Pervasive PSQL Meets Critical Business Requirements

Pervasive PSQL White Paper

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Introduction

Mission critical databases must provide data backup, high availability, fault tolerance, and disaster recovery. Because data storage can take place in so many different environments–an on-site physical server, a private cloud, or a public cloud implemented physically or virtually–provisions for satisfying critical requirements can differ. What worked in a physical environment can require adjustment to accommodate a virtual environment.

Pervasive Software provides two editions of its server database engine, Pervasive PSQL Server and Pervasive PSQL Vx Server. Both have been designed to meet those requirements. PSQL Server, in conjunction with several Pervasive products, can ensure protection of data and maximization of uptime in the physical environment. PSQL Vx Server, because it has been optimized to operate under a hypervisor, can do the same for a virtual environment.

Data Backup

In the past–and still in the present in some cases–a database engine would be shut down while a backup application read sequentially through all files or tables. Shutdown was required to ensure data consistency, because multiple records from a single transaction could be written to widely separated tables and even a single record could be written to different parts of a file.

Because today's business environment often requires continuous system availability, the backup process is more complex: it must ensure both uptime and data consistency as well as provide for all the backup location options. Pervasive PSQL provides three solutions to meet these requirements: Pervasive Backup Agent, Pervasive PSQL VSS Writer, and Pervasive DataExchange Real-Time Backup. Both Backup Agent and PSQL VSS Writer are included as part of PSQL Server and PSQL Vx Server in a Windows environment; only Backup Agent is included in a Linux environment.
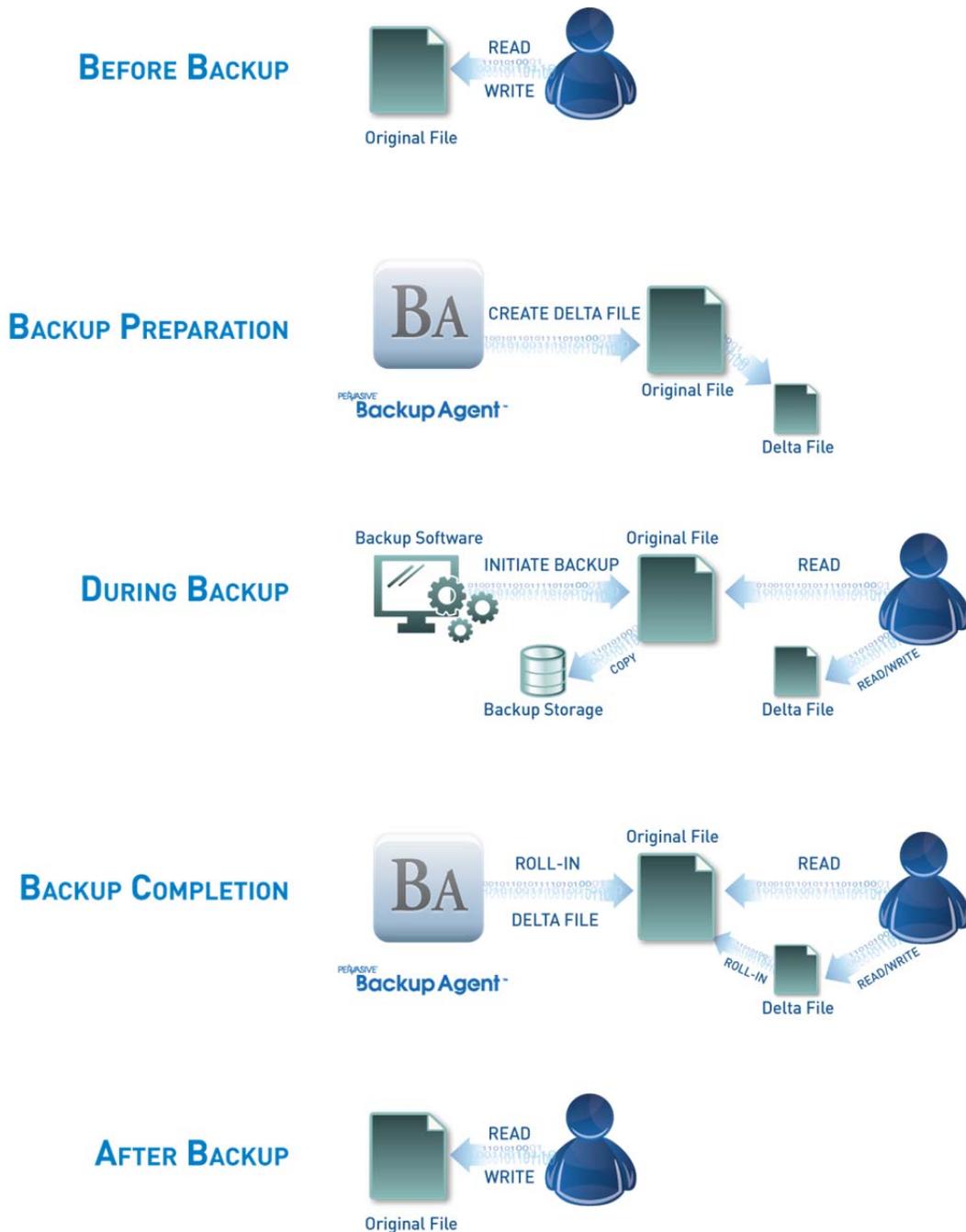
Pervasive Backup Agent

Backup Agent prepares data for backup with one click, integrates with most third-party backup software, and can be added to a Pervasive PSQL installation without any changes to the application code. Whether Backup Agent is running in a physical or virtual environment, it operates the same way: by guaranteeing data consistency during Continuous Operations of the database engine.

Backup Agent guarantees data consistency by using intelligent Continuous Operations management: the database engine maintains open files in read-only mode for the backup software to copy. At the same time, it creates for each open file a temporary–or delta–file to capture any updates that occur during the duration of the backup process. After the completion of the backup, changes from the temporary file are rolled into the original file and the temporary file is deleted.

The database engine handles any queries made to the file by reading both the original and temporary file versions, thus ensuring Continuous Operations. Intelligent management ensures that only files in use are put into Continuous Operations, by employing an event handler that monitors database for open events.

Figure 1: Pervasive Backup Agent
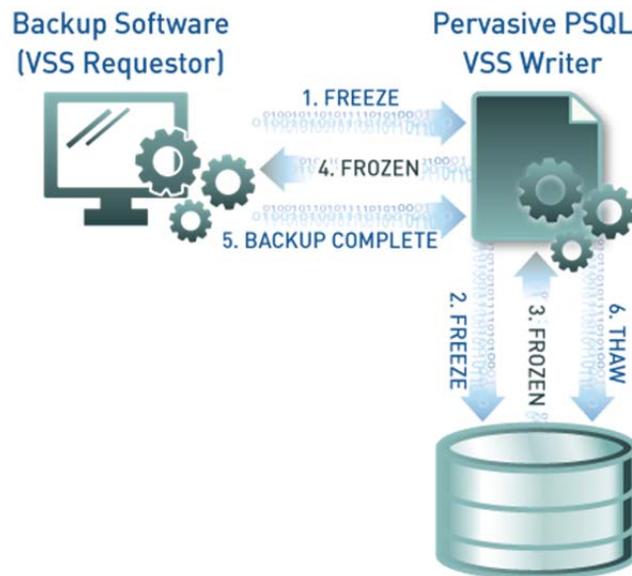
Pervasive PSQL VSS Writer

Microsoft Volume Shadow Copy Service (VSS) is a Windows framework designed to facilitate backup without data corruption. It coordinates the actions of the backup software (known as the requestor), a component that controls the database (known as the writer), and a storage device (known as the provider). The VSS framework is included with Windows Server 2003 and newer operating systems.

Like Backup Agent, PSQL VSS Writer allows for Continuous Operations of the database engine and enables rather than performs backup. The process is the same in both physical and virtual environments, and backup can be manual or automatic.

The backup application informs PSQL VSS Writer to prepare for a backup. PSQL VSS Writer responds by freezing all write activity to the database and notifying the backup application that the database is frozen. Read activity proceeds normally. After the snapshot is taken, the backup software sends the message that backup is complete, and PSQL VSS Writer thaws the database to restart write activity. Any writes paused during the frozen period take place following the thaw.

If your backup software is VSS aware and you are working in a Windows environment, PSQL VSS Writer is automatically invoked during VSS backups, without requiring any previous configuration. If not, Backup Agent is included with both PSQL Server and PSQL Vx Server in a Windows or Linux environment and only requires installation. There is no advantage to using both.

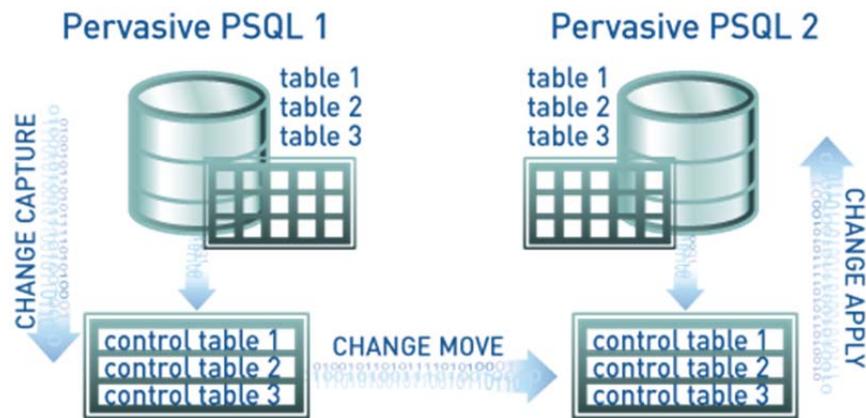*Figure 2: Pervasive PSQL VSS Writer*

Pervasive DataExchange Real-Time Backup

Unlike Backup Agent and PSQL VSS Writer, DataExchange Real-Time Backup edition actually moves data from a primary to a backup Pervasive PSQL database and requires no additional backup software. Like Backup Agent and PSQL VSS Writer, DataExchange Real-Time Backup can operate in either a physical or a virtual environment. Backup sessions can be automated to run at a scheduled interval, including one immediately after the conclusion of another, or they can be manually initiated.

To perform its real-time backup, DataExchange adds to each database a set of control tables that duplicate the tables in the database. As changes (insert, update, delete) occur to the database tables, those changes are captured and passed on to the control tables, along with a timestamp.

At backup time, the control tables on the two servers are compared to locate changes. Then changes are moved from the primary server control tables to the backup server control tables, which in turn apply those changes to the database tables.

Figure 3: Pervasive DataExchange Real-Time Backup

Fault Tolerance

Fault tolerance–the uninterrupted operation of a system even after the failure of a component–is crucial in any computing environment that requires continuous uptime and secure data. When one device fails, another must take over, even if it means a reduction in performance.

In the virtual world, PSQL Vx Server is compatible with the immediate, seamless failover capability offered by vSphere and XenServer, which operates by maintaining virtual servers in lockstep with each other. For fault tolerance to work in a virtual environment, the virtual machine that fails must be on a different physical host from the virtual machine that replaces it.
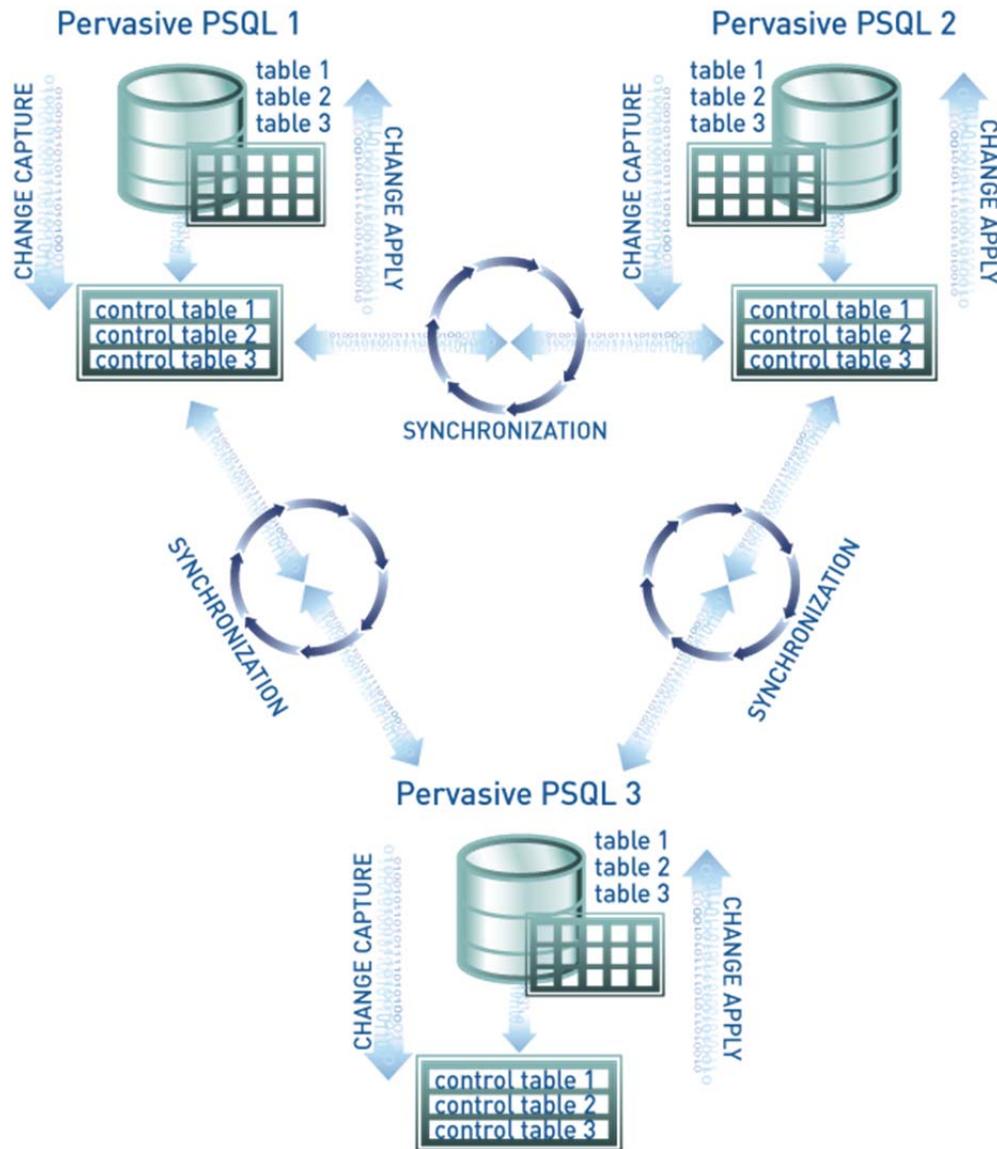
High Availability

While fault tolerant systems are designed to guarantee continuous uptime through the use of redundant hardware and specialized software, high availability aims for a predictable baseline level of uptime, despite hardware failure, software failure, or required downtime. Several different scenarios can accomplish this.

The most common approach to ensure high availability, in the physical environment, is clustering. PSQL Server is designed to function as a resource in an active/passive failover cluster environment, in which only one server node at a time can access the shared storage subsystem. Both Microsoft and Linux provide utilities to manage this kind of cluster. If the primary node fails, a failover (or switch) to a secondary node occurs, with downtime only to move the server license and reestablish connections. If the active node fails with a transaction in progress, Pervasive PSQL rolls transactions back to the last completed checkpoint. If database Transaction Durability is active, any completed transactions that occurred between the last completed check point and a cluster node failure can be recovered.

In situations where each server stores its own data, a successful failover requires that data between redundant servers must be identical. Pervasive DataExchange Data Synchronization edition solves that problem; it keeps the data in multiple database instances synchronized.

DataExchange Data Synchronization replicates data between multiple PSQL database servers. Each of the connected servers performs a change capture from its data tables to a duplicate set of control tables. The two bodies of changes–one from each server–are compared and synchronized. If the same record has been changed on both servers, the version with the most recent timestamp is considered final by default. After synchronization, each server receives the changes it needs and applies those changes.

Figure 4: Pervasive DataExchange Data Synchronization

In a virtual environment, PSQL Vx Server is compatible with the live migration capability offered by Hyper-V, vSphere, and XenServer. Live migration is also a perfect solution for maintaining availability during planned interruptions such as scheduled software updates, operating system updates, server load, and maintenance.

Disaster Recovery

Depending on the size of your business, disaster recovery can range from a relatively simple operation to a multi-faceted process.

If your business is small, your primary concern is probably your data. Any of the earlier-described data backup options is a possibility, as long as the data is backed up to a remote location over a wide-area network. Data can be backed up between physical or virtual servers or from a physical to a virtual server. After ensuring the safety of the data, returning to normal business activity requires setting up or activating a remote server and reloading necessary software and data.

If your business is on the enterprise level, efficient disaster recovery requires more than data backup. Because a server includes an operating system, applications, patches, and correct configuration settings, reestablishing an enterprise-level server can be a time-consuming process. You may select to invest in a complete off-site replacement.

Figure 5: Role of Pervasive PSQL in Disaster Recovery

PSQL Vx Server is compatible with major hypervisors that support remote clustering and disaster recovery technology that initializes backup virtual machines. As long as virtual MAC addresses and host names remain the same after virtual machines are moved, Pervasive PSQL Vx Server continues to operate normally. These options enable rapid server replacement, allowing recovery time to be measured in minutes instead of hours or days.

Conclusion

Critical business requirements remain the same, regardless of the size of the business and its choice of physical or virtual technology. Only the implementation differs. Pervasive Software stands ready to satisfy those requirements.

Its servers–PSQL Server and PSQL Vx Server–are designed to be compatible with common technologies used to implement solutions for high availability, fault tolerance, and disaster recovery needs. Its additional products, DataExchange, Backup Agent, and PSQL VSS Writer, provide multiple alternatives to data backup and synchronization. A Pervasive solution can ensure data integrity and maximum uptime for every circumstance.