SEOUL NATIONAL UNIVERSITY
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서 울 대 학 교
공 과 대 학, 기술경영경제정책 대학원과정
151-742 서울시 관악구 관악로 1

Technology Management, Economics, and Policy Program
College of Engineering, Seoul National University
1 Gwanak-Ro, Gwanak-Gu, Seoul 151-742, South-Korea
Phone: ++82-2-880-9140, Fax: ++82-2-880-8389

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Office: 37-305
Technology Management, Economics, and Policy Program
College of Engineering
Seoul National University
1 Gwanak-Ro, Gwanak-Gu
Seoul 08826
South-Korea

Phone: +82-70-7678-6676
Fax: +1-501-641-5384
E-mail: jorn.altmann@acm.org

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Jörn Altmann[1], Emanuele Carlini[4], Massimo Coppola[4], Patrizio Dazzi[4], Ana Juan Ferrer[7], Netsanet Haile[1], Young-Woo Jung[5], Dong-Jae Kang[5], Iain-James Marshall[6], Konstantinos Tserpes[2], Theodora Varvarigou[3]

[1] Seoul National University
Seoul, Korea
jorn.altmann@acm.org, netsaneth@snu.ac.kr

[2] Harokopio University
Athens, Greece
tserpes@hua.gr

[3] National Technical University of Athens
Athens, Greece
dora@telecom.ntua.gr

[4] ISTI, CNR
Pisa, Italy
emanuele.carlini@isti.cnr.it, massimo.coppola@isti.cnr.it, patrizio.dazzi@isti.cnr.it

[5] ETRI
Daejeon, Korea
jungyw@etri.re.kr, djkang@etri.re.kr

[6] Amenesik
Paris, France
ijm@amenesik.com

[7] Atos Origin
Barcelona, Spain
ana.juanf@atos.net

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Abstract: Although mobile devices became more powerful and sophisticated over the last decade, enabling rich-multimedia services, resource constraints still hinder today's mobile applications from reaching their potential. To address this, this work aims at delivering an architecture that supports changing needs of mobile users through an end-to-end approach. The outcomes are sets of requirements, each representing a set of prioritized platform functionalities, and the BASMATI architecture that integrates the sets.

Keywords: Brokerage, Business-Aware Cloud Federation, Architecture, Off-loading, Mobility.

JEL Classification Numbers: L24, L86.

1. Introduction

Although mobile devices became more powerful and sophisticated over the last decade, enabling rich-multimedia services, resource constraints still hinder today's mobile applications from reaching their potential. In this context, cloud environments are considered to be the enabling technology for a broad set of scenarios and applications. Clouds can help overcoming mobile device limitations by achieving a seamless usage of clouds and mobile devices. As existing solutions target specific cloud providers and not federations of cloud providers that allow strategic sharing of resources, location and capacity constraints are still a challenge.

To address this, this work aims at delivering an architecture that supports changing needs of mobile users through an end-to-end approach. The architecture supports: (i) modelling and runtime-adaptable prediction of mobile applications and mobile users, (ii) cross-border, business-aware federation of cloud resources, and (iii) scalable brokerage and dynamic offloading of services. The basis for the architecture comes from a wide area of projects and technologies, comprising CompatibleOne [1], BetaaS, OPTIMIS [3], PaaSport, and Broker@Cloud, Easiclouds [2], and AnyBroker.

The methodology used comprises the specification of requirements and, based on the requirements, the specification of the architecture. The requirements come from insights of stakeholders, who operate in different application domains, and innovation experts through ad-hoc meetings. Requirements are also obtained from a literature research that includes market studies, scientific articles, innovation roadmaps, relevant standards, and project-specific requirements. These requirements are analyzed with requirements engineering techniques. The outcomes are sets of requirements, each representing a set of prioritized platform functionalities, and the BASMATI architecture that integrates the sets.

2. Architectural Requirements

The requirements have been grouped into four groups. The first group is services enablement, which comprises modelling of applications and users in terms of their different mobility patterns. Mobile applications are classified with respect to functional and non-functional properties that provide a-priori knowledge of the resource demands, the interactions between atomic application service on the client-side and the server-side, as well as the contextual situation. The second group focuses on cloud federation. It provides information for enabling the development of different federation decisions. It takes into consideration business aspects and resource information. The third group of requirements refers to infrastructure management. It is concerned with the development of infrastructures built from heterogeneous resources (e.g., data, networking resources, devices). The fourth group focuses on algorithms for brokerage and offloading, considering legal, governance and socio-economic aspects.

3. The Modified Preferential Attachment Rule

The BASMATI architecture considers an ecosystem that encompasses different entities whose interplay is enabled by the brokerage platform (Fig.1). The entities include mobile users (and their devices), mobile application vendors, and federated cloud

providers. For each entity, architectural requirements were translated into a wide set of functions (Fig.1). It includes functions for determining the demand patterns and operational models of applications. Further functions include functions for strategic adaptation and for automated reconfigurations of applications, both on the device-side and on the cloud-side, at different locations and costs.

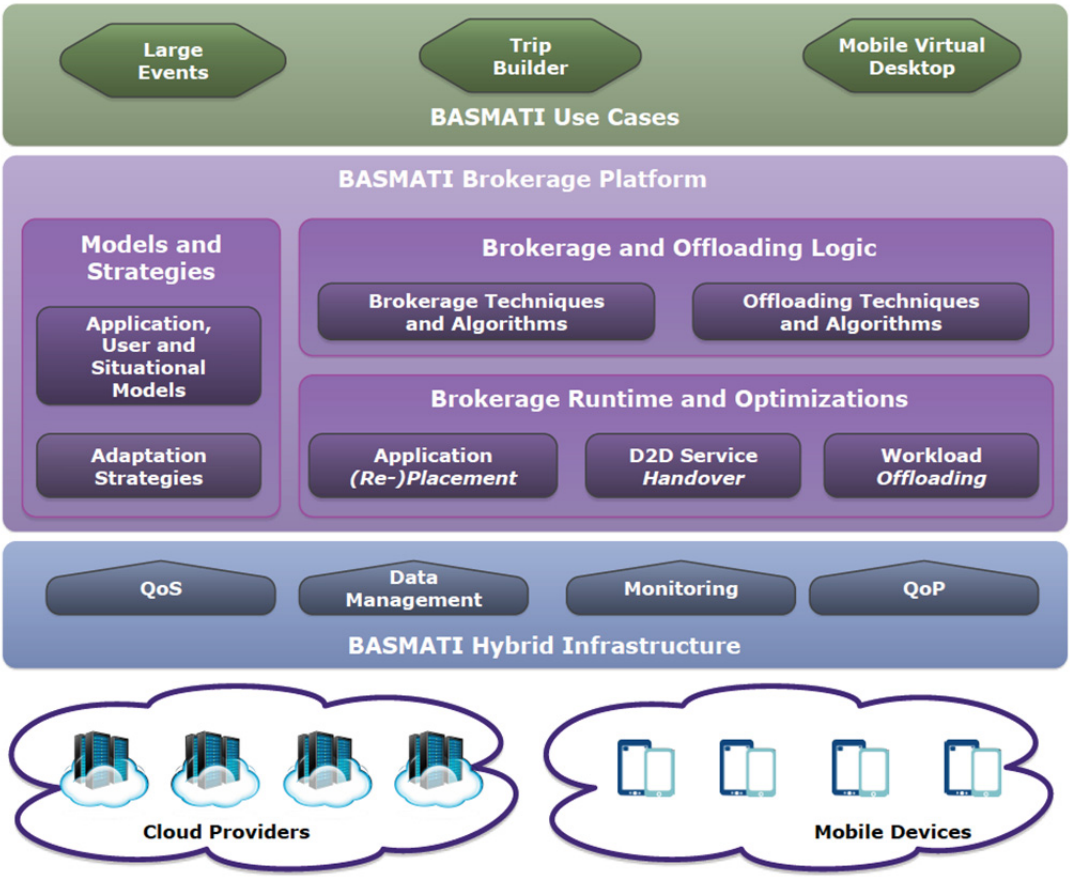

Figure 1. BASMATI Architecture

The major features of the architecture are (i) algorithms and methodologies for identifying the optimal set of resources assigned to mobile applications, and (ii) techniques for offloading applications. Runtime optimizations are considered to perform fine-tunings of applications depending on specific, unpredictably occurring conditions. By means of the brokerage platform, mobile cloud applications can be seamlessly placed and offloaded both on the resources belonging to the cloud federation and on those belonging to mobile devices. The set of these federated resources, including the management logic, constitutes the hybrid infrastructure (Fig. 1) that supports QoS of applications, data management, and resource monitoring.

4. Conclusions and Future Work

The achievement of BASMATI is an architecture that includes: (1) multi-objective optimization techniques for enhancing the brokerage logic with respect to legal, governance and socio-economic aspects that may affect the brokerage and offloading decisions; (2) management models for adaptive and reconfigurable mobile applications; and (3) federation models that consider cooperative modes and strategic utilizations of computing resources.

Our future work will comprise detailed interaction models between the different functions and stakeholders of the architecture, which will be validated by a prototype implementation.

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