The research leading to these results has received funding from the European Community's Seventh Framework Programme [FP7/2007-2013] under grant agreement no. 611875

Project full title: Orchestrating Information Technologies and Global Systems Science for Policy Design and Regulation of a Resilient and Sustainable Global Economy

Contract no.: 611875

D4.2

Early version of the SYMPHONY Serious Game

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<th>Workpackage:</th>
<th>WP4</th>
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Doc Ref:

Reviewer(s):

Dissemination Level

PU
SYMPHONY Consortium

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**Document History**

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<td>Jack Cannon/PlayGen</td>
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<tr>
<td>0.1.1</td>
<td>27/03/2015</td>
<td>Addition of technical details</td>
<td>Mayur Ahir/PlayGen</td>
</tr>
<tr>
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<td>30/03/2015</td>
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<td>0.1.3</td>
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Executive Summary
This report accompanies the early version of the SYMPHONY Serious Game, as part of the D4.2 deliverable, and covers work done towards Task 4.2 (Game Interfaces) and Task 4.3 (Game Implementation). The game, known simply as ‘Symphony’, is accessible at http://symphony.playgen.com.

For the gamification of SYMPHONY, we’ve made various considerations regarding what player’s would respond better to, and which approaches can lead to a concise, yet meaningful, implementation. While building iterative prototypes for the game, we have been constantly communicating and providing technical inputs towards components that are being built by other partners in the group such as ATC, ICCS, UJI.

This report outlines the development efforts towards the deliverable, and provides a high level analysis of the composite features, components and architecture. Due to the nature of the development of this game, this early version deliverable constitutes a ‘vertical slice’, and not a fully playable ‘alpha’. This prototypical early version of the Symphony game utilises the simulation systems set out in other Project SYMPHONY work packages to create a gamified interface for observing and manipulating variables within a simulated economy.

Going further we aim to deliver a game which is fully integrated within the dashboard under development by ATC (as a part of MS3, MS5 & D5.2) and exchanging inputs in regards to ABM with UNIGE. As per our next deliverable D4.3, the major focus would be on improved mechanism, intuitive and functional game interface, user engagement and integration along with several user case validations.
Table of Contents

Executive Summary ........................................................................................................... 3

1  Introduction .................................................................................................................. 5

2  The Role of Gamification within SYMPHONY ............................................................ 6

3  Design of Symphony Gamification .............................................................................. 7

3.1 Overview / Home Page .............................................................................................. 7

3.2 Responsiveness .......................................................................................................... 9

3.3 Navigation Bar ........................................................................................................... 10

3.4 Ticker Bar ................................................................................................................ 11

3.5 Tabs ............................................................................................................................ 12

3.6 Graph Items .............................................................................................................. 13

3.7 World Sidebar .......................................................................................................... 14

3.8 News ........................................................................................................................... 15

3.9 Ranks Sidebar ........................................................................................................... 16

3.10 Chat Sidebar ............................................................................................................ 17

3.11 Activity Sidebar ...................................................................................................... 18

3.12 Goals ....................................................................................................................... 19

4  Functional and Technical Architecture of Symphony Gamification ......................... 21

4.1 Integration ............................................................................................................... 22

4.2 Back End .................................................................................................................. 23

4.3 Front End ................................................................................................................ 25

4.4 Other components .................................................................................................... 27

5  Usage Scenario .......................................................................................................... 28

6  Conclusions and next steps ....................................................................................... 33
1 Introduction

This D4.2 accompanying document contains a detailed description of how the Symphony Gamification works, what the different components being developed are (e.g. communication between the ABM engine and the game), and how the communication within internal components of the game is achieved. This document will cover following topics at large,

- The Role of Gamification within SYMPHONY Project
- Technical architecture of the Game
- Primary components along with description
- Integration with other SYMPHONY packages

It will be too early to describe exact functionality of the modules that will added as part of upcoming Milestones and Deliverables. However as an early prototype the goal is to make sure all necessary bits and pieces are in place Such as goals mechanism, user authentication using SSO, storage and display of historical variables, communication between game’s backend & frontend. The primary motive is to allow players to enjoy the game in a way that is easy to understand, intuitive, and provides a sense of collaboration. With the help of game mechanics such as goals, achievements, chat etc., it facilitates many aspects of a modern game. D4.2 is an early version of this game, with a limited set of features that will allow players to understand and utilise the underlying platform.

With the help of the Symphony Game platform, we aim to assist policy makers, stakeholders, businesses and citizens to form a collaborative network, which can further assist in making deterministic conclusions about future financial policies, governance strategies, and social & economic stability. By means of balanced gameplay, it is possible to form a game group focusing on particular problem scenarios, such as “how to avoid the next financial meltdown”.

The game can be found at http://symphony.playgen.com, however users will need login details in order to access the main portion of the site. Here is a list of demonstration account details:

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<td>?PN3tq</td>
</tr>
<tr>
<td>government</td>
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</tr>
<tr>
<td>eurostat</td>
<td>6^V%jW</td>
</tr>
<tr>
<td>centralbank</td>
<td>+E-9k{</td>
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2 The Role of Gamification within SYMPHONY

In the context of Symphony, gamification is a practical technique to take advantage of large data sets and simulations. It is a powerful tool for motivating participation, driving better policy designs, and generating competitive decision making. By capturing and analysing the player’s behaviors, the consortium can create a more engaging experience that motivates different strata of people, such as policy makers, businesses, and financial institutions.

With the help of Symphony, citizens will be able to learn and appreciate how governments operate, including highlighting the primary factors that drive decisions. Policy makers will be able to learn more about the effect of various policies undertaken by government and observe the corresponding effects on banks, firms and households. By means of gamification and simulating an artificial economy, we aim to equip the community with a platform that can sustain the various needs of the different experience levels of participants and try to provide common solutions towards major problems related to transparency, education of novice users, and economic stability.

Figure 1. Gamification within Project SYMPHONY

The Symphony serious game, as part of Work Package 4, is the primary user-facing interface for the Symphony project at large. Its purpose is to focus less upon the technical details of the economic simulation, and more upon creating an open-to-all, fun and engaging experience to users of various backgrounds and economic experience.
3 Design of Symphony Gamification

3.1 Overview / Home Page

The initial design for the Symphony serious game utilised several components and features in order to create a simple, easy-to-learn interface that finds a balance between conveying as much information as possible, and not overloading the user with too much to focus on.

An important component of the Gamification is to provide a meaningful, engaging experience to a variety of user types, with a large range of experience and knowledge. This means the designs, layout and overall interface need to be suitable for both policy makers

Figure 1. Initial policy maker design

Figure 2. Current policy maker implementation
(large degree of knowledge about the economic system) to everyday citizens (considerably less understanding of the economy).

The current implementation of the design follows the initial layout as closely as possible, but several alterations have been made in order to better accommodate this wide demographic.

The first change is that the goals are no longer in their own panel, but have their own page, which opens up in the main panel. This change was made to simplify the interface, and is explained in section 3.12.

Another change was to stop the interface components going right up to the edge of the screen. This was done for responsiveness purposes, and allows for a more stable experience on a wide variety of devices and screen sizes.
3.2 Responsiveness

With an ever-growing proportion of web access coming from mobile devices, it is becoming increasingly important to design and develop websites to be fully (or near fully) functional on a large variety of screen sizes and resolutions, without compromising on usability. With this in mind, the Symphony game interface is fully responsive, working on a plethora of devices including desktops, laptops, televisions, tablet PCs, convertible tablets, and mobile smartphones.

This allows for a wider audience of users to be able to play the Symphony game, irrespective of their device, internet speed, or even location (e.g. it would be completely feasible to play Symphony on your phone on the train, and continue on your desktop later on).
3.3 Navigation Bar

![Initial design for navigation bar](image1)

*Figure 6. Initial design for navigation bar*

![Current implementation for navigation bar](image2)

*Figure 7. Current implementation for navigation bar*

In the original design for the navigation bar, it was split into three distinct sections: navigation items, simulation controls, and user’s victory points. The current implementation stays close to this premise, but several changes have been made.

The navigation items are little icons, which, when clicked on, take the user to the relevant page. To fit in with the rest of the design, these icons have been scaled down slightly, but have largely remained unchanged.

As no player has absolute control of the simulation (i.e. play/pause, next/previous cycle), these buttons were removed, and a simple date display is shown instead. This date is representative of the cycle number (based on there being 1 cycle per day, 5 days per week, and 4 weeks per month).

The player’s Victory Points total is displayed on the far-right hand side of the navigation bar. This is an immediate indicator of how well the player is doing overall, and updates when the player performs certain activities that earns points. The only change to this has been a change of icon, as victory points are shown alongside stars, not music notes, throughout the rest of the interface.
3.4 Ticker Bar

The ticker bar displays the current status of various firms and banks, along with whether they are gaining, falling, or remaining steady in value. Green values with an upwards-pointing chevron indicate a rising value, purple with a horizontal dash represents a steady value, whilst red with a downwards-pointing chevron is a falling value.
3.5 Tabs

Tabs are an effective skeuomorph, providing simple, easy to understand context to the user, and, as such, have been used for several aspects in the Symphony interface. The most notable use is the dynamic tab navigation for the main panel. When a new page is opened, a new tab is opened for that page, allowing the user to easily hop between different pages, without the hassle of constantly re-finding previously visited pages. These tabs can be closed/removed at any time by clicking their corresponding ‘X’s, so that obsolete and unused tabs don’t crowd out the used ones.
3.6 Graph Items

A Graph Item is how a metric, instrument, or other simulation variable is displayed to, and interacts with, the user. They rarely appear individually, but are shown one after another. The consistent layout between each one allows for easy comparison between items. The main components are the icons, the info section, and the graph.

The icons section consists of 2 icon buttons. The first is a minimise/maximise icon for expanding or collapsing the graph item. When expanded (see figure 13), the graph item becomes larger, showing extra content (such as goal information, a form for changing the value, etc). The second is a star icon for favouriting/unfavouriting items. Favourited items are displayed on the home page, for easy access.

The info section displays the name on the graph item, and some buttons for interaction (such as an info button (only appears on goals), which opens the relevant modal, and a play button, which plays a generated song based upon the ups and downs of the graph).

The graph shows a large graph of the historical values for this item. At the moment, this is limited to the last 3 months, but this will be extended in later versions of the game. These graphs show, cleanly and simply, the history of the item, allowing them to judge any impact or consequences of their actions.
3.7 World Sidebar

The World sidebar panel is a tree-structure which allows the user to easily find and access other agents within the simulation. The agents are first sorted into countries, then by agent type (Government, Central Bank, Bank, etc) which are additionally identified with short symbols for each (e.g. Germany’s short symbol is DEU and United Kingdom is represented as GBR).

Clicking on an agent opens the relevant agent page in the main panel. All agents, not just player-controlled agents, are listed, however, in later versions of the game, player-controlled agents will be indicated by a small icon, and clicking on them will open a page showing a hybrid of player and agent information.
3.8 News

![News sidebar panel](image1)

![News main panel page](image2)

*Figure 16. Current implementation for ‘News’ sidebar panel

Figure 17. Current implementation for ‘News’ main panel page

The news sidebar shows titles for recent news articles. Clicking on a title opens that article in the news page in the main panel.

The news functionality, currently in its early infancy, provides a large degree of context to players, keeping them up to date on current affairs within the simulated economy. Players will be able to use the system to take advantage of short windows of opportunity, see the consequences of their past decisions, and gain an overall understanding of the comings and goings of the economic market.
3.9 Ranks Sidebar

![Ranks Sidebar Panel]

Figure 18. Current implementation for ‘Ranks’ sidebar panel

The ranks sidebar panel lists the top users, in terms of Victory Points. It also displays the current user, should they not be in the top 10, for comparison. The inclusion of this panel means that users can quickly and easily see how their efforts compare to their competitors, inciting competition within the community. At this stage, the rankings are not limited to certain types, or filtered in any way, but in the future, players will only see rankings of their player type (e.g. Banks will only see other Bank players listed).
3.10 Chat Sidebar

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The player chat sidebar panel allows human players of all types to communicate within the game. This feature facilitates community discussions about the simulated economy, the impact of a given player’s actions, or even collaboration on shared goals. Conversations are held within a public forum, in order to encourage community discussion, whilst private messages will be supported in later versions. This sense of community can greatly increase a player’s enjoyment of the experience, and helps humanise the experience, leading to an impression of responsibility towards the other players. These factors will hopefully help keep players coming back to continue playing, and improve overall engagement.

Figure 19. Initial design for ‘Chat’ sidebar panel

Figure 20. Current implementation for ‘Chat’ sidebar panel
3.11 Activity Sidebar

![Activity Sidebar Panel]

*Figure 21. Current implementation for the ‘Activity’ sidebar panel*

The activity sidebar panel shows the player various activities within the simulation. These activities include the player’s own actions, plus the relevant actions of other players. Activities currently only consist of changing variable values, but this will be expanded in the future to include a wider range of actions.

The inclusion of this section allows the user to easily monitor the behaviour of other players. Whether an ally is going back on promises, a competitor is enacting an offensive ploy, or a bank is affecting the user’s interests, would all be seen and discovered in this panel.
3.12 Goals

The goals page displays the user’s current goals and targets. The relevant metric/instrument graph item is shown, with extra modifications, such as stars on the graph when the graph is on target, and an extra button to open a modal detailing the specifics of the goal.

The goals were originally designed to be shown as their own semi-permanent panel above the main panel in the game’s layout. This was changed to make goals a separate page (and therefore shown in the main panel), in order to reserve above-the-fold space on the screen, simplify the interface, and improve usability on mobile and handheld devices.

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Each goal consists of several basic parts. Firstly, it is attached to a metric of their own agent that no player type can directly influence (e.g. a Government player may be given a goal regarding their own ‘Unemployment Rate’ metric, which they (nor anyone else) can directly change). The second part of a goal is the target. This is an attainable value that the player should aim to keep the variable above or below. The final part of a goal is a timescale, which determines the end of the goal, when the overall success of its completion can be determined. Put together, a typical goal would be “Lower Unemployment Rate to below 2% by 2020”.

![GOV MONTHLY GDP](image)

*Figure 24. Initial design for the Single Goal modal.*

![YOUR GOALS](image)

*Figure 25. Current implementation for the Goals modal.*

Goals are attainable targets that the player is given in order to provide context and a purpose to the game. Goals are the primary method of gaining Victory Points, which is how the rankings are judged. Therefore, a player who does well with their goals is indirectly rewarded with the social acclaim of having a higher rank. This introduces a competitive edge to the game, however, players will soon learn that it is in their best interests to cooperate and collaborate in order to maintain a healthy, functioning economy.
Primarily goals are of the two types: system defined and dynamic goals. System defined goals are the one which are already set as part of initial game play and to provide same starting point for different players of the same agent type. System goals are simple in nature focusing on to allow new users to adapt to the game and learn about what game is about. As they progress further in game dynamic goals are added depending on the current simulation state, player’s progress and in future adding level of complexity or team size as well.

A feature of graph items is a procedurally generated song, based upon the performance of the graph over time. This feature is greatly improved when used in conjunction with goals, as the songs (which will be greatly improved in future iterations of the game), have further beats introduced, with snares and kicks playing when the graph is on target.
4 Functional and Technical Architecture of Symphony Gamification

4.1 Integration

The Symphony gamification layer is divided into two distinct systems: the back end and the front end. This separation of interests allowed for a modular approach to development, accommodating for various features to be added in tandem. The back end acts as a gamification middleware to other services, as well as providing game-centric features. As such, the front end communicates with the back end exclusively, and doesn’t make any requests to any other external services. This allows for a tighter, more secure system, as we control all the data passing between the gamification systems, providing dependable data in a consistent format.

*Figure 26. Diagram showing the planned flow of data between components*
4.2 Back End

Symphony gamification backend is written using Microsoft C# on top of .NET 4.5 framework and uses Entity Framework 6 as a middleware to communicate with Database. A few of the major backend gamification components are authentication (with SSO), historical data storage and goals management.

The Game front end communicates with the back end using RESTful JSON APIs. When a request is received by the game back end, an API call is made to a SSO system that has been provided by ATC. The response from the SSO is then validated and translated into an appropriate format, data is stored and updated in the database and then transmitted back to the front end. Although the authentication process involves several API calls (in order to avoid any security compromise) over TCP/HTTP, the whole transaction takes very little time thanks to use the of asynchronous HTTP calls provided by ASP.NET’s HttpClient module. This quick speed is vital to providing a fast, and responsive experience for the players.

An important part of the Symphony game is to allow users to manipulate a set of variables depending upon their role within the game. These variables must be presented in a meaningful way, explaining what their importance in the simulation scenario is. Symphony’s gamification platform interacts with a native C# library provided by ATC, which facilitates all communication and computations requested between the game and the ABM. Upon completion of each turn, a request is made to the ABM via this library and, depending on the request type, it returns a history of changes for a specific variable of an agent. This data is then parsed and presented back to front end, which displays it in the form of graphs or any other required format. There is as the option to change values and send it back to the back end, so it may be changed during the next game cycle.

Goals that are system defined are already stored in the game environment, even before the player starts the game. However, as the game involves dynamic interactions, more goals are created depending on the player’s progress, promoting a constant sense of competition. Every goal has two components. The first is the goal itself, which contains a number of victory points, overall progress, brief description and a human readable string explaining what the goal is. The second component is Target, which contains all machine readable information about various goal parameters. The game’s front end handles all user interaction related to goals. Whenever a new goal is created in the game or a target for existing goal is achieved, the back end system makes a push call to the front end, informing it of the goal status, after which the front end assumes control and informs the user in a meaningful way.
Figure 27. The class diagram for the back end architecture

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4.3 Front End

The front end portion of the symphony gamification was primarily built using AngularJS, a JavaScript based MVC (Model-View-Controller) framework made by Google. Whilst Angular is a JavaScript based framework, the Symphony gamification front end was written using CoffeeScript, a language that compiles to JavaScript, allowing for 100% library support. The code is pre-compiled to JavaScript, and then minified in order to reduce the size of the files and, in turn, loading time.

The structure of the front end was separated based upon the panels in the design. Each panel has a view (to control how things are shown), a controller (to control what is shown), and a service (to access relevant data from the back end). Some panels shared services, such as the News service being used by both the sidebar panel and the news page. This structure can be seen in figure 28.

For the appearance, we used Twitter Bootstrap, a popular open source HTML/CSS framework, which includes some extra components that came in useful for Symphony (e.g. accordions, modals, etc). The style for the Front End was primarily handled by the Symphony policy maker Twitter Bootstrap theme. Written in LESS, and compiled to CSS, this theme overwrites the default Bootstrap styles, whilst still following standard Bootstrap convention. This means that the themes can be switched and changed around, without needing to make any changes to the markup. As a part of collaborative effort, towards the end of D4.2 we have shared a reusable theme with project partners, so that a consistent design may be used for all the user interfaces.
The research leading to these results has received funding from the European Community’s Seventh Framework Programme [FP7/2007-2013] under grant agreement no. 611875

Figure 28. The class diagram for the front end architecture
4.4 Other components

The Symphony Game also utilises several external components, including an SSO system, a C# library, and the ABM platform with APIs.

The SSO (Single Sign-On) system facilitates a few key tasks related to users, including authentication, session validation and profile information. When a new user is redirected from the dashboard to the game, an authentication cookie is set which is retrieved by the game using an API. Since the game and SSO reside on different networks of servers, it is good practice to validate such cookies against a session in order to avoid any unauthorised access to a player’s profile or data. When the game detects an existing session, a request is made to the SSO to validate the authenticity of the cookie and potentially stop invalid access to the game. Similarly, upon login, player’s profile data is retrieved and stored in the game’s local database and updated regularly with asynchronous API calls, so as not to hamper the game’s performance.

In order to communicate with the ABM, ATC has provided a middleware library written in the same technology as the gamification platform: C#. It handles lots of critical tasks, such as providing lists of active agents within the current simulation, an API to get and set particular variables for an agent, and historical information about variables. The primary reason for it being developed in C# is for ease of integration without involving any additional third-party libraries, which can affect response (and therefore game) speed. The library also provides models for various agents within the simulation to make integration process seamless. By doing so, it also takes away any additional maintenance that may be required when the library is changed.

At the other end of the Symphony architecture, there is the ABM, which performs actual simulations based upon various predefined rules, set by financial experts and researchers. The ABM engine also takes game dynamics into consideration, allowing the alteration of the whole system, depending on the inputs provided by players, by means of changing values of parameters. This allows clear bifurcation of roles of two systems: one focusing on player engagement and the other on how dynamics should be calculated.
5 Usage Scenario

Here is a sample usage scenario for the Symphony serious game.

Step 1. User logs in using the dashboard, and enters game

Step 2. User arrives on Home page
Step 3. User navigates the World sidebar (1), and opens an agent page (2)

Step 4. User expands (1) a graph item, and ‘plays’ (2) it.
Step 5. User manipulates a variable by: expanding it (1), entering a new value in the number field (2), and clicking ‘Save’ (3).

Step 6. User sees their activity (changing the variable value) in the Activity sidebar panel.
Step 7. User favourites metrics that look interesting to them

Step 8. User returns to Home page (via the tabs (1)) to find their favourites (2)
Step 9. User chats with another player in the chat sidebar panel

Step 10. User evaluates progress on their Goals on the Goals page
6 Conclusions and next steps

As this is an early version of the serious game, there are features that are mentioned in D4.1 that are under development, or are in the planning stages. The focus of this early version wasn’t to implement every feature, but to collate the various components, and ensure that they work together. This has been achieved, with the correct data being accessible to the front end, and any changes made to values being correctly applied back into the ABM.

The next steps for the gamification, and the work package overall, is to further expand the game, adding and improving the features to better align with what was specified in D4.1. These features include dynamic goals, the full range of player types, and interactive tutorial.

The current version of the game features some simple goals, following a single goal formula. Over the next few iterations of the game, these will be expanded to include all the formulas specified in D4.1. The goals will also be supported by a dynamic system that will monitor the effects on the economy, and create goals to balance to books. An example of how this will be used would be if a Central Bank were increasing the interest rates in order to increase assets. If this were to have a negative impact upon, say, the unemployment rate, then the system would highlight this, and create a goal for the Government user to lower the unemployment rate. This sort of system would allow for competitive manipulation without compromising on the accuracy of the economic simulation (i.e. it would be unrealistic for the unemployment rate to be 90%).

At this stage in the project, the player types have been limited to the two highest levels: Governments and Central Banks. In time for the D4.3 final version of the game, this will be expanded to include all playable agent types, adding in the currently unsupported Bank, Firm and Household types. This will provide a much larger context for the game, and allow for the relationship between the powerful Government and Central Bank types, and the large numbers of the lower types, to play a large role in the game.

In order for the whole of the target demographic to be able to play the game on an equal footing, an interactive tutorial sequence was specified in the D4.1 deliverable. This was omitted in this version, in order to focus upon the core priorities of getting the ABM data cycle in place. However, it will be a fully functioning presentation of the interface in next version, including education on the core principles of the simulation, a walkthrough of the layout, and an introduction to game elements such as goals, playable songs, and achievements.