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Using Oracle9*i* to Extend Application Availability

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“One minute of system downtime can cost an organization anywhere from $2,500 to $10,000 per minute.”

- The Standish Group 2001

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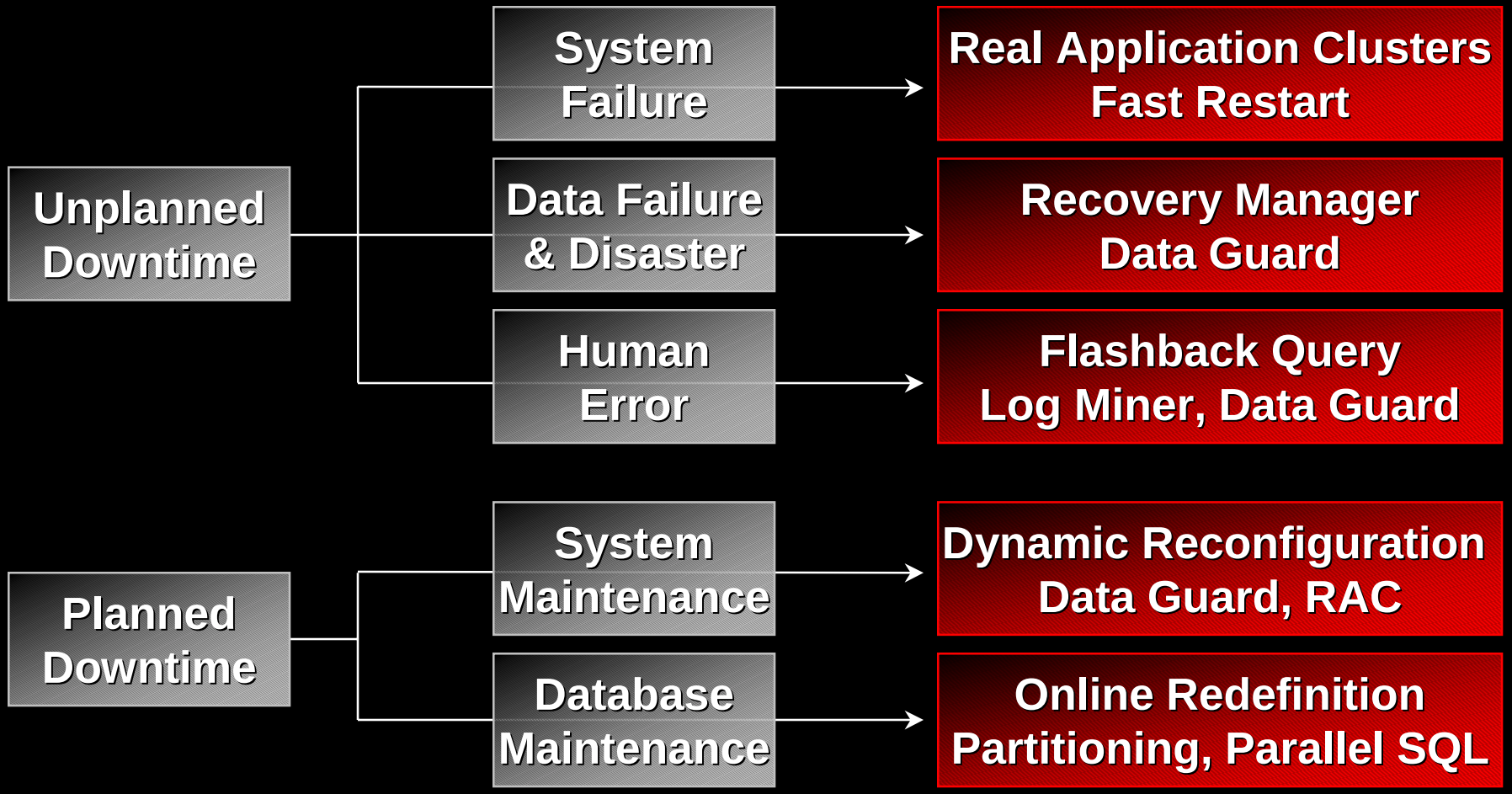
The Cost of Downtime?

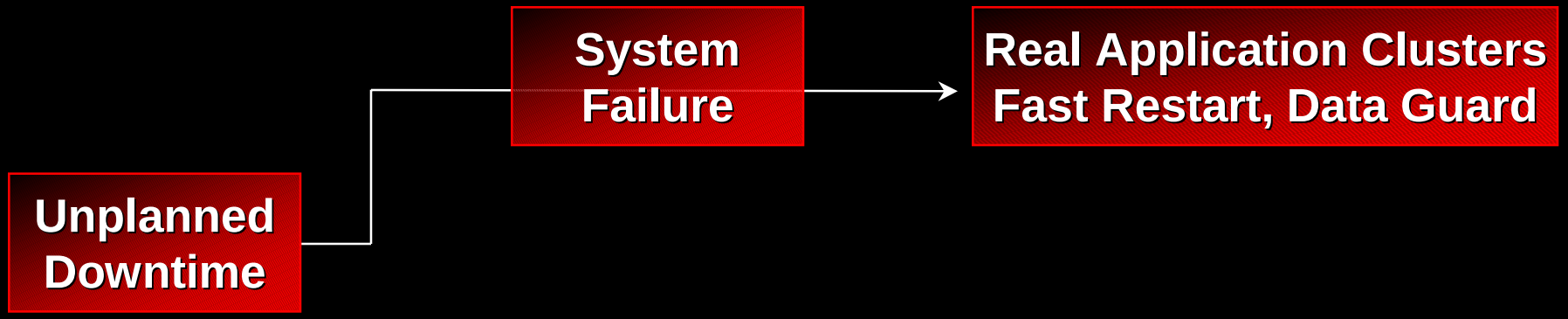
Percentage Availability	Downtime Per Year (7x24x365)		
	Days	Hours	Minutes
95%	18	6	0
99%	3	15	36
99.9%	0	8	46
99.99%	0	0	53
99.999%	0	0	5
99.9999%	0	0	1

"…even 99.9% data availability can cost a company nearly $5m a year" **- The Standish Group 2001**

Oracle9*i* Handles Causes of Downtime

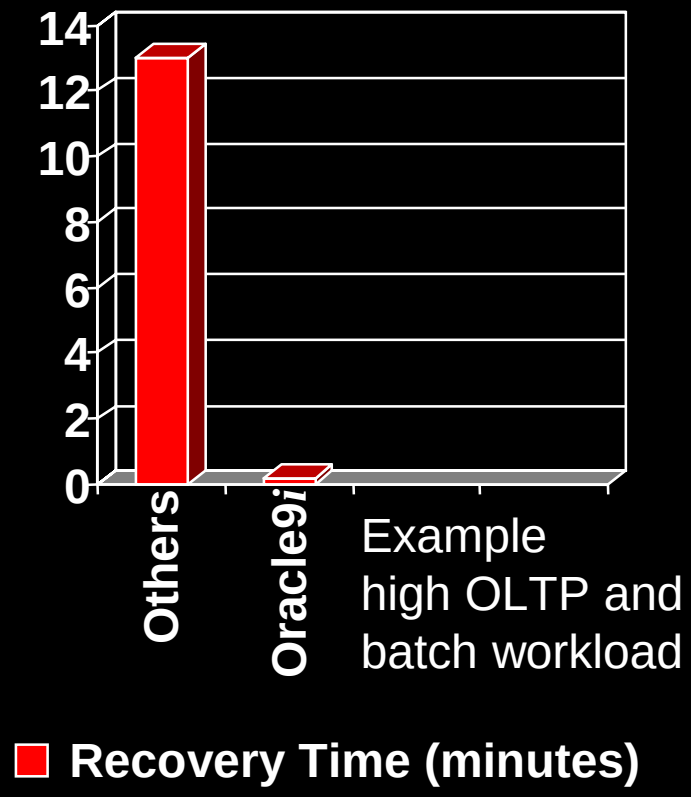


System Failure



Fast-Start™ Fault Recovery

Provides near instantaneous recovery time



- Oracle9*i* automatically recovers data
- DBA can specify time limit for recovery process
- Oracle9*i* dramatically reduces recovery times
- Minimal impact from deferred rollback operations

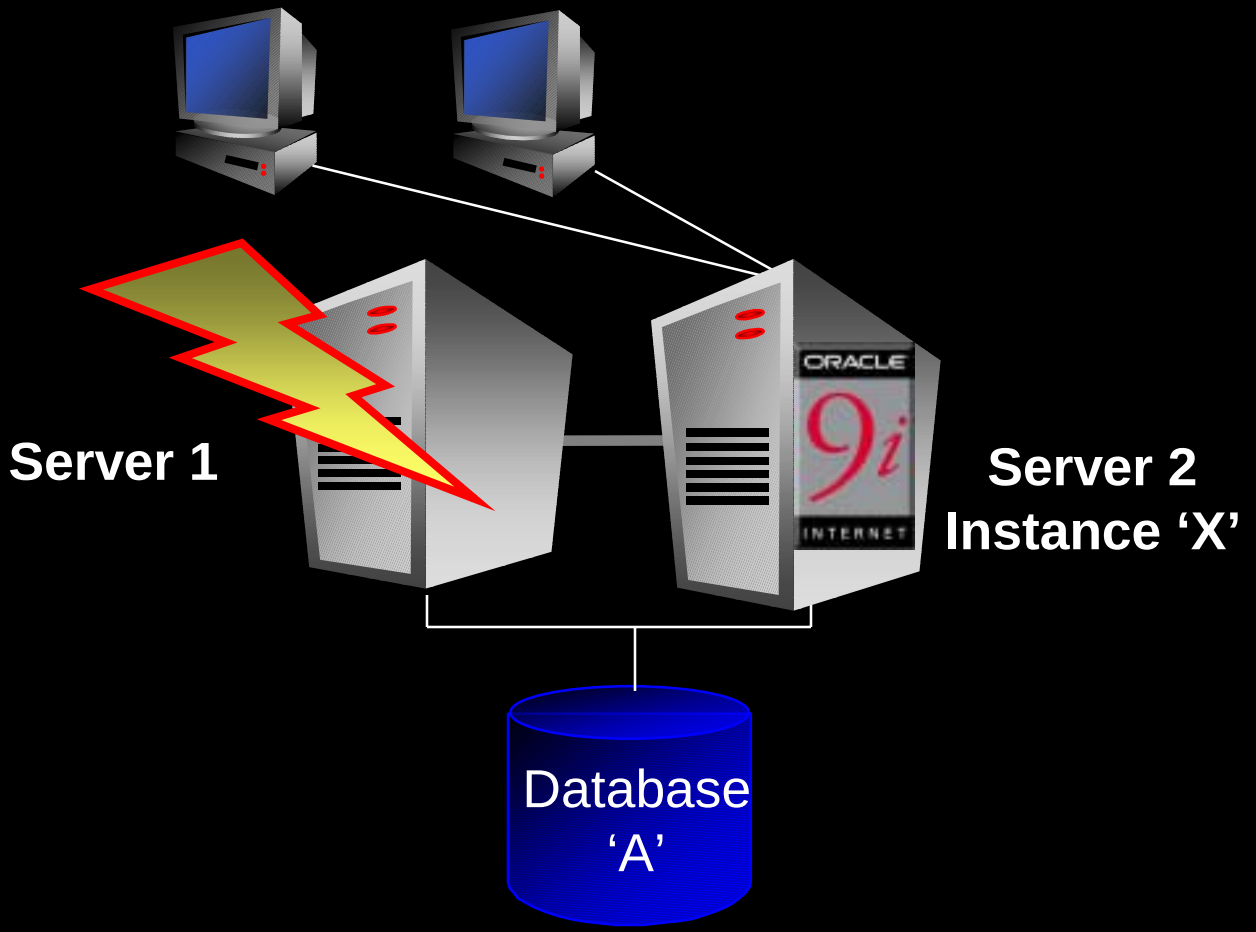
Single Instance Failure

Server 1
Single Instance ‘X’

Database
‘A’

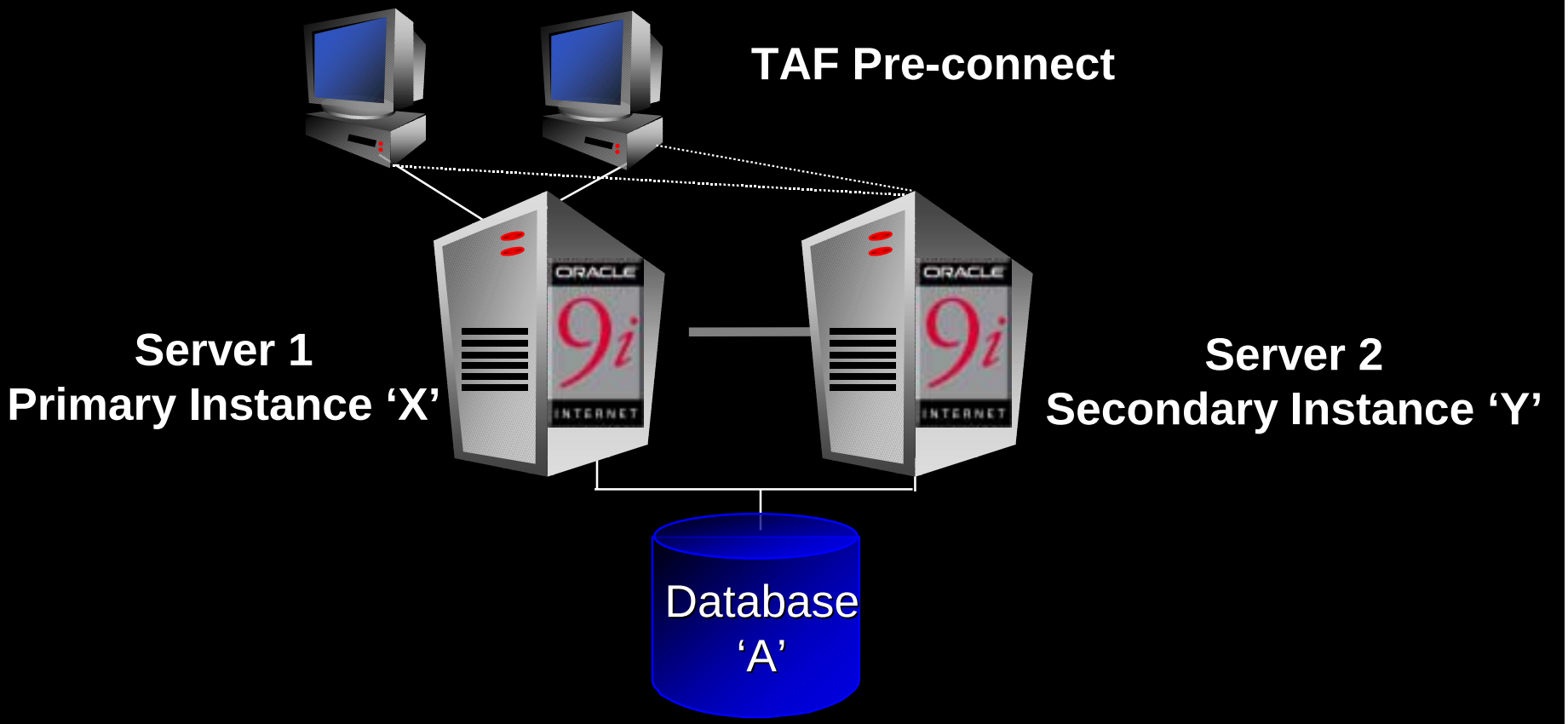
Server presents a single point of failure

Clusters with ‘cold’ Failover



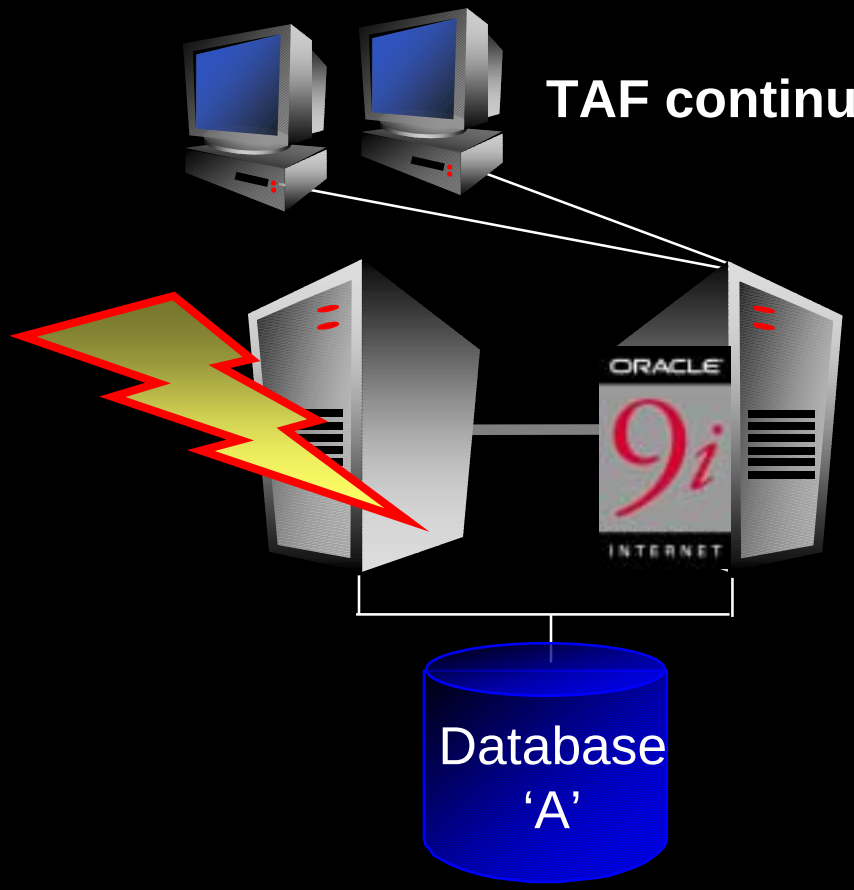
Examples include HP ServiceGuard & MSCS

Oracle9*i* Real Application Clusters for 'hot' Failover



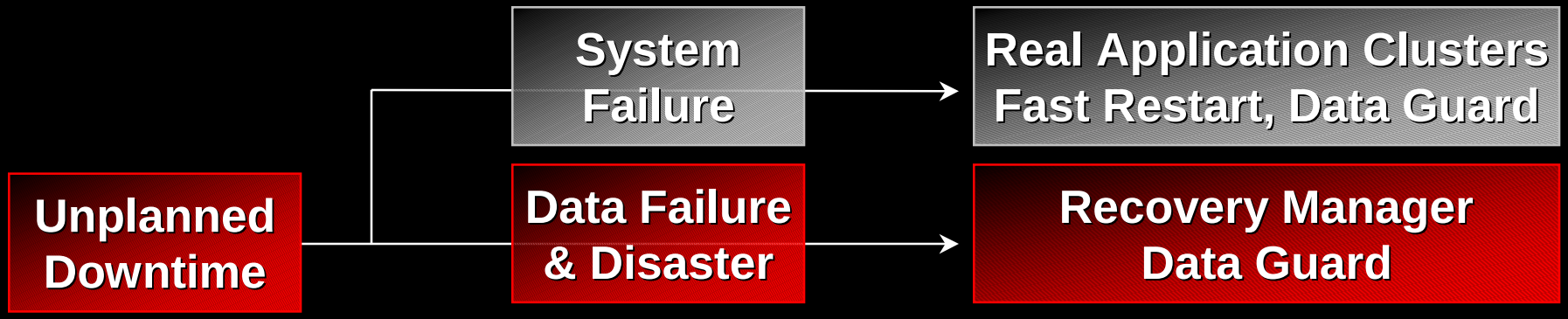
Enhanced configuration of Oracle9*i* RAC for availability

Oracle9*i* RAC Guard ‘hot’ Failover

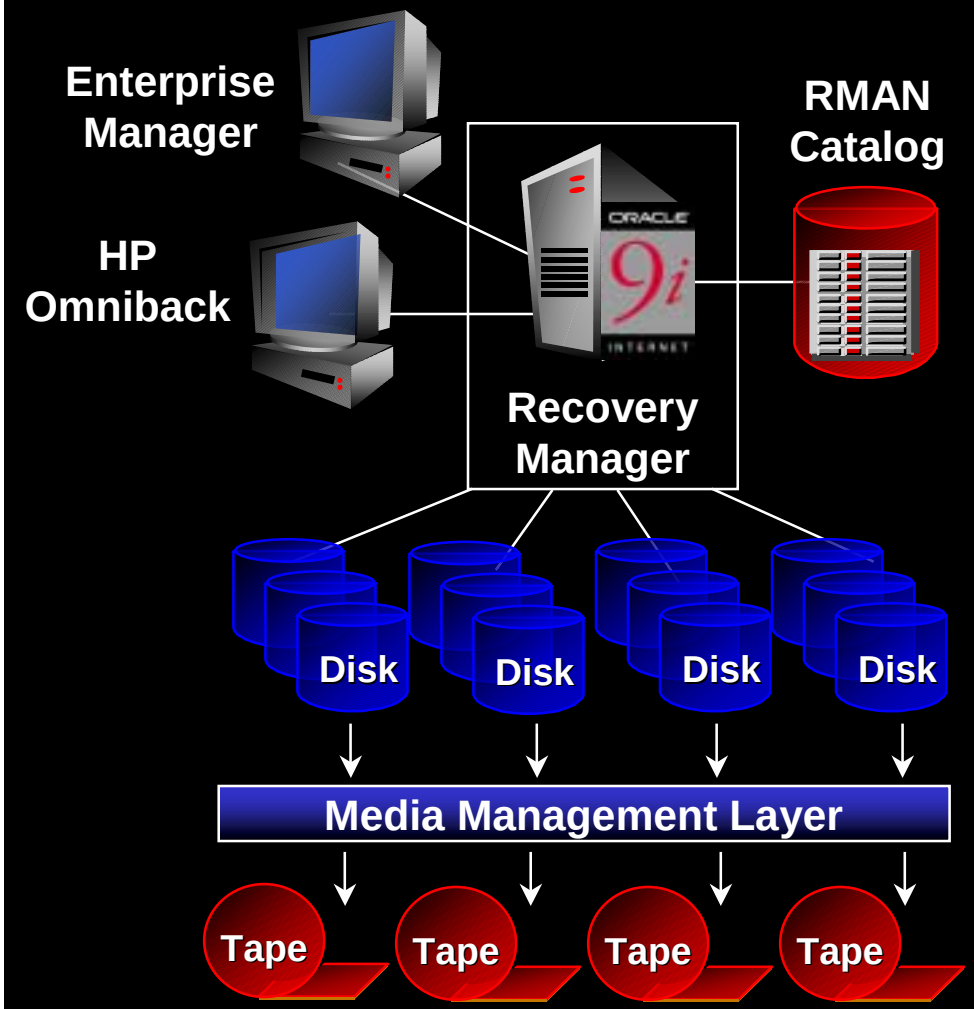


Fastest recovery from system faults in the industry

Data Failure and Disaster

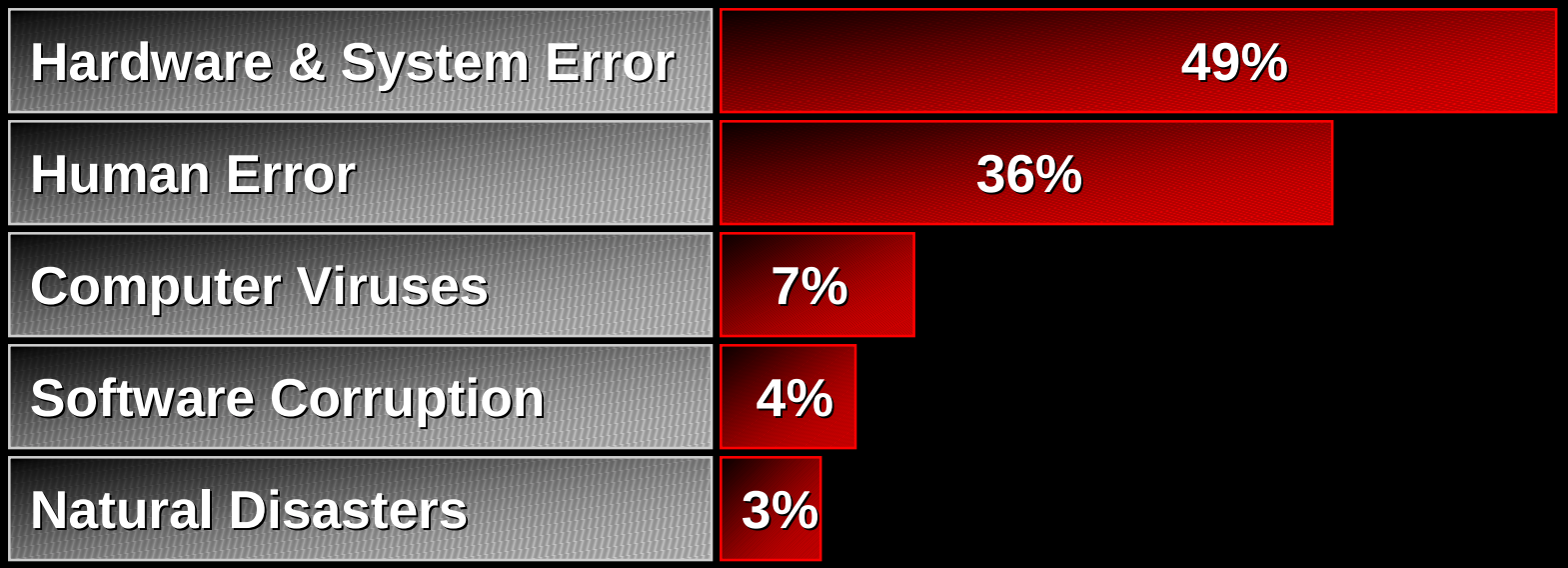


Oracle9*i* Recovery Manager



- Manages the backup, restore, and recovery process
- Operates on-line and in parallel for fast processing
- Proxy Copy Backup Accelerator
- Corrupt block detection
- Block level media recovery
- Restartable backup and restore
- Integrated with Enterprise Manager & 3rd Party Tools such as HP Omniback

Leading Causes of Data Loss



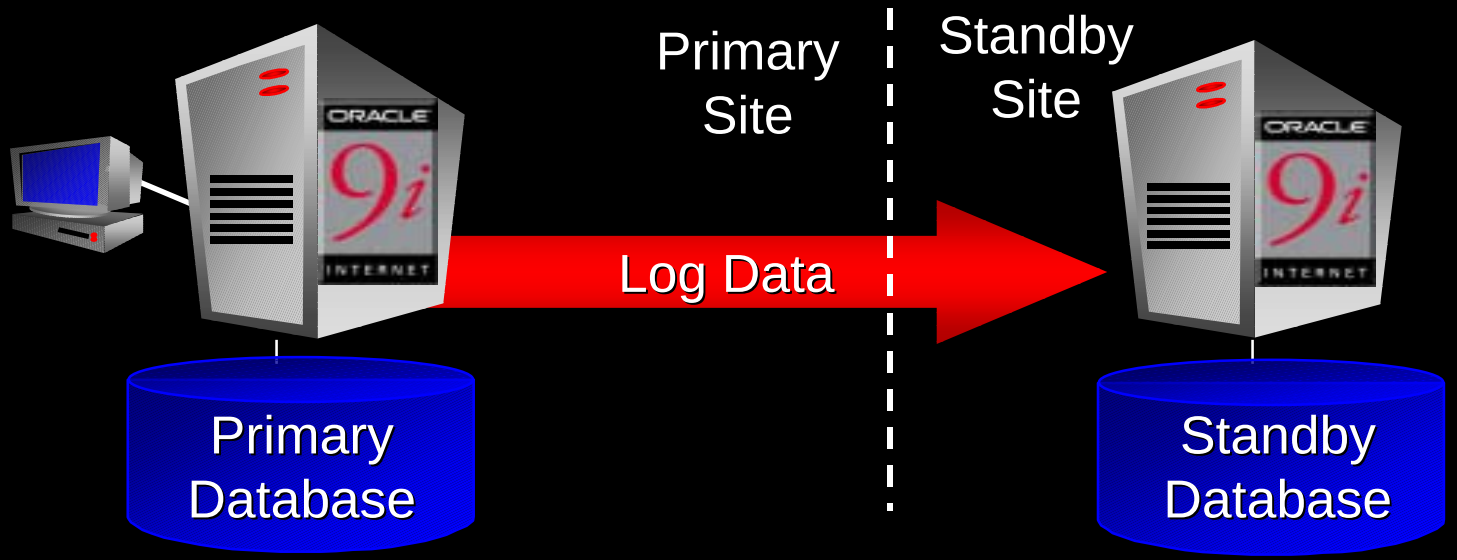
- The Disaster Recovery Journal 2001

Why Have a Standby Database

A standby database enables the creation and maintenance of one or more duplicate, or standby copies of your production database

In the event of disaster at the production site, the standby database can be activated to take over the data serving needs of the enterprise

What is a Standby Database



- Replica of Primary database
- As primary database is modified, changes are propagated to (possibly remote) standby databases
- Primary database is open and active. Standby database is either in recovery or open read-only
- If something goes wrong with primary, activate standby

Benefits of Standby Databases

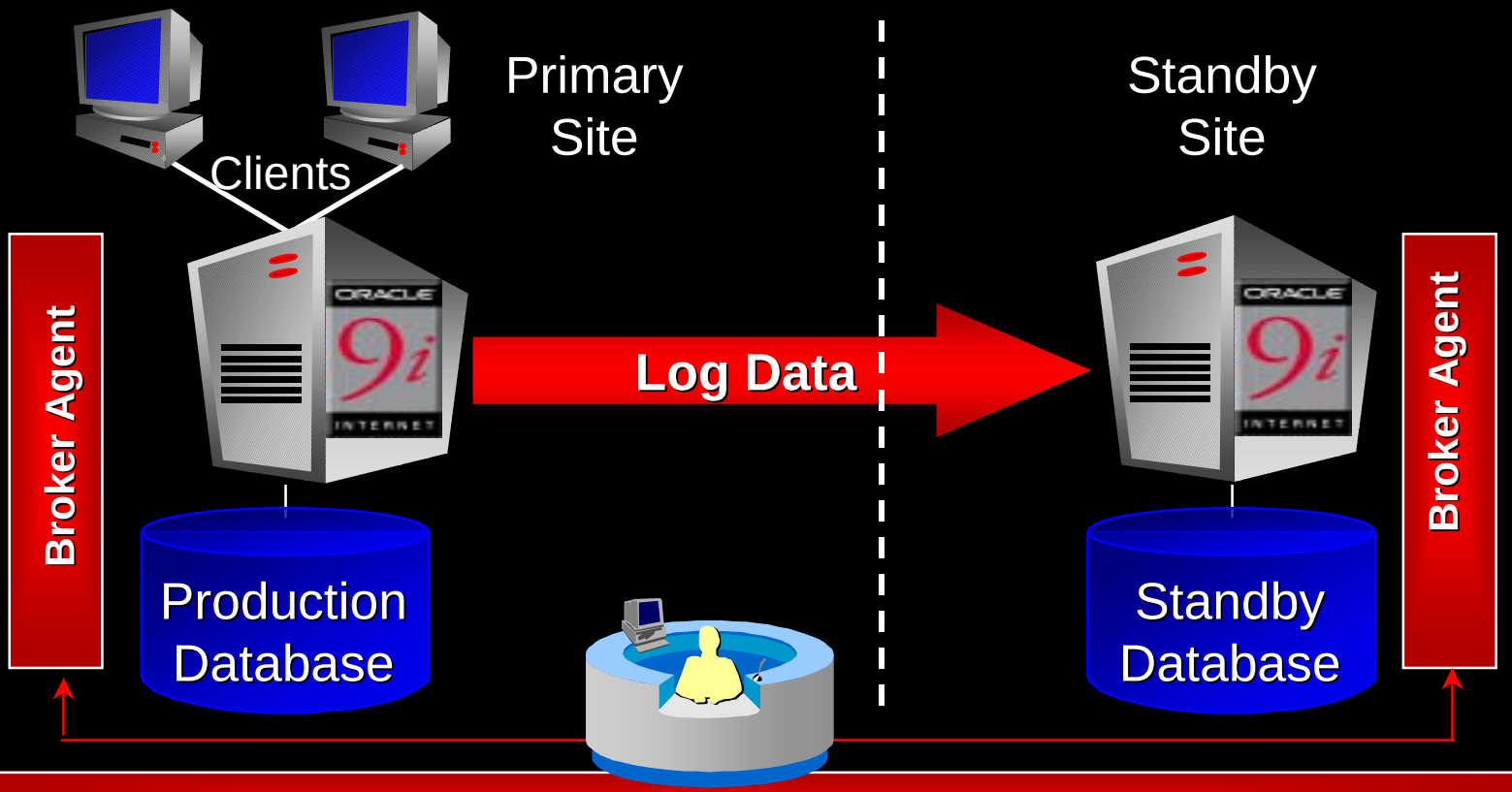
- Standby is application transparent
  - No application code changes are required
  - Standby has minimal impact on the Primary database
  - Standby can keep up with very high transaction rates
  - Standby can be started/stopped while the primary database is opened
- Standby database can be queried read-only
- One of the most popular high availability solutions used by Oracle customers

Benefits of Standby Databases

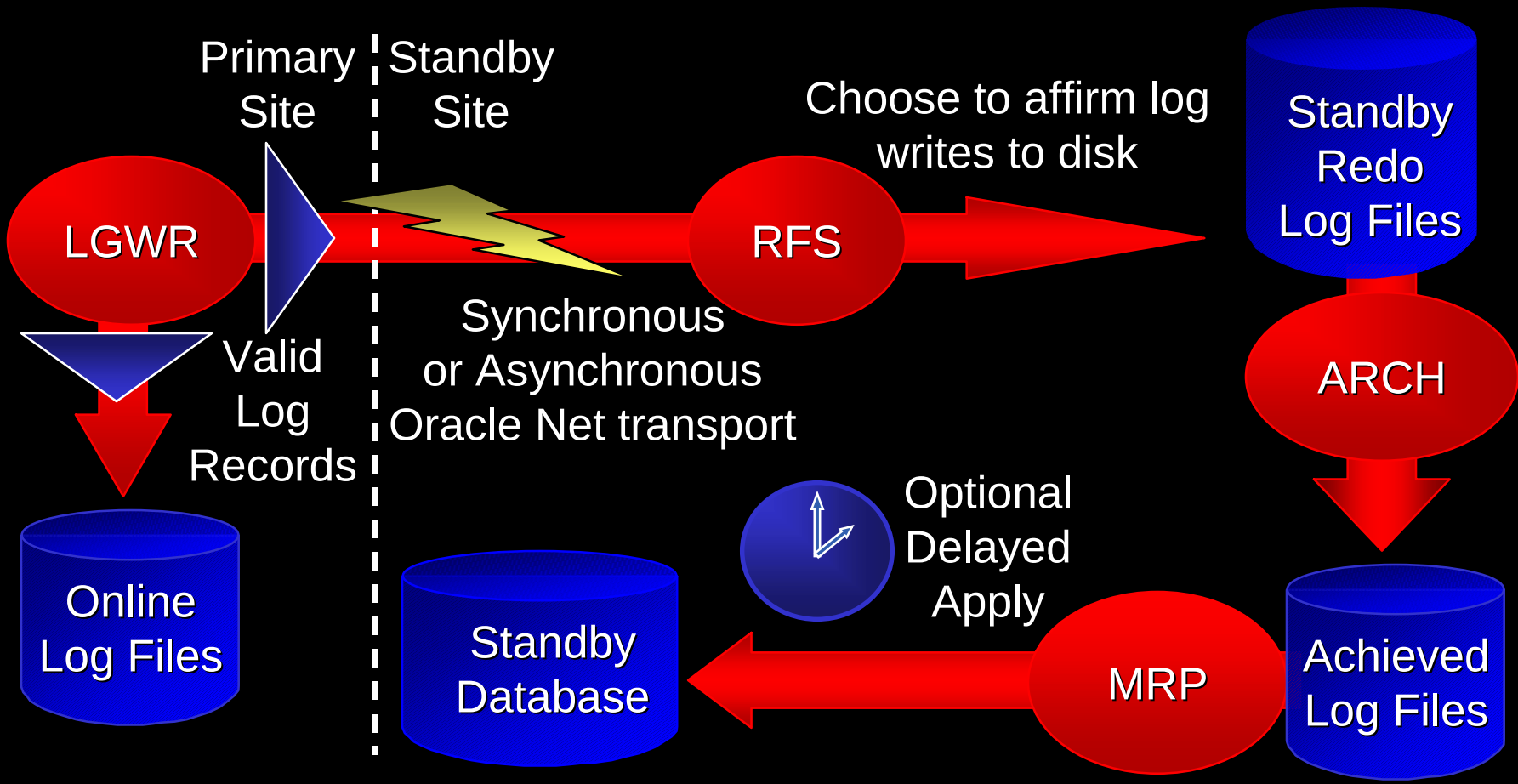
- Standby databases have traditionally been thought of as a disaster recovery solution
- Standby databases are useful for much more
  - Protect against user errors
    - Standby can delay *applying* the changes to avoid errors that may occur on the primary (note: changes are still *shipped* normally)
  - Protect against data corruption
    - File system corruptions, overwritten volumes do not propagate
  - Reduces downtime for planned outages such as operating system or hardware upgrades

Oracle9*i* Data Guard Broker

Provides monitoring and management capability



Oracle9*i* Data Guard Log Data Flow

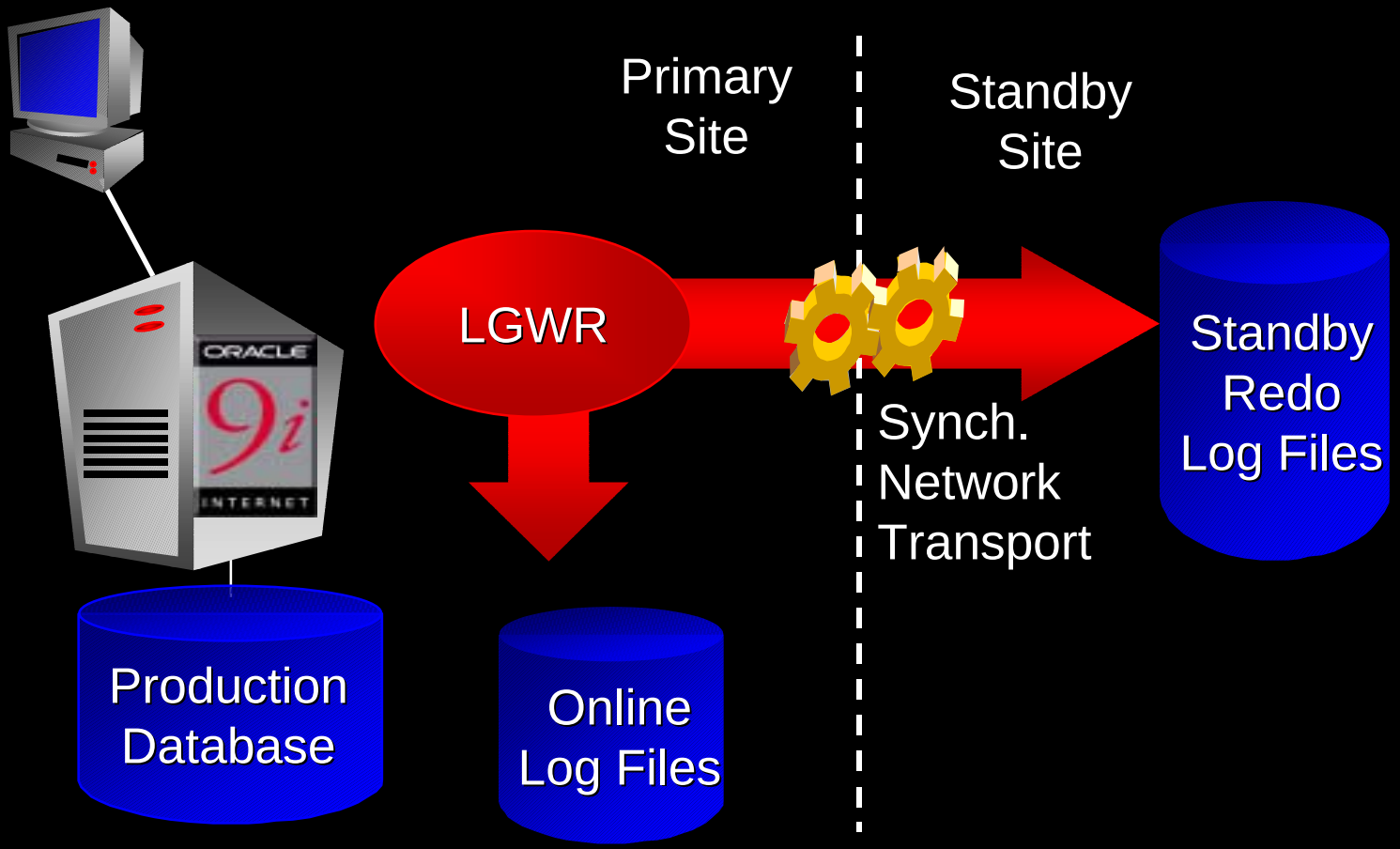


Simultaneous log writes to online logs and standby logs

Flexible Data Availability Modes

Protection Mode	Risk of Data Loss	Production Impact
Instant (Sync Log Writes)	Zero (If only primary fails)	Moderate (Has Fallback Mode)
Guaranteed (Sync Log Writes)	Zero (Handles Double Failures)	High (No Fallback Mode)
Rapid (Asynchronous)	Minimal	Low (Async Log Writes)
Delayed (Archive Logs Only)	High (Current Online Log Lost)	Low

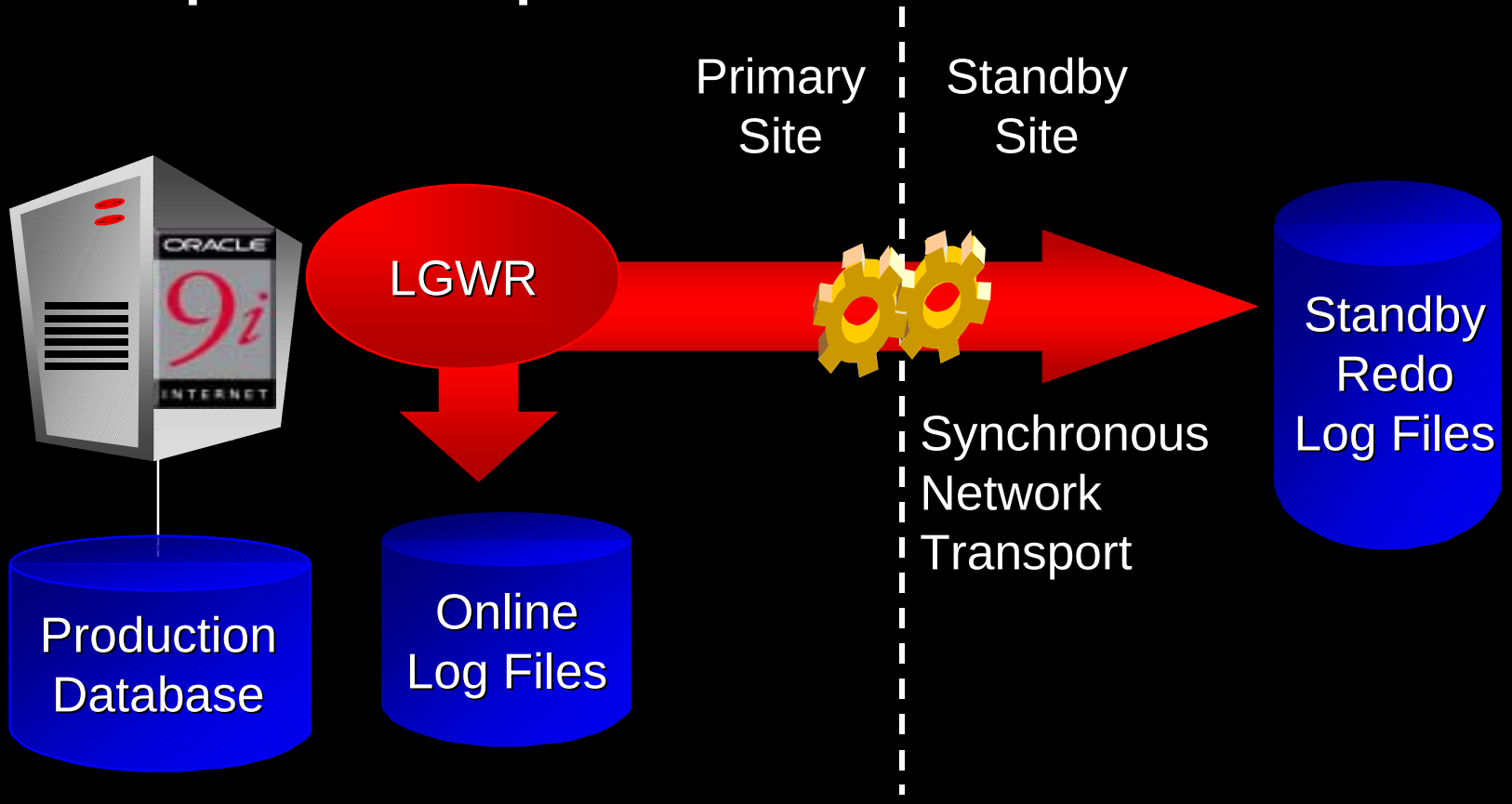
Instant Protection Mode



Fallback to Delayed Mode if standby down or unreachable

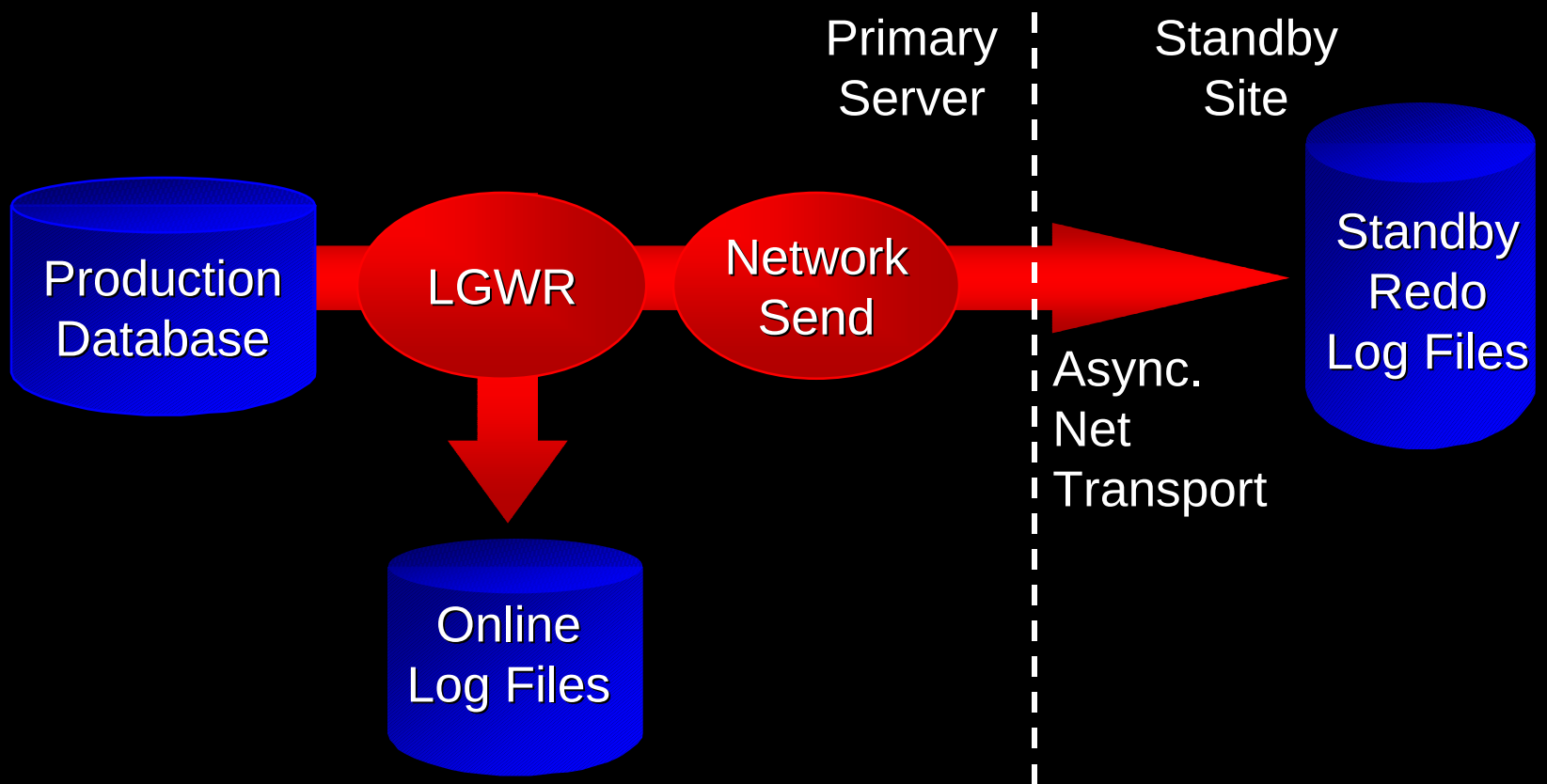
Guaranteed Protection Mode

No Unprotected Updates - Handles Double Failures



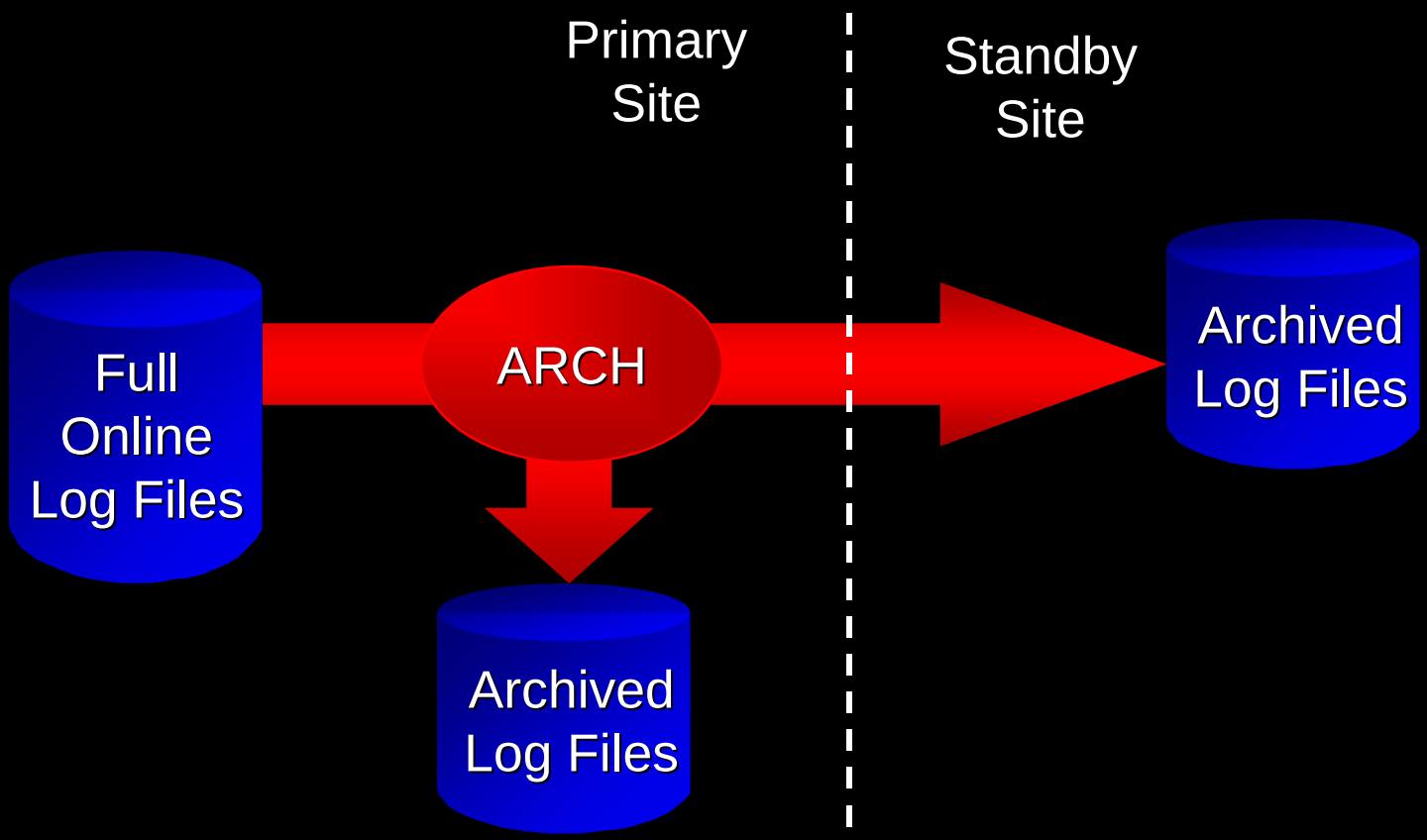
Stalls primary if standby site down or unreachable

Rapid Protection Mode



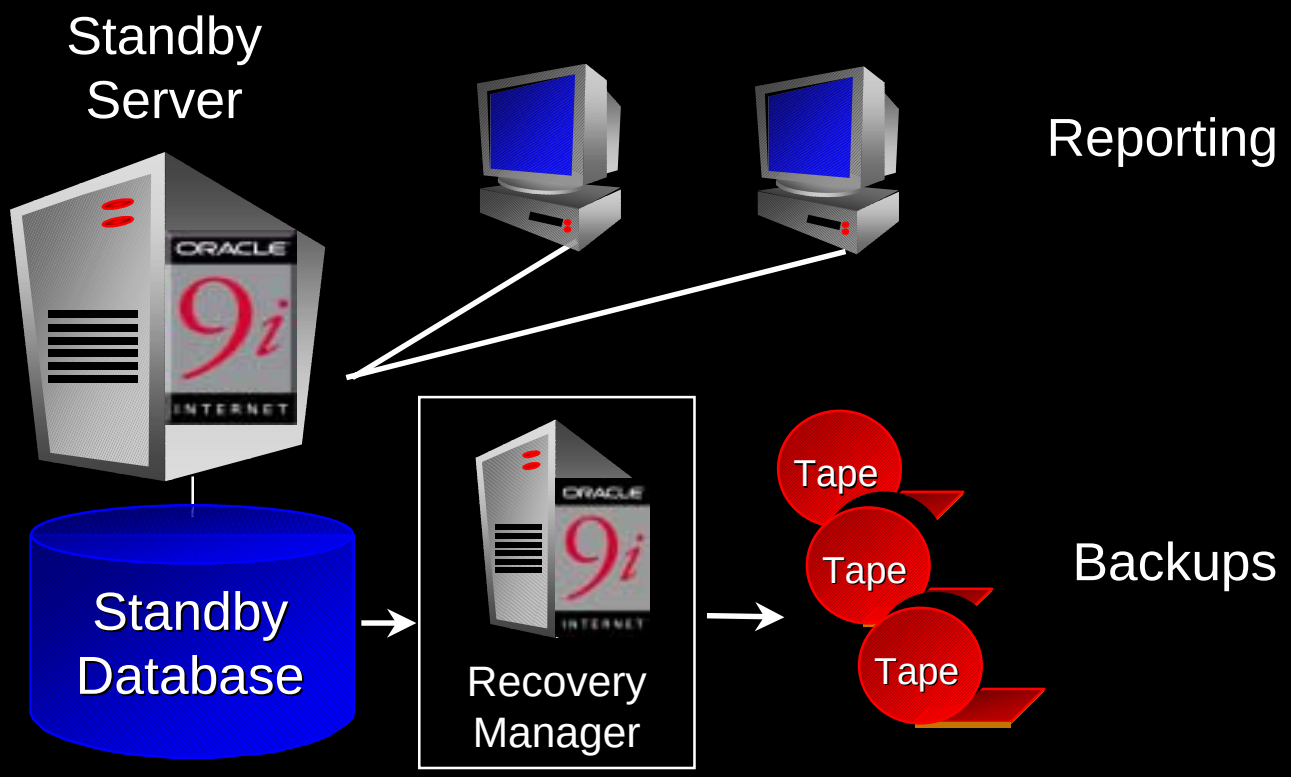
Log Writer returns control to primary after write to Network

Delayed Protection Mode



Changes propagated to standby site when online logs fill

Offload Reporting and Backups



Standby database can be used to offload reporting and backups using Recovery Manager

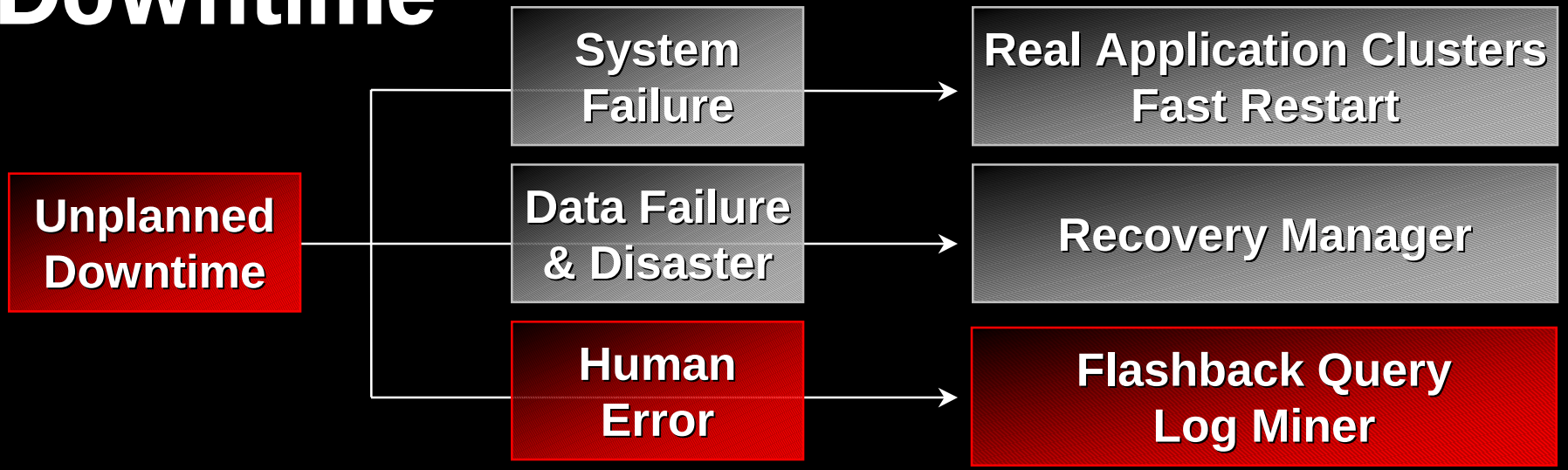
Oracle9*i* Data Guard Vs. Clusters

- Clusters address system issues
  - Provide rapid and automatic recovery from failures that don't effect data (node death, DB crash, …)
  - Can provide increased scalability
- Data Guard addresses data issues
  - Does not share disk nor run in lock step
  - Can recover from human errors
  - Can protect against data corruptions
  - Can be remote
  - Does not require any special hardware or cluster software
- Standby and clusters are complementary

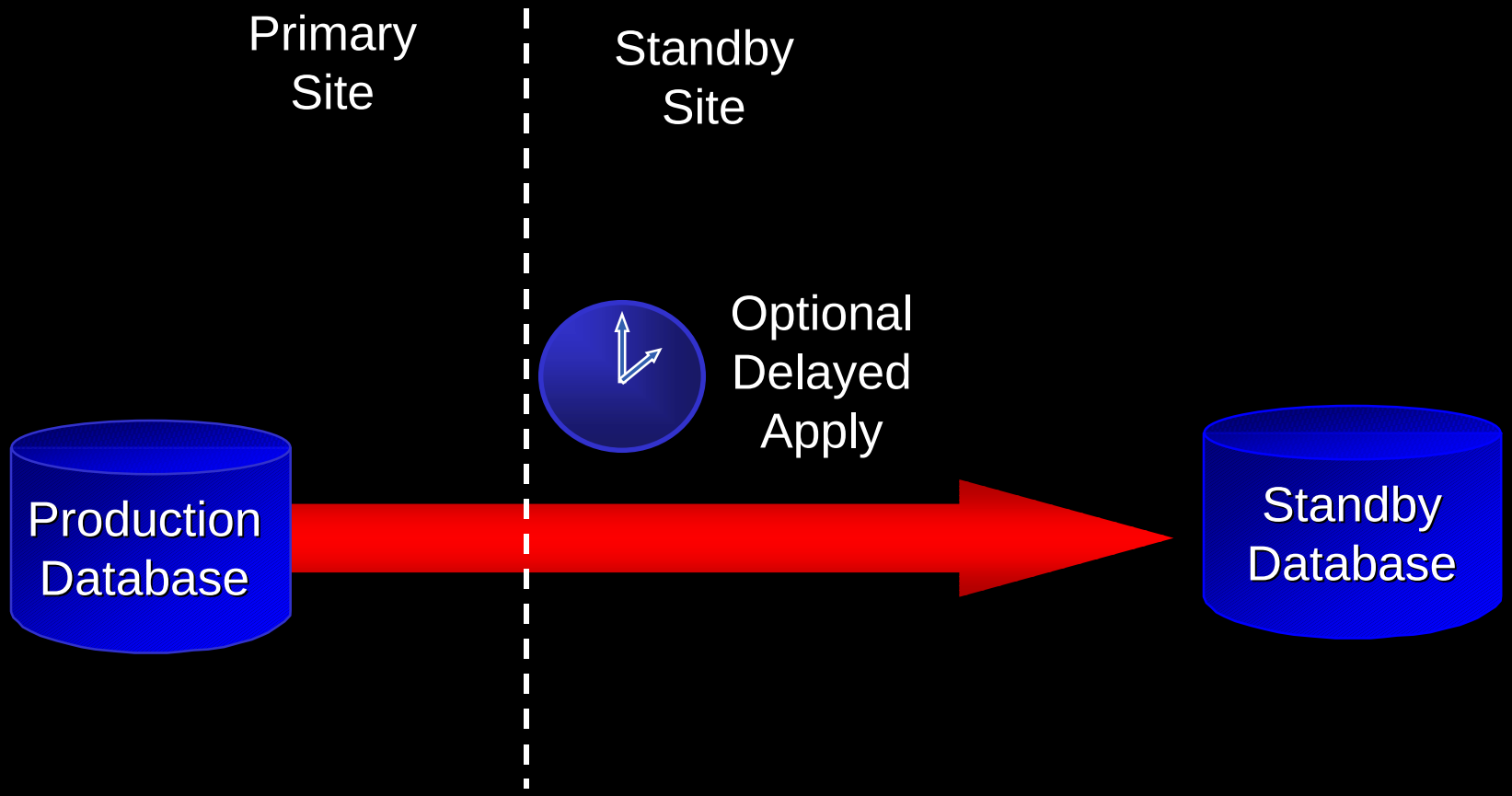
Oracle9*i* Data Guard Vs. Remote Mirroring

- Remote Mirroring is Simple and Complete
  - Propagates changes to non-database data
- Data Guard is Resilient and Efficient
  - Logical application of changes prevents many data corruptions from propagating
  - Standby allows change application to be delayed
  - Standby performs better than remote mirroring since only changes are transferred
    - 7x less data and 27x less I/O for Oracle Mail Database
  - Standby can be opened read-only while changes are still propagating

Oracle9*i* Handles Causes of Downtime



Protection from Human Error



Tunable delayed apply used to catch human errors

Oracle9*i* Log Miner
View all database changes

- Query contents of Redo Log using SQL
- GUI and Command Line Interface
- Query by value and undo any change
- Supports DDL, chained rows, primary keys and Direct Path
- Support for schema evolution

Addresses ‘human error’ challenge

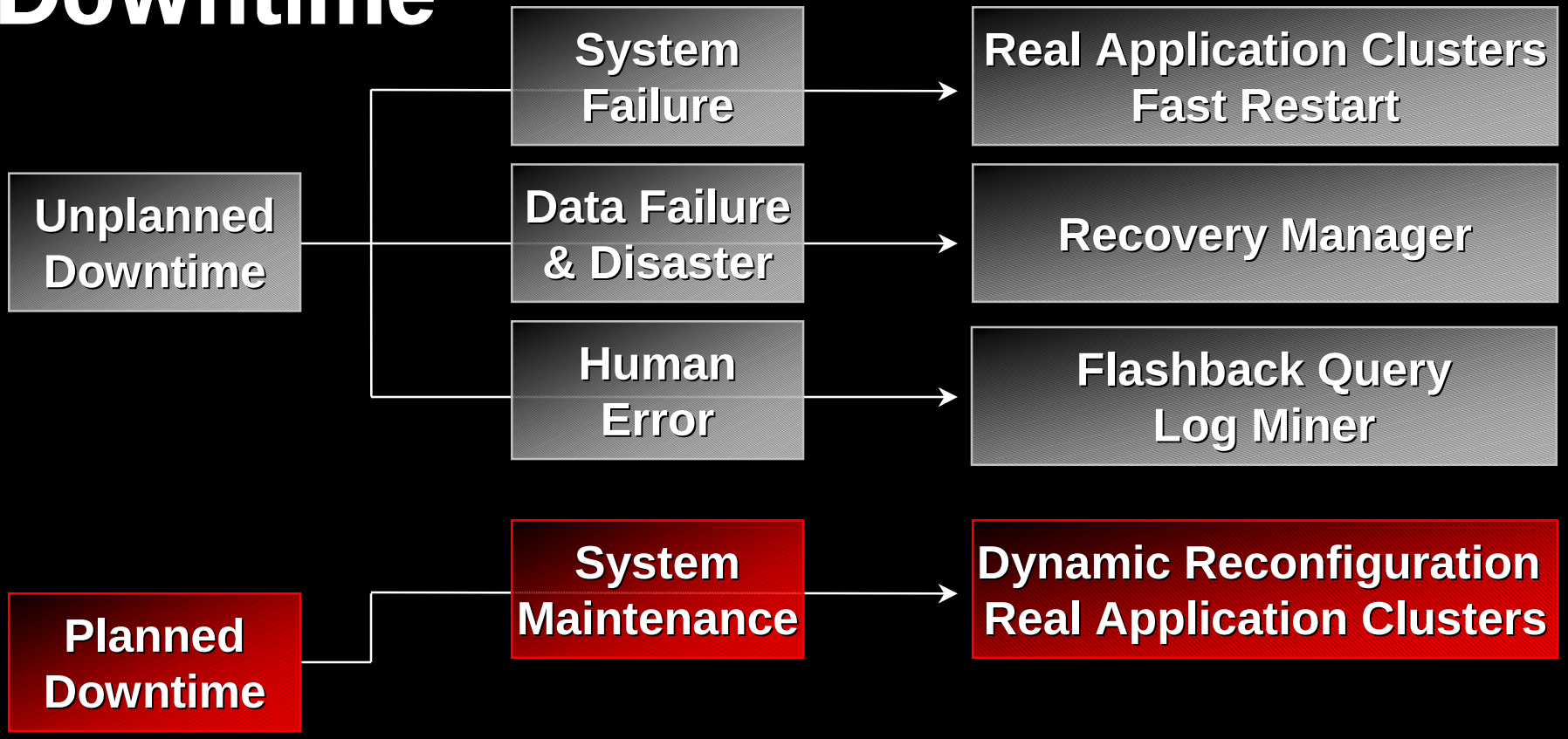
Oracle9*i* Flashback Query
Self service error correction

- Allows viewing of data at a point in time in the past
- Simple SQL interface
- Easily identify changes made over time
- System managed undo
- Accessed via user or application control

```
Insert into EMP select * from EMP
  AS OF yesterday
  where ENAME='Smith';
```

Addresses 'human error' challenge

Oracle9*i* Handles Causes of Downtime



Dynamic Reconfiguration

- Oracle9*i* dynamically adjusts to hardware reconfiguration
  - Dynamically add and subtract CPUs to SMP
  - Dynamically grow and shrink shared memory
  - Dynamically adjust data storage
  - Dynamically add and remove nodes in a cluster
- Capacity on demand

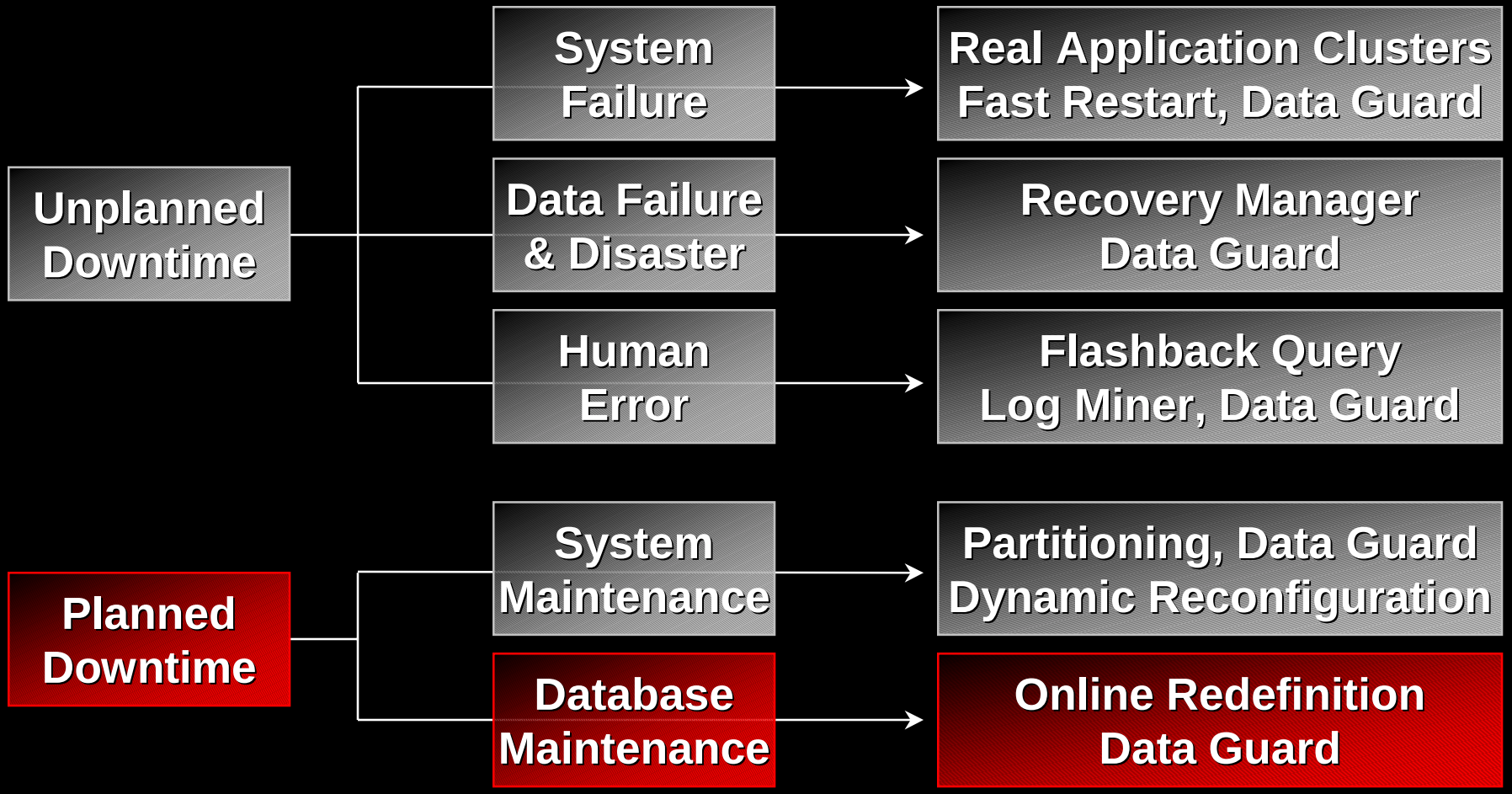
Addresses 'Planned Downtime' challenge

Oracle9*i* Data Guard Switchover

- Members of an Oracle9*i* Data Guard configuration
  - Primary or Standby Role
- Planned Switchover
  - Used for maintenance of OS or hardware
  - Planned role reversal with no reinstantiation

Addresses ‘Planned Downtime’ challenge

Database Maintenance

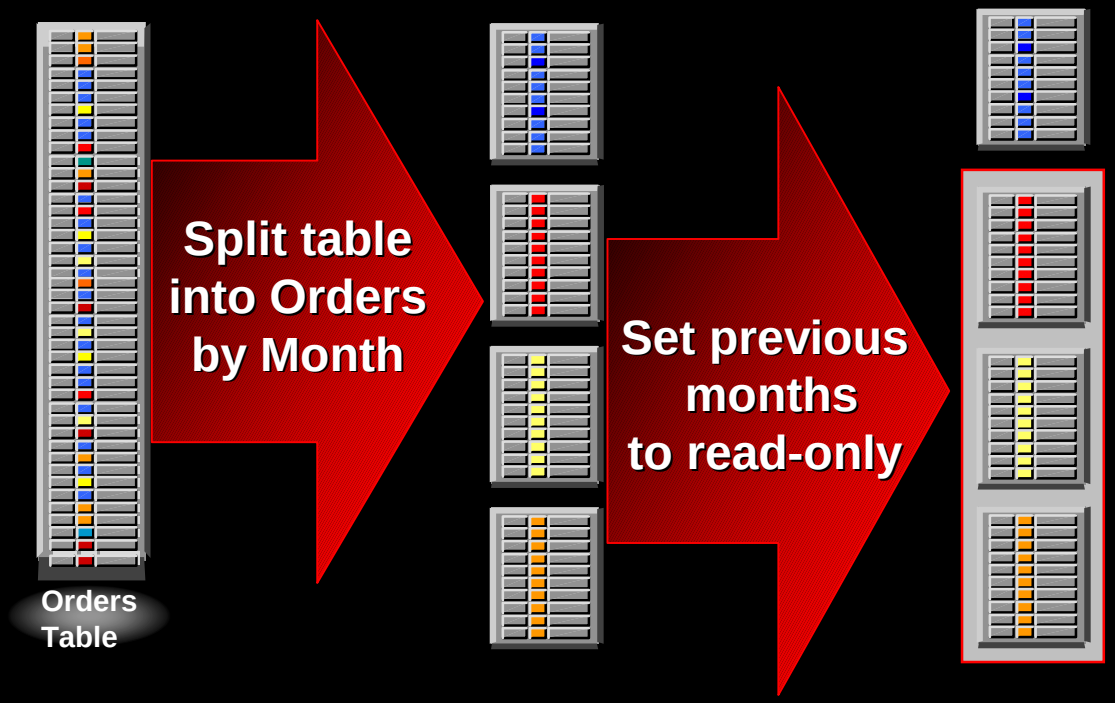


Online Redefinition

- On-line schema redefinition
  - add, modify, drop table columns
- Complete on-line index operations
  - create, recreate
- On-line table re-organization and redefinition
- On-line analyze and validate
- Updates & queries continue uninterrupted

Addresses ‘Planned Downtime’ challenge

Oracle9*i* Partitioning

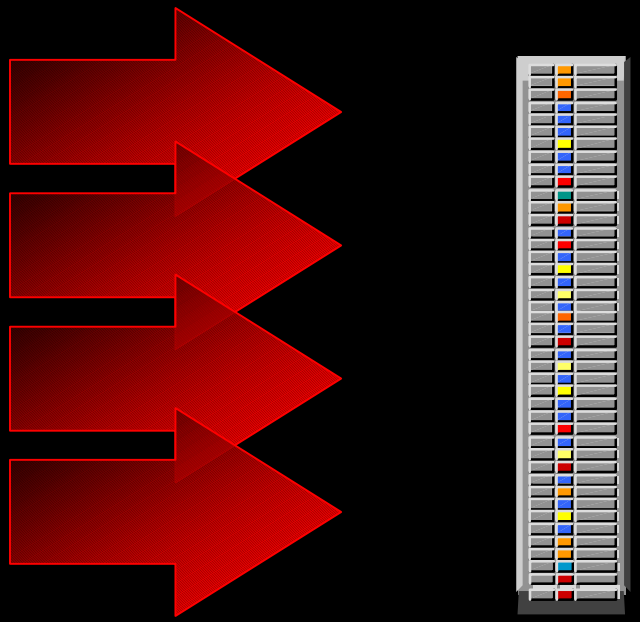


Partition by...

- Range
- List
- Hash
- Composite

Maintenance by partition reduces planned and unplanned downtime

Oracle9*i* Parallel Operations



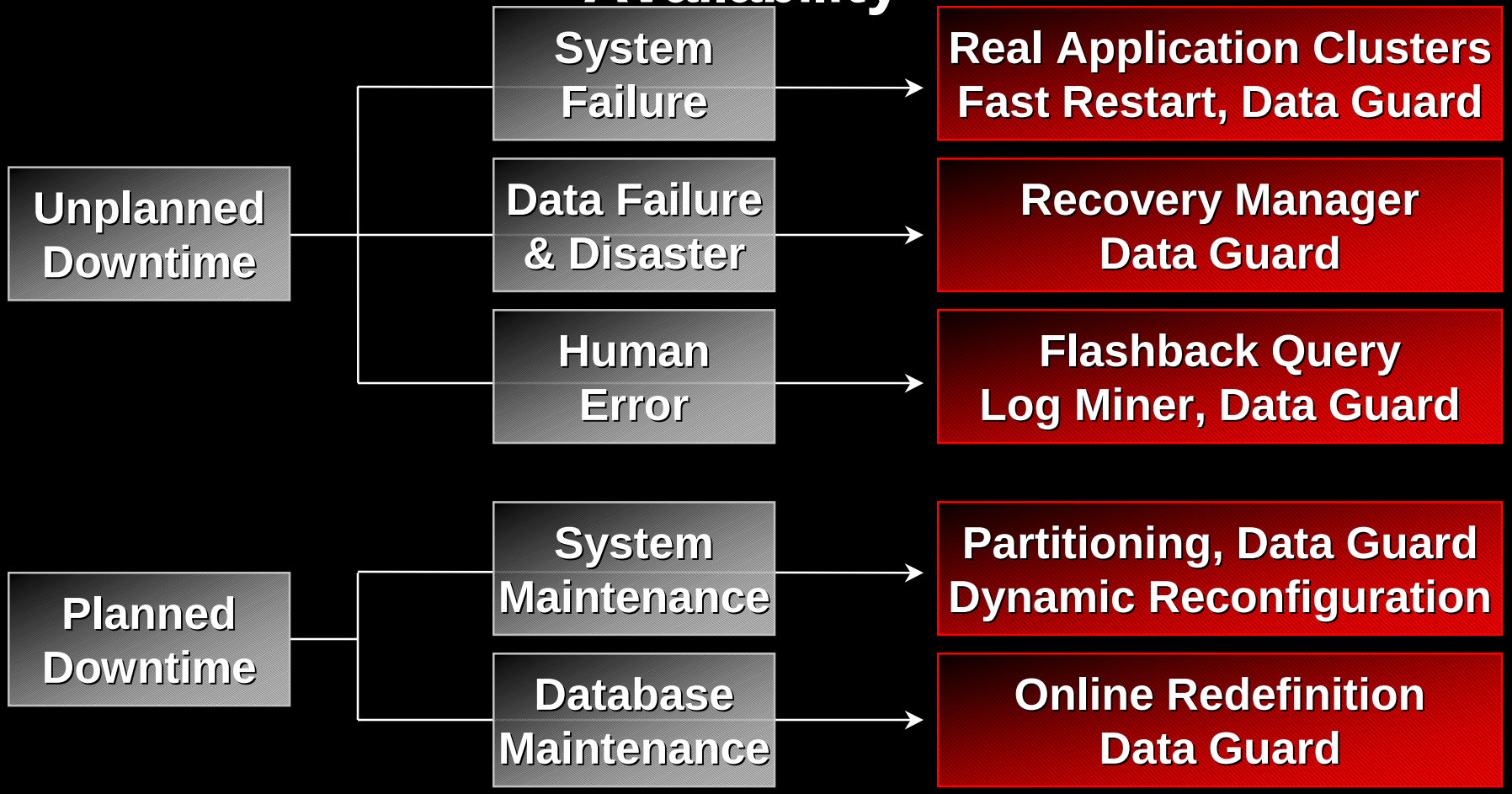
Parallel

- Insert
- Update
- Load
- Delete

Reduce planned downtime for database maintenance

Summary

Oracle9*i* architected for Continuous Data Availability



For more information on Oracle High Availability, Disaster Protection, Backup & Recovery, Storage Management, and Server Manageability technology visit:
http://OTN.oracle.com/deploy/availability/

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