ACCESSING BORN-DIGITAL MATERIALS IN THE FACE OF TECHNICAL OBSOLESCENCE

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EXAMPLES

Haldeman Diaries CD-ROM

- H. R. Haldeman, Nixon's Chief of Staff, refers to Felt on April 26 and 27, 1973, in the CD-ROM version of his diaries. These references do not appear in the print version of The Haldeman Diaries.

- The CD-ROM of The Haldeman Diaries is out of print. Copies, however, can be located in libraries, including the National Archives' library located on the third floor of the College Park, Maryland, facility.

SUGGESTED BY NICK CULLATHER, IU DEPARTMENT OF HISTORY
apparently ne will say that ne had explicit confidences in Ehrlichman and Dean. The P said that
won't wash, they didn't tell him to destroy it. He will say he was told that the papers should be
destroyed. The P asked Petersen what his view is as to what Ziegler should say. And Petersen
told him that Gray now says, I was told to destroy them. The question is, does Dean corroborate
Gray's story. He told Kleindienst and Petersen to meet with Gray and that probably there should
be no statement tonight. The problem is if Gray leaves, Felt becomes acting Director, and we
would have to make that move in the morning. We should just say we're investigating it, and we
don't even have Dean under oath yet. So we don't know about this.

He asked Petersen, what about the meeting with Dean, he should get that done with. He
said you've got to decide the Dean thing, but don't be concerned about a trump card. There's no
blackmail here. Magruder's and Dean's stories vary. They want Dean to plead and then they'll
have a case. They're still short on both Ehrlichman and Haldeman. The P is not trying to run the
case, he says, but you have to wrestle with the Dean problem, not just Ehrlichman and
Haldeman, and the P can't move on Dean without jeopardizing the prosecution, so I'll wait for
you. But Dean's decision should be made soon. Don't be concerned regarding blackmailing
anybody. Not the B, not the C's men, and not you. Don't let him get any club on you. Dean now,
Rego Park, N.Y. 6-1956

It was summer, I remember, I was ten or eleven...

LAST ONE TO THE SCHOOLYARD IS A ROTTEN EGG!

I was roller skating with Howie and Steve...

...until my skate came loose.

OW!

HEY! WAIT UP FELLAS!

ROTTEN EGG! HA HA!

HEY! WAIT UP FELLAS!

ROTTEN EGG! HA HA!

My father was in front. Threw something...
The United States Government Printing Office (GPO) has published nearly 5000 CDROMs containing data on the economy, the environment, the sciences and society.

The Indiana University Libraries hold roughly 3000 of these along with 1000’s of other CDROMs.
OVERVIEW

- VIRTUALIZED COLLECTIONS
- ASSISTED EMULATION
  - WINDOWS
  - CLASSIC MAC
VIRTUALIZING A COLLECTION

VIRTUALIZATION - RLG-OCLC TECHNICAL REPORT (2002)

CATALOG RECORD

FILE BROWSING

VIRTUALIZATION
Virtual CD-ROM / Floppy Disk Library

Search Virtual CD-ROM/Floppy Disk Library

This website provides public access and preservation services for the nearly 5,000 CD-ROMs, DVDs, and floppy disks distributed by the GPO under the Federal Depository Library Program (FDLP). These tangible products have been received through the FDLP since the 1980s and consist of millions of individual files containing fundamental data on economics, the environment, population, and life and physical sciences. The products will be more easily accessed through this project as the collection becomes more comprehensive.

This project is based on proven technologies and techniques that have been developed in the research lab of Dr. Geoffrey Brown, Professor of Computer Science in the School of Informatics and Computing at IU Bloomington, with input from Lou Malcomb, Head, Government Information and the Geosciences Library. It supports browsing the digital documentation and other files such as data, images, audio, and video in convenient alternative formats, as well as searching the collection metadata and full text via a search engine on the site or through popular web search engines. Additional access is provided to the collection through IUCAT (Indiana University’s online library catalog), the Indiana State Library Catalog, and OCLC WorldCat.

IU Bloomington Libraries
Comments: libsys@indiana.edu
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HTTP://WEBAPP1.DLIB.INDIANA.EDU/
VIRTUAL_DISK_LIBRARY/
MIGRATION AND ACCESS

Virtual CD-ROM / Floppy Disk Library

- Parent Directory
- algae.htm
- algae.xls
- algae1.htm
- algae2.htm
- algae3.htm
- algae4.htm
- algae5.htm
- bird.xls
- bird01.htm
- bird02.htm
- bird03.htm

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ASSISTED EMULATION

☐ This portion of the talk explores the use of an "emulation assistant" to automate key tasks required to use a CD-ROM in an emulation environment.

☐ We explore on-the-fly customization of an emulation environment by automation of installation and set-up.

☐ Test set 1325 titles drawn from ~5000 CD-ROMs including government and commercial.
EMULATION FOR ACCESS TO LEGACY EXECUTABLES

THE PROBLEM:

- MANY CD-ROMS CONTAIN EXECUTABLE SOFTWARE THAT CANNOT BE EASILY MIGRATED, MAY NOT RUN CORRECTLY USING CURRENT HARDWARE OR OPERATING SYSTEMS, OR INCLUDES SPECIFIC HARDWARE AND SOFTWARE DEPENDENCIES.

- CASUAL USERS MAY NOT HAVE THE KNOWLEDGE TO RECREATE OR TUNE THE NECESSARY ENVIRONMENTS. ADDITIONALLY, THE PROCESS CAN BE TIME-CONSUMING AND LABOR-INTENSIVE.
WHY ASSISTED EMULATION?

- It's not possible to have a single reference image with a whole collection “installed.”

- We found great diversity in requirements -- even to specific versions of Office.

- A pre-configured VM takes 4-8GB (plus license issues for multiple copies of OS).

- Script for customization of base image a few KB.

- We took opposite approach with classic MAC emulation -- there a predefined image made more sense (and was small -- 128MB).
Figure 2: Organization of the Virtual Archive

4.1 Exploration Phase

The exploration process can be quite simple – for example, many CD-ROMs contain README files that explain installation procedures and define externally required software. However, in some cases there is little or no guidance provided. Furthermore, many of the CD-ROMs we considered were in foreign languages which our research team could not readily read. Where external software is required, it is frequently difficult to determine which versions are compatible both with the CD-ROM software and our execution environment (e.g. some CD-ROMs require 16-bit QuickTime and only the last 16-bit version works correctly on Windows XP). Once the necessary software version is determined, it can be a challenge to find a copy (e.g. Multimedia Toolbox 3.0).

One of the more vexing problems we ran into was dealing with foreign languages – especially Asian. There are two aspects to this problem – our inability to read the language and the need for foreign language support in Windows. Resolving this problem typically required: (1) determining the appropriate language, (2) for east Asian languages installing Windows support, (3) configuring the appropriate language option in Windows.

We found it most efficient to install language support as part of our base image meaning that only steps (1) and (3) are necessary on a per-CD-ROM basis. In order to execute some programs provided on images it was necessary to configure various compatibility modes in Windows XP. These include changes to virtual memory settings, changing to 16-bit color, and setting file properties for specific compatibility modes. For programs designed to run in DOS mode, some images also required configuration of extended memory (XMS).

An additional complication was dealing with objects which were published on multiple CD-ROMs where there are cross-disk dependencies. For example, a program on one image might require access to a file on another image. Our current strategy is to simultaneously mount all dependent disks. This has a known limitation – VMware can only support up to three simultaneous virtual CD-ROMs. Ultimately, we may need to develop a more sophisticated helper program which will help the user to selectively mount CD-ROM images from a given set.

In summary, exploring the CD-ROM images revealed the program requirements, special cases, and required the development of strategies to handle these special cases. However, these problems are not unique to assisted emulation – even if patrons were provided access to the original CD-ROMs and machines capable of executing them, somebody would have to understand these obsolete environments sufficiently to overcome any obstacles. With assisted emulation there is at least the possibility to capture the required knowledge in scripts.

4.2 Helper Scripts

As mentioned previously, we use AutoIt for our script development. AutoIt executes simple programs in a BASIC-like language. Furthermore, the program provides a tool to...
EMULATION ASSISTANT – USER INTERFACE

Welcome to the Emulation Assistant.

Virtual Machine
Which VMware service provider are you using? Server
Please enter the path to your Virtual Machine Configuration File (.vmx)
(i.e. Windows XP Professional.vmx)
C:\Virtual Machines\Windows-XP-Pro-Bare-Image\Windows XP Professional.vmx
Browse

Disk Image
Enter the path to the file or image you wish to open:
Browse
* Note: If you are wanting to use a file or image that is on the AFS, it may take a few seconds after clicking Browse until you see the file dialog. Please be aware that this is normal.

Quit Cancel Continue
Welcome to the Emulation Assistant

Virtual Machine
Which VMware service provider are you using?  
Server

Please enter the path to your Virtual Machine Configuration File (vmx)  
(i.e. Windows XP Professional.vmx)

C:\Virtual Machines\Windows-XP-Pro-Bare-Image\Windows XP Professional.vmx

Disk Image
Enter the path to the file or image you wish to open:

\afs\edu\public\sudo\volumes\01\30000036885253\30000036885253.iso

* Note: If you are wanting to use a file or image that is on the AFS, it may take a few seconds after clicking Browse until you see the file dialog. Please be aware that this is normal.

Browse

Connecting with VMware...
### ADDITIONAL SOFTWARE

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<th>Number</th>
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<tr>
<td>Internet Explorer</td>
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<td>QuickTime</td>
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<td>Microsoft Office</td>
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<tr>
<td>Java</td>
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<tr>
<td>Photoshop Pro</td>
<td>6</td>
<td>&lt; 1%</td>
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<tr>
<td>Real Audio</td>
<td>2</td>
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<tr>
<td>Multimedia Toolbox</td>
<td>1</td>
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AUTOMATION PHASE

- Helper Script
- Analysis
- Additional Software
- Failures -- A small number of CD-ROMs require Windows 3.1 and we have not pursued emulation for these
- Temporal cost of scripting -- later
- Script complexity issues
  - Language change (12%)
  - Computer restart (13%)
  - Java installation (1.5%)
  - Memory configuration (1.2%)
NUMBER OF SCRIPTS BY CREATION TIME (MINUTES)

Figure 4: Number of Scripts by Creation Time (minutes)

Java installation (1.5%), free virtual memory (1.1%), display settings change (0.1%), Compatibility Settings (0.4%), and XMS memory configuration (0.1%).

4.7 Script Complexity

Another way to measure the difficulty of scripting is to consider the length of scripts. In Figure 5 we provide a chart of script lengths. The shortest scripts were a single line, for example:

```
Run("D:\start.exe")
```

which hardly justifies a dedicated script! A more typical script, such as that illustrated in Figure 3 requires some interaction with the CD-ROM installer as well as initialization of an environment for the end-user. This example is 21 lines whereas our average script was 27.5 lines. Many of the longest scripts involved either rebooting the virtual machine during installation, changing the platform language (e.g. to support Asian languages) or installing multiple additional software applications. For example, the 158 scripts that performed language changes averaged 52 code lines. An additional 14 scripts required rebooting and averaged 68 code lines. The longest scripts which did not involve a reboot, also altered system properties (e.g. colors) to create a compatible environment for software designed to execute on older platforms.

As mentioned previously, many of these installation “tricks” are reusable – indeed they are recorded in our scripts. Consider, as an example, a fragment of a script that reboots the virtual machine during installation as illustrated in Figure 6. The key idea is that there are two phases – “prereboot” and “postreboot”. The first phase performs the basic installation (mostly elided) and, through the "RunOnce" procedure marks a suitable variable in the registry. The postreboot procedure starts the installed application.

```
If not FileExists (...) Then
  prereboot()
Else
  postreboot()
EndIf

func prereboot()
  Run ('D:/SETUP.EXE')
  ...
  RunOnce()
  Shutdown(2)
EndFunc

func RunOnce()
  ...
  If @Compiled Then
    RegWrite ( ...
  Else
    RegWrite ( ...
  EndIf
EndFunc

func postreboot()
  ...
EndFunc
```

Figure 6: Script Performing Reboot
5. DISCUSSION

Clearly the creation of scripts is an extra layer of work required beyond installing and configuring software. The alternative would be to store a separate virtual machine image for each preserved object. For Windows XP these images are 4-8GB which implies a substantial overhead for a 500MB CD-ROM. In contrast with the development of install programs for arbitrary machines with arbitrary software configurations as is required for the development of commercial software, our scripts are required to work only in the tightly controlled environment of a virtual machine image. Furthermore, we have not found the temporal cost of writing scripts is a large additional burden. In a separate project we studied the emulation of CD-ROMs published for "classic Macintosh" machines. In that case, storing customized virtual machine images imposes a much smaller overhead (these images are typically 128MB). [1]

For many in the preservation community, the fundamental questions are how expensive is this approach and what skills are required. Most of the script development was performed by Computer Science undergraduates working as research assistants. These are bright students with some degree of programming sophistication. The data we have presented suggest that, on a per-item basis, an average of 15 minutes is required. In a more realistic production environment with the overhead of developing proper documentation and additional testing, it is reasonable to budget an hour per-item. The actual time requirements of creating the images is quite small (less than 10 minutes per item).

A side benefit of this project is that the process of creating scripts has helped us understand and collate both the common installation problems and the additional software required to preserve CD-ROM materials. In this sense, the creation of install scripts represents only an incremental effort over any principled preservation strategy.

We assumed from previous work that Windows XP would be an adequate platform for emulation of most CD-ROMs created for Windows and MS-DOS operating systems. This has proven to be largely correct; however, as we have noted, we have encountered a handful of CD-ROMs that are so tightly tied to Windows 3.1 that we have not (yet) succeeded in executing them in the Windows XP environment.

The work described in this paper is part of a larger project which aims to create open-source tools to support assisted emulation and which will greatly expand the set of test cases from those we have discussed. We plan to make all of the data, scripts, and helper code available at the end of the project.

Acknowledgment

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6. REFERENCES


CLASSIC MAC EMULATION

- PLATFORMS
  - SHEEPSHAVER (PPC) (OS 7 ON)
  - BASILISKII (68000) (UP TO OS 8.5)
- HOSTS -- LINUX, MAC, WINDOWS
- SOFTWARE
  - MAC ROMS -- NOT FREELY AVAILABLE
  - OS 7.5 FREE ON APPLE WEBSITE (USED 7.6)
VOYAGER PUBLICATIONS

☐ THE INDUSTRY LEADER IN INTERACTIVE CD-ROMS
    1989-1997
☐ ROU沟LY 75 PUBLICATIONS (DIFFICULT TO PIN DOWN)
    ☐ ROBERT WINTER INTERACTIVE BEETHOVEN’S 9TH
    ☐ PEDRO MEYER “I PHOTOGRAPH TO REMEMBER”
    ☐ ART SPEIGELMAN “MAUS”
    ☐ LAURIE ANDERSON “PUPPET MOTEL”
☐ NOW DIFFICULT TO FIND -- I USED INTERLIBRARY LOAN
    AND EBAY, AND COULD ONLY ACCESS ~50
☐ ALL ARE “CLASSIC MAC” APPLICATIONS
LAURIE ANDERSON PUPPET MOTEL

☐ SPOKEN WORD/INSTRUMENTAL PERFORMANCE

☐ QUIRKY AND WINDING PATH THROUGH VARIOUS “ROOMS”

HTTP://CS.INDIANA.EDU/~GEOBROWN/IPRES2011/MOVIES/PUPPET.MOV
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Key: H uses Hypercard, P includes custom program, F includes custom fonts, D MacroMind Director, M Mixed-mode CD-ROM.
CO-CONSPIRATORS

☐ KAM WOODS
☐ SWETHA TOSHNIWAL
☐ KEVIN CORNELIUS
☐ GAVIN WHELAN
☐ ENRIQUE AREYAN
☐ LOU MALCOMB
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