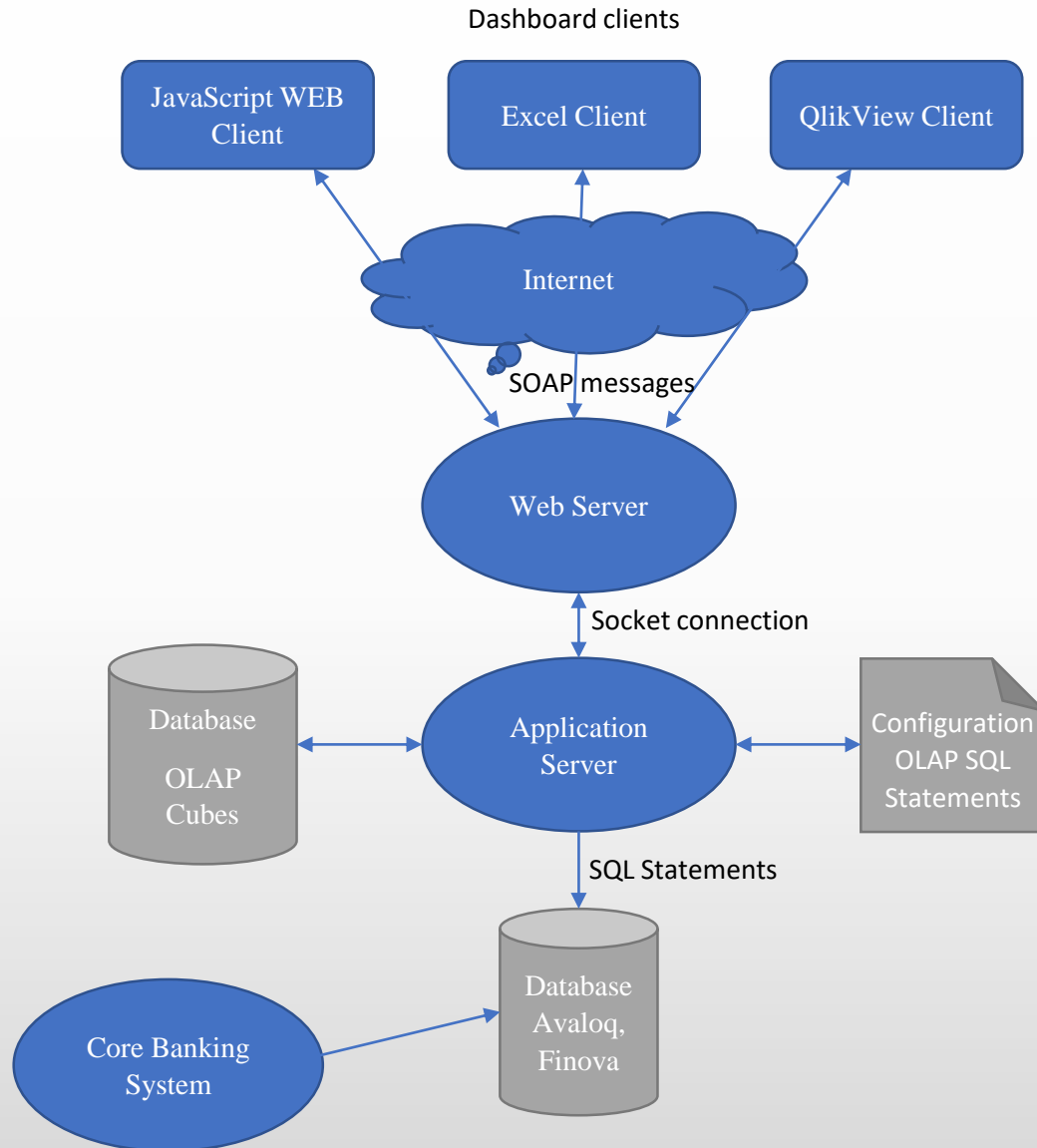


# Visualization of Financial Data

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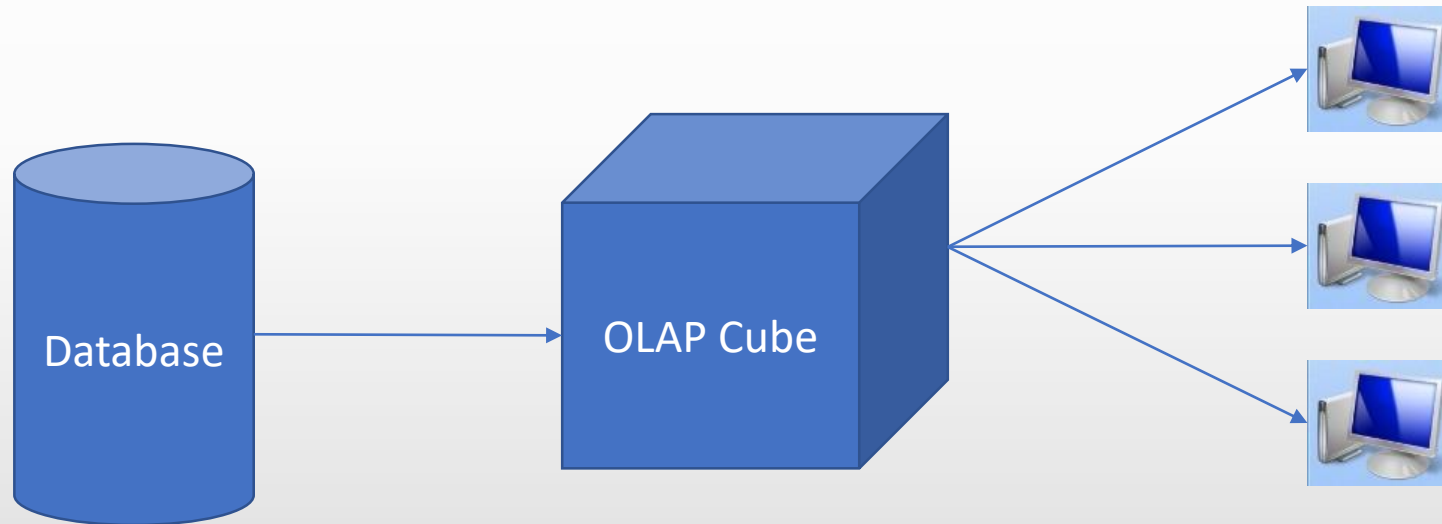
Dr. Anatoliy Antonov, Ivan Bogdanov  
Eurorisk Systems Ltd.



To visualize financial data generated from existing Core Banking System one needs the components shown in the diagram left. It is considered that the Core Banking System and its database already exists so following components are needed:

- Application Server to extract data from Core Banking Database and to generate Visualization OLAP Cubes
  - SQL Configuration for the OLAP Cube Load Scripts, ETL (Extract Transform Load) tools can be used too
  - Database to store the created visualization information
- Web Server to exchange commands and data between the clients and the Application Server via SOAP and Sockets
- Available WEB Clients which can represent Dashboards:
  - In JavaScript or in Excel using Pivot and WEB Services
  - In QlikView using the Visualization and WEB Services

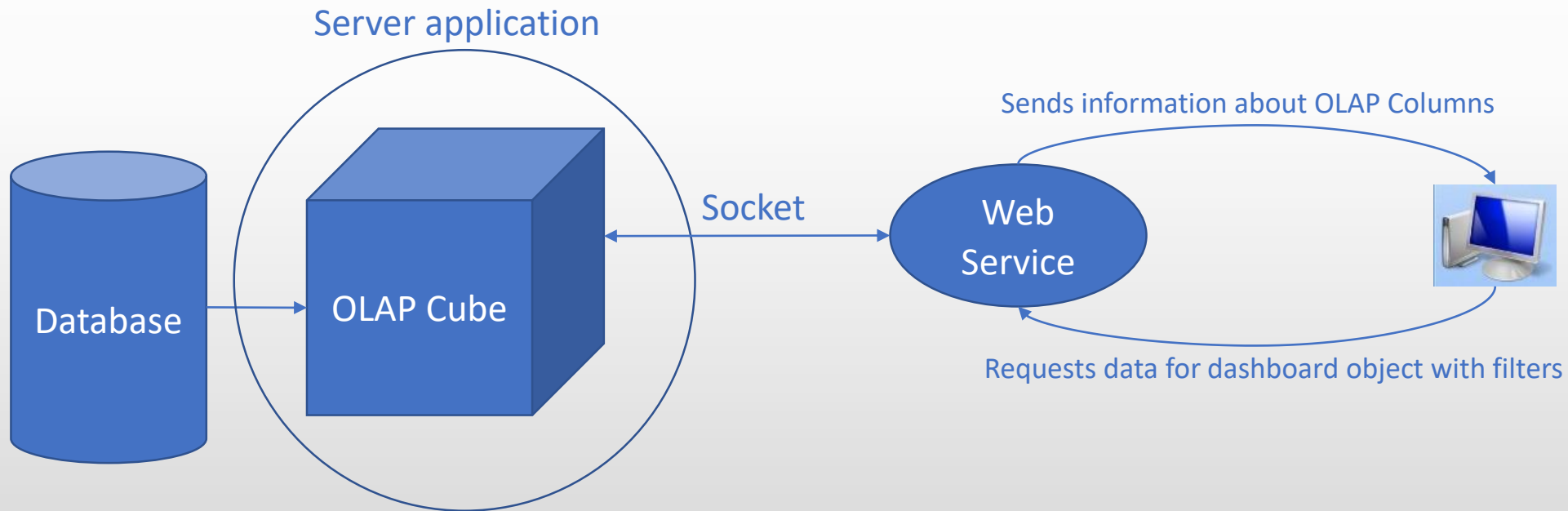
The main purpose of the application server is to access the raw data from the database, generate visualization information as OLAP Cubes and send Sub-Cubes according to commands to the Web server via XML-defined socket protocol. The application server also needs a configuration for the OLAP Cube Load Scripts in which is stored information for the database structure and also SQL statements for generating the OLAP Cube. This is a typical ETL (Extract Transform Load) procedure, so ETL Tools are applicable too, see last slide



The Web Server is communicating with multiple client instances by Internet via SOAP/WSDL, i.e. via WEB Services. It receives commands from the specific client application, requests data from the application server (which have access to already prepared OLAP Cubes) and returns a response message including visualization data to the client. Some of the current functionalities of the application server are:

- getOLAPCubes – returns all available OLAP Cubes as a list
- getCubeMetaData – returns all available columns from the Cube and its types
- getCubeDataByColumnsAndFiltered – returns to the Dashboard specific visualization data (Sub-Cubes) from existing Cube, filtered by column and row selection
- import/export/delete Cubes of the application server database
- manage the OLAP Cube SQL Load Scripts

Example workflow of the Web Service and connection to application server and clients is given below:  
At first information about all OLAP Columns available is sent via Web Service to the Client. User selects the columns and rows and filters that want to apply on the dashboard and sends request for building the corresponding dashboard object. The Web server processes the request to the application server which apply the filters over the OLAP Cube and returns the data to the Web Server which transfers it to the client application.



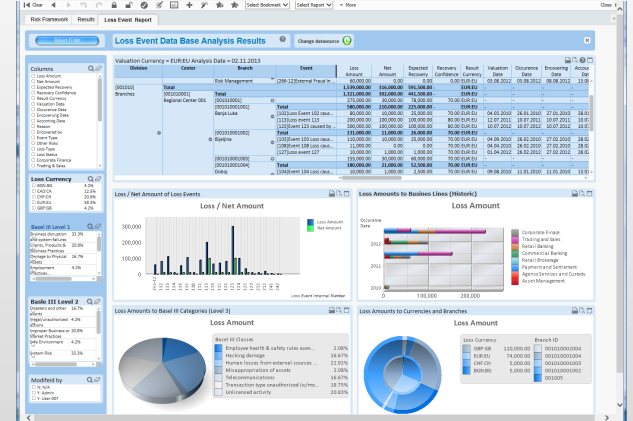
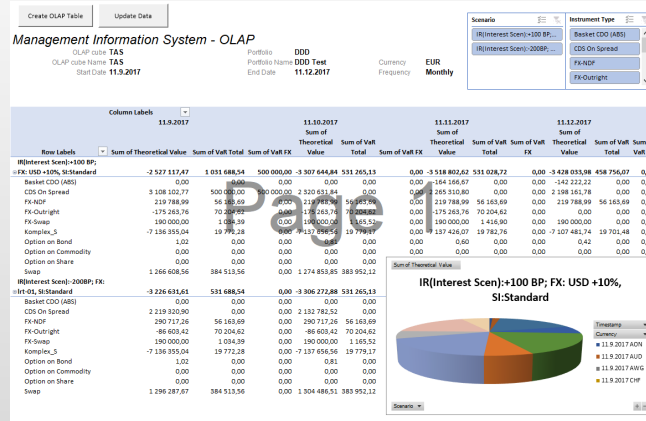
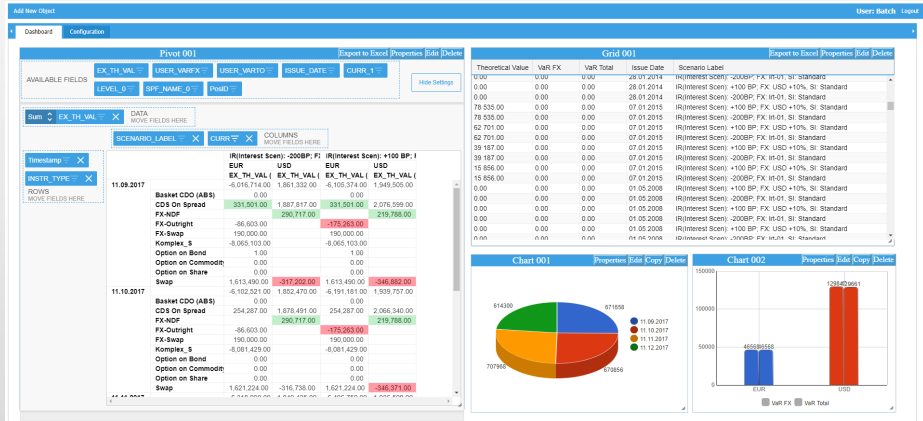
The Client application solutions can be made in different ways. Some proposals are:

- JavaScript WEB Client – JavaScript based GUI developed with DHTMLX library, deployed on a WEB Server and can be accessed via browser. 3D interactive graphic can be added in addition. Both tools are of low cost or cost free
- Excel Document Client – Excel Document including Pivot Tables which is designed to work as a client of the Web Server and which runs according to same protocol as the JavaScript WEB Client
- QlikView Client – It is also possible to provide a client using the visualization features and WEB Service scripts of the QlikView tool in non-server mode

JavaScript WEB client Dashboard

Excel WEB client incl. Pivot Dashboard

QlikView WEB client Dashboard



Dashboard
Configuration

### Pivot 001

Export to Excel Properties Edit Delete

AVAILABLE FIELDS: EX\_TH\_VAL, USER\_VARFX, USER\_VARTO, ISSUE\_DATE, CURR\_1, LEVEL\_0, SPF\_NAME\_0, PosID

Sum: EX\_TH\_VAL (DATA MOVE FIELDS HERE)

SCENARIO\_LABEL, CURR (COLUMNS MOVE FIELDS HERE)

Timestamp, INSTR\_TYPE (ROWS MOVE FIELDS HERE)

	IR(Interest Scen): -200BP; F		IR(Interest Scen): +100 BP; f	
	EUR	USD	EUR	USD
EX_TH_VAL (	EX_TH_VAL (	EX_TH_VAL (	EX_TH_VAL (	
11.09.2017	-6,016,714.00	1,861,332.00	-6,105,374.00	1,949,505.00
Basket CDO (ABS)	0.00		0.00	
CDS On Spread	331,501.00	1,887,817.00	331,501.00	2,076,599.00
FX-NDF		290,717.00		219,788.00
FX-Outright	-86,603.00		-175,263.00	
FX-Swap	190,000.00		190,000.00	
Komplex_S	-8,065,103.00		-8,065,103.00	
Option on Bond	1.00		1.00	
Option on Commodity	0.00		0.00	
Option on Share	0.00		0.00	
Swap	1,613,490.00	-317,202.00	1,613,490.00	-346,882.00
11.10.2017	-6,102,521.00	1,852,470.00	-6,191,181.00	1,939,757.00
Basket CDO (ABS)	0.00		0.00	
CDS On Spread	254,287.00	1,878,491.00	254,287.00	2,066,340.00
FX-NDF		290,717.00		219,788.00
FX-Outright	-86,603.00		-175,263.00	
FX-Swap	190,000.00		190,000.00	
Komplex_S	-8,081,429.00		-8,081,429.00	
Option on Bond	0.00		0.00	
Option on Commodity	0.00		0.00	
Option on Share	0.00		0.00	
Swap	1,621,224.00	-316,738.00	1,621,224.00	-346,371.00

### Grid 001

Export to Excel Properties Edit Delete

Theoretical Value	VaR FX	VaR Total	Issue Date	Scenario Label
0.00	0.00	0.00	28.01.2014	IR(Interest Scen): -200BP; FX: Irt-01, SI: Standard
0.00	0.00	0.00	28.01.2014	IR(Interest Scen): +100 BP; FX: USD +10%, SI: Standard
0.00	0.00	0.00	28.01.2014	IR(Interest Scen): -200BP; FX: Irt-01, SI: Standard
78 535.00	0.00	0.00	07.01.2015	IR(Interest Scen): +100 BP; FX: USD +10%, SI: Standard
78 535.00	0.00	0.00	07.01.2015	IR(Interest Scen): -200BP; FX: Irt-01, SI: Standard
62 701.00	0.00	0.00	07.01.2015	IR(Interest Scen): +100 BP; FX: USD +10%, SI: Standard
62 701.00	0.00	0.00	07.01.2015	IR(Interest Scen): -200BP; FX: Irt-01, SI: Standard
39 187.00	0.00	0.00	07.01.2015	IR(Interest Scen): +100 BP; FX: USD +10%, SI: Standard
39 187.00	0.00	0.00	07.01.2015	IR(Interest Scen): -200BP; FX: Irt-01, SI: Standard
15 856.00	0.00	0.00	07.01.2015	IR(Interest Scen): +100 BP; FX: USD +10%, SI: Standard
15 856.00	0.00	0.00	07.01.2015	IR(Interest Scen): -200BP; FX: Irt-01, SI: Standard
0.00	0.00	0.00	01.05.2008	IR(Interest Scen): +100 BP; FX: USD +10%, SI: Standard
0.00	0.00	0.00	01.05.2008	IR(Interest Scen): -200BP; FX: Irt-01, SI: Standard
0.00	0.00	0.00	01.05.2008	IR(Interest Scen): +100 BP; FX: USD +10%, SI: Standard
0.00	0.00	0.00	01.05.2008	IR(Interest Scen): -200BP; FX: Irt-01, SI: Standard
0.00	0.00	0.00	01.05.2008	IR(Interest Scen): +100 BP; FX: USD +10%, SI: Standard

### Chart 001

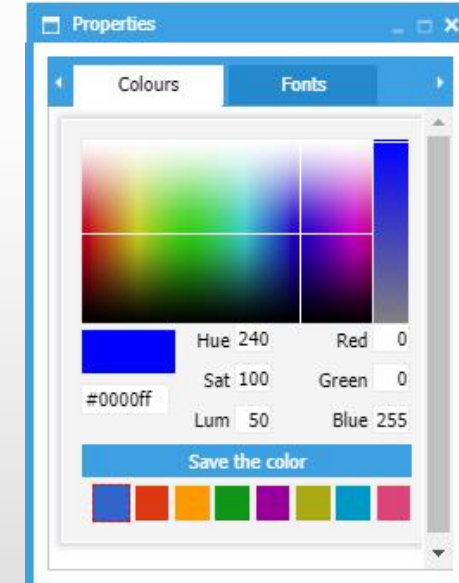
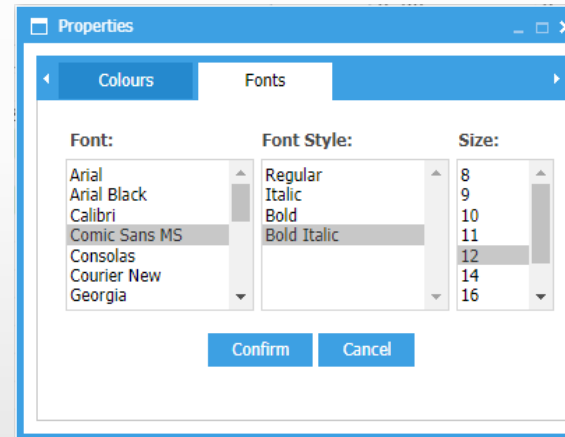
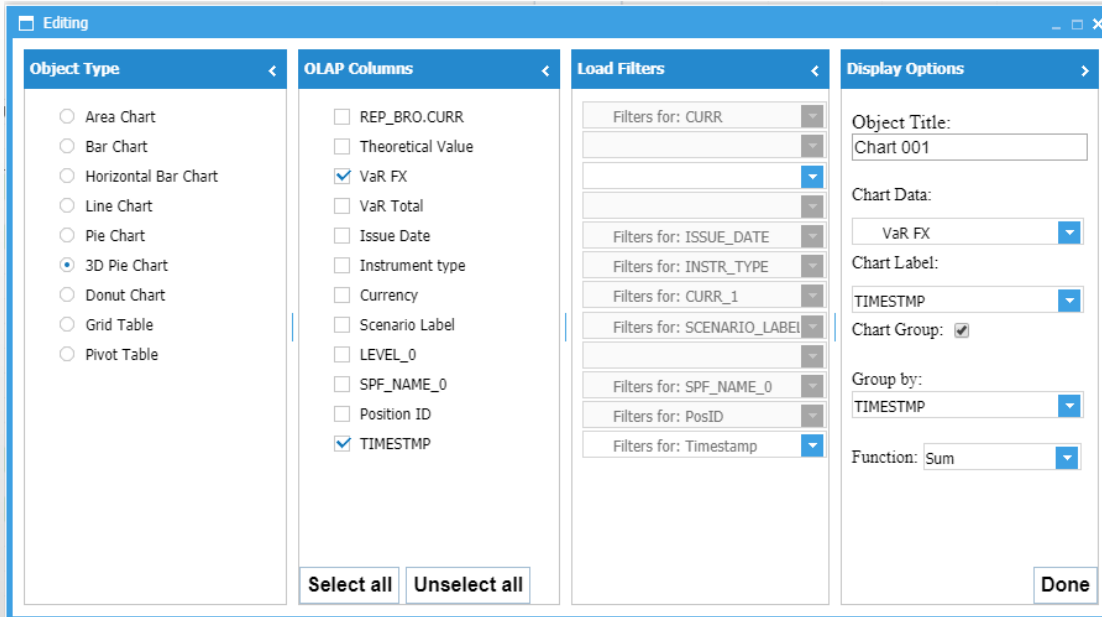
Properties Edit Copy Delete

### Chart 002

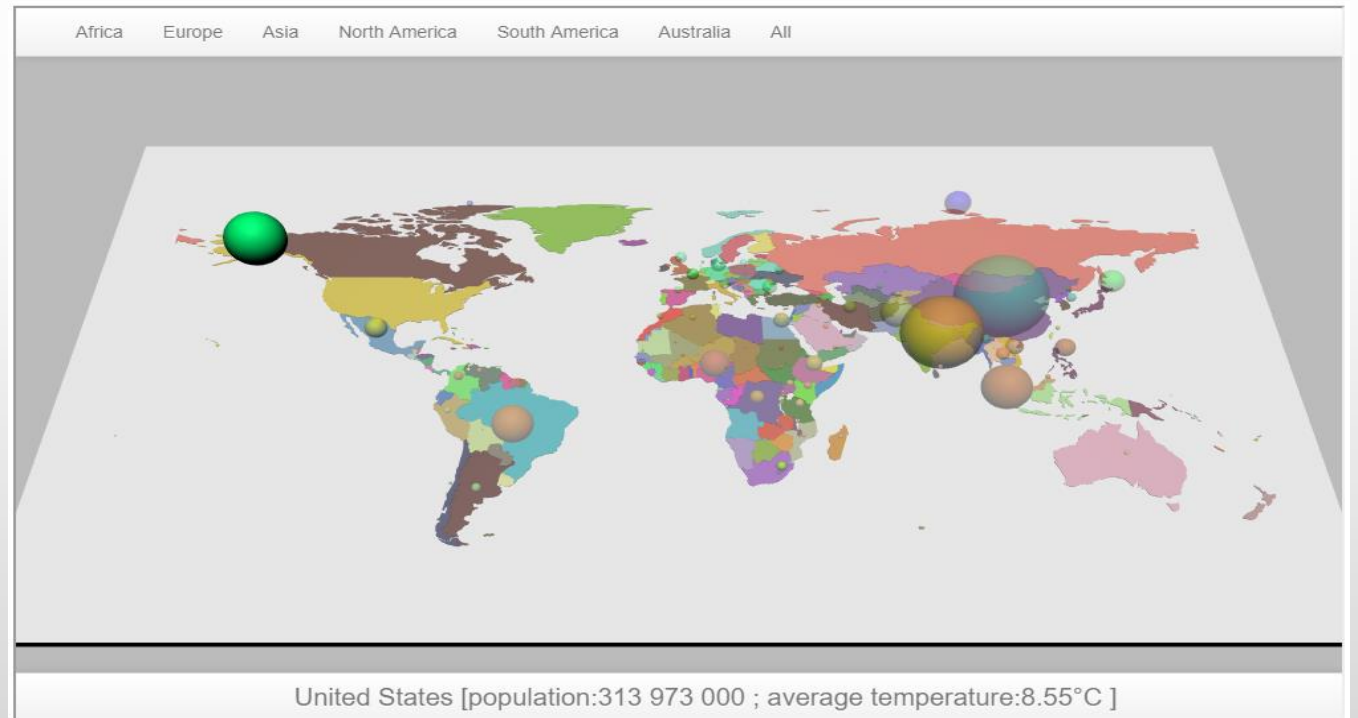
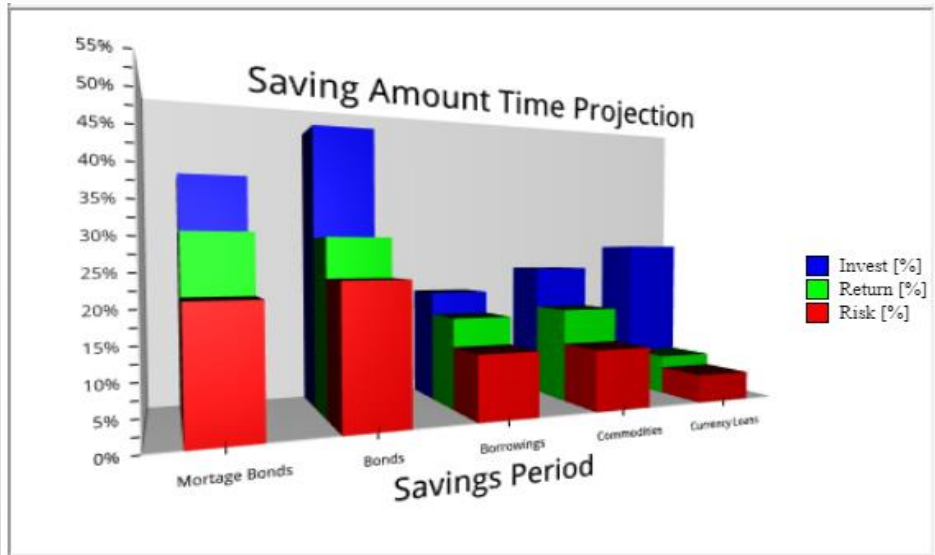
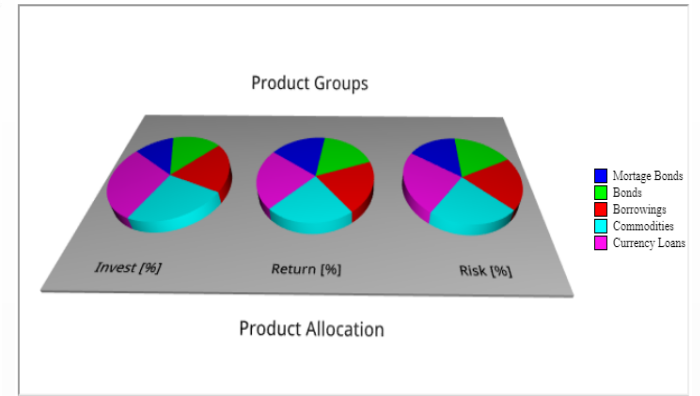
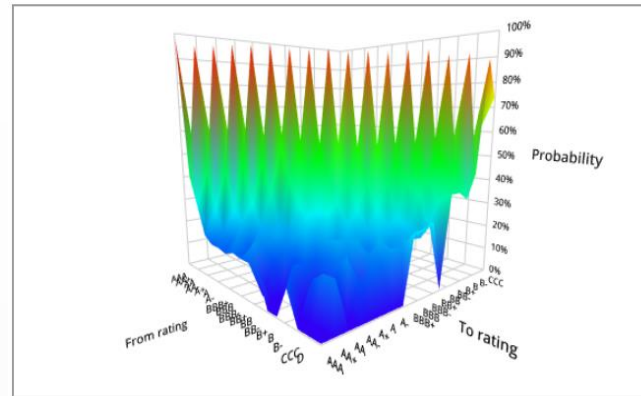
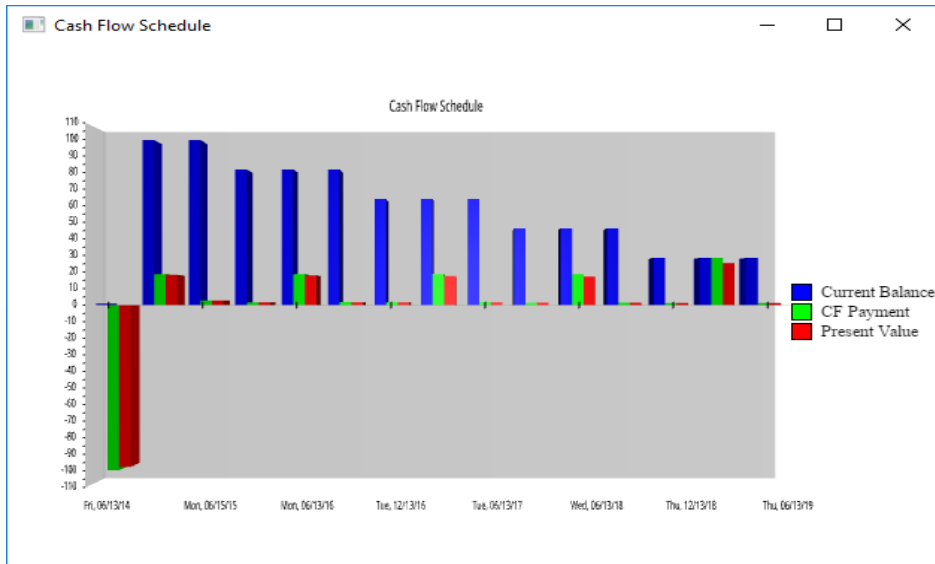
Properties Edit Copy Delete



The WEB graphical user interface is JavaScript based and developed with DHTMLX library. It can be accessed via any WEB browser, tablet or smartphone. It has a Configuration tab where is specified the settings and filtering of the OLAP Cube and a Dashboard tab where is visualized the data. You can dynamically add, edit or remove dashboard elements with request for data from the server. Each element has its own settings such as OLAP columns, Load row filters, chart colors, font style, font size. You can customize your dashboard and store its settings to external database so you can load it there after.







Create OLAP Table    Update Data

## Management Information System - OLAP

OLAP cube **TAS**      Portfolio **DDD**  
 OLAP cube Name **TAS**      Portfolio Name **DDD Test**      Currency **EUR**  
 Start Date **11.9.2017**      End Date **11.12.2017**      Frequency **Monthly**

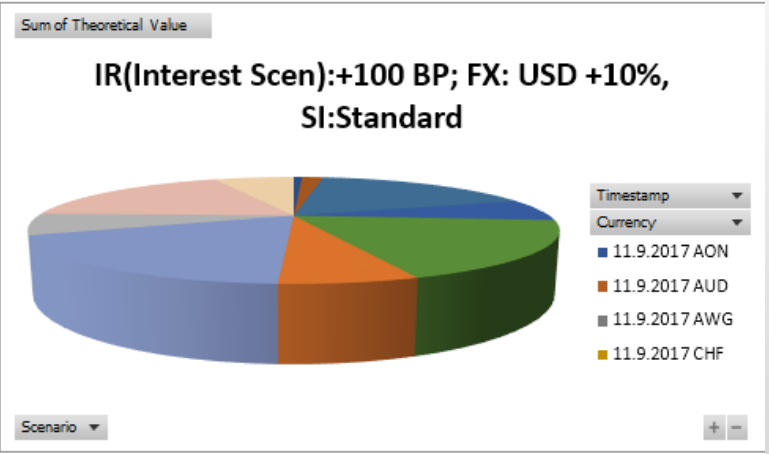
**Scenario**

- IR(Interest Scen):+100 BP;...
- IR(Interest Scen):-200BP; ...

**Instrument Type**

- Basket CDO (ABS)
- CDS On Spread
- FX-NDF
- FX-Outright

Row Labels	Column Labels											
	11.9.2017			11.10.2017			11.11.2017			11.12.2017		
	Sum of Theoretical Value	Sum of VaR Total	Sum of VaR FX	Sum of Theoretical Value	Sum of VaR Total	Sum of VaR FX	Sum of Theoretical Value	Sum of VaR Total	Sum of VaR FX	Sum of Theoretical Value	Sum of VaR Total	Sum of VaR FX
<b>IR(Interest Scen):+100 BP;</b>												
<b>FX: USD +10%, SI:Standard</b>	-2 527 117,47	1 031 688,54	500 000,00	-3 307 644,84	531 265,13	0,00	-3 518 802,62	531 028,72	0,00	-3 428 033,98	458 756,07	0,00
Basket CDO (ABS)	0,00	0,00	0,00	0,00	0,00	0,00	-164 166,67	0,00	0,00	-142 222,22	0,00	0,00
CDS On Spread	3 108 102,77	500 000,00	500 000,00	2 320 631,84	0,00	0,00	2 265 310,80	0,00	0,00	2 198 161,78	0,00	0,00
FX-NDF	219 788,99	56 163,69	0,00	219 788,99	56 163,69	0,00	219 788,99	56 163,69	0,00	219 788,99	56 163,69	0,00
FX-Outright	-175 263,76	70 204,62	0,00	-175 263,76	70 204,62	0,00	-175 263,76	70 204,62	0,00	0,00	0,00	0,00
FX-Swap	190 000,00	1 034,39	0,00	190 000,00	1 165,52	0,00	190 000,00	1 416,90	0,00	190 000,00	0,00	0,00
Komplex_S	-7 136 355,04	19 772,28	0,00	-7 137 656,56	19 779,17	0,00	-7 137 426,07	19 782,76	0,00	-7 107 481,74	19 701,48	0,00
Option on Bond	1,02	0,00	0,00	0,81	0,00	0,00	0,60	0,00	0,00	0,42	0,00	0,00
Option on Commodity	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Option on Share	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Swap	1 266 608,56	384 513,56	0,00	1 274 853,85	383 952,12							
<b>IR(Interest Scen):-200BP; FX:</b>												
<b>Irt-01, SI:Standard</b>	-3 226 631,61	531 688,54	0,00	-3 306 272,88	531 265,13							
Basket CDO (ABS)	0,00	0,00	0,00	0,00	0,00							
CDS On Spread	2 219 320,90	0,00	0,00	2 132 782,52	0,00							
FX-NDF	290 717,26	56 163,69	0,00	290 717,26	56 163,69							
FX-Outright	-86 603,42	70 204,62	0,00	-86 603,42	70 204,62							
FX-Swap	190 000,00	1 034,39	0,00	190 000,00	1 165,52							
Komplex_S	-7 136 355,04	19 772,28	0,00	-7 137 656,56	19 779,17							
Option on Bond	1,02	0,00	0,00	0,81	0,00							
Option on Commodity	0,00	0,00	0,00	0,00	0,00							
Option on Share	0,00	0,00	0,00	0,00	0,00							
Swap	1 296 287,67	384 513,56	0,00	1 304 486,51	383 952,12							



## Features of the Excel client pivot table:

- Work with dimensions and aggregable columns
- Filters for dimensions
- Aggregation of calculated results
- Drop-Down-Feature
- Excel Charts
- Macros in Visual Basic Script
- WEB Services support

QlikView client interface showing 'Loss Event Data Base Analysis Results'.

**Table: Valuation Currency = EUR:EU Analysis Date = 02.11.2013**

Division	Center	Branch	Event	Loss Amount	Net Amount	Expected Recovery	Recovery Confidence	Result Currency	Valuation Date	Occurrence Date	Enclosing Date	Accounting Date
[001010]	Total	Risk Management	[266-12]External Fraud in ...	60,000.00	0.00	0.00	0.00	EUR:EU	03.08.2012	03.08.2012	08.08.2012	13.08.2012
Branches	[001010001] Regional Center 001	Total		1,539,000.00	316,000.00	591,500.00	-	EUR:EU	-	-	-	-
		[001010001] Banja Luka	Total	275,000.00	30,000.00	78,000.00	70.00	EUR:EU	-	-	-	-
		[001010001001] Bijeljina	Total	580,000.00	210,000.00	225,000.00	-	EUR:EU	-	-	-	-
			[102]Loss Event 102 caus...	80,000.00	10,000.00	25,000.00	70.00	EUR:EU	04.03.2010	26.01.2010	27.01.2010	28.01.2010
			[113]Loss event 113	200,000.00	100,000.00	100,000.00	80.00	EUR:EU	12.07.2011	10.07.2011	10.07.2011	10.07.2011
			[123]Event 123 caused by ...	300,000.00	100,000.00	100,000.00	80.00	EUR:EU	10.07.2012	10.07.2012	10.07.2012	10.07.2012
		[001010001002] Dobo	Total	131,000.00	11,000.00	26,000.00	70.00	EUR:EU	-	-	-	-
			[103]Event 103 Loss caus...	110,000.00	10,000.00	25,000.00	70.00	EUR:EU	04.09.2010	26.02.2010	27.02.2010	28.02.2010
			[108]Event 108 Loss caus...	11,000.00	0.00	0.00	70.00	EUR:EU	04.04.2010	26.02.2010	27.02.2010	28.02.2010
			[127]Loss event 127	10,000.00	1,000.00	1,000.00	70.00	EUR:EU	01.04.2012	26.02.2012	27.02.2012	28.02.2012
		[001010001003] Dobo	Total	180,000.00	21,000.00	52,500.00	70.00	EUR:EU	-	-	-	-
		[001010001004] Dobo	Total	180,000.00	21,000.00	52,500.00	70.00	EUR:EU	-	-	-	-
			[104]Event 104 Loss caus...	10,000.00	1,000.00	2,500.00	70.00	EUR:EU	09.08.2010	11.01.2010	11.01.2010	13.01.2010

**Loss / Net Amount of Loss Events** (Bar chart): Shows Loss Amount (blue) and Net Amount (green) for various loss event internal numbers (e.g., 102, 103, 104, 105, 106, 108, 111, 113, 115, 116, 123, 124, 126, 127, 211, 212, 241, 242).

**Loss Amounts to Business Lines (Historic)** (Stacked bar chart): Shows Loss Amount by Occurrence Date (2010, 2011, 2012) across business lines: Corporate Finance, Trading and Sales, Retail Banking, Commercial Banking, Retail Brokerage, Payment and Settlement, Agency Services and Custody, Asset Management.

**Loss Amounts to Basel III Categories (Level 3)** (Pie chart): Shows Loss Amount distribution across Basel III Classes:

Basel III Class	Percentage
Employee health & safety rules even...	2.08%
Hacking damage	16.67%
Human losses from external sources ...	22.92%
Misappropriation of assets	2.08%
Telecommunications	16.67%
Transaction type unauthorised (w/mo...	18.75%
Unlicensed activity	20.83%

**Loss Amounts to Currencies and Branches** (Donut chart): Shows Loss Amount distribution by Loss Currency and Branch ID.

Loss Currency	Branch ID	Amount
GBP:GB	001010002004	110,000.00
EUR:EU	001010001004	74,000.00
CHF:CH	001010001003	5,000.00
BGN:BG	001010001002	5,000.00
	001005	

## Features of the QlikView client:

- Work with dimensions and aggregable columns
- Filters of dimensions
- Aggregation of calculated results
- Drop-Down-Feature
- Various charts and table representations
- Selection of table columns
- Macros in JavaScript
- WEB Services support

To become fully working systems there are few steps of installation:

1. Place the application server on server machine in a LAN with access to the database of the Core Banking System
2. Setup the configuration with information for connection to the database of the Core Banking System and create scripts to extract visualization data into OLAP cubes
3. Install a WEB Server (we suggest Apache Tomcat)
4. Deploy the Web Service package on the WEB Server
5. Configure the settings of the Web Service package
6. You receive there after access to the application via the WEB clients:
  - WEB application via browser and WEB Services or
  - Desktop application in Excel or in QlikView which connects using WEB Services

One of the main task of the application server is to prepare the OLAP cubes via access to the database tables of the Core Banking System using SQL load scripts which extract the visualization data from database of the Core Banking System, transform and reorganize it and load it as OLAP cubes. This is a typical task for configurable ETL (Extract Visualize Load) tools, so this task can be performed alternatively using ETL. An example transformation and a list of provider of ETL integration tools are given below, many of the tools are at low cost or cost free.

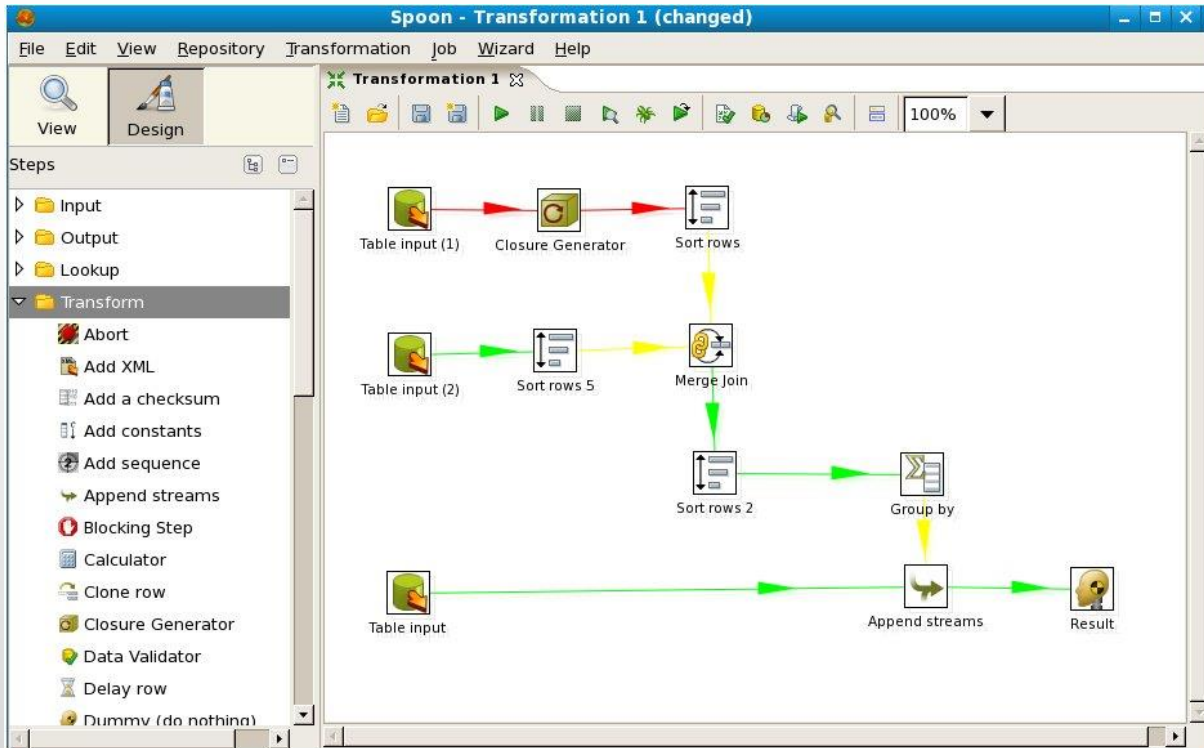


Figure 1. Magic Quadrant for Data Integration Tools

