



Storage Strategies Backup Options Disaster Preparedness and Disaster Recovery

ICCM 2002 Tech2

Saturday: 1:30

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Today's Objectives

- Front load –
 - Discuss some ICCM Specific topics
 - RAID, Storage, Backup
- 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



Oklahoma City, '95

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



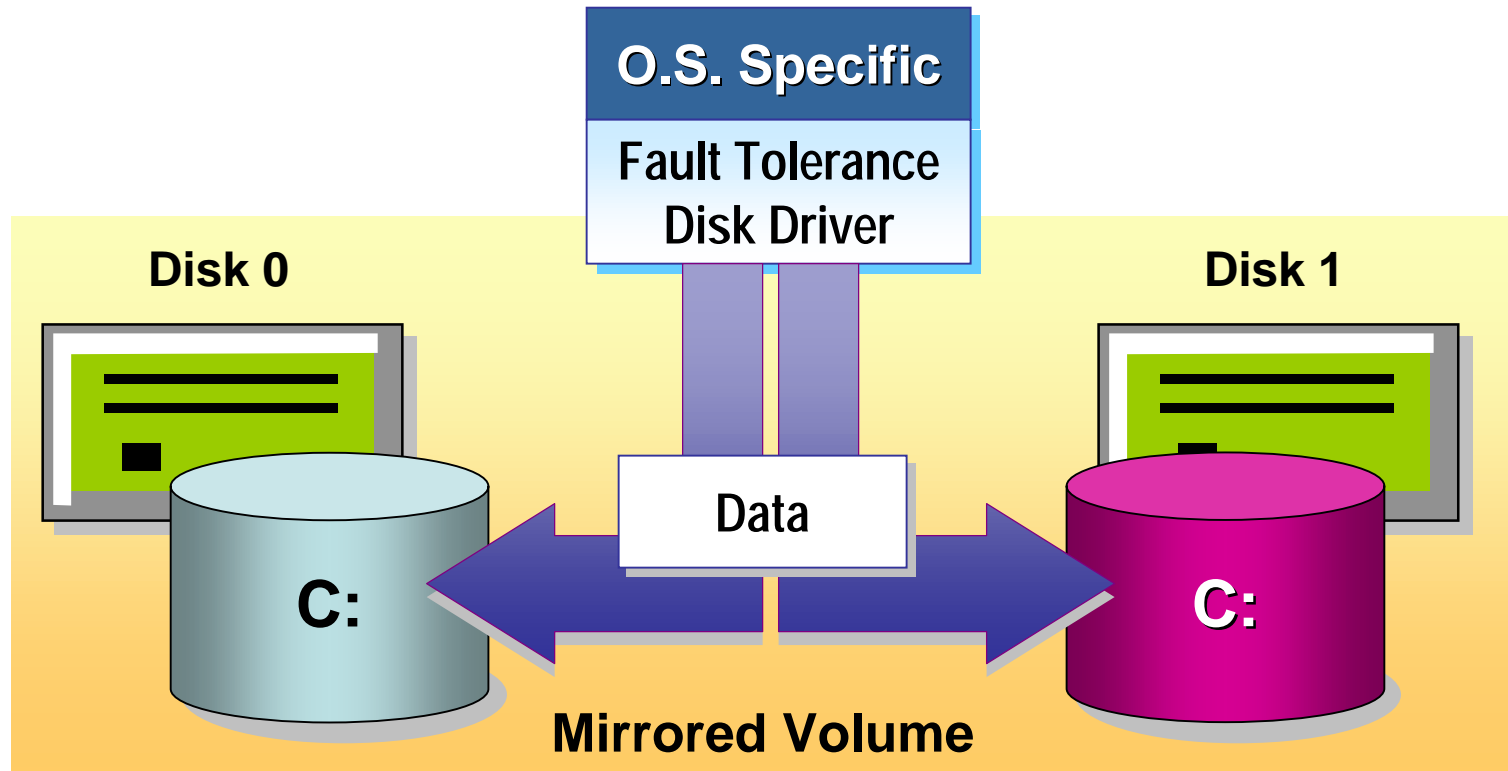
RAID Storage Strategies

- 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.

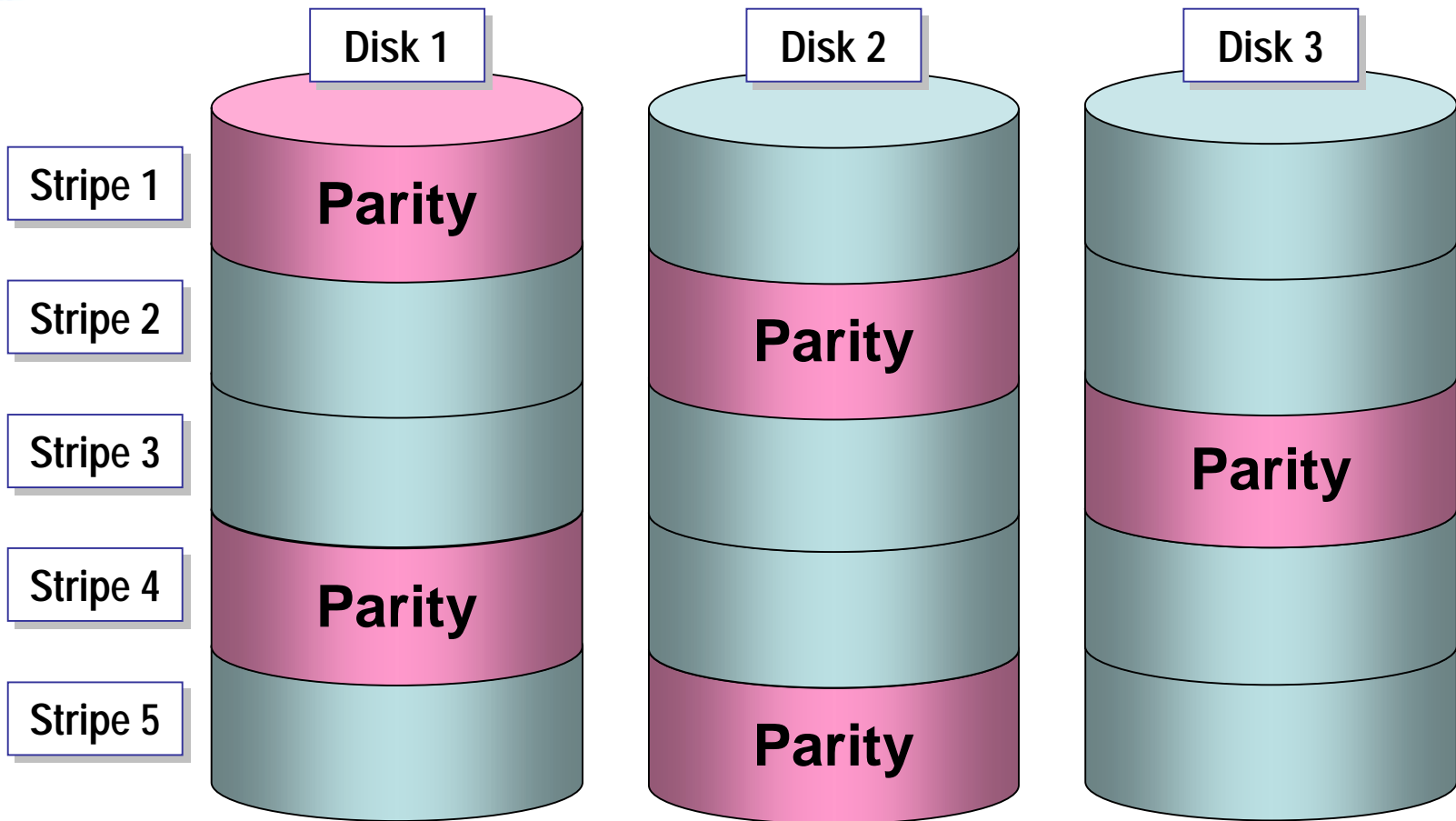
Mirrored Volumes (RAID 1)

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)



Standard RAID-5 Volumes



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

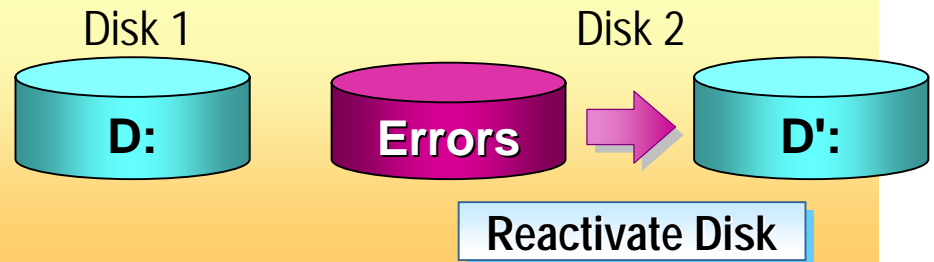


RAID Usage

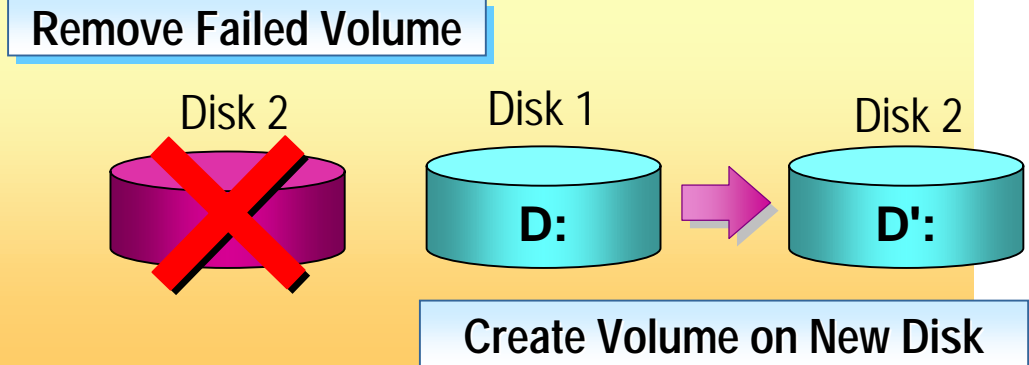
- Disk Mirroring
 - Performs best for linear writes (RDBMS Logs)
 - 50% of disk is usable
 - Supportable for NT/2000 boot volumes
- Disk Striping
 - Ideal for read intensive operations
 - Not supported in software for NT/2000 boot
 - $(N-1) * \text{Size}$ usable disk space
 - Research shows 6 or 7 disks appears optimum
- Either
 - Use the SAME disk type!
 - Online changes require high end controllers

RAID 1 Recovery: Recovering a Failed Mirrored Volume

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

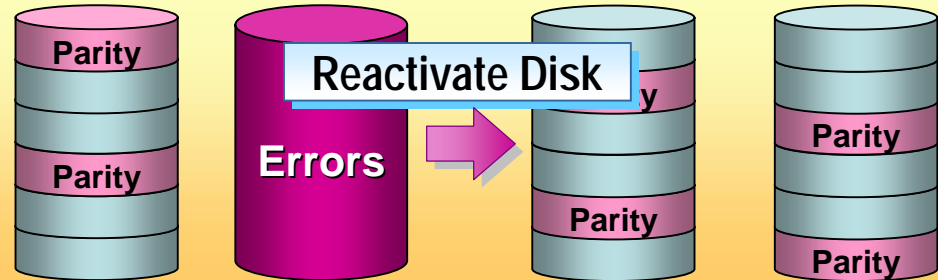


- Replace the failed disk and create a new mirrored volume



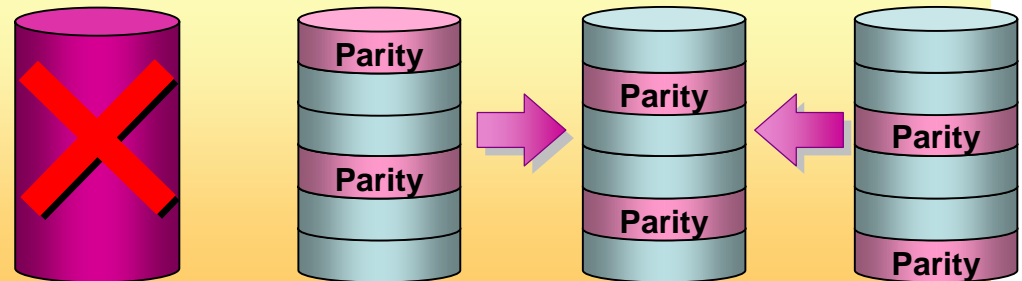
Recovering a Failed RAID-5 Volume

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



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

Replace Failed Disk

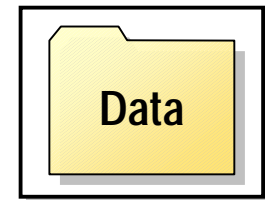
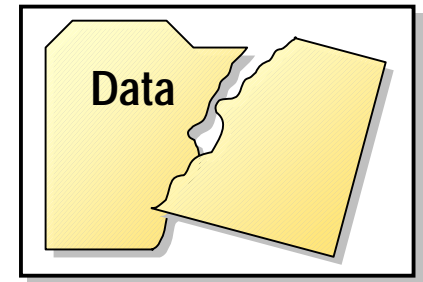


Regenerate Volume on New Disk



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

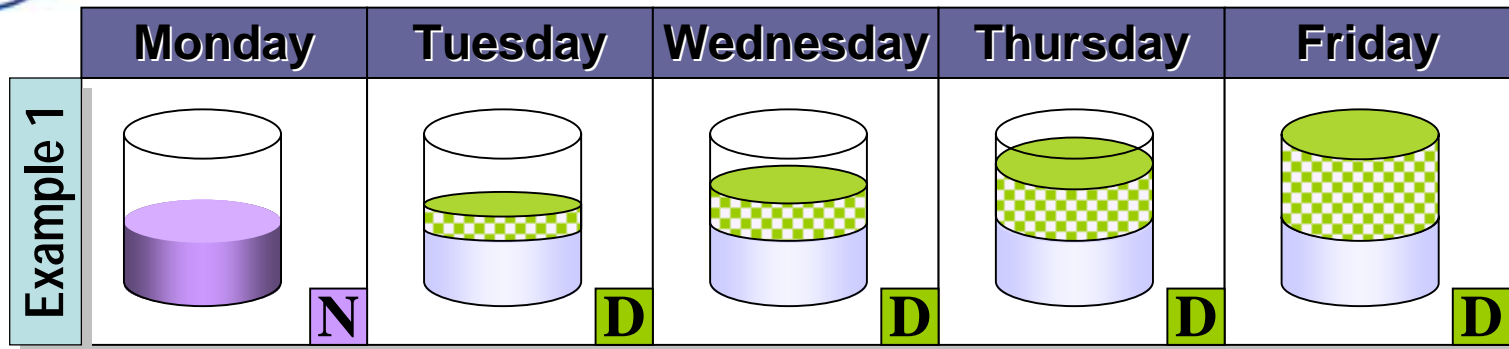




Industry Standard Backup Terms

- 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

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.

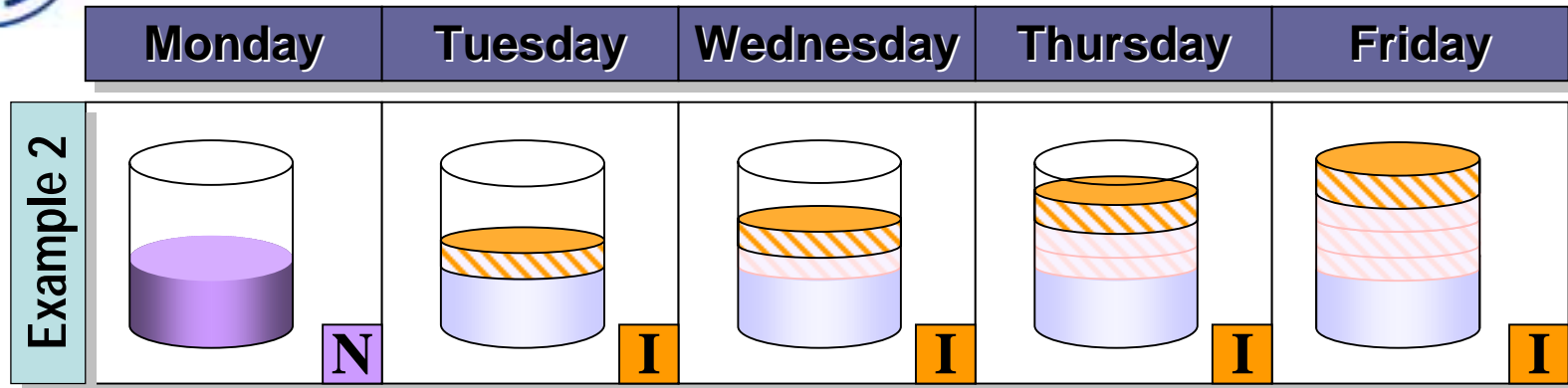
N Normal (Clears Markers)

D Differential

I Incremental (Clears Markers)

C Copy

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



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



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



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





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





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





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!





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???





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 ...



DRP and BCP Planning

- 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



Oklahoma City, '95

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... ”

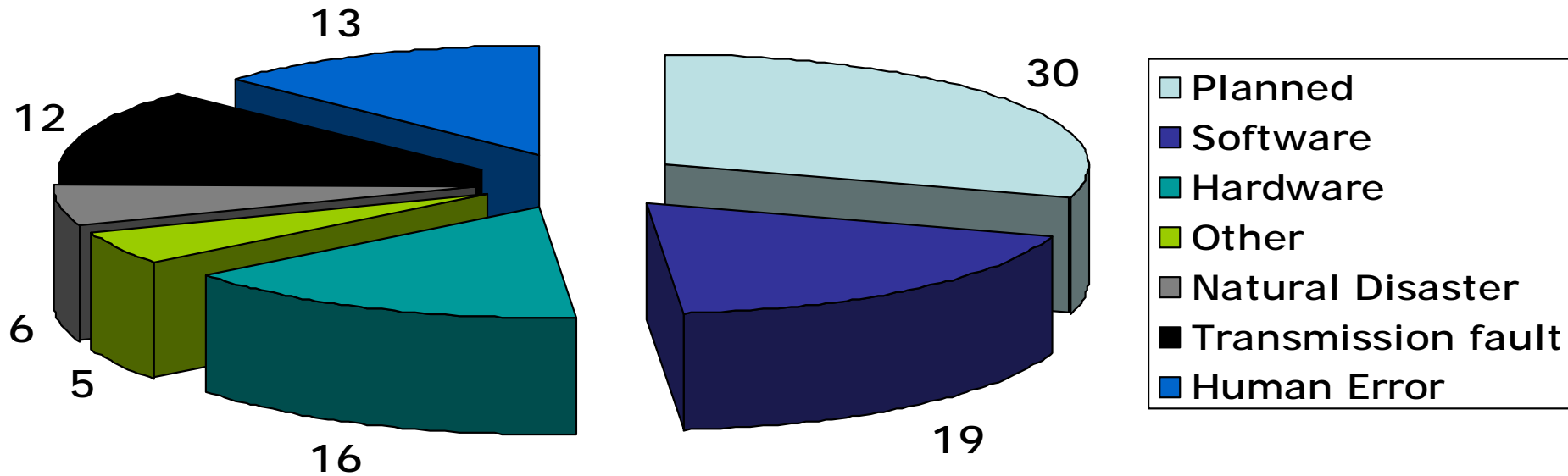
The Need for Planning



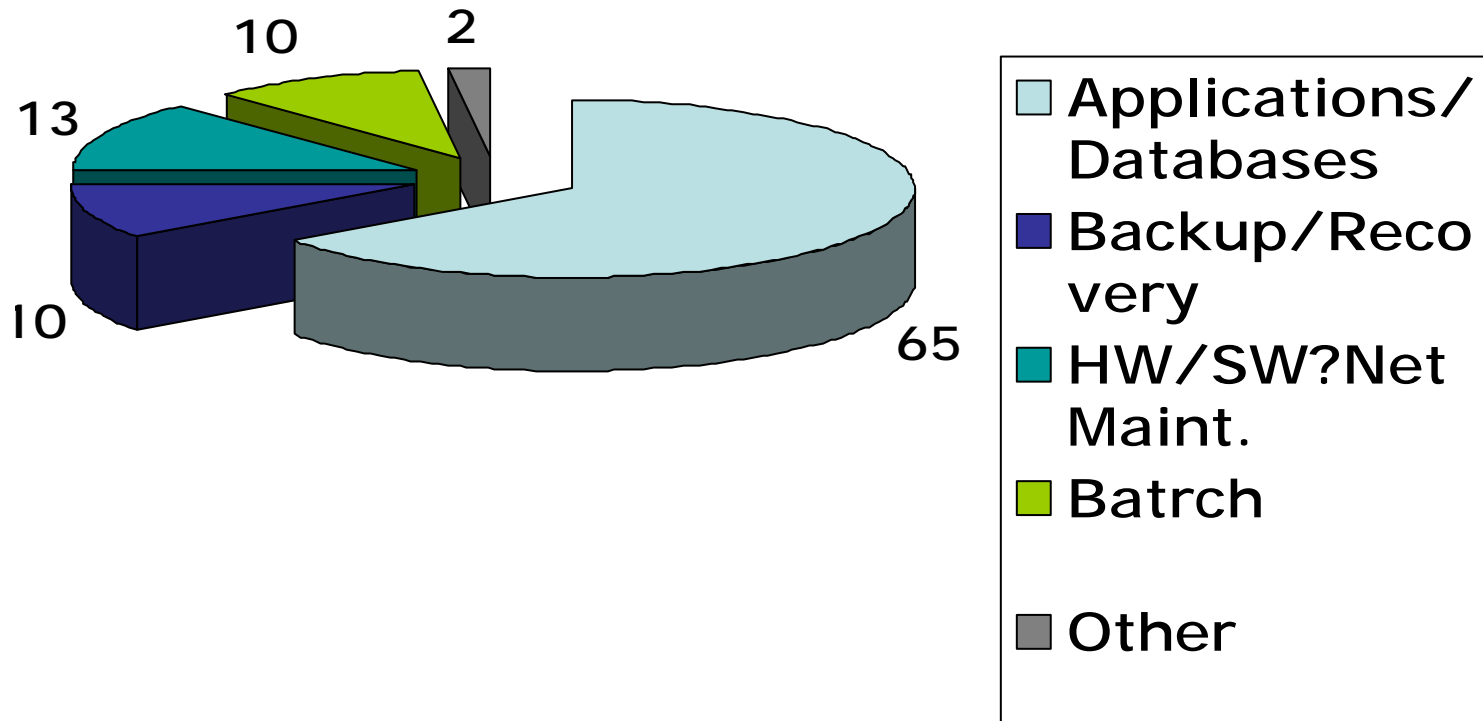
Toxic Spill –Inez, KY

- IT managers' self interest!
- Ethical mandate
- Legal mandate for some industries
- Supporting investments
- Emergency planning – think ahead
- One cannot readily predict a disaster environment

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



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





The EBay Example



- 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)



Hurricane Floyd

September 15, - 19, 1999



- **Virginia**

- 43 counties – Franklin obliterated – \$148,000,000 lost revenue
- Structure Impact – 472 destroyed, 2413 significantly damaged, 6054 damaged

Wallace, NC.

- **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**



Utility Issues



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



Practical Lessons in a Natural disaster Situation

- 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



VDOT, I 64, evacuate
from Virginia Beach

Analyzing the Risks

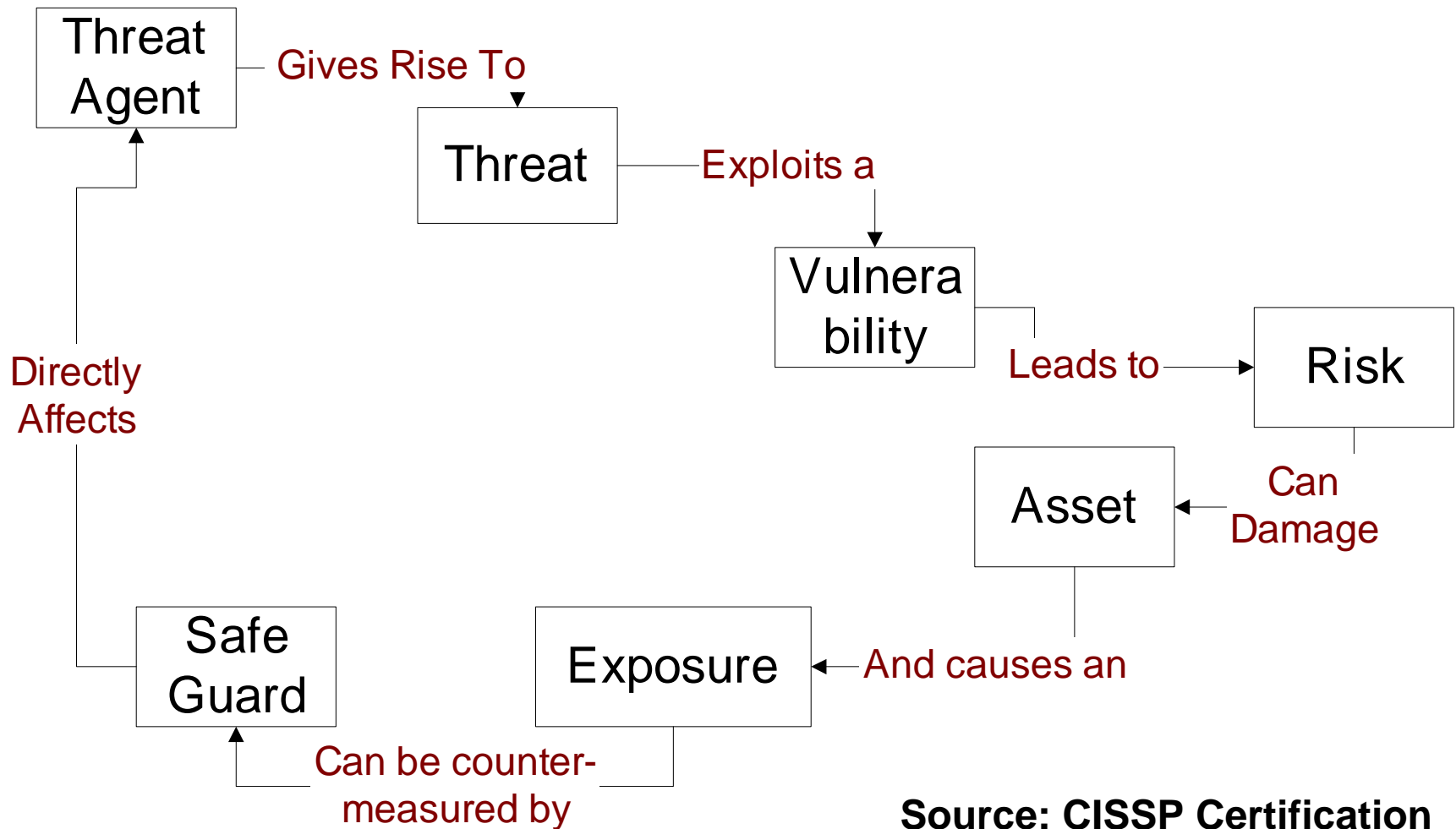


Washed out
bridge, Tobarro, NC

- **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...”



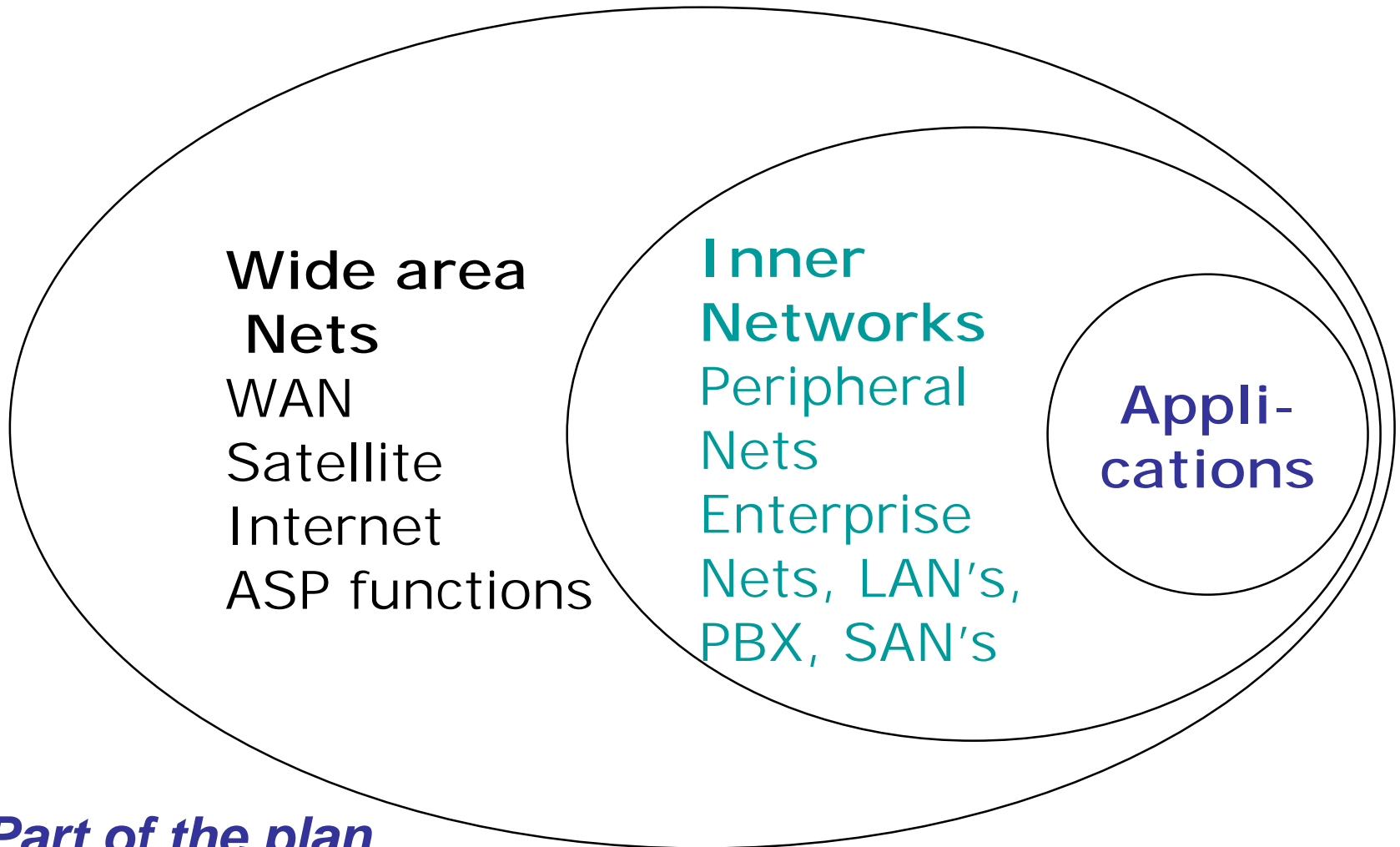
Risk and Threat Analysis Continuum



Source: CISSP Certification Guide by Shon Harris



Criticality spectrum based analysis



Part of the plan



A Disaster Recovery PLAN – Main Sections



Los Alamos Fire

- Executive overview
- Contingency planning
 - Introduction and overview
 - Decision to implement
 - Checklists and asset identification
 - Timed recovery
- Plan testing
- Alternate site requirements



Executive Overview Section

- Company Overview
 - Products, Processes, People
- Day to Day Contacts
- Best / Worst case scenarios
- Committees and Appointments



Loveland, CO fire

Part of the plan



Contingency Planning Process

- Very “business specific” process
 - 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”



Loveland, CO fire

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Decision to Implement Criteria

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



Loveland, CO fire

Part of the plan

Check Lists

- Detailed activity items
 - “Pre-covery” tasks
 - Implementation tasks
 - Recovery Issues
 - Personnel identification
 - Locations
 - PR Communications (detailed next)



Oklahoma tornado

Part of the plan



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

Part of the plan



Example Checklist

IT Backup and Recovery

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

Part of the plan

Protecting the Facility

- Water Detection
- Fire suppression
 - Forrest Fire – ten yr average of 3.1M acres (1989 – 1999)
- Lightning
 - \$350M/Yr in damages, S.E. USA
- Contamination reduction
- Power failure
- Physical access control



Oklahoma City, '95

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Protecting the Business



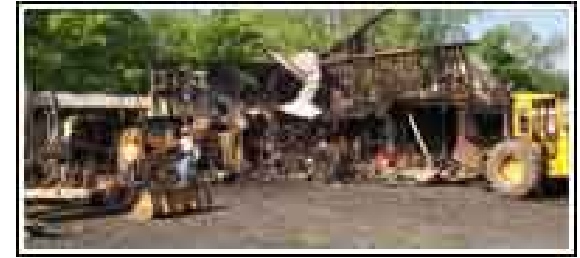
Union, MO – propane
Tank explosion

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

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Protecting the Business Impact on People



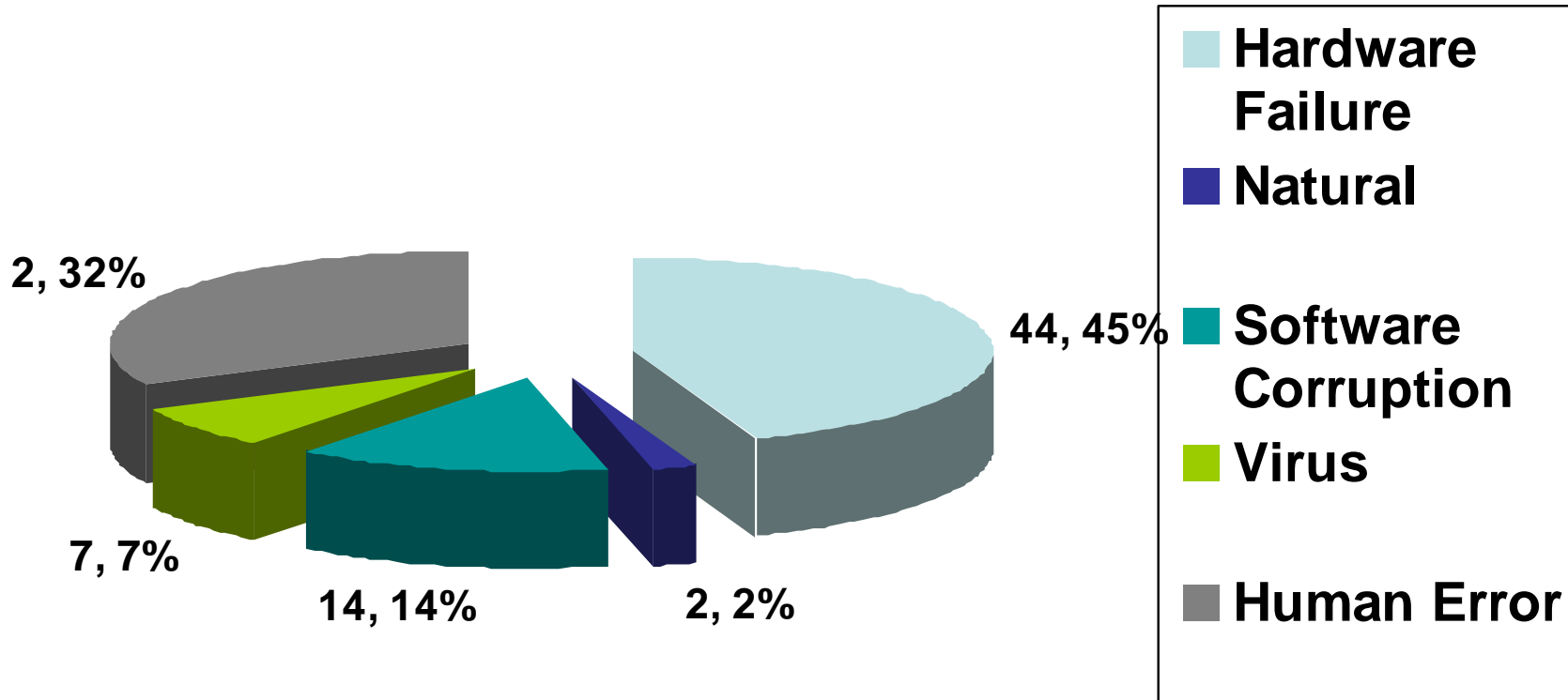
Union, MO – propane Tank explosion

- 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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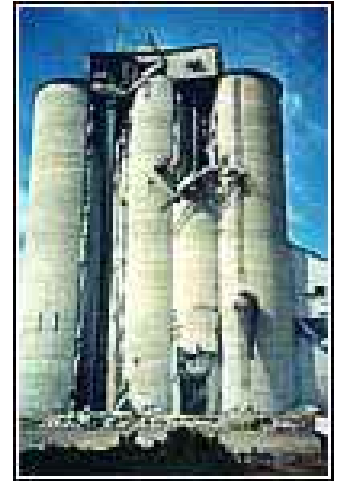
Causes of data loss (Ontrack, 2000)





Planning for Data Recovery

- Planning is much more than just the backups – three levels
 - Routine daily backups
 - Vault based WAN based backup
 - Remote data Center mirroring
- Data must be analyzed and classified
- Backup procedures must be verified and validated
- Catalog of necessary HW / SW **Part of the plan**



Grain Elevator,
Kansas



Strategies for Backup



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
- Variety of hardware in IT and in field

Part of the plan



Backup Strategy

- Server image
- Snapshot/versioning
- Full volume
- Full volume with open files support
- Incremental, differential
- Parallel tape drives
- RAID based tape drives



Owensboro, KY,
Destroyed Apartments

Part of the plan

Timed Recovery



Rock Creel, AL
Tornado '98

- What are the SLA's?
 - To customers and partners
 - From vendors and suppliers
- 0 to 6 hrs – absolutely mission critical
 - dependency services, base services
- 6 to 24 hrs – Line of Business systems
- 24 to 46 hrs – Important systems

Part of the plan

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

Part of the plan



Emergency Decision Making - Plan Processes



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

Part of the plan



Emergency Decision Making Teams



- **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

Part of the plan



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
- Part of the plan**



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
- **Protocols – People invested – the stakeholders - in business need to prioritize!**

Part of the plan



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.

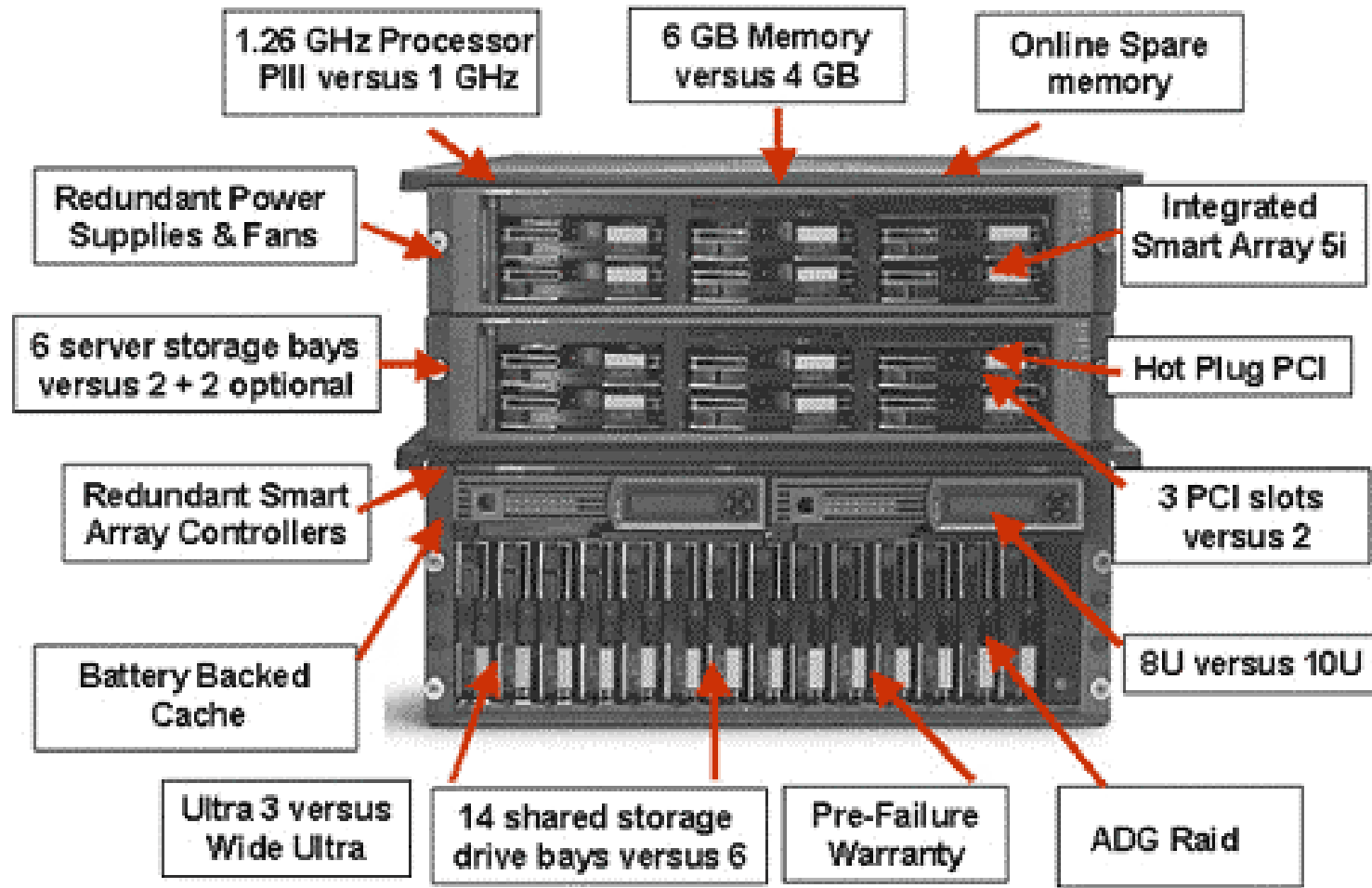
Part of the plan

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



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





Hardware Clustering example (6/2002 MSRP data)

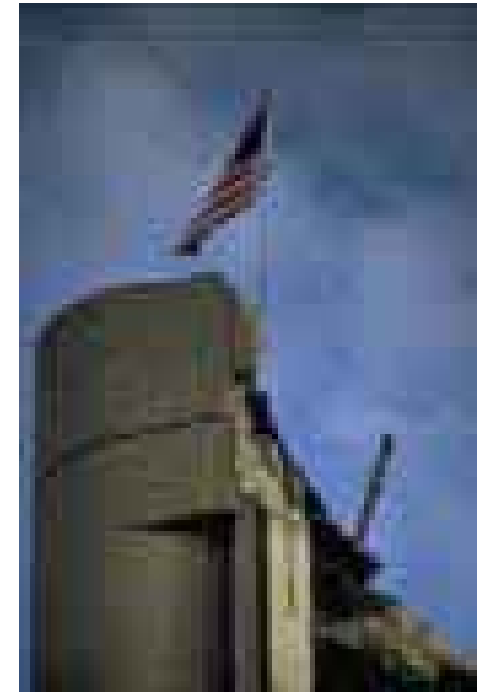
- Example Cluster
- MSRP Base: 14K.
- MSRP – Minimal system, fully fault tolerant:
 - Mirrored OS drives
 - RAID 5, 5 Drives
 - Power and Fans
 - Tape backup
 - \$25,000
- Win2K/Advanced Server/0 CAL
 - MSRP: 2500 (cdw.com)
 - NPO: 500 (cdw.com)





How may Compass help?

- 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.



Old Glory Still Stands
in Oklahoma City