FUJITSU Software
Systemwalker Service Catalog Manager V15.3.2

Technology Provider's Guide

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Contents

About this Manual

This manual describes the tasks of technology providers in order to prepare software applications for usage in a SaaS model and integrate them with FUJITSU Software Systemwalker Service Catalog Manager - hereafter referred to as Catalog Manager (CT-MG).

The manual is structured as follows:

Chapter	Description
Introduction on page 7	Explains how to prepare applications for SaaS and gives an overview of the integration tasks.
Access Types on page 14	Describes how users can access an application that is integrated with CT-MG.
Integrating Applications with CT-MG on page 21	Describes how to implement the interfaces between an application and CT-MG.
Provisioning Applications as Services in CT-MG on page 25	Describes how to register applications as services in CT-MG and appoint suppliers for them.
Reporting on page 29	Describes the reports available for technology providers in CT-MG.
Menu Options and User Roles on page 30	Gives an overview of the menu options relevant for technology providers.
Technical Service Definition XML File on page 31	Describes the elements of a technical service definition.

Readers of this Manual

This manual is directed to technology providers who are responsible for integrating applications with CT-MG.

This manual assumes that you are familiar with the following:

- CT-MG concepts as explained in the *Overview* manual
- Basic Web service concepts
- XML and the XSD language
- A programming language that can be used to create and invoke Web services, for example, Java
- Java, Java servlets, and Java server pages
- Installation and basic administration of Web servers

Notational Conventions

This manual uses the following notational conventions:

Add	The names of graphical user interface elements like menu options are shown in boldface.

`init`	System names, for example command names and text that is entered from the keyboard, are shown in Courier font.
`<variable>`	Variables for which values must be entered are enclosed in angle brackets.
`[option]`	Optional items, for example optional command parameters, are enclosed in square brackets.
`one	two`	Alternative entries are separated by a vertical bar.
`{one	two}`	Mandatory entries with alternatives are enclosed in curly brackets.

Abbreviations

This manual uses the following abbreviations:

APP	Asynchronous Provisioning Platform
CT-MG	Catalog Manager
IaaS	Infrastructure as a Service
PaaS	Platform as a Service
SaaS	Software as a Service
SAML	Security Assertion Markup Language
WSDL	Web Services Description Language
XSD	XML Schema Definition

Available Documentation

The following documentation on CT-MG is available:

- *Overview:* A PDF manual introducing CT-MG. It is written for everybody interested in CT-MG and does not require any special knowledge.
- *Online Help:* Online help pages describing how to work with the administration portal of CT-MG. The online help is intended for and available to everybody working with the administration portal.
- *Installation Guide (GlassFish):* A PDF manual describing how to install and uninstall CT-MG. It is intended for operators who set up and maintain CT-MG in their environment.
- *Operator's Guide:* A PDF manual for operators describing how to administrate and maintain CT-MG.
- *Technology Provider's Guide:* A PDF manual for technology providers describing how to prepare applications for usage in a SaaS model and how to integrate them with CT-MG.
- *Supplier's Guide:* A PDF manual for suppliers describing how to define and manage service offerings for applications that have been integrated with CT-MG.
- *Reseller's Guide:* A PDF manual for resellers describing how to prepare, offer, and sell services defined by suppliers.
- *Broker's Guide:* A PDF manual for brokers describing how to support suppliers in establishing relationships to customers by offering their services on a marketplace.

- *Marketplace Owner's Guide:* A PDF manual for marketplace owners describing how to administrate and customize marketplaces in CT-MG.
- *Developer's Guide:* A PDF manual for application developers describing the public Web service interface of CT-MG and how to integrate applications and external systems with CT-MG.
- *ServerView Resource Orchestrator Integration (GlassFish):* A PDF manual for operators describing how to offer and use virtual platforms and servers controlled by ServerView Resource Orchestrator through services in CT-MG.
- *Amazon Web Services Integration (GlassFish):* A PDF manual for operators describing how to offer and use virtual servers controlled by the Amazon Elastic Compute Cloud Web service through services in CT-MG.
- *OpenStack Integration (GlassFish):* A PDF manual for operators describing how to offer and use virtual systems controlled by OpenStack through services in CT-MG.
- Javadoc documentation for the public Web service interface of CT-MG and additional resources and utilities for application developers.

1 Introduction

Catalog Manager (CT-MG) is a set of services which provide all business-related functions and features required for turning on-premise software applications into Software as a Service (SaaS) offerings and using them in the Cloud. This includes ready-to-use account and subscription management, online service provisioning, billing and payment services, and reporting facilities.

With its components, CT-MG covers all the business-related aspects of a Platform as a Service (PaaS) or Cloud platform. It supports software vendors as well as their customers in leveraging the advantages of Cloud Computing.

The basic scenario of deploying and using applications as services in the CT-MG framework involves the following organizations:

- **Technology providers** (e.g. independent software vendors) technically prepare their applications for usage in the Cloud and integrate them with CT-MG. They register the applications as technical services in CT-MG.
- **Suppliers** (e.g. independent software vendors or sales organizations) define service offerings, so-called marketable services, for the technical services in CT-MG. They publish the services to a marketplace.
- **Customers** register themselves or are registered by an authorized organization in CT-MG and subscribe to one or more services. Users appointed by the customers work with the underlying applications under the conditions of the corresponding subscriptions.
- **Marketplace owners** are responsible for administrating and customizing the marketplaces to which services are published.
- **Operators** are responsible for installing and maintaining CT-MG.

In extended usage scenarios, the suppliers who define marketable services may involve additional users and organizations in offering and selling these services:

- **Brokers** support suppliers in establishing relationships to customers by offering the suppliers' services on a marketplace. A service subscription is a contract between the customer and the supplier.
- **Resellers** offer services defined by suppliers to customers applying their own terms and conditions. A service subscription establishes a contract between the customer and the reseller.

1.1 The Technology Provider's Tasks in CT-MG
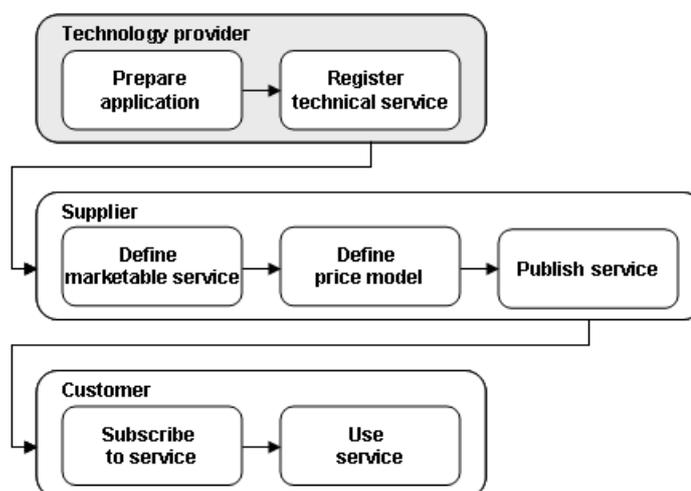
As a technology provider, you own or develop applications which you intend to provide as services in the Cloud using CT-MG to cover the business-related functionality.

To achieve this goal, you perform the following basic tasks:

- Prepare your applications for usage in a SaaS model, taking into consideration aspects such as a remote interface, multi-tenancy, high scalability and availability, and security.
- Implement the technical interfaces for integrating the applications with CT-MG.
- Provision the applications as technical services in CT-MG.

As soon as a technical service is available in CT-MG, one or more suppliers appointed by you can define actual service offerings, so-called marketable services, for it. The suppliers (or brokers or resellers appointed by them) publish these services to a marketplace, where customers can subscribe to them.

CT-MG provides specific reports for technology providers. For example, you can retrieve information on the number of subscriptions for your services and on the usage and load of the underlying applications.

As a technology provider, you can also act as a customer in CT-MG. This means that you are automatically privileged to subscribe to services and work with the services you have subscribed to.

If you also need to perform supplier or marketplace owner tasks, your organization must be assigned the corresponding roles by the CT-MG operator.

1.2 Preparing Applications for Usage in a SaaS Model

An application that is to be offered in a SaaS model should take the following aspects into consideration:

Remote Interface

Your application should have a remote interface by which users can access it from anywhere in the Web (Internet/Intranet). This may be, for example, a Web user interface or a Web service.

Multi-Tenancy

Your application should have multi-tenancy capabilities, at least with respect to the management of data: The data of different customers or of different service subscriptions of a customer should be clearly separated from each other and only be accessible by the respective customer or subscription user.

In CT-MG, the term "instance" refers to what is provisioned for a tenant (customer or subscription) on the application side. Before integrating an application with CT-MG, you must decide what to consider an instance in the context of the application. Possible solutions range from using different workspaces in one data container over maintaining different databases to instantiating different virtual servers in an Infrastructure as a Service (IaaS) environment.

Also, you need to decide what you want to provision an instance for. The usual and recommended way is to provision one instance for each subscription:
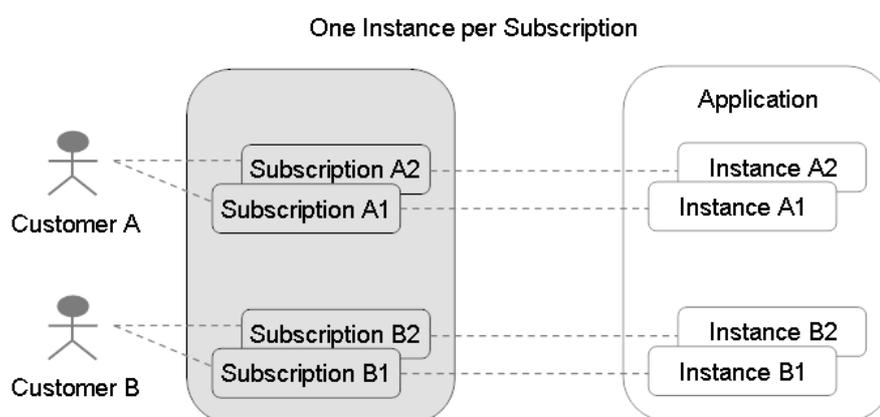
In case your application runs in a stateless mode and there is no need to store any data, or in case you know that a customer will only use one subscription, you could use one instance for a customer or you could even use a single instance for all subscriptions of all customers:

One Instance per Customer

One Instance for all Subscriptions
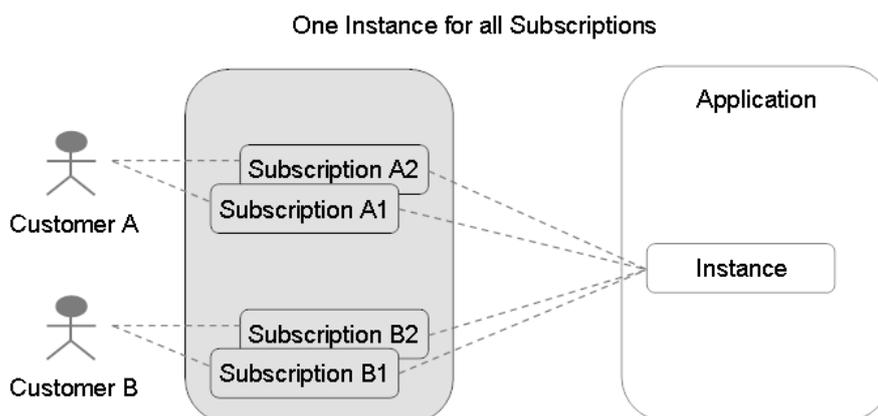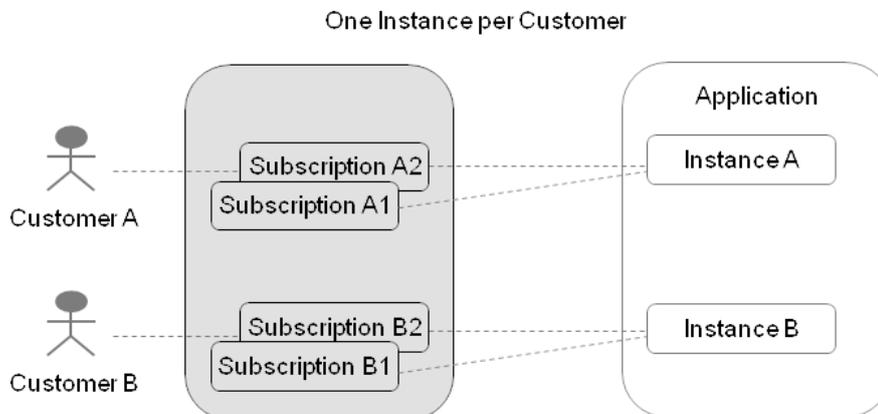
High Scalability

The number of users, performance, and space requirements may differ to a great extent for each customer. Therefore, your application should provide for high scalability.

High Availability

Ideally, your application should be available 24x7. You may consider having your application hosted in a professional data center that takes care of non-stop operation, backup, data security, and regular maintenance.

Security

Consider the following security aspects when implementing your application: Web service calls between CT-MG and the application can be sent as plain text containing a user ID and password.

For secure communication, the usage of certificates is recommended.

1.3 Overview of Integration Tasks

An application can be integrated with CT-MG components as shown in the following illustration. The CT-MG components are colored in dark grey:
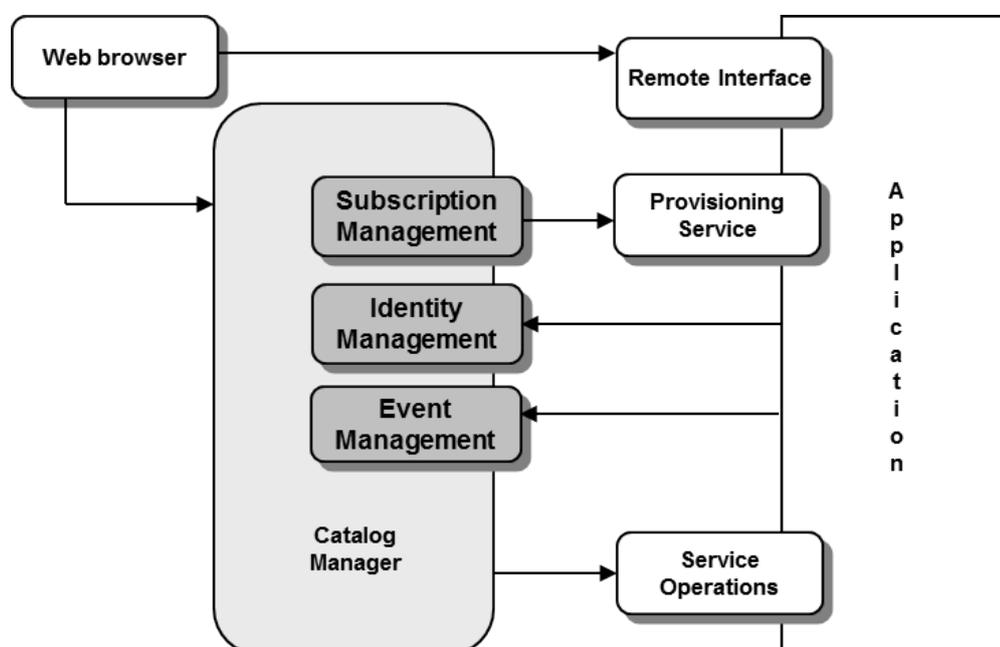
Depending on your requirements, the integration involves the following tasks:

1. Decide how users access your application. Depending on the type of access, you need to consider different aspects for integration.

   Users may access an application directly or through CT-MG. When access occurs through CT-MG, user management and authentication are under full control of the CT-MG identity management, and price models on a per-user basis can be used.

   For details on access types, refer to *Access Types* on page 14.

2. Implement a provisioning service (optional).

   If an application is to integrate with the subscription management of CT-MG, it must provide a corresponding Web service (provisioning service). By the provisioning service, CT-MG triggers the application to provision and manage whatever is required for a subscription.

   For more details, refer to *Implementing a Provisioning Service* on page 21.

3. Adapt the application's login/logout implementation (optional).

   If an application is to be accessed through CT-MG, its login/logout implementation must be adapted. Depending on the access type, specific methods defined by the provisioning service must be implemented.

   For more details, refer to *Adapting the Login/Logout Implementation* on page 22.

4. Integrate with the CT-MG event management (optional, but recommended for fine-grained pay-per-use billing).

   The application can send events to the event management of CT-MG. Events can be used as a basis for price models, billing, and reporting.

For more details, refer to *Integrating with CT-MG Event Management* on page 23.

5. Implement service operations (optional).

   The application can implement operations that can be executed from the CT-MG user interface. Service operations can be used to access the resources of the application and perform administrative tasks.

   For more details, refer to *Implementing Technical Service Operations* on page 23.

6. Provision your application as a service in CT-MG.

   To do so, you first have to register the application as a technical service with CT-MG, either via the CT-MG user interface or by preparing an XML service definition and importing it into CT-MG. Afterwards, you appoint suppliers for your services, who can then define service offerings.

   For details, refer to *Provisioning Applications as Services in CT-MG* on page 25.

1.4 Accessing CT-MG

You use the CT-MG user interface to perform some of your tasks. The role of your organization as a technology provider basically determines which features are available to you at the CT-MG user interface. The actions available to you as an individual user additionally depend on your user role within the organization.

CT-MG distinguishes between the following user roles within technology provider organizations:

- **Administrator**: Each technology provider organization must have at least one user with this role. An administrator can manage the organization's account and subscriptions as well as its users and their roles. The first administrator of an organization is defined when the organization is created.
- **Technology manager**: This role allows a user to define technical services in CT-MG.

To access the CT-MG user interface, you use the login information provided by CT-MG in the email confirming the creation of your user account. If your organization uses an external authentication system, passwords are managed in this system. This means that you log in with the password as stored in this system, and the email sent by CT-MG does not contain a password.

To log in to the administration portal where you will perform your tasks:

1. Click the link provided in the email, or type the access URL in your Web browser's address bar.

   The access URL has the following format:

   ```
   http://<server>:<port>/<context-root>
   ```

2. On the **Login** page, type your user ID and password.
3. Click **Login**, or press **Return**.

You are either logged in directly, or you are prompted to change your initial password when you log in for the first time. It is highly recommended to change the initial password.

If you try to log in with a wrong password, your account may be locked after the third attempt. This depends on whether your organization maintains its user data in an external authentication system. In this case, passwords can only be changed or reset in this system. If user data are maintained in the platform, contact your administrator who can reset your password. You will get a new temporary password for your next login.

If you have forgotten your password, click **Forgot your password?** on the **Login** page. This allows you to define a new password for your user ID. Defining a new password is not possible if

your account is locked or if your organization maintains its user data in an external authentication system.

If you have forgotten your user ID, contact your administrator who can look up the IDs of all users registered for your organization.

If your session expires, you have to log in again.

2   Access Types

CT-MG offers various ways of integrating and accessing your application. The interaction takes place between the following components:

*   The client which in fact is the user who accesses a service using a Web browser or a Web service
*   CT-MG
*   The application which is accessed by the user

There are some criteria to be considered before you decide to use a specific access type. The following decision diagram helps you in deciding which access type to use according to your environment and requirements:
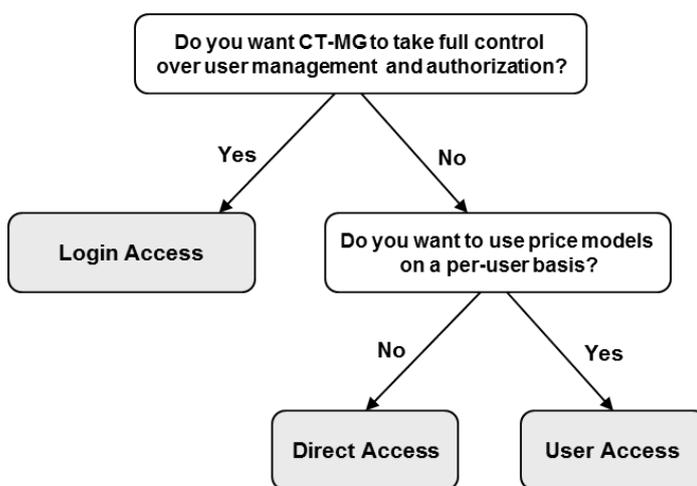
The decision you make is reversible. If the basic requirements of your system are changing, you can, of course, also change the access type.

The access type determines

*   whether your application uses CT-MG for user authentication and CT-MG forwards login information to your application (**application login**).
*   whether your application needs to implement a **provisioning service**.

The following table provides an overview of the different access types and the available combinations:

Functionality / Access type	Application Login (to be supported by the application)	Provisioning Service (to be supported by the application)
Login access	yes	yes
Direct access	no	yes without CT-MG user management
User access	yes *	yes
External access	no	no

* With user access, the application login can be controlled completely by the application, or SAML 1.1 can be used as a single sign-on mechanism for user authentication.

You define the desired access type when preparing a technical service definition for your application. If you opt for access through CT-MG (login access), you need to adapt the login/logout implementation in your application. Depending on the access type you choose, you must implement the methods defined by the provisioning service.

The following sections provide detailed information on the different access types. The sequence diagrams illustrate the interaction between the involved components. Arrows with solid lines represent messages requiring a response, arrows with dotted lines represent the response messages.

2.1   Login Access

With login access, CT-MG is involved during login.

User management and authentication are under full control of the CT-MG identity management, and price models on a per-user basis and corresponding billing services can be used.

After login, any interaction between the client and the application takes place directly and without CT-MG being involved.

The following figure shows the interaction between the client, CT-MG, and the application:

Login Access
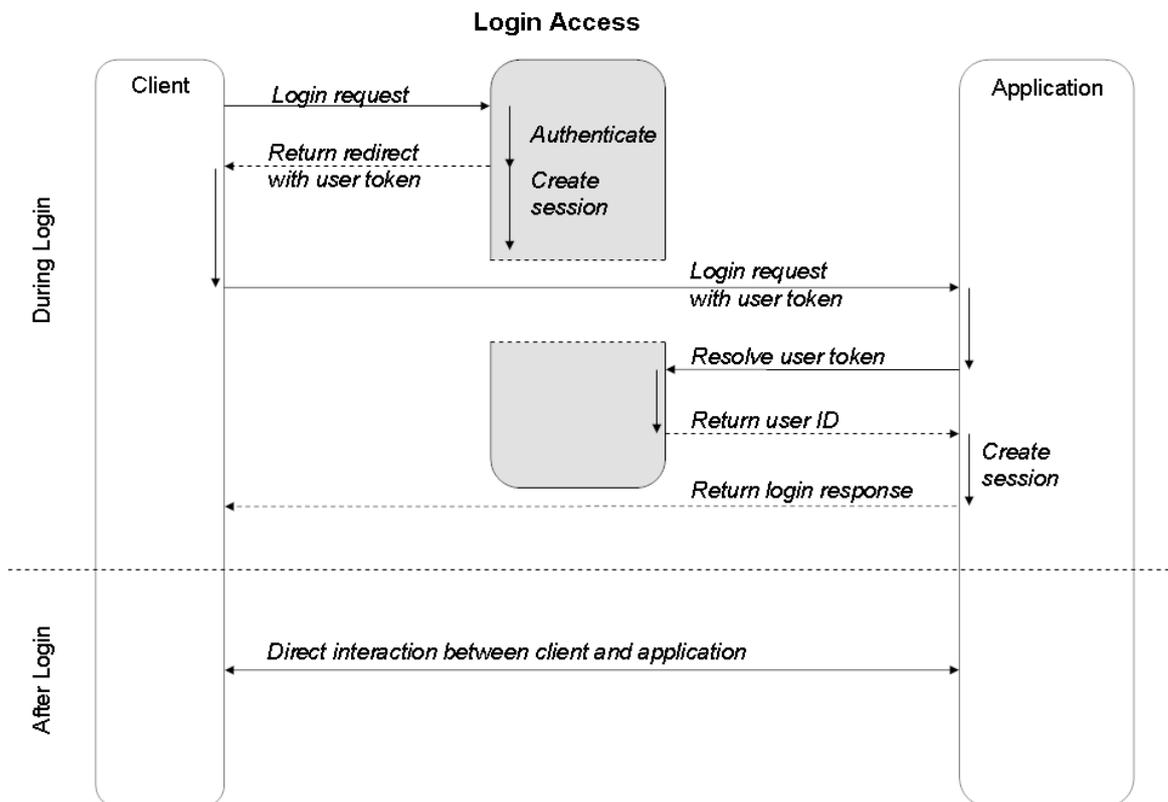
When a user logs in to CT-MG in order to use a service, he is authenticated by CT-MG and a CT-MG session is created. CT-MG creates a user token and returns it to the client together with a redirect to the application. The client, in turn, sends the login request with the user token to the application, which must be publicly visible. To be able to log the user in, the application sends a login request to CT-MG prompting for the user ID corresponding to the user token. Once the user ID is returned, the application needs to log the user in without requesting any further credentials. Users are trusted because they have been authenticated by CT-MG.

After login, any interaction takes place directly between the client and the application.

Note: Your application should provide some default content for the base URL, since this URL specifies the application's remote interface if a user is already logged in to CT-MG. The base URL is specified in the technical service definition (see *Technical Service Definition XML File* on page 31).

Logout

CT-MG needs to be notified by the application when a user logs out. The corresponding CT-MG user session is then closed and the session data is updated in the CT-MG database.

After logout, the application must redirect the user to its own logout page. The full URL of this page is returned by the `deleteServiceSession` method of the CT-MG session service.

> **Note:** Users must not be redirected to the session after logout. Access to the application is no longer authorized because the CT-MG session has been closed.

2.2 Direct Access

With direct access, users interact directly with the application.

As login is not carried out through CT-MG, there are no special requirements from CT-MG concerning the application's login/logout functionality. CT-MG has no information about the number and duration of user sessions. Therefore, price models on a per-user basis and corresponding billing services in CT-MG cannot be used.

The following figure shows the interaction between the client, CT-MG, and the application:

Direct Access

The client sends a user's login request directly to the application. The application authenticates the user, creates a session, and returns that session to the client. Any subsequent interaction also takes place directly between the client and the application.

The application needs to ensure that users are directed to the application instance that belongs to the relevant subscription in CT-MG. For Web applications, this could be achieved, for example, by configuring separate application URLs for the individual subscriptions. The relevant application URL can be included in the information which is returned to CT-MG when the instance for a new subscription is created.

2.3 User Access

With user access, users interact directly with the application.

However, a basic user management is still carried out in CT-MG, which means that the corresponding methods of the provisioning service are called when assigning a user to a

subscription. Thus, price models on a per-user basis and corresponding billing services in CT-MG can be used.

The application login can either be controlled completely by the application, or you can use SAML to provide a single sign-on mechanism. If you use SAML, the required authorization must be performed by the application itself.

Access Without Single Sign-on

Users may interact directly with the application without involving CT-MG in any way.

The following figure shows the interaction between the client, CT-MG, and the application:
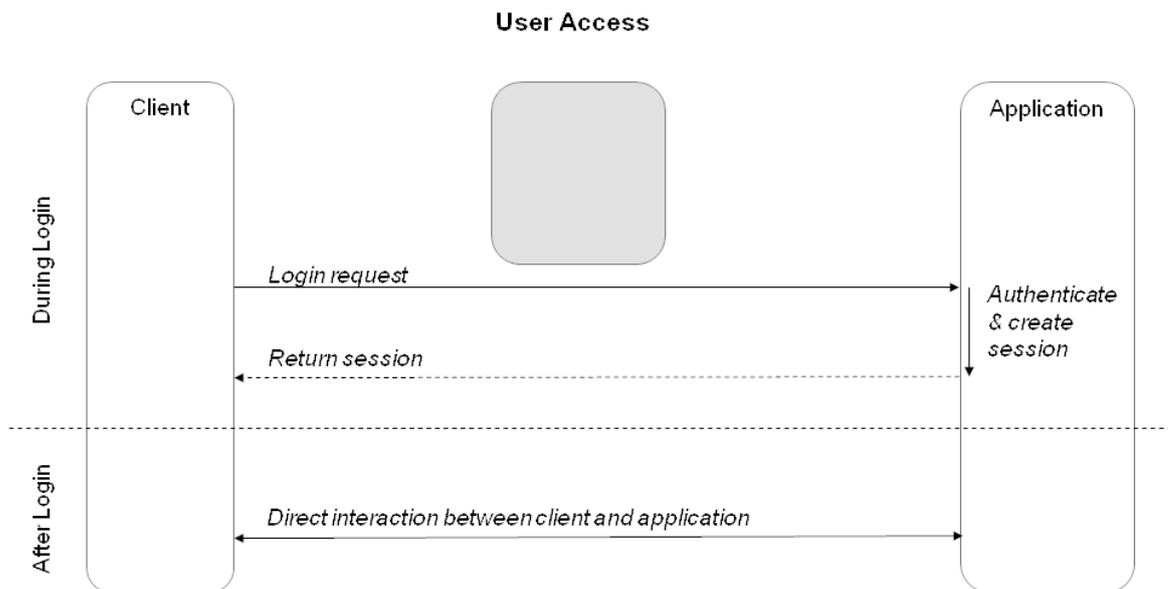
The client sends a user's login request directly to the application. The application authenticates the user, creates a session, and returns that session to the client. Any subsequent interaction also takes place directly between the client and the application.

The application needs to ensure that users are directed to the application instance that belongs to the relevant subscription in CT-MG. For Web applications, this could be achieved, for example, by configuring separate application URLs for the individual subscriptions. The relevant application URL can be included in the information which is returned to CT-MG when the instance for a new subscription is created.

Access With Single Sign-on Using SAML

The Security Assertion Markup Language (SAML) is an XML-based open standard for exchanging authentication and authorization data between security domains, that is between an **Identity Provider** (a producer of assertions) and a **Service Provider** (a consumer of assertions). SAML assertions contain statements that Service Providers use to make access control decisions.

In CT-MG terms, the Identity Provider is CT-MG itself, the Service Provider is the application to be accessed. Authorization data are not exchanged.

For details on SAML, refer to the information on the relevant websites. CT-MG supports the SAML 1.1 standard.

The following figure shows the interaction between the client, CT-MG (Identity Provider), and the application (Service Provider):
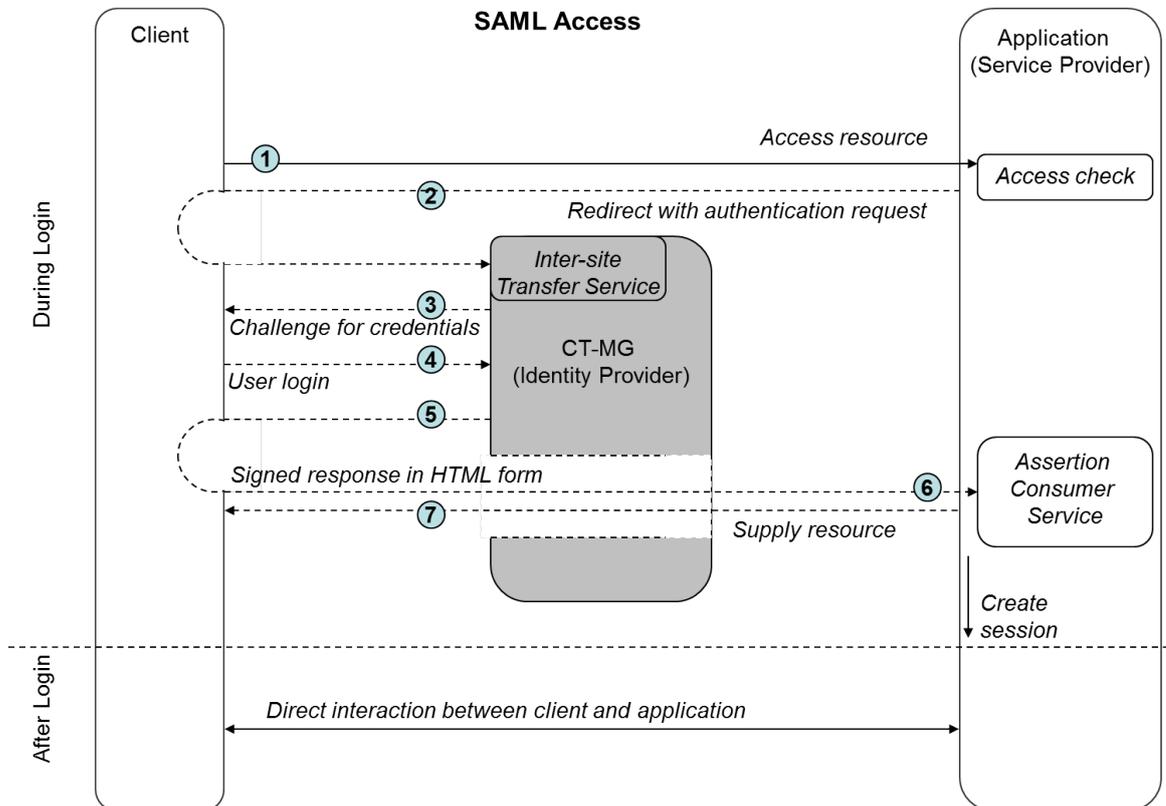
The following steps are depicted in the figure above:

1. A user tries to access a resource of the application (Service Provider) integrated with CT-MG (Identity Provider).

2. The application requests the inter-site Transfer Service (SSO Service) of CT-MG:

    `https://idp.example.org/TransferService?TARGET=<target>`

    where `<target>` is the desired resource at the Service Provider.

    Be aware that the browser/POST profile does not specify how the URL to the Transfer Service (with the `TARGET` parameter) is obtained by the Service Provider. The Service Provider must be configured so that it can obtain the URL to the Transfer Service.

3. The inter-site Transfer Service determines whether the user has an existing logon security context. If this is not the case, CT-MG interacts with the client to prompt the user to provide valid credentials.

4. The user provides valid credentials and a local logon security context is created for him within CT-MG.

5. The inter-site Transfer Service returns an HTML document containing a `FORM` element, where the `TARGET` parameter of step 2 has been preserved. The value of the `SAMLResponse`

parameter is the base64 encoding of a SAML `Response` element. The SAML `Response` is digitally signed by the Identity Provider. This signature contains the public certificate to be used for validating the signature value.

It is assumed that the Service Provider has already established a security context at the Identity Provider, otherwise the inter-site Transfer Service is unable to provide an authentication statement in the SAML `Response` element.

6. The Identity Provider requests the Assertion Consumer Service at the Service Provider, where the values of the `TARGET` and `SAMLResponse` parameters are taken from the HTML form created in step 5.

7. The Assertion Consumer Service consumes the SAML `Response` element and creates a local security context at the Service Provider. The Service Provider must take care of validating the SAML `Subject` identifying the user and perform the required authorization. If the validation is successful and the user is allowed to access the application, the Service Provider redirects the client to the target resource.

After login, any interaction takes place directly between the client and the application.

> **Note:** Your application should provide some default content for the base URL, since this URL specifies the application's remote interface if a user is already logged in to CT-MG. The base URL is specified in the technical service definition (see *Technical Service Definition XML File* on page 31).

In order for your application to use CT-MG as Identity Provider, you must observe and take care of the following:

- Your application must support SAML 1.1. For example, the authentication ID passed with the SAML request (see below) must conform to the SAML 1.1 standard.

- The SAML request your application sends as HTTP redirect response to the inter-site Transfer Service of CT-MG contains the following parameters:
  - `ACS`: URL of the Service Provider Assertion Consumer Service
  - `TARGET`: Target URL of the requested resource
  - `authID`: Authentication ID for the SAML request

  Example:

```
https://myserver.example.com/fujitsu-bss-portal/saml/identityProvider.jsf?
 ACS=http%3A%2F%2Fmyapp.info%2Fcom.myplace.sso.POSTProfileGateway.wcp&
 TARGET=http://user.myapp.info/olc/&
 authID=63f1848a-699a-11e0-f029-2871ec2d5
```

- The Service Provider Assertion Consumer Service must be able to validate the digitally-signed assertion returned by the inter-site Transfer Service of CT-MG.

2.4 External Access

With external access, users can access an application directly after subscribing to a corresponding service. The users are redirected immediately to the application. The URL leading to the application is specified in the technical service definition.

Any further interaction takes place directly between the client and the application without involving CT-MG in any way.

3 Integrating Applications with CT-MG

Integrating an application with CT-MG involves the following implementation tasks:

- Implement a provisioning service
- Adapt the login/logout implementation
- Integrate the application with the CT-MG event management
- Implement service operations

These tasks are described in detail in the sections below.

To help you perform these tasks, the CT-MG integration package (`fujitsu-bss-integration-pack.zip` file) with the following artifacts is shipped and provided with CT-MG:

- Web service specifications as Javadoc
- WSDL and XSD files
- Java archives with resources required for implementing the necessary Web services

The following Web services and utilities are shipped for public use with CT-MG:

- Platform services
- Provisioning API for implementing a provisioning service
- Notification API for implementing a notification service
- Operation API for implementing service operations

For a detailed description of the Web services and the usage of the utilities, refer to the *Developer's Guide*.

Prerequisites

Integrating applications with CT-MG involves several interfaces for communication between the CT-MG platform and the technical service or application. The communication takes place in two directions: Calls from the application to CT-MG (inbound calls) as well as calls from CT-MG to the application (outbound calls). For inbound calls, the application must implement a client; for outbound calls, the application must provide a server.

Before you begin, make sure that the following prerequisites are met:

- The application to be integrated is installed and operational.
- An application server is installed and operational.
- You have access to the CT-MG integration package.

3.1 Implementing a Provisioning Service

As a first integration step, you implement a so-called provisioning service that exposes its operations as a Web service. A provisioning service is required for integrating an application with the subscription management of CT-MG. The provisioning service is called by CT-MG when customers subscribe to a service and manage their subscriptions. Additionally, the provisioning service may be called for creating and managing users.

You do not need to implement a provisioning service if you have chosen to use the external access type. For details on access types, refer to *Access Types* on page 14.

For the implementation of a provisioning service, you need to consider the following:

- **Instance provisioning**

When a customer subscribes to a service, the underlying application is supposed to perform specific steps required for the subscription and return an identifier to CT-MG for future reference. The term 'instance' denotes all the items that the application has provisioned for a subscription.

The actions to be performed and the items to be created, if any, depend entirely on the concepts and functionality of your application. For example, if a customer creates and stores data when using your application, your application may create a separate workspace in a data container or a separate database instance.

- **Provisioning mode**

  Instance provisioning can be performed in synchronous or asynchronous mode.

  Synchronous mode is used if provisioning can be completed right away. The provisioning service triggers the application to perform all the required actions and confirms the operation as complete. CT-MG then sets the subscription to active, which means that the service is ready to be used by the customer.

  Asynchronous mode is used if provisioning operations take a long time because long-running processes or manual steps are involved, or when huge amounts of data or virtual machines need to be set up. In this case, the provisioning service notifies CT-MG that the provisioning is pending. Required actions may have started on the application side, but have not been completed yet. The provisioning service needs to notify CT-MG using the subscription management service when provisioning is either complete or cannot be completed.

  CT-MG supports the development of asynchronous provisioning services with the asynchronous provisioning platform (APP). This is a framework which provides a provisioning service as well as functions, data persistence, and notification features which are always required for integrating applications in asynchronous mode. The framework, samples, and documentation are provided in the integration package for asynchronous provisioning (`fujitsu-bss-integration-app-pack.zip` file).

- **Application parameters**

  An application may have parameters that are of relevance for the service provisioning in CT-MG. Parameters can be used to define different feature configurations or service restrictions, for example, the maximum number of folders, files, or objects that can be created. Application parameters are specified in the technical service definition.

  CT-MG can pass parameters to your application through the instance provisioning call. Any further processing must be carried out by your application. Especially if parameters are used to impose restrictions on service usage, the application needs to ensure that the restrictions are met. For example, if there is a parameter to restrict the maximum number of files created for a subscription, the application needs to track the actual number and ensure that the maximum number is not exceeded.

  For details on how to define parameters in the technical service definition, refer to *Technical Service Definition XML File* on page 31.

- **User management**

  If users access your application through CT-MG, you need to implement user management operations. These operations are called when users are assigned to or deassigned from a subscription in CT-MG, or when user profiles are updated. Your application may take corresponding actions, for example, create corresponding user accounts in its own user management system.

For details on how to implement a provisioning service, refer to the *Developer's Guide*.

3.2 Adapting the Login/Logout Implementation

If you opt for access through CT-MG (login access), you need to adapt the login/logout implementation of your application to pass the control and authentication of users from the application to CT-MG, and implement the relevant methods defined by the provisioning service.

The required functionality for login and logout is distributed between a token handler, a custom login module, a custom logout module, and a logout listener:

- The **token handler** is responsible for requesting CT-MG to resolve a user token into a user ID. It takes up the task of creating a session object and storing the user ID in that object. Additionally, it forwards requests containing a resolved user token to the custom login module.

- The **custom login module** passes the user ID to the application. It enables users to log in to the application without requesting any further credentials. Users are trusted because they have already been authenticated by CT-MG. For example, a custom login module might pass the user ID and a default password to the application.

  To ensure that any login takes place through CT-MG, the direct login to your application must be bypassed. For this purpose, you have to implement the required interface methods between the application and CT-MG.

- The **custom logout module** closes user sessions on the application side and redirects users to the logout page of CT-MG. The URL of the logout page is returned to the application by the `deleteServiceSession` method of the CT-MG session service.

- The **logout listener** notifies CT-MG when a user logs out or a session timeout occurs.

For details on how to adapt the login/logout implementation, refer to the *Developer's Guide*.

3.3 Integrating with CT-MG Event Management

The event management service in CT-MG collects specific events generated during application operation. These events can be used for price models, billing, and reporting. Examples of events are the completion of a specific transaction, or the creation or deletion of specific data.

Your application can send events to CT-MG at runtime through the event management service, which is one of the CT-MG platform services.

To integrate with CT-MG event management:

1. If your application does not generate the required events yet, implement the generation of events.

2. Implement the sending of events to CT-MG.

   For details, refer to the *Developer's Guide*.

3. When preparing the technical service definition, declare the events that your application will send.

   For details on the technical service definition, refer to *Technical Service Definition XML File* on page 31.

3.4 Implementing Technical Service Operations

You may wish that your technical service offers additional operations or functions that are to be accessible via the CT-MG user interface. In a SaaS environment, applications are not installed locally but provisioned as services. Therefore, users cannot access the system resources the applications are using, for example, to perform administrative tasks such as system backup or

shutdown. Technical service operations can be used to access the resources of an application and perform administrative tasks without actually opening the application.

To provide technical service operations, a Web service based on the operation service API must be implemented. The operations, their parameters, and the access information of the Web service must be specified in the technical service definition for the application. Refer to *Technical Service Definition XML File* on page 31 for details.

For details on how to implement a Web service with technical service operations, refer to the *Developer's Guide*.

4 Provisioning Applications as Services in CT-MG

After the required adaptations of your application are finished, you register your application as a technical service in CT-MG.

There are two possibilities for achieving this task:

1. If the application does not provide any parameters, options, roles, events, or operations, register the application as a technical service using the CT-MG user interface. Here, you can define the basic features for the technical service you want to provide.

2. If an application is more complex and provides parameters, options, etc., create an XML file containing the technical service definition and import this file into CT-MG.

The figure below provides an overview of the two possibilities:

Possibility 1

1 | CT-MG administration portal: Register technical service

> Technical service name
> Access type
> Service URL
> Provisioning service URL
> Login path

2 | CT-MG administration portal: Update service definition

> Descriptive texts
> License information

Possibility 2

1 | Create service definition in XML file

> Technical service name
> Access type
> Service URL
> Provisioning service URL
> Login path
>
> Descriptive texts
> License information
>
> Parameters and options
> Events
> Roles
> Operations

2 | CT-MG administration portal: Import service definition

Possibility 1 consists of registering the application and then updating the service definition. Possibility 2 consists of creating an XML file and importing this file into CT-MG.

You can also combine both ways. For example:

1. Register the service using the CT-MG user interface.

2. Export the service definition and save it to an XML file.

3. Edit the XML file: Specify descriptions, license information, parameters, options, events, roles, operations, etc.

4. Import the XML file into CT-MG again.

After registering your application as a technical service, you need to appoint suppliers for it in CT-MG so that marketable services can be defined and published.

The following sections describe the individual steps in detail.

4.1 Registering a Technical Service

By registering an application as a technical service, you make it available in CT-MG.

To register a technical service:

1. Log in to the CT-MG administration portal using the login information provided by CT-MG.

2. Do one of the following:

   - Select **Technical Service** > **Register service definition**, and fill in the fields as desired.
   - Select **Technical Service** > **Import service definition**, and import the XML file containing your service definition.

     For details on how to create a technical service definition, refer to *Defining a Technical Service in an XML File* on page 26.

4.2 Defining a Technical Service in an XML File

You can define a technical service in an XML file. The file contains a description of the service's purpose, the license agreement, application parameters, options, events, service roles, and operations.

A service definition must conform to the `TechnicalServices.xsd` XML schema. For detailed information on the elements and attributes, refer to *Technical Service Definition XML File* on page 31.

To prepare a service definition in an XML file:

1. Create an XML file according to the `TechnicalServices.xsd` XML schema, and save it under a name of your choice, for example, `ServiceDefinition.xml`.

2. In the `TechnicalService` section of the file, specify at least the following information:

   - `id`
   - `accessType`
   - `provisioningType` (if not specified, instance provisioning is performed in synchronous mode)
   - `provisioningUrl` (optional for external access, otherwise required)

3. If you have configured basic user authentication (authentication without certificates) and since CT-MG is the only application allowed to access your provisioning service, specify the following information:

   - `provisioningUserName`
   - `provisioningPassword`

4. Do one of the following:

   - If users log in directly to your application (user or direct access), describe how to access the application using the `accessInfo` element.
   - Fill in the `baseUrl` attribute (mandatory for login and external access).
   - If login is performed through CT-MG (login access), fill in the `loginPath` attribute.

5. If there are any parameters that are to be passed to your application by an instance provisioning call, declare them in the `ParameterDefinition` sections.

6. If your application sends events to CT-MG, declare all the events in the `Event` sections.

7. If you want to define your own service roles, declare them in the `Role` sections.

8. If you want to allow users to invoke specific operations on your technical service, declare the operations in the `Operation` sections.

4.3 Appointing Suppliers for a Technical Service

After registering a technical service either by importing the technical service definition XML file or by providing the required information at the user interface, you appoint one or more suppliers for it. Suppliers are the companies, departments, or people who offer your technical service as marketable services. Your organization may act as a supplier of its own, if it is granted the corresponding role by the CT-MG operator.

To appoint suppliers:

1. Log in to the CT-MG administration portal using the login information provided by CT-MG.

2. Select **Account** > **Manage suppliers** and select the technical service for which you want to appoint a supplier.

3. Specify the organization ID of the supplier to be appointed and click **Add**.

    You can only specify suppliers that have previously been registered by the CT-MG operator. You can obtain the organization IDs from your suppliers.

The suppliers can now start defining marketable services for the technical services they are appointed for. These can be different editions of the technical services with individual price models, configurations, upgrade options, and restrictions.

You can also delete suppliers from the list of appointed suppliers. If customer subscriptions exist for the marketable services of a supplier, a corresponding message is displayed. It lists the instance IDs of the underlying application instances. If you want to view the instance IDs for your technical services, you can create an instance report.

4.4 Updating and Maintaining the Service Definition

You can update the descriptive texts and the license agreement text for a technical service either by editing the XML service definition file, or - in a more convenient way - at the CT-MG user interface. The changes are effective for all newly defined marketable services based on this technical service.

To update the texts for the technical service in CT-MG:

1. Log in to the CT-MG administration portal using the login information provided by CT-MG.

2. Select **Technical Service** > **Update service definition**, and edit the texts as desired.

You can also update an existing technical service by editing the technical service definition and importing it again:

1. Log in to the CT-MG administration portal using the login information provided by CT-MG.

2. Select **Technical Service** > **Import service definition**.

Observe the following:

*   If there is no marketable service based on the technical service, you can change all properties of the technical service.

- If there is a marketable service based on the technical service, you cannot:
    - Change parameters and their options
    - Change event types
    - Remove parameters, options, or event types
- Roles cannot be removed if prices are defined for them or users having one of the roles are assigned to a related subscription.

You can also delete an existing technical service. If marketable services exist for the technical service, and if there are active subscriptions, it cannot be deleted. The technical service definition XML file is not deleted physically, and you can import it again on demand.

To delete a technical service:

1. Log in to the CT-MG administration portal using the login information provided by CT-MG.
2. Select **Technical Service** > **Delete service definition**.

5   Reporting

CT-MG offers comprehensive reports for different purposes and at different levels of detail. You can choose from various predefined reports.

The following reports are available for technology providers:

- **Technical service usage report**: Shows all technical services of a technology provider, including the type and number of the events that were collected during the usage of the services.
- **Supplier report**: Shows the suppliers registered by a technology provider for the technical services, and lists the marketable services which the suppliers have defined based on the technical services.
- **Subscription report**: Shows the marketable services suppliers created based on the technical services of the technology provider, and the number of subscriptions to the marketable services.
- **Instance report**: Shows all application instances of the technology provider's technical services and their configuration (parameters and values).

Use the **Create report** menu option in the **Account** menu of the CT-MG user interface and choose the desired report. Depending on the report type, you might have to enter additional report parameters.

The generated report is instantly displayed at the CT-MG user interface. You can choose to print the report or save it in several formats.

Note:	Contact your platform operator if the reporting functionality is not available. He is responsible for defining the respective configuration parameters.

Appendix A: Menu Options and User Roles

This appendix provides an overview of the user roles required for using the menu options at the CT-MG administration portal which are of relevance to a technology provider. For details on the menu options, refer to the *Online Help*.

Account Menu

The following user roles are required for using the menu options in the **Account** menu:

Edit profile	Any user role
Import users (if the organization uses LDAP-based user authentication)	Administrator
Change password (if the organization does not use LDAP-based user authentication)	Any user role
Register new users (if the organization does not use LDAP-based user authentication)	Administrator
Manage users	Administrator
LDAP settings (if the organization uses LDAP-based user authentication)	Administrator
Create report	Administrator
Process triggers	Administrator
Manage processes (if the organization is connected to an external process control system)	Any user role
Manage suppliers	Technology manager

Technical Service Menu

The following user roles are required for using the menu options in the **Technical service** menu:

Register technical service	Technology manager
Import technical service	Technology manager
Update technical service	Technology manager
Export technical service	Technology manager
Delete technical service	Technology manager

Appendix B: Technical Service Definition XML File

A service definition contains the information required to register an application as a technical service in CT-MG. It is specified in an XML file which needs to conform to the `TechnicalServices.xsd` XML schema.

This section describes the meaning of the elements and attributes that can be defined. For information on the syntax, refer to the `TechnicalServices.xsd` schema.

TechnicalServices

Top-level element of a service definition file.

TechnicalService

Contains all the information required to register an application as a technical service in CT-MG.

Attributes:

- `id` - ID of the application (required).

  The `id` is the key that uniquely identifies your application as a technical service. The ID must be unique across all your applications registered as technical services.

- `build` - Build number of the application (optional).

  You can use this number to specify the build number or patch level of the application underlying the technical service.

- `provisioningType` - Specifies whether instance provisioning is performed in synchronous or asynchronous mode (optional). The default is synchronous mode.

  For details on provisioning modes, refer to *Implementing a Provisioning Service* on page 21.

- `provisioningTimeout` - Specifies the time in milliseconds after which an asynchronous provisioning operation is considered to have failed (optional). By default, no timeout occurs.

- `provisioningUrl` - URL of the WSDL document that defines the provisioning service you implemented for your application (optional for the `EXTERNAL` access type, otherwise required).

  Be aware that for asynchronous provisioning, you need to use the HTTPS protocol.

- `provisioningVersion` - Version number of your provisioning service (optional).

- `provisioningUsername` - Name of the user who is authorized to access the provisioning service (optional).

  Only required if you secure your provisioning service by basic user authentication (authentication with user ID and password without certificates). Basic user authentication must ensure that the provisioning service can be called by CT-MG only.

  For details on securing the communication between CT-MG and the provisioning service and for details on authentication methods, refer to the *Developer's Guide*.

- `provisioningPassword` - Password of the user specified in `provisioningUserName` (optional).

- `accessType` - Specifies how users access your application (required).

  Use `DIRECT` if users log in directly to your application without involving CT-MG.

  Use `LOGIN` if users log in to your application through CT-MG. Subsequent interactions take place directly between the client and the application without involving CT-MG.

Use `USER` if the user-specific methods of the provisioning service should be used. With this access type, the application login can be controlled completely by the application, or SAML can be used as a single sign-on mechanism.

Use `EXTERNAL` if users should be able to access an application directly via the URL specified in the `baseUrl` attribute. The application ID (`id` attribute) is appended to the URL when accessing the service.

For details on access types, refer to *Access Types* on page 14.

- **baseUrl** - URL of the remote interface of your application. Users are forwarded to this URL for service access.

  Required for the `LOGIN` and `EXTERNAL` access type. For the `EXTERNAL` access type, you specify the external URL here. In the sample below (`baseUrl="http://myserver:7777/myservice"`), your Web application is running on `myserver` at port `7777`.

  Optional for the `DIRECT` and `USER` access type. At the CT-MG administration portal, a marketplace owner can define featured services for his marketplace home page. If a marketplace owner decides to display services and subscriptions grouped by category on his home page, the specification of the **baseUrl** is recommended. It allows the home page visitor to directly use the service if his organization has subscribed to it.

  Your application should provide some default content for the base URL, since this URL specifies the application's remote interface.

  Be aware that internet domain names must follow the following rules:

  - They must start with a letter and end with a letter or number.

  - They may contain letters, numbers, or hyphens only. Special characters are not allowed.

  - They may consist of a maximum of 63 characters.

- **loginPath** - Path to the token handler, a module of your application that handles login requests containing a user token (optional). Required for the `LOGIN` access type.

  The path must be relative to the URL specified as `baseUrl` and start with a `/`.

- **onlyOneSubscriptionPerUser** - Defines whether an organization can subscribe only once to a service. Can be set to `true` or `false`. If set to `false` (default), an organization can subscribe to several marketable services based on your technical service. If set to `true`, an organization can subscribe to one marketable service based on your technical service only. In this case, the supplier can still define several marketable services, but as soon as a customer subscribes to one of these services, the other marketable services will no longer be available to him for subscription.

  At the CT-MG administration portal, a marketplace owner can define featured services for his marketplace home page. If a marketplace owner decides to display services and subscriptions grouped by category on his home page, it is recommended that you set **onlyOneSubscriptionPerUser** to `true`. This allows the home page visitor to start using the service directly from the marketplace home page without the need to select the subscription from the list of existing subscriptions.

- **allowingOnBehalfActing** - Defines whether an organization can act on behalf of another organization. Can be set to `true` or `false` (default). If set to `true`, an organization with the technology provider and the supplier role can act in CT-MG on behalf of a customer organization. This is achieved via a customer's subscription whose underlying technical service has the `allowingOnBehalfActing` attribute set to `true`.

Example:

```
<TechnicalService
    accessType="LOGIN"
    baseUrl="http://myserver:7777/myservice"
    build="25.01.2010"
    id="SampleService"
    loginPath="/login"
   provisioningType="SYNCHRONOUS"
    provisioningUrl=
        "http://myserver:8090/axis/services/MyProvisioningService?wsdl"
    onlyOneSubscriptionPerUser="false">
```

AccessInfo

Only required for the `DIRECT` or `USER` access type.

Contains a textual description of how users can access your application in the language specified by the `locale` attribute. The access information may consist of up to 4096 characters. The description is required because users do not access the application through CT-MG.

For example, if your application has a Web user interface, you could provide some introductory text and the URL of the login page.

The description is displayed at the CT-MG user interface and included in the email that is sent to users of services based on your technical service. The description can be specified for multiple languages. Make sure that you always specify the access information at least for the default language, English (`locale=en`). This is also used for any language for which no separate text has been stored.

Attribute:

`locale` - Locale code, for example `en` for English or `en-US` for English - United States.

LocalizedDescription

Contains a description of the item's purpose in the language specified by the `locale` attribute. Can be specified for multiple languages.

`LocalizedDescription` elements are contained in the following elements:

- `TechnicalService`

  At the CT-MG user interface, the service description is visible to you as the technology provider and to any supplier, reseller, or broker who sells your service.

- `ParameterDefinition`

  At the CT-MG user interface, the parameter description is visible to you as the technology provider, to any supplier, reseller, or broker who sells your service, and to the customers subscribing to the service.

- `Event`

  At the CT-MG user interface, the event description is visible to you as the technology provider, to any supplier, reseller, or broker who sells your service, and to the customers subscribing to the service.

- `Role`

  At the CT-MG user interface, the role description is visible to you as the technology provider and to any supplier, reseller, or broker who sells your service.

- `Operation`

At the CT-MG user interface, the operation description is visible to you as the technology provider when updating the technical service definition and to customers when they select an operation to be executed for your service.

Attribute:

`locale` - Locale code, for example `en` for English or `en-US` for English - United States.

Example:

```
<LocalizedDescription locale="en">
     Our Service supports you in ...
   </LocalizedDescription>
```

LocalizedLicense

Contains the license agreement for the customer in the language specified by the `locale` attribute. Can be specified in multiple languages.

At the CT-MG user interface, the license agreement is visible to you as the technology provider, to any supplier, reseller or broker who sells your service, and to the customers subscribing to your service. It can be changed by suppliers and resellers.

Attribute:

`locale` - Locale code, for example `en` for English or `en-US` for English - United States.

Example:

```
<LocalizedLicense locale="en">
     Please read this software license agreement ... The license terms
     are applied for the concession of the rights ...
   </LocalizedLicense>
```

LocalizedTag

Contains tags (search terms) to be associated with the technical service in the language specified by the `locale` attribute. Can be specified in multiple languages.

At the CT-MG administration portal, the tags are visible to you as the technology provider. On a marketplace, customers can use the tags to search for marketable services based on the technical service, provided that the tag display is enabled for the marketplace by the marketplace owner.

You can enter up to five terms, separated by commas. The tags are not case-sensitive. They must not consist of more than 20 characters.

Attribute:

`locale` - Locale code, for example `en` for English or `en-US` for English - United States.

Example:

```
<LocalizedTag locale="en">
     Documentation
   </LocalizedTag>
```

LocalizedName

Contains the name of a service role, operation, or operation parameter in the language specified by the `locale` attribute. Can be specified for multiple languages.

At the CT-MG user interface, the role name is visible to you as the technology provider, to any supplier, reseller, or broker who sells your service, and to the customers when they assign users to subscriptions. The operation and operation parameter name is visible to customers when

they start to use your service and to you as the technology provider when updating the technical service definition.

Attribute:

`locale` - Locale code, for example `en` for English or `en-US` for English - United States.

ParameterDefinition

Declares a parameter that is passed to your application during instance provisioning.

Suppliers can use parameters to make different values available to customers as different options, for example, different feature configurations or service restrictions. For parameters of type `ENUMERATION`, you can define specific options. For example, for a `MEMORY_STORAGE` parameter that may take a value of 1 GB, 2 GB, or 4 GB, you could define three options: one for minimum space, one for medium space, and one for maximum space. The options are available to a supplier when defining a price model; a customer can choose between the options when subscribing to a service.

CT-MG passes all parameters that you declare in the service definition to your application through the instance provisioning call. Any further processing must be carried out by your application. Especially if parameters are used to impose restrictions on service usage, the application needs to ensure that the restrictions are met. For example, if you declare a `MAX_FILE_NUMBER` parameter that restricts the maximum number of files created by a user, the application needs to track the actual number and ensure that the maximum number is not exceeded.

CT-MG offers the following predefined parameters:

Parameter	Description
NAMED_USER	This parameter is used to restrict the maximum number of users per subscription. It is relevant for login and user access.
CONCURRENT_USER	This parameter is used to restrict the maximum number of concurrent users. It is relevant for login and user access.
PERIOD	This parameter is used to define the maximum lifetime of a subscription. As soon as this period has expired, the instances related to the subscription are deactivated. The parameter is relevant for all access types except external access.

Predefined parameters are controlled by CT-MG and can be set for any marketable service. No implementation effort is required from your side.

Attributes:

- `id` - ID of the parameter. The ID must be unique across the parameters of a technical service.

- `valueType` - Data type of the parameter: `BOOLEAN`, `INTEGER`, `LONG`, `STRING`, `ENUMERATION`.

- `mandatory` - Defines whether a value for the parameter must be set for a subscription. Can be set to `true` or `false`.

- `configurable` - Defines whether the parameter is visible to suppliers. Can be set to `true` or `false`. If set to `false`, only you can see and modify the parameter. If set to `true`, the supplier can define whether to provide this parameter with different options to customers. Only if the supplier defines the parameter as configurable for his customers, he can define a price for it and the customer can choose an option when subscribing to the service. Irrespective of any setting, the parameter will be sent to the service during the provisioning.

- **modificationType** - Defines whether the parameter can be set only at the time a customer subscribes to a service (one-time parameter), or whether it can be set or modified when updating a subscription (standard parameter). Can be set to ONE_TIME or STANDARD. If set to ONE_TIME or left empty, parameter options cannot be changed once a subscription to the marketable service based on this technical service has been created. If a customer upgrades to a service with a parameter with the modificationType set to ONE_TIME, the parameter options defined by the customer during the initial subscription apply.

  If set to STANDARD, the parameter options can be changed when a subscription to the marketable service based on this technical service is updated. Irrespective of any setting, the parameter will be sent to the service during the provisioning.

- **default** - Defines the default value for the parameter. Values for the data types INTEGER, LONG, and BOOLEAN are evaluated by native Java mechanisms. For boolean values, this means, for example, that all values except true or TRUE are converted to false.

- **minValue** - For parameters of type INTEGER and LONG, defines the minimum value for the parameter.

- **maxValue** - For parameters of type INTEGER and LONG, defines the maximum value for the parameter.

- **Options** - For parameters of type ENUMERATION, declares the possible options that can be passed to the application for this parameter during instance provisioning. The Options element contains various **Option** elements that have the following attributes:

  - **id** - ID of the option. The ID must be unique across the options of a parameter.

  - **LocalizedOption** - Contains a description of the option's purpose in the language specified by the locale attribute. Can be specified in multiple languages.

Example:

```
<ParameterDefinition
      configurable="true"
      default="2"
      id="MEMORY_STORAGE"
      mandatory="false"
      valueType="ENUMERATION">

      <Options>
         <Option id="1">
            <LocalizedOption locale="en">Minimum space (1GB)
            </LocalizedOption>
         </Option>
         <Option id="2">
            <LocalizedOption locale="en">Medium space (2GB)
            </LocalizedOption>
         </Option>
         <Option id="3">
            <LocalizedOption locale="en">Maximum space (4GB)
            </LocalizedOption>
         </Option>
      </Options>
 </ParameterDefinition>

 <ParameterDefinition
      configurable="true"
      modificationType="STANDARD"
      default="200"
      id="MAX_FOLDER_NUMBER2"
      mandatory="true"
```

```
        maxValue="500"
        minValue="12"
        valueType="INTEGER">
   <LocalizedDescription locale="en">
      Number of folders that can be created.</LocalizedDescription>
  </ParameterDefinition>
```

Event

Declares an event type. The application can notify CT-MG about its occurrence. Only required if you implemented the notification of events. For details, refer to *Integrating with CT-MG Event Management* on page 23.

Attribute:

`id` - ID of the event. The ID must be unique across the events of a technical service.

Example:

```
<Event id="FILE_DOWNLOAD">
      <LocalizedDescription locale="en">
         File Download
      </LocalizedDescription>
   </Event>
```

Role

Declares a service role. Service roles provide different types of access to the underlying application. Each service role can be mapped to corresponding access rights or privileges in the application.

Attribute:

`id` - ID of the service role. The ID must be unique across the service roles of a technical service.

Example:

```
<Role id="ADMIN">
      <LocalizedName locale="en">Administrator</LocalizedName>
      <LocalizedDescription locale="en">
        Administrators have full access to all data entities
        and can execute administrative tasks such as
        role assignments and user creation.
      </LocalizedDescription>
   </Role>

   <Role id="GUEST">
      <LocalizedName locale="en">Guest</LocalizedName>
      <LocalizedDescription locale="en">
         Guests only have limited read access.
      </LocalizedDescription>
   </Role>
```

Operation

Declares an operation that can be executed on a technical service.

You may wish that your technical service offers additional operations or functions that are to be accessible via the CT-MG user interface. In a SaaS environment, applications are not installed locally but provisioned as services. Therefore, users cannot access the system resources the applications are using, for example, to perform administrative tasks such as system backup or

shutdown. Technical service operations can be used to access the resources of an application and perform administrative tasks without actually opening the application.

To provide for technical service operations, a Web service based on the operation service API must be implemented. Refer to the *Developer's Guide* for details.

Attributes:

- `id` - ID of the operation. The ID must be unique across the operations of a technical service.

- `actionURL` - URL of the WSDL document defining the implemented operation service. The server and port to be used must match the ones where the provisioning service of the application is running. Be aware that for asynchronous provisioning, you need to use the HTTPS protocol. In addition, for ensuring correct communication between CT-MG and APP, certificates must have been exchanged, and the server given in the `actionURL` attribute must be specified as the host name whose certificate has been registered. Refer to the APP documentation for details on certificate handling.

- `OperationParameter` - For every operation, declares the possible parameters and their values that can be passed to the operation during service provisioning. The `OperationParameter` element has the following attributes:

  - `id` - ID of the parameter. The ID must be unique across the operation parameters.

  - `mandatory` - Defines whether a value for the operation parameter must be specified. Can be set to `true` or `false`.

  - `type` - Defines whether the value for the operation parameter is retrieved from the technical service or from a text string. Can be set to `REQUEST_SELECT` (users can select from a list of options retrieved from the techical service) or `INPUT_STRING` (users can enter a text string for further information).

  - `LocalizedName` - Contains the name of the parameter in the language specified by the `locale` attribute. Can be specified in multiple languages.

Example:

```
<Operation id="SNAPSHOT"
     actionURL="https://myserver:8091/OperationService/
                                 AsynchronousOperationProxy?wsdl">
     <LocalizedName locale="en">Create snapshot</LocalizedName>
     <LocalizedDescription locale="en">
       Creates a snapshot of the system.
     </LocalizedDescription>
     <OperationParameter
        id="SERVER" mandatory="true" type="REQUEST_SELECT">
        <LocalizedName locale="en">Server</LocalizedName>
     </OperationParameter>
     <OperationParameter
        id="COMMENT" mandatory="false" type="INPUT_STRING">
        <LocalizedName locale="en">Comment</LocalizedName>
     </OperationParameter>
</Operation>
```

Glossary

Administrator

A privileged user role within an organization with the permission to manage the organization's account and subscriptions as well as its users and their roles. Each organization has at least one administrator.

Application

A software, including procedures and documentation, which performs productive tasks for users.

Broker

An organization which supports suppliers in establishing relationships to customers by offering the suppliers' services on a marketplace, as well as a privileged user role within such an organization.

Cloud

A metaphor for the Internet and an abstraction of the underlying infrastructure it conceals.

Cloud Computing

The provisioning of dynamically scalable and often virtualized resources as a service over the Internet on a utility basis.

Customer

An organization which subscribes to one or more marketable services in CT-MG in order to use the underlying applications in the Cloud.

Infrastructure as a Service (IaaS)

The delivery of computer infrastructure (typically a platform virtualization environment) as a service.

Marketable Service

A service offering to customers in CT-MG, based on a technical service. A marketable service defines prices, conditions, and restrictions for using the underlying application.

Marketplace

A virtual platform for suppliers, brokers, and resellers in CT-MG to provide their services to customers.

Marketplace Owner

An organization which holds a marketplace in CT-MG, where one or more suppliers, brokers, or resellers can offer their marketable services.

Marketplace Manager

A privileged user role within a marketplace owner organization.

Operator

An organization or person responsible for maintaining and operating CT-MG.

Organization

An organization typically represents a company, but it may also stand for a department of a company or a single person. An organization has a unique account and ID, and is assigned one or more of the following roles: technology provider, supplier, customer, broker, reseller, marketplace owner, operator.

Payment Service Provider (PSP)

A company that offers suppliers or resellers online services for accepting electronic payments by a variety of payment methods including credit card or bank-based payments such as direct debit or bank transfer. Suppliers and resellers can use the services of a PSP for the creation of invoices and payment collection.

Payment Type

A specification of how a customer may pay for the usage of his subscriptions. The operator defines the payment types available in CT-MG; the supplier or reseller determines which payment types are offered to his customers, for example payment on receipt of invoice, direct debit, or credit card.

Platform as a Service (PaaS)

The delivery of a computing platform and solution stack as a service.

Price Model

A specification for a marketable service defining whether and how much customers subscribing to the service will be charged for the subscription as such, each user assigned to the subscription, specific events, or parameters and their options.

Reseller

An organization which offers services defined by suppliers to customers applying its own terms and conditions, as well as a privileged user role within such an organization.

Role

A collection of authorities that control which actions can be carried out by an organization or user to whom the role is assigned.

Seller

Collective term for supplier, broker, and reseller organizations.

Service

Generally, a discretely defined set of contiguous or autonomous business or technical functionality, for example an infrastructure or Web service. CT-MG distinguishes between technical services and marketable services, and uses the term "service" as a synonym for "marketable service".

Service Manager

A privileged user role within a supplier organization.

Standard User

A non-privileged user role within an organization.

Software as a Service (SaaS)

A model of software deployment where a provider licenses an application to customers for use as a service on demand.

Subscription

An agreement registered by a customer for a marketable service in CT-MG. By subscribing to a service, the customer is given access to the underlying application under the conditions defined in the marketable service.

Subscription Manager

A privileged user role within an organization with the permission to create and manage his own subscriptions.

Supplier

An organization which defines marketable services in CT-MG for offering applications provisioned by technology providers to customers.

Technical Service

The representation of an application in CT-MG. A technical service describes parameters and interfaces of the underlying application and is the basis for one or more marketable services.

Technology Manager

A privileged user role within a technology provider organization.

Technology Provider

An organization which provisions applications as technical services in CT-MG.

User Group

A set of one or more users representing, for example, a department in a company, an individual project, or a single person. Groups provide a means to restrict the visibility of services on a marketplace.