

Graph-oriented test design methods

Overview

Problems

Traceability

State based testing

State based test design

Example: railway shunt

Activity diagrams

Summary

- Problem
- Traceability
- State based testing
- State based test design
- Example: railway shunt
- Activity diagrams
- Summary

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- Traceability from test-cases to requirements isn't possible
- Bad quality of specifications
- Textual specifications are ambiguous
- Description of dynamic behaviour is incomplete

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Overview

Problems

Traceability

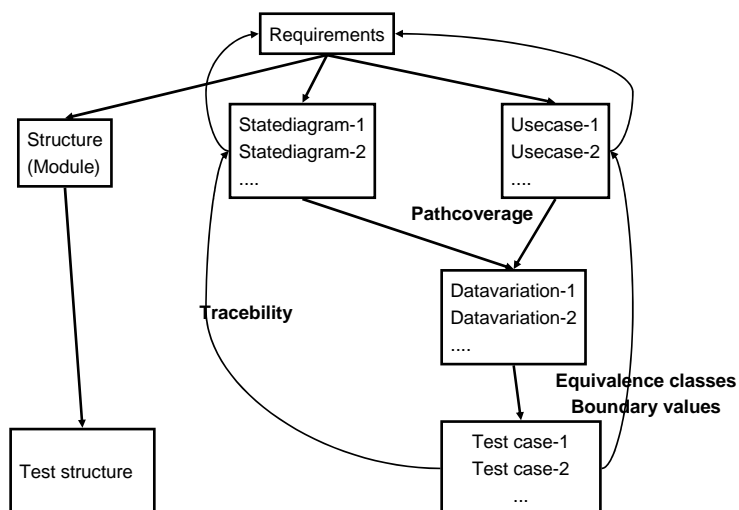
State based testing

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Summary



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Overview

Problems

Traceability

State based testing

State based test design

Example: railway shunt

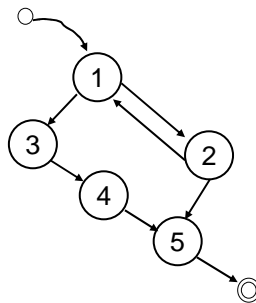
Activity diagrams

Summary

State-based testing:

Testing with test cases developed by modelling the system under test as a state machine.

[R.V. Binder, 1999]



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Overview

Problems

Traceability

State based testing

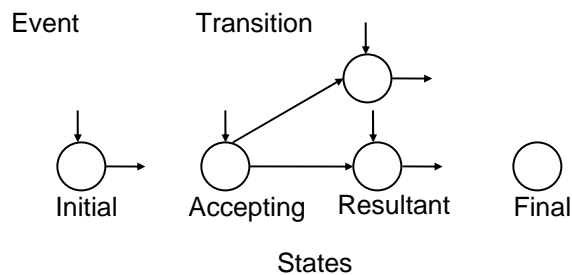
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Summary

- A state machine is a system whose output is determined by both current and past input. The effect of previous inputs is represented by a state.
- A state machine consists of **Events, States, Actions, Transitions**



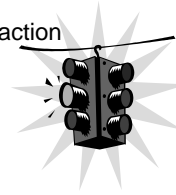
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Overview
Problems
Traceability

State based testing

State based test design
Example: railway shunt
Activity diagrams
Summary

- A **guard** is a **predicate expression** associated with an **event**
- A guarded transition cannot fire unless:
 - The system is in an accepting state for this transition,
 - the guarded event occurs and
 - the guard predicate evaluates to true.
- Notation in UML:
 - Event arg-list '[' guard-condition'] '/' action



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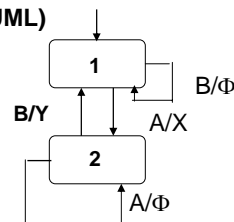
Overview
Problems
Traceability

State based testing

State based test design
Example: railway shunt
Activity diagrams
Summary

- **Graphical representation**
 - Nodes => states
 - Arrows => transitions
 - Annotations on edges => events and actions
- Several variants do exist:
 - Traditional
 - Structured analysis
 - **State chart notation (UML)**

States: 1,2,...
Events: A,B,...
Actions: X,Y,..., Φ
 Φ : null action



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PSE: <i>support</i> Center Test	Statecharts	SIEMENS
Overview Problems Traceability	<ul style="list-style-type: none"> • Modelling of concurrency <ul style="list-style-type: none"> – In basic model only a single state may be active – No support for simultaneous transition processes ➔ Introduction of product machines ➔ Statecharts: XOR decomposition & AND decomposition ➔ [Harel 88] : Statecharts = state diagrams + depth + orthogonality + broadcast communication. <ul style="list-style-type: none"> ➔ State diagrams: incorporate semantics of state diagram from the basic model. ➔ Depth: hierarchic nesting ➔ Orthogonality: modeling of two or more independent control hierarchies ➔ Broadcast communication: all machines are visible to each other (interaction) 	Armin Beer, Siemens PSE 9
State based testing		
State based test design Example: railway shunt Activity diagrams Summary		

PSE: <i>support</i> Center Test	State-based Test Design	SIEMENS
Overview Problems Traceability State based testing	<ul style="list-style-type: none"> • State-based testing: <ul style="list-style-type: none"> – Testing with test cases developed by modelling the system under test as a state machine. • Typical failures: <ul style="list-style-type: none"> – A missing or incorrect transition – A missing or incorrect event – A missing or incorrect action – An extra, missing, or corrupt state – A sneak path – An illegal message failure – A trap door • These faults may occur individually or in any combination! 	Armin Beer, Siemens PSE 10
State based test design		
Example: railway shunt Activity diagrams Summary		

Overview

Problems

Traceability

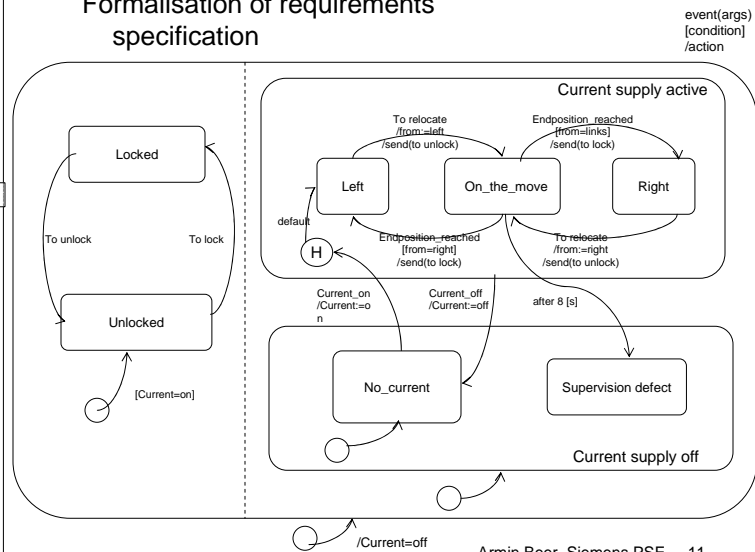
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Example: railway shunt

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Summary

Formalisation of requirements
specification

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Problems

Traceability

State based testing

State based test design

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Summary

- State after „Current_on“?
assumption: the last valid state (H: History, default: left)
- How the state „Supervision defect“ is attained?
- Misunderstandings?
- Something forgotten?

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PSEsupportCenter Test	Errors in state-based models	SIEMENS
<div>Overview</div> <div>Problems</div> <div>Traceability</div> <div>State based testing</div> <div>State based test design</div> <div>Example: railway shunt</div> <div>Activity diagrams</div> <div>Summary</div>	<ul style="list-style-type: none"> - <u>Incorrect state transitions</u> at <ul style="list-style-type: none"> • certain events • certain conditions - <u>Incorrect actions at</u> <ul style="list-style-type: none"> • certain events • certain conditions - <u>Missing</u> <ul style="list-style-type: none"> • State transitions • Conditions • Actions - <u>Additional</u> (not modeled) state transitions at <ul style="list-style-type: none"> • certain events • certain conditions - <u>Additional</u> (not modeled) actions at <ul style="list-style-type: none"> • certain events • certain conditions - <u>Path-errors</u> <ul style="list-style-type: none"> • all errors mentioned above, • only for certain paths (e.g. after changing 2x) 	Armin Beer, Siemens PSE 13

PSEsupportCenter Test	Activity diagrams	SIEMENS
<div>Overview</div> <div>Problems</div> <div>Traceability</div> <div>State based testing</div> <div>State based test design</div> <div>Example: railway shunt</div> <div>Activity diagrams</div> <div>Summary</div>	<div>Seat booking system</div>	Armin Beer, Siemens PSE 14

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Problems

Traceability

State based testing

State based test design

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Summary

- Graph-oriented testing, if model of the application exists
- State-transition diagrams are common and easy to understand
- Number of test cases depend on to what extent the graph is covered