

# Modeling Textual Requirements

Systems Engineering BSc Course

**Budapest University of Technology and Economics**  
**Fault Tolerant Systems Research Group**



# REQUIREMENTS

**Rephrase the following sentences such that they become well-formed requirements!**

# Rephrasing

Pattern: **Subject** **Auxiliary** **Verb** **Object** **Conditions**

Requests are to be handled by the server in not more than 30 seconds after they have been submitted by clients.

It is undesired that a client could access private information about other clients.

We want the steering wheel to have two buttons for honking on the sides.

# Rephrasing

Pattern: Subject Auxiliary Verb Object Conditions

Requests ~~are to be~~ handled by the server in not more than 30 seconds after they have been submitted by clients.

- The server must handle requests in not more than 30 seconds after they have been submitted by clients.

It is ~~undesired~~ that a client ~~could~~ access private information about other clients.

- Clients must not be able to access private information about other clients.

We ~~want~~ the steering wheel to have two buttons for honking on the sides.

- The steering wheel shall have two buttons for honking on the side.

# REQUIREMENTS

**Are the following sentences well-formed requirements?**

# Correct?

1. The car has to be fast.
2. The controller has to use breadth-first search to calculate the shortest path to the target.
3. The system shall not be unavailable for too long.
4. Invalid requests should be handled by replying with an error message.
5. No pilot may be in the cockpit during flight.
6. The motion sensor should send a notification whenever something starts moving in its field of view.
7. System downtime must not exceed 3 hours unless advertised at least a week in advance.

# Correct?

1. The car has to be fast.
2. The controller has to use breadth-first search to calculate the shortest path to the target.
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# REQUIREMENTS

**Out of the following requirements,  
which one may be „derived” from another?**



# Which one is derived?

1. The trollies moving next to the conveyor belt have to operate autonomously.
2. The trollies moving next to the conveyor belt have to be able to determine the path leading to their goal.
3. The trollies moving next to the conveyor belt have to react to their environment adaptively.
4. The trollies moving next to the conveyor belt have to be able to sense their environment.

# Which one is derived?

1. The trollies moving next to the conveyor belt have to operate autonomously.
2. The trollies moving next to the conveyor belt have to be able to determine the path leading to their goal.
3. The trollies moving next to the conveyor belt have to react to their environment adaptively.
4. The trollies moving next to the conveyor belt have to be able to sense their environment.

# REQUIREMENTS

**Decide whether the following requirements are functional (F), usability (U), reliability (R), performability (P), supportability (Su), safety (Sa) or security (Se) requirements.**

# Func., Usa., Rel., Perf., Supp., Safe., Sec.?

1. The driver shall be able to change the strength of headlights.
2. No single faults shall result in system failure.
3. The server should be able to send 1000 mails per second.
4. The system must not fail more frequently than 1 in 1000 hours.
5. The case shall have a hatch through which internal parts are accessible.
6. The server must block users for at least an hour if they fail to provide their credentials correctly 3 times in a row.
7. The monitoring software must not present a new error before the previous one has been acknowledged.
8. Hazard rate has to be below 1 accident in 100 years.

# Func., Usa., Rel., Perf., Supp., Safe., Sec.?

- F** The driver shall be able to change the strength of headlights.
- Sa** No single faults shall result in system failure.
- P** The server should be able to send 1000 mails per second.
- R** The system must not fail more frequently than 1 in 1000 hours.
- Su** The case shall have a hatch through which internal parts are accessible.
- Se** The server must block users for at least an hour if they fail to provide their credentials correctly 3 times in a row.
- Us** The monitoring software must not present a new error before the previous one has been acknowledged.
- Sa** Hazard rate has to be below 1 accident in 100 years.

# USE CASES

**Collect the relevant actors for a smartphone!  
The system boundary should be the case of the phone.  
Which ones can be primary or secondary actors?**

# Actors (examples)

User

Carrier

Application developers

Device manufacturer

OS manufacturer

...

# USE CASES

**Decide which of the three relations (*include, extend, generalization*) apply the best to the following pairs of use cases!**



# Include, extend, or generalization?

Connect device – Connect through WiFi

Connect device – Fail connection

Connect through WiFi – Authenticate user

Fail connection – Time out connection

Authenticate user – Type username

Authenticate user – Re-enter password

# Include, extend, or generalization?

Connect device – Connect through WiFi

- generalization

Connect device – Fail connection

- extend

Connect through WiFi – Authenticate user

- include

Fail connection – Time out connection

- generalization

Authenticate user – Type username

- include

Authenticate user – Re-enter password

- extend

# USE CASES

**Which of the following relationships can be correct?**

# Which one can be correct?

Drive car -«extend»-> Emergency break

Drive car -«include»-> Emergency break

Drive car --|> Emergency break

Emergency break -«extend»-> Drive car

Emergency break -«include»-> Drive car

Emergency break --|> Drive car

# Which one can be correct?

Drive car -«extend»-> Emergency break

Drive car -«include»-> Emergency break

Drive car --|> Emergency break

**Emergency break -«extend»-> Drive car**

Emergency break -«include»-> Drive car

Emergency break --|> Drive car

# Which one can be correct?

Drive car -«extend»-> Steer car

Drive car -«include»-> Steer car

Drive car --|> Steer car

Steer car -«extend»-> Drive car

Steer car -«include»-> Drive car

Steer car --|> Drive car

# Which one can be correct?

Drive car -«extend»-> Steer car

**Drive car -«include»-> Steer car**

Drive car --|> Steer car

Steer car -«extend»-> Drive car

Steer car -«include»-> Drive car

Steer car --|> Drive car

# Which one can be correct?

Drive car -«extend»-> Drive taxi

Drive car -«include»-> Drive taxi

Drive car --|> Drive taxi

Drive taxi -«extend»-> Drive car

Drive taxi -«include»-> Drive car

Drive taxi --|> Drive car



# Which one can be correct?

Drive car -«extend»-> Drive taxi

Drive car -«include»-> Drive taxi

Drive car --|> Drive taxi

Drive taxi -«extend»-> Drive car

Drive taxi -«include»-> Drive car

**Drive taxi --|> Drive car**

# COMPLEX TASK

**Projector**

# System context, Requirements, Use cases

Model the requirements of the projector in a lecture room! Let the system boundary be the physical boundaries of the projector device and the remote controller.

Assume that the projector device itself comes from a subcontractor. Our task is to integrate it into the lecture room based on specific requirements.

Task 1: Collect stakeholders!

# (Some) Requirements from stakeholders

[University:] The projector shall hang from the ceiling to save space.

[Subcontractor:] The projector cannot be turned on for 5 minutes after shutdown.

[Building maintenance:] The projector is hard to access, so maintenance has to be minimized.

[Teachers:] The system shall support two types of inputs: HDMI and VGA.

[University:] When the projector is not used, the system shall save power.

[Building maintenance:] The system should notify the maintainers when the battery in the remote is low.

# Tasks

Task 2: System context

Task 3: High-level requirements

Task 4: Use cases