



# Backup & Restore

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# Agenda

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- Why backups?
- Backup Types
- Binary or Raw Backups
- Logical Backups
- Binlog mirroring
- Backups Locks
- Examples
- Tips



# Why Backups?

# Why Backups?

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- At some point anything can and will fail
- Hardware issues
- Application bugs
- Operational mistakes
- Attacks

# Why Backups?

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- Depending on the fail you will need to:
  - Restore a complete server
  - Restore a complete DB
  - A complete table
  - A few rows



# Backup types

# Different Backup types

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- Logical
  - Plain text files
  - Can be Remote
  - Slower on large datasets
  - Sometimes the only option

# Different Backup types

- Binary or Raw
  - Filesystem level access
  - Local
  - Faster on large datasets
  - Storage engine dependent
  - Can be useless on filesystem corruption



# Different Backup types

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- Binlog
  - For point in time recovery
  - PITR even for a single schema



# Binary Backups

# Binary Backups

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- Tools
  - Percona XtraBackup
  - mylvm snapshot
  - MySQL Enterprise Backup

# Binary Backups

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- Percona XtraBackup
  - Fast, limited by IO
  - Almost no locks (--rsync)
  - Compress on the fly (--compress)
  - Best option for full server restore or setting up new slaves



# Logical Backups

# Logical Backups

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- Tools
  - mysqldump
  - Mydumper

# Logical Backups

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- mysqldump
  - General use
  - Simple to use
  - By default lock tables
  - One big output file
  - Can be piped to mysql client

# Logical Backups

- mysqldump
  - --opt = --add-drop-table --add-locks --create-options --quick --extended-insert --lock-tables --set-charset --disable-keys (default)
  - --single-transaction (innodb)
  - --master-data (FTWRL) for binlog coordinates
  - --dump-slave
  - --innodb-optimize-keys (PS only feature)
  - --triggers (ON) --routines (OFF)



# Logical Backups

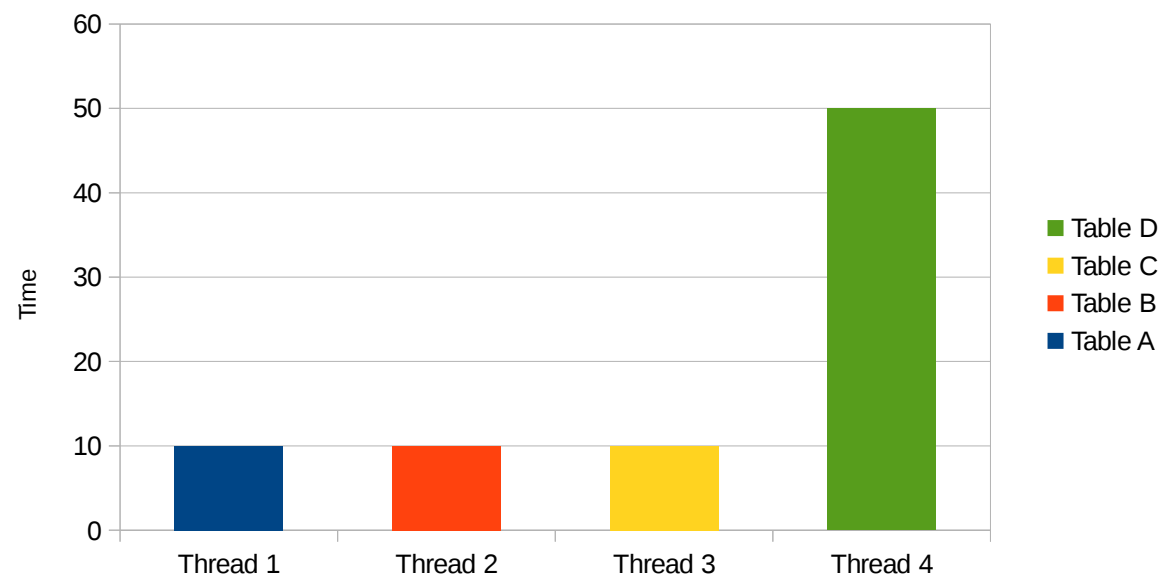
- Mydumper
  - Faster logical backups as is multithread
  - Almost no locking with innodb tables
  - Compress on the fly
  - Doesn't handle Views, Triggers and Procedures
  - Separate files per table, one row per line

# Logical Backups

- Mydumper
  - --threads
  - --outputdir
  - --rows, --chunk-filesize
  - --compress
  - --less-locking
  - --kill-long-queries
  - --use-savepoints

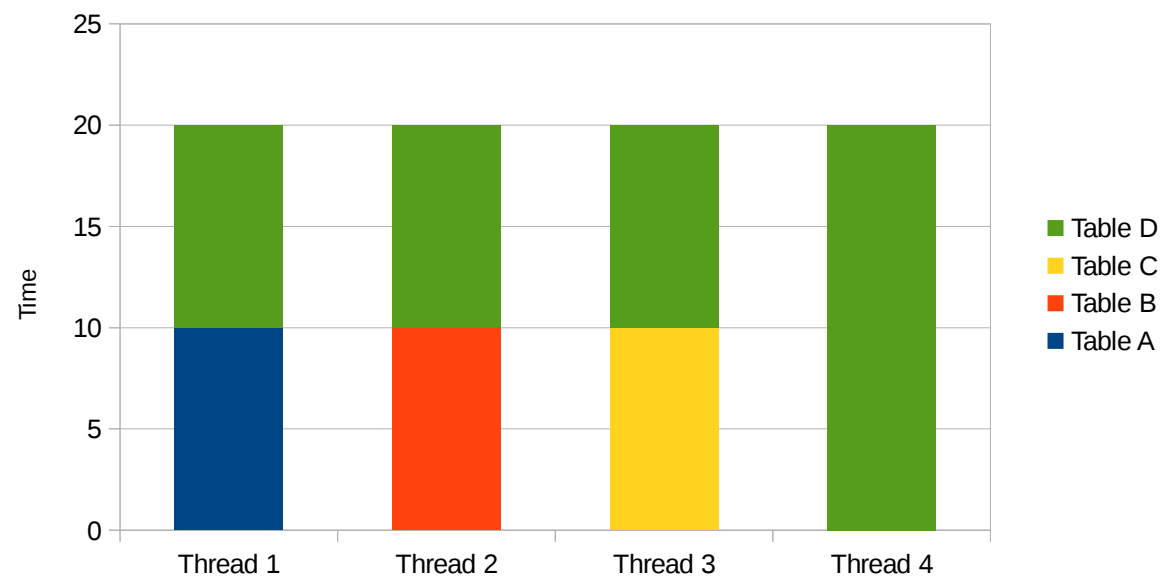
# Logical Backups

- Without chunks



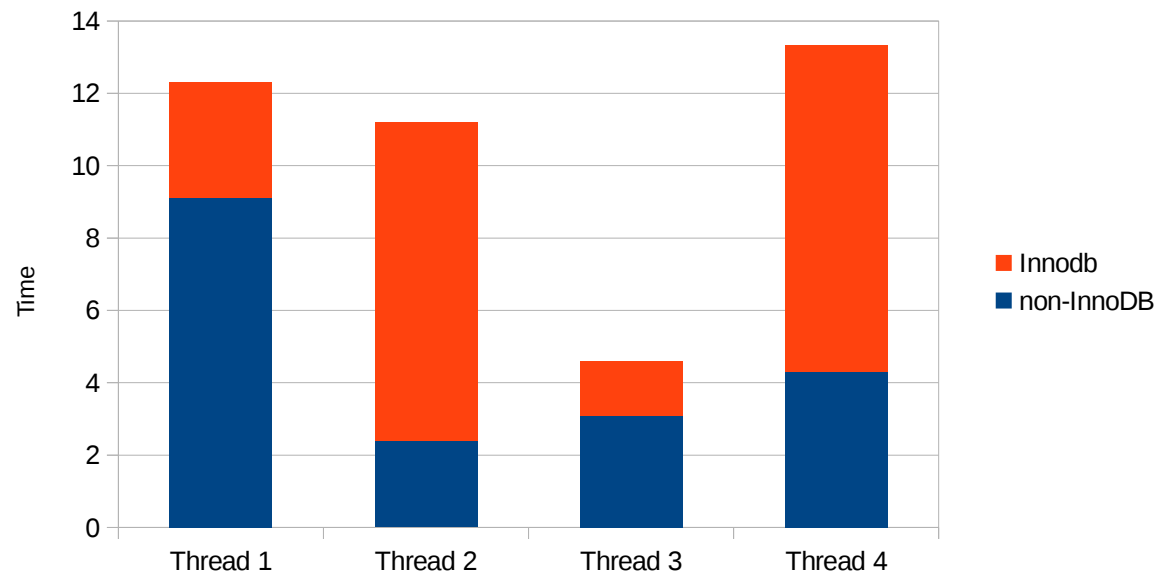
# Logical Backups

- With chunks (--rows)



# Logical Backups

- Less-locking, without it Mydumper needs to keep FTWRL until all non-InnoDB tables are dumped



# Logical Backups

- Mydumper output files
  - metadata

Started dump at: 2014-04-18 22:01:30

SHOW MASTER STATUS:

Log: mysql-bin.017436

Pos: 890402821

SHOW SLAVE STATUS:

Host: 192.168.56.101

Log: mysql-bin.017057

Pos: 968001054

Finished dump at: 2014-04-19 03:10:05

# Logical Backups

- Mydumper output files
  - database.table.sql

```
/*!40101 SET NAMES binary*/;  
/*!40014 SET FOREIGN_KEY_CHECKS=0*/;  
/*!40103 SET TIME_ZONE='+00:00' */;  
INSERT INTO `t1` VALUES  
(1,"abc"),  
(2,"def"),  
(4,"abc"),  
(5,"abc"),  
(6,"abc"),  
(7,"abc"),  
(8,"abc");
```



# Binlog Mirroring



# Binlog Mirroring

- Mysqlbinlog (5.6)
  - Works with 5.1 and 5.5 master also
  - Mirror binlogs on the master on a second server
  - `mysqlbinlog --read-from-remote-server --raw --stop-never`



# Backup Locks

# Backup Locks

- **LOCK TABLE ... READ LOCAL**
  - Other sessions can read the table but can't write
  - LOCAL allows non conflicting INSERTs to MyISAM
- **FLUSH TABLES WITH READ LOCK**
  - Global read lock
  - Big issue on busy servers and long running selects
  - Requires tables be reopened which can be another bottleneck on busy servers
- **metadata locking since 5.5**
  - No DDLs to tables used in a transaction

# Backup Locks

- mysqldump
  - --lock-tables (default)
    - LOCK TABLES READ LOCAL
  - --lock-all-tables –master-data and –dump-slave
    - FLUSH TABLES WITH READ LOCK
  - --single-transaction (innodb only)
    - START TRANSACTION /\*!40100 WITH CONSISTENT SNAPSHOT \*/
  - --skip-lock-tables
    - No locks

# Backup Locks

- Mydumper
  - Always needs FTWRL to coordinate threads but for a small time if all tables are innodb
  - --less-locking
    - LOCK TABLES READ LOCAL for non-innodb
    - CONSISTENT SNAPSHOT for innodb
  - --use-savepoints
    - Reduce metadata locking issues
  - --no-locks
    - Not ensure a consistent backup

# Backup Locks

- Percona XtraBackup
  - FTWRL at the end to copy non transactional files and get binlog coordinates.
  - --rsync
    - Use rsync twice instead of cp each file, FTWRL for only the second rsync, didn't work with stream
  - --no-locks
    - Not ensure a consistent backup

# Backup Locks

- Percona Server 5.6 new locks for backups
- LOCK TABLES FOR BACKUP
  - Block updates to non-transactional tables
  - Block DDL to all tables
- LOCK BINLOG FOR BACKUP
  - blocks all updates to binary log
- UNLOCK BINLOG

# Backup Locks

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- Percona Server 5.6 new locks for backups
  - Percona XtraBackup 2.2
  - Mysqldump --lock-for-backup --single-transaction
  - Mydumper 0.6.2





# Examples

# Using Percona XtraBackup

- **Simple Backup:**

```
innobackupex --rsync --slave-info /backups/
```

- **Prepare**

```
innobackupex --apply-log --use-memory=2G --defaults-file=/etc/my.cnf /backups/latest/
```

- **Restore**

```
innobackupex --copy-back /backups/latest/
```

# Using Percona XtraBackup

- **Stream Backup:**

```
innobackupex -stream=tar ./ | gzip - > xb.tar
```

- **Unpack**

```
tar xvif xb.tar.gz
```

- **Can be piped to remote host:**

- **On destination:**

```
cd /destination/dir  
nc -l 873 | tar xvif -
```

- **On source:**

```
innobackupex -stream=tar ./ | gzip - | nc <dest_ip> 873
```

# Using Percona XtraBackup

- **Stream Backup:**

```
innobackupex --stream=xbstream --compress  
--parallel=4 ./ > xb.xbs
```

- **Unpack**

```
xbstream -x < xb.xbs -C /destination/dir
```

- **Can be piped to remote host:**

- **On destination:**

```
nc -l 873 | xbstream -x -C /destination/dir
```

- **On source:**

```
innobackupex --stream=xbstream ./ | nc <dest_ip> 873
```

# Using Mydumper

- Full Backup:

```
mydumper -h x.x.x.x --less-locking --compress -o  
/backup/dir
```

- Full Restore:

```
myloader -h x.x.x.x -d /backup/dir -o
```

# Using Mydumper

- **Partial Restore:**

```
cd /backup/dir
```

```
mkdir restore
```

```
cp -l db.* ./restore/
```

```
cp -l metadata ./restore/
```

```
myloader -h x.x.x.x -d /backup/dir/restore/ -o
```

# Using mysqlbinlog

- Copy binlogs:

```
mysqlbinlog --stop-never --raw --read-from-remote-server  
--host=127.0.0.1 mysql-bin.000001
```



**Tips**



# Tips

- Use the three types of backups
  - Binary for full restores, new slaves
  - Logical for partial restores
  - Binlog for point in time recovery
- Store on more than one server and off-site
- Test your backups!!!!
- Document restore procedures, script them and test them!!!

# Tips (cont)

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- If taking from a slave run `pt-table-checksum`
- Configuration files, scripts
- Do you need to backup everything all days?
- Hardlinking backups can save lot of disk space in some circumstances
- Monitor your Backups



# Percona Backup Service

# Percona Backup Service

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- Managed MySQL backup and recovery combining our best practices and software tools with your backup servers
  - Percona ensures your backups run smoothly and reliably
  - Backup data sets are always available
  - Percona manages production recovery
  - Lower TCO than managing in-house
  - Any combination of MySQL server and backup locations
  - Flexible backup configurations per customer
  - More information at [www.percona.com](http://www.percona.com)



# Thank you and Q&A

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