

The SAS® Visual Analytics Environment: Behind the Scenes

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ABSTRACT

As a SAS® Visual Analytics administrator, how do you efficiently manage your SAS® LASR™ environment? How do you ensure reliable data availability to your end users? How do you ensure that your users have the proper permissions to perform their tasks in SAS Visual Analytics? This paper covers some common management issues in SAS Visual Analytics, why and how they might arise, and how to resolve them. It discusses methods of programmatically managing your SAS® LASR™ Analytic Server and tables, as well as using SAS® Visual Analytics Administrator. Furthermore, it provides a better understanding of the roles in SAS Visual Analytics and demonstrates how to set up appropriate user permissions. Using the methods discussed in this paper can help you improve the end-user experience as well as system performance.

INTRODUCTION

There can be many challenges as a SAS Visual Analytics administrator in keeping the required data and content available to your end users, users might require different levels of access, users might find that they are unable to load a table, users might find that their required table is not available. We walk through some of the common LASR challenges and show you how to properly set up permissions to ensure your users have proper access and share some programmatic methods for managing the content of your SAS LASR Analytic Servers.

A typical organization might have several types of users, those that only need access to view reports (this may be the executives), those that need to manipulate data, load data to SAS Visual Analytics and create the reports (Analysts) and those who manage how the data is loaded and manage access for other users and other behind the scenes activities (SAS Visual Analytics Administrator). In addition, within the Analyst and Executive groups, individuals might need access to different content.

This paper discusses how to set up the roles and briefly discuss security for each of these groups. Then we discuss how to manage the LASR space both from the interface and with code and how to use these tools to resolve some common management issues.

Note: For the purpose of examples in this paper, we used a Windows 2008 Server Machine 64 bit with SAS® 9.4, SAS® Visual Analytics 7.3, SAS® Enterprise Guide®, IMSTAT, SAS® Management Console, and SMP LASR 16w48 Production.

SETTING UP PERMISSIONS

SAS Visual Analytics applications and the contents are secured via three levels of permissions assigned to them:

1. User roles and groups, to manage functional capabilities
2. Metadata permissions
3. Permissions on the host layer (application server and the nodes)

ROLES AND CAPABILITIES: VISUAL ANALYTICS COMPONENT LEVEL ACCESS

Visual Analytics users are given role based access to its web application components, including Manage Environment/Administration, Explorer, Report Builder and Visual Data Builder. All Visual analytics users require a metadata identity. Managing users in SAS Management Console involves the following primary tasks:

- Add or remove users

- Define groups and roles
- Assign users to appropriate groups and roles

Users are assigned to various roles and groups in the metadata based on the job functionality. Roles are mapped to capabilities. A capability is an operation a user can perform in a component. SAS Visual Analytics is shipped with five predefined roles. Asking a few basic questions, such as the following, help administrators define and assign the correct groups and roles to a user's account.

Will this user:

- Only view content that others create?
- Create reports or explorations for others?
- Create and load data for others?
- Need to start or stop LASR Analytic Servers?

[Table 1](#) shows SAS Visual Analytics roles and their associated application capabilities and accessible components.

SAS Visual Analytics Roles	Application Capabilities	Accessible SAS Visual Analytics Component
Visual Analytics: Basic	View reports and stored process	Report Viewer
	Export or print to pdf	Hub
	Email	
Visual Analytics: Report Viewing	All the capabilities available to the Visual Analytics: Basic role	Report Viewer Hub
	Add and view comments	
	Personalization	
Visual Analytics: Analysis	All the capabilities available to the Visual Analytics: Report Viewing role	Report Designer Explorer
	Explore data	Report Viewer
	Build custom graphs	Hub
	Export Data	Custom Graph Builder
	Export report and image	
	Self-service data import	
	Distribute reports via email	
	Build Analytical Model	
	Refresh Data	
	Export exploration as report	
	Export exploration as image	

SAS Visual Analytics Roles	Application Capabilities	Accessible SAS Visual Analytics Component
Visual Analytics: Data building	All the capabilities available to the Visual Analytics: Analysis role	Data Builder Report Designer
	Build data	Explorer Report Viewer Hub Data Builder Custom Graph Builder
Visual Analytics: Administration	All the capabilities available to the Visual Analytics: Analysis role	Administrator (Manage Environment) Report Designer
	Manage environment	Explorer
	Manage mobile device	Report Viewer
	Manage LASR Analytic Server	Hub
	Monitor LASR Analytic Server	
	Manage authorization of LASR tables	
	Browse Hadoop distributed file system	
	Administer Hub	

Table 1. Pre-Defined Roles in Visual Analytics and Associated Capabilities

Based on the organizational need, the roles can be combined to groups for giving multiple roles to a single user. For example, in one organization these out of the box roles represent different people in different divisions. In another organization one person assumes all these roles. You can also create custom roles with added or reduced capabilities using the SAS Management Console.

It is recommended that SAS Visual Analytics users should belong to at least one of the following three specific groups:

- Visual Analytics Users for non-administrative tasks such as exploration, reporting and viewing
- Visual Analytics Data Administrators for suite level administration such as start/stop SAS LASR Analytic Server, LASR table authentication, and so on.
- Visual Data Builders for data administration such as creating and loading data.

SECURITY: METADATA AND HOST LAYER (OS LEVEL) PERMISSIONS FOR LASR DATA

The SAS LASR Authorization Service collaborates with the metadata authorization layer to manage user access to in-memory (LASR) data. Metadata permissions for SAS Visual Analytics objects (reports, explorations, queries, LASR tables, and so on) are honored when users access data. Refer to [Figure 8](#) in the Appendix for a detailed explanation of the authorization process.

Exploring Metadata Permissions and Host Layer (OS Level) Permissions to Maintain Security

Administrators can use the metadata authorization layer to manage access to the following SAS Visual Analytics resources:

- Reports
- Explorations

- Queries
- LASR tables
- Folder
- LASR libraries
- Stored process
- Information maps

Reports and explorations are metadata objects stored in the metadata server. Access to reports and explorations is managed through metadata permissions. Table 2 summarizes the metadata permissions required for various reporting and exploration tasks. Please note that access to reports and explorations do not require permissions at the host layer (Operating System level). See [Table 4](#) in the Appendix for list and definitions of available metadata permissions.

Task	Target Folder	Report	Stored Process1	Information Map1	LASR Table
Create and save a new report	RM, WMM	-	RM	RM, R	RM, R
Delete a report	RM, WMM	RM, WM	-	-	-
View or refresh a report	RM	RM	RM	RM, R	RM, R
View a batch report	RM	RM	-	-	-
Edit or rename a report	WM	WM	-	-	-
Set report permissions	RM	RM, WM	-	-	-

Table 2. Metadata Permissions Required for Visual Analytics Components

In addition, SAS Visual Analytics offers table-level security, as well as row-level security for in-memory tables. Access to in-memory data for data viewers is also managed through metadata permissions (Table 3).

Task	LASR Server1	LASR Library	Target Folder	LASR Table	Host Layer
Load a table	RM	RM, WM, R, A	RM, WMM, R, W	-	Yes
Delete a table	RM	RM, WM	RM, WMM	RM, WM, R, W	-
Set table permissions	-	RM	RM	RM, WM	-
Read in-memory data	RM	RM	RM	RM, R	
Edit computed columns in a LASR Analytic Server	RM,	RM	RM	RM, R, W	-
Append / Delete LASR table rows	RM	RM	RM	RM, R, W	

Table 3. Metadata Permissions for LASR Tables

Row-Level Security

Row-level security allows the LASR Administrator to selectively grant the ability to use particular rows within the LASR tables. End users who have restricted access to certain rows, only see the rows they have access to. These permission conditions are stored in the SAS Metadata Server.

Row-level security can be administered both from the SAS Visual Analytics user interface, as well as from batch tools. Row-level security is set via a Conditional Grant. Permission conditions must be applied on a per LASR table basis. For star schemas that are used in LASR, the permission condition must be applied to the entire schema, not the individual tables within it. For more detail on Row Level Security, refer to Paper SAS1779-2015 Row-Level Security and SAS® Visual Analytics.

MANAGING THE LASR SPACE

The LASR space includes the SAS LASR Analytic Servers and the LASR tables loaded to each LASR Analytic Server. A standard implementation includes both a public LASR Analytic Server, accessible to everyone and a Private LASR Analytic Server, to which usage and visibility can be restricted. The LASR space can be managed in several ways. We discuss how to manage LASR through the User Interface, the “Manage Environment” or Administration application in Visual Analytics and using code in Base SAS or SAS Enterprise Guide. A standard Visual Analytics implementation also includes an autoloader folder structure. Autoloader automatically manages the tables placed in its folders (which includes Unload, Append, Logs, and so on), Figure 1 displays an example of a typical Autoloader folder. Autoloader is useful for non-programmer Analysts who want a simple drag and drop option for loading tables to LASR, unloading and appending tables. For more information about autoloader, see [Implementing Automatic Loading of Data to Memory](#).



Figure 1 Typical Autoloader Folder Structure

MANAGE ENVIRONMENT (ADMINISTRATION)

The simplest way to manage LASR is through the Manage Environment (Administration) interface within Visual Analytics. From this application, the Visual Analytics Administrator can start and stop LASR Analytic Servers, monitor memory usage, load and unload tables and view information about tables that are in LASR or had been in LASR. Tables can be loaded from metadata folder structure connections via simple right-click and load functionality (Figure 2). Tables can be unloaded in a similar manner by right-clicking and selecting unload from the LASR Tables tab in the Manage Environment application (Figure 3).

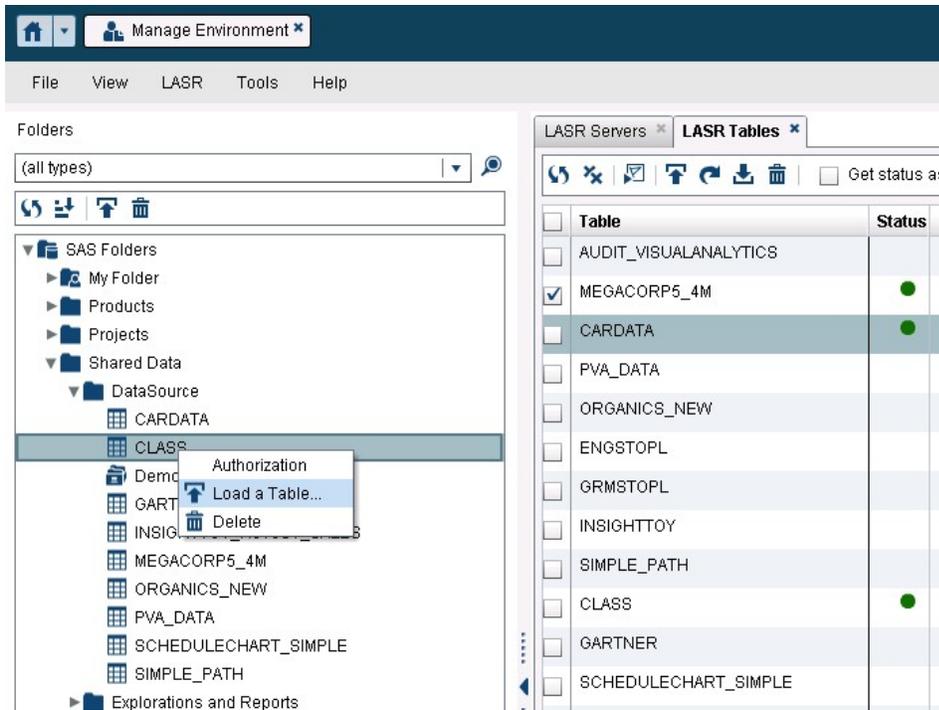


Figure 2. Loading a Table from Manage Environment

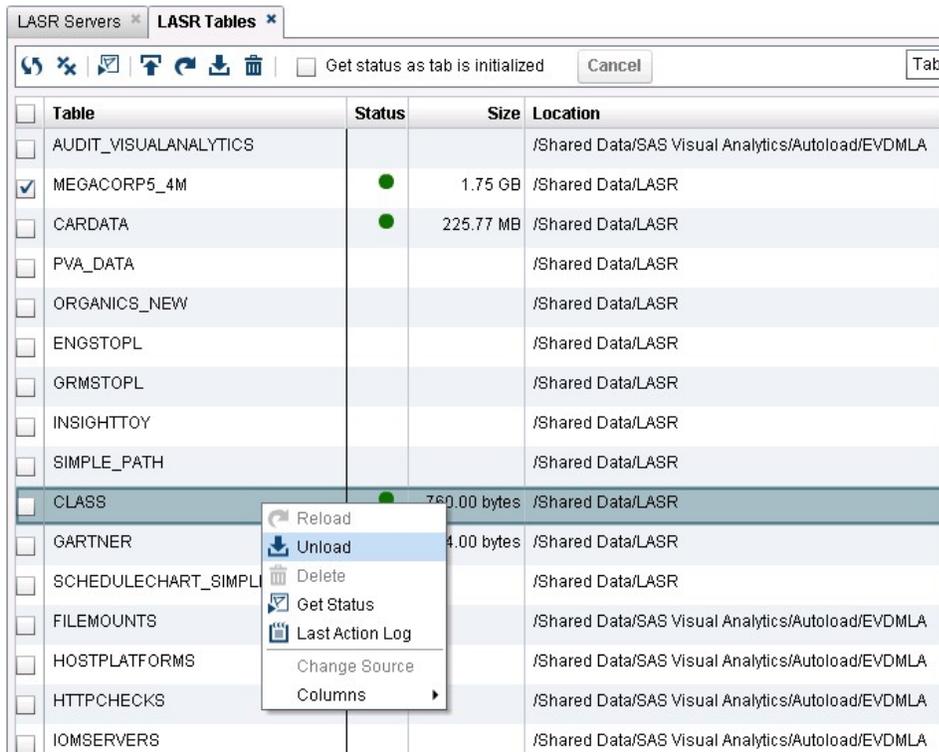


Figure 3. Unloading a Table from Manage Environment

MANAGING LASR WITH CODE

While using the interface to load and unload tables is quick and convenient, there are times when it is necessary to use code to manage LASR. For example, a user might find that they are unable to load a desired table even though it does not appear to be loaded in Manage Environment. This might be because the table is loaded but the LASR metadata does not exist. In this case, the LASR administrator can inventory the LASR Analytic Server using PROC IMSTAT as follows:

```
proc imstat;
tableinfo/host="sasva.demo.sas.com"
port=10031;
run;
```

This code produces the following output (Figure 4), a list of tables currently loaded into the LASR library associated with this host and port, which correspond to the Visual Analytics Public LASR library.

The IMSTAT Procedure						
Table Information						
Table Name	Label	NLS encoding	Number of Rows	Number of Columns	Owner	Created
VAPUBLIC.VA_SAMPLE_SMALLINSIGHT		wlatin1	1012364	50	sasdemo	Tue Feb 14 14:29:18 2017
VAPUBLIC.VA_SAMPLE_BANKCAMPAIGN		wlatin1	1060038	22	sasdemo	Tue Feb 14 14:29:35 2017
VAPUBLIC.VA_SAMPLE_ACME_BANK		wlatin1	399920	66	sasdemo	Tue Feb 14 14:29:45 2017
VAPUBLIC.VA_SAMPLE_CASINO_REV_FCST2		wlatin1	7306	17	sasdemo	Tue Feb 14 14:29:56 2017
VAPUBLIC.VA_SAMPLE_K12_STUDENT		wlatin1	40087	25	sasdemo	Tue Feb 14 14:30:02 2017
VAPUBLIC.VA_SAMPLE_RETAIL_RO_COST_GT_COMP		wlatin1	11170	36	sasdemo	Tue Feb 14 14:30:08 2017
VAPUBLIC.VA_SAMPLE_RETAIL_RO_MD_CANDIDATE		wlatin1	53045	39	sasdemo	Tue Feb 14 14:30:13 2017
VAPUBLIC.VA_SAMPLE_RETAIL_RO_PROMO_EFFECTV		wlatin1	165	38	sasdemo	Tue Feb 14 14:30:22 2017
VAPUBLIC.VA_SAMPLE_TELCO03		wlatin1	249710	78	sasdemo	Tue Feb 14 14:30:27 2017
VAPUBLIC.VA_SAMPLE_WARRANTY_CLAIMS		wlatin1	428027	42	sasdemo	Tue Feb 14 14:30:38 2017
VAPUBLIC.CARS	Loaded on Tuesday, February 14, 2017 03:02:47 PM GMT-0500 from "DemoData.CARDATA" by "sasdemo"	wlatin1	1020455	27	sasdemo	Tue Feb 14 15:03:51 2017

Figure 4. PROC IMSTAT Output

Server name (host) and port can be found in the LIBNAME statement for the LASR library in SAS Management Console or by right-clicking on the library in the server window of SAS Enterprise Guide and selecting "Properties," as shown in Figure 5.

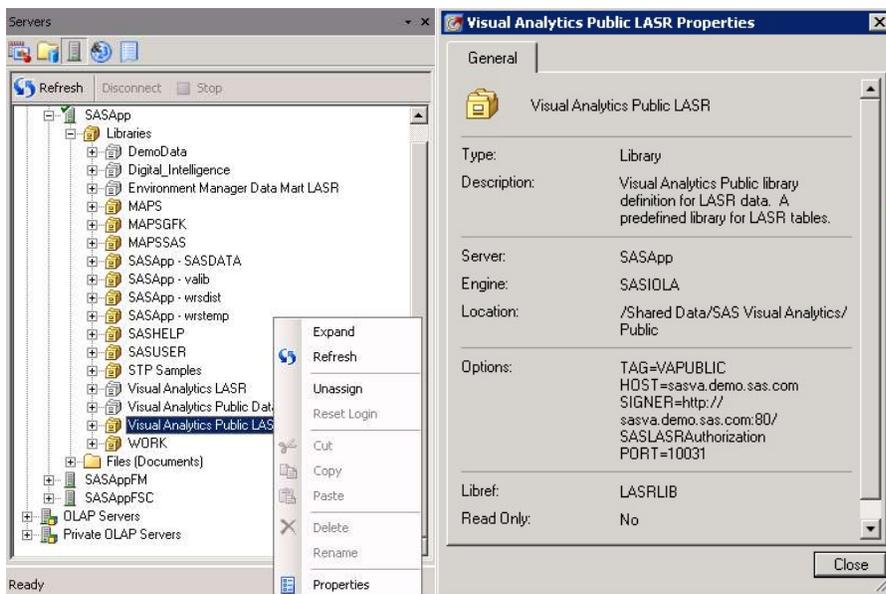


Figure 5. Finding the Host Name and Port from SAS Management Console

If you find that there are tables loaded into LASR that do not appear in the in Manage Environment, you can either unload and delete them using PROC DATASETS or register them in metadata using PROC METALIB. **Note:** Other procedures can be used but these are fairly simple and straight forward.

After you have determined what tables are loaded into LASR and which tables need to be removed, you can use the following code to remove the desire table(s). In this case, CARS does not appear as loaded in the Manage Environment application, but by running PROC IMSTAT, we can see that it is still loaded in LASR but has no metadata presence. The following code can be used to remove it from LASR:

```
LIBNAME LASRLIB SASIOLA TAG=VAPUBLIC PORT=10031 HOST="sasva.demo.sas.com"
SIGNER="http://sasva.demo.sas.com:80/SASLASRAuthorization";
```

```
proc datasets library=lasrlib nolist;
delete cars;
run;
```

```
23          GOPTIONS ACCESSIBLE;
24          proc datasets library=lasrlib nolist;
25          delete cars;
26          run;

NOTE: Deleting LASRLIB.CARS (memtype=DATA).
NOTE: The table VAPUBLIC.CARS has been removed from the SAS LASR Analytic Server.
27
```

Figure 6. Log Output for PROC DATASETS Showing the Removal of the Cars LASR Table

Now the unwanted data has been removed from LASR and can be reloaded or replaced by the user as desired. This method is valid in both distributed and non-distributed implementations of LASR.

You can also choose to update/synchronize the metadata and restore tables listed in PROC IMSTAT output which are not displayed in Manage Environment. The following code can be run to update the metadata for the CARS LASR table in the previous example:

```
proc metalib;
  omr (library="Visual Analytics LASR");
  select("cars");
  folder="/Shared Data/LASR";
  report=(type=detail);
run;
```

In the above code, the library is the display name for the LASR metadata library and the folder is the metadata location of the LASR metadata registration for the tables in question.

PROC METALIB produces the output shown in Figure 7, in which you can see that the metadata was added for the cars LASR table. This table is now displayed in Environment Manager and can be used in SAS Visual Analytics, as desired.

The METALIB Procedure

Detail Report for Library Visual Analytics LASR
Repository Foundation
15FEB2017

Metadata Summary Statistics	
Total tables analyzed	1
Tables Updated	0
Tables Added	1
Tables matching data source	0
Tables not found	0
Tables not processed	0

Tables Added		
Metadata Name	Metadata ID	SAS Name
CARS	A5IM64TN.BF0000TJ	cars

Figure 7. PROC METALIB Output

See the Appendix for more information about each of the procedures discussed in this paper.

HELPFUL TIPS FOR THE SAS VISUAL ANALYTICS ADMINISTRATOR

- It is helpful to use the metadata folder structure to help differentiate between LASR tables and SAS tables in metadata.
- The Visual Analytics administrator cannot manage LASR tables stored in “My Folder” thus, it is a best practice not to save LASR tables to “My Folder.”
- Visual Analytics is also available on mobile devices, for more information see HTML5 and SAS® Mobile BI—Empowering Business Managers with Analytics and Business Intelligence.

CONCLUSION

It can be challenging as a Visual Analytics administrator to ensure your users have the proper roles for their respective jobs and ensure the needed data is loaded into LASR. Understanding SAS Visual Analytics’ capabilities, groups and roles is an essential part of maintaining your environment and ensuring proper security. By understanding the multiple layers of permissions and learning some methods of managing the LASR space you can improve the end user experience.

APPENDIX

[Figure 8](#) depicts the authorization process in SAS Visual Analytics to access the data stored in the SAS LASR Analytic Server.

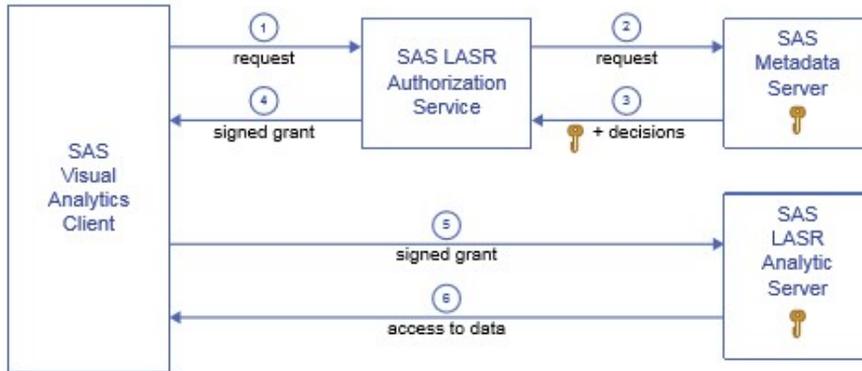


Figure 8 User Authorization

1. In a SAS Visual Analytics client, a user performs an action that uses a SAS LASR Analytic Server. For example, a request is to read data. The client sends the request to the authorization service.
2. The authorization service requests the following information from the metadata server:
 - a. Authorization decisions that indicate whether the requesting user has the effective metadata-layer permissions that are required to perform the requested action.
 - b. The security key for the target SAS LASR Analytic Server (a LASR security key is a unique, shared secret between a SAS LASR Analytic Server and the metadata server that is created when a LASR analytic server is started).
3. The authorization service receives the authorization decisions and security key from the metadata server. If the requesting user has a conditional grant of the Read permission, the authorization service also receives a clause (or set of clauses) that specifies which rows the user can access.
4. If the requesting user has effective grants of all permissions that are required for the requested action, the authorization service provides a signed grant to the client. The client submits the signed grant to the SAS LASR Analytic Server.

The SAS LASR Analytic Server uses its knowledge of the security key to validate the signed grant that the client supplies. If the signed grant is valid, the server provides access to the requested in-memory table (conforming to any row-level security conditions in the signed grant).

AVAILABLE METADATA PERMISSIONS

Table 4 contains the metadata permissions and their respective definitions.

Permission	Definition
Read metadata (RM)	View an item or navigate past a folder
Write metadata (WM)	Edit, delete, change permissions, or rename an item
Write member metadata (WMM)	Add an item to a metadata folder or delete and item from a metadata folder
Check in metadata	Check in or check out items in a change-managed area (change management is a SAS data integration feature)
Read (R)	Read data
Create (C)	Add data
Write (W)	Update data
Delete (D)	Delete data
Administer (A)	Monitor an OLAP server, stop, pause, resume, refresh

Table 4. Metadata Permissions and Definitions

CODE SAMPLES

PROC IMSTAT

PROC IMSTAT is used, in part, to manage in-memory tables and SAS LASR Analytic Server Instances.

Syntax:

```
Proc imstat <options>;
    tableinfo / hostname="host-name" port="port number";
run;
```

The TABLEINFO statement is used to return information about in-memory table(s). The host specifies the server name for the SAS LASR Analytic Server and the port number specifies the port number associated with that SAS LASR Analytic Server. This information can be found in SAS Management Console, as shown in Figure 5.

PROC DATASETS

PROC DATASETS is used to manage SAS files, copying, renaming, deleting, and more. You need to run the LIBNAME statement for the library from which you wish to manipulate tables before attempting to run PROC DATASETS.

Syntax:

```
proc datasets library=libref nolist;
delete tablename;
run;
```

The library option specifies the library the procedure affects. The NOLIST option prevents SAS from printing the directory of SAS files to the log. The delete statement specifies the list of tables to be removed from the library specified.

PROC METALIB

PROC METALIB updates the metadata on the metadata server to match the data contained in the library. It can be used to create metadata for tables where metadata does not exist, remove metadata for tables no longer in the library or update metadata for tables that have had changes.

Syntax:

```
proc metalib;
    omr (library="Library Name");
    select("table");
    folder="/path/folder";
    report=(type=detail);
run;
```

In the OMR statement, the library specifies the library name as indicated in the General Tab of the libraries SAS Management Console properties.

REFERENCES

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RECOMMENDED READING

- Williams, Zuzu. 2015. "Row-Level Security and SAS® Visual Analytics." *Proceedings of the SAS Global Forum 2015 Conference*. Available at support.sas.com/resources/papers/proceedings15/SAS1779-2015.pdf.
- SAS® *Visual Analytics 7.3: Administration Guide*, "Loading Data." Available at support.sas.com/documentation/onlinedoc/va/7.3/en/vaag.pdf.
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