Simulcast Version 4.2

General

The NASA Goddard Space Flight Center's (GSFC) Direct Readout Laboratory (DRL), Code 606.3 developed this Simulcast software for the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) In-Situ Ground System (NISGS) and the International Polar Orbiter Processing Package (IPOPP).

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:

http://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:

http://directreadout.sci.gsfc.nasa.gov/index.cfm?section=contact%20usAlgorithm

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. Simulcast functions in two modes: Standalone, or as an IPOPP plug-in.

The Simulcast Client consists of the Simulcast Viewer and the Simulcast Console. The Viewer displays data from satellite passes (currently MODIS data from Aqua and Terra). The Console displays and controls administrative information.

Before data can be displayed with the Viewer, the data must first be acquired, routed and processed by Simulcast Services. Simulcast Services contains 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. See Figure 1.

The Server receives viewable data from the Processor and notifies 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 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:

http://directreadout.sci.gsfc.nasa.gov/index.cfm?section=technology

Simulcast Download Options

The DRL Web Portal offers users the option of downloading either the complete Simulcast package (for Linux or Windows) or the Simulcast Viewer alone (for Windows only).

Download the complete Simulcast package to configure Simulcast to view data from any ground station and/or Simulcast Server. The complete Simulcast package for Linux is contained in the file SIMULCAST_4.2.tar.gz. The complete Simulcast package for Windows is contained in the file SIMULCAST_4.2.exe.

Download the Simulcast Viewer alone to view data received by the DRL and other ground stations that make their data available to the DRL. The Simulcast Viewer is contained in the file SIMULCAST_VIEWER_4.2.exe. The Viewer alone requires no configuration by the user. The Program Operation section details use of the Viewer.

Software Version

Enhancements in Version 4.2 include:

a) enhanced installer to automatically configure Simulcast for either Standalone or IPOPP mode;

b) expanded documentation detailing the Downstream Server and Multiple Downstream Server configurations;

c) automatic correction of passes with errors;

d) automatic deletion of passes containing no data;

e) enhanced logging capability.

Prerequisites

To run this package, you must have the Java Development Kit (JDK) or Java Runtime Engine (JRE) (Java 1.5 or higher) installed on your computer. If you plan to rebuild the Simulcast distribution, you must install the JDK. Otherwise, only the Java Runtime Environment (JRE) must be installed. Linux users should ensure that /lib/ld-linux.so.2 is installed. Ensure that Java applications can be executed. The bin directory of the JRE (or JDK) must be added to the beginning of the PATH environment variable so that the 'java' executable can be found (and the 'javac' and 'javadoc' executables, if you plan to rebuild). Placing the bin directory at the beginning of the PATH environment variable ensures use of the correct Java version rather than the system default.

Simulcast has been tested under these operating systems:

a) Fedora 10 (Cambridge) x86_64;

b) CentOS Linux 5.3 (Final) x86_64;

c) Open SUSE Linux 11.1 x86_64;

d) Kubuntu 8.10 (Intrepid) x86_64;

e) Microsoft Windows XP Professional.

Program Inputs and Outputs

Simulcast input data are Level 0 data from a Real-time Software Telemetry Processing System (RT-STPS) socket connection. (Go to the DRL Web Portal at http://directreadout.sci.gsfc.nasa.gov to learn more about RT-STPS, and to download the software.) Simulcast software can send Level 0 data (.PDS data) for testing. Simulcast outputs images of pass data in real time. It also outputs files with the extension .SC in the InstalledDir/spool/server directory for later replay.

Installation and Configuration of Simulcast Services

Linux Platform Installation

NOTE: Simulcast may be installed in two modes of operation: Standalone, or as an IPOPP plug-in. In either case, Simulcast should be installed into a drl directory. When installing Simulcast on a computer where IPOPP has been installed previously, be sure to install Simulcast in the existing drl directory. If you are upgrading from a previous version of Simulcast, first stop the Simulcast Services, then delete the existing sc directory. The Simulcast Services can be stopped at any time from a shell by entering:

"<path>/jsw/bin/sc-services.sh stop"

where <path> is the absolute path of the sc directory.

To install:

Create a user account under which the Simulcast Services will run.

If IPOPP software has been installed previously on the computer that will run Simulcast Services, change (cd) to the existing drl directory. If installing in Standalone mode, create a drl directory (if there is no existing drl directory) on the computer that will run the Simulcast Services. Change (cd) to the drl directory.

Copy the downloaded SIMULCAST_4.2.tar.gz file to the drl directory. Decompress SIMULCAST_4.2.tar.gz by running:

tar xzvf SIMULCAST_4.2.tar.gz

You should now have an sc directory in the drl directory.

Configure the Simulcast Services for Linux

This section contain 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 B, or a Multiple Downstream Server Configuration, as described in Appendix C.

Basic Default Configuration

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

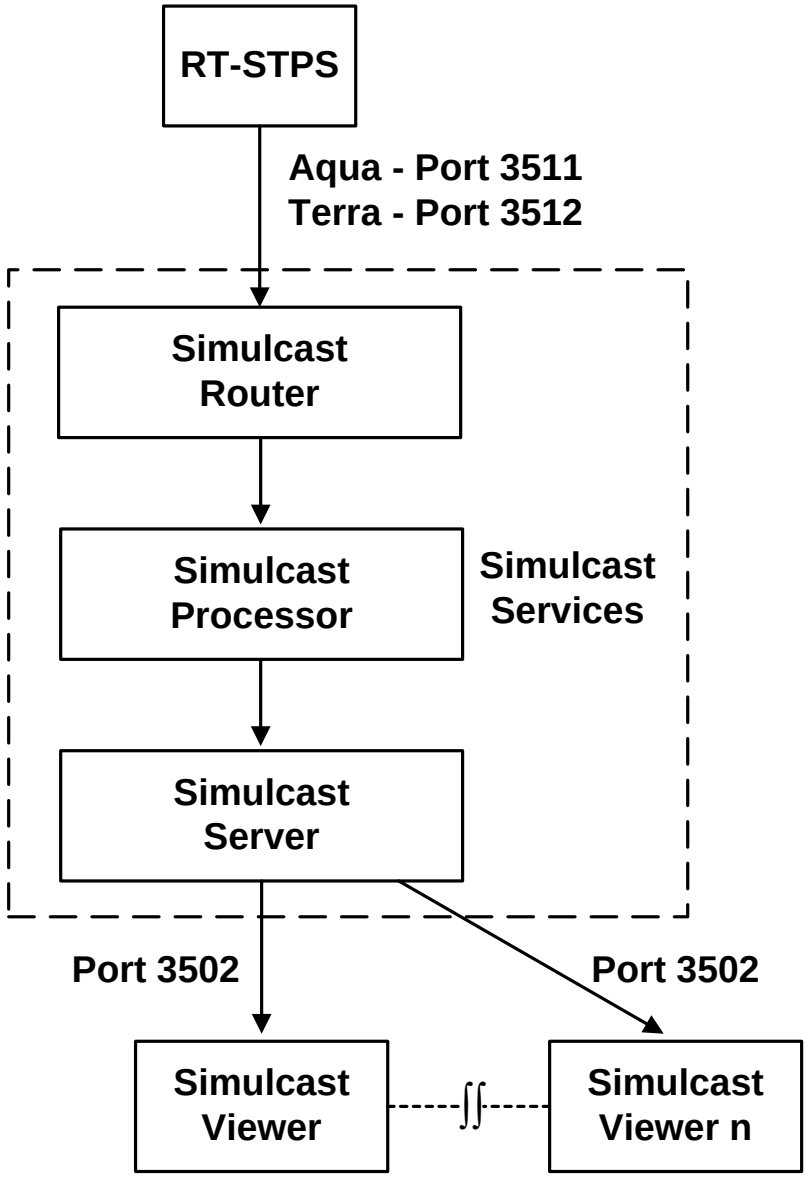


Figure 1. Basic Default Configuration

NOTE: Default port numbers for Aqua and Terra are set to 3511 and 3512, respectively. These port numbers are configurable, 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;

b) station name;

c) latitude (in degrees) of the ground station;

d) longitude (in degrees) of the ground station.

To enable the Basic Default Configuration, change (cd) to the sc directory.

Run the script: ./install.sh

If IPOPP software has been installed previously on the computer where the user is installing Simulcast, the user will receive the following message:

Configuring Simulcast for IPOPP Mode.

If IPOPP software has not been installed previously, the user will receive the following message:

Configuring Simulcast for Standalone Mode.

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 for Linux

Figure 3 contains the unique ground station information inserted into both the Router and Server configuration files during the automatic configuration process. The complete Router and Server configuration files corresponding to this example are contained in Appendix A, "Basic Default Configuration Files." The Extensible Mark-up Language (XML) elements found in Simulcast configuration files are defined in Appendix D, "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

To Start the Simulcast Services Automatically at Boot

NOTE: Before starting Simulcast Services, ensure that /lib/ld-linux.so.2 is installed.

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

su - <user> -c "<path>/jsw/bin/sc-services.sh start"

where <user> is the user the Simulcast Services will run as, and <path> is the absolute path of the sc directory. Do not run the Simulcast Services as root.

To Start the Simulcast Services Manually

The Simulcast Services can be started, restarted, or stopped at any time from a shell by entering:

"<path>/jsw/bin/sc-services.sh <cmd>"

where <path> is the absolute path of the sc directory, and <cmd> is "start", "restart", or "stop". This must be done as the same user that originally started the Simulcast Services.

Launch Viewer and Console

To launch the Simulcast Viewer, in InstalledDir/sc, run:

./bin/sc-viewer.sh

To launch the Simulcast Console, in InstalledDir/sc, run:

./bin/sc-console.sh

Software Package Testing and Validation

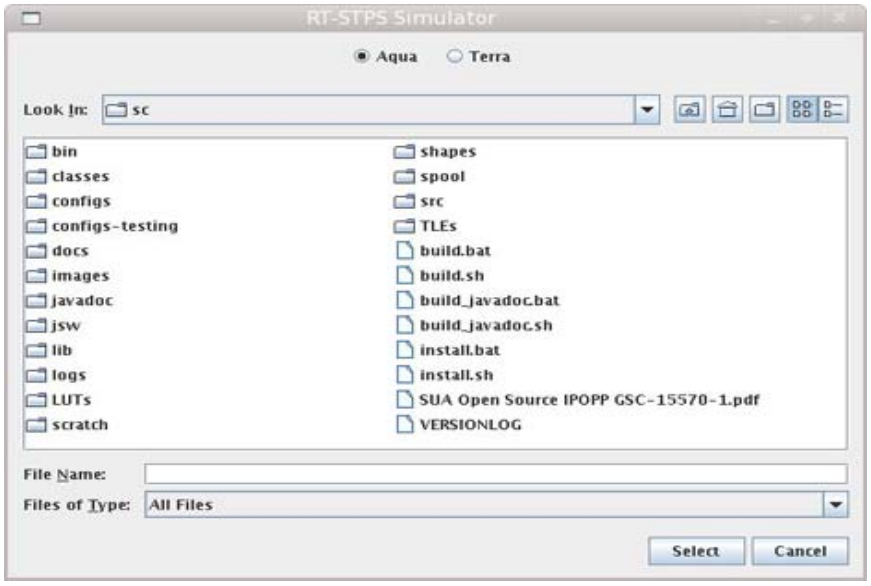
Follow the procedures contained in this section to verify that your installation of Simulcast is configured to receive data from RT-STPS.

NOTE: Ensure that you are in the SimulcastInstalledDir/sc directory before performing these test procedures. For Level 0 data, go to:
ftp://is.sci.gsfc.nasa.gov/gsfcdata/terra/modis/level0

1) change (cd) to the sc directory;

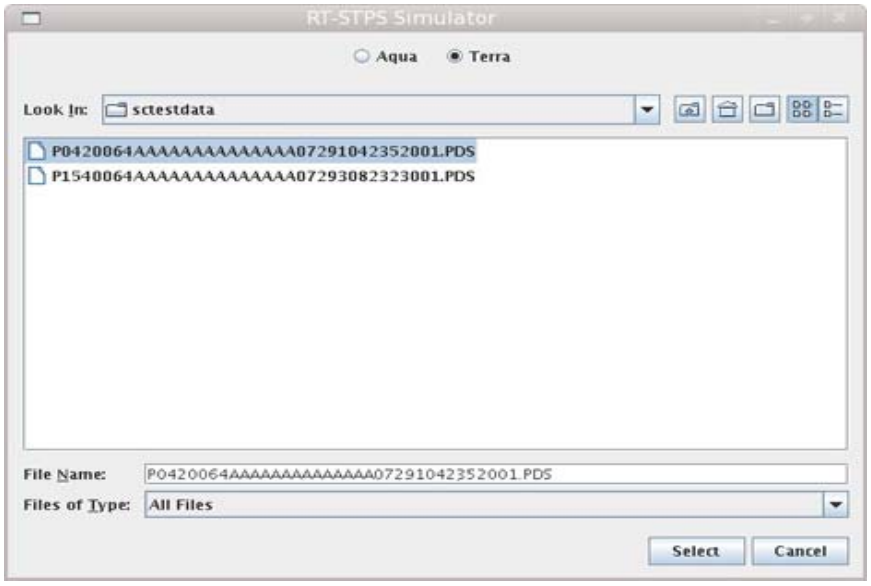
2) Run the script: bin/test/sc-rtstps.sh localhost:3511 localhost:3512

   Once the script is run, the RT-STPS Simulator will be displayed, as shown below.



3) Click on the Terra button.

4) Select the PDS file downloaded, as shown below.



5) Click the Select button;

6) Uncheck the Pause button to start. When you see a message like "EOF (148.79 MB sent)" as shown below, it indicates that Simulcast is configured to receive data from RT-STPS.

Rebuilding Simulcast

Instructions for rebuilding Simulcast are contained in Appendix E.

NOTE: Linux users may now go directly to the Program Operation section of this document.

Windows Platform Installation

NOTE: If you are upgrading from a previous version of Simulcast, first remove the existing Simulcast Services. To remove the Simulcast Services, use Control Panel > Add or Remove Programs.

Double-click SIMULCAST_4.2.exe and follow the steps in the Setup Wizard. The installation will automatically install a Java Runtime Environment (JRE) if necessary. The default location for the Simulcast installation is: C:\Program Files\DRL\Simulcast Services\sc. All directory paths referred to in these instructions will be relative to the sc directory.

Configure the Simulcast Services for Windows

This section contain instructions to enable the Basic Default Configuration. The user must run the install.bat 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 B, or a Multiple Downstream Server Configuration, as described in Appendix C.

Basic Default Configuration

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

Most Simulcast installations can simply use the default configuration values, with the exception of 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.bat script, which generates a series of queries requesting the following:

a) station ID;

b) station name;

c) latitude (in degrees) of the ground station;

d) longitude (in degrees) of the ground station.

To enable the Basic Default Configuration, run the script: .\install.bat. Provide the unique ground station information in response to the subsequent queries.

Figure 4 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.

```
c:\simulcast\sc>.\install.bat\
Install.bat starts at: C:\simulcast\sc\install.bat
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 4. Automatic Configuration Sequence Example for Windows

Figure 5 contains the unique ground station information inserted into both the Router and Server configuration files during the automatic configuration process. The complete Router and Server configuration files corresponding to this example are contained in Appendix A, "Basic Default Configuration Files."

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

Figure 5. Configuration File Ground Station Information

Start the Simulcast Services as a Windows Service

Use Control Panel > Administrative Tools > Services to display the available Windows services. A service named "Simulcast Services" will have been created during the installation. Selecting the entry for the Simulcast Services allows the Services to be started, restarted, or stopped.

Right-click the entry and select Properties to specify whether or not the Simulcast Services automatically start at boot, as well as to specify the action to take if the Simulcast Services fail (we recommend restarting).

Launch Viewer and Console

Shortcuts for the Simulcast Console and Simulcast Viewer will have been created on the Desktop during the installation process. They are configured by default to connect to the Simulcast Services on the localhost. This behavior can be changed by right-clicking the shortcut and modifying the command line arguments as described in the "Program Operation" section of this document.

Software Package Testing and Validation

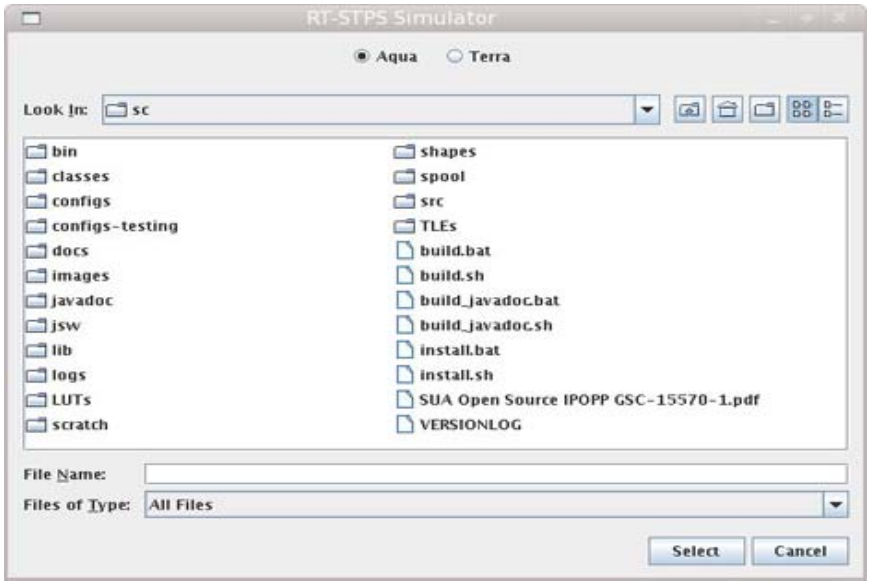
Follow the procedures contained in this section to verify that your installation of Simulcast is configured to receive data from RT-STPS.

NOTE: Ensure that you are in the sc directory before performing these test procedures. For Level 0 data, go to: ftp://is.sci.gsfc.nasa.gov/gsfcdata/terra/modis/level0

1) change (cd) to the sc directory;

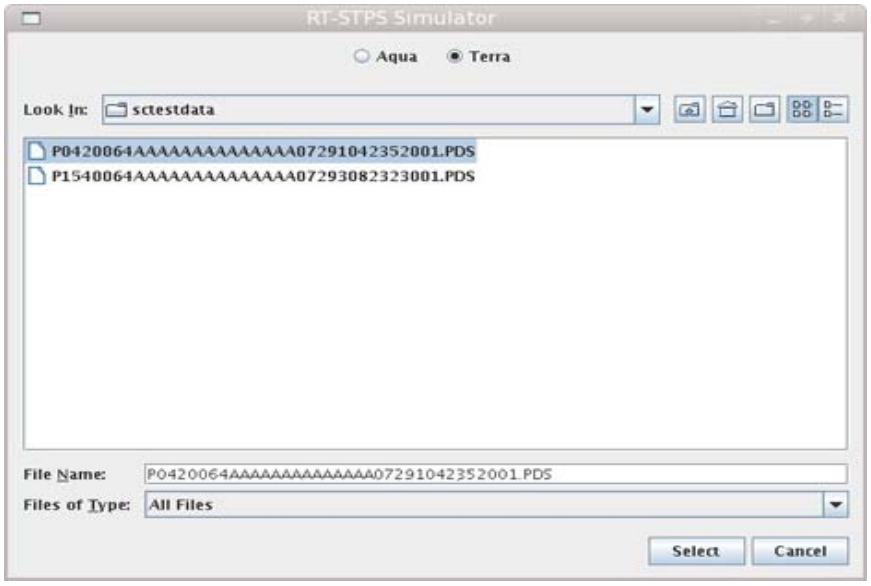
2) Run the script: bin\test\sc-rtstps.bat localhost:3511 localhost:3512

   Once the script is run, the RT-STPS Simulator will be displayed, as shown below.



3) Click on the Terra button.

4) Select the PDS file downloaded, as shown below.



5) Click the Select button;

6) Uncheck the Pause button to start. When you see a message like "EOF (148.79 MB sent)" as shown below, it indicates that Simulcast is configured to receive data from RT-STPS.

Rebuilding Simulcast

Instructions for rebuilding Simulcast are contained in Appendix E.

Program Operation

The instructions contained in this section apply to Simulcast installations on both Linux and Windows platforms.

Simulcast Viewer

The Simulcast Viewer displays data from satellite passes (currently MODIS data from Aqua and Terra). 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 command line arguments:

a) -maximize: if specified, the window is maximized initially (optional);

b) -auto_play {map|instrument}: if specified, when a pass starts it is automatically played on the layout specified (optional);

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 (optional);

d) -server_choice host:port: zero or more may be specified for the drop-down list on the "Simulcast Server Connection" dialog (optional);

e) host:port: a Simulcast Server address to automatically connect to. If specified, this must be the last argument (optional).

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.

NOTE: If you have installed only the Simulcast Viewer, connect to nisds1.sci.gsfc.nasa.gov:3502.

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.

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. 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 (currently MODIS) was in day mode or night mode or both, if the pass crossed the terminator.

9. Duration of Pass: the length of time 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.

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.

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 the next subsection, is at the bottom of the screen.

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 (AQUA or TERRA), instrument (MODIS), direction (Ascending or Descending), and instrument mode (Day or Night) (for example, TERRA/MODIS/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 (currently MODIS data from Aqua or Terra) should be displayed. The Visual indicator contains a drop-down menu containing the Visuals supported by Simulcast, as follows:

a) MODIS Auto Day/Night;

b) MODIS True Color;

c) MODIS Infrared;

d) MODIS Gray Scale;

e) 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, Enhancement, 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) MODIS Auto Day/Night: switches between MODIS True Color for the day portion of a pass, and 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. Note that 1 km is the finest resolution allowed for this Visual.

2. Enhancement: specifies the enhancement algorithm (none, algorithm 1 or algorithm 2) to be applied (before any additional contrast or brightness adjustments). Both algorithm 1 and algorithm 2 raise the brightness level of the dark parts of the image, without affecting the bright parts, in order to enhance the detail in the clouds. Algorithm 2 is actually an improved version of algorithm 1.

Algorithm 2 should be considered the preferred enhancement algorithm. Algorithm 1 will be removed with the next release of Simulcast.

3. Contrast: specifies the contrast to be applied (after any enhancement, but before any brightness adjustment).

4. Brightness: specifies the brightness to be applied (after any enhancement or contrast adjustment).

5. Mode: indicates if the instrument is in Day or Night mode.

b) MODIS True Color: a true color representation using 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. Enhancement: specifies the enhancement algorithm (none, algorithm 1 or algorithm 2) to be applied (before any additional contrast or brightness adjustments). Both algorithm 1 and algorithm 2 raise the brightness level of the dark parts of the image, without affecting the bright parts, in order to enhance the detail in the clouds. Algorithm 2 is actually an improved version of algorithm 1. Algorithm 2 should be considered the preferred enhancement algorithm. Algorithm 1 will be removed with the next release of Simulcast.

3. Contrast: specifies the contrast to be applied (after any enhancement, but before any brightness adjustment).

4. Brightness: specifies the brightness to be applied (after any enhancement or contrast adjustment).

c) 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. Enhancement: specifies the enhancement algorithm (none, algorithm 1 or algorithm 2) to be applied (before any additional contrast or brightness adjustments). Both algorithm 1 and algorithm 2 raise the brightness level of the dark parts of the image, without affecting the bright parts, in order to enhance the detail in the clouds. Algorithm 2 is actually an improved version of algorithm 1. Algorithm 2 should be considered the preferred enhancement algorithm. Algorithm 1 will be removed with the next release of Simulcast.

3. Band: specifies the emissive band to be used.

4. Contrast: specifies the contrast to be applied (before any brightness adjustment).

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

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

1. Resolution: specifies the resolution (at nadir) to be displayed.

2. Band: specifies the MODIS 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) 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 MODIS 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).

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 the next time the 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 when a pass is played, .

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 (day or night for MODIS) 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.

Simulcast Console

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 Client hosts, ports and players.

d) Downstream Servers: displays Downstream Server hosts and ports.

e) Ping: displays hosts and ports of ping computer.

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.

Appendix A
Basic Default Configuration Files

Figure A-1 contains the complete Router configuration file corresponding to the Basic Default Configuration instructions under "Configure the Simulcast Services for Linux" and "Configure the Simulcast Services for Windows." The unique ground station information inserted automatically into the file during the configuration process is highlighted.

The Extensible Mark-up Language (XML) elements found in Simulcast configuration files are defined in Appendix D, "Configuration File Details."

```
<routerConfig>
  <log>
    <!--
    <server>
      <hostPort>localhost:3500</hostPort>
      <tmpDir>./logs/tmp/router</tmpDir>
    </server>
    -->
    <local>
      <logFiles>
        <logFile>./logs/router.log</logFile>
        <logFile>./logs/router.log.1</logFile>
        <logFile>./logs/router.log.2</logFile>
      </logFiles>
      <maxLogFileSize>1m</maxLogFileSize>
    </local>
    <!--
    <stdout/>
    -->
    <stderr/>
  </log>
  <routes>
    <route>
      <inputPort>3511</inputPort>
<handlerClassName>gov.nasa.gsfc.aisb.simulcast.router.AquaModisHandler</handl
erClassName>
      <groundStation>
        <id>SC1</id>
        <name>MOON</name>
        <lat>50.123</lat>
        <lon>-70.456</lon>
      </groundStation>
      <processors>
        <hostPort>localhost:3520</hostPort>
      </processors>
    </route>
    <route>
      <inputPort>3512</inputPort>
<handlerClassName>gov.nasa.gsfc.aisb.simulcast.router.TerraModisHandler</hand
lerClassName>
      <groundStation>
        <id>SC1</id>
        <name>MOON</name>
        <lat>50.123</lat>
        <lon>-70.456</lon>
      </groundStation>
      <processors>
        <hostPort>localhost:3520</hostPort>
      </processors>
    </route>
  </routes>
  <inputTimeOut>30m</inputTimeOut>
  <pingInterval>1h</pingInterval>
</routerConfig>
```

Figure A-1. Example Router Configuration File

Figure A-2 contains the complete Server configuration file corresponding to the Basic Default Configuration instructions under "Configure the Simulcast Services for Linux" and "Configure the Simulcast Services for Windows." The unique ground station information inserted automatically into the file during the configuration process is highlighted.

```
<serverConfig>
  <log>
    <!--
    <server>
      <hostPort>localhost:3500</hostPort>
      <tmpDir>./logs/tmp/server</tmpDir>
    </server>
    -->
    <local>
      <logFiles>
        <logFile>./logs/server.log</logFile>
        <logFile>./logs/server.log.1</logFile>
        <logFile>./logs/server.log.2</logFile>
      </logFiles>
      <maxLogFileSize>1m</maxLogFileSize>
    </local>
    <!--
    <stdout/>
    -->
    <stderr/>
  </log>
  <tle>
    <aqua>
      <archive>./TLEs/aqua.tle</archive>
<source>ftp://is.sci.gsfc.nasa.gov/ancillary/ephemeris/tle/tle.txt</source>
    </aqua>
    <terra>
      <archive>./TLEs/terra.tle</archive>
<source>ftp://is.sci.gsfc.nasa.gov/ancillary/ephemeris/tle/tle.txt</source>
    </terra>
  </tle>
  <fix>yes</fix>
  <groundStations>
    <groundStation>
      <id>SC1</id>
      <name>MOON</name>
      <lat>50.123</lat>
      <lon>-70.456</lon>
    </groundStation>
  </groundStations>
  <spoolDirPath>./spool/server</spoolDirPath>
  <maxSavedPasses>30</maxSavedPasses>
  <inputPort>3530</inputPort>
  <inputTimeOut>30m</inputTimeOut>
  <clientPort>3502</clientPort>
  <noFirewallClientPort>3509</noFirewallClientPort>
  <loopbackTest>
    <hostPort>localhost:3502</hostPort>
    <interval>5m</interval>
    <timeout>3m</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 A-2. Example Server Configuration File

Appendix B
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 sections "Configure the Simulcast Services for Linux" and "Configure the Simulcast Services for Windows."

Figure B-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.

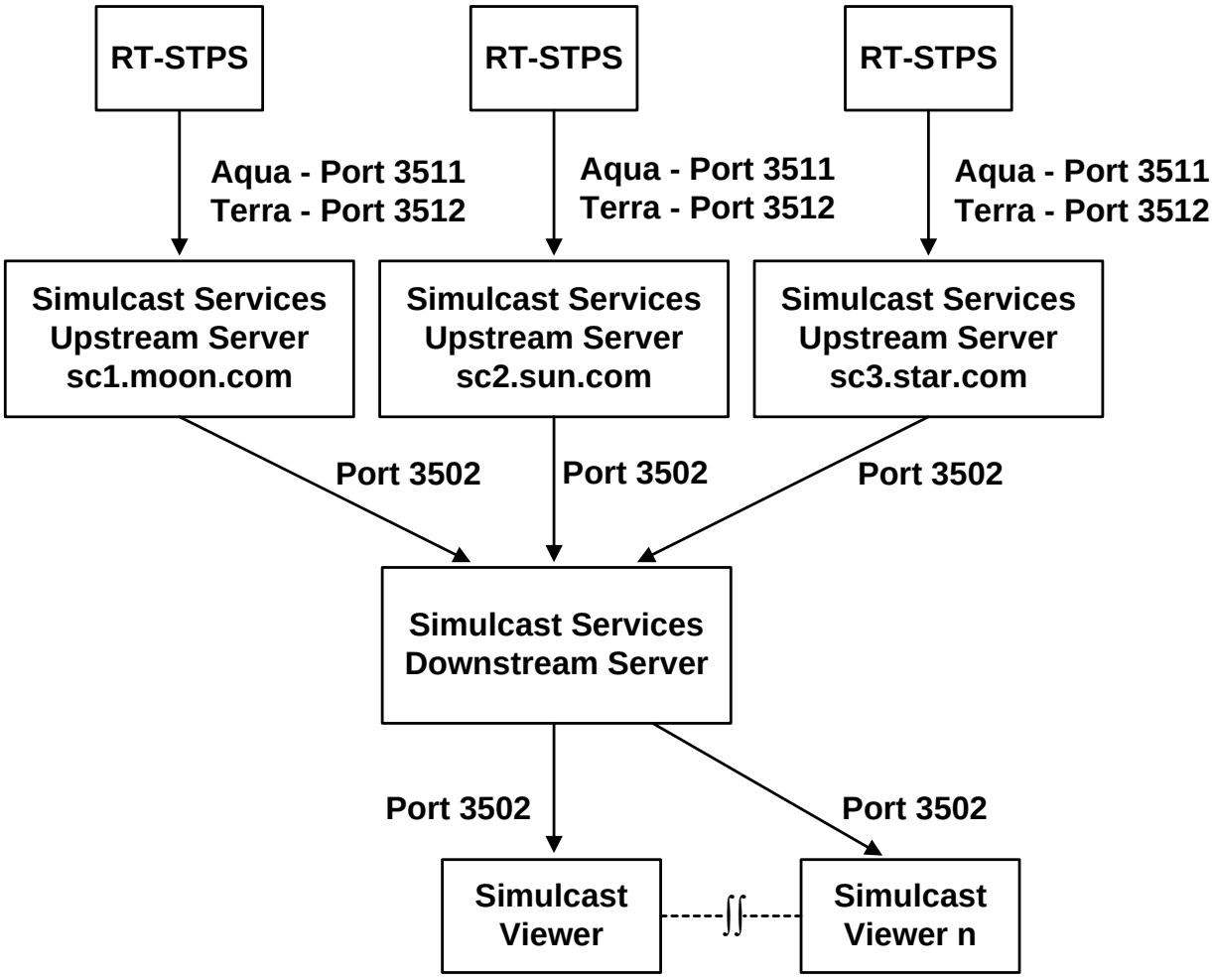


Figure B-1. Example Downstream Server Configuration

If Simulcast is already running in the Basic Default Configuration, stop the Simulcast Services. Edit the configuration files as instructed below before restarting the Services to enable the Downstream Server Configuration.

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

a) Downstream Services configuration file;

b) Downstream Server configuration file.

Edit the Downstream Services configuration file, services-config.xml. Comment out the Router, Processor, and Server Services, then comment out the Downstream Service. Figure B-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 B-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>.

Restart the Downstream Server.

Figure B-3 contains an example Downstream Server Configuration file corresponding to the example Downstream Server Configuration depicted in Figure B-1. Edited items corresponding to the example Upstream Servers are highlighted.

NOTE: Default port numbers for Aqua and Terra are set to 3511 and 3512, respectively. 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>
<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>
  </tle>
  <fix>yes</fix>
  <logDisplayTime>10</logDisplayTime>
  <upstreamServers>
    <upstreamServer>
      <hostPort>sc1.moon.com:3502</hostPort>
      <partial>
        <bands>
          <band>
            <bandIndex>0</bandIndex>
            <resolution>1000</resolution>
          </band>
          <band>
            <bandIndex>2</bandIndex>
            <resolution>1000</resolution>
          </band>
          <band>
            <bandIndex>3</bandIndex>
            <resolution>1000</resolution>
          </band>
```

Figure B-3. Example Downstream Server Configuration File

```
      <band>
        <bandIndex>23</bandIndex>
        <resolution>1000</resolution>
      </band>
    </bands>
  </partial>
</upstreamServer>
<upstreamServer>
  <hostPort>sc2.sun.com:3502</hostPort>
  <partial>
    <bands>
      <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>
    </bands>
  </partial>
</upstreamServer>
<upstreamServer>
  <hostPort>sc3.star.com:3502</hostPort>
  <partial>
    <bands>
      <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>
```

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

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

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

Appendix C
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 sections "Configure the Simulcast Services for Linux" and "Configure the Simulcast Services for Windows." Appendix B 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 B-1, can be connected to a second Downstream Server Configuration. Figure C-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 C-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.

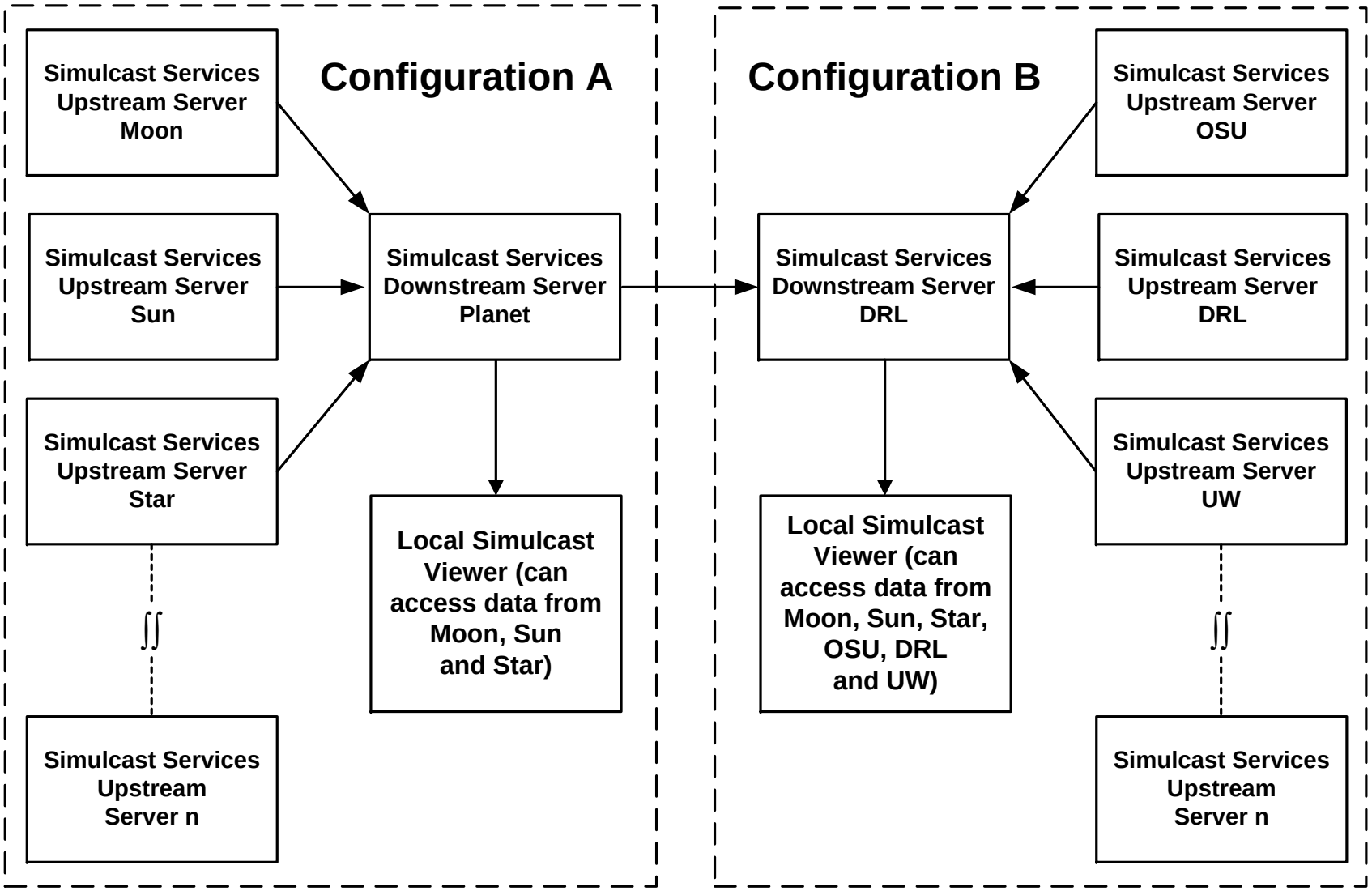


Figure C-1. Multiple Downstream Server Configuration

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 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 C-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.

```
<?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>
  <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>
  </tle>
  <fix>yes</fix>
  <logDisplayTime>10</logDisplayTime>
  <upstreamServers>
    <upstreamServer>
      <hostPort>nisfes.sci.gsfc.nasa.gov:3502</hostPort>
      <partial>
        <bands>
          <band>
            <bandIndex>0</bandIndex>
            <resolution>1000</resolution>
          </band>
          <band>
            <bandIndex>2</bandIndex>
            <resolution>1000</resolution>
          </band>
          <band>
            <bandIndex>3</bandIndex>
            <resolution>1000</resolution>
          </band>
```

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

```
      <band>
        <bandIndex>23</bandIndex>
        <resolution>1000</resolution>
      </band>
    </bands>
  </partial>
</upstreamServer>
<upstreamServer>
  <hostPort>freddie.coas.oregonstate.edu:3502</hostPort>
  <partial>
    <bands>
      <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>
    </bands>
  </partial>
</upstreamServer>
<upstreamServer>
  <hostPort>springbok.ssec.wisc.edu:3502</hostPort>
  <partial>
    <bands>
      <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>
    </bands>
  </partial>
</upstreamServer>
```

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

```
    <upstreamServer>
      <hostPort>sc4.planet.com:3502</hostPort>
      <partial>
        <bands>
          <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>
        </bands>
      </partial>
    </upstreamServer>
    <upstreamServer>
      <hostPort>sc4.planet.com:3502</hostPort>
      <partial>
        <bands>
          <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>
        </bands>
      </partial>
    </upstreamServer>
    <upstreamServer>
      <hostPort>sc4.planet.com:3502</hostPort>
      <partial>
        <bands>
          <band>
            <bandIndex>0</bandIndex>
            <resolution>1000</resolution>
          </band>
```

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

```
          <band>
            <bandIndex>2</bandIndex>
            <resolution>1000</resolution>
          </band>
          <band>
            <bandIndex>3</bandIndex>
            <resolution>1000</resolution>
          </band>
          <band>
            <bandIndex>23</bandIndex>
            <resolution>1000</resolution>
          </band>
        </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>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>
```

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

```
  <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 C-2. Downstream Server Configuration File for Multiple Downstream Server Configuration (continued)

Appendix D
Configuration File Details

Configuration File Details

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>
  <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>
  AND/OR
  <server>
    <hostPort>
        The host:port of the NISGS Status/Event Logging System (NSLS)
        Server.
    </hostPort>
    <tmpDir>
        A directory to temporarily hold events when the NSLS Server
        is unreachable (e.g., during a network outage).
    </tmpDir>
  </server>
</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>
    <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>
      </route>
    </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>
```

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>
    <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>
    AND/OR
    <server>
      <hostPort>
        The host:port of the NSLS Server.
      </hostPort>
```

```
      <tmpDir>
         A directory to temporarily hold events when the NSLS Server is
         unreachable (e.g., during a network outage).
      </tmpDir>
    </server>
  </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>
```

3. Server, server-config.xml

This configuration file sets the following:

a) input port for processor;

b) handler class name;

c) output port for client;

d) data directory;

e) log server;

f) log file;

g) log file size;

h) input timeout;

i) Two-line Element (TLE) information;

j) Simulcast ground station information.

```
<serverConfig>
   <log>
     <server>
       <hostPort>
         The host:port of the NSLS Server.
       </hostPort>
       <tmpDir>
         A directory to temporarily hold events when the NSLS
         Server is unreachable (e.g., during a network outage).
       </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" and "terra".
  <"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 the pass error and
delete the pass with no data.  If the value is "no", the Server
will do nothing.  Default is "yes".
</fix>
<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 hort:port to connect to (typically "locahost: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.
                   Linux: If the Java Service Wrapper (JSW) is
                   being used, it will automatically restart the
                   JVM.
                   Windows: Depends on settings on Services control
                   panel.
        exit       The JVM is exited.
                   Linux: This will not cause the JSW to restart
                   the JVM.
                   Windows: Depends on settings on Services control
                   panel.
        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>
```

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

This configuration file sets the following:

a) input port for processor;

b) handler class name;

c) output port for client;

d) data directory;

e) log server;

f) log file;

g) log file size;

h) input timeout;

i) Two-line Element (TLE) information;

j) Simulcast ground station information.

k) Upstream Server information.

```
<serverConfig>
   <log>
     <server>
       <hostPort>
         The host:port of the NSLS Server.
       </hostPort>
       <tmpDir>
         A directory to temporarily hold events when the NSLS
         Server is unreachable (e.g., during a network outage).
       </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>
  <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" and "terra".
  <"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 the pass error and
delete the pass with no data.  If the value is "no", the Server
will do nothing.  Default is "yes".
</fix>
<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.
        <band>
          <bandIndex>
            The band index (0-37 for the MODIS bands).
          </bandIndex>
          <resolution>
            The resolution in meters.
          </resolution>
        </band>
      </bands>
    </partial>
  </upstreamServer>
</upstreamServers>
<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>
<loopbackTest>
  If present, performs a loopback test at a regular interval
  to make sure that the Server can connect to itself.
  <hostPort>
    The hort:port to connect to (typically "locahost: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.
               Linux: If the Java Service Wrapper (JSW) is
               being used, it will automatically restart the
               JVM.
               Windows: Depends on settings on Services control
               panel.
    exit       The JVM is exited.
               Linux: This will not cause the JSW to restart
               the JVM.
               Windows: Depends on settings on Services control
               panel.
    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>
```

5. 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).
        <arguments>
            An argument.
        </arguments>
      </arguments>
    </service>
  </services>
</servicesConfig>
```

Appendix E
Rebuilding Simulcast

Rebuilding for Linux

To rebuild Simulcast on a Linux platform, run the script:

./build.sh

to compile the Java source files and create the simulcast.jar file in the lib directory.

Rebuilding for Windows

To rebuild Simulcast on a Windows platform, run the script:

.\build.bat

while in the .\sc directory to compile the Java source files, and create the simulcast.jar file in the lib directory.