XAM250

Patterns for Cross Platform Mobile Development

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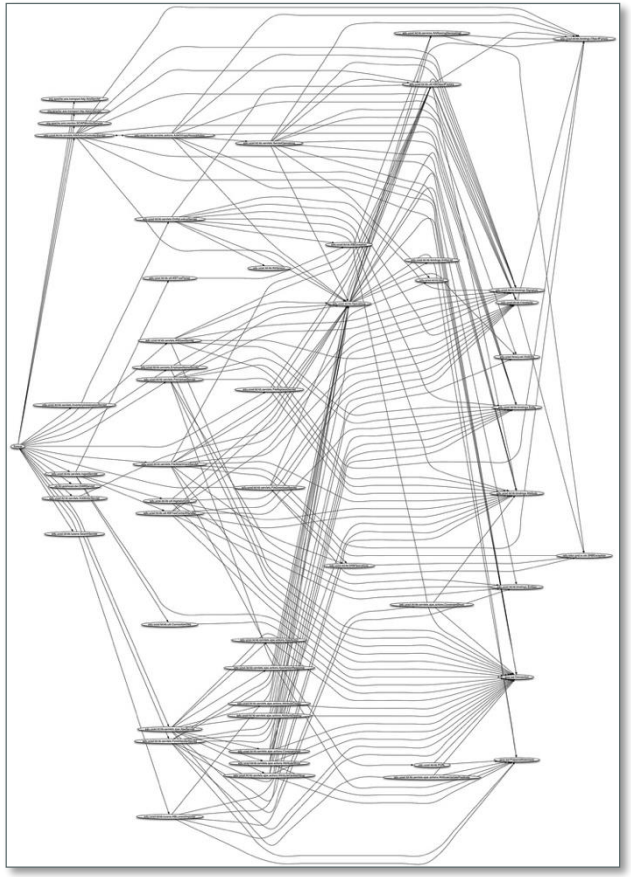
Objectives

1. Locate dependencies using the Factory Pattern
2. Use a Service Locator to register and retrieve dependencies
3. Use an IoC container to automatically inject dependencies



Locate dependencies using the Factory Pattern

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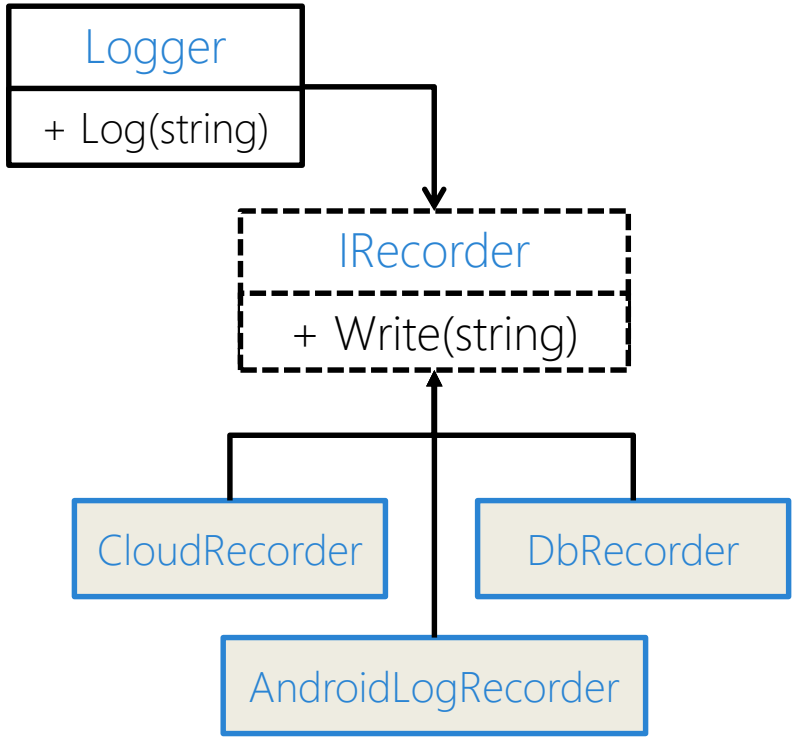
Tasks

1. Define a Factory
2. Assign a dependency to a Factory
3. Access the Factory from shared code

Using Platform Features

- Common problem to require APIs which are platform-specific
  - alerts / notifications
  - file I/O
  - UI marshaling
  - …
- Use Bridge Pattern to decouple implementation; this also enables testing



Example: Alert Service

- For example – every platform has a unique way to notify the user that something has occurred
- Shared code will use the `IAlertService` *abstraction*
- Platform(s) must each *implement abstraction* using their own unique API

```
public interface IAlertService
{
    bool Show(string title,
              string message,
              string yesButton,
              string noButton);
}
```

Using Services from our Shared Code

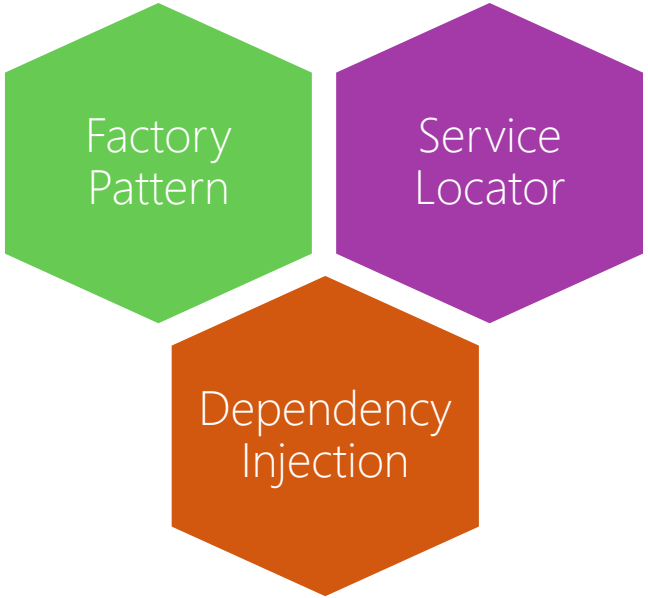
- Once we have abstractions and implementations we need to tie them together

Need to provide the **IAlertService** to the class or method

```
public class TerminatorViewModel
{
    ...
    public void TerminateJohnConner()
    {
        IAlertService alert = ??;
        if (!alert.Show("John Conner Located!",
             "Initiate termination sequence?",
             "Yes", "No")) { ... }
    }
}
```

Locating Services – Inversion of Control

- Several well-known patterns can be used to break dependencies and loosely-couple components together
  - referred to as "Inversion of Control" (IoC)
  - allow reusable components to call into platform-specific code (vs. the other way around)



Factory Pattern

- Dependencies can be located through factories which are responsible for creating the abstractions

Defining a Factory

Delegate is set by platform which returns implementation of the defined **AlertService**

```
public abstract class AlertService
{
    public static Func<AlertService> Create { get; set; }

    public abstract bool Show(string title,
                              string message,
                              string yesButton,
                              string noButton);
}
```

Note: this is just one way to build a Factory, as with any pattern, the implementation can be tailored to the language and platform capabilities

Setting up a Factory

- Each platform would implement the abstraction and then set the factory property to a delegate that returns the implementation

```
class AlertServiceiOS : AlertService
{
    public bool Show(string title, string message,
                     string yesButton, string noButton) { ... }
}
```

```
public override bool FinishedLaunching(...) {
    ...
    AlertService.Create = () => new AlertServiceiOS();
}
```

iOS

Using a Factory

- Then any code in the project that needed that feature would go to the known factory to create the object to be used

```
public void OnReceivedError(string errorMessage)
{
   var alertService = AlertService.Create();
   alertService.Show ("Error",
      $"Got error: {errorMessage}", "OK", null);
   ...
}
```

Now the client doesn't need to know or care about the implementation – it goes to the factory to get one and just uses it from anywhere in the app

Individual Exercise

Use the Factory Pattern to access a dependency from shared code

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Factory Pros and Cons

Pros	Cons
▪ Hides the implementation	▪ Requires separate “factory” for each abstraction (possible maintenance issue)
▪ Easy to use and understand	▪ Client must take dependency against factory
▪ Can decide implementation at runtime and return specific version based on environment	▪ Missing dependencies are not known until runtime

Use a Service Locator to register and retrieve dependencies

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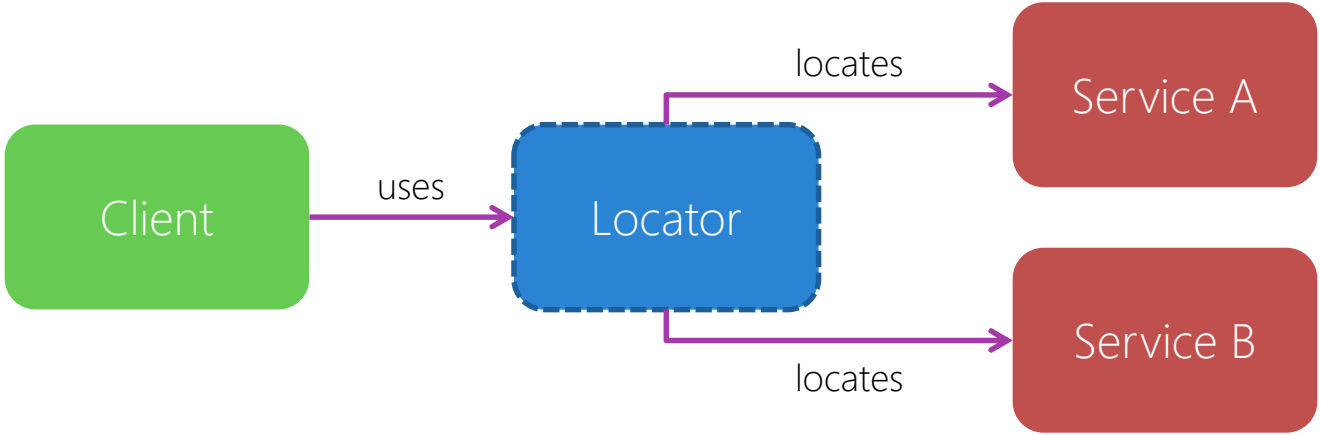
Tasks

1. Define a Service Locator
2. Register dependencies with a Service Locator
3. Resolve dependencies from a Service Locator

Service Locator

- Service Locator pattern uses a container that maps abstractions (interfaces) to concrete, registered types – client then uses locator to find dependencies



Service Locator Example Definition

Uses Singleton pattern to provide global accessibility

```
public sealed class ServiceLocator
{
    public static ServiceLocator Instance { get; set; }

    public void Add(Type contractType, object value);
    public void Add(Type contractType, Type serviceType);
    public object Resolve(Type contractType);
    public T Resolve<T>();
}
```

Provide capability to register and locate types

Registering Dependencies

```
public partial class AppDelegate
{
    ...
    public override void FinishedLaunching(UIApplication application)
    {
        ...
        ServiceLocator.Instance.Add<IAlertService,MyAlertService>();
    }
}
```

Platform-specific code *registers* implementation for the abstraction

Using the Service Locator

```
public void DialNumber(string number)
{
   var alert = ServiceLocator.Instance.Resolve<IAlertService>();
   if (!alert.Show("Dial Number",
        "Are you sure you want to dial " + number,
        "Yes", "No")) { ... }
}
```

Client then *requests* the abstraction and locator returns the registered implementation

Service Locator implementations

- Easy to create your own service locator, but there are many usable 3rd-party implementations including:
  - Common Service Locator [`commonservicelocator.codeplex.com`]
  - Most Mvvm/Pattern libraries have a Service Locator
  - Xamarin.Forms `DependencyService`

Service Locator Pros and Cons

Pros	Cons
▪ Easy to use and understand ▪ Clients can JIT-request services ▪ Can be used with any client	▪ Clients must all have access to Locator ▪ Harder to identify dependencies in code ▪ Missing dependencies harder to detect

Group Exercise

Build a Service Locator

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Use an IoC container to automatically inject dependencies

Tasks

1. Register dependencies with an IoC container
2. Inject dependencies
3. Automate dependence injection

Dependency Injection

- Another option is to have the platform-specific code "inject" the dependency by passing it as a parameter or setting a property

```
public class DataAccessLayer
{
   public DataAccessLayer(
            IDbRepository db,
            IAlertService alerts) { ... }

   public ILogger Logger { get; set; }
   ...
}
```

Services this class depends on must be supplied ("injected") through constructor parameters, properties or method parameters

Using Dependency Injection

- Can then connect the client and required dependencies together manually in our code

```
public DataAccessLayer CreateDataLayer()
{
   var dataAccessLayer = new DataAccessLayer(
      new SqliteRepository(),                    // IDbRepository
      new WinRTAlertService());                  // IAlertService
   dataAccessLayer.Logger = new AzureLogger(); // ILogger

   return dataAccessLayer
}
```

Inversion of Control (IoC) container

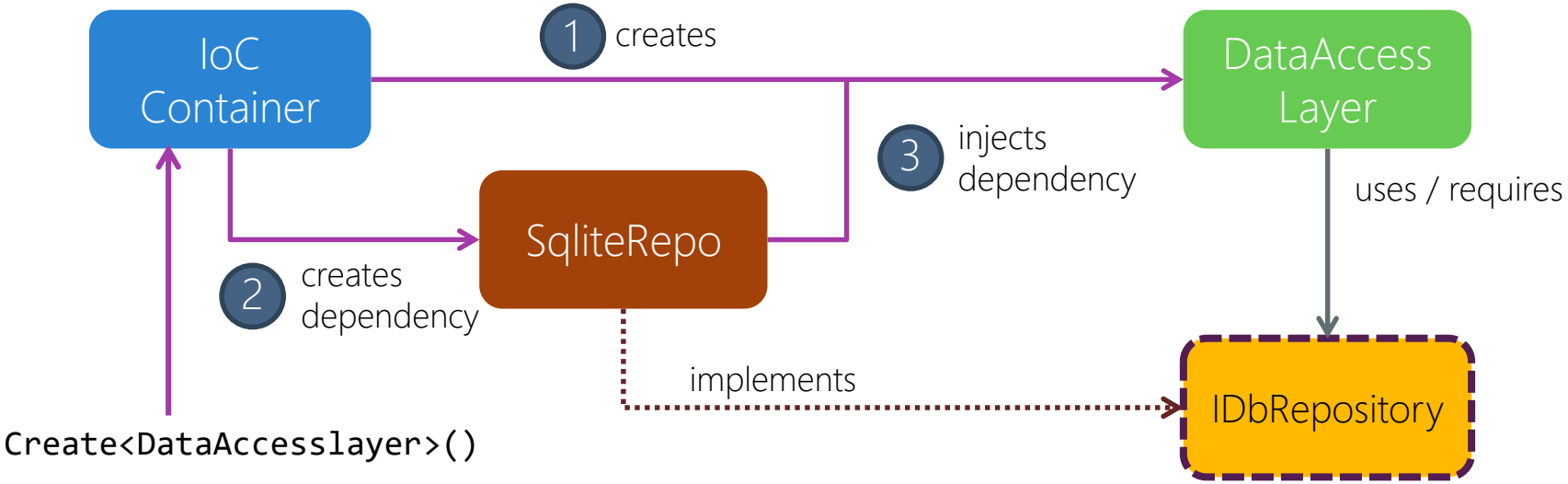
- An IoC container is a **dependency manager** used to create and control the lifetime of dependencies in your application; it has two purposes:

Registry of known dependencies

Creates objects and "injects" required dependencies

DI with an IoC Container

- Can automate DI with a *container* that dependencies are registered with which then *create* types – automatically supplying the dependencies



DI Container Example

Dependencies are typically registered in platform-specific code (but don't have to be!)

```
MyContainer container = new MyContainer();
container.Register<IDbRepository,SqliteRepository>();
container.Register<IAlertService,WinRTAlertService>();
container.Register<ILogger>(new AzureLogger(AzureToken));
container.Register< MessageBus>(new MessageBus(this));
```

```
var dataLayer = container.Create<DataAccessLayer>();
...
```

Can then ask container to *create* the **`DataAccessLayer`** from anywhere in our code – it will automatically supply the required dependencies

DI + Containers Pros and Cons

Pros	Cons
▪ Client only needs **real dependencies**, no container reference necessary	▪ Involves a bit of magic (!), the big picture can be harder to understand (what depends on what)
▪ Easier to identify dependencies being used since they are often passed to constructors or filled in properties	▪ Often requires some form of reflection; not generally a performance issue but could be

DI / IoC Containers

- Many popular 3rd-party IoC containers available:
  - TinyIoC
  - Ninject
  - AutoFac
  - Unity
  - MvvmCross
  - …

Individual Exercise

Use Dependency Injection

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Flash Quiz

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Flash Quiz

① Key to all these patterns is _____.

a) Custom attributes

b) Containers

c) Singletons

d) Abstractions

Flash Quiz

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Flash Quiz

② Service Locator is where _____.

a) Services are found and set into properties on the client
b) Client request specific abstraction through a shared locator
c) Client creates service directly
d) You use *Accio* summoning charm to create the service

Flash Quiz

② Service Locator is where _____.

a) Services are found and set into properties on the client

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Flash Quiz

③ To inject dependencies the IoC container will often need to create the dependencies as well as the type that uses those dependencies

a) True

b) False

Flash Quiz

③ To inject dependencies the IoC container will often need to create the dependencies as well as the type that uses those dependencies

a) True

b) False

Flash Quiz

④ The best technique to manage dependencies is _____.

a) Factory Pattern
b) Service Locator Pattern
c) Dependency Injection
d) Depends on the project, team, and personal preference.

Flash Quiz

④ The best technique to manage dependencies is _____.

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Summary

1. Register dependencies with an IoC container
2. Inject dependencies
3. Automate dependence injection

Thank You!

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