
云智未来
9th
第九届中国系统架构师大会
SYSTEM ARCHITECT CONFERENCE CHINA 2017

Event Sourcing & CQRS

architecting a cloud based micro-service system

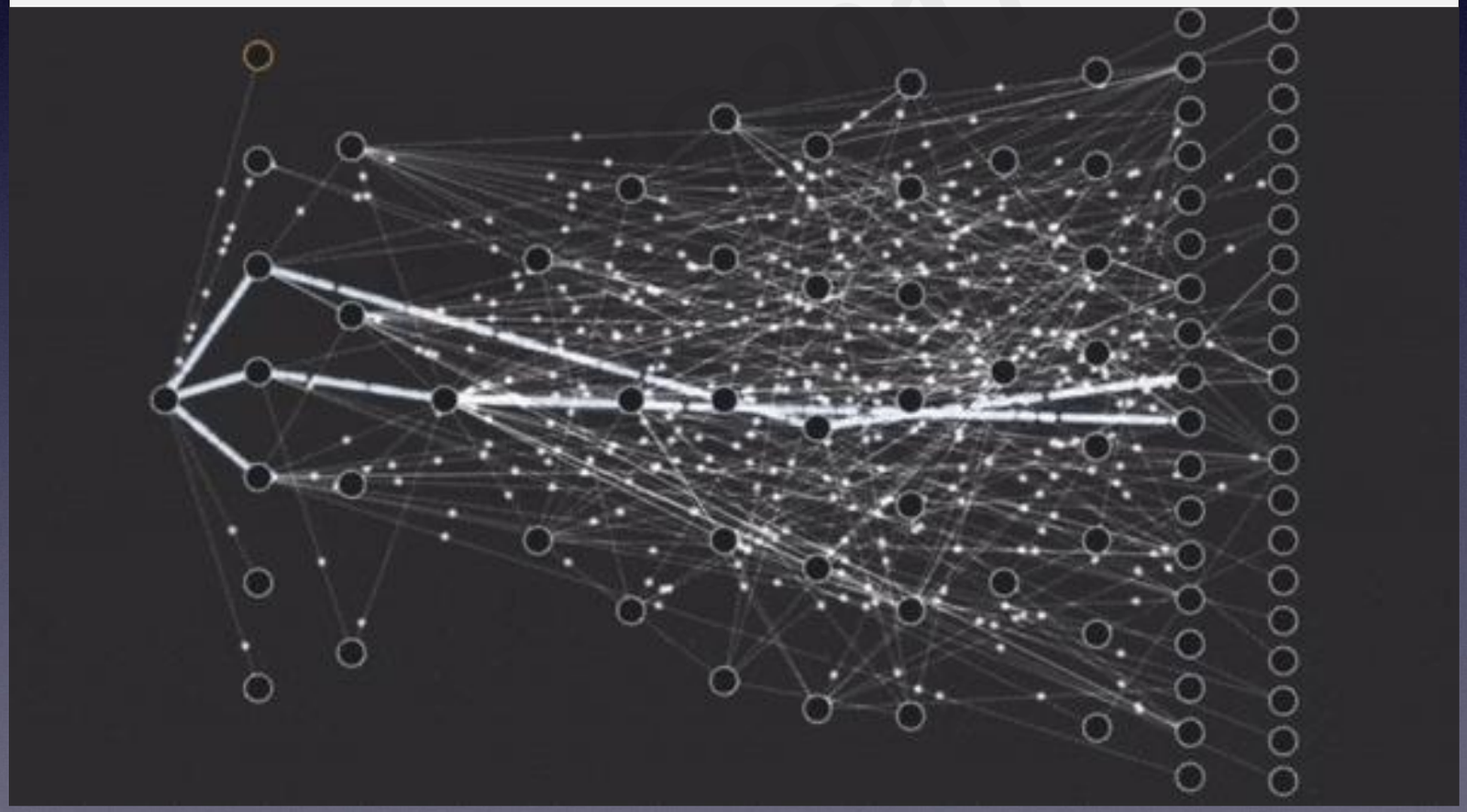
About me

- Oracle Certified Expert J2EE
- Software Engineer
- Software Architect

Agenda

- Event Driven Architecture
- Event Sourcing
- CQRS
- Lagom in a nut shell
- Demo
- Q&A

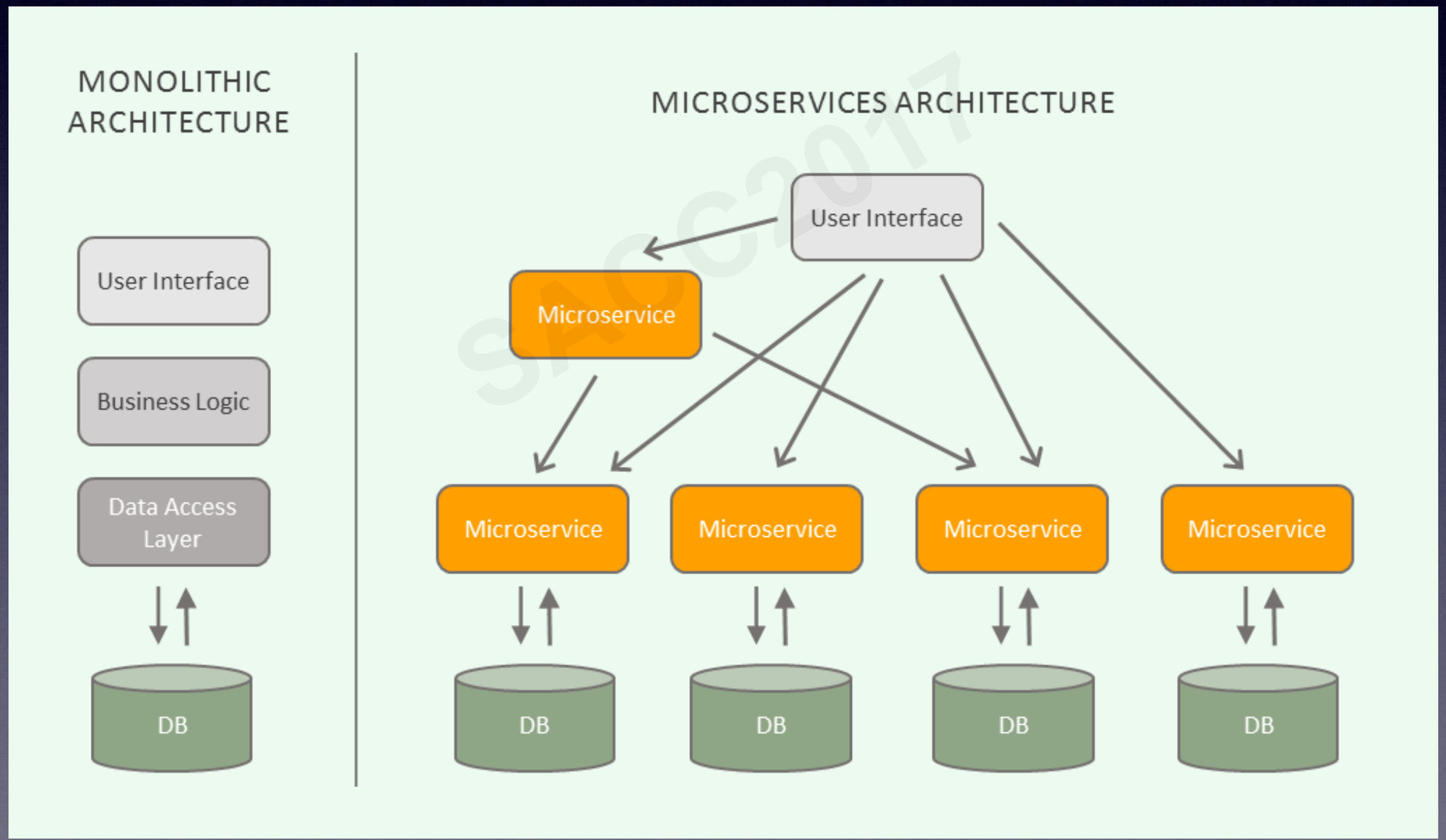
NETFLIX



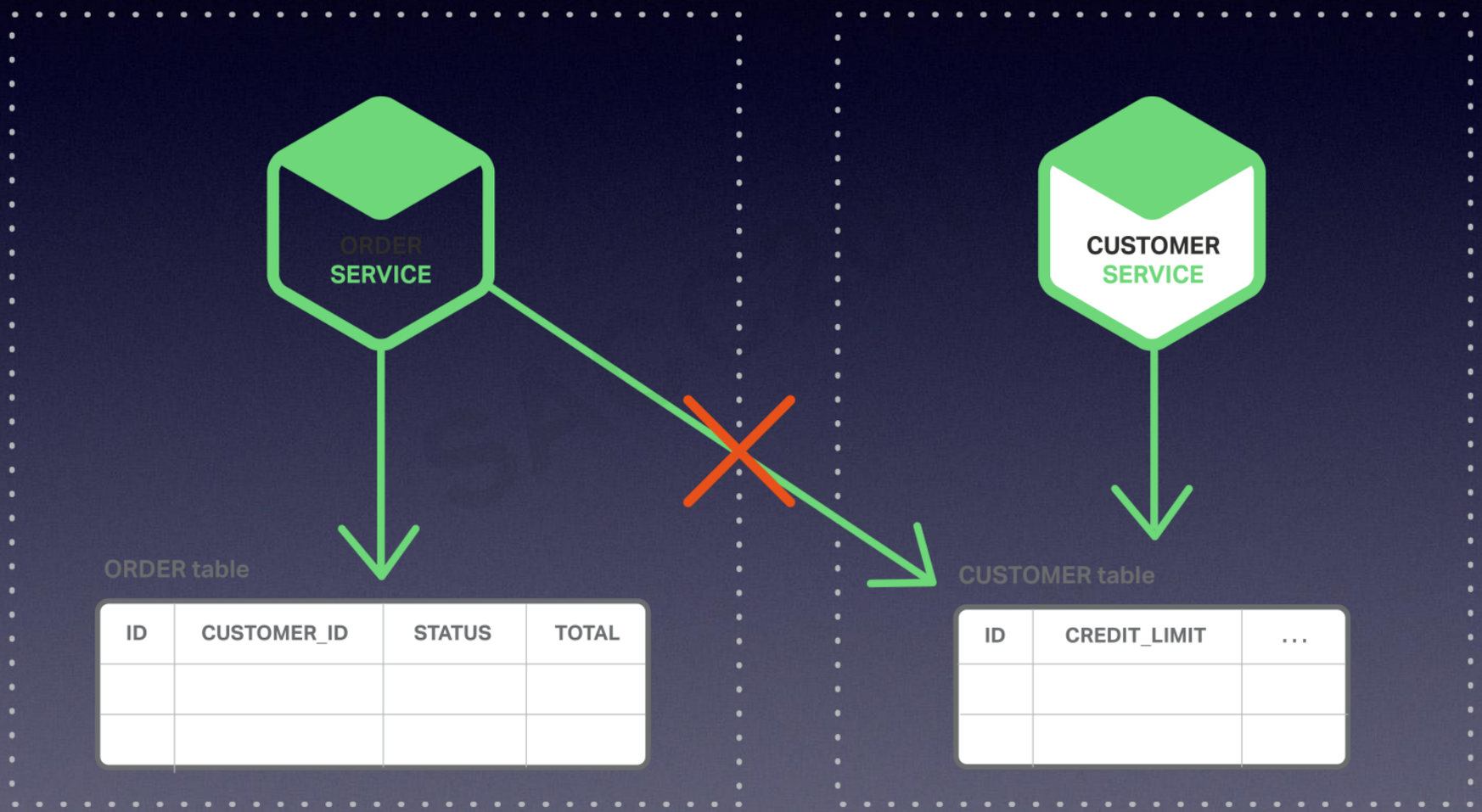
What we need?

- Availability
- Performance
- Scalability
- Resiliency
- Innovation

Monolith VS Micro-Service



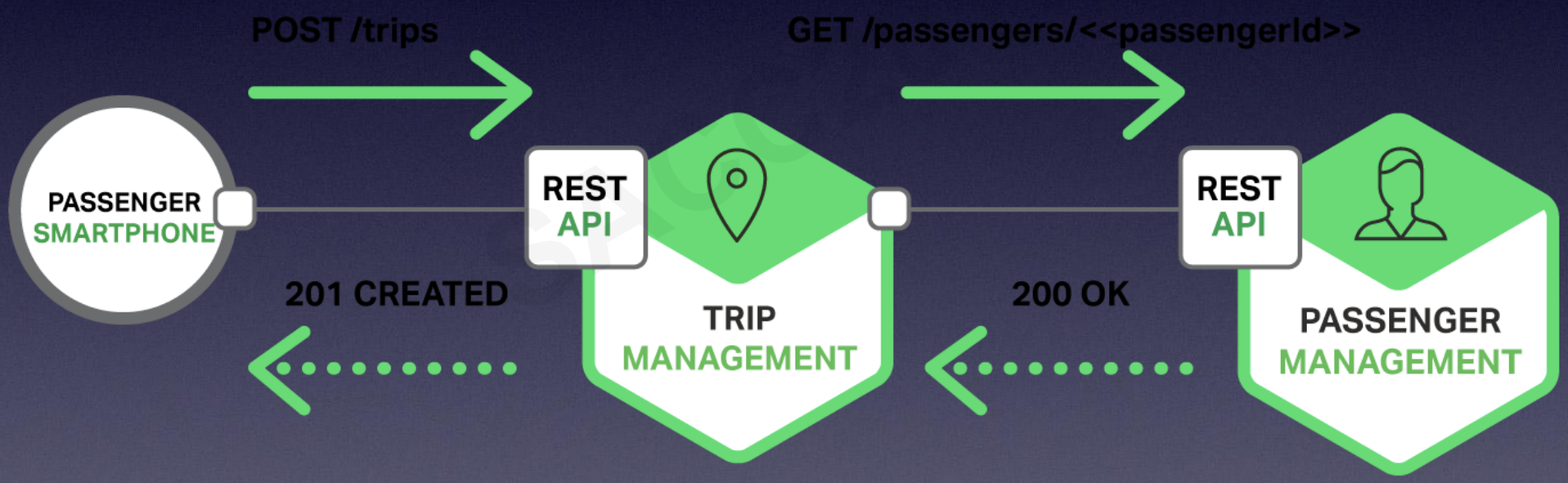
Inter-service Communication



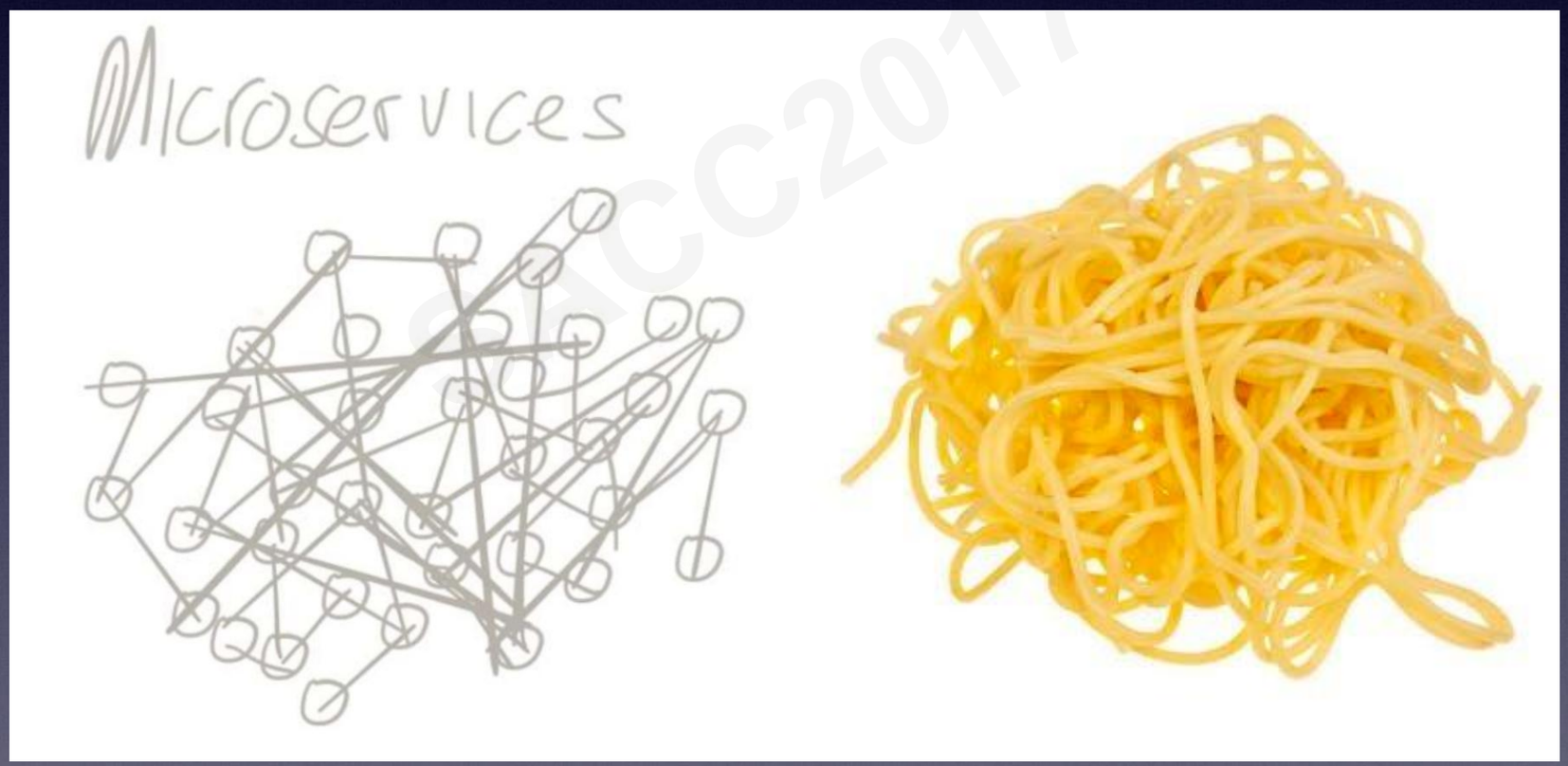
NO.

A big NO NO !

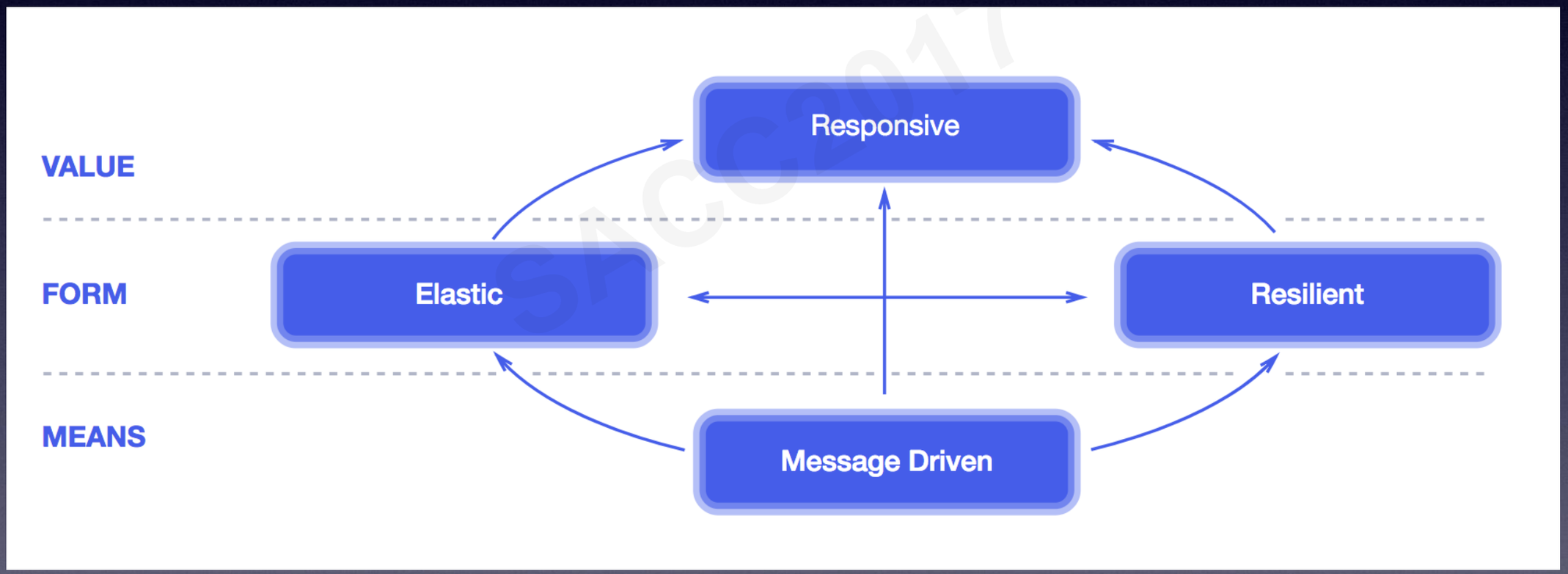
REST API Call



Micro service spaghetti



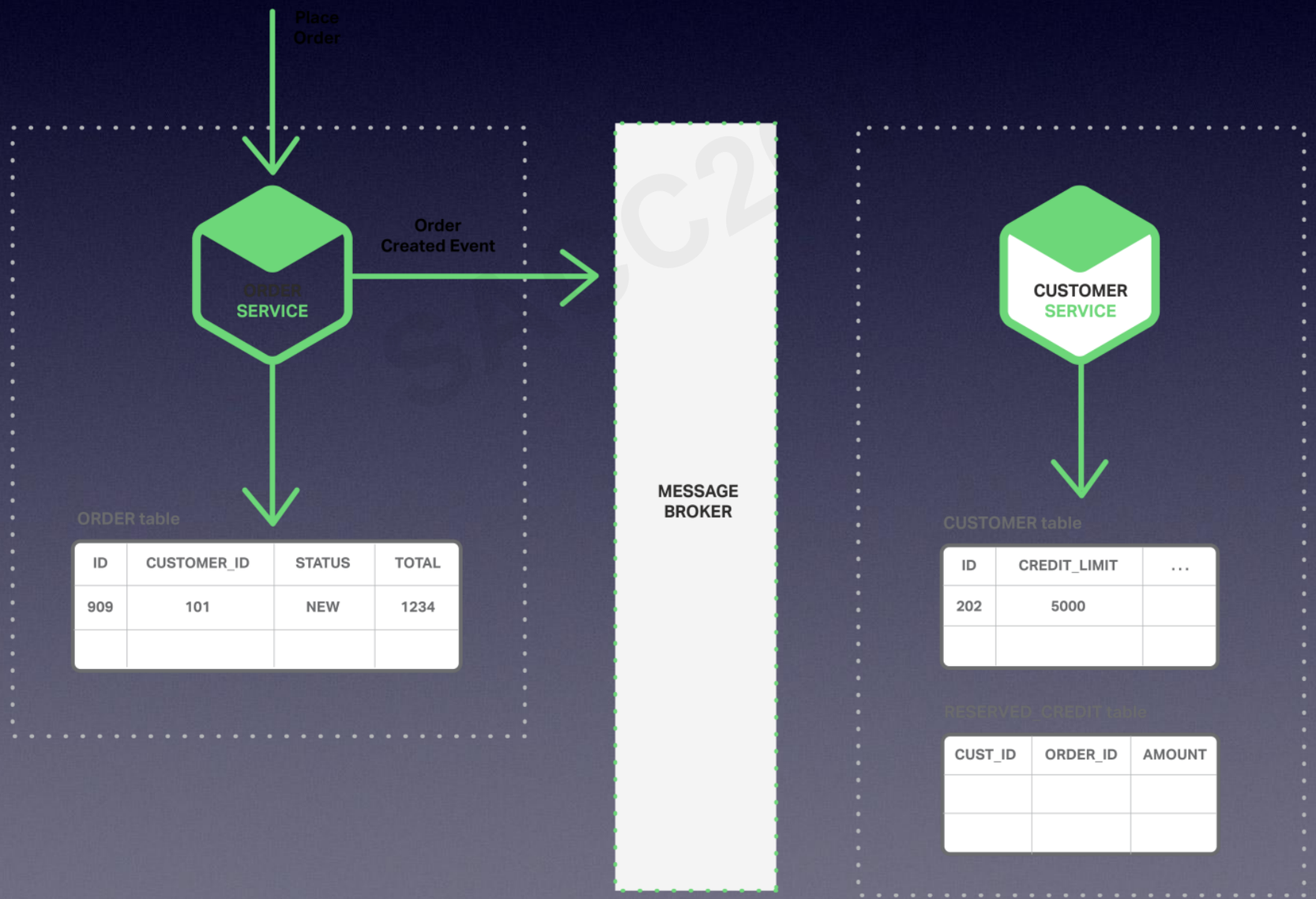
Reactive Manifesto



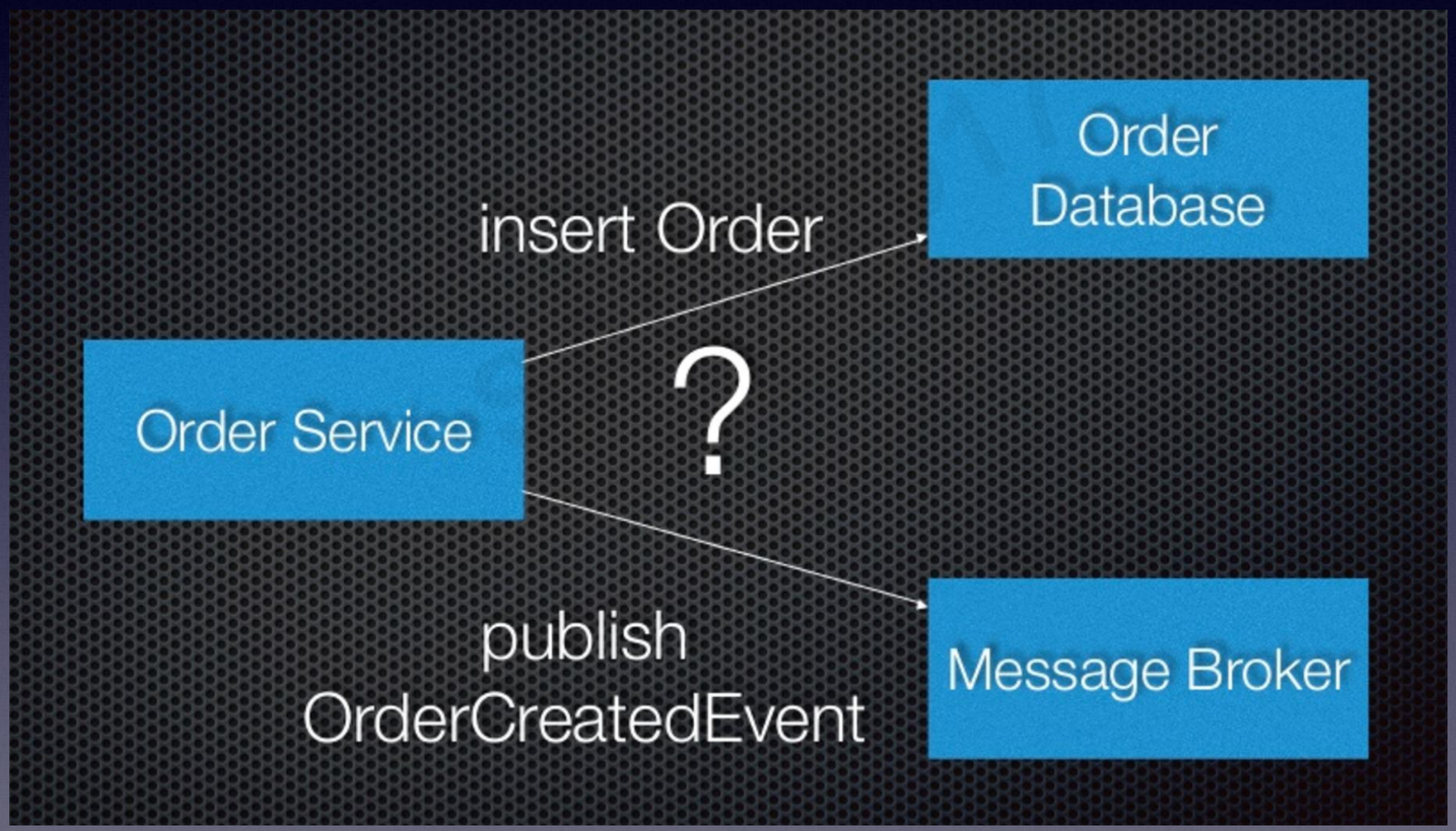
Event Driven Architecture

- Production, detection, consumption and reaction to events
- Services publish events when there is a state change
- Other services subscribe events to obtain state changes
- To achieve a loosely coupled distributed system

Event Driven Architecture

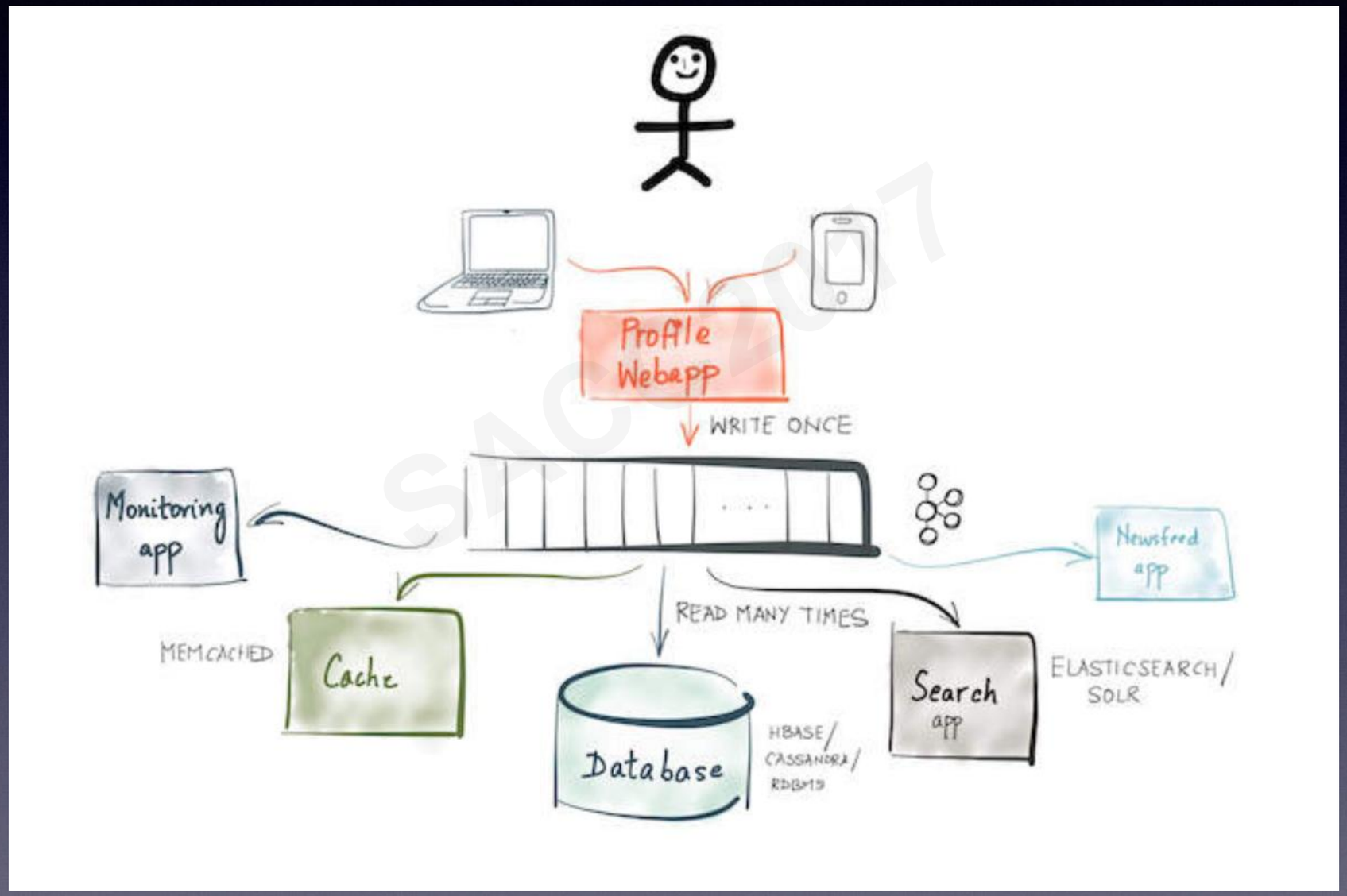


Problem: How Atomicity update database and publish event



https://www.slideshare.net/chris.e.richardson/developing-eventdriven-microservices-with-event-sourcing-and-cqrs-svcc-svcc2015

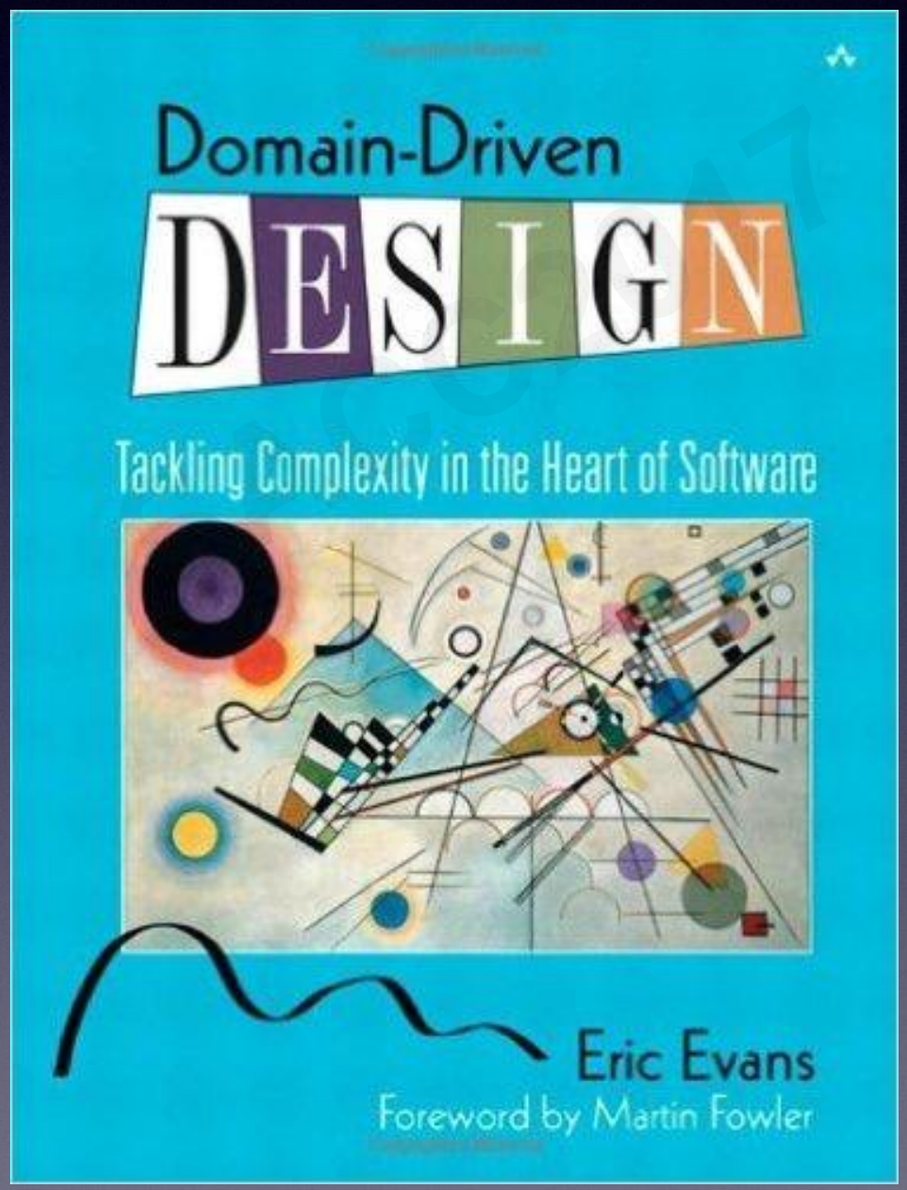
Kafka as a message bus



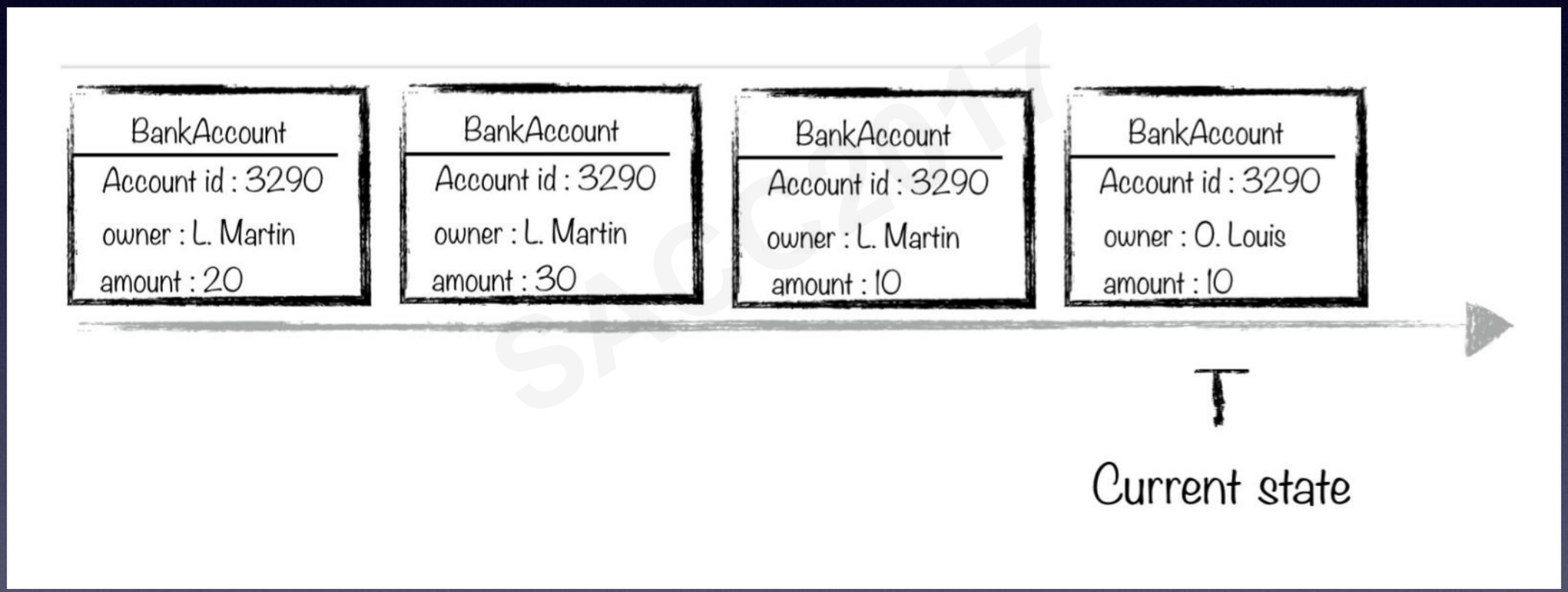
https://www.confluent.io/blog/event-sourcing-cqrs-stream-processing-apache-kafka-whats-connection/

Event Sourcing

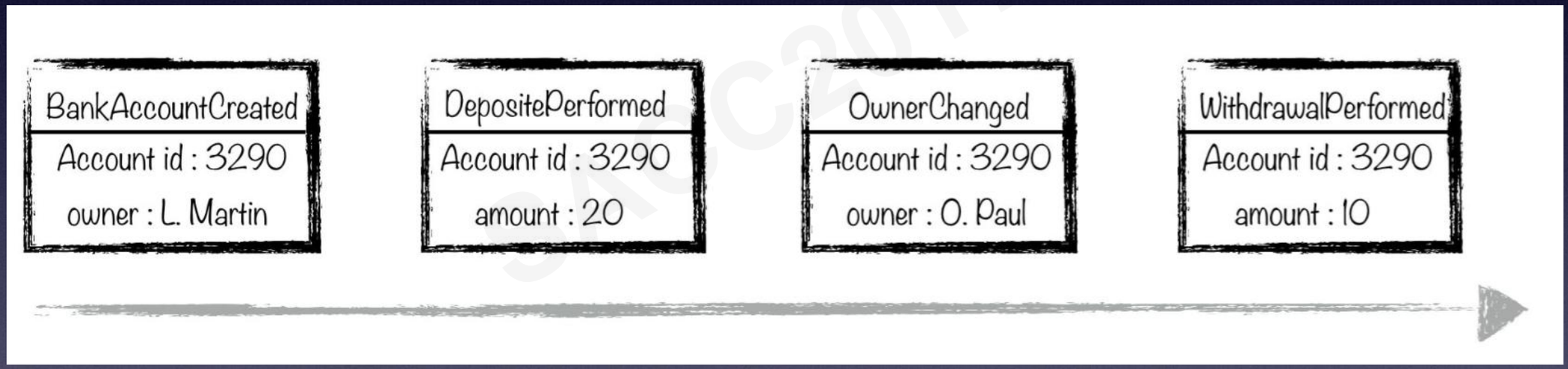
a core concept from DDD



Active current record



Actual event happened



no update, no delete
only append

Event sourcing like application

- bank statement
- git
- database transaction log

Events

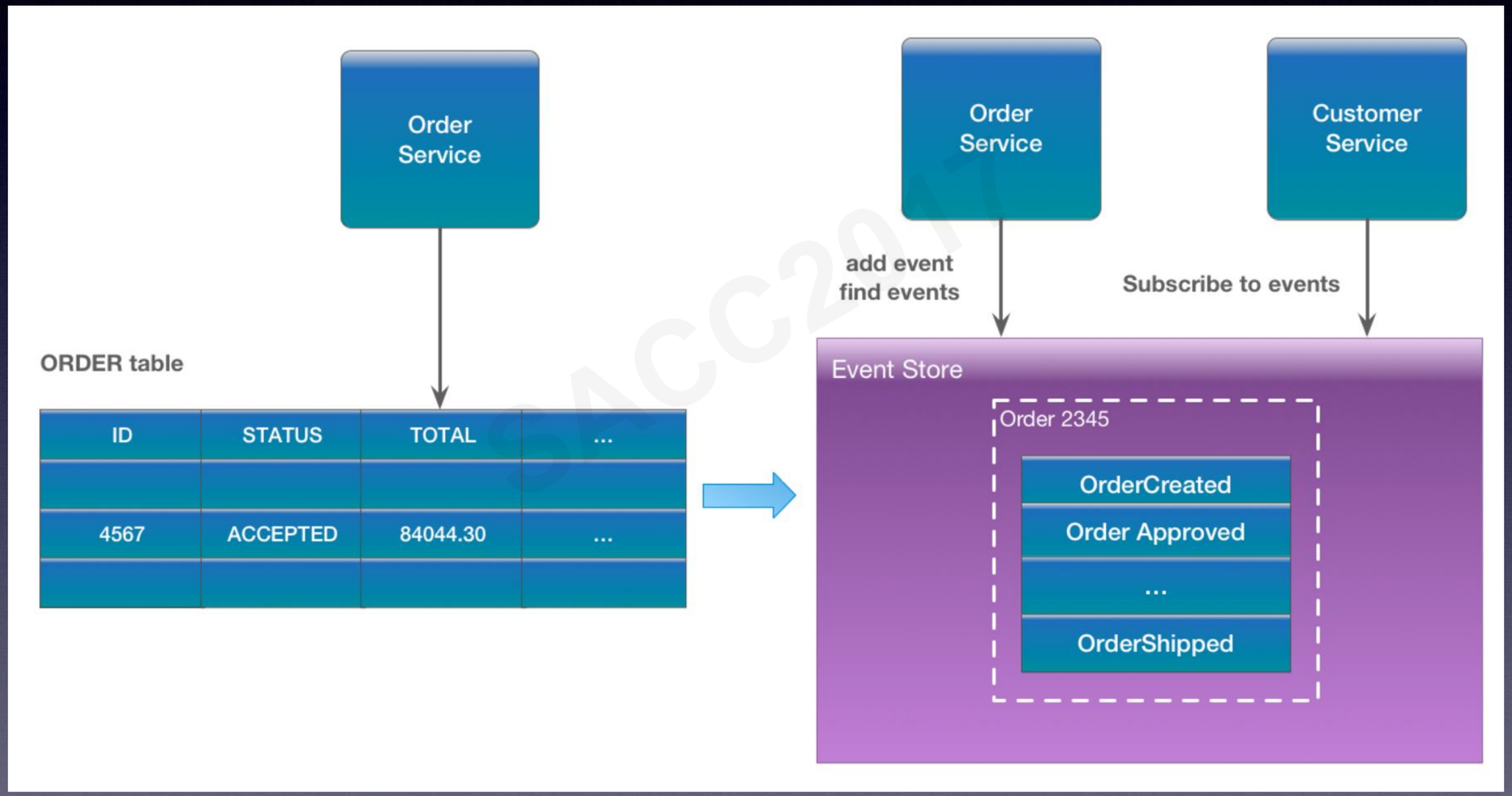
- History, can never be changed
- Immutable, we love immutability
- Generate corrective events
- Allow asynchronous communication

Event Sourcing

- Define the aggregates, or domain entities
- Identify domain events
- Capture all changes (commands) and convert them to domain events

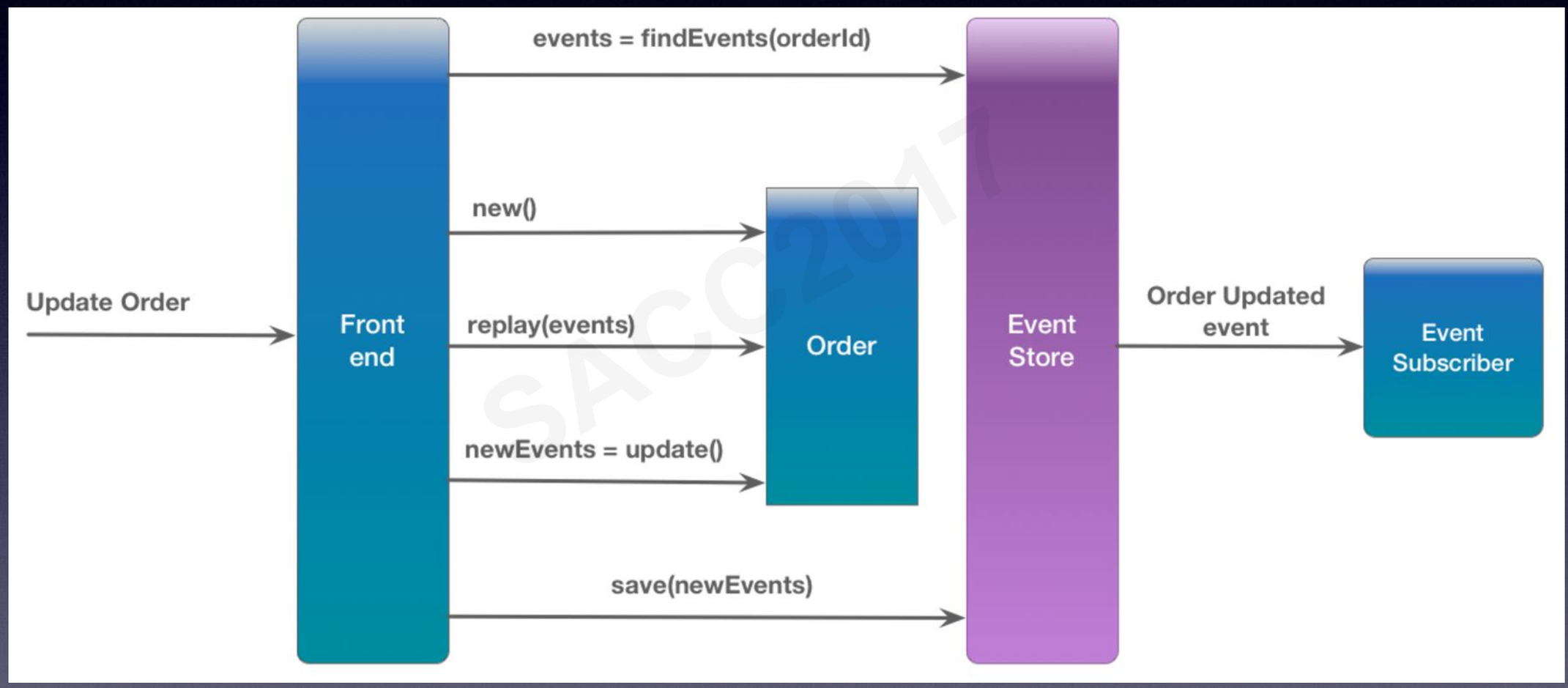
- Examples:
  - Bank Account : accountCreated; depositPerformed; withdrawalPerformed
  - Order : orderCreated; orderUpdated; orderPaid; orderShipped

Event Sourcing



http://eventuate.io/whyeventsourcing.html

Update an order



http://eventuate.io/whyeventsourcing.html

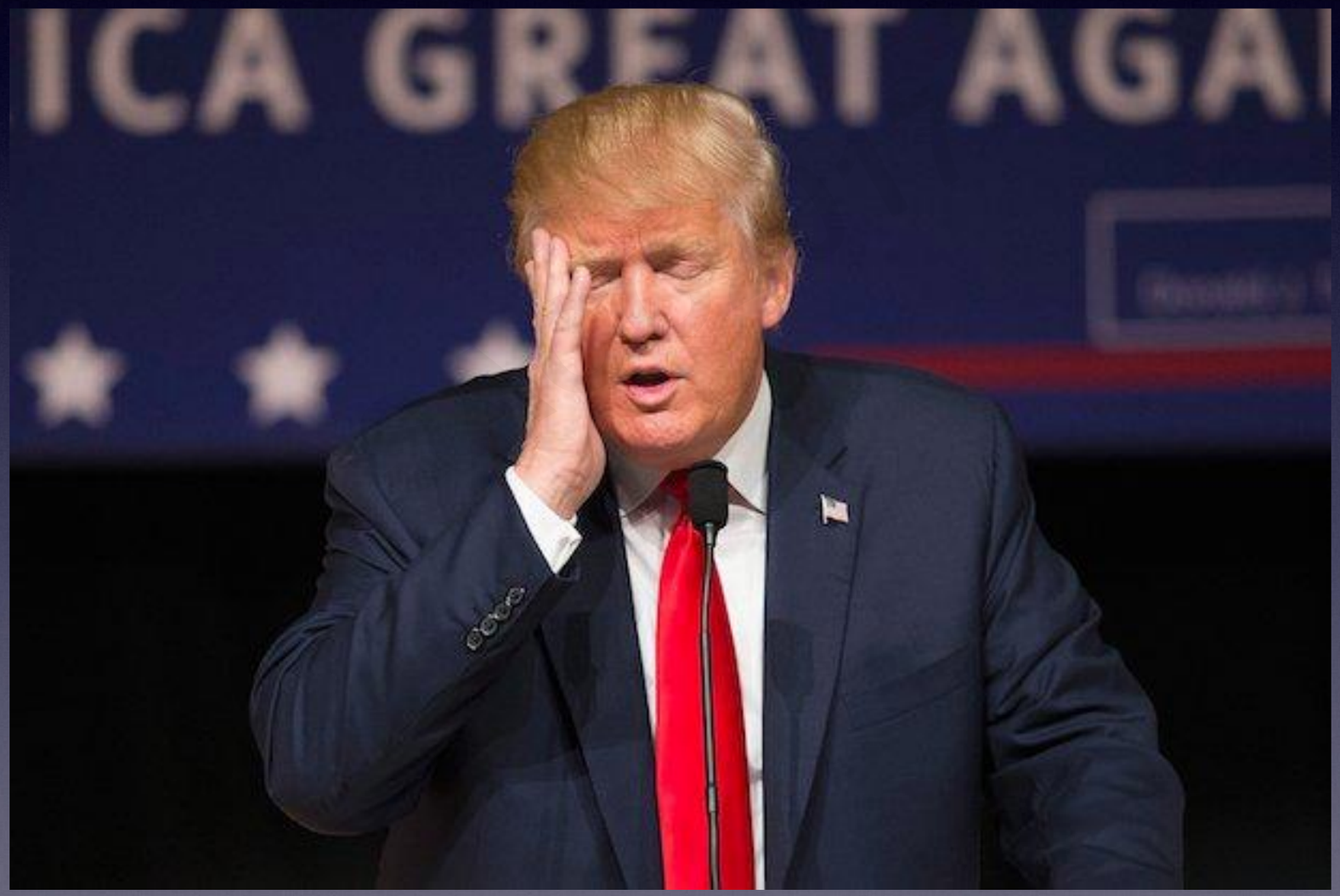
Benefits

- 100% accurate audit logging
- easy debugging
- real time stream processing
- writing is blazing fast, since it is append only
- no impedance mismatch
- building a forward-compatible application architecture

But!

- What’s the total amount of all transaction from this month?
- Search all products with the brand Gucci and cost less than 1000 euro for female?

Oh dear !

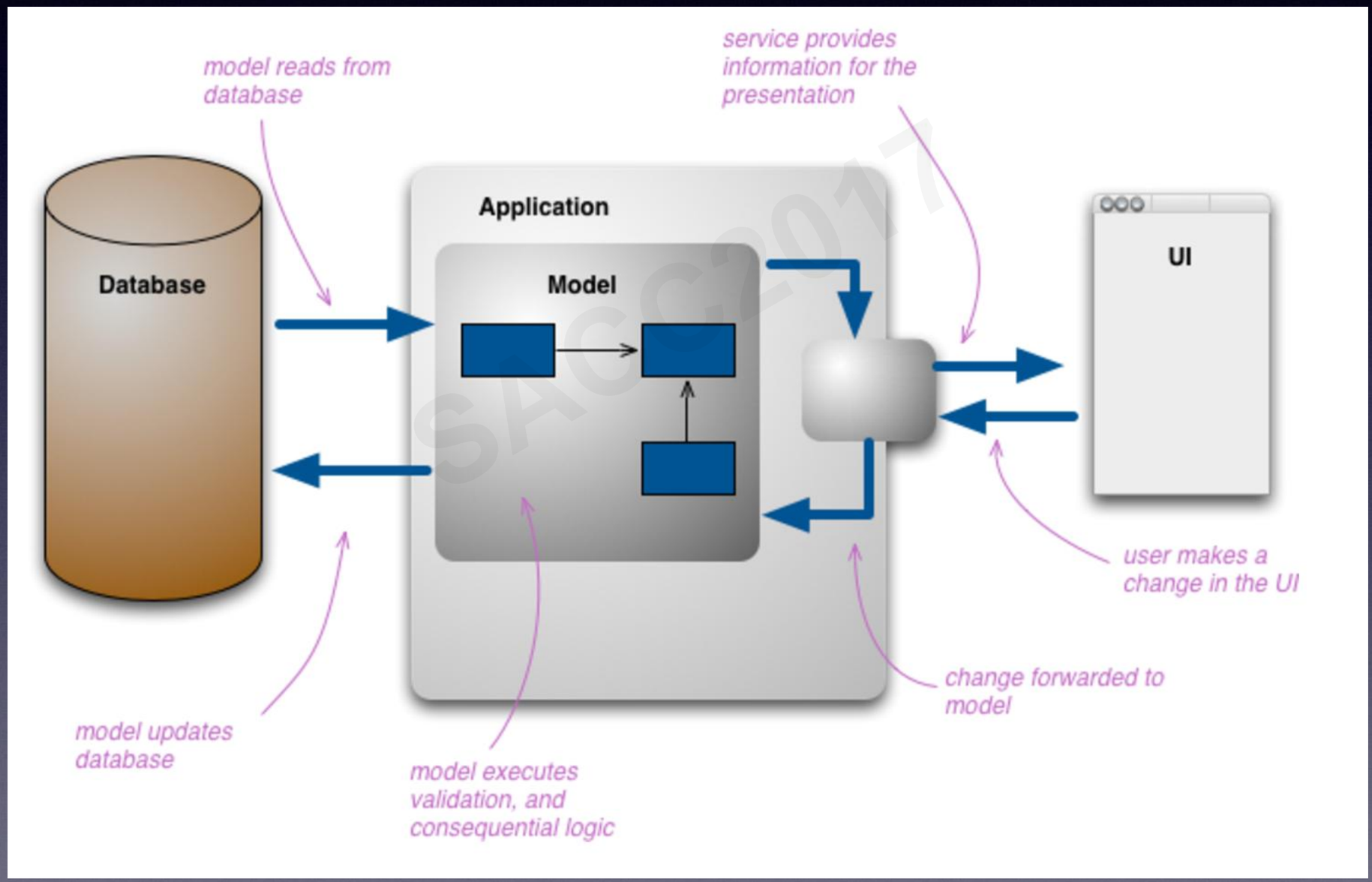


CQRS

CQRS

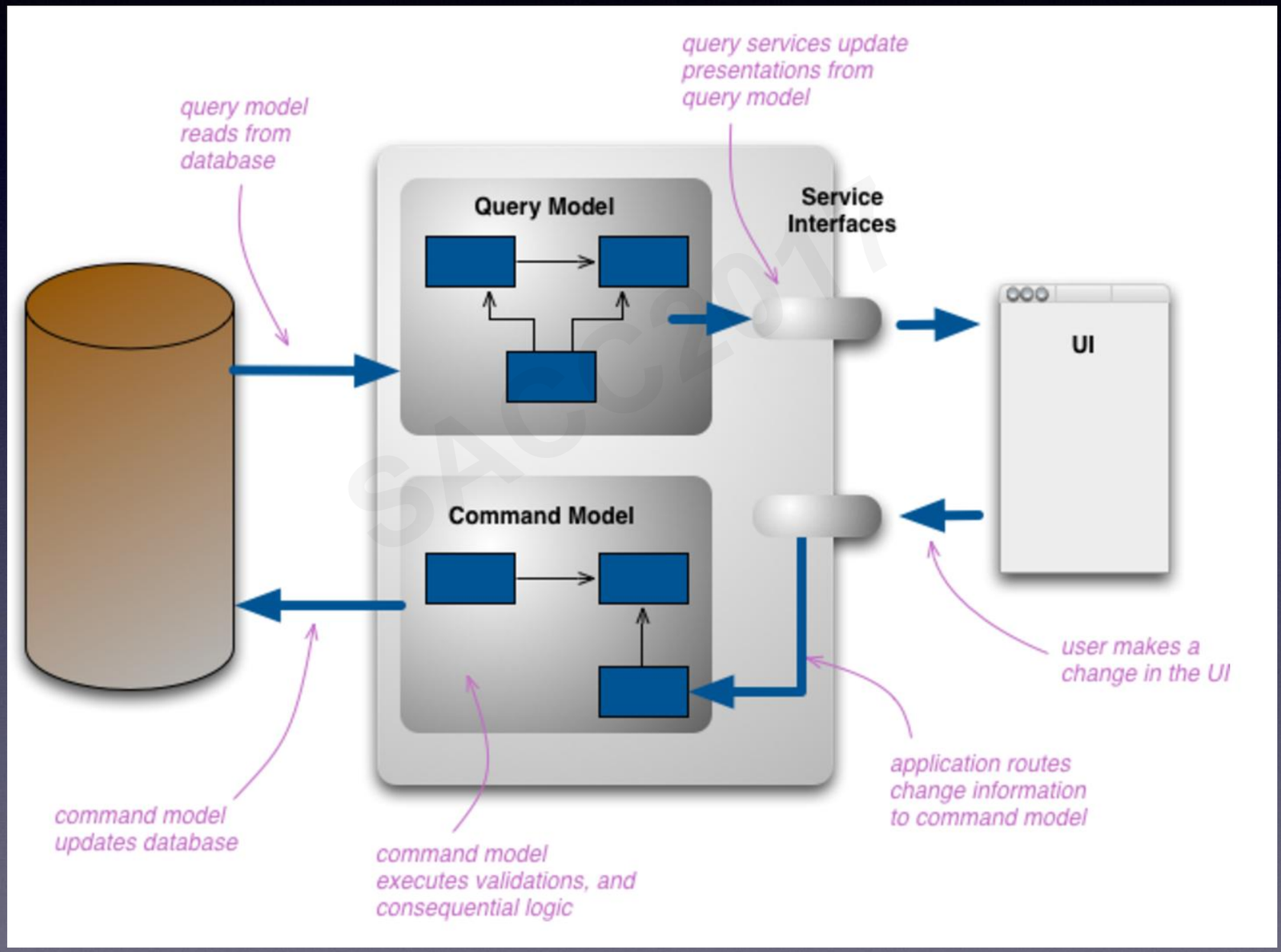
C : command -> write/append
Q : query -> read
R : responsibility
S : segregation

Traditional approach



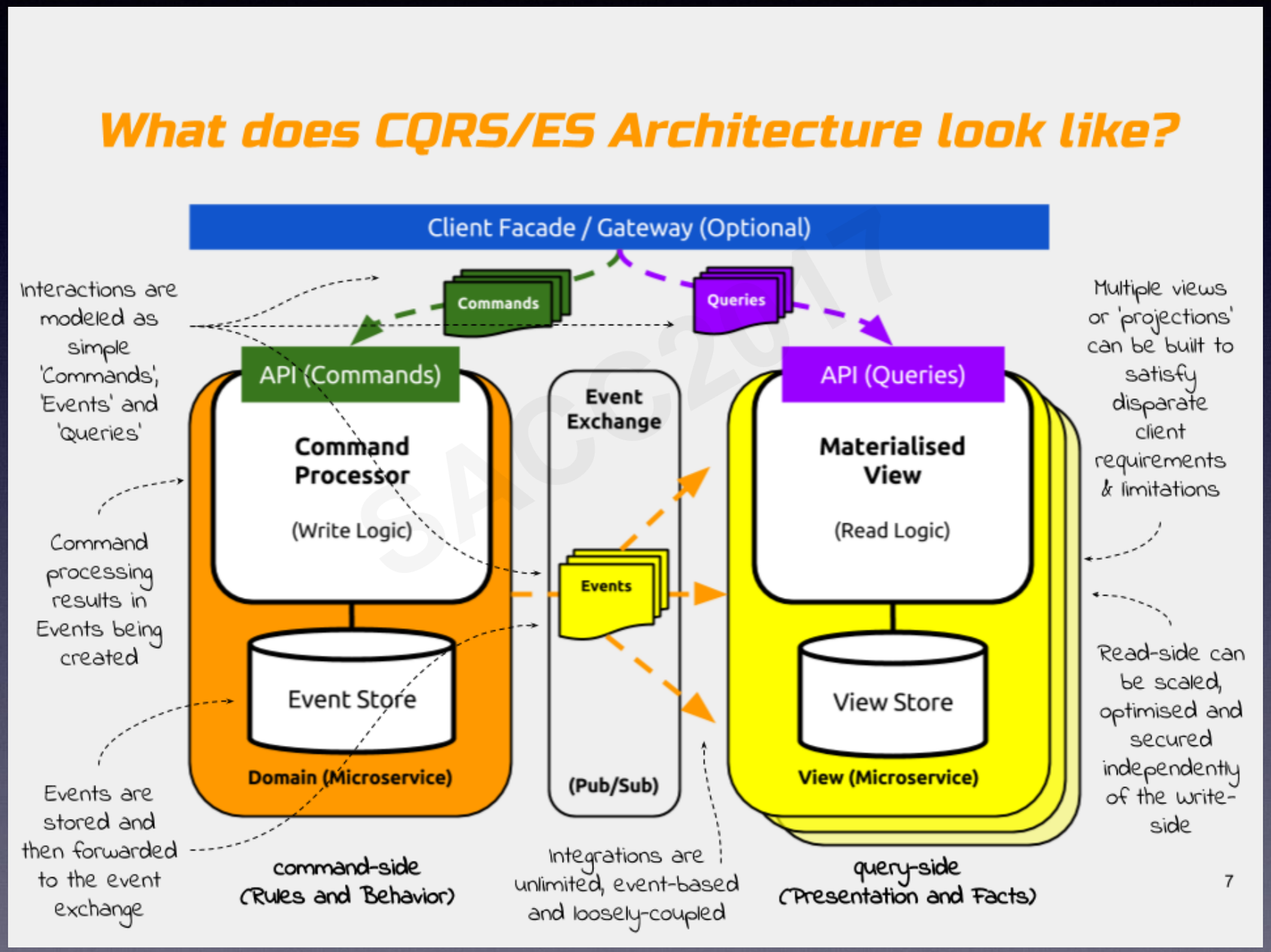
https://martinfowler.com/bliki/CQRS.html

CQRS



https://martinfowler.com/bliki/CQRS.html

ES + CQRS



https://dzone.com/articles/microservices-with-spring-boot-axon-cqrses-anddock

Lagom

Lagom

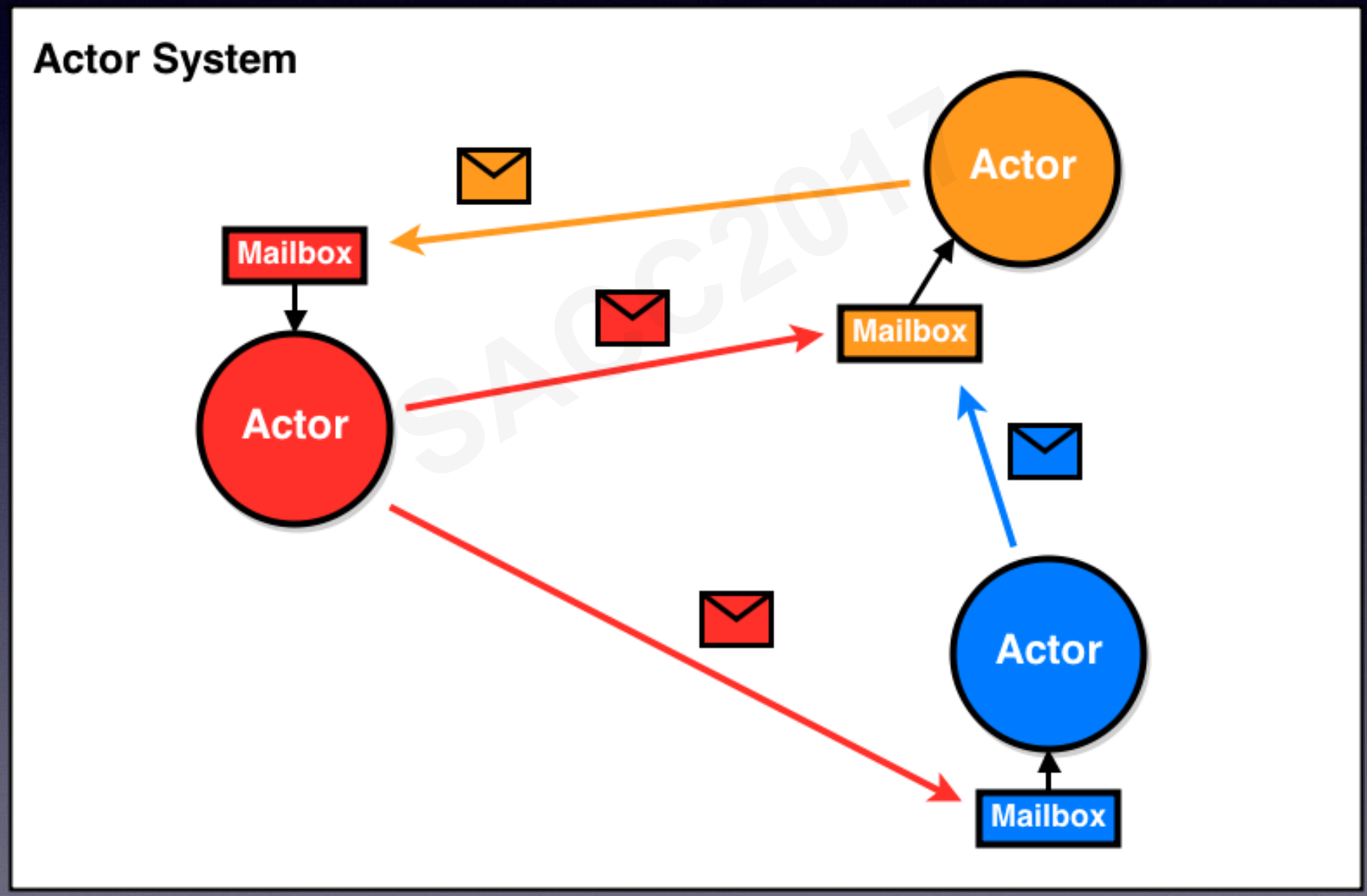
- From Lightbend, a Scala company
- Opinionated Microservices Framework
- Early adoption phase
- Aims for micro-service system
- Based on actor model

Lagom Technology Stack

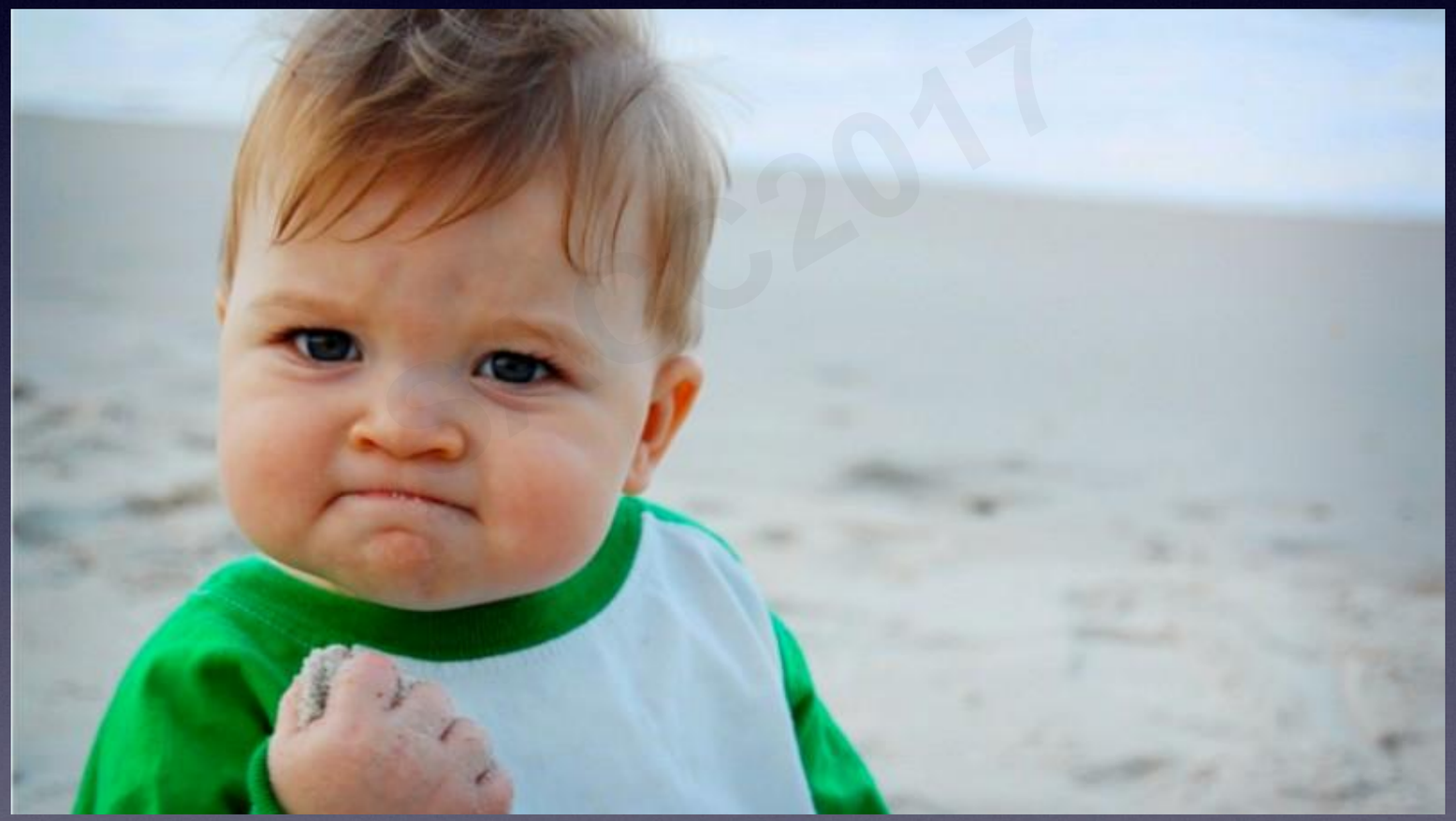
API Overview

- Service API
  - Asynchronous streaming between services
  - Synchronous request-response calls
- Persistence API
  - Event-sourced persistent, CQRS read-side support
  - Persistent entities managed automatically across a cluster of nodes
  - Persistent entity is an actor
  - Cassandra
- Message Broker API
  - Publish-subscribe model
  - Share data via topics
  - Push and pull, back pressure
  - Kafka

Actor Model



Let’s Demo



Service API

Declaration of Service Descriptors

```
/**
 * The friend service.
 */
public interface FriendService extends Service {

  ServiceCall<NotUsed, User> getUser(String userId);

  ServiceCall<User, Done> createUser();

  ServiceCall<FriendId, NotUsed> addFriend(String userId);

  ServiceCall<NotUsed, PSequence<String>> getFollowers(String userId);

  @Override
  default Descriptor descriptor() {
    // @formatter:off
    return named( s: "friendservice").withCalls(
            Service.restCall(Method.GET, s: "/api/users/:userId", this::getUser),
            Service.pathCall( s: "/api/users", this::createUser),
            Service.pathCall( s: "/api/users/:userId/friends", this::addFriend),
            Service.pathCall( s: "/api/users/:userId/followers", this::getFollowers)
      ).withAutoAcl(true);
    // @formatter:on
  }
}
```

Service API

Implementation of HelloService

```
public class FriendServiceImpl implements FriendService {

  private final PersistentEntityRegistry persistentEntities;
  private final CassandraSession db;

  @Inject
  public FriendServiceImpl(PersistentEntityRegistry persistentEntities, ReadSide readSide,
      CassandraSession db) {
    this.persistentEntities = persistentEntities;
    this.db = db;

    persistentEntities.register(FriendEntity.class);
    readSide.register(FriendEventProcessor.class);
  }


  @Override
  public ServiceCall<User, Done> createUser() {
    return request -> {
      return friendEntityRef(request.userId).ask(new CreateUser(request))
          .thenApply(ack -> Done.getInstance());
    };
  }

  @Override
  public ServiceCall<FriendId, NotUsed> addFriend(String userId) {
    return request -> {
      return friendEntityRef(userId).ask(new AddFriend(request.friendId))
          .thenApply(ack -> NotUsed.getInstance());
    };
  }
```

Persistence API

CreateUser Command handler

```
public class FriendEntity extends PersistentEntity<FriendCommand, FriendEvent, FriendState> {

  @Override
  public Behavior initialBehavior(Optional<FriendState> snapshotState) {

    BehaviorBuilder b = newBehaviorBuilder(snapshotState.orElse(new FriendState(Optional.empty())));

    b.setCommandHandler(CreateUser.class, (cmd, ctx) -> {
      if (state().user.isPresent()) {
        ctx.invalidCommand("User " + entityId() + " is already created");
        return ctx.done();
      } else {
        User user = cmd.user;
        List<FriendEvent> events = new ArrayList<~>();
        events.add(new UserCreated(user.userId, user.name));
        for (String friendId : user.friends) {
          events.add(new FriendAdded(user.userId, friendId));
        }
        return ctx.thenPersistAll(events, () -> ctx.reply(Done.getInstance()));
      }
    });

    b.setEventHandler(UserCreated.class,
        evt -> new FriendState(Optional.of(new User(evt.userId, evt.name))));
```

Persistence API

AddFriend Command and GetUser Command Handler

```
b.setCommandHandler(AddFriend.class, (cmd, ctx) -> {
  if (!state().user.isPresent()) {
    ctx.invalidCommand("User " + entityId() + " is not  created");
    return ctx.done();
  } else if (state().user.get().friends.contains(cmd.friendUserId)) {
    ctx.reply(Done.getInstance());
    return ctx.done();
  } else {
    return ctx.thenPersist(new FriendAdded(getUserId(), cmd.friendUserId), evt ->
      ctx.reply(Done.getInstance()));
  }
});

b.setEventHandler(FriendAdded.class, evt -> state().addFriend(evt.friendId));

b.setReadOnlyCommandHandler(GetUser.class, (cmd, ctx) -> {
  ctx.reply(new GetUserReply(state().user));
});
```

Persistence API

CQRS Read Side Support Definition

```
public class FriendEventProcessor extends ReadSideProcessor<FriendEvent> {

  private final CassandraSession session;
  private final CassandraReadSide readSide;

  private PreparedStatement writeFollowers = null; // initialized in prepare

  @Inject
  public FriendEventProcessor(CassandraSession session, CassandraReadSide readSide) {
    this.session = session;
    this.readSide = readSide;
  }

  private void setWriteFollowers(PreparedStatement writeFollowers) { this.writeFollowers = writeFollowers; }

  @Override
  public PSequence<AggregateEventTag<FriendEvent>> aggregateTags() {
    return TreePVector.singleton(FriendEventTag.INSTANCE);
  }

  @Override
  public ReadSideHandler<FriendEvent> buildHandler() {
    return readSide.<>builder( s: "friend_offset")
            .setGlobalPrepare(this::prepareCreateTables)
            .setPrepare((ignored) -> prepareWriteFollowers())
            .setEventHandler(FriendAdded.class, this::processFriendChanged)
            .build();
  }
```

Persistence API

View update based on FriendAdded event

```
@Override
public ReadSideHandler<FriendEvent> buildHandler() {
  return readSide.<~>builder( s: "friend_offset")
          .setGlobalPrepare(this::prepareCreateTables)
          .setPrepare((ignored) -> prepareWriteFollowers())
          .setEventHandler(FriendAdded.class, this::processFriendChanged)
          .build();
}

private CompletionStage<Done> prepareCreateTables() {
  // @formatter:off
  return session.executeCreateTable(
       stmt: "CREATE TABLE IF NOT EXISTS follower ("
        + "userId text, followedBy text, "
        + "PRIMARY KEY (userId, followedBy))");
  // @formatter:on
}

private CompletionStage<Done> prepareWriteFollowers() {
  return session.prepare( stmt: "INSERT INTO follower (userId, followedBy) VALUES (?, ?)").thenApply(ps -> {
    setWriteFollowers(ps);
    return Done.getInstance();
  });
}

private CompletionStage<List<BoundStatement>> processFriendChanged(FriendAdded event) {
  BoundStatement bindWriteFollowers = writeFollowers.bind();
  bindWriteFollowers.setString("userId", event.friendId);
  bindWriteFollowers.setString("followedBy", event.userId);
  return completedStatement(bindWriteFollowers);
}
```

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Dublin, Ireland

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