



HOLLYWOOD

M8 (a) – Inversion of Control

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Image Source: https://c1.staticflickr.com/9/8363/29350436510_efe6626995_b.jpg

Objective

- Be able to Use Callback to achieve decoupling
- Be able to use the Observer design pattern effectively;
- Event Handling in GUI applications
- Understand the concept of an application framework;
- Understand the Model-View-Controller Decomposition;
- Be able to use the Visitor Design Pattern effectively;
- Be able to determine when to used different design patterns effectively.

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Job Hunting Example



```
public interface JobSeeker
{
    public void noticeMe();
}
```



```
public interface JobProvider
{
    public void acceptApplication(JobSeeker pJobSeeker);
    public void noticeCandidates();
}
```



```
public class Company implements JobProvider
{
    private JobSeeker aJobseeker;
    private boolean applicationAccepted=false;
    @Override
    public void acceptApplication(JobSeeker pJobseeker)
    {
        assert pJobseeker != null;
        aJobseeker = pJobseeker;
        applicationAccepted = true;
    }
    @Override
    public void noticeCandidates() {
        if(applicationAccepted)
            aJobseeker.noticeMe();
    }
}
```

Callback method



```
public class UndergradJobSeeker implements JobSeeker
{
    private int aSkillLevel = 5;

    @Override
    public void noticeMe()
    {
        practiceDesignPatterns();
    }

    private void practiceDesignPatterns()
    {
        aSkillLevel++;
    }
}
```

Provide the interview schedule to JobSeeker?

```
public class Company implements JobProvider
{
    private LocalDateTime aInterviewSchedule;
    .....
    @Override
    public void noticeCandidates() {
        if(applicationAccepted)
            aJobseeker.noticeMe(); //Callback method
    }

    /**
     * Setup interview date is three days from today
     */
    private void scheduleInterview() {
        aInterviewSchedule = LocalDateTime.now().plusDays(3);
    }
}
```


Provide the interview schedule to JobSeeker?

```
public class Company implements JobProvider
{
    private LocalDateTime aInterviewSchedule;
    .....
    @Override
    public void noticeCandidates() {
        if(applicationAccepted)
            aJobseeker.noticeMe(aInterviewSchedule); //Callback method
    }

    /**
     * Setup interview date is three days from today
     */
    private void scheduleInterview() {
        aInterviewSchedule = LocalDateTime.now().plusDays(3);
    }
}
```

Provide the interview schedule to JobSeeker?

```
public class Company implements JobProvider
{
    private LocalDateTime aInterviewSchedule;
    .....
    @Override
    public void noticeCandidates() {
        if(applicationAccepted)
            aJobseeker.noticeMe(this); //Callback method
    }
    /**
     * Setup interview date is three days from today
     */
    private void scheduleInterview() {
        aInterviewSchedule = LocalDateTime.now().plusDays(3);
    }
}
```

Plus, a public method to get aInterviewSchedule

Activity 1: Add
additional functions
to the current design.

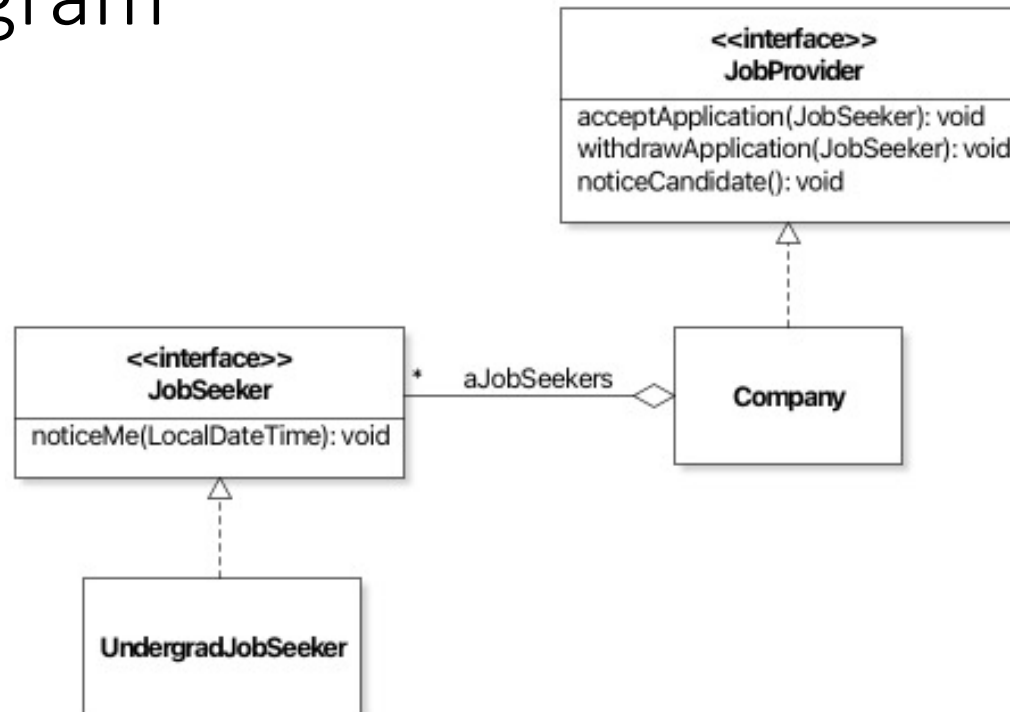


JOBSEEKER CAN
WITHDRAW
APPLICATION



JOBPROVIDER ACCEPT
MORE THAN ONE
APPLICATIONS

Class diagram



JobSeeker and JobProvider are loosely-coupled

Observer Pattern

- Intent

Define a one-to-many dependency between objects so that when one object changes state, all its dependents are notified and updated automatically.

- Participants:

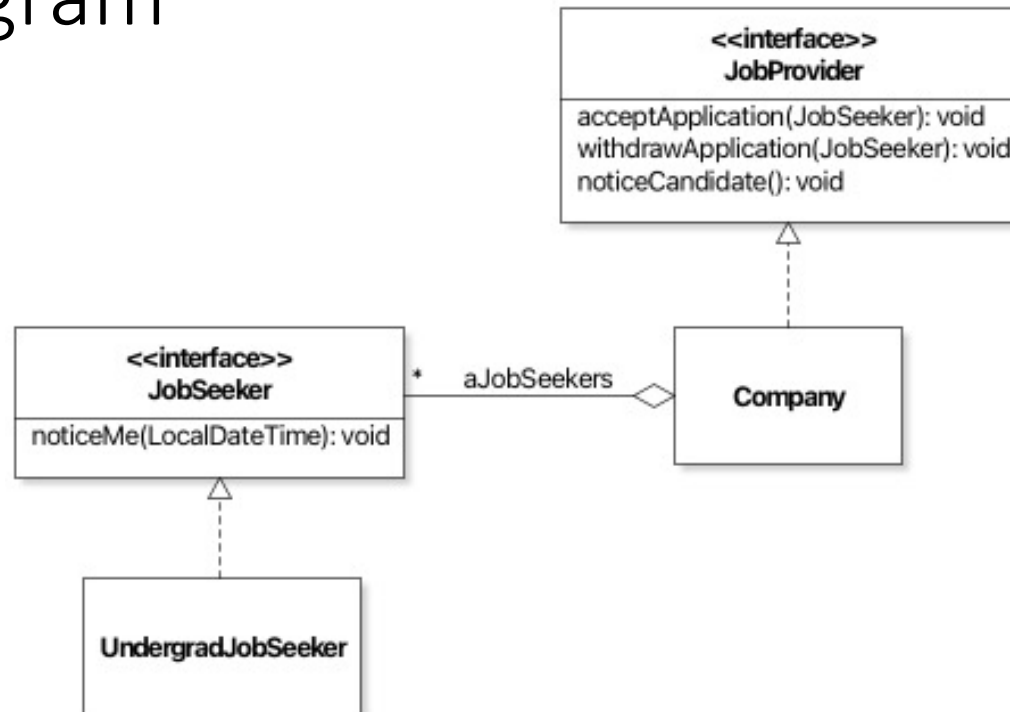
- Subject

- Observer

- Concrete Subject

- Concrete Observer

Class diagram



JobSeeker and JobProvider are loosely-coupled

Activity 2: Matching Participants with (potential) Responsibilities

Subject

Observer

Concrete Subject

Concrete Observer

defines an updating interface for objects that should be notified of changes in a subject.

implements the updating interface to keep its state consistent with the subject's.

stores state that should stay consistent with the subject's.

maintains a reference to a ConcreteSubject object.

sends a notification to its observers when its state changes.

provides an interface for attaching and detaching Observer objects

stores state of interest to ConcreteObserver objects.

Observer Pattern for more complex situations

- Different departments/teams in the company need the information of jobseekers:

Design team in SE development department

Needs candidates who are specialized in design with minimal 5-year experience

Testing team in SE development department

Needs candidate who are specialized in testing with reference letters.

HR departments

Performs analysis on the statistics of all job seekers

ApplicationObserver


```
public interface JobSeeker
{
    public void noticeMe(LocalDateTime date);
    public TechSpecialty getTechSpecialty();
    public int getYearOfExperience();
    public boolean haveReference();
}
```

provides an interface for attaching and detaching Observer objects?

```
public class Company implements JobProvider, ApplicationPool
{
```

```
List<JobSeeker> aJobseekers;
```

What is the state of interest for those teams

```
boolean acceptApplication=false;
```

```
Map<JobSeeker, LocalDateTime> aInterviewSchedules;
```

```
private List<ApplicationObserver> aApplicationObservers;
```

```
@Override
```

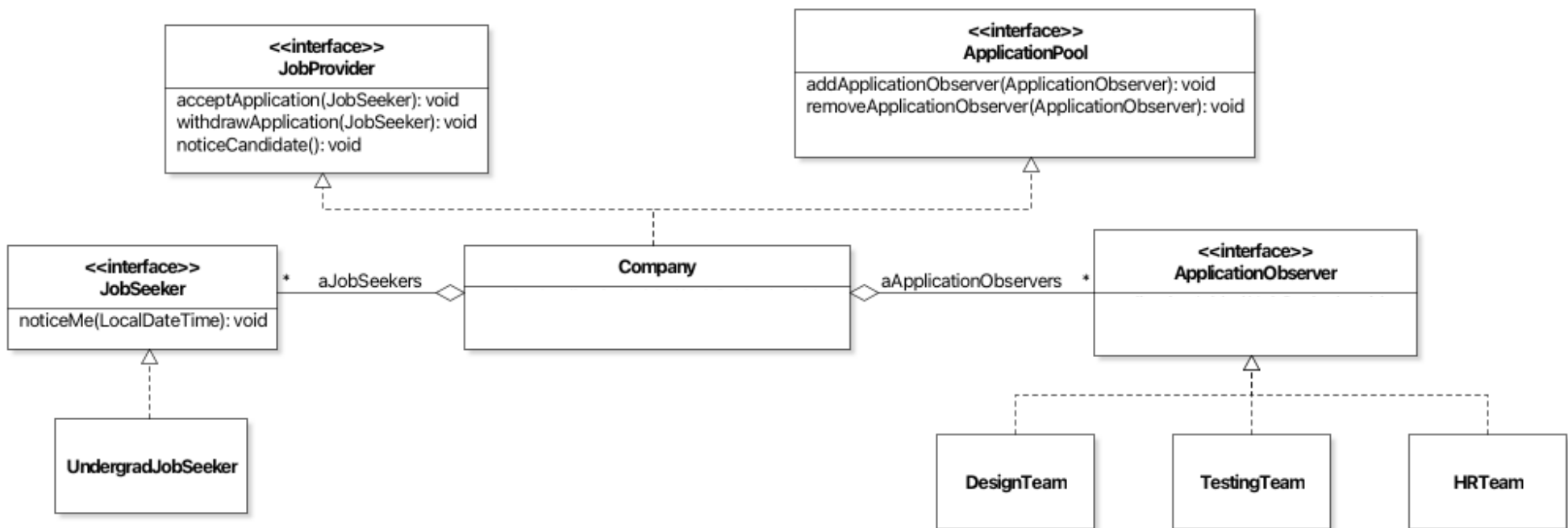
```
public void addApplicationObserver(ApplicationObserver pApplicationObservers)
{
```

```
}
```

```
@Override
```

```
public void removeApplicationObserver(ApplicationObserver pApplicationObservers)
{
```

```
}
```



When and how to send Notification

- Requirements:

Design team in SE development department

Needs candidates who are specialized in design with minimal 5-years experience

Testing team in SE development department

Needs candidate who are specialized in testing with reference letters.

HR departments

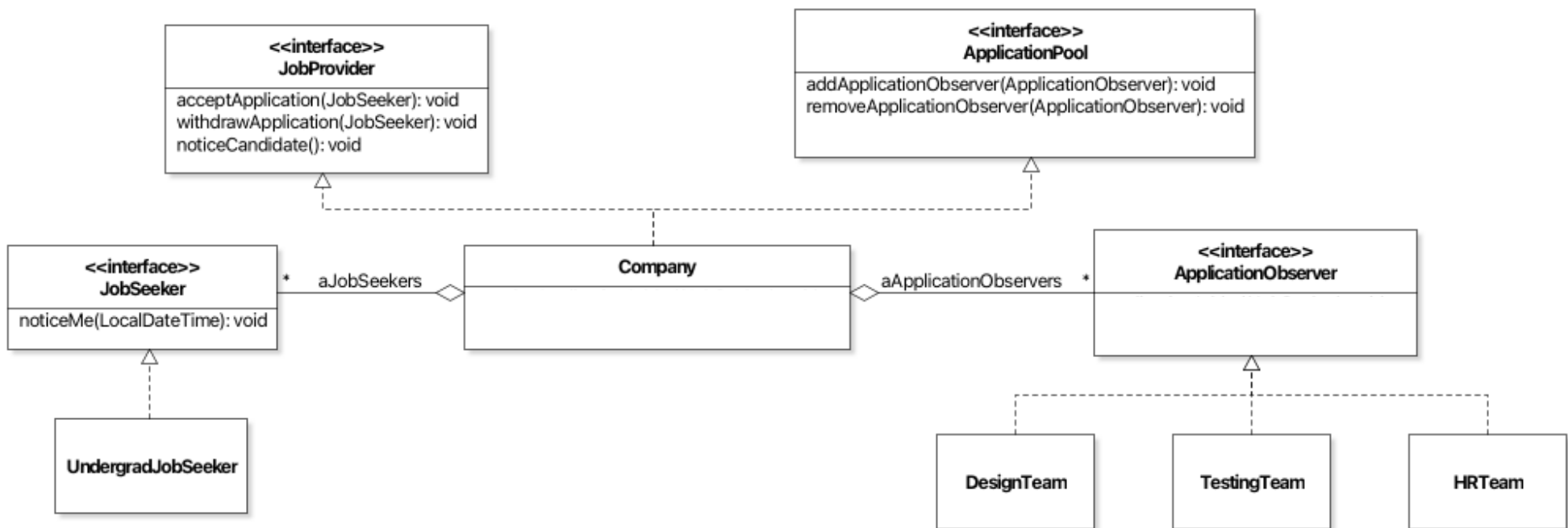
Performs analysis on the statistics of all job seekers

When and how to send Notification

Who should trigger the notification?

`ApplicationPool` sends notification as soon as an application is added or removed.

`ApplicationPool` provides a notification method to be called by client



When and how to send Notification

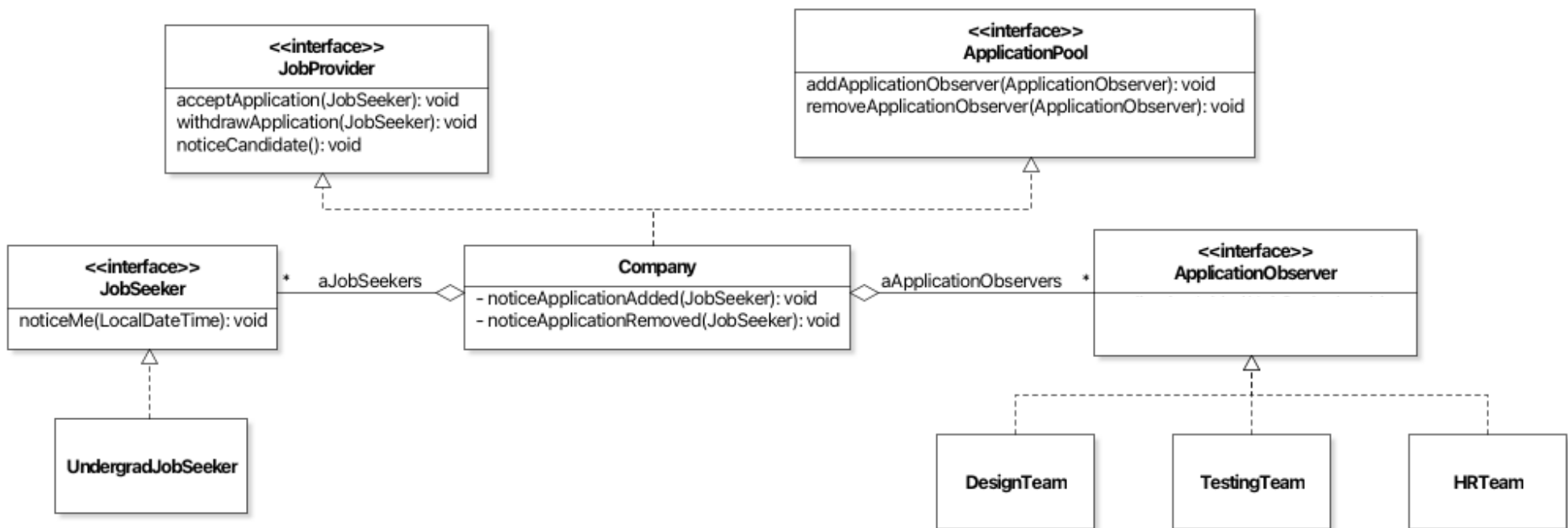
Data Flow Strategy?

`ApplicationPool` sends observers detailed information about the change, whether `ApplicationObserver` want it or not

Push model

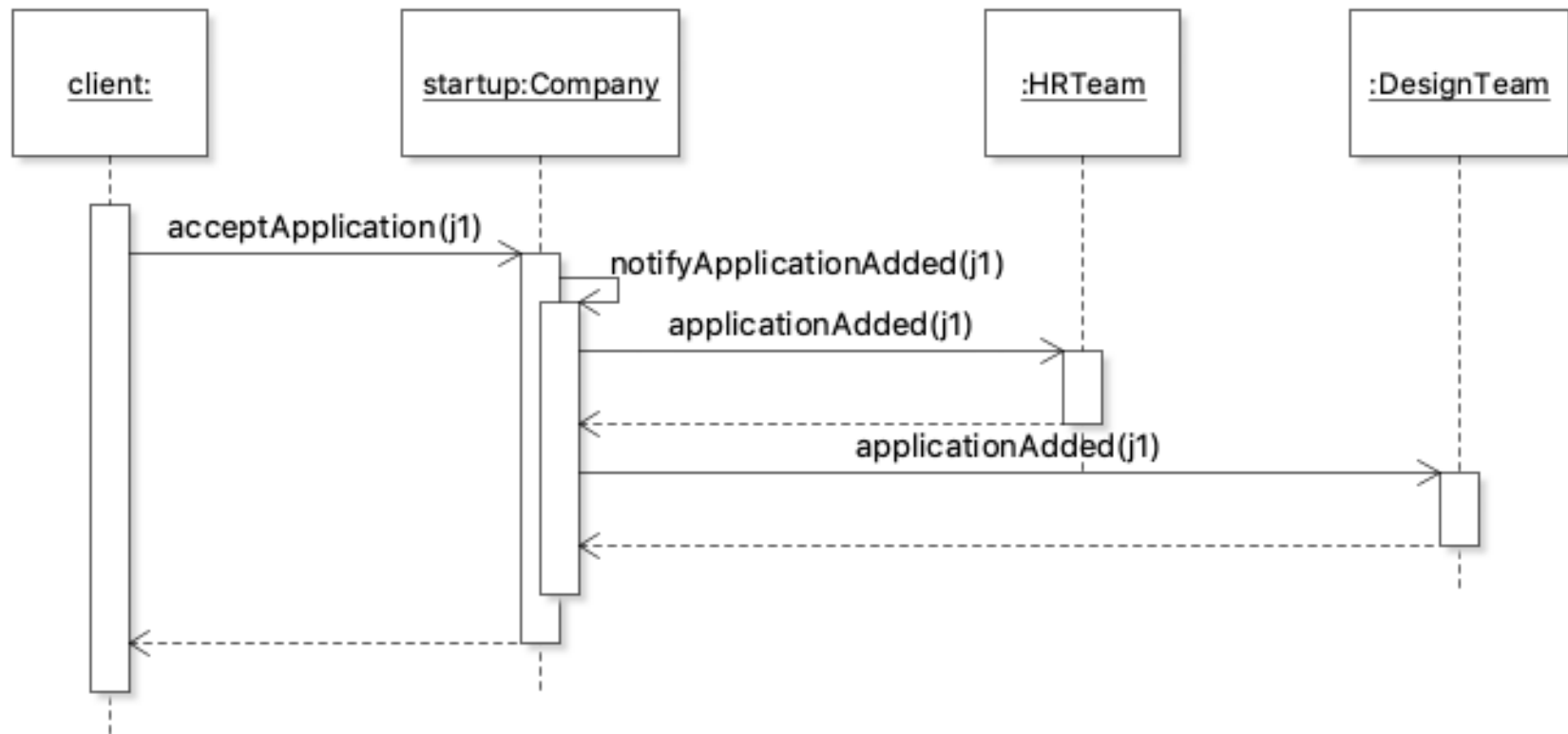
`ApplicationPool` sends the most minimal notification, and `ApplicationObserver` ask for details explicitly thereafter.

Pull model



Activity3: Draw sequence diagram

```
Company startup = new Company("Frontier");  
ApplicationObserver hrTeam = new HRTeam();  
ApplicationObserver designTeam = new DesignTeam();  
startup.addApplicationObserver(hrTeam);  
startup.addApplicationObserver(designTeam);  
  
JobSeeker j1 = new UndergradJobSeeker(TechSpecialty.UI_Design, 10, true);  
  
startup.acceptApplication(j1);    <= When this statement is executed
```



Push model

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Event

- A notification that something interesting has happened.
- Examples in Graphic Interface?

Move a mouse

User click a button

Press a key

Mouse press and drag

Menu item is selected

Window is closed

Popup window is hidden



How to capture event and act accordingly

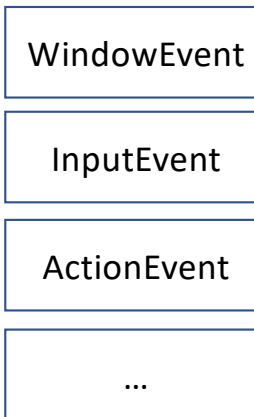
- Define an event handler

implement

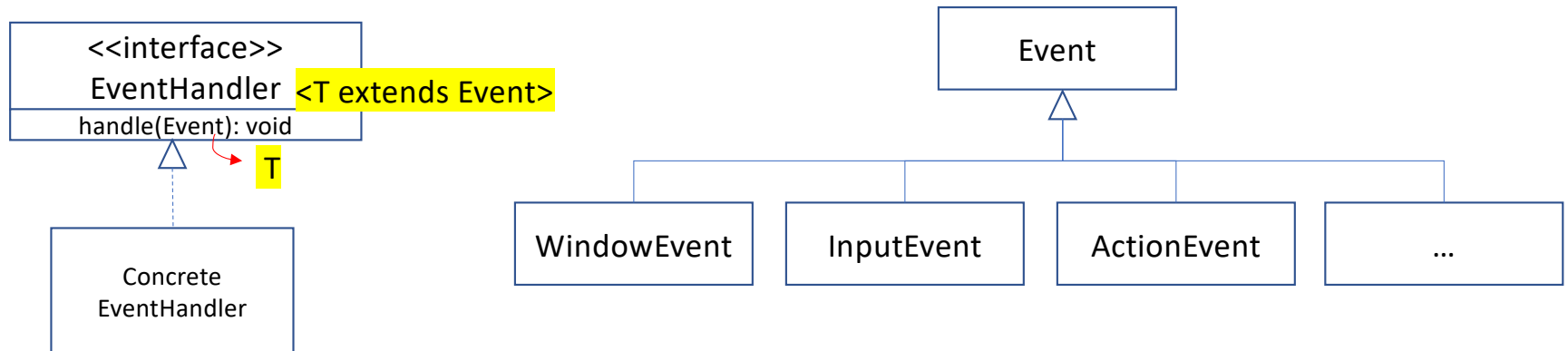
Interface EventHandler<T extends Event>

void handle(T event) **<= Callback method**

Invoked when a specific event of the type for which this handler is registered happens.



How to capture event and act accordingly



```
Public class MyEventHandler implements EventHandler<ActionEvent>
{
    @Override
    public void handle(ActionEvent event)
    {
        //Event Handling steps
    }
}
```

How to capture event and act accordingly

- Instantiate and register the event handler

```
MyEventHandler eventHandler = new MyEventHandler();
```

```
Button btn = new Button();
```

```
btn.setOnAction(eventHandler);
```



Button

How to capture event and act accordingly

- Instantiate and register the event handler

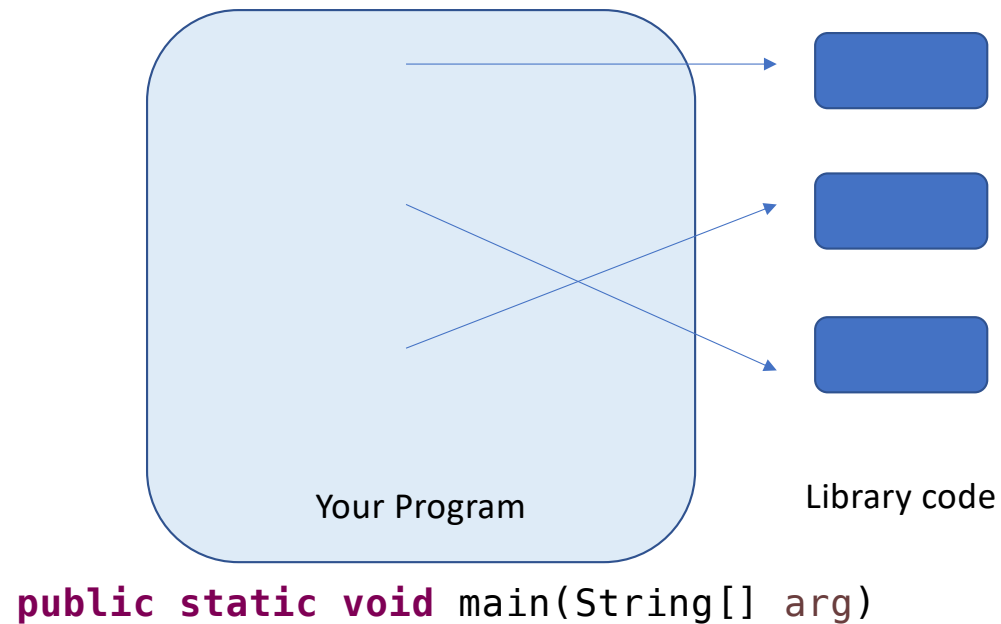
```
Button btn = new Button();
```

anonymous class

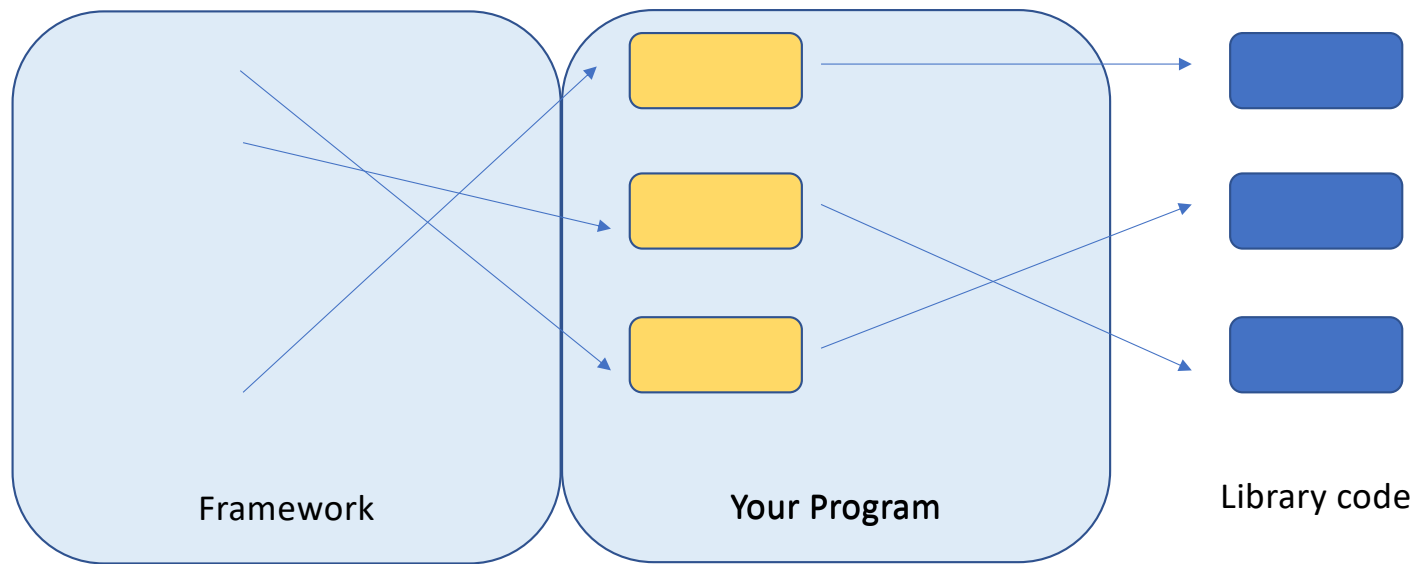
Button

```
btn.setOnAction(new EventHandler<ActionEvent>() {  
    public void handle(ActionEvent event) {  
        //Event Handling steps  
    }  
});
```

Library vs Framework



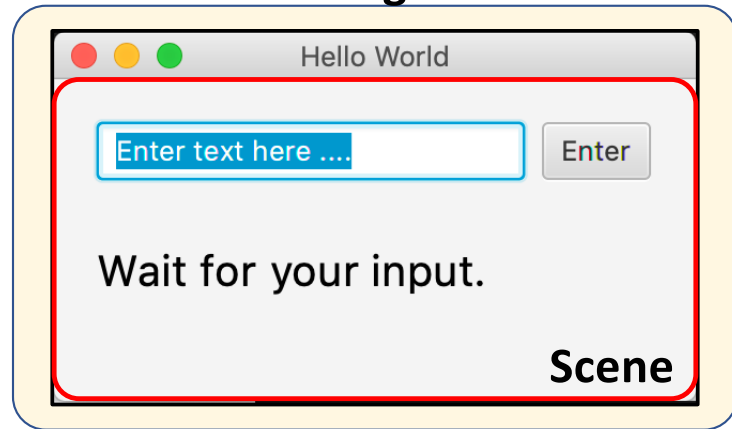
Library vs Framework



Launch JavaFX framework

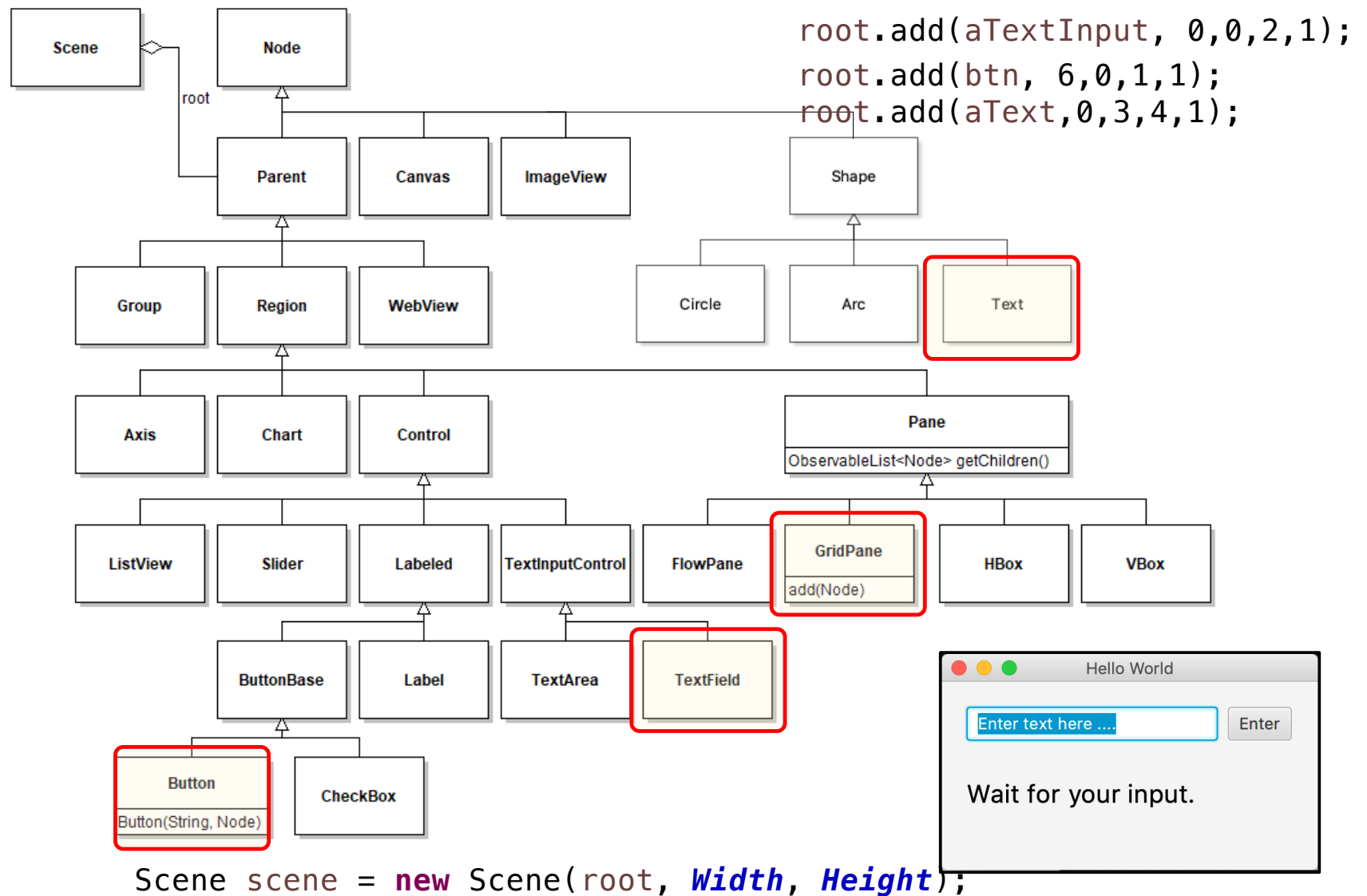
```
public class MyApplication extends Application
{
    /**
     * Launches the application.
     * @param pArgs the command line arguments passed to the
     * application.
     */
    public static void main(String[] pArgs)
    {
        launch(pArgs);
    }
    @Override
    public void start(Stage pPrimaryStage)
    {
        //Setup the stage
        pPrimaryStage.show();
    }
}
```

Stage

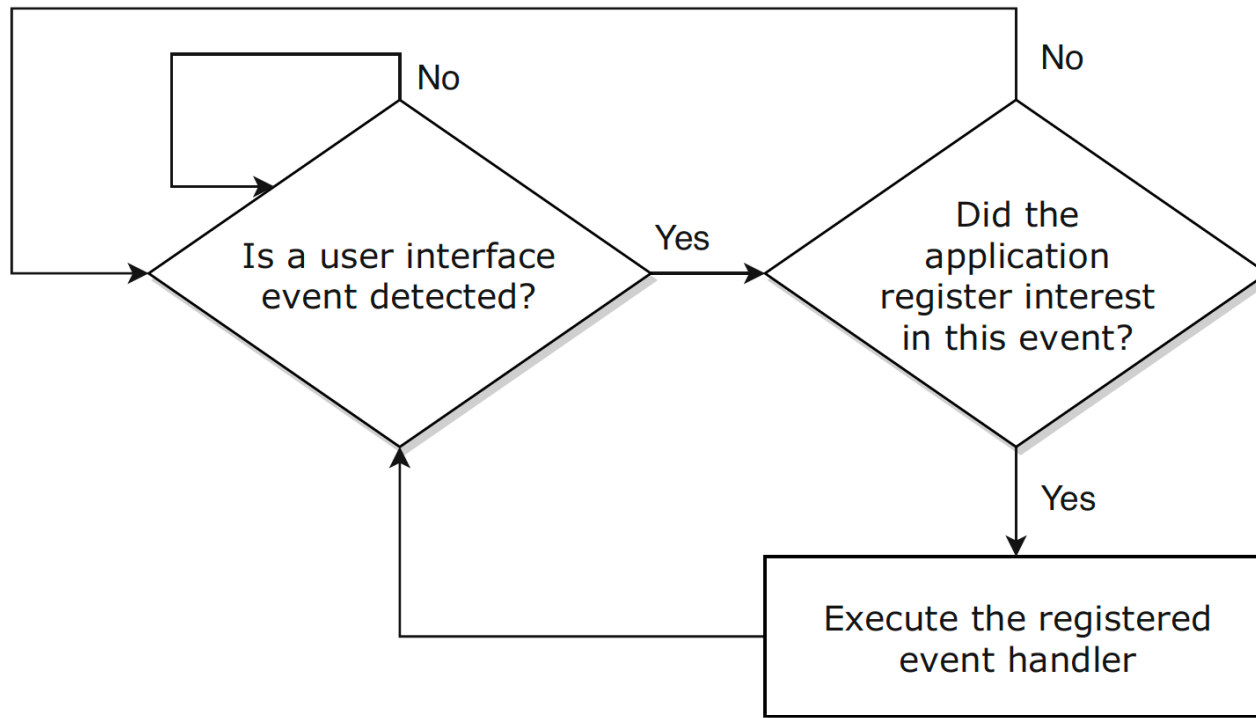


```
GridPane root = new GridPane();  
root.add(aTextInput, 0,0,6,1);  
root.add(btn, 6,0,1,1);  
root.add(aText,0,3,4,1);
```

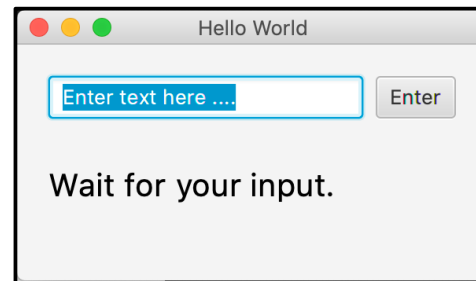
```
Scene scene = new Scene(root, Width, Height)  
primaryStage.setScene(scene);
```



When does event handling happen?



Text Display Demo



```
Text aText = new Text();  
TextField aTextInput = new TextField();  
  
aTextInput.setOnAction((actionEvent) -> aText.setText(aTextInput.getText()));  
  
Button btn = new Button();  
btn.setOnAction((actionEvent) -> aText.setText(aTextInput.getText()));
```


Recap: Objective

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