

ARCAM Avatar Update

Draft Version v0.4

Version

| Version | Date | By | Description |
|---------|------------|------------|--|
| 0.1 | 11/09/2019 | Chris Mann | First draft. Still has sections to be completed. |
| 0.2 | 05/12/2019 | Chris Mann | Updated to reflect the removal of Upgrade Options |
| 0.3 | 05/05/2020 | Chris Mann | Added ST60.Images |
| 0.4 | 12/05/2020 | Chris Mann | Added instructions for using the acam_debug_key.ppk file with WinSCP and PuTTY |

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Overview

This document describes the steps involved in the ARCAM Avatar Update process. It should be seen as an addendum to the ARCAM Avatar Messaging document.

The Avatar module is currently used in the following ARCAM products:

- Solo Uno
- SA30
- AVR range (ARCAM, JBL, Audio Control)

Each product has its own firmware and update procedure. The requirement of the Avatar update is that it accommodates the differences in approach.

Terms

The following terms are used through the document:

| Term | Description |
|-------------------|---|
| Avatar | The Avatar board running Stream Unlimited firmware. |
| Device | The ARCAM device that is communication with the Avatar |
| Message | The mechanism by which information is transferred between the device and the Avatar and visa-versa. |
| Hostlink Protocol | A lightweight protocol used to communicate simple data structures between a master microcontroller running StreamSDK and the device. |
| SWU File | The software update file containing Avatar and Device software included in a single release, and published on the arcamupdate.co.uk website. |

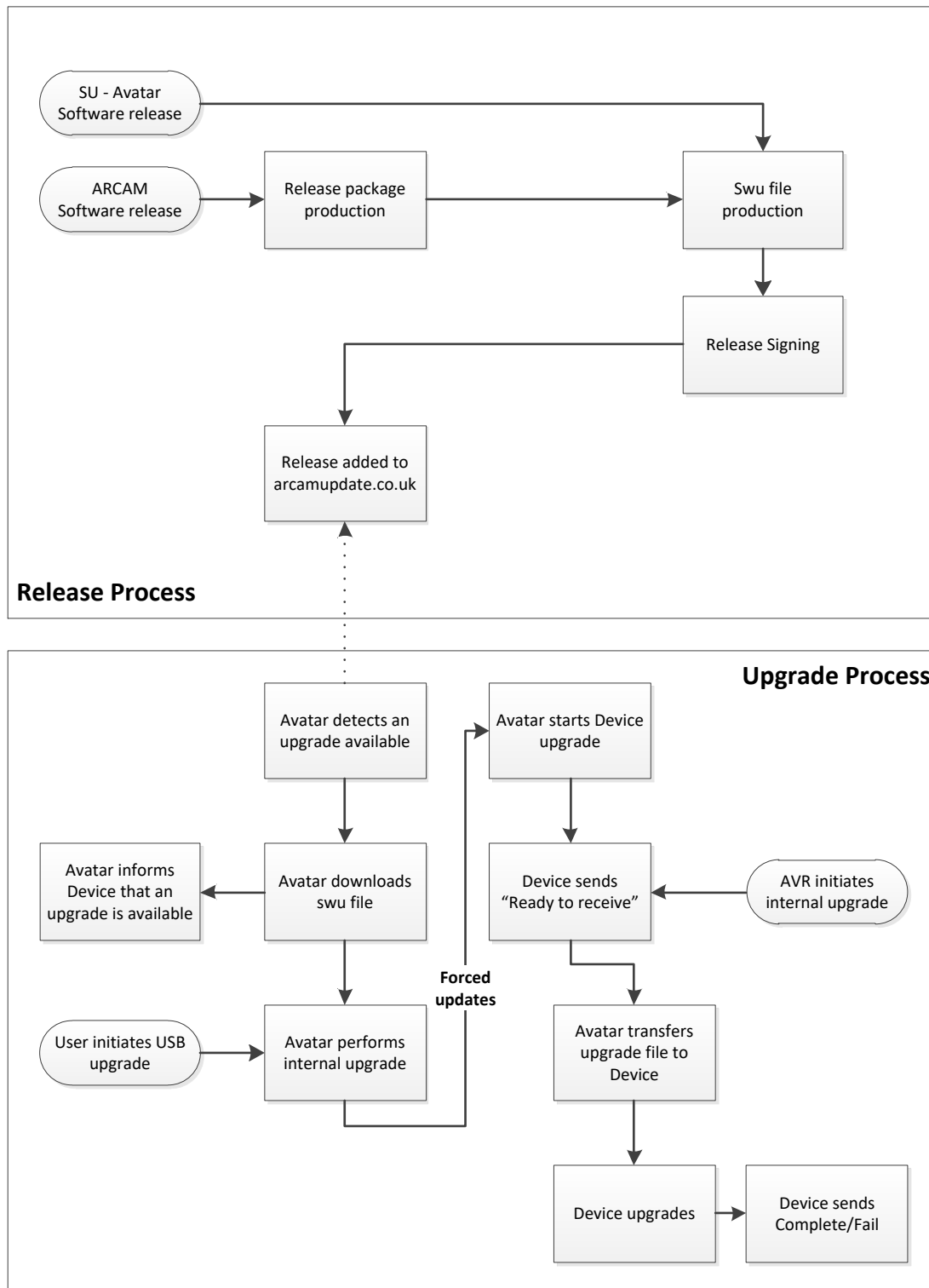
References

| Title | Location |
|--|----------|
| Stream Unlimited Hostlink protocol | |
| HK Citation MCU AML Communication_2.7 | |
| HostLink protocol_ I2C and SPI Hostlink Examples | |
| StreamSDK update documentation | |

The Update process

The same upgrade process is followed for all products. This comprises of 2 distinct phases:

- Release – The upgrade software is made available for download
- Upgrade – The upgrade software is downloaded by the Avatar and used to update the Avatar and Device.



Release Process

The release process takes new releases of software from either the ARCAM products or Avatar, combines them into a single SWU file, and publishes it on the arcamupdate.co.uk website.

The process is initiated when a new software release is produced for either one of the ARCAM products or the Avatar module.

ARCAM software release

Each ARCAM product has its own unique software. When a change is made to a products software a new release will be generated for that product.

Each product uses its own file format for the release package that is included in the SWU file. To handle this the design of the messages used to transfer data between the Avatar and the Device is agnostic to the content of the data being transferred.

AVRs

The AVR upgrade files can be large (100MB+) containing packaged upgrade for different parts of the device. The upgrade files can be zipped which greatly reduces their size in the resulting SWU file. These are then unpacked on the Avatar before transfer to the AVR. Mechanisms have been built onto the Avatar/Device upgrade messages to allow the AVR to control which parts of the upgrade data are transferred.

SA30/ST60

The SA30 and ST60 upgrade files package up software updates for the main device and the other components in the product (HDMI ARC, Display MCU). The file header contains metadata that describes the layout of the software packages in the upgrade file, and which is used by the device when upgrading. A bespoke software application has been created to generate the upgrade files from the combined software packages. (See Appendix 1: SA30/ST60 Release Packager).

Solo Uno

The Solo Uno upgrade file include metadata in its header in a similar format to the single software package metadata used for the SA30/ST60.

Avatar software release

It is expected that Stream Unlimited will need to make periodic changes to the Avatar software to accommodate security updates etc. Whenever one of these update is required a new release will be produced.

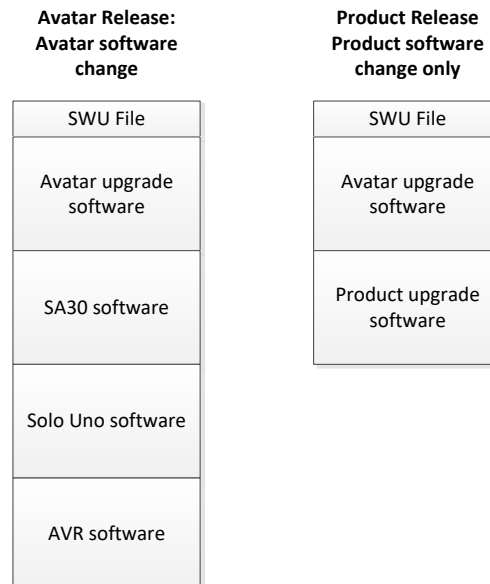
SWU file production

When either (or both) new ARCAM or Avatar releases are produced they will need packaging up into an SWU file which is the file format used by the Avatar for upgrades.

The content of the SWU file can take 2 forms dependent on whether there are changes to the Avatar software:

- **Avatar Release** - Where there are changes to the Avatar software the SWU file will contain the Avatar software upgrade and the current software version for all products that use the Avatar.
- **Product Release** - Where the only changes are to product software, the SWU file will contain the latest version of the Avatar software and the software for products involved in the update.

Because an Avatar Release contains the current software for all products it can become large (the AVR upgrade is 100MB+). The purpose of the Product Release is to reduce the size of the SWU file that is downloaded.



Question

Who will be creating the SWU file? Will Stream supply us with a mechanism for packaging up releases into an SWU file, or will they expect to handle the process.

Ideally ARCAM will have the ability to generate SWU files and manage the release numbers.

(v0.2) It appears that in general product releases will not be used.

Naming

The name of the SWU file on the arcamupdate.co.uk website will be as follows:

For Avatar Releases:

- It will have an "Avatar_Upgrade" prefix, followed by an underscore.
- The prefix will be followed by the Avatar version number using underscores as separators

E.g. **Avatar_Upgrade_0_100_50_0x78cf959.swu**

For Product Releases:

- It will have a "*product_name*_Upgrade" prefix, followed by an underscore.
- The prefix will be followed by the Avatar version number using underscores as separators

E.g. **Arcam_SA30_Upgrade_0_100_51_0x78cf959.swu**

Note: The version number for the release can be found in the swuversions.txt file included in the Stream Unlimited build folder containing the release.

ARCAM Avatar Update

Versioning

Each SWU file release is regarded as a new Avatar release (even if the Avatar code base does not change).

The release version is then used in the upgrade web site json files to control which products download the new release (See Release Publication below).

Signing the release

This process is described in the document “ARCAM Avatar Release Signing”. The process is handled in the Avatar.Release.Packager application.

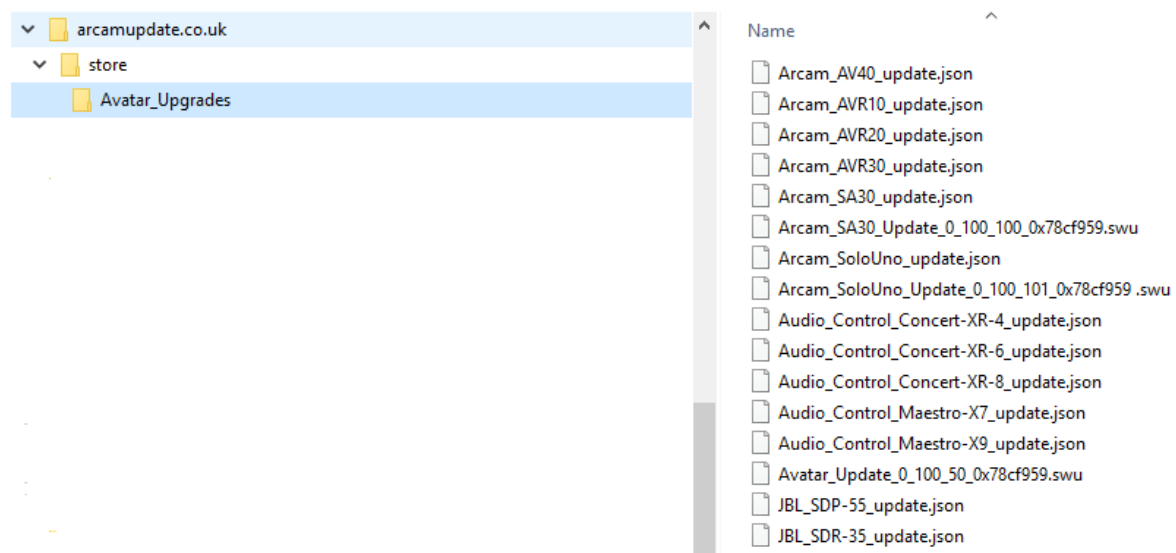
Release publication to arcamupdate.co.uk

Once the SWU release file has been produced and signed it can be added to the arcamupdate.co.uk website. This is handled in the Avatar.Release.Packager application.

The SWU files for all available upgrades will be kept in the same location on the arcamupdate.co.uk website:

www.arcamupdate.co.uk/store/Avatar_Updates

e.g.



For clarity each SWU file will include the Avatar version number in the file name e.g.

Avatar_Upgrade_0_100_50_0x78cf959.swu

Accompanying the SWU files there will be a json file for each Device type that identifies the latest upgrade for the given device. This file is polled by the Avatar to identify whether an upgrade is available for download. The naming convention used for the json files will be:

device_name_update.json e.g. Arcam_SA30_update.json

The json file contains fields identifying the version of the SWU upgrade file, the location of the file, and whether the upgrade should be an immediate forced upgrade.

```
{
  "version": "0.100.50.0x78cf959",
  "url":
    "http://www.arcamupdate.co.uk/store/Avatar_Updates/Avatar_Upgrade_0_100_50_0x78cf959.swu",
}
```

ARCAM Avatar Upgrade

```
"forcedUpdate": true,  
"lastForcedVersion": "0.0.0.0x0"  
"imageSize": "100000"  
}
```

Development releases

A second location [www.arcamupdate.co.uk/store/Avatar Upgrades Dev](http://www.arcamupdate.co.uk/store/Avatar%20Upgrades%20Dev) on the arcamupdate.co.uk is used to hold development releases. The layout and content of the directory mirrors the live release directory.

Upgrade Process

Identifying that an upgrade is available

The URL used by the Avatar to check for updates is stored in **/settings-default/fwupdate/firmwareUpdateServerUrl**. This will point at the appropriate json file for the Device in the www.arcamupdate.co.uk/store/Avatar_Upgrades directory.

```
{
  "title" : "Firmware Update Server",
  "modifiable": true,
  "value": {
    "type": "string_",
    "string_": "http://
www.arcamupdate.co.uk/store/Avatar\_Upgrades/Arcam\_SA30\_update.json
  }
}
```

If the “version” in the json file is newer than the current Avatar version then an upgrade is available. The values of “forcedUpdate” and “lastForcedVersion” determine whether the update should be performed immediately.

“imageSize” is used by the Avatar to determine whether it has sufficient NAND space to download the upgrade in the background or not. If not, The Avatar may go into upgrade mode first then download and install the image at the same time. This can take significantly longer.

```
{
  "version": "0.100.50.0x78cf959",
  "url":
    "http://www.arcamupdate.co.uk/store/Avatar_Upgrades/Avatar_Upgrade_0_100_50_0x78cf959.swu",
  "forcedUpdate": true,
  "lastForcedVersion": "0.0.0.0x0"
  "imageSize": "100000"
}
```

Note (from Stream Update documentation)

The update will be only requested if the device's current version is lower than the version in the description. A non-forced update will be force applied on devices which have a lower current version than the lastForcedVersion of the description

Checks for updates are performed at regular intervals. The default period is every 4 hours for GoogleCast enabled devices, and 24 hours otherwise. The interval is defined in **/settings-default/fwupdate/periodicCheckInterval**.

```
{
  "value": {
    "type": "i32_",
    "i32_": 4
  },
  "title": "Periodic check interval [h]"
}
```

Informing the Device that an upgrade is available

Information about the latest version of the Device upgrade package stored on the Avatar is kept in **/lib/firmware/versions.json**.

The Device Upgrade Available message will always be sent when the "version" field doesn't match the reported device version. If "forced" is set to true, an upgrade will be trigger before the StreamSDK is even booted.

```
...
  "arc_solouno": {},
  "arc_sa30": {
    "file": "ARCAM_SA30_0_12.FWU",
    "version": "0.12",
    "forced": "false"
  },
  "arc_st60": {},
  "arc_avr10": {},
  "arc_avr20": {},
  ...
```

Question

- How does the Avatar work out the current device version when associating it with an upgrade file? Is that included in the SWU file? Yes its included in [/lib/firmware/versions.json](#)

Initiating the upgrade

Two definitions of "Forced"

The upgrade process uses the term forced in two separate places.

- If an update is marked as forced in the [/lib/firmware/versions.json](#) file included in the upgrade, then the device upgrade will be performed immediately after the Avatar upgrade. Otherwise the device upgrade will be postponed until the device issues a "Ready to Receive" message (used on AVR's only. SA30/Solo Uno will always be forced)
- If an update is marked a forced in the website json file, of the current Avatar version is less than the lastForcedUpgrade value, then the upgrade will be initiated immediately. If it is not marked as forced a Silent or Reboot upgrade will be scheduled. Whether the device upgrade is initiated is dependent on the forced option described above.

Upgrade Types

The table below shows the effect of different combinations of the two forced options.

| Website json | /lib/firmware/versions.json | |
|--------------|---|---|
| | Forced | Not forced |
| Forced | <ul style="list-style-type: none"> • The upgrade is initiated immediately • The device upgrade is triggered as soon as the Avatar upgrade completes. | <ul style="list-style-type: none"> • The upgrade is initiated immediately • The device upgrade is triggered when the Avatar receives a "Ready to Receive" message from the device. |
| Not Forced | <ul style="list-style-type: none"> • The upgrade is initiated either during the night or when the device is rebooted, whichever comes first. • The device upgrade is triggered as soon as the Avatar upgrade completes. | <ul style="list-style-type: none"> • The upgrade is initiated either during the night or when the device is rebooted, whichever comes first. • The device upgrade is triggered when the Avatar receives a "Ready to Receive" message from the device. |

Silent (Night time) Updates

Silent updates are initiated at 3AM +/- 1 hour, and only when the device is in an idle state (i.e. playback has been stopped for 10 minutes and there has been no user activity). If a device reboot occurs while a Silent update is scheduled the update will start as soon as the device is re-loaded.

Testing the upgrade

Testing an OTA upgrade

Generating an SWU file for upload to the testing website

TODO: To be completed

Copying the SWU file to the [arcamupdate.co.uk](http://www.arcamupdate.co.uk) website

Once the SWU file containing an Avatar releases plus the Device upgrade package has been generated it can be copied to the [arcamupdate.co.uk](http://www.arcamupdate.co.uk) website.

Development releases should be copied to:

www.arcamupdate.co.uk/store/Avatar_Upgrades_Dev

The json file for the device should be updated with the SWU release version, and the name of the SWU file. The value for "forcedUpdate", "imageSize" etc. should be set depending on what is being tested.

```
{
  "version": "0.100.50.0x78cf959",
  "url":
"http://www.arcamupdate.co.uk/store/Avatar_Upgrades/Avatar_Upgrade_0_100_50_0x78cf959.swu",
  "forcedUpdate": true,
  "lastForcedVersion": "0.0.0.0x0"
  "imageSize": "100000"
}
```

Identifying that a release is available

Once the release has been copied to the development website it can be tested. A check can be made that the Avatar is using the correct location by looking in **/settings-default/fwupdate/firmwareUpdateServerUrl** and checking that it is pointing at the correct URL.

E.g.

```
{
  "title" : "Firmware Update Server",
  "modifiable": true,
  "value": {
    "type": "string_",
    "string_":
"http://www.arcamupdate.co.uk/store/Avatar_Upgrades_Dev/Arcam_SA30_update.json"
  }
}
```

At this point the Avatar should identify that a release is available, and begin the upgrade dependent on the Upgrade Option (Forced, Silent, and User).

Manual initiation of the device upgrade from the Avatar

It is possible to test the Device upgrade stage of the upgrade process manually by copying the device upgrade package to the Avatar and manually initiating the upgrade.

Step 1: Prepare the Device upgrade package

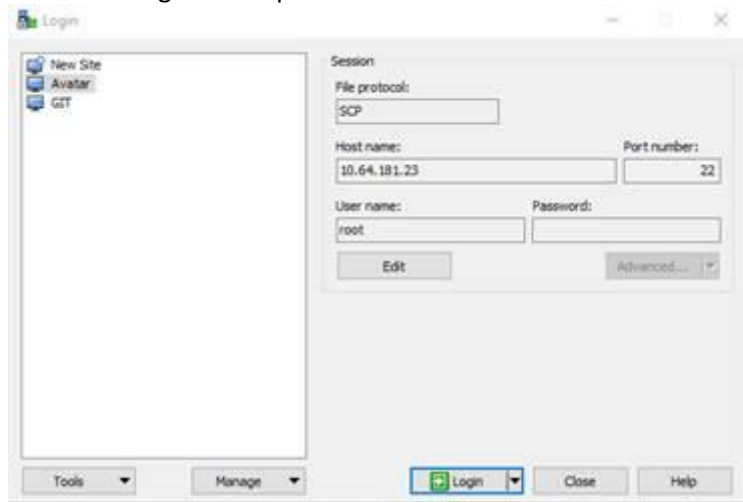
This is device specific. For an example of an SA30 upgrade see SA30/ST60 Release Packager below.

Step 2: Copy the file to the Avatar

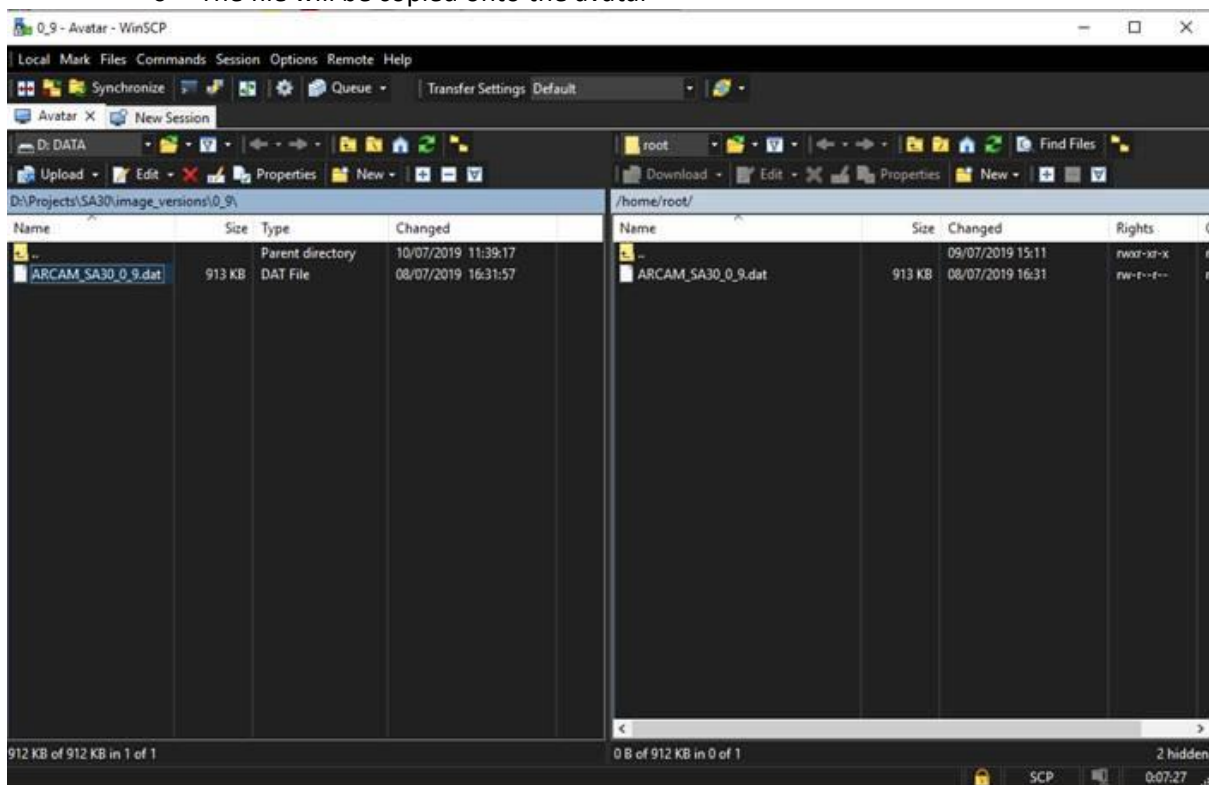
Having produced the Device upgrade package file it should be copied into the Avatars file system. This can be achieved using a product such as WinSCP.

ARCAM Avatar Update

- Download and install WinSCP (<https://winscp.net/eng/download.php>)
- Login to the Avatar using the SCP protocol



- On the Advanced page, specify the path to the arcam_debug_key.ppk file used for authentication with the avatar (SSH->Authentication->Private Key File)
- Navigate to /home/root
- Find the upgrade package file on your file system in the left hand pane.
- Drag it over to the right hand pane.
 - The file will be copied onto the avatar

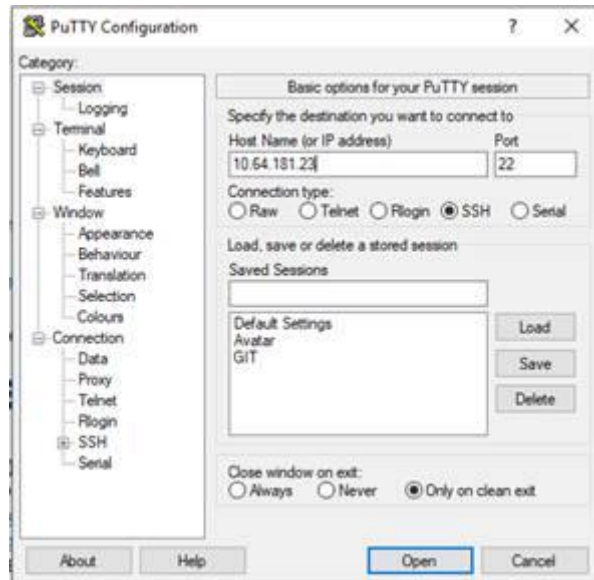


Step 3: Initiate the Device upgrade

The Device upgrade stage can be initiated by starting a terminal session on the Avatar using a product such as PuTTY (<https://www.putty.org/>)

Using PuTTY:

- Start a session on the Avatar



- On the SSH page, specify the path to the `arcam_debug_key.ppk` file used for authentication with the avatar (Private Key File)
- In the session window
 - Login as root (no password)
 - Type “stop”
 - Type “`hostlink_cli -D i2c /dev/i2c-0 6 56 -T 15000 -C update_host 4096 /home/root/your_image_file_name`”
 - That will start the upload of the image file from the Avatar

```
10.64.181.23 - PuTTY
login as: root
root@sa30-3ba620:~# stop
Stopping nSDK components
killall: sddpd: no process killed
killall: conlibui: no process killed
killall: logger.sh: no process killed
killall: nsdk_watchdog: no process killed
killall: nsdk_watchdog: no process killed
killall: nSDK: no process killed
killall: scwd: no process killed
killall: nsdk_streamer: no process killed
killall: MediaRendererApp: no process killed
killall: ntpd: no process killed
killall: bluetoothd: no process killed
killall: mdnsd: no process killed
killall: castControlApp: no process killed
killall: cast_cli: no process killed
killall: process_manager: no process killed
killall: crash_uploader: no process killed
killall: update_engine: no process killed
killall: cast_shell: no process killed
.
root@sa30-3ba620:~# hostlink_cli -D i2c /dev/i2c-0 6 56 -T 15000 -C update_host 4096
/home/root/ARCAM_SA30_0_9.dat
Update host selected
File chunk size set to: 4096
Path to host firmware file: /home/root/ARCAM_SA30_0_9.dat
Loading upgrade data from file ... Done!
Sending update request to host.
Waiting for reply from host. Timeout set to 15000ms
Received message with contents: 01 00 01 0b f3 cc 00
State: 0xF30B DeviceUpgradeStatus
Value: 0x0 ReadyToReceiveData
Sending first upgrade packet ...
Sending packet #1 (4096/934154)
Upgrade data packet sent! Waiting for response ...
Received message with contents: 01 00 01 0b f3 cc 01
State: 0xF30B DeviceUpgradeStatus
Value: 0x1 DataReceived
Sending next upgrade packet ...
```

- The first message sent by the Avatar is Avatar Upgrade Status 0x03 Start Upgrade

Note: In the command `hostlink_cli -D i2c /dev/i2c-0 6 56 -T 15000 -C update_host 4096 /home/root/your_image_file_name`

- 15000 is the timeout in milliseconds where the Avatar waits for a response.
- 4096 is the packet data size.

Appendix1: SA30/ST60 Release packager

The SA30 and ST60 upgrades can optionally include upgrade data for other components in the device (e.g. ST60 Display, HDMI ARC). For these products the upgrade package includes metadata in the package header that describes the contents of the package.

| Byte | Encoding | Description |
|-------|----------|---|
| 1 | UINT8 | Number of Images |
| | | <i>For each Image</i> |
| 1-20 | CHAR | Component Identifier (i.e. SA30, ST60.Display) |
| 21-24 | UINT32 | Upgrade Image Size (Image Data Size + metadata size (22)) |
| | | <i>For each image</i> |
| 1 | UINT8 | Major Version |
| 2 | UINT8 | Minor Version |
| 3-6 | UINT32 | Component Image Data Size |
| 7-22 | BIN | MD5 Data Checksum (as a UINT8[16] array) |
| 23-N | BIN | Component Image Data |

SA30/ST60 upgrade package metadata

SA30 version 0.38 is the last version to be packaged with version 1. Subsequent releases should be packaged using version 2 which has an extended header.

| Byte | Encoding | Description |
|-------|----------|---|
| 1 | UINT8 | 0xFE (Indicates new file format) |
| 2 | UINT8 | Upgrade Major Version (=0x02) |
| 3 | UINT8 | Upgrade Minor Version (=0x00) |
| 4 | UINT8 | Number of Images |
| | | <i>For each Image (in the header)</i> |
| 1-20 | CHAR | Component Identifier (i.e. SA30, ST60.Display) |
| 21 | UINT8 | Major Version |
| 22 | UINT8 | Minor Version |
| 23-26 | UINT32 | Upgrade Image Size (Image Data Size + metadata size (22)) |
| | | <i>For each image</i> |
| 1 | UINT8 | Major Version |
| 2 | UINT8 | Minor Version |
| 3-6 | UINT32 | Component Image Data Size |
| 7-22 | BIN | MD5 Data Checksum (as a UINT8[16] array) |
| 23-N | BIN | Component Image Data |

SA30/ST60 upgrade package metadata (V2)

Each component is identified by a hardcoded identifier in the product software as follows¹:

- SA30
- HDMI_ARC
- ST60
- ST60.Display

¹ These are defined in app_initialise.c – initialise_avatar();

- ST60.Images

Avatar Release Packager

Output Update File Location:

Product (Version)

- SA30 (0.14)

Product

Major Version

Minor Version

Image Location

File Size 1218076

MD5 Hash 1e.88.ea.b4.85.6d.b7.be.24.06.8b.61.0c.d2.b2.aa

Add **Remove**

C:\Temp\Releases\ARCAMSA30_20190916.FWU

The structure of the Device upgrade data is device dependent. For the Solo Uno, SA30 and ST60 the layout of the Device Upgrade data will be as follows:

| Byte | Encoding | Description |
|------|----------|--|
| 1 | UINT8 | Major Version |
| 2 | UINT8 | Minor Version |
| 3-6 | UINT32 | Image Data Size |
| 7-22 | BIN | MD5 Data Checksum (as a UINT8[16] array) |
| 23-N | BIN | Image Data (Software HEX file) |

Appendix 2: Avatar file locations

| Location | Description |
|---|--|
| /lib/firmware/versions.json | <p>Keeps a record of the latest available version of a devices upgrade package stored on the Avatar. If this is different to the version of the firmware reported by the Device an Upgrade Available message will be sent on start-up.</p> <pre>{ "arc_solouno": {}, "arc_sa30": { "file": "ARCAM_SA30_0_12.FWU", "version": "0.12", "forced": "false" }, "arc_st60": {}, .. }</pre> |
| /settings-default/fwupdate/firmwareUpdateServerUrl | <p>Identifies the URL that the Avatar uses to check for updates.</p> <pre>{ "title" : "Firmware Update Server", "modifiable": true, "value": { "type": "string_", "string_": "http://www.arcamupdate.co.uk/store/Avatar_Upgrades/Arcam_SA30_update.json" } }</pre> <p>This URL is overwritten on OTA but persists over a Factory update.</p> |
| /media/settings/settings/fwupdate/firmwareUpdateServerUrl | <p>Identical to <i>/settings-default/fwupdate/firmwareUpdateServerUrl</i> but is cleared on a Factory reset and persists over OTA.</p> |
| /settings-default/fwupdate/periodicCheckInterval | <p>Defines the interval (in hours) that checks are made for updates. This defaults to 4 hours if GoogleCast is enabled, 24 hours if not.</p> <pre>{ "value": { "type": "i32_", "i32_": 4 }, "title": "Periodic check interval [h]" }</pre> |
| Upgrade website json file | <p>This file is used on the arcamupdate.co.uk website to identify the current release of a given device. The files will have the naming convention of <i>device_name_update.json</i></p> <pre>{ "version": "0.100.50.0x78cf959", "url": "http://www.arcamupdate.co.uk/store/Avatar_Upgrades/Avatar_Upgrade_0_100_118_0x72f931a.swu", "forcedUpdate": true, "lastForcedVersion": "0.0.0.0x0" "imageSize": "100000" }</pre> |

| | |
|--|--|
| | |
|--|--|