Concurrent Programming Using The Disruptor

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The Disruptor?

What I'm covering

- Overview of the Disruptor
- Create your own!
- Turn it up to Eleven
- Q&A

What is it?

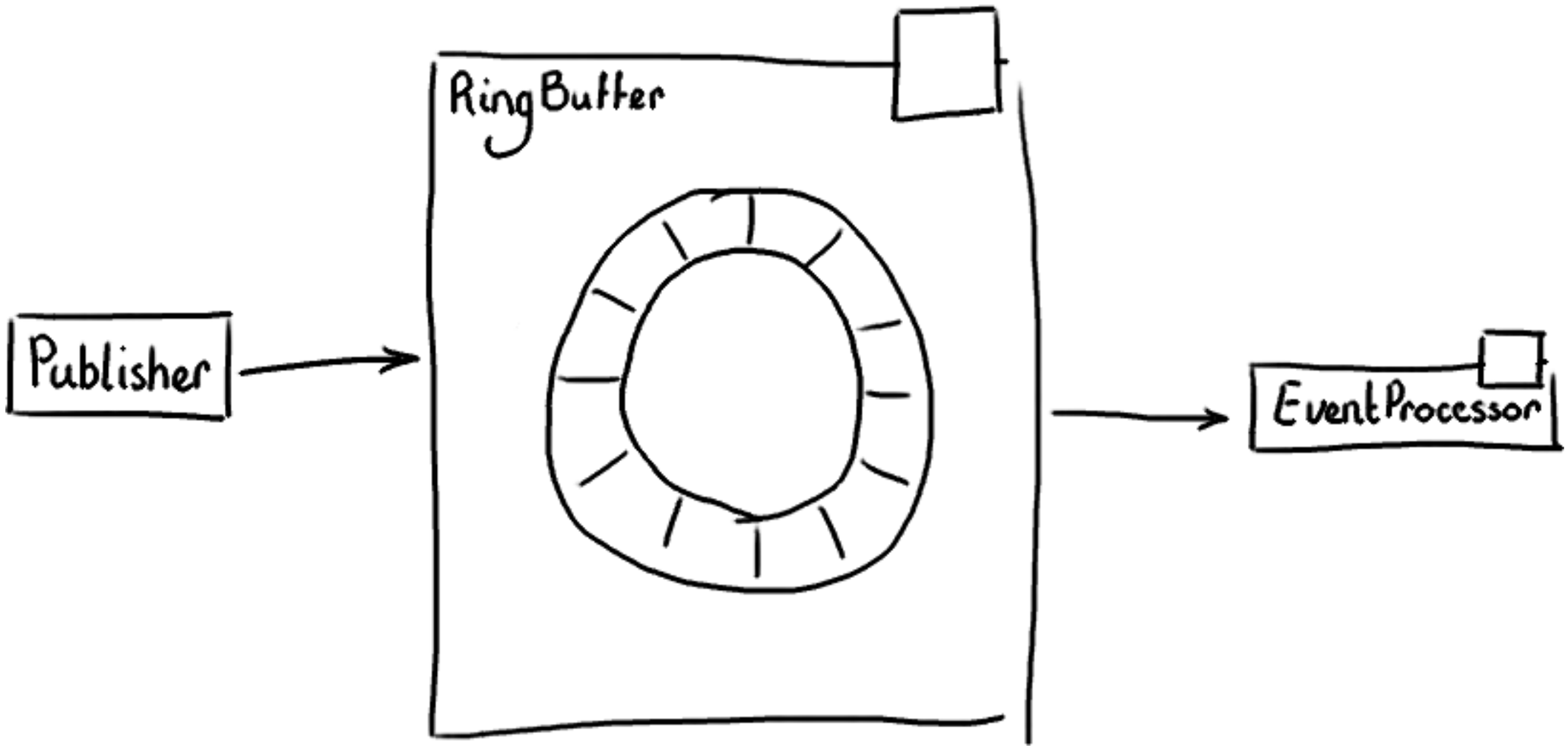
- Data structure and work flow with no contention.
- Very fast message passing.
- Allows you to go truly parallel.

Why Open Source it?

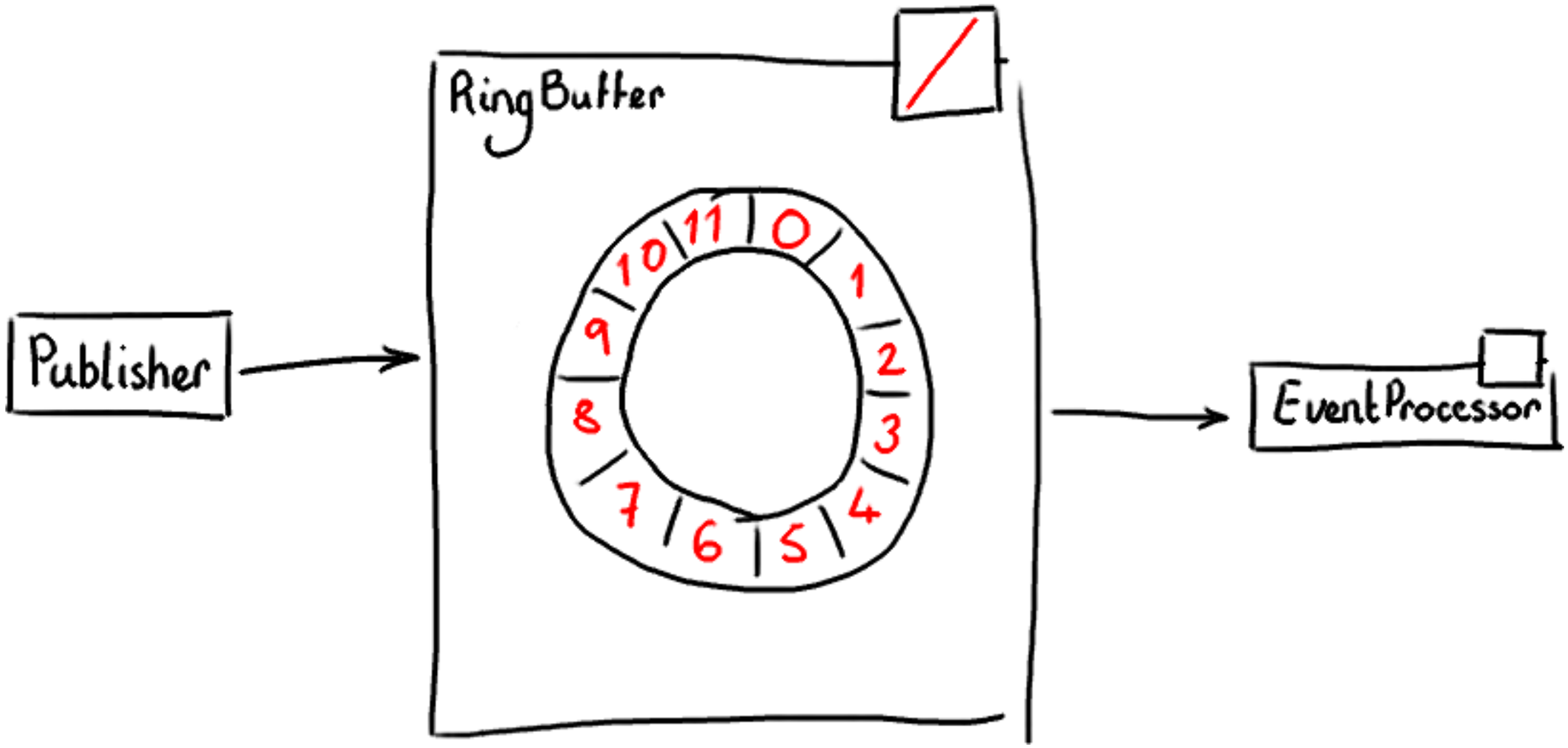
- We did something new that we wanted to share
- We were a young company and wanted to showcase our skills

So...?

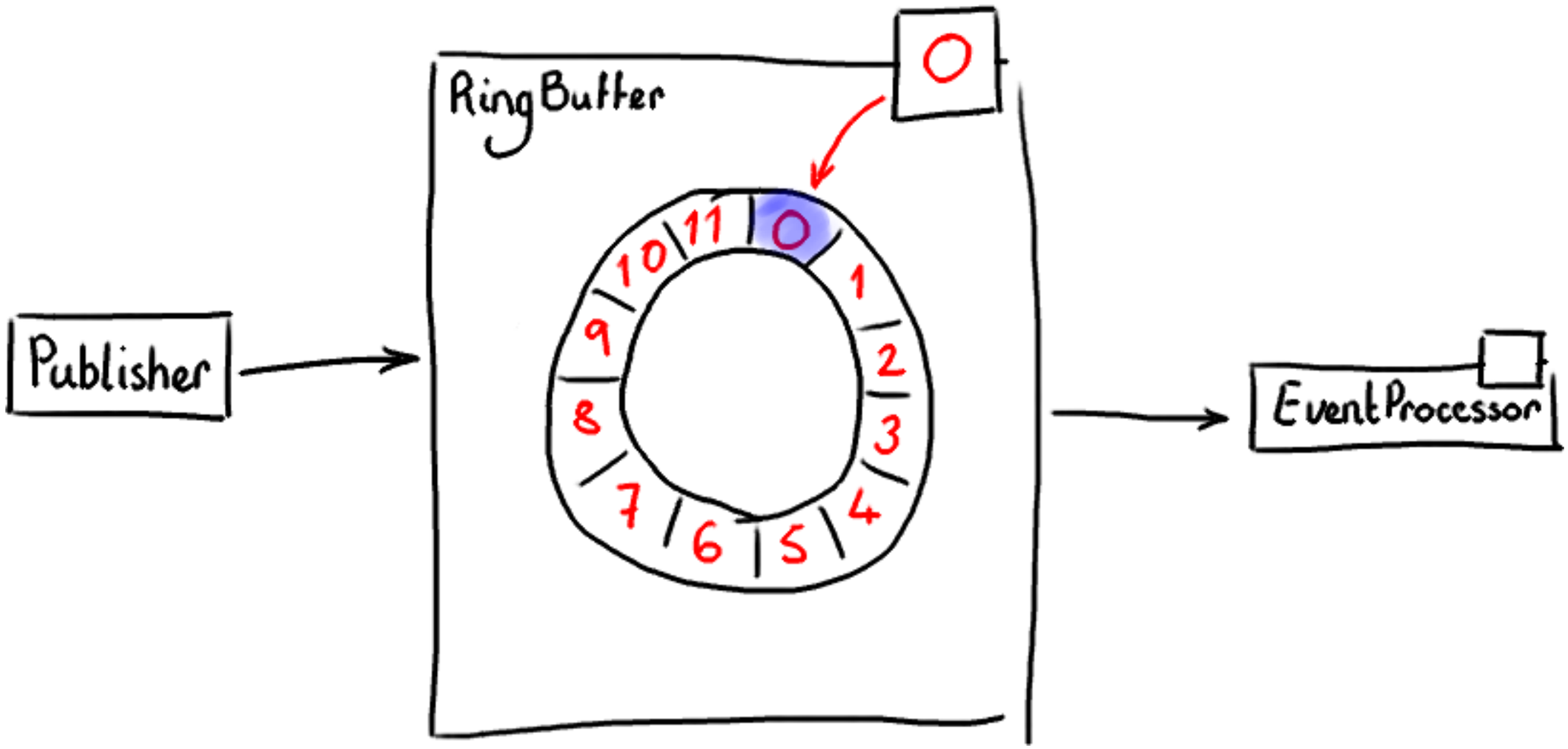
The Magic RingBuffer



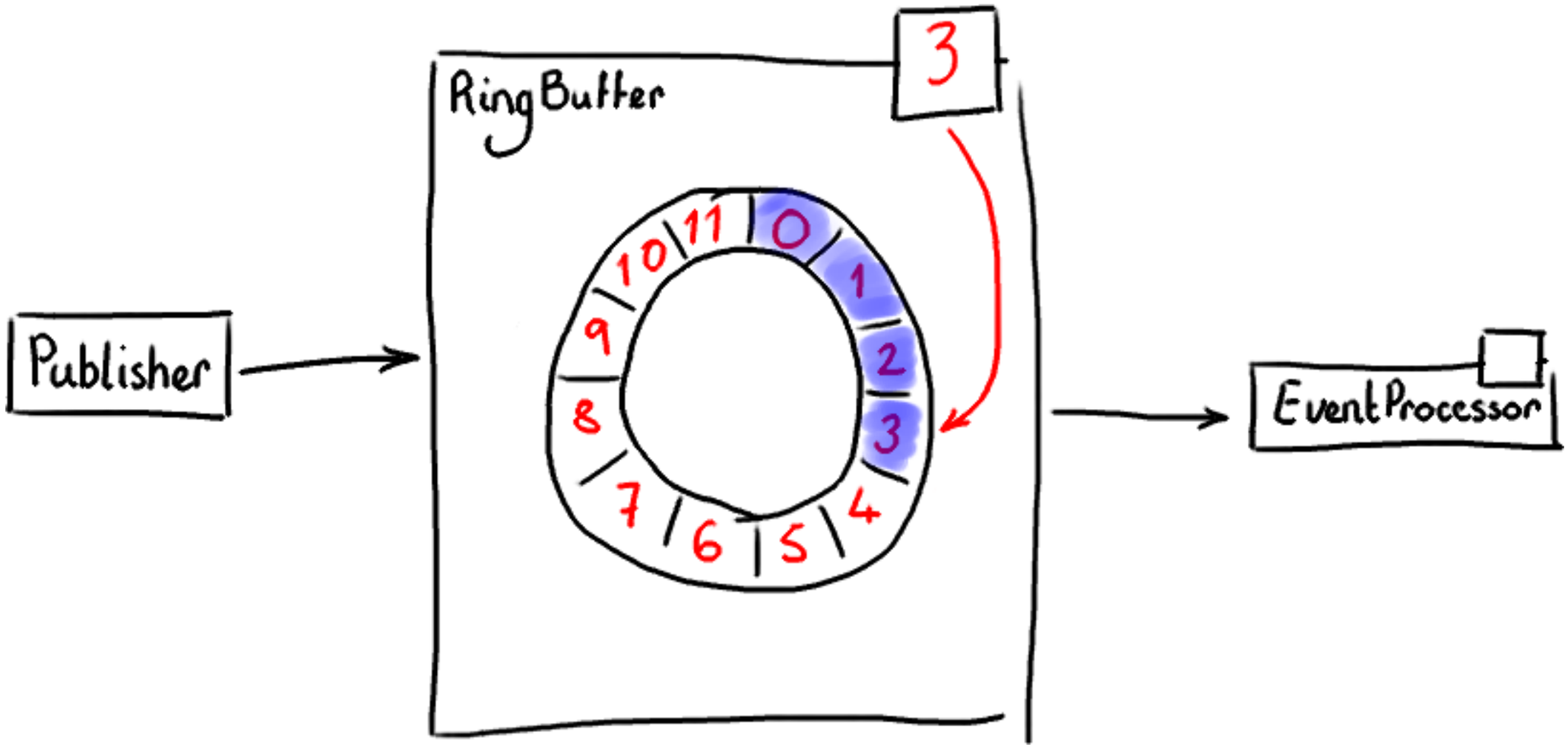
The Magic RingBuffer



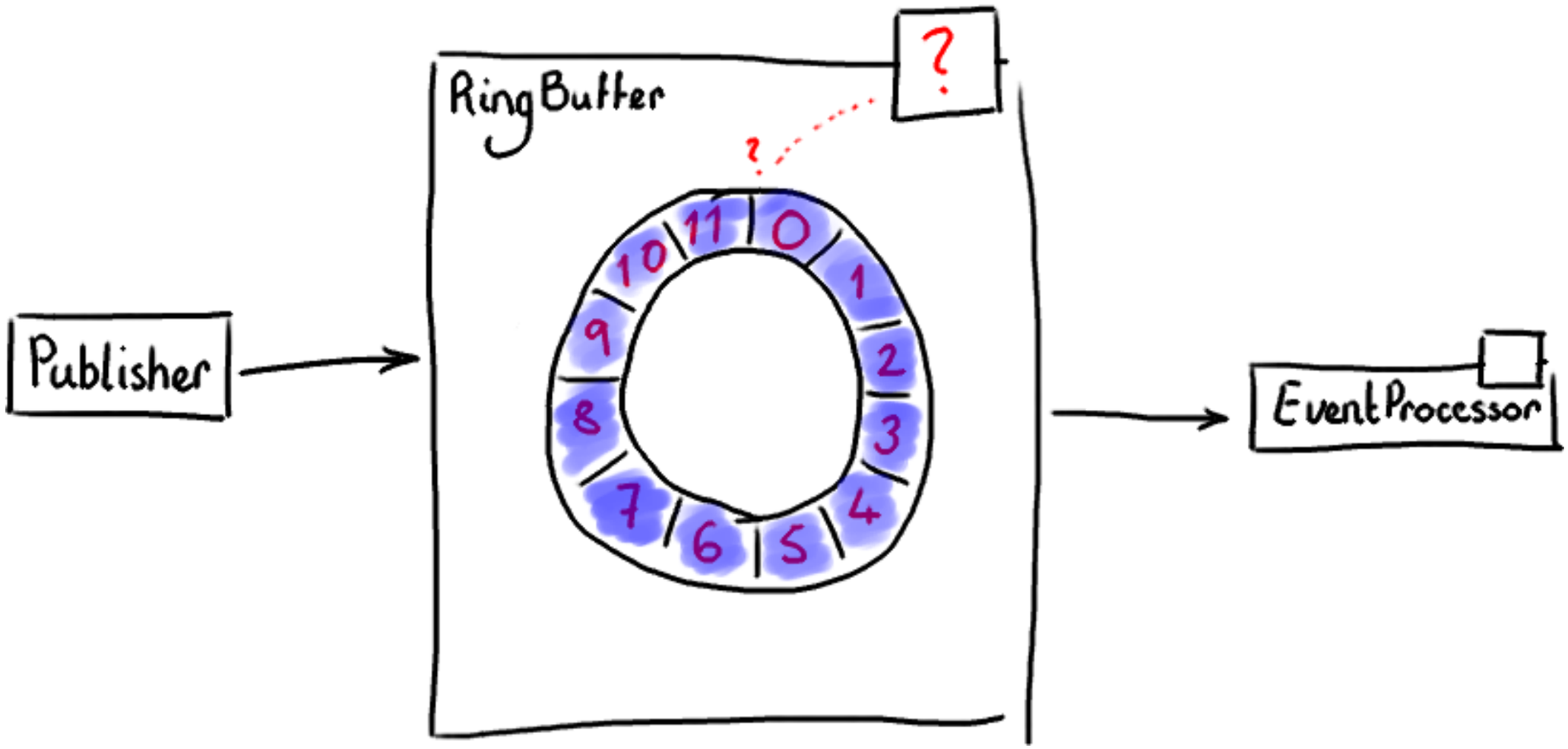
The Magic RingBuffer



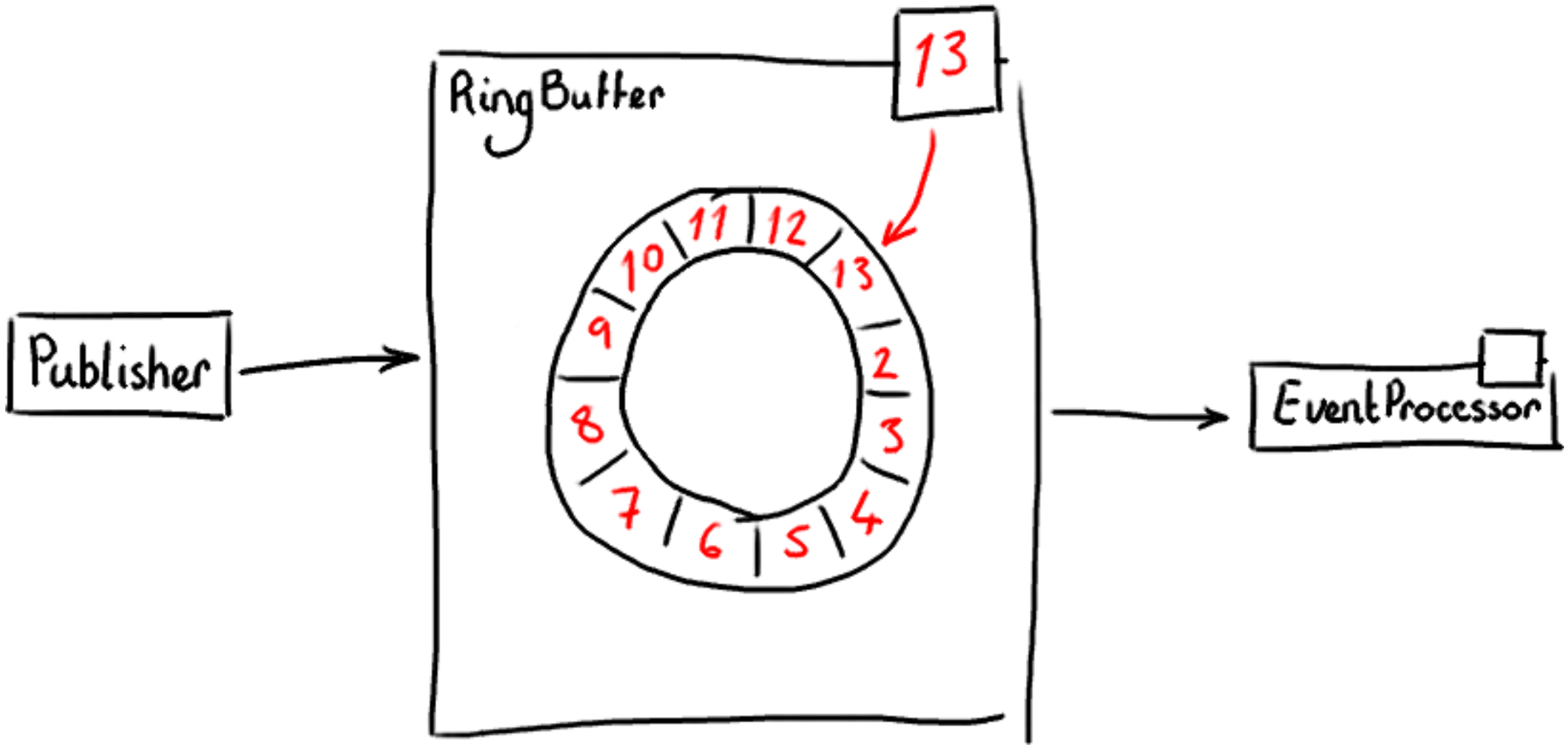
The Magic RingBuffer



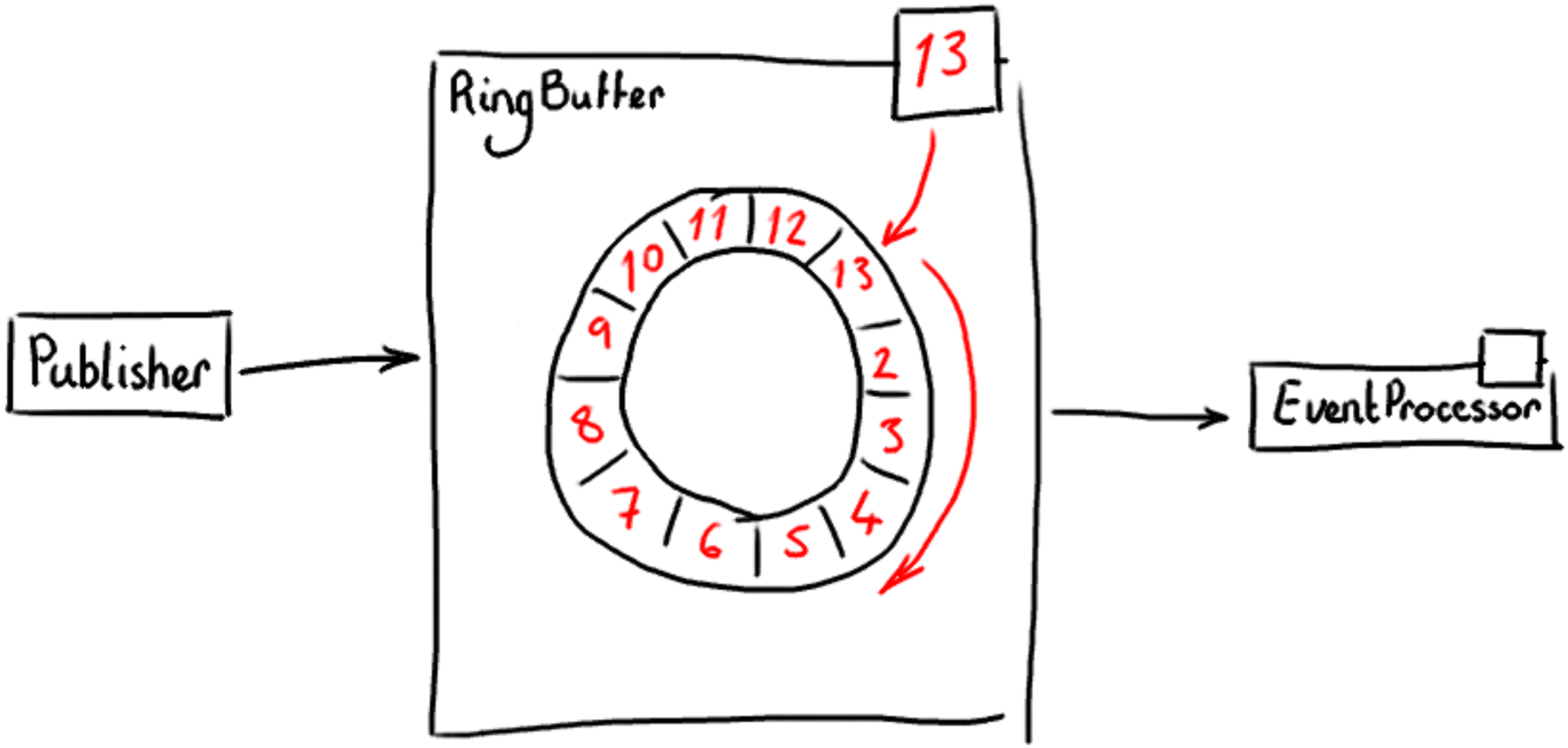
The Magic RingBuffer



The Magic RingBuffer



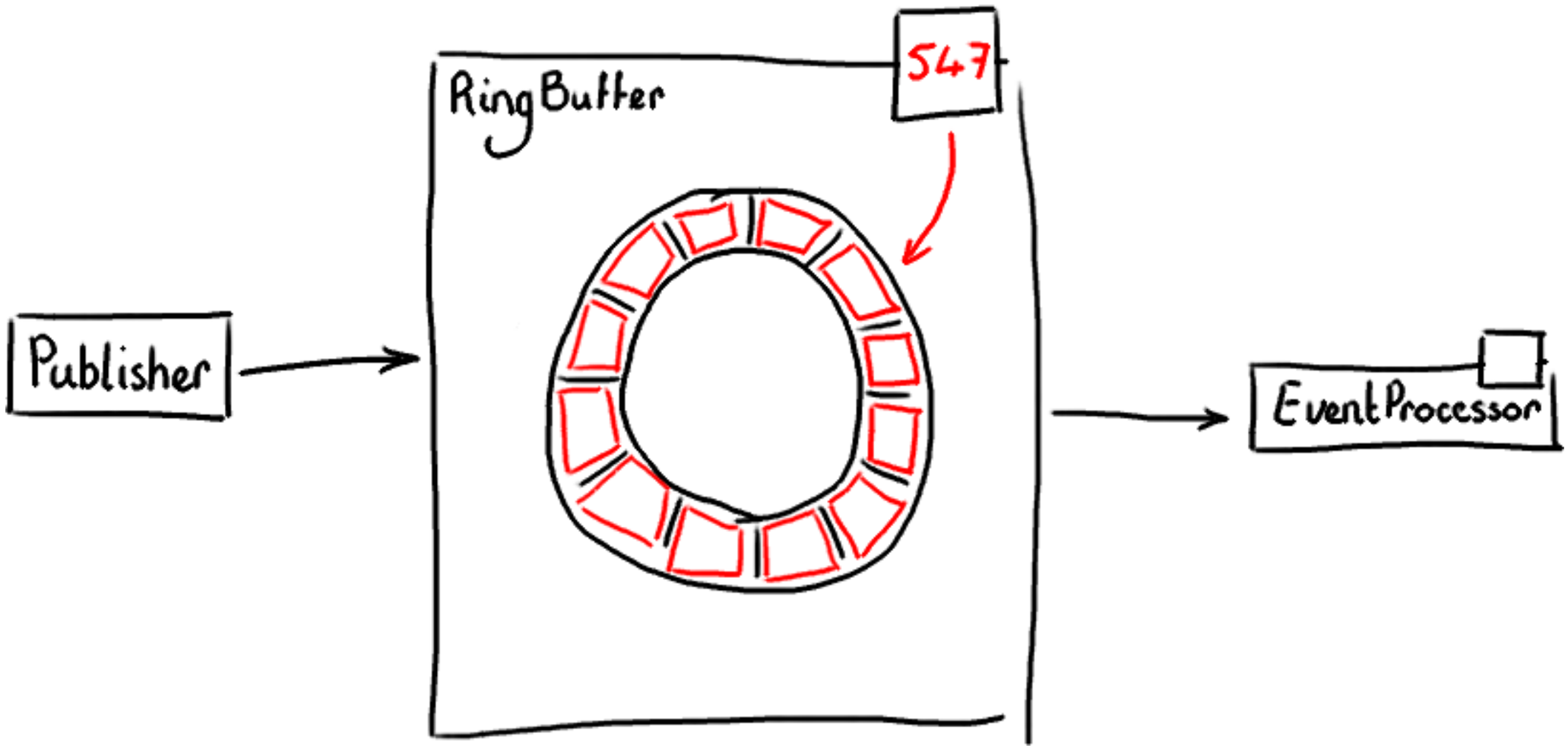
The Magic RingBuffer



Creating a RingBuffer

```
final RingBuffer<SimpleEvent> ringBuffer =
    new RingBuffer<SimpleEvent>(SimpleEvent.EVENT_FACTORY,
                                RING_BUFFER_SIZE);
```

The Events are Buckets



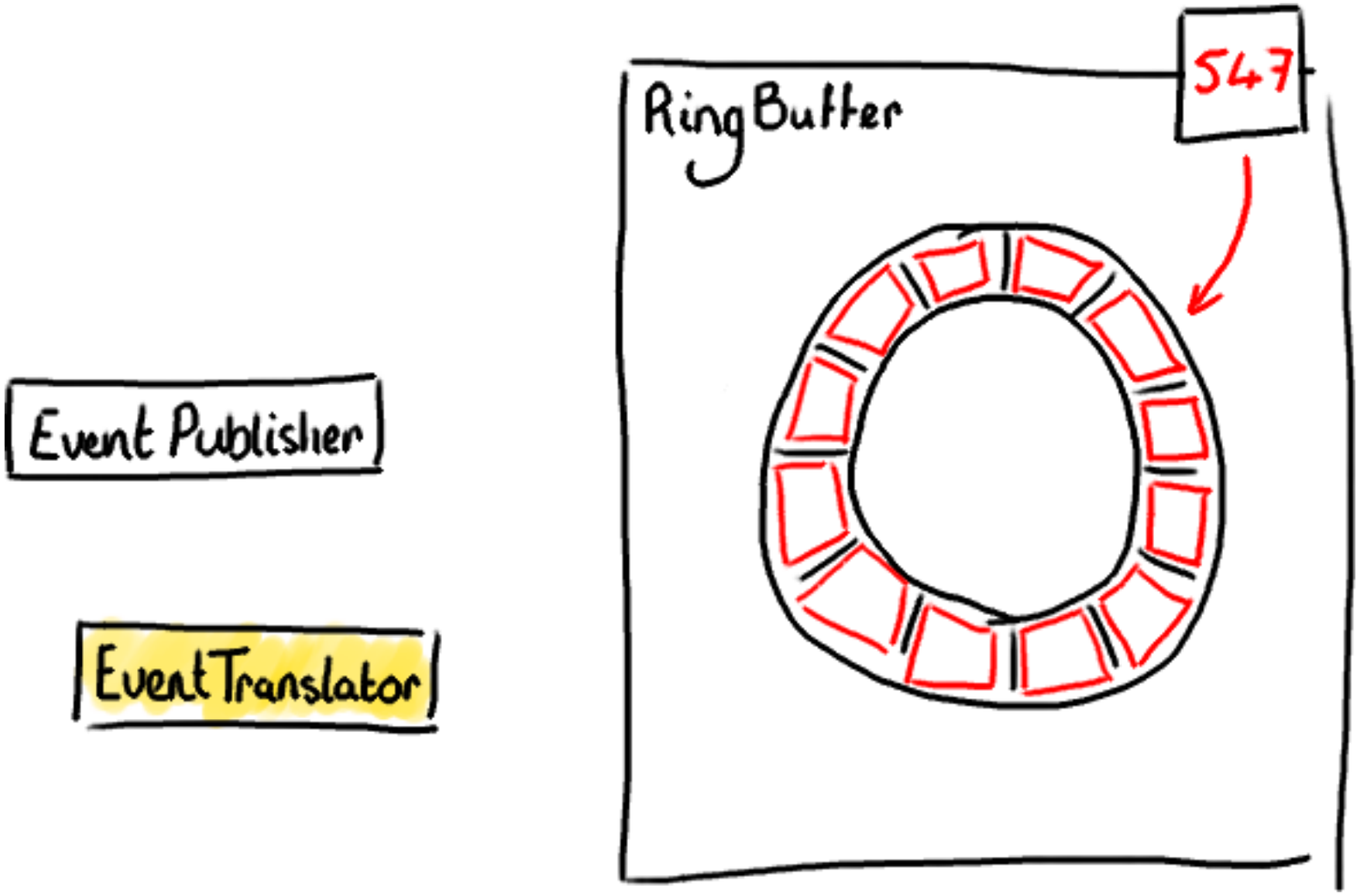
Great! I want one!

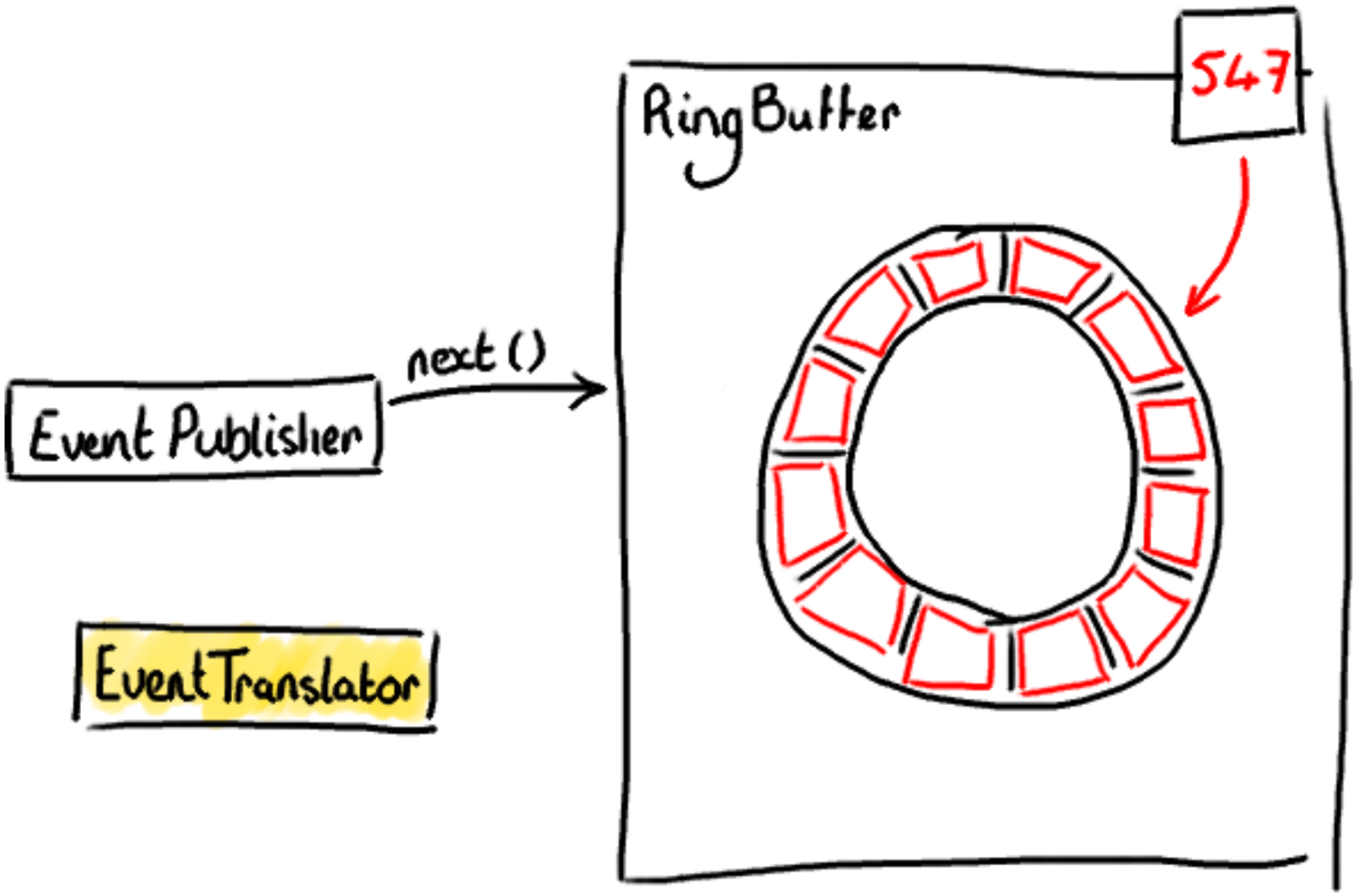
```
public class SimpleEvent {
    public static final EventFactory<SimpleEvent> EVENT_FACTORY =
        new SimpleEventFactory();

    private String value;


    private static class SimpleEventFactory implements EventFactory<SimpleEvent> {
        @Override
        public SimpleEvent newInstance() {
            return new SimpleEvent();
        }
    }
}
```

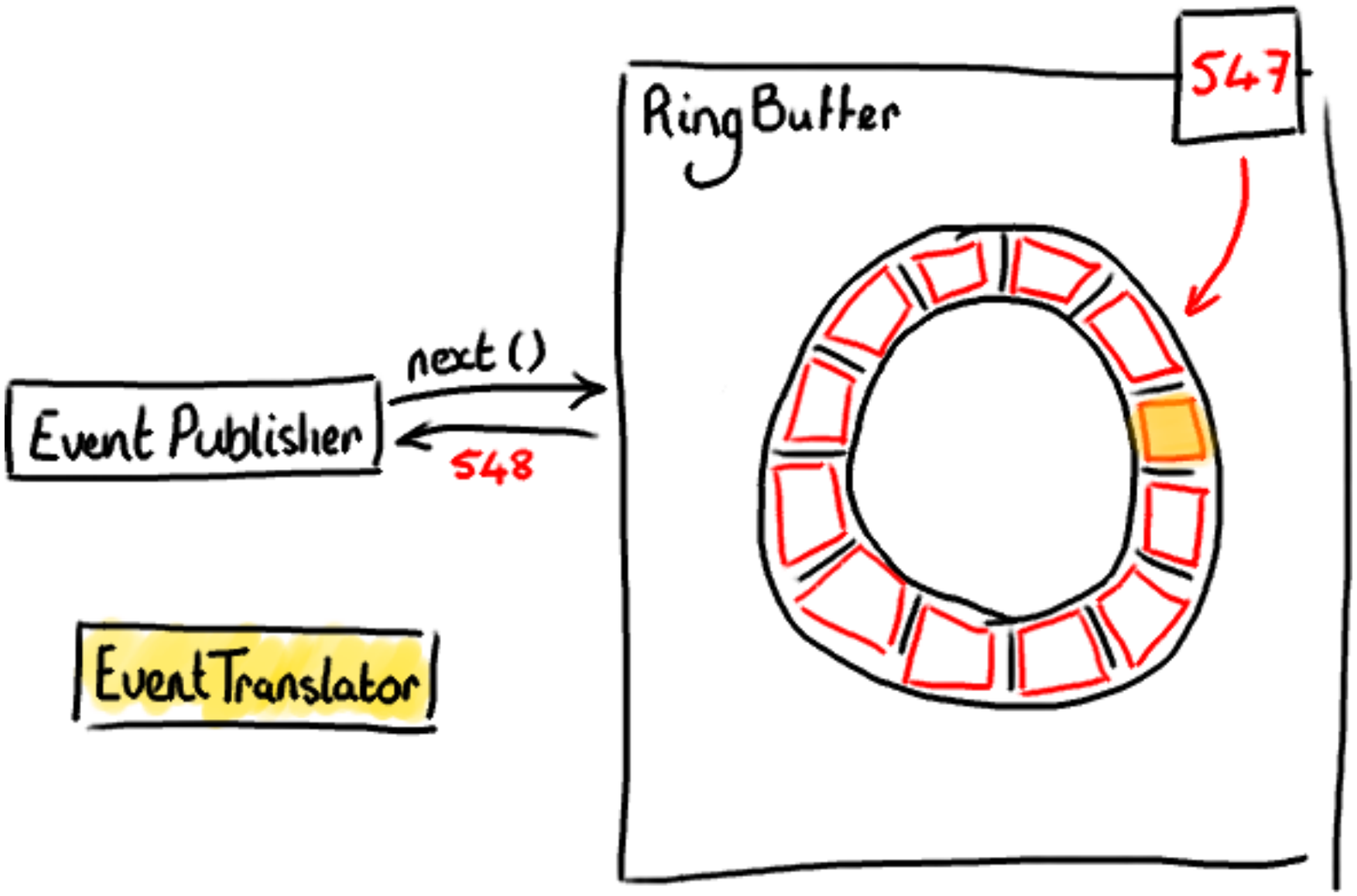
I've got a RingBuffer!

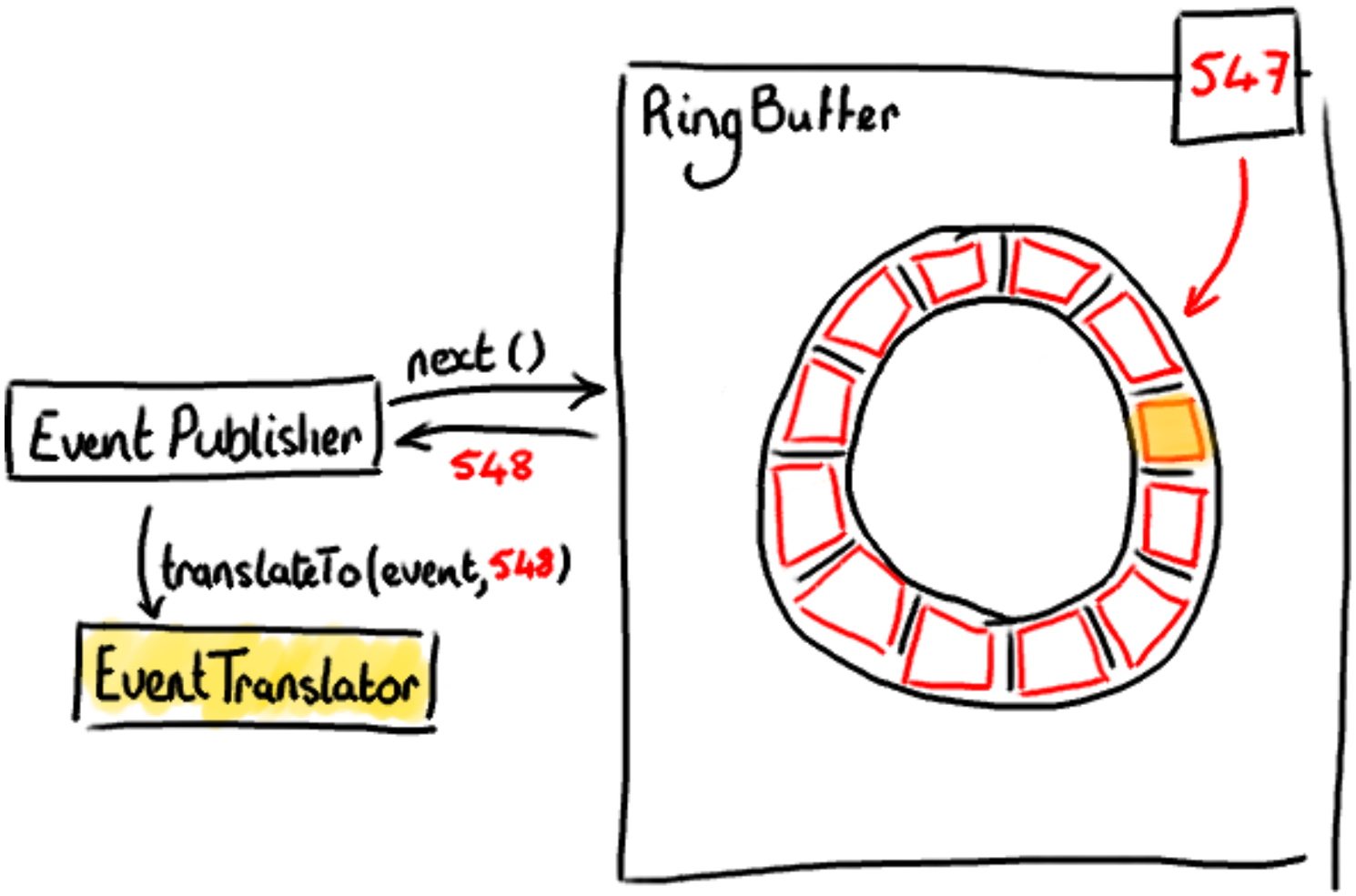
- Erm.... how do I poke things into it?

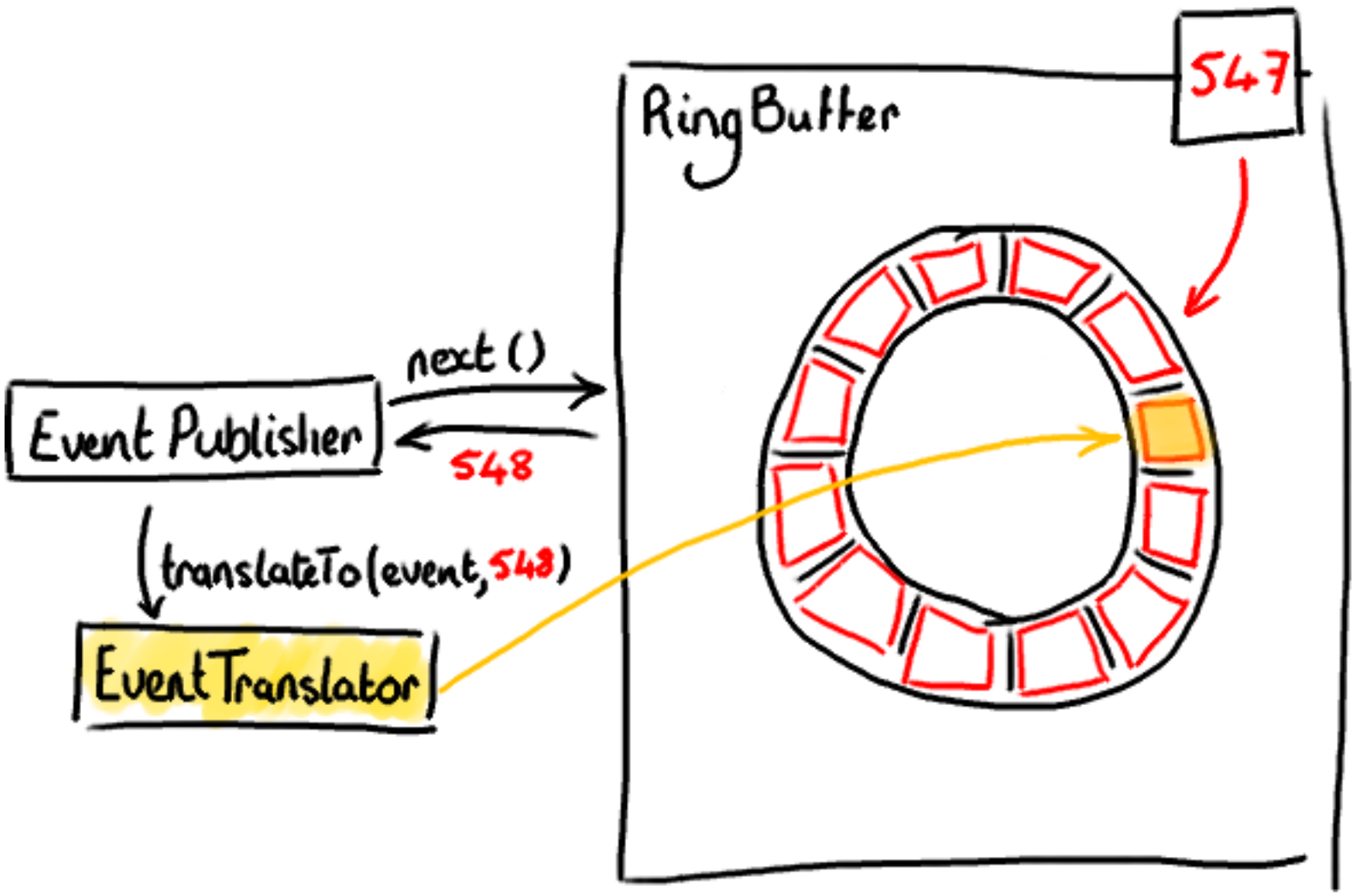
The Publisher

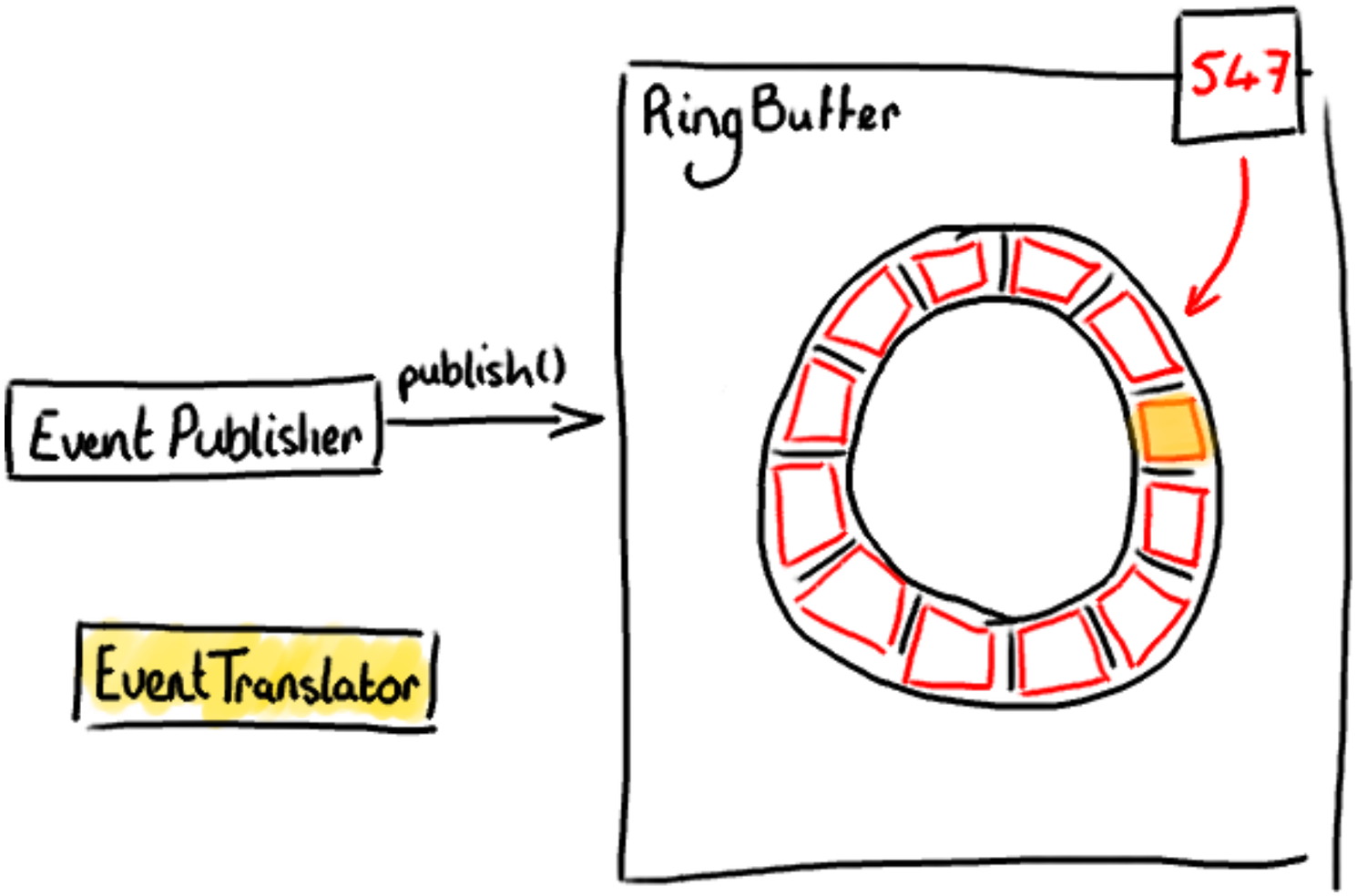


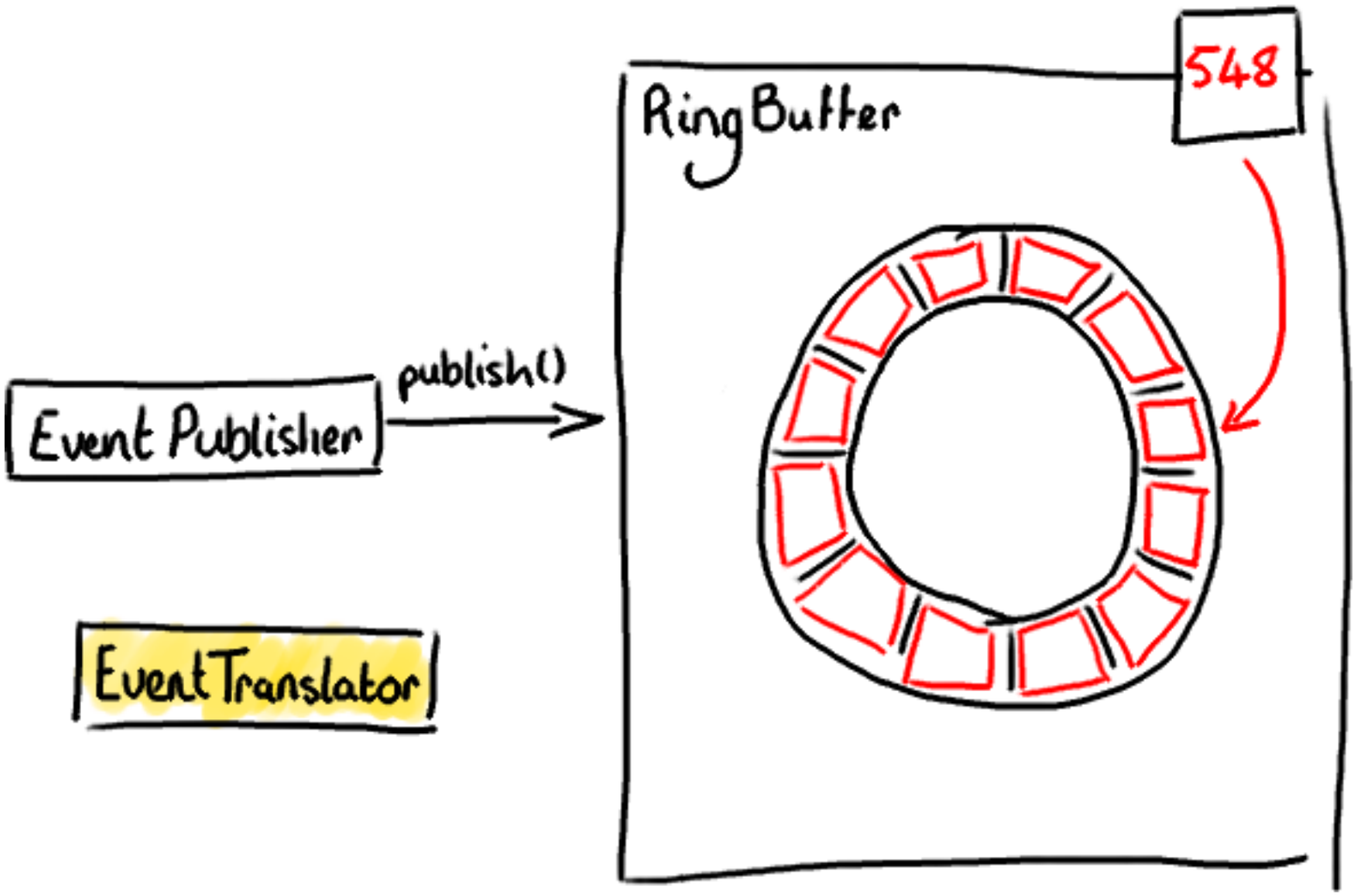

RingButter
547
next()
Event Publisher
EventTranslator


RingButter
547
next()
Event Publisher
548
EventTranslator


RingButter
547
next()
548
Event Publisher
translateTo(event, 548)
EventTranslator


RingButter
547
next()
548
Event Publisher
translateTo(event, 548)
EventTranslator


RingButter
547
publish()
Event Publisher
EventTranslator


RingButter
548
publish()
Event Publisher
EventTranslator

What do I do?

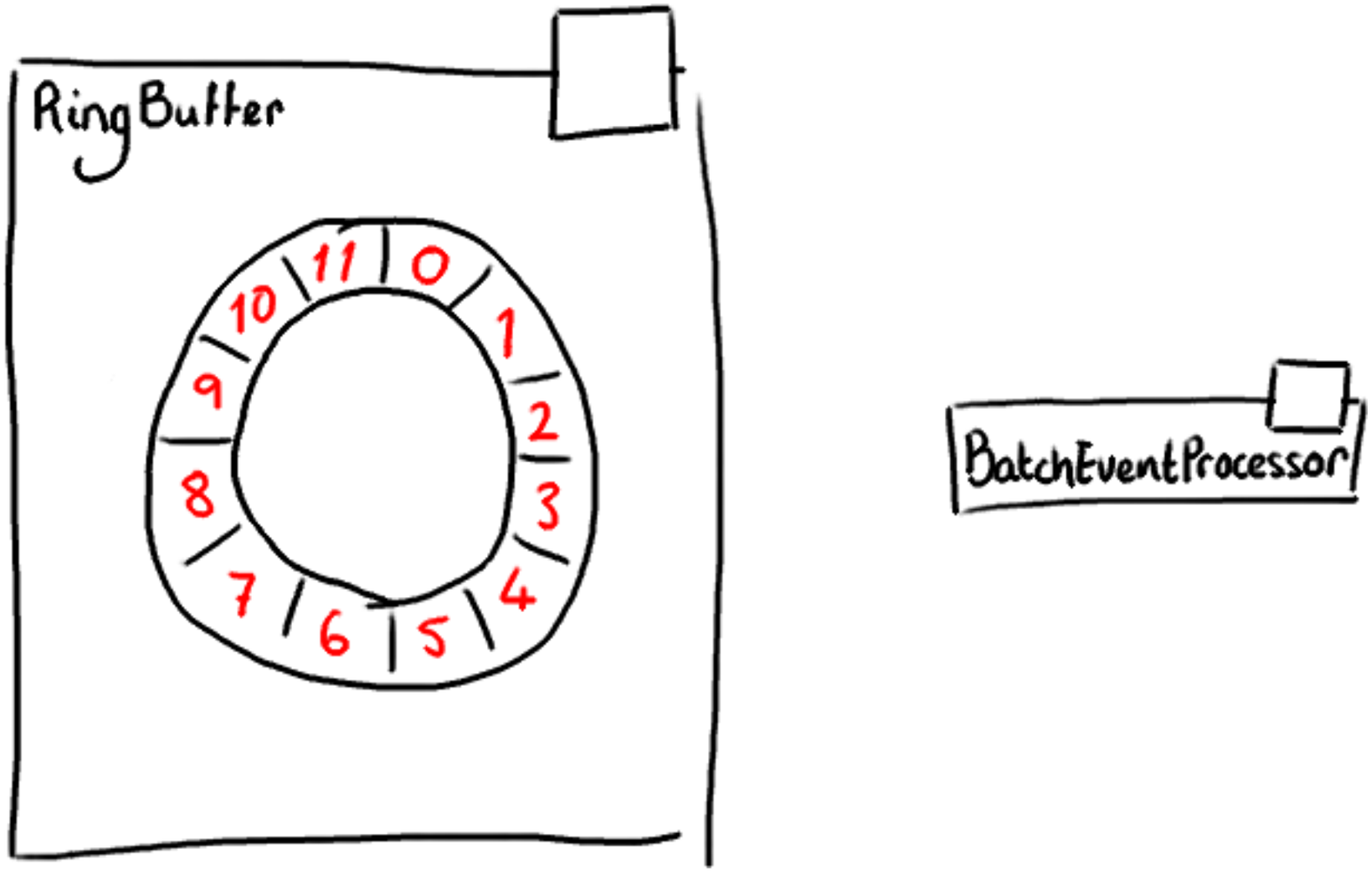
```
public class SimpleEventTranslator implements
    EventTranslator<SimpleEvent>
```

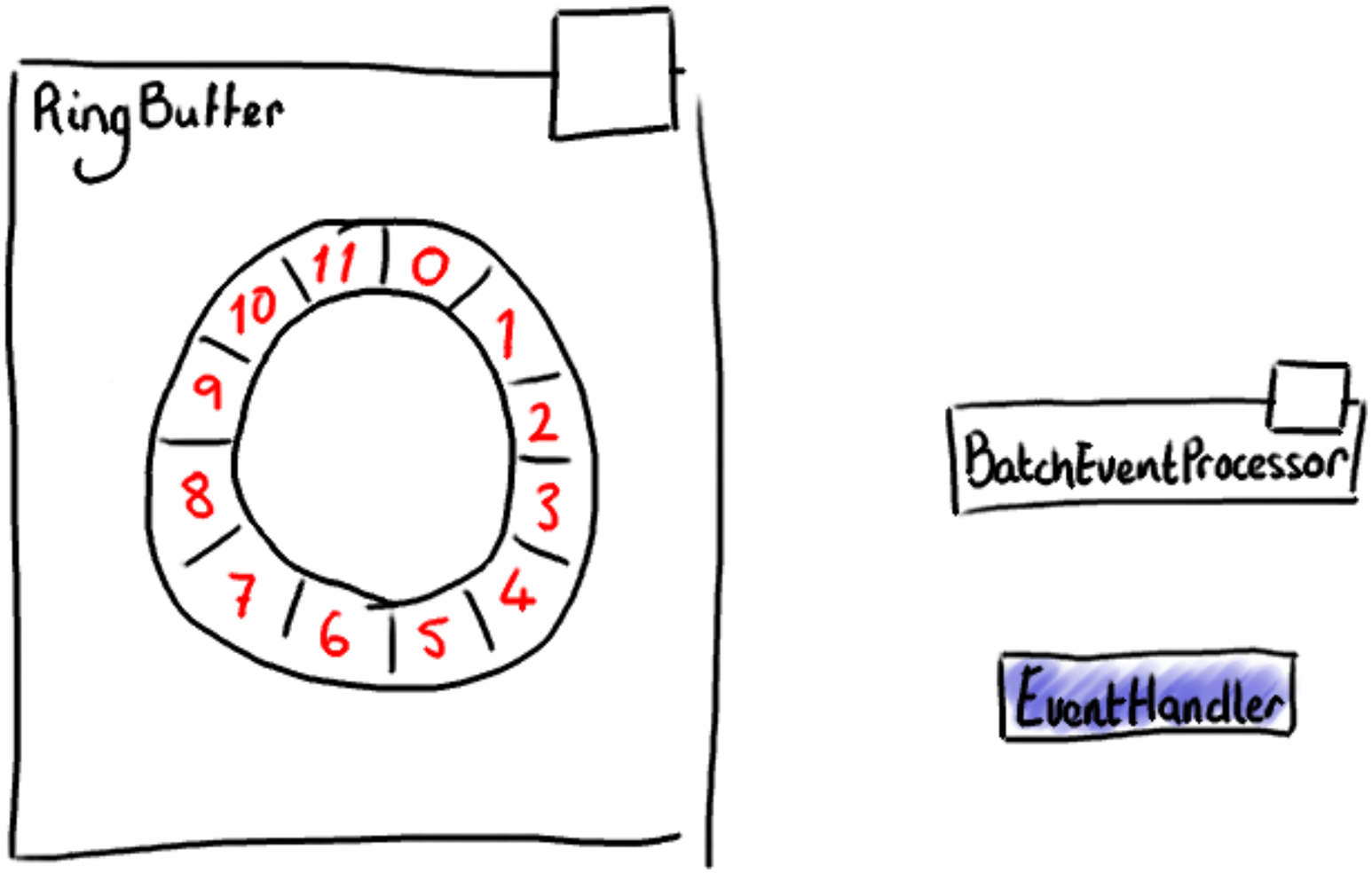
```
SimpleEventTranslator translator = new SimpleEventTranslator();

EventPublisher<SimpleEvent> publisher =
    new EventPublisher<SimpleEvent>(ringBuffer);

// poke your translator here
// ...and when you're done...
publisher.publishEvent(translator);
```

...so now I want to read

- The Disruptor provides nice batching behaviour for free

BatchEventProcessor




RingButter
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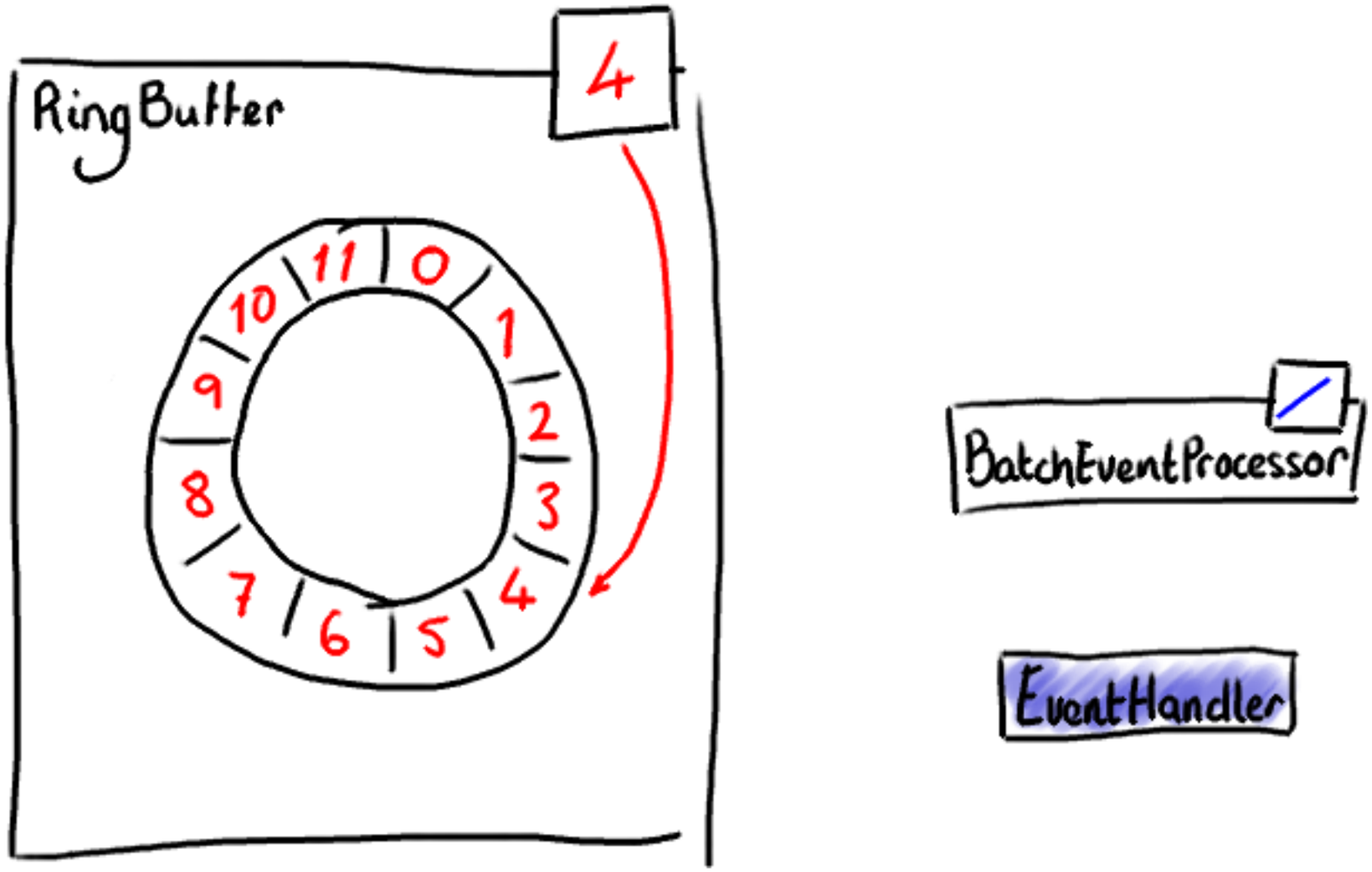
10
BatchEventProcessor
EventHandler


RingButter
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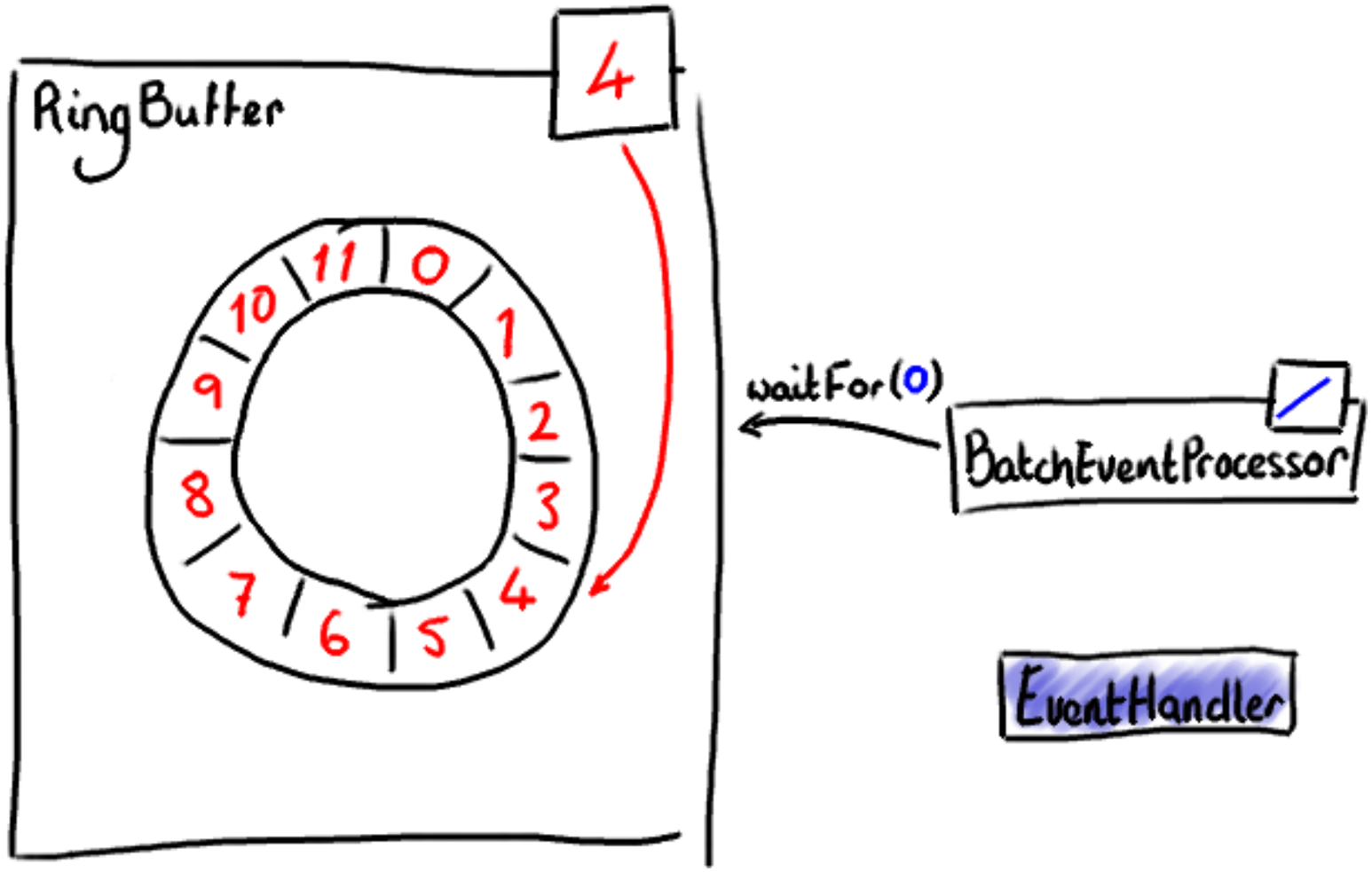
BatchEventProcessor
EventHandler


RingButter
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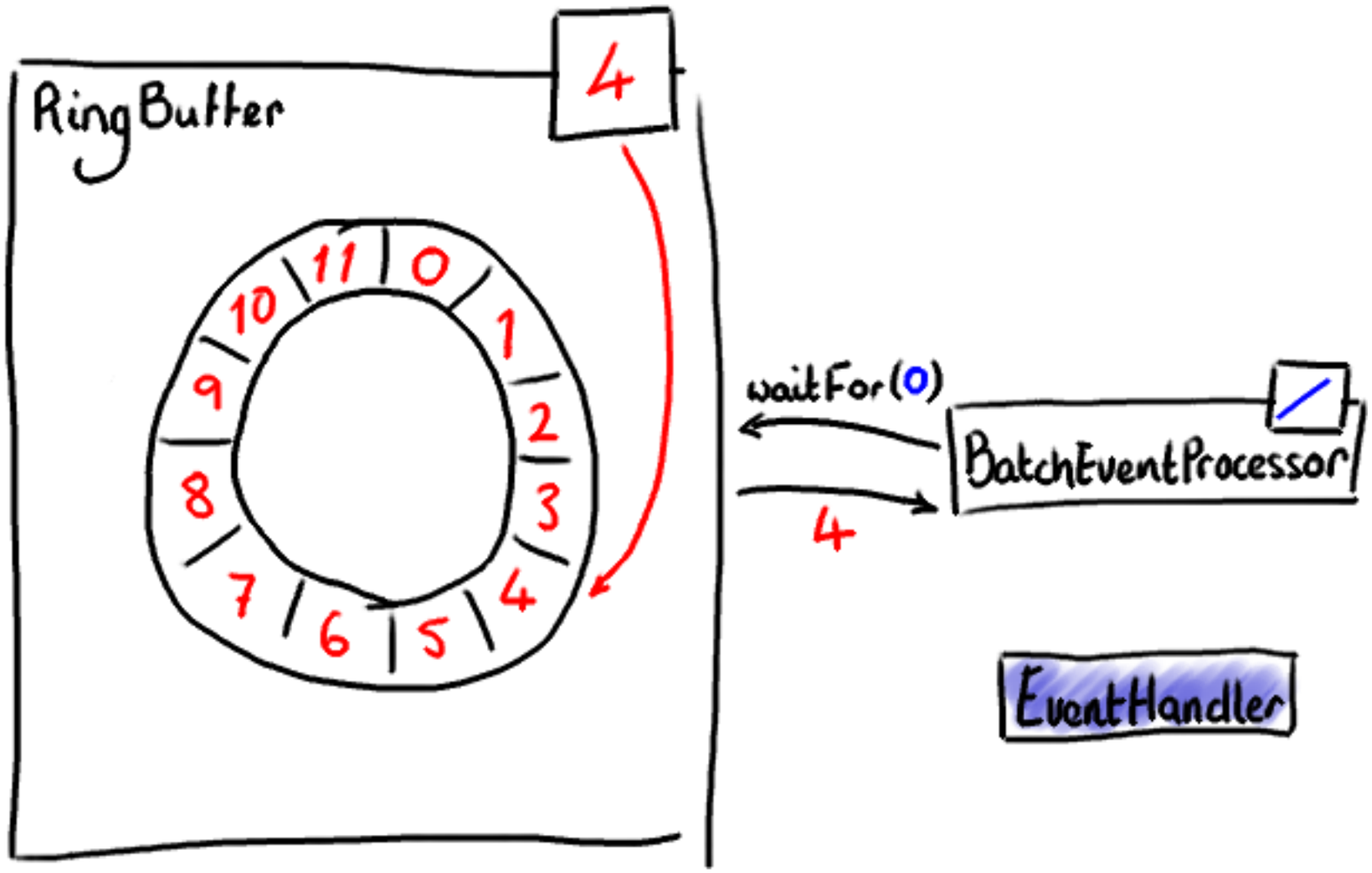
waitFor(0)
BatchEventProcessor
EventHandler


RingButter
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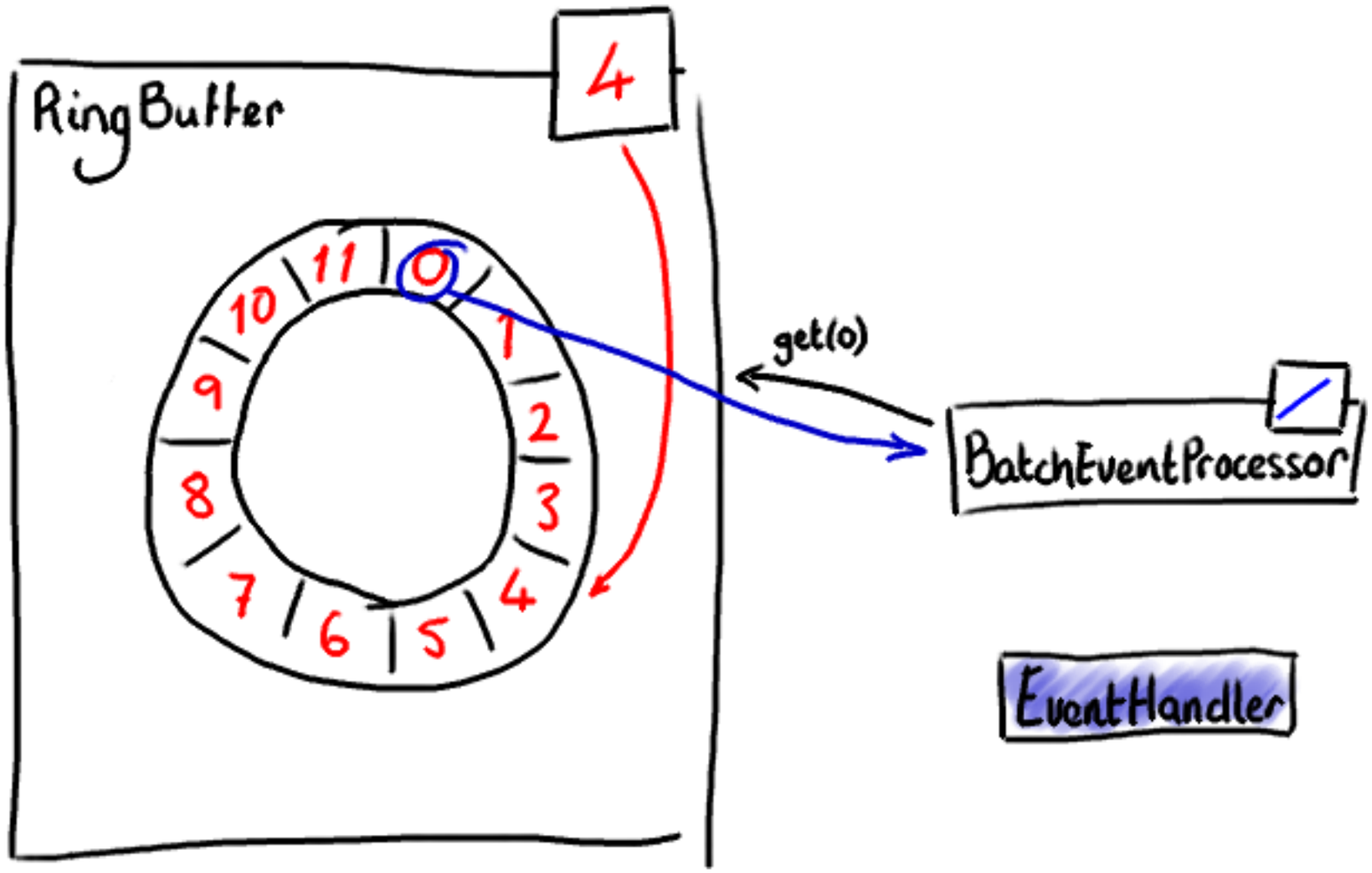
waitFor(0)
BatchEventProcessor
4
EventHandler


RingButter
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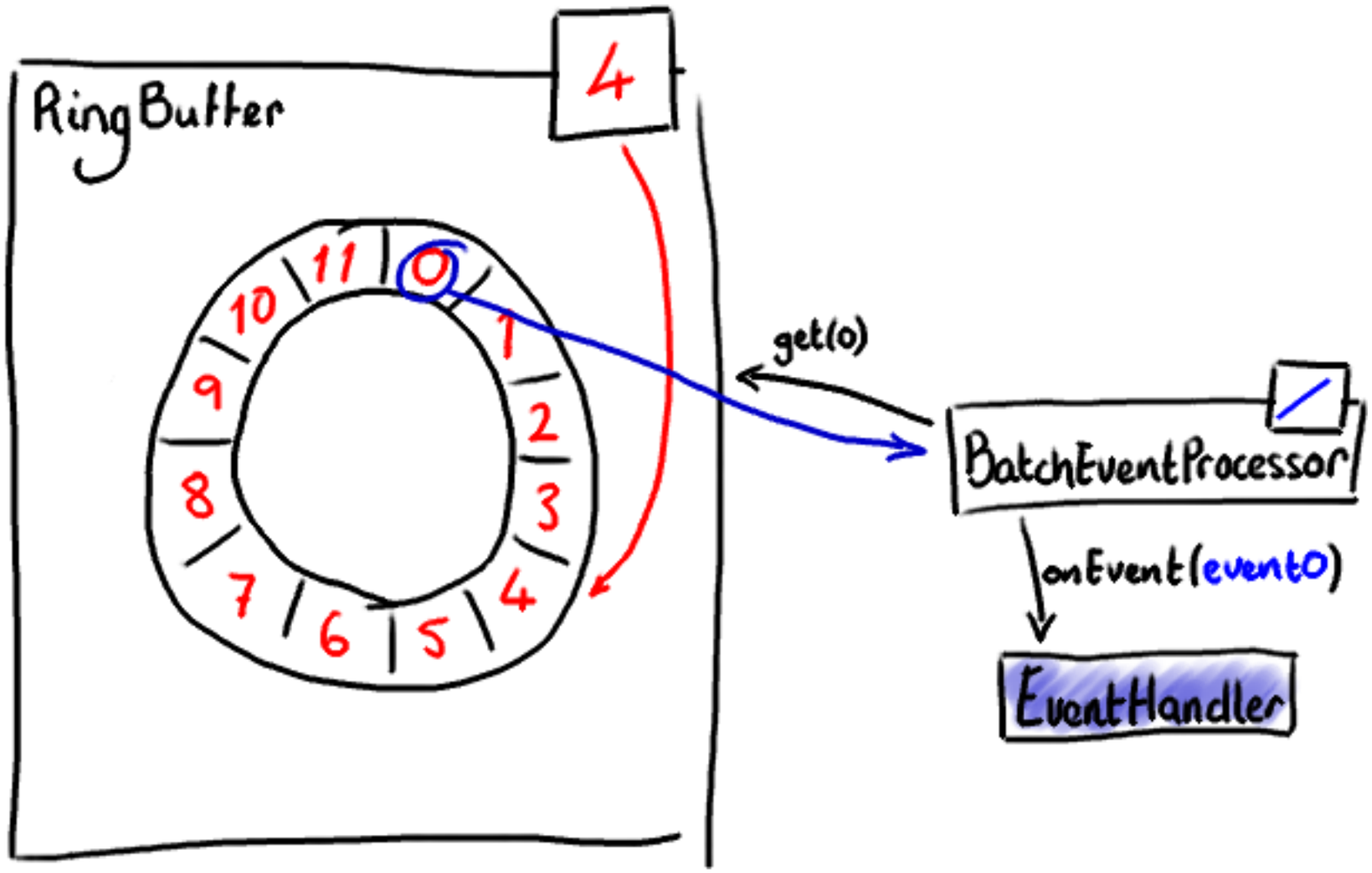
get(0)
BatchEventProcessor
EventHandler


RingBuffer
4
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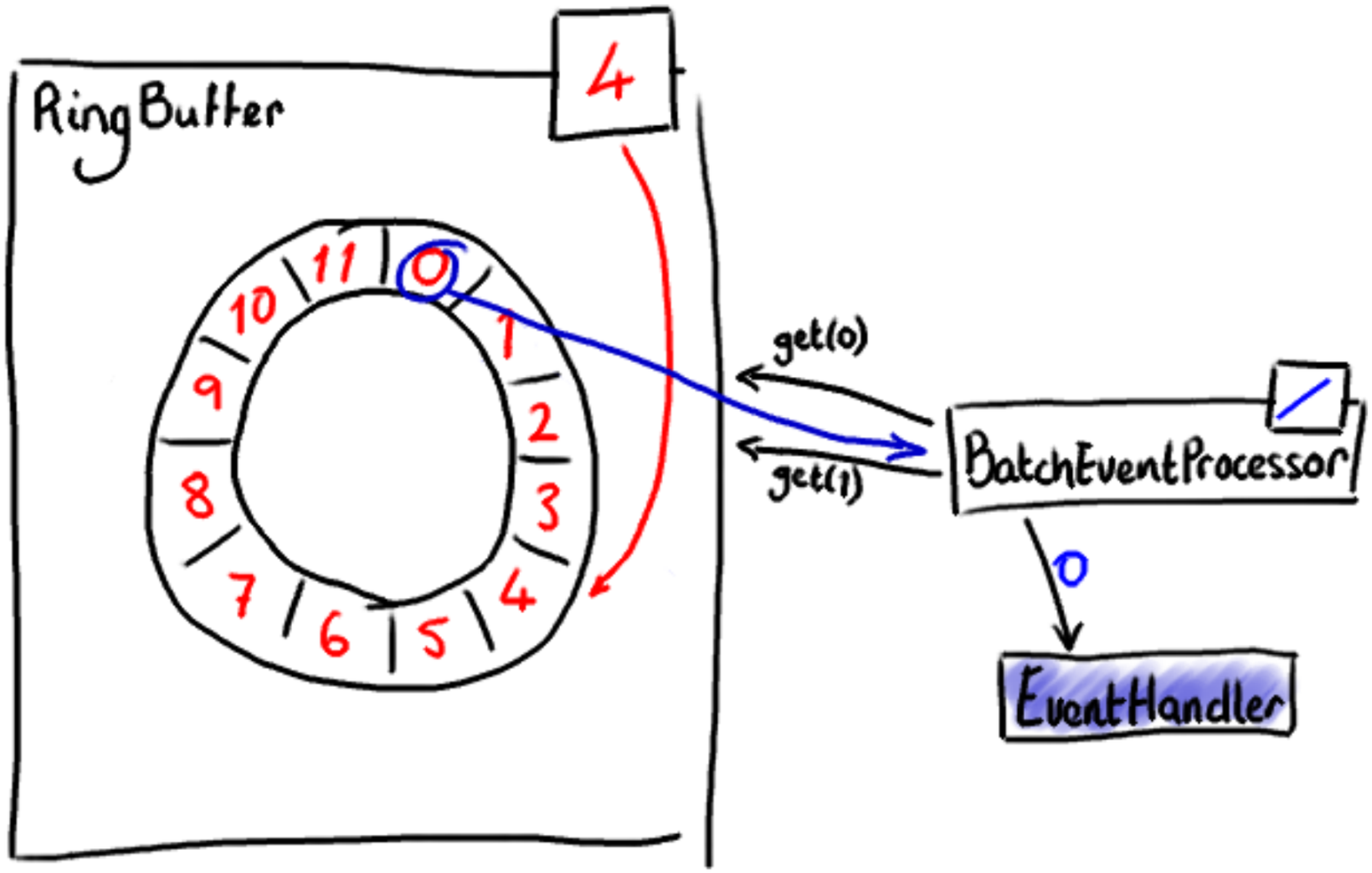
10
get(0)
BatchEventProcessor
onEvent(event0)
EventHandler


RingBuffer
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11
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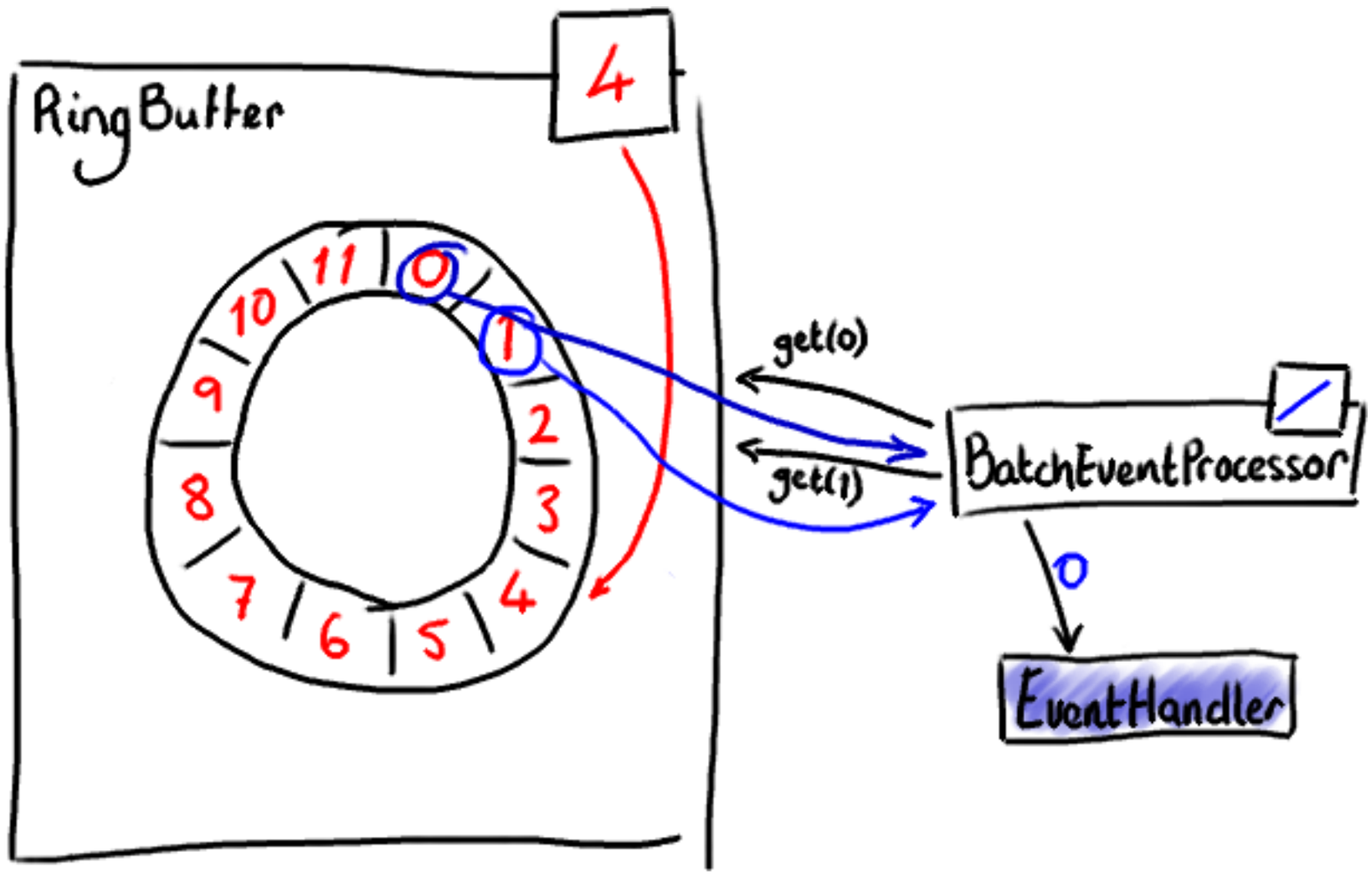
get(0)
get(1)
BatchEventProcessor
0
EventHandler


RingBuffer
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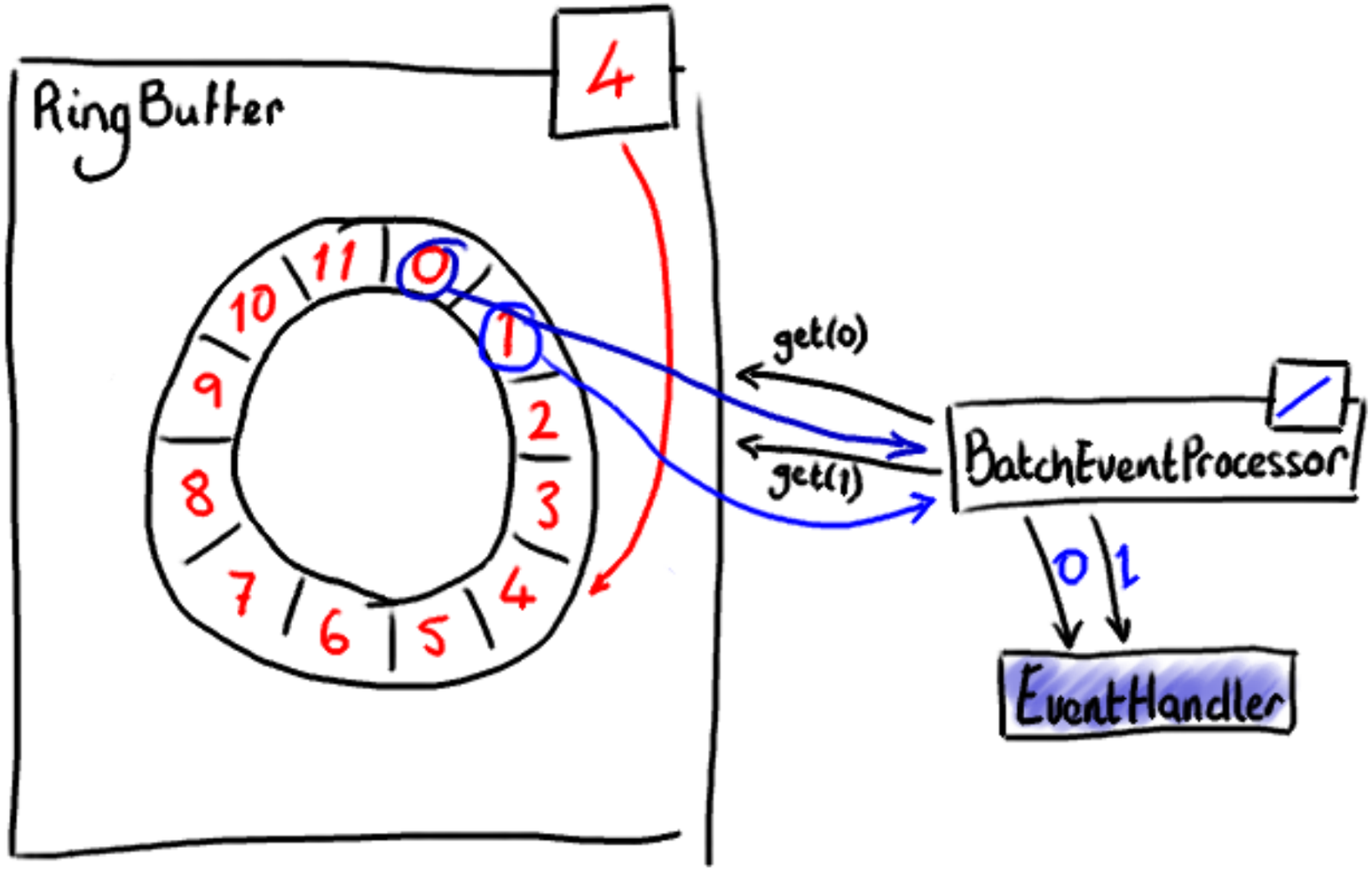
get(0)
get(1)
BatchEventProcessor
0
EventHandler


RingButter
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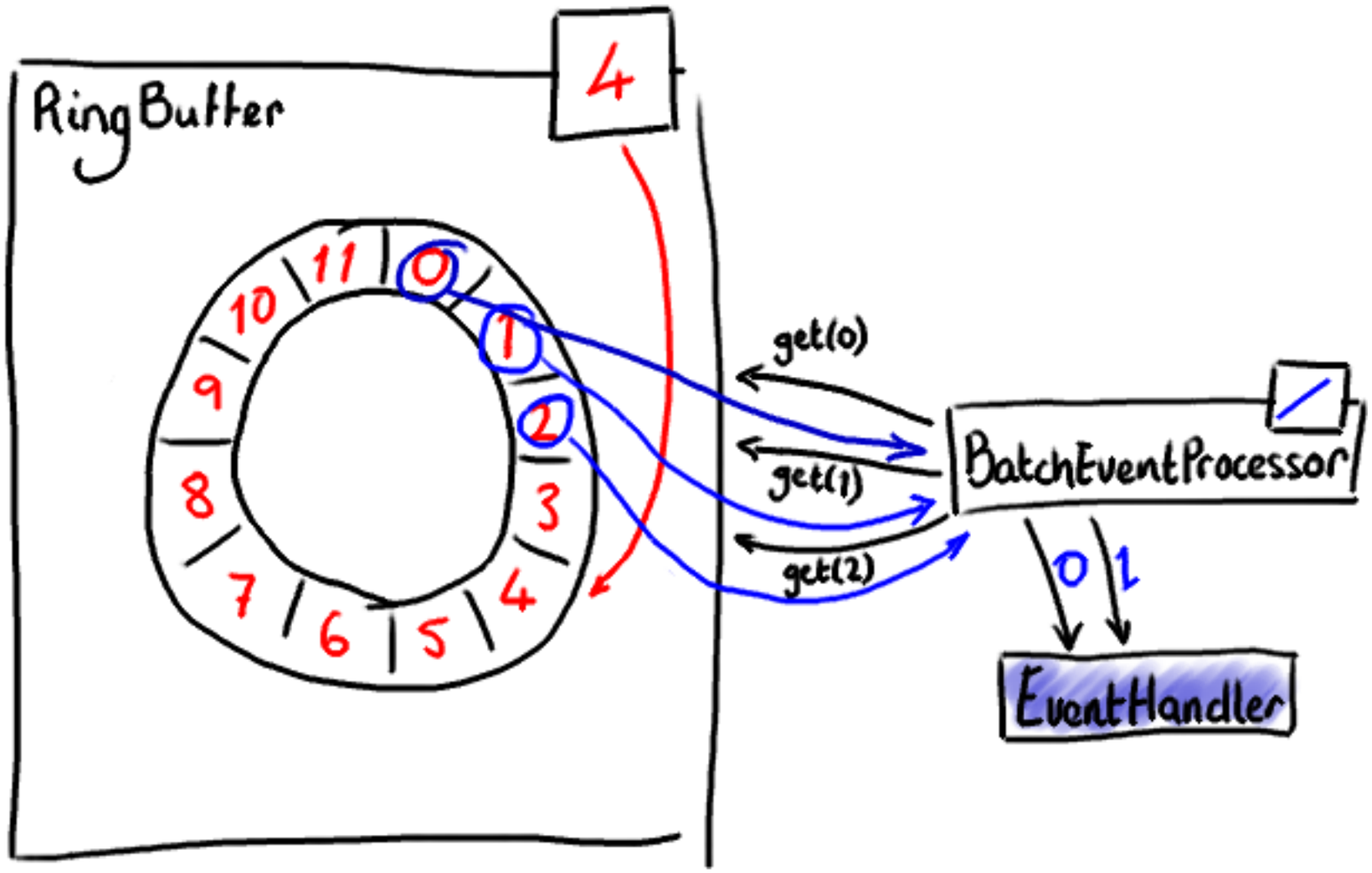
4
get(0)
get(1)
BatchEventProcessor
0
1
EventHandler


RingBuffer
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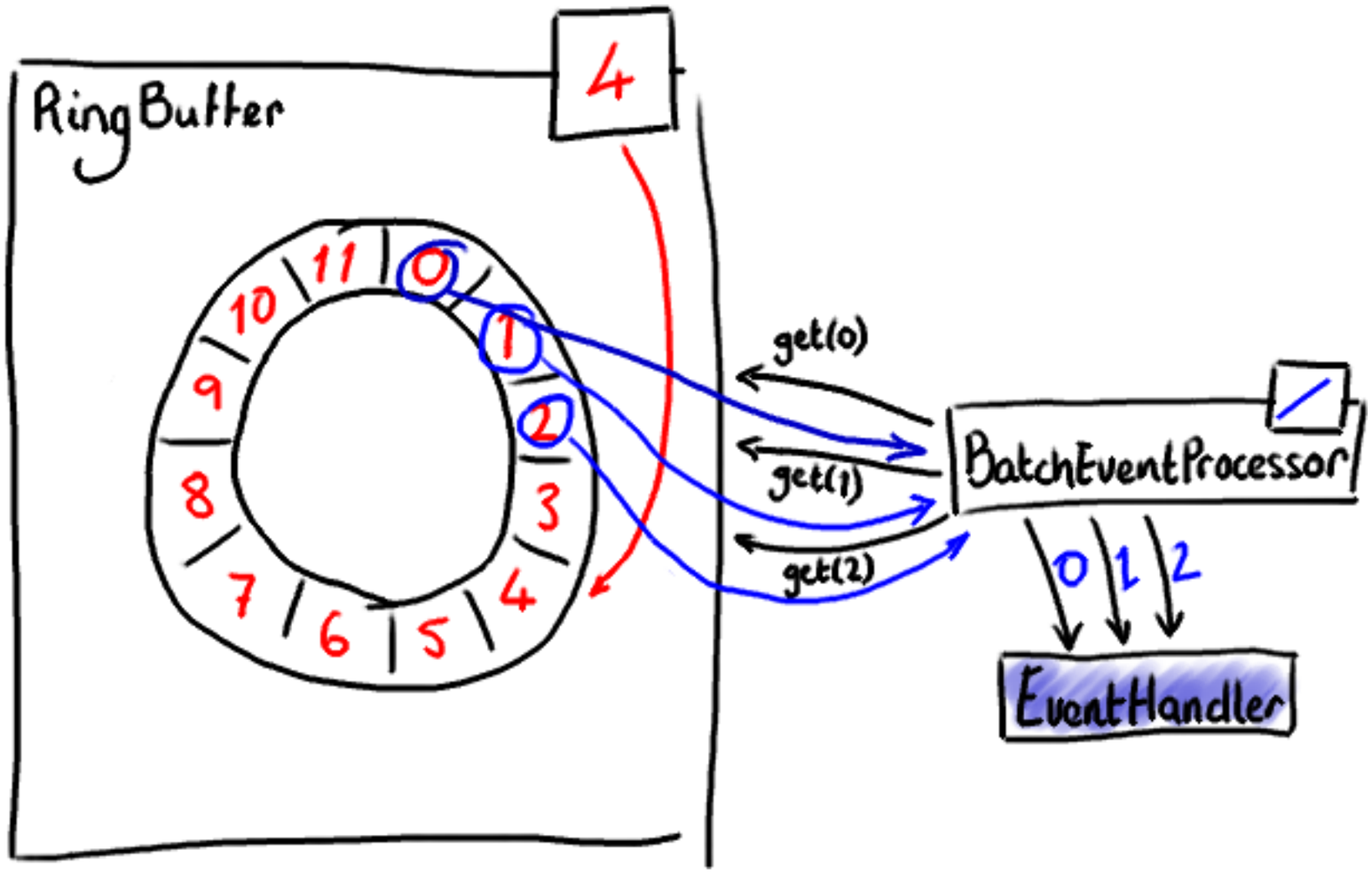
9
10
get(0)
get(1)
get(2)
BatchEventProcessor
0
1
EventHandler


RingBuffer
4
11
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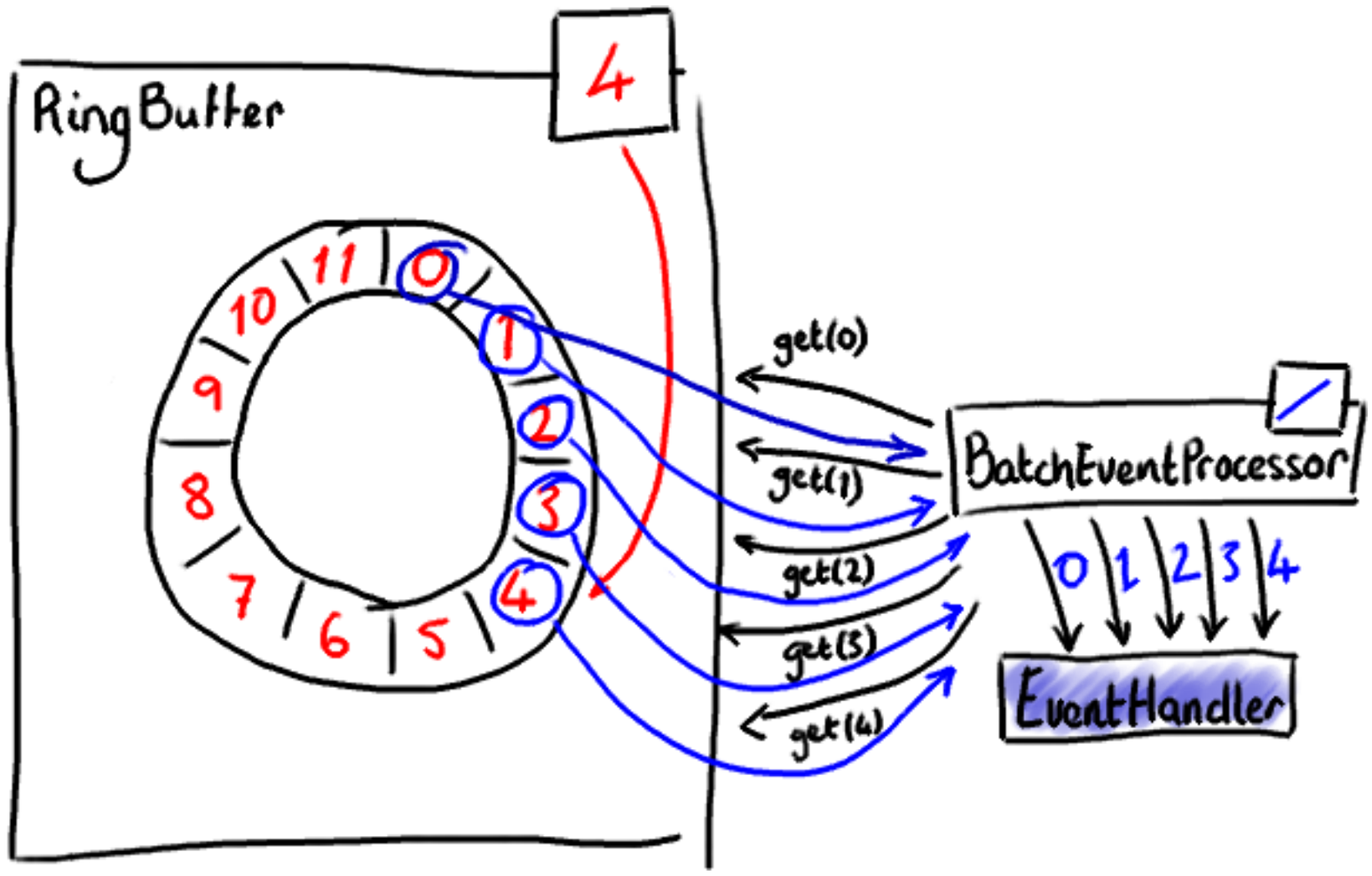
get(0)
get(1)
get(2)
BatchEventProcessor
0
1
2
EventHandler


RingButter
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11
0
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6
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4
get(0)
get(1)
get(2)
get(3)
get(4)
BatchEventProcessor
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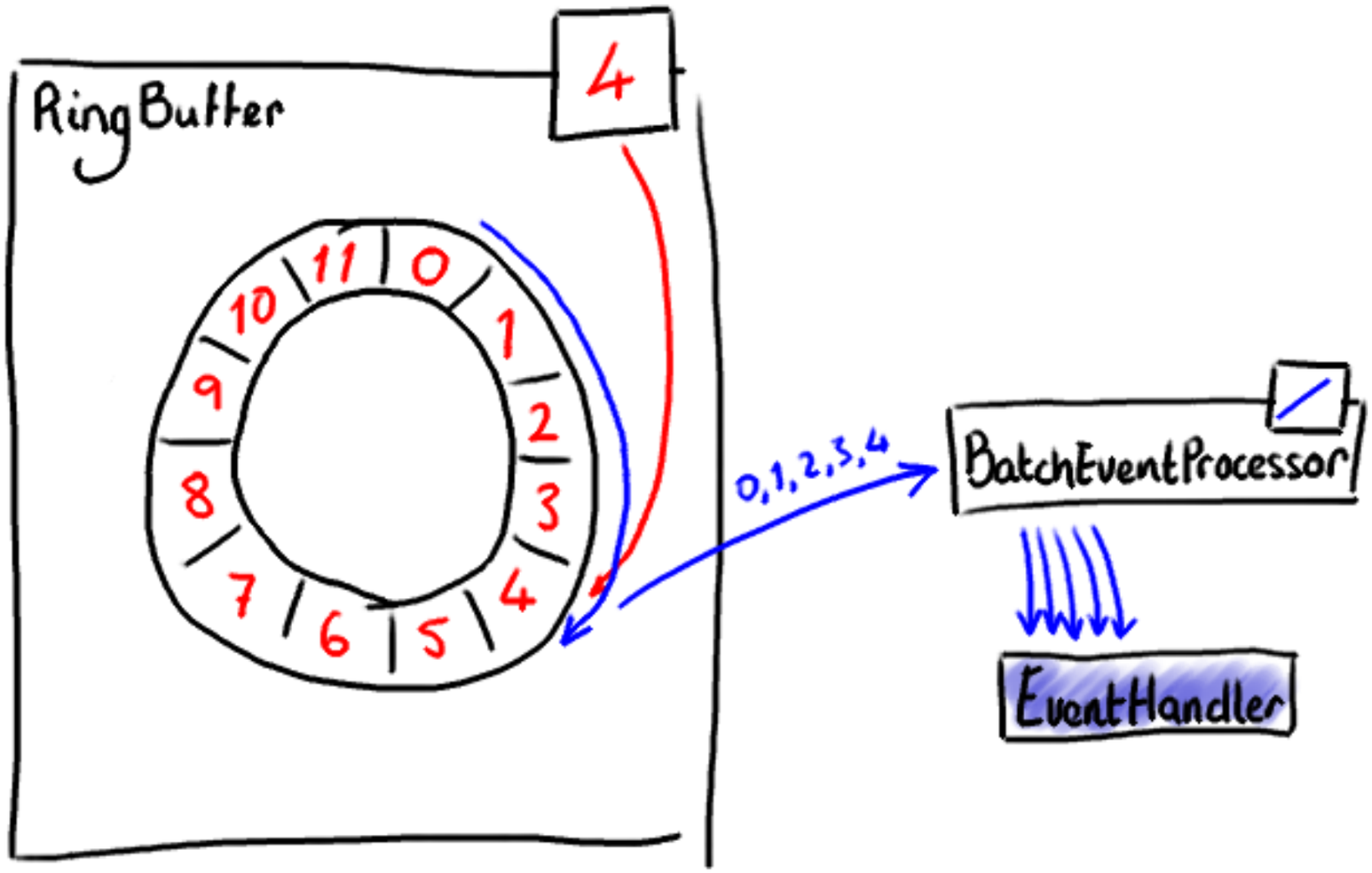
4
EventHandler


RingBuffer
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11
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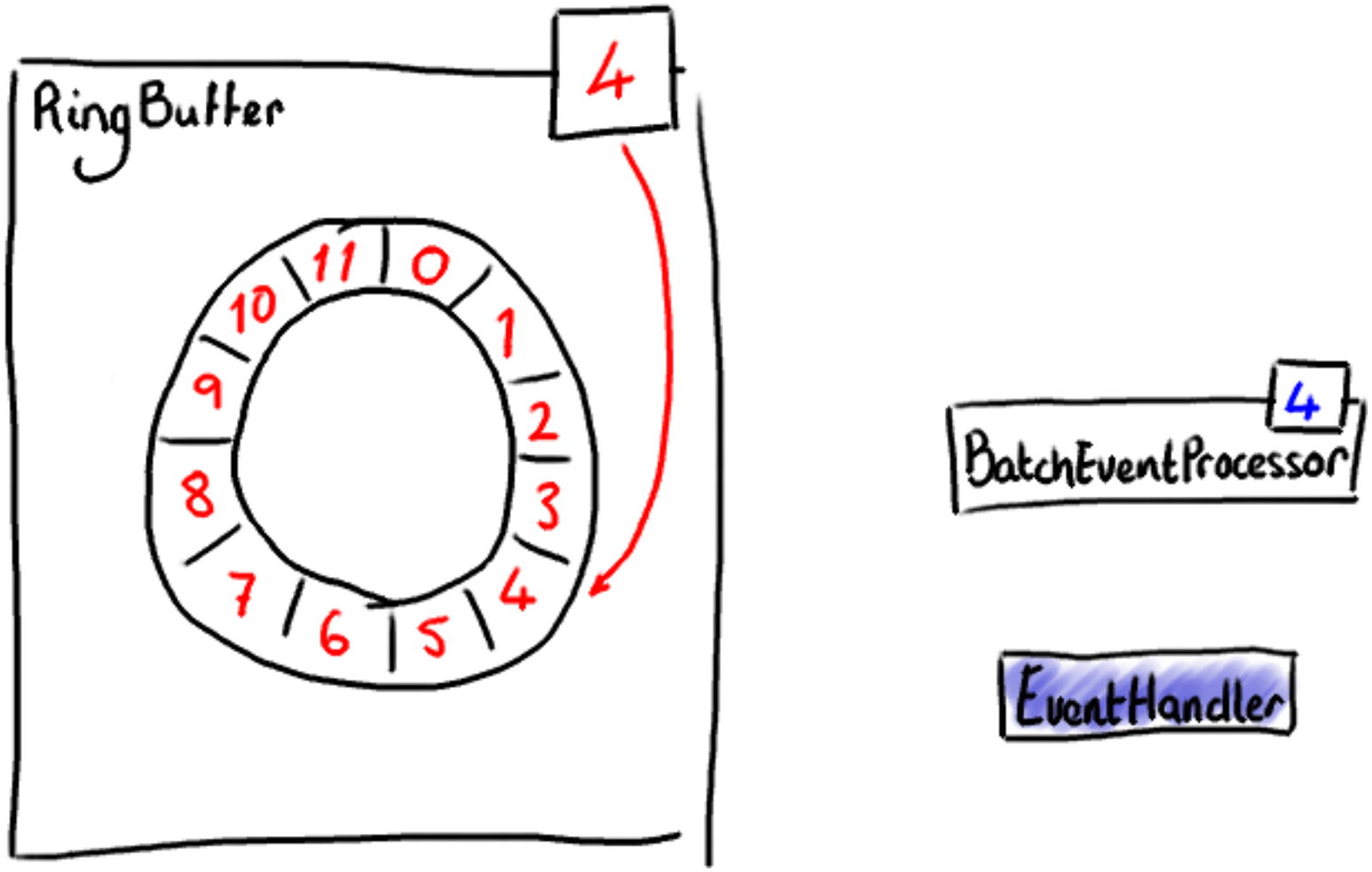
0,1,2,3,4
BatchEventProcessor
EventHandler


RingBuffer
4
11
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10
4
BatchEventProcessor
EventHandler

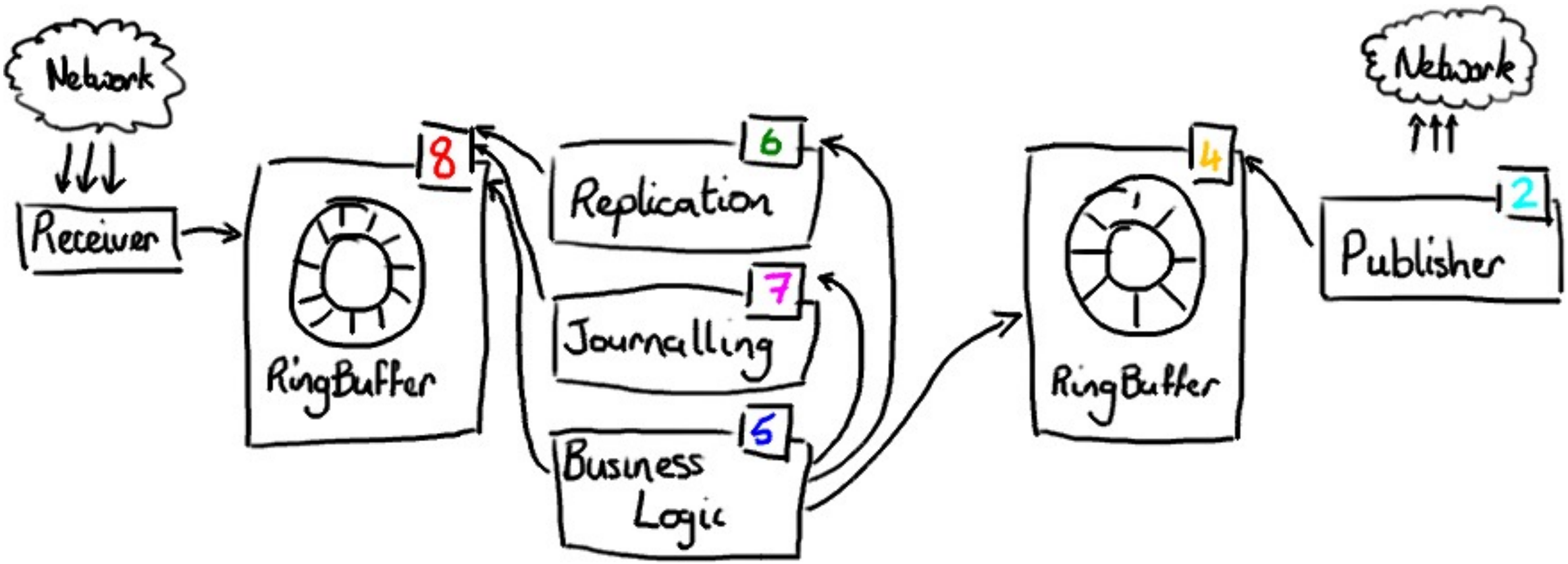
...and all you need is...

```
public class SimpleEventHandler implements EventHandler<SimpleEvent>
{

    @Override
    public void onEvent(final SimpleEvent event,
                        final long sequence,
                        final boolean endOfBatch) throws Exception {
        // do stuff
    }
}
```

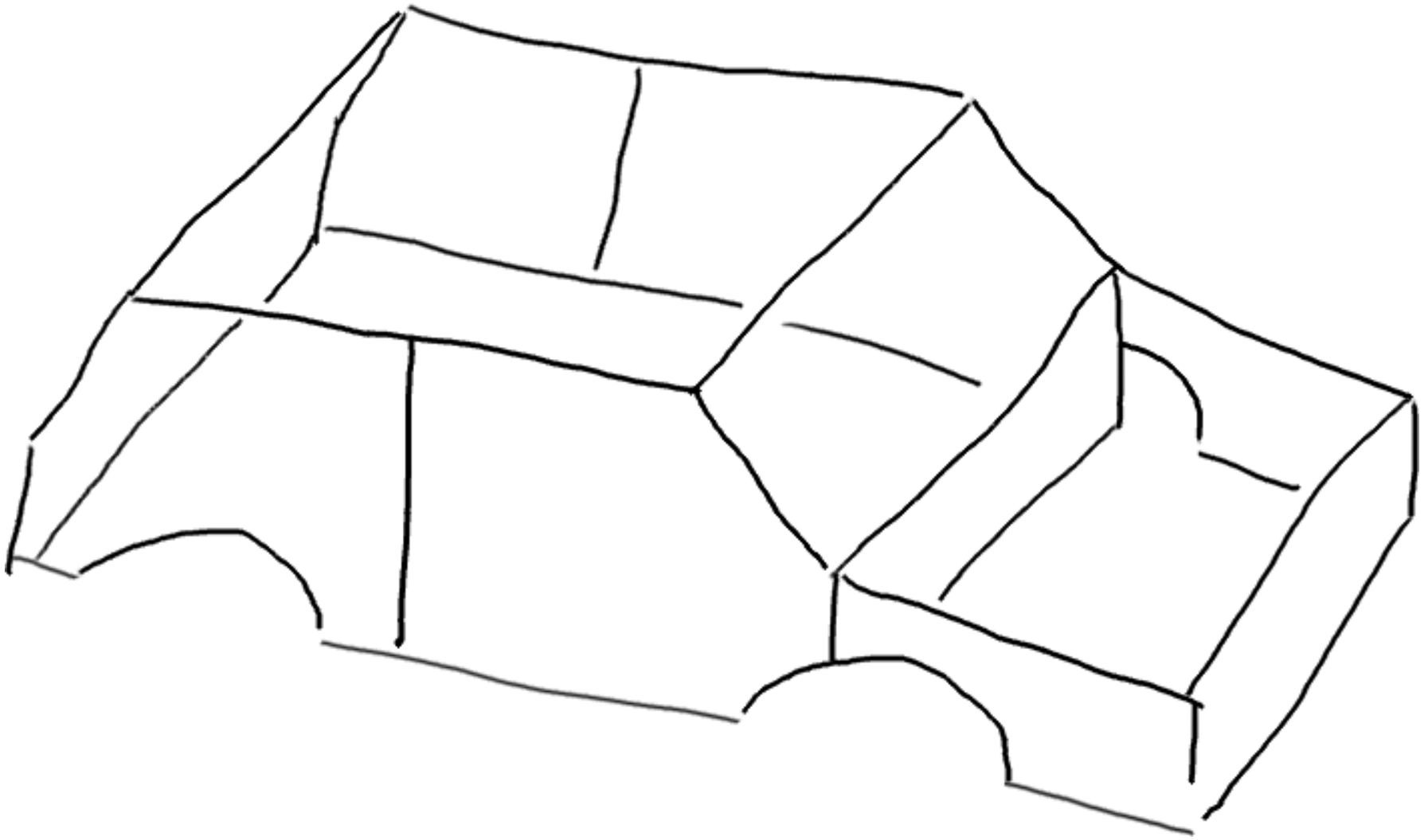
Shiny. So what?

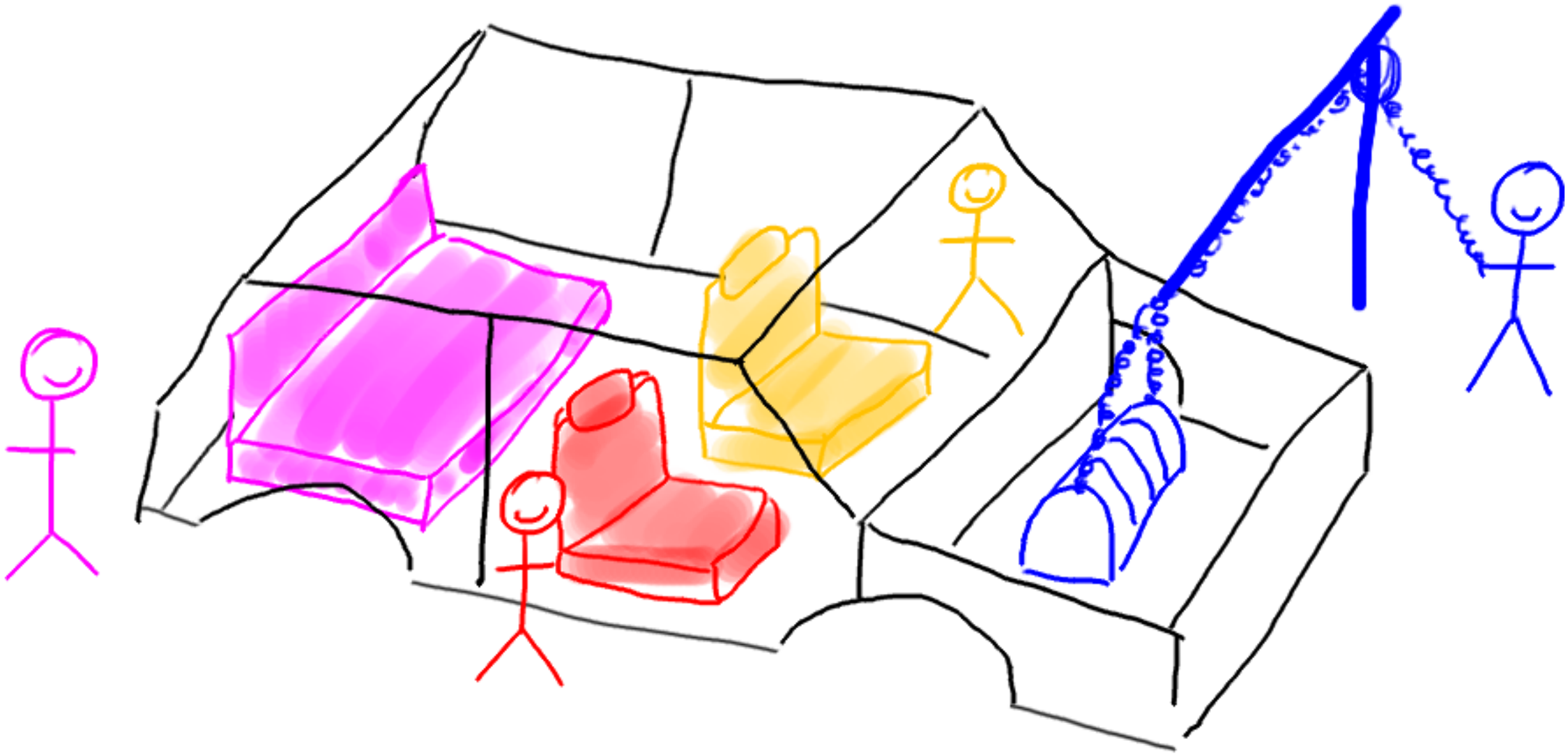
Let's go parallel



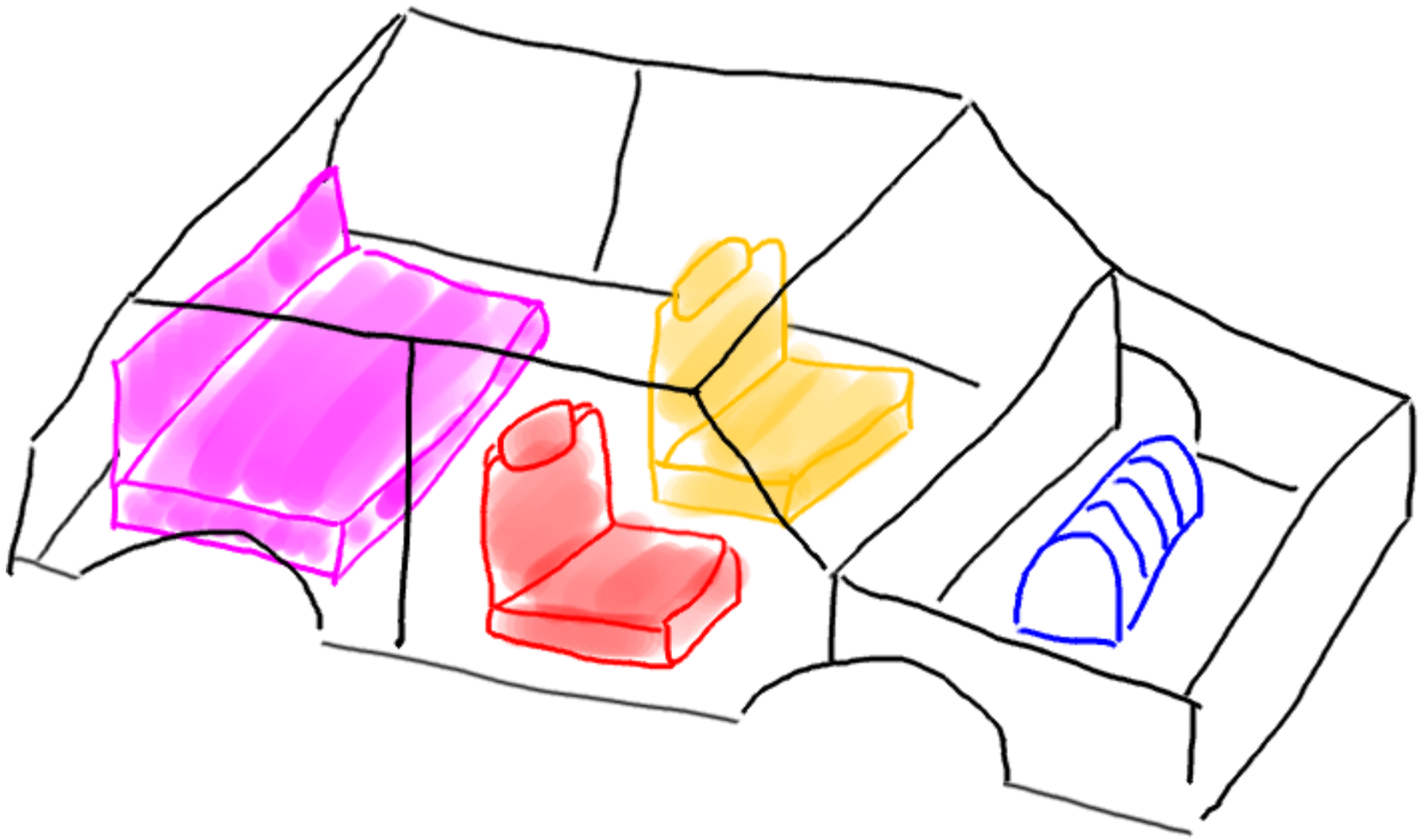
And now for something different...

Remember Henry Ford?

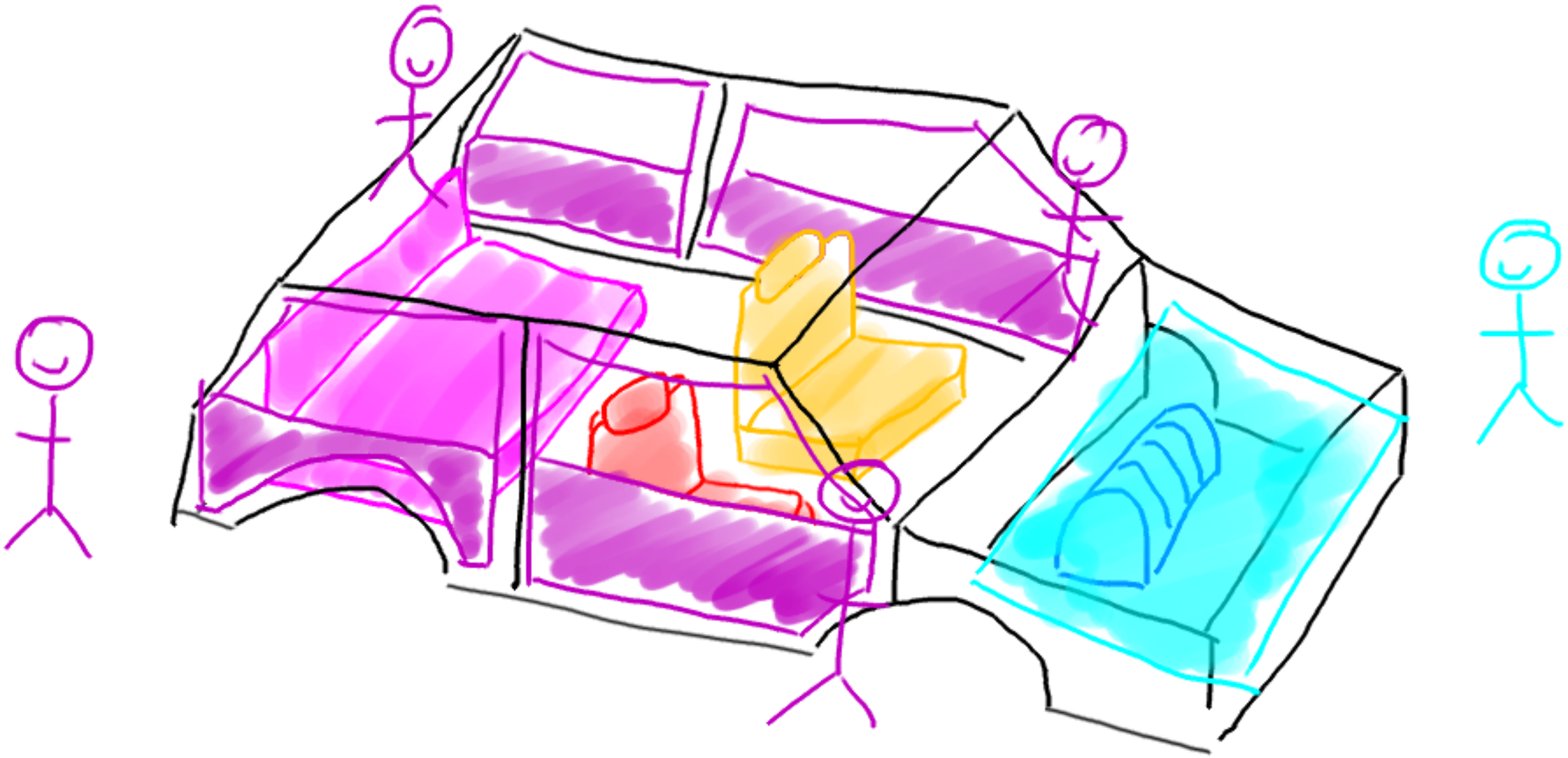




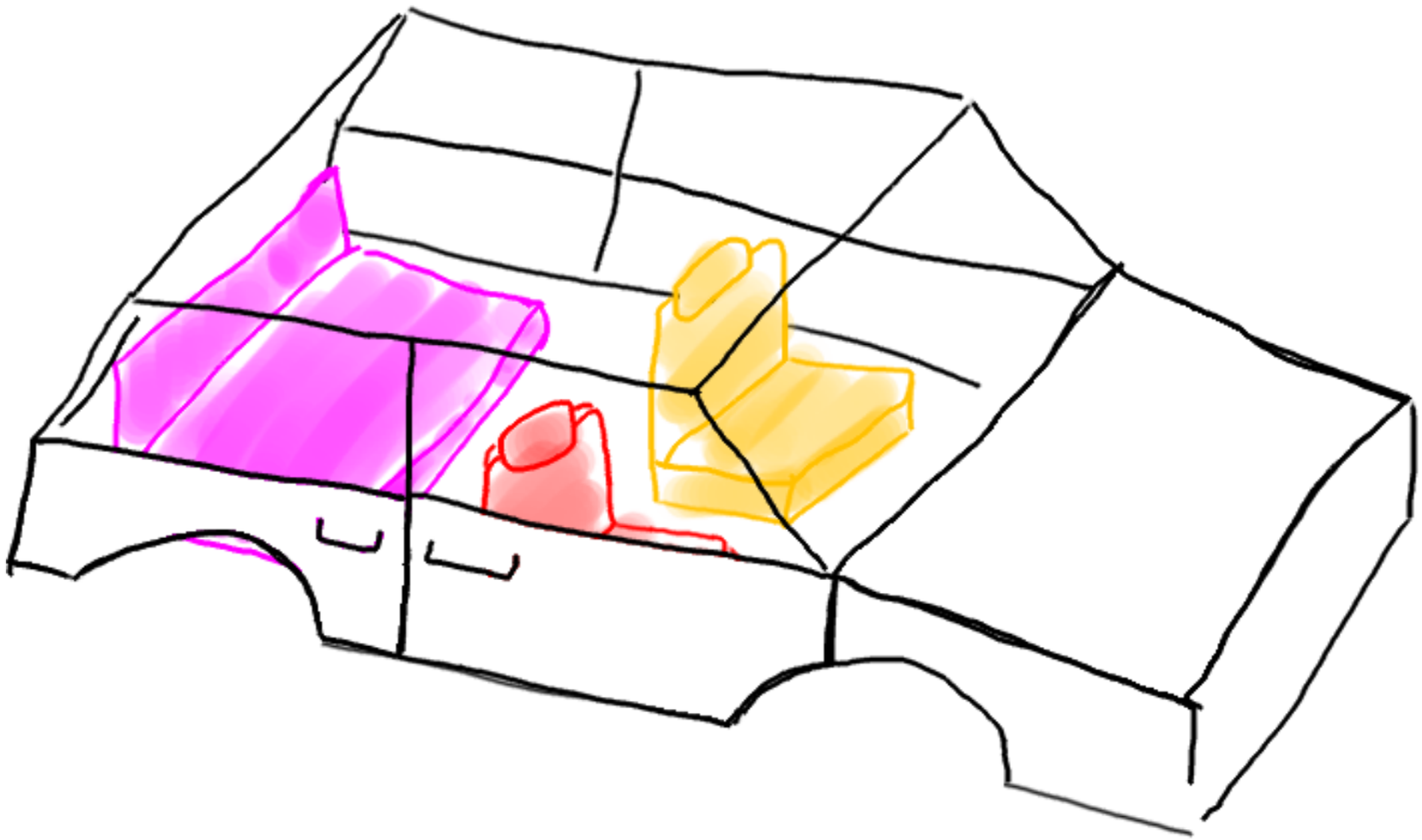
*Not to Scale



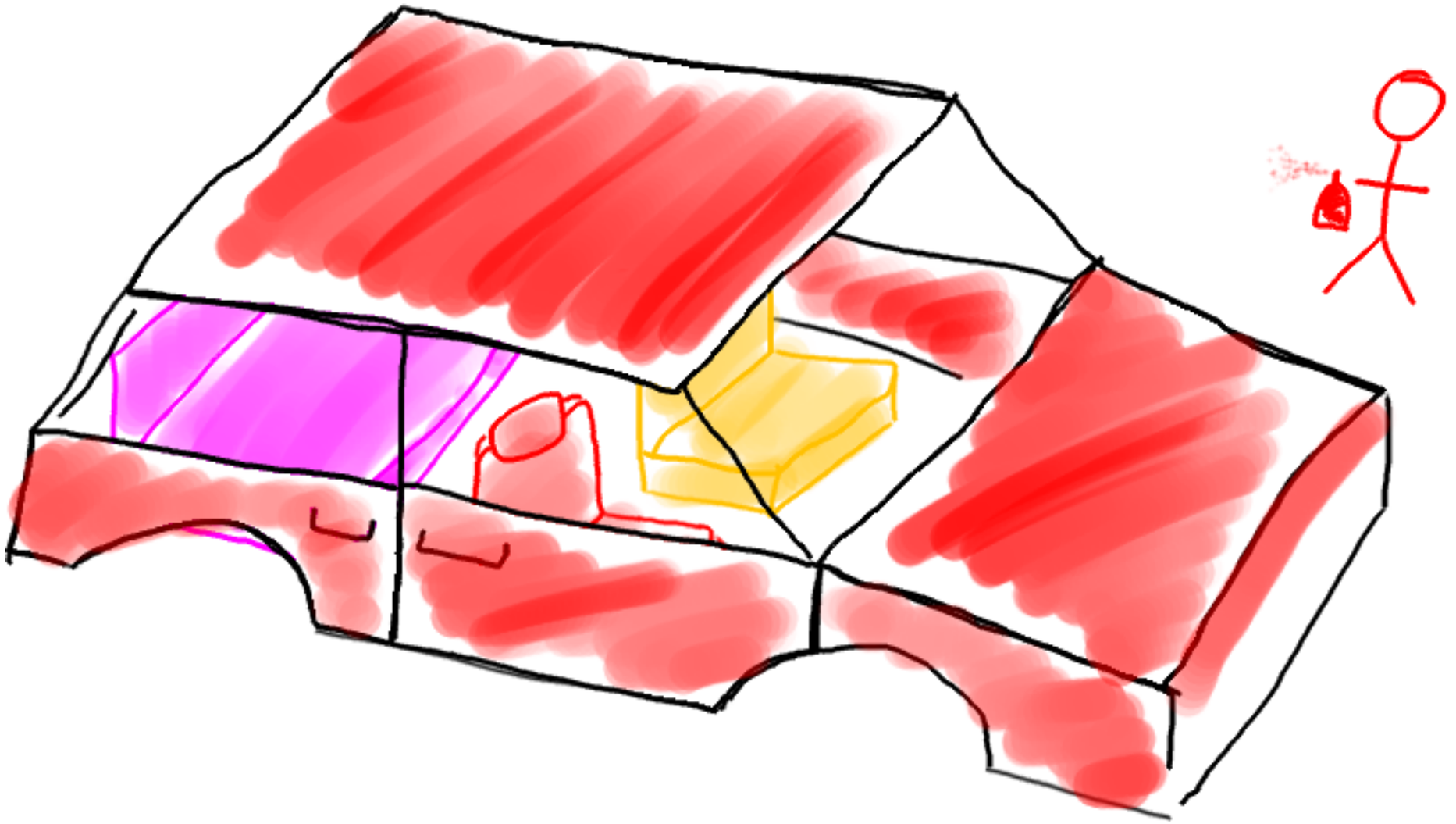
*Not to Scale



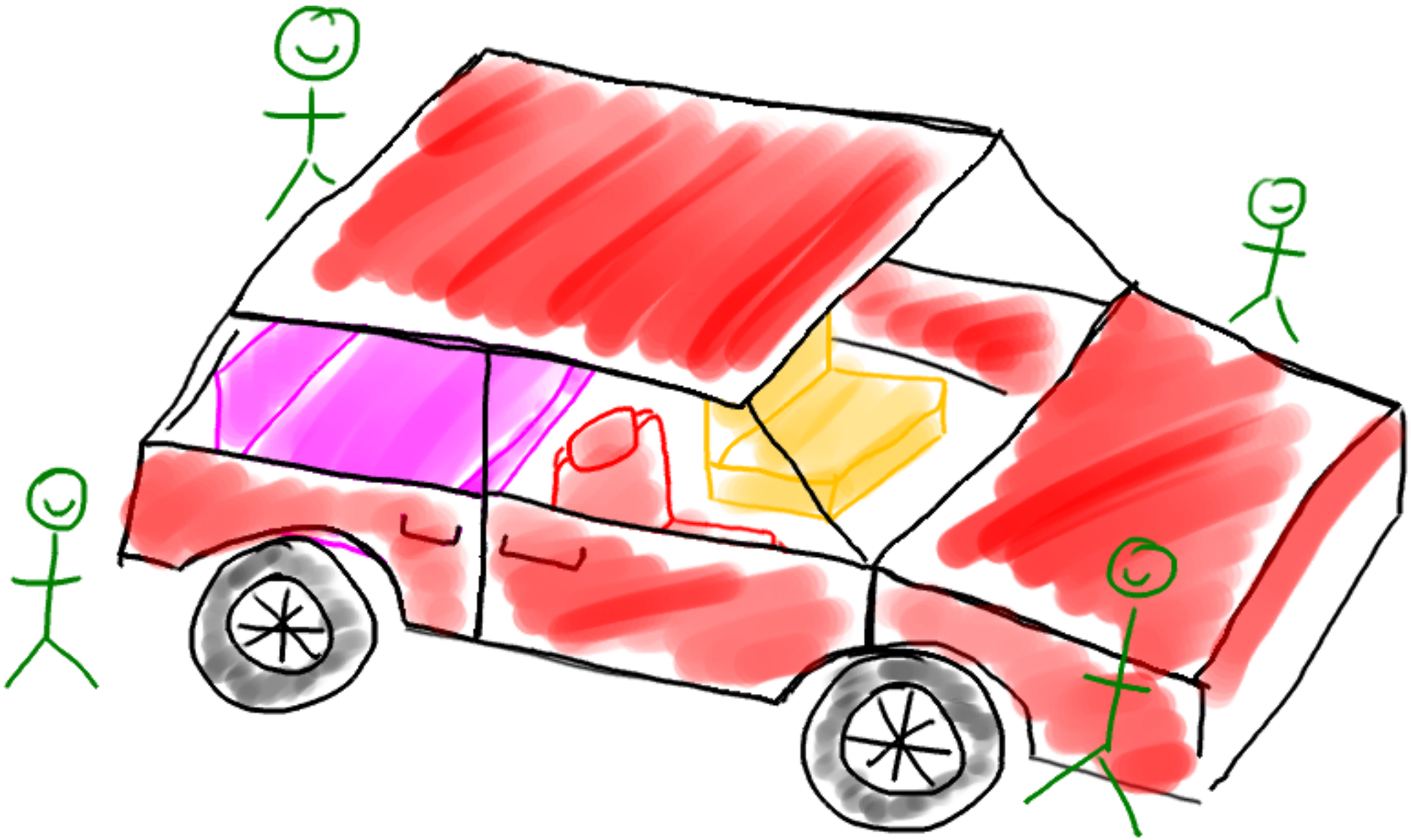
*Not to Scale



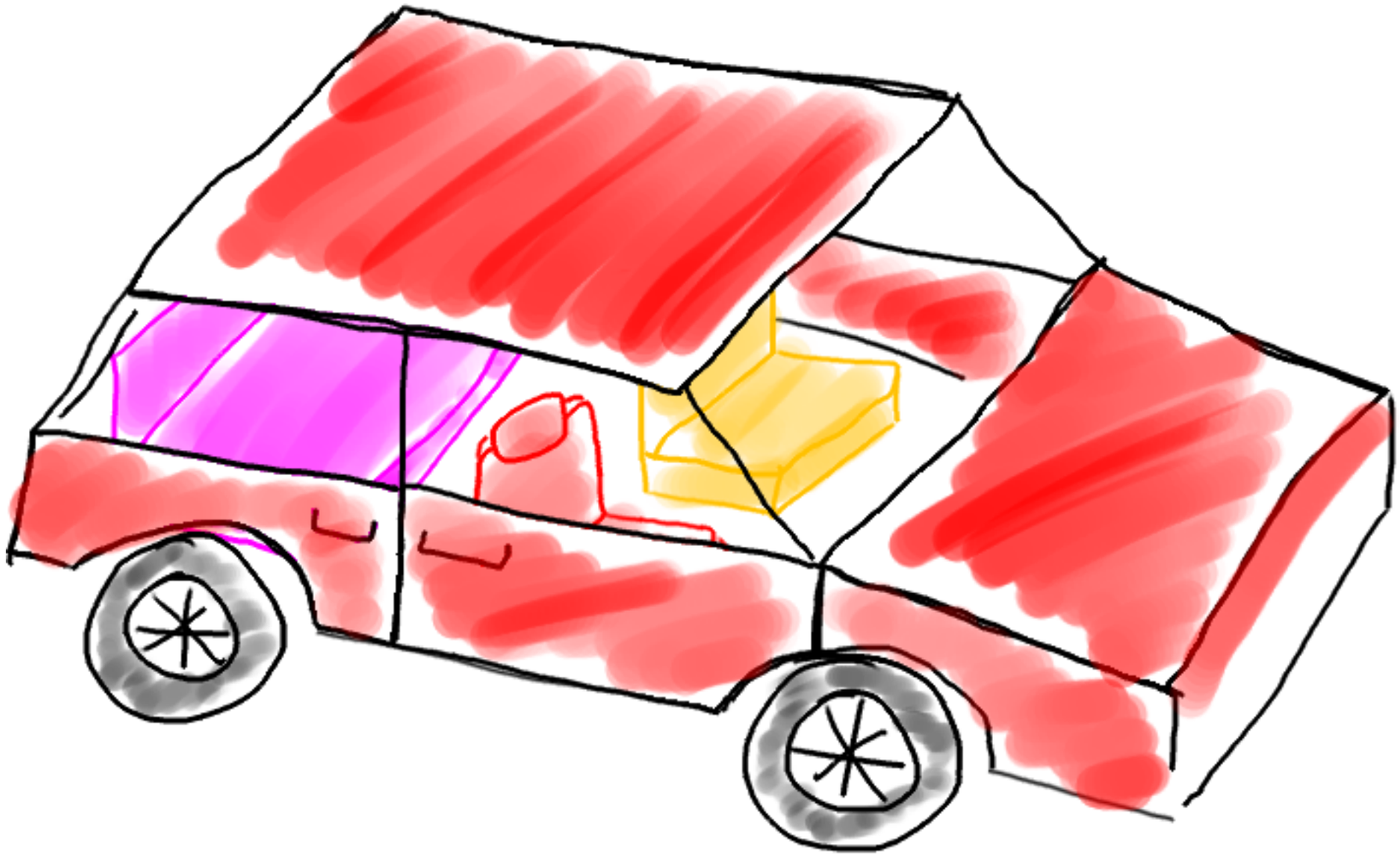
*Not to Scale



*Not to Scale

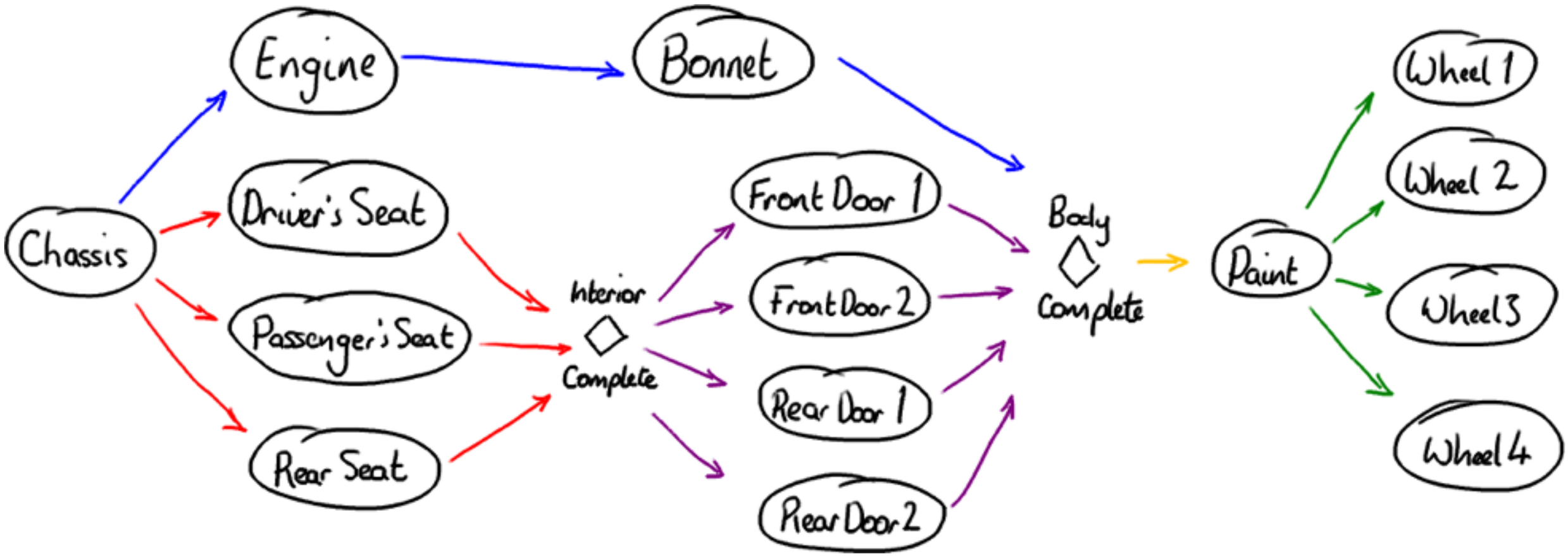


*Not to Scale

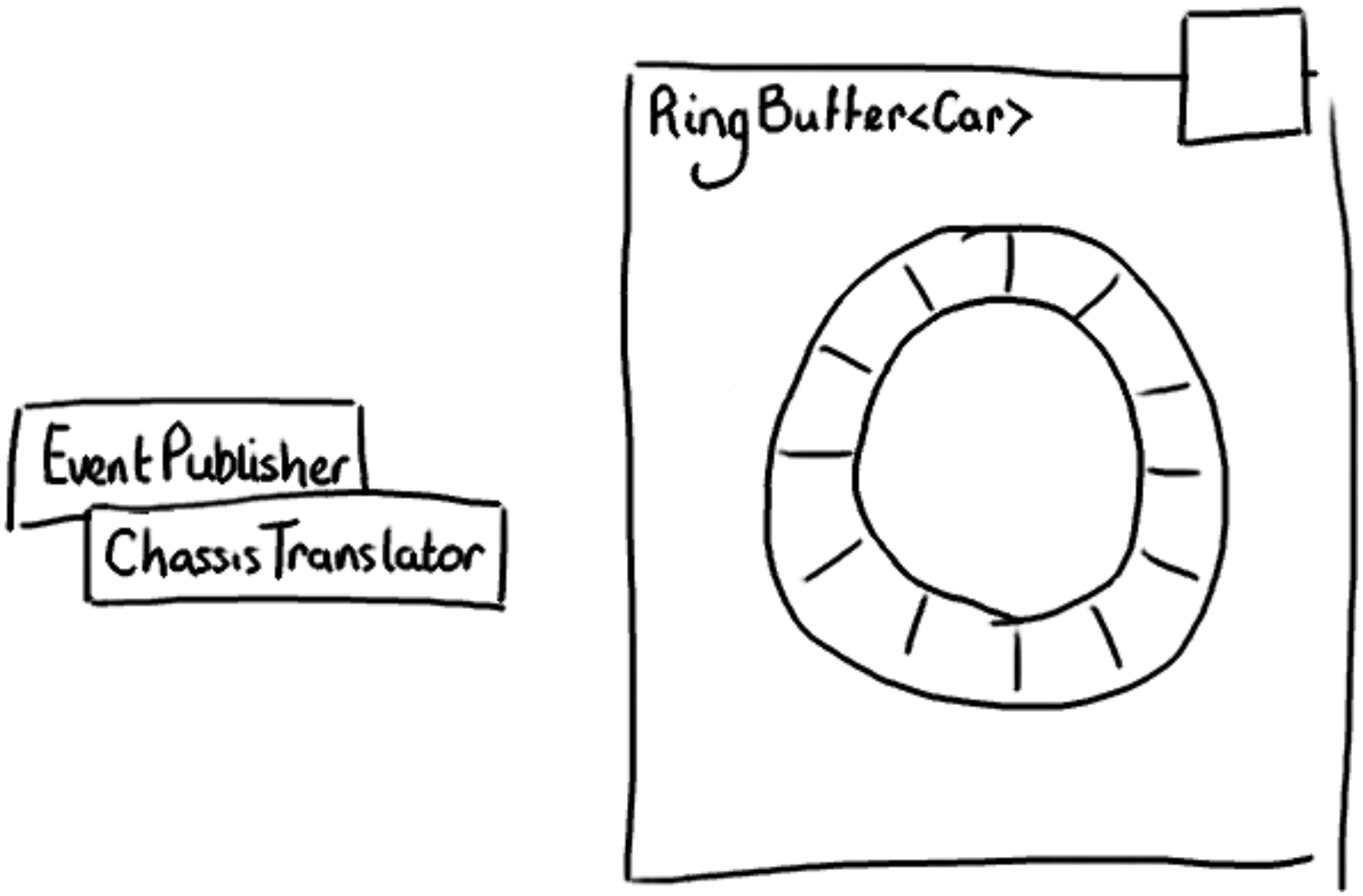


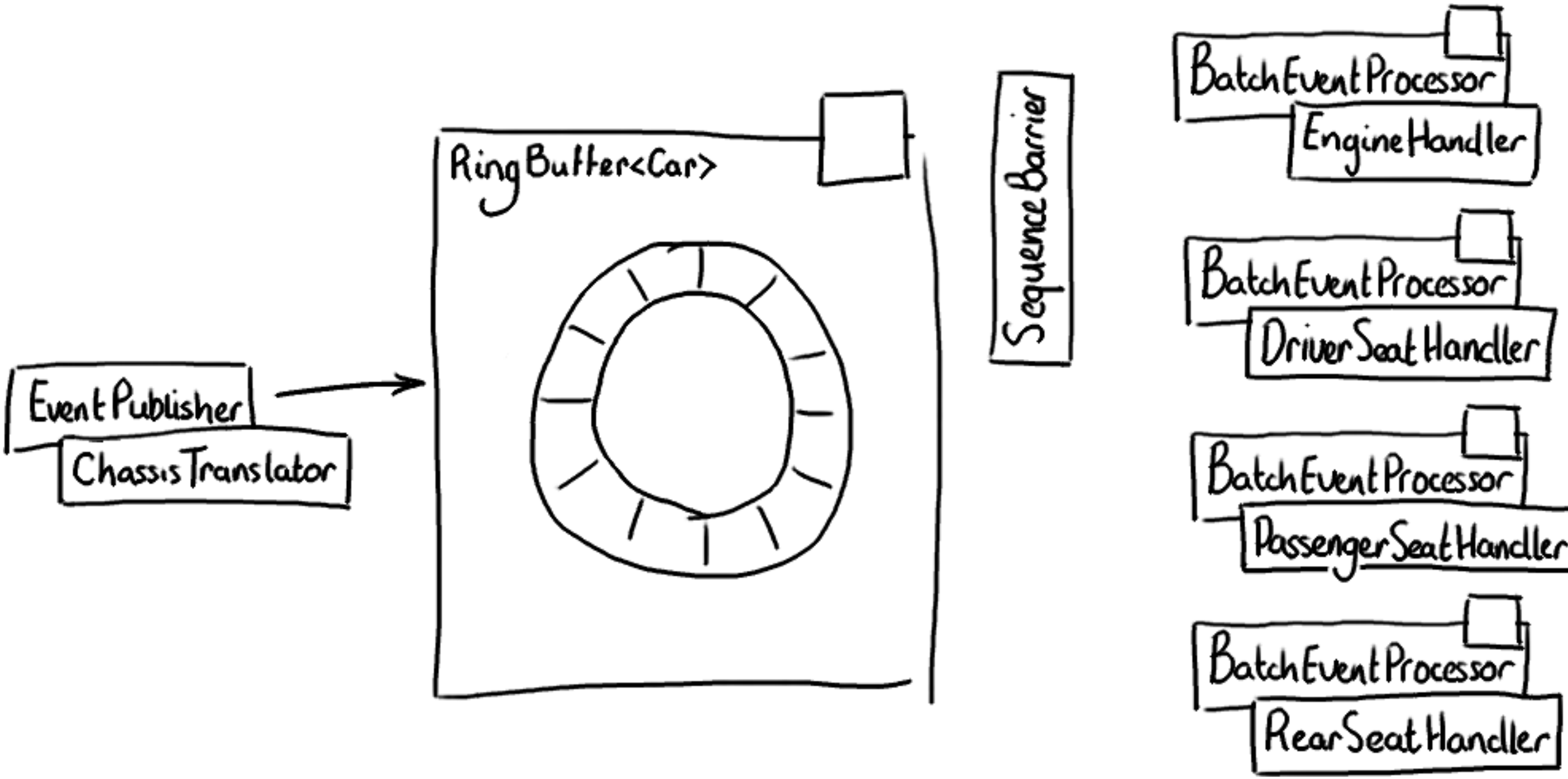
*Not to Scale

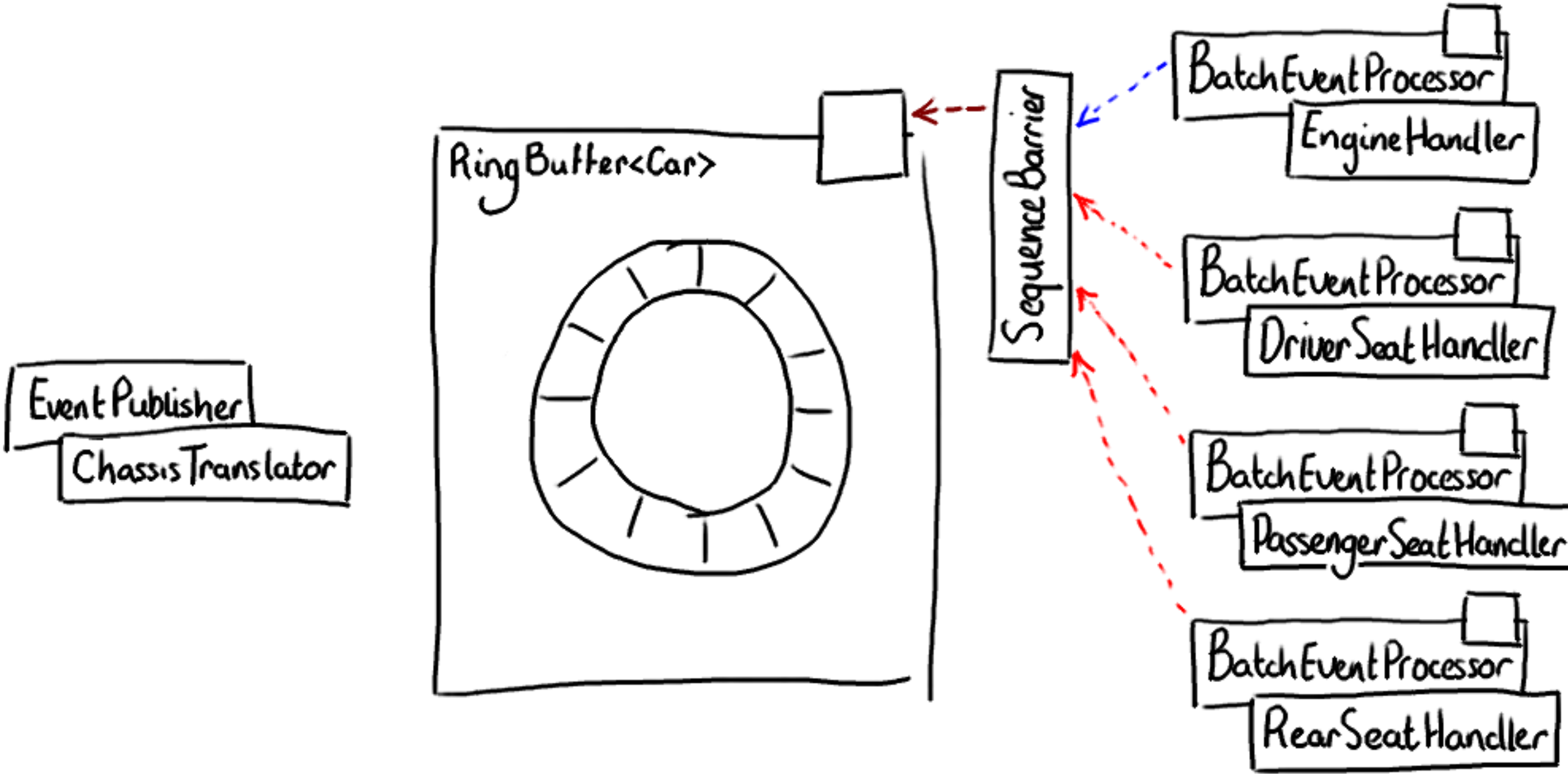
Complex workflow...



What on Earth has this got to do with RingBuffers?!


RingButter<Car>
EventPublisher
ChassisTranslator


RingButter<Car>
SequenceBarrier
BatchEventProcessor
EngineHandler
BatchEventProcessor
DriverSeatHandler
EventPublisher
ChassisTranslator
BatchEventProcessor
PassengerSeatHandler
BatchEventProcessor
RearSeatHandler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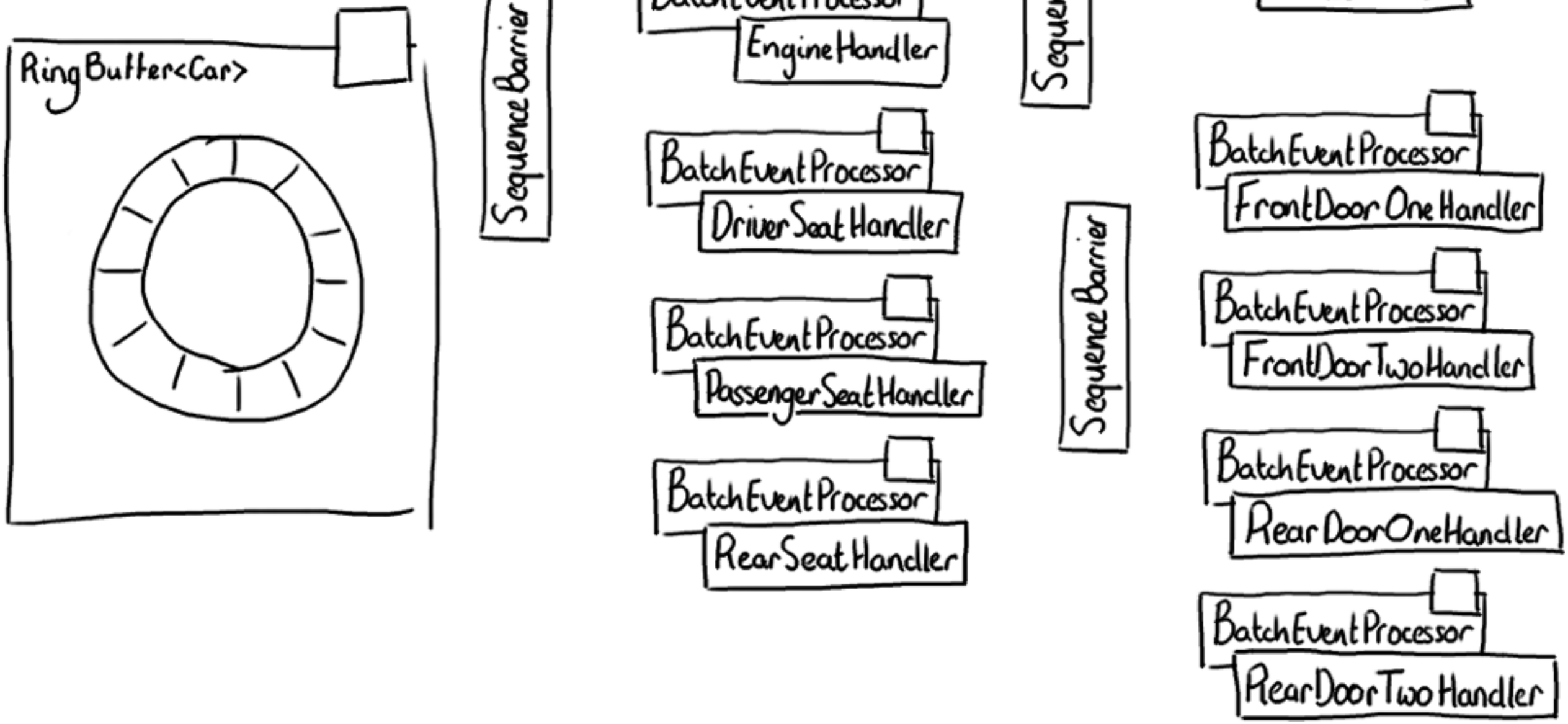
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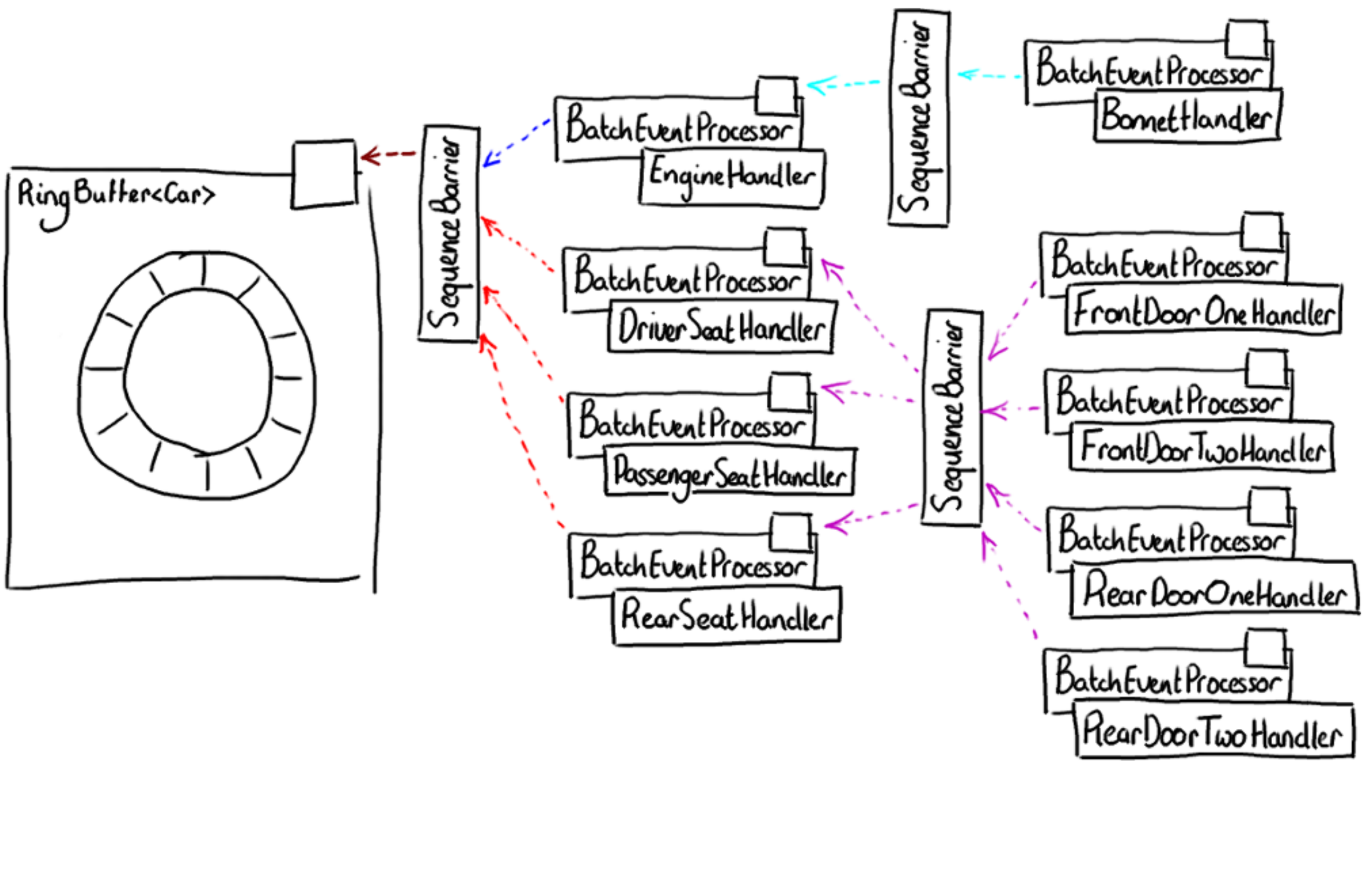
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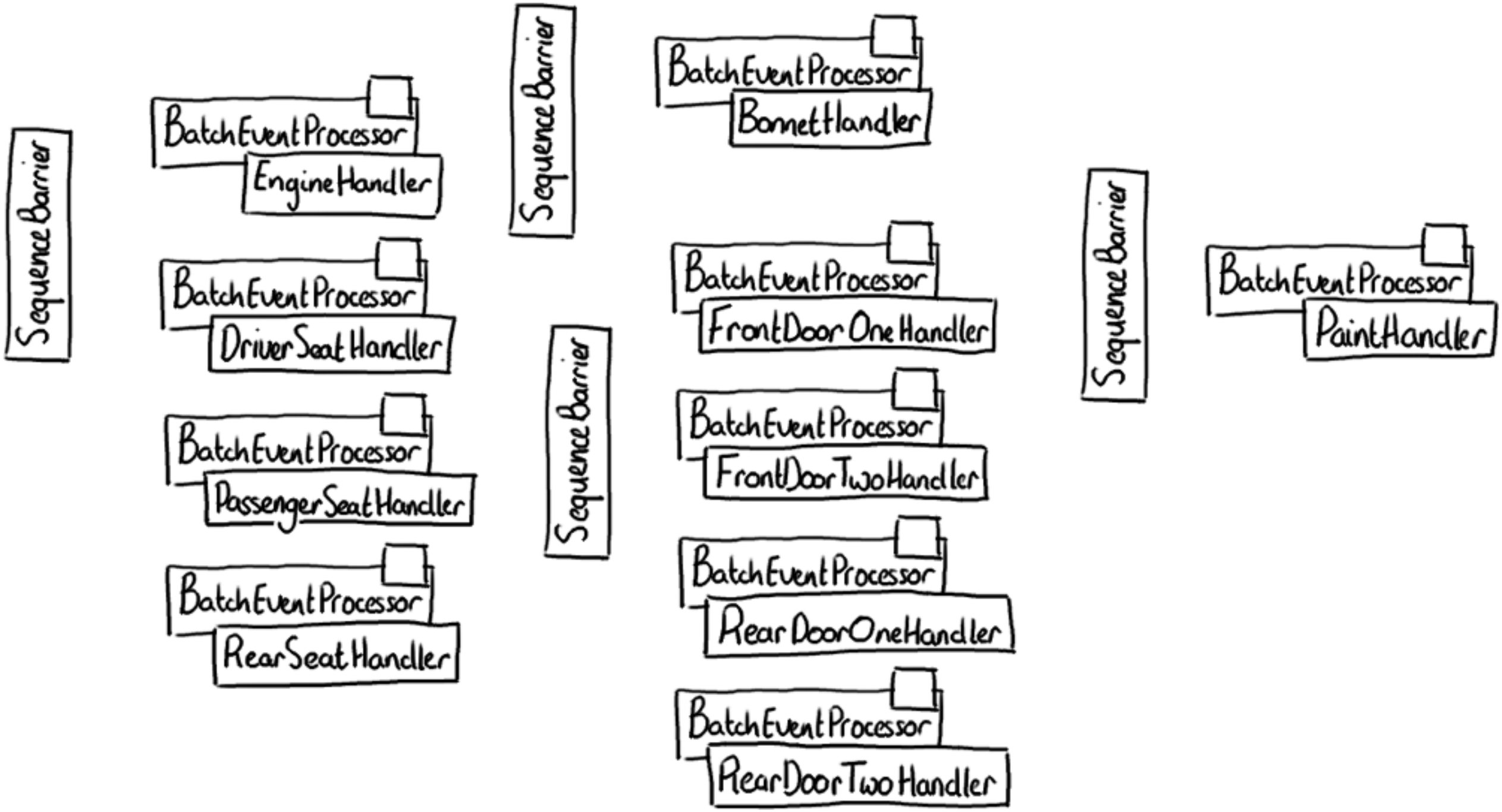
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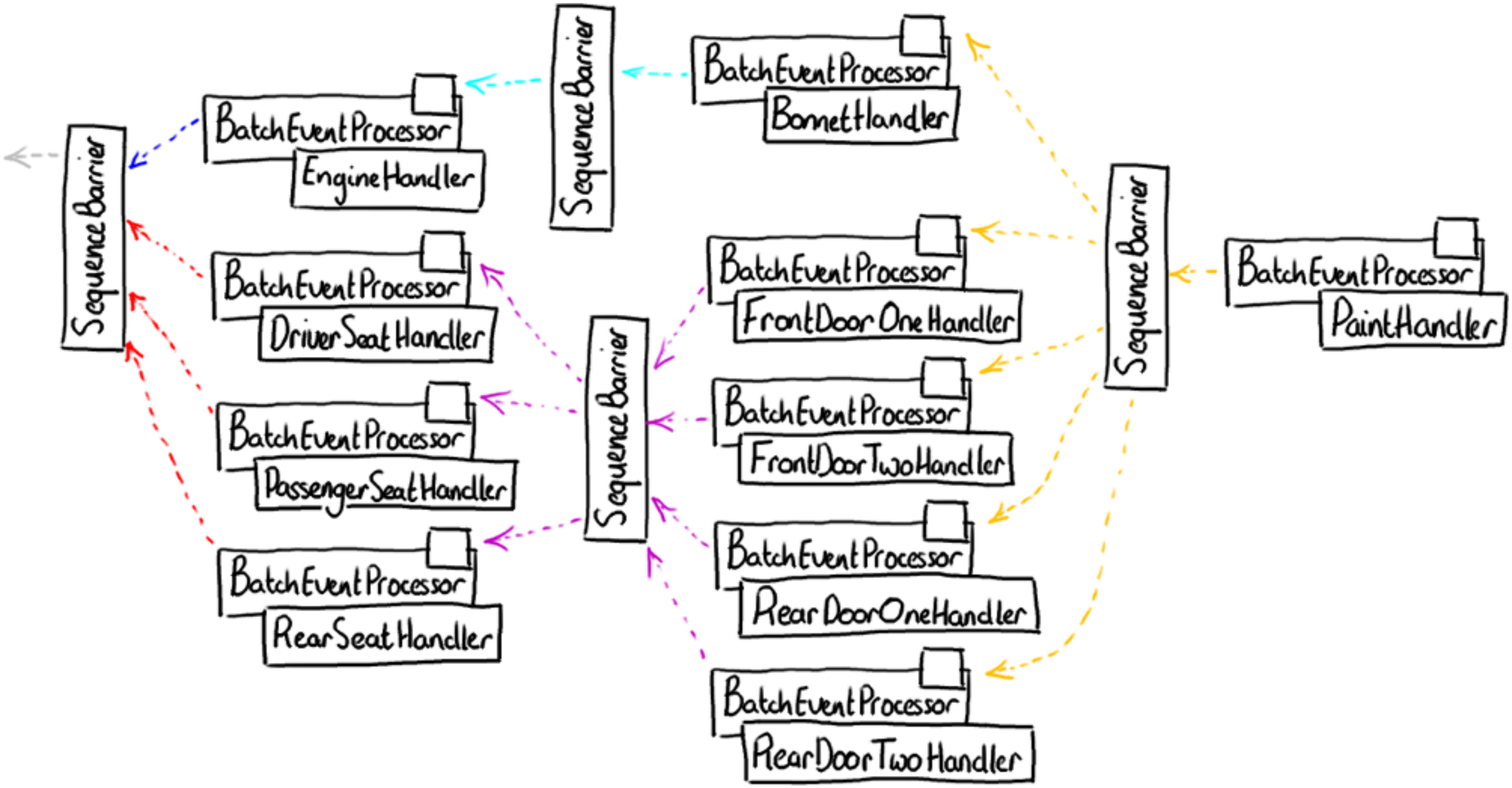
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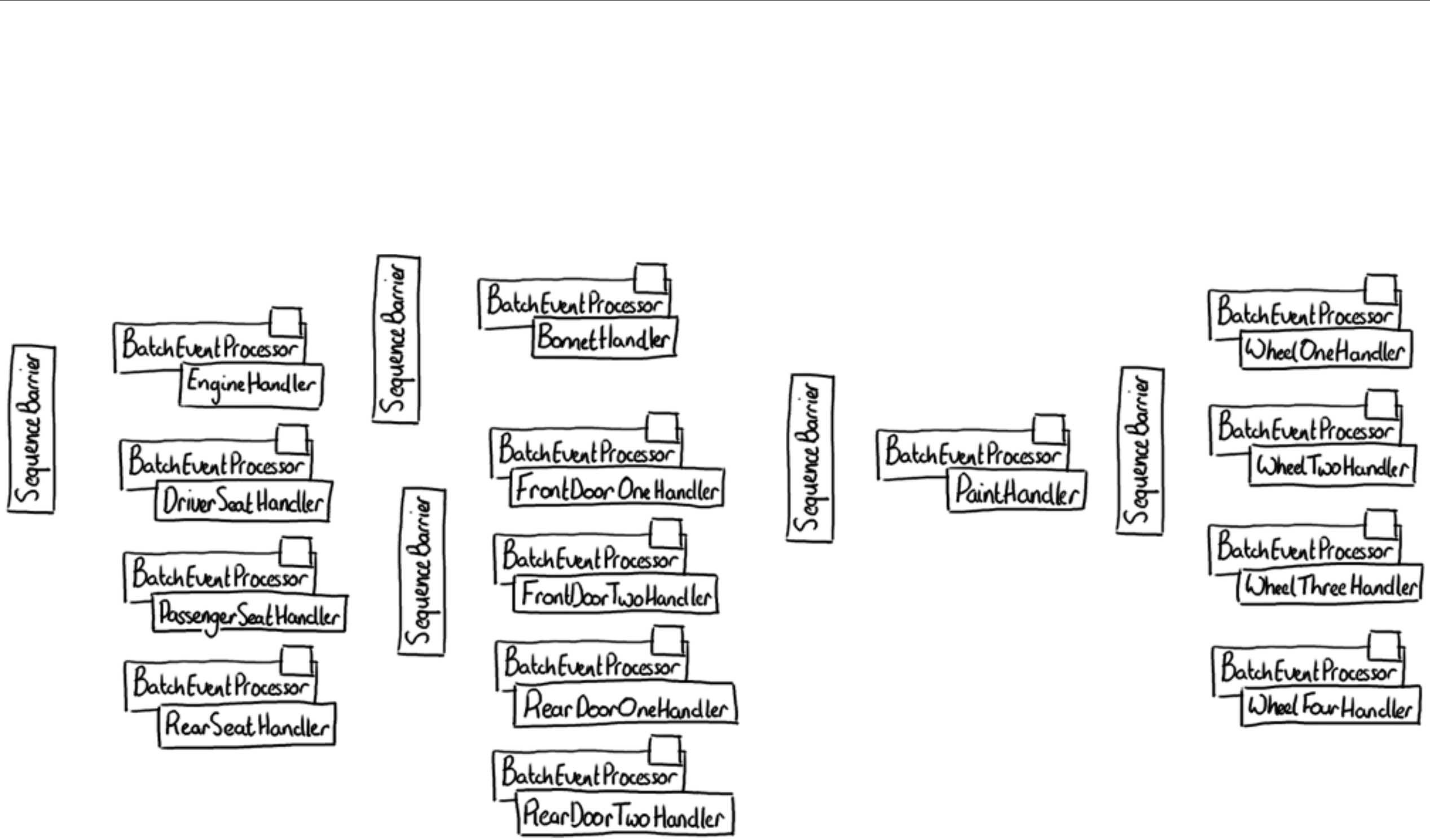
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RearDoorTwoHandler
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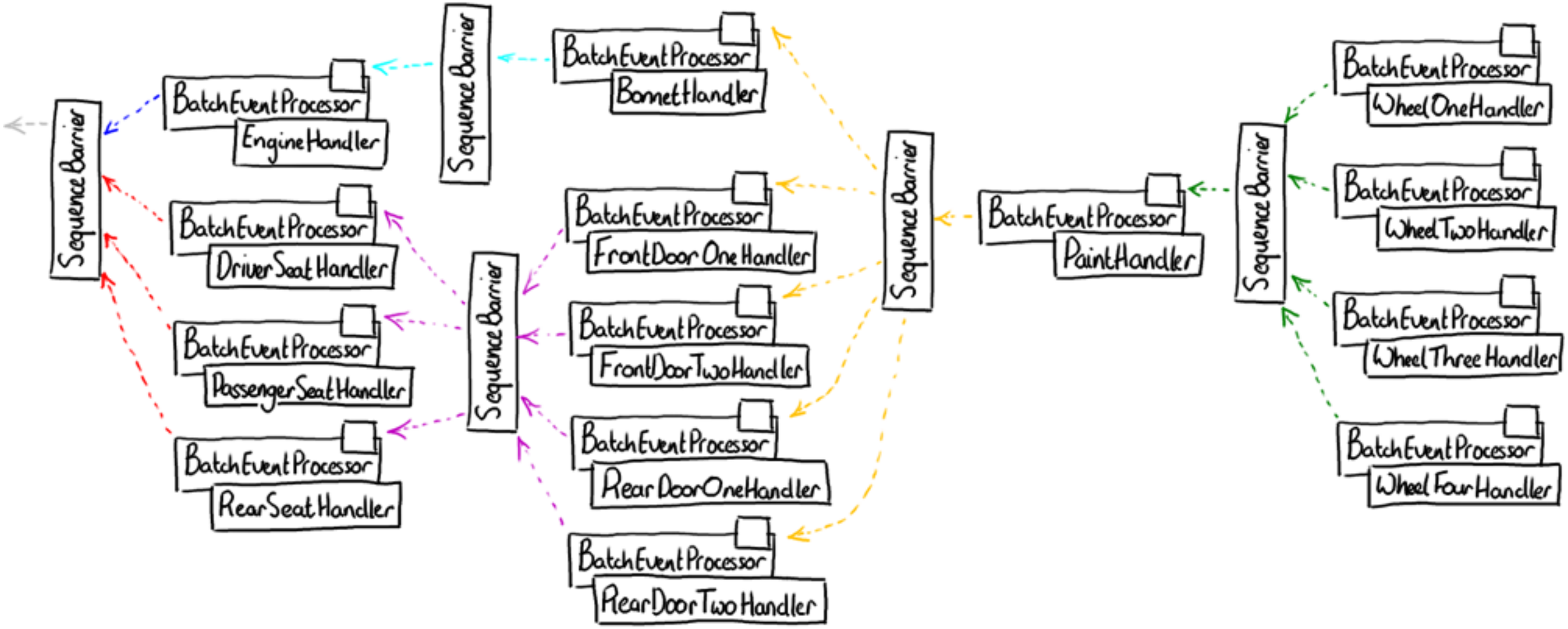
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RearDoorTwoHandler
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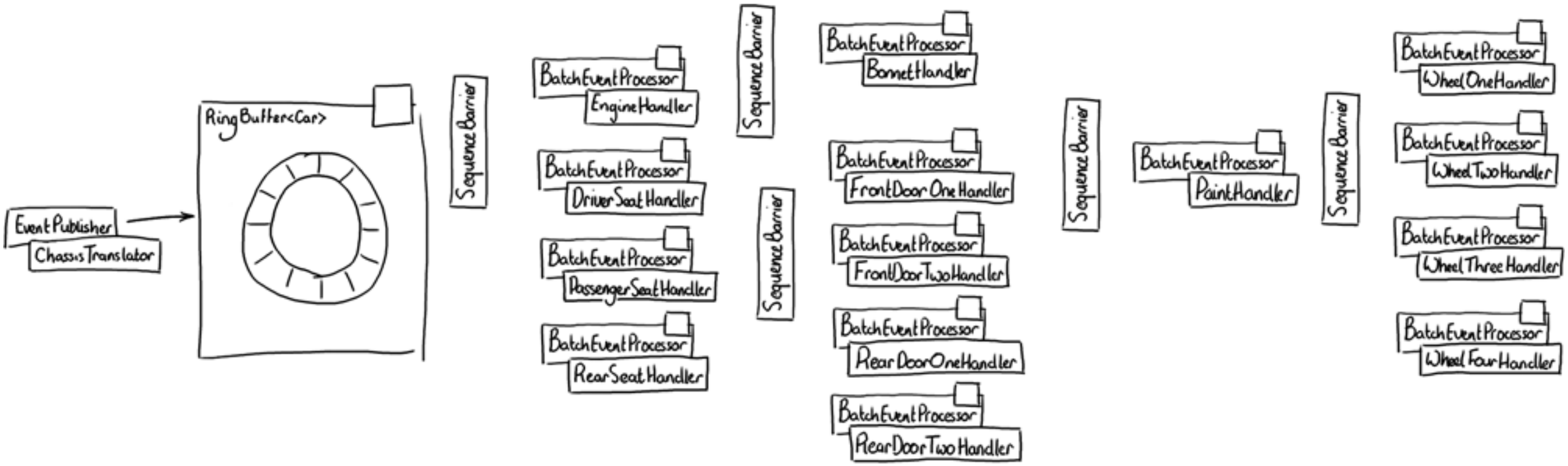
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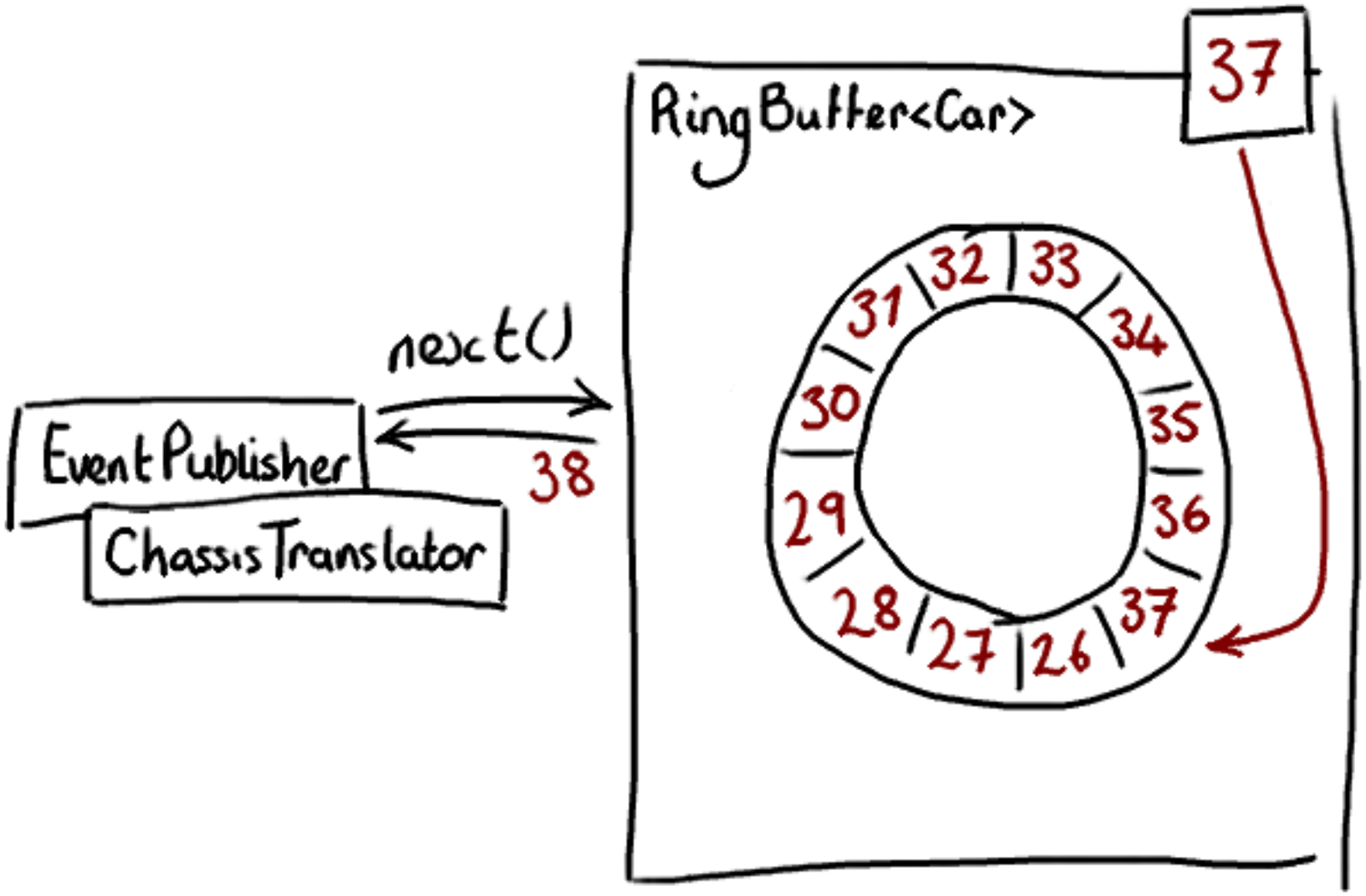
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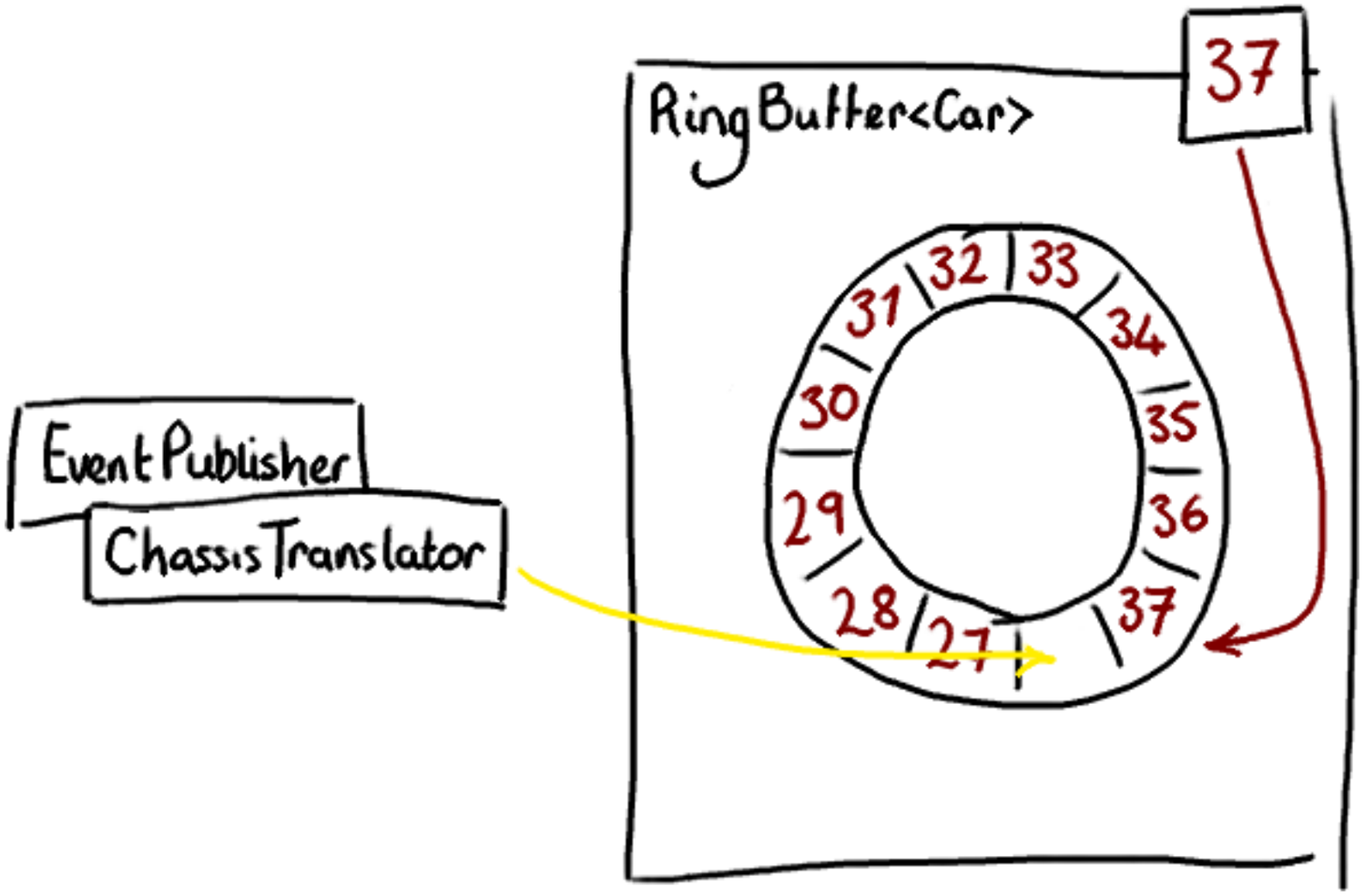
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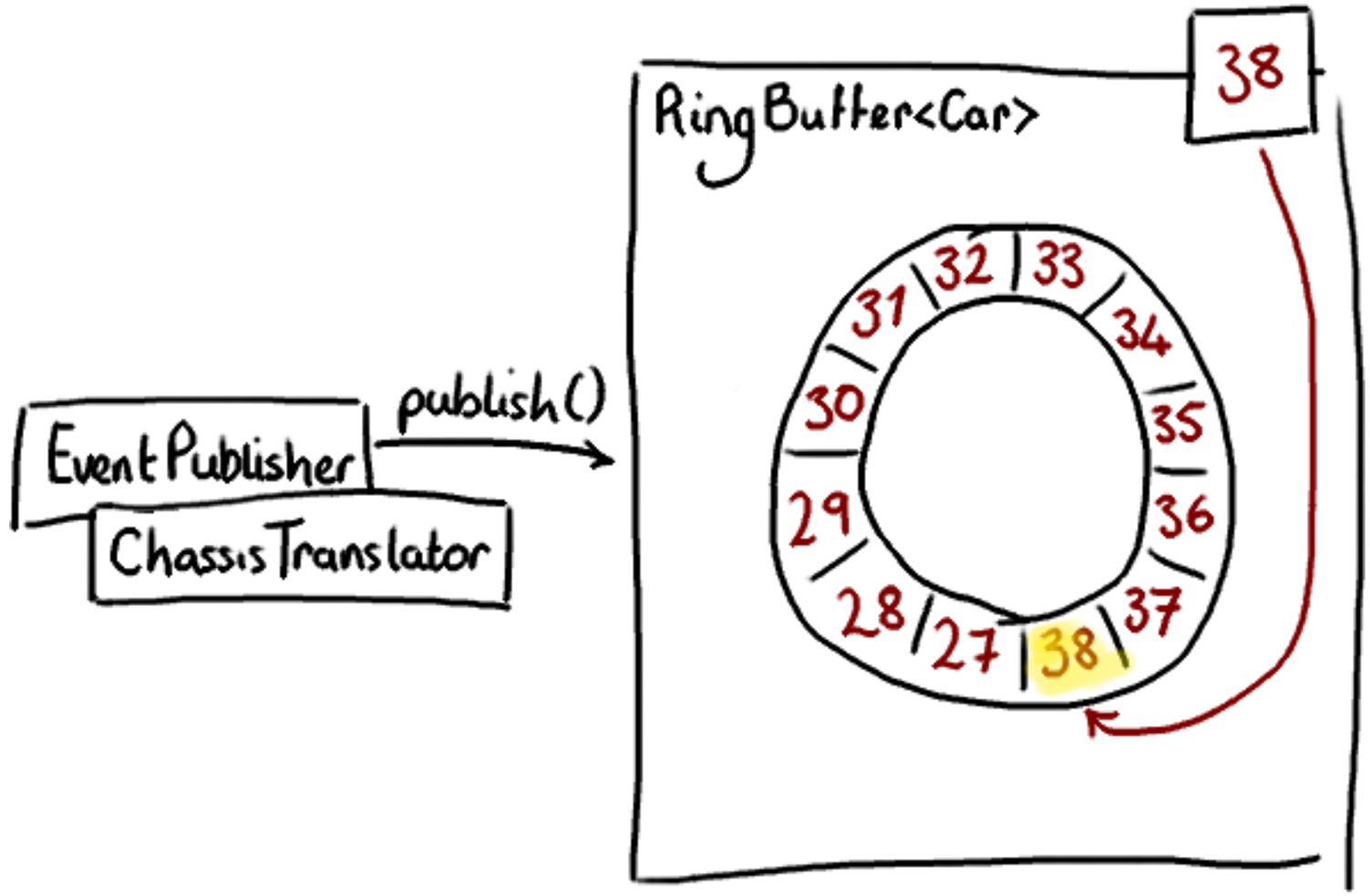
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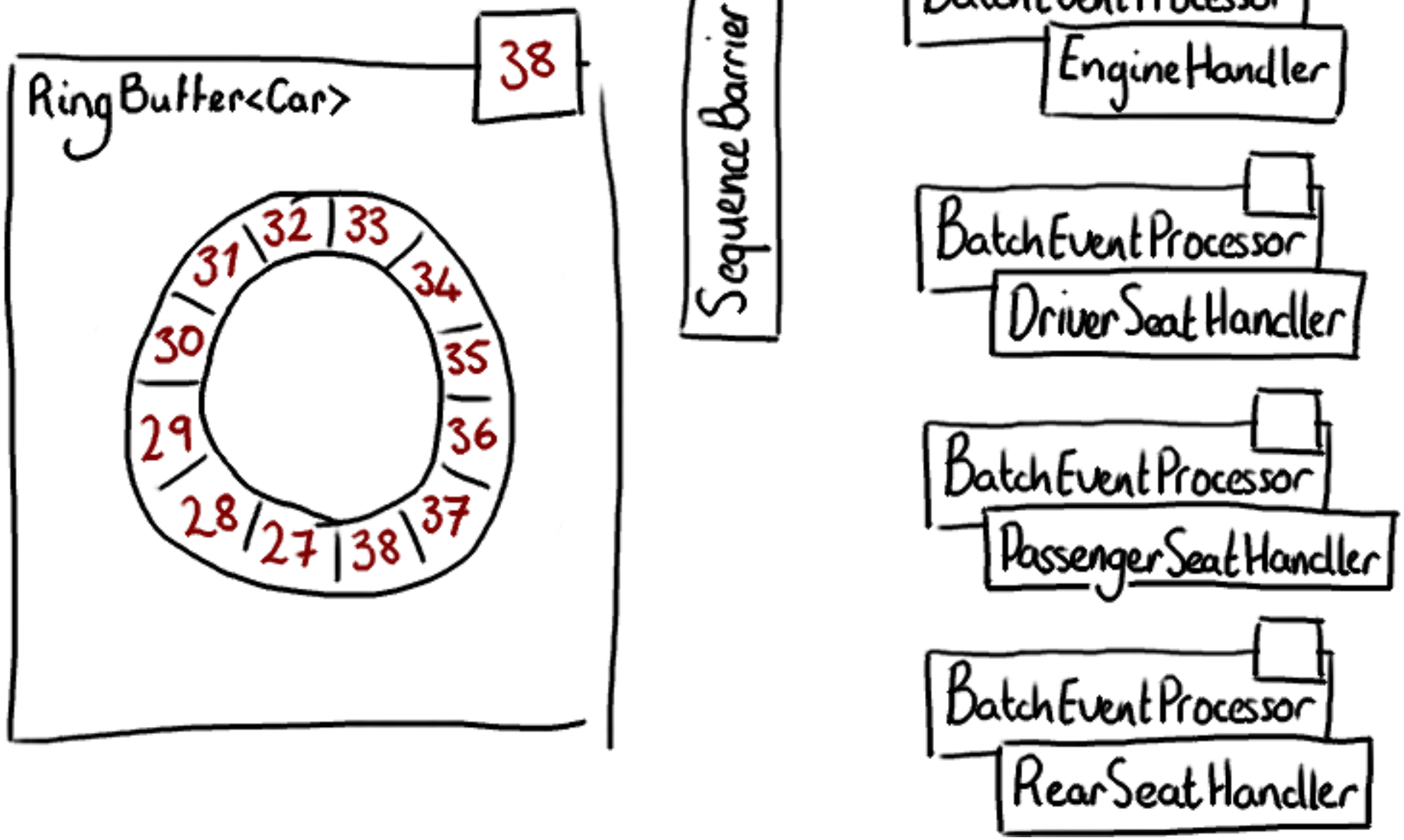
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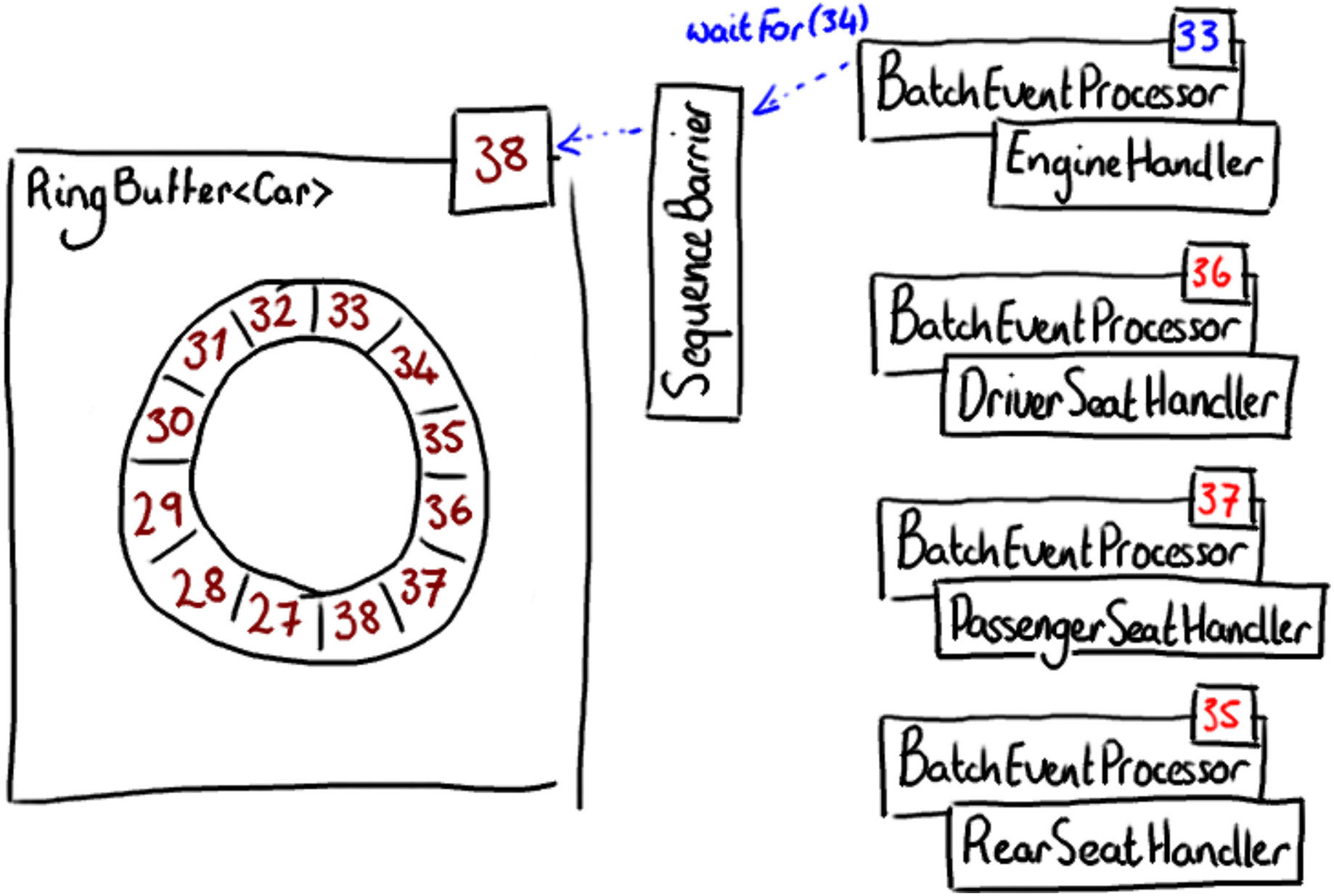
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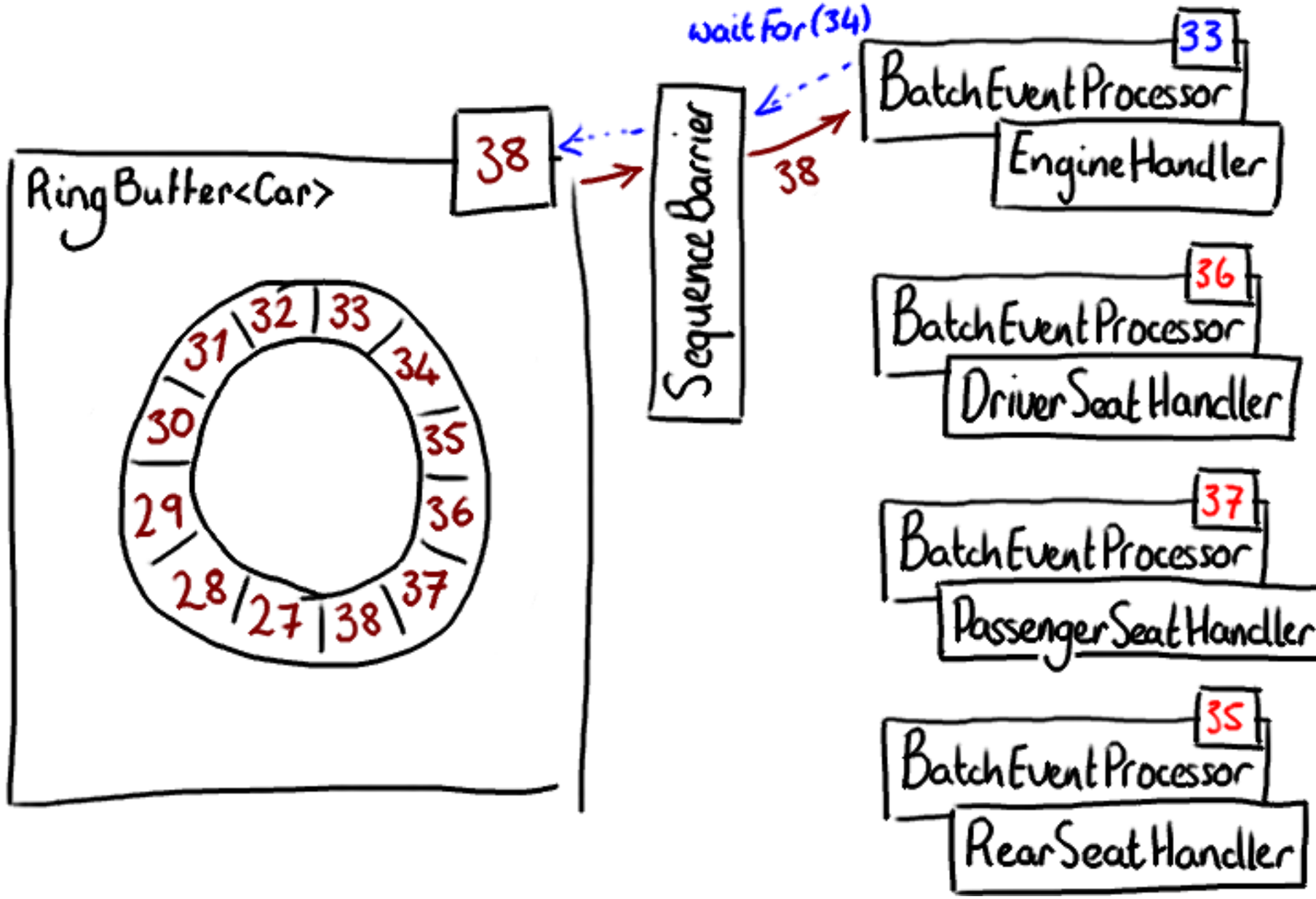
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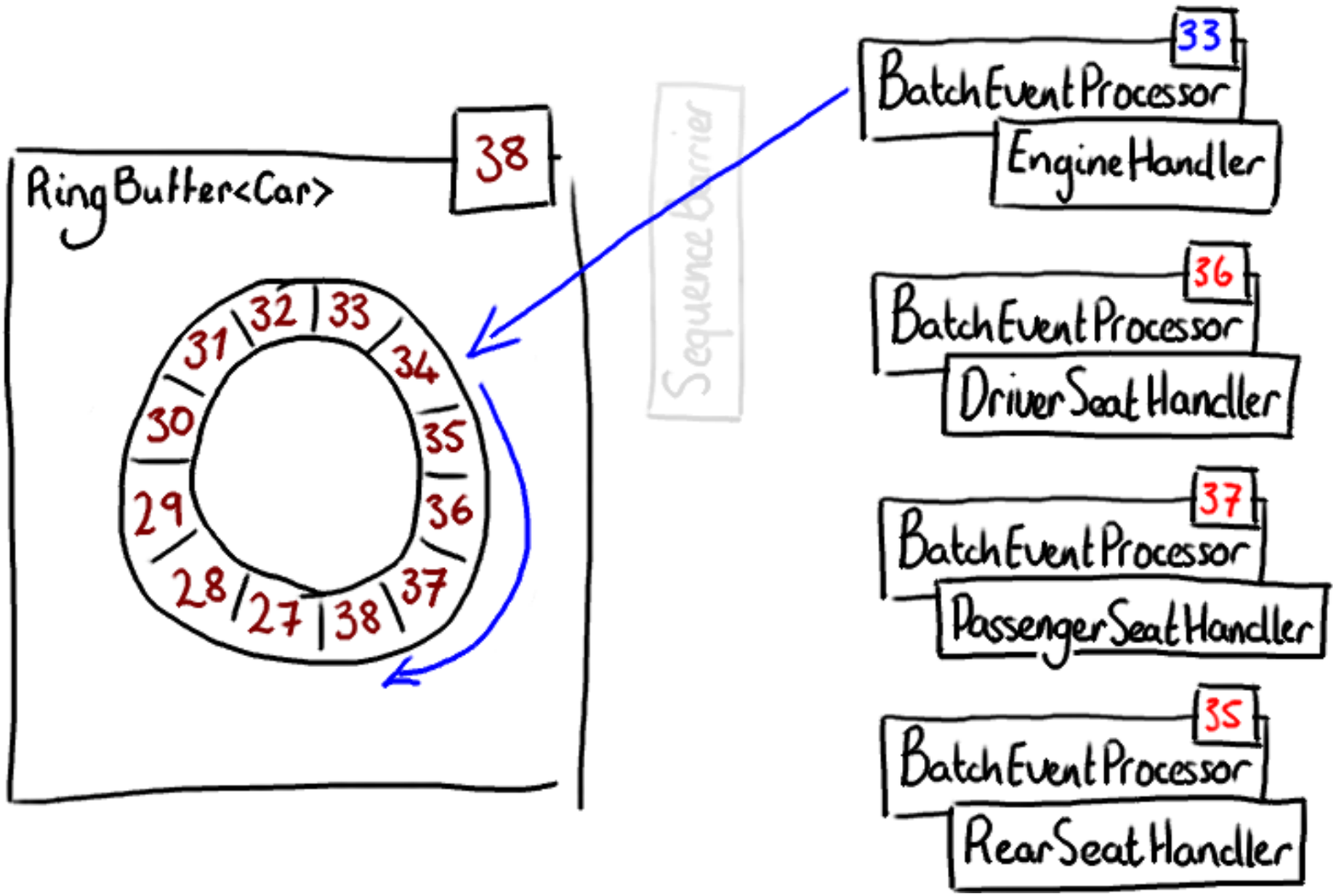
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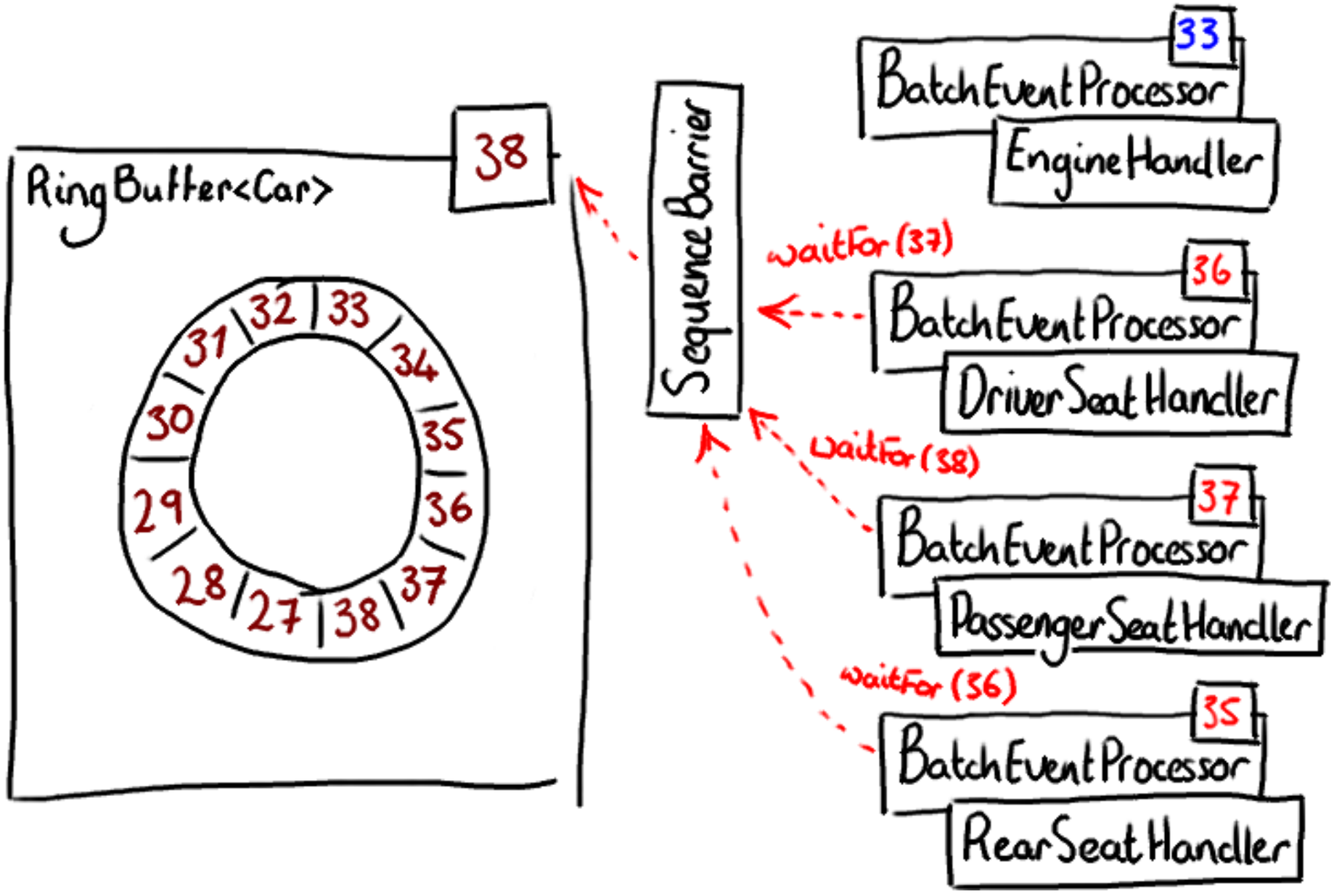
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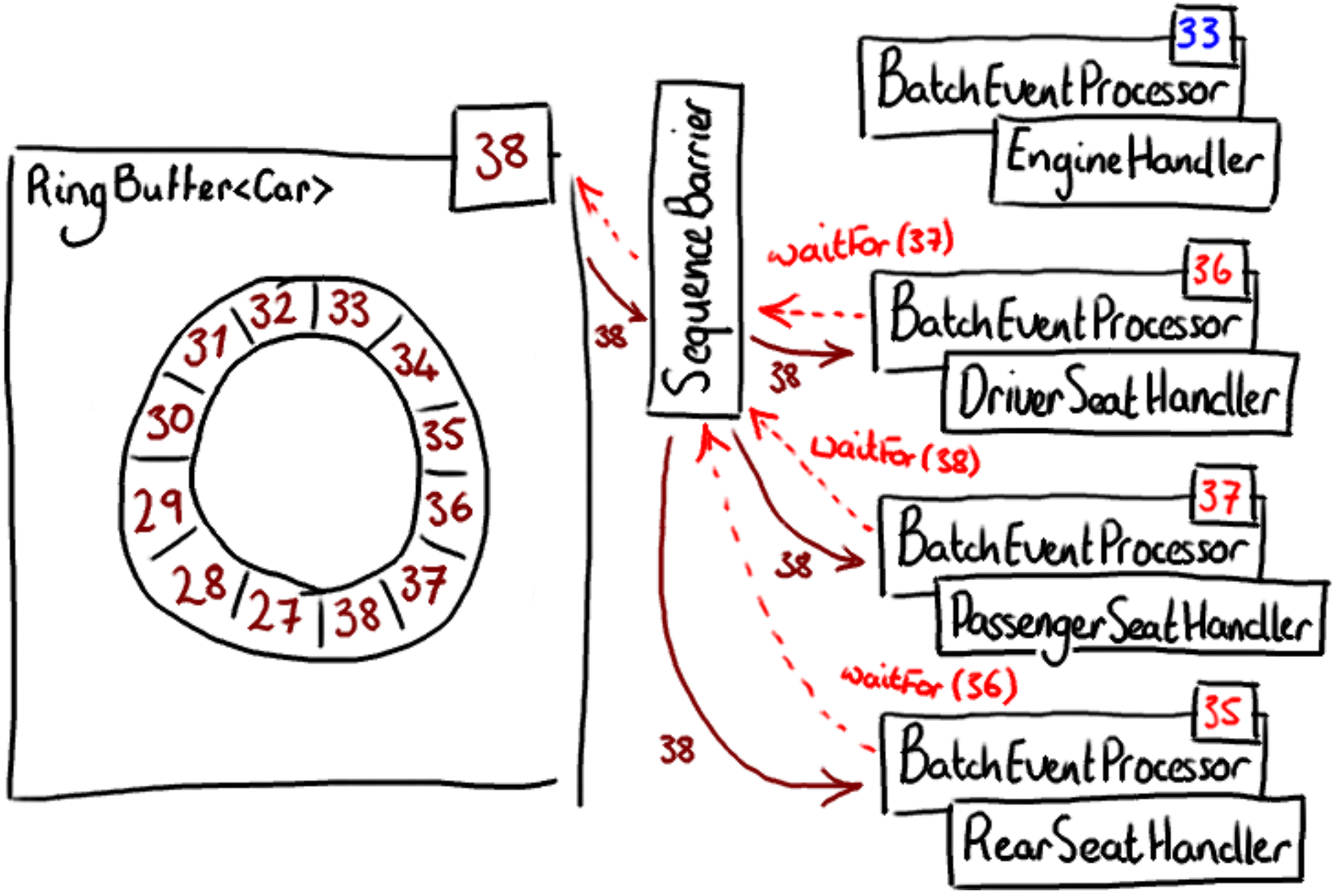
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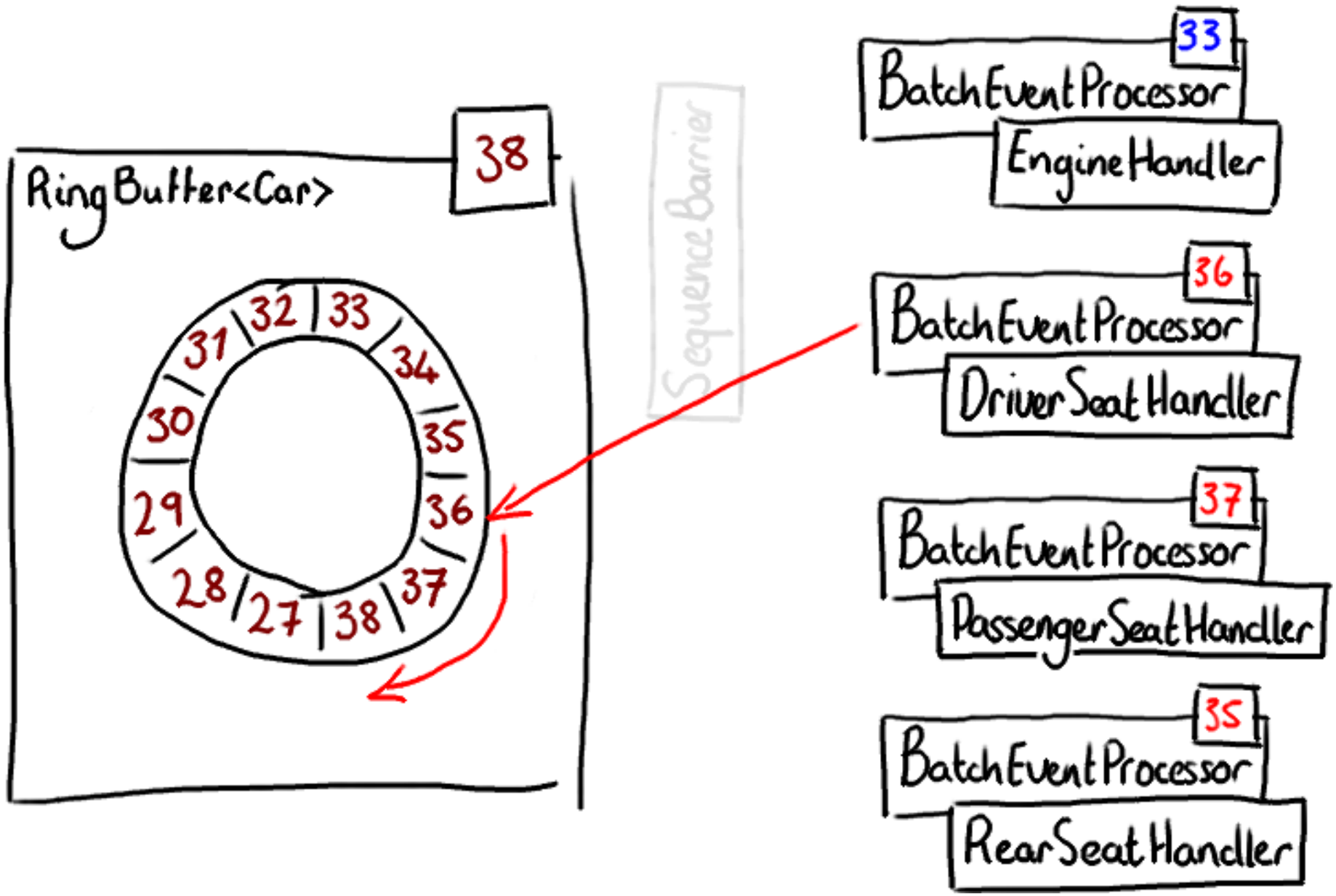
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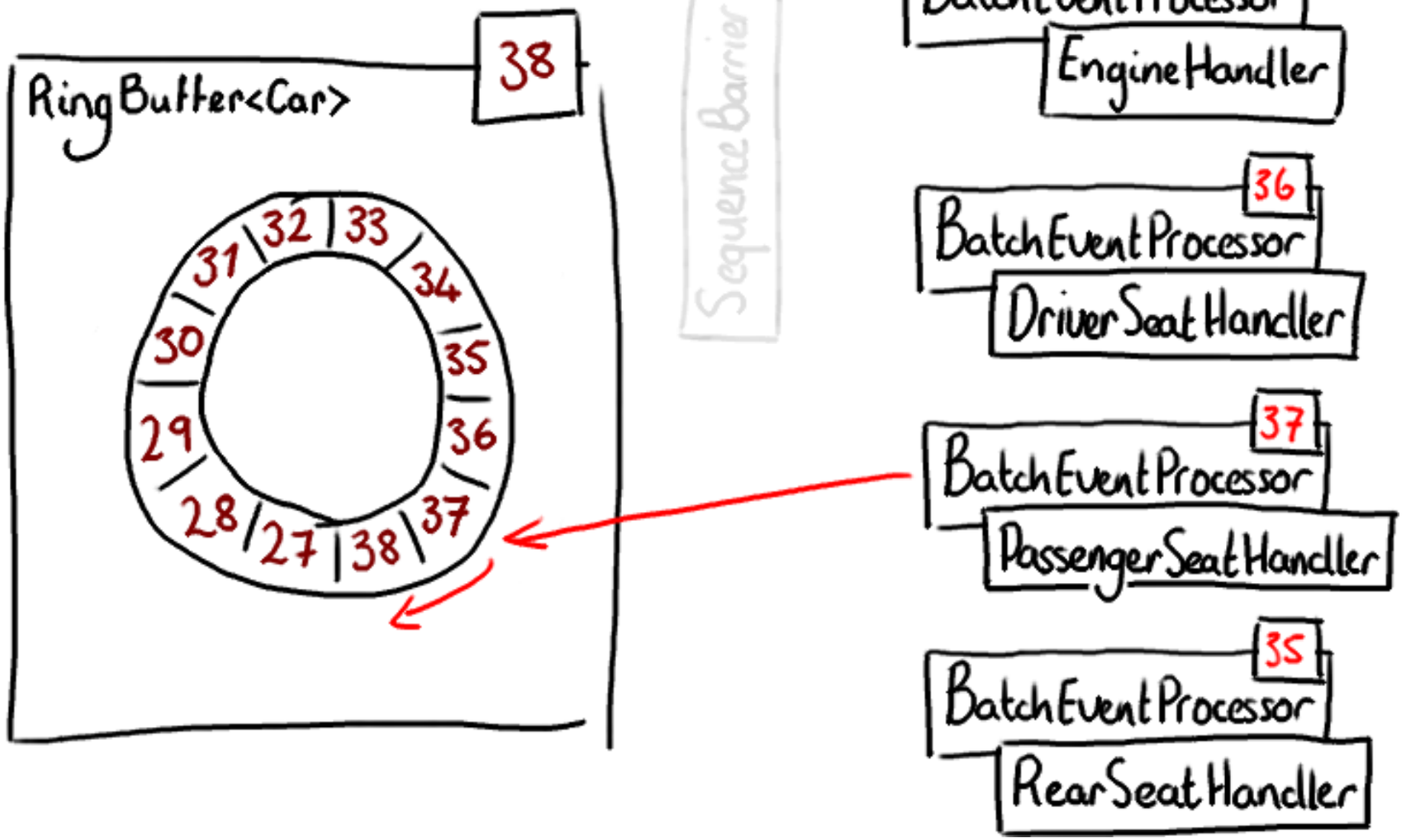
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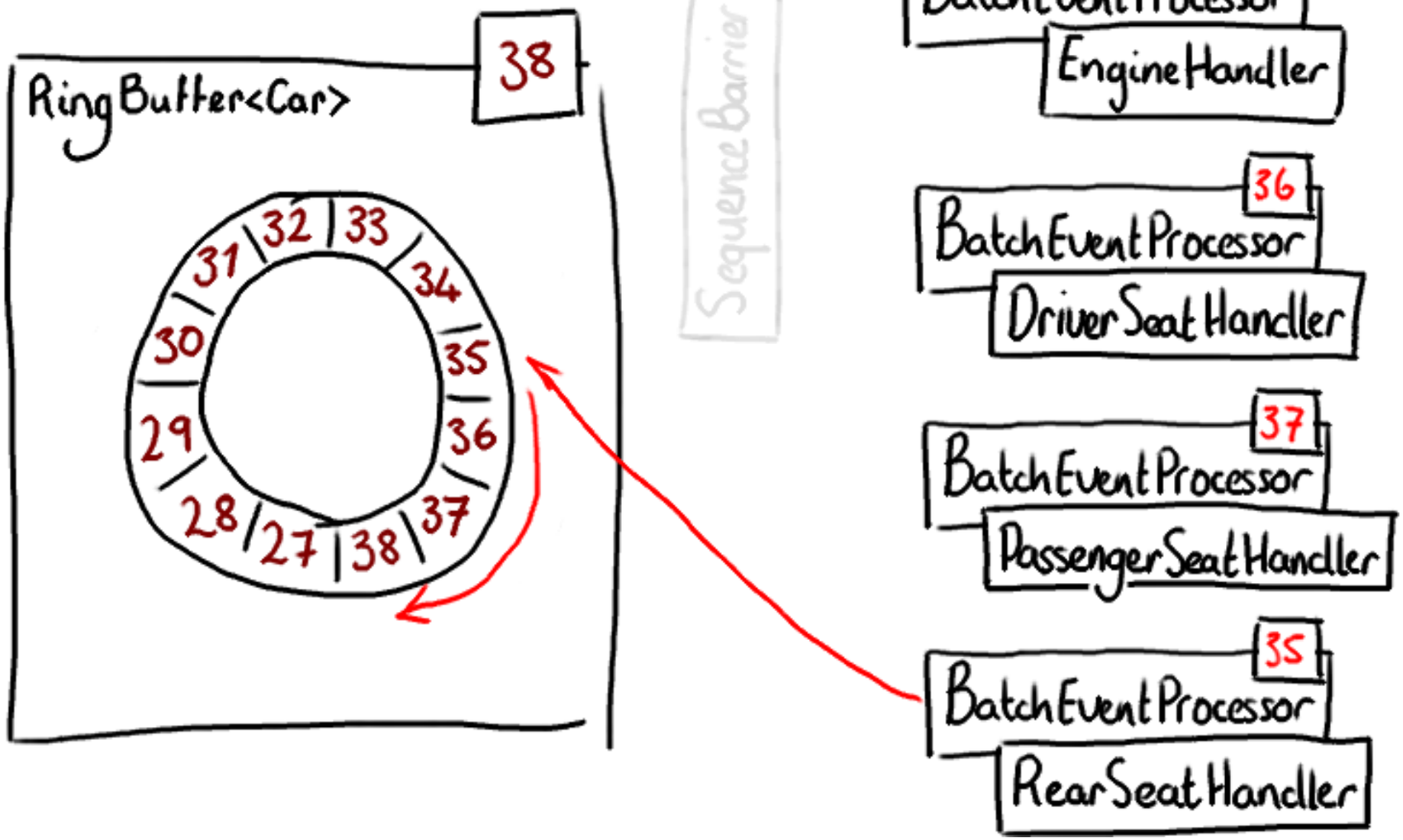
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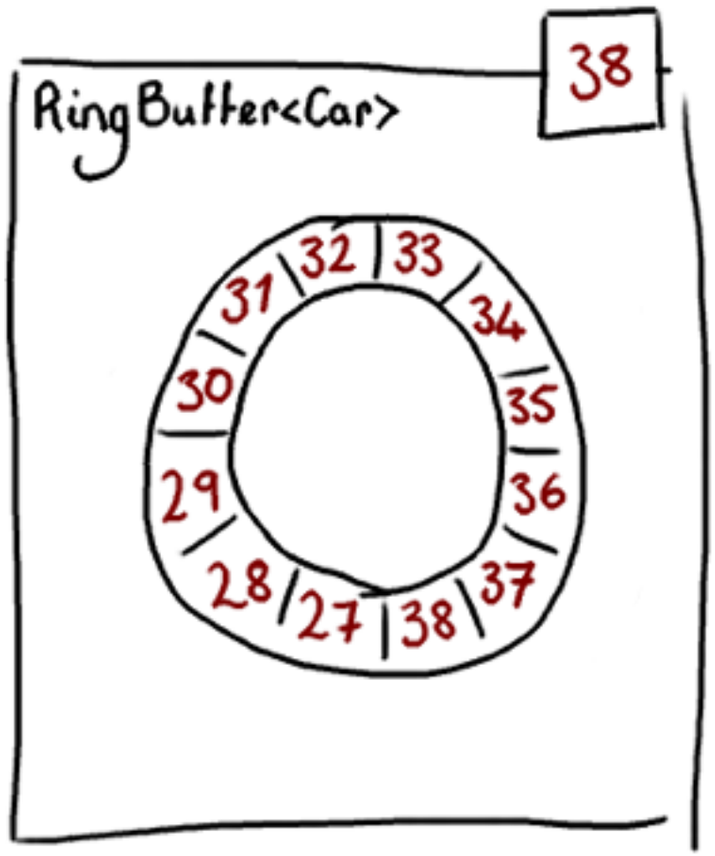

Sequence Barrier

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RearSeatHandler

Sequence Barrier

Sequence Barrier

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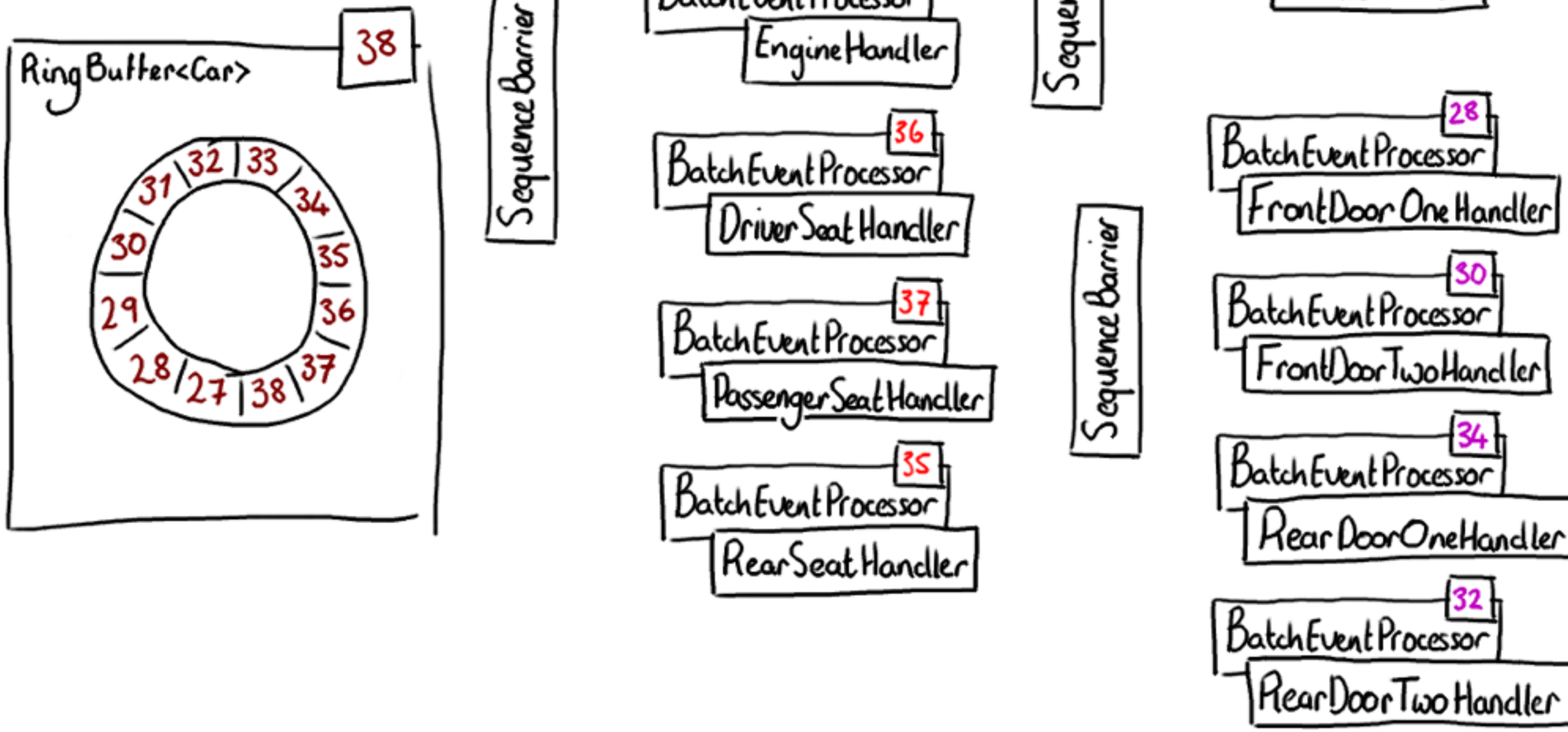
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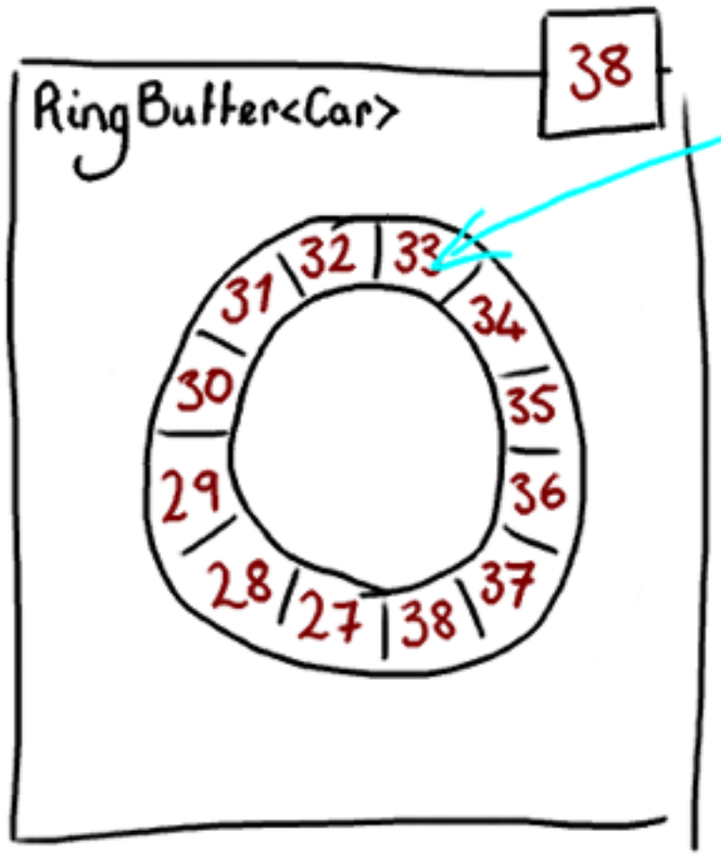
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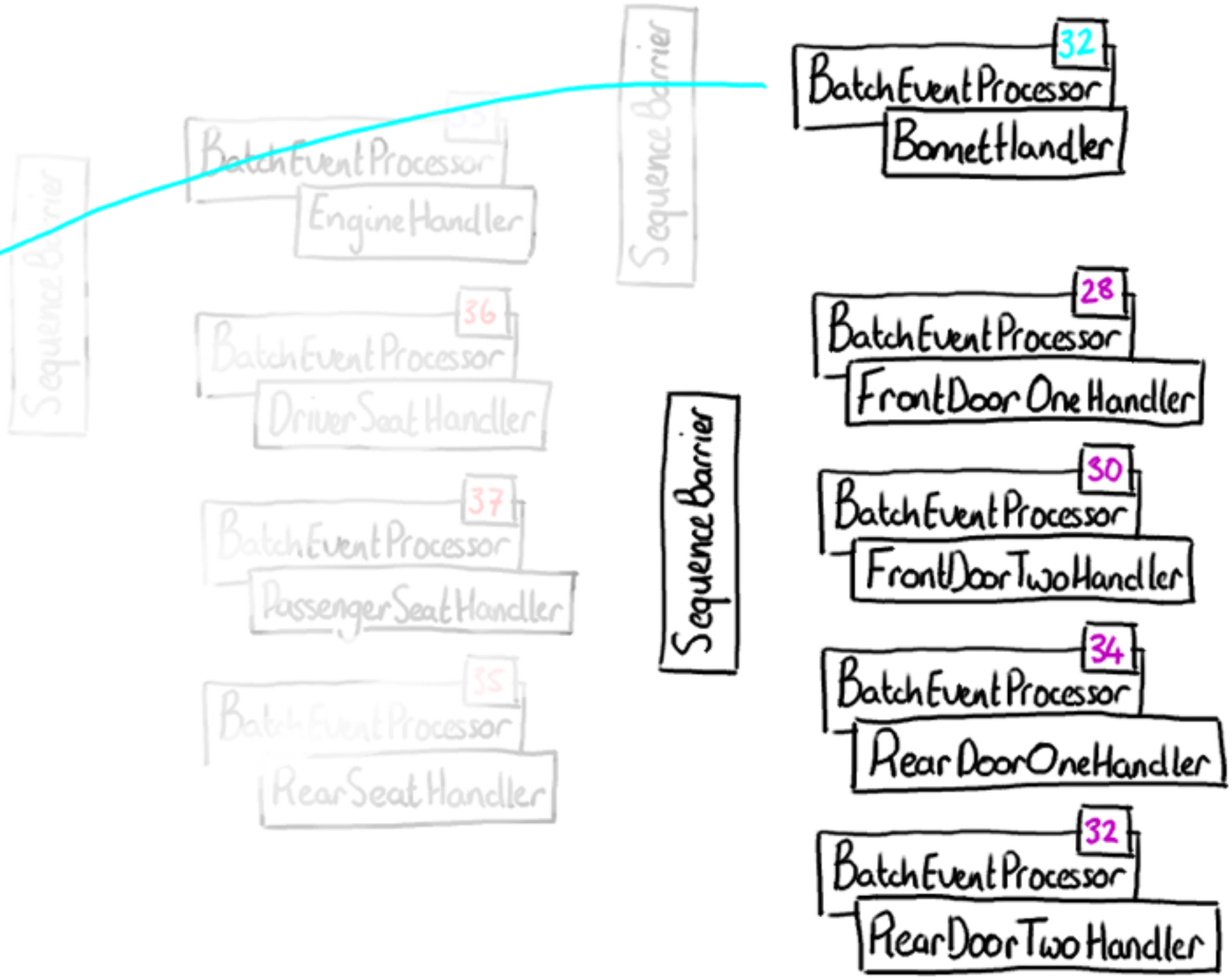
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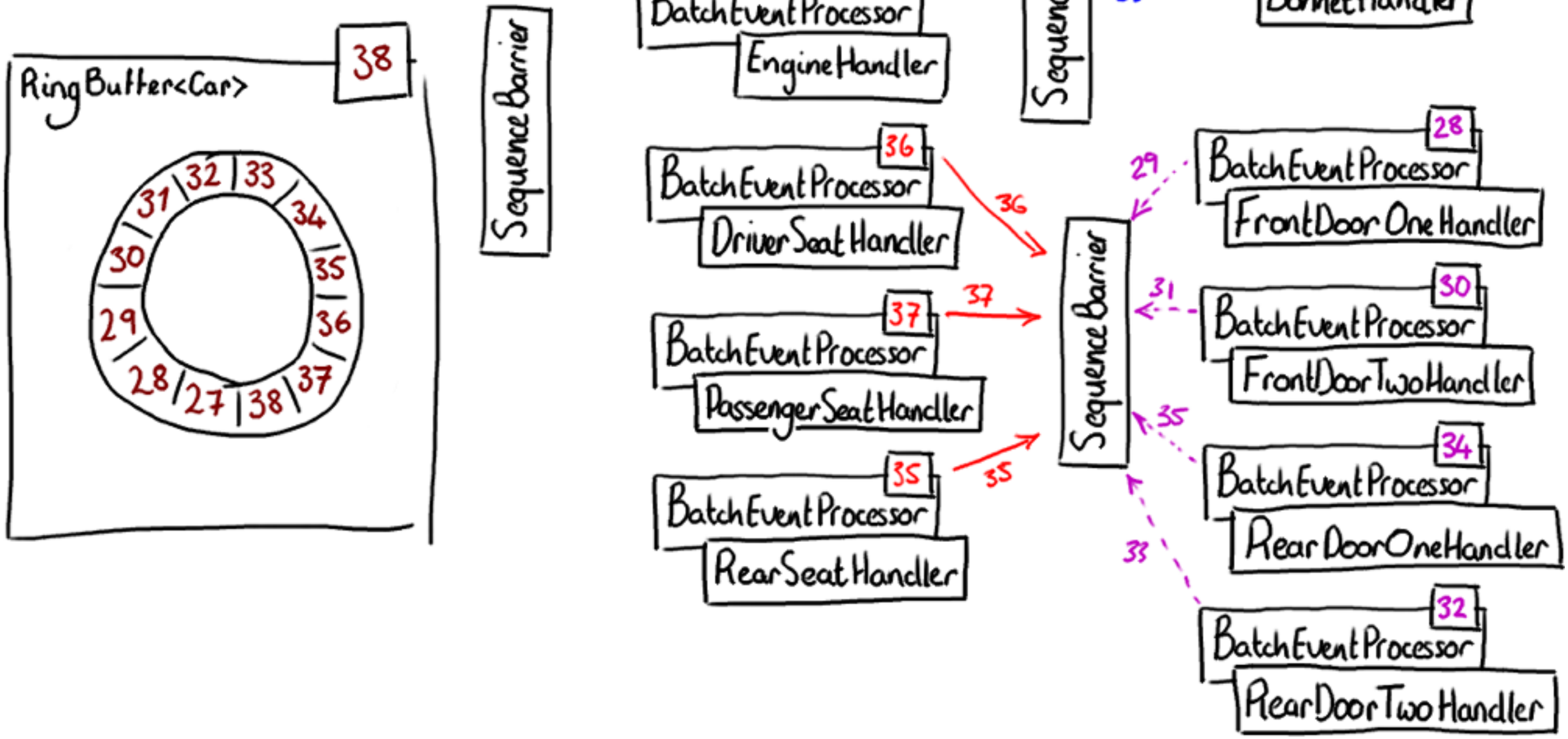
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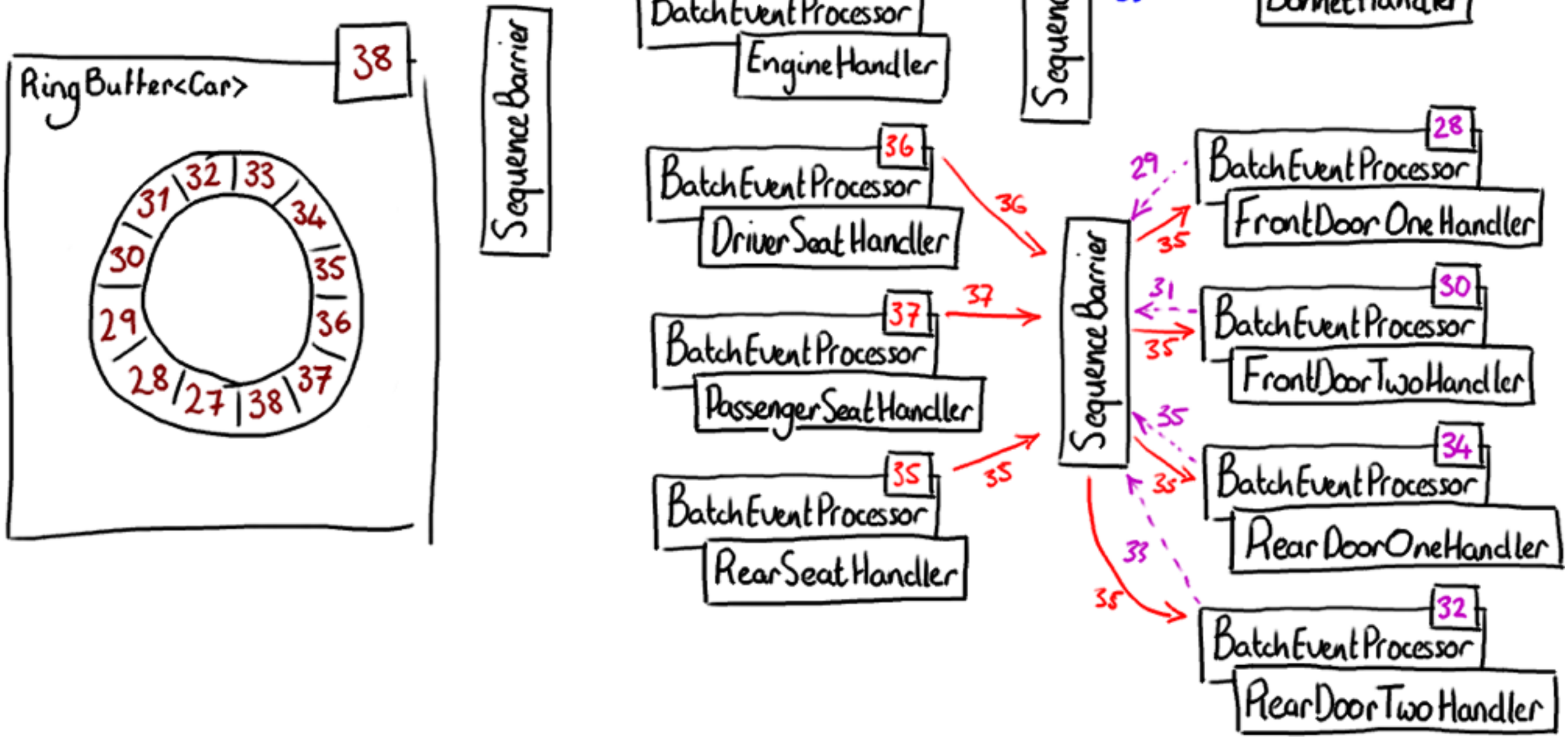
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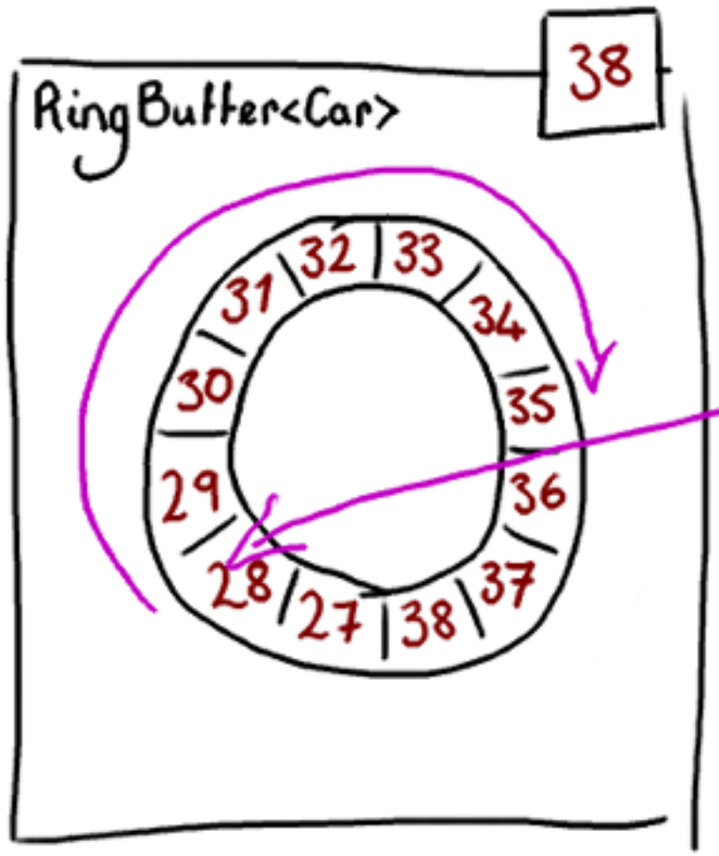
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BatchEventProcessor
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SequenceBarrier


SequenceBarrier

SequenceBarrier


32
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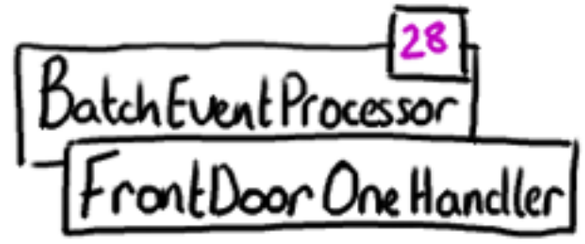
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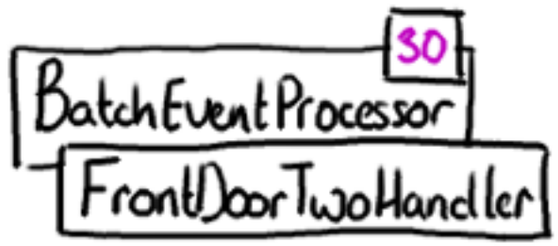
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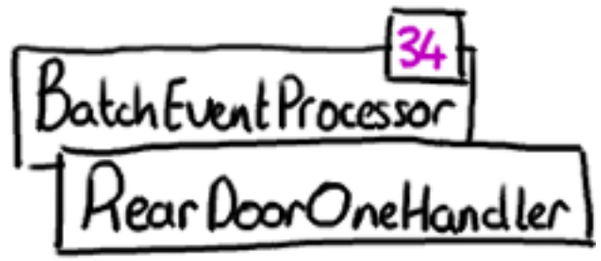
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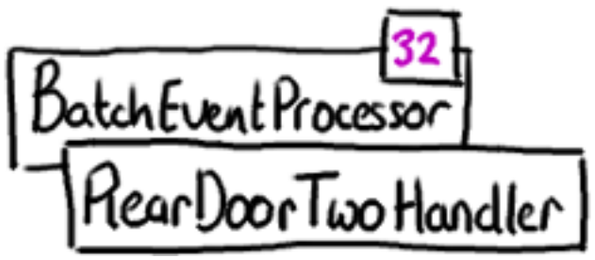
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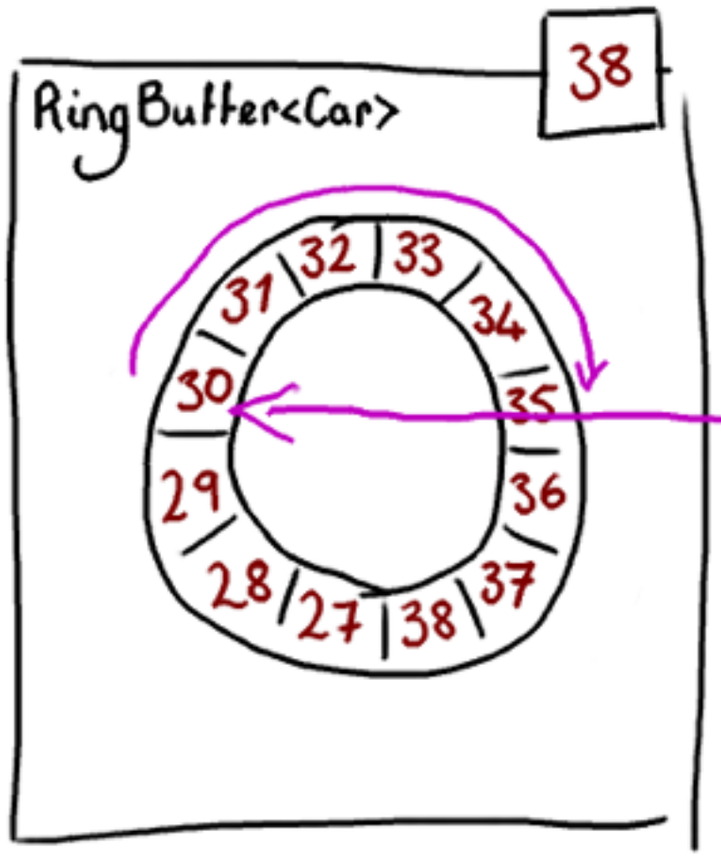
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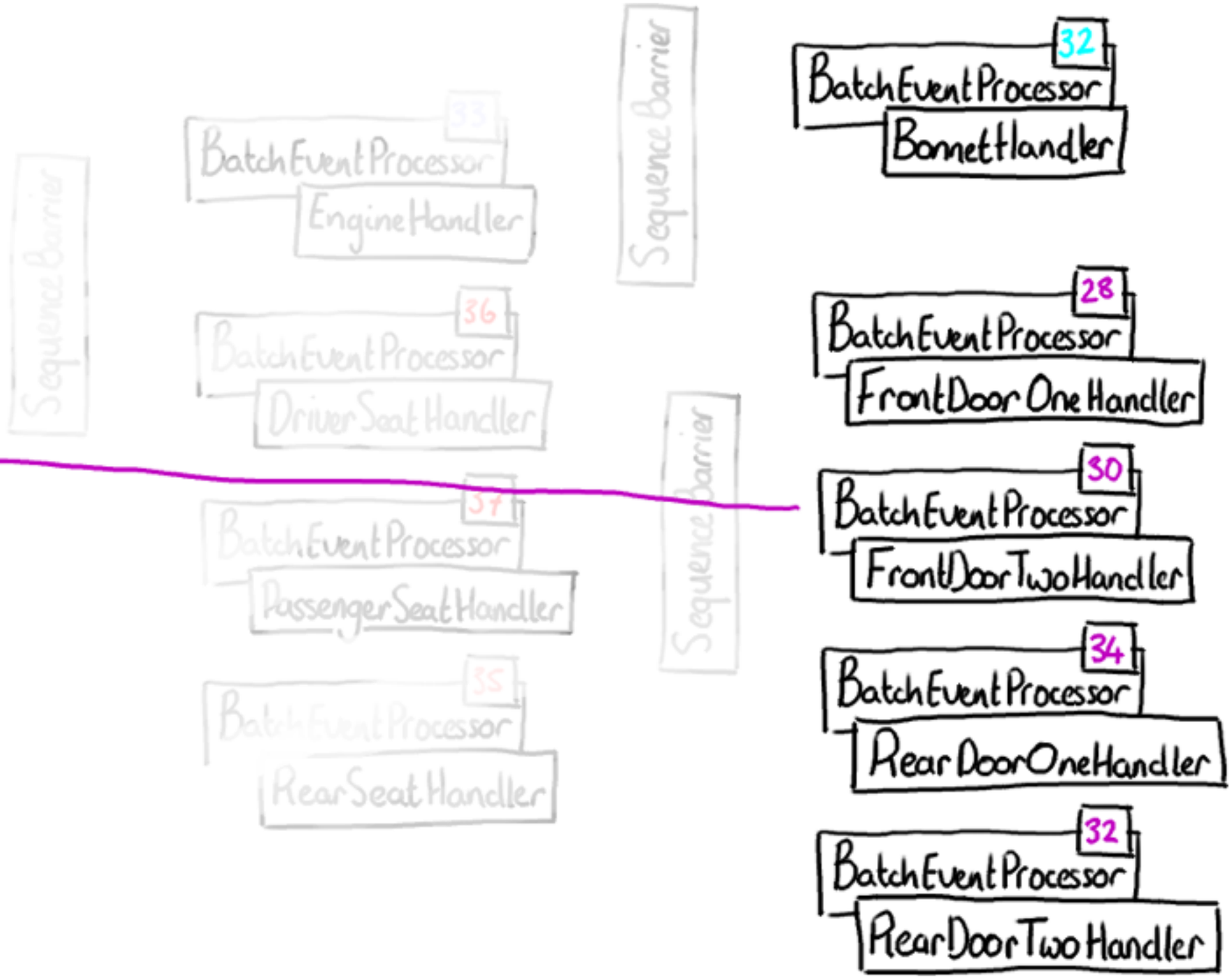
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RearDoorTwoHandler


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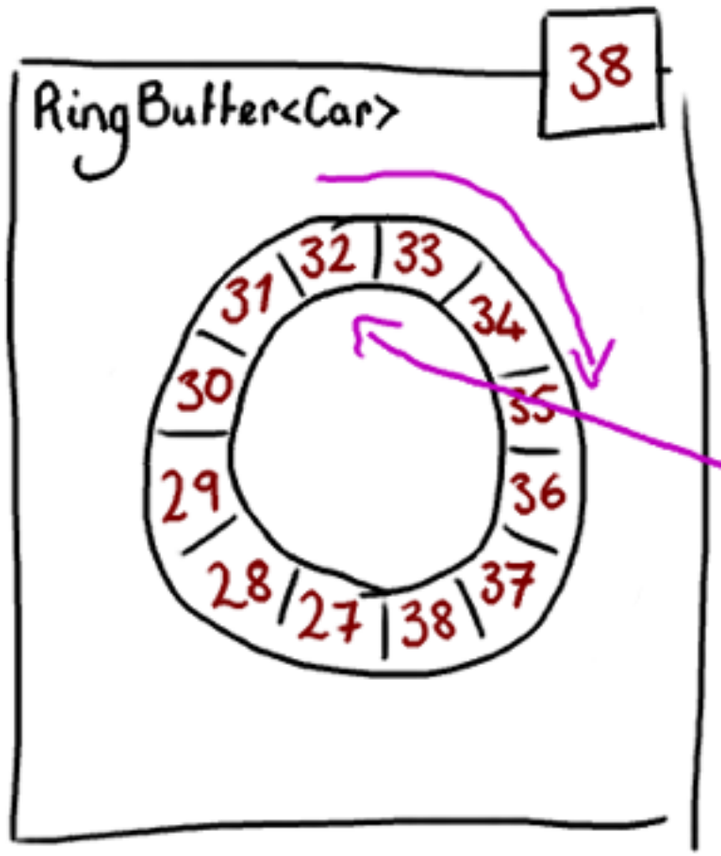
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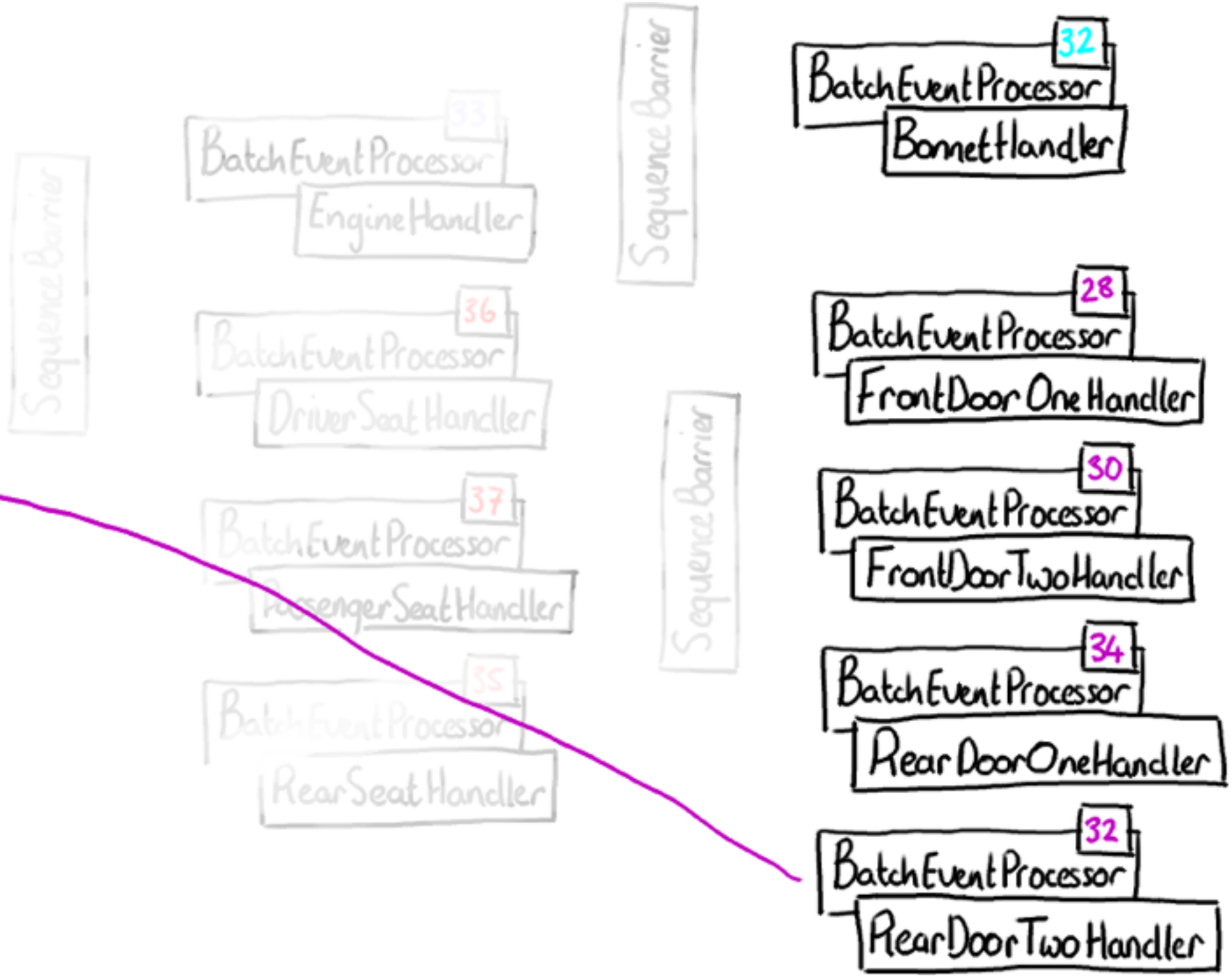
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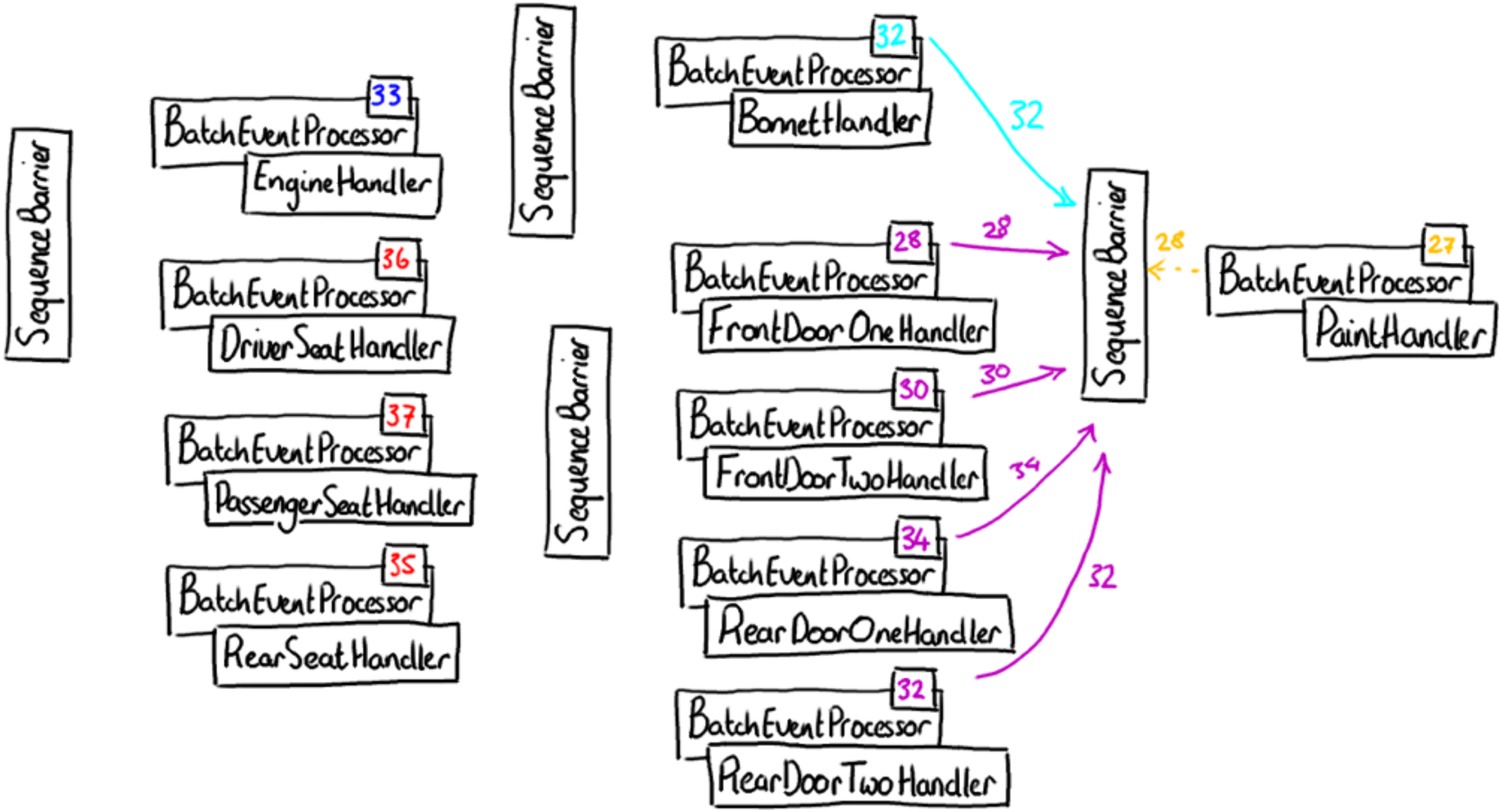
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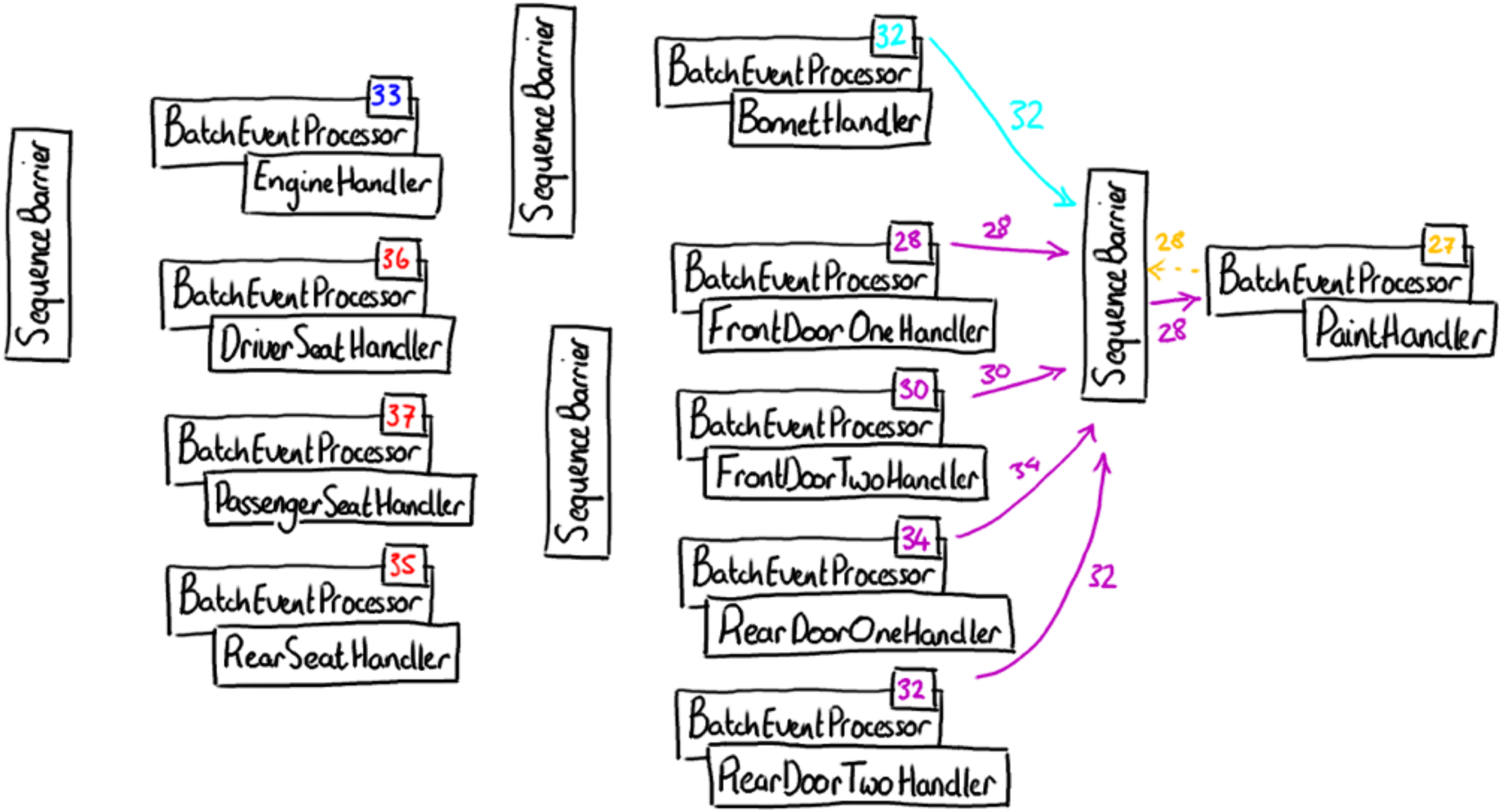
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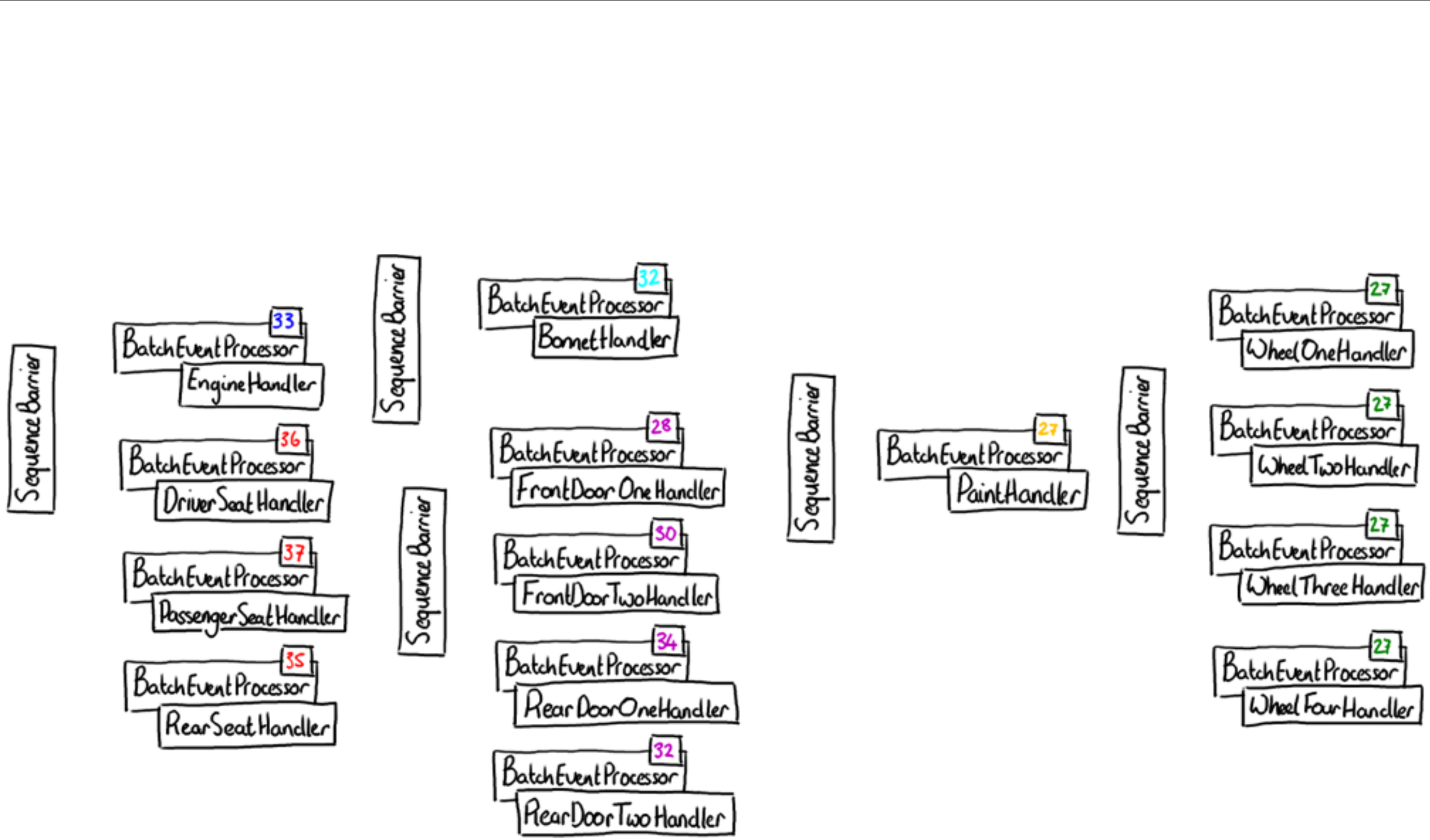
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Sequence Barrier
BatchEventProcessor
PaintHandler
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Sequence Barrier
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WheelThreeHandler
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WheelFourHandler
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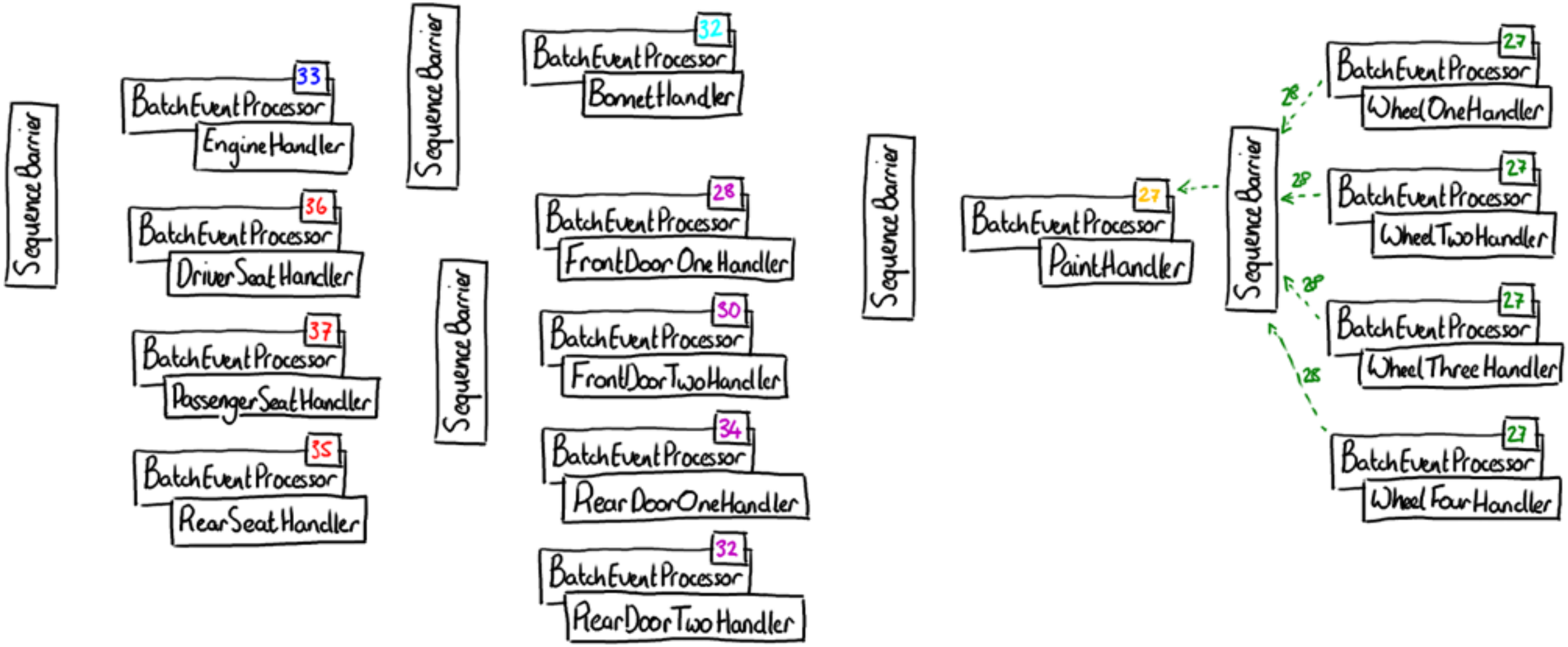
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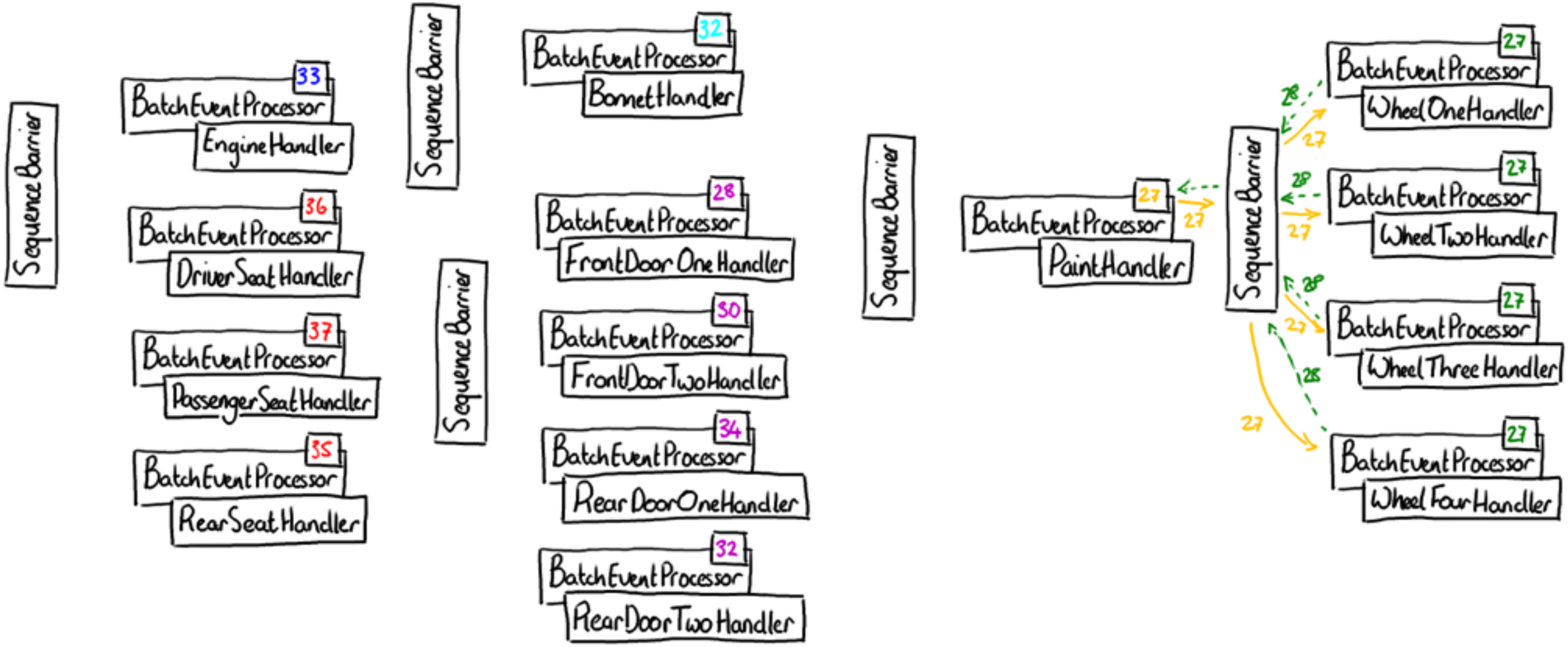
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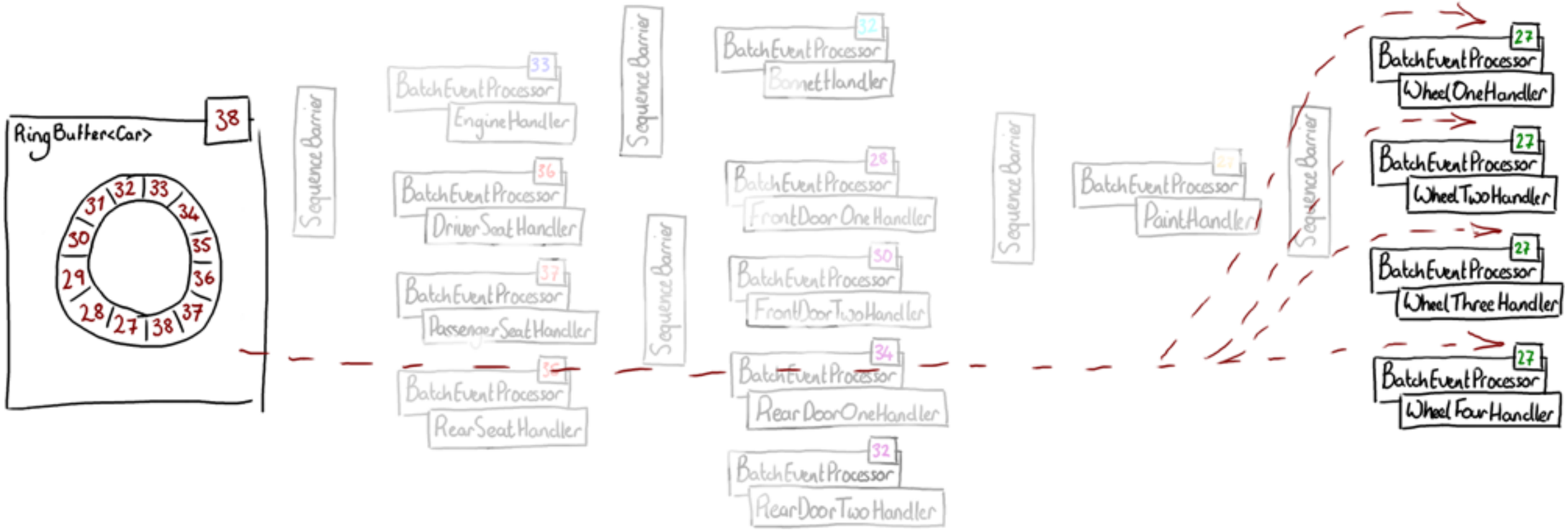
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BatchEventProcessor
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PaintHandler
Sequence Barrier
BatchEventProcessor
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WheelOneHandler
BatchEventProcessor
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WheelTwoHandler
BatchEventProcessor
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WheelThreeHandler
BatchEventProcessor
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WheelFourHandler

Don’t wrap the buffer!

```
ringBuffer.setGatingSequences(finalEventProcessor.getSequence());
```

Caveats

- Can't run this car example at high speed with only 2 cores
- Your ring buffer needs to be bigger than 12
- Event handlers need to be on separate threads

Is that it?

- Wait strategies
- Batch publishing
- Multiple publishers
- Different EventHandlers
- The Wizard
- You don’t even need a RingBuffer...

You get...

- A framework the encourages you to model your domain
- The ability to run in parallel but single-threaded
- Nice, simple Java
- Reliable ordering
- ...and it can be very fast

...and we got...

- Better design
- Great PR
- An improved product

More Information

- Google Code Site, including Wiki
  http://code.google.com/p/disruptor/
- Blogs, e.g. mine: mechanitis.blogspot.com
- Presentations
- Google Group

Q&A