

QB50



FP7-284427

**WP 250: Satellite Control
Software**

**Deliverable D250.3:
SCS User Manual**

Issue 1, Revision 2

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RECORD OF REVISIONS

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1 INTRODUCTION

This document provides instructions for the users of the Satellite Control Software of QB50. It gives an overview of the system and its components, defines the system requirements and explains how to operate the SCS including its installation and configuration.

For a good understanding of this document, it is key to have read the QB50 SCS ICD [A3] before.

Questions regarding this document should be addressed to Yann Voumard¹ or posted in the QB50 Forums under Ground Segment > SCS.

¹ To: yann.voumard@solenix.ch / CC: muriel.richard@epfl.sh



2 APPLICABLE AND REFERENCE DOCUMENTS

2.1 Applicable Documents

- [A1] “QB50_Systems_Requirements_issue_5”, VKI report, 11 Oct. 2013
- [A2] “QB50_VKI_D510.1_Ground Segment Definition - Issue 2”, VKI report, Nov. 2013
- [A3] “QB50-EPFL-SSC-SCS-ICD-D2501-4-1”, EPFL report, 23 March 2015

2.2 Reference Documents

- [R1] “QB50-EPFL-SSC-SCS-ICD-TMTC_PD-4-1”, EPFL report, release 23 March 2015
- [R2] “QB50-EPFL-SSC-SCS-ICD-AX.25-TFF-3-1”, EPFL report, release 23 March 2015
- [R3] “QB50-EPFL-SSC-SCS-ICD-EGSE-RI-2-0”, EPFL report, release 06 Nov. 2013
- [R4] “QB50-EPFL-SSC-SCS-ICD-MCS-E-2-0”, EPFL report, release 06 Nov. 2013
- [R5] “QB50-EPFL-SSC-SCS-ICD-MDC-E-2-0”, EPFL report, release 06 Nov. 2013
- [R6] “QB50-EPFL-SSC-SCS-ICD-FSW-1-0”, EPFL report, release 30 Apr. 2014
- [R7] “QB50-EPFL-SSC-SCS-ICD-Function Definitions-1-0”
- [R8] “QB50-EPFL-SSC-SCS-ICD-Housekeeping Parameter Definitions-1-0”
- [R9] “QB50 INMS Science Unit Interface Control Document”, Issue 7, MSSSL, 4 Dec. 2013
- [R10] “Whole Orbit Data Packet Format D510.1”, Rev. 4, VKI, 23 Oct. 2014
- [R11] ECSS-E-70-41A Packet Utilization Standard



3 TERMS, DEFINITIONS AND ABBREVIATED TERMS

3.1 Acronyms

APID	Application Process ID
ECSS	European Cooperation on Space Standardization
EGSE	Electrical Ground Support Equipment
EPFL	École Polytechnique Fédérale de Lausanne
MCS	Mission Control System
MIB	Mission Information Base
MSMQ	Microsoft Message Queuing
PUS	Packet Utilization Standard
SCOE	Special Check-Out Equipment
SCS	Satellite Control Software
SQL	Structured Query Language
SSC	Swiss Space Center
SSL	Secure Sockets Layer
TC	TeleCommand
TCP	Transmission Control Protocol
TM	TeleMetry
UM	User Manual

3.2 Terms

Administrator Console	http://technet.microsoft.com/en-us/library/cc947813(v=ws.10).aspx
Certificates Store	http://msdn.microsoft.com/en-us/library/ms788967(v=vs.110).aspx
ECSS-E-70-41A	http://192.167.166.86/public/gtb_manuals/ECSS-E-70-41A(30Jan2003).pdf
Microsoft .NET Framework	http://www.microsoft.com/net
Microsoft SQL Server	http://www.microsoft.com/sql
Net.TCP Port Sharing	http://msdn.microsoft.com/en-us/library/ms734772(v=vs.110).aspx
Windows Services	http://en.wikipedia.org/wiki/Windows_service



4 CONVENTIONS

Variables and Parameters

Variables and parameters to be changed by the user are surrounded by the characters “<>” and highlighted in **bold**.

Example: <**hostname**>

Commands

Commands to be entered in a command prompt are written in **Consolas 10** and prefixed with the character “>”.

Example: > **hello.cmd** <**name**>

File Paths

File paths, e.g. to configuration or executable files, are written in **Consolas 10**.

Example: <**install_dir**>/configuration.xml

Recognisable Names

Name of systems, tools, menu items that can be recognised easily in a user interface or a list are highlighted in *italic*.

Example: *Computer* > *Uninstall or change a program*

5 OVERVIEW OF THE SCS

The Satellite Control Software (SCS) is a part of the overall ground segment of a CubeSat. The SCS manages the satellite data on the ground, uplinks commands, downlinks telemetry and science data. It has graphical interfaces for the CubeSat Operation Team and provides decoded satellite data to the radio-amateurs. The SCS is typically located at the university owning the CubeSat, although client applications allow control of the satellite from any Internet-enabled workstation.

The QB50 ground segment architecture is shown in an SCS-centric representation in Figure 1. Complementary information about the overall ground segment can be found in [A2]. The Satellite Control Software is able to communicate with many different ground stations to control a CubeSat.

Detailed information about the SCS is provided in its ICD [A3].

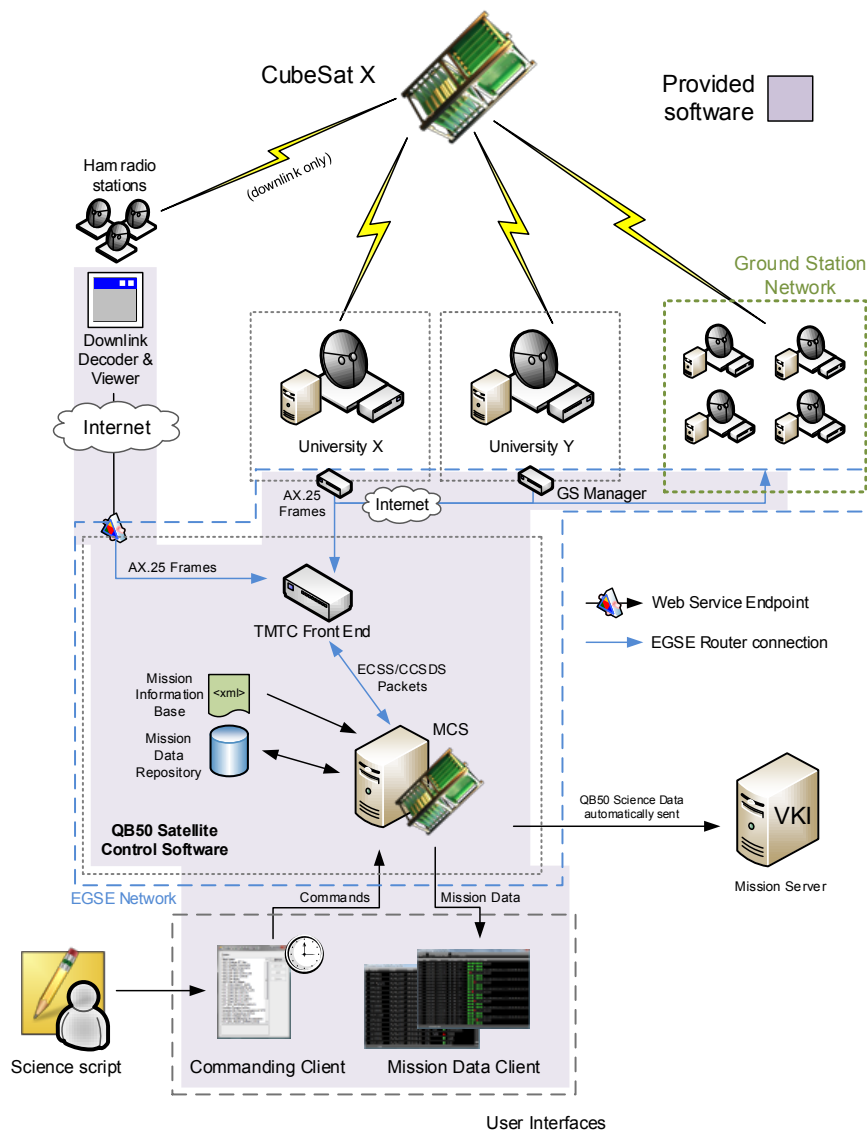


Figure 1: Overview of the Satellite Control Software



6 SYSTEM REQUIREMENTS

This section describes the environment required for running the components of the SCS from a hardware, software and network perspective.

6.1 Hardware Configuration

All components of the SCS run on standard workstation hardware. The setup can be virtualised. Once installed, the server can run independently, i.e. without a mouse, a keyboard and a screen. For the server components, server-specific hardware is recommended, but not required.

The table below presents considerations for the memory and storage resources for the key components of the system. These are in addition to the operating system and other applications installed on the system. Regarding the processor speed, 1.4 GHz single-core is the strict minimum.

Table 1: Memory and Storage System Requirements

	Memory	Storage
QB50 SCS Server	1.5 GB	6 GB
EGSE Router	32 MB	5 MB
Core and Distribution	128 MB	5 MB
Scheduler	64 MB	10 MB
TM/TC Front End	64 MB	5 MB
Microsoft Internet Information Services 7.0+	512 MB	10 MB
Microsoft SQL Server Express Edition 2014	1 GB	6 GB
QB50 SCS Client	256 MB	15 MB
Mission Data Client	128 MB	5 MB
Single Script Client	64 MB	5 MB
Upload Data Client	64 MB	5 MB
QB50 SCS Ground Station	32 MB	5 MB
Ground Station Manager	32 MB	5 MB
QB50 Radio Amateur Ground Station	32 MB	5 MB
Downlink Forwarder	32 MB	5 MB

Deployment scenario can range:

- from everything running locally on a laptop for testing purpose;
- to each of the component running on a separated physical or virtual machine.

The block diagram below presents a typical deployment for an operational environment with three machines: server, client and ground station.

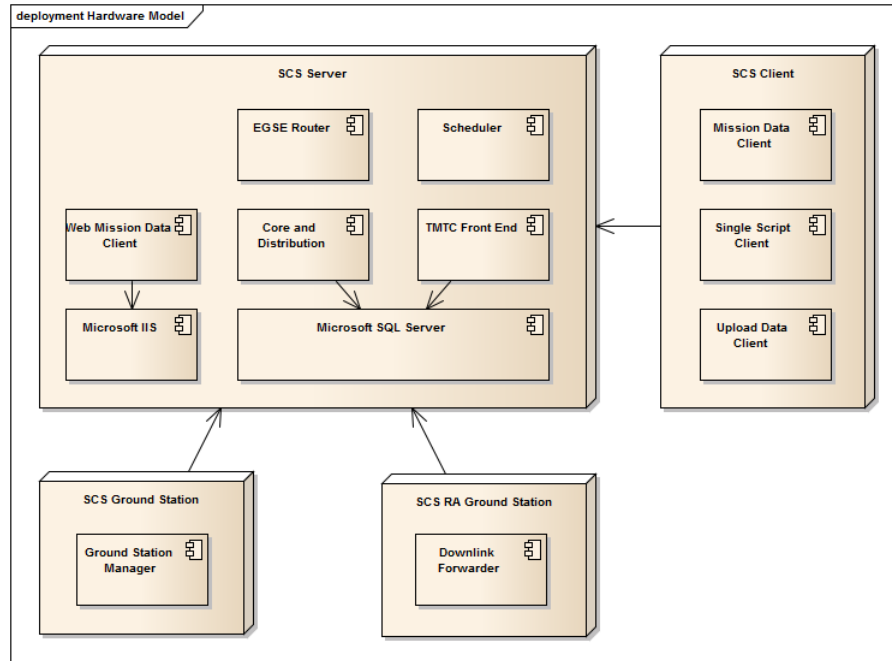


Figure 2: Typical Hardware Deployment

6.2 Software Configuration

The SCS components run atop a compatible operating system. In addition, they need a runtime framework to be installed on the system. Finally, the *Core*, the *Distribution* and the *TM/TC FrontEnd* require access to a database. The SCS components are compatible with the systems presented in the table below.

In addition, Microsoft Windows PowerShell 2.0 or above is required for some steps of the installation procedure. It is already included in most recent versions of Windows. For the compatible operating systems listed below, it must be installed manually only on Microsoft Windows Vista SP2 and Microsoft Windows Server 2008 SP2 if not already available.

Table 2: Software System Requirements

Operating System 32-bit and 64-bit	Microsoft Windows 7 SP1 Microsoft Windows Vista SP2 Microsoft Windows Server 2012 R2 (64-bit only) Microsoft Windows Server 2012 (64-bit only) Microsoft Windows Server 2008 R2 SP1 (64-bit only) Microsoft Windows Server 2008 SP2 <i>The standard version of Windows Server is enough, but not Server Core.</i>
Runtime Framework	Microsoft .NET Framework 4.5 Microsoft .NET Framework 4.5.1
Database	Microsoft SQL Server 2012 Microsoft SQL Server 2014 <i>The Express Edition is enough.</i>
Web Server	Microsoft IIS 7.0 Microsoft IIS 7.5 Microsoft IIS 8.0 Microsoft IIS 8.5

The block diagram below highlights the dependencies between the SCS components and these systems.

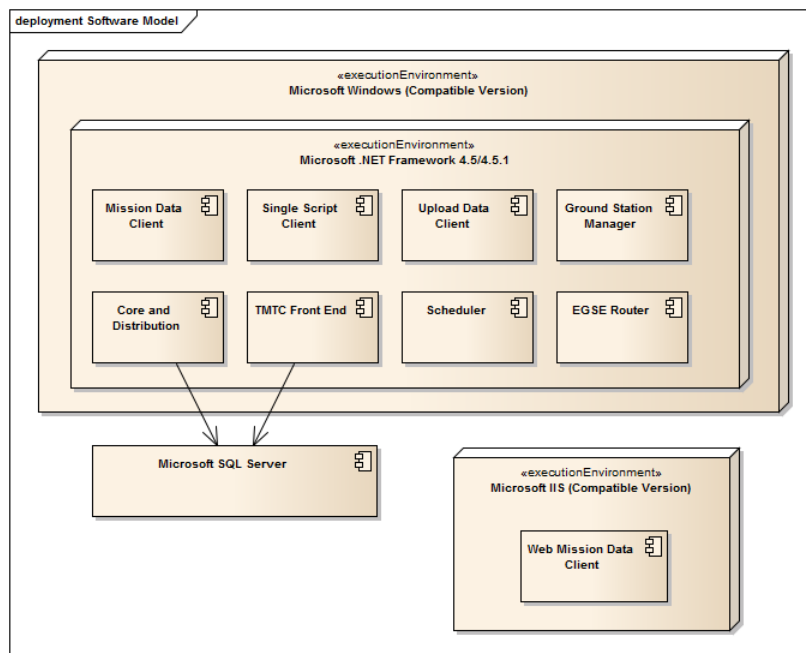


Figure 3: Software Dependencies

6.3 Network Configuration

There are two main types of communication between the components of the SCS. Client-server exchanges are done using the Windows Communication Framework over TCP/IP and the HTTP protocol. Ground segment communications are performed via the *EGSE Router* and the EGSE protocol. There are two exceptions: the *Core* and the *Distribution* communicate via a message queue and the *Ground Station Manager* connects to the ground station equipment via COM ports.

Some components have to listen for incoming connections on configurable ports. The table below lists the standard ports and associated processes then the block diagram depicts the dependencies.

Table 3: Standard TCP/IP Ports

Server	Ports and Protocols	Clients
Core	TCP/808 - Binary	Scheduler and Upload Data Client
Distribution	TCP/80 - HTTP TCP/443 - HTTPS TCP/808 - Binary	Mission Data Client, Scheduler and Upload Data Client
EGSE Router	TCP/9876 - Binary	Core, TM/TC FrontEnd and Ground Station Manager
Microsoft SQL	TCP/1433 - Binary	Core, Distribution and TM/TC Front End
Scheduler	TCP/80 - HTTP	Single Script Client
Microsoft IIS	TCP/80 - HTTP	Web Mission Data Client

Ports 80, 443 and 808 are shared by components running on the same machine using Net.TCP Port Sharing².

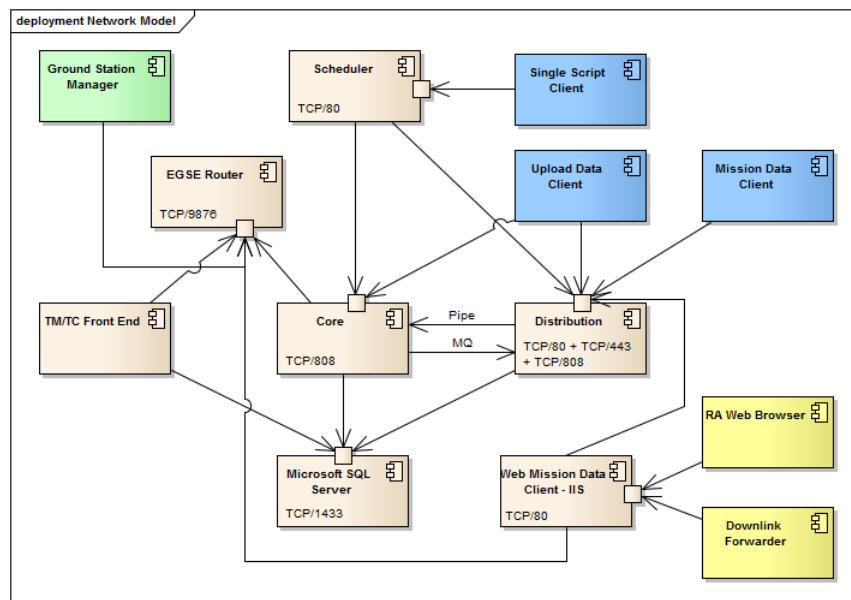


Figure 4: Network Dependencies

² [http://msdn.microsoft.com/en-us/library/ms734772\(v=vs.110\).aspx](http://msdn.microsoft.com/en-us/library/ms734772(v=vs.110).aspx)



7 INSTALLATION GUIDE

This section presents a typical installation of the whole SCS using three types of machine: server, client and ground station. There is a single server hosting all the server-side services. There can be as many as client machines as needed for the operations. Finally, there is a ground station machine per ground station. This setup is depicted in Figure 2 above.

The procedure does not assume that any system is already available. The SCS can of course run on and connect to compatible systems already available, see Table 2 above.

The steps to be run in a console must be executed as administrator³. Being connected with an administrator account is not enough. The verification steps are optional.

The following variable parameters are used in the procedures below.

- **install_dir**: the location where the SCS component is being installed, e.g. c:/qb50_scs_server
- **sql_server**: the address of the SQL server, e.g. .\SQLExpress for a default local installation of the Express Edition
- **srv_hostname**: the hostname of the SCS server, e.g. scs-server

Please note that the values given here are examples, which need to be adapted to your configuration. Particularly the machine hosting the server needs to be accessible via your network at the hostname you choose to use for the variable **srv_hostname**.

7.1 QB50 SCS Server

- 1) Install Microsoft Windows Server 2012 R2 Standard Edition or another compatible operating system
- 2) Install Microsoft .NET Framework 4.5.1 if not included in the selected operating system
Download at <http://www.microsoft.com/en-us/download/details.aspx?id=40779>
- 3) Install Microsoft SQL Server 2014 Express Edition
Download at <http://msdn.microsoft.com/en-us/evalcenter/dn434042.aspx>

Note: The installation process will ask for the instance name, e.g. .\SQLExpress. This name is to be used as value for the **<sql_server>** placeholder.

³ [http://technet.microsoft.com/en-us/library/cc947813\(v=ws.10\).aspx](http://technet.microsoft.com/en-us/library/cc947813(v=ws.10).aspx)



- 4) Install Microsoft Windows PowerShell 2.0 if not already included in the selected operation system
Download at <http://www.microsoft.com/en-us/download/details.aspx?id=40855>
- 5) Copy the *Server* and *Setup* folder as well as the *ConfigConnectionStrings* and *ConfigHostname* tools of the release to a location of your choosing hereafter referred to as the installation directory
- 6) Install the EGSE Router
> `<install_dir>/Setup/EgseRouterSetup64.exe` (or `EgseRouterSetup.exe` for 32-bit)
Verification: you should have the *EGSE Router.exe* process running. In the task manager, the option “show processes from all users” must be enabled.
- 7) Set the connection to the database
> `<install_dir>/ConfigConnectionStrings.exe <sql_server>`
- 8) Set the server hostname
> `<install_dir>/ConfigHostname.exe <srv_hostname>`
- 9) Create the database
> `<install_dir>/Setup/Database/Create.cmd <sql_server>`
Verification: using Microsoft SQL Server Management Studio, you should see three databases in the server: Log, MissionData and tmtc-frontend
- 10) Create the user database
> `%windir%\Microsoft.NET\Framework\v4.0.30319\aspnet_regsql.exe -E -S <sql_server> -A m`
Verification: using Microsoft SQL Server Management Studio, you should see an additional database in the server: aspnetdb
- 11) Install the message queue server
 - Go in *Computer* > *Uninstall or change a program* > *Turn Windows features on or off*
 - Enable *Microsoft Message Queue (MSMQ) Server* (no need to enable more sub-features)
 - Click OK
 - Wait for the installation to complete and close the *Program and Features* window



Verification: run `compmgmt.msc` then under *Services and Applications*, you should have *Message Queuing*

12) Create the message queue

> `<install_dir>/Setup/MSMQ/Create.cmd`

Verification: run `compmgmt.msc` then under *Services and Applications* > *Message Queuing* > *Private Queues*, you should have the *groundsegmentdistribution* queue

13) Enable Net.TCP Port Sharing

> `sc.exe config NetTcpPortSharing start= demand`

14) Install Microsoft IIS

- Go in *Computer* > *Uninstall or change a program* > *Turn Windows features on or off*

- Enable *Internet Information Services* and the sub-feature *ASP.NET* in *World Wide Web Services* > *Application Development Features*

- Click OK

- Wait for the installation to complete and close the *Program and Features* window

Verification: in *All Programs* > *Administrative Tools*, you should have *Internet Information Services (IIS) Manager*

15) Enable ASP.NET

> `%windir%\Microsoft.NET\Framework64\v4.0.30319\aspnet_regiis.exe -i`

16) Deploy the Web Mission Data Client

- Go in *All Programs* > *Administrative Tools* > *Internet Information Services (IIS) Manager*

- Remove the default site (right click on it and then *Remove*) in *Sites*

- Add a new site (right click on *Sites* and then *Add Web Site...*)

- Enter `WebMissionDataClient` as *Site name*

- Enter `<install_dir>/Server/WebMissionDataClient` as *Physical path*

- Click OK

Verification: open `http://localhost` in your browser, you should see “The remote server returned an error: (503) Server Unavailable.” because the distribution is not started, but this means that the Web site has successfully been deployed.



17) Generate and register the SSL certificates (same hostname as in step 8)

```
> <install_dir>/Setup/SSL/gencert.cmd <srv_hostname>
```

Verification: open the certificate store of the local computer⁴ then under *Console Root* >

Certificates (Local Computer) > *Personal* > *Certificates*, you should have a certificate matching the given hostname

18) Optional: allow authenticated users and local service user to run the system

This step has to be executed only if you plan to run the *Core* and *Distribution* or the *Scheduler* with a regular user or any of the server components as Windows Services.

```
> powershell.exe
```

```
PS > set-executionpolicy remotesigned
```

```
PS > .\<install_dir>\Setup\ConfigNoAdmin\ConfigNoAdmin.ps1 <srv_hostname>
```

19) Add the license key

Open the configurations file of the Core and add the provided license information (*LicenseName* and *LicenseKey*) in the application settings (<*appSettings*>). If you do not have a license name and key, please contact Muriel Richard⁵.

```
<install_dir>/Server/CoreDistribution/Core.exe.config
```

20) Configure the EGSE network

Each client connecting to the EGSE router must have a unique ID and know the address of the router. This can be changed in the configurations file of the respective applications: Core and TM/TC Front End using the keys *EGSERouter**, *EGSEClient** and *EGSEPartners** in the application settings (<*appSettings*>).

```
<install_dir>/Server/CoreDistribution/Core.exe.config
```

```
<install_dir>/Server/Scheduler/FrontEnd.exe.config
```

21) Add a user for the *Mission Data Client*

Create the default user “qb50” with the password “qb50” or create your own user. Later, make sure that the *Mission Data Client* is configured with a valid username and password.

```
> <install_dir>/Setup/MembershipManager.exe
```

⁴ [http://msdn.microsoft.com/en-us/library/ms788967\(v=vs.110\).aspx](http://msdn.microsoft.com/en-us/library/ms788967(v=vs.110).aspx)

⁵ muriel.richard@epfl.ch



At this point, the server software is deployed. Please refer to section 10 for starting the system.

7.2 QB50 SCS Client

- 1) Install Microsoft Windows 7 SP1 or another compatible operating system
- 2) Install Microsoft .NET Framework 4.5.1 if not included in the selected operating system
Download at <http://www.microsoft.com/en-us/download/details.aspx?id=40779>
- 3) Copy the *Client* folder and the *ConfigHostname* tool of the release to a location of your choosing hereafter referred to as the installation directory
- 4) Set the server hostname
> `<install_dir>/ConfigHostname.exe <srv_hostname>`

If custom credentials were created in step 17 of the server installation, they must be changed in the options of the Mission Data Client accessible from the top bar of the application.

At this point, the client software is deployed. Please refer to section 10 for starting the system.

7.3 QB50 SCS Ground Station

- 1) Install Microsoft Windows 7 SP1 or another compatible operating system
- 2) Install Microsoft .NET Framework 4.5.1 if not included in the selected operating system
Download at <http://www.microsoft.com/en-us/download/details.aspx?id=40779>
- 3) Copy the *GroundStation* folder of the release to a location of your choosing
- 4) Configure the EGSE network
Each client connecting to the EGSE router must have a unique ID and know the address of the router. This can be changed in the configurations file of the Ground Station Manager using the keys *EGSERouter**, *EGSEClient** and *EGSEPartners** in the application settings (`<appSettings>`).
`<install_dir>/GroundStation/GroundStationManager/GroundStationManager.exe.config`

At this point, the ground station software is deployed. Please refer to section 10 for operations.



7.4 QB50 Radio Amateur Ground Station

Please note that only the **Downlink Forwarder** is licensed to you for redistribution. When sending it to a radio amateur, make sure that you distribute only this component.

Before distributing it, configure the address of your Web Mission Data Client (*DownlinkForwarderUrl*) in `<install_dir>/GroundStation/DownlinkForwarder/DownlinkForwarder.exe.config`.

Then send the folder `<install_dir>/GroundStation/DownlinkForwarder` to the radio amateur.

On the radio amateur's side, the installation procedure is the following:

- 1) Install Microsoft Windows 7 SP1 or another compatible operating system
- 2) Install Microsoft .NET Framework 4.5.1 if not included in the selected operating system
Download at <http://www.microsoft.com/en-us/download/details.aspx?id=40779>
- 3) Copy the *DownlinkForwarder* folder of the release to a location of your choosing
- 4) Configure the connection to the TNC using *DownlinkTncComPort* and *DownlinkTncBaudrate*
`<install_dir>/DownlinkForwarder/DownlinkForwarder.exe.config`



8 UPGRADE GUIDE

If you already have a previous version of the SCS installed, you don't need to reinstall everything and can upgrade following the steps in this guide.

8.1 Upgrade from 2.0 to 2.1

Version 2.1 includes the Downlink Forwarder, the Web Mission Data Client and the automatic upload of Whole Orbit and Science Data to VKI.

For each machine to upgrade and according to the components installed on this machine:

- 1) Stop all running components, see section 10
- 2) Copy your configuration files out of the installation directory:
 - <install_dir>/Server/CoreDistribution/Distribution.exe.config
 - <install_dir>/Server/CoreDistribution/Core.exe.config
 - <install_dir>/Server/Scheduler/Scheduler.exe.config
 - <install_dir>/Server/FrontEnd/FrontEnd.exe.config
 - <install_dir>/Client/MissionDataClient/MissionDataClient.exe.config
 - <install_dir>/Client/SingleScriptClient/SingleScriptClient.exe.config
 - <install_dir>/Client/UploadDataClient/UploadDataClient.exe.config
 - <install_dir>/GroundStation/GroundStationManager/GroundStationManager.exe.config
- 3) Copy your scripts and MIB out of the installation directory:
 - <install_dir>/Server/Scheduler/Scripts/*
 - <install_dir>/Server/CoreDistribution/MIB/*
 - <install_dir>/Tools/SpacecraftSimulator/qb50-base.xml
- 4) Delete the installed components: Server, Client and/or Ground Station.
- 5) Copy the new version of the components to deploy into the installation directory
- 6) Move the configuration files saved at step 2) and the scripts and MIB saved at step 3 back at their place of origin
- 7) Add the new settings in <install_dir>/Server/CoreDistribution/Core.exe.config in the appSettings section:



```
<!-- Automatic Upload to VKI (Basic) -->
<add key="VkiAuthId" value="" />
<add key="VkiCubesat" value="DUMMY" />

<!-- Automatic Upload to VKI (Advanced - defaults should be fine) -->
<add key="VkiServerUrl" value="https://upload.qb50.eu/upload" />
<add key="VkiSaveFolder" value="vki-data" />
<add key="VkiSdPrefix" value="SD-" />
<add key="VkiWodPrefix" value="WOD-" />
<add key="VkiWodSid" value="255" />
```

- 8) Add the new processing module for Whole Orbit Data in

<install_dir>/Server/CoreDistribution/Core.exe.config in the processingModules section:

```
<add type="Epfl.Qb50.GroundSegment.WholeOrbitData.ProcessingModule,
WholeOrbitData.ProcessingModule" />
```

- 9) Add the new application settings section in the configuration section of

<install_dir>/Client/UploadDataClient/UploadDataClient.exe.config:

```
<appSettings>
  <add key="MibPath" value="qb50-base.xml" />
</appSettings>
```

- 10) Authorize the Web Mission Data Client as telemetry source for the downlink forwarder in

<install_dir>/Server/FrontEnd/FrontEnd.exe.config in the appSettings section:

```
<add key="EgsePartnersGSReceiveId1" value="49" />
```

- 11) Install and configure the Web Mission Data Client as described at steps 14 to 16 of the installation guide of the server, section 7.1.

At this point, your previous installation is upgraded to 2.1. Please refer to section 10 for starting the system.



9 CONFIGURATION GUIDE

9.1 Mission Information Base

The Mission Information Base (MIB) contains all mission-specific configurations:

- Application Process IDs
- Housekeeping (Parameters, Calibration, Checks and Structures)
- Functions (Service 8)
- Service Types and Subtypes
- Telecommands and their Parameters
- SCOE Definition (Service Types, Service Subtypes and Commands with their parameters)
- MCS General Configuration (Telemetry, Telecommand, Constants and Defaults)

By default, the MIB is located in `<install_dir>/Server/CoreDistribution/MIB`. An initial MIB with examples and standard configurations for QB50 is available in this folder (`qb50-base.xml`). The team must extend this file with their specific configurations.

Edition of this file requires working knowledge of the “ECSS-E-70-41A Packet Utilization Standard” [R11] and its proposed tailoring for QB50 [R1]. Beforehand, most of the structure can be prepared with two Excel spreadsheets [R7][R8].

9.2 QB50 SCS Server

9.2.1 Distribution

There is an important configuration option in this file: the location of the MIB.

In addition, please use the *ConfigHostname* and *ConfigConnectionStrings* tools for configuring the address of the server.

`<install_dir>/Server/CoreDistribution/Distribution.exe.config`

9.2.2 Core

There are important configuration options in this file such as the location of the MIB and the address of the Core in the EGSE network. This file also contains the license information. See step 16 of the server installation in section 7.1. The available options are in the section *Application Settings* and documented directly in the file.

In addition, please use the *ConfigHostname* and *ConfigConnectionStrings* tools for configuring the address of the server.

`<install_dir>/Server/CoreDistribution/Core.exe.config`



9.2.3 Scheduler

There is usually nothing to modify in this file, please use the *ConfigHostname* tool instead for configuring the address of the server.

<install_dir>/Server/Scheduler/Scheduler.exe.config

9.2.4 TM/TC FrontEnd

There are important configuration options in this file such as the address of the authorized ground stations and the TM/TC Front End in the EGSE network. The available options are documented directly in the configuration file.

<install_dir>/Server/FrontEnd/FrontEnd.exe.config

9.2.1 Web Mission Data Client

This configuration file contains mainly settings for the Web service receiving data from the Downlink Forwarder. This includes its connection to the EGSE router and some basic mission-specific settings. The available options are documented directly in the configuration file.

<install_dir>/Server/WebMissionDataClient/Web.config

9.3 QB50 SCS Client

9.3.1 Mission Data Client

There is usually nothing to modify in this file, please use the *ConfigHostname* tool instead for configuring this client for a particular server.

<install_dir>/Client/MissionDataClient/MissionDataClient.exe.config

9.3.2 Single Script Client

There is usually nothing to modify in this file, please use the *ConfigHostname* tool instead for configuring this client for a particular server.

<install_dir>/Client/SingleScriptClient/SingleScriptClient.exe.config

9.3.3 Upload Data Client

There is usually nothing to modify in this file, please use the *ConfigHostname* tool instead for configuring this client for a particular server.

<install_dir>/Client/UploadDataClient/UploadDataClient.exe.config

9.4 QB50 SCS Ground Station

9.4.1 Ground Station Manager

There are important configuration options in this file such as the address of the ground station and the TM/TC Front End in the EGSE network. This file also configures the connection to the receiver and transceiver. The available options are documented directly in the configuration file.



<install_dir>/GroundStation/GroundStationManager/GroundStationManager.exe.config

9.1 QB50 Radio Amateur Ground Station

9.1.1 Downlink Forwarder

The downlink forwarder can be distributed to radio amateurs in order to forward a copy of the stream they receive at their ground station to the central SCS of the cubesat. The downlink forwarder requires the Web Mission Data Client to be running and accessible from the Internet.

The Internet address of the Web Mission Data Client (*DownlinkForwarderUrl*) should be set in the configuration file of the downlink forwarder. The radio amateur receiving the downlink forwarder can then configure the connection to its TNC (*DownlinkTncComPort* and *DownlinkTncBaudrate*). The available options are also documented directly in the configuration file.

<install_dir>/GroundStation/DownlinkForwarder/DownlinkForwarder.exe.config

10 OPERATIONS MANUAL

10.1 Dependencies and Start Sequence

As already presented in section 6.3 about the network configuration, there are dependencies between the components of the ground segment. The diagram below details these dependencies giving at the same time the sequence for starting the entire SCS.

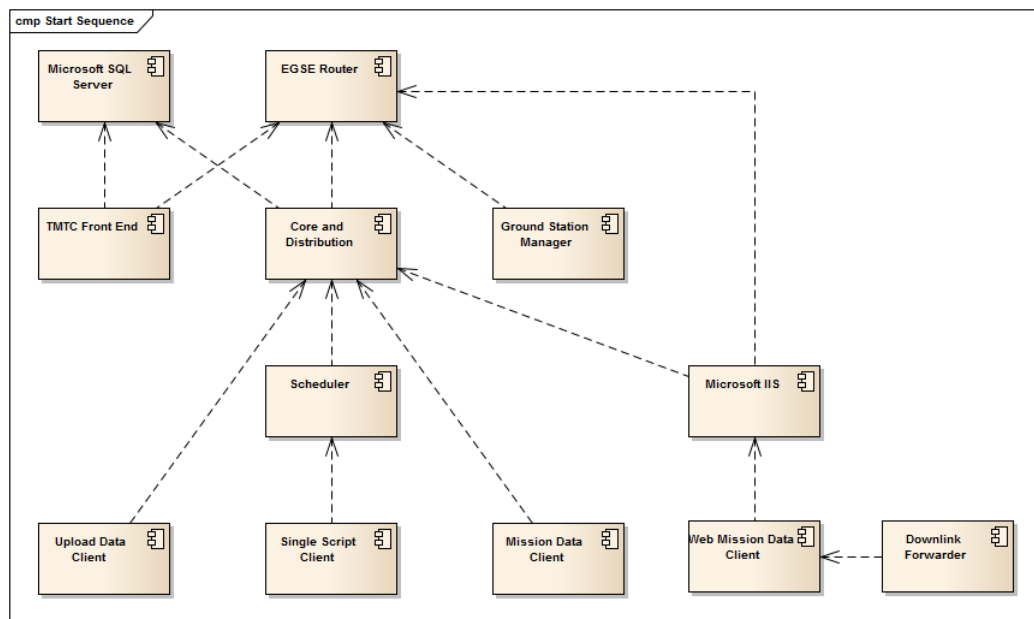


Figure 5: Dependencies between the Components

Microsoft SQL Server and the EGSE Router are usually installed as Windows Services starting when the machine boots. There is therefore no need to start them individually. In this situation, the TM/TC Front End, the Ground Station Manager and the Core and Distribution can be started independently. The other components depend mainly on the availability of the Web services provided by the Core and Distribution.

The next sections list the executable files and commands needed to start and stop each element of the SCS.



10.2 QB50 SCS Server

10.2.1 Windows Services

The server components can be executed in the console as shown below or as Windows Services. In order to install the corresponding Windows Services, use the *InstallService.cmd* command file. To remove the Windows Services, use the *UninstallService.cmd* command file. For the *Core* and *Distribution*, there is a single file called *InstallServices.cmd* and *UninstallServices.cmd* respectively. These files can be found in the folder of the respective components and must be run in an administrator console.

The log output of the services can be found in the *Event Viewer (eventvwr.msc) > Applications and Services Logs > MCS*.

10.2.2 Core and Distribution

The Core will not start if incorrect license information or an expired license is provided in its configuration file. See step 16 of the server installation in section 7.1.

Start: `<install_dir>/Server/CoreDistribution/CoreDistribution.cmd`

Stop: press any key in both consoles

10.2.3 Scheduler

Start: `<install_dir>/Server/Scheduler/Scheduler.exe`

Stop: press any key

10.2.4 TM/TC FrontEnd

Start: `<install_dir>/Server/FrontEnd/FrontEnd.exe`

Stop: type “quit” in the console

Help: type “help” in the console for a list of supported operations

10.2.5 Web Mission Data Client

To start or stop the Web Mission Data Client, start or stop the associated Web site or Microsoft IIS via its manager:

1. Open IIS Manager and navigate to the Web server node in the tree.
2. In the Actions pane, click Start if you want to start the Web server or Stop if you want to stop the Web server.

10.2.6 Database

In order to remove all user data from the database, e.g. to clean it after a test, execute as administrator: `<install_dir>/Setup/Database/Truncate.cmd <sql_server>`



10.3 QB50 SCS Client

10.3.1 Mission Data Client

Start: <install_dir>/Client/MissionDataClient/MissionDataClient.exe

Stop: close the window

10.3.2 Single Script Client

Start: <install_dir>/Client/SingleScriptClient/SingleScriptClient.exe

Stop: close the window

10.3.3 Upload Data Client

Start: <install_dir>/Client/UploadDataClient/UploadDataClient.exe

Stop: close the window

10.4 QB50 SCS Ground Station

10.4.1 Ground Station Manager

Start: <install_dir>/GroundStation/GroundStationManager/GroundStationManager.exe

Stop: type “quit” in the console

Help: type “help” in the console for a list of supported operations

10.5 QB50 Radio Amateur Ground Station

10.5.1 Downlink Forwarder

Start: <install_dir>/GroundStation/DownlinkForwarder/DownlinkForwarder.exe

Stop: type “quit” in the console

Help: type “help” in the console for a list of supported operations

10.6 Common Errors

10.6.1 TypeInitializationException

TypeInitializationException: The type initializer for 'System.ServiceModel.Channels.Msmq' threw an exception.

Microsoft Message Queuing is not installed. See step 10 in section 7.1 for the installation.

10.6.2 EndpointNotFoundException

EndpointNotFoundException: An error occurred while opening the queue:Unrecognized error -1072824317 (0xc00e0003). The message cannot be sent or received from the queue.



Ensure that MSMQ is installed and running. Also ensure that the queue is available to open with the required access mode and authorization.

The queue was not created. See step 11 in section 7.1 for the creation.

10.6.3 CommunicationException

CommunicationException: The TransportManager failed to listen on the supplied URI using the NetTcpPortSharing service: failed to start the service because it is disabled. An administrator can enable it by running 'sc.exe config NetTcpPortSharing start= demand'.

The TCP.Net Port Sharing service not enabled. Run the command given in the error message and in step 12 of section 7.1.

CommunicationException: The service endpoint failed to listen on the URI 'net.tcp://localhost/GroundSegment/MCS/Uplink/' because access was denied. Verify that the current user is granted access in the appropriate allowedAccounts section of SMSvcHost.exe.config.

The current user does not have the right to use the TCP.Net Port Sharing service. Grant the required privileges (step 14 in section 7.1) or run the application as administrator (or elevated).

10.6.4 InvalidOperationException

InvalidOperationException: Cannot find the X.509 certificate using the following search criteria: StoreName 'My', StoreLocation 'LocalMachine', FindType 'FindBySubjectDistinguishedName', FindValue 'CN=localhost'.

The SSL certificate for the distribution was not created or does not match the configured hostname. Use the *ConfigHostname* tool to change the hostname or the *gencert* command to create a certificate depending on the root cause of the error. See step 7 and 13 in section 7.1 for more details.

10.6.5 AddressAccessDeniedException

AddressAccessDeniedException: HTTP could not register URL http://+:80/GroundSegment/MCS/ArchiveDistribution/. Your process does not have access rights to this namespace (see <http://go.microsoft.com/fwlink/?LinkId=70353> for details).

The current user does not have the right to use the HTTP service. Grant the required privileges (step 14 in section 7.1) or run the application as administrator (or elevated).

10.6.6 Authentication Failed

Could not load Mission Information Base: authentication failed. Check that your credentials are correct.

This error appears in the Mission Data Client when the provided username and password are incorrect. Make sure that the credentials are correct. See step 18 of the server installation in section 7.1.

10.7 Integration Points

In order to integrate the SCS within the overall ground segment, a few integration points can be used:



- Via the uplink and downlink COM ports of the ground station manager and the KISS protocol. This is the regular use case for a full communication chain using AX.25 as transfer frame format.
- By replacing the Ground Station Manager, e.g. for forwarding the AX.25 frames to a test system or via an equipment not supported by the provided Ground Station Manager. In this case, the telecommand transfer frames are sent by the TM/TC Front End to the destination system via the EGSE Router. In the other direction, telemetry transfer frames can be sent to the TM/TC Front End by the system acting as ground station.
- By replacing the TM/TC Front End, e.g. for sending the CCSDS packets to a test system or using a protocol different than AX.25. In this case, the telecommand packets are sent by the core of the SCS to the destination system via the EGSE Router. In the other direction, telemetry transfer frames can be sent to the core of the SCS by the system acting as TM/TC front end.

The EGSE protocol is described in the EGSE Router Infrastructure ICD [R3]. The section 5 of this document presents data flow scenarios for both telecommand delivery and telemetry reporting and the associated EGSE messages.