Computing at CERN - I

Summer Student Lectures 2002

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Overview

- Computing at CERN Today

- Software at CERN Today

- The future & LHC Computing

Background Material

http://cern.ch/ssl-computing/default.htm

Will not cover:

- History of computing at CERN
  - Excellent articles in CERN Computing Newsletters via above Web site

- Topics of last year's lectures by Tony Cass:
  - Looking at Data,
  - Looking Around,
  - Looking Forward (also via above Web)

Two Examples...

- On the history of mainframes at CERN...
  - "I came to CERN in 1964, more or less packed in a box with the CDC 6600. This was the third system to be manufactured. Serial Number 1 was installed at the Livermore Laboratory and Serial Number 2 was used for software development until it caught fire."

Example 11

- On the development of large packages…
  - "To login, I had to type my name and a tape number. Following this message, a lamp was flashing in the computer center. The lamp told the operators to mount a tape and copy the contents of my previous session to a local disk of a total capacity of about 10 Mbytes."

Who am I ?

- 1984 – 1988: central VAX (VMS & Unix) systems
- 1989 – 1993: application development & support
- 1993 – 1995: CERN Program Library
- 1995 – 1999: Object Databases, C++ applications
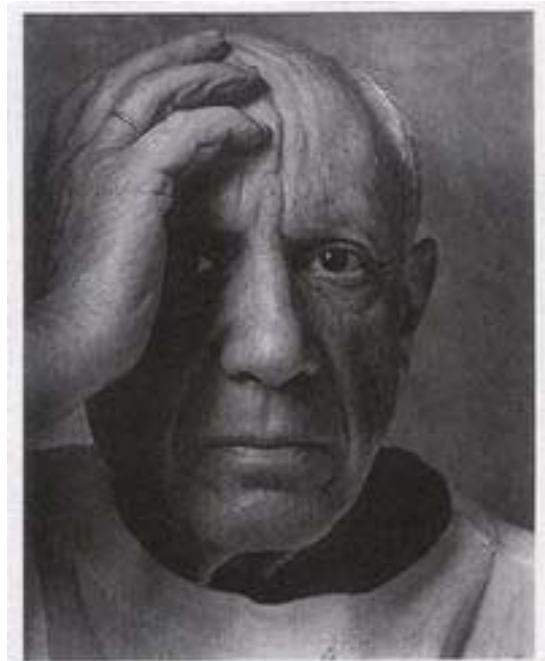- 2000 - : Database Group (Oracle, odbms)

Lecture I

➢ **Computing at CERN Today**

• Software at CERN Today

• The future: LHC Computing

Computers

- Computers are useless – they can only give you answers
  - Pablo Picasso

I THINK THEREFORE I AM

PABLO PICASSO
ARNOLD NEWMAN

The Ultimate Answer

- Some time ago a group of hyper-intelligent pan dimensional beings decided to finally answer the great question of Life, The Universe and Everything.
- To this end they built an incredibly powerful computer, Deep Thought. After the great computer programme had run (a very quick seven and a half million years) the answer was announced.
- The Ultimate answer to Life, the Universe and Everything is…
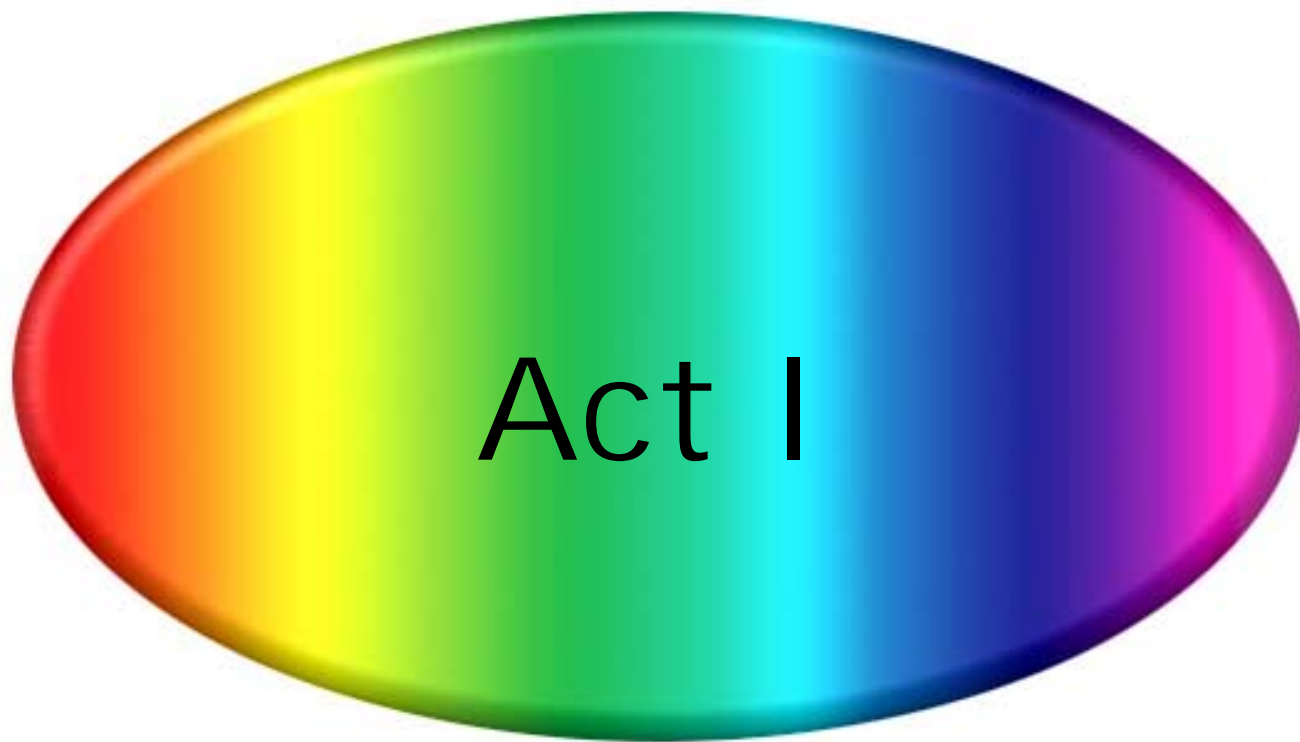- (You're not going to like it…)
- Is…

- ## 42

- Which suggests that what you really need to know is 'What was the Question?'.

Computing at CERN Today

- In a nutshell…

- Intel + Linux for scientific computing

- Intel + Windows for the rest

➢ But how did we get here???
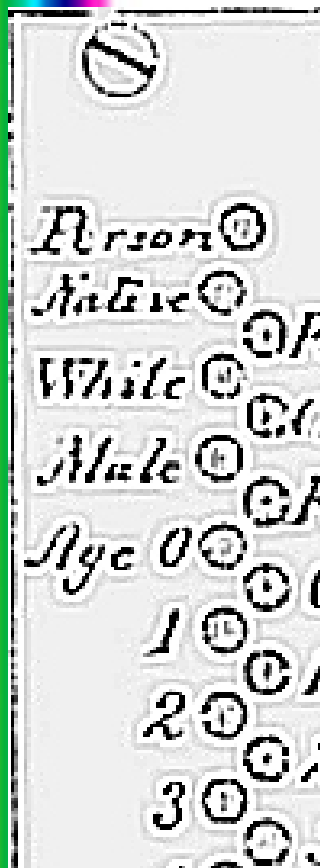 ➢ Focus on events during <u>your</u> lifetime!

Act I

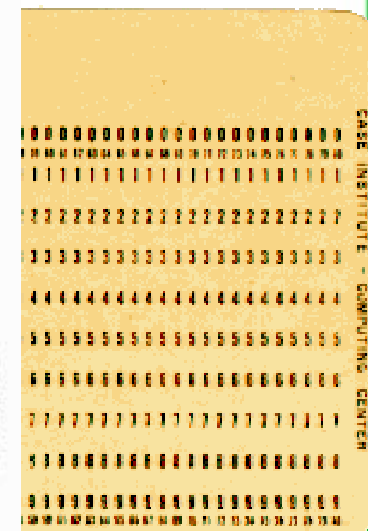The PC

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[Jacquard-card Making.]

Hollerith's Successes

- In 1890 Hollerith founded a company called the Tabulating Machine Company.

- In 1911, his company merged with two other companies to create the Computing-Tabulating-Recording Company.

- Under the direction of Thomas Watson, Sr, CTR would change its name in 1924 to International Business Machines. Hollerith's machine would provide the basis for IBM's success and make him the father of information processing.

Thomas Watson Jr

- I think there is a world market for maybe five computers
  - 1943

The IBM PC
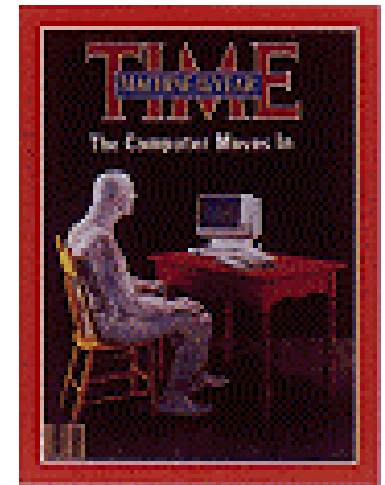
- On August 12, 1981, IBM released their new computer, the IBM PC
- In July of 1980, IBM representatives met with Microsoft's Bill Gates to talk about an operating system for the PC
- In 1983, Time Magazine named the PC "Man of the Year"
  - i.e. just over 1 year from the launch

PCs at CERN

- IBM PCs already in use at CERN from 1984
  - Used to control e.g. tape robots
  - Some 5 years before widespread desktop usage
  - My first PC: 1995
  - PCs vs RISC workstations

Computers: Predictions

- "Computers in the Future may weigh no more than 1.5 tons"
  - Popular Mechanics, 1949

- "I have travelled the length and breadth of this country and talked with the best people, and I can assure you that data processing is a fad that won't last out the year."
 - Editor in charge, Prentice Hall, 1957

Digital Equipment Corporation

- DEC is one of the most successful computer manufacturers in the world.

- It has struggled through the ups and downs that have plagued virtually every company in the computer industry.

- Unlike many others, however, DEC has managed to reemerge time and again as a top player in the industry.

DEC – A Radical Strategy

- Founded in late 1950s by Ken Olson et al
- Strategy was based on mini-computers: PDP; VAX; Alpha.
- Not computers but "Programmed Data Processor" to circumvent Washington edict
  - "No more Computers until the ones we've got are 100% full!"
- Strong focus on interactive computing versus monolithic mainframes…
- Birthplace of Unix… But…

Ken Olson on the PC
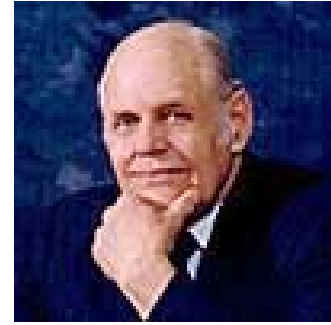
- "There is no reason for any individual to have a computer in his home."
  - Ken Olson, President, Digital Equipment Corporation, 1977
- Ironic that DEC was subsequently taken over by COMPAQ...

Act II

Unix

Before Unix…

- Multiplexed Information and Computing Service – Multics – was a mainframe timesharing operating system begun in 1960s and used until 2000 (Y2K)

- Written in a high(?)level language

- Supported virtual memory, online h/w reconfiguration and – in 1978 – the world's first commercial Relational Database Management System

Before Multics there was chaos…
and afterwards too…

Ken Thom

- I allocated a w operating syste editor, and the essentially one
- If I had to do again? Hmm... *'creat'* with an
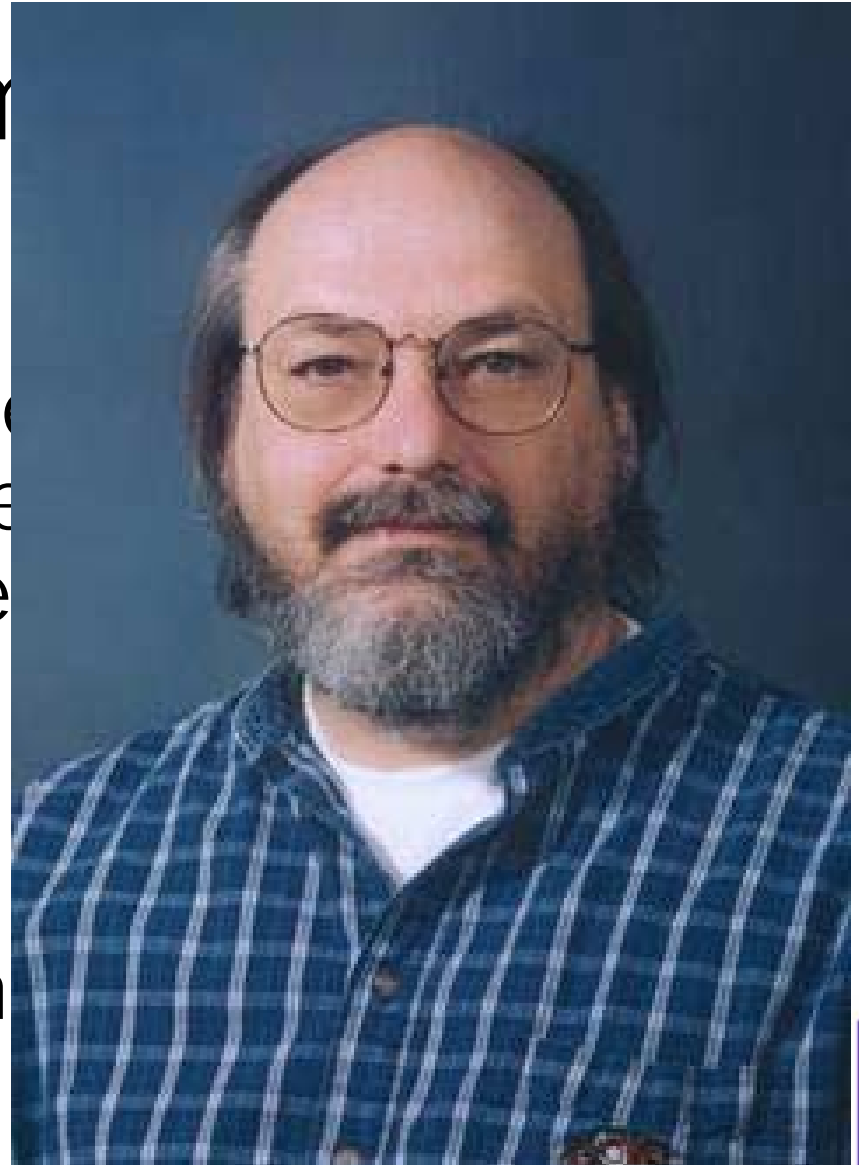
Why Unix?

- Many people hated Unix for its unintuitive interface
- "You learn Unix in a Unix class whereas you learn VAX/VMS in an English lesson"
- Many predicted that multiple varieties of Unix, particularly in 1980s, would cause it to fail
  - East coast Unix; West coast Unix (BSD)
- But it was free and ran also on RISC systems
- Which were the future in the past…

Unix at CERN

1981 – first Unix
1988 – Cray
1989 – HOPE
1991 – SHIFT
1995 – UMTF

Second Edition

OPERATING
SYSTEMS

CD ROM
Included

From: torvalds@klaava.Helsinki.FI
(Linus Benedict Torvalds)
Newsgroups: comp.os.minix
Subject: Gcc-1.40 and a posix-question
Date: 3 Jul 91 10:00:50 GMT
Hello netlanders,
Due to a project I'm working on (in minix),
I'm interested in the posix standard definition.
Could somebody please point me to a (preferably)
machine-readable format of the latest posix rules?
Ftp-sites would be nice.

ANDREW S. TANENBAUM
ALBERT S. WOODHULL

Summary: small poll for my new operating system
Date: 25 Aug 91 20:57:08 GMT

I'm doing a (free) operating system (...won't be big and professional like gnu) for 386(486) AT clones. This has been brewing since april, and is starting to get ready. I'd like any feedback on things people like/dislike in minix, as my OS resembles it somewhat ... I've currently ported bash(1.08) and gcc(1.40), and things seem to work. This implies that I'll get something practical within a few months, and I'd like to know what features most people would want. Any suggestions are welcome, but I won't promise I'll implement them :-)
Linus (torvalds@kruuna.helsinki.fi)
PS. Yes - it's free of any minix code, and it has a multi-threaded fs. It is NOT protable ..., and it probably never will support anything other than AT-harddisks, as that's all I have :-(.

Some Linux Quotes…
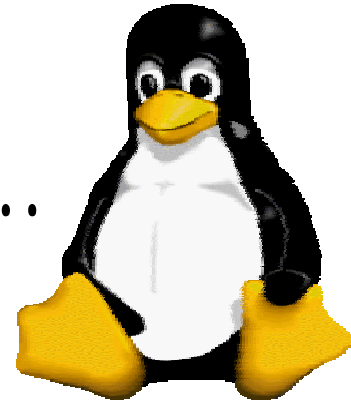
- I still maintain the point that designing a monolithic kernel in 1991 is a fundamental error. Be thankful you are not my student. You would not get a high grade for such a design :-)

  (Andrew Tanenbaum to Linus Torvalds)

- Your job is being a professor and researcher: That's one hell of a good excuse for some of the brain-damages of minix.

  (Torvalds to Tanenbaum)

- Other than the fact Linux has a cool name, could someone explain why I should use Linux over BSD?
  > No. That's it. The cool name, that is.

Unix / Linux Timeline

- 1971: First release of Unix from Bell labs
- 1985: Stallmann publishes GNU Manifesto
- 1987: Tanenbaum produces Minix
- 1991: Torvalds announces Linux
- 1997: Torvalds moves to Transmeta
- 1999: Red Hat IPO

Linux Today

- Seen as offering serious competition to Windows & commercial Unix
- Companies such as Oracle, IBM etc are endorsing Linux
  - Oracle claims that it is moving a significant fraction of its internal operations to Linux…
- At CERN: by far the leading platform in terms of data processing…

Act III

The Internet

Internet Timeline

- 1957: Sputnik, ARPA
- Early 1960s: papers on packet switching, ideas for a "Galactic Network"
- Late 1960s: ARPANET
  - Original design speed: 2.4kbps
- Early 1970s: Network Control Protocol
- 1 January 1983: move to TCP/IP
  - originally 32 bit addresses
- 1986: US NSF develops NFSNET
  - Today leading backbone of Internet

Birth of the Web

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What

Web, What

Web,

net, 26
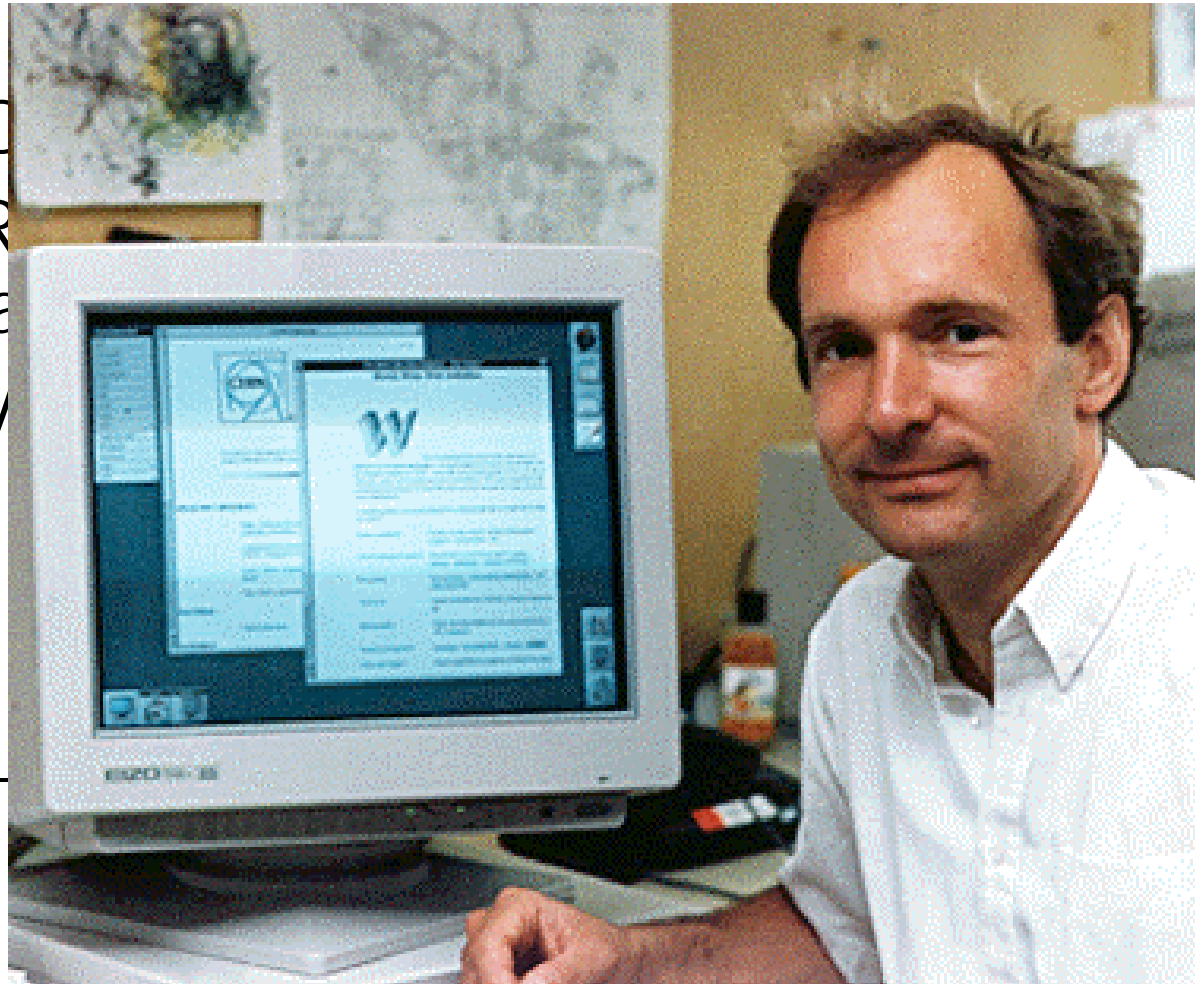
ne 1998

1998

Timecheck
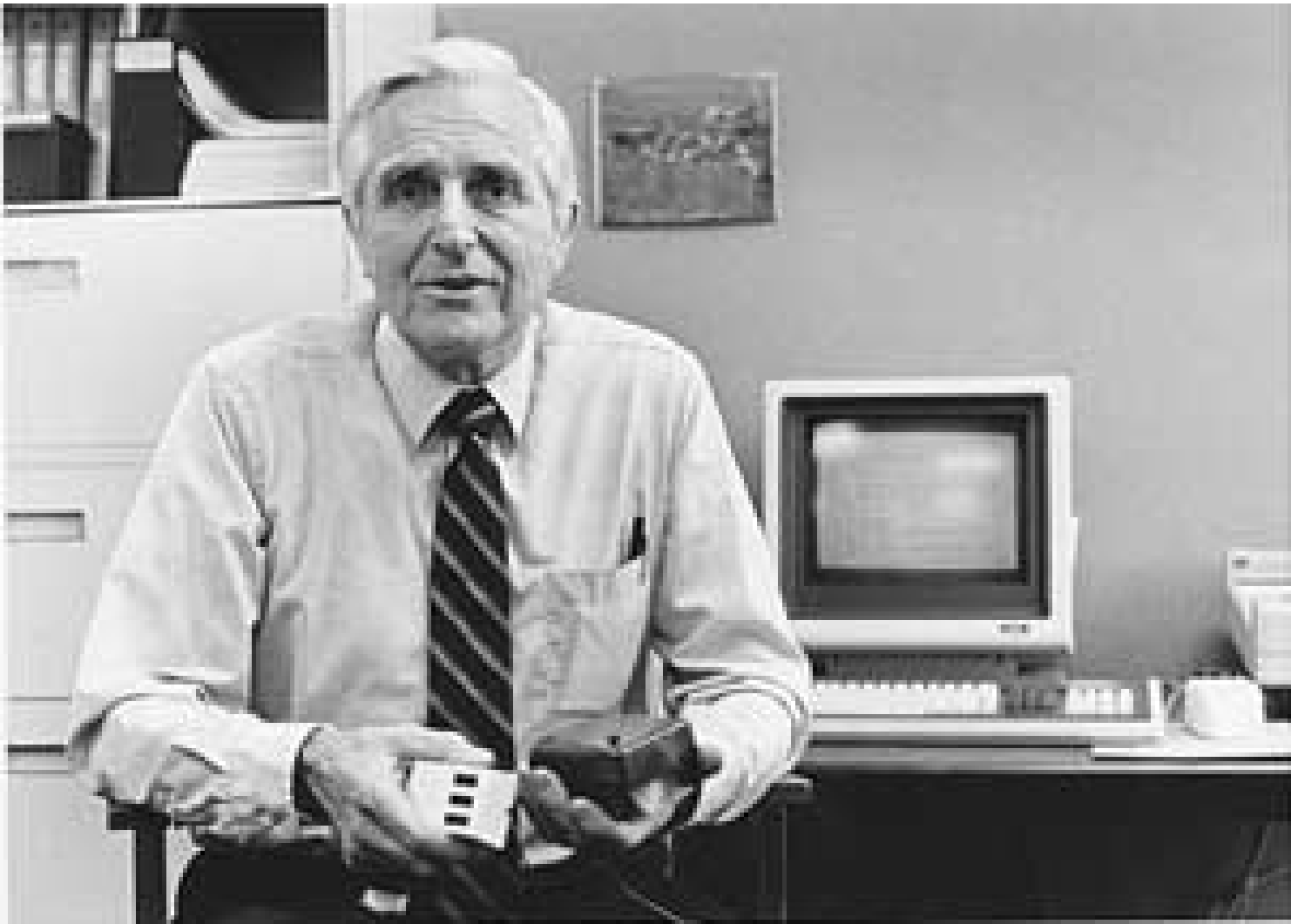
- 1969:
    - Man walks on the moon
    - End of first Star Trek series
    - First Arpanet nodes
- 1972:
    - First e-mail program
    - Telnet
    - Ethernet
- 1991:
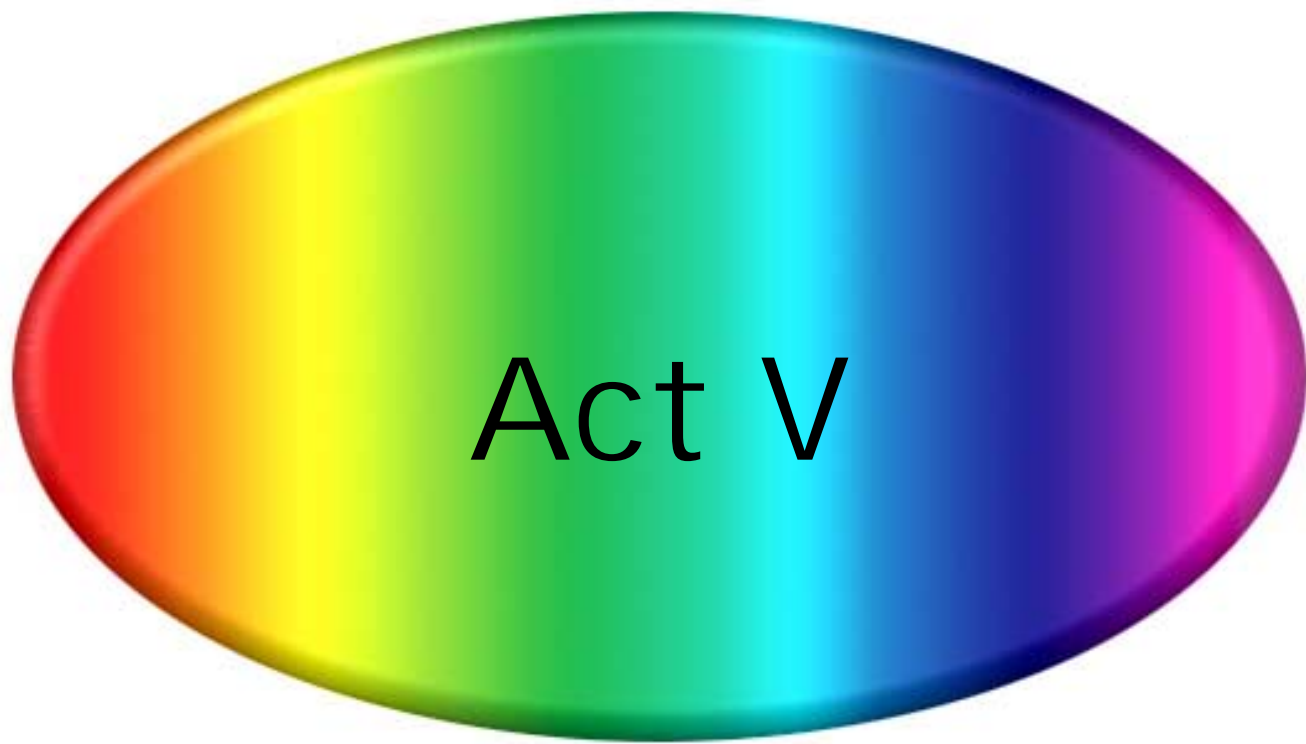   - WWW protocols posted to alt.hypertext

Act I V

Xerox PARC / Palo Alto

Xerox PARC: 1970 on

Act V

Summary

Computing at CERN Today

- Intel + Linux for scientific computing

- Intel + Windows for the rest

- Who would have *correctly* predicted this in 1992?

Summary

- We've looked at:
    - The birth of IBM,
    - The IBM PC,
    - Unix, then Linux,
    - The Internet, The Web,
    - GUI / mouse, …

Today's Computing World

- Technologies that were developed in the past decades came to simultaneous maturity in the Nineties
  - Powerful Intel processors
  - Unix / Linux
  - Internet / Web
  - Open Source culture
- Provide the basis of Computing for the Noughties
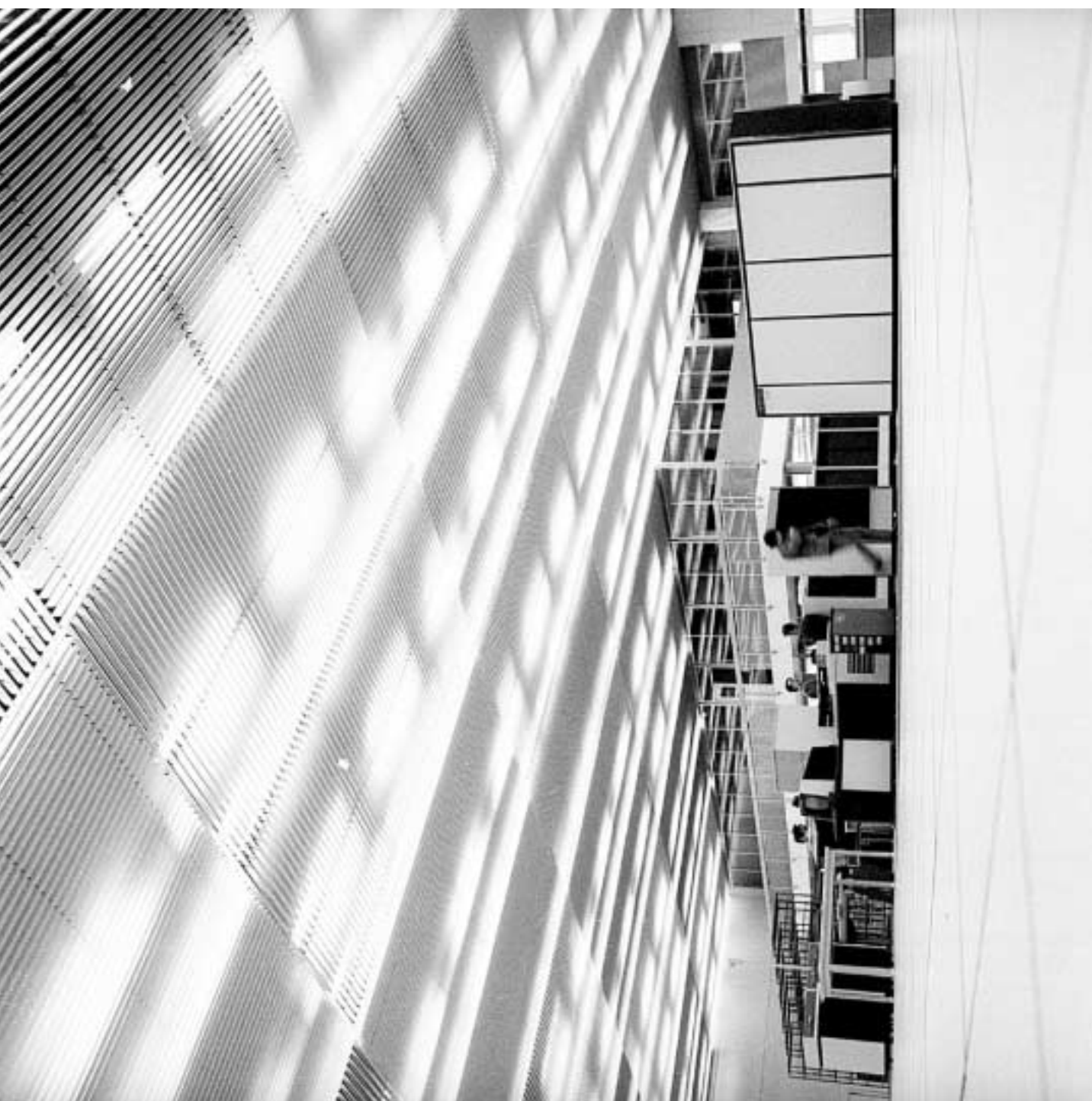
Lecture II

- Computing at CERN Today

➢**Software at CERN Today**

- The future & LHC Computing

Exercise I

- Implement a Unix utility (grep, cron, …) according to *man* specification
- You don't actually need to do the exercise – just pretend you have!