Risk Framework

Analytical Software System for Institutions and Companies in the Financial Industry

Risk Framework Modules are based on models and rules

Bulgarian English, German

Credit Risk
Standard Model, Internal Model, IRB, Credit Metrics

Bulgarian English, German

Operational Risk
BIA, STA, AMA, Events and Losses, Self-Assessment

Bulgarian English, German

ALM, IFRS, Liquidity
Asset & Liability Mngt., Cash Flows, GAP, FTP, Liquidity Risk

Bulgarian English, German

Basic Modules
Registers, Catalogues, Settings, Rights, Roles

CORE SYSTEM

Databases:
Oracle, MS SQL, etc. Imports/exports, Excel, Crystal reports, XML/XSL/COREP, Parallel activities (CPU/GPU), Windows and WEB interfaces

Bulgarian English, German

Rating & Scoring
Retail & Corporate Clients, Balances, P & L Indicators

Bulgarian English, German

Market Data
Market Curves, Prices, FX Rates, Indexes, Scenarios, Liquidity

Bulgarian English, German

Portfolios
Structures, Filters, Lists, Hierarchy, Management of Packages, Analysis

Bulgarian English, German

Clients
Retail & Corporate Clients, Related Clients

Risk Framework Architecture

APPLICATION SERVER

RISK FRAMEWORK

RISK FRAMEWORK

RISK FRAMEWORK

Terminal Server

DATABASE SERVER
(Oracle, MS SQL, DB2, My SQL, Tera Data)

Desktop

Desktop

WEB APPLICATION SERVER

RISK FRAMEWORK

RISK FRAMEWORK

Web Browser

INTERNET
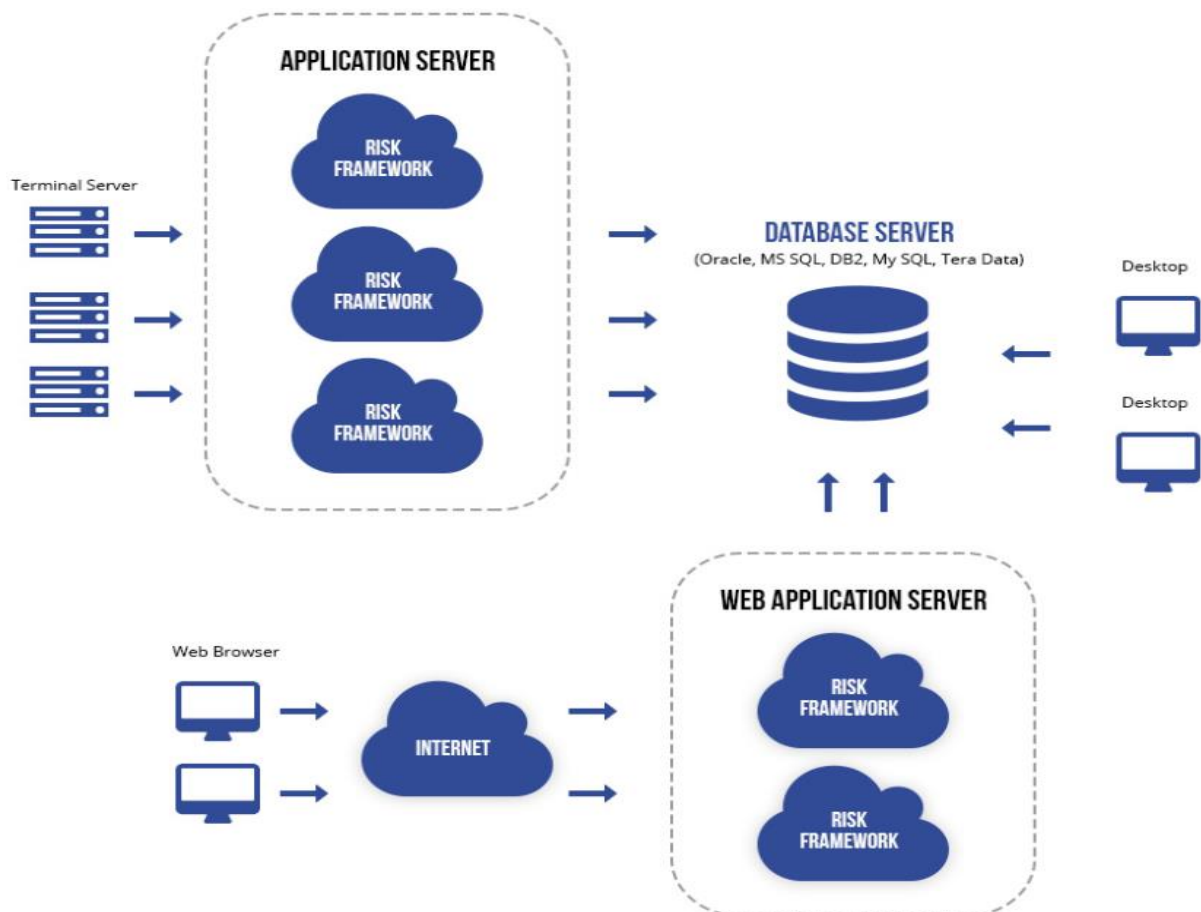
Risk Framework

Risk Framework (RFW) is a multi-user software system, designed for small and medium enterprises, banks, insurance companies and financial institutions, that enables the calculation, analysis and evaluation of financial portfolios. The system incorporates regulatory requirements of Basel III, IFRS 9, Solvency II, Asset and Liability Management, etc. It provides a complete set of risk management solutions.

Convenient user interface and efficient calculation methods enable:

- Fast and easy calculation of results in browsers, charts and graphs
- Generation of data and results using predefined report forms
- Generation of XML reports (COREP) or session logs
- Retrieval of logs and reports in Excel tables

Risk Framework is suitable for companies and institutions with up to 250 users and can be implemented either directly by Eurorisk Systems or by our partners.

The system is characterized by its extremely simple integration to other systems, such as banking systems, profile and data management systems, etc. Using various rule-based modules, Risk Framework allows users to easily extend and change the functionality of the system in order to find the best solution for their specific requirements.

Risk Framework can be used by all types of companies throughout the financial industry, particularly the ones operating in the following areas:

- Retail and Corporate Banking
- Financial Markets and Ratings
- Capital and Property Investment
- Insurance Industry
- Fund Management

In addition to the software system, customers will be given an extensive company training and system maintenance, providing fast and efficient work with Risk Framework.

Eurorisk Systems Ltd.

Eurorisk Systems Ltd. is an independent, financial software manufacturer, that provides software solutions in the fields of business and risk. Primarily active in the DACH-region (Germany, Austria and Switzerland), it is also present in the Eastern European market. Together with a number of longstanding partners, the company has successfully executed hundreds of implementations in more than 10 countries.

Eurorisk Systems Ltd. is a highly reliable and trusted business partner. Through general agreements of 2008, for the maintenance, implementation and distribution of financial software, Eurorisk Systems and its partner Profit Software Ltd. implemented software systems for financial risk assessment throughout the Bulgarian market.

Since its beginnings in 1993, our company has specialized in doing what it does best – developing and implementing high-quality business and financial solutions that help customers respond to their daily challenges. Years of experience and our long-term stability are the main reasons why so many companies and financial institutions have chosen to work with us.

After the financial crisis of 2007/2008 and its negative impact on the global economy, many countries around the world were bound to comply to Basel III and its Liquidity Standards, in order to ensure financial security. To meet the current needs of small and medium-sized enterprises, banks and institutions, Eurorisk Systems has expanded its portfolio of software solutions and offers rating modules for Retail and Corporate Clients, IFRS 9 and Basel III for the evaluation of Operational, Market, Credit, Liquidity, and Asset and Liability Risk.

Many companies have already given us their trust and discovered the benefits of Risk Framework. Isn't it time you do the same?

Risk Framework Features

Risk Framework is a high-performance, standardized platform, designed for financial or other types of calculations, that includes:

- Calculations of financial instruments
- Portfolio calculations and analysis, portfolio management, overall banking management
- Scoring and rating calculations for retail and corporate clients
- Market, credit and operational risk assessment, based on well-known methods, such as RiskMetrics™, CreditMetrics, Monte Carlo Simulation, STA, BIA, AMA
- Assessment of solvency capital requirements for insurance companies

It contains basic modules, that are required for the system performance, as they create fundamental structures and data. Different application modules are available for different application areas, as models implement specific calculation methods and approaches.

№	Module	Model
1	System Models	Initial Setup (Stored Procedures, Templates) Settings, Nomenclatures, Finance Calenders, Registers, Catalogues Finance Centers, Roles, Users with Roles and Passwords Definition and Management of Sessions and Packages
2	Market Data and Scenarios	Market Data: Market Curves, FX Tables, Indices, Time Series Stress Scenario: Curves, Exchange Rates, Indices, Ratings, Liquidity
3	Portfolio Definition	Definition of Portfolios, Lists, Filters, Analytical Schemes Statistical and Dynamical Structures (Sub-portfolio)
4	Instruments, Positions and Analysis Asset & Liability Management	Cashflow Tools, Exposures, Attributes, Transactions Portfolio Evaluation, Cash Flow and Interest Income Analysis Margin Calculation
5	Operational Risk (Basel III)	Data and Classifications for Operational Events and Self-Assessments Basic, Standardized and Mature Approach Consolidation of Risks via Monte Carlo Simulation
6	Credit Risk (Basel III)	Exposure Data - Standardized Approach Data and Optimization of Collaterals Capital Adequacy Scenario Management of Customer Data Assessment of Capital Adequacy by Sectors
7	Solvency II	Insurance Instruments Probabilities and Mortality Scenarios Attributes and Insurance Settings SCR for Counterparty, Market and Insurance Risk Assessment of the Solvency Requirement
8	Credit Risk (CreditMetrics)	Rating Agencies and Migration Matrix Branch Index, Spreads, Classes and Attributes Credit Risk Calculation via Monte Carlo Simulation
9	Market Risk (RiskMetrics)	Data and Allocation of Market Factors Correlation Matrix Market Risk Calculation via Monte Carlo Simulation
10	Credit Scoring and Rating	Scoring und Credit Application for Retail Customers Rating for Corporate Customers Balance Sheet and P&L for Corporate Customers Rating for Banks Setting, Validation and Optimization of Models
11	Regulatory Requirements	IFRS 9 (Classification, Accounting and Hedging) Basel III, Liquidity (LCR, NSFR) and Attributes
12	Other Modules	Management of Limits and Compliances Management of Internal and External Events Data and Evaluation of Real Estate and Transactions Investment Consultation with Expert Judgment Generation of Interactive OLAP Reports Graphic Processor Unit (GPU) Applications: Phantom Generation, Simulation and Structured Evaluation of Financial Instruments

Module IFRS 9 in Risk Framework

IFRS 9 Financial Instruments is a new standard that replaces IAS 39 Financial Instruments: Recognition and Measurement. The project for the development of IFRS 9 consists of three phases:

1. Classification and measurement of financial assets and liabilities
2. Balance accounting and asset impairment
3. Hedge accounting

Module IFRS 9: 1. Classification and Valuation of Assets & Liabilities

According to IFRS 9, assets are divided into two categories:

- Valuation at Amortization Cost (depreciated at Amortized Cost) and
- Valuation according to Fair Value (valuated at Fair Value)

The classification occurs at the time of the initial re-detection of the asset, based on:

- Company-based business models for asset management
- Characteristics of the company's contractual cash flows
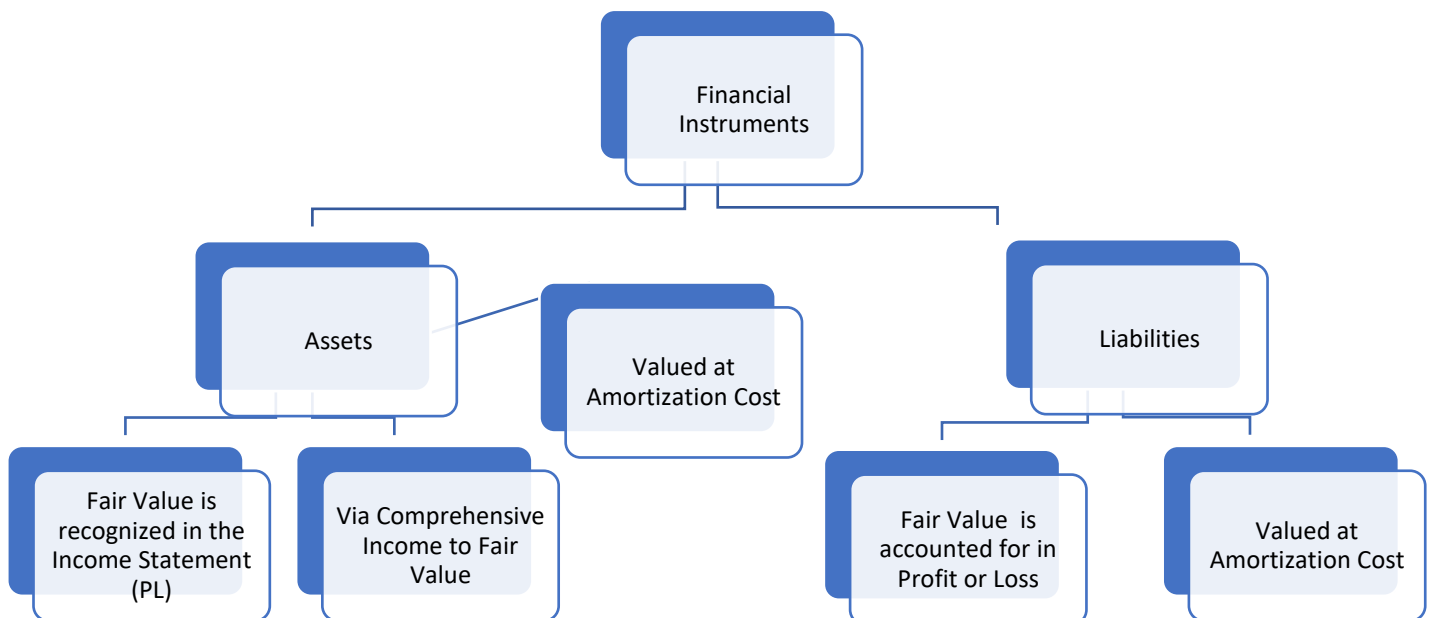
Classification of financial assets

in Risk Framework

Module IFRS 9: 2. Accounting and Depreciation of Assets

The Impairment Model for financial assets in IFRS 9 requires Expected Loss (EL) to be recognized in the Profit and Loss (PL) category up until the maturity of the exposures. It imposes extensive provisioning requirements on financial institutions that use IFRS.

The valuation system generates forecasts and calculates the EL based on EAD (Exposure at Default), CPD (Cumulative Probability of Default) and LGD (Loss Given Default) for each position that is to be accounted for.

Balance Accounting:

- Calculation of the balance for all portfolio items at Fair Value or according to the Amortized Cost Method
- Aggregation of the balance sheet data at sub-portfolio level
- Storage of calculation results in the database for reporting purposes
- Export to report forms that are specified in Excel by the Regulator

Level 1	Level 2	Level 3
(Very good credit quality)	(Significant deterioration in credit quality)	(Default)
Amount of the impairment provision: Expected Loss 12 months	Amount of the impairment provision: Expected Loss to maturity	Amount of the impairment provision: Expected Loss to maturity
Recognizes Interest Income, such as effective interest of Gross Book Value	Recognizes Interest Income, such as effective interest of Gross Book Value	Recognizes Interest Income, such as effective interest of Amortized Book Value

Accounting on portfolio level through exposure consolidation

Module for Credit Scoring/Rating and Validation in Risk Framework

Credit Scoring/Rating:

- Credit Scoring/Rating of the borrower's creditworthiness for future periods
- Number representation: scoring symbol representation: rating
- Input data: Age, Net Income, Property, Sum, Time period, Property size in sqm, Number of people in the household, Education, Region, Profession, etc.
- Output data: Scoring/Rating
- Usage of mathematical and statistical models for the analysis and validation

Principles of the Validation:

- The logic of the scoring model is transferred to the neural network
- The neural network is analyzed in place of the original scoring system
- Analysis and evaluation of the scoring model's characteristics
- Requirements of regulatory authorities under Regulation (EU) No 575/2013:
  - Validation of the scoring method
  - Significance of factors
  - Independence of factors
  - Contributions and sensitivities of factors

Analytical Statement

Data for an individual borrower
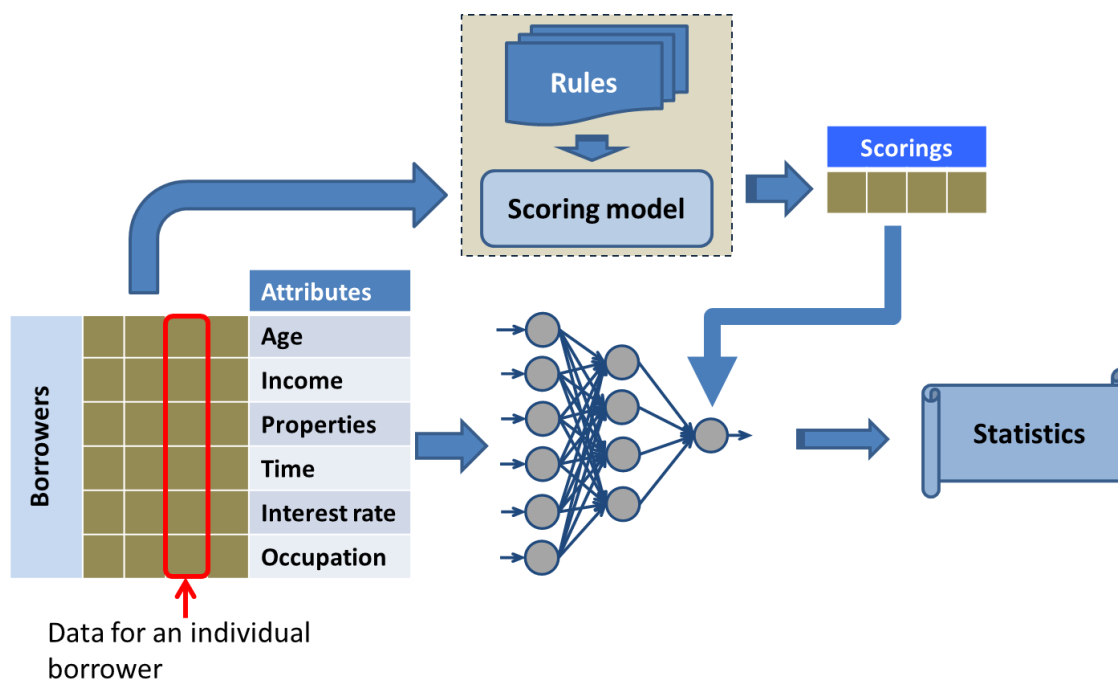
Evaluation during Valuation:

- Through historical statistical data of losses at default; these data require storage, synchronization and accumulation for a longer historical period.
- The rating system can be validated and calibrated based on historical data.
- Autoregressive validation, i.e. the scoring model's scoring set determines the scoring ´knowledge´.
- Evaluation of significant factors can be performed by excluding individual factors and assessing the changes in the CAP (Cumulative Accuracy Profile). The results can then be compared to the valuation significance of excluded factors.

Module for Credit Scoring/Rating and Validation in Risk Framework

Module for Credit Rating Evaluation
WEB Client-Server

Evaluation of indicators from the balance sheet and income statements, taking into account trend movements.

Assessment of subjective factors, such as management profile, company evaluation and economic risk.

Results: points, evaluations, rating levels and probability of default.

Rating Validation:
- Input data – factors
- Grouping according to credit type: mortgage loan, consumer credit or overdraft
- Network settings
- Iterative changes in the structure
- Generation of individual ratings, as well as ratings for all borrowers

Module for Time Series Prediction in Risk Framework
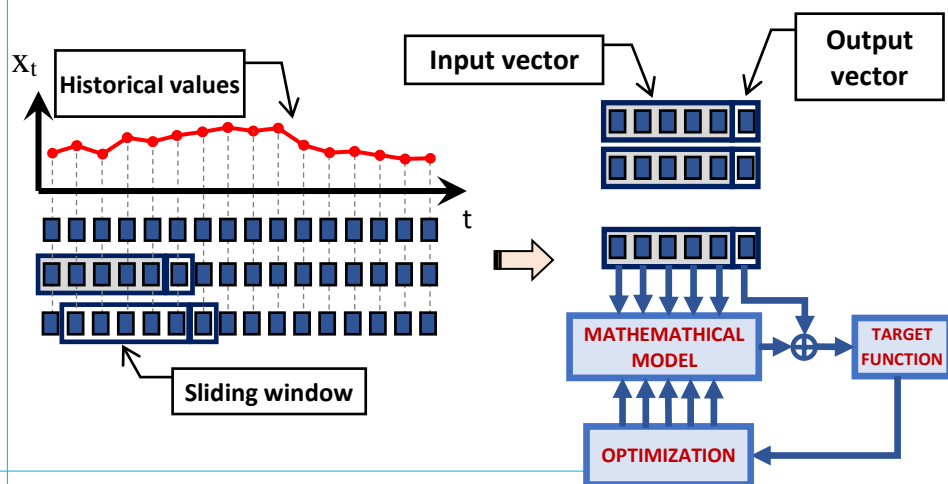
Time series prediction:

- Time series represents a sequence of observations that are arranged in time or space and are expressed as sequences of real numbers.

- Successive observations within a sequence can be dependent, which enables their prediction.

- The effectiveness of predictions depends on the time series' characteristics, such as average, volatility, trend, seasonality, etc.
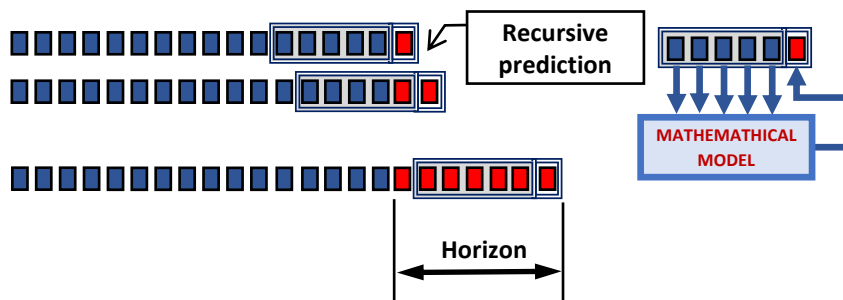
Main principles:

- Execution of univariate time series predictions. The only information required for the generation of predictions is historical time series.

- The prediction of time series that applies a mathematical model is carried out in two stages: 1) model building, and 2) prediction.

A sliding time window is used to traverse the original time series. During each step, sub-series of smaller lengths than the original time series are formed. These sub-series compose matrices and by analyzing the dependencies in these matrices, the model is built.

Building the model for prediction

x_t — Historical values

Input vector — Output vector

Sliding window

MATHEMATHICAL MODEL — TARGET FUNCTION

OPTIMIZATION

Prediction

Recursive prediction

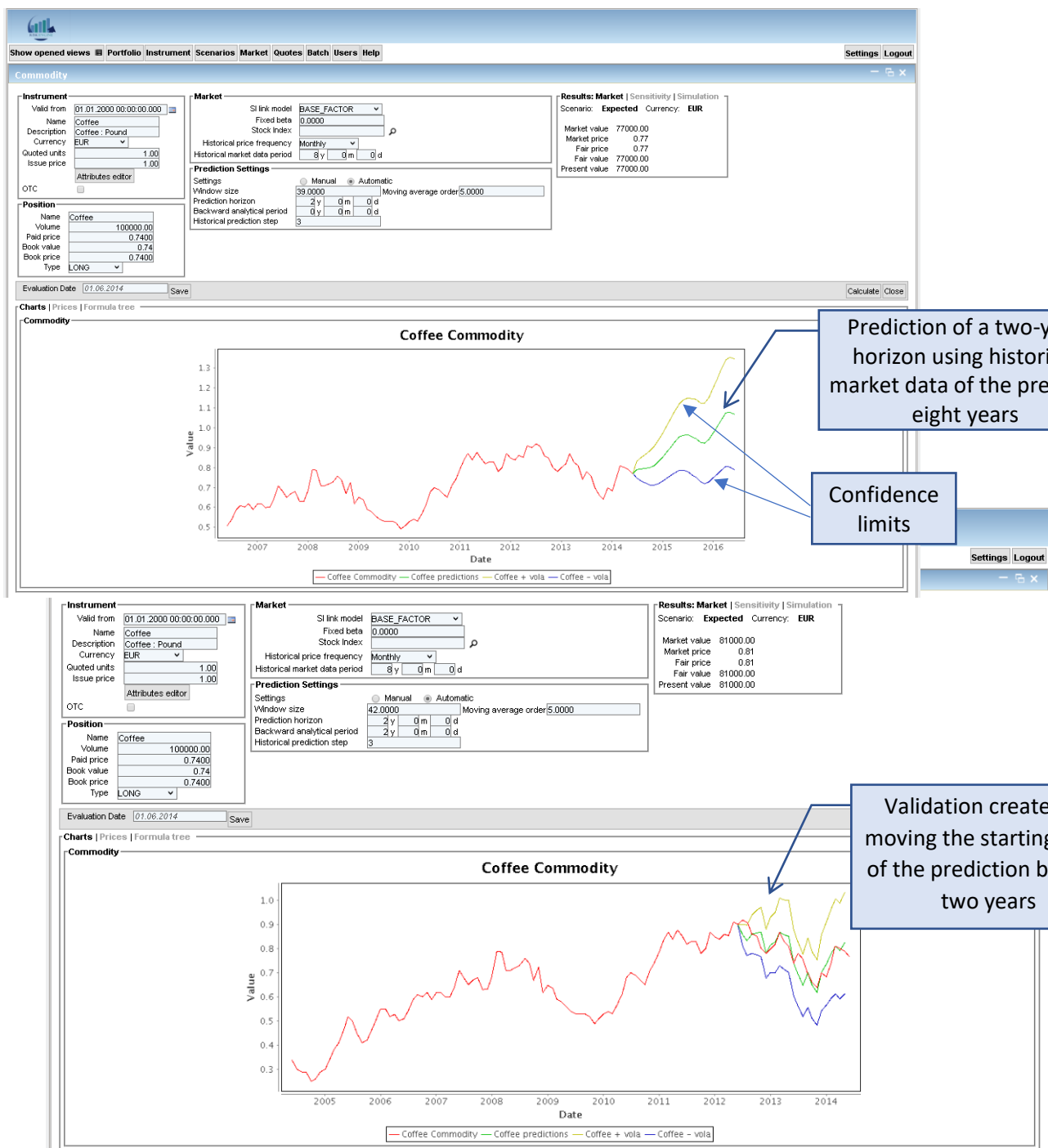MATHEMATHICAL MODEL

Horizon

The number of predictions determines the prediction horizon. Recursive prediction is realized by acknowledging each predicted value as real. In this way, it is possible to predict an arbitrary long prediction horizon.
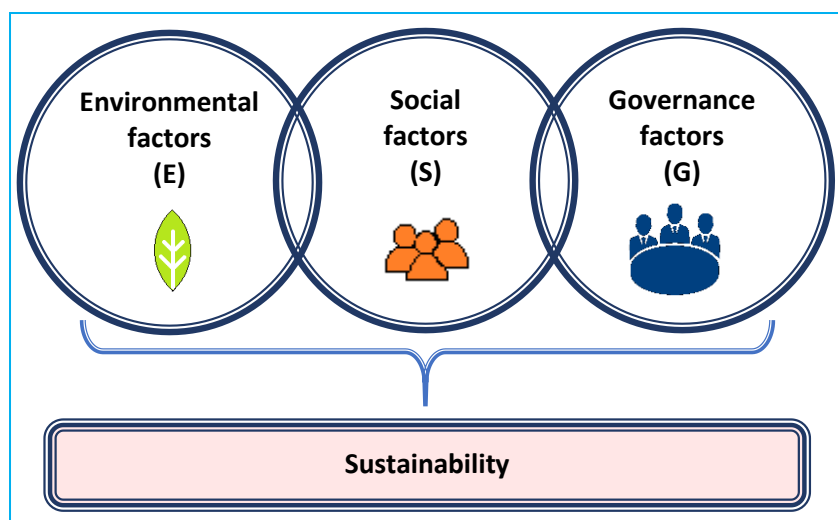
Module for Time Series Prediction: Software Implementation

- Validation of results by moving the starting point of the prediction back.
- Automatic definition of the size of the sliding time window using historical validation.
- Manual setting of the sliding window size.
- Automatic pre-processing of time series that converts them into stationary series prior to the building of the model and transforms them back after the prediction.
- The indicator for prediction can be analyzed and predicted at different time frequencies.
- The prediction is visualized with confidence limits.

To a large extent, results depend on the nature of the time series: how long it is, what its parameters are, whether there is a trend or seasonality and, if so, what is it (additive or multiplicative), are there outliers in the series, whether interpolation is needed to generate additional internal values, etc.

Prediction of a two-year horizon using historical market data of the previous eight years

Confidence limits

Validation created by moving the starting point of the prediction back by two years

Module for Calculation of Environmental, Social and Governance (ESG) Factors

Environmental factors (E)

Social factors (S)

Governance factors (G)

Sustainability

ESG factors measure the sustainable development of companies in the financial sector and express whether corporate solutions and activities take into account different environmental, social and governance aspects.

They play an important role in the investment analysis, influencing the reputation and trustworthiness of participants in the financial market.

Analysis and modelling using ESG factors:

- Long-term sustainable development strategies require analysis such as: environmentally friendly and efficient use of available resources, effective management, etc.
- The ESG calculation in Risk Framework is based on automatic or manual choice of a sub-set of other participants in the market, having known values for their ESG factors, and finding of their influence, which can be positive or negative, on the company to be evaluated.
- EGS values of the rated company are calculated by considering the values of ESG factors from the selected sub-set of market participants, together with the significance of their influence, which is represented in the form of weights.

Software execution in Risk Framework

Parameters for automatic suggestion of global ESG indexes

Parameters for the definition of weights that represent the company share

ESG indexes and weights that represent the company share

Module for Calculation of ESG Factors: Software Implementation

- Given:
    - A historical development of the company's share, which is subject to ESG rating.
    - Multiple historical developments of global ESG indexes for the ESG factors.
- Aim:

    Finding similarities within historical developments of the company share and the selected indexes. After that, the goal is to define weights for the representation of the share by an ESG index, and finally to define the ESG rating.
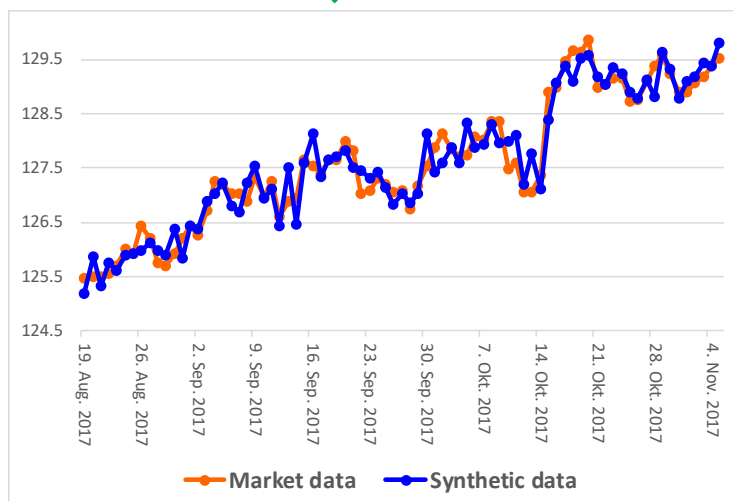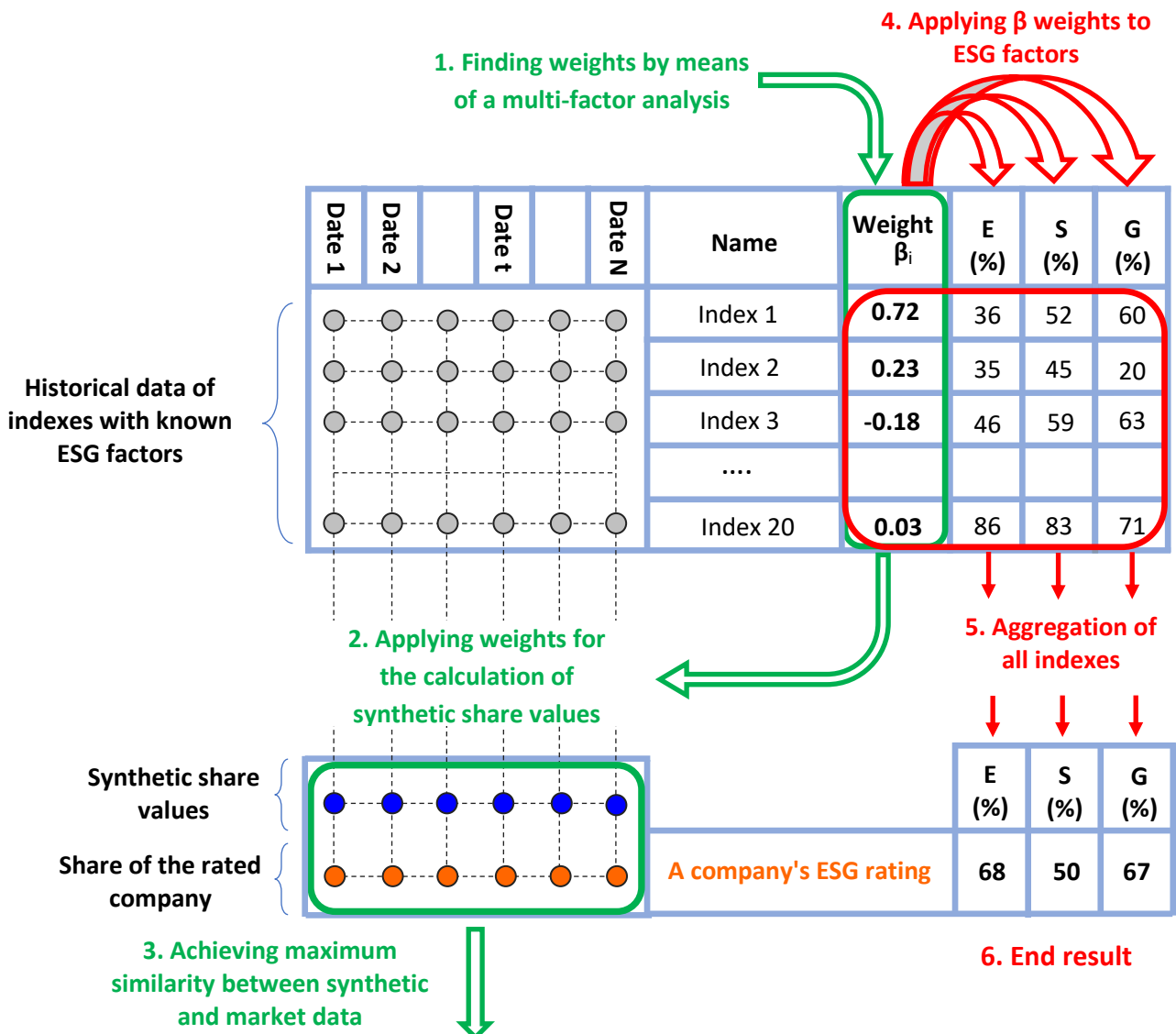
Module for Natural Language Processing (NLP) in Risk Framework

In recent years it has become prevalent to use voice commands to obtain information from computers or mobile devices. This approach is nowadays considered a resourceful and simple way to stay informed. Such a feature is possible through the usage of Natural language processing (NLP) algorithms. NLP is a subfield of linguistics, computer science, and artificial intelligence and is concerned with the interaction between human language and computers. It enables people to interact with all computer devices in an easy and user-friendly way by simply stating a sentence.
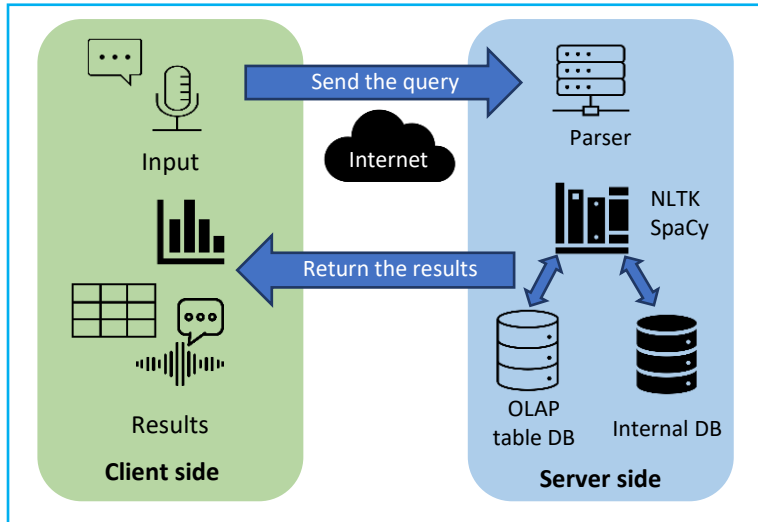
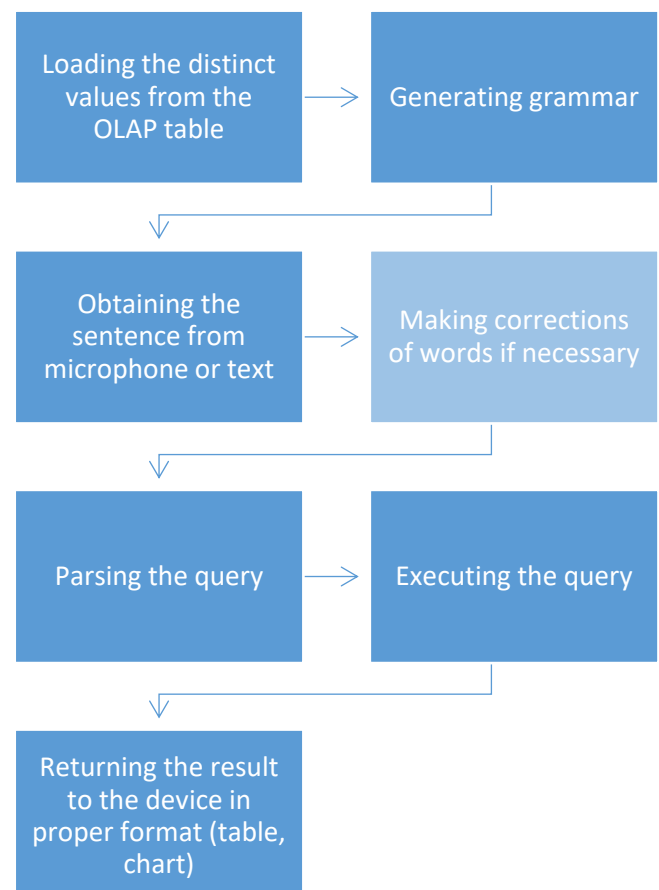**Steps required to transform a human language sentence to a database (DB) query:**

- Send the sentence to the parsing application using your microphone or by typing it.
- The needed grammar rules and all key words are loaded.
- The sentence is parsed into a DB query.
- The DB query is executed on an OLAP table.
- The retrieved information is returned to the user in a user-friendly form, e.g. chart, table, etc.

- Since the application for parsing sentences runs on a server, it can be accessed anytime and anywhere.
- The application can be connected to a user interface for desktop applications, as well as accessed from web browsers or mobile applications.
- The input required from the user side is only a sentence that describes the information needs to be obtained.

The NLP parser algorithm details:

- First, information from the OLAP table is loaded. All distinct values are recorded into an internal structure which is used later.
- Information from the internal structure is used for the grammar generation. The grammar consists of rules that are defined **automatically** using tables.
- Once the grammar is generated, the parser is ready to be used. The input, in form of a sentence requesting information, can be articulated into a microphone, or typed via keyboard.
- Each word from the input must be recognized by the parser. In case of unrecognized words, the **Edit Distance Algorithm** is used. It identifies similar words, that come closest to the unfamiliar term and are known by the parser.
- After the word has been successfully identified, the sentence is parsed through the grammar. If the word order is correct, the process continues onto the next step.
- The sentence is transformed into a DB query using labels placed from the parser, after which the DB query is executed.
- The information from the DB is transformed into a table, chart, graph or text and can be displayed on the screen or read by the device.

Scheme of the algorithm steps:

Module for Natural Language Processing (NLP) in Risk Framework

- **Screenshot of the demo for desktop:**

The button for parsing, pressed after the sentence is entered via the keyboard

Recognized keywords needed for the parsing

The parsed query is ready

Results of the execution

Input text

Correction Screens

Options for correction

Misspelled, incorrect words

- **Screenshot of the demo for mobile:**