DEPARTMENT OF INFORMATICS

TECHNISCHE UNIVERSITÄT MÜNCHEN

Bachelor's Thesis in Informatics: Games Engineering

Smartphone-assisted Virtual Reality using Ubi-Interact

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Smartphone-gestützte Virtuelle Realität mit Ubi-Interact

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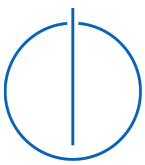


I confirm that this bachelor's thesis is my own work and I have documented all sources and material used.

Munich, October 15, 2019 Michael Alexander Lohr

Acknowledgments

Abstract

Contents

Abbreviations

VR Virtual Reality

UBII UBI-Interact

IMU Inertial Measurement Unit

1 Introduction

Hi, this is my thesis, and I'm going to be the introduction.

2 Implementation

2.1 Ubi-Interact

UBI-Interact (UBII) is a framework for distributed applications, which enables to connect all kinds of different devices together. A centralized server is used to manage the system in a local network. It is currently developed and maintained by by Sandro Weber, who is also the advisor for this thesis. The abstraction into devices, topics and interactions allows to decouple the implementation of a software from device specific environments.

2.1.1 Architecture

The main components of the UBII framework are:

Clients describe a basic network participant. For every client in the network, there is one network socket adress. They are described by a unique identifier.

Devices can be registered by clients. A device is an abstraction for a virtual device, which groups different input and output devices together. It is defined by a unique identifier and a list of components.

Components contain the topic name, message format for input/output devices and wether it publishes input or output data. A data source for such an input device, could be any sensor for example a button or an Inertial Measurement Unit (IMU). Examples for data sources for input devices are lamps or displays.

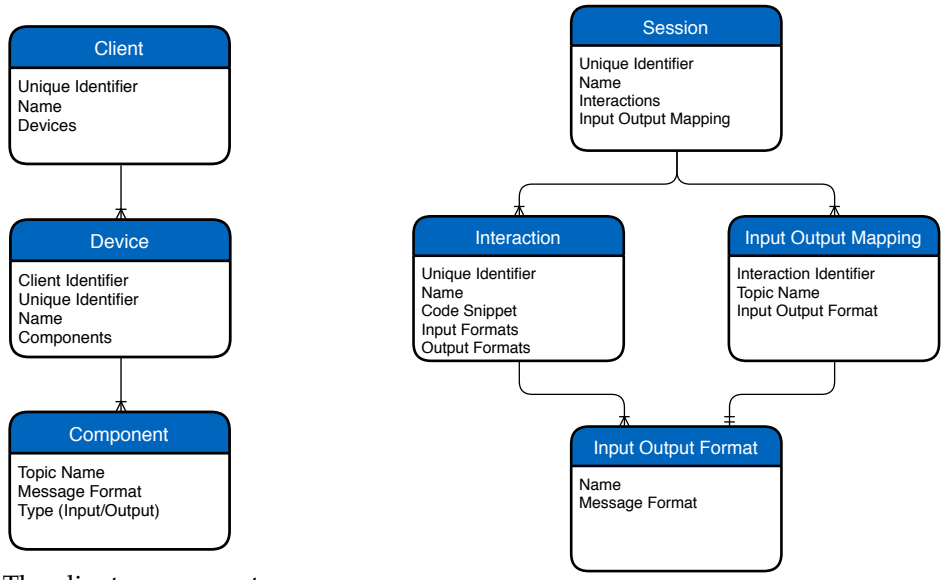
Message Formats are strings which identify a certain data format. Most common data types are available, like for example *Vector4x4*, *Vector2* or *Vector3*.

Topics are data channels which are addressed by a name. Clients can publish messages to topics, which are registered by a device. Clients are also able to receive messages, after subscribing to a topic. Such messages (also called "topic data") are formatted as JSON[1]-string, whose structure is defined by the device.

[1]JSON is a standardized data exchange format, that uses human-readable text. It is often used for web-based data communication.

Sessions operate on the server, but can be specified by the client. They are defined by a unique identifier as well as a list of interactions and **input/output mappings**. The mappings are defined by a message format and topic name.

Interactions are reactive components. They operate on topics and are defined by a source code snippet[2]. Interactions are executed in a fixed interval on the UBII server. They can subscribe to topics and use the the received topic data as input, given an input/output mapping description. The output of the interaction is published into another topic. It is also possible to keep data to use in future executions (persistent state).



(a) The client components.

(b) The server components.

Figure 2.1: Relationships of the core components in an entity relationship diagram.

[2]Currently only JavaScript is supported as a script language.

3 Introduction

3.1 Section

3.1.1 Cite Tests

Citation test [Afo+17] vs [Afo+17].
More [pre Afo+17, post]
Also possible[1]

Acronym test Virtual Reality (VR) cool.
And a second time VR awesome.

3.1.2 Draw Test

3.1.3 Other Tests

See Table 3.1, Figure 3.2, Figure 3.3, Figure 3.4.

Table 3.1: An example for a simple table.

A	B	C	D
1	2	1	2
2	3	2	3

[1] Afo+17.

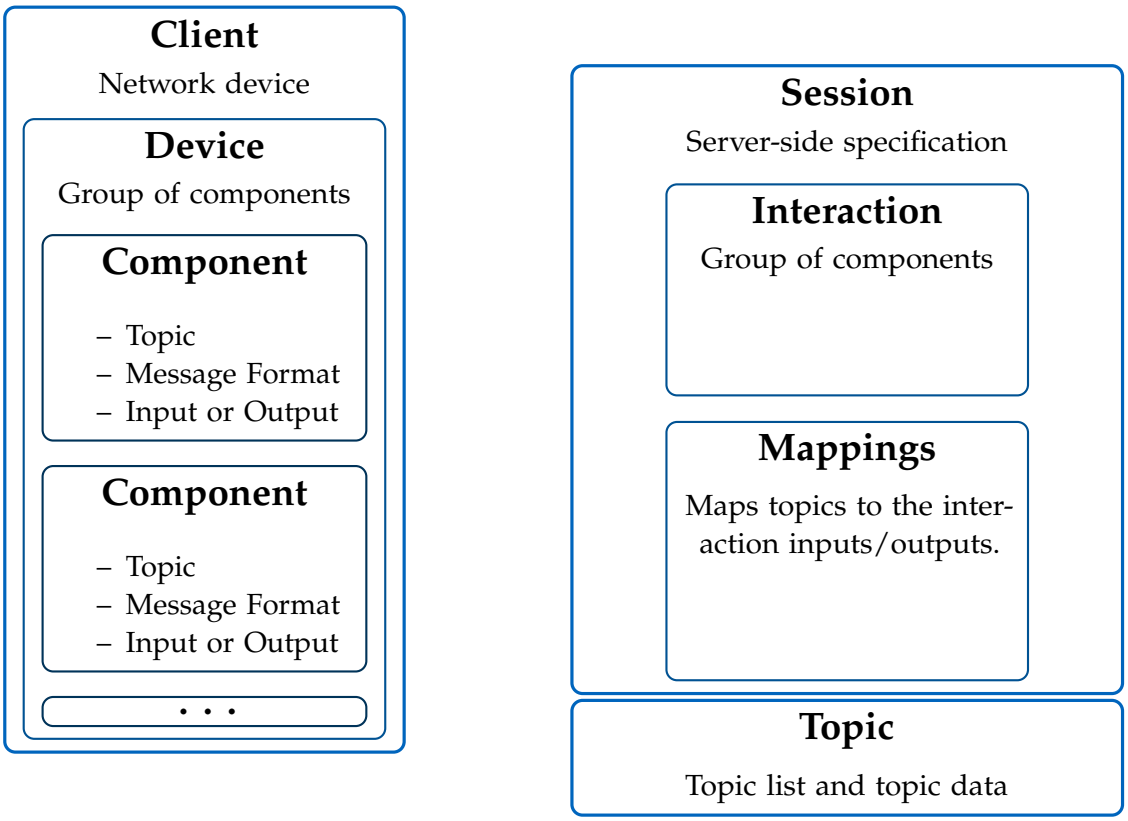


Figure 3.1: Do not forget!

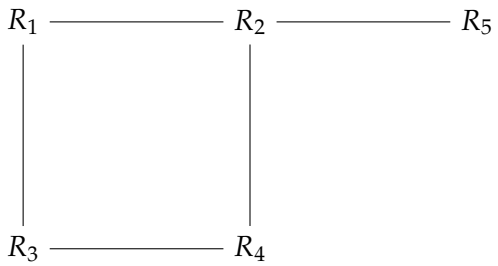


Figure 3.2: An example for a simple drawing.

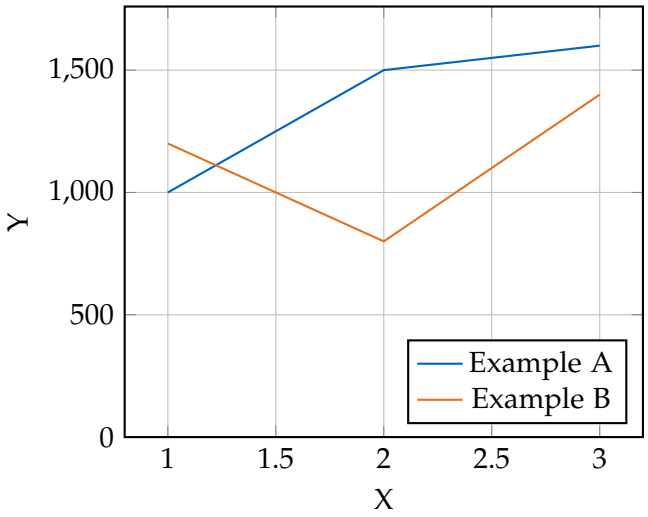


Figure 3.3: An example for a simple plot.

```
SELECT * FROM tbl WHERE tbl.str = "str"
```

Figure 3.4: An example for a source code listing.

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Bibliography

[Afo+17] L. Afonso, P. Dias, C. Ferreira, and B. S. Santos. "Effect of hand-avatar in a selection task using a tablet as input device in an immersive virtual environment." In: *2017 IEEE Symposium on 3D User Interfaces (3DUI)*. Piscataway, NJ: IEEE, 2017, pp. 247–248. ISBN: 978-1-5090-6716-9. DOI: 10.1109/3DUI.2017.7893364.