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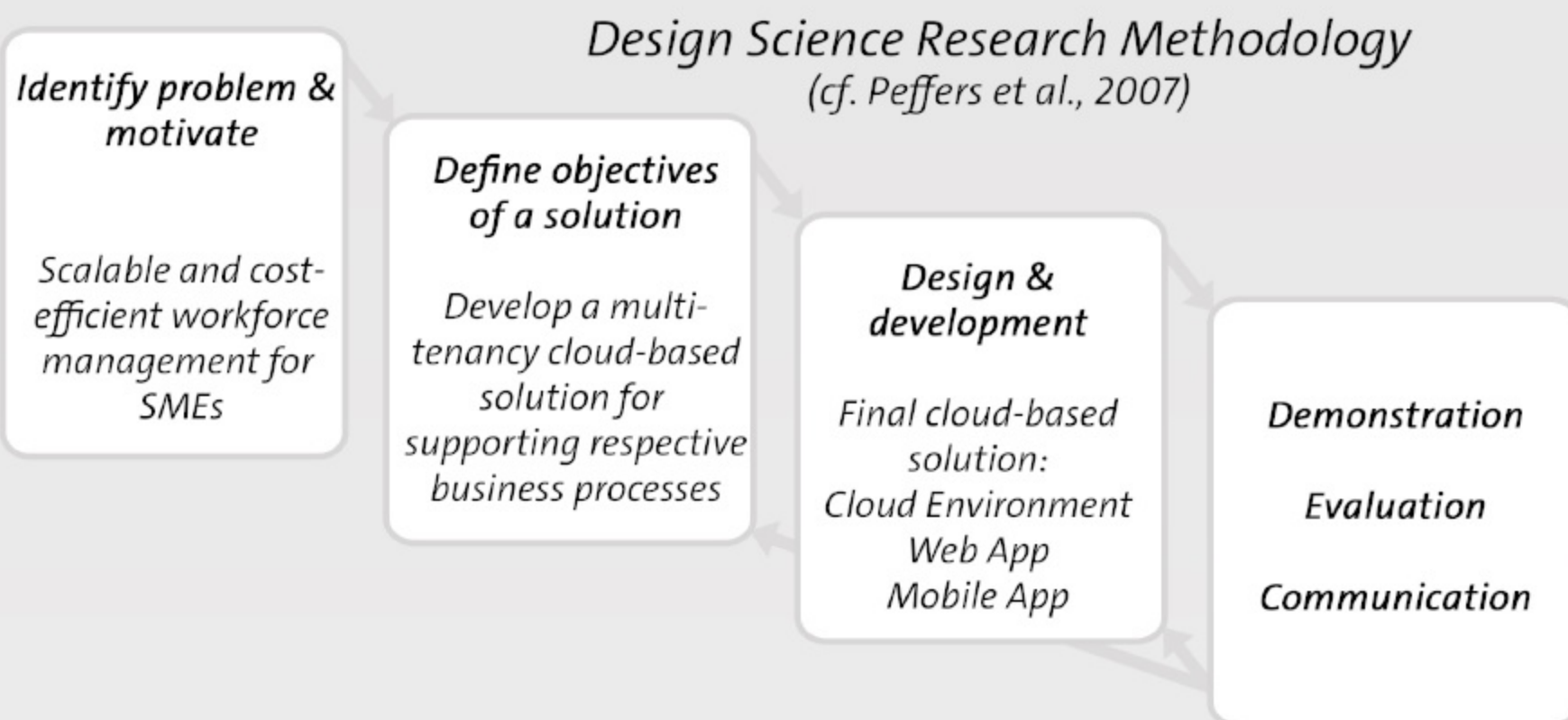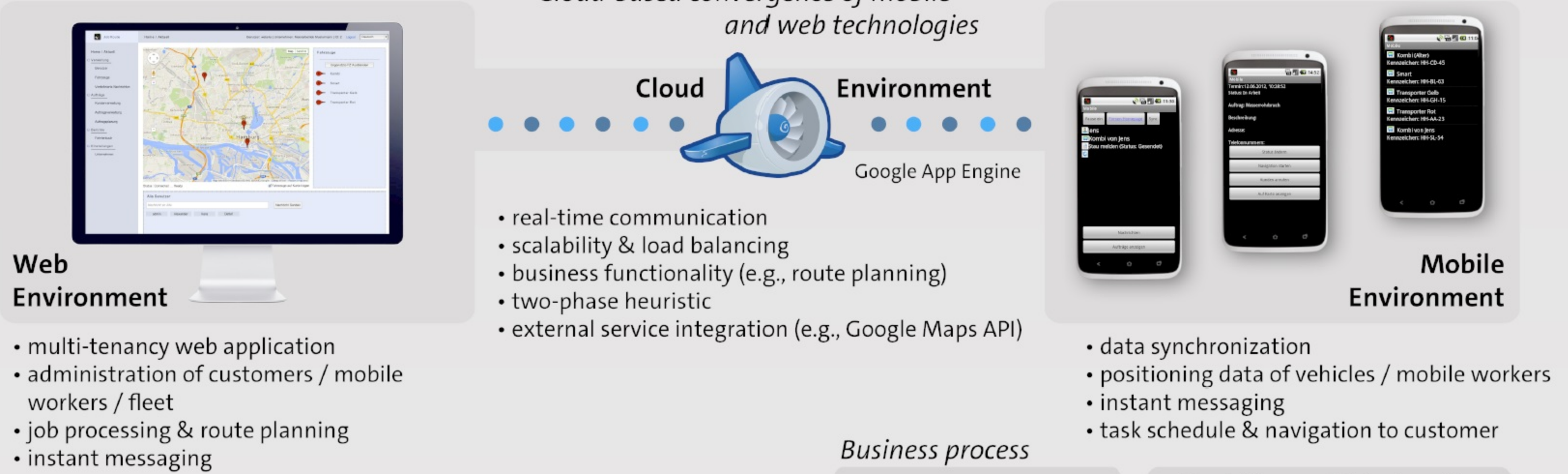Prof. Dr. Stefan Voß

IWI HAMBURG

JobRoute

A Mobile Cloud Workforce Management System for SMEs

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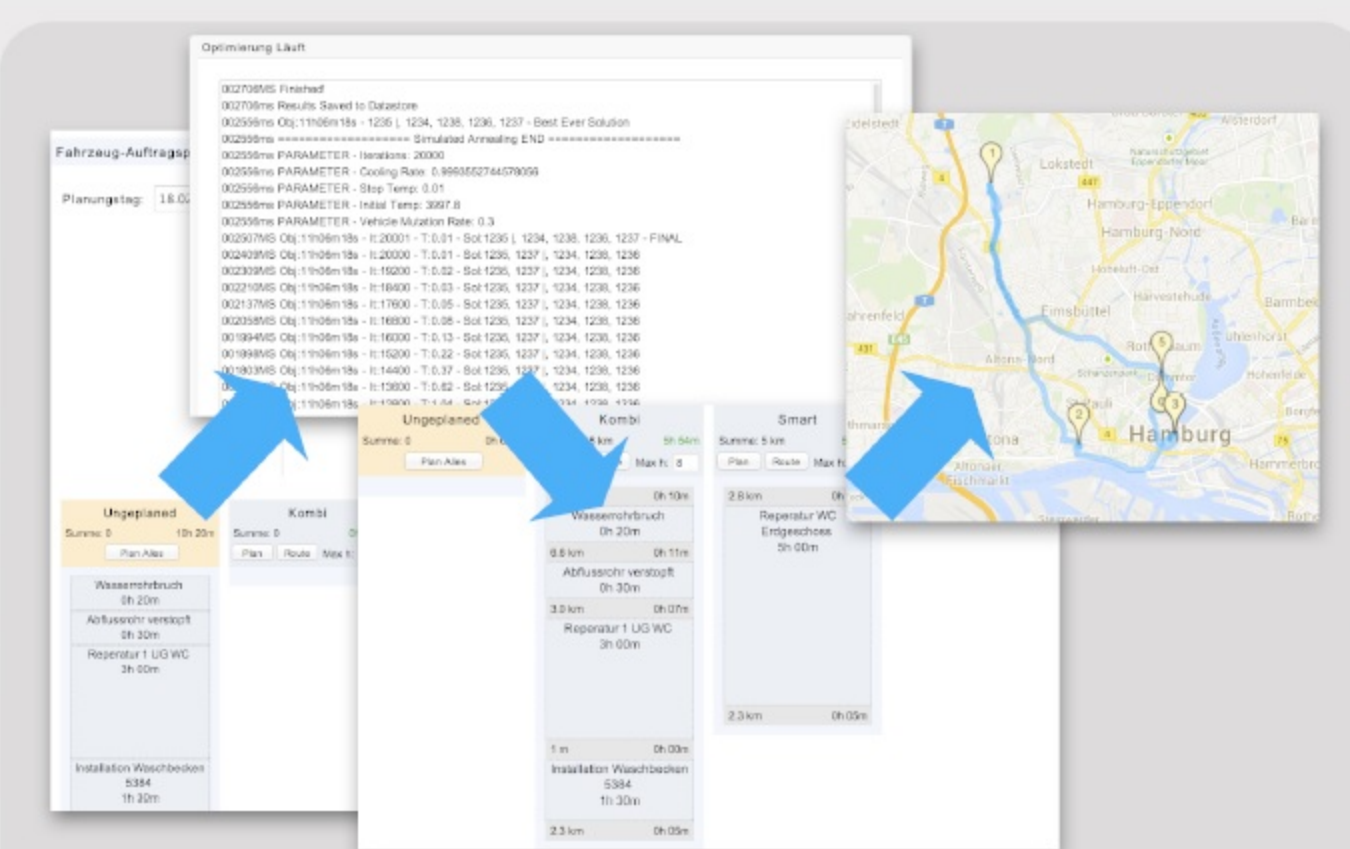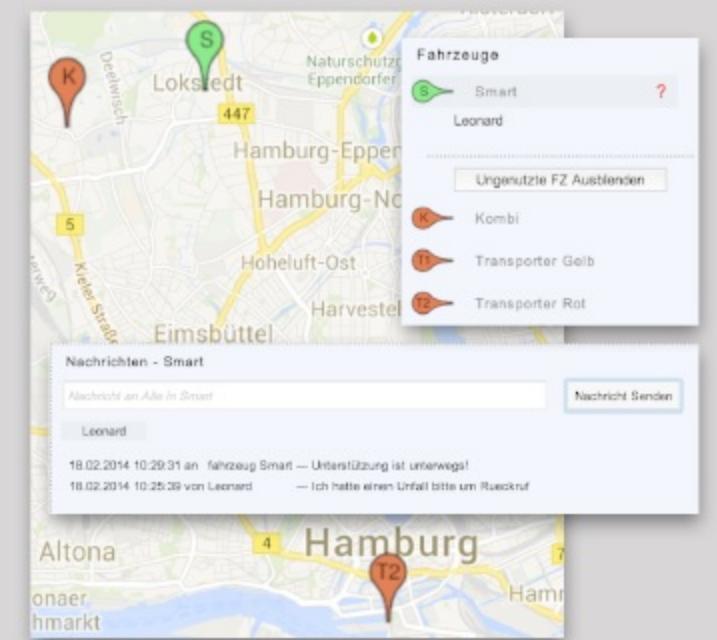
Cloud-based convergence of mobile and web technologies

Cloud   **Environment**

Google App Engine

- real-time communication
- scalability & load balancing
- business functionality (e.g., route planning)
- two-phase heuristic
- external service integration (e.g., Google Maps API)

Web Environment

- multi-tenancy web application
- administration of customers / mobile workers / fleet
- job processing & route planning
- instant messaging

Mobile Environment

- data synchronization
- positioning data of vehicles / mobile workers
- instant messaging
- task schedule & navigation to customer

Design Science Research Methodology
(cf. Peffers et al., 2007)

Identify problem & motivate

Scalable and cost-efficient workforce management for SMEs

Define objectives of a solution

Develop a multi-tenancy cloud-based solution for supporting respective business processes

Design & development

Final cloud-based solution:
Cloud Environment
Web App
Mobile App

Demonstration

Evaluation

Communication

Business process

JOB ENTRY

ROUTE PLANNING

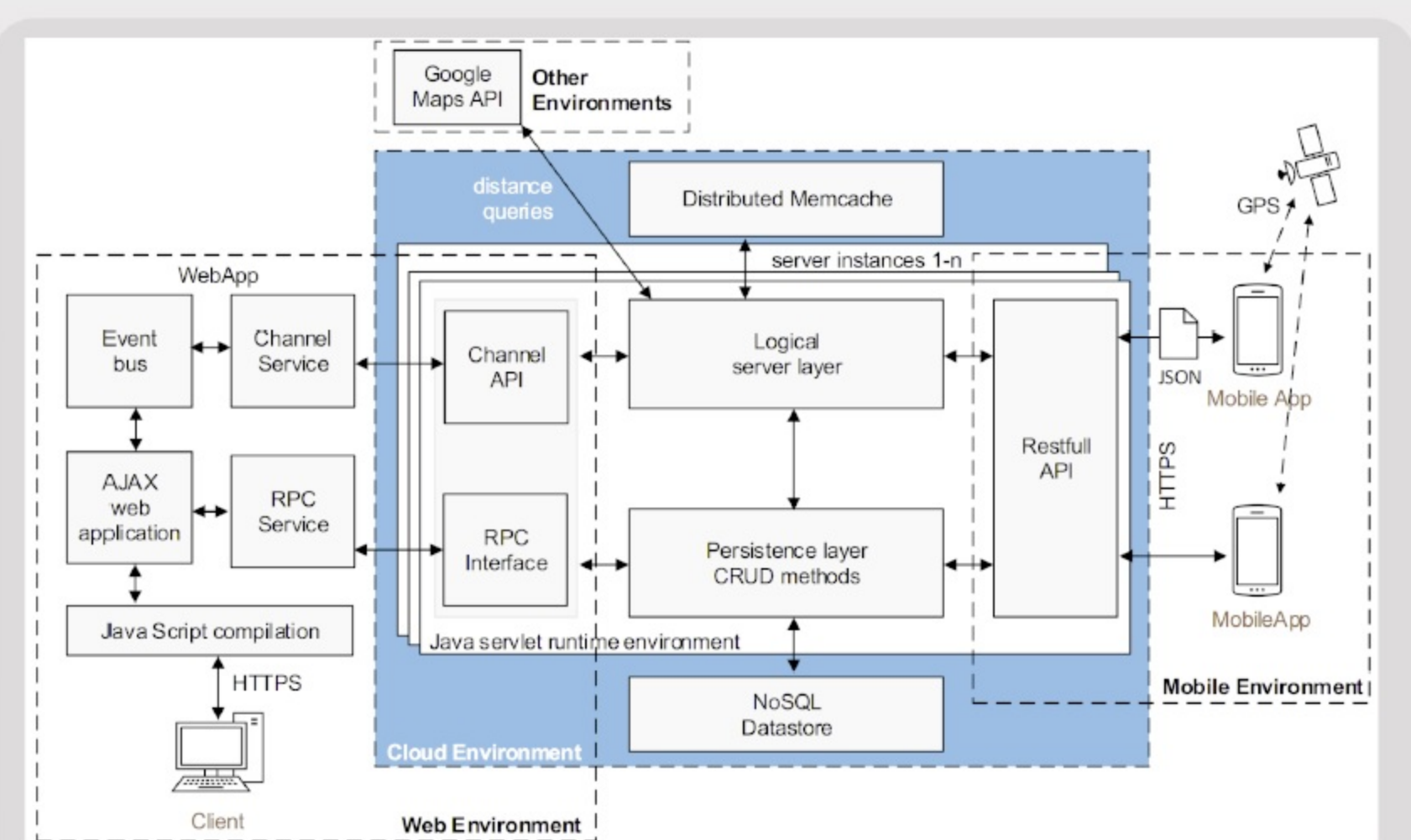**JOB EXECUTION**

JOB COMPLETION

Real-time vehicle tracking & messaging

Route planning

First phase: Simple heuristic (e.g., nearest neighbor, cheapest insertion)

Second phase: Metaheuristic (e.g., simulated annealing, genetic algorithm)

System architecture

Google Maps API — Other Environments

distance queries

Distributed Memcache

server instances 1–n

WebApp

Event bus

Channel Service

Channel API

Logical server layer

AJAX web application

RPC Service

RPC Interface

Persistence layer CRUD methods

Restfull API

Java Script compilation

Java servlet runtime environment

HTTPS

NoSQL Datastore

Client

Web Environment

Cloud Environment

JSON — Mobile App

HTTPS

MobileApp

Mobile Environment

GPS

AJAX = Asynchronous JavaScript and XML
JSON = JavaScript Object Notation
RPC = Remote Procedure Call
API = Application Programming Interface
GPS = Global Positioning System

Objectives

- *Artifact 1:* Design of a generic systems architecture to integrate web and mobile applications and provide common computation tasks as a cloud service based on Google App Engine
- *Artifact 2:* Construction of a problem-specific multi-tenancy mobile workforce management system
- *Artifact 3:* Implementation of a two-phase heuristic to solve the vehicle routing problem (VRP) in a highly scalable cloud environment

Conclusion and Outlook

- Small and medium enterprises (SMEs) benefit from a cloud-based system: no upfront costs, on-demand usage / flexible pricing, interoperable access
- Data- and computationally intensive tasks are outsourced into the cloud to ensure a high performance in order to support real-time decision making
- The proposed workforce management prototype is the first integrative approach to support route planning and job execution in the cloud
- Further research is required to fully evaluate the proposed solution in terms of costs and performance in a case study