

# MySQL Corruptions Troubleshooting: Case Studies

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**Company: SIA CoMinder (Latvia)**

# About speaker

## Andrey Chervonets (Андрей Червонец)

- founded company: SIA CoMinder (Latvia) in 2011.
- Experience: 25+ years' experience of supporting systems based on Oracle products and technologies (and all around) on several OS platforms.
- Education: Higher, Economics (Rīga, Moscow).
- IT Certified:
  - Oracle Database OCP/OCE
  - Oracle AS/WebLogic OCP
  - IBM DB2, Guardium,
  - Zabbix CS (monitoring system)
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# About CoMinder

The logo for CoMinder, featuring the word "CoMinder" in a blue sans-serif font. The "Co" is in a lighter blue, and "Minder" is in a darker blue. A thin red horizontal line is positioned below the text.

- SIA CoMinder has been founded in 2011:
  - to provide better DBA expert services
  - for customers interested in improvements
- Main focus areas:
  - Database/Middleware administration:  
**consulting, project works, 24\*7\*365 SLA based outsourcing**
  - Operating system administration (Linux, Windows)
  - Data processing automation
  - Monitoring
  - Support tools development
  - Specific task upon customers request
- Visit <https://cominder.eu/> for more details.

# Agenda



## Agenda for "Database" focused 154th DevClub.lv

- **Andrey Chervonets** from **CoMinder** will give a talk "MySQL Corruptions Troubleshooting: Case Studies".

This presentation is intended for beginners.

After years of work, every IT professional gains their own unique experience that can help them in the future.

Good old common sense, based on human intellect and time-proven methods, will save your time in the age of AI-driven technologies.

Using real-life cases, I will show how basic troubleshooting methods can save your time and how to avoid common pitfalls when unplanned issues arise.

Some corruption recovery techniques will be learned as well.

Case 1: Ubuntu + Zabbix upgrade failed due to problems with MySQL database. Logical data corruption while no issues with software upgrade .

Case 2: Zabbix MySQL database corruptions recovery after storage hardware issues.

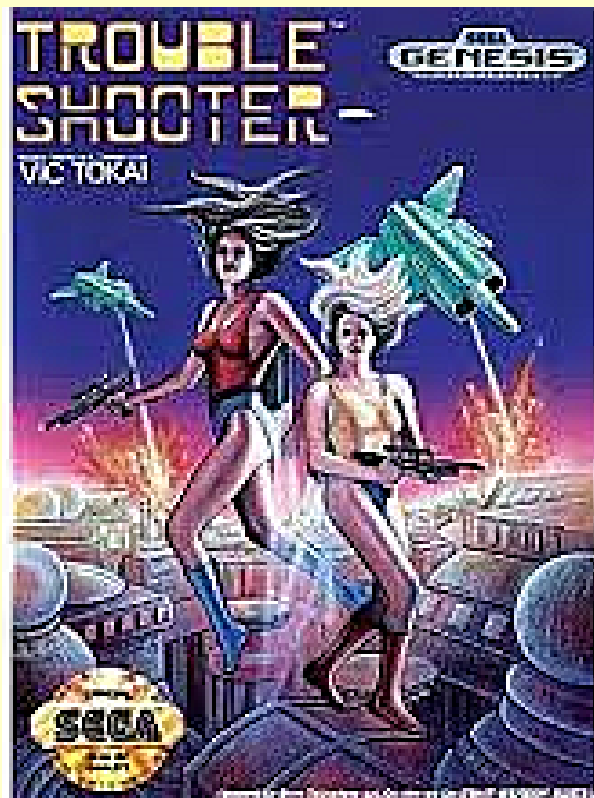
# Agenda

- Troubleshooting – what is it about?!
- Troubleshooting constraints matter
- Case-1: Ubuntu + Zabbix upgrade attempt failed due to problems with MySQL database data. Logical data corruption while no issues with software upgrade
- Case-2: Zabbix MySQL database corruptions recovery after physical storage hardware issues.
- Q + A

# Disclaimer

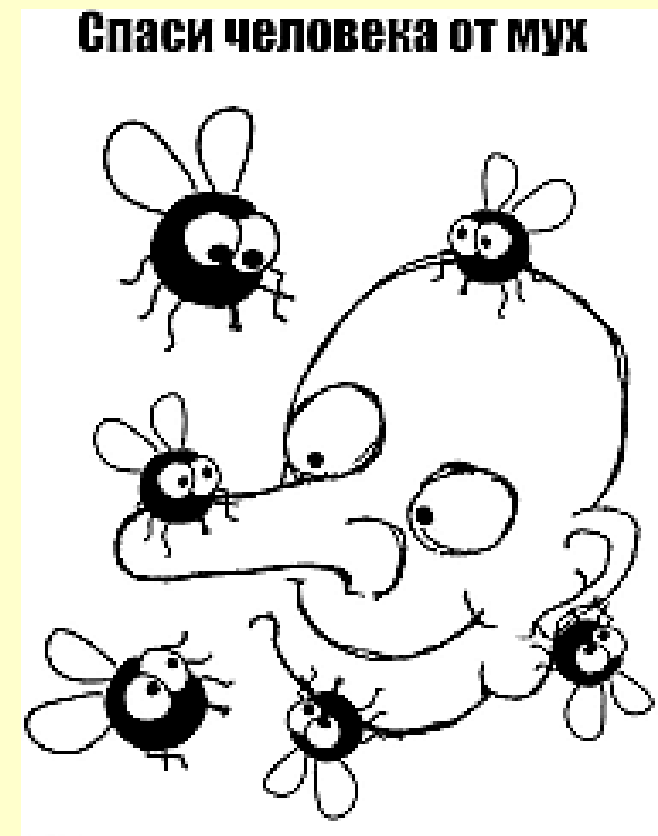
- Will NOT discuss:
  - Exact command syntax, specifications
  - Does it work in .... version .... at ... platform..
- Use at Your own risk!
- Do NOT believe me!
  - Try to understand first how does it really work
  - **Test** in your specific project / environment(s)
  - Everything may change in new version
  - Invent, design better (and share to community)

Any feedback is welcome!



Troubleshooting

What is it?!



# Troubleshooting is...

- **0) Do NOT panic! Do not make too fast decisions/actions (15+ min.)!**
- **1) Find what is the trouble is exact case (not a generic)**
  - How it should be (A)
  - How it is now (B)
  - Find the difference
    - ›  $\Delta > 0$
    - › Is it a problem? Why?
    - › Is is a trouble? What is the impact on .... ?!
- **2) Define what is the real trouble(s), priorities?!**
  - Service Downtime
  - Data loss
  - Lack Time / Availability of expert (DBA, Admin, Manager, Owner)
  - Resources (disk space, processor, ....)
  - Security
  - Price: Penalties/Cost of recovery for DBA/Manager/Company/Customer/...

# Troubleshooting steps...

- **3) Define acceptable solution/outcome**
  - System is running (with some | no data loss | missing)
  - All data recovered
  - System state and data restored to some point in time
  - Process (upgrade/migration...) is completed / restarted....
  - .....
- **4) Determine Constraints**
  - Time (fix should be done in 123... minutes/hours/days)
  - Resources (VM, disk space, network, CPU, memory)
  - Services running (must/wanted/nice-to-have - all/some)
  - Money – how much \$ € Ls may be spent
  - Silence (we need some un-interruptable time-space for thinking/ decisions )
  - Experts advice available....

**Make the right choice....**



# Troubleshooting steps...

- **5) Investigate facts and Evaluate the “execution”/”fix” path**
  - Carefully read the error messages (all layers)
  - Investigate log-records (app/db/os/storage)
  - Record time-line on all layers
  - Determine the cause of issue and required changes to fix
  - **Agree on expected results,constraints** (time/data-loss/service-loss/etc)
- **6) “Shoot the trouble” – choose the acceptable way, based on constraints**
  - Restore the database from backup (cold/hot)
  - Restore VM from backup/snapshot
  - Investigate the issue cause and implement fix/workaround solution
  - Investigate root cause and fix it (yourself or with adhoc people)
  - **Agree on better/wider constraints if required**
  - Ask advice (Expert/Search/AI) and **TEST It first!**
  - **Apply solution in final environment!**

# Troubleshooting steps...

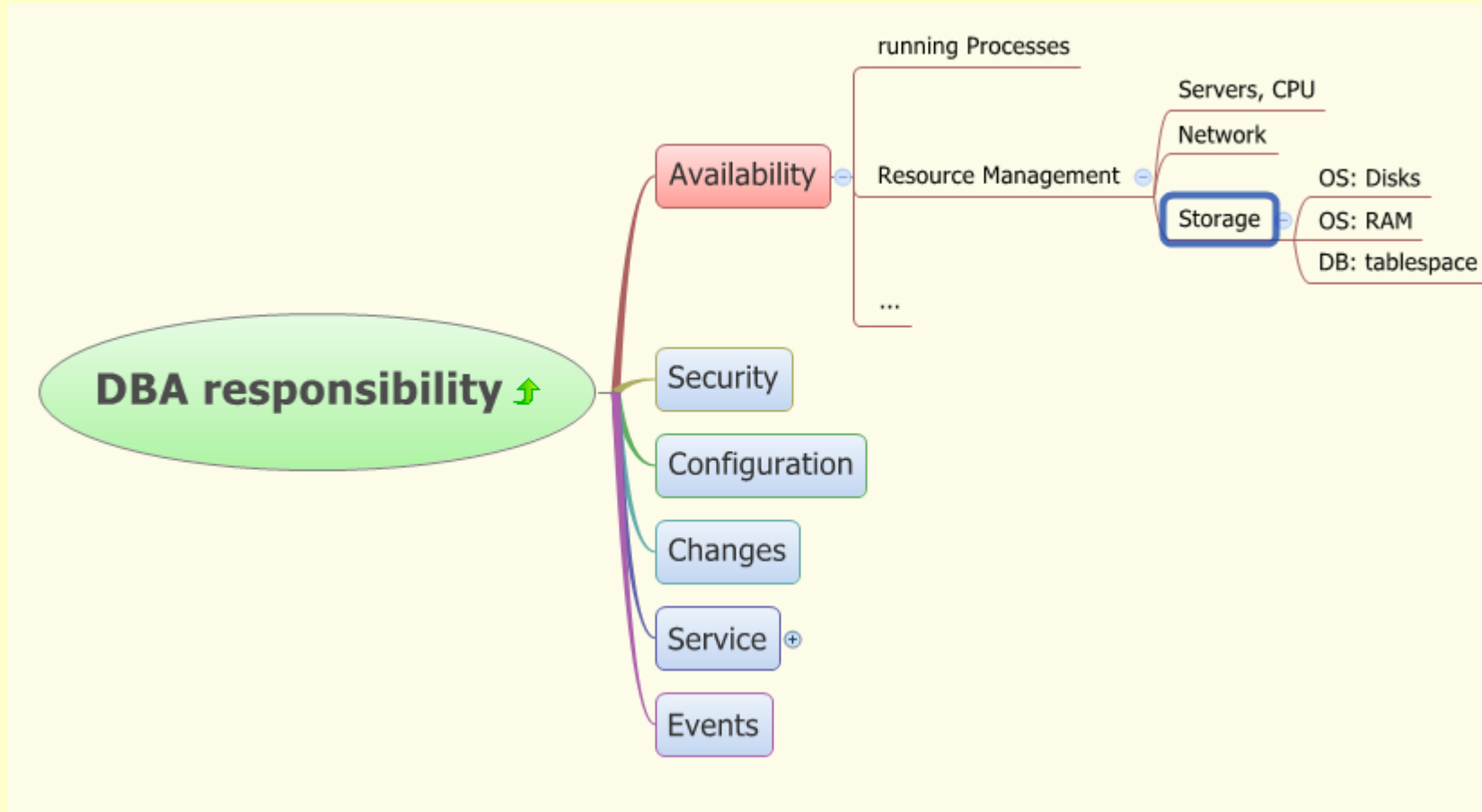
- **7) Check and Report the results**
  - Verify the results of performed actions
  - **Compare with acceptable result defined at step 3**
  - Report the result and work/changes done!
  - **Get written confirmation that the result tested/accepted!**
- **8) Record case results to your Knowledge Base / Issues tracking system**
  - Log-records, human communications, timestamp for each fact!
  - Findings, notes, ideas
  - Lessons learned
  - Solutions found
  - How to avoid trouble in the future
  - Homework to do later, deadlines

**Make the right choice....**



# Who cares?

Why me?



## Case-1:

# Ubuntu + Zabbix upgrade attempt failed

**Cause:** Problems with MySQL database data.

But: Wrong data returned by some queries

while no issues during OS and software upgrade

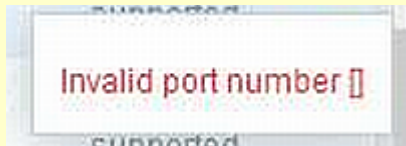
**Root Cause:** Software Bug

# Case-1: Problem after upgrade

- **Task: Zabbix upgrade from V5 to V6**
  - Source
    - › Operating System: Ubuntu 20.04.1 LTS ( 5.4.0-66-generic)
    - › Zabbix: 5.2.3
    - › MySQL: 5.7.32
  - Target (plan)
    - › Operating System: Ubuntu 22.04.2 LTS (5.15.10-nnnnn)
    - › Zabbix: 6.4.4
    - › MySQL: 8.0.33
  - Action Plan
    - › Clone source VM
    - › Do upgrade steps on cloned VM + TEST
    - › Repeat upgrade steps on target VM

# Case-1: Problem after upgrade

- **What happened:**
  - Upgrade:
    - › Ubuntu OS – OK, no issues
    - › MySQL packages, DB upgrade steps – OK, no errors
    - › Zabbix upgrade steps: no errors
  - Zabbix service:
    - › Database – no corruption reported
    - › Zabbix UI - “Invalid port number” on some hosts information
    - › Zabbix server logs: plenty of errors like:
      - › “item ""HOSTNAME:system.swap.size[,free]” became not supported: **Invalid port number []**
  - Problem cause:
    - › **Some** queries from zabbix.interface, zabbix.scripts tables returned wrong results
    - › Root cause: MySQL bug (in version 8.0.33)



# Case-1: Problem after upgrade

- **Diagnostic actions (also after good upgrades):**
  - Check tables metadata, structure, compare with source system:
    - › `desc zabbix.scripts | desc zabbix.interface;`
    - › `show create table zabbix.scripts | desc zabbix.interface;`
  - Check execution plans (assume problem with just wrong index):
    - › `explain select name from zabbix.scripts;`
    - › `explain select scriptid, name from zabbix.scripts;`
    - › `explain select * from zabbix.scripts;`
  - Query some | all records and compare results:
    - › `select name from zabbix.scripts;`
    - › `select scriptid, name from zabbix.scripts;`
    - › `select scriptid, name, command, description from zabbix.scripts;`
    - › `select * from zabbix.scripts;`

# Case-1: table structure/data diagnostic

```
mysql> desc zabbix.scripts;
```

Field	Type	Null	Key	Default	Extra
scriptid	bigint unsigned	NO	PRI	NULL	
name	varchar(255)	NO	UNI		
command	varchar(255)	NO			
host_access	int	NO		2	
usrgrpid	bigint unsigned	YES	MUL	NULL	
groupid	bigint unsigned	YES	MUL	NULL	
description	text	NO		NULL	
confirmation	varchar(255)	NO			
type	int	NO		0	
execute_on	int	NO		2	
timeout	varchar(32)	NO		30s	

```
11 rows in set (0.01 sec)
```

```
mysql> show create table zabbix.scripts;
```

```
+-----+-----+
| Table | Create Table
+-----+-----+
| scripts | CREATE TABLE `scripts` (
  `scriptid` bigint unsigned NOT NULL,
  `name` varchar(255) COLLATE utf8mb3_bin NOT NULL DEFAULT '',
  `command` varchar(255) COLLATE utf8mb3_bin NOT NULL DEFAULT '',
  `host_access` int NOT NULL DEFAULT '2',
  `usrgrpid` bigint unsigned DEFAULT NULL,
  `groupid` bigint unsigned DEFAULT NULL,
  `description` text COLLATE utf8mb3_bin NOT NULL,
  `confirmation` varchar(255) COLLATE utf8mb3_bin NOT NULL DEFAULT '',
  `type` int NOT NULL DEFAULT '0',
  `execute_on` int NOT NULL DEFAULT '2',
  `timeout` varchar(32) CHARACTER SET utf8mb3 COLLATE utf8mb3_bin NOT NULL DEFAULT '30s',
  PRIMARY KEY (`scriptid`),
  UNIQUE KEY `scripts_3` (`name`),
  KEY `scripts_1` (`usrgrpid`),
  KEY `scripts_2` (`groupid`),
  CONSTRAINT `c_scripts_1` FOREIGN KEY (`usrgrpid`) REFERENCES `usrgrp` (`usrgrpid`) ON DELETE RESTRICT ON UPDATE RESTRICT,
  CONSTRAINT `c_scripts_2` FOREIGN KEY (`groupid`) REFERENCES `hstgrp` (`groupid`) ON DELETE RESTRICT ON UPDATE RESTRICT
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb3 COLLATE=utf8mb3_bin |
```

```
1 row in set (0.00 sec)
```

# Case-1: table structure/data diagnostic

```
mysql> explain select name from zabbix.scripts;
+----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| id | select_type | table | partitions | type | possible_keys | key | key_len | ref | rows | filtered | Extra |
+----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| 1 | SIMPLE | scripts | NULL | index | NULL | scripts_3 | 767 | NULL | 3 | 100.00 | Using index |
+----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
1 row in set, 1 warning (0.00 sec)

mysql> explain select scriptid, name from zabbix.scripts;
+----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| id | select_type | table | partitions | type | possible_keys | key | key_len | ref | rows | filtered | Extra |
+----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| 1 | SIMPLE | scripts | NULL | index | NULL | scripts_3 | 767 | NULL | 3 | 100.00 | Using index |
+----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
1 row in set, 1 warning (0.00 sec)

mysql> explain select * from zabbix.scripts;
+----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| id | select_type | table | partitions | type | possible_keys | key | key_len | ref | rows | filtered | Extra |
+----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| 1 | SIMPLE | scripts | NULL | ALL | NULL | NULL | NULL | NULL | 3 | 100.00 | NULL |
+----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
1 row in set, 1 warning (0.00 sec)

mysql> explain select scriptid, name, command, description from zabbix.scripts;
+----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| id | select_type | table | partitions | type | possible_keys | key | key_len | ref | rows | filtered | Extra |
+----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| 1 | SIMPLE | scripts | NULL | ALL | NULL | NULL | NULL | NULL | 3 | 100.00 | NULL |
+----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
1 row in set, 1 warning (0.00 sec)
```

# Case-1: table structure/data diagnostic

```
mysql> select name from zabbix.scripts;
```

```
+-----+
| name |
+-----+
| Detect operating system |
| Ping |
| Traceroute |
+-----+
```

```
3 rows in set (0.00 sec)
```

```
mysql> select scriptid, name from zabbix.scripts;
```

```
+-----+-----+
| scriptid | name |
+-----+-----+
| 3 | Detect operating system |
| 1 | Ping |
| 2 | Traceroute |
+-----+-----+
```

```
3 rows in set (0.00 sec)
```

```
mysql> select scriptid, name, command, description from zabbix.scripts;
```

```
+-----+-----+-----+-----+
| scriptid | name | command | description |
+-----+-----+-----+-----+
| 1 | 30s | Ping | /ping -c 3 {HOST.CONN} 2>&1? |
| 2 | 30s | Traceroute | /bin/traceroute {HOST.CONN} 2>&1? |
| 3 | 30s | Detect operating system | n/nmap -O {HOST.CONN} 2>&1? |
+-----+-----+-----+-----+
```

```
3 rows in set (0.00 sec)
```

```
mysql> select * from zabbix.scripts;
```

```
+-----+-----+-----+-----+-----+-----+
| scriptid | name | command | host_access | usrgrpid | groupid | description |
+-----+-----+-----+-----+-----+-----+
| 1 | 30s | Ping | -1352504978 | NULL | NULL | /ping -c 3 {HOST.CONN} 2>&1? |
| 2 | 30s | Traceroute | -1351257230 | NULL | NULL | /bin/traceroute {HOST.CONN} 2>&1? |
| 3 | 30s | Detect operating system | -210410385 | 2319201471816491625 | NULL | n/nmap -O {HOST.CONN} 2>&1? |
+-----+-----+-----+-----+-----+-----+
```

```
3 rows in set (0.00 sec)
```

# Case-1: table structure/data diagnostic

```
mysql> select name from zabbix.scripts;
```

```
+-----+
| name |
+-----+
| Detect operating system |
| Ping |
| Traceroute |
+-----+
3 rows in set (0.00 sec)
```

```
mysql> select scriptid, name from zabbix.scripts;
```

```
+-----+-----+
| scriptid | name |
+-----+-----+
| 3 | Detect operating system |
| 1 | Ping |
| 2 | Traceroute |
+-----+-----+
3 rows in set (0.00 sec)
```

```
mysql> select scriptid, name, command, description from zabbix.scripts;
```

```
+-----+-----+-----+-----+
| scriptid | name | command | description |
+-----+-----+-----+-----+
| 1 | 30s | Ping | /ping -c 3 {HOST.CONN} 2>&1? |
| 2 | 30s | Traceroute | /bin/traceroute {HOST.CONN} 2>&1? |
| 3 | 30s | Detect operating system | n/nmap -O {HOST.CONN} 2>&1? |
+-----+-----+-----+-----+
3 rows in set (0.00 sec)
```

```
mysql> select * from zabbix.scripts;
```

```
+-----+-----+-----+-----+-----+-----+-----+
| scriptid | name | command | host_access | usrgroupid | groupid | description |
+-----+-----+-----+-----+-----+-----+-----+
| 1 | 30s | Ping | -1352504978 | NULL | NULL | /ping -c 3 {HOST.CONN} 2>&1? |
| 2 | 30s | Traceroute | -1351257230 | NULL | NULL | /bin/traceroute {HOST.CONN} 2>&1? |
| 3 | 30s | Detect operating system | -210410385 | 2319201471816491625 | NULL | n/nmap -O {HOST.CONN} 2>&1? |
+-----+-----+-----+-----+-----+-----+-----+
3 rows in set (0.00 sec)
```

# Case-1: table structure/data diagnostic

```
DISABLE_URL1 | int | NO | | | |
+-----+-----+-----+-----+-----+
12 rows in set (0.00 sec)

mysql> explain select hostid, type from zabbix.interface;
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| id | select_type | table | partitions | type | possible_keys | key | key_len | ref | rows | filtered | Extra |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| 1 | SIMPLE | interface | NULL | index | NULL | interface_1 | 12 | NULL | 62 | 100.00 | Using in
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
1 row in set, 1 warning (0.00 sec)

mysql> explain select hostid, interfaceid, useip, dns, ip from zabbix.interface;
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| id | select_type | table | partitions | type | possible_keys | key | key_len | ref | rows | filtered | Extra |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| 1 | SIMPLE | interface | NULL | ALL | NULL | NULL | NULL | NULL | 62 | 100.00 | NULL |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
1 row in set, 1 warning (0.00 sec)

+-----+-----+
| hostid | type |
+-----+-----+
| 10084 | 1 |
| 10110 | 1 |
| 10124 | 1 |
| 10125 | 1 |
| 10126 | 1 |
| 10126 | 2 |
| 10132 | 1 |
+-----+-----+
7 rows in set (0.01 sec)
```

# Case-1: table structure/data diagnostic

- Diagnostic

```
+-----+-----+
| hostid | type |
+-----+-----+
| 10084  | 1    |
| 10110  | 1    |
| 10124  | 1    |
| 10125  | 1    |
| 10126  | 1    |
| 10126  | 2    |
| 10132  | 1    |
+-----+-----+
7 rows in set (0.01 sec)

mysql> select hostid, interfaceid, useip, dns, ip from zabbix.interface LIMIT 7;
+-----+-----+-----+-----+-----+
| hostid          | interfaceid | useip | dns          | ip          |
+-----+-----+-----+-----+-----+
| 2147483648      | 1           | 1     | 27.0.0.1159.1 | ? ? 1      |
| 139640124211200 | 11          | 1     | 68.0.129192.1 | ? ? 192.1  |
| 2147483648      | 36          | 1     | 16.134.2159.1 | ? ? 172.   |
| 139640124211200 | 39          | 1     | 68.0.131192.1 | ? ? 192.1  |
| 2147483648      | 42          | 1     | 68.0.12691.19 | ? ? 192.1  |
| 6930582895689990144 | 43         | 1     |                | ? ? 1      |
| 6442450944      | 54          | 1     | 16.134.3159.1 | ? ? 172.   |
+-----+-----+-----+-----+-----+
7 rows in set (0.00 sec)
```

# Case-1: table structure/data diagnostic

- Diagnostic

```
+-----+-----+
| hostid | type |
+-----+-----+
| 10084  | 1    |
| 10110  | 1    |
| 10124  | 1    |
| 10125  | 1    |
| 10126  | 1    |
| 10126  | 2    |
| 10132  | 1    |
+-----+-----+
7 rows in set (0.01 sec)
```

mysql> select hostid, interfaceid, useip, dns, ip from zabbix.interface LIMIT 7;

```
+-----+-----+-----+-----+-----+
| hostid | interfaceid | useip | dns | ip |
+-----+-----+-----+-----+-----+
| 2147483648 | 1 | 1 | 27.0.0.1159.1 | ? ? 1 |
| 139640124211200 | 11 | 1 | 68.0.129192.1 | ? ? 192.1 |
| 2147483648 | 36 | 1 | 16.134.2159.1 | ? ? 172. |
| 139640124211200 | 39 | 1 | 68.0.131192.1 | ? ? 192.1 |
| 2147483648 | 42 | 1 | 68.0.12691.19 | ? ? 192.1 |
| 6930582895689990144 | 43 | 1 | | ? ? 1 |
| 6442450944 | 54 | 1 | 16.134.3159.1 | ? ? 172. |
+-----+-----+-----+-----+-----+
7 rows in set (0.00 sec)
```

# Case-1: WA/Fix steps

- **Investigation:**
  - Own SQL queries:
    - › Found that result depends on execution plans
    - › Found totally wrong values are returned on some queries
  - External search
    - › No identical case found
    - › Zabbix Forum – no relevant case
    - › Registered Zabbix Forum topic, then updated myself after fix  
Subject: **“Interface, scripts tables content corrupted during upgrade to 6.4.4 or 6.0.19 (LTS).”**
    - › <https://www.zabbix.com/forum/zabbix-troubleshooting-and-problems/467806-interface-scripts-tables-content-corrupted-during-upgrade-to-6-4-4-or-6-0-19-lts>
  - Tested with 2 Zabbix (target) versions!!! **So => MySQL issue!**

# Case-1: database/table metadata check

- **Diagnostic**

```
SELECT TABLE_SCHEMA  
      , TABLE_NAME  
      , TABLE_COLLATION  
FROM INFORMATION_SCHEMA.TABLES where TABLE_SCHEMA='zabbix' and TABLE_NAME='interface';
```

TABLE_SCHEMA	TABLE_NAME	TABLE_COLLATION
zabbix	interface	utf8mb3_bin

- **WA - not helped:**

```
ALTER DATABASE  
  database_name  
  CHARACTER SET = utf8mb4  
  COLLATE = utf8mb4_unicode_ci;
```

# Case-1: WA/Fix steps

- **Action plan:**
  - **Assume it is MySQL Bug ( indirect confirmation found):**
  - From MySQL docs (8.x): “The **utf8mb3** character set is **deprecated** and you should expect it to be removed in a future MySQL release. Please use utf8mb4 instead. **utf8 is currently an alias for utf8mb3**, but it is now deprecated as such, and utf8 is expected subsequently to become a reference to utf8mb4. Beginning with MySQL 8.0.28, utf8mb3 is also displayed in place of utf8 in columns of Information Schema tables, and in the output of SQL SHOW statements.”
  - **Restore TEST VM/DB from backup, wait for next MySQL version:**
  - Looks like a **MySQL Bug #35410528**, fixed in 8.0.34: “An in-place upgrade from MySQL 5.7 to MySQL 8.0, without a server restart, could result in unexpected errors when executing queries on tables. This fix eliminates the need to restart the server between the upgrade and queries.”
  - Src: <https://dev.mysql.com/doc/relnotes/mysql/8.0/en/news-8-0-34.html>
  - **Install fresh MySQL version – 8.0.34**
  - **Repeat /restart upgrade steps (in TEST env.) => SUCCESS!**
  - **Do the same for Production environment.**

# Case-1: Final configuration

- **Task Final Result: Zabbix Server upgraded from V5 to V6**
  - Source:
    - › Operating System: Ubuntu 20.04.1 LTS ( 5.4.0-66-generic)
    - › Zabbix: 5.2.3
    - › MySQL: 5.7.32
  - Target (fact)
    - › Operating System: Ubuntu 22.04.2 LTS (5.15.0-76-generic )
    - › Zabbix: **6.4.6**
    - › MySQL: **8.0.34-0ubuntu0.22.04.1** (with bug fixed)
  - **Critical Resources:**
    - › VM for TEST
    - › Have enough Time for test/investigate/MySQL fix.

## Case-2:

Zabbix MySQL database corruptions recovery  
after physical storage hardware issues.

**Cause:** file system corruption.

**Root Cause:** Incomplete storage array RAID rebuild after hardware issues  
and HDD replacement.

# Case-2: What happened

- Issue facts:
  - Zabbix – charts, trends and some other reports not working in Web UI
  - Zabbix Server
    - › Many errors [Z3005], [Z3001] in zabbix\_server.log
    - › Happened once per 30 minutes (scheduled to update trends?)

```
[Z3005] query failed: [2013] Lost connection to MySQL server during query [insert into trends (itemid,clock,num,value_min,value_avg,value_max) values (  
[Z3001] connection to database 'zabbix' failed: [2013] Lost connection to MySQL server at 'reading initial communication packet', system error: 104  
database is down: reconnecting in 10 seconds  
[Z3001] connection to database 'zabbix' failed: [2013] Lost connection to MySQL server at 'reading initial communication packet', system error: 104  
database is down: reconnecting in 10 seconds  
[Z3001] connection to database 'zabbix' failed: [2013] Lost connection to MySQL server at 'reading initial communication packet', system error: 104
```



# Case-2: TA

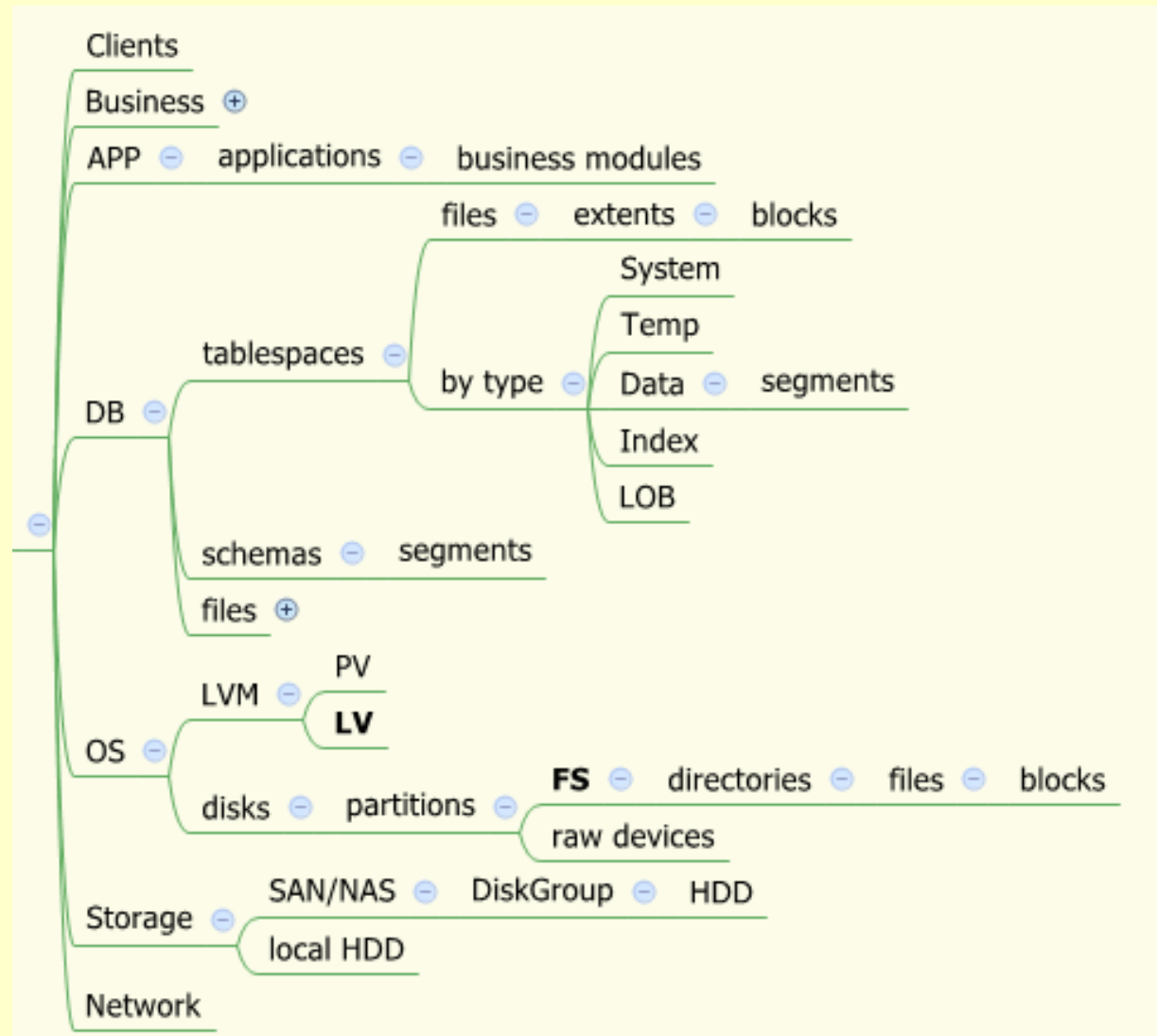
- **System TA**

- Zabbix, MySQL on the same host (Ubuntu) – virtual machine (VM)
- VM processed by Hyper-V:
  - › Virtual HDD provided as Windows FS files (not SAN/NAS)
  - › Dedicates logical disk for VMs files
  - › Logical disk use hardware RAID(5/6?) volume
- OS: Ubuntu Linux 22.04
- MySQL version: mysqld 8.0.39-0ubuntu0.22.04.1
- **Host role: Monitoring server!!!**

>

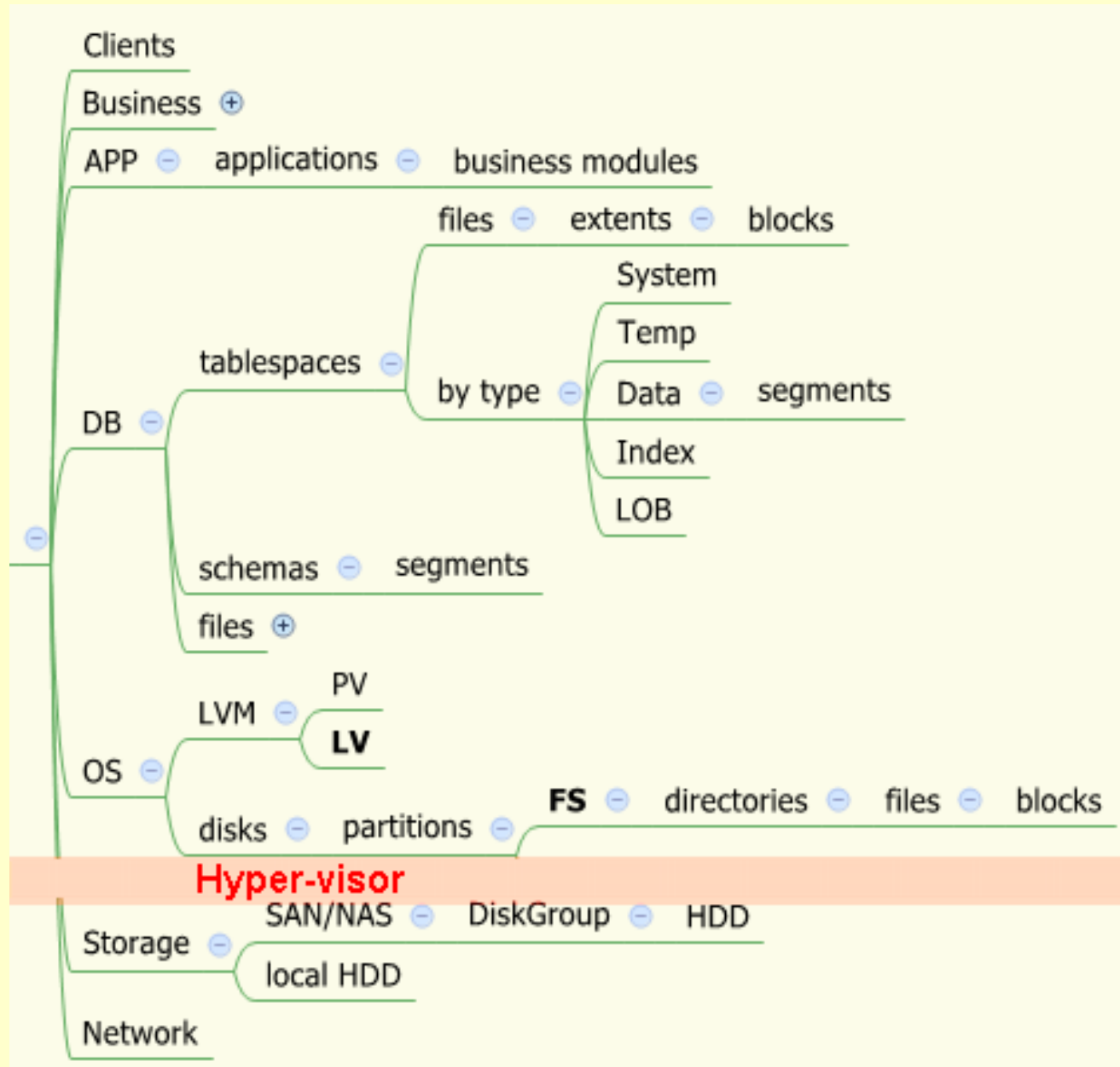
# Disk Space Architecture

- 7 level vertical model



# Disk Space Architecture

- 7+ level vertical model



# Troubleshooting steps...

- **Events Time log**
  - 03.03 (Tue) – DBA received phone call about Zabbix services troubles once per 30 min. for several days.
  - 26.02/27.02- Issue happened after unplanned hardware downtime (Hypervisor-server) – down 26.02. restarted 27.02
  - 03/04.03 – Diagnostic summary reported to Help Desk + system administrators
  - 04/05.03 – some tables was able to recreate
  - Zabbix was stated as critical service, so advised to minimise downtime
- **Diagnostic findings:**
  - File pages corrupted: 56 pages (in 11 tables)
  - Files corrupted: 11 files (11 tables)
    - 1 table not changed – restored from FS backup
    - some tables are readable (used data blocks not affected)

# Diagnostics steps...

- **Corruption diagnostics actions - offline**
  - Stop Zabbix (other apps) + MySQL Service
  - Run **innochecksum** with `--allow-mismatches=NNN` for every data-file
    - › NNN – how many errors to ignore until terminate call.

```
# -- where DB files are located
MYSQL_DATA_PATH=/database-data-mountpoint-or-dir-path
# -- where to store local backup (recommended)
BACKUP_DIR_PATH=/backup-mountpoint-or-dir-path
#
# for every table, for example:
TARGET_TABLE_NAME=trends
TARGET_FILE_NAME=${TARGET_TABLE_NAME}.ibd
TARGET_FILE_FILEPATH=${MYSQL_DATA_PATH}/${TARGET_FILE_NAME}
BACKUP_FILE_FILEPATH=${BACKUP_DIR_PATH}/${TARGET_FILE_NAME}

# check size, do backup
du -sh ${TARGET_FILE_FILEPATH}
cp -pv ${TARGET_FILE_FILEPATH} ${BACKUP_FILE_FILEPATH}; echo $?
# verify:
date; ls -l ${BACKUP_FILE_FILEPATH}; du -sh ${BACKUP_FILE_FILEPATH}
#==

#==: restore file (if required)
# SKIP until required
# cp -pv ${BACKUP_SNAP_FILEPATH} ${TARGET_FILE_FILEPATH}; echo $?
# du -sh ${TARGET_FILE_FILEPATH}
# ls -l ${TARGET_FILE_FILEPATH}
#==

# test with innodbcheck:
#==:
innochecksum --verbose --page-type-summary --allow-mismatches=200 ${TARGET_FILE_FILEPATH}
#==
```

# Diagnostics steps...

- **Corruption diagnostics actions – online**
  - Run **mysqlcheck** tool for each table with some options
    - --check + --quick -- a bot less check/trials
    - --check - normal check
    - -- repair (if check normally finished)
    - -- repair may not work in some cases
  - Or execute **CHECK TABLE** in MySQL client
  - If OK – do query on table, export.

```
# check online
#==:
date; echo "# checking table zabbix.${TARGET_TABLE_NAME} online QUICK MODE ..."
mysqlcheck -hlocalhost -uroot --check -p --quick --tables zabbix ${TARGET_TABLE_NAME}
echo $?

#==
#==:
date; echo "# checking table zabbix.${TARGET_TABLE_NAME} online NORMAL MODE ..."
mysqlcheck -hlocalhost -uroot --check -p --tables zabbix ${TARGET_TABLE_NAME}
echo $?

#==
# zabbix.changelog OK
# checkig table zabbix.trends online NORMAL MODE ...
# Enter password:
# mysqlcheck: Got error: 2013: Lost connection to MySQL server during query when executing 'CHECK TABLE ... '
# THIS ALSO cause MySQL service to restart
```

# Diagnostics steps...

- **In case of crash/corruption**
  - Can try employ adhoc MySQL instance settings
    - › **log\_error\_verbosity=3**
    - › **innodb\_force\_recovery=1**
    - › Higher values must be used very carefully!!
    - › Db instance/service restart is required
  - Will see warnings in MySQL error.log:  
“[Note] [MY-012946] [InnoDB] !!! innodb\_force\_recovery is set to 1 !!!”
  - **Read the documentation BEFORE use:**
    - › <https://dev.mysql.com/doc/refman/9.7/en/forcing-innodb-recovery.html>
    - › <https://rossmannngroup.com/services/database-recovery/mysql>

# Fix options...

- **Restore database from Backup (if acceptable)**
  - Offline backup – if available – will return data to backup time
  - Offline backup + MySQL Binary logs - if available – up to Time-X
  - Online backup (export dump) if available – will return data to backup time (consistency)
  - Online backups (like Veeam) + MySQL binary logs – up to Time-X
- **Repair table one-by one**
  - Run **mysqlcheck** tool with – repair option
  - Or execute REPAIR **TABLE** in MySQL client
  - -- repair (if check normally finished)
  - -- repair may not work in some cases
  - -- if CHECK has completed
  - -- and If You are lucky one – REPAIR option does NOT apply in some cases

# Fix options...

- **Recover table one-by one**
  - Run **mysqlcheck** tool with – check option
  - Or execute REPAIR **TABLE** in MySQL client
  - IF OK, do the following:
    - Export all rows using mysqldump (or other tool)
    - Truncate or drop table
    - Re-create/Import using mysqldump (or other tool)
  - BUT:
    - **Constraints (PK, FK, UK)!!**
    - **Time and Disk space for large tables!!!**
  - May need to use with innodb\_force\_recovery

```
# DO export in recovery mode
#==:
mysqldump -uroot -p --set-gtid-purged=OFF --single-transaction zabbix ${TARGET_TABLE_NAME} 1>${BACKUP_DIR_PATH}/backup.zabbix.${TARGET_TABLE_NAME}.sql
mysqldump -uroot -p --set-gtid-purged=OFF zabbix ${TARGET_TABLE_NAME} 1>${BACKUP_DIR_PATH}/backup.zabbix.${TARGET_TABLE_NAME}.sql

ls -l ${BACKUP_DIR_PATH}/backup.zabbix.${TARGET_TABLE_NAME}.sql
du -sh ${BACKUP_DIR_PATH}/backup.zabbix.${TARGET_TABLE_NAME}.sql
#==
Enter password:

#--: this may crash as well:
mysqldump: Error 2013: Lost connection to MySQL server during query when dumping table `trends` at row: 2426247
#--
```

# Fix options...

- **Table salvage one-by one**
  - Run **mysqlcheck** tool with – check option
  - Or execute REPAIR **TABLE** in MySQL client
  - IF OK, do the following:
    - Export all rows using, but SKIP some of them (construct where ... yourselves)
    - Export not-corrupted rows | fields (construct where ... yourselves)
    - Truncate or drop table
    - Re-create table, Import exported data using mysqldump (or other tool)
  - BUT:
    - **Constraints (PK, FK, UK)!!**
    - **Time for downtime and Disk space for large tables!!!**
  - May need to use with innodb\_force\_recovery
  - Some Data LOSS – re-check it is acceptable for data owner.

# Case-2 – final results

- **Using some of described options:**
  - Restored/Recovered all tables, with exception of 3 ones:
    - **trends** – 284 MiB (5 pages corrupted) – not too critical
    - **history** – 2.6 GiB (19 pages failed) – not too critical
    - **events** - 2.9 GiB (9 pages failed), **exported**, but constraints – requested longer downtime for recovery.
- **But at the same time** ..... (in “parallel universe” .... )  
someone else tried to do the best... at deeper level of TA.

# Case-2 – final results

- **But – Human behaviour:**

- BUT1:

- New corruptions observed at Linux OS!!!
- Cause: Storage RAID rebuild was not really rebuilt as expected.  
Admins started re-build storage RAID again  
without any notice to DBA.  
On running system (Hyper-V)

> :(

- BUT2:

- **After Storage RAID had been finally rebuilt – admins just restored VM from offline backup 2-3 weeks before without any notice to DBA.**
- => DBA time, efforts – wasted!

- **Lessons learned:**

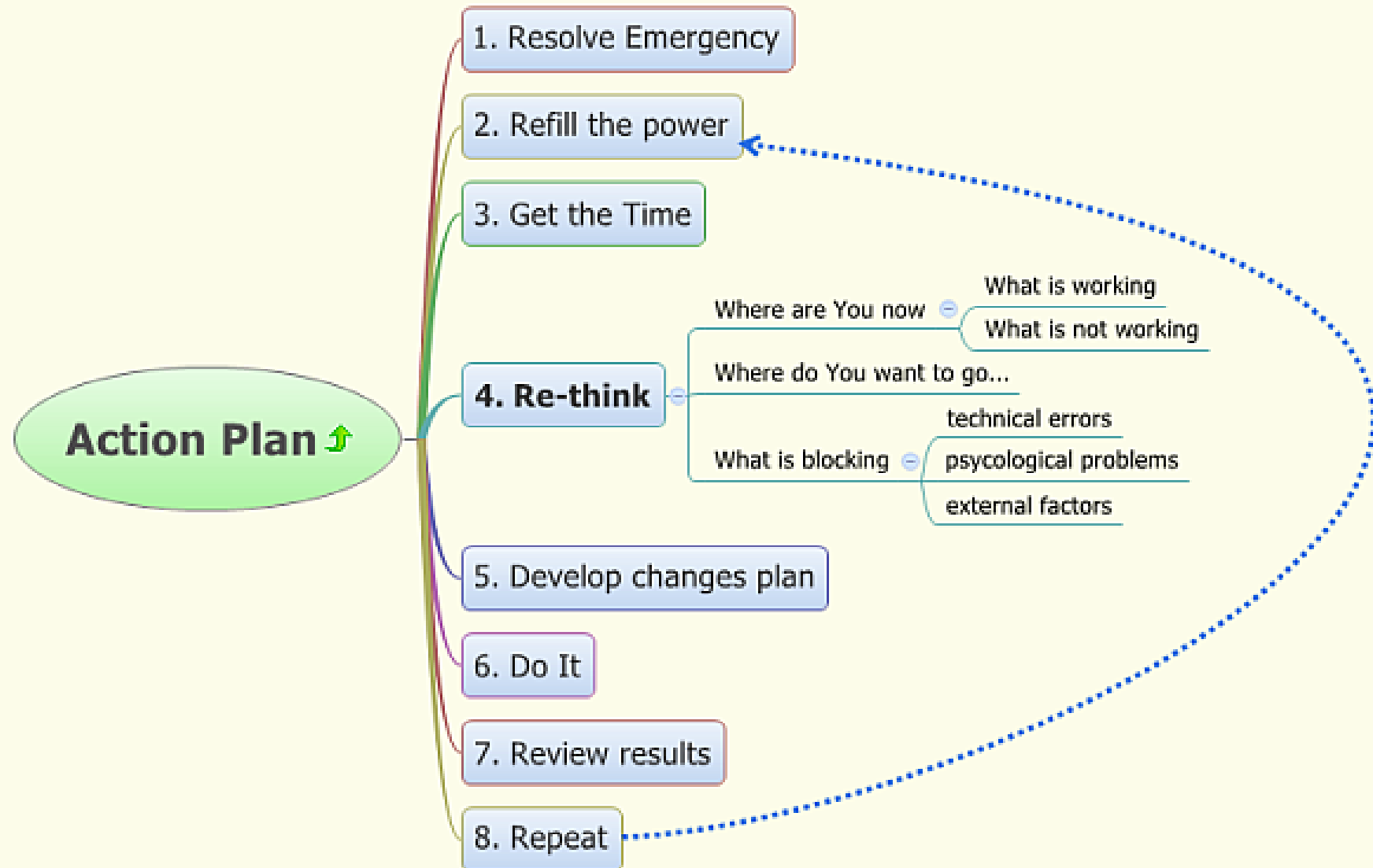
- **MySQL Recovery IS possible!**
- **Something important was missing in communication!**

How to stay alive...

and

make life better

# Live is possible (after 50+ too)!



# Be prepared - In-Advance:

## System Regular LifeCycle should have:

- TA, configuration documentation (text and visual), (updated on changes)
- Define: Who is responsible for what?
- Schedule: Who is on duty today?
- Backup service: (regular, execution/results monitoring + notifications)
- Recovery (test) environment
- Monitoring (hardware, resources, versions, services) – **green** – **yellow** – **red**

but:

- **“Quis custodiet ipsos custodes?”**

*(what if monitoring service fails? How would you know what is going on?)*

- Must have **“Спецнадзор за Спецконтролем”**

*(small monitoring monitoring service/script from independent (hardware) location  
may be enough in most cases)*

# Summary

# Summary

- “There is no spoon!”
  - **Boy: Do not try and bend the spoon. That's impossible. Instead only try to realize the truth.**
  - **Neo: What truth?**
  - **Boy: There is no spoon.**
  - **Neo: There is no spoon?**
  - **Boy: Then you'll see that it is not the spoon that bends, it is only yourself.**
- There is “No Silver Bullet” too:
  - Any more. And never was
  - Read for more details: "No Silver Bullet – Essence and Accident in Software Engineering"  
*by Frederick Phillips Brooks in 1986*
- **“Everything You do not know - is not Your favour!”**
- **Key Point: Human Communications Matters!**
- **But, sometimes #@%#@^%@\* just happens.**

# Summary

- Know Your system
- Be prepared
- Read the Documentation
- Know your limits/constraints
- Know other humans limits/constraints/objectives
- Recheck Search results, AI generated text, documentation, hints..
- To make the right decision, sometimes You have to know more...
  - More then expected!
  - Be prepared – in-advance!

# Links

- Case-1 – details at Zabbix Forum:

<https://www.zabbix.com/forum/zabbix-troubleshooting-and-problems/467806-interface-scripts-tables-content-corrupted-during-upgrade-to-6-4-4-or-6-0-19-lts>

<https://www.zabbix.com/forum/zabbix-troubleshooting-and-problems/467806.....> (click to follow)

- Case-2 – backup and recovery:

<https://dev.mysql.com/doc/refman/9.7/en/forcing-innodb-recovery.html>

<https://rossmannngroup.com/services/database-recovery/mysql>

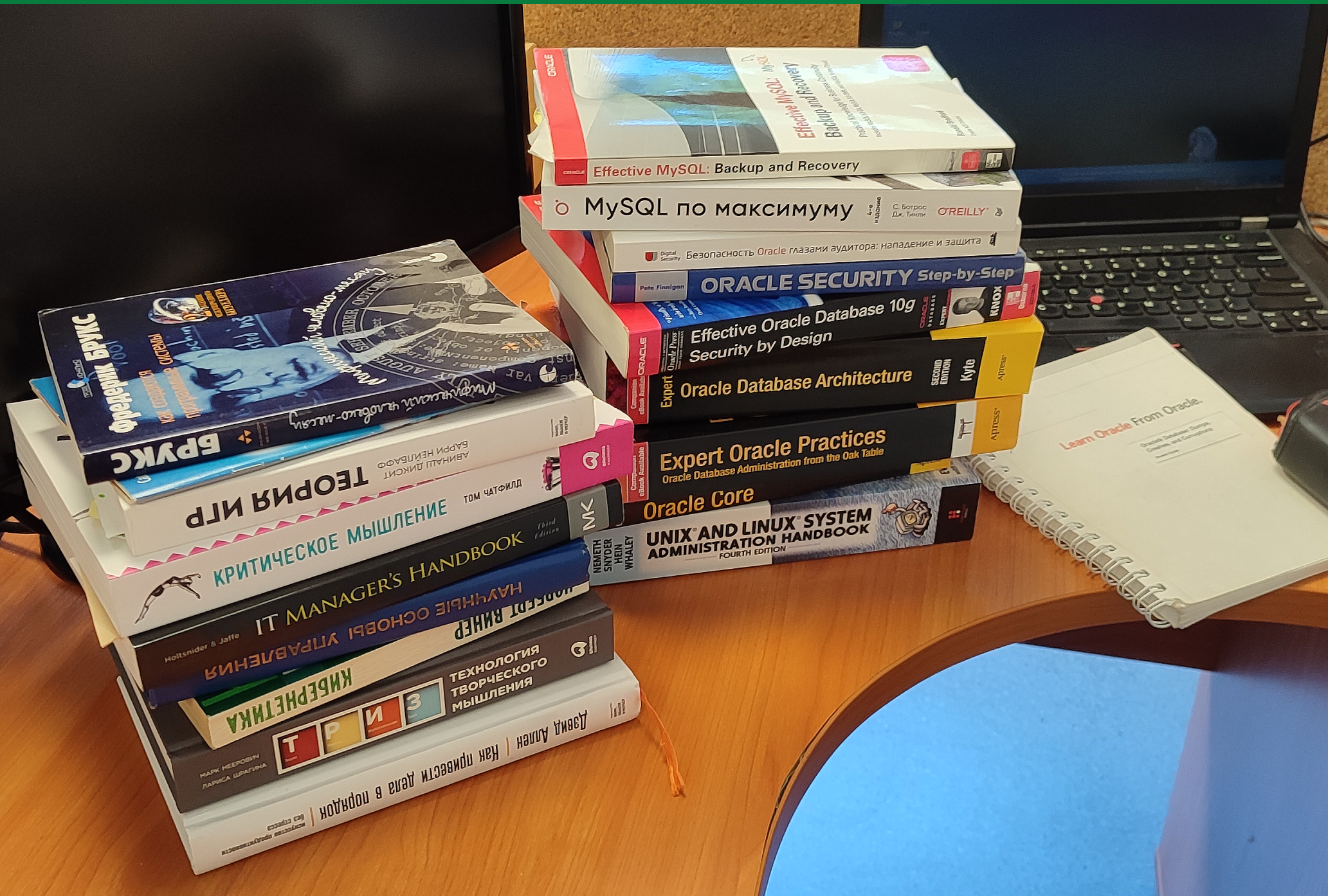
- Other MySQL database topics:

<https://ronaldbradford.com/> (Books, Blog, Quotes, Presentations)

- This and other presentations at CoMinder website:

<https://cominder.eu/index.php?action=technotes>

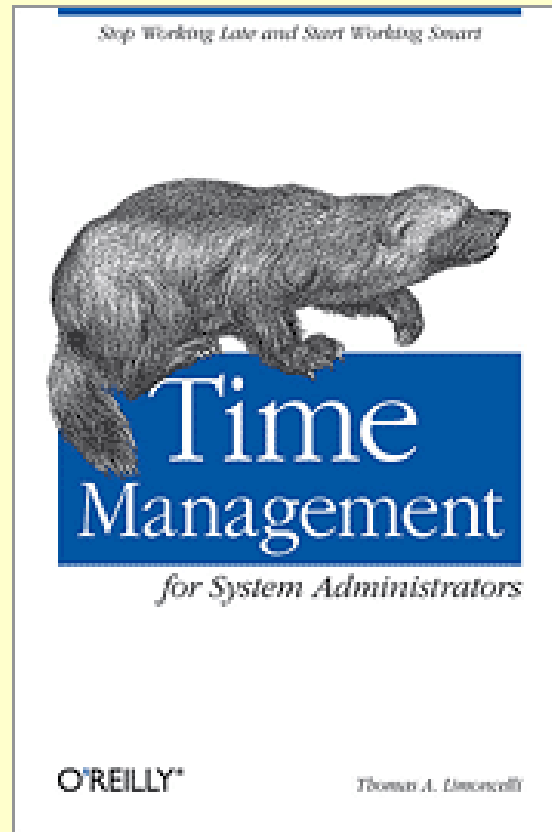
# ... and Books



# off-topic:

- Recommended Book to read:

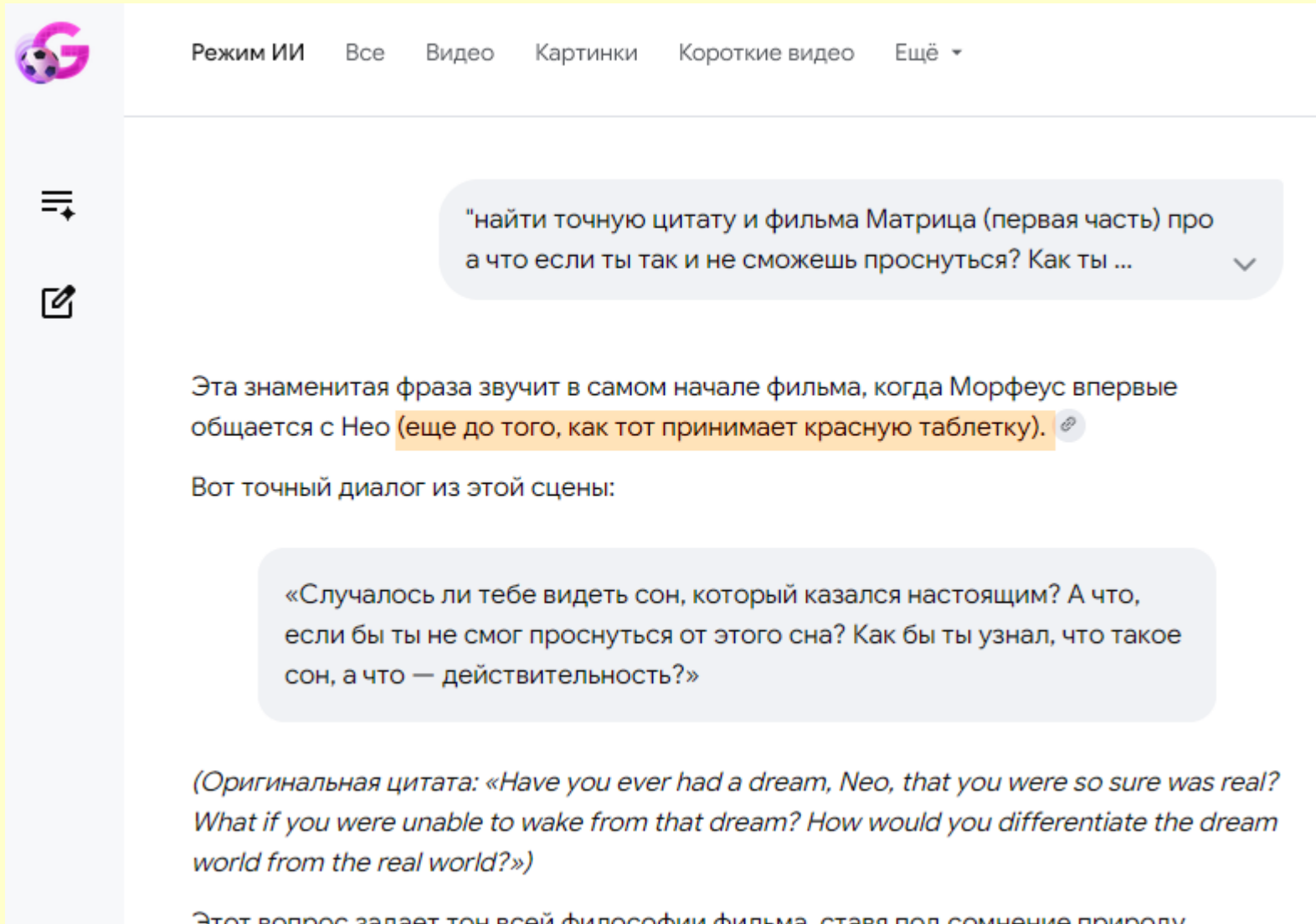
**“Time Management for System Administrators”** ( *By Thomas A. Limoncelli* )



Q + A

# P.S. some notes about AI...

Real Case (in Russian): asked Free Google Search (AI mode) to find something



The screenshot shows the Google AI mode interface. At the top, there's a search bar with a pink 'G' logo and navigation options: 'Режим ИИ', 'Все', 'Видео', 'Картинки', 'Короткие видео', and 'Ещё'. Below the search bar, a user query is displayed in a light blue bubble: "найти точную цитату и фильма Матрица (первая часть) про а что если ты так и не сможешь проснуться? Как ты ...". The AI response follows, starting with "Эта знаменитая фраза звучит в самом начале фильма, когда Морфеус впервые общается с Нео (еще до того, как тот принимает красную таблетку)." The phrase in parentheses is highlighted in orange. Below this, the AI provides the exact dialogue from the scene in a light blue bubble: «Случалось ли тебе видеть сон, который казался настоящим? А что, если бы ты не смог проснуться от этого сна? Как бы ты узнал, что такое сон, а что — действительность?». At the bottom, the AI provides the original English quote in italics: (Оригинальная цитата: «Have you ever had a dream, Neo, that you were so sure was real? What if you were unable to wake from that dream? How would you differentiate the dream world from the real world?») and begins to explain that this question sets the tone for the film's philosophy.

Режим ИИ Все Видео Картинки Короткие видео Ещё ▾

"найти точную цитату и фильма Матрица (первая часть) про а что если ты так и не сможешь проснуться? Как ты ... ▾

Эта знаменитая фраза звучит в самом начале фильма, когда Морфеус впервые общается с Нео (еще до того, как тот принимает красную таблетку). ↻

Вот точный диалог из этой сцены:

«Случалось ли тебе видеть сон, который казался настоящим? А что, если бы ты не смог проснуться от этого сна? Как бы ты узнал, что такое сон, а что — действительность?»

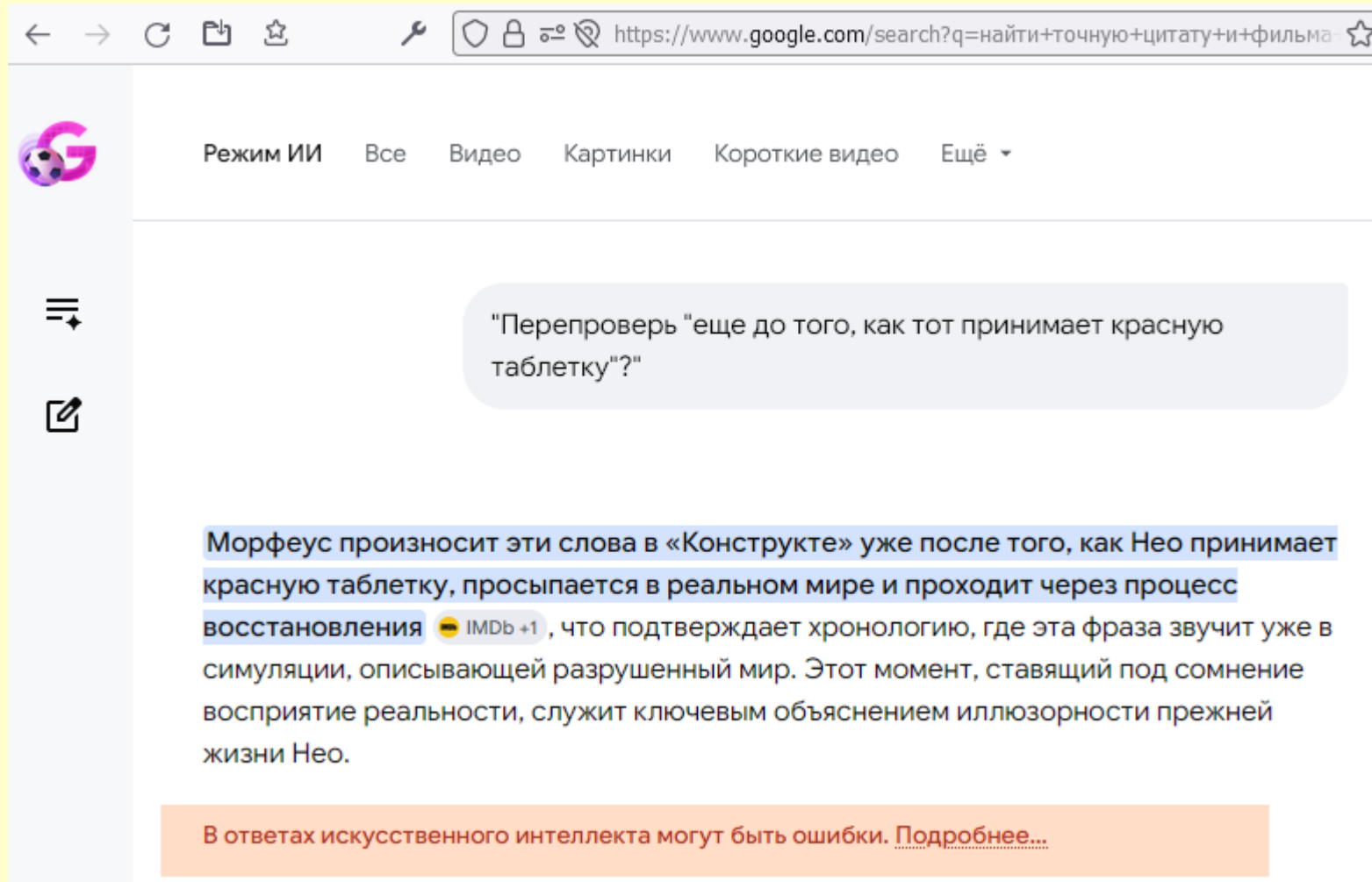
(Оригинальная цитата: «Have you ever had a dream, Neo, that you were so sure was real? What if you were unable to wake from that dream? How would you differentiate the dream world from the real world?») ↻

Этот вопрос задает тон всей философии фильма, ставя под сомнение природу

# P.S. some notes about AI...

Real Case (in Russian): Free AI generated incorrect result.

Extra prompt may be required to get correct one!



The screenshot shows a Google search interface in Russian. The search query is "найти+точную+цитату+и+фильма". The search results display a quote: "Перепроверь "еще до того, как тот принимает красную таблетку"?". Below the quote, the text reads: "Морфеус произносит эти слова в «Конструкте» уже после того, как Нео принимает красную таблетку, просыпается в реальном мире и проходит через процесс восстановления" (with an IMDb +1 rating), "что подтверждает хронологию, где эта фраза звучит уже в симуляции, описывающей разрушенный мир. Этот момент, ставящий под сомнение восприятие реальности, служит ключевым объяснением иллюзорности прежней жизни Нео." At the bottom, there is a warning: "В ответах искусственного интеллекта могут быть ошибки. Подробнее..."

**What if you were unable to wake from that dream?**



# MySQL Corruptions Troubleshooting: Case Studies

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