Rational. software

IBM RATIONAL SOFTWARE DEVELOPMENT USER CONFERENCE 04

software runs the world

IBM

Celebrating Rational's 50th Anniversary

Grady Booch
IBM Fellow

Rational. software

IBM

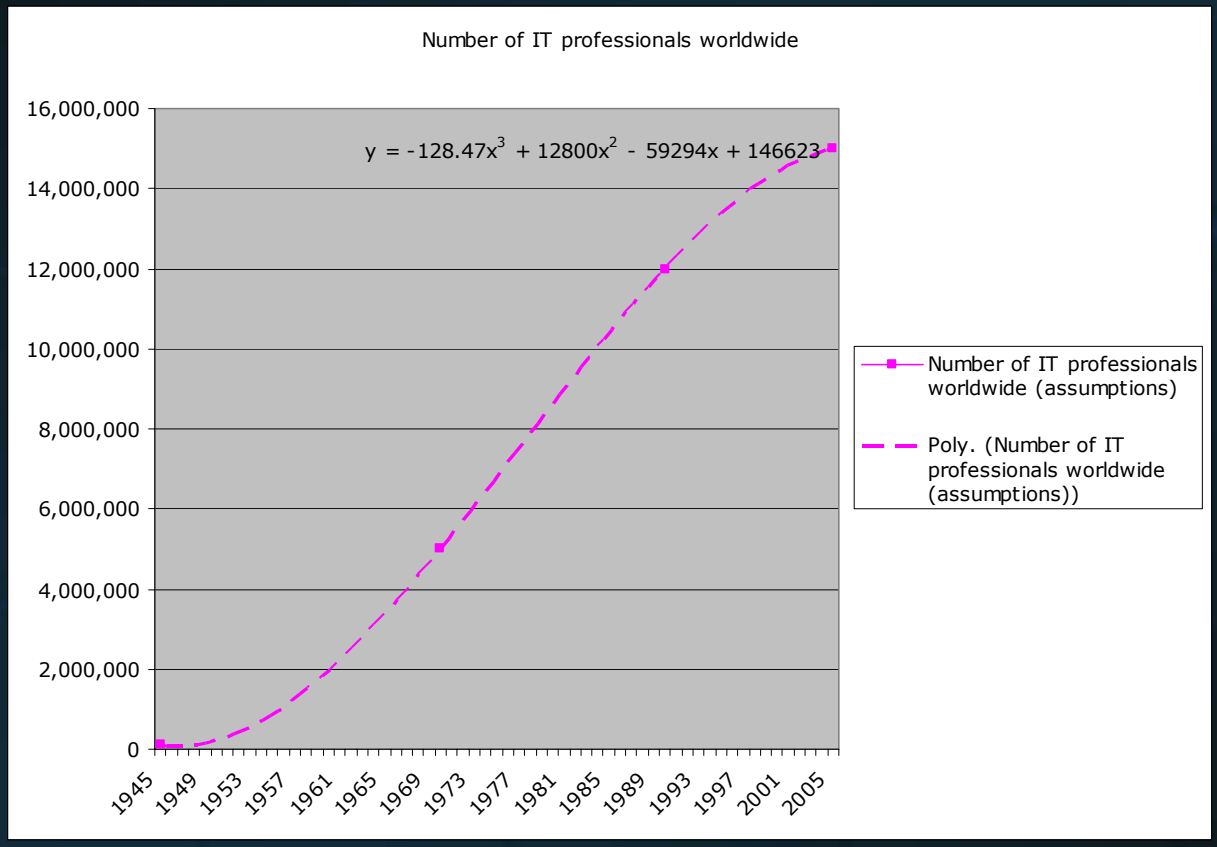
Celebrating Rational's 50th Anniversary

- How we got here
- The state of the world in 2031
- The state of software in 2031
- Getting from here to there

Software Runs the World

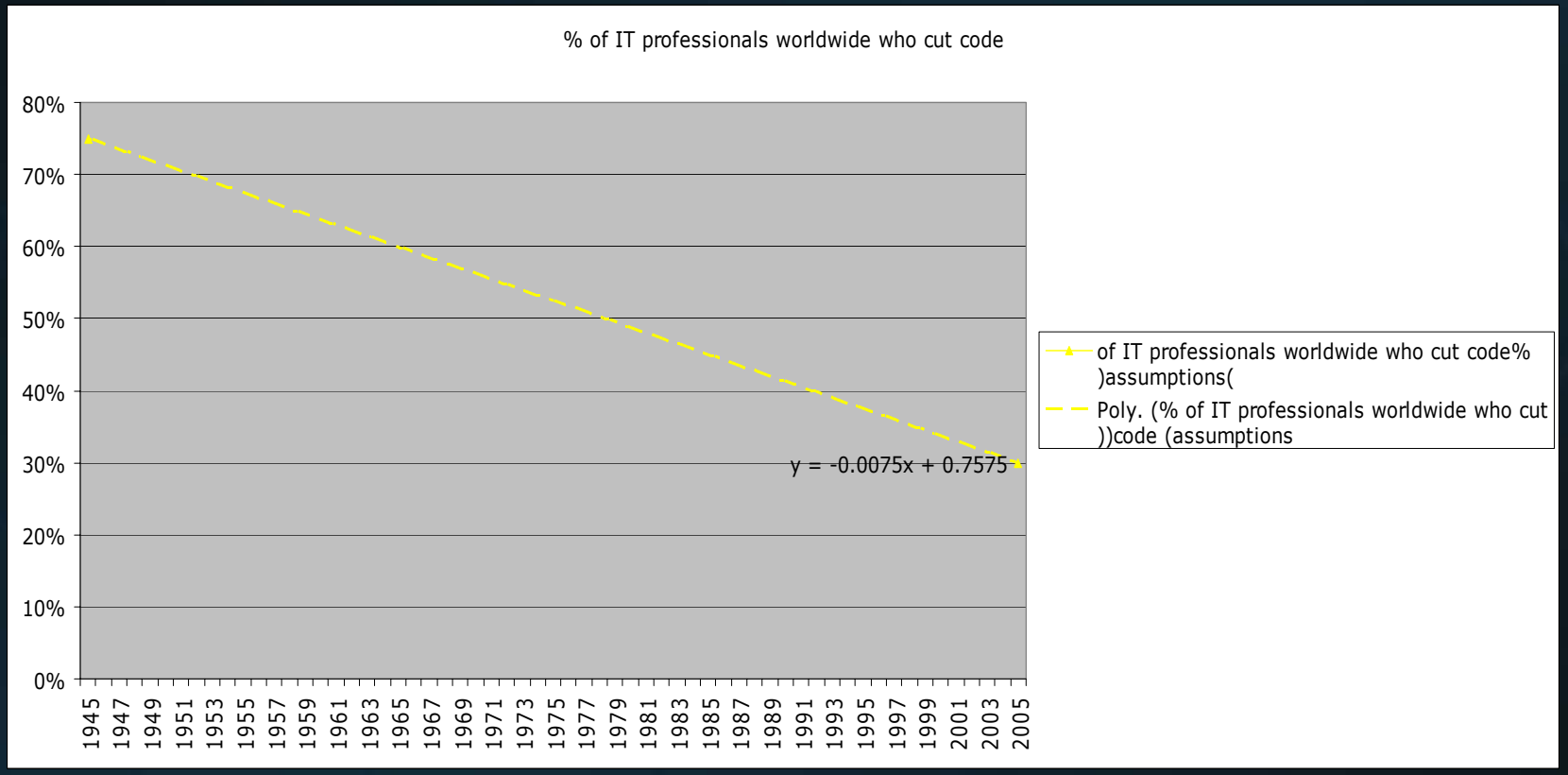
- Our civilization runs on software
  - Bjarne Stroustrup
- The privilege and responsibility of software development
  - Grady Booch

Software Runs the World



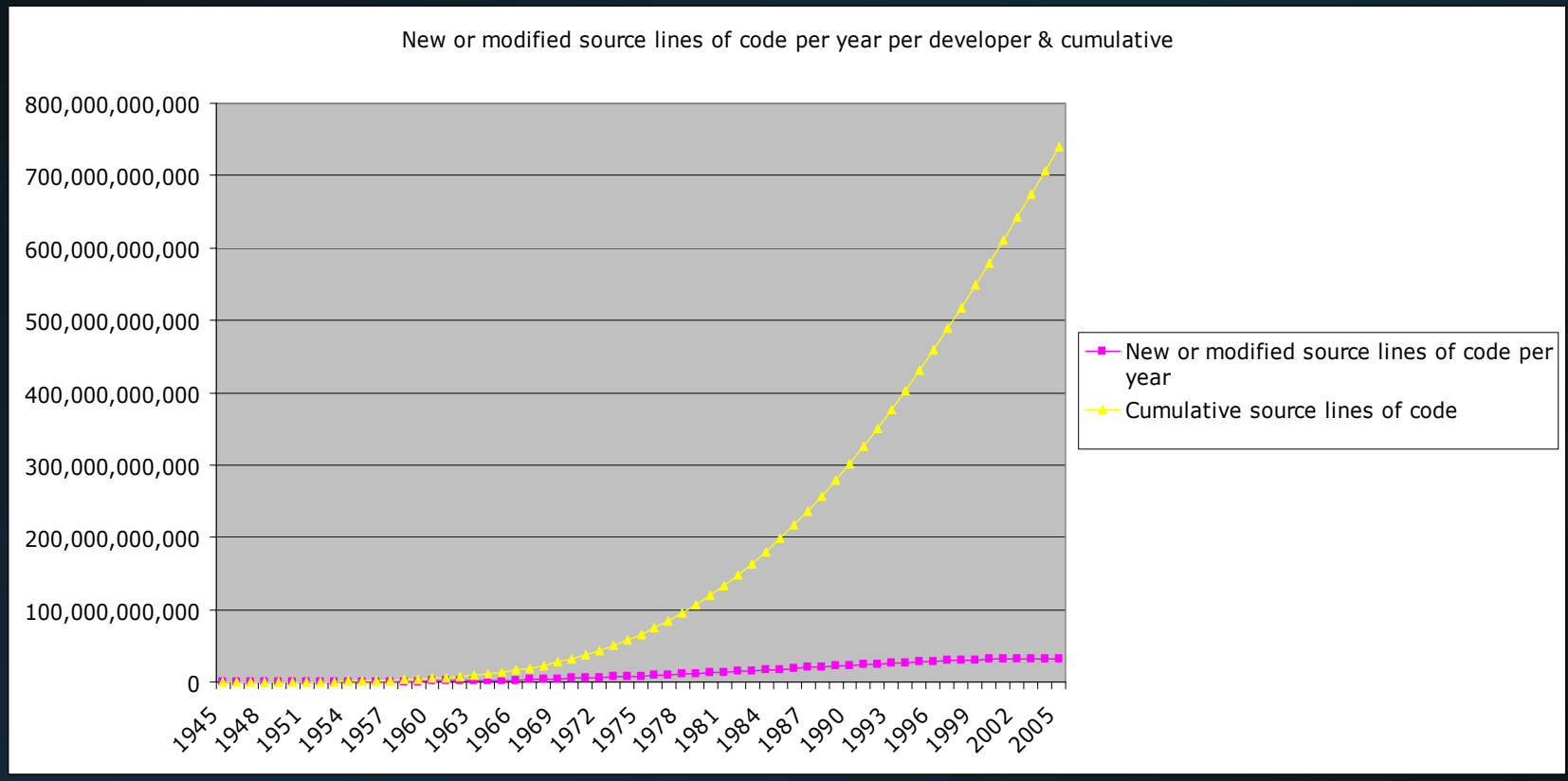
Number of software professionals worldwide

Software Runs the World



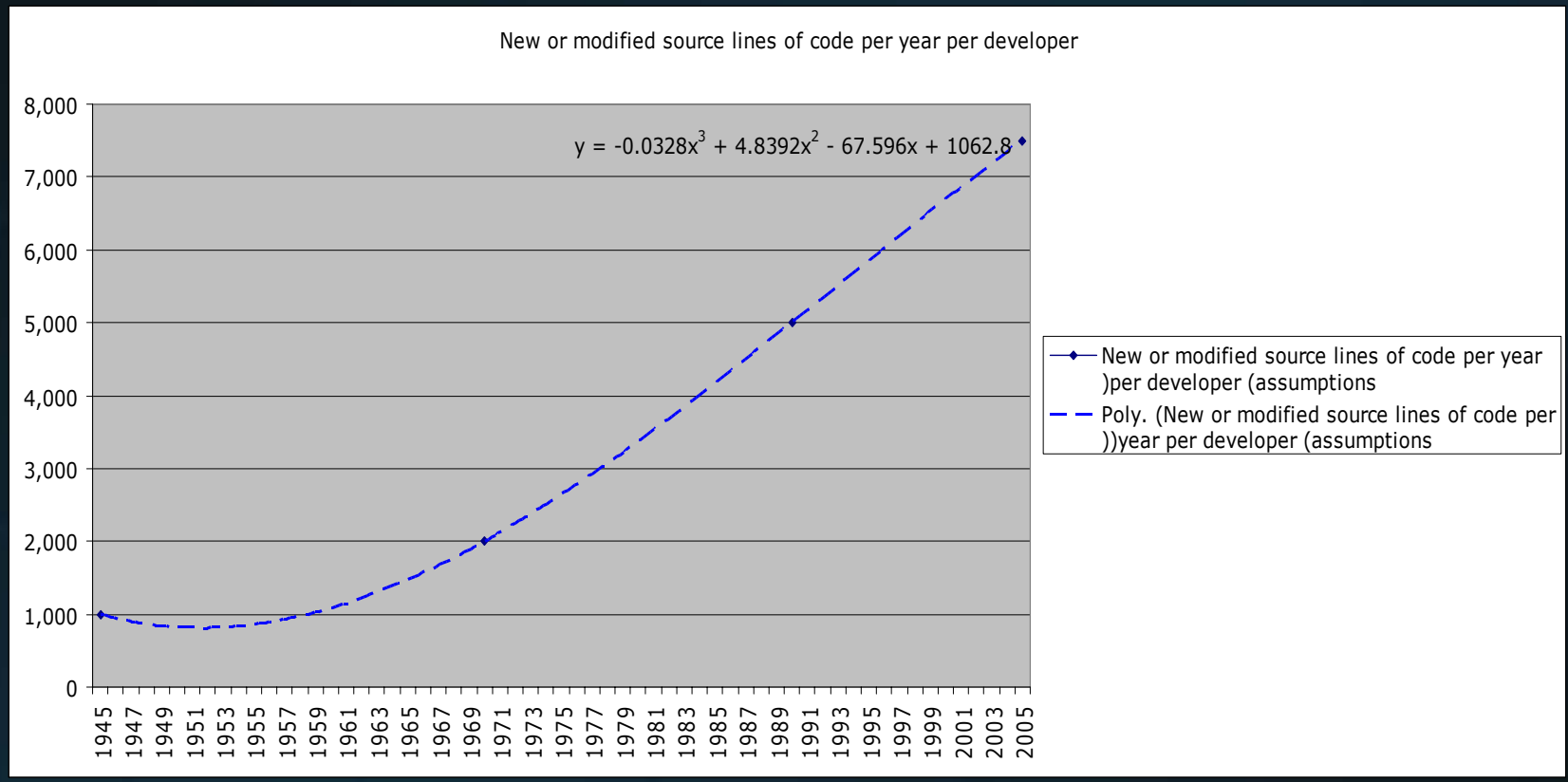
% of software professionals who cut code

Software Runs the World



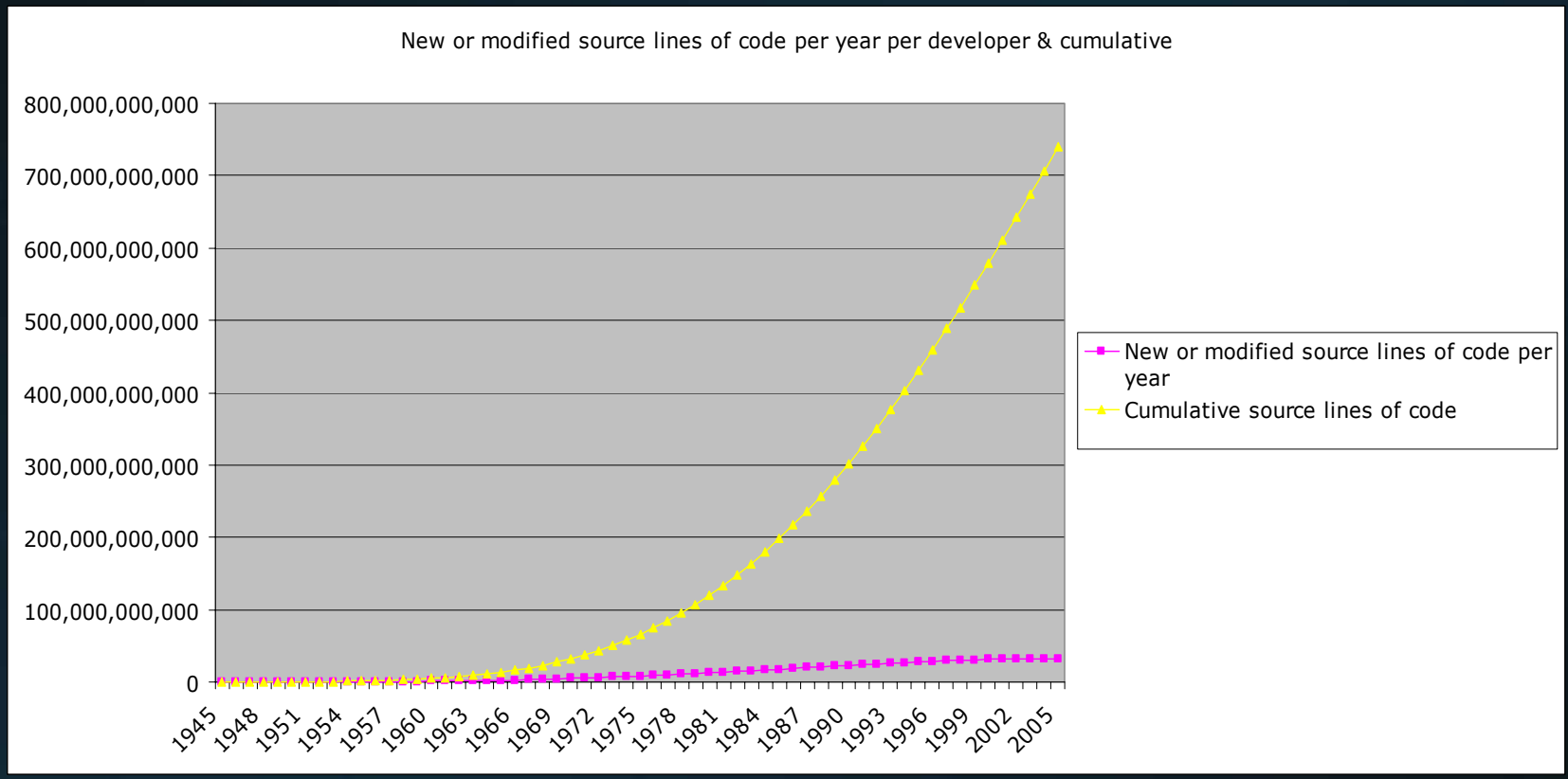
New or modified SLOC/year and cummulative

Software Runs the World



SLOC/developer/year

Software Runs the World



New or modified SLOC/year and cummulative

How We Got Here

- A brief history of computing
- A brief history of IBM
- A brief history of Rational

www.computerhistory.org
www.ibm.com/history
www.microsoft.com/museum

1910s

1911 C-T-R incorporated

1914 accounting machines

1915 first sales convention

1917 enters NA markets as IBM, Ltd

1918 synchronized clocks

1910s

3,000 employees

$11 million revenue

$1 million profit

1920s

1920 Great War expansion; printing tabulator

1923 electric keypunch

1924 enters Asian markets; renamed IBM

1928 IBM 80 column punch card

1929 accounting printing sorter

1920s

6,000 employees

$18 million revenue

$7 million profit

1930s

1930 Great Depression

1931 series 400/600 accounting machines

1932 R&D division created

1936 support for Social Security Act

1938 world headquarters in NYC

1930s

11,000 employees
$38 million revenue
$9 million profit

1940s

1940 WW II expansion

1941 electric typewriter

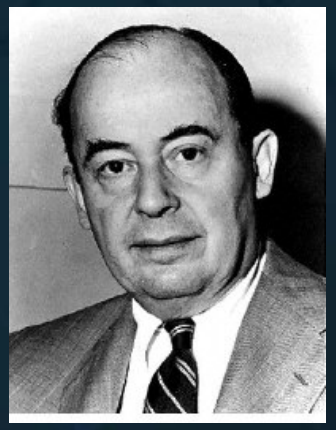
1942 subroutine

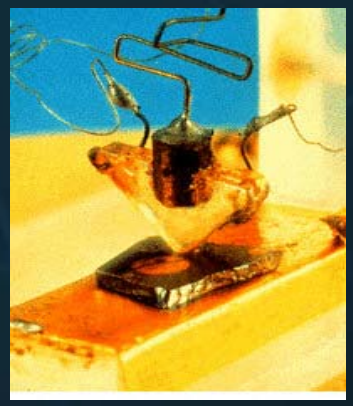
1944 Mark I

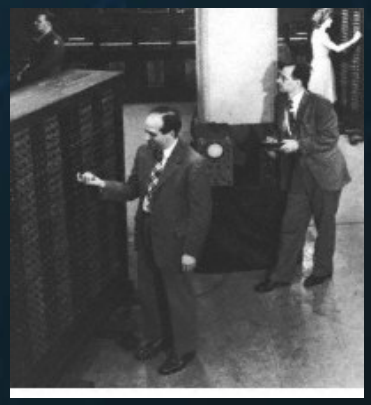
1945 von Neuman report on EDVC & first bug

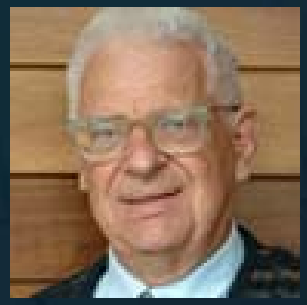
1946 ENIAC

1948 first transistor



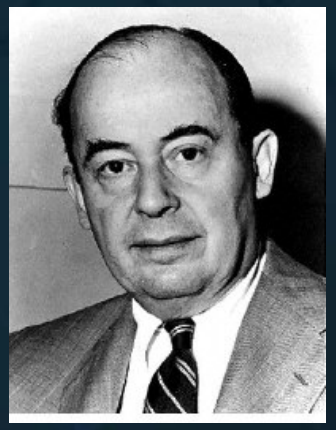


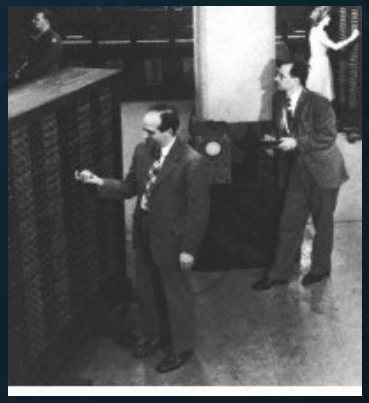


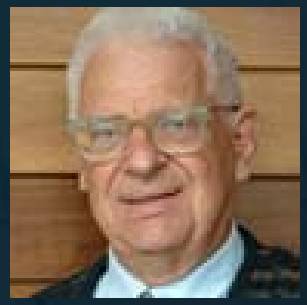


1940s

27,000 employees
$183 million revenue
$33 million profit

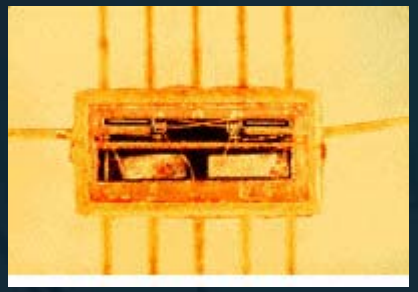






1950s

- 1951 UNIVAC I
- 1952 series 701 & magnetic tape drive
- 1953 series 650 drum calculator
- 1955 commercial transistor & magnetic core
- 1956 Whirlwind
- 1957 FORTRAN
- 1958 IC & SAGE
- 1959 Stretch

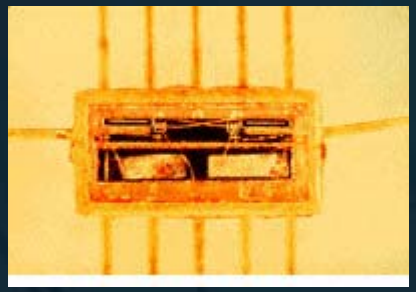


1950s

95,000 employees

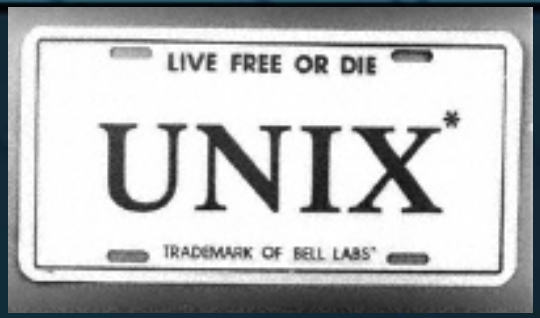
$1.61 billion revenue

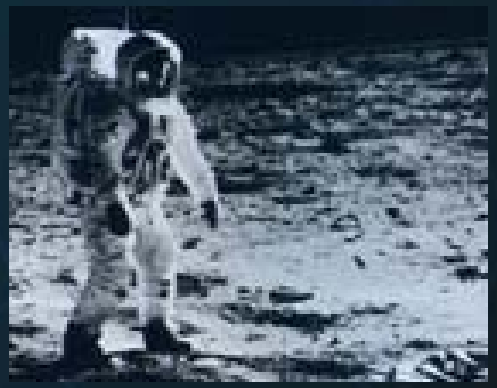
$176 million profit

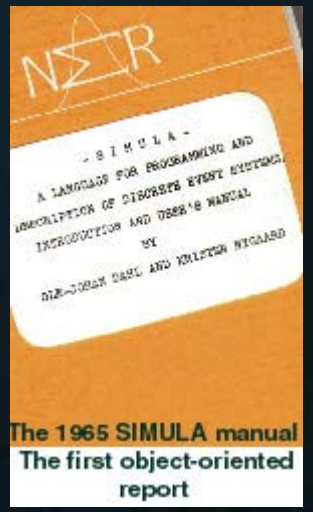


1960s

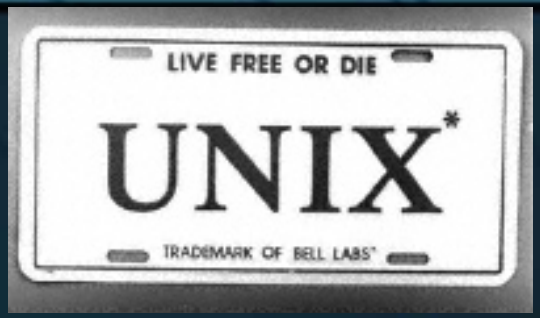
- 1960 COBOL & LISP
- 1961 Selectric
- 1962 SABRE
- 1964 BASIC & JOSS & series 360
- 1965 SIMULA
- 1968 Illiac & CICS & Dynabook
- 1969 lunar landing & UNIX & ARPANET



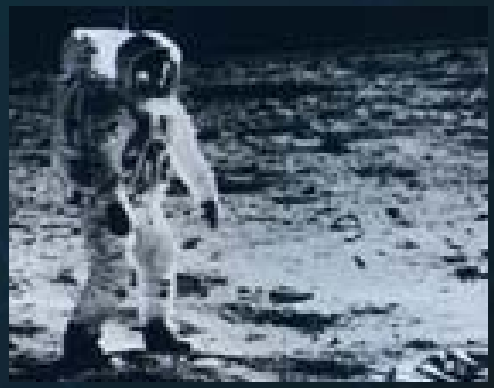




1960s

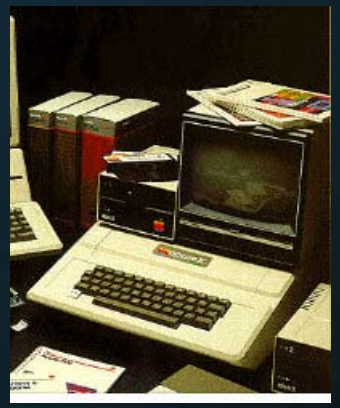


259,000 employees
$7.19 billion revenue
$934 million profit



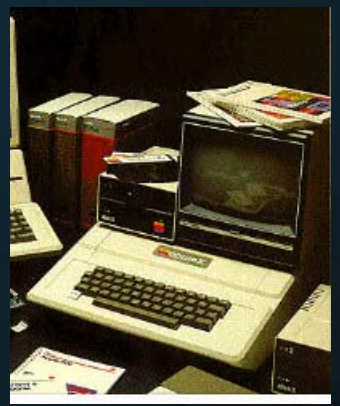
1970s

- 1970 PDP-11 & RDBMS
- 1971 Intel 4040 & floppy disk
- 1972 HP35 & Pong
- 1975 Microsoft founded
- 1976 Cray I & CP/M & Smalltalk
- 1977 Apple II & TRS-80 & IMSAI 8080



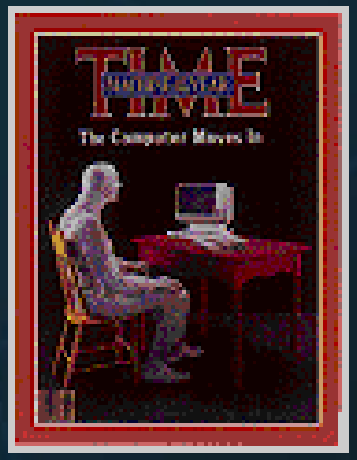
1970s

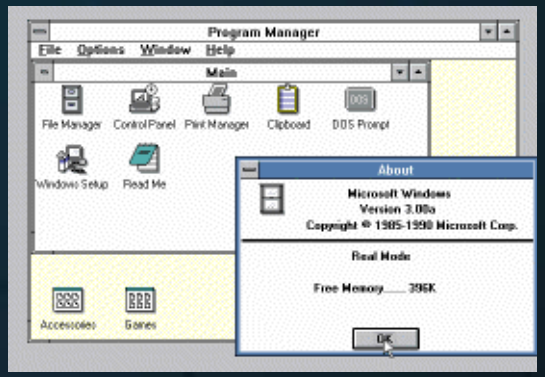
337,000 employees
$22.86 billion revenue
$3.01 billion profit



1980s

- 1981 MS-DOS/ IBM PC & Rational
- 1982 Machine of the Year & OOAD
- 1983 Microsoft Windows & Ada
- 1985 C++ & R1000
- 1986 Thinking Machine
- 1988 series AS/400



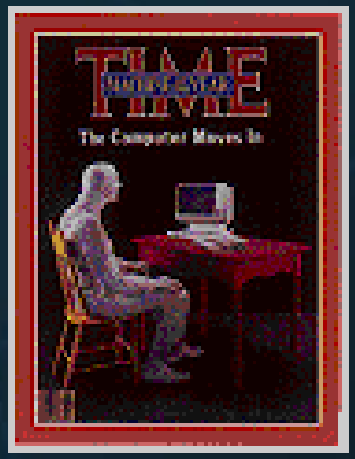


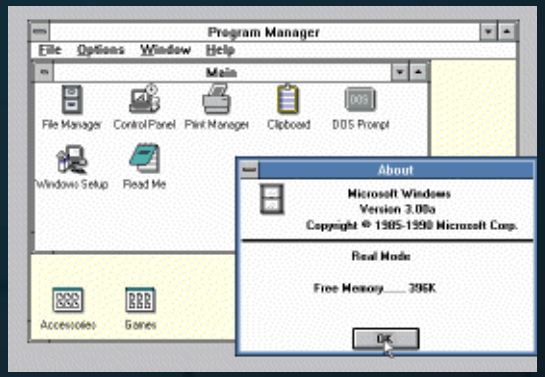
1980s

383,000 employees

$62.7 billion revenue

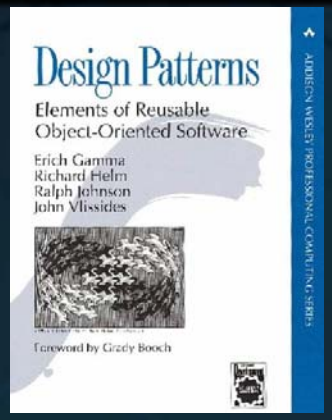
$3.7 billion profit

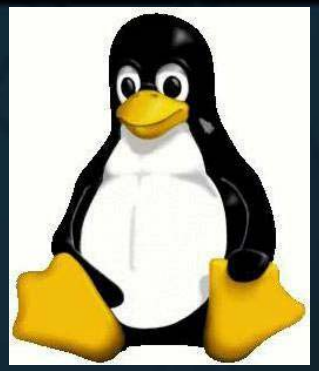


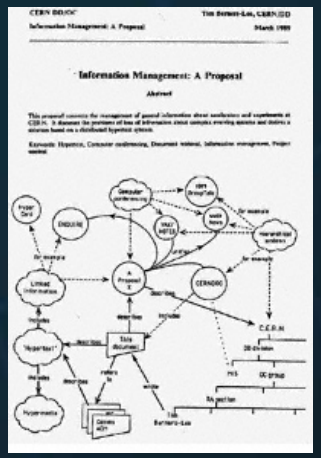


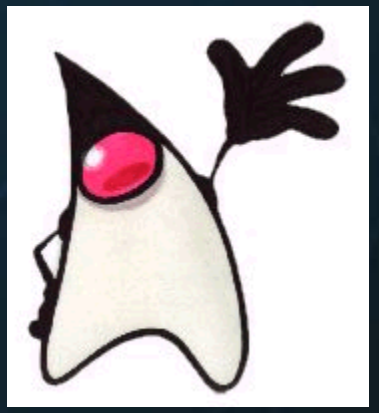
1990s

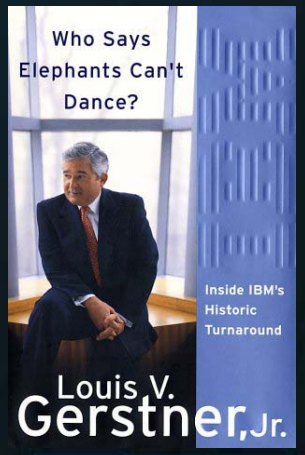
- 1990 WWW
- 1991 Patterns
- 1992 ThinkPad & Linux
- 1993 near death experience & APEX/Ada & NT
- 1994 APEX/C++ & ROSE & www.ibm.com
- 1995 Lotus & Java
- 1996 DB2 & Tivoli
- 1997 DeepBlue & Suites & RUP/UML & IE











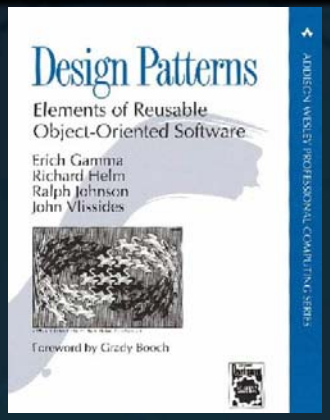
Rational Rose

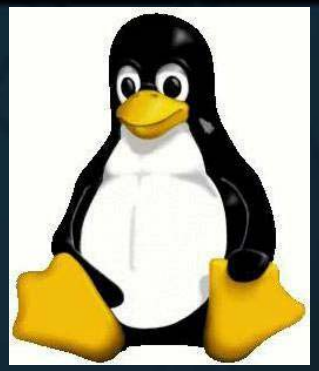
Lotus.

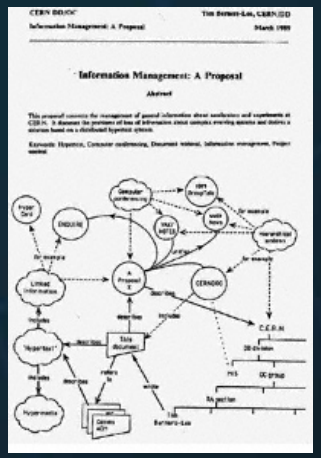
UNIFIED MODELING LANGUAGE UML™

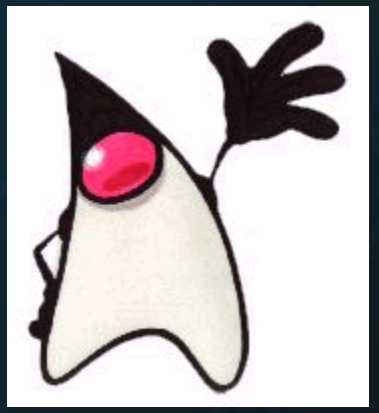
1990s

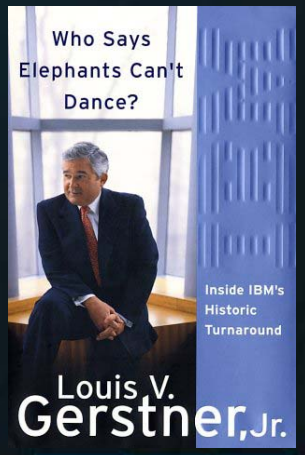
307,000 employees
$87.5 billion revenue
$7.7 billion profit











Rational Rose

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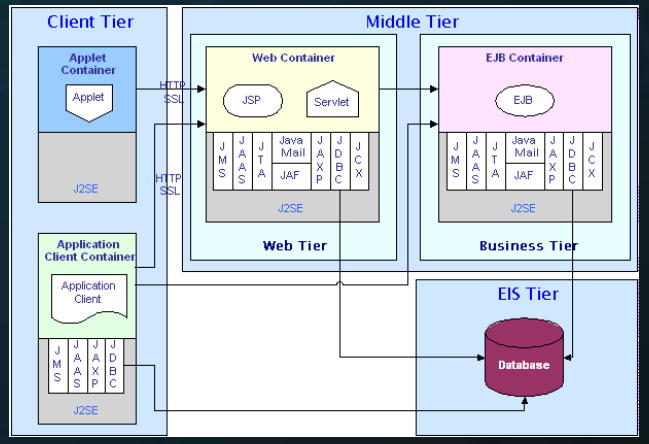
2000s

2000 Y2K & eServer
2002 .NET and J2EE
2003 Rational

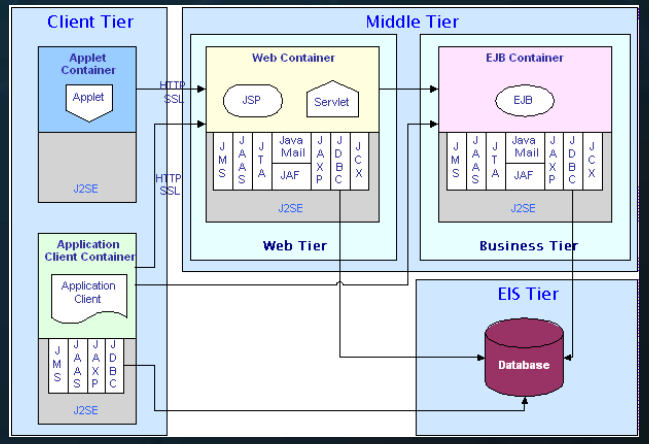
Rational. software



2000s

316,000 employees
$89.1 billion revenue
$7.6 billion profit

Rational. software



How We Got Here

1910s beginning of automation
1920s beginning of expansion
1930s beginning of dependence
1940s beginning of von Neuman machines
1950s rise of the machines
1960s rise of the languages and methods
1970s death of the mainframe
1980s age of the personal computer
1990s age of the Internet and new methods
2000s retrenchment

How We Got Here

2010s age of transparency
2020s total dependence
2030s rise of the machines

The State of the World - 2031

- Population
- Resources
- Politics & Society
- Warfare
- Agriculture
- Business
- Manufacturing
- Transportation
- Consumers
- Entertainment
- Medicine
- Science and technology

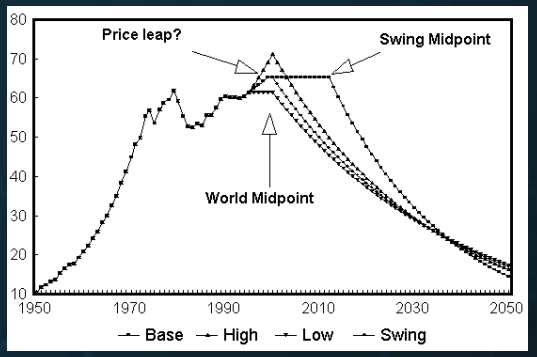
www.longbets.org
www.wfs.org
www.chronicle-future.co.uk
www.gwforecast.gwu.edu

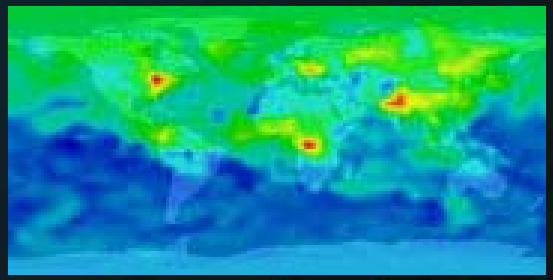
Population

- Global population nearing peak of 8.8 billion
- Global decline in fertility rate
- Population decline in developing nations
- Mortality decline in developing nations
- Continuing shift of population to 100 mile cities

Resources

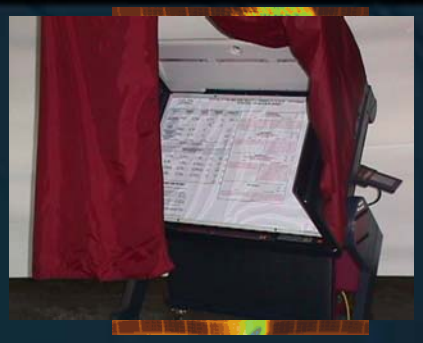
- Significant % of the world's population chronically short of fresh water
- Global oil production in decline (Hubbert Peak)
- Some fisheries have collapsed, some have been saved
- Air pollution plagues a number of cities

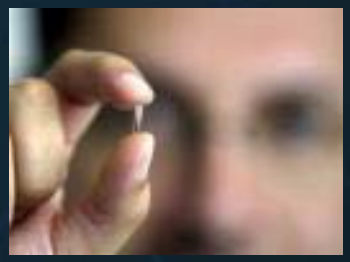




Politics & Society

- Entrenchment of the EU and other trading blocks
- Online representative government common
- Web continues to penetrate national boundaries
- Biometrics commonly used to track the moment of individuals
- New kinds of crime emerging
- Information dark age continues





Warfare

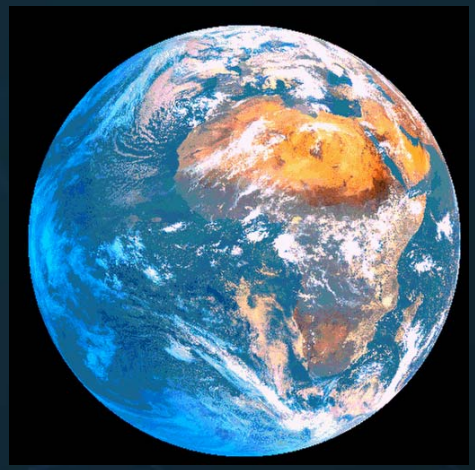
- Continuing battle against stateless combatants
- Terrorism and the proliferation of WMD
- Electronic battlefield
- Remotely controlled weapons

Agriculture

- Genetically modified crops surpass natural crops in acreage planted
- Consolidation of commercial farms
- Continued loss of habitat with localized famines

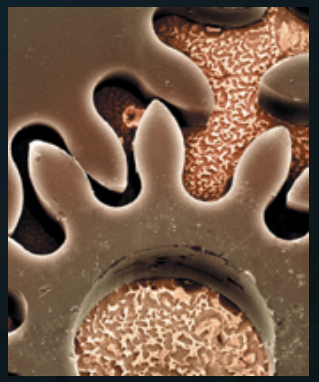
Business

- Dominance of transnational companies
- Innovation in some sectors
  - Biotechnology and materials
- Economization in others
  - Communications and media



Manufacturing

- Increased automation yielding personalized manufacturing
- New materials including ceramics, metallic glass, and nanotubes
- Nanoscale machines



Transportation

- Hybrid connected cars dominate
- Increased mass transit
- Airline consolidation
- Regular commercial space travel

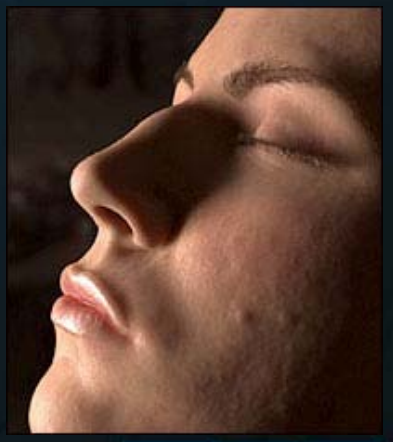
Consumers

- Shift from mass to micromarkets
- Convergence of communication
- Pervasive personal assistants
- Increased loss of privacy

Entertainment

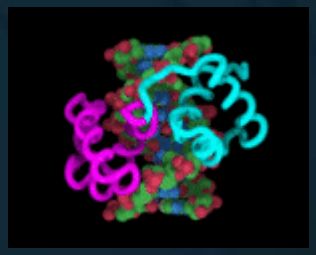
- Books are typically electronic or

  printed on demand
- Virtually all news and entertainment is delivered digitally across the Internet
- Immersive games and reality adventures dominate the landscape
- Complete photorealism in movies
- Local portable storage persists



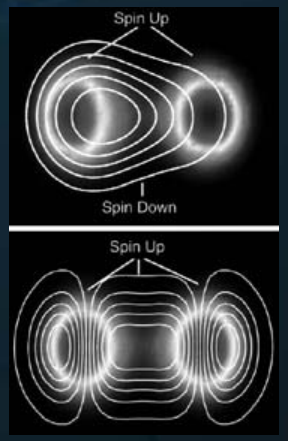
Medicine

- Genetic treatment commonly used to improve the quality and length of life
- Seamless and remote diagnosis and treatment with personal wellness assistants
- AIDS pandemic and growth of drug-resistant strains



Science and Technology

- Pervasiveness of RFID & GPS
- Coded aperture imaging common
- Practical optical and limited quantum computing
  - Bekenstein's Bound



The State of Software - 2031

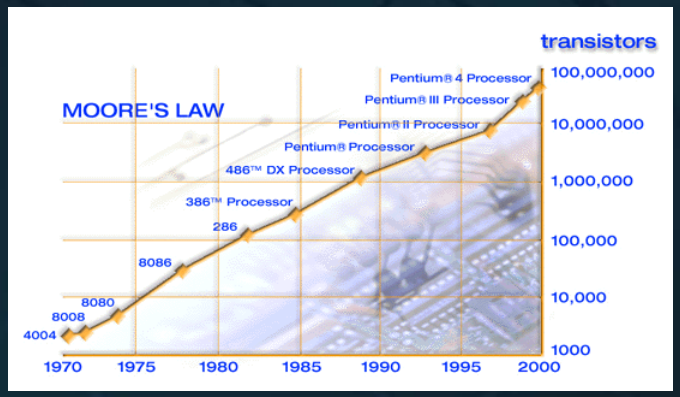
- Every advance leading to this state of the world in 2031 requires the presence of software yet-unwritten as of 2004
- The typical software-intensive system is
  - Continuously evolving
  - Connected, distributed & concurrent
  - Secure
  - Autonomic

The State of Software - 2031

- Platforms
- Languages
- Operating systems & middleware
- Connection
- Security
- Autonomics
- Developer experience

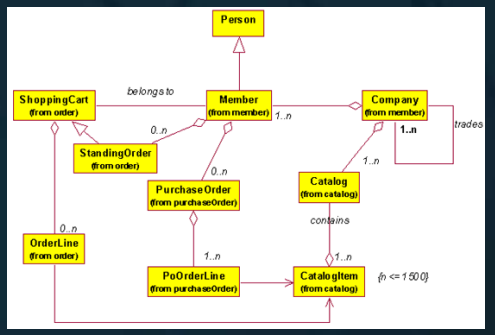
Platforms

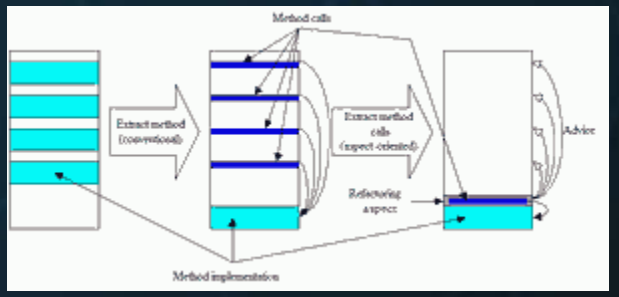
- Moore's law has died
- The typical personal computer contains multiple processors, a petabyte of main memory, an exabyte of external memory, and untethered terabit connectivity
- Virtual high resolution displays dominate
- Most personal computers will be wearable or embedded
- Most software is embedded in devices



Languages

- Most programmers still write algorithmic snippets in the context of a sea of objects
- Legacy XML, Java, C++, and UML persist
- Domain-specific frameworks are mainstream
- Aspects are mainstream
- Algorithmic breakthroughs have emerged



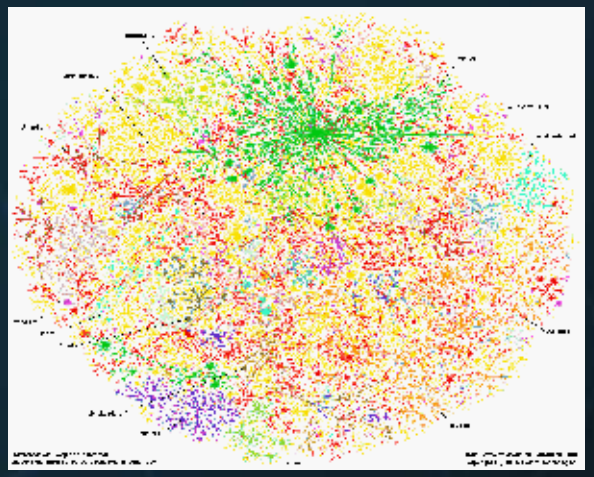


Operating Systems

- Operating systems have largely been commoditized
- Middleware that does transaction isolation, load balancing, resource management, and data access still dominates
  - but it too has largely been commoditized

Connection

- More than ever, the network is the computer
  - Monolithic -> client/server -> Web -> grid
- Network access is a global utility
- Not everything is an enterprise system, but most applications are connected to several

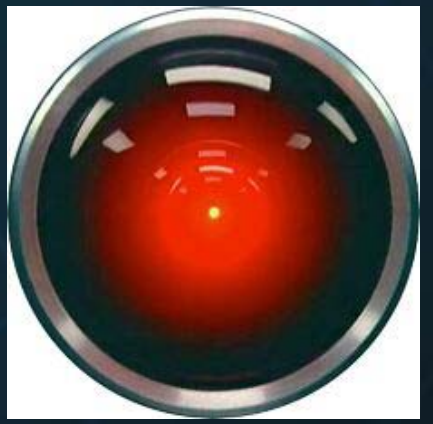


Security

- *New kinds of cybercrime have arisen*
  - *unlimited piles of money still do not yield secure systems*
  - *Air gaps are still not enough*
- *Rolling failures still plague some systems*

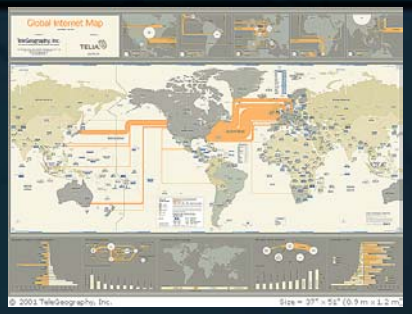
Autonomics

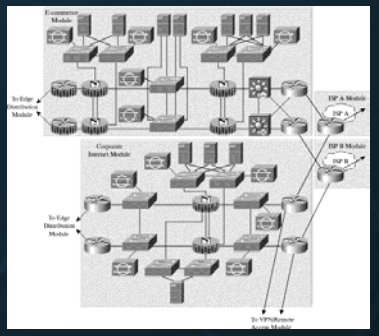
- No computer has yet passed the Turing Test (but we have come close)
- Most interesting systems exhibit signs of agency and self-repair



Developer Experience

- Most developers have grown up believing that the Internet always existed
- Most programming is now done by domain-specific developers who only incidentally learn how to program
  - Most development occurs along the edge and the seams of systems
- There have been only incremental improvements in programmer productivity and the programming model
  - The developer experience is centered around the collaborative development environment
  - Distributed development is common
- Lawyers are now commonly a part of most development teams





The State of Software – 2031

2010s age of transparency

Software burrows itself into the interstitial spaces of society

2020s total dependency

Virtually every human activity touches and hence requires some software

2030s rise of the machines

Semiautonomous entities with varying degrees of agency amplify human activity

Getting From Here to There

- The complexity ceiling
- The limits of software
  - The laws of physics
  - The laws of software
  - The challenge of algorithms
  - The difficulty of distribution
  - The problems of design
  - The importance of organization
  - The impact of economics
  - The influence of politics
  - The limits of human imagination

Getting From Here to There

- Languages for systems
- Mechanisms for interconnection
- Architectural patterns
- Tools for understanding and reasoning about continuously evolving systems
- Tools for collaboration and organization

Conclusion

- The world runs on software
  - Innovation
  - Economization
- The fundamental of software engineering never go out of style
- It is a privilege and a responsibility to be a software professional
  - Live your passion

We'll see you again in 2031 to celebrate Rational's 50th anniversary!

Thank
You