

MODULE *Memory*

This module is the abstraction for the *Memory* structure used by Generic Multicast 1 and 2. Inserting a new message will either create a new entry or update an existing one. The requirement here is that, at any time, we must always have only one entry for a message, never duplicating. Besides the insert, we have some additional procedures wrapping the buffer for verifying entries and removing them. Each process owns a buffer and accesses only its own buffer, never the others'.

LOCAL INSTANCE *FiniteSets*

LOCAL INSTANCE *Naturals*

Number of groups.

CONSTANT *NGROUPS*

Number of processes.

CONSTANT *NPROCESSES*

The underlying buffer, each process owns one.

We use a set, and the entries are the message tuples.

VARIABLE *MemoryBuffer*

Insert the new entry into the process buffer in the specific group. We remove the previous entry and put the new one in its place.

$$\begin{aligned} \text{Insert}(g, p, t) &\triangleq \\ &\wedge \text{MemoryBuffer}' = [\\ &\quad \text{MemoryBuffer} \text{ EXCEPT } ![g][p] = \{ \\ &\quad \langle \text{msg}, \text{state}, \text{ts} \rangle \in \text{MemoryBuffer}[g][p] : \\ &\quad \text{msg.id} \neq t[1].\text{id} \} \cup \{t\}] \end{aligned}$$

Verify if an entry exists in the process buffer in the specific group using the callback.

$$\begin{aligned} \text{Contains}(g, p, Fn(-)) &\triangleq \\ &\exists t \in \text{MemoryBuffer}[g][p] : Fn(t) \end{aligned}$$

We filter the entries in the process buffer in the specific group using the callback. An entry must be valid when compared with all others except itself.

$$\begin{aligned} \text{ForAllFilter}(g, p, Fn(-, -)) &\triangleq \\ &\{t_1 \in \text{MemoryBuffer}[g][p] : \\ &\quad \forall t_2 \in (\text{MemoryBuffer}[g][p] \setminus \{t_1\}) : Fn(t_1, t_2)\} \end{aligned}$$

Remove the entries in the process buffer in the specific group.

$$\begin{aligned} \text{Remove}(g, p, S) &\triangleq \\ &\wedge \text{MemoryBuffer}' = [\text{MemoryBuffer} \text{ EXCEPT } ![g][p] = @ \setminus S] \end{aligned}$$

Initialize the structure for all processes with an empty buffer.

$$\begin{aligned} \text{Init} &\triangleq \\ &\wedge \text{MemoryBuffer} = [\\ &\quad g \in 1 \dots \text{NGROUPS} \mapsto [\\ &\quad \quad p \in 1 \dots \text{NPROCESSES} \mapsto \{\}]] \end{aligned}$$