

Configuration Strategies of an AR Toolkit-based Wide Area Tracker

The Second IEEE International AR Toolkit Workshop

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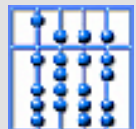
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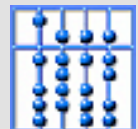
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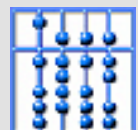
Summary

- Scenario: mobile user in intelligent “AR-ready” building
- AR Toolkit used for
 - High-precision tracking in small areas
 - Coarse room-based wide area tracking (“ID tags”)
- Software architecture for
 - Dynamic context aware reconfiguration of AR Toolkit marker detection
 - Room-dependent choice of transition strategies

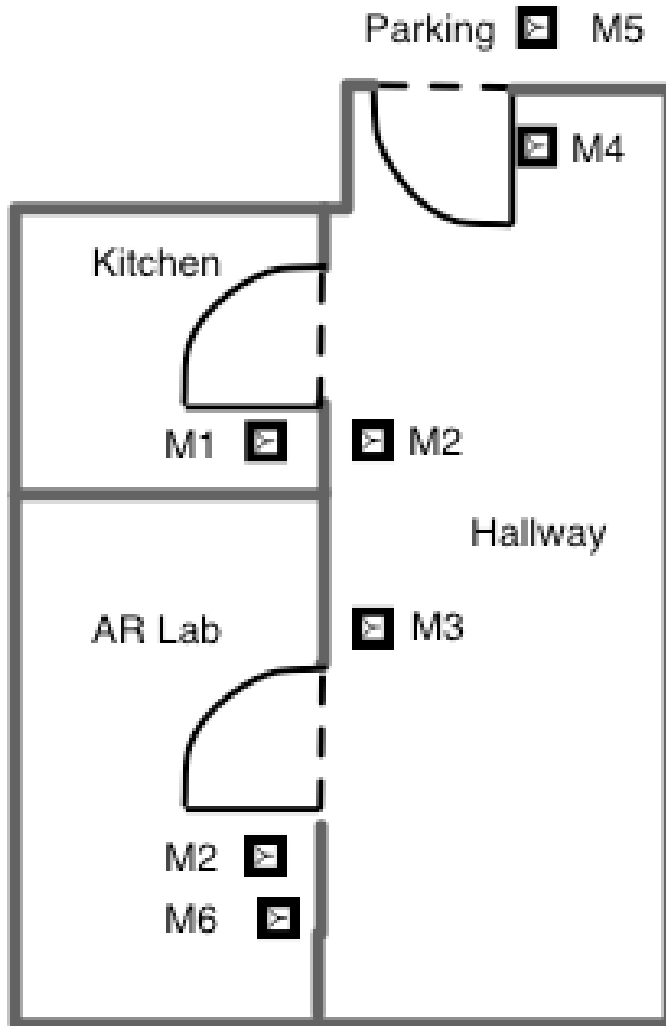


Outline

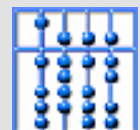
- Scenario: Intelligent Building
- System Components
 - DWARF overview
 - Configuration components
- Distributed Configuration
 - Description of concepts
 - Detailed example scenario
- Strategies for Using AR Toolkit as Wide Area Tracker
- Conclusion & Future Work



Scenario: Intelligent Building

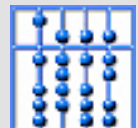


- User walks around in an intelligent building, wearing mobile client with camera and AR Toolkit
- AR apps tied to specific rooms, i.e. table-based AR in Lab
- Mobile client has no a priori knowledge of environment
- Detection of current room triggered by sets of Toolkit markers



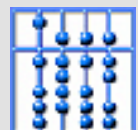
Scenario: Requirements

- No a priori knowledge about environment:
 - Distributed architecture
 - Dynamic configuration
 - Split AR Toolkit functionality in components
- Trigger detection of room changes using AR Toolkit markers
 - Allow varying room-dependent strategies to increase robustness
 - Provide flexible architecture to use additional information sources (RF ID tags, ultra wideband trackers, ...)



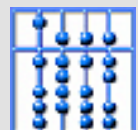
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DWARF Overview

- Distributed Wearable Augmented Reality Framework
- CORBA-based middleware dynamically connects *Services* (DWARF components) based on description of their *Needs* and *Abilities*
- Ability descriptions may be enhanced using *Attributes* describing contextual information
- Many communication protocols
 - CORBA method invocations
 - CORBA notification service (events)
 - Shared memory (for video transmission)



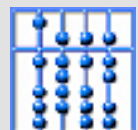
Components - Overview

Video Grabber: gets video image and puts it in a shared memory segment

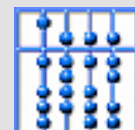
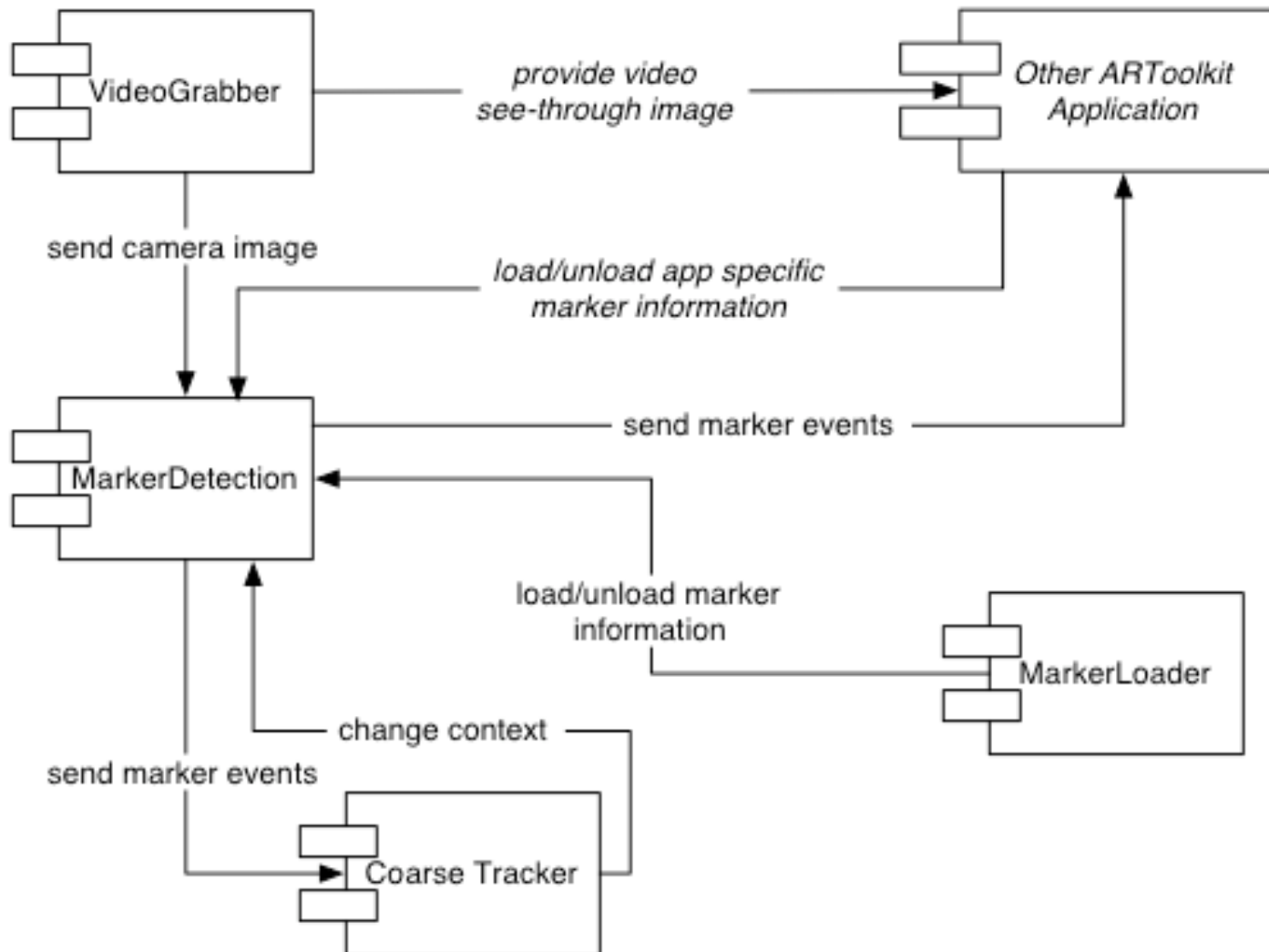
Marker Detection: takes video image out of shared memory, detects AR Toolkit markers, sends events describing position and ID of markers

Marker Loader: configures the Marker Detection using remote method invocation with marker descriptions suitable for the current context

Coarse Tracker: listens for events from Marker Detection and changes the mobile client's context according to the new room

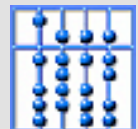


Components - Connections



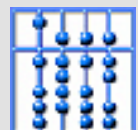
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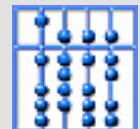
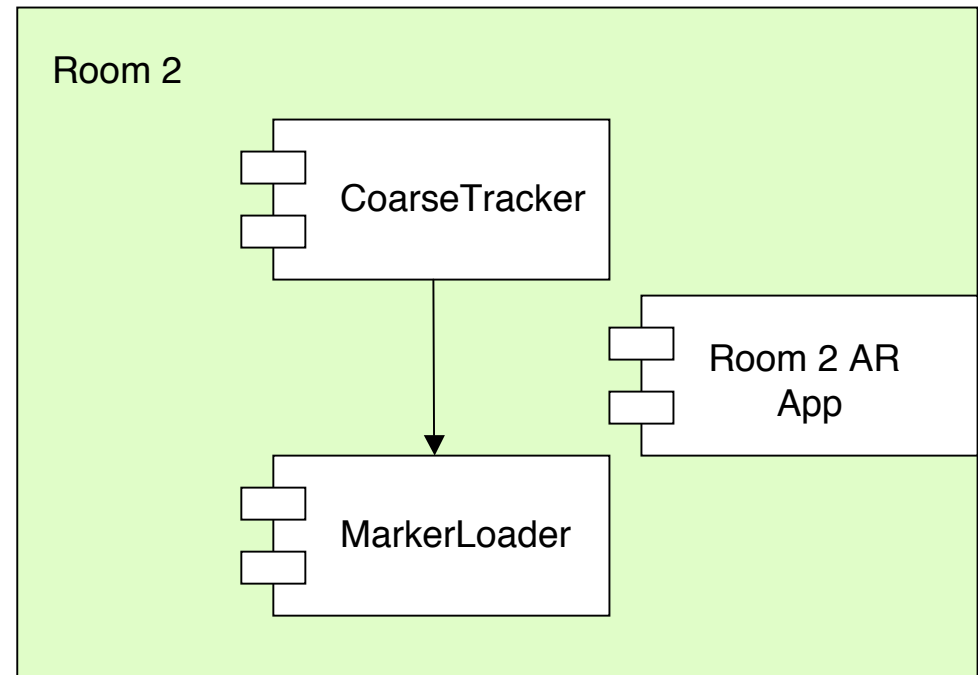
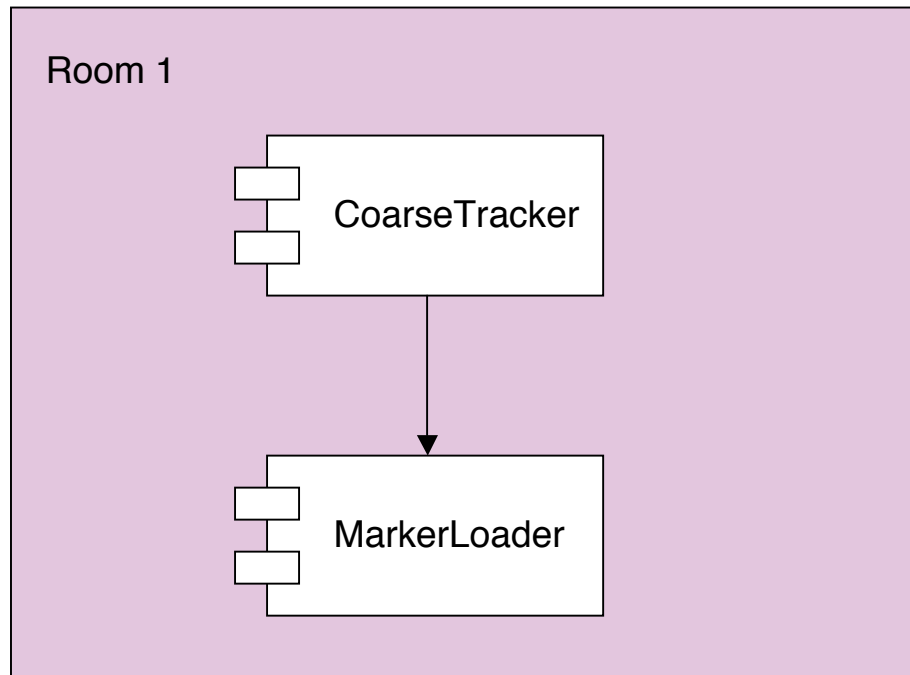
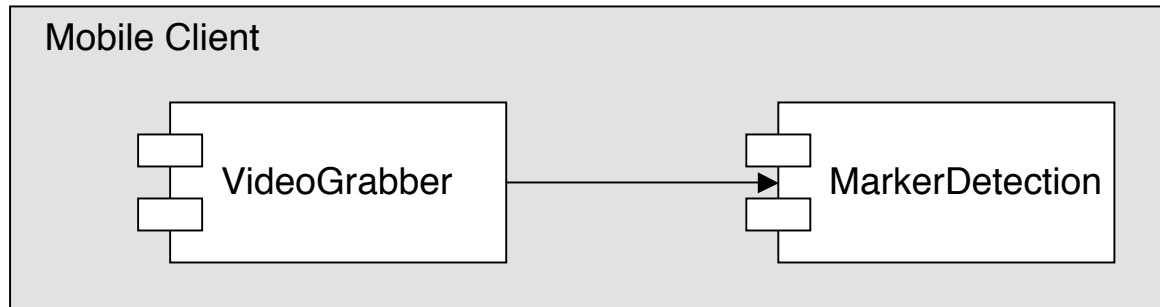


Distributed Configuration

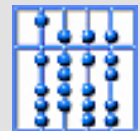
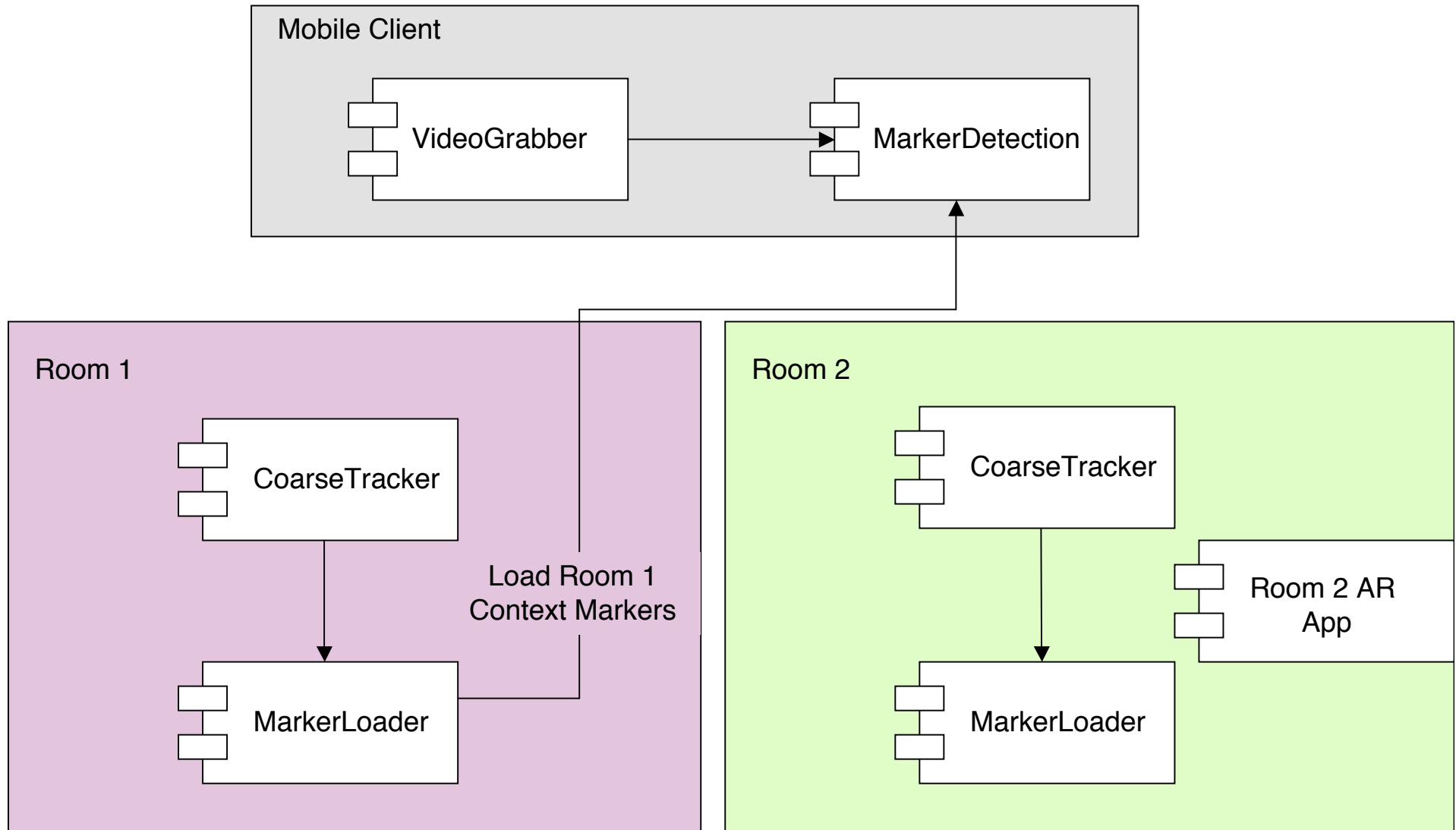
- Basic Idea: distribute information processing
 - Video Grabber and Marker Detection on user's mobile client
 - Marker Loaders and Coarse Trackers in rooms
- Environmental services run in multiple instances, one for each room
 - Room-dependent evaluation of Marker Detection events gets possible
 - Available more accurate tracking technology (i.e. ultra wideband tracker) can be integrated seamlessly



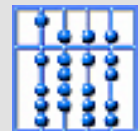
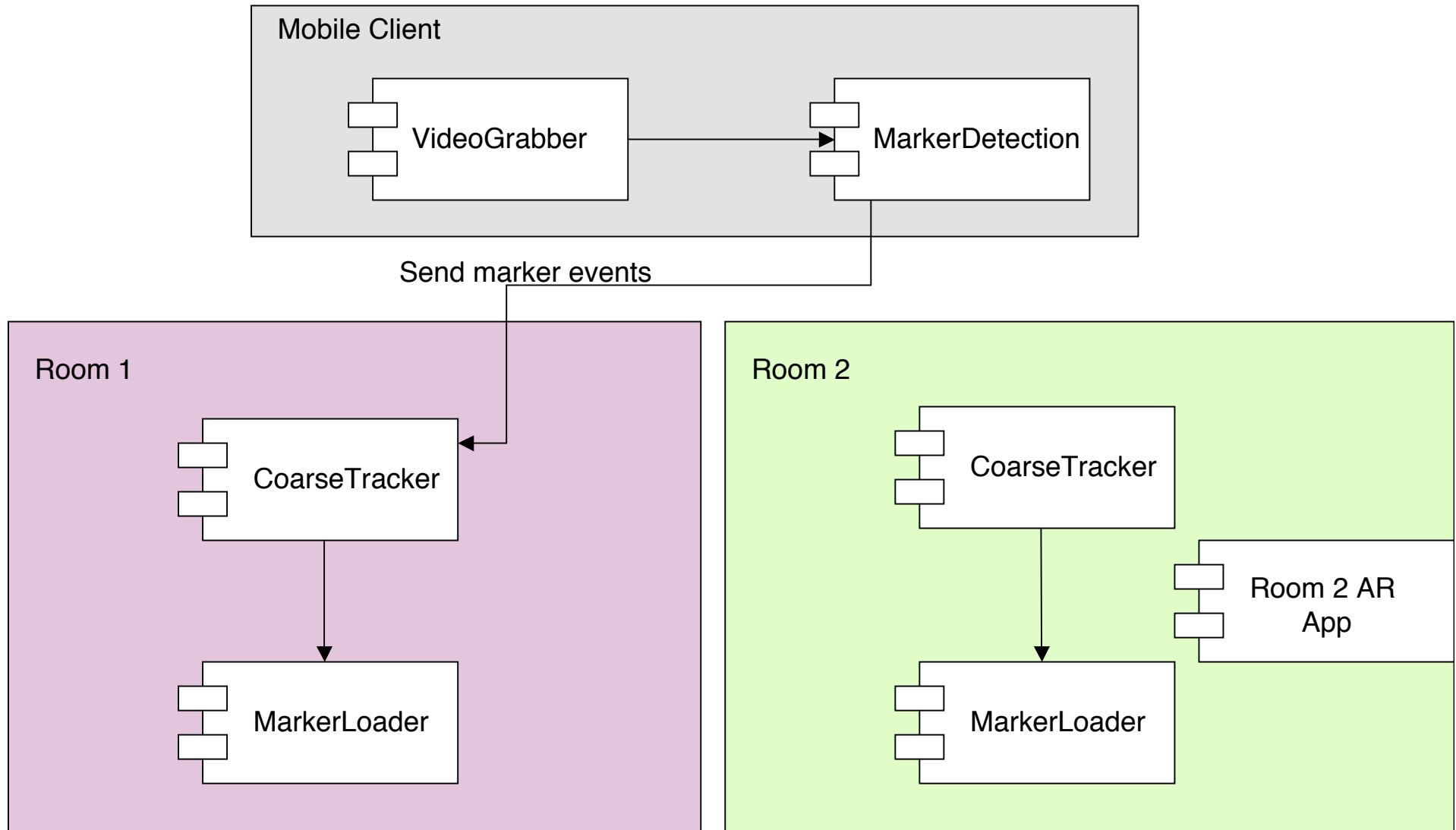
Distributed Configuration - Example



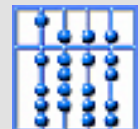
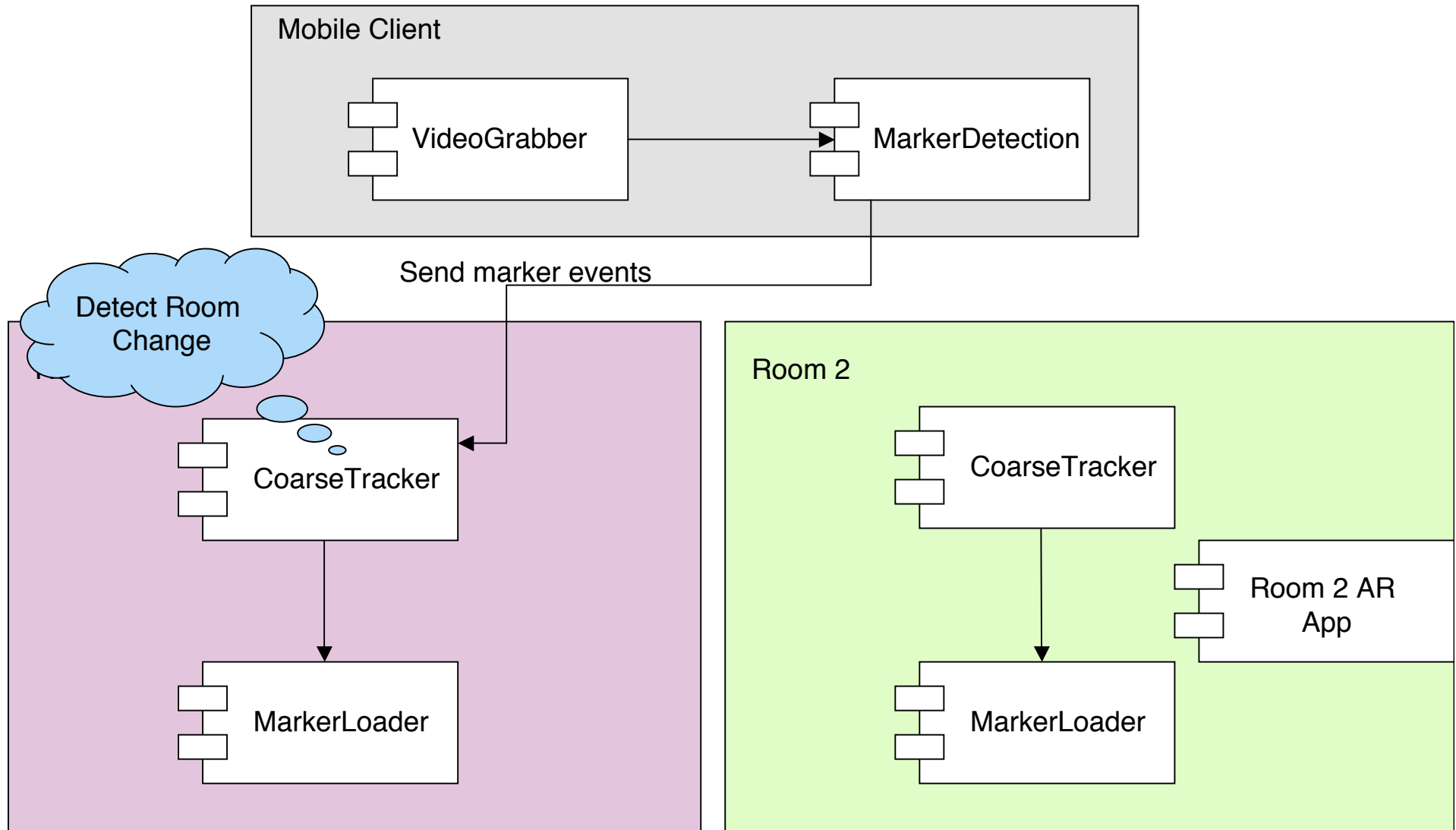
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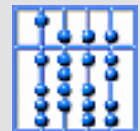
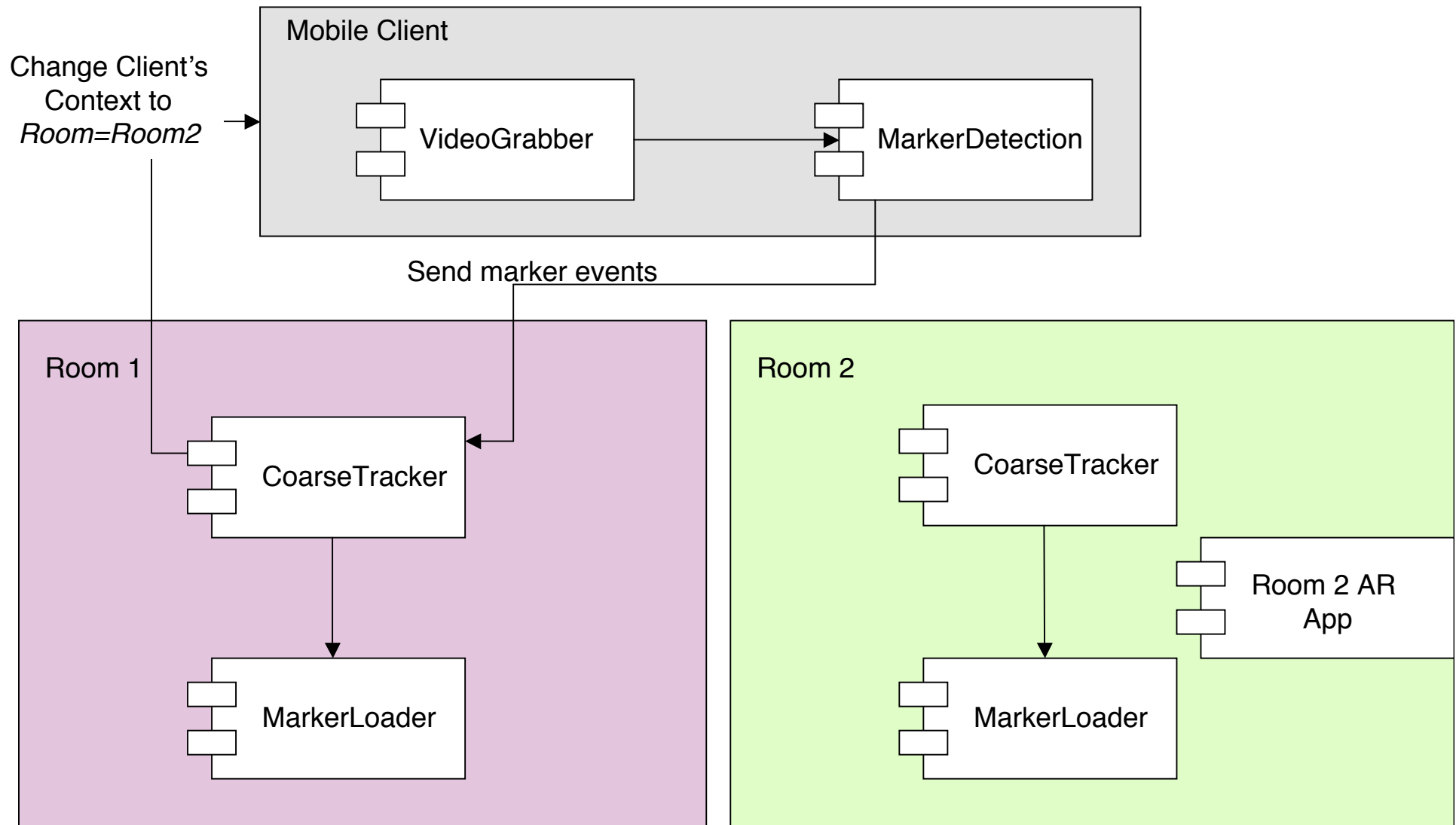
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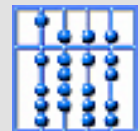
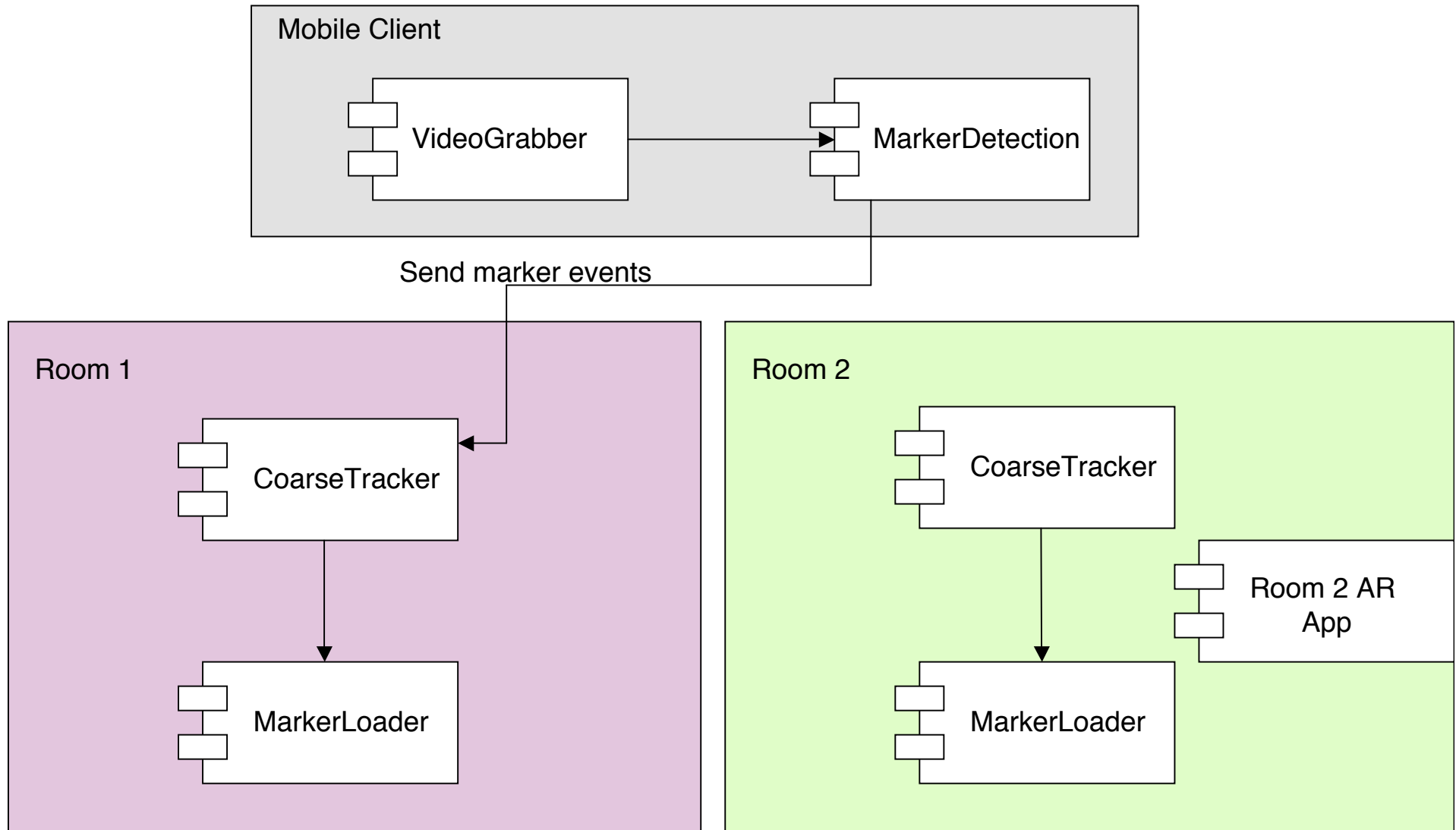
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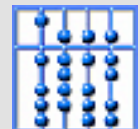
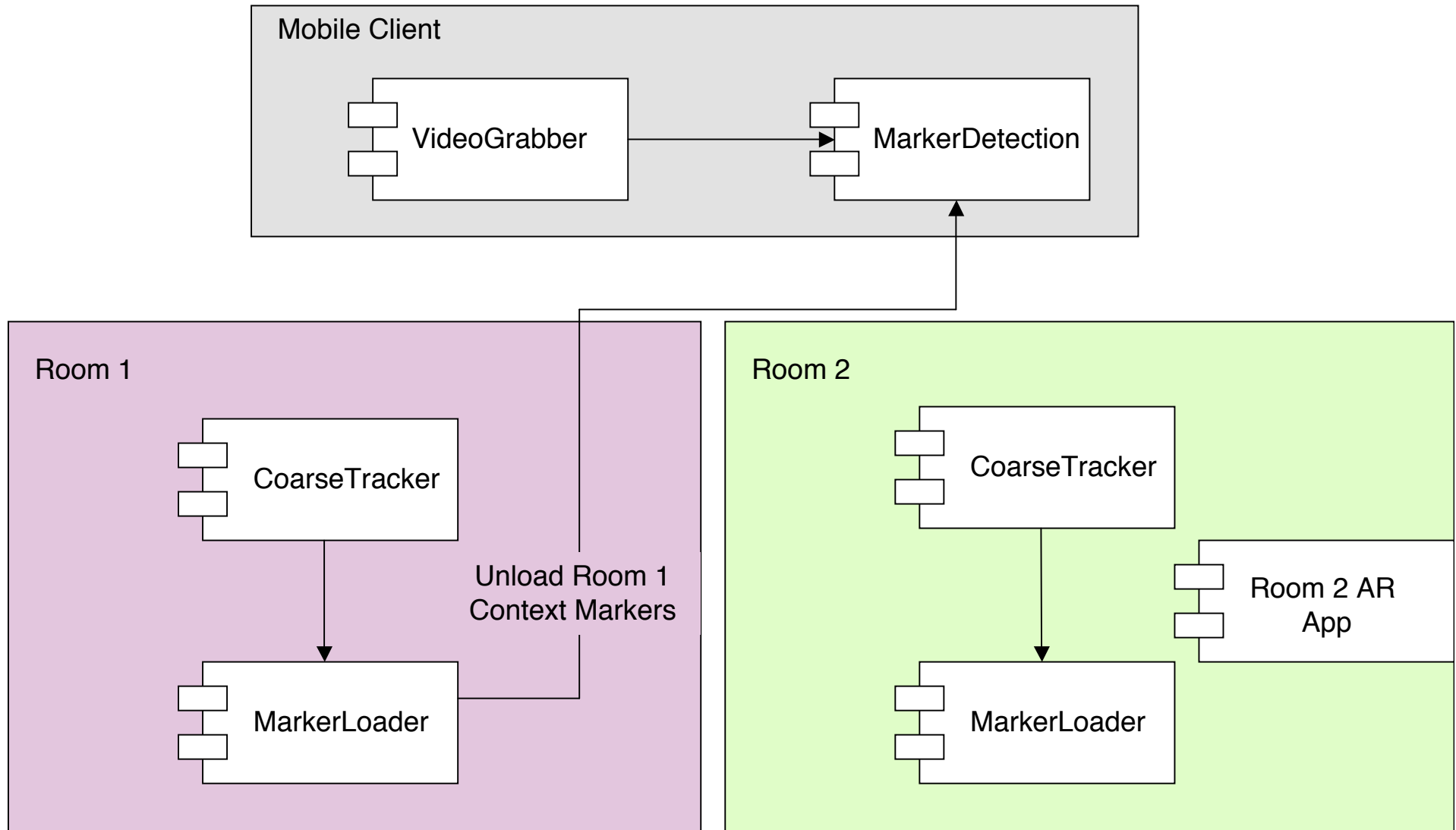
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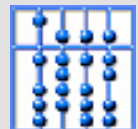
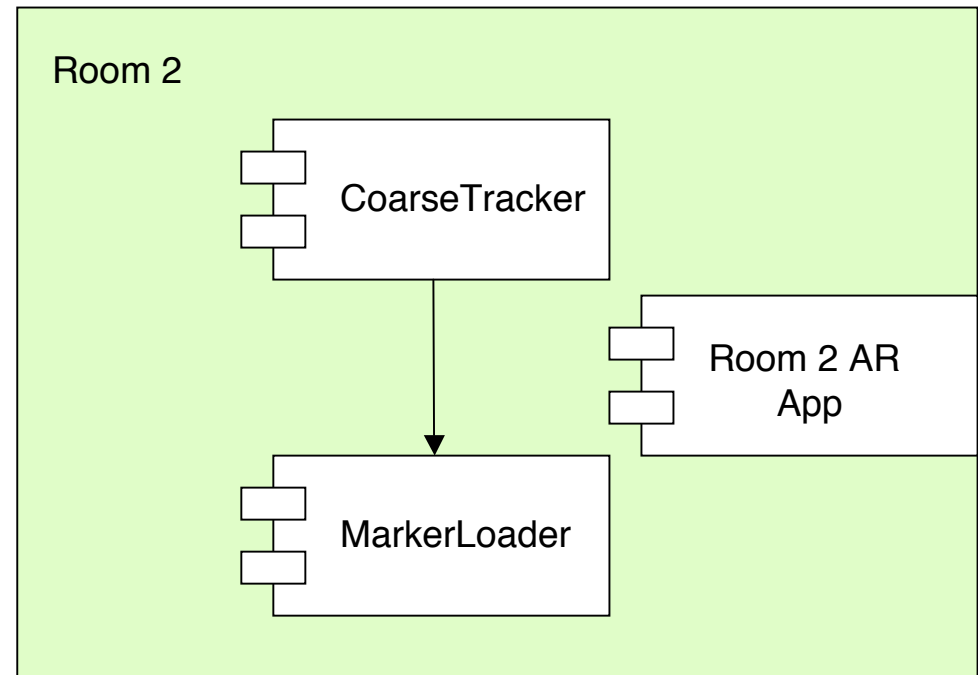
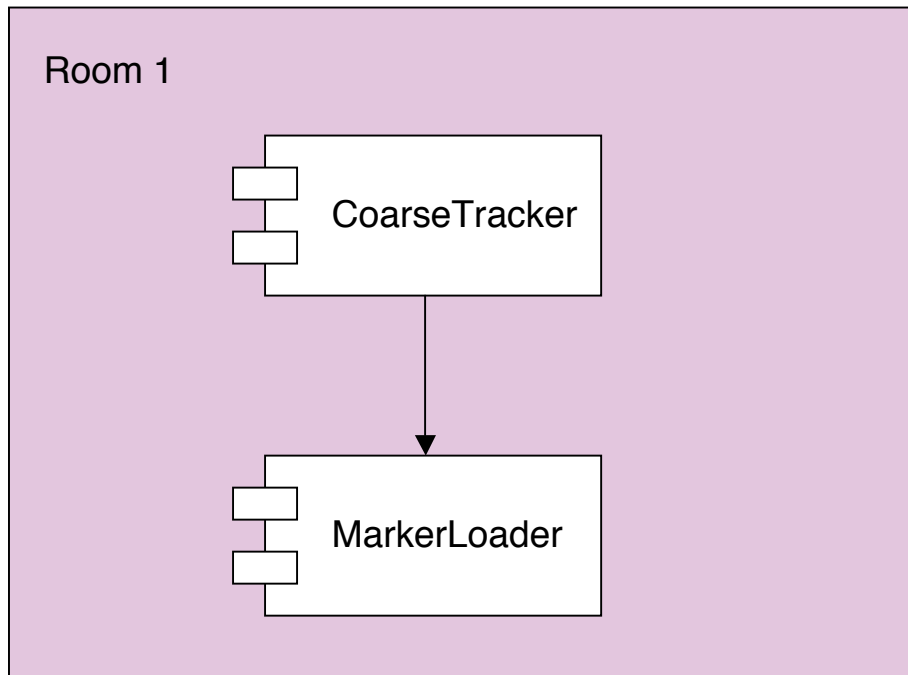
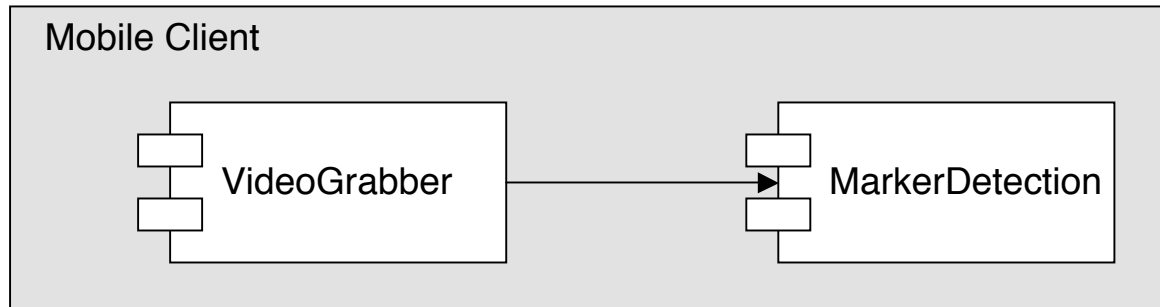
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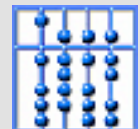
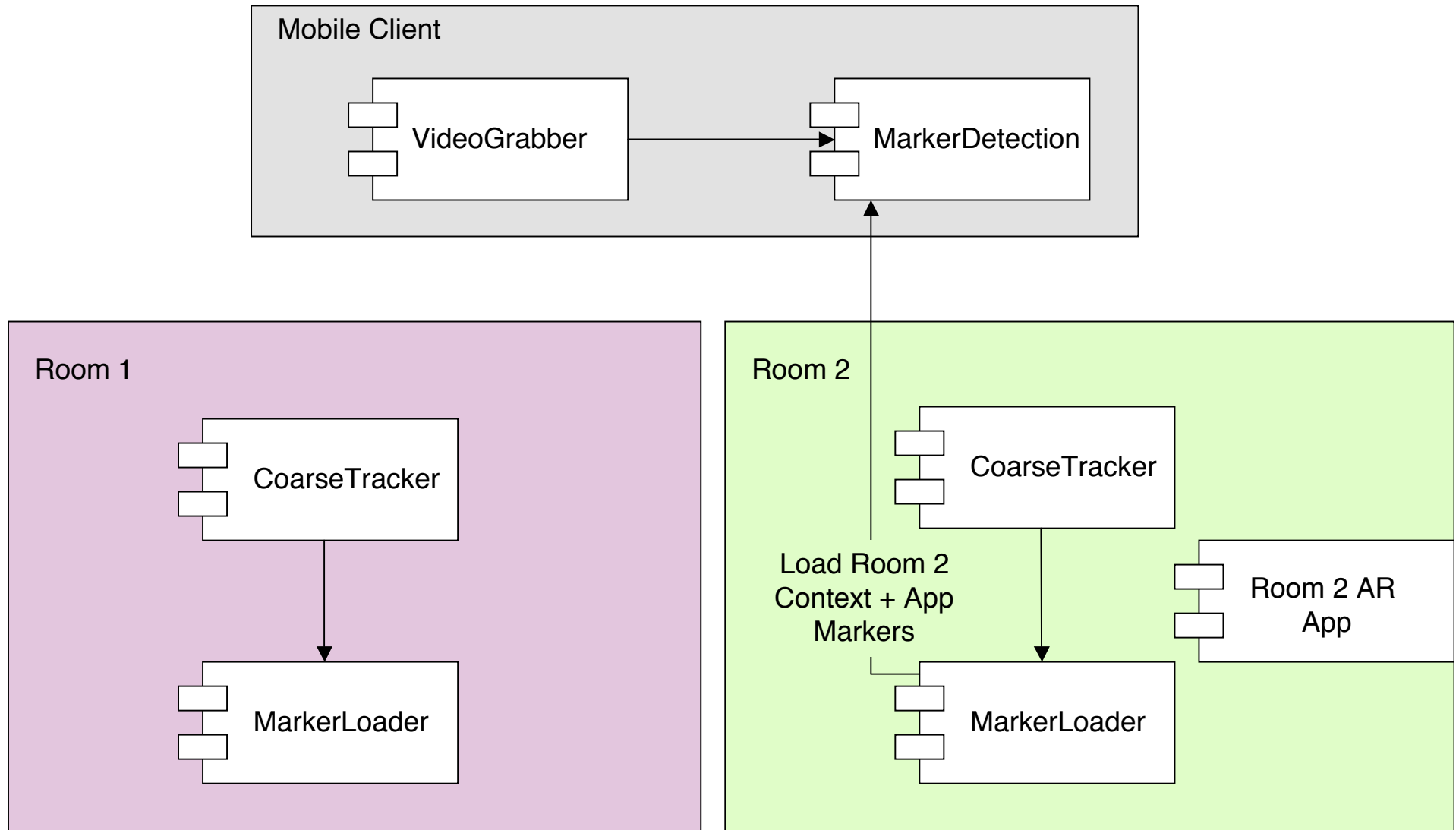
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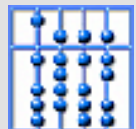
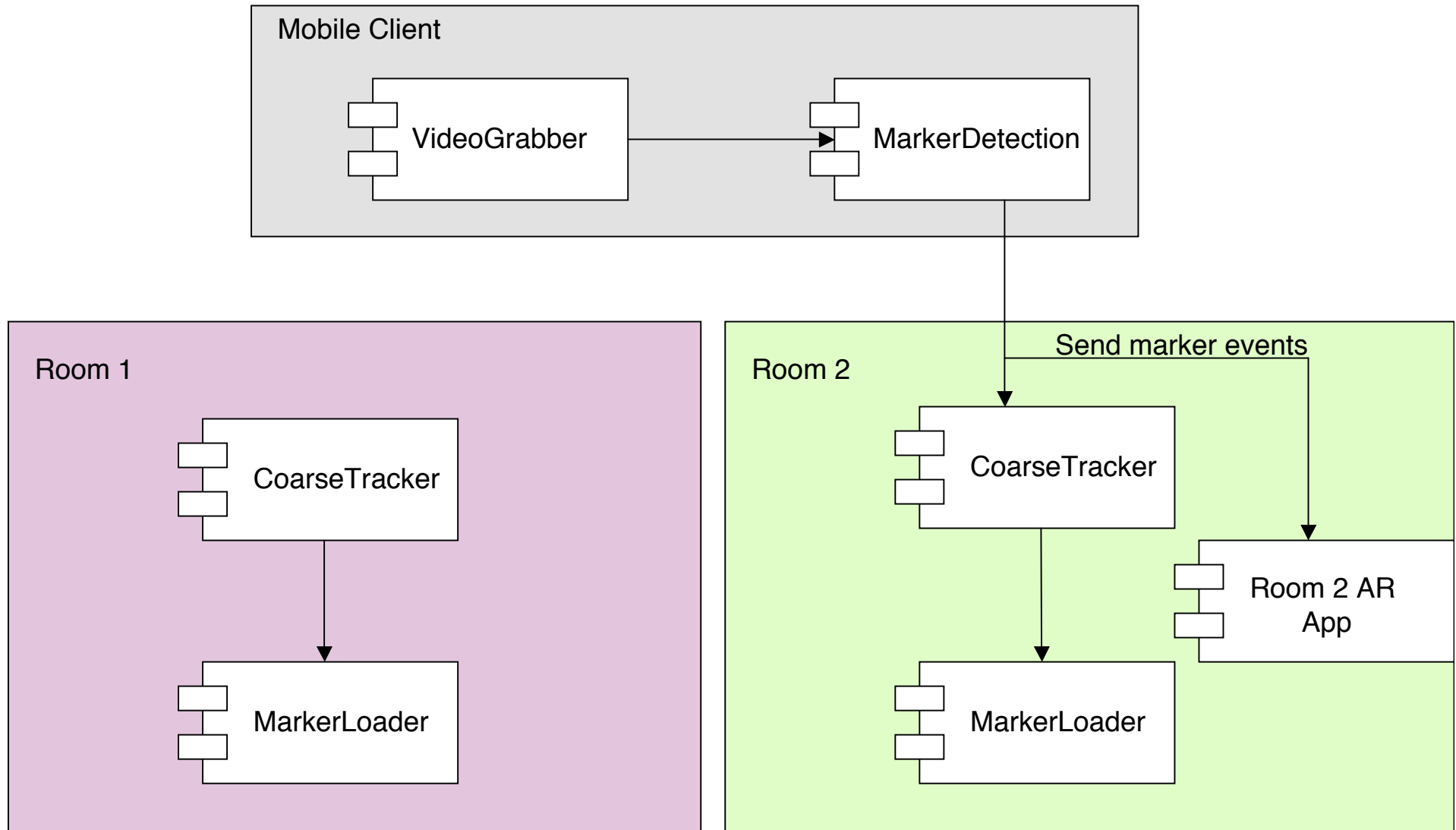
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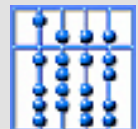


Distributed Configuration - Example



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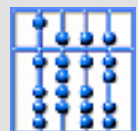
Strategies for Marker-Based Wide Area Tracking

Factors influencing the choice of strategies:

- Light conditions
- Movement of user
- Marker position
- Camera
- Room properties

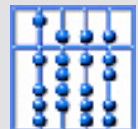
Basic strategies:

- Minimum number of frames
- Weighting number of frames by confidence value
- Detect multiple markers simultaneously
- Detect sequence of markers



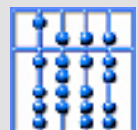
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Conclusion & Future Work

- Prototypical implementation:
 - Proof of concept for configuration architecture
 - Demonstration within ARCHIE project
- Future Work:
 - Evaluate robustness of different strategies
 - Describe criteria for suitability of different strategies
 - Design combination strategies
 - Incorporate additional trackers/ information sources
 - Algorithms for detecting and reverting wrongly triggered context changes



Thank you!



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