The Mainframe – Past, Present and Future

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Agenda


The Mainframe – a "trip" back


The System/360 announcement


Current state of mainframe business


Mainframe technical evolution and futures from Dr. Strassemeyer

The Mainframe – a "Trip Back"

- Born on April 7, 1964

- What else was going on in 1964?

1964 - Headlines

- President Johnson re-elected in a landslide after President Kennedy's shortened term
- Medicare is introduced
- 3 civil rights workers are murdered in Mississippi
- Soviet leader Khrushchev falls from power, replaced by Leonid Brezhnev
- U.S. Surgeon General links smoking to cancer
- Congress passes Gulf of Tonkin resolution
- U.S. launch attacks on North Vietnam

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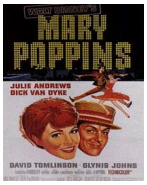
1964 – Economy and Demographics

- U.S. population 191,888,791
- Economic indicators
  - Dow Jones high = 891, low = 776
  - Cost of a new home: $20,500.00
  - Cost of a first-class stamp: $0.05
  - Cost of a gallon of regular gas: $0.30
  - Cost of a dozen eggs: $0.54
  - Cost of a gallon of Milk: $0.95
- Ford introduces the sporty "Mustang"

1964 - Sports

- World Series: St. Louis beat NY Yankees 4-3 (Yogi Berra is Yankee's coach)
- NFL champions Cleveland Browns defeat Johnny Unitas and the Baltimore Colts 27-0
- NBA champions Boston Celtics defeat San Francisco Warriors 4-1
- Cassius Clay (future Muhammad Ali) beats Sonny Liston to win heavyweight boxing title

1964 - Entertainment



- Top Movies:
  - Mary Poppins $102,300,000
  - Goldfinger $51,100,000
- TV Shows
  - The Munsters
  - The Virginian
  - Outer Limits
  - Gilligan's Island
- Music
  - Billboard Top 3:
    - 1. Bread And Butter - The Newbeats
    - 2. Under The Boardwalk - The Drifters
    - 3. I Get Around - Beach Boys
  - Grammy Award for Best New Artist: The Beatles

Beatles - Original TV Commercial (1964).avi

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1964 – Science and Technology

- Space probe Mariner IV flies by Mars, transmits pictures back to earth
- World's Fair held in New York
- First lung transplant is achieved
- The world's largest suspension bridge, the Verrazano Narrows Bridge opens in NY
- …And the bedrock of commercial computing was born

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IBM - Leading up to 1964

- 1952 - Remington Rand's Univac I accurately predicts the outcome of the presidential election
  - Prediction made just 2 ½ hours after East Coast polls closed, and with only 5% of the votes tallied
- 1952 - Tom Watson, Jr. named president
- 1952 - IBM enters the "computer" age with the 701 Electronic Data Processing Machine
  - IBM builds and sells 19 units
- From 1950 to 1962 IBM's revenue and earnings grow tenfold, employees grow from 30,000 to 127,000
- Fortune refers to "Fortress IBM"

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IBM - Leading up to 1964…

- Started to feel like they were reaching a plateau
- Growth tapers off substantially in 1960
  - New competitors fueled by WWII and Cold War investment
- By 1963 Burroughs, Honeywell, Remington Rand, Control Data, and GE introduce computers, superior in some ways to IBM's

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IBM – Leading up to 1964…

- "Management by contention" style helps to contribute to a hodge-podge product line of eight computers
- Incompatible architectures
- Customers needing to grow often had to buy a new computer, new printers, new storage and new software

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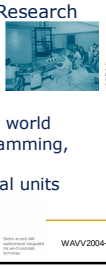
IBM – Leading up to 1964

- Several ambitious projects helped shape the technology
  - Semi-Automatic Ground Environment (SAGE)
  - Semi-Automatic Business Environment Research (SABER, later SABRE)
  - Space – NASA projects
  - Stretch System – Later the 7030
    - Intended to "stretch" IBM's capabilities
    - Supercomputer – fastest computer in the world
    - Helped to pioneer solid-state, multiprogramming, even the 8-bit byte
    - Didn't live up to sales expectations: 8 total units



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IBM – Leading up to 1964…

North Street Laboratory – Endicott, NY

IBM Laboratory – Poughkeepsie, NY

The competition between the IBM laboratories and manufacturing facilities in Endicott and Poughkeepsie was intense.

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IBM – Leading up to 1964…

- Data Systems Division (DSD) in Poughkeepsie
  - Responsible for large computer systems
  - Systems that rented for more than $10,000 per month
  - Built first fully-electronic product – 700 series
- General Products Division (GPD) in Endicott
  - Responsible for building systems that rented for less than $10,000 per month
  - Built low-cost IBM 650 Magnetic Drum Calculator, IBM's first computer to ship more than 1000 units
  - In 1960, started shipping the IBM 1401, first computer to sell more than 10,000 units
- Overall revenues from computer systems were about to exceed electro-mechanical accounting machines

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IBM – Leading up to 1964…

- IBM Product line in early 1960s
  - General Products Division
    - IBM 1401, 1410, and announced the 1610
    - Selling in record quantities
  - Data Systems Division
    - High-end, vacuum tube-based 700 series evolved to transistor-based 7000 series
    - 8000 series well into development, near announcement
  - IBM World Trade Corporation
    - Contributing 20 percent of total revenue; growing faster than U.S. business
    - U.K. Hursley lab working on a computer called SCAMP, never produced but eventually contributes important technology to the S/360

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IBM – Leading up to 1964…

- IBM Product line in early 1960s…
  - "Our computer product line had become wildly disorganized." – Tom Watson, Jr.
  - Customers exasperated by incompatibility
    - No upgrade path, all new hardware if needed to grow
    - IBM 1410 was a huge success, showed how upgrade compatibility was valued
  - Also caused numerous, expensive problems for IBM
    - Different personnel to keep trained on all systems
    - Manufacturing economies of scale reduced
    - Engineers and customers became committed to whatever they had adopted

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IBM – Leading up to 1964…

- Watson turned to T. Vincent (Vin) Learson to solve the problem
  - Joined in 1935, rose in sales and by 1961 was Group Executive in charge of DSD, GPD, ASD and the new Components Division
  - Management style of "abrasive interaction"
  - GPD had announced the 1410, DSD was about to announce the 8000 series
  - Learson replaced the DSD executive (Fred P. Brooks, Jr.) with the engineering manager from GPD, responsible for the 1401/1410 line (Bob O. Evans)
  - Evans decided to kill the 8000 – in its place, IBM should make a "company-wide effort to develop a total cohesive product line"

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IBM – Leading up to 1964…

- New 11 member task group was formed: Systems Programming, Research, Engineering and Development (SPREAD) chaired by Evans
- Charge was to examine everything IBM was doing with computers and then determine development and direction for the next 10 years
- Started work in fall of 1961
- Finally sequestered to a remote hotel in Connecticut with orders not to come back until they agreed

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IBM – Leading up to 1964…

- SPREAD Report
  - Develop 5 processors, with the largest one 200 times more powerful than smallest (grew to 6 by announcement day)
  - Each processor would have high-speed memory with permanently stored information to control the system
  - Each processor's software would be compatible with larger and smaller systems
  - Entire line would use standard interfaces for I/O equipment, allowing customers to upgrade gradually
  - And a bombshell: New Product Line (NPL) "will not be compatible with our existing processors"
- IBM Executive Response: Do it.
- Evans asks Brooks to lead the planning for the NPL!

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New Product Line (NPL) Design

- Honeywell had developed a "Liberator" program that emulated 1401 programs
- IBM sales staff were pleading for help
- Engineers decided to bring out the System/360 with emulators
- Flip of an electronic switch could make the System/360 appear as a 1410, 7080 or 7090
- Second important breakthrough

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April 7, 1964 – Computing Grows Up

- System/360 Family of Computers
  - Named for the 360 degrees on a compass, signifying it could be used for useful for any job, any size
  - Largest privately financed commercial project ever undertaken
  - Culmination of a daring decision to replace the company's entire product line of computers with one family
  - Decision to commit was "gut wrenching"; made and broke careers
  - Development, launch and getting production on its feet cost IBM $5 billion ($30 billion in 2004 dollars)

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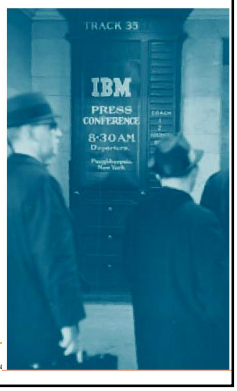
System/360 Announcement

- Announcement planned for a full year
  - Rehearsed for six months
  - Chartered a train from Manhattan to Poughkeepsie
  - Held same day in 165 U.S. cities and in 14 other countries
- Replaced "hodge-podge" product line of eight computers
- Created the idea of code portability from the smallest to the largest processor within the family



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System/360 Announcement…

"System/360 was the biggest, riskiest decision I ever made, and I agonized about it for weeks, but deep down I believed there was nothing IBM couldn't do." – Tom Watson, Jr.

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System/360 Technology

- Six completely new processors, 44 peripheral devices
- Within 4 weeks of announcement customers had ordered over 1000 machines, and another 1000 4 weeks later
- But success was slower than appeared, 3 major problems
  - SLT module supply from vendors was quickly exhausted: solved by creation of East Fishkill production plant
  - Logistics, delivery, production problems: solved by replacing Tom Watson's brother with Learson
  - Operating System challenges – complexity of compatibility plus multiprogramming
    - IBM 650 had 10k lines of code
    - IBM 1401 had 100k
    - System/360 initially had 1,000,000 and grew to 10 million
    - Largest single expenditure in the history of IBM – $500 million

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System/360 Technology…

- Resulted in delivery of Operating System/360 (OS/360)
- OPSYS software for the lower-end System/360 offered other challenges
  - In part because Poughkeepsie's limited experience with small systems
  - Endicott GPD picked up the challenge and eventually developed three operating systems
    - Basic Operating System (BOS)
    - Tape Operating System (TOS)
    - Disk Operating System (DOS)
      - "would live on to become the most widely used operating system in the world."

The Effects of System/360

- By 1966
  - Nearly 8000 systems installed, generating $4 billion in revenue
  - IBM hired 25,000 new employees
  - Producing 1000 units a month
- From 1964 to 1970
  - IBM's revenues more than doubled, from $3.2 billion to $7.5 billion
  - Employees grew from 120,000 to 269,000
- Compatibility contribution changed the world of computing
  - Initial performance range of 25-1, 6 years later 200-1
  - First "intersection of business and modern technology"

The Effects of System/360.

- Powered NASA, Pioneer, Galileo and Apollo development
- Tokai Bank in Japan moved from banking operations on an abacus to System/360
- Architecture lowered customer costs, improved computing efficiency and took all the "mystery" out of comparing computers
- By the end of the 1960s, more than 3000 different types of businesses and science, from rockets to railroads to Wall Street, were using one of System/360s models

The Effects of System/360…

President Ronald Reagan presenting Fred Brooks with the National Medal of Technology. Bob Evans and Erich Bloch also received the honor.

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The Mainframe Today

- After surviving NDE in early 90s, System 390 began re-invention again with CMOS technology
- Same pundit that in 1991 predicted the death, wrote in 2002

  "It's clear that corporate customers still like to have centrally controlled, very predictable, reliable computing systems – exactly the kind of systems that IBM specializes in."
- Continued with IBM eServer zSeries technology
- Ongoing with Open standards including Linux

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The Mainframe Today…

- Last year, IBM mainframe sales increased 33% from previous year to $4.2 billion
- Strongest growth driven by new applications and Linux workloads
- Customer base:
  - In 2001, more than 70 new mainframe customers
  - In 2002, more than 100 new mainframe customers
  - In 2003, more than 150 new mainframe customers
  - Compared to 30-35 per year in the 1990s
- Everyone acknowledges – 70% of the world's data resides on mainframes

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The Mainframe Today…

- Linux for zSeries accounted for strong growth in new MIPS in 203
- More than 300 mainframe customers have at least one Linux application in production
- Majority of the Linux apps are infrastructure (Web, Mail, print/file sharing)
- Consolidation is easier--database and transaction processing developing

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The Mainframe's Outlook

- The mainframe is the benchmark for all to compare Who says so? Every competing vendor or product!
  - IBM's new pSeries 630 model Unix-class server: "bringing mainframe-inspired logical partitioning to entry servers."
  - In Jan 2003 Sun announced that their: "Sun Fire 6800 server offers mainframe-class availability and resource management features."
  - Intel Corporation describes servers using their processors as having: "…four-way and eight-way application servers to mainframe-class servers with up to 64 processors…"
  - In fact, search for the term "mainframe-class" on nearly all serious server manufacturers' websites!

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The Mainframe's Outlook…

- Challenges
  - Application growth and development
    - Many ISVs not continuing development
    - Discrete interfaces, discrete languages
    - Perceived dearth of talent
  - Perception
    - Executives belief that the mainframe is obsolete and antiquated
    - Interfaces appear old, and *are* old
  - Senior Workforce

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The Mainframe's Outlook…

- Solutions
  - Application growth and development
    - Full exploitation and development of interfaces that provide real interaction with all platforms
      - Web Services/XML/SOAP etc.
      - Usage of connectors and other methods to allow "today's" generation to use mainframe resources
  - Perception
    - Information – gather facts and figures. IBM has never been a better resource
    - Interfaces: appearance is everything

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The Mainframe's Outlook…

- Solutions
  - Senior Workforce
    - Few college grads are exiting with mainframe exposure
    - Cross-training essential in systems area
      - Today's systems interface is a major impediment
    - Best response is to adapt the mainframe to today's emerging standards
      - Use Web interfaces exclusively
      - XML-enabled data to generalize access
      - Implement "current" language support
    - Need to blur the lines of the mainframe versus any other system

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The Mainframe's Outlook…

- Network computing dominates the world
- Pervasive connections/pervasive "computing"
- Any Information from Anywhere
- Universal interface via web browser

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The Story of Mainframe Technology from one who has helped create it…

- Dr. Karl-Heinz Strassemeyer
  - Distinguished Engineer IBM Deutschland Entwicklung GmbH
  - MS and Doctorate in Physics from University of Goettingen
  - Employed with IBM since 1967

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Dr. Strassemeyer – IBM Distinguished Engineer

1967 – 1968	System Programming and Compiler Development (BPS, S/360 Model 20 PL1)
1969 – 1971	Diverse management positions in the development field
1972 – 1981	Responsible visionary for micro programming and future systems Architecture (S/370 Models 121)
1982 – 1986	Assignment at IBM Development Divisions in White Plains, NY as Technical assistant for different development executives
1987	Return to Boeblingen as manager of System Design Control Developing expert status and gaining responsibility for the development of S/390 Design in Boeblingen and the IBM Global S/390 Hardware Lab

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Dr. Strassemeyer – IBM Distinguished Engineer…

1990	Nomination to Senior Technical Staff Member by the IBM Corporate Technical Board - Special status as visionary and "technical father", leading technical strategic functions concerning future systems: - New system structures for S/390 systems - CMOS-Processor-Design - Transformation from bipolar to CMOS based S/390 systems
1997	Nomination to Distinguished Engineer working mainly on server platform strategy
1998	Election as member of the IBM Academy of Technology -- an independent, highly reputed technical community of 300 Leaders within IBM
1999	Linux experiment on the mainframe succeeds with enormous result - he is Godfather of Linux' for S/390
Today	Promoting the open source culture of Linux in the Enterprise World with customers and applications. Envisioning and promoting technology breakthroughs for leading edge IBM e-Server vendors.

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Dr. Strassemeyer – IBM Distinguished Engineer…

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