Hintergrundinformationen zur Vorlesung **Spezifikation eingebetteter Systeme** SoSe 2006 AG Betriebssysteme FB3 Jan Peleska, Kirsten Berkenkötter

Trace Logic

Trace logic according to Steve Schneider, Concurrent and Real-time Systems, The CSP Approach, John Wiley & Sons, Ltd, 2000.

1 General

Σ	universal set of events
\checkmark	termination event, not in Σ
au	internal event, not in Σ
Σ^{\checkmark}	$\Sigma \cup \{\checkmark\}$
$\sum \{ \checkmark, \tau \}$	$\Sigma \cup \{\checkmark, au\}$
Α	set of events $A \subseteq \Sigma^{\checkmark}$
A^{\checkmark}	$A\cup\checkmark$
а	$\text{external event from } \Sigma^\checkmark$
μ	external or internal event from $\Sigma^{\{\checkmark,\tau\}}$
С. О	${\rm communication}\ {\rm event}\ {\rm with}\ {\rm event}\ {\rm v}\ {\rm and}\ {\rm channel}\ {\rm communication}\ {\rm communication}\ {\rm event}\ {\rm with}\ {\rm event}\ {\rm v}\ {\rm and}\ {\rm channel}\ {\rm communication}\ {\rm $
$\operatorname{channel}(c.v)$	$\operatorname{channel} \operatorname{c} \operatorname{of} \operatorname{c.v}$
value(c.v)	value v of c.v
seq	sequence
tr	finite trace
и	infinite trace
S	timed trace
TRACE	set of finite traces
ITRACE	set of infinite traces
TT	set of timed traces
t	$t\in \mathbb{R}^+$
Ι	$interval \in \mathbb{R}^+$
P(a)	predicate P
PROC sat P(tr)	$\forall tr \in traces(PROC) \bullet P(tr)$

2 Untimed Traces and Sequences

<>		empty sequence
$< a_1, a_2,, a_n >$		sequence of listed elements
$< a \mid a \leftarrow seq, P(a) >$		sequencecomprehension
$seq_1 \cap seq_2$		sequence concatenation
<i>head</i> (<i>seq</i>)		first element of seq
<i>tail</i> (<i>seq</i>)		seq without its first element
<i>foot</i> (<i>seq</i>)		last element of seq
init(seq)		seq without its last element
#seq		length of seq
seq@i		ith element of seq
		(counting from 0)
$\sigma(seq)$		set of events appearing in seq
a in seq		event a appears in seq
term(seq)		$\operatorname{seq}\operatorname{includes}\checkmark$
$seq_1 = seq_2$		$\operatorname{seq}_1 \operatorname{and} \operatorname{seq}_2 \operatorname{identical}$
$seq_1 \leqslant seq_2$		seq_1 is prefix of seq_2
$seq_1 \preceq seq_2$		$\operatorname{seq}_1 \operatorname{is} \operatorname{subsequence} \operatorname{of} \operatorname{seq}_2$
		(notnecessarilycontiguous)
seq interleaves seq_1, seq_2		seq is an interleaving of sequences
		$\operatorname{seq}_1 \operatorname{and} \operatorname{seq}_2$
$\mathit{seq} \operatorname{synch}_A \mathit{seq}_1, \mathit{seq}_2$		$\operatorname{seq}\operatorname{synchronizes}\operatorname{seq}_1 \operatorname{and} \operatorname{seq}_2$
		on events in A^{\checkmark}
$seq \restriction A$		subsequence of elements of seq
		in A
$seq \setminus A$		subsequence of elements of seq
		not in A
$seq \downarrow A$	$\equiv \#(seq \restriction A)$	number of elements of A in seq
$\operatorname{channels}(tr)$	$\equiv \{channel(x) \mid x in tr\}$	set of channels in trace
$tr \Downarrow c$	$\equiv < value(x) \mid x \leftarrow tr, channel(x) = c >$	sequence of values c in trace
$tr \Downarrow C$	$\equiv < value(x) \mid x \leftarrow tr, channel(x) \in C >$	sequence of values in C in trace

3 Timed Traces

$s \restriction A$		$s restricted to A : < (t,a) \mid (t,a) \leftarrow s, a \in A >$
$s \backslash A$	$\equiv s \upharpoonright \Sigma \backslash A$	${\rm subsequence}\ of\ elements\ of\ seq\ not\ in\ A$
$s \downarrow A$	$\equiv \#(s\restriction A)$	number of elements of A in s
strip(s)	$\equiv < a \mid (t,a) \leftarrow s >$	s with times removed
s + t	$<(t'+t,a)\mid (t',a)\leftarrow s)>$	s delayed by t
s-t	$<(t'-t,a)\mid (t',a)\leftarrow s,t'\geqslant t>$	s brought earlier by t
begin(s)		time of the first event in s (and ∞ for the empty trace)
end(s)		time of the last event in s (and 0 for the empty trace) $$
first(s)		first event to appear in s
last(s)		last event to appear in s
$s\uparrow I$	$<(t,a)\mid (t,a)\leftarrow s,t\in I>$	s during I
$s \mid \restriction t$	$s \uparrow [0,t)$	s strictly before t
$s \restriction t$	$s \uparrow [0,t]$	s before t
$s \mid \mid t$	$s \uparrow (t,\infty)$	s strictly after t
$s \uparrow t$	$s \uparrow [t,\infty)$	s after t

4 Macros for Timed Traces

<i>a</i> at <i>t</i>	$\equiv <(t,a)> \preceq s$	a occurres at time t
$a \operatorname{at} I$	$\equiv \exists t \in I \bullet a \text{ at } t$	a occurs in interval I
A at I	$\equiv \exists a \in A \bullet a \text{ at } I$	an Event from A occurres in interval I
no A	$\equiv \neg(A \operatorname{at} [0,\infty))$	no events from A appear in s
only A	$\equiv \neg(\Sigma^{\checkmark} \setminus A \text{ at } [0,\infty))$	only events from A appear in s