

Step-by-Step Simulation example

Example 1 decimal comma version



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

(If you are using decimal points please change to the other version of the example).



How to follow the example

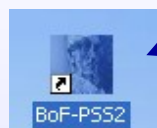
Instructions in this example are mainly presented with screenshots from simulator. These will tell you what the simulator window looks like, when you have finished the necessary actions in that simulator window. Instructions for steps in one window can however be divided into several slides.

Therefore follow the steps of the example by repeating **only** the actions which are pointed with  thick arrows (from top to down)

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



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

5

First time you run the simulator initial specifications open up.

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

Click on one of the fields and the default database and directory names emerge. (Stick to the defaults if no particular reason to change.)

Save project

Go to main menu

Initial specifications

Bank of Finland Payment and Settlement Simulator

Version: 0.9.6/2004-02-24
Licensee: Bank of Finland
Financial Markets

Initial specifications

☒ Create new project: ☐ Modify old project:

Databases

The simulator will create a new input and output database for each project in the indicated default directory. The user can change directory and also specify an already existing input and output database when desired. However, there can only be one input and output database assigned to the same project at one time.

Input database:

Output database:

Default directories

The simulator will use indicated default directories for the different file types. Each project is assumed to have its own default directories. The user can change the defaults and also use common directories.

Default directory for input files:

Default directory for error list:

Default directory for output files:

Default directory for output reports:



Bank of Finland Payment and Settlement Simulator

Main menu

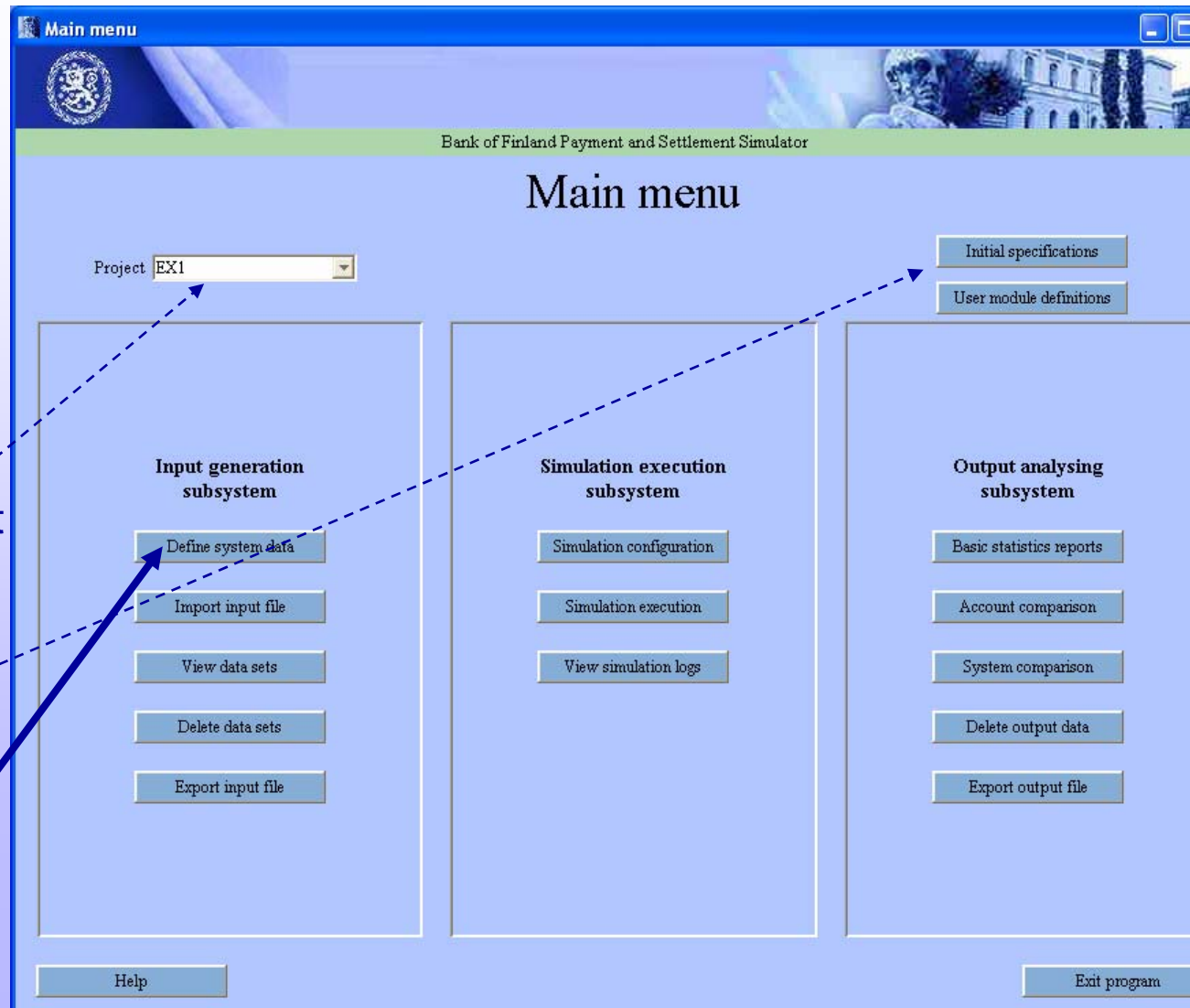
The main menu will open up whenever you start the simulator in the future.

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).



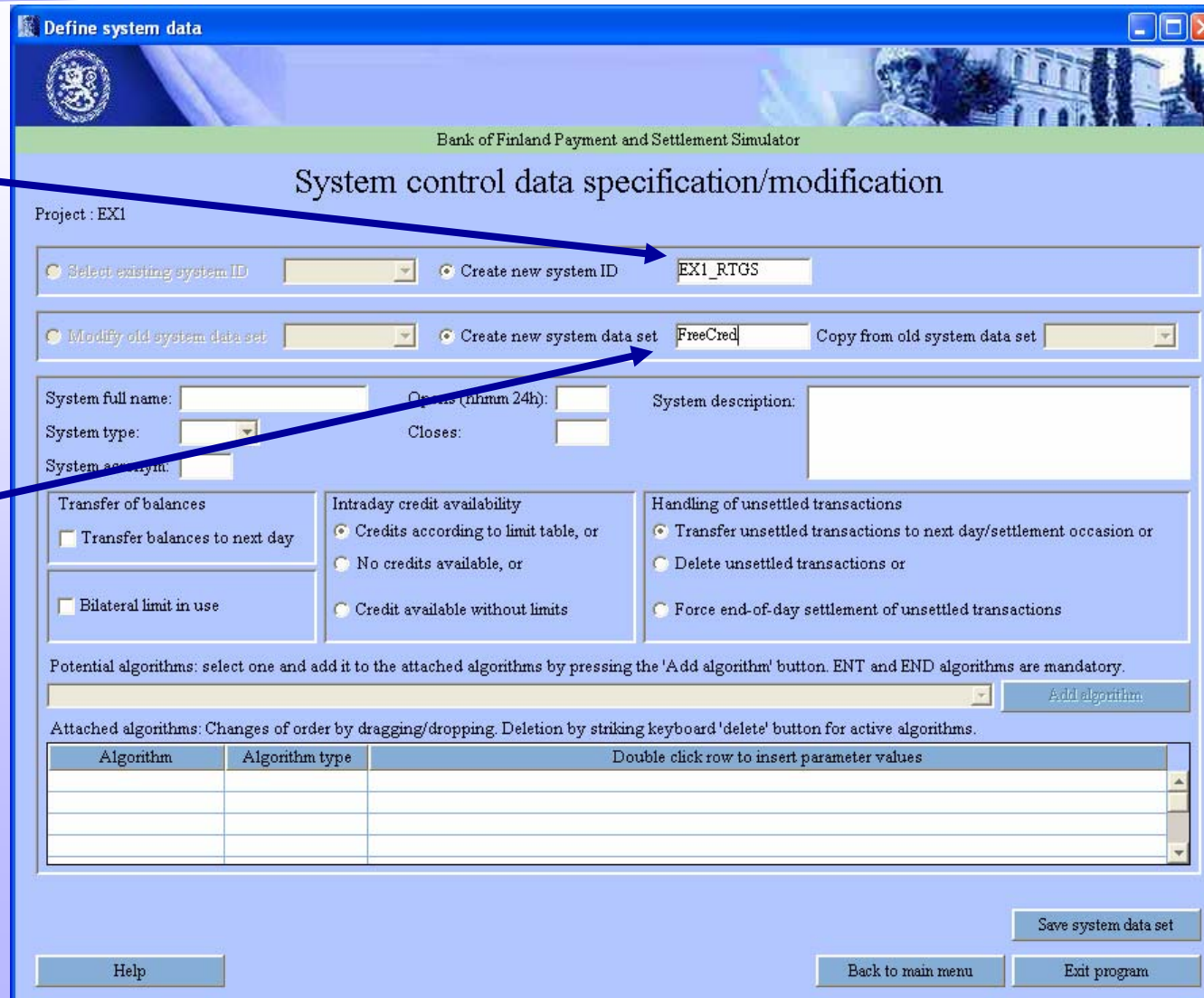
System data definition 1

7

In system definition

Type the system ID
EX1_RTGS again
precisely in the same
form as it was used
when importing data.
(case sensitive)

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



Define system data

Bank of Finland Payment and Settlement 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 (minimum 24h): System description:

System type: Closes:

System account:

Transfer of balances

☐ Transfer balances to next day

☐ Bilateral limit in use

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 or

☐ 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	Double click row to insert parameter values

Help

Save system data set

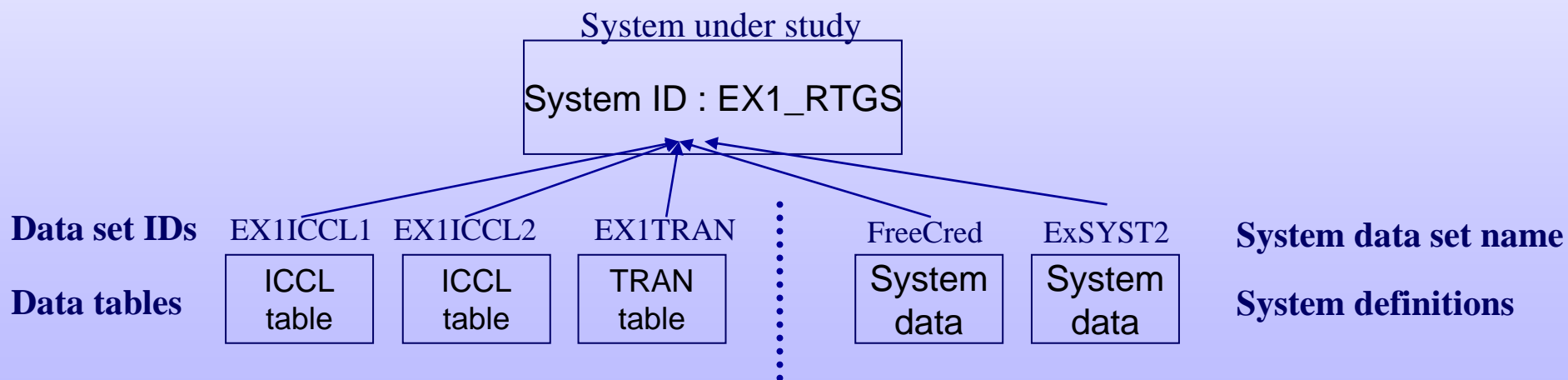
Back to main menu

Exit program

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 ID:s 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 ID:s are needed because there can be several “real” systems in one project or one simulation e.g. parallel RTGS and DNS-systems.



System data definition 2

9

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) and
- DNS (deferred net settlement)

-Set the opening hours. (in this example 0700 – 1900)

Define system data

Bank of Finland Payment and Settlement 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 (hhmm 24h): System description:

System type: Close:

System acronym:

Transfer of balances

☐ Transfer balances to next day

☐ Bilateral limit in use

Intraday credit availability

☒ Credits according to limit table, or

☐ No credits

☐ Credit availability

Handling of unsettled transactions

☒ Transfer unsettled transactions to next day/settlement occasion or

☐ Other

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

ENBASIC1 ENT

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

Algorithm	Algorithm type	Double click row to insert parameter values

System data definition 3

10

-Choose (in this example) *credit available without limits* in to allow free intraday credit.

Intraday credit-settings always affect all participants and accounts in one simulated system

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

Define system data

Bank of Finland Payment and Settlement 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 (hhmm 24h): System description:

System type: Closes:

System acronym:

Transfer of balances

☐ Transfer balances to next day

☐ Bilateral limit in use

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 or

☐ 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.

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

Algorithm	Algorithm type	Double click row to insert parameter values



Bank of Finland Payment and Settlement Simulator

System data definition 4

11

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

Define system data

Bank of Finland Payment and Settlement 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 (hhmm 24h): System description:

System type: Closes:

System acronym:

Transfer of balances

☐ Transfer balances to next day

☐ Bilateral limit in use

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 or

☐ 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.

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

Double click row to insert parameter values

Algorithm	Algorithm type
ENBASIC1	ENT
SEBASIC1	SET
ENDRTGS1	END
QUFIFOPR	QUE

- **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)



Main algorithms

- **SUB** (submission) algorithm determines when a transaction is submitted for processing, i.e. chooses next transaction to be processed. SUB algorithm is **not** selected in the system definition.
- **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



These can be invoked by ENT, SET and END algorithms

- **QUE** (queue release) algorithms release 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** (complete multilateral settlement) netting of all transactions in queues

Precise definitions for algorithms can be found in simulator manuals

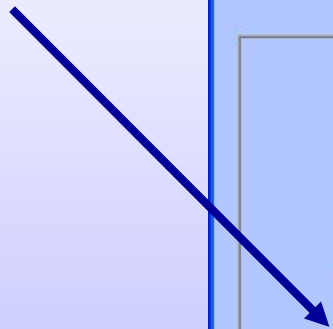


Main menu

15

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

and proceed with
importing data

The screenshot shows the 'Main menu' window of the 'Bank of Finland Payment and Settlement Simulator'. The window has a blue title bar and a light blue background. At the top, there is a green banner with the text 'Bank of Finland Payment and Settlement Simulator'. Below the banner, the title 'Main menu' is centered. On the left, there is a 'Project' dropdown menu showing 'EX1'. The main area is divided into three vertical panels. The first panel, 'Input generation subsystem', contains buttons for 'Define system data', 'Import input file', 'View data sets', 'Delete data sets', and 'Export input file'. The second panel, 'Simulation execution subsystem', contains buttons for 'Simulation configuration', 'Simulation execution', and 'View simulation logs'. The third panel, 'Output analysing subsystem', contains buttons for 'Basic statistics reports', 'Account comparison', 'System comparison', 'Delete output data', and 'Export output file'. At the bottom left is a 'Help' button, and at the bottom right is an 'Exit program' button. The Bank of Finland logo is visible in the top left corner of the window.

Bank of Finland Payment and Settlement Simulator

There are four types of input files

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

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

The default folder for input files is INPUT in the corresponding project directory. In our project EX1 –case 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_COMMA 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. See www.bof.fi/sc/bof-pss

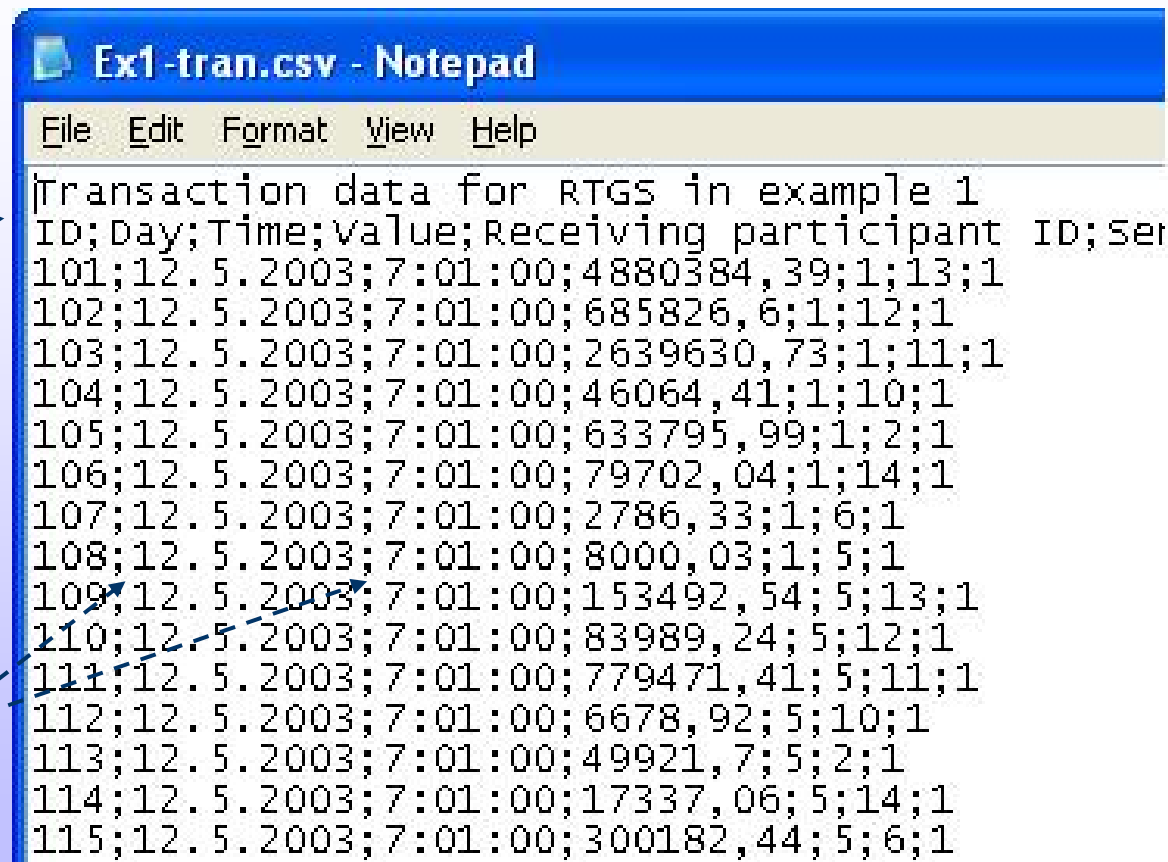
The “import input file” screen can now be used to import the data to input database of the simulator.



Typical CSV-file

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;Receiving participant ID;Ser
101;12.5.2003;7:01:00;4880384,39;1;13;1
102;12.5.2003;7:01:00;685826,6;1;12;1
103;12.5.2003;7:01:00;2639630,73;1;11;1
104;12.5.2003;7:01:00;46064,41;1;10;1
105;12.5.2003;7:01:00;633795,99;1;2;1
106;12.5.2003;7:01:00;79702,04;1;14;1
107;12.5.2003;7:01:00;2786,33;1;6;1
108;12.5.2003;7:01:00;8000,03;1;5;1
109;12.5.2003;7:01:00;153492,54;5;13;1
110;12.5.2003;7:01:00;83989,24;5;12;1
111;12.5.2003;7:01:00;779471,41;5;11;1
112;12.5.2003;7:01:00;6678,92;5;10;1
113;12.5.2003;7:01:00;49921,7;5;2;1
114;12.5.2003;7:01:00;17337,06;5;14;1
115;12.5.2003;7:01:00;300182,44;5;6;1
```

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



Import participant data 1

18

Select PART table

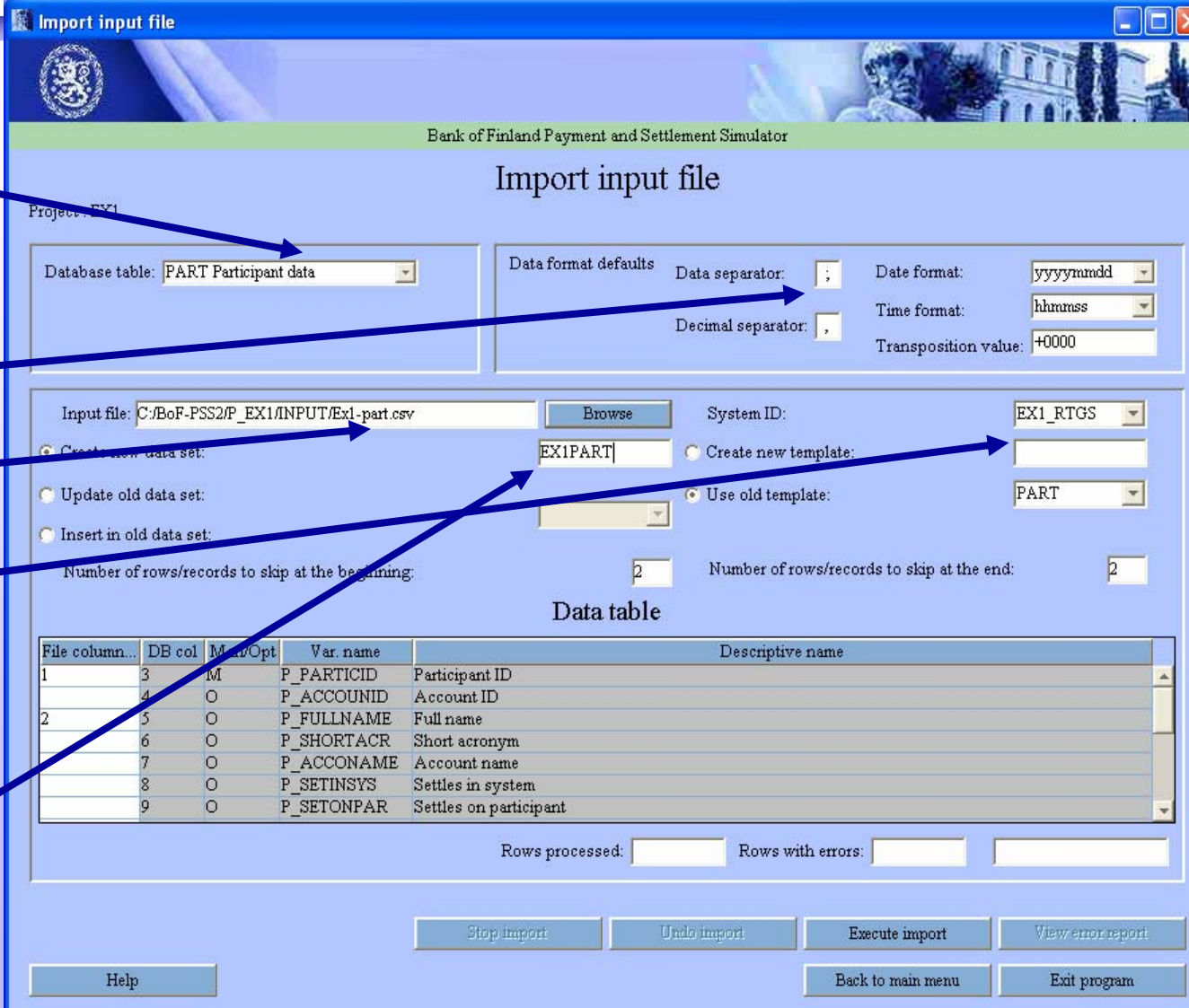
Check that data and decimal separator are correct (; and ,)

Browse for input file

Select system ID from the drop down list (in this example EX1_RTGS)

State data set ID, (i.e. EX1PART)

See explanation on next page



Bank of Finland Payment and Settlement Simulator

Import input file

Project: EX1

Database table: **PART Participant data**

Data format defaults

Data separator: ; Date format: yyyyymmdd

Decimal separator: , Time format: hhmmss

Transposition value: +0000

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

System ID: **EX1_RTGS**

☒ Create new data set: **EX1PART** ☐ Create new template:

☐ Update old data set: ☐ Use old template: **PART**

☐ Insert in old data set:

Number of rows/records to skip at the beginning: 2 Number of rows/records to skip at the end: 2

Data table

File column...	DB col	MapOpt	Var. name	Descriptive name
1	3	M	P_PARTICID	Participant ID
	4	O	P_ACCOUNTID	Account ID
2	5	O	P_FULLNAME	Full name
	6	O	P_SHORTACR	Short acronym
	7	O	P_ACCONAME	Account name
	8	O	P_SETINSYS	Settles in system
	9	O	P_SETONPAR	Settles on participant

Rows processed: Rows with errors:

Stop import **Undo import** **Execute import** **View error report**

Help **Back to main menu** **Exit program**

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		CRVALn
Data tables	ICCL table	ICCL table	...	ICCL table

*Use a clear naming convention
for different data sets*



Import participant data 2

20

Import input file

Bank of Finland Payment and Settlement Simulator

Project : EX1

Data source table:

Data format defaults
Data separator: Date format:
Decimal separator: Time format:
Transposition value:

Input file:

System ID:

☒ Create new data set: ☒ Create new template:

☐ Update old data set:

☐ Insert in old data set:

Use old template:

Number of rows/records to skip at the beginning: Number of rows/records to skip at the end:

Data table

File column...	DB col	Man/Opt	Var. name	Descriptive name
1	3	M	P_PARTICID	Participant ID
	4	O	P_ACCOUNTID	Account ID
2	5	O	P_FULLNAME	Full name
	6	O	P_SHORTACR	Short acronym
	7	O	P_ACCOUNTNAME	Account name
	8	O	P_SETINSYS	Settles in system
	9	O	P_SETONPAR	Settles on participant

Rows processed: Rows with errors:

Create a new template that corresponds to your input data

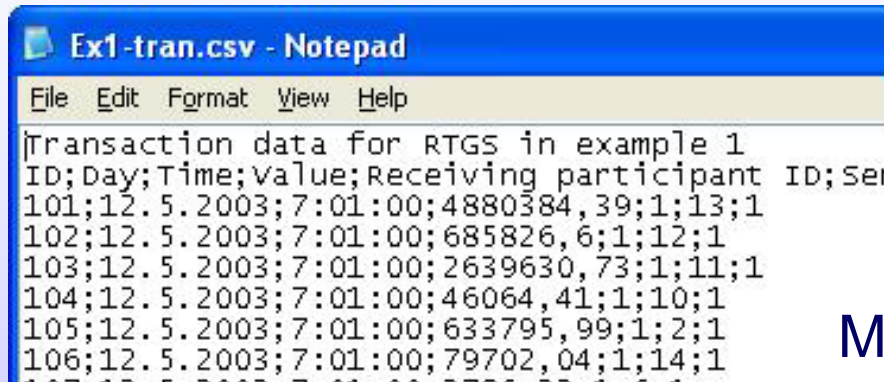
State the name of the new template (see also next slide)

State how many lines to skip in the beginning

State the columns in the CSV file which correspond to database fields

Template to CSV-file relationship, Example for transaction data²¹

Templates are used to convert csv-files to simulator database. Created templates are saved and can be used later for new imports.



```
Ex1-tran.csv - Notepad
File Edit Format View Help
Transaction data for RTGS in example 1
ID;Day;Time;Value;Receiving participant ID;Ser
101;12.5.2003;7:01:00;4880384,39;1;13;1
102;12.5.2003;7:01:00;685826,6;1;12;1
103;12.5.2003;7:01:00;2639630,73;1;11;1
104;12.5.2003;7:01:00;46064,41;1;10;1
105;12.5.2003;7:01:00;633795,99;1;2;1
106;12.5.2003;7:01:00;79702,04;1;14;1
```

Two introductory
explanation rows
to be skipped

Mandatory (M) and optional (O)
fields to import are marked here

Simulator input screen

File column...	DB col	Man/Opt	Var. 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
	7	O	T_FRSYSTID	From system ID
6	8	M	T_FRPARTID	From participant ID
	9	O	T_FRACCOID	From account ID
	10	O	T_TOSYSTID	To system ID
5	11	M	T_TOPARTID	To participant ID

File column in input
template tells the data
order in the input
CSV-file



Import participant data 3

22

Bank of Finland Payment and Settlement Simulator

Import input file

Project: EX1

Database table:

Data format defaults

Data separator: Date format:
Decimal separator: Time format:
Transposition value:

Input file: System ID:
☐ Create new data set
☐ Update old data set
☐ Insert in old data set
Number of rows/records to skip at the beginning: Rows/records to skip at the end:

Information

Import data created and saved to database!

Data table

File column...	DB col	Man/Opt	Var. name	Descriptive name
1	3	M	P_PARTICID	Participant ID
4	O	P_ACCOUNTID	Account ID	
2	5	O	P_FULLNAME	Full name
	6	O	P_SHORTNAME	Short acronym
	7	O	P_ACCOUNTNAME	Account name
	8	O	P_SETINSYS	Settles in system
	9	O	P_SETONPAR	Settles on participant

Rows processed: Rows with errors:

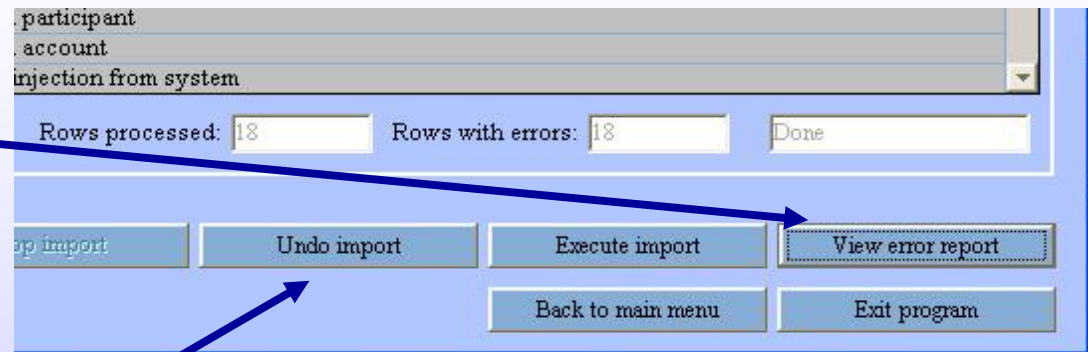
- Start the import by Clicking “Execute import” button
- Clic “Ok” in popup Informing the ending of import
- Check that all lines were imported successfully (0 lines with error)
- If there were errors see the next two slides, otherwise return to the main menu.

If the import wasn't
Successful you
can view error report.
See the next slide.

(It opens in Excel, which
needs to be closed in order
to get back to the simulator)

And undo the import.

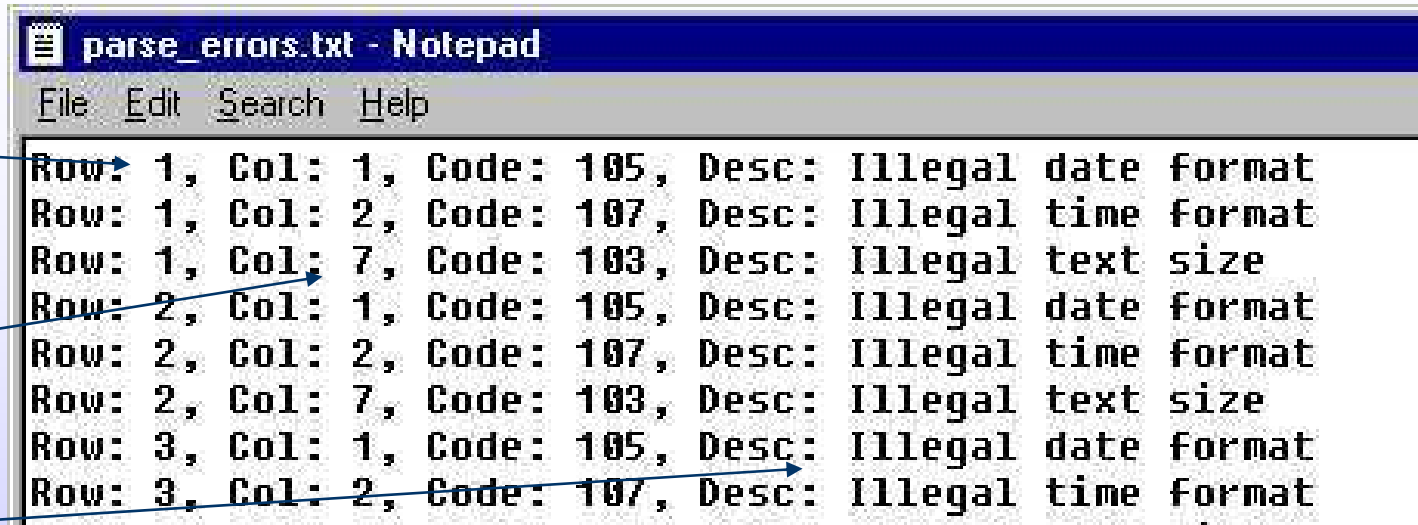
For opening the error reports outside the simulator look in
to ERRORLIST folder in the projects directory (in this
example C:\BoF-PSS2\P_EX1\ERRORLIST)



Line in CSV-file
with error

Column/field
with error

Error type



Row: 1, Col: 1, Code: 105, Desc: Illegal date format
Row: 1, Col: 2, Code: 107, Desc: Illegal time format
Row: 1, Col: 7, Code: 103, Desc: Illegal text size
Row: 2, Col: 1, Code: 105, Desc: Illegal date format
Row: 2, Col: 2, Code: 107, Desc: Illegal time format
Row: 2, Col: 7, Code: 103, Desc: Illegal text size
Row: 3, Col: 1, Code: 105, Desc: Illegal date format
Row: 3, Col: 2, Code: 107, Desc: Illegal time 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)



Main menu

25

Next proceed with
transaction data import.



Bank of Finland Payment and Settlement Simulator

Import transaction data 1

26

Change the database table to TRAN for importing transactions

Check the date and time format. (in this example d-m-yyyy and hh:mm:ss) Data and decimal separators settings are remembered from previous import.

Choose the file to import

State data set ID

Select the System ID from the drop down list.

Bank of Finland Payment and Settlement Simulator

Import input file

Project: EX1

Database table: **TRAN Transaction data**

Data format defaults

Data separator: , Date format: d-m-yyyy

Time format: hh:mm:ss

Decimal separator: , Transposition value: +0000

Input file: C:\BoF-PSS2P_EX1\INPUT\Ex1-tran.csv Browse

System ID: EX1_RTGS

Create new data set: ☐ Create new template: ☐

Update old data set: ☐ Use old template: TRAN

Insert in old data set: ☐

EXITRAN

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

Data table

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_FRSYSTID	From system ID
6	8	M	T_FRPARTID	From participant ID
7	9	O	T_FRACCOID	From 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

27

Choose to create new template and state the name for it

Choose the number of lines to skip

Enter the numbers of columns where the required fields are located in the csv-file (for this recall the more detailed explanation on slide 11)

Start the import by clicking “Execute import”

Bank of Finland Payment and Settlement Simulator

Import input file

Project : EX1

Database table: TRAN Transaction data

Data format defaults

Data separator: ; Date format: d-m-yyyy

Decimal separator: . Time format: hh:mm:ss

Transposition value: +0000

Import file: C:\BoF-PSS2P_EX1\INPUT\Ex1-tran.csv

System ID: EX1_RTGS

☒ Create new data set: EX1TRAN

☐ Update old data set:

☐ Insert in old data set:

Number of rows/records to skip at the beginning: 2

Number of rows/records to skip at the end: 0

Create new template: TRAN

Use old template:

Data table

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

Rows processed: Rows with errors:

Stop import Undo import Execute import View error report

Help Back to main menu Exit program

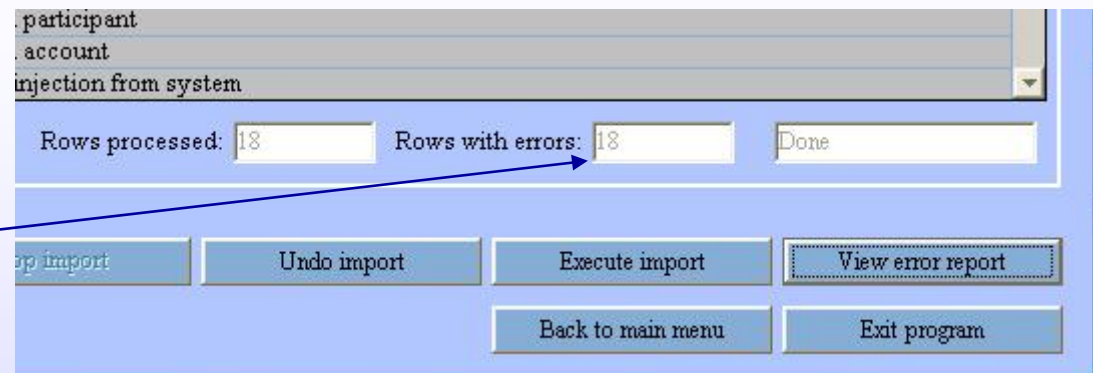


Import transaction data 3

28

When import is finished check that it was successful (0 rows with errors)

If there were errors you can view the error report and undo the import.



The screenshot shows a software interface for importing transaction data. At the top, there is a list of data types: 'participant', 'account', and 'injection from system'. Below this, two text boxes show 'Rows processed: 18' and 'Rows with errors: 18'. A blue arrow points from the text 'If there were errors you can view the error report and undo the import.' to the 'Rows with errors' box. To the right of the error count is a 'Done' button. Below these are several buttons: 'Import' (partially visible), 'Undo import', 'Execute import', 'View error report' (highlighted with a dashed border), 'Back to main menu', and 'Exit program'.

Basic solutions to error situations were listed on slide “Import error handling for participant data”. New things to check here are for instance:

- **Date and time format in simulator. Dash (-) in date format and colon (:) in time format can represent any separator mark in date or time data of csv file.**
- **Check the template and data file again to see that the data is situated and presented as you expected (open the csv file in notepad)**

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



Input generation subsystem

Define system data

Import input file

View data sets

Delete data sets

Export input file

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 set window is useful for checking moderate size data tables

View data sets

Bank of Finland Payment and Settlement Simulator

View data sets

Project : p_test

Data type: TRAN Transaction data

System ID: S-RTGS

Data set ID: tran0814

Transaction ID	Introduction date	Introduction time	Transaction value	From system ID	From participant ID	From account ID	To sy
101	2003-05-12	07:01:00	4880384,39	S-RTGS	1		S-RTGS
102	2003-05-12	07:01:00	685826,60	S-RTGS	1		S-RTGS
103	2003-05-12	07:01:00	2639630,73	S-RTGS	1		S-RTGS
104	2003-05-12	07:01:00	46064,41	S-RTGS	1		S-RTGS
105	2003-05-12	07:01:00	633795,99	S-RTGS	1		S-RTGS
106	2003-05-12	07:01:00	79702,04	S-RTGS	1		S-RTGS
107	2003-05-12	07:01:00	2786,33	S-RTGS	1		S-RTGS
108	2003-05-12	07:01:00	8000,03	S-RTGS	1		S-RTGS
109	2003-05-12	07:01:00	153492,54	S-RTGS	5		S-RTGS
110	2003-05-12	07:01:00	83989,24	S-RTGS	5		S-RTGS
111	2003-05-12	07:01:00	779471,41	S-RTGS	5		S-RTGS
112	2003-05-12	07:01:00	6678,92	S-RTGS	5		S-RTGS
113	2003-05-12	07:01:00	49921,70	S-RTGS	5		S-RTGS
114	2003-05-12	07:01:00	17337,06	S-RTGS	5		S-RTGS
115	2003-05-12	07:01:00	300182,44	S-RTGS	5		S-RTGS
116	2003-05-12	07:01:00	18950,49	S-RTGS	5		S-RTGS
117	2003-05-12	07:01:00	1634545,51	S-RTGS	6		S-RTGS
118	2003-05-12	07:01:00	408639,34	S-RTGS	6		S-RTGS
119	2003-05-12	07:01:00	1856551,99	S-RTGS	6		S-RTGS
120	2003-05-12	07:01:00	184378,62	S-RTGS	6		S-RTGS
121	2003-05-12	07:01:00	16723,85	S-RTGS	6		S-RTGS
122	2003-05-12	07:01:00	12084,40	S-RTGS	6		S-RTGS
123	2003-05-12	07:01:00	57860,37	S-RTGS	6		S-RTGS
124	2003-05-12	07:01:00	4920425,27	S-RTGS	14		S-RTGS
125	2003-05-12	07:01:00	1826540,68	S-RTGS	14		S-RTGS

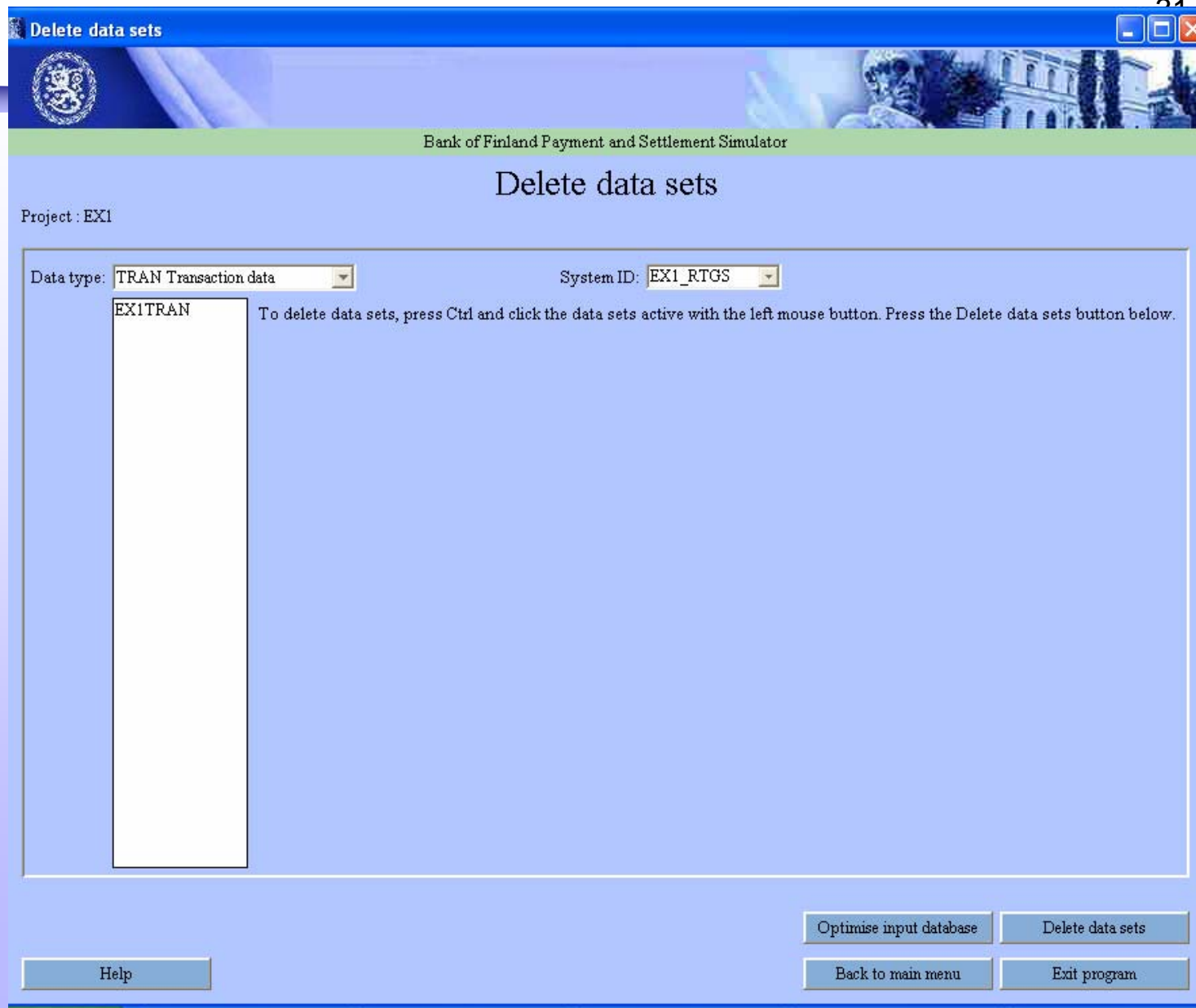
Help

Back to main menu

Exit program

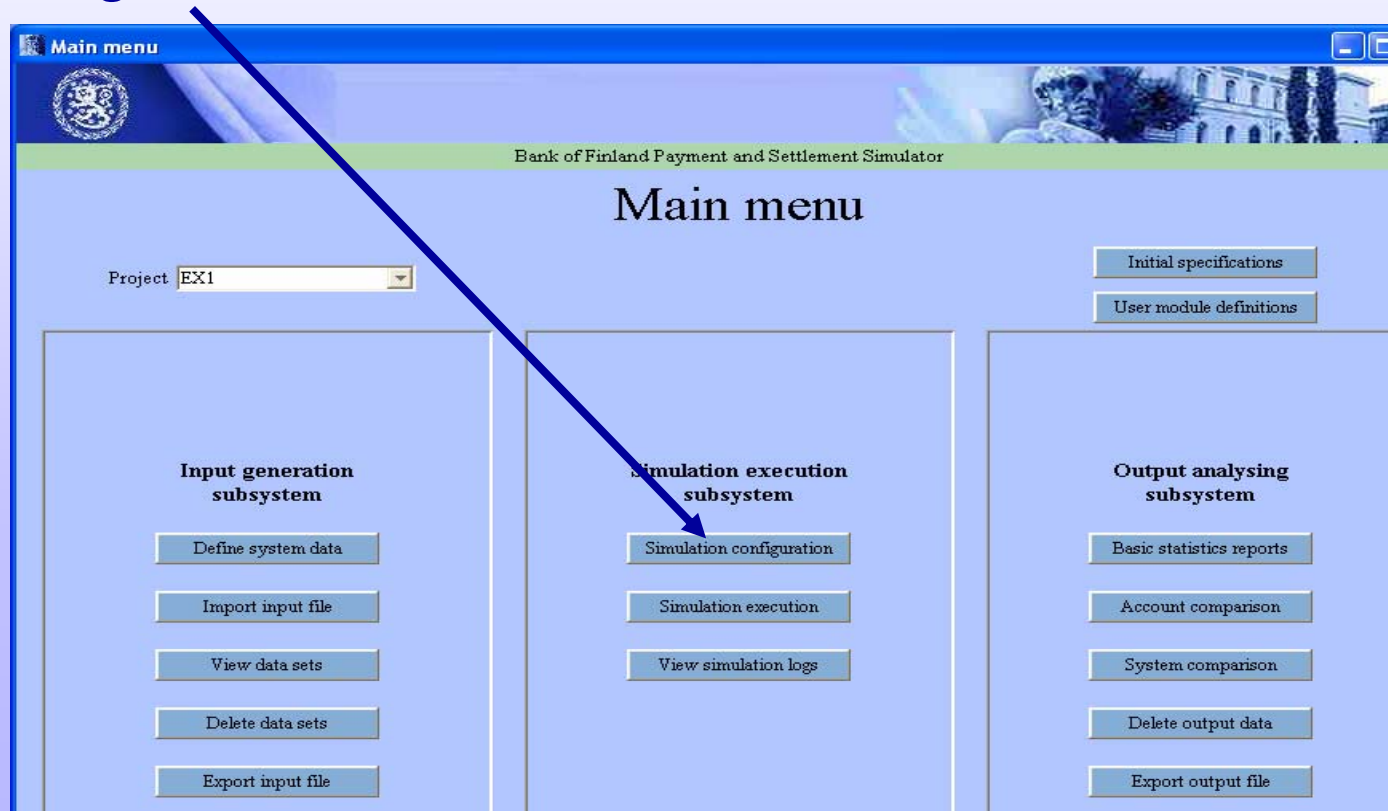
Delete data sets
window
provides view
of available
data sets

Erroneous or
unnecessary
data sets can be
deleted



Now the first main phase *input data creation* is cleared.

Move to simulation execution by selecting *simulation configuration* in main menu



Simulation configuration 1

33

In simulation configuration window simulations are built by selecting the desired combination of imported data sets.

Start by typing simulation ID
Simulation name and description are optional.

Again use good naming convention which describes the configured simulation.

Select which datasets are included in this simulation.

If you have several options available in System ID or you can't find some dataset you imported see the next slide.

Simulation configuration

Bank of Finland Payment and Settlement Simulator

Project : EX1

☐ Modify old simulation ID ☒ Create new simulation ID Copy from old simulation ID

Simulation name:

Description:

Sub-algorithm: Parameters

Data sets to simulation:

System ID	SYCD	TRAN	PART	ICCL	DBAL	BLIM
EX1_R...	FreeCred	EX1TR...	EX1PA...			

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.

Add/update data set

Delete

Number of errors:

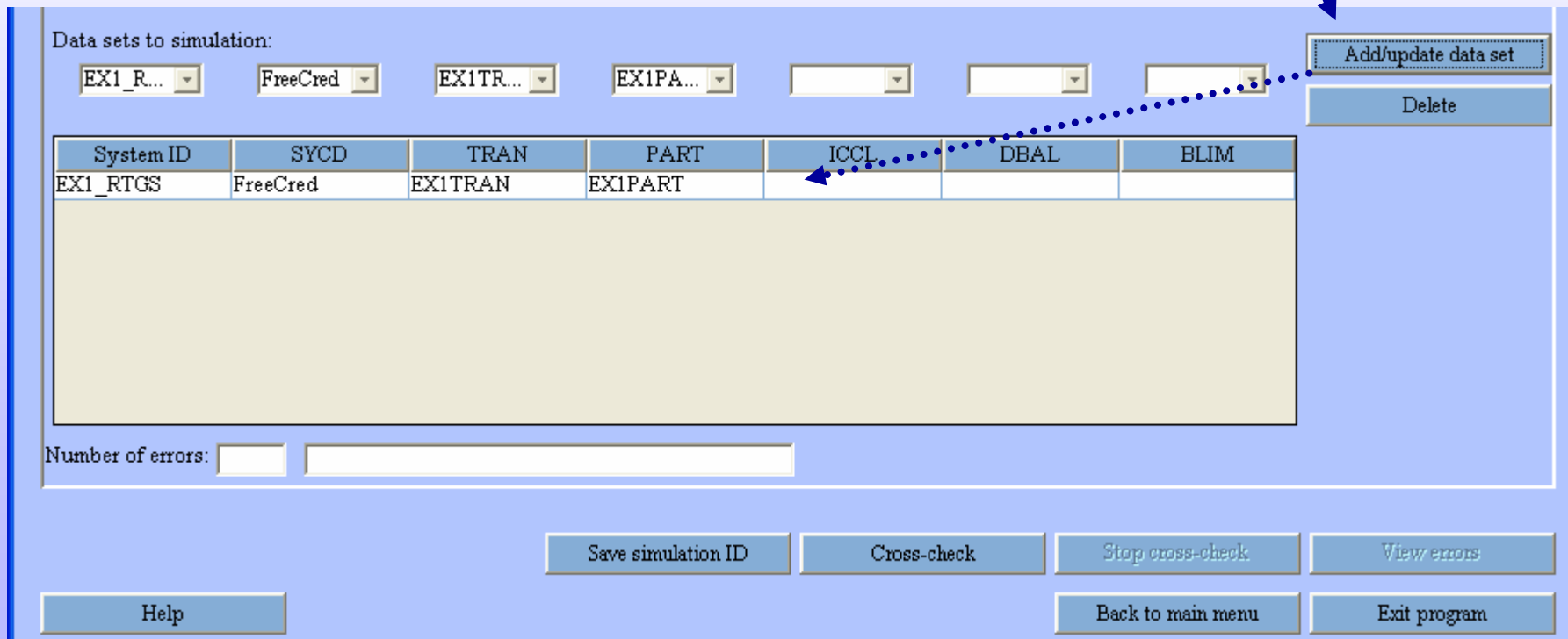
Save simulation ID Cross-check Stop cross-check View errors

Help Back to main menu Exit program

Simulation configuration 2

34

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



Data sets to simulation:

EX1_R... FreeCred EX1TR... EX1PA... [] [] []

System ID	SYCD	TRAN	PART	ICCL	DBAL	BLIM
EX1_RTGS	FreeCred	EX1TRAN	EX1PART			

Number of errors: [] []

Buttons: Add/update data set, Delete, Save simulation ID, Cross-check, Stop cross-check, View errors, Help, Back to main menu, Exit program



Simulation configuration 2

35

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.

(Otherwise see the next slide)

And save the created simulation ID

The screenshot displays the 'Simulation configuration 2' window. At the top, 'Sub-algorithm' is set to 'SUFIFOPR'. Below it, 'Data sets to simulation' includes 'EX1_R...', 'FreeCred', and 'EX1TR...'. A table lists simulation data:

System ID	SYCD	TRAN	AL	BLIM
EX1_RTGS	FreeCred	EXITRAN	EXIPART	

An 'Information' dialog box is open in the center, displaying 'cross check completed' with an 'OK' button. At the bottom left, 'Number of errors: 0' is shown next to a 'Done' button. The bottom of the window features a row of buttons: 'Save simulation ID', 'Cross-check', 'Stop cross-check', and 'View errors'. Below these are 'Help', 'Back to main menu', and 'Exit program'.



Cross-checking for data coherency

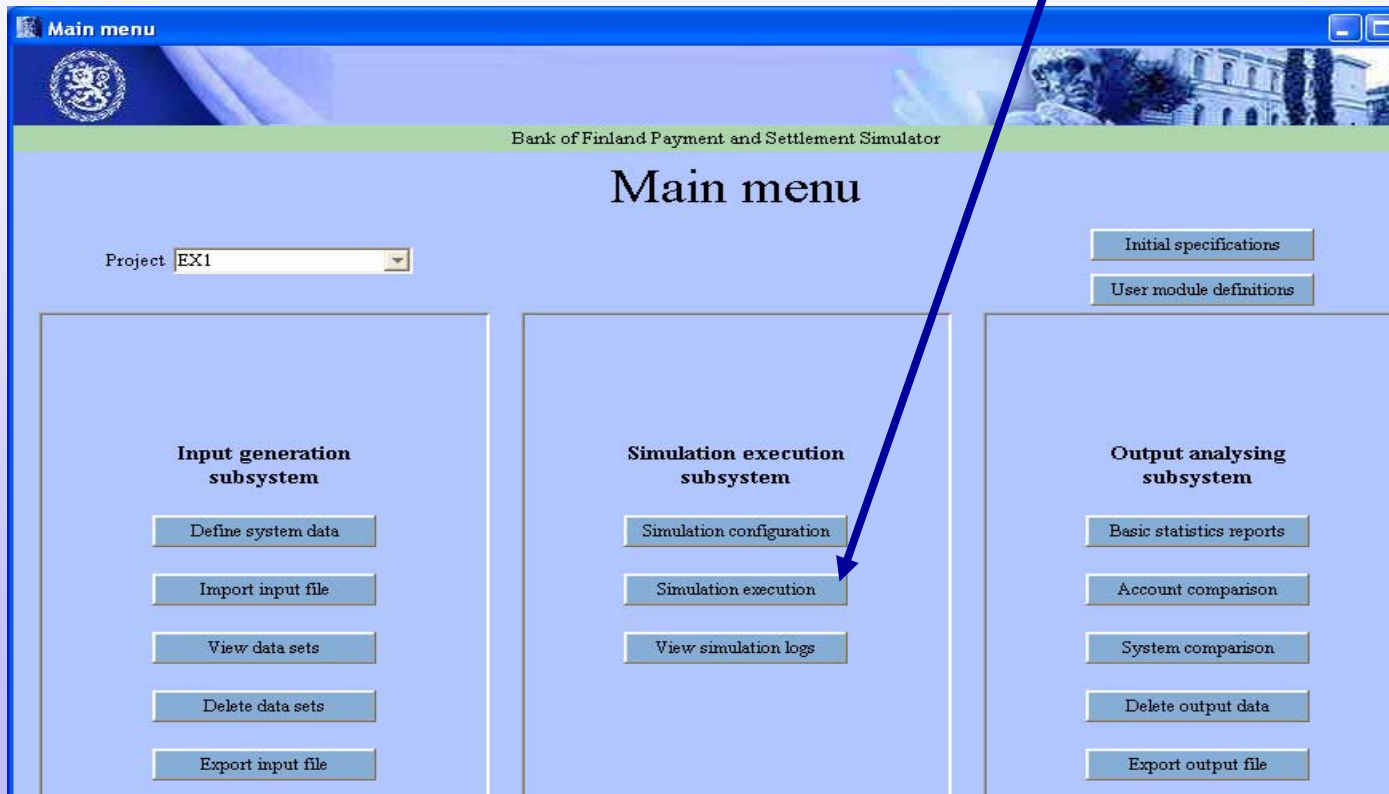
- Simulation configuration implies definition of which systems will run and with which data sets
- Cross-checking implies checking for data coherency eg that
 - all participants/accounts mentioned in transactions are available.
 - all systems are available as demanded by inter-system transactions
 - 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



Simulation execution 1

37

Return to main menu and select simulation execution



Bank of Finland Payment and Settlement Simulator

Simulation execution 1

38

Batch run info can be saved for re-use (optional)

Select the simulation you want to execute and click Add simulation.

(Several simulations can be included in one batch run)

Define which output databases are saved (Basic set: SYLS, ACST & TEST)

Start the simulation

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 table 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 ☐ Execute cross-check ☐ Skip cross-check

Simulation id	Simulation name	System level stat.	Account stat.	Transact. event stat.	Netting event stat.	Account violation stat.	Booking event stat.	Unsettled transact. stat.	Submitted transact. stat.	Queued transact. stat.	Bilateral account stat.	Queue reason stat.
EIFREE	Ex1 with FREE cre...	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

writing output EIFREE 2003-05-12 TEST

The progress of simulation execution is shown as the current time in simulation or as the name of the output table written

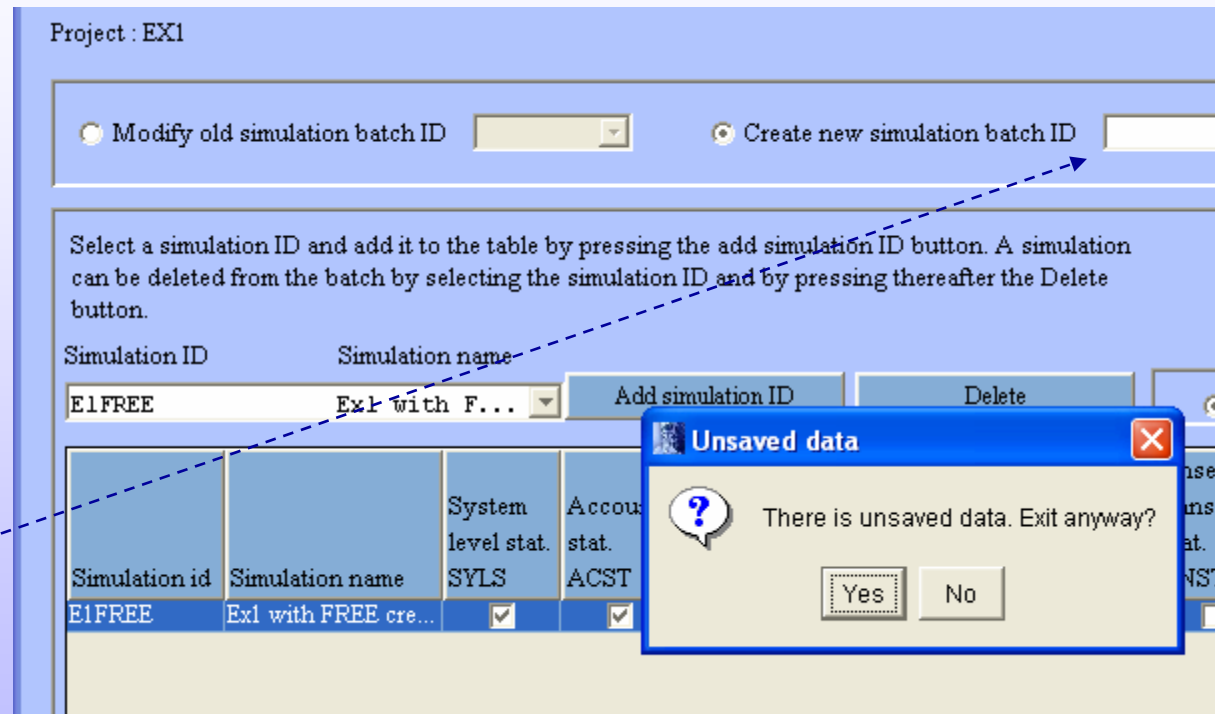


Simulation execution 2

39

After simulation is successfully executed, return to main menu.

You will be asked about unsaved data. (batch run information) Select to exit anyway.



With Batch ID it is possible to save the created setup (which simulations to run and which output tables to save for each simulation) For this tiny example such is not worthwhile.



Simulation execution 3

40

Simulation execution subsystem

Simulation configuration

Simulation execution

View simulation logs

The third button in execution subsystem (*view simulation logs*) can be used to examine previous simulations and available output data tables

View simulation logs

Bank of Finland Payment and Settlement Simulator

Project : p_test

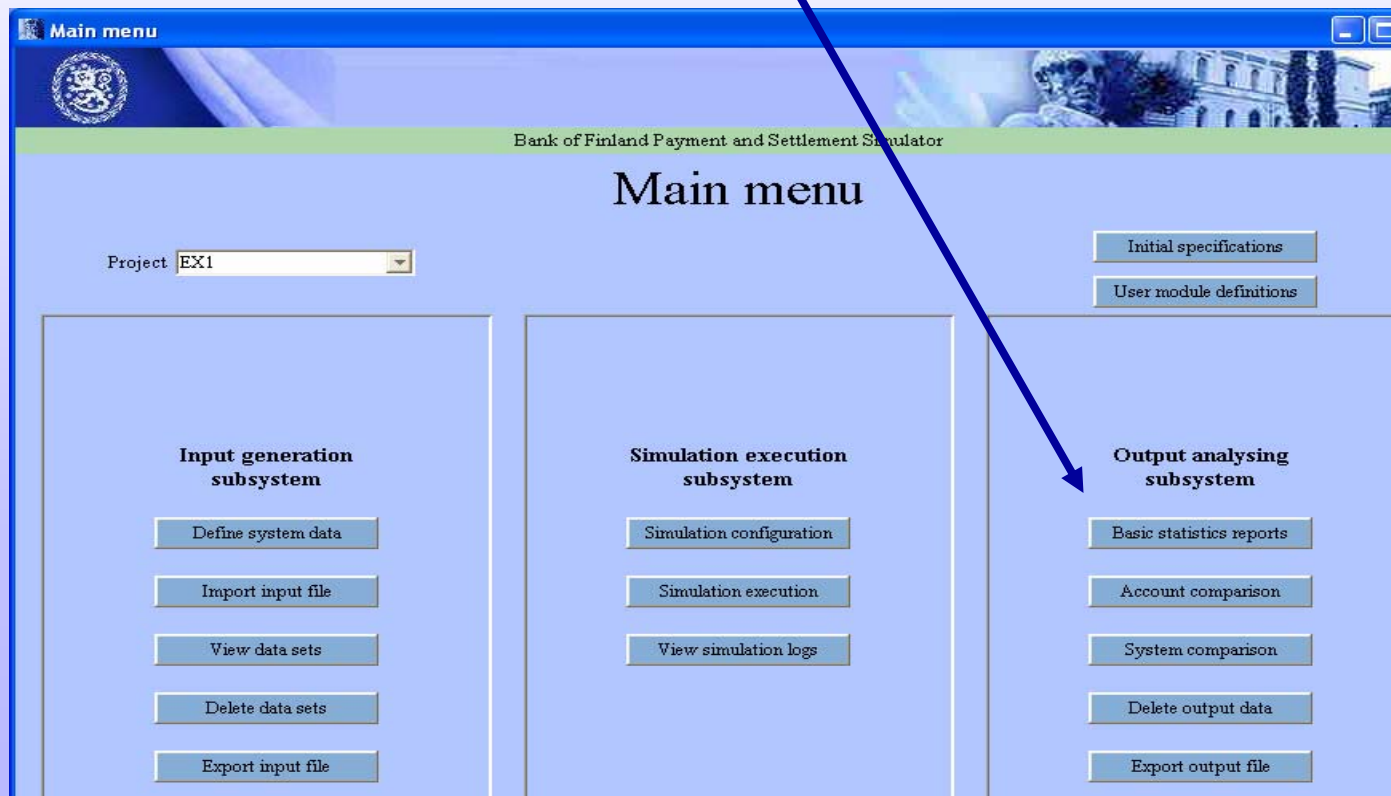
Simulation ID	Simulation name ▼	Date/time	Duration	SYLS	ACST	TEST	NEST	AVST	BEST
2Fjono		14-07-2003/11:21:35	00:00:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2Painall		14-07-2003/01:45:11	00:00:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2Pbalnc		14-07-2003/02:03:53	00:00:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2Pque1		15-07-2003/12:21:09	00:00:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2Pque3		15-07-2003/01:12:05	00:00:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2Fjono2	toinen yrittämä	14-07-2003/11:24:24	00:00:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Help Back to main menu Exit program



Bank of Finland Payment and Settlement Simulator

Reports can be created after successful execution of a simulation



The output analysing subsystem provides basic output reports and export facilities

Output analysing subsystem

Basic statistics reports

Account comparison

System comparison

Delete output data

Export output file

Basic statistics report

Account level comparisons of simulations

System level comparisons of simulations

Deleting unnecessary output data

Exporting output files for further analyses
(all data from output database to CSV files)



Ready made reports: basic statistics

43

Simple reports can be exported (Output file name) from *Basic statistics reports* window after choosing the executed simulation

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)

Bank of Finland Payment and Settlement Simulator

Basic statistics reports

Project : EX1

Simulation ID	Simulation name	Output file:
E1FREE	Ex1 with FREE c...	C:/BoF-PSS2/P_EX1/OUTPUT_REPORTS/Systemstatistics_E1FREE.csv

- ☒ System statistics report
- ☐ Account statistics report System ID:
- ☐ Bilateral limits statistics report
- ☐ System time series report System ID:
- ☐ Account time series report System ID:
Participant ID:
Account ID:
- ☐ Bilateral limits time series System ID:
Participant ID:
Account ID:

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

Note:

Saving of certain output tables in simulation configuration (see slide 36) is required to enable basic statistic reports.

SYLS for system statistics

ACST for account statistics

TEST for all time series

BIST for bilateral reports

Example 1 results

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

For example file Ex1_Accountstatistics_free_dp.csv

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Account statistics													
2														
3	Simul. ID:	ex1_free	Simul. date:	5-25-2004										
4	Simul. name:	Example1	Simul. time:	11:48:02										
5	System:	SMALL												
6														
7	Date	Participant	Account	Bod	Eod	Ave	Min	Max	Average credit	Value settled	Value unsettled	Number settled	Number unsettled	
8	12.5.2003	1		0	-9920125.53	-1.55E+07	-6.25E+07	8976191	4.10E+07	7.56E+07	0	52	0	
9	12.5.2003	10		0	201801.95	-8117389.29	-1.24E+07	1204704	1.14E+07	1.51E+07	0	16	0	
10	12.5.2003	11		0	-2.57E+08	-9.76E+07	-4.16E+08	3.59E+08	2.17E+08	1.68E+09	0	115	0	
11	12.5.2003	12		0	2.04E+08	3.56E+08	-6.79E+07	7.77E+08	6.78E+07	9.51E+08	0	71	0	
12	12.5.2003	13		0	-2.31E+08	1.45E+07	-2.31E+08	2.00E+08	1.34E+08	9.94E+08	0	89	0	
13	12.5.2003	14		0	2.32E+08	2.16E+08	-113762.95	4.98E+08	113605	3.18E+08	0	63	0	
14	12.5.2003	15		0	-237.21	-150.32	-237.21	0	150.32	237.21	0	2	0	
15	12.5.2003	16		0	-3.09E+07	-9.72E+07	-1.28E+08	0	1.28E+08	2.09E+08	0	60	0	
16	12.5.2003	17		0	0.03	-1.74E+07	-9.55E+07	1.28E+08	6.29E+07	2.75E+08	0	9	0	
17	12.5.2003	18		0	0	-1.74E+07	-1.21E+08	0	9.04E+07	1.21E+08	0	26	0	
18	12.5.2003	2		0	-8257211.55	-2.45E+07	-4.63E+07	4.27E+07	3.52E+07	1.04E+08	0	47	0	
19	12.5.2003	3		0	231.61	-2.24E+07	-9.85E+07	231.61	4.58E+07	1.44E+08	0	102	0	
20	12.5.2003	4		0	140	91.97	0	140	0	0	0	0	0	
21	12.5.2003	5		0	-5.47E+07	2.54E+07	-5.47E+07	1.24E+08	1.68E+07	2.02E+08	0	25	0	
22	12.5.2003	6		0	1.56E+08	1.29E+08	-3.15E+07	2.15E+08	2.63E+07	9.81E+07	0	31	0	
23	12.5.2003	7		0	0	0	0	0	0	0	0	0	0	
24	12.5.2003	8		0	3.90E+08	6.11E+07	0	3.90E+08	0	0	0	0	0	
25	12.5.2003	9		0	-3.90E+08	-5.02E+08	-1.46E+09	0	1.06E+09	2.58E+09	0	70	0	
26														



With *Export output file* tool detailed data can be exported to csv files. (Exported tables must be selected in simulation Execution window. Now 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)

SIMULATION, SYSTEM AND

ACOCUNT LEVEL

BARI, simulation batch run data

SIRI, simulation run data

SYLS, system level statistics

ACST, account level statistics

BIST, bilateral statistics

TRANSACTIONS LEVEL

TEST, Transaction event statistics,

NEST, Netting event statistics,

AVST, account violation statistics

BEST, booking event statistics,

UNST, unsettled transactions statistics

SUST, submitted transactions statistics

QUST, queued transactions statistics

CTST, comment transactions statistics

CCST, comment intraday credit statistics



Exporting output data 2

Specify/change data formats

46

Choose simulation
Choose output table

Name for output file

Enable column names
if necessary

Choose or define
output template

Export criteria can be
useful for large data sets
(see help topic 5.8 for
Selection criteria)

Export file (next slide)

Bank of Finland Payment and Settlement Simulator

Export output file

Project: EX1

Simulation ID:

Database table:

Data format defaults

Data separator: Date format:

Decimal separator: Time format:

Output file:

☒ Create new template:

☐ Use old template:

☒ Create names of columns

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

Rows processed:

Example of output export CSV-file opened with Excel

Microsoft Excel - Test1

File Edit View Insert Format Tools Data Window Help

Arial 10 B I U % , +.0 .00 +.0

A1 = FIRSTSMA

	A	B	C	D	E	F	G	H	K	L	M	N
1	FIRSTSMA	FIRST SMALL										
2	System ID	Transactio	Data set ID	Introductio	Introductio	Transaction val	From p	To p	Settlement time	Settlement	Sending account's balance	
3	RTGS-A	100	TRAN1	12.5.2003	22:10:00	4880384,39	13	1	22:10:00	1	-4880384,39	
4	RTGS-A	101	TRAN1	12.5.2003	22:10:00	685826,6	12	1	22:10:00	1	-685826,6	
5	RTGS-A	102	TRAN1	12.5.2003	22:10:00	2639630,73	11	1	22:10:00	1	-2639630,73	
6	RTGS-A	103	TRAN1	12.5.2003	22:10:00	46064,41	10	1	22:10:00	1	-46064,41	
7	RTGS-A	104	TRAN1	12.5.2003	22:10:00	633795,99	2	1	22:10:00	1	-633795,99	
8	RTGS-A	105	TRAN1	12.5.2003	22:10:00	79702,04	14	1	22:10:00	1	-79702,04	
9	RTGS-A	106	TRAN1	12.5.2003	22:10:00	2786,33	6	1	22:10:00	1	-2786,33	
10	RTGS-A	107	TRAN1	12.5.2003	22:10:00	8000,03	5	1	22:10:00	1	-8000,03	
11	RTGS-A	108	TRAN1	12.5.2003	22:10:00	153492,54	13	5	22:10:00	1	-5033876,93	
12	RTGS-A	109	TRAN1	12.5.2003	22:10:00	83989,24	12	5	22:10:00	1	-769815,84	
13	RTGS-A	110	TRAN1	12.5.2003	22:10:00	779471,41	11	5	22:10:00	1	-3419102,14	
14	RTGS-A	111	TRAN1	12.5.2003	22:10:00	6678,92	10	5	22:10:00	1	-52743,33	
15	RTGS-A	112	TRAN1	12.5.2003	22:10:00	49921,7	2	5	22:10:00	1	-683717,69	
16	RTGS-A	113	TRAN1	12.5.2003	22:10:00	17337,06	14	5	22:10:00	1	-97039,1	
17	RTGS-A	114	TRAN1	12.5.2003	22:10:00	300182,44	6	5	22:10:00	1	-302968,77	
18	RTGS-A	115	TRAN1	12.5.2003	22:10:00	18950,49	1	5	22:10:00	1	8957240,03	
19	RTGS-A	116	TRAN1	12.5.2003	22:10:00	1634545,51	13	6	22:10:00	1	-6668422,44	

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



What next?

- You can run the same simulation with intraday credit limits. For this new data set(s) need to be imported. (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.

