TLS for MySQL at Large Scale

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Things we are *NOT* going to talk about:

- Security and encryption fundamentals
- “At rest” encryption
- Best practices for web/HTTP encryption
- How perfectly and good we are- we made mistakes and we will present them to you

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Things we *ARE* going to talk about:

- “On the wire” encryption
- Focused on for large scale web applications
- Operational/DBA point of view
- Feature requests for MySQL/MariaDB developers
- Failures that can serve as lessons learned for other ops

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Why deploying TLS for MySQL?

- Privacy and security over cost- we aim for full stack encryption
- Known, documented security threads
- Compliance with modern security standards; getting modern authentication methods

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TLS Myths

- TLS is slow
- TLS doesn’t work at scale
- TLS is not needed on a private network/for databases
- TLS is hard - it is not, it is mostly an operational challenge

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TLS on MySQL is easy

```
+Subproject commit 6014a235e35a8ac0ab2deadaf0de4690a4e63791
diff --git a/templates/mariadb/production.my.cnf.erb b/templates/mariadb/production.my.cn
f.erb
index 298c739d91..b57af97140 100644
--- a/templates/mariadb/production.my.cnf.erb
+++ b/templates/mariadb/production.my.cnf.erb
@@ -4,6 +4,12 @@
 [client]
 port   = 3306
 socket = /tmp/mysql.sock
+<% if @ssl == 'on' %>
+# ssl
+ssl-ca=/etc/mysql/ssl/cacert.pem
+ssl-cert=/etc/mysql/ssl/server-cert.pem
+ssl-key=/etc/mysql/ssl/server-key.pem
+<% end %>

 [mysqld]

@@ -86,7 +92,13 @@ innodb_use_native_aio          = 0
 innodb_read_io_threads         = 16
 innodb_write_io_threads        = 8
 <% end %>
-
+<% if @ssl == 'on' %>
+# ssl
+ssl-ca=/etc/mysql/ssl/cacert.pem
+ssl-cert=/etc/mysql/ssl/server-cert.pem
+ssl-key=/etc/mysql/ssl/server-key.pem
+ssl-cipher=TLSv1.2
+<% end %>
 <% if @p_s == 'on' %>
 # Enabling performance_schema (disabled by default in MariaDB10)
 performance_schema                                     = 1
```

* Latest MySQL versions even do this for you automatically

Thank you!

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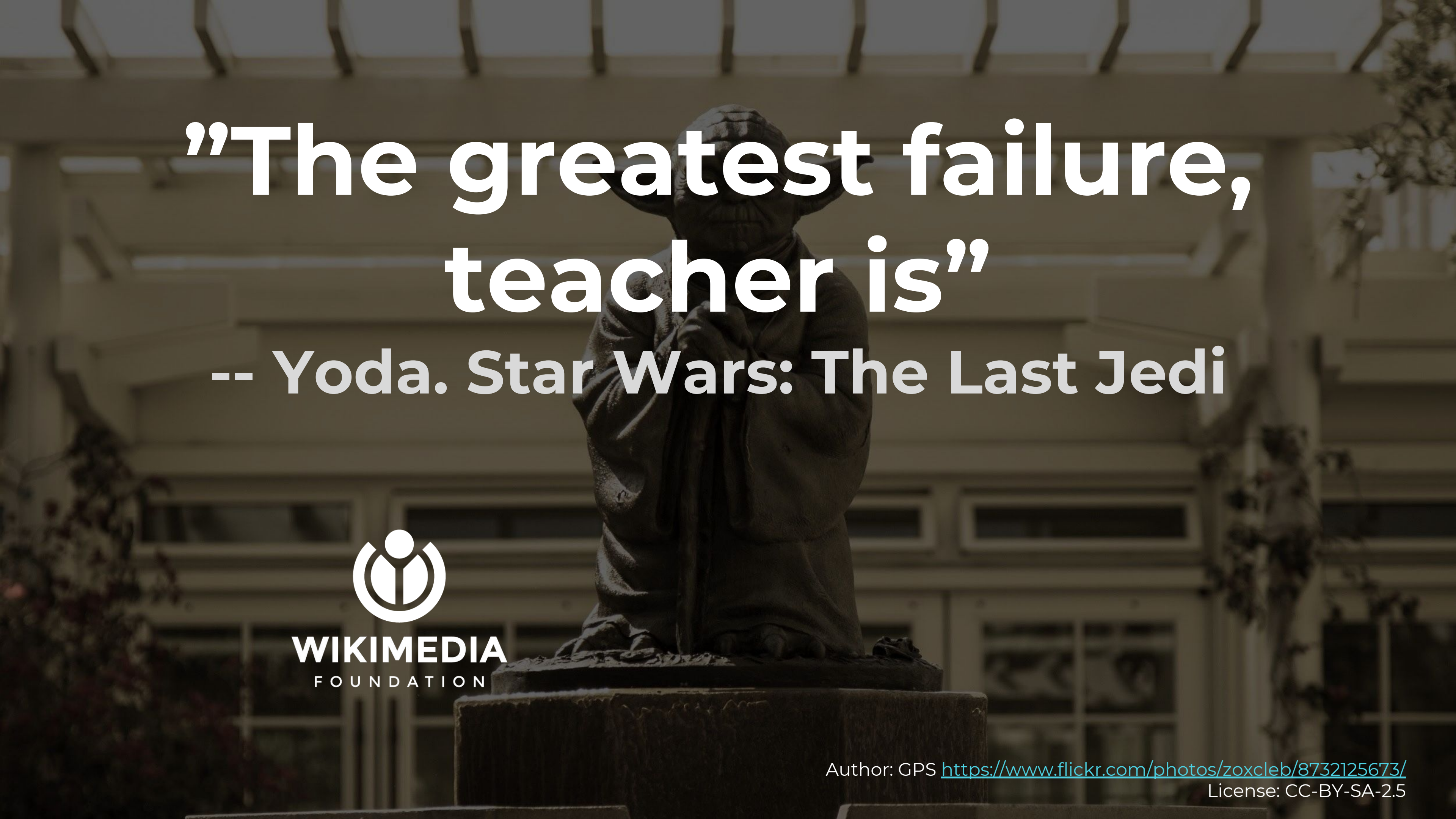

”The greatest failure, teacher is”

-- Yoda. Star Wars: The Last Jedi

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We rushed to production

- We were going to activate a second datacenter for the first time - people on top wanted encryption rolled in ASAP
- We setup some initial configuration with some test certificates
- We ended up working 3 times as much: first when we set them up, again to remove it and setup it again
- Resources were limited: 1 full time employee (which were already in charge of all MySQL maintenance and firefighting); no external resources

- TLS at internal storage treated like rolling public HTTPS - different use case and problems
- We didn’t have a proper certificate manager service
- Older OpenSSL version had frequent security problems
- Every time OpenSSL or MySQL had to be upgraded, we had to restart the daemon
- If the change was incompatible (e.g. CA update), you had to sync client/server and master/replicas

We didn’t have proper orchestration in place

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Server support was poor

- MySQL/MariaDB older version (5.5) had problems with modern ciphers/protocols
- Only OpenSSL-linked servers had proper modern TLS support (>=1.2)
- OpenSSL was not GPL-compatible
- We had to deploy our own package (wmf-mariadb, wmf-mysql)

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Client and 3rd party support was poor

- Client libraries also had to be upgraded/linked to OpenSSL
- Some problems with clients (Mono/Sharp) silently enabling TLS for “MySQL as a service” products
- Most issues related to **TLSv1.2 support**
- Old client connectors (PHP5) incompatibilities
- ProxySQL did not support TLSv1.2
- Colleagues report mysql cli “no longer works”

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Successes and things we did right

- We rolled TLS at first opt-in- This allowed easy rollback. We defaulted to TLS enabled, though.
- Communicated the change to fellow ops
- Organization support
- We went for replication channel and administration encryption first- indetectable overhead due to almost no reconnections
- We went for TLSv1.2 from the beginning (2015)
- 100% coverage is not rushed- we can wait for CA, licensing and client library support

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Metrics

- Same-DC, non-SSL:
  - 0.001132071018219 s/conn
  - 0.00024072647094727 s/query
- Same-DC, SSL:
  - 0.057012629508972 s/conn
  - 0.00025907039642334 s/query
- Cross-DC, non-SSL:
  - 0.1113884806633 s/conn
  - 0.036313643455505 s/query
- Cross-DC, SSL:
  - 0.22943157196045 s/conn
  - 0.036422135829926 sec/query
- Local ProxySQL+Cross-DC, non-SSL:
  - 0.0002328896522522 s/conn
  - 0.036425504684448 s/query

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MySQL community wishlist

- Easier certificate/TLS library handling from the servers (#81461, #75404, #83758)
- Proper TLS 1.2+ support from connectors/clients/middleware (e.g. ProxySQL #1247)
- Proper OpenSSL 1.1+ support (#83814, #12811)
- Sharing more tests/metrics/ performance benchmarks

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Pending work for us

- Setup persistent connections (not only for TLS, but also for active-active cross-dc requests)
- Enable TLS also for regular connections
- Better monitoring (certificate expiration)
- Enforce TLS at grant level
- Roll in modern authentication (sha256)

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Thank you!

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