
# Async-Save Design

By Ashod Nakashian

Consultant Collabora Online

ash@collabora.com

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# Agenda

- Problem
- Challenge
- Risks
- Solution
- Results

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# The Problem

## Saving

- Document contents must be saved to disk first.
- Once saving is completed, the file needs to be uploaded to storage.
- Saving is asynchronous; no UI interruptions.

## Uploading

- Uploading to storage, via WOPI, can be unreliable.
- It can be very slow, get interrupted, or return temporary errors.
- Used blocking sockets, resulting in unresponsive UI while uploading.

# The Challenge

**Sockets**

- Upload using asynchronous connection instead of blocking.
  - But over-reliance on Poco makes this harder; drop-in replacement, ideally.
- Leverage own asynchronous sockets for HTTP.
  - Used for all WebSocket communication, in production for years.
- Avoid per-request threads, avoid complex library integration.

**Protocols, Application**

- Support SSL, Terminating-SSL (for reverse proxies), and non-SSL setups.
- Implement HTTP protocol with the various features:
  - Chunked transfer, redirection, connection reuse… and any imaginable failures.

# Risks

## HTTP

- Reinventing the wheel always problematic.
  - Requires extensive automated testing infrastructure.
- Significant reliance on Poco means less flexibility in new API design.

## Application

- Saving and uploading are not always independent activities.
  - Both are done as part of more complex operations: renaming, converting, conflict resolution.
  - Requires state modelling and management.

# Solution

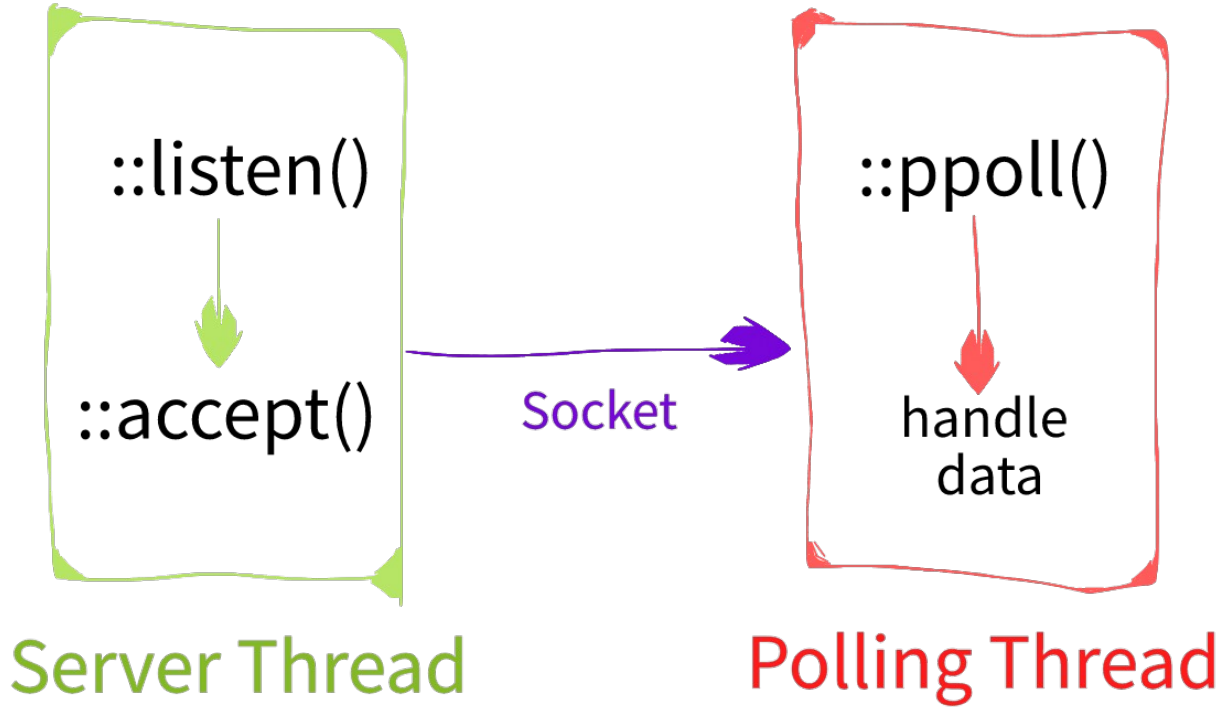
## Sockets

- Build async HTTP around internal async sockets and polling.
- Shared socket polling thread that polls on multiple sockets simultaneously.
- Support socket reuse, or per-request sockets.

## Implementation

- New HTTP Request/Response handlers, with compliant parsers.
- Can run in blocking and non-blocking modes.
- Used for all HTTP requests, replacing Poco (mostly).

# Low-Overhead Design




- One ppoll syscall
- One thread
- High scalability

# Solution (Continued)

**Testing**

- HTTP is reasonably self-contained and reasonably easy to test.
  - Leaving out networking.
- Extensive class-level unit-tests.
- Exhaustive coverage for incomplete data parsing.
- Built-in server: emulates all status codes, returns random data, echo, etc.
- External test-server tests, for compliance and regression testing.

**Fuzzing**

- Fuzzing for the HTTP protocol parsers.
- Fuzzing of the HTTP round-trip, with built-in server:
  - Client Request, Server Response, Client handling of response.

# Results

**Performance**

- UI completely unaffected by storage performance.
- Independent and potentially overlapping Save and Upload operations.
- Transparent and automatic retrying of failed Uploading.
- Smooth auto-saving user experience.
- Fuzzing shows thousands of loopback round-trips per-second, per core.

**Implementation**

- More homogeneous codebase with own sockets, polling, and now HTTP layers.
  - Fewer overlapping libraries reduces defect surface-area, improves readability.
- Better code integration, more maintainable, better performance.

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# Thanks !

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By Ashod Nakashian

@CollaboraOffice
hello@collaboraoffice.com
Collaboraoffice.com