



yugabyte**DB**

Backup and Restore

Learn Best Practices for a
Distributed Database Backup
Strategy

Build

Meet

Learn

Purpose of Backups

Business/Application Continuity

- Traditional relational databases maintain a single copy of the data while online. Backups are conducted to maintain business continuity in the event of a disaster.
- Since YugabyteDB maintains at least 3 copies of the data while online, the focus shifts to application continuity and extreme disaster situations.
- YugabyteDB's backups are primarily for application corruption situations or if the majority of copies of a tablet are lost.

Backup/Restore in YugabyteDB

Features

- Can be run while the database is online
- Topologically independent backup format
- Nodes are backed up/restored in parallel
- Choice of file store targets:
 - AWS S3 (and compatibles like MinIO, IBM Cloud, Nutanix Buckets, etc)
 - Google GCS
 - Azure Blob Store
 - NFS (e.g. Filers, DataDomain, Linux FS)
- Table/Keyspace level backups for YCQL
- Database level backups for YSQL

Backup/Restore in YugabyteDB

Core concept: Snapshots

- A snapshot is a stable version of all of the flushed SST files at a specific point in time.
- For each table and each tablet, there is a <tablet_id>.snapshots directory
- Contained within each .snapshots directory, there is a <snapshot-id> directory that contains hard links to the flushed SST files
- These files will persist through compactions and will not change due to new data being inserted
- Deletion of a snapshot (typically at end of backup) removes these hard link files.

Backing up a database

First we need a place to put our backups

Cloud Provider Configuration

Infrastructure Backup Security

Amazon S3 Network File System Google Cloud Storage Azure Storage

Configuration Name

IAM Role ☒ Whether to use instance's IAM role for S3 backup.

Access Key

Access Secret

S3 Bucket

S3 Bucket Host Base

Cancel Save

YugabyteDB Platform Version: 2.8.4.0-b7

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Then we can create a backup

The screenshot displays the YugabyteDB management interface. A modal window titled "Create Backup" is open, allowing configuration of a new backup. The modal includes tabs for "YSQL", "YCQL", and "YEDIS", with "YSQL" selected. Configuration options include:

- Storage:** A dropdown menu set to "S3-Default".
- Namespace:** A dropdown menu set to "northwind".
- Encrypt Backup:** A toggle switch that is currently turned on.
- Parallel Threads:** A text input field containing the value "8".
- Number of Days to Retain Backup:** A text input field containing the value "10".

At the bottom of the modal are "Cancel" and "OK" buttons. The background interface shows the "Backups" section with a table that is currently empty, and buttons for "Delete Backup", "Restore Backup", and "Create Backup". The footer of the interface includes the YugabyteDB logo, platform version "2.8.4.0-b7", and social media links for Slack, GitHub, and a t-shirt.

What's going on behind the scenes?

Backup steps

1. For YSQL, check the catalog version
2. Create the snapshot
3. For YSQL, export the schema with `ysql_dump` and copy it to our S3 location.
4. For YSQL, check the catalog version again!
5. Export the snapshot and copy it to our S3 location
6. For each table, on the nodes with leader tablets, copy the snapshot directories to S3 (and checksum!)
7. Save the encryption key to S3 at the end. (If EAR is enabled)

Docs:

<https://docs.yugabyte.com/latest/manage/backup-restore/snapshot-ysql/#create-a-snapshot-for-a-ysql-database>


Why all the fuss with rechecking the catalog version?

Consistency


- The snapshot file contains DocDB's notion of what the table schema is as well as the tablet information for each table.
- The schema dump conducted by the *ysql_dump* utility must match in the number of objects, attributes in each table, and the **ORDER** of objects

If there is a mismatch between the two, then the restore will fail.


Backup is complete




Dashboard




Universes




Metrics




Tasks




Alerts



Configs



Admin



Help

alan-yftt-backupstore Ready

Overview

Tables

Nodes

Metrics

Queries

Replication

Tasks

Backups

Health

Connect

Actions

Scheduled Backups

Create Scheduled Backup

There is no data to display

Backups

Show deleted backups ☐

Delete Backup

Restore Backup

Create Backup

☐

TYPE

CREATED AT

2022/03/16 21:47 UTC-0400

EXPIRY TIME

2022/03/26 21:47 UTC-0400

DURATION

a minute

STATUS

Completed

ACTIONS

Actions

Namespace backup

NAMESPACE

BACKUP TYPE

TABLE NAME

STORAGE LOCATION

northwind


YSQL

COPY


s3://backups.yugabyte.com/s3Backup/univr-687a9a9e-4403-4d1d-ba81-83a287138ac9/backup-2022-03-17T01:47:34-314538598/keyspace-northwind


10


1

 yugabyteDB

Platform Version: 2.8.4.0-b7

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So how does it look in S3?

Amazon S3

Buckets

Access Points

Object Lambda Access Points

Multi-Region Access Points

Batch Operations

Access analyzer for S3

Block Public Access settings for this account

Storage Lens

Dashboards

AWS Organizations settings

Feature spotlight

AWS Marketplace for S3

Objects (340)

Objects are the fundamental entities stored in Amazon S3. You can use [Amazon S3 inventory](#) to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. [Learn more](#)

Copy S3 URI

Copy URL

Download

Open

Delete

Actions

Create folder

Upload

Find objects by prefix

	Name	Type	Last modified	Size	Storage class
<input type="checkbox"/>	SnapshotInfoPB	-	March 16, 2022, 21:47:47 (UTC-04:00)	147.2 KB	Standard
<input type="checkbox"/>	SnapshotInfoPB.sha256	sha256	March 16, 2022, 21:47:46 (UTC-04:00)	113.0 B	Standard
<input type="checkbox"/>	tablet-0039b8862e9844a6ba961f631ecdcad3.sha256	sha256	March 16, 2022, 21:48:04 (UTC-04:00)	971.0 B	Standard
<input type="checkbox"/>	tablet-0039b8862e9844a6ba961f631ecdcad3/	Folder	-	-	-
<input type="checkbox"/>	tablet-019b669ce91e4f48ab70d58dc74e020d.sha256	sha256	March 16, 2022, 21:47:57 (UTC-04:00)	482.0 B	Standard
<input type="checkbox"/>	tablet-019b669ce91e4f48ab70d58dc74e020d/	Folder	-	-	-
<input type="checkbox"/>	tablet-0305dbed40fd4db198bbc4fe026483fe.sha256	sha256	March 16, 2022, 21:48:11 (UTC-04:00)	971.0 B	Standard
<input type="checkbox"/>	tablet-0305dbed40fd4db198bbc4fe026483fe/	Folder	-	-	-
<input type="checkbox"/>	tablet-041110a03529438aa72120508049f25d.sha256	sha256	March 16, 2022, 21:48:43 (UTC-04:00)	971.0 B	Standard
<input type="checkbox"/>	tablet-041110a03529438aa72120508049f25d/	Folder	-	-	-
<input type="checkbox"/>	tablet-06b435b4185f472a96d0014d43842b4f.sha256	sha256	March 16, 2022, 21:48:28 (UTC-04:00)	971.0 B	Standard
<input type="checkbox"/>	tablet-06b435b4185f472a96d0014d43842b4f/	Folder	-	-	-
<input type="checkbox"/>	tablet-0782447628354cb79fb10a015e761956.sha256	sha256	March 16, 2022, 21:48:20 (UTC-04:00)	971.0 B	Standard
<input type="checkbox"/>	tablet-0782447628354cb79fb10a015e761956/	Folder	-	-	-
<input type="checkbox"/>	tablet-08c36a476991481da23bcf8577f164f2.sha256	sha256	March 16, 2022, 21:48:11 (UTC-04:00)	971.0 B	Standard
<input type="checkbox"/>	tablet-08c36a476991481da23bcf8577f164f2/	Folder	-	-	-
<input type="checkbox"/>	tablet-0981c24792474ee3a60a259a5a6f41f9.sha256	sha256	March 16, 2022, 21:48:21 (UTC-04:00)	971.0 B	Standard
<input type="checkbox"/>	tablet-0981c24792474ee3a60a259a5a6f41f9/	Folder	-	-	-
<input type="checkbox"/>	tablet-09e3b7ba27dd414fa6da08bd92a235fd.sha256	sha256	March 16, 2022, 21:48:42 (UTC-04:00)	971.0 B	Standard

Restoring a database

Now lets restore to a single node cluster

The screenshot shows the YugabyteDB web console interface. A modal dialog titled "Restore data to" is open in the center. The dialog contains the following fields:

- Storage:** A dropdown menu with "S3-Default" selected.
- Storage Location:** A text input field containing the S3 path: `s3://backups.yugabyte.com/s3Backup/univ-687a9a9e-4403-4d1d-ba81-83a287138ac9/backup-2022-03-17T01:47:34-314538598/keyspace-northwind`.
- Universe:** A dropdown menu with "alan-yftt-restore-rf1" selected.
- Keyspace:** A text input field containing "northwind_dev".
- Table:** An empty text input field.
- Parallel Threads:** A text input field containing "8".
- KMS Configuration:** A dropdown menu with "Select..." selected.

At the bottom of the dialog are "Cancel" and "OK" buttons. The background interface shows the "Scheduled Backups" section with a "Create Scheduled Backup" button and a "Backups" section with a "Restore Backup" button. The top navigation bar includes "Overview", "Tables", "Nodes", "Metrics", and "Queries". The bottom footer contains the YugabyteDB logo, platform version (2.8.4.0-b7), and social media links.

What's going on behind the scenes when restoring?

Restore steps

1. Copy the YSQLDump from S3 and execute the YSQLDump script to create the tables & tablets necessary to receive the data.
2. Copy the SnapshotInfoPB down from S3
3. Import the SnapshotInfoPB file. The output of this step contains all of the new mappings for tablet-uuids generated on the new cluster.
4. Copy each tablets snapshot data from S3 to ALL tablet peers (and verify checksums!) to a temporary location.
5. Restore the snapshot to make it visible to the cluster.

Docs: <https://docs.yugabyte.com/latest/manage/backup-restore/snapshot-ysql/#restore-a-snapshot>

Point-in-time recovery

Point-in-time Recovery

What is PITR?

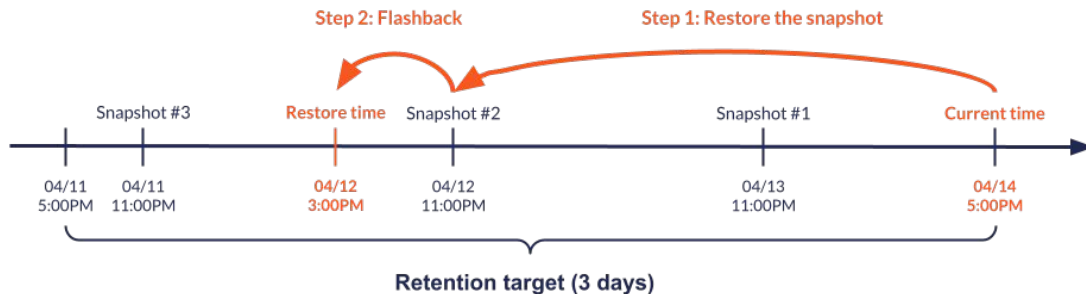
- Ability to restore a database or a keyspace to an arbitrary point in time representing the latest known working state
- Typically used to recover from user or software errors
 - Incorrect data modifications
 - Accidental schema changes
- GA since 2.14

Why PITR?

- Restore to any time => minimum RPO
- Based on **in-cluster** snapshots => minimum RTO

Point-in-time Recovery: under the hood

- PITR = periodic snapshots + MVCC
 - MVCC - history of past changes within a single snapshot (a.k.a. flashback)
- Example:
 - Retention target: 3 days
 - Snapshot interval: 1 day
 - Every snapshot holds 1 day worth of data changes



Coming attractions

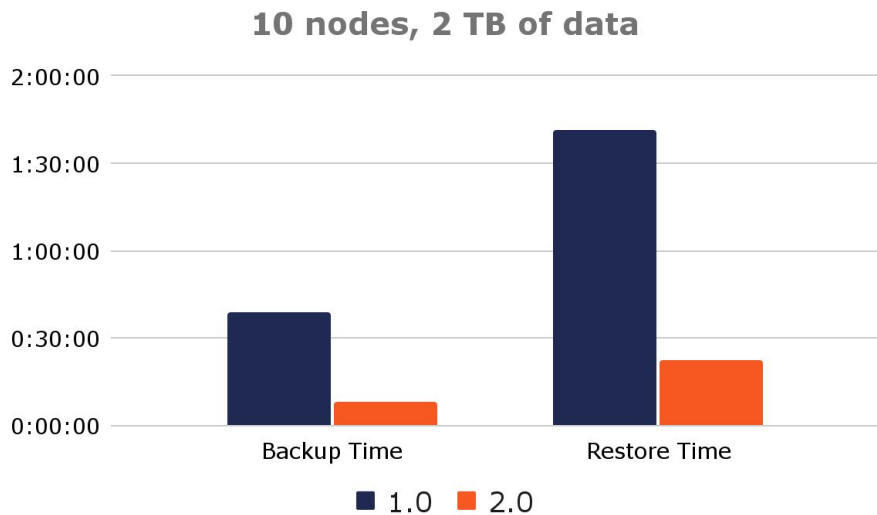
Coming Soon!

- Point-in-time recovery management
- Backups 2.0
 - Performance improvements
 - Cost improvements

Coming Soon!

Backups 2.0

- Updated architecture and implementation for backup management
- Improved performance, lower resource consumption, better metrics



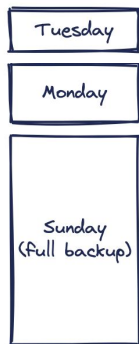
Backups 2.0

- Only copy added or updated since the latest backup
- Back up large datasets faster
- Reduce storage and data transmission cost



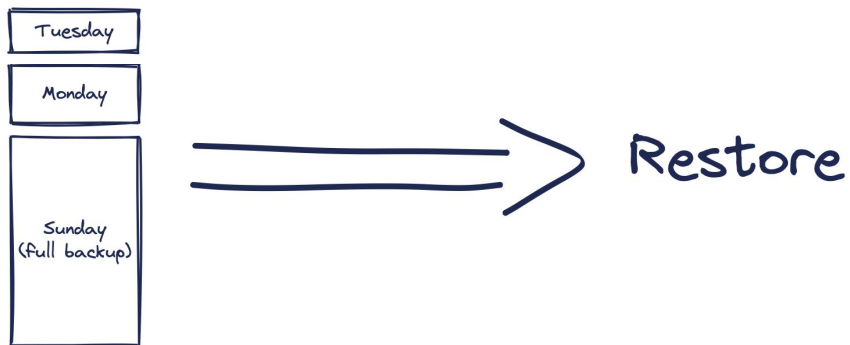
Backups 2.0

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Backups 2.0

- Only copy added or updated since the latest backup
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Summary

- Distributed snapshots are at the core of YugabyteDB backup/restore functionality
- YB Anywhere and YB Managed provide scheduled and on-demand backups stored in cloud storage or NFS
- PITR allows to quickly recover from user or software errors with minimal RPO and RTO
- Backups 2.0 will further reduce backup creation time and minimize the cost

<https://docs.yugabyte.com/preview/manage/backup-restore/>



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