

Simulcast User's Guide

Version 7.0

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**GODDARD SPACE FLIGHT CENTER
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Simulcast Version 7.0

1 General

The NASA Goddard Space Flight Center's (GSFC) Direct Readout Laboratory (DRL) developed this Simulcast software.

Users must agree to all terms and conditions in the Software Usage Agreement on the DRL Web Portal before downloading this software.

Software and documentation published on the DRL Web Portal may occasionally be updated or modified. The most current versions of DRL software are available at the DRL Web Portal:

<https://directreadout.sci.gsfc.nasa.gov>

Questions relating to the contents or status of this software and its documentation should be addressed to the DRL via the Contact Us mechanism at the DRL Web Portal:

<https://directreadout.sci.gsfc.nasa.gov/?id=dspContent&cid=66>

2 Software Description

Simulcast is a real-time Java application that allows users to select and view quicklook instrument data from multiple missions and spacecraft. Simulcast provides real-time geolocation and pseudo-calibration, and projects data on Mercator and Polar maps. Simulcast can replay recent satellite passes, export displayed images to JPEG format, and save replayed passes to AVI/Quicktime movies.

The Simulcast client software consists of the Simulcast Viewer and Console. The Viewer displays data from the:

- Moderate Resolution Imaging Spectroradiometer (MODIS) instruments on board the Aqua and Terra spacecraft;
- Visible Infrared Imaging Radiometer Suite (VIIRS) instruments on board the Suomi National Polar-orbiting Partnership (SNPP) and Joint Polar Satellite System (JPSS-1 and JPSS-2) spacecraft.

The Console displays and controls administrative information regarding Simulcast Services.

Before data can be displayed with the Viewer, the data must first be acquired, routed and processed by Simulcast Services. The Simulcast Services software consists of the Simulcast Router, Processor, and Server.

When a pass starts, the Router receives the Consultative Committee for Space Data Systems (CCSDS) packet stream from the Real-time Software Telemetry Processing System (RT-STPS) and transmits the packets to one or more Processors. The Router filters the packets by instrument type.

The Processor receives the filtered packets from the Router and extracts instrument data. The Processor calibrates the data, corrects the bow tie effect, and reduces data volume. The Processor transmits viewable data to the Server.

The Server receives viewable data from the Processor and notifies Simulcast clients that the new pass data are available. The Server simultaneously stores the data locally (for possible replay later) and transmits it to clients and other Simulcast Servers. A Server can handle connections from multiple clients simultaneously, with each client either receiving the data from the current pass or from a previous pass.

For a more detailed description of Simulcast and other DRL technologies, go to:

<https://directreadout.sci.gsfc.nasa.gov>

3 Simulcast Download Options

Download the complete Simulcast package to configure Simulcast to view data from any ground station and/or Simulcast Server. The complete Simulcast package is contained in the file `SIMULCAST_7.0.tar.gz`. Sample data for testing the Simulcast installation are contained in the file `SIMULCAST_7.0_testdata.tar.gz` (Testing procedures are contained in the “Software Package Testing and Validation” sections of this document).

4 Software Version

This software package contains Simulcast Version 7.0. Enhancements to Simulcast Version 7.0 include:

- JPSS-2 VIIRS support;
- bundled Java Runtime Environment (JRE) (running Oracle OpenJDK 11.0.1);
- test data for all supported instruments, including JPSS-2 VIIRS.

This software will execute on a 64-bit computer. This software has been tested on a computer with 16GB of RAM and a CentOS Linux 7 X86_64 operating system.

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5 Prerequisites

Users should ensure that `/lib/ld-linux.so.2` is installed. Simulcast comes pre-compiled using the 64-bit Oracle OpenJDK 11.0.1. Simulcast comes packaged with and executes on a custom standalone Java Runtime Environment (JRE) built using Oracle OpenJDK 11.0.1. A 64-bit version of Linux is required for proper operation.

A firewall may in some cases prevent Simulcast from running correctly, and it may need to be disabled or configured to allow access for certain ports. On default configurations, Simulcast requires access to the following port numbers: 3500, 3502, 3509, 3511- 3515, 3520, 3530.

6 Program Inputs and Outputs

Simulcast input data are CCSDS packet data from a Real-time Software Telemetry Processing System (RT-STPS) socket connection (go to the DRL Web Portal at <https://directreadout.sci.gsfc.nasa.gov> to learn more about RT-STPS, and to download the software). Simulcast outputs images of pass data in real time. It also outputs files with the extension .SC in its spool/server/ directory for later replay. Simulcast can send instrument-specific packet data for testing.

7 Installation and Configuration of Simulcast Services

WARNING: Due to potential resource concerns, Simulcast should not be installed on a system that is also running an IPOPP installation.

NOTES:

1. These installation instructions assume that the Simulcast package was installed in '/home/username'.
2. If you are upgrading to Version 7.0 from a previous version of Simulcast, it is recommended that you save your existing configuration files (which are found in Simulcast's configs/ directory) for possible future reference.

If you are upgrading from a previous version of Simulcast, first close any open Simulcast Viewer/Console windows and stop the Simulcast Services, then delete the existing sc/ directory. The Simulcast Services can be stopped at any time from a shell by entering:

```
/home> cd /home/username/sc  
/home/username/sc> ./jsv/bin/sc-services stop
```

Once the Simulcast Services are stopped, delete the existing Simulcast installation:

```
/home> cd /home/username/  
/home> rm -rf sc/
```

Then to install the new package:

- 1) create a user account (if it does not already exist) under which the server will run;
- 2) copy the downloaded SIMULCAST_7.0.tar.gz file to the desired installation directory (e.g., /home/username/);
- 3) decompress SIMULCAST_7.0.tar.gz using the command:

```
$ tar xzvf SIMULCAST_7.0.tar.gz
```

An 'sc' directory containing the Simulcast package should now be present in the selected installation directory. The Simulcast user must own and have full read/write permissions to the installation and 'sc' directories.

Copy the downloaded SIMULCAST_7.0_testdata.tar.gz file to the installation directory (same directory as the 'sc' directory). Decompress and un-archive the SIMULCAST_7.0_testdata.tar.gz file:

```
$ tar -xzf SIMULCAST_7.0_testdata.tar.gz
```

7.1 Configure the Simulcast Services

This section contains instructions to enable the Basic Default Configuration. Simulcast distributions come pre-compiled, but the user must run the ./install.sh script to automatically configure Simulcast Services for the Basic Default Configuration. Once the Basic Default Configuration has been enabled automatically, the user can enable a Downstream Server Configuration, as described in Appendix A, or a Multiple Downstream Server Configuration, as described in Appendix B.

7.1.1 Basic Default Configuration

Figure 1 depicts the Basic Default Configuration, including port numbers.

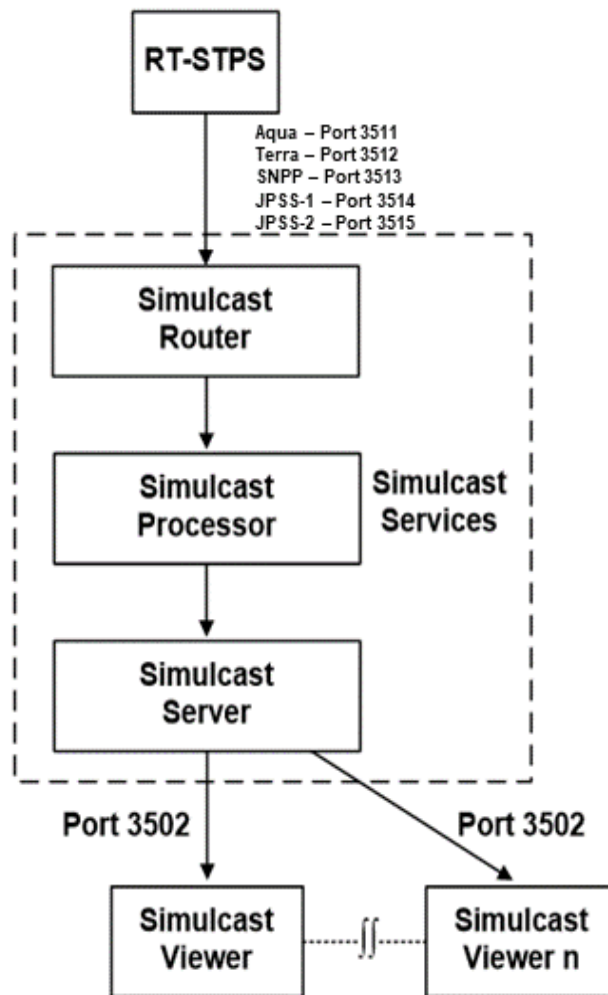


Figure 1. Basic Default Configuration

NOTE: Default port numbers are as follows:

- Aqua – Port 3511;
- Terra – Port 3512;
- SNPP – Port 3513;
- JPSS-1 – Port 3514;
- JPSS-2 – Port 3515.

These port numbers are configurable (configs/router-config.xml), but it is strongly recommended that the user maintain the default settings. There is no limit to the number of Viewers that may be connected to the Server.

Most Simulcast installations can simply use the default configuration values, excepting

the unique ground station information in the configuration files for the Router and the Server; these files are edited automatically when the user runs the `./install.sh` script, which generates a series of queries requesting the following:

- a) station ID: A short acronym used to identify the ground station.
- b) station name: The full name of the ground station.
- c) latitude (in degrees, -90.000 to 90.000) of the ground station;
- d) longitude (in degrees, -180.000 to 180.000) of the ground station.

To enable the Basic Default Configuration, change (cd) to the `sc` directory, then run the script: `./install.sh`

Provide the unique ground station information in response to the subsequent queries. Figure 2 contains an example of the automatic configuration sequence for a user whose ground station is “sc1.moon.com”, located at 50.123 degrees latitude and -70.456 degrees longitude.

```
[jdoe@usercomputer sc]$ ./install.sh
Install.sh starts at: /home/jdoe/sc/install.sh
Configuring Simulcast for Standalone Mode.
Enter station id, for example, DRL: SC1
Enter station name, for example, Direct Readout Laboratory: MOON
Enter lat, for example, 39.005: 50.123
Enter lon, for example, -76.876: -70.456
Configuration complete.
```

Figure 2. Automatic Configuration Sequence Example

Figure 3 contains the unique ground station information inserted into both the Router and Server configuration files (`configs/router-config.xml`, `configs/server-config.xml`) during the automatic configuration process. The complete Router and Server configuration files corresponding to this example are contained in corresponding default configuration files listed in the previous sentence. The Extensible Mark-up Language (XML) elements found in Simulcast configuration files are defined in Appendix C, “Configuration File Details.”


```

...
    <groundStation>
      <id>SC1</id>
      <name>MOON</name>
      <lat>50.123</lat>
      <lon>-70.456</lon>
    </groundStation>
...

```

Figure 3. Configuration File Ground Station Information

7.1.2 To Start the Simulcast Services Automatically at Boot

The Simulcast Services can be started at boot. In `/etc/rc.local`, add:

```
su - <username> -c "/home/username/sc/jsb/bin/sc-services.sh start"
```

where `<username>` is the user the Simulcast Services will run as. Do not run the Simulcast Services as root.

7.1.3 To Start or Stop the Simulcast Services Manually

The Simulcast Services can be started or stopped at any time by changing directories into the Simulcast directory (`sc/`) from a shell and entering:

```
/home> cd /home/username/sc
/home/username/sc> ./jsb/bin/sc-services.sh <cmd>
```

Where `<cmd>` is either “start” or “stop”. This must be done as the same user that originally started the Simulcast Services.

7.2 Launch the Simulcast Viewer and Console

To launch the Simulcast Viewer, run:

```
/home> cd /home/username/sc
/home/username/sc> ./bin/sc-viewer.sh &
```

To launch the Simulcast Console, run:

```
/home> cd /home/username/sc
/home/username/sc> ./bin/sc-console.sh &
```

When both commands are executed, the “Simulcast Server Selection” dialog box will appear, prompting a fully-qualified hostname of the server running Simulcast Services and port to connect to (defaults to `localhost:3502`). Enter the desired host name and port, e.g. `localhost:3502` if running the Viewer/Console and Simulcast Services on the same system, and click Connect.

8 Software Package Testing and Validation

NOTE: The test scripts described in this section require the command “ncat” in order to write packets successfully to Simulcast’s input ports.

Follow the procedures contained in this section to verify that your installation of Simulcast is configured to receive data from RT-STPS. The testscripts subdirectory contains test scripts that can be used to verify that your current installation of Simulcast is working properly, as described below. Note that the optional SIMULCAST_7.0_testdata.tar.gz file is required to execute these testing procedures.

Step 1: Start the Simulcast Services and open the Simulcast Viewer as documented above.

Step 2: In the Simulcast Viewer window, click on the “Options” button at the top. Ensure that the “Auto Play” checkbox is selected under “Map Layout”, and deselected under “Instrument Layout”. Then, in the “Pass Outlines” drop-down menu, select “Selected”

Step 3: cd into the testscripts directory.

Step 4: There are scripts named inside the testscripts directory corresponding to each spacecraft and instrument.

To run the Aqua MODIS test data into Simulcast, use

```
$ ./run_AQUA_MODIS.sh
```

This script will write Aqua MODIS CCSDS packets into port 3511, and the resulting Aqua MODIS image will be rendered onto the Simulcast Viewer Map Layout. A successful execution usually requires 1 minute or more, depending on the speed of your computer. If everything is working properly, the script will terminate with a message such as:

```
INFO - Sending AQUA MODIS packets to localhost port 3511...
DONE
```

To run the Terra MODIS test data into Simulcast, use

```
$ ./run_TERRA_MODIS.sh
```

This script will write Terra MODIS CCSDS packets into port 3512, and the resulting Terra MODIS image will be rendered onto the Simulcast Viewer Map Layout. A successful execution usually requires 1 minute or more, depending on the speed of your computer. If everything is working properly, the script will terminate with a message such as:

```
INFO - Sending TERRA MODIS packets to localhost port 3512...
DONE
```

To run the SNPP VIIRS test data into Simulcast, use

```
$ ./run_SNPP_VIIRS.sh
```

This script will write SNPP VIIRS CCSDS packets into port 3513, and the resulting SNPP VIIRS image will be rendered onto the Simulcast Viewer Map Layout. A successful execution usually requires 4 minutes or more, depending on the speed of your computer. If everything is working properly, the script will terminate with a message such as:

```
INFO - Sending SNPP VIIRS packets to localhost port 3513...
```

```
DONE
```

To run the JPSS-1 VIIRS test data into Simulcast, use

```
$ ./run_JPSS-1_VIIRS.sh
```

This script will write JPSS-1 VIIRS CCSDS packets into port 3514, and the resulting JPSS-1 VIIRS image will be rendered onto the Simulcast Viewer Map Layout. A successful execution usually requires 4 minutes or more, depending on the speed of your computer. If everything is working properly, the script will terminate with a message such as:

```
INFO - Sending JPSS-1 VIIRS packets to localhost port 3514...
```

```
DONE
```

To run the JPSS-2 VIIRS test data into Simulcast, use

```
$ ./run_JPSS-2_VIIRS.sh
```

This script will write JPSS-2 VIIRS CCSDS packets into port 3515, and the resulting JPSS-2 VIIRS image will be rendered onto the Simulcast Viewer Map Layout. A successful execution usually requires 1 minute or more, depending on the speed of your computer. If everything is working properly, the script will terminate with a message such as:

```
INFO - Sending JPSS-2 VIIRS packets to localhost port 3515...
```

```
DONE
```

The JPSS-2 VIIRS image rendered onto the Simulcast Viewer Map Layout should look similar to the JPSS-2_VIIRS_test.jpg image (Figure 4) in the testdata/output/ directory.

NOTE: The data used to create this image (Figure 4) was captured during the JPSS-2 spacecraft integration phase. This image is supplied solely for testing purposes.

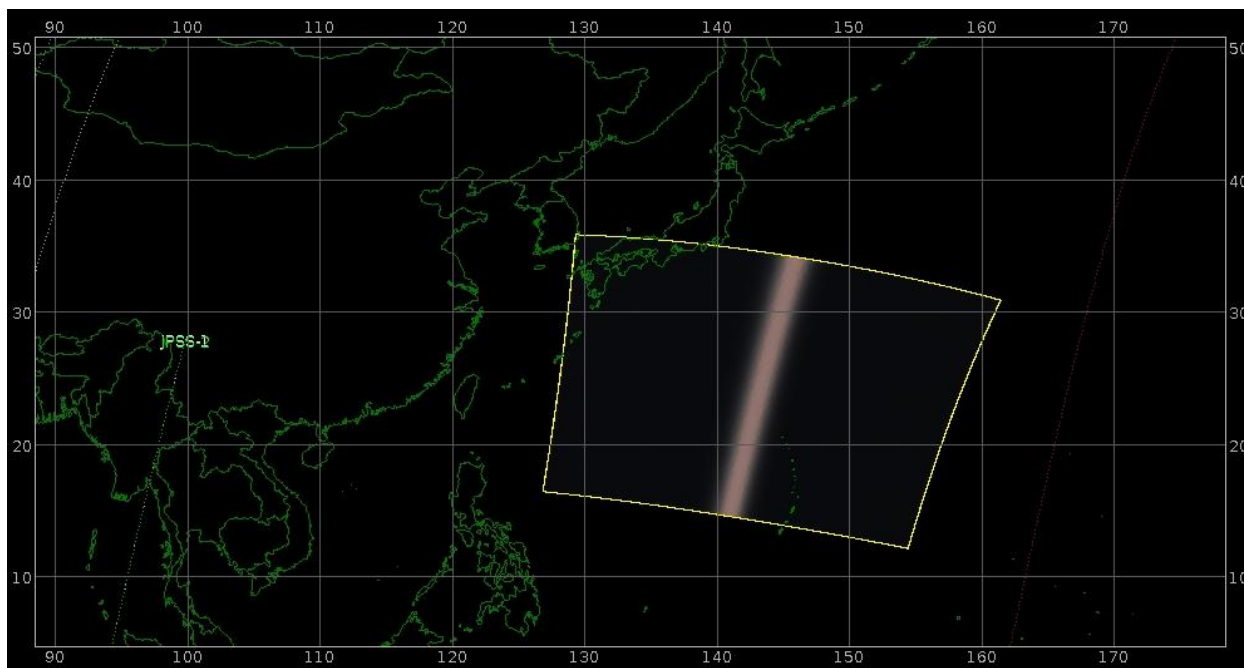


Figure 4. JPSS-2 VIIRS Test Data Image (JPSS-2_VIIRS_test.jpg)

Sample Simulcast Viewer images for all five test scripts are available for visual comparison in the testdata/output directory. These sample images were generated on a 64-bit PC architecture computer running CentOS 7. The sample images serve as an indicator of expected program output.

9 Program Operation

9.1 Simulcast Viewer

To launch the Simulcast Viewer using default arguments, run:

```
/home> cd /home/username/sc
/home/username/sc>./bin/sc-viewer.sh &
```

The Simulcast Viewer displays data from satellite passes. The Simulcast Viewer connects to the Simulcast Server and is informed of past passes and new passes when they occur. The Simulcast Viewer consists of the Pass Manager, Map Layout, Instrument Layout, and Options sections. Each is selected with the buttons at the top of the window.

The Simulcast Viewer takes the following optional command line arguments:

- a) -maximize: if specified, the window is maximized initially. This argument is not recommended when using X11 forwarding to launch the Simulcast Viewer on a remote system;

b) `-auto_play {map|instrument}`: if specified, when a pass starts it is automatically played on the layout specified, which is Map Layout for 'map' and Instrument Layout for 'instrument';

c) `-map_auto_zoom`: if specified, when a pass is played on one of the map views, the view will automatically zoom to cover the estimated extents of the pass relative to the user-defined ground station (passes of a considerable distance from the user-defined ground station are not covered by this feature);

d) `-server_choice "host:port"` : specifies the Simulcast server host name and port to connect to; "host:port" must be in double quotes (e.g. "localhost:3502"). If specified, this must be the last argument.

Example usage:

```
/home/username/sc>./bin/sc-viewer.sh    -maximize    -auto_play    map    -  
map_auto_zoom -server_choice "localhost:3502"
```

9.1.1 Menu Bar

The Simulcast Viewer Menu Bar contains the following items:

a) File, from which you can select the following:

1. Connect: displays a dialog in which the Simulcast Server to connect to may be specified.
2. Disconnect: disconnects from the current Simulcast Server.
3. Save Visuals as Defaults: saves current visual setting as default visual setting.
4. Show Video Recorder: saves view as video.
5. Exit: exits the Simulcast Viewer.

b) Help, from which you can select About Simulcast..., which displays a dialog showing the version numbers of the Simulcast Client and Server (if connected to a Server).

c) UTC Clock, which displays the UTC time for the computer on which the Simulcast Viewer is running.

9.1.2 Pass Manager

The Pass Manager lists all of the passes currently held by the Simulcast Server. The Simulcast Server holds a limited number of passes, so as new passes occur, the oldest passes are discarded. The maximum number of passes held by the Simulcast Server may be defined in the configs/server-config.xml file, under the "<maxSavedPasses>"

XML element, default value of 5. Each pass contains the following:

- a) Select Checkbox: If selected, the pass is loaded to the subsequently selected layout (Map or Instrument).
- b) Pass Information: Information about each pass consists of the following items:
 - 1. Pass Name: the name of the pass as given by Simulcast.
 - 2. Ground Station Name: the name of the ground station receiving the pass.
 - 3. Satellite: the name of the satellite.
 - 4. Instrument Name: the name of the instrument from which data was collected by Simulcast.
 - 5. Start Date/Time of Pass: the satellite date/time of the first scan received.
 - 6. Stop Date/Time of Pass: the satellite date/time of the last scan received.
 - 7. Pass Direction: whether the pass is ascending (going north) or descending (going south). For passes near the poles, Pass Direction refers to the direction at the start of the pass.
 - 8. Instrument Mode: whether the instrument was in day mode or night mode or both, if the pass crossed the terminator.
 - 9. Duration of Pass: the length of time (shown in *minutes:seconds*) from the first scan to the last scan received.
 - 10. Scan Count: the number of scans received. A separate count is shown for the Day Mode and the Night Mode.
 - 11. Error: blank if a successful pass, an error indicator if not. Use the Details button for an explanation of the error.
- c) Map Button: loads the pass into the Player Manager for the Map Layout, and automatically switches to the Map Layout.
- d) Instrument Button: loads the pass into the Player Manager for the Instrument Layout, and automatically switches to the Instrument Layout.
- e) Details Button: displays a small window containing details about the pass.

9.1.3 Map Layout

The Map Layout displays a map on which passes are drawn. Mercator and Polar projections are available. (The Player Manager appears at the bottom of the display for both the Map Layout and the Instrument Layout. The Player Manager functions are discussed in more detail on the next page.) Left-clicking on the map zooms in centered at that point. A press-drag-release zooms in on the selected area. Right-clicking displays a pop-up menu with the following choices:

- a) Zoom In (2X): zooms in (2x) centered at the mouse pointer.
- b) Zoom Out (2X): zooms out (2x) centered at the mouse pointer.
- c) Zoom Out (All): zooms out to view the entire Earth.
- d) Center: re-centers the map at the mouse pointer location.
- e) Grid: if checked, latitude/longitude lines are displayed.
- f) Features: if checked, geographic/political features are displayed.
- g) Orbits: if checked, satellite locations/orbits are displayed.
- h) Ground Stations: if checked, ground stations are displayed.
- i) Mercator Projection: if selected, a Mercator projection is displayed.
- j) Polar Projections: if selected, Polar projections of both poles are displayed.
- k) North Polar Projection: if selected, a Polar projection of the North Pole is displayed.
- l) South Polar Projection: if selected, a Polar projection of the South Pole is displayed.
- m) Erase Passes: erases all passes from the map.
- n) Save As...: displays a dialog used to save the map as an image file. The Save As dialog includes the following options:
 - 1. Size: the desired size of the image: full resolution, half resolution, quarter resolution, or a custom size with the option of maintaining the proper aspect ratio as the width or height is specified.
 - 2. Quality: image quality for lossy compressions (e.g., JPEG).
 - 3. Format: currently only the JPEG format is supported.

4. Save As: the image file to save. The Browse button displays a file chooser dialog with which the file may be specified.
5. Create Button: creates the image file.
6. Cancel Button: closes the Save As dialog.

9.1.4 Instrument Layout

The Instrument Layout displays scan lines from a pass as they would appear if viewed from the satellite. Scroll bars exist to allow scrolling from the beginning to the end of the pass, and from side to side along scan lines. The Player Manager discussed in detail in section 9.1.5 is at the bottom of the screen.

9.1.5 Player Manager

The Player Manager appears at the bottom of both the Map and Instrument Layouts. The Player Manager contains a Pass Selector in the left corner. The Pass Selector contains a drop-down list of the currently loaded passes, and displays the name of the currently selected pass. Above the drop-down list is a button (upward arrow icon) that causes the previous pass to become the current selection, and below the drop-down list is a button (downward arrow icon) that causes the next pass to become the current selection.

To the right of the Pass Selector, at the very bottom of the Player Manager, are the control buttons to play (green), pause (yellow) and stop (red) a pass. To the right of the Stop button, the Player Manager displays the following pass information:

- a) Pass Information: the satellite name (e.g. AQUA, TERRA, NPP, JPSS-1, JPSS-2), instrument name (MODIS or VIIRS), direction (Ascending or Descending), and instrument mode (Day or Night). For example, NPP/VIIRS/Ascending/Night.
- b) Scan Date/Time: the date/time of the most recently drawn scan line.
- c) Scan Number: the scan number (since the beginning of the pass) of the most recently drawn scan lines.
- d) Data Rate: the data rate between the Simulcast Server and Client. The rate is also shown as a percentage of real time (which would be 100% during a live pass). When the pass ends, the average rates are displayed.

NOTE: Items (b) through (d) appear once you click on the Play button.

Located above the control buttons is the Visual indicator, with which you can specify how the instrument data from a satellite (VIIRS data from SNPP, JPSS-1, and JPSS-2, or MODIS data from Aqua and Terra) should be displayed. The Visual indicator contains a drop-down menu containing the Visuals supported by Simulcast, as follows:

- a) VIIRS/MODIS Auto Day/Night;
- b) VIIRS/MODIS True Color;
- c) VIIRS/MODIS Infrared;
- d) VIIRS/MODIS Gray Scale;
- e) VIIRS/MODIS False Color.

NOTE: The control options appearing to the right of the Visual indicator will change automatically depending upon which of the Visuals you select. For example, if MODIS Auto/Day Night is selected, the available controls, as they appear from left to right, are Resolution, Contrast, Brightness and Mode. However, if MODIS Gray Scale is selected, the available controls are Resolution, Band, Contrast and Brightness.

The Visuals, and the controls associated with each of them, are described below.

a) VIIRS/MODIS Auto Day/Night: switches between VIIRS or MODIS True Color for the day portion of a pass, and VIIRS or MODIS Infrared for the night portion. This option is typically used for passes near the North or South Poles. Controls available for this Visual are as follows:

1. Resolution: specifies the resolution (at nadir) to be displayed. For VIIRS the finest resolution allowed for this Visual is 750m. For MODIS the finest resolution allowed for this Visual is 1km.
2. Contrast: specifies the contrast to be applied (before any brightness adjustment).
3. Band: (Night only) specifies the band to be used.
4. Brightness: specifies the brightness to be applied (after any contrast adjustment).
5. Mode: indicates if the instrument is in Day or Night mode.

b) VIIRS/MODIS True Color: a true color representation using VIIRS bands 5, 4, and 3, or MODIS bands 1, 4, and 3. Controls available for this Visual are as follows:

1. Resolution: specifies the resolution (at nadir) to be displayed.
2. Contrast: specifies the contrast to be applied (before any brightness adjustment).

3. Brightness: specifies the brightness to be applied (after any contrast adjustment).

c) VIIRS/MODIS Infrared: an infrared (inverse gray scale) using the selected emissive band. Controls available for this Visual are as follows:

1. Resolution: specifies the resolution (at nadir) to be displayed.
2. Band: specifies the emissive band to be used.
3. Contrast: specifies the contrast to be applied (before any brightness adjustment).
4. Brightness: specifies the brightness to be applied (after any contrast adjustment).

d) VIIRS/MODIS Gray Scale: a gray-scale representation of the selected band. Controls available for this Visual are as follows:

1. Resolution: specifies the resolution (at nadir) to be displayed.
2. Band: specifies the band to be used.
3. Contrast: specifies the contrast to be applied (before any brightness adjustment).
4. Brightness: specifies the brightness to be applied (after any contrast adjustment).

e) VIIRS/MODIS False Color: a false color representation using the selected bands. Controls available for this Visual are as follows:

1. Resolution: specifies the resolution (at nadir) to be displayed.
2. Color: selects which color plane (red, green, or blue) is being adjusted.
3. Band: specifies the band to be assigned to the specified color plane.
4. Contrast: specifies the contrast to be applied (before any brightness adjustment, and applied to each band individually).
5. Brightness: specifies the brightness to be applied (after any contrast adjustment, and applied to each band individually).

9.1.6 Options

Select Options to change the way data are displayed in the Pass Manager, Map Layout Instrument Layout, and the Player Manager.

NOTE: Selected options are automatically saved when the Simulcast Viewer is exited. The saved options will then be retrieved and applied the next time the Simulcast Viewer is started.

a) Pass Manager: Sort By is used to select whether passes are sorted by start time, or alphabetically by pass name.

b) Instrument Layout

1. Auto Play: if checked, new passes are automatically loaded/played on the Instrument Layout.

2. Auto Scroll: if checked, automatically scrolls the display as new scan lines are received while playing a pass.

3. Limit View: if checked, as scan lines are received, the old scan lines are discarded (as opposed to saving all scan lines in a scrollable window).

c) Map Layout

1. Auto Play: if checked, new passes are automatically loaded/played on the Map Layout.

2. Auto Zoom: if checked, the map will automatically zoom to the estimated extents of the pass, relative to the user-defined ground station, when a pass is played. Passes that are of a considerable distance from the user's ground station will not be covered by this feature.

3. Erase Passes On Auto Play: if checked, all currently loaded passes are erased when a pass is automatically loaded/played.

4. Erase Passes On Auto Zoom: if checked, all currently loaded passes are erased when the playing of a pass results in the map being automatically zoomed.

5. Erase Passes On Zoom: if checked, all currently loaded passes are erased when the map is zoomed.

6. Erase Pass On Replay: if checked, a pass is first erased before it is replayed.

7. Show Orbits: if checked, current satellite locations and scheduled orbit tracks are shown on the map.

8. Show Grid: if checked, latitude and longitude grid lines are shown on the map.
9. Show Ground Station: if checked, ground station locations are shown on the map.
10. Show Features: if checked, geographic and political features are shown on the map.
11. Pass Outlines: selects which passes should be outlined. Available options are All, Selected (i.e., just the currently selected pass in the Player Manager), or Off (i.e., no passes will be outlined).

d) Map Features

1. Show Countries: if checked, country borders are shown on the map.
2. Show US States: if checked, US state borders are shown on the map.
3. Show US Urban Areas: if checked, US urban areas are shown on the map.
4. Show US Cities: if checked, US cities are shown on the map.
5. Show Canadian Territories: if checked, Canadian territory borders are shown on the map.
6. Show Mexican States: if checked, Mexican state borders are shown on the map.
7. Show Caribbean Islands: if checked, Caribbean islands are shown on the map.

e) Player Manager

1. Compress: if checked, the connection between the Simulcast Viewer and Server while playing a pass is compressed. This increases the Central Processing Unit (CPU) load on each end, but might be useful when the connection speed is slow.
2. Passes Per Layout: selects the number of passes that may be displayed on a layout (Map or Instrument) at the same time: Unlimited, Maximum Total, Maximum Per Ground Station, or Maximum Per Satellite.
3. Looping: selects the type of playback looping (typically used for demonstrations). Looping options are as follows:

- Off: no looping.
- On: when the playing of a pass ends, the next pass on the Pass Manager is played.
- On Station: when the playing of a pass ends, the next pass on the Pass Manager from the same ground station is played.
- On Satellite: when the playing of a pass ends, the next pass on the Pass Manager from the same satellite is played.
- On Station/Satellite: when the playing of a pass ends, the next pass on the Pass Manager from the same ground station and satellite is played.
- On Station/Satellite/Mode: When the playing of a pass ends, the next pass on the Pass Manager from the same ground station, satellite, and having the same instrument mode is played.

4. Throttle: selects whether how fast a pass is played should be limited as a factor of real-time (1X).

f) Default Visuals. The Visuals to be used when a pass is loaded on a layout.

9.2 Simulcast Console

To launch the Simulcast Console, run:

```
/home> cd /home/username/sc
/home/username/sc>./bin/sc-console.sh &
```

The Simulcast Console is used to display and control administrative information about the Simulcast Services.

The Menu Bar at the top of the screen contains the following items:

a) File, from which you can select the following:

1. Connect: displays a dialog in which the Simulcast Server to connect to may be specified.
2. Exit: exits the Simulcast Console.

b) Help, from which you can select About Simulcast..., which displays a dialog showing the version number of the Simulcast Console.

c) UTC Clock, which displays the UTC time for the computer on which the Simulcast Console is running.

You can disconnect from the current Simulcast Server using the Disconnect Button beneath the UTC Clock.

The Simulcast Console contains the administrative tools described below, which can be expanded with a mouse click to reveal more specific information:

- a) Server: displays the Server host and port number. Click Server to reveal the administrative tools discussed in items (b) through (g).
- b) Console: displays the Console hosts and ports.
- c) Client: displays Simulcast Viewer hosts, ports and players.
- d) Downstream Servers: displays Downstream Server hosts and ports.
- e) Ping: displays hosts and ports of Simulcast Servers performing pings for pass status.
- f) Pass History: displays passes received when this Console is connected.
- g) Pass Archive: displays all passes on the Server. Clicking on an individual pass will show when the pass started and ended, any error information associated with the pass, and also display a Delete button, which you can click to delete the pass.

The Purge Passes button is located beneath the Pass Archive tool. Click on Purge Passes to delete all passes with errors.

9.3 TLE Updates

Simulcast requires updated TLEs for proper operation, otherwise, Simulcast will default to the closest dated TLE it has available for each spacecraft. Simulcast automatically retrieves spacecraft TLEs from the Direct Readout Laboratory via FTPS for all its supported satellites. These updates occur at the program's startup, then at the top of every hour thereafter (e.g., 1:00, 2:00, and so on).

The TLE file is available at:

<https://is.sci.gsfc.nasa.gov/ancillary/ephemeris/tle/drl.tle>

Simulcast puts each spacecraft TLE that is within drl.tle into its own file in the TLE directory (e.g., aqua.tle contains AQUA TLE).

Any system running Simulcast should allow access within their firewall to port 21 and the ports spanning 60000-62000 for the TLE updates to work.

Appendix A

Downstream Server Configuration

Downstream Server Configuration

NOTE: Users must enable the Basic Default Configuration prior to enabling a Downstream Server Configuration. Instructions are contained in the section “Configure the Simulcast Services”.

Figure A-1 depicts an example of a Downstream Server Configuration, where three Upstream Servers are connected to one Downstream Server. The Upstream Servers correspond to example ground station locations sc1.moon.com (from the previous Basic Default Configuration example), sc2.sun.com, and sc3.star.com.

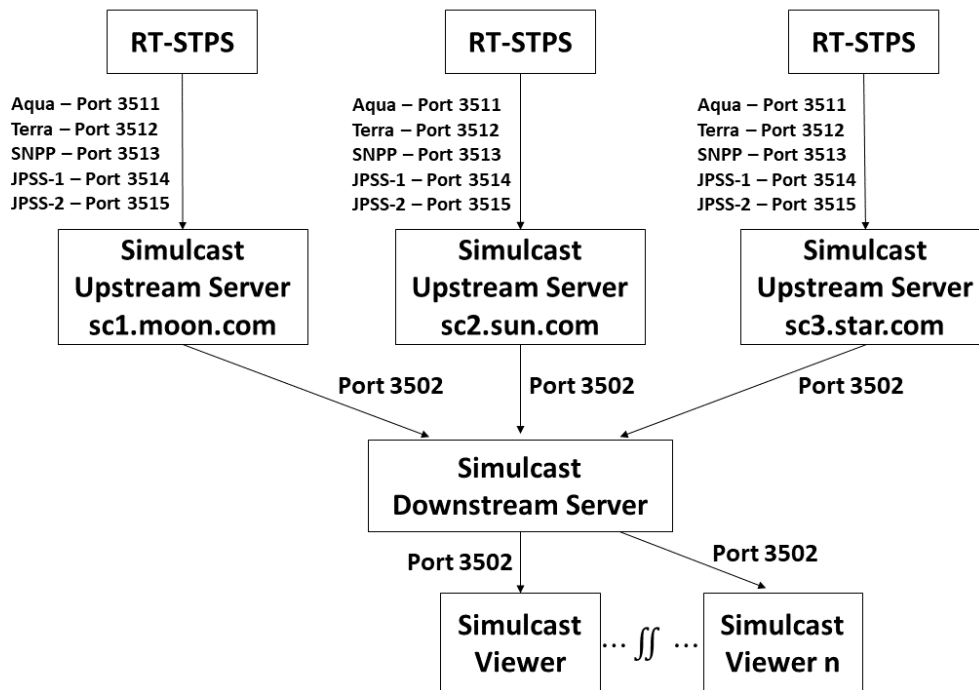


Figure A-1. Example Downstream Server Configuration

If Simulcast is already running in the Basic Default Configuration, stop the Simulcast Services. Edit the intended downstream server’s Simulcast configuration files as instructed below before starting the Services to enable the Downstream Server Configuration.

Change directory (cd) to /home/username/sc/configs. Enabling the Downstream Server Configuration requires the following configuration files to be edited:

- a) Downstream Services configuration file – services-config.xml;

b) Downstream Server configuration file – downstream-server-config.xml.

Edit the Downstream Services configuration file, services-config.xml. Comment out the Router, Processor, and Server Services, then add the following Downstream Server Service node in their place:

```
<service>
  <name>downstream-server</name>
  <className>gov.nasa.gsfc.aisb.simulcast.server.Server</className>
  <arguments>
    <argument>./configs/downstream-server-config.xml</argument>
  </arguments>
</service>
```

Figure A-2 contains an example Downstream Services configuration file:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?> <servicesConfig>
  <services>
<!--
    <service>
      <name>router</name>
      <className>gov.nasa.gsfc.aisb.simulcast.router.Router</className>
      <arguments>
        <argument>./configs/router-config.xml</argument>
      </arguments>
    </service>

    <service>
      <name>processor</name>
      <className>gov.nasa.gsfc.aisb.simulcast.processor.Processor</className>
      <arguments>
        <argument>./configs/processor-config.xml</argument>
      </arguments>
    </service>

    <service>
      <name>server</name>
      <className>gov.nasa.gsfc.aisb.simulcast.server.Server</className>
      <arguments>
        <argument>./configs/server-config.xml</argument>
      </arguments>
    </service>
-->
    <service>
      <name>downstream-server</name>
      <className>gov.nasa.gsfc.aisb.simulcast.server.Server</className>
      <arguments>
        <argument>./configs/downstream-server-config.xml</argument>
      </arguments>
    </service>
  </services>
</servicesConfig>
```

Figure A-2. Example Downstream Services Configuration File

Next, edit the Downstream Server configuration file, downstream-server-config.xml, to contain the unique ground station information (including the host:port) for each Upstream Server, as follows:

- a) The host:port on which the Upstream Server is listening for Client connections, <hostPort>;
- b) Ground station ID, <id>;
- c) Full name of the ground station, <name>;
- d) Latitude (in degrees) of the ground station, <lat>;
- e) Longitude (in degrees) of the ground station, <lon>.

NOTE: The order and number of Upstream Servers (<upstreamServer>) must correspond to the order and number of ground station IDs (<groundStation>) contained in the downstream-server-config.xml file.

Start the Downstream Server.

Figure A-3 contains an example Downstream Server Configuration file, downstream-server-config.xml, corresponding to the example Downstream Server Configuration depicted in Figure A-1 below. Edited items corresponding to the example Upstream Servers are highlighted in yellow.

NOTE: Default port numbers are as follows:

- Aqua – Port 3511;
- Terra – Port 3512;
- SNPP – Port 3513;
- JPSS-1 – Port 3514;
- JPSS-2 – Port 3515.

These port numbers are configurable, but it is strongly recommended that the user maintain the default settings.

```

<serverConfig>
  <log>
    <server>
      <hostPort>localhost:3500</hostPort>
      <tmpDir>./logs/tmp/downstream-server</tmpDir>
    </server>
    <local>
      <logFiles>
        <logFile>./logs/downstream-server.log</logFile>
        <logFile>./logs/downstream-server.log.1</logFile>
        <logFile>./logs/downstream-server.log.2</logFile>
      </logFiles>
      <maxLogFileSize>1m</maxLogFileSize>
    </local>
    <!--
    <stdout/>
    -->
    <stderr/>
  </log>
  <spoolDirPath>./spool/downstream-server</spoolDirPath>
  <maxSavedPasses>30</maxSavedPasses>
  <inputTimeOut>30m</inputTimeOut>
  <clientPort>3502</clientPort>
  <noFirewallClientPort>3509</noFirewallClientPort>
  <tle>
    <aqua>
      <archive>./TLEs/aqua.tle</archive>
    </aqua>
    <source>ftp://is.sci.gsfc.nasa.gov/ancillary/ephemeris/tle/drl.tle</source>
    <terra>
      <archive>./TLEs/terra.tle</archive>
    </terra>
    <npp>
      <archive>./TLEs/npp.tle</archive>
      <source>ftp://is.sci.gsfc.nasa.gov/ancillary/ephemeris/tle/drl.tle
      </source>
    </npp>
    <jpss1>
      <archive>./TLEs/jpss1.tle</archive>
      <source>ftp://is.sci.gsfc.nasa.gov/ancillary/ephemeris/tle/drl.tle</source>
    </jpss1>
    <jpss2>
      <archive>./TLEs/jpss2.tle</archive>
      <source>ftp://is.sci.gsfc.nasa.gov/ancillary/ephemeris/tle/drl.tle</source>
    </jpss2>
  </tle>
  <fix>yes</fix>
  <consoleIP>1.2.3.4</consoleIP>
  <logDisplayTime>10</logDisplayTime>
  <upstreamServers>
    <upstreamServer>
      <hostPort>sc1.moon.com:3502</hostPort>
      <partial>
        <bands>
          <modis>
            <band>
              <bandIndex>0</bandIndex>
              <resolution>1000</resolution>
            </band>
          </modis>
        </bands>
      </partial>
    </upstreamServer>
  </upstreamServers>

```

Figure A-3. Example Downstream Server Configuration File

```

    <band>
      <bandIndex>2</bandIndex>
      <resolution>1000</resolution>
    </band>
    <band>
      <bandIndex>3</bandIndex>
      <resolution>1000</resolution>
    </band>
    <band>
      <bandIndex>23</bandIndex>
      <resolution>1000</resolution>
    </band>
  </modis>
</viirs>
  <band>
    <bandIndex>0</bandIndex>
    <resolution>750</resolution>
  </band>
  <band>
    <bandIndex>1</bandIndex>
    <resolution>750</resolution>
  </band>
  <band>
    <bandIndex>2</bandIndex>
    <resolution>750</resolution>
  </band>
  <band>
    <bandIndex>12</bandIndex>
    <resolution>750</resolution>
  </band>
</viirs>
</bands>
</partial>
</upstreamServer>
<upstreamServer>
  <hostPort>sc2.sun.com:3502</hostPort>
  <partial>
    <bands>
      <modis>
        <band>
          <bandIndex>0</bandIndex>
          <resolution>1000</resolution>
        </band>
        <band>
          <bandIndex>2</bandIndex>
          <resolution>1000</resolution>
        </band>

```

Figure A-3. Example Downstream Server Configuration File (continued)

```

    <band>
      <bandIndex>3</bandIndex>
      <resolution>1000</resolution>
    </band>
    <band>
      <bandIndex>23</bandIndex>
      <resolution>1000</resolution>
    </band>
  </modis>
</viirs>
<viirs>
  <band>
    <bandIndex>0</bandIndex>
    <resolution>750</resolution>
  </band>
  <band>
    <bandIndex>1</bandIndex>
    <resolution>750</resolution>
  </band>
  <band>
    <bandIndex>2</bandIndex>
    <resolution>750</resolution>
  </band>
  <band>
    <bandIndex>12</bandIndex>
    <resolution>750</resolution>
  </band>
</viirs>
</bands>
</partial>
</upstreamServer>
<upstreamServer>
  <hostPort>sc3.star.com:3502</hostPort>
  <partial>
    <bands>
      <modis>
        <band>
          <bandIndex>0</bandIndex>
          <resolution>1000</resolution>
        </band>
        <band>
          <bandIndex>2</bandIndex>
          <resolution>1000</resolution>
        </band>
        <band>
          <bandIndex>3</bandIndex>
          <resolution>1000</resolution>
        </band>
        <band>
          <bandIndex>23</bandIndex>
          <resolution>1000</resolution>
        </band>
      </modis>

```

Figure A-3. Example Downstream Server Configuration File (continued)

```

    <viirs>
      <band>
        <bandIndex>0</bandIndex>
        <resolution>750</resolution>
      </band>
      <band>
        <bandIndex>1</bandIndex>
        <resolution>750</resolution>
      </band>
      <band>
        <bandIndex>2</bandIndex>
        <resolution>750</resolution>
      </band>
      <band>
        <bandIndex>12</bandIndex>
        <resolution>750</resolution>
      </band>
    </viirs>
  </bands>
</partial>
</upstreamServer>
</upstreamServers>
<groundStations>
  <groundStation>
    <id>SC1</id>
    <name>MOON</name>
    <lat>50.123</lat>
    <lon>-70.456</lon>
  </groundStation>
  <groundStation>
    <id>SC2</id>
    <name>SUN</name>
    <lat>43.08</lat>
    <lon>-89.39</lon>
  </groundStation>
  <groundStation>
    <id>SC3</id>
    <name>STAR</name>
    <lat>78.230</lat>
    <lon>15.393</lon>
  </groundStation>
</groundStations>
<loopbackTest>
  <hostPort>localhost:3502</hostPort>
  <interval>5m</interval>
  <timeout>2s</timeout>
  <maxFailures>3</maxFailures>
  <onMaxFailures>halt</onMaxFailures>

```

Figure A-3. Example Downstream Server Configuration File (continued)

```
</loopbackTest>
<noFirewallLoopbackTest>
  <hostPort>localhost:3509</hostPort>
  <interval>5m</interval>
  <timeout>3m</timeout>
  <maxFailures>3</maxFailures>
  <onMaxFailures>halt</onMaxFailures>
</noFirewallLoopbackTest>
</serverConfig>
```

Figure A-3. Example Downstream Server Configuration File (continued)

Appendix B

Multiple Downstream Server Configuration

Multiple Downstream Server Configuration

NOTE: Users must enable the Basic Default Configuration prior to enabling a Multiple Downstream Server Configuration. Instructions are contained in the section 7.1, “Configure the Simulcast Services”. Appendix A contains instructions for enabling a Downstream Server Configuration.

A Multiple Downstream Server Configuration provides a bandwidth-efficient method for multiple Simulcast sites to share data. In a Multiple Downstream Server Configuration, one Downstream Server Configuration, such as the configuration depicted in Figure A-1, can be connected to a second Downstream Server Configuration. Figure B-1 illustrates this Multiple Downstream Server Configuration, where the Server “DRL” in Configuration B is connected to the Server “Planet” in Configuration A. The Simulcast Viewer in Configuration B can view all data provided by “Planet” and “DRL”.

As depicted in Figure B-1 by “Simulcast Services Upstream Server n” in both Configurations A and B, there is no limit to the number of Upstream Servers that may be connected.

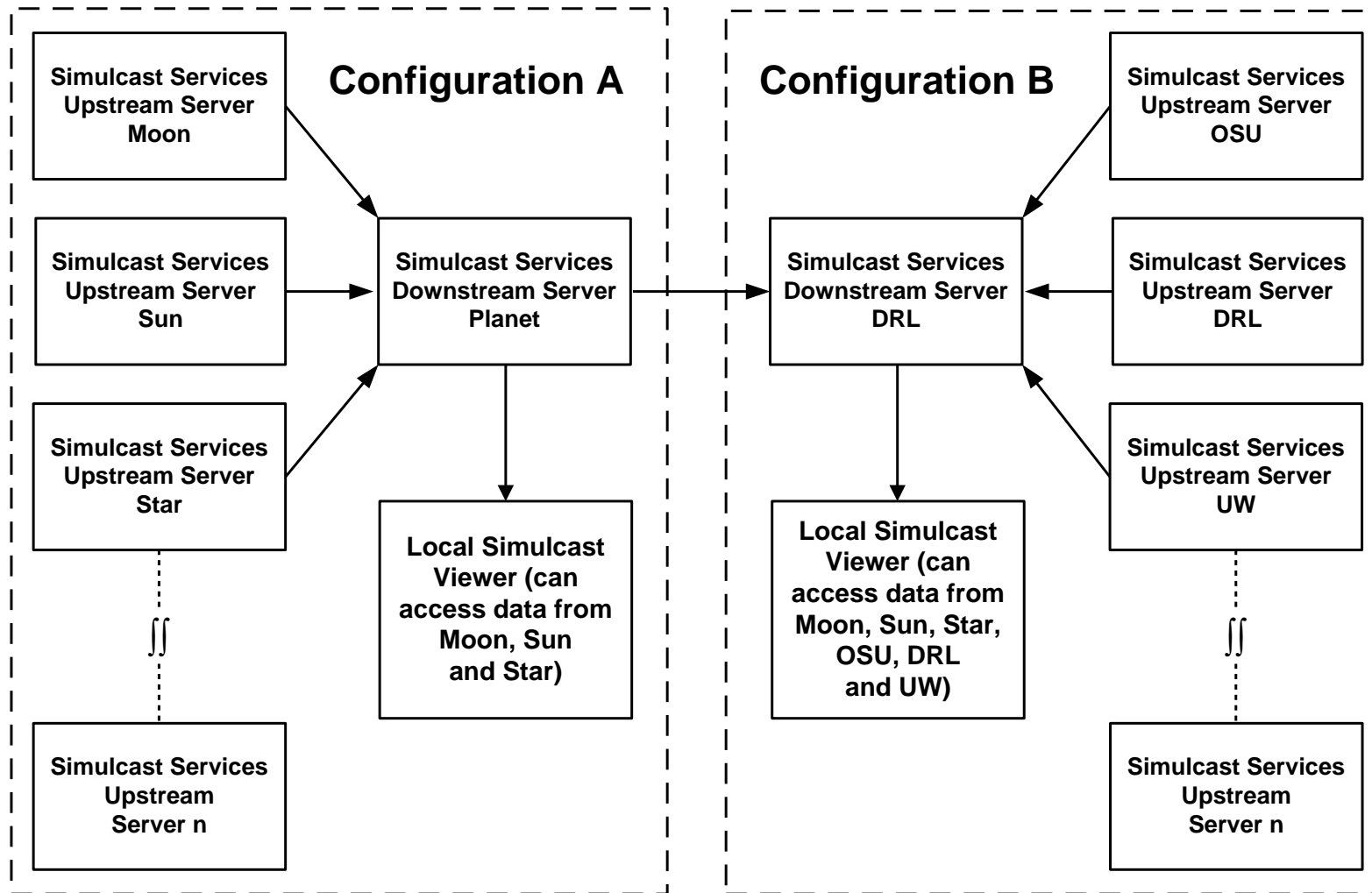


Figure B-1. Multiple Downstream Server Configuration

All of the configuration files associated with Configuration A, described in the previous section “Downstream Server Configuration,” would remain the same in the Multiple Downstream Server Configuration. The link between Configurations A and B is created in the Downstream Server configuration file for Downstream Server DRL in Configuration B. Downstream Server DRL treats Downstream Server sc4.planet.com as another Upstream Server, so the unique ground station information for sc4.planet.com must also be added to the DRL Downstream Server configuration file, as follows:

- a) The host:port on which the Upstream Server is listening for Client connections, <hostPort> (e.g., sc4.planet.com);
- b) Ground station ID, <id> (e.g., SC4);
- c) Full name of the ground station, <name> (e.g., PLANET);
- d) Latitude (in degrees) of the ground station, <lat> (e.g., 45.456);
- e) Longitude (in degrees) of the ground station, <lon> (e.g., -78.789).

Figure B-2 contains the new example Downstream Server configuration file that would enable the Multiple Downstream Server Configuration. The new Upstream Server information for sc4.planet.com is highlighted in yellow.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<serverConfig>
  <log>
    <server>
      <hostPort>localhost:3500</hostPort>
      <tmpDir>./logs/tmp/downstream-server</tmpDir>
    </server>
    <local>
      <logFiles>
        <logFile>./logs/downstream-server.log</logFile>
        <logFile>./logs/downstream-server.log.1</logFile>
        <logFile>./logs/downstream-server.log.2</logFile>
      </logFiles>
      <maxLogFileSize>1m</maxLogFileSize>
    </local>
    <!--
    <stdout/>
    -->
    <stderr/>
  </log>
  <spoolDirPath>./spool/downstream-server</spoolDirPath>
  <maxSavedPasses>30</maxSavedPasses>
  <inputTimeOut>30m</inputTimeOut>
  <clientPort>3502</clientPort>
  <noFirewallClientPort>3509</noFirewallClientPort>
```

Figure B-2. Downstream Server Configuration File for Multiple Downstream Server Configuration

```

<tle>
  <aqua>
    <archive>./TLEs/aqua.tle</archive>
<source>ftp://is.sci.gsfc.nasa.gov/ancillary/ephemeris/tle/drl.tle</source>
  </aqua>
  <terra>
    <archive>./TLEs/terra.tle</archive>
<source>ftp://is.sci.gsfc.nasa.gov/ancillary/ephemeris/tle/drl.tle</source>
  </terra>
  <npp>
    <archive>./TLEs/npp.tle</archive>
<source>ftp://is.sci.gsfc.nasa.gov/ancillary/ephemeris/tle/drl.tle</source>
  </npp>
  <jpss1>
    <archive>./TLEs/jpss1.tle</archive>
    <source>ftp://is.sci.gsfc.nasa.gov/ancillary/ephemeris/tle/drl.tle</source>
  </jpss1>
  <jpss2>
    <archive>./TLEs/jpss2.tle</archive>
    <source>ftp://is.sci.gsfc.nasa.gov/ancillary/ephemeris/tle/drl.tle</source>
  </jpss2>
</tle>
</tle>
<fix>yes</fix>
<consoleIP>1.2.3.4</consoleIP>
<logDisplayTime>10</logDisplayTime>
<upstreamServers>
  <upstreamServer>
    <hostPort>nisfes.sci.gsfc.nasa.gov:3502</hostPort>
    <partial>
      <bands>
        <modis>

```

Figure B-2. Downstream Server Configuration File for Multiple Downstream Server Configuration (continued)

```

    <band>
      <bandIndex>0</bandIndex>
      <resolution>1000</resolution>
    </band>
    <band>
      <bandIndex>2</bandIndex>
      <resolution>1000</resolution>
    </band>
    <band>
      <bandIndex>3</bandIndex>
      <resolution>1000</resolution>
    </band>
    <band>
      <bandIndex>23</bandIndex>
      <resolution>1000</resolution>
    </band>
  </modis>
<viirs>
  <band>
    <bandIndex>0</bandIndex>
    <resolution>750</resolution>
  </band>
  <band>
    <bandIndex>1</bandIndex>
    <resolution>750</resolution>
  </band>
  <band>
    <bandIndex>2</bandIndex>
    <resolution>750</resolution>
  </band>
  <band>
    <bandIndex>12</bandIndex>
    <resolution>750</resolution>
  </band>
</viirs>
</bands>
</partial>
</upstreamServer>
<upstreamServer>
  <hostPort>freddie.coas.oregonstate.edu:3502</hostPort>
  <partial>
    <bands>
      <modis>
        <band>
          <bandIndex>0</bandIndex>
          <resolution>1000</resolution>
        </band>
        <band>
          <bandIndex>2</bandIndex>
          <resolution>1000</resolution>
        </band>

```

Figure B-2. Downstream Server Configuration File for Multiple Downstream Server Configuration (continued)

```

    <band>
      <bandIndex>3</bandIndex>
      <resolution>1000</resolution>
    </band>
    <band>
      <bandIndex>23</bandIndex>
      <resolution>1000</resolution>
    </band>
  </modis>
</viirs>
  <band>
    <bandIndex>0</bandIndex>
    <resolution>750</resolution>
  </band>
  <band>
    <bandIndex>1</bandIndex>
    <resolution>750</resolution>
  </band>
  <band>
    <bandIndex>2</bandIndex>
    <resolution>750</resolution>
  </band>
  <band>
    <bandIndex>12</bandIndex>
    <resolution>750</resolution>
  </band>
</viirs>
</bands>
</partial>
</upstreamServer>
<upstreamServer>
  <hostPort>springbok.ssec.wisc.edu:3502</hostPort>
  <partial>
    <bands>
      <modis>
        <band>
          <bandIndex>0</bandIndex>
          <resolution>1000</resolution>
        </band>
        <band>
          <bandIndex>2</bandIndex>
          <resolution>1000</resolution>
        </band>
        <band>
          <bandIndex>3</bandIndex>
          <resolution>1000</resolution>
        </band>
        <band>
          <bandIndex>23</bandIndex>
          <resolution>1000</resolution>
        </band>
      </modis>
    </bands>
  </partial>
</upstreamServer>

```

Figure B-2. Downstream Server Configuration File for Multiple Downstream Server Configuration (continued)

```

    </modis>
  <viirs>
    <band>
      <bandIndex>0</bandIndex>
      <resolution>750</resolution>
    </band>
    <band>
      <bandIndex>1</bandIndex>
      <resolution>750</resolution>
    </band>
    <band>
      <bandIndex>2</bandIndex>
      <resolution>750</resolution>
    </band>
    <band>
      <bandIndex>12</bandIndex>
      <resolution>750</resolution>
    </band>
  </viirs>
</bands>
</partial>
</upstreamServer>
<upstreamServer>
  <hostPort>sc4.planet.com:3502</hostPort>
  <partial>
    <bands>
      <modis>
        <band>
          <bandIndex>0</bandIndex>
          <resolution>1000</resolution>
        </band>
        <band>
          <bandIndex>2</bandIndex>
          <resolution>1000</resolution>
        </band>
        <band>
          <bandIndex>3</bandIndex>
          <resolution>1000</resolution>
        </band>
        <band>
          <bandIndex>23</bandIndex>
          <resolution>1000</resolution>
        </band>
      </modis>
      <viirs>
        <band>
          <bandIndex>0</bandIndex>
          <resolution>750</resolution>
        </band>
        <band>
          <bandIndex>1</bandIndex>
          <resolution>750</resolution>
        </band>
      </viirs>
    </bands>
  </partial>
</upstreamServer>

```

Figure B-2. Downstream Server Configuration File for Multiple Downstream Server Configuration (continued)

```

        <band>
          <bandIndex>2</bandIndex>
          <resolution>750</resolution>
        </band>
        <band>
          <bandIndex>12</bandIndex>
          <resolution>750</resolution>
        </band>
      </viirs>
    </bands>
  </partial>
</upstreamServer>
</upstreamServers>
<groundStations>
  <groundStation>
    <id>DRL</id>
    <name>NASA/GSFC/DRL</name>
    <lat>39.005</lat>
    <lon>-76.876</lon>
  </groundStation>
  <groundStation>
    <id>OSU</id>
    <name>COAS/OSU</name>
    <lat>50.123</lat>
    <lon>-70.456</lon>
  </groundStation>
  <groundStation>
    <id>CIMSS</id>
    <name>UW/SSEC/CIMSS</name>
    <lat>43.08</lat>
    <lon>-89.39</lon>
  </groundStation>
  <groundStation>
    <id>SC4</id>
    <name>PLANET</name>
    <lat>45.456</lat>
    <lon>-78.789</lon>
  </groundStation>
</groundStations>
<loopbackTest>
  <hostPort>localhost:3502</hostPort>
  <interval>5m</interval>
  <timeout>2s</timeout>
  <maxFailures>3</maxFailures>
  <onMaxFailures>halt</onMaxFailures>
</loopbackTest>
<noFirewallLoopbackTest>
  <hostPort>localhost:3509</hostPort>
  <interval>5m</interval>
  <timeout>3m</timeout>
  <maxFailures>3</maxFailures>
  <onMaxFailures>halt</onMaxFailures>
</noFirewallLoopbackTest>
</serverConfig>

```

Figure B-2. Downstream Server Configuration File for Multiple Downstream Server Configuration (continued)

Appendix C

Configuration File Details

Configuration File Details

C.1 Router, router-config.xml

This configuration file sets the following:

- a) input port for RT-STPS;
- b) description of ground station;
- c) handler class name;
- d) output port for processor;
- e) log server;
- f) log file;
- g) log file size;
- h) input timeout;
- i) ping interval.

```
<routerConfig>
  <server>
    <hostPort> server address along with port </hostPort>
    <tmpDir> directory to store temporary logs </tmpDir>
  </server>
  <log>
    <stderr/>
    AND/OR
    <stdout/>
    AND/OR
    <local>
      <logFiles>
        <logFile>
          The path of the current Router log file: either relative
          from the simulcast directory, or an absolute path.
        </logFile>
        One or more of...
        <logFile>
          The path of an "old" Router log file.  When the current log
```

file reaches its maximum size, it is moved to the first "old" log file, the first "old" log file is moved to the next "old" log file, and so on, with the last "old" log file being deleted as necessary.

```

    </logFile>
  </logFiles>
  <maxLogFileSize>
    The maximum size for a log file. It may be specified in
    bytes (e.g., 100000), kilobytes (e.g., 500k), megabytes
    (e.g., 1.5m), or gigabytes (e.g., 1.35g).
  </maxLogFileSize>
</local>
</log>
<routes>
  One or more routes may be specified.
  <route>
    <inputPort>
      The port number on which socket connections are accepted
      (usually from RT-STPS) for a particular spacecraft.
    </inputPort>
    <handlerClassName>
      The Java class that handles this route (usually spacecraft-
      specific).
    </handlerClassName>
    <groundStation>
      <id>
        A short acronym used to identify the ground station.
      </id>

      <name>
        The full name of the ground station.
      </name>

      <lat>
        The latitude (in degrees) of the ground station.
      </lat>

      <lon>
        The longitude (in degrees, -180.0 to 180.0) of the ground
        station.
      </lon>
    </groundStation>
  </route>
  <processors>
    One of more Processors may receive the routed pass data.
    <hostPort>
      The hostname and port number (host:port) of a Processor
      that is to receive the routed pass data via a socket
      connection.
    </hostPort>
  </processors>
</routes>

```



```
<inputTimeOut>
    The amount of time that must elapse with no data being received on
    the input socket connection (typically from RT-STPS) before a
    timeout will be declared and the routing is aborted. The amount
    of time may be specified with a number immediately followed by 's'
    (seconds), 'm' (minutes), 'h' (hours), or 'd' (day). For example,
    15m specifies 15 minutes.
</inputTimeOut>
<pingInterval>
    The time between pings on each route. The amount of time may be
    specified with a number immediately followed by 's' (seconds), 'm'
    (minutes), 'h' (hours), or 'd' (day). For example, 1h specifies 1
    hour.
</pingInterval>
</routerConfig>
```

C.2 Processor, processor-config.xml

This configuration file sets the following:

- a) input port for router;
- b) handler class name;
- c) output port for server;
- d) log server;
- e) log file;
- f) log file size;
- g) input timeout.

```
<processorConfig>
  <log>
    <server>
      <hostPort> server address along with port </hostPort>
      <tmpDir> directory to store temporary logs </tmpDir>
    </server>
    <stderr/>
    AND/OR
    <stdout/>
    AND/OR
    <local>
      <logFiles>
        <logFile>
          The path of the current Processor log file: either
          relative from the simulcast directory or an absolute path.
        </logFile>
        One or more of...
        <logFile>
          The path of an "old" Processor log file. When the current
          log file reaches its maximum size, it is moved to the first
          "old" log file, the first "old" log file is moved to the
          next "old" log file, and so on with the last "old" log file
          being deleted as necessary.
        </logFile>
      </logFiles>
      <maxLogFileSize>
        The maximum size for a log file. It may be specified in bytes
        (e.g., 100000), kilobytes (e.g., 500k), megabytes (e.g.,
        1.5m), or gigabytes (e.g., 1.35g).
      </maxLogFileSize>
    </local>
  </log>
</processorConfig>
```

```

    </local>
</log>
<inputPort>
    The port number on which socket connections are accepted from a
    Router.
</inputPort>
<inputTimeOut>
    The amount of time that must elapse with no data being received on
    the input socket connection (typically from a Simulcast Router)
    before a timeout will be declared and the processing is aborted.
    The amount of time may be specified with a number immediately
    followed by 's' (seconds), 'm' (minutes), 'h' (hours), or 'd'
    (day). For example, 15m specifies 15 minutes.
</inputTimeOut>
<processes>
    One <process>...</process> element for each type of processing
    that can be performed by the Processor (usually one per
    satellite).
    <process passType="...">
        The attribute "passType" identifies the satellite/instrument
        being processed.
        <handlerClassName>
            The Java class that handles the processing.
        </handlerClassName>
        <handlerParameters>
            Zero or more processing parameters that are specific to the
            Java class handling the processing.
            <parameter>
                A processing parameter.
            </parameter>
        </handlerParameters>
        <serverHostPort>
            The hostname and port number (host:port) of the Server that is
            to receive the processed pass data via a socket connection.
        </serverHostPort>
    </process>
</processes>
</processorConfig>

```

C.3 Server, server-config.xml

This configuration file sets the following:

- a) input port for processor;
- b) output port for client;
- c) data directory;
- d) log server;
- e) log file;
- f) log file size;
- g) input timeout;
- h) Two-line Element (TLE) information;
- i) Simulcast ground station information.

```
<serverConfig>
  <log>
    <server>
      <hostPort> server address along with port </hostPort>
      <tmpDir> directory to store temporary logs </tmpDir>
    </server>
    <local>
      <logFiles>
        <logFile>
          The path of the current Server log file: either
          relative from the simulcast directory or an absolute
          path.
        </logFile>
        One or more of...
        <logFile>
          The path of an "old" Server log file. When the
          current log file reaches its maximum size, it is moved
          to the first "old" log file, the first "old" log file
          is moved to the next "old" log file, and so on, with
          the last "old" log file being deleted as necessary.
        </logFile>
      </logFiles>
      <maxLogFileSize>
        The maximum size for a log file. It may be specified in
        bytes (e.g., 100000), kilobytes (e.g., 500k), megabytes
        (e.g., 1.5m), or gigabytes (e.g., 1.35g).
```

```

    </maxLogFileSize>
</local>
<stderr/> Display standard error.
<stdout/> Optional. Display log to standard output.
</log>
<tle>
    Two-line Elements (TLEs) for the various satellites,
    currently "aqua", "terra", "npp", "jpss1", and "jpss2".
    <"satellite">
        <archive>
            The file in which an archive of TLEs is kept.
        </archive>
        <source>
            An FTP URL that is the source of the TLEs.
        </source>
    </"satellite">
</tle>
<fix>
    If the value is "yes", the Server will fix error(s) with pass and
    delete the pass with no data. If the value is "no", the Server
    will do nothing. Default is "yes".
</fix>
<consoleIP>
    Only the console that launched from this IP address can delete
    passes on the Server.
</consoleIP>
<groundStations>
    One or more ground stations that may send passes to this
    Server.
    <groundStation>
        <id>
            A short acronym used to identify the ground station.
        </id>
        <name>
            The full name of the ground station.
        </name>
        <lat>
            The latitude (in degrees) of the ground station.
        </lat>
        <lon>
            The longitude (in degrees, -180.0 to 180.0) of the
            ground station.
        </lon>
    </groundStation>
</groundStations>
<spoolDirPath>
    The directory in which the Server spools pass data: either
    relative from the simulcast directory, or an absolute path.
    Note that each pass may be quite large (1GB or more), so
    this directory should be on a disk with plenty of space.
</spoolDirPath>
<maxSavedPasses>

```

The maximum number of passes that will be saved by the Server. When this number is reached, the oldest pass is deleted when a new pass is received.

</maxSavedPasses>

<inputPort>
If present, the port number on which socket connections are accepted from a Processor.

</inputPort>

<inputTimeOut>
The amount of time that must elapse with no data being received on the input socket connection (typically from a Simulcast Processor or Upstream Simulcast Server) before a timeout will be declared and the spooling is aborted. The amount of time may be specified with a number immediately followed by 's' (seconds), 'm' (minutes), 'h' (hours), or 'd' (day). For example, 15m specifies 15 minutes.

</inputTimeOut>

<clientPort>
If present, the port number on which socket connections are accepted from Clients.

</clientPort>

<noFirewallClientPort>
If clientPort is not able to be accessed by clients under firewall, this port can be added to Simulcast server for those clients to access this server.

</noFirewallClientPort>

<loopbackTest>
If present, performs a loopback test at a regular interval to make sure that the Server can connect to itself.

<hostPort>
The host:port to connect to (typically "localhost:3502").

</hostPort>

<interval>
The amount of time between tests. The amount of time may be specified with a number immediately followed by 's' (seconds), 'm' (minutes), 'h' (hours), or 'd' (day). For example, 15m specifies 15 minutes.

</interval>

<timeout>
The amount of time to wait before declaring a test a failure (in those situations where network timeouts are occurring). The amount of time may be specified with a number immediately followed by 's' (seconds), 'm' (minutes), 'h' (hours), or 'd' (day). For example, 15m specifies 15 minutes.

</timeout>

<maxFailures>
The maximum number of consecutive failed tests before an action is taken.

</maxFailures>

<onMaxFailures>
The action to perform after the maximum number of consecutive

```

    failed tests is reached. It may be one of the following:
    halt      The Java Virtual Machine (JVM) is halted.
              If the Java Service Wrapper (JSW) is
              being used, it will automatically restart the
              JVM.
    exit      The JVM is exited.
              This will not cause the JSW to restart
              the JVM.
    continue  Ignore the errors and continue.
  </onMaxFailures>
</loopbackTest>
<noFirewallLoopbackTest>
  This is the same function as loopbackTest for the
  noFirewallClientPort. If present, performs a loopback test
  at a regular interval to make sure that the Server can
  connect to itself.
</noFirewallLoopbackTest>
</serverConfig>

```

C.4 Downstream Server, downstream-server-config.xml

This configuration file sets the following:

- a) input port for processor;
- b) output port for client;
- c) data directory;
- d) log server;
- e) log file;
- f) log file size;
- g) input timeout;
- h) Two-line Element (TLE) information;
- i) Simulcast ground station information.
- j) Upstream Server information.

```
<serverConfig>
  <log>
    <server>
      <hostPort> server address along with port </hostPort>
      <tmpDir> directory to store temporary logs </tmpDir>
    </server>
    <local>
      <logFiles>
        <logFile>
          The path of the current Downstream Server log file: either
          relative from the simulcast directory or an absolute
          path.
        </logFile>
        One or more of...
        <logFile>
          The path of an "old" Downstream Server log file. When the
          current log file reaches its maximum size, it is moved
          to the first "old" log file, the first "old" log file
          is moved to the next "old" log file, and so on, with
          the last "old" log file being deleted as necessary.
        </logFile>
      </logFiles>
      <maxLogFileSize>
        The maximum size for a log file. It may be specified in
```



```

        bytes (e.g., 100000), kilobytes (e.g., 500k), megabytes
        (e.g., 1.5m), or gigabytes (e.g., 1.35g).
    </maxLogFileSize>
</local>
<stdout/> Optional. Display log to standard output.
<stderr/> Display standard error.
</log>
<spoolDirPath>
    The directory in which the Server spools pass data: either
    relative from the simulcast directory, or an absolute path.
    Note that each pass may be quite large (1GB or more), so
    this directory should be on a disk with plenty of space.
</spoolDirPath>
<maxSavedPasses>
    The maximum number of passes that will be saved by the
    Server. When this number is reached, the oldest pass is
    deleted when a new pass is received.
</maxSavedPasses>
<inputPort>
    If present, the port number on which socket connections are
    accepted from a Processor.
</inputPort>
<inputTimeOut>
    The amount of time that must elapse with no data being
    received on the input socket connection (typically from a
    Simulcast Processor or Upstream Simulcast Server) before a
    timeout will be declared and the spooling is aborted. The
    amount of time may be specified with a number immediately
    followed by 's' (seconds), 'm' (minutes), 'h' (hours), or
    'd' (day). For example, 15m specifies 15 minutes.
</inputTimeOut>
<clientPort>
    If present, the port number on which socket connections are
    accepted from Clients.
</clientPort>
<noFirewallClientPort>
    If clientPort is not able to be accessed by clients under
    firewall, this port can be added to Simulcast server for
    those clients to access this server.
</noFirewallClientPort>
<tle>
    Two-line Elements (TLEs) for the various satellites,
    currently "aqua", "terra", "npp", "jpss1", and "jpss2".
    <"satellite">
        <archive>
            The file in which an archive of TLEs is kept.
        </archive>
        <source>
            An FTP URL that is the source of the TLEs.
        </source>
    </"satellite">
</tle>

```

<fix>
 If the value is "yes", the Server will fix error(s) with pass and delete the pass with no data. If the value is "no", the Server will do nothing. Default is "yes".
 </fix>
 <consoleIP>
 Only the console that launched from this IP address can delete passes on the Server.
 </consoleIP>
 <logDisplayTime>
 If unable to connect to the Upstream Server, display log in intervals of minutes as specified by this value. Default is 1.
 </logDisplayTime>
 <upstreamServers>
 If present, zero or more Upstream Servers from which to download passes at startup and as they occur.
 <upstreamServer>
 <hostPort>
 The host:port on which the Upstream Server is listening for Client connections.
 </hostPort>
 <full/>
 If present, then full passes should be downloaded.
 OR
 <partial>
 If present, then only partial passes should be downloaded.
 <bands>
 One or more bands that should be included in a downloaded pass.
 <modis>
 Specify MODIS bands.
 <band>
 <bandIndex>
 The band index (0-37 for the MODIS bands).
 </bandIndex>
 <resolution>
 The resolution in meters.
 </resolution>
 </band>
 </modis>
 <viirs>
 Specify VIIRS bands.
 <band>
 <bandIndex>
 The band index (0-21 for the VIIRS bands).
 </bandIndex>
 <resolution>
 The resolution in meters.
 </resolution>
 </band>
 </viirs>

```

    </bands>
  </partial>
</upstreamServer>
</upstreamServers>
<groundStations>
  One or more ground stations that may send passes to this
  Server. The order and number of ground stations must correspond
  to the order and number of upstream servers. Ground station IDs
  must correspond to their respective upstream servers.
  <groundStation>
    <id>
      A short acronym used to identify the ground station.
    </id>
    <name>
      The full name of the ground station.
    </name>
    <lat>
      The latitude (in degrees) of the ground station.
    </lat>
    <lon>
      The longitude (in degrees, -180.0 to 180.0) of the
      ground station.
    </lon>
  </groundStation>
</groundStations>
<loopbackTest>
  If present, performs a loopback test at a regular interval
  to make sure that the Server can connect to itself.
  <hostPort>
    The host:port to connect to (typically "localhost:3502").
  </hostPort>
  <interval>
    The amount of time between tests. The amount of time may
    be specified with a number immediately followed by 's'
    (seconds), 'm' (minutes), 'h' (hours), or 'd' (day). For
    example, 15m specifies 15 minutes.
  </interval>
  <timeout>
    The amount of time to wait before declaring a test a
    failure (in those situations where network timeouts are
    occurring). The amount of time may be specified with a
    number immediately followed by 's' (seconds), 'm'
    (minutes), 'h' (hours), or 'd' (day). For example, 15m
    specifies 15 minutes.
  </timeout>
  <maxFailures>
    The maximum number of consecutive failed tests before an
    action is taken.
  </maxFailures>
  <onMaxFailures>
    The action to perform after the maximum number of consecutive
    failed tests is reached. It may be one of the following:

```

```

    halt      The Java Virtual Machine (JVM) is halted.
              If the Java Service Wrapper (JSW) is
              being used, it will automatically restart the
              JVM.
    exit      The JVM is exited.
              This will not cause the JSW to restart
              the JVM.
    continue  Ignore the errors and continue.
</onMaxFailures>
</loopbackTest>
<noFirewallLoopbackTest>
    This is the same function as loopbackTest for
    noFirewallClientPort. If present, performs a loopback test
    at a regular interval to make sure that the Server can
    connect to itself.
</noFirewallLoopbackTest>
</serverConfig>

```

C.5 Images, images-config.xml

This configuration file sets the following:

- a) Server info;
- b) Log files;
- c) Image Resolution;
- d) Image Enhancement;
- e) E-mail Settings;
- f) Image File Transfer Settings.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<imagesConfig>
  <log>
    <server>
      <hostPort> server address along with port </hostPort>
      <tmpDir> directory to store temporary logs </tmpDir>
    </server>
    <local>
      <logFiles>
        <logFile>
          The path of the current Downstream Server log file: either
          relative from the simulcast directory or an absolute
          path.
        </logFile>
        One or more of...
        <logFile>
          The path of an "old" Downstream Server log file. When the
          current log file reaches its maximum size, it is moved
          to the first "old" log file, the first "old" log file
          is moved to the next "old" log file, and so on, with
          the last "old" log file being deleted as necessary.
        </logFile>
      </logFiles>
      <maxLogFileSize>
        The maximum size for a log file. It may be specified in
        bytes (e.g., 100000), kilobytes (e.g., 500k), megabytes
        (e.g., 1.5m), or gigabytes (e.g., 1.35g).
      </maxLogFileSize>
    </local>
    <stdout/> Optional. Display log to standard output.
    <stderr/> Display standard error.
  </log>
  <scratchDirPath>./scratch/images</scratchDirPath>
  <serverHostPort>
    The hostname and port number (host:port) of the Server that is to
    receive the processed pass data via a socket connection.
```

```

</serverHostPort>
<imageExistingPasses>
    Option to create imagery for existing passes in Simulcast.
</imageExistingPasses>
<imageNewPasses>
    Option to create imagery for new passes.
</imageNewPasses>
<handlerScript>
    Relative path (from Simulcast top-level directory) to script that
handles image creation.
</handlerScript>
<lowResolution>
    <width> Width of the map </width>
    <height> Height of the map </height>
    <resolution> Resolution of the map in meters </resolution>
    <mail/>
    <scp/>
</lowResolution>
<highResolution>
    <width> Width of the map </width>
    <height> Height of the map </height>
    <resolution> Resolution of the map in meters </resolution>
    <scp/>
</highResolution>
<lowResolutionViirs>
    <width> Width of the map </width>
    <height> Height of the map </height>
    <resolution> Resolution of the map in meters</resolution>
    <mail/>
    <scp/>
</lowResolutionViirs>
<highResolutionViirs>
    <width> Width of the map </width>
    <height> Height of the map </height>
    <resolution> Resolution of the map </resolution>
    <scp/>
</highResolutionViirs>
<trueColorImageEnhancement>
    <algorithmClassName>
        The Java class to process image.
    </algorithmClassName>
    <contrast> Image contrast setting (0.00 to 9.99) </contrast>
    <brightness> Image Brightness setting (-99 to 99) </brightness>
</trueColorImageEnhancement>
<infraredImageEnhancement>
    <algorithmClassName>
        The Java class to process with infrared enhancements.
    </algorithmClassName>
    <contrast> Image contrast setting </contrast>
    <brightness> Image brightness setting </brightness>
</infraredImageEnhancement>
<mailDestinations>

```

```

<mailDestination>
  <smtpHost> Address of SMTP host </smtpHost>
  <toAddresses>
    <toAddress>
      Email address that will receive quicklook images. To send to
      multiple email addresses, add more <toAddress> tags.
    </toAddress>
  </toAddresses>
  <ccAddresses>
    <ccAddress>
      Email address that will receive quicklook imagery as a
      CC'd recipient
    </ccAddress>
  </ccAddresses>
  <fromAddress>
    Email address from which quicklook imagery will be sent
    from.
  </fromAddress>
</mailDestination>
</mailDestinations>
<scpDestinations>
  <scpDestination>
    <user> Username that will receive quicklook imagery </user>
    <host> Host address that will receive quicklook imagery </host>
    <dir> Directory on host where quicklook imagery is sent </dir>
  </scpDestination>
</scpDestinations>
</imagesConfig>

```

C.6 Services, services-config.xml

This configuration file lists the services to use, including service name, class, and configuration files (router-config.xml, processor-config.xml, and server-config.xml).

```
<servicesConfig>
  <services>
    One <service>...</service> element for each service.
    <service>
      <name>
        The name of the service.
      </name>
      <className>
        The Java class containing the "start" method for the service.
      </className>
      <arguments>
        Zero or more arguments passed to the "start" method (typically
        just the location of the configuration file for the service).
        <argument>
          An argument.
        </argument>
      </arguments>
    </service>
  </services>
</servicesConfig>
```


Appendix D

Enabling and Saving Quicklook JPEG Imagery

Simulcast can produce quicklook JPEG images that can be configured to automatically be saved to the local system or sent to another host via scp.

To automatically produce quicklook imagery:

1. In Simulcast file config/images-config.xml, uncomment the following section (XML comment begin with `<!--` and end with `-->`):

```
<scpDestinations>
  <!-- 6.0: Uncomment this section and put valid
user/host/path to receive quicklook image files>
  <scpDestination>
    <user>simulcast</user>
    <host>directreadout.sci.gsfc.nasa.gov</host>
    <dir>/var/www/html/Image_Archive/</dir>
  </scpDestination>
  -->
</scpDestinations>
```

Then, change the entries for the `<user>`, `<host>`, and `<dir>` fields (shown in **bold** text above) to your username, host, and directory where you want the images to reside. The directory must already exist.

2. In Simulcast file config/images-config.xml, add/uncomment the `<fromAddress>` tag. Example below:

```
<mailDestinations>
  <mailDestination>
    <smtpHost>localhost</smtpHost>
    <toAddresses>
      <!-- 6.0: Uncomment this section and put valid email
address to receive quicklook emails>
      <toAddress>EMAIL ADDRESS HERE</toAddress>
      <toAddress>EMAIL ADDRESS HERE</toAddress>
      <toAddress>EMAIL ADDRESS HERE</toAddress>
      -->
    </toAddresses>
    <ccAddresses>
      <!-- 6.0: Uncomment this section and put valid email
address to receive quicklook emails>
      <ccAddress>EMAIL ADDRESS HERE</ccAddress>
      -->
    </ccAddresses>
    <!-- 6.0: Uncomment this section and put valid email
address to receive quicklook emails -->
    <fromAddress>example@email.com</fromAddress>
  </mailDestination>
```

```
</mailDestinations>
```

3. In Simulcast file `config/services-config.xml`, uncomment the following section (XML comment begin with `<!--` and end with `-->`):

```
<!-- 6.0: Uncomment this section to enable generation of
quicklook images
  <service>
    <name>images</name>
    <className>gov.nasa.gsfc.aisb.simulcast.images.Images</class
Name>
    <arguments>
      <argument>./configs/images-config.xml</argument>
    </arguments>
  </service>
-->
```

4. Ensure that your host machine does not require a password login or any prompt for user input to login to the `<user>` and `<host>` specified in step 1. You may also setup SSH keys for your account to automatically log-in.
5. Restart Simulcast.

```
sc/jsw/bin/sc-services.sh restart
```