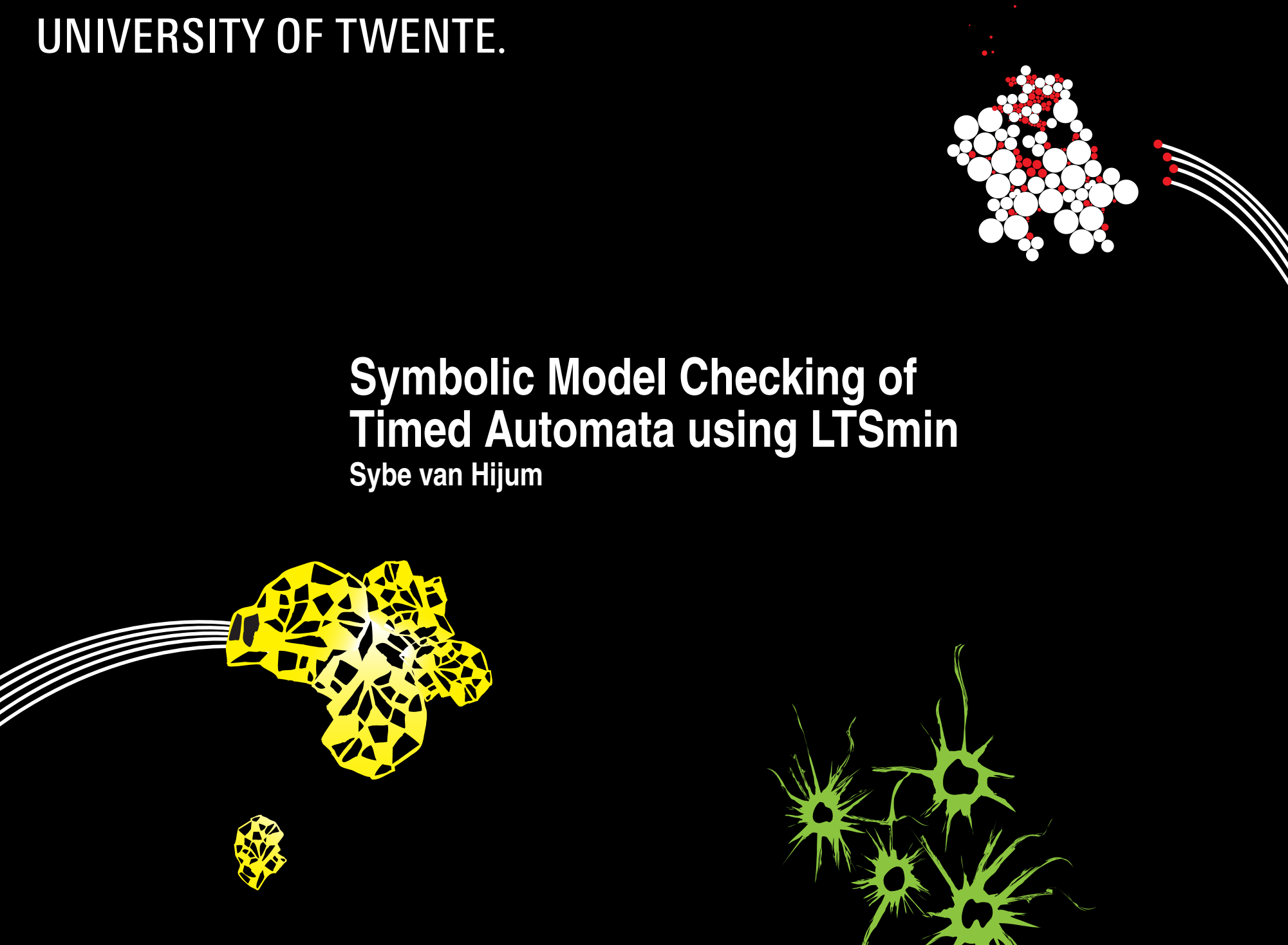
UNIVERSITY OF TWENTE.



Symbolic Model Checking of Timed Automata using LTSmin

Sybe van Hijum

Overview

Timed Automata

Symbolic Model Checking

LTSmin

Working with LaTeX

Second Section

Third Section

Transition System

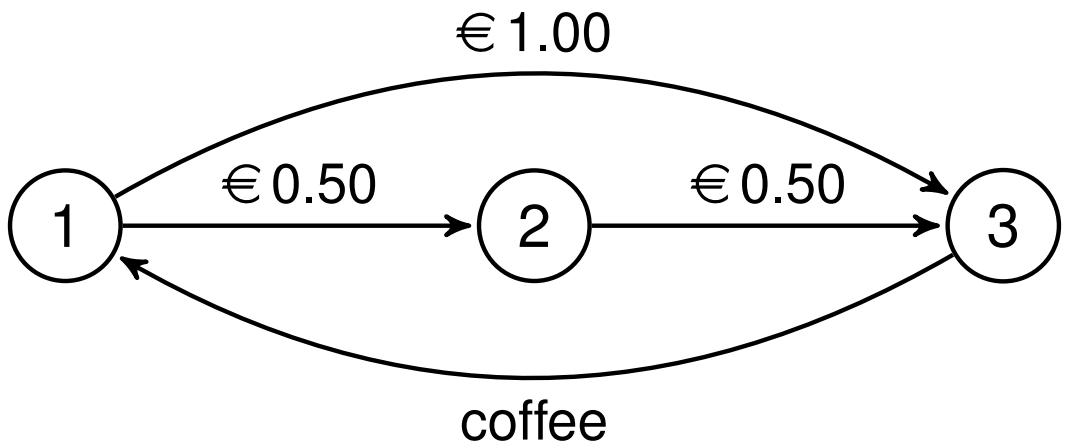
Definition (Labeled Transition System)

A labeled transition system is a 3-tuple $A = \langle S, Act, s_o \rangle$ *where*

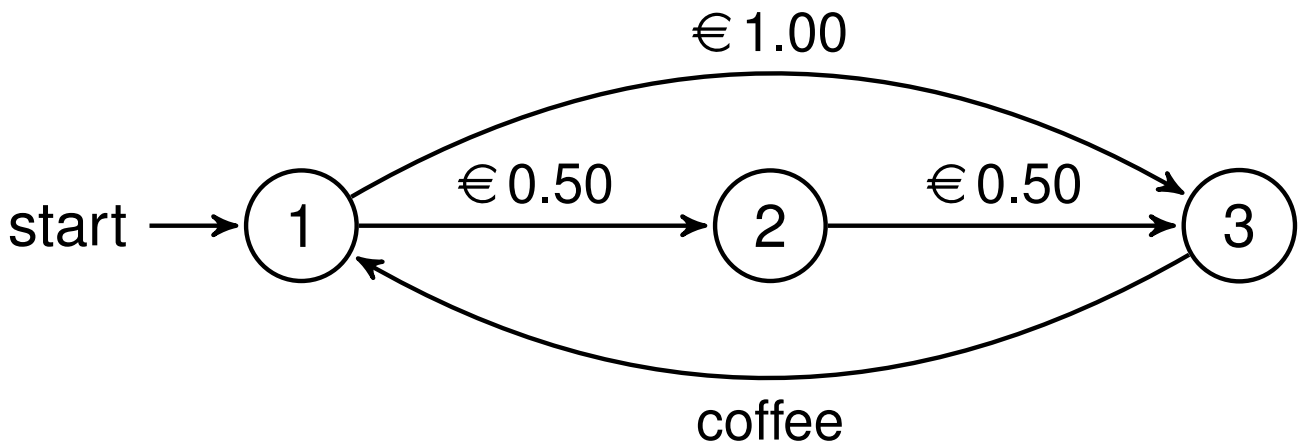
- S *is a finite set of states*
- Act *is a finite set of labelled actions*
- $s_o \in S$ *is a finite set of actions*

Transition System

Transition System



Transition System



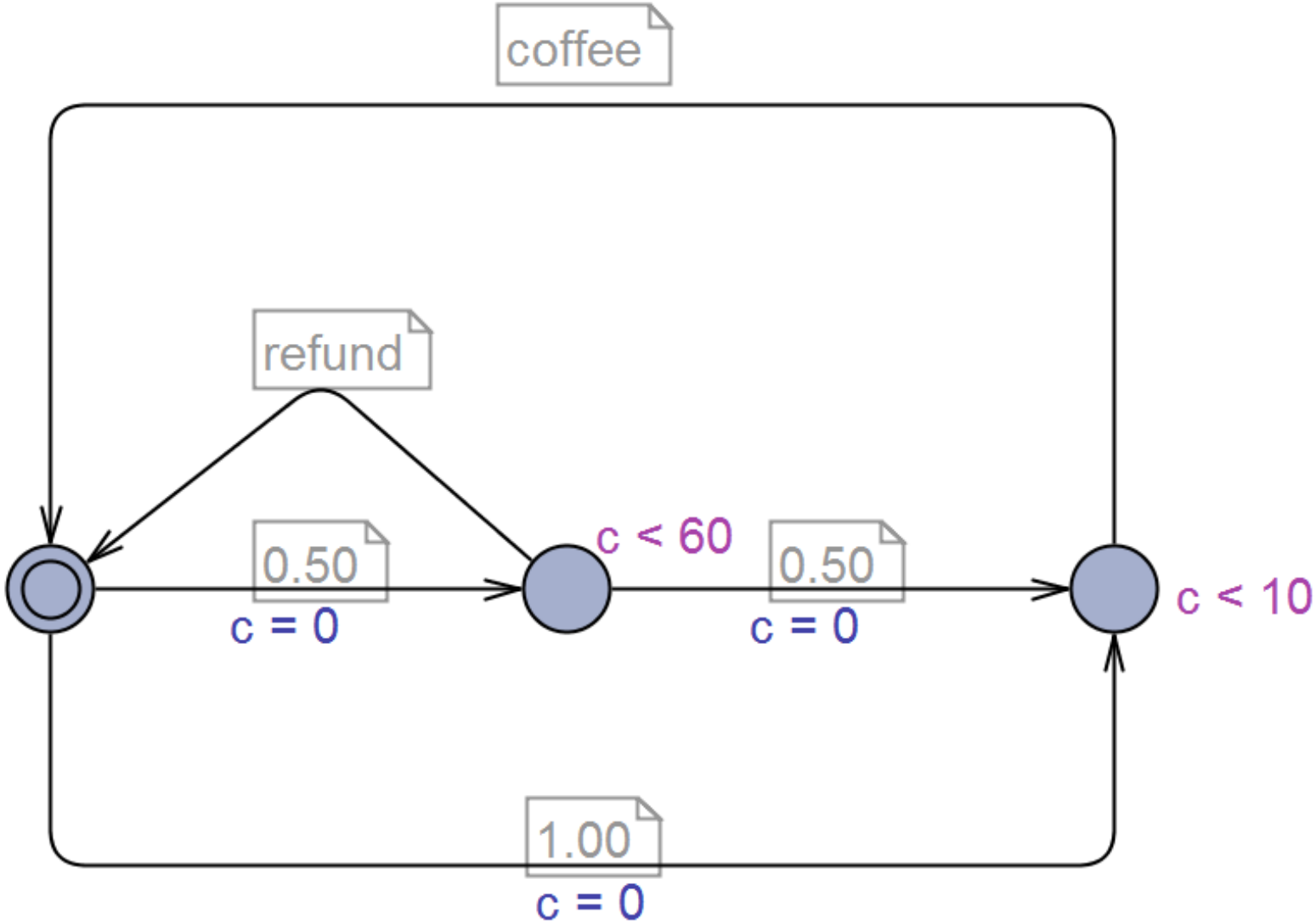
Timed Automata

Definition (Timed Automata)

An extended timed automaton is a 6-tuple $A = \langle L, C, Act, l_0, \rightarrow, I_c \rangle$ *where*

- L *is a finite set of locations, typically denoted by* l
- C *is a finite set of clocks, typically denoted by* c
- Act *is a finite set of actions*
- $l_0 \in L$ *is the initial location*
- $\rightarrow \subseteq L \times G(C) \times Act \times 2^C \times L$ *is the (non-deterministic) transition relation.*
- $I_C : L \rightarrow G(C)$ *is a function mapping locations to downwards closed clock invariants.*

Timed Automata



Overview

Timed Automata

Symbolic Model Checking

LTSmin

Working with LaTeX

Second Section

Third Section

Boolean Decision Diagram

- Expresses boolean expressions

Boolean Decision Diagram

- Expresses boolean expressions
- States can be seen as boolean expressions

Boolean Decision Diagram

- Expresses boolean expressions
- States can be seen as boolean expressions
- Memory efficient

Boolean Decision Diagram

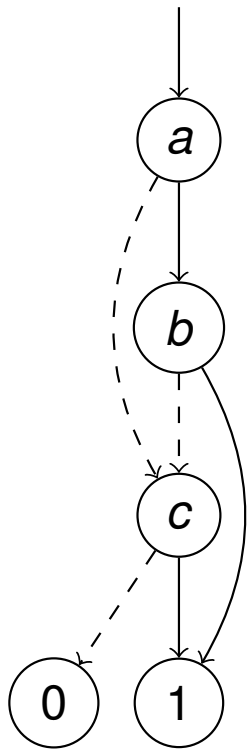
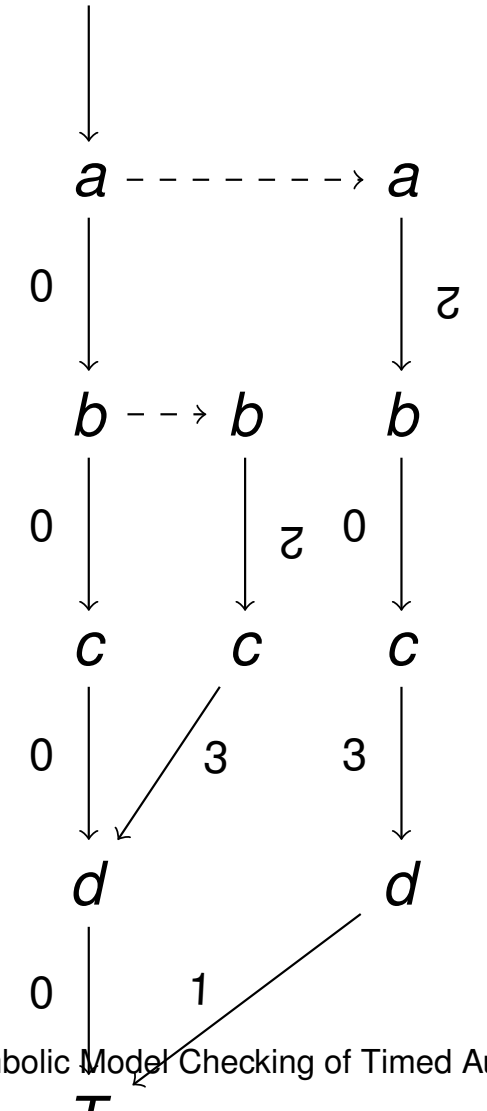


Figure: A BDD representing $(a \wedge b) \vee c$

List Decision Diagram



Overview

Timed Automata

Symbolic Model Checking

LTSmin

Working with LaTeX

Second Section

Third Section

Overview

Timed Automata

Symbolic Model Checking

LTSmin

Working with LaTeX

Second Section

Third Section

Font Sizes

Table: The different font sizes within LaTeX

tiny	sample text
scriptsize	sample text
footnotesize	sample text
small	sample text
normalsize	sample text
large	sample text
Large	sample text
LARGE	sample text
huge	sample text
Huge	sample text

Creation of a new frame

The text within the frame

Creation of a new frame - source

```
\begin{frame}{Creation of a new frame}
    The text within the frame
\end{frame}
```

Frame with `pause` itemes

- First item

Frame with `pause` itemes

- First item
- Second item

Frame with `pause` itemes

- First item
- Second item
- You get the point.

Frame with `pause` itemes - `source`

```
\begin{frame}{Frame with \texttt{pause} itemes}
\begin{itemize}
\item First item \pause
\item Second item \pause
\item You get the point.
\end{itemize}
\end{frame}
```

Frame with `pause` tables

Table: Caption

Class	A	B	C	D
X	1	2	3	4

Frame with `pause` tables

Table: Caption

Class	A	B	C	D
X	1	2	3	4
Y	3	4	5	6

Frame with `pause` tables

Table: Caption

Class	A	B	C	D
X	1	2	3	4
Y	3	4	5	6
Z	5	6	7	8

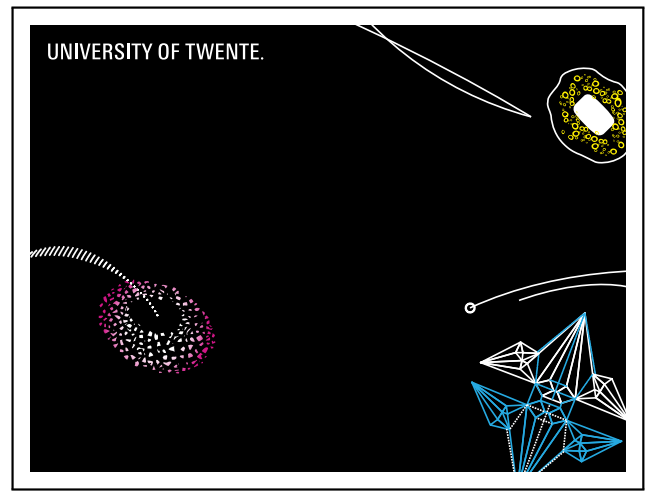
Frame with `pause` tables - `source`

```
\begin{frame}{Frame with \texttt{pause} tables}

\rowcolors[]{1}{blue!20}{blue!10}
\begin{table}
\caption{Caption}
\begin{tabular}{l!{\vrule}cccc}
Class & A & B & C & D \\\hline
X & 1 & 2 & 3 & 4 \pause \\
Y & 3 & 4 & 5 & 6 \pause \\
Z & 5 & 6 & 7 & 8
\end{tabular}
\end{table}
\end{frame}
```

Two Column Output

Text here.
Text here.
Text here.



Two Column Output - source

```
\begin{frame}{Two Column Output}
  \begin{columns}[c]
    \column{1.5in}
      Text here.\\
      Text here.\\
      Text here.
    \column{1.5in}
    \framebox{\includegraphics[width=1.5in]{img/back2}}
  \end{columns}
\end{frame}
```

Overview

Timed Automata

Symbolic Model Checking

LTSmin

Working with LaTeX

Second Section

Third Section

First frame of the Second Section

Each new section starts with an Table Of Contents.

Overview

Timed Automata

Symbolic Model Checking

LTSmin

Working with LaTeX

Second Section

Third Section

First frame of the Second Section

The Table Of Contents is clickable