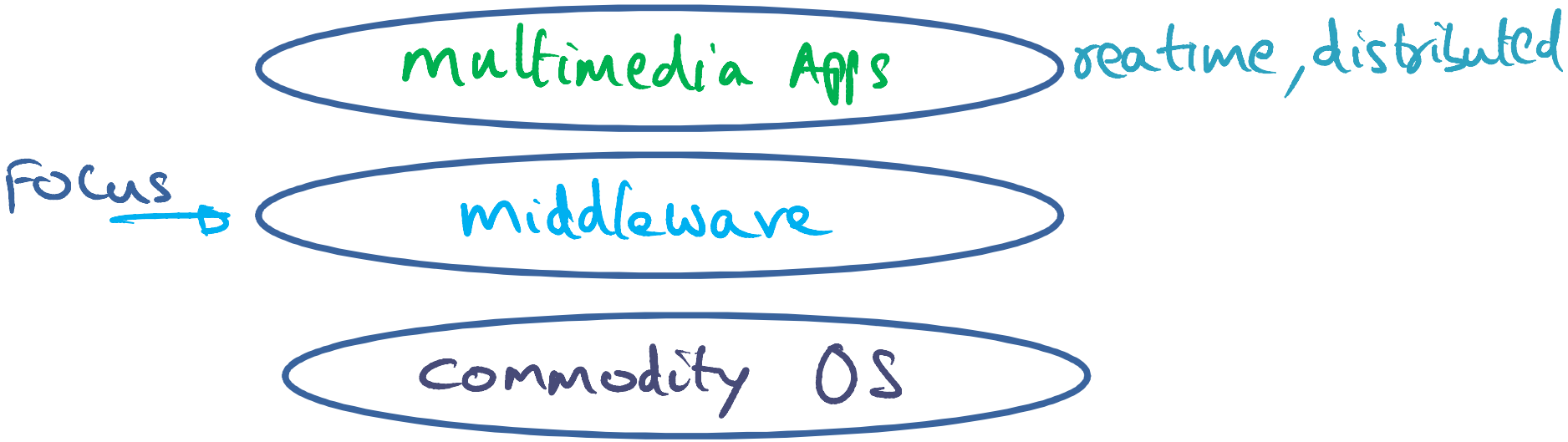
Real Time Computing - PTS

Lesson outline

✓ TS- Linux

→ Persistent Temporal streams



Programming Paradigms

Parallel Program

- Pthreads: API for parallel programs

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Distributed Programs
- Sockets: API for distributed programs

Programming Paradigms

Parallel program

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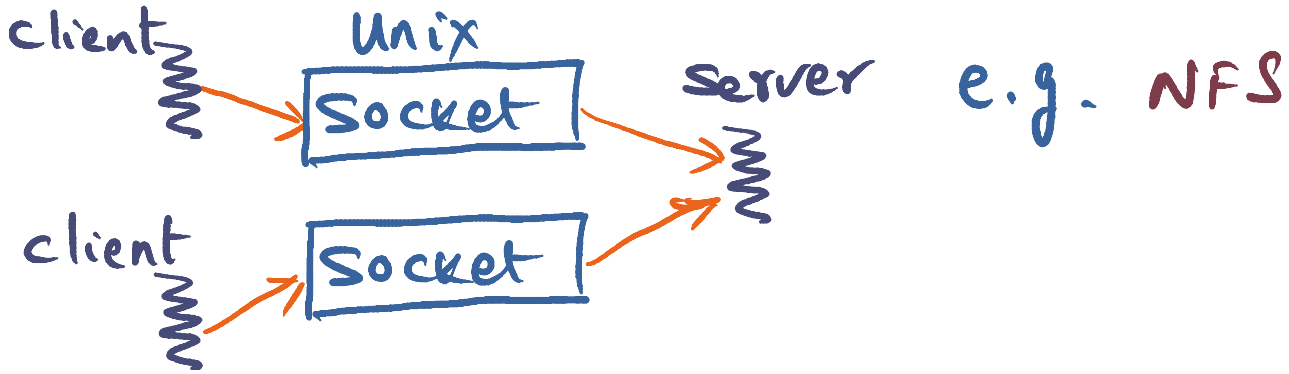
Distributed Programs

- Sockets: API for distributed programs

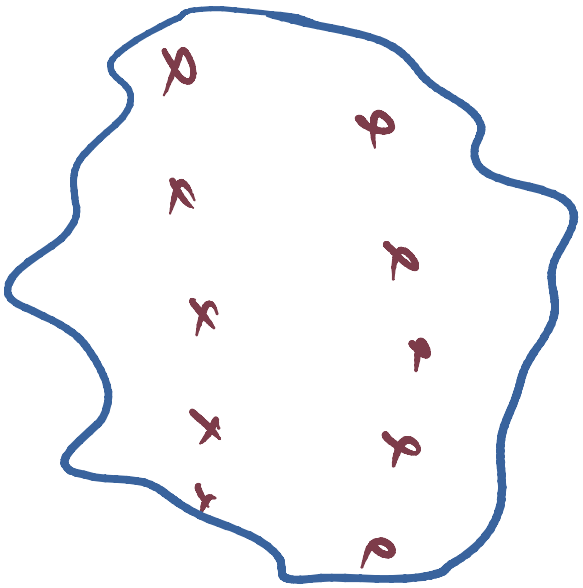
Conventional Distributed program



e.g. NFS

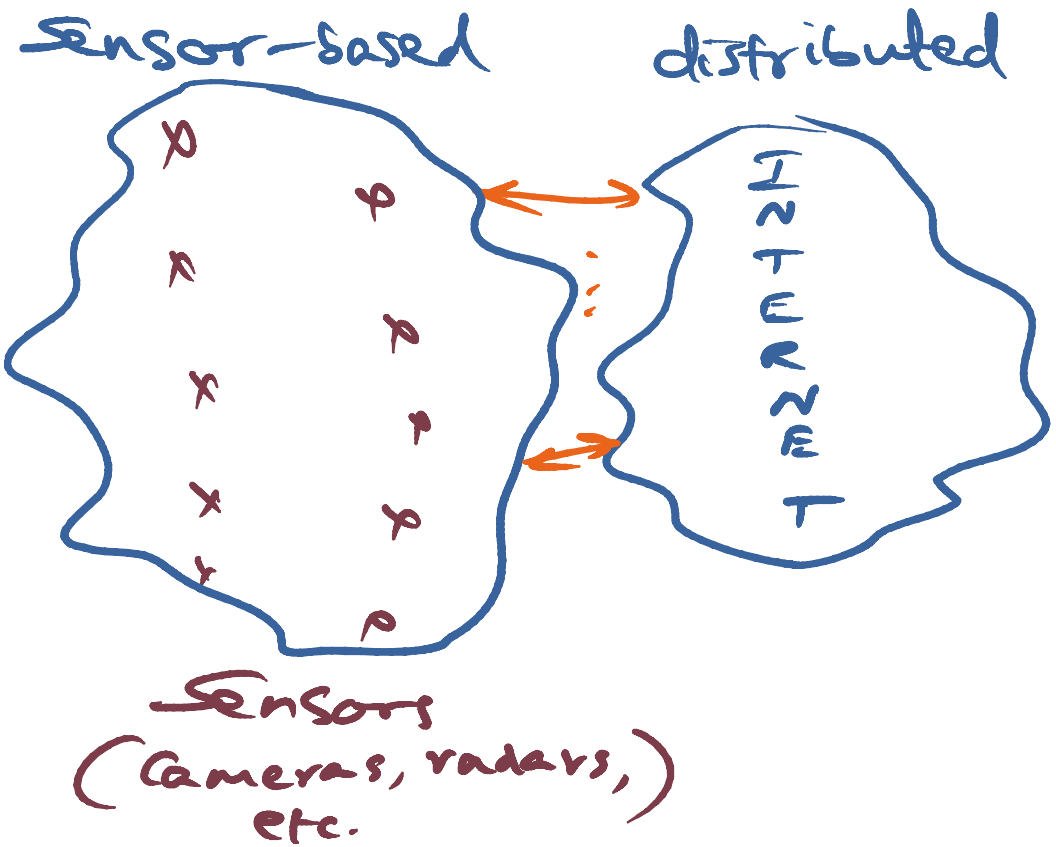
Novel Multimedia Apps

Sensor-based



Sensors
(cameras, radars,)
etc.

Novel Multimedia Apps



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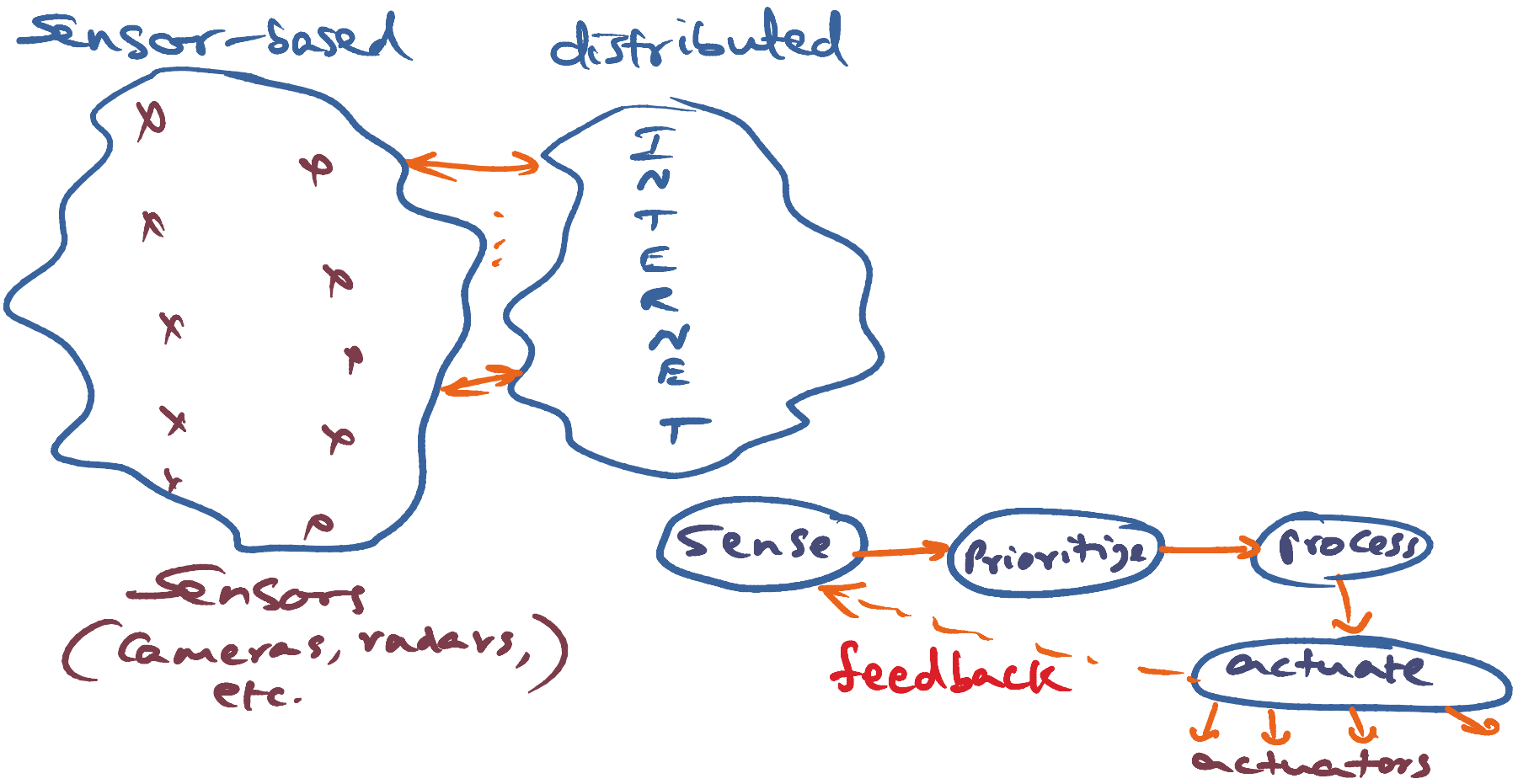
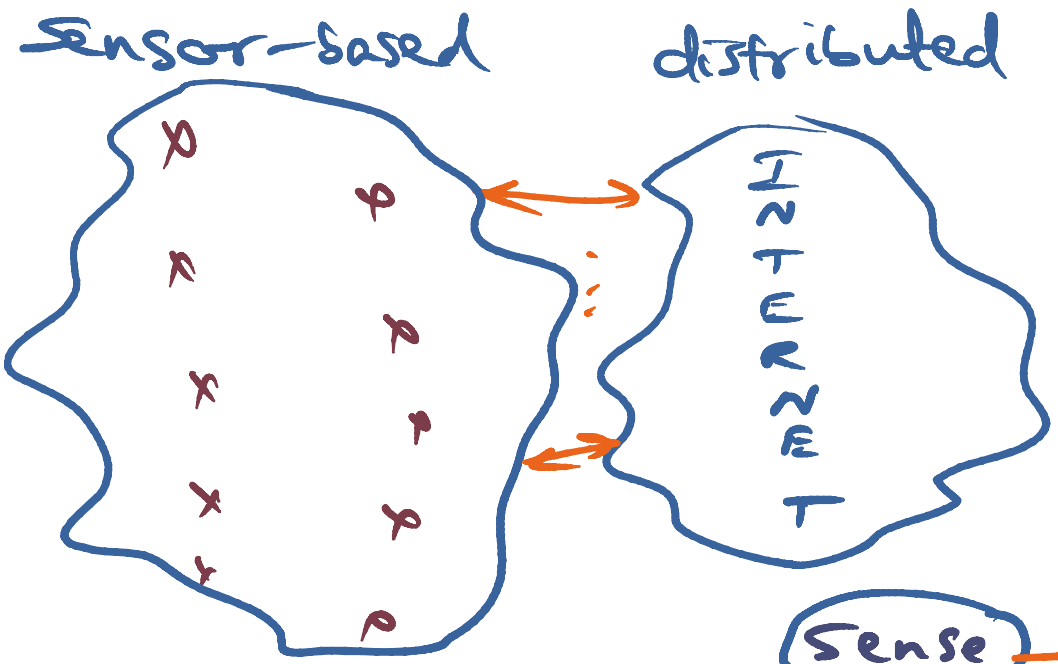
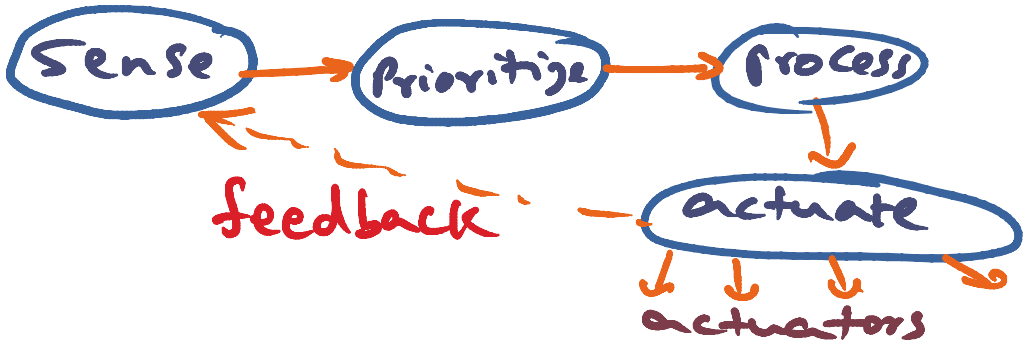


Novel Multimedia Apps

Computationally intensive
real-time





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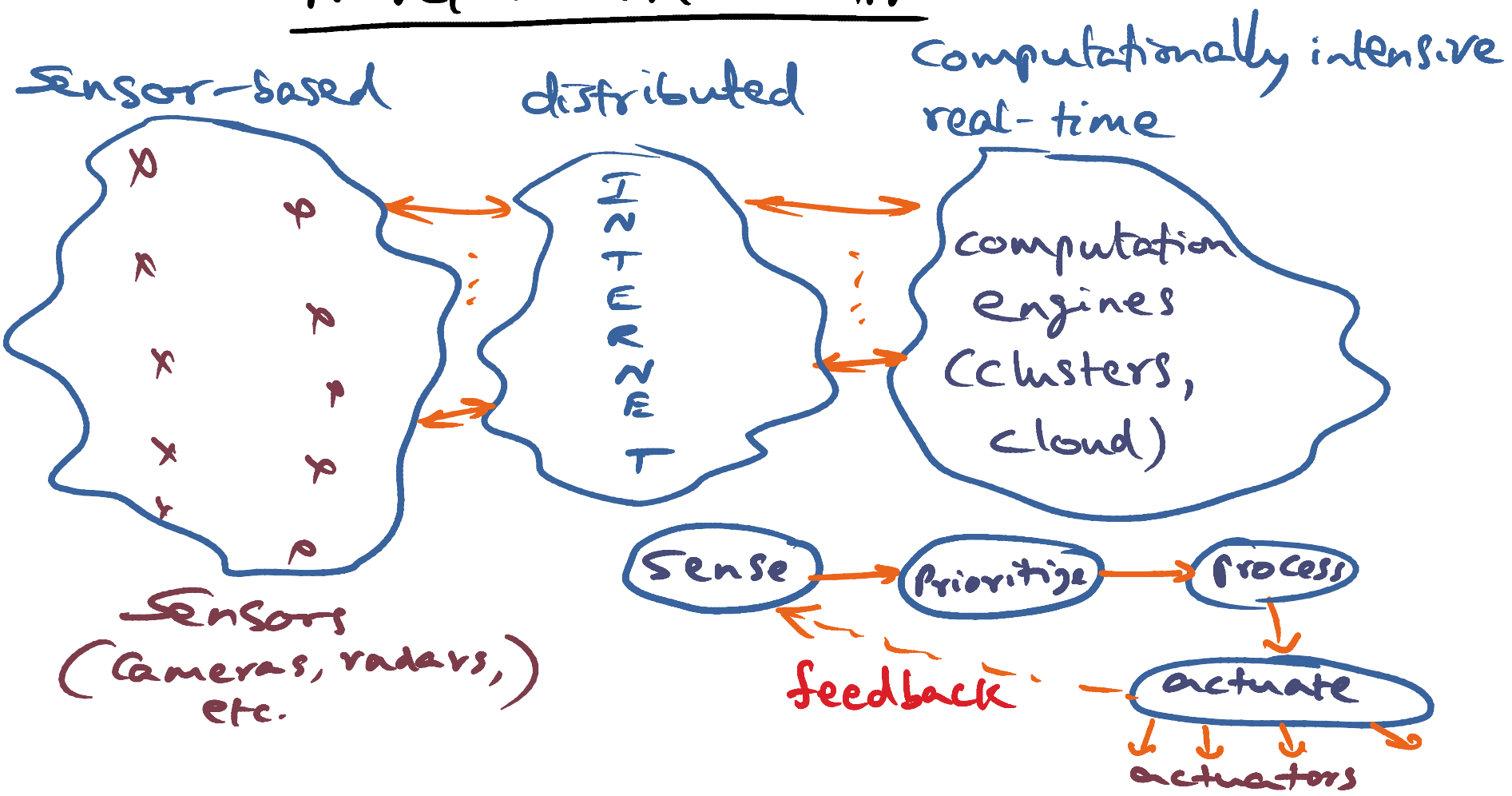

Example: Large-scale Situation Awareness

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Infrastructure Overhead

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Infrastructure Overhead

Cognitive Overhead

Example: Large-scale Situation Awareness

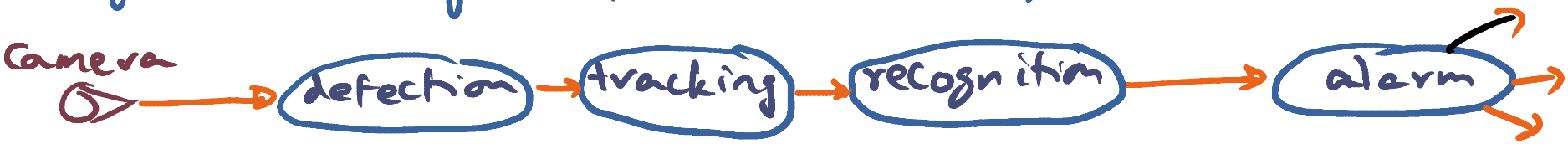
Infrastructure Overhead

Cognitive Overhead

False Positives
False Negatives

Programming Model for Situation Awareness

Sequential program for video analytics



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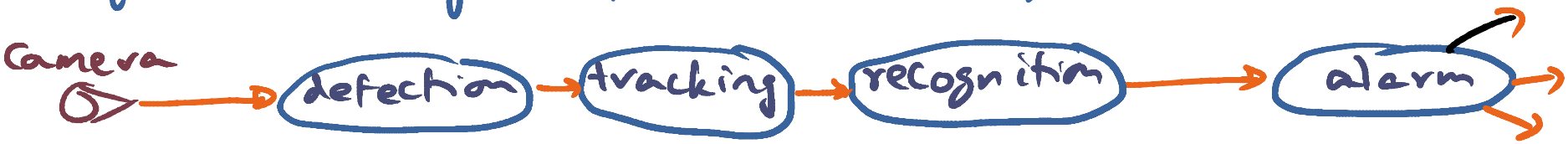

Objective in Situation Awareness Apps

- Process streams for high level inference

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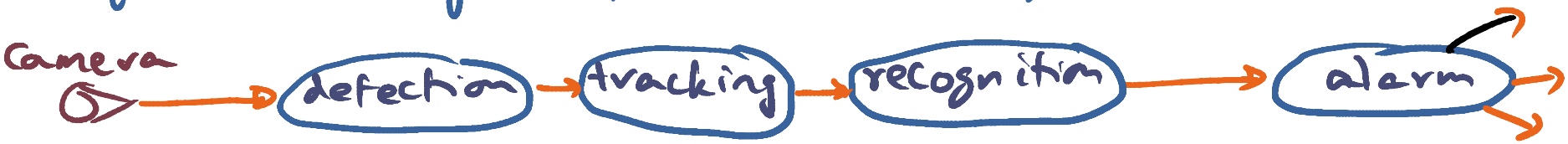

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!Not watch youtube video! ☺

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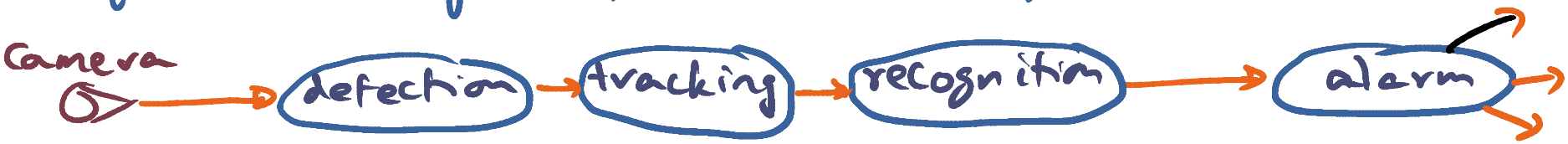

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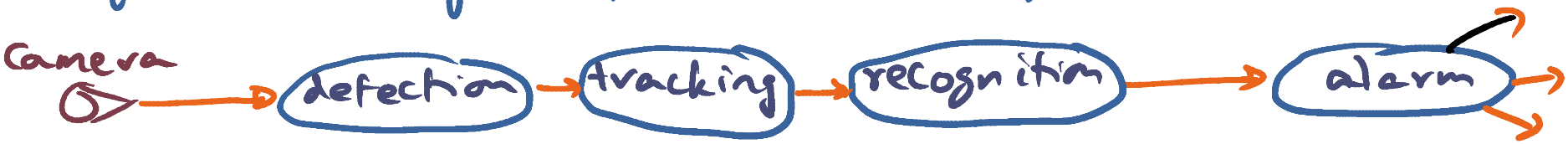

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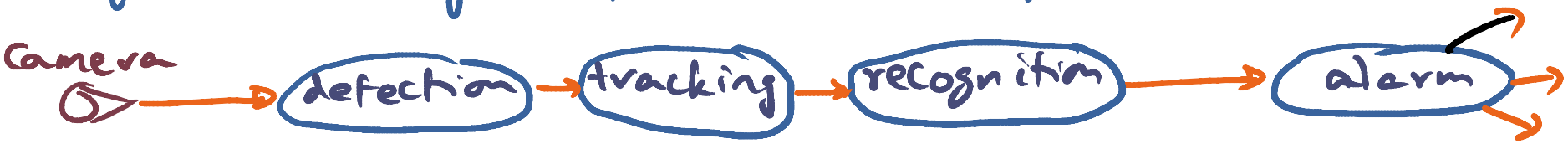

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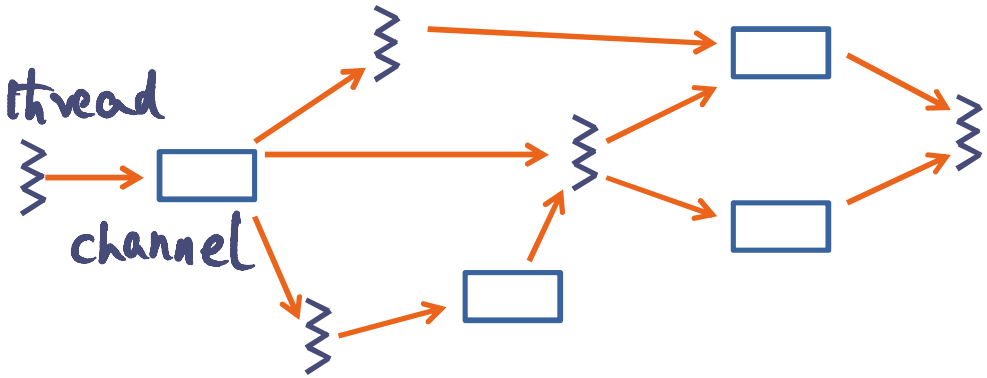
....not the last word!!

PTS Programming Model



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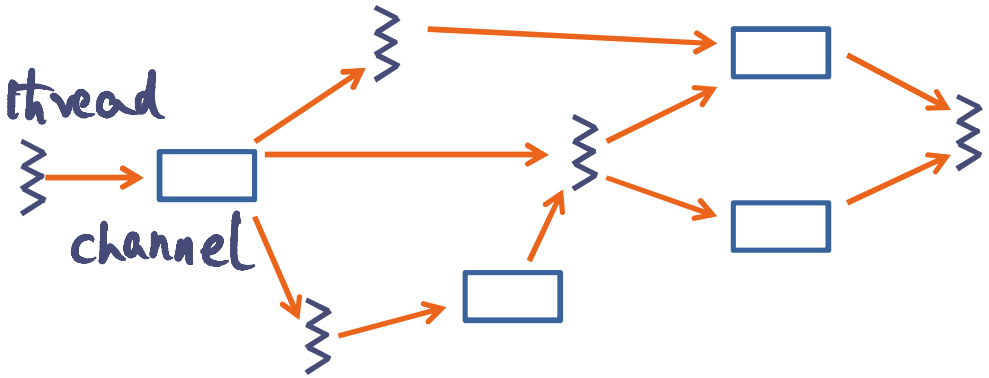

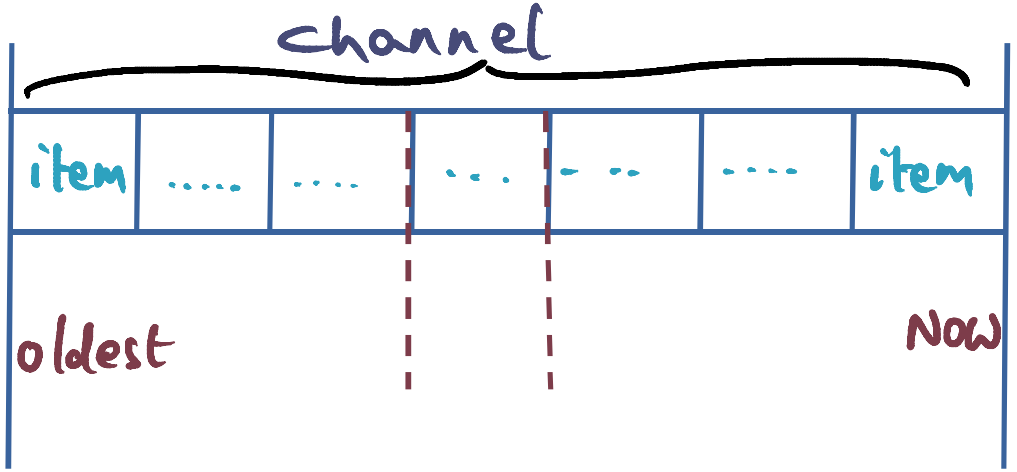

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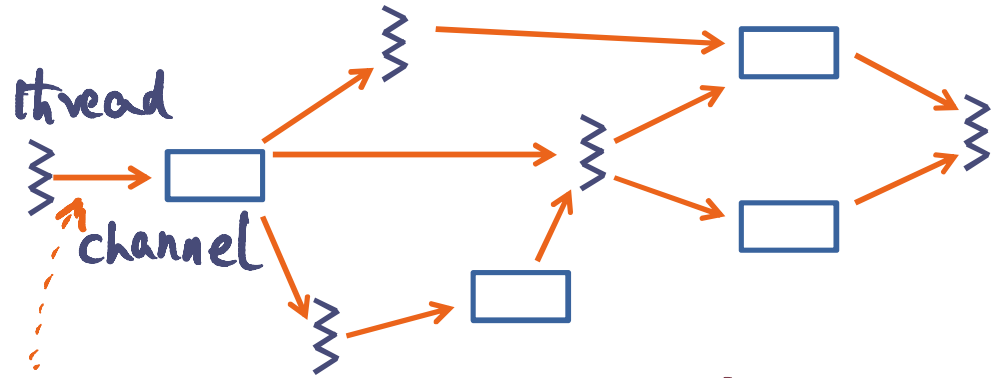

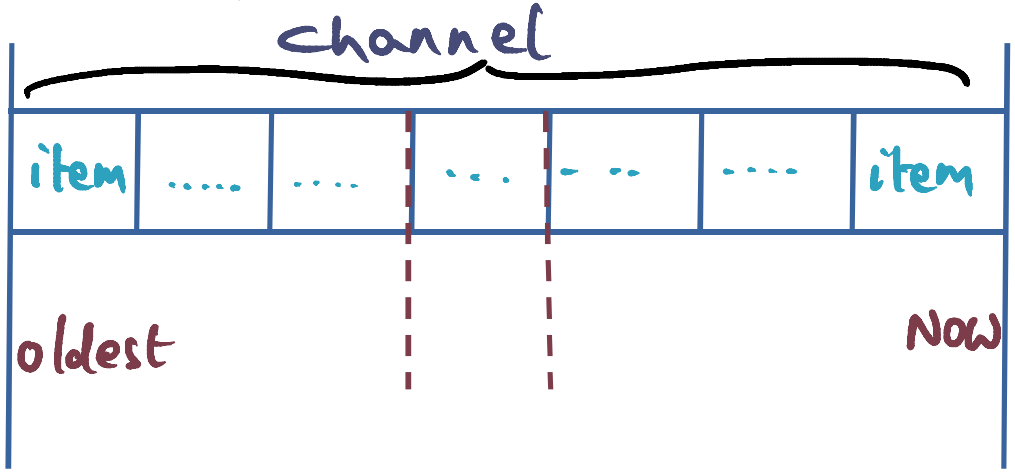

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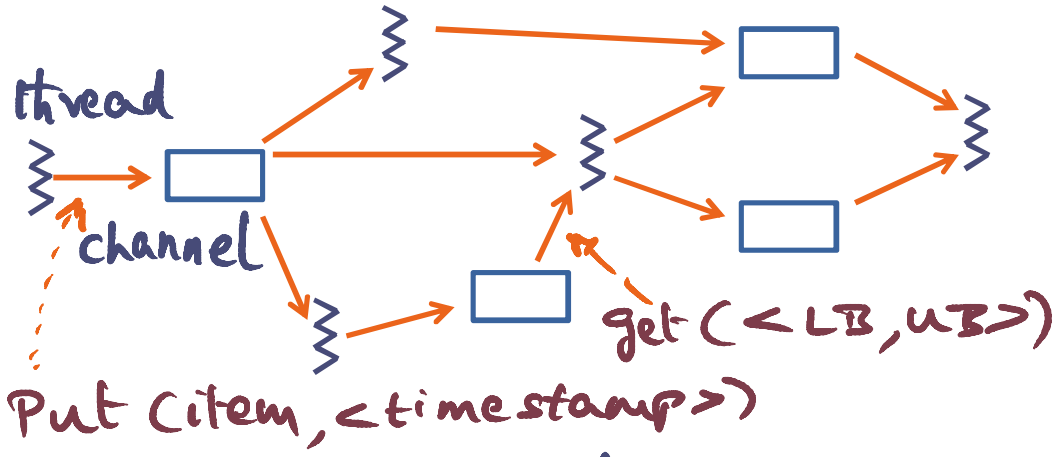

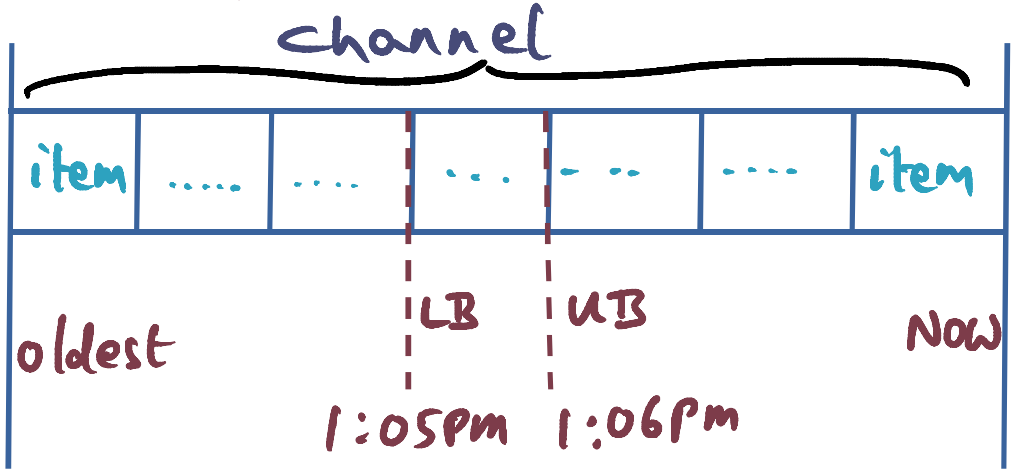

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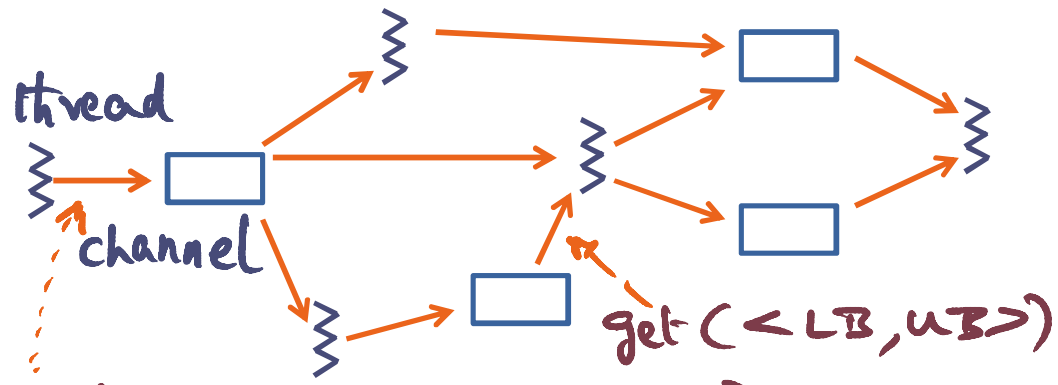
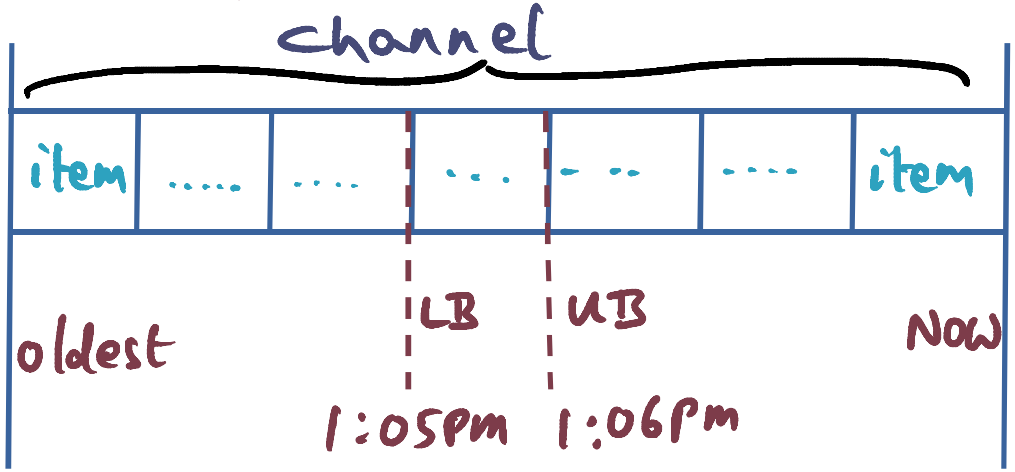
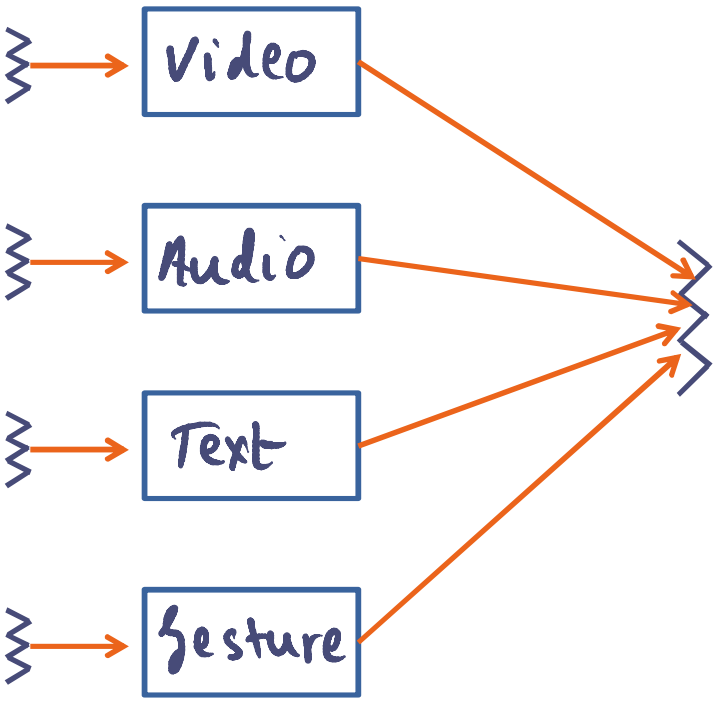





```
Channel ch1 =
    lookup ("Video channel");
While (1){
  //get data
  response r =
    ch1.get (<LB,UB>);
  //Process data
    :
  //Produce output
    ch2.put (item,<ts>);
}
```

PTS: Bundling Streams



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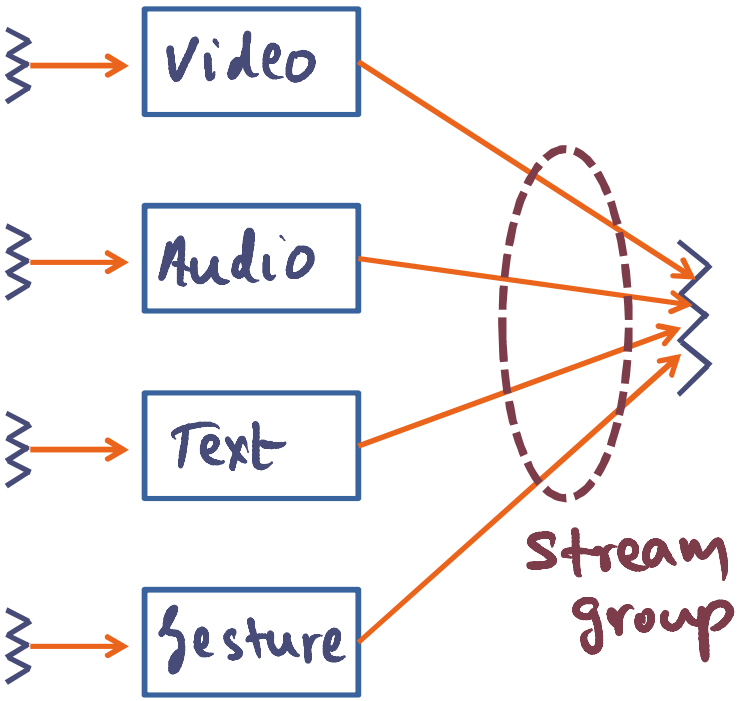

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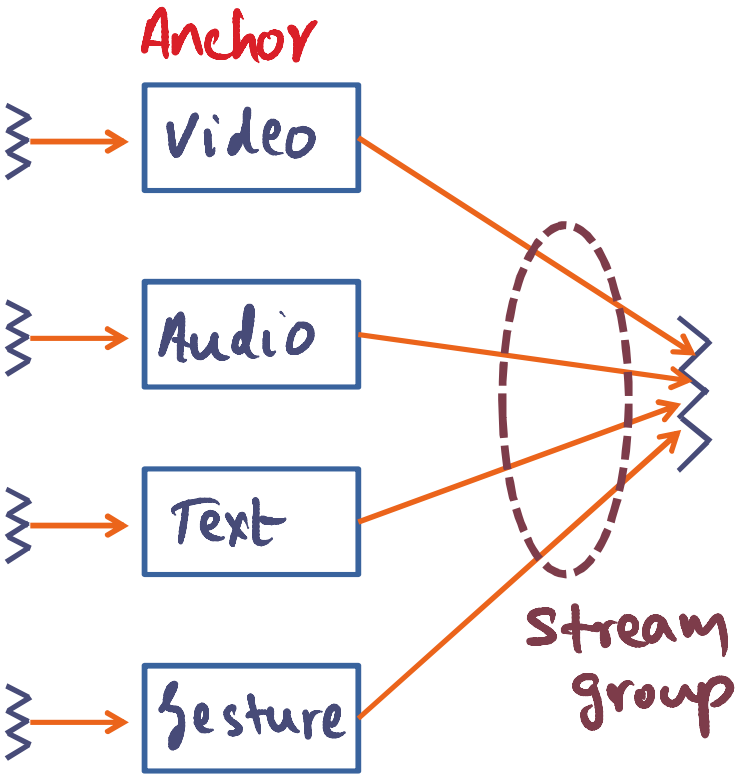

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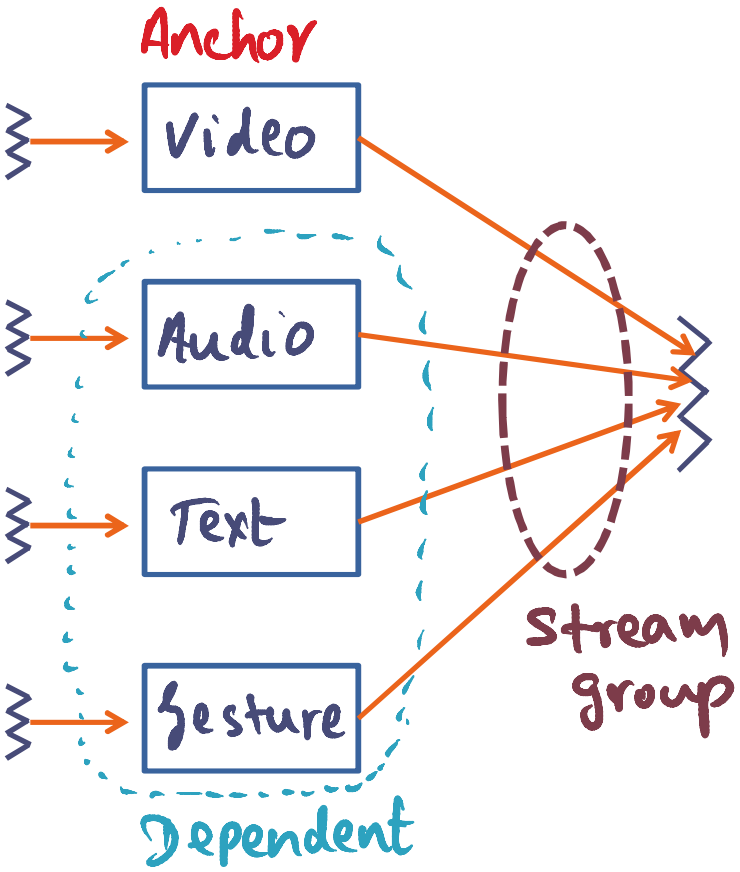

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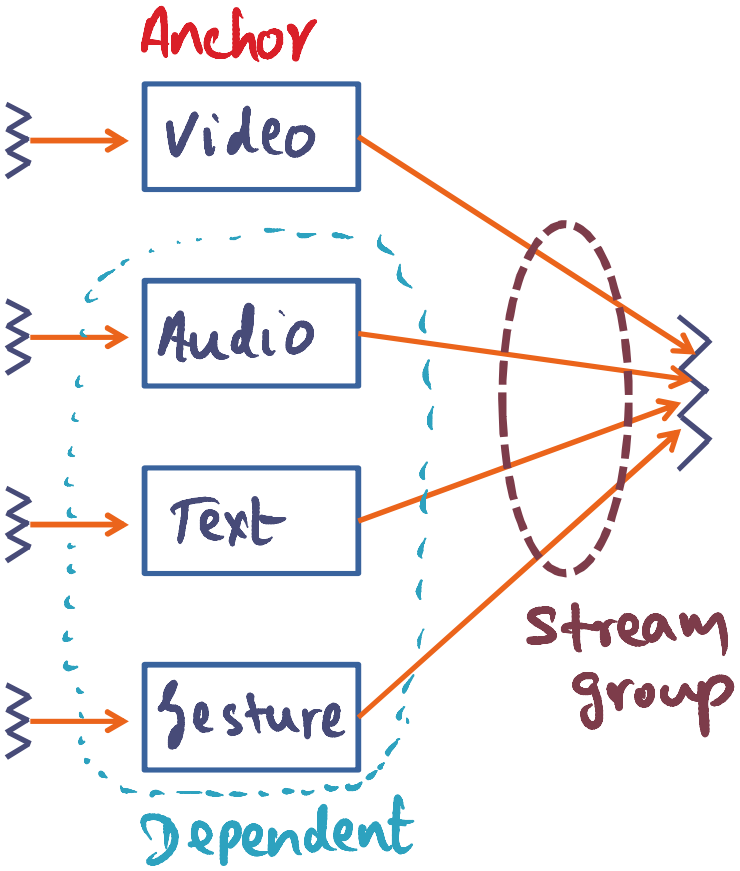
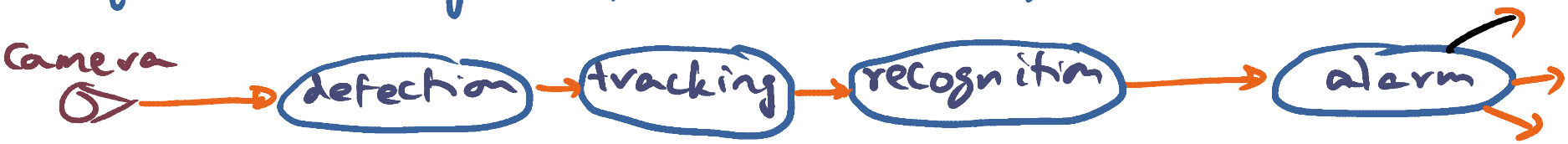


Group get :

- get corresponding time-stamped items from all the streams in the group

Power of Simplicity

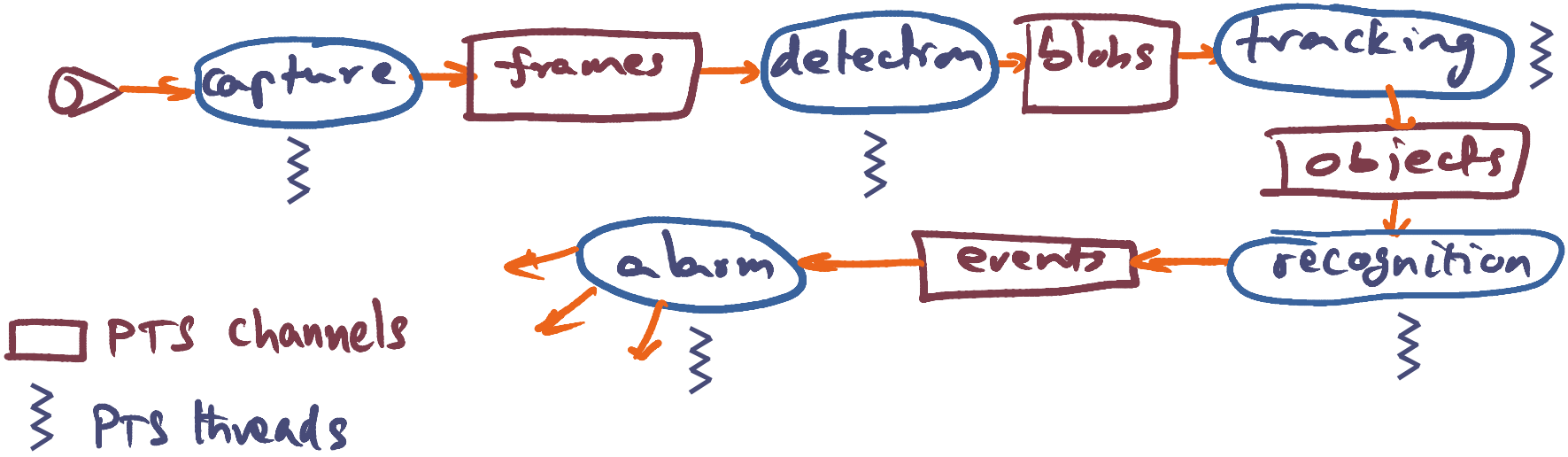
Sequential program for video analytics



Power of Simplicity

Sequential program for video analytics

Distributed program with get/put between modules



PTS Design Principles

Simple Abstractions / interfaces

— channel and get/put

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Do the heavy lifting (systems) under the covers

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PTS channels
- Can be anywhere
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- network-wide unique

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} Similarity to Unix sockets

- time first class entity
- Persist streams under App control

Group Activity

Similarity of Unix Socket + PTS channel?

Differences between Unix Socket + PTS channel?

Synchronization causality?

Temporal causality?

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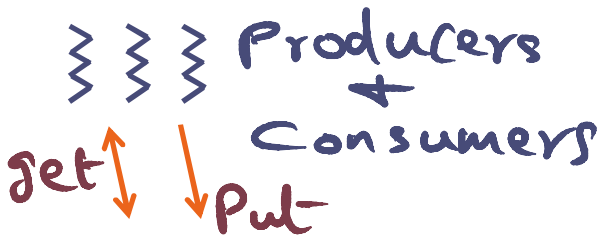
} Similarity to Unix sockets

- time first class entity
- Persist streams under App control
- Seamlessly handle live and historical data

Persistent Channel Architecture



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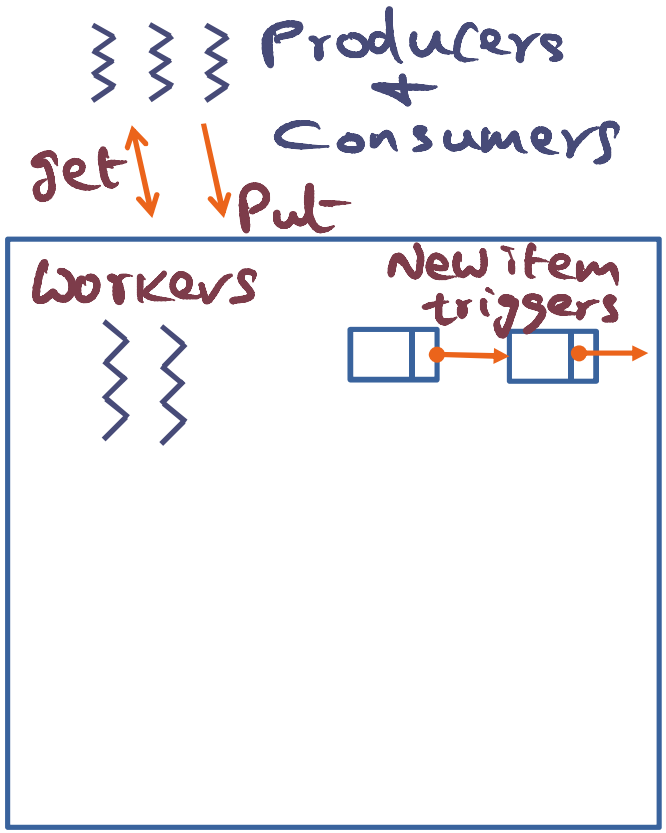

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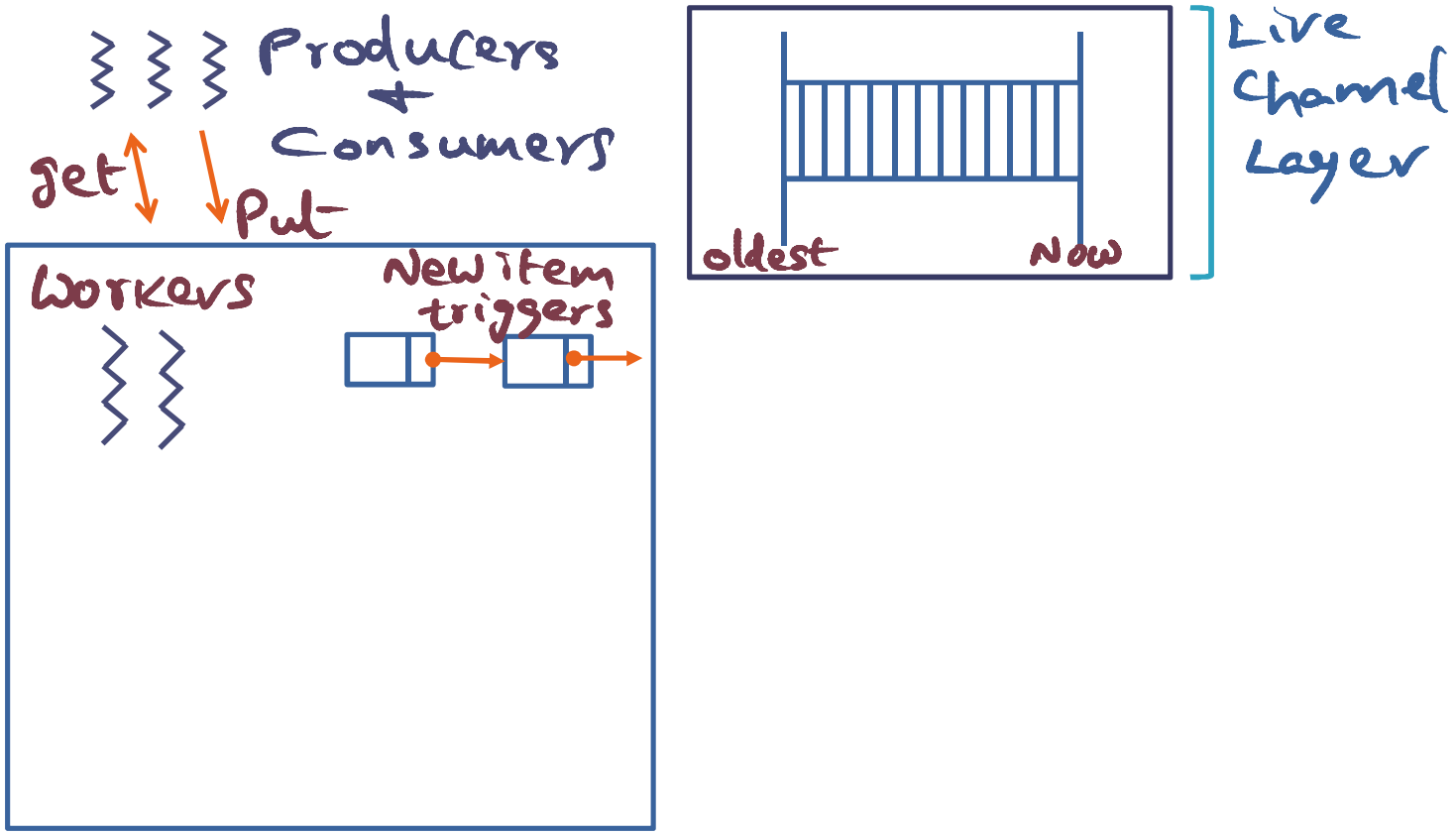

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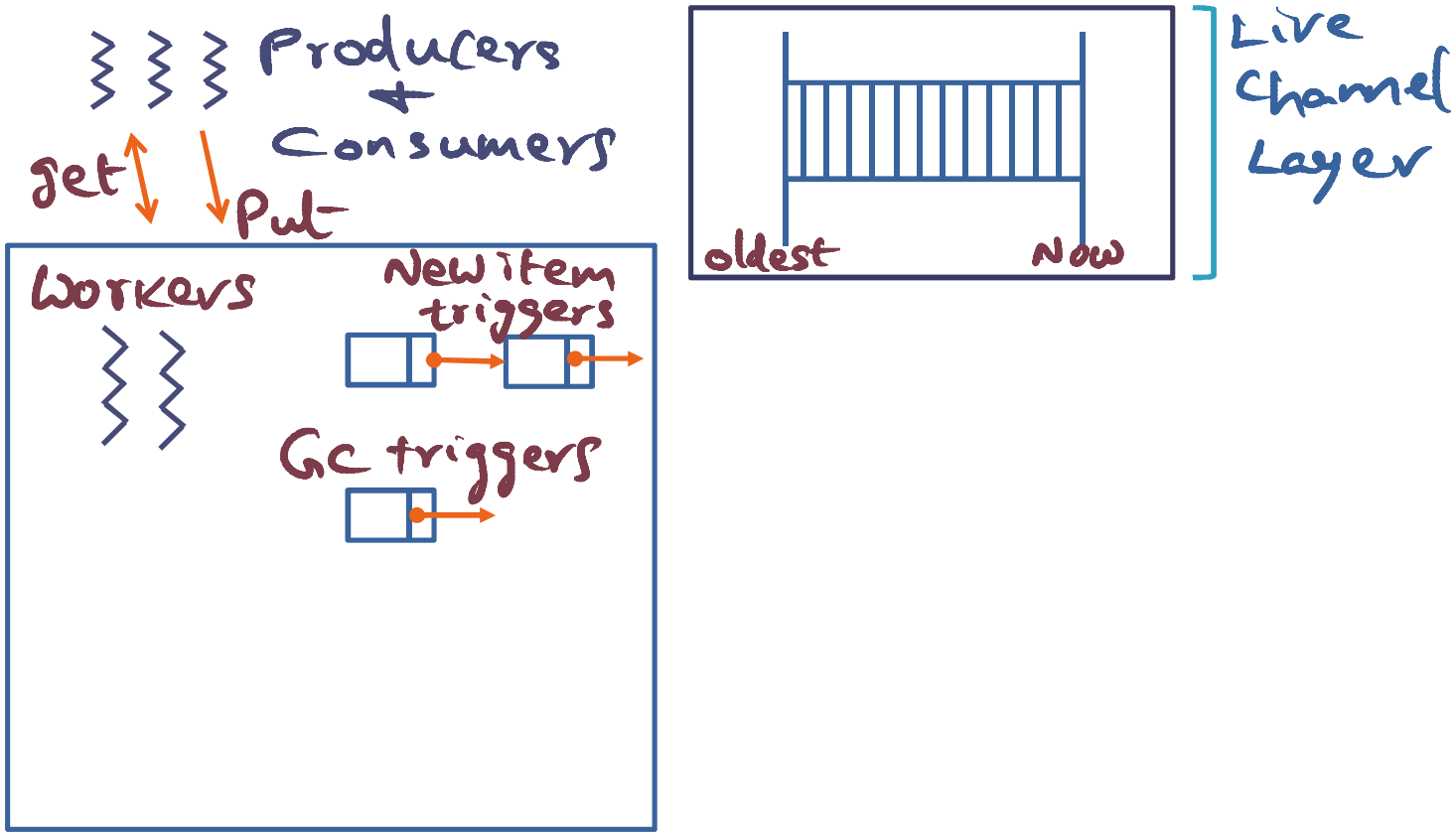

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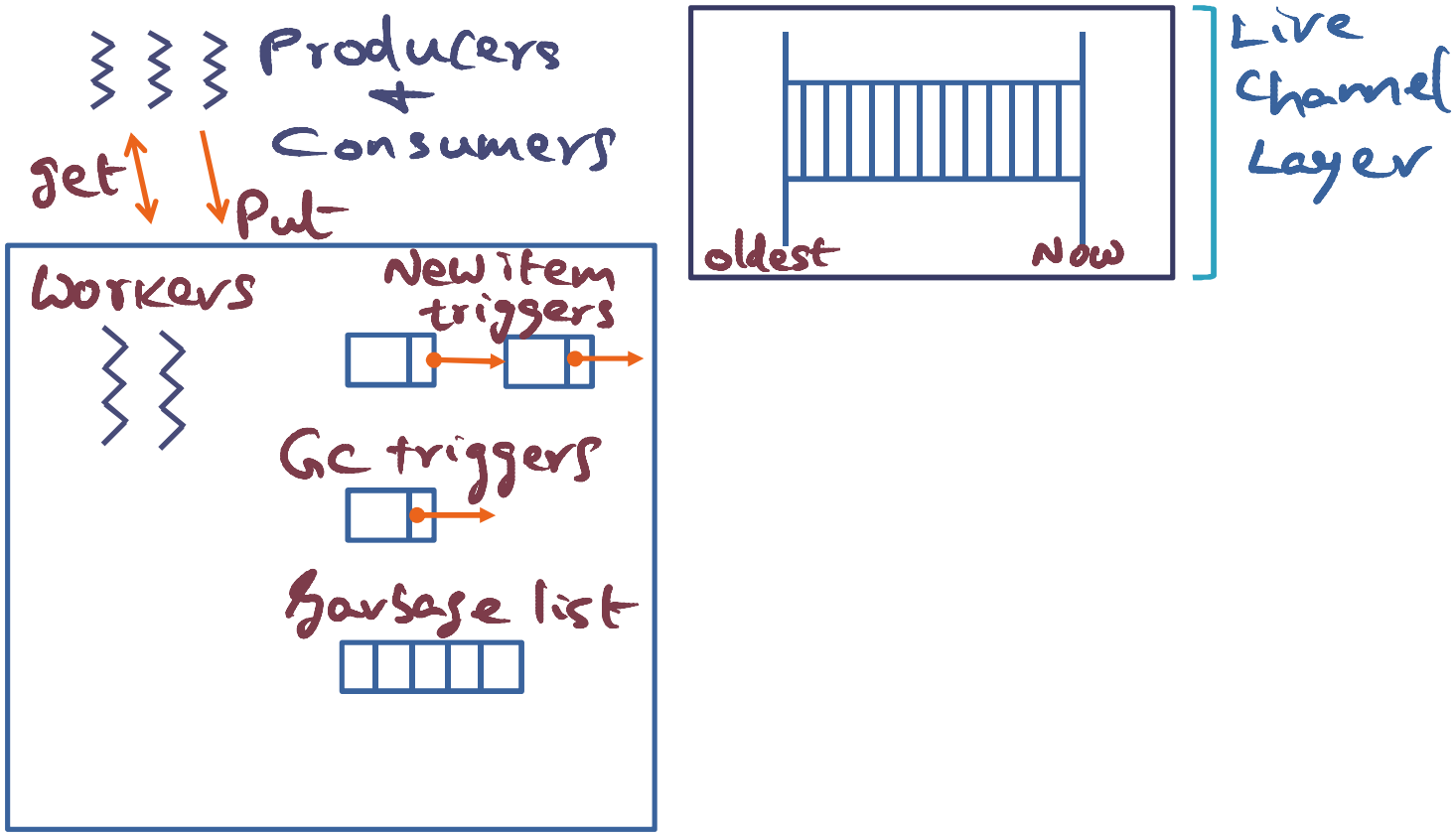

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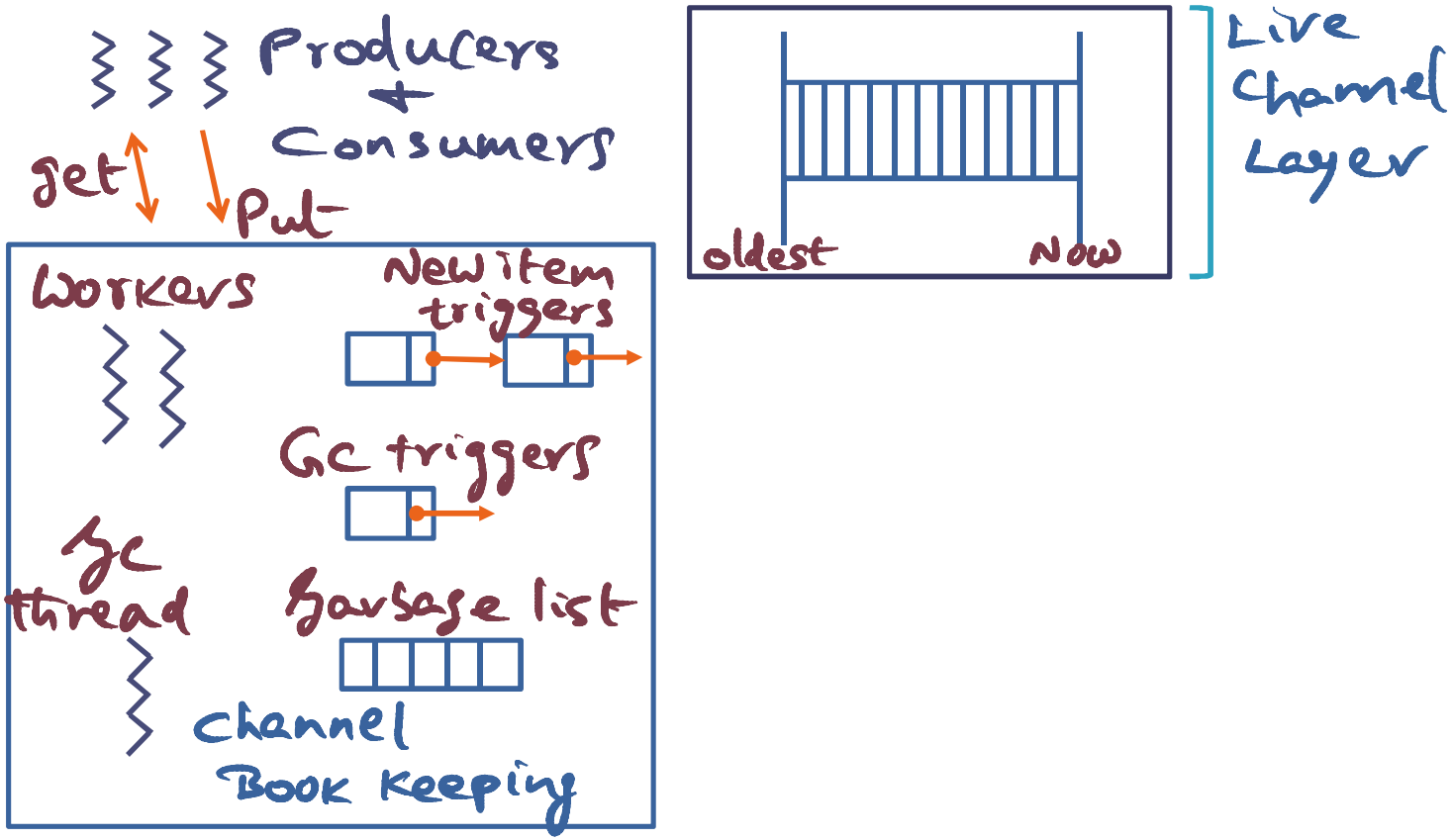

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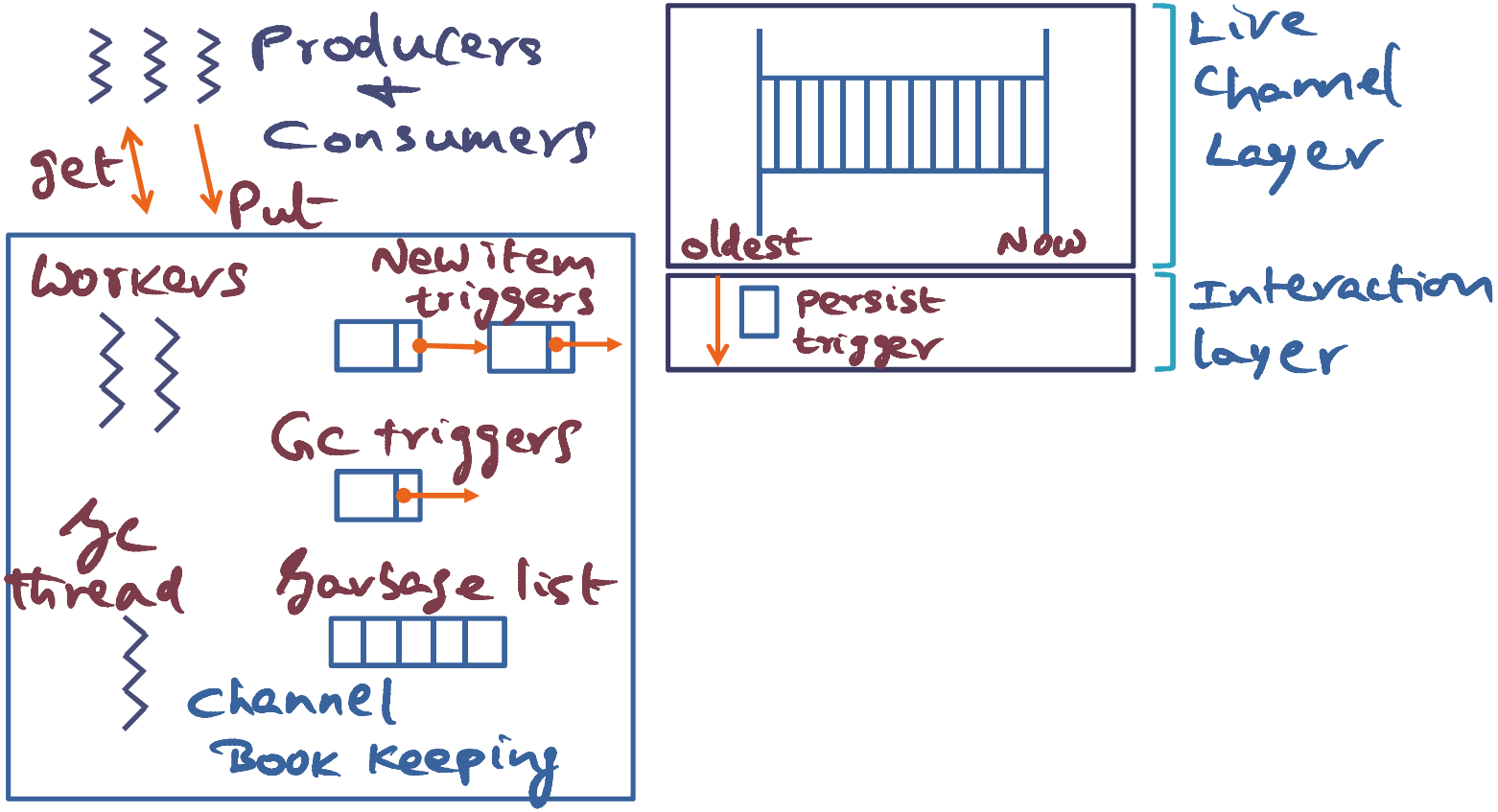

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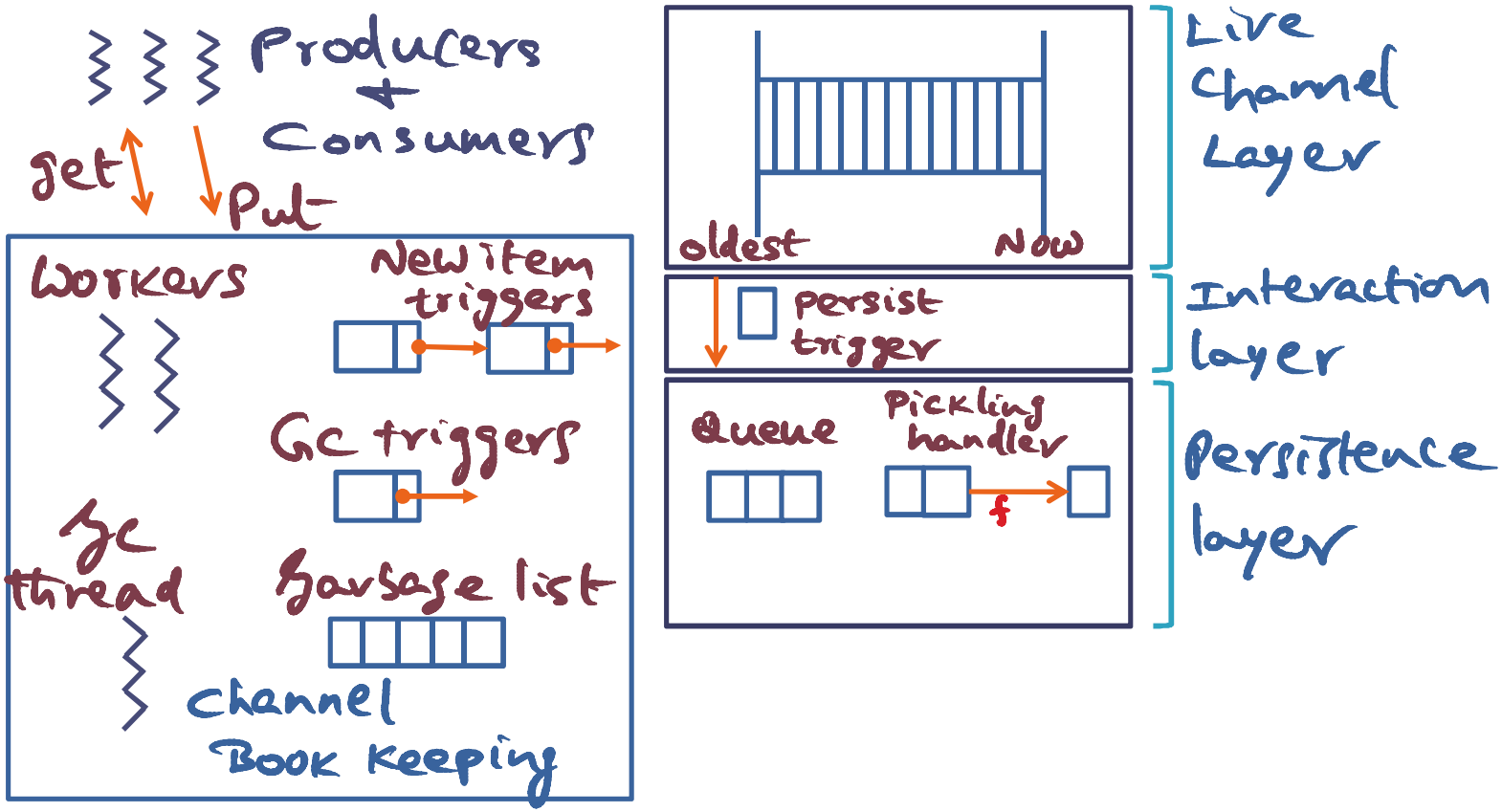

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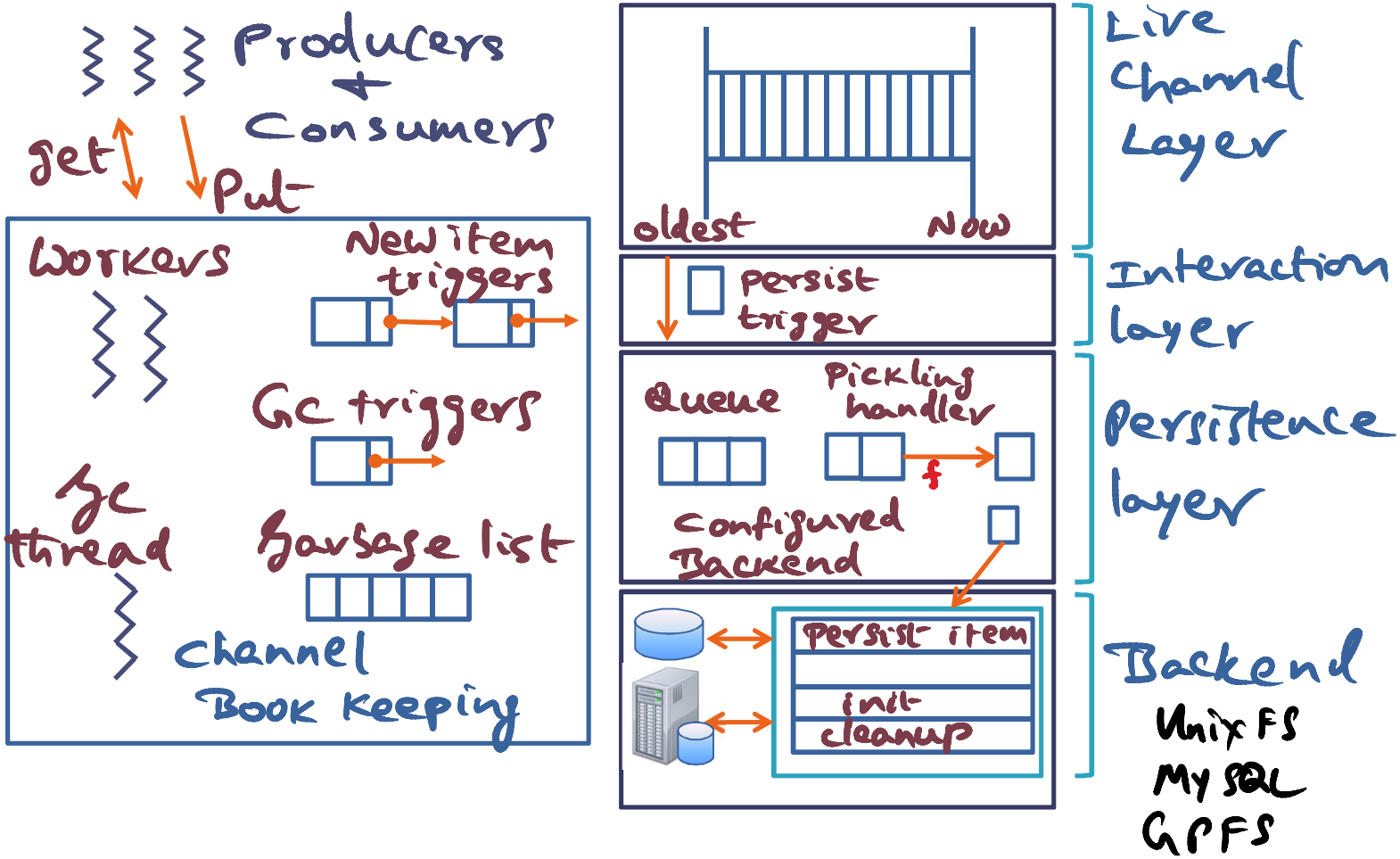

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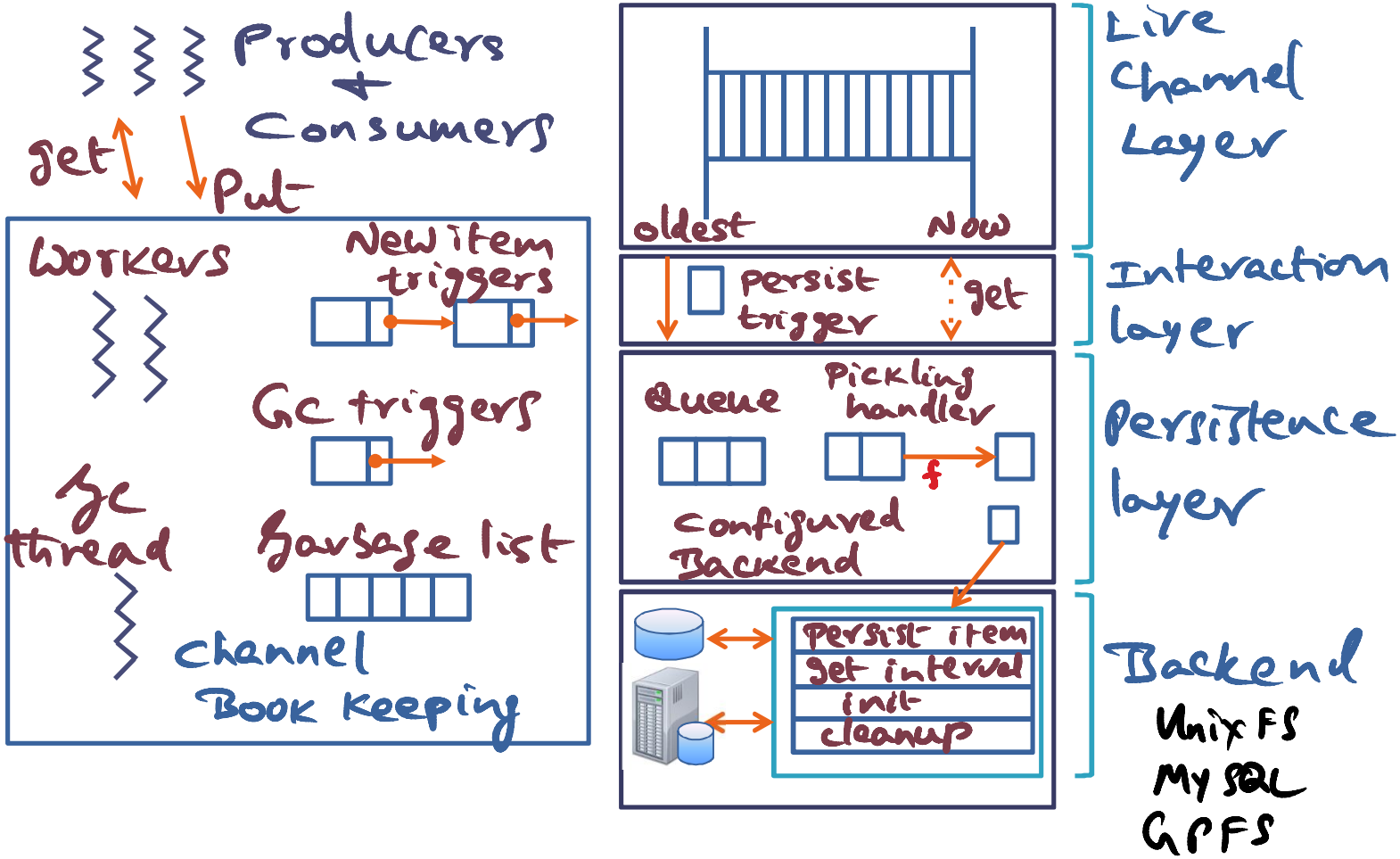

Key takeaways

- Similarity to map-reduce provides a simple and intuitive programming model for the domain expert to develop “big data” processing apps, PTS is providing a simple programming model for the domain expert to develop “live stream analysis” applications.
- Time-based distributed data structures for streams, automatic data management, transparent stream persistence are the unique features of the PTS programming model that facilitate live stream analysis.