Introduction to VAX/VMS

Bill Degnan
Vintage Computer Festival 13

VAXEN

Digital VAX Computers

- Digital Introduced VAX family of computers in 1977

- Height of "VAX generation" 1977 through 1987

- VMS Default Operating System designed for all VAX machines

VAX is …

- DEC's Line of 32-bit computers
- VAX = Virtual Address eXtension
- VAX can use memory storage that does not exist as true physical memory
- VAX designed to support multiprogramming (a.k.a. multitasking) users running programs simultaneously

The VAX Product Line

- 11/700
- 8000 Series
- MicroVAX

VAX 11/700

- Descended from PDP-11
- Share MASSBUS and UNIBUS
- 11/780 was the first VAX processor (1978)
- 1 Million Instructions per Second

VAX 8000

- VAX BUS Interconnect (VAXBI) but will also support UNIBUS
- High Performance
- Large VAX Systems

MicroVAX

- Digital Q-22 Bus
- Smaller Systems / Less Expensive
- Designed for Office Environment

VAXstation

- Computer Workstation VAX CPU
- Intended as single user
- Optional GUI graphic display terminal / mouse
- Older VAXStations support VT100 / Tektronix 4014 only, newer VAXStations support newer terminals and displays

VAX Compatibility

- Processing speed is only major difference between VAX computers

- Program produced on one VAX will run on another VAX

- A VAXcluster is two or more VAX computers networked together, up to 16 DECNet / Digital Network Architecture

What is VMS?

- VMS (Virtual Memory System) OS
- Multiprocessing
- Scheduling term used for sharing CPU time among users and processes.
- Operates continuously
- Handles the virtual memory / programs broken down into "pages"

VMS Continued

- Each time one uses VAX/VMS the system treats the use as a "process"

- VMS checks user account requesting access to a program image or files/directory to see if the required privileges exist to access required memory, processes, CPU, and I/O
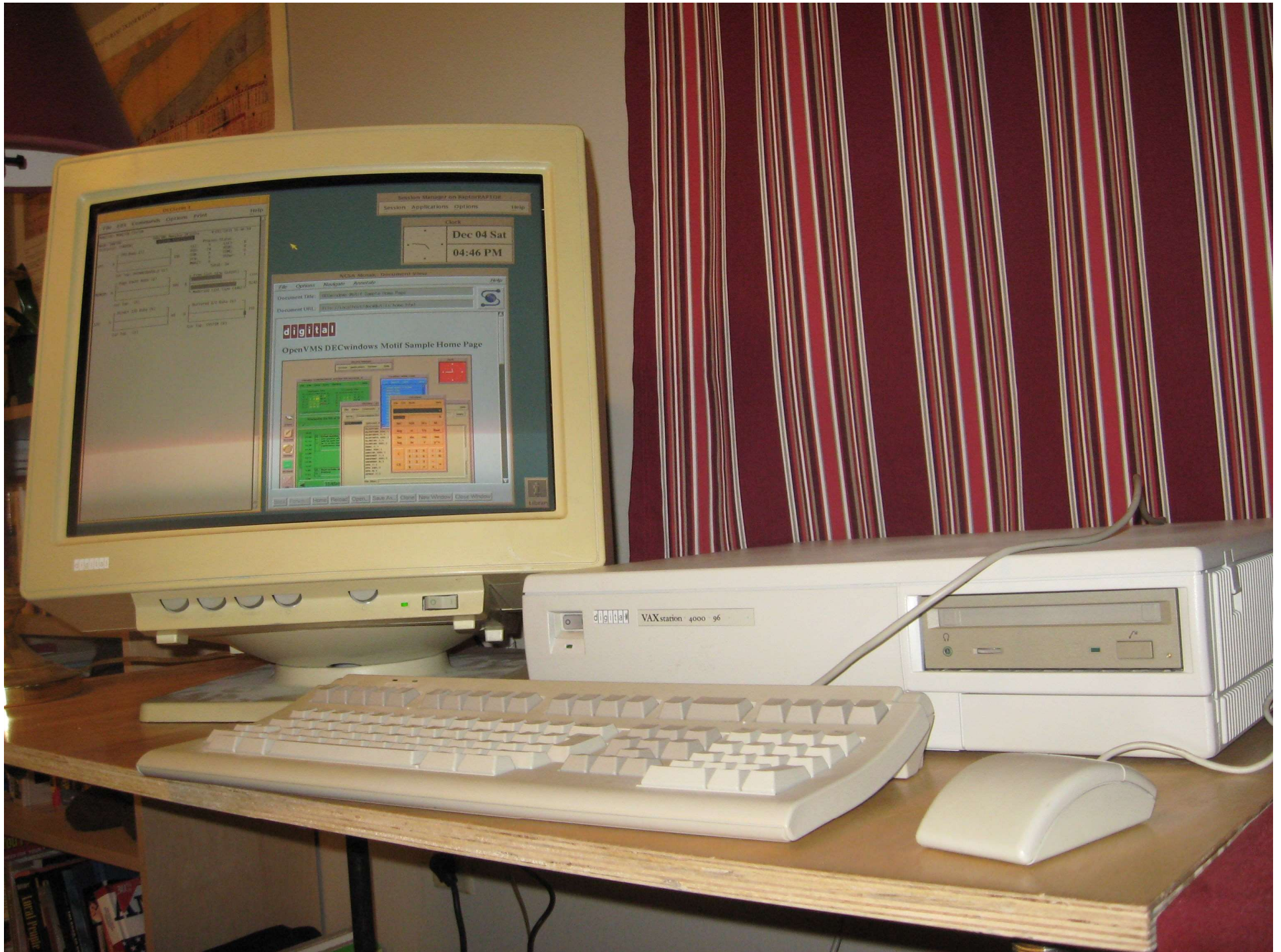
- Groups with quotas, limits and privileges

DEC Terminals

- Terminal Printer (for era, 300-1200 baud
- Serial Terminal (for era, 4800-19200)
- Graphic Terminal (Color, Hi-res, GUI. Baud not relevant)
- Headless (not all VAX have a terminal attached)

DEC Terminals

Display Set-Up   VT240 V1.3

Looking Around

To obtain a list of boot devices available on the system, issue the
console command SHOW DEVICE.

>>> show dev [enter]

Looking Around

DSSI Bus 0 Node 0 (CLYDE)
-DIA0 (RF73) [THIS IS MY BOOT DEVICE]
DSSI Bus 0 Node 1 (BONNIE)
-DIA1 (RF73)
DSSI Bus 0 Node 5 (TFDR1)
-MIA5 (TF85)
DSSI Bus 0 Node 6 (*)
DSSI Bus 1 Node 7 (*)
UQSSP Tape Controller 0 (774500)
-MUA0 (TK70)
SCSI Adaptor 0 (761400), SCSI ID 7
-MKA0 (DEC TLZ04 1991(c)DEC)
Ethernet Adapter
-EZA0 (08-00-2B-06-10-42)
- c — Disk or tape controller designator: A = first, B = second, and so on
- u — unit number
- x — SCSI ID of device, (except ID 6 — reserved for SCSI controller)
- nn — SCSI logical unit number; usually 00.

```
?40 NOSUCHDEV
 84 FAIL
>>> show dev
VMS/VMB   ULTRIX    ADDR      DEVTYP    NUMBYTES   RM/FX  WP  DEVNAM  REV
-------   ------    -------   ------    --------   -----  --  ------  ---

ESA0      SE0       08-00-2B-16-09-C1

MKA500    TZ5       A/5/0/00  TAPE      ........   RM
...HostID....       A/6       INITR
DKA700    RZ7       A/7/0/00  DISK      209 MB     FX         RZ24    1D18

DKB0      RZ8       B/0/0/00  DISK      332 MB     FX         RZ55    0900
DKB100    RZ9       B/1/0/00  DISK      332 MB     FX         RZ55    0900
DKB200    RZ10      B/2/0/00  DISK      1.38 GB    FX         RZ58    2000
DKB500    RZ13      B/5/0/00  DISK      209 MB     FX         RZ24    1D18
...HostID....       B/6       INITR

>>> _
```

Hacking the Password

>>> B/1 DIA0: (for example)

This will eventually drop you to the SYSBOOT prompt.

SYSBOOT> SET/STARTUP OPA0:
SYSBOOT> SET WINDOW_SYSTEM 0
SYSBOOT> SET WRITESYSPARAMS 0
SYSBOOT> CONTINUE

This will drop you to the $ prompt.

Hacking the Password

```
$ SPAWN
$ @SYS$SYSTEM:STARTUP
$ SET DEFAULT SYS$SYSTEM:
$ RUN SYS$SYSTEM:AUTHORIZE
```

This will drop you to the UAF prompt.

Hacking the Password

UAF> MODIFY SYSTEM
/PASSWORD=DEGNANISPERSISTANT
UAF> EXIT

This will bring you back to the $ prompt. Log out

$ LOGOUT

reset my password to something 8-32 chars, etc.

$ prompt with full access privs.

Booting the System

>>> BOOT/R5:0 DIA0 [AUTOBOOT MY SYSTEM]

The BOOT command syntax is as follows:

>>> BOOT [/qualifier...] [device_name[,device_name...]]

```
KA660-A V3.7, VMB 2.12
Performing normal system tests.
95..94..93..92..91..90..89..88..87..86..85..84..83..82..81..80..
79..78..77..76..75..74..73..72..71..70..69..68..67..66..65..64..
63..62..61..60..59..58..57..56..55..54..53..52..51..50..49..48..
47..46..45..44..43..42..41..40..39..38..37..36..35..34..33..32..
31..30..29..28..27..26..25..24..23..22..21..20..19..18..17..16..
15..14..13..12..11..10..09..08..07..06..05..04..03..
Tests completed.
>>>b/1 dia5:
(BOOT/R5:1 DIA5:)

  2..
-RF72$DIA5
  1..0..


SYSBOOT>  CONTINUE

%SYSBOOT-I-SYSBOOT Mapping the SYSDUMP.DMP on the System Disk
%SYSBOOT-I-SYSBOOT SYSDUMP.DMP on System Disk successfully mapped
    OpenVMS (TM) VAX Version V6.2    Major version id = 1 Minor version id = 0

_
```

Booting the System

>>> b/1 DIA0:

"boot the system installed on DIA0 in interactive mode."

SYSBOOT> CONTINUE

Booting the System

The SET BOOT console command allows you to specify a default boot device, or a list of devices, which the system will search for boot software.

Once a default boot device is defined, the system will automatically boot from the device on power up or after a power-fail or error halt. If a boot device list is defined, the system will boot from the first device on the list which contains bootable software

Booting the System

>>> SET BOOT [/qualifier...] device_name[,device_name...]

SET BOOT EZA0 Defines the default boot device to be the Ethernet controller.

SET BOOT DUA0,DIA0,MIA5,EZA0
Defines a boot device search string with DUA0, DIA0, MIA5, and EZA0 as possible boot devices.

When attempting an autoboot, or if the BOOT command is issued without specifying a device, the system checks each device in order and boots from the first one that contains bootable software

Replace NiCad Battery

At this point, unless the internal battery has been replaced, it's dead and possibly leaking. Remove or replace it.
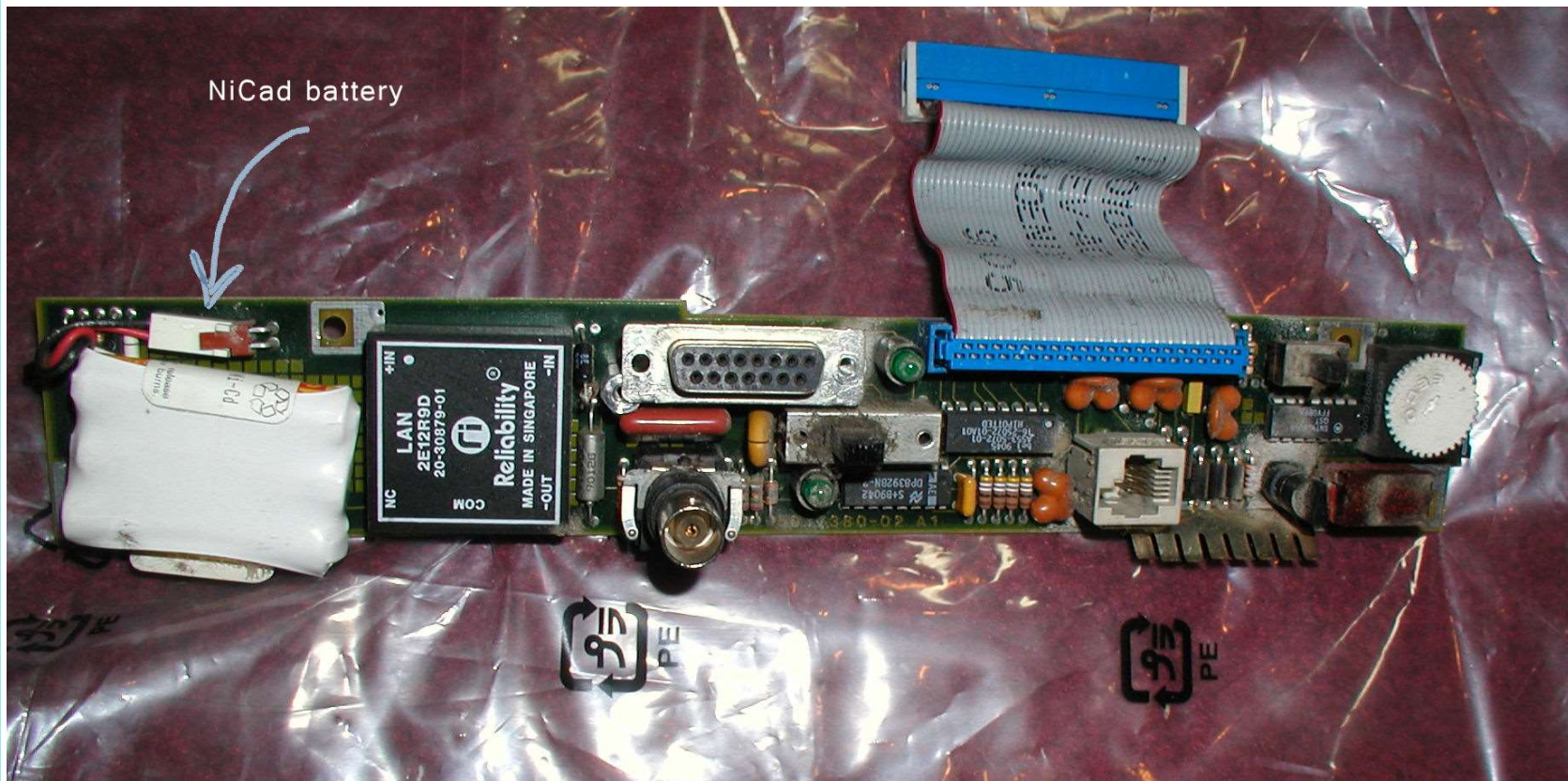

OK?
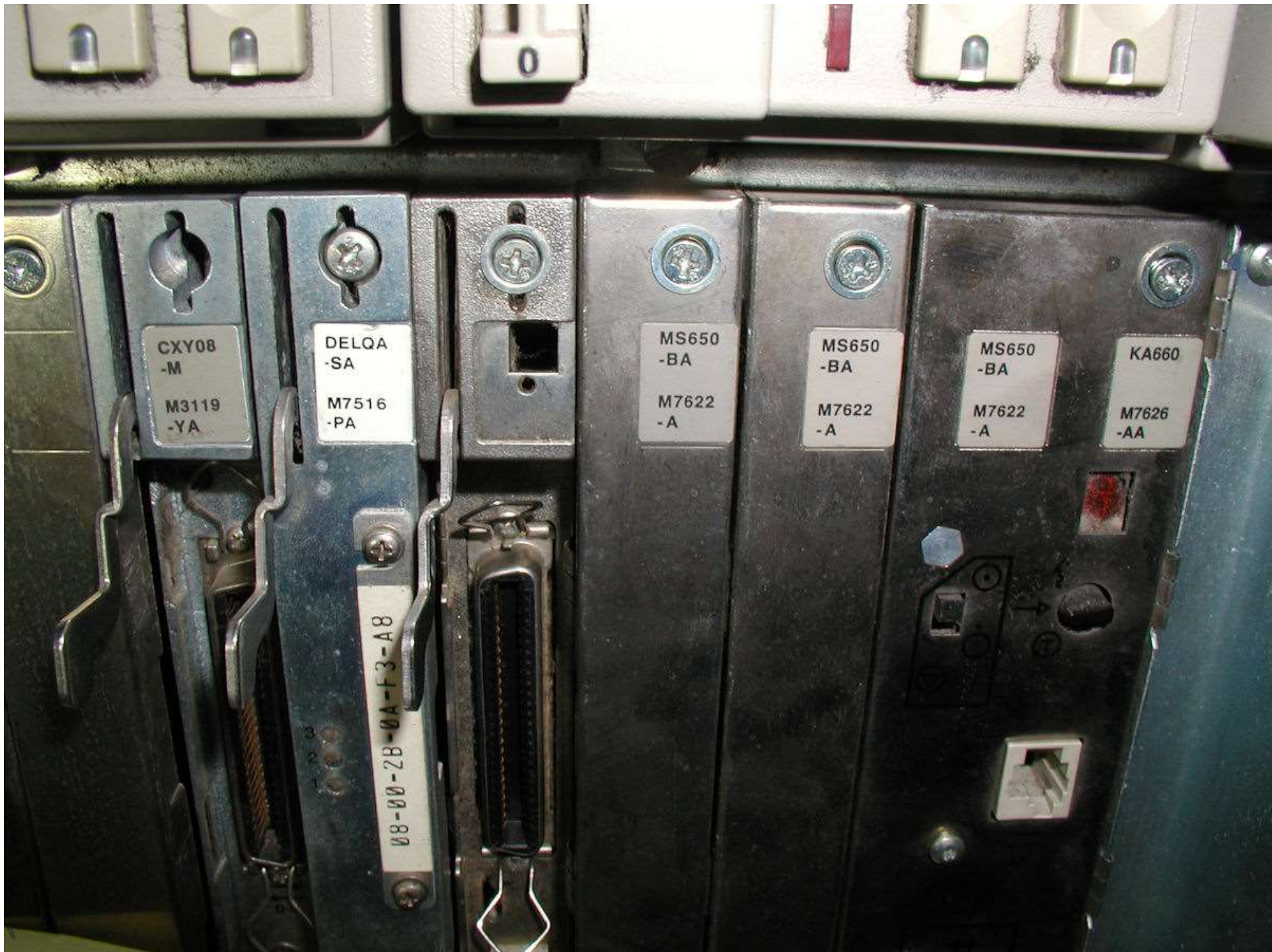
CXY08
-M

M3119
-YA

DELQA
-SA

M7516
-PA

MS650
-BA

M7622
-A

MS650
-BA

M7622
-A

MS650
-BA

M7622
-A

KA660

M7626
-AA

08-00-2B-0A-F3-A8

3
2
1

NiCad battery

KA660 from VAX 4000-200

Vintage Computer.net

System Backup

installing standalone BACKUP (check whether it's already there, if not..)

$ @SYS$UPDATE:STABACKIT SYS$SYSDEVICE:

When the procedure finishes, the system displays the following message:

The kit is complete.

The STABACKIT procedure places the files in the directories

[SYSE.SYSEXE] and [SYSE.SYS$LDR] on the system disk. It lists the files as they are copied.

If you want to install standalone BACKUP in another directory,change the target directory from SYS$SYSDEVICE: to the directory of your choice. Note you should install on the backup drive so you can restore from it.

System Backup

BACKUP

1. Boot standalone BACKUP.
2. Enter the BACKUP command in one of the following formats. If backing up to disk:

$ BACKUP/IMAGE/VERIFY source_drive: target_drive:

source_drive Device name of the system disk drive.
target_drive Device name of the drive holding the backup disk or tape.

Note:
Before the backup operation begins,
the target device is initialized,
erasing all data currently on the
device.

System Backup

example

$ BACKUP/IMAGE/VERIFY DIA0: DIA1
The system displays the following message.
%BACKUP-I-STARTVERIFY, starting verification pass

When the procedure is finished, the system displays a message similar to the following:
%BACKUP-I-PROCDONE, operation completed.

Processing finished at 18-JAN-1993 15:23

If you do not want to perform another standalone BACKUP operation, use the console to halt the system.

If you do want to perform another standalone BACKUP operation, ensure the standalone application volume is on-line and ready.

System Backup

example (continued)

Enter "YES" to continue

Action: Stop the system. If the system has a Halt button, press it twice. Ensure that the light on the button goes off. If the system does not have a Halt button, press the Break (F5) key.

Reboot the system.

To prevent the BACKUP command from reinitializing the target disk, use the /NOINITIALIZE qualifier. For more information about initializing a disk, see the Guide to Maintaining a VMS
System. For more information on the BACKUP command, see the VMS Backup Utility Manual.

Exploring Old Backups

Guess what the files containing the backups are called.
Savesets created by BACKUP are sometimes given .SAV
or .BCK file extensions but
this is just a convention and they could be called anything.

$ DIRECTORY DKA0:[...].SAV,.BCK /SIZE=ALL*
/DATE=(CREATE,MODIFIED)

will list all files with extensions .SAV or .BCK on the DKA0
disk for example
and give their sizes and creation and modification dates.

System Restore

Boot standalone BACKUP

Enter the BACKUP command in one of the following formats.

• To restore from a backup disk:

$ BACKUP/IMAGE/VERIFY source_drive: target_drive:

source_drive Device name of the drive holding the backup disk or tape cartridge.
target_drive Device name of

Examples:

• Restoring from a backup disk:

$ BACKUP/IMAGE/VERIFY DIA0: DIA1:

System Start Script

- Systartup_v5.com
- Systartup_vms.com

Initialise

Example: Initialize DKA700 and change the label to its original name, USER3:

$ INITIALISE /SYSTEM DKA700 USER3

next mount the drive:

$ MOUNT /NOASSIST /SYSTEM DKA700 USER3

Exploring the File System

Mount a disk that is not mounted automatically:

$ MOUNT /NOASSIST /SYSTEM DKA100 label

where label is the disk volume label. If you don't know what the label is, try any random label. VMS will tell you what the actual label is in an error message and you can repeat the command with the correct label.

ALLOCLASS

$ INITIALIZE 255DIA5: vmsbak

The $255 in the DIA5 device name is the device allocation class, also known as ALLOCLASS. This is a not very well explained and rather obscure corner of VMS.

Show Users

- Username: SYSTEM
Password:
Welcome to VAX/VMS version V5.5-2 on node COBUCK
Last interactive login on Sunday, 13-MAR-2016 23:33
Last non-interactive login on Sunday, 13-MAR-2016 20:39

$ sh users /full
VAX/VMS User Processes at 13-MAR-2016 23:36:32.17
Total number of users = 1, number of processes = 6

Username Process Name PID Terminal
SYSTEM NTY2*SYSTEM 0000011A NTY2: ([10.1.10.52])
SYSTEM NTY33*SYSTEM 0000013A NTY33: ([10.1.10.223])
SYSTEM NTY36*SYSTEM 0000013D NTY36: (mailout.beyondthepale.ie)
SYSTEM OPA0:SYSTEM 00000115 OPA0:
SYSTEM RTA1*SYSTEM 0000013F RTA1: (COBUCK::SYSTEM)
SYSTEM Time Stamp 0000010B (batch)

Explore DecNet Nodes

```
$ mcr ncp
NCP>show known nodes

Known Node Volatile Summary as of 13-MAR-2016 23:36:58

Executor node = 1.1 (COBUCK)

State = on
Identification = DECnet-VAX V5.5-2, VMS V5.5-2
Active links = 2

Node State Active Delay Circuit Next node
Links

1.2 (RALPH) SVA-0 0
$ logout
```

Contact vintagecomputer.net

Vintagecomputer.net is hosted and managed by:

degnanCO.| CONSULTING