Strengthen Your Cyber IBM Z and Db2 for z/OS Resiliency

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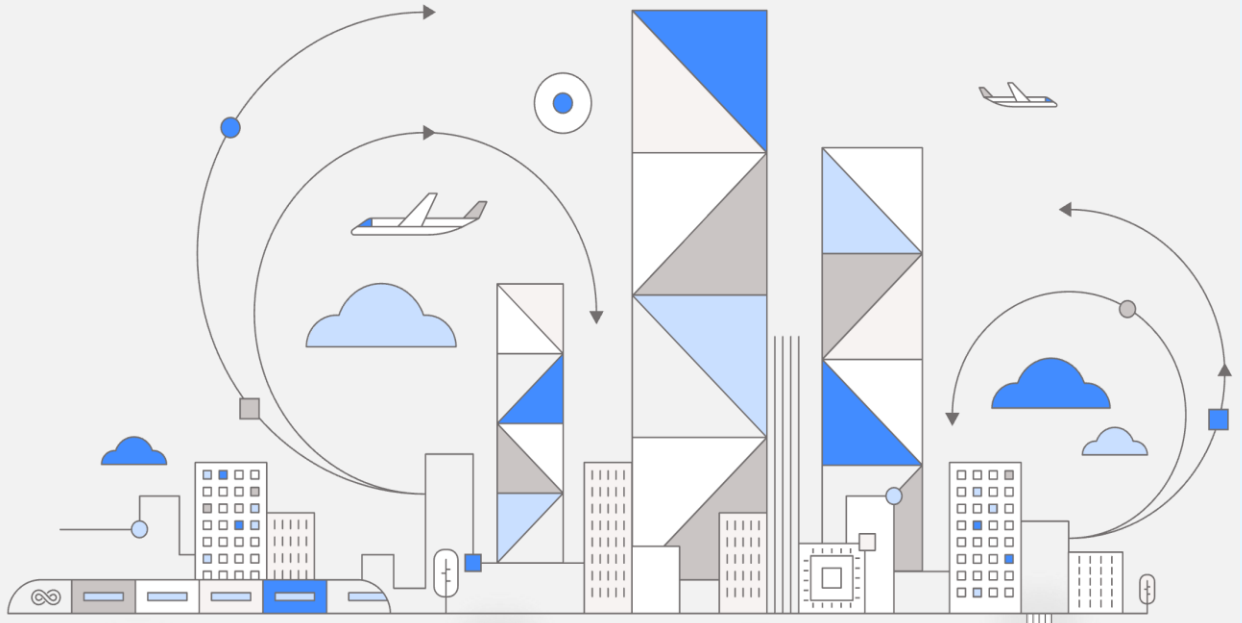
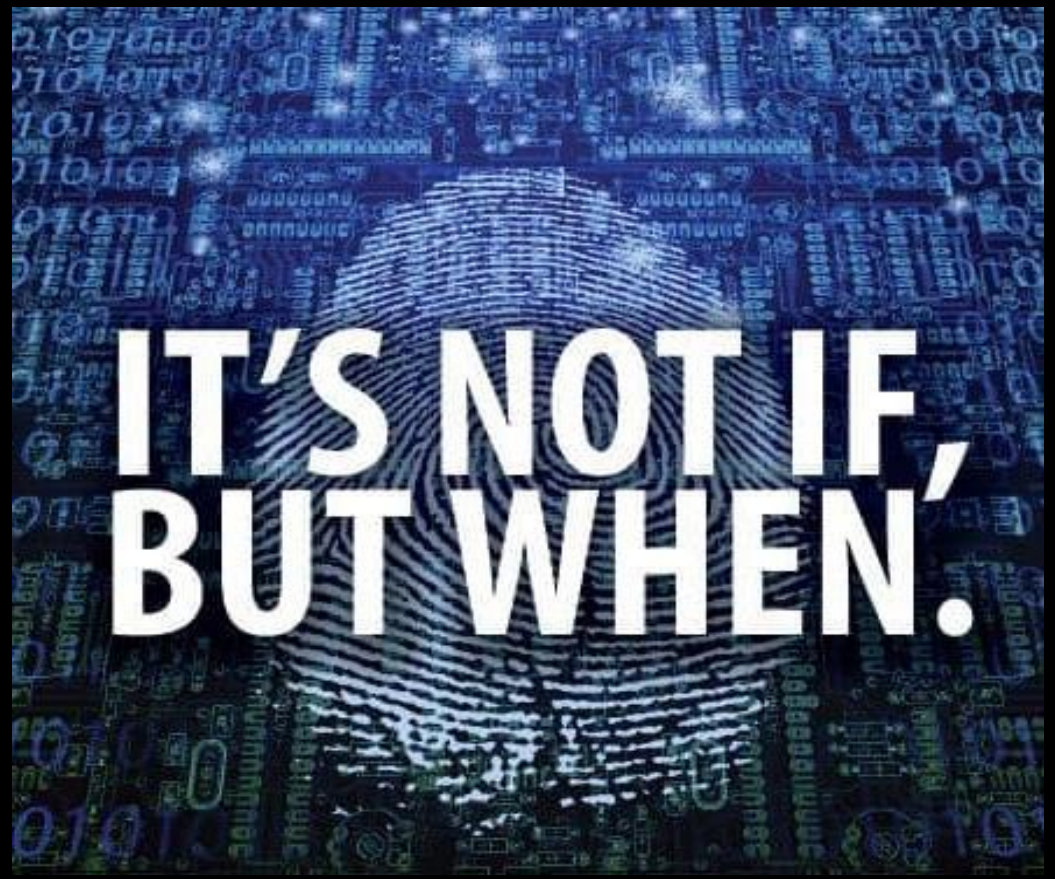
Agenda

- Cyber Resiliency
- Cyber Vault and Safeguarded Copies
- Db2 Recovery Options
- Additional use cases
- Questions



Guaranteed absolute resiliency or security is impossible



Systems need to be built for Cyber Resiliency

- ✓ The ability to continuously deliver the intended outcome despite any adverse event or attacks
- ✓ Do everything you can to prevent downtime and attacks, plus minimize the impact and potential loss when an event does happen

Ransomware is in the news

Within weeks in September 2023, two of the world's largest casino-hotel companies, MGM Resorts and Caesars, were hit with ransomware attacks

- Caesars met the hacker's demands
- MGM Resort elected to resist

Casino giant MGM expects $100+ million hit from the hack that led to the data breach

Caesars paid $15 million in ransom to cybercrime group prior to MGM attack

Ransomware is in the news …

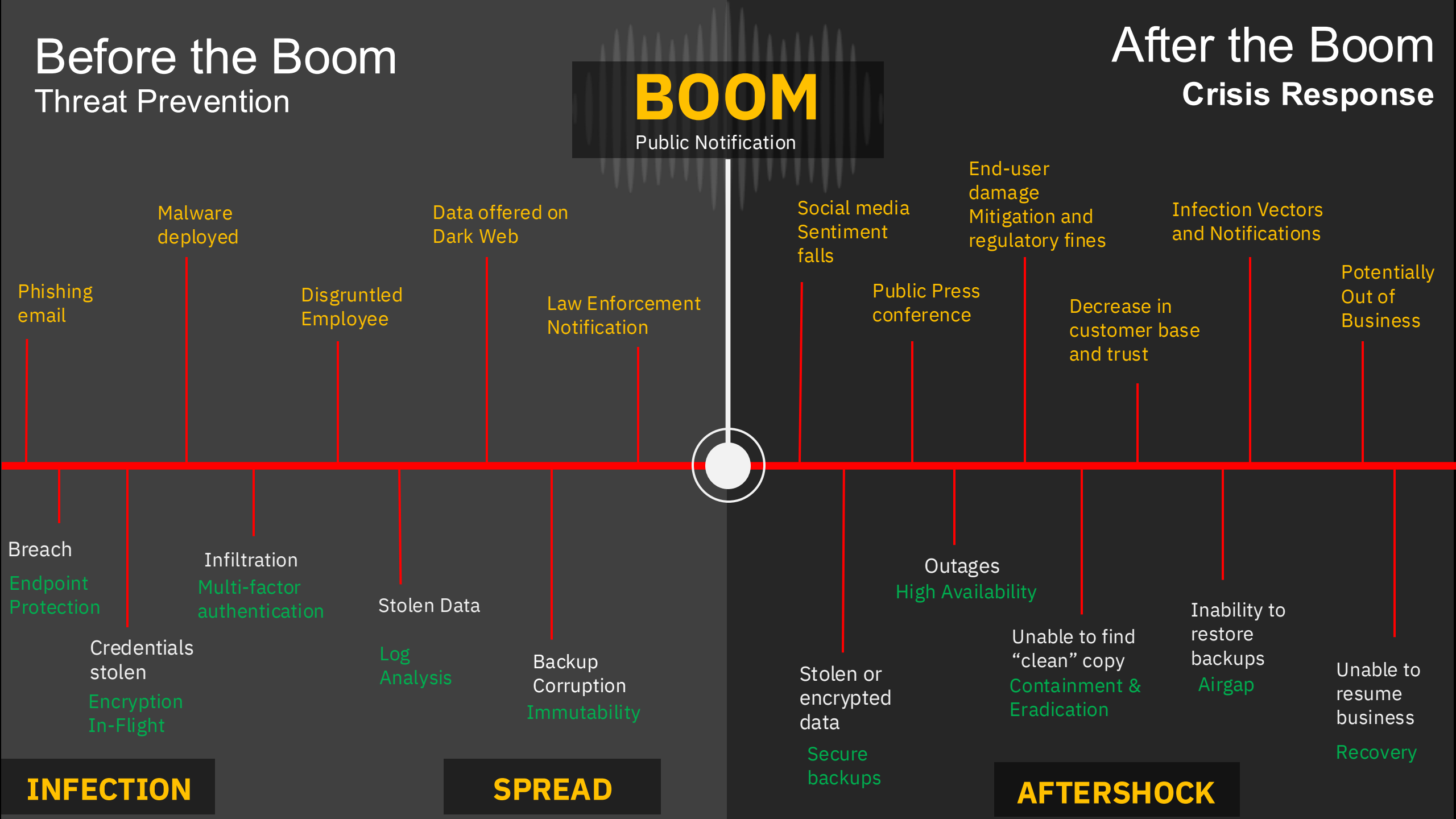
A third of Americans could have had data stolen in big health care hack

Witty told the committee that cybercriminals accessed Change Healthcare through *a server that was not protected by multi-factor authentication, or MFA, which requires users to verify their identity in at least two different ways.* He said UnitedHealth now has MFA in place across all external-facing systems.

CNN — A third of Americans may have had their personal data swept up in a February ransomware attack on a UnitedHealth Group subsidiary that disrupted pharmacies across the US, UnitedHealth CEO Andrew Witty estimated in testimony to Congress on Wednesday.

It will likely take “several months” before UnitedHealth is able to identify and notify Americans impacted by the hack because the company is still combing through the stolen data, Witty said in written testimony.

In hours of hearings in the Senate and House Wednesday, Witty apologized to patients and doctors, admitted that hackers broke into the subsidiary through a *poorly protected computer server and confirmed that he authorized a $22 million ransom payment to the hackers.*


Before the Boom
Threat Prevention
BOOM
Public Notification
After the Boom
Crisis Response
Phishing email
Malware deployed
Disgruntled Employee
Data offered on Dark Web
Law Enforcement Notification
Social media Sentiment falls
Public Press conference
End-user damage Mitigation and regulatory fines
Decrease in customer base and trust
Infection Vectors and Notifications
Potentially Out of Business
Breach
Endpoint Protection
Credentials stolen
Encryption In-Flight
Infiltration
Multi-factor authentication
Stolen Data
Log Analysis
Backup Corruption
Immutability
Stolen or encrypted data
Secure backups
Outages
High Availability
Unable to find “clean” copy
Containment & Eradication
Inability to restore backups
Airgap
Unable to resume business
Recovery
INFECTION
SPREAD
AFTERSHOCK

$4.88M
Average total cost of a breach

$4.81M
Average cost of a breach when attackers used compromised credentials, which happen in 16% of the breach cases studied

292
Days to identify and contain breaches involving stolen credentials

26.2%
Growth of the cyber skills shortage

$4.99M
Average cost of a malicious insider attack

46%
Share of breaches involving customer personal data

Data Resilience

Why Act Now?

https://www.ibm.com/reports/data-breach

Cyber Security and Cyber Resilience

Cyber Security

Cyber security is about prevention; it's about trying to keep the bad actors out of your environment

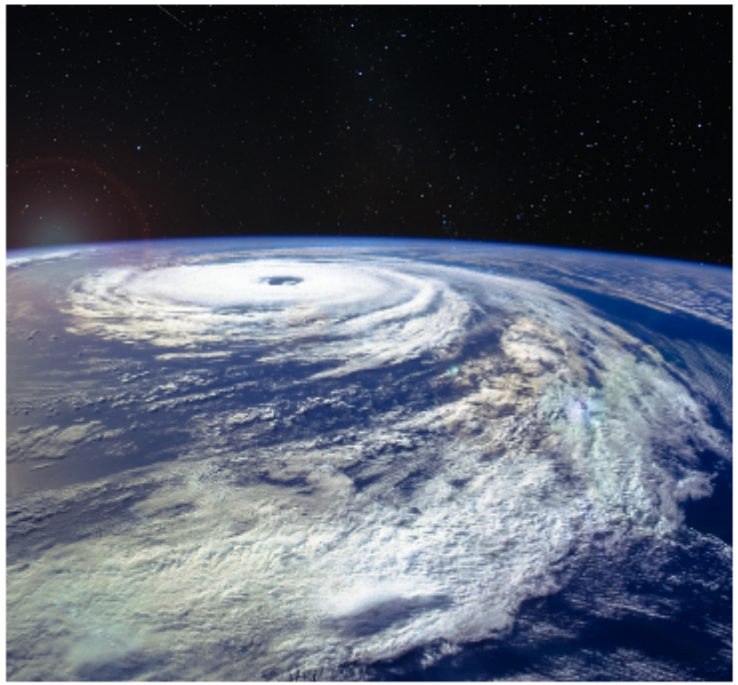
Cyber Resilience

Cyber resilience is about an organizations ability to continue operations and rapidly recover despite a cyber-incident

Organizations need to be both cyber secure and cyber resilient

Cyber Security and Cyber Resilience …

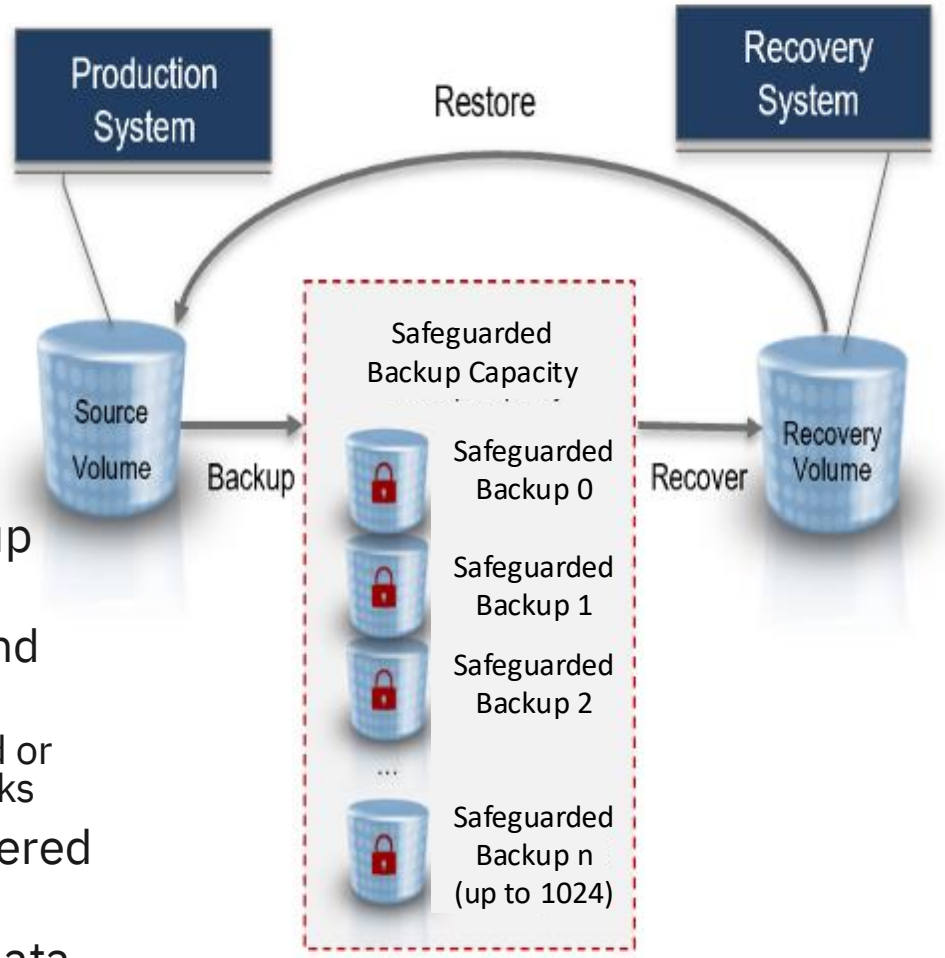
Traditional resiliency solutions will not protect you from cyber attack



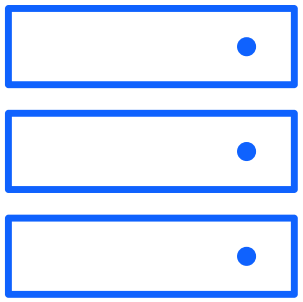
	Traditional resiliency	What is required
Replication	Data is being replicated continuously but logical errors are also replicated instantaneously	Scheduled point in time copies stored in an isolated, secure location
Error detection	Immediate detection of system and application outages	Regular data analytics on point in time copies to validate data consistency
Recovery points	Single recovery point that likely will be compromised	Multiple recovery points
Isolation	All systems, storage and tape pools participate in the same logical system structure	Air gapped systems and storage so that logical errors and malicious intruders can not propagate
Recovery Scope	Continuous availability and disaster recovery	Forensic, surgical or catastrophic recovery capabilities

DS8K Series Safeguarded Copy

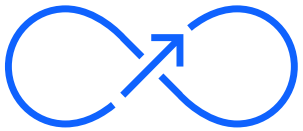
- Safeguarded Copies are secure, point-in-time copies of production data that can later be used for identification, repair, or replacement of production data that has been compromised by either Cyber or Internal attack or corrupted by system failures or human error
  - Provides functionality to create up to 1024 Safeguarded Backups for a source volume
  - Source devices are where the production copies are taken from
    - Production source devices
    - HA/DR copy using data replication
- They are stored in a storage space that is called Safeguarded Backup Capacity which is hidden and not accessible by any server
  - Protection devices provide one or more logical protection copies and are not accessible by any system
    - Additional security measures aim to protect these from being modified or deleted due to user errors, malicious destruction or ransomware attacks
- The data can only be accessed after a Safeguarded Backup is recovered to a separate recovery volume
- Recovery volumes can be used with a recovery system to perform data validation, forensic analysis or to restore production data. It is also possible to restart the production systems directly on the Recovery Volume



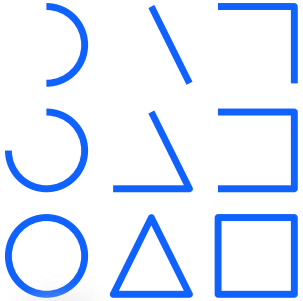
IBM Z Cyber Vault



- ✓ IBM Z Cyber Vault Storage
  - DS8000 with Safeguarded Copy
  - TS7700 with LWORM Retention

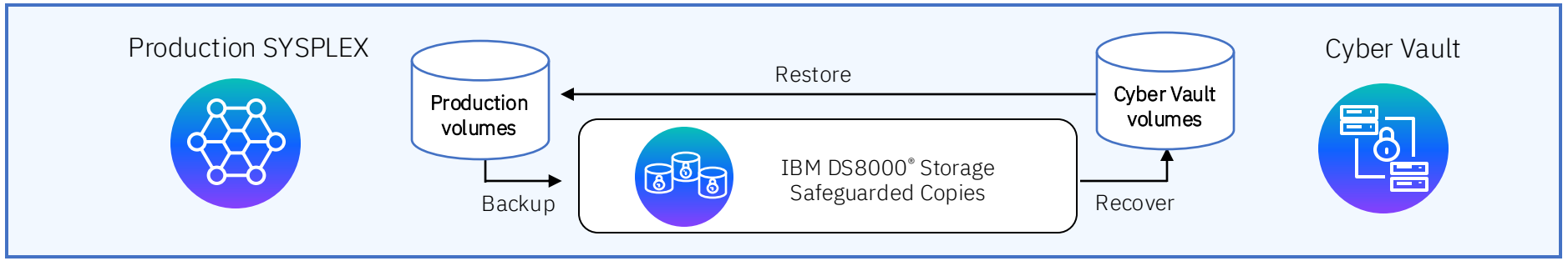


- ✓ IBM Z Cyber Vault Automation
  - GDPS Logical Corruption Protection (LCP) Manager
  - IBM Technology Expert Labs Cyber Vault data validation services asset



- ✓ IBM Z Cyber Vault Environment
  - IBM Z Hardware including CPs, zIIPs, ICF, memory and required infrastructure
  - IBM Z Cyber Vault Environment pid for SW licensing
  - IBM Z Software Tools including, IZBR, Db2 Recovery Expert, Db2 Tools, etc.

IBM Z Cyber Vault



Data Validation
Detect data corruption early or validate that the copy is clear

Forensic Analysis
Investigate the problem and determine the best recovery action

Surgical Recovery
Extract data from the copy and logically restore back to production environment

Catastrophic Recovery
Recover the entire environment back to a point in time copy

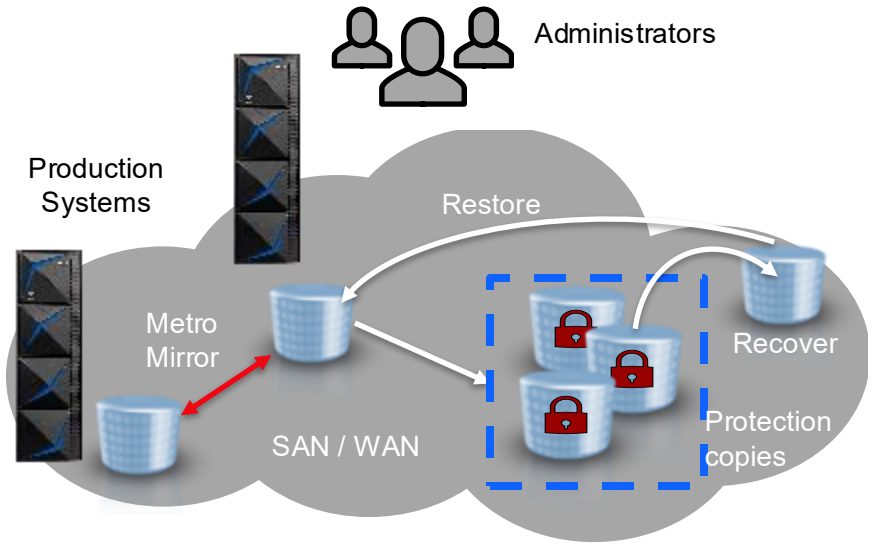
Offline Backup
Backup copy of the clean environment to offline tape media

IBM Z Cyber Vault capabilities are supported by

IBM GDPS® LCP Manager	IBM z/OS® Utilities	IBM Security zSecure™	IBM Z® Catalog management tools	IBM Z Batch Resiliency	IBM DFSMShsm™ tools	Db2® and IMS™ Tools

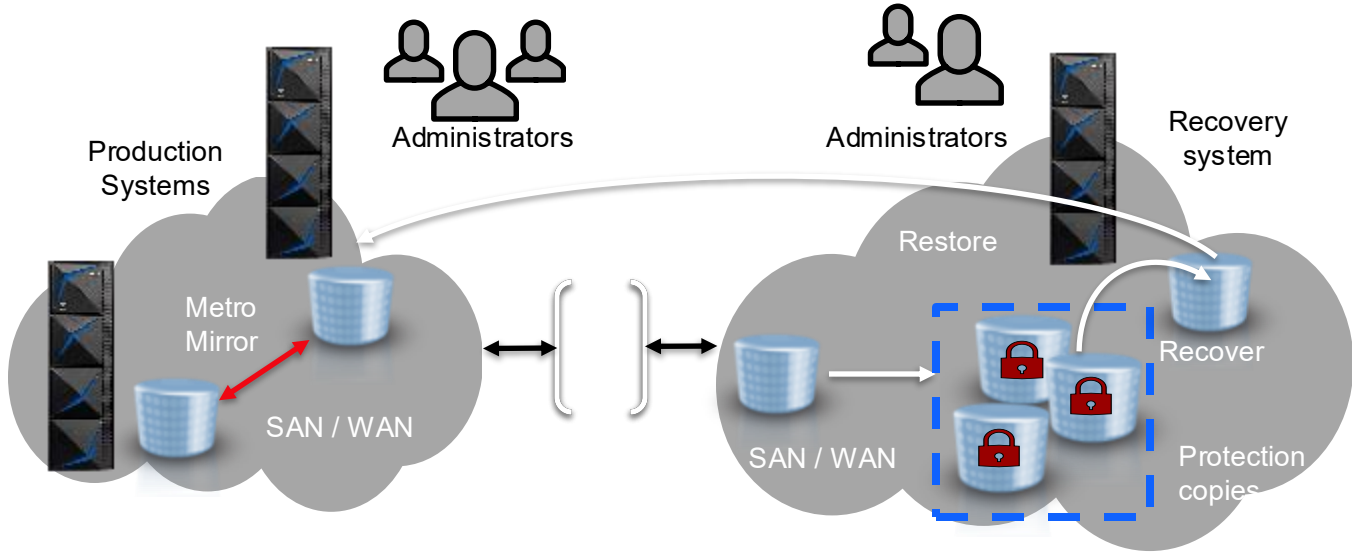
Air gap: Virtual and physical isolation of protection copies

Virtual isolation



- The protection copies are created in one or more storage systems in the existing high availability and disaster recovery topology
- The storage systems are typically in the same SAN or IP network as the production environment

Physical isolation



- Additional storage systems are used for the protection copies
- The storage systems are typically not on the same SAN or IP network as the production environment
- The storage systems have restricted access and even different administrators to provide separation of duties

TS7700 Security and Air gap Summary

Auditing & Compliancy
- Flash Copy DR Testing
- Event & Task logging (MI/SNMP)
- Rsyslog tamperproof logging
- Upload SSL Certificates or use default
- SP800-131a Compliancy Settings

Management Interface Security
- Granular Roles & Permissions
- Local or LDAP Login
- Dual Control Sensitive Settings

- HTTPS

Cloud Tier
- Cloud Storage Tier
- Cloud Export
- Cloud Export Recovery
- Cloud Export Recovery Testing
- Logical Volume Version Retention
- Single Logical Volume Version Recovery
- PIT snapshots for airgap
- Multi-cloud support (public, private, multi-tenancy)
- Cloud device encryption

Secure Data Transfer (AES256)
- DS8K to TS7700 TCT Objects
- Copies between TS7700s
- Exports to cloud storage devices

Object Store

Ethernet

IBM z/OS

DS8000

GRID
- TS7700 Grid technology to store multiple copies of data anywhere in the world (up to 8 clusters)
- Fast migrate/recall at disk speeds
- Active/Active…
- Each cluster is an access point

TS7700 Grid

Physical Tape Tier
- Tape Encryption AES256 (EKM)
- Copy Export Secondary Copy
- Copy Export Offsite Airgap
- Copy Export Recovery
- Copy Export Recovery Testing

TS4500

FICON

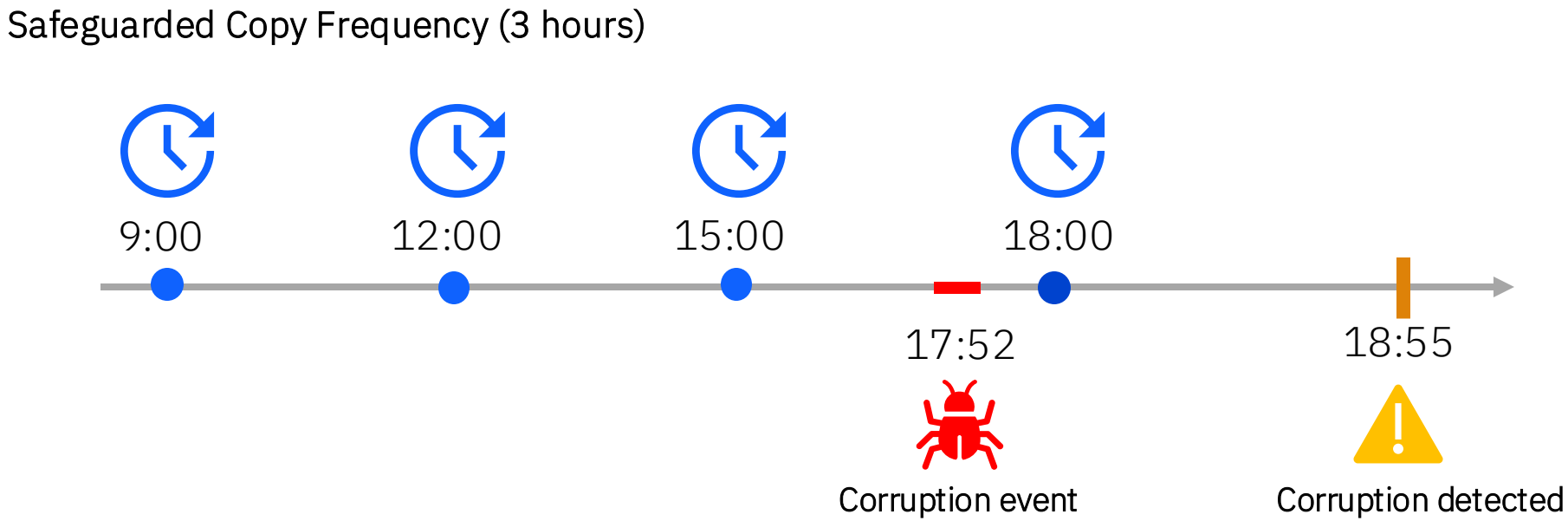
Virtual Tape

Fibre Channel

Physical Tape

Extended Retention and Access
- Selective Device Access Control (SDAC)
- Category Retention w/Expire Hold
- LWORM
- LWORM Retention

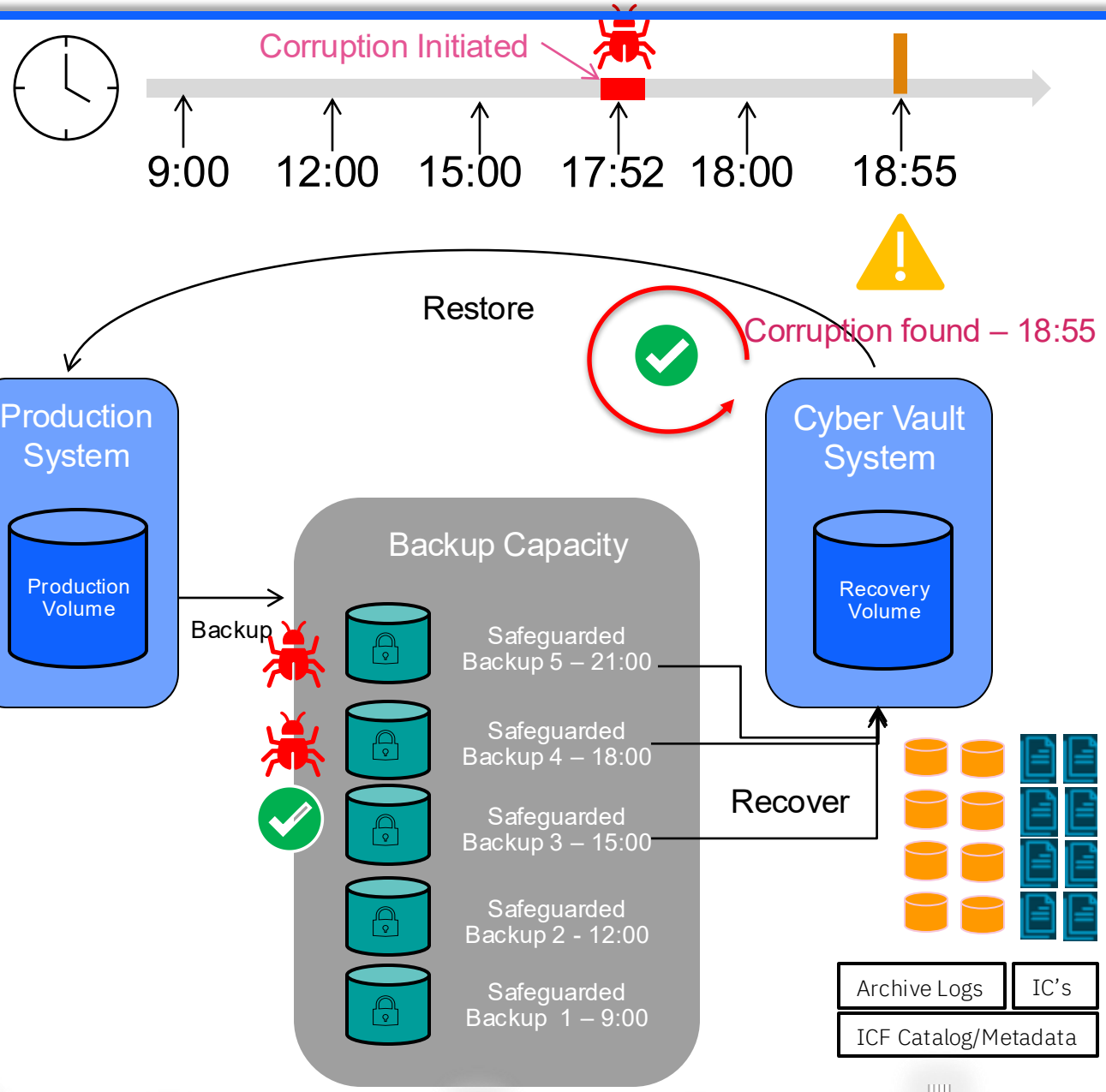
Recovery Point Objective (RPO)



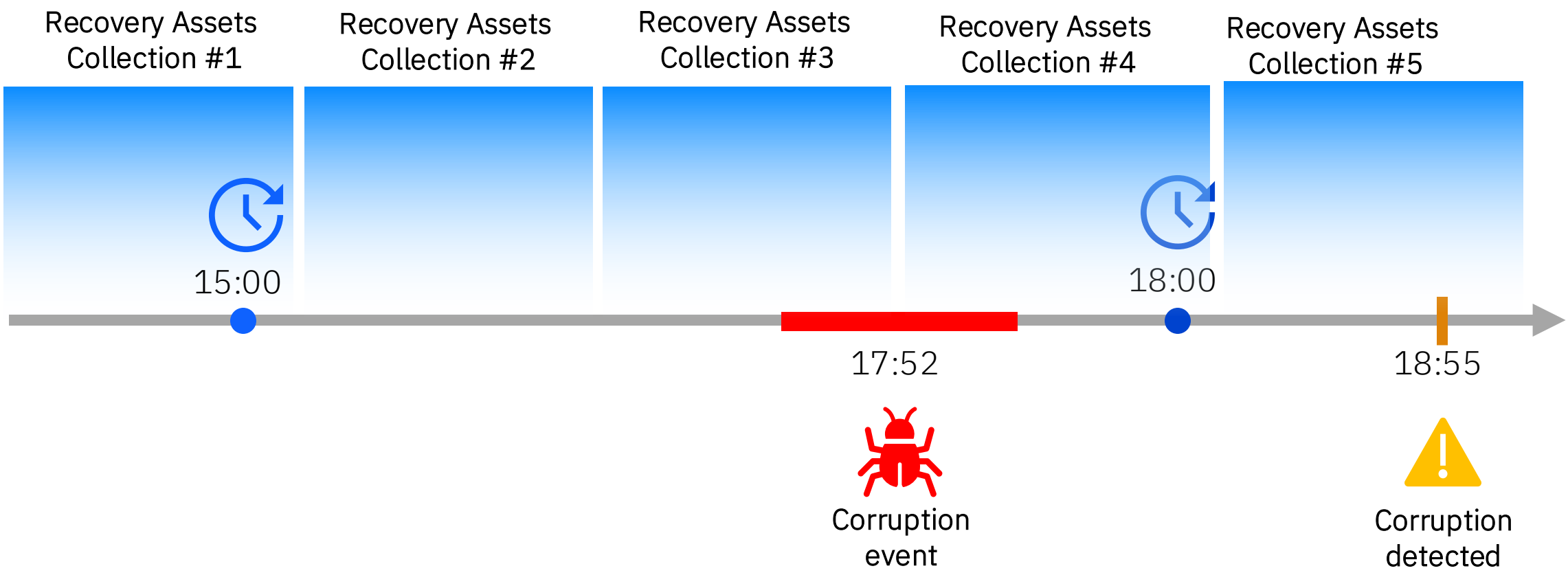
- Safeguarded Copy (SGC) is taken every 3 hours
- Corruption event initiated at 17:52
- Last good SGC prior to corruption was created at 15:00
- Corruption identified at 18:55 in the live production system
- Problem:
  - Last good SGC was taken at 15:00
  - Point-in-Time recovery would result in 2 hours and 52 minutes

Recovery Point Objective (RPO)
Roll Forward

- Additional Recovery Assets are required
  - Db2 archive logs
  - Db2 LOG NO Image Copies
  - ICF Catalog or Metadata
- Advantages
  - Minimize Db2 data loss
  - Use traditionally established reusable disaster recovery/group restart procedures (initial step)
- Operational opportunities
  - Additional procedures and processes
- Operational steps
  - The data is accessible only after a SafeGuarded Backup is recovered to a separate recovery volume IPL Cyber Vault Recovery LPARs
  - Db2 Group Restart
  - Roll forward
    - RESTORE LOGONLY
  - Data Validation



Recovery Point Objective (RPO)



Recovery Assets: Archive Logs, Image Copies, Metadata

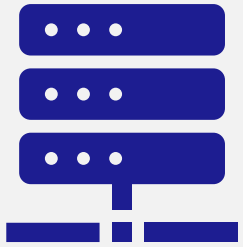
Roll Forward Recovery

- Db2 13 Recovery Roll Forward
  - Db2 13 RESTORE SYSTEM LOGONLY
    - Recovery starting point and ending point must be established
      - Recovery starting point
        - Recovery Base Log Point (RBLP) continuously being incremented
      - Recovery ending point
        - SYSPITRT
        - SYSPITR
    - *Db2 13 provides additional RESTORE SYSTEM LOGONLY capabilities*
      - *RBLP is updated by Db2 every 5 minutes, starting point always incremented*
      - *RESTORE SYSTEM LOGONLY to point in time is now very appealing*
    - Db2 mass application object level recovery is technically an option but for large, active systems the recovery time will likely be significantly longer than restoring an entire system with one log apply event
      - Lack of planning, intelligent design, optimization and large-scale recovery testing
        - Not optimizing job scheduling based on object size, update rate, number and size of indexes all leading to elongated recovery time
        - Not efficiently using of Db2 Fast Log Apply (FLA)
      - No prioritized list of application objects and inter-dependencies

Resource collection

Production SYSPLEX

Recover technology started task



Archive logs

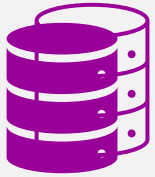
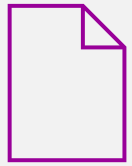


Image Copies

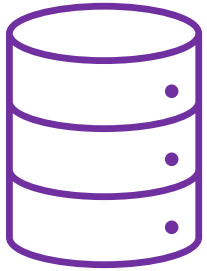
BSDS



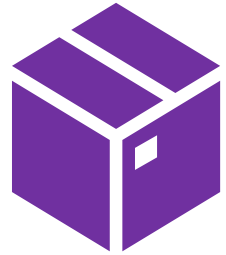
RE Metadata

Immutable Storage

Cloud Storage



TS7700 LWORM Storage

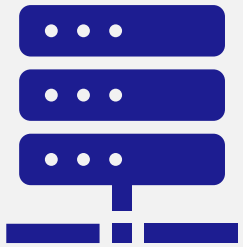


Separate SGC pool

Resource collection

Production SYSPLEX

Recover technology started task



Archive logs

Image Copies

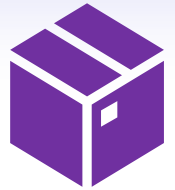
BSDS

RE Metadata

Immutable Storage

Cloud Storage

TS7700 LWORM Storage



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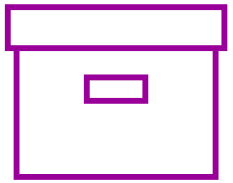
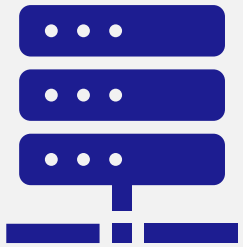


Resource collection

Production SYSPLEX

Recover technology started task



Archive logs

Image Copies

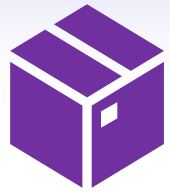
BSDS

RE Metadata

Immutable Storage

Cloud Storage

TS7700 LWORM Storage



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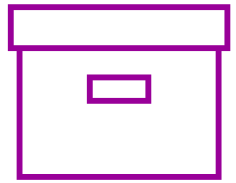

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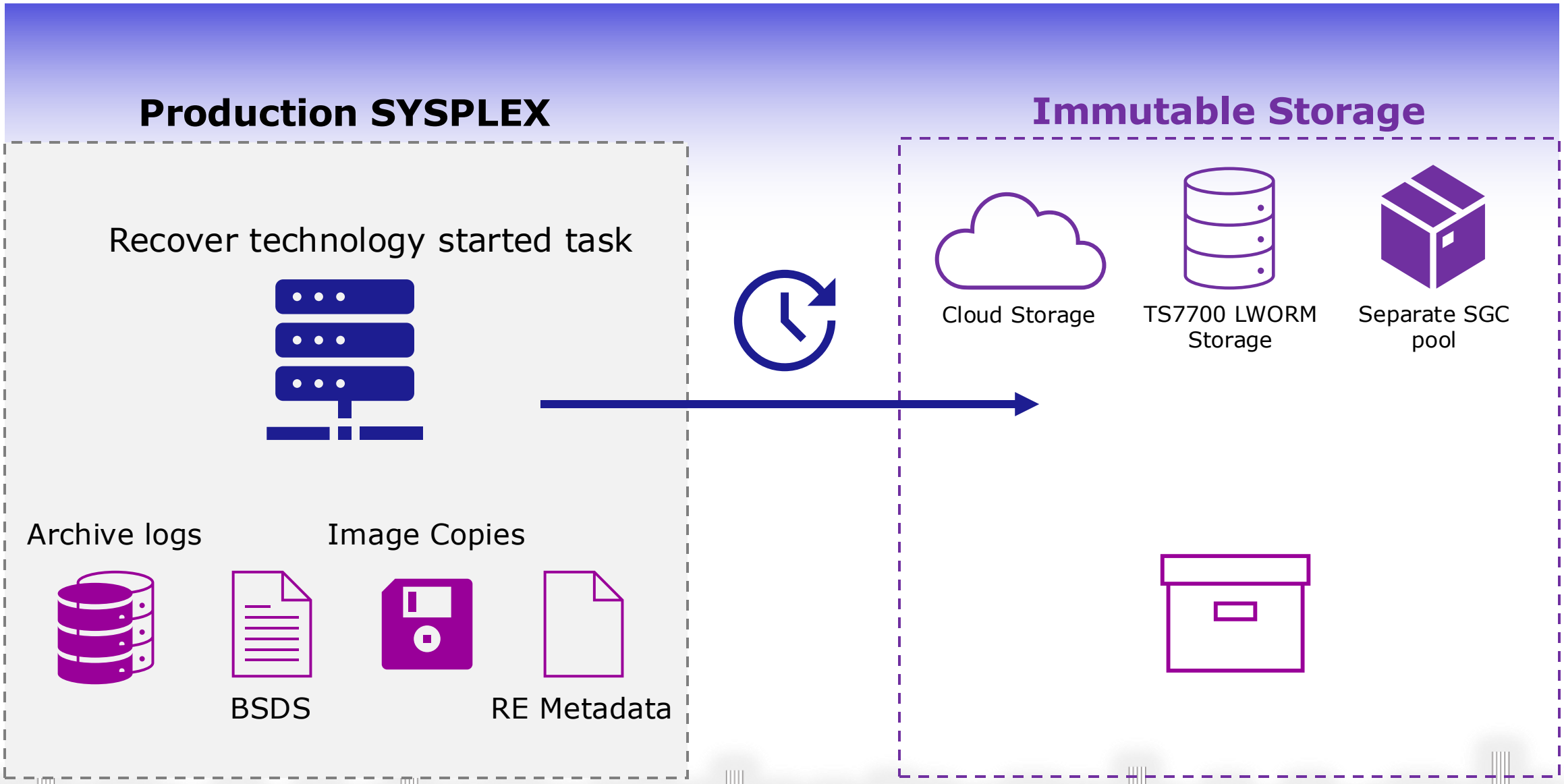

Resource collection

Production SYSPLEX

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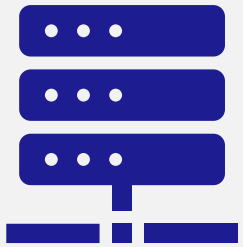

Archive logs

Image Copies

BSDS

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Immutable Storage

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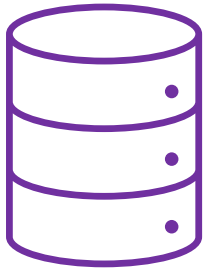
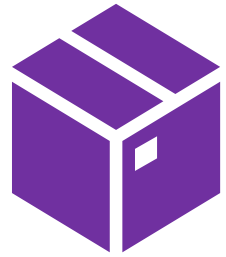


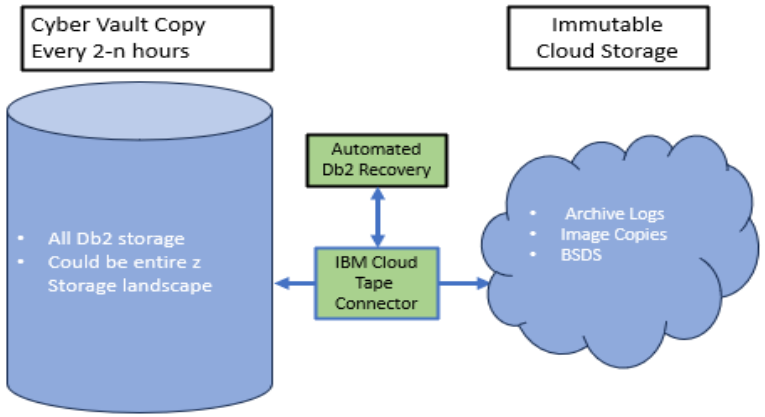
TS7700 LWORM Storage

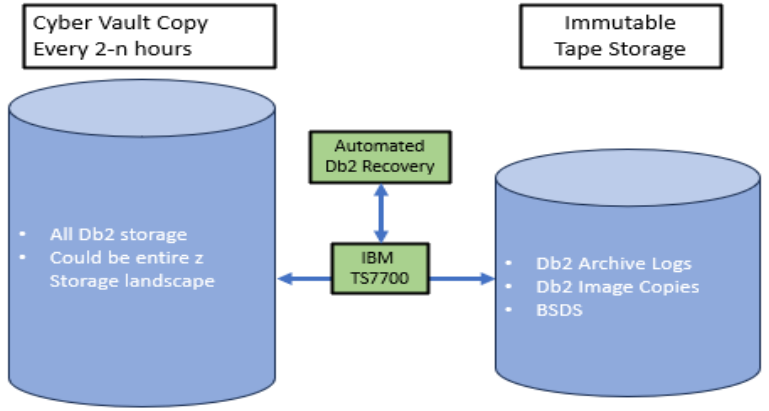


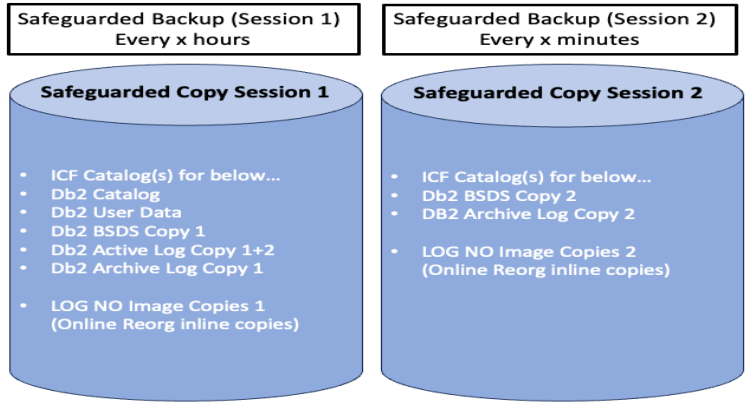
Separate SGC pool

Improve Recovery Point Objective (RPO)

- Write additional Db2 recovery assets to immutable storage at predefined intervals (in minutes) that is accessible to Cyber Vault Recovery LPAR(s)
  - IBM Cloud Tape Connector
  - IBM TS7700 with LWORM Retention
  - An additional Safeguarded Copy Session
- In the event of a cyber attack, user restores storage back to last good Cyber Vault copy
- Restore additional Db2 Archive Logs and LOG NO Image Copies from immutable cloud storage
- Conditions the Db2 environment and rolls forward Db2 to just before the cyber event







End-to-End Cyber Vault Recovery

✓ Preparation and recovery steps

Tower 1

Preparation at the production system

- ❑ Set archive log frequency based on asset collection interval
- ❑ Periodically save recovery assets to immutable storage that is accessible at the recovery system
  - ❑ Archive logs with BSDS
  - ☑ Image copies for table spaces and indexes after LOG NO events
  - ❑ ICF catalog information about the recovery assets

Tower 2

Preparation at the Cyber Vault recovery system after Safeguarded Copy is restored

- ☑ From immutable storage retrieve:
  - ☑ Archive logs, BSDS, and image copies that are more recent than the Safeguarded Copy that was restored.
- ☑ For each Db2 member:
  - ☑ Replace the BSDS with the most recent BSDS.
  - ☑ Run DSN1LOGP on most recent archive log data set.
- ☑ Identify SYSPITR system recovery point - lowest LRSN across the members from the DSN1LOGP output. This is the ending point for the roll forward (log apply).
- ☑ Allow user to override SYSPITR system recovery point

Tower 3

Recovery roll forward at the Cyber Vault recovery system

- ☑ Conditional restart process with SYSPITR
- ☑ Run RESTORE SYSTEM LOGONLY
- ☑ Stop and start Db2
- ☑ Terminate any outstanding utilities
- ☑ Run RECOVER utility on table spaces and indexes in RECOVER-pending status
- ☑ Run REBUILD INDEX on indexes in REBUILD-pending status
- ☑ Validation of data

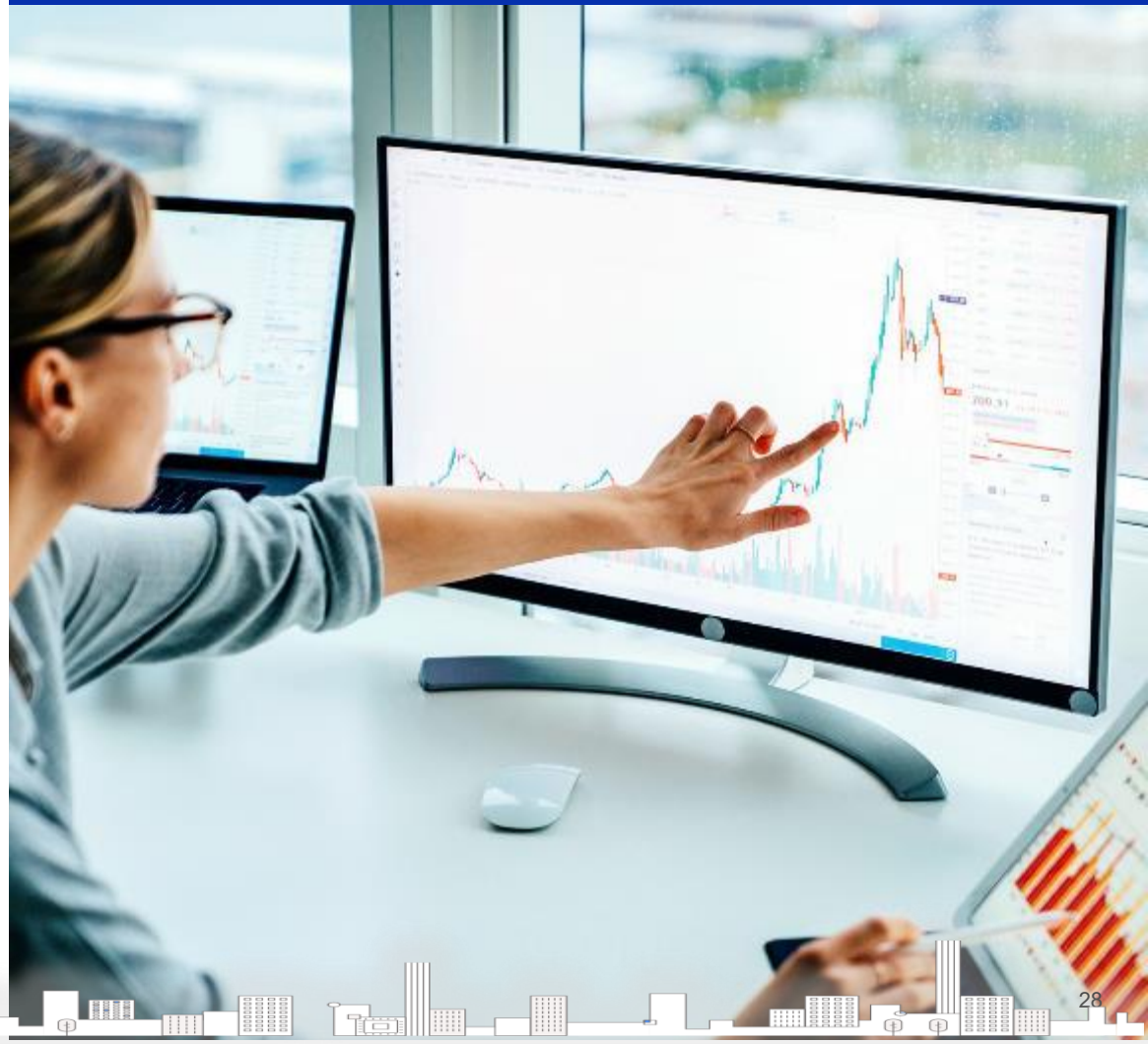
Safeguarded Copy Restore to Production

- The majority of DS8000 users are replicating their data with Metro Mirror and/or Global Mirror
- It is possible to restore a recovered Safeguarded Copy back to a Production copy of data using an incremental copy of data
- The Global Copy is performed back to the PPRC pair of the Safeguarded Source device (RS1 in the picture) enabling this to be done both in physical isolation and virtual isolation scenarios
- It is possible to restart the recovered systems on the RC1 volumes while the copy process is happening. This would typically be done to validate that this is the correct copy and then perhaps for application people to prepare for the restart of the production applications

Continuous Data Validation

- Stay one step ahead with continuous automated data validation
  - Data validation is the process of executing regular analytics
    - Identify a data corruption event and scope of corruption
    - Determine the appropriate recovery action
  - Performing corruption detection and validation processes against a copy of data is more practical than doing this in the live production environment
  - Valid data can be sent to offline media to have a reliable and isolated point-in-time copy

Continuous data validation allows the early detection of a problem or reassurance that a given protection copy is uncorrupted.



Forensic Analysis

- Back trace a cyber attack by forensic analysis
  - Determine:
    - What data is corrupted (scope)
    - When the data corruption occurred
    - Which available protection copies is the last good one
  - Based on this analysis (corruption scope), it can be determined how to proceed:
    - Fix the corruption from the production environment
    - Extract and recover certain parts of the data from a valid backup copy (surgical recovery)
    - Restore the entire environment to a point-in-time that is known to be unaffected by the corruption (catastrophic recovery)

A forensic analysis identifies the cause and scope of a problem before deciding on a recovery action.

Surgical Data Recovery

- Surgical Recovery may be a faster method if only a small portion of the production data is corrupted and if consistency between current production data and the restored parts can be re-established
- Another case may occur if the last known good backup copy is too old to restore the complete environment. It may then be desirable to leave most of the production volumes in its present state, and just copy replacement data to correct actually corrupted data
- Must be super confident about understanding application and data dependencies when recovering individual datasets and subset of datasets
- Solutions designed for recovering individual dataset, subset of datasets, whole system and building a “forensic” environment need to be tested, validated and regularly practiced to make sure they are in correct working order

Surgical recovery consists of the extraction of specific data from a valid copy and logically restore it back to the production environment.

Future Db2 utitilities and tools integration planned with Cyber Vault SafeGuard Copies

Questions …


Thank You