Managarm: A Fully Asynchronous Operating System

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The Managarm Project

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- Open-source project, mostly written in modern C++.
- Started in 2014.
- Many active contributors.

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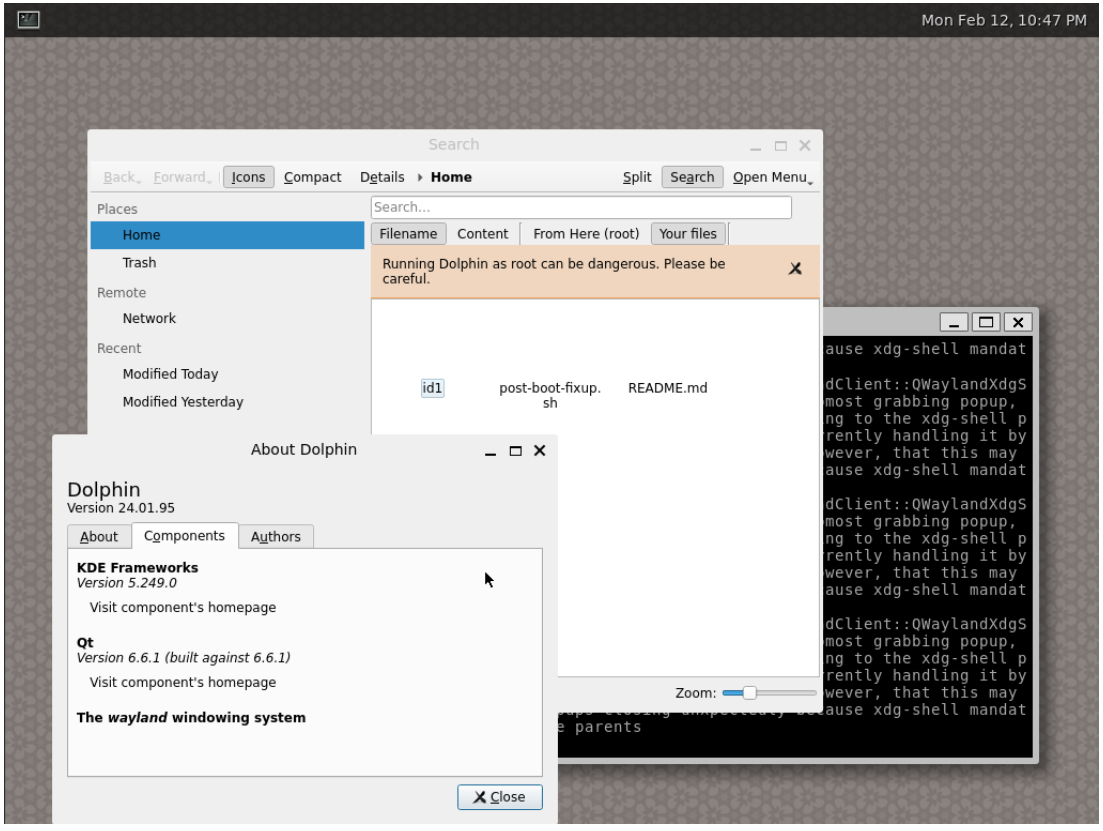

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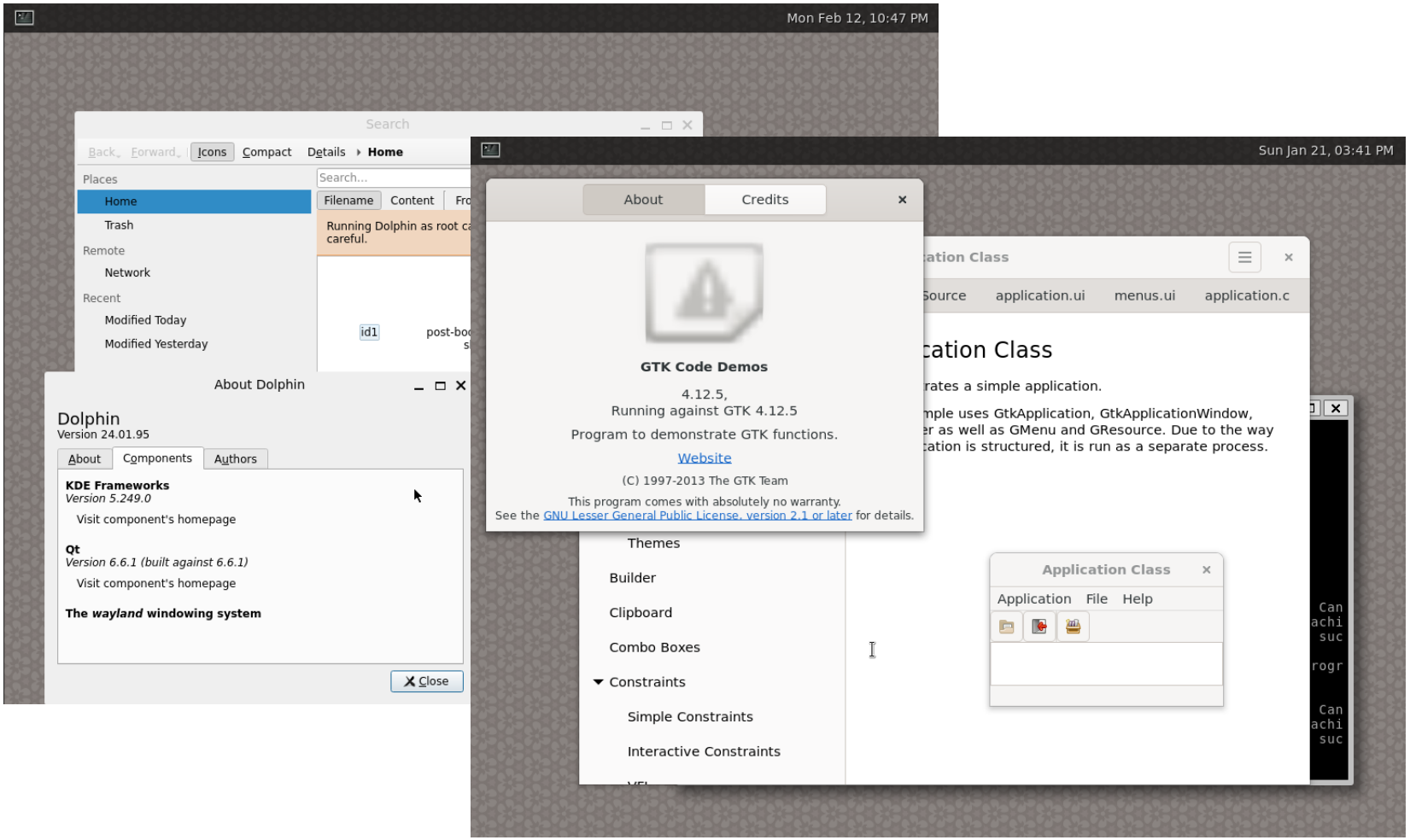

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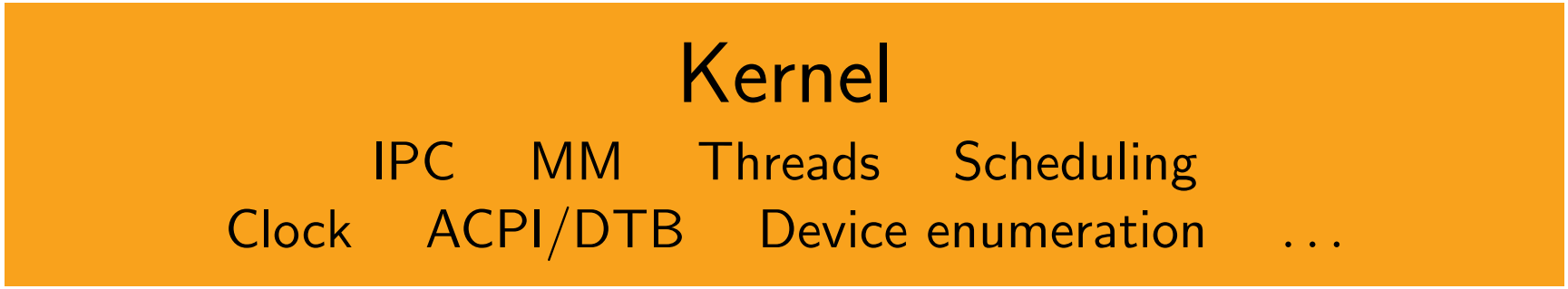
Advantage of asynchronicity: can handle higher bandwidth of concurrent requests and uses fewer resources than synchronous approaches
(e.g., fewer threads, less RAM).

Agenda

- System Architecture
- Inter-Process Communication (IPC)

System Architecture

Managarm: block diagram



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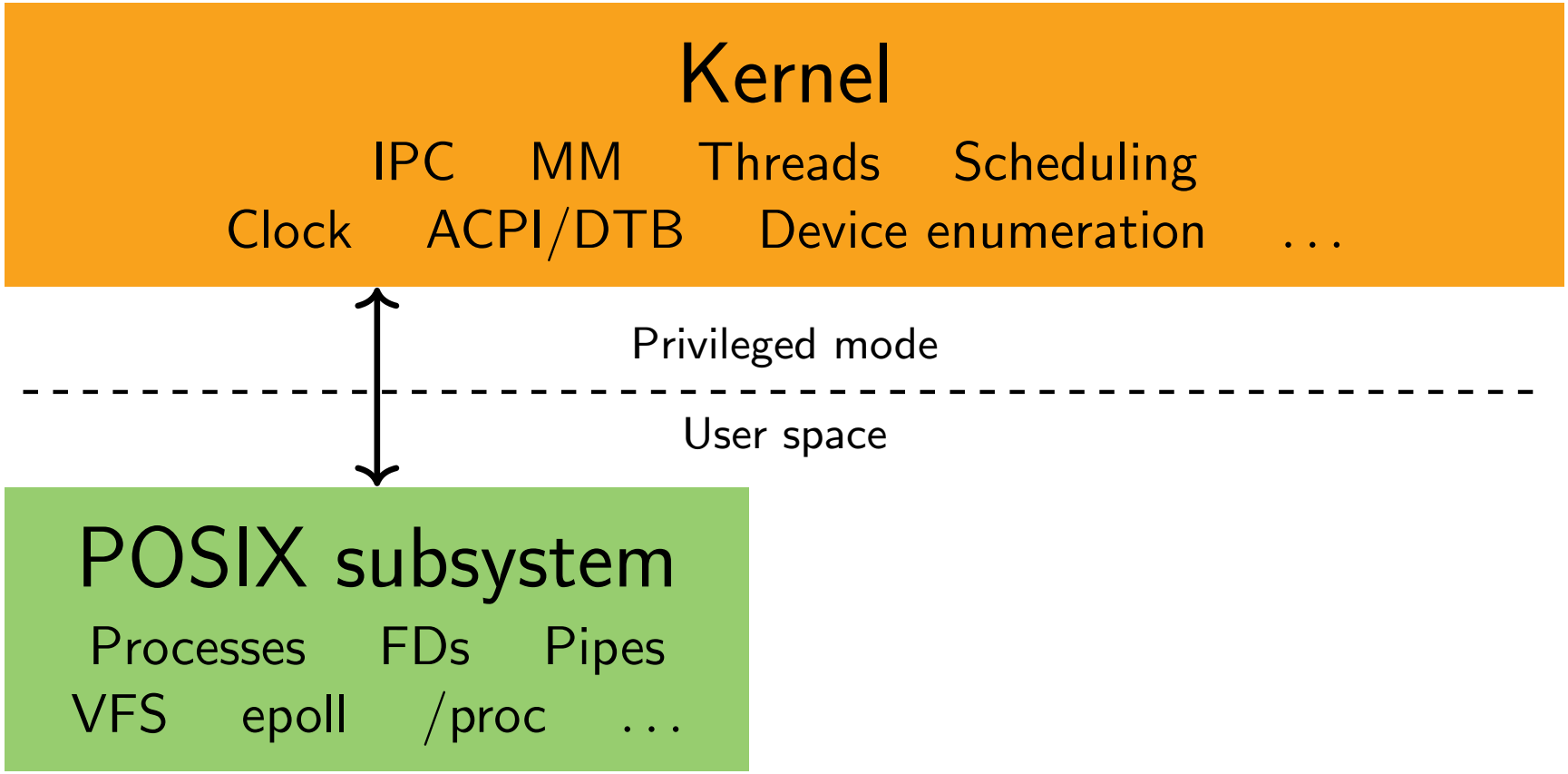

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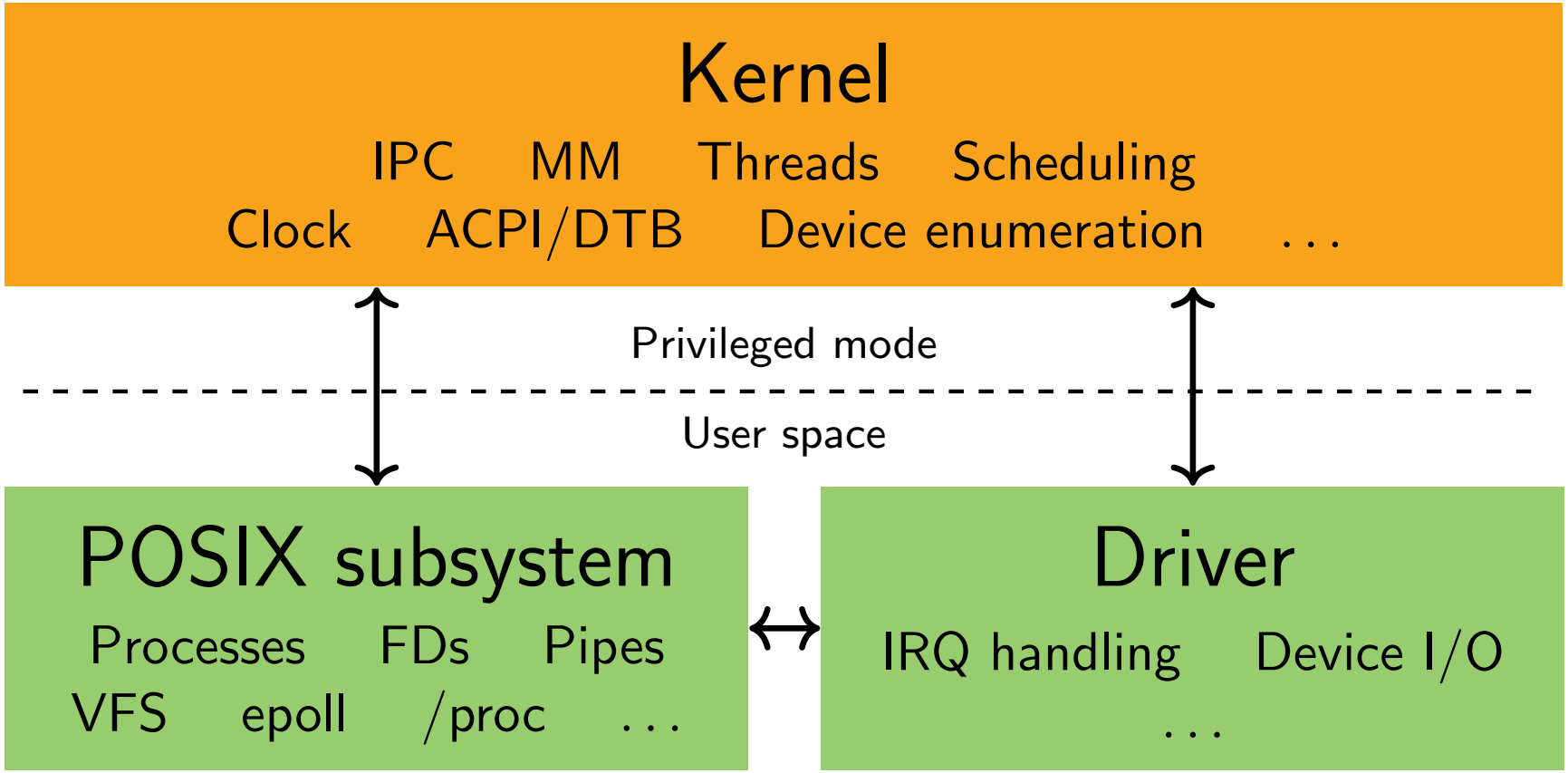

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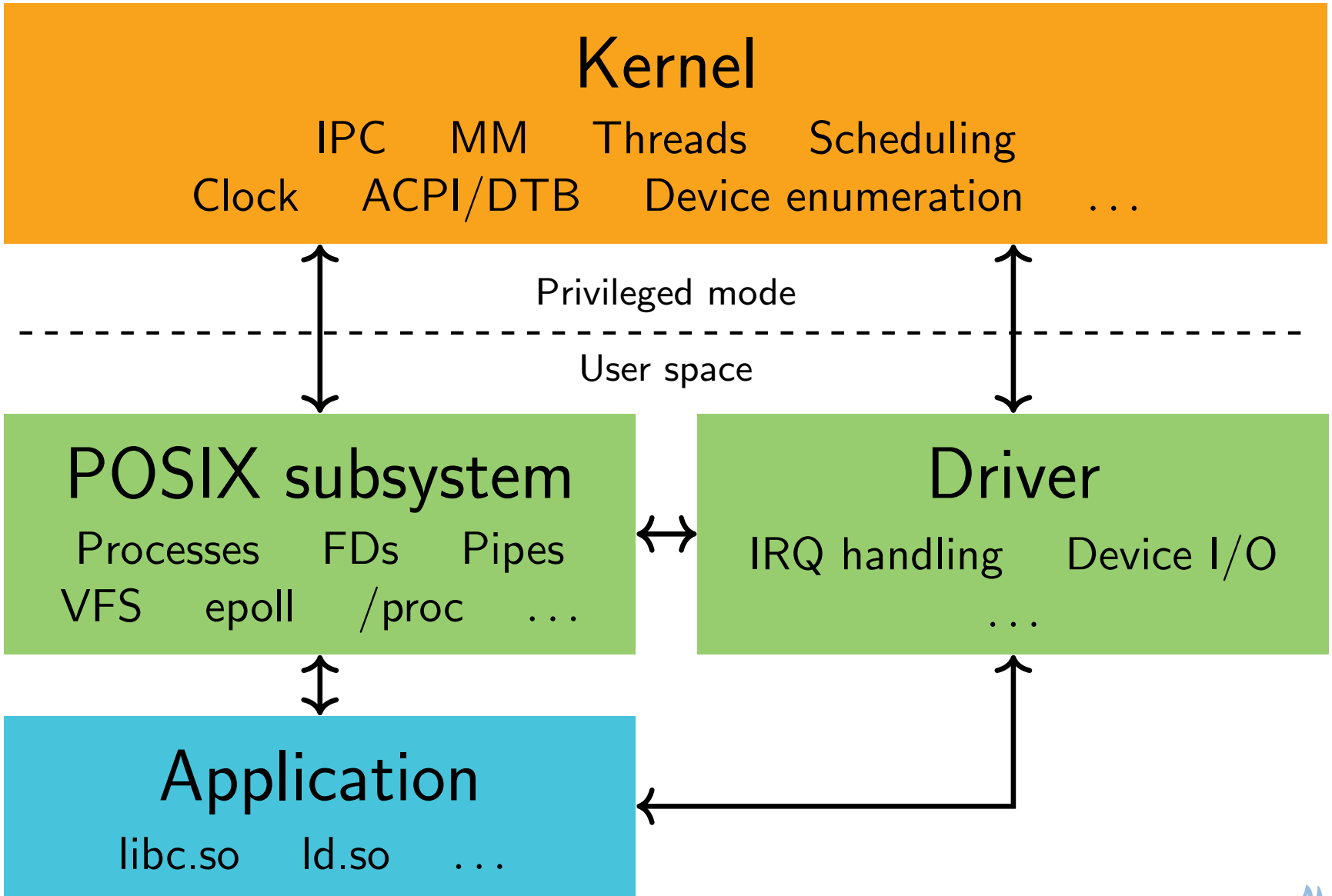

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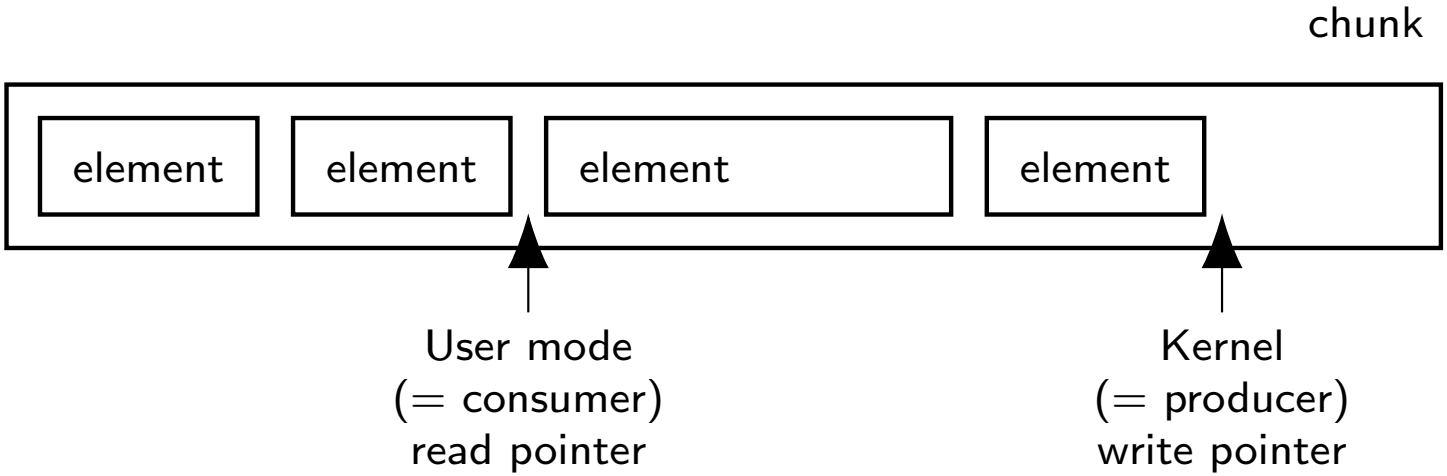
- Other async/await mechanisms could be used as well (e.g., in Rust, Python, ...).

Notification ring buffer



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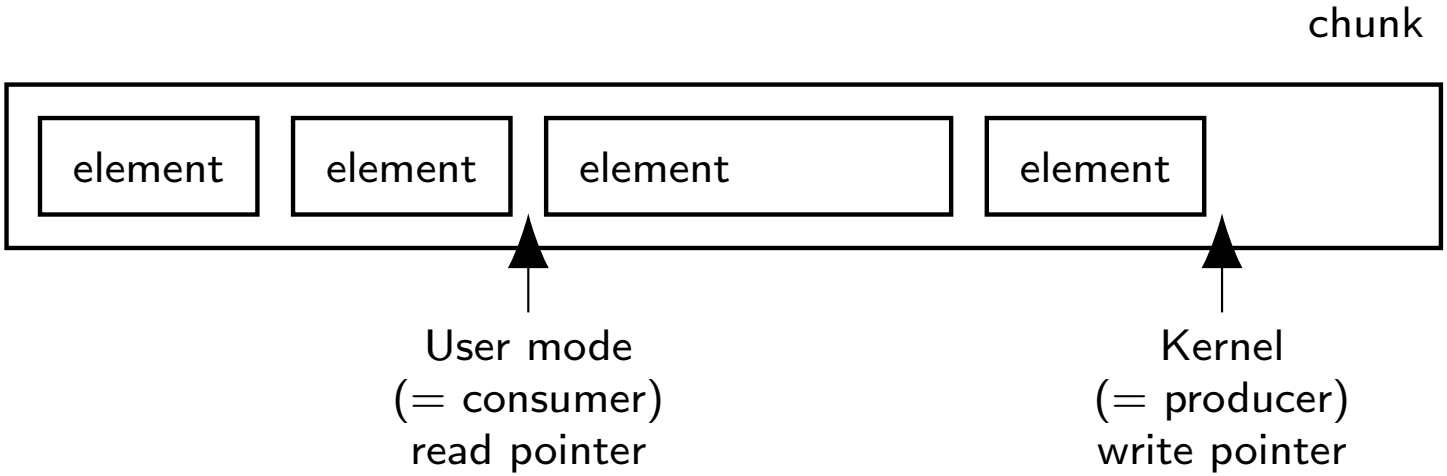

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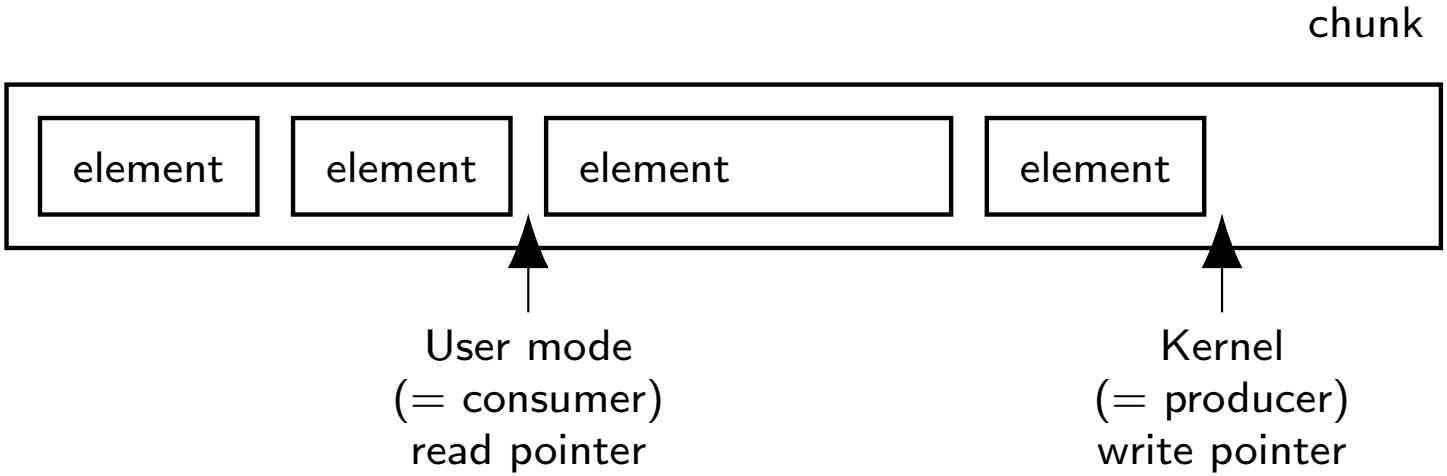

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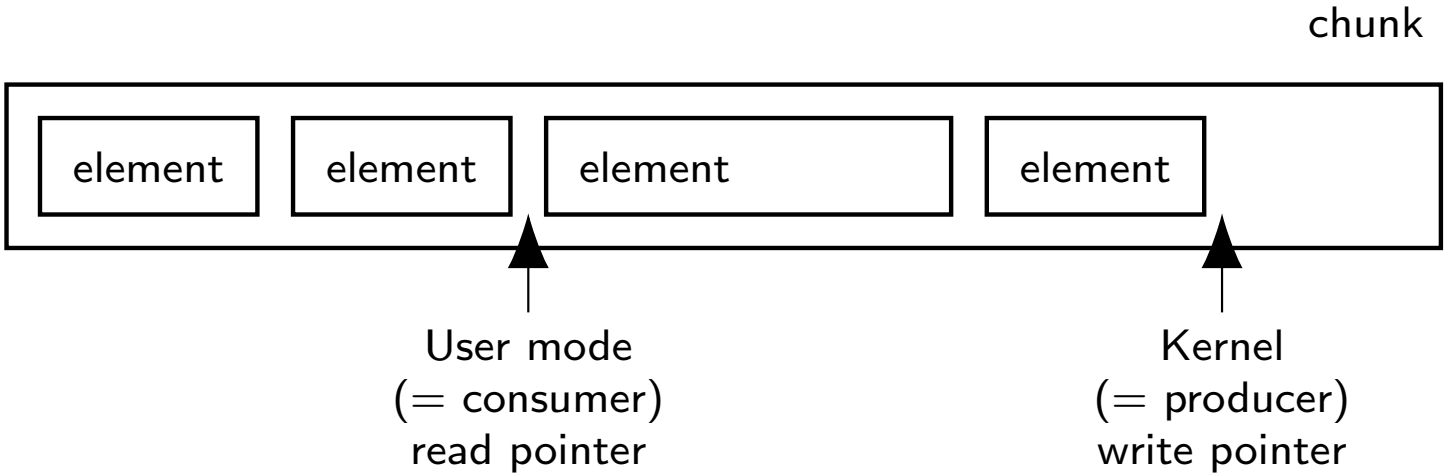

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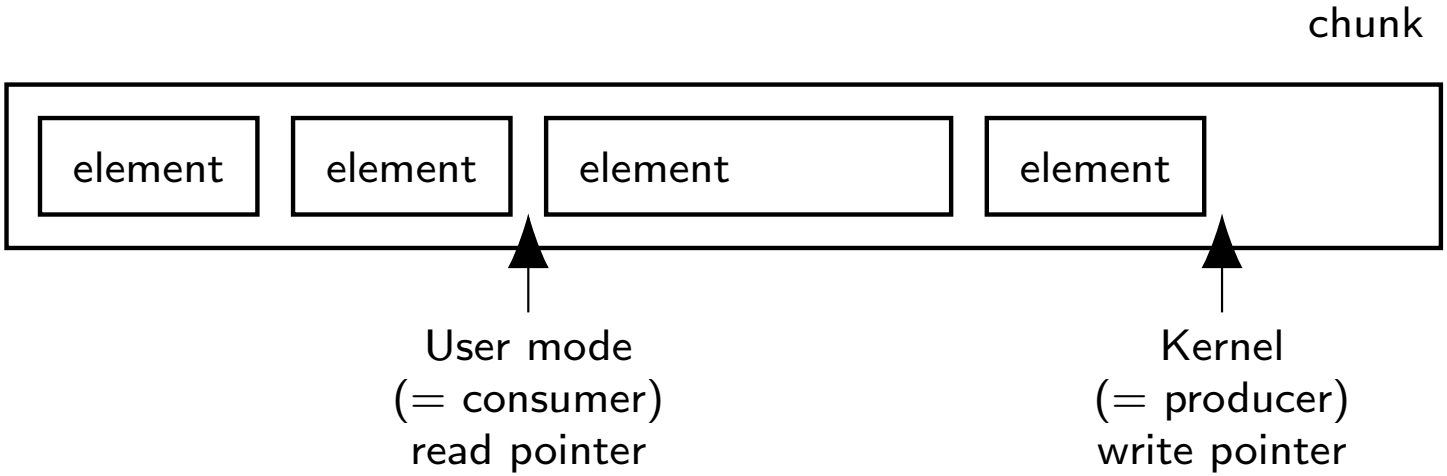

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  Syscall is only required if thread needs to block when no notifications are available.
- User space uses a pointer-sized value to match completion notifications to pending syscalls.

Asynchronous system calls

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- Required to implement mutexes, condition variables etc. in user space.
- Also **required to block a thread** when there is no work to do.

Inter-Process Communication (IPC)

IPC: overview

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$\rightsquigarrow$ Many cases achieve **competitive** performance with simpler synchronous IPC (e.g., in Linux)

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A single IPC syscall can submit multiple actions to a stream.

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Other actions allow **transfering capabilities** or have specialized purposes (e.g., proving the identity of the thread that operates on the first endpoint to the second endpoint).

Request/response logic

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- `Offer`/`Accept` pair creates a new "**ancillary**" stream (Ancillary stream is usually short-lived and discarded after a single request/response).
- Subsequent actions can be directed to the new stream (without the need to invoke an additional syscall).

Example: client/server IPC

1st endpoint,
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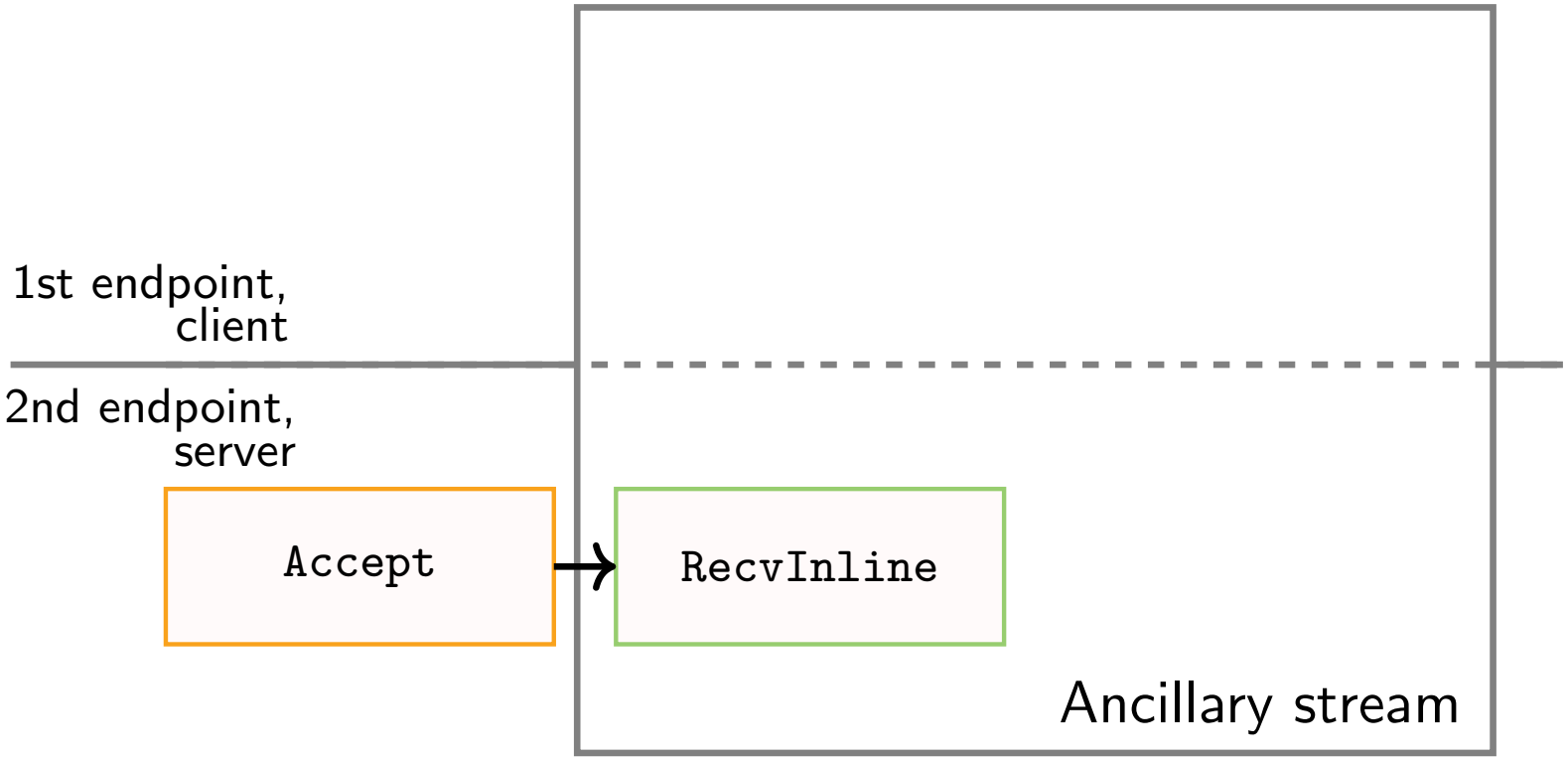

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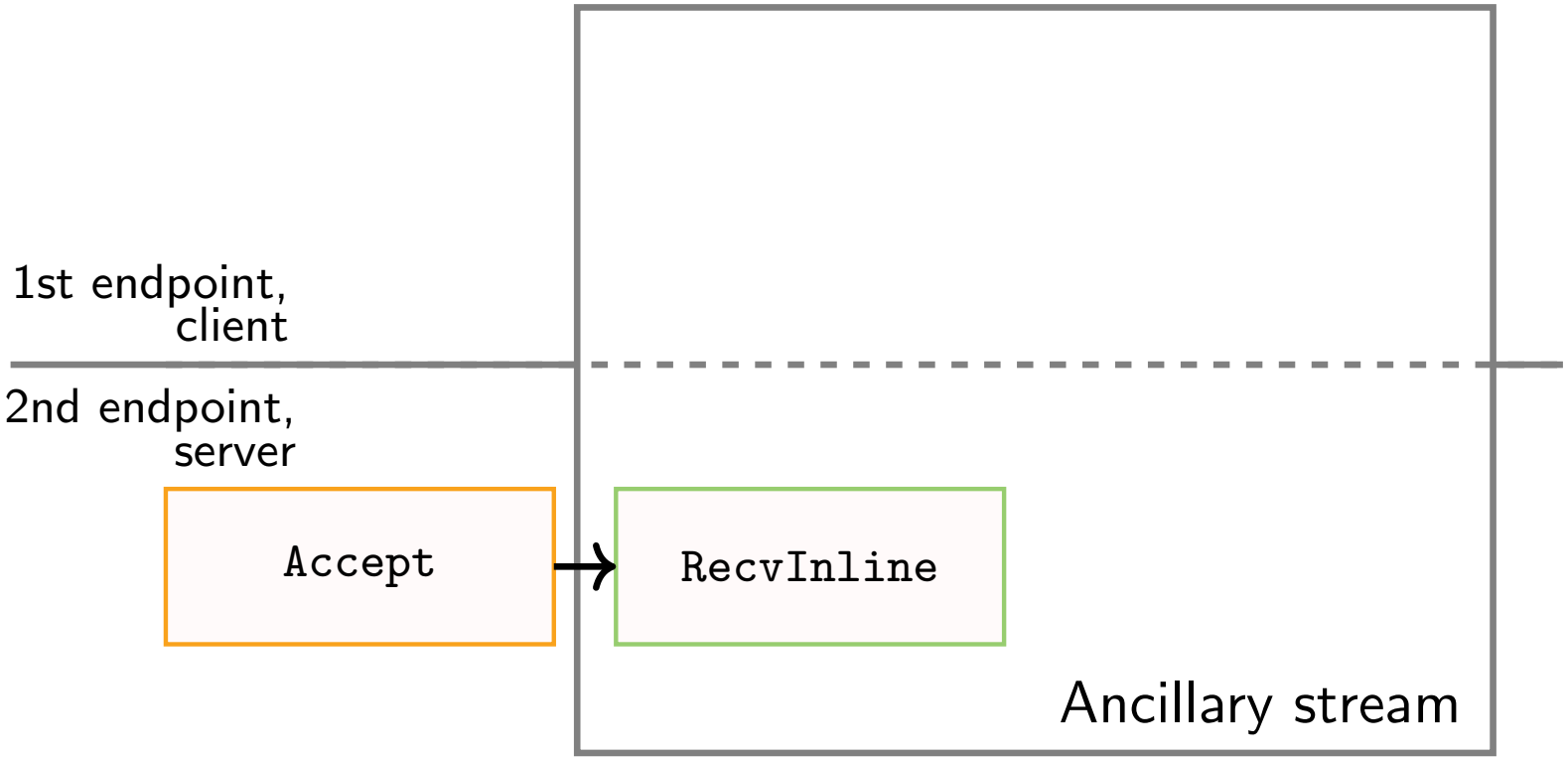

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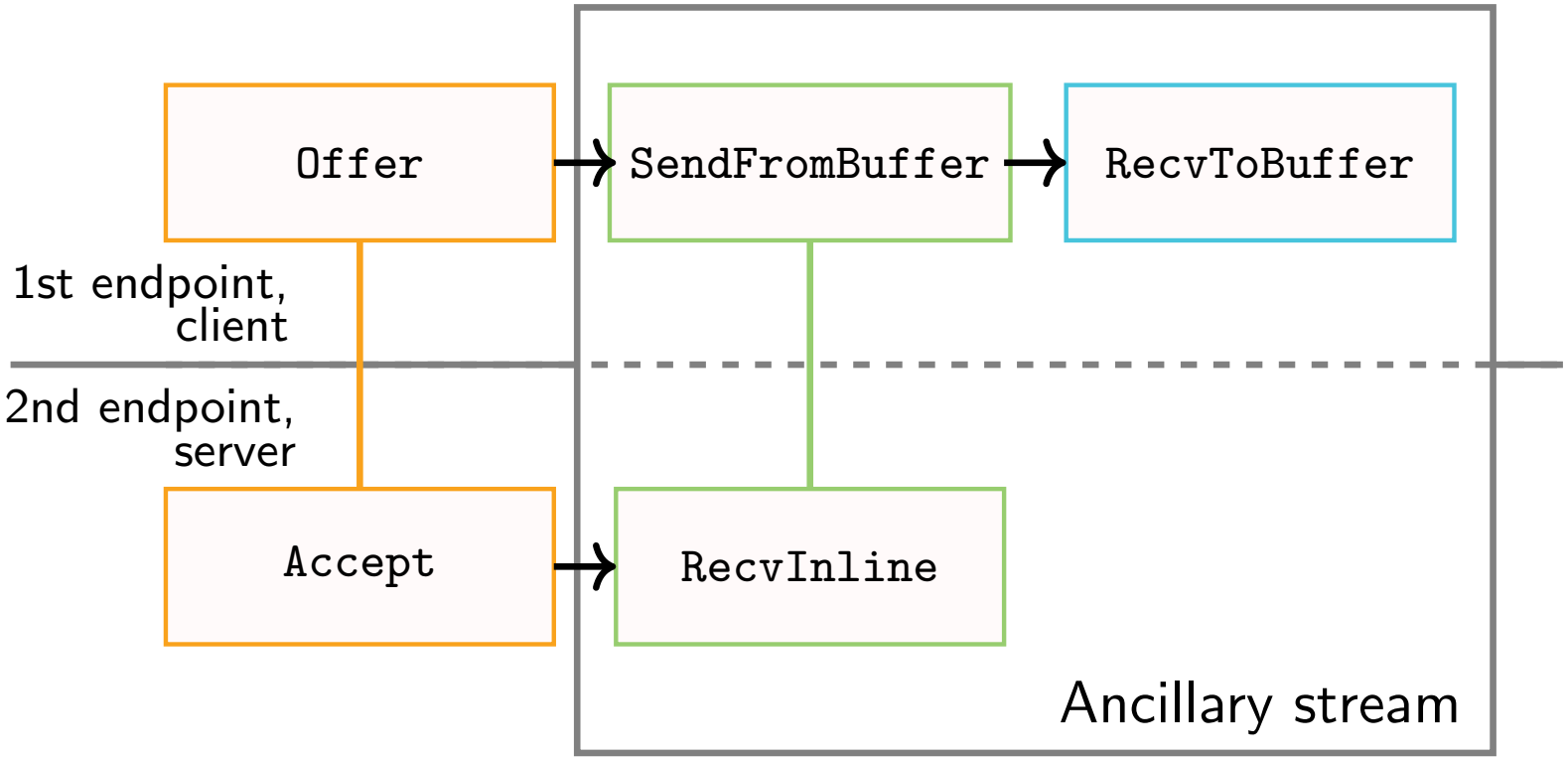

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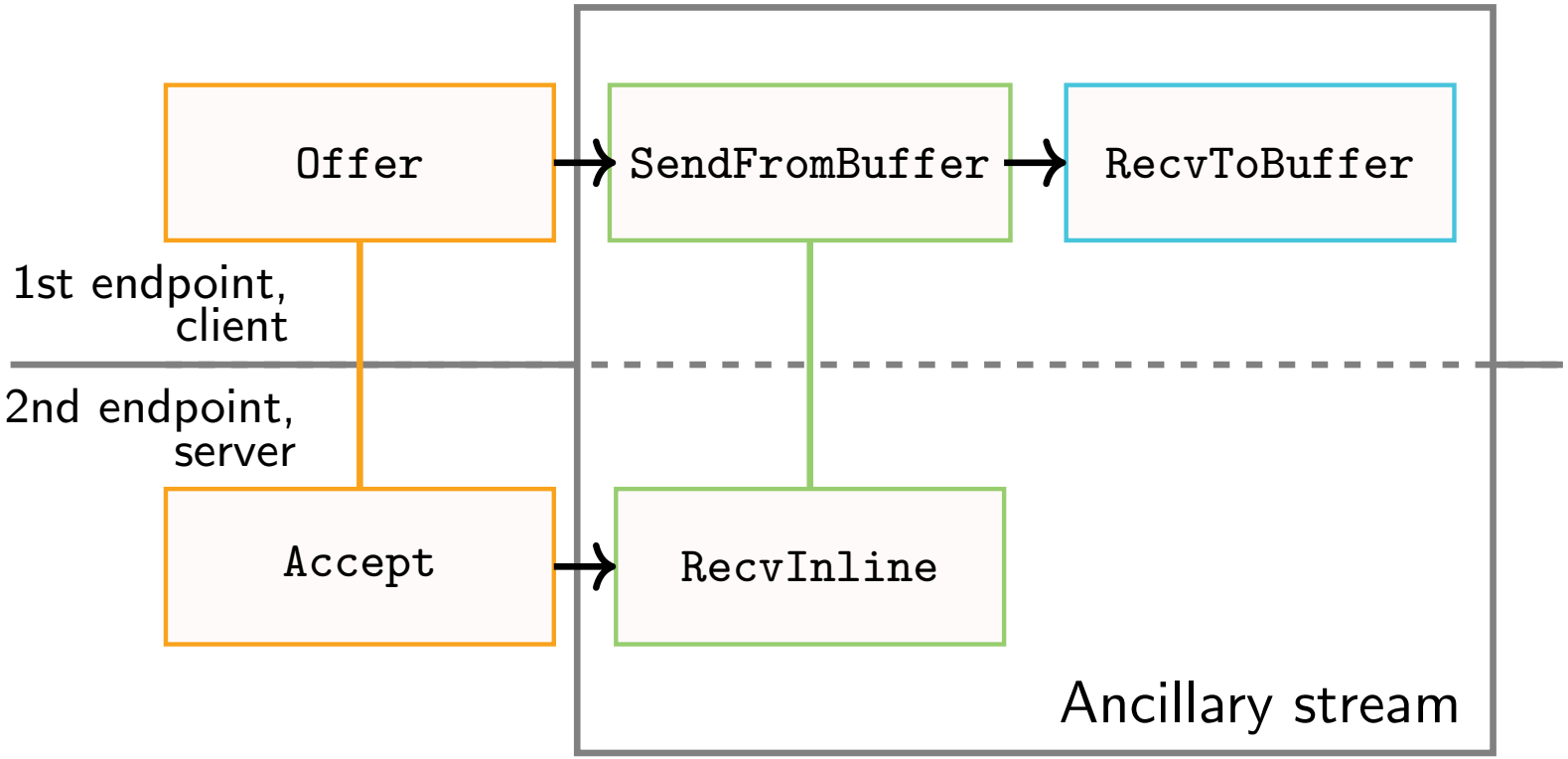

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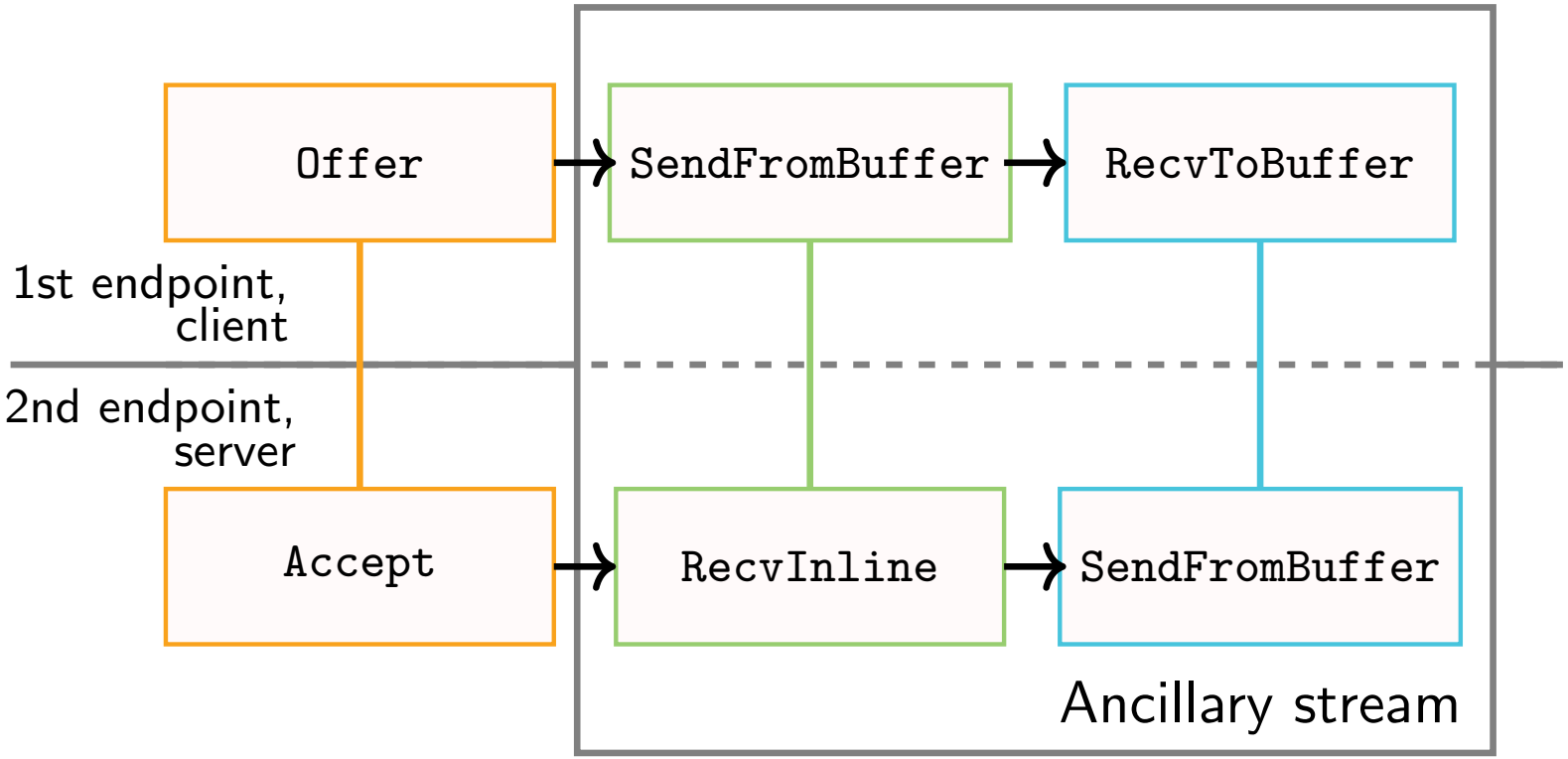

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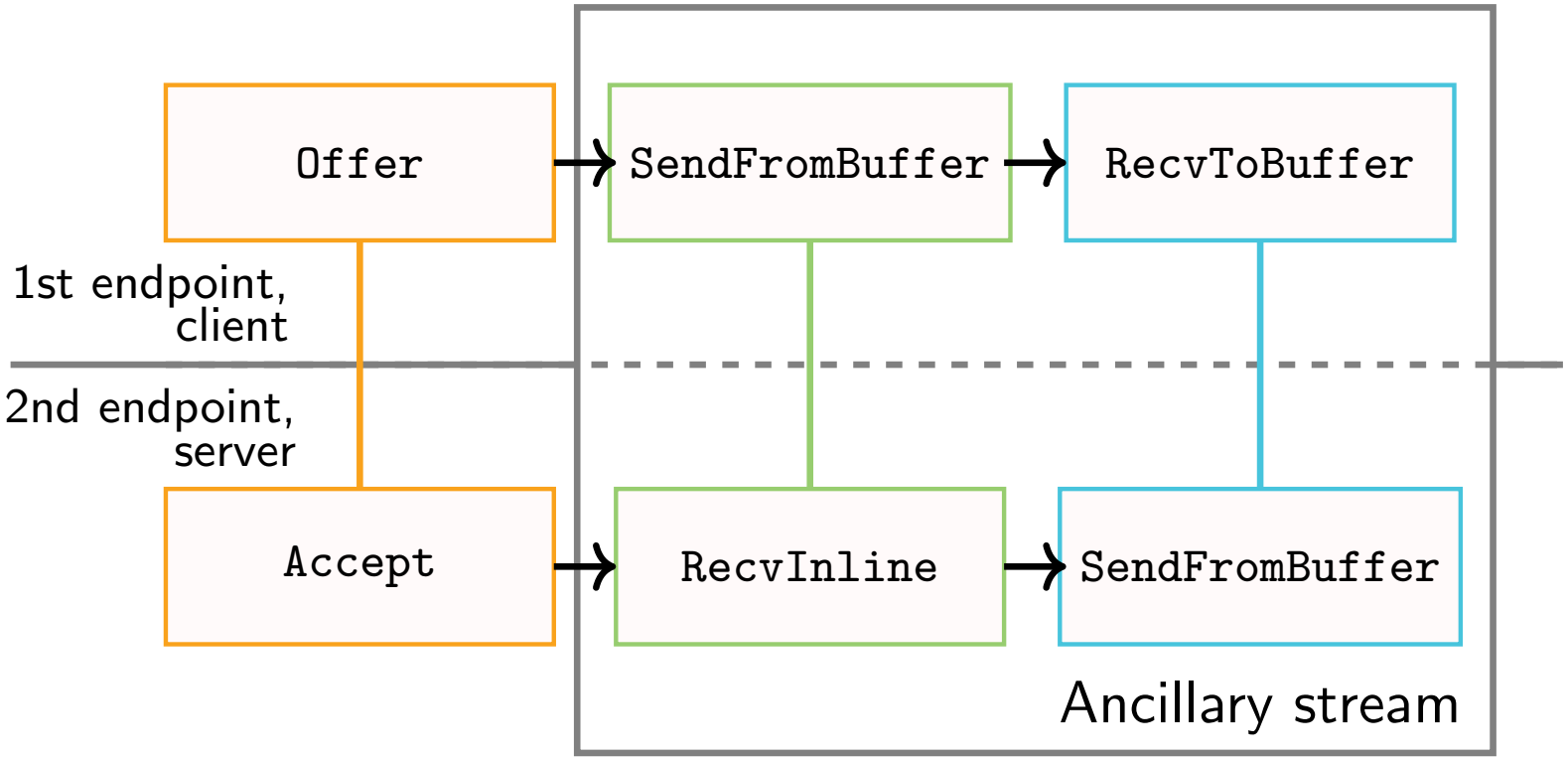

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Blog: `managarm.org` Twitter: `@managarm_OS`

Thanks to all contributors!

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Thank You! Questions?

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