

Global Simulator 0.01

Krzysztof Czarnecki

December 25, 2018

Contents

1	Introduction	1
1.1	Authorship Note	1
1.2	Version Note	1
1.3	Licence Note	1
1.4	Terms Definition	2
2	Data: Tables and Maps	3
2.1	Frozen Tables (FT)	3
2.1.1	Config Frozen Table	3
2.1.2	Force Frozen Table	4
2.1.3	Action Frozen Table	4
2.1.4	Building Frozen Table	6
2.1.5	Stock Frozen Table	6
2.2	Constant Tables	6
2.2.1	Terrain Constant Table	6
2.2.2	Stock Constant Table	7
2.2.3	Process Constant Table	7
2.3	Static Tables (ST)	7
2.3.1	Control Static Table	7
2.3.2	Nation Static Table	8
2.3.3	Swap Static Table	8
2.4	Dynamic Tables (DT)	8
2.4.1	Action Dynamic Table	8
2.4.2	Force Dynamic Table	8
2.4.3	Stream Dynamic Table	9
2.4.4	Flow Dynamic Table	9
2.4.5	Market Dynamic Table	9
2.5	Constant Maps (CM)	9
2.5.1	Diagram Constant Map	10
2.5.2	Source Constant Map	10
2.6	Static Maps (SM)	10
2.6.1	Nation Static Map	10
2.6.2	Building Static Map	10
2.6.3	Noosphere Static Map	11
2.6.4	Stock Static Map	11
3	Mechanisms	12
3.1	Event Order	12
3.2	Node Control	12
3.3	Actions	12
3.4	Map Projection	12
3.4.1	Cylinder Projection	12
3.5	Transport	12
3.5.1	Stock Transport	13

3.5.2	Force Transport	13
3.6	Population	13
3.6.1	Employment	13
3.6.2	Birth Rate	13
3.6.3	Migration	13
3.7	Production	13
3.7.1	Stock Production	13
3.7.2	Force Production	13
3.7.3	Development	13
3.8	Maintenance	13
3.8.1	Force Maintenance	13
3.8.2	Building Maintenance	13
3.8.3	Stream Maintenance	13
3.9	Stock Exchange	13
3.9.1	Swap Ratio	13
3.9.2	Local Exchange	13
3.9.3	Inter-Controller Trade	13

Chapter 1

Introduction

1.1 Authorship Note

The author is

- Krzysztof Czarnecki, czarnecki.krzysiek@gmail.com, Gdansk, Poland

1.2 Version Note

Version of this document: 0.01

1.3 Licence Note

1. The authors of this document do not provide any guarantee of using the presented model or any part of this model.
2. All authors of this document should be efficiently informed about any use (especially commercial and public) of the presented model or any part of this model.
3. Scientific and other publications, which provide results obtained by using the presented model or any part of this model, should have an appropriate note (including all authors names and surnames) about this fact at least in bibliography.

1.4 Terms Definition

1. **model** – a set of configurations, a specific instance of world/map
2. **node** – limited area, territorial administration unit
3. **nation** – an ethnically homogeneous group of people
4. **stock** – a type of good which can be controlled, transported and processed
5. **stream** – a pipe between 2 adjacent nodes for stock transport
6. **population** – sum of all people (over nations) in a node
7. **process** – a defined way to process an combination of stocks to:
 - another combination of stocks (stock process)
 - any selected force (force process)
8. **action** – a type of acting, it gives possibility to impact on a model
9. **controller** – an object giving access for human player or controlled by AI
10. **force** – a type of power (both civilian and military) which represents quantitative impact on a node
11. **attitude** – quantitative representation of sympathies or dislikes from a nation to a controller
12. **noosphere** – sphere of human thought, it represents control of population using media
13. **current** – this quantity characterizes strength (steepness) and direction of:
 - surface slope
 - sea currents
 - rivers

Chapter 2

Data: Tables and Maps

All data, including maps, shall be organized in tables. Each table has to contain at least a single key (column of the table). Division between keys and values are defined by "role" column in a corresponding table header definition. Each key has to be unique in a table.

2.1 Frozen Tables (FT)

Frozen Tables are tables which are defined for a specific simulator version. They have fixed size and constant keys defined by this document. The column configuration is also constant or depends on other constant or static tables. Selected values can be set only before simulating. During the simulation, they are always read only.

2.1.1 Config Frozen Table

- table name: config_ft
- table type: frozen table
- brief: a list of predefined global parameters

Tab. 2.1.1 Header

column title	column type	column role	column brief
name	string	key	parameter name
value	float	value	parameter value

Tab. 2.1.1 Content

name	parameter brief
map_scale	map scale
map_width	map width (rounded to int)
map_height	map height (rounded to int)
map_project	code of map projection (rounded to int, only 0)
toll_transship	cost metric for land-see/see-land transport
toll_transport	cost metric for civilian transport
toll_fortress	cost metric for units moving during a battle
toll_current	cost metric for currents
transship_gain	building gain for land-see/see-land transport
transport_gain	building gain for civilian transport
product_gain	building gain for production
depot_gain	depot capacity (mean amount of stock per depot)
house_gain	house capacity (mean number of people per house)
build_staff	mean number of people needed to building maintenance
build_cost	amount of building stock needed to building
offensive_cost	cost of offensive as factor

Continued on next page

Continued from previous page

name	parameter brief
defensive_cost barrack_cost	cost of defensive as factor cost of barrack as factor
media_attitude capitol_attitude leader_attitude nation_attitude	impact on noosphere from infrastructure impact on noosphere from capitol impact on nation from leadership impact on noosphere from nation
human_consumption employ_impact attitude_impact birth_rate	amount of stock needed for people for life employ impact on birth rate attitude impact on birth rate base birth rate
swap_tollerance swap_dynamic	swap tollerance swap dynamic
employ_dynamic attitude_dynamic emigration_dynamic	employ dynamic attitude dynamic emigration dynamic
land_range see_range	land trade/civil range see trade/civil range
air_range navy_range light_range heavy_range	air force range navy warfare range land light range land heavy range

2.1.2 Force Frozen Table

- table name: force_ft
- table type: frozen table
- brief: a list of predefined military processes

Tab. 2.1.2 Header

column title	column type	column role	column brief
name	string	key	force name
code	char	key	force code
offensive	float	value	offensive power (0, ∞)
defensive	float	value	defensive power (0, ∞)
civil	float	value	civil power (0, ∞)
$\forall \text{ name} \in \text{stock_ft}$	float	value	stocks needed to work
$\forall \text{ name} \in \text{stock_ct}$	float	value	stocks needed to work
<i>Each unit needs stocks to work.</i>			

Tab. 2.1.2 Content

name	code	force brief
civil	C	civil service (diplomats, intelligence, corporations)
light	L	land light army (mainly infantry)
heavy	H	land heavy army (mechanized, artillery)
navy	N	naval warfare (selected actions on adjacent land allowed)
air	A	air force (selected remote actions allowed)

2.1.3 Action Frozen Table

- table name: action_ft
- table type: frozen table
- brief: a list of predefined action types

Tab. 2.1.3 Header

column title	column type	column role	column brief
name	string	key	action name
type	string	value	types are defined by Tab. 2.1.3 Coding
factor	float	value	factor ($0, \infty$) expresses efficient of the action
target	string	value	target type (controller, nation, process, ...)
attitude	float	value	attitude $(-\infty, \infty)$ on population

Tab. 2.1.3 Coding

type code	code brief
C	can be realized by civil service
L	can be realized by light forces
H	can be realized by heavy forces
N	can be realized by naval forces
A	can be realized by air forces
1	can be realized if defence of population will be overcome
2	can be realized if defence of action target (including population support) will be overcome
3	can be realized if defence of all enemies and population will be overcome
X	civil power using
D	defencive power using
O	offencive power using

Tab. 2.1.3 Content

action	type	target	brief
A0	CLHN-3-X	stock	apply input duty
A1	CLHN-3-X	stock	apply output duty
A2	CLHN-3-X	stock	apply transit duty
A3	CLH-1-X	stock	get taxes
B0	CLHA-1-O	process	block stock process
B1	CLHA-2-O	controller	block force processes
B2	CLHA-1-X	—	control force processes
B3	C-1-X	—	realize stock processes
C0	C-1-X	—	get economy info
C1	C-2-X	controller	get military info
C2	C-2-X	controller	get service info
D0	CLHNA-1-D	—	block X2 and X3 actions (default)
D1	CLHNA-2-O	controller	remove service
E0	C-1-X	nation	spreading positive propaganda
E1	C-2-X	controller	spreading negative propaganda
F0	CVMNA-1-X	stock	create stream
F1	CVMNA-2-O	controller	block/destroy stream
F2	CVMNA-2-O	controller	confiscate/destroy stock (remote only A)
G0	C-1-X	node	move civil force
G0	LHNA-3-O	node	move non civil force
G1	CLHNA-2-O	controller	strike militarily (remote only A)
H0	CL-1-X	building	develope selected building
H1	CLH-1-O	building	destroy selected non-critical building
H2	CLHAN-3-O	—	destroy critical building (remote only AN)
H3	CLHAN-3-O	—	destroy all building (remote only AN)
I0	CLH-3-O	nation	persecute selected nation
I1	CLH-3-O	—	persecute all nations
J0	CLHAN-1-X	nation	change leader nation (only in capitol)
J1	CLHAN-1-X	node	change capital node (only in capitol)
J2	CLHAN-1-X	controller	peace declare (only in capitol)
J3	CLHAN-1-X	controller	war declare (only in capitol)

Continued on next page

Continued from previous page

action	type	target	brief
K0	CLHN-1-X	stock	declare stock buy
K1	CLHN-1-X	stock	declare stock sell
K2	CLHN-1-X	stock	declare stock distribution

2.1.4 Building Frozen Table

- table name: building_ft
- table type: frozen table
- brief: a set of predefined buildings

Tab. 2.1.4 Header

column title	column type	column role	column brief
name	string	key	name of building

Tab. 2.1.4 Content

name	building brief
transship	transship infrastructure (critical)
transport	transport infrastructure (critical)
fortress	fortress used for defence during battle (critical)
media	information infrastructure (impact)
house	housing infrastructure (capacity)
depot	depot infrastructure (capacity)

2.1.5 Stock Frozen Table

- table name: stock_ft
- table type: frozen table
- brief: a list of predefined stocks

Tab. 2.1.5 Header

column title	column type	column role	column brief
name	string	key	stock name
decay	float (0, 1]	value	decay of the stock per each round
toll	float (0, ∞)	value	toll for stock transport

Tab. 2.1.5 Content

name	decay range	toll range	stock brief
energy	1	(0, ∞)	energy which can be consumed in the current round
building	1	∞	building possible to develop in the current round
consumption	1	∞	it represents consumption in the current round

2.2 Constant Tables

Constant Tables are tables which are defined for a specific model. Their sizes, column configuration, and content (keys and values) have to be set before simulating. During the simulation, their are always read only.

2.2.1 Terrain Constant Table

- table name: terrain_ct
- table type: constant table
- brief: a list of terrains

Tab. 2.2.1 Header

column title	column type	role	brief
name	string	key	terrain name
color	string	key	RGB in HEX
drag	float $(0, \infty)$	value	drag / resistance
charge	float $(0, \infty)$	value	building maintenance charge
capacity	float $[0, \infty)$	value	capacity for stock and people

2.2.2 Stock Constant Table

- table name: stock_ct
- table type: constant table
- brief: a list of stocks

Tab. 2.2.2 Header

column title	column type	column role	column brief
name	string	key	stock name
decay	float $(0, 1]$	value	decay in each round
toll	float $(0, \infty)$	value	toll for transport

2.2.3 Process Constant Table

- table name: process_ct
- table type: constant table
- brief: a list of processes

Tab. 2.2.3 Header

column title	column type	column role	column brief
name	string	key	process name
energy	float $(-\infty, \infty)$	value	energy amount
building	float $[0, \infty)$	value	building amount
consumption	float $[0, \infty)$	value	consumption amount
$\forall \text{name} \in \text{stock_ct}$	float $(-\infty, \infty)$	value	stock amount
<i>Each process can have any combinations of stocks.</i>			

2.3 Static Tables (ST)

Static Tables are tables which are defined for a specific model. Their sizes and column configuration have to be set before simulating and are read only. However, during the simulation, their content (values only) can freely be modified.

2.3.1 Control Static Table

- table name: control_st
- table type: static table
- brief: a list of controllers

Tab. 2.3.1 Header

column title	column type	column role	column brief
name	string	key	controller name
nation	string	value	nation of leader
capitol	string	value	base node name of the controller
employment	float $(0, 1]$	value	model of employment
$\forall \text{name} \in \text{control_st}$	bool	value	war declaration
<i>Each controller can declare war for any other controller.</i>			

2.3.2 Nation Static Table

- table name: nation_st
- table type: static table
- brief: a list of nations with their attitude to controllers

Tab. 2.3.2 Header

column title	column type	column role	column brief
name	string	key	nation name
employment	float (0, 1]	value	fraction of employment
$\forall \text{ name} \in \text{control_st}$	float [-1, 1]	value	attitude

Each nation has specified attitude to all controllers.

2.3.3 Swap Static Table

- table name: swap_st
- table type: static table
- brief: a list of stocks with their mean prices expressed in amount of different stocks

Tab. 2.3.3 Header

column title	column type	column role	column brief
name	string	key	stock name
volume	float	value	stock volume exchanged
offer	float	value	total stock offer
need	float	value	total stock need
$\forall \text{ name} \in \text{stock_ft}$	float (0, ∞)	value	mean ratio/price
$\forall \text{ name} \in \text{stock_ct}$	float (0, ∞)	value	mean ratio/price

Each stock has specified prices expressed by all stocks.

2.4 Dynamic Tables (DT)

Dynamic Tables are used as buffers for data which can be modified during simulating. Their sizes can be freely changed (even to 0 rows). Only the column configuration has to be set before the simulation but later it is read only.

2.4.1 Action Dynamic Table

- table name: action_dt
- table type: dynamic table
- brief: a list of actions to process

Tab. 2.4.1 Header

column title	column type	column role	column brief
owner	string	value	controller name
action	string	value	action name
force	char	value	force code – defined by Tab. 2.1.2
share	float	value	share/fraction of available impact
start	string	value	starting node name
stop	string	value	destination node name
target	string	value	controller/nation/stock/process

2.4.2 Force Dynamic Table

- table name: force_dt
- table type: dynamic table
- brief: a list of forces over controllers

Tab. 2.4.2 Header

column title	column type	column role	column brief
owner	string	value	controller name
node	string	value	node name
force	char	value	force code – defined by Tab. 2.1.2
amount	float (0, ∞)	value	force amount

2.4.3 Stream Dynamic Table

- table name: stream_dt
- table type: dynamic table
- brief: a list of streams over nodes

Tab. 2.4.3 Header

column title	column type	column role	column brief
id	int [0, ∞)	key	stream identifier
owner	string	value	controller name
stock	string	value	stock name
start	string	value	starting node name
stop	string	value	destination node name
amount	float	value	stock amount

2.4.4 Flow Dynamic Table

- table name: flow_dt
- table type: dynamic table
- brief: a list of components of streams

Tab. 2.4.4 Header

column title	column type	column role	column brief
id	int [0, ∞)	value	stream identifier
start	string	value	starting node name
stop	string	value	destination node name

2.4.5 Market Dynamic Table

- table name: market_dt
- table type: dynamic table
- brief: a list of offered stock transactions over nodes

Tab. 2.4.5 Header

column title	column type	column role	column brief
owner	string	value	controller name
node	string	value	node name
stock	string	value	stock name
amount	float	value	stock amount

2.5 Constant Maps (CM)

Constant Maps are tables which are defined for a specific model with the geographical context. Their sizes, column configuration, and content have to be set before simulating. During the simulation, their are always read only.

2.5.1 Diagram Constant Map

- table name: diagram_cm
- table type: constant map
- brief: a list of atoms with terrain and node characterization over the geographical context

Tab. 2.5.1 Header

column title	column type	column role	column brief
x	int [0, ∞)	part of key	x coordinate
y	int [0, ∞)	part of key	y coordinate
color	string	value	terrain color / id
node	string	value	node name
dx	float (- ∞ , ∞)	value	vector x component
dy	float (- ∞ , ∞)	value	vector y component

2.5.2 Source Constant Map

- table name: source_cm
- table type: constant map
- brief: a list of natural stock source over the geographical context

Tab. 2.5.2 Header

column title	column type	column role	column brief
node	string	key	node name
$\forall \text{ name} \in \text{stock_ct}$	float [0, ∞)	value	yield of stock
<i>Each node can be a source of any stock from stock_ct.</i>			

2.6 Static Maps (SM)

Static Maps are tables which are defined for a specific model with the geographical context. Their sizes and column configuration have to be set before simulating and are read only. However, during the simulation, their content (values) can freely be modified.

2.6.1 Nation Static Map

- table name: nation_sm
- table type: static map
- brief: a list of nation over the geographical context

Tab. 2.6.1 Header

column title	column type	column role	column brief
node	string	key	node name
$\forall \text{ name} \in \text{nation_st}$	int [0, ∞)	value	number of people
<i>Each nation has a specific distribution over nodes.</i>			

2.6.2 Building Static Map

- table name: building_sm
- table type: static map
- brief: a list of building over the geographical context

Tab. 2.6.2 Header

column title	column type	column role	column brief
node	string	key	node name
$\forall \text{ name} \in \text{building_ft}$	int $[0, \infty)$	value	number of buildings
$\forall \text{ name} \in \text{process_ct}$	int $[0, \infty)$	value	number of buildings
$\forall \text{ name} \in \text{force_ft}$	int $[0, \infty)$	value	number of buildings
$\forall \text{ name} \in \text{stock_ct}$	int $[0, \infty)$	value	number of buildings

Each building has a specific distribution over nodes.

2.6.3 Noosphere Static Map

- table name: noosphere_sm
- table type: static map
- brief: a list of controller share of information media over the geographical context

Tab. 2.6.3 Header

column title	column type	column role	column brief
node	string	key	node name
$\forall \text{ name} \in \text{control_st}$	float $[0, 1]$	value	share

Each controller can have a specific distribution of impact over nodes.

2.6.4 Stock Static Map

- table name: stock_sm
- table type: static map
- brief: a list of gathered stock over the geographical context

Tab. 2.6.4 Header

column title	column type	column role	column brief
node	string	key	node name
$\forall \text{ name} \in \text{stock_ft}$	float $[0, \infty)$	value	amount
$\forall \text{ name} \in \text{stock_ct}$	float $[0, \infty)$	value	amount

Each stock can have a specific distribution over nodes.

Chapter 3

Mechanisms

3.1 Event Order

3.2 Node Control

3.3 Actions

3.4 Map Projection

3.4.1 Cylinder Projection

3.5 Transport

$$R_{\text{next}} = R_{\text{curr}} + R_{\text{atom}} X^{-S_{\text{stream}}}$$

3.5.1 Stock Transport

3.5.2 Force Transport

3.6 Population

3.6.1 Employment

3.6.2 Birth Rate

3.6.3 Migration

3.7 Production

3.7.1 Stock Production

3.7.2 Force Production

3.7.3 Development

3.8 Maintenance

3.8.1 Force Maintenance

3.8.2 Building Maintenance

3.8.3 Stream Maintenance

3.9 Stock Exchange

3.9.1 Swap Ratio

3.9.2 Local Exchange

3.9.3 Inter-Controller Trade