PERCONA LIVE 2023


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Lead Senior Support Engineer
Percona

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Senior Software Engineer
Percona

# Percona Xtrabackup: From Zero To Hero

Monday, May 22nd

09:00 AM MST


# Intro

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# Marcelo Altmann

- Senior Software Engineer @ Percona
- Working on Xtrabackup Project
- Author of key features
  - FIFO Datasink / xbcloud multi-thread
  - Memory Estimation
  - ZSTD Compression Support
  - Xbcloud exponential Backoff
  - Xbcloud instance profile
  - KMIP & KMS Keyring Component Integration

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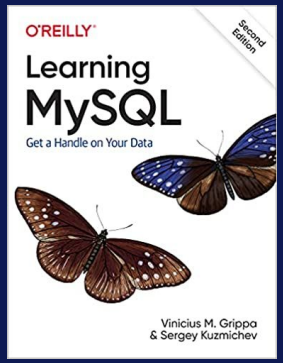
# Vinicius Grippa

- Senior Support Engineer @ Percona
- MySQL and MongoDB specialist
- Working with databases for 18 years
- Co-Author of the book Learning MySQL

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# Before we Start

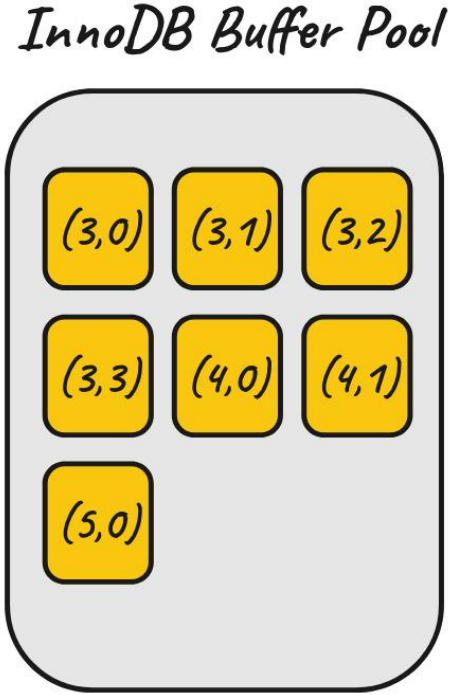
# Before we start

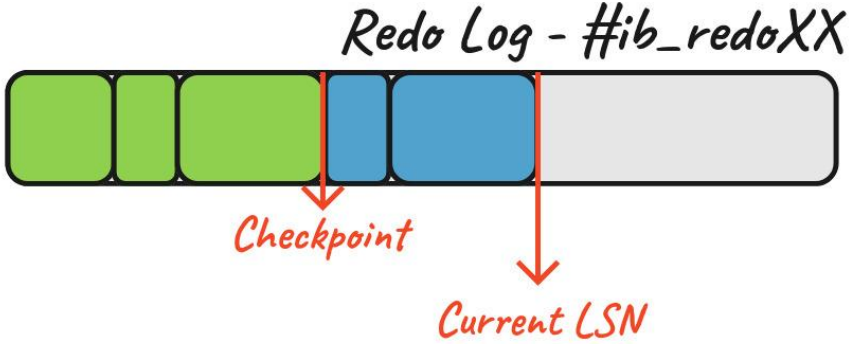
- Download the PDF with examples to follow at https://bit.ly/pl_tutorial

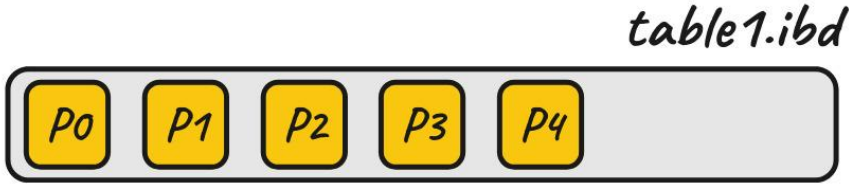
- If you are on ARM - Ask presenter for a remote Instance credentials.


# The Basics - How it works

# InnoDB - General Componentes



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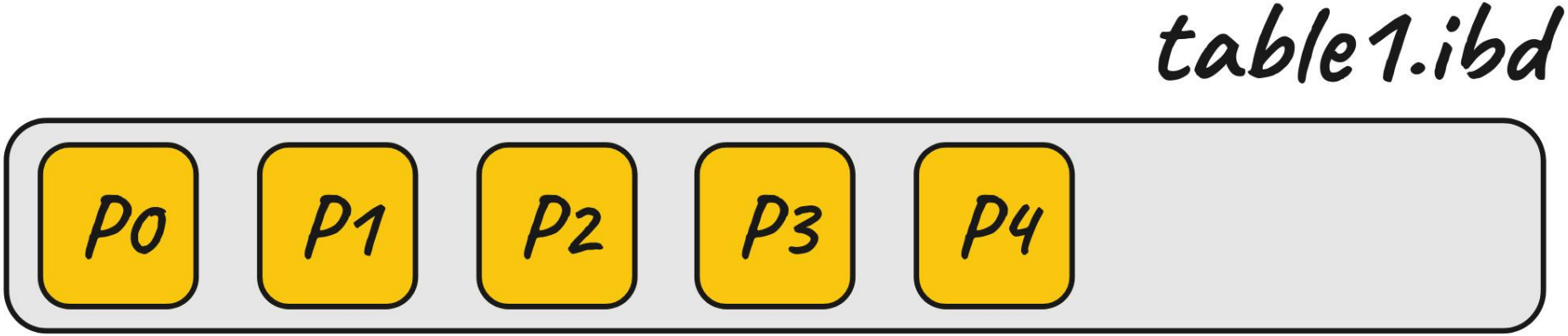
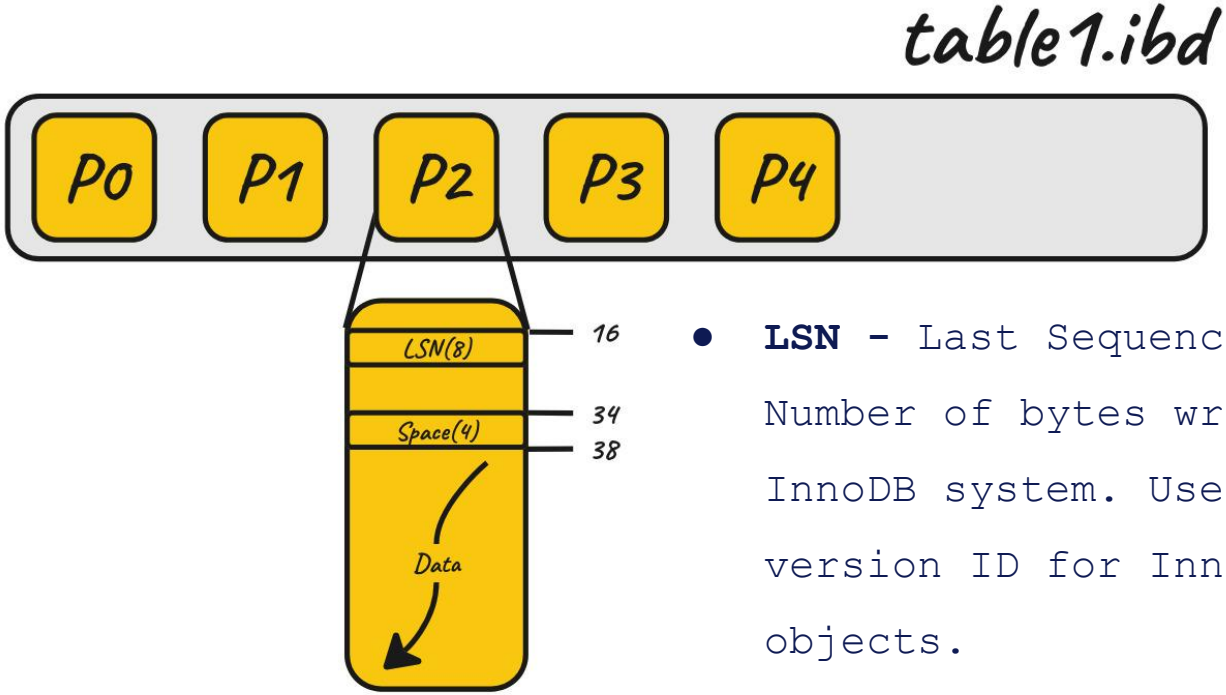
# InnoDB - Disk Table Layout



# InnoDB - Disk Table Layout




- **LSN** - Last Sequence Number Number of bytes written on InnoDB system. Used as a version ID for InnoDB objects.

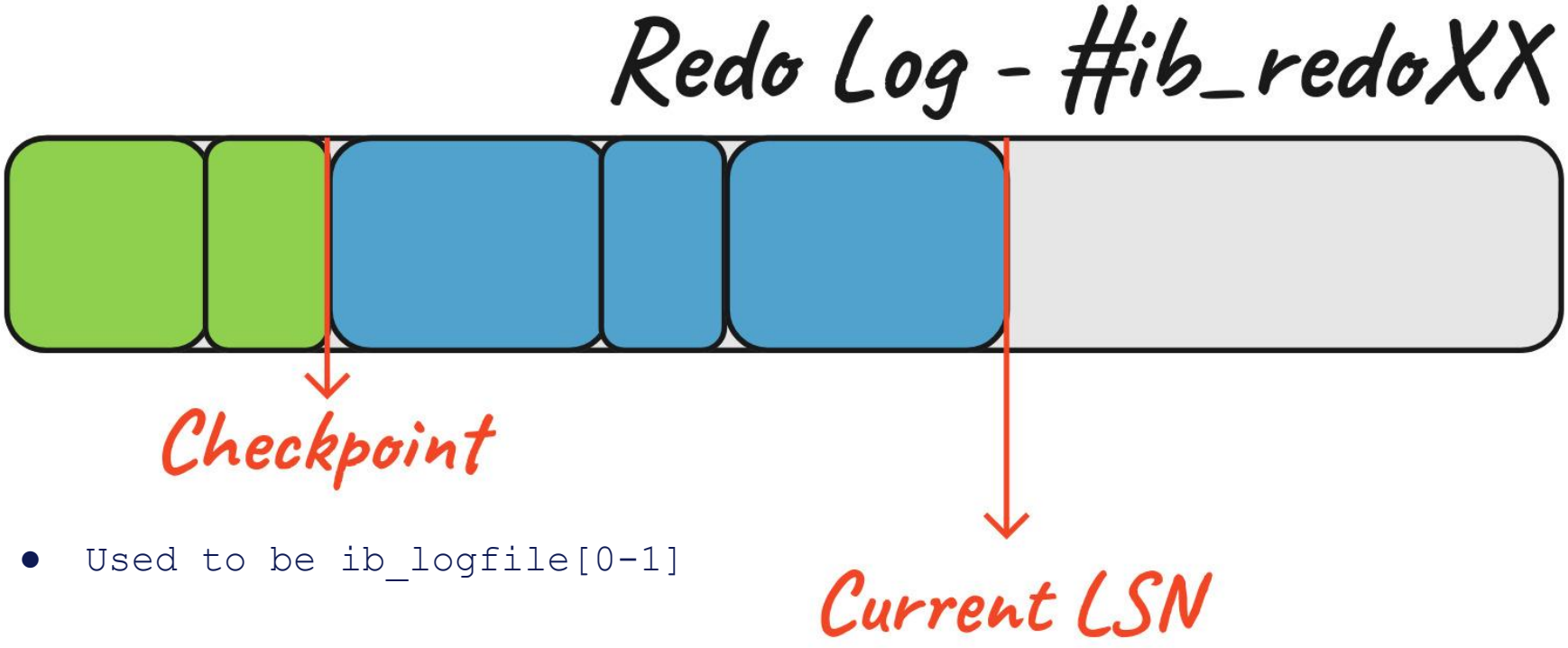
# InnoDB - Disk Table Layout

```
mysql> SELECT SPACE, NAME FROM INFORMATION_SCHEMA.INNODB_TABLESPACES
    -> WHERE NAME = 'test/tb1';
+-------+----------+
| SPACE | NAME     |
+-------+----------+
|    10 | test/tb1 |
+-------+----------+
1 row in set (0,01 sec)

mysql> ^DBye

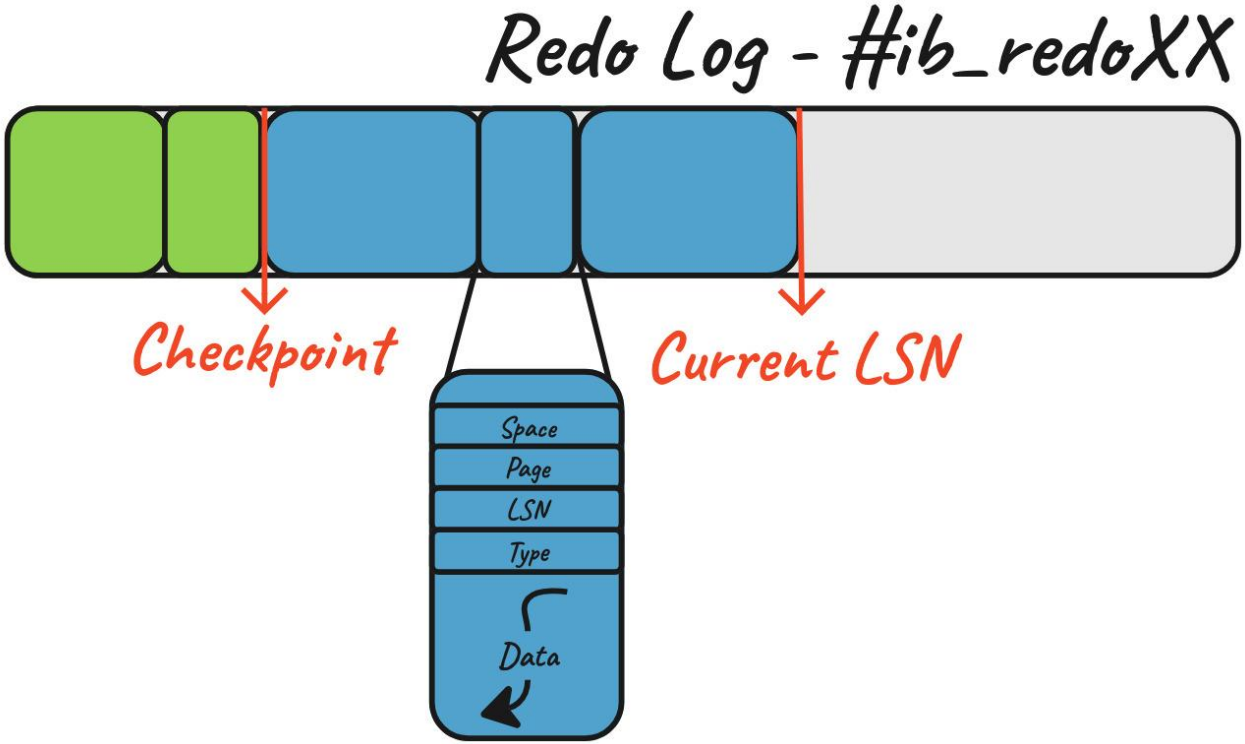
 marcelo  ~ ▶
  ▶ $ xxd -s 34 -l 4 /work/ps/ins/8.0/datadir1/test/tb1.ibd
00000022: 0000 000a                                ....
```

# InnoDB - Redo Log (WAL)




- Used to be ib_logfile[0-1]

# InnoDB - Redo Log (WAL)



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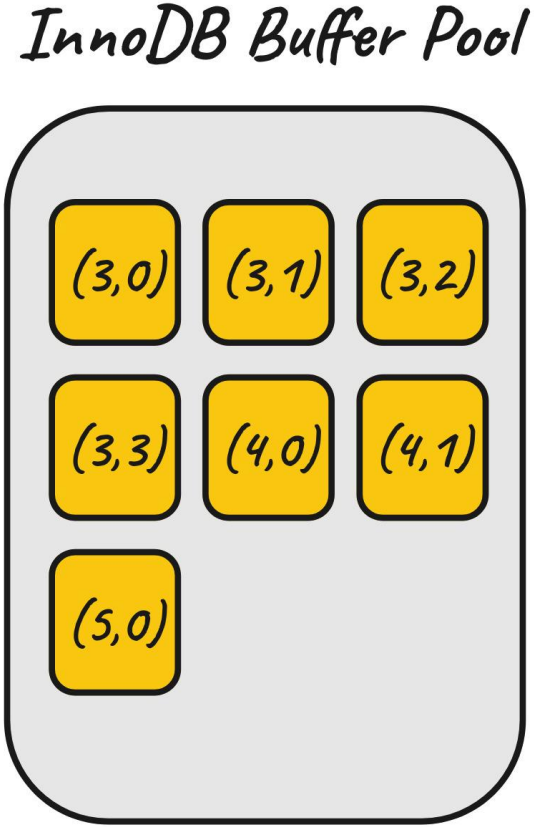
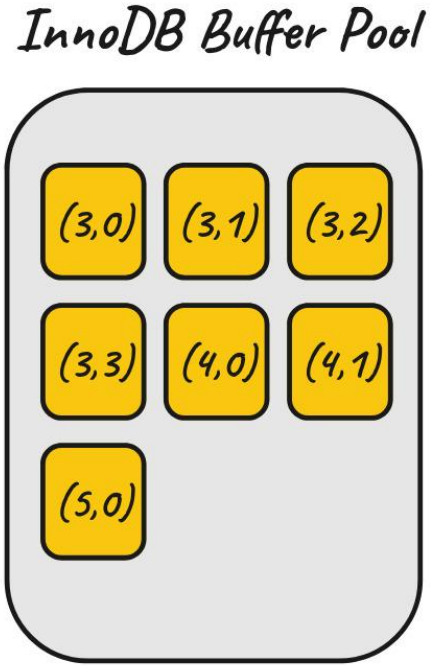
# InnoDB – Buffer Pool



# InnoDB – Write workflow

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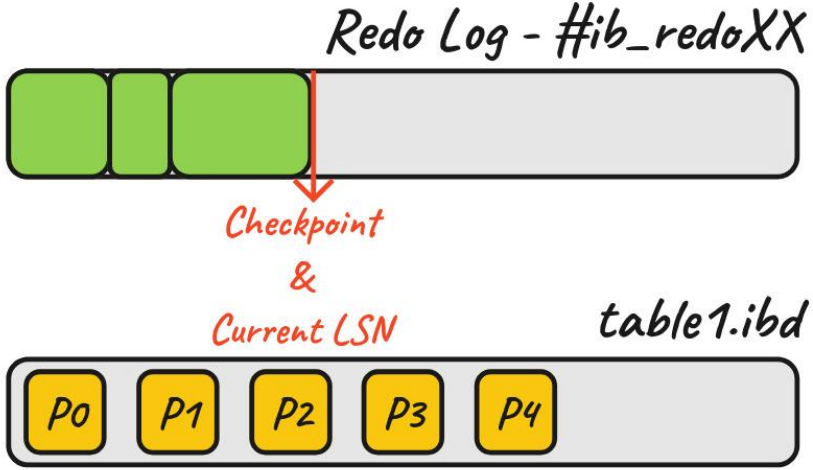
mysql> UPDATE TABLE table1 SET name = 'Marcelo' WHERE ID = 88
```



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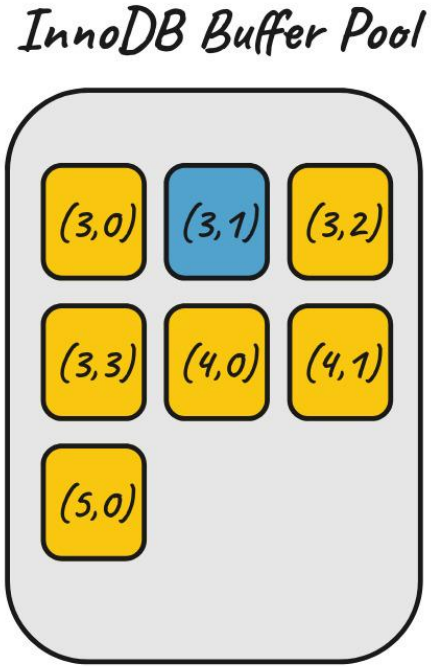
# InnoDB – Write workflow

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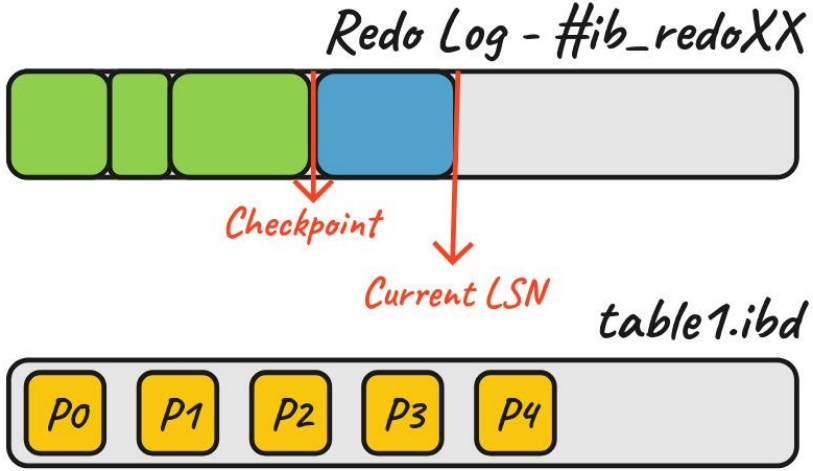




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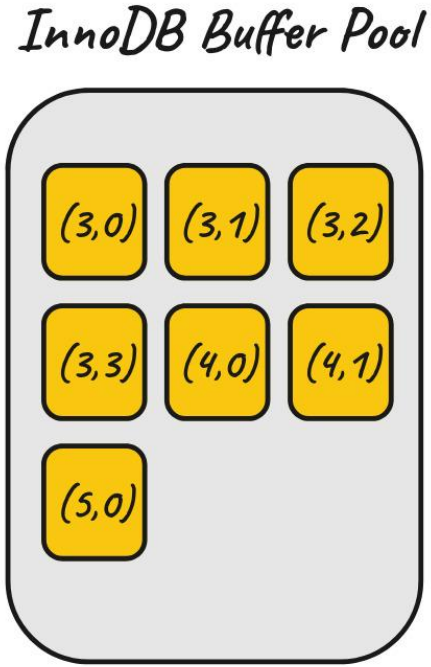


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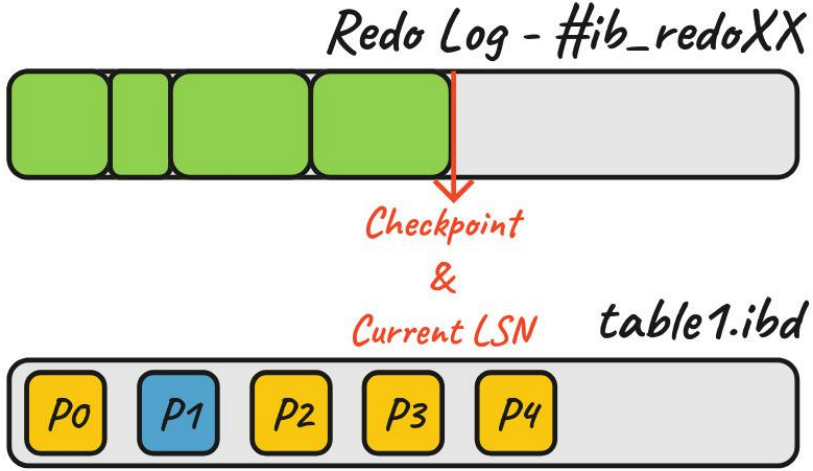




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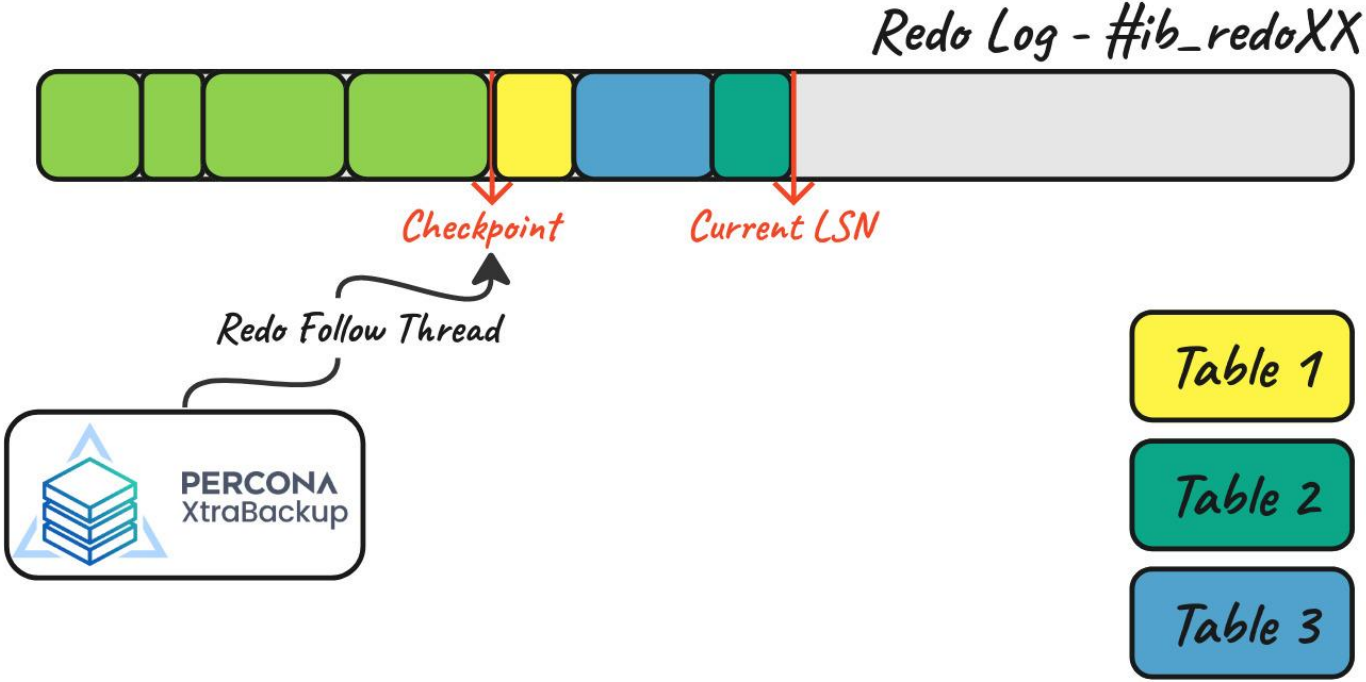
# Percona Xtrabackup Workflow - --backup



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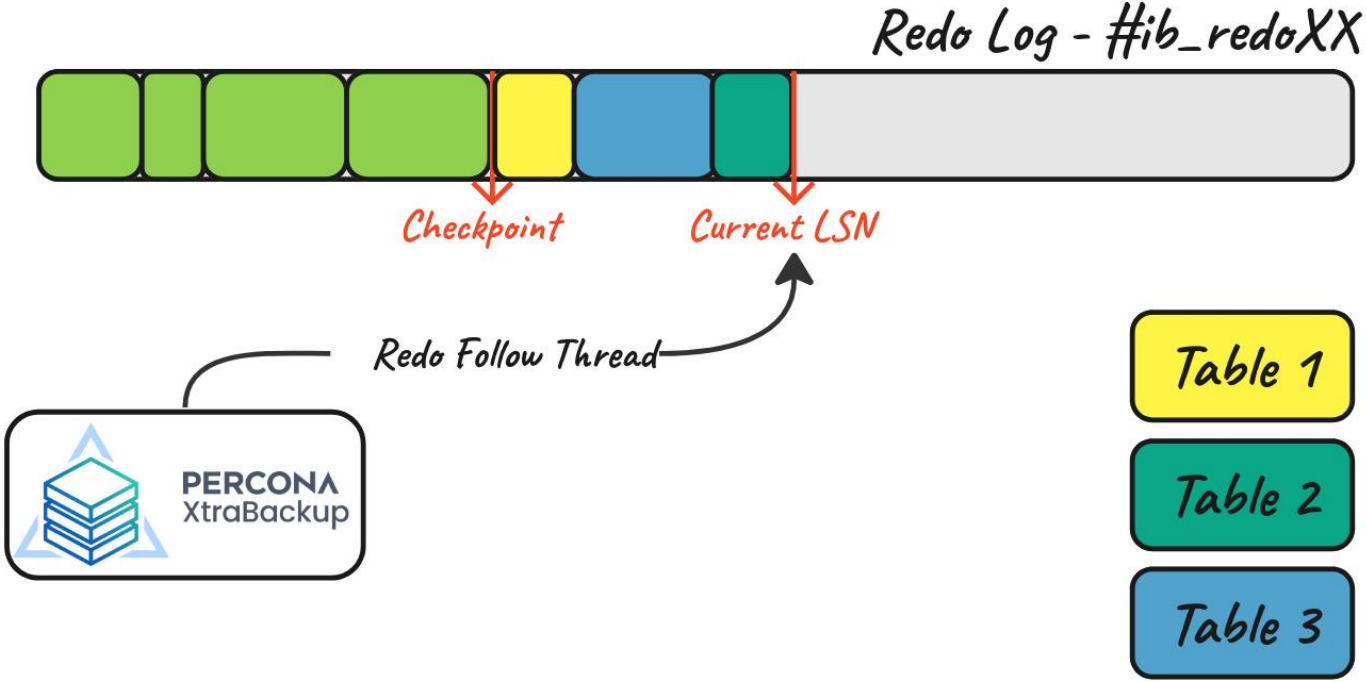

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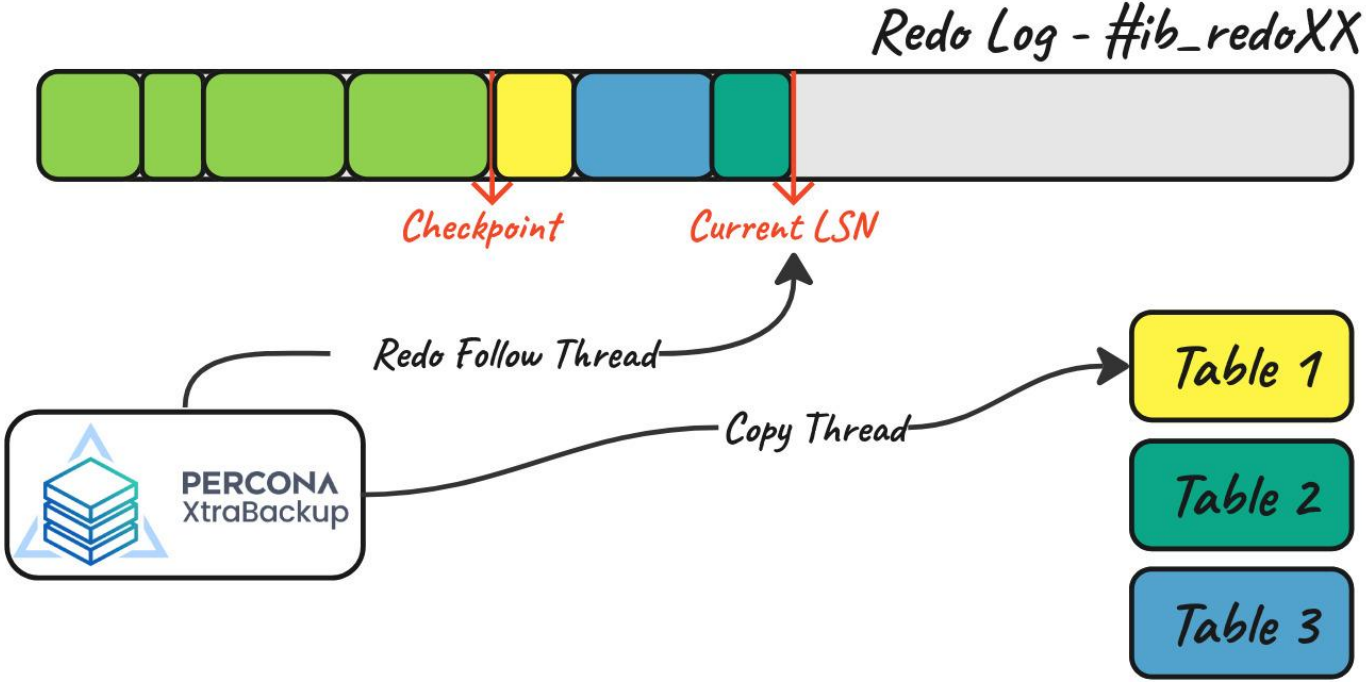

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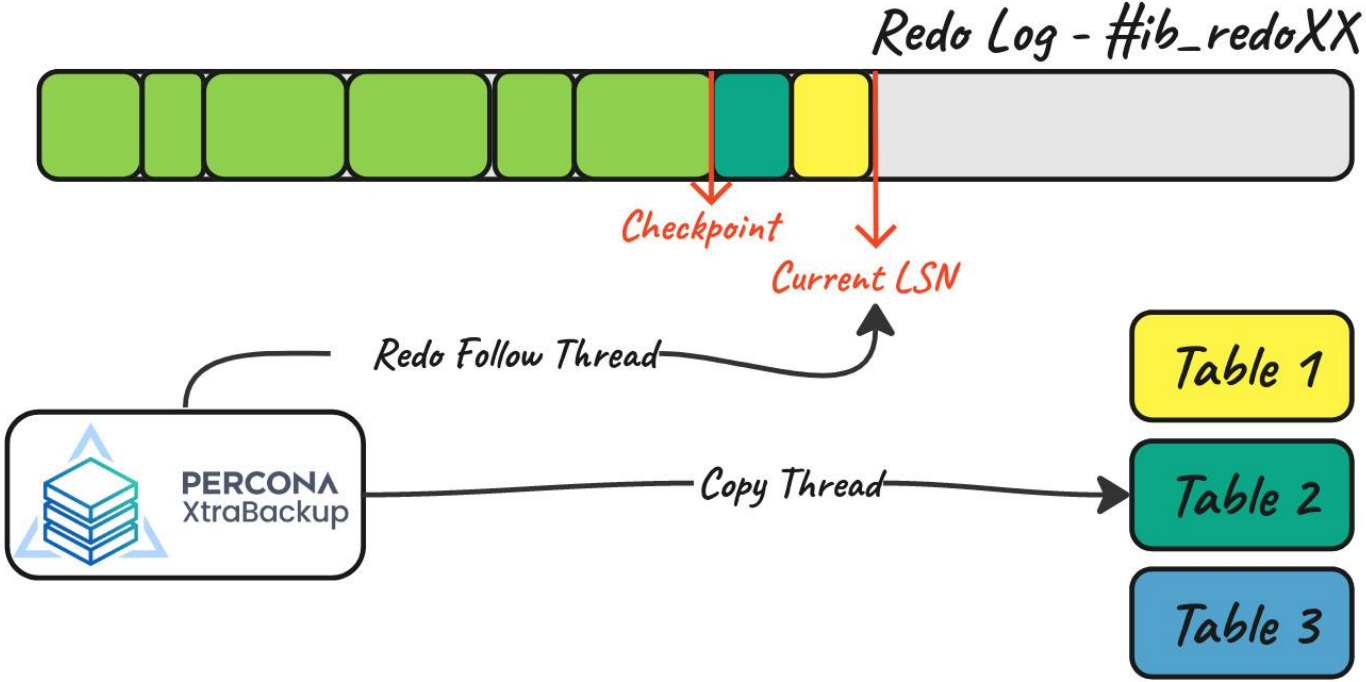

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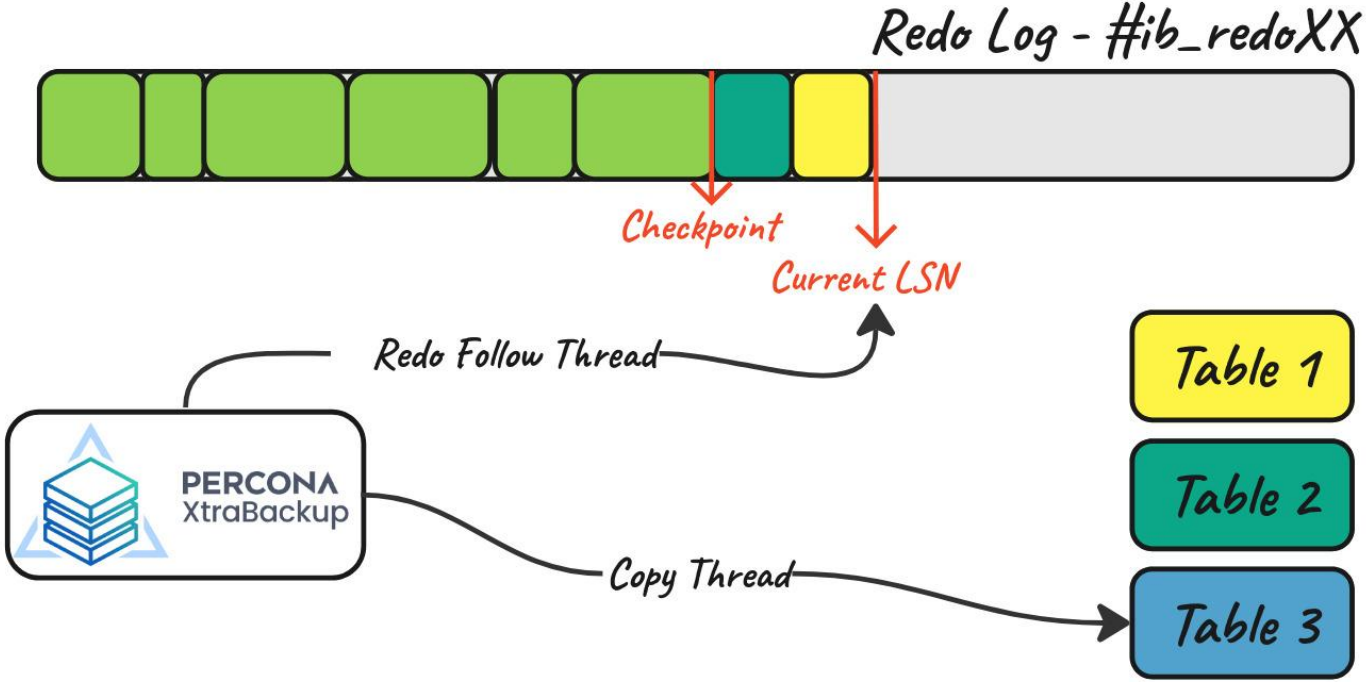

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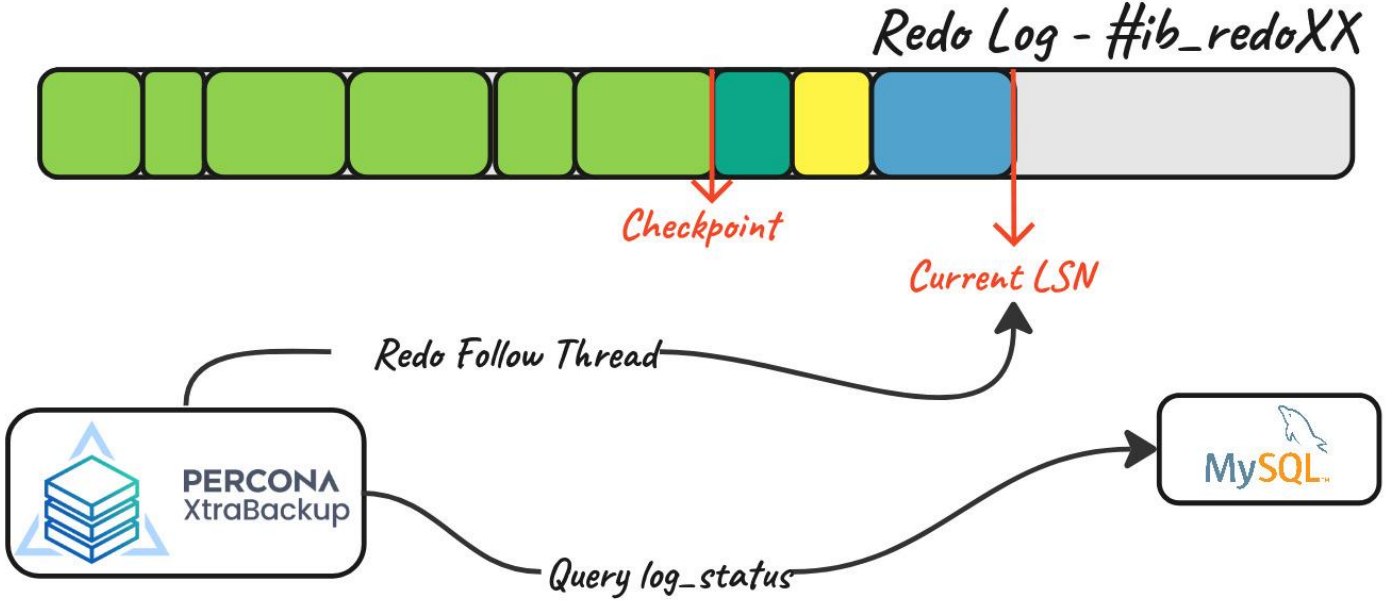
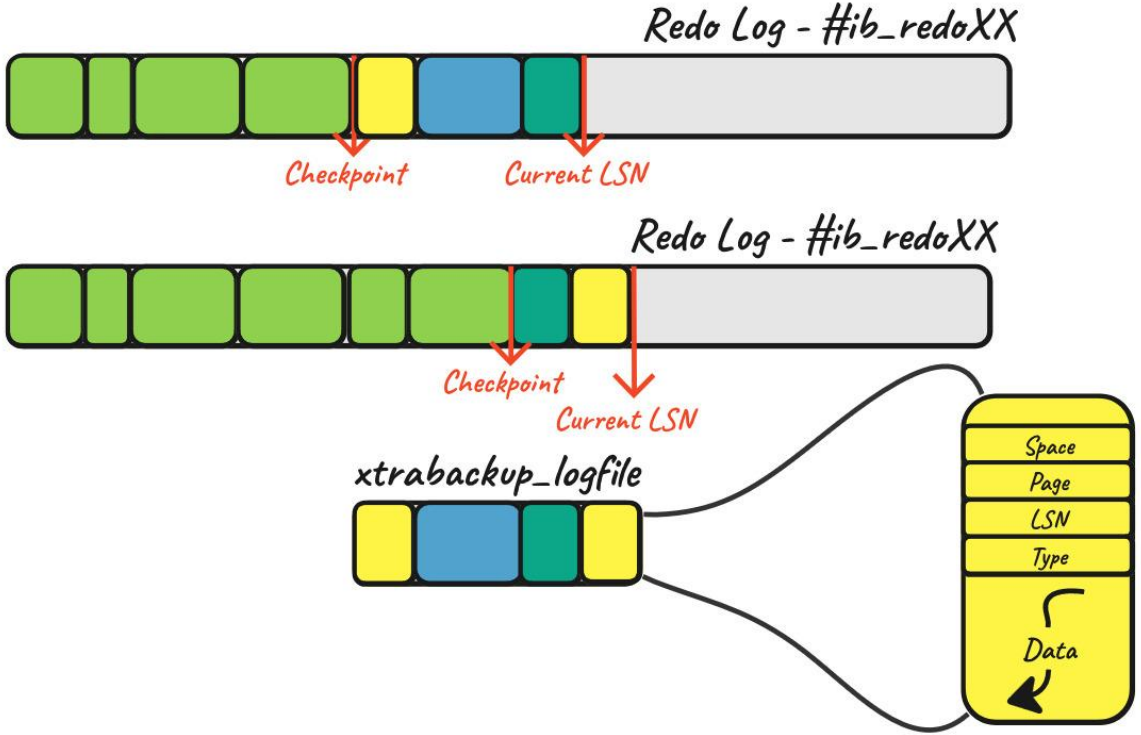


# Percona Xtrabackup Workflow - --backup

```
marcelo ~ ▶
  ▶ $ mysql -e "SELECT * FROM performance_schema.log_status\G"
*************************** 1. row ***************************
    SERVER_UUID: f219fadc-e29a-11ed-bdad-60a4b722b33a
          LOCAL: {"gtid_executed": "", "binary_log_file": "binlog.000001", "binary_log_position": 157}
    REPLICATION: {"channels": []}
STORAGE_ENGINES: {"InnoDB": {"LSN": 19549557, "LSN_checkpoint": 19549557}}
```

# Percona Xtrabackup Workflow - --prepare



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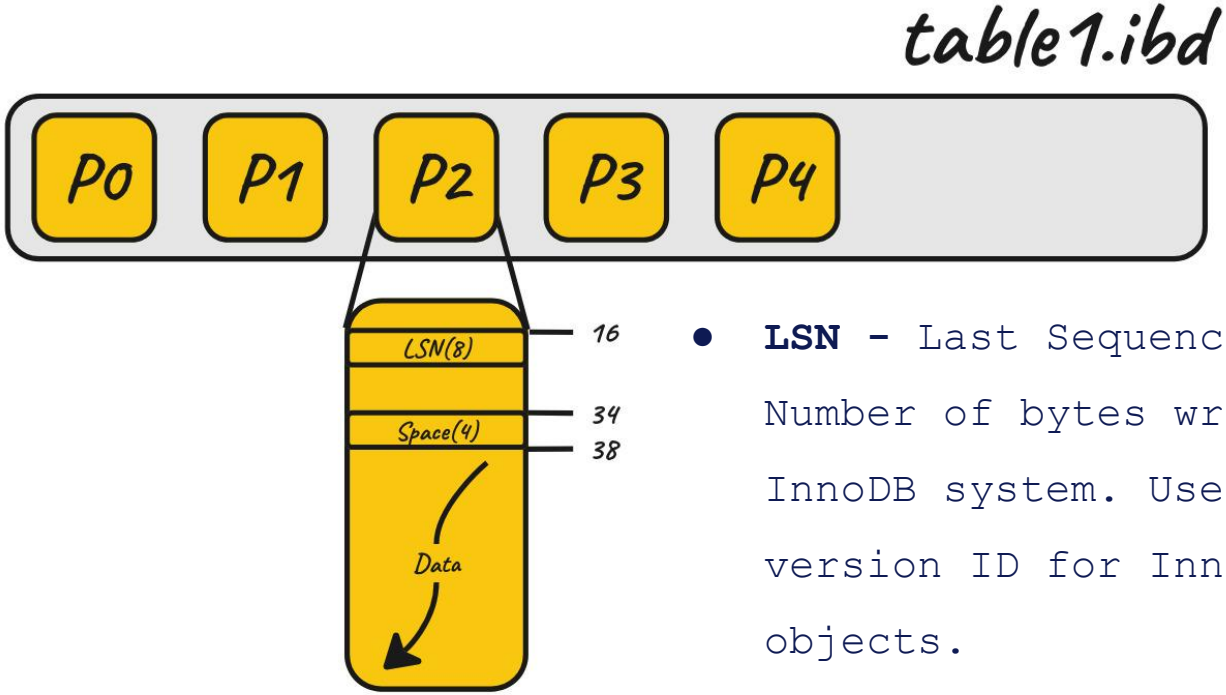
# Hands On!!!
# Full Backup

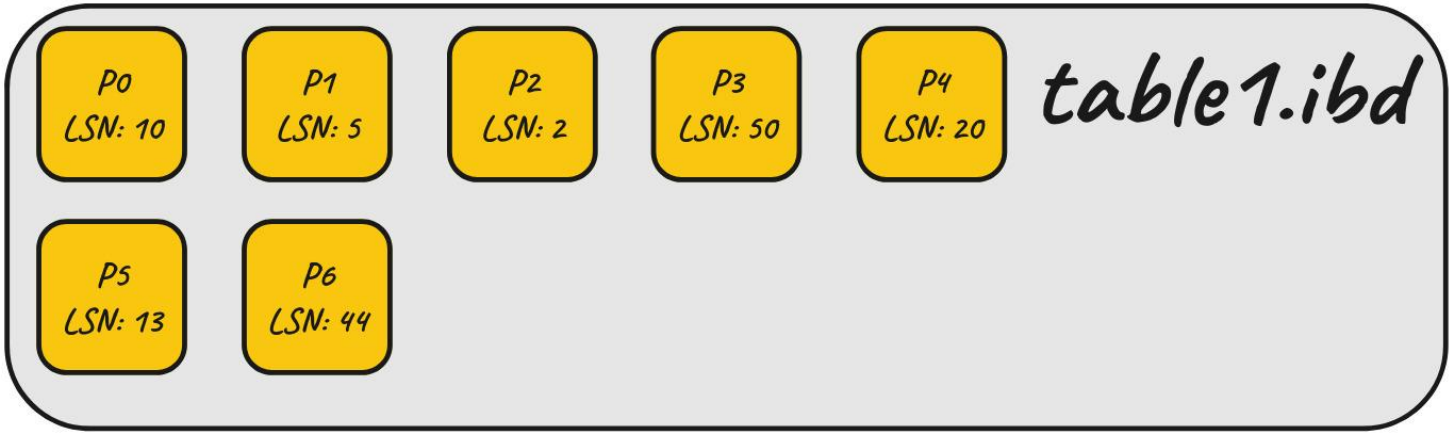

# Incremental Backup

# InnoDB - Disk Table Layout




- **LSN** - Last Sequence Number Number of bytes written on InnoDB system. Used as a version ID for InnoDB objects.

# Incremental Backups




- LSN from last backup (LSN 50)
- Copy pages from that LSN forward
- Redo Follow Thread



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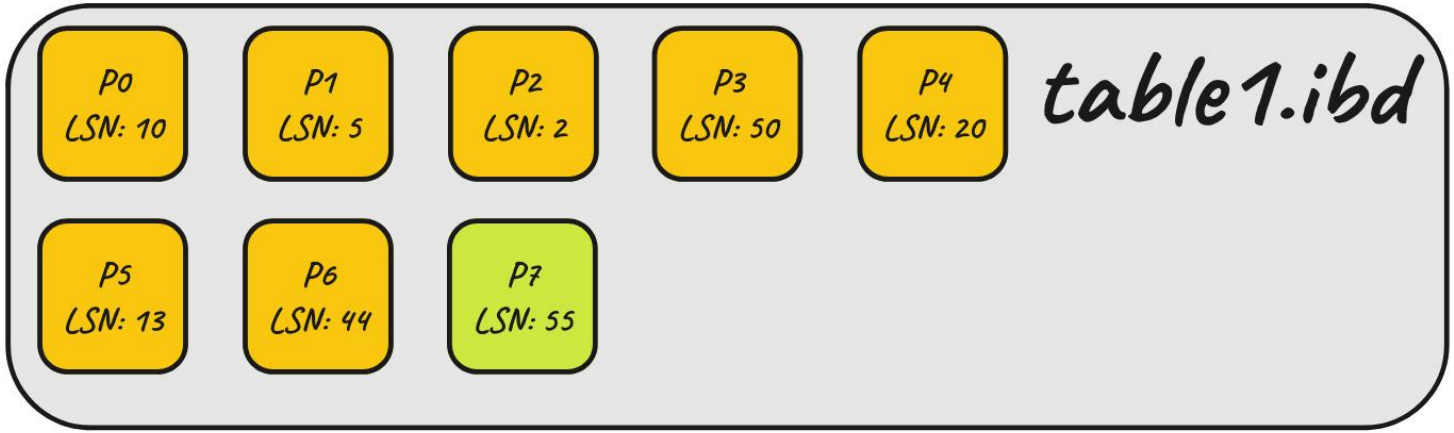
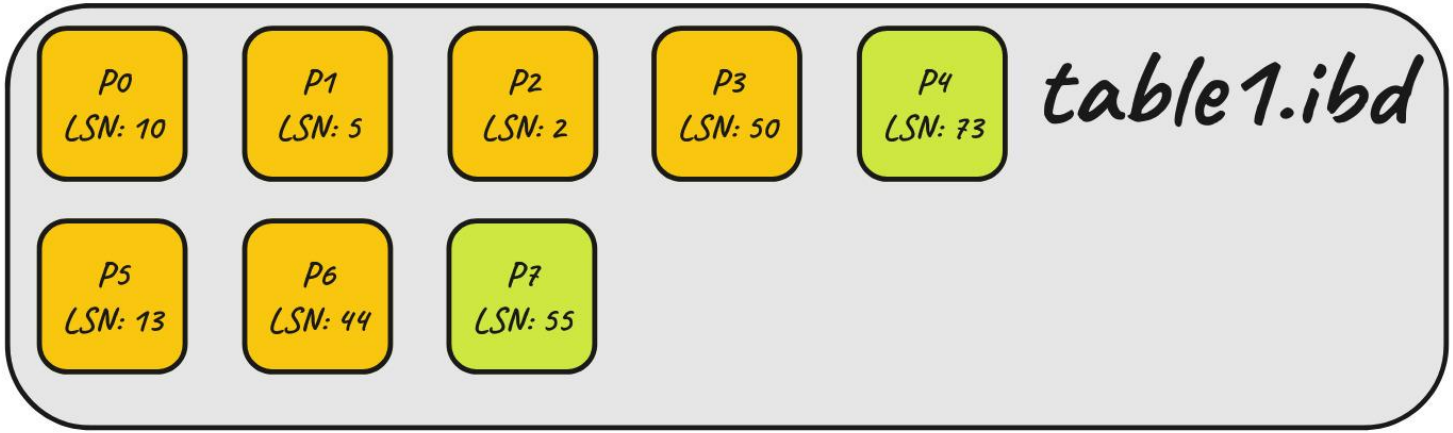
# Incremental Backups



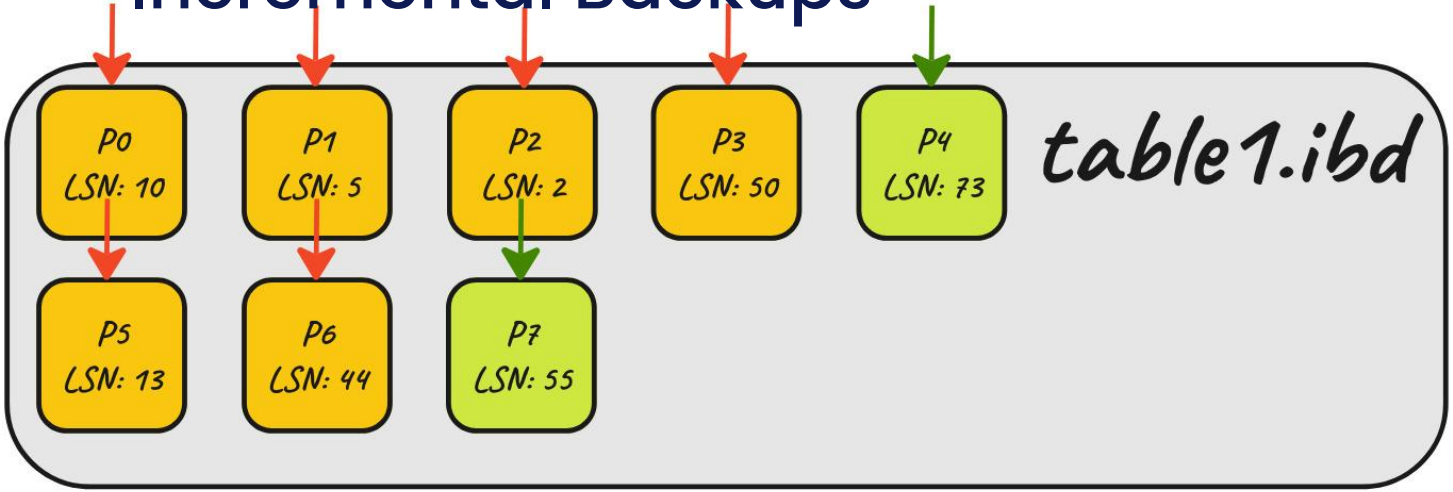

- `INSERT INTO table1 VALUES ();`

# Incremental Backups



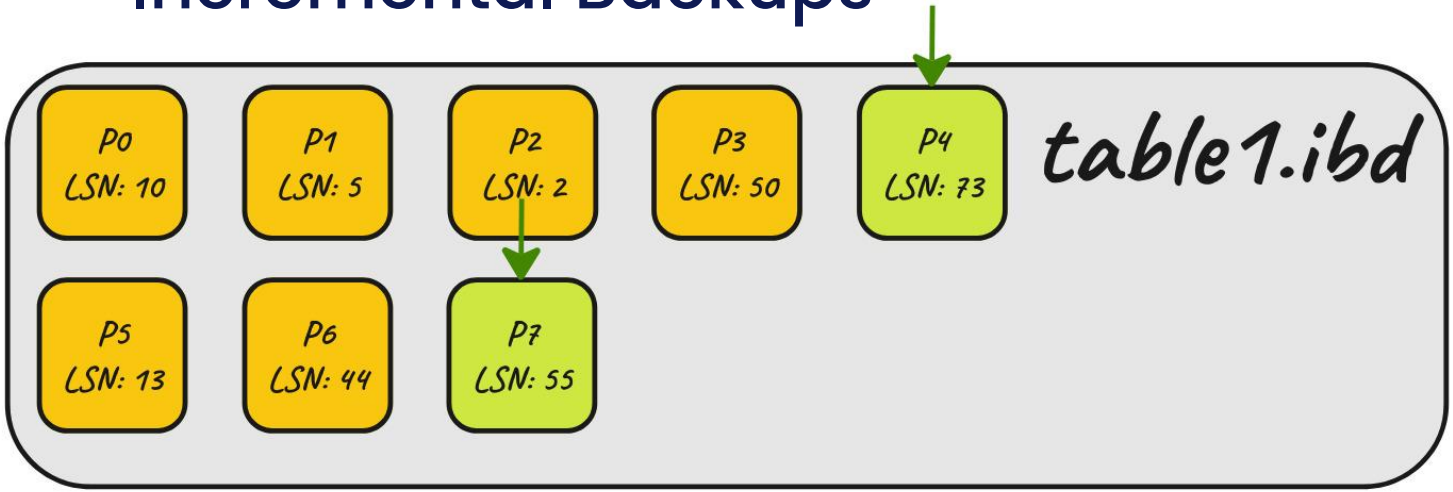

- `UPDATE table1 SET name = 'Marcelo' WHERE ID = 88;`

# Incremental Backups




- Brutal Force - Scan all pages and check LSN

# Incremental Backups




- Page Tracking (8.0.27+)
- Server Component to keep track of changed pages
- Xtrabackup calls server API and get list of changed pages between range of LSN

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# Hands On!!!


# Streaming

# Streaming

- Used to stream data to another machine or Object Storage
- Currently supported Object Storages:
  - S3 / Azure / GCP / Swift
- Uses custom xbstream format - https://bit.ly/xbstream-format
- Introduces two new binaries
  - Xbstream - responsible for interpret xbstream chunks and reassembly the original file
  - Xbcloud - responsible for downloading and uploading chunks to object storage

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# Hands On!!!


# Encrypted and compressed

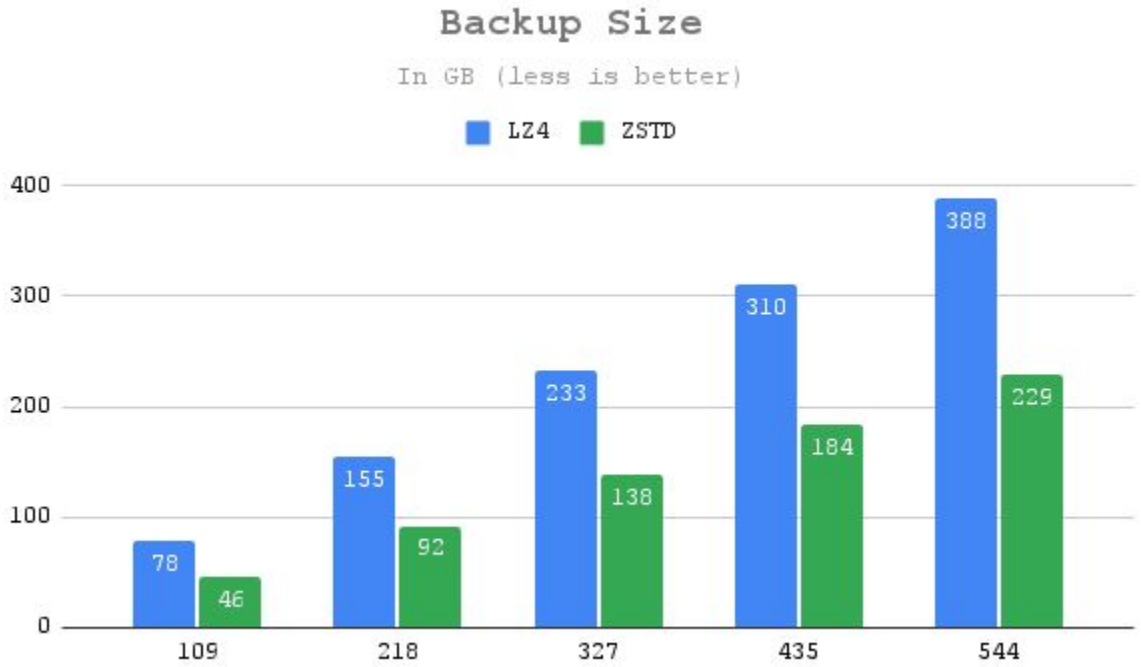
# Encrypted Backups

- Uses GnuPG (GPG) library
- Uses Advanced Encryption Standard (AES) algorithm
- Support key lengths of 128 / 192 / 256

# Compressed Backups

- Currently support for ~~QuickLZ~~, LZ4 and ZSTD
  - QuickLZ no longer maintained
  - Deprecated on 8.0.32
  - Ability to --backup will be removed at 8.0.35 (TBC)
- Use LZ4 and ZSTD instead

# Compressed Backups



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# Encrypted & Compressed Backups

- Can be tuned with:
  - --parallel - number of parallel copy threads
  - --compress-threads - number of threads responsible for compression work
  - --encrypt-threads - number of threads responsible for encryption work
- Rule of thumbs - parallel > compress > encrypt

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# Hands On!!!


# Partial Backup / Restore

# Partial Backups

- Intentionally copy just required tables
- Can be done by providing:
  - Regular Expression of matching tables
  - File with list of tables
  - File with a list of databases

# Partial Restore

- Restore just specific table(s) from full backup
- Works using Transportable Tablespace
- `xtrabackup --prepare --export`- produces exportable table spaces files
- For each table, user needs to:
  - Create table with same definition
  - Discard Tablespace
  - Copy table files (.ibd, .cfg) to server datadir
  - Import Tablespace

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# Hands On!!!


# Point In Time Recovery (PITR)

# Point In Time Recovery

- Allows for restoring a backup and replay transactions up to a specific point in time
- Useful when a disaster has occurred and the data between the last backup and time of disaster cannot be lost
- Requires copy of binary logs

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# Hands On!!!

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# Rate this tutorial!

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Thank you!

Grazie

Obrigado

Merci

Mam'noon

Danke

Dhanyavaad

Xièxiè

Arigato