

Tatu Laine

Bank of Finland

Step-by-Step Simulation example

Example 1 decimal point version





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Background information

This presentation describes step-by-step how a basic RTGS simulation is performed using the BoF-PSS2 simulator.

The main steps are

- Input data creation
- Simulation execution
- Analysis of results

This version uses decimal point as decimal delimiter and semicolon as data delimiter, which is important to note in order to get the Excel interface to function properly.



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How to follow the example

Instructions in this example are mainly presented with screenshots from simulator. These will tell you what the simulator window looks like, when you have finished the necessary actions in that simulator window. Instructions for steps in one window can however be divided into several slides.

Therefore follow the steps of the example by repeating **only** the actions which are pointed with thick arrows.



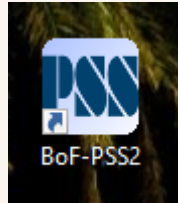
Thin arrows are used occasionally in explanations and require no action.





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Start the simulator



Double click on the simulator icon or start the program from the windows program menu.

Three windows will open up:

- Start-up window for simulator
- MySQL window for database interface
- Simulator user interface window

All three windows are necessary during simulations and will be closed automatically when you exit from the simulator.



Initial start up

First time you run the simulator initial specifications open up.

Specify a project name. Projects are used to separate simulation topics.

Click tab key and the default database and directory names emerge.

Save project
Go to main menu



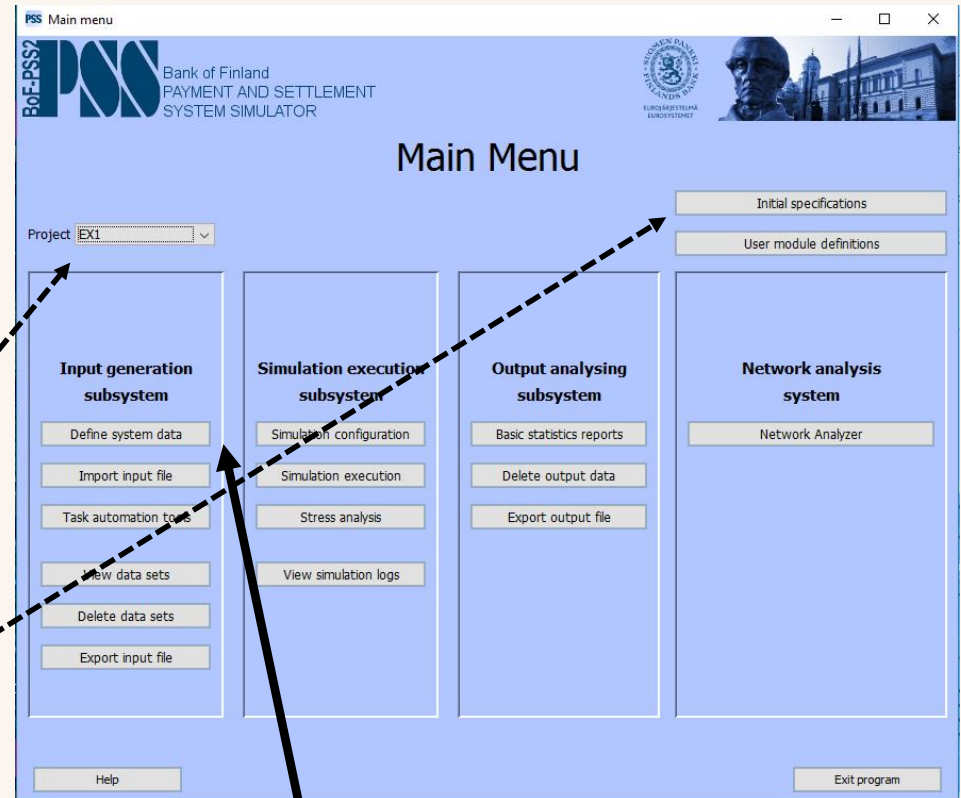
Main menu

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The main menu will open up whenever you start the simulator in the future.

It provides the window to the different functions of the simulator.

You can choose the project you are working with and define new projects when necessary (see previous slide).



Start by defining system data (click on the button).



System data definition 1

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In system data definition

Type the system ID
CB_RTGS (best practice is to use real system name)

and give name
(FreeCred) for this system data set.
(see next slide)

Project : EX1

Select existing system ID Create new system ID CB_RTGS

Modify old system data set Create new system data set FreeCred Copy from old system data set

System full name: Opens (hours/24h): System description:
System type: Business day deduction: Deducted from transaction ...

Transfer of balances
 Transfer balances to next day
 Filter algorithms supporting bilater...

Intraday credit availability
 Credits according to limit table, or
 No credits available, or
 Credit available without limits

Handling of unsettled transactions
 Transfer unsettled transactions to next day/settlement occasion or
 Delete unsettled transactions (include in statistics)
 Delete unsettled transactions (exclude from statistics)
 Force end-of-day settlement of unsettled transactions

Potential algorithms: select one and add it to the attached algorithms by pressing the 'Add algorithm' button. ENT and END algorithms are mandatory.
Add algorithm

Attached algorithms: Changes of order by dragging/dropping. Deletion by striking keyboard 'delete' button for active algorithms.

Algorithm	Algorithm type	Time estimation algorithm	Double click row to insert parameter values
-----------	----------------	---------------------------	---

Save system data set
Help Back to main menu Exit program



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System ID & system data set name

System ID is the name for the real system under study. It is used to link together all different datasets belonging to one system.

Dataset IDs were used to allow storage of parallel data tables. Similarly system definitions are given a system dataset name to allow parallel system setups. These can easily be used to test i.e. different queuing methods or effects of including some optimization feature.

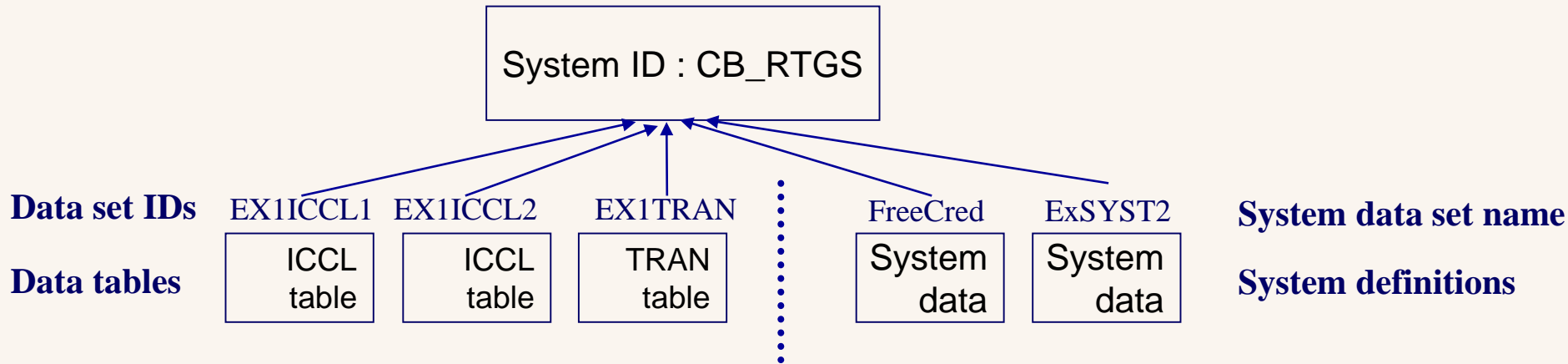
System IDs are needed because there can be several real systems in one project or one simulation e.g. parallel RTGS and DNS-systems.



System ID & system data set name

Relations between system ID, data set ID and data tables.

System under study





System data definition 2

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System full name and description are optional. (use these for notes)

Choose system type (RTGS)

System types available:

- RTGS (real time gross settlement)
- CNS (continuous net settlement)
- DNS (deferred net settlement)

Set the opening hours (in this example 070000 – 190000).

Project: EX1

Select existing system ID: Create new system ID:

Modify old system data set: Create new system data set: Copy from old system data set:

System full name: Opens (hhmmss 24h): System description:
System type: Closes:
System acronym: Business day deduction:

Transfer of balances
 Transfer balances to next day
 Filter algorithms supporting bilateral

Intraday credit availability
 Credit according to limit table, or
 No credits available, or
 Credit available without limits

Handling of unsettled transactions
 Transfer unsettled transactions to next day/settlement occasion or
 Delete unsettled transactions (include in statistics)
 Delete unsettled transactions (exclude from statistics)
 Force end-of-day settlement of unsettled transactions

Potential algorithms: select one and add it to the attached algorithms by pressing the 'Add algorithm' button. ENT and END algorithms are mandatory.
SEH T2EVTEND urgent priority limit, Positive integer; highly urgent priority limit, Positive...

Attached algorithms: Changes of order by dragging/dropping. Deletion by striking keyboard 'delete' button for active algorithms.

Algorithm	Algorithm type	Time estimation algorithm	Double click row to insert parameter values
-----------	----------------	---------------------------	---



System data definition 3

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In this FreeCred system dataset, choose *credit available without limits* to allow free intraday credit.

Transferring of balances and options for handling unsettled transactions at the end of day can be defined. These are currently irrelevant since EX1 data has only one day.

Define system data

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SYSTEM SIMULATOR

System control data specification/modification

Project : EX1

Select existing system ID Create new system ID

Modify old system data set Create new system data set Copy from old system data set

System full name: Opens (hhmmss 24h): System description:
System type: Closes:
System acronym: Business day deduction:

Transfer of balances
 Transfer balances to next day
 Filter algorithms supporting bilater...

Intraday credit availability
 Credits according to limit table, or
 No credits available, or
 Credit available without limits

Handling of unsettled transactions
 Transfer unsettled transactions to next day/settlement occasion or
 Delete unsettled transactions (include in statistics)
 Delete unsettled transactions (exclude from statistics)
 Force end-of-day settlement of unsettled transactions

Potential algorithms: select one and add it to the attached algorithms by pressing the 'Add algorithm' button. ENT and END algorithms are mandatory.
SEH T2EVTIHD urgent priority limit, Positive integer; highly urgent priority limit, Positive...

Attached algorithms: Change of order by dragging/dropping. Deletion by striking keyboard 'delete' button for active algorithms.

Algorithm	Algorithm type	Time estimation algorithm
		Double click row to insert parameter values



System data definition 4

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Add following algorithms to system by selecting them one by one in drop down list and clicking “add algorithm”.

- ENBASIC1
- SEBASIC1
- ENDRTGS1
- QUFIFOPR

(see also next slides)

After these steps system definition can be saved.

Return to Main menu

System full name: Example 1 FreeCred
System type: RTGS
System acronym:
Opens (hhmmss 24h): 070000
Closes: 190000
Business day deduction: Deducted from transaction ...
System description: CB_RTGS system with FREE credit

Transfer of balances
 Transfer balances to next day
 Filter algorithms supporting bilater...

Intraday credit availability
 Credits according to limit table, or
 No credits available, or
 Credit available without limits

Handling of unsettled transactions
 Transfer unsettled transactions to next day/settlement occasion or
 Delete unsettled transactions (include in statistics)
 Delete unsettled transactions (exclude from statistics)
 Force end-of-day settlement of unsettled transactions

Potential algorithms: select one and add it to the attached algorithms by pressing the 'Add algorithm' button. ENT and END algorithms are mandatory.
QUE QUFIFOPR [Add algorithm]

Algorithm	Algorithm type	Time estimation algorithm	Double click row to insert parameter values
ENBASIC1	ENT	not supported	
SEBASIC1	SET	not supported	
ENDRTGS1	END	not supported	
QUFIFOPR	QUE	not supported	

Save system data set
Back to main menu
Exit program



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Algorithms

- Algorithms are used to define the processing conventions for each system. There are several algorithm types (with three letter names e.g. QUE) and often more than one actual algorithm within each type to choose from (e.g. QUFIFOPR and QUBYPAFI).
- One simulated system can not include two algorithms of same type.
- Three types are mandatory (SUB, ENT & END) others are optional.

Types can be classified in main- and sub-algorithms
(see next 2 slides)



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Main algorithms

- ENT (entry) algorithm is first processing phase for a transaction. Transactions are generally transferred to bookings when liquidity is available or queued/discarded if there is a lack of liquidity.
- SET (settlement) algorithm processes queued transactions, e.g. invoking gridlock- resolution algorithms. Is needed always if there is a queue in system structure
- END (end-of-day) algorithm clears up end-of-day situations
- SUB (submission) algorithm determines what happens next in the simulation, i.e. it chooses the next transaction or system event to be processed. SUB algorithm is selected in the simulation configuration (slide 31).



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Sub-algorithms

These can be invoked by ENT, SET and END algorithms

- QUE (queue release) algorithms release individual transactions from waiting queues in a defined order
- SPL (splitting) algorithms split large transactions into small, easy-to-process transactions
- INJ (injection) algorithms transfer liquidity from/to accounts to/from other systems
- BOS (bilateral offsetting) nets queued transactions between two counterparties in a given order
- PNS (partial net settlement) algorithms seek multilateral payment batches that can be netted
- MNS (multilateral net settlement) Multilateral netting of “all or nothing” transactions in queues.

Precise definitions for algorithms can be found in simulator manuals.



Main menu

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When system definition is successfully done, return to main menu...

and proceed with importing data.





Input files and directories 1

There are five types of input files

- Participant data files
- Transaction data files
- Intraday credit data files
- Beginning-of-day balances files
- Bilateral credit limit data

CSV-files can be easily Created with Excel, Access, MySQL etc. The 'true' content can be easily checked with Notepad.

All input files are comma-separate-value files (CSV-files).

Title lines are helpful for labelling data fields and data set. They can be skipped in import.

Data delimiter between each data field.

```
Ex1-tran.csv - Notepad
File Edit Format View Help
Transaction data for RTGS in example 1; ; ; ; ; ; ; ;
ID;Day;Time;Value;Sending participant ID;Sending account ID
101;20030512;070100;4880384.39;13;13;1;1;1;20030512
102;20030512;070100;685826.6;12;12;1;1;1;20030512
103;20030512;070100;2639630.73;11;11;1;1;1;20030512
104;20030512;070100;46064.41;10;10;1;1;1;20030512
105;20030512;070100;633795.99;2;2;1;1;1;20030512
106;20030512;070100;79702.04;14;14;1;1;1;20030512
107;20030512;070100;2786.33;6;6;1;1;1;20030512
108;20030512;070100;8000.03;5;5;1;1;1;20030512
109;20030512;070100;153492.54;13;13;5;5;1;20030512
110;20030512;070100;83989.24;12;12;5;5;1;20030512
111;20030512;070100;779471.41;11;11;5;5;1;20030512
112;20030512;070100;6678.92;10;10;5;5;1;20030512
113;20030512;070100;49921.7;2;2;5;5;1;20030512
114;20030512;070100;17337.06;14;14;5;5;1;20030512
115;20030512;070100;300182.44;6;6;5;5;1;20030512
116;20030512;070100;18850.40;1;1;5;5;1;20030512
```



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Input files and directories 2

The default folder for input files is INPUT in the corresponding project directory. In this project EX1 it is C:/BoF-PSS2/P_EX1/INPUT

Please copy the input files Ex1-part.csv and Ex1-tran.csv from the directory c:/BoF-PSS2/EXAMPLES/DECIMAL_POINT to the example default input directory C:/BoF-PSS2/P_EX1/INPUT. Example material can also be found on the web pages of the simulator (www.suomenpankki.fi/simulator).

The “import input file” screen can now be used to import the data to input database of the simulator.



Import participant data 1



- Select PART table
- Check that data and decimal separator are correct (; and .)
- Browse for input file
- Select system ID from Drop down list
- State data set ID, (i.e. EX1PART)

See explanation on next slide

Project : EX1

Database table: PART Participant data

Data format defaults

Data separator: ; Date format: yyyyymmdd

Decimal separator: . Time format: hhmmss

System ID: CB_RTGS

Input file: C:\BoF-PSS2\p...EX1-part.csv

Create new data set: EX1PART

Use old data set: example

Number of rows to skip at the beginning: 2

Number of rows to skip at the end: 0

File column...	DB col...	Man/Opt	Var. name	Descriptive name
1	3	M	P_PARTICID	Participant ID
2	4	M	P_ACCOUNID	Account ID
	5	O	P_ACCOTYPE	Account type
	6	O	P_FULLNAME	Full name
	7	O	P_SHORTACR	Short acronym
	8	O	P_ACCONAME	Account name
	9	O	P_SETINSYS	Settles in system
	10	O	P_SETONPAR	Settles on participant
	11	O	P_SETONACC	Settles on account
	12	O	P_LIQFRSYS	Liquidity injection from system

Rows processed: Rows with errors:

Stop import Undo import Execute import View error report

Help Back to main menu Exit program



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Data sets

- Data set IDs allow storage of parallel data tables in database
- Simulations may use different data sets for varying the input data, e.g. more or less intraday credit, normal or exceptional transaction flows

Data set IDs

CRVAL1

CRVAL2

CRVAL_n

Data tables

ICCL
table



• • •

ICCL
table

*Use a clear naming convention
for different data sets*

Import participant data 2



- Create a new template that corresponds to your input data. Now you can use ready made “*example*” template
- State how many title lines to skip in the beginning
- State the columns in the CSV file which correspond to database fields

Project : EX1

Database table: PART Participant data

Data format defaults: Data separator: ; Date format: yyyyymmdd
Decimal separator: . Time format: hhmmss

System ID: CB_RTGS

Input file: C:\BoF-PSS2\P_EX1\INPUT\Ex1-part.csv

Create new data set: EXIPART Create new template
 Insert into old data set: Use old template: example

Number of rows to skip at the beginning: 2 Number of rows to skip at the end: 0

File column...	DB col	Man/Opt	Var. name	Descriptive name
1	3	M	P_PARTICID	Participant ID
2	4	M	P_ACCOUNTID	Account ID
	5	O	P_ACCOTYPE	Account type
3	6	O	P_FULLNAME	Full name
	7	O	P_SHORTACR	Short acronym
	8	O	P_ACCONAME	Account name
	9	O	P_SETINSYS	Settles in system
	10	O	P_SETONPAR	Settles on participant
	11	O	P_SETONACC	Settles on account
	12	O	P_LIQFRSYS	Liquidity injection from system

Rows processed: Rows with errors:

Buttons: Stop import, Undo import, Execute import, View error report, Help, Back to main menu, Exit program



Import participant data 3



- Start the import by clicking “Execute import” button.
- Click “Ok” in popup informing the ending of import.
- Check that all lines were imported successfully (0 lines with error).
- If there were errors see the next two Slides.

Project : EX1

Database table: PART Participant data

Data format defaults: Data separator: ; Date format: yyyyymmdd
Decimal separator: . Time format: hhmmss

System ID: CB_RTGS Select referenced PART data set:

Input file: C:\BoF-PSS2\P_EX1\INPUT\Ex1-part.csv

Create new data set:
 Insert into old data set:

Number of rows to skip at the beginning: 0 Rows to skip at the end: 0

File column...	DB col	Man/Opt	Var. name	Description
1	3	M	P_PARTICID	Participant ID
2	4	M	P_ACCOUNTID	Account ID
3	5	O	P_ACCOTYPE	Account type
4	6	O	P_FULLNAME	Full name
5	7	O	P_SHORTACR	Short acronym
6	8	O	P_ACCOUNTN	Account name
7	9	O	P_SETINSYS	Settles in system
8	10	O	P_SETONPAR	Settles on participant
9	11	O	P_SETONACC	Settles on account
10	12	O	P_LIQFRSYS	Liquidity injection from system

Rows processed: 18 Rows with errors: 0 Done

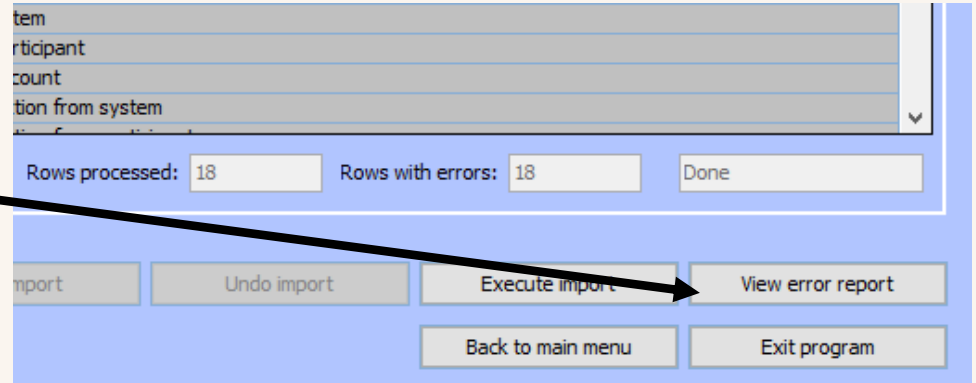
Buttons: Stop import, Undo import, Execute import, View error report, Help, Back to main menu, Exit program



Import error handling for participant data



If the import wasn't successful you can view error report. See the next slide. (It opens in Excel. After studying the report close Excel to return to BoF-PSS2.)



For opening the error reports outside the simulator look in to ERRORLIST folder in the projects directory (in this example C:\BoF-PSS2\P_EX1\ERRORLIST).



Import error handling for participant data

Line in CSV-file with error

Column/field with error

Error type

Row:	Col:	Code:	Excp:	Desc:		
1	13	1	null	Illegal number format		
2	13	1	null	Illegal number format		
3	13	1	null	Illegal number format		
4	13	1	null	Illegal number format		

Some possible problems now:

- Incorrect data or decimal separator (look at the slide “Import participant data 1”)
- Incorrect number of lines to skip in the beginning of csv-file (same as above)

Common problems with real data (not present in these examples):

- The csv-file can contain empty rows (usually) at the end of the file. Open the csv-file in notepad to check if there are rows like “,,,,” at the end of file.
- Or the data in cvs-file just isn’t looking like what was expected, check the template and data file (use notepad again).

When repeating the import after making corrections, choose “use old template”. Changes in template are saved automatically when the template is used.



Import transaction data 1



- Change the database table to TRAN for importing transactions. Use again ready made template “*example*”.
- Check data and decimal separator and that date and time format match the contents of CSV-file (in this example *yyyymmdd* and *hhmmss*).
- Choose the file to import.
- State data set ID.

Project : EX1

Database table: TRAN Transaction data

Data format defaults
Data separator: ; Date format: yyyymmdd
Decimal separator: . Time format: hhmmss

System ID: CB_RTGS

Input file: C:\BoF-PSS2\p_EX1\INPUT\Ex1-tran.csv

Create new data set: EXITRAN
 Insert into old data set:

Number of rows to skip at the beginning: 2

Select referenced PART data set: EXIPART
 Create new template:
 Use old template: example

Number of rows to skip at the end: 0

File column...	DB column	Man/Opt	Var. name	Descriptive name
1		M	T_TRANSAID	Transaction ID
2	4	M	T_INTRDATE	Introduction date
3	5	M	T_INTRTIME	Introduction time
6		M	T_TRANVALU	Transaction value
7		O	T_FRSYSTID	From system ID
8		M	T_FRPARTID	From participant ID
9		M	T_FRACCOID	From account ID
10		O	T_TOSYSTID	To system ID
11		M	T_TOPARTID	To participant ID
12		M	T_TOACCOID	To account ID

Rows processed: Rows with errors:

Stop import Undo import Execute import View error report

Help Back to main menu Exit program



Import transaction data 2

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- Start the import by clicking “Execute import” button.
- Click “Ok” in popup informing the ending of import.
- Check that all lines were imported successfully (0 lines with error).

Project : EX1

Database table: TRAN Transaction data

Data format defaults
Data separator: ; Date format: yyyyymmdd
Decimal separator: . Time format: hhmmss

System ID: CB_RTGS Select referenced PART data set: EX1PART

Input file: C:\BoF-PSS2\IP_EX1\INPUT\Ex1-tran.csv

Create new data set:
 Insert into old data set:
Number of rows to skip at the beginning:
New template:
Example template: example
Rows to skip at the end: 0

File column...	DB col	Man/Opt	Var. name	Descriptive name
1	3	M	T_TRANSAID	Transaction ID
2	4	M	T_INTRDATE	Introduction date
3	5	M	T_INTRTIME	Introduction time
4	6	M	T_TRANVALU	Transaction value
5	7	O	T_FRSYSTEMID	From system ID
6	8	M	T_FRPARTID	From participant ID
7	9	M	T_FRACCOID	From account ID
8	10	O	T_TOSYSTEMID	To system ID
9	11	M	T_TOPARTID	To participant ID
10	12	M	T_TOACCOID	To account ID

Rows processed: 778 Rows with errors: 0 Done

Buttons: Stop import, Undo import, Execute import, View error report, Help, Back to main menu, Exit program

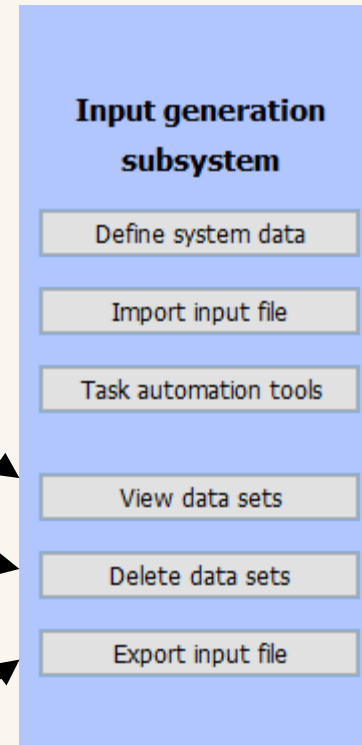


Input generation subsystem

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Three last buttons in import subsystem can be used to handle already imported datasets.

- View data in input database (see next slide)
- Delete data from input database (second next slide)
- Export data from the input database, e.g. for editing purposes





View data sets

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View data set window is useful for checking moderate size data tables.

Project : EX1

Data type: **TRAN Transaction data** System ID: **CB_RTGS** Data set ID: **EXITRAN**

Transaction ID	Introduction date	Introduction time	Transaction value	From system ID	From participant ID	From account ID	To sy
101	0512-03-20	070100	4880384.39	1	13	13	1
102	0512-03-20	070100	685826.60	1	12	12	1
103	0512-03-20	070100	2639630.73	1	11	11	1
104	0512-03-20	070100	46064.41	1	10	10	1
105	0512-03-20	070100	633795.99	1	2	2	1
106	0512-03-20	070100	79702.04	1	14	14	1
107	0512-03-20	070100	2786.33	1	6	6	1
108	0512-03-20	070100	8000.03	1	5	5	1
109	0512-03-20	070100	153492.54	1	13	13	1
110	0512-03-20	070100	83989.24	1	12	12	1
111	0512-03-20	070100	779471.41	1	11	11	1
112	0512-03-20	070100	6678.92	1	10	10	1
113	0512-03-20	070100	49921.70	1	2	2	1
114	0512-03-20	070100	17337.06	1	14	14	1
115	0512-03-20	070100	300182.44	1	6	6	1
116	0512-03-20	070100	18950.49	1	1	1	1
117	0512-03-20	070100	1634545.51	1	13	13	1
118	0512-03-20	070100	408639.34	1	12	12	1
119	0512-03-20	070100	1856551.99	1	11	11	1
120	0512-03-20	070100	184378.62	1	2	2	1
121	0512-03-20	070100	16723.85	1	14	14	1
122	0512-03-20	070100	12084.40	1	5	5	1
123	0512-03-20	070100	57860.37	1	1	1	1
124	0512-03-20	070100	4920425.27	1	13	13	1
125	0512-03-20	070100	1826540.68	1	12	12	1
126	0512-03-20	070100	11317666.71	1	11	11	1

Buttons: Help, Back to main menu, Exit program

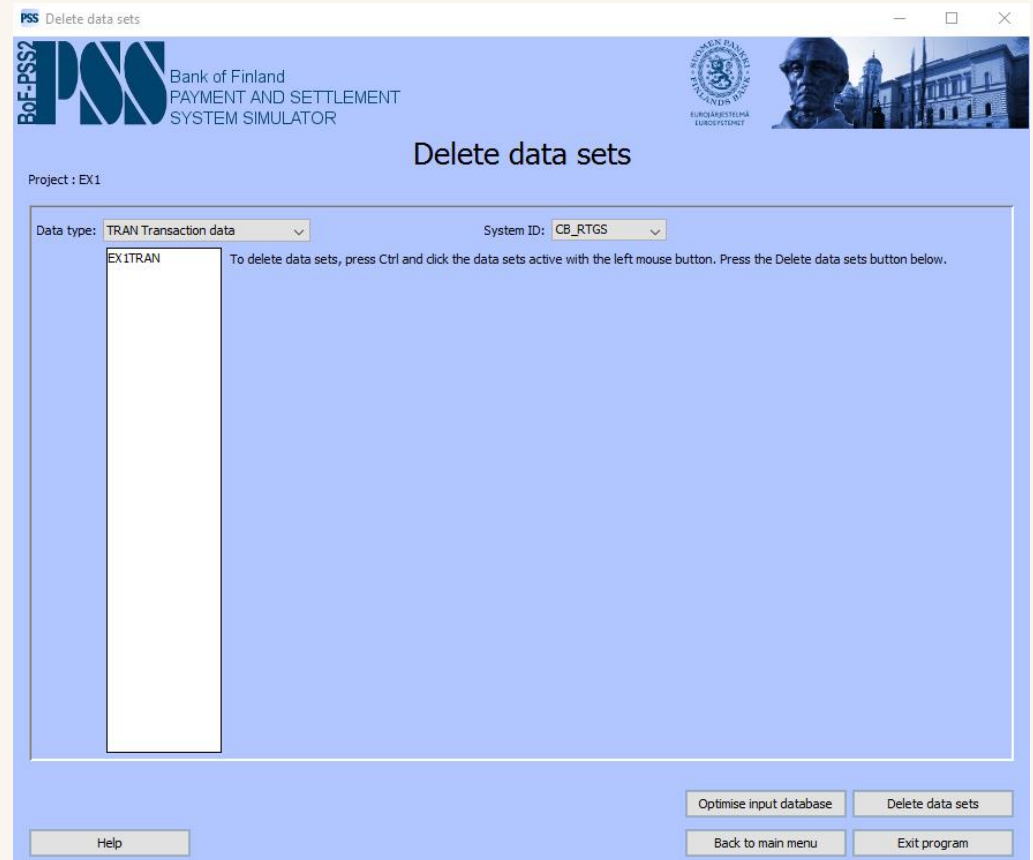


Delete data sets

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Delete data sets window provides view of available data sets.

Erroneous or unnecessary data sets can be Deleted.





Main manu (simulation configuration)

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- Now the first main phase *input data creation* is cleared.
- Move to simulation *execution* by selecting *simulation configuration* in main menu.





Simulation configuration 1

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- Start by typing simulation ID.
- Type simulation name (mandatory) and description (optional).
- Again use good naming convention which describes the configured simulation.
- A simulation is built by selecting the desired combination of imported data sets.

Simulation configuration

Project : EX1

Use old simulation ID Create new simulation ID EX1FREE Copy from old simulation ID

Simulation name: Ex1 with FREE credit
Description:

Sub-algorithm: SUFIFOPR Parameters, double click to modify the parameter values.

Data sets to simulation: CB_R... Free... EX1T... EX1P... Add/update data set Delete

System ID	SYCD	TRAN	PART	ICCL	DBAL	BLIM	RSRV	BusinessDa...
-----------	------	------	------	------	------	------	------	---------------

Number of errors:

Save simulation ID Cross-check Stop cross-check View errors Help Back to main menu Exit program



Simulation configuration 2

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- After selecting all necessary datasets from drop down menus, add them to simulation.

Simulation configuration

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SYSTEM SIMULATOR

Project : EX1

Modify old simulation ID Create new simulation ID EX1FREE Copy from old simulation ID

Simulation name: Ex1 with FREE credit

Description:

Sub-algorithm: SUFFOPR Parameters, double click to modify the parameter values.

Data sets to simulation:

System ID	SYCD	TRAN	PART	ICCL	DBAL	BLIM	RSRV	BusinessDa...
CB_RTGS	FreeCred	EX1TRAN	EX1PART					

Number of errors:

Buttons: Save simulation ID, Cross-check, Stop cross-check, View errors, Help, Back to main menu, Exit program

Text: For defining data sets for the simulation first select the desired system ID in the corresponding drop-down box above the table, then the desired data sets. Next press the add/update data set button to move the new data to the data table. A system can be deleted from the table by selecting the system ID and pressing the Delete button.



Simulation configuration 3

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- The integrity of configured simulation data must be checked. This is done by executing Cross-check.
- When cross-check is completed, make sure there were no errors.
- And save the created simulation ID.

Simulation configuration

Project : EX1

Modify old simulation ID EX1FREE Create new simulation ID Copy from old simulation ID

Simulation name: Ex1 with FREE credit

Description:

Sub-algorithm: Parameters, double click to modify the parameter values.
SUFIFOPR

Data sets to simulation:

System ID	SYCD	TRAN	PART	SRV	BusinessDa...
CB_RTGS	FreeCred	EX ITRAN	EX ITRT		

Information

Cross-check completed

OK

Number of errors: 0 Done

Save simulation ID Cross-check Stop cross-check View errors

Help Back to main menu Exit program



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Cross-checking for data coherency

- Simulation configuration implies definition of which systems will run and with which data sets
- Cross-checking implies checking for data coherency e.g. that
 - all participants/accounts mentioned in transactions are available
 - all systems are available as demanded by inter-system transactions
 - systems are open when transactions are entering (same for intraday credit limit changes and beginning of day balances)
- Import functions have only checked the correctness of data values, but no cross-table checks have been made
- Incoherent data (sets) will not execute
- Cross-check will give error reports similar to import errors if there are problems



Main manu (simulation execution)

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- Return to main menu and select simulation execution.





Simulation execution 1



- Select the simulation you want to execute and click Add simulation. (Several simulations can be included in one batch run.)
- Define which output database are saved (Basic set: SYLS, ACST & TEST)
- Start the simulation

Simulation execution

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SYSTEM SIMULATOR

Simulation execution

Project : EX1

Modify old simulation batch ID Create new simulation batch ID Copy from old simulation batch ID

Select a simulation ID and add it to the batch by pressing the add simulation ID button. A simulation can be deleted from the batch by selecting the simulation ID and by pressing thereafter the Delete button.

Simulation ID Simulation name

EX1FREE Ex1 with FREE... Add simulation ID Delete Execute cross-check Skip cross-check

Simulation id	Simulation name	System level stat. SYLS	Account stat. ACST	Transact. event stat. TEST	Netting event stat. NEST	Account violation stat. AVST	Bilateral account stat. BIST	Queue reason stat. QURE
EX1FREE	Ex1 with FREE credit	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Write execution information into process log

Start Stop View error report

Help Back to main menu Exit program

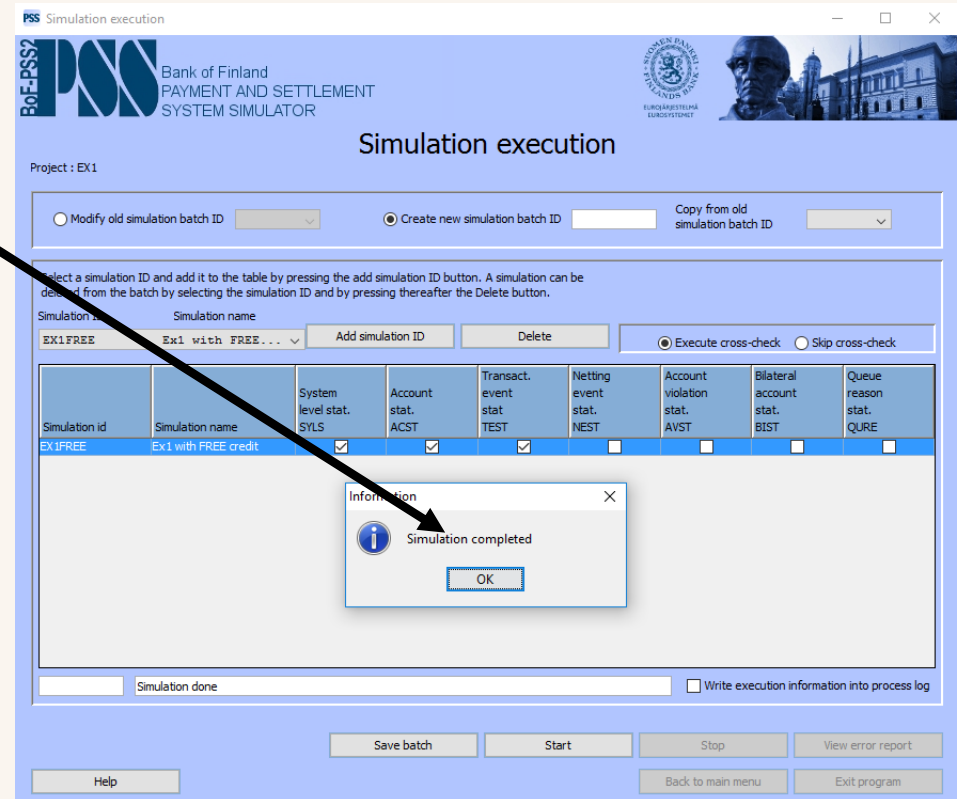
The progress of simulation execution is shown here.



Simulation execution 2

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- Click “Ok” in popup informing the ending of simulation.
- After simulation is successfully executed, return to main menu.
- You will be asked about unsaved data (batch run information).
- For this tiny example such is not worthwhile. Select to exit anyway.





Simulation execution 3

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- *View simulation logs* button in Main menu can be used to examine previous simulations and available output data tables.

Simulation execution subsystem

Simulation configuration

Simulation execution

Stress analysis

View simulation logs

View simulation logs

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View simulation logs

Project : EX1

Simulation ID	Simulation name	Date/time	Duration	SYLS	ACST	TEST	NEST	AVST	BIST	QU
EX1FREE	Ex1 with FREE credit	20171010/155536	000000	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Help

Back to main menu

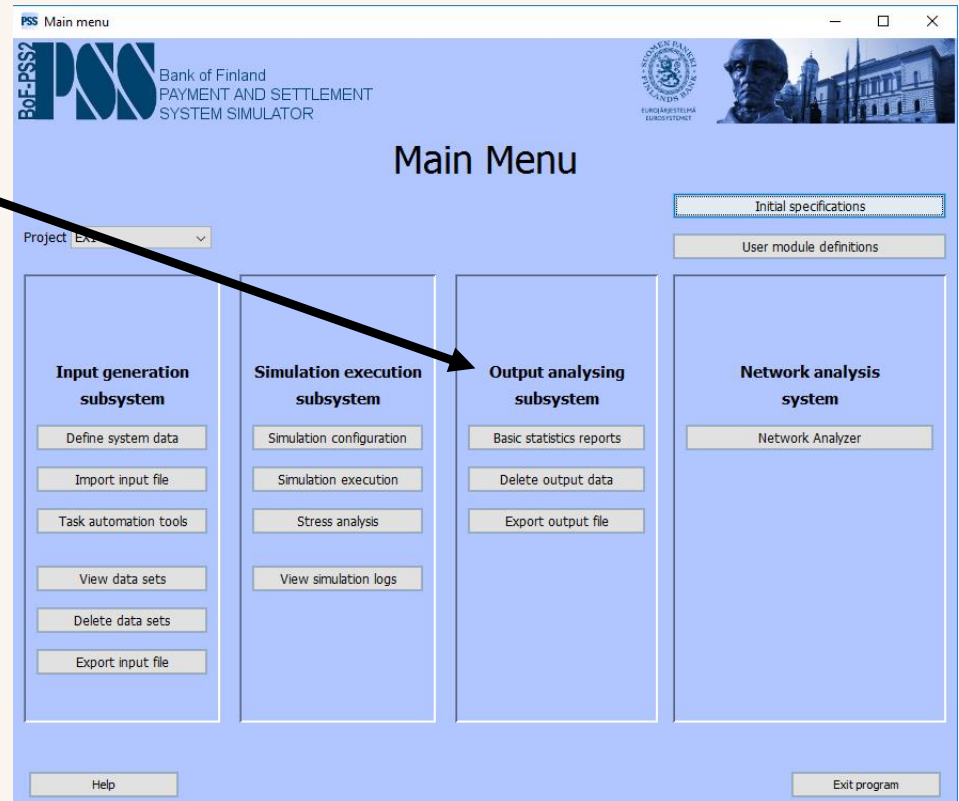
Exit program



Output analyzing subsystem

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- Reports can be created after successful execution of a simulation.

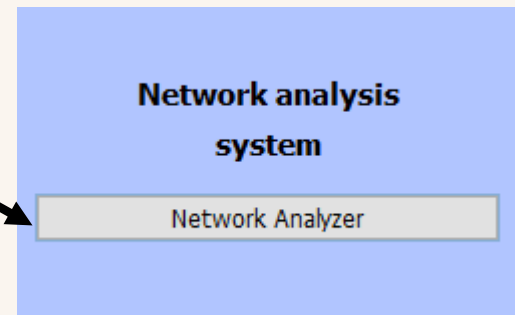
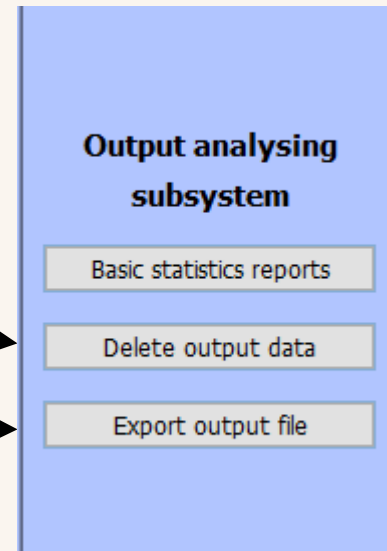




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The output analyzing subsystem provides basic output reports and export facilities

- Basic statistics report:
 - System level statistics of simulation
 - Account level statistics of simulation
- Delete unnecessary output data
- Exporting output files for further analyses (all data from output database to CSV files)
- Complementary tool that one can use to draw basic network graphs based on simulation input / output transaction data





Ready made reports: basic statistics

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- Simple reports can be exported from Basic statistics reports window after choosing the executed simulation. Path and name of the output file can be edited here.
- These include i.e. simple system or account level statistics (see next slide) and time series with defined time interval.
- After choosing the desired report, you can save it or save & open with Excel (close excel to return to simulator).

Project: EX1

Simulation ID	Simulation name	Output file:
EX1FREE	Ex1 with FREE c...	C:/BoF-PSS2/P_EX1/OUTPUT_REPORTS/Systemstatistics_EX1FREE.csv

System statistics report

Account statistics report System ID: [dropdown]

Bilateral limits statistics report

System time series report System ID: [dropdown] Reporting interval per [input] minutes

Account time series report System ID: [dropdown] Reporting interval per [input] minutes

Participant ID [dropdown] Account ID [dropdown]

Account ID: [dropdown]

Bilateral limits time series System ID: [dropdown] Reporting interval per [input] minutes

Participant ID [dropdown] Account ID [dropdown]

Account ID: [dropdown]

Buttons: Help, Save in csv-file, Save and open csv-file, Back to main menu, Exit program



Example 1 results



- Correct results for example simulations are distributed with the example material. These are listed in the example description text file. Accountstatistics_EX1FREE_CB_RTGS.csv

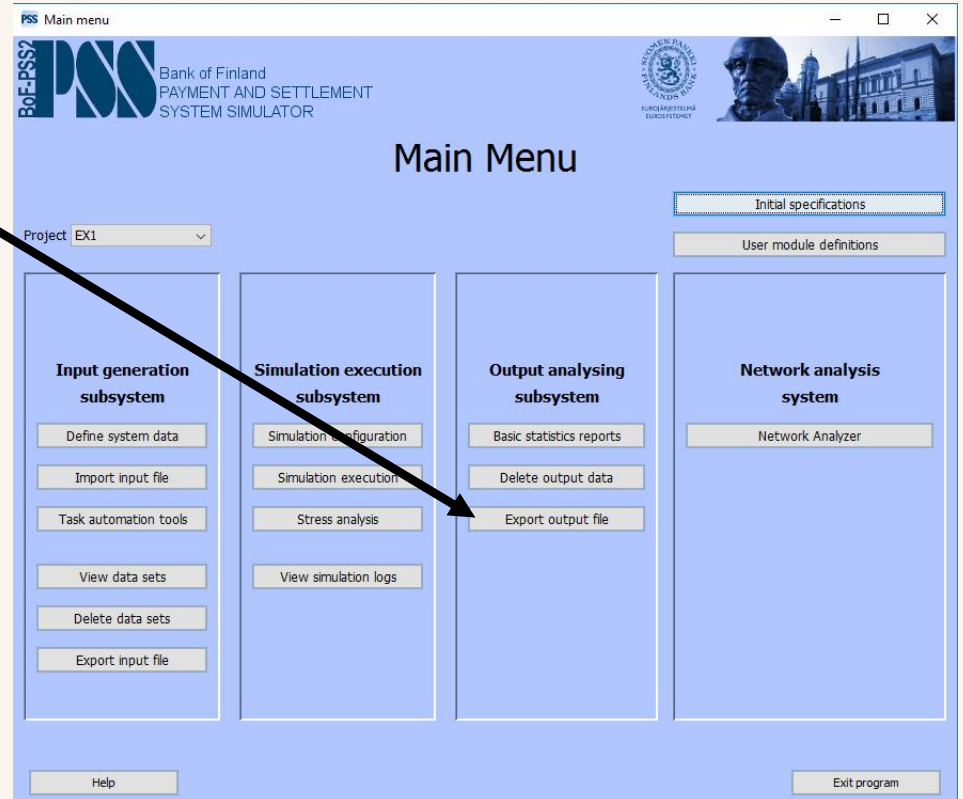
Date	Participant	Account	Bod	Eod	Ave	Min	Max	Average c	Value sett	Value uns	Number s	Number unsett
20030512	1	1	0	-9920126	-1.55E+07	-6.25E+07	8976191	4.10E+07	7.56E+07	0	52	0
20030512	10	10	0	201802	-8117389	-1.24E+07	1204704	1.14E+07	1.51E+07	0	16	0
20030512	11	11	0	-2.57E+08	-9.76E+07	-4.16E+08	3.59E+08	2.17E+08	1.68E+09	0	115	0
20030512	12	12	0	2.04E+08	3.56E+08	-6.79E+07	7.77E+08	6.78E+07	9.51E+08	0	71	0
20030512	13	13	0	-2.31E+08	1.45E+07	-2.31E+08	2.00E+08	1.34E+08	9.94E+08	0	89	0
20030512	14	14	0	2.32E+08	2.16E+08	-113763	4.98E+08	113605	3.18E+08	0	63	0
20030512	15	15	0	-237.21	-150.32	-237.21	0	150.32	237.21	0	2	0
20030512	16	16	0	-3.09E+07	-9.72E+07	-1.28E+08	0	1.28E+08	2.09E+08	0	60	0
20030512	17	17	0	0.03	-1.74E+07	-9.55E+07	1.28E+08	6.29E+07	2.75E+08	0	9	0
20030512	18	18	0	0	-1.74E+07	-1.21E+08	0	9.04E+07	1.21E+08	0	26	0
20030512	2	2	0	-8257212	-2.45E+07	-4.63E+07	4.27E+07	3.52E+07	1.04E+08	0	47	0
20030512	3	3	0	231.61	-2.24E+07	-9.85E+07	231.61	4.58E+07	1.44E+08	0	102	0
20030512	4	4	0	140	91.97	0	140	0	0	0	0	0
20030512	5	5	0	-5.47E+07	2.54E+07	-5.47E+07	1.24E+08	1.68E+07	2.02E+08	0	25	0
20030512	6	6	0	1.56E+08	1.29E+08	-3.15E+07	2.15E+08	2.63E+07	9.81E+07	0	31	0
20030512	7	7	0	0	0	0	0	0	0	0	0	0
20030512	8	8	0	3.90E+08	6.11E+07	0	3.90E+08	0	0	0	0	0
20030512	9	9	0	-3.90E+08	-5.02E+08	-1.46E+09	0	1.06E+09	2.58E+09	0	70	0



Exporting output data

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- With Export output file tool detailed data can be exported to CSV files.





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Exporting output data 1

- Data from tables which were saved in the simulation execution can be exported. In this example SYLS, ACST and TEST were saved.
- Similar templates as in data import are used
- Data can be analysed in any program i.e. Excel
- Available output databases:
 - (exact definitions of data fields are found in Descriptions of databases and files -manual)
- System and Account level statistics
 - SYLS, system level statistics
 - ACST, account level statistics
 - BIST, bilateral statistics
- Transaction level statistics
 - TEST, transaction event statistics
 - NEST, netting event statistics
 - AVST, account violation statistics
 - QURE, queuing reason statistics
 - IOES, lcl order execution statistics

Exporting output data 2



- Choose simulation and output table.
- Name for output file.
- Enable column names if necessary.
- Choose or define output template (i.e. which lines will be included in the export).
- Export criteria can be useful for large data sets (see help topic 5.9 for selection criteria).
- Execute export (next slide).

File column...	DB col	Var. name	Description	Selection criteria
1	2	id	Index number	
2	3	SYSTEM_ID	System ID	
3	4	E_TRANSID	Transaction ID	
4	5	E_DATSETID	Data set ID	
5	6	E_INTRDATE	Introduction date	
6	7	E_INTRTIME	Introduction time	
7	8	E_TRANVALU	Transaction value	
8	9	E_FRSYSTID	From system ID	
9	10	E_FRPARTID	From participant ID	
10	11	E_FRACCOID	From account ID	
11	12	E_TOSYSTID	To system ID	
12	13	E_TOPARTID	To participant ID	
13	14	E_TOACCOID	To account ID	
14	15	E_TRANCLAS	Transaction class	
15	16	E_TRANCLA2	Transaction class 2	
16	17	E_LINKCODE	Link code	
17	18	E_LINKSYST	Linked system	



Example of output export CSV-file opened with Excel



- All data fields and rows of a given data table recognized by the simulation ID can be exported.

	A	B	C	D	E	F	G	H	I	J
1	EX1FREE	Ex1 with F	20171010	155536						
2	Index num	System ID	Transactio	Data set ID	Introducti	Introducti	Transactio	From syst	From part	From acco
3	1	1	101 EX1TRAN	20030512	70100	4880384	1	13	13	
4	2	1	102 EX1TRAN	20030512	70100	685826.6	1	12	12	
5	3	1	103 EX1TRAN	20030512	70100	2639631	1	11	11	
6	4	1	104 EX1TRAN	20030512	70100	46064.41	1	10	10	
7	5	1	105 EX1TRAN	20030512	70100	633796	1	2	2	
8	6	1	106 EX1TRAN	20030512	70100	79702.04	1	14	14	
9	7	1	107 EX1TRAN	20030512	70100	2786.33	1	6	6	
10	8	1	108 EX1TRAN	20030512	70100	8000.03	1	5	5	
11	9	1	109 EX1TRAN	20030512	70100	153492.5	1	13	13	
12	10	1	110 EX1TRAN	20030512	70100	83989.24	1	12	12	
13	11	1	111 EX1TRAN	20030512	70100	779471.4	1	11	11	
14	12	1	112 EX1TRAN	20030512	70100	6678.92	1	10	10	
15	13	1	113 EX1TRAN	20030512	70100	49921.7	1	2	2	
16	14	1	114 EX1TRAN	20030512	70100	17337.06	1	14	14	
17	15	1	115 EX1TRAN	20030512	70100	300182.4	1	6	6	
18	16	1	116 EX1TRAN	20030512	70100	18950.49	1	1	1	



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That's it!

- What next?
 - You can run the same simulation with intraday credit limits. For this you need to import additional data and create a new system setup (see Ex1-description.txt).
 - Having several simulations run in one project, you can test account & system comparison reports.

- There are also three other examples provided with different systems structures (correct answers are also included):
 - Example 2 with two systems, a main RTGS and a continuous net settlement system in interaction.
 - Example 3 with two systems, a main RTGS and a deferred net settlement system, in interaction.
 - Example 4 with RTGS based securities settlement system with Delivery Versus Payment -functionality.