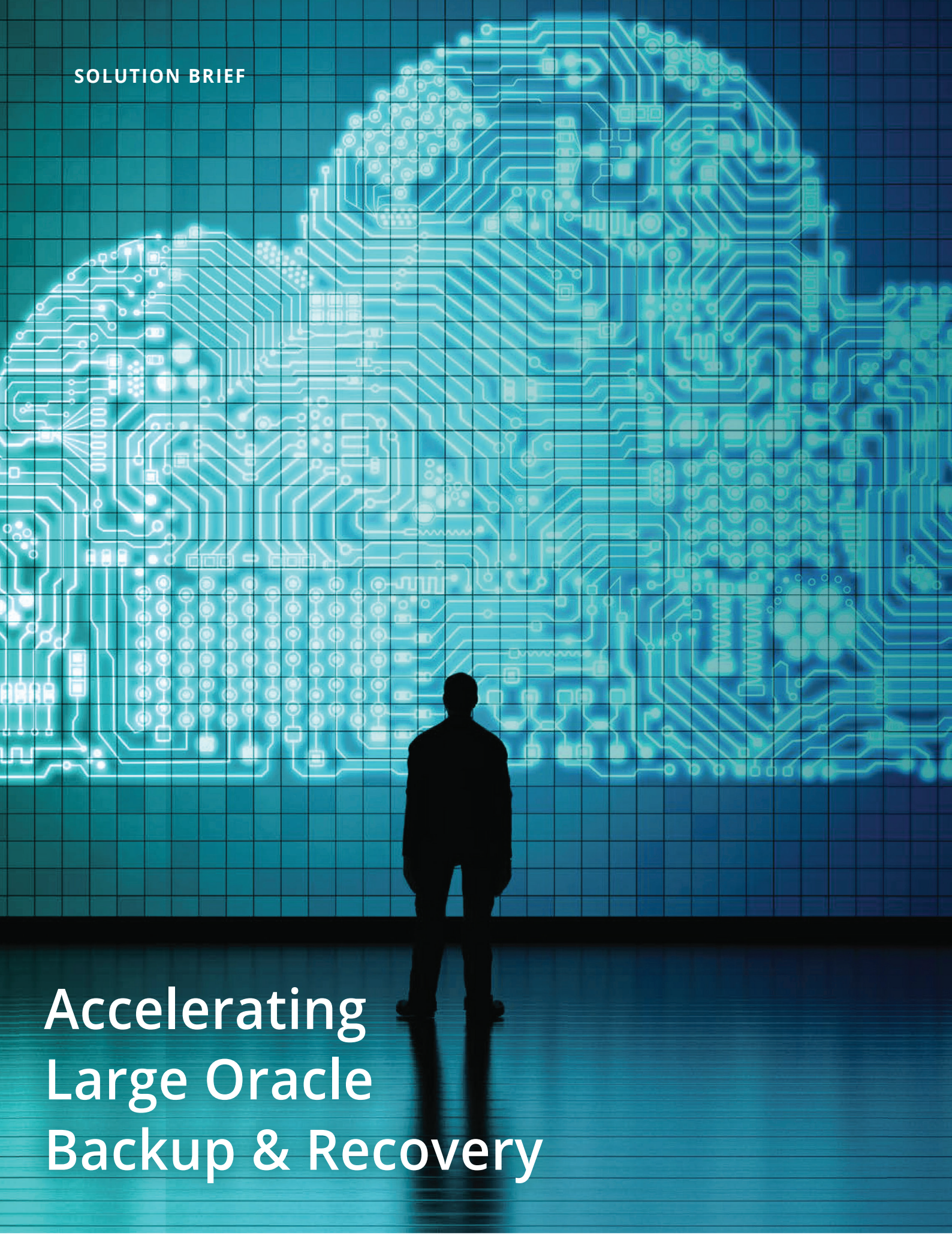
SOLUTION BRIEF



Accelerating Large Oracle Backup & Recovery

SCALE TO WIN

INFINIDAT

Executive Summary

Today, Oracle databases run the world's most critical applications and as we witness rapid growth in the size of these databases (often reaching dozens of terabytes), enterprises are struggling to meet their backup Service Level Agreements (SLAs). Traditional approaches that require a periodic full database backup (whether to a remote target or local disk using source-dedupe technologies) can no longer deliver the required RPO/RTO and have a substantial negative impact on production performance.

In this paper, we will examine the challenges in a modern backup environment of large Oracle databases and present a modern approach to resolve them, achieving near-instant recovery for dozens or even hundreds of terabytes.

Backup & Recovery of Oracle Databases: Challenges at Scale

As Oracle databases have grown, more and more organisations have been struggling to find efficient backup solutions and more importantly, efficient recovery solutions for multi-terabyte databases. With data growth on the rise, traditional solutions now face multiple limitations:

- **Full backup** - Any solution requiring a periodic full backup would over time fail to complete in time, even when performed over a weekend or when using source deduplication.
- **Performance impact** - The long backup windows (full, incremental or synthetic full) grew over time, keeping the database in hot backup mode for a long time and impacting user experience. At the same time, the large data movement requires a lot of resources from the data fabric and underlying storage (even when using source-dedupe), further impacting other services.
- **Recovery point** - Nowadays, most organisations expect to recover without data loss (Zero RPO). However, with traditional backups, the user can restore the data to the time of the backup (typically once a day) resulting in an average time of 12 hours of data loss, which is unacceptable for modern enterprises.
- **Recovery time** - Perhaps the measurement that affects business units the most - current expectation is to recover in minutes to hours, not days.
- **Cyber threats** - Ransomware changes the types of recoveries expected from the backup infrastructure, as it's designed to stay dormant and maximise the amount of encrypted data. This results in large over-the-network data copy during recovery, slowing the recovery.
- **Using the backup copy** - Traditional backups transform the data format, making it impossible to use the backup data for additional uses (like Test/Dev or backup validation) without prolonged and complex restore operations

While all of these challenges can be solved using storage snapshots, they usually offer short-term protection and are hosted within the same physical system as the primary data. For example, most customers do not keep snapshots long enough to handle ransomware recovery scenarios.

THE ORACLE SOLUTION

To avoid large full backups, Oracle introduced RMAN Incremental Merge offering the ability to provide incremental-forever and synthetic-full backup by merging changed blocks into a mounted backup copy. This works hand-in-hand with Block Change Tracking (BCT) to further accelerate backups and reduce the impact on the production system.

Realising the recovery time challenge is critical, Oracle does offer its customers an ability called "Switch-to-copy", allowing the DBA to start operating directly from the backup copy. Running the production application against the backup copy effectively cuts recovery time to minutes.

When adding snapshots on the backup copy, these mountable database copies become ideal for Test & Dev, making them quickly available and easy to automate.

While Incremental Merge has been around for years and solves many challenges, its adoption has been somewhat limited as it introduced new challenges.

CHALLENGES SOLVED BY INCREMENTAL MERGE

The combination of fast, synthetic full backups with the ability to mount the backup copy of the database instantly solves many of the challenges above:

- **Full Backups** - The backup is block-level incremental-forever after the initial (baseline) backup.
- **Performance impact** - The short block-level incremental minimises the time the database stays in hot backup mode. BCT minimises resource utilisation of backups.
- **Recovery point** - Application-consistent recovery point and applying logs allow a zero RPO SLA when using log mirroring to protect logs from storage failures.
- **Using the backup copy** - The backup is stored in its source format so it is accessible for Test & Dev, and can be mounted to verify it.
- **Recovery time** - Switch-to-copy enables near-instant recovery
- **Cyber Threats** - Large data changes created by ransomware still pose a challenge, extending recovery times

NEW CHALLENGES CREATED BY INCREMENTAL MERGE

- **Write Performance** - The IO pattern created by incremental merge is random by definition, which backup targets are not designed for. Simultaneously, log mirroring requires high sequential throughput and very low latency and Test & Dev copies require additional random writes.
- **Read Performance** - Switch-to-copy requires the backup target to support high-performance random reads during recovery and to support a response time, which is typically expected from a production grade storage system. Additionally, Test & Dev copies require additional random read at all times.
- **Cost** - To accommodate new performance requirements customers needed to use Tier-1 storage arrays, often increasing the cost of backups to unsustainable levels
- **Complexity** - The addition of a Tier-1 storage array to the backup infrastructure increases administrative overhead.

Innovation = Acceleration + Cost Reduction

To complete the solution offered by Oracle, an underlying backup target is required that can alleviate the unresolved challenges and the new challenges created by Incremental Merge while keeping cost at bay.

THE MISSING INNOVATION FOR ORACLE INCREMENTAL MERGE

InfiniGuard is the first backup target designed to not only consolidate Oracle Incremental Merge backups with traditional backups, but also allows consolidating traditional use cases such as CommVault, NetBackup, Veeam and others within a single platform.

Each InfiniGuard includes 3 DeDuplication Engines (DDEs), which operate the traditional backup streams and offer data reduction (e.g. compression, deduplication). However, instead of relying on JBODs for the backend storage, InfiniGuard uses InfiniBox. InfiniBox is a Tier-1 storage array that was designed to disrupt the high cost of enterprise storage, by leveraging a combination of DRAM, Flash and spinning disks, combined with sophisticated data placement algorithms that enable it to simultaneously handle both sequential workloads (e.g. traditional backups) and random operations (such as Oracle Incremental Merge as well as Test &Dev).

INFINIGUARD DUAL ACCESS

InfiniGuard

InfiniGuard access usecases

- Traditional backups
- Full and Incrementals
- Variable block & Inline Dedupe
- VTL, OST, NetBoost, NFS, SMB
- 99% of the backup related usecases

InfiniBox

Direct InfiniBox access usecases

- Low dedupe-able content
- Ultra fast random reads & writes
- NFS, iSCSI, FC
- CLI/API only

INFINIGUARD & INCREMENTAL MERGE - BETTER TOGETHER

When using InfiniGuard, all the challenges mentioned above are resolved in a single solution:

- **Backup Time** - InfiniGuard's fast random write capability accelerates RMAN Incremental Merge backup.
- **Recovery Time** - The InfiniBox system within the InfiniGuard can be used for immediate failover of the database, in order to resume business services immediately.
- **Recovery Point** - All the logs since the last backup are mirrored to the InfiniBox within the InfiniGuard, enabling zero RPO.
- **Write Performance** - InfiniBox accepts all writes in DRAM, accelerating them beyond what an All-Flash Array can achieve and yielding the highest possible write throughput, as a result. This in turn, translates to a shorter backup window.
- **Read Performance** - InfiniBox organises the random writes into larger, sequential stripes despite the fact they are physically located in far points on the file system. This temporal location capability enables Neural Cache, the group of data placement algorithms in InfiniBox to prefetch them during a recovery. It also accelerates the recovery despite the fact that from the host's perspective these are random reads.
- **Cost** - By consolidating multiple backup use cases into a single solution and avoiding the need for an expensive All-Flash Array to support the random IO of Incremental Merge, InfiniGuard provides multiple cost savings and reduces administrative overhead.
- **Cyber Threats** - InfiniBox offers Immutable Snapshots, allowing the backup administrators to set a minimal expiry time on each snapshot, until which the snapshot can't be deleted or modified.
- **Complexity** - Instead of adding a Tier-1 storage array to the backup infrastructure, customers leveraging InfiniGuard get a single solution for all their backup workloads. This minimises administration and allows simpler automation, as fewer tools need to be included in the automation.
- **Test & Dev** - InfiniBox snapshots of the database copy can be used as thin copies for Test & Dev as well as validating the backups, enabling customers to get more from their backup infrastructure.

Conclusion

Implementing Oracle Incremental Merge can reduce backup times by up to x25 and provides a more scalable backup strategy. However, it's only feasible for customers who can solve the performance requirements without increasing the backup budget. By leveraging InfiniGuard's unique ability to provide a cost-efficient infrastructure for Oracle Incremental Merge, Infinidat enables customers to simultaneously accelerate their backups and their recoveries, meet their SLAs and their budgetary requirements.

By adding Capacity On Demand (COD) consumption models, customers can also dynamically grow their backup infrastructure as new projects are launched, accelerating time-to-market while only paying for the consumed capacity.