It Was Twenty Years Ago 'Today'...

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Jesus Computer Science Society

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Outline

- Locomotive Software Ltd
- The Amstrad CPC464
  - concept
  - BASIC
  - some Computer Science
  - tools
- What we did next
  - CPC664, CPC6128
  - PCW8256 & 9512
  - BASIC 2
  - Turnpike

Thirty Years Ago...

- Oct 1971 - came up to read Maths at Churchill
- Jun 1973 - accepted for Part II Computer Science
  - refused permission to return into residence ☹
- Oct 1973 - started work for ICL
- Jan 1975 - met Chris Hall
- Feb 1975 - started work for Data Recall Ltd
- Oct 1975 - started Computer Science at Manchester
- Jun 1976 - Chris Hall started work for Data Recall
- Jun 1978 - graduated with top First from Manchester ☺

Locomotive Software

- Chris left Data Recall to become a consultant
- Arrival of IBM PC impressed us both
  - rock solid screen and keyboard
  - but 4.77MHz 8088 was somewhat slow
- Decided to manufacture add-on boards for IBM PC to make it faster. Chose NS16032 chip for this and raised money from DTI
- Started Locomotive 14 FEB 83 with a contract to provide a BASIC to Acorn to run accounting software for their ABC "business machine"

Amstrad

- Summer 1983 spent on the NS16032 and on improving file handling in the BASIC
- Roland Perry arrived mid August with a prototype CPC464
  - externals disguised
  - but I took the lid off!
  - clear that Amstrad had a serious problem
- Called in Mej (Mark Jones) and Roger Hurrey
  - proposed changing to Z80 chip so that Amstrad could make their timescale : January 1984

"Arnold" - The Mug's Eyeful

- Z80 running at "4MHz" (M1 cycles only every 4 clocks - rest of time for the video access)
- 64K RAM ("watts") and 32K ROM
- Came with monitor (green or colour)
- Single power supply ("tower-system" idea)
- Keyboard mounted in system unit
- Built-in cassette deck (no messing with volume)
- Used a ~4000 gate "Gate Array"
- Built-in BASIC and firmware (suitable for £s)

Firmware

- Kernel
  - memory switching, interrupt handling, events etc

- Sound
  - complex operation queuing system

- Cassette
  - read, write, filenames & types

- Video & Graphics
  - 256 characters, streams, VT52 emulation
  - windowed graphics routines, points, lines

- Keyboard, Printer etc etc

Real Computer Science!

- Cassette must work at many speeds
  - spot transition from high to low (or inverted!)
  - '1's twice as long as '0's
  - 2048 leading '1's sets the distinguishing value
- Needed write-precompensation
  - peaks move towards each other
  - make '1' extra long and '0' extra short
- Precompensation wasn't symmetrical
  - until engineer in Korea adjusted the later prototypes
- Interrupts disabled (so sound chip off!)

BASIC

- Locomotive's existing "Microsoft clone" BASIC
  - Removed the fancy file handling & double length INT
- Added lots of commands for COLOUR etc
  - hated the BBC BASIC *FX approach
- Added multi-tasking: AFTER, EVERY, ON SQ
  - and hence there is a DI and EI!
- Extremely fast
  - we'd pared down the instruction despatch loop
  - interrupts meant we avoided flag testing
  - we'd done a lot of work on the floating point
  - we knew what the benchmark was !

Jumpblocks etc

- Planning for the future, so placed accessible routines at well-known addresses (in RAM)
- Intention to allow people to use some of our code but not all of it
- Also had jump vias at crucial points
- Could move HIMEM down to add assembler
- Had a better scheme than Microsoft for handling protected BASIC -- zeroed program when returned to `Ready>`
  - Markus Kuhn used a via to get around this!

More Computer Science

- Floating point was key part of benchmark
- Must also be accurate (across entire range)
- Algorithm choice important for sin, cos etc
- Needs significant testing (lots of special cases)
- BASIC wouldn't fit into 16K so FLOAT pack was placed in lower ROM
  - meant had to be accessed via jumpblock
  - considered valuable IP so not documented
  - jumpblock re-ordered for 664/6128 to make a point

Development Tools

- All written in our own Assembler
    - dated back to first use of 8080 !
    - Sensible mnemonics (R8R, R9L)
    - !MEMBER (allowed us to change things safely!)
- Team used to assembler & co-operation
- Each "package" lived on its own 5.25" disk
- Compilation results copied to a linker disk
- Result placed into EPROM and tested
- "TRACY" allowed interactive debugging

Twenty Years Ago...

- Jan 14 1984
  - shipped firmware to Brentwood (& hence Japan)
- Jan 17 1984
  - found first bug with "DEC$$"
  - Amstrad refused to fix it! So documentation altered!!
- Spring 1984 (twenty years ago today)
  - writing BASIC manual
  - writing Firmware manual (Bruce Godden)
- April 14 1984
  - launch party ("last successful UK games machine")
  - available in the shops (Dixons!) on 21st June

What Locomotive Did Next

- CPC 664 (launched April 1985)
  - built-in disk drive
  - minor changes to BASIC &c (eg FILL)
- CPC 6128 (launched Autumn? 1985)
  - 128K RAM for the USA
- PCW 8256
  - electric typewriter/word processor
  - developed June 84 -> May 85
- Also supposed to be an ANT ("CPCng")
  - but dropped, much to our relief!

AIRO - October 1986

- Amstrad's IBM Rip-Off
  - £399 (ex VAT)
  - 512K
  - 8MHz 8086 (runnable at 4.77 as well)
  - 360K floppy
- Shipped with DRDOS and Gem
- … AND with MSDOS 3.2
- We wrote BASIC2 for Gem
- But we failed to convert this for Windows #1

And Later On...

- LocoScript 2 developed for PCW9512
  - shipped for PCW8256 as upgrade (July1987)
- LocoScript 3
  - handling external printers
- LocoScript PC
- Turnpike
  - started 1993 shipped May 1995
- Demon Internet bought Turnpike Dec 1995
  - PCW side sold to Howard Fisher
  - others continued with Demon, many to this day

Some Numbers

- ## CPC machines
  - 3 million across Europe (few in the US)
  - never quite the success of Acorn Model B, Spectrum or the C64, but didn't do badly

- ## PCW machines
  - 2 million +
  - icon of the 80s
  - too late for the US (Macs and PCs dominated)

- ## Turnpike
  - 150K users (?) & still widely used

Coda

- Who you know matters
  - people prepared to hire (& trust) their friends
- What you know matters
  - all that boring stuff about mag tapes may get used
- Arnold would have sold a lot without us, but it was so successful because we gave it class
- The PCW was a entirely remarkable machine
- The team still know each other even today, so maybe we'll do something more in the future ?

Demonstrations

- AMSTRAD "Welcome" tape
  - April 1984

- GMCH's demo set
  - showing off the BASIC and the graphics

- Paul Overell's CHARIOTS
  - showing off the sound capabilities
  - written shortly before Xmas 1983