

Performance Evaluation of Android IPC for Continuous Sensing Applications

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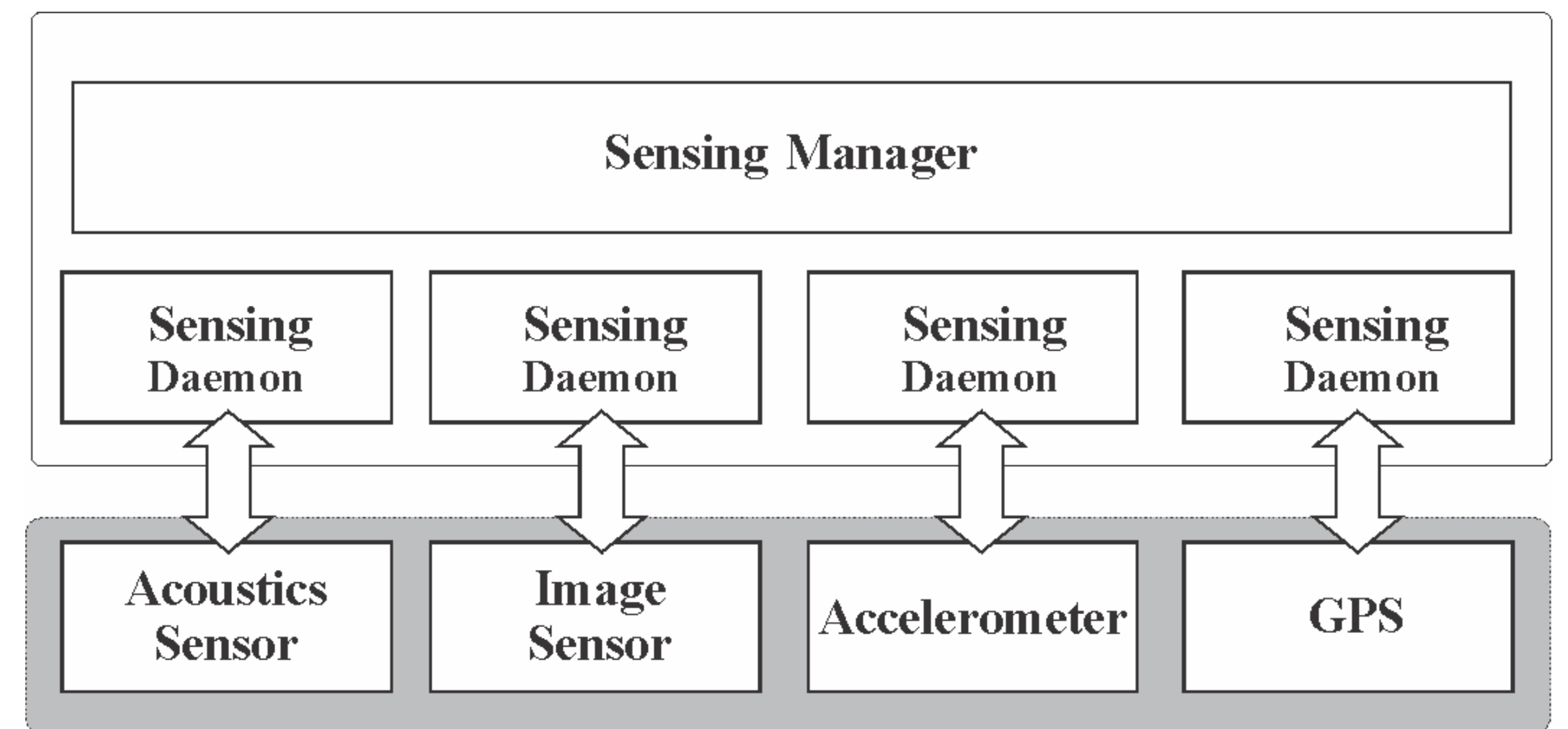
IPC Requirements of Continuous Sensing Applications

Continuous Sensing Applications

- A continuous sensing application is usually comprised of several components, each of which runs in its own processes with separated memory spaces.
- Only via inter-process-communication (IPC) mechanisms can components interact with each other.

IPC Requirements

- The IPC transactions of continuous sensing applications tend to occur periodically and frequently.
- Some applications require large transfer sizes (e.g. acoustic sensing.)
- Low latency & low resource usages (i.e. memory, CPU) are required to minimize the impact to user's normal phone usage.



Continuous Sensing Application Examples

Android IPC Mechanisms

Binder

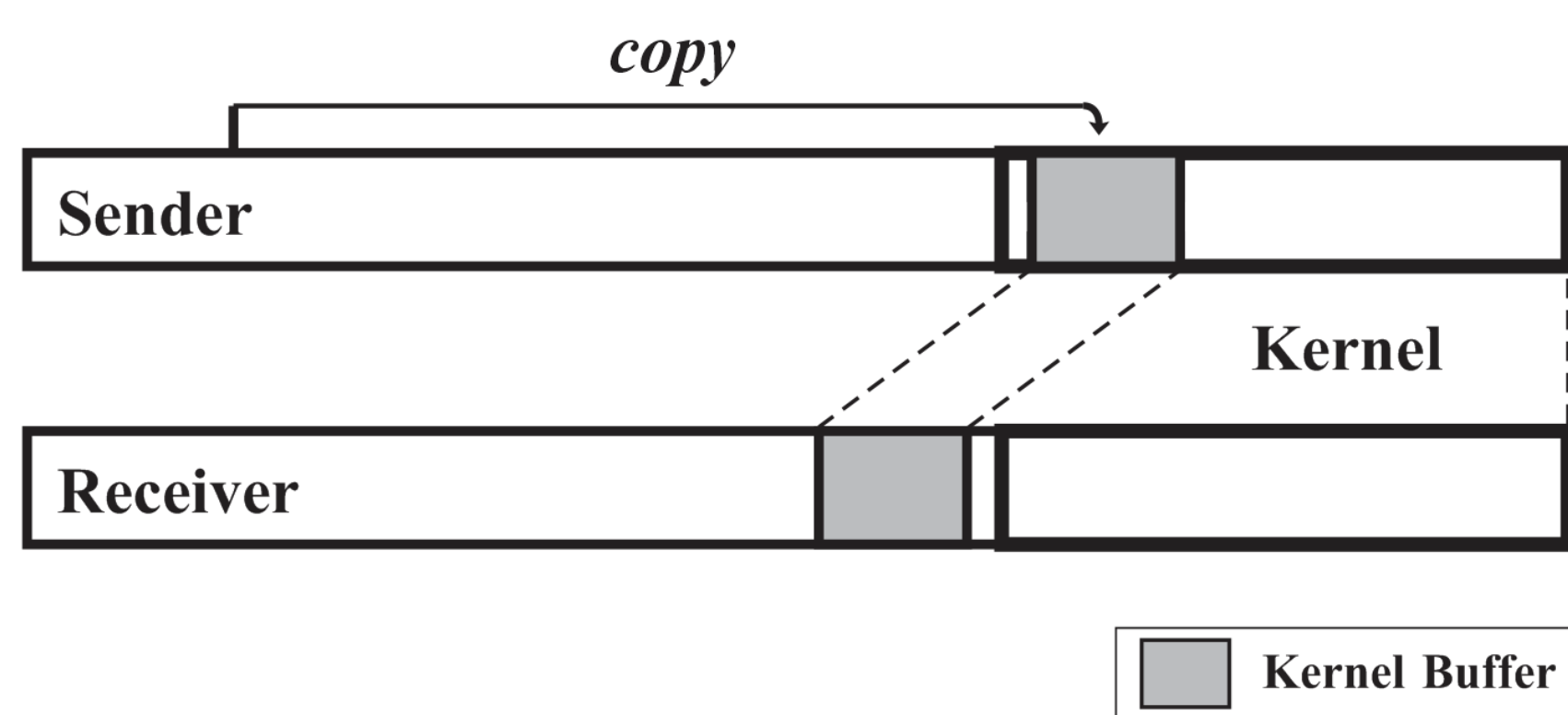
Binder is a remote procedure call mechanism that allows a client process to remotely invoke a function on a server process.

Pros:

- Binder requires only one data copy plus a temporal memory mapping to transmit data from one process to another.

Cons:

- Binder requires pre-defined interfaces between the processes, which limits the communication flexibility.
- Binder causes higher kernel overhead.



Intent

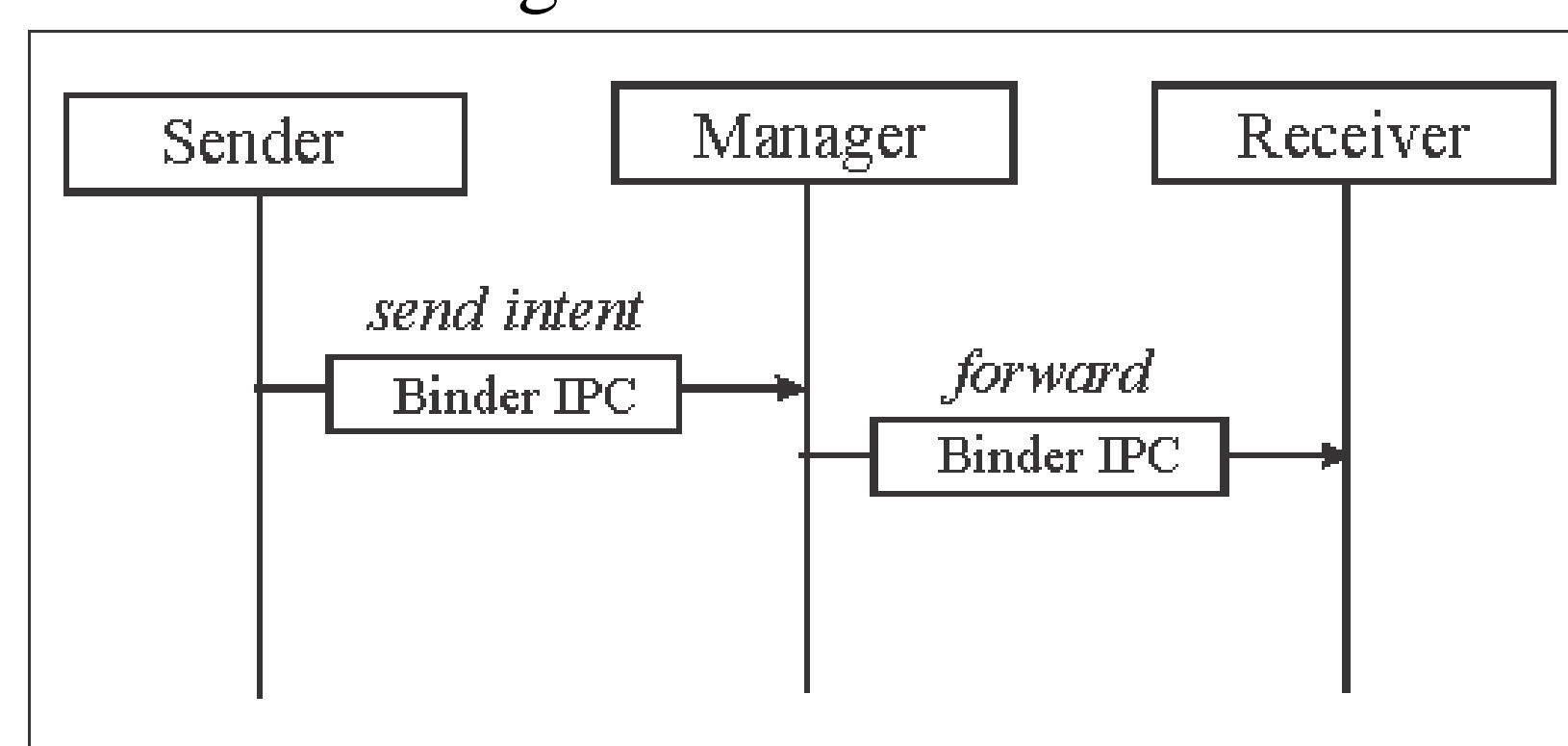
Intent is a message forwarding system, where a system service forwards a message to its proper receivers based on intent-filtering policies.

Pros:

- The intent-filtering policies enable more flexible interaction between processors.
- Message broadcasting is supported.

Cons:

- Two-fold transmission is required, resulting in longer transmission latency and higher resource usage.



Content Provider

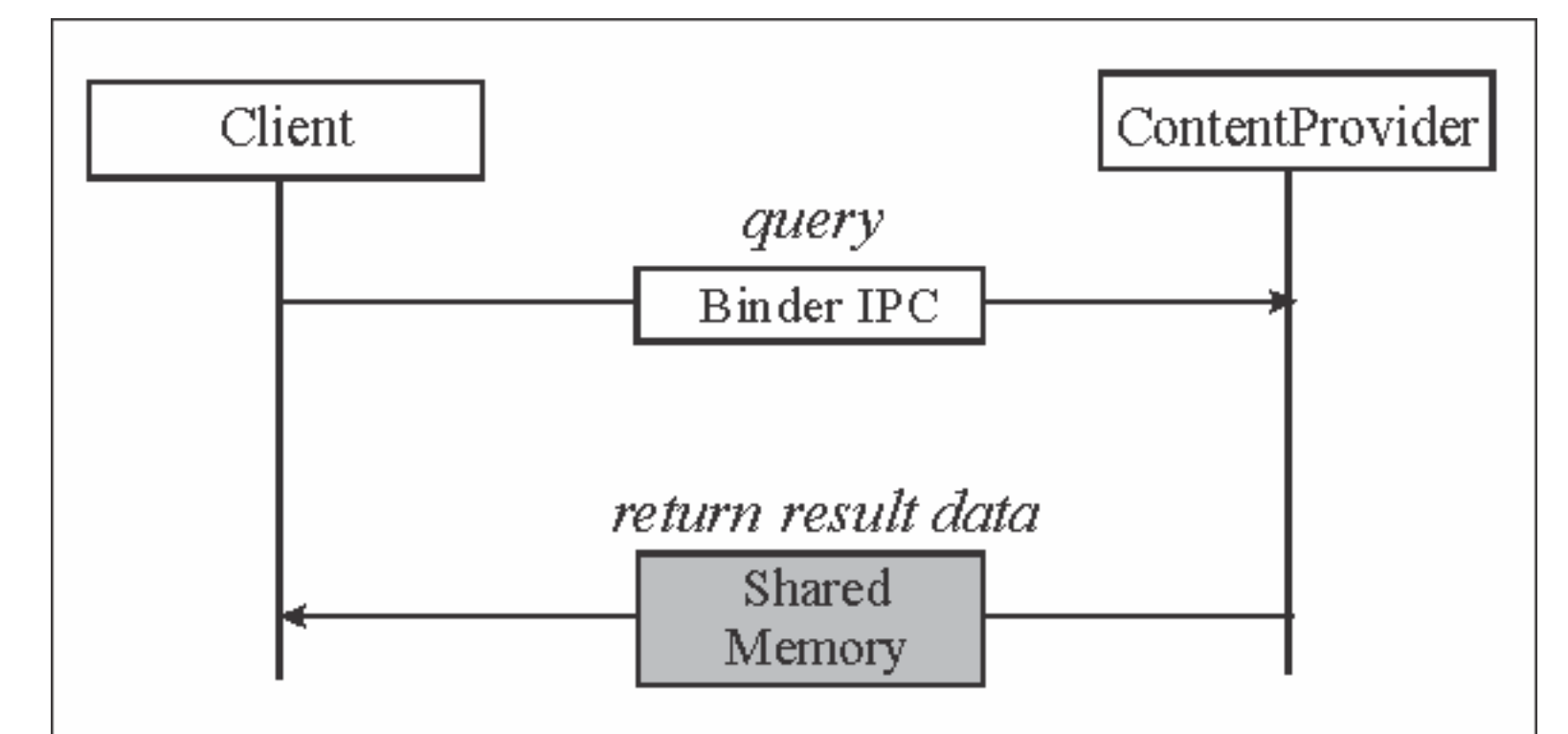
Content provider is a data storehouse mechanism that provides SQL-like APIs and enables the data sharing among processes.

Pros:

- It adopts shared memory technique to transmit query results and has the lowest data transmission overhead.

Cons:

- Content provider only favors large transfer size due to the high shared memory allocation overhead.



Performance Evaluation

- **Evaluation methodology:** Two processes communicated every one second via different IPC mechanisms, while the packet sizes ranged from 4B to 256KB to simulate different continuous sensing IPC needs. Each data point is an average of 100 transactions, and the error bars represent 95% confidential intervals.

Latency: Content provider performs the best for larger packet sizes, but is outperformed by Binder for smaller packet sizes.

Memory Usage: Intent uses two times more memory than other mechanisms due to its two-fold transmission design.

CPU Usage: Content provider shows the lowest CPU usage for larger packet sizes, while Binder performs the best for the smaller packet sizes.

