Stand-Alone Integration

Operating Instructions

17/1543-LZA 701 6012/1 Uen A2

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Contents

1 Introduction

This document describes the stand-alone integration for the Pico Radio Base Station (Pico RBS). Stand-alone integration makes it possible to integrate without the use of Operations Support System – Radio and Core (OSS-RC).

This integration method is intended for temporary use during small projects like trials and demonstrations, with a limited number of nodes.

Without the connection to OSS-RC, normal live monitoring and remote connection are not available.

An alternative remote support connection to the RBS must be provided by the local team responsible for the network setup.

The remote support connection is mandatory in order for Ericsson to deliver customer support services.

1.1 Limitations

- No monitoring or supervision through OSS-RC
- No data collection through OSS-RC
- Only for a limited number of RBSs

2 Prerequisites

2.1 Documents

The contents of the following documents must be known:

- *Personal Health and Safety Information*
- *System Safety Information*

2.2 Tools

- A client laptop with the following installed:
  - Ubuntu Linux 12.04 LTS operative system installed
  - Secure File Transfer Protocol (SFTP) server
- Ethernet cables to connect the following:
  - Client laptop to the RBS
  - RBS to the Local Area Network (LAN)

3 Setting up Client Laptop

Ubuntu Linux 12.04 LTS operating system must be used since OpenSSH version 5.4 or later, is needed to support Secure Shell (SSH) certificate based authentication. The Linux operating system also simplifies the whole stand-alone integration process.

Ubuntu Linux 12.04 LTS can be obtained from *http://releases.ubuntu.com/12.04/*

To use Ubuntu Linux in a laptop with Windows operative system, **VirtualBox** can be used. **VirtualBox** is downloaded from *https://www.virtualbox.org/*

After finished Ubuntu installation, the openSSH server can require a manual installation. If a manual installation is needed, use the following syntax:

```
sudo apt-get install openssh-server
```

4 Local Super User Account

The stand-alone integration feature introduces the possibility to create a local super user account for the node. If O&M access to the node is required, it is mandatory to create a local super user account.

The local super user account uses SSH certificate-based authentication. This means that the client SSH RSA public key is signed with the private key of another key pair created by the operator. The later key pair acts as Certificate Authority (CA). The public key of the CA is imported into the RBS during the stand-alone integration. During the integration process the public CA key makes it possible for O&M to create and enable the local super user account.

For more information regarding certificate handling, see *Security for O&M Node Access* and *IP Transport*.

4.1 Creating Client Side SSH Certificate

A client laptop that uses local super user account to connect to the RBS, must be prepared before the integration.

Note: Certificate-based authentication support is introduced in OpenSSH version 5.4.

To create a Client Side SSH Certificate, use the following procedure:

Steps

1. 1. Create a CA key pair. Its private key is used to create and sign the client certificate:

   ```
   ssh-keygen -f users_ca
   ```

2. If file `~/.ssh/id_rsa` does not exist, create a client key pair:

   ```
   ssh-keygen
   ```

3. Create a client certificate by signing the client public key (`~/.ssh/id_rsa.pub`) with earlier generated private CA key, that is, `users_ca`.

   ```
   ssh-keygen -s users_ca -I <user_full_name> -n
   <loginname> ~/.ssh/id_rsa.pub
   ```

   ```
   # where <user_full_name> can be any text identifying
   the certificate # <loginname> shall be set to desired
   user/ login name  for super user account
   ```

4. Copy the generated client side certificate to the laptop which will be used for remote login using super user credential

4.2 Preparing Combined File Template with Local Super User Account Details

After the certificates are created on the client laptop, account details must be added to the Combined file template before the file is stored on the client laptop.

The Combined file consists of an Initial Configuration File (ICF) and an optional Site installation file. The Site installation file is not necessary if a DHCP provides the following IP addresses:

- For trusted Network: O&M IP addresses
- For untrusted Network: Public network IP addresses and Security Gateway (SEG) address

The content of public CA key created in Section 4.1 on page 4, that is, `users_ca.pub` is added to the Combined file template. The information is added to the `<superUserAccount>` tags and the `<usersCa>` attribute.

The variable between the `<superUserName>` tags must match the **loginname** given in Section 4.1 on page 4:

Note: The content of SSH-rsa public key is purposely shortened in Example 1

```
<combinedConfigurationFileType>
<RbsSiteInstallationFile>       ...       </
RbsSiteInstallationFile>       <rpc>       ...       </
rpc>       <superUserAccount>       <superUserName>oam</
superUserName>       <usersCa>ssh-rsa
AAAB3NzaC1yc/       4Yexample@sed652403</usersCa>
</superUserAccount> </combinedConfigurationFileType>
```

Example 1   Combined File Example

4.3 Enabling Local Super User Account

After the preparations described in Section 4.2 on page 5 are done, the account is created during the first phase of the stand-alone integration. See Section 7 on page 16.

During this phase, O&M stores the account information to a permanent file system partition. The local super user account is not allowed to be active while the integration still runs in the Basic Software Package.

Note: Golden Software is another name for Basic Software Package, often used in non-CPI documentation.

O&M enables the certificate-based authentication for the provided user account during the start of the second phase of selected integration procedure.

The following syntax is used to log in from the laptop with the local super user account:

```
ssh -v loginname@pRBS.ip.address
```

With SSH verbose enabled, the following prints in the console show that the certificate is used in the authentication:

```
debug1: identity file ~/username/.ssh/id_rsa-cert type 4

debug1: Offering RSA-CERT public key: ~/username/.ssh/
id_rsa
```

5 Creating Certificates

5.1 Creating Certificates Flow Chart

The flow chart illustrates an overview over the certificates creation for the RBS and the SEG.

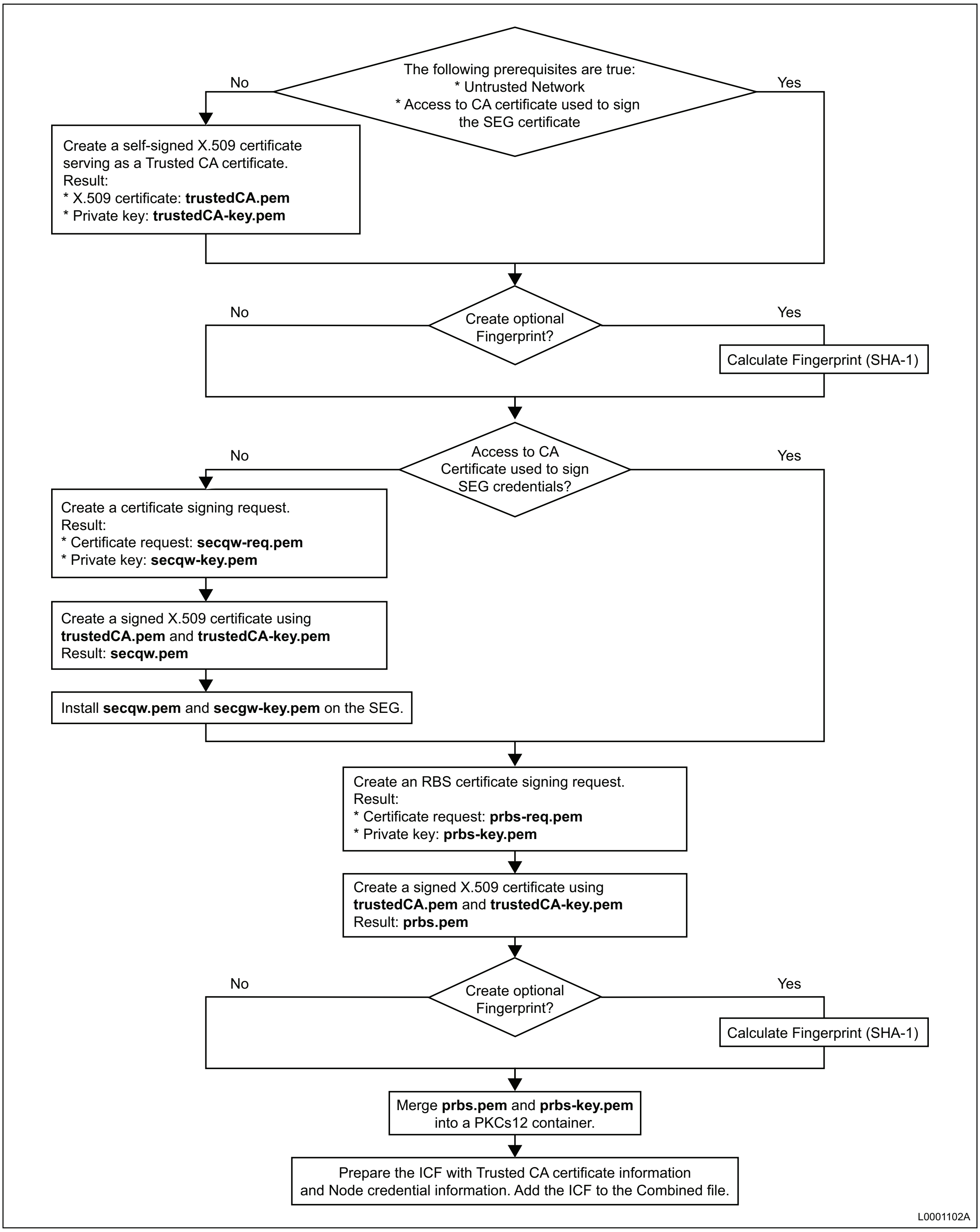
The following prerequisites are true:
* Untrusted Network
* Access to CA certificate used to sign the SEG certificate
No
Yes
Create a self-signed X.509 certificate serving as a Trusted CA certificate.
Result:
* X.509 certificate: **trustedCA.pem**
* Private key: **trustedCA-key.pem**
No
Create optional Fingerprint?
Yes
Calculate Fingerprint (SHA-1)
No
Access to CA Certificate used to sign SEG credentials?
Yes
Create a certificate signing request.
Result:
* Certificate request: **secqw-req.pem**
* Private key: **secqw-key.pem**
Create a signed X.509 certificate using **trustedCA.pem** and **trustedCA-key.pem**
Result: **secqw.pem**
Install **secqw.pem** and **secgw-key.pem** on the SEG.
Create an RBS certificate signing request.
Result:
* Certificate request: **prbs-req.pem**
* Private key: **prbs-key.pem**
Create a signed X.509 certificate using **trustedCA.pem** and **trustedCA-key.pem**
Result: **prbs.pem**
No
Create optional Fingerprint?
Yes
Calculate Fingerprint (SHA-1)
Merge **prbs.pem** and **prbs-key.pem** into a PKCs12 container.
Prepare the ICF with Trusted CA certificate information and Node credential information. Add the ICF to the Combined file.
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Figure 1 Certificates Flow Chart

5.2 Trusted CA Certificate

step 1 on page 9 to step 3 on page 9 in the procedure are left out, if the following is true:

- Stand-alone integration is performed in an untrusted network
- The user has access to the CA certificate that was used to sign the SEG existing certificate

To create a CA certificate, perform the following procedure:

Steps

1. Use openSSL to create a self-signed X.509 certificate. This serves as Trusted CA certificate.

   The `-days` attribute sets the validity period for the certificate:

   ```
   openssl req -x509 -nodes -newkey rsa:2048 -keyout
   trustedCA-key.pem -out trustedCA.pem -days 5000
   ```

2. Fill in the subject of the certificate, for example:

   ```
   Country Name (2 letter code) [AU]:SE State or
   Province Name (full name) [Some-State]:Stockholm
   Locality Name (eg, city) []:Kista Organization Name
   (eg, company)  [Internet Widgits Pty Ltd]:Ericsson
   Organizational Unit Name (eg, section) []:Support
   Common Name (e.g. server FQDN or YOUR name)
   []:trustedCA Email Address []:no.name@example.com
   ```

3. As a result, two files are created. The X.509 certificate `trustedCA.pem` and its private key `trustedCA-key.pem`

   The content of the certificate can be printed as text to check that given parameters are correct:

   ```
   openssl x509 -noout -text -in trustedCA.pem
   ```

4. As an option, fingerprint (SHA-1) can be calculated for the certificate:

   ```
   openssl dgst -c -hex -sha1 trustedCA.pem
   ```

5. The certificate file `trustedCA.pem` is stored on the client laptop. Later, the certificate file can be installed to the RBS through SFTP.

   Optional fingerprint information must also be stored if fingerprint validation is to be used during certificate installation.

5.3 Operator Certificate and Credential for SEG

This section describes how to create certificate and credential for a SEG in an untrusted network.

Note: This section is not applicable if the user already have access to the CA certificate which was used to sign the SEG existing credential.

Also, it is not applicable for a trusted network where no SEG is needed.

If the user have no CA certificate access, a new credential must be created for the SEG. It must be signed with the self-signed CA certificate created in Section 5.2 on page 9.

To create a SEG certificate, perform the following procedure:

Steps

1. Use openSSL to create a certificate signing request:

   ```
   openssl req -newkey rsa:2048 -nodes -keyout secgw-
   key.pem -out secgw-req.pem -days 5000
   ```

2. Fill in the subject of the certificate.

   Note: The same information can be used as for the CA certificate, but a different **Common Name** must be defined.

   ```
   Country Name (2 letter code) [AU]:SE State or
   Province Name (full name) [Some-State]:Stockholm
   Locality Name (eg, city) []:Kista Organization Name
   (eg, company)  [Internet Widgits Pty Ltd]:Ericsson
   Organizational Unit Name (eg, section) []:Support
   Common Name (e.g. server FQDN or YOUR name) []:SecGW
   Email Address []:no.name@example.com
   ```

3. Verify that, two files are created, the certificate request `secgw-req.pem` and the private key `secgw-key.pem`

4. Use the CA certificate `trustedCA.pem` and its private key `trustedCA-key.pem` to create a signed X.509 certificate:

   ```
   openssl x509 -req -in secgw-req.pem -CA trustedCA.pem
   -CAkey trustedCA-key.pem -set_serial 1234 -out
   secgw.pem -days 5000
   ```

5. Verify the certificate `secgw.pem` with:

   ```
   openssl verify -CAfile trustedCA.pem secgw.pem
   ```

6. Install the generated credential `secgw.pem` and `secgw-key.pem` on the SEG. For strongSwan based SEG implementations in lab environments, copy the files to the strongSwan installation folder. For real hardware based SEGs, follow the manufacturer's instruction for certificate installation.

5.4 Operator Certificate and Credential for RBS

To create an RBS certificate, perform the following procedure:

Steps

1. Use openSSL to create a certificate signing request:

   ```
   openssl req -newkey rsa:2048 -nodes -keyout prbs-key.pem -out prbs-req.pem -days 5000
   ```

2. Fill in the subject of the certificate:

   Note: The same information can be used as for the CA certificate, but a different common name must be defined.

   ```
   Country Name (2 letter code) [AU]:SE State or
   Province Name (full name) [Some-State]:Stockholm
   Locality Name (eg, city) []:Kista Organization Name
   (eg, company)  [Internet Widgits Pty Ltd]:Ericsson
   Organizational Unit Name (eg, section) []:Support
   Common Name (e.g. server FQDN or YOUR name)
   []:C827309086 Email Address []:no.name@ericsson.com
   ```

3. Verify that two files are created, the certificate request `prbs-req.pem` and private key `prbs-key.pem`

4. Use the CA certificate `trustedCA.pem` and it's private key `trustedCA-key.pem` to create a signed X.509 certificate:

   ```
   openssl x509 -req -in prbs-req.pem -CA trustedCA.pem -CAkey trustedCA-key.pem -set_serial 5678 -out prbs.pem -days 5000
   ```

5. Verify the certificate `prbs.pem` with:

   ```
   openssl verify -CAfile trustedCA.pem prbs.pem
   ```

6. As an option, fingerprint (SHA-1) can be calculated for the certificate:

   ```
   openssl dgst -c -hex -sha1 prbs.pem
   ```

7. The operator node credential must be archived in the PKCS12 container, because it contains the private key, which must not be exposed.

The PKCS12 is the only supported certificate format for stand-alone integration.

The certificate and the private key must be merged into one file and then password-encrypted. The user is prompted for the desired password. The file is stored in the PKCS12 container.

```
cat prbs-key.pem prbs.pem> combined_prbs.pem
```

```
openssl pkcs12 -export -in combined_prbs.pem -out
prbs_credential.pkcs12
```

8. The generated PKCS12 container `prbs_credential.pkcs12` is stored on the client laptop. Later, the PKCS12 container can be installed to the RBS through SFTP.

   Optional fingerprint information and container encryption password must also be stored in a safe location.

6 Preparing the Configuration Files

To perform a stand-alone integration on a node, the On-Site RBS Integrator (ORI) is used. ORI is the graphical user interface (GUI) in the RBS software. Stand-alone integration is only possible when using ORI and not during an autointegration.

Stand-alone integration is triggered by MOM actions that the user needs to define in the Semi-AI ICF. Before a stand-alone integration can be initiated, necessary MO actions must be done in the Semi-AI ICF. The content of the Semi-AI ICF then needs to be added to the combined file template inside the `<rpc>` tags. See Section 6.3 on page 15.

Note: The templates must be filled with values corresponding to the actual network and test environment. An exception is the definitions for registration authority servers under `<CertM>` object. The certificate enrollment is left out in the Stand-alone integration. Therefore, the server URIs, that is, `%TLSenrollmentServerAddressUri%`, must be defined with dummy IP addresses.

It is important that the right configuration files are used. For example, the Semi-AI ICF must be used for Stand-alone integration, not the ICF used for autointegration.

Depending on Radio Access Technology (RAT) and security solution, the following Semi-AI ICF must be used:

- LTE:
  - IPSec: *ICF Template IPSec, for Semi-AI*
  - no IPSec: *ICF Template without IPSec, for Semi-AI*
- WCDMA:
  - IPSec: *SEMIAI_configuration_file_WCDMA_IPSEC*
  - no IPSec: *SEMIAI_configuration_file_WCDMA_NOIPSEC*

Note: The file templates are found in the *Initial Configuration* folder in the CPI library.

6.1 Trusted CA Certificate Installation Information

Store the trusted CA certificate and the node credential created in Section 5.2 on page 9 in the folder `/var/ftp-` in the client laptop.

Use the Semi-AI ICF that is relevant for the specific case, that is, the RAT and security solution. See Section 6 on page 13.

For object `<CertM>` , the following lines must be added to the original code in the Semi-AI ICF, starting from, starting from `<certMId>1</certMId>` :

Note: To not "copy and paste" the text from the example to the Semi-AI ICF directly from this document. Write it manually.

If the user wants to execute fingerprint check, fingerprint must first have been calculated for `trustedCA.pem` in Section 5.2 on page 9. It then needs to be added in the `<fingerprint>` attribute. If no fingerprint check is needed, the attribute is left undefined.

Attribute `<uri>` always needs to point to the RBS local access port, that is, address range 10.1.1.0/24

```
<installTrustedCertFromUri> <uri>sftp://
example@10.1.1.12/var/ftp/trustedCA.pem</uri>
<uriPassword>barfoo</uriPassword> <fingerprint>69:5a:ee:
57:ad:4f:b1:f1:5e:b3:ad:9c:45:70</fingerprint> </
installTrustedCertFromUri>
```

Example 2 ICF Parameters - Trusted CA Certificate Installation

6.2 Node Credential Installation Information

Use the Semi-AI ICF that is relevant for the specific case, that is, RAT and security solution. See Section 6 on page 13.

For object `<NodeCredential>` , the following lines must be added to the original code in the Semi-AI ICF, starting from:

- `<nodeCredentialId>2</nodeCredentialId>` - IPSec
- `<nodeCredentialId>1</nodeCredentialId>` - no IPSec

Note: To not "copy and paste" the text from the example to the Semi-AI ICF directly from this document. Write it manually.

If the user wants to execute fingerprint check, fingerprint must first have been calculated for `prbs.pem` in step 6 on page 11 in Section 5.4 on page 11. It then needs to be added in attribute `<fingerprint>` . If no fingerprint check is needed, the attribute is left undefined.

Attribute `<uri>` always needs to point to the RBS local access port, that is, address range 10.1.1.0/24

```
<installCredentialFromUri> <uri>sftp://
example@10.1.1.12/var/ftp/prbs_credential.pkcs12</uri>
<uriPassword>barfoo</uriPassword>
```

```
<credentialPassword>12345</credentialPassword>
<fingerprint>49:f5:73:cb:a7:36:a5:cc:25:31</fingerprint>
</installCredentialFromUri>
```

Example 3   ICF Parameters - Node Credential Installation

6.3 Adding Semi-AI ICF Content to Combined File

After the Semi-AI ICF updates are completed, the entire file content must be placed inside the `<rpc>` tags in the combined file. Thereafter, the combined file is stored on the client laptop.

Depending on RAT, the following Combined file must be used:

- LTE: *Combined File template*
- WCDMA: *MSRBS_V1 Combined file*

Note: The file templates are found in the *Initial Configuration* folder in the CPI library.

7 Integrating with Stand-Alone

7.1 Preparations

Prior to integration, the following preparations must have been performed:

- The operator must have prepared the required node credential and trusted CA certificate.
- For integration in an untrusted network, it is assumed that the operator has installed corresponding SEG certificates. The SEG certificate must be signed with the same trusted CA certificate that the operator is about to install in the RBS.
- The installation files for the RBS are stored on the client laptop.
- The client laptop is connected to the RBS **WAN B** port.

  Note: To connect the cable to the WAN B port, use an SFP module. See *RBS Description*.
- The remote transport network to OSS-RC is connected to one of the following RBS ports:
  - **WAN A / PoE** port if electrical connection.
  - **WAN B** port if optical connection. Since WAN B is used also by the client laptop, the optical connection must be connected after the integration is initiated. See procedure in Section 7.2 on page 16.

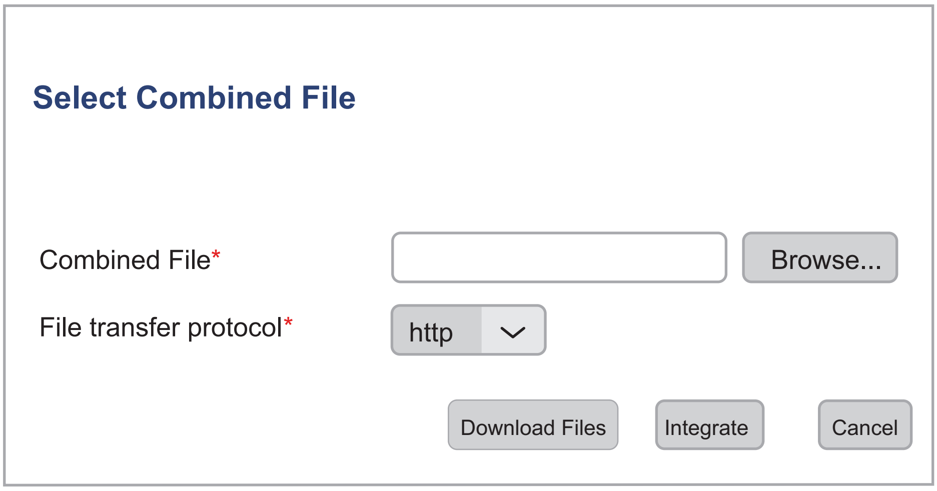
7.2 Integrating using ORI

To start the stand-alone integration procedure, use ORI to download the combined file created in Section 6 on page 13 from the laptop to the RBS.

Steps

1. On the laptop, start the web browser.

   In the browser address bar, enter the RBS IP address `10.1.1.11`
2. The **Select Combined File** dialog box opens.



Select Combined File

Combined File*

File transfer protocol* http

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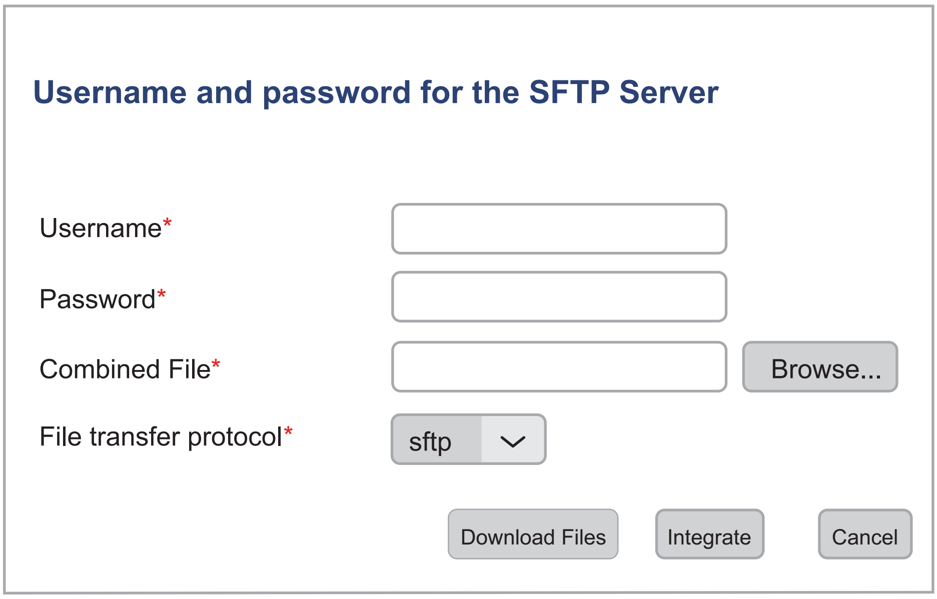
Default file transfer protocol is HTTP. For SFTP, select **sftp** in the **File transfer protocol** drop-down list. The **Username and password for the SFTP Server** dialog box opens.



Username and password for the SFTP Server

Username*

Password*

Combined File*

File transfer protocol* sftp

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Note: In older GUI versions, **SFTP** is default. Also, **Combined File** is instead called **Site Installation File**, although it is the combined file that must be used.

3. Enter the following credentials (user name and password are omitted if HTTP is used):

   - **Username**: `admin`
   - **Password**: `webui`

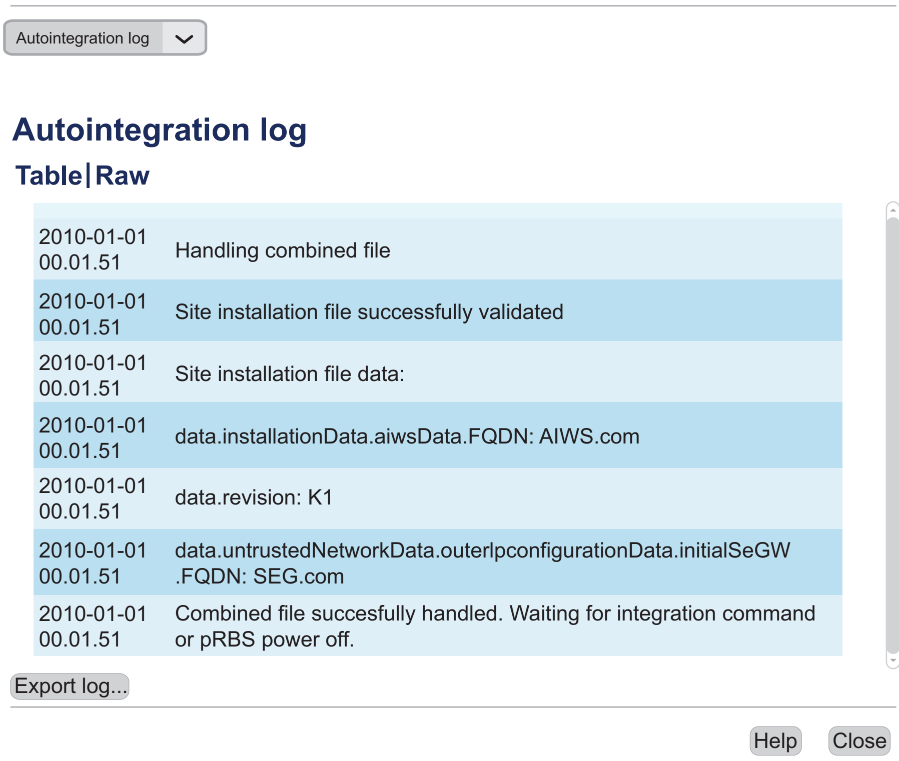
- **Combined File**: **`<file name>`** or click **Browse** to select the file.

Note: If **Browse** is used with **File transfer protocol** set to **sftp**, the installation file must be located in the SFTP server root folder on the laptop.

4. Click the **Download files** button. The download procedure starts.

   This step cancels the ongoing autointegration process. There is no need to prevent autointegration from proceeding using other methods.

5. The download procedure can be followed in the **Autointegration log**.



Autointegration log

Table|Raw

2010-01-01 00.01.51	Handling combined file
2010-01-01 00.01.51	Site installation file successfully validated
2010-01-01 00.01.51	Site installation file data:
2010-01-01 00.01.51	data.installationData.aiwsData.FQDN: AIWS.com
2010-01-01 00.01.51	data.revision: K1
2010-01-01 00.01.51	data.untrustedNetworkData.outerIpconfigurationData.initialSeGW .FQDN: SEG.com
2010-01-01 00.01.51	Combined file succesfully handled. Waiting for integration command or pRBS power off.

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6. Click **Integrate** to start the integration.

   The RBS performs a restart.

7. If an optical connection to OSS-RC is used, remove the laptop cable from the **WAN B** port. Immediately plug in the OSS-RC connection in the WAN B port.

8. To confirm that the certificates are successfully installed on the RBS, the following transcript are visible in the **Autointegration log**:

```
Stand alone integration. Installing node credentials.
```

```
...

Installing node credential certificate for ipsec.

...

Node credential certificate downloaded successfully.

Trusted certificate downloaded successfully.

...

Reading of node certificate container successful.

Certificate fingerprint verification successful.

Trust chain is valid for certificate.

Node certificate written to secure storage.

...

Trusted certificate written to secure storage.

...

Certificates written to secure storage.

Node credential and trusted certificate installed
successfully.

ipsec certificate installation OK.
```

Note: The Autointegration log is visible only when the laptop is connected to the WAN B port. Therefore, real-time integration information cannot be monitored if an optical OSS-RC connection is used.

9. No further user interaction is needed. Wait a few minutes and check that the green optical indicator is lit and not blinking. When the green indicator is lit, the integration is finished and the RBS is up and running.

10. Disconnect the client laptop cable from the RBS port.

8 Disabling Stand-Alone Integration

If a new integration of the RBS is planned with an integration method other than the stand-alone, the ICF must first be updated. The local account updates for the super user in the ICF need to be removed.

8.1 Disabling the Local Super User Account

To delete the local super user account information from the permanent file system partition, a factory reset must be performed. For information about the reset procedure, see *Recovering a Node on Site*.

If a new stand-alone integration attempt is planned, the combined file must first be edited. The `<superUserAccount>` tags and the contents between the tags must be removed from the file. If not, O&M uses the information from the combined file to create the local super user account again.