University of Glasgow | School of Computing Science

Assessed Coursework

Course Name	CBSE exercise 2			
Coursework Number				
Deadline	Time: 4.30pm		Date:	20th Feb 2015.
% Contribution to final course mark	5%		This should take this many hours:	2hrs/week
Solo or Group ✓	Solo		Group	X
Submission Instructions	Submission is via Moodle			
Marking Criteria	Task based			
Please Note: This Coursework cannot be Re-Done				

CBSE 2014/2015

Exercise 2

This exercise builds on your experience of exercise 1, and is based on a new version of mCom (version1.0.1). This version is streamlined specifically for manual execution of remote invocations. It can also be used as the basis for your exercise 3.

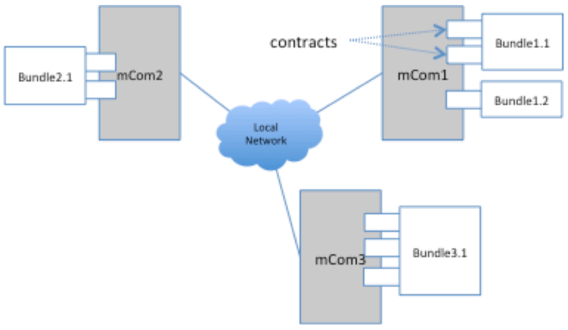
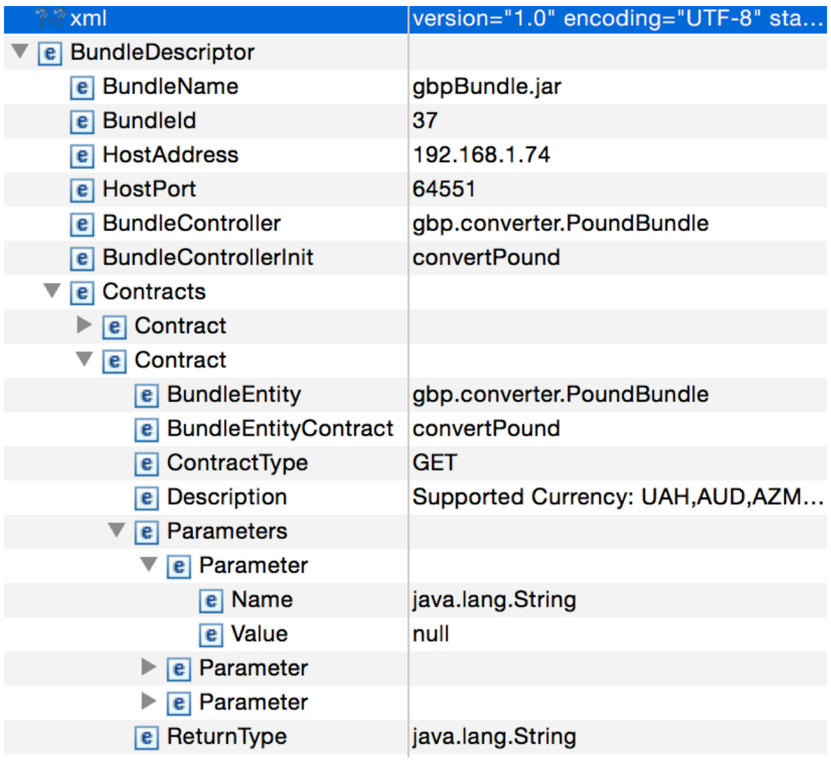


Figure 1. Structural diagram of mCom component platform

A structural representation of a mCom instance is as shown in Figure 1.

The following terms are used in mCom component model:

1. **Bundle** – A bundle is a unit of deployment on mCom platform.
2. **Contract** – A contract is an agreed service that a bundle provides to other bundles in the network. A bundle can consist of one or more contracts.
3. **Bundle descriptor** - A bundle deployment is described by a bundle descriptor and stored as .xml file in the local directory of a mCom instance. An xml tree diagram of a bundle descriptor is as shown in Figure 2.



xml	version="1.0" encoding="UTF-8" sta…
▼ BundleDescriptor	
BundleName	gbpBundle.jar
BundleId	37
HostAddress	192.168.1.74
HostPort	64551
BundleController	gbp.converter.PoundBundle
BundleControllerInit	convertPound
▼ Contracts	
▶ Contract	
▼ Contract	
BundleEntity	gbp.converter.PoundBundle
BundleEntityContract	convertPound
ContractType	GET
Description	Supported Currency: UAH,AUD,AZM…
▼ Parameters	
▼ Parameter	
Name	java.lang.String
Value	null
▶ Parameter	
▶ Parameter	
ReturnType	java.lang.String

Figure 2. xml tree diagram of a bundle descriptor

A set of mCom annotations stored in `mbundle-annotations.jar` is used to specify the behavior of a bundle, and also influence the automatic generation of bundle descriptors during deployment. There are four types of mcom annotations:

1. **@mController:** This is a ElementType.TYPE annotation that is used to identify the class that controls the bundle. A bundle has can have at most one @mController annotation.
2. **@mControllerInit:** This is an a ElementType.METHOD annotation used to identify a method that initializes parameters and calls methods required for the bundle to run appropriately during invocation. A @mControllerInit can only exist within a @mController class.
3. **@mEntity:** This is a ElementType.TYPE annotation that is used to identify the class that contains a bundle contract.
4. **@mEntityContract:** This is a ElementType.METHOD annotation that is used to identify contracts specified in a @mEntity. This annotation takes the description of the contract and contractType as parameters. The current version of contract specifies two main types of contracts: GET or POST (Although they are not directly used in this exercise, you may choose to leverage on contract types for session management for your exercise 3. You can also define new ones).

Annotation code can be found in the package `mcom.bundle.annotations`. The file `gbpBundle.jar` is an example illustrating the usage of mCom annotations

Each time a mCom instance is executed using the command-line, the following actions are automatically carried out:

- The instance automatically creates a local bundle directory /LocalBundleDir where all bundles that can be deployed and advertised by that instance is kept.
- The instance automatically creates a local bundle description directory /LocalBundleDescDir. This the directory where BundleDescriptors that describe deployed bundles are kept.

Once mCom is running, the following command features can be executed:

Command	Action
isReg%<bool>	Enables the instance to switch on/off registry service.
drs	The instance executes Dynamic Registrar Discovery. This involves the automatic discovery of instances on the platform (including itself) that also assume the role of a Registrar.
reg	show a list of all available Registrars that the instance can advertise or lookup contracts.
deploy	deploys all bundles in LocalBundleDir directory. For each deployed Bundle, a BundleDescriptor is generated. The descriptor is stored as .xml file in /LocalBundleDescDir. Only deployed bundles can be advertised, looked up and invocked.
llookup	The instance executes a local lookup all bundle contracts in LocalBundleDir. This provides information on each bundle and the associated contracts that it provides.
rlookup	The instance executes a remote lookup of all advertised contracts with known Registrars
adv%<bundleId>	The instance advertises all the contracts in a bundle descriptor referenced by bundleId. The advert is sent to all known Registers.
sadv	Shows all the adverts that has been made on the instance. This command is only active if the instance also assumes the rolw of a Registrar.
invoke	A remote invocation of a specified bundle contract. This function requires bundleId, contract name and contract parameters as input. (This command is to be completed as part of task 1)

The java class files and dependencies for compiling and running `mCom`, `mbundle-annotation` and `gbpBundle` is contained in the bundle `mComCompendium.zip` (available for download from Moodle). The shell script `mcom.sh` is also included. This script is to enable you start mcom.jar from command line, you can amend to suit your environment.

Task 1 (2.5 marks):
This task is essential to complete the invoke command. This should be achieved by completing the code for `executeRemoteCall` method in `mcom.kernel.impl.RemoteMComInvocation` class. The method takes as parameter inv_doc., which is a xml text encoding for the remote invocation, and returns an object representing the result of invocation. You may uncomment the first line of this function to study content of text encoding by using eclipse on debug mode. To complete this task, you will need to carry out the following:

1. Get the object class from the BundleDescriptor. The object class is the bundle controller (i.e. a class annotated with @mController).
2. Identify the right method to call and associated parameters by comparing methods in object class with encoded contract in inv_doc.
3. When the right method is identified, call the method on an instance of the class and store in the returned object result.

You may find page 33 (invoking methods) of lecture slides on reflective and adaptive components useful to achieve this task. You may also want to investigate how class loader has been used in MCom to generate BundleDescriptors

Task 2 (2.5 marks):
Study the code and usage of mCom annotation in gbpBundle. Based on that, convert the code in the folder wbundle to a deployable mCom bundle.

Deliverables:

1. Group demonstration of each tasks to the course tutor. This will be done during scheduled lab session.
2. Submit your refactored code and jar as a compressed zip file on Moodle.

Datelines:

- Exercise will be assessed during labs sessions of week 21 and 22. That is: **Friday 13th Feb 2015** and **Friday 20th Feb 2015**.

Process:

This is a group exercise and every member of the group is expected to take an active role. At the end of the exercise, every individual in a group will submit an objective peer review of effort and contributions of group member to the tutor. Submission shall be made via Moodle. For the review, you will benchmark each member of the team on a Likert scale of 1-5. Where 1 means no contribution and 5 is excellent contribution.