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Ff4j Reference Guide

v1.2.0

2014

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1. Feature Toggle

1.1 Introduction

The principe of *Feature Toggle* is to enable or disable feature through configuration, eventually at runtime. The condition statement to toggle can be a simple flag (boolean) but also a more elaborate test with a set of rules. It's also called *feature flipping*, *feature flags*, or even *feature bits*. Toggle features at runtime is mandatory to change behaviour of the application without restarting. FF4J is an implementation of the principle for the Java Plateform. It stands as *Feature Flipping for Java*.

Note

As ff4j provides a restFul WebAPI, any application could work and check features through HTTP. It's not limited to the Java platform

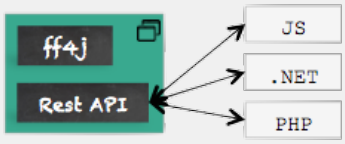

Figure 1.1.

1.2 References

1.2.1 Martin Fowler

Martin Fowler, an architect working at Thoughtworks, has written on his professional blog in 2010, a introduction to the concept. The full article can be consulted here. He is known in the community as one father of the continuous integration.

He defines feature toggle as : *The basic idea is to have a configuration file that defines a bunch of toggles for various features you have pending. The running application then uses these toggles in order to decide whether or not to show the new feature.*

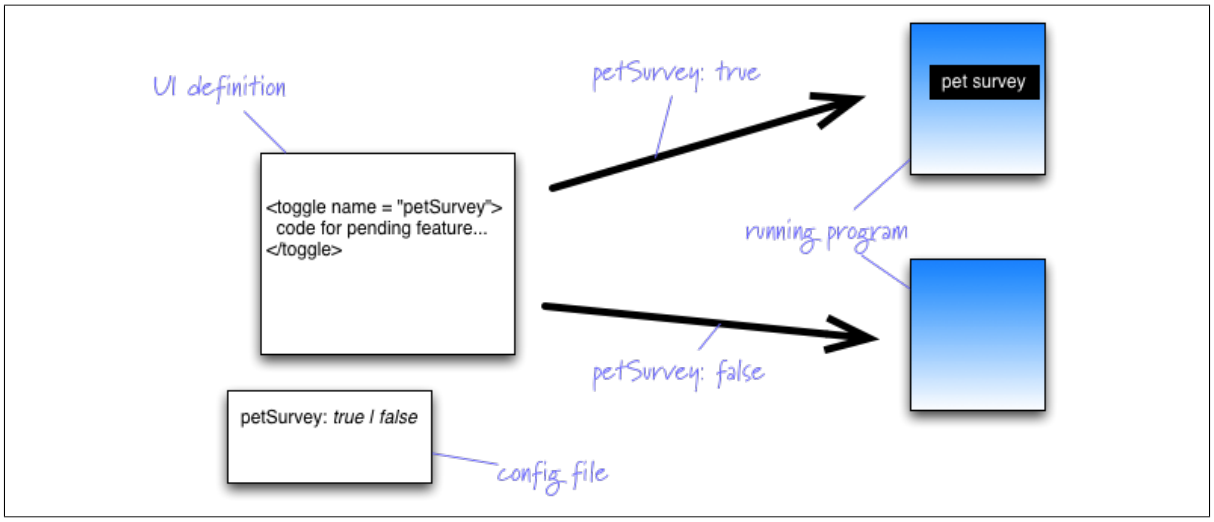

Figure 1.2. Martin Fowler reference article

1.2.2 Blogs and articles

The feature toggle has been mostly promoted by the continuous delivery. Webgiants such as GAFA (Google, Amazon, Facebook, Apple) or Etsy have post quite a lot of information of their realisations.

Table 1.1. Blog references

Title	Description
Presentation of concept on InfoQ	http://www.infoq.com/presentations/Feature-Bits
Presentation on 99Design	http://99designs.com/tech-blog/blog/2012/03/01/feature-flipping/
About Etsy	This article is available on codeascraft
About Flickr	http://code.flickr.com/blog/2009/12/02/flipping-out/
Octo Technology	introduced the concepts in their: french article but also in their book.

Figure 1.3. WebGiants practices by Octo (fr)

1.3 Use Cases

1.3.1 Continuous Delivery

1.3.1.1 Definition

As suggested by its name, the purpose of the continuous delivery set of practices is to release softwares as often as required. The delivery process is obviously automatic and triggered on demand, eventually after each developper commit. It allows 'non-event' releases : no more prepared or anticipated, but performed anytime needed. For instance, Amazon pushes code into production in average, every 11.6 seconds.

1.3.1.2 Feature Branching vs Feature Toggle

To be able to develop several features in the same time yet be compliant with the short-time development cycle there are 2 possibilities.

Feature Branching

The first solution is to create branches in the source control system for each new feature. The release is performed from sources hosted on trunk : features under development are ignored and won't be part of the build. When a feature is 'ready', the related branch is merged to the trunk. This operation may become very complex. Indeed, if several releases have be made since the initial 'fork' of the current branch, source codes can be potentially very different. This leads to a large number of conflicts to deals with.

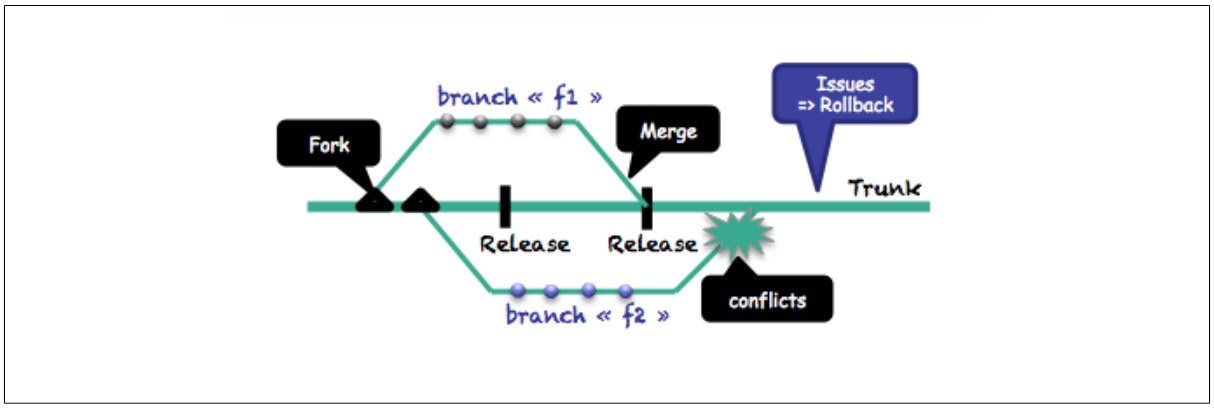

Figure 1.4. Feature Branching

Trunk-based developement

The second solution is, on the contrary, to keep on developing in the trunk. The direct consequence is that incomplete or non-working (yet compiling) code will be embedded in a release and pushed into production. To avoid any incidents the relevant source code is wrapped in a always-false condition. The value of the condition is defined through configuration. As soon as the code is ready, the condition is set to true to start executing.

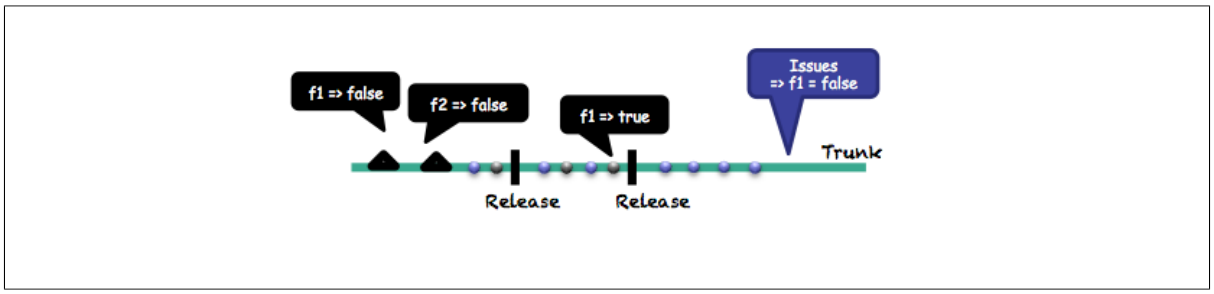

Figure 1.5. Trunk-based developement

1.3.1.3 Zero Downtime deployment

Blue/Green Deployments

BlueGreen deployment is a term to describe the old way to perform "hot deploy" in high availability architectures. The application is deployed on several nodes of a cluster. During deployment, each node is stopped, the new version of the product is released and the node is restarted. One common problem is a lack of consistency between nodes. Is the release required to change the datamodel for instance, the hot deploy is no more possible. Feature Toggle can be an answer. All servers will be updated in ther same way but without enabling the the modifications. When the environnement is ready all nodes of the cluster can activate the new feature as the same time.

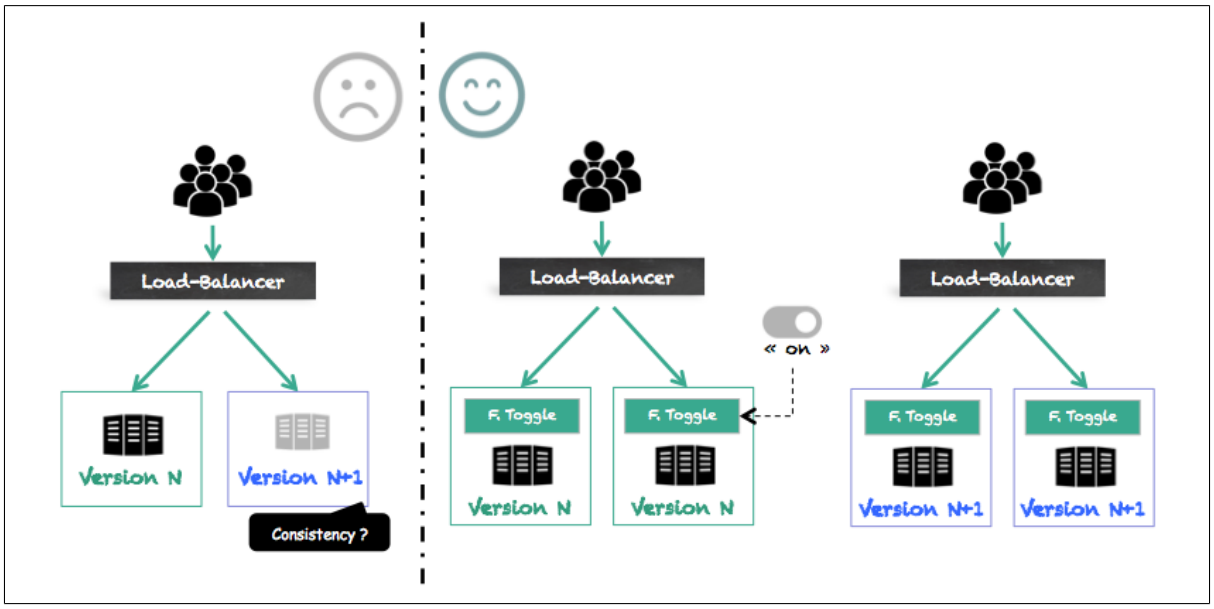

Figure 1.6. Blue/Green deployment

Canary Release

The concept of canary release is to enable a feature for a subset of the users population. Thoses users may have a particular role ()like "beta-tester", or may be located in some place (like pilot), or like Amazon feature can be first propose to employees and then to customers. It's an excellent way to get feedback from users but also real metrics on production environment. The feature toggle system wrapped any feature definition which can be enabled at runtime through configuration console.

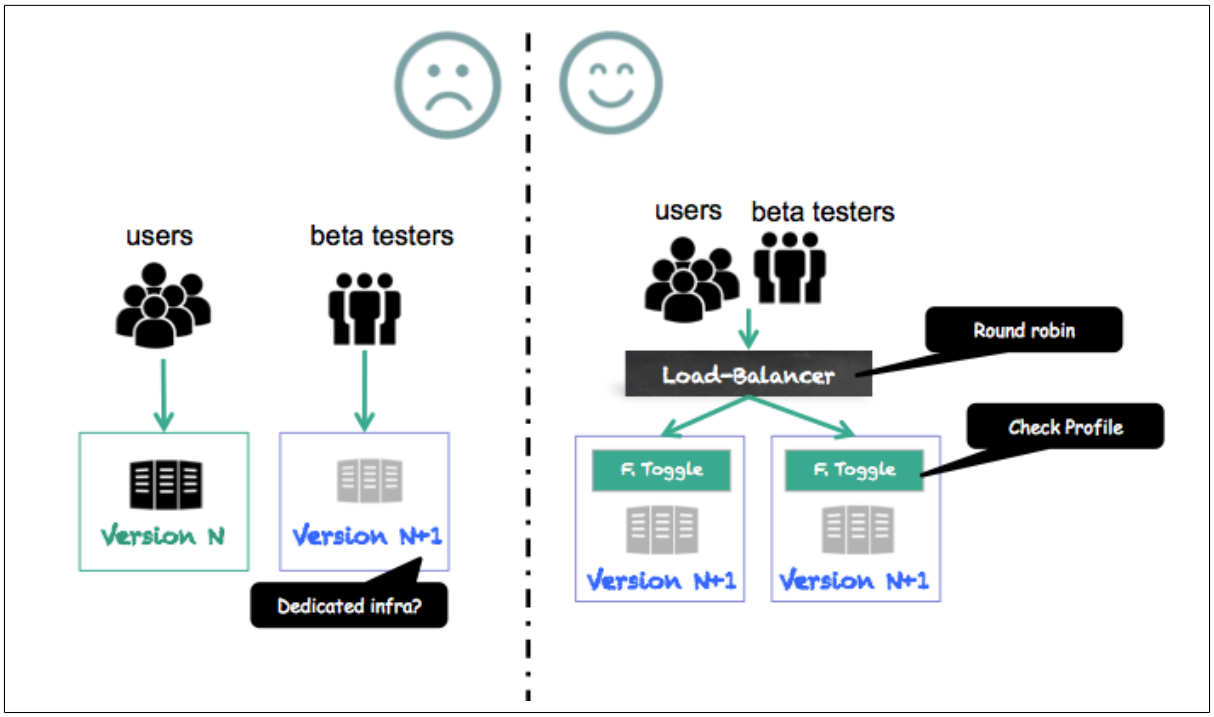

Figure 1.7. Canary Release

DarkLaunch

The concept of Dark launch is to enable features progressively. For instance, only a fixed rate of incoming requests will use the new version of the product. The main advantage is to measure the

impact of evolutions for a limited flow of requests and then anticipate any load, performance or capacity problems. As detailed later, ff4j provides a "PonderationStrategy"" to implement exactly this use case.

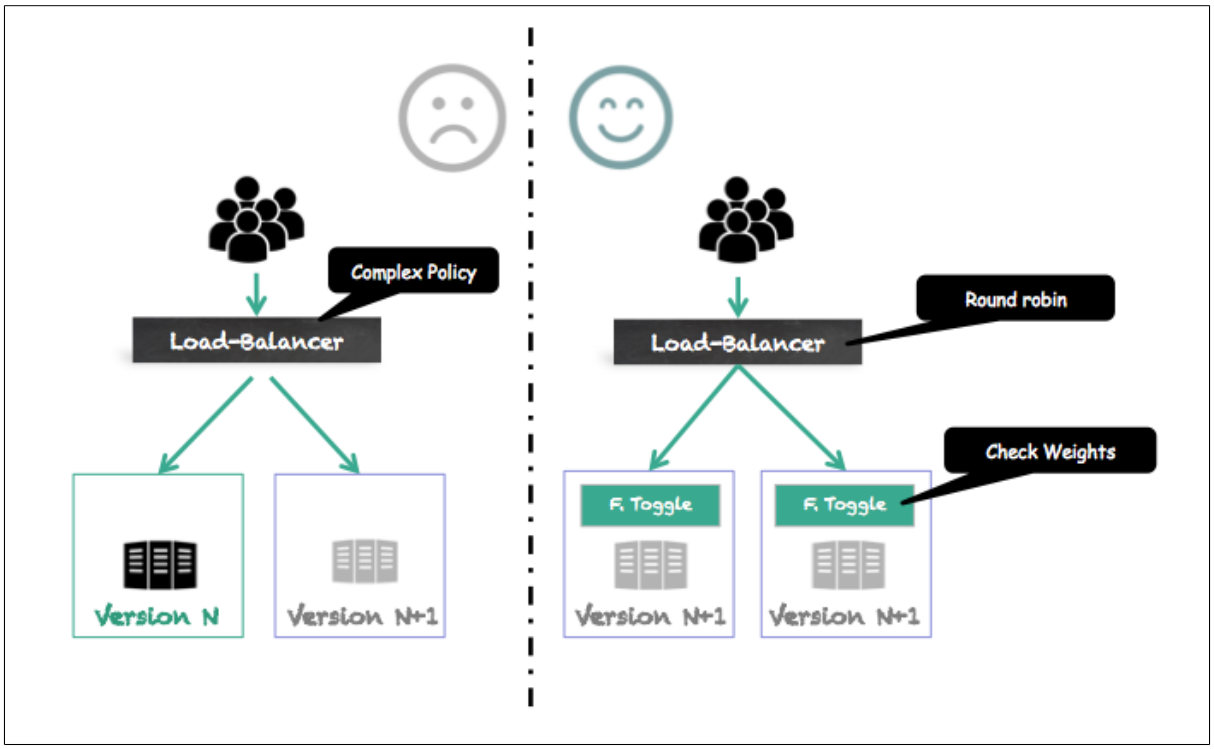

Figure 1.8. Dark Launch

1.3.1.4 Thin Client deployment

This clever use case should be considered when the release process is painful or the application is installed on third party devices. It has been used by Facebook for their iOS application. To publish an application on the appstore the process is always the same. Developpers package and submit the new version to apple teams which MANUALLY validate it. It can take up to 48H. Once the application is published, any single user must have to download the application - again - from Apple servers.

The basic idea of *Thin Client deployment* is to never publish new versions of the application in stores, but, instead, at startup, check current installed application against a web service and download new content if required.

Feature toggle should be part of the process. When the feature is ready, it's activated in the server. Target clients (not all if you do no want to) at startup of their applications will get the updates.

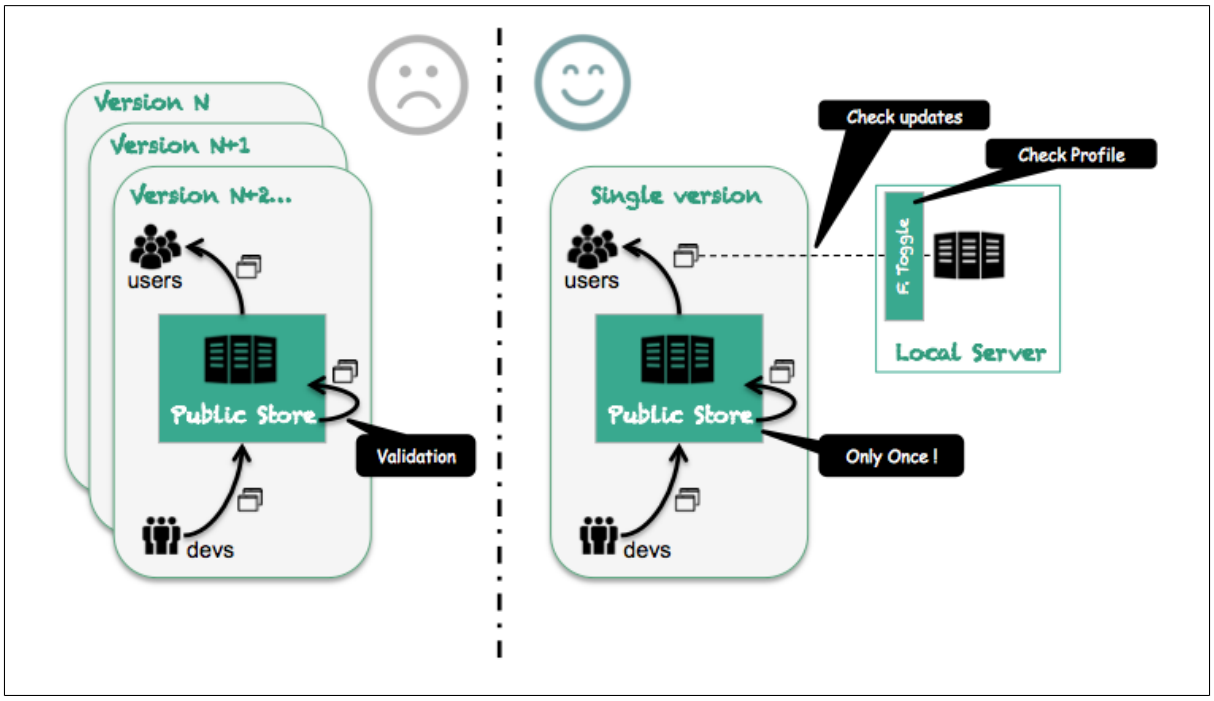

Figure 1.9. Thin-client deployment

1.3.2 Ops and Infrastructure

1.3.2.1 Graceful Degradation

The graceful degradation is a capability of a system to disable non-core functionnalities to free ressources for more important ones. As an example, on heavy load of an e-commerce website, you can priorize the requests of customers which already have something in their cart, they are more likely to buy something. When a request hit the landing page, and feature toggle strategy evaluates that it's not an important one, the user could be redirect to a dedicated page telling him to try later.

Another example is the set up of quota. Imagine you would like to create a chatroom with 20 people. Once the quota is reached, the new users will be put in waiting room.

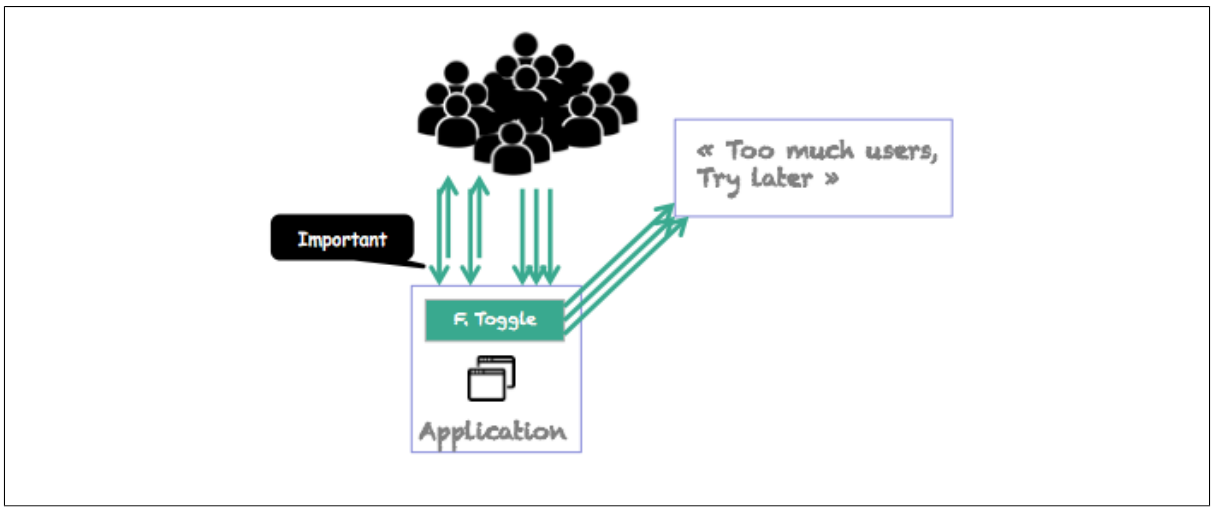

Figure 1.10. Graceful Degradation

1.3.2.2 Service Catalog

A feature can be distributed among several applications. For those uses cases the features storage is a unique repository and all applications work as clients. Once the administrator toggle off a feature, a whole part of IS could shut down. This pattern can be used to handle a collection of services.

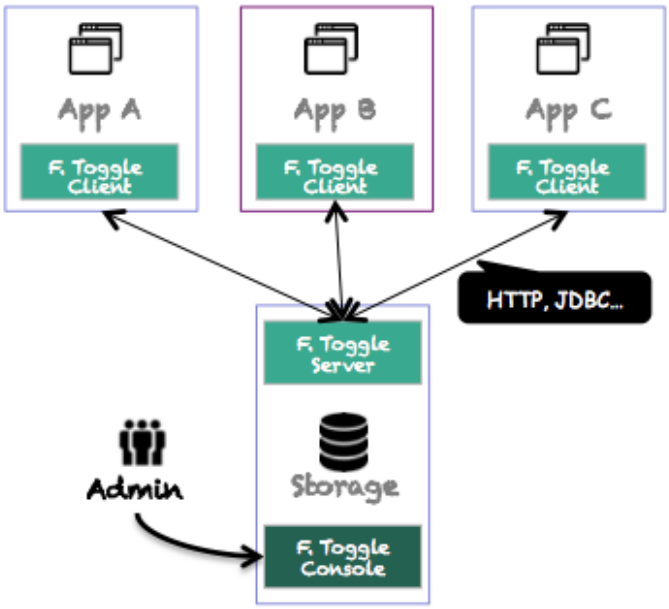

Figure 1.11. Service Catalog

1.3.3 Business Toggle

1.3.3.1 Overview

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1.3.3.2 Business Rules

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Figure 1.12. Business rules

1.3.3.3 A/B Testing

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Figure 1.13. A/B testing

2. Getting Started

Note

All source code and working samples are available HERE for download and testing.

2.1 About Feature

A feature represents any service, treatment, or functionality. It is identified by a unique reference name (or uid) within the application runtime. In a feature toggle environnement each feature has a status or a state which indicate if it's enabled or not (ie: disabled). Toggling or flipping is the action to change the state of the feature.

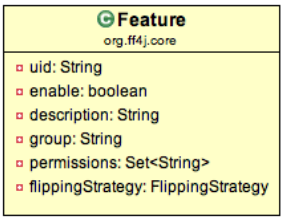

Figure 2.1. Feature UML Diagram

2.2 Introducing FeatureStore

The featureStore is the persistent unit to store the features with their attributes and status. It proposes a set of CRUD operations to work with features but also groups of feature or permissions on features. As detailed in further cahpters, different implementations will persist the data in different location such as relational database (rdbms, jdbc) , NoSQl databases (mongodb, redis), InMemory and even others. to

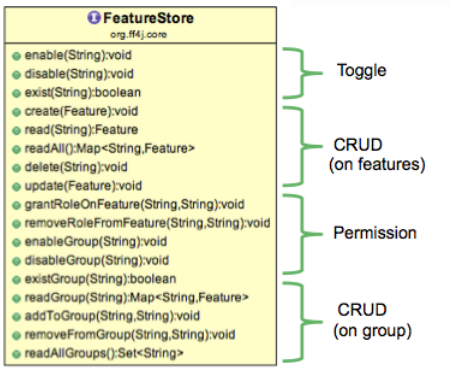

Figure 2.2. Feature Store

2.3 Ff4j core class

It's the **single class** to be used in your code. It's wrapped any other components of the framework, `FeatureStore` included).

Figure 2.3. Feature Store

2.4 First samples

In this part we guide you to create a working example from scratch

- Create a empty maven project

```
mvn archetype:create -Dpackaging=jar -Dversion=1.0 -DartifactId=ff4j-simple -DgroupId=org.ff4j.sample
```

- Declare this dependency into your `pom.xml` file/

```
<dependency>
 <groupId>org.ff4j</groupId>
  <artifactId>ff4j-core</artifactId>
  <version>1.2.0</version>
</dependency>
```

- Create the following `ff4j.xml` file in 'src/test/resources' folder (create it does not exist)

```
<?xml version="1.0" encoding="UTF-8" ?>
<features>
 <feature uid="sayHello"   enable="true" description="my first feature" />
 <feature uid="sayGoodBye" enable="false" />
</features>
```

- Write the following Junit test : (you may have to update junit version in your pom file)

```
package org.ff4j.sample;

import static org.junit.Assert.assertEquals;
import static org.junit.Assert.assertTrue;
import static org.junit.Assert.assertFalse;
import static org.junit.Assert.fail;

import org.ff4j.FF4j;
import org.junit.Test;

public class HelloWorldTest {

    @Test
    public void myFirstFF4JTest() {

        FF4j ff4j = new FF4j("ff4j.xml");
        assertEquals(2, ff4j.getFeatures().size());
        assertTrue(ff4j.exist("sayHello"));
        assertTrue(ff4j.check("sayHello"));
```

```
        // Test value at runtime
        if (ff4j.check("sayHello")) {
            // Feature ok !
            System.out.println("Hello World !");
        } else {
            fail();
        }
    }
}
```

Features are loaded from xml configuration file (ff4j.xml) and registered in a store (default is in-memory).

If a feature does not exist, the method `check(..)` will raise a FeatureNotFoundException but you can change this behaviour by setting the autoCreate flag as true. If feature is not found the method will return false.

- Update your unit test with this second method illustrating `autoCreate`

```
@Test
  public void autoCreateFeatureEnableTest() {

    // Default : store = inMemory, load features from ff4j.xml file
    FF4j ff4j = new FF4j("ff4j.xml");

    try {
        ff4j.check("autoCreatedFeature");
        fail(); // error is Expected here
    } catch(FeatureNotFoundException fnfe) {
        System.out.println("Standard behaviour");
    }

    // Change default behavior
    ff4j.autoCreate(true);

    if (!ff4j.check("autoCreatedFeature")) {
       System.out.println("Not available but code won't failed, feature created");
       assertTrue(ff4j.exist("autoCreatedFeature"));
       assertFalse(ff4j.check("autoCreatedFeature"));
    } else {
      fail();
    }
  }
```

Features can be created programmatically (for testing purposes for instance).

- Update your unit test with this third method illustrating dynamic creation of features

Remember : Once implementing a Feature flipping pattern, services must be tested WITH and WITHOUT features enabled

```
@Test
    public void createFeatureDynamically() {

        // Initialize with empty store
        FF4j ff4j = new FF4j();

        // Dynamically register new features
        ff4j.create("f1").enable("f1");

        // Testing
        assertTrue(ff4j.exist("f1"));
        assertTrue(ff4j.check("f1"));
    }
```

2.5 Integration with Spring

The `ff4j` component can be easily defined as a Spring Bean.

- Add Spring dependencies to your project

```
<dependency>
  <groupId>org.springframework</groupId>
  <artifactId>spring-test</artifactId>
  <version>4.0.5.RELEASE</version>
</dependency>
<dependency>
   <groupId>org.springframework</groupId>
   <artifactId>spring-context</artifactId>
   <version>4.0.5.RELEASE</version>
</dependency></programlisting>
```

- Add the following `applicationContext.xml` file to your `src/test/resources`

```
<beans xmlns="http://www.springframework.org/schema/beans"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xmlns:context="http://www.springframework.org/schema/context"
       xsi:schemaLocation="http://www.springframework.org/schema/beans
           http://www.springframework.org/schema/beans/spring-beans-3.0.xsd
           http://www.springframework.org/schema/context
           http://www.springframework.org/schema/context/spring-context-3.0.xsd">

  <bean id="ff4j" class="org.ff4j.FF4j" >
    <property name="store" ref="ff4j.store.inmemory" />
  </bean>

  <bean id="ff4j.store.inmemory" class="org.ff4j.store.InMemoryFeatureStore" >
    <property name="location" value="ff4j.xml" />
  </bean>

</beans>
```

- The features are registered within in-memory store.Write the following spring-oriented test

```
        package org.ff4j.sample;

import static org.junit.Assert.fail;

import org.ff4j.FF4j;
import org.junit.Test;
import org.junit.runner.RunWith;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.test.context.ContextConfiguration;
import org.springframework.test.context.junit4.SpringJUnit4ClassRunner;

@RunWith(SpringJUnit4ClassRunner.class)
@ContextConfiguration(locations = {"classpath:*applicationContext.xml"})
public class CoreSpringTest {

    @Autowired
    private FF4j ff4j;

    @Test
    public void testWithSpring() {
        // Test value at runtime
        if (ff4j.check("sayHello")) {
            // Feature ok !
            System.out.println("Hello World !");
        } else {
            fail();
        }
    }
```

```
}
```

3. Core Concepts

3.1 Feature Groups

Features can be gathered as group. It is then possible to toggle the whole group. This capability can be useful for instance, if you want to group all the "user stories" of sprint in the same release.

- Let's create a new XML file `ff4j-group.xml` to illustrate

```
<?xml version="1.0" encoding="UTF-8" ?>
<!DOCTYPE configuration>
<features>

 <feature uid="featA" description="my first feature" enable="true">
 </feature>

 <feature uid="featA" enable="false" />


 <!-- Sample Feature Group -->
 <feature-group name="release-2.3">

  <feature uid="users-story1" description="desc1" enable="false">
  </feature>

  <feature uid="users-story2" description="null" enable="false">
  </feature>

 </feature-group>

</features>
```

- Here is a sample utilisation of groups.

```
@Test
public void myGroupTest() {

   FF4j ff4j = new FF4j("ff4j-groups.xml");

   // Check features loaded
   assertEquals(4, ff4j.getFeatures().size());
   assertTrue(ff4j.exist("featA"));
   assertTrue(ff4j.exist("users-story1"));
   assertTrue(ff4j.getStore().existGroup("release-2.3"));
   System.out.println("Features loaded OK");

   // Given
   assertFalse(ff4j.check("users-story1"));
   assertFalse(ff4j.check("users-story2"));

   // When
   ff4j.enableGroup("release-2.3");

   // Then
   assertTrue(ff4j.check("users-story1"));
   assertTrue(ff4j.check("users-story2"));

}
```

- You can also access to all operation dynamically through the `FeatureStore`

```
@Test
public void workWithGroupTest() {

   // Given
```

```
   FF4j ff4j = new FF4j("ff4j-groups.xml");
   assertTrue(ff4j.exist("featA"));

   // When
   ff4j.getStore().addToGroup("featA", "new-group");

   // Then
   assertTrue(ff4j.getStore().existGroup("new-group"));
   assertTrue(ff4j.getStore().readAllGroups().contains("new-group"));

   Map<String, Feature> myGroup = ff4j.getStore().readGroup("new-group");
   assertTrue(myGroup.containsKey("featA"));

   // A feature can be in a single group
   // Here changing => deleting the last element of a group => deleting the group
   ff4j.getStore().addToGroup("featA", "group2");
   assertFalse(ff4j.getStore().existGroup("new-group"));
}
```

3.2 Aspect Oriented Programming (AOP)

3.2.1 Overview

From the beginning of this guide, we use intrusive tests statements within source code to perform flipping like in :

```
if (ff4j.check("featA")) {
  // new code
} else {
  // legacy
}
```

This approach is quite intrusive into source code. You can nested different feature toggles at you may consider to clean often your code and remove obsolete features. A good alternative is to rely on Dependency Injection, also called Inversion of control (ioc) to choose the correct implementation of the service at runtime.

Ff4j provide the `@Flip` annotation to perform flipping on methods using AOP proxies. At runtime, the target service is proxified by the ff4j component which choose an implementation instead of another using feature status (enable/disable). It leverage on Spring AOP Framework.

3.2.2 Illustrate with example

In the following chapter, we modify the project created in getting started to illustrate flipping through aop

- Add the dependency to `ff4j-aop` in your project

```
<dependency>
 <groupId>org.ff4j</groupId>
  <artifactId>ff4j-aop</artifactId>
  <version>1.2.0</version>
</dependency>
```

- Define a sample interface with the annotation :

```
public interface GreetingService {

   @Flip(name="language-french", alterBean="greeting.french")
   String sayHello(String name);

}
```

- Define a first implementation, to tell hello in english

```
@Component("greeting.english")
public class GreetingServiceEnglishImpl implements GreetingService {
    public String sayHello(String name) {
      return "Hello " + name;
    }
}
```

- Define a second implementation, to tell hello in french

```
@Component("greeting.french")
public class GreetingServiceFrenchImpl implements GreetingService {
  public String sayHello(String name) {
    return "Bonjour " + name;
  }
}
```

- The AOP capability leverage on Spring Framework. To enable the Autoproxy, please ensure that the package `org.ff4j.aop` is scanned by spring at startup. The `applicationContext-aop.xml` should look like :

```
<beans xmlns="http://www.springframework.org/schema/beans"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xmlns:context="http://www.springframework.org/schema/context"
       xsi:schemaLocation="http://www.springframework.org/schema/beans
           http://www.springframework.org/schema/beans/spring-beans-3.0.xsd
           http://www.springframework.org/schema/context
           http://www.springframework.org/schema/context/spring-context-3.0.xsd">

   <context:component-scan base-package="org.ff4j.aop, org.ff4j.sample"/>

  <bean id="ff4j" class="org.ff4j.FF4j" >
    <property name="store" ref="ff4j.store.inmemory" />
  </bean>

  <bean id="ff4j.store.inmemory" class="org.ff4j.store.InMemoryFeatureStore" >
    <property name="location" value="ff4j-aop.xml" />
  </bean>

</beans>
```

- Create a dedicated ff4j.xml file with the feature name `language-french` let's say `ff4j-demo-aop.xml`

```
<?xml version="1.0" encoding="UTF-8" ?>
<features>
 <feature uid="language-french" enable="false" />
</features>
```

- Demonstrate how does it work through a test :

```
import junit.framework.Assert;

import org.ff4j.FF4j;
import org.junit.Test;
import org.junit.runner.RunWith;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.beans.factory.annotation.Qualifier;
import org.springframework.test.context.ContextConfiguration;
import org.springframework.test.context.junit4.SpringJUnit4ClassRunner;

@RunWith(SpringJUnit4ClassRunner.class)
@ContextConfiguration("classpath:*applicationContext-aop.xml")
public class FeatureFlippingThoughAopTest {
```

```
    @Autowired
    private FF4j ff4j;

    @Autowired
    @Qualifier("greeting.english")
    private GreetingService greeting;

    @Test
    public void testAOP() {
        Assert.assertTrue(greeting.sayHello("CLU").startsWith("Hello"));
        ff4j.enable("language-french");
        Assert.assertTrue(greeting.sayHello("CLU").startsWith("Bonjour"));
    }

}
```

3.3 Permissions and security

3.3.1 Overview

You may have to enable your feature for a subset of your users identified by a dedicated group or profile. With the `Canary Realease` pattern for instance, the feature could be activated only for beta-tester.

ff4j does not provide any user/group declaration system but instead leverage on existing one (Spring Security, Apache Chiro...), they are not declared, defined and administrate with ff4j. A set of permissions is defined for each feature but the permissions must already exist in the external security provider.

3.3.2 AuthorizationManager

This is the class where ff4j test permissions of current user against the list in the feature. It will leverage on existing framework. Today the only implementation available is through `Spring security` but you can define your own.

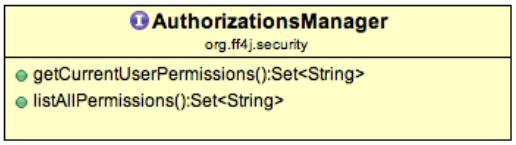

Figure 3.1. AuthorizationManager UML Diagram

3.3.3 Illustrate through sample code

In this first sample we will create our own `AuthorizationManager` with the list of permissions in Memory.

- There is no new dependency to declare the `AuthorizationManager` is in the `ff4j-core.jar` file. So let's propose a implementation for this interface

```
<dependency>
```

3.3.4 Working with Spring Security

Xml update, custom permission manager, unit testing Principle, use cases (canary release, beta feature), sequence diagram Sed egestas molestie elit. Mauris urna mi, scelerisque vitae, ultrices vel, euismod vel, eros. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Pellentesque dictum felis a nisi.

3.4 Custom Strategy

Text here

3.4.1 Overview

Reference to conclusion #1, sequence diagram, Sed egestas molestie elit. Mauris urna mi, scelerisque vitae, ultrices vel, euismod vel, eros. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Pellentesque dictum felis a nisi.

3.4.2 FeatureFlippingStrategy Interface

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3.4.3 Sample Code

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3.4.4 Overriding Strategy

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3.4.5 Available Strategies

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3.4.5.1 Expression Language

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3.4.5.2 ReleaseDate

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3.4.5.3 ClientList

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3.4.5.4 ServerList

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3.4.5.5 Ponderation

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3.5 Feature Stores

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3.5.1 Introduction

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3.5.1.1 Objectives

Status, crud, storage,Sed egestas molestie elit. Mauris urna mi, scelerisque vitae, ultrices vel, euismod vel, eros. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Pellentesque dictum felis a nisi.

3.5.1.2 Architecture Patterns

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3.5.2 InMemoryFeatureStore

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3.5.3 >RDBMS FeatureStore

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3.5.3.1 Core JDBC

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3.5.3.2 Spring JDBC

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3.5.4 MongoDB FeatureStore

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3.5.4.1 Overview

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3.5.4.2 Sample Code

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3.5.5 Remote HTTP (client) FeatureStore

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3.5.5.1 Overview

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3.5.5.2 Sample Code

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3.6 Caching

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3.6.1 Architecture Concerns

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3.6.2 Working with EHCache

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3.6.3 Working with Redis

Status, crud, storage,Sed egestas molestie elit. Mauris urna mi, scelerisque vitae, ultrices vel, euismod vel, eros. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Pellentesque dictum felis a nisi.

3.7 Monitoring

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3.7.1 Overview

Status, crud, storage,Sed egestas molestie elit. Mauris urna mi, scelerisque vitae, ultrices vel, euismod vel, eros. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Pellentesque dictum felis a nisi.

3.7.2 Metrics

Usage vs actions, exporter Status, crud, storage,Sed egestas molestie elit. Mauris urna mi, scelerisque vitae, ultrices vel, euismod vel, eros. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Pellentesque dictum felis a nisi.

3.7.3 Curves and Graphics

Usage vs actions, exporter Status, crud, storage,Sed egestas molestie elit. Mauris urna mi, scelerisque vitae, ultrices vel, euismod vel, eros. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Pellentesque dictum felis a nisi.

4. Web

4.1 Embedded Console

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4.1.1 Overview

Phylosophy, capability, architecture, limits as security Sed egestas molestie elit. Mauris urna mi, scelerisque vitae, ultrices vel, euismod vel, eros. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Pellentesque dictum felis a nisi.

4.1.2 Declaring Servlet

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4.1.3 User Guide

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4.2 Taglib Library

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4.2.1 Introducing Taglib

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4.2.2 Available Tags

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4.3 RestFul API

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4.3.1 Introduction

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4.3.2 State Diagram

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4.3.3 API BluePrint

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4.3.4 Security

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4.3.5 Sample Clients

HttpClient, CURL, Javascript.... Sed egestas molestie elit. Mauris urna mi, scelerisque vitae, ultrices vel, euismod vel, eros. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Pellentesque dictum felis a nisi.

4.4 WebConsole Full Stack

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4.4.1 Introduction

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4.4.2 Configuration

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4.4.3 User Guide

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5. Advanced Concepts

5.1 JMX Support

Definition, UML Diagram, description attributes, ff4j definition, status

5.1.1 Overview

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5.1.2 Sample Code

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