

Backups

CSH5 Chapter 57

Backups

M. E. Kabay & Don Holden

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Topics

- Backup Bloopers
- Definitions and Needs
- Strategies
- Archives, Maintenance and Retention
- Storage
- Disposal
- Costs
- Optimizing Frequency



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Backup Bloopers

- | | |
|---|---|
| ➤ BerkshireNet | ➤ US Customs |
| ➤ Margot Kidder | ➤ US National Archives |
| ➤ Digital Technologies Group | ➤ MIT "Cheating Scandal" |
| ➤ Amtrak Reservations | ➤ Office of the Vice President of the USA |
| ➤ Newcastle University Prof | ➤ Norwegian Banks |
| ➤ Sun Valley Ski Resort | ➤ Swisscom Mobile GSM Network Failure |
| ➤ Stanford University Grad School of Business | ➤ Macomb County (Michigan) Sheriff's Dept |
| ➤ McAfee's QuickBackup 2.04 | ➤ Electronic Voting Machines |



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BerkshireNet

Feb 96 -- RISKS 17.83

- BerkshireNet, Pittsfield, MA
 - Swastikas and racist messages
 - Masqueraded as provider's administrator
 - Erased data on two computers
 - Shut down system
- Down 12 hours
 - no current backup
 - older deleted files restored
 - but several days of data lost



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Margot Kidder

Sept 96 -- *People Online* via
RISKS 18.46

- Computer virus was last straw
- Led to nervous breakdown
- Unidentified virus apparently destroyed only copy of her book
- No backup



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Digital Technologies Group

Oct 96 -- AP

- Digital Technologies Group lost all computer files and backups
 - ❑ U\$17,000 direct costs
 - ❑ loss of months of work
 - ❑ 1-week shutdown
 - ❑ seriously damaged credibility as ISP
- Disgruntled ex-employee
- Alleged perpetrator arrested



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Newcastle University Prof

1997-08

- Prof. David Newell
- School of Clinical & Laboratory Research
- Expert in cancer research and anti-cancer drugs
- Computer + 5 floppy disks stolen
- Contained only copy of his research data
- Thieves kindly returned his disks



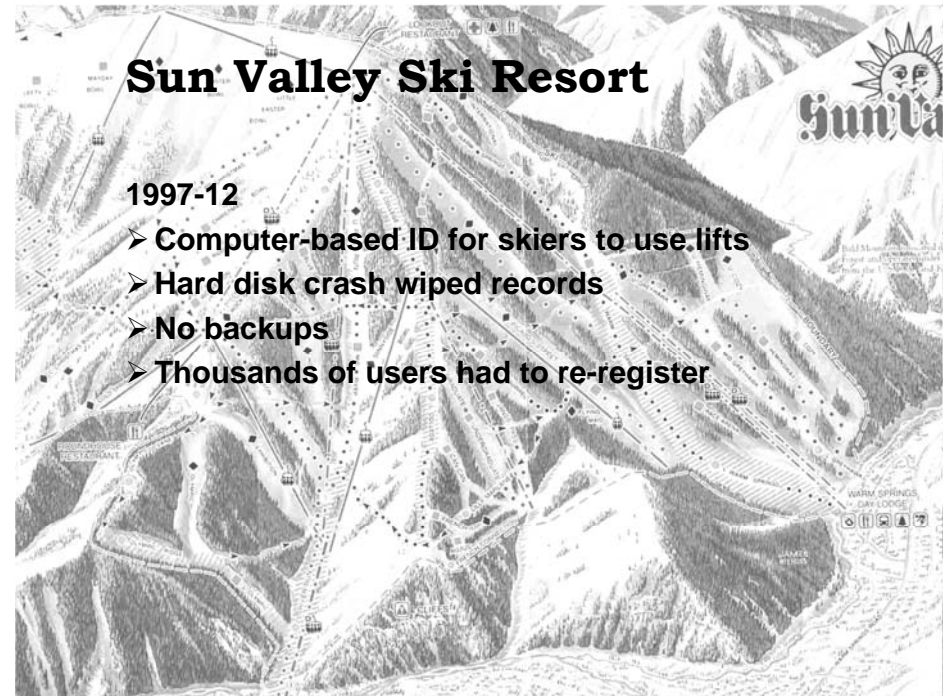
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Sun Valley Ski Resort

1997-12

- Computer-based ID for skiers to use lifts
- Hard disk crash wiped records
- No backups
- Thousands of users had to re-register



Stanford University Grad School of Business



1998-03

- Installed additional disk capacity on servers
- Reloaded files from a corrupt backup tape
- All faculty and student files destroyed
- Many faculty and graduate students lost research data – because they didn't keep their OWN backups!



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US Customs



U.S. Customs and Border Protection Securing America's Borders CBP.gov

1998-10

- Hard disk failure
- Chain of system failures
- 6 hour downtime
 - ❑ 80,000 requests backlogged
- Sys admins shut down modem lines
 - ❑ Importers had auto-redial
 - ❑ Each redial counted as new request
- Customs Service deleted 45,000 import requests
- Required resubmission from importers

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US National Archives



1999

- System problem wiped 43,000 messages from e-mail system
- But contractor responsible for backups had made no backups
- Someone had also turned off system logging
- Assistant Archivist said, "Safest way to save important messages is to print them out."

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MIT "Cheating Scandal"

2000-03

- Boston Globe reported "cheating scandal"
 - ❑ 22 students in cell bio class had wrong grades
- Turned out a grad student had sorted the names but not included the grades. . . .
- No backups, so no records of correct grades
- No logs, no tracking, no *nothing*

Office of the Vice President of the USA

- 1998-04
 - ❑ Migrated e-mail server to Windows NT4
 - ❑ Moved e-mail files to a new partition
 - ❑ Forgot to include that partition in backup schedule
- 1999-05
 - ❑ Staffers discovered zero backups for e-mail for over a year

Macomb County (Michigan) Sheriff's Dept



- 2002-05: RISKS 22.08
- Lost 50,000 photos of criminals
 - ❑ Hard drive crashed
- Had some pictures printed out as backups
- But had made no electronic backups at all on any medium



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Electronic Voting Machines

- 2004 election period saw growing concern about electronic voting machines
 - ❑ Entirely proprietary (secret) code
- Most had no audit trail of any kind
 - ❑ Trust the electronic counts without means of verification
 - ❑ Documented cases of votes being switched to opposite party
- Demands growing for paper trail
 - ❑ Print ticket to allow user to see vote supposedly registered by machine
 - ❑ Place tickets in ballot box as backup measure in case of recount



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Definitions



- Backups – copies of data files or records
 - ❑ *Should be* on different device
 - ✓ Tape, hard disk, CD, DVD...
 - ❑ *May be* on same disk (*.wbk, *.bak etc.)
- Units
 - ❑ KB = kilobyte = 1024 bytes (characters)
 - ❑ MB = megabyte = 1024 KB = 1,048,576 bytes
 - ❑ GB = gigabyte = 1024 MB = 1,073,741,824 bytes
 - ❑ TB = terabyte = 1024 GB = 1,099,511,627,776 bytes

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" I ALWAYS BACK UP EVERYTHING."

Needs

- Provide valid information in case of data corruption or loss
- Satisfy legal requirements for access to storable data, as for audit purposes;
- In forensic examination of data to recognize and characterize a crime, and to identify suspects;
- For statistical purposes in research;
- To satisfy requirements of due care and diligence in safeguarding corporate assets;
- To meet unforeseen requirements.

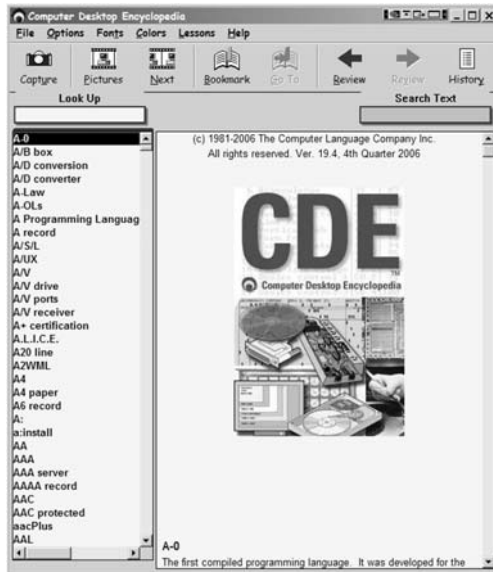


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Backup Media

- Following slides are built using information and images from the *Computer Desktop Encyclopedia v 17.4*.
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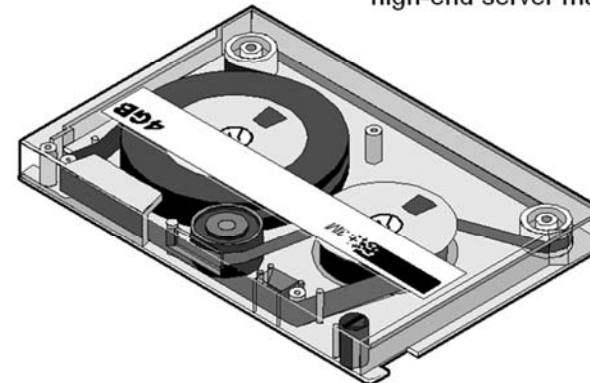


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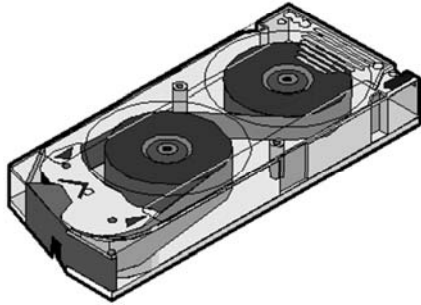
5.25" SLR Data Cartridges

Data Cartridges come in capacities up to 70GB. Tandberg Data has enhanced the Data Cartridge with its SLR line for use in medium to high-end server markets.



(Magstar MP Tape)

Magstar MP Tape



IBM's Magstar MP uses an 8mm, cassette-style cartridge that holds 5GB. Intended for midrange server use, it is especially designed for use in robotic libraries.

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(Ultrium – LTO)

Ultrium - LTO



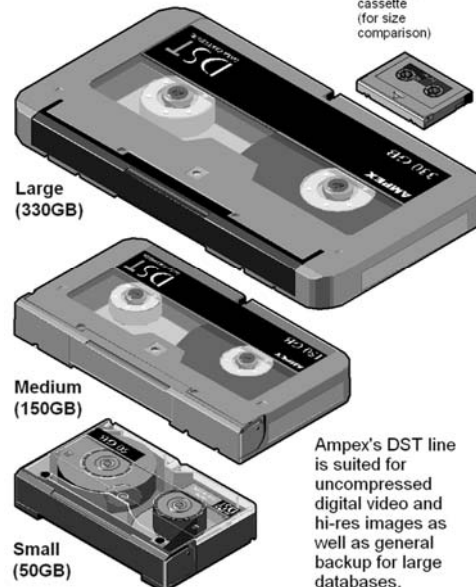
The Ultrium is the high-end LTO format with native capacities starting at 100GB.

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(Ampex DST)

DST



4mm DAT
cassette
(for size
comparison)

Large
(330GB)

Medium
(150GB)

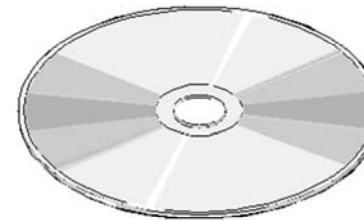
Small
(50GB)

Ampex's DST line is suited for uncompressed digital video and hi-res images as well as general backup for large databases.

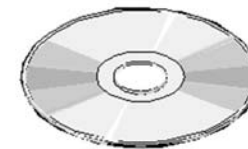
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CD-ROM, CD-R, CD-RW



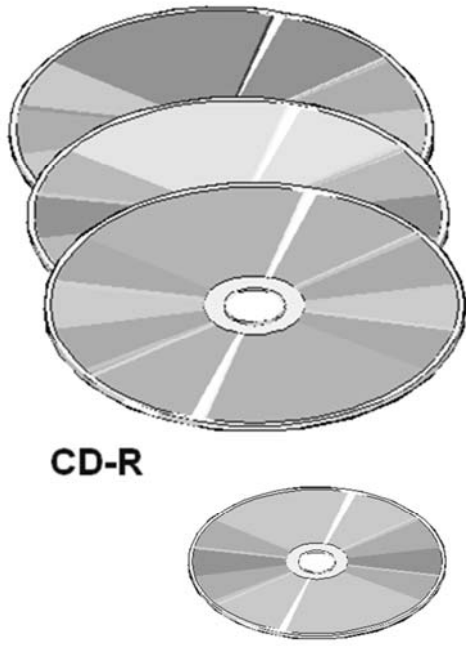
CD-ROM



Mini CD-ROM

The 120mm CD-ROM is the de facto standard for software distribution and for publishing large databases. The smaller mini CD-ROM is only 80mm in diameter and holds 180MB (compared to the full-size 650MB). It fits into the deeper well in the center of the tray in most CD-ROM drives.

CD-ROMs have a silver cast just like audio CDs.



CD-R

CD-RW

Blank CD-R discs can be recorded once and read on any CD-ROM reader. CD-Rs have a gold, blue or green cast.

CD-RWs can be rewritten, but must be read on newer MultiRead CD and DVD drives. CD-RWs have a blue cast.

DVD Types

Standards from the DVD Forum

- DVD-R: DVD-Recordable
 - ❑ Write-once, read-many
 - ❑ “DVD-dash-R” or “DVD-minus-R”
 - ❑ 4.7 GB standard
- DVD-RW: DVD-Read-Write
 - ❑ Write many, read many
 - ❑ “DVD-dash-RW” or “DVD-minus-RW”
 - ❑ 4.7 GB standard
 - ❑ Rewrite 1,000 times



DVD Types (cont'd)

Standards from the DVD+RW Alliance

- DVD+R: DVD+Recordable
 - ❑ Write-once, read many
 - ❑ 4.7 GB
- DVD+RW: DVD+ReadWrite
 - ❑ Write many, read many
 - ❑ 4.7 GB
 - ❑ Supports CAV recording format especially good for data random access
 - ❑ DVD+RW drives typically read DVD-R media as well



Blu-ray Disks for Backups

- Developed in 2002 by Sony, Hitachi, Philips...
 - ❑ Same size as CDs and DVDs
 - ❑ Single-layer: 25 GB
 - ❑ Dual-layer: 50 GB
- Blu-ray Burners
 - ❑ Internal
 - ❑ External
 - ❑ In 2011, about \$130
- Blu-ray software
 - ❑ E.g., *Handy Backup 6.9.3*
 - ❑ 25 GB/disk
 - ❑ <http://tinyurl.com/6ahk78o>



Hard Drives for Backups

- For consumers: small external drives
- USB 2.0/3.0, Firewire
 - ❑ Maxtor, Seagate, Western Digital,
 - ❑ In Mar 2011, ~\$55/TB for 2 TB drive
- For corporate servers
 - ❑ Network Attached Server (NAS)
 - ❑ More expensive (2-10x)
 - ❑ Fail-safe engineering
 - ❑ RAID technology
 - ❑ Rack-mounted or standalone
 - ❑ In Mar 2011, ~\$112/TB for 12 TB unit



Seagate FreeAgent .5-2 TB
2TB: \$108



Seagate BlackArmor 4-12 TB
12TB: \$1343

Strategies

- Exclusive access°
- Types by coverage
 - ❑ Full °
 - ❑ Differential°
 - ❑ Incremental°
 - ❑ Delta °
- Types by target
 - ❑ System
 - ❑ Application
- Testing

Everything

Everything changed since the last *full* BU

Everything changed since the last BU of any type

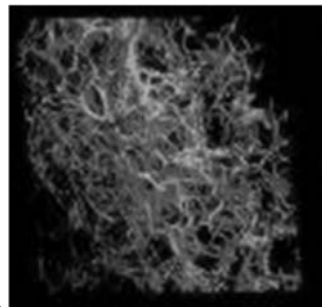
All the records that have changed since the last BU

WARNING:
Always ask for a *definition* of "Daily" or "Partial" BU

Archives, Maintenance and Retention

- Retention policies
- Rotation of media
- Media longevity and technology changes
 - ❑ Media degradation (e.g., fungus*)
 - ❑ Software and hardware changes
 - ✓ Application programs
 - ✓ Operating systems
 - ✓ Transport mechanisms
 - ✓ Data encoding schemes

What to keep?
How long?



* See Mendham, S. (2005). A little care goes a long way. *PC World*.
<http://www.pcworld.idg.com.au/index.php/secid;3;id;461315701>

Storage

- Environmental protection
- Onsite ° ° °
- Offsite
 - ❑ Care during transport
 - ❑ Homes ° ° °
 - ❑ Safes
 - ❑ Banks ° °
 - ❑ Data vaults
 - ❑ Online backups

Humidity 40-60%
Temp 50-70F

Location
Storage Type

Bad idea

Access?

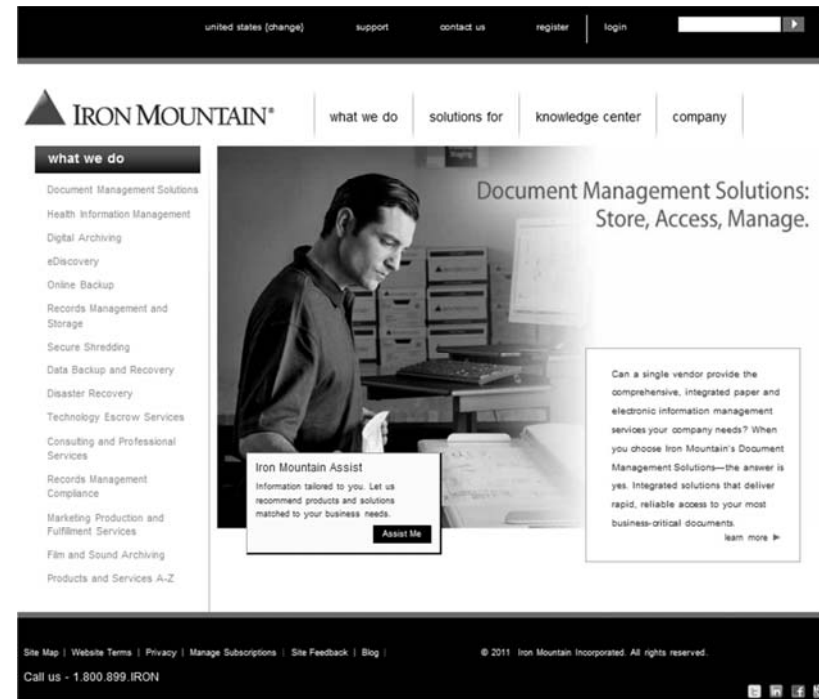
Offsite Storage IRON MOUNTAIN®



- Document Management Solutions
- Health Information Management
- Digital Archiving
- eDiscovery
- Online Backup
- Records Management and Storage
- Secure Shredding
- Data Backup and Recovery
- Disaster Recovery
- Technology Escrow Services
- Consulting and Professional Services
- Records Management Compliance
- Marketing Production and Fulfillment Services
- Film and Sound Archiving

These functions are copied verbatim from Iron Mountain list of services.

<http://www.ironmountain.com/services/>



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IRON MOUNTAIN® what we do solutions for knowledge center company

what we do

- Document Management Solutions
- Health Information Management
- Digital Archiving
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- Online Backup
- Records Management and Storage
- Secure Shredding
- Data Backup and Recovery
- Disaster Recovery
- Technology Escrow Services
- Consulting and Professional Services
- Records Management Compliance
- Marketing Production and Fulfillment Services
- Film and Sound Archiving
- Products and Services A-Z

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Can a single vendor provide the comprehensive, integrated paper and electronic information management services your company needs? When you choose Iron Mountain's Document Management Solutions—the answer is yes. Integrated solutions that deliver rapid, reliable access to your most business-critical documents. [learn more >](#)

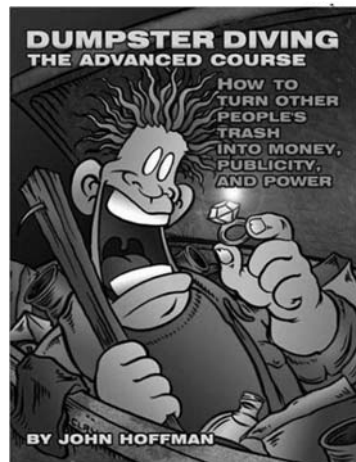
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Disposal

- Scavenging
 - Dumpster® Diving
 - Scratch tapes
 - Diskettes
- Data and media destruction
 - Erase ≠ destroy
 - Reformatting inadequate
 - Degaussers inadequate
 - Random overwrites
 - ✓ Military-grade = 7 passes



<http://tinyurl.com/6dhnu2y>

Stop data remanence!

"Wipe"

Disposal (cont'd)

- Physical destruction works
 - Band-saw
 - Incineration (special types)
- Secure collection points
 - Lockbox magnetic garbage
- Mobile data destruction services
 - Paper shredders
 - Special facilities for tapes

Royal Media Shredder



<http://tinyurl.com/24mwtb>



Secure Data Destruction

- Equipment
 - ❑ Paper shredders (crosscut ONLY – see oval)
 - ❑ See “Cross Cut Shredders – 5 Reasons Why They Are Better” < <http://tinyurl.com/65cuw52> >
- Considerations when evaluating services
 - ❑ Costs
 - ❑ Types of media processed
 - ❑ Onsite vs offsite
 - ❑ Chain of custody assurance
 - ❑ Regulatory compliance
 - ❑ Environmental protection



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Costs

- Tape costs
 - ❑ Tapes / BU
 - ❑ Cost/tape
- Time costs
 - ❑ Hours/BU
 - ❑ Operator cost/hour
- Fixed costs
 - ❑ Storage space, racks, insurance, transport, hardware rental/maintenance, software. . .



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Optimizing Frequency

$$E(x) = P(u) * C(u) - P(n) * C(n)$$

Where

- x is particular strategy
- E(x) is the expected value or cost of the strategy
- P(u) is the probability of having to use the backup within a single day
- C(u) is money saved by not having to redo all the work
- P(n) is probability of not having to use the backups at all
- C(n) is cost of making and storing BU

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Personal Notes on Kabay BUs

- Two ~identical computers: MAIN & SPARE
- 1 TB portable USB drive
- ViceVersa synchronization software (MS)
- AM:
 - ❑ Synch MAIN → USB (including Backups)
 - ❑ Synch USB → SPARE
- PM
 - ❑ Synch SPARE → USB
 - ❑ Synch USB → MAIN
- Daily incremental BU 23:00 → MAIN HD & MAIN Flashdrive
- Monthly FULL BU MAIN → TB drives in fire safe

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