UNIVERSIDAD TÉCNICA DEL NORTE

FACULTAD DE INGENIERÍA EN CIENCIAS APLICADAS

ESCUELA DE INGENIERÍA EN SISTEMAS COMPUTACIONALES

TECHNICAL RESUME

THEME: "ESTUDIO DE SEGURIDAD DE BASE DE DATOS MEDIANTE REPLICACIÓN Y SISTEMAS RAID CON SYBASE EN ARQUITECTURA SPARC."

APLICATION: "IMPLEMENTACIÓN DE SEGURIDAD DE LA INFORMACIÓN MEDIANTE LA REPLICACIÓN DEL TIPO WARM STANDBY Y SISTEMAS RAID."

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ÍNDICE GENERAL

ÍNDICE DE FIGURAS

1. RESUME

Upon completion of the investigation and development of this project, we can conclude that a scheme was introduced to information security through the implementation of a Warm Standby Replication Server with Sybase Auto Sparc architecture as the focus of this solution was to provide an infrastructure that guarantees high performance replication in response to today's requirements, strengthening and improving some points such as:

- Safe environment using two computers: a primary server and another that leads both Replication Server and Secondary Server.
- Continuous availability, when there are external circumstances threaten ongoing operations, or prompt recovery in the event of a disaster and reliability through the implementation of automatic Warm Standby.
- Recoverability and reliability for devices built on file systems because its management becomes easier by using file systems in large environments.
- Fault tolerance by implementing Raid 0 +1 level operating system level.
- Continuous operation regardless of the failures of hardware / software and for maintenance processes at the same time it provides support to decision making in real time without affecting production systems using manual handling Switchover in this case, thus allowing maintain business continuity.

According to the above it follows that information security has improved significantly, so the hypothesis is tested with the following limitations:

- Given the growing need to separate infrastructure applications for the rapid construction and deployment of flexible solutions and taking into account that you have a single team for the event, the solution is limited temporarily to a facility as Replication Server and the Secondary Server in the same environment.
- Statements about Sybase's future growth, prospects and new product releases are, by their nature, forward-looking statements involve risks and uncertainties. These outcomes are limited to a single version is 12.5.4 Sybase Enterprise, which is the one used throughout the application, preventing take advantage of features, caused by new versions.
- Implementation of information security and creating user roles equally limited free use of replication tools and user access.

2. INTRODUCTION

The objective of this thesis project was to have a solution for the main production servers to provide increased security and redundancy of information and to improve the continuous recovery in the event of a failure due to the many risks which is exposed, then saw fit to install a replication server and extended handling volumes (RAID), by which they can have a proper system of contingency for any eventuality, thus maintaining the availability integrity and confidentiality of information at all times.

3. PROBLEM DEFINITION

Despite the need to build robust applications, able to continue functioning in the presence of failures, or at least to recover quickly after its occurrence, especially in today's distributed environments, it is difficult to see applications and systems able to continue operating properly after a failure in any component. This is due largely to the real shortage of solutions for the creation of such applications.

The information is becoming an increasingly important concern for small and medium enterprises. A failure or loss of information in the database operations can seriously damage a company's most important, affecting productivity and business continuity, jeopardizing the integrity, confidentiality and availability of data, reducing the confidence of customers interrupting the flow of revenues and stopping communications.

4. GENERAL OBJETIVES

Our objective was to investigate the different types of replication and RAID systems thus enabling us to recognize its features and benefits to any failure and vulnerability to those who may be exposed to a database and information in general, was designed and implemented a replication server database and a RAID disk system with fail-safe criteria and a shorter recovery time to the unexpected.

5. SPECIFIC OBJETIVES

- We determined the type of replication that best fit to the needs of the environment.
- We determined the feasibility of implementing a Replication Server.
- Implemented a RAID solution that is in accordance to the needs of the company.
- We determined the extent of Warm Standby replication.

6. SCOPE

The objective of this project was to improve the security of a database by implementing a Warm Standby Replication Server with Sybase Sparc architecture, the focus of this solution is to provide an infrastructure that guarantees high performance heterogeneous replication in response to current requirements, such as:

- Safe environment using two computers: a Primary Server and another that leads both Replication Server and Secondary Server.
- Continuous availability, when there are external circumstances threaten ongoing operations, or prompt recovery in the event of a disaster amd reliability though the implementation of automatic.
- Warm Standby. Recoverability and reliability for devices built on file systems because its management becomes easier by using file systems in large environments.

7. CHAPTER I: Introduction to security levels

7.1 BASIC CONCEPTS

Security

Refers to measures taken for the sole purpose of preserving the data or information about the company or organization.

The information stored in a database can have a great value, why should ensure that this information is safe from malicious users who attempt to read privileged information against attacks that wish to manipulate or destroy data , or just to the stupidity of a user authorized but clueless.

Backup and recovery

Transmission Systems Database (DBMS) must provide an efficient way to backup the information stored on them, and restore from these backups the data that may have been lost.

Concurrency control

In most environments (except perhaps the home), you would typically be many people accessing a database, either to retrieve information, or for storage. It is also common for those accesses are performed simultaneously.

Thus, a DBMS must control the concurrent access to information, which could lead to inconsistencies.

Response time

Logically, it is desirable to minimize the time that the DBMS takes to give us the requested information and store changes.

Consistency

In cases in which there has been no redundancy for vigilance that is repeated information that is updated consistently, ie, all repeated entries are updated simultaneously.

8. CHAPTER II: Replication Server

8.1 Introduction to Sybase Replication Server

Sybase Replication Server moves and synchronizes data across the company to meet all kinds of challenges, while providing the highest level of management for the data. Delivers operational data across complex and extensive infrastructure distributed in near real time.

Replication Server increases the flexibility and reduces costs associated with managing multiple data management platforms. Provides replication and synchronization mechanisms for bi-directional heterogeneous enterprise-wide, for clients and servers, desktop and mobile systems. Combines the advantages of bi-directional heterogeneous data replication in real time with an integrated data model, development and administration. Allows reporting and business analysis applications, carry out IT initiatives in terms of processes and technologies as well as the consolidation of resources.

8.2 Advantages

- Continuous availability in case of occurrence of external factors that threaten the continuity of operations and the ability to carry out a speedy recovery in the event of a disaster.
- Possible to carry out the integration and synchronization of operations across multiple remote locations.
- Allows creation of reports in a timely and easily.
- Compatible with platforms of heterogeneous databases: Sybase ASE, Oracle, IBM DB2 and Microsoft SQL Server.

Sybase Replication Server provides a continuous system of the duplication of application data that are mission critical. Once established, you can automate this environment to ensure that information is replicated to meet the changing demands of business. Regardless of the setting, no matter how complex or distributed it and

regardless of restrictions in time, it can meet the requirements of your company regarding the transfer of those data with increased demand.

8.3 Components of the Replication Server System (RSS).

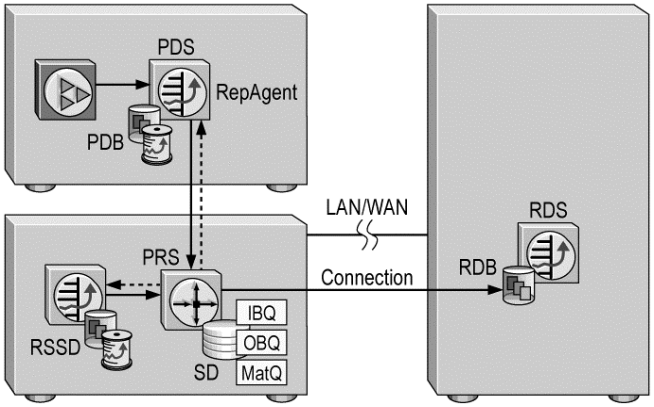

Fig. 8.1 Connection
Ref: Manual Fast Track to Replication Server Volume 1 y 2

Server Components Active Data

PDS: Primary Data Server

PDB: Primary Database

RepAgent: Replication Agent

Components of the secondary data server

PRS: Primary Replication Server

RSSD: Replication Server System Data

SD: Stable device

IBQ: Inbound Queue

OBQ: Output queue

MatQ: Materialization queue

Replication Server Components

RDS: Replicated data server

RDB: Replicated database.

9. CHAPTER III: Warm Standby

9.1 Warm Standby system definition

Warm Standby System is a pair of database servers Adaptive consistent state united by a single server replication.

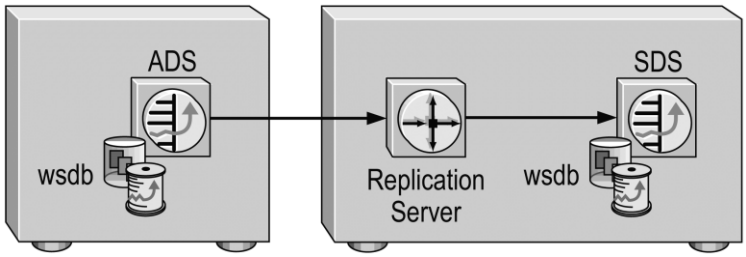

Fig. 9.1 Warm Standby system definition
Ref: Manual Warm Standby with Replication Server Volume 1

- **Active Database.** Adaptive data server to which clients connect now.
- **Standby Database.** An online copy of the current database to a separate Adaptive Server on a machine part.
- **Replication Server.** Forwards all commands performed on the assets to Standby.
- **Warm Standby pair.** Warm Standby system is always even. Three or more Warm Standby are not supported.
- **Adaptive Server only**. Warm Standby is only supported by Adaptive databases. Heterogeneous Warm Standby is not supported.
- **Additional features of the Replication Server.** Send changes the default schema for Warm Standby automatic. Coordinating the shift to standby if the asset fails.

Two types of Warm Standby

Automatic.

Replication enables the database level.

Replica both (DDL) Data Definition Language and (DML) Data Manipulation Language.

DDL affect the structure of the database, for example:

- create table
- drop index

DML affect only the data in the database, for example:

- insert
- update
- delete

Adaptive Server and requires replication server 11.5 or later.

Semiautomatic.

Replication enables the table level.

Replicates only DML.

Requires Adaptive Server 10.0 or later and replication server 11.5 or later.

9.2 Switchover

Switchover is the process of changing the direction of replication between two databases in a couple Warm Standby, during the switchover, the replication server:

- Performs all other asset transactions in the standby.
- Enter the old standby as the new asset and change the internal properties of the Warm Standby.
- After some manual intervention, start queuing of transactions for replication on the new standby (old asset).
- Replication Server does not:
- Automatically changing client applications to Standby.
- Repair of the active database.

9.3 Six steps to make a SwitchOver

1. Disconnect the client applications.
2. Stop RepAgent active.
3. Enter the command enable switch
4. Start the RepAgent for the new asset.
5. Reconnect client applications to the new assets.
6. Reconnect the database in the new standby.

10. CHAPTER IV: Raid Systems

10.1 Introduction to system raid

Fig. 10.1 RAID system
Ref: http://www.proredes.net/raid.html

In computing, originally from the English acronym RAID Redundant Array of Inexpensive Disks (redundant array of inexpensive disks), now Redundant Array of Independent Disks (redundant array of independent disks) refers to a storage system that uses multiple disks Hard including distributed or replicated data. Depending on your setup (which is often called level).

At the simplest level, RAID combines multiple drives into one logical drive. So instead of seeing several different hard drives, the operating system sees one. The RAID commonly used in servers and usually (though not necessary) is implemented with disk drives of the same capacity. Due to the decrease in the price of hard drives and the increased availability of RAID options including the chipsets for motherboards, the RAID are also an option in the most advanced personal computers. This is especially common in computers dedicated to storage-intensive tasks such as audio and video editing.

The original RAID specification suggested a number of "RAID levels" or different combinations of disks. Each had theoretical advantages and disadvantages. Over the years have seen different implementations of RAID concept.

The very definition of RAID has been in dispute for years. The use of the term "redundant" means that many objects on the RAID 0 is really a RAID. Similarly, the change "cheap" to "independent" confuses many on the intended purpose of RAID. Even there are some implementations of the RAID concept using a single disk. But in general, we say that any system which employs the basic RAID concepts to combine physical disk space for the purpose of improving the reliability, capacity or performance is a RAID system.

10.2 RAID system advantage

The benefits of RAID are several:

Increased fault tolerante.

RAID protects against data loss and recovery data provides real-time access interrupted in case of failure of a disk.

Improving performance/speed

An array consists of two or more hard drives to the host system function as a single device. The data are broken into fragments that are written to multiple drives simultaneously. This process, called fragmentation of data, significantly increasing the storage capacity and offers significant performance improvements.

RAID allows multiple units working in parallel, which increases system performance.

Reliability

RAID uses two techniques to increase reliability:

- Redundancy involves storing the same data on more than one unit. Thus, if one drive fails, all data are available on the other drive, immediately. While this approach is very effective, is also very expensive because it requires the use of duplicate sets of units.
- The parity data. Parity uses a mathematical algorithm to describe the data of one unit. When a fault occurs in a unit data is read right to left and compared with the parity data stored in the array. The use of parity for data reliability is less costly than redundancy, it does not require the use of a redundant array of disk drives.

High availability

RAID increases uptime and network availability. To avoid downtime, it should be possible to access data at any time. The availability of data is divided into two aspects:

- Data Integrity: This refers to the ability to obtain adequate data at any time. Most RAID solutions offer Dynamic sector repair, which repairs on the fly due to bad sectors software errors.
- Fault tolerance, the second aspect of availability is the ability to keep data available in case of occurrence of one or more failures in the system.

11. CHAPTER V: Systems Architecture

11.1 Introduction

The first operating system from Sun was born in 1983 and was initially called SunOS. Was based on BSD UNIX system, the University of Berkeley, where one of the founders of the company was a programmer in his college days. Later incorporated features of System V, effectively becoming a fully operational system based on System V.

This version based on System V was released in 1992 and was first called Solaris, specifically Solaris 2. The above were called Solaris 1 retroactively. SunOS only makes sense from that point as the core of this new Solaris operating environment. In this way contained SunOS 5.0 Solaris 2. Since then distinguishes between the core

operating system (SunOS), and the general operating environment (Solaris), adding other packages such as Apache or DTrace.

Features

Among the features of Solaris are:

Portability.

The software consists of an ABI Application Binary Interfaces (Application Binary Interface) running with a shrink-wrapped (Shrink wrapped) software on all systems sold with the architecture of the microprocessor. This requires application developers to reduce software development costs and bring products to market quickly, and forcing users to upgrade hardware while retaining their software applications and minimize their costs of conversion.

Scalability.

The applications are used most frequently in overtime, and require more powerful systems to support them. To operate in a growing environment, the software must be able to run on a wide range of powerful and should be able to take advantage of additional power being processed.

Interoperability.

Heterogeneous computing environment is a reality today. Users purchase from many vendors to implement the solution they need. Standardization and interface are clear criteria for a heterogeneous environment, allowing users to develop strategies to communicate through your network. The Solaris operating system can interoperate with systems popular in today's market, and applications that run on UNIX can communicate easily.

Compatibility.

Computer technology continues to advance rapidly, but needs to stay in the competitive environment to minimize costs and maximize profits.

11.2 Architecture of the Sybase database

Introduction

ADAPTIVE SERVER ENTERPRISE

Adaptive Server Enterprise (ASE) is the database engine (RDBMS), Sybase company logo. ASE is a data management system, highly scalable, high performance, with support for large volumes of data, transactions and users, and low cost, enabling:

- Store data safely.

- Access and process data intelligently.
- Mobilize data.

Features

- A query optimizer completely renovated and smarter.
- Techniques for semantic partitioning of tables that increase the speed of data access.
- Columns encrypted for added data security.
- Computed Columns "virtual" materialized, and functional indexes, which provide higher performance.
- Improvements to Transact-SQL language for added productivity.
- Improvements to Java and XML services on the database.
- Improvements to services for use and publication of Web Services.
- Improved tools for managing and monitoring.
- More performance and lower total cost of ownership.
- VSA architecture of Sybase.
- Resource Manager software and tasks.
- Multiple data locking schemes.
- Online Backup and high performance.
- Seamless integration with remote data sources.
- Task Scheduler.
- SSL secure connections.
- Support for LDAP for user authentication and connectivity client / server.
- Support for multiple development tools and programming languages such as PowerBuilder, Visual Basic, Java, C, PHP, etc.
- Support multiple connectivity protocols such as Open Client (Sybase's own).

12. CHAPTER VI: Application installation and configuration

The implemented solution has two redundant systems, the first means of dealing with a RAID 0 +1 through software, with the Volume Manager Tool System OS level.

The team in question has 2 mirrored disks for the operating system for a UFS file system, so that if one disk stops working one could boot from another disk with minimal change, just as it has a system of 6-disc storage where to store the database device, with a ZFS file system, as follows:

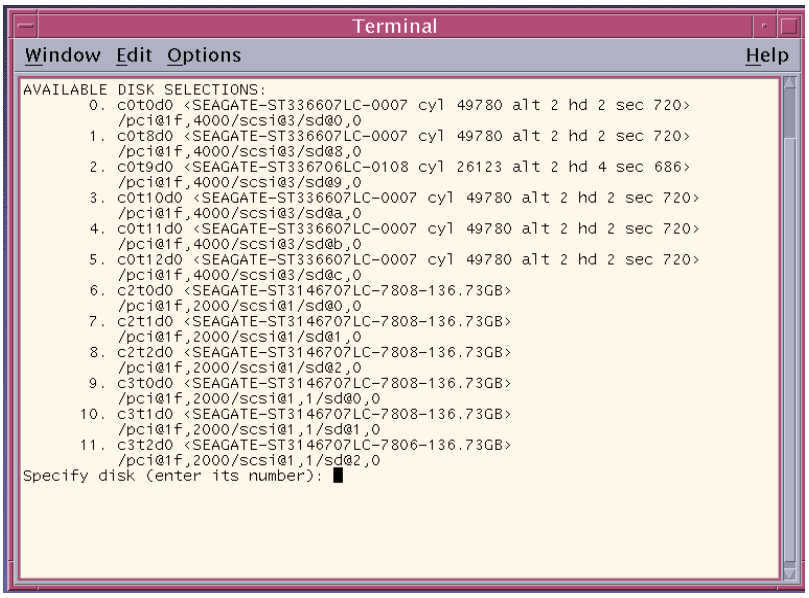

Fig. 12.1 Computer disk
Ref: Property of the authors of theses

Here are the partition tables 0 and 1 disk, c0t0d0 and c0t8d0 respectively, which are known as slices, it is important that both discs remain the same geometry and structure.

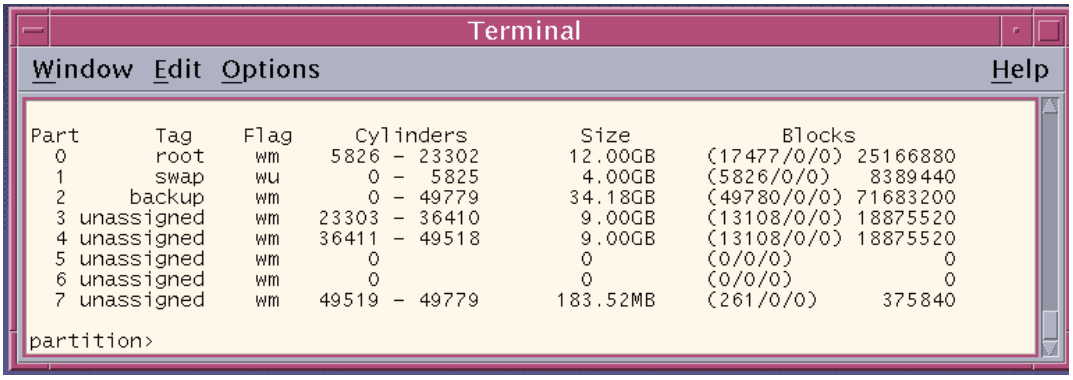

Fig. 12.2 Partitions table disks c0t0d0 and c0t8d0
Ref: Property of the authors of theses

This also indicates the mount points and filesystems, data considered for redundancy.

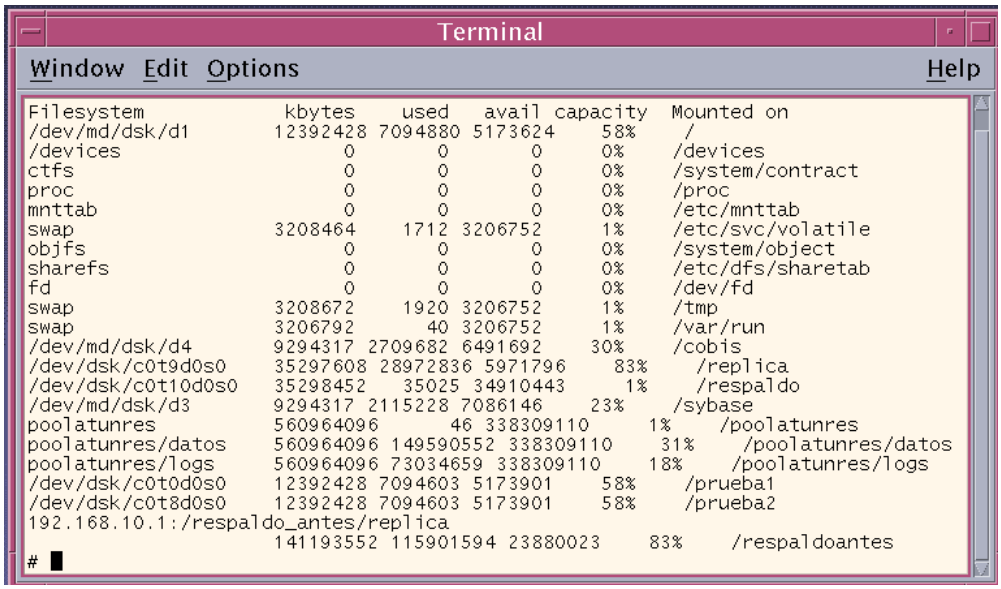

Fig. 12.3 System mount points
Ref: Property of the authors of theses

This image graphically shows the solution structure of the RAIDs.

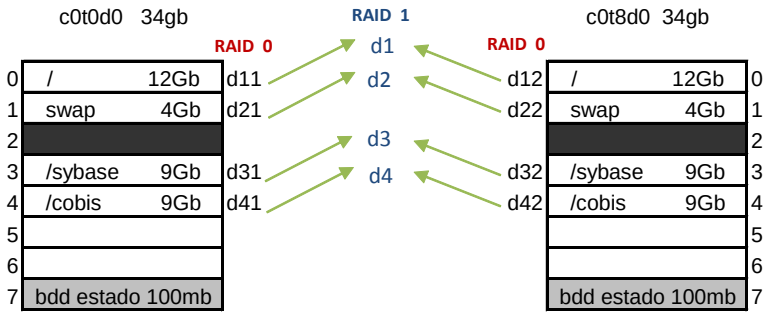

Fig. 12.4 Structure RAID0+1
Ref: Property of the authors of theses

This should indicate that you can not remotely mirroring solaris slices, only RAIDS or logical volumes (metadevice) where d11 (RAID0) and d12 (RAID0) are components of d1 (RAID1) and similarly for d2 d3 and d4, each created as one of the metadevice and UFS file systems.

The settings made, is shown in the image:

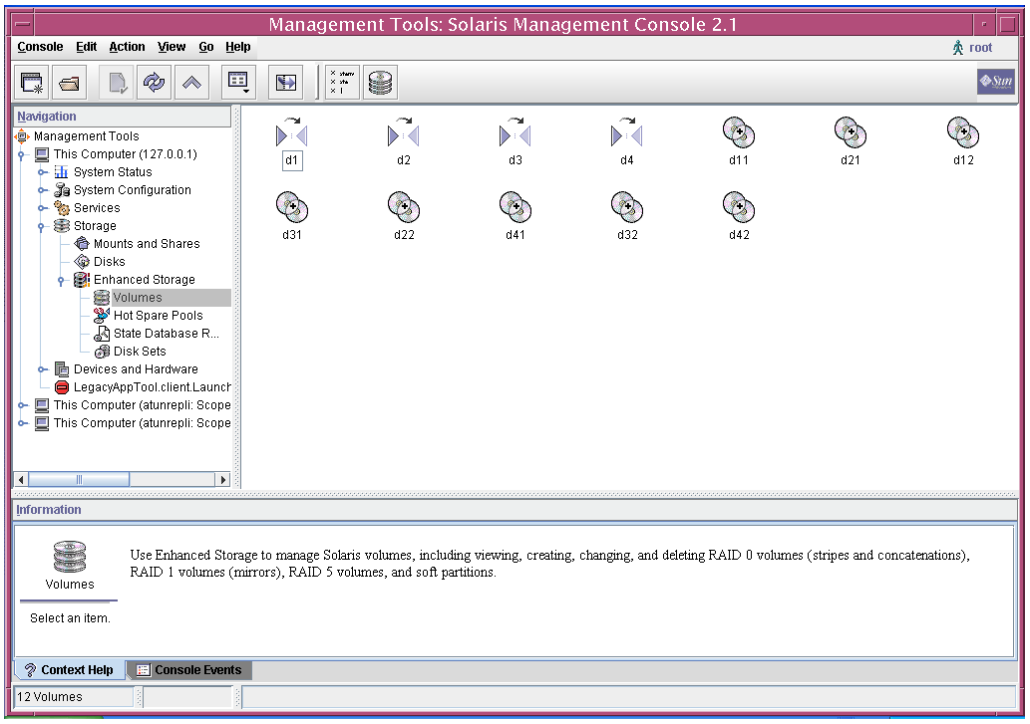

Fig. 12.5 Logical volumes
Ref: Property of the authors of theses

Additionally, I also believe the disks RAID5 c2t0d0, c2t1d0, c2t2d0, c3t0d0, c3t1d0, c3t2d0, known as raidz solaris and named as a zpool, and that its implementation was used ZFS file systems, and whose mount point is in / poolatunres.

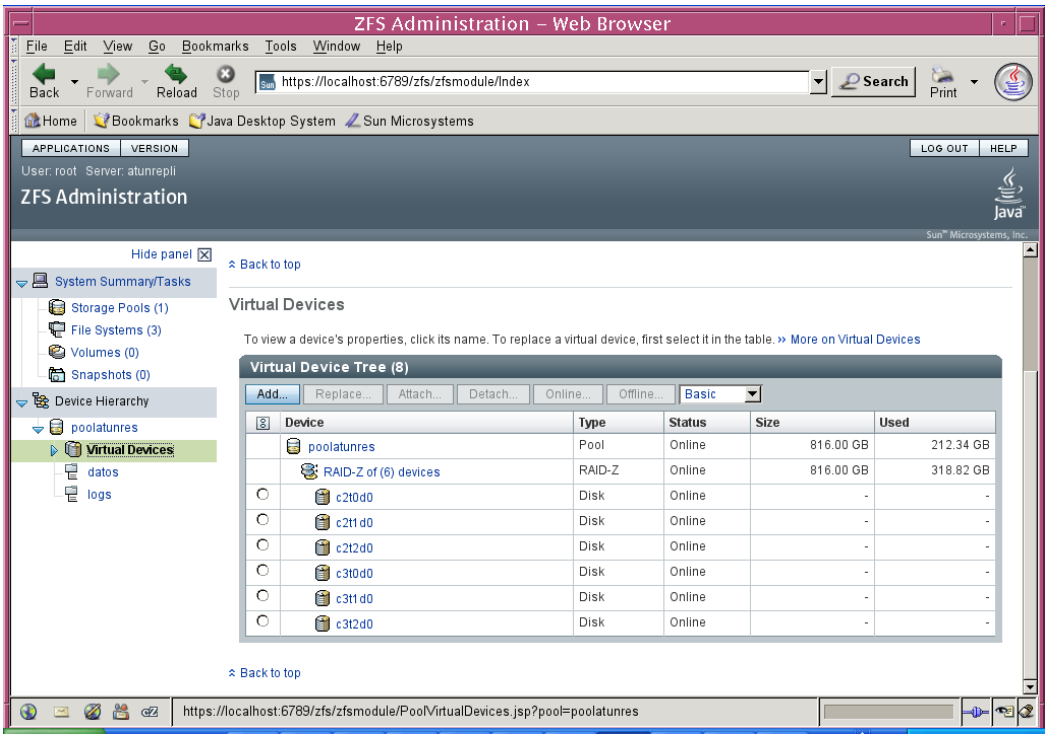

Fig. 12.6 Structure zpool/ poolatunres
Ref: Property of the authors of theses

About this zpool is created two called ZFS file systems and data logs that store the database device, both data and log respectively.

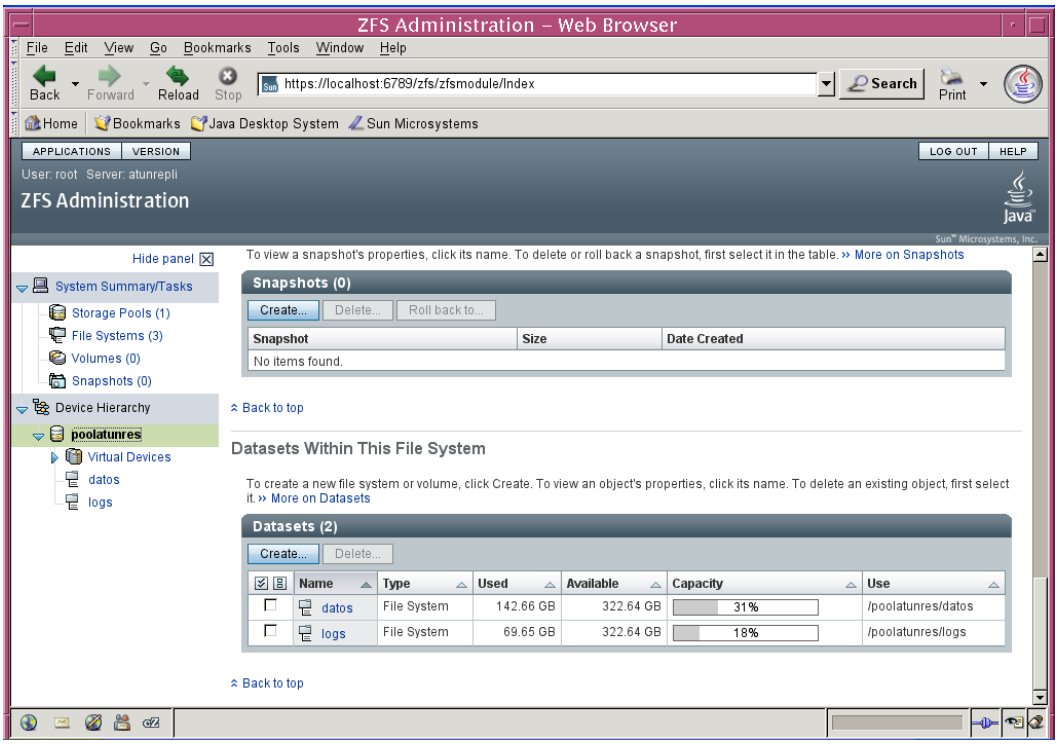

Fig. 12.7 ZFS file system
Ref: Property of the authors of theses

The other system redundancy was handled by implementing a replication system, at the database using Sybase Replication Server 15.2, which aims to capture all transactions that have been applied to the primary data server using a replication agent, sent to the replication queue to be processed and then implement a standby database server, using a maintenance user or login, depending on the type of command to replicate either DML or DDL respectively, the replication scheme is structured as follows:

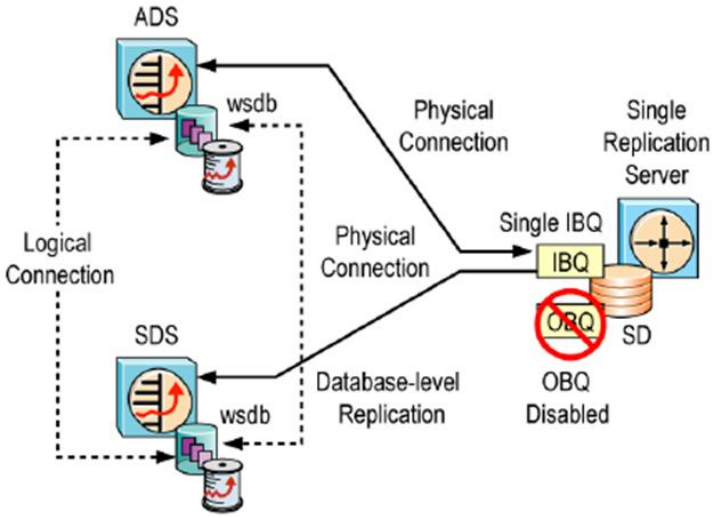

Fig. 12.8 Replication scheme
Ref: Manual Warm Standby with Replication Server Volume 1

For initial setup was installed both the server and server replication to standby on a single computer but with all available databases separately to make it easier to migrate to another environment and another locality, the follows.

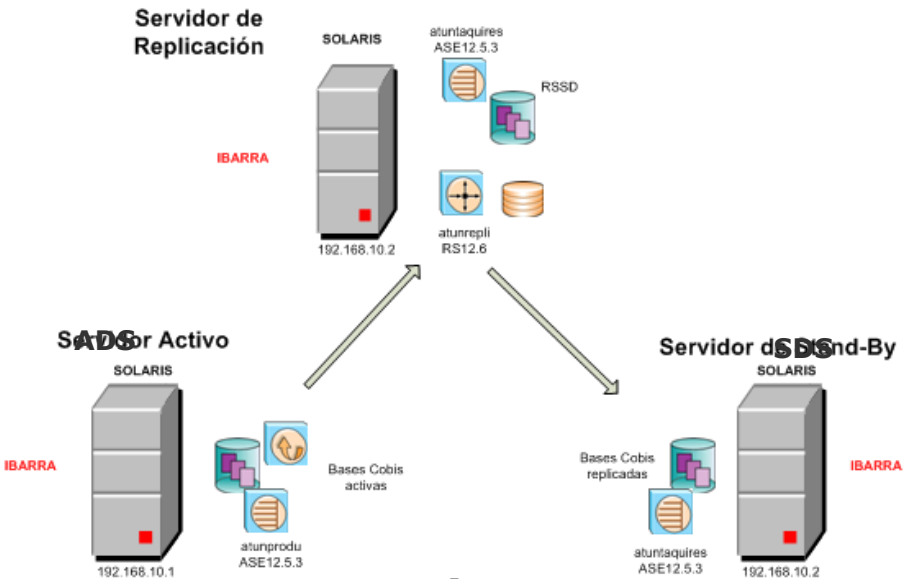

Fig. 12.9 Replication scheme
Ref: Manual Warm Standby with Replication Server Volume 1

Should be a contingency should take into account the following points for a successful swithover, and as part of a business continuity plan.

1. Disconnect the client applications.

2. Stop the replication agent on the active bases.
3. Execute the switchover.
4. Raise the replication agent on the active base.
5. Reconnect client applications to the new active base.
6. Summarize new connections to the standby database.

In addition to this and as part of the application was necessary to provide the following security policies.

Only the user responsible for the administration of replication should have access to replication_rol role.

Each change reflected on the boards of the system like syslogins and sysusers as: change password, change roles, etc, should be performed immediately on the standby server and these are not replicated.

For a management that ensures better performance of replication is necessary to revise the lines of I / S and if necessary, create the replication definition for this solution was necessary to create the following, although not in Warm Standby you must use the replication definition:

```
--creacion de una definicion para la base cob_ahorros la tabla ah_cuenta
create replication definition ah_cuenta_definition
with primary at SB.cob_ahorros_sb
with all tables named ah_cuenta
(ah_cuenta     int,
 ah_cta_banco  char(16)
)
primary key (ah_cta_banco)
send standby all columns      --que envie todas las columnas
replicate minimal columns     --para solo update y delete

--creacion de una definicion para la base atun_riesgos a la tabla consep_perfil_acu_mes
create replication definition perfil_acu_mes_definition
with primary at SB.atun_riesgos_sb
with all tables named consep_perfil_acu_mes
(per_cliente          int,
 per_mes              int,
 per_anio             int
)
primary key (per_cliente, per_mes, per_anio)
send standby all columns      --que envie todas las columnas
replicate minimal columns     --para solo update y delete

--creacion de una definicion para la base atun_riesgos a la tabla consep_perfil_cli_acu
create replication definition perfil_cli_acu_definition
with primary at SB.atun_riesgos_sb
with all tables named consep_perfil_cli_acu
(per_cliente   int,
 per_producto  varchar(3),
 per_estado    varchar(1)
)
primary key (per_cliente, per_producto, per_estado)
send standby all columns      --que envie todas las columnas
replicate minimal columns     --para solo update y delete
```

Once implemented the solution in two different locations, you need to encrypt the connections between computers in a replication topology using a standard method, such as virtual private network (VPN), Secure Sockets Layer (SSL) or IP Security (IPSEC).

Grant only required permissions for each replication agent, to allow access to reading and writing in each instance.

Finally we must take into account these considerations as a result of implementeación:

Recovery rate. It was possible to achieve uninterrupted recovery when databases are duplicated and housed in more physical devices.

Storage space. The immediate recovery requires full redundancy (all databases and journals duplicates), which uses disk space.

Impact on performance. Duplication of user data bases increases the time required to write transactions to both disks.

13. CHAPTER VII: Monitoring tools

13.1 XP and server configuration Growth Thresholds

A threshold is a limit on a segment, used to monitor the available space.

Has always associated with a procedure.

- The procedure is executed when the limit is exceeded. Can be used to send notifications at different levels.

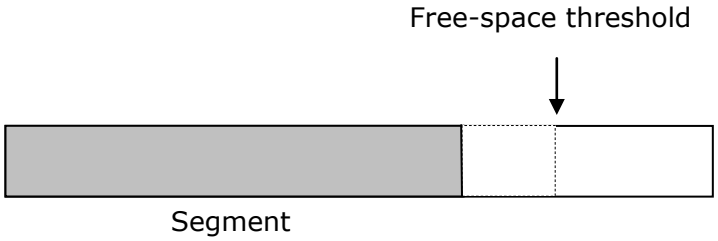

Fig. 13.1 Segment of a threshold
Ref: Property of the authors of theses

XP Server configuration

From a console where the server installation of ASE srvbuild execute the command.

Select XP Server and set the XP Server name must be written in capital letters correspond to the nomenclature SERVIDOR_ASE_XP. That is, if the Sybase ASE server is called, the server name should be SYBASE_XP XP.

Creating a threshold procedure

Clearanse procedures.

When a threshold is exceeded, the server passes 4 parameters to the procedure specified.

- Parameters are passed by position.
- Any name can be used, but the parameters must be declared in the same name.
- The print command is used, only printed information in the error log.

13.2 Configuring servers of monitoring

ASE Monitor

ASE Monitor provides the ability to monitor the performance of ASE server at the following levels:

- Configuring ASE.
- Design of Databases.
- SQL statements in applications and Stored Procedures.

Historical Server

It's a server that can store monitoring data in flat files, through session management.

14. CHAPTER VIII: Conclusions Y Recommendations

14.1 Conclusions

- While it is true that all components of a computer system are exposed to an attack (hardware, software and data) is data and information the main subject of protection of security techniques. Computer security is primarily to protect the confidentiality, integrity and availability of information. From here we saw the need to implement a solution that mitigates this type of contingency or attack, with Warm Standby an application that meets the best needs of the business.
- Using Warm Standby is evident that security is a concept associated with certainty, lack of risk or contingency. It is not possible to clarify that absolute certainty, the element of risk is always present, independent of the actions we take, we must talk about levels of security. Absolute security is impossible and we understand that computer security is a set of techniques designed to achieve high levels of security in computer systems.

- Need to strengthen security and integrity of information is why it has been necessary to mount contingency systems to ensure the availability of data handled within a company, offering a fail-safe and a shorter recovery all applications for any unforeseen.
- Many applications need to provide their services on an ongoing basis such as electronic commerce, banking, etc.. therefore require that their components are highly available, why was desirable to implement a proper backup environment to facilitate the immediate recovery of applications that are running at the time, without regretting loss of information and allowing us to maintain a secondary database in a fit state to take over from the production database if necessary.
- At the end of this thesis we can conclude that it could not meet the timelines in the schedule proposed by the q dependence was taken as to the arrival of equipment and q devices were necessary for their implementation.
- At the end as the result of the vision and our mission accomplished we conclude that the work was a success, as the results meet the expectations of the institution.
- We conclude that this solution will help the University to strengthen its safety standards, fulfilling recommendations made by the inspection bodies, thus maintaining its strength and confidence.
- We are confident that this document will serve as a technical guide for those who need information about what is Database Replication.
- The implementation of this project had a high economic cost q is justified in having a security system that will keep the information available for any event.

14.2 Recommendations

- For any particular item of data, the database should be replicated a database other than the primary database, for this way to avoid confusion at the time of administration.
- To improve fault tolerance and reduce the suspension of the CPU, we recommend placing the primary Replication Server on your machine, if this is not possible, put in the same machine as Server Data Replication (SBR) in the Secondary Data Server (SDS).
- For the production of Unix applications, use a raw partition for the device stable.

- Install the unit of replication in an individual server, for best performance and application management.
- It is essential to remember that stanby database should not be changed under any circumstances, for the modification of this can lead to inconsistencies.
- While there are commands for managing replication, but it is the responsibility of database administrator run with caution.
- It is recommended that the technical documentation for each provider before making any changes or updates to these packages or tools.
- Maintain adequate monitoring and control, especially in the connection status and management of queues, to avoid queuing so large and hence the suspension of replication.

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