Electrical & Computer
ENGINEERING

18-642:
Traceability

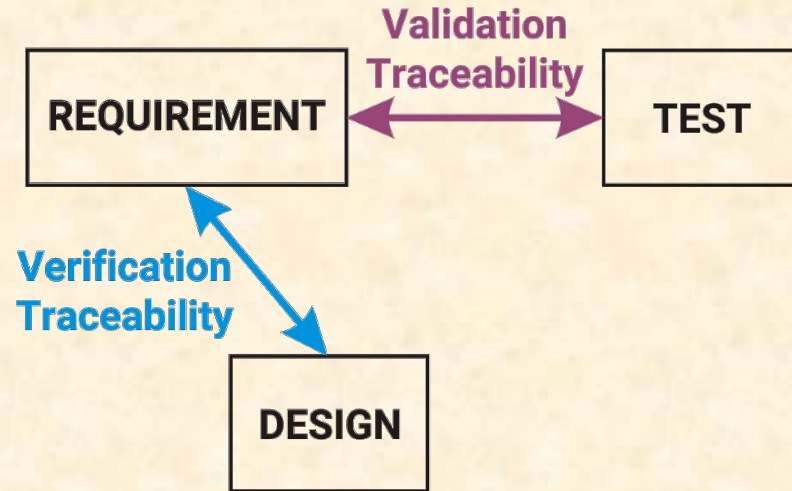## 10/3/2019

EDGE CASE
RESEARCH

There is never enough time to do
it right the first time, but there is
always enough time to do it over.

Carnegie
Mellon
University

Traceability

■ **Anti-Patterns:**
- **Tests don't map to requirements**
- **Requirements aren't tested**
- **Reqts/design elements missing**
- **Gold plating (extra functionality)**

■ **Traceability**
- Creating something traces to a quality check on the result
  - <u>Verification:</u> you did something the way you said you'd do it
  - <u>Validation:</u> the thing you created behaves the way it should
- Ensure nothing left out; nothing added that shouldn't be there

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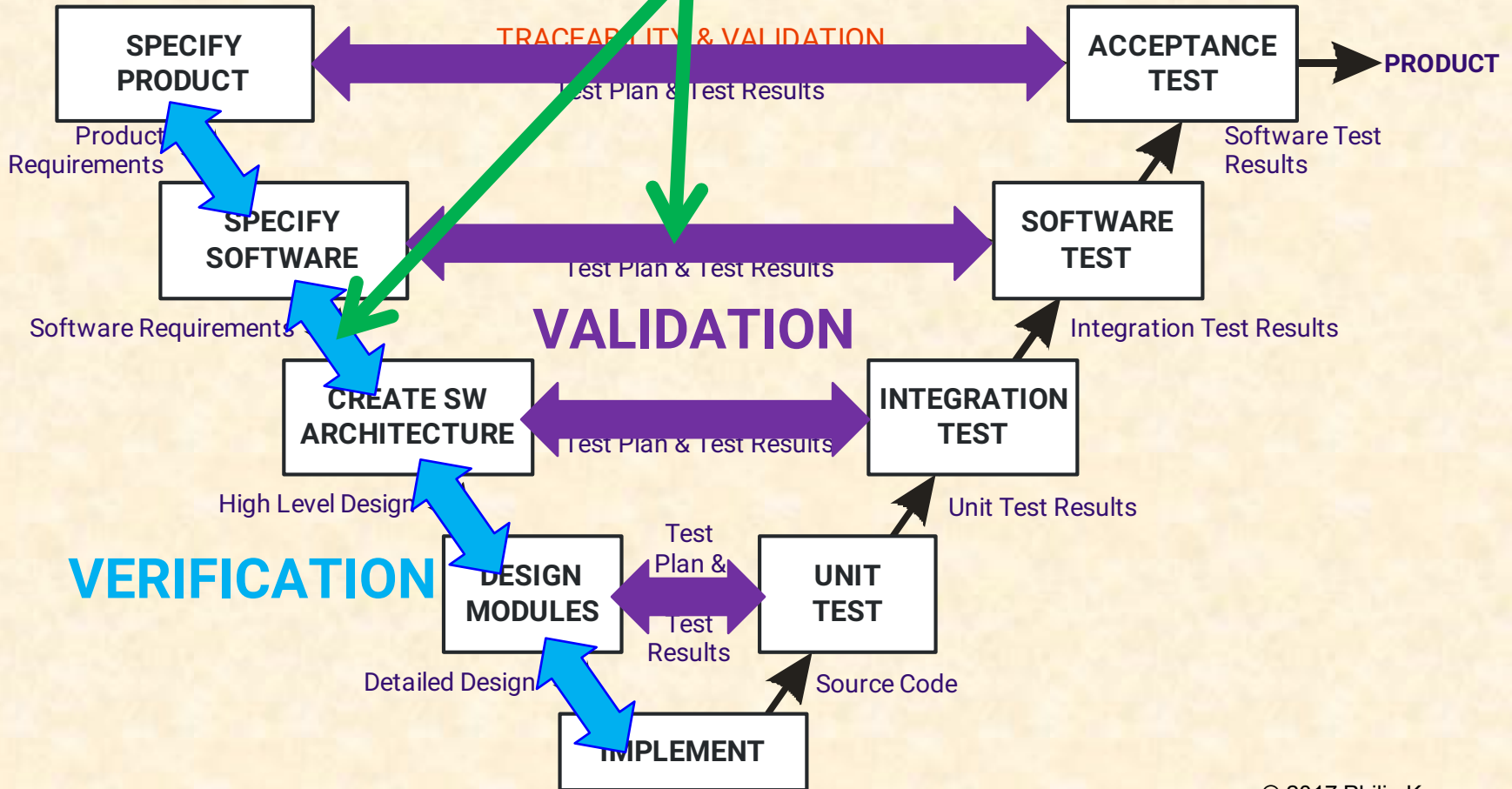
Traceability Examples

- **Design traceability**
  - Requirement ➜ design ➜ implementation
  - Requirement ➜ test
- **SQA traceability**
  - Confirm process is being carried out
  - Process step ➜ document/artifact ➜ quality metric
- **Safety analysis traceability**
  - Confirm all hazards successfully mitigated
  - Hazard ➜ requirement ➜ mitigation ➜ validation
- **Defect traceability**
  - Ensure that all bugs are fixed
  - Bug report ➜ defect identified ➜ fix task ➜ code check-in ➜ regression test

Requirements-to-Statecharts Traceability

States	Requirements					
	R2.1	R2.2	R2.3	R2.4a	R2.4b	R2.5
S2.1 IDLE	x		x			x
S2.2 EMPTY	x	x				x
S2.3 VEND	x			x	x	
S2.4 FLASH_OFF	x			x	x	
S2.5 FLASH_ON	x			x	x	
Transitions						
T2.1				x	x	x
T2.2			x			
T2.3		x				
T2.4					x	
T2.5					x	
T2.6		x				
T2.7			x			

REQUIREMENTS TRACEABILITY MATRIX

Project Name: Online Flight Booking Application

Business Requirements Document BRD		Functional Requirements Document FSD			Test Case Document
Business Requirement ID#	Business Requirement / Business Use case	Functional Requirement ID#	Functional Requirement / Use Case	Priority	Test Case ID#
BR_1	Reservation Module	FR_1	One Way Ticket booking	High	TC#001 TC#002
		FR_2	Round Way Ticket		TC#003 TC#004
		FR_3	Multicity Ticket booking	High	TC#005 TC#006
BR_2	Payment Module	FR_4	By Credit Card	High	TC#007 TC#008
		FR_5	By Debit Card	High	TC#009
		FR_6	By Reward Points	Medium	TC#010 TC#011

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Traceability for Hazard Mitigation

Mader et al. 2013:
http://doi.ieeecomputersociety.org/10.1109/MS.2013.60
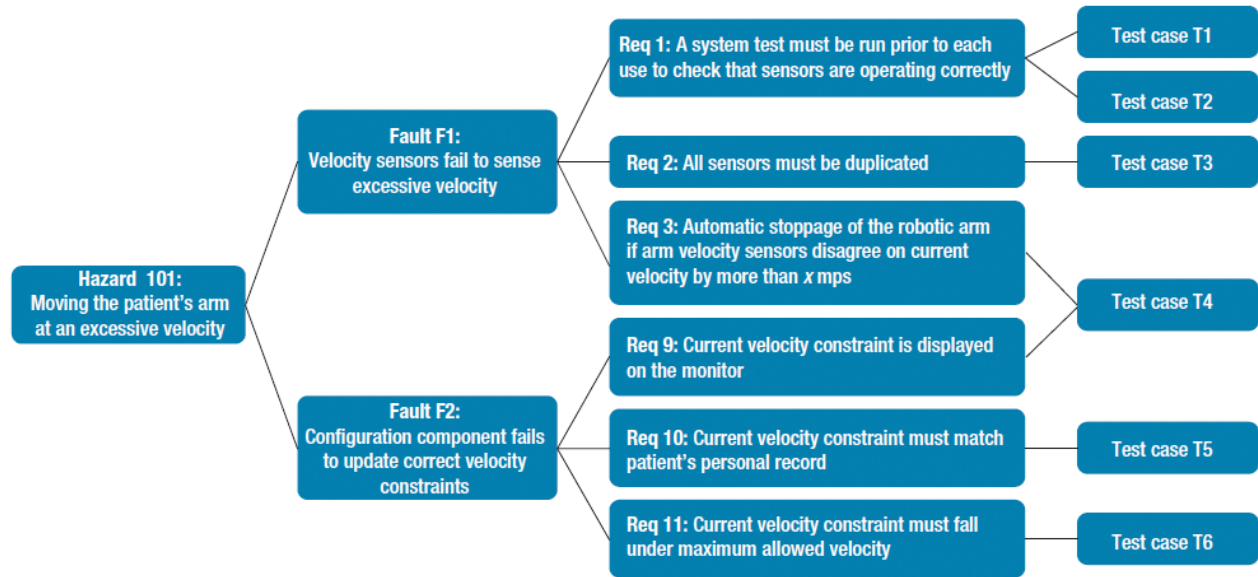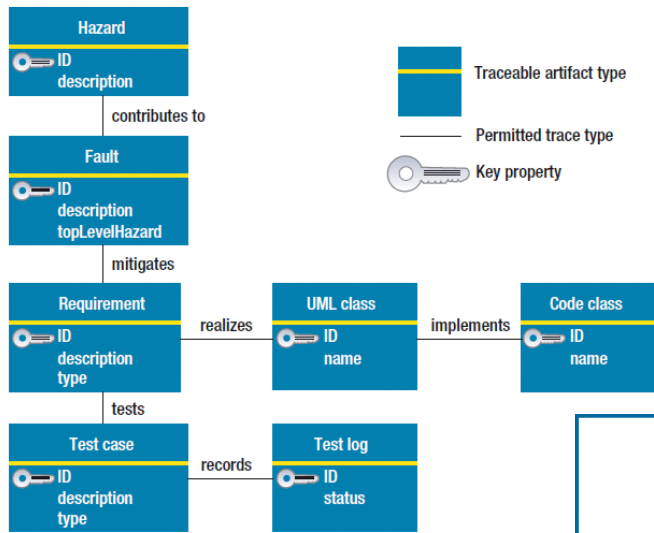
Traceability Best Practices

- **Trace everything in design package**
  - Even simple traceability checks can find problems
    - Gold plating: design item not traced to a requirement
  - Everything in design has an ID tag for traceability
    - Map left and right sides of V to each other
    - Map each layer of V upward and downward
  - Trace changes to see what else they affect
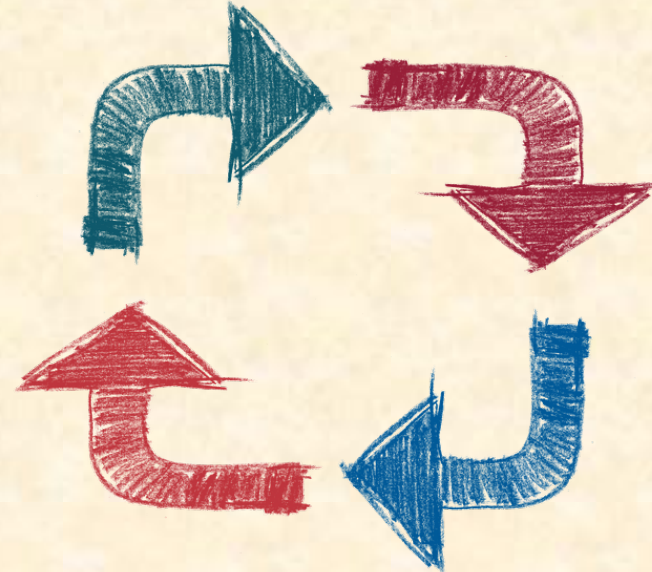
- **Traceability pitfalls**
  - Making granularity of trace IDs too big causes problems
  - Re-numbering breaks auto-generated document sections used as trace IDs
  - Don't use the wrong tool
    - Spreadsheets don't scale to big projects
    - Big project tools might be overkill where a spreadsheet approach will do

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