Disaster Preparedness and Recovery Planning

Compass Technology Management
Chesapeake VA 757.233.7300

ICCM 2003

www.compass.net &
www.intellisafevault.com

Today's Objectives

- Set the stage
  - Definitions for DPRP
- Some statistics
- Analyzing the Risks
- Protecting the Facility and the Business
- Planning for Data Recovery
- Strategies for Recovery
- Network Backup Topics
- Emergency Decision Making
- Time Permitting … Technology Topics –
  - Discuss some ICCM Specific topics
  - RAID, Storage, Backup

Oklahoma City, '95

Special Note: The majority of pictures in this presentation are from FEMA and Are used for illustration purposes only.

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Set the stage: DPRP Definitions

Earthquake, Venezuela '99

- A working Definition …
  - "A disaster is …"
- Risk Mitigation is …
  - "Reducing Risks… "
- Business Continuity Planning is …
  - "Making sure we can function…. "
- Risk Analysis is …
  - "Knowing where we can be hurt…."
- Disaster Recovery is …
  - "Getting back to business… "

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The Need for Planning

Toxic Spill –Inez, KY

- IT and all managers' self interest!
- Ethical mandate
- Legal mandate for some industries
- Supporting investments/supporters – a requirement for venture capital
- Emergency planning – think ahead
- One cannot readily predict a disaster environment

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What the Industry is Telling Us

- Forrester Research estimates that companies with revenues of $1 million from online business will lose up to $8,000 per hour from systems outages (circa 1998).
- Over half of the businesses with significant offices in the World Trade Center are closed/out of business.

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One WTC-II Success Story - eSpeed

- eSpeed, Inc. operates multiple buyer/multiple seller real-time electronic marketplaces.
- E-Speed transacts over $200 billion of financial instruments daily and is headquartered in New York City
- Lost 750 people in the attacks
- Up and running 47 hours after the attack
  - Three data centers: WTC, Rochelle, NJ, and London, England
  - Sites run concurrently and redundantly
  - Voice-based broker business discontinued (bulk of what Cantor did at WTC)

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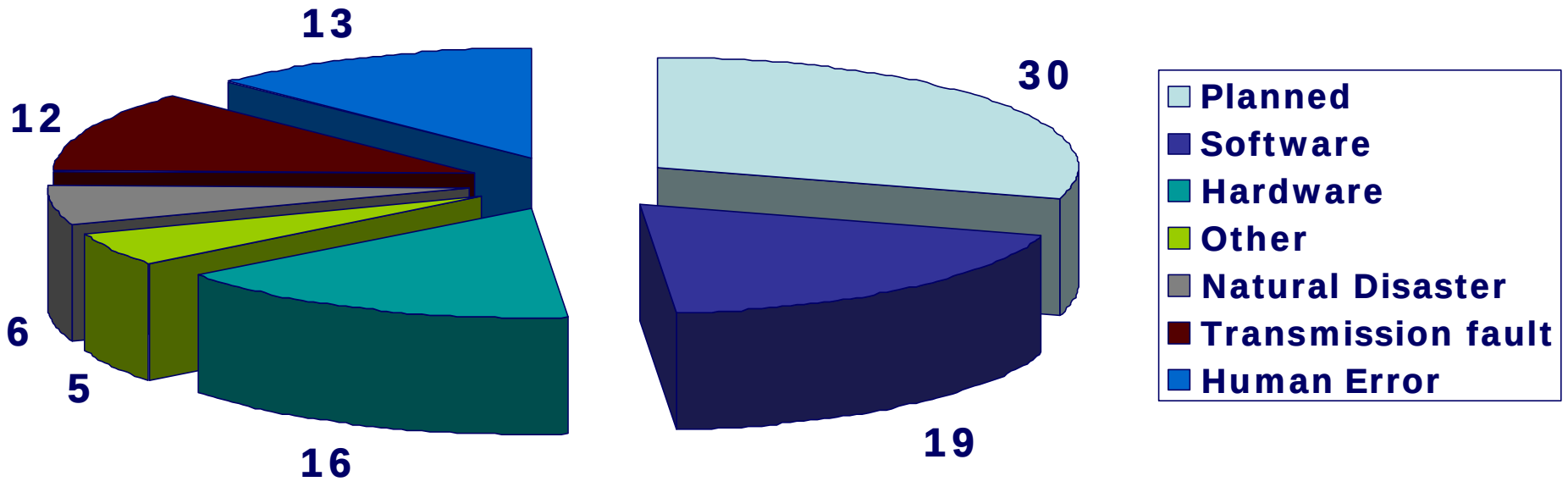
Overall causes of Down Time (Gartner Research 1999/2000)



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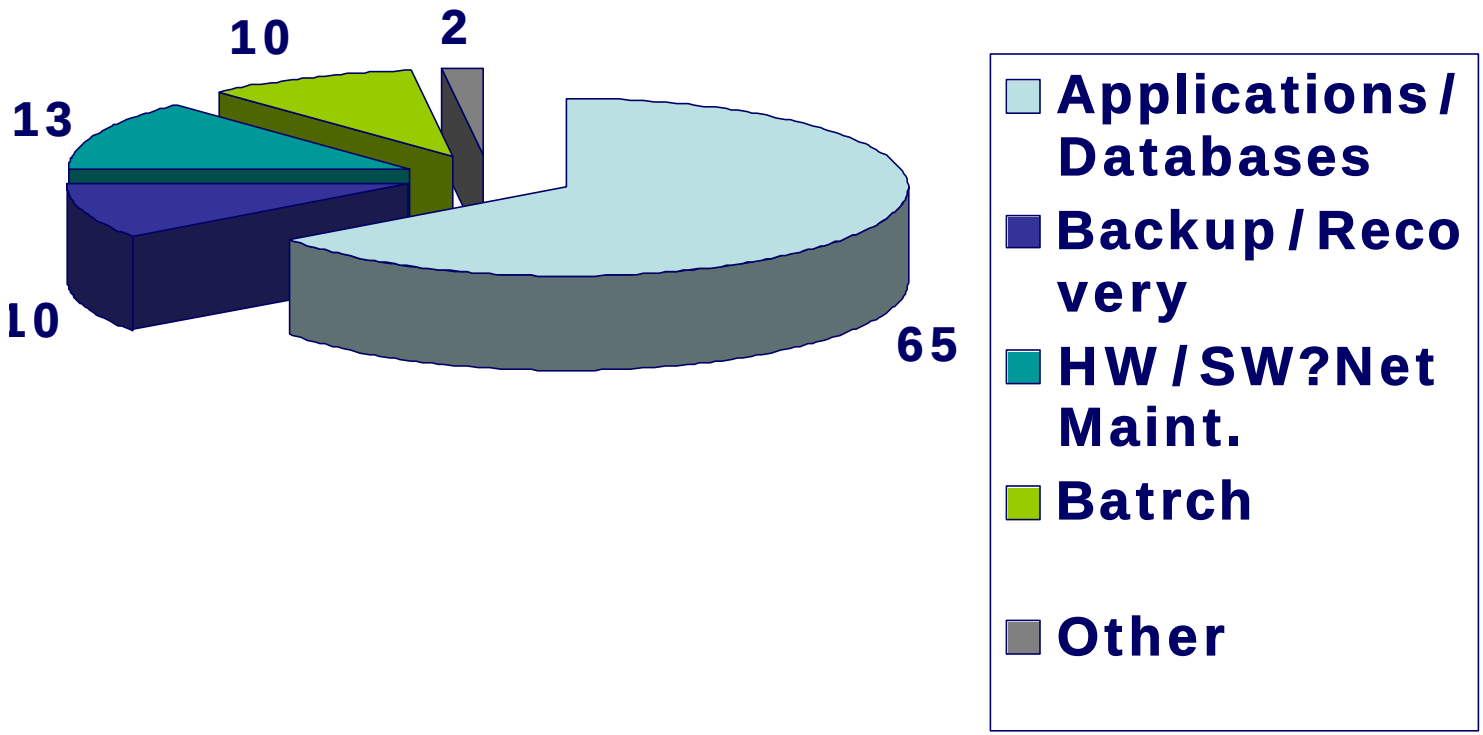
Causes of Down Time – of the 30% Planned downtime (Gartner Research, 1999/2000)



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The EBay Example
Repeated downtime

- From December 1998 to June 1999 the eBay web site was inaccessible for at least 57 hours caused by the following:
  - December 7 Storage software fails (14 hours)
  - December 18 Database server fails (3 hours)
  - March 15 Power outage shuts down ISP
  - May 20 CGI Server fails (7 hours)
  - May 30 Database server fails (3 hours)
  - June 9 New UI goes live; database server fails (6 hours)
  - June 10 Database server fails (22 hours)
  - June 12 New UI and personalization killed
  - June 13-15 Site taken offline for maintenance (2 hours)

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Hurricane Floyd
September 15-19, 1999

Wallace, NC.

- Virginia
  - 43 counties – Franklin obliterated – $148,000,000 lost revenue
  - Structure Impact – 472 destroyed, 2413 significantly damaged, 6054 damaged
- New Jersey - $127,000,000
  - 76.338 residents, 9 counties, 4,000+ businesses
- North Carolina - $6 Billion
  - 66 counties,80% of business in eastern region
- FEMA – thirty-eight disasters so far this year

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Utility Issues and Outages

Washington, MO

- Electrical Power
  - 1949 to 1998: demand grew by 192%, population by 82%
  - Lightning – 20M strikes/yr, in US
- Loss of Telecom - Outages
  - Q1, 1999, 41 outages that lasted for 30+ minutes affecting 30,000+ customers
- Tunnel Flood (5/1992)
  - Dock improvements caused tunnel flooding
  - $1B+ damages/loss/cleanup, 150 of 200 customers on the loop closed

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Practical Lessons in Recent Natural Disaster Situations

VDOT, I 64, evacuate from Virginia Beach

- Hurricane Hugo
  - No Cell Phones for company personnel
- Hurricane Fran
  - IT manager had to dodge power lines
- Hurricane Fran
  - Egress difficult - Interstates became parking lots

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Protecting the Organization

Union, MO – propane Tank explosion

- Recovery isn't just about computers and IT
  - Vital records
  - License/Government documents
  - Insurance assessment
  - Intellectual property
  - Contact information
- Staff Impact
  - "After a disaster, performance decreased from 30 – to 75% for 6 to 12 weeks" – Carol Anderson

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Protecting the Organization Impact on People

Union, MO – propane Tank explosion

- The work force needs to return quickly – Everything hits the bottom line
- Post Crisis Human Factors
  - People need peer support
  - Contact “next of kin” on behalf of staff
  - Shield staff from media – image
  - Plan communications to the Media
  - PTSS
  - Daily updates after a Disaster

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DPRP and BCP – Mechanics in Motion

Often Start with a Risk Assessment

Washed out bridge, Tobaro, NC

- Objectives for Risk Assessment
  - Determine the “business process” and what IT elements support the business
  - Categorize threats to the process
  - Strategize to mitigate and eliminate
- Process
  - Assets and their functions
  - Rate items on a scale or spectrum
  - Look at history – Local, Regional, Company
  - Begin “the plan…”

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Specific Aspect of Risk Assessment
The Business Impact Analysis

- BIA is critical for BCP development
- DPRP is a specific, focused area
- BCP's seven phases are:
  - Project Initiation
  - Functional Requirement
  - Plan Design/Development
  - Implementation
  - Plan Testing and Review
  - Plan maintenance and Updates
  - Execution

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BCP Phases

- Project Initiation
  - State or determine “Objectives”
  - Discuss / Document any Assumptions)
- Functional Requirements
  - Fact finding efforts
  - Internal Interviews
  - Resource identification
- Plan Design/Development
  - Determine plan scope
  - Empower the author
  - Schedule, schedule, schedule … schedule

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BCP Phases

- Implementation (plan creation)
  - Identify top N resources
  - Strategize on alternatives for service and product delivery
- Plan Testing and Review
  - Variety of ways to test / validate a plan
- Plan maintenance and Updates
  - Schedule, schedule, schedule …
- Execution (disaster declaration)

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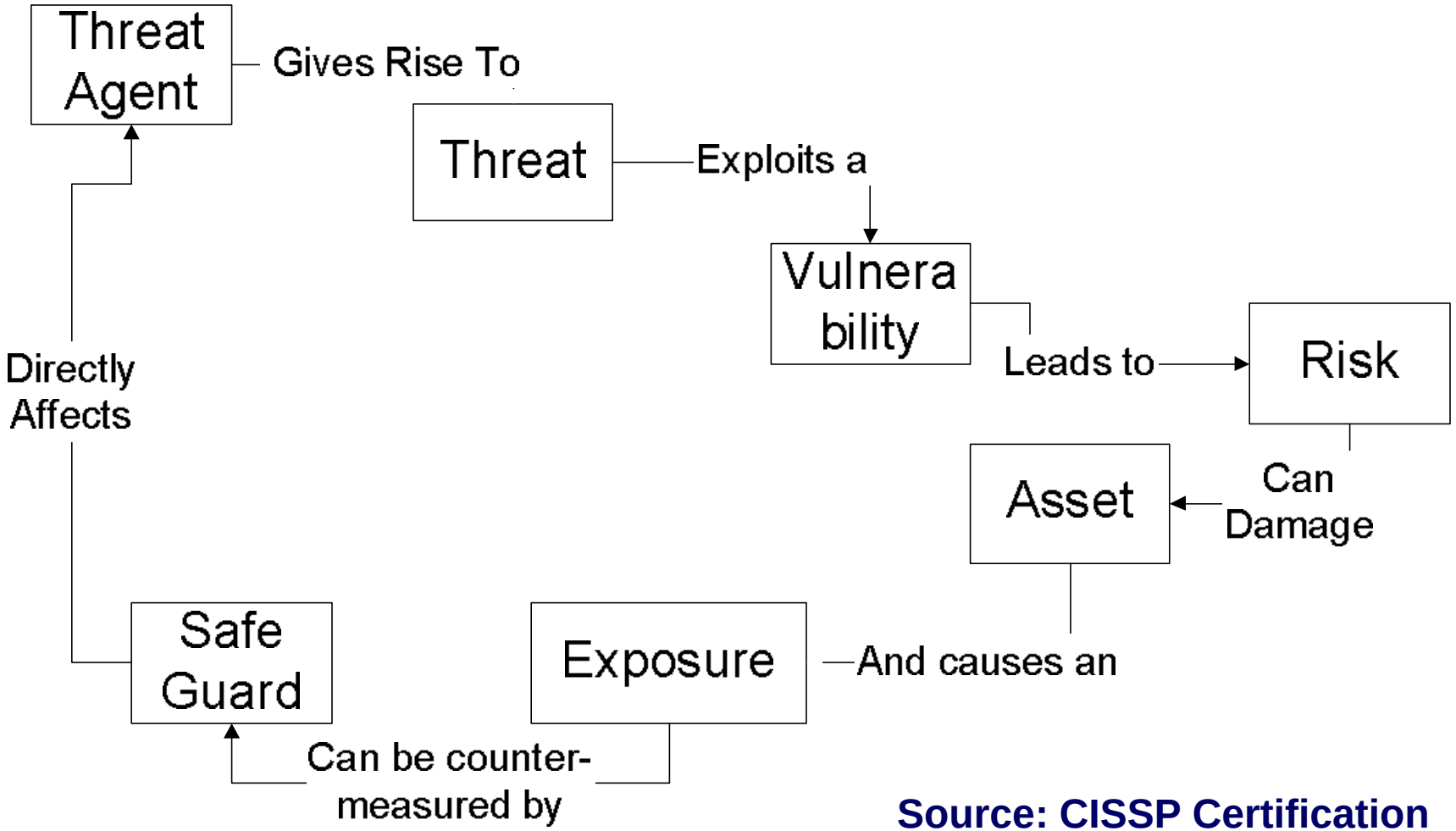
The Threat Continuum

Applying structure and order to risk Analysis

Risk and Threat Analysis Continuum – A Repeatable Analysis Structure



Source: CISSP Certification Guide by Shon Harris

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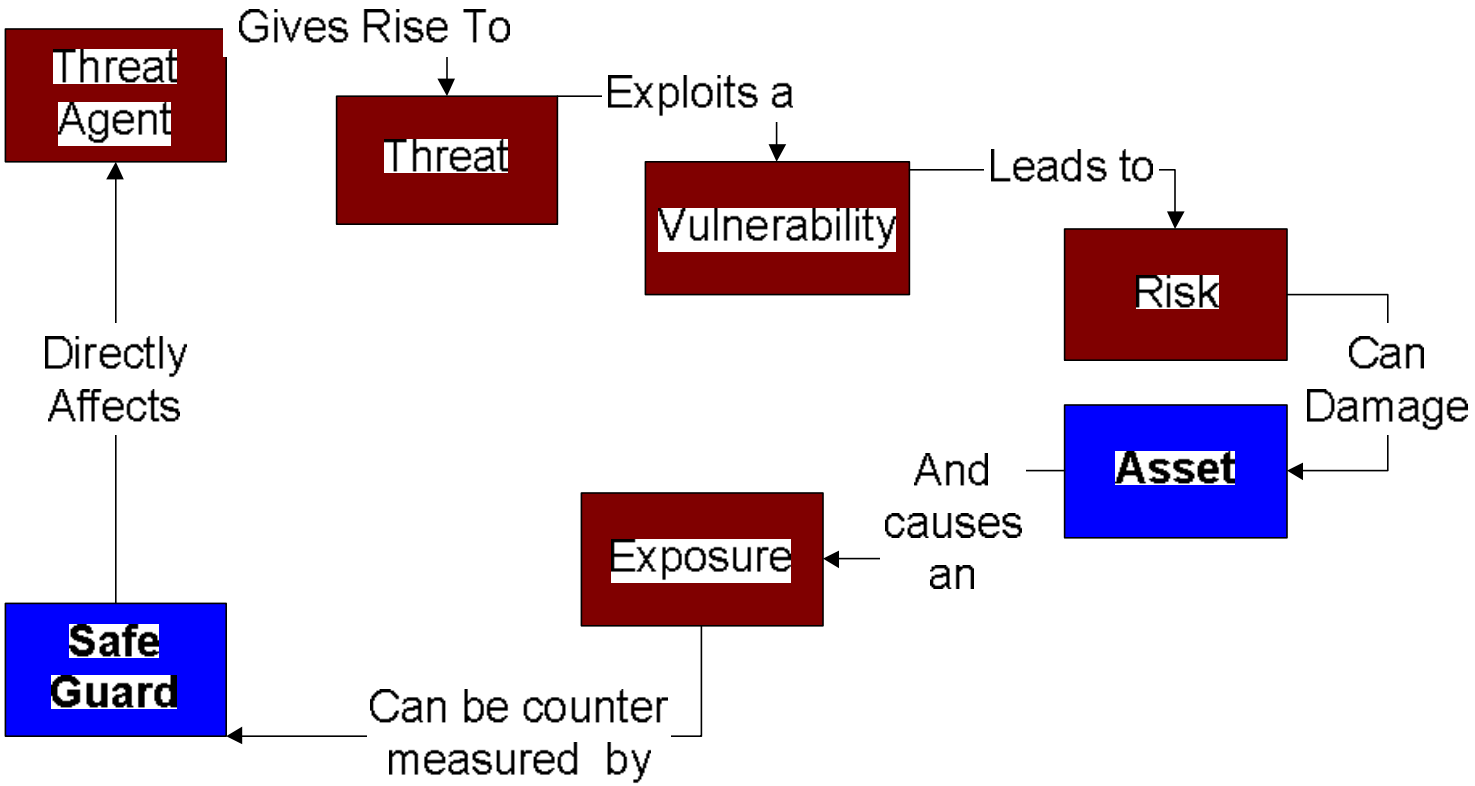
Risk and Threat Analysis Continuum – A Repeatable Analysis Structure



Source: CISSP Certification Guide by Shon Harris

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Using the Threat Continuum

- Can pick up anywhere, so long as the team makes it all the way around
- Brings structure to the risk analysis and information security evaluation process
- Provides answers to many questions:
  - What must be protected and its value?
  - Who/What/When are threats and vulnerabilities?
  - Implications if there is an exposure?
  - What is the cost of mitigation?
  - What are the likely threats, their agents, and the tools needed to respond to them?

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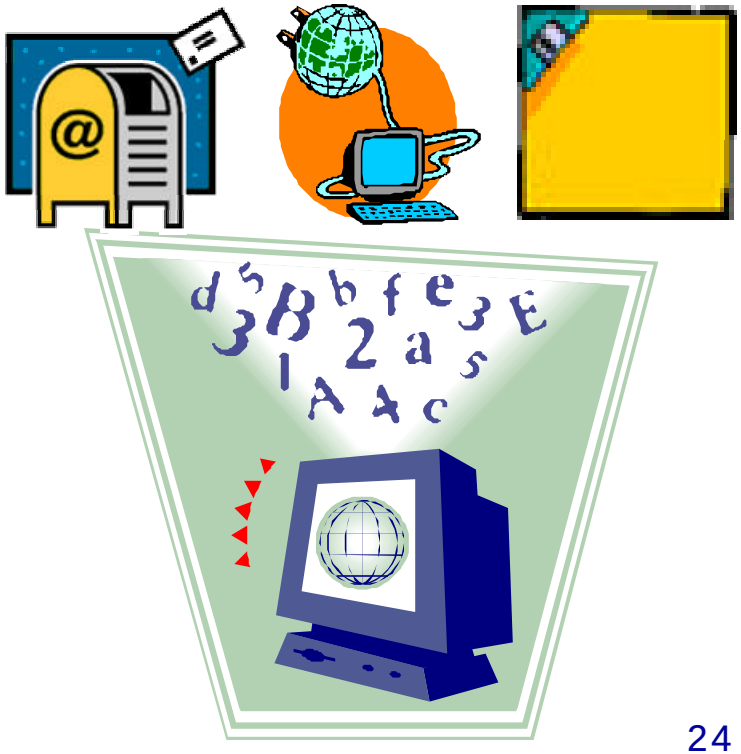
Drill Down: Threat Agents

- *Any* way that a threat can be delivered to your system
- Web, diskette, email, shareware, macros
- Accidental or sabotage
- CIA
  - *How can your messages and data be compromised?*



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Drill Down:
Threat – Vulnerability - Risk

- Threat: Any potential danger to a system
  - Receiving Viruses; Information Theft
- Vulnerability: A weakness in the system
  - Older AV definitions; Information Leakage
- Risk: The loss potential or probability
  - Document archive infected; trade secrets lost
- Ask this question - Where can integrity break down?

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Drill Down: (Information) Assets

- Information owned by the organization
- Information that the organization is responsible for/needs/uses/produces
- Resources
- Organizational image
- CIA
  - How open is your system internally within your company?

Confidential Data
Trade Secrets

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Defining Acceptable Risk Part 1

- Quantitatively – each risk is measured
  - Determine the value of information
  - Estimate potential loss and frequency
  - Analyze threats to the assets
  - Determine ALE
  - Cost of remedial measures
  - Reduce/Assign/ Accept
- CIA
  - Cost of availability?

ALE = AV * EF * ARO

ALE: Annualized Loss Expectancy
AV: Asset Value
EF: Exposure Factor
ARO: Annualized Rate of Occurrence

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Defining Acceptable Risk Part 2

- Qualitatively – each scenario is considered
  - Review risks and apply judgment, intuition, experience about the threats
  - Apply history and intestinal fortitude
  - Write scenarios and determine and match threats, likelihood, safeguards to assets
- CIA
  - How confidential is your information?
  - When has data been unavailable in the past?

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Example Discoveries of a Risk Assessment of a Computer Room

- Over temperature
  - Failure of Primary / Back-Up Air Conditioning Systems
  - UPS keeps CPUs alive while Air Conditioning is off
- Water flow
  - Ruptured water pipes
  - Structural leaks from outside the building
- AC Power Irregularities
  - Over/Under Voltage
  - Spikes, Drops and Black-Outs
- Restricted Air-flow
  - Failure of chassis fans
  - Blockage of Air Conditioning ducts

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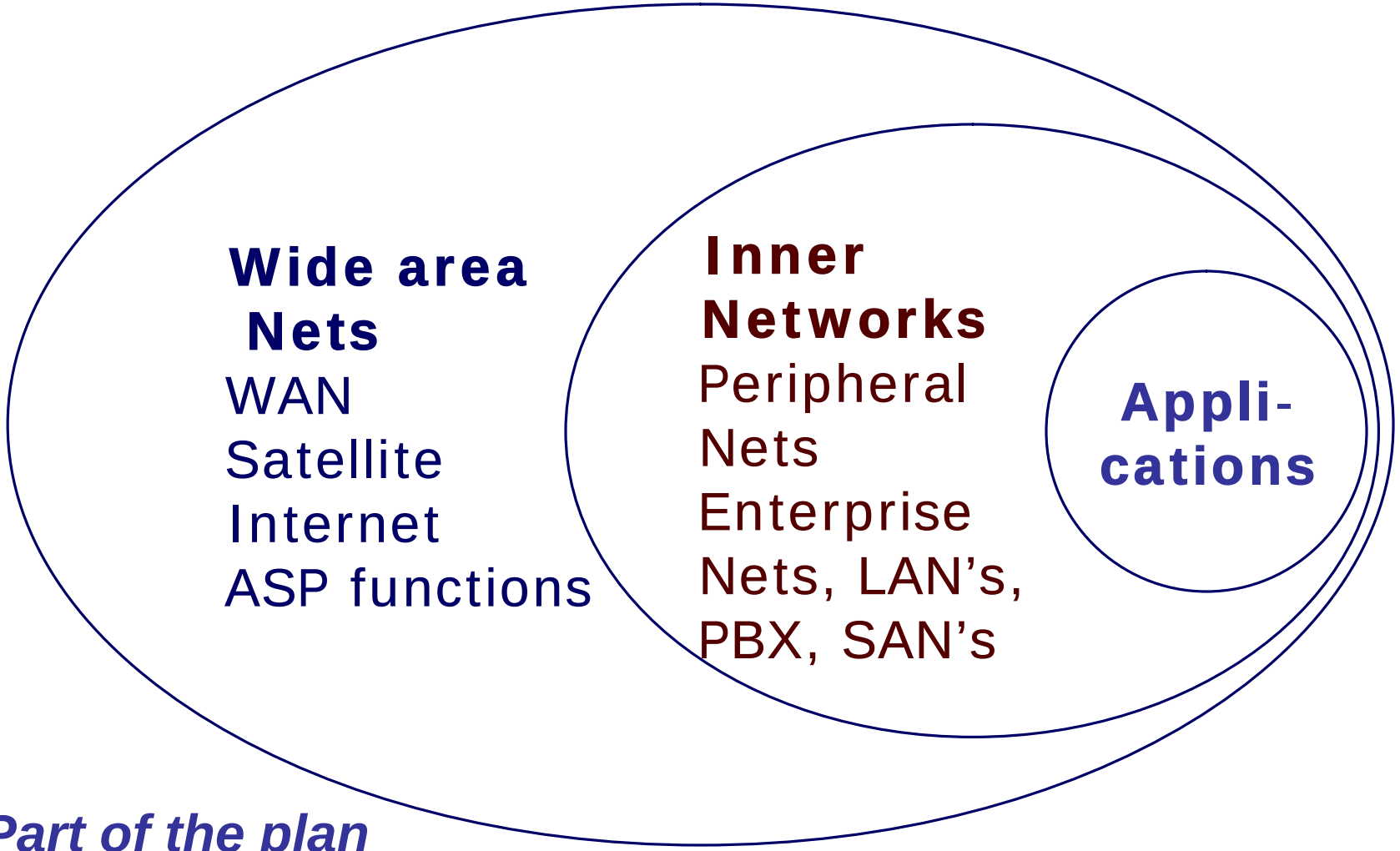
Another Common Approach
Criticality Spectrum Based Analysis



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Classical Risk Analysis
Another approach for RA

- 1 - Identify essential business functions
  - Dollar losses or added expense
  - Contract/legal/regulatory requirements
  - Competitive advantage/market share
  - Interviews, questionnaires, workshops
- 2 - Establish recovery plan parameters
  - Prioritize business functions
- 3 - Gather impact data/Threat analysis
  - Probability of occurrence, source of help
  - Document business functions
  - Define support requirements
  - Document effects of disruption
  - Determine maximum acceptable outage period
  - Create outage scenarios

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Risk Analysis (cont'd)

- 4 - Analyze and summarize
  - Estimate potential losses
    - Destruction/theft of assets
    - Loss of data
    - Theft of information
    - Indirect theft of assets
    - Delayed processing
    - Consider periodicity
  - Combine potential loss & probability
  - Magnitude of risk is the ALE (Annual Loss Expectancy)
  - Guide to security measures and how much to spend

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Information Valuation

Just how valuable is your data?

Vital Records – Identified as Part of a Risk Assessment

- Importance – ensures viability of business operations: essential information
- Characteristics – contains information needed to continue; irreplaceable
- Protect against damage (natural/other)
- Identification – determine organizations mission and then supporting records that would cause great loss if destroyed
- Levels – Vital, Important, Useful
- Offsite storage a must
- Must review and maintain over time

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Information Valuation

- Information has cost/value
  - Acquire/develop/maintain
  - Owner/Custodian/User/Adversary
- Do a cost/value estimate for
  - Cost/benefit analysis
  - Integrate security in systems
  - Avoid penalties
  - Preserve proprietary information
  - Business continuity
- Circumstances effect valuation timing
  - Relevance increases or decreases over time

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Information Valuation (2)

- Ethical obligation to use justifiable tools/techniques
- Determine Confidentiality
  - Private – must not be disclosed
  - Confidential – may be disclosed under agreement
  - Personal – specific to an individual, will not hurt the organization if disclosed
  - Public – may be vegan out at will

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DPRP Plan Mechanics

The steps involved in developing a DRP

Building A Disaster Preparedness and Recovery PLAN

Los Alamos Fire

- The main sections of a DPRP include:
  - Executive overview
  - Contingency planning
    - Introduction and overview
    - Decision to implement
    - Checklists and asset identification
    - Timed recovery
  - Communications sub plans
  - Plan testing and maintenance schedule
  - Alternate site requirements

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Executive Overview Section

Loveland, CO fire

- Organization Overview
  - Products, Processes, People
- Preliminary Planning Section
  - Purpose/Rationale
  - Objectives o/t Plan
  - Scope
  - Assumptions and exclusions (w/reasons!)
- Day to Day Contacts and Calling Tree
- Best / Worst case scenarios with likely threats based on geography
- Committees and Appointments

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Decision to Implement Criteria in the Executive Summary Section

Loveland, CO fire

- What are “the windows?” that affect the DtI?
  - Egress – how long to get out of Dodge?
  - Backup – how long to get enough on tape?
  - Recovery – how long before the data is usable?
- Who decides?
  - Committee & Alternates
  - Officers & Principals
  - State/Federal Advisories have impact

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Contingency Planning Section – Detailed Steps and Processes

Loveland, CO fire

- Very organization specific process when developed
  - Identify the line of business applications or the mission of the organization – what they do
  - Avoid what they *don't* do
  - Identify the technologies they depend upon
  - Determine the minimum number and systems that need to "survive"
  - Identify the "manufacturing process"
- Organizations overall strategy

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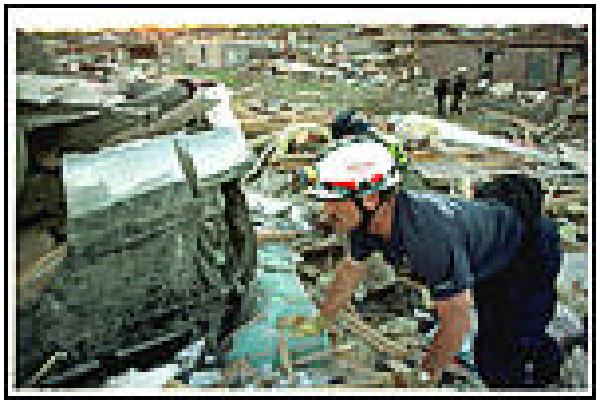
Check Lists: Developed Along the Way



Oklahoma tornado

- Roles and Responsibilities
  - Who does What When
  - Chain of Command
- Detailed activity items
  - “Pre-covery” tasks (risks and mitigations)
  - Plan implementation tasks
  - Recovery Issues
  - Personnel identification, notification
  - Locations
  - PR Communications

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Example Checklist: PR Communications Tasks

Flood, Water Main
Miami, FL

- Prior to a disaster, draft these documents
  - Public Relations Policy
  - "Window" information (Backup, Egress)
  - Key Personnel identifiers (#'s, titles,...)
  - Media liaison – spokesperson & script
  - Identify media outlets and PoC's

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Example Checklist: IT Backup and Recovery

- Identify top N mission critical systems during the planning phase and provide for recovery
  - Ensure backups are proceeding
  - Test backups through mock recovery
  - Determine time to recover and time to data
  - Determine target hardware suite
  - Plan for spares
  - Seek alternatives to tape wherever possible (mirroring offsite, database replication, domain controller replication, etc).

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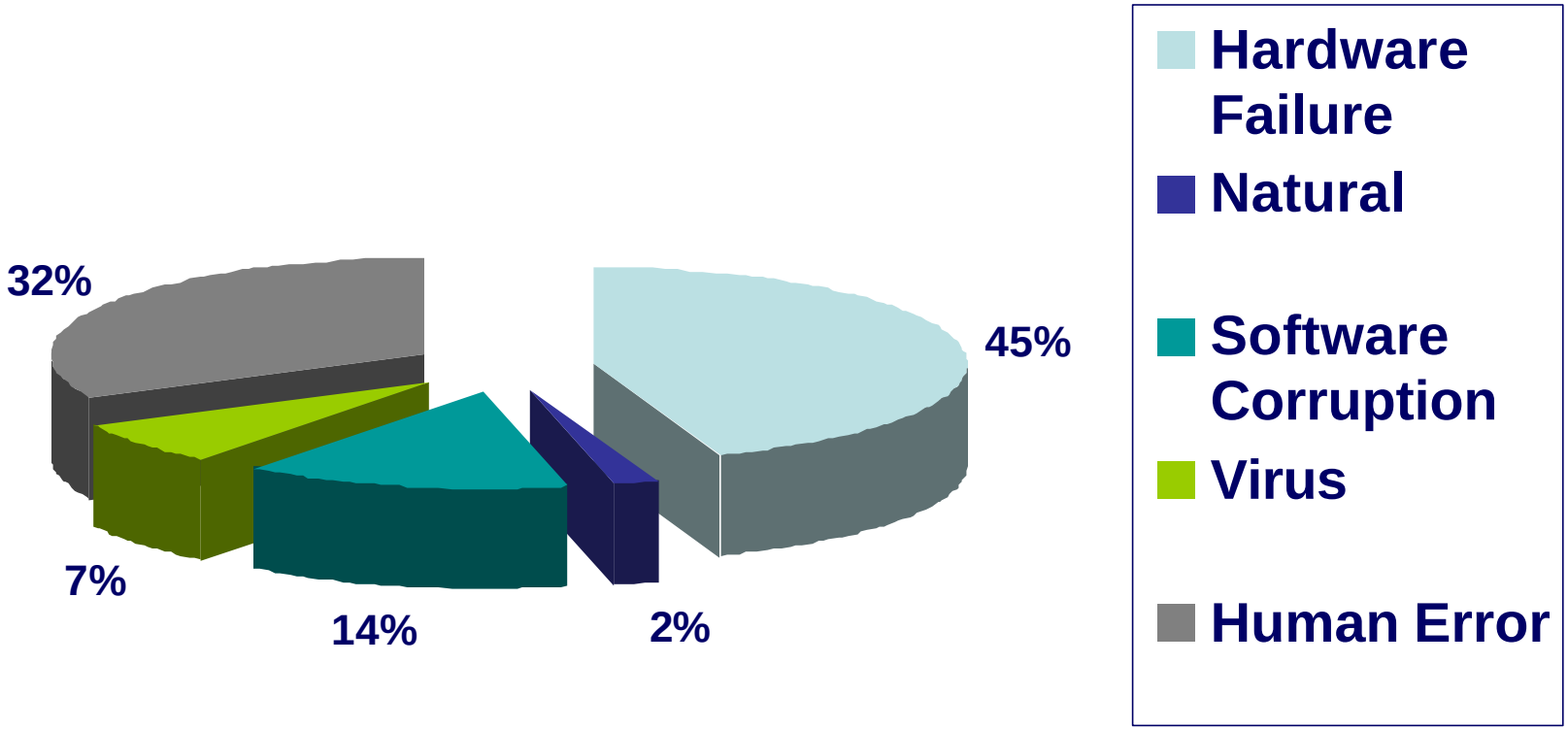
Causes of Data Loss (Ontrack, 2000)



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Data Recovery Section and Procedures Section

Grain Elevator, Kansas

- Planning is much more than "just the backups"
  - Initial system images and install base
  - Perform routine daily backups
  - Test, test, test, revise, test …
- Data must be analyzed and classified in order to insure priority appropriate
- Backup procedures must be verified and validated
- Catalog of necessary HW / SW

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Strategies and Issues Relating to Backup and Recovery

Los Alamos Fire

- Two important terms
  - Time to data
  - Backup window
- Centralized – what will it take to recover?
- Decentralized – tape management issues arise
- End User Issues
  - Application deployment

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- Variety of hardware in IT and in field

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Backup Strategy: These May Change Over Time

Owensboro, KY, Destroyed Apartments

- Server image
- Snapshot/versioning
- Full volume (offline)
- Full volume with open files support
- Incremental, differential
- Application specific procedures (RDBMS)
- Parallel tape drives
- RAID based tape drives

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Timed Recovery Topics and Issues

Rock Creel, AL
Tornado '98

- What are the SLA's?
  - To customers and partners
  - From vendors and suppliers
- Common Guidance
  - 0 to 6 hrs – absolutely mission critical – dependency services, base services
  - 6 to 24 hrs – Line of Business systems
  - 24 to 48 hrs – Important systems
  - 48+ - product and service delivery resumes

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Emergency Decision Making

- Emergency management planning
  - Evacuation, recovery, relocation, re-entry – plan for these event
- Timelines and flowcharts
  - Sequence of events
  - Interrelationship and dependencies
  - Workable medium – a planned to guide decision-making activity without dictating

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Emergency Decision Making - Plan Processes

- Disaster declaration
- Emergency action processes
- Notification processes
- Systems recovery
- Network recovery
- User recovery
- Salvage operations

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Disaster Recovery Roles and Teams Involved

- Off Site Storage – media/documentation
- Software – testing, programming
- Applications – restore/verify custom apps
- Emergency Ops – Alternate site staff
- Network Recovery – LAN / WAN
- Transport – moving media

- Example Teams
  - Initial Response
  - Computer Operations
  - Technical Support
  - Application Support
  - RDBMS Support
  - Network (LAN and WAN) Support
  - Administrative and Operations

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Emergency Decision Making - Post Disaster

- Salvage – who, what, when, prioritize
  - Hardware, Software, Vital Records
  - Photograph for insurance purposes
- Relocation
  - Where are we going? Command posts?
- Transition
  - From emergency mode service level to normal service level

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Emergency Decision Making – Staffing

- Residence
  - Who is vulnerable to a disaster?
  - Who can be allowed in post a disaster?
- Notification Directory
  - ALL contact information!
  - List as a tree and keep updates!
- Protocols – People invested – the stakeholders - in business need to prioritize!

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DPRP Plan Testing Methodologies

- Checklist (minimal sanity check)
- Structured walk through
- Simulation test
- Parallel test (most common)
- Full Interruption (highest risk)

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Auditing a plan
What to look for

Hurricane Irene

- Full planning rational
  - Threat Overview business impact
- Disaster prevention and mitigation
  - Strategies to respond for interruptions
- Necessary business artifacts
  - Supplier and customer information
- IT management
  - backups,off site storage, vaulting.

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In summary – the Eight R's

- Reason for Planning
- Recognition
- Reaction
- Recovery
- Restoration
- Return to Normal
- Rest and Relax
- Re-evaluate and Re-Document

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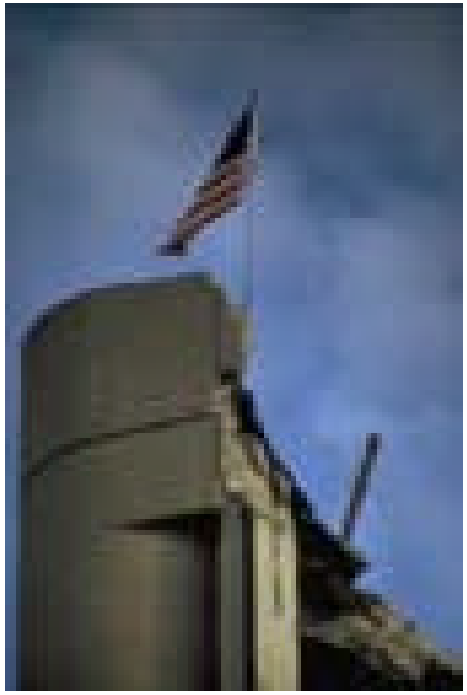
How may Compass help?



Old Glory Still Stands in Oklahoma City

- Technical Assessments
- IT DPRP development
- DRP BCP development
- Plan Testing
- Plan Assessment
- By taking on part of the work, we can help ensure the project is completed hand in hand with your own staff.

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How can Technology Help?

- Backup and Restore
  - Testing / Validation
- Redundancy
  - Drives, Servers, Directories, Databases
  - Domain controllers
- Terminal Services / MetaFrame
  - Allows server based computing on low end clients
- UPS – power *and* line conditioning
- Backup WAN lines

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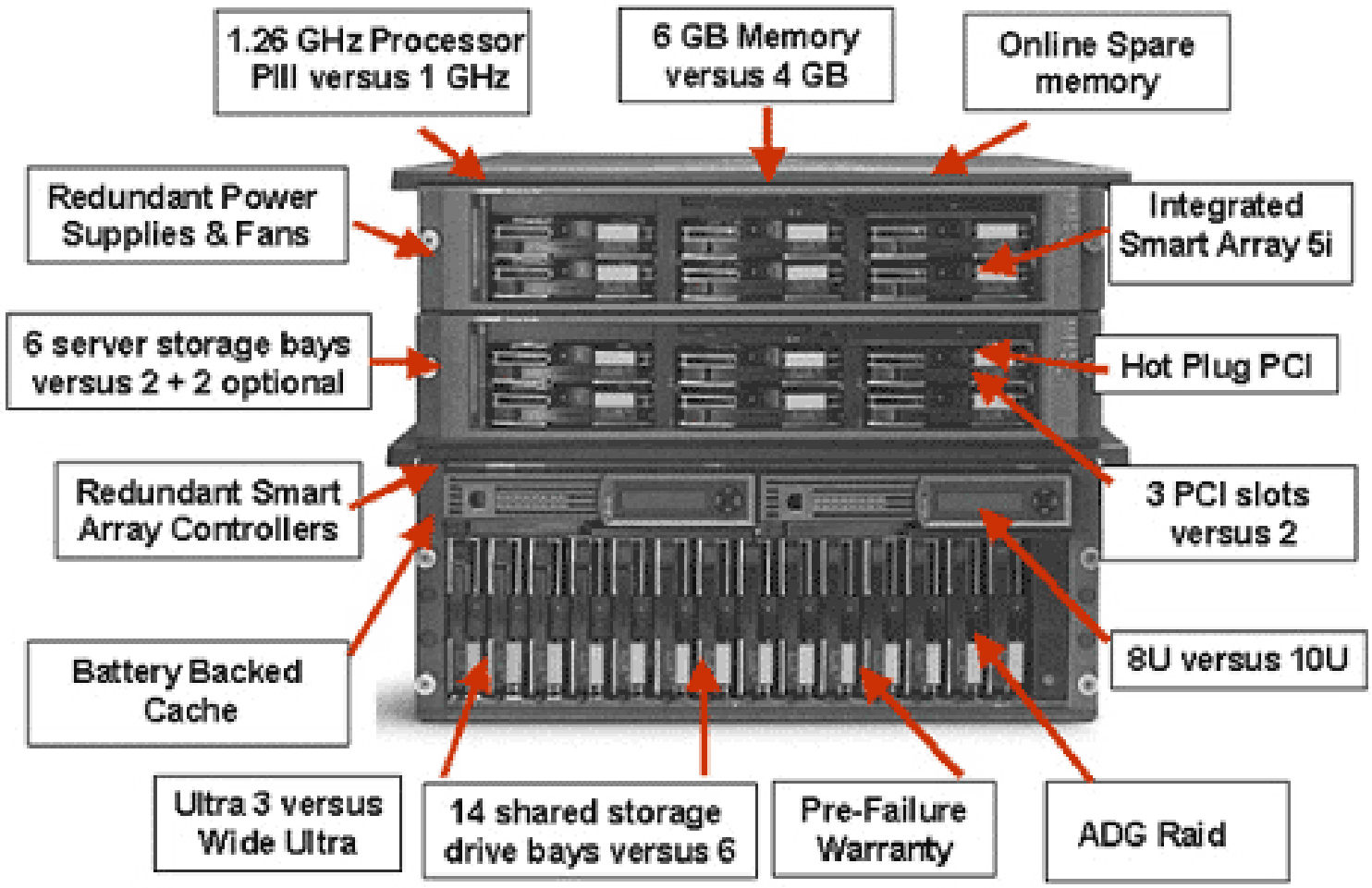
Compaq Cluster in a Box – Failover and Fault Tolerance in a package.



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Hardware Clustering example (6/2002 MSRP data)

- Example Cluster
- MSRP Base: 14K.
- MSRP – Minimal system, fully fault tolerant:
  - Mirrored OS drives
  - RAID 5, 5 Drives
  - Power and Fans
  - Tape backup
  - $25,000
- Win2K/Advanced Server/0 CAL
  - MSRP: 2500 (cdw.com)
  - NPO: 500 (cdw.com)

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RAID Storage Strategies

- RAID Explained
  - RAID 0: RAID Stripe
  - RAID 1: Mirroring
  - RAID 5: Stripe Set with Parity
  - RAID 5 ADG: Compaq specific RAID 5 with Advanced Data Guarding (Like HP R5DP)
  - RAID 0+1 – Striped Mirror
  - RAID 1+0 - Mirrored Stripe
- 10 types, 5 in common use today
- Implemented with a disk controller or through O.S. level support.

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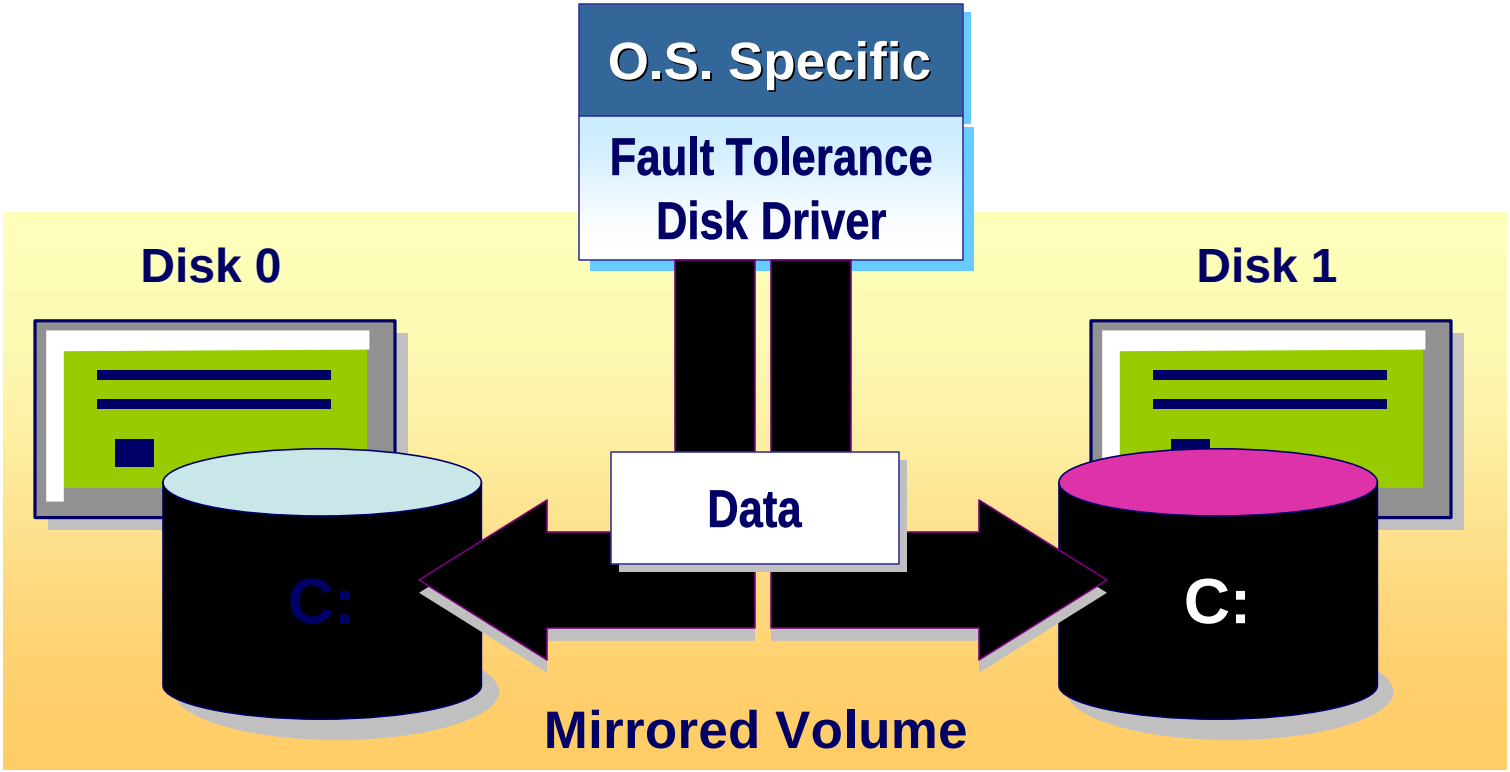
Mirrored Volumes (RAID 1)

Mirrored volumes use an operating specific driver to simultaneously write data to two volumes on two physical disks

Special boot floppies are used to boot the OS (WinNT/2000)



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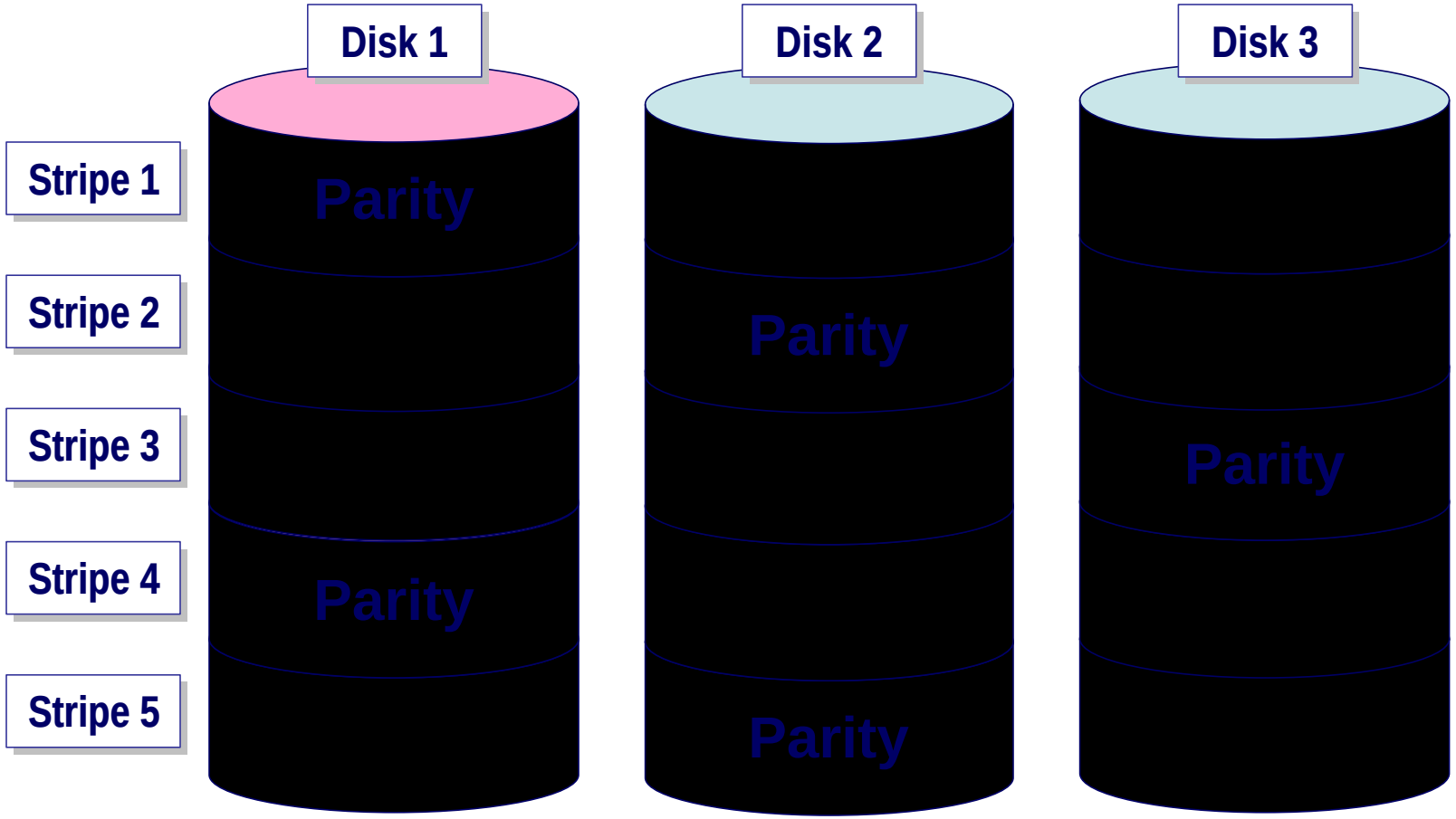
Standard RAID-5 Volumes



Under Windows,NT/2000 this pattern continues in 64 KB data chunks …

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RAID Usage

- Disk Mirroring
  - Performs best for linear writes (RDBMS Logs)
  - f50% of disk is usable
  - Supportable for NT/2000 boot volumes
- Disk Striping
  - Ideal for read intensive operations
  - Not supported in software for NT/2000 boot
  - (N-1)*Size usable disk space
  - Research shows 6 or 7 disks appears optimum
- Either
  - Use the SAME disk type!
  - Online changes require high end controllers

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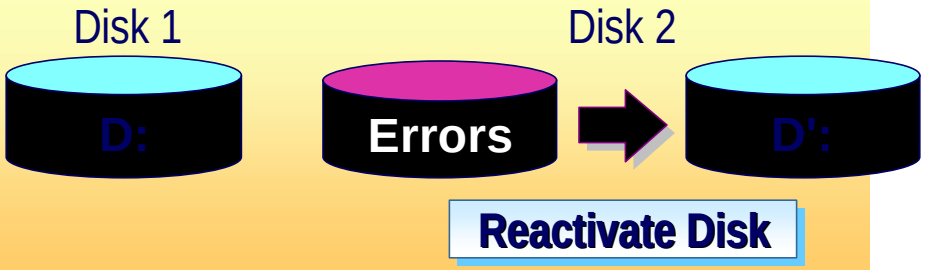
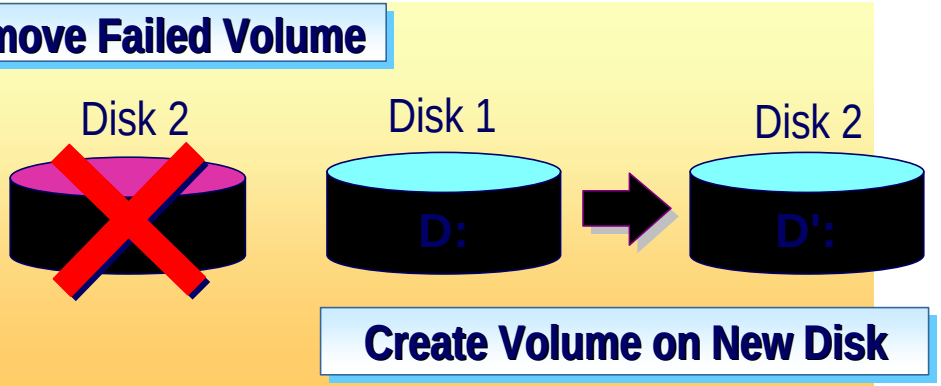
RAID 1 Recovery: Recovering a Failed Mirrored Volume

- Recover a disk identified as **Online (Errors), Offline, or Missing**



- Replace the failed disk and create a new mirrored volume



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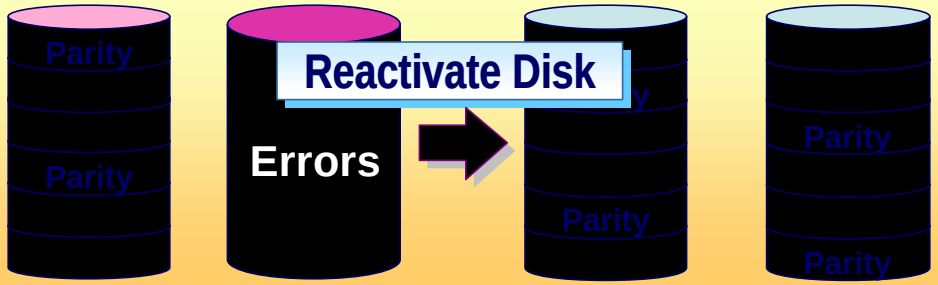
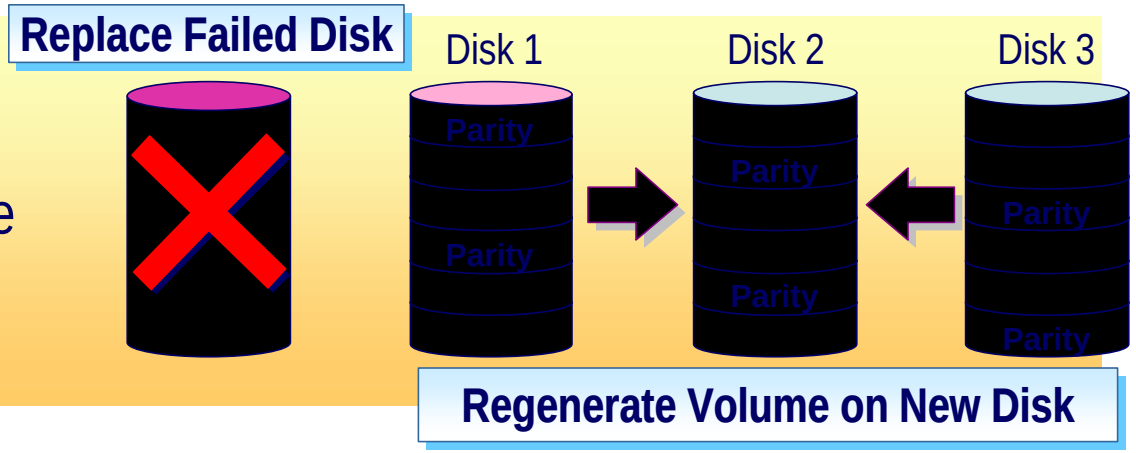
Recovering a Failed RAID-5 Volume

- Recover a disk identified as **Online (Errors)** **Offline, Missing**



- Replace the failed disk and regenerate the RAID-5 volume



(MOC 2252)

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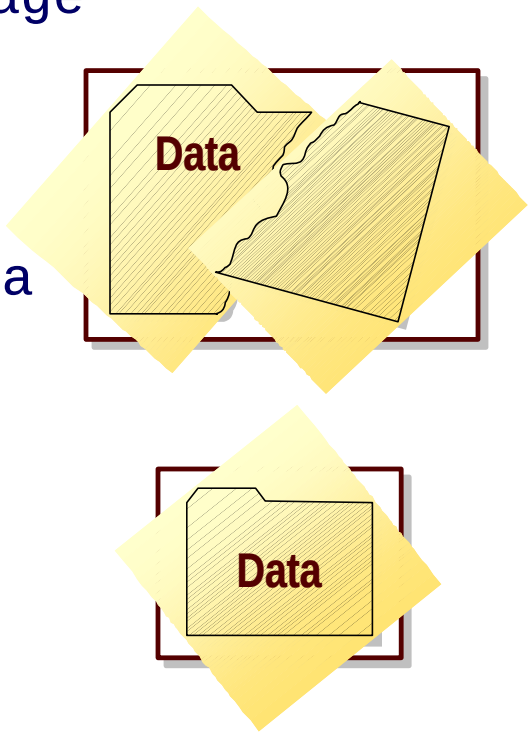
Overview of Data Backup and Restoration

- The normal flow of events:
  - Backup data overnight or during low usage times
  - A user or some other thread destroys/damaged data
  - Use the B/R software to recover the data
- The Goal of Backing Up Data Is to Restore Data If It Is Lost
- Permissions and User Rights Are Required to Back Up and Restore Data



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Industry Standard Backup Terms

- Normal
  - Copies selected files, folders; clears archive bit
- Differential
  - Files/Folders that have changed since last backup; doesn't clear archive bit
- Incremental
  - Files/Folders that have changed since last backup; clears archive bit
- Copy
  - Just that; doesn't clear archive bit
- Daily
  - What changed today; doesn't clear archive bit

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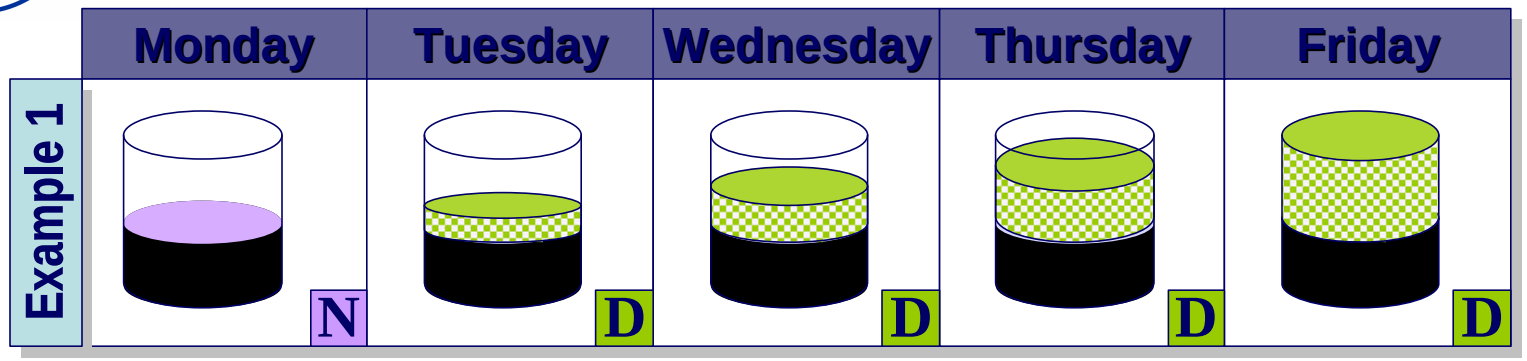
Example Backup Schedules



Here, a full backup is performed on Monday, A Differential each night. This allows recovery of the Previous days work by restoring the Monday full backup and the differential from the previous night.

N Normal (Clears Markers)	D Differential	I Incremental (Clears Markers)	C Copy

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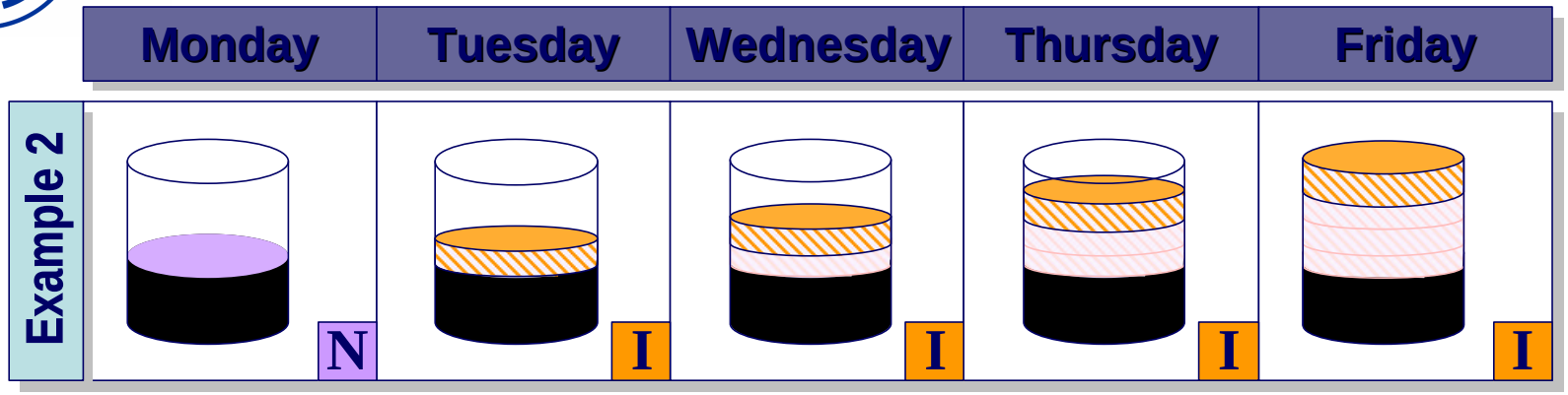
Example Backup Schedules



Here, a full backup is performed on Monday. An incremental backup is performed each night. Recovery requires that you restore the full backup, and the incremental in order of generation.

N Normal (Clears Markers)	D Differential	I Incremental (Clears Markers)	C Copy

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Tape Backup Alternatives

- Nearline Mirroring
  - Mirror the HD and remove it
  - Usually requires a reboot, format, and disk import or remount
  - 60 GB ~$100.00 + chassis
- DVD Rewriteable
  - ***Max*** speeds of ~ 5.8GB/Hr
  - Capacity: 4.7 GB
  - Costs: Media $4.00 Drives ~350 (Pioneer)
- CD Rewriteable
  - Single system only – no jukeboxes or autoloaders available

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OS/Software Notes

- WinNT backup – won't capture open files
- Win2K – Require SP2 for to actually work
- Commercial – Backup Exec, NetBackup, ArcServIT and its agents
  - Windows – Generally, agents are required to capture open files and are specialized
  - Tracks backup in a database that requires periodic maintenance
- RDBMS – Generally provide their own B/R
- Linux – CPIO, TAR, DD, Bru, ...
  - Be aware of link handling and file ownership

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RAID Assist Hardware
Promise Technology (IDE Disk)

- TX2000 ($100)
  - ATA 133
  - RAID 0,1,0+1
  - Handles 4 drives
  - O.S. independent
  - < $100.00 street

- SX6000 ($260)
  - ATA 100
  - RAID 0,1,3,5
  - Cacheable
  - Handles 6 drives
  - 3 Hot Swap Chassis

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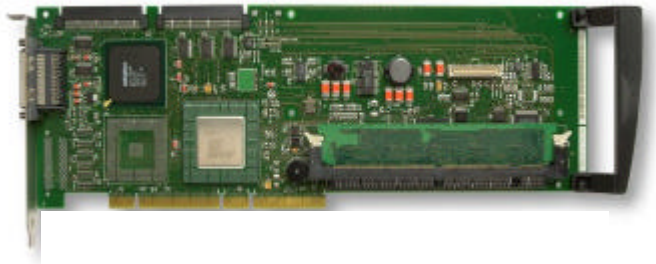
RAID Assist Hardware – Adaptec SCSI

- 3210S ($650)
  - 2x15 drive channel
  - Ultra 160
  - 32 MB cache
  - RAID 0,1,0/1,5
- 5400S ($1300)
  - 4 Channel
  - Online Expansion
  - 4x15 drive channel
  - 128 MB cache



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RAID Assist Hardware
Storage Area Networks
Compaq StorageWorks

- MSA1000 – Entry level Fiber Channel SAN
  - 2GB Fibre Channel I/O
  - 14 36 GB drives (max)
  - Redundant HBA in two servers
  - SAN Switch Fabric
  - $42,000

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Backup Solutions
Quantum ATL 200

- DLT tape
  - Single Drive – variety of tape formats
  - 6 cartridge magazine
  - 8 Internal tape slots
  - SCSI Interface
  - Rack mount kit: $230
- Examples:
  - DLT 4000 640 GB capacity at 10.8 GB/Hr: $2200
  - Super DLTape w/1.8 TB capacity 79.2 GB/Hr: $5500.
- Media Costs – budget for it!

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Backup Offerings
Compaq SSL2020 DLT Library

- AIT/DLT Tape
  - Backup rate of 40 GB/Hr
  - 19 Cassettes/magazine
  - Single/Dual drive
  - PEP $10,200 (dual)
  - Software must support the TBU autoloader (normally separate)
- Did I mention budgeting for media costs???

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Storage Summary

- RAID 1 – use for disk mirroring
- RAID 5 – use for disk striping with parity
- Promise – Inexpensive IDE support controllers
- Tape backup – autoloaders are getting cheaper and have greater capacity
- OH – budget for tapes …

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