Some Insights for UCSD Pascal Generation
offered by Ken Bowles, 22 October 2004

I was your current age when Mark Overgaard & I started what became UCSD Pascal

- It was 30 years ago (give / take a few weeks)
- I had just been forced to re-start in what amounted to 3rd of 5 careers.
- Some of the reasons for those re-starts may now, *or soon*, be familiar to you too.

All but last (retirement) involved *engineering* at levels recognized as research in some major university engineering schools.

Rapid technology changes will (continue to) suggest you re-check reality occasionally.

Preview of this talk

Quick summaries of my 5 careers
- Activities, Objectives, Successes in each
- Reasons for moving on

Comments
- All transitions messy
- Work *environment* is dominant – many *domains*
- In modern engineering you're almost always member of a *team of people*
- Team-based project-instruction works.
- Marketing success as important as technology
- Can't win all battles
- What realistically might have been different

Engineering: "the discipline dealing with the art or science of applying scientific knowledge to practical problems"
(WordNet, Princeton University, 2003)

Career #1 - Radar Studies of Ionized Outer Atmosphere

We designed, built, and used this radar near Lima, Peru starting in 1960
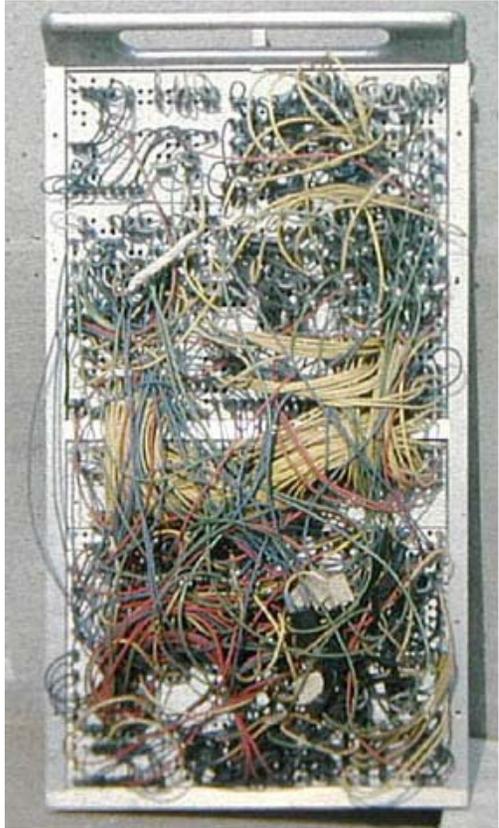 **• I worked for Central Radio Propagation Lab, Nat. Bur. Standards**

Radar Studies -2-

Antenna Array Closeup

- **We re-invented unpublished German antenna design from mid 1930's**

Radar Studies -3-

Computers we used in 1963 period

Wilkes microprogram controller for transmitter pulses

Packard-Bell PB250 computer with mercury delay-line memory.

Radar Studies -4-

Success with the science . . . but it had to end . . . 1964

- **Schools for our kids**
- **Budget competition amid changing national priorities**

- **Footnote: Jicamarca Radar Observatory now enjoying renewed US/worldwide support . . . re. satellite communications problems in equatorial ionosphere**

Invited to help start Applied ElectroPhysics Dept at UCSD . . . 1965

- **Gov't Lab to UC transition . . . culture shock**
- **Tangled with UC-wide restrictions re. lab computers**
- **Pushed into directing UCSD campus computer center**
- **Regrets at leaving Radar commitments and associations behind**

Director UCSD Computer Center -1-

1st Task . . . Replace aging CDC 3600 mainframe

- **Chose Burroughs 6500**
- **Objectives . . . improved student & interactive services**
- **Controversial . . . no longer best number-cruncher available**

Instant Introduction to Software Engineering

- **Bx500 computers pioneered multi-program design, stack-machine**

  . . . but needed fix to handle *many* small student jobs

- **Memory management and queue design were hot research topics**
- **UCSD task-scheduler fixes were used on B6500's in univ's worldwide**

Director Computer Center -2-

Early participant in ARPAnet (now called *Internet*)

- **Reason: National & Statewide budget crunches for research**
- **ARPA needed B6500 cycles for *Illiac-IV* development at U of Illinois**
- **UCSD computer center usage had dropped**
- **Collaboration with Burroughs & big users in tuning Op-System**

Controversy grew . . . tried to serve many diverse user communities

- **County/UCSD hospital budget crisis - admin computing blamed**
- **Big research number cruncher projects wanted supercomputer**

But . . .

- ***Burroughs* told me B6500 lease had been cancelled by UCSD . . . while I was at Oxford Univ conference, summer 1974**
- **I took instant sabbatical !!**

UCSD Pascal -1-

Goal: Drastically increase student instructional computer use

Method: Take advantage of small computer price/benefit

Choice of Pascal
- **Niklaus Wirth's P-H book quickly adopted at >300 C/S dept's**
- **Urs-Ammann's P-machine allowed (almost) instant Pascal on diverse machines**
- **Pascal a big influence on adding *Science* to Computer Science . . . P-H editor Karl Karlstrom helped to *market* Pascal**

Computer Science only recently (in 1974) was getting accepted as university *discipline* independent of traditional disciplines
- **Combined Electronics, Mathematics, Psychology**
- **Established departments competed for control of C/S**

UCSD Pascal -2-

Engineering Approach

- **P-machine similarity to B6500 stack machine hardware**
- **Used Assembly Language to implement P-machine on PDP-11**
- **Compiled Pascal on B6500 to write primitive UCSD Operating System, and to *port* Ammann's compiler.**
- **Ammann's Pascal Compiler re-compiled for UCSD P-machine**
- **Students developed Editor, Filer, . . . on PDP-11 using Pascal**

UCSD Pascal -3-

Classroom Approach

- **PDP-11 machines contributed by Digital Equipment Corp**
- **Used Keller's *self-paced* format for instruction**
- **Dared to teach intro-programming with Pascal for non C/S students . . . taught safer design habits**
- **Controversial among dept's who preferred FORTRAN as default . . . though already known to be obsolete**

Persuaded Terak to build cheaper LSI-11 small computer

- **Terak/UCSD design widely adopted at other universities**

Outgrew Terak lab, and moved to network of Apple II's

UCSD Pascal -4-

Program Portability had grown to be a Major C/S Issue

- **Proliferation of competing hardware/software prevented sharing of programs among collaborating groups in separate places**
- **Big NSF bucks were being spent on research looking for solution**

- **Intro of 8080 microcomputer end 1974 offered even lower costs for classroom**
- **Debut of competing LSI designs increased need for *portable* S/W**

First Port to Z80 . . . a *Revelation*

- **Lawrence & McCormack 1st trial demo in lab - early 1976**
- **First step . . . showed Sumner's Op System seemingly worked**
- **Plugged in floppy disk with Kaufmann's Editor**
- **All Pascal software worked on Z80 as on PDP-11 *with no change!!***

UCSD Pascal -5-

More CPU designs became popular . . .

More student implementation teams . . .

More $$$ needed to pay for teams to work . . .

I went on road show with Terak box to demonstrate
- **San Jose convention center . . . gasps of amazement !!**
- **EDUCOM, ACM conferences**
- **Cornell . . . to Tasmania C/S dept's**

More $15 licenses required serious Project *Infrastructure*
- **Documentation, Tech-Support, Accounting, . . .**

UCSD Pascal -6-

We *Extended* Wirth's Pascal Language definition
- **Needed to achieve efficient software on microcomputers**
- **Influenced by *Smalltalk* success at Xerox PARC**
- **Pascal needed *Objects* to cope with complexity of large software**
- ***String* processing capability for non-numerical work**
- **Programming Interface (*API*) support for various objectives**

With fame came controversy over *Tinkering* with Wirth's Pascal
- **Purists regarded this as blasphemy**
- **We staged summer workshop seeking compromise toward international Pascal definition suitable for complex systems**
- **Proceedings distributed to participants . . . but never submitted for *publication* . . . we were overcome by events!!**

UCSD Pascal -7-

The UCSD *Pascal Micro-Engine*

- **Western Digital Corp built hardware for UCSD Pascal**
- **Team led by Mark Overgaard did the P-machine microcode**
- **Cited initially as proof of special CPU design advantages**
- **Barry Smith at Oregon Software soon proved that clever compiler design made Pascal code faster for the same chip with LSI-11 microcode**

Licensing Controversy

- **In late 70's every vendor sought competitive advantage by altering, extending, . . . designs obtained from others.**
- **UCSD Pascal license written to prevent identifying altered software as "*UCSD Pascal*"**
- **Though paid for by those $15 fees, we were loudly accused of illegally preventing open use of code paid for by the public**

UCSD Pascal -8-

UC Tax Status Sealed Our Fate in early 1979

- **We were too successful !!**
- **Though making no profit, income exceeded 10^6 per year**
- **UC files no income tax return . . . but only if all income is from *Teaching, Research, Public-Service***
- **UC-wide feared UCSD Pascal "*unrelated-business*" income would trigger IRS demand for *tax return for all of UC***

Three Options Offered

- **Shut down "cold turkey"**
- **Ask Regents to request special IRS status for UCSD Pascal . . . might have established $$$ were for public service, but would have involved 2 year project suspension**
- **License an outside for-profit vendor, and stop licensing from UCSD itself . . . *only choice fair to 1000's of licensees already depending on us***

UCSD Pascal -9-

I Spent 6 Months Shopping For Vendor . . . Negotiating, Marketing

- **Talked a lot with people named Kildahl, Jobs, Gates and others who had small microcomputer software businesses**
- **Needed to select bidder with established business . . . led to SofTech, a software contractor to Fed Gov't and Industry**
- **UC-wide *Patents* Administrator controlled the license**
- **SofTech MicroSystems was the licensee . . . initially staffed by graduates of UCSD Pascal project**

Calif Fair Political Practices act . . . Proposition 9

- **Prevented split appointment that would have permitted me to influence MicroSystems business decisions that were counter to UCSD interests**
- **I might have helped UCSD Pascal to compete more "fairly" against MS-DOS . . . especially re. royalties**

Ada Language & TeleSoft -1-

Ada Language Design Sponsored by (D)ARPA starting late '70s
- **Competition among several software contractors**
- **Goal: basis for more reliable software in critical systems**
- **Extensive consultation with C/S people from many univ's**
- **Winning design strongly influenced by Pascal**
- **UCSD Pascal *Units* probably influenced Ada *Packages***

Western Digital CEO convinced me to start off-campus company
- **Goal: Build Ada-based software similar to UCSD Pascal**
- ***Tele*… name: Plan to deliver our products via telephone**
- **Initial Staff: Pascal project graduates & faculty colleagues**

Financial realities soon led to merger with Renaissance Systems
- **UCSD spin-off founded by former Computer Center student employees . . . the team approach had worked there too!!**

Ada Language & TeleSoft -2-

Market Realities Forced Us To:

- **Concentrate on compilers only . . . initially for VAX machine**
- **Forget the *Tele* . . . another example when I was too early**
- **Seek additional venture capital . . . and I lost control of T/S**

Loss of Engineer Control of Company

- **Embarrassing promotion of flawed software**
- **Abandoned efforts to educate potential users about benefits of using Ada . . . though *marketing*, not enough profit**

Eventual Sale of Company to Swedish Telecom Admin (*Telia*)

- **Initial plan to employ TeleSoft Ada in new telephone switch**
- **Abandoned when Ericsson programmers demanded C++**

Ada Language & TeleSoft -3-

ISO and ANSI Ada Standards

- **Early participation by UCSD Pascal "alumni" (both students and faculty) in DARPA's Ada meetings led several of us to continue as members of ISO and ANSI Ada standards committees.**

- **Represented TeleSoft during 80's & early 90's**

- **I continued until Ada95 completed. Gary Dismukes is still involved (others too ??)**

- **Standards committees make decisions by consensus . . . they are important, but frustrating for participants.**

By 1995, TeleSoft had been merged/re-sold several times

- **I retired (from even part-time employment) then because we no longer had anything in common**

- **Most UCSD Pascal alumni had long since departed**

Thoughts in Closing -1-

Migration from Engineering to Non-Technical Issues

- **Fact of life for most engineers**
- **Tends to start age 35 . . . 50**
- **Gets harder to compete with sharp people in their mid 20's**
- **Team development inevitably dulls all but the sharpest (those who are also most nimble coping with work environment)**

Hard to avoid a career path explained partly by *Chaos Theory*

***Darwinian* evolution lamentably leads to less than optimum results.**

- **IBM, though dominant in 60's, has been passed by a small company started in an Albuquerque garage in 1975**
- **Ada, Macintosh, Mosaic/Netscape, . . . still superior but now just niche products**
- **Various outstanding products are now extinct . . . e.g. Burroughs stack machines, Xerox PARC's ALTO machine, . . .**

Thoughts in Closing -2-

Young Individuals (or Partners) Still Make Outsize Contributions

- **Marc Andreesen & Eric Bina, while students at Univ Illinois' NCSA, created *Mosaic*, 1st general Web browser, in 1992**
- **Larry Page and Sergey Brin launched *Google* while students working at Stanford's digital library project in 1995**

The Right Venture Investor Can Make a World of Difference

- **Mike Markulla took the Steve's (Jobs & Wozniak) under his wing to start and nurture Apple . . . one could *feel the symbiosis* when visiting their office**

Software is fundamentally different from hardware

- **Low manufacturing overhead, incentives to sell buggy S/W**
- **Too easy to tinker, low respect for standards**
- **Security concerns must/should not lead to rigid controls**

Thoughts in Closing -3-

Serious Regrets

- **My inability to arrange thesis committees for several outstanding students**
- **Getting forced to lay-off good employees during occasional budget crunch periods . . . which I was helpless to prevent**

Serious Satisfaction

- **Long list of accomplishments by UCSD Pascal alumni**
- **Recent renewed worldwide dependence on Jicamarca Radar, and on those Peruvian and American old-timers still contributing to the project**
- **Legacy influence of UCSD Pascal designs . . . though *published* only thru software distributions**

Thoughts in Closing -4-

What Might Have Been . . .

- **Richard Kaufmann has suggested that UCSD Pascal might have been allowed to continue at UCSD . . . had *Open-Source* licensing been accepted by UC at the time.**

- **Headline: "*California Considers Open-Source Shift*" . . . CNet, 27 Aug 2004**

- **Mozilla Foundation, Mosaic & FireFox licenses and support, widespread University participation . . . all provide an excellent updated model of what might have been**

- **ARPAnet provided the glue among many universities even in 1979 . . . and could have provided the "*Tele*"**

- **UCSD Pascal usage on IBM PC might have gone differently**

Where would you be today had that happened? - Sigh . . . . . .

Thoughts in Closing -5-

Stay Active When You Retire

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