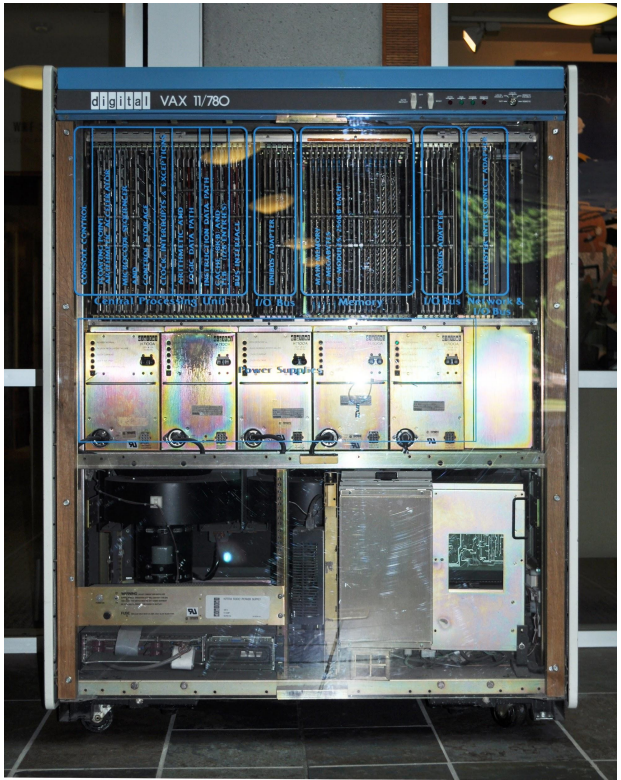
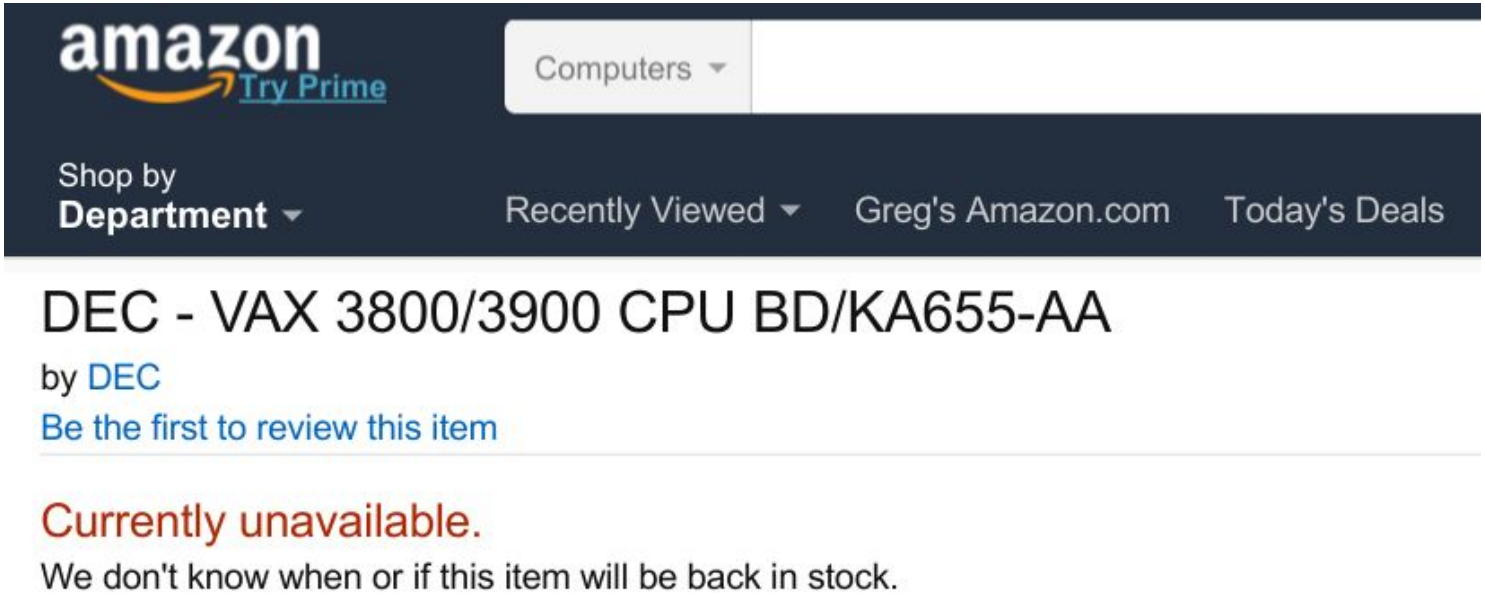
PostgreSQL on VAX ! Or….

What I did for fun during my summer vacation!

VAX?



Where to find a VAX?



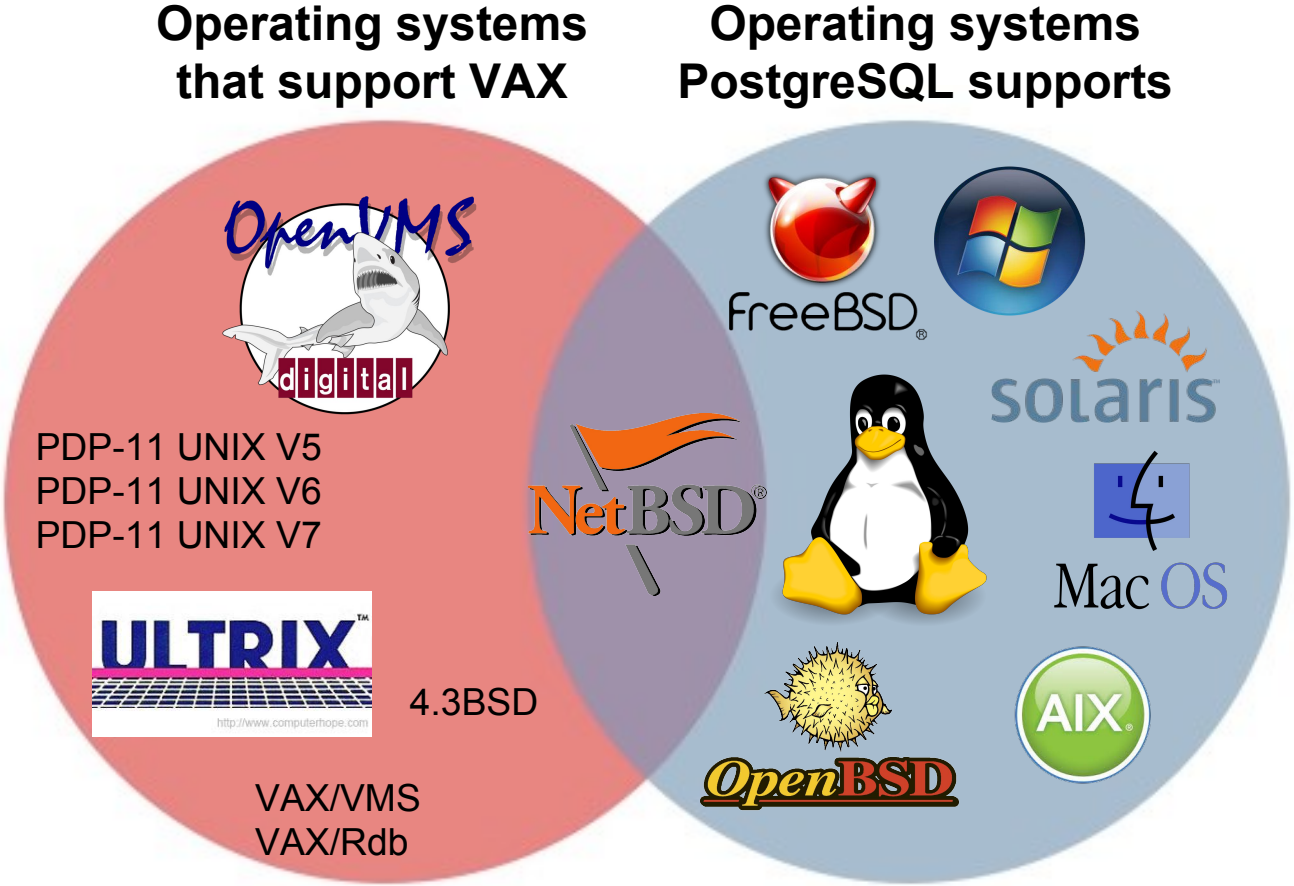
simh - VAX emulator

The Computer History Simulation Project

http://simh.trailing-edge.com/

Installing NetBSD on a ka655x VAX 3800:

http://www.netbsd.org/ports/vax/emulator-howto.html


Operating systems
that support VAX
Operating systems
PostgreSQL supports
OpenVMS
digital
PDP-11 UNIX V5
PDP-11 UNIX V6
PDP-11 UNIX V7
ULTRIX
http://www.computerhope.com
4.3BSD
VAX/VMS
VAX/Rdb
FreeBSD
NetBSD
solaris
Mac OS
AIX
OpenBSD

Install NetBSD

Time passes….

24 hours later...

```
>>>boot dua0:
(BOOT/R5:0 DUA0



  2..
-DUA0
  1..0..


>> NetBSD/vax boot [1.11] <<
>> Press any key to abort autoboot 3
nfs_open: must mount first.
open netbsd.vax: Device not configured
> boot netbsd
2591168+174136 [211456+201165]=0x3081e8
Copyright (c) 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005,
    2006, 2007, 2008, 2009, 2010, 2011, 2012
    The NetBSD Foundation, Inc.  All rights reserved.
Copyright (c) 1982, 1986, 1989, 1991, 1993
    The Regents of the University of California.  All rights reserved.

NetBSD 6.1.5 (GENERIC)
MicroVAX 3800/3900
total memory = 65468 KB
avail memory = 59728 KB
mainbus0 (root)
cpu0 at mainbus0: KA655, CVAX microcode rev 6 Firmware rev 83
lance at mainbus0 not configured
```

MicroVAX 3800

Relative Performance x VAX-11/780 (1 MIP)	3.8
Number of Processors	1
Max. Memory Support	64 MB
Max. Local Disk Capacity (formatted)	MV 3800: 2.4 GB; MV 3900: 9.7 GB
Max I/O Throughput	3.3 MB/s
Floating Point Accelerator	Standard
Floating Point Data Types	F, D, G, H
Cache Size	1 KB on chip 64 KB on board

Install pkgsrc

Time passes….

Run out of disk space… drives are limited to 2.4GB … create new drive
Time passes….

Ran out of inodes … create new file system
Time passes…

48 hours later….

Build perl, python, bison, ...

Time passes….

Ran out of space again… create 20G NFS volume from host machine and mount it from guest machine ...

Time passes….

72 hours later...

Build Postgres!

Time passes….

48 hours later

Run regression tests...

Kernel panic (probably NetBSD PR#28379 http://gnats.netbsd.org/28379):

```
panic: usrptmap space leakage
cpu0: Begin traceback...
panic: usrptmap space leakage
Stack traceback :
         Process is executing in user space.
cpu0: End traceback...
```

Out of memory … initdb's smallest numbers are still too large ...
Reduce max_backends and run tests with MAX_CONNECTIONS=2

It took 7h20m to run the regression tests

No IEEE Floating Point

Expected.

Postgres documents that users should expect the floating point semantics of the architecture, so job done?

Not quite, the consequences are a bit surprising:

```
=> SELECT '' AS three, f.f1, exp(ln(f.f1)) AS exp_ln_f1
     FROM FLOAT8_TBL f
     WHERE f.f1 > '0.0';

 server closed the connection unexpectedly
       This probably means the server terminated abnormally
       before or while processing the request.
 connection to server was lost
```

No IEEE Floating Point

On a modern architecture with IEEE floating point:

```
$ gcc -Wall  exp.c -lm
$ ./a.out
exp(88.0297) = 1.70141e+38
```

On VAX:

```
simh$  gcc -Wall  exp.c -lm
simh$ ./a.out
[4]   Illegal instruction (core dumped) ./a.out
```

Postgres needs to catch SIGILL or override infnan() so it signals a floating point error rather than crash.

Infinite loop in GROUPING SETS test

```
commit 44ed65a5459708293220 98e22d10947e6d545d9a
Author: Tom Lane <tgl@sss.pgh.pa.us>
Date:   Sun Aug 23 13:02:13 2015 -0400

    Avoid use of float arithmetic in bipartite_match.c.

    Since the distances used in this algorithm are small integers (not more
    than the size of the U set, in fact), there is no good reason to use float
    arithmetic for them.  Use short ints instead: they're smaller, faster, and
    require no special portability assumptions.

    Per testing by Greg Stark, which disclosed that the code got into an
    infinite loop on VAX for lack of IEEE-style float infinities.  We don't
    really care all that much whether Postgres can run on a VAX anymore,
    but there seems sufficient reason to change this code anyway
```

Planner FP overflows

```
commit aad663a0b4af785d0b245bbded27537f23932839
Author: Tom Lane <tgl@sss.pgh.pa.us>
Date:   Sun Aug 23 15:15:47 2015 -0400

    Reduce number of bytes examined by convert_one_string_to_scalar().

    Previously, convert_one_string_to_scalar() would examine up to 20 bytes of the input string,
    producing a scalar conversion with theoretical precision far greater than is of any possible use
    considering the other limitations on the accuracy of the resulting selectivity estimate.  (I
    think this choice might pre-date the caller-level logic that strips any common prefix of the
    strings; before that, there could have been value in scanning the strings far enough to use all
    the precision available in a double.)

    Aside from wasting cycles to little purpose, this choice meant that the "denom" variable could
    grow to as much as 256^21 = 3.74e50, which could overflow in some non-IEEE float arithmetics.
    While we don't really support any machines with non-IEEE arithmetic anymore, this still seems
    like quite an unnecessary platform dependency.  Limit the scan to 12 bytes instead, thus
    limiting "denom" to 256^13 = 2.03e31, a value more likely to be computable everywhere.

    Per testing by Greg Stark, which showed overflow failures in our standard regression tests on VAX.
```

The Bad News

Goal was to add new build farm member building Postgres regularly and testing it on VAX architecture (even if emulated).

Sadly that hope is doomed. We would never pass the regression tests without significantly weakening our testing.

Without a build farm member we can’t seriously say we “support” VAX :(

The Good News

Nonetheless this exercise helped us learn more about our own source tree and what dependencies it had grown.

It led to two small commits that significantly simplified code and removed unnecessary overhead as well as the unnecessary portability hazard.