

Experiment scoping

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Roadmap

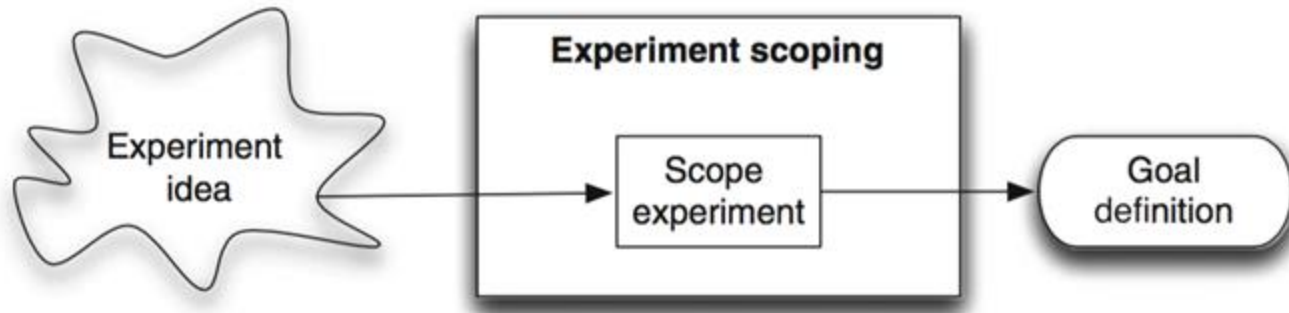
Experiment goal definition

The Goal-Question-Metric approach

A final Example

Experiment scoping

- Define the **goal** of the study



- Research approach: **Goal-Question-Metric** [1]

[1] V.R. Basili, "Software Modeling and Measurement: The Goal Question Metric Paradigm," Computer Science Technical Report Series, CS-TR-2956 (UMIACS-TR-92-96), University of Maryland, College Park, MD, September 1992.

Overview

Conceptual level

Goal

Operational level

Question

Question

Question

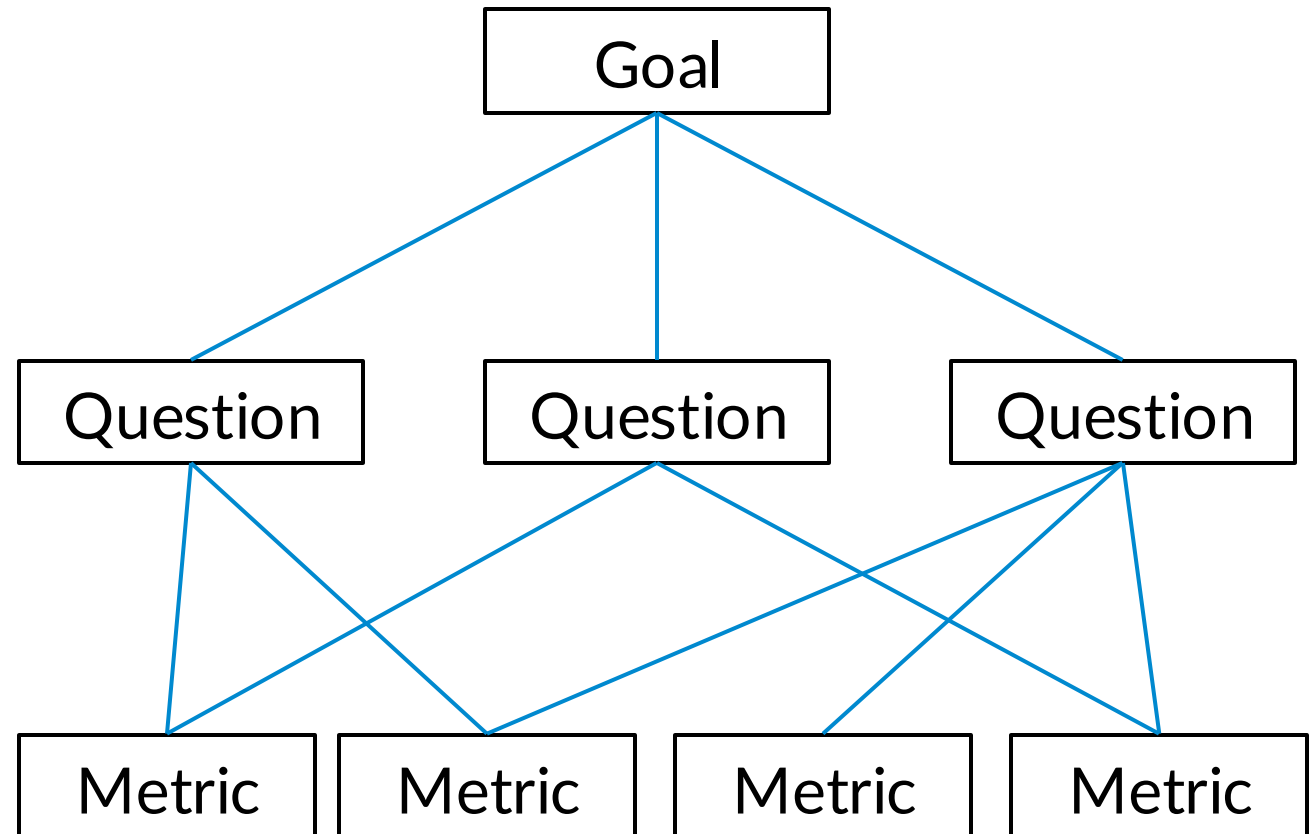
Quantitative level

Metric

Metric

Metric

Metric



Experiment goal definition

How to define a goal?

<i>Analyze</i>	Object(s) of study
<i>for the purpose of</i>	Purpose
<i>with respect to their</i>	Quality focus
<i>from the point of view of</i>	Perspective
<i>in the context of</i>	Context

Goal definition framework

Object of study	Purpose	Quality focus	Perspective	Context
Product	Characterize	Effectiveness	Developer	<depends on experiment>
Technology	Monitor	Energy consumption	Maintainer	
Technical choice	Evaluate	Cost	Project manager	
Process	Predict	Reliability	Corporate manager	
Model	Control	Maintainability	Customer	
Metric	Change	Portability	User	
Theory		Performance	Researcher	
		Understandability		

Image encoding example - goal

Analyze

for the purpose of

with respect to their

from the point of view of

in the context of



Image encoding example - goal

Analyze

for the purpose of

with respect to their

from the point of view of

in the context of

**Image encoding
algorithms**

evaluation

Energy efficiency

Software developers

Android mobile apps

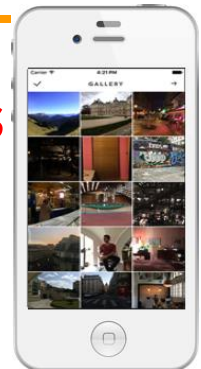


Image encoding example - goal

"Analyze image encoding algorithms for the purpose of evaluation with respect to their energy efficiency from the point of view of a software developer in the context of Android mobile apps".



From goals to questions

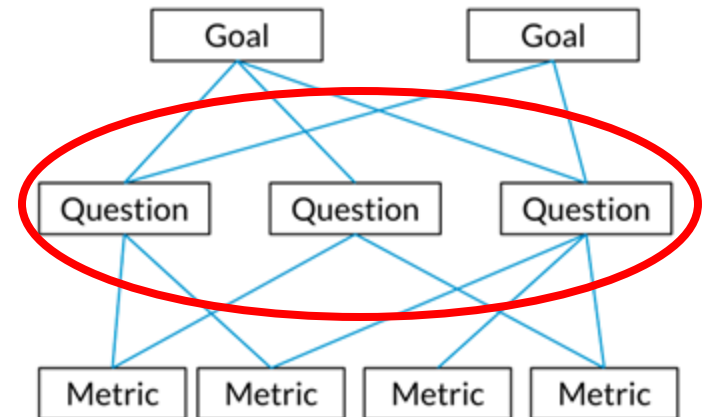
- Questions are at the **operational** level
- Answering a question should tell you if the goal has been reached
- Questions must be **quantifiable**



Research questions formulation

Research questions detail the specific objectives of the empirical study

Incepted from the study definition



Starting point to identify the variables of interest of your study

Suggestions

Research questions should be as clear as possible
→ they will guide the whole experiment

Avoid "boolean" questions!

Avoid questions you cannot answer




- What is the best programming framework in terms of performance?
- What is the most productive programming language?
- ...

Golden words: to what extent..., what is the impact of X to Y,
what are the traits of Xs, what are the characteristics of T...

Remind that in your report you will come back to them and explicitly answer each of them in details

Question examples

Analyze	Encoding algorithms
for the purpose of	Evaluation
with respect to their	Energy Efficiency
from the point of view of	Software Developer
in the context of	Android mobile apps

- How does the *energy consumption* of a mobile device vary when using different image encoding algorithms? 
- What is the impact of using different image encoding algorithms on the *energy efficiency*  *of mobile apps?*
- Which algorithm provides the best *quality* of the image? 

Other examples...

Analyze	Encoding algorithms
for the purpose of	Evaluation
with respect to their	Energy Efficiency
from the point of view of	Software Developer
in the context of	Mobile Software Applications

- Which algorithm is most used in Android applications?



- What is the *effort* of changing algorithm implementation?



- How does the image encoding algorithm affect energy efficiency?



From questions to metrics

- Metrics are at the **quantitative** level



- Metrics can be **objective** (e.g. energy consumption) or **subjective** (e.g. readability of code)

Examples of metrics

- How does the *energy consumption* of a mobile device vary when using different encoding algorithms?

Metric: Energy Consumption (Joules)

- What is the *efficiency* of the encoding algorithm?

Metric: Amount of Joules used to render an image (joules/image)

- What is the *effort* of changing algorithm implementation?

Metric: Effort (person/hours, money)

What this module means to you?

You know how to:

- define the goal of an experiment
- precisely scope an experiment
 - ... and have a hint about how to plan it
- You are able to work on assignment 1:
 - Describe the motivation and high-level idea of your experiment
 - Report about related work (use Google Scholar, at least 4-5 studies)
 - Describe your goal using the provided template
 - Formalize the scope of your experiment via the GQM methodology

Acknowledgements

Some contents of this lecture extracted from:

- Giuseppe Procaccianti's lectures at VU in 2016