SkyRAN
Element Management System

www.EXFO.com
Telecom Test and Measurement
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Contents

Copyright Information ............................................................................................................ii

1 Introduction ..................................................................................................................1
   Overview .............................................................................................................................1
   Main Features ...................................................................................................................2
   Conventions .....................................................................................................................4

2 Getting Started .........................................................................................................5
   Logging on to SkyRAN EMS ..........................................................................................5
   Navigating .......................................................................................................................7

3 User Management .......................................................................................................11
   Administration Console ................................................................................................11
   Realm Settings ...............................................................................................................13
   Roles ................................................................................................................................13
   Managing Users .............................................................................................................14
   Managing Groups ..........................................................................................................25
   User Federation .............................................................................................................26

4 Configuring SkyRAN Topology ................................................................................31
   Configuration Solutions ...............................................................................................31
   Defining Diagrams .........................................................................................................33
   Defining Sites .................................................................................................................39
   Managing RTUs .............................................................................................................44

5 Managing Optical Routes ........................................................................................47
   Defining Cable Segments .............................................................................................47
   Defining Optical Routes ...............................................................................................49
   Defining Test Setups ..................................................................................................51

6 Managing RF Links .....................................................................................................53
   Defining RRH .................................................................................................................53
   Defining RF Links .........................................................................................................54
   Defining RF Test Setups ...............................................................................................56

7 Testing Network Elements ........................................................................................57
   Entering an Interactive Session ...................................................................................57
   Performing a Test on Demand .....................................................................................58
   Performing an iOLM Ad Hoc Test .............................................................................58
8 Managing Results ........................................................................................................ 59
   Viewing RF Results .................................................................................................. 59
   Viewing iOLM Results ........................................................................................... 61
   Viewing Status on Topology .................................................................................. 63

9 Maintenance ............................................................................................................. 65
   Updating RTU Software .......................................................................................... 66

10 Troubleshooting ..................................................................................................... 67
   Contacting the Technical Support Group ............................................................... 67
   Viewing User Documentation ............................................................................... 68

Index .......................................................................................................................... 69
1 Introduction

Overview

EXFO’s SkyRAN solution is a physical layer monitoring management system. It provides a fronthaul remote access testing solution for real-time, on-demand testing, and 24/7 monitoring of the RF (radio frequency) spectrum and optical fiber networks. SkyRAN includes RF monitoring, macro and C-RAN (Centralized/Cloud-Radio Access Network) optical switch expansion, automatic PIM (Passive Intermodulation) detection, and CPRI™ (Common Public Radio Interface) rates up to option 7 (9.8 Gbit/s).

SkyRAN is ideal for today’s macro cell sites with compact 1U rackmount chassis and is easily scalable to address tomorrow’s large C-RAN hubs. As a server-based solution, it delivers network-wide visibility of the mobile spectrum and provides MNOs (mobile network operators) performance, flexibility, and scalability. Significant savings in cost and time can be achieved through the following:

- Eliminating unnecessary travel time to remote or hard-to-reach cell sites.
- Minimizing troubleshooting time.
- Pinpointing the exact location of fiber network issues along the fiber span.
- The solution is future-proof to support higher CPRI rates and NGFI (next-generation fronthaul interface) protocols.
Main Features

RF Spectrum Analysis over CPRI

➤ Quickly and easily identifies any type of RF interference and PIM issues with OpticalRF—the industry’s most powerful real-time, highest resolution RF spectrum analysis over CPRI.

➤ In monitoring or test on-demand mode, SkyRAN automatically detects and identifies any type of RF interference and PIM issues.

➤ Simultaneously displays up to four antenna carriers (AxCs) for quick identification of antenna diversity imbalance or implied PIM issues.

Fiber Characterization

➤ SkyRAN delivers best-in-class fiber monitoring thanks to its patented OTDR (optical time domain reflectometer)/iOLM (intelligent optical link mapper) technology and Link-Aware™ technology.

➤ iOLM application uses advanced algorithms to pinpoint the exact locations of fiber faults, 85% faster than the traditional OTDR approach.

➤ Two modes of operation: on-demand testing and monitoring of the fiber links.

Field Portable and Rackmount Solutions

➤ Seamless transition from field portable to remote solution—bringing workforce efficiencies to the forefront.

➤ Same RF spectrum analysis capability on either a portable test unit or rackmount solution.

➤ No learning curve from field to desk.
Network Visibility

- SkyRAN provides a server-based solution delivering visibility across fronthaul networks.
- Fronthaul network health status at the RF and fiber levels.
Conventions

Before using the product described in this guide, you should understand the following conventions:

**WARNING**
Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Do not proceed unless you understand and meet the required conditions.

**CAUTION**
Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. Do not proceed unless you understand and meet the required conditions.

**CAUTION**
Indicates a potentially hazardous situation which, if not avoided, may result in component damage. Do not proceed unless you understand and meet the required conditions.

**IMPORTANT**
Refers to information about this product you should not overlook.
2 Getting Started

This chapter provides information on accessing SkyRAN EMS (element management system) as well as navigating the user interface.

Logging on to SkyRAN EMS

It is typically the system administrator who specifies the login names and passwords for the users when creating them. All the procedures and information presented in this user guide are intended for a user that has administrator rights.

To reach an EMS application over the LAN, you should enter the address provided by your organization. For example, https://skyran.internal.yourorganization.com, where skyran.internal.yourorganization.com is the EMS address. You can create a link on this browser to server address, to make the access easier and faster.

The EMS application can only be accessed on a secured connection. All the data, including user names and passwords are sent in an encrypted form. This ensures data security while accessing the application.
**Getting Started**

*Logging on to SkyRAN EMS*

---

**To log onto SkyRAN:**

Before logging onto the system, ensure that EXFO technical support has created an administrator account with the proper access rights to create SkyRAN users.

1. Double-click the icon located on the desktop.

   The SkyRAN **Log in** screen is displayed.

2. Enter your **Username or email** and **Password**.

3. Click **Log in** to enter.

   After a successful login, the SkyRAN Topology view is displayed.
Navigating

The SkyRAN solution supports the integration of both OpticalRF and iOLM measurement capabilities provided by the RTU-2. Platform control, configuration, and test result management is done by the SkyRAN EMS. Real time analytics are provided by Xtract.

Once logged on, a general section on the right of the header gives access to your Account including the Logout function and an Information menu.

SkyRAN has a menu structure that enables you to access the functions of the system and easily navigate the following Applications:

- **Topology** provides an overview of the network under test using the physical inventory. Integrating with the internal system through identifiers, this application allows you to prepare to monitor.

- **Users** opens the Keycloak user management admin console login page.

Upon minimizing the full desktop screen, click on the menu bars to the left of EXFO to access the drop-down items:
User Account Management

With the **Account** function, you can edit your information, change your password, and view your sessions. Clicking on the **Account** tab opens the following **Edit Account** page:
Password

Clicking on the Current Password tab opens the following Change Password page:

Information

The information panel consists of the following data:

- EXFO address and technical support contacts
- Current application name, version and copyright information
- Access to user guides
- Date and time
The Fiber console module is an open-source enterprise-class Identity and Access Management (IAM) solution which EXFO has customized and integrated to its Fiber Guardian products. It offers simple, secured, and extensive authentication and auditing functions. As a user in a centrally managed installation, you are now authenticated through a single sign-in/out instance which can itself be connected to your existing LDAP (Lightweight Directory Access Protocol) service. For centrally managed solutions, it means one log-on to move from one application (e.g. central) to another (e.g. local).

**Logging In**

*To log in to the Admin Console:*

2. To access the console, use the **Users** menu item in the navigation bar once logged in.
3. Enter your **Username or email** and **Password**. The user Admin Console page opens.

**Note:** If you are curious about a certain feature, button, or field within the Admin Console, hover your mouse over the question mark ? icon. This will pop up tooltip text to describe the area of the console you are interested in.
Realm Settings

A realm manages a set of users, credentials, roles, and groups. A user belongs to and logs into a default realm named fiber, display name SkyRAN. Realms are isolated from one another and can only manage and authenticate the users that they control. For all standard installs, only one realm is to be used.

Roles

Roles are configured at the realm level and identify a type or category of user. Admin, user, manager, and employee are all typical roles that may exist in an organization. For example, the Admin Console has specific roles which give permission to users to access parts of the Admin Console UI and perform certain actions. There is a global namespace for roles and each user also has its own dedicated namespace where roles can be defined.
Managing Users

If you need to manage a specific user, click on Users in the left menu bar. This menu option brings you to the user list page.

To search for users:

1. In the search box, type in a full name, last name, or email address you want to search for in the user database. The query will bring up all users that match your criteria. The View all users button will list every user in the system. This will search just the local user database and not the federated database (LDAP) because some LDAP does not have a way to page through users.

2. So if you want the users from federated backend to be synced into the user database you need to either:

   2a. Adjust search criteria. That will sync just the backend users matching the criteria into the user database.

   2b. Go to User Federation tab and click Sync all users or Sync changed users in the page with your federation provider. See User Federation on page 26 for more details.
To create new users:

1. From the user list page, on the right side of the empty user list, click the Add User button to start creating your new user.

2. Enter the mandatory fields highlighted with an asterisk.
3. Click **Save**. This will bring you to the management page for your new user.

![User Management interface](image)
The user management page allows you to manage and view user information, by selecting the desired tab.

- The **Details** tab displays all the data relevant to the user, including the following:
  - **User Type** (not applicable to SkyRAN) is either **Regular User** or **Customer**.

  **Regular User** refers to a person who uses the system to provide Quality of Service (QoS) data for the customer. Regular users do not receive alerts according to the fault position, as they are not associated with the optical route sections. However, they receive alerts for each alarm defined in the alarm type.

  **Customer** refers to an individual, a partner, an association, a joint stock company, a trust, a corporation, or a governmental entity that subscribes to telecommunications services offered by the company operating the SkyRAN system. Customers are different from regular users because they cannot access the system (neither EMS nor RTU) through the administrative workstation (AW) but can receive alerts and automatically generated reports through emails. However, they are mostly interested in faults that occur on the sections of an optical route that belong to them. Thus, different customers can be defined for different sections of each optical route.

**Note:** If you are not part of a region in which the RTU is located, you will not see the alarms coming from that RTU as well as the status and the results associated. You will not be able to access that RTU and change its configurations.

- **Time Zone** is the preferred time zone used to display the date and time.
- **Language** is the preferred language for the user interface: English.
Units can be either Metric or Imperial.

Mobile Number is the number of the user’s mobile device.

 Trap receiver address (not applicable to SkyRAN) is for the RTU (remote test unit) only. The default is the manager IP address/DNS name of the SNMP manager. You can change the value when you configure a user. For existing users, this value is configured under Configuration > Host > Northbound Settings > SNMP.

 HTTP post URL (not applicable to SkyRAN): Parameters in a post are either in the body (default) or directly in the string. You can also have parameters in the string like this: https://example.com/page?parameter=value&also=another.

Include the names of the desired fields with a $ in front. For example,
https://example.com/page?param1=$FaultGroupDate&param2=$Position. In this example, the values of FaultGroupDate and Position would go in param1 and param2.

Available values are as follows (case insensitive):

FaultIdOnRtu, FaultResultIdonRTU, FirstReferenceIdonRTU, LastLearningIdonRTU, FaultType, Confirmations, Position, MinPosition, MaxPosition, Loss, ThresholdType, ThresholdValue, AppliedThreshold, EventType, OpticalRoute, TestSetupId, TestSetupName, TestType, RTUName, RTUIP and OTDRSerialNumber.
User Management

Managing Users

➤ **User Interface Access** (not applicable to SkyRAN) allows you to select **ON** or **OFF** for the following:

- **AW** (administrative workstation) which is required to view the EMS web interface.
- **RTU** (remote test unit) for access from the EMS.
- **MOBILE** for mobile app access.

➤ **User Rights for RTU** (not applicable to SkyRAN) is **View** or **Edit**, allowing you to grant viewing or editing rights for the RTU application.
Credentials are pieces of data that are used to verify the identity of a user. Examples are passwords, OTP (one-time-passwords), digital certificates, or even fingerprints. This tab allows you to create, disable, and reset passwords.

To change a password:

1. Enter a new password. A Reset Password button will pop up that you click, after you’ve typed everything in. If the Temporary switch is ON, this new password can only be used once and will need to be changed after login.

2. Alternatively, if you have email set up in Realm Settings, you can send an email to the user that asks them to reset their password. Choose Update Password from the Reset Actions list box and click Send email. The sent email contains a link that will bring the user to the update-password screen.
3. Like passwords, you can send an email to the user that asks them to reset their OTP (one-time password) generator. Choose **Configure OTP** in the **Reset Actions** list box and click the **Send email** button. The sent email contains a link that will bring the user to the OTP setup screen.

**Required Actions**

Required actions are tasks that a user must finish before they are allowed to log in. A user must provide their credentials before required actions are executed. Once a required action is completed, the user will not have to perform the action again. Here are explanations of some of the built-in required action types:

- **Update Password**: When set, a user must change their password.
- **Configure OTP**: When set, a user must configure a one-time password generator on their mobile device using either the Free OTP or Google Authenticator application.
- **Verify Email**: When set, a user must verify that they have a valid email account. An email will be sent to the user with a link they have to click. Once this workflow is successfully completed, they will be allowed to log in.
- **Update Profile**: This required action asks the user to update their profile information, i.e. their name, address, email, and/or phone number.
Admins can add required actions for each individual user within the user’s **Details** tab in the Admin Console.

- User **Role Mappings** can be assigned individually to each user and defines a mapping between a role and a user. A user can be associated with zero or more roles. This role mapping information can be encapsulated into tokens and assertions so that applications can decide access permissions on various resources they manage.

**Roles** are configured at the realm level. For more information, see **Roles** on page 4.
Groups manage groups of users. Attributes can be defined for a group. You can map roles to a group as well. Users that become members of a group inherit the attributes and role mappings that group defines.

Select a group from the Available Groups tree and click the Join button to add the user to a group. Vice versa to remove a group. If you go to Groups and the detail page for that group, and select the Members tab, the user list has been updated.
**Sessions** are created when a user logs in. A session manages the login session and contains information like when the user logged in and what applications have participated within single-sign on during that session. Both admins and users can view session information.
Managing Groups

Groups allow you to manage a common set of attributes and role mappings for a set of users. Users can be members of zero or more groups. Users inherit the attributes and role mappings assigned to each group. To manage groups go to the Groups left menu item.

Groups are hierarchical. A group can have many subgroups, but a group can only have one parent. Subgroups inherit the attributes and role mappings from the parent. This applies to the user as well. So, if you have a parent group and a child group and a user that only belongs to the child group, the user inherits the attributes and role mappings of both the parent and child. To add a group, click on the parent you want to add a new child to and click New button. Select the Groups icon in the tree to make a top-level group. Entering in a group name in the Create group screen and hitting Save will bring you to the individual group management page.

Any attributes and role mappings you define will be inherited by the groups and users that are members of this group. To add a user to a group you need to go back to the user detail page and click on the Groups tab there. For more information, see page 23.
User Federation

Users can federate existing external user databases with support for LDAP and Active Directory by using the User Storage SPI. Once you log in, the internal user store searches to find you. If you can not be found, an iteration over every User Storage provider configured for the realm will be performed until a match is found. Data from the external store is mapped into a common user model that is consumed by the runtime. This common user model can then be mapped to OIDC token claims and SAML assertion attributes.

To add a storage provider:

1. Click on User Federation in the left menu of the Admin Console.
2. Click in the Add provider... list box and choose the desired provider. The configuration page of that provider will open.
LDAP and Active Directory

The user management console comes with a built-in LDAP/AD provider. It is possible to federate multiple different LDAP servers in the same user realm where you can map LDAP user attributes into the common user model. By default, it maps username, email, first name, and last name, but you are free to configure additional mappings. The LDAP provider also supports password validation via LDAP/AD protocols and different storage, edit, and synchronization modes.

Selecting **ldap** as the desired provider from the **User Federation** page will bring you to the LDAP configuration page.
Configuring LDAP Settings

- **Console Display Name** is used when this provider is referenced in the admin console.

- **Priority** denotes the priority of this provider when looking up users or for adding registrations.

- **Edit Mode** allows users, through the User Account Service, and admins, through the Admin Console, to have the ability to modify user metadata. Depending on your setup you may or may not have LDAP update privileges. The Edit Mode configuration option defines the edit policy you have with User Documentation LDAP/AD Integration 314 in your LDAP store.

  - **READ_ONLY** does not allow changes to username, email, first name, last name, and other mapped attributes. An error will be displayed anytime anybody tries to update these fields. Also, password updates will not be supported.

  - **WRITABLE** allows for updates to username, email, first name, last name, other mapped attributes and passwords. All will be synchronized automatically with your LDAP store.

  - **UNSYNCED** allows any changes to username, email, first name, last name, and passwords to be stored in the user local storage. It is up to you to figure out how to synchronize back to LDAP. This allows user deployments to support updates of user metadata on a read-only LDAP server. This option only applies when you are importing users from LDAP into the local user database.

- **Sync Registrations** enables/disables your LDAP adding new users. Click **ON** if you want new users created in the admin console or the registration page to be added to LDAP.

- **Allow Kerberos authentication** allows you to select **ON/OFF** for Kerberos/SPNEGO authentication in realm with users data provisioned from LDAP.
Sync Settings allows you to sync all LDAP users into the user database, by configuring and enabling the following settings:

- **Batch Size** is the number of LDAP users to be imported from LDAP in a single transaction.
- **Periodic Full Sync** will synchronize all LDAP users when ON is selected. Those LDAP users, which already exist and were changed in LDAP directly will be updated.
- **Periodic Changed Users Sync** will update and/or import only those users that were created or updated after the last sync, when ON is selected.

**Storage Mode**

By default, users from LDAP will be imported into the local user database. This copy of the user is either synchronized on demand, or through a periodic background task. The one exception to this is passwords. They are not imported and password validation is delegated to the LDAP server. The benefits to this approach is that all features will work, while any extra per-user data that is needed can be stored locally. This approach also reduces load on the LDAP server as uncached users are loaded from the user database the second time they are accessed. The only load your LDAP server will have is password validation. The downside to is that when a user is first queried, this will require a user database insert. The import will also have to be synchronized with your LDAP server as needed.

Alternatively, you can choose not to import users into the user database. In this case, the common user model that the runtime uses is backed only by the LDAP server. This means that if LDAP doesn’t support a piece of data that a feature needs, that feature will not work. The benefit to this approach is that there is no overhead of importing and synchronizing a copy of the LDAP user into the user database.
4 Configuring SkyRAN Topology

The Topology features are as follows:

- Inventory of sites, cable segments, optical routes, RF links, RTU, RRH
- Threshold control
- Logical diagrams
- REST API

Configuration Solutions

Macro Cell Site Configurations

SkyRAN’s modularity, flexibility, and scalability are designed for macro cell sites where rackmount space is limited. With a 1U rackmount, various RF monitoring port counts are available. The basic SkyRAN system starts at 12 ports using a simplex 12-port optical switch module which is ideal for macro cell sites where 9 to 12 RRHs (remote radio head) are present, supporting 3 to 4 different RF bands.

As new RF bands are added to macro cell sites, SkyRAN can be upgraded to 18 ports by swapping or replacing the optical switch module for a larger simplex 18-port optical switch module. If monitoring uplink and downlink RF spectrum is required, a duplex optical switch module can be installed along with the activation of the second port on the RF spectrum module of the SkyRAN platform.

C-RAN Configurations

There are two types of C-RAN topologies, small and large C-RAN hub sites. In some cases, a macro cell site may be converted to a small C-RAN site where two or more macro cell sites are combined into one. For a small C-RAN site, the total count of fiber links is low (below 50), the fiber spans are short (below 2 km), and point-to-point (using grey optics) is used as the transport mechanism between the BBU (baseband unit) and the RRH.
With large C-RAN hub sites, the total number of links may be in the hundreds with fiber spans between the central BBU location and the remote antenna sites reaching up to 15 km (10 miles). For C-RAN hub sites, the transport mechanism between the BBU and the RRH may use grey optics for point-to-point communication but also colored optics C/DWDM (course/dense wavelength division multiplexing) technology thus reducing the fiber count.

- Small C-RAN hub sites
  
  Port count can be increased (beyond 18 ports) with external $\frac{1}{2}U$ optical switches to address testing and monitoring requirements of small C-RAN architectures. The external optical switch is available in various port densities such as 26 or 52 ports for simplex monitoring (uplink) or duplex 26 ports monitoring (uplink and downlink).

- Large C-RAN hub sites
  
  SkyRAN is designed to address large C-RAN hub site topologies with its on-demand and monitoring test features for the RF spectrum and the fiber network. SkyRAN is capable of monitoring hundreds of links at the RF and fiber level for grey or colored fronthaul transport systems.

  SkyRAN can grow as the C-RAN hub site grows allowing for port count monitoring expansion by stacking external optical switches to increase the number of links to be monitored. SkyRAN external optical switches can be stacked to allow for monitoring of thousands of RF and fiber links. The decision factor of how many ports should be monitored using a single SkyRAN system comes down to desired testing availability (that is, total amount of time required to test each port in a system).
Defining Diagrams

Diagrams allow you to map RTUs and related RRHs as a logical network displaying their relations through RF links and optical routes. With diagrams, you can edit test configurations for both iOLM and OpticalRF.

In order to maintain up-to-date diagrams with relevant views, changes made on the diagram canvas and to the diagram name, description, content, and background are propagated to each connected browser on the diagram. A user session remains active as long as the diagram is kept open. However, upon loss of connectivity, the diagram cannot be updated. A visual indicator is displayed also showing reconnect attempts every 30 seconds.

To manually route links and place sites, SkyRAN allows you to change the visual shape of any link represented on the diagram canvas by adding elbows, thus keeping each link. You can drag sites while maintaining their links or reset the link shape to its default straight shape. The system stores changes made on the shape of any link.

RTUs located within the topology can be accessed based on their location. Optical devices located in a site are listed below cable segments, optical routes, and RF links.
### Diagram Controls

From the Topology Home page, diagrams can be added or listed from the **Diagrams** drop-down menu. Additional actions can be accessed from the top right corner of a selected diagram: Edit, Delete, Copy. See *Structuring Diagrams into a Dashboard* on page 36.

Adding a diagram opens the edit pane docked on the bottom of the window:
Topology Object Summary

Each optical device is listed by name, type, and model. The topology object summary displays the following.

- For a given RTU:
  - RTU name
  - model and serial number
  - network address IPv4 and IPv6
  - total number of effective ports, RF Links, and Optical Routes.

- For a given site:
  - site name and level
  - address
  - latitude and longitude.

- For a given optical route: the optical route name.

- For a given optical route linked to a RTU:
  - the RTU with its name
  - manufacturer
  - model
  - attach state of the optical route with the RTU.

Connection to an RTU enables linking to it and opening its summary when available in the current diagram. Otherwise the system indicates the absence of an RTU in the diagram and suggests opening the edit panel instead.

Attach state shows attached when both the RTU and the link (either RF link or optical route) is attached. Otherwise, the state is unattached.
Configuring SkyRAN Topology

Defining Diagrams

The topology presents the type of action available depending on your role in it. For example, the call to action can be either edit or view in the object summary.

**Structuring Diagrams into a Dashboard**

The diagram dashboard is the first view of the topology application after logging in. The diagram section in the application has a menu that enables you to create a diagram or to return to the dashboard of diagrams. In order to use the topology as a centralized dashboard, the diagram displays a summary of all alarms for optical routes and RF links, and allows you to access each attached RTU.

Each diagram is shown in a tiled list that includes its name, an additional actions menu, and the diagram background image. The tiled list is adaptable to mobile and small displays. Accessing the logical view of a diagram is made when clicking on a diagram tile outside of the additional actions menu.

Additional actions of a diagram are as follows (*not* for read-only access):

- **Edit**: opens the edit panel at the bottom of the screen in the specific diagram context. If you have read only access, Edit is replaced with Details.
- **Copy**: creates a copy of the diagram appending *Copy* to the name. If duplicate copies are made, an incremental number is added. When the copy is done, the diagram list displays the new diagram with a slight yellow tiled background color. This lasts until another action is performed (delete, edit, copy, or access logical view).
- **Delete**: erases the diagram without removing the content itself. A confirmation (Yes/No) is required when prompted. After deletion, the tiled list is updated.
You can include a background image in the diagram so sites can be viewed within a regional context. Images are limited to a maximum of 5000 pixels for either width or height and you will be warned about longer diagram loading times when the uploaded image is larger than 500 kbytes. Supported formats are: GIF, JPG, and PNG.

**Editing a Logical Network Diagram**

Edit capabilities are only enabled to users having the Topology Master role. Changes to the content of a diagram, such as the topology object, its position on the canvas, and the visual properties of the links, are automatically saved. Edits are saved immediately limiting the chances of a concurrency validation failure.

Concurrent changes from multiple users are identified by a version indicator where a higher version suggests that the diagram was modified by another user. Prior to saving changes, the concurrency validation elects a winner and loser where the winner has a higher version indicator. So that when a diagram is saved and that action is concurrent to another save action, the loser is shown a message indicating that the last changes made on the diagram were lost.

Background diagram update is implemented as soon as there are changes performed by another user. When you begin editing the diagram, no updates are implemented until they are saved and pending (or not yet processed) updates are cancelled. When you discard changes while editing (for example, cancelling a site), the diagram is updated immediately.

The topology object name and properties remain as is unless a diagram update provides new objects where only unknown objects are obtained. A manual update will update the diagram itself and all its contained topology object properties.

If loss of connectivity with the topology server occurs while trying to update, you will be alerted as no updates can be performed. When connectivity returns, the diagram will automatically be updated thus
resuming the edit capabilities. A manual diagram update will update the connectivity loss status. The date and time since the last update is also shown.

**Automatically Structure Sites and Links**

Given a diagram without a visual representation of its contents, SkyRAN performs an auto-layout of sites and links (cable segments, optical routes, RF links) preserving the automatically-created diagram’s visual representation. This function greatly simplifies the diagram layout.

The system allows you to reset the visual aspect of a diagram through automatic layouts without losing its content. You can edit the visual disposition of the topology objects in the canvas, once the auto-layout is performed, by dragging objects. Auto-layout is only available to users having the Topology Master role.
Defining Sites

Sites can be created in Topology in order to define the look of the network before the inventory is created or available. When a site is created in the topology, the defined default site’s attributes are graphically updated when saved. Sites can be added directly on the diagram canvas itself and their position on the canvas saved.

To add a site:

1. Access the Edit function by clicking on an Active Diagram.
2. Select Site from the Edit drop-down menu.
3. Click once anywhere in the diagram canvas to create a site.
4. Enter Site Name in the text box.
5. Press Enter to confirm.
Configuring SkyRAN Topology

Defining Sites

Adding a site on the diagram canvas also creates a site in the topology and is added automatically to the diagram content. The site name is mandatory otherwise the site cannot be created.

Mandatory properties are identified for editing purposes. Invalid properties display a message and a distinctive characteristic that indicate their validity state. When saving, validation messages are displayed for any invalid property even those that are not currently visible. When navigating away from a changed edit panel for actions such as context change, you need to agree to either losing the changes or staying in the panel.
In addition to name and description base properties, the following site properties are editable:

- **Site level** - list of site level names available on the system.
- **Address** - including civic address.
- **Managed by** - name of the person or organization responsible for the site.
- **Latitude** - in decimal notation, between -90 to +90.
- **Longitude** - in decimal notation, between -180 to +180.

*Note:* Both latitude and longitude properties become mandatory when either is filled.

- **Altitude** - in meters, between -1000 to 8000.
- **Altitude mode**
  - Clamp to ground
  - Relative to ground
  - Absolute

When both latitude and longitude are filled, altitude has a default value of 0 and altitude mode is automatically set to **Clamp to ground**.

Changes in the details tab are saved when the save action is performed for the site. Changes in the site name or level are shown on the diagram view when the edited site is part of that diagram.

- Each optical device located in a site is listed with the following common optical device properties:
  - **Name** - of the optical device displayed as a hyperlink. It links to the edit panel of the device.
  - **Optical Device Type** - complete optical device type name. For example, Remote Test Unit, Patch Panel, etc.
  - **Model** - of the optical device.
Configuring SkyRAN Topology

Defining Sites

- Status - of the optical device. N/A when no status available.
- Details - list of additional specific properties based on each different optical device.

- An RTU optical device has the following properties:
  - Serial Number
  - Ports
  - Optical Routes
  - Network Address

All other optical devices have only a Ports property. Absence of any optical device in a site displays the empty state information.

- Each cable segment having the current site at one of its ends is listed with the following properties:
  - Name - of the cable segment displayed as an hyperlink.
  - Physical Length - of the cable segment in meters.
  - Fiber Count - fiber strand count.
  - Site - located at the other end (not the current site) displayed as a hyperlink linking to the edit panel of that site.

- Each optical route that passes through the current site is listed with the following properties:
  - Name - of the optical route displayed as an hyperlink. It links to the edit panel of that optical route.
  - Remote Test Unit - named on which the optical route is linked displayed as a hyperlink. It links to the edit panel of that optical device. N/A when not linked.
  - Connection - list of local RTU ports that connect to the Optical Route.
Configuring SkyRAN Topology

Defining Sites

- Status - last status on the optical route; N/A when no status and Not Linked when not linked to RTU.

- Last test - number of minutes since the last test; N/A when not available.

Optical routes related to a site are the routes that have a relationship with at least one cable segment linked to the current site. Absence of any optical route related to the site displays the empty state information where a specific message will direct you on how to link an optical route to a site.
Managing RTUs

SkyRAN allows you to specify where RTUs are located in order to position the monitoring point of origin. You can add an RTU by name in the topology directly from the selected site where the RTU is located. The list of RTU models include EXFO RTU-2 and once saved, the model is read-only along with the displayed site location. Interaction with the canvas when adding an RTU is similar to adding a site. See Defining Sites on page 39.

Attaching an RTU

SkyRAN allows you to attach a logical RTU with serial number to a discovered RTU. Additional data edits are allowed. The system lists changes performed on the RTU configuration during the attach process for the following cases:

- Modules added are described as discovered, and module model and serial number are displayed, as well as the port count for the switch
- Modules matched are described as changed with the same details as added modules
- Modules unmatched by the attach process are listed as such with the same details

Supporting RTUs

In order to view RF performance, you can view and access the RTU-2 configuration and the optical ports capacity of the device. RTU edits for the RTU-2 model allow adding modules to its configuration when the RTU is not attached.

- The following RTU-2 modules are editable:
  - FTBx-8870 - OpticalRF
  - FTBx-730C-SM7 - iOLM
Configuring SkyRAN Topology
Managing RTUs

- FTBx-730C-SM7-TAM - iOLM
- FTBx/RTUe-9110 - Optical Switches

Optical switch modules allow the number of ports and channels to be set. Number of ports is an integer from 0 to 999 (inclusive).

- An attached RTU prevents adding a module.
- Modules matched to an attached RTU are read-only.

The following additional features are supported:

- Manual ordering of RTUe-9110 modules on the RTU even when attached.
- Module interconnectivity is defined through either optical routes or RF links.

Access to all optical routes and RF links related to a given RTU is available with the following details:

- Optical route or RF link name
- Connected instrument module
- Status
- Alarm
- Time since last measurement, N/A when not available
- Access to open the last measurement.
Managing Optical Routes

Defining Cable Segments

When a fiber fault occurs, it is necessary to be able to define the cable segments in a network.

**To create a cable segment from the diagram canvas:**

1. Select an origin site.
2. Select a destination.
3. Select End Site to confirm the end of your cable segment.

The cable segment is displayed as a line between each site name, and named using the first selected site name. You can define these segments similarly to defining a diagram. See Defining Diagrams on page 34.

In addition to common properties defined in the common edit panel, cable segments consist of the following optional properties:

- Fiber Count - min: 0, max: 1000
- Optical Power Budget - min: 0, max: 100
- Helix Factor - min: 0, max: 100

Cable segment slacks located from the near and far sites are configurable with the following properties:

- Position from site either near or far - min: 0, max: 1000000 - Default: 0
- Length of the slack - min: 0, max 1000000 - Default: 0

Main cable lengths which serve to specify the physical length property of the cable segment are: min: 0, max: 1000000 - Default: 0
Managing Optical Routes

Defining Cable Segments

Based on the addition of all the following values, the physical length of a cable segment is calculated as soon as any of these are changed:

► Main cable length
► Slack position from near/far site
► Slack length from near/far site

A list of optical routes related to the cable segment is shown with the following properties:

► Name
► RTU name on which the optical route is connected to
Defining Optical Routes

Optical routes can be similarly edited and consist of the following properties:

- Remote Test Unit - Optional
- Average Helix Factor - min: 0, max 100 - Optional
- Test Ready - Default: true
- Type - Value domain: Dark, Live - Default: Dark
- Physical Route ID - Optional
- External NMS Field 1/2 - Optional

All cable segments linked to a given optical route are listed in a specified order. Each segment has the following properties:

- Name
- Physical length
- Order or the cable segment in the optical route
- Optical Power Budget
- Fiber count

You can select the RTU when assigning an optical route.

Note: All defined RTUs are available irrespective of their presence in the diagram.

Given an assigned RTU, port selection is performed for the optical route and includes all defined optical switch modules. Each one is described with its model name, effective port count, and serial number. The FTBx module form factor is shown first. Ports already assigned are not available for selection as an optical switch module can only be assigned once. Order of selection indicates the connectivity order between each optical switch.
You can select an optical route and command an ad hoc test directly from the topology diagram. You can also command the test from the optical route edit panel. Once accepted by the RTU, you will be informed of the request status.

**Drawing Optical Routes and Cable Segments**

A line represents the optical route.

*To create an optical route from the diagram canvas:*

1. Select a first site.
2. Select and confirm the end site.

The name of the optical route is generated from the names of the first and last sites. You can change the name before creating the optical route. When linking an optical route, the system determines the shortest path with the fewest cable segments between first and last sites. If no path exists, SkyRAN will create the missing cable segment.

**Configuring an Optical Route**

When configuring an optical route, the following selection of live fiber types are available:

- Dark
- Live / TAM - when measuring through a filtered Test Access Module.
- Live / TAP - when measuring live fiber without a filtered TAP.

The status of an optical route or an RF link is provided with the following information:

- Inactive - when unattached to the RTU. Displayed as Inactive.
- Irregular - when attached and no test setup is enabled to monitor. Displayed as *not* monitoring.
- Active - when attached and at least one test setup is enabled to monitor. Displayed as monitoring.
Defining Test Setups

SkyRAN allows you to define an iOLM test for a specific optical route so that its behaviour can be set regarding schedule and test specific settings. You can add, change, and remove multiple test setups for a single optical route. When creating a test setup, a name is generated by using the related optical route or RF link name and adding test setup to the end. A given test setup can be enabled/disabled from round robin monitoring.

A list of predefined cabling thresholds can be customized for the specific test setup and saved. Deviation threshold edits are provided for the following:

- Link IL deviation - min: 0.1, max: 10, default: 2 dB
- Element IL deviation - min: 0.1, max: 5 dB, default: 1 dB

Link Loss Deviation is the difference of total link loss between the current and baseline measurements.

Element Loss Deviation is the difference of loss of the link element between current and baseline measurements.
Managing RF Links

Defining RRH

In order to launch tests using the OpticalRF application, SkyRAN identifies and profiles each RRH (remote radio head) located on antenna sites. You can add an RRH name in a similar manner as adding a site. See Defining Sites on page 39. For a given RRH, the topology object summary displays the RRH name.

Editing is available only to users with proper authorization. Others can access the edit panel in read-only mode. The following RRH properties may be specified:

- Azimuth - decimal degrees, min 0, max 360. Default is empty.
- Tilt - decimal degrees, min 0, max 180 - optional. Default is empty.

The topology defines a list of all RRHs. When deleting an RRH, the corresponding RF link is automatically deleted.
Defining RF Links

An OpticalRF test can be launched by associating one RTU and RRH with an RF link. It can be defined as simplex or duplex. Configuration changes are only authorized for users having the Topology Master role.

SkyRAN specifies the RF link with the RRH name keeping the name in sync. It requires an RF link to be associated with an instrument module port when linked to the RTU and when attaching the RF link to the RTU.

An RF link is defined by the following actions:

- Associate an RF link with an RTU module supporting OpticalRF as the instrument module.
- Link an optical switch module and its ports to an RF link.

SkyRAN carries out the following actions:

- Pushes an RF link configuration on the RTU when a link is attached to the RTU.
- Completes an RF link configuration change upon confirmation from the RTU.
- Deletes an attached RF link when the RTU confirms the change in the configuration.
- Provides a success or failure status of the RF link configuration change after applying it on the RTU.
Drawing RF Links on the Canvas

An RF link can be created inside the same site, through the diagram by selecting an RTU and an RRH at each end of the link. Edits are made in the common edition panel with the RTU and local port selection.

An RF link drawn on a logical diagram supports the following features:

➢ Linked RTUs and RRHs are displayed on the same site related to each other.

➢ A single RRH cannot be linked to multiple RTUs.

➢ The topology object summary displays the RF link name.

➢ For a given RF link, either connected to an RTU or through an RF link to an RTU, the topology object summary displays the connection to the RTU with its name, manufacturer, model, and attach state with the RF link with the RTU.
Defining RF Test Setups

A test setup is related to an OpticalRF monitoring configuration. SkyRAN allows you to apply multiple test setups per RF links including creating, changing, and removing them. Write capabilities are only enabled to users having the Topology Master role.

- Test setups are associated with RF links having the following properties:
  - Test duration - integer in seconds, min: 3, max: 99999, mandatory, default: 10; represents a minimum test duration to enable long running tests.
  - Monitoring is enabled - true, false, mandatory - default: true.
  - Name - text, max length: 250 characters, mandatory
  - Description - text, optional

- A given test can be enabled/disabled from round robin monitoring.
7 Testing Network Elements

Entering an Interactive Session

SkyRAN allows you to open an interactive session by getting the RTU address and providing it to the local application supporting the interactive session on your computer. The RTU must acknowledge the session request in order to continue.

Initiation with an RTU occurs when selecting an RRH or RF link and when no other interactive session is currently active. At the same time, you can select another RRH or launch a session for an RF link and related test setup. However, if no test setup exists for the selected RF link, a session cannot be started.

SkyRAN informs you if a session is already active with another user. The session is maintained until you either end it through the topology UI or close the browser. You must confirm the start of an interactive session only in the absence of an active one. The system tracks the user starting the session and the time started.

A visual indication of the ongoing session displays the connected RTU and selected RRH. The first and last name of the user in the topology object summary for both RTU and RRH is displayed to identify who is currently in the session with a specific RTU, as well as when the session was started.
Performing a Test on Demand

By specifying a test setup, a TOD (test on demand) can be performed on an optical route. Each test requested is tracked and a notification is sent to the specific user once the test has completed or the request has failed. Every result produced by the RTU is kept in result storage.

Performing an iOLM Ad Hoc Test

To perform an iOLM ad hoc test:

1. Select an optical route from the topology diagram.
2. If desired, select a cabling threshold from the predefined list of P/F Thresholds Template.

Note: The cabling threshold selection is optional.

3. Click on the Ad Hoc Test button. Once accepted by the RTU, you will be informed of the request status.
Managing Results

Historic data results are displayed for each RF link and optical route. They are made during monitoring and tests on demand on RF links, and TOD (test on demand) and ad hoc tests requested on a specific optical route.

Results are listed with the following acquisition types:

- baseline
- ad hoc test
- test on demand
- monitoring with deviation

Results are loaded dynamically and are ordered by date with descending order starting with the latest result. Use the appropriate viewer from the result list to view your results.

Viewing RF Results

OpticalRF results are listed as follows:

- Alarm statuses:
  - LOS/LOF
  - Link Down
  - PIM
  - RF power
- Acquisition type:
  - Interactive
  - TOD
  - monitoring
- Date
- Link to measure
Managing Results

Viewing RF Results

A measurement acquisition date is displayed in relation to a user's time zone. Measurement distance values are displayed based on your unit’s preferences in either metric (km) or imperial (kft).

SkyRAN sets the RF link alarm based on the presence of the alarm in the latest measurement.

The following alarm states are supported for an RF link:

► N/A - no monitoring performed
► Actively monitoring without PIM and RF power alarm statuses - last measurement PASS
► Actively monitoring with either PIM or RF power alarm status - last measurement FAIL

OpticalRF results made by an RTU are associated to an RF link. Its status in the context of an RTU will be provided. Refer to the OpticalRF for SkyRAN user guide.
Viewing iOLM Results

When a test is completed, a toast will appear beside the requested test in the list of diagrams. To get the results, click the link to open a modal window with the appropriate viewer. Refer to the iOLM Viewer user guide for more information.

iOLM results are listed as follows:

- Deviation verdict as Alarm
- P/F verdict (cabling)
- Acquisition type: baseline, ad hoc, TOD, monitoring
- Date
- Link length/loss
- Deviation loss/position
- Measurement links and a baseline when applicable

The related iOLM baseline can be opened when the result category is either Test On Demand or Monitoring. Refer to the iOLM Viewer user guide.

Setting and Maintaining the Topology Object

SkyRAN associates deviation verdicts received from the RTU with the optical route alarm in the topology. The following alarm states are supported for an optical route:

- N/A - no monitoring performed
- Actively monitoring without deviation - last measurement that gave a deviation verdict of PASS
- Actively monitoring with deviation - last measurement that gave a deviation verdict of FAIL
Managing Results

Viewing iOLM Results

The optical route or RF link alarm is updated with either a monitoring test or a test on demand. The status and alarms to be applied are supported on linked objects such as:

- Optical route alarm applied to linked cable segments
- RF link status and alarm applied to linked RRH

Given multiple optical route alarms for the same cable segment, a single cable segment alarm is applied as follows:

- All linked optical routes are unattached - N/A
- At least one optical route is monitoring without deviation while other optical routes are not attached - PASS
- At least one optical route has a deviation while other optical routes are either without deviation or not attached - FAIL

The alarms of each RTU’s measured optical routes and RF links can be summarized. When updating the object alarm with the last measurement, the following information is included:

- Timestamp to be displayed as ISO8601
- Alarm state
- Test setup on which the alarm was detected (if any)

Results made by an RTU associated to an optical route can be listed. As well, its status in the context of an RTU will be provided.
Viewing Status on Topology

Invalid fields are displayed with a red border and a red message beneath containing the cause of the status. The red border enables you to quickly see the cause of the failure.

Statues are also displayed on the topology diagram for the following:

➤ Loss of connectivity with the topology server while trying to update and when connectivity returns.

➤ Each optical device located in a site.

➤ Each optical route that passes through the current site.

➤ RF links related to a given RTU.

➤ An ad hoc test once accepted by the RTU.

➤ Alarms

➤ OpticalRF results made by an RTU associated to an RF link.
9 Maintenance

To help ensure long, trouble-free operation:

➤ Always inspect fiber-optic connectors before using them and clean them if necessary.

➤ Keep the unit free of dust.

➤ Clean the unit casing and front panel with a cloth slightly dampened with water.

➤ Store unit at room temperature in a clean and dry area. Keep the unit out of direct sunlight.

➤ Avoid high humidity or significant temperature fluctuations.

➤ Avoid unnecessary shocks and vibrations.

➤ If any liquids are spilled on or into the unit, turn off the power immediately, disconnect from any external power source, remove the batteries and let the unit dry completely.

**WARNING**

The use of controls, adjustments and procedures, namely for operation and maintenance, other than those specified herein may result in hazardous radiation exposure or impair the protection provided by this unit.
Maintenance

Updating RTU Software

By registering your new EXFO products either online or directly from your unit (if it is connected to the Internet), you will always be notified of the latest software updates. Refer to the RTU-2 SkyRAN Platform user guide for information on Product Registration and Upgrading the Applications.
10 Troubleshooting

Help options for SkyRAN are available on the Help menu.

Contacting the Technical Support Group

To obtain after-sales service or technical support for this product, contact EXFO at one of the following numbers. The Technical Support Group is available to take your calls from Monday to Friday, 8:00 a.m. to 7:00 p.m. (Eastern Time in North America). All inquiries regarding service, calibration and technical assistance should be directed to the Customer Service department:

Technical Support Group
400 Godin Avenue
Quebec (Quebec) G1M 2K2
CANADA
1 866 683-0155 (USA and Canada)
Tel.: 1 418 683-5498
Fax: 1 418 683-9224
support@exfo.com

For detailed information about technical support, and for a list of other worldwide locations, visit the EXFO Web site at www.exfo.com.

If you have comments or suggestions about this user documentation, you can send them to customer.feedback.manual@exfo.com.
Viewing User Documentation

Help on using the features in SkyRAN is available on the user interface in a PDF format.

To view the documentation:
1. On the Help menu, click About.
2. Select the Documentation tab, click skyran_user_manual.pdf.

Note: If you do not already have Adobe Acrobat Reader to view the PDF documents, or if you have an older version installed, you can download it directly from the Acrobat Web site.
### Index

<table>
<thead>
<tr>
<th>Index</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td></td>
</tr>
<tr>
<td>account management</td>
<td>8</td>
</tr>
<tr>
<td>after-sales service</td>
<td>67</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td></td>
</tr>
<tr>
<td>caution</td>
<td></td>
</tr>
<tr>
<td>of personal hazard</td>
<td>4</td>
</tr>
<tr>
<td>of product hazard</td>
<td>4</td>
</tr>
<tr>
<td>cleaning</td>
<td></td>
</tr>
<tr>
<td>front panel</td>
<td>65</td>
</tr>
<tr>
<td>conventions, safety</td>
<td>4</td>
</tr>
<tr>
<td>copy</td>
<td>36</td>
</tr>
<tr>
<td>CPRI</td>
<td>2</td>
</tr>
<tr>
<td>C-RAN</td>
<td>1, 31</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td></td>
</tr>
<tr>
<td>dashboard</td>
<td>36</td>
</tr>
<tr>
<td>delete</td>
<td>36</td>
</tr>
<tr>
<td><strong>E</strong></td>
<td></td>
</tr>
<tr>
<td>edit</td>
<td>36, 37</td>
</tr>
<tr>
<td>EMS</td>
<td></td>
</tr>
<tr>
<td>login</td>
<td>5</td>
</tr>
<tr>
<td><strong>F</strong></td>
<td></td>
</tr>
<tr>
<td>fiber</td>
<td>2</td>
</tr>
<tr>
<td>front panel, cleaning</td>
<td>65</td>
</tr>
<tr>
<td>fronthaul network</td>
<td>3</td>
</tr>
<tr>
<td><strong>I</strong></td>
<td></td>
</tr>
<tr>
<td>information</td>
<td>9</td>
</tr>
<tr>
<td>iOILM</td>
<td>2, 7, 33</td>
</tr>
<tr>
<td><strong>L</strong></td>
<td></td>
</tr>
<tr>
<td>LDAP</td>
<td>11, 27, 28, 29</td>
</tr>
<tr>
<td>links</td>
<td>38</td>
</tr>
<tr>
<td>login</td>
<td>6, 11</td>
</tr>
<tr>
<td><strong>M</strong></td>
<td></td>
</tr>
<tr>
<td>macro cell site</td>
<td>31</td>
</tr>
<tr>
<td>maintenance</td>
<td></td>
</tr>
<tr>
<td>front panel</td>
<td>65</td>
</tr>
<tr>
<td>general information</td>
<td>65</td>
</tr>
<tr>
<td><strong>O</strong></td>
<td></td>
</tr>
<tr>
<td>optical route</td>
<td></td>
</tr>
<tr>
<td>configuring</td>
<td>50</td>
</tr>
<tr>
<td>drawing</td>
<td>50</td>
</tr>
<tr>
<td>OpticalRF</td>
<td>2, 7, 33, 54, 60</td>
</tr>
<tr>
<td><strong>P</strong></td>
<td></td>
</tr>
<tr>
<td>password</td>
<td>5, 6, 8, 9, 20, 21, 27, 28, 29</td>
</tr>
<tr>
<td><strong>R</strong></td>
<td></td>
</tr>
<tr>
<td>rackmount</td>
<td>1, 2, 31</td>
</tr>
<tr>
<td>RF link</td>
<td></td>
</tr>
<tr>
<td>drawing</td>
<td>55</td>
</tr>
<tr>
<td>RRH</td>
<td>33, 54, 57</td>
</tr>
<tr>
<td>RTU</td>
<td>7, 33, 35, 36, 42, 48, 49, 54, 57, 60</td>
</tr>
<tr>
<td><strong>S</strong></td>
<td></td>
</tr>
<tr>
<td>safety</td>
<td></td>
</tr>
<tr>
<td>caution</td>
<td>4</td>
</tr>
<tr>
<td>conventions</td>
<td>4</td>
</tr>
<tr>
<td>warning</td>
<td>4</td>
</tr>
<tr>
<td>sites</td>
<td>38</td>
</tr>
<tr>
<td>storage requirements</td>
<td>65</td>
</tr>
<tr>
<td>symbols, safety</td>
<td>4</td>
</tr>
</tbody>
</table>
Index

T
- technical support ........................................ 67
- temperature for storage.............................. 65
- topology ........ 6, 7, 50, 53, 54, 55, 56, 57, 58
  setting and maintaining ........................ 61
- transportation requirements ....................... 65

U
- user documentation view............................ 68

V
- view
  - documentation...................................... 68