A Baseline for XP Boot Changes

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Outline

- Introduction
- Methodology/Approach
- Expected Results
- Analysis/Findings
- Conclusion

Introduction

- Question: What changes on a hard drive when you boot a system?
- Answer:
  - Sector content of installed devices containing volumes
    - Accessed, write, created date and time metadata
    - Files created
    - Files deleted

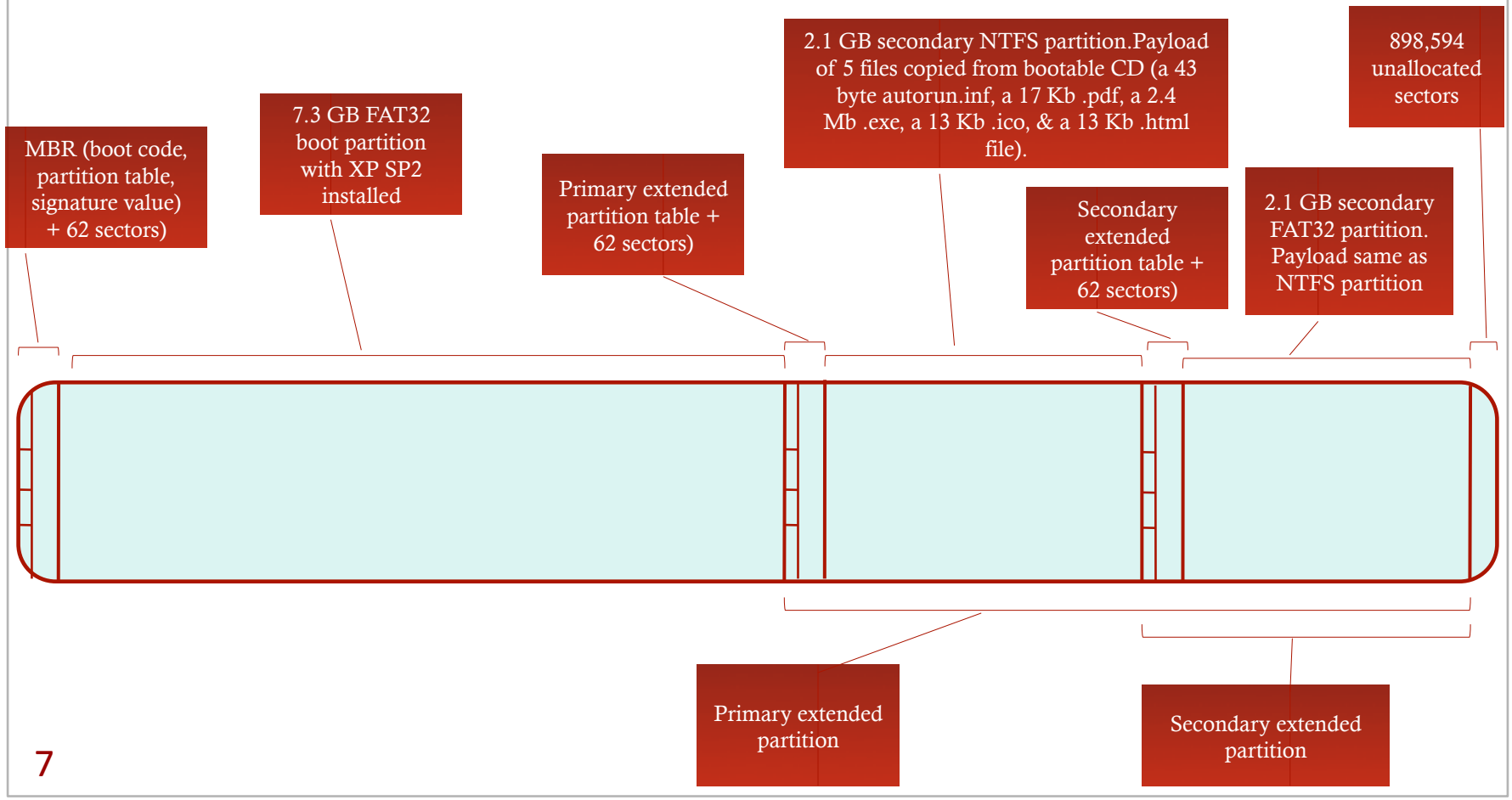
Methodology and Approach

- Build Vanilla XP system not networked
- Cycle through several boots and shutdowns
- Image with dd
- Boot, 2 minutes idle, shutdown, and reimage (5x)
- Compare images- Linux & perl
- Analyze differences- perl scripts and SleuthKit Tools

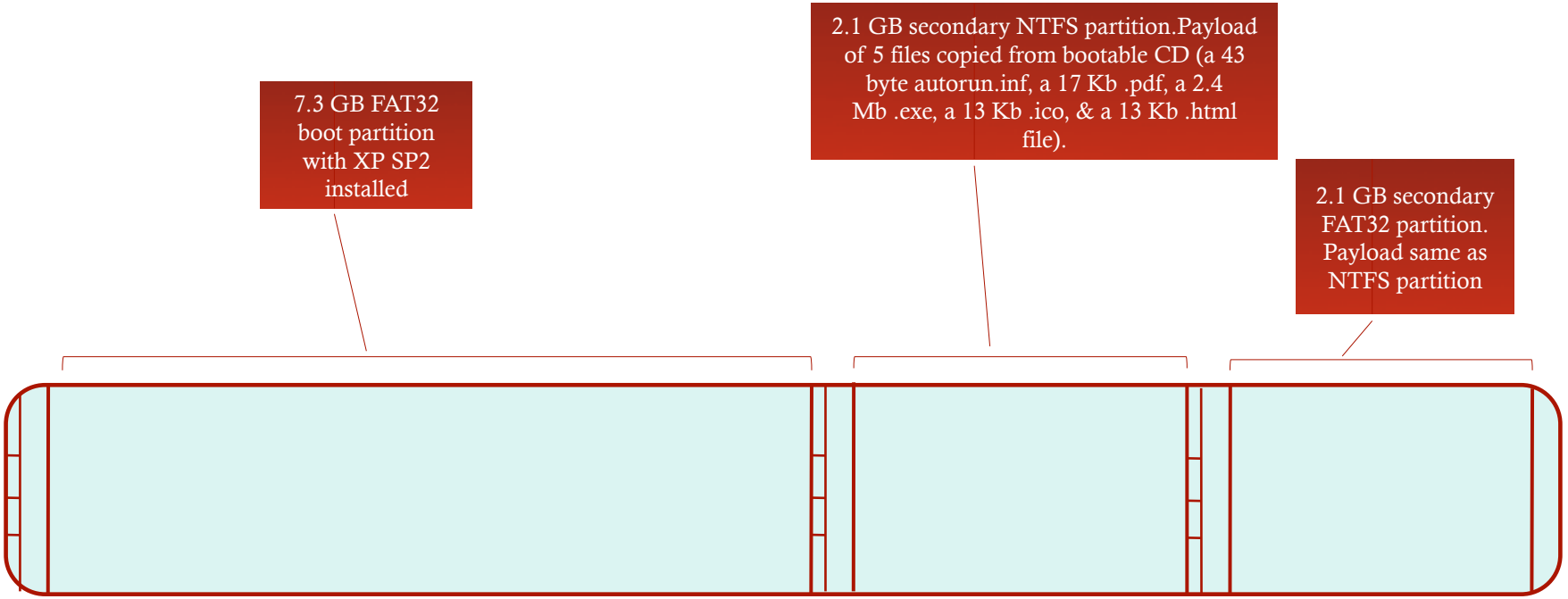
Methodology and Approach

- Build (vanilla) XP system
  - DCO drive to 12 GB
  - Partitioned
    - 7 GB primary FAT32
    - 2 GB secondary NTFS & 2 GB secondary FAT32
  - Windows XP Professional SP2
  - Add user files to secondary partitions
    - 5 files - 2.4 Mb
    - Types: .inf, .pdf, .exe, .ico, & .html

Expected Results



Analysis/Findings



- Changes confined to file system partitions
- Few changes to the secondary file system partitions

Analysis/Findings: Boot Volume

analyze_partitions.pl p0 Output (from run 1)

- Reserved Area: 1 (FS Info Sector)
- FAT Area:
  - FAT 0: 1105 1122 6170 10821 10823 10829
  - FAT 1: 15417 15434 20482 25133 25135 25141

Analysis/Findings: Boot Volume Data Area

- Total data area sectors changed:
  - 12,501-14,827 sectors, 6.2-7.4 MB
  - Average: 13,865 sectors (6.9 MB)
- Changes to content of:
  - 9,436 -11,931 (10,883 ave or 78%) allocated sectors, file content
  - 2,740-3,359 (2,923 ave or 21%) unallocated sectors
  - 34-149 sectors (1%) containing directory entries

Unallocated Space: File Growth

- File Growth:
  - Log Files & Prefetch Files
  - Collective growth: 10-609 sectors
  - 100-500+ sectors to prefetch boot trace file

# cycles file grew	Files that Grew
5	WINDOWS/Debug/UserMode/userenv.log
5	WINDOWS/system32/wbem/Logs/wbemess.log
5	WINDOWS/WindowsUpdate.log
2	WINDOWS/SchedLgU.Txt
3	WINDOWS/Prefetch/NTOSBOOT-B00DFAAD.pf
2	WINDOWS/Prefetch/WSCNTFY.EXE-1B24F5EB.pf

Unallocated Space: New & Temporary Files

- New Files
  - 5 restore point files
  - change.log cycled
- Temporary Files
  - WINDOWS/Temp/_sg034g7.TMP (616 KB) &
  - WINDOWS/SoftwareDistribution/DataStore/Logs/_mp.edb (65 KB)
- No Persistent Files Deleted
- Some changes to unallocated space not accounted for

New Files (paths abbreviated)
System Volume Information/_restore{ … }/RP1/change.log
System Volume Information/_restore{ … }/RP1/A0000052.INI
System Volume Information/_restore{ … }/RP1/A0000053.INI
System Volume Information/_restore{ … }/RP1/A0000054.INI
System Volume Information/_restore{ … }/RP1/A0000055.ini

Changes to File Content

- Changes to File Content
  - 39 common files every cycle
  - 40-45 Files
- Amount Changed
  - Average: 11,049 sectors
  - 95% were to PAGEFILE.SYS & SYSTEM files

Changes to File Content (by Directory)

- Documents and Settings & WINDOWS/system32/config
  - 22 registry files (Usrclass.dat, Ntuser.dat, DEFAULT, SAM, SECURITY, SOFTWARE, SYSTEM, .log files)
  - Average Total: 1322 sectors
- WINDOWS/system32/wbem
  - 7 WMI Files
  - Average Total: 30 sectors
- WINDOWS/Prefetch
  - 3 .pf Prefetch Files (NTOSBOOT-B00DFAAD.pf, WSCNTFY.EXE-1B24F5EB.pf, & WUAUCLT.EXE-399A8E72.pf)
  - Average Total: 651 sectors

Changes to File Content (Misc)

- Miscellaneous Other Files

# of cycles file chgd	ave # sectors chgd	Misc. Files that Changed
5	9284.4	PAGEFILE.SYS
5	1	System Volume Information/_restore {1E17E5A1-FE9A-4F64-AA4B-1C4617CFC305}/_driver.cfg
5	3	WINDOWS/system32/config/ AppEvent.Evt
5	7.8	WINDOWS/system32/config/ SysEvent.Evt
4	1	WINDOWS/system32/wpa.dbl
2	2	System Volume Information/_restore {1E17E5A1-FE9A-4F64-AA4B-1C4617CFC305}/drivetable.txt
1	2	WINDOWS/Tasks/SA.DAT
5	3	WINDOWS/Debug/UserMode/ userenv.log
5	1.6	WINDOWS/SchedLgU.Txt
5	6	WINDOWS/WindowsUpdate.log

Changes to File Content (Summary)

# of cydes file chgd	ave # sectors chgd	file
5	2	Documents and Settings/lab/Local Settings/Application Data/Microsoft/Windows/UsrClass.dat
5	1.6	Documents and Settings/lab/Local Settings/Application Data/Microsoft/Windows/UsrClass.dat.LOG
5	24	Documents and Settings/lab/NTUSER.DAT
5	1.6	Documents and Settings/lab/ntuser.dat.LOG
5	2	Documents and Settings/LocalService/Local Settings/Application Data/Microsoft/Windows/UsrClass.dat
5	1.8	Documents and Settings/LocalService/Local Settings/Application Data/Microsoft/Windows/UsrClass.dat.LOG
5	7	Documents and Settings/LocalService/NTUSER.DAT
5	1.8	Documents and Settings/LocalService/ntuser.dat.LOG
5	2	Documents and Settings/NetworkService/Local Settings/Application Data/Microsoft/Windows/UsrClass.dat
5	1.8	Documents and Settings/NetworkService/Local Settings/Application Data/Microsoft/Windows/UsrClass.dat.LOG
5	7	Documents and Settings/NetworkService/NTUSER.DAT
5	1.8	Documents and Settings/NetworkService/ntuser.dat.LOG
5	9284.4	PAGEFILE.SYS
5	1	System Volume Information/_restore{1E17E5A1-FE9A-4F64-AA4B-1C4617CFC305}/_driver.cfg
5	3	WINDOWS/Debug/UserMode/userenv.log
5	1.6	WINDOWS/SchedLgU.Txt
5	2	WINDOWS/SoftwareDistribution/DataStore/DataStore.edb
5	2	WINDOWS/SoftwareDistribution/DataStore/Logs/edb.chk
5	3.6	WINDOWS/SoftwareDistribution/DataStore/Logs/edb.log
5	3	WINDOWS/system32/config/AppEvent.Evt
5	4	WINDOWS/system32/config/DEFAULT
5	1.8	WINDOWS/system32/config/default.LOG
5	4	WINDOWS/system32/config/SAM
5	1.6	WINDOWS/system32/config/SAM.LOG
5	3.4	WINDOWS/system32/config/SECURITY
5	1.4	WINDOWS/system32/config/SECURITY.LOG
5	31.6	WINDOWS/system32/config/SOFTWARE
5	1	WINDOWS/system32/config/software.LOG
5	7.8	WINDOWS/system32/config/SysEvent.Evt
5	1207.2	WINDOWS/system32/config/SYSTEM
5	1	WINDOWS/system32/config/system.LOG
5	9.2	WINDOWS/system32/wbem/Logs/wbemess.log
5	6	WINDOWS/system32/wbem/Repository/FS/INDEX.BTR
5	1	WINDOWS/system32/wbem/Repository/FS/INDEX.MAP
5	2	WINDOWS/system32/wbem/Repository/FS/MAPPING1.MAP
5	2	WINDOWS/system32/wbem/Repository/FS/MAPPING2.MAP
5	9	WINDOWS/system32/wbem/Repository/FS/OBJECTS.DATA
5	1	WINDOWS/system32/wbem/Repository/FS/OBJECTS.MAP
5	6	WINDOWS/WindowsUpdate.log
4	1	WINDOWS/system32/wpa.dbl
3	608.7	WINDOWS/Prefetch/NTOSBOOT-B00DFAAD.pf
3	12.3	WINDOWS/Prefetch/WSCNTFY.EXE-1B24F5EB.pf
3	30.7	WINDOWS/Prefetch/WUAUCLT.EXE-399A8E72.pf
2	2	System Volume Information/_restore{1E17E5A1-FE9A-4F64-AA4B-1C4617CFC305}/drivetable.txt
1	2	WINDOWS/Tasks/SA.DAT

Conclusion

- The boot process creates new files.
- Some files grew, notably log files.
- Some temporary files were created and then deleted.
- No system files were deleted.
- If an XP SP2 PC is booted an average of 13,873 sectors will change in 40-45 files, metadata, and unallocated space.

Future Research

- Use of an NTFS boot partition
- Investigate changes in secondary partitions
- Use of other OSes- Vista, Windows 7
- Pulling plug vs. proper shut down
- Directory entry/meta data analysis
- Investigate prefetch file change variance

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