

One year of Akka 2.6

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I am Sean Glover



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Some major features since Akka 2.6

Akka

- Akka Typed APIs marked stable
- Akka Persistence & Sharding APIs
- Artery default remoting layer
- Serialization with Jackson
- Separation of internals and default user dispatchers
- Drop need to provide Materializer to streams
- External shard allocation strategy
- Reliable delivery
- Sharded daemon process
- Distributed publish subscribe
- New persistence testkit
- Open sourced split brain resolver
- Replicated event sourcing AKA Multi-DC persistence
- Faster cluster sharding rebalance algorithms

Akka Projects

- Alpakka Kafka 2.0
- Akka Persistence Cassandra 1.0
- Akka Persistence JDBC 4.0
- Akka Http 10.2.0 using Akka 2.6
- Akka gRPC 1.0 (built on top of Akka-http)
- Akka Projections 1.0
- Akka Platform Guide



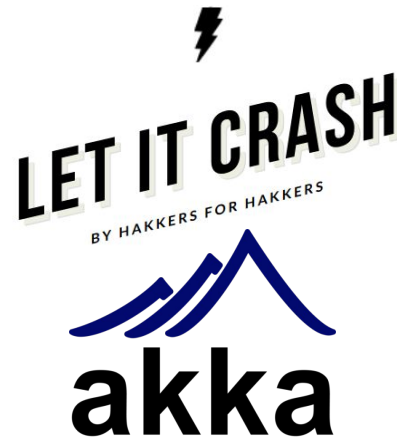
TM & © WBEI (s18)

We'll only talk about these today 😊

Akka Actors [Typed]

Akka Actors Typed

- The Typed Actors API was introduced with Akka 2.4.0 in 2015
- Chiefly the creation of Dr. Roland Kuhn
- Since the release of Akka 2.6.0 the “old” Actors API is known as Classic Akka
- The Typed Actors API became the default for docs, reference projects, and new features



Akka Actors Typed

Define a message protocol

```
sealed trait Command

final case class Withdraw(amount: Long, ack: ActorRef[Response]) extends Command
final case class Deposit(amount: Long, ack: ActorRef[Done]) extends Command
final case class GetBalance(replyTo: ActorRef[Long]) extends Command

sealed trait Response
case object Ack extends Response
case object InsufficientFunds extends Response
```

Akka Actors Typed

Implement an Actor Behavior

```
def openAccount(balance: Long = 0L): Behavior[Command] = {
  Behaviors.receiveMessage {
    case Deposit(amount, ack) =>
      ack ! Done
      openAccount(balance + amount)
    case GetBalance(replyTo) =>
      replyTo ! balance
      Behaviors.same
    case Withdraw(amount, ack) =>
      ...
  }
}
```

Akka Actors Typed

State transition: Open Account => Frozen Account!

Append message protocol

```
sealed trait Command
```

```
...
```

```
final case class FreezeAccount(replyTo: ActorRef[Done]) extends Command
```

```
sealed trait Response
```

```
...
```

```
case object AccountFrozen extends Response
```


Akka Actors Typed

State transition: Transition to a Frozen Account Behavior

```
def openAccount(balance: Long = 0L): Behavior[Command] = {  
  Behaviors.receiveMessage {  
    ...  
    case FreezeAccount(replyTo) =>  
      replyTo ! Done  
      frozenAccount(balance)  
  }  
}  
  
def frozenAccount(balance: Long = 0L): Behavior[Command] = ...
```

Akka Actors Typed

State transition: Implement a new Behavior for frozen state

```
def frozenAccount(balance: Long = 0L): Behavior[Command] = {
  Behaviors.receiveMessage {
    case GetBalance(replyTo) =>
      replyTo ! balance
      Behaviors.same
    case Deposit(_, ack) =>
      ack ! AccountFrozen
      Behaviors.same
    case Withdraw(_, ack) =>
      ...
  }
}
```

Akka Persistence Typed

Akka Persistence & Event Sourcing

Expand message protocol to include

- Command
- Event
- State (optional)
- Reply (optional)

Ex)

```
final case class Deposit(amount: Long, replyTo: ActorRef[Reply]) extends Command
final case class Deposited(amount: Long) extends Event
final case class AccountState(balance: Long) extends State
case object Ack extends Reply
```

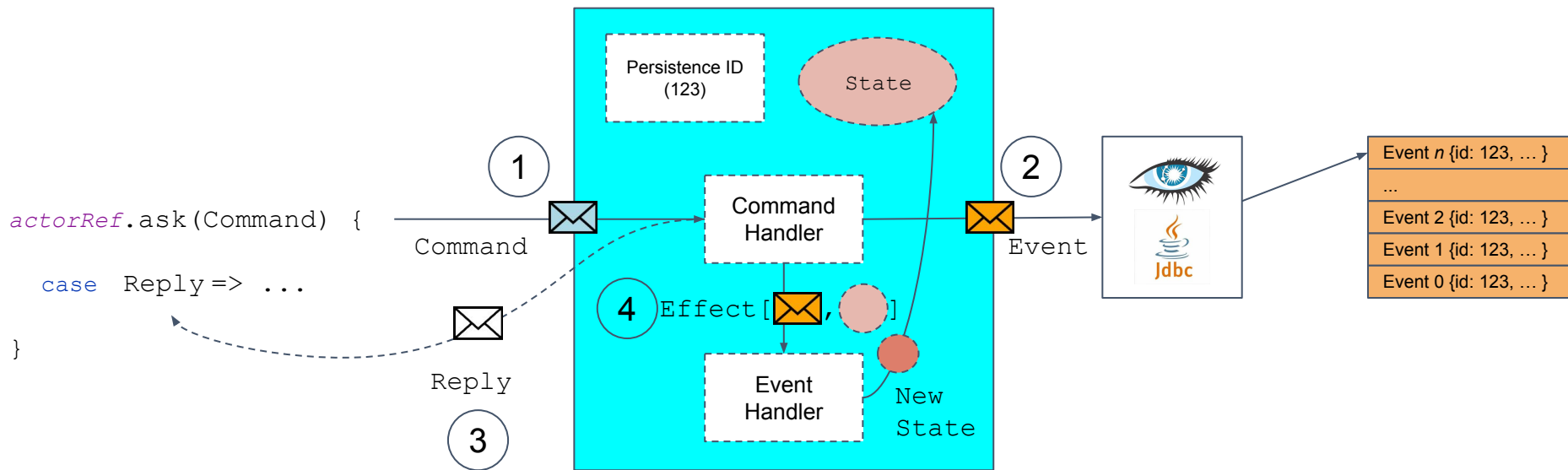
Akka Persistence & Event Sourcing

Caller

Event Sourced Actor

Akka Persistence Plugin

Event Journal



Akka Persistence & Event Sourcing

Usage

```
val actorRef = context.spawn[Command] (
  persistedAccount("123")
)

actorRef.ask(Deposit(10, context.self)) {
  case Reply => ...
}
```

Implementation

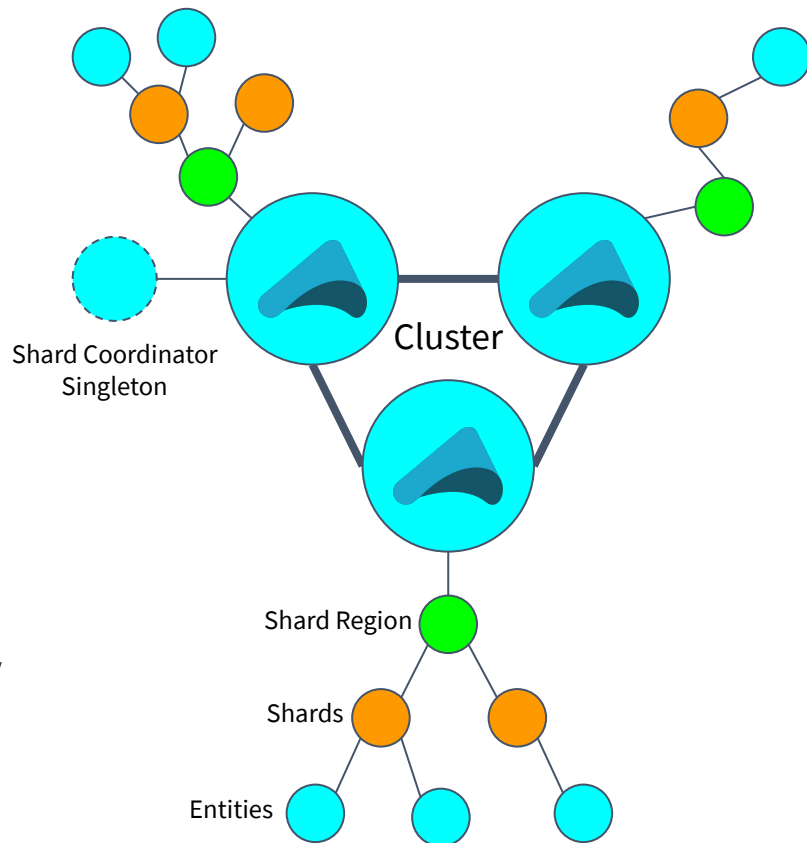
```
def persistedAccount(accountId: String): Behavior[Command] = {
  EventSourcedBehavior[Command, Event, AccountState] (
    persistenceId = PersistenceId.ofUniqueId(accountId),
    emptyState = AccountState(balance = 0L),
    commandHandler = (state, command) => command match {
      case Deposit(amount, ackTo) =>
        Effect.persist(Deposited(amount)).thenRun { _ =>
          ackTo ! Ack
        }
    },
    eventHandler = (state, event) => state.applyEvent(event)
  )
}
```

Akka Cluster Sharding Typed

Akka Cluster Sharding

Scale, Consistency, and Failover

- Balance resources (memory, disk, network) across multiple nodes for scalability
- Distribute entities and data across cluster
- Location transparency: Interact with entities by logical id instead of physical address
- Automatic relocation on failure or rebalance

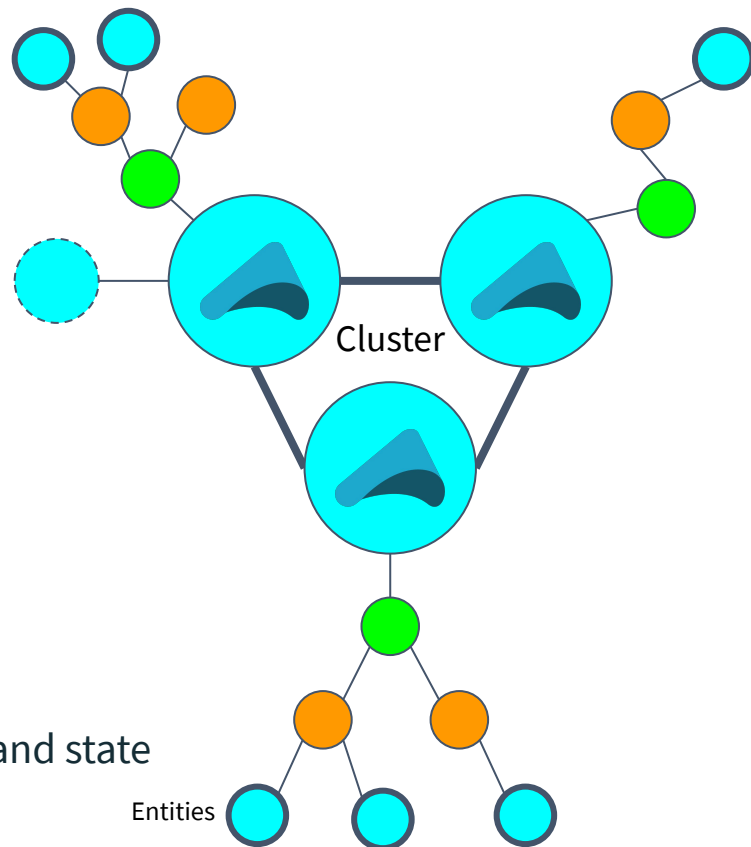


akka cluster flux capacitor 😂

Akka Cluster Sharding

Entities

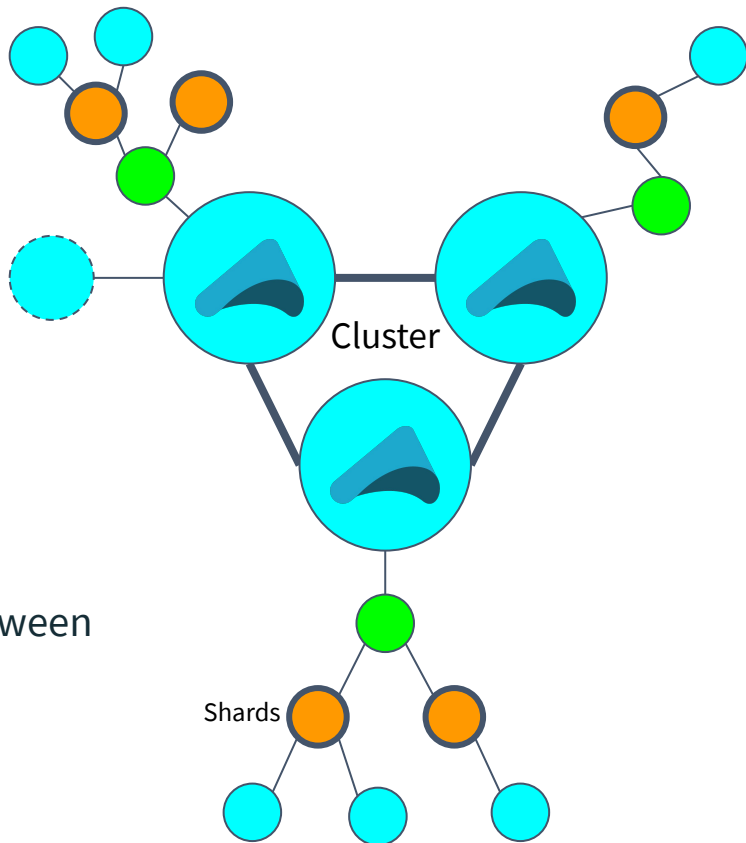
- Represented by an Actor
- Sharding identifies an entity by a unique id
- Only 1 instance of an entity is running
- Entities are a consistency boundary for messages and state



Akka Cluster Sharding

Shards

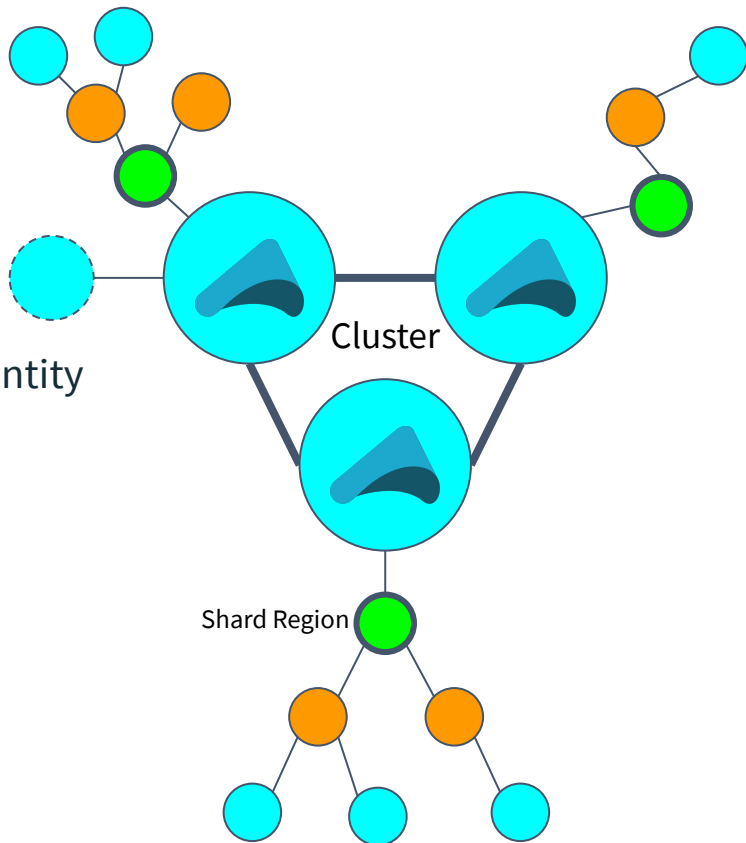
- Encapsulate a set of entities
- Create entities on demand
- Distribution of entities is represented as a map between shards and entities



Akka Cluster Sharding

Shard regions

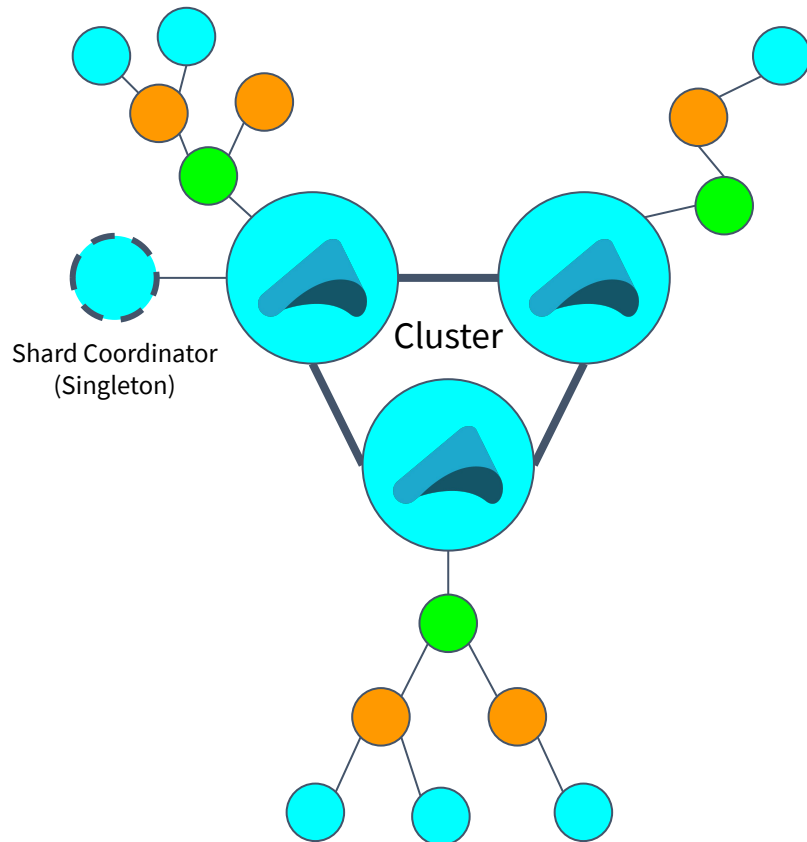
- Forwards messages to the appropriate shard and entity
- May be represented as a local or proxy
 - Local manages entities on the same JVM
 - Proxies forward messages to other regions



Akka Cluster Sharding

Shard coordinator

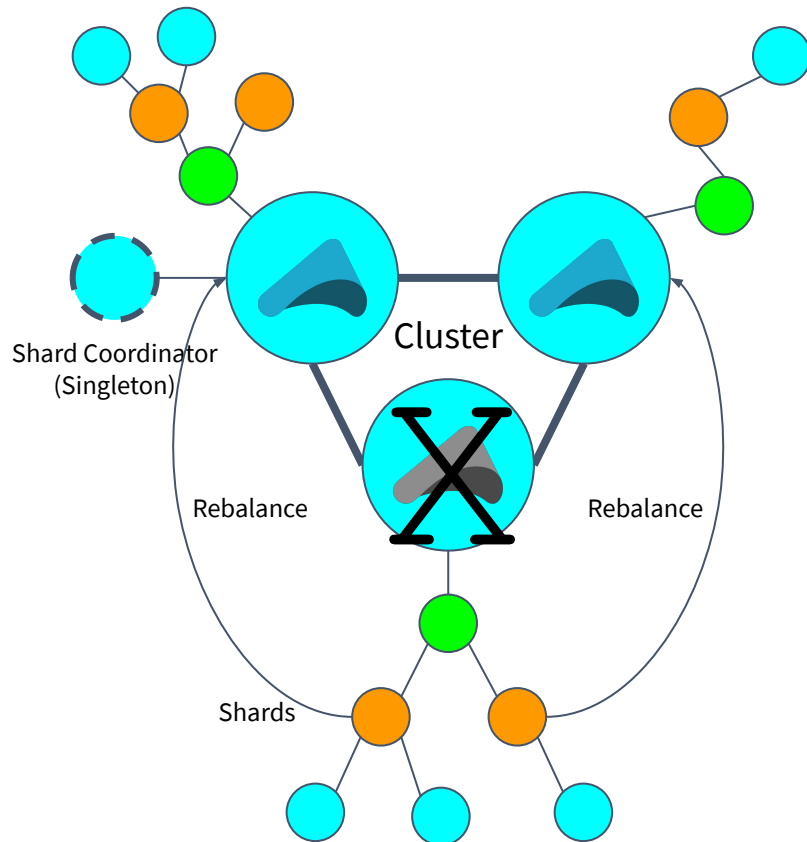
- Brains of cluster sharding
- Executes shard allocation strategy to control distribution of shards across cluster nodes
- Runs as a Cluster Singleton
- Retains state of shard locations



Akka Cluster Sharding

Shard Rebalancing

- Shard coordinator rebalances shards when a cluster node goes down



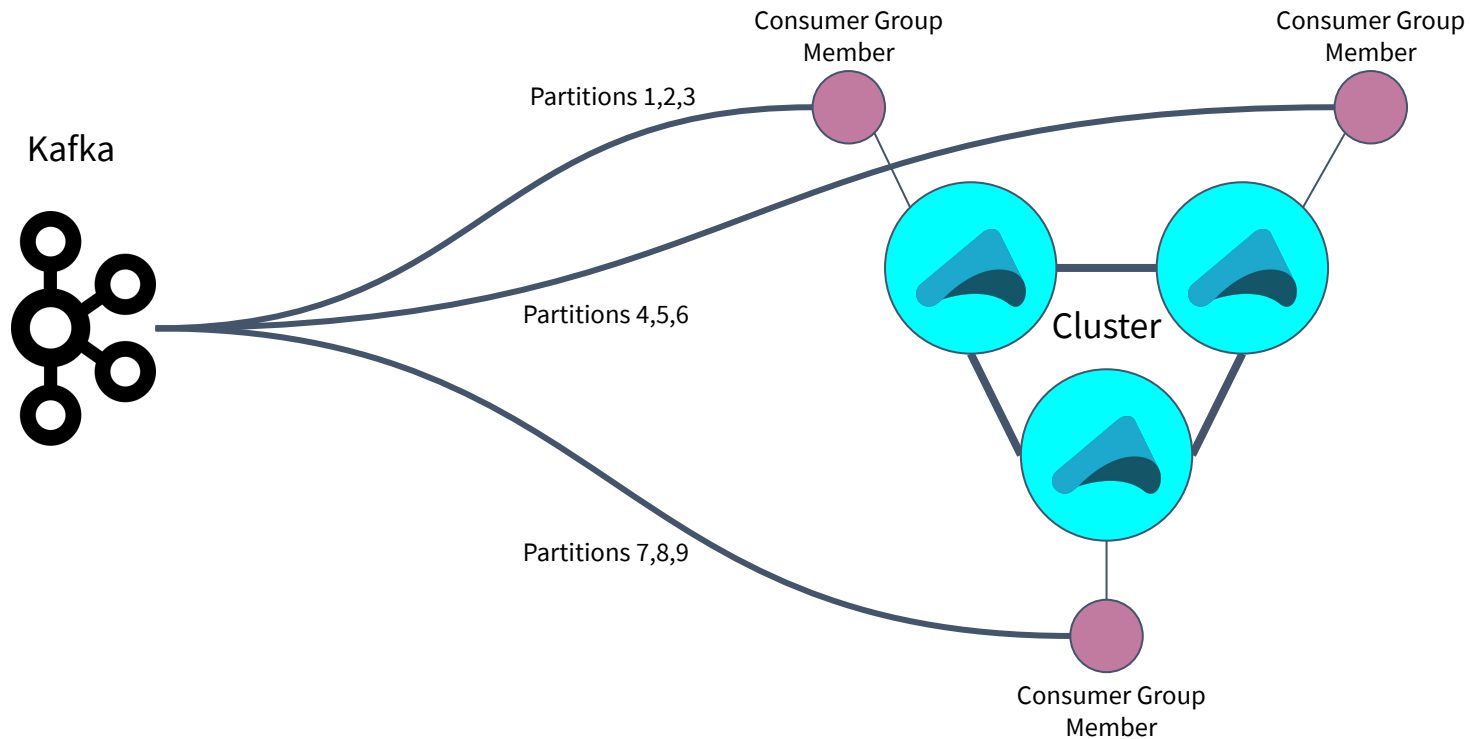
External Shard Allocation Strategies

External Shard Allocation Strategy

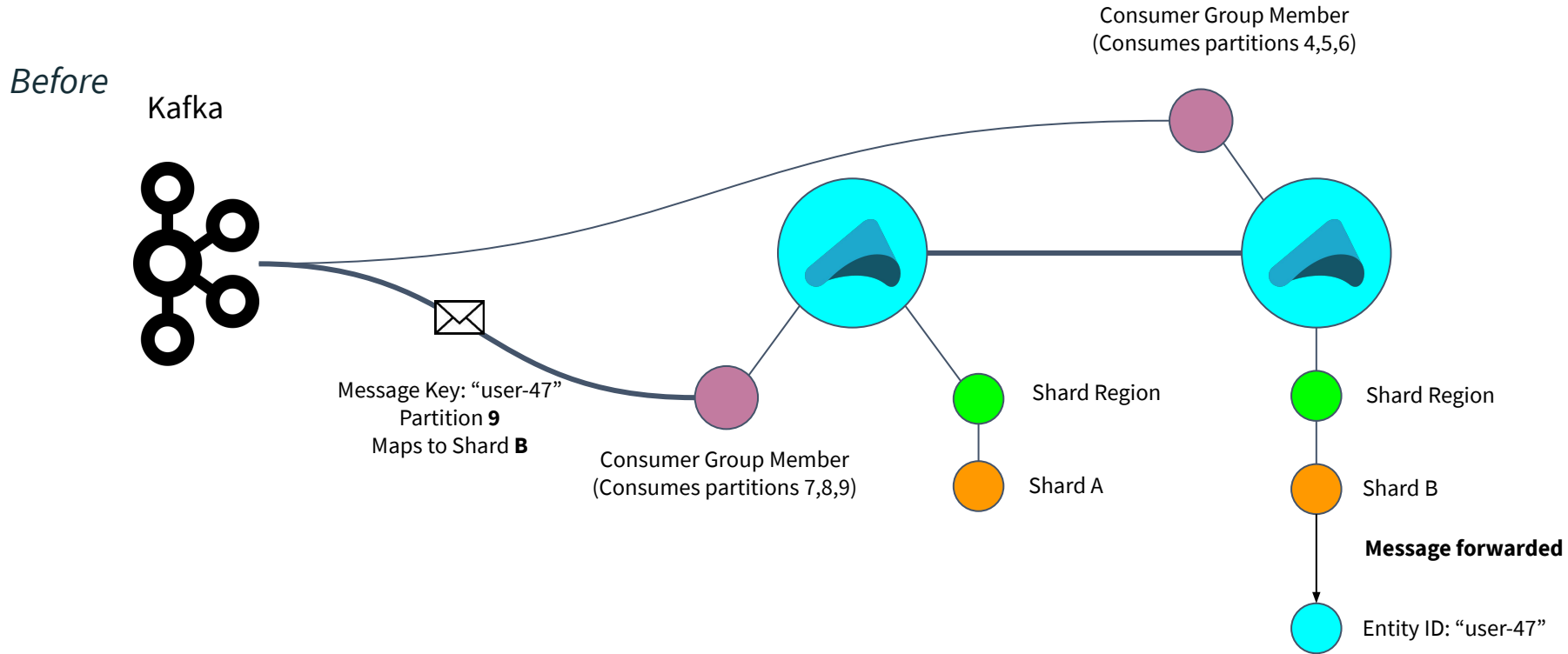
Control shard to Akka cluster node map

- Provides a way to “follow” the partition/sharding strategy of another distributed system
- Canonical example: Kafka Consumer group partitions to Akka cluster shards
- Reduces inter-cluster message traffic by eliminating unnecessary network hops

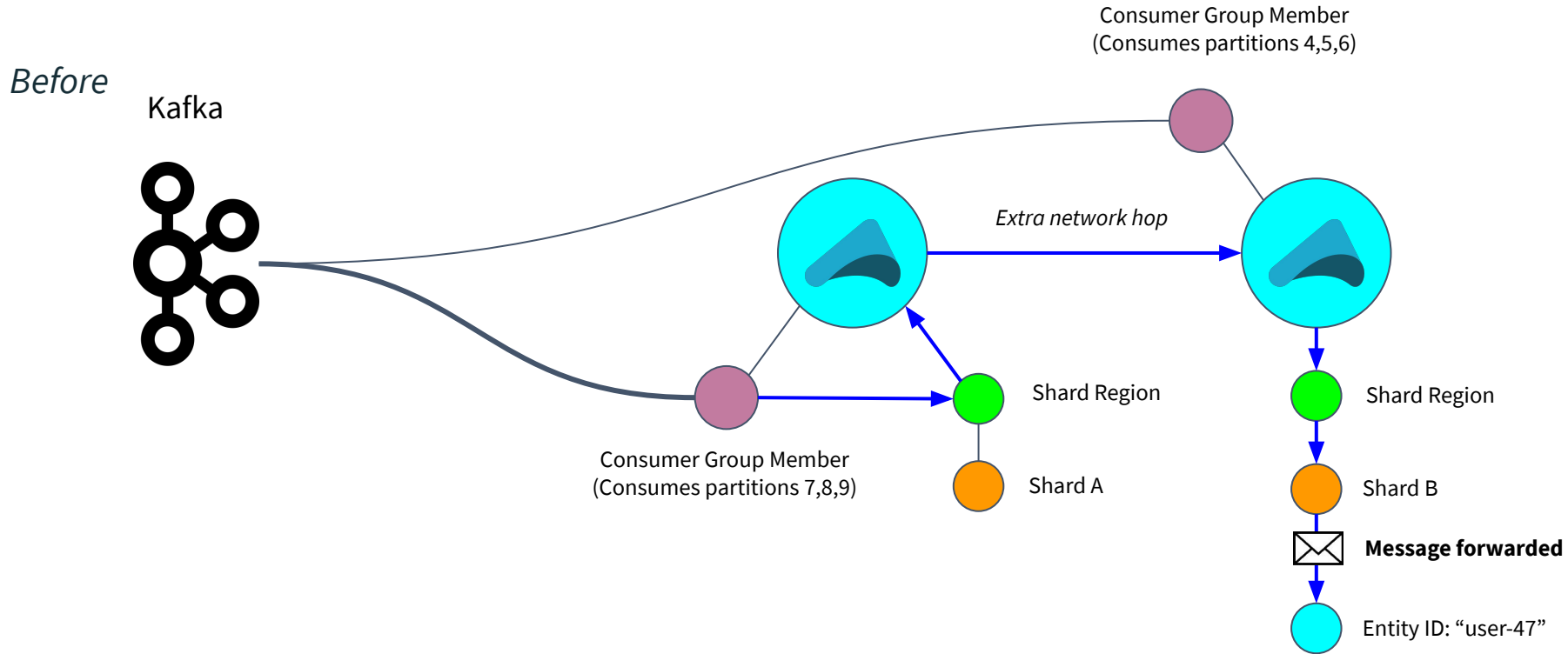
External Shard Allocation Strategy



External Shard Allocation Strategy



External Shard Allocation Strategy



External Shard Allocation Strategy



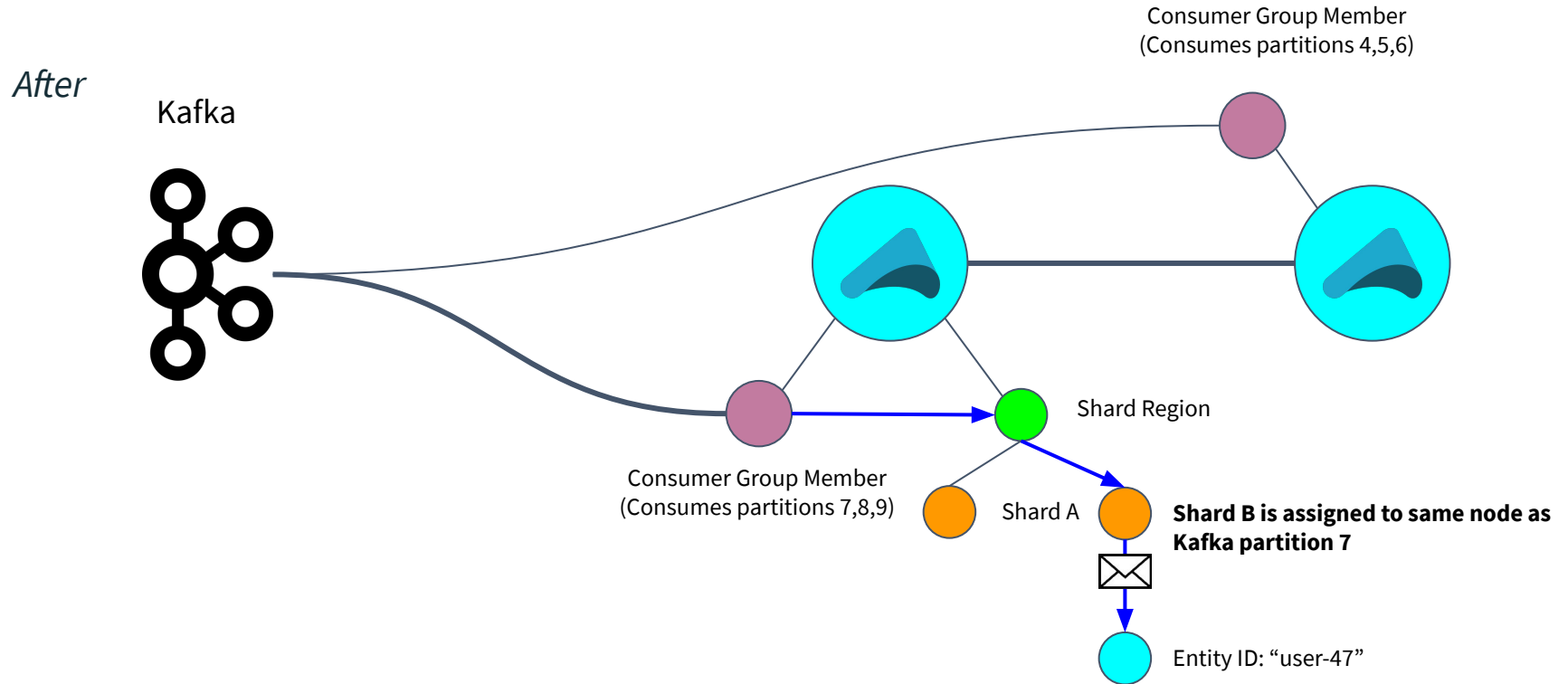
Kafka Partition to Akka Shard Map

Congruency between Kafka partitioning and Akka sharding models

- Alpakka Kafka Cluster Sharding module
- Akka shards and Kafka partitions on same node
- Same sharding & partitioning function with the same number of shards & partitions
- Kafka rebalances trigger Akka shard rebalances
- Sharded Actors (entities) belonging to rebalanced shards are shut down and relocated

Kafka Partition	Consumer Group Member	Akka Shard	Akka Cluster Node
1	192.168.0.1	"shard-1"	192.168.0.1
2	192.168.0.1	"shard-2"	192.168.0.1
3	192.168.0.1	"shard-3"	192.168.0.1
4	192.168.0.2	"shard-4"	192.168.0.2
5	192.168.0.2	"shard-5"	192.168.0.2
6	192.168.0.2	"shard-6"	192.168.0.2

External Shard Allocation Strategy



Akka Projections

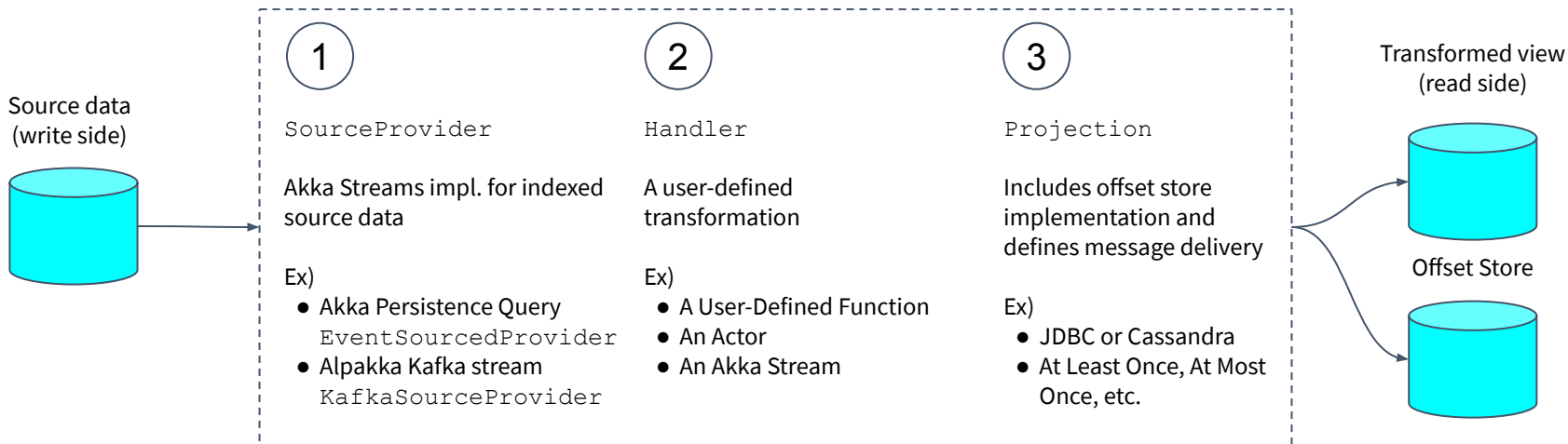
Akka Projections

Akka Projections is a library to generate a read side view

- Consume events from an Akka Stream Source, transform, and write the results to the read side view (i.e. the read-side model in CQRS, a Kafka topic, a Database table, an Actor, etc.)
- Track the offset in an Offset Store
- Manage its lifecycle, restart in the case of failures
- Distribute the consumption in an Akka Cluster



Akka Projections

A Projection is defined with 3 components



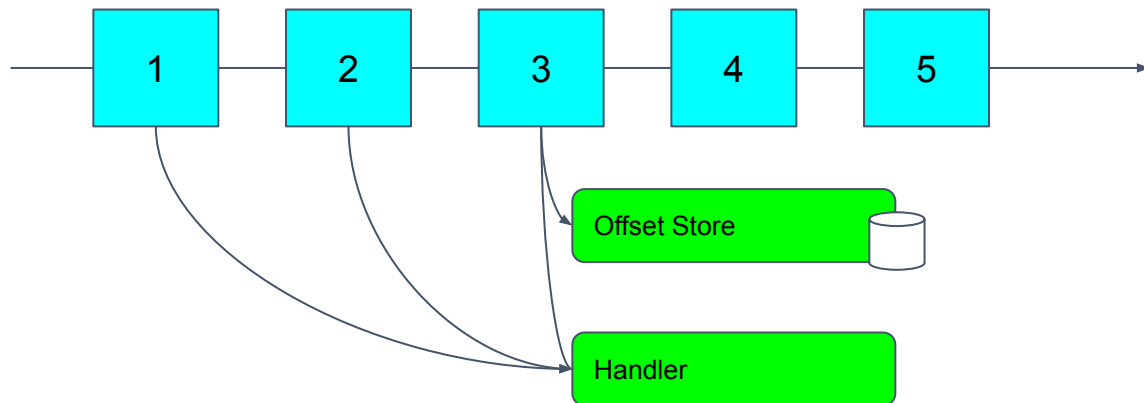
Akka Projections

Offset Stores and Message Delivery Strategies

Message Delivery Strategy		
atLeastOnce	✓	✓
atLeastOnceFlow	✓	✓
atMostOnce	✓	
exactlyOnce		✓
groupedWithin	✓	✓

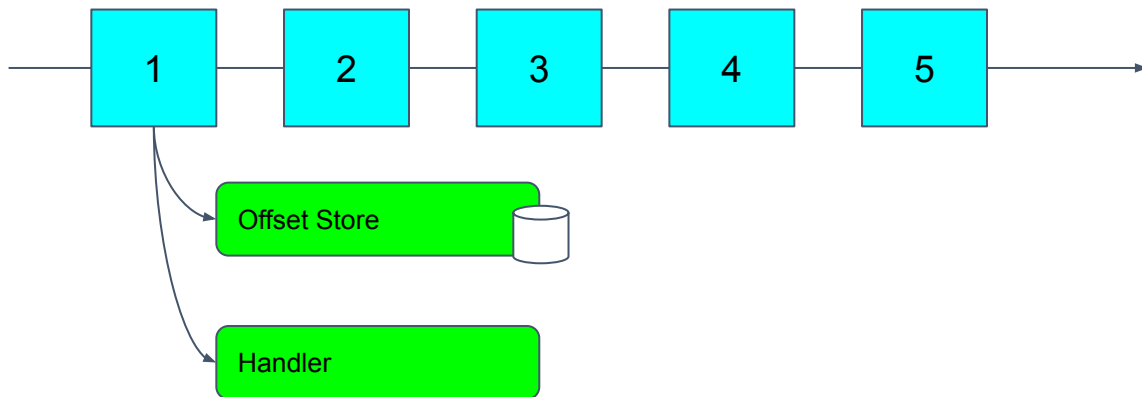
Akka Projections

`atLeastOnce`



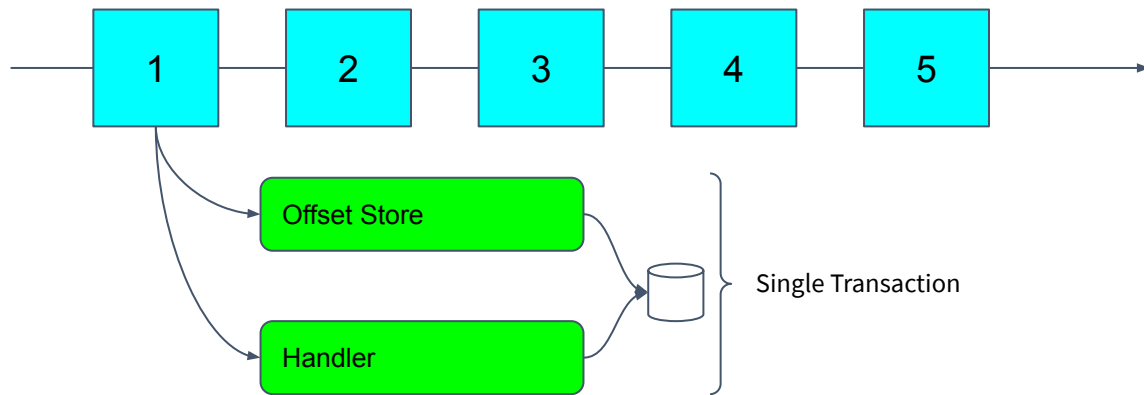
Akka Projections

atMostOnce



Akka Projections

`exactlyOnce`



Akka Projections

```
val tag = "shopping-cart-checkout" // this becomes important when we distribute the projection
```

```
CassandraProjection.atLeastOnce[Offset, EventEnvelope[ShoppingCartEvents.Event]](  
  projectionId = ProjectionId("shopping-carts", tag),  
  sourceProvider = EventSourcedProvider.eventsByTag(system,  
    readJournalPluginId = CassandraReadJournal.Identifier,  
    tag = tag),  
  handler = () => Handler { envelope =>  
    // do something with `envelope.event`  
    Future.successful(Done)  
  })
```

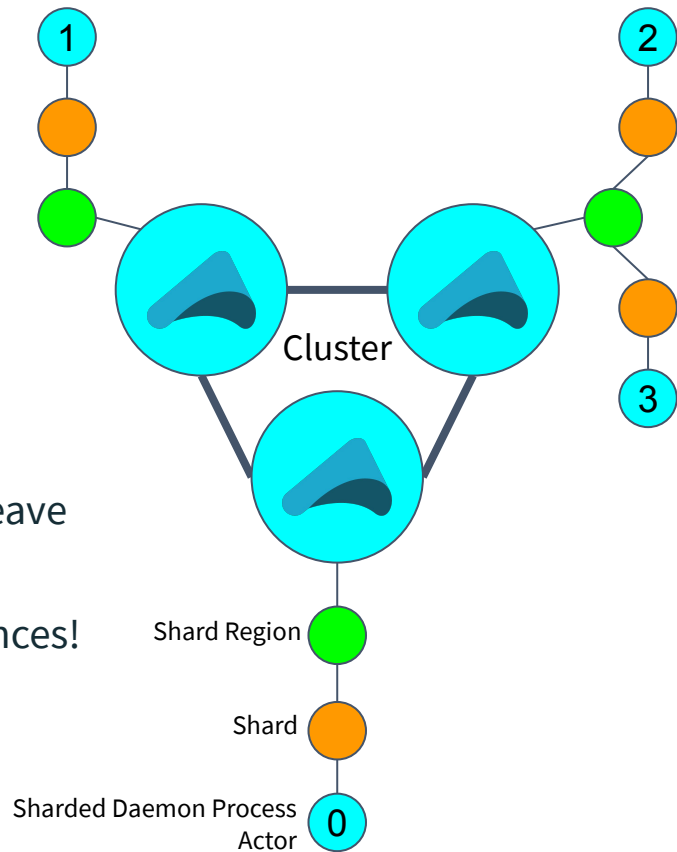
Sharded Daemon Process

To distribute an Akka Projection

Sharded Daemon Process

Distribute a fixed number of workers across Akka Cluster

- Each actor given a unique index: 0, 1, 2 ... n
- Automatic rebalancing when cluster nodes join and leave
- Common use case: distributing Akka Projection instances!



Sharded Daemon Process

write side

To distribute Akka Projections instances to read from an Akka Persistence event journal we must “slice” or “partition” the data when it’s written.

```
val tags = Vector("shopping-cart-0", "shopping-cart-1", "shopping-cart-2", "shopping-cart-3")
ClusterSharding(system).init(Entity(EntityKey) { entityContext =>
  val i = scala.math.abs(entityContext.entityId.hashCode % tags.size)
  val selectedTag = tags(i)

  EventSourcedBehavior[Command, Event, State](
    PersistenceId(EntityKey.name, entityContext.entityId),
    State.empty,
    (state, command) => handleCommand(state, command),
    (state, event) => handleEvent(state, event)
  ).withTagger(_ => Set(selectedTag))
})
```

Sharded Daemon Process

read side

With a partitioned event journal we can run as many Akka Projection instances as there are partitions using a Sharded Daemon Process.

```
val tags = Vector("shopping-cart-0", "shopping-cart-1", "shopping-cart-2", "shopping-cart-3")
```

```
ShardedDaemonProcess(system).init[ProjectionBehavior.Command] (
  name = "shopping-cart-projection",
  numberOfInstances = tags.size,
  behaviorFactory = (i: Int) => ProjectionBehavior(shoppingCartProjection(tags(i)))
  stopMessage = ProjectionBehavior.Stop
)
```


Split Brain Resolver

Split Brain Resolver

Split Brain Resolver (SBR) was open sourced in Akka 2.6.6!

- Formerly a commercial Lightbend component
- Battletested by Lightbend customers
- Now open source and free to use by the community
- Missing piece of the puzzle to run Akka Cluster



Split Brain Resolver

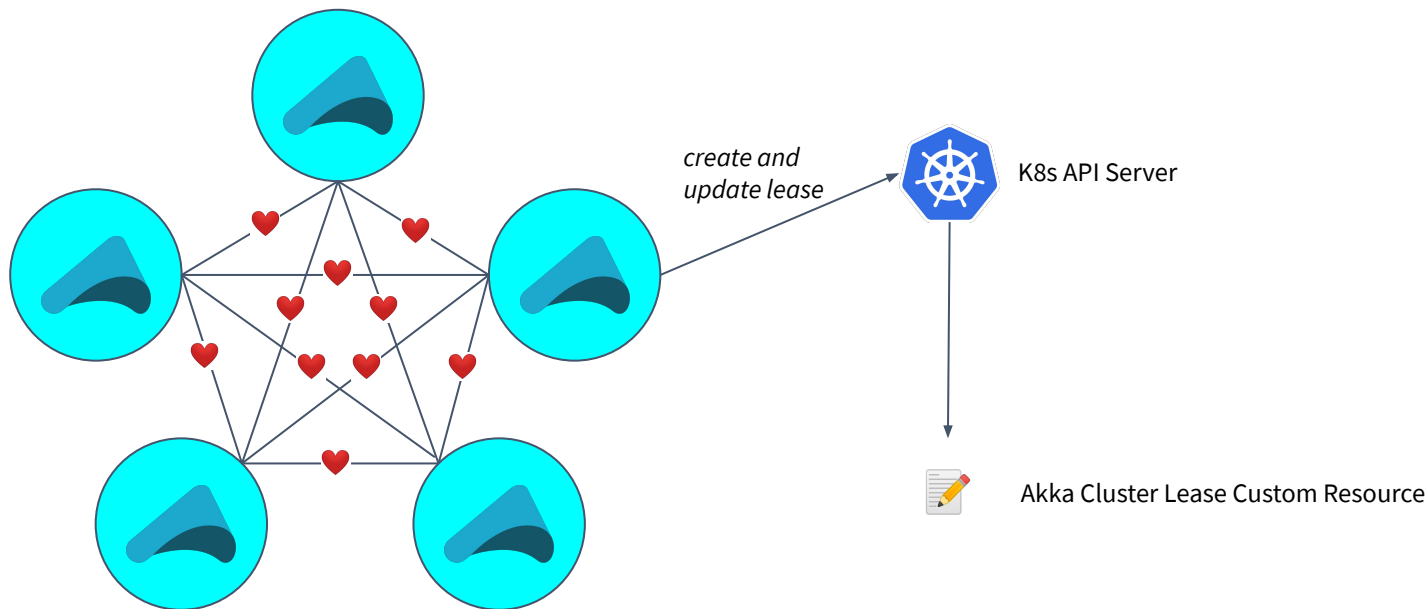
Split Brain Resolver (SBR) in a nutshell

- Strategies to handle network partitions in Akka Cluster
- Network partition: one node cannot communicate with another
- **There's no way to know** if a node is down or unreachable
- Akka Cluster Singleton and Cluster Sharding require a complete view of the cluster

Split Brain Resolver

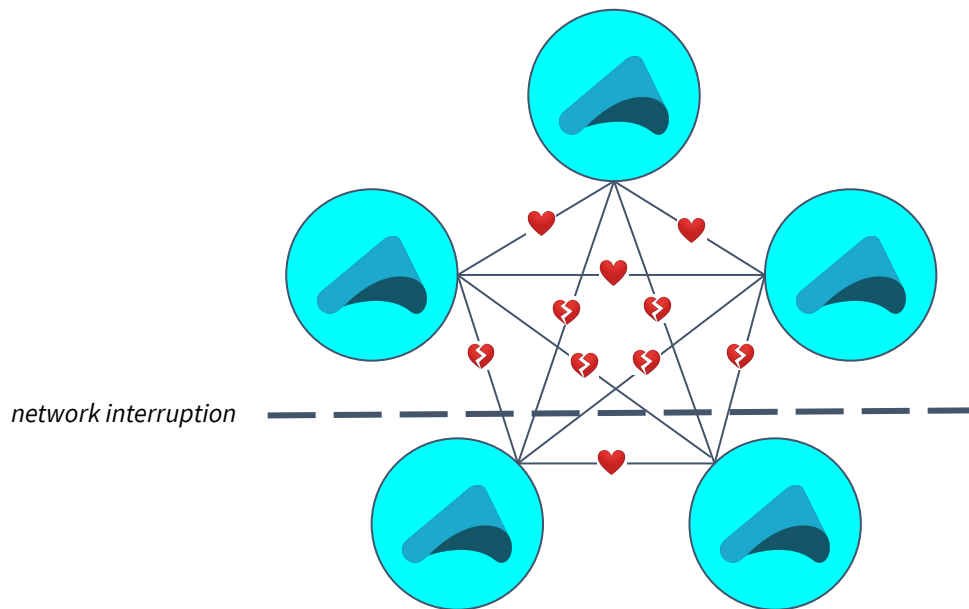
♥ cupid + rock & roll 🤘?

Ex) Kubernetes Lease Strategy “lease-majority”



Split Brain Resolver

Network partition



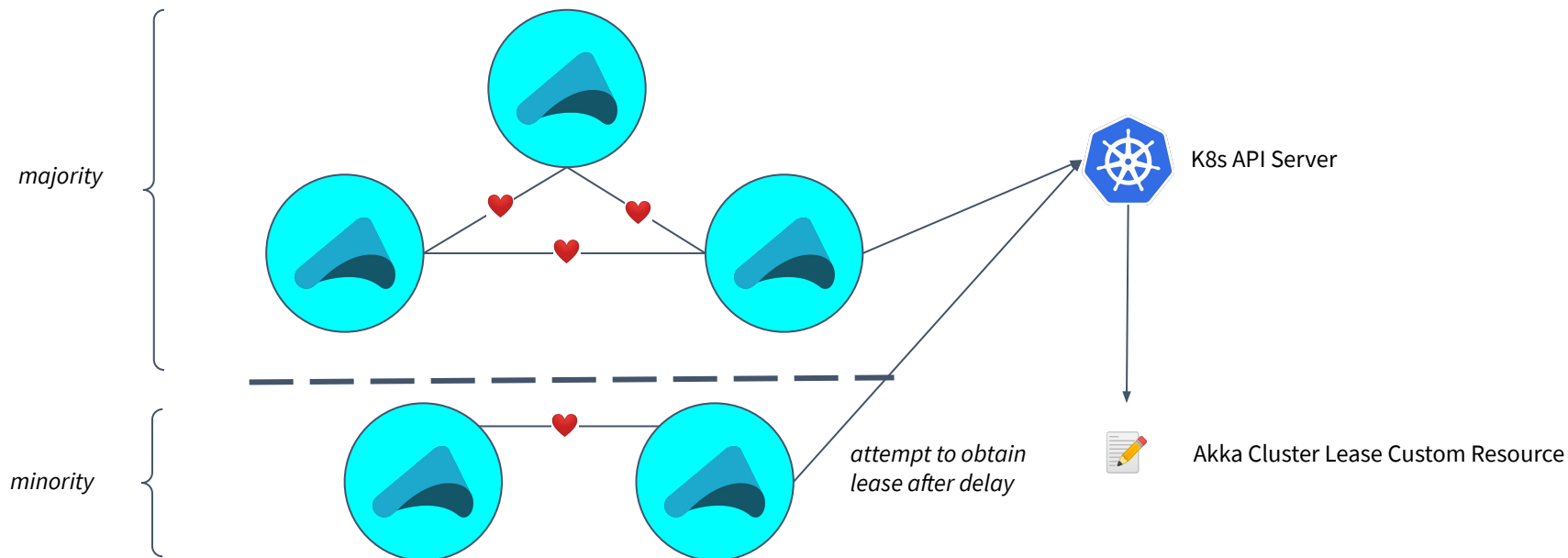
K8s API Server



Akka Cluster Lease Custom Resource

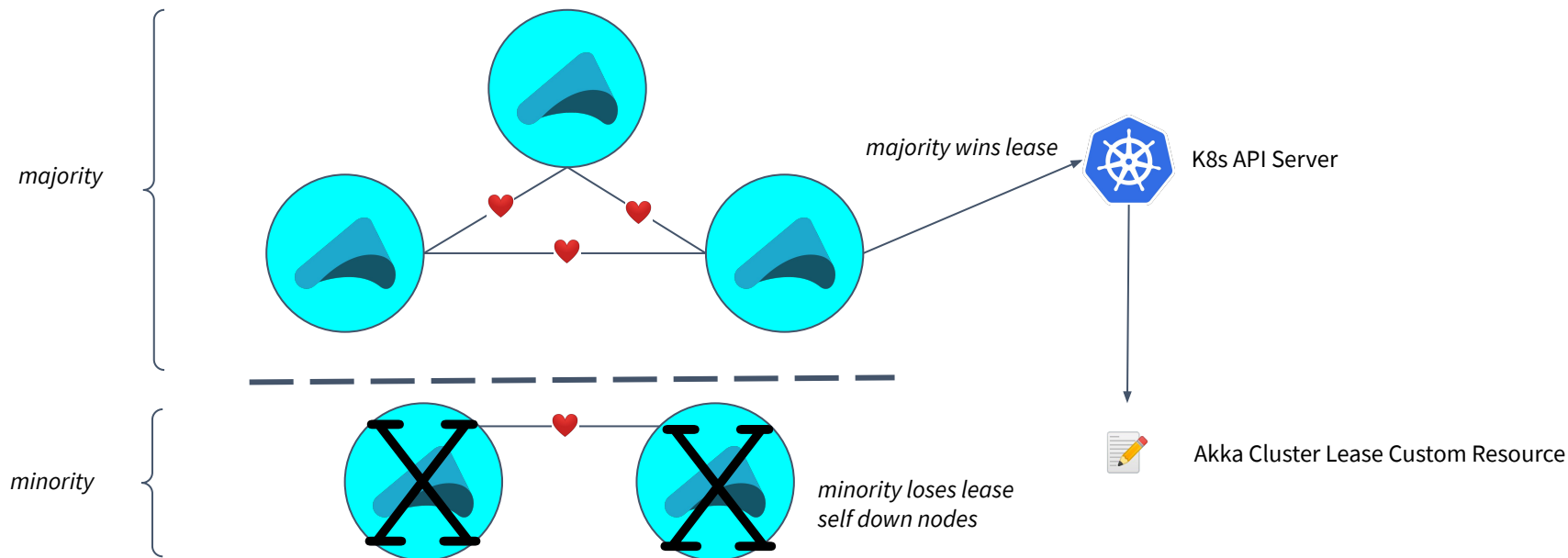
Split Brain Resolver

Heal Split Brain



Split Brain Resolver

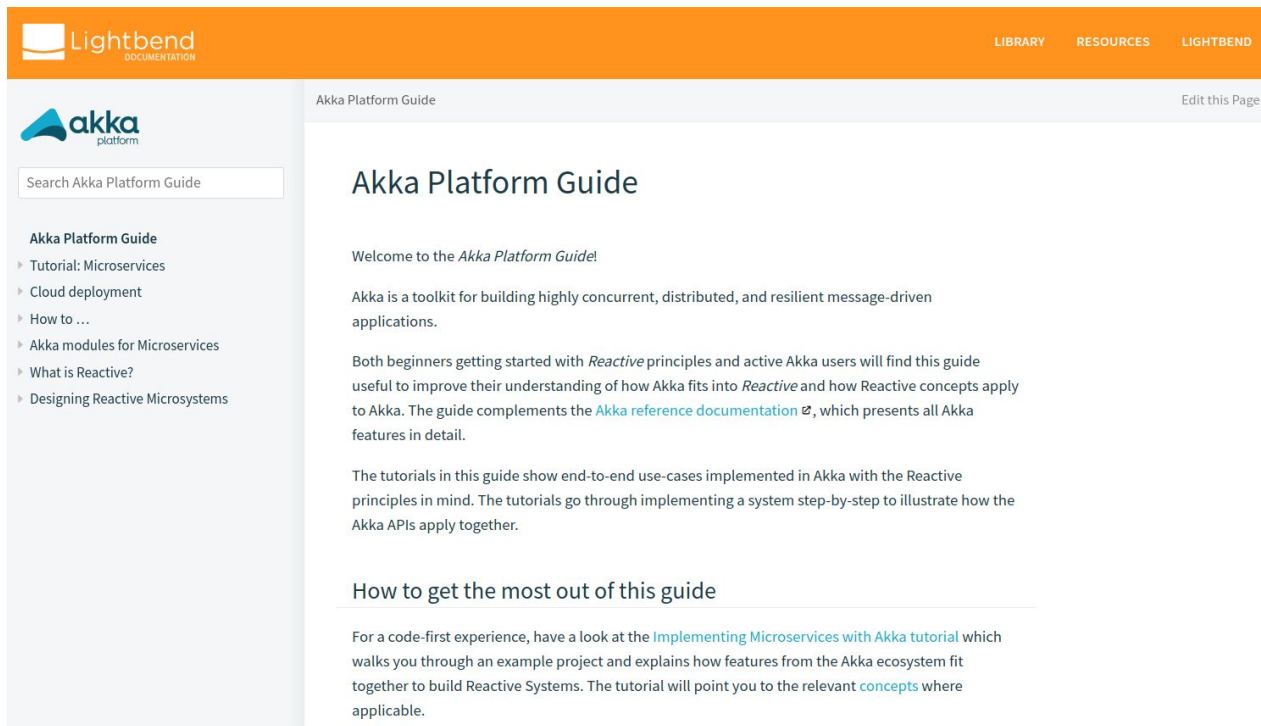
Heal Split Brain



Akka Platform Guide

Akka Platform Guide

<https://developer.lightbend.com/docs/akka-platform-guide/index.html>



The screenshot shows the Akka Platform Guide documentation page. The top navigation bar is orange with the Lightbend logo and 'DOCUMENTATION' text on the left, and 'LIBRARY', 'RESOURCES', and 'LIGHTBEND' links on the right. Below the navigation bar, the page title 'Akka Platform Guide' is displayed. The left sidebar contains the Akka Platform logo, a search bar, and a list of navigation links: 'Akka Platform Guide', 'Tutorial: Microservices', 'Cloud deployment', 'How to ...', 'Akka modules for Microservices', 'What is Reactive?', and 'Designing Reactive Microsystems'. The main content area has the title 'Akka Platform Guide' and a welcome message: 'Welcome to the Akka Platform Guide!'. It then describes Akka as a toolkit for building highly concurrent, distributed, and resilient message-driven applications. It mentions that both beginners and active Akka users will find the guide useful to improve their understanding of how Akka fits into Reactive and how Reactive concepts apply to Akka. It also states that the guide complements the Akka reference documentation, which presents all Akka features in detail. The page then introduces the tutorials, which show end-to-end use-cases implemented in Akka with the Reactive principles in mind. The tutorials go through implementing a system step-by-step to illustrate how the Akka APIs apply together. Finally, it provides a section titled 'How to get the most out of this guide', which suggests looking at the 'Implementing Microservices with Akka tutorial' for a code-first experience, explaining how features from the Akka ecosystem fit together to build Reactive Systems. The tutorial will point to the relevant concepts where applicable.

Lightbend
DOCUMENTATION

LIBRARY RESOURCES LIGHTBEND

Akka Platform Guide

Edit this Page

Akka Platform Guide

Welcome to the *Akka Platform Guide*!

Akka is a toolkit for building highly concurrent, distributed, and resilient message-driven applications.

Both beginners getting started with *Reactive* principles and active Akka users will find this guide useful to improve their understanding of how Akka fits into *Reactive* and how Reactive concepts apply to Akka. The guide complements the [Akka reference documentation](#), which presents all Akka features in detail.

The tutorials in this guide show end-to-end use-cases implemented in Akka with the Reactive principles in mind. The tutorials go through implementing a system step-by-step to illustrate how the Akka APIs apply together.

How to get the most out of this guide

For a code-first experience, have a look at the [Implementing Microservices with Akka tutorial](#) which walks you through an example project and explains how features from the Akka ecosystem fit together to build Reactive Systems. The tutorial will point you to the relevant [concepts](#) where applicable.

Resources

Learning Refs and Resources

- [One year of Akka 2.6 \(blog post\)](#)
- [Akka 2.6.0 Release Announcement](#)
- [Akka Platform Guide](#)
- [Documentation](#)
 - [Akka Actors](#)
 - [Akka Persistence Typed](#)
 - [Akka Cluster Sharding Typed](#)
 - [External Shard Allocation Strategy](#)
 - [Alpakka Kafka Cluster Sharding Support](#)
 - [Aligning Kafka Partitions with Akka Cluster Sharding Sample Project](#)
 - [Akka Projections](#)
 - [Sharded Daemon Process](#)
 - [Split Brain Resolver](#)
 - [Akka Management Kubernetes API](#)
 - [Akka Management Kubernetes Lease](#)
- Videos
 - [Six things you can do in Akka 2.6](#)
 - [Distributed processing with Akka Cluster & Kafka \(External Shard Allocation Strategy\)](#)
 - [Intro to Akka Cluster Sharding](#)
 - [Akka Projections 1.0](#)
 - [Replicated event sourcing for active-active event sourcing](#)
 - [Data modeling for Replicated event sourcing](#)
 - [Split Brain Resolver in Akka Cluster](#)
 - [How Akka Cluster works, Split Brain Resolver](#)



Thank You!

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