Software Quality Assurance turns 50

A Critical Look at the Profession

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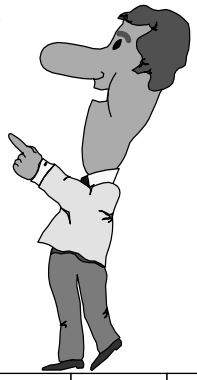
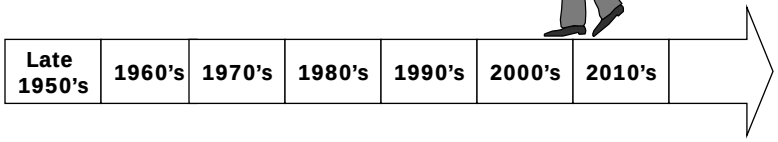
Topics

- **A look back – history and evolution**
- **State of the Profession – Today**
- **Future of SQA?**

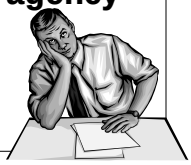




State of the SQA Profession

Late 1950's	1960's	1970's	1980's	1990's	2000's	2010's

- **Software first used in large, complex systems procured by US govt agencies (Census, DoD)**
  - **Projects consistently behind schedule, over budget, and had many technical problems.**
  - **Frequently, software never worked as intended and many projects cancelled before anything was delivered**
- **Software contractors often gave overly optimistic assessments of status of progress to govt agency**
- **Govt agency frequently unaware of schedule, budget, and technical problems until too late.**



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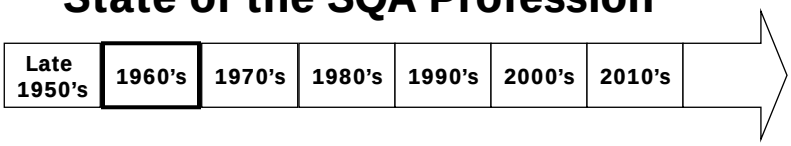
- **Atlas Missile Program Manager hired an "independent software tester" perform additional, unbiased testing of software**
- **This established function of IV&V**
- **IV&V totally separate from prime contractor…**
  - **Program managers hoped to get accurate, objective technical assessment of project status**

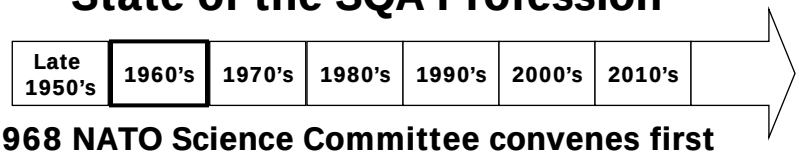
Nelson, J. Gary, "Software Testing in Computer-Driven Systems", in *Software Quality Management*, ed. Fisher, Matthew J., and Cooper, John D., Petrocelli Books, 1979

State of the SQA Profession



- **First independent test team on a large software project used for NASA's Project Mercury**
  - **first US manned space flight program**
  - **Real-time software developed by over 100 engineers and scientists**
  - **led by Jerry Weinberg**

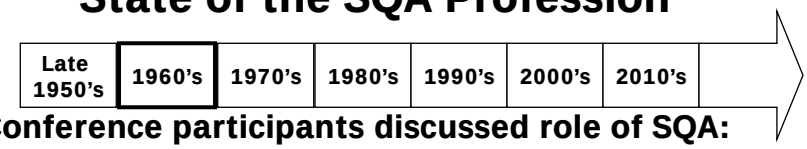
State of the SQA Profession



- **1968 NATO Science Committee convenes first Software Engineering Conference**
  - **"Although the term [software engineering] was not in general use at that time, its adoption for the titles of these conferences was deliberately provocative.**
  - **The motivation for these conferences was that the computer industry at large was having a great deal of trouble in producing large and complex software systems."**
- **Term Software Quality Assurance first used**

Robert M. McClure, Introduction to the 1968 NATO Software Engineering Conference

State of the SQA Profession



- **Conference participants discussed role of SQA:**
  - **Is software quality assurance done by an independently reporting agency representing interests of the eventual user?**
  - **Is product tested to ensure that it is most useful for customers in addition to matching functional specifications?**
  - **Do software quality assurance test programs undergo same production cycle and method (except Q/A) as software they test? Are they defined and constructed concurrently with the software?**
  - **Is at least one person engaged in software quality assurance for every ten engaged in its fabrication?**
  - **Are there tests for overall system performance as well as for components?**
  - **Can software field release be held up if these tests are not passed?**
  - **Do the tests include a system logic exerciser?**
  - **Is each customer's system tape tested on the software production machine for a sufficient period of time, where feasible?**

Software Engineering, Report on conference sponsored by NATO Science Committee Garmisch, Germany, Oct 7-11, 1968

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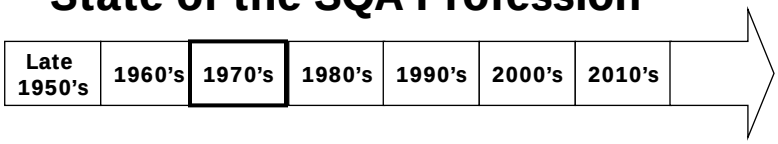


- **Role of independent software test team evolved from focusing on testing to focusing on entire software life cycle**
- **IV&V used on many large mission-critical projects for many Govt agencies**
- **Key aspect of IV&V was total independence from Software Development organization...**
- **First IEEE Software Engineering Standards were published**
  - **Among first was IEEE 730-1981 Standard for SQA Plans**

State of the SQA Profession

Late 1950's	1960's	1970's	**1980's**	1990's	2000's	2010's

- **"Software crisis" – spending on software maintenance exceeded spending on creating new software products**
- **Search for Silver Bullet…**
  - **Methodology Wars…**
  - **CASE Tools…**

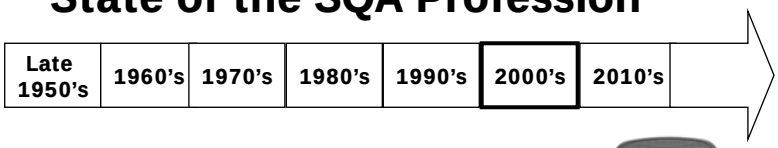
- **SQA viewed as an internal IV&V function and adopted some IV&V practices…**
- **SQA emerged as a critical function to be performed on software development projects**

State of the SQA Profession

Late 1950's	1960's	1970's	1980's	**1990's**	2000's	2010's

- **Many software companies establish SQA functions**
  - **Yet, high profile software failures continued to occur**
- **Several differences in nature of software being developed:**
  - **Complexity of software apps increased significantly**
- **People working in SQA received little formal SQA training**
  - **Expected to learn from on-the-job training**
- **Outsourcing Software Development and Testing**
  - **Relocation of many development and IT jobs**
  - **Many failures – few successes**

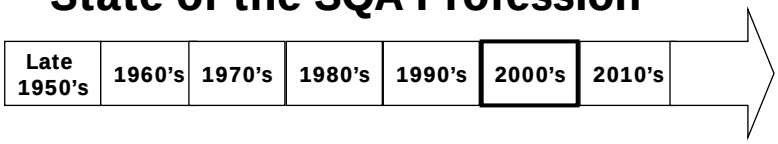
State of the SQA Profession



- **Dot-bomb!**
  - **Testers need to learn to test web apps**
  - **Performance testing issues**
  - **Many web sites utter failures**

- **Agile Manifesto published 2001**
  - **Value individuals and interactions over processes and tools**
  - **Value working software over comprehensive documentation**
  - **Value customer collaboration over contract negotiation**
  - **Value responding to change over following a plan**
- **Search for Silver Bullet continues…**

State of the SQA Profession



- **Most highly skilled software developers inject an avg. of one defect for every 8 lines of code**
  - **Typically we find about 95% of injected defects**
  - **End result is released software has a defect density of about 5-6 defects per KLOC**
- **Single most common reason software engineers inject defects has been and still is poorly written requirements**
- **Complexity of applications increasing exponentially**

Humphrey, W., "The Quality Attitude", *news@sei newsletter*, Number 3, 2004.

State of the SQA Profession

Late 1950's	1960's	1970's	1980's	1990's	2000's	2010's

- **Typical software applications ~ one million LOC:**
  - **Defects injected: ~120,000** (one defect injected / 8 LOC)
  - **Defects removed: ~114,000** (assuming 95% found & removed)
  - **Defects remaining: 6,000**
- **2010 model-year cars have about 100 million LOC**

- **Could be 600,000 defects in software that controls cars**

State of the SQA Profession

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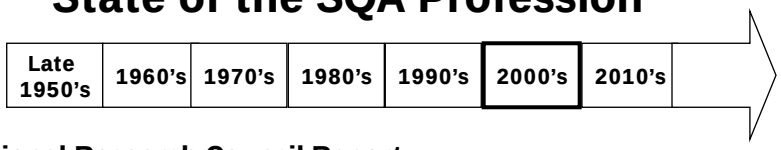
- **Standish Group's CHAOS 2009 Report shows a marked decrease in project success rate**

Results	'09	'06	'04	'02	'00	'98	'96	'94
Successful	32%	35%	29%	34%	28%	26%	27%	16%
Challenged	44%	19%	53%	15%	23%	28%	40%	31%
Failed	24%	46%	18%	51%	49%	46%	33%	53%

- **Successful - delivered on time, on budget, with required features and functions**
- **Challenged - late, over budget, and/or with less than required features and functions**
- **Failed - cancelled prior to completion or delivered and never used**

State of the SQA Profession



- **National Research Council Report:**

  "Society is increasingly dependent on software. Software failures can cause or contribute to serious accidents that result in death, injury, significant environmental damage, or major financial loss. Such accidents have already occurred and without intervention, the increasingly pervasive use of software - especially in arenas such as transportation, heath care, and the broader infrastructure - may make them more frequent and more serious."

- **Problem exacerbated by a pervasive lack of evidence about both incidence and severity of software failures.**

Jackson, D., et. al., *Software for Dependable Systems - Sufficient Evidence?*, National Research Council, National Academies Press, 2007.

Slide 15

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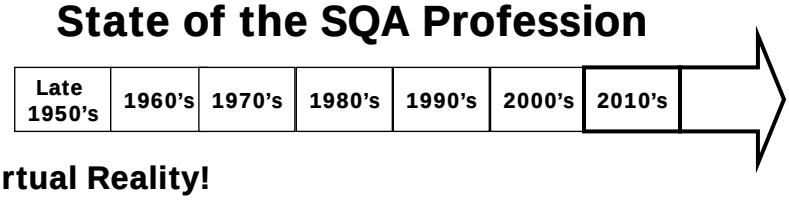
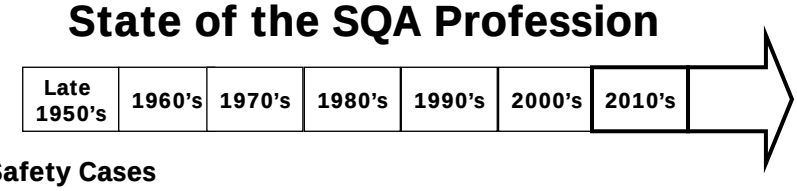


- **Virtual Reality!**
  - **Virtual test labs - configured and easily and used for other purposes when testing completed**
  - **Virtual test teams – geographically distributed, test from home models**
  - **Pay per Defect cost models for testing services**
- **Increased dependence on automated test tools**
  - **Testers increasingly need programming skills**
- **Increased need for testers with domain knowledge**

Slide 16

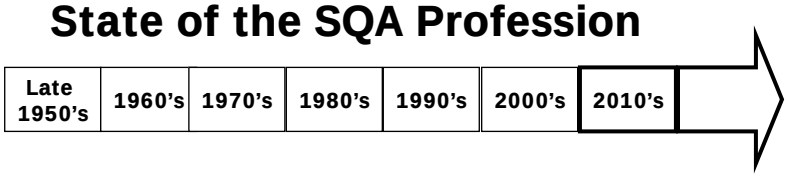
State of the SQA Profession

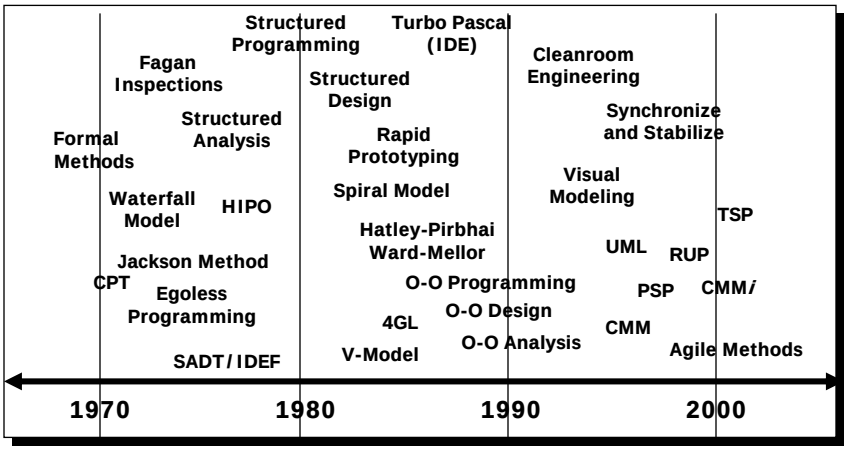


- **Safety Cases**
  - **A safety case presents high level arguments that a system will be acceptably safe in a given context**
  - **High Level Arguments**
    - Explanation of how available evidence can be reasonably interpreted as indicating acceptable safety – usually by demonstrating compliance with requirements, sufficient mitigation and/or avoidance of hazards etc.
  - **Supporting Evidence**
    - Results of observing, analyzing, testing, simulating and estimating properties of a system that provide fundamental information from which safety can be inferred.
  - **Arguments without Evidence is unfounded**
  - **Evidence without Arguments is unexplained**

Tim Kelly, "Assurance Cases, Argumentation and Patterns" High Integrity Systems Engr Group, Dept. of CS, Univ. of York

State of the SQA Profession





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State of the SQA Profession

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"The dissemination of knowledge is of obvious value — the massive dissemination of error-loaded software is frightening."

Prof. Edsger Dijkstra
Eindhoven University of Technology, Netherlands
University of Texas - Austin

Software Engineering, Report on conference sponsored by NATO Science Committee Garmisch, Germany, Oct 7-11, 1968

Thank you…

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- Steve Rakitin – Programs and web site
- Gene Freyberger – Annual Survey
- Dawn Wu – our new greeter!!

Our gracious Hosts

- Paul Ratty - room, copies, cookies
- Tom Arakel - room, copies, cookies
- Margaret Shinkle - room, copies, cookies
- Jack Guilderson – A/V equipment

Mission

- To promote use of engineering and management techniques that lead to delivery of high quality software
- To disseminate concepts and techniques related to software quality engineering and software engineering process
- To provide a forum for discussion of concepts and techniques related to software quality engineering and the software engineering process
- To provide networking opportunities for software quality professionals

ASQ Software Division

- Software Quality Live - for ASQ SW Div members…
- Software Quality Professional Journal www.asq.org/pub/sqp/
- CSQE Certification info at www.asq.org/software/getcertified
- SW Div info at www.asq.org/software
- ICSQ Nov 9-11 2009 Northbrook, IL www.asq-icsq.org/

SQGNE 2009-10 Schedule

Speaker	Company/Affiliation	Date	Topic
Eric Lotter	Surgient	9/9/09	Using Virtualization to Accelerate Quality/Test Cycles
Steve Rakitin	Software Quality Consulting	10/14/09	Software Quality Assurance Turns 50 A Critical Look at the Profession
Howie Dow and Steve Rakitin		11/11/09	Interactive Requirements Exercise…
Michael Mah	QSM Associates	12/9/09	Rightsizing Your Project in a Down Economy
Robin Goldsmith	GoPro Management	1/13/10	I went to a Testing Conference and all they talked about was Requirements
Stan Wrobel	CSC	2/10/10	To be announced…
Billie Bell	Intuit	3/10/10	End-to-End Testing in a SaaS environment: Extending the Definition of Quality
Linda McInnis		4/14/10	Metrics: The Where, How and Why?
Urvashi Tyagi	Microsoft	5/12/10	A day in the life of a tester at Microsoft…
Brian LeSuer	Star Quality	6/9/10	To be announced…
Everyone		7/14/10	Annual Hot Topics Night…

Tonight's Speaker…

Software Quality Assurance Turns 50
A Critical Look at the Profession
Steven R. Rakitin

Software Quality Assurance (SQA) was used for the first time on a software development project about 50 years ago. In the past five decades, much has changed. As software development has evolved from quirky artisans into a mainstream engineering profession, so to has the SQA profession evolved from its early roots in large government programs. This talk presents a critical retrospective of the SQA profession including how SQA came into existence, the present state of the profession and some thoughts on the future of SQA.

Steve has over 35 years experience as a software engineer and software quality manager. He frequently speaks on topics related to software development and software quality at conferences worldwide. He's published several papers on the subject of software quality and a written a book titled Software Verification & Validation for Practitioners and Managers. As President of Software Quality Consulting, Inc., he works with clients who are interested in improving the predictability of their development process and the quality of their products.