LibreOfficeKit & Online event delivery & scheduling

What happens; in what order ?

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First synchronous vs. asynchronous

What does it mean ?

A **synchronous** operation blocks a process till the operation completes.

- `int read(char *data, size_t buffer_size);`

  “Do it now, while I wait !”

An **asynchronous** operation is non-blocking and only initiates the operation. The caller could discover completion by some other mechanism discussed later.

- `readAsync(std::function<void (std::vector<char> &)>& cb);`

  “Go away and do it, tell me when you’re done”

Problems of async:

Producer / consumer mismatch

- `for (i = 0; i < 1000000; ++i)`
  - `writeAsync("Hello world");`

How is that solved generally ?

- Queueing
- Protocol knowledge:
  - eg. invalidations – we can coalesce.
  - eg. state changes – eliding intermediate state transitions.
  - eg. mouse moves (?) …

Debuggability

- What are we waiting for ?
  - Stack trace: an empty loop …
  - kill -USR2 → expose state …

Some problems of sync

- Endless threads – all of them blocking doing nothing:
  - Hammers the O(1) scheduler, memory cost
  - Typical thread problems …
- 'read' thread, 'write' thread + 'do' thread - per socket ?

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LibreOfficeKit workings

LibreOffice main app ...

Nastily complicated threading

- Won't go into this here – lots of synchronization and complexity
  - 1+ epsilon threading mostly

Threading successes

- Manageable small zones, of code-locking, targetted:
  - threading for image scaling
  - ZIP compress / de-compress
  - XML parsing
  - Calc Formula calculation

Everything else

- Uses the main-loop:
  - Idle
  - Timer
  - Scheduler ...
- One big lock: SolarMutex ...

LibreOfficeKit advantages

- headless/svpinst.cpp
  - a somewhat simpler ImplYield
- SolarMutexReleaser

Main-loop integration

What is a main-loop ?

- Process – consumes events from various directions, and processes them
- Then it sleeps – in a ‘poll’ type call waiting for more work.
- This is Scheduler and ImplYield() in LibreOfficeKit core

Even when super-busy – 10x users

- Spend lots of time in poll

Problem:

- LibreOffice has no good async I/O abstraction and/or APIs.
- COOL – is ~100% async to improve debuggability

Unipoll - vcl::lok::isUnipoll()

- We replace VCL’s headless backend with our own poll callback:

```
int nPollResult =
pSVData->mpPollCallback(
    pSVData->mpPollClosure,
    nTimeoutMicroS);
```

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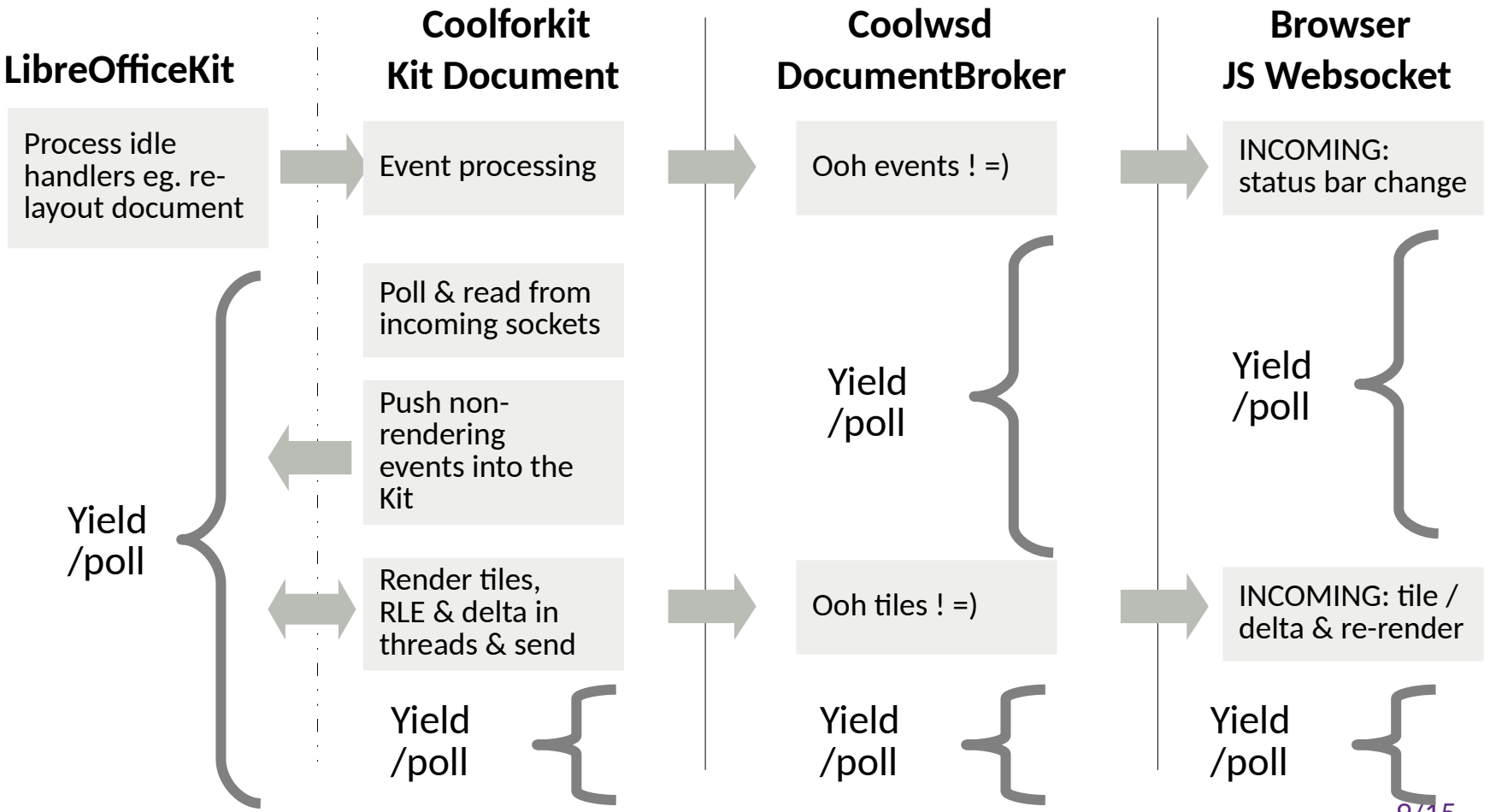
COOL polling pieces

How does that look ?



Queues – important …

LOK: CallbackFlushHandler

core/desktop/source/lib/init.cxx:

- Queues core LOK events before sending them.

```
void CallbackFlushHandler::
libreOfficeKitViewCallback
     (int nType,
      const OString& pPayload)

{

    CallbackData

         callbackData(pPayload);

    queue(nType, callbackData);

}
```

Problem:

- LibreOfficeKit loves to give duplicate event notifications:
  - 1st step – de-duplicate in the queue.
- LibreOfficeKit loves to emit events at unhelpful times:
  - eg. invalidations during rendering
- Potential threading issues …

Solution:

- Queue events, de-duplicate, sanitize
- `scheduleFlush()`

```
Application::PostUserEvent(
LINK(this,CallbackFlushHandler,
FlushQueue));
```

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Kit: KitQueue ...

online/kit/KitQueue.hpp

- Queues events from CallbackFlushHandler
- Queues incoming events from DocumentBroker
- ‘poll’ callback works on this queue
  - First → sending callbacks to the coolwsd
  - Then processing the incoming events

```
// a LOK compatible poll function merging the functions.

// returns the number of events signalled

int KitSocketPoll::kitPoll(int timeoutMicroS)

    → void Document::drainQueue()
```

Queue filling:

Kit.hpp: CallbackFlushHandler:

```
/// A new message from wsd for the queue

    void queueMessage(const std::string &msg)
{ _queue->put(msg); }
```

Solution:

- From one queue to another ...
- Similar work – de-duplication etc.

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coolwsd: DocumentBroker

Queue …

- Process incoming data from Kit fast …
- For outgoing data:

  ClientSession

```
void enqueueSendMessage(const std::shared_ptr<Message>& data);
```

Producer /Consumer handling:

- Notified when space in the outgoing socket → browser

```
void ClientSession::writeQueuedMessages(std::size_t capacity)
{
    LOG_TRC("performing writes, up to " << capacity << " bytes");
    std::shared_ptr<Message> item;
    std::size_t wrote = 0;
    try
    {
        // Drain the queue, for efficient communication.

        while (capacity > wrote && _senderQueue.dequeue(item)…


            if (item→isBinary())
                Session::sendBinaryFrame(data.data(), size);
            else
            {
                Session::sendTextFrame(data.data(), size);
```

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JS – Queueing incoming messages

online/browser/src/core/Socket.js

- Touching the DOM is -very- expensive
- We badly need to control when we mutate anything that is not internal state.
- Two queues:
  - this._delayedMessages
  - this._slurpQueue

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Thank you!

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