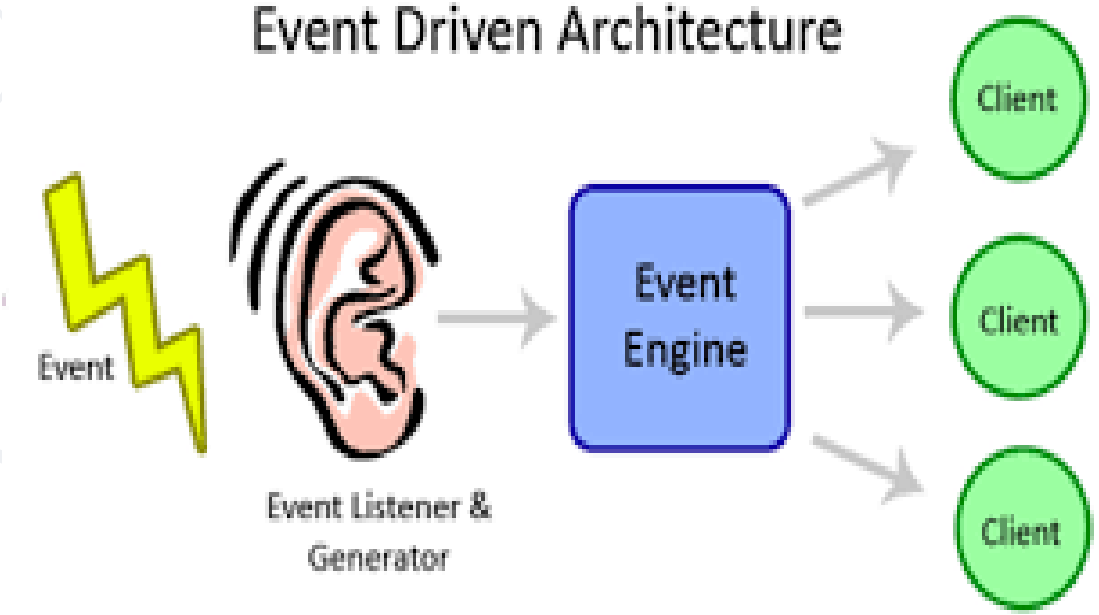
Events in Spring



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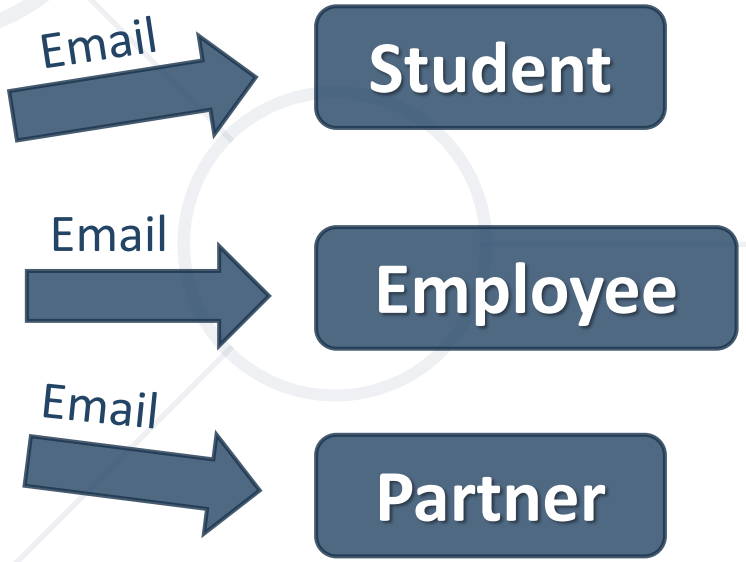
What Are the Events

Observer Pattern in JAVA

- Observer pattern is a **behavioral pattern**
- Provides **one object** with a loosely coupled method of **informing multiple objects** of property changes



Events in Spring

- The core of Spring is the **ApplicationContext**, which manages the complete **life cycle** of the beans
- The ApplicationContext **publishes** certain types of **events** when **loading** the beans
- Spring's event handling is **single-threaded** so if an event is published, until all the receivers get the message, the **processes** are **blocked** and the flow will not continue

Spring Build-in Events (1)

- **ContextRefreshedEvent**
  - published when the ApplicationContext is either initialized/refreshed
- **ContextStartedEvent**
  - published when the ApplicationContext is started using the **start()**
- **ContextStoppedEvent**
  - published when the ApplicationContext is stopped using the **stop()**

Spring Build-in Events (2)

- **ContextClosedEvent**
  - published when the ApplicationContext is closed using the **close()**
- **RequestHandledEvent**
  - Web-specific event telling all beans that an HTTP request has been serviced

Listening for Events

Listening for Events

- There are ways to listens for events in Spring:
  - **Implement** the **ApplicationListener** interface
    - Which has just one method **onApplicationEvent()**
  - Use **@EventListener()**
    - Annotate on a method
- Some of the events are **published too early** for a listener to be found via annotations and the application context. Then you must **register them** in the Spring Application instance

Using ApplicationListeners Example

- Implementing **ApplicationListener** interface

```
@Component
public class EventsListener implements
ApplicationListener<SpringApplicationEvent> {
    @Override
    public void onApplicationEvent(SpringApplicationEvent e) {
        System.out.printf("Event-%s!%n",
                e.getClass().getSimpleName());
    }}
```

Using @EventListener

- Use `@EventListener()` with specific event class

```
@EventListener(ApplicationStartingEvent.class)
public void startEvent(){
        System.out.println("Starting Event!"); }

@EventListener(RequestHandledEvent.class)
public void requestHandler(){
        System.out.println("Request Handler event!");
}
```

Listening for Multiple Events

- Use `@EventListener(classes = {EventOne.class, EventTwo.class})` to listen for multiple events

```
@EventListener(classes = {MyEventOne.class,
MyEventTwo.class})
public void handleTwoEvents(){
        System.out.println("Listens for two events!");
}
```

Using Lambda When Adding Listener

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- Using **lambda expressions** with specific event class

```
@SpringBootApplication
public class DemoForCustomEventsApplication {
    public static void main(String[] args) {
        SpringApplication springApp = new SpringApplication
                        (DemoForCustomEventsApplication.class);
        springApp.addListeners((ApplicationContextInitializedEvent e) -> {
                System.out.println("App context init event"); });
        springApp.run(args);
    }
}
```

Register Events in Spring Application

- **Remember** that for some event is published too early for a listener to be found and needs to **be added**

```
@SpringBootApplication
...
    springApp.addListeners(new MyEventsClass());
    springApp.run(args);
...
```

Transaction Bound Events (1)

- The listener of an event to a **phase** of the **transaction**
- Transaction **phases**:
  - **AFTER_COMMIT** - The default, used to fire the event if the transaction has **completed successfully**
  - **AFTER_ROLLBACK** - when transaction has **rolled back**
  - **AFTER_COMPLETION** - when transaction has **completed**
  - **BEFORE_COMMIT** - used to fire the event right **before** transaction **commit**

Transaction Bound Events (2)

- An example of Transaction Bound Event, that will fire before transaction commit

```
@TransactionalEventListener(phase =
TransactionPhase.BEFORE_COMMIT)
public void transactionEventListener
                        (MyCustomEvent event){
    System.out.println("Hit before transaction commit!");
}
```

Creating Custom Event

Creating Custom Event

- To create and publish our custom event, there is some steps that we need to follow:
  - **Create** our custom **event class** that **extends ApplicationEvent** class
  - **Create publisher**, that publish our new event
  - **Add event listener**, that listens for our new event

Create Our Custom Event Class

- Create our event class, that extends ApplicationEvent

```
public class MyCustomEvent extends ApplicationEvent {
    private String msg;
    public MyCustomEvent(Object source, String msg) {
        super(source);
        this.msg = msg;
    }
       ... }
```

Create Publisher

- Create a publisher that publish our custom event and inject in him the ApplicationEventPublisher object

```
@Component
public class MyPublisher {
    @Autowired // It is better to inject in constructor
    private ApplicationEventPublisher appEventPublisher;
    public void publishEvent(String message) {
        MyCustomEvent myEvent = new MyCustomEvent(this, message);
        appEventPublisher.publishEvent(myCustomEvent);
    } } ;
```

Create Listener

- Create listeners, already explain the different ways

```
@Component
public class Listeners {
    @EventListener(MyCustomEvent.class)
    public void listener(MyCustomEvent myCustomEvent) {
        System.out.printf("Custom event listeners with message
                                    -%s!%n", myCustomEvent.getMsg());
    }
}
```

Scheduling Tasks

Scheduling Tasks

- **Scheduling** is a process of executing the tasks for the **specific time** period
- Spring Boot provides a good support to write a scheduler on the Spring applications
- We can specify the time period by different ways:
  - Using **Cron**
  - Using **Fixed Rate**
  - Using **Fixed Delay**

Scheduled Task Using Cron

- Java **Cron expressions** are used to configure the instances of **CronTrigger**
- The *cron* expression consists of **six fields**:

```
<second><minute><hour><day-of-month><month><day-of-week>
```

```
@Scheduled(cron = "0 5 * * * ?")
public void showTimeWithCron(){
        System.out.println(LocalDateTime.now());
}
```

Scheduled Task Using Fixed Rate

- **Fixed Rate** scheduler is used to execute the tasks at the **specific time**
- It **does not wait** for the completion of **previous task**
- The values should be in **milliseconds**

```
@Scheduled(fixedRate = 5000)
    public void showTimeWithFixedRate() {
        System.out.println(LocalDateTime.now());
}
```

Scheduled Task Using Fixed Delay

- **FixedDelay** is the time between tasks
- The **initialDelay** is the time after which the task will be executed the first time after the initial delay value
- It **wait** for the completion of **previous task**

```
@Scheduled(fixedDelay = 5000, initialDelay = 10000)
public void showTimeWithFixedDelay() {
        System.out.println(LocalDateTime.now());
}
```

Enable Scheduling

- The **@EnableScheduling** annotation is used to **enable** the **scheduler** for your application.
- This annotation should be added into the main Spring Boot application class file.

```
@SpringBootApplication
@EnableScheduling
public class MyApp {
   public static void main(String[] args) {
      SpringApplication.run(MyApp.class, args); } }
```

Caching Data

Caching

- If you using Spring Boot, then simply use the **spring-boot-starter-cache** dependency
- Under the hood, the starter brings the spring-context-support module

```
<dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-cache</artifactId>
</dependency>
```

Enable Caching

- When using Spring Boot, the **@EnableCaching** annotation would register the **ConcurrentMapCacheManager**
- No need for separate Bean declaration
- Simply adding the **@EnableCaching** annotation to any of the configuration classes

```
@Configuration
@EnableCaching
public class MyConfig {
        // Some configurations }}
```

@Cacheable (1)

- Use **@Cacheable** to demarcate methods that are cacheable
- Result is **stored** in the **cache** and on subsequent invocations (with the same arguments), the value in the cache is returned **without** having to actually **execute** the method
- the **findAllStudents** method is associated with the cache named **students**

```
@Cacheable("students")
public List<Student> findAllStudents() { //...  }
```

@Cacheable (2)

- Custom Cache Resolution

```
@Cacheable("students", cacheManager = "myCacheManager")
public List<Student> findAllStudents() { //...  }
```

- Conditional Caching

```
@Cacheable("student", condition = "#avg > 4")
public List<Student> findStudentsByAvgScore(Double avg) {
//...
}
```

@CachePut

- When the **cache** needs to be **updated** without interfering with the method execution
- The **method** is **always executed** and its result is placed into the cache
- It supports the same options as **@Cacheable**

```
@CachePut("students")
public List<Student> findAll() {
        //...    }
```

@CacheEvict

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- This process is useful for **removing** stale or unused data from the cache
- Using the **allEntries** attribute to evict all entries from the cache

```
@CacheEvict(cacheNames="books", allEntries=true)
public void loadStudents() {
        //...
}
```

Customize The auto-configured CacheManager

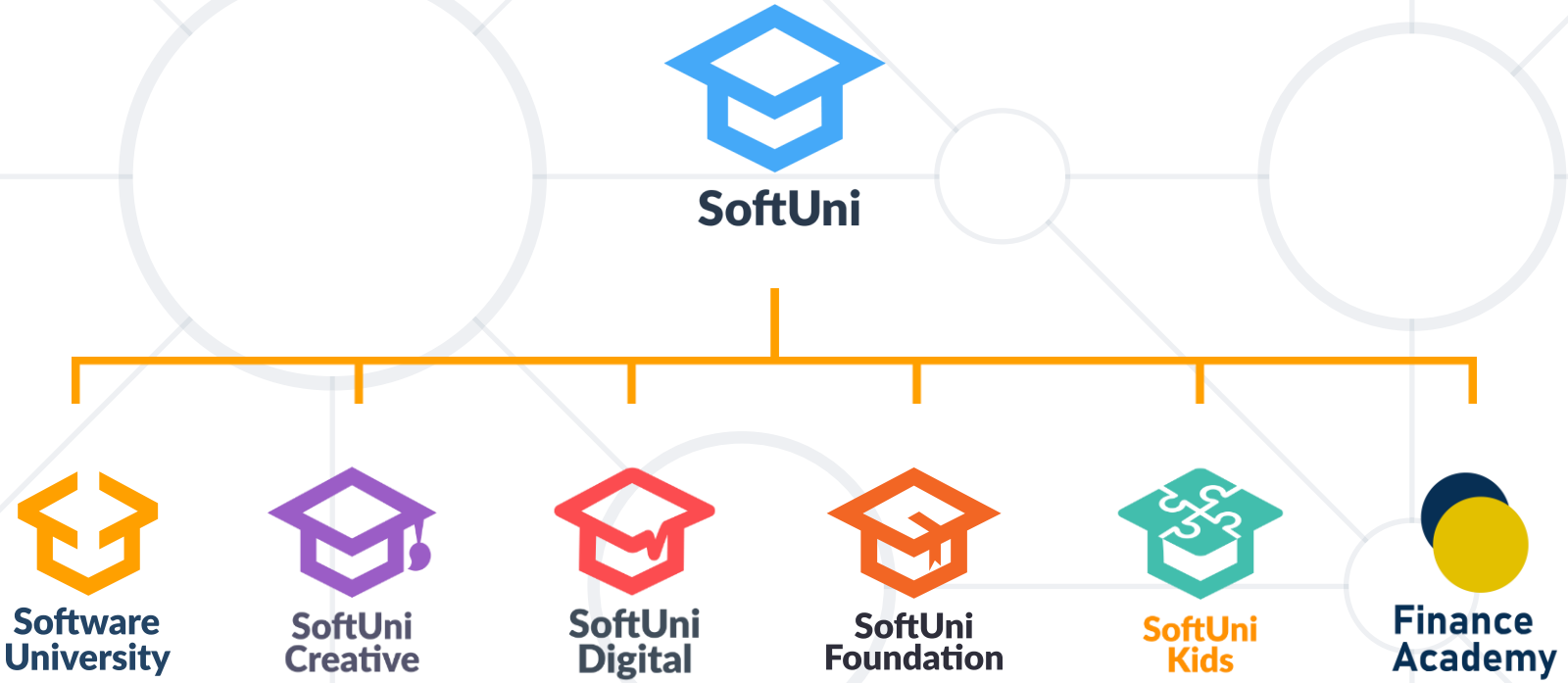
- To customize the CacheManager we must implement **CacheManagerCustomizer<ConcurentMapCacheManager>**
- Create Bean CacheManager that returns new **ConcurentMapChacheManager**

```
@Component
public class MyCacheCustomizer implements
        CacheManagerCustomizer<ConcurrentMapCacheManager> {
        @Override
        public void customize(ConcurrentMapCacheManager cacheM){
          cacheM.setCacheNames(asList("students","courses"));
        }  }
```

Summary

- What are the **build-in** Events in Spring
  - How easy to use them
- How to make **listeners** for Events
  - Different ways to implement it
- How to create and use our **custom Events**
- Creating **Scheduled tasks** and **Caching** data

Questions?



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