SRVN Input File Format

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SRVN Input File Format

The Stochastic Rendezvous Network (SRVN) is a modelling method under development, and is currently being upgraded and extendend. Due to this fact, the input file format was chosen to be as flexible as possible, and easy to be expand when the need for new input data occurs.

The SRVN input file has four sections, each consisting of a variable length list, possibly with other lists nested therein. The end of list marker is $\text{,}$. The input file may be annotated with comments. Comments start with the octothorpe symbol, $\#$, and finish at the end of the line. Comments may appear anywhere except within strings.

General information section gives input parameters related to the numerical computation. It consists of five fields:

1. the convergence value,
2. the underrelaxation coefficient,
3. the maximum number of iterations,
4. the number of iterations after which intermediate results are printed,
5. and a field for comments on model which is not interpreted by the analysis program.

Processor information section declares the total number of processors in the system, and the corresponding scheduling policy for each processor. The scheduling policy may be First Come First Served (FCFS) (the default value), Priority Preemptive Resume (PPR) or Head Of the Line (HOL)\(^1\). The processors are named using symbolic identifiers.

Task information section declares the total number of tasks in the system, and the following parameters for each task: task type (reference or non-reference), the list of entries belonging

\(^1\text{Also known as Priority, Non-preemptive.}\)
to this task, the processor on which the task is allocated, and task priority (if it applies). The tasks are named using symbolic identifiers. Each task must have at least one entry because the workload parameters are associated with entries. As a particular case, a reference task has one and only one entry, which is never called by other tasks (entries).

**Entry information section** declares the total number of entries and the workload parameters associated with each. The entries are named using symbolic identifiers. Each entry is associated to a task by way of an *entry list* for the task. (The model description is invalid if an entry is associated to more than one task, or no task at all). In the BNF description below, the non-terminals from entry and to entry must belong to separate tasks.

The entry workload is divided in phases. The input file format does not limit the number of phases: it uses a variable length list with parameters ordered by phase. Default values are assumed for all undeclared parameters. The parameters declared for entries are:

- open arrival rate to entry (default = 0);
- list of mean service times per phase (default = 0);
- list of phase type flags (default = 0):
  1. exponentially distributed service time and geometrically distributed number of calls;
  2. deterministic service time and deterministic number of calls;
  3. exponential service time and deterministic number of calls;
- coefficient of variation of the service time slice between two calls, given by phase (default = 1.0);
- mean number of RNVs per phase from this entry to other entries (default = 0.0);
- mean number of nonblocking sends per phase from this entry to other entries (default = 0.0);
- probability of forwarding a rendezvous to another entry (default = 0.0).
- internal messaging between entries.

**BNF Description of SRVN Input File Format**

This section gives the formal description of SRVN input file grammar in BNF form. For the nonterminals the notation ⟨nonterminal_id⟩ is used, while the terminals are written without brackets as they appear in the input text.

The notation

\[ \{ \cdots \}^m_n \text{, where } n \leq m \]

means that the part inside the curly brackets is repeated at least \( n \) times and at most \( m \) times. If \( n = 0 \), then the part may be missing in the input text.
General Information

\[ <SRVN_input_file> \rightarrow <general_info> <processor_info> <task_info> <entry_info> \]
\{ <activity_info> \}^0 \quad \Leftarrow 9

\[ <general_info> \rightarrow G <comment> <conv_val> <it_limit> <print_int> \text{opt} <underrelaxation\_coeff> \text{opt} <end\_list> \quad \Leftarrow 4 \]

\[ <comment> \rightarrow <string> \quad /* \text{comment on the model} */ \]

\[ <conv_val> \rightarrow <real> \quad /* \text{convergence value} */ \quad \Leftarrow 1 \]

\[ <it\_limit> \rightarrow <integer> \quad /* \text{max. nb. of iterations} */ \quad \Leftarrow 1 \]

\[ <print\_int> \rightarrow <integer> \quad /* \text{intermed. res. print interval} */ \quad \Leftarrow 1 \]

\[ <underrelaxation\_coeff> \rightarrow <real> \quad /* \text{underrelaxation coefficient} */ \quad \Leftarrow 1 \]

\[ <end\_list> \rightarrow -1 \quad /* \text{end of list mark} */ \]

\[ <string> \rightarrow " <text> " \]

Processor Information

\[ <processor\_info> \rightarrow P <np> <p\_decl\_list> \]

\[ <np> \rightarrow <integer> \quad /* \text{total number of processors} */ \]

\[ <p\_decl\_list> \rightarrow \{ <p\_decl> \}_{i} <end\_list> \]

\[ <p\_decl> \rightarrow p <proc\_id> <scheduling\_flag> <quantum> <multi\_server\_flag> <replication\_flag> <proc\_rate> \text{opt} \quad \Leftarrow 1, 7, 8 \]

\[ <proc\_id> \rightarrow <integer> \mid <identifier> \quad /* \text{processor identifier} */ \quad \Leftarrow 2 \]

\[ <scheduling\_flag> \rightarrow f \quad /* \text{First come, first served} */ \]

\[ \mid p \quad /* \text{Priority, preemptive} */ \]

\[ \mid h \quad /* \text{Head Of Line} */ \]

\[ \mid r \quad /* \text{Random} */ \quad \Leftarrow 4 \]

\[ \mid s \quad /* \text{Processor sharing} */ \]

\[ <quantum> \rightarrow <real> \]

\[ <multi\_server\_flag> \rightarrow m <copies> \quad /* \text{number of duplicates} */ \quad \Leftarrow 1 \]

\[ \mid i \quad /* \text{Infinite server} */ \quad \Leftarrow 6 \]

\[ <replication\_flag> \rightarrow r <copies> \quad /* \text{number of replicas} */ \quad \Leftarrow 8 \]

\[ <proc\_rate> \rightarrow R <ratio> \quad /* \text{Relative proc. speed} */ \quad \Leftarrow 7, 8 \]

\[ <copies> \rightarrow <integer> \]

\[ <ratio> \rightarrow <real> \quad \Leftarrow 7 \]
Task Information

\[
\langle \text{task_info} \rangle \rightarrow T \langle nt \rangle \langle t\_decl\_list \rangle
\]

\[
\langle nt \rangle \rightarrow \langle \text{integer} \rangle /\star \text{total number of tasks} /\star
\]

\[
\langle t\_decl\_list \rangle \rightarrow \{\langle t\_decl \rangle^q \langle \text{end_list} \rangle\}
\]

\[
\langle t\_decl \rangle \rightarrow t \langle \text{task_id} \rangle \langle \text{task_sched_type} \rangle \langle \text{entry_list} \rangle \langle \text{proc_id} \rangle \langle \text{task_pri} \rangle \langle \text{think_time_flag} \rangle \langle \text{multi_server_flag} \rangle \langle \text{replication_flag} \rangle \ni
\]

\[
\langle \text{task_id} \rangle \rightarrow \langle \text{integer} \rangle | \langle \text{identifier} \rangle
\]

\[
/\star \text{task identifier} /\star
\]

\[
\langle \text{task_sched_type} \rangle \rightarrow r \ni
\]

\[
/\star \text{reference task} /\star
\]

\[
| n \ni
\]

\[
/\star \text{non-reference task} /\star
\]

\[
| h \ni
\]

\[
/\star \text{Head of line} /\star
\]

\[
| f \ni
\]

\[
/\star \text{FIFO Scheduling} /\star
\]

\[
| p \ni
\]

\[
/\star \text{Polling Scheduling} /\star
\]

\[
| b \ni
\]

\[
/\star \text{Bursty Reference task} /\star
\]

\[
\langle \text{entry_list} \rangle \rightarrow \{\langle \text{entry_id} \rangle^q \langle \text{end_list} \rangle\}
\]

\[
/\star \text{task t has ne_t entries} /\star
\]

\[
\langle \text{entry_id} \rangle \rightarrow \langle \text{integer} \rangle | \langle \text{identifier} \rangle
\]

\[
/\star \text{entry identifier} /\star
\]

\[
\langle \text{task_pri} \rangle \rightarrow \langle \text{integer} \rangle /\star \text{task priority, optional} /\star
\]

Entry Information

\[
\langle \text{entry_info} \rangle \rightarrow E \langle ne \rangle \langle \text{entry_decl_list} \rangle
\]

\[
\langle ne \rangle \rightarrow \langle \text{integer} \rangle /\star \text{total number of entries} /\star
\]

\[
\langle \text{entry_decl_list} \rangle \rightarrow \{\langle \text{entry_decl} \rangle^q \langle \text{end_list} \rangle\}
\]

\[
/\star k = \text{maximum nb of phases} /\star
\]

\[
\langle \text{entry_decl} \rangle \rightarrow a \langle \text{entry_id} \rangle \langle \text{arrival_rate} \rangle
\]

\[
| c \langle \text{entry_id} \rangle \{\langle \text{coefficient_of_variation} \rangle^q \langle \text{end_list} \rangle\}
\]

\[
| f \langle \text{entry_id} \rangle \{\langle \text{phase_flag} \rangle^q \langle \text{end_list} \rangle\}
\]

\[
| i \langle \text{from_entry} \rangle \langle \text{to_entry} \rangle \{\langle \text{fan_in} \rangle^q \langle \text{end_list} \rangle\}
\]

\[
| o \langle \text{from_entry} \rangle \langle \text{to_entry} \rangle \{\langle \text{fan_out} \rangle^q \langle \text{end_list} \rangle\}
\]

\[
| p \langle \text{entry_id} \rangle \langle \text{entry_priority} \rangle
\]

\[
| s \langle \text{entry_id} \rangle \{\langle \text{service_time} \rangle^q \langle \text{end_list} \rangle\}
\]

\[
| y \langle \text{from_entry} \rangle \langle \text{to_entry} \rangle \{\langle \text{rendezvous} \rangle^q \langle \text{end_list} \rangle\}
\]

\[
| z \langle \text{from_entry} \rangle \langle \text{to_entry} \rangle \{\langle \text{send_no_reply} \rangle^q \langle \text{end_list} \rangle\}
\]

\[
| A \langle \text{entry_id} \rangle \langle \text{activity_id} \rangle
\]

\[
| M \langle \text{entry_id} \rangle \{\langle \text{max_service_time} \rangle^q \langle \text{end_list} \rangle\}
\]

\[
| F \langle \text{from_entry} \rangle \langle \text{to_entry} \rangle \{\langle \text{p_forward} \rangle \langle \text{end_list} \rangle\}
\]
Z <entry_id> \{<think_time>\}\^k <end_list>

\langle arrival_rate \rangle \rightarrow \langle real \rangle /* open arrival rate to entry */
\langle service_time \rangle \rightarrow \langle real \rangle /* mean phase service time */
\langle ph_type_flag \rangle \rightarrow \langle integer \rangle /* 0 - stochastic phase */
/* 1 - deterministic phase */
\langle coeff_of_variation \rangle \rightarrow \langle real \rangle /* squared service time coefficient of variation */
\langle fan_in \rangle \rightarrow \langle integer \rangle /* fan in to this entry */ \equiv 8
\langle fan_out \rangle \rightarrow \langle integer \rangle /* fan out of this entry */ \equiv 8
\langle rendezvous \rangle \rightarrow \langle real \rangle /* mean number of RNVs/ph */
\langle send_no_reply \rangle \rightarrow \langle real \rangle /* mean nb. of non-blck.sends/ph */
\langle p_forward \rangle \rightarrow \langle real \rangle /* probability of forwarding */ \equiv 1
\langle rate \rangle \rightarrow \langle real \rangle /* nb. of calls per arrival */ \equiv 4
\langle max_service_time \rangle \rightarrow \langle real \rangle /* Max time to flag */ \equiv 4
\langle think_time \rangle \rightarrow \langle real \rangle /* Think time for phase */ \equiv 10
\langle from_entry \rangle \rightarrow \langle entry_id \rangle /* Source of a message */
\langle to_entry \rangle \rightarrow \langle entry_id \rangle /* Destination of a message */ \equiv 4

Activity Information

\langle activity_info \rangle \rightarrow \langle activity_def_list \rangle \langle activity_connections \rangle_\text{ext} <end_list> \equiv 9
/* Activity definition. */

\langle activity_def_list \rangle \rightarrow \{ \langle activity_def \rangle \}_n^a
/* Activity Connections. */

\langle activity_def \rangle \rightarrow \langle activity_id \rangle \langle ph_serv_time \rangle /* Service time */
\langle activity_id \rangle \langle coeff_of_variation \rangle /* Sqr. Coeff. of Var. */
\langle activity_id \rangle \langle coeff_of_variation \rangle /* Phase type */
\langle activity_id \rangle \langle ph_type_flag \rangle /* Phase type */
\langle activity_id \rangle \langle from_entry \rangle \langle rendezvous \rangle /* Rendezvous */
\langle activity_id \rangle \langle from_entry \rangle \langle rendezvous \rangle /* Send-no-reply */
\langle activity_id \rangle \langle think_time \rangle /* Think time */

\langle activity_connections \rangle \rightarrow : \langle activity_conn_list \rangle

\langle activity_conn_list \rangle \rightarrow \langle activity_conn \rangle \{ ; \langle activity_conn \rangle \}_n^a

\langle activity_conn \rangle \rightarrow \langle join_list \rangle
\langle join_list \rangle \rightarrow \langle reply_activity \rangle
\langle and_join_list \rangle
\[
\langle \text{split_list} \rangle \rightarrow \langle \text{activity_id} \rangle \\
| \langle \text{repeat_list} \rangle \\
| \langle \text{and_split_list} \rangle \\
| \langle \text{or_split_list} \rangle
\]

\[
\langle \text{and_join_list} \rangle \rightarrow \langle \text{reply_activity} \rangle \{ \& \langle \text{reply_activity} \rangle \}^n \alpha
\]

\[
\langle \text{or_join_list} \rangle \rightarrow \langle \text{reply_activity} \rangle \{ + \langle \text{reply_activity} \rangle \}^n \alpha
\]

\[
\langle \text{and_split_list} \rangle \rightarrow \langle \text{activity_id} \rangle \{ \& \langle \text{activity_id} \rangle \}^n \alpha
\]

\[
\langle \text{or_split_list} \rangle \rightarrow \langle \text{prob_activity} \rangle \{ + \langle \text{prob_activity} \rangle \}^n \alpha
\]

\[
\langle \text{repeat_list} \rangle \rightarrow \langle \text{real} \rangle * \langle \text{sub_activity_id} \rangle \langle \text{next_activity_id} \rangle_{\text{opt}}
\]

\[
\langle \text{prob_activity} \rangle \rightarrow \langle \{ \langle \text{real} \rangle \} \langle \text{activity_id} \rangle \rangle
\]

\[
\langle \text{reply_activity} \rangle \rightarrow \langle \text{activity_id} \rangle \langle \text{reply_list} \rangle_{\text{opt}}
\]

\[
\langle \text{sub_activity_id} \rangle \rightarrow \langle \text{activity_id} \rangle \quad / * \text{head of nested sub-list} */
\]

\[
\langle \text{next_activity_id} \rangle \rightarrow , \langle \text{activity_id} \rangle \quad / * \text{next activity after sublist} */
\]

\[
\langle \text{reply_list} \rangle \rightarrow [ \langle \text{entry_id} \rangle \{ , \langle \text{entry_id} \rangle \}^n ]
\]

**Identifiers**

Identifiers may be zero or more leading underscores (\_\_), followed by a character, followed by any \( \leq 2 \) number of characters, numbers or underscores. Punctuation characters and other special characters such as the dollar-sign (\$\$) are not permitted. The following, \_p1, \_foo\_bar, and \_P21\_proc are valid identifiers, while \_21 and \$proc are not.

**Other Solvers**

**Parasol**

The SRVN input file is also used by the SRVN Parasol simulator. Certain optional nonterminals \( \leq 3 \) only apply to the simulator (for example, \text{cpu_quantum}). These nonterminals are identified by a ‘\|’. If they are present as input to the SRVN solver, they are ignored. Mandatory fields marked by a ‘\|’ are ignored by the simulator.

**PetriSRVN**

Mandatory fields marked by a ‘\|’ are ignored by the Petri net solver.
Layered Queueing Network Solver

Bounds Solver

Summary of Changes

1. Multiservers have been added as an optional field for tasks and processors. This change has not been implemented.

2. Symbolic names have been added for tasks, processors and entries. This change has been incorporated into the source.


4. Items for entry “queues”. “Random” scheduling. Optional specification of underrelaxation and print interval. The latter parameters default to 0.5 for underrelaxation, and 0 for print interval.

5. Queues can have an initial number of tokens.

6. Infinite server capability. Semantic analysis will catch bogus infinite server combinations (for example, reference tasks).

7. Added relative processor speed information for processor information.

8. Added replication information for processors, tasks, and entries. Note that the processor rate flag has changed from ‘r’ to ‘R’.

9. Priorities. Activities

10. Specialized scheduling types and information. Not supported by most solvers.