Modules

Modules commands

Commands

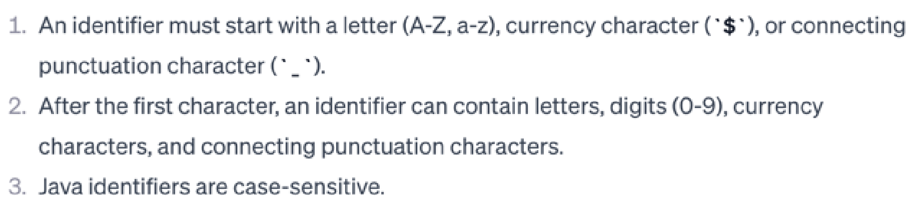
Example

module-info.java

```java
module zoo.animal.feeding {
  exports zoo.animal.feeding;
}
```

Module Name Rules

Identifier or identifier segments may not start with a digit nor contain a dash.



1. An identifier must start with a letter (A-Z, a-z), currency character (`$`), or connecting punctuation character (`_`).
2. After the first character, an identifier can contain letters, digits (0-9), currency characters, and connecting punctuation characters.
3. Java identifiers are case-sensitive.

Examples

- com.enrico : valid
- com.4enrico: **NOT VALID**
- _test: valid
- com.apple$: valid
- ____$$$$: valid

Module Directives

exports

Packages inside a module are not exported by default.

```java
exports zoo.animal.talks.content to zoo.staff;
```

requires

Specifies another module as dependency.

```
    requires zoo.animal.feeding;
```

requires transitive

```
    requires transitive zoo.animal.care;
```

requires mandated

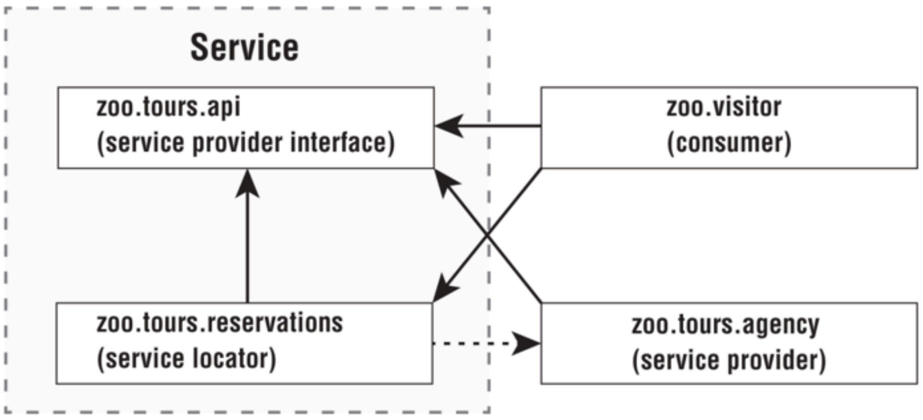
```
  // moduleA/module-info.java
  module moduleA {
      requires mandated moduleB;
  }
```

The term `mandated` signifies that the dependency is required by the Java platform itself and is not optional.

opens

```
      opens zoo.animal.talks.schedule;
      opens zoo.animal.talks.media to zoo.staff;
```

Creating a service



Service Provider Interface

interface

```
public interface Tour {
  String name();
}
```

module

```
// module-info.java
module zoo.tours.api {
  exports zoo.tours.api;
}
```

The module needs to export the package containing the interface.

Service Provider Implementation

A service provider is the implementation of a service provider interface.

```
public class TourImpl implements Tour {
  public String name() {
    return "service name";
  }
}
```

module

```
// module-info.java
module zoo.tours.agency {
  requires zoo.tours.api;
  provides zoo.tours.api.Tour with zoo.tours.agency.TourImpl;
}
```

provide *interface* with *implementation*.

It contains **exactly one implementation** of the service provider interface.
It is a compile-time error if more than one provides directive in a module declaration specifies the same service.

Invalid service provider implementation:

```
// module-info.java
//DOES NOT COMPILE
module zoo.tours.agency {
  requires zoo.tours.api;
  provides zoo.tours.api.Tour with zoo.tours.agency.TourImpl;  //1
  provides zoo.tours.api.Tour with zoo.tours.agency.SuperTour;  //2
}
```

Service Locator

A service locator can find any classes that implement a service provider interface.
Methods of `ServiceLoader`

- `ServiceLoader.load()` is a static method
- `ServiceLoader stream()` is an instance method!

```
List<Dog> all = new ArrayList<>();
//here it's using the iterator of ServiceLoader
for (Dog current : ServiceLoader.load(Dog.class)) {
  all.add(current);
}
```

stream

In order to call `stream()` I need an instance of `ServiceLoader` which I get through `load()`.

```
List<Dog> list = ServiceLoader.load(Dog.class)
    .stream()
    .map(Provider::get)
    .toList();
```

ServiceLoader

module-info of the Service Locator.

```
// module-info.java
module zoo.tours.reservations {
  exports zoo.tours.reservations;
  requires zoo.tours.api;
  uses zoo.tours.api.Tour;
}
```

`zoo.tours.reservation` is the package containing the `ServiceLocator`.

Consumer

```java
public class Tourist {
    public static void main(String[] args) {
        Tour tour = TourFinder.findSingleTour();
        System.out.println("Single tour: " + tour);
        List<Tour> tours = TourFinder.findAllTours();
        System.out.println("# tours: " + tours.size());
    }
}
```

module-info

```java
// module-info.java
module zoo.visitor {
    requires zoo.tours.api;
    requires zoo.tours.reservations;
}
```

It requires the modules of the service provider interface and the module of the service locator.

Combining modules of a service

It is most logical to combine the **service locator** and **service provider interface** because neither has a direct reference to the service provider (implementation).

A service is composed by:

- service provider interface
- service locator

Module Types

Named Modules

A named module must be on the module path and contain a `module-info` file.

Automatic Modules

An *automatic module* appears on the module path but **does not contain** a `module-info` file.
In an automatic module **all packages are exported**.

Unnamed Modules

An *unnamed module* appears on the classpath.
Unlike an automatic module, it is on the classpath rather than the module path.

In an unnamed module, a `sealed` class must include all its subclasses within the same package.

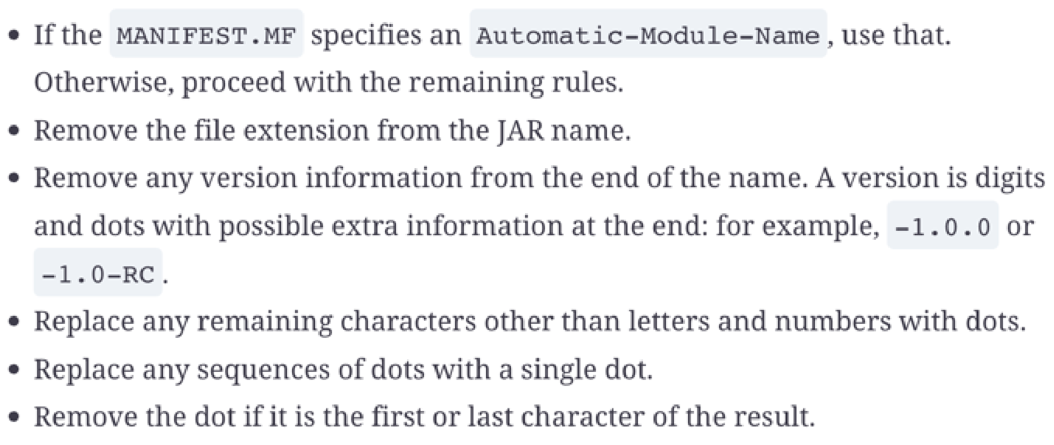
Migration Strategies

- Bottom-Up Migration Strategy:
- Top-Down Migration Strategy: starts by moving all the modules to the module path as automatic modules

Naming Strategy

The rules for determining the name of the `module-info`, from the jar file name, include:

- removing the **extension**
- changing **special characters** to periods (.)
- Additionally, we remove the **version information from the end**.



- If the `MANIFEST.MF` specifies an `Automatic-Module-Name`, use that. Otherwise, proceed with the remaining rules.
- Remove the file extension from the JAR name.
- Remove any version information from the end of the name. A version is digits and dots with possible extra information at the end: for example, `-1.0.0` or `-1.0-RC`.
- Replace any remaining characters other than letters and numbers with dots.
- Replace any sequences of dots with a single dot.
- Remove the dot if it is the first or last character of the result.

Examples

- lizard-^-cricket-^-1.0.0-SNAPSHOT.jar --> lizard.cricket
- cat-enrico2.jar --> cat.enrico2

Modules supplied by JDK

java based modules (some)

- java.logging
- java.management
- java.naming

- java.desktop
- java.sql

JDK based modules (some)

- jdk.javadoc
- jdk.jdeps
- jdk.net

References

- Scott Selikoff, Jeanne Boyarsky - OCP Oracle® Certified Professional Java SE 17 Developer Study Guide Exam 1Z0-829
- www.selikoff.net/ocp-17/
- sybex-1Z0-829-chapter-12