CS3300 Introduction to Software Engineering

Lecture 16: Black-Box Testing
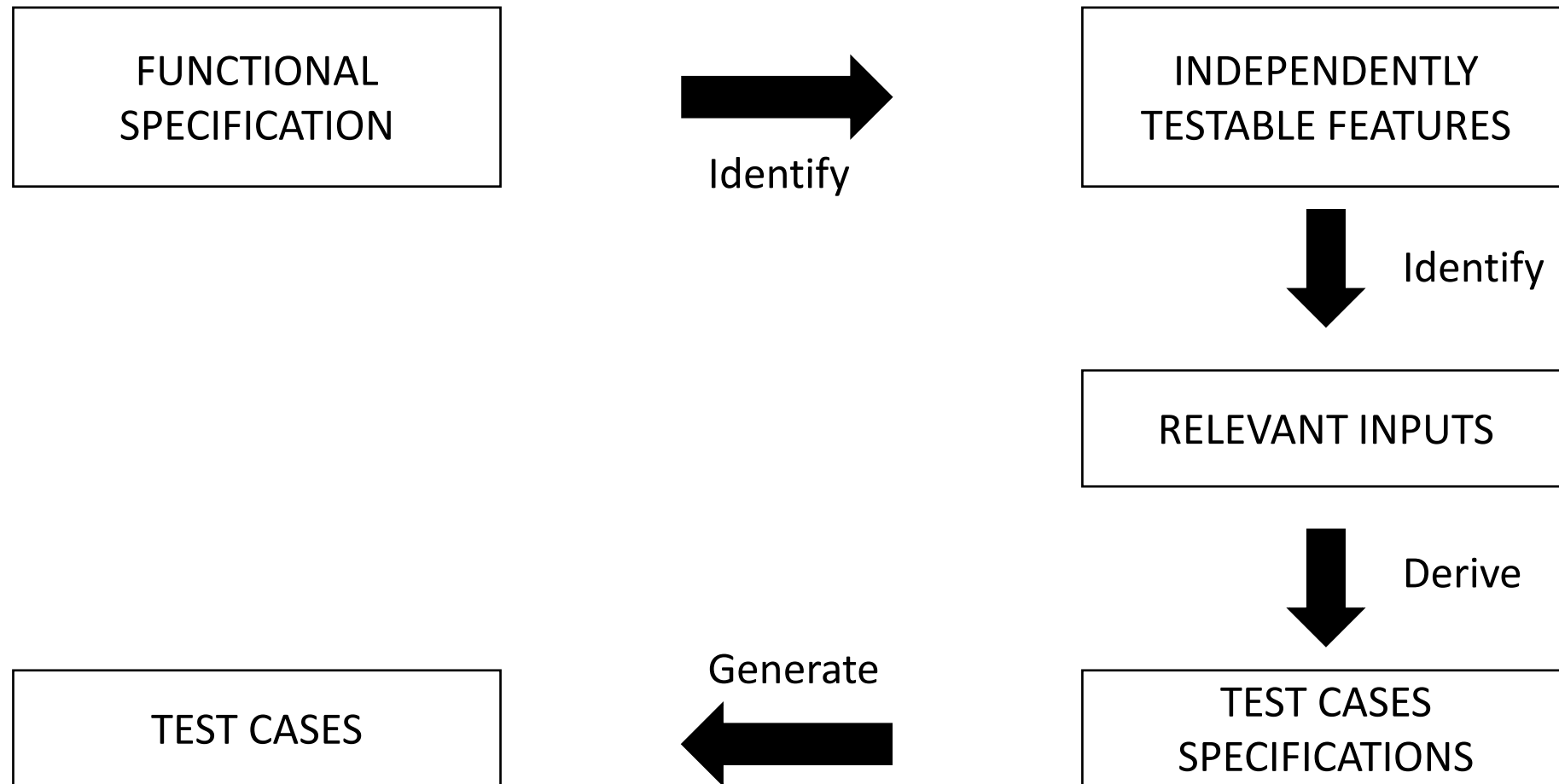
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Black- Box Testing

Advantages
- Focus on the domain
- No need for the code
    - Early test design
    - Prevents the highly occurring scenario of no-time-for-testing
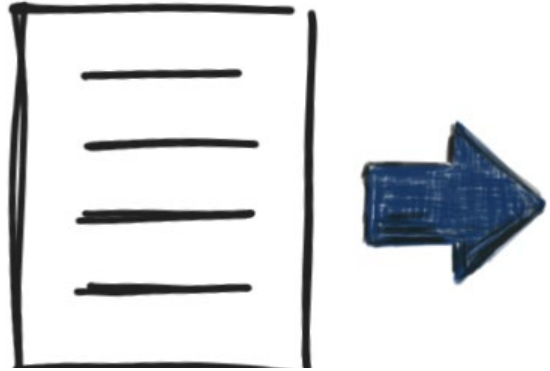- Catches logic defects
- Applicable at all granularity levels

A systematic Functional-Testing Approach

Decoupling; Automated Sub-tasks; Monitor testing process

A systematic Functional-Testing Approach

The Category-Partition Method

Functional
Specification

1. Identify independently testable features
2. Identify Categories (characteristic features of input)
3. Partition Categories into choices (interesting values – boundary values)
4. Identify constraints among choices (PROPERTY---- IF, ERROR, SINGLE)
5. Produce/Evaluate test case specifications (Produce test frames, can be automated using TSLGenerator)
6. Generate test cases from test case specifications (by instantiating)

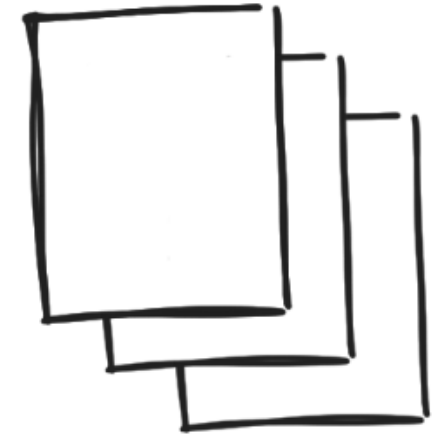# Model-Based Testing
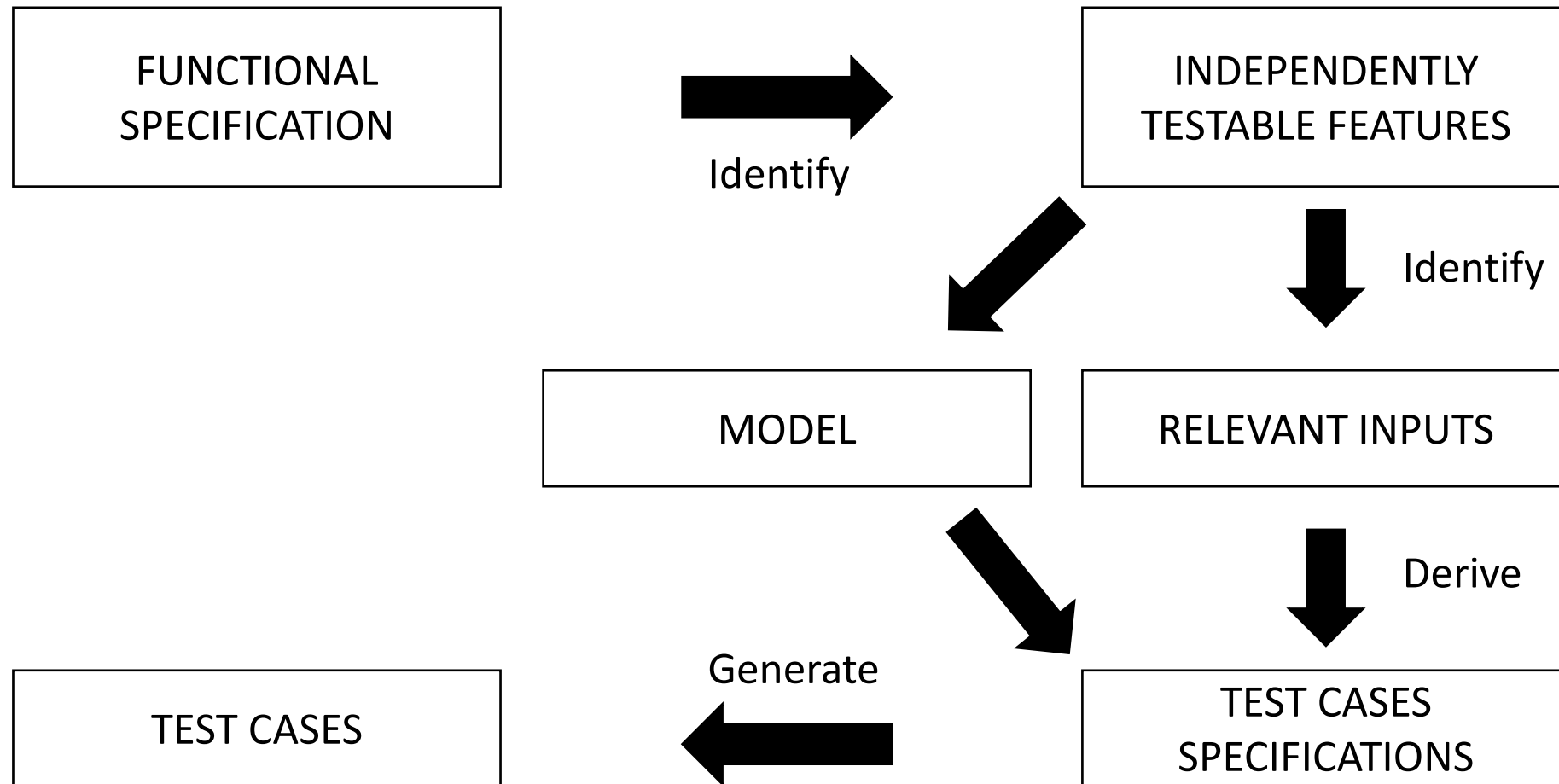
Model-Based Testing

Specification

Model
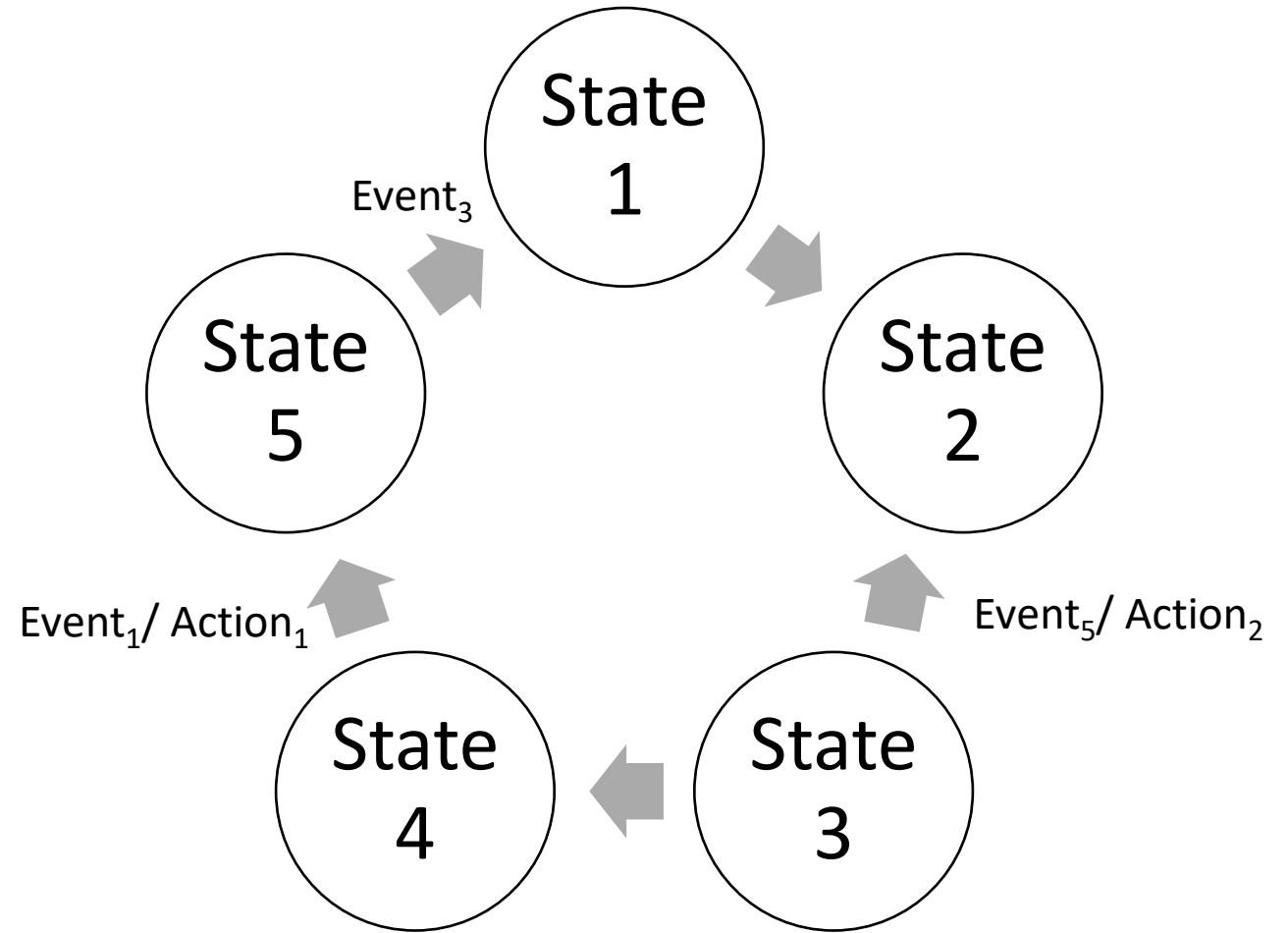(Abstract representation
of the software)

Test Cases

Finite State Machines (FSM)

Nodes = States
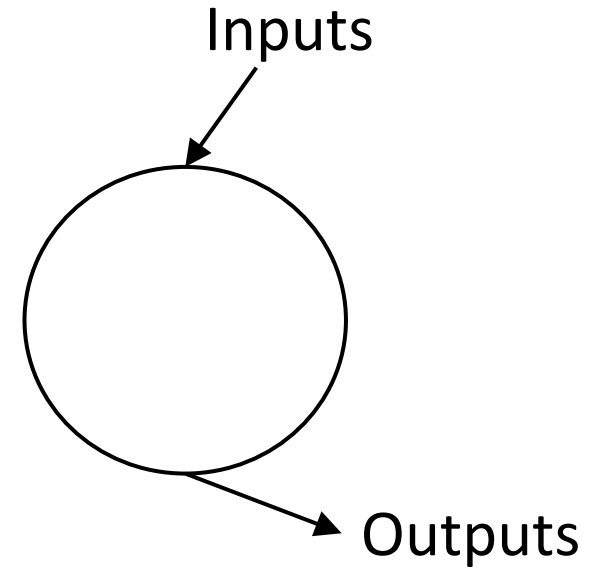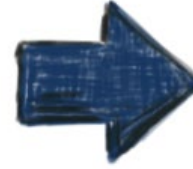Edges = Transitions
Edge Labels = Events/Actions

Building an FSM

Specification

Identify System's Boundaries, and Input and Output

Inputs

Outputs
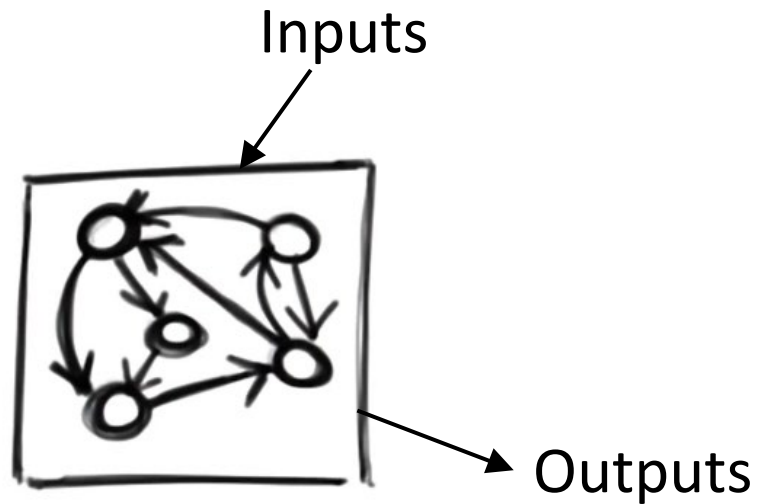
Identify relevant states and transitions

Inputs

Outputs

From an Informal Specification...

Maintenance: The Maintenance function records the history of items undergoing maintenance.

If the product is covered by warranty or maintenance contract, maintenance can be requested either by calling the maintenance toll free number, or through the web site, or by bringing the item to a designated maintenance station.

If the maintenance is requested by phone or web site and the customer is a US or EU resident, the item is picked up at the customer site, otherwise, the customer shall ship the item with an express courier.

If the maintenance contract number provided by the customer is not valid, the item follows the procedure for items not covered by warranty.

If the product is not covered by warranty or maintenance contract, maintenance can be requested only by bringing the item to a maintenance station. The maintenance station informs the customer of the estimated costs for repair. Maintenance starts only when the customer accepts the estimate.

If the customer does not accept the estimate, the product is returned to the customer.

Small problems can be repaired directly at the maintenance station. If the maintenance station cannot solve the problem, the product is sent to the maintenance regional headquarters (if in US or EU) or to the maintenance main headquarters (otherwise).

If the maintenance regional headquarters cannot solve the problem, the product is sent to the maintenance main headquarters.

Maintenance is suspended if some components are not available.

Once repaired, the product is returned to the customer.
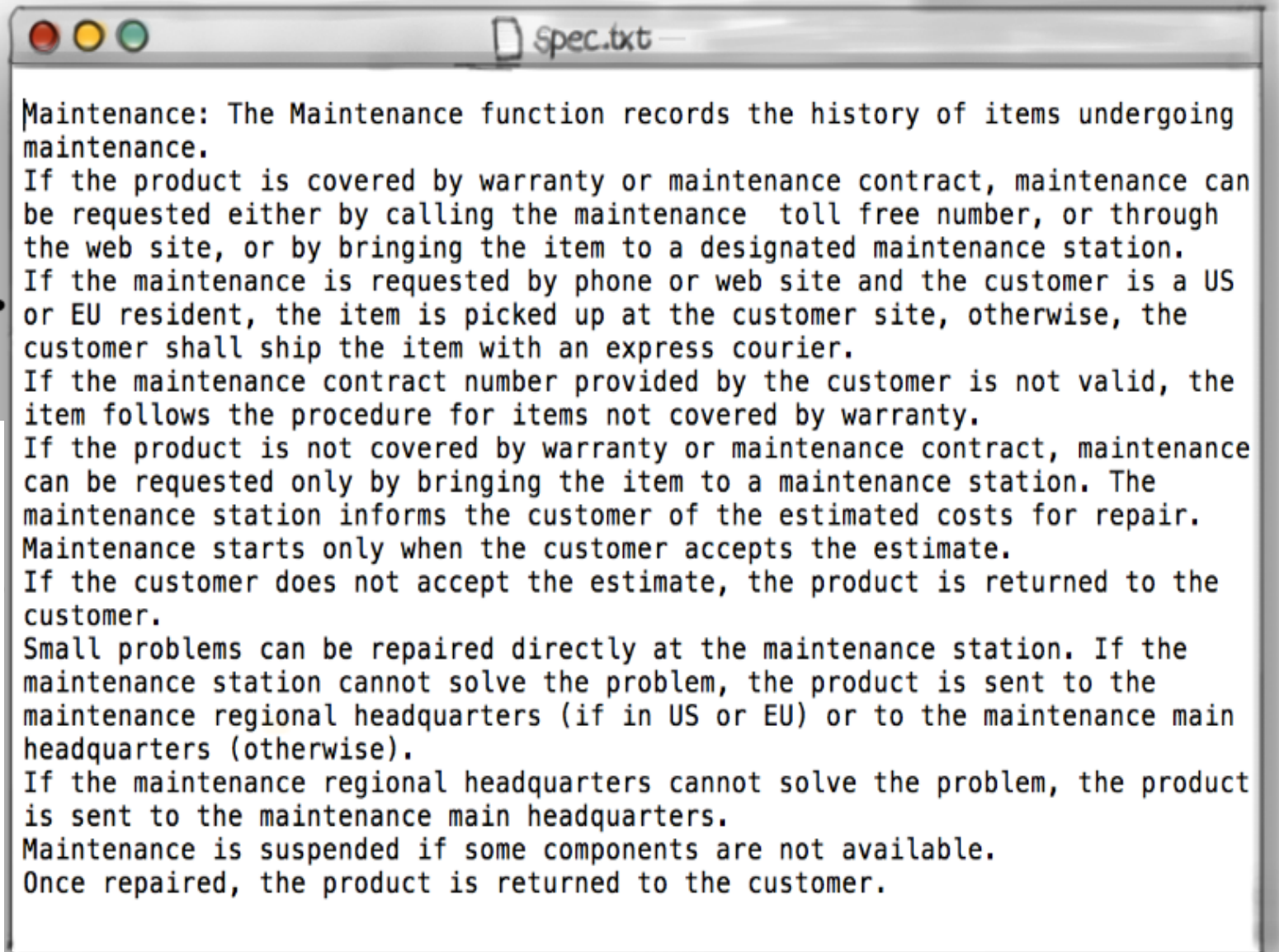
From an Informal Specification…

Spec.txt

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From an Informal Specification...

Multiple choices here →

Determine the next step →

spec.txt

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… To a Finite State Model
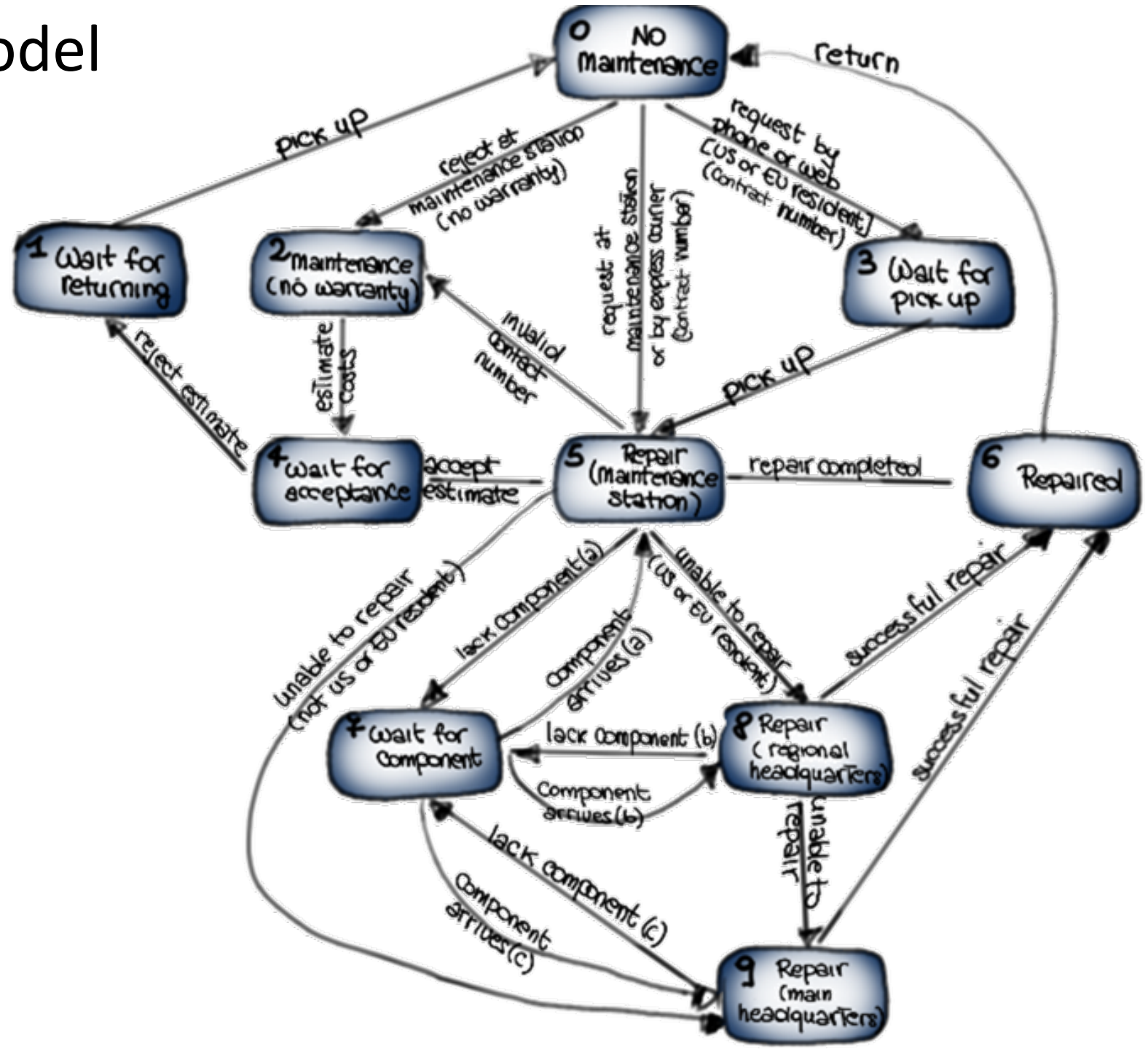
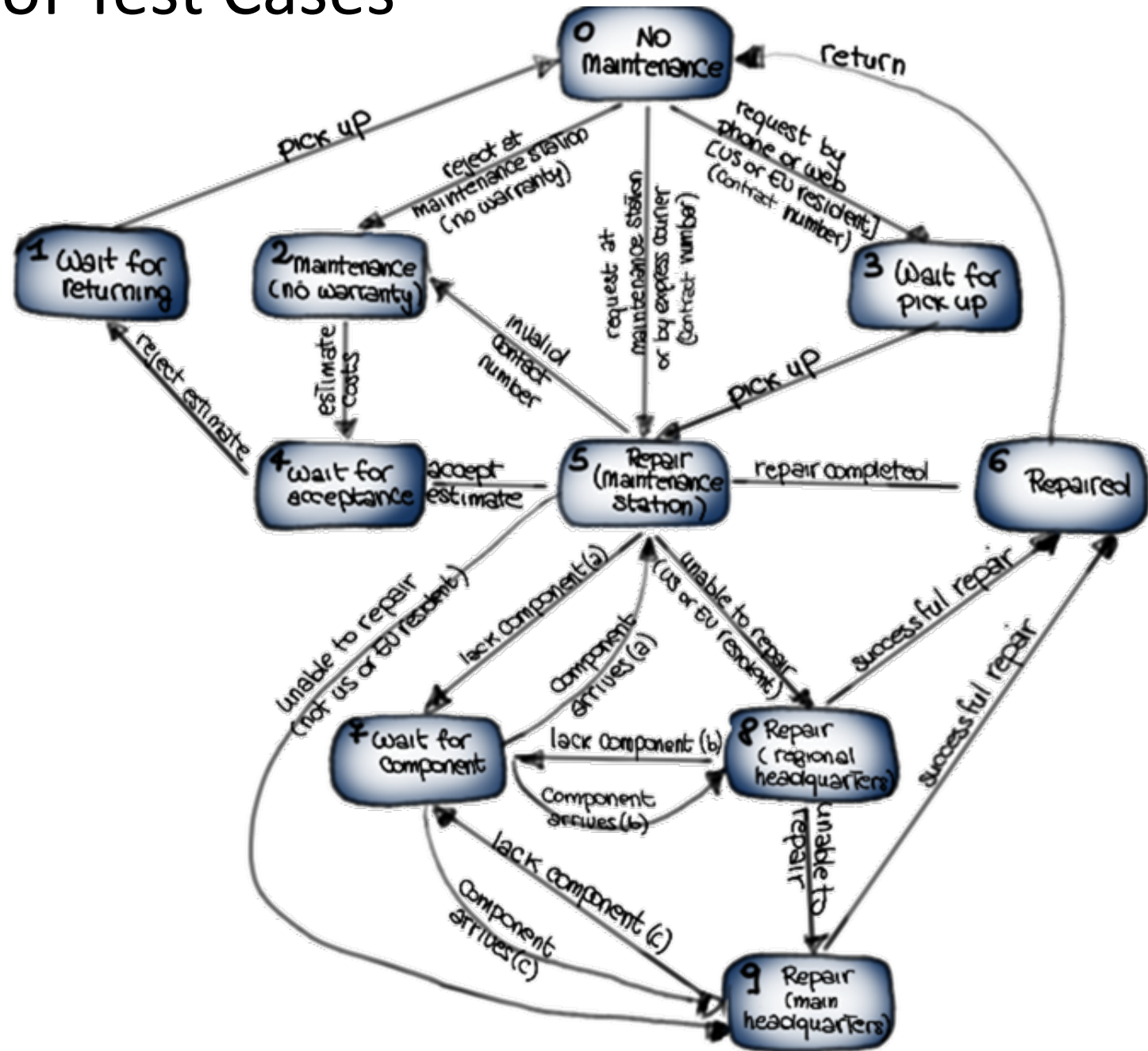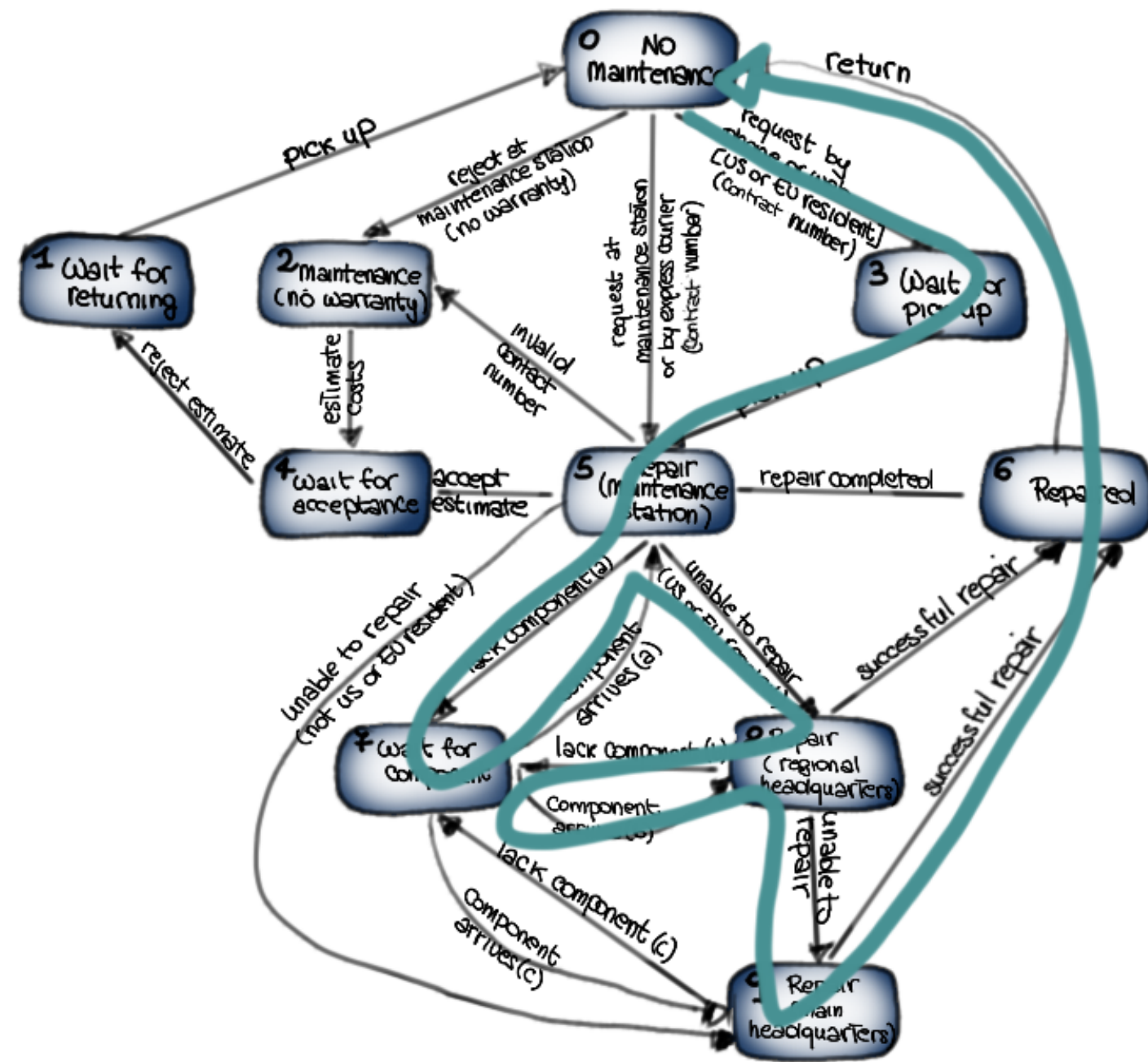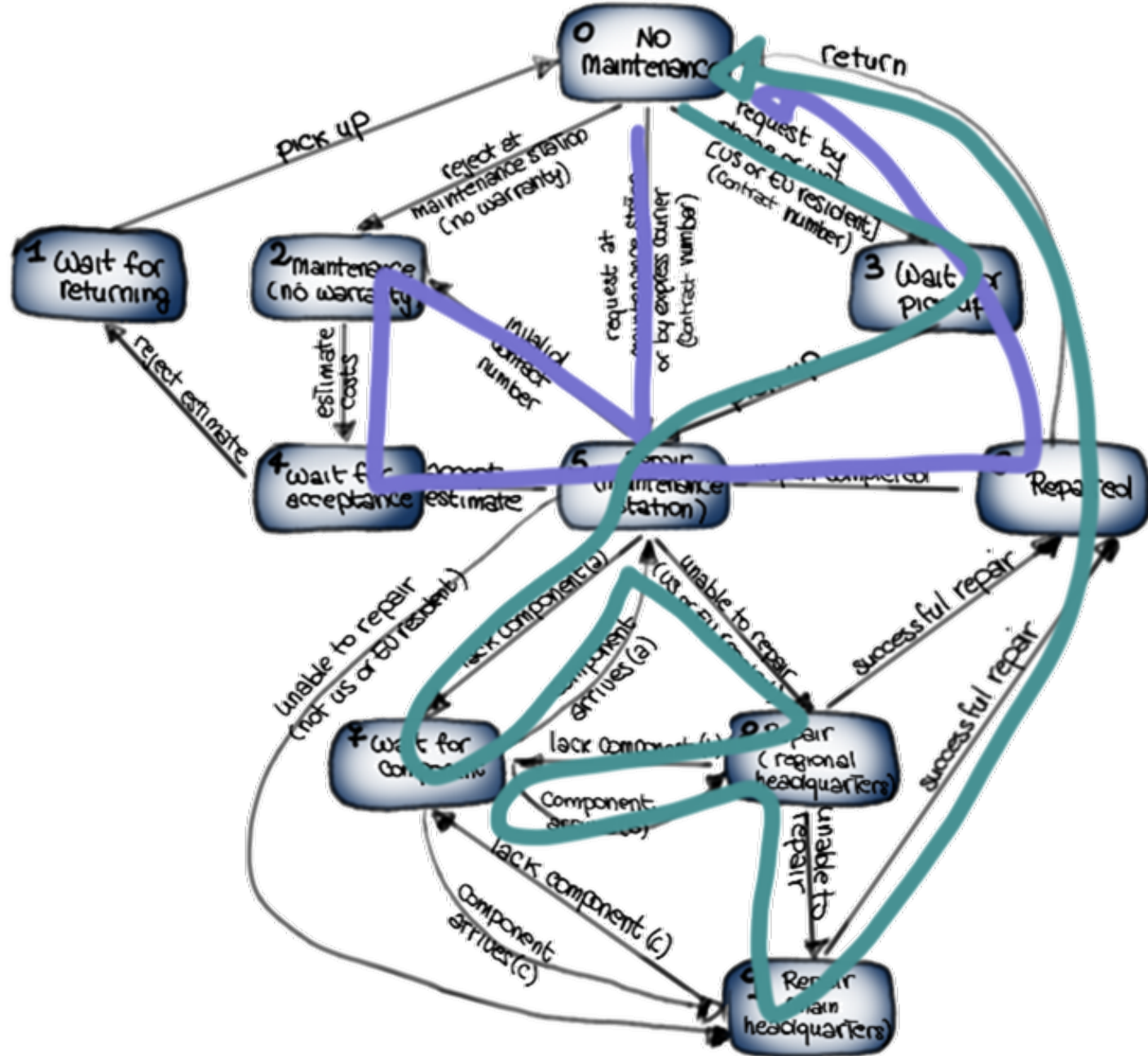# Finite State Model to a Set of Test Cases
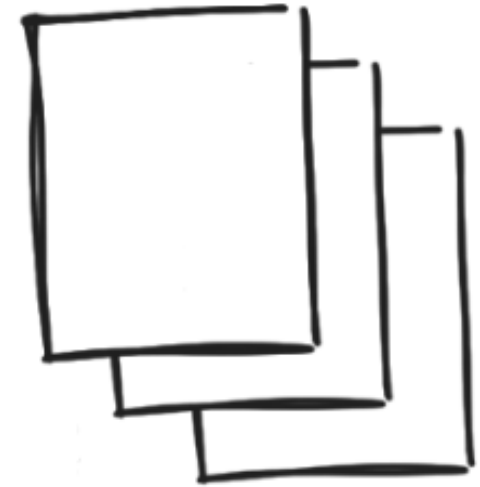
Test Cases

Finite State Model to a Set of Test Cases

Cover the behaviors represented by the state machine.

- Cover all the states
- Or Identify paths in state machine that go through all states in the machine

Finite State Model to a Set of Test Cases

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TC1: Φ, 3, 5, 7, 5, 8, 7, 8, 9, 6, Φ
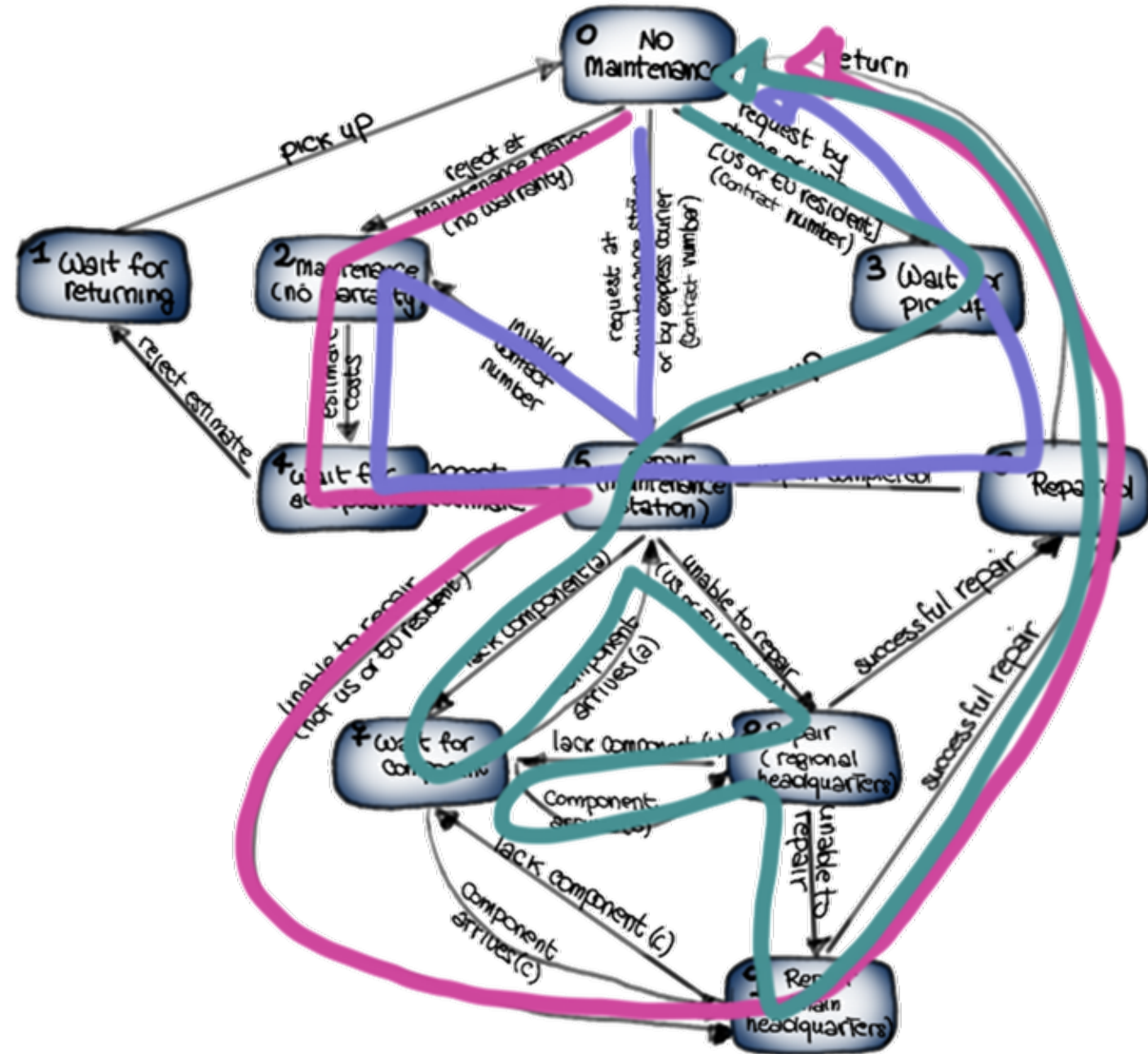
Finite State Model to a Set of Test Cases

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TC2: Φ, 5, 2, 4, 5, 6, Φ

Finite State Model to a Set of Test Cases

Cover the behaviors represented by the state machine.

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TC1: Φ, 3, 5, 7, 5, 8, 7, 8, 9, 6, Φ

TC2: Φ, 5, 2, 4, 5, 6, Φ

TC3: Φ, 2, 4, 5, 9, 6, Φ

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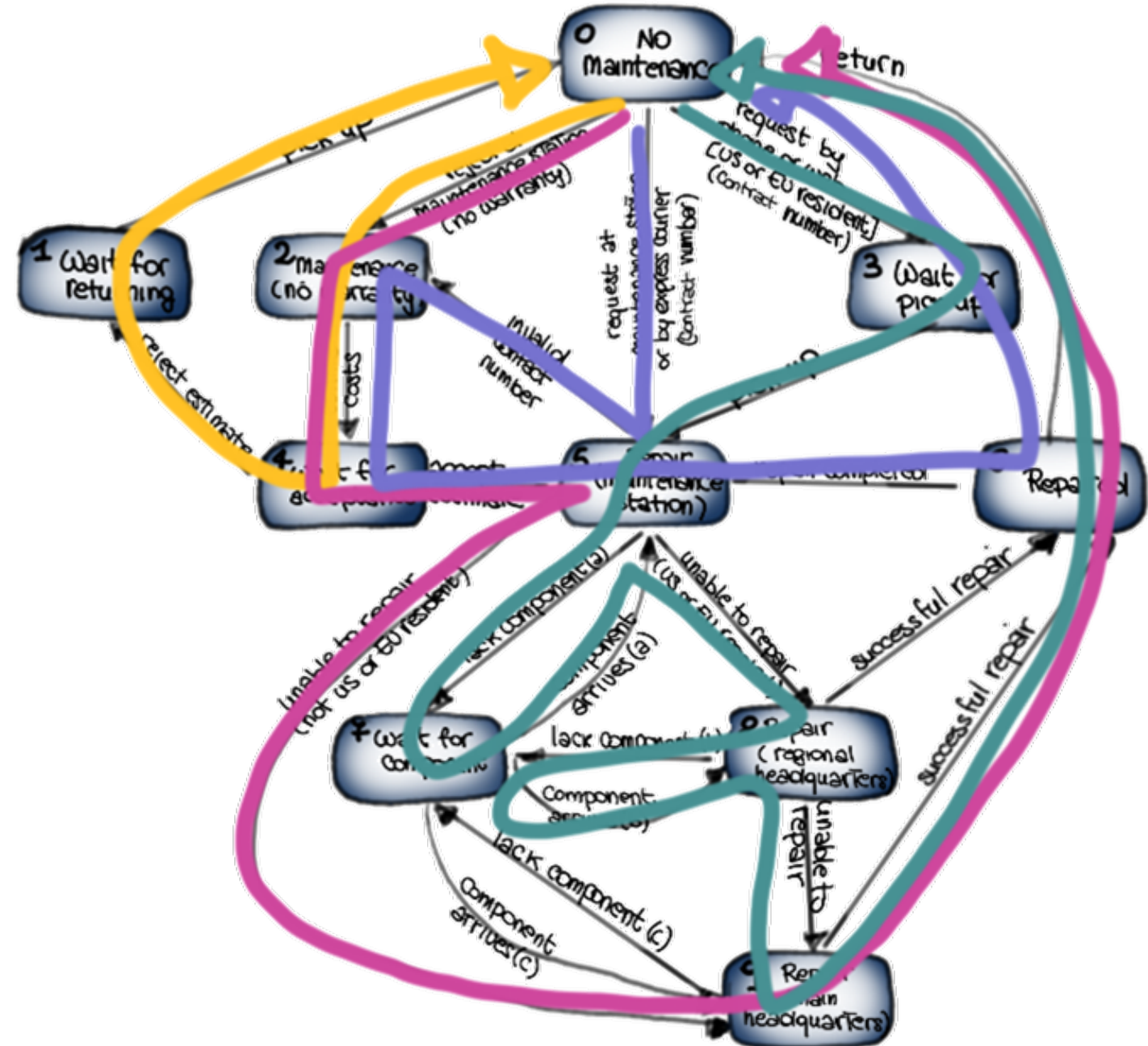
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- Cover all the states
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- Or cover all transitions

TC1: Φ, 3, 5, 7, 5, 8, 7, 8, 9, 6, Φ

TC2: Φ, 5, 2, 4, 5, 6, Φ

TC3: Φ, 2, 4, 5, 9, 6, Φ

TC4: Φ, 2, 4, 1, Φ

Finite State Model to a Set of Test Cases
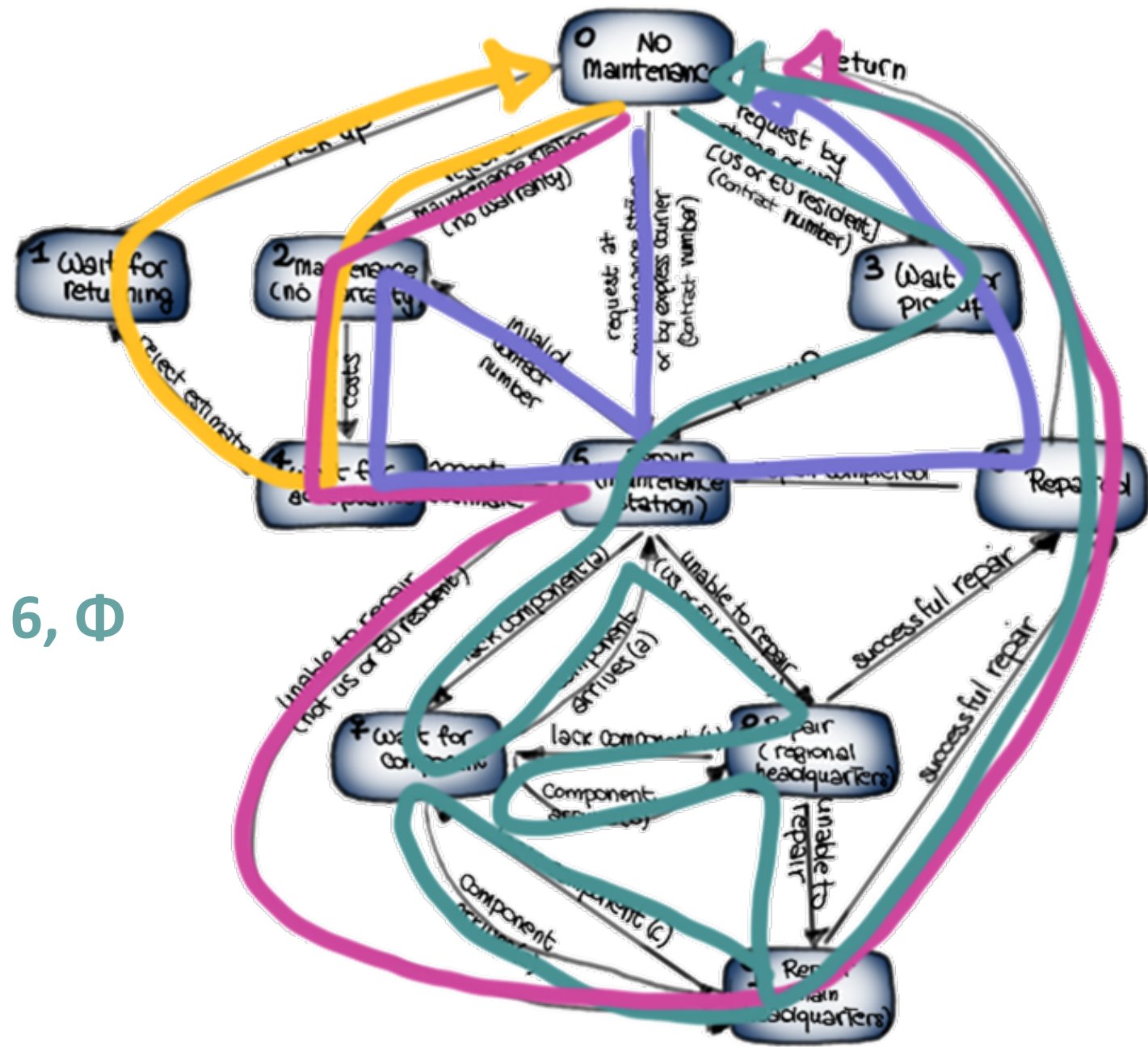
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TC4: Φ, 2, 4, 1, Φ

Finite State Model to a Set of Test Cases

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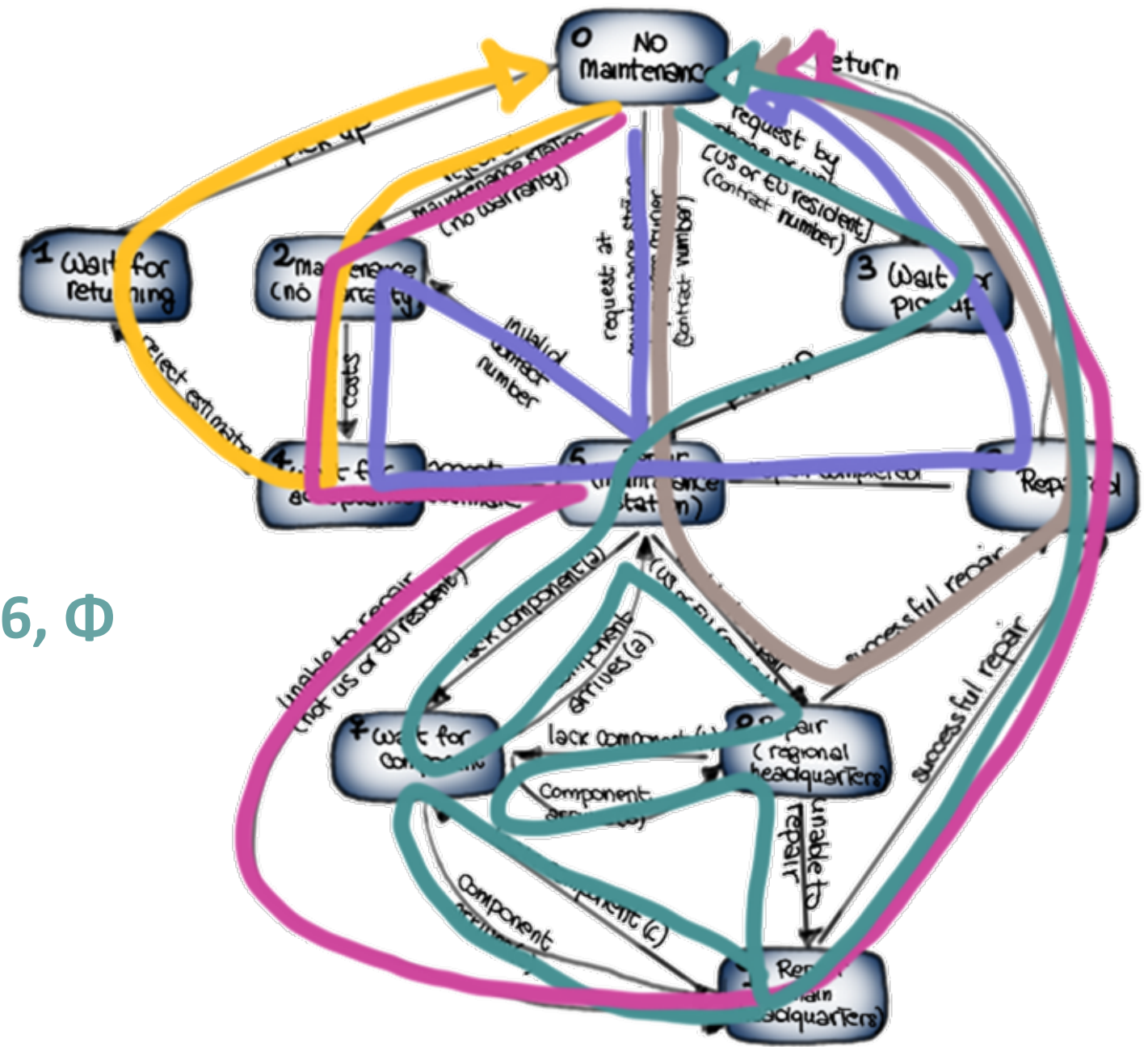- Or cover all transitions

TC1: Φ, 3, 5, 7, 5, 8, 7, 8, 9, 7, 9, 6, Φ

TC2: Φ, 5, 2, 4, 5, 6, Φ

TC3: Φ, 2, 4, 5, 9, 6, Φ

TC4: Φ, 2, 4, 1, Φ
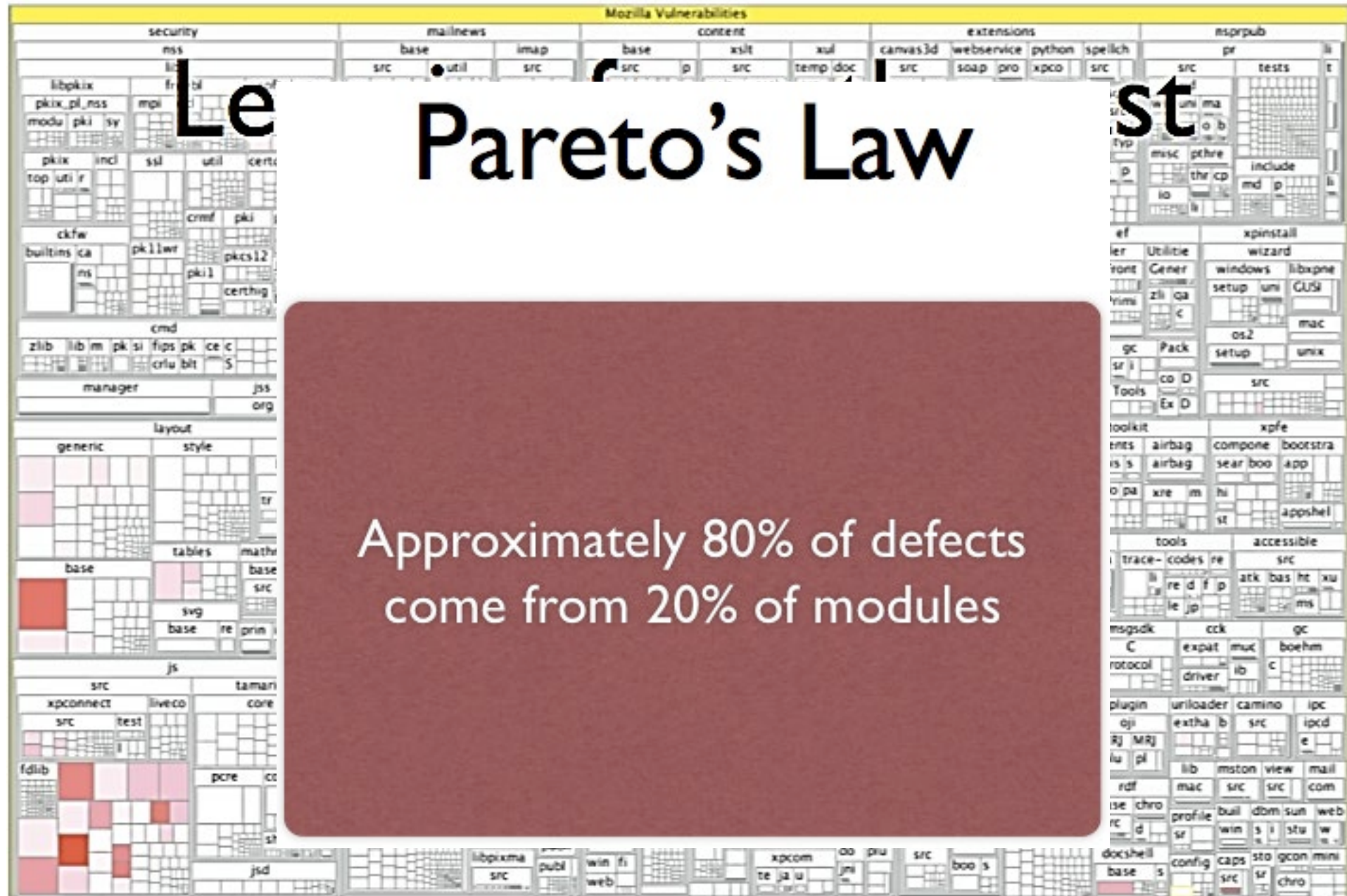
TC5: Φ, 5, 8, 6, Φ

Some Considerations

Applicability
- Very General Approach
- In UML, state machine are readily available

Abstraction is key – right balance between abstracting and expensive testing
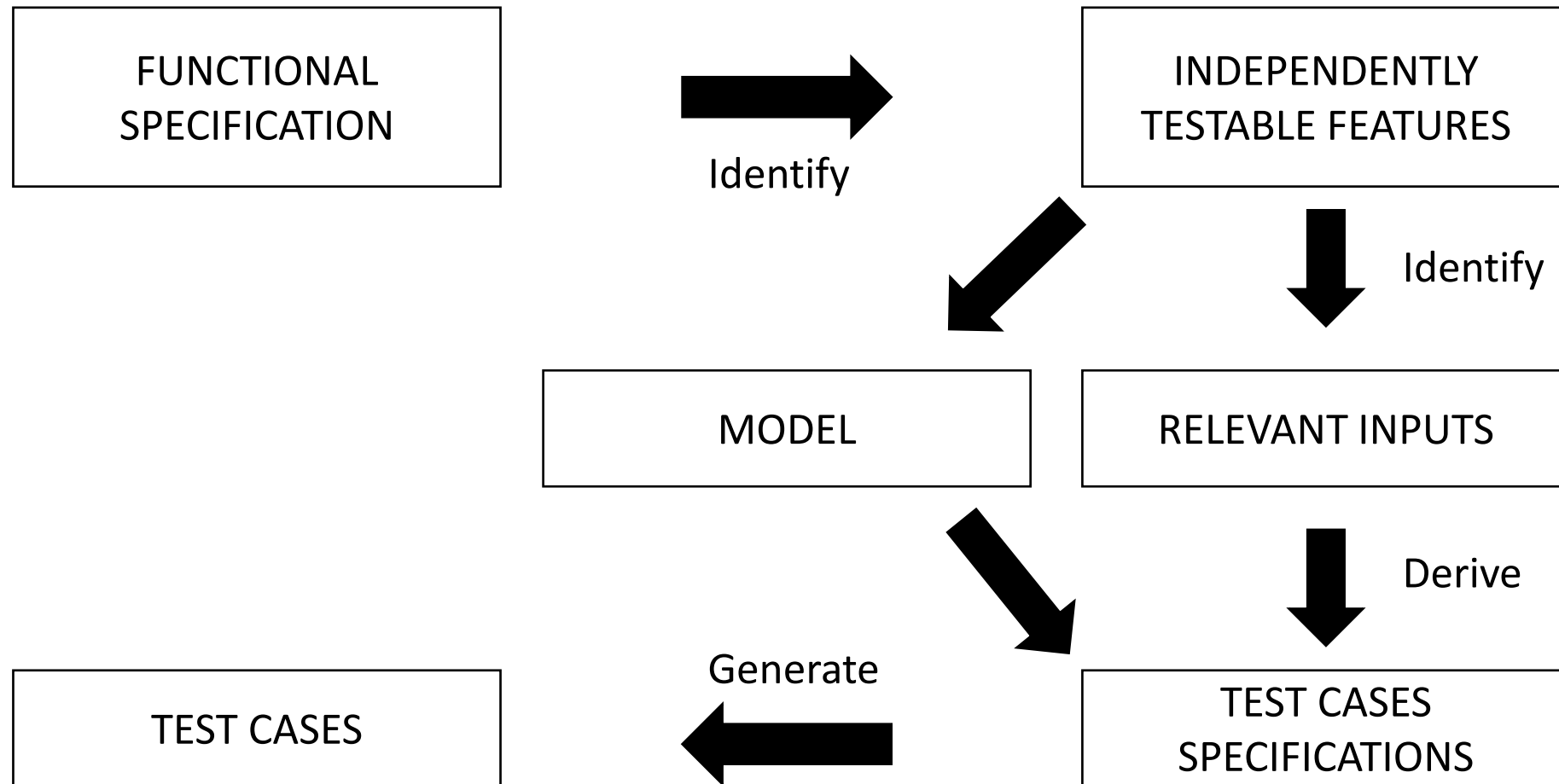
Many other approaches
- Decision tables
- Flow graphs
- Historical Models
- …

Historical models – Distribution of security vulnerabilities in Firefox

Pareto's Law

Approximately 80% of defects come from 20% of modules

Black-Box Testing

FUNCTIONAL SPECIFICATION

Identify

INDEPENDENTLY TESTABLE FEATURES

Identify

MODEL

RELEVANT INPUTS

Derive

TEST CASES SPECIFICATIONS

Generate

TEST CASES

Decoupling; Automated Sub-tasks; Monitor testing process

Industry Standards Today

- Many techniques of Black Box Testing
  - 2 important techniques discussed in class- Category partition & Model based testing
- Automating Black-Box Testing is very important
- Tools popular in Industry:
  - UFT (Unified Testing Tool)
    - designed for automated regression, and functional testing.
    - widely used by many big companies like Microsoft, IBM, Apple
    - difficult to use on GUI-rich browser-based applications.
  - Selenium WebDriver
    - designed as a language-independent automated black-box testing tool (open source)
    - most popular open-source solution for web application functional and regression testing
    - recording and playing back scripts, exporting and importing test cases from one language to another, debugging capabilities, and creating custom commands
  - Watir (Ruby), Ranorex Studio (commercial solution), SilkTest, Squish
  - Postman
- AI in Testing – Extensions with most standard tools available - dynamic element detection, intelligent test case generation, and predictive failure analysis.

Example demo: Postman + Postbot