



Development Guide

Development Guide

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Development Guide v1.5.1

The deployment framework consists of several correlating documents. This document explains how to develop using Qlik Deployment Framework (QDF). Deployment Framework is initially created for QlikView but has been enhanced for Qlik Sense.

The Deployment Framework documents are:

- **Getting Started Guide** Get an overall understanding of the framework basics and how to start installing and develop.
- **Operations Guide** for Administrators maintaining the platform, security, tasks and containers.
- **Development Guide** for Developers how to work with DF in an efficient way, naming conventions, data modeling, optimization tricks/tools and other guide lines regarding development.
- **Deployment Guide** Project management guide on how to govern and manage Qlik deployment (DTAP) process, how to create Qlik projects and development teams and skill sets

Why the need for a Development Guide?

The Developer Guide is a reference manual for Qlik developers. Qlik developers are individuals who design and implement applications and their areas of expertise range from data modeling to scripting to UI design. This document is designed to facilitate much clearer understanding of the methodologies and practices that are optimal for producing highly usable, highly optimized and highly configurable Qlik applications, whether used by small departments or by large enterprises.

Company Specific Development Guide

This document is a high level guide on how to develop using Qlik Deployment Framework and predefinitions. Best practice is to create an adapted company specific development guide containing your development guidelines like:

- ETL and QVD strategy
- Container strategy
- Security requirements
- DTAP process

Platform strategy from a development perspective

When it comes to development, QlikView and Qlik Sense offer a wide range of flexibility. For many reasons there's a good idea to set up a corporate developing best practice. A corporate developing standard doesn't only include standards for how to optimize each and every single application but does also embrace methodologies and practices like reusability and overview.

Standards

It's important to have and use standards during Qlik development. There are many ways of getting the same result, but not all of them are efficient and understandable. Utilizing *Qlik Deployment Framework* in combination with development guide lines we create consistent multi development environment.

Standards are needed for:

- Reuse of data
- Reuse of code
- Reuse of expressions and variables
- Multiple development
- Governance
- Creating and collecting understandable metadata

Using standards will result in lower cost of ownership by making governance easier and TCO lower.

Qlik Deployment framework

The Deployment framework is based the use of content repositories or containers as we call them. Containers are isolated file structures placed side by side. A container can be moved and/or renamed without changing any script or logic in Qlik. Each container has identical file structures and contains predefined script functions. Deployment Framework always includes the *0.Administration* container it's from here additional containers are created and managed. By default QDF also contains a shared folders container a repository to store scripts, configuration and data files that are shared and reusable by all applications. More details on containers and Deployments can be found in ***Deployment Framework Operations Guide***.

Folder Naming Convention

Folder names inside the container are standardized and simplified to fit as many languages and companies as possible. Not all folders will be used treat them as they are placeholders for future needs. Before each container and subfolder there are a sequential number that makes it easier to identify containers and subfolders when publishing and in documentation. Example *1.2.1* symbolizes the first Container (1), The QVD folder (2) and a subfolder (1). Follow the number sequence and never use space when creating new containers or subfolders inside the container.

Container folders

0.Template	Folder used for examples and templates. <i>Only exists in the 0.Administration Container.</i>
1.Application	QlikView Applications are resided in subfolders under 1.Applications
2.QVD	QlikView Data files are stored in subfolders under 2.QVD
3.Include	Folder where QlikView Include files are stored. These are script parts that are called from the main QlikView script.
1.BaseVariable	Stores all the variables needed to use the framework, like paths inside the container
2.Locale	Locale for different regions, used for easy migration between regions
3.ConnString	Stores connection strings to data sources
4.Sub	Store for sub routines, this is a way to reuse code between applications
5.ColorScheme	Company standard Color Scheme would be placed here
6.Custom	Store for custom include scripts
4.Mart	Resides QlikView QVW marts (in subfolders) for data discovery usage, these folders could be shared.
5.Config	Configuration and language files like Excel and txt. This folders could be shared to make configuration changes easier
6.Script	Store for special scripts run by the publisher or scheduled tasks
7.Export	Folder used to store from QlikView exported data, probably txt or qvx
8.Import	Folder used to store import data from external systems
Info.txt	Information files describing the folder purpose and Path variable. There are Info files in every folder.
Version.xx.txt	Version Revision list

Container Variables

Each default folder in a container has corresponding unique variable (environmental *Global Variable*) in QlikView and Qlik Sense. Using these variables when scripting will make it possible to move applications between containers without any script modifications, it also makes it possible to seamlessly share scripts between QlikView and Qlik Sense. To initiate QDF and create the global variables a script (*InitLink.qvs*) need to be added in the beginning of the Qlik scripts. Read more under Get started with QDF in QlikView Developer

Container Global Variables

0.Administration		
1.AcmeStore		
1.Application	<u>vG.ApplicationPath</u>	Application Folder
2.QVD	<u>vG.QVDPPath</u>	QlikView Data files (QVD) repository
3.Include	<u>vG.IncludePath</u>	QlikView Include files repository
1.BaseVariable	<u>vG.BaseVariablePath</u>	Initiation script and Global Variables storage
2.Locale	<u>vG.LocalePath</u>	Regional /language Locale
3.ConnString	<u>vG.ConnStringPath</u>	Connection string repository
4.Sub	<u>vG.SubPath</u>	Sub Function Library
5.ColorScheme	<u>vG.ColorSchemePath</u>	Color and Picture templates
6.Custom	<u>vG.CustomPath</u>	Repository to keep custom include scripts
4.Mart	<u>vG.MartPath</u>	Qlik mart repository
5.Config	<u>vG.ConfigPath</u>	Stores QlikView configuration files
6.Script	<u>vG.ScriptPath</u>	Folder to store special scripts used by publisher
7.Export	<u>vG.ExportPath</u>	Data Export repository, probably txt or qvx
8.Import	<u>vG.ImportPath</u>	Data Import from external systems
2.AcmeHR		
99.Shared_Folders		

Variable Naming Convention

It's important to follow the variable naming convention so that existing application variables don't collide with the framework variables. A name standard also makes it easier to understand and search among variables.

- Variables created by QDF are called **Global** because they are reused between applications across the entire container. The name standard is *vG.xxx* (**Variable Global**). Custom Global variables can be added and maintained using the Variable Editor.
- Ordinary variables that are individual within each application are called **Local** and named *vL.xxx* (**Variable Local**).
- Variables reused across all containers are called **Universal** and named *vU.xxx* (**Variable Universal**). The Universal variables are stored in the Shared Folders container and can be added and maintained using the Variable Editor.

Global and universal variables are modified by the Variable Editor application (read more in VariableEditor section) and stored in *\$(BaseVariablePath)\CustomVariables.csv* files within each container.

- Global variables should only be used when variables are shared by several applications in a Container.
- Universal variables should be used when variables are shared by several applications across all Containers.

By using Universal Variables that are stored in *\$(SharedBaseVariablePath)\CustomVariables.csv* files in the Shared Folders Container, we get "single point of truth" across all containers. Universal Variables are by default loaded during the framework initiation process, have the prefix *vU* and is also modified by the Variable Editor application.

Additional Variable standards

- Store often used expressions as Local variables
- Store reusable expressions as Global or Universal variables
- Extended name standard for Variables are possible, example:
 - Local expressions variables starts with *vL.Calc_*
 - Global expressions variables starts with *vG.Calc_*
- Variables defining a path should always end with a '\'
- Reset local variables that are only used inside the script and not in the UI.
Enter the variable name and =; example: SET *vL.test* =;

Development skill set

The development process can be split into two overall groups, *Front End* and *Back End* development. One notice, an individual developer is seldom expert in all the skill sets, try to find and utilize the developer's sweet spot. The Deployment Guide sections are bases on the skill sets below.

Back End developers skill set

- Typically DBA knowledge like
 - Data source expert
 - QlikView data modeling
 - QlikView data model optimization
 - Good understanding in ETL process
 - Data security (Section Access) models

Front End developers skill set

- Typically a BI developer
 - Business specific understanding
 - KPI and measurements
 - QlikView Front End optimization
- Typically a designer skill set
 - Design skills
 - Visualization
 - Usability
- In Qlik Sense Java script and CSS knowhow can be useful

QlikView Development Teams

QlikView and Qlik Sense are flexible and adaptable BI tools. As such, development teams can organize around several models for support, administration, back and front end development, training and management

It is recommended that the client consult its own IT standards for development, as they may drive this decision, or at least narrow the allowed choices. Qlik does not expressly promote one of these scenarios over the others, but asks that clients determine for themselves which of these configurations might work best, given the nature of the Qlik development and the skills sets that exist.

Read more regarding Development Teams in Deployment Guide

Optimization strategy

Qlik is known for its wide user adoption. One of the main reasons for this is its capability to manage large data sets with short response time. Although a Qlik application most often is easy and fast to develop it's a very good idea to establish an optimization strategy as part of your development platform. As with most Qlik development, optimization is divided into a back-end and a front-end part. While back-end optimization focus on effective script and data modeling, the front end focus on user interface design with its charts, dimension and expressions. For long term success it is strongly recommended that you have an optimization focus in your application development, especially when you know that the application should hold a large data set and be distributed to a large number of users. A good idea is to have an optimization step connected to the validation/approval phase in your development process, this of course both for new applications as well as for changed/ improved applications.

You can read more detailed information, tips and tricks, about optimization in the back-end and front-end section of this document.

Back End Development

Back end development involves the process that starts with extracting data from one or many data sources and ends up in creating a Qlik's associative data model managed by the load script editor.

Scripting basics

Scripting is the environment in which a Qlik Developer will automate the extract, transform and loading process of bringing data in the Qlik environment. Each Qlik application contains a script through which this process is enabled.

Best practices dictate that using multiple tabs within a script will split out the various parts, enabling a simple view of the information for future development and support. Depending on the complexity of the application, you may have a variety of different script sections. The common parts of a script are below:

- QDF initiation tab
- Security (usually hidden script)
- Dates and Calendar information
- Tab per data source
- Tab per key measure/core table
- Tab per lookup table

Using Deployment Framework Containers when scripting

When using the Deployment Framework applications need to have an initiation include script in the beginning of the load script which identifies the environment (within your home container) and generates global variables that is used during development. This initiation script is called `InitLink.qvs` and resides in the base of every container.

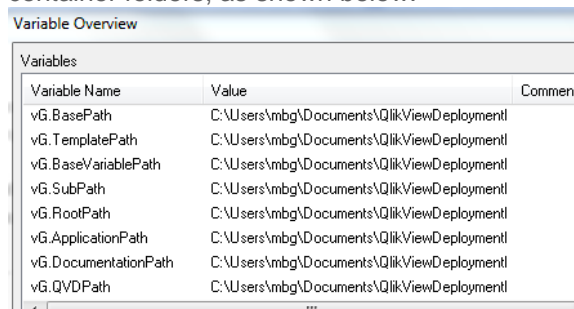
Get started with QDF in QlikView Developer

This initiation creates environmental *Global Variables* like container folder path and *Custom Global Variables* that is additional Global Variables created by you.

1. Create or save QlikView application (preferably in a subfolder) under 1.Application folder in the container.
Create a first Tab called **Qlik Deployment framework** and Paste the script code down below in. Use relative path for `1.init`.

```
$(Include=..\..\..\InitLink.qvs);  
$(Include=..\..\..\InitLink.qvs);  
$(Include=..\..\InitLink.qvs);  
$(Include=..\InitLink.qvs);  
$(Include=InitLink.qvs);
```

2. Reload and check in QlikView Variable Overview for Global Variables (`vG.xxx`) pointing to container folders, as shown below:



The screenshot shows the 'Variable Overview' window in QlikView. It contains a table with three columns: 'Variable Name', 'Value', and 'Comment'. The table lists several global variables, all of which have the same value: 'C:\Users\mbg\Documents\QlikViewDeployment\'. The variables listed are vG.BasePath, vG.TemplatePath, vG.BaseVariablePath, vG.SubPath, vG.RootPath, vG.ApplicationPath, vG.DocumentationPath, and vG.QVDPPath.

Variable Name	Value	Comment
vG.BasePath	C:\Users\mbg\Documents\QlikViewDeployment\	
vG.TemplatePath	C:\Users\mbg\Documents\QlikViewDeployment\	
vG.BaseVariablePath	C:\Users\mbg\Documents\QlikViewDeployment\	
vG.SubPath	C:\Users\mbg\Documents\QlikViewDeployment\	
vG.RootPath	C:\Users\mbg\Documents\QlikViewDeployment\	
vG.ApplicationPath	C:\Users\mbg\Documents\QlikViewDeployment\	
vG.DocumentationPath	C:\Users\mbg\Documents\QlikViewDeployment\	
vG.QVDPPath	C:\Users\mbg\Documents\QlikViewDeployment\	

3. These variables are used when developing instead of hardcoding or using relative paths. The benefit is that applications can be moved in all directions without breaking the script.

Get started with QDF in Qlik Sense

Please read the *Qlik Deployment Framework-Qlik Sense additional notes.pdf* document

Linking (mount) Containers

By using `LoadContainerGlobalVariables` function it's possible to create Global Variable links (mounts) between containers, this depending on security access. The short name `LCGV` can also be used and will work the same, example: `LCGV('SQL','QVD');`

Example: `call LCGV('AcmeTravel')` Will create all Global Variables linking to 2.AcmeTravel container. Variables created will have similar name as home container but with the additional *AcmeTravel* prefix, like `vG.AcmeTravel/QVDPath` for QVD path to AcmeTravel container

`call LCGV('Oracle','QVD;Include');` Will create two Global Variable links to different resources in Oracle container, by using an additional switch and ';' separator creates Global Variables `vG.OracleQVDPath` and `vG.OracleIncludePath` (instead of linking all folders as in the first example).

Sub Functions

Qlik have the possibility of reusing scripts and functions by using the `Sub` and `Call` commands. As presented above with the `LCGV` function. The Framework contains library of nice to have functions. All sub functions are stored under the `3.Include\4.Sub` folder and are initiated during QDF initiation. Use `Call function_name('Input parameters or variables')` command to execute the preloaded function. As of v1.4 all sub functions included with QDF are preloaded *during the initiation process*.

Sub Function example, `vL.FileExist` will return true or false depending on if the file exists

`Call vL.FileExist ('$(vG.QVDPath)\SOE.qvd')`

Read more under Sub Function section

Data strategy

To handle infinite amounts of data using Qlik we need to store data into Qlik Data (QVD) files, Qlik then reads QVD data in millions of records per second. This means that instead of loading all available data into Qlik, we only load needed data. This seems simple at first, but for this we need to understand what data we have and data needed? There could also be a need to prepare and “stage data” this to cleans and aggregate. A data strategy is to structure (using containers) and document the process. Read more in the *Qlik Deployment Framework-Deployment Guide.pdf*

Staging data

Staging data is a process of intermediately storing data between the sources of information, most often in QVD files. Staging usually consists on these steps:

- Main
 - Include statement for connection string ODBC/OLE DB stored in *vG.ConnStringPath*
 - Meta information about the application. I.E owner, purpose.
- Extract
 - Extracting the sources needed. Using an incremental approach when applicable. If there is no need for transformation the source could be stored directly to the presentation layer in the QVD-folder using Global variable (*vG.QVDPath*).
- Transform
 - When transformation is needed. For example creating new fields, cleansing information, aggregate and so on. This will be executed here.
 - In this stage recommendation is to use the QDF Index function to tag and index the QVD for easy search and retrieval.

Database Connection String in QlikView

Connection strings are a security credential and should always reside in the architecture Back end, in the data tier. Well protected from unauthorized access. Remember that architecture front-end (QlikView Server and QlikView Web Server) does not have any open ports the back-end, these servers could be in different network zones and security boundaries. When distributing QlikView applications via the Publisher in Back end to the application tier, scripts and connection strings will automatically be removed.

Security considerations

By separating the connection string from the script reusability and higher security will be achieved. There are two ways to separate and reuse the connection strings:

Include File

Best practice is to keep the connection strings in a separate Include file. This behavior is supported by Deployment Framework. Use the Global Variable *vG.ConnStringPath* to connect inside your container, example:

```
// Connection string to Northwind Access data source
$(Must_Include=$(vG.ConnStringPath)\0.example_access_northwind.qvs);
```

If the connection string is in another container, for example the Shared folders use the Global Variable *vG.SharedConnStringPath* to connect, example:

```
// Connection string to Northwind Access data source
$(Must_Include Include=$(vG.SharedConnStringPath)\0.example_access_northwind.qvs);
```

Recommendation is to use **Must_Include** so that the QlikView script will fail if the connection string is missing.

Global Variable

In Global Variable Editor there is the possibility to add the connection string into a Custom Global Variable. This method is not as secure as using an include file. Include files can be secured by different security groups this is not possible when using Global Variables that will be reused across all applications within a Container. But when a container is secured and dedicated for a source system (example Oracle container) connection strings as global variables could be used.

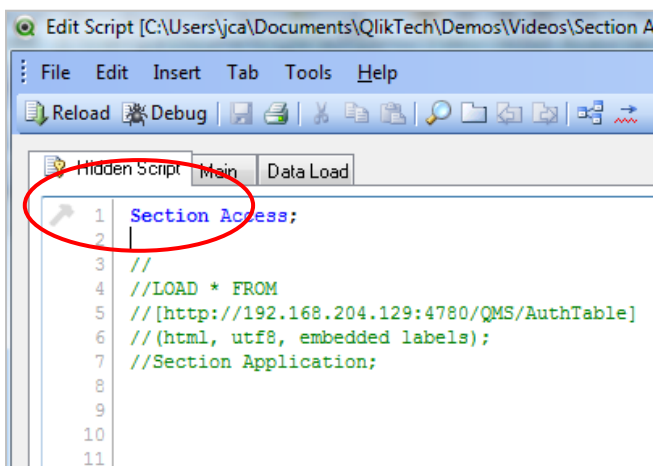
Database Connection String in Qlik Sense

Connection strings are in the library and stored encrypted in Qlik Sense repository. We do not use connection string include files within Qlik Sense load script.

QlikView Security Tab (Hidden Script)

In QlikView it is possible to restrict the privileges of a document user from the **Document Properties: Security** and the **Sheet Properties: Security pages**. Any settings can be altered if the document user is logged in as ADMIN.

The user identity and password needed for opening a user restricted document are specified in the load script and will show up in the log file if you allow QlikView to generate one. However, by having the user access in the hidden script instead, the log file will not give away any login information. The Hidden Script button opening the hidden script is found in the Edit Script menu.



QlikView Security Table (Section Access)

In QlikView the security settings of the QlikView file is set in the script. Access rights and User Levels are defined in the Section Access part of the script. Section Access can be used to set access restrictions to data, sheets and sheet objects. All access control is managed via files, SQL databases or inline clauses in the same way as QlikView normally handles data. If an access section is defined in the script it must be followed by the statement Section Application in order to load normal data.

Section Access system fields

Access levels are assigned to users in one or several tables loaded within the Section Access. These tables can contain several different user-specific system fields, typically NTNAME and the field defining the access level, ACCESS. The full set of section access system fields are described below. Other fields like GROUP or ORGANISATION may be added to facilitate the administration, but QlikView does not treat these fields in any special way. None, all, or any combination of the security fields may be loaded in the access section. However, if the ACCESS field is not loaded, all the users will have ADMIN access to the document and the section access will not be meaningful.

Section access system fields are:

- **ACCESS** A field that defines what access the user should have.
- **NTNAME** A field that contains a string corresponding to a SSO user name or group name.
- **USERID** A field that contains a user ID that has the privilege specified in the field ACCESS.
- **PASSWORD** A field that contains an accepted password.
- **SERIAL** A field that contains a number corresponding to the QlikView serial number.
- **NTDOMAINSID** A field that contains a string corresponding to a Windows NT Domain SID
- **NTSID** A field that contains a Windows NT SID.

Section Access in Combination with Publisher

While QlikView Publisher can use its “loop and reduce” functionality to reduce a QVW by rows by user or group as it is being reloaded, you can also accomplish this in Section Access dynamically as the document is opened, either method will work and both have benefits. The Loop and reduce from Publisher will help you to reduce the memory footprint of the QVWs on your server(s), while the Section Access method is portable with the document. Another reason to use Section Access is the application of authentication in the QVW, through SSO or user ID and password. This is especially important if the QVW is going to be enabled for download from the AccessPoint or otherwise distributed to users.

Best Practices when using Section Access:

- In Section Access, always use the Upper() function when utilizing a load statement, use it on every column no matter what. (even when reading from .qvd)
- AD Groups for security if possible
- Security in include files for reuse
- Add the Publisher's service account to the Section Access table
- Utilizing a 'Star Schema' design for the data model with NO LINK Tables.
Link tables hurt performance greatly!
- Best case is to have 1 fact table with the dimensions all directly connected to the fact.
In rare instances should additional 'snowflake' dimensions to be used.
- In the fact tables, have no more than 30 – 40 columns defined.(there can be a few more/less, but do not have 150 columns unless you fact is less than 10 Million records (with a decent server)
- Many times having too many columns are a situation brought on by utilizing 'Role Playing Metrics'. While this may be helpful, too many of these metrics create a performance degradation on the server.

Reuse of script code

For easier manageability and faster development it's recommended to reuse script code as much as possible. By using Deployment Frameworks predefined structures and variables it's easy to reuse script code. There are two ways of reusing code in Qlik Script:

- Include files
- Use of functions

Include files

An include file is just a Qlik script (text file) that is included into the main script during execution. Qlik include scripts use the prefix *qvs*. The entire or parts of the script can thus be put in a file for reuse.

All Include files are stored in *6.Custom* folder, the global variable for *6.Custom* folder is *vG.CustomPath* and should always be used when accessing a custom script, meaning that it's not a part of the Deployment Framework initiation process. Example:

```
$(Include=$(vG.CustomPath)\1.xyz_Calculations.qvs);
```

Sub Functions

Qlik have the possibility of reusing scripts and functions by using the [Sub](#) and [Call](#) commands. As shown above with the [LCGV](#) function. The Framework contains several nice to have functions. All sub functions are stored in *4.Sub* folder and are included in the script start right after the *1.Init* script. Use [Call function_name\('Input parameters or variables'\)](#) command to execute the preloaded function. Another function example is [LCGV](#) that is creates Global Variable link (mount) to a container. As of v1.4 all sub functions included with QDF are preloaded *during the initiation process*.

Sub Function example, *vL.FileExist* will return true or false depending on if the file exists

```
Call vL.FileExist ('$(vG.QVDPPath)\SOE.qvd')
```

The predefined Sub functions that exist in the *4.Sub* folder should not be deleted or modified the sub library is used by Deployment Framework initiation process and tools like Variable Editor.

Hint. Use the QlikCommunity to find additional sub function, instead of coding everything from scratch

Pre-Defined Functions

Below is description and syntax for all of the predefined Sub functions available in QDF, these functions are pre-loaded when running the initiation script. The functions are stored under `vG.SubPath` in every container

1.FileExist.qvs

`vL.FileExist` sub function checks if a file or folder exists, can be used before load to avoid errors during script load.

`vL.FileExist` returns *true* or *false*. First include the script: `$(Include=$(vG.SubPath)\1.FileExist.qvs);`

Syntax example in the script: `call vL.FileExist('$(vL.CVSTableName)'`

Example, action exit script after check:

```
call vL.FileExist ('$(vL.MetadataQVDPPath)\1.NorthWind');
```

Will Check if `1.NorthWind` folder exists and return `vL.FileExist = true` or *false*

```
call vL.FileExist ('$(vL.MetadataQVDPPath)\SOE.qvd');
```

```
if vL.FileExist = 'false' then; trace '### Did not find file, exit script'; exit script; endif;
```

Use `*` with caution as this could return a false true if a variable in the statement is missing for example:

```
call vL.FileExist ('$(NullVariable)*'); Will return true as the function will search for * in the application location using relative path as $(NullVariable) returns null .
```

2.LoadVariableCSV.qvs

SUB routine used for loading variables stored in csv files into the Qlik Script.

This file is used by `1.Init` to load Custom Global Variables.

First include the script in the beginning: `$(Include=$(vG.SubPath)\2.LoadVariableCSV.qvs);`

Execute (Call) the Sub inside the script:

```
call LoadVariableCSV('My Variable File.csv', ['Search Tag'], ['Container Prefix'], ['Comments as variables']  
['Container Map Mode']);
```

- **My Variable File** Is the Variable File name to load, wild cards is possible. the function will by default try to find the variable file in `$(vG.BaseVariablePath)` (your container) or in `$(vG.SharedBaseVariablePath)` shared container
- **Variable Tag** Is optional, will load variables based on tag's managed by the variable editor
- **Container Prefix** Is optional, will load variables from any container by using the prefix
- **Comments as variables** Is optional, will create a `_comment` variable for every real variable (if comments exist), this is nice way to add meta-data into expressions. *Comments as variables* can also be activated by setting the variable `SET vL.CommentsAsVariables=True;` before the `1.Init.qvs` Initiation script.
- **Container Map Mode** is a special mode to create variables based on the Container Map, this is used internally by the Variable Editor.

Examples:

```
call LoadVariableCSV('') Load all variables within my home container
```

```
call LoadVariableCSV('','HR','Shared') Load all the HR tagged variables in the Shared container
```

```
call LoadVariableCSV('MyVariables','HR') Open MyVariables file and Load HR tagged variables
```

```
call LoadVariableCSV('MyVariables.csv','',',','True') Load variables and Variable Comments
```

```
call LoadVariableCSV('','HR','AcmeHR') Load all HR tagged variables within AcmeHR container
```


3.LoadContainerMap.qvs

SUB routine used for loading a Container Map csv file. This routine will return information for a specific container. These parameters are used when creating Global Variables to Link a container.

The *LoadContainerMap* function is used by the *4.GenericContainerLoader.qvs* script and by the *LoadContainerGlobalVariables* function.

First include the script in the beginning: `$(Include=$(vG.SubPath)\3.LoadContainerMap.qvs);`

Execute (Call) the Sub inside the script, example:

```
sub LoadContainerMap('Container Map file', 'Container name', [' Optional $(vG.BasePath)']);
```

Load Container Map returns these variables:

vL.ContainerFolderName This is the Container folder name

vL.ContainerPathName This is the Container prefix name

vL.RootPath This is container path *vG.RootPath* or alternative Path

vL.Comment Comments regarding the container

vL.LoadContainerMapCount Returns a result (Variable prefix name) only if Variable prefix duplication found. This so that Variable Editor can alert operator to remove duplication.

The third switch *\$(vG.BasePath)* is optional and specially designed to identify Root Path (*vG.RootPath*) during initiation (1.Init). This is done by opening the container map and checking where I am and where the Root Path is in relation to my container? The value must be global variable base path (*vG.BasePath*). If this process fails the Root Path will be set to one folder above your container. When using this switch the *Container name* parameter is not needed.

4.GenericContainerLoader.qvs

The [LoadContainerGlobalVariables](#) or [LCGV](#) function creates Container Global Variable links to other containers based on the Container Map. SUB routine loading Container link Global Variables into Qlik Script. This routine is intended to be used inside the Qlik scripts and is designed for easy use.

4.GenericContainerLoader.qvs is a SUB that is loaded during *1.init* initiation phase but is not used until the [LoadContainerGlobalVariables](#) function is called.

The function will exit without mapping if the physical container is missing. *Container Path Name* created and maintained by the Variable Editor is a mandatory value.

There is also a short name for [LoadContainerGlobalVariables](#) available named [LCGV](#) that will work the same

Execute (call) the Sub function inside the script,

Call [LoadContainerGlobalVariables](#) ('Container Path Name', [Optional Single Folder [:Additional folders separated by ;]);

Container Path Name This is container prefix name (Tag) to retrieve variables from *Single Folder* This is used to select folder/folders that should retrieve variables, these are separated by ;

Example 1, load all global path variables to the AcmeTravel Container:

```
call LoadContainerGlobalVariables ('AcmeTravel'); or
```

```
call LCGV ('AcmeTravel');
```

Example2, load a single global path variable, in this case Acme Travel QVD path (*vG.AcmeTravelQVDPath*).

```
call LoadContainerGlobalVariables ('AcmeTravel','QVD'); or
```

```
call LCGV ('AcmeTravel','QVD');
```

Example 3, load several global path variables by use ';' as separator, in this case *vG.OracleQVDPath*, *vG.OracleIncludePath* and *vG.OracleApplicationPath* variables will be created

```
call LoadContainerGlobalVariables ('Oracle','QVD;Include;Application'); or
```

```
call LCGV ('Oracle','QVD;Include;Application');
```

Example 4, load global path variables to AcmeTravel based on Container Map stored in Shared Folders:

```
call LoadContainerGlobalVariables ('AcmeTravel',,'true'); or
```

```
call LCGV ('AcmeTravel',,'true');
```

5.DoDir.qvs

DoDir is a simple to use but powerful function that will index selected folder/file structure and return a Table containing file name and path under selected file system. First include the script:

```
$(Include=$(vG.SubPath)\5.DoDir.qvs);
```

After execute (call) the Sub DoDir inside the script.

Call DoDir (*Scan Path*, [*Table Name*], [*Folders Only*], [*Single Folder*], [*Qualified Felds*], [*Hide QDF Templates*])

Scan Path It the folder path to scan

Table Name Is the Table name, optional default name is *DoDirFileList*

Folders Only Is an optional switch if set to 'true' only folders will be returned

Single Folder Is an optional switch if set to 'true' only one single folder will be indexed

Qualified Felds Is an optional switch if set to 'true' all field named will be Qualified *based on the Table Name*

Hide QDF Templates Is an optional switch if set to 'true' Template folders that starts with 0. Or includes a # in QDF will be excluded. This switch is primarily used by the *DynamicContainerGlobalVariables* function.

Examples:

- **call DoDir** ('\$(vG.IncludePath)'); *Simple Example, returns all files under vG.IncludePath*
- **call DoDir** ('\$(vG.IncludePath)*.qvs'); *Will only return files with file type qvs under vG.IncludePath*
- **call DoDir** ('\$(vG.IncludePath)', 'IncludeFileTable'); *Change Table name to IncludeFileTable*
- **call DoDir** ('\$(vG.IncludePath)', '', 'true'); *Returns folder names only under vG.IncludePath*
- **call DoDir** ('\$(vG.QVDPPath)\HR.qvd'); *Returns a line for this single file*
- **call DoDir** ('\$(vG.QVDPPath)', 'Tmp_Field', '', 'true'); *adds qualification on fields, example Tmp_Field.DoDirFileTime*

Table and fields that is returned:

DoDirFileName	FullyQualifiedName	DoDirFileSize	DoDirFileTime	DoDirContainerPath	DoDirFileExtension	DoDirFileN
desktop.ini	C:\QV-Docs\SourceDoc	46	3/2014 8:33:42 PM	desktop.ini	INI	
desktop.ini	C:\QV-Docs\SourceDoc	46	3/2014 8:33:41 PM	0.Template\1.Container1	INI	
Folder.ico	C:\QV-Docs\SourceDoc	36870	3/2014 8:33:42 PM	Folder.ico	ICO	
Folder.ico	C:\QV-Docs\SourceDoc	99462	3/2014 8:33:41 PM	0.Template\1.Container1	ICO	
Info.txt	C:\QV-Docs\SourceDoc	418	3/2014 8:33:42 PM	Info.txt	TXT	
Info.txt	C:\QV-Docs\SourceDoc	420	3/2014 8:33:41 PM	0.Template\Info.txt	TXT	
Info.txt	C:\QV-Docs\SourceDoc	418	3/2014 8:33:41 PM	0.Template\1.Container1	TXT	
Info.txt	C:\QV-Docs\SourceDoc	438	3/2014 8:33:41 PM	0.Template\1.Container1	TXT	
Info.txt	C:\QV-Docs\SourceDoc	455	3/2014 8:33:41 PM	0.Template\1.Container1	TXT	
Info.txt	C:\QV-Docs\SourceDoc	432	3/2014 8:33:41 PM	0.Template\1.Container1	TXT	

- **DoDirFileName** is the File Name without path
- **FullyQualifiedName** is the file name and complete path
- **DoDirFileSize** is the file size
- **DoDirFileTime** is file date and time
- **DoDirContainerPath** lists the files in relationship with the current container
- **DoDirFileExtension** Contains the File Extension in upper case, perfect to use when searching for types
- **DoDirFileNameCount** Counts file name (DoDirFileName) duplications.

6.CreateFolder.qvs

Create Folder function will -as the name says- create a folder (if non existing) or a folder structure. CreateFolder does not work in Qlik Sense without changing Engine to legacy mode.

First include the script: `$(Include=$(vG.SubPath)\6.CreateFolder.qvs);`

After execute (call) the Sub CreateFolder inside the script.

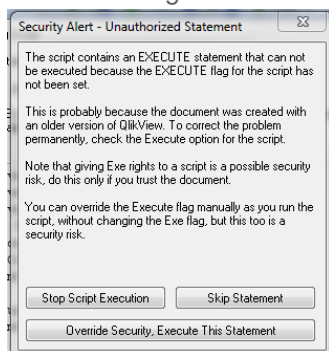
`sub CreateFolder (vL.FolderName)`

`vL.FolderName` Is the folder name or folder structure to create

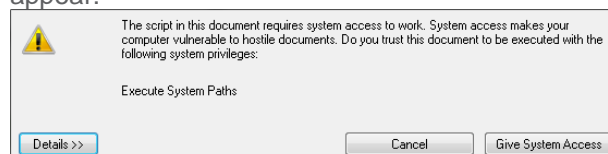
Examples:

- `call CreateFolder(' $(vG.QVDPPath)1.Northwind');` Will create Northwind folder under vG.QVDPPath
- `sub CreateFolder (' $(vG.QVDPPath)1.Extract\1.Northwind');` Will create Northwind folder under vG.QVDPPath\Extract

When executing this function in QlikView Developer and creating a folder one of these popup boxes will



appear:



Press Override Security to execute the folder creation, next run the folders are already created and the box will not return. Recommendation is to activate *Can Execute External Programs* this will also allow Publisher to run the function.

Script Privileges

Selecting any of these options will make QlikView warn users about executing the script.

- ☐ Open Databases in Read and Write mode
- ☒ Can Execute External Programs

Note that Qlik Sense will not allow folder creation by default, legacy mode need to be activated.

7.CalendarGen.qvs

Calendar Generation Function created by *Jonas Valleskog* and functions added by Qlik. Generic calendar generation script that enables scalable handling of creating and navigating multiple date fields

Implementation instructions

In the script editor, Deployment framework tab include the sub:

```
$(Include=$(vG.SubPath)\7.CalendarGen.qvs);
```

Call the SUB function (once per date field) after table load statements.

CALL CalendarGen('Date Field', 'Calendar Table' [, 'Months Left Fiscal Date'] [, 'Min Date', 'Max Date'] [, 'Link Table'];

- **Date Field** is the date field to link calendar. Generated Calendar is based on this field
- **Calendar Table** (Optional) is the master calendar table name default is the same name as Date Field
- **Months Left Fiscal Date** (Optional) to activate Fiscal Dates, set no of months left of the Calendar year the month the Fiscal year begins. E g '3' if the first month of the Fiscal year is October.
- **Min Date** Optional Set hard Minimum calendar date ex. '11/7/1996' (depending on locale settings)
- **Max Date** Optional Set hard Maximum calendar date ex.'8/13/1999'(depending on locale settings)
- **Link Table** (Optional) By default link table is identified based on Date Field use this setting if need to override

Examples:

```
CALL CalendarGen('OrderDate');
```

```
CALL CalendarGen('OrderDate','OrderDateCalendar', '3'); //Fiscal Dates
```

```
CALL CalendarGen('OrderDate','OrderDateCalendar', '', '11/7/1996','8/13/1999'); //Min and Max date
```

The sub function will return table with the standard fields below:

- **Table Name** – The *Date Field* table name used as key field to data model
- **Table Name Week** – Week number field Ex. 32,33,34
- **Table Name Year** – Year field Ex. 2001, 2002
- **Table Name Month** – Month field Ex. Jul, Aug
- **Table Name Day** – Day number field Ex. 1,2,3,4
- **Table Name WeekDay** – Weekday short name field Ex. Mon, Tue, Wen
- **Table Name Quarter** – Quarter field Ex Q1, Q2, Q3, Q4
- **Table Name MonthYear** – Concatenated month and year field Ex. 08-2002, 09-2002
- **Table Name QuarterYear**– Concatenated quarter year field Ex. Q3-2002, Q4-2002
- **Table Name WeekYear**– Concatenated week year field Ex. 32-2002, 33-2002
- **Table Name YTD Flag** – Year to Date Flag field shows 1 if current year
- **Table Name PYTD Flag** - Past Year to Date flag field shows 1 if last year
- **Table Name CurrentMonth Flag**– Current Month flag shows 1 if historical month is same as current month
- **Table Name LastMonth Flag**- Last Month flag shows 1 if historical month is same as last month
- **num Table Name**- Autonumber field based on rows ex. 1,2,3,4,5,6...700,701,702
- **Table Name numMonthYear** – Autonumber field based on MonthYear field ex. 2, 28, 59, 89
- **Table Name numQuarterYear** – Autonumber field based on QuaterYear field ex. 2, 89, 181
- **Table Name numWeekYear** – Autonumber field based on WeekYear field ex. 2, 4, 11, 18, 25

Tips and tricks:

- Check out *6.Calendar-Example* to get inspiration. Copy or re-create the calendar objects (time related list boxes) laid out in the front-end of the example QVW file.
- Use *DateFormat* variable when formatting date, this creates flexibility when changing locale.
ex. `Date(OrderDate,$(DateFormat)) AS OrderDate`
- To avoid potentially slow queries against large in-memory tables, contemplate storing out the date field to QVD first and use the QVD store as the input source to the MinMax: table creation.
- If gaps in calendars for missing dates are not an issue, consider replacing AUTOGENERATE() logic for generating the calendar table with a distinct list of each date seen in the source table instead.

8.QVFileInfo.qvs

QvFileInfo sub function returns information (in table format) regarding Qlik files that stores metadata at the moment QVW and QVD file formats. First include the script: `$(Include=$(vG.SubPath)\8.QVFileInfo.qvs);`

After execute (call) the Sub *QVFileInfo* inside the script.

`Call QVFileInfo('Fully Qualified file Name','Table Name')`

Fully Qualified file Name is the path and name of qvd or qvw file. *Table Name* (Optional) is name of the table returning the result default table name is *QVFileInfo* linked with *QVFileInfo_field* (field details table)

Examples:

```
call QVFileInfo('$(vG.QVDPATH)\Customer.qvd') // Will get MetaData regarding Customer.qvd
call QVFileInfo('$(vG.QVDPATH)\Customer.qvd','QVFileTable')
```

Table *QVFileInfo* contains table and file information regarding QVD and QVW files:

- **FullyQualifiedName** is the file name and complete path, use as link to DoDir Table
- **QVTablesKey** Table link key to *QVFileInfo_Fields* table
- **QVTableName** Name of tables in an QVW file or name of Table in a QVD file
- **QVFileTime** Data reload date
- **QVTableNbrRows** Total number of rows in *QVTableName*
- **QVTableNbrFields** Total number of fields in *QVTableName*
- **QVTableNbrKeyFields** Total number of Key fields in *QVTableName* only used by QVW files
- **QVTableComment** Table Comments, only used by QVW files

QVFileInfo_Fields is a help table, containing Field information regarding QVD and QVW files:

- **QVTablesKey** Table link key to *QVFileInfo* table
- **QVFieldName** Name of Fields in a Table
- **QVFieldComment** Field Comments, only used by QVW files

It's best used in combination with *DoDir* function that will index the Qlik files and use *FullyQualifiedName* field as link to the *QVFileInfoTable*. This is an example of *DoDir* and *QvFileInfo* functions working together:

```
$(Include=$(vG.SubPath)\8.QVFileInfo.qvs);
$(Include=$(vG.SubPath)\5.DoDir.qvs);
call DoDir('$(vG.BasePath)');
for vL.LoopDoDirRows = 1 to NoOfRows('DoDirFileList')
    LET vL.FullyQualifiedName =
peek('FullyQualifiedName',$(vL.LoopDoDirRows),'DoDirFileList');    call QVFileInfo
('$(vL.FullyQualifiedName)');
next
```

9.QVDMigration.qvs

QVDMigration sub function migrates and consolidates qvd data between containers, using fixed file names or wildcard (*) migrating a qvd folder in one single statement. QVDMigration can optionally migrate selected fields and scramble fields if needed. The sub function is primarily designed for data migration into a self-service (sandbox) environment. Needed subfolders in destination path will automatically be created by use of *CreateFolders* function.

First include the script: `$(Include=$(vG.SubPath)\9.QVDMigration.qvs);`

Execute (call) the Sub function inside the script,

Call QVDMigration (QVD Source File, QVD Destination File, [Select specific fields (, separator) leave blank for all fields], [Scrambled fields (, separator)], [Table Name Suffix], [Include Subfolders], [Format-Spec]);

- **QVD Source** File is the QVD source file or folder
- **QVD Destination** File is QVD destination path. Optionaly, to rename file add filename
- **Fields to select** (Optional) used when selecting specific fields from the Source QVD. Multiple fields are separated with (,).
- **Scrambled fields** (Optional) used when scrambling fields from the Source QVD. Multiple fields are separated with (,). Scramble overrides Fields to select parameter if dual entries found. Scrambling will have performance impact so carefully select fields to scramble.
- **Table Name Suffix** (Optional) primarily used as meta-data separator between source and destination this by adding a suffix on the destination qvd table names. The difference will be exposed in Governance Dashboard as shown below.

TableName	QVD\QVX
Customer	C:\QV-Docs\SourceDocs\1.Production\0.Administration\2.QVD\Customer.qvd
	C:\QV-Docs\SourceDocs\1.Production\1.AcmeSales\2.QVD\Customer.qvd
Customer-Shared	C:\QV-Docs\SourceDocs\1.Production\99.Shared_folders\2.QVD\Customer.qvd

Separating Table Name (Meta Data) by using Table Name Suffix, shown in Governance Dashboard

- **Include Subfolders** (Optional) If set to true subfolders under Source Files will also be migrated, needed subfolders in destination path will automatically be created by use of *CreateFolders* function
- **Format-Spec** (Optional) export to other formats than qvd, options are txt or qvx

Examples:

Migrate Customer.qvd to shared QVD folder without any manipulation

Call QVDMigration ('\$(vG.QVDPATH)\Customer.qvd','\$(vG.SharedQVDPATH)');

Migrate Customer.qvd to shared QVD folder and changing name to Customer_new.qvd

Call QVDMigration ('\$(vG.QVDPATH)\Customer.qvd','\$(vG.SharedQVDPATH)\Customer_new.qvd');

Migrate fields CustomerID and CompanyName in all Customer*.qvd files to shared QVD folder

Call QVDMigration ('\$(vG.QVDPATH)\Customer*.qvd','\$(vG.SharedQVDPATH)','CustomerID,CompanyName');

Migrate fields CustomerID and CompanyName in Customer.qvd to shared QVD folder scramble CustomerID field

Call QVDMigration ('\$(vG.QVDPATH)\Customer.qvd','\$(vG.SharedQVDPATH)',

'CustomerID,CompanyName','CustomerID');

Migrate all Customer qvd files to shared QVD folder, scrambling CustomerID field in all the qvd's

Call QVDMigration ('\$(vG.QVDPATH)\Customer*.qvd','\$(vG.SharedQVDPATH)\Customer.qvd','','CustomerID');

10.QVDLoad.qvs

QVDLoad will load up qvd files into a data model based on the meta-data headers in the qvd files. Also qvd files stored in subfolders can optional be loaded. QVDLoad is based on *QVDMigration* and have the same code and switches except for destination path.

First include the script: `$(Include=$(vG.SubPath)\10.QVDLoad.qvs);`

Execute (call) the Sub function inside the script,

Call QVDLoad(QVD Repository, [Select specific fields (, separator) leave blank for all fields], [Scrambled fields (, separator)], [Table Name Suffix], [Include Subfolders]);

- **QVD Repository** is the QVD source file or folder storage
- **Fields to select** (Optional) used when selecting specific fields from Repository. Multiple fields are separated with (,).
- **Scrambled fields** (Optional) used when scrambling fields from Repository into the application. Multiple fields are separated with (,). Scramble overrides Fields to select parameter if dual entries found. Scrambling will have performance impact so carefully select fields to scramble.
- **Table Name Suffix** (Optional) will add a suffix on all tables in the data model
- **Include Subfolders** (Optional) If set to true qvd files in subfolders will also be loaded

Examples:

Load in all qvd files in vG.QVDPath folder and create a data-model based on table headers

Call QVDLoad ('\$(vG.QVDPath)');

Load in all qvd files stored in every subfolder under vG.QVDPath

Call QVDLoad ('\$(vG.QVDPath)', '', '', 'true');

Load in fields CustomerID and CompanyName in all qvd files.

Call QVDLoad ('\$(vG.QVDPath)', 'CustomerID,CompanyName');

Loads fields CustomerID and CompanyName and scramble CustomerID field from Customer.qvd

Call QVDLoad ('\$(vG.QVDPath)\Customer.qvd', 'CustomerID,CompanyName','CustomerID');

11.DynamicContainerGlobalVariables

DynamicContainerGlobalVariables (or **DCGV**) works in almost the same way as

LoadContainerGlobalVariables. **DCGV** loads environmental global variables from other containers. The difference is that this function identifies the global variable path names based on indexed folder name instead of using the container mapping table (stored in 1.Init.qvs). **DCGV** can actually be used from any folder structure not only containers.

There is a naming convention that needs to be obliged to identify and create global path variables:

- Only folders containing an initial number will be identified as a Container folder and get a variable. Example: Folder *1.Extract* will get the global variable *vG.xxxExtractPath* where *xxx* is the container prefix name.
- Folders with a starting *0*. will be discarded as they are template folders, no global variables will be created. Example: Folder *0.Templates* will not get a correlating global path variable
- Folders that includes a *#* will also be discarded, as this is treated as a remarked folder. Example: Folder *1.Extract#* will not get a correlating global path variable
- The global variable name is the name (without space) between first and second dot (.) or between first dot and file name end if there's only one dot. Text after the second dot is treated as descriptive information. Example:
Folder *1.Extract.QVDFiles* will have the global variable *vG.xxxExtractPath*

Folder *1.Extract* will have the global variable *vG.xxxExtractPath*

Folder *1.Extract QVDFiles* will have the global variable *vG.xxxExtractQVDFilesPath* (space is removed)

Execute (call) the Sub function inside the script

Call DynamicContainerGlobalVariables ('Container Path Name', ['Single Folder [; Additional folders separated by ;]', ['Override Prefix'], ['Use Shared Folder Container Map']);

- *Container Path Name* Container prefix name (Tag) or path to a folder structure to retrieve global path variables from
- *Single Folder (Optional)* This is used to select folder/folders that should retrieve variables, these are separated by ;
- *Override Prefix (Optional)* Uses override prefix in created global variable names instead of using the map. This is neat to use when pointing *Container Path Name* to a file structure or containers not included in the map.
- *Shared Folder Container Map (Optional)* If 'true' shared container map will be used instead of the locally stored container map

Example 1, load all global path variables to the *AcmeTravel* Container:

```
call DynamicContainerGlobalVariables('AcmeTravel'); or  
call DCGV('AcmeTravel');
```

Example2, load a single global path variable, in this case Acme Travel QVD path (*vG.AcmeTravelQVDPath*).

```
call DynamicContainerGlobalVariables('AcmeTravel','QVD'); or  
call DCGV('AcmeTravel','QVD');
```

Example 3, load several global path variables by use ';' as separator, in this case *vG.OracleQVDPath*, *vG.OracleIncludePath* and *vG.OracleApplicationPath* variables will be created

```
call DynamicContainerGlobalVariables('Oracle','QVD;Include;Application'); or  
call DCGV('Oracle','QVD;Include;Application');
```

Example 4, Retrieve global path variables from folders under *c:\temp* that have *QVDEExtract* in the name

```
call DynamicContainerGlobalVariables('c:\temp', 'QVDEExtract'); or  
call DCGV('c:\temp', 'QVDEExtract');
```

Example 4, Retrieve global path variables from a folder under *c:\temp* that have *QVDEExtract* in the name and set a custom *Oracle* Prefix name, this will create the Global Variable *vG.OracleQVDEExtractPath*

```
call DynamicContainerGlobalVariables('c:\temp', 'QVDEExtract', 'Oracle'); or  
call DCGV('c:\temp', 'QVDEExtract', 'Oracle');
```

Index Functions (12.Index.qvs)

```
$(Include=$(vG.SubPath)\12.Index.qvs);
```

Index is functions that creates and maintains a set of indexes for Qlik Data files (QVD). These indexes are used when searching for data types across multiple qvd files this means that developers and power users select needed data using a simple command. Finding the data is done autonomously by the system in the background. The index is stored in one single location (vG.SharedConfigPath) while the qvd's can be spread out across the environment depending on security or organizational considerations. There are index functions implemented:

- **IndexAdd** Will create the QVD indexes, should be done during qvd creation.
- **IndexLoad** Loads Qlik data based on combination of index criteria's like file name, tags, table, fiels...
- **IndexDel** Delete index and optionally referring qvd file.

Use the *Index Monitor* application under *0.Administration/3.IndexMonitor* to monitor Indexes and QVD files.

IndexAdd

IndexAdd creates a QVD index. The index is based on meta-data and tags collected from the QVD header. The index can thereby be recreated if need be. The index default location is \$(vG.SharedConfigPath)/Index location can be modified if needed.

Execute *IndexAdd* sub function inside the script:

```
Call IndexAdd('QVD path and name','[Index folder name]','[Container name]','[Tags]','[Alternative Index path]')
```

- **QVD path and name** Path and name of QVD file to Index, wild card (*) is supported
- **Index folder name** (Optional) Place the Index in a specific folder, default is to use qvd folder name
- **Container name** (Optional) Specify the QVD files container name, this is usually identified automatically
- **Tags** (Optional) Add index tag, recommendation is to use the *comment table* function instead as this will be more persistent.
- **Alternative Index path** (Optional) will change the default Index path (\$(vG.SharedConfigPath)/Index) This is not recommended as all functions would need the alternative path specified

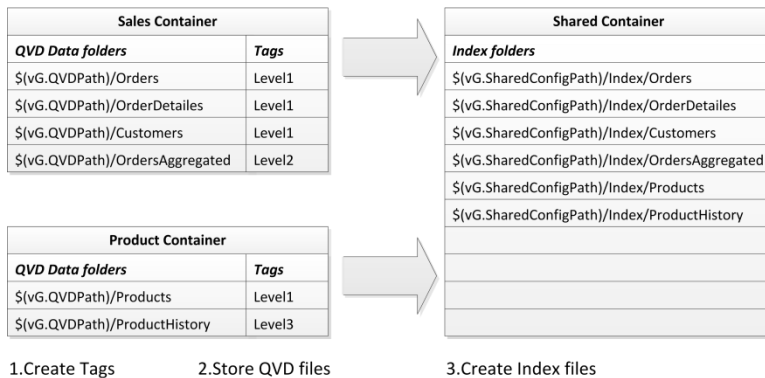
Examples:

```
Call IndexAdd('vG.QVDPath\Customers.qvd'); Will add an index for Customers.qvd file
```

```
Call IndexAdd('vG.QVDPath\*.qvd'); Will add an index for all qvd files in vG.QVDPath path
```

Using Comment field to tag QVD data

It is strongly recommended to add tags into your Qlik data files, these tags will identify what data to load. For example if we create an aggregated QVD data layer it could be tagged -for example- as *Level2* (where level 1 is un-aggregated). This is done by adding tag (or tags) into the qvd meta-data header using the *Comment Table* function. This should be done before storing the QVD, creating the index using *IndexAdd* should be done after *Store into qvd* command.



Example:

```
Comment Table [$(vL.TableName)] with 'Level2';
Store [$(vL.TableName)] into '$(vG.QVDPATH)\Folder\$(vL.TableName).qvd';
Call IndexAdd('$(vG.QVDPATH)\Folder\$(vL.TableName).qvd');
```

Several tags can be added using comma (,) as separator as shown below:

```
Comment Table [$(vL.TableName)] with 'Level2,SalesAgg';
```

QVD naming conventions

When using the Index functionality it's important to have a good qvd naming convention as [IndexLoad](#) function will use the qvd name as primary search criteria, example:

```
$(vG.QVDPATH)\Orders\01-02-2015.qvd [Table Name][Day]-[Month]-[Year]
```

In this case orders are stored according to date, and the QVD folder is the same as table name. The date and folder name can be used during search.

Security requirements

Orders folder will be automatically created in the Index by using the [CreateFolder](#) function, for this the qvw file should have **Can Execute External Programs** switch checked.

Qlik Sense limitations

Qlik Sense Native mode does not allow the execution command, thereby creation of index folders will not work (Indexing of Qlik qvd files works in Sense). Qlik Sense qvd files is in a different format and have no meta-tags just yet, so [IndexAdd](#) function will not work against this qvd format.

Index fields

[IndexAdd](#) will create a tiny index file for every qvd file. The index file contains descriptive meta-data of the Qlik Data File (QVD). Almost all the index fields are searchable when using the [IndexLoad](#) function. Below is a list of the Index fields:

- **QVDFileName** Name of the added qvd file
- **QVTableName** Table name
- **QVDSourcePath** URL to the qvd file (only used as backup for Container + relative path)
- **QVDSourceContainerName** Name of qvd container (used when retrieving the qvd)
- **RelativePath** Relatively where in the container is the qvd stored
- **QVDTag** Tags that is referred to this qvd (created by [Comment Table](#))
- **QVDIndexStorageName** Index storage sub folder name (usually the same as qvd folder name)
- **QVDTimestamp** Time of qvd creation taken from meta-data (not the same as file time).
Convert timestamp to date: `Let vL.Date = timestamp(QVDTimestamp, '$(DateFormat)');`
- **QVDFields** Field that the qvd contains
- **QVDTableCreator** qvd creator file name (qvw)
- **QVDNbrRecords** Number of records the qvd contains
- **QVDNbrFields** Number of fields the qvd contains

IndexLoad

IndexLoad loads qvd data based on index search criteria's like tags and field names. The qvd fieldname is the primary search criteria so it's strongly recommended to have a qvd naming convention like *day-month-year-TableName.qvd*.

Execute **IndexLoad** sub function inside the script:

Call IndexLoad(['QVD file name'],['Table Name'],['Index Folder Name'],['Tags'],['Fields'],['Index Only'],['Load Max Rows'],['Alternative Index path'])

- **QVD file name** (Optional) Name of QVD to load, wild cards (*01-2015*) is supported
- **Table Name** (Optional) Load in a table, can be combined with **QVD file name**
- **Index Folder Name** (Optional) use this specific index only, can be combined with **QVD file name**
- **Tags** (Optional) load data containing a specific tag, can be combined with **QVD file name**
- **Fields** (Optional) load selected fields separated by comma (,) can be combined with **QVD file name**
- **Index Only** (Optional) will only load in the Index, true will use default table name (vL._QVDIndexTable).
Type table name from default vL._QVDIndexTable. This is used when developing apps where the Index is needed.
- **LoadMaxRows** (Optional) will limit how many rows that can be loaded. This will only stop sequential QVD file to load a big QVD will probably load above this limit.
- **Alternative Index path** (Optional) will change the default Index path (\$(vG.SharedConfigPath)/Index) This is not recommended as all functions would need the alternative path specified

Examples:

Call IndexLoad("2014"); Load all qvd files that contains the name 2014

Call IndexLoad("","Customers"); Load all qvd files that contains the customer table

Call IndexLoad("","","Orders"); Load all qvd's in the Orders Index

Call IndexLoad("","","Level2"); Load all Level2 tagged qvd files

Call IndexLoad("","","CustomerID,ContactName,Fax"); Load all QVD's that contains these three fields

Call IndexLoad("","","","IndexTable"); Will not load any data, just the Index table as IndexTable

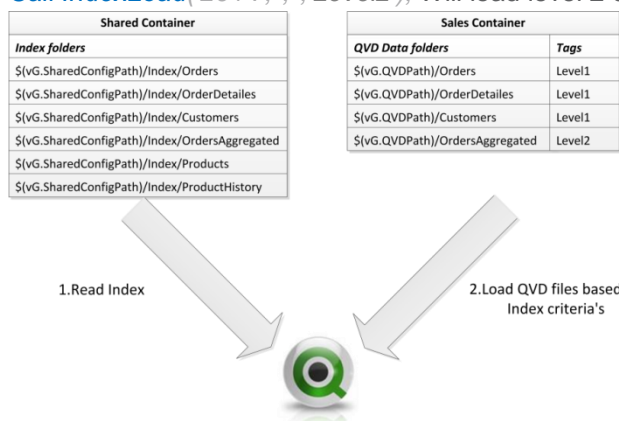
Call IndexLoad("","","","","30000"); Load all qvd's until reaching about 30000 records

These different criteria's can be combined, Examples:

Call IndexLoad("2014','Customers','","CustomerID,ContactName,Fax','30000"); Loads year 2014 containing the table

Customers and fields [CustomerID,ContactName,Fax] also we should not load more than 30000 records.

Call IndexLoad("2014","","Level2"); Will load level 2 data from year 2014



IndexDel

IndexDel delete indexes and optionally associated qvd files. This could be needed keeping a consistent qvd strategy. Example, Storing 24 month of history indexes and qvd files older than 24 month should be removed else history will keep on growing infinite. *IndexDel* will search for the qvd fieldname (from the index) so it's strongly recommended to have a qvd file naming convention, like *TableName\day-month-year-TableName.qvd*.

Execute *IndexDel* sub function inside the script:

Call IndexDel('Index file name', ['Delete associated QVD files'], ['Index Folder Name'], ['Alternative Index path'])

- **Index file name** Name of index to delete, wild cards (*) is supported
- **Delete associated QVD files** (Optional) if *true* qvd files associated to the indexes will also be deleted
- **Index Folder Name** (Optional) use this specific index only, can be combined with **Index file name**
- **Alternative Index path** (Optional) will change the default Index path $(\$(vG.SharedConfigPath)/Index)$ This is not recommended as all functions would need the alternative path specified

Call IndexDel('2011-12*'); Deletes all Index files that starts with the name 2011-12

Call IndexDel('2011-12*', 'true'); Will delete all index and associated qvd files that starts with the name 2011-12

Security requirements

IndexDel uses the execution command in Qlik to delete files, for this the qvw file need to have **Can Execute External Programs** switch checked in.

Qlik Sense limitation

Qlik Sense Native mode does not allow the execution command thereby *IndexDel* will not work in Sense.

1.Delete Index

Shared Container
Index folders
$\$(vG.SharedConfigPath)/Index/Orders$
$\$(vG.SharedConfigPath)/Index/OrderDetails$
$\$(vG.SharedConfigPath)/Index/Customers$
$\$(vG.SharedConfigPath)/Index/OrdersAggregated$
$\$(vG.SharedConfigPath)/Index/Products$
$\$(vG.SharedConfigPath)/Index/ProductHistory$

2. Optionally, delete associated qvd files

Sales Container	
QVD Data folders	Tags
$\$(vG.QVDPPath)/Orders$	Level1
$\$(vG.QVDPPath)/OrderDetails$	Level1
$\$(vG.QVDPPath)/Customers$	Level1
$\$(vG.QVDPPath)/OrdersAggregated$	Level2

99.LoadAll.qvs

Simple include scrip that will load in all available sub functions in one single go. Recommendation is to use *Must_Include* so that the script breaks if *99.LoadAll.qvs* is missing.

In first tab include the script: `$(Must_Include=$(vG.SubPath)\99.LoadAll.qvs) .`

From version 1.4 the *99.LoadAll.qvs* script runs by default inside *4.Custom.qvs* file so that it all sub functions is initiated during *1.Init* initial load within all applications.

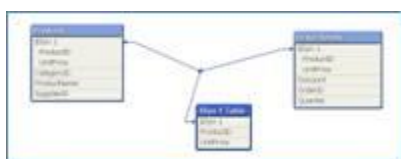
Data Modeling

Understanding

The cornerstone of Qlik is the associative in-memory search technology.

There are some very specific characteristics with this technology that you have to keep in mind.

- Two fields in different tables with exactly the same name, case sensitive, will automatically be connected to each other and fields with exactly the same field value, case sensitive, will be associated with each other.
- If two tables have more than one field in common, Qlik will automatically create a synthetic key a kind of link table. The easiest way to detect a synthetic key is by opening the table viewer (Ctrl-T):



Synthetic key

Another characteristic with the associative database is that the number of distinct (unique) values in a table is more important than the number records. By delimit the number of distinct values in a table the performance of an application can be significantly improved.

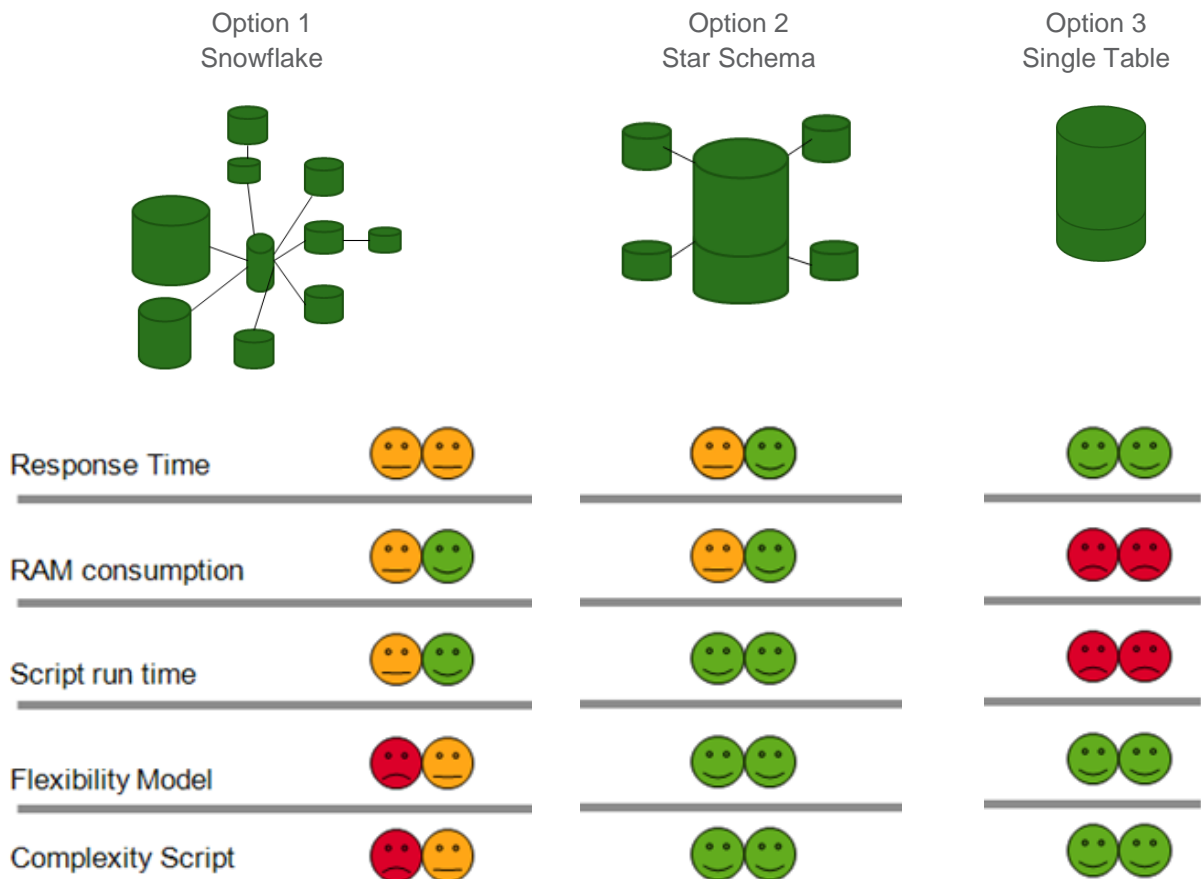
Example: Let's say you have a fact table with 1 billion recs, one of the fields is a timestamp field containing date and time (measured down to fraction of seconds) with almost 800 million distinct values.

Two alternative actions will both improve the performance:

- If you don't need to analyze on time level, simply transfer the field to a date field (use makedate function) and there will not be more than 365 distinct values for one year.
- If you need to analyze on time level, determine on what time level you need to analyze (hour, minute) and create a new field, Time. Depending on what level you decide to analyze, hour will give you 24 distinct values and minute will give maximum 1440 distinct values)

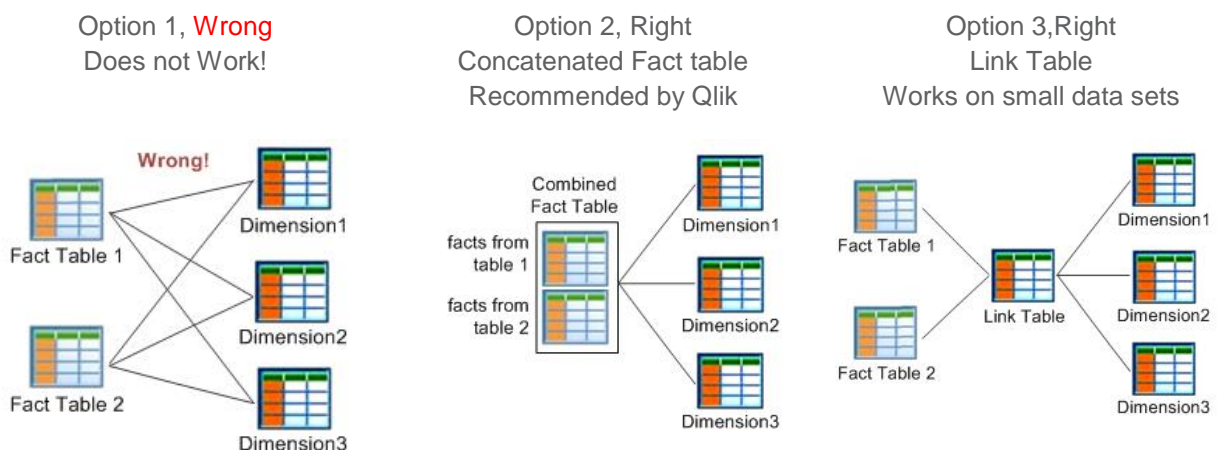
Data models

Represented below are diagrams of 3 basic data models that can be built in Qlik (along with many other combinations). Using these 3 examples we can demonstrate some of the differences in performance, complexity and flexibility between them.



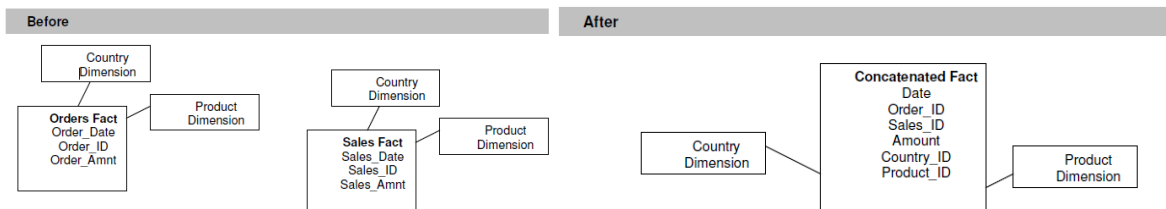
Multiple fact tables

While star schemas are generally the best solution for fast, flexible QlikView applications, there are times when multiple fact tables are needed. Here are the wrong and right ways to join them:



Further examples of how to build and use link tables are contained in QlikCommunity on line (<http://community.Qlik.com/>)

To show how this could be accomplished, the section below takes us through a scenario of two facts tables to be combined into one fact table.



Script Example:

```
Load OrdersFact
Order_Date as Date
Order_ID
Order_Amount as Amount
Country_ID
Product_ID
'Order' as TransactionType
```

CONCATENATE

```
Load SalesFact
Sales_Date as Date
Sales_ID
Sales_Amount as Amount
Country_ID
Product_ID
'Sale' as TransactionType
```

Placing the 'Sale' and 'Order' text types in the script will provide you with a column to determine the transaction type.

Sales

Region	Product	Date	Sales
RegionA	P1	2009-01-31	100
RegionA	P1	2009-02-28	120
RegionA	P1	2009-03-31	140
RegionA	P2	2009-01-31	500
RegionA	P2	2009-02-28	550
RegionA	P2	2009-03-31	600
RegionB	P1	2009-01-31	50
RegionB	P1	2009-02-28	55
RegionB	P1	2009-03-31	60
RegionB	P2	2009-01-31	200
RegionB	P2	2009-02-28	180
RegionB	P2	2009-03-31	160

Plan Yearly

Region	Date	Plan
RegionA	2009-01-1	8000
RegionB	2009-01-1	10000

Procurement Cost

Product	Date	Cost
P1	2009-01-31	130
P1	2009-02-28	1400
P1	2009-03-31	1600
P2	2009-01-31	500
P2	2009-02-28	650
P2	2009-03-31	600

Concatenated Facts

Region	Product	Date	Sales	Plan	Cost
RegionA	P1	2009-01-31	100		
RegionA	P1	2009-02-28	120		
RegionA	P1	2009-03-31	140		
RegionA	P2	2009-01-31	500		
RegionA	P2	2009-02-28	550		
RegionA	P2	2009-03-31	600		
RegionB	P1	2009-01-31	50		
RegionB	P1	2009-02-28	55		
RegionB	P1	2009-03-31	60		
RegionB	P2	2009-01-31	200		
RegionB	P2	2009-02-28	180		
RegionB	P2	2009-03-31	160		
RegionA		2009-01-1		8000	
RegionB		2009-01-1		10000	
	P1	2009-01-31			130
	P1	2009-02-28			1400
	P1	2009-03-31			1600
	P2	2009-01-31			500
	P2	2009-02-28			650
	P2	2009-03-31			600

A concatenation of fact tables example.

Preceding Loads

The use of preceding load statements can simplify your script and make it easier to understand. See the code below for an example of this.

Table1:

```
LOAD CustNbr as [Customer Number],
      ProdID as [Product ID],
floor(EventTime) as [Event Date],
month(EventTime) as [Event Month],
year(EventTime) as [Event Year],
hour(EventTime) as [Event Hour];
```

```
SQL SELECT
      CustNbr,
      ProdID,
EventTime
FROM MyDB;
```

This will simplify the SQL SELECT statement so that the developer can continue to test/augment the statement using other tools, without the complexity of the Qlik transformations embedded in the same SQL statement.

For more information on the Preceding LOAD feature, see the Qlik Reference Manual.

Large Data Sets

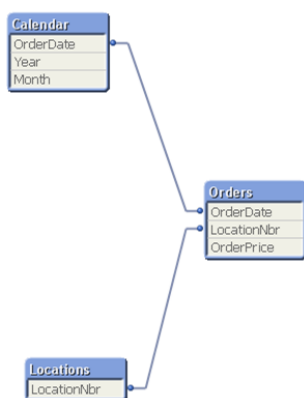
Qlik can handle very large data sets and routinely does so. However, to optimize the user experience and hardware needed, you have options.

Consider the following scenario: You have a large orders data set (1 billion rows). You need to provide high level summary metrics for your executives, trending analysis for your Business Analysts, and detail tables and values for your Orders Processing team. You have many data design options with Qlik, but for demonstration purposes let's explore just 3 of them below:

Detailed fact table only – allow Qlik to do all of the work to display the details and summarize metrics from the lowest level of detail to the highest summary needed.

Advantages – simplicity. This is the easiest solution to code. You simply connect the Orders at a detailed level (perhaps SKU level) to the data model and design all of the high level metrics, trending charts and detailed tables and selections into the QVW.

Disadvantages – Qlik will need to aggregate up to 1 billion rows of detail with every selection made. While Qlik is probably the only BI tool that can do this with acceptable performance, it will still result in a slower user experience than it needs to.



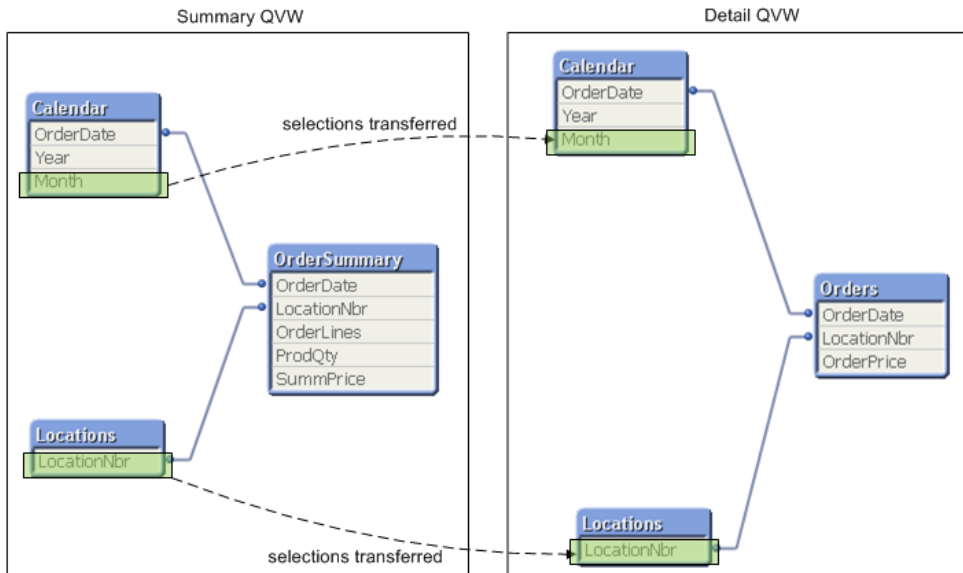
QlikView Document Chaining

Document Chaining – 2 (or more) versions of the QVW are built. One of them has the detailed Orders table as the primary fact table the others have pre-aggregated versions of the Orders table as their primary fact tables. Let's assume just 2 QVWs for this case. You have a diagram below showing the data model from the "summary" QVW and a data model from the "detail" QVW. Note that the dimension values are largely the same between the two models. The main distinction is the fact table in the data model. The users can start from the summary application, showing high level metrics and charts.

If they want to drill into details you can use the Document Chaining feature in QlikView to transfer selections from one QVW to another QVW and open that second QVW. The user will see new charts and tabs show up and (if you design it as such) doesn't even need to know they have transferred from one QVW to another. This means you will only be using the 1 billion row fact table **when your users need it**. The rest of the processing will take place on the pre-aggregated version of the Orders table, which might be smaller than 100 million rows, for example. Document Chaining is discussed in detail in the QlikView Reference Manual and in several QlikView documents.

Advantages – optimizes hardware and speed of response for QlikView navigation and charting. Because the users' selections and navigation are specific to their needs, you don't waste CPU and RAM processing 1 billion rows of detail when the user didn't need things processed at that level.

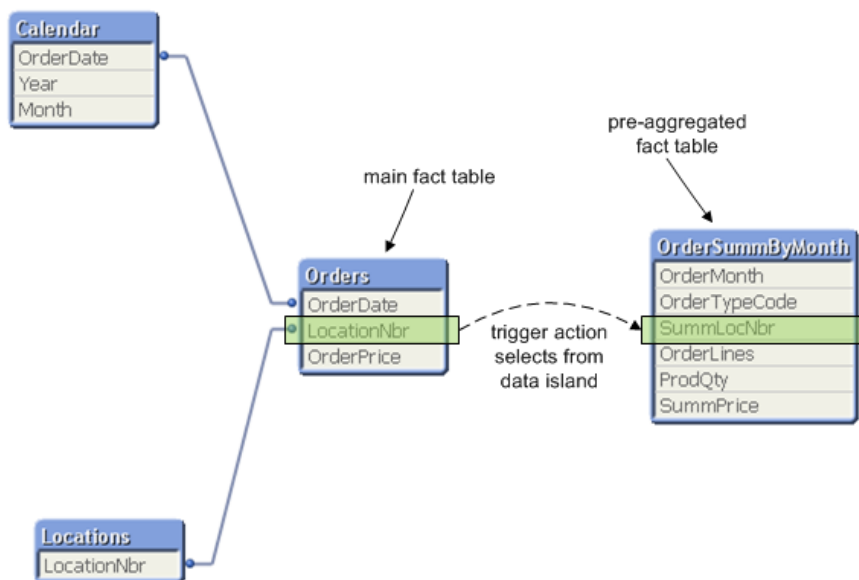
Disadvantages – tables (QVDs) need to be pre-aggregated and maintained for this approach. While this is a one-time development effort, it is slightly more complex than option 1, where only one version of the Orders table is needed.



The 3rd option (and by no means the last) is to use a pre-aggregated summary table **in addition to** the detailed table in a single QVW data model. The diagram shown below is one way to use a pre-aggregated table in the same data model as the detailed version of the table. You would load the pre-aggregated table as a data island (not connected to the other tables in the data model). Then, as relevant selections in the detailed fact table are made you can transfer those selections to the pre-aggregated table using a triggered Action (QlikView version 9 and above).

Advantages – this option doesn't require a second QVW and document chaining in order to use both detailed and summary versions of a large table.

Disadvantages – this option will require some settings to be made in the QVW to trigger the actions that transfer selections from one table to another. As the QVW changes over time, you will need to keep track of where/when to make these actions trigger.



Please note: these are many more ways you could meet the needs described in the above scenario. These are just 3 methods that call out the features and capabilities of QlikView to manage very large data sets. Please see the Architecture Best Practices Guide for more examples of ways to manage large data sets and large deployments of QlikView in an optimal way.

Key factors that affect the model:

Distinct column data.

Distinct key field information.

Both can affect the memory size of the Data Model and the user experience. By having many tables, the links can become a memory hog. It has been known that you can reduce your memory foot print by fifty percent when modifying the data structure; and thus, additionally increasing the UI response.

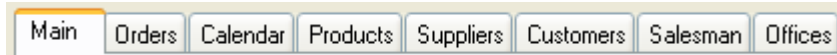
Optimization Tips and Tricks

- Please keep in mind that what really counts when it comes to optimization of a data model is the number of records.
- Don't normalize data too much. Plan for 6 – 10 total tables in a typical application. This is just a guideline, but there is a balance to be struck with data models. See the Data Model section of this document for more details.
- Eliminate small "leaf" tables by using Mapping Load to roll code values into other dimensions or fact tables.
- Store any possible field as a number instead of a string
- De-normalize tables with small numbers of field
- Use integers to join tables together
- Only allow 1 level of snow flaked dimensions from the fact record.(fact, dimension, snowflake, none)
- Use Autonumber when appropriate, will reduce application size
- Split timestamp into date and time fields when date and time is needed
- Remove time from date by floor() or by date(date#(..)) when time is not needed
- Reduce wide concatenated key fields via Autonumber, when all related tables are processed in one script (There is no advantage when transforming alphanumeric fields, when string and the resulting numeric field have the same length)
- Use numeric fields in logical functions (string comparisons are slower)
- Is the granularity of the source data needed for analysis? If not aggregate by using aggregating function like "sum() group by"
- Create numeric flags (e.g. with 1 or 0)
- Reduce the amount of open chart objects
- Calculate measures within the script (model size <> online performance)
- Limit the amount of expressions within chart/pivot objects, distribute them in multiple objects (use auto minimize)

Additional scripting best practice

Other scripting best practices include:

- Use Autonumber only after development debugging is done. It's easier to debug values with a number in it instead of only being able to use surrogates. See Reference Manual if you are not sure how/when to use Autonumber.
- Put subject areas on different tabs so you don't confuse the developers with too much complexity



- Name the concatenate/join statements
- Use *HidePrefix=%;* to allow the enterprise developer to hide key fields and other fields which are seldom used by the designer (this is only relevant when co-development is being done).
- When using the *Applymap()* function, fill in the default value with something standard like 'Unknown' & Value which is unknown so users know which value is unknown and can go fill it in on the source system without the administrators having to get involved. See Reference Manual if you are not sure how/when to use Applymap().

```
StateMapping:
mapping load * inline [
  St,State
  Tx,TX
  Te,TX
  Tex,TX];

LOAD
ApplyMap( 'StateMapping' , St, 'Other')
```

- Never use Underscores or slashes (or anything 'techie') in the field names. Instead code user friendly names, with spaces.
- Instead of: "mnth_end_tx_ct" use: "Month End Transaction Count"
- Only use Qualify * when absolutely necessary. Some developers use Qualify * at the beginning of the script, and only unqualify the keys. This causes a lot of trouble scripting with left join statements, etc. It's more work than it's worth in the long run. See Reference Manual if you are not sure how/when to use Qualify and Unqualify.
- Use "Include" files or hidden script for all ODBC/OLEDB database connections.
- Use variables for path name instead of hard-coding them throughout your script. This reduces maintenance and also provides a simple way to find paths (assuming you put them in the first tab to make it easy to find).
- All file references should use Container naming convention.
- Always have the Log file option turned on if you need to capture load-time information for debugging purpose
- Comment script headings for each tab. See example below:

```
//=====
// App Name:      Wireframe
// Author:         Matt Stephens, QlikTech
// Created:        June, 2010
// Purpose:        This app is a template app demonstrating the use of
//                  wireframe backgrounds to organize QlikView screens into
//                  logical and effective presentation themes.  There is also
//                  a zip file called Wireframe Images.zip that accompanies
//                  this QVW.  It holds dozens of pre-built wireframe images
//                  in various color schemes.
// Modified:       July 18, 2010 BPN - added Intro tab comments
//=====
```

- Comment script sections within a tab with short descriptions. See example below:


```
// -----
// Load the Sessions table first
// -----
Sessions:
LOAD
    MakeDate(LEFT(Timestamp,4), MID(
        Date(Timestamp, 'YYYYMMDD') & '_'
        Time(Timestamp)      as SessionsTi
        Timestamp            as Timestamp,
```

- Add change date comments where appropriate. See example below:

```
Looptable:
LOAD FileName as QVDName
//FROM $(MetaPath)FileList.qvd(qvd)
resident FileList //changed 2010-09-06
WHERE UPPER(Extention) = 'QVD';
```

- Use indentation to make script more readable by developers. See example below:

```
// -----
// Main loop though all QVDs found above
// -----
for X = 1 to fieldvaluecount('QVDName');
    let QVDName = fieldvalue('QVDName', $(X));

    Load *,
        upper('$ (QVDName)' & '_' & Date(Today(), 'YYYY-MM-DD')) as LoadDateKey,
        lower('$ (QVDName)') as FieldQVDFileName,
        Upper('$ (QVDName)' & '-' & date(Today(), 'YYYY-MM-DD')) as FieldHeaderKey;

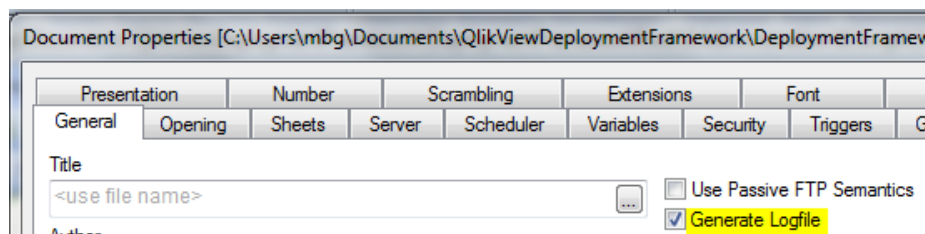
    QvdFieldHeader:
    LOAD
        //lower('$ (QVDName)') as QVDFileName,
        date(Today(), 'YYYY-MM-DD') as FieldHeaderDate,
        FieldName as QVDFieldName,
```

- Never use LOAD * in a load statement. Instead list the columns to load explicitly so that you know what fields will be loaded and this won't change as new columns are added or deleted from source tables. This also helps developers to identify the loaded fields in the script. See example below:

```
// =====
// Locations Data from a QVD
// =====
Locations:
LOAD LocationNbr      as [Location Nbr],
    AddressLine1      as [Address Line 1],
    AddressLine2      as [Address Line 2],
    City              as City,
    Country            as Country,
    CountryRegionCode as [Region Code],
    PostalCode        as [Postal Code],
    [State / Province] as [State Code]
FROM [$(QvdPath)Locations.qvd] (qvd);
```

Application logging

In QlikView it's best practice to turn Document logging on under Document Properties and General Tab. These logs can be used to monitor the system by use of the Governance Dashboard. These logs are also very handy when debugging.



Qlik Sense always has the script log activated.

Deployment Framework log tracing and debugging

When the log is activated it's easy to find where in the QDF initiation scripts the problem has accrued.

Search for the log trace that starts with **### DF** alt **### DF Error** and after the section/include file name.

If error in the script is not generated in Deployment Framework section a good idea is to comment the initiation scripts and thereby using old Global Variables. The advantages of this is that the application log and debug sequence is shorter thereby easier to debug. Remember to activate QDF initiation after the debugging.

If having problems with Section Access, Input Fields or other faults making application access impossible, use the initiation script (*1.Init.qvs*) as your escape. The command **Exit script;** in the beginning of *1.Init.qvs* will exit before the faulty script part executes.

Using binary load with Deployment Framework

To load from a Qlik mart the binary load statement need to be used in the scripts. Binary load can only be put as the first statement of a script. Best practice is thereby to use relative search path to the qvw or qvf in the binary section, instead of the framework global variables. Example:

```
Binary [..\4.mart\0.example_northwind_mart\example_northwind_mart.qvw];
```

The Deployment framework *InitLink.qvs* include sections will follow the Binary load section.

Front End Development in QlikView

When creating a new user application it should always take the starting point from a Template Application. The document template should include the standard structure in the script and the companies visual guidelines implemented. Qlik Sense is not valid in this section as to uses responsive design and a limited color scheme.

UI Design

Design matters. It impacts user adoption rates, utilization rates, speed of analysis and usage patterns. All of these things impact how effective your QlikView document can be. The principles of good interface design promoted by Stephen Few and Edward Tufte are the basis for the best practices Qlik recommends when designing and building a QlikView application. The outline below shows (at a high level) some of those tenants of good design.

QlikView Developer Toolkit

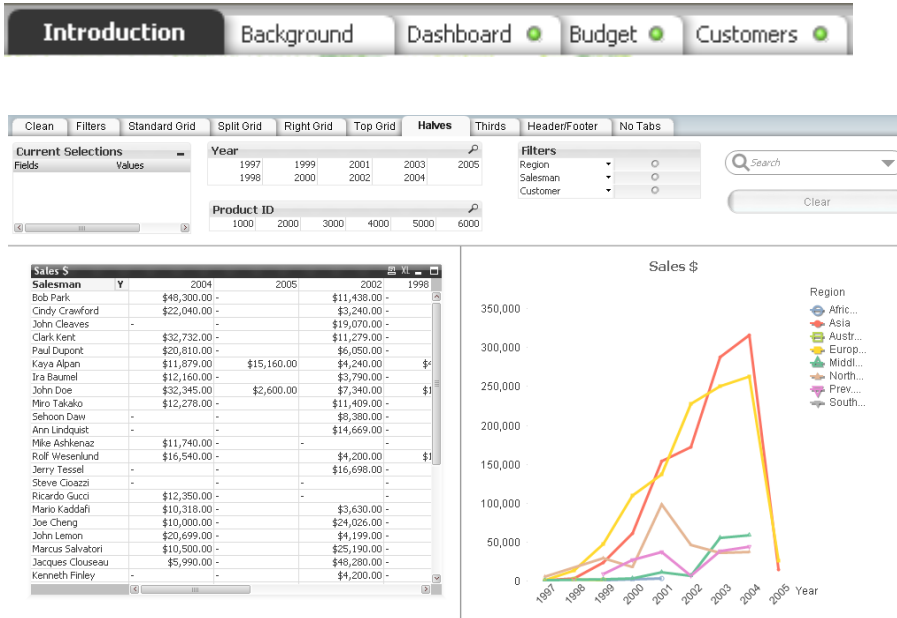
The number one tool for a QlikView Designer is the *QlikView Developer Toolkit* which is available with the installation of QlikView 11. The purpose of the Developer Toolkit is to help QlikView developers make more attractive & useable applications. There are a variety of backgrounds, guides, and panels that can be incorporated into your design to get you started

Developer Toolkit is divided up into several folders of assets

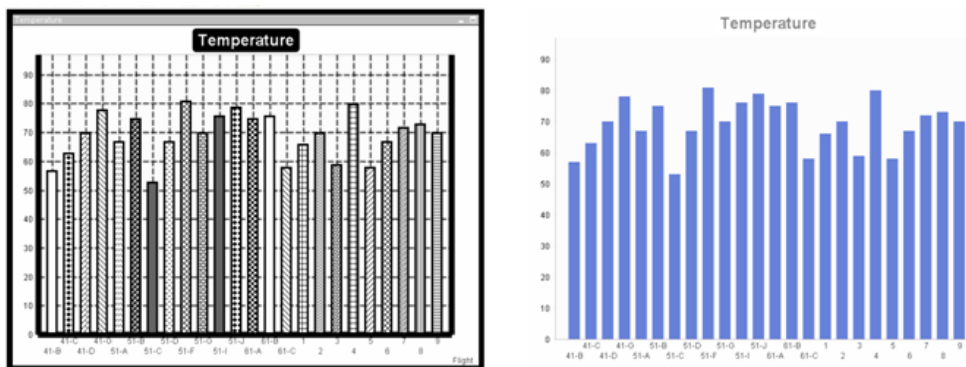
- Backgrounds: help define space to place objects on
- Buttons: images to use as buttons
- Guides & Rulers: help you align objects within QlikView
- Icons: useful images for common tasks
- Panels: can be used to define spaces when using a background you have found
- Qlik: Qlik branded images
- Rules: are simple line styles to divide up regions of space
- Shadows: are more graduated ways of dividing space

UI Best Practice

Use of supplied or developed templates and tabs for consistency and simplicity:



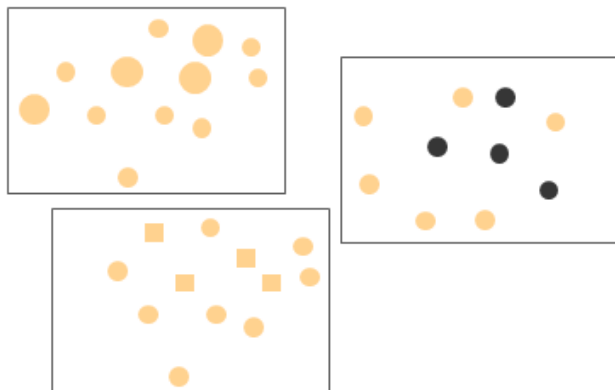
Use of implied closure to limit non-data ink space:



Use of neutral and muted colors and use of contrast: Muted and neutral colors are much less strenuous on the eyes and increase user adoption. Use of contrast helps the eyes quickly identify interest points or exceptions. These concepts go together, since the use of contrast with primary colors is difficult to do. Consider a combination of muted colors and the use of contrast in all charts, especially where exceptions or outliers are meant to be highlighted.



Use of size, shapes and intensity to call attention to data points: Shapes are another rapid identification point for the eyes. They can be used to segment data points into groups. Color intensities work well for ranges of values or outliers.



Additional UI Best Practice

- Put a current selections box on every sheet in the same location
- Make list boxes appear in the same locations on every sheet
- Organize list boxes and multi-boxes first in the frequency of use (most used on the top, least used on the bottom). Then, sub-sort the list boxes into groups in hierarchical order (largest group on the top, smallest group on the bottom).
- Put dropdown select properties on every straight/pivot table
- Use Variables as expressions instead of defining the expressions directly in the expression editor
- When Creating a Drill group, add an expression for the label of the field in the drill group. The expression should be equal to Only(All Higher fields) & '>' & 'current field name', so that it equates to SalesRepA>Product. SalesRepA is the item which was drilled into, Product is the values which are represented in the chart
- Instead of defining exceptions in straight/pivot tables, instead use charts which show the exceptions quickly
- Always include a Help / How-To tab and/or a link to a help site on our website. Examples of Help/How-To tabs are included in the Getting Started section in QlikView. Consider copying one of the interactive How-To pages into a template that you can use across applications.
- Name each sheet and object with descriptive headers
- Black & White charts are best when considering color blindness and simplicity
- Red & Green - Many people are red/green color-blind - consider this e.g. when using visual cues
- Red and green are also associated with good and bad indicators / performance. Only use red and green when you mean to indicate good and bad.
- Design for a fixed resolution that applies to your organizations desktops (e.g. 1024 x 768)
- Always consider sort order and whether to present frequency (# or %) in list boxes (sometimes very useful but definitely not always)
- Repeated objects (clear buttons) at the same position in every sheet
- Multi boxes can be good for people that are used to working with QV but they are not very intuitive. List boxes take more space but are better (you can e.g. see the gray areas better).
- Clean layout in charts – line up axis titles, chart title, text, etc...
- Hierarchy dimensions placed in order
- Time and Dates are crucial elements of most apps and they must be highly intuitive to search and use
- Table columns should always be searchable (display totals in tables whenever it makes sense)

Qlik strongly recommends the incorporation of design best practices for all developers and designers when starting a Qlik deployment. Good interface design leads to high adoption rates and effective interfaces. QlikView's rich UI layer allows for world class visualization and design in all applications.

For new QlikView deployments and new designers it is strongly recommended that QlikView Designer training be attended by all developers and designers. The Designer courses are structured to reinforce good design and to learn the QlikView techniques that help deliver that design in a simple, elegant way. They are also a great opportunity to practice good design and apply that design to your QlikView applications in a lab setting.

Many of the design best practices are displayed in the demo applications that are publicly available at <http://www.demo.qlik.com>. Also visit QlikCommunity for more tips.

UI Design References

- QlikView Developer Toolkit
- QlikView Demo <http://www.demo.qlikview.com>
- [Information Dashboard Design](#), by Stephen Few
- [Show Me the Numbers](#), by Stephen Few
- [The Visual Display of Quantitative Information](#), Edward R. Tufte
- [Visual Explanations](#), by Edward R. Tufte

Color Scheme Variables

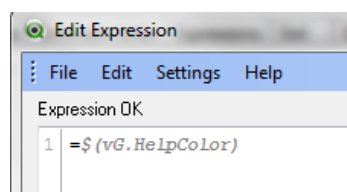
Use Global Variables to reuse company color schemes. It is easier more consistent to develop the GUI when using pre-defined color variables. Use the Color Scheme global variable `vG.ColorSchemePath` and store schemas in include files. Example, include Color scheme script in Deployment Framework tab after init section:

```
$(Include=$(vG.ColorScheme)\0.Example_ColorScheme.qvs);
```

In the scheme include file add global color variables by using the company RGB codes

```
SET vG.HelpColor = RGB(234,94,13);
```

Apply the global color variables on the objects



Variable expressions

Global Variables is a good way of reusing expressions, edit the expressions in Variable Editor.

Reasons for holding expressions in variables:

- To achieve reuse: the formula for a measure such as Sales usually remains the same across an application, so it doesn't make sense to write it on every chart.
- To enforce consistency in the formulas: by avoiding the risk of having different formulas that calculate the same measure.
- To provide a single point to apply changes: if and when a formula needs to be changed, you only need to change one variable and all the charts and other objects that refer to that variable will follow.
- To allow the end user to make changes through an input box, when needed. This could be the case of targets for KPIs or general parameters.

Expression Optimization Tips

- Eliminate Count(Distinct x)'s They are very slow
- Eliminate Count Numbers, or Count Texts, they are almost as slow as Count(Distinct)
- `date(max(SDATE,'DD.MM.YYYY'))` is factor xxx faster than `max(date(SDATE,'DD.MM.YYYY'))`
- Use numeric flags (e.g. with 1 or 0) which are pre-calculated in the script
- `sum(Flag * Amount)` and `sum(if(Flag, Amount))` use instead `sum({Flag=1} Flag * Amount)`
- Reduce the amount of open chart objects
- Limit the amount of expressions within chart/pivot objects, distribute them in multiple objects (use auto minimize)

QlikView Macros

The following are some reflections you should be aware of when you start including macro statements in your application. There are also a number of reasons why to avoid macros

Running a macro could result in deletion of the QlikView Server cache. undo-layout buffers and undo logical operation buffers and this in general has a very large negative impact on performance as experienced by the clients. The reason for deleting the caches etc. is that it is possible to modify properties, selections from the macros, thus opening up for conflicts between the cached state and the state that was modified from a macro and these conflicts will practically always crash or hang the clients (and in worst case; hang or crash the server as well).

The macros themselves are executed at VBS level while QlikView in general is executed at assembler level which is thousands of times faster by de-fault. Furthermore, the macros are single threaded synchronous as opposed to QlikView that is asynchronous and heavily threaded and this causes the macros to effectively interrupt all calculations in QlikView until finished and thereafter QlikView has to resume all interrupted calculations which is a delicate process and very much a source (at least historically) for deadlocks (i.e. QlikView freezes while the macro is still running, without any possibility that the macro will be finished).

While QlikView is increasingly optimized in terms of performance and stability, the macros will always maintain their poor performance and the gap between genuine QlikView functionality and the macros will continue to increase, making macros less and less desirable from a performance point of view. This fact combined with the above fact that the macros tend to under-mine all optimizations made in QlikView calls for severe negative tradeoffs as soon as macros become an integral part of any larger application.

The macros are of secondary nature when it comes to QlikView functionality - first all internal basic QlikView functions are run and tested and thereafter the macros are run and tested which effectively

means that macros will never have the same status or priority as basic QlikView functionality - always consider macros as a last resort but nothing much else. Since the automation API reflects the basic QlikView in terms of object properties etc., the macro content may actually change between versions making this a very common area for migration issues. Once a macro is incorporated in an application, this application has to be revisited with each new version in order to make sure that the macros were not affected by any structural changes in QlikView and this makes macros extremely heavy in terms of maintenance.

Only a subset of macros will work in a server environment with thin clients (Java, Ajax) since local operations (copy to clipboard, export, print etc.) are not supported, though some of these have a server-side equivalent (e.g. ServerSideExport etc.) that is very expensive in terms of performance with each client effectively affecting the server performance in a negative way.

In conclusion: what we are striving for is a heightened awareness when it comes to macros and what may work with a few thousand records does not necessarily scale very well when macros are involved and the problems tends to manifest themselves and become more serious when larger datasets are involved. It is also important to note that certain events can only be captured through the use of macros and for this reason it may be difficult to avoid macros altogether. The R&D department always strives to incorporate as much of this functionality as possible as basic QlikView functionality, thus limiting the use of macros in the long run – however as previously stated: certain events are difficult to catch except from an outside macro...

Given all of the above, macros cannot be part of any recommended QlikView design pattern!

QlikView Actions

Action has been around since QlikView 9. They are derived from the old button shortcuts, which they also replace. Apart from offering a much wider range of operations than the old shortcuts (including most common operations on sheets, sheet objects, fields and variables), you may also define a series of operations within a single action. The introduction of actions should greatly reduce the need for macros, which is good since macros are never efficient from a performance point-of-view.

Actions can not only be used on buttons. Also text objects, line/arrow objects and gauge charts can be given actions, which are executed when clicking on the sheet object in question.


The trigger macros of previous versions of QlikView have been replaced by trigger actions. This gives you the possibility to build quite elaborate triggers without the use of macros. Trigger macros from previous versions will be automatically translated to a Run Macro action when loaded into QlikView.

Read more about Triggers in the QlikView Reference Manual.

Tools

Variable Editor

Variable Editor is a QlikView application that graphically controls Deployment Framework. System and Custom Global Variables can be added and edit within Variable Editor and all containers are plotted in a Container Map (master is stored in Administration container) this map is edited and containers created using Variable Editor. Start by clicking on the Variable Editor Shortcut.

 **VariableEditor Shortcut**

Variable Editor with Qlik Sense

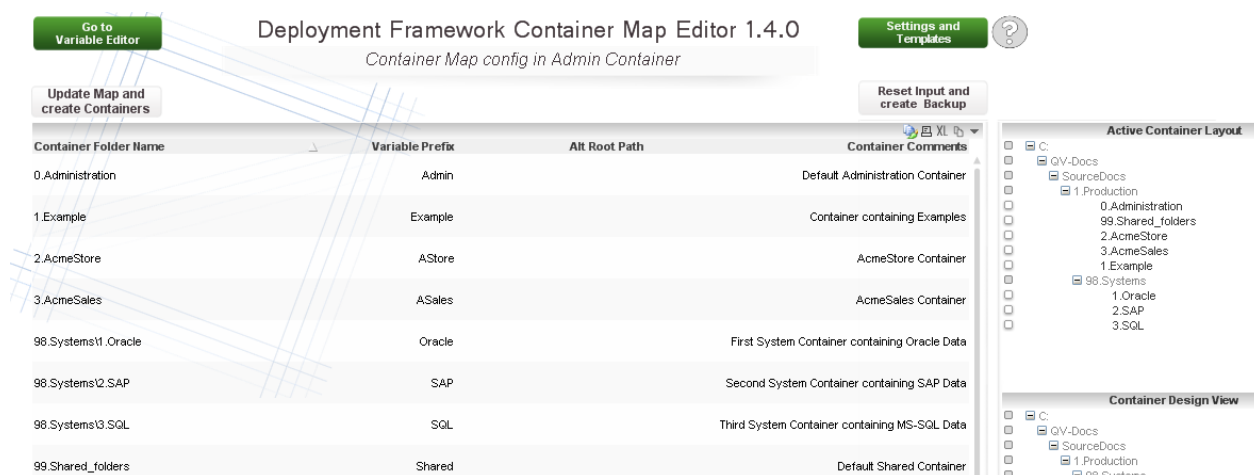
There is for the moment no variable editor for Qlik Sense. As Variable Editor uses an imbedded license it works with QlikView personal edition without the need of a QlikView license, personal edition can be downloaded for free. This means that Qlik Sense administrators can maintain QDF without additional costs.

Help

There is a help button in the VariableEditor available when needed.

Container Map Editor

Is used to administrate and populate containers within the framework. Press Go to Container Map to change to container view. Container Map is used by Deployment framework to identify containers.



Container Folder Name	Variable Prefix	Alt Root Path	Container Comments
0.Administration	Admin		Default Administration Container
1.Example	Example		Container containing Examples
2.AcmeStore	AStore		AcmeStore Container
3.AcmeSales	ASales		AcmeSales Container
98.Systems\1.Oracle	Oracle		First System Container containing Oracle Data
98.Systems\2.SAP	SAP		Second System Container containing SAP Data
98.Systems\3.SQL	SQL		Third System Container containing MS-SQL Data
99.Shared_folders	Shared		Default Shared Container

Edit or modify container map in the table, remember that it's only the container Map that is changing not the physical container structure.

Container Input Fields

- ContainerFolderName* contains the Container folder Name. To create or add in a sub container structure type *folder name\container name*. Example 1: *1.Oracle* to create a container in the same level as 0.Administration
Example 2: *98.System\1.Oracle* to create a container under a system folder. To add a container in another file system.
- ContainerPathName*, enter prefix share variable names in *ContainerPathName* field, example *Oracle*.
- Alt root path*, Edit an optional container path in *alt root path* field. A container could also be copied in a subfolder structure the subfolder name will be created automatically.

- *Container Comments* Is descriptive Meta Data regarding the containers, very good to use for documenting the solution.

Reset Input and Create Backup

Will reset (revert) all inputs and also create a backup of the Container Map.

Retrieve Backup

Use Retrieve Container Map Backup to get back to the backup stage.

Update Container Map

Use this button to apply the new Container map after adding and/or modifying the container layout.



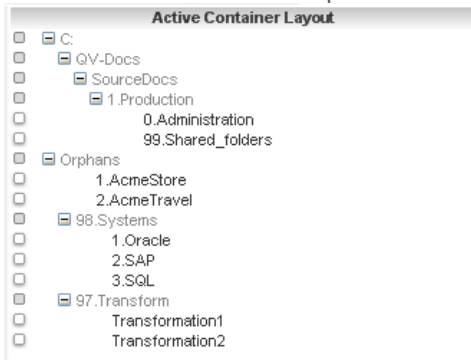
Create New Containers option

Create New Containers will create containers based on the current container Map. This button is only shown after Update Container Map is applied and accepted. New Containers can only be created from the 0.Administration container this means that the selected and applied container either is *vG.BasePath* or *vG.AdminBasePath*.



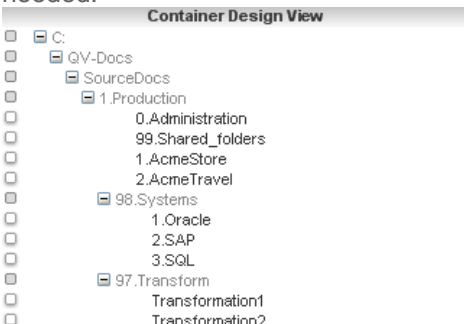
Active Container Layout

Shows physical containers that exist within the Container Map Container that exists in the Map and not in real life will be shown as Orphans as shown in the example below:



Container Design View

Shows the architecture while designing, in this view no Orphans is shown and no reload/refresh is needed.



Variable Editor Tab

Deployment Framework Global Variable Editor 1.3

HR_KPIVariables file in 0.Administration Container

Variable Files = HR_KPIVariables

Select Container = \$(vG.BasePath)

Update Variables

Refresh and Create a Backup

Add Variable File =

Variable Name	Variable Value	Variable Comments	Search Tag
---------------	----------------	-------------------	------------

Retrieve Backup

Search

Help

Variable Name
Type SET or LET in front of your variable.
Use vG. as global variable prefix.
Example SET vG.statistics

Variable Value
Do not combine numbers and letters
when using LET function use the
SET function instead

Variable Files
Variable files other than CustomVariables
will not be loaded by into the applications by default.
Add Sub Function below into the application script:
call LoadVariableCSV("\${vG.BasePath}\HR_KPIVariables.csv",
[Specific variable Optional])

Global Variables

The Global variables are modified by the Variable Editor and I stored in `$(BaseVariablePath)\CustomVariables.csv` files in each container. Global variables (with the prefix `vG.`) are loaded by default into QlikView during the framework initiation process in the beginning of the script (read more in using Deployment Framework Containers). Global variables should only be used when a variable is shared by several applications in a Container.

Universal Variables

By using Universal Variables that are stored in `$(SharedBaseVariablePath)\CustomVariables.csv` files in the Shared Folders Container, we get “single point of truth” across all containers. Universal Variables are by default loaded during the framework initiation process, have the prefix `vU` and is also modified by the Variable Editor application.

System Variables

System Variables are actually also Global Variables that start with (vG.), the difference is that System Variables are predefined variables used to store system settings like QlikView Server log path. System Variables are also not preloaded, 3.SystemVariables.qvs include script needs to be run to load in the System Variables into QlikView. System Variables are modified by the Variable Editor and stored in \$(BaseVariablePath)\SystemVariables.csv. There is usually only need for one System Variable version, the main is stored in 0.Administration container and is by default replicated out to the other containers.

Variable Input Fields

- *VariableName* Type *SET* or *LET* in front of your variable name. Use vG. or vU. as Global or Universal Variable prefix. Example1 *SET vG.statistics*. Example2 *SET vU.statistics*.
- *VariableValue* Type value or text, when entering text do not use brackets (") this is done automatically.
Do not combine numbers and letters when using LET function, use the SET function instead for this.
- *Comments* Used for comments like author and creation date
- *Search Tag* Used only for easy search

Variable Files, Custom Global Variables

Custom Global Variables will automatically be loaded into QlikView applications when using Deployment Framework. Each Container has its own Custom Global Variable file that the applications use. For Global Variables that need to be used across containers modify Shared Custom Variable file with Variable editor.

Refresh Create a Backup

Will refresh the view without updating Variable files and at the same time create a backup.

Retrieve Backup

Use Retrieve Backup to get back to the backup stage created by Change Variable File and Create a Backup button.

Update Variables

Use this button to apply the new variables after adding and/or modifying.

Add and Remove Variable Files

Variable Editor has the possibility to add variable files into the selected container in addition to the default *Custom Global Variables*. Type the variable filename into the *Add Variable File* input box and press enter like example below:

Add Variable File = HR_KPI

The *Refresh and Create a Backup* box will now change to a Create Variable File box

Create Variable File

When pressing apply the new csv file (empty) will be created as *HR_KPIVariables.csv* and stored under selected container *3.Include\1.BaseVariable*.

To remove a Variable File add the command **del** before the filename and run the script like example below:

Add Variable File = del HR_KPI

The box will change to *Delete Variable File*.

Delete Variable
File

Variable files other than Custom Variables will not be loaded by *1.Init.qvs* into the applications by default. Add Sub Function below into the application script instead:

```
$(Include=$(vG.SubPath)\2.LoadVariableCSV.qvs);
```

```
call LoadVariableCSV('$(vG.BaseVariablePath)\HR_KPIVariables.csv', '[Tag]')
```

More detailed documentation on Variable Editor can be found in **Operations Guide**.

Troubleshooting & Support

Support Types

Supporting Qlik applications and environments can be done in several ways.

As a best practice, Qlik recommends that support levels and services be identified for the following areas:

- Qlik Applications (QVW, QVF)
- QlikView Interface (end user support)
- Qlik Sense platform
- QlikView platform (Server/Publisher)
- Qlik Data Architecture

Many clients utilize a certification process for applications of high importance. This can help especially when business teams are creating their own apps and your support team is only responsible for supporting the certified applications that it had a chance to code/interface/data review. Read more in Qlik Deployment Framework-Deployment Guide.pdf.

Appendix A, Checklists

Development Checklists

Qlik recommends the use of a developer checklist to highlight and reinforce development best practices. One way to help promote the visibility and presence of the checklist is to limit it to one page and laminate it for each developer. This will make it easier to post the checklist and refer to it often. Some clients will use the checklist in code reviews to ensure that best practices were followed before releasing the app to Test or Production environments.

Data Model Performance

- ☐ Synthetic keys removed from data model
- ☐ Ambiguous loops removed from data model
- ☐ Correct granularity of data
- ☐ Use of QVDs where possible
- ☐ Use integers to join tables where possible
- ☐ Remove system keys/timestamps from data model
- ☐ Unused fields removed from data model
- ☐ Remove link tables from very large data models
- ☐ Remove unneeded snowflake tables (consolidate)
- ☐ Break concatenated dim. fields into distinct fields
- ☐ All QVD reads optimized
- ☐ Use Autonumber to replace large concatenated keys

Interface Performance

- ☐ Use show condition on big data sets to minimize load
- ☐ QlikView Minimize count distinct functions
- ☐ QlikView Minimize nested ifs
- ☐ QlikView Minimize string comparisons
- ☐ QlikView macros minimized or eliminated
- ☐ QlikView Minimize Show Frequency feature
- ☐ QlikView Minimize open objects on sheet
- ☐ QlikView Minimize set analysis against large fact tables
- ☐ QlikView Minimize pivot charts in very large apps
- ☐ Avoid "Show Frequency" feature on large data
- ☐ Avoid AGGR function when possible
- ☐ Avoid IF statements in calculated chart dimensions
- ☐ Avoid built-in time functions in GUI (inmonth, etc...)

Design Best Practices

- ☐ QlikView Use of colors for contrast/focus only
- ☐ QlikView Use of neutral and muted colors
- ☐ QlikView Use of templates/themes where available
- ☐ QlikView Display optimized for user screen resolutions
- ☐ Design consistency across tabs
- ☐ QlikView Formatting consistency across objects
- ☐ Most used selections at top - least at bottom
- ☐ Drop-down selections on all straight/pivot table columns
- ☐ Qlik Versions matches production
- ☐ Test client types for rendering
- ☐ Reuse of Global Variables for expressions
- ☐ QlikView use calculation conditions on large charts

Script Best Practices

- ☐ Naming standards used for columns, tables, variables
- ☐ Script is well commented - changes date flagged
- ☐ First tab holds information section
- ☐ Subject areas each have tab in script
- ☐ QlikView Use of Include files for all data connections
- ☐ All code blocks with comment sections
- ☐ All file references using Global Variables naming
- ☐ Business names for UI fields
- ☐ Connection strings in Include file
- ☐ QlikView Turn Generate Log file option on
- ☐ UPPER() function used on Section Access fields
- ☐ QlikView Publisher Service Acct added to Section Access
- ☐ Use numeric flags where possible