

**DEVELOPMENT OF BUSINESS PROCESS MANAGEMENT** on system backups with Veeam backup and replications for SMBs (Small and midsize businesses).

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Work project Proposal presented as partial requirement for obtaining:  
Master's degree in information management, with a specialization in Information Systems and Technologies Management

**NOVA Information Management School Instituto Superior de  
Estatística e Gestão de Informação**

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**DEVELOPMENT OF BUSINESS PROCESS MANAGEMENT ON SYSTEM BACKUPS WITH VEEAM  
BACKUP AND REPLICATIONS AS SOLUTION FOR  
SMBs (Small and midsize businesses).**

by

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Management.**

**Supervisor:** Pedro Manuel Carqueijeiro Espiga da Maia Malta. PhD.

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**The LORD is my shepherd; I shall not want!**

## Abstract

In a fast and volatile world, where countless amount of data flows continuously and the information multiplies instantly, small, and large companies run a successful business by keeping, organizing and managing the available data, which is not only extremely valuable in the decision-making process, but it is also safe recoverable storage. The fact that this flow of information is valuable in certain circumstances poses a risk on some key details regarding the proper care and management of backups and storage of information, especially when unforeseen hazardous events occur in the company.

Nowadays, loss of data, stored for a long time, is frequent in big enterprises, but it also happens commonly daily to individuals. This issue can result from an oversight, including sometype of computer sabotage, flooding, malicious software, theft of devices, or even the inclusion of own employees. Losing information declines and compromises business, causing considerable misfortunes of both, resources, and unplanned processes.

Every company is required to have means that guarantee the continuity of their services without causing a risk to their organic structure. As it is known, the technology continues to develop, taking huge strides, providing solutions as well as processes to prevent such issues.

The implementation of a backup system (Backups) suggested in this work project provides the necessary tools to safeguard and implement effectively Veeam Backup Replication, within the possibilities of the company.

However, the main purpose of this project is to conduct a thorough analysis from the point of view of implementation and solutions but also the perspective of business process management backup (BPM), using it appropriately and approaching the backups to process the future technological solutions, as well as other aspects to be learned further.

## Keywords

Backup, Information, Technologies, procedures, storage, Infrastructure, bpm.

## Resumo

Em um mundo rápido e volátil, onde a quantidade incontável de dados flui continuamente e a informação se multiplica instantaneamente, pequenas e grandes empresas conduzem um negócio de sucesso mantendo, organizando e gerenciando os dados disponíveis, o que não é apenas extremamente valioso na tomada de decisões de processo, mas também é um armazenamento seguro e recuperável. O fato de esse fluxo de informações ser valioso em determinadas circunstâncias representa um risco em alguns detalhes importantes sobre o cuidado e gerenciamento adequados de backups e armazenamento de informações, especialmente quando ocorrem eventos perigosos imprevistos na empresa.

Hoje em dia, a perda de dados, armazenados há muito tempo, é frequente nas grandes empresas, mas também acontece no dia a dia das pessoas. Esse problema pode ser decorrente de descuido, incluindo algum tipo de sabotagem de computador, inundação, software malicioso, roubo de dispositivo ou até mesmo a inclusão de funcionários próprios. A perda de informações diminui e compromete os negócios, causando problemas consideráveis de recursos e processos não planejados.

Toda empresa é obrigada a ter meios que garantam a continuidade de seus serviços sem causar riscos à sua estrutura orgânica. Como se sabe, a tecnologia continua se desenvolvendo, dando passos largos, fornecendo soluções e processos para prevenir tais problemas.

A implementação de um sistema de backup (Backups) sugerida neste projeto de trabalho fornece as ferramentas necessárias para salvaguardar e efetivamente implementar o Veeam Backup Replication, dentro das possibilidades da empresa.

No entanto, o principal objetivo deste projeto é realizar uma análise aprofundada do ponto de vista de implementação e soluções, mas também da perspectiva de backup de gestão de processos de negócios (BPM), utilizando-o de forma adequada e direcionando backups para processar o futuro soluções tecnológicas, bem como outros aspectos a serem aprendidos.

## Palavras-Chave

Backup, Informação, Tecnologias, procedimentos, armazenamento, Infraestrutura, bpm.

## Abbreviations

- **Backup** English term that refers to data backup.
- **Restore** the English term that refers to data recovery.
- **SLA** term in English that refers to service level agreements.
- **RTO** term in English that refers to the recovery objective over time.
- **RPO** term in English that refers to the recovery objective at a point.
- **BIA** term in English that refers to the report called Service Impact Analysis.
- **Technical** deduplication where duplicate data is removed.
- **LOPD** term that refers to the Organic Law on Data Protection.
- **Vaulting** action by which data tapes are exchanged between different locations.
- **Retention** period established to safeguard the information.
- **SMBs** Small and midsize business
- **BCP** Business continuity plan
- **VBEM** Veeam Backup Enterprise Manager

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# 1 Introduction

## 1.1 Context and justification of the work

Backup should be part of the company's Information Systems Strategy. Many businesses work with data and information technology (IT) systems, where the flow of information is increasing and the exchange of customer information, emails, financial data, projects, documents, images, content is a routine. It is nearly impossible to imagine a sudden loss of all the work and data and no possibility of retrieving information as losing files can cost time and money and can even imply the closure of the company. (*2020 Gartner Magic Quadrant - Veeam Remains a Leader 4 Years Running*, n.d.)

What mechanisms can guarantee the entrepreneur consistent recovery of their data and preserve the continuity of their business? Is the company aware of all its vulnerabilities? What is a company without data? How should a company prevent the loss of its data? Many companies face different types of threats that compromise important information in the development of their business. These threats could be caused by human errors, such as the accidental deletion of hundreds of files to computer attacks, such as malware that encrypts files and requires the company (victim) to receive an economic reward in exchange for unlocking the files or data (current example: cryptographic ransomware (*What Are the Risks of Not Backing Up Data*, n.d.))

At this level, backup copies become fundamental since they guarantee the progressive continuity of the business in case of a data emergency. (*Why Data Backup Is Important for Your Business*, n.d.)

This is the main reason why the author's interest is to provide the right tools to implement a good system to apply a business process management and a solid backup infrastructure that meets the integrity guarantees of both, the service and business information.

It is crucial to remember that the proper backup infrastructure will respond to guarantees of data integrity and consistency, service continuity and business continuity. Regarding the permanency of the service, it is worth highlighting the fundamental objectives of recovery: maximum time at which a minimum service level must be reached after a lost service (RTO) and closed at the time when the data will be restored after a lost service (RPO). (*Understanding RPO and RTO | Druva*, n.d.)

The tool used for this project is Veeam Backup & Replication, as it provides intelligent data management for all virtual, physical, and cloud-based workloads. Also, this software has a character with a single management console, and it allows for flexible and reliable management of the backup, recovery, and replication of all data and applications, eliminating permanently legacy backup solutions.

Furthermore, it is also available for all virtual, physical, and cloud-based workloads from an individual management console.

Moreover, it helps organizations to meet current service level goals for virtual, physical, and cloud-based environments, including VMware vSphere and Microsoft Hyper-V. Thus, key features include:

- Backup and Replication Intelligent Recovery Cloud Mobility
- Copy Data Management Monitoring
- Analysis Orchestration and Automation Veeam Agent for Microsoft Windows
- Veeam Agent for Linux

(*Message from Veeam*, n.d.-a)

## 1.2 What Is Veeam Backup and How Does It Work?

Veeam Backup & Replication is a proprietary backup application developed by Veeam for virtual environments, created with VMware vSphere and Microsoft Hyper-V hypervisors. The software provides backup, restore and replication functionality for virtual machines, physical servers, and workstations, as well as cloud-based workload. Veeam Backup & Replication offers availability for all virtual, physical and cloud workloads - from a single management console, extending Veeam's leading position to be the best for VMware vSphere and Microsoft Hyper-V for availability for any application, any data in any cloud. It allows customers to completely remove legacy backup and brings backup and replication together in a single software solution. (*About Backup - User Guide for VMware vSphere*, n.d.)

### **BACKUP**

- Image-level VM backups: Create backups consistent with applications with advanced application recognition processing
- Storage snapshot backup: Generates ultra-fast backups with low RPOs from storage snapshots from an ever-growing list of the world's leading storage providers
- Backup Repository with Expansion: Creates a single virtual pool of backup storage to which backups can be assigned, providing the freedom to easily extend backup with a storage capacity
- Veeam Cloud Connect: Obtains backups off-site without the cost and complexity of building and maintaining off-site infrastructure; fast and secure cloud backup for a service provider
- SureBackup: automatically tests and verifies each backup and each virtual machine (VM) for recovery
- Integrated WAN acceleration: Obtains offsite backups up to 50x faster and saves bandwidth
- Direct storage access: Creates vSphere backups faster and with less impact by backing up through Direct SAN Access and Direct NFS Access.

### **RECOVERY**

- Instant VM Recovery: Recovers a failed VM in less than two minutes
- Instant File-Level Recovery: Recovers guest OS files and folders on the fly
- Veeam Explorer for Microsoft Active Directory: Instantly recovers individual AD objects and entire containers, easily recover user accounts and passwords, enables restoring of Group Policy Objects (GPOs), Active Directory-integrated DNS records among others

### **REPLICATION**

- Image-based VM Replication: Replicates VMs onsite for high-Availability or offsite for disaster recovery
- Cloud-Connect Replication: Obtains replicas off-site without the cost and complexity of building and maintaining a disaster recovery site; fast and secure cloud-based disaster recovery (DRaaS)

(*Cloud Connect Backup and Replication – Data Harbor Company*, n.d.).

## 2 Problem Statement

The importance of developing this project involves a real-life case study. Even though the backup process is highly valued as it needs to be established by the whole company to find the best solution, today's projects are becoming more and more technically complex as well as logistically challenging, which exposes construction operations to even bigger constraints.

Additionally, according to Veeam report, 85% of SMBs are experiencing problems with Backup and Recovery, and they also identified cost-related challenges with their backup and recovery of virtual environments, including high ongoing management costs (51%), expensive licensing models (48%) and backups either requiring or using too much storage (44%). (*Message from Veeam, n.d.-b*).

Moreover, 80% of SMBs are facing complexity-related challenges with their data protection, including backups that require ongoing management (52%), too many virtual servers to backup (35%) and backup tools being difficult to configure and use (32%).

The future forecasts growth in virtualization. While virtual servers that currently form 52% of the IT infrastructure are expected to form 63% within the next 2 years. This may also increase the number of servers that are protected. Currently, 67% of the virtual environment is backed-up, meaning that almost a third of SMBs' virtual infrastructure is unprotected.

The traditional scheduling methods merge characteristic specifics using business processes management (BPM) where its capability in modelling and resolving constraints allows a solution. (*85% of SMBs Experiencing Problems with Backup and Recovery, Veeam Survey Finds, n.d.*).

## 3 Background and Problem Identification

The company under study is a global innovation system partner to almost all automobile manufacturers and it is among the top 100 suppliers in this sector worldwide. Its core business areas of sunroofs and panorama roofs, convertible roofs and parking heaters have consistently set trends in technology and design. With electric heating systems, charging solutions and battery systems, the company also addresses the growing market of electromobility. Besides the headquarters in Stockford near Munich, it is present in over 50 locations around the world – with over 30 of them being manufacturing plants. ([www.cargo-partner.com](http://www.cargo-partner.com), n.d.).

Given the case of the corporation described above, the data is extremely important, and therefore a few years ago, the company decided to seek a competitive tool to manage all the backup repositories choosing Veeam backup and replication.

However, everyday data and files that companies generate for the development of their business face different types of threats. They can result from human error such as accidentally removing hundreds of files to computer attacks, or malware encrypting files while requiring a reward from the company in exchange for unlocking their data (current example: cryptographic ransomware).

This is where security copies are relevant, prominent and of great importance to the company because the business owners must ensure the continuity of their operations in the event of a disaster. Moreover, all the stakeholders surrounding the business activity, with special emphasis on the customers that trust the privacy policy, should not be forgotten.

Proper backup infrastructure will respond to guarantees of data integrity and consistency, continuity of service and business. As far as continuity of service is concerned, it is worth mentioning the fundamental objectives of recovery: the maximum time that must be reached at the minimum service level after a loss of service (RTO) and closed at the time when the data will be restored after a lost service (RPO).

However, the requirement of the information requires a suitable strategy and therefore, an effective business continuity plan should possess the right key metrics and the most important ones are RTO and RPO. (*RPO vs. RTO: Key Differences Explained with Examples, Tips*, n.d.)

- *RTO: Recovery Time Objective is the target time you set for the recovery of your IT and business activities after a disaster has struck. The goal here is to calculate how quickly you need to recover, which can then dictate the type of preparations you need to implement and the overall budget you should assign to business continuity. RTO is usually large scale and looks at your whole business and systems involved.*
- *RPO: Recovery Point Objective is focused on data and the company's loss tolerance concerning data. RPO is determined by looking at the time between data backups and the amount of data that could be lost in between backups. RPO focuses just on data and your company's overall resilience to the loss of it.*

Thus, both metrics should be considered when trying to develop an effective business continuity plan (BCP) and understand the purposes of the requirements.

## 4 Study Purposes

The purpose of this project is to offer availability for all virtual, physical, and cloud-based workloads from an individual management console but also the configuration, implementation and monitoring of the following services:

- Knowing the implications of the implementation of the architecture of backup.
- Having a global vision of the need to have a backup system in a business environment.
- Knowing the latest innovations at the hardware and software level related to backup.
- Knowing different backup strategies that a company can implement.
- Knowing how to define SLA, RTO and RPO based on the backup strategy chosen.
- Implementing Veeam Backup & Replication.
- Implementing business project management.

Besides that, as it was mentioned before, the process of the backup is to create a copy of data that can be recovered in the event of a primary data failure, resulting from hardware or software failure, data corruption, or a human-caused event, such as a malicious attack (virus or malware), or accidental deletion of data.

## 5 Approach and Method Followed

According to the present research, data backup is crucial for protecting business continuity. It is also significant because if the backup is only stored on a single desktop/laptop computer or a mobile, all the business data is gone in case of loss or robbery. At the same time, having paper copies of business data is not adequate data protection. And what if the business premises burn down or experience severe flooding? In this case, as well, the data belonging to the business could be irretrievably lost. All things considered, a strategy to implement a backup environment can be applied in three different ways, depending on the nature of the company: (*Create Your Data Backup Strategy: A Comprehensive Guide*, n.d.)

- a) A strategy where the employer holds a person (or group of people) responsible for the implementation and subsequent management of the backup.
- b) Strategy where the employer makes an external company responsible for the implementation and subsequent management of the backup.
- c) Strategy where the employer holds one person (or group of people) and an external company responsible for the implementation and subsequent management of the backup.

In this case, the most appropriate strategy to achieve the objectives will be the one in which the employer holds one person (or a group of people) and an external company responsible for the implementation and subsequent management of the backup.

**The advantages of this type of strategy are:**

- Having a person on site who controls backups daily
- Having an outsourced backup to complement the administrator of backup in case of vacation or sick leave.
- Having an updated and competent environment
- SLA, RTO and RPO guarantee.
- Having a support centre where they resolve product failures.
- Having a supplier who can adapt and meet changes in the company

**The disadvantages of this type of strategy are:**

- Possible excessive costs
- Difference in strategic backup opinions.

*(The Advantages and Disadvantages of Strategic Management | CharityVillage, n.d.)*

## 5.1 Planification and Scheduling

As it was mentioned above, the objective of this project is to provide information about the possibilities of implementation of some business process management, including certain characteristics of realization of the project and organizing it through planning where we indicate guidelines to be followed.

### 1) Implementation of the backup process:

Description of the resources needed to carry out the work and, subsequently, a Gantt diagram that shows all the phases, tasks, habits, and stakeholders involved in the implantation.

However, resources are divided into two categories:

#### **A. Internal resources of the company**

The company's internal resources are the administrator who manages the backup process management and the servers managed by the backup manager, from the most operational point of view, including backup monitoring, belt replacement, periodic restoration execution, backup monitoring, and error identification, among others.

#### **B. External company resources**

The company's external resources are the external supplier that installs, configures, and posts the product. In this case, the types of external resources can be divided into the following:

Commercial supplier, technical supplier, a supplier who installs and configures the backup product.

### 5.1.1 Gantt Chart

According to the Gantt chart, the Backup System administrator will take on the role of the project manager as he will always be involved in all project tasks and be obliged to report the progress of the project.

represents the Gantt diagram of the backup implementation project.

Table 1. Gantt Diagram

NAME	DURATION	START	END	PREDECESSORS	RESOURCE NAMES
Implementation of backup solution	40,778 days?	28/02/2020 8:00	25/04/2020 15:13		
Start project	11,2 days	28/02/2020 8:00	15/03/2020 9:36		Administrator; Supplier-Commercial
Definition of strategy, objectives and scope	1,6 days	28/02/2020 8:00	01/03/2020 13:48		Administrator [80%]; Supplier-Commercial [20%]
Solution Analysis	3,2 days	01/03/2020 13:48	06/03/2020 15:24	3	Administrator [80%]; Supplier-Commercial [20%]
Impact and risk analysis	1,6 days	06/03/2020 15:24	08/03/2020 11:12	4	Administrator [80%]; Supplier-Commercial [20%]
Backup Software Selection	3,2 days	08/03/2020 11:12	13/03/2020 13:48	5	Administrator [80%]; Supplier-Commercial [20%]
Implant Selection	0,8 days	13/03/2020 13:48	14/03/2020 11:12	6	Administrator [80%]; Supplier-Commercial [20%]
Project Constitution	0,8 days	14/03/2020 11:12	15/03/2020 9:36	7	Administrator [80%]; Supplier-Commercial [20%]
Milestone: Approval and publication of the project	0 days	15/03/2020 9:36	15/03/2020 9:36	8	
Planning	21 days	15/03/2020 9:36	13/04/2020 9:36	9	
Establish work teams	2 days	15/03/2020 9:36	17/03/2020 9:36		Administrator [80%]
Define and assign roles and responsibilities	2 days	15/03/2020 9:36	17/03/2020 9:36		Administrator [80%]
Timeline and baseline	1 day	17/03/2020 9:36	20/03/2020 9:36	11;12	Administrator [80%]
Budget	2 days	20/03/2020 9:36	22/03/2020 9:36	13	Administrator [80%]
Risk management plan	2 days	22/03/2020 9:36	24/03/2020 9:36	14	Administrator [80%]
Quality plan	2 days	24/03/2020 9:36	28/03/2020 9:36	15	Administrator [80%]
Communications plan	2 days	28/03/2020 9:36	30/03/2020 9:36	16	Administrator [80%]
HR, administration and purchasing plan	2 days	30/03/2020 9:36	03/04/2020 9:36	17	Administrator [80%]
Establish process and data map	4 days	03/04/2020 9:36	07/04/2020 9:36	18	Administrator [80%]
Impact and infrastructure needs	4 days	07/04/2020 9:36	13/04/2020 9:36	19	Administrator [80%]
Milestone: Approval and publication of project planning	0 days	13/04/2020 9:36	13/04/2020 9:36	20	
Execution and Control	7,778 days	13/04/2020 9:36	24/04/2020 16:49	21	
Define the objectives and scope of the system	0,889 days	13/04/2020 9:36	14/04/2020 8:42		Administrator [80%]; Proveedor-Integrador
Define requirements in detail	0,889 days	14/04/2020 8:42	14/04/2020 16:49	23	Administrator [80%]; Proveedor-Integrador
Analyze integration system modules and other	1,333 days	14/04/2020 16:49	18/04/2020 10:29	24	Administrator [80%]; Proveedor-Integrador

applications					
Backup Implementation	4,667 days	18/04/2020 10:29	24/04/2020 16:49	25	
Physical requirements of the solution (power supply, rack space, etc.)	0,333 days	18/04/2020 10:29	18/04/2020 14:09		Administrator [50%]; Provider-Integrator
Analysis, design and construction of backup infrastructure	1 day	18/04/2020 14:09	19/04/2020 14:09	27	Administrator [50%]; Provider-Integrator
Installation and parameterization of backup software	2 days	19/04/2020 14:09	21/04/2020 14:09	28	Administrator [50%]; Provider-Integrator
Testing and analysis of backup software (backup and restore)	1 day	21/04/2020 14:09	24/04/2020 14:09	29	Administrator [50%]; Provider-Integrator
High availability test of backup software	0,333 days	24/04/2020 14:09	24/04/2020 16:49	30	Administrator [50%]; Provider-Integrator
Milestone: Successful tests	0 days	24/04/2020 16:49	24/04/2020 16:49	31	
Closing	0,8 days	24/04/2020 16:49	25/04/2020 15:13	32	
Product Delivery / Receipt	0,2 days	24/04/2020 16:49	25/04/2020 9:25		Administrator; Operator [50%]; Provider-Integrator
Analysis of lessons learned	0,2 days	25/04/2020 9:25	25/04/2020 11:01	34	Administrator; Operator [50%]; Provider-Integrator
Deliverable Approval	0,2 days	25/04/2020 11:01	25/04/2020 13:37	35	Administrator; Operator [50%]; Provider-Integrator
End of Project Act	0,2 days	25/04/2020 13:37	25/04/2020 15:13	36	Administrator; Operator [50%]; Provider-Integrator
Milestone: Project Closure	0 days	25/04/2020 15:13	25/04/2020 15:13	37	
Change management	40,778 days	28/02/2020 8:00	25/04/2020 15:13		
Define change management strategy	2 days	28/02/2020 8:00	01/03/2020 17:00		
Communication	29,578 days	15/03/2020 9:36	25/04/2020 15:13		
Define Communication Plan	1,2 days	15/03/2020 9:36	16/03/2020 11:12	9	Administrator; Operator [50%]; Provider-Integrator
Project Presentation	0,4 days	16/03/2020 11:12	16/03/2020 15:24	42	Administrator; Operator [50%]; Provider-Integrator
Communicate project progress	8 days	16/03/2020 15:24	28/03/2020 15:24	43	Administrator; Operator [50%]; Provider-Integrator
Communicate project completion	0,8 days	24/04/2020 16:49	25/04/2020 15:13	32	Administrator; Operator [50%]; Provider-Integrator
Management of stakeholders (stakeholders)	1,5 days	17/03/2020 9:36	20/03/2020 14:36	12	
Define project stakeholders	1,5 days	17/03/2020 9:36	20/03/2020 14:36		Administrator; [50%]; Operator [50%]; Supplier-Commercial [50%]; Supplier-Integrator [50%]
Initial meeting with project stakeholders	0,5 days	17/03/2020 9:36	17/03/2020 14:36		Administrator; [50%]; Operator [50%]; Supplier-Commercial [50%]; Supplier-Integrator [50%]

Management interests, fears, etc.	0,5 days	17/03/2020 9:36	17/03/2020 14:36		Administrator; [50%]; Operator [50%]; Supplier-Commercial [50%]; Supplier-Integrator [50%]
<b>Documentation</b>	16 days	15/03/2020 9:36	06/04/2020 9:36		
Definition of documentation standards	16 days	15/03/2020 9:36	06/04/2020 9:36	9	Supplier-Commercial; Supplier-Integrator. Administrator [50%]
Verification generated documentation	16 days	15/03/2020 9:36	06/04/2020 9:36	9	Supplier-Commercial; Supplier-Integrator. Administrator [50%]
<b>Training</b>	6,667 days	13/04/2020 9:36	21/04/2020 15:56	21	
Project team training	0,667 days	13/04/2020 9:36	13/04/2020 15:56		Administrator [50%]; Operator [50%]; Provider-Integrator [50%]
Training content development	5 days	13/04/2020 15:56	20/04/2020 15:56	54	Administrator [50%]; Operator [50%]; Provider-Integrator [50%]
User training	1 day	20/04/2020 15:56	21/04/2020 15:56	55	Administrator [50%]; Operator [50%]; Provider-Integrator [50%]
<b>Project Management</b>	40 days?	28/02/2020 8:00	24/04/2020 17:00		
Project meetings	40 days?	28/02/2020 8:00	24/04/2020 17:00		Administrator [50%]; Provider-Integrator[50%];Operator[50%]
Monitoring and control	40 days?	28/02/2020 8:00	24/04/2020 17:00		Administrator [50%]; Provider-Integrator[50%];Operator[50%]
Scope and cost management	40 days?	28/02/2020 8:00	24/04/2020 17:00		Administrator [50%]; Provider-Integrator[50%];Operator[50%]
Incident and change management	40 days?	28/02/2020 8:00	24/04/2020 17:00		Administrator [50%]; Provider-Integrator[50%];Operator[50%]
Risk management	40 days?	28/02/2020 8:00	24/04/2020 17:00		Administrator [50%]; Provider-Integrator[50%];Operator[50%]
Project quality management	40 days?	28/02/2020 8:00	24/04/2020 17:00		Administrator [50%]; Provider-Integrator[50%];Operator[50%]
Progress Information	40 days?	28/02/2020 8:00	24/04/2020 17:00		Administrator [50%]; Provider-Integrator[50%];Operator[50%]

## From the point of view of the work project

Table 2 the detailed tasks to be carried out in this final Work project can be found.

*Table 2. Summary of Gantt Chart*

Activity	Process	Start	End
Definition of proposal Project		10-Sep	17-Sep
Definition of the objectives, approach and method followed in the work project	Index	18-Sep	23-Sep
<b>Final Proposal Delivery: Work Plan</b>		23-Sep	25-Sep
Definition of strategy, objectives and scope		13- Oct	19 -Oct
Solution Analysis, infrastructure planning		21 – Oct	25 -Oct
Impact and risk analysis		13 – Nov	19 - Nov
Backup Software Selection		21 - Nov	25 - Nov
<b>Delivery: Work Plan 2</b>	Background + proposal	02 – Feb	04 - Feb
Physical requirements of the solution (power supply, rack space, etc.)		06 - Feb	10 - Feb
Analysis, design, and construction of backup infrastructure		11 - Feb	16 - Feb
Installation and parameterization of backup software		18 - Feb	23 - Feb
Testing and analysis of backup software (Backup and restore)		24 - Feb	27 - Feb
<b>Delivery: Work Plan 3</b>	Results	02 - Mar	08 - Mar
Delivery and Presentation			

## 6 Backup Environment

### 6.1 Definition of strategy, objectives, and scope

Defining the strategy for implementing a backup system is challenging because it depends on nature and objectives. However, the organizational model is proposed based on the approach of the following main aspects:

- Ensure coordination and understanding between all the working groups involved in the project.
- Service-oriented optimization.
- Clearly defined workflow and responsibilities.
- Specialized support in all areas of the project.
- Flexible work teams to adapt and redefine according to the evolution of the project's needs, taking advantage of all synergies and guaranteeing the deadlines and objectives established.
- Well-defined scale mechanisms.
- Formalized communication at all levels.
- Provide gradual information about project monitoring.

Therefore, the objectives to be achieved while implementing a backup environment reside in:

- Securely consolidating application charges.
- Avoiding the use of infrastructure resources for internal tasks that affect the service level.
- Dimensioning the solution based on an exhaustive study of data and real needs, ensuring adequate and predictable performance.
- A complete and secure information protection strategy that ensures compliance with the RPOs and RTOs in each application.
- Assuming unpredictable growth in capacity and performance without having to purchase new equipment or migrate, representing unprecedented scalability and optimization of future investments.

## 6.2 Analysis of the Infrastructure, solutions, and environment

This thesis aims to improve both, the backup and restore and implementation, using the corresponding process management.

After analyzing some entities, companies, and institutions, to consider if they have these types of backup tools, the author has discovered some incoherence in the process of configuration and management of the tool.

Thus, at the very beginning, it was necessary to understand and take important notes in the technical meetings with the departments involved in this platform where the service is held to obtain all the relevant information.

This includes information retrieval to elaborate the solution design on the new infrastructure provided, based on the existing solution.

It also includes the collection of detailed information about the existing storage infrastructure with its technical characteristics and current use, in the form of inventories, status reports, capacity, distribution and performance, which can be valid for project development.

During the research at University Nova IMS, information for the present work was compiled to provide acceptable data related to backups. At the same time, while collecting more specific information, some issues arose.

At University Nova IMS, the backup system is quite outdated and does not fit the standard that indicates correct use according to Veeam Backup. Since it establishes a minimum of requirements and at present, Nova IMS does not use this method, a useful update could be the 3 + 2 + 1 system, which is the use of SureBackup, according to the reference action (*How to Avoid Misconfigurations Setting up Veeam?* n.d.).

Conforming to Joaquim David (System Administrator) and Official Technician at University Nova IMS, the backup process is complex, with some weaknesses in the part of recurring updates after bad habits that can have a negative impact.

To understand the process management and infrastructure status related to backup administration at Nova IMS, certain observations should be analyzed.

## 7 Properties and Capabilities in Veeam Backup

### 7.1 What is Veeam Backup and Replication?

According to (*About Backup - User Guide for VMware vSphere*, n.d.) VeeamBackup & Replication is a commercial and complete backup and disaster recovery solution that is hardware and cloud-agnostic. It aims to help businesses achieve comprehensive data protection for all workloads — including virtual, physical, and cloud-based workloads. With a single console, the vendor aims to help users achieve fast, flexible, and reliable backup, recovery and replication of all applications and data.



Figure 1. Gartner Magic Quadrant for backups

(2020 Gartner Magic Quadrant - Veeam Remains a Leader 4 Years Running, n.d.)

Essential characteristics:

Veeam is enabled to help to jump to a digital transformation, its means bring all support and environment of the backup infrastructure. Many companies approve the efficiency and support even the conforming to the following reference: (Backups, 2020)

ADVANTAGES	VEEAM BACKUP AND REPLICATION	LEGACY BACKUP TOOLS
Agentless	✓	–
Built-in advanced replication	✓	–
Instant Vm Recovery	Patented	–
Instant File-Level Recovery	Any OS and file system	Any Windows, maybe Linux
Instant application-item recovery	Any application and file system	Select application only
Automated recovery verification	Patented	–
Built-in, source-side compression and deduplication	✓	–
Simple offsite backup	✓	–
Storage agnostic	✓	–
Easy to deploy and configure	15 minutes to self-setup	Weeks of extensive deployment

Figure 2. The top 10 advantages according to Veeam customers and partners

Besides that, many companies bring the environmental capacities with different types of technologies and solutions required in the infrastructure, such as:

- **On-premises backup:**

On-premise backups are those in which a copy of data is saved onto in-house storage devices. Examples of **storage servers, and tape or disk backups**. Most organizations traditionally begin with an on-premises solution because of its simplicity and cost.

- **Tape Backup System:**

The tape can be one of the best options for fixing an unstructured data backup problem because of its inexpensive operational and ownership cost, capacity, and speed. Magnetic tape is especially attractive in an era of massive data growth. Customers can copy and store archives and backup data on tape for use with cloud seeding. Also, the Tape is still a relevant means for archiving, and it remains in use in large enterprises that may have petabytes of data backed up on tape libraries.

- **On-site backup**

On-premises backup can be quite costly. First, there are the electrical costs associated with powering and maintaining hardware. Second, there are costs associated with purchasing the hardware itself as well as investing in additional upgrades and repairs. Setting up an on-premises backup solution is typically more expensive than storing data in the cloud. Additionally, on-premises backup may require IT teams, investment in human resources to provide adequate support for emergency hotfixes and repairs that may emerge. Using cloud backup, routine, 24/7 maintenance and support for backups is typically handled by the vendor. The information is saved on Virtual Recorded OR Linear Tape-Open (LTO) which is a magnetic tape data storage. However, unlike cloud backups, On-site backups are vulnerable to disasters, including physical damage, such as fire or water damage, management, or theft.

- **Cloud backup:**

The cloud has changed the data backup industry due to its affordable price point, for SMBs (small and midsize businesses). Moreover, the solution is also simple, and the data is available anytime and anywhere. Cloud backups assist with mitigating problems as data is stored in data centres with built-in redundancy. These centres are also shielded by highly regulated safety measures and 24-hour monitoring. This revolutionary period of cloud backups is leading a higher and higher number of companies to consider cloud-based services as a more feasible and efficient alternative due to the following four important factors: cost, recovery, time, and security.

- **Cloud Hybrid backup:**

Hybrid cloud backup provides a combination of cloud data backup and storage with local backup. The cloud storage is integrated with the local backup to ensure that critical data is protected in the event of a disaster. A hybrid data backup solution automatically backs up critical data to a remote server in the cloud, while a local backup is typically performed using a drive on the local network which is shared, or a network-attached storage (NAS) device. If the local backup fails, the cloud storage and backup assure that data can be recovered in the event of a loss.

However, all this information depends on the objectives of the company that intends to take care of the correct management in the administration of the backups.

The correct service continuity process (RPO and RTO) must be maintained and guaranteed:

- RPO (recovery point objective)  
It determines the objective of the maximum possible loss of data entered from the last backup, until the system failure and does not depend on the recovery time.
- RTO (recovery time objective)  
It expresses the time during which an organization can tolerate the failure of its applications and the drop in the associated service level, without affecting business continuity. It aligns with strategy and business processes and improves backup and data recovery performance.

For the time being, large companies are choosing hybrid technology that allows:

- Recovery from backups as quickly as possible, without affecting business.
- While the restoration process is performed as quickly as possible, the copy process is performed simultaneously so that it does not collide with business processes.
- According to country regulations, data must be safeguarded for security.
- One of the great measures of using Backup Cloud is to save money and physical maintenance to the tapes.

## 7.2 Directly Competitor of Veeam Backup.

As it can be seen in Figure 3, some of Veeam Backups' strongest competitors and opponents are Veritas NetBackup and CommVault. Following closely the history of backup and traditional vendors that offer device backup support and represent specific information and cooperation between brands.

These two brands have complementary tools that led to the achievement of relevant system and process specifics for the current companies.

However, Veeam Backup Highlight a comparative table of pro and cons for these brands.

**Veritas Technologies:** is a historic data protection vendor, adequate for protecting a traditional client-server infrastructure. Veritas provides some benefits, such as offering an all-in-one backup appliance and support for a broad range of workloads and devices but comes with significant drawbacks.






	Veritas NetBackup limitations	Veeam benefits
 <b>Choice</b>	<b>Proprietary hardware</b> To realize the full benefits of NetBackup, appliances are required which increases costs and complexity and limits flexibility.	<b>Total flexibility</b> Choose the infrastructure that best fits your business needs and leverage your existing hardware investments.
 <b>Complexity</b>	<b>Disconnected architecture</b> With complex user interfaces and point products, NetBackup requires significant time for everyday management.	<b>Intuitive management</b> Spend up to 50% less time managing backups. Without point products to manage, Veeam minimizes your workload.
 <b>Functionality</b>	<b>Missing key features</b> Without capabilities like 2-in-1 Backup & Replication™ or recovery verification, NetBackup has fallen behind the curve.	<b>One solution for ALL workloads</b> Consolidate multiple solutions into a single platform providing backup, recovery, cloud mobility, analytics, orchestration and more.
 <b>Scalability</b>	<b>Lack of flexibility at scale</b> Veritas appliances increase costs and complexity and do not independently scale, leading to unnecessary costs.	<b>Distributed scalability</b> Only buy what you need and scale backup infrastructure infinitely, with no additional licensing costs.
 <b>Costs</b>	<b>Penalties for growth</b> Capacity-based licensing from Veritas penalizes you for data growth. Licensing costs increase each year, breaking your budget.	<b>Limitless potential</b> Unlock limitless savings with Veeam Universal License. As your data grows, the amount of Veeam licenses stays the same.

Figure 3. Pros and cons for Veritas NetBackup compared to Veeam (Backup, 2020b).

**Commvault:** is a historic backup vendor that provides many features and is a unified platform for data protection and management of both on-premises and cloud workloads. Its key capabilities include data **backup**, snapshots, replication, archive, cloud migration and protection, granular recovery, content index and search, disaster recovery, and reporting.





	Commvault limitations	Veeam benefits
 Complexity	<b>Increased complexity at scale</b> Commvault infrastructure requires significant resource overhead - often resulting in twice the administrative burden of Veeam.	<b>Straightforward scalability</b> Deploy and administer Veeam's solutions effortlessly - freeing up your budget, resources and most importantly - time.
 Cost	<b>High TCO</b> Hardware, required Professional Services and administrative overhead raise the cost of a Commvault solution far beyond licensing.	<b>Low overhead</b> Save on budget, thanks to a solution that is simple to deploy and manage with no costly professional services required.
 Capabilities	<b>Manual workarounds</b> Lacking important features requires Commvault Administrators to manually perform activities beyond basic backup.	<b>Complete solution</b> Gain access to a complete Availability solution, including DR orchestration, copy data management and more.
 Risk	<b>Divided interests</b> Public companies like Commvault have a primary responsibility to their shareholders, not their customers or products.	<b>Safe and proven</b> Join more than 375,000 customers across the globe that rely on Veeam's customer-first approach to backup, recovery, DR and more.

Figure 4. Pros and cons for Commvault compared to Veeam

(Backup, 2020a)

## 8 Field of Study Backup

Webasto, where the author is currently employed, is one of the top 100 suppliers to the automotive industry. The company provides innovation in solar roofs, panoramic roofs, convertible roofs and pioneering systems for heating, cooling, batteries and charging solutions. It continues to add value to the burgeoning mobility sector, also ensuring that commercial and special vehicles, recreational vehicles and boats are kept at the optimum temperature. The IT headquarters of Webasto is located in Portugal, where the company coordinates and manages the entire global technical infrastructure, integrating the three corresponding regions: AMERICA, EMEA and APAC.



*Figure 5. Worldwide Group*

Its product portfolio comprises a wide range of roof and heating systems for every type of vehicle and all types of units, as well as battery systems and charging solutions. Besides that, Webasto has a strong position in the aftermarket offering distributors and end customers customized solutions and services related to thermal management and electromobility. In 2019, the company generated sales of around EUR 3.7 billion and had almost 14,000 employees in more than 50 locations (of which more than 30 are manufacturing plants).

Although the company is based in Stockford near Munich, Germany, the IT headquarters of the IT operations and infrastructure team is in Portugal where international guidelines are determined in each of the delegations and distributed in previously mentioned regions: AMERICA, EMEA and APAC.

The current IT infrastructure of Webasto is technically complex and in general, considering that the company has an organized infrastructure done according to the requirements needed in each country, it is also influenced by certain factors which will always depend on the organization and the functions.

As stated previously, its infrastructure is in Lisbon composed of two data centres, which means that the data processing centre consist of firewalls, VPN gateway, Reuters, Switches, database servers, backup servers, Netapp, application files, web and middleware, computers, all in physical hardware and consolidated and virtual platforms.

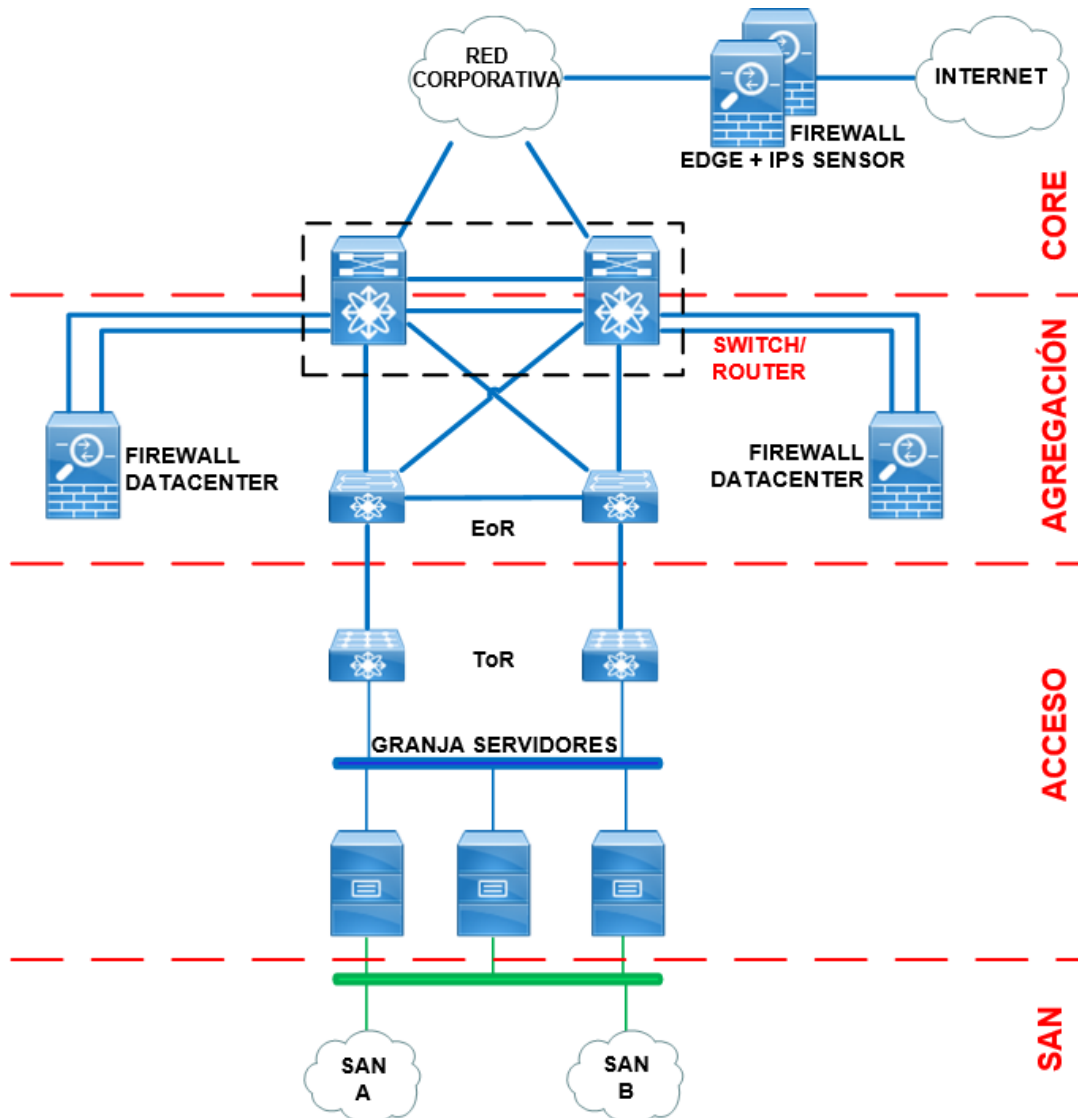


Figure 6. Infrastructure IT

This schemaFigure2. Infrastructure IT presents that is only an illustration of the possible infrastructure of the IT Headquarters in Lisbon.

## 8.1 Backups Infrastructure

Concerning the type of infrastructure used for the information, the company has a private organization designed for its use. It allows the company to have an entire organization chart, separating infrastructure from production, operations and those referred to in production, while defining exclusive policy storage of structured information according to the requirements and use.

These measures have been designed to optimize resources. Moreover, this backup structure and information retention are automated allowing to have backups services provided most efficiently.

The implantation of administered backups is subdivided into different types of storage, sea, full, incremental, reverse incremental. Also, the secondary backup policy is defined depending on what type of main storage repository is in use.

Below, in Figure 3 a sample of the company's backups organization chart is shown.

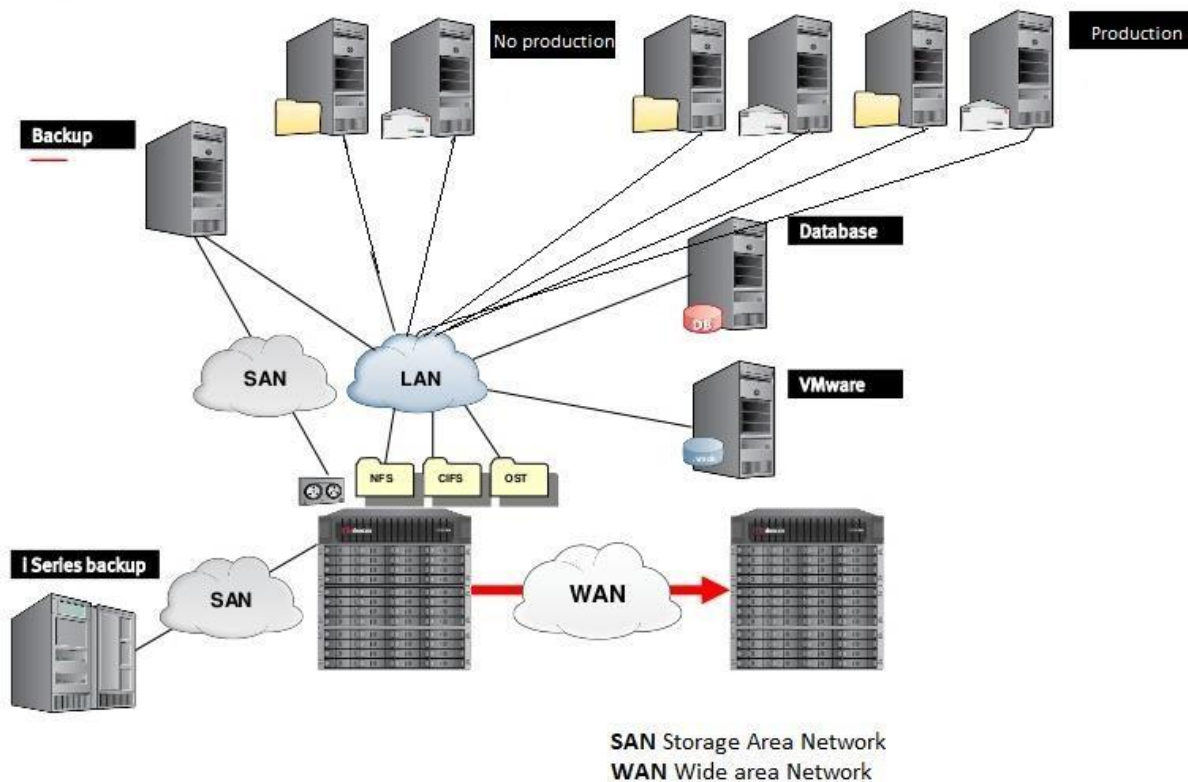


Figure 7. Webasto Backup Infrastructure

However, looking at the current backup IT infrastructure at the current company, with a complexity architecture organization was considering and defined like this, according to the performance and requirement developed on all global IT Infrastructure.

The main purpose of this work project is to highlight every aspect related to the backup environment. Considering the information contained in the following thesis and the fact that I am a company employee, some information will remain confidential due to security policy and some IT infrastructure information will be excluded.

### 8.1.1 Veeam Backup Enterprise Manager

The present architecture corresponding to Veeam backup Enterprise manager is one of the important tools to organize all backup information. It also aggregates data from multiple Veeam backup servers, as well as from the underlying VMware vCenter servers, even to synchronize and monitor information.

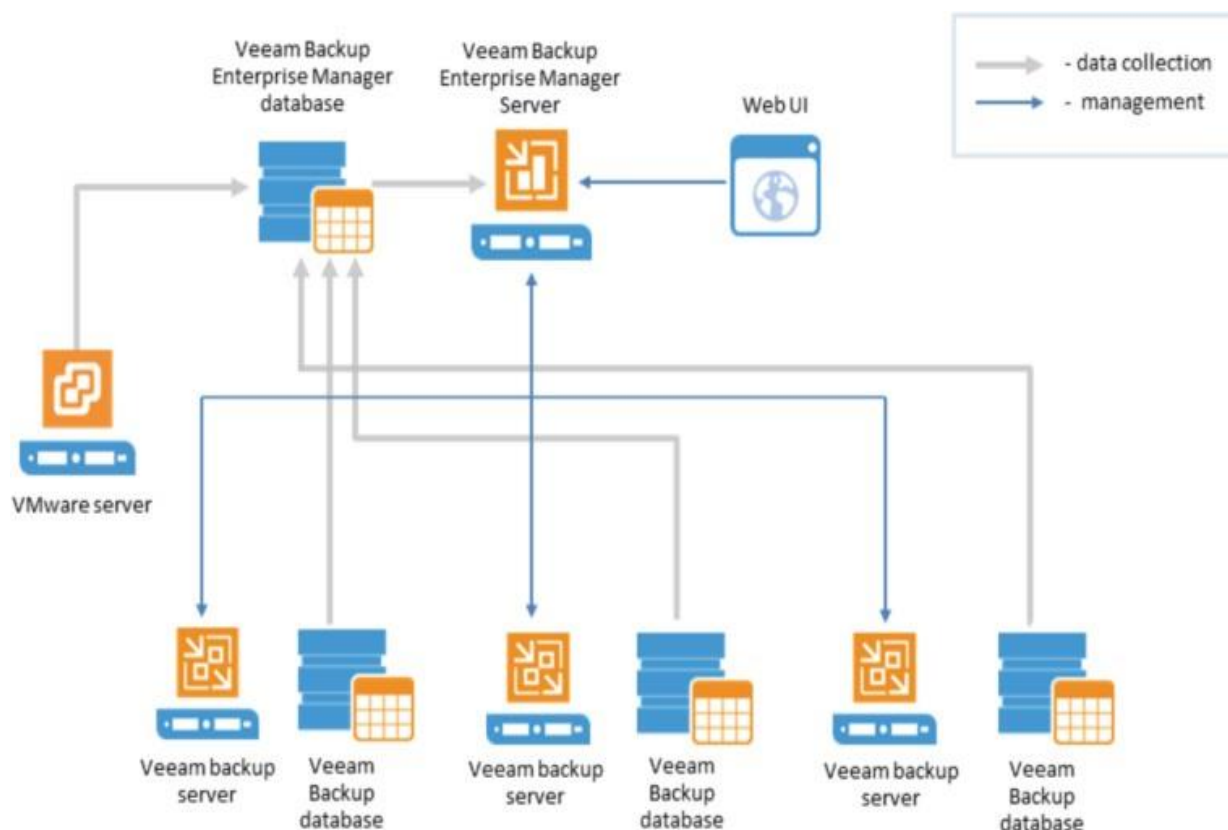


Figure 8. Veeam Enterprise Manager Architecture

Some benefits of EM include:

- Centrally manage and update licenses to ensure compliance
- Manage jobs across some Veeam backup servers
- View ongoing reporting data for all jobs running on these servers, set up e-mail notifications to get informed on the status of all jobs
- Search for machines and guest files in backups and replicas
- Perform recovery operations for VMs and physical machines, including 1-Click restore, 1-Click guest OS file restore, and application items restore (for Microsoft Exchange mailboxes, Microsoft SQL server databases and Oracle databases)
- Delegate permissions for restore operations to personnel in charge
- Manage VMware vCloud Director organizations and support their administrators with self-service restore portal
- Install Veeam plug-in for the vSphere web client to vCenter server(s)
- Implement data encryption and decryption processes for Veeam solution
- Support operations automation, providing access to Veeam RESTful API

According to the knowledge of Veeam Backup and Replication:

*(How Veeam Backup Enterprise Manager Works - Veeam Backup Enterprise Manager Guide, n.d.)*

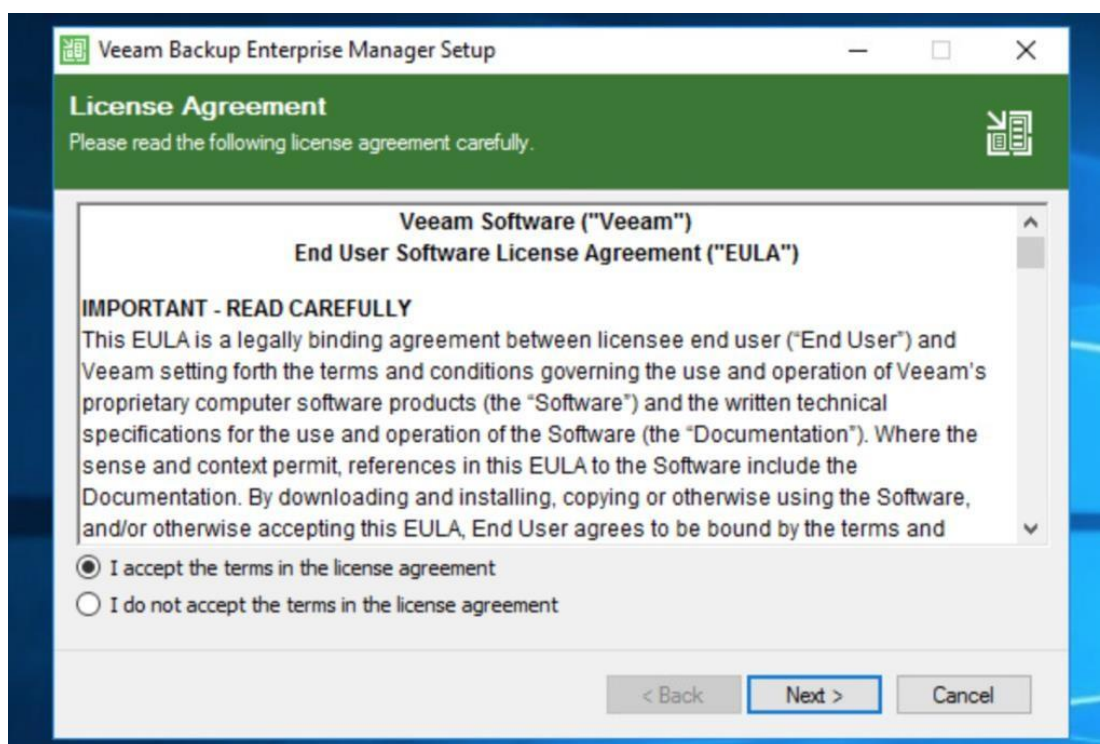


Figure 9. Enterprise Manager License Agreement

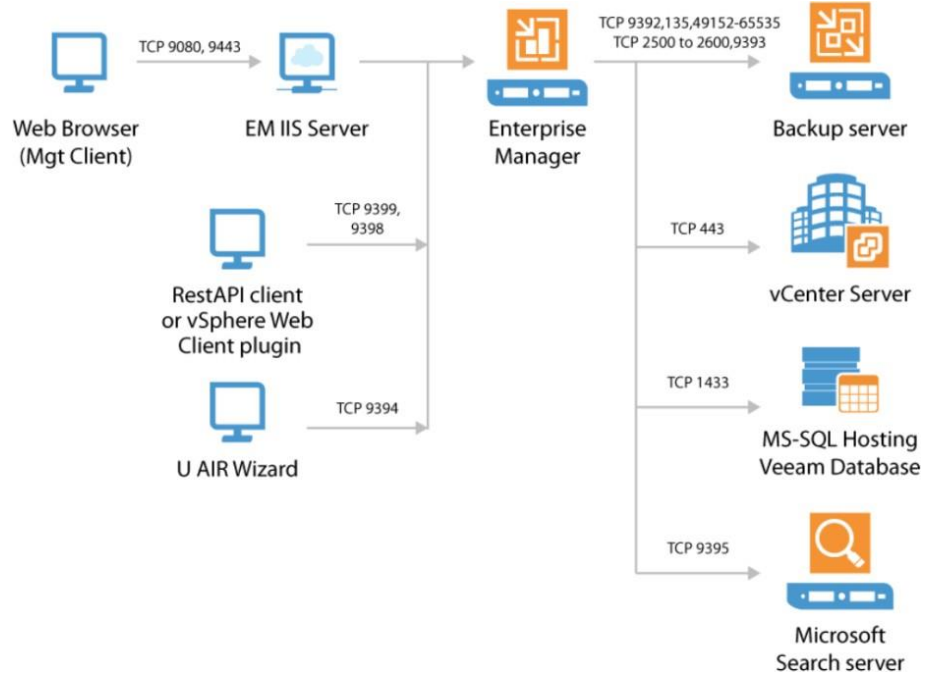


Figure 10. Required Ports for Veeam Enterprise Manager

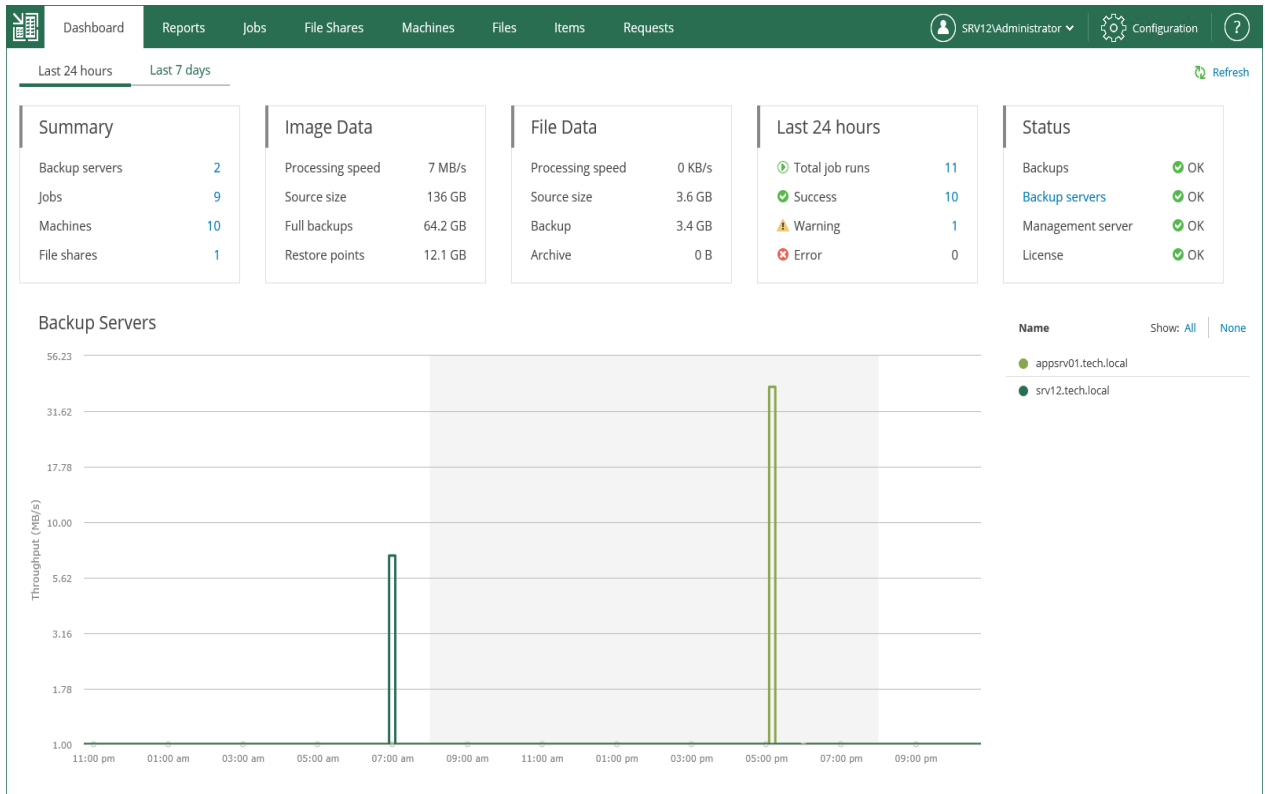


Figure 11. Veeam Backup Enterprise Dashboard



Figure 12. The following image corresponds to the Veeam backup server installed on the environmental infrastructure.

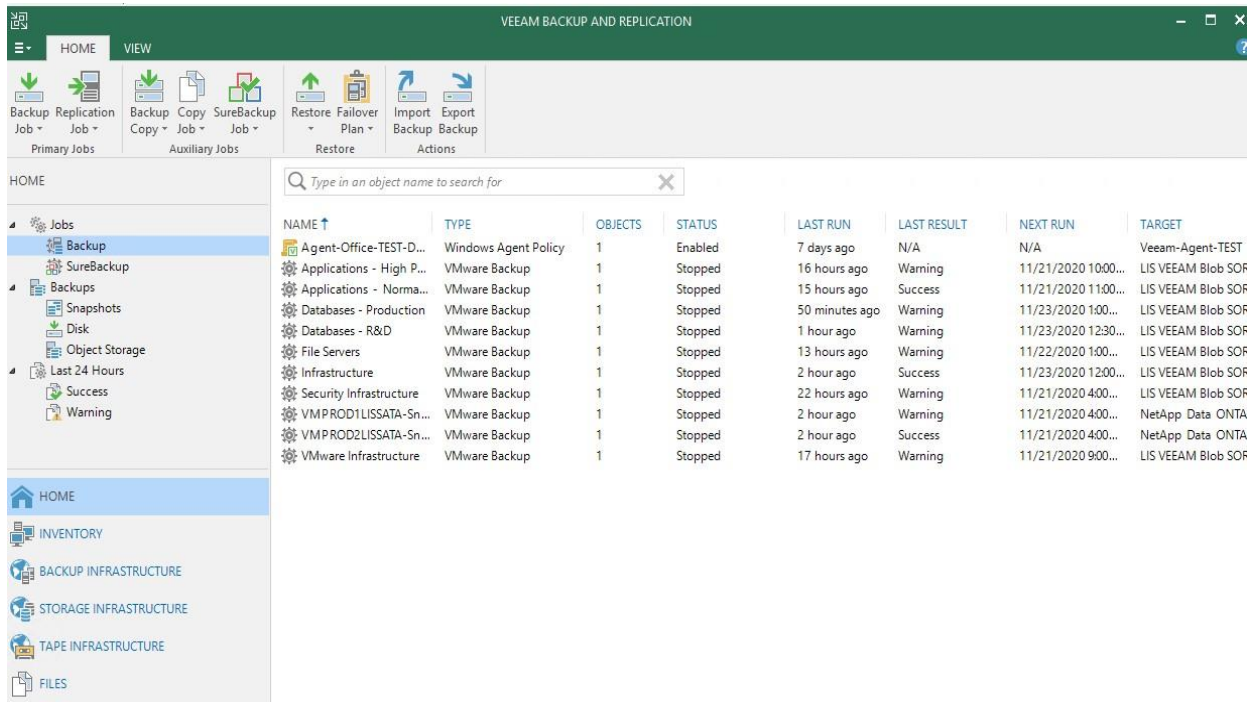


Figure 13. Dashboard with Veeam Backup server environment implemented on the IT infrastructure.

## 8.1.2 Surebackup component of the backup virtual environment

Veeam Surebackup provides the capacity to verify the recoverability of information. The main reason to use it is the ability to promptly check the data restore health. It is vitally important that Veeam Surebackup recognizes a test for the backup environments by restoring them, to avoid issues when the original system is still under production.

Normally this type of test is done in a private and isolated network so that there is no conflict with the production systems. Confirming with the reference ((Veeam SureBackup - Spiceworks, n.d.)

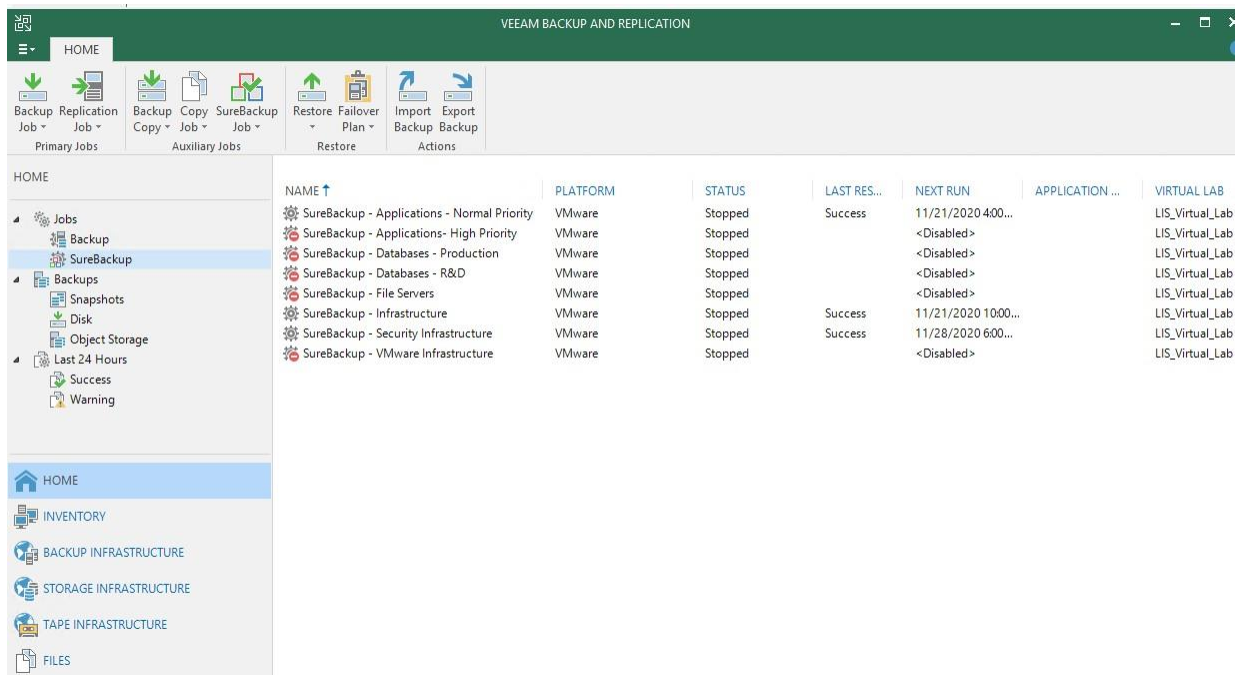


Figure 14. Dashboard with SureBackup server environment implemented with the IT infrastructure.

## 8.2 Standard Backup Procedure

As we know, a backup is a process to avoid that creates a copy of system data on backup media, which is stored and kept for future use in case the original is destroyed or stolen.

A backup session is based on the backup specification and can be started interactively. During the session, the backup reads the backup objects, transfers their data through the network and copies them into the media residing in the devices.

However, for each company or organization, backup is an important strategic component to manage data information. All the infrastructure backup is effective when it is defined as a standard process that is clear, and which understands the corresponding tasks transforming a most efficient procedure.

In consonance with (*Database Backup and Recovery Best Practices | ISACA Journal, n.d.*) for defining logic and basic standard backup procedure, several steps should be taken into consideration:

- Selecting the data to be backed up
- Selecting the backup storage
- Selecting how many additional backup copies (mirrors) to create
- Starting or scheduling a backup session
- 

Nonetheless, each standard procedure present for systems backup is as follows:

- a. A full or incremental backup system will be performed with sufficient frequency so that the entire system and all data from the end of the prior day can be completely restored, if necessary. Each backup should be maintained for the entire month.
- b. Data to be backed up include the following information:
  - User data stored on the hard drive
  - System state data
  - The registry
- c. Systems to be backed up include but are not limited to:
  - File server
  - Mail server
  - Production web server
  - Production database server
  - Domain controllers
  - The last full backup of the month saved as archival records
- d. Monthly backups will be saved for one year, while the media will be recycled or destroyed.
- e. Incremental backups of new data will be performed daily. Incremental backups will be retained for enough time to restore data for at least a week, while the media will be recycled or destroyed.

- f. Periodic tests of the backups will be performed to determine if files can be restored.
- The testing should be conducted quarterly.
  - The tests should be personally monitored by an auditor, and the auditor’s report of their findings should be maintained for 5 years.
  - Testing should be conducted on clean servers, and all servers should be restored at the same time.
  - Applications testing of the restored servers should be conducted and the results included in the auditor’s report.
- g. All backups will be stored in a secure, off-site location. Proper environment controls, temperature, humidity, and fire protection should be maintained at the storage location.
- h. All backup media that is not re-usable should be thoroughly destroyed in an approved manner. Backup media that is used for other purposes should be thoroughly erased.

(Computer Systems Backup Policy and Procedure, 2018)

To implement the proper practice of an efficient backup process, the following strategy should be considered: ((Planning a Backup and Recovery Strategy - IBM Documentation, n.d.)

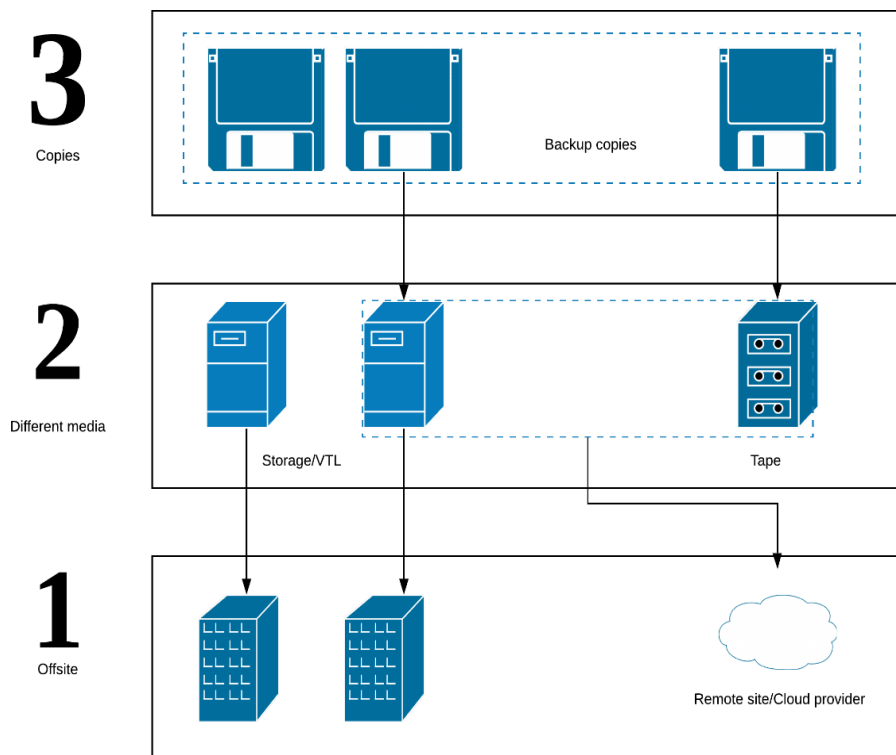


Figure 15. The 3-2-1 backup strategy is composed of three steps in descending order

(How to Follow the 3-2-1 Backup Rule with Veeam Backup & Replication, n.d.).

### 8.3 Error Backup incident

On this occasion, in addition to identifying and reducing possible fall points in the event of disasters, to design the right backup solution for companies, it is required to use and optimize the communication methods, determining new storage mapping procedures. This will allow having a more effective information collection process, efficiently transforming the backup process as well as identifying the locations of storage and their periodicity.

According to conducted research, more than 70% of the loss of information is due to human errors (*Data Loss: Causes, Effects & Prevention Methods | Consolidated Technologies, Inc., n.d.*) and these errors have in turn multiple causes which could be from:

- Failures in the technical team
- Usurpation of the device
- Set fire to random flooding.
- Human error, the user failed
- Robbery or deleted files and partitions
- Security breaches, viruses, and intrusions
- Domestic accidents



Figure 16. Error Backup incident

This process contributes to a large extent to the continued improvement in the business line in the company, guaranteeing the optimization of the processes.

At present, Webasto has determined several ways to store all the information as already explained above, according to the right use of the backup procedure, however, some advantages and disadvantages of each of the models should be highlighted:

## **Tape storage**

A backup tape is a physical device whose operation is based on the translation of a magnetic tape while the data is copied or restored. So far, there have been only two writing methods on this type of device: start-stop or streaming. Currently, the company uses this procedure since the Portuguese government has created policies that impose the use of such devices.

The features of the method include:

- Compression and capacity: depending on the copying of the tape, the LTO Ultrium technology allows to compress the resources of up to 120TB on a single tape (generation 10 LTO Ultrium).
- Encryption: being a hardware device, or encryption of copied data, it is useful in case of theft of the mentioned device.
- Write speed: the writing speed on the latest generation of tape can reach 2750 MB/s
- This type of technology has been very reliable in legal aspects such as data retention. As the tapes are more durable, their long life makes them very profitable. The tape is locatable in space, that is, it is known exactly where the data of the machine is located within the company's premises.

## **Disk storage**

This method uses a large variety of technologies or a set of storage repositories, being much faster and more efficient both for local storage use and, specifically, in an exclusive repository.

This option allows the management of new data locally, or through an alternative like a QNAP or an instantaneous storage manager with SSD recognition, reliable and scalable. It has an intuitive graphical interface, and the storage easily enables the management of disks, volumes, storage pools, iSCSI storage, as well as SSD caches (Data Storage Management: What Is It and Why Is It Important? n.d.)

## **Cloud storage**

Nowadays, backup storage in the cloud cannot be precisely described because this type of technology is transparent to the client or user. This feature is an advantage as it does not cause issues associated with the hardware. However, the lack of information can be concerning to the user because they do not have information about the storage of their data (application of the LOPD).

Nowadays, cloud storage has very low data transfer rates (slow speed) and the costs associated with safeguarding information, uploading and/or downloading information can increase the cost of the backup service.

As indicated in a reference from one of the most important cloud storage providers in the market

## 9 Measures to Optimize Backup Management

A measure of optimization of the backup storage process is to keep a backup processing system in constant questioning, considering that it is crucial to receive feedback about ongoing processes. It is known that they are repetitive processes and that because of this, the system optimization process may be postponed. Since it will be allowed to pay special attention to the systems, according to the defined flowchart, this measure can be illustrated in

Figure 5, as follows:

However, to carry out a detailed survey of the environment, the mapping of which device stores the information necessary for the business is crucial. Servers, computers, tablets and cell phones are the most common equipment, however, some types of businesses require customized solutions, for example, call centres with telephone exchanges that automatically record calls or geo-location companies that need to keep copies of the coordinates of the GPS devices.

After identifying the potential backup points, the next step is to identify which path the information takes until it reaches the storage device that will centralize the backup and to what extent the IT infrastructure will be affected by the process.

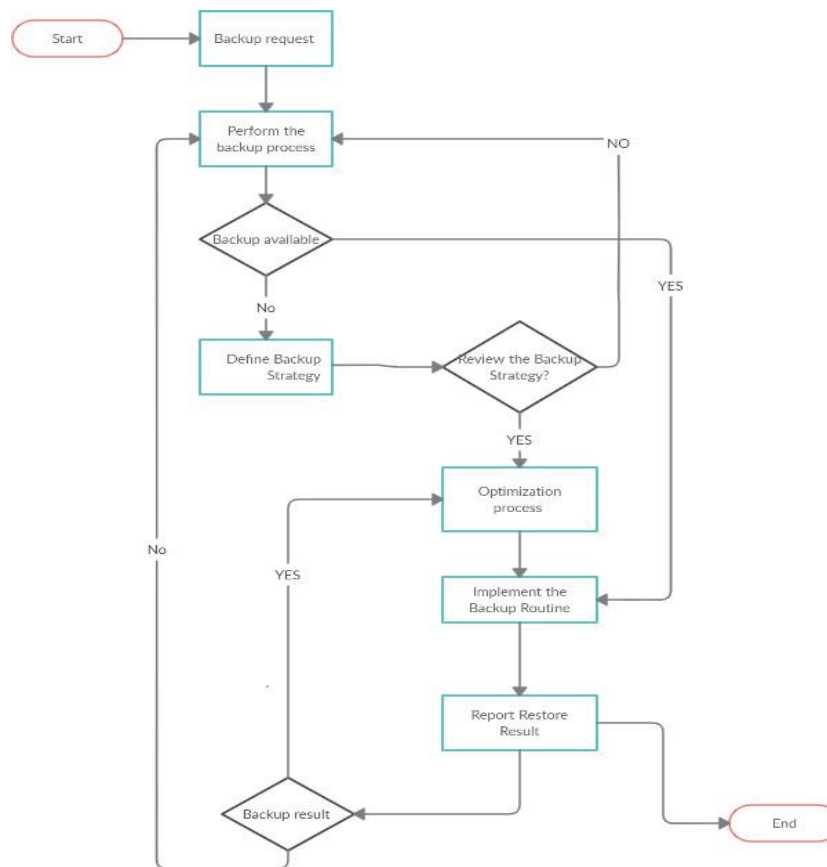


Figure 17. Backup analysis procedures continue

For the backup to take place, any software must read the data and transmit it to the chosen solution, whether through server processing, local network bandwidth, or an Internet connection.

Depending on the time required for this process, the backup system will require additional work from the servers and stations since, in addition to responding to routine requests from users, the storage system must also send the data to be copied. This implies a decrease in the performance of the computer, the local network, and the Internet bandwidth, which directly affects productivity. As any corporate backup plan must consider local infrastructure, it is important to note that the data to be backed up will generate additional disk activity and more data traffic, consuming more network bandwidth.

Therefore, some aspects should be considered when preparing the backup plan:

- Backup window
- Version
- Holding time
- Archiving or deletion
- Estimated time for the restoration processes
- Required storage capacity

The backup window is the period in which the execution of the data copy process will not hinder the productivity of the users. It is generally defined when there is no one working, but in this case, someone may ask: and what if my environment works 24 hours?

In such cases, it is advisable to verify on which day or in which week there is the least workload before implementing a backup solution. Some monitoring technologies allow the development of strategies to back up the business without disturbing the work, executing the task according to the level of processing at the time. In these circumstances, consulting a specialist to identify and size which solutions are the most appropriate for each situation can help substantially to make a decision.

Another important matter is to understand if the company requires different versions of the same files. Situations in which it is necessary to maintain multiple versions of the same file, changed by one or more users over time, require more storage space in the backup solution than in the production environment.

For instance, if there are fifty files of 10GB each (a total of 500GB), and it is necessary to keep the last three changes of each, the backup solution will need at least 1.5TB of storage capacity.

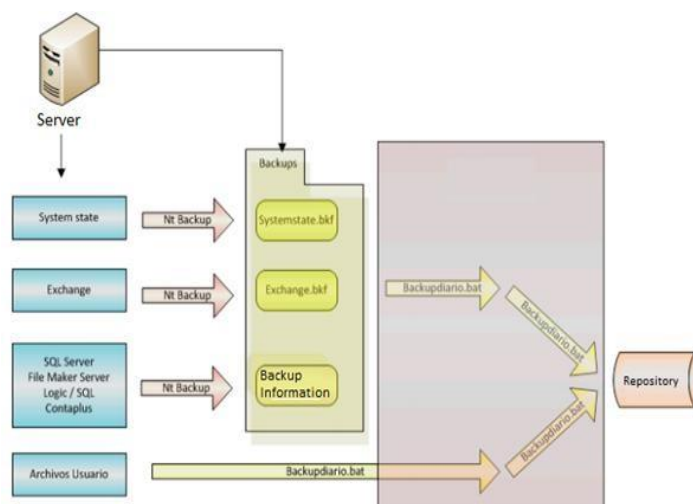


Figure 18. Conceptual Backup scheme

## 9.1 Methodology Using Backup Process

The Backup process avoids or minimizes the loss of work in case of undesirable events, and therefore it must be performed regularly in a responsible and defined manner, to prevent data from being permanently lost or damaged, regardless of the type of incident, whether it is physical, logical, environmental, or it is simply a human error.

Additionally, the importance of a good backup process implies that it is very laborious and time-consuming since it requires the alignment of IT professionals with the needs of other areas or the company departments.

Nowadays, companies do not consider all data equally important. According to the administrative area, it is legally required to keep proof of tax collection for at least 5 years to avoid fines. Other documents and records may need less time to be discarded.

The backup process system determines an operational methodology, where the IT team could execute the complete routine or use software to automate the backup, being responsible only for the restores. These daily routines of incremental backups only copy files that have changed since the last copy while others use shorter time depending on the number of files that are created or manipulated in their departments.

The routine must be established based on the volume of important files used by your employees in carrying out their work. The process will further conform to:

- Backup request
- Definition of operational strategy
- The implication of the operational routine
- Communication about the backup action
- Proof of each of the mentioned steps is fulfilled.

As it was mentioned before, the purpose of this methodology is to support an effective data backup process, which requires certain tasks to be completed successfully every day. Besides that, weekly, monthly, quarterly and even annual tasks are also performed, and they are equally important. While short-term tasks are highly tactical, long-term tasks tend to be more strategic.

Considering the responsibilities of having an effective backup operations environment, all tasks should be documented and performed on time. In terms of the current backups, a common practice is to take an incremental backup daily and a complete backup each month.

## 10 Applying the Methodologies Backup Process with Business Process Management (Bpm)

In agreement with the reference, (AIIM, n.d.) Business Process Management (BPM) is a way of analyzing and then controlling the processes that are present in an organization. It is an effective methodology to ensure that the processes are efficient and effective, as this will result in a better and more cost-efficient organization. Also, (BPM) is concentrated on repetitive and ongoing processes that follow a predictable pattern, or process management, such as the backups process being an example of process management.

Applying business process management and organizations can improve some processes and keep all aspects of operations running optimally.

Moreover, BPM has a life cycle that allows to fully optimize the entire process, but it also grants the tool to create, map, analyze and improve business processes. In general, this appliance tracks individual items closely as they move through a workflow, adapting the backup process to the life cycle so that the individual's needs will develop a new and efficacy process. (Richard Adams, 2019)



Figure 19. business process management (BPM) lifecycle  
(kissflow.com, n.d.)

#### BPM LIFECYCLE OF NEW BACKUP PROCESS ARE:

- a. DESIGN: At this stage there are two formats, a standard version as well as an improved version of the Backups process and according to our evaluation, we conclude that there are two backup designs. However, they are not equally efficient, and this is the only reference of agreements to the results obtained and complying with the development standard of the BPM lifecycle.
- b. MODEL: At this point, the inner workings of the organization - from end to end must be understood. For this reason, various artefacts are used such as organization charts, positioning diagrams, process flows, among others. They provide an overview of the activities performed by employees daily, and as it was already shown, the development of these processes has revealed a deep analysis of improvement in the backup process, from the beginning, decision making and the development of which models to use.
- c. EXECUTE: For the execution of this process, we determine several steps of which we simulate the processes in both, a standard model and the proposed one of which we show some results.
- d. MONITOR: Every company has strategic goals. At this stage of the BPM life cycle, we can find out whether the processes are aligned with these objectives or not, by monitoring appropriate indicators to assess the results obtained. In addition, the present proposal is a clear example of optimization of the process since it must be continuous in order to obtain excellent results.
- e. OPTIMIZE: It can also be called process transformation through planned development, analyzing the indicators from the previous stage, and deciding whether the strategic objectives are being achieved or not. For instance, if the goals defined from modelling are being met about the results continuously observed in the proposed backup process.

(Venki, 2020)

## 11 Backup Software Testing and Analysis

A backup tool is of little use if recovery fails. This reasoning is what leads us to carry out some tests on a business process management (BPM) model, which was previously used as a way to know its development to determine and make relevant decisions in our new process.

For this purpose, the Bizagui software will be used, which will allow us to analyze and compare two models: a standard backup process model and a model with some improvements and proposals.

The results obtained will allow us to determine which model is relatively better.

It is necessary to have an environment similar to the company's current environment where possible contingencies can be reproduced. This environment may or may not be isolated, but such tests cannot affect the service or the business.

On the other hand, the tests that must be performed can be grouped into two blocks:

- Create backup procedure as (Standard Version and proposal version)
- Restore backup procedure as (Standard Version and proposal version)

Each of them is explained in detail below:

### 11.1 Create a backup process

Creating a backup copy is of great importance in companies and this is the first stage where it is confirmed that the information is 100% protected. But it must be remembered that while doing a test of security copies, it must be ensured that the copied data is easy to recover. All these options will depend on the needs of the company and the configuration process carried out by the backup administrator.

#### 11.1.1 Type of backup copies.

- **INCREMENTAL:** A type of backup copy where blocks are copied, and they were modified concerning the full backup or the previous incremental backup. Each set of blocks is grouped independently, and if determined, not all modified blocks accumulate in the same group. Advantages:
  - It depends on the system, the space occupied by this backup will be less concerning the complete copy.
  - In the previous collection works, the ejection time is less than the complete copy.
- **DIFFERENTIALS:** A type of backup copy where the blocks modified concerning the full backup or the previous differential backup are copied. Each set of modified blocks is grouped and accumulates in the same group. Advantages:
  - It depends on the system, the space occupied by this backup will be less concerning the complete copy.

- FULL-SYNTHETIC (FULL SYNTHETIC BACKUP):** A type of backup made if the blocking data map is copied into a real and complete one. In case differential or incremental backups are being done, there will be a time when the company would like to have a full backup again with the data saved in previous backups. This is the synthetic backup that appears because this type of technology can unite the information and save it in a single synthetic and complete backup. Advantages:
  - It is just an operation if you have all the data saved.
  - Consume fewer resources because it works directly with backup storage.
- INCREMENTAL:** A type of backup of the data map is the most authentic and only if it keeps the blocks and the modified data. Each modified data block is referenced from the backup primer, therefore, only the modified block is saved in each copy (incremental for itself). Advantages:
  - Space for storage.
  - Reduction of ejection time.
  - Improvement of the RTO because the operation can restore data in less time

### 11.1 Create a backup process as a standard version

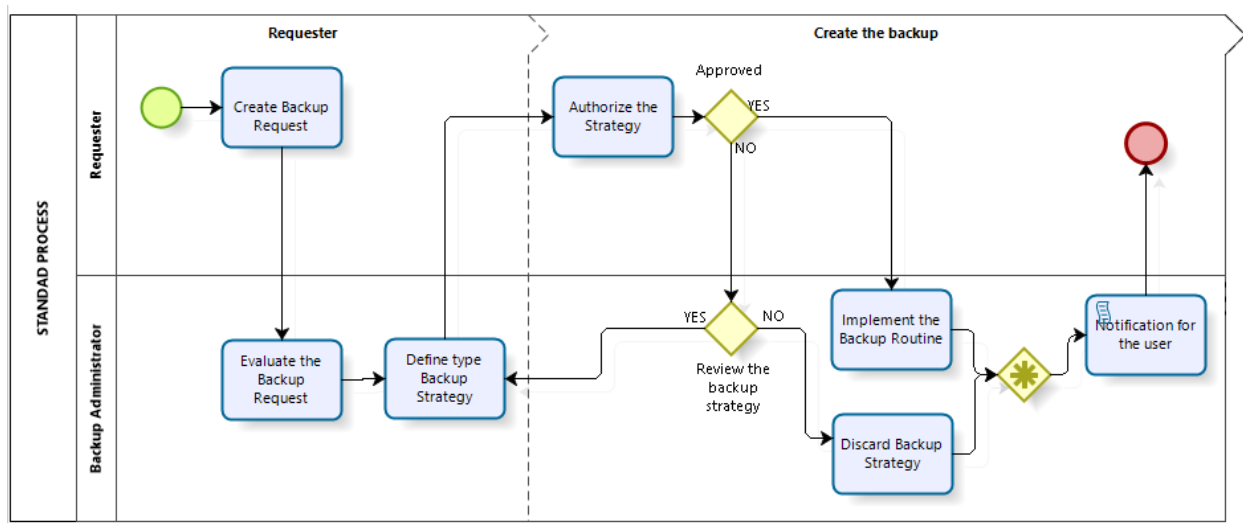


Figure 20. Regular standard Backup process

## 11.2 Create a backup process as a proposal version

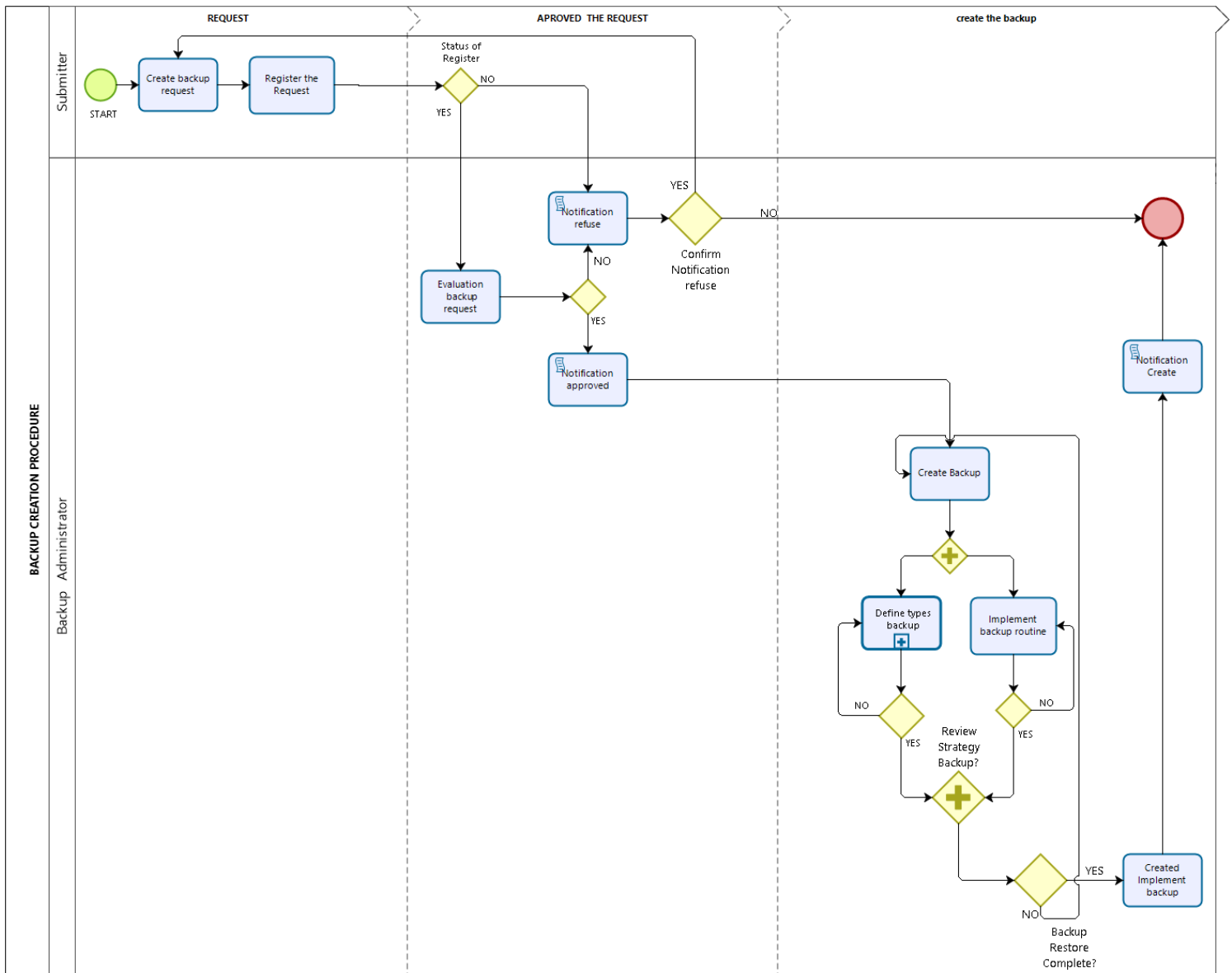


Figure 21. Proposal standard Backup process

Based on the results and models developed in the bpm software, it would be possible to simulate the following process according to Bizagui where each instance, task time as well as resources and costs would achieve the expected results.

In the end, the resources are a set of machines available to perform a backup. The simulation with nearly virtual machines, the standard backup model, and the proposed model, would reveal that the proposed one can reach the expected values. It is much more robust and controlled, with the conclusion that it should be used instead of the standard model, as you can verify in the answers of the smart backups in the confirmation of this information.

## 12 Backup Survey process for backup administrators

*This survey is intended only for professionals working as Backup Administrators, preferable Veeam Backup and Replication. Also, the answer corresponds to two professionals in this area:*

### 1. What do you like the most about using Veeam Backup & Replication?

- Answer user 1: *I like to use backup reporting, as for the graphical interface of the application it's time already to review it and provide some type of dashboards that we can adapt to the different needs and functions of the operators.*
- Answer user 2: *Every set of tools are useful for each specific need.*

### 2. So far, what has been the most unpleasant situation using VBR software?

- Answer user 1: *The most unpleasant situation was trying to restore a Virtual Machine and the backup was corrupted causing that the Virtual Machine had to be rebuilt from scratch.*
- Answer user 2: *To recover the Headquarters Veeam server (Stockdorf) from a failure*

### 3. Has Veeam fulfilled the objectives in the Operation and Infrastructure Team in Lisbon?

- Answer user 1: *Yes, the objectives have been accomplished.*
- Answer user 2: *It's a Yes. Veeam B&R is a solution very stable and well implemented on Webasto. Veeam Webasto operations team it's working hard to maintain infrastructure running issueless*

### 4. In terms of process, what do you value more: rapidity compromising stability or stability compromising rapidity?

- Answer user 1: *Restore time is the most important, as we manage a 24/7 operation, we cannot afford to have a system down for a long period.*
- Answer user 2: *The most important it's in a middle. Fast to recover and a stable restore point.*

### 5. The proposed model intends to reduce operation time. What is your opinion about it?

- Answer user 1: *Yes, reviewing backup failures can be very time costly and I think with the new verification procedures that time is reduced.*
- Answer user 2: *The success of the Veeam infrastructure does not end on Veeam, depends on all Webasto infrastructure (Storage, Network, Vmware).*

6. In general, what is your consideration about using Veeam backup Replication and would you like to suggest any improvement?

- Answer user 1: *Application-aware should be reviewed, as the need for permissions from the Veeam Service account on the server should not be necessary if there was an implementation of an agent on the Server.*
- Answer user 2: *Veeam is a great application to medium and large companies. V10 is now fully working on Webasto and will contribute to the service quality and disaster recovery processes.*

The survey confirmed that the purpose of this research is relevant and justified that the proposed process is important to healthy and efficient backup procedures.

Link to the [survey](#)

## 13 Conclusion

The lessons learned in this report:

- Before facing a backup software implementation, it must be clear that it is a complex and fundamental challenge for the continuity of the service and the business. In other words, if a company lacks this service, it risks suffering the complete closure of its business activity at a certain time.
- From the beginning, the company must be involved in the project because certain decisions are neither the responsibility of the backup administrator nor the provider that supports or implements this solution, such as data retention, service levels (SLA), RTOs and RPOs.
- This project represents a guarantee for the future of the company's activity. Therefore, shortening the duration of the implementation, not analyzing the risks in detail, and reducing costs can be a serious problem for the company since they would harm key aspects for the development of the draft.
- It should not be forgotten that, as a fundamental tool for the company, it must be equipped with high availability at three levels: physical, where it must have electrical redundancy and data connectivity; logic, where the business data must be accessible even when failures occur and, finally, at the service level, where the backup service must always be active.
- During the last few years, the backup industry has evolved in two different paths: the first focuses on backups as they can be saved in cloud storage; the second focuses on the concept of the data block, disappearing the files as a copy unit. Both paths have in common deduplication that not only improves backup performance but also saves costs for the business.
- The calculations that dictate the space that the future storage should have to safeguard the information are increasingly complex because the data grows day by day and additionally, there are new backup techniques such as the full synthetic or incremental copy whose main characteristic is to reduce the information to be safeguarded.
- The location of the data or the type of data has legal implications regarding data protection (LOPD). In the first case, each country and/or continent is governed by its laws, so its confidentiality may be compromised. In the second case, the loss of information due to its retention not being well established has legal consequences.

Based on the previous observations, the objectives initially set have been achieved. This work has followed the planning defined at the beginning of the report. Due to the nature of the project, the planned methodology appears to be the most appropriate and it has not been necessary to introduce significant changes in the project to guarantee the success of the work.

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