- Consensus-based estimation technique for estimating effort
- Method is useful when estimating time to develop something that's unlike anything you've done before
- Several experienced software engineers given problem statement and separately estimate how long it would take them to develop software – assuming they could work uninterrupted
- When done, estimates are collected and analyzed
- Differences in assumptions are discussed...

Boehm, B., Software Engineering Economics, Prentice-Hall, 1981

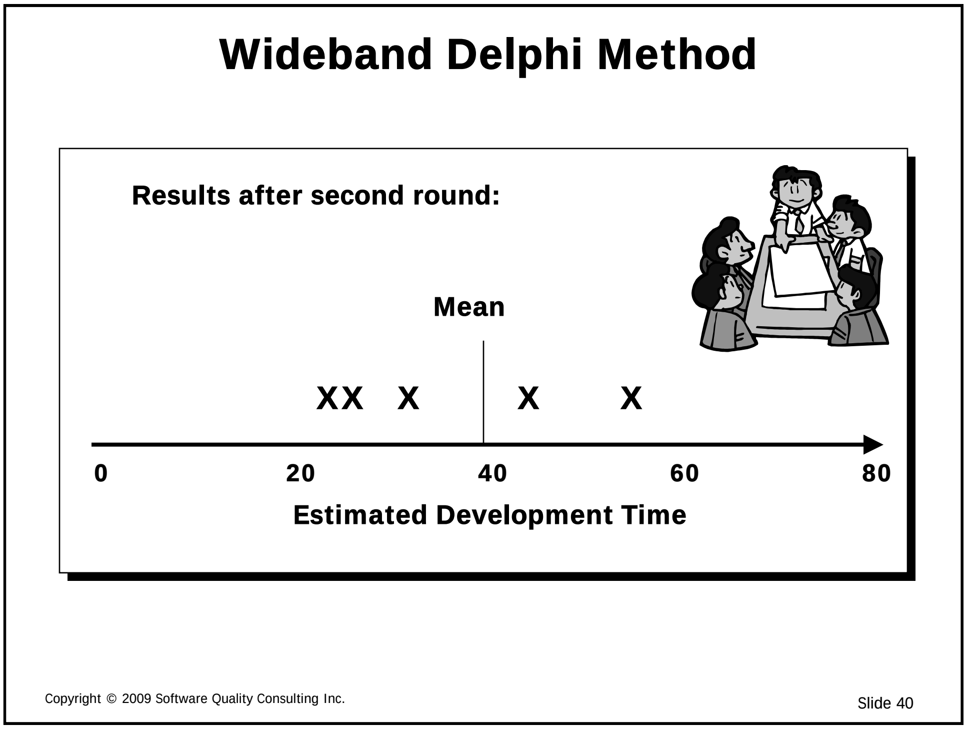
Slide 38



Wideband Delphi Method

Results after first round:

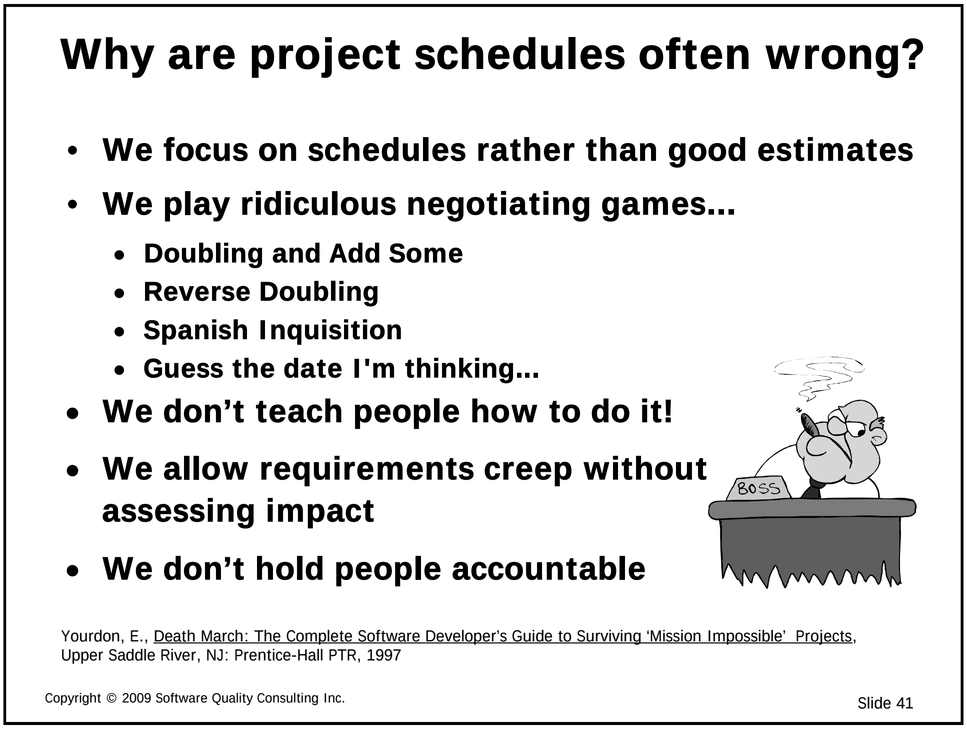
Slide 39



Wideband Delphi Method

Results after second round:

Slide 40

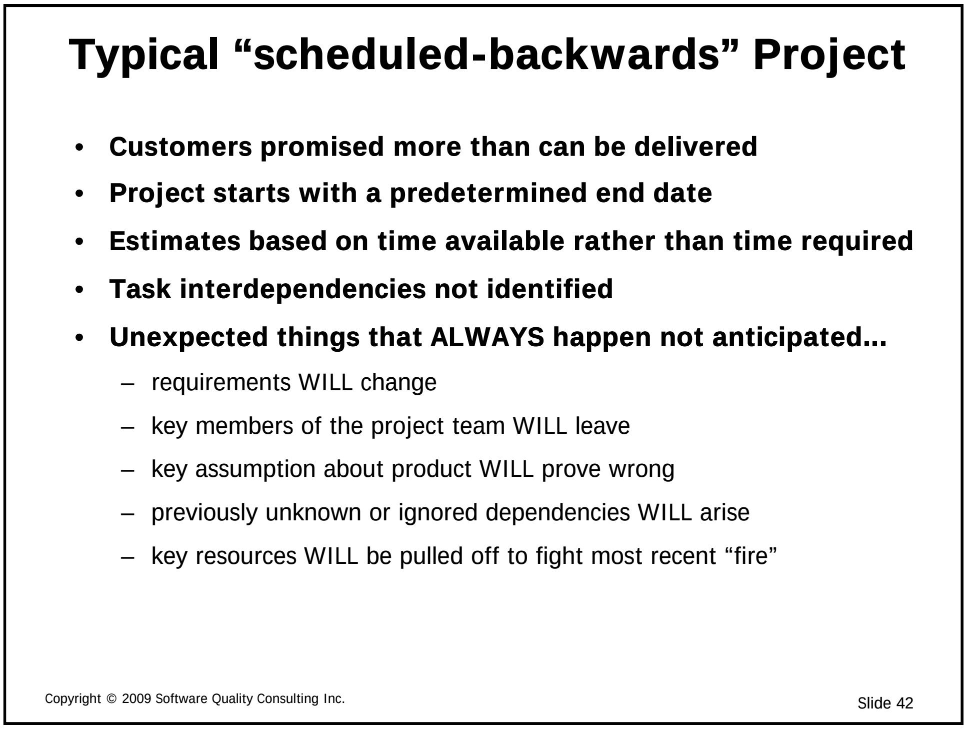


Why are project schedules often wrong?

- We focus on schedules rather than good estimates
- We play ridiculous negotiating games...
  - Doubling and Add Some
  - Reverse Doubling
  - Spanish Inquisition
  - Guess the date I'm thinking...
- We don’t teach people how to do it!
- We allow requirements creep without assessing impact
- We don’t hold people accountable

Yourdon, E., Death March: The Complete Software Developer’s Guide to Surviving ‘Mission Impossible’ Projects, Upper Saddle River, NJ: Prentice-Hall PTR, 1997

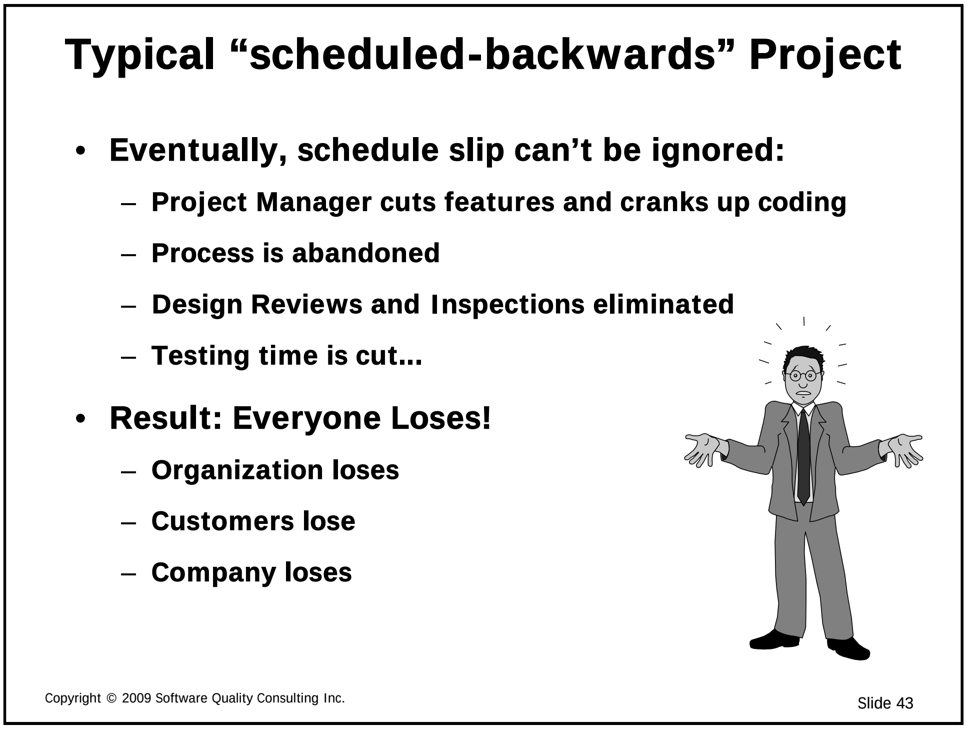
Slide 41



Typical “scheduled-backwards” Project

- Customers promised more than can be delivered
- Project starts with a predetermined end date
- Estimates based on time available rather than time required
- Task interdependencies not identified
- Unexpected things that ALWAYS happen not anticipated...
  - requirements WILL change
  - key members of the project team WILL leave
  - key assumption about product WILL prove wrong
  - previously unknown or ignored dependencies WILL arise
  - key resources WILL be pulled off to fight most recent “fire”

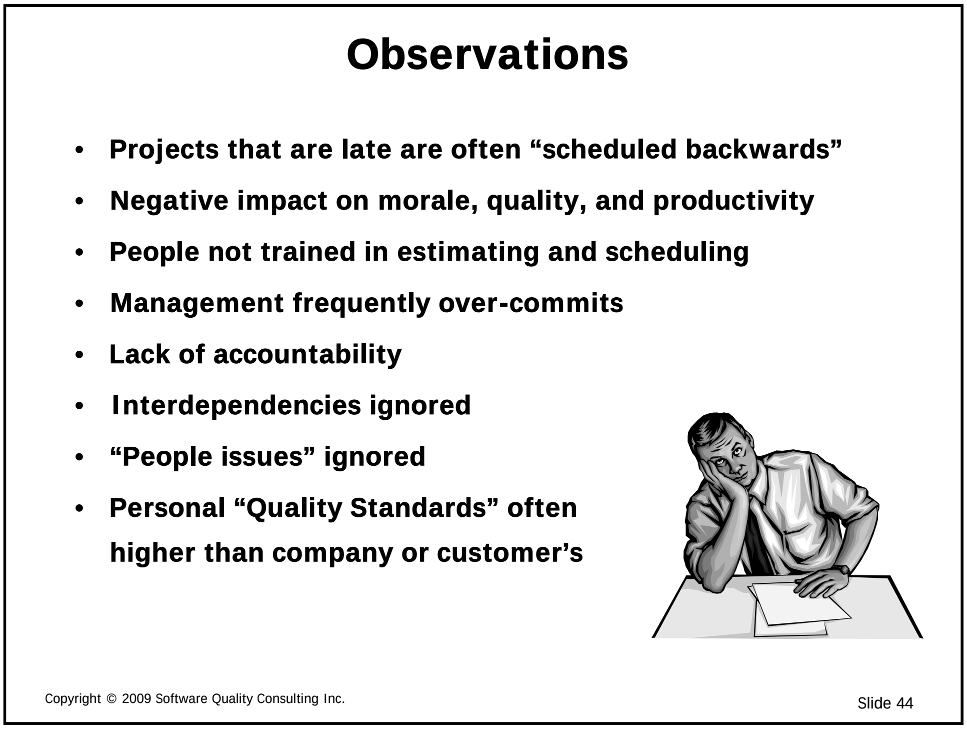
Slide 42



Typical “scheduled-backwards” Project

- Eventually, schedule slip can’t be ignored:
  - Project Manager cuts features and cranks up coding
  - Process is abandoned
  - Design Reviews and Inspections eliminated
  - Testing time is cut…
- Result: Everyone Loses!
  - Organization loses
  - Customers lose
  - Company loses

Slide 43



Observations

- Projects that are late are often “scheduled backwards”
- Negative impact on morale, quality, and productivity
- People not trained in estimating and scheduling
- Management frequently over-commits
- Lack of accountability
- Interdependencies ignored
- “People issues” ignored
- Personal “Quality Standards” often higher than company or customer’s

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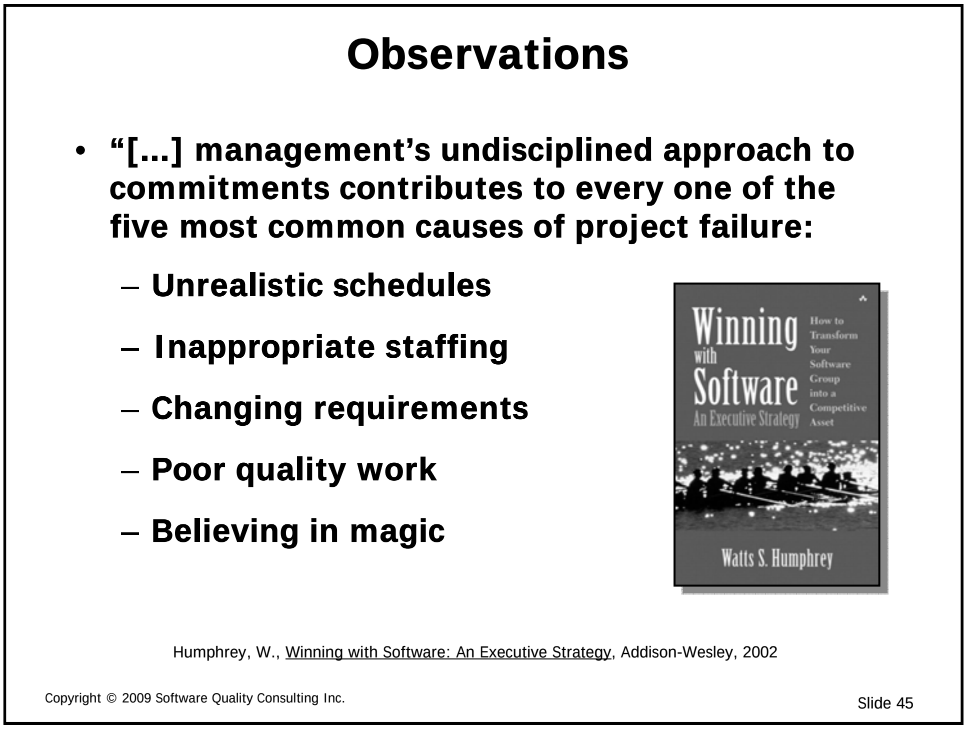

Observations

- **“[...] management’s undisciplined approach to commitments contributes to every one of the five most common causes of project failure:**
  - **Unrealistic schedules**
  - **Inappropriate staffing**
  - **Changing requirements**
  - **Poor quality work**
  - **Believing in magic**

Winning with Software
An Executive Strategy
How to Transform Your Software Group into a Competitive Asset
Watts S. Humphrey

Humphrey, W., Winning with Software: An Executive Strategy, Addison-Wesley, 2002

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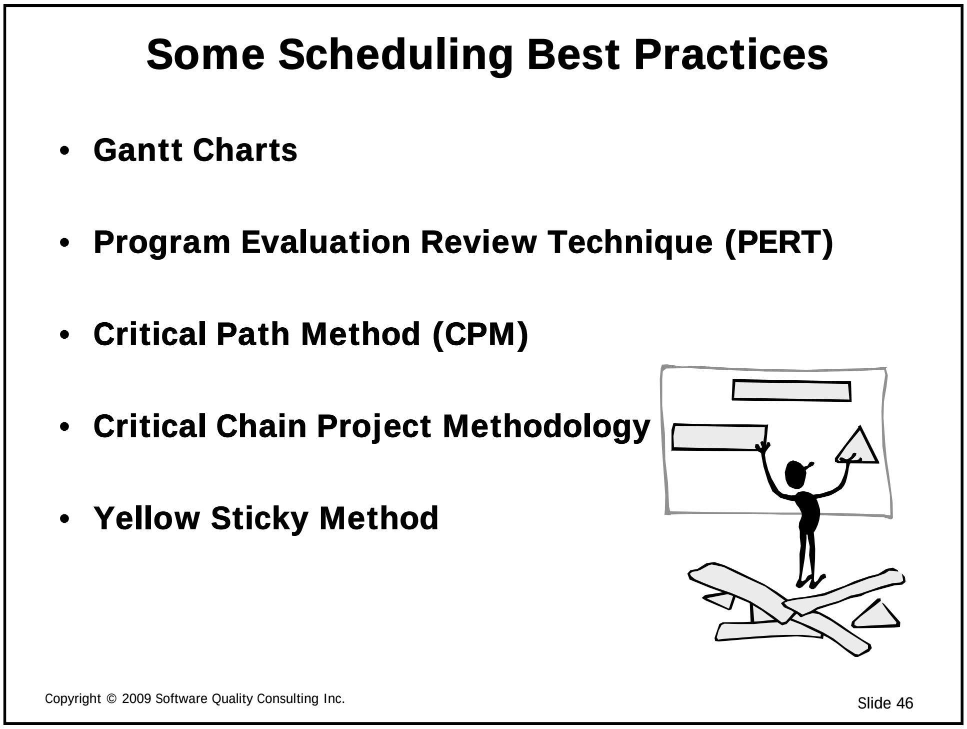

Some Scheduling Best Practices

- **Gantt Charts**
- **Program Evaluation Review Technique (PERT)**
- **Critical Path Method (CPM)**
- **Critical Chain Project Methodology**
- **Yellow Sticky Method**

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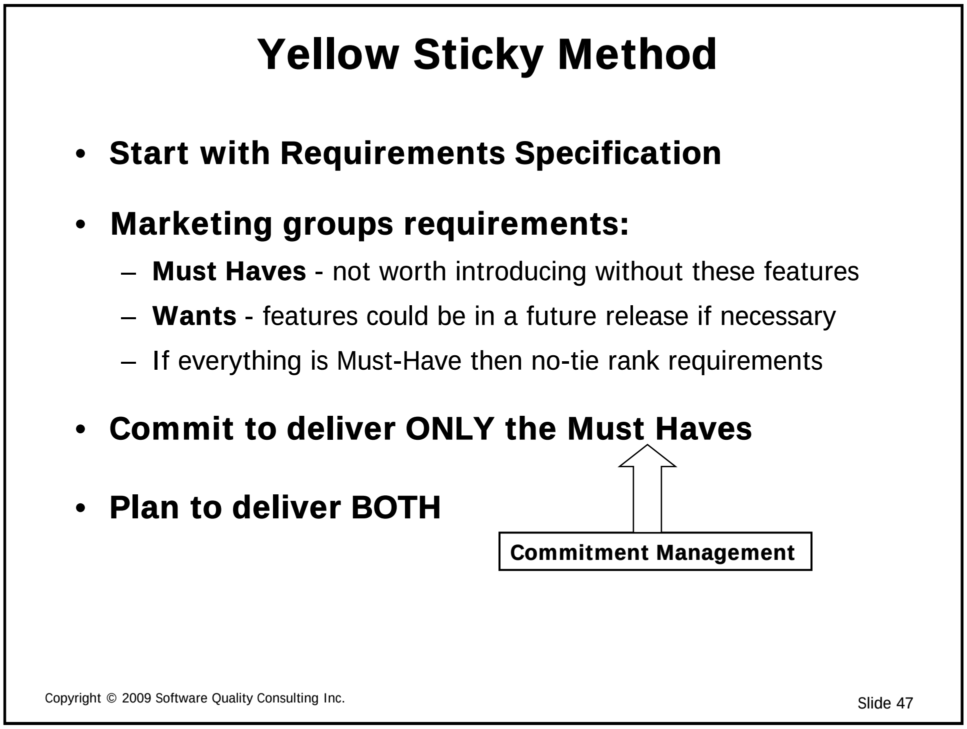

Yellow Sticky Method

- **Start with Requirements Specification**
- **Marketing groups requirements:**
  - **Must Haves** - not worth introducing without these features
  - **Wants** - features could be in a future release if necessary
  - If everything is Must-Have then no-tie rank requirements
- **Commit to deliver ONLY the Must Haves**
- **Plan to deliver BOTH**

Commitment Management

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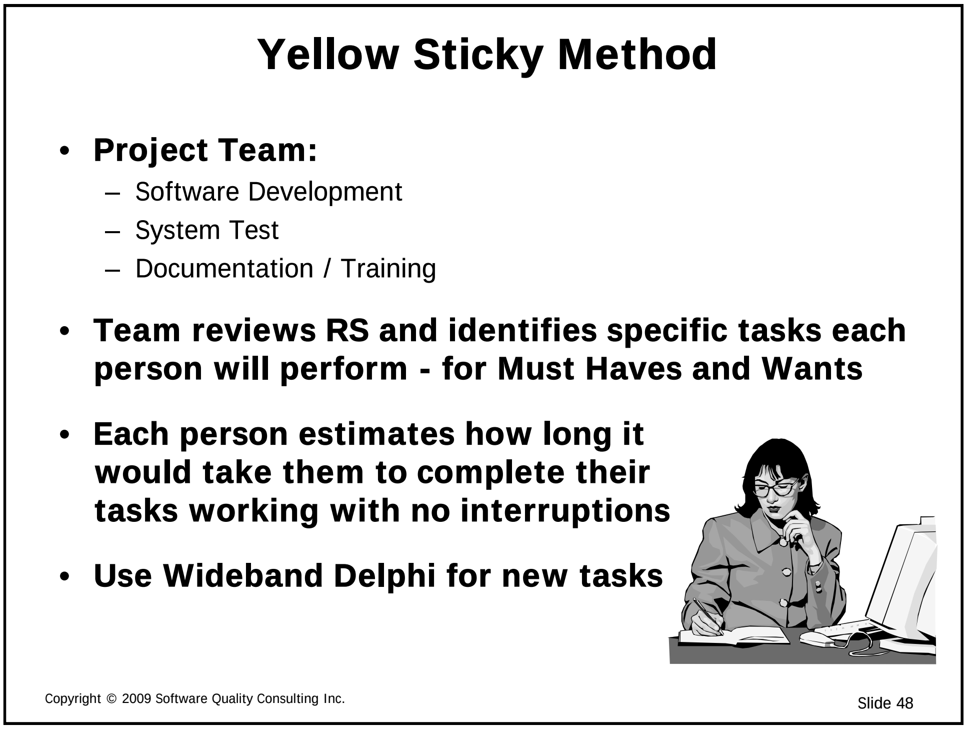

Yellow Sticky Method

- **Project Team:**
  - Software Development
  - System Test
  - Documentation / Training
- **Team reviews RS and identifies specific tasks each person will perform - for Must Haves and Wants**
- **Each person estimates how long it would take them to complete their tasks working with no interruptions**
- **Use Wideband Delphi for new tasks**

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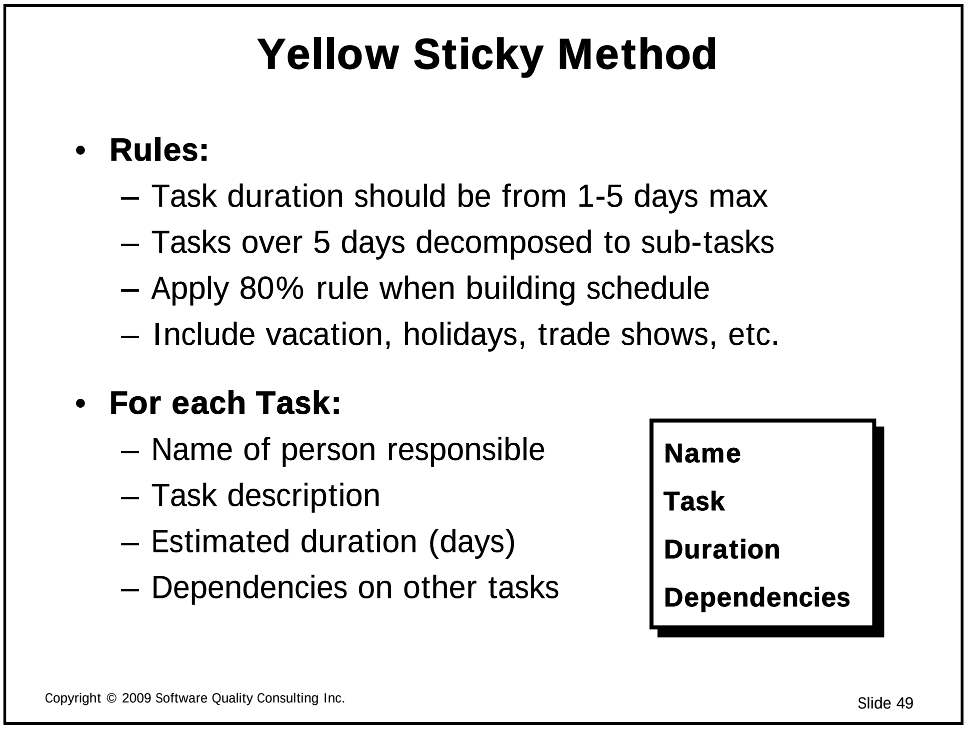

Yellow Sticky Method

- **Rules:**
  - – Task duration should be from 1-5 days max
  - – Tasks over 5 days decomposed to sub-tasks
  - – Apply 80% rule when building schedule
  - – Include vacation, holidays, trade shows, etc.
- **For each Task:**
  - – Name of person responsible
  - – Task description
  - – Estimated duration (days)
  - – Dependencies on other tasks

Name
Task
Duration
Dependencies

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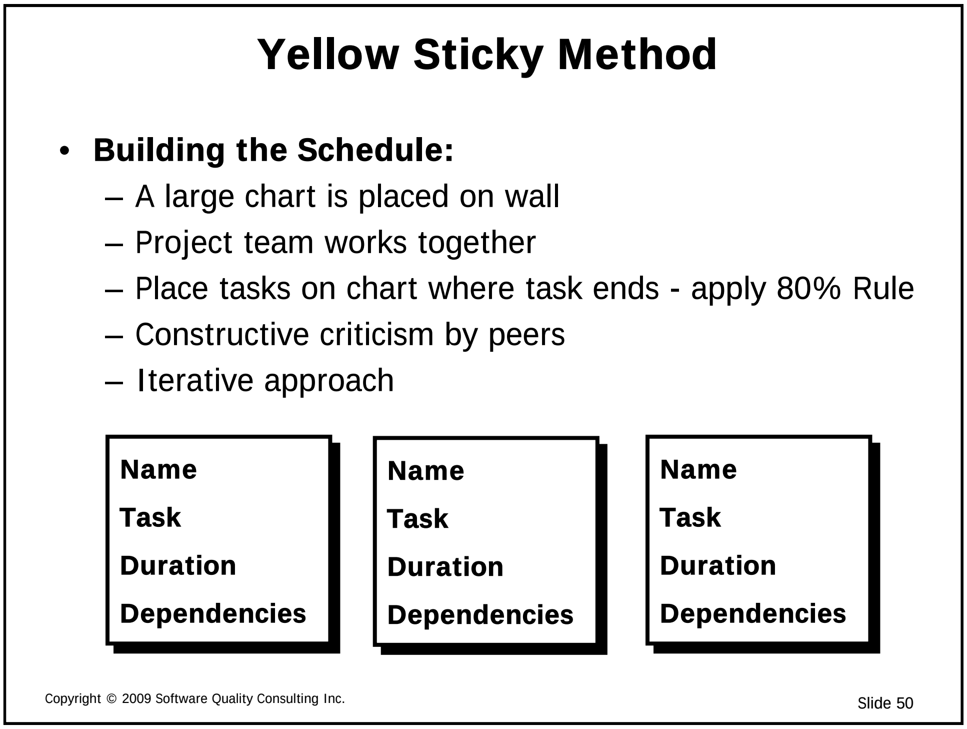


Yellow Sticky Method

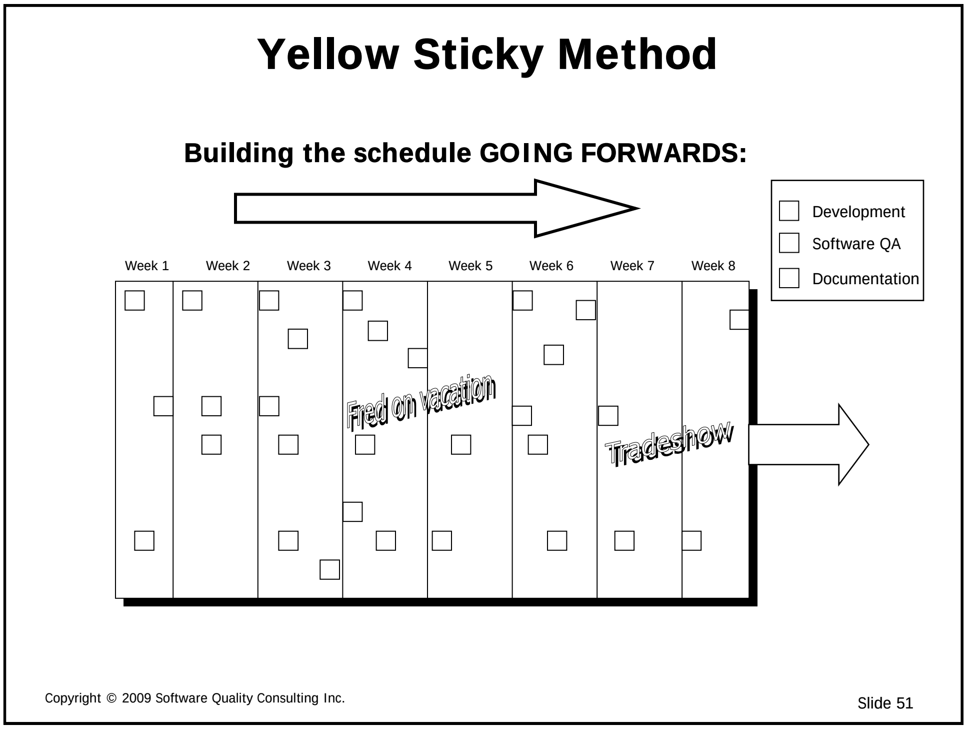
- **Building the Schedule:**
  - – A large chart is placed on wall
  - – Project team works together
  - – Place tasks on chart where task ends - apply 80% Rule
  - – Constructive criticism by peers
  - – Iterative approach

Name
Task
Duration
Dependencies

Name
Task
Duration
Dependencies

Name
Task
Duration
Dependencies

Slide 50



Yellow Sticky Method

Building the schedule GOING FORWARDS:

□ Development
□ Software QA
□ Documentation

Week 1 Week 2 Week 3 Week 4 Week 5 Week 6 Week 7 Week 8

Fred on vacation

Tradeshow

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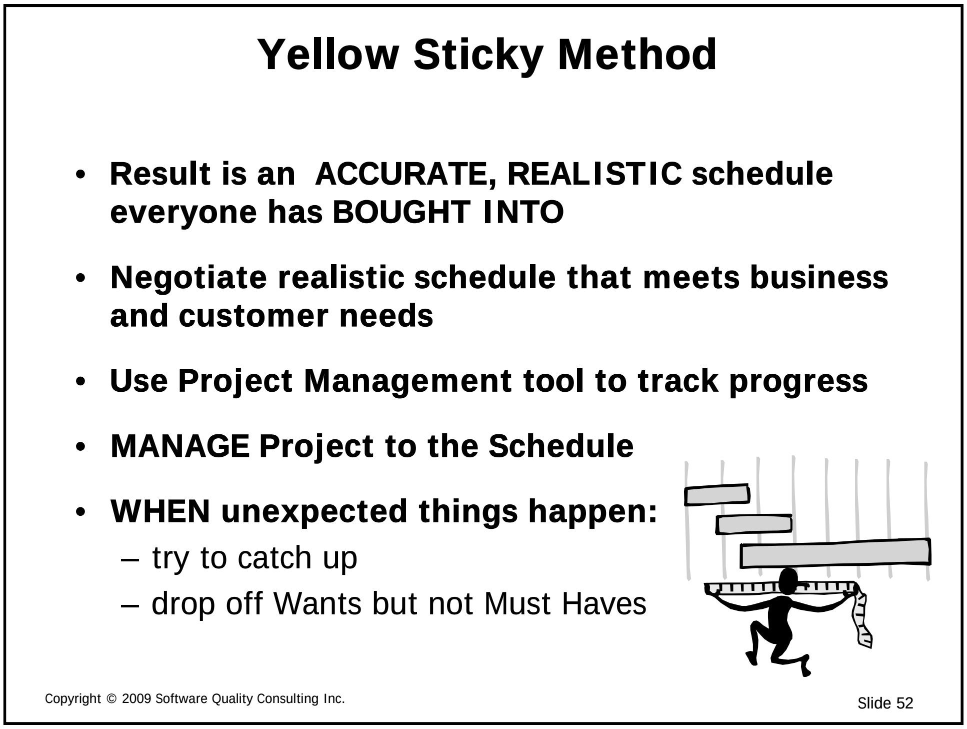

Yellow Sticky Method

- **Result is an ACCURATE, REALISTIC schedule everyone has BOUGHT INTO**
- **Negotiate realistic schedule that meets business and customer needs**
- **Use Project Management tool to track progress**
- **MANAGE Project to the Schedule**
- **WHEN unexpected things happen:**
  - try to catch up
  - drop off Wants but not Must Haves

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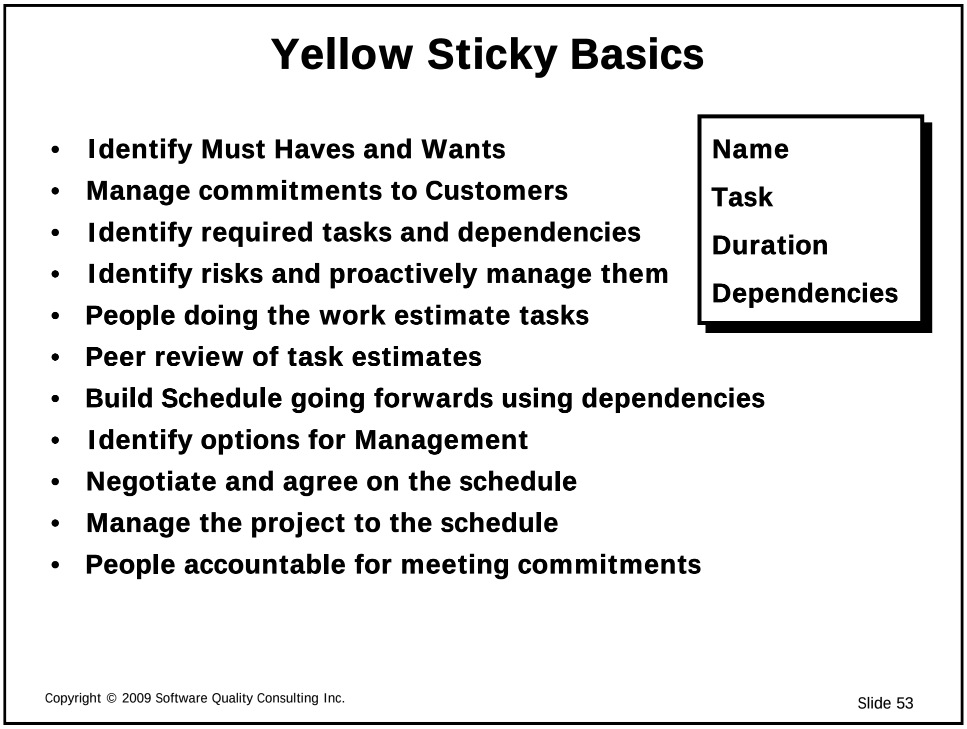

Yellow Sticky Basics

- Identify Must Haves and Wants
- Manage commitments to Customers
- Identify required tasks and dependencies
- Identify risks and proactively manage them
- People doing the work estimate tasks
- Peer review of task estimates
- Build Schedule going forwards using dependencies
- Identify options for Management
- Negotiate and agree on the schedule
- Manage the project to the schedule
- People accountable for meeting commitments

Name
Task
Duration
Dependencies

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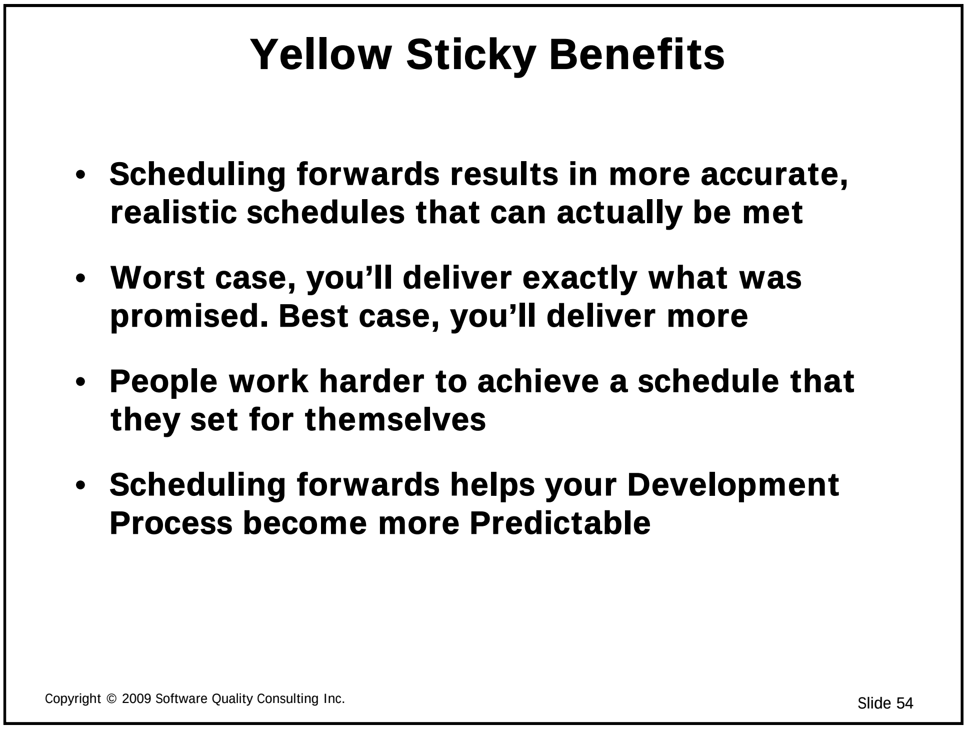


Yellow Sticky Benefits

- Scheduling forwards results in more accurate, realistic schedules that can actually be met
- Worst case, you’ll deliver exactly what was promised. Best case, you’ll deliver more
- People work harder to achieve a schedule that they set for themselves
- Scheduling forwards helps your Development Process become more Predictable

Slide 54

How to know if you’re on right track?

- **Software Development Process**
  - **Is it well-defined and is it followed?**
  - **Does it have objective criteria for measuring progress?**
- **Estimating**
  - **Provide training in basic estimating techniques…**
  - **Track estimates and compare to actuals, reconcile differences**
- **Scheduling**
  - **Track schedules to original commitments, reconcile differences**
- **Product Quality**
  - **Defect Removal Efficiency…**
  - **Is number of unplanned bug fix releases declining?**
- **Commitments and Risk**
  - **Strive to under-commit and over-deliver**
  - **Ensure project managers are focused on risk**

Slide 55

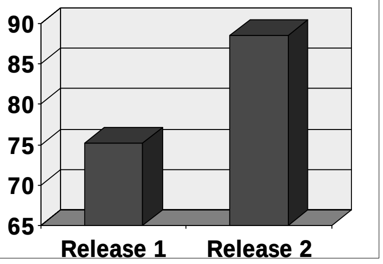
Measuring Software Quality: Post Release

- **Defect Removal Efficiency**

$$\frac{\textbf{Number defects found during development}}{\textbf{Number found during development + Number reported by Customers}}$$

based on at least n months of Customer use

- Average for most software: 75-85%
- Best in Class: 99.5% or better



Jones, C., “Software Defect-removal Efficiency”, *IEEE Computer*, Vol. 29, No. 4, April 1996, pp. 94-95.

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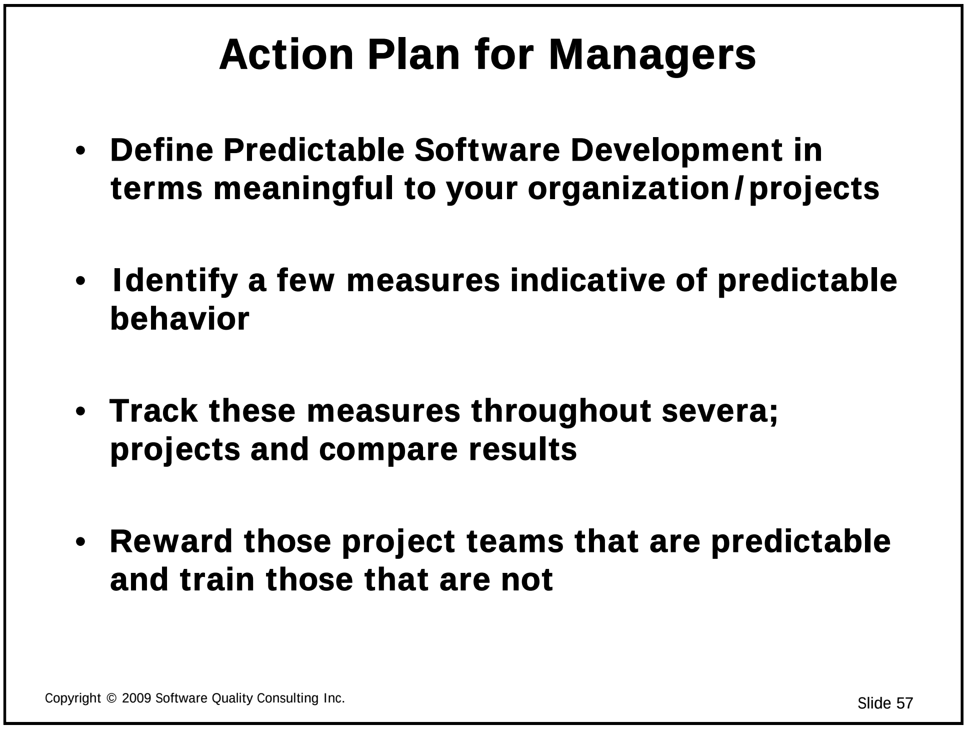

Action Plan for Managers

- Define Predictable Software Development in terms meaningful to your organization/projects
- Identify a few measures indicative of predictable behavior
- Track these measures throughout severa; projects and compare results
- Reward those project teams that are predictable and train those that are not

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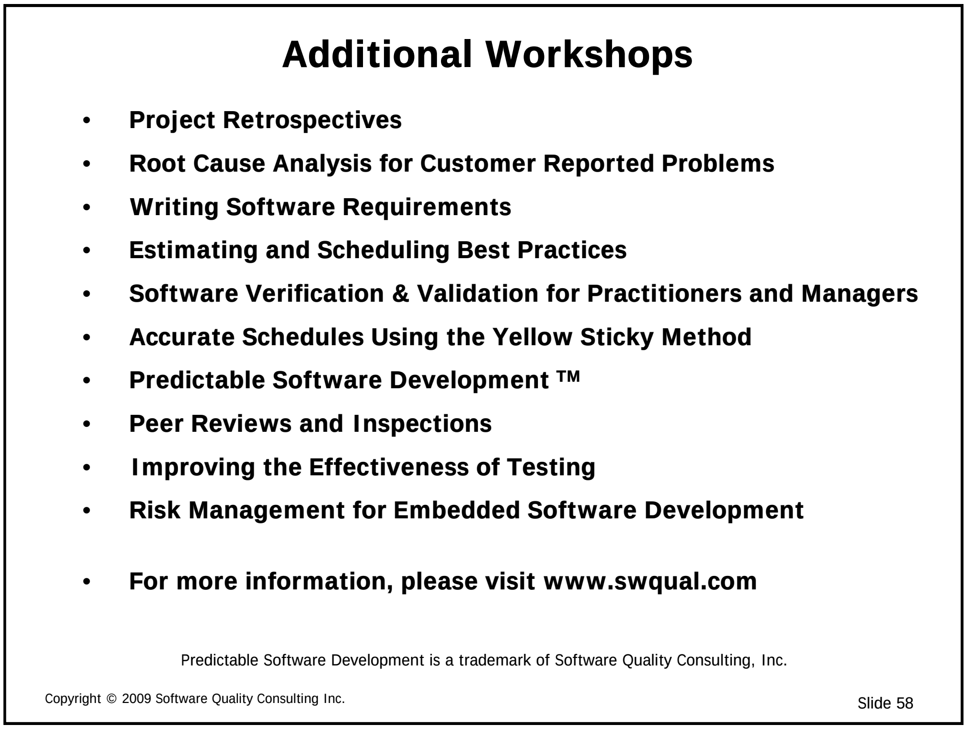

Additional Workshops

- Project Retrospectives
- Root Cause Analysis for Customer Reported Problems
- Writing Software Requirements
- Estimating and Scheduling Best Practices
- Software Verification & Validation for Practitioners and Managers
- Accurate Schedules Using the Yellow Sticky Method
- Predictable Software Development ™
- Peer Reviews and Inspections
- Improving the Effectiveness of Testing
- Risk Management for Embedded Software Development

- For more information, please visit www.swqual.com

Predictable Software Development is a trademark of Software Quality Consulting, Inc.

Slide 58

Thank you...

- If you have questions, please call or e-mail...
- To opt-in to my e-newsletter and view past newsletters, visit www.swqual.com

Food for Thought™

The e-newsletter for Software Development and QA Professionals

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