20 Years of SW Engineering in Industry

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Contents

• Setting the Scene (<1983)
• Early Years (1983-1989)
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Setting the Scene (< 1983)
IT prior to 1983

- ~1837 Analytical Engine, concept, Babbage and Lovelace
- 1896 IBM founded as the Tabulating Machine Company
- 1904 Vacuum Diode, John Fleming
- 1920's - German Enigma Machine
- 1936 Alonzo Church and Alan Turin - Turing machines
- 1941 Z3 1st electronic programm. computer, Konrad Zuse
- 1947 Transistor invented, Bell Labs
- 1951 UNIVAC first commercially successful computer
- 1952 Integrated Circuit proposed – Geoffrey Dummer
- 1954 Fortran; 1959; Cobol; 1961 PL/1
- 1962 1st Influential Game, Spacewar, Steve Russell & MIT
- 1962 Simula (first Obj Oriented)
- 1963 Computer Mouse, Doug Engelbart
IT prior to 1983

- 1964 BASIC; 1965 LISP; 1968 Forth
- 1968 Software Engineering coined
- 1969 ARPNET the original internet
- 1970 Intel 1103, first dynamic RAM chip
- 1970 Pascal, SQL
- 1972 Pong, Atari Inc, first successful arcade video game
- 1973 C; Unix rewritten in C; wins OS wars
- 1975 Bill Gates and Paul Allen found Microsoft
- 1977 Apple founded by Steve Jobs & Steve Wozniak (Apple II)
- 1977 Software Development Laboratories (becomes Oracle)
- 1978 Space Invaders, Taito
- 1979 Xerox PARC first comp. network and graphical UI
- 1980 Microsoft MS-DOS, First Application Specific IC (ASIC)
- 1981 C++ Bjarne Stroustrup; Commodore 64; Osborne 1 (1st laptop)
- 1982 SunOS, QNX
Software Engineering prior to 1983

- Late 1950s large computers available to universities
  - Fortran and Algol used for numerical calculations
- 1962 Cobol for business applications
- 1961 PL/1 designed to unify scientific and commercial programming
- 1963 First time sharing system
  - Research into multiprocessing and concurrent processing
  - Semaphores introduced, E.W. Dijkstra
- 1968 Software Engineering and Software Crisis coined
- 1970 Waterfall Methodology
- 1970 Top Down Approach (IBM)
Early Years (1983-89)
IT (1983-89)

- 1983 Intel 80286 (16 bit, no cache)
- 1983 TCP/IP, Smalltalk, Objective C, MS Windows 1.0
- 1983 GNU, Richard Stallman, Unix clone available freely
- 1984 Macintosh, ksh
- 1984 Free Software Foundation, Richard Stallman
- 1985, Motorola 68020 (16 bit, 256 cache)
- 1985 Amiga, 1st commercial pre-emptive multitasking
- 1985 Microsoft Windows 1.0 (illegal clone Mac OS)
- 1986 Eiffel (precursor to Java and C#)
- 1986 Microsoft & IBM work on OS/2
- 1987 Perl, Mathematica
- 1988 alt.drugs etc on Usenet
- 1988 First ever internet worm, Robert Morris
- 1988 OS/2 is released, TCL
- 1989 HTML, Tim Berners-Lee
- 1989 NEXTSTEP 1.0 (father of Mac OS X)
Software Methodology (1983-89)

• 1965 to 1985: The Software Crisis
  – Budget and schedule overrun
  – Property damage (identity theft); loss of life (Therac 25)
  – OS/360 took 10 years, 1000 programmers
  – Systems announced not delivered on time
  – Difficulties brought large companies to brink of collapse

• 1983 Structured Systems Analysis and Design Method (SSADM)
  – UK Government initiative
  – Waterfall model
  – Logical Data Modeling (Entities)
  – Data Flow Modeling (Activities)
  – Entity Behavior Modeling (Events and sequences)

• 1986 Spiral Method, Barry Boehm

• 1987 Capability Maturity Model (CMM, US)
Spiral Method

1. Determine objectives
2. Identify and resolve risks
3. Development and Test
4. Plan the next iteration
Undergraduate Years (1983-86)

- Electronics and Comms Engineering (UWA)
  - No lectures in programming
  - No lectures in software methodology
  - Fortran 77 using batch cards (1983)
  - Honours Project – Medical Image Processing
    - Turbo Pascal programming under DOS
    - IBM PC, MS DOS 3.0
    - First colour printer in department
Graduate Positions (1987-88)

- ACE-T (1987, no longer around)
  - Train simulators; remote sensor logging
  - Assembly level programming (Motorola 6802)
  - Debugging using in circuit emulators (huge and expensive)
  - Train simulator written all in Fortran 77
  - Company launches first project using C language

- QPSX (1988)
  - DBDQ Metropolitan Area Network (MAN) system
  - C programming
  - Embedded Software
    - Real Time Operating System (RTOS)
    - Device drivers
Overseas and Postgraduate Studies (1989)

• MSc in Math Modelling and Numerical Analysis (Oxford, 1989)
  – Fortran 77
  – Numerical programming

• Part time desk top publishing
  – Macintosh
  – Ventura, Pagemaker

• Oxford Communications Company (1989)
  – Fax becoming mainstream business communications
  – Fax Server to manage high volume fax traffic
  – C programming under Windows 2.1 and Netware
  – IBM PC Clones
The Internet Age (1990s)
IT (1990s: The Internet Age)

- 1990 Windows 3.0, Haskell OS, CD ROM, SPARC
- 1991 Linux, MP3, Python, VB
- 1992 Solaris 2.0, Field Programmable Gate Array Patent (FPGA)
- 1993 AppleScript, Ruby, Intel Pentium (32 bit), Power PC 601
- 1993 Mosaic web browser (renamed later to Netscape)
- 1994 Yahoo; Netscape Navigator 1.0, Red Hat Linux
- 1995 Java, PHP, Altavista, AMD 5x86
- 1995 e-commerce, Amazon.com, Ebay.com
- 1996 Flash Version 1.0, UML, Wireless LAN
- 1996 Voodoo chipset (1st affordable 3D Accelerator card for PC)
- 1997 Google
- 1998 Windows 98
- 1999 Pentium 3, AMD Athlon, Power PC G3
- 1999 Napster, Dot-com BOOM
Software Methodology (1990s)

- Object-oriented programming (OOP)
- Rapid application development (RAD)
- Scrum
- CMM evolves
  - Personal Software Process (PSP)
  - Team Software Process (TSP)
- Extreme Programming
- Rational Unified Process (UML)
Extreme Programming (XP)

http://www.extremeprogramming.org/
Overseas and Postgraduate Studies (1992-96)

• PhD in Lie Groups and Partial Differential Equations
  – Symbolic Algebraic Software
    • Maple
    • Mathematica
• Java becoming popular at universities
• Internet becoming indispensable to research
  – Publications becoming available on internet
  – Email enhancing communications/collaborations
Intellect Pty Ltd (1997-98)

- Senior Software Engineer - Contractor

  - EFTPOS/Smart Card Systems
    - Real Time Operating System
    - Motorola 68000 processors
    - Smart card security

- Development Platform
  - Windows 98
  - Cygwin
  - C Cross Compiler and Debugger
  - Integrated Development Environment
  - CVS version control
  - Waterfall
Nautronix (1998-99)

- Senior Software Engineer/Team Leader
- Underwater Positioning Systems
  - Beacons on ocean floor
  - Triangulate acoustic signals
  - Feedback to positioning system
- Application Software
  - Microsoft Windows NT
  - Microsoft Visual Studio 6.0
  - System software written in C++
  - GUI: MS Foundation Class (MFC)
  - Design Patterns
- Underwater Beacon Software
  - Motorola 6802
  - Embedded software written in C
Waterfall Methodology

• All projects up to now:
  – Waterfall methodology
  – Varying degrees of documentation
    • Requirements
    • Design
    • Test
  – Manual testing (minimal automated testing)
  – Long release cycles
    • Eg Nautronix Underwater Positioning Beacon
      – 1 week trial off Rotnest to discover a bug
      – Can avoid expensive testing if one can do more automated testing
The Naughties (2000s)

- Windows Vista
- iPod
- YouTube
- RSS
- Wii
- iPhone
- Facebook
- Android
- Intel Pentium 4
- Ubuntu
- Free Wi-Fi spot
IT (2000s)

- Mar 2000 dot-com bust
  - The Learning Company, bought by Mattel in 1999 for $3.5 billion, sold for $27.3 million in 2000; amazon, ebay, google survive
- 2000 WiFi, Pentium 4, AMD K7, Sparc Ultra, Power PC G4,
- 2000 Windows 2000, Solaris 8, TheSims
- 2001 iPod, iTunes, Ultra Sparc III, Wikipedia, Mac OSX 10, Windows XP
- 2002 Web 2.0, Weblogs, RSS
- 2004 AMD Opteron (64 bit), Power PC G5, Ubuntu
- 2004 Facebook, Nintendo DS, Playstation Portable
- 2005 YouTube, Xbox, Google buys Android Inc
- 2006 Intel Core, Wii, Open SUSE
- 2006 Cloud Computing - Amazon Elastic Compute Cloud (EC2)
- 2007 iPhone
- 2009 Windows 7
- 2010 iPad
Software Methodology (2000s)

• 2001 Agile Manifesto
  – Individuals and interactions over processes and tools
  – Working software over comprehensive documentation
  – Customer collaboration over contract negotiation
  – Responding to change over following a plan

• Examples
  – Agile Modeling
  – Agile Unified Process (AUP)
  – Dynamic Systems Development Method (DSDM)
  – Extreme Programming (XP)
  – Feature Driven Development (FDD)
  – Scrum
Scrum Methodology

- As in Rugby, where the whole team "tries to go the distance as a unit, passing the ball back and forth".
- Daily Scrum time boxed to 15 minutes
- Product backlog is list of high level features - prioritised
- Sprint backlog is list of features for this sprint (2-4 weeks)
- Burndown chart (remaining work) reviewed at daily scrum
ERG Pty Ltd (1999, 2000)

- Senior Software Engineer/Team Leader (Contractor)

- Mass Transit System
  - Smart Card Devices (ticketing)
  - Backend transaction processing
  - Eg Hong Kong, Singapore
    - Replaced collection of many tonnes of coins each day

- Backend System Development Environment
  - Windows 98
  - C++/Microsoft Visual Studio 6.0
  - Common Object Request Broker Architecture (CORBA)
  - Oracle database
ERG Pty Ltd (cont)

- Rational Unified Process (RUP)
  - Rational Rose Case Tool (Model Driven Development)
  - UML designs
  - C++ Code Generation
  - ClearCase Software Configuration Management
  - CppUnit testing

- Project Failed despite improved methodology
  - Requirements too ambitious
  - 75+ developers new to RUP/UML/Case Tools
  - Analysis Paralysis
Lateral Sands (2001-2002)

• Principle Software Engineer

• ASIC and FPGA verification services
  – VHDL and Verilog hardware description languages
  – 802.11, Packet-Over-SONET, USB, ATM and Ethernet
  – C/C++/Perl test harnesses
  – Co-simulation
  – SystemC modeling of ASIC
  – Behavioral Verilog and VHDL modeling

• Projects
  – Sun Microsystems Verilog Compiler (Silicon Valley, 9/11)
  – BeamReach 802.11g chip (Silicon Valley)
Tieline Research (2002-2006)

- R&D Manager

- Audio and Video Broadcast Equipment
  - Broadcast quality audio codecs
  - Real time talkback over modem, ISDN, wired and wireless internet
  - Used at Greek and Chinese Olympics (NBC, USA)
  - Audio and Video Surveillance

- Agile Methodology
  - Product backlogs
  - 4 week iteration cycles
  - Automated testing
  - Continuous build and regression testing
Tieline Research (cont)

• Development Tools
  – Java J2EE
  – Eclipse
  – Ant build scripts
  – CruiseControl for automated builds
  – Unit and Regression testing using Junit
  – MySql database clusters
  – JNI/SOAP/XML/Swing
QMAC Pty Ltd (2006-2008)

- R&D Manager

- Tactical Military Radios
  - Digital Battlefield/ Network Centric Warfare
  - HF radios, VHF Combat Net Radios,
  - Multiband Software Defined Radios,
  - Advanced antenna design

- $5.6M R&D government grant

- Project Cancelled
  - Global Financial Crisis
  - Company Sold
Technologies

- Agile Methodology
- Embedded C++
- Keil Compiler and RTOS
- C#.Net PC Applications
- Trac Collaboration Tool
  - Wiki
  - Ticketing System
  - Integrated svn source control
www.thebroth.com (2009-10)

- Facebook and MySpace Games
  - Kickmania (physics simulation)
  - Puzzlebee (puzzle)
  - BarnBuddy (farm app)
  - HoopFever (basketball app)

- Technologies
  - ActionScript 3.0/PHP/JavaScript/HTML
  - Adobe Flesh Builder (based on Eclipse)
  - Facebook and MySpace API
  - Cloud computing (100k’s concurrent users)
  - Box2D open source physics simulation
Beacon Technology Pty Ltd (Current)

- Custom Business Software Development
- Intelligent Traffic System
  - Timely/accurate information to road users
  - Effective control of road use
- Team Foundation Server 2010 (Agile Template)
  - Scrum
  - User Stories
  - Burn Down Chart
  - Daily Standup
  - 4 week iterations
Beacon Technology Pty Ltd (Current)

- Windows 7
- Visual Studio 2010
- C#.Net, WCF, WPF, Silverlight, Sharepoint
- Business Intelligence
- Online Analytical Processing (OLAP), Cube
  - Multi-Dimensional eXpressions (MDX)
  - Multi Terra bytes of data
Conclusion

• Technology changes rapidly
• Need to remain relevant and keep up to date
• Processing power, data storage, comms speeds keep going up
• Tools and Methodologies evolve to increase productivity
• Applications keep getting more complex
• Projects can fail for many reasons
• Find interesting/meaningful work; Work with good teams