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Delivering Software Project Success

After the Gold Rush: Prospects for a True Profession of Software Engineering

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Welcome to the Gold Rush

Two Styles of Software Development

- ❖ “Gold Rush Development”
- ❖ “Post-Gold-Rush Development”

Gold Rush Software Development

- ❖ Development Team Characteristics
 - ◆ Small team sizes
 - ◆ Tacit work practices
 - ◆ Minimal or no management
 - ◆ Indiscriminant risk taking
 - ◆ Extremely low formal overhead
- ❖ Sample Product: Microsoft Mac Word 1.0

Post-Gold Rush Software Development

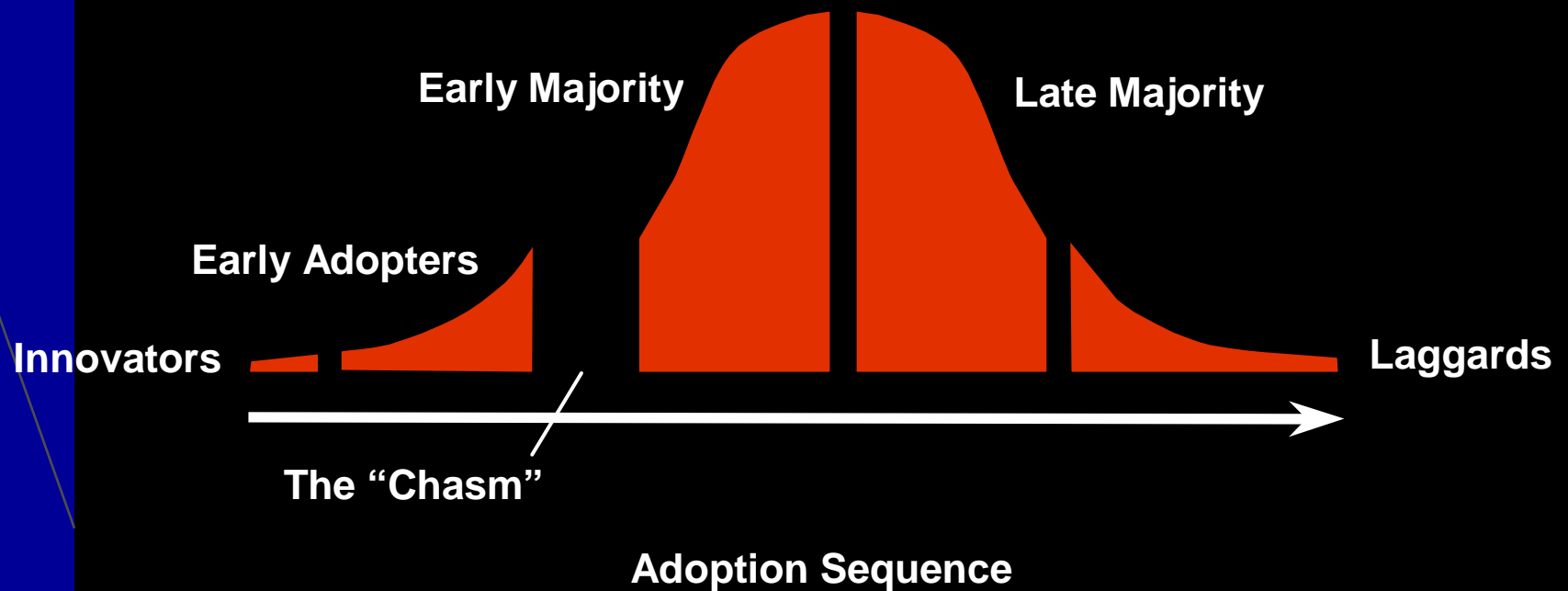
- ❖ Developer Characteristics
 - ◆ Larger team sizes are often required
 - ◆ Formally defined work practices
 - ◆ Explicit management
 - ◆ Calculated risk taking
 - ◆ Higher overhead
- ❖ Sample Product: Current version of Microsoft Office

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“Diffusion of Innovation”

Diffusion Cycle



Normal Risk/Reward Structure



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How the Software Industry Is Doing at Diffusion of Innovation

Best Practices (year first available)

❖ Project planning and management practices

- ◆ Automated estimation tools (1973)
- ◆ Evolutionary delivery (1988)
- ◆ Measurement (1977)
- ◆ Productivity environments (1984)
- ◆ Risk-management planning (1981)

❖ Requirements engineering practices

- ◆ Change board (1978)
- ◆ Throwaway user interface prototyping (1975)
- ◆ JAD sessions (1985)

Best Practices

(year first available, cont.)

❖ Design practices

- ◆ Information hiding (1972)
- ◆ Design for change (1979)

❖ Construction practices

- ◆ Source code control (1980)
- ◆ Incremental integration (1979)

❖ Quality assurance practices

- ◆ Branch-coverage testing (1979)
- ◆ Inspections (1976)

❖ Process improvement

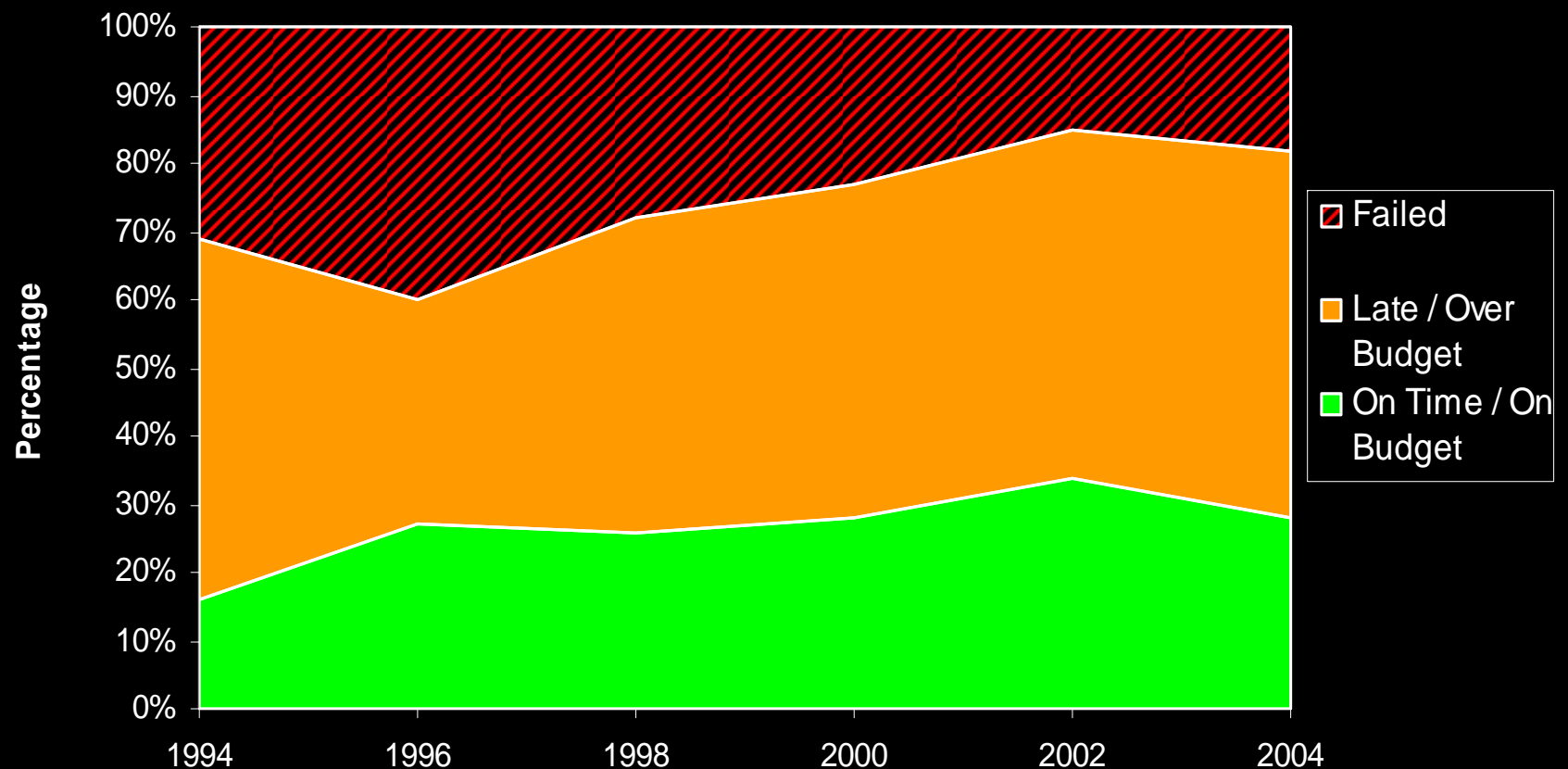
- ◆ SW-CMM (1987)
- ◆ Software Engineering Process Groups (1988)

Causes of Software Failure: KPMG Report

- ❖ Project Objectives Not Fully Specified (51%)
- ❖ Bad Planning and Estimating (48%)
- ❖ Technology New to the Organization (45%)
- ❖ Inadequate/No Project Management Methodology (42%)
- ❖ Insufficient Senior Staff on the Team (42%)
- ❖ Poor Performance by Suppliers of Hardware/Software (42%)

State of the Practice: Project Resolution

Project Outcomes 1994-2004



Source: Standish Group Chaos Report, 1994, 1996, 1998, 2000, 2002, 2004

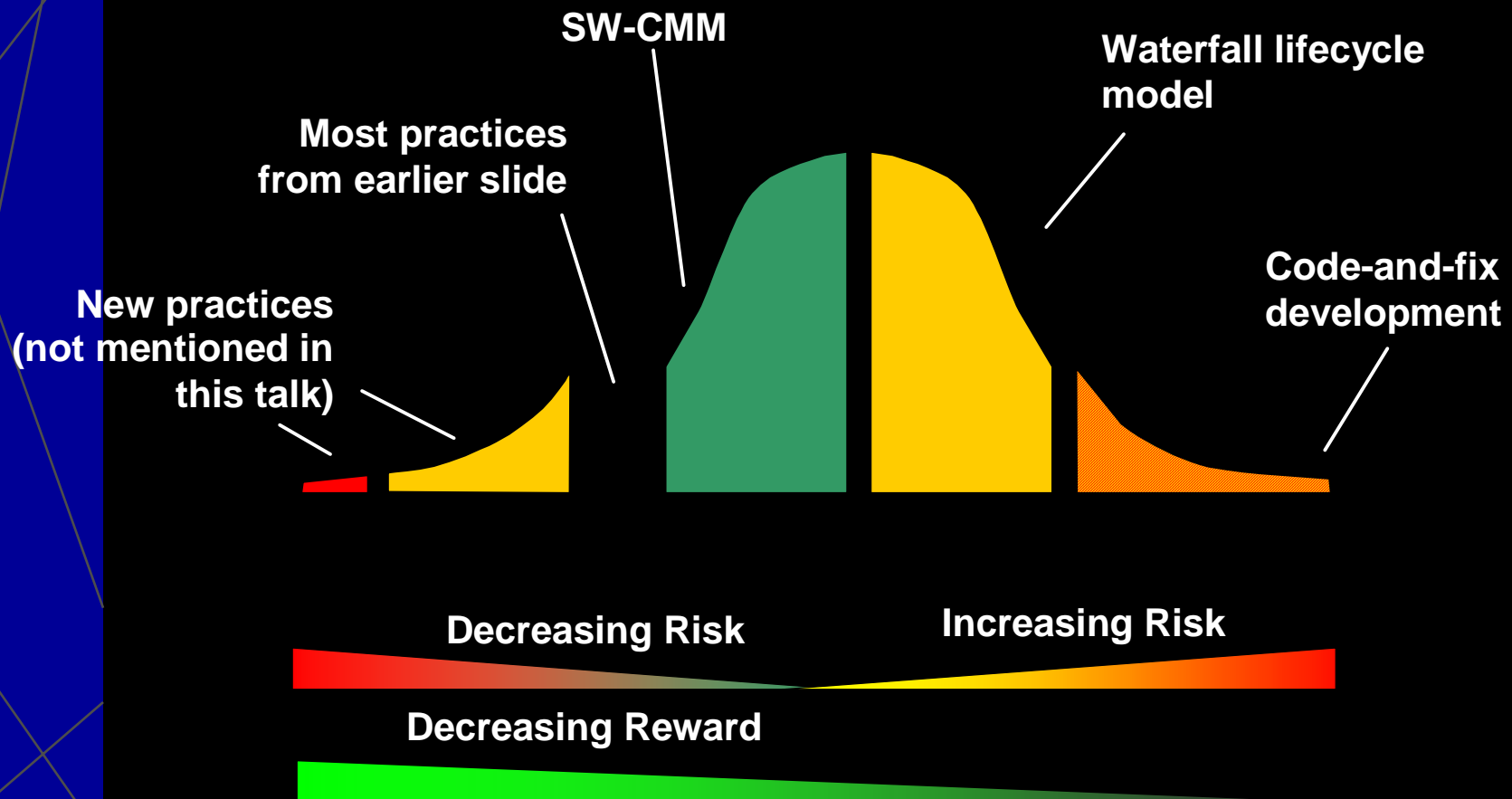
Observations

- ❖ Many key practice have been proven effective for 15 years or more
- ❖ We have known how to avoid most software development problems for 15 years or more
- ❖ What is needed to encourage projects to use these key practices?
- ❖ Diffusion has not been working very well

Software's Unusual Risk/Reward Structure



Some Software Examples

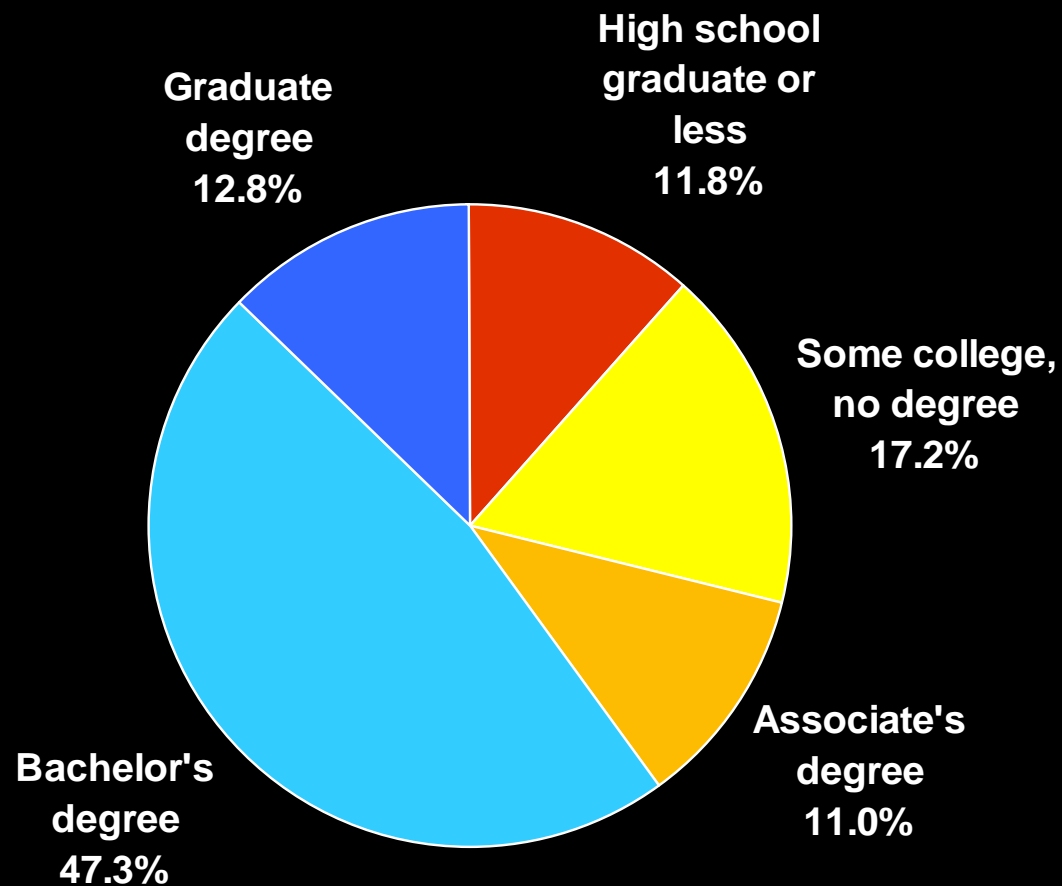


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Why Isn't Diffusion Occurring?

Programmer Education



Details on Education

- ❖ About 40% of all workers have a software-related degree
- ❖ About half of the 40% obtained a degree in something else first
- ❖ About 20% have a degree in something else, but no software-related degree
- ❖ About 40% do not have a 4-year degree

Gold Rush Mentality

- ❖ If you're truly in a gold rush, you would be foolish to add formal processes, training, QA, or other development practices that impair your ability to pick up the gold!

Orphans Preferred

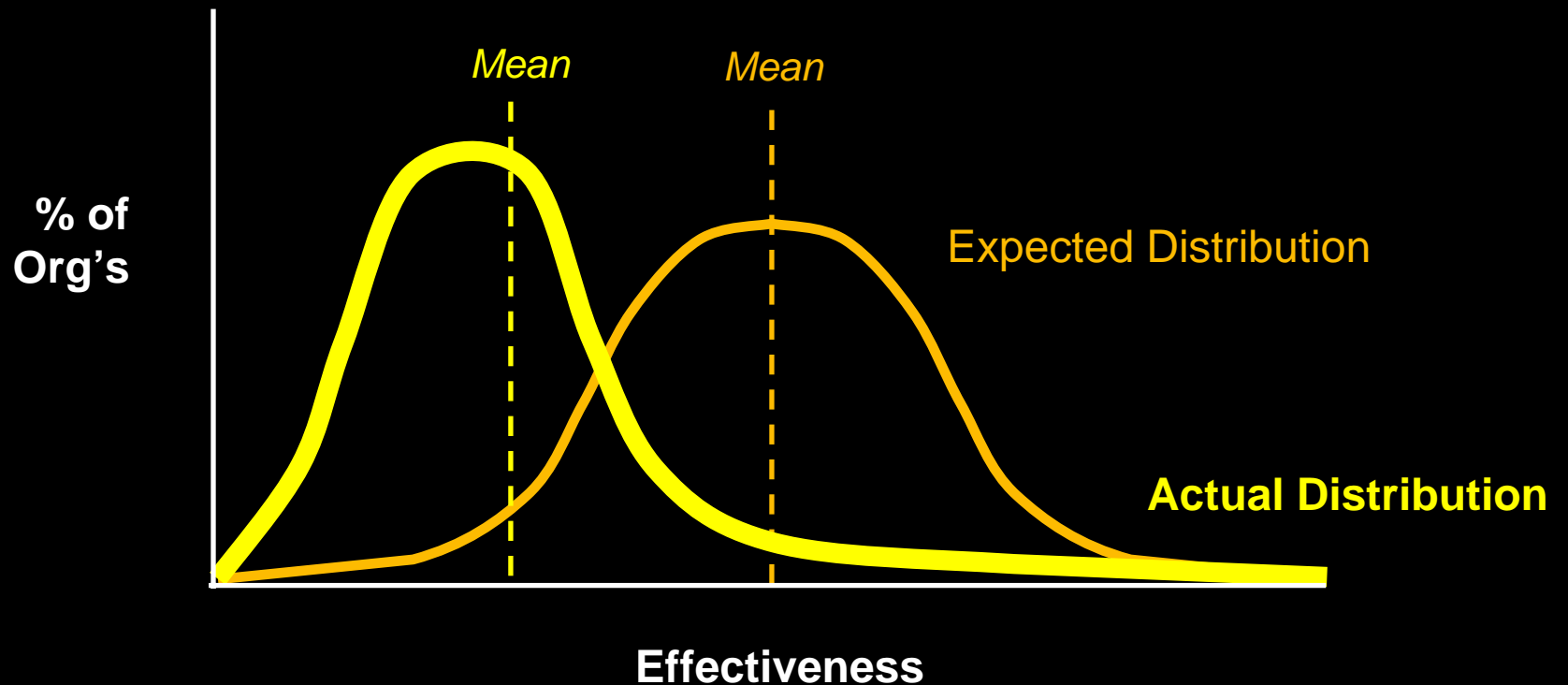
"Wanted: Young, skinny, wirey fellows not over 18. Must be expert riders willing to risk death daily. Orphans preferred. Wages \$25 per week"

- Pony Express advertisement, 1860

We realize the skills, intellect and personality we seek are rare, and our compensation plan reflects that. In return, we expect **TOTAL AND ABSOLUTE COMMITMENT** to project success-overcoming all obstacles to create applications on time and within budget"

- *Seattle Times*, Software developer advertisement, present day

Average Practice is Close to the Worst Practice



How Often Do Companies Believe They Are in a Gold Rush?

- ❖ In 2000, 81 percent of all small-company CEOs (<500 employees) surveyed thought an IPO was “very likely” or “somewhat likely”
- ❖ Of *Inc. Magazine*’s 500 fastest growing companies in 1998, 108 planned an IPO within 12 months

continued...

How Often Are Companies *Actually* in a Gold Rush?

- ❖ One year later, in 2001, only 8 of 108 had actually gone public or filed to go public
- ❖ In other words, 80% of companies think they are in a gold rush, but less than 10% really are

In Other Words....

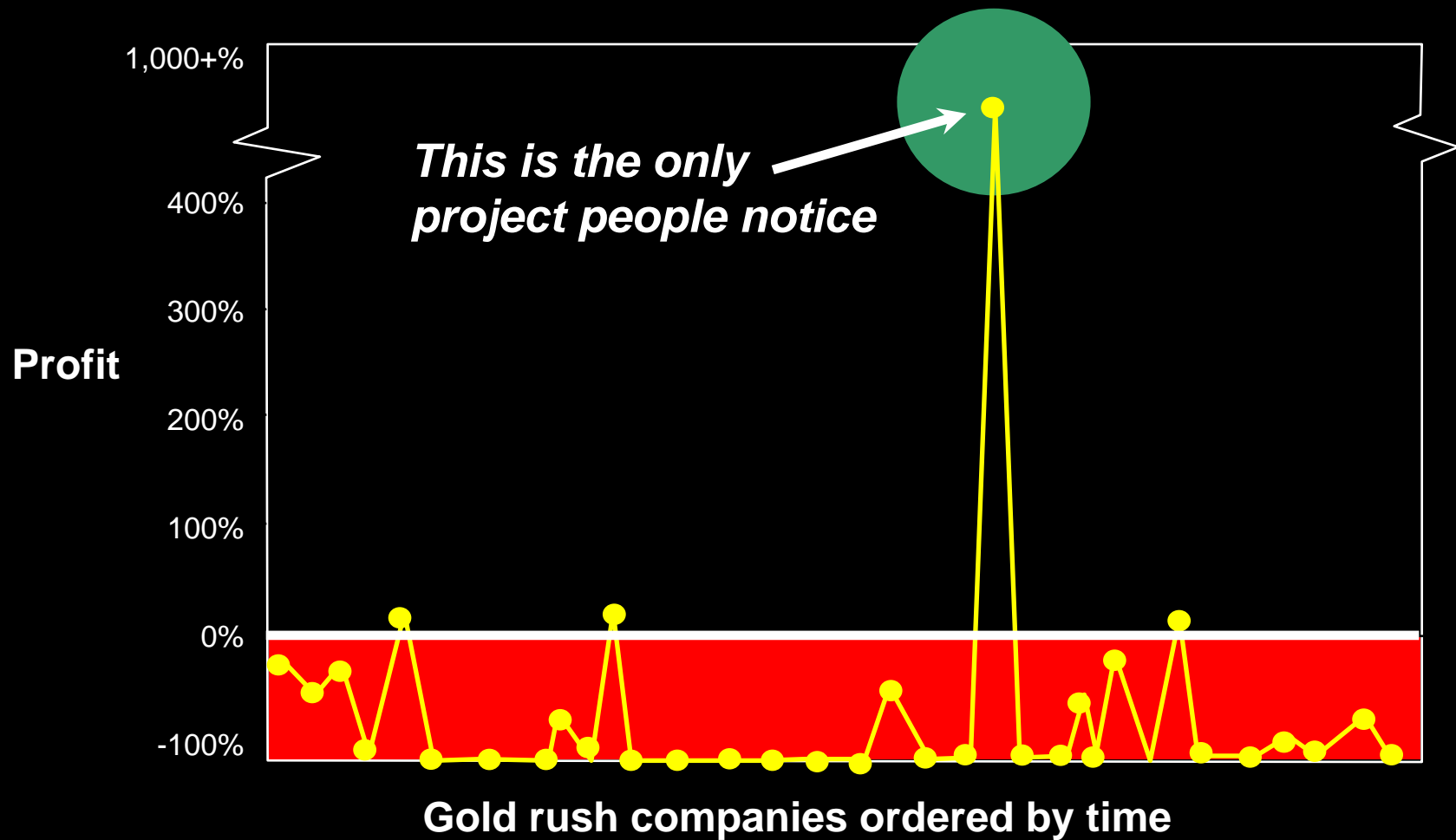
“By mid 1849, most of the easy gold had been found, which meant that a typical miner spent 10 hours a day in ice cold water, digging, sifting, and washing. As time passed, this backbreaking work yielded less and less gold. There were occasional lucky strikes well into the 1850s, which provided just enough good news to encourage thousands to keep digging. Most failed every day, but they kept on for years.”

Why People Believe in Gold Rush Development (as expressed 350 years ago)

“The root of all superstition is that men observe when a thing hits but not when it misses.”

-- Francis Bacon

Why People Believe in Gold Rush Development (expressed in today's terms)



The Problem

- ❖ The problem with gold-rush development practices is that every once in a while they work!

Do We Still Need to Worry About This Phenomenon in 2006, Part I?

[There] “seems to be a new bubble in the software industry. Signs of this bubble include a hiring crunch, soaring salaries, and M&A feeding frenzy, and an accelerated push by NASDAQ to launch a new generation of tech companies into the public market. One industry veteran we spoke to told us that ‘people outside the Valley don’t understand how crazy things have gotten. It is like 1999 all over again.’”

-- *SoftLetter*, April 15, 2006

Do We Still Need to Worry About This Phenomenon in 2006, Part II?

- ❖ 1967: Fortune Magazine reports that 100,000 programmers are working in the U.S., and there are 50,000 job openings (i.e., a labor shortage of 33%)
- ❖ 1999: Various sources cite a 20-30% labor shortage in the U.S.
- ❖ 2006: CNN and Money magazine report that “Software Engineer” is the 2nd fastest growing job out of 216 jobs
- ❖ The “Gold Rush Feeling” is normal for software development; the past few years were the aberration

Food for Thought

(Courtesy of the U.S. Department of Agriculture)

- ❖ U.S. Agricultural Extension Service has been the most successful technology diffusion program in the world
- ❖ Agricultural extension employs 17,000 people to serve 3.8 million farm workers
- ❖ SEI employs 300 people to serve 1.8 million software workers
- ❖ Diffusion has not and will not occur by itself!

General Approaches to Diffusion

❖ Organizational level

- ◆ Hospitals, universities, accounting firms
- ◆ Mechanism is organizational assessment
- ◆ This is already happening through SW-CMM and CMMI

❖ Individual level: Professionalism

- ◆ Doctors, nurses, professors, accountants
- ◆ Mechanisms are certification and licensing
- ◆ This is underway in software engineering

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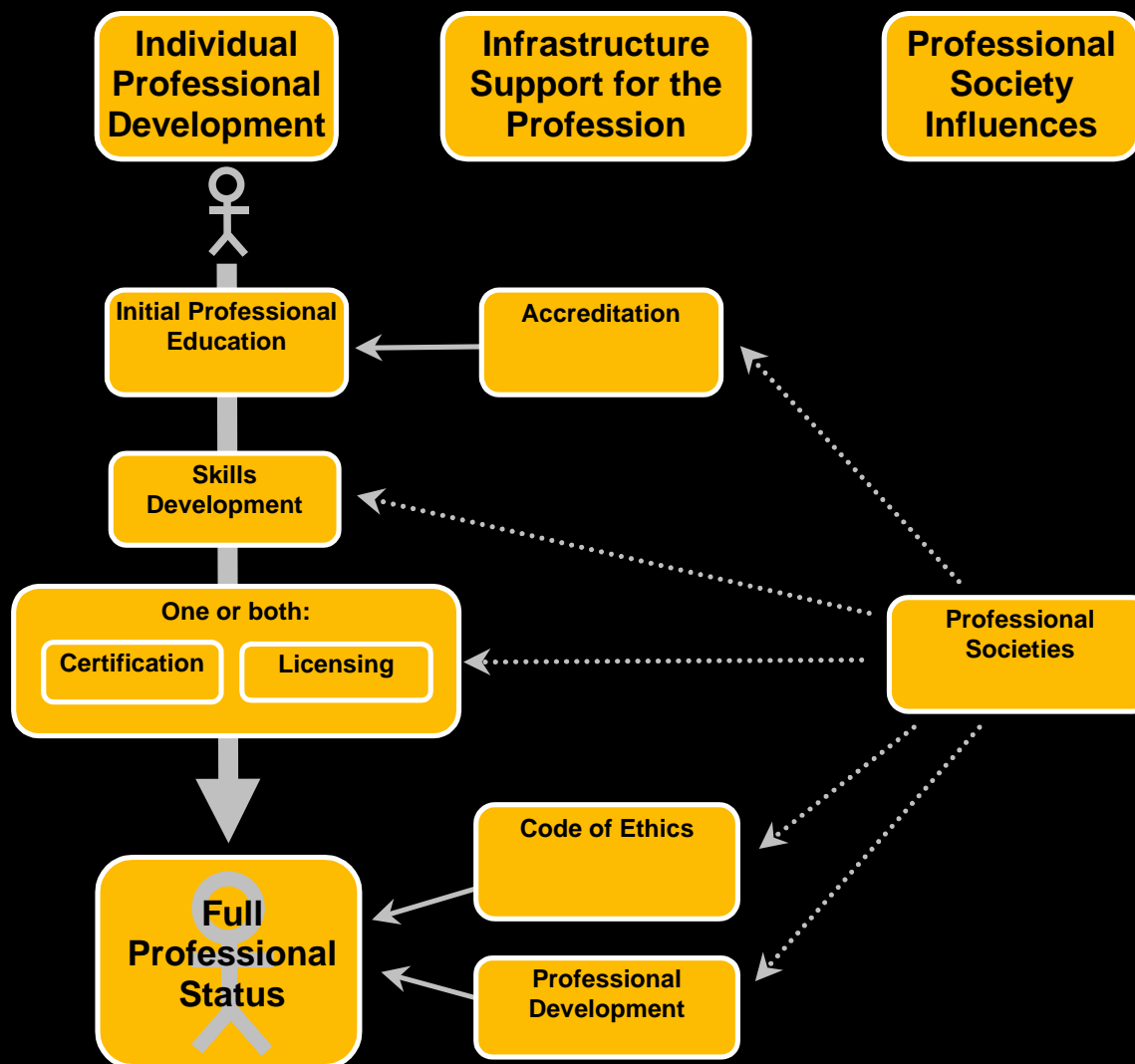
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After the Gold Rush: Creating a True Profession of Software Engineering

My Contention

- ❖ Most companies are not in gold rush situations (even if they think they are)
- ❖ Post-gold-rush development practices work better in non-gold-rush circumstances
- ❖ Post-gold-rush development practices work better *even during a gold rush*
 - ◆ But only if you're ready ahead of time

Elements of a Profession



Current Status of the Software Engineering Profession

- ❖ Many of the elements already exist
- ❖ The rest are underway
- ❖ Further details on the following slides...

Professional Societies Already Exist

- ❖ IEEE Computer Society
www.computer.organization
- ❖ Association for Computing Machinery (ACM) www.acm.org

Code of Ethics

- ❖ A “Code of Ethics and Professional Conduct” was adopted by the ACM and IEEE-CS in 1998
 - ◆ see *www.computer.org/certification/ethics.htm*
- ❖ Similarly, “Guideline on Professional Responsibilities in Developing Software,” by APEGGA
 - ◆ see *www.apegga.org/pdf/Guidelines/software.pdf*

Software Engineering Body of Knowledge (SWEBOK) Project

- ❖ Goal is to define software engineering's body of knowledge
- ❖ Project has released version 2 ("2004" version)
- ❖ The following knowledge areas are being used:
 - ◆ Construction
 - ◆ Configuration Management
 - ◆ Design
 - ◆ Tools and Methods
 - ◆ Maintenance
 - ◆ Management
 - ◆ Process
 - ◆ Quality
 - ◆ Requirements
 - ◆ Testing
- ❖ For more information, see www.swebok.org

Masters Degree Programs Are Well Established

U.S.

- ❖ Andrews University
- ❖ Auburn University
- ❖ California State University, Fullerton
- ❖ California State University, Sacramento
- ❖ Carroll College
- ❖ Carnegie Mellon University
- ❖ DePaul University
- ❖ Drexel University
- ❖ East Tennessee State University
- ❖ Embry-Riddle Aeronautical University (Florida)
- ❖ Fairfield University
- ❖ Florida A&M University
- ❖ Florida Atlantic University
- ❖ Florida Institute of Technology
- ❖ Florida State University
- ❖ George Washington University
- ❖ Gannon University
- ❖ George Mason University
- ❖ International Technological University
- ❖ Kansas State University
- ❖ Mercer University
- ❖ Monmouth University
- ❖ National Technological University
- ❖ Naval Postgraduate School
- ❖ North Dakota State University
- ❖ Oakland University
- ❖ Oregon University System
- ❖ Penn State University-Great Valley
- ❖ Rochester Institute of Technology

U.S. (cont.)

- ❖ San Jose State University
- ❖ Santa Clara University
- ❖ Seattle University
- ❖ Southern Methodist University
- ❖ Southern Polytechnic State University
- ❖ St. Mary's University at San Antonio
- ❖ Texas Tech University
- ❖ University of Advancing Technology
- ❖ University of Alabama-Huntsville
- ❖ University of Alaska at Fairbanks
- ❖ University of Colorado-Colorado Springs
- ❖ University of Houston-Clear Lake
- ❖ University of Maryland, University College
- ❖ University of Michigan-Dearborn
- ❖ University of Minnesota
- ❖ University of Missouri-Kansas City
- ❖ University of Nebraska
- ❖ University of Pittsburgh
- ❖ University of Scranton
- ❖ University of St. Thomas (Minnesota)
- ❖ University of Texas-Arlington
- ❖ University of West Florida
- ❖ University of Wisconsin-LaCrosse
- ❖ West Virginia University

Ph.D. Programs Are Still New

- ❖ Carnegie Mellon University
- ❖ Naval Postgraduate School
- ❖ North Dakota State University
- ❖ University of Texas at Dallas

New Undergraduate Programs Are Being Created. Programs in Canada...

Canada

- ❖ Carleton University
- ❖ Concordia University
- ❖ McMaster University
- ❖ Memorial University
- ❖ Queen's University
- ❖ Simon Fraser University
- ❖ University of Alberta
- ❖ University of British Columbia
- ❖ University of Calgary
- ❖ University of Guelph
- ❖ University of Manitoba
- ❖ University of Montreal
- ❖ University of New Brunswick
- ❖ University of Northern British Columbia

Canada (cont.)

- ❖ University of Ottawa
- ❖ University of Regina
- ❖ University of Saskatchewan
- ❖ University of Toronto
- ❖ University of Victoria
- ❖ University of Waterloo
- ❖ University of Western Ontario
- ❖ University of Windsor
- ❖ York University

** List current as of 2004

New Undergraduate Programs Are Being Created. All But One of these has been Created Since 1999...

U.S.

- ❖ Auburn University
- ❖ Butler University
- ❖ California Poly – San Luis Obispo
- ❖ Capitol College
- ❖ Champlain College
- ❖ Clarkson University
- ❖ Cogswell College
- ❖ Colorado Tech
- ❖ Drexel University
- ❖ Embry-Riddle Aeronautical University (Florida)
- ❖ Fairfield University
- ❖ Florida Institute of Technology
- ❖ Gannon University
- ❖ Indiana Wesleyan University
- ❖ Michigan Tech
- ❖ Milwaukee School of Engineering
- ❖ Mississippi State University
- ❖ Missouri Tech

U.S. (cont)

- ❖ Monmouth University
- ❖ Montana Tech
- ❖ National University
- ❖ Penn State University – Erie
- ❖ Rochester Institute of Technology
- ❖ Rose-Hulman Institute of Technology
- ❖ San Jose State University
- ❖ South Dakota State University
- ❖ Southern Polytechnic State University
- ❖ University of Advancing Technology
- ❖ University of Michigan-Dearborn
- ❖ University of Texas at Arlington
- ❖ University of Texas at Dallas
- ❖ University of Wisconsin-Platteville

*Created in 1996

** List current as of Fall 2005

Accreditation of Undergraduate Programs–Canada

- ❖ Accreditation of undergraduate university programs in Canada is done by CEAB:
 - ◆ University of Calgary (2002) - Calgary, Alberta
 - ◆ Carleton University (2003) - Ottawa, Ontario
 - ◆ Concordia University (2002) - Montreal, Quebec
 - ◆ Lakehead University (2002) - Thunder Bay, Ontario
 - ◆ McMaster University (2001) - Hamilton, Ontario
 - ◆ University of Ottawa (2001) - Ottawa, Ontario
 - ◆ University of Western Ontario (2001) - London, Ontario
 - ◆ Ecole de Technologie Superieure (2004) - Montreal, Quebec

Accreditation of Undergraduate Programs–U.S.

- ❖ Accreditation of undergraduate university programs is being done by ABET:
 - ◆ Auburn University
 - ◆ Clarkson University
 - ◆ Embry-Riddle Aeronautical University
 - ◆ Florida Institute of Technology
 - ◆ University of Michigan-Dearborn
 - ◆ Milwaukee School of Engineering
 - ◆ Mississippi State University
 - ◆ Monmouth University
 - ◆ Rochester Institute of Technology
 - ◆ University of Texas at Arlington
- ❖ Complete list available from ABET's website at www.abet.org/accrediteac.asp

Certification of Software Engineers (Voluntary)

- ❖ IEEE CSDP Certification was rolled out in early 2002
- ❖ About 550 CSDP Certificate holders as of Spring 2006

Licensing of Software Engineers (Mandatory)

This is already underway

- ❖ Canada
 - ◆ British Columbia
 - ◆ Ontario
- ❖ U.S.
 - ◆ Texas

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Conclusion & Resources

Elements of a Software Engineering Profession

Element	Current Status
Initial Professional Education	Established and moving toward Maturing
Accreditation	Established
Skills Development	Established
Certification	Established
Licensing	Ad Hoc
Professional Development	Ad Hoc, moving toward Established. For examples, see the IEEE Computer Society's continuing education guidelines at www.computer.org/certification/ .
Professional Societies	Established, moving toward Maturing. The IEEE Computer Society, ACM, and CIPS
Code of Ethics	Established.
Organizational Certification	Established, moving toward Maturing.

Is This the Ultimate Answer?

“Truth will sooner come out of error
than from confusion.”
– *Francis Bacon*

Professionalism Resources

- ❖ Professionalism Website:
www.construx.com/profession/
- ❖ Wikipedia article on software engineering
en.wikipedia.org/wiki/Software_engineering
- ❖ *IEEE Software Magazine*
www.computer.org/software/
- ❖ *Professional Software Development*, by Steve McConnell (Addison-Wesley, 2004)

Contact Info

Steve McConnell

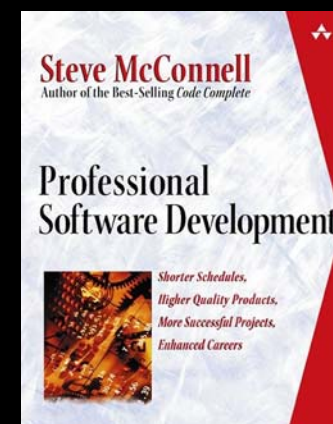
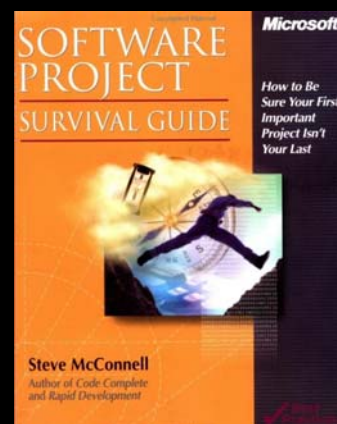
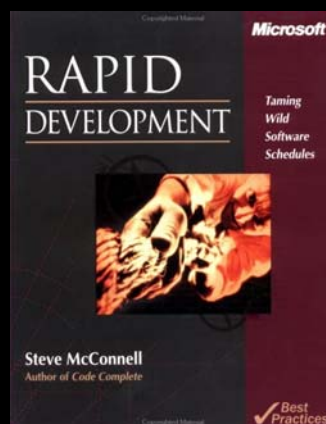
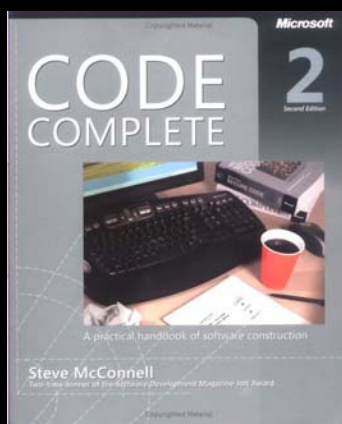
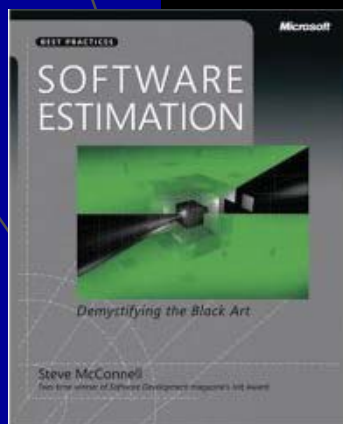
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