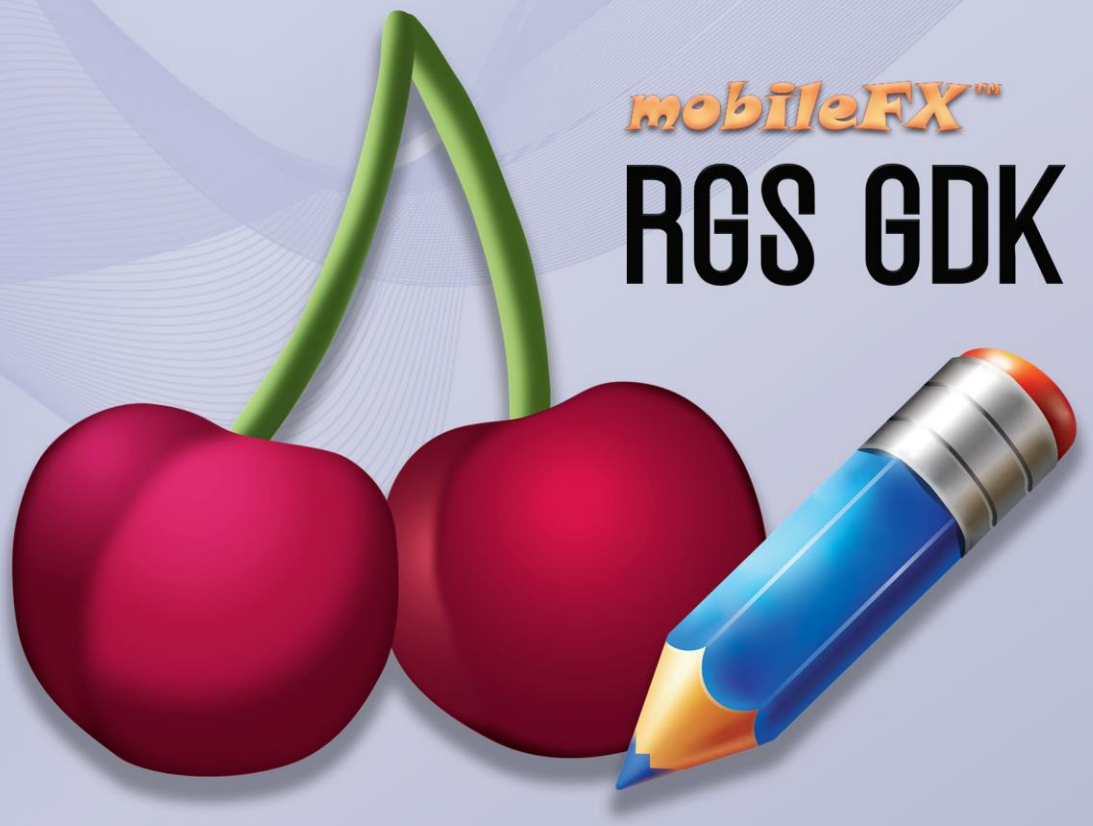


mobileFX™ RGS GDK

ChatGPT

https://chat.openai.com/g/g-or9HeE7Li-mobilefx-rgs-gdk

EXECUTIVE SUMMARY

mobileFX has designed and implements an ecosystem for the production and publishing of games of chance with the commercial title "mobileFX Remote Games Server Workbench" (abbreviated RGS Workbench), which consists of the following software components:

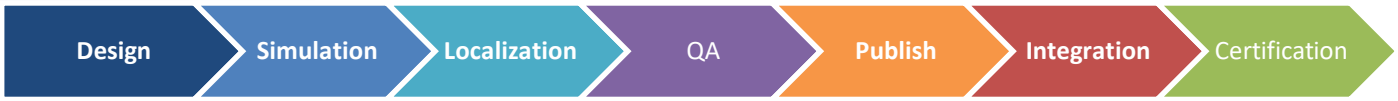
1. An integrated development environment (IDE) that implements the design-time services, i.e. the services necessary during the design, emulation, internationalization, quality control, publishing, integration and certification of a probabilistic game.

2. A Remote Games Server (RGS) that implements the corresponding run-time services, i.e. the services that are necessary when publishing a game online for actual use by real players and publishers.

3. A template game (template game) in Unity 3D to serve as a starting point for any company wishing to take full advantage of this ecosystem and immediately start producing their own games.

The commercial goal is either the full exploitation of all software parts, or the individual use and exploitation of selective parts of the software by game producer companies. Specifically, seven (7) Value Added Services (VAS) offered by the above software components during both the design-time and run-time phases of a probabilistic game have been designed and implemented, taking into account in each case the need to ensure game performance (RTP) so that the games produced comply with the needs and requirements of individual markets and regulatory authorities.

The following Value-Added Services (VAS) offered by the above software departments provide an end-to-end workflow from the design of a game to its release in a globalized business environment:



Picture 1 - End-to-End Value-Added Services

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RGS GDK Guide

Contents

1 RGS Game Development Kit (GDK) 10
2 RGS Workbench 11
2.1 Tab 1 - RTP Analysis and RTP Graph 12
2.2 Tab 2 - Reel Strips Editor 14
2.2.1 Prize Table Editor 15
2.2.2 Symbol Distribution editor 16
2.2.3 Wild Substitutions Editor 18
2.2.4 Free Spins Editor 19
2.2.5 Paylines Editor 19
2.3 Tab 3 - Bonus Editor 20
2.3.1 Bonuses can have depleting or non-depleting Bonus Prize Tables 26
2.3.2 Algorithmic Bonus Game 27
2.4 Tab 4 - Prize Rules 29
2.4.1 Theoretical RTP Calculation 29
2.4.2 Prize Rules 30
2.5 Workbench can perform real-time RTP Calculation! 34
2.6 Tab 5 - Monte Carlo Simulator 34
2.6.1 Simulation data are stored in Simulation Datasets 35
2.6.2 Max Exposure for Max Bet 37
2.6.3 Simulation datasets can be represented in several Charts 38
2.7 Tab 6 - Visualization Tool 42
2.8 Tab 7 - Localization Editor 44
2.8.1 Locales Editor 44
2.8.2 Currency Concerns 45
2.8.3 Currency Editor 46

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2.8.4 Tokens Editor 48
2.8.5 Game Rules Editor 52
2.8.6 Unicode Code Ranges 53
2.9 Tab 8 - Responsible Gaming Editor 54
2.10 Tab 9 - Game Client Tools 56
2.10.1 RGS API Generator Tool 56
2.10.2 Bill of Materials Project Management Tool 58
2.11 Tab 10 - Publishing Tool 61
2.11.1 Debug RGS Infrastructure using Visual Studio Code 67
2.11.2 Publish your Game for first time! 67
2.12 Tab 10 - Integration Tool 71
2.12.1 Integration Tool Use Case 72
2.12.2 RGS Provider 73
2.12.3 RNG functors 74
2.12.4 Stat the Game Engine 76
2.12.5 Place a Bet and fetch a Ticket 77
2.12.6 Money Path 78
2.12.7 Other APIs in Integrator Tool Debugger API 80
2.12.8 Actuator API 81
2.12.9 Lobby API 81
2.12.10 Wallet API 82
2.12.11 Backend Wallet Integration 83
2.12.12 Forward Wallet Integration 83
2.12.13 Certification Simulation API 85
2.13 Tab 11 - Certification Tool 86
2.14 Tab 12 - Release Manager 89
2.15 Tab 13 - GGR Analytics Tool 91

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3 RGS Server 92

3.1 RGS Server Architecture 93

4 Unity 3D Template 96

4.1 Design Goals 96

4.2 Installation 96

4.3 RGS API Integration 96

4.4 API Security 96

4.5 Finite State Machine 96

4.6 Components 96

4.7 Localization 96

4.8 Best Practices 96

5 FAQ 97

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Pictures Table

Picture 1 - End-to-End Value-Added Services 2
Picture 2 - RTP Graph 12
Picture 3 - Reel Strips Editor 14
Picture 4 - Prize Table Editor 15
Picture 5 - Symbol Distribution Editor 16
Picture 6 - Wild Substitutions Editor 18
Picture 7 - Free Spins Editor 19
Picture 8 - Free Spins Returns 19
Picture 9 - Payline Editor 19
Picture 10 - Bonus Editor 20
Picture 11 - Bonus Weighted Table Chart 21
Picture 12 - Lobstermania RPT Graph 21
Picture 13 - Zorbas Tavern Bonus within Bonus within Bonus 22
Picture 14 - Bonus Prize Distributions 22
Picture 15 - Using Bonus Symbol Count as initial Bonus RNG 23
Picture 16 - Hexbreaker Mirror-Mirror Bonus 24
Picture 17 - Binomial Distribution combining two Bonus Game winnings 25
Picture 18 - Setting Depleting and non-depleting Bonus Prizes 26
Picture 19 - Algorithmic Bonus Game - Hexbreaker Money Ladder 27
Picture 20 - Transformation of Algorithmic Bonus Game to Weighted Prize Table 28
Picture 21 - Calculate RTP 29
Picture 22 - Full Cycle Theoretical RTP Calculation 29
Picture 23 - Prize Rule Permutations Report 30
Picture 24 - Symbol Statistics Report 31
Picture 25 - Betline Statistics Report 31
Picture 26 - Confidence Levels Report 32
Picture 27 - Scatter Returns and Free Spins Returns Reports 32
Picture 28 - Bonus Returns Report 33
Picture 29 - Reel View Probabilities Report 33
Picture 30 - Monte Carlo Simulator – Datasets and Charts 34
Picture 31 - Simulation Presets 35
Picture 32 - Simulation Master-Detail Datasets 35
Picture 33 - Returns per Symbol Simulation Report 36

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Picture 34 - Returns per Prize Simulation Report 36
Picture 35 - Winnings Histogram Simulation Report 36
Picture 36 - Winnings Ranges Simulation Report 37
Picture 37 - Max Exposure Simulation Options 37
Picture 38 - Simulation RTP Ranges Chart 38
Picture 39 - Simulation RTP Histogram Chart 39
Picture 40 - Simulation RTP Distribution Chart 39
Picture 41 - Simulation Player Volatility Chart 40
Picture 42 - Simulation Confidence Level Chart with play-time RTP 41
Picture 43 - Visualization Tool, RTP Breakdown Chart 42
Picture 44 - Visualization Tool, Hits per Symbol in logarithmic scale 42
Picture 45 - Visualization Tool, Returns per Symbol 43
Picture 46 - Localization Editor, Locales Editor 44
Picture 47 - Floating Point Number Arithmetic Problem 45
Picture 48 - Floating-Point Mantissa 46
Picture 49 - Localization Editor, Currency Editor 47
Picture 50 - Localization Editor, Translation Token Editor (Heatmap Mode) 48
Picture 51 - Localization Editor, Translation Token Editor (Language Mode) 48
Picture 52 - Localization Editor, Translation Token Editor Default Tokens 49
Picture 53 - Localization Editor, Translation Token Editor Google Translate API 49
Picture 54 - Localization Editor, Translation Token Editor, Font Coverage Tool 50
Picture 55 - Localization Editor, Translation Token Editor, Export to Excel tool 51
Picture 56 - Localization Editor, Hyperlanguage processing Game Rules 52
Picture 57 - Unicode Code-Ranges 53
Picture 58 - Input Unicode Code Ranges from RGS Workbench to Unity3D 53
Picture 59 - Responsible Gaming 54
Picture 60 - Responsible Gaming UI in Game Client 55
Picture 61 - RGS API Generator Tool 56
Picture 62 - RGS API Generator Tool 56
Picture 63 - RGS API Generator Tool 57
Picture 64 - Game Client, Bill of Materials Editor 58
Picture 65 - Game Client, Bill of Materials Editor, Calendar Tool 58
Picture 66 - Game Client, Bill of Materials Editor, Resource Allocation 59
Picture 67 - Game Client, Bill of Materials Editor, Organic Resources Editor 59

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Picture 68 - Game Client, Bill of Materials Editor, Workflow Editor 60
Picture 69 - Publishing Tool, Infrastructure Profile Graph 61
Picture 70 - Create and Initialize Infrastructure Profile 62
Picture 71 - Compose Infrastructure 63
Picture 72 - Infrastructure Profile Selection 63
Picture 73 - Docker Topology of a Game System 64
Picture 74 - Running a Game from RGS Workbench in Chrome 64
Picture 75 - Docker Compose Scripts Editor 65
Picture 76 - Infrastructure Explorer 66
Picture 77 - Debug Infrastructure Profiles with VSCode 67
Picture 78 - Publisher Editor in Tools > Options 68
Picture 79 - Game publishing to Content Aggregator GitLab through CI/DP Pipelines 69
Picture 80 - Content Aggregator Games Management Console 70
Picture 81 - Integration Tool 71
Picture 82 - Integration Tool, Currency Selector 72
Picture 83 - RGS Provider Selection 73
Picture 84 - Open Player Session through Stateless Wallet Proxy 74
Picture 85 - RNG Functor Selection 75
Picture 86 - RNG Sample Selection 75
Picture 87 - Citification Tool – RNG Samples Generator 75
Picture 88 - Integration Tool, GET-CONFIG result 76
Picture 89 - Integration Tool, GET-TICKET result 77
Picture 90 - Integration Tool, Money Path viewer 78
Picture 91 - Winnings Credit Policies 79
Picture 92 - Integration Tool, Exceptions Emulator Tool 80
Picture 93 - Actuator API 81
Picture 94 - Lobby API 81
Picture 95 - Integration Tool Wallet API commands 82
Picture 96 - Integration Tool Wallet API interface Dialog 82
Picture 97 - Integration Tool, Wallet API History Dialog 82
Picture 98 - Integration Tool, Wallet API Tools, Player History List 82
Picture 99 - Integration Tool, Backend Wallet Topology 83
Picture 100 - Certification Simulation API commands 85
Picture 101 - Game Client Specifications Editor 86

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Picture 102 - Test Accounts Editor 86
Picture 103 - RNG Samples Editor 87
Picture 104 - QA Test Cases Editor 87
Picture 105 - Certification Application Form Generator Tool 88
Picture 106 - Release Manager Tool 89
Picture 106 - GGR Analytics Tool 91
Picture 107 - Remote Games Server (RGS) 92
Picture 108 - RGS Server Blue Print 93

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1 RGS Game Development Kit (GDK)

mobileFX RGS GDK is an end-to-end toolchain for producing and publishing casino slot games. The GDK consists of three items: A **Unity Casino Slot Game Template**, an **RGS Server** and the **Workbench IDE**.

Unity Template is optimized for rapid prototyping of HTML5 WebGL slot games. It is pre-integrated with RGS Server and implements the RGS API for placing a bet and fetching a ticket, as well as APIs for integrating with Lobbies and Wallets. The template is fully compliant with gaming authorities, such as MGA and UKGC, and applies to regulated markets. It implements a vast array of Responsible Gaming features and it can handle both fiat and crypto currencies. mobileFX provides a Unity Developer's Guide with step-by-step information on building a casino slot game from scratch.

Next item of the GDK is RGS Server. It is a host of Game Engines, which are mathematical models of Games of Chance or Instant Win Games. Game Engine configuration files are generated by mobileFX RGS Workbench software. This Remote Games Server is a robust C++17 binary using only STL and Boost libraries. Sources are portable and can be compiled for both Windows and Linux systems. Server binary can be a console application, a Windows Service, or Linux Daemon. The server can be either single-tenant, hosting a single Game Engine, or multi-tenant, serving multiple game engines. mobileFX provides an RGS Integrator's Guide that demonstrates how to integrate the sever in your architecture.

mobileFX RGS Workbench is an Integrated Development Environment that offers a specialized Toolchain to casino game Producers. Packed with rapid prototyping features and pre-integrated with popular content aggregators, it will help you monetize your casino game ideas faster than ever! You can use RGS Workbench to **design, simulate, localize, integrate, certify** and **publish** casino games to on-line Publishers, Operators and content Aggregators. The IDE integrates with CI/CD GitLab pipelines, offering continuous integration and development and includes a Release Manager for managing and publishing your games in batch mode.

This broad and yet specialized spectrum makes mobileFX RGS Workbench the only end-to-end turn-key solution available on the market today! So, let us outline those end-to-end features, starting from Game Design up to Publishing the game to a content Aggregator and reveal all the in-between steps.

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2 RGS Workbench

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For starters, RGS Workbench is an innovative **Mathematical and Statistical tool**. Anyone with basic knowledge of Casino games can use RGS Workbench and you don't need to be mathematician to operate it. In fact, you can design your games using graphical RTP nodes and parameterizing your games features. The PAR sheets and simulations generated by RGS Workbench are fully certifiable in regulated markets.

The tool can perform Full Cycle statistical analysis of a game as well as Monte Carlo simulations. It can derive the Theoretical RTP of the game; calculate Max Exposure for Max Bet; calculate the Theoretical Standard Deviation of the Game and its Confidence Levels.

Also, it can calculate Game Volatility and rate the Volatility Index; finally, it can generate many key statistical reports required either by certification authorities or Casino Operators.

The gaming features include:

- Normal, Scatter, Wild and Bonus Symbols;
- variable number and sizes of Reels;
- Free Spins and Bonus rounds; multiple Wild Multipliers, Stacked Wilds and Expanding Wilds;
- Fixed or variable Pay Lines with Left-to-Right and Right-to-Left win directions;
- Multi-level Bonus Games; variable Bet Levels and Coin Values;
- Responsible Gaming features for multiple jurisdictions such as auto-play, self-exclusion, session timeouts and many others.

RGS Workbench comes with many **sample games**, each implementing the mathematical Game Engine of a popular slot game. Some of those samples are Lionfish, Atkins Diet, Cleopatra, Neon Starts, Lobstermania, Hexbreaker and others. First you need to select the sample that its features are closer to the game you have in mind, and start working on it. Once you have created a new game, you can then start using the various Editors to customize your game.

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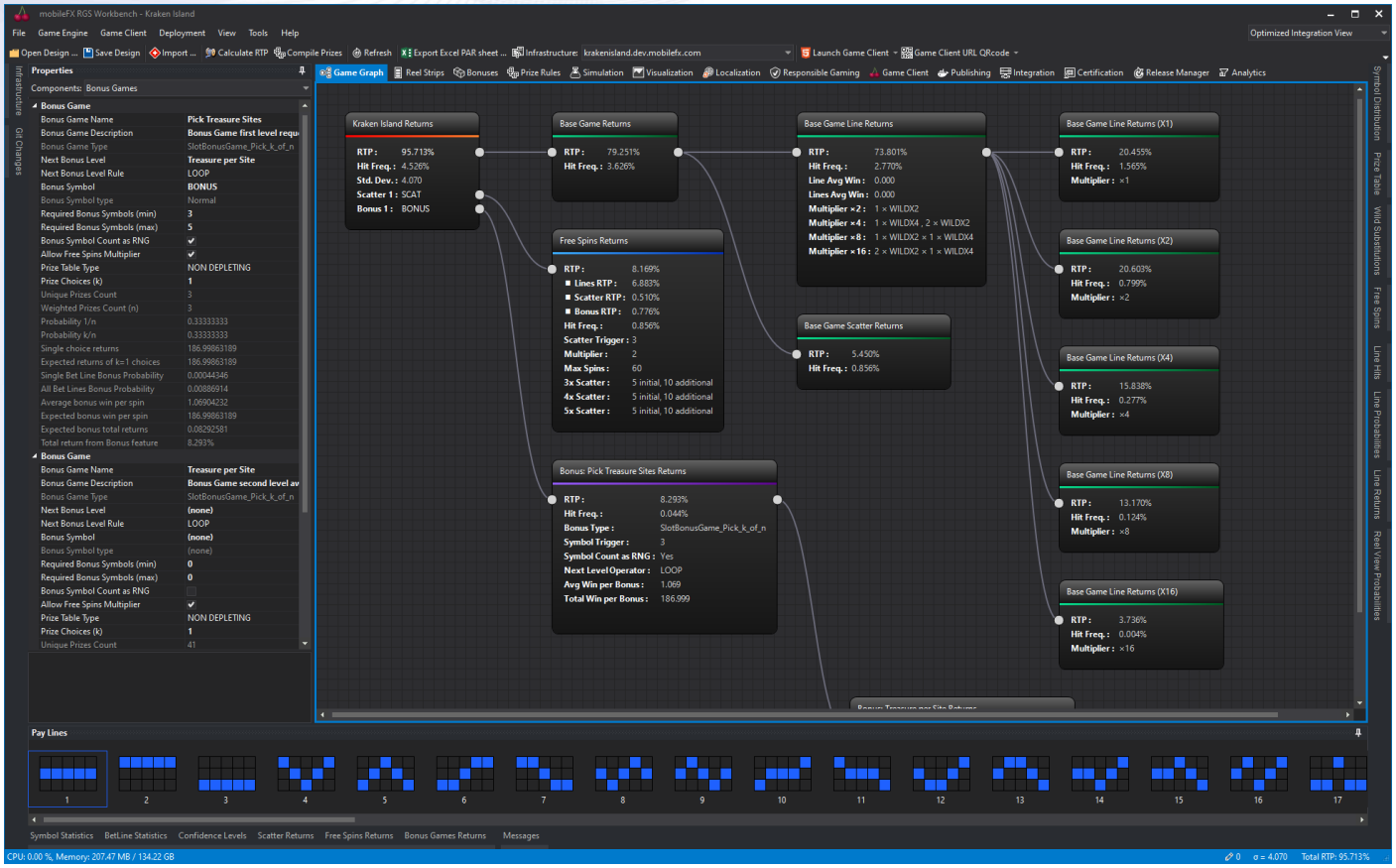
In RGS Workbench there are two kinds of tools: **Editors and Reports**. An Editor allows you to customize game features, add or remove game features and edit game parameters. Reports display various **Datasets**, either as data-grids or as charts and allow you to transform and export their data. Both Editors and Reports are organized into **Tabs** and **Panes**. Tabs are placed in main workspace area and resemble the end-to-end workflow steps: game design, simulation, localization, publishing, integration and certification. Typically, there is at least one tab per workflow step. Panes are docked around the main workspace area and you can hide them to maximize your workspace.

2.1 Tab 1 - RTP Analysis and RTP Graph

This tool maps a game as RTP nodes starting from the Base Game and adding one RTP node per game feature that contributes to the overall RTP of the game. There are RTP nodes for Line Multipliers, Free Spins and Bonus games, all linked to their contribution to RTP so that the game designer can have an overview of how RTP is distributed in the game.



Picture 2 - RTP Graph

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By selecting an RTP node you can see its properties in **Properties Explorer**. Properties Explorer is an Editor that can display the properties of any **Game Component**. The high-level Game Components in RGS Workbench are:

- **The Base Game Component:** a collection of properties affecting the behavior of the game, including properties that trigger and control Free Spins, Operator-specific settings, game identity and versioning.
- **The Bonus Game Component:** a collection of properties affecting bonus game behavior.
- **Symbol Component:** a collection of properties defining the behavior of a symbol on the reels.
- **Win Level Component:** a collection of properties defining an animation triggered by players winnings if they are greater than a specific multiple of Bet. Win Levels are Small Win, Medium Win, Big Win, Mega Win, Top Prize Win and Jackpot.
- **Locale Component:** a collection of properties defining language and currency parameters of the game.
- **Infrastructure Profile Component:** a collection of properties controlling the publishing of the game to a dev, test, stage or production environment.

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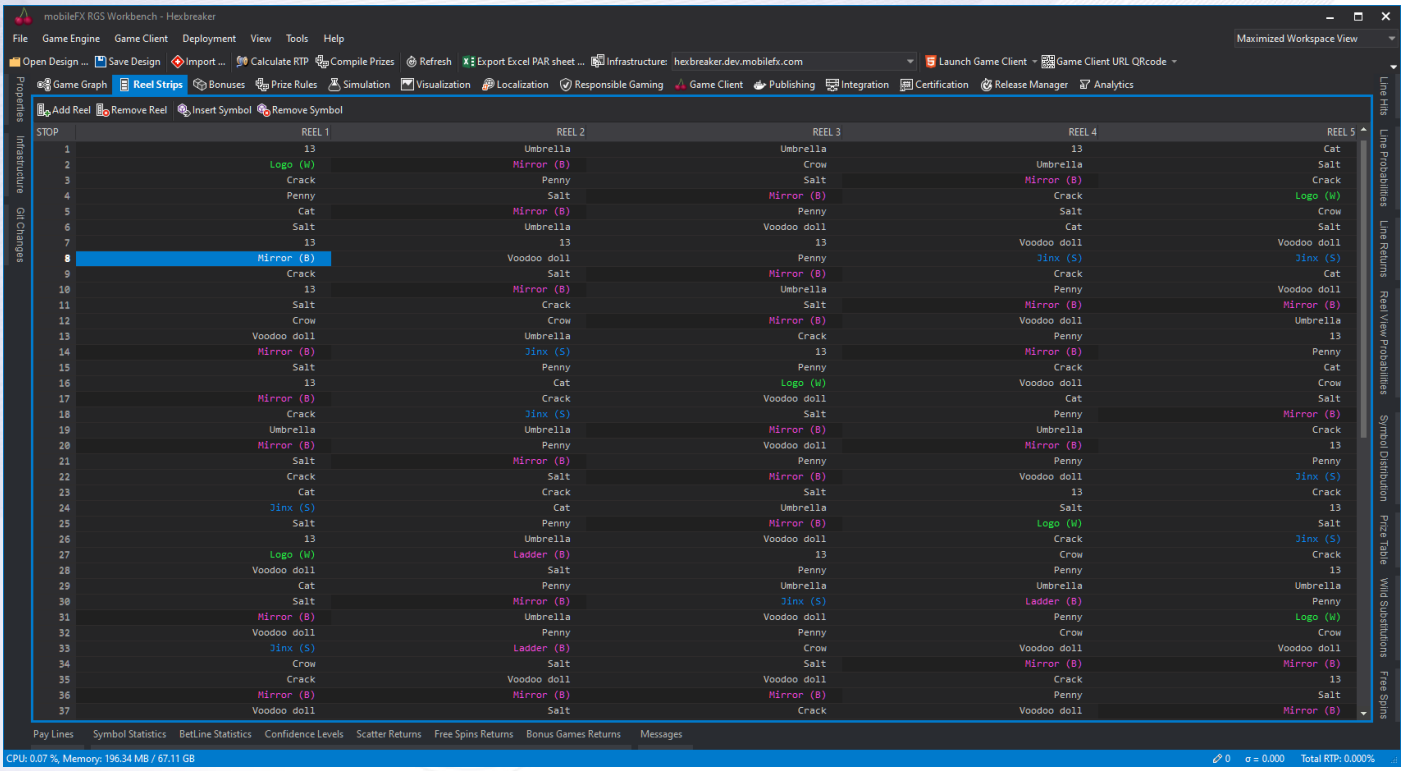
2.2 Tab 2 - Reel Strips Editor



Picture 3 - Reel Strips Editor

With **Reel Strips Editor** tool, you can add or remove reels and symbols per reel. The tool works closely with **Symbol Distribution Editor, Prize Table Editor, Wild Substitutions Editor** and **Free Spins Editor**. The tool works closely with the Symbol Distribution Editor, the Prize Table Editor, the Wild Substitutions Editor and the Free Spins Editor.

Reel Strips Editor has several productivity features. It can help you visually detect the Symbol locations and distribution across Reels, insert or delete Symbols in your Reels, and offers extensive drag-and-move features.

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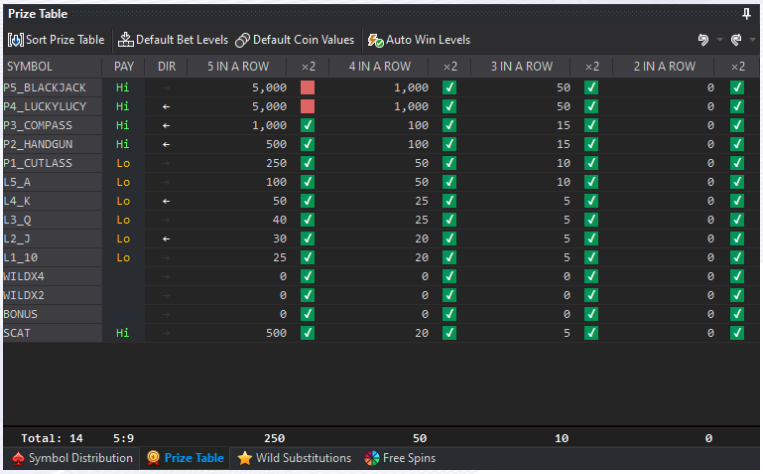
2.2.1 Prize Table Editor



Picture 4 - Prize Table Editor

Prize Table Editor is the tool for defining prize tiers for game Symbols. The tool sorts prizes diagonally to help you create prize tiers that pay more for larger Symbol sequences, and can indicate prize inconsistencies by marking illogical prizes with red color. The tool automatically analyses the Prize Table and partitions the Symbols to **High-Paying and Low-Paying Symbols**.

For games that pay from Right-to-Left or Both-Ways, you can set the **Prefer Win Direction** per Symbol for the highest Symbol occurrences. For example, in Godly Riches 5-reel game, Cleopatra is on the left and Goddess Aphrodite is on the right. Both ladies are symbols of the game and both have prizes for 5 in-a-row. In this game we wanted 5-Cleopatra symbols to trigger left-side win and 5- Aphrodite symbols to trigger right-side win.

Prize Table Editor can also be used to indicate in a prize participates in **Free Spins Multiplier**. Typically, during Free Spins winnings are multiplied by a multiplier (eg. doubled, tripled, etc.). This is set in game settings but you might want to exclude the highest prize tier of high-paying symbols in order to limit the RTP of the game. For example, in IGT Cleopatra game, 5 in-a-row Cleopatra symbols are excluded from doubling the wins during Free Spins.

From Prize Table Editor you can reset the **Bet Levels** and **Coin Values** of the game to defaults and auto-generate the Win Levels of the game. **Win Levels** are winning animation triggers that are expressed as multiples of Bet. The framework offers six (6) win levels: **Small Win**, **Medium Win**, **Big Win**, **Mega Win**, **Top Win** and **Jack Pot** win levels. Win Levels are expected to be handled by Game Client and display the appropriate Win Animation to the Player. Certain jurisdictions set specific rules for Win Levels, especially for Small Win.

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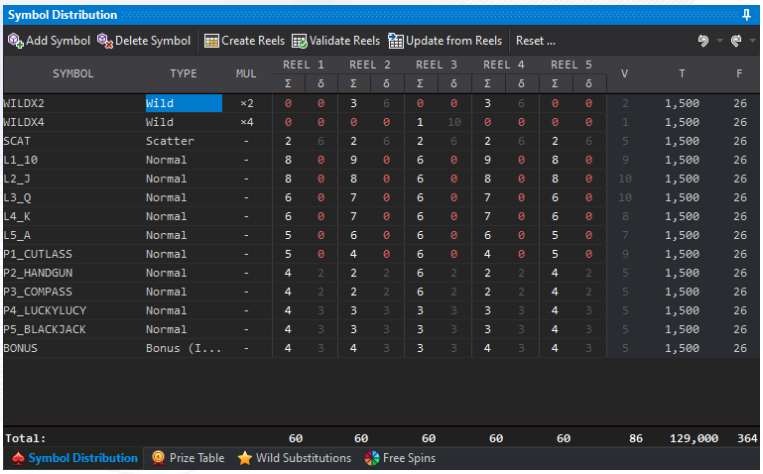
Top Win is associated with **Max Win Cap** that is usually set by Operators complying with jurisdictional rules and limitations for Player winnings. Max Win Cap in this framework can be applied per Ticket or per Round and is configurable from Operator Settings. Max Win Cap is checked for every generated win (eg. Line win, Free Spin win, Bonus win) and it can be configured to stop the game at the Round that accumulatively reached the cap, or continue generating remaining Rounds but with zero wins. Jack Pot win level should be triggered by Wallet when the Player has won the pot accumulated for this game or across games. This requires API integration with a Jackpot interface. Jackpot engine is not included in this framework.

2.2.2 Symbol Distribution editor



Picture 5 - Symbol Distribution Editor

Symbol Distribution Editor describes the symbols on each reel in terms of symbol occurrences and spacing, and it can generate the reels automatically for you. This is the tool for **adding or removing the Symbols** of your game and defining the **Symbol Type**. The framework supports the following symbols:

- **Normal Symbols:** pay out winnings when a certain number of them align on active paylines.
- **Wild Symbols:** are special symbols commonly found in slot games that serve as versatile substitutes for other symbols to help create winning combinations. The framework supports the following varieties:
    - **Standard Wilds:** these are basic Wild symbols that substitute for other symbols without additional features.
    - **Expanding Wilds:** these Wild symbols expand to cover entire reels or multiple positions on the reels, increasing the likelihood of forming winning combinations.
    - **Stacked Wilds:** Stacked Wild symbols appear in stacks on the reels, potentially covering multiple positions on a reel and increasing the chances of forming winning combinations.

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- **Multiplier Wilds:** These Wild symbols come with a multiplier value that increases the payout of any winning combination they contribute to. You can set this Multiplier in the 3rd column of Symbol Distribution Editor.

- **Bonus Symbols:** are special symbols that typically triggers bonus features or bonus rounds when a certain number of them appear on the reels. The framework supports the following varieties:

  - **Triggering Bonus Game:** the primary function of a Bonus symbol is to activate bonus features or bonus rounds within the slot game. These features include interactive bonus games, pick-and-win games, algorithmic bonus games and other exciting gameplay elements that offer additional opportunities to win prizes or increase payouts.

  - **Scatter Bonus Symbols:** these symbols typically serve as both bonus symbols and scatter symbols. They can trigger bonus features regardless of their position on the reels and often pay out prizes independently of paylines.

Symbol Distribution Editor defines the following variables per Reel:

- **Σ variable** is used to describe the total number a Symbol can appear on a Reel. Symbol Distribution Editor takes this limitation into account when generating the Reels.

- **δ variable** is used to describe the minimum distance between two same Symbols on a Reel. For example, you might want to keep special symbols such as Wild, Scatter and Bonus with some distance between them. Symbol Distribution Editor takes this limitation into account when generating the Reels.

- **V variable** is calculated during Full Cycle analysis and stand for (Reel) View Count of a Symbol. This represents the maximum number of instances (copies) that a Symbol can appear on any 5x3 Reel View combination. The number is calculated in order to help Unity3D developers pre-create (cache) the 3D model of a symbol for seamless Spin animations. Creating and destroying a 3D model at run-time during spinning of the Reels is expensive, so a good practice is to cache the required number of Symbols off-screen.

- **T variable** can be set by game designer and is the number of Triangles of the Symbol's 3D model. By providing the number of triangles for each model of your Symbols, Symbol Distribution Editor can calculate the Total Number of triangles your game will allocate at run-time. This information is vital for Mobile WebGL games that often cap to 500,000 triangles.

- **F variable** can also be set by game designer and is the number of Frames of a Symbol's 2D sprite. If instead of 3D models you develop your game with traditional 2D sprites, then by providing the number of unique frames per sprite Symbol Distribution Editor can calculate the total number of frames for all your Symbol sprites. Since in most cases those frames are rectangular, by knowing the Width x Height of each frame you can derive the number of **Spite Atlases** you will need for your game in advance.

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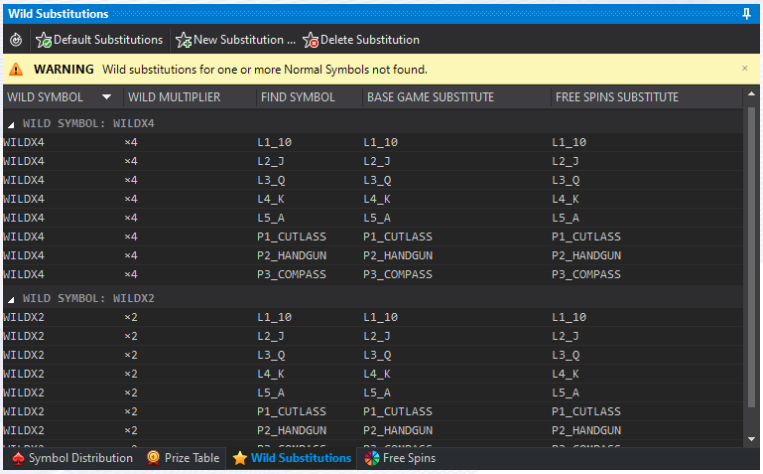
2.2.3 Wild Substitutions Editor



Picture 6 - Wild Substitutions Editor

Wild Substitutions Editor is used to define how Wild symbols substitute Normal Symbols. By default, Workbench will generate the same Wild substitutions for Base game and Free Spins and for all Wild symbols.

If your game uses Wild Multipliers such as Wild times 2 and Wild times 4, you can control the multipliers behavior from **'Symbol Multiplier Rule'** property of the Base Game component. You can combine multiplier Wild symbols in 'Reels Editor' to produce winning symbol sequences of times 8 16 32 or even higher multipliers of bet.

Likewise, if your game supports Free Spins, you must define the 'Scatter Count for Free Spin Rounds', 'Max Free Spins' and 'Free Spins Multiplier' properties in Base Game component. You can set Initial and Additional Free Spins per Scatter count in Free Spins pane and overwrite the defaults generated by Workbench. When both Free Spins and Wild multipliers are enabled, then all multipliers are multiplied respectively. Multipliers are rendered in Game RTP Graph by separate RTP nodes.

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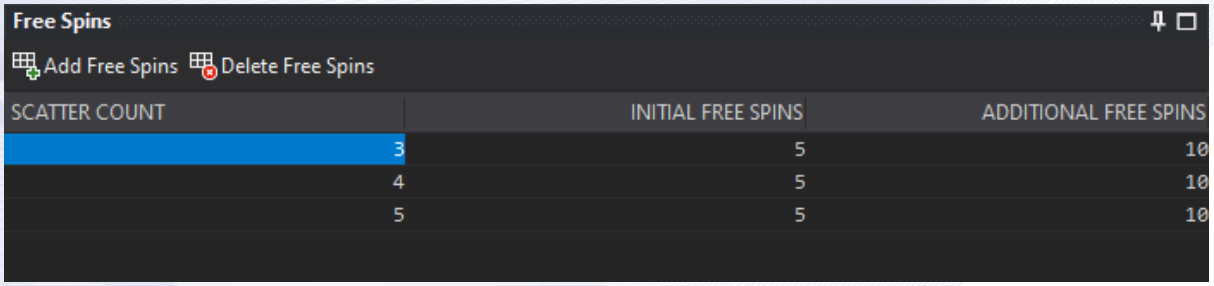
2.2.4 Free Spins Editor



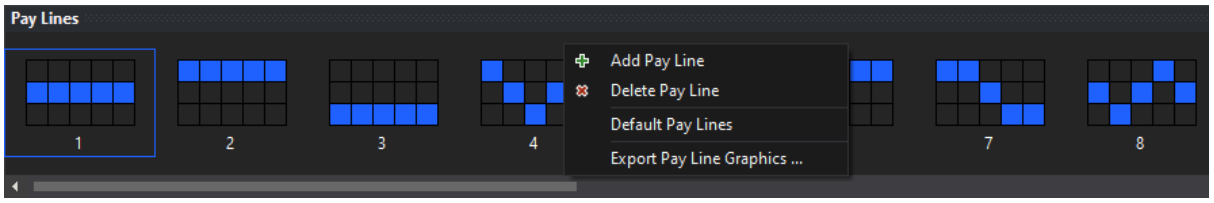
Picture 7 - Free Spins Editor

INITIAL FREE SPINS PROBABILITY n_1p_1	ADDITIONAL FREE SPINS PROBABILITY n_2p_2	EXPECTED FREE SPINS FOR SCATTERS IN VIEW $n_1/[1-\sum(n_2p_2)]$	EXPECTED WINS PER FREE SPIN	EXPECTED FINAL WIN PER BONUS	EXPECTED FREE SPINS PER BASE GAME $\sum(n_1p_1)/[1-\sum(n_2p_2)]$
0.04050000	0.08100000	5.46806649	1.74532570	9.54355698	0.04429134
0.00225000	0.00450000	5.46806649	1.74532570	9.54355698	0.00246063
0.00005000	0.00010000	5.46806649	1.74532570	9.54355698	0.00005468

Picture 8 - Free Spins Returns

The Free Spins Editor allows you to set the Free Spins award per number of SCATTER symbols. The award is defined as Initial Free Spins number, which is awarded the first time the player hits the specified number of SCATTER symbols, and Additional Free Spins number, which is awarded if the player hits a specified number of SCATTER symbols during the Free Spins. Calculation of payout and contribution to RTP is based on statistical analysis and is reflected in the Free Spins Payout Analysis table.

2.2.5 Paylines Editor



Picture 9 - Payline Editor

Paylines Editor is used to add or remove Pay Lines from your game. Right-click on it to reveal its context menu and commands. You can edit the layout of a Pay Line by clicking on its cells. If the Pay Line is valid it will appear with blue color but if it is invalid it will appear red. RGS Workbench can calculate the Pay Line layouts for you automatically by providing the number of lines you want.

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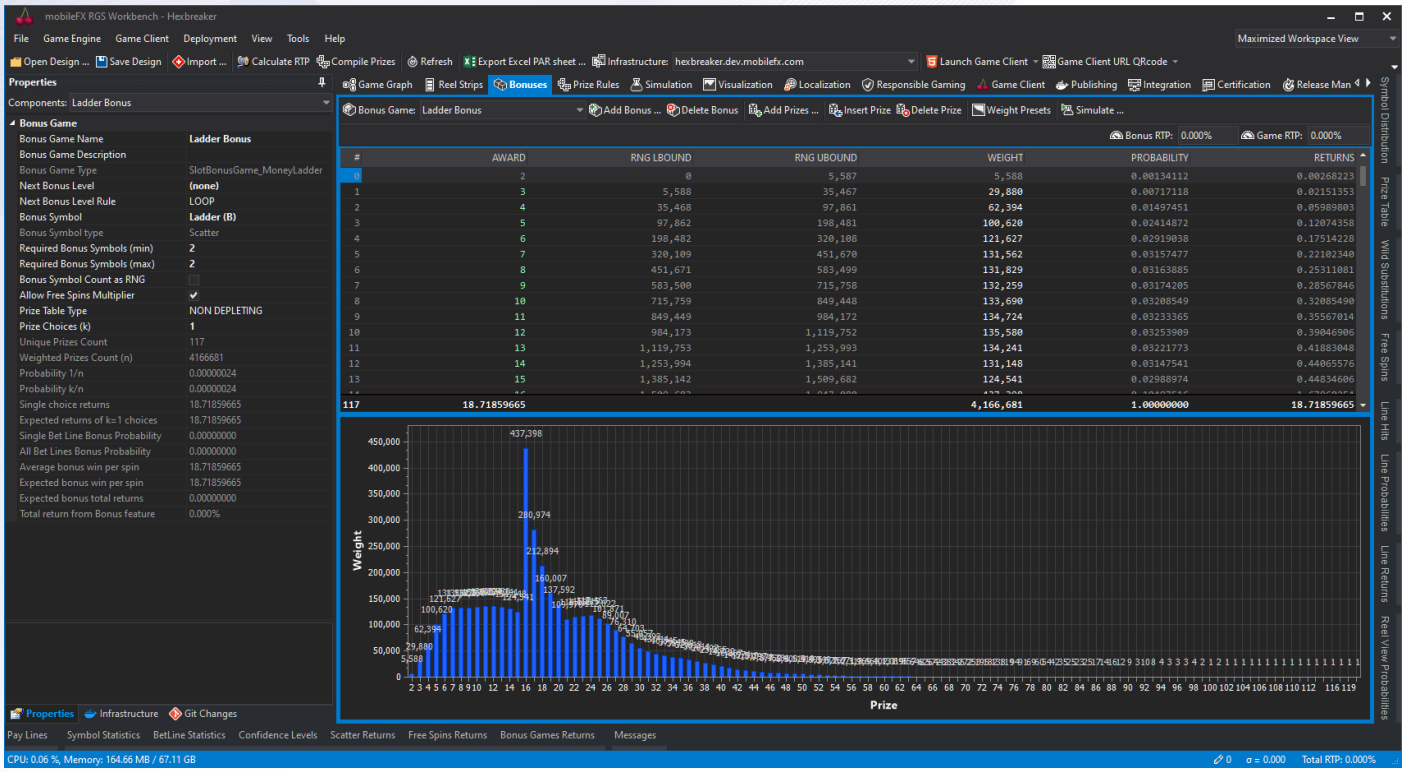
Right-click on it to display the context menu and its commands. You can edit the layout of a Payline by clicking on its cells. If the Payline is valid it will be displayed in blue but if it is not valid it will be displayed in red. RGS Workbench can automatically calculate Payline layouts for you by providing the number of lines you want.

2.3 Tab 3 - Bonus Editor

Bonus Editor tool is for adding, removing and editing Bonus Games. There are two kinds of Bonus Games: **Pick k of n Bonus Games** and **Algorithmic Bonus Games**.



Picture 10 - Bonus Editor

A **Pick k of n Bonus** game consists of a **Weighted Prize Table** where each Prize is associated with a Weight. The weight defines the RNG range of each prize and weights per prize are render in a graph for your convenience.

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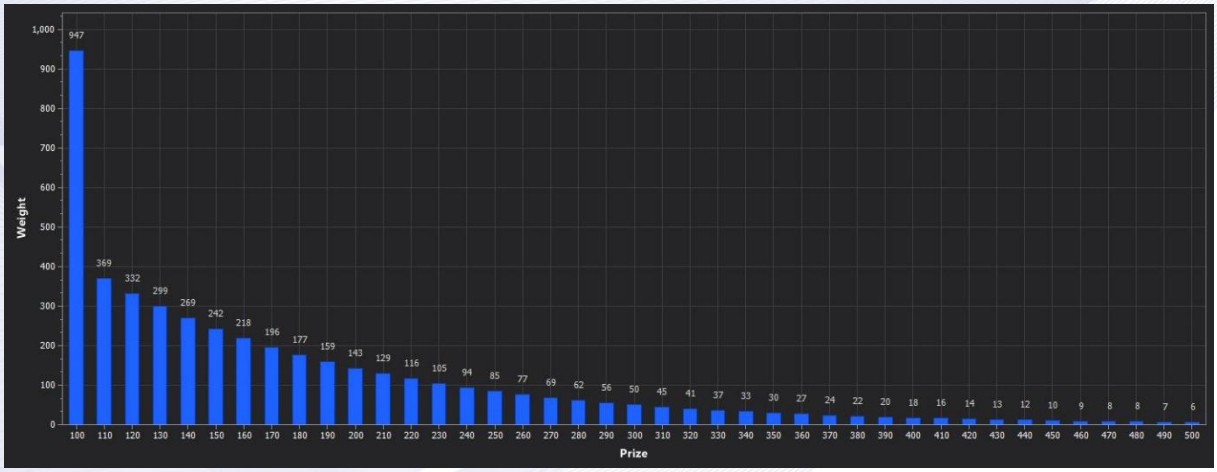
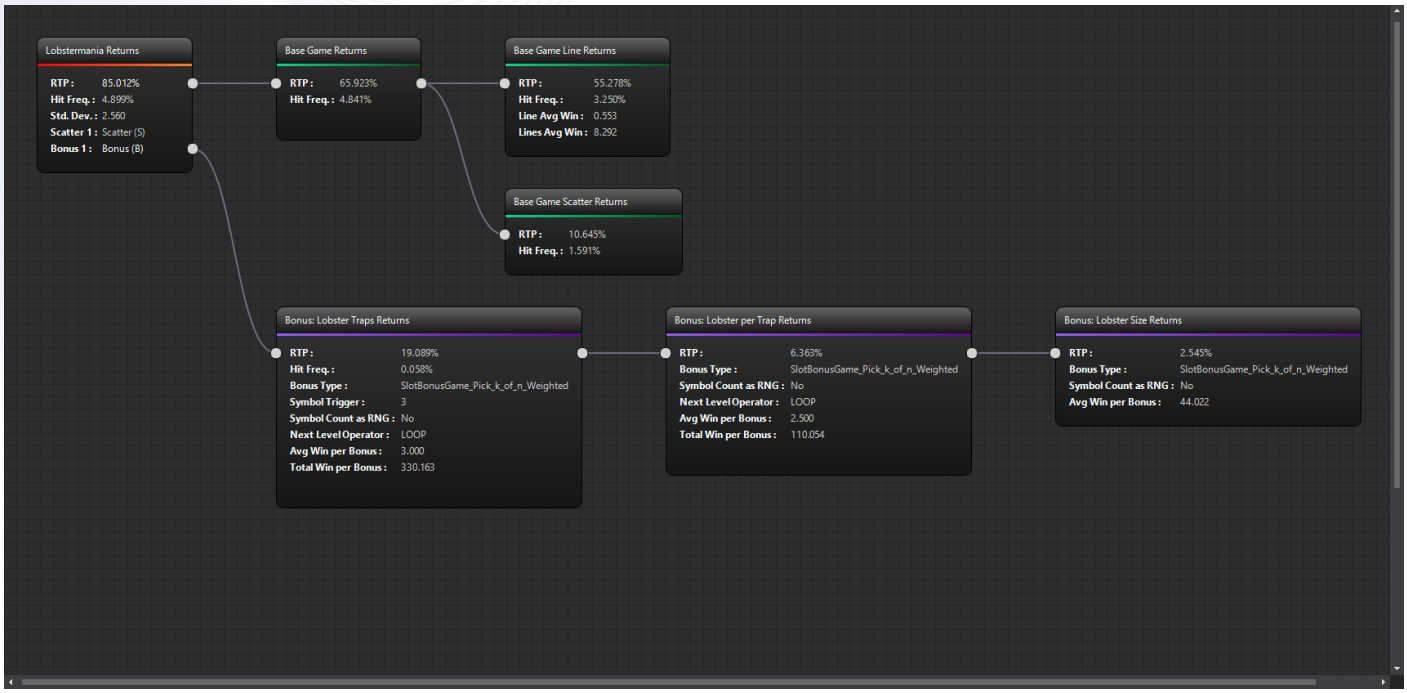


Picture 11 - Bonus Weighted Table Chart

You can interconnect pick bonus games making your Bonuses more exciting for the players. An example of interconnected pick bonus games is Lobstermania and Hexbreaker that both display the advanced Bonus features of RGS Workbench. In Lobstermania the bonus game has three levels represented by 3 interconnected bonus nodes in game graph and 3 animations on the game client.



Picture 12 - Lobstermania RPT Graph

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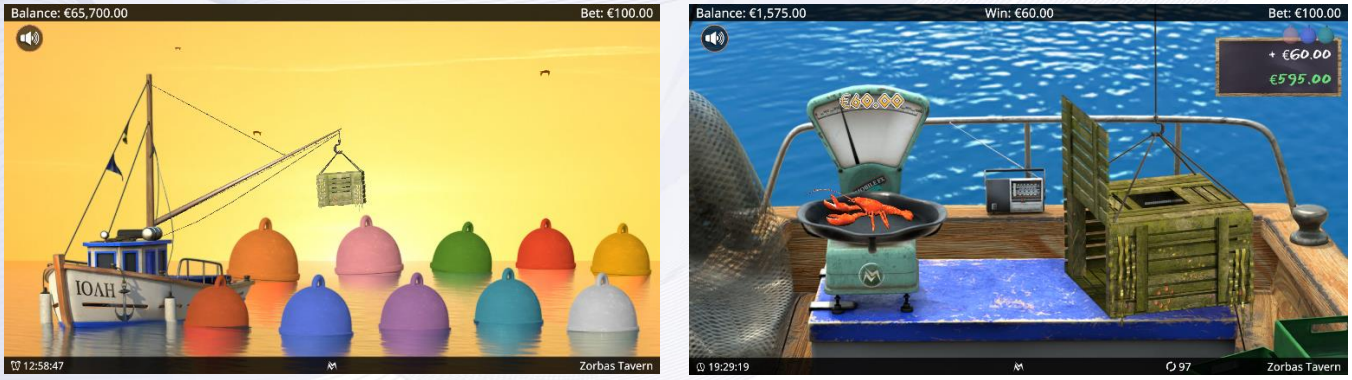
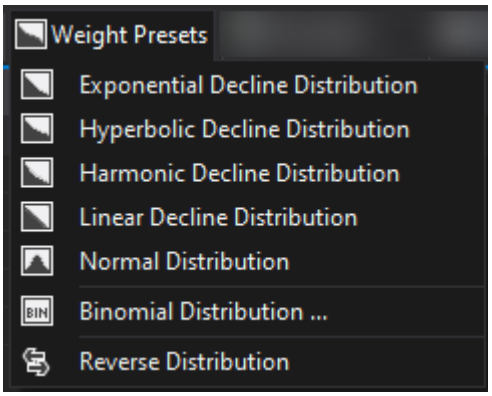
In the first level the Player is asked to interactively pick a number of buoys which are wired to lobster traps. On the second level a fisherman opens each lobster trap revealing the number of lobsters per trap. On the third level each Lobster is weighted and the Player accumulates the winnings. All 3 levels are Pick k of n games defined in Bonus Editor.



Picture 13 - Zorbas Tavern Bonus within Bonus within Bonus

RGS Workbench calculates the RTP of the combined bonus games and you can fiddle with the prices while watching the RTP adjust in real-time. You can also apply different distributions to your bonus prizes by selecting from **Exponent, Hyperbolic, Harmonic, Linear and Normal distributions**.



Picture 14 - Bonus Prize Distributions

A nice Bonus Game feature is using the Bonus Symbol Count for picking a Bonus Game Prize. For example, in Lobstermania, the number of buoys could depend on number of Bonus symbols won during the base game. So, with 3 bonus symbols the player will be allowed to pick 2 buoys, with 4 symbols 3 buoys and so on. To enable this feature, select the Bonus in Bonus Editor, go to Properties Explorer and check 'Bonus Symbol Count as RNG'.

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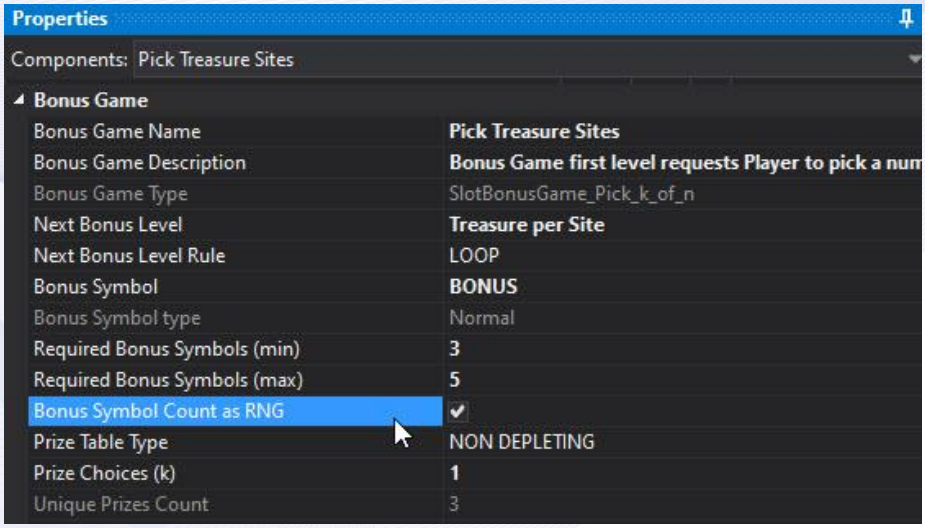

Picture 15 - Using Bonus Symbol Count as initial Bonus RNG

In this case Workbench calculates the probabilities of Bonus Prizes, from the probabilities of the Bonus Symbols.

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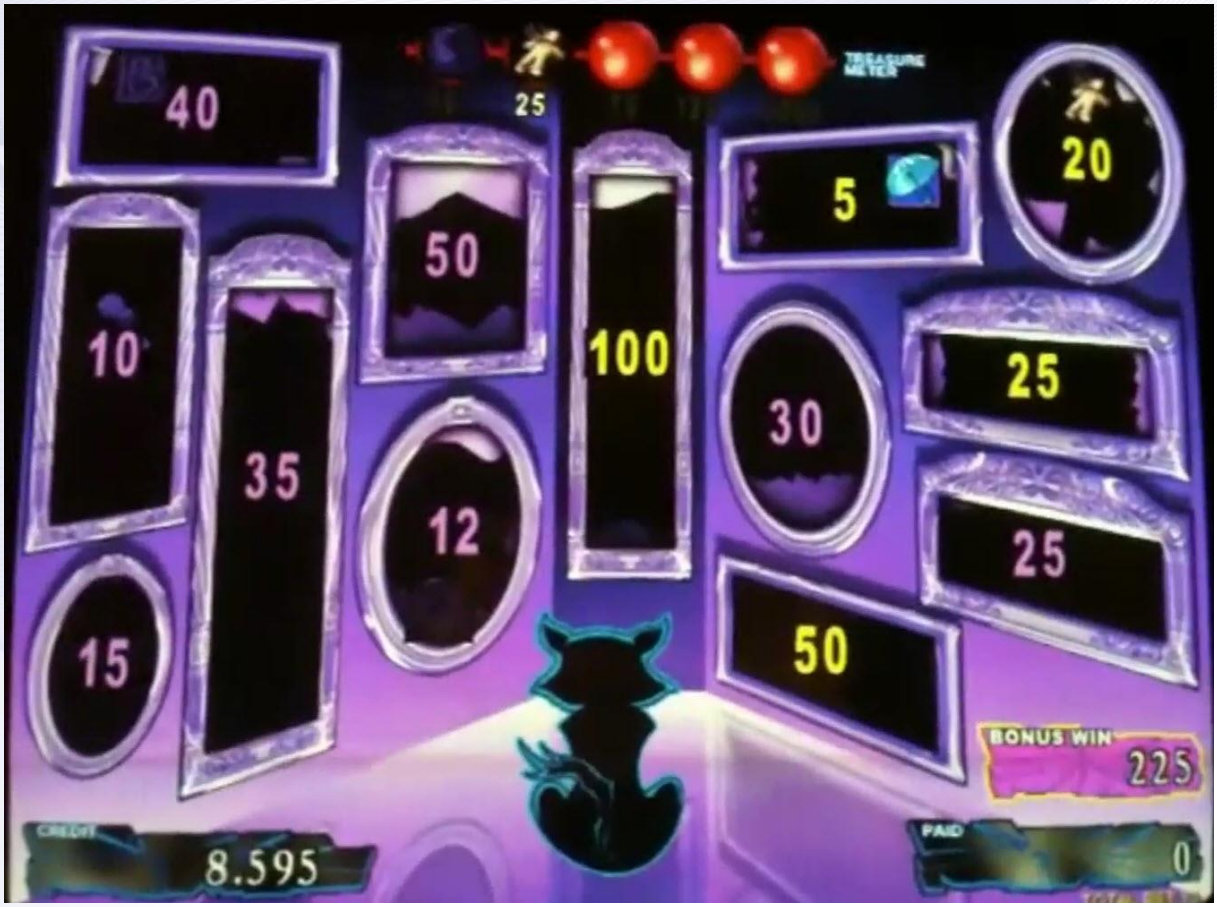

Picture 16 - Hexbreaker Mirror-Mirror Bonus

A more complex Pick k of n bonus game that includes a **Shell Game** is demonstrated by Hexbreaker Mirror-Mirror bonus. A typical shell game consists of shells and beans that are hidden under the shells. The player picks a number of shells hopping to find any beans under them. In Hexbreaker the player will play the Mirror-Mirror bonus if he gets at least four consecutive mirrors on any active pay-line. Wins are based on the bet amount per line. In the Mirror-Mirror Bonus, there are 13 mirrors.

The game will randomly place 13 prizes behind the mirrors. The prizes are larger if the bonus is triggered with five mirror symbols. Then, the player gets to break any five of the mirrors and keep the associated prizes. In addition, the game randomly places five Treasure Symbols behind the mirrors, this is the Shell Game. It is possible that one mirror will have more than one symbol.

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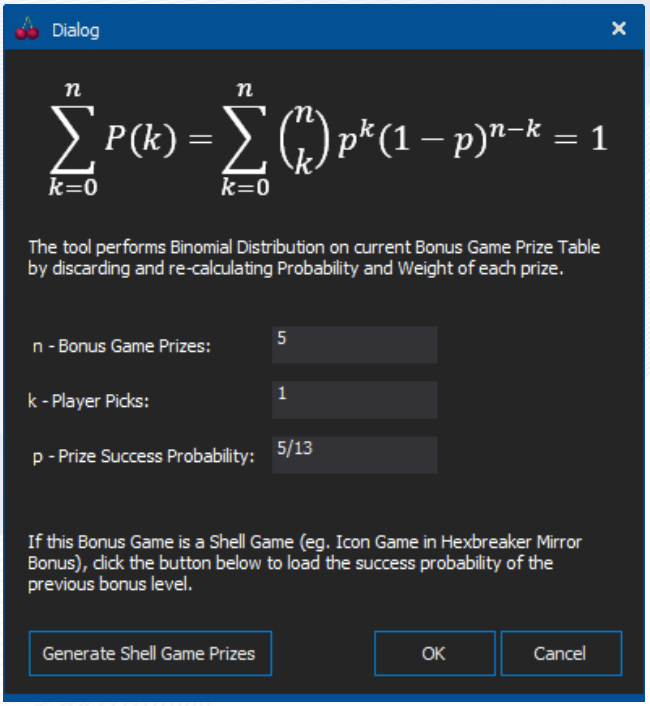

Picture 17 - Binomial Distribution combining two Bonus Game winnings

Workbench can easily combine the two bonus games and apply **Binomial Distribution** on the shell game using the win probability of the mirror game.

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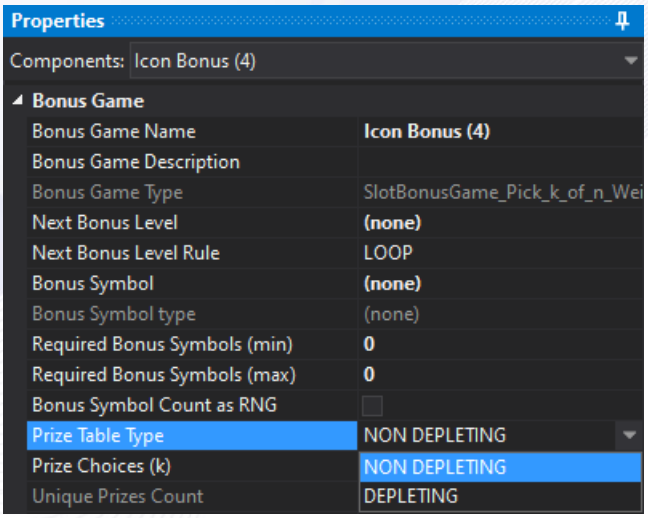
2.3.1 Bonuses can have depleting or non-depleting Bonus Prize Tables

In Lobstermania the player can find several lobsters having the same weight in a single bonus round and thus win the same prize more than once. However, in a Hexbreaker bonus round you cannot break the same mirror twice! Workbench allows you to define both **depleting and non-depleting bonus prize-tables** per bonus-round and implement both behaviors!



Picture 18 - Setting Depleting and non-depleting Bonus Prizes

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2.3.2 Algorithmic Bonus Game

'Algorithmic Bonus Games' do not have prize tables but use an algorithm to compute the prize by feeding the algorithm with RNG values. An example of such bonus game is Hexbreaker Money Ladder Bonus that is triggered by a '**Scatter Bonus Symbol'**. The player will play the Money Ladder Bonus if he gets the ladder symbol anywhere on reels 2 and 4. All wins in the Money Ladder Bonus are based on the total amount bet on the initiating spin.

Picture 19 - Algorithmic Bonus Game - Hexbreaker Money Ladder

The bonus features a ladder with 12 steps on each side, starting with the bottom step on the right side, and going counter-clockwise. Hoodoo the cat will start at the bottom of the ladder and move around it counter-clockwise. The player will touch a Ouija Board, which will pick a number from 1 to 13. Then the cat will move that many steps around the ladder. As the cat stops on each step, the player will collect the prize on that step. Then the prize associated with that step will zero out.

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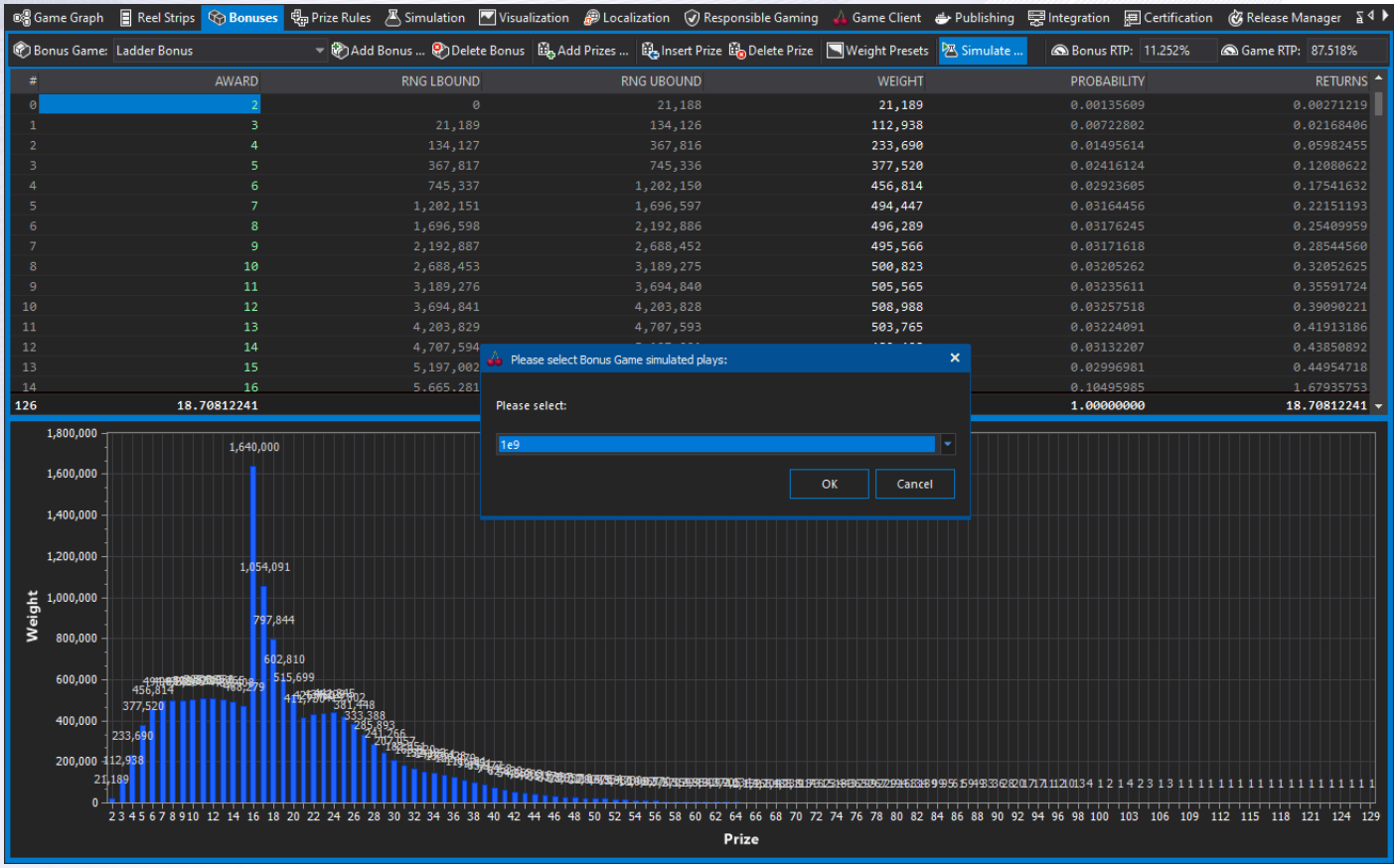
Every time the cat moves across the floor to do another lap around the ladder, each remaining prize will increase by the total amount bet. If the cat ever stops on a step she previously stopped on, or at the top of the ladder, then the bonus will be over.



Picture 20 - Transformation of Algorithmic Bonus Game to Weighted Prize Table

This algorithm can be easily implemented in **JavaScript or C++** and ported to RGS Workbench. Workbench will then simulate the Algorithmic Bonus game billions of times in order to derive an **Approximation Prize Table** and calculate its RTP contribution. Both RGS Workbench and RGS server, link with Google's V8 JavaScript VM and you can use the Scripting Tool in Workbench to code and debug your algorithmic games.

Advanced programmers can use C++ to produce a dynamic link library with their bonus game and register it with Workbench.

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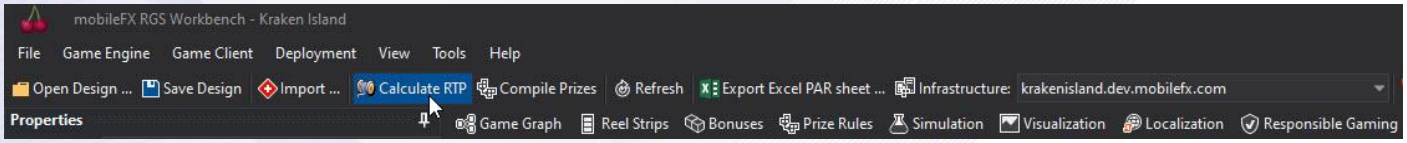
2.4 Tab 4 - Prize Rules

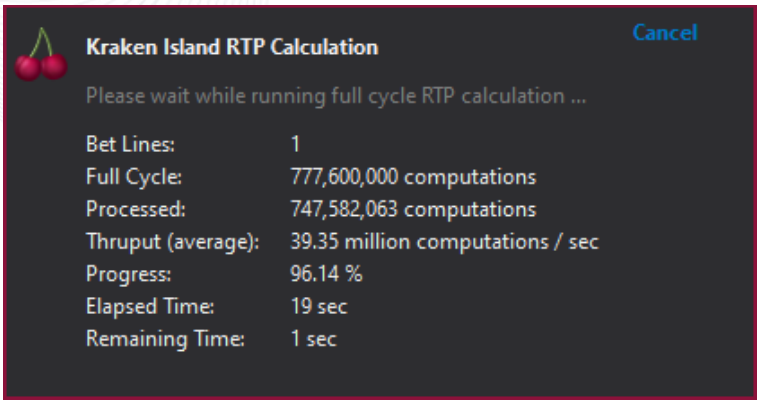
2.4.1 Theoretical RTP Calculation

When you set math-related parameters of your game, click the Calculate RTP button on the main toolbar to perform '**Full Cycle Analysis**' and calculate the theoretical RTP.



Picture 21 - Calculate RTP

RGS Workbench will use all the CPU cores of your computer in order to minimize the time required for Full Cycle analysis. All RGS Workbench calculations are parallel so the more CPU cores you have the faster it will calculate the result.



Picture 22 - Full Cycle Theoretical RTP Calculation

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2.4.2 Prize Rules

As soon as RTP calculation is finished, all full-cycle related reports will be populated with data:

Game Graph | Reel Strips | Bonuses | **Prize Rules** | Simulation | Visualization | Localization | Responsible Gaming | Game Client | Publishing | Integration | Certification | Releas

SYMBOL	S + W	REEL 1	REEL 2	REEL 3	REEL 4	REEL 5	BASE GAME HITS	BASE GAME PROBABILITY	SYMBOL PAY	BASE GAME MULTIPLIER	BASE GAME LINE PAY	BASE GAME TOTAL PAY	BASE GAME RETURNS
SYMBOL: BONUS													
BONUS	5 + 0	BONUS	BONUS	BONUS	BONUS	BONUS	768	0.00000099	0	×1	0	0	0.00000000
BONUS	4 + 0	BONUS	BONUS	BONUS	BONUS	-	21,504	0.00002765	0	×1	0	0	0.00000000
BONUS	3 + 0	BONUS	BONUS	BONUS	-	-	322,560	0.00041481	0	×1	0	0	0.00000000
BONUS	2 + 0	BONUS	BONUS	-	-	-	6,551,808	0.00842568	0	×1	0	0	0.00000000
SYMBOL: L1_10													
L1_10	5 + 0	L1_10	L1_10	L1_10	L1_10	L1_10	31,104	0.00004000	25	×1	25	777,600	0.00100000
L1_10	4 + 1	L1_10	L1_10	WILDX4	L1_10	L1_10	5,184	0.00000667	25	×4	100	518,400	0.00066667
L1_10	4 + 1	L1_10	WILDX2	L1_10	L1_10	L1_10	10,368	0.00001333	25	×2	50	518,400	0.00066667
L1_10	4 + 1	L1_10	L1_10	L1_10	WILDX2	L1_10	10,368	0.00001333	25	×2	50	518,400	0.00066667
L1_10	3 + 2	L1_10	WILDX2	WILDX4	L1_10	L1_10	1,728	0.00000222	25	×8	200	345,600	0.00044444
L1_10	3 + 2	L1_10	L1_10	WILDX4	WILDX2	L1_10	1,728	0.00000222	25	×8	200	345,600	0.00044444
L1_10	3 + 2	L1_10	WILDX2	L1_10	WILDX2	L1_10	3,456	0.00000444	25	×4	100	345,600	0.00044444
L1_10	2 + 3	L1_10	WILDX2	WILDX4	WILDX2	L1_10	576	0.00000074	25	×16	400	230,400	0.00029630
L1_10	4 + 0	L1_10	L1_10	L1_10	L1_10	-	404,352	0.00052000	20	×1	20	8,087,040	0.01040000
L1_10	3 + 1	L1_10	L1_10	WILDX4	L1_10	-	67,392	0.00008667	20	×4	80	5,391,360	0.00693333
L1_10	3 + 1	L1_10	WILDX2	L1_10	L1_10	-	134,784	0.00017333	20	×2	40	5,391,360	0.00693333
L1_10	3 + 1	L1_10	L1_10	L1_10	WILDX2	-	134,784	0.00017333	20	×2	40	5,391,360	0.00693333
L1_10	2 + 2	L1_10	WILDX2	WILDX4	L1_10	-	22,464	0.00002889	20	×8	160	3,594,240	0.00462222
L1_10	2 + 2	L1_10	L1_10	WILDX4	WILDX2	-	22,464	0.00002889	20	×8	160	3,594,240	0.00462222
L1_10	2 + 2	L1_10	WILDX2	L1_10	WILDX2	-	44,928	0.00005778	20	×4	80	3,594,240	0.00462222
L1_10	1 + 3	L1_10	WILDX2	WILDX4	WILDX2	-	2,592	0.00000333	20	×16	320	829,440	0.00106667
L1_10	3 + 0	L1_10	L1_10	L1_10	-	-	2,488,320	0.00320000	5	×1	5	12,441,600	0.01600000
L1_10	2 + 1	L1_10	L1_10	WILDX4	-	-	394,560	0.00050741	5	×4	20	7,891,200	0.01014815
L1_10	2 + 1	L1_10	WILDX2	L1_10	-	-	829,440	0.00106667	5	×2	10	8,294,400	0.01066667
L1_10	1 + 2	L1_10	WILDX2	WILDX4	-	-	127,968	0.00016457	5	×8	40	5,118,720	0.00658272
L1_10	2 + 0	L1_10	L1_10	-	-	-	31,104,000	0.04000000	0	×1	0	0	0.00000000
L1_10	1 + 1	L1_10	WILDX2	-	-	-	10,368,000	0.01333333	0	×2	0	0	0.00000000
SYMBOL: L2_J													
L2_J	5 + 0	L2_J	L2_J	L2_J	L2_J	L2_J	24,576	0.00003160	30	×1	30	737,280	0.00094815
Total:	188						21,538,100	0.02769817				573,880,320	0.73801481

Permutations | Combinations

Picture 23 - Prize Rule Permutations Report

Such a report is **Prize Permutations Report** in Prize Rules tab. This report shows all the Prize Rules that are used for calculating line winnings. Each record accumulates Hits and Returns per Symbol Tier and per Multiplier. Symbol Tier is the sum of Symbol occurrences and Wild occurrences that substitute for that symbol on a line. **Prize Combinations Report** consolidates Symbol Hits and is located on the same tab.

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Moving on with the reports in the bottom panes:

Symbol Statistics

SYMBOL	TIER	HITS	PROBABILITIES	MULTIPLIER	BASE PRIZE	FREE SPINS PRIZE	BASE VARIANCE	FREE SPINS FEATURE VARIANCE	FREE SPINS VARIANCE	TOTAL VARIANCE
L2_J	2 IN A ROW	27,648,000	0.03555556	×1	0	0	0.00000000	0.00000000	0.00000000	0.00000000
L2_J	3 IN A ROW	2,257,920	0.00290370	×1	5	10	0.04746037	0.23744583	0.01111404	0.05857441
L2_J	4 IN A ROW	319,488	0.00041086	×1	20	40	0.14899200	0.62629896	0.02931496	0.17830695
L2_J	5 IN A ROW	24,576	0.00003160	×1	30	60	0.02665839	0.11017671	0.00515700	0.03181539
L1_10	2 IN A ROW	31,104,000	0.04000000	×1	0	0	0.00000000	0.00000000	0.00000000	0.00000000
L1_10	3 IN A ROW	2,488,320	0.00320000	×1	5	10	0.05230326	0.26167499	0.01224813	0.06455139
L1_10	4 IN A ROW	404,352	0.00052000	×1	20	40	0.18856800	0.79265962	0.03710174	0.22566974
L1_10	5 IN A ROW	31,104	0.00004000	×1	25	50	0.02312238	0.09620811	0.00450318	0.02762556
L3_Q	2 IN A ROW	18,144,000	0.02333333	×1	0	0	0.00000000	0.00000000	0.00000000	0.00000000
L3_Q	3 IN A ROW	1,512,000	0.00194444	×1	5	10	0.03178150	0.15900390	0.00744244	0.03922394
L3_Q	4 IN A ROW	190,512	0.00024500	×1	25	50	0.14162456	0.58927468	0.02758197	0.16920653
L3_Q	5 IN A ROW	10,584	0.00001361	×1	40	80	0.02074803	0.08503916	0.00398040	0.02472843
L5_A	2 IN A ROW	12.960.000	0.01666667	×1	0	0	0.00000000	0.00000000	0.00000000	0.00000000
Total:		**28,194,356**					**282.28279185**	**1,048.74298990**	**49.08814520**	**331.37093705**
Std. Dev. (σ):							**16.80127352**	**32.38430160**	**7.00629326**	**18.20359682**

Symbol Statistics | BetLine Statistics | Confidence Levels | Scatter Returns | Free Spins Returns | Bonus Games Returns

Picture 24 - Symbol Statistics Report

Symbols Statistics Report has records with Hits and Probabilities per Symbol per Tier and per Multiplier. The report calculates the **Variance** of winnings in each record in order to derive the theoretical **Standard Deviation** from the Total Variance.

BetLine Statistics

BET LINES	BASE GAME VARIANCE	BASE GAME STANDARD DEVIATION WIN	BASE GAME STANDARD DEVIATION RTP	FREE SPINS VARIANCE	FREE SPINS STANDARD DEVIATION WIN	FREE SPINS STANDARD DEVIATION RTP	TOTAL VARIANCE	TOTAL STANDARD DEVIATION WIN	TOTAL STANDARD DEVIATION RTP	90% CONFIDENCE VOLATILITY INDEX	95% CONFIDENCE VOLATILITY INDEX	99% CONFIDENCE VOLATILITY INDEX
1	282.283	16.80127352	16.80127352	49.088	7.00629326	7.00629326	331.371	18.20359682	18.20359682	29.85389878	35.67904976	46.96527979
2	564.566	23.76058888	11.88029444	98.176	9.90839495	4.95419747	662.742	25.74377350	12.87188675	21.10989427	25.22889803	33.20946782
3	846.848	29.10065937	9.70021979	147.264	12.13525589	4.04508530	994.113	31.52955457	10.50985152	17.23615650	20.59930898	27.11541693
4	1,129.131	33.60254704	8.40063676	196.353	14.01258651	3.50314663	1,325.484	36.40719363	9.10179841	14.92694939	17.83952488	23.48263989
5	1,411.414	37.56878970	7.51375794	245.441	15.66654799	3.13330960	1,656.855	40.70447992	8.14089598	13.35106941	15.95615613	21.00351164
6	1,693.697	41.15454715	6.85909119	294.529	17.16184347	2.86030724	1,988.226	44.58952368	7.43158728	12.18780314	14.56591107	19.17349518
7	1,975.980	44.45199144	6.35028449	343.617	18.53690957	2.64812994	2,319.597	48.16219014	6.88031288	11.28371312	13.48541324	17.75120722
8	2,258.262	47.52117775	5.94014722	392.705	19.81678989	2.47709874	2,650.967	51.48754700	6.43594338	10.55494714	12.61444902	16.60473391
9	2,540.545	50.40382056	5.60042451	441.793	21.01887977	2.33543109	2,982.338	54.61079045	6.06786561	9.95129959	11.89301659	15.65509326
10	2,822.828	53.13029191	5.31302919	490.881	22.15584465	2.21558446	3,313.709	57.56482755	5.75648275	9.44063172	11.28270620	14.85172551
11	3,105.111	55.72352026	5.06577457	539.970	23.23724590	2.11247690	3,645.080	60.37450047	5.48859095	9.00128916	10.75763827	14.16056466
12	3,387.394	58.20131873	4.85010989	589.058	24.27051179	2.02254265	3,976.451	63.05910913	5.25492576	8.61807825	10.29965449	13.55770846
13	3,669.676	60.57785316	4.65983486	638.146	25.26154959	1.94319612	4,307.822	65.63400172	5.04876936	8.27998176	9.89558795	13.02582496

Symbol Statistics | BetLine Statistics | Confidence Levels | Scatter Returns | Free Spins Returns | Bonus Games Returns

Picture 25 - Betline Statistics Report

The **Betline Statistics Report** includes Variance, Standard Deviation and Volatility Index records per Bet Line. This report is useful for games with variable Bet Lines for observing how the volatility changes per Bet Line.

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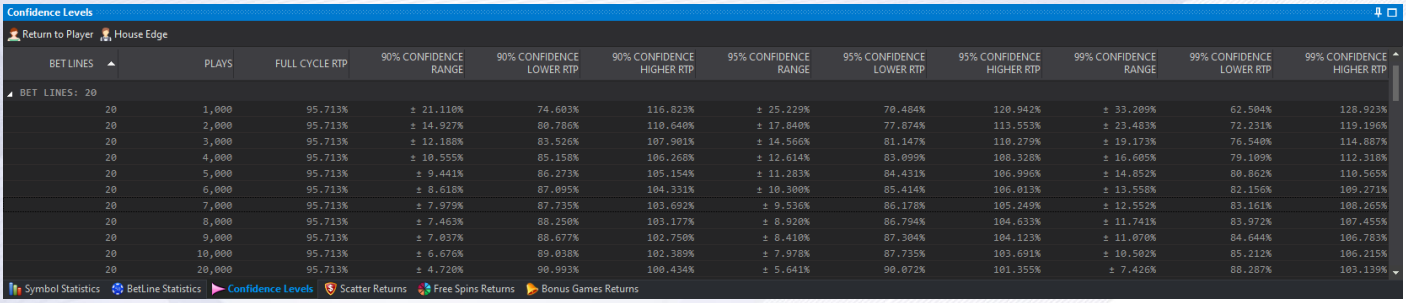
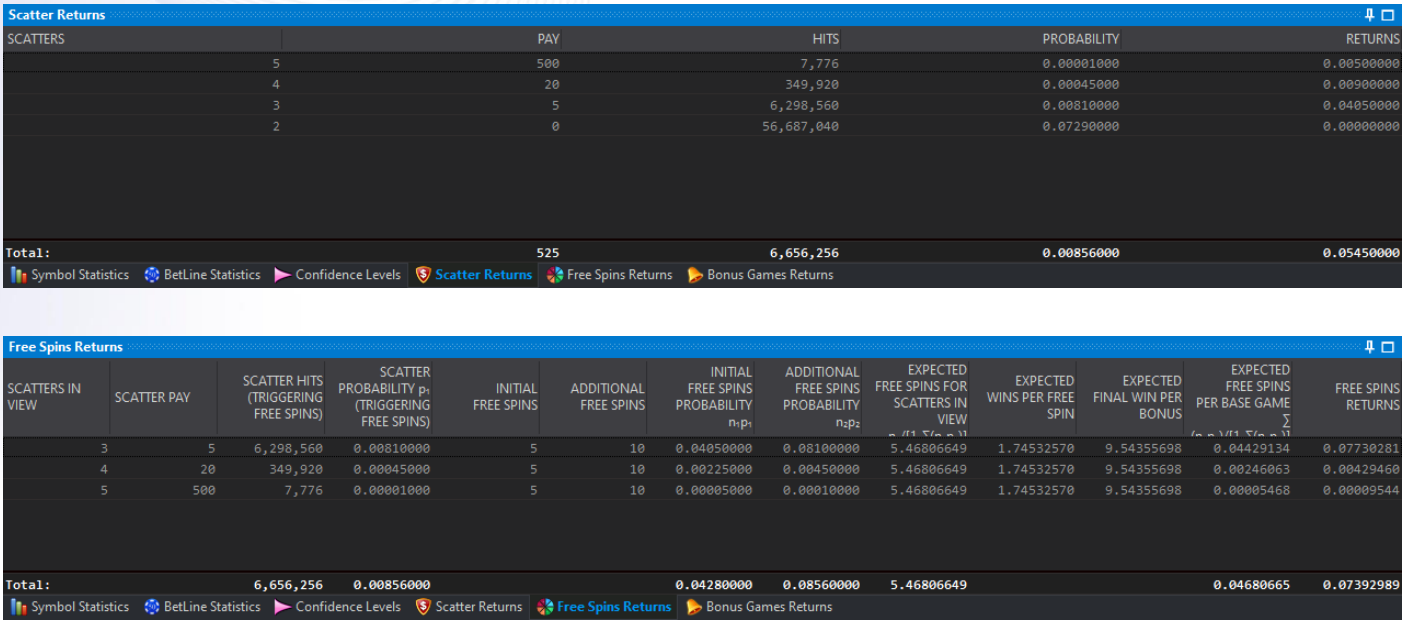


Picture 26 - Confidence Levels Report

The **Confidence Levels Report** shows the RTP for 90%, 95% and 99% confidence levels per Bet Line, for 1000 up to 1 billion spins. The data of this report render the confidence chart in the Simulator tab or in the Visualization tab.

It is an important report, because it defines the acceptable RTP deviation during Monte Carlo simulations from the theoretical RTP of the game. More details about this when we talk about simulation.



Picture 27 - Scatter Returns and Free Spins Returns Reports

The records of **Free Spins Returns Report**, show among other fields, the Scatter probabilities for entering free spins feature, the expected free spins per base game, and free spin returns. Those are all theoretical numbers and can be verified by simulations. For example, when expected free spins per base game is 0.008, you expect to collect around 80,000 Free Spins in 1 million simulation plays.

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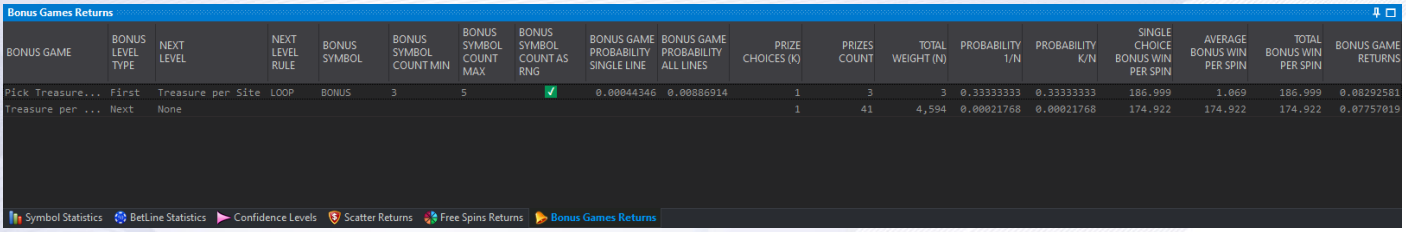
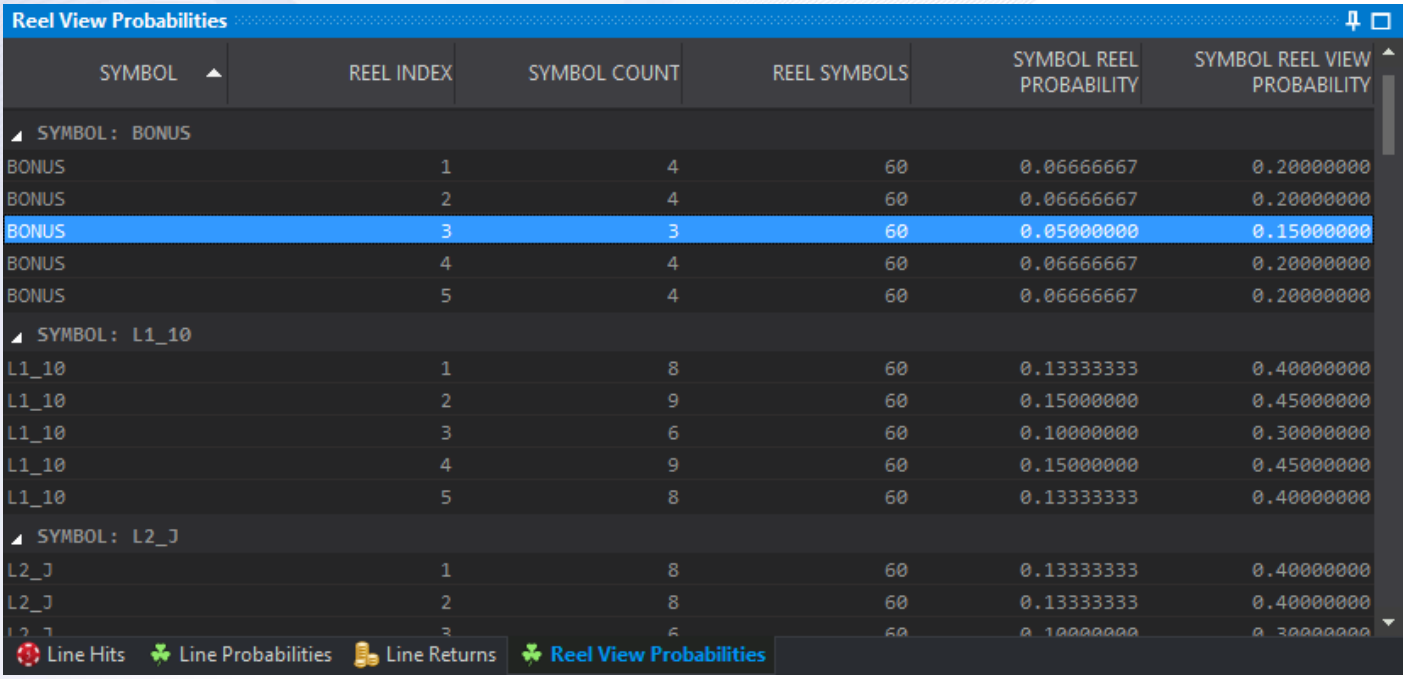


Picture 28 - Bonus Returns Report



Picture 29 - Reel View Probabilities Report

All the above reports are populated each time you calculate the theoretical RTP of the game, by performing Full Cycle analysis.

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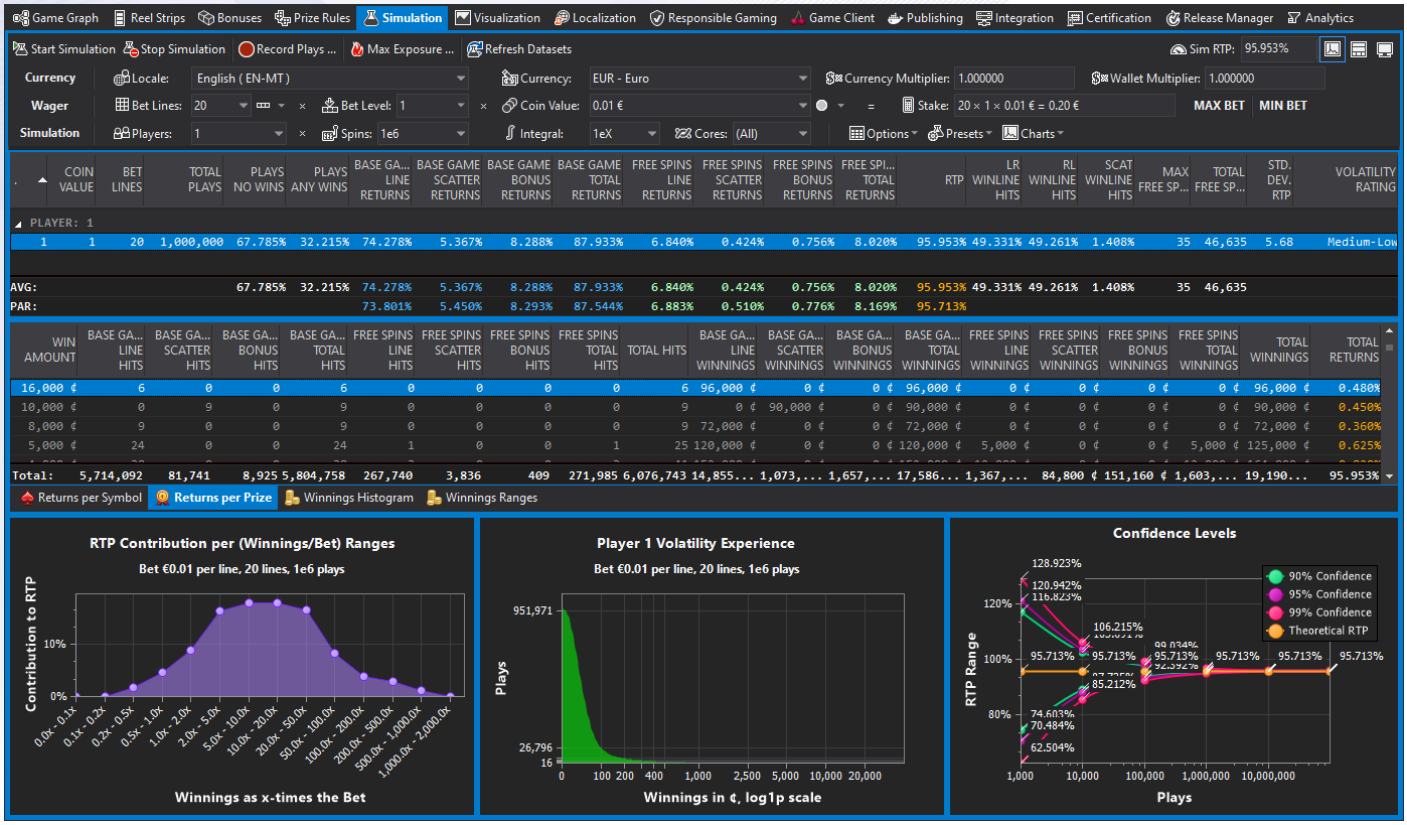
2.5 Workbench can perform real-time RTP Calculation!

A handy Workbench feature is that all those reports and RTP calculations can be updated in real-time as long as the Reels remain the same. For example, when you change a prize in Prize Table, Workbench will update the RTP in real-time, without running Full Cycle analysis for it. The same real-time calculations take place when editing Bonus prizes, allowing you to target the RTP you need for your game with ease.

2.6 Tab 5 - Monte Carlo Simulator



Picture 30 - Monte Carlo Simulator – Datasets and Charts

In Monte Carlo Simulator you can define player properties like currency and wager, as well as simulation properties like number of players and spins. Alternatively, you can choose a **'Simulation Preset'** that focuses on revealing specific game characteristics such as Volatility, Variance and RTP distribution. RGS Workbench has the most advanced Simulator available on the market today, taking full advantage of parallel computing and your CPU cores.

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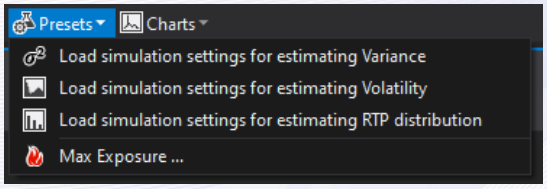

Picture 31 - Simulation Presets

2.6.1 Simulation data are stored in Simulation Datasets

Simulator Datasets are exhaustive and have several layers of information accessible in a master-detail manner. The top simulation report is the Master that displays simulation RTP breakdown information, hits and statistics per player, bet line and coin value. Master dataset has a vast array of fields and some are hidden to save space but you can reveal them all together or customize them.

P...	COIN VALUE	BET LINES	TOTAL PLAYS	PLAYS NO WINS	PLAYS ANY WI...	BASE G... LINE RETURNS	BASE G... SCATTER RETURNS	BASE G... BONUS RETURNS	BASE G... TOTAL RETURNS	FREE SP... LINE RETURNS	FREE SP... SCATTER RETURNS	FREE SP... BONUS RETURNS	FREE SP... TOTAL RETURNS	RTP	LR WINLINE HITS	RL WINLINE HITS	SCAT WINLINE HITS	MAX FREE SP...	TOTAL FREE SP...	STD. DEV. RTP	VOLATI... RATING
PLAYER: 1																					
1	1	20	1,000	137.600%	62.400%	63.050%	5.750%	5.825%	74.625%	31.000%	0.000%	0.000%	31.000%	105.625%	48.286%	50.280%	1.434%	5	115	3.34	Low
1	1	20	10,000	74.490%	35.510%	67.127%	9.909%	7.236%	84.273%	13.641%	0.455%	0.882%	14.977%	99.250%	49.361%	49.258%	1.381%	25	585	6.57	Mediu...
1	1	20	100,000	68.546%	32.454%	73.610%	7.678%	7.951%	89.240%	7.602%	0.446%	1.054%	9.102%	98.342%	49.451%	49.111%	1.438%	25	4,905	6.16	Mediu...
1	1	201,000...		67.950%	32.150%	74.025%	5.825%	8.175%	88.025%	6.580%	0.551%	0.768%	7.900%	95.924%	49.356%	49.234%	1.410%	45	46,730	5.69	Mediu...
AVG:				87.146%	40.629%	69.453%	7.291%	7.297%	84.040%	14.706%	0.363%	0.676%	15.745%	99.785%	49.113%	49.471%	1.416%	25	13,083		
PAR:						73.801%	5.450%	8.293%	87.544%	6.883%	0.510%	0.776%	8.169%	95.713%							

WIN AMOUNT	BASE GA... LINE HITS	BASE GA... SCATTER HITS	BASE GA... BONUS HITS	BASE GA... TOTAL HITS	FREE SPI... LINE HITS	FREE SPI... SCATTER HITS	FREE SPI... BONUS HITS	FREE SPI... TOTAL HITS	TOTAL HITS	BASE GA... LINE WINNIN...	BASE GA... SCATTER WINNIN...	BASE GA... BONUS WINNIN...	BASE GA... TOTAL WINNIN...	FREE SPI... LINE WINNIN...	FREE SPI... SCATTER WINNIN...	FREE SPI... BONUS WINNIN...	FREE SPI... TOTAL WINNIN...	TOTAL WINNIN...	TOTAL RETURNS
8,000 ¢	0	0	0	0	1	0	0	1	1	0 ¢	0 ¢	0 ¢	0 ¢	8,000 ¢	0 ¢	0 ¢	8,000 ¢	8,000 ¢	20.000%
1,000 ¢	0	0	0	0	1	0	0	1	1	0 ¢	0 ¢	0 ¢	0 ¢	1,000 ¢	0 ¢	0 ¢	1,000 ¢	1,000 ¢	2.500%
460 ¢	0	0	1	1	0	0	0	0	1	0 ¢	0 ¢	460 ¢	460 ¢	0 ¢	0 ¢	0 ¢	0 ¢	460 ¢	1.150%
400 ¢	4	0	0	4	0	0	0	0	4	1,600 ¢	0 ¢	0 ¢	1,600 ¢	0 ¢	0 ¢	0 ¢	0 ¢	1,600 ¢	4.000%
350 ¢	0	0	1	1	0	0	0	0	1	0 ¢	0 ¢	350 ¢	350 ¢	0 ¢	0 ¢	0 ¢	0 ¢	350 ¢	0.875%
250 ¢	2	0	0	2	0	0	0	0	2	500 ¢	0 ¢	0 ¢	500 ¢	0 ¢	0 ¢	0 ¢	0 ¢	500 ¢	1.250%
240 ¢	1	0	1	2	0	0	0	0	2	240 ¢	0 ¢	240 ¢	480 ¢	0 ¢	0 ¢	0 ¢	0 ¢	480 ¢	1.200%
210 ¢	0	0	1	1	0	0	0	0	1	0 ¢	0 ¢	210 ¢	210 ¢	0 ¢	0 ¢	0 ¢	0 ¢	210 ¢	0.525%
200 ¢	12	0	1	13	2	0	0	2	15	2,400 ¢	0 ¢	200 ¢	2,600 ¢	400 ¢	0 ¢	0 ¢	400 ¢	3,000 ¢	7.500%
180 ¢	0	0	2	2	0	0	0	0	2	0 ¢	0 ¢	360 ¢	360 ¢	0 ¢	0 ¢	0 ¢	0 ¢	360 ¢	0.900%
170 ¢	0	0	1	1	0	0	0	0	1	0 ¢	0 ¢	170 ¢	170 ¢	0 ¢	0 ¢	0 ¢	0 ¢	170 ¢	0.425%
160 ¢	7	0	0	7	5	0	0	5	12	1,120 ¢	0 ¢	0 ¢	1,120 ¢	800 ¢	0 ¢	0 ¢	800 ¢	1,920 ¢	4.800%
120 ¢	10	0	2	12	1	0	0	1	13	1,200 ¢	0 ¢	240 ¢	1,440 ¢	120 ¢	0 ¢	0 ¢	120 ¢	1,560 ¢	3.900%
100 ¢	18	23	1	42	4	0	0	4	46	1,800 ¢	2,300 ¢	100 ¢	4,200 ¢	400 ¢	0 ¢	0 ¢	400 ¢	4,600 ¢	11.500%
Total:	11,203	167	11	11,381	744	7	0	751	12,132	25,220 ¢	2,300 ¢	2,330 ¢	29,850 ¢	12,400 ¢	0 ¢	0 ¢	12,400 ¢	42,250 ¢	105.625%

Returns per Symbol | Returns per Prize | Winnings Histogram | Winnings Ranges

Picture 32 - Simulation Master-Detail Datasets

Master dataset displays its records in an integral power of ten manner, starting from 1,000 spins, 10,000 spins, 100,000 spins and so on. This can help you observe how your game statistics progress over the number of spins. Alternatively, you can simply consolidate the master dataset into a single record.

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SYMBOL	TIER	MULTIPLIER	BASE GAME HITS	FREE SPINS HITS	TOTAL HITS	BASE GAME WINNINGS	FREE SPINS WINNINGS	TOTAL WINNINGS	BASE GAME RETURNS	FREE SPINS RETURNS	TOTAL RETURNS
SYMBOL: BONUS											
BONUS	5 IN A ROW	×1	0	0	0	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
BONUS	4 IN A ROW	×1	1	0	1	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
BONUS	3 IN A ROW	×1	10	0	10	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
BONUS	2 IN A ROW	×1	359	13	372	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
BONUS	5 IN A ROW	×2	0	0	0	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
BONUS	4 IN A ROW	×2	0	0	0	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
BONUS	3 IN A ROW	×2	0	0	0	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
BONUS	2 IN A ROW	×2	0	0	0	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
BONUS	5 IN A ROW	×4	0	0	0	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
BONUS	4 IN A ROW	×4	0	0	0	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
BONUS	3 IN A ROW	×4	0	0	0	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
BONUS	2 IN A ROW	×4	0	0	0	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
BONUS	5 IN A ROW	×8	0	0	0	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
BONUS	4 IN A ROW	×8	0	0	0	0 ¢	0 ¢	0 ¢	0.000%	0.000%	0.000%
Total:			11,370	751	12,121	27,520 ¢	12,400 ¢	39,920 ¢	68.800%	31.000%	99.800%

Returns per Symbol | Returns per Prize | Winnings Histogram | Winnings Ranges

Picture 33 - Returns per Symbol Simulation Report

WIN AMOUNT	BASE GA... LINE HITS	BASE GA... SCATTER HITS	BASE GA... BONUS HITS	BASE GA... TOTAL HITS	FREE SPI... LINE HITS	FREE SPI... SCATTER HITS	FREE SPI... BONUS HITS	FREE SPI... TOTAL HITS	TOTAL HITS	BASE GA... LINE WINNIN...	BASE GA... SCATTER WINNIN...	BASE GA... BONUS WINNIN...	BASE GA... TOTAL WINNIN...	FREE SPI... LINE WINNIN...	FREE SPI... SCATTER WINNIN...	FREE SPI... BONUS WINNIN...	FREE SPI... TOTAL WINNIN...	TOTAL WINNIN...	TOTAL RETURNS
8,000 ¢	0	0	0	0	1	0	0	1	1	0 ¢	0 ¢	0 ¢	0 ¢	8,000 ¢	0 ¢	0 ¢	8,000 ¢	8,000 ¢	20.000%
1,000 ¢	0	0	0	0	1	0	0	1	1	0 ¢	0 ¢	0 ¢	0 ¢	1,000 ¢	0 ¢	0 ¢	1,000 ¢	1,000 ¢	2.500%
460 ¢	0	0	1	1	0	0	0	0	1	0 ¢	0 ¢	460 ¢	460 ¢	0 ¢	0 ¢	0 ¢	0 ¢	460 ¢	1.150%
400 ¢	4	0	0	4	0	0	0	0	4	1,600 ¢	0 ¢	0 ¢	1,600 ¢	0 ¢	0 ¢	0 ¢	0 ¢	1,600 ¢	4.000%
350 ¢	0	0	1	1	0	0	0	0	1	0 ¢	0 ¢	350 ¢	350 ¢	0 ¢	0 ¢	0 ¢	0 ¢	350 ¢	0.875%
250 ¢	2	0	0	2	0	0	0	0	2	500 ¢	0 ¢	0 ¢	500 ¢	0 ¢	0 ¢	0 ¢	0 ¢	500 ¢	1.250%
240 ¢	1	0	1	2	0	0	0	0	2	240 ¢	0 ¢	240 ¢	480 ¢	0 ¢	0 ¢	0 ¢	0 ¢	480 ¢	1.200%
210 ¢	0	0	1	1	0	0	0	0	1	0 ¢	0 ¢	210 ¢	210 ¢	0 ¢	0 ¢	0 ¢	0 ¢	210 ¢	0.525%
200 ¢	12	0	1	13	2	0	0	2	15	2,400 ¢	0 ¢	200 ¢	2,600 ¢	400 ¢	0 ¢	0 ¢	400 ¢	3,000 ¢	7.500%
180 ¢	0	0	2	2	0	0	0	0	2	0 ¢	0 ¢	360 ¢	360 ¢	0 ¢	0 ¢	0 ¢	0 ¢	360 ¢	0.900%
170 ¢	0	0	1	1	0	0	0	0	1	0 ¢	0 ¢	170 ¢	170 ¢	0 ¢	0 ¢	0 ¢	0 ¢	170 ¢	0.425%
160 ¢	7	0	0	7	5	0	0	5	12	1,120 ¢	0 ¢	0 ¢	1,120 ¢	800 ¢	0 ¢	0 ¢	800 ¢	1,920 ¢	4.800%
120 ¢	10	0	2	12	1	0	0	1	13	1,200 ¢	0 ¢	240 ¢	1,440 ¢	120 ¢	0 ¢	0 ¢	120 ¢	1,560 ¢	3.900%
100 ¢	18	23	1	42	4	0	0	4	46	1,800 ¢	2,300 ¢	100 ¢	4,200 ¢	400 ¢	0 ¢	0 ¢	400 ¢	4,600 ¢	11.500%
Total:	11,203	167	11	11,381	744	7	0	751	12,132	25,220 ¢	2,300 ¢	2,330 ¢	29,850 ¢	12,400 ¢	0 ¢	0 ¢	12,400 ¢	42,250 ¢	105.625%

Returns per Symbol | Returns per Prize | Winnings Histogram | Winnings Ranges

Picture 34 - Returns per Prize Simulation Report

WIN AMOUNT	TOTAL HITS	TOTAL WINNINGS	TOTAL WINNINGS (%)	TOTAL RETURNS
0 ¢	676	0 ¢	0.000%	0.000%
5 ¢	68	340 ¢	1.769%	0.850%
10 ¢	54	540 ¢	2.810%	1.350%
15 ¢	14	210 ¢	1.093%	0.525%
20 ¢	45	900 ¢	4.684%	2.250%
25 ¢	9	225 ¢	1.171%	0.562%
30 ¢	13	390 ¢	2.030%	0.975%
35 ¢	2	70 ¢	0.364%	0.175%
40 ¢	22	880 ¢	4.580%	2.200%
45 ¢	4	180 ¢	0.937%	0.450%
50 ¢	13	650 ¢	3.383%	1.625%
55 ¢	2	110 ¢	0.572%	0.275%
60 ¢	8	480 ¢	2.498%	1.200%
65 ¢	2	130 ¢	0.677%	0.325%
70 ¢	3	210 ¢	1.093%	0.525%
75 ¢	1	75 ¢	0.390%	0.188%
Total:	1,000	19,215 ¢	100.000%	48.037%

Returns per Symbol | Returns per Prize | Winnings Histogram | Winnings Ranges

Picture 35 - Winnings Histogram Simulation Report

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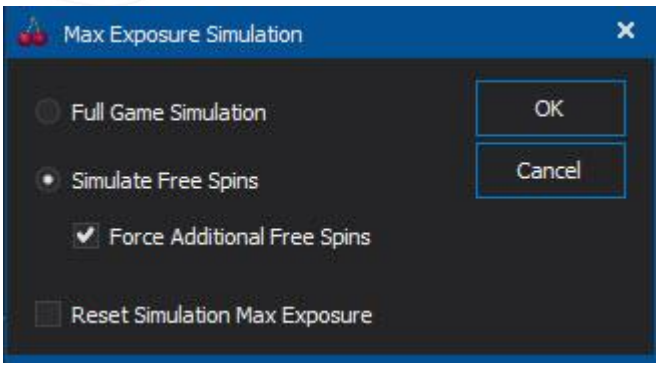
WIN AS TIMES BET	TOTAL HITS	SHARE ON RTP
0.0x - 0.1x	676	0.000%
0.1x - 0.2x	0	0.000%
0.2x - 0.5x	68	1.769%
0.5x - 1.0x	68	3.903%
1.0x - 2.0x	69	8.249%
2.0x - 5.0x	64	18.007%
5.0x - 10.0x	28	18.475%
10.0x - 20.0x	19	26.308%
20.0x - 50.0x	8	23.289%
50.0x - 100.0x	0	0.000%
100.0x - 200.0x	0	0.000%
200.0x - 500.0x	0	0.000%
500.0x - 1,000.0x	0	0.000%
1,000.0x - 2,000.0x	0	0.000%
2,000.0x - 5,000.0x	0	0.000%
5,000.0x - 10,000.0x	0	0.000%
Total:	1,000	100.000%

Returns per Symbol | Returns per Prize | Winnings Histogram | Winnings Ranges

Picture 36 - Winnings Ranges Simulation Report

By selecting a record in master dataset, the detail datasets get populated. Detail Datasets are **Returns per Symbol, Returns per Prize, Winnings Histogram** and **Winning Ranges**. You have absolute sorting, filtering and grouping freedom in all simulation datasets and there are several features designed for your convenience. Such as color-coding of fields, correlation of simulated values with the theoretical values, visible fields selection, currency formatting, frequency formatting and export to Excel.

2.6.2 Max Exposure for Max Bet



Picture 37 - Max Exposure Simulation Options

Max Exposure for Max Bet is required by online casino Operators and Publishers. Click on MAX EXPOSURE button to instruct simulator to record the Max Exposure for Max Bet. If your game has Free Spins, you can save energy and ask simulator to perform Max Exposure simulation by forcing Free Spins simulation.

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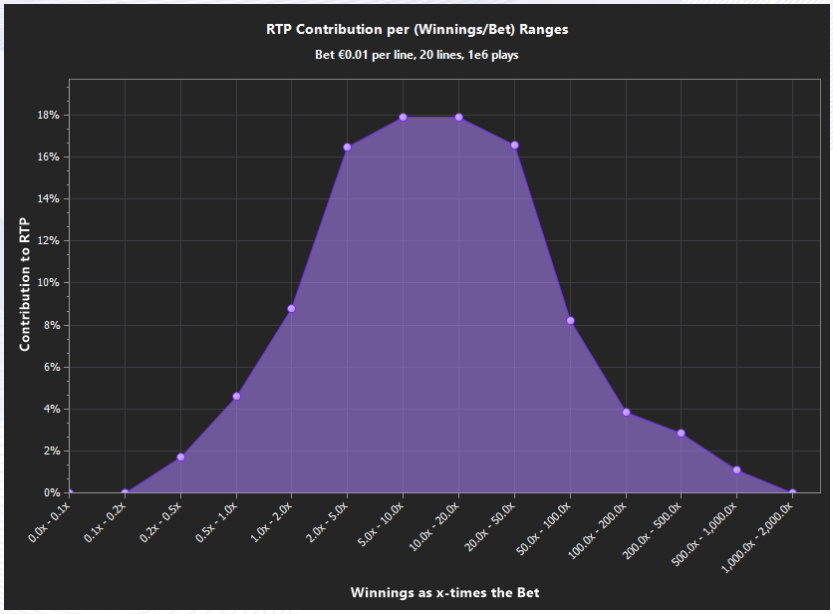
2.6.3 Simulation datasets can be represented in several Charts

All charts can be exported as image or copied to clipboard and each chart is designed to reveal properties of your game:



Picture 38 - Simulation RTP Ranges Chart

RTP Ranges Chart: renders RTP contribution per Winnings as x-times the Bet. In essence it displays what portion of money were paid out in certain range of win size. From this chart you can derive the percentage of the winnings volume that is paid out in individual wins higher than x-times the bet.

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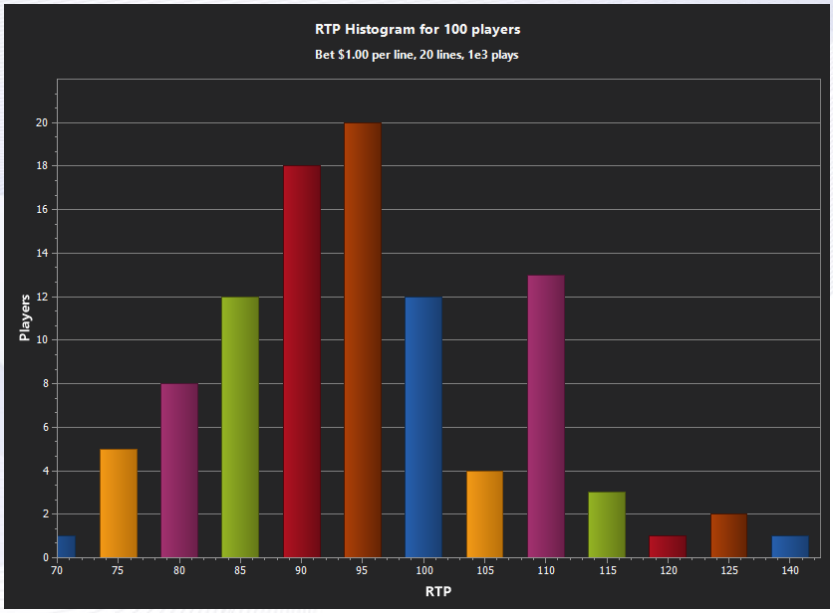
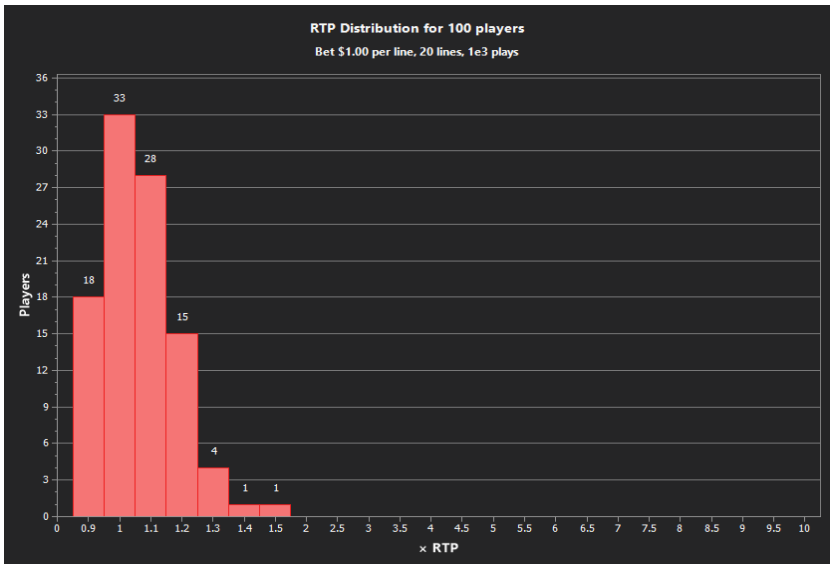


Picture 39 - Simulation RTP Histogram Chart

RTP Histogram Chart: renders Players per RTP range and requires that you configure Simulator to run for several hundreds of players. The report will reveal the volume of Players per RTP per Bet and per Line and you can observe how many players exceeded the expected RTP. The histogram bins are dynamically allocated from winnings.



Picture 40 - Simulation RTP Distribution Chart

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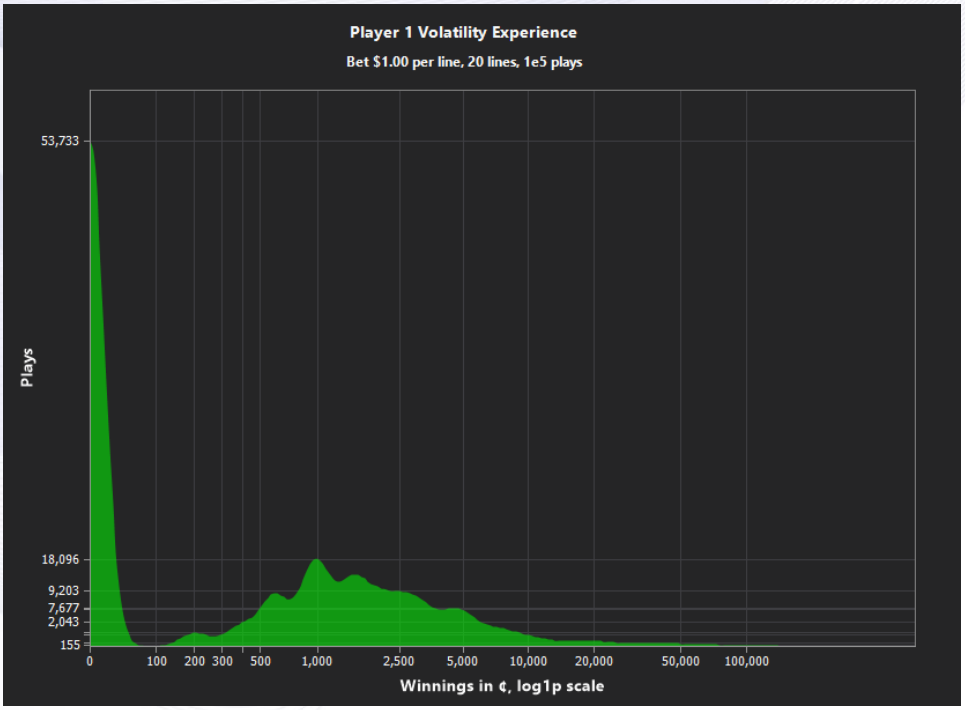
RTP Distribution Chart: is another report that requires that you configure Simulator to run for several hundreds of players. The report is similar to RTP Histogram chart, and renders Players per x-times RTP per Bet and per Line.



Picture 41 - Simulation Player Volatility Chart

Player Volatility Chart: renders Plays per Winnings in log1p scale. The chart reveals the impact of bet size and the number of lines played, and there is dedicated simulation-preset for it. From Presets menu select the 'Load simulation settings for estimating Volatility', and from the Charts menu enable 'Calculate Volatility from raw Winnings'. The preset will run simulation for min and max Coin Value, and for min and max Bet Lines; and produce 4 records in Master Dataset with their combinations.

The idea is that playing one 20-line game isn't the same as playing twenty 1-line games, because the re-use of the symbols means multi-line wins are not independent. A high-value symbol like a Wild may contribute to wins on multiple lines. Conversely, losing combinations have a tendency to cluster together too. It all balances in the end, but the possibility of **more frequent wins coupled with higher-value losses is apparently appealing to players**, since many machines encourage multi-line play.

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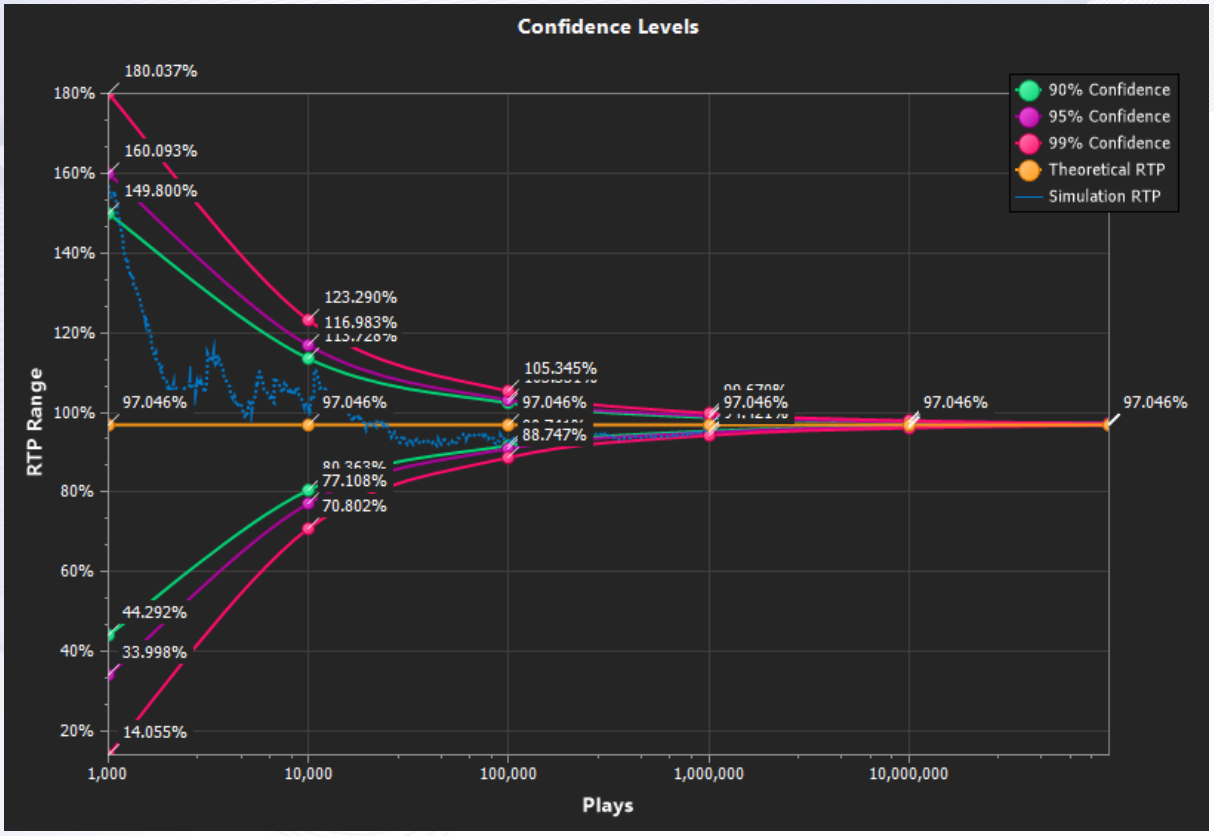

Picture 42 - Simulation Confidence Level Chart with play-time RTP

Confidence Level Chart: requires that you enable 'Calculate Volatility from raw Winnings' from the Charts menu, in order to record RTP detail blocks during simulation. Confidence Levels chart, renders the RTP for 90%, 95% and 99% confidence levels per Bet Line, for 1000 up to 1 billion spins. It is an important report, because it defines the acceptable RTP deviation during Monte Carlo simulations, from the theoretical RTP of the game.

When recording of raw winnings is enabled, RTP detail blocks will render with blue color over the Confidence Level Chart. This actually shows if your simulation is within acceptable range. In this report you can also derive when your game will balance around the theoretical RTP.

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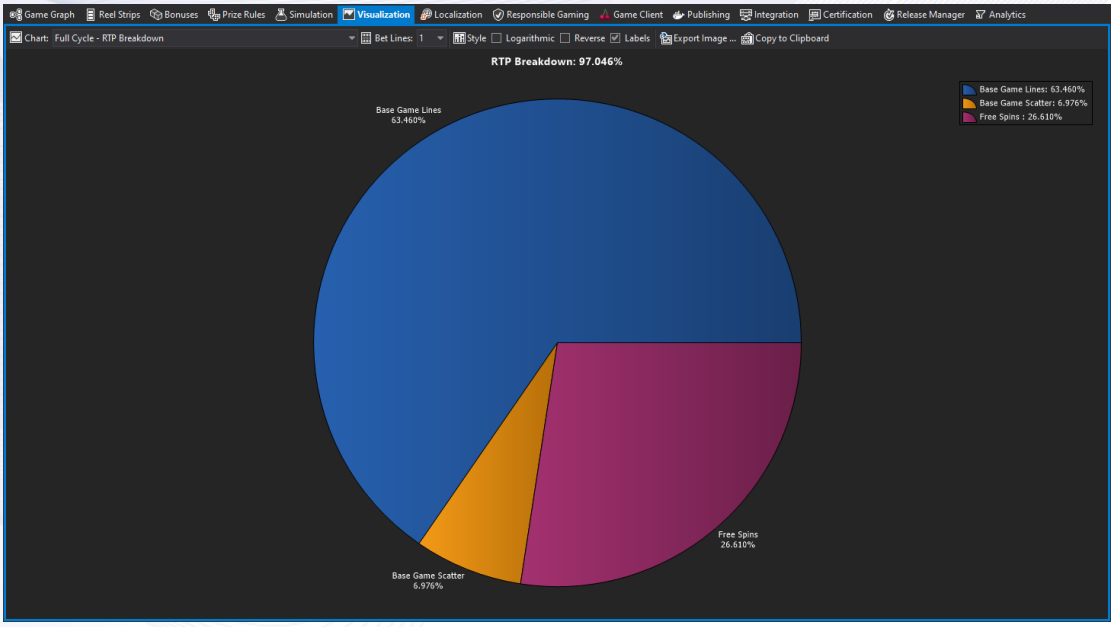
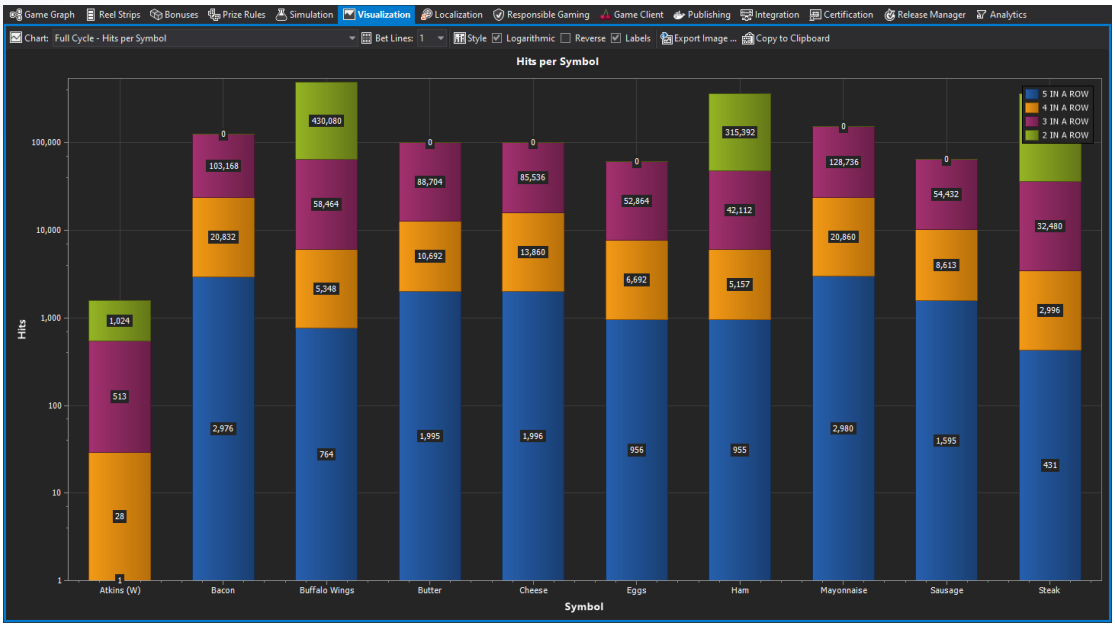
2.7 Tab 6 - Visualization Tool

Visualization tab can be used to generate charts of various data in the game.



Picture 43 - Visualization Tool, RTP Breakdown Chart



Picture 44 - Visualization Tool, Hits per Symbol in logarithmic scale

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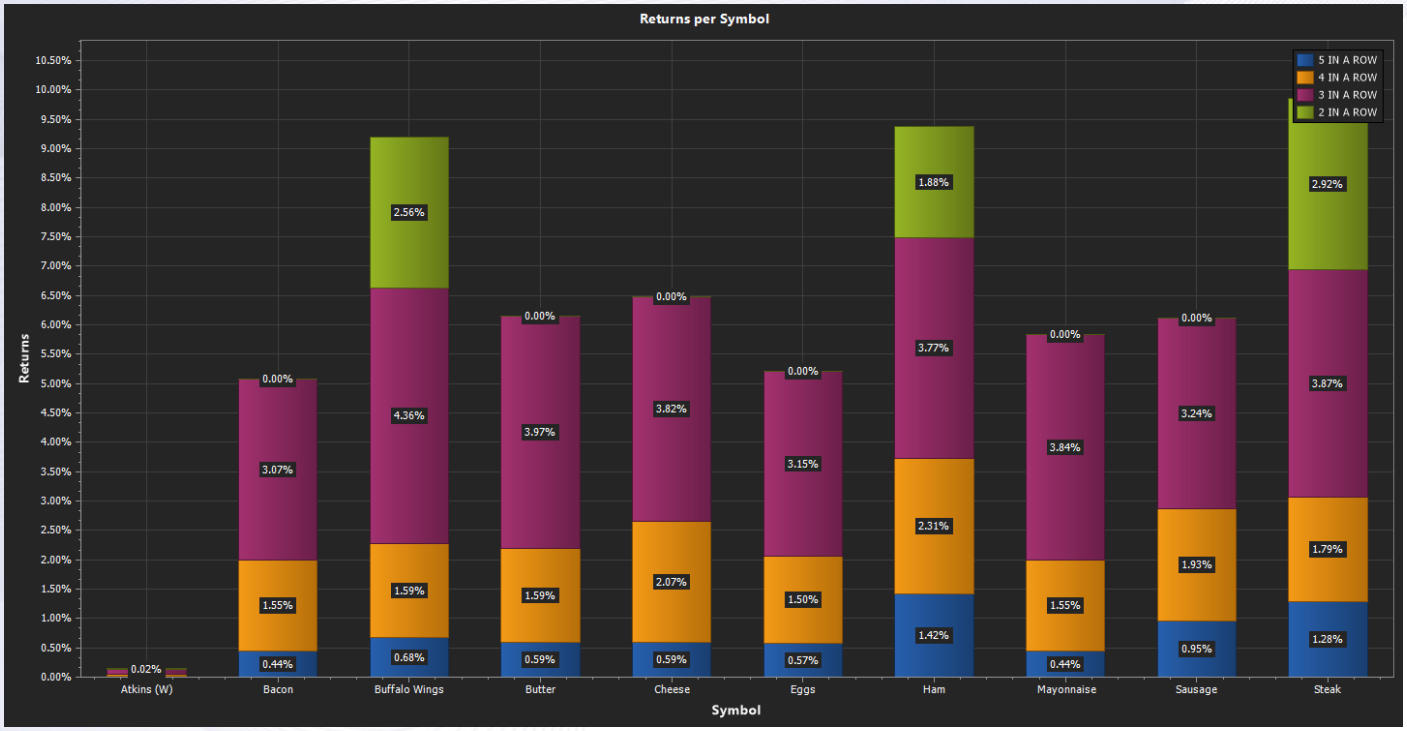

Picture 45 - Visualization Tool, Returns per Symbol

You get a list of pre-defined charts for which you can change their style, scale or even transpose the axis. Like any other charts in Workbench, you can export chart image to a file or copy it to clipboard. In most Workbench reports, the context menu allows you to select a column for X-axis and one for Y-axis and render their data as a graph in Visualization tool.

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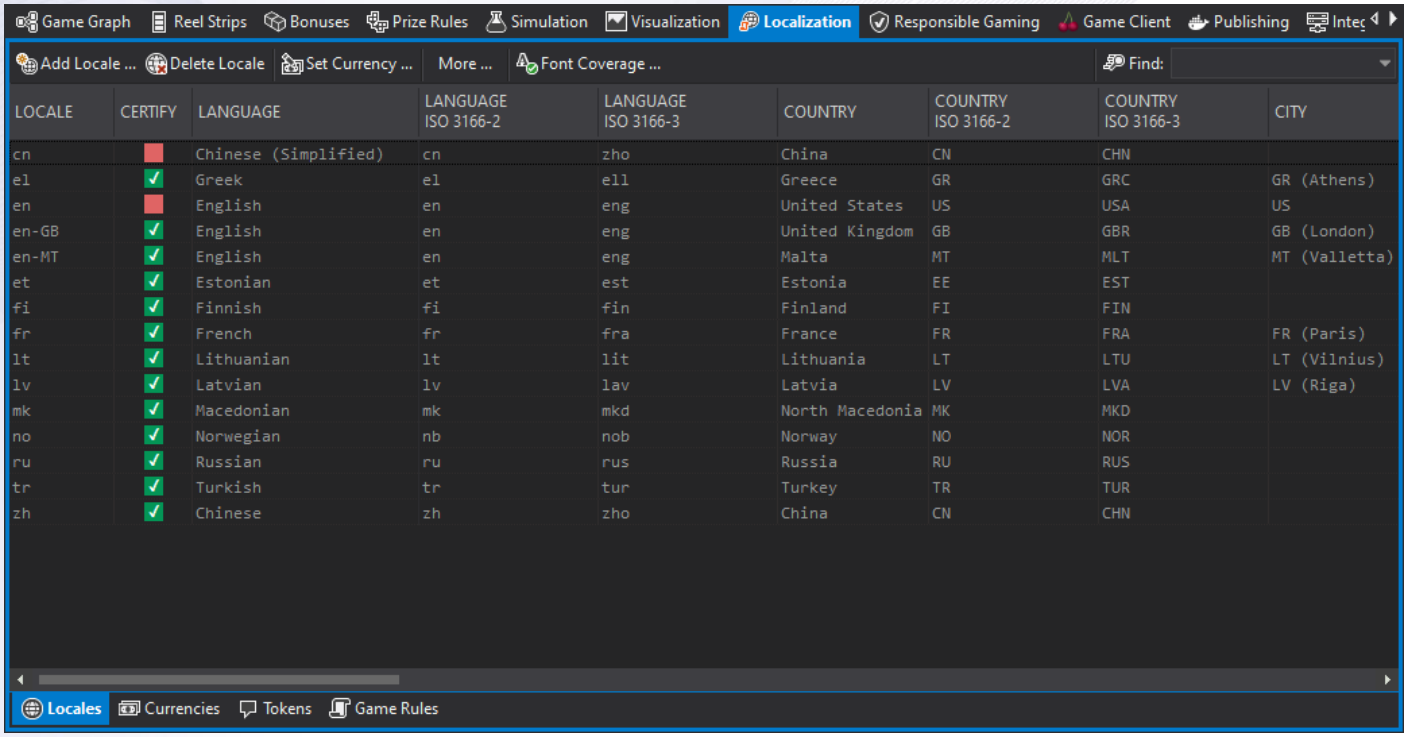
2.8 Tab 7 - Localization Editor

Localization Editor is placed on the seventh tab in Workbench IDE and consist of a **Locales Editor, Currencies Editor, Tokens Editor** and **Game Rules Editor**.

2.8.1 Locales Editor



LOCALE	CERTIFY	LANGUAGE	LANGUAGE ISO 3166-2	LANGUAGE ISO 3166-3	COUNTRY	COUNTRY ISO 3166-2	COUNTRY ISO 3166-3	CITY
cn	☐	Chinese (Simplified)	cn	zho	China	CN	CHN	
el	☑	Greek	el	ell	Greece	GR	GRC	GR (Athens)
en	☐	English	en	eng	United States	US	USA	US
en-GB	☑	English	en	eng	United Kingdom	GB	GBR	GB (London)
en-MT	☑	English	en	eng	Malta	MT	MLT	MT (Valletta)
et	☑	Estonian	et	est	Estonia	EE	EST	
fi	☑	Finnish	fi	fin	Finland	FI	FIN	
fr	☑	French	fr	fra	France	FR	FRA	FR (Paris)
lt	☑	Lithuanian	lt	lit	Lithuania	LT	LTU	LT (Vilnius)
lv	☑	Latvian	lv	lav	Latvia	LV	LVA	LV (Riga)
mk	☑	Macedonian	mk	mkd	North Macedonia	MK	MKD	
no	☑	Norwegian	nb	nob	Norway	NO	NOR	
ru	☑	Russian	ru	rus	Russia	RU	RUS	
tr	☑	Turkish	tr	tur	Turkey	TR	TUR	
zh	☑	Chinese	zh	zho	China	CN	CHN	

Picture 46 - Localization Editor, Locales Editor

Locales Editor can be used for defining Locales. A **Locale** is a combination of **Language Code, Region Code, Currency Code** and **Localized Currency Formatting**. You can add a Locale directly from Windows operating system database or define one manually. A Locale typically provides localized currency formatting information. For example, in Europe most countries have Euro as currency but almost all of them format money differently.

In some countries place the euro-sign before the value while in others after. In some countries use dot for decimal separation while in others use comma, and so on. A game must define at least one Locale at Operator level that is used as fallback currency. At runtime RGS can generate Locales on-the-fly by combining Language, Currency and Formatting information obtained from Wallet or Lobby.

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2.8.2 Currency Concerns

Before we introduce the Currency Editor, we need to talk about Coins. In our modern world there are many Fiat coins with different subdivisions. Currency subdivisions are called Currency Fractional Units (CFUs for short). For example, the fractional division in Euro and Dollar is 100 CFU, which means cents.

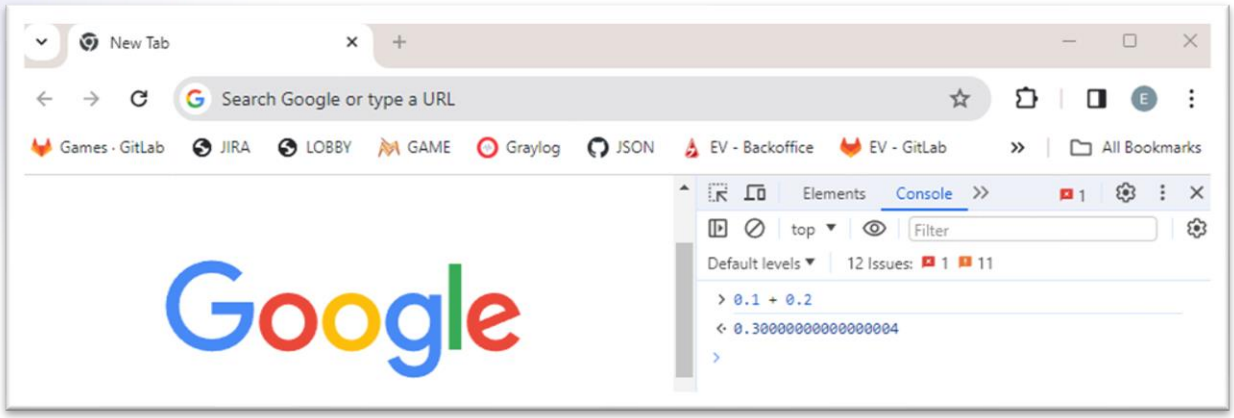
However, there are currencies such as the Tunisian Dinar with a subdivision of 1000 CFU. In addition, the Japanese Yen has no subdivision and is equivalent to 1 CFU, while cryptocurrencies such as Bitcoin have subdivisions equal to 8 - 18.

This raises a concern about the appearance of coins in your game as well as the handling of coins on the server.

Most Wallet platforms use concepts such as the Bet Currency Multiplier (Bet Currency Multiplier or BCM for short) to implement Currency Exchange Rates and adjust the currency formatting in-game. The inclusion of Exchange Rates is also very important. For example, the Indonesian Rupiah has an exchange rate of 18,000 to the Euro. Similarly, the Kuwaiti Dinar has an exchange rate of 0.3 to the Euro.

This means that your game's user interface must be prepared to display very large or very small numbers, something that most developers do not consider to be true in their games at first glance.

Wallet and RGS servers typically run on Fractional Currency Units (CFU) in order to use integer numbers and avoid rounding floating point numbers.



Picture 47 - Floating Point Number Arithmetic Problem

Floating-point numbers need special attention because they indicate rounding and rounding can lead to inaccurate results. Strange as it may sound, 0.1 + 0.2 in JavaScript or C++ does not equal 0.3 !!! The reason for this is mantissa:

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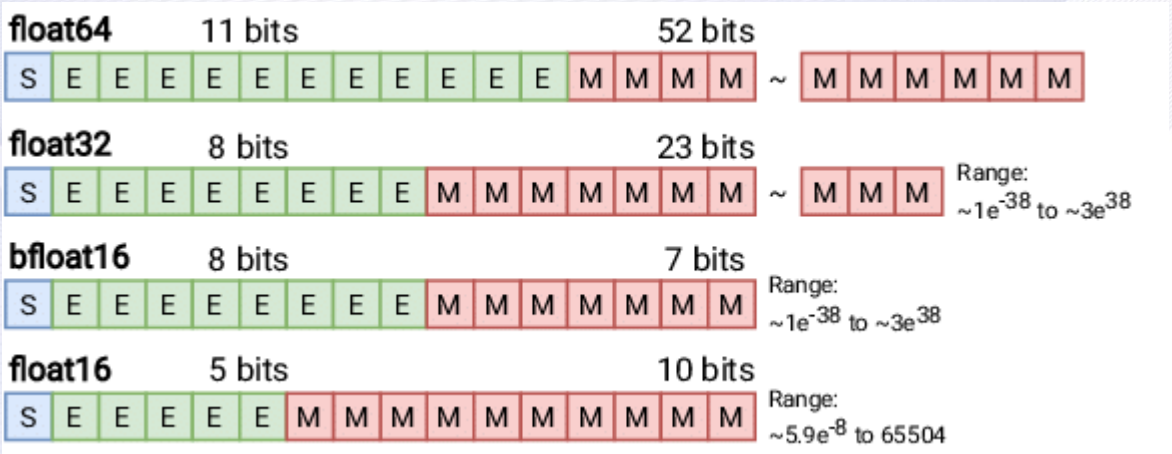

Picture 48 - Floating-Point Mantissa

In 1946, Arthur Burks used the terms mantissa and characteristic to describe the two parts of a floating-point number by analogy with the then prevalent common logarithm tables: the characteristic is the integer part of the logarithm (i.e., the exponent), and the mantissa is the fractional part. The usage remains common among computer scientists today. The term significand was introduced by George Forsythe and Cleve Moler in 1967 and is the word used in the IEEE standard as the factor in front of a scientific notation number discussed above. The fractional part is called a fraction. To understand both terms, notice that in binary 1 + (mantissa) ≈ (significant) and the correspondence is exact when storing a power-of-2. This fact allows a fast approximation of the base-2 logarithm, leading to algorithms for e.g. computing the fast square root and the fast inverse square root. The implicit initial 1 is nothing but the hidden bit in the IEEE 754 mobile subspace, and the bit field that stores the remainder is therefore the mantissa.

This means that money-related API calls between RGS and Wallets must be based on ISO currency codes and integers. Things get more complicated if Wallets are old with outdated currencies or poorly designed. For example, we have encountered one Wallet that treats all currencies as if they were 100 CFU currencies and another Wallet operates in primary currency instead of CFU, exchanging money as floating point numbers.

The mobileFX Workbench addresses similar bad designs by introducing a correction and adjustment multiplier called the Wallet Currency Multiplier or WCM.

2.8.3 Currency Editor

Currency Editor displays all known Fiat currencies per territory, along with: ISO currency code, currency symbol, currency fractional units (CFU), decimal digits, exchange rate, bet currency multiplier (BCM), wallet currency multiplier (WCM), min max bet on local currency, min max bet on exchange rate base currency and other important currency data.

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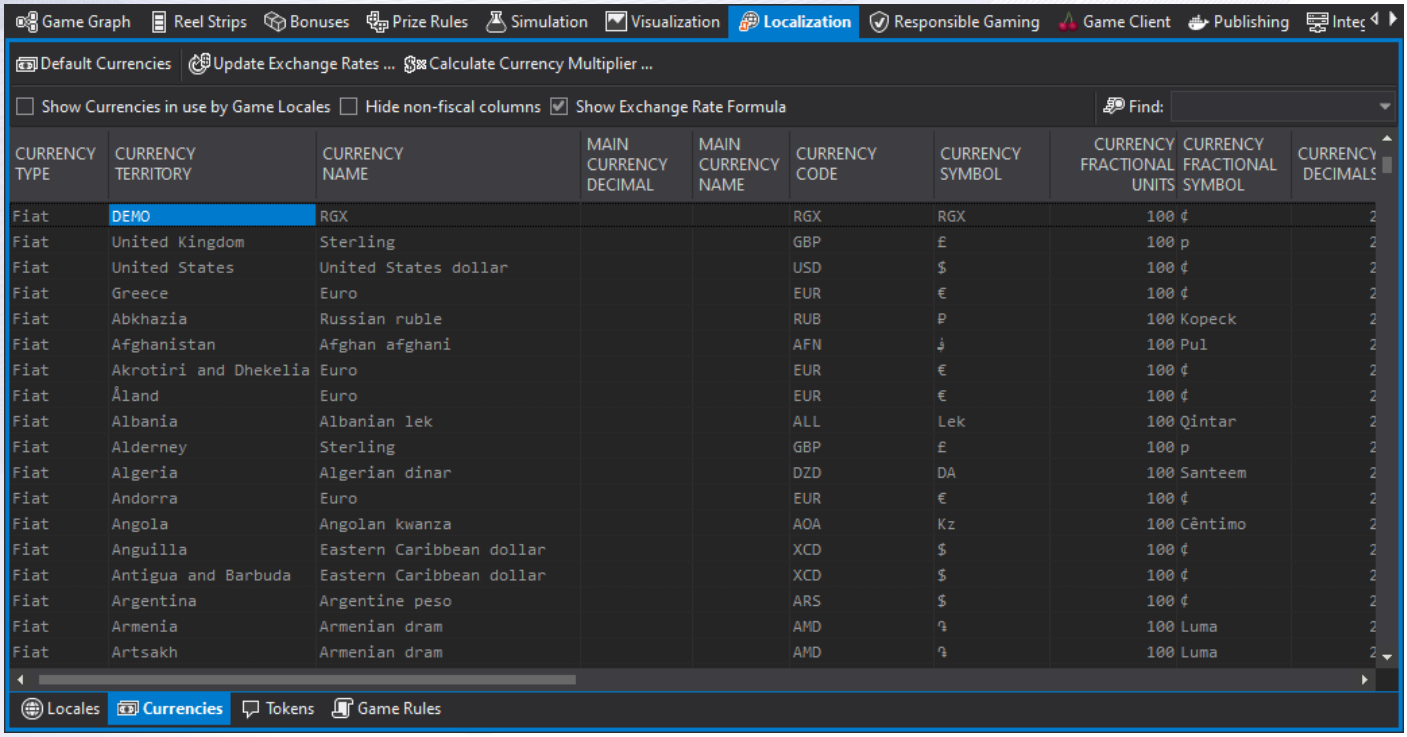
Currency Editor can fetch currency exchange rates from the internet and use them to re-calculate BCM and WCM coefficients. Currency Editor shows you at a glance what you need to know and support if you want your game to be published to an online casino.



CURRENCY TYPE	CURRENCY TERRITORY	CURRENCY NAME	MAIN CURRENCY DECIMAL	MAIN CURRENCY NAME	CURRENCY CODE	CURRENCY SYMBOL	CURRENCY FRACTIONAL UNITS	CURRENCY FRACTIONAL SYMBOL	CURRENCY DECIMALS
Fiat	DEMO	RGX			RGX	RGX	100	¢	2
Fiat	United Kingdom	Sterling			GBP	£	100	p	2
Fiat	United States	United States dollar			USD	$	100	¢	2
Fiat	Greece	Euro			EUR	€	100	¢	2
Fiat	Abkhazia	Russian ruble			RUB	₽	100	Kopeck	2
Fiat	Afghanistan	Afghan afghani			AFN	؋	100	Pul	2
Fiat	Akrotiri and Dhekelia	Euro			EUR	€	100	¢	2
Fiat	Åland	Euro			EUR	€	100	¢	2
Fiat	Albania	Albanian lek			ALL	Lek	100	Qintar	2
Fiat	Alderney	Sterling			GBP	£	100	p	2
Fiat	Algeria	Algerian dinar			DZD	DA	100	Santeem	2
Fiat	Andorra	Euro			EUR	€	100	¢	2
Fiat	Angola	Angolan kwanza			AOA	Kz	100	Cêntimo	2
Fiat	Anguilla	Eastern Caribbean dollar			XCD	$	100	¢	2
Fiat	Antigua and Barbuda	Eastern Caribbean dollar			XCD	$	100	¢	2
Fiat	Argentina	Argentine peso			ARS	$	100	¢	2
Fiat	Armenia	Armenian dram			AMD	֏	100	Luma	2
Fiat	Artsakh	Armenian dram			AMD	֏	100	Luma	2

Picture 49 - Localization Editor, Currency Editor

In Currency Editor we also display well-known Crypto currencies such as **Bitcoin, Ethereum** and **Litecoin**. Since 1 Bitcoin exchange rate is many thousands of US dollars, it is assumed that in your games you would deal with subdivisions such as micro or milli Bitcoin. Thus, for each crypto currency the tool has calculated the subdivisions that probably make sense to online casino gaming.

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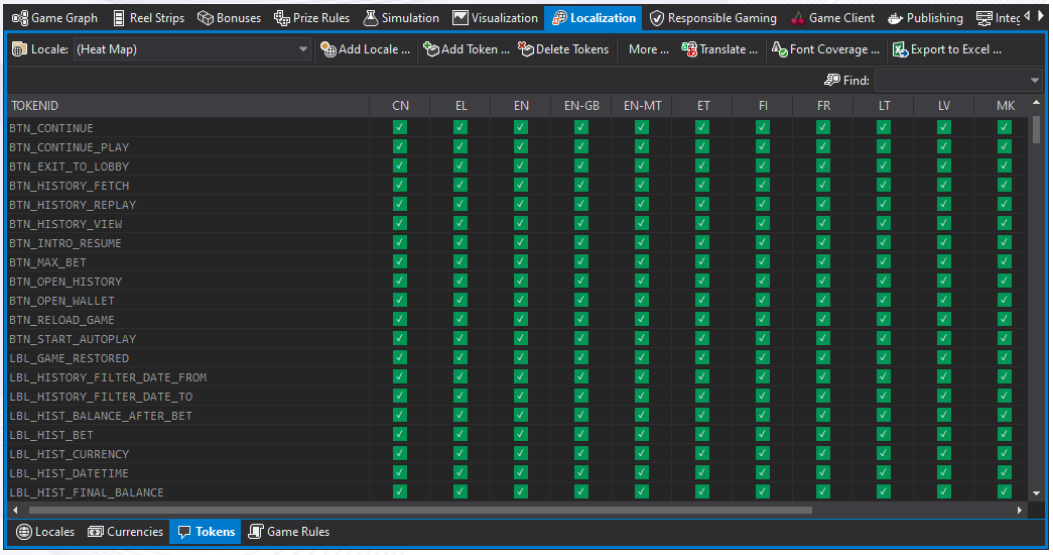
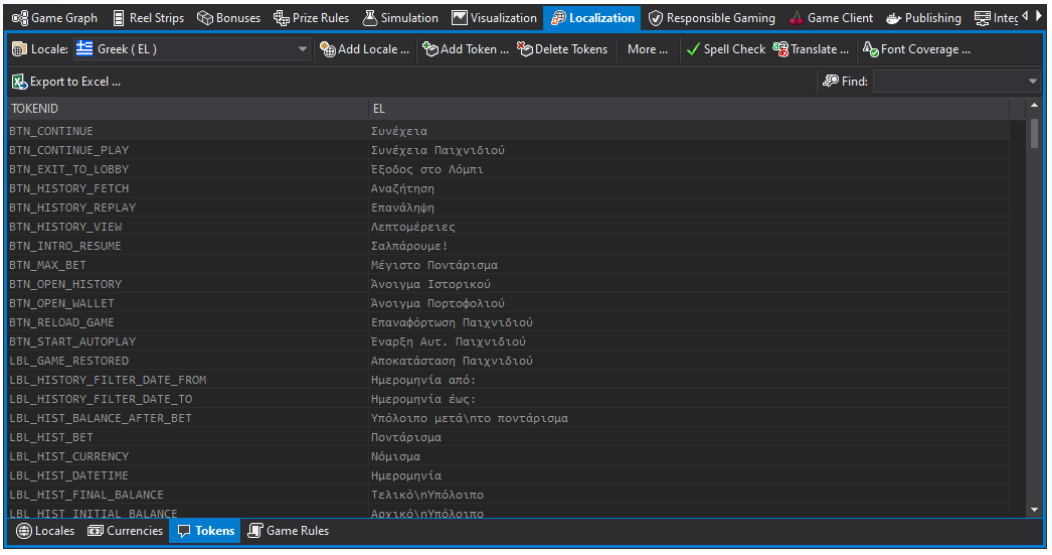
2.8.4 Tokens Editor

Tokens Editor manages a list of Translation Tokens. Each Token is an identifier that expands to a localized phrase in your game's UI.

Tokens Editor has a heatmap-mode showing for every language the existing or missing tokens.



Picture 50 - Localization Editor, Translation Token Editor (Heatmap Mode)



Picture 51 - Localization Editor, Translation Token Editor (Language Mode)

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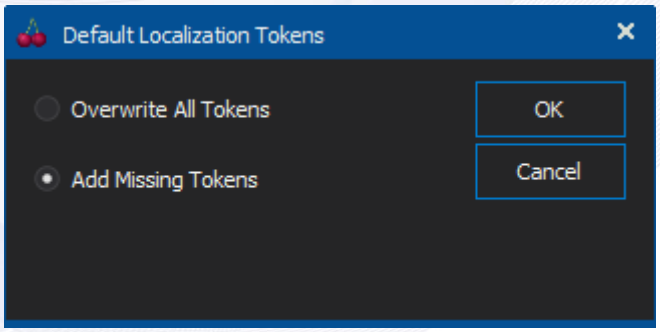
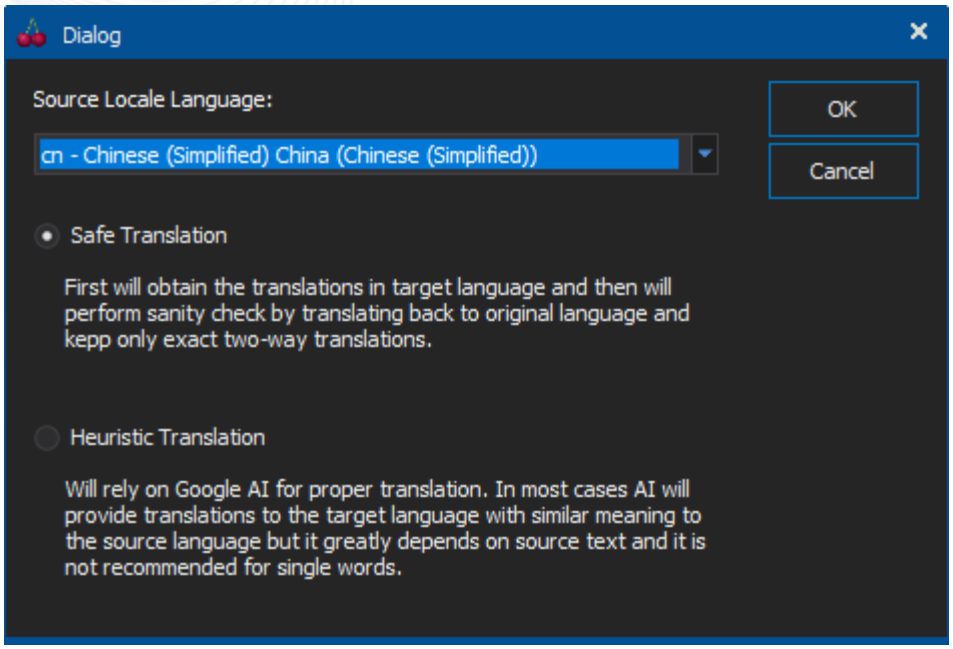
When changing to language mode you can see the translations and edit them. You can copy translations from Workbench to Excel and vice versa and it can detect new or updated localization tokens.

Tokens Editor has several productivity features:



Picture 52 - Localization Editor, Translation Token Editor Default Tokens

With Default Localization Tokens dialog, you can overwrite existing tokens or add missing tokens to your game.



Picture 53 - Localization Editor, Translation Token Editor Google Translate API

Tokens Editor integrates with Google Translate API for taking control of your translations internally.

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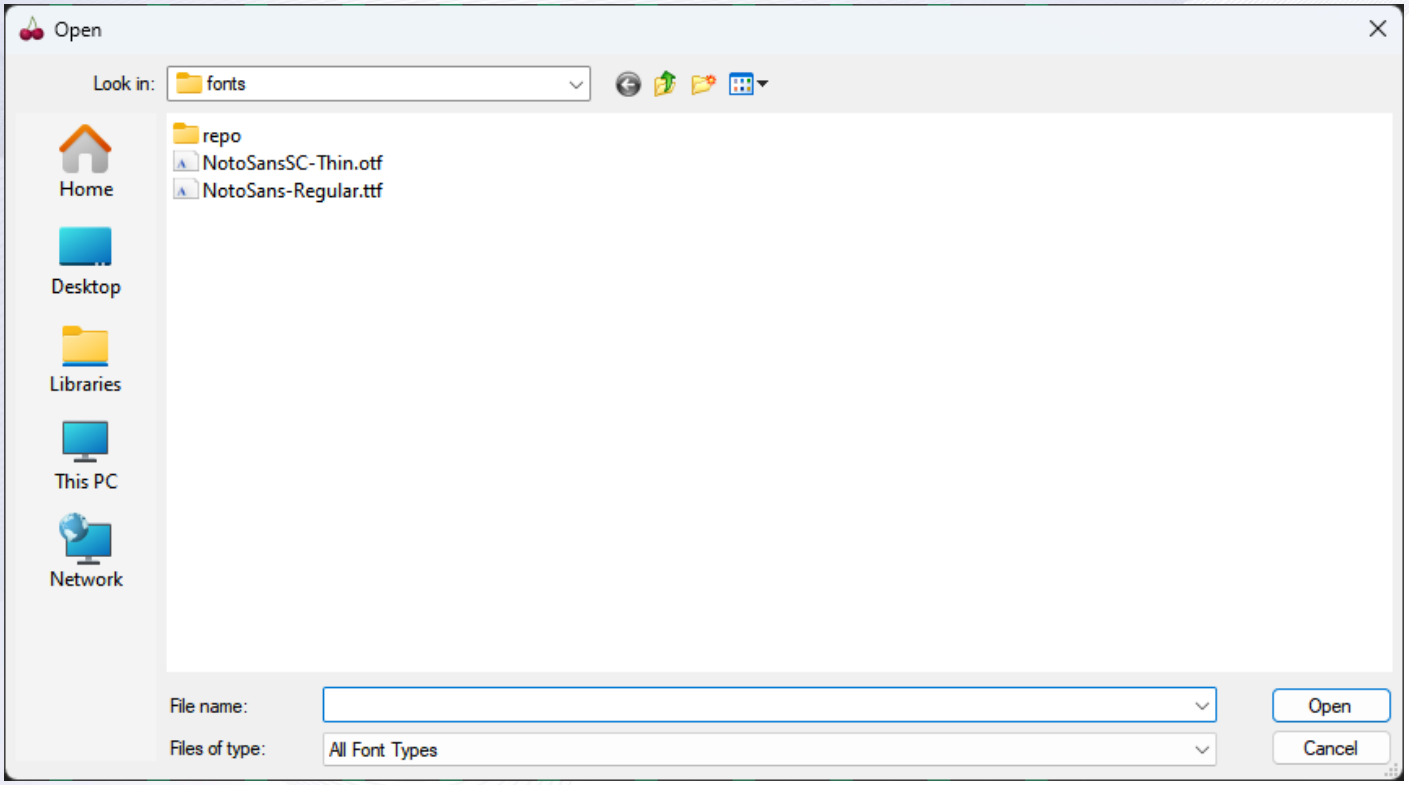

Picture 54 - Localization Editor, Translation Token Editor, Font Coverage Tool

In **Tokens Editor** you can pick a Font File and examine each Token's Unicode character against the Glyphs included in the font. This way you can be sure that your games can render properly using selected fonts. Font Coverage is triggered automatically by Publishing Tool too, when you compose the infrastructure of your game or before you publish it to your Content Aggregator, thus ensuring (and restricting) that your game will have the necessary Unicode fonts.

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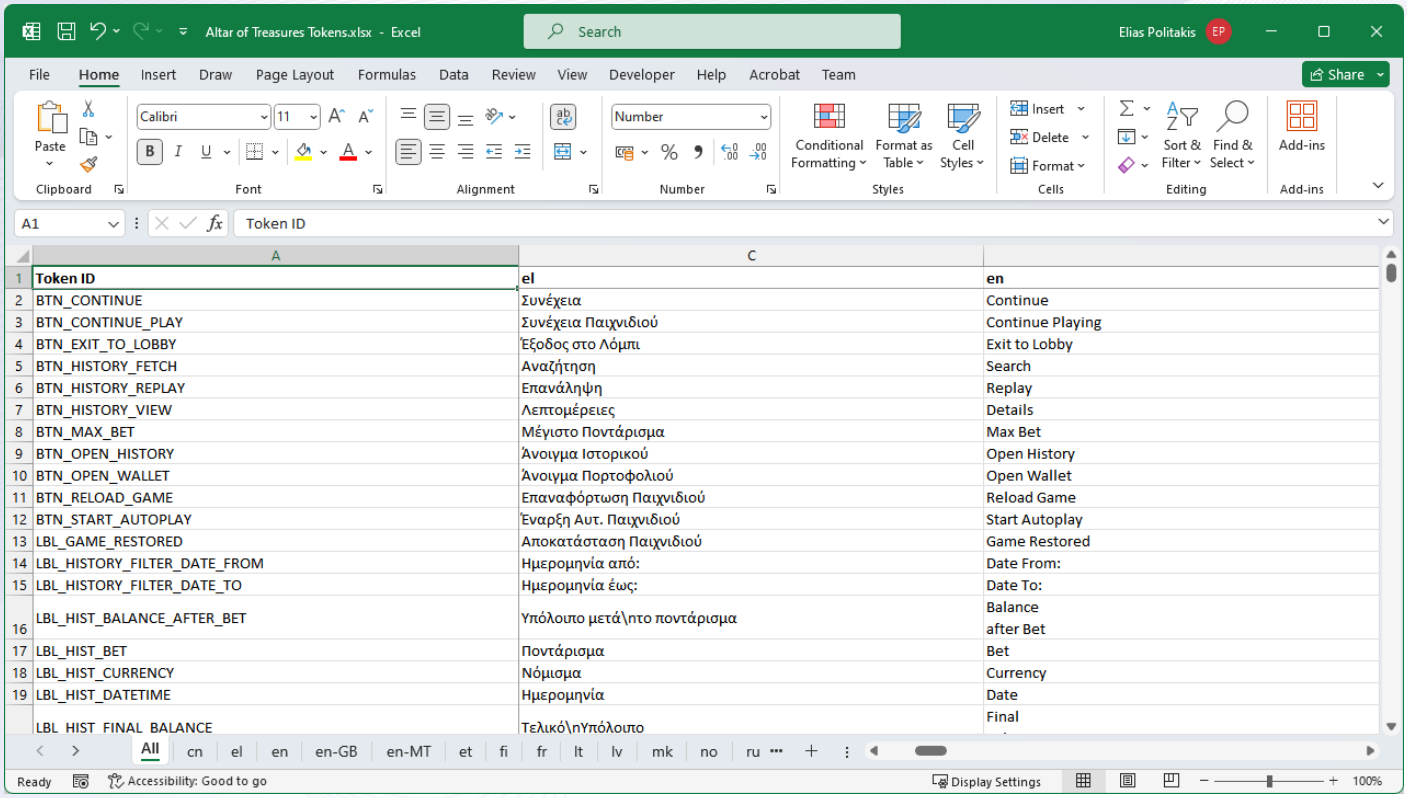

	A	C	
1	**Token ID**	**el**	**en**
2	BTN_CONTINUE	Συνέχεια	Continue
3	BTN_CONTINUE_PLAY	Συνέχεια Παιχνιδιού	Continue Playing
4	BTN_EXIT_TO_LOBBY	Έξοδος στο Λόμπι	Exit to Lobby
5	BTN_HISTORY_FETCH	Αναζήτηση	Search
6	BTN_HISTORY_REPLAY	Επανάληψη	Replay
7	BTN_HISTORY_VIEW	Λεπτομέρειες	Details
8	BTN_MAX_BET	Μέγιστο Ποντάρισμα	Max Bet
9	BTN_OPEN_HISTORY	Άνοιγμα Ιστορικού	Open History
10	BTN_OPEN_WALLET	Άνοιγμα Πορτοφολιού	Open Wallet
11	BTN_RELOAD_GAME	Επαναφόρτωση Παιχνιδιού	Reload Game
12	BTN_START_AUTOPLAY	Έναρξη Αυτ. Παιχνιδιού	Start Autoplay
13	LBL_GAME_RESTORED	Αποκατάσταση Παιχνιδιού	Game Restored
14	LBL_HISTORY_FILTER_DATE_FROM	Ημερομηνία από:	Date From:
15	LBL_HISTORY_FILTER_DATE_TO	Ημερομηνία έως:	Date To:
16	LBL_HIST_BALANCE_AFTER_BET	Υπόλοιπο μετά\nτο ποντάρισμα	Balance after Bet
17	LBL_HIST_BET	Ποντάρισμα	Bet
18	LBL_HIST_CURRENCY	Νόμισμα	Currency
19	LBL_HIST_DATETIME	Ημερομηνία	Date
	LBL_HIST_FINAL_BALANCE	Τελικό\nΥπόλοιπο	Final

Picture 55 - Localization Editor, Translation Token Editor, Export to Excel tool

Tokens Editor can export tokens to Excel for further processing, submission to AI translation services or Translation Agencies. Once you complete your external processing of Tokens, you can simply select them in Excel, copy the selection to Clipboard and paste it directly to Tokens Editor. The tool can parse Excel Clipboard format and replace or append the pasted Tokens.

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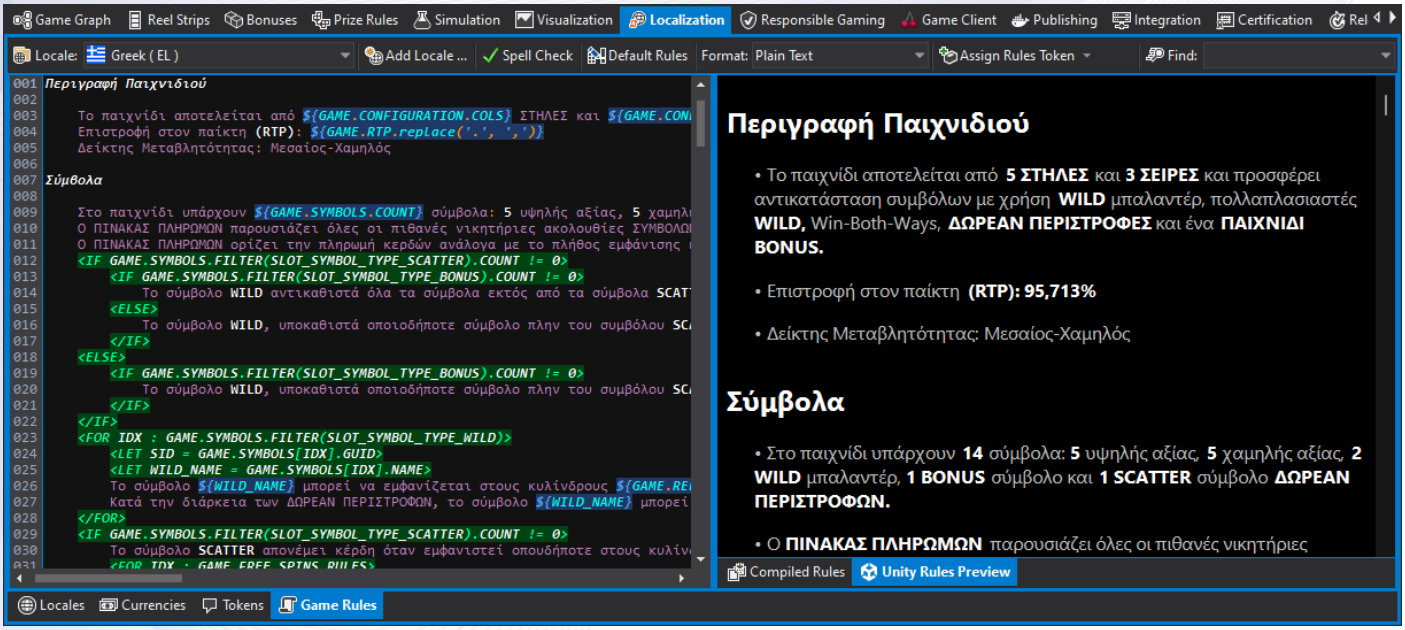
2.8.5 Game Rules Editor



Picture 56 - Localization Editor, Hyperlanguage processing Game Rules

Game Rules Editor is our best and most advanced feature in the Localization tool. With use of **Hyperlanguage**, RGS Workbench can automatically generate the exact Game Rules required for game certification directly from the game features and for any language. We expect that with Hyperlanguage you will never have to edit the game rules for any language! This definitely saves a lot of time and resources for the production of your game. The editor can export the game rules in plain text, **HTML5, XAML** and Unity **Rich Text** format. It can also bulk generate the game rules for all languages in your game project.

Hyperlanguage syntax is similar to XML markup and consists of Tags that instruct Hyperlanguage Processor on generating the proper text by taking input directly from game properties and metadata. The tags supported are <IF>, <ELSE>, <FOR> and <LET>. Hyperlanguage Editor is using intelligence with Code Popus and Code Completion to help you author your scripts with ease and it is rather intuitive.

The rules are organized using **Headers** and **Lists** using one bullet per rule and one list per header. Words in UPPERCASE are considered terms. Terms and Numbers and are automatically rendered in white color and bold style to indicate significance. For Unity3D developers, the tool offers real-time rendering of Game Rules at the selected Language, that displays the rules exactly as the Game Client would at run-time.

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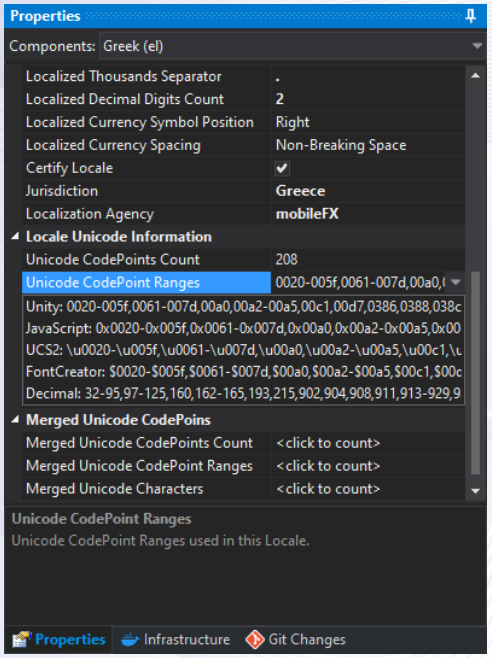
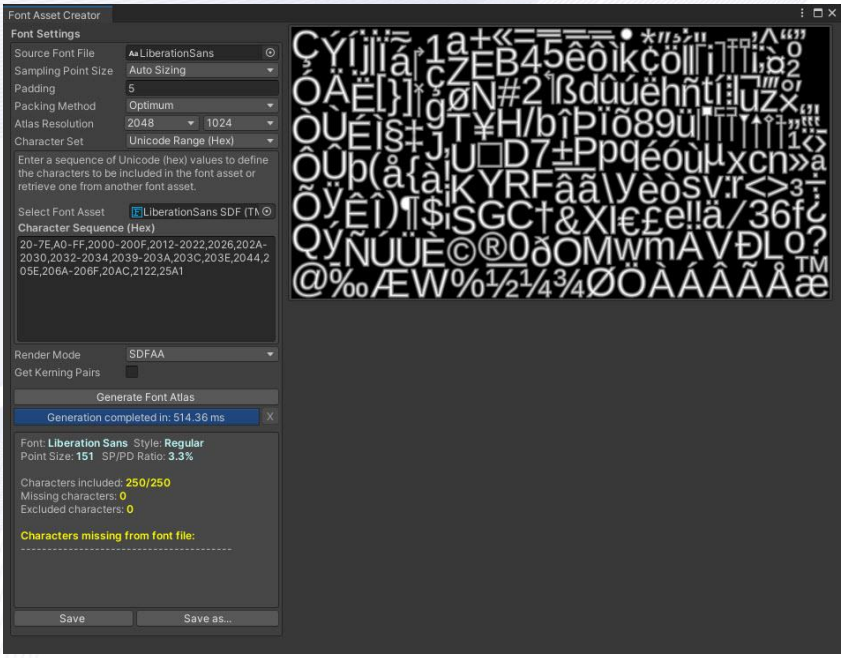
2.8.6 Unicode Code Ranges





Picture 57 - Unicode Code-Ranges

Picture 58 - Input Unicode Code Ranges from RGS Workbench to Unity3D

Localizations Editor generates **Unicode Code Ranges** for all characters used in translations, either per language or for a group of languages, thus optimizing your Font Textures in Unity3D. Simply copy-paste the Unicode code ranges in Unity Font Asset Creator and you will get the exact glyphs required for printing every single translation text in your game client.

For best memory efficiency at run-time, we recommend grouping Latin-based languages together and leaving ideographic languages such as Chinese in an isolated group. You can control language grouping by setting the **Merge CodePoints** property of the languages you want to merge in Properties Explorer pane.

Despite the characters deriving from the analysis of your Tokens, RGS Workbench will automatically extends CodePoints to include English lower-case and upper-case letters, Currency Sigs, Numbers and some special characters used by the Unity3D templates:

```
abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ 1234567890 @,.#%|-:?;<>.!^&*()[]{}_ \u00a0\u00D7\u00c1,\u2713, \u25CF, \u2776,
\u2777, \u2778, \u2779, \u277a, \u277b, \u277c, \u277d, \u277e, \u277f, \u2027, \u0024 Dollar Sign, \u00A2 Cent Sign, \u00A3 Pound Sign,
\u00A4 Currency Sign, \u00A5 Yen Sign, \u20A0 Euro-Currency Sign, \u20A1 Colon Sign, \u20A2 Cruzeiro Sign, \u20A3 French Franc Sign,
\u20A4 Lira Sign, \u20A5 Mill Sign, \u20A6 Naira Sign, \u20A7 Peseta Sign, \u20A8 Rupee Sign, \u20A9 Won Sign, \u20AA New Sheqel Sign,
\u20AB Dong Sign, \u20AC Euro Sign, \u20AD Kip Sign, \u20AE Tugrik Sign, \u20AF Drachma Sign, \u20B0 German Penny Sign, \u20B1 Peso
Sign, \u20B2 Guarani Sign, \u20B3 Austral Sign, \u20B4 Hryvnia Sign, \u20B5 Cedi Sign, \u20B6 Livre Tournois Sign, \u20B7 Spesmilo Sign,
\u20B8 Tenge Sign, \u20B9 Indian Rupee Sign, \u20BA Turkish Lira Sign, \u20BB Nordic Mark Sign, \u20BC Manat Sign, \u20BD Ruble Sign,
\u20BE Lari Sign, \u20BF Bitcoin Sign, \uA838 North Indic Rupee Mark
```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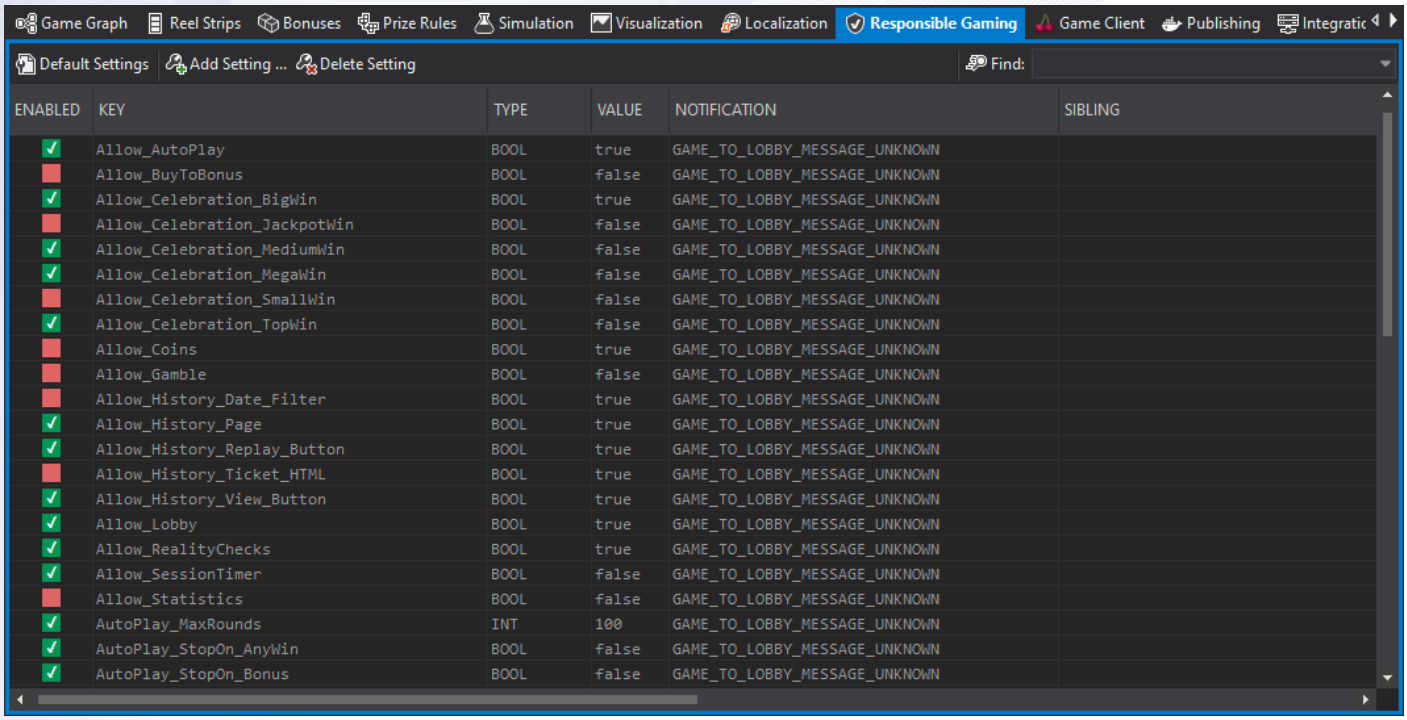
2.9 Tab 8 - Responsible Gaming Editor

The term **Responsible Gaming** encompasses the total of regulations and provisions aiming at mitigating the negative effects of excessive exposure to games of chance; as well as the responsible and conscious decision-making on the part of the player. Still, each country and region has a different set of responsible gaming rules and requirements, so what this tool does is accumulates all known rules and makes them available to game designers.



ENABLED	KEY	TYPE	VALUE	NOTIFICATION	SIBLING
☑	Allow_AutoPlay	BOOL	true	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☐	Allow_BuyToBonus	BOOL	false	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☑	Allow_Celebration_BigWin	BOOL	true	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☐	Allow_Celebration_JackpotWin	BOOL	false	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☑	Allow_Celebration_MediumWin	BOOL	false	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☑	Allow_Celebration_MegaWin	BOOL	false	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☐	Allow_Celebration_SmallWin	BOOL	false	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☑	Allow_Celebration_TopWin	BOOL	false	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☐	Allow_Coins	BOOL	true	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☐	Allow_Gamble	BOOL	false	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☐	Allow_History_Date_Filter	BOOL	true	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☑	Allow_History_Page	BOOL	true	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☑	Allow_History_Replay_Button	BOOL	true	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☐	Allow_History_Ticket_HTML	BOOL	true	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☑	Allow_History_View_Button	BOOL	true	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☑	Allow_Lobby	BOOL	true	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☑	Allow_RealityChecks	BOOL	true	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☑	Allow_SessionTimer	BOOL	false	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☐	Allow_Statistics	BOOL	false	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☑	AutoPlay_MaxRounds	INT	100	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☑	AutoPlay_StopOn_AnyWin	BOOL	false	GAME_TO_LOBBY_MESSAGE_UNKNOWN	
☑	AutoPlay_StopOn_Bonus	BOOL	false	GAME_TO_LOBBY_MESSAGE_UNKNOWN	

Picture 59 - Responsible Gaming

Furthermore, Responsible Gaming tool handles the various settings of a slot game that affect either the gameplay or the available options as these are accessed through the game client menu. For example regarding the gameplay, we can set the desired duration of a spin or whether or not player-interaction is required to access certain features of the game, like the Free Spins or a Bonus.

As far as the available options are concerned, these can refer to the conditions that would stop a session of Autoplay, or the possibility to notify the player of his in-game progress as a mean of enforcing a policy of Responsible Gaming.

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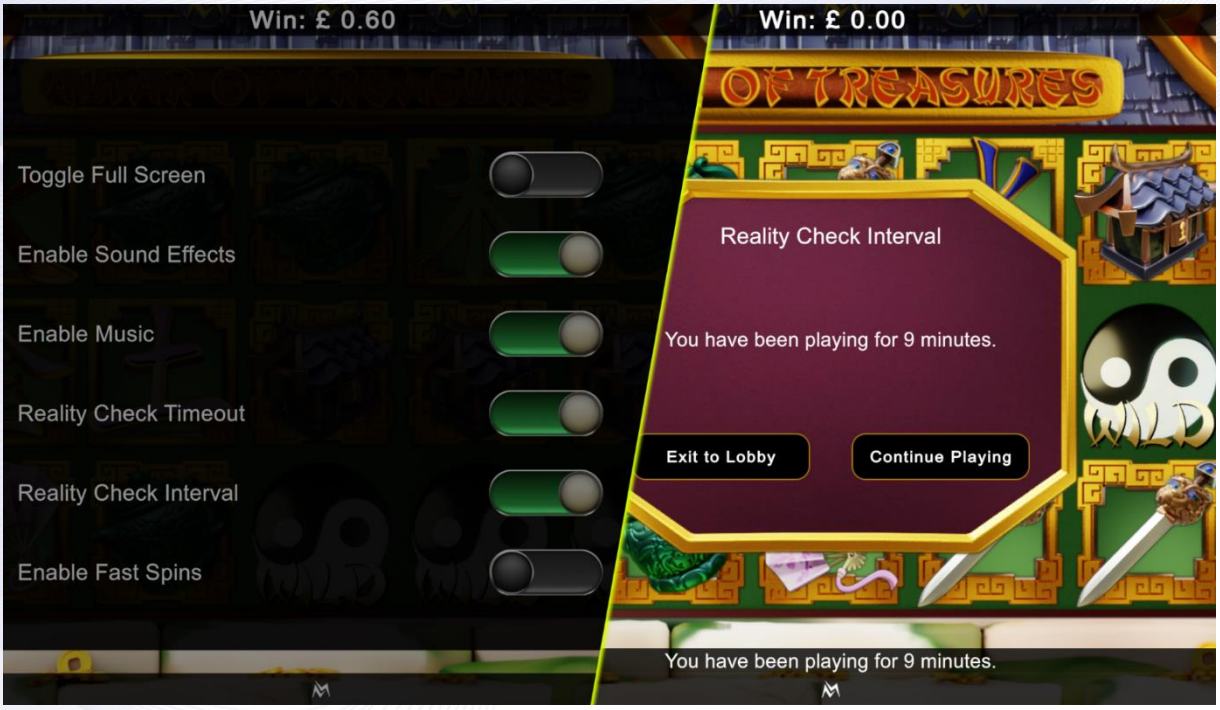

Picture 60 - Responsible Gaming UI in Game Client

There two main categories of settings; first there are the settings that do not appear in the game UI but are used to control certain aspects of the game according to jurisdictional requirements. These are accessed through their KEY and provide an ENABLED field to determine whether the specific setting is utilized or not in the game.

Secondly, there are those settings that do appear in game UI and are used to dynamically create the proper UI controls in the game. Those settings enable the player to adjust gameplay according to own preferences and provide all the necessary detail fields that should be taken into consideration when setting such an option. In this case, the ENABLED field controls whether such an option should be available to the player at all.

Should such an option be available, we can use the VALUE field to set the default value of that option. We can use the NOTIFICATION field to determine whether a notification should be sent when the player makes use of that option. We can use the SIBLING field to resolve the connection between a UI control and its label. We can use CAPTION field to set control caption from a Localization Token. Finally, we can use PAGE field to assign the control to the proper page.

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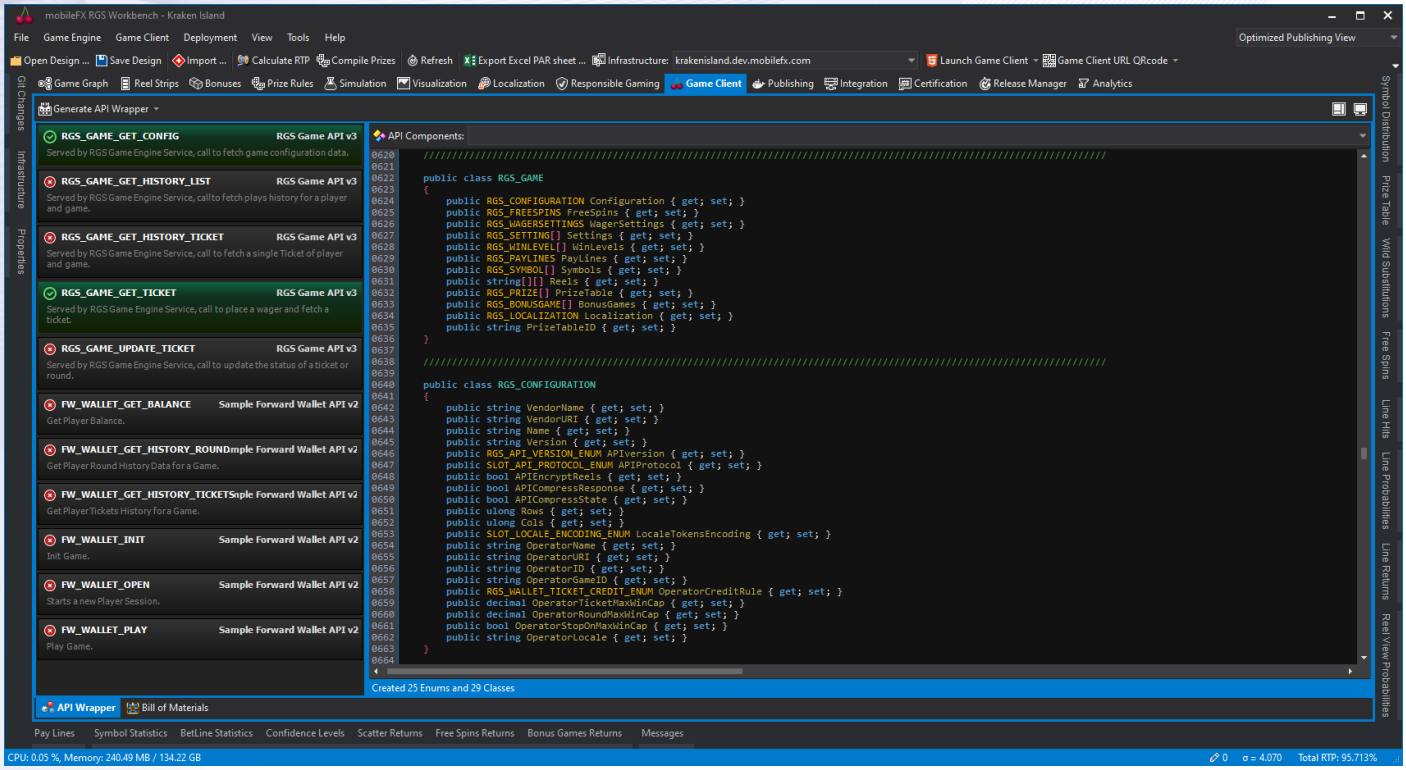
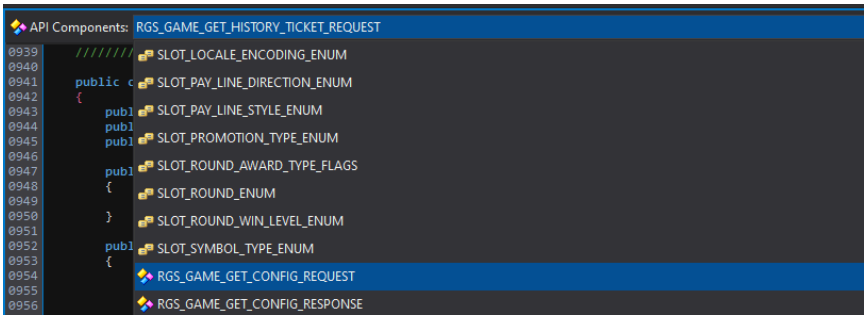
2.10 Tab 9 - Game Client Tools

2.10.1 RGS API Generator Tool



Picture 61 - RGS API Generator Tool



Picture 62 - RGS API Generator Tool

RGS Workbench API Generator expertly automates the crafting of RGS APIs generating code for C#, C++, and JavaScript. This facilitates streamlined integration and seamless communication between games, servers, and platforms, optimizing the development workflow across the gaming ecosystem.

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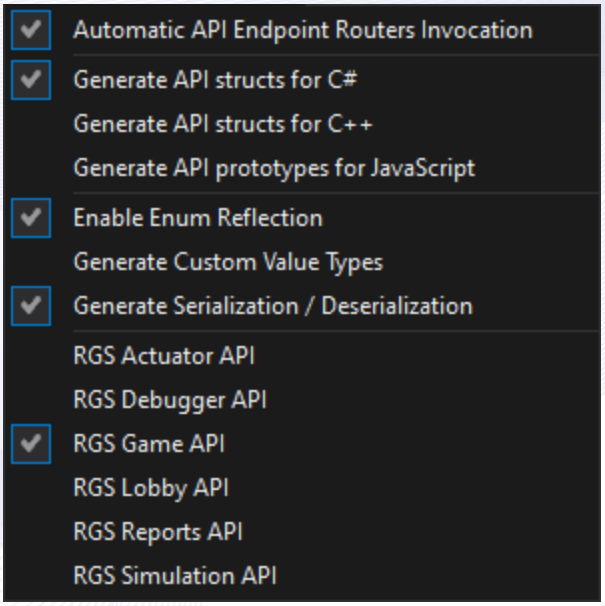

Picture 63 - RGS API Generator Tool

RGS API Generator Tool works closely with **Integration Tool** where you should invoke the various API endpoints in order to record the Request / Response pairs. Each endpoint offers information about API name and purpose that is used by API generator to list the available endpoint calls.

RGS API Generator Tool uses compile-time C++ reflection techniques to capture Enumerations and emits them to the target API programming language. The tool also generates enumerations and code-maps for RGS server-side and client-side exceptions along with error recovery information, so that your game client can know the severity of an error. Errors are mapped to Localization Tokens for displaying localized error information to the Player.

RGS APIs can be serialized and deserialized in various formats: RGS Server supports **JSON** format for maximum compatibility with other gaming frameworks. However, we provide and recommend more advanced and secure formats such as **DataStream** that uses compression and asymmetric encryption by default. DataStream implementation is supported out-of-the-box in RGS Server and Unity3D Templates.

To take advantage of RGS DataStream API serialization format you must use RGS Workbench to generate RGS Server and Game Client encryption **RSA Public / Private key pairs**. DataStream implementation for Game Clients is available in C++, C# and JavaScript for seamless integration of your games with the RGS Server.

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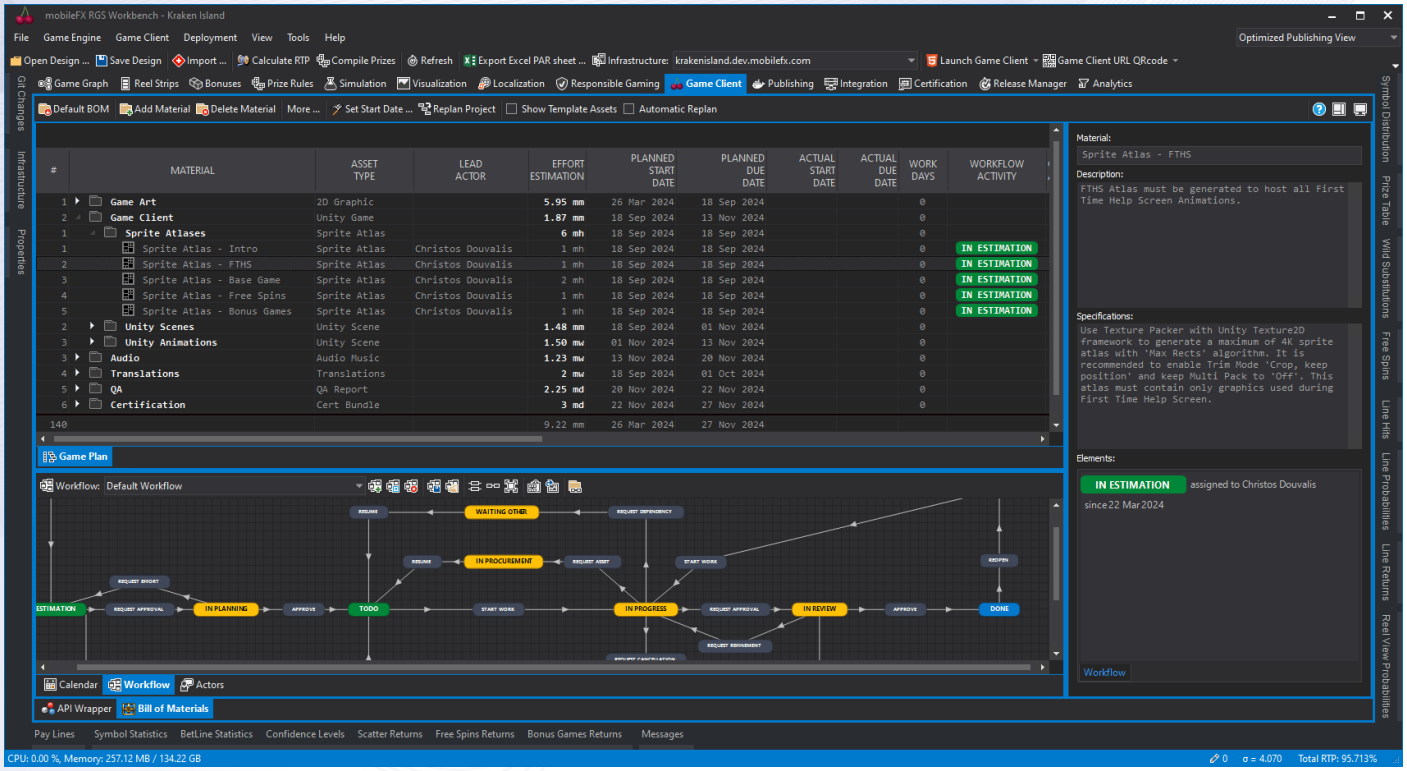
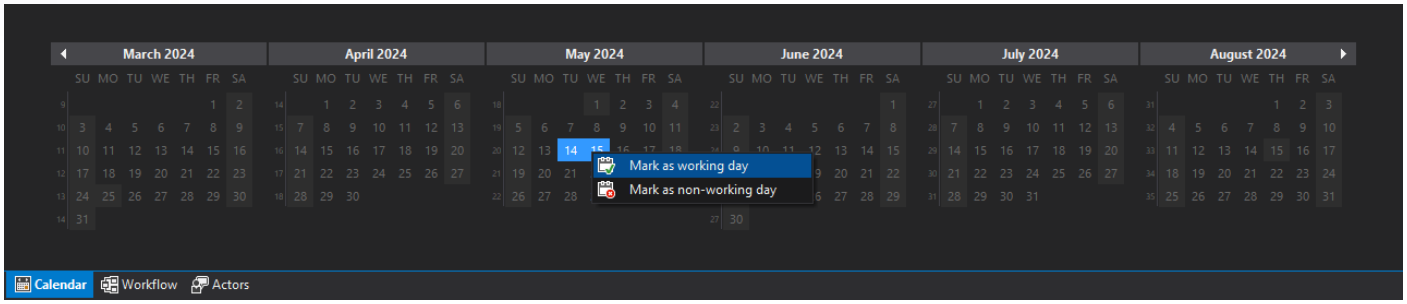
2.10.2 Bill of Materials Project Management Tool



Picture 64 - Game Client, Bill of Materials Editor

BOM Project Management Tool analyzes game metadata and derives the **Bill of Materials (BOM)** list of assets that assemble the Game Client. It uses AI to generate asset descriptions and effort estimation. The tool takes into account working days and generates an effective Project Plan that executes by using customizable Workflows.



Picture 65 - Game Client, Bill of Materials Editor, Calendar Tool

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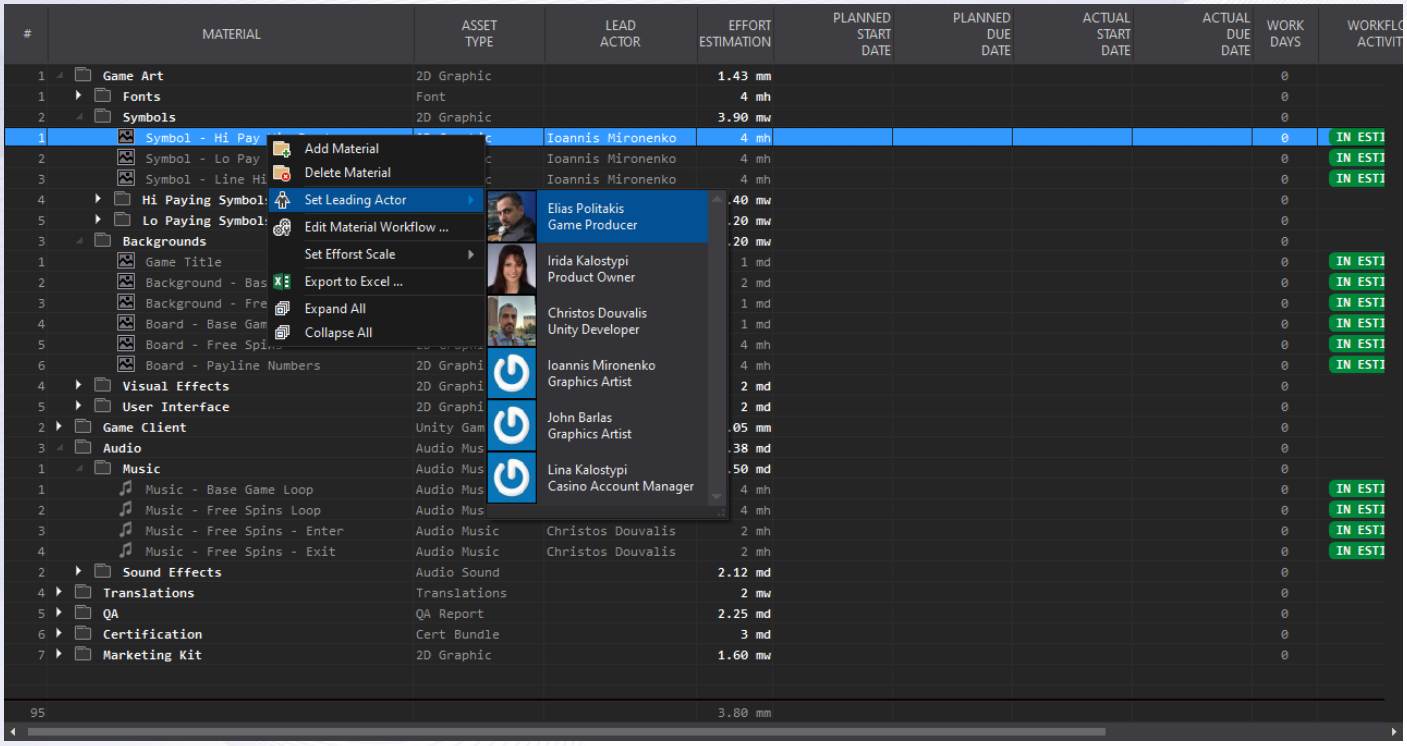
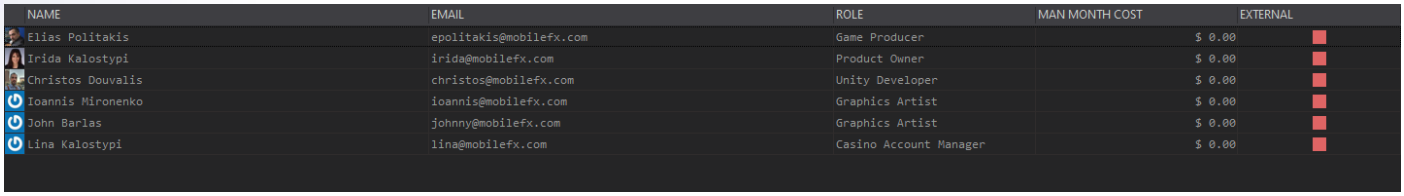


Picture 66 - Game Client, Bill of Materials Editor, Resource Allocation

The tool offers productivity features that allow you to assign tasks to your team, monitor progress and reallocate resources. You can define your team and provide costs for organic resources (employees, outsourcers) and inorganic resources (such as licensing costs, etc.). By providing the email of an organic resource, the tool interconnects with Gravatar to download the profile picture of the actor.



Picture 67 - Game Client, Bill of Materials Editor, Organic Resources Editor

The tool allows to input **Effort Estimations** in work-scale (man month, man week, man day, man hour) and you can choose between automatic scaling or specify the scale you want. Conversions between Gregorian Calendar and Workplan Calendar are automatic and take into account major Western Holidays but you can easily edit Working days yourself. Project Plan generator can re-calculate on-the-fly when you add, remove or drag tasks around. BOM and project plan can be exported to Excel.

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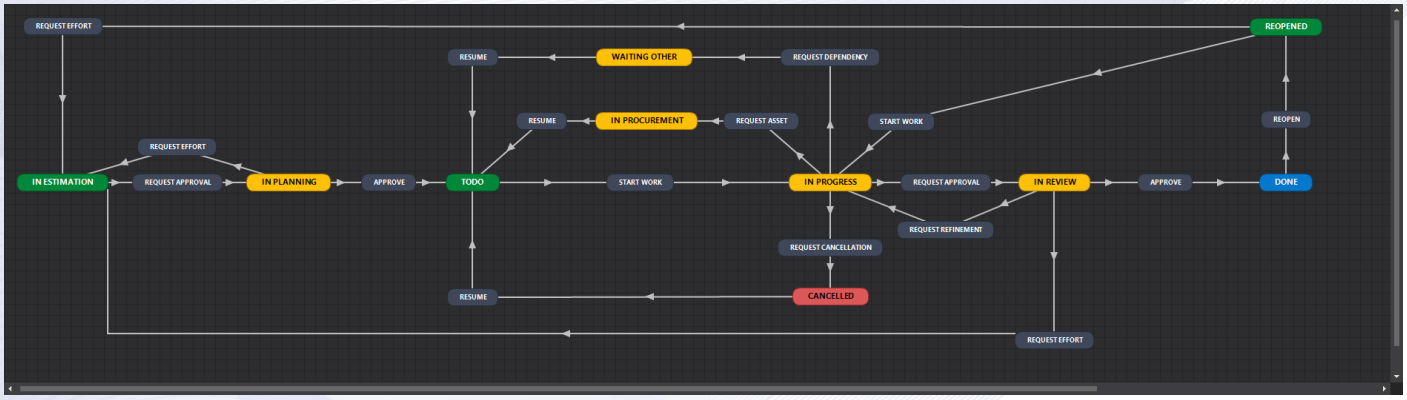

Picture 68 - Game Client, Bill of Materials Editor, Workflow Editor

Quick Gude using RGS Workbench Bill of Materials Project Management Tool:

1. Click on Default BOM to generate the bill of materials based on game features. You can edit, add, remove and re-parent materials forming groups.
2. For each Material you must provide a Tile, a Description, Specifications and a list of Asset Files. Asset Files are the deliverables of each Material.
3. It is recommended to continue by creating your team, click on Actors tab and insert your team members.
4. Fill-in Effort Estimation field and assign a Leading Actor to each material. For speed you can assign actors to groups.
5. Go to Calendar tab to add or remove non-working days and holidays. Those will be used for mapping effort to Gregorian calendar.
6. Once you are done, click Set Start Date to generate the Project Plan and display project tracks.
7. The tool will assign a default Workflow to each material. By clicking Edit Material Workflow from context menu, you can clone or edit it to your needs.
8. Workflows must have at least a Bootcamp State representing effort estimation phase, an Initial State representing a Backlog, and a Final State.
9. Material progress tracking starts when a material enters the Initial State and ends when it reaches the Final State.
10. During works you can revise Effort Estimation and re-generate the Project Plan.

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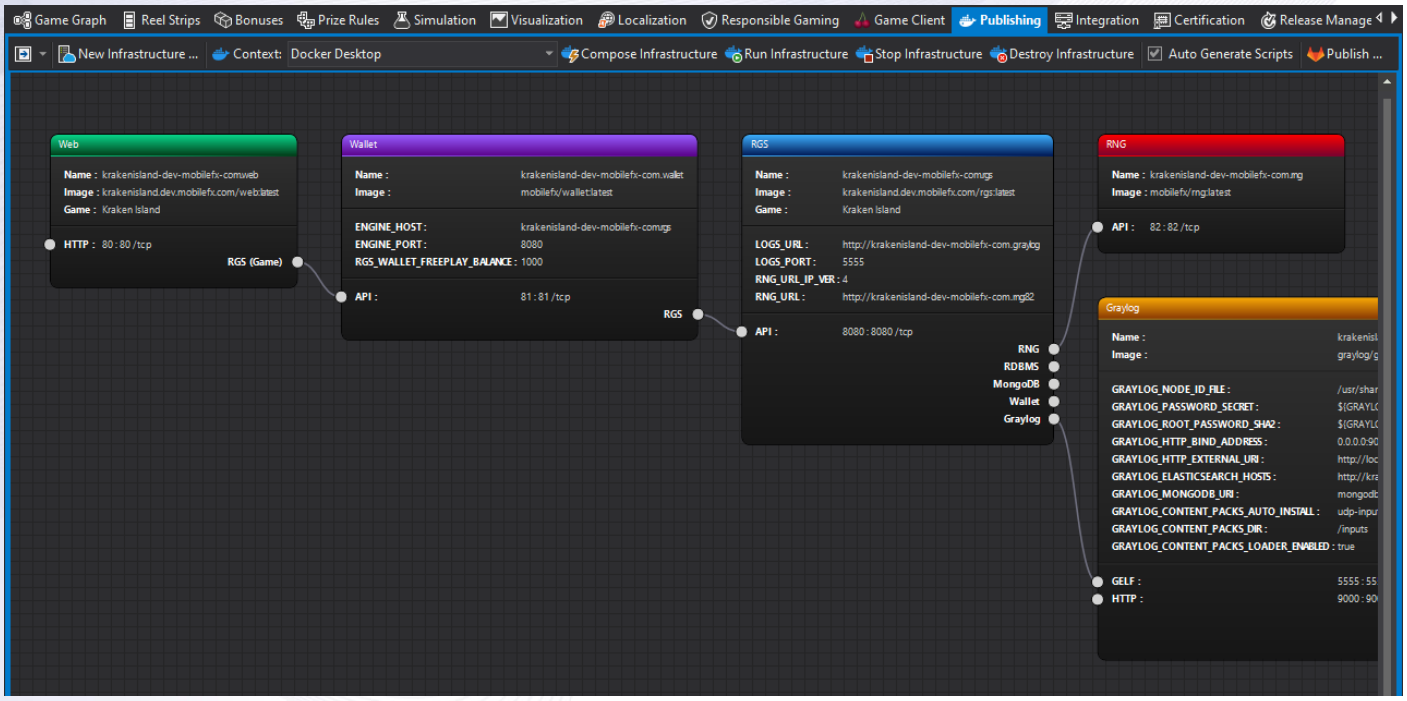
2.11 Tab 10 - Publishing Tool



Picture 69 - Publishing Tool, Infrastructure Profile Graph

Publishing Tool is used to design, interconnect endpoints and compose dockerized infrastructure topologies containing the necessary micro-services for running the game. Additionally, the tool can be used to publish those micro-services to Publisher's Gitlab CI/CD pipelines. The tool is designed around the concept of an **'Infrastructure Profile'** that defines all the micro-services necessary for composing and publishing your game and deployment settings. With Publishing Tool, you can add the following micro-services in your infrastructure topology:

- **RGS:** the remote game server hosting math game engines.
- **Web:** the web server micro-service hosting the game client, such as Unity3D WebGL HTML files.
- **RNG:** a PRNG implementation or PRNG proxy for fetching random numbers.
- **Wallet:** a Player Wallet Account Management system or a Wallet Proxy.
- **Graylog:** a log manager for collecting, centralizing, indexing, and analyzing data.
- **Elastic Search:** a search and analytics engine.
- **MongoDB:** a no SQL database.
- **MySQL:** an RDBMS database.

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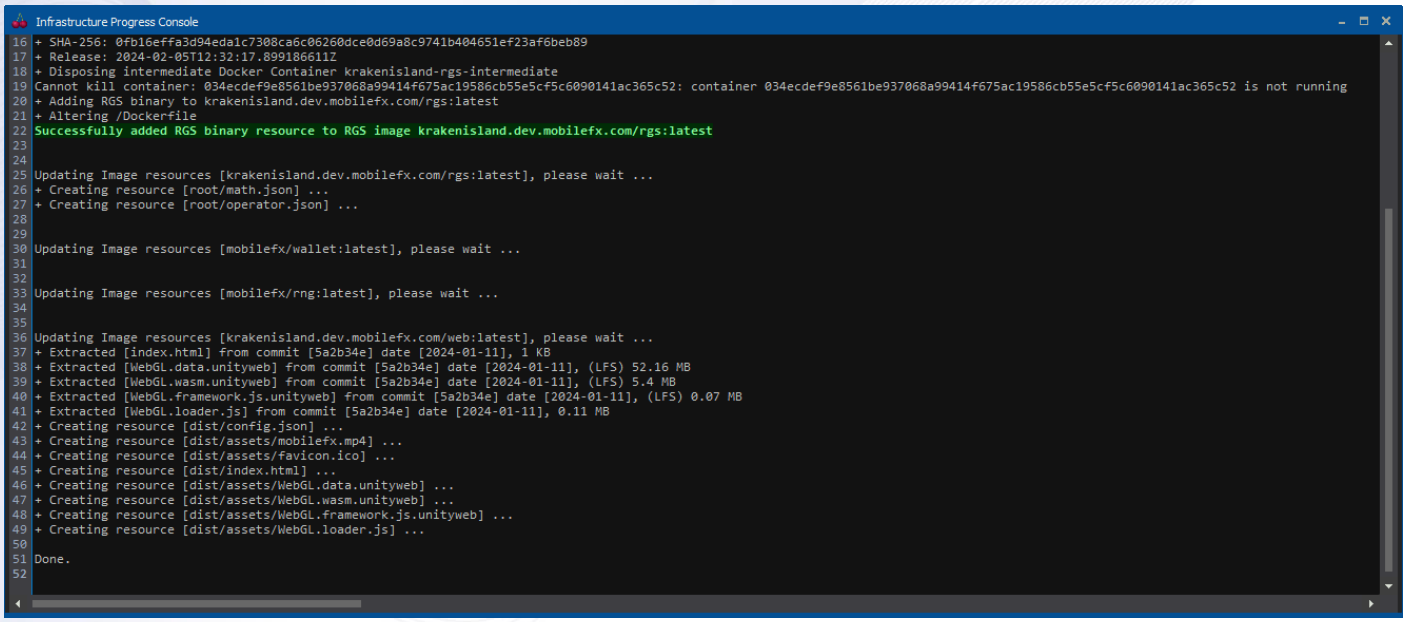
When you select an Infrastructure Profile, the IDE renders it as a graph of interconnected docker containers. Each container references a docker image and exposes its ports on the left and a list of required and optional services on the right. For example, the RGS node exposes its API on TCP port 8080 and requires a connection to an RNG node to operate properly. Yet, other nodes such as RDBMS and Graylog are optional, and RGS would work without those services linked to it.



Picture 70 - Create and Initialize Infrastructure Profile

A typical continuous development scenario requires that you click the '**New Infrastructure**' button to obtain any changed game client files and regenerate the Dockerfiles of your infrastructure…

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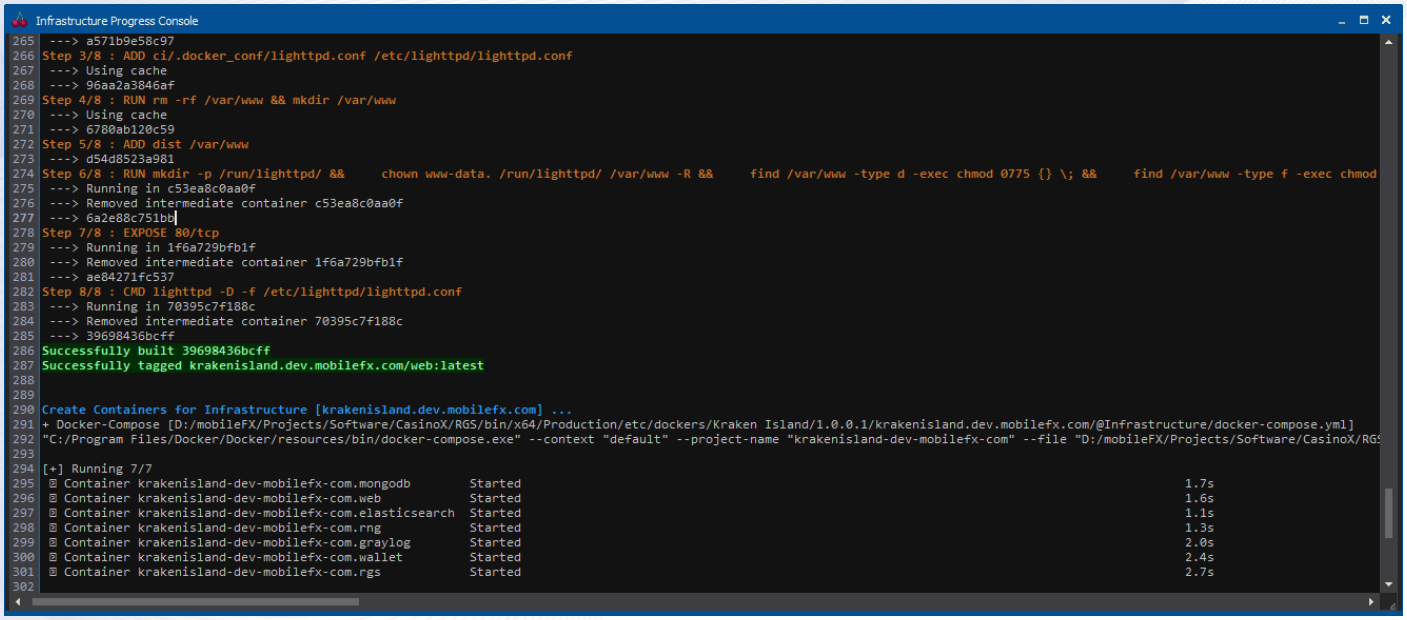
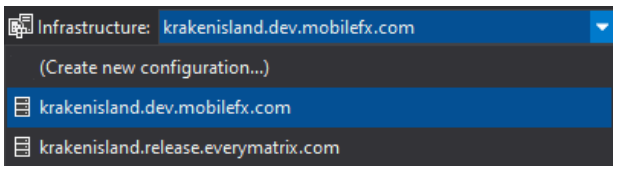


Picture 71 - Compose Infrastructure

... and then click the '**Compose Infrastructure**' button to compose the selected infrastructure profile on the selected docker context. The IDE expects you to have **Docker Desktop** installed on your PC and it uses docker API to operate on local or remote docker context. You can manage docker contexts from the Tools > Options menu in main menu.



Picture 72 - Infrastructure Profile Selection

Typically, you would have a **development profile** and a **release profile** per Content Aggregator or Publisher. After you compose an infrastructure, to test a game on your local HTML5 browser, you can click the **'Launch Game Client'** button on the main toolbar. Or if you want to test the game on a smartphone or tablet device, click the **'Game Client URL QR code'** button and scan the generated QR. The browser and QR URL is generated from default game properties, that you can overwrite from the Integration Tool.

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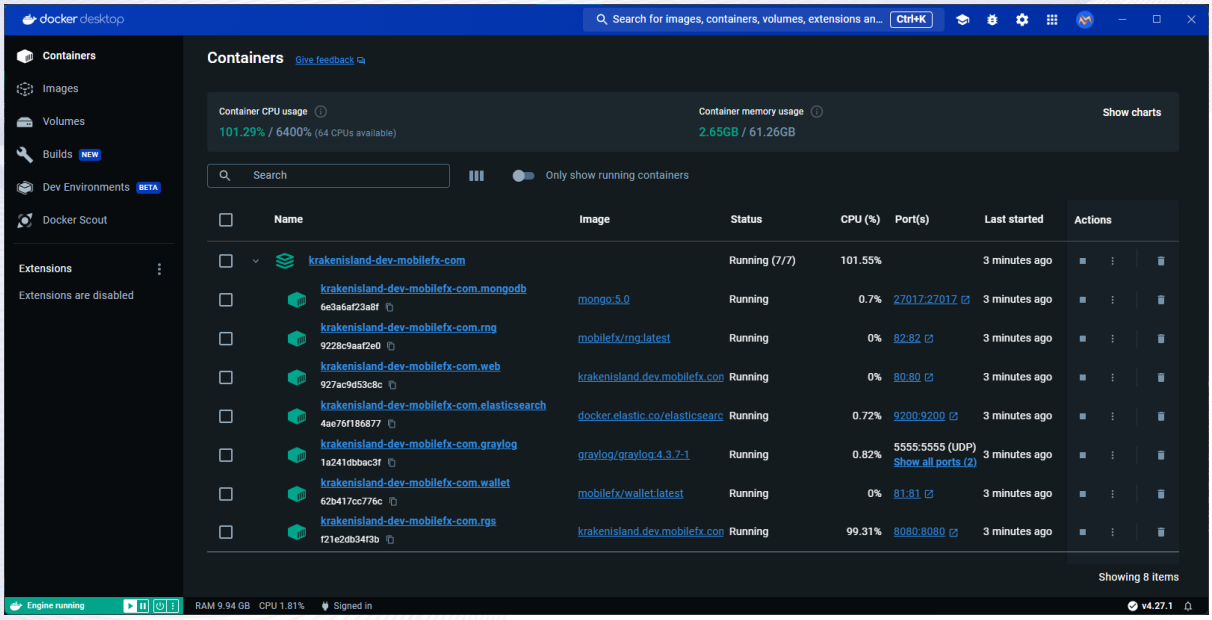
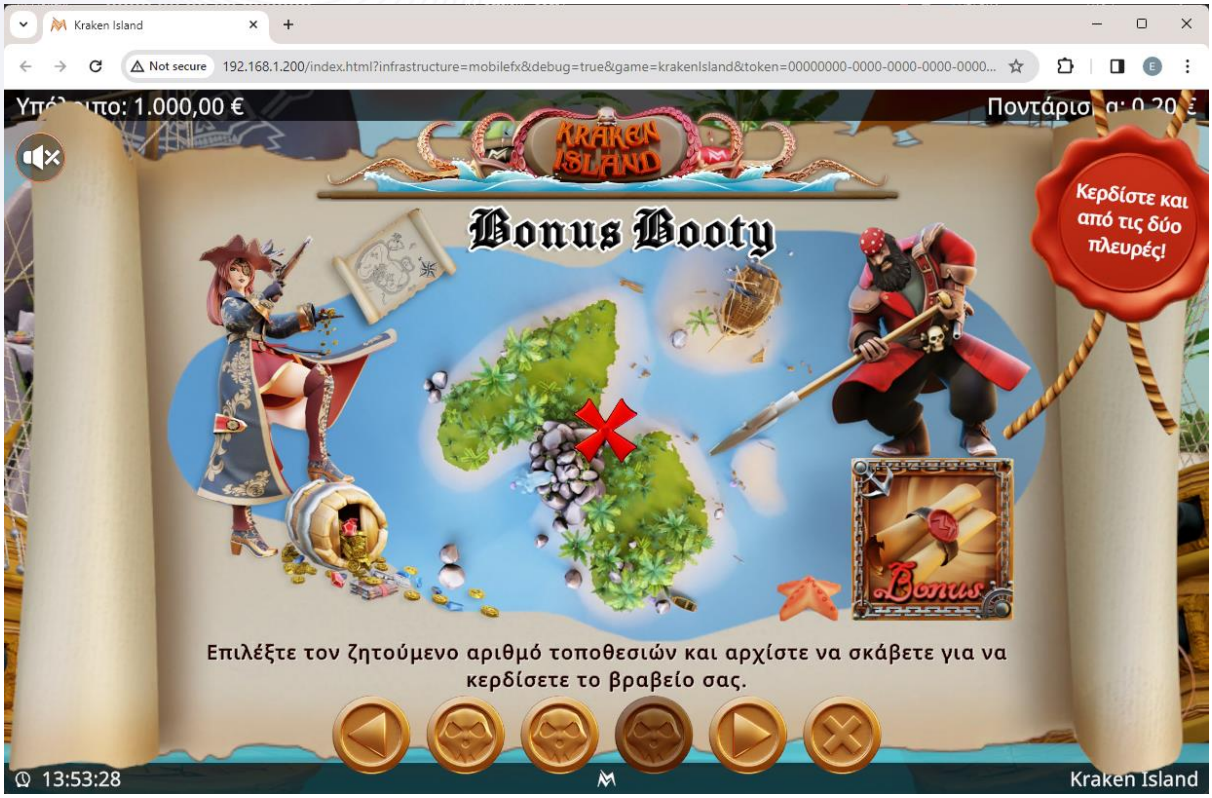


Picture 73 - Docker Topology of a Game System



Picture 74 - Running a Game from RGS Workbench in Chrome

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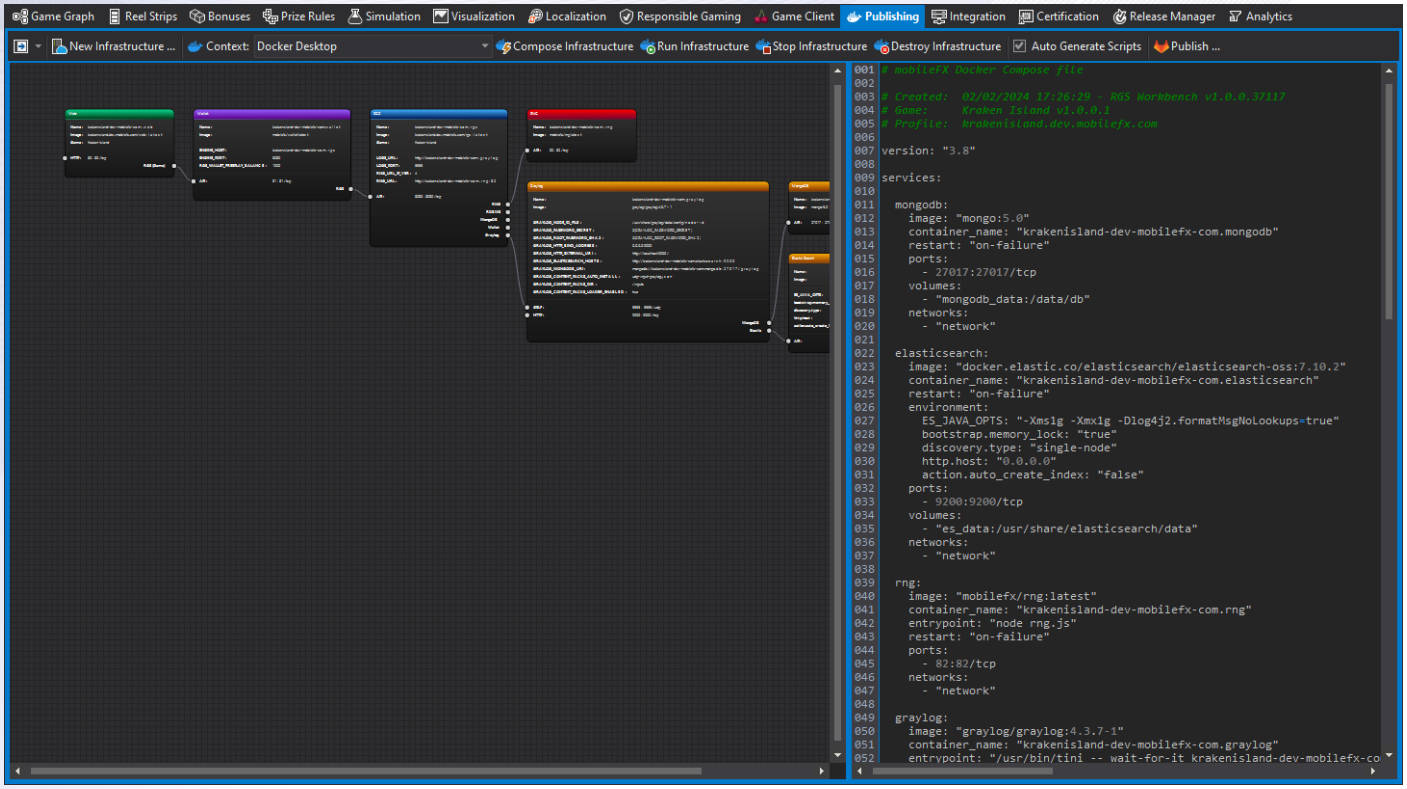
Workbench has a dedicated view associated with the Publishing Tool that enables the display of the **Infrastructure Explorer** pane along with the Properties Explorer. Additionally, you can reveal a code editor by clicking the **Toggle Visibility.**



Picture 75 - Docker Compose Scripts Editor

By clicking on a docker container node you can edit in Script Editor its Dockerfile contents. Similarly in Infrastructure Explorer pane you can select any text file resources and edit them in Script Editor. Read-only resources controlled by Workbench such as config.json in web image or math.json in RGS image appear with a dark-red color.

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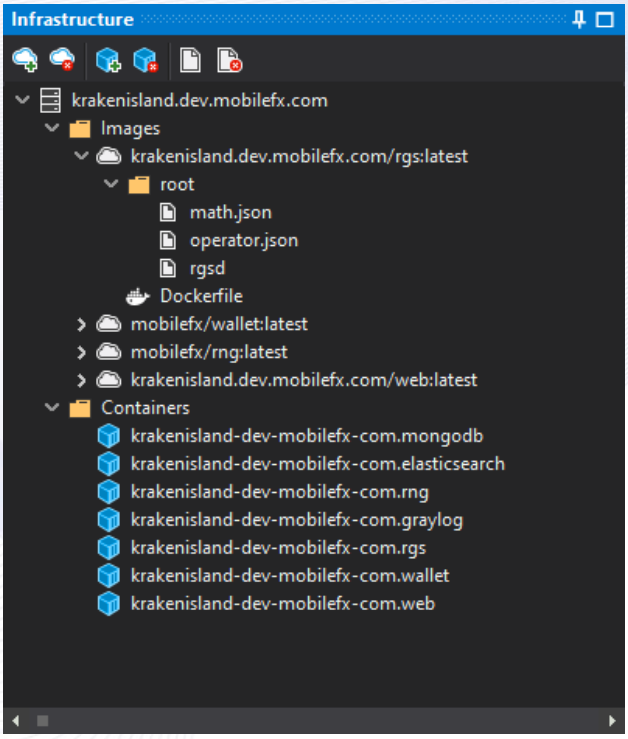

Picture 76 - Infrastructure Explorer

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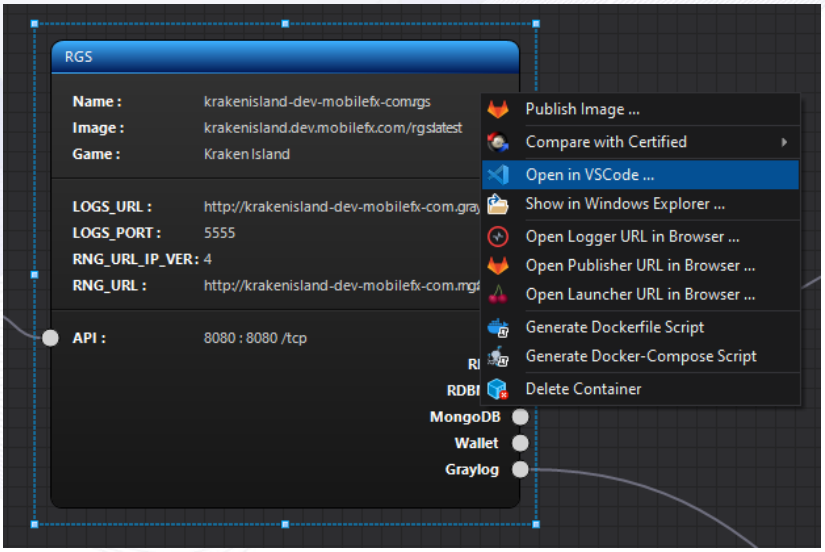
2.11.1 Debug RGS Infrastructure using Visual Studio Code

Publishing Tool enables you to extend Web Server, Wallet Server and RNG Server with Visual Studio Code. First you need to stop the micro service you want to debug in your Docker Desktop to avoid port conflicts. And then right-click on the container in the graph and select 'Open in VSCode'. The tool builds all the necessary files and configurations for starting the above services, and debugging them from Visual Studio Code.



Picture 77 - Debug Infrastructure Profiles with VSCode

Similarly, you can extend RGS assuming you have the source code loaded in Visual Studio 2022 Community Edition. To debug you should compile RGS as a console application and make sure you provide the math.json and operator json.files in the folder where rgs binary resides. A trick to generate math.json and operator.json is to click the Deployement ... Start RGS Server command in the main menu; this will generate the files in the Workbench folder where you should copy them from.

2.11.2 Publish your Game for first time!

Before you publish your game for the first time, you need to select a release Infrastructure Profile and link it with a Publisher. Normally a release infrastructure profile has only RGS and Web endpoints, as most publishers offer their own RNG, Wallet, Graylog and RDBMS endpoints. In most integration cases this is harder than it looks because you need to properly interlink your endpoints with publisher endpoints, but this is out of the scope of this video.

Workbench expects that when you publish your game you do so by uploading your game to a Publisher's GitLab account. GitLab offers reliable Continuous Integration and Continuous Development pipelines and is a commodity in game publishing business. However, if your Publisher is using a different or proprietary system, you would then need to publish your game outside Workbench.

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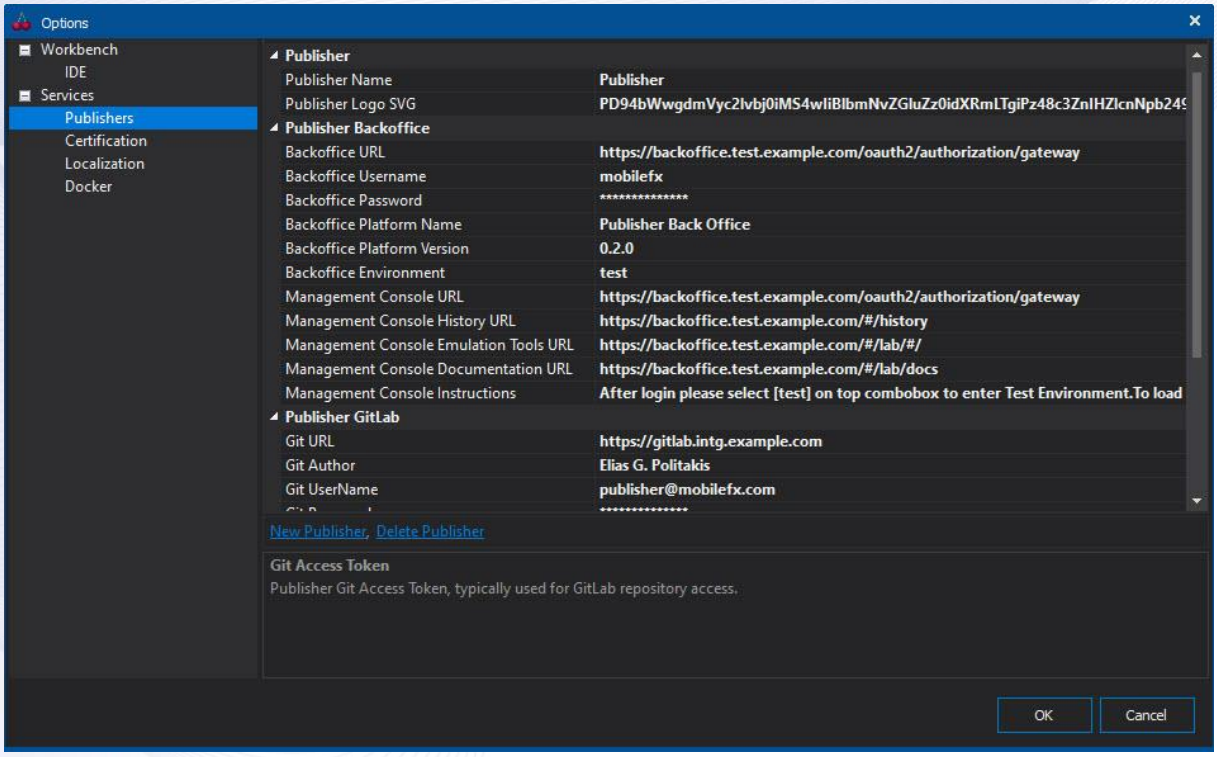

Picture 78 - Publisher Editor in Tools > Options

You can manage your Publishers from the Tools > Options menu, under the Publishers section. Click on New Publisher to create a new entry and define publisher properties. You should provide the SVG logo of your Publisher but most importantly you must define the GitLab properties. Assuming you have defined those, then select the release Infrastructure Profile, and from Properties Explorer pick the Publisher you want to link with this profile. Publisher properties are copied into your profile, so you can further customize them.

Next step is to link each endpoint of your game with a GitLab project URL. Typically, project URLs are pre-created and provided by your Publisher beforehand. Select your endpoint to load its properties in Properties Explorer and then set Publisher Git URL and Publisher URL by using the GitLab Project Browser dialog. This way you can be certain that you have the correct URL for your endpoint. There should be a different URL for RGS and Web. Publishers tend to call those front-end and back-end.

You are now ready to publish your game! Click on the Publish button. Workbench will make some last-minute sanity checks of your game, including analyzing the translations and performing font coverage just to make sure that everything is in place. Then the publishing progress dialog will appear, which actually runs git to upload your game. First it clones the publisher projects locally, copies your files over, commits and then pushes the game back to GitLab.

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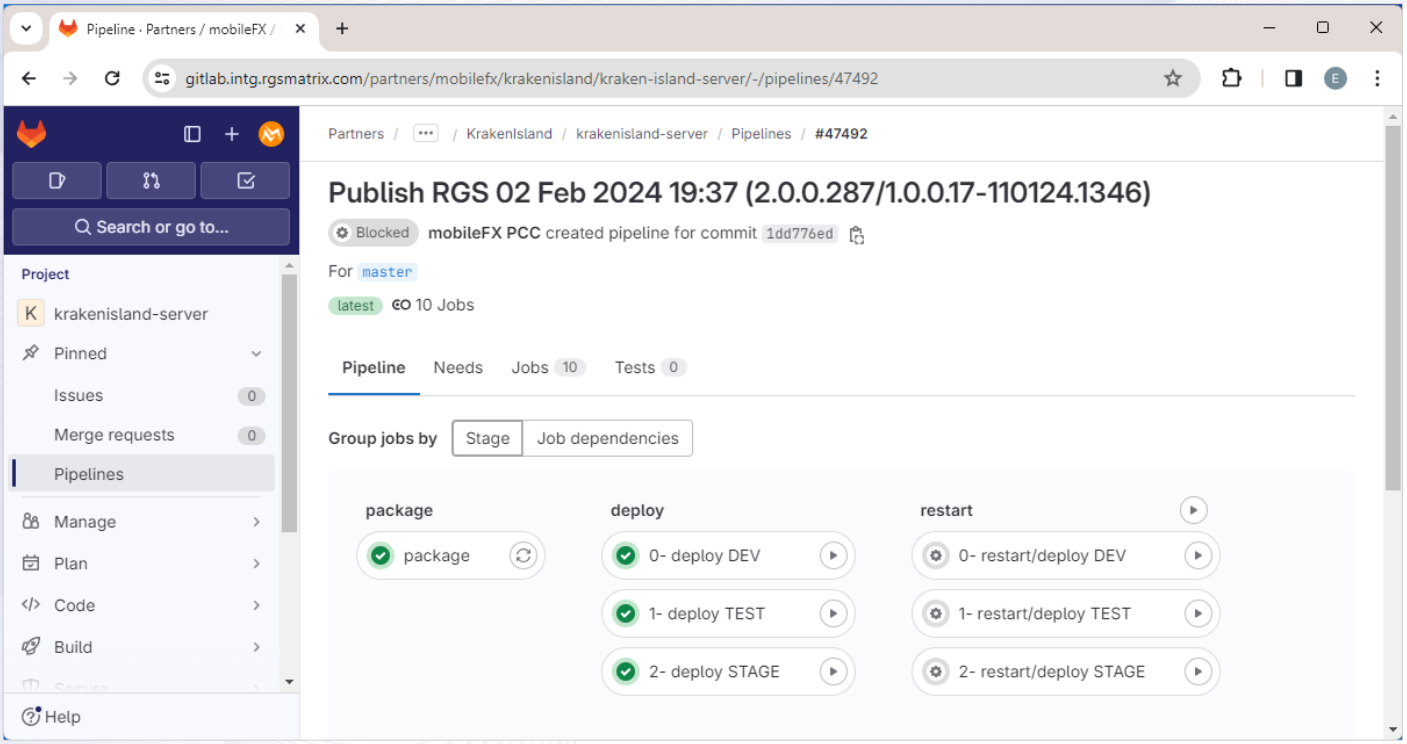

Picture 79 - Game publishing to Content Aggregator GitLab through CI/DP Pipelines

As soon as upload is complete, you need to logon to your Publishers GitLab to push the CI/CD pipelines. Alternatively, you can use Workbench Release Manager to do so. **And there you have it; your game is published!**

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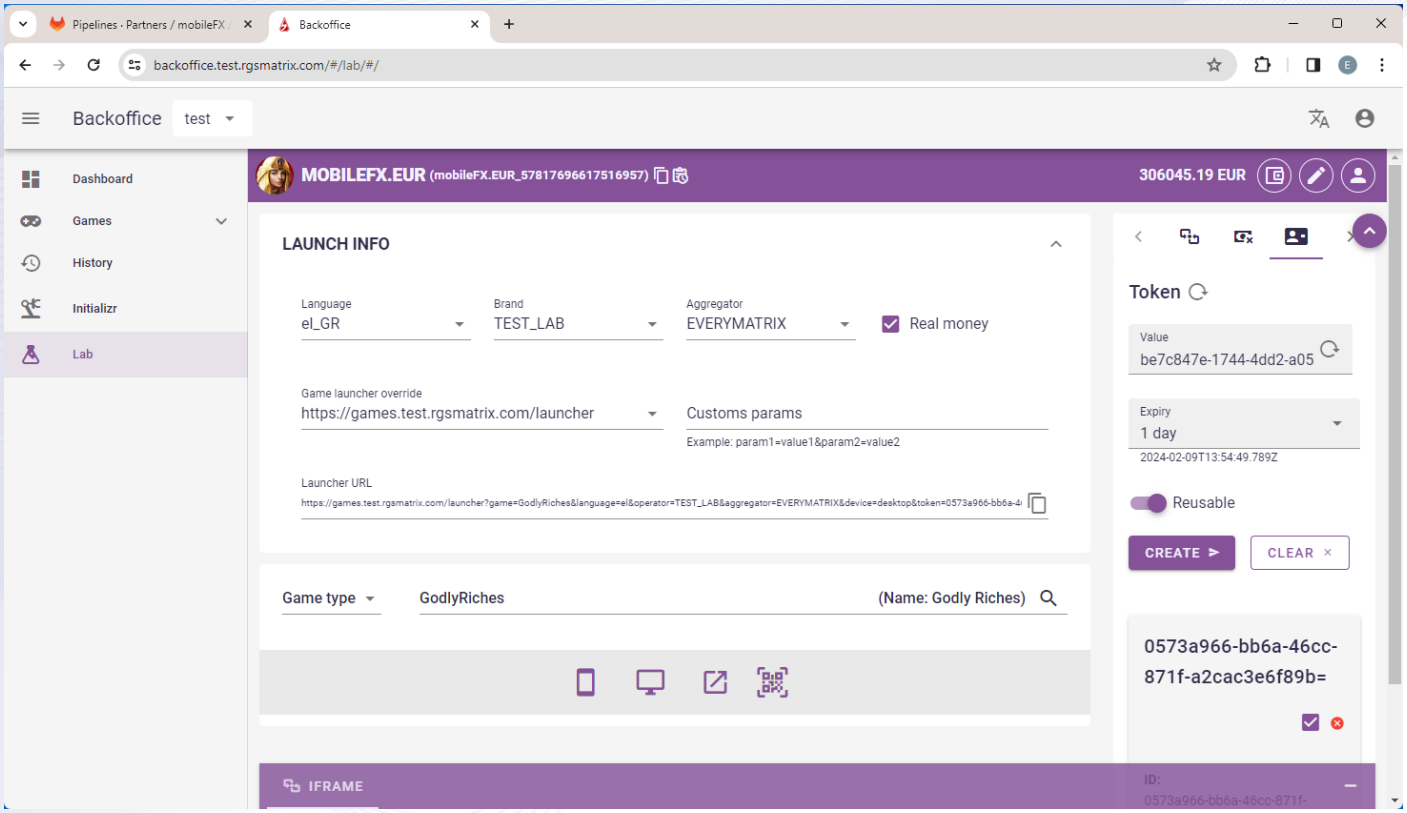

Picture 80 - Content Aggregator Games Management Console

Assuming your Publisher provides you with a Management Console or Backoffice you should access it to check your game and ensure that it integrates properly with your Publisher's infrastructure.

There are several utilities under the Certification Tool that should be handy for performing those tests. For example, you can push your Sample Plays or RNG rigs to your Publishers Backoffice before you start testing your game, create Test Accounts per language and currency and so on. We will talk more about those in the Testing and Certification chapter.

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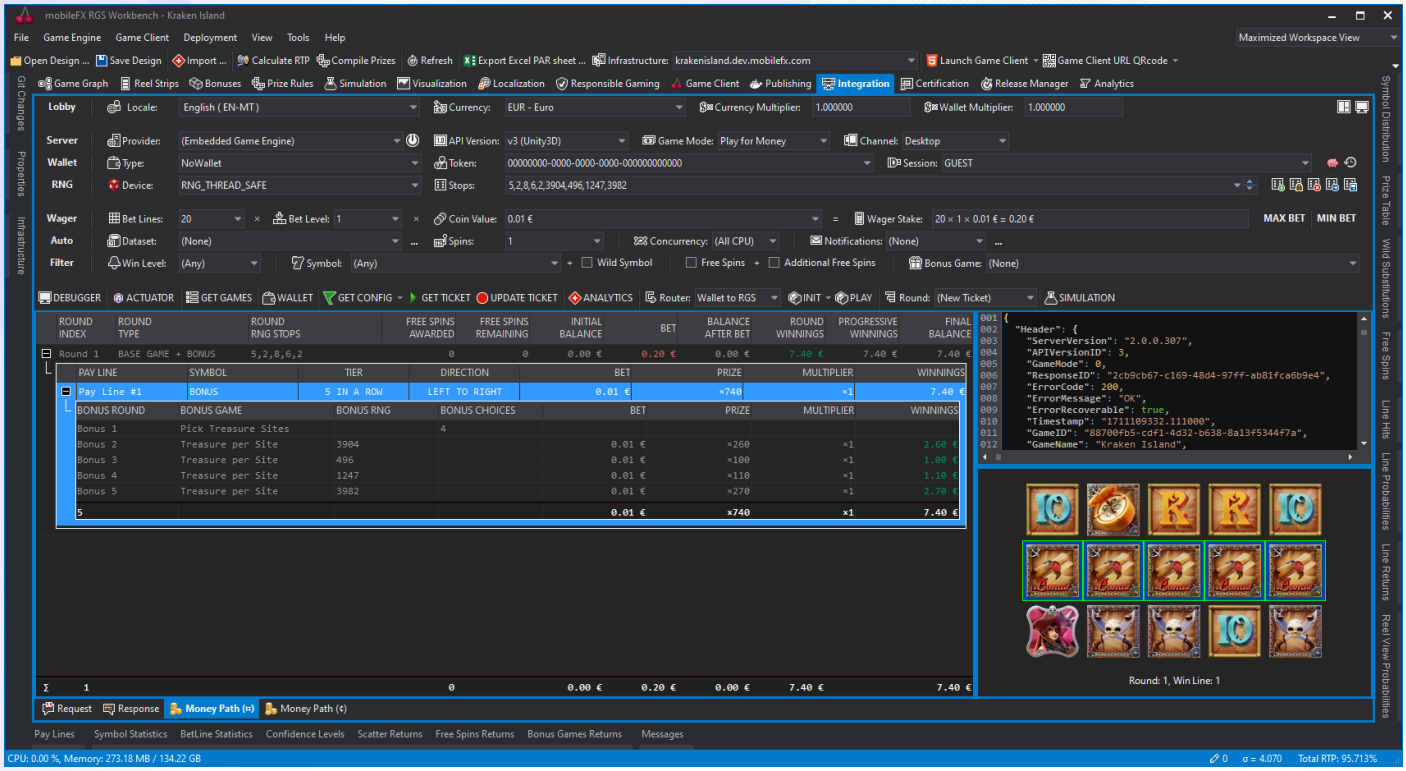
2.12 Tab 10 - Integration Tool

The 'Integration Tool' is designed to help you integrate your game with various endpoints like the Lobby, RGS, Wallet and RNG. It is like Postman but tailor-made for RGS infrastructures! The idea behind this tool is to emulate and investigate the API calls that your game performs against those endpoints, or the calls that the endpoints exchange with each other.



Picture 81 - Integration Tool

Furthermore, the tool can parse Graylog permalinks generated by the endpoints, and display request-response payload and data, thus enabling you to reproduce and investigate a problem. The tool has a dedicated toolbar per endpoint:

- From the **'Lobby Toolbar'** you can define game launching parameters such as Language and Currency.
- From the **'Server Toolbar'** you can select the RGS provider that will be serving bets.
- From the **'Wallet Toolbar'** you can overwrite the default wallet type and provide Player Token and Session ID.
- From the **'RNG Toolbar'** you can enable a specific PRNG device and select Play Samples to reproduce.

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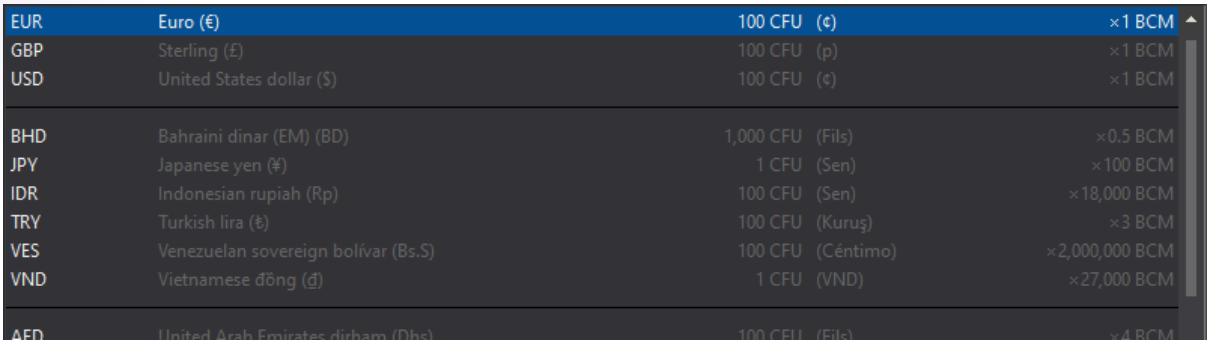
- From the **'Wager Toolbar'** you create your bet, or fix it to min or max bet. A nice little feature is that is calculates your bet both on selected and local currency, so that you have an idea how much your stakes worth in Dollars or Euros when you play with exotic currencies, such Rupees … or Bitcoins!
- From the **'Auto Toolbar'** you provide automation settings for certification simulation or stress tests.
- From **'Filter Toolbar'** you can define filters that will apply while fetching tickets. The tool will keep placing bets to the RGS provider until it finds one that meets your criteria.
- From **'Reports Toolbar'** you can fetch a list of available reports offered by the RGS provider and execute a report.

With all those toolbars the tool looks like a mess on small monitors; so you might need to budget a bigger monitor! To be honest the tool looks sharp on 2560 by 1440 pixels resolution.

Finally, on the command-bar menu located at the bottom, there are several menus and buttons, each giving you access to a specific endpoint API and API method calls, like: the Debugger API, the Actuator API, the Lobby API, the Wallet API, the RGS API, the Forward Wallet Proxy API and the Simulator API.

2.12.1 Integration Tool Use Case

To emulate a player starting your game, first you need to select your Locale which sets an initial Language and Currency. You can overwrite the currency by select the one you want to test. Bet Currency Multiplier and Wallet Currency Multiplier are automatically set. Currencies are grouped by CFU and sorted alphabetically.



Picture 82 - Integration Tool, Currency Selector

At the top of the currencies list we have placed common currencies followed by currencies that require special attention, either due to exotic exchange rates or non-standard currency multipliers.

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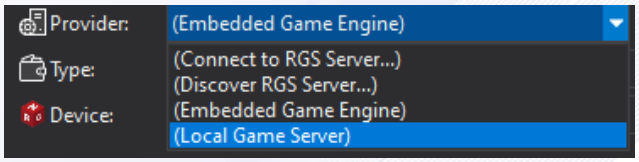
2.12.2 RGS Provider

An RGS provider is simply a host to an RGS server. To start a game and place a bet you need to select an RGS provider: this can be either the embedded RGS in RGS Workbench, or the local RGS of your dev Infrastructure Profile, hosted by Docker Desktop, or a remote RGS provider hosted by your Publisher, accessible by a public URL.



Picture 83 - RGS Provider Selection

RGS server implements a discovery service that if enabled it can announce itself to Workbench. Next you must select the API version used by your game client, the game mode and channel. Game mode controls if you are playing for money or if you are playing for fun. The Wallet type is automatically set by the selected Infrastructure Profile but you can change it by select one of the following interfaces:

No Wallet: this wallet type should be used for Publishers that implement a Forward Wallet topology. In this topology your game client implements the Wallet API rather than the RGS API and all communications go through the Wallet endpoint. The Wallet invokes your RGS game engine to provide game configuration data and to play a ticket. Typically those calls are implemented by an INIT and a PLAY method but each Publisher has a different name for them.

The idea behind the Forward Wallet topology is that your RGS is prevented from obtaining Player fiscal data such as balance. Thus, the No Wallet will generate a Ticket assuming zero balance and then your game client will combine the initial player balance with the generated Ticket. It is a very complicated circuitry and many things can go wrong. mobileFX has successfully implemented this circuit for Everymatrix Slotmatrix Wallet.

Stateless Wallet Base: this wallet type is a base class implementing the basic API of a typical Backend Wallet. The minimum methods a wallet must implement in order to integrate with our RGS are: Player Login, Balance, Debit, Credit and optionally Refund.

Stateless Wallet Proxy: this wallet type is a base class that should be used for implementing a proxy to a real Wallet system. It demonstrates the implementation of an adaptor that transcodes APIs between mobileFX and a proprietary Wallet.

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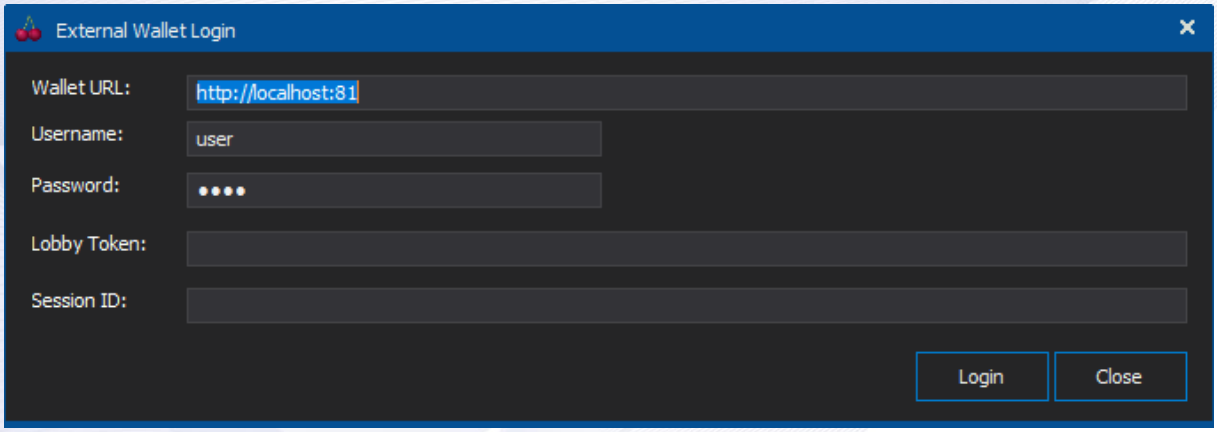

Picture 84 - Open Player Session through Stateless Wallet Proxy

Blockchain Wallet: this wallet type is a base class implementing a basic blockchain wallet API.

Depending on wallet selection, you might need to provide a **Player Token** and a **Session ID**. Player Token is an expiring impersonation token representing the Player across all endpoint communications and is generated and controlled by the Wallet endpoint. Similarly, the Session ID is used to identify the Player's current session. The relation is that a Player Token can have multiple Sessions.

2.12.3 RNG functors

The RNG type can be set only for **Embedded RGS Provider** and you can select one of the following:

- **RNG THREAD LOCAL:** instructs the provider to use a copy of mobileFX PRNG per thread. Each PRNG is different by seed.
- **RNG THREAD SAFE:** instructs the provider to use a singleton of mobileFX PRNG for all threads. This resembles a production environment where you would have a single PRNG device.
- **RNG EXTERNAL:** instructs the provider to use an external PRNG device and Workbench will ask you to provide the URL of this device. You can use this option to set your Publisher's RNG when you want to perform a Certification Simulation or if you want to debug the RNG API.
- **RNG FULL CYCLE:** instructs the provider to circulate across the Reels in an odometer manner in order to provide the stops for every combination of lines. This RNG is used to enforce Full Cycle during your integration tests.

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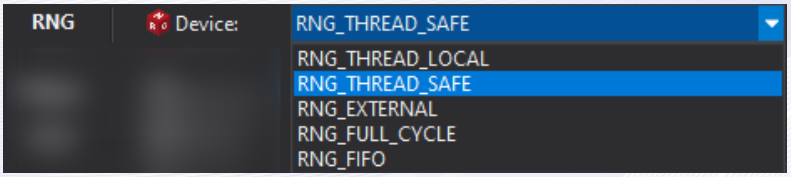
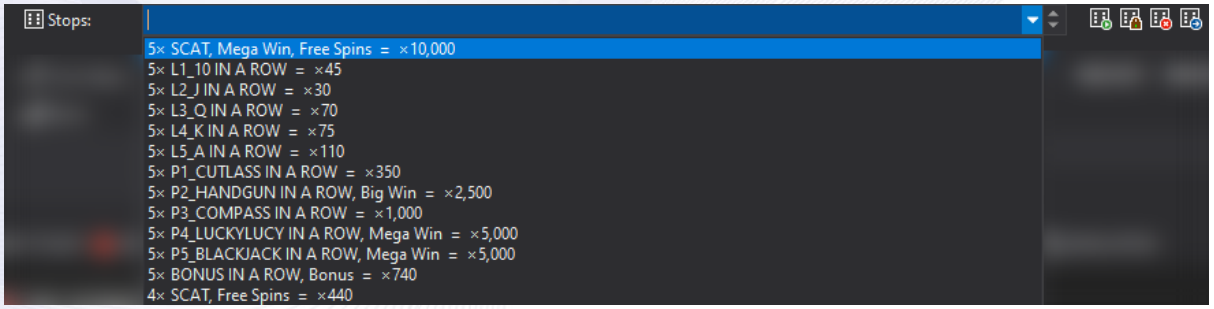
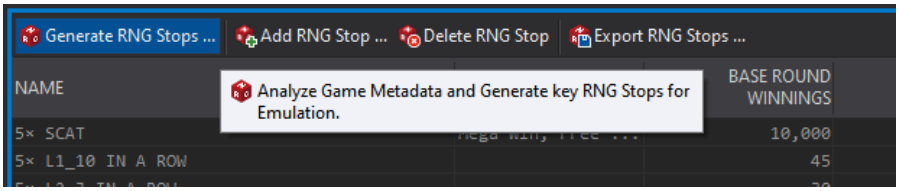


Picture 85 - RNG Functor Selection



Picture 86 - RNG Sample Selection

The '**Stops combo**' in RNG toolbar shows a list of **Play Samples** along with their win amounts. To use this feature, you must connect to the Debugger Service of an RGS provider. To generate play samples automatically you need to get to the Certification Tool, select the Play Samples tab and click on Generate RNG Stops button.



Picture 87 - Citification Tool – RNG Samples Generator

With the buttons on the right of the combo you can Push RNG stops to selected RGS provider, clear RNG queue, load RNG stops from current Ticket and save RNG stops as new Play Sample.

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2.12.4 Stat the Game Engine

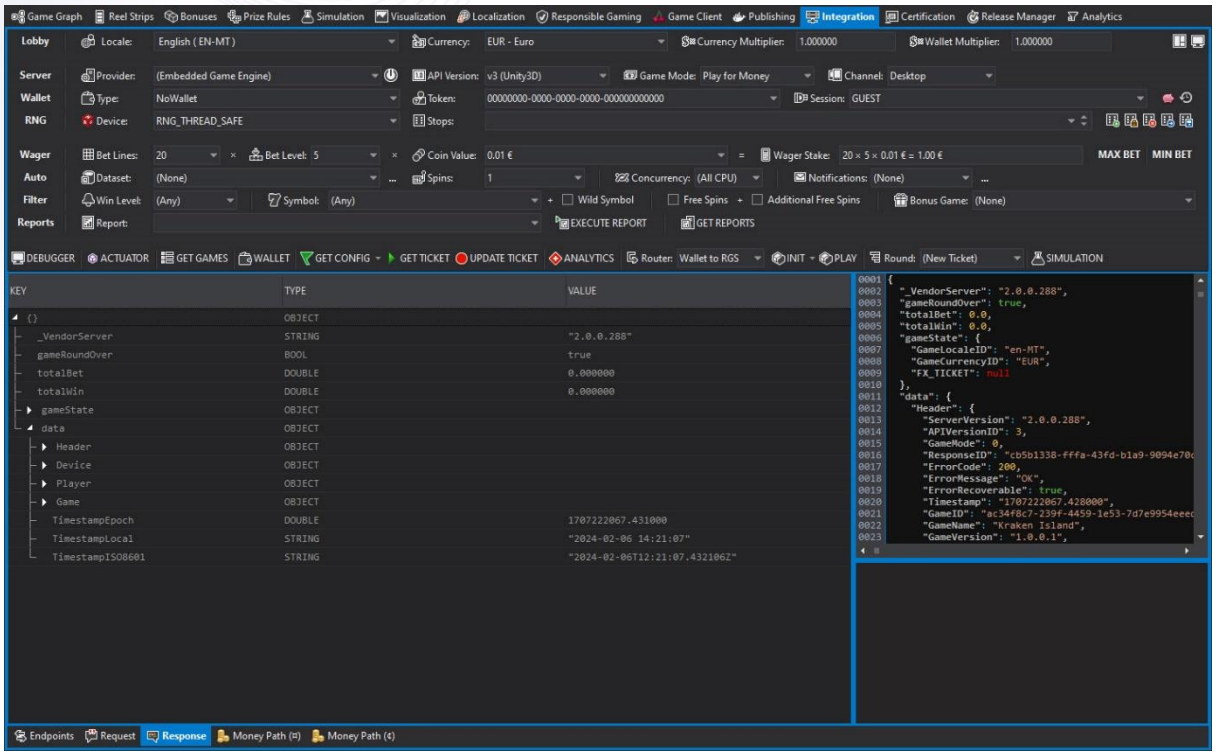
There are several ways to start a game:

You can press the **GET-CONFIG** button. This performs a call directly to the selected RGS provider using RGS API. This call works for all RGS providers.

If you are using a Forward Wallet topology then you have two options: You can select 'Wallet to RGS Router' and click the INIT button. This would perform a call to the selected RGS provider using the Forward Wallet API, as if our server was being invoked by a Forward Wallet. You can select 'Game to Wallet Router' and click the INIT button. This emulates the case where your game invokes the Forward Wallet, which in turn invokes the selected RGS provider. Both calls are using the wallet vendor API.

RGS provider will respond by providing the game configuration data. In the first case it will provide the data using the RGS API, and for the Forward Wallet cases it will inject the RGS API data inside a designated field available in wallet vendor API.

After you perform a GET-CONFIG you will see that several buttons are enabled. You can now define your **Wager** by selecting **Bet Lines, Bet Level** and **Coin Value**. The tool will calculate the stake in selected currency and will use exchange rate to present the bet in your currency.



Picture 88 - Integration Tool, GET-CONFIG result

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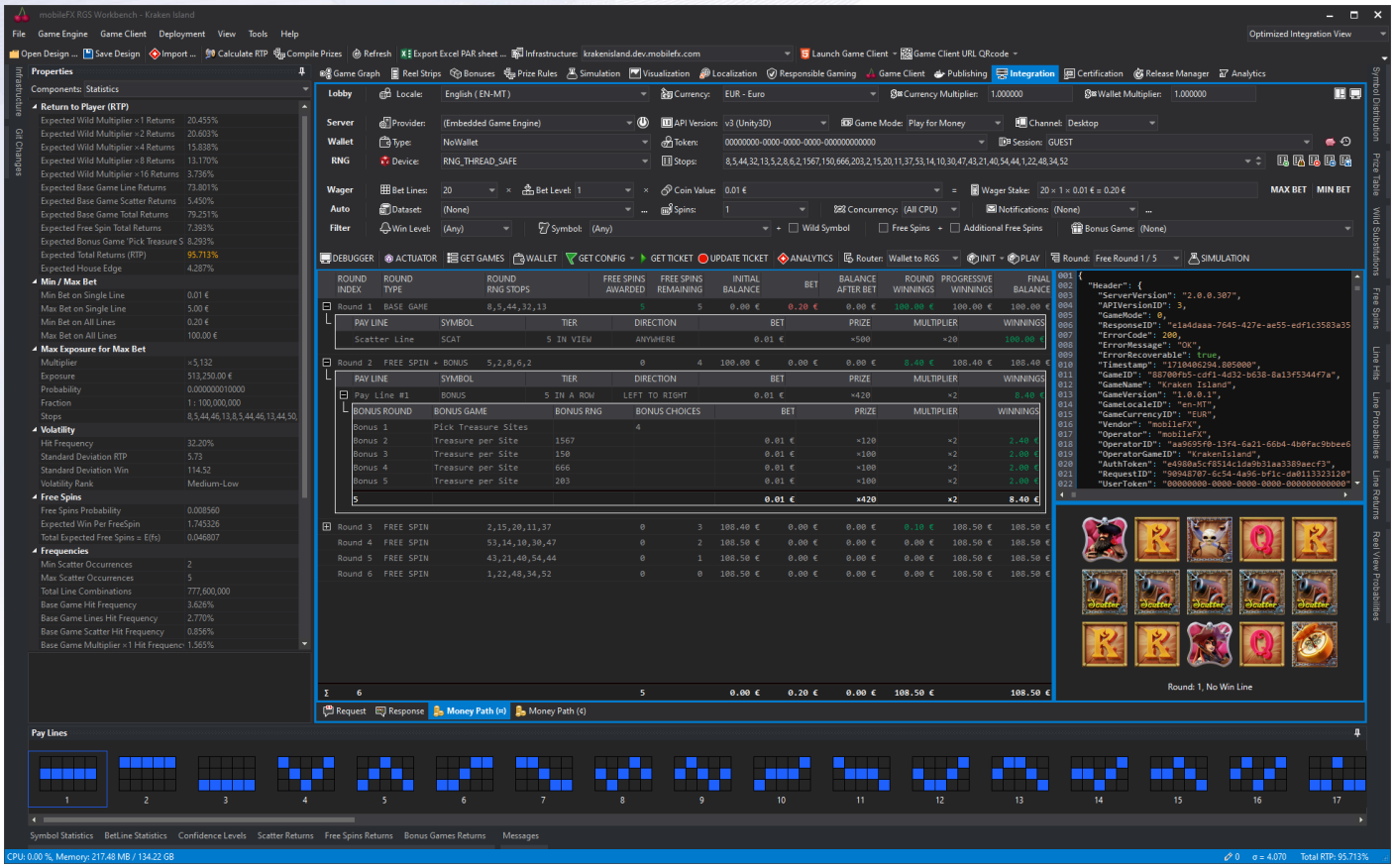
In analogy with GET-CONFIG, there are also several methods to place a bet and get a Ticket:

2.12.5 Place a Bet and fetch a Ticket

You can press the **GET-TICKET** button. This performs a call directly to the selected RGS provider using RGS API. This call works for all RGS providers.

If you are using a Forward Wallet topology then you have two options: You can select 'Wallet to RGS Router' and click the PLAY button. This would perform a call to the selected RGS provider using the Forward Wallet API, as if our server was being invoked by a Forward Wallet. You can select 'Game to Wallet Router' and click the PLAY button. This emulates the case where your game invokes the Forward Wallet, which in turn invokes the selected RGS provider. Both calls are using the wallet vendor API.



Picture 89 - Integration Tool, GET-TICKET result

RGS provider will respond by providing a Ticket. In the first case it will provide the Ticket using the RGS API, and for the Forward Wallet cases it will inject the Ticket inside a designated field available in wallet vendor API.

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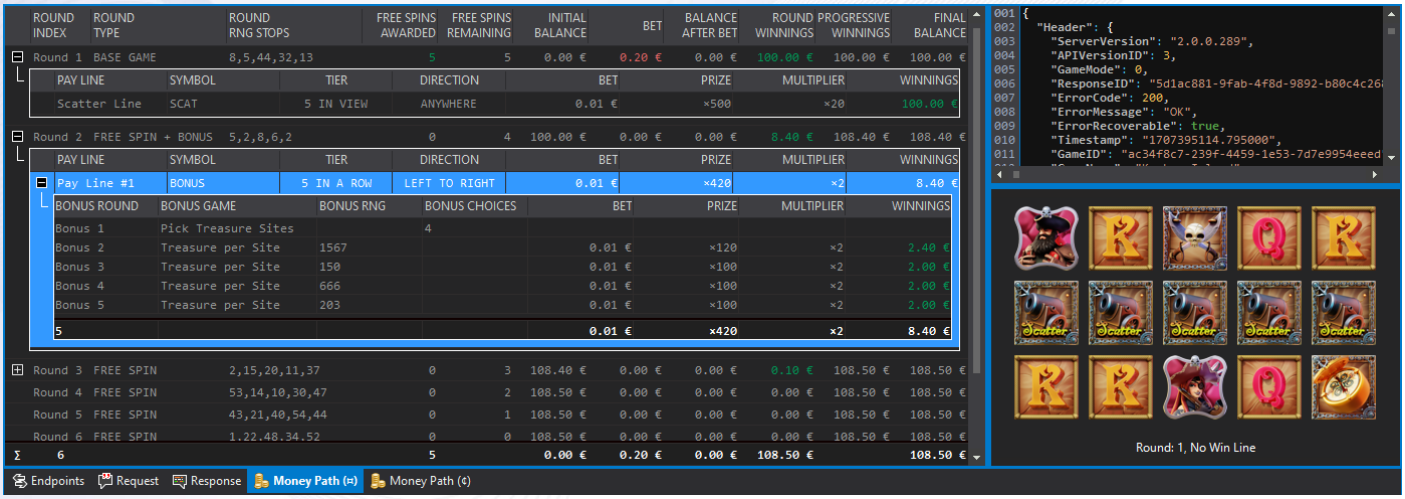
2.12.6 Money Path

When you fetch a Ticket, it will be displayed both in Tree View and Code View. By clicking a node in the Tree View, the Code View gets synchronized showing the node's text data. If RGS is configured to apply API compression, then the data are automatically de-compressed by Workbench. If you have provided Marketing Symbol Images in your game Symbol settings, the ticket renders as image. The image reflects the selected Ticket Round or Win Line selected in Tree View.



Picture 90 - Integration Tool, Money Path viewer

In Money Path view, you can filter ticket data by keeping only money-related information. In Money Path view, the ticket is presented as master-detail, where each Round is a master record. By expanding the master record, you can see information about Win Lines, and by expanding Win Lines you can see information about Bonus Rounds.

Money Path focuses on presenting how Player balance is affected. It starts with Player's initial balance and debits bet amount. Then begins crediting round winnings and free spins. If a bonus game is triggered then bonus rounds are credited too. The entire view is a balance sheet starting from player's initial balance up to player's final balance after the ticket is fully awarded to the player.

In order to visually award the entire ticket winnings to the player all ticket round animations must be viewed by the player. Otherwise, the player balance reflects the winnings up to the current revealed round. When the Player places a bet to fetch a ticket, RGS game engine generates the entire ticket rounds, including bonus rounds. RGS API takes advantage of REST semantics and uses a state variable to keep track of revealed rounds.

Each time a player propagates from one round to another, the RGS API is invoked to perform this propagation on the server and update ticket state.

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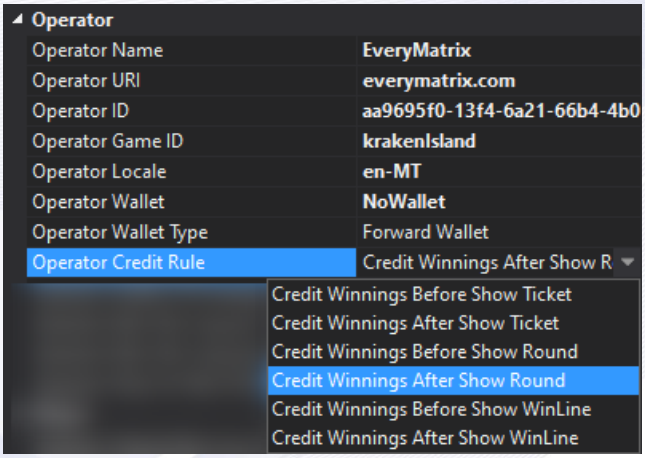

Picture 91 - Winnings Credit Policies

This reflects visual award of ticket winnings or in other words what the player sees on his screen. However, when it comes to crediting actual money to the player this is controlled by jurisdictional policies, which in turn are configured at Operator level in Workbench. For example, in some jurisdictions the entire win amount is credited to the player straight after the ticket is generated. While on other jurisdictions the credit is partitioned and awarded per round or even win line.

Depending on game settings, Money Path view is meant to reflect what the player sees.

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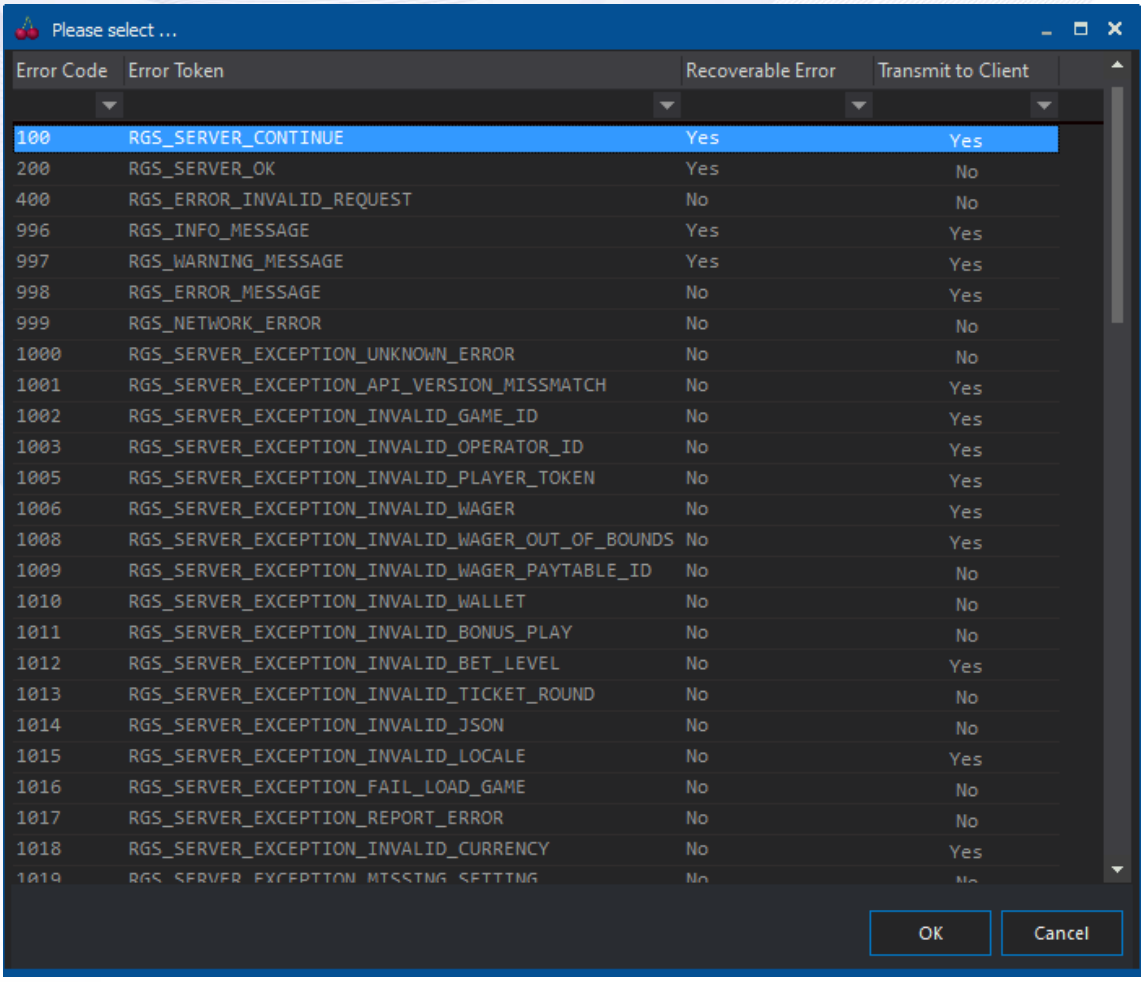
2.12.7 Other APIs in Integrator Tool Debugger API

RGS Debugger API is available to dev infrastructure only. It requires that you explicitly whitelist your IP address in Project Explorer, and enable the API before you compose the docker containers.



Picture 92 - Integration Tool, Exceptions Emulator Tool

The tool can connect with RGS debugger service. The debugger exposes two functions, the first is rigging the RNG in order to test special play cases, and the second is emulating errors in order to test stability of both the server and the game client.

Every possible or impossible error that can occur on the RGS server or the Game Client or the Wallet, are coded. Furthermore, every error has properties to indicate if it should be transmitted to the game client and if it is recoverable or not. For example, an insufficient funds wallet error should be recoverable, while a network error should cause the game to stop. For errors that should display a message to the Player, a Translation Token is reserved in Localization Tool.

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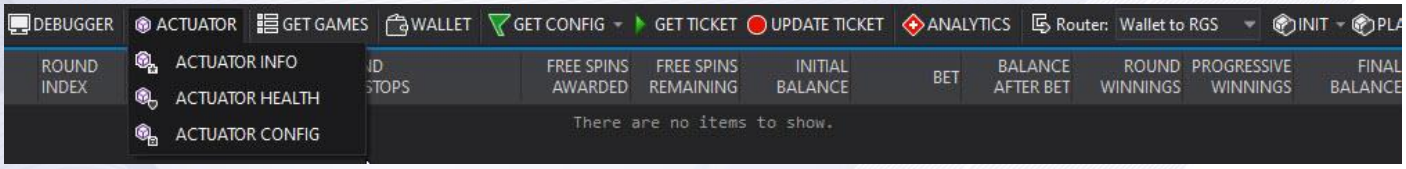
2.12.8 Actuator API

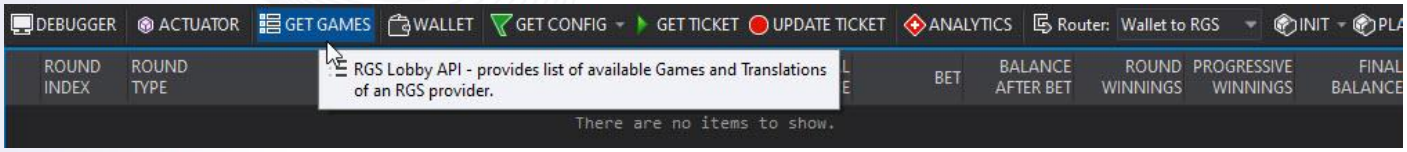


Picture 93 - Actuator API

Actuator API provides endpoints to query RGS server configuration and health. The API serves three functions:

- **GET INFO:** intended to return checksums of critical server and game engine files.
- **GET HEALTH:** intended to return status and uptime of server.
- **GET CONFIG:** intended to return the configuration of the server.

2.12.9 Lobby API



Picture 94 - Lobby API

This is a single GET GAMES call that return the list of games loaded in RGS provider along with Localization information.

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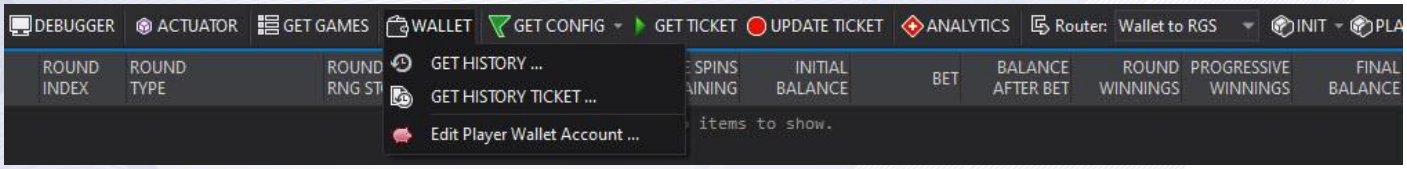
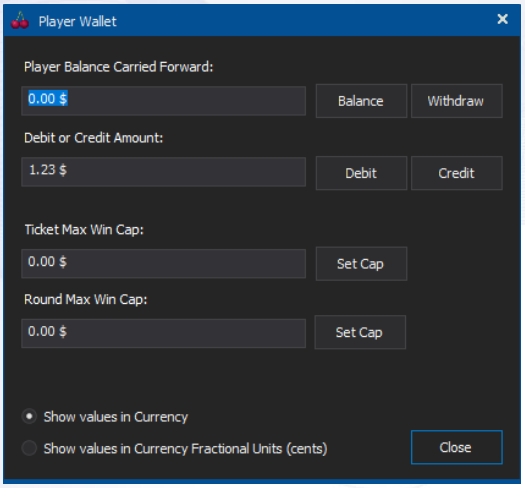
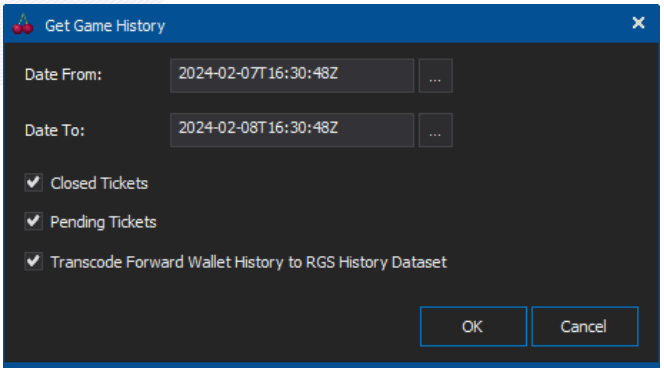
2.12.10 Wallet API



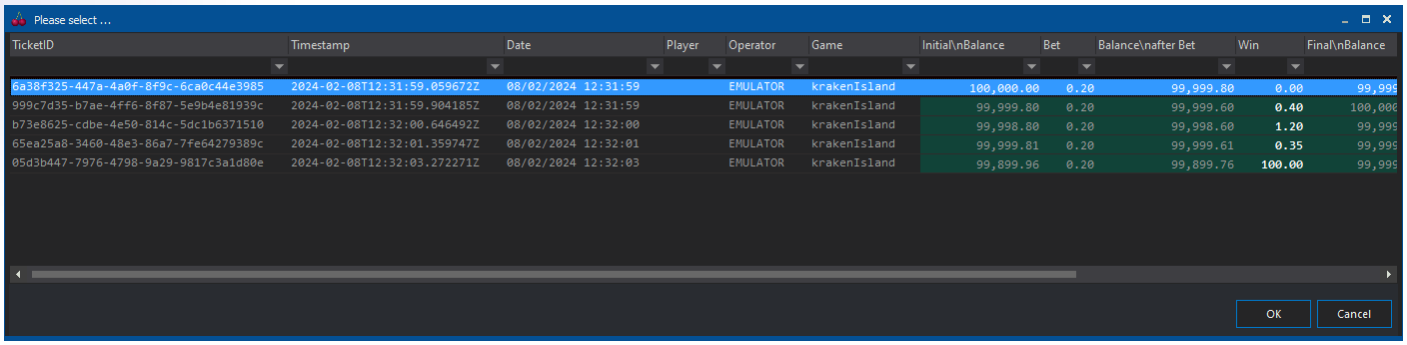
Picture 95 - Integration Tool Wallet API commands



Picture 96 - Integration Tool Wallet API interface Dialog



Picture 97 - Integration Tool, Wallet API History Dialog



Picture 98 - Integration Tool, Wallet API Tools, Player History List

Integration Tool integrates with Wallet API through commands and tools, assuming your Wallet offers a Backoffice API for development purposes. The expected API methods are: **Transactional Methods** for manipulating Player account such as GET BALANCE / SET BALANCE, GET HISTORY to retrieve list of Player spins for the Game, GET HISTORY TICKET to retrieve a specific Ticket.

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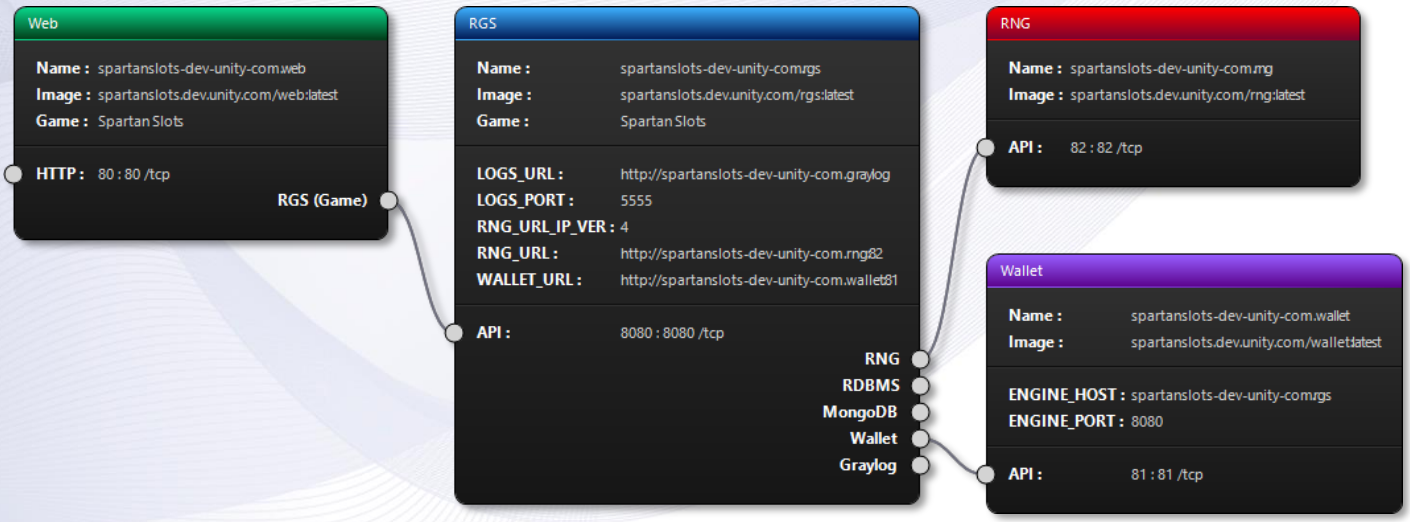
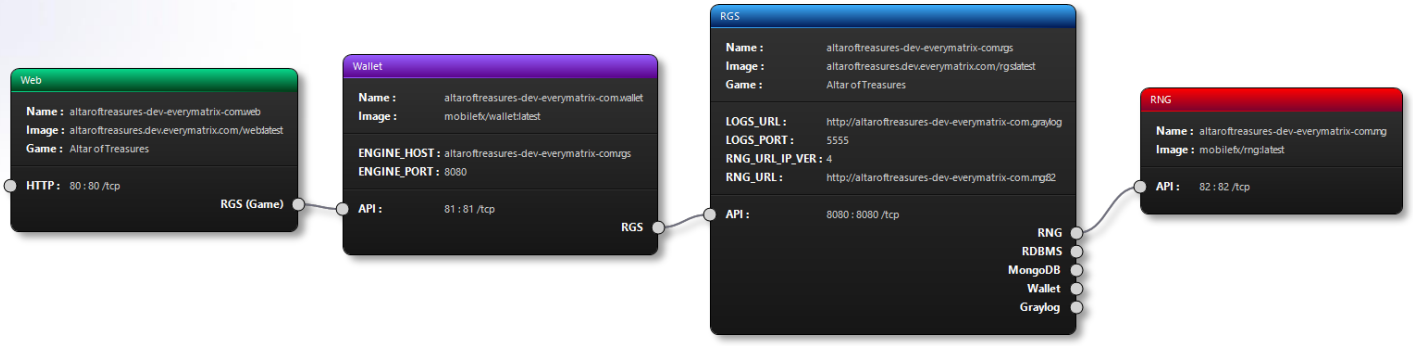
2.12.11 Backend Wallet Integration



Picture 99 - Integration Tool, Backend Wallet Topology

In a **Backend Wallet** topology, the RGS Server is placed in front of a Wallet, receiving Bet requests from Game Clients directly and interfacing with the Wallet through Transactional Methods (Debit, Credit, Balance, etc). In Backend Wallet architecture the Game Clients (Native or WebGL) can communicate directly with RGS API implemented by mobileFX Slot Unity3D Template.

2.12.12 Forward Wallet Integration



On the contrast, in Forward Wallet topology, the RGS Server is placed behind a Wallet. The Wallet receives Bet requests from Game Clients and forwards them to the RGS server. In Forward Wallet Architecture configuration, Game Clients must implement proprietary Wallet API calls and the Wallet must implement the RGS API. mobileFX RGS Workbench provides templates for Forward Wallet Proxy client and server implementation.

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mobileFX in the past integrated with a Forward Wallet, and even though we strongly discourage you from integrating with such Wallets, what we learned from this integration process might be useful to you:

- Make sure your integration with Forward Wallets is secure against Cyberattacks and use AI tools to analyze your integration end-points. Apparently, some well-known Forward Wallets do not even offer **Transaction Identifiers**, thus allowing replays of same rounds over-and-over, posing an open-door security risk for your Business.
- Make sure you enable Reels encryption so that your symbol distribution is not revealed to third parties.
- Make sure you enable RGS API compression to keep the state of a ticket as small as possible. Forward Wallets offer a way to store and restore ticket state, but often this storage is limited to a few kilobytes.
- Make sure language ISO codes are mapped properly between your RGS and Forward Wallet. For example, Chinese is zh-CN but a Wallet might introduce it as CN or even ZH. Those minor differences need special care.
- Make sure currency ISO codes are mapped properly between your RGS and Forward Wallet.
- Identify if your Forward Wallet API operates with primary currency or currency subdivisions. Make sure the Forward Wallet can handle any CFU (1, 100, 1000) and decimal places. You will be surprised to see well-known Forward Wallets treat JPY or BHD as 100 CFU currencies. Do exhausting tests of all supported currencies.
- Make sure you respect and test the Max Win Cap introduced by Forward Wallet or Operator.
- Make sure you respect the Max Bet introduced by Forward Wallet or Operator.
- Examine all currencies supported by your Forward Wallet against Bet Currency Multiplier and Wallet Currency Multiplier.
- Make sure you support the PLAY FOR FUN currency. Each Forward Wallet has a pseudo-ISO code for such currencies.
- Likewise, make sure you support any fidelity and loyalty currencies.
- **ASK FOR UPDATED DOCUMENTATION OF THE PROPRIETARY FORWARD WALLET API.** Unlike Transactional APIs that tend to be robust, Forward Wallet APIs get updated frequently adding features or removing support for existing features out of the blue, resulting in publishing delays, numerous regression-testing cycles and God forbid, a vast-array of recertifications of your games. From experience, all those costs add-up to a more expenses than game income!

Luckily Workbench and RGS SDK can handle all those issues successfully, but still consider the risks to your business.

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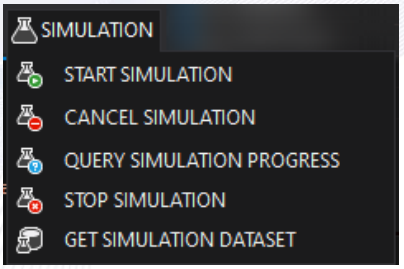
2.12.13 Certification Simulation API

Certification simulation on a production infrastructure with external RNG device can be rather slow. Certification Simulation API offers methods to query the progress of the simulation, cancel it, or obtain the simulation dataset. The RGS server implements SMTP protocol for sending the simulation as compressed zip file to you or to the Certification Authority!

The API is intended to be used on a production server in order to record a simulation requested by a Certification Authority. The API is built on top of GET-CONFIG and INIT methods to allow you to invoke it remotely on a production server. First you need to go to the **Automation** toolbar and define the simulation properties like the dataset format, simulation plays and notification settings.



Picture 100 - Certification Simulation API commands

Typically, you need about 1 million plays and the default dataset format is compressed CSV. Then you simply invoke one the specialized GET-CONFIG or INIT methods.

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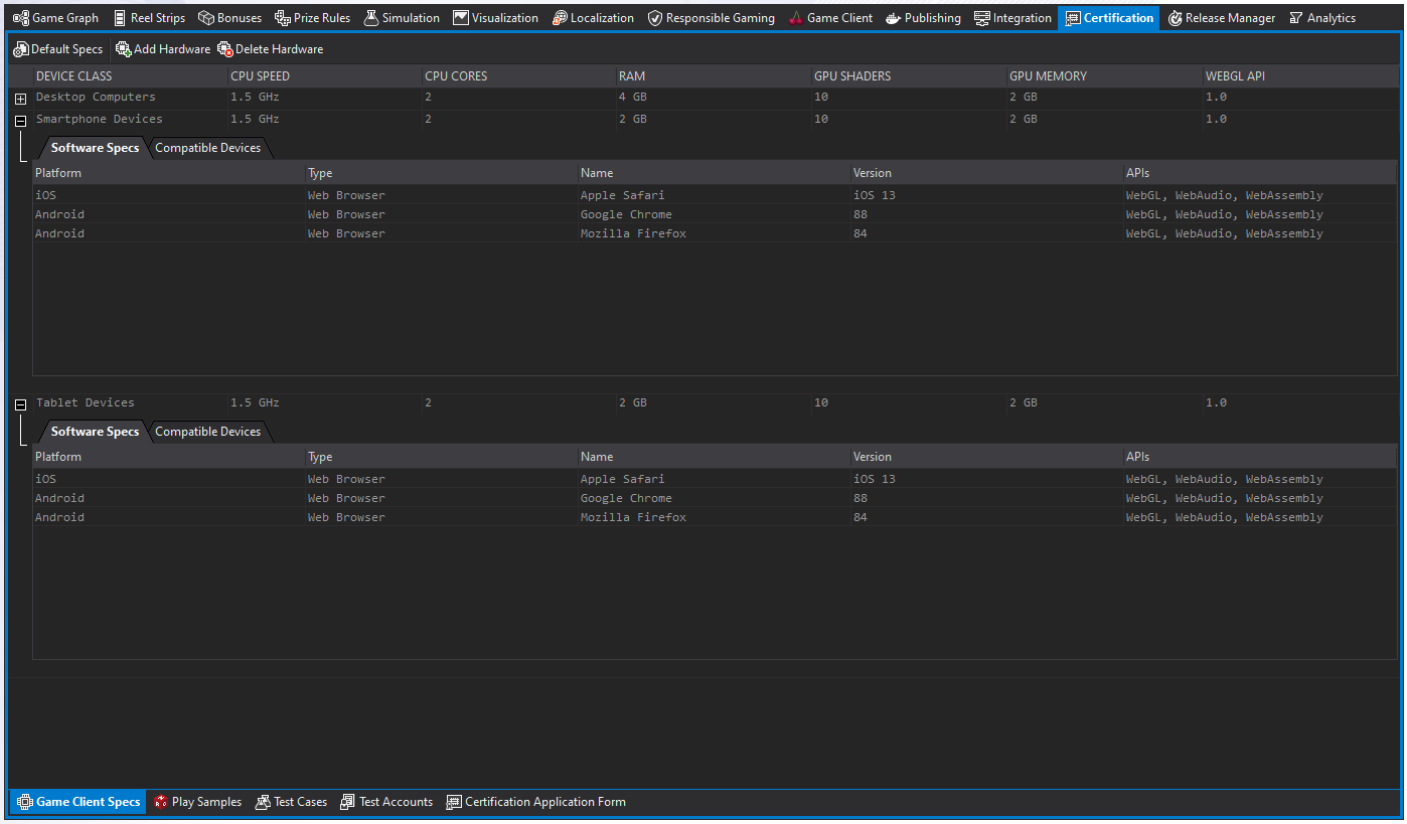
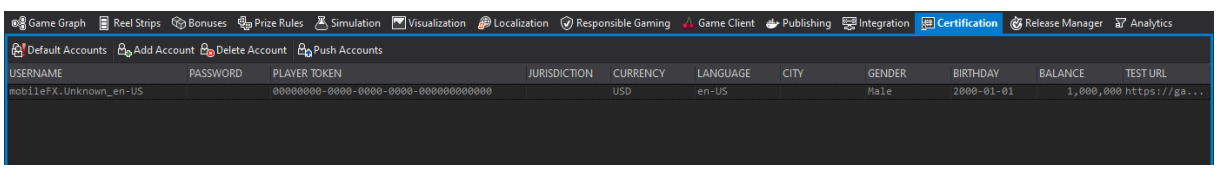
2.13 Tab 11 - Certification Tool

Next we will talk about the Certification Tool. Purpose of the **Certification Tool** is to organize and help you gather all the required information for certifying your game. The tool then compiles a **Certification Application Form** that you must submit to a **Certification Agency**. The tool offers the following editors:



Picture 101 - Game Client Specifications Editor

Gane Client Specifications Editor used for defining the software and hardware specifications of your game.



Picture 102 - Test Accounts Editor

Test Accounts Editor used for defining player profiles and accounts for the test and certification agents.

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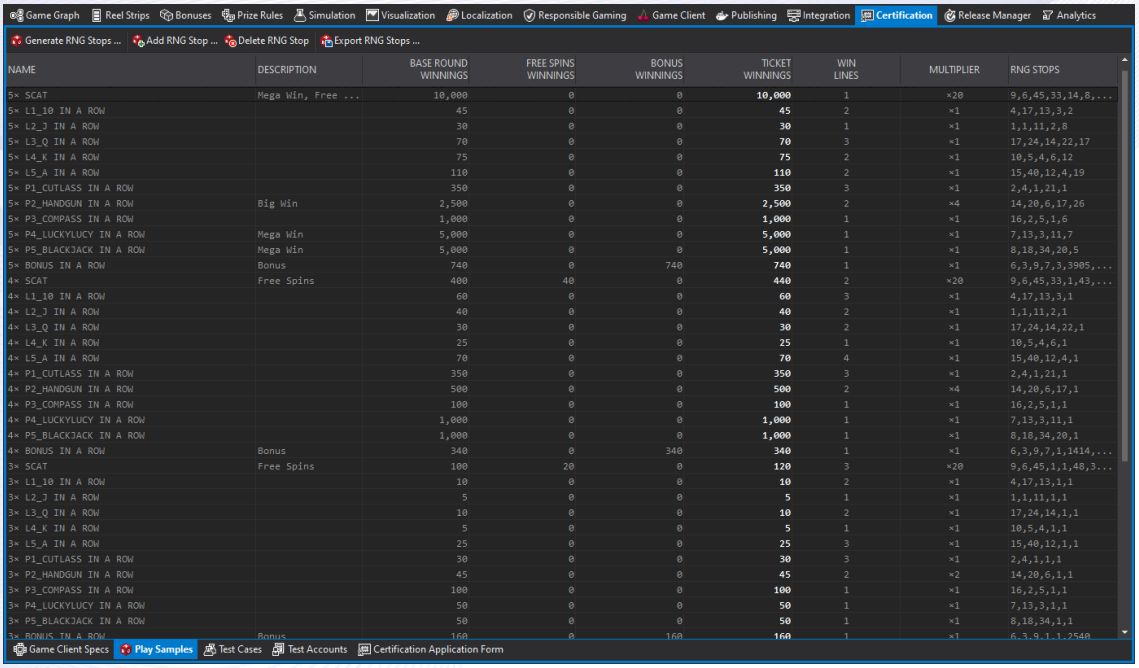
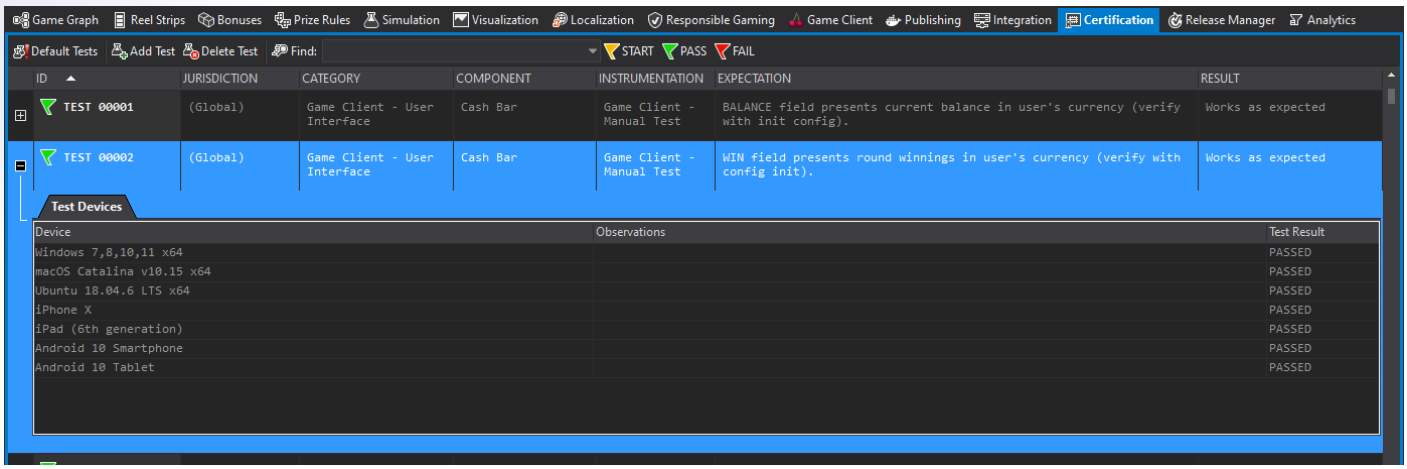


NAME	DESCRIPTION	BASE ROUND WINNINGS	FREE SPINS WINNINGS	BONUS WINNINGS	TICKET WINNINGS	WIN LINES	MULTIPLIER	RNG STOPS
5× SCAT	Mega Win, Free ...	10,000	0	0	10,000	1	×20	9,6,45,33,14,8,...
5× L1_10 IN A ROW		45	0	0	45	2	×1	4,17,13,3,2
5× L2_J IN A ROW		30	0	0	30	1	×1	1,1,11,2,8
5× L3_Q IN A ROW		70	0	0	70	3	×1	17,24,14,22,17
5× L4_K IN A ROW		75	0	0	75	2	×1	10,5,4,6,12
5× L5_A IN A ROW		110	0	0	110	2	×1	15,40,12,4,19
5× P1_CUTLASS IN A ROW		350	0	0	350	3	×1	2,4,1,21,1
5× P2_HANDGUN IN A ROW	Big Win	2,500	0	0	2,500	2	×4	14,20,6,17,26
5× P3_COMPASS IN A ROW		1,000	0	0	1,000	1	×1	16,2,5,1,6
5× P4_LUCKYLUCY IN A ROW	Mega Win	5,000	0	0	5,000	1	×1	7,13,3,11,7
5× P5_BLACKJACK IN A ROW	Mega Win	5,000	0	0	5,000	1	×1	8,18,34,20,5
5× BONUS IN A ROW	Bonus	740	0	740	740	1	×1	6,3,9,7,3,3905,...
4× SCAT	Free Spins	400	40	0	440	2	×20	9,6,45,33,1,43,...
4× L1_10 IN A ROW		60	0	0	60	3	×1	4,17,13,3,1
4× L2_J IN A ROW		40	0	0	40	2	×1	1,1,11,2,1
4× L3_Q IN A ROW		30	0	0	30	2	×1	17,24,14,22,1
4× L4_K IN A ROW		25	0	0	25	1	×1	10,5,4,6,1
4× L5_A IN A ROW		70	0	0	70	4	×1	15,40,12,4,1
4× P1_CUTLASS IN A ROW		350	0	0	350	3	×1	2,4,1,21,1
4× P2_HANDGUN IN A ROW		500	0	0	500	2	×4	14,20,6,17,1
4× P3_COMPASS IN A ROW		100	0	0	100	1	×1	16,2,5,1,1
4× P4_LUCKYLUCY IN A ROW		1,000	0	0	1,000	1	×1	7,13,3,11,1
4× P5_BLACKJACK IN A ROW		1,000	0	0	1,000	1	×1	8,18,34,20,1
4× BONUS IN A ROW	Bonus	340	0	340	340	1	×1	6,3,9,7,1,1414,...
3× SCAT	Free Spins	100	20	0	120	3	×20	9,6,45,1,1,48,3...
3× L1_10 IN A ROW		10	0	0	10	2	×1	4,17,13,1,1
3× L2_J IN A ROW		5	0	0	5	1	×1	1,1,11,1,1
3× L3_Q IN A ROW		10	0	0	10	2	×1	17,24,14,1,1
3× L4_K IN A ROW		5	0	0	5	1	×1	10,5,4,1,1
3× L5_A IN A ROW		25	0	0	25	3	×1	15,40,12,1,1
3× P1_CUTLASS IN A ROW		30	0	0	30	3	×1	2,4,1,1,1
3× P2_HANDGUN IN A ROW		45	0	0	45	2	×2	14,20,6,1,1
3× P3_COMPASS IN A ROW		100	0	0	100	1	×1	16,2,5,1,1
3× P4_LUCKYLUCY IN A ROW		50	0	0	50	1	×1	7,13,3,1,1
3× P5_BLACKJACK IN A ROW		50	0	0	50	1	×1	8,18,34,1,1
3× BONUS IN A ROW	Bonus	160	0	160	160	1	×1	6,3,9,1,1,2540

Picture 103 - RNG Samples Editor

Play Samples Editor used for defining RNG stops that are needed by certification agents to test borderline cases of your game. Those can also be generated by the tool automatically by analyzing the configuration of your game.



Picture 104 - QA Test Cases Editor

Test Cases Editor used for creating test and use cases of your game. Workbench can generate a default list for you. In absence of software such as Jira, you can use Workbench as PM tool for your QA.

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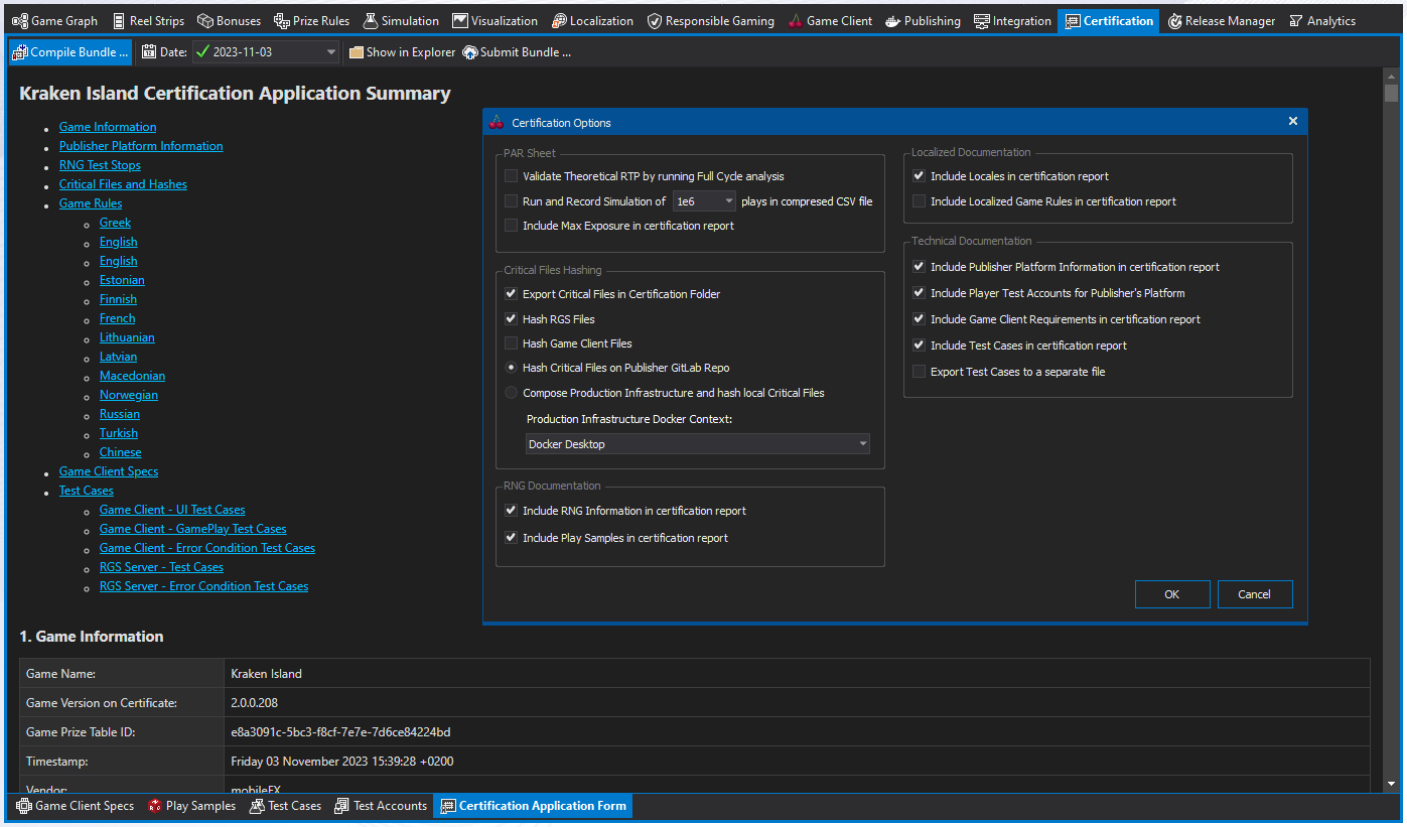

Picture 105 - Certification Application Form Generator Tool

Certification Application Form Generator gathers information about your game and compiles the Certification Application Form. The tool displays a dialog so that you can customize the sections of the form. This generator will download from your Publisher's GitLab repositories the critical files of your games and generate MD5, SHA-1 and SHA-256 hashes. Also, it will compile Game Rules into separate files and finally it will export an Excel form of the game's PAR sheet. Managing to get over this tool, means you are about to start making money from your games!

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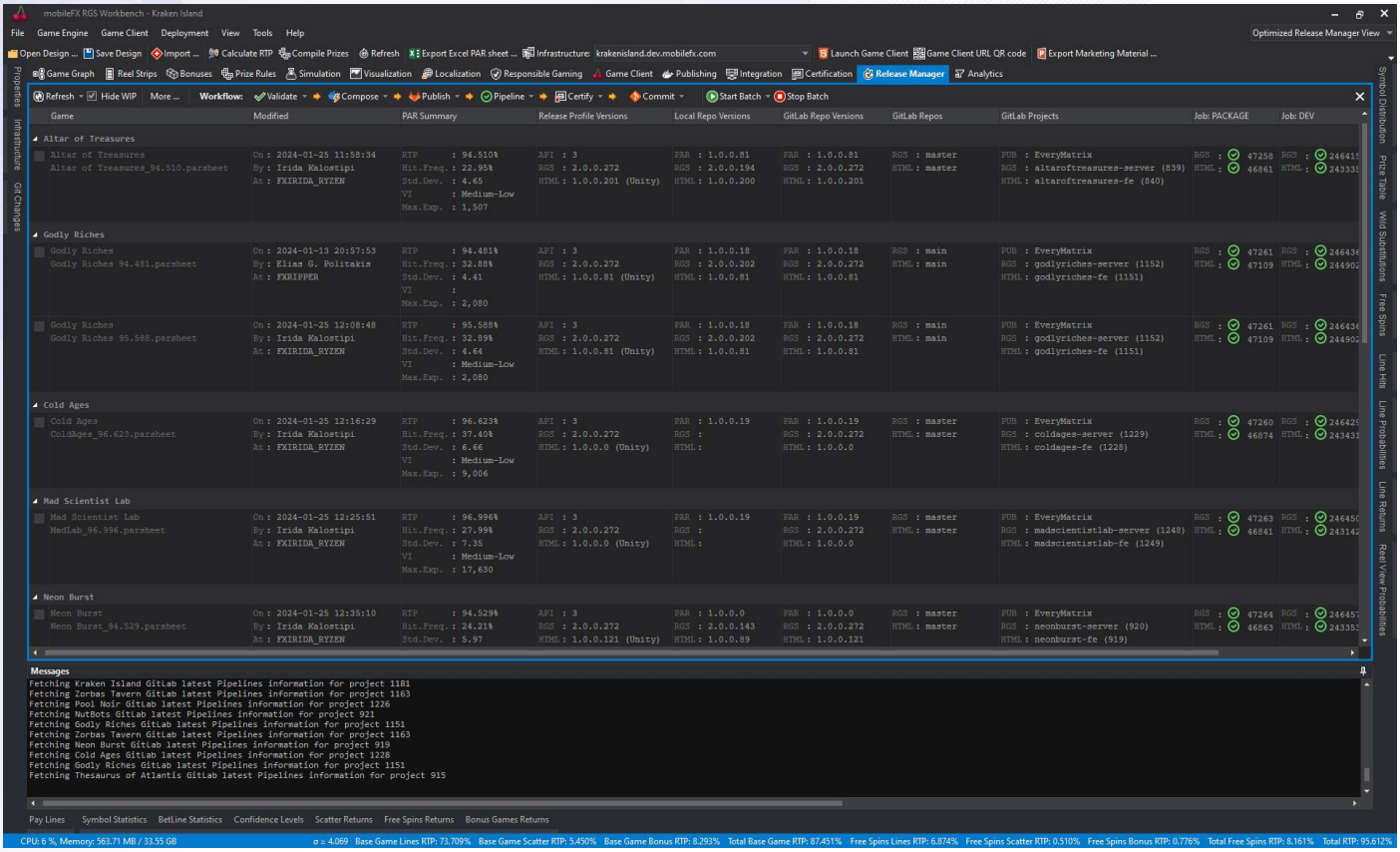
2.14 Tab 12 - Release Manager

Another tool is the Release Manager Tool that gives you an overview of your games, both published and under development. The tool groups games by name, so under one group you can have multiple variants of your game. Those can be RTP variants, Operator variants or Publisher variants.



Picture 106 - Release Manager Tool

The tool will extract a vast array of information about your game from anywhere it can. It will access your local game projects and your Unity game projects. It will access your local docker repositories and your Publisher's GitLab repositories, projects and pipelines. Finally it will also access the certification folders. With all that information collected you will truly get an overview of your games.

The tool displays a PAR summary per game, including RTP, Hit Frequency, Standard Deviation, Volatility Index and Max Exposure. It will also display the versions of the key ingredients of your game. Those are PAR sheet version, RGS server version and HTML game client version. Versions are presented for the Release Profile, Local repositories and Publisher GitLab repositories. This way you can instantly spot which published games need an update.

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Another handy display is those of Publisher GitLab pipelines status. You can instantly spot which pipelines have errors or need a push. Last but not least, the tool will verify if critical files on your Publisher's GitLab have the same hashes with those in your certification application forms!

Release Manager also implements a Workflow Engine. With the workflow you can Validate, Compose, Publish, push Pipelines, Certify and Commit to git, any number of games, all in batch mode. The Workflow is fully customizable, you can select which actions to perform, with many options per action.

Needless to say, we use this tool for our own games and it was designed and developed to make our lives easier!

Thank you for being a lovely audience and I hope my AI voice was music to your ears. In fact, I am a male fat developer and got assigned the tedious task to write this narration, so I tried to make it fun for all of us!

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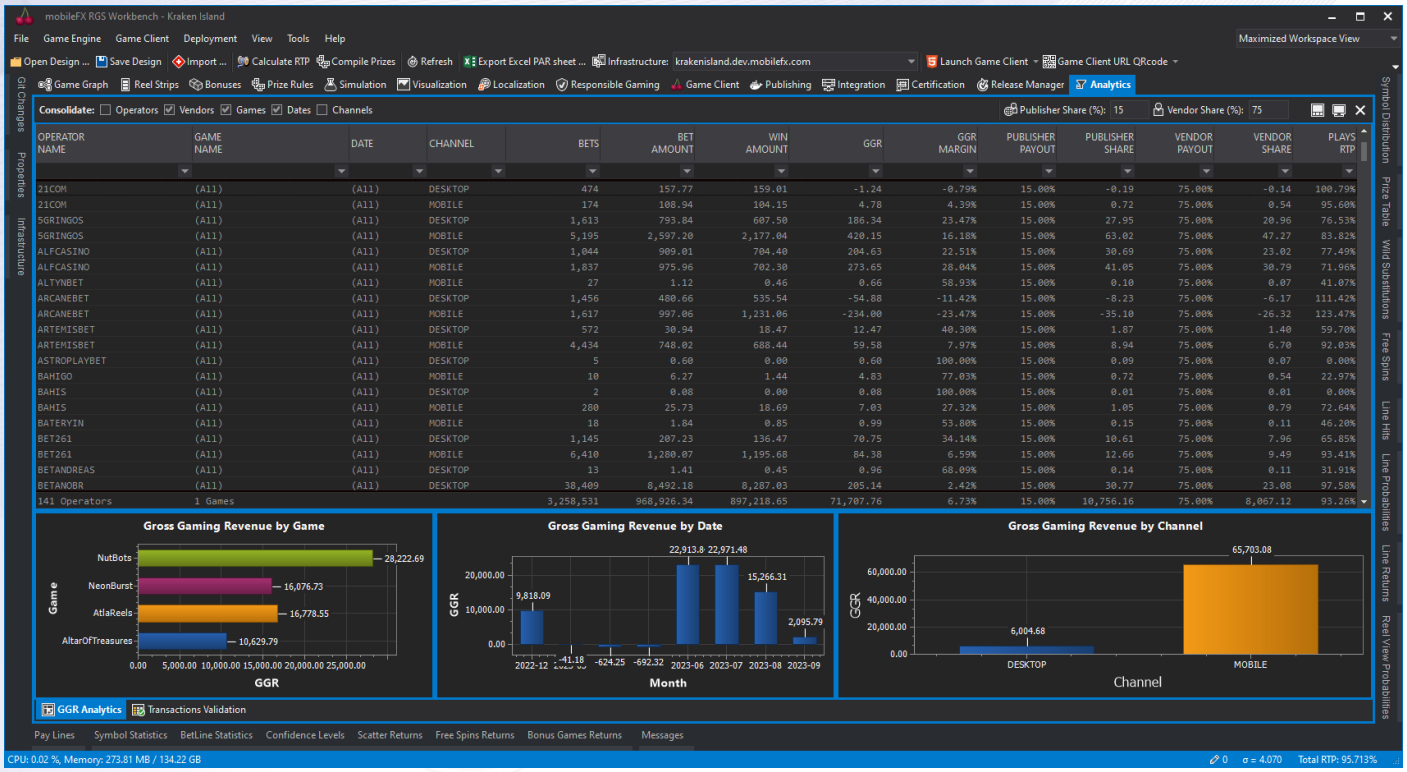
2.15 Tab 13 - GGR Analytics Tool



Picture 107 - GGR Analytics Tool

The Gross Gaming Revenue (GGR) Analytics Tool is designed to process sales data obtained from Content Aggregators and Publishers, offering a sophisticated means of analyzing gaming performance across various dimensions. By ingesting detailed transactional information, the tool is capable of organizing and summarizing data across multiple axes, including Casino Operators, Game Vendors, specific Game Titles, Date Ranges, and Distribution Channels. Its advanced algorithms enable users to group and compare data effectively, facilitating a deeper understanding of market dynamics and performance indicators.

With its comprehensive charting capabilities, the GGR Analytics Tool visually represents trends, highlighting areas of success and pinpointing potential issues that require attention. It can identify patterns of player engagement and revenue generation, offering insights into the effectiveness of different games and the performance of vendors across time periods and channels. By leveraging this tool, stakeholders can make informed decisions, optimizing strategies for content placement, promotional activities, and overall portfolio management, ultimately driving revenue growth and enhancing market competitiveness.

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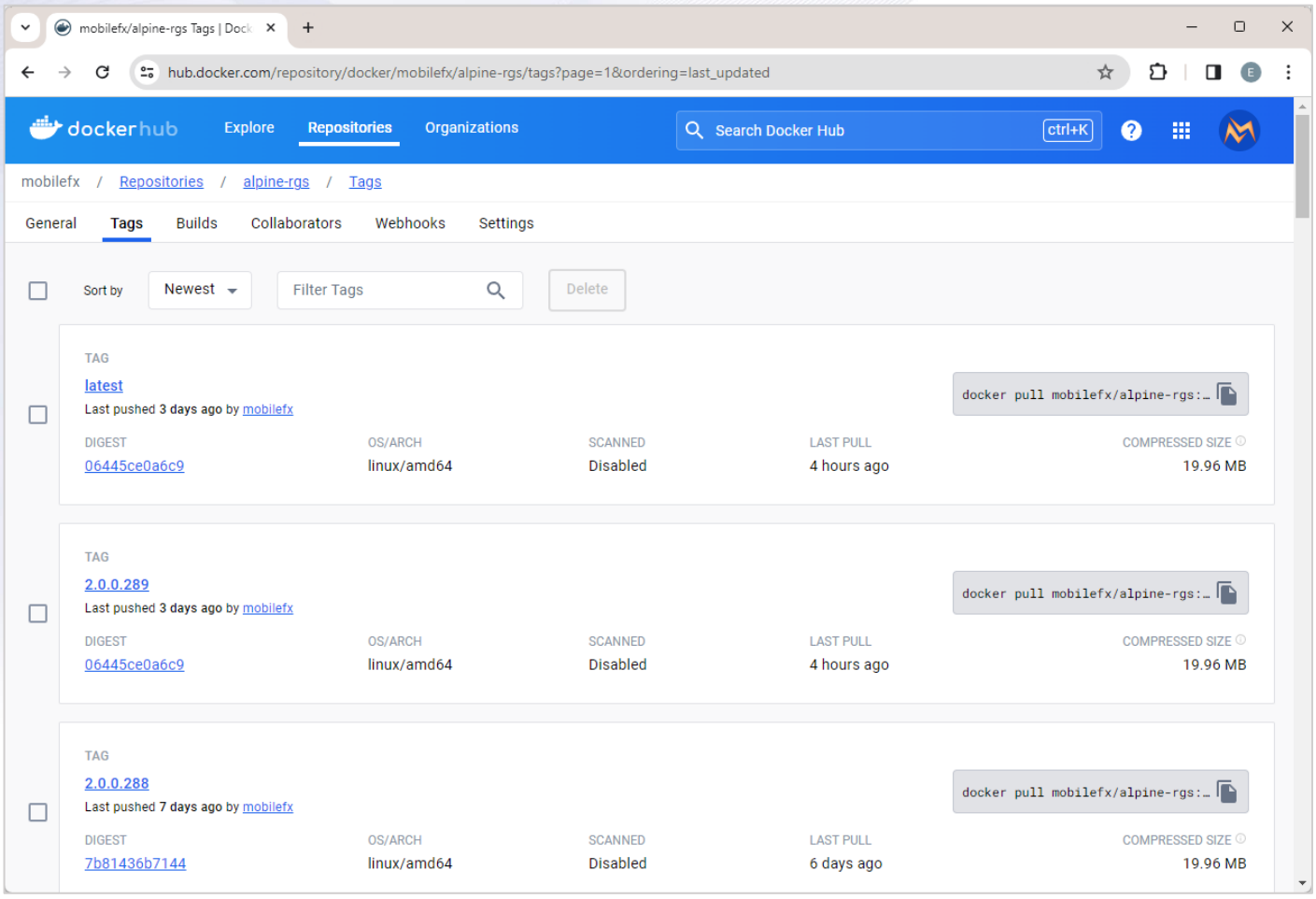
3 RGS Server

Remote Games Server (RGS) implements the corresponding run-time services, i.e. the services that are necessary when a game is published on the web for actual use by real players and publishers. Largely the software is embedded in the RGS Workbench and in particular in the Embedding Tool as Embedded RGS Provider, whose features we described in the previous section. The standalone version of RGS is available on Docerhub at:

https://hub.docker.com/repository/docker/mobilefx/alpine-rgs/tags?page=1&ordering=last_updated



Picture 108 - Remote Games Server (RGS)

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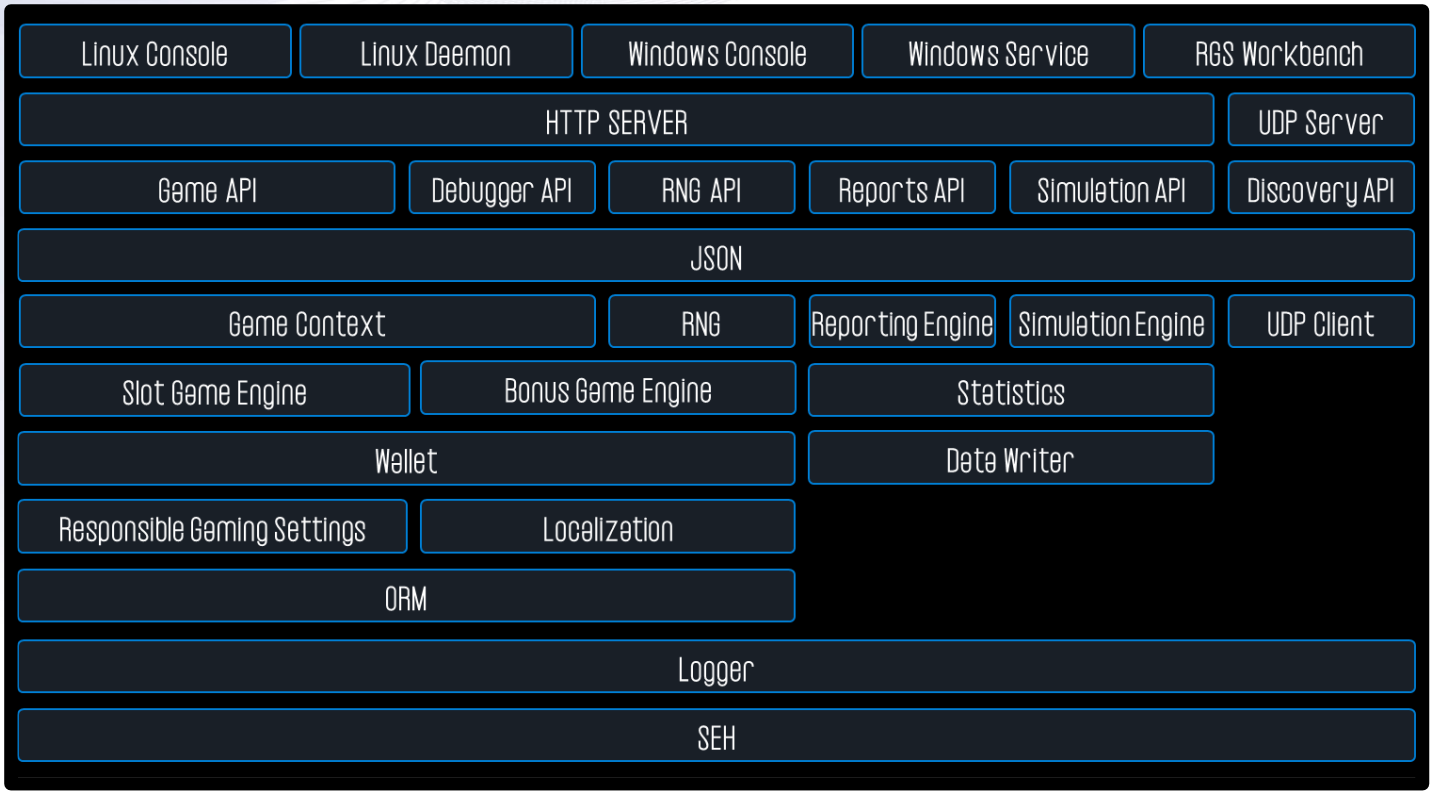
mobileFX Remote Games Server (RGS) docker image implements a host execution environment for Game Engines. Game Engines are mathematical models of Games of Chance or Instant Win Games. Game Engine configuration files are generated by mobileFX RGS Workbench software.

This Remote Games Server is a robust C++17 binary using only STL and Boost libraries. Sources are portable and can compiled for both Windows and Linux systems, both as console application or Windows Service or Linux Daemon. For networking the server uses Boost ASIO Beast framework and supports both HTTP and HTTPS allowing the server to operate either in front or behind a managed network. For RDBMS the server uses SQLite but in reality the server is RDBMS independent.

3.1 RGS Server Architecture

The server is partitioned to the following service layers:



Picture 109 - RGS Server Blue Print

- **Game Engines Layer:** Contains the implementation of the mathematical models for a generic Instant Win Game Engine and a generic Game of Chance Game Engine. Game Engines support the following features: Wild Symbols, Stacked Wilds, Expanding Wilds, Scatter Symbol, Free Rounds, Bonus Symbol, Bonus Games (pick k of n).

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- **RNG Layer:** The RNG Layer contains the implementation of various PRNGs functors used by Game Engines. The default built-in RNG implementation is 64-bit Mersenne Twister. However the system enables RNG over HTTP/S allowing the use of external RNG devices.

- **Simulation Layer:** The Simulation Layer implements Monte Carlo Simulation for Game of Chance game engines. There are several simulation presets depending on the dataset we need to derive, such as Volatility Simulation, Variance and Standard Deviation Simulation and RTP distribution simulation. Many user-defined simulation profiles can be defined with arbitrary Bet Lines, Bet Levels, Coin Values, number of Players and number of Plays. Simulator engine utilizes multi-CPU cores and several simulator engine instances can run in parallel over the same simulation job. Simulation dataset detail level can be adjusted from recording Histograms of winnings to full raw winnings.

- **Logger and Exception Handling Layer:** Logger is the lowest layer of the server and its purpose is to record structured information in logging systems. The default logger transport is Graylog and server transmits log records over UDP in GELF format. Logger inter-operates with Exception Handling Layer which records detailed run-time exceptions and forwards them to the logger. The detail consists of: timestamp, host, game engine, filename, class name, function name, line number. In addition we record data such as HTTP request / response pairs, SQL statements, JSON structures, etc. The design concept behind this layer is to provide as much information as possible for debugging and reconciliation purposes.

- **ORM Layer:** ORM layer is responsible for capturing objects in an RDBMS and persisting or reading them from it. It is a specialized framework created specifically for the server's code base. Mapping between C++ classes and RDBMS tables is one-to-one so that the Database Schema can also be used as a Class Diagram. The server supports loading game configurations directly from RDBMS.

- **Localization Layer:** Localization Layer is responsible currency management and rendering depending on the locale of the game. In addition it manages translations of games which consist of tokens. A token contains an identifier-like phrase that translates into one or more languages at run-time. Locales are defined by ISO639-1 language code, ISO3166-1-alpha-2 country code and ISO-4217 currency code. Locales bare information about currency formatting, currency symbol, currency symbol position and currency fractional units (cents, pens, etc.).

- **Statistics Layer:** Statistics Layer contains algorithms that reveal the Volatility, Variance and Standard Deviation of a Game Engine configuration and implements various types of Histograms that are used to calculate Hit Frequencies, RTP and other essential game metrics. Statistics Layer can export datasets for visualizing into charts the Volatility of a Game, Confidence Levels, House Edge, RTP distribution, Money Path, and more.

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- **Wallet Layer - Blockchain Wallet:** Wallet Layer manages Debit, Credit, Balance and Refund transactions per Player Session. There are 3 different Wallet implementations available: a Free Play Wallet, a Block Chain Wallet and a No Wallet used when the server topologically is behind a Wallet instead of in front (eg. EveryMatrix RGS Matrix topology).

- **Reports Layer:** Reports Layer is used to prepare and execute any report supported by each game engine. Reports are exported by using a Data Writer, a simple reporting engine interface that exports data in a typical HTML table structure (THEAD, TR, TH, TD). The server implements several Data Writers: Excel Data Writer, Text Data Writer, Console Data Writer, JSON Data Writer, Datastream Data Writer (for JAVA environments), SafeArray Data Writer (for COM environments), PDF Data Writer, and more.

- **JSON Layer:** The JSON layer is shared among many layers and contains data conversion routines in JSON format. It is used mostly by the API layer.

- **API Layer:** The API layer implements the HTTP JSON REST application programming interface for both Game Engines. The API essentially implements GET_GAME_CONFIG and GET_TICKET calls that a game can receive from a Game Client. The API is designed to be future-proof and consists of segments.

- **Server Layer:** Server Layer implements asynchronous HTTP/S over TCP/IP Socket Server and an HTTP API Router system similar to Node.JS Express, only native. The Server Layer has a special interface with the Exception Handling and Logger layers so that any network error (or malicious call) can be recorded in logs.

- **Docker Layer:** Docker Layer allows the system to be installed in standalone Docker containers to maximize Portability. Windows and Linux versions are supported.

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4 Unity 3D Template

4.1 Design Goals

4.2 Installation

4.3 RGS API Integration

4.4 API Security

4.5 Finite State Machine

4.6 Components

4.7 Localization

4.8 Best Practices

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5 FAQ

1. **Is RGS GDK Open Source?**
   RGS GDK is a Source-Available Solution where the source code is accessible under a proprietary license.

2. **What is the programming language of this GDK?**
   RGS Server is a portable C++ console application that can be compiled for Windows and Linux. It uses boost::asio for networking and OpenSSL. RGS Workbench is a Windows MFC application written in C++ that encapsulates RGS Server, RNG Server and Wallet Proxy. Unity3D Template is in C#, it implements RGS APIs and targets WebGL, but it can certainly be used for land-based games too.

3. **What makes RGS GDK stand out compared to other game development kits?**
   RGS GDK distinguishes itself through its comprehensive integration of development tools, server infrastructure, and a customizable Unity3D Template, all source-available. This unique combination accelerates development, simplifies compliance, and supports scalability, making it an unparalleled choice for game studios looking to innovate and expand their game portfolio efficiently.

4. **How can RGS GDK integrate with our existing game framework?**
   RGS GDK is designed for flexibility and can be easily integrated with existing frameworks. Given its Source-Available nature, your development team can customize the code to ensure seamless integration and compatibility with your framework's specific requirements. Integrating the RGS GDK with your existing game infrastructure can be streamlined using Docker Technology. This method simplifies the integration process by mitigating compatibility issues and accelerates the deployment of updates or new features from the GDK to your framework. You can find more FAQ about Docker micro-services of RGS GDK further below.

5. **How can we manage version control and collaboration among our development team using RGS Workbench?**
   RGS Workbench integrates with Git facilitating version control and collaboration both for your Game Server project as well as your Game Client. Your team can work on different aspects of game development simultaneously, with changes easily merged and managed through the RGS Workbench IDE.

6. **How customizable are the symbol types for slot games, and can we create proprietary symbol behaviors?**
   RGS GDK offers extensive customization for symbol types, allowing studios to not only adjust the appearance and function of standard symbols like Wilds and Scatters but also to create unique, proprietary symbol behaviors specific to their games. The source-available nature facilitates the addition of custom scripts and functionalities to symbols, tailoring them to your game's narrative and mechanics.

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7. **Can RGS GDK support complex win directions beyond the traditional left-to-right?**
   Absolutely. RGS GDK is designed to support a variety of win directions, including right-to-left and even more complex patterns like diagonal or zig-zag. This flexibility allows game designers to innovate beyond traditional slot game layouts, offering players a richer, more engaging experience.

8. **How can we implement and manage different win levels within our slot games using RGS GDK?**
   Win levels, from small wins to jackpots, can be defined and managed within RGS GDK through the game logic and payout table configurations. Studios can specify the criteria for each win level, tailoring the excitement and reward frequency to the desired gameplay experience. Additionally, the source-available framework enables custom adjustments to fine-tune how win levels interact with overall game mechanics.

9. **Is there support for progressive jackpots within RGS GDK, and how are they managed across multiple games or studios?**
   Not out of the box. RGS GDK facilitates the semantics of progressive jackpots, which can grow across multiple games or even across different studios using a shared jackpot pool, but you would need to supply the implementation of such pool. The RGS Server component can be programmed to handle the pooling and distribution of jackpot funds, ensuring transparency and fairness in jackpot growth and payouts. However, this feature is not part of the RGS GDK codebase.

10. **How does RGS GDK handle symbol animation and interaction, particularly for bonus rounds?**
    RGS GDK, coupled with the Unity3D Template, provides robust support for symbol animation and interaction. This includes dynamic animations for winning combinations, bonus round triggers, and interactive bonus game elements. Developers can use Unity's animation system to create immersive, engaging symbol behaviors that elevate the gaming experience.

11. **What features does RGS GDK offer for customizing the volatility and RTP of our slot games?**
    RGS Workbench includes tools for adjusting game parameters that directly affect volatility and RTP, such as symbol distribution, pay line configuration, and bonus feature frequency. Through statistical analysis and simulation tools, studios can precisely balance game mechanics to achieve the desired player experience and compliance with regulatory RTP requirements.

12. **How are scatter wins calculated and customized within RGS GDK?**
    Scatter wins can be customized in RGS Workbench by defining the scatter symbol behavior, payout values, and the conditions under which they trigger bonus features. The payout for scatter wins can be set as a multiple of the total bet or configured to trigger free spins or other bonus games, with the flexibility to adjust these settings to fit the game design.

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13. **What are the Docker micro-services in a typical RGS GDK topology?**

    Targeted at game developers and operators, our platform includes essential services such as RGS (Remote Gaming Server), Web interfaces, RNG (Random Number Generator), Wallet services, and powerful analytical tools like Graylog and Elastic Search: RGS (Remote Gaming Server): At the heart of our platform, the RGS is a powerhouse for deploying and managing your casino games. It's designed to deliver a high-quality gaming experience, with robust support for slot mechanics, seamless API integrations for game launches, and comprehensive game logic functionalities. The RGS ensures that your games are not only engaging but also meet industry standards for fairness and transparency. Web Server: Our platform's web services are tailored to host Unity WebGL/WebAssembly games. Leveraging Brotli compression, we ensure lightning-fast delivery across CDN networks, dramatically reducing load times and enhancing performance. Experience seamless, high-quality gaming anywhere, anytime. RNG Server (Random Number Generator): At the core of our commitment to fairness lies our versatile RNG service, capable of utilizing both PRNG (Pseudo Random Number Generator) implementations like the Mersenne Twister for mathematical precision, or acting as a proxy to an external PRNG device or service. This adaptability ensures the generation of unpredictable and unbiased game outcomes, upholding the highest standards of fairness and regulatory compliance. Wallet Proxy: Our platform's Wallet service offers unparalleled flexibility, functioning either as a comprehensive wallet implementation, as showcased in our sample code, or as a proxy to an external Forward Wallet or Backend Wallet system. This dual capability ensures secure, efficient management of player funds and transactions, providing a safe and seamless financial experience for users across the board. Analytical Tools (Graylog and Elastic Search): To empower developers and operators with real-time insights, our platform integrates powerful analytical tools like Graylog and Elastic Search. These services are invaluable for monitoring game performance, player behaviors, and system health. They provide actionable analytics, helping you make informed decisions to optimize game offerings, improve player experiences, and maintain operational efficiency. Our gaming platform is designed with the future in mind, offering scalability, reliability, and a rich set of features to support the ever-evolving needs of game developers and operators. Whether you're looking to deploy new games, engage players, or analyze performance, our comprehensive suite of services has you covered. Join us in redefining the gaming industry with technology that empowers creativity, ensures fairness, and drives success.

14. **Is there support for multi-language and multi-currency in RGS GDK for global game releases?**

    Yes, RGS GDK supports multi-language and multi-currency options, making it easier for studios to release their games globally. You can localize content directly within the RGS Workbench IDE, ensuring your games are accessible to a worldwide audience.

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15. **Does RGS GDK include a Wallet?**

    No, but it includes Wallet Proxies for both Forward Wallets and Backend Wallets in order to cover every possible topology for every possible Content Aggregator and Publisher. A Wallet Proxy serves as an intermediary between the game (or RGS Server) and an external wallet system. It forwards requests from the game to an external wallet API for operations such as balance queries, debits, credits, and refunds, and then returns the response back to the game. This allows the RGS Server to interact with various wallet systems in a standardized way, without needing to implement specific protocols for each external wallet.

16. **Can a game implement custom logic for wallet transactions through a Wallet Proxy?**

    Yes, a game can implement custom logic for wallet transactions through a Wallet Proxy by configuring the proxy to handle specific transaction rules or behaviors based on player activity or game events. This allows for flexible and game-specific financial interactions while still leveraging the standardized communication framework provided by the Wallet Proxy for interacting with external wallets.

17. **What Currencies does RGS GDK support?**

    All of them, both fiat and crypto! RGS GDK components deal with money by using Currency Fractional Units (CFU). This is the smallest sub-division of an ISO-4217 fiat currency. For example, USD has 100 CFU, JPY has 1 CFU, and BHD has 1000 CFU. If your Wallet deals with money differently, then you can extend the Wallet Proxy code to adapt between different money logic. For smooth integration with any Wallet implementation, RGS GDK uses the concepts of Bet Currency A: Multiplier and Wallet Currency Multiplier. These multipliers are crucial when the RGS and the Wallet system handle currency units at different scales.

18. **What is Bet Currency Multiplier?**

    Bet Currency Multiplier (BCM) is an Exchange Rate bet adjustment factor. BCM is applied to adjust the bet amounts based on current exchange rates or predefined exchange parameters. This ensures that when players place bets in their local currencies, the bet amounts are adapted and processed in the game's base currency. It also ensures that winnings are calculated correctly and converted back into the player's local currency at the correct rate. Suppose we design a game with bet ranging between 0.1 Euro and 5 Euro and we want to preserve this range across all countries and currencies. 1 Euro (EUR) is equivalent to 27,000 Vietnamese Dong (VND). In this case, the BCM for scaling Euros to Vietnamese Dong is 27,000. Similarly, let's assume 1 EUR = 18 TRY (Turkish Lira). BCM in this case would be 18. BCM is then multiplied with Bet Levels to offer Players bet options in their local currencies, while the game bets are within the desired Euro range of game design. Depending on territory and demographics, BCM can be adjusted by Operators without affecting game logic.

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19. **What is Wallet Currency Multiplier?**

    Most RGS and Wallets operate at Currency Fractional Units (CFU) in order to use integer numbers for money values (eg. 150 CFU = 1.5 USD). However, if a Wallet operates at a different scale (eg. main currency such as USD) then WCM ensures that when a bet is placed or winnings are credited, the amount is correctly converted from the RGS currency scale to the Wallet's currency scale, and vice versa. This conversion is vital for maintaining financial accuracy and integrity, allowing players from various regions to seamlessly engage with the game while managing their funds in their local or preferred currency. For example, if the wallet system operates in a currency where 100 units make up the base currency unit (like cents to dollars), and the player makes a bet in a currency where this ratio differs, the WCM will convert the bet amount to the correct value in the wallet's currency, ensuring the transaction reflects the proper amounts in the player's account. By using the WCM, developers can design games and wallet interactions that are flexible and inclusive, supporting a global player base without the need for complex currency management logic within the game itself. This abstraction simplifies financial transactions, enhances user experience, and ensures compliance with international gaming regulations.

20. **How does RGS GDK authenticate a player's account?**

    A game authenticates a player's account using the PlayerToken, which is provided by Wallets through the game's launching URL constructed per player by Lobbies. This token is part of the `RGS_PLAYER_IDENTIFIER` structure and is used in place of a username and password for authentication purposes. The `PlayerToken` is validated by the Wallet Proxy during session initialization to ensure secure access to the player's wallet and account information.

21. **How can a game retrieve a player's current wallet balance through a Wallet Proxy?**

    A game retrieves a player's current wallet balance by making a request through the Wallet Proxy using the Balance method and PlayerToken. The Wallet Proxy then forwards this request to the external wallet's API, retrieves the current balance, and returns it to the game, ensuring the game can access up-to-date wallet information without direct integration with the external wallet system.

22. **What process does the Wallet Proxy use to update a player's wallet after a bet?**

    The Wallet Proxy updates a player's wallet after a bet by forwarding debit and credit requests to the external wallet's API. It debits the bet amount from the player's balance and, if applicable, credits any winnings. This ensures that all wallet transactions are accurately reflected in the external wallet system, providing a consistent and secure financial transaction process.

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23. **How does RGS GDK process refunds for bets in exceptional scenarios?**
    In exceptional scenarios, a game processes refunds by sending a refund request to the Wallet Proxy. The Wallet Proxy then communicates with the external wallet's API to perform the refund operation, ensuring the bet amount is correctly returned to the player's wallet. This mechanism facilitates the handling of refunds seamlessly, maintaining the integrity of player balances across systems.

24. **How does RGS GDK ensure compliance with gaming regulations in different jurisdictions?**
    RGS GDK includes features for Responsible Gaming and compliance, such as setting bet limits and providing player self-exclusion options. As regulations vary by jurisdiction, the licensed-source nature allows for custom adjustments to meet specific legal requirements.

25. **How does RGS GDK facilitate game certification for regulated markets?**
    RGS GDK includes tools for generating Certification Application Forms and dataset bundles that you can submit to Certification Agencies for testing games against compliance criteria. RGS Workbench exports PAR Sheet in Excel format including statistics and design data for Base Game, Free Spins and every Bonus Game. This streamlined approach, combined with the ability to customize for specific regulations, makes certification in regulated markets more efficient.

26. **Can we import our existing game assets into RGS GDK?**
    Yes, you can import existing game assets into RGS GDK. The platform supports a wide range of file formats, allowing you to utilize your studio's existing assets seamlessly within the GDK environment.

27. **Can RGS GDK handle the development of games with complex graphics and animations?**
    Yes, the Unity3D Template provided with RGS GDK is specifically designed to support complex graphics and animations. Unity3D's powerful rendering engine ensures your games can include high-quality visuals and smooth animations.

28. **Can we customize the Unity3D Template to fit our game design standards?**
    Absolutely! The Unity3D Template within the RGS GDK kit is fully customizable. Being open source, it allows your designers and developers to adjust and extend the template to meet your studio's unique design language and standards.

29. **Is there a way to test our games on different devices and platforms directly from RGS GDK?**
    RGS GDK allows for testing across various devices and platforms through the Unity3D engine. While direct device emulation isn't built into GDK, the Unity3D Template facilitates cross-platform testing to ensure compatibility and performance. Still, RGS Workbench's Integration Tool emulates a Casino Lobby allowing you to launch a WebGL Unity game in Google Chrome and even generates a QR code for testing the game on a mobile or tablet device. Furthermore, you can test the game in various languages and currencies.

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30. **How frequently is RGS GDK updated, and how do we access the latest features?**

    As a source-available project, RGS GDK benefits from continuous contributions and updates. Updates are made available through the repository, where your team can pull the latest version to access new features and improvements.

31. **Can we monetize games developed with RGS GDK through in-game purchases or advertisements?**

    Yes, games developed with RGS GDK can include various monetization strategies, including in-game purchases and advertisements. The platform's source-available nature allows for integration with payment gateways and ad networks.

32. **Can we use RGS GDK for developing non-casino type games?**

    While specifically designed for casino and betting games, the flexibility and customization options of RGS GDK allow for the development of a variety of game types, as long as the core functionalities align with your project needs.

33. **Can we implement skill-based elements within slot games using RGS GDK?**

    Yes, RGS GDK's flexible framework supports the incorporation of skill-based elements into slot games, offering a new layer of engagement beyond chance. Developers can integrate mini-games or features that require player input and strategy, influencing the game outcome or bonus rewards, enhancing the depth and appeal of the gaming experience. However, you should care for RTP when you add skill-based features in your games and research mechanisms that compensate between skill and chance.

34. **Does RGS GDK support the creation of branded slot games with licensed content?**

    While RGS GDK provides the technical capabilities to develop games with any thematic content, including branded or licensed material, studios are responsible for securing the necessary rights and permissions. The source-available platform allows for extensive customization, enabling studios to adapt their games to feature licensed characters, themes, and soundtracks, provided all legal compliance and intellectual property rights are observed.

35. **What support is available for game studios new to RGS GDK?**

    For new users, RGS GDK offers documentation, tutorials, and a developer community forum where studios can seek advice, share experiences, and find solutions to common challenges. Our Professional Services team can provide dedicated help to your team through Support Contract.

36. **How does the RGS Server handle high traffic and ensure scalability for our games?**

    The RGS Server is built to handle high traffic volumes and ensure scalability by taking advantage of C++ boost::asio framework. Its architecture supports asynchronous I/O and can dynamically adjust resources based on demand, ensuring your games remain smooth and responsive even during peak times. Furthermore, RGS Server is designed to operate in Docker containers in Single-Tenant mode hosting a single Game or Multi-Tenant mode, hosting multiple games.

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37. **Does RGS Server offer analytics or insights into game performance?**

    By default, RGS Server integrates with Graylog analytics server over GLF UDP protocol and exposes functions for logging events directly to Graylog. Bet request and responses are submitted to Graylog by default and you can control the detail level by editing RGS Server configuration profile settings. Also, any error or exception generated in RGS Server's Game Context is forwarded to Graylog by default. The Source-Available nature of the GDK means you can easily integrate third-party analytics tools or develop custom solutions tailored to your studio's needs for comprehensive performance insights.

38. **How does RGS Server handle player data security and privacy?**

    The RGS Server component of RGS GDK is designed with security in mind, including encryption and secure communication protocols to protect player data. Studios can further customize security measures to comply with privacy laws and implement their own protocols by taking advantage the Source-Available nature of the GDK. RGS APIs can be serialized and deserialized in various formats: RGS Server supports JSON format for maximum compatibility with other gaming frameworks. However, we provide and recommend more advanced and secure formats such as Datastreams that use compression and asymmetric encryption by default. Datastream implementation is supported out-of-the-box in RGS Server and Unity3D Templates.

39. **Is there a feature for player feedback collection within RGS GDK?**

    While RGS GDK focuses on development and server management, incorporating player feedback mechanisms can be achieved by integrating third-party services or developing custom solutions, leveraging the Source-Available flexibility.

40. **How does the RGS Server manage connections with external APIs or services?**

    The RGS Server supports integration with external APIs and services, allowing for a seamless connection to payment processors, analytics tools, and more. This ensures your games can operate within a broader ecosystem. The design pattern for such extensibility are the Docker containers of RGS GDK topology. The idea is that you can extend RGS Server leveraging the Source-Available flexibility and then add the Docker containers that implement or proxy these extensions. We provide samples for RNG, Wallet and RDBMS.

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41. **Does RGS Workbench calculate Max Exposure for Max Bet?**

    Max Exposure for Max Bet in a slot game refers to the maximum potential payout a player can receive when placing the maximum bet on that particular game. It indicates the highest amount of winnings achievable under ideal circumstances. To calculate Max Exposure for Max Bet, especially in games that include Free Spins, the RGS Workbench employs simulation options. These options allow developers to instruct the simulator to record the Max Exposure specifically for the Max Bet setting. If a game includes Free Spins, developers can optimize the simulation process by directly simulating Max Exposure scenarios that force Free Spins, thus saving time and computational resources. This simulation process is vital for accurately determining the game's potential payout maximums under the most favorable conditions. By leveraging the Workbench's simulation capabilities, developers can ensure that their game designs align with the expectations of online casino platforms, while also adhering to regulatory requirements regarding transparency and player information.

42. **Does RGS Workbench calculate game statistics?**

    Workbench facilitates the calculation of various critical game statistics and metrics through both full-cycle statistical analysis and Monte Carlo simulations. This comprehensive approach enables the calculation of not only Max Exposure but also the Theoretical RTP (Return to Player), Theoretical Standard Deviation, and Confidence Levels of a game. It also includes the capability to calculate and rate the game's Volatility and Volatility Index, ensuring a thorough understanding of the game's performance characteristics. This methodical approach to game analysis and certification provided by the RGS Workbench ensures that games meet regulatory standards and align with the expectations of operators, publishers, and players in terms of fairness, transparency, and excitement.

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