



*Ibermática*  
EMBRACING THE FUTURE

# Fundamentos de SQL Server



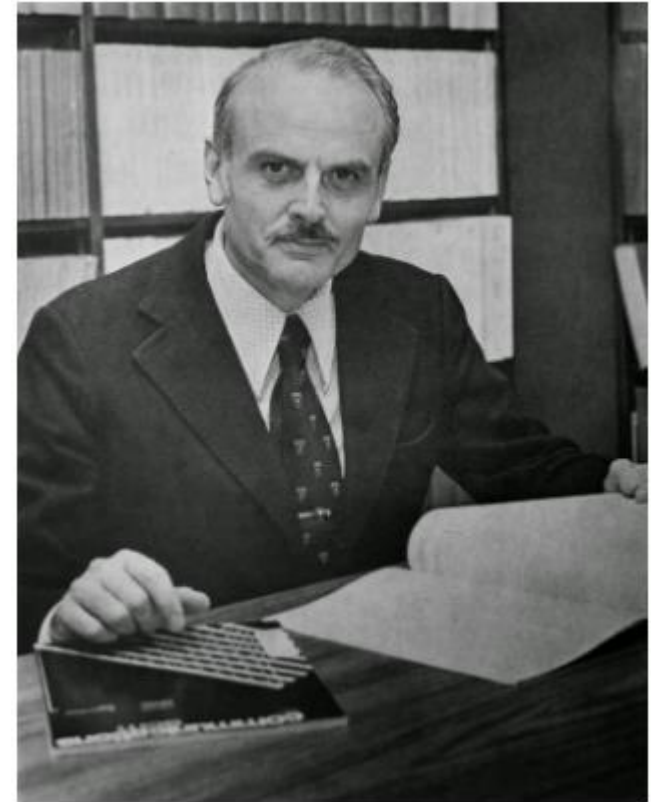
# 1. Porqué usar bases de datos relacionales en el 2022?

## Un poco de historia....

**Codd**, trabajó en las décadas de los 60 y 70 en sus teorías sobre modelado de datos para **IBM**, publicando su trabajo "*Un modelo relacional de datos para grandes bancos de datos compartidos*" ("A Relational Model of Data for Large Shared Data Banks") en 1970.

Para su descontento, **IBM** no desarrolló ni comercializó estos estudios hasta que otras empresas empezaron a poner en práctica los estudios de base de datos relacional diseñados por **Codd**.

Por ejemplo, **Larry Ellison** diseñó la base de datos **Oracle** basándose en las ideas de Codd.



Un poco de historia....



IBM's System/370 Model 145 in 1970 Wikimedia

System/370 Model 145

RAM: 500 KB

DD: 233 MB

Procesador: 1slot 2.5 MHz.

Año: 1970

Necesitaba el aula completa para esto.



System/370 Model 145

RAM: 4 MB – 6MB

DD: 4 GB

Procesador: 486SX 25 MHz.

Año: 1970

Necesita una mesa para funcionar

Un poco de historia....

**Virtual Machines**

REGION:  OPERATING SYSTEM:  TYPE:

CATEGORY:  INSTANCE SERIES:

Virtual machines  x  Hours

Computación en la nube

RAM: 384 GB

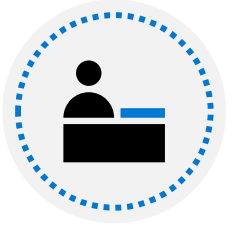
DD: casi infinito...

Procesador: 96 vCPUs 2.5GHz.

Año: 2022

Necesitas un móvil, café y conexión a internet.

# Razones por las cuales seguir utilizando SQL Server



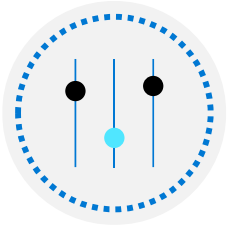
Soporte a Sistemas existentes ejecutandose en esta tecnología.

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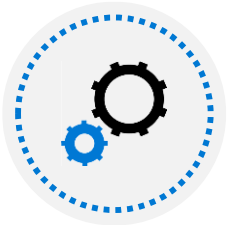
Desarrollo de nuevas soluciones, donde se reutiliza el hardware y el software existente en la compañía.

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El equipo de desarrollo se siente más a gusto desarrollando sobre modelos conocidos.

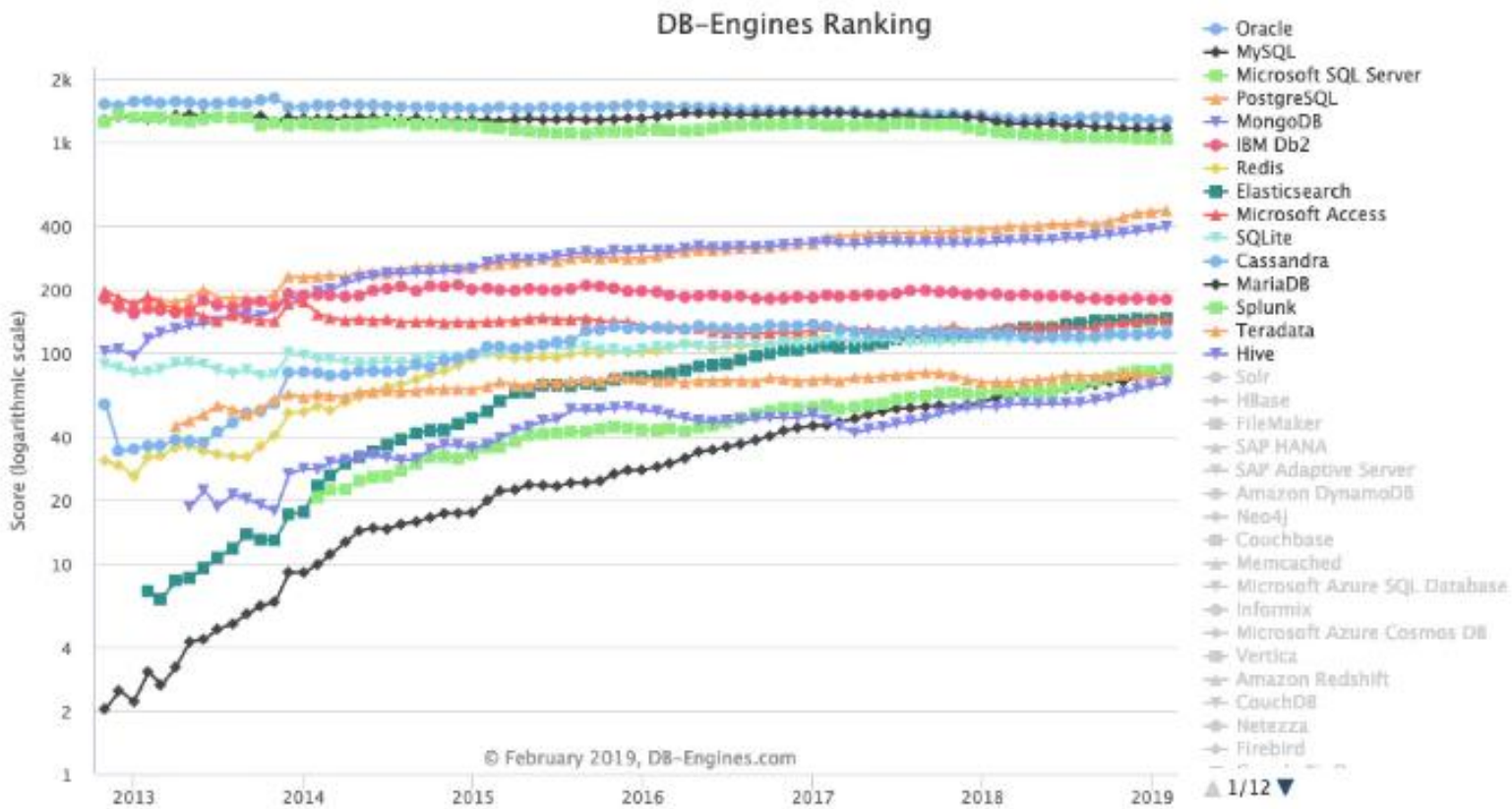
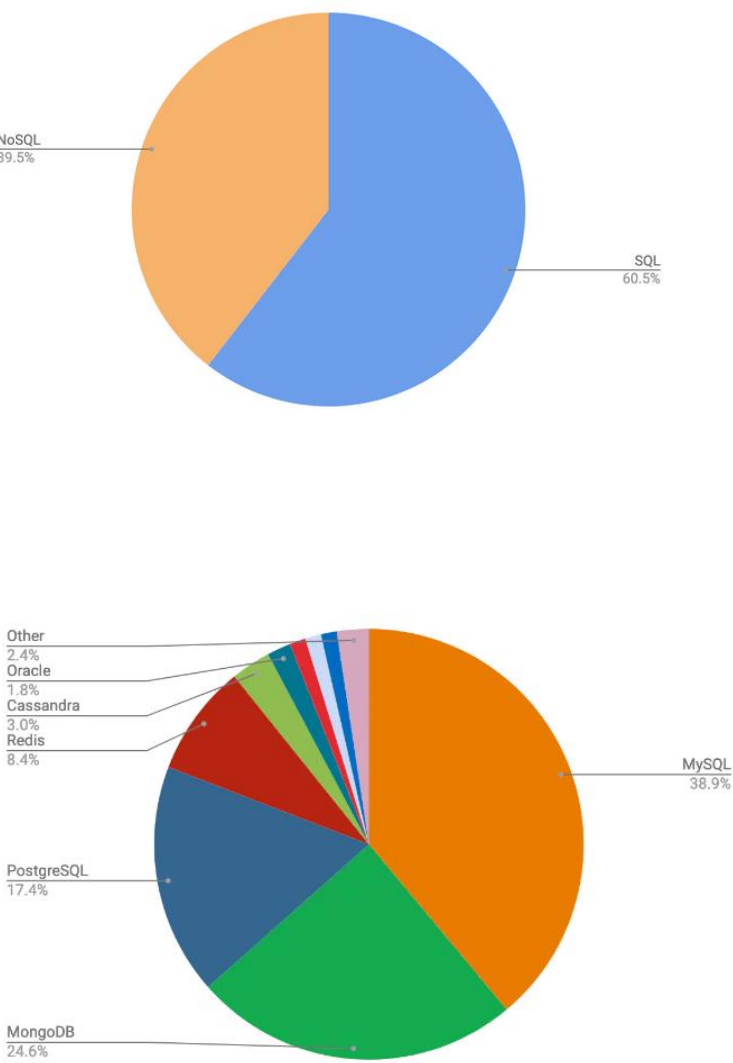
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Adaptación de los productos a las nuevas necesidades tecnológicas, bases columnares, documentales y demás.



# Actualidad ..2019 ...

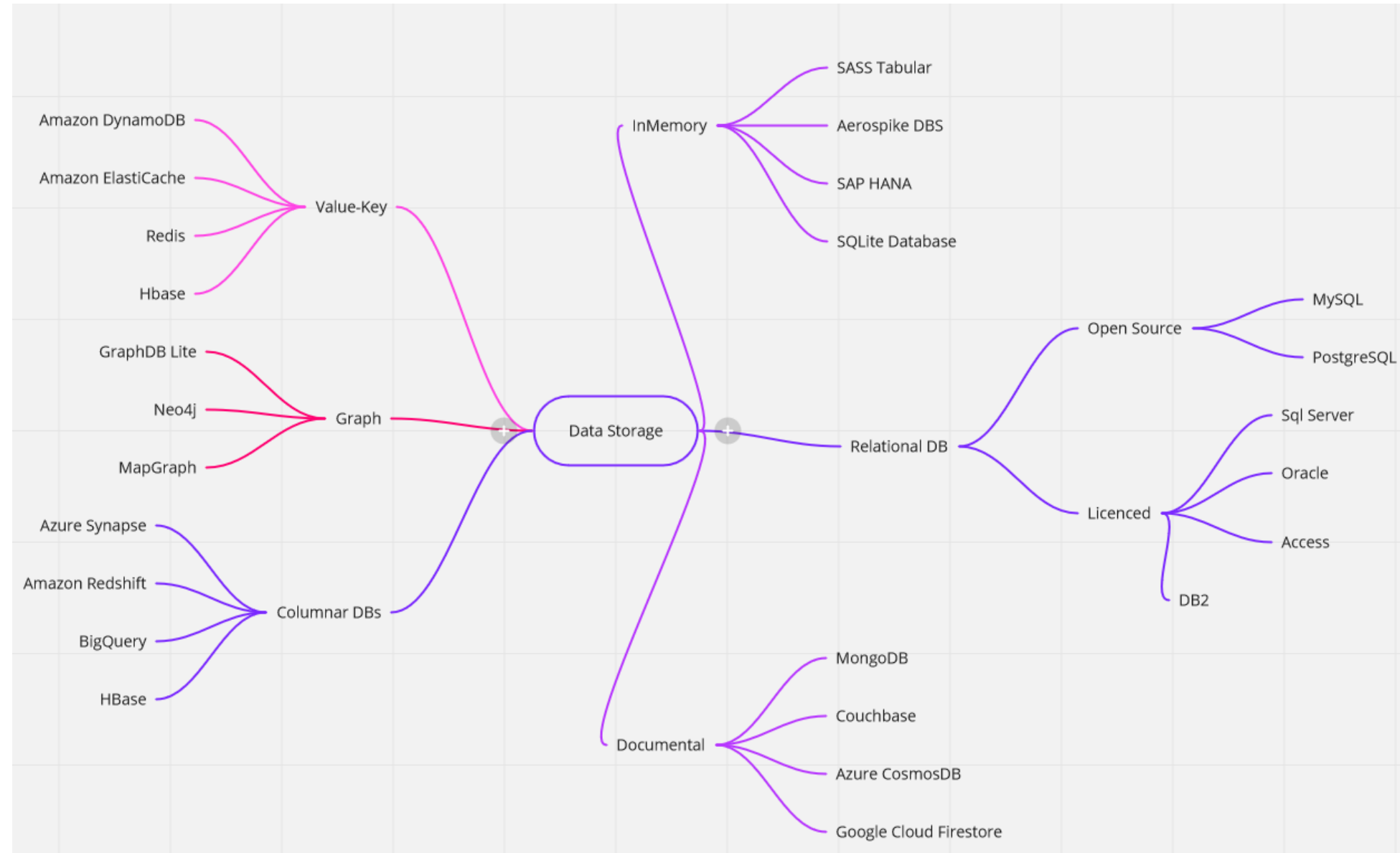




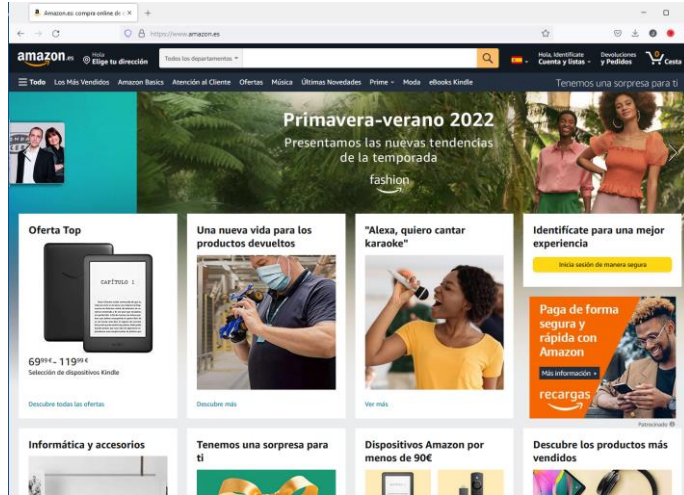
## 2. Otras Bases de datos



## Algunas de las bases de datos que están dominando el mercado



# Implementaciones



## Elon Musk



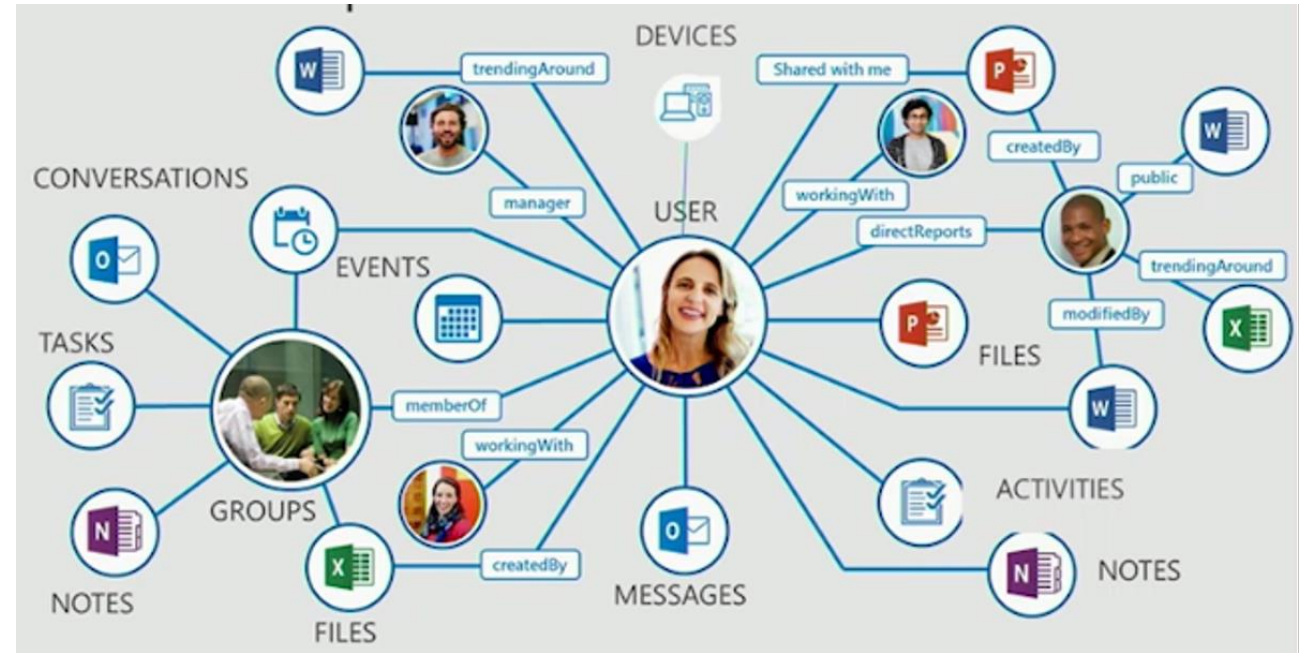
### 2 Carrera

2.1 Zip2

2.2 X.com y PayPal

2.3 SpaceX

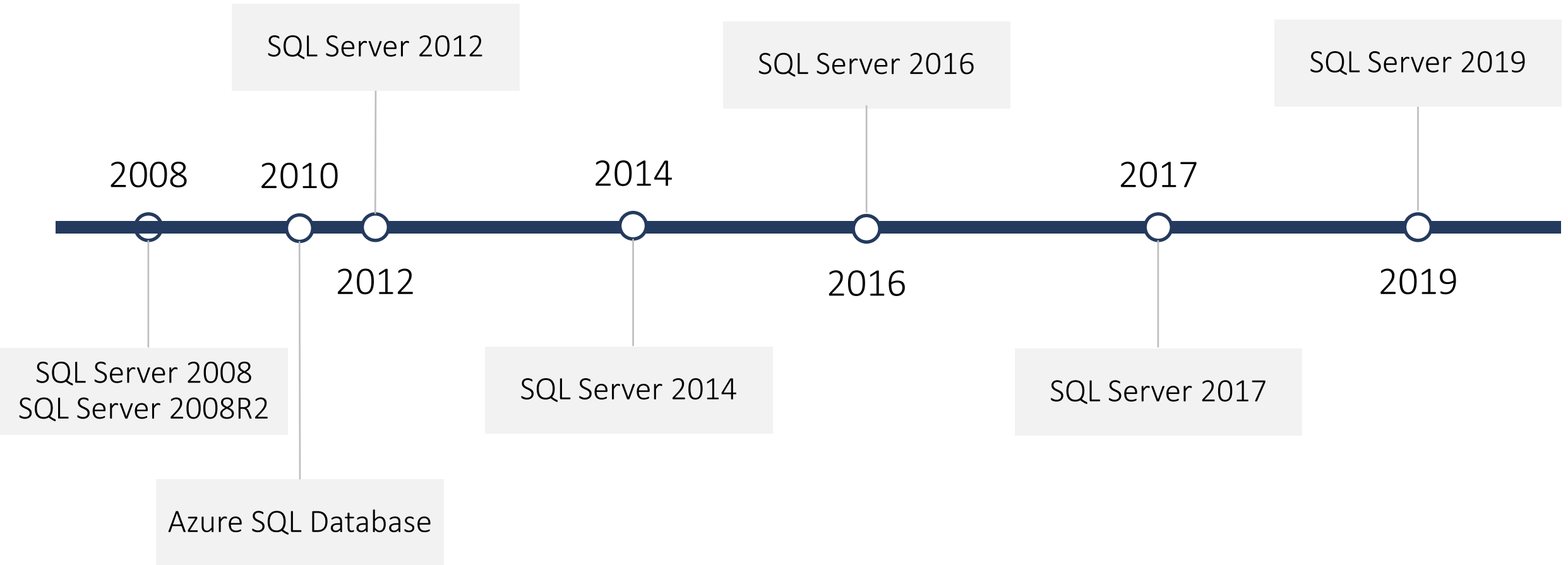
2.3.1 Starlink





### 3. Versiones y Ediciones

## Versiones de SQL Server



# Soportadas!!



## Ediciones de SQL Server

### Enterprise

Niveles de servicio para aplicaciones crítica, virtualización ilimitada, características de HA, seguridad, inteligencia de negocios y NoSQL en un solo motor.

### Standard

Diseñada para aplicaciones departamentales y/o organizaciones pequeñas, características de HA y BI limitadas.

### Web

Es una versión de bajo costo creada para soportar aplicaciones Web.

### Developer

Crea, prueba y demuestra aplicaciones con todas las características de la edición Enterprise en entornos de desarrollo y pruebas fuera de producción. Disponible de forma gratuita.

### Express

Crea pequeñas aplicaciones móviles y web basadas en datos de hasta 10 GB de tamaño con esta base de datos básica. Disponible de forma gratuita.

## Scale limits

Feature	Enterprise	Standard	Web	Express with Advanced Services	Express
Maximum compute capacity used by a single instance - SQL Server Database Engine <sup>1</sup>	Operating system maximum	Limited to lesser of 4 sockets or 24 cores	Limited to lesser of 4 sockets or 16 cores	Limited to lesser of 1 socket or 4 cores	Limited to lesser of 1 socket or 4 cores
Maximum compute capacity used by a single instance - Analysis Services or Reporting Services	Operating system maximum	Limited to lesser of 4 sockets or 24 cores	Limited to lesser of 4 sockets or 16 cores	Limited to lesser of 1 socket or 4 cores	Limited to lesser of 1 socket or 4 cores
Maximum memory for buffer pool per instance of SQL Server Database Engine	Operating System Maximum	128 GB	64 GB	1410 MB	1410 MB
Maximum memory for Columnstore segment cache per instance of SQL Server Database Engine	Unlimited memory	32 GB	16 GB	352 MB	352 MB
Maximum memory-optimized data size per database in SQL Server Database Engine	Unlimited memory	32 GB	16 GB	352 MB	352 MB
Maximum memory utilized per instance of Analysis Services	Operating System Maximum	16 GB <sup>2</sup> 64 GB <sup>3</sup>	N/A	N/A	N/A
Maximum memory utilized per instance of Reporting Services	Operating System Maximum	64 GB	64 GB	4 GB	N/A
Maximum relational database size	524 PB	524 PB	524 PB	10 GB	10 GB

<sup>1</sup> Enterprise Edition with Server + Client Access License (CAL) based licensing (not available for new agreements) is limited to a maximum of 20 cores per SQL Server instance. There are no limits under the Core-based Server Licensing model. For more information, see [Compute Capacity Limits by Edition of SQL Server](#).

<sup>2</sup> Tabular

<sup>3</sup> MOLAP



## Características

Server features	Description
SQL Server Database Engine	SQL Server Database Engine includes the Database Engine, the core service for storing, processing, and securing data, replication, full-text search, tools for managing relational and XML data, in database analytics integration, and PolyBase integration for access to Hadoop and other heterogeneous data sources, and Machine Learning Services to run Python and R scripts with relational data.
Analysis Services	Analysis Services includes the tools for creating and managing online analytical processing (OLAP) and data mining applications.
Reporting Services	Reporting Services includes server and client components for creating, managing, and deploying tabular, matrix, graphical, and free-form reports. Reporting Services is also an extensible platform that you can use to develop report applications.
Integration Services	Integration Services is a set of graphical tools and programmable objects for moving, copying, and transforming data. It also includes the Data Quality Services (DQS) component for Integration Services.
Master Data Services	Master Data Services (MDS) is the SQL Server solution for master data management. MDS can be configured to manage any domain (products, customers, accounts) and includes hierarchies, granular security, transactions, data versioning, and business rules, as well as an Add-in for Excel that can be used to manage data.
Machine Learning Services (In-Database)	Machine Learning Services (In-Database) supports distributed, scalable machine learning solutions using enterprise data sources. In SQL Server 2016, the R language was supported. SQL Server 2019 (15.x) supports R and Python.
Machine Learning Server (Standalone)	Machine Learning Server (Standalone) supports deployment of distributed, scalable machine learning solutions on multiple platforms and using multiple enterprise data sources, including Linux and Hadoop. In SQL Server 2016, the R language was supported. SQL Server 2019 (15.x) supports R and Python.

## 4. Instalación

## Windows Update

\*Some settings are managed by your organization

[View configured update policies](#)



### Updates available

Last checked: Today, 2:50 AM

Your device is missing important security and quality fixes.

Windows Malicious Software Removal Tool x64 - v5.100 (KB890830)

**Status:** Pending install

2022-04 Cumulative Update for .NET Framework 3.5, 4.7.2 and 4.8 for Windows Server 2019 for x64 (KB5012328)

**Status:** Pending install

2022-04 Cumulative Update for Windows Server 2019 (1809) for x64-based Systems (KB5012647)

**Status:** Getting things ready - 70%

Windows Malicious Software Removal Tool x64 - v5.98 (KB890830)

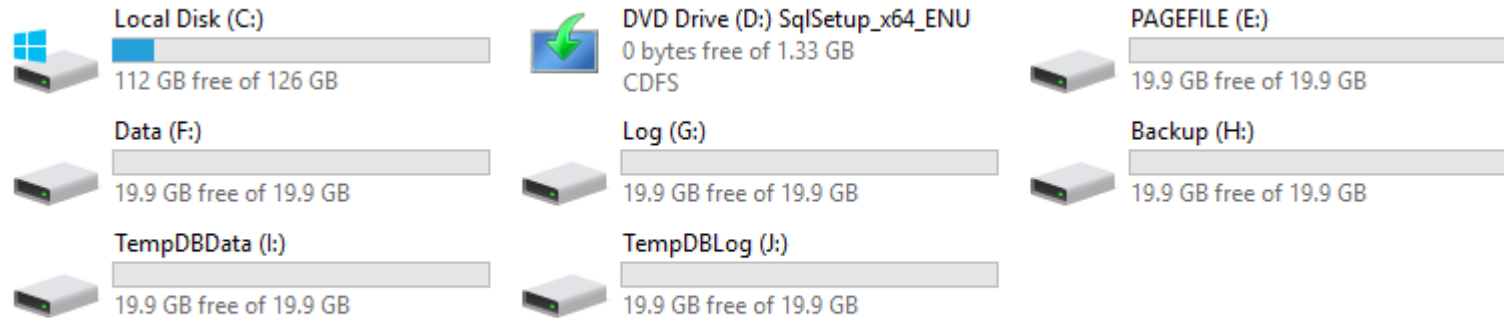
**Status:** Pending install

2021-01 Update for Windows Server 2019 for x64-based Systems (KB4589208)

**Status:** Pending install

Security Update for Windows Server 2019 for x64-based Systems

## Devices and drives (8)



Procure actualizar el sistema operativo antes de iniciar la instalación del motor.

Procure tener separados discos de logs y datos en discos separados, al igual que los archivos temporales y los archivos de paginación fuera del disco C.

Virtual Memory

☐ Automatically manage paging file size for all drives

Paging file size for each drive

Drive [Volume Label]	Paging File Size (MB)
C: [PAGEFILE]	None
E: [PAGEFILE]	1024 - 2048
F: [Data]	None
G: [Log]	None
H: [Backup]	None

Selected drive: E: [PAGEFILE]  
Space available: 20400 MB

☒ Custom size:  
Initial size (MB): 1024  
Maximum size (MB): 2048

☐ System managed size  
☐ No paging file

Set

Total paging file size for all drives

Minimum allowed:	16 MB
Recommended:	1124 MB
Currently allocated:	1408 MB

OK Cancel

Procure mover la paginación del disco C a una unidad diferente.

Instance Features

☐ Database Engine Services

- ☐ SQL Server Replication
- ☐ Machine Learning Services and Language Extensions
  - ☐ R
  - ☐ Python
  - ☐ Java
- ☐ Full-Text and Semantic Extractions for Search
- ☐ Data Quality Services
- ☐ PolyBase Query Service for External Data
  - ☐ Java connector for HDFS data sources
- ☐ Analysis Services

Shared Features

- ☐ Machine Learning Server (Standalone)
  - ☐ R
  - ☐ Python
- ☐ Data Quality Client
- ☐ Client Tools Connectivity
- ☐ Integration Services
  - ☐ Scale Out Master
  - ☐ Scale Out Worker
- ☐ Client Tools Backwards Compatibility
- ☐ Client Tools SDK
- ☐ Distributed Replay Controller
- ☐ Distributed Replay Client
- ☐ SQL Client Connectivity SDK
- ☐ Master Data Services

Redistributable Features

Que servicios instalar?

Service Accounts Collation

Microsoft recommends that you use a separate account for each SQL Server service.

Service	Account Name	Password	Startup Type
SQL Server Agent	NT Service\SQLSERVERAGENT		Manual
SQL Server Database Engine	NT Service\MSSQLSERVER		Automatic
SQL Server Browser	NT AUTHORITY\LOCAL SERVICE		Disabled

☒ Grant Perform Volume Maintenance Task privilege to SQL Server Database Engine Service

This privilege enables instant file initialization by avoiding zeroing of data pages. This may lead to information disclosure by allowing deleted content to be accessed.

[Click here for details](#)

Elija las cuentas de servicio para ejecutar los programas, actualmente la mejor práctica es utilizar cuentas administradas por el sistema operativo y/o por el dominio.

Instance Features

☒ Database Engine Services

- ☐ SQL Server Replication
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- ☐ Distributed Replay Client
- ☒ SQL Client Connectivity SDK
- ☐ Master Data Services

Redistributable Features

Siempre instale solo los servicios mínimos que cumplen los requisitos del cliente

Server Configuration | Data Directories | TempDB | MaxDOP | Memory | FILESTREAM

Specify the authentication mode and administrators for the Database Engine.

Authentication Mode

☒ Windows authentication mode

☐ Mixed Mode (SQL Server authentication and Windows authentication)

Specify the password for the SQL Server system administrator (sa) account.

Enter password:

Confirm password:

Specify SQL Server administrators

WIN-DJJE4FO3697\DBA\_Group (DBA\_Group)

Agregue al grupo de

Server Configuration | Data Directories | TempDB | MaxDOP | Memory | FILESTREAM

Data root directory:

System database directory:

User database directory:

User database log directory:

Backup directory:

Configure los discos apropiados para la creación de archivos por defecto



SQL Server 2019 Setup

### Database Engine Configuration

Specify Database Engine authentication security mode, administrators, data directories, TempDB, Max degree of parallelism, memory, filestream, and other options.

**TempDB Configuration:**

- TempDB data files: tempdb.mdf, tempdb\_mssql\_#.ndf
- Number of files: 8
- Initial size (MB): 8
- Autogrowth (MB): 64
- Data directories: J:\TempData

**TempDB Log File Configuration:**

- TempDB log file: templog.ldf
- Initial size (MB): 8
- Autogrowth (MB): 64
- Log directory: J:\TempLog

Task Manager Performance tab:

- CPU: 0% 3.80 GHz
- Memory: 1.9/2.5 GB (76%)
- Ethernet: S: 0 Kbps R: 0 Kbps

CPU AMD Ryzen 7 5800X 8-Core Processor

% Utilization over 60 seconds

Utilization	Speed	Base speed:
0%	3.80 GHz	3.80 GHz

Processes	Threads	Handles	Sockets:
114	912	39368	1

Virtual processors:	Virtual machine:	L1 cache:
8	Yes	N/A

Up time: 0:06:55:01

Activate Windows

Configure el número de archivos de tempdb basado en el número de cores que tendrá disponible la instancia.

Server Configuration Data Directories TempDB MaxDOP Memory FILESTREAM

When an instance of SQL Server runs on a computer that has more than one CPU logical core, it detects the best degree of parallelism, that is, the number of processors employed to run a single statement, for each parallel plan execution. MAXDOP specifies the maximum number of cores to utilize for this instance.

Detected logical CPU cores on this computer: 8

Maximum degree of parallelism (MaxDOP)\*: 8

\* The displayed default value was either calculated by Setup, or was explicitly specified on the Setup command line with the /SQLMAXDOP parameter.

You can modify the MaxDOP here to be used as the default in all query executions for this instance, unless overridden at the query level. To suppress parallel query plan generation, set MaxDOP to 1.

See [Configure the max degree of parallelism Server Configuration Option](#) for more information.

Task Manager

File Options View

Processes Performance Users Details Services

Server Configuration Data Directories TempDB MaxDOP Memory FILESTREAM

SQL Server can change its memory requirements dynamically based on available system memory. SQL Server Memory Manager for this instance, by specifying min server memory.

☒ Recommended ☐ Default

Min Server Memory (MB): 0 0

Max Server Memory (MB): 2125 2147483647

\* The displayed recommended values were calculated by Setup based on your system configuration and /SQLMAXMEMORY parameters.

For more information see: [Server Memory Server Configuration Options](#).

☐ Click here to accept the recommended memory configurations for the SQL Server instance.

Memory

2.5 GB

Memory usage

1.9/2.5 GB (76%)

60 seconds

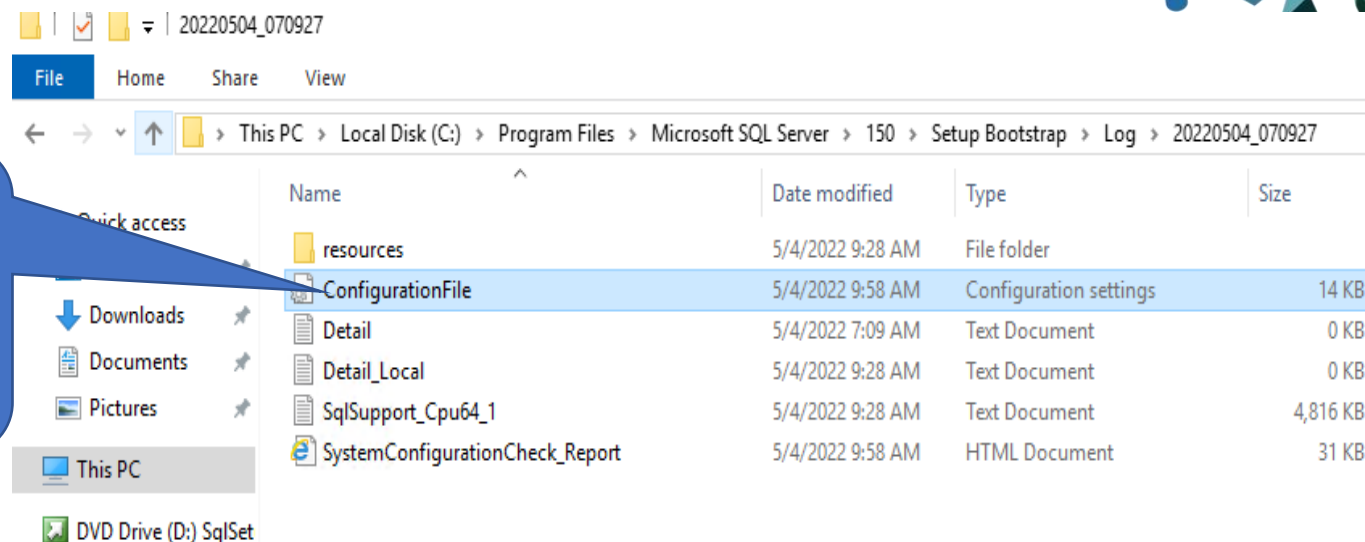
Memory composition

In use (Compressed)	Available	Slots used:	N/A
1.9 GB (0 MB)	653 MB	Hardware reserved:	0 MB
Committed	Cached	Maximum memory:	1.0 TB
2.1/4.9 GB	525 MB		
Paged pool	Non-paged pool		
159 MB	97.5 MB		

^ Fewer details | Open Resource Monitor

Configure la memoria de acuerdo a la capacidad real de la máquina y el número de hilos

Podemos tomar este archivo como plantilla para hacer estandarizar las instalaciones en la organización



#### SQL Server Installation Center

Planning

Installation

Maintenance

Tools

Resources

**Advanced**

Options



[Install based on configuration file](#)

Use an existing configuration file to install SQL Server 2019.



[Advanced cluster preparation](#)

Launch a wizard to prepare a SQL Server 2019 failover cluster installation.



[Advanced cluster completion](#)

Launch a wizard to complete a SQL Server 2019 failover cluster from a list of cluster-prepared SQL Server 2019 instances.  
This action is only available in the clustered environment.



[Image preparation of a stand-alone instance of SQL Server](#)

Launch a wizard to prepare an imaged instance of SQL Server 2019.



[Image completion of a prepared stand-alone instance of SQL Server](#)

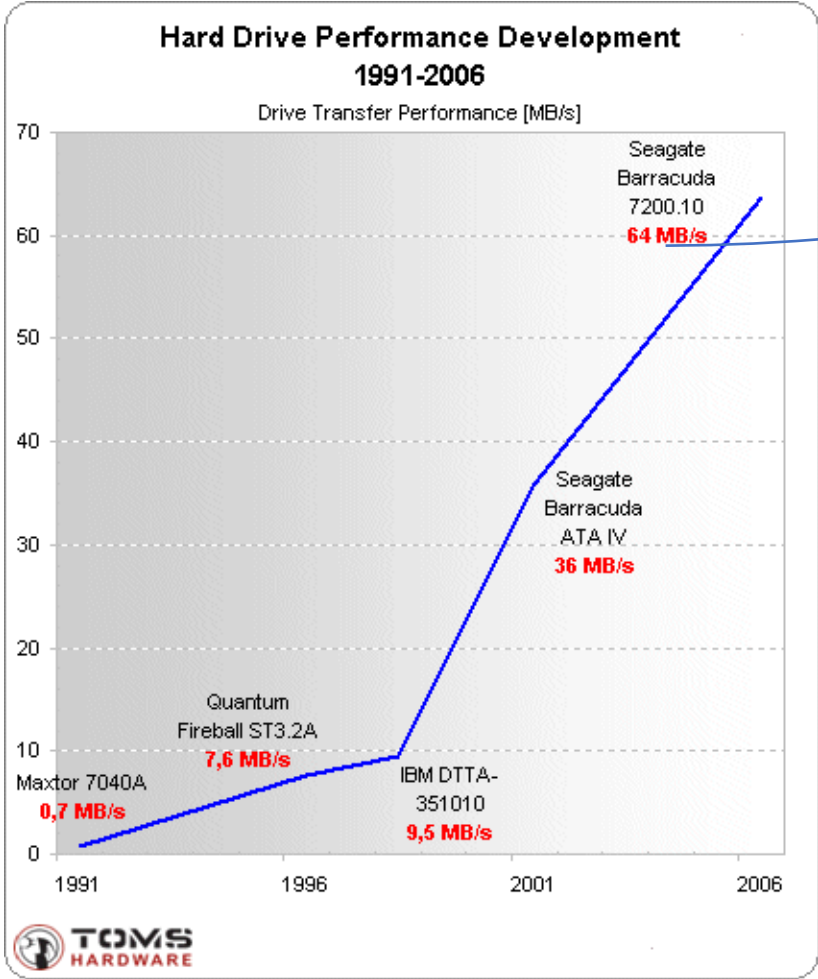
Launch a wizard to configure a prepared imaged instance of SQL Server 2019.

Por las opciones avanzadas de instalación se elige la opción de utilizar el archivo de configuración



## 5. Configuración de archivos

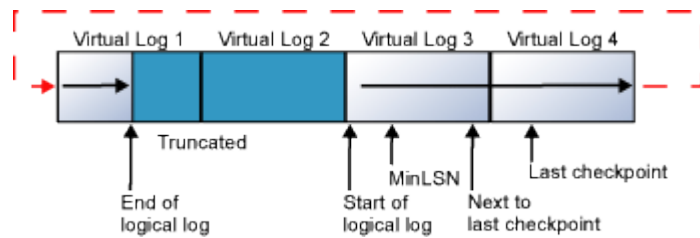
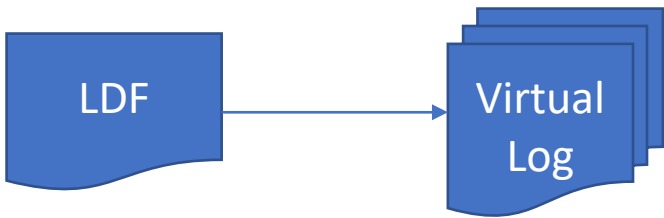
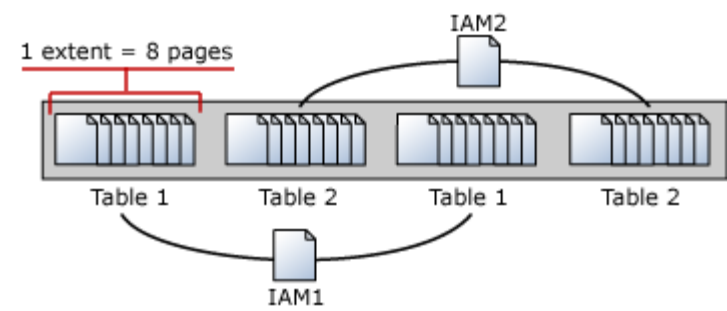
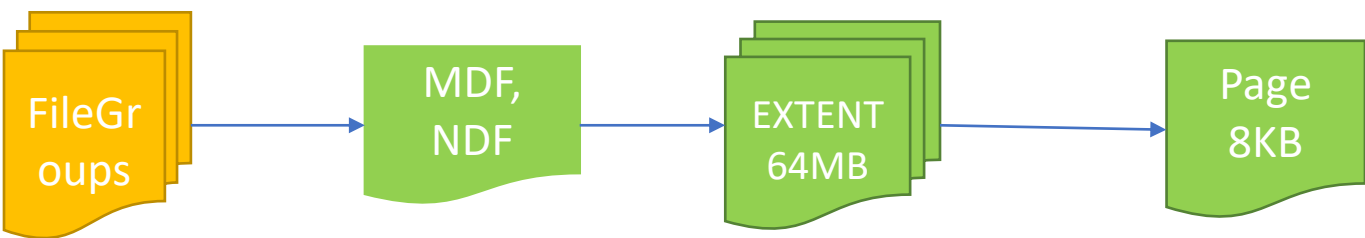
Más historia...



SSD	SSD Interface	SSD Speed
Samsung 850 Pro	SATA III 6 Gbps	560MB/s read (256GB) 550MB/s write (256GB)
Crucial MX500	SATA III 6 Gbps	560MB/s read 510MB/s write
SanDisk Extreme Pro	SATA III 6 Gbps	550MB/s read 520MB/s write
Transcend SSD370	SATA III 6 Gbps	560MB/s read (256GB) 460MB/s write (512GB)
SanDisk Extreme II	SATA III 6 Gbps	550MB/s read 510MB/s write

	NVMe SSD	M.2 SSD	SATA SSD
Price range	250GB \$50 to \$90 500GB \$70 to \$160 1TB \$120 to \$200	250GB \$40 to \$90 500GB \$50 to \$160 1TB \$90 to \$200	250GB \$40 to \$70 500GB \$50 to \$90 1TB \$90 to \$140
Speed	PCIe Gen 3 Up to 3,500MB per second PCIe Gen 4 Up to 7,500MB per second	SATA Up to 550MB per second NVMe PCIe Gen 3 Up to 3,500MB per second PCIe Gen 4 Up to 7,500MB per second	Up to 550MB per second

# Cómo funcionan los archivos



```
Select * FROM sys.fn_dblog(NULL,NULL)
```

	Current LSN	Operation	Context	Transaction ID	LogBlockGeneration	Tag Bits	Log Record Fixed Length	Log Record Length
1	00000058.000001a8.0001	LOP_BEGIN_XACT	LCX_NULL	0000.000057bb	0	0x0000	76	168
2	00000058.000001a8.0002	LOP_BEGIN_XACT	LCX_NULL	0000.000057bc	0	0x0000	76	168
3	00000058.000001a8.0003	LOP_MODIFY_ROW	LCX_BOOT_PAGE	0000.000057bc	0	0x0000	62	100
4	00000058.000001a8.0004	LOP_MODIFY_ROW	LCX_BOOT_PAGE	0000.000057bc	0	0x0000	62	100
5	00000058.000001a8.0005	LOP_MODIFY_ROW	LCX_BOOT_PAGE	0000.000057bc	0	0x0000	62	100
6	00000058.000001a8.0006	LOP_MODIFY_ROW	LCX_BOOT_PAGE	0000.000057bc	0	0x0000	62	92
7	00000058.000001a8.0007	LOP_COMMIT_XACT	LCX_NULL	0000.000057bc	0	0x0000	80	84
8	00000058.000001a8.0008	LOP_COMMIT_XACT	LCX_NULL	0000.000057bb	0	0x0000	80	84
9	00000058.000001a8.0001	LOP_SHRINK_NOOP	LCX_DIAGNOSTICS	0000.00000000	0	0x0000	24	128

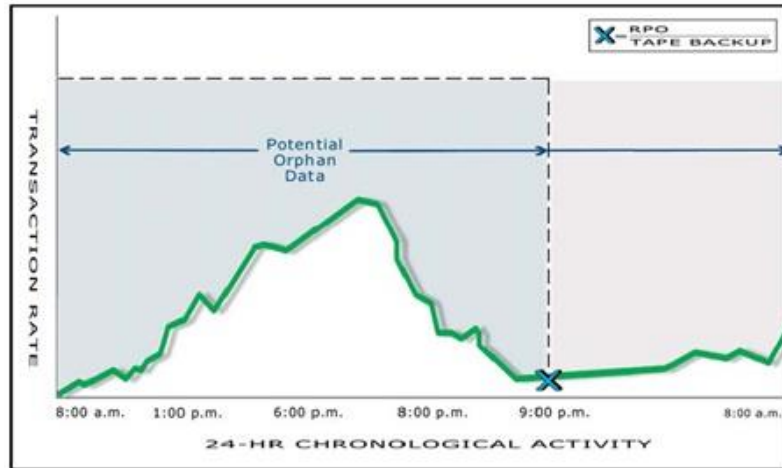




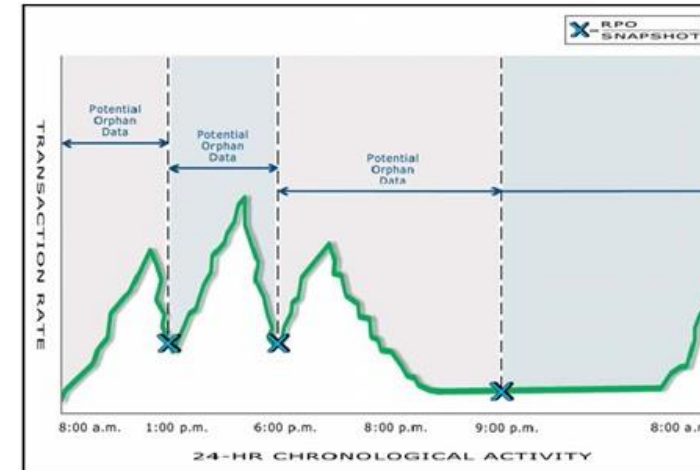
## 5. Configuración de Copias de Seguridad

## Plan de recuperación de desastres

RPO (Punto de recuperación Objetivo): se refiere al volumen de datos en riesgo de pérdida que la organización considera tolerable. ¿Las transacciones de cuánto tiempo estamos dispuestos a perder, o a tener que reintroducir al sistema?.



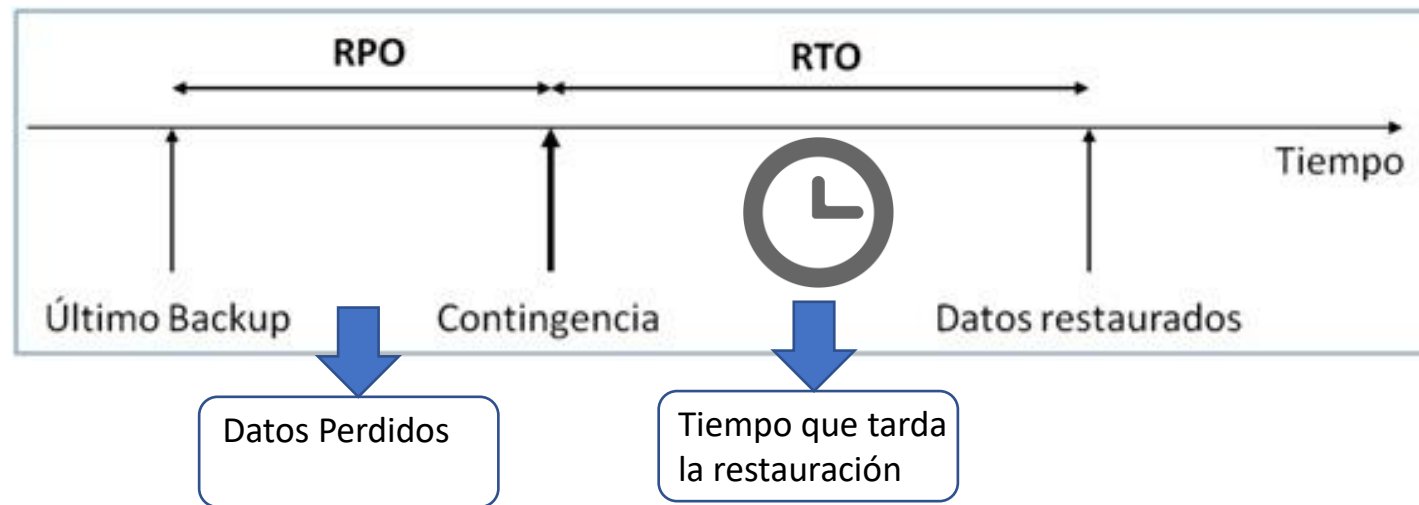
Backup Diario Nocturno



Nueva estrategia implementada

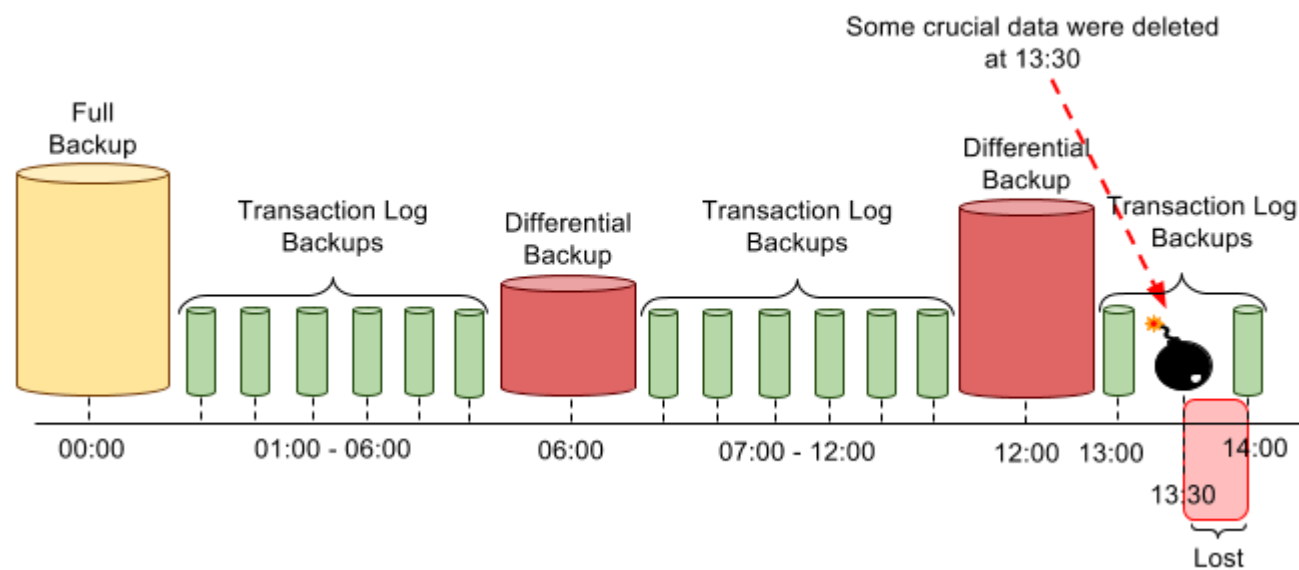
## Recuperación de desastres

RTO (Tiempo de recuperación Objetivo): Expresa el tiempo durante el cual una organización pueda tolerar la falta de funcionamiento de sus aplicaciones y la caída de nivel de servicio asociada, sin afectar a la continuidad del negocio.



## Como se maneja esto en SQL Server

La estrategia de copias de respaldo en SQL Server, está compuesta por tres diferentes tipos de copia: Completa, diferencial y de log de transacciones.



## Como se configuró en Fagor

Instancia	Número de Bases Negocio	Tamaño En Disco GB
GLOBAL	8	15,2
FRENO	6	39,5
MOTOR	8	40,6
PMH	7	24,2
ALBP	10	22,9
<b>Total</b>	<b>39</b>	<b>142,4</b>

- El Nuevo modelo garantiza recuperación a punto de máximo 4 horas de pérdida de información.
- El crecimiento de los archivos de log es controlado, minimizando el uso de disco.
- Se mantienen las copias diarias de Veam.

Log Backup



Se realiza  
cada 4  
horas de L-  
V

Diff Backup



Se realiza de  
L-V y D  
Noche

Full Backup



Se realiza  
los  
Sábados.  
Una copia  
full diaria  
todos los  
días con  
Veam