

# Chapter 41

## Reasoning Qualitatively about Handheld Multimedia Framework Quality Attributes

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### ABSTRACT

*Today's mobile handheld devices, such as smartphones and action cameras, are well equipped for a wide range of multimedia and context-aware tasks. Such tasks can leverage traditional services like streaming audio and video as well as newer services like sensor fusion. Ubiquitous network access, coupled with an increasingly sophisticated mixture of device-based hardware and software, is enabling context-aware applications at an unprecedented rate. The objective of this chapter is to discuss specific quality attributes with respect to device-side software architectures providing these multimedia and sensor capabilities. This chapter focuses specifically on device-side client architectures rather than network or server architectures. Specific domain requirements and quality attributes are first derived through a synthesis of current research and industry trends, and subsequently analyzed. The analysis reveals some qualitative results that seem unintuitive at first glance but that become more understandable when provided with rationale relative to the handheld domain context.*

### INTRODUCTION

Today's non-tablet, mobile handheld devices (i.e., smartphones) are well equipped for a wide range of multimedia and context-aware tasks (e.g., augmented reality). Already, current wireless and cellular technologies like Wi-Fi (802.11), 4G LTE, and HSPA+ enable streaming audio and video content to a wide range of mobile devices (Choi, Choi, and Bahk, 2007). Applications such as audio or video streaming, video conferencing, video surveillance, and web browser applications are migrating from PC/notebook computers to their handheld counterparts (Kim and Nieh, 2006). In addition, the complex mesh of sen-

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sors on many of today's smart phones, combined with mobile data, enable completely new applications such as augmented reality (Wagner, 2012). The wide availability of sensors such as barometric altitude, gyroscopic rotation, and GPS sensors also enable new context-aware applications and usage modes. With handheld computing devices outnumbering conventional desktop systems in much of the developed world (GSMA Intelligence, 2014), both manufacturers and developers would do well to consider the special limitations inherent in the handheld domain. By giving careful consideration to quality attributes and their corresponding impact within this domain, manufacturers and developers are more likely to develop applications that work intelligently to mitigate shortcomings imposed by small-screened devices with limited battery life. The objective of this chapter is to discuss architectural attributes of multimedia frameworks on client-side mobile devices such as mobile phones and other handheld computers.

Our goal is to consolidate handheld factors such as power and screen size limitations in order to stimulate deeper consideration during software specification and design, particularly with respect to multimedia and contextual computing frameworks. The following sections further explain the motivation behind this objective and provide an overview of the chapter's organization.

Currently, there is a lack of a standard approach to architectural evaluation for device side multimedia architectures in the handheld domain. This implies that handheld multimedia frameworks must be assessed more through trial and error than through a fitness assessment of some kind. Ultimately, this may lead to inflexible architectures that are difficult to modify later in the software's lifetime. Not only that, but these architectures and the software built on top of them may not adequately address the availability, testability, and performance needs of software operating in the handheld domain. This problem, and its more specific incarnations are addressed in the research and observations section.

## **Motivation**

The motivation for addressing architectural issues on the device-side, or client side, is in reaction to steadily growing body of literature and research in server-side middleware, wireless network protocols, and network infrastructures. Many challenges must be overcome with regard to these network and server-side aspects of ubiquitous computing, but at the same time, the impact of these evolving technologies on client devices must not be overlooked. The motivation for discussing software quality attributes stems from the need for greater awareness of the impact of the multimedia software architecture on the device itself, and its development as a whole

Software architecture is of course essential to the success of the developing organization as it largely determines the success of the organization's software on many levels. Bass, Clements, and Kazman (2012, p. 25) enumerate more thirteen reasons why software architecture is important. Of those, we find the following reasons especially key:

1. An architecture will inhibit or enable a system's driving quality attributes,
2. The analysis of an architecture enables early prediction of a system's qualities,
3. A documented architecture enhances communication among stakeholders,
4. An architecture can be created as a transferrable, reusable model that forms the heart of a product line

We believe the architectural considerations discussed in this work will benefit developing organizations by providing a basis for reasoning about candidate multimedia architectures (i.e. facilitating com-

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