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# **Your Laptop's Midlife Crisis - How to Help It Cope**

## **Part 2 – Upgrading Your Laptop's Hard Drive**

**Presentation to APCUG VTC - 5/07/16**

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# What is the Lifespan of a Laptop?

- Hardware is “current” for about 2 years
- Expect to avoid repair problems for about 4 years
- Could likely run for 10 years without problems if cared for
- “Useful” life is typically 5 years
- Varies with initial cost and capabilities
- Probably good for the useful life of the installed operating system

# Example: My two Fujitsu Laptops

- Lifebook AH531 - \$380 new in Sept. 2011
  - 15.6” display, Intel i3 processor
- Lifebook LH531 - \$400 new in June 2012
  - 14” display, Intel i5 processor
- Both have:
  - 500 GB hard drive, 2 GB RAM
  - USB 2.0, HDMI, 10/100/1000 LAN, 802.11N
  - Dual-layer DVD-RW, 1.3 Mpixel camera
  - Windows 7

# Useful Life Trade-offs

- What they have going for them
  - Still fairly fast
  - Have most current interfaces
  - Good operating system
  - Appear to be reliable
- What they lack
  - More RAM
  - Larger hard drive and/or solid state drive
  - USB3
  - Blu-ray drive

# Most Popular Laptop Upgrades

- More memory
- Larger hard drive
- Solid-state drive
- Faster interfaces (USB3, Gigabit Ethernet, 802.11N wireless)
- HDMI output
- Blu-ray drive
- New battery\*

# Why Upgrade Your Hard Drive?

- Increase storage space
  - More room for data and applications
- Speed up laptop
  - Magnetic drive (HDD)
    - Higher rotational speed (5400 or 7200 RPM)
    - Faster electrical interface (3 or 6 Gbits/s)
  - Solid State Drive (SSD)
    - Faster access time
    - Faster electrical interface

# Hard Drive Interfaces

- PATA - Parallel ATA (AT attachment)
  - Old technology - uses pins on drive
- SATA - Serial ATA
  - Standardized serial high-speed interface
    - Same for 2.5” and 3.5” hard drives
    - Uses fingers on connector

# SATA Interface Speeds

- SATA Revision 2
  - 3 Gbit/s, 300 MB/s
  - SATA/300
- SATA Revision 3
  - 6 Gbit/s, 600 MB/s
  - SATA/600
- SATA Revision 3.2
  - 16 Gbit/s, 1969 MB/s
- Rev. 3 is backwards compatible with Rev. 2



# Types of Upgrade Drives

- Magnetic Media Hard Drive (HDD)
  - Rotating magnetic platter, slower access
  - Large capacity, low cost per GB
- Solid-State Drive (SSD)
  - semiconductor memory, fast access
  - Smaller capacity, high cost per GB
- Hybrid Drive (SSHD)
  - Combines magnetic platter and Flash memory
  - Large capacity, faster access, medium cost

# Magnetic Media Hard Drives

- 2.5” Laptop Hard Drive (3.5” for desktops)
  - 320 GB to 6 TB capacity (1 TB typical)
  - SATA/300 and SATA/600
  - 5400 RPM or 7200 RPM
  - 8 MB to 64 MB buffer capacity
  - Seagate (Maxtor, Samsung), Western Digital (Hitachi / HGST), Toshiba
  - \$30 to \$250
  - 1 TB can be had for around \$50

# Magnetic Drive Characteristics

- Based on older, proven, reliable technology
- Large capacity, good data retention, low \$
- Mechanical - susceptible to shock
- Physical failures
  - Bearing failures
  - Overheating
  - Head crash
  - Bad sectors
  - Controller board failures

# SSD Hard Drives

- 2.5” SSD (almost all are this size)
  - 60 GB to 2 TB capacity (240-320 GB typical)
  - Almost all are SATA 3 (6 Gb/s)
  - Multi-level cell
  - 401 to 600 Mb/s read/write speeds
  - Samsung, Corsair, PNY, Patriot, Sandisk, Toshiba
  - \$40 to \$400
  - 240 GB for around \$100, 1 TB for around \$300

# SSD Drive Characteristics

- Based on new, reliable Flash memory tech
- Lower capacity, good data retention, high \$
- Limited writes per cell - wear leveling
- Rugged, shock resistant, quiet
- Failures
  - Cell wear failures
  - Overheating
  - Electrical failures

# Hybrid Hard Drives

- 2.5” Laptop Solid State Hybrid Drive SSHD
  - 500 GB to 1 TB capacity (1 TB typical)
  - Almost all are SATA 3 (6 Gb/s)
  - 5400 RPM (mostly) or 7200 RPM
  - 8 GB SLC or MLC NAND Flash
  - 32 MB to 64 MB buffer capacity
  - Seagate, Toshiba
  - \$60 to \$100
  - 1 TB can be had for around \$80

# Hybrid Drive Characteristics

- Based on HDD and SSD technology
- Large capacity, good data retention, mid \$
- Mechanical - susceptible to shock
- Limited writes per cell in the Flash memory
- Failures
  - Same mechanical failures as HDDs
  - Same failures as SSDs

# Changing a Laptop Hard Drive

- Most laptops accommodate one 2.5” SATA hard drive and allow access to it.
  - SATA connector is standardized
- Old drive is removed and replaced with a new 2.5” drive (larger and/or SSD)
- SATA interface speed is limited by host
  - Rev. 2 drive runs at 3 Gbit/s on Rev. 3 interface
  - Rev. 3 drive runs at 3 Gbit/s on Rev. 2 interface



# Example: My Fujitsu Laptops

- Per user manuals (both list the same):

## Mass Storage Device Options

### Hard Drive

Serial ATA, 5400 rpm, 2.5". The hard drive capacity and speed is dependent upon the system configuration. (For more information about your hard drive capacity, see "Changing Partition Sizes" on page 39.)

- Per purchase specifications, installed hard drive is 500 GB in each laptop
- How to verify hard drive size
  - Through Windows 7 Control Panel
    - Control Panel -> System and Security -> Administrative Tools -> Computer Management -> Disk Management

# Windows Control Panel

The screenshot shows the Windows Disk Management console. At the top is a table listing system volumes. Below this is a detailed view of Disk 0, which is a 465.76 GB Basic disk. The detailed view shows a grid of partitions for Disk 0, including the OS (C:) and several application data drives (D: through J:). A legend at the bottom identifies the colors used in the grid: Unallocated (black), Primary partition (dark blue), Extended partition (green), Free space (light green), and Logical drive (blue).

Volume	Layout	Type	File System	Status	Capacity	Free Spa...	% Free	Fault Tolerance	Overhead
	Simple	Basic		Healthy (R...	16.00 GB	16.00 GB	100 %	No	0%
	Simple	Basic	NTFS	Healthy (S...	200 MB	162 MB	81 %	No	0%
APPS1 (D:)	Simple	Basic	NTFS	Healthy (L...	20.59 GB	17.95 GB	87 %	No	0%
APPS2 (E:)	Simple	Basic	NTFS	Healthy (L...	20.63 GB	19.31 GB	94 %	No	0%
APPS3 (H:)	Simple	Basic	NTFS	Healthy (L...	19.89 GB	19.75 GB	99 %	No	0%
APPS4 (I:)	Simple	Basic	NTFS	Healthy (L...	20.67 GB	20.50 GB	99 %	No	0%
DATA (G:)	Simple	Basic	NTFS	Healthy (L...	99.97 GB	27.58 GB	28 %	No	0%
GAMES (F:)	Simple	Basic	NTFS	Healthy (L...	5.35 GB	5.26 GB	98 %	No	0%
LOCAL (J:)	Simple	Basic	NTFS	Healthy (L...	142.31 GB	46.85 GB	33 %	No	0%
OS (C:)	Simple	Basic	NTFS	Healthy (B...	120.16 GB	65.83 GB	55 %	No	0%

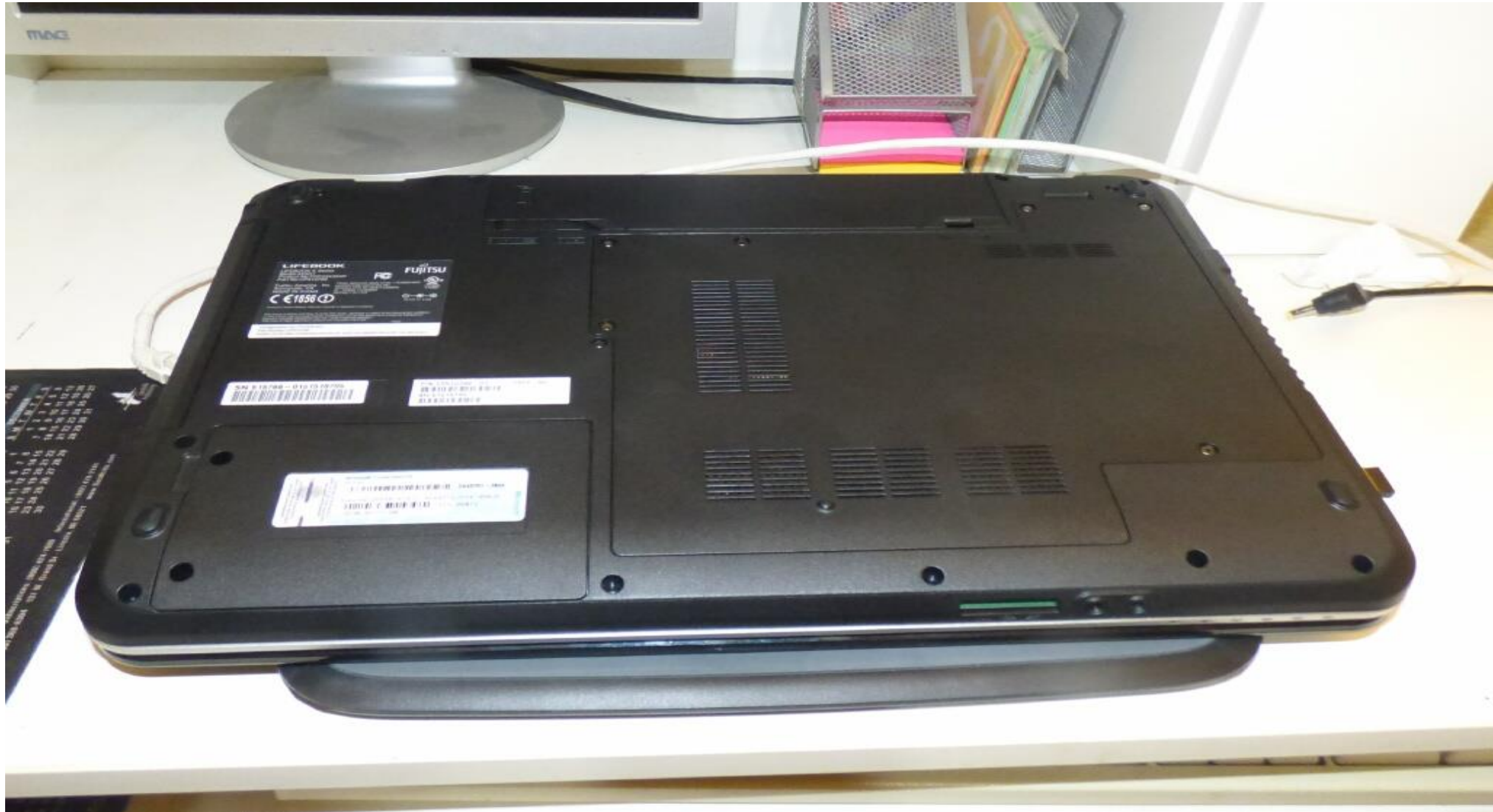
Disk 0	16.00 GB	200 MB	120.16 GB	20.59 GB	20.63 GB	5.35 GB	99.97 GB	19.89 GB	20.67 GB	142.31 GB
Basic 465.76 GB Online	Healthy (Rec)	Health	NTFS Healthy (Boot, I	NTFS Healthy (Lo:	NTFS Healthy (Log	NTFS Healthy (L	NTFS Healthy (Logic:	NTFS Healthy (Log	NTFS Healthy (Log	NTFS Healthy (Logica

■ Unallocated ■ Primary partition ■ Extended partition ■ Free space ■ Logical drive

# How to Access the Hard Drive

- Requires a small screwdriver (typically phillips)
- Turn laptop over on work surface
- Locate the access door for the hard drive
- Remove the screw(s)
- Carefully pry the door up and off

# Fujitsu AH531



# Fujitsu AH531





# Fujitsu LH531



# Fujitsu LH531



# What Kind of New Drive to Get?

- Assumptions:
  - Old drive is 2.5” SATA
  - New drive  $\leq 2$  TB (to avoid possible limits)
- If laptop supports SATA Rev. 3, get Rev. 3 if possible to fully utilize interface
- For more storage, get a HDD (magnetic)
- For faster access, get an SSD (solid-state)
- For a compromise between more storage and faster access, try a SSHD (hybrid drive)



# My Upgrade

- Original drives were 500 GB HDD
  - Would really like to increase to 1 TB
  - Boot time is over a minute - would like faster
  - No info on my laptop's interface speed
- 1 TB laptop hard drive costs
  - Around \$50 for HDD - lowest cost
  - Around \$300 for SSD - expensive
  - Around \$80 for SSHD - best value?
    - Seagate claims boot times as shown

## Start-up time in seconds

SSD	:20
SSHD	:22
HDD	:37

# My Upgrade - AH531

- Toshiba MQ01ABD100H
  - 1 TB, 2.5” SSHD (hybrid drive)
  - 8 GB NAND Flash
  - 5400 RPM
  - SATA Rev. 3 (6 Gbit/s) interface
  - 8 MB buffer
  - \$50 - \$120 (Amazon & Fry’s)



# My Upgrade - LH531

- Seagate ST1000LM014
  - 1 TB, 2.5” SSHD (hybrid drive)
  - 8 GB NAND Flash
  - 5400 RPM
  - SATA Rev. 3 (6 Gbit/s) interface
  - 64 MB buffer
  - \$73 (Amazon)

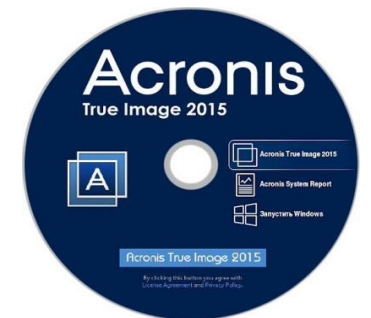
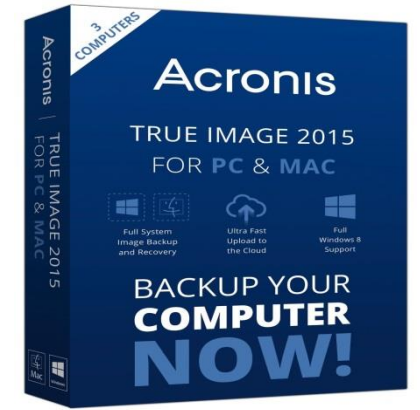


# The Upgrade Process

- Update and clean up original drive
- Back up (image) to external hard drive (boot back-up program from CD)
- Remove old hard drive and replace
- Boot from CD and restore drive from external hard drive
- Enlarge/adjust partitions on new drive as required to utilize added space
- Verify laptop boot and check boot speed

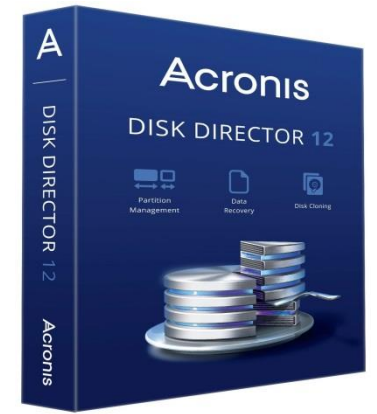
# Software Tools

- Acronis True Image PC Backup & Recovery (2016 is latest version)
  - Creates images of individual partitions or of the entire drive
    - Full image backup is essential for backup restoration or transfer to another hard drive
  - Bootable version on the program CD
  - Supports external and network drives
- Or any software that creates backup images



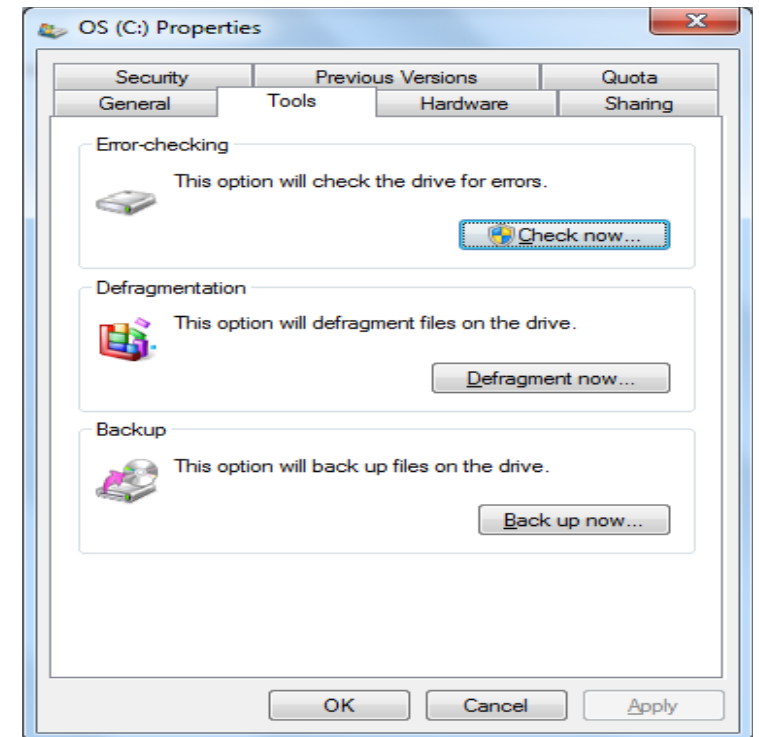
# Software Tools

- Acronis Disk Director (12 is latest version)
  - Manages partitions on a hard drive
    - Can create, delete, split, resize, convert, copy, format and label partitions
  - Bootable version on the program CD
- Or any software that manages partitions
  - Windows Disk Management can perform limited partition management



# Hard Drive Tests

- Verify Drive Size
  - in Windows Disk Management
- Error Checking
  - Windows Disk Error Checking
    - Right-click on a drive (or partition) and select “Properties”. Perform the error checking under the “Tools” tab



# Changing Hard Drives

- Remove drive cover
- Touch a metal chassis part or use a wrist strap connected to laptop chassis
- Remove any additional screws holding in the drive
- Carefully lift the loose end and tip up, then pull the drive away from the connector
- Install the new drive by reversing the operations



Once the new hard drive is installed and verified, your laptop will feel better about itself!

# Questions?

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