Energy Reservation Service for Smart Phone Application

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Introduction

Motivations

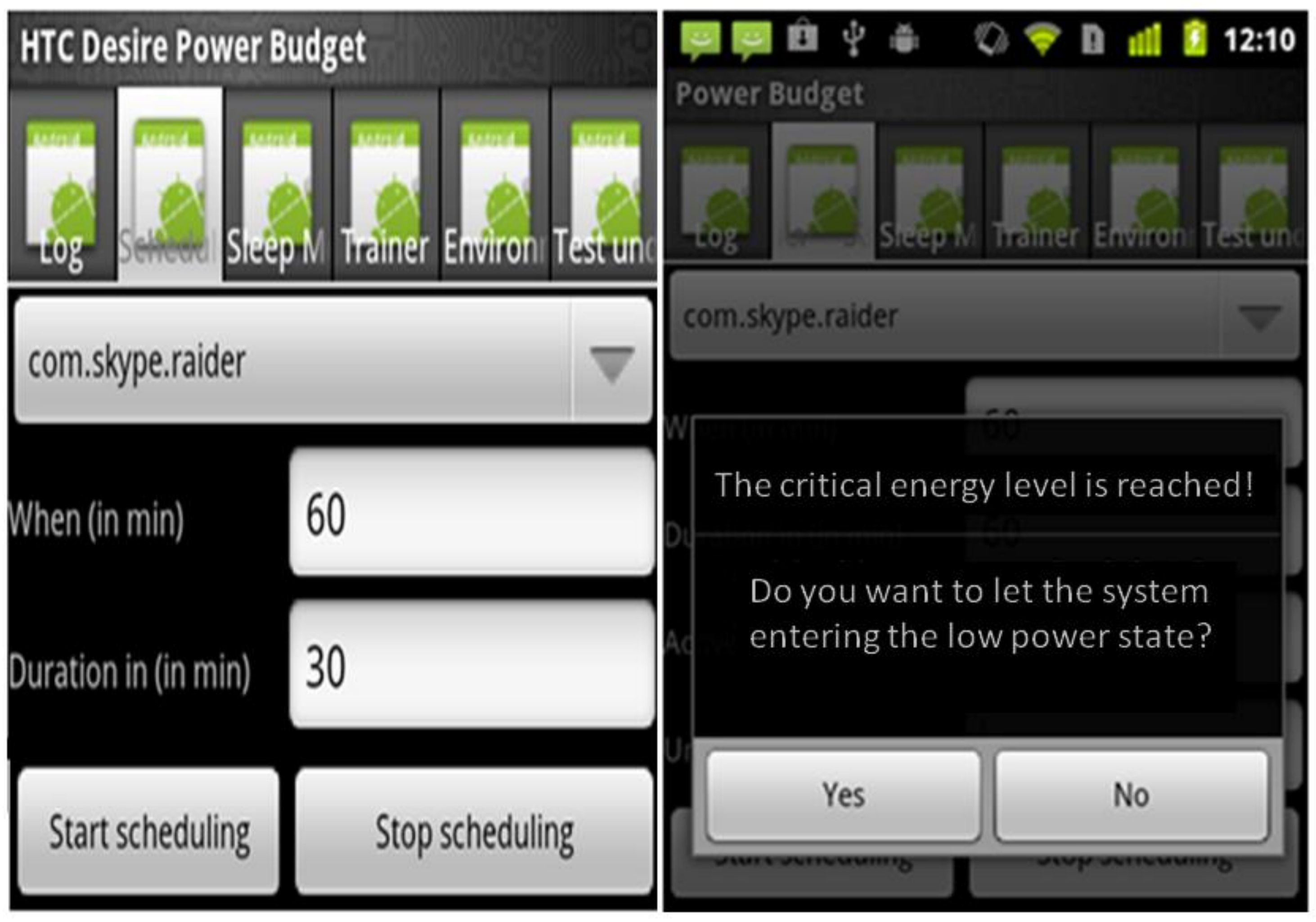
- Importance of smart phones in daily life
- Battery lifetime
- Users want to execute applications whenever they need them
- The energy availability is not guaranteed on current smart phones OS

Objectives

- Reserving energy for important applications
- Adapting the energy quantities in function of the environment
- Advising the user before the remaining energy is too low to run the important applications

Background

- Users decide (Fig 1 – a)
  - Which applications are important (critical applications)
  - When the critical applications will be executed (critical time)
  - How long the critical applications will be used (critical duration)
- The power consumed by applications is known



(a) (b)
Figure 1: Energy Reservation Service GUI

Service Architecture

Energy Reservation Service

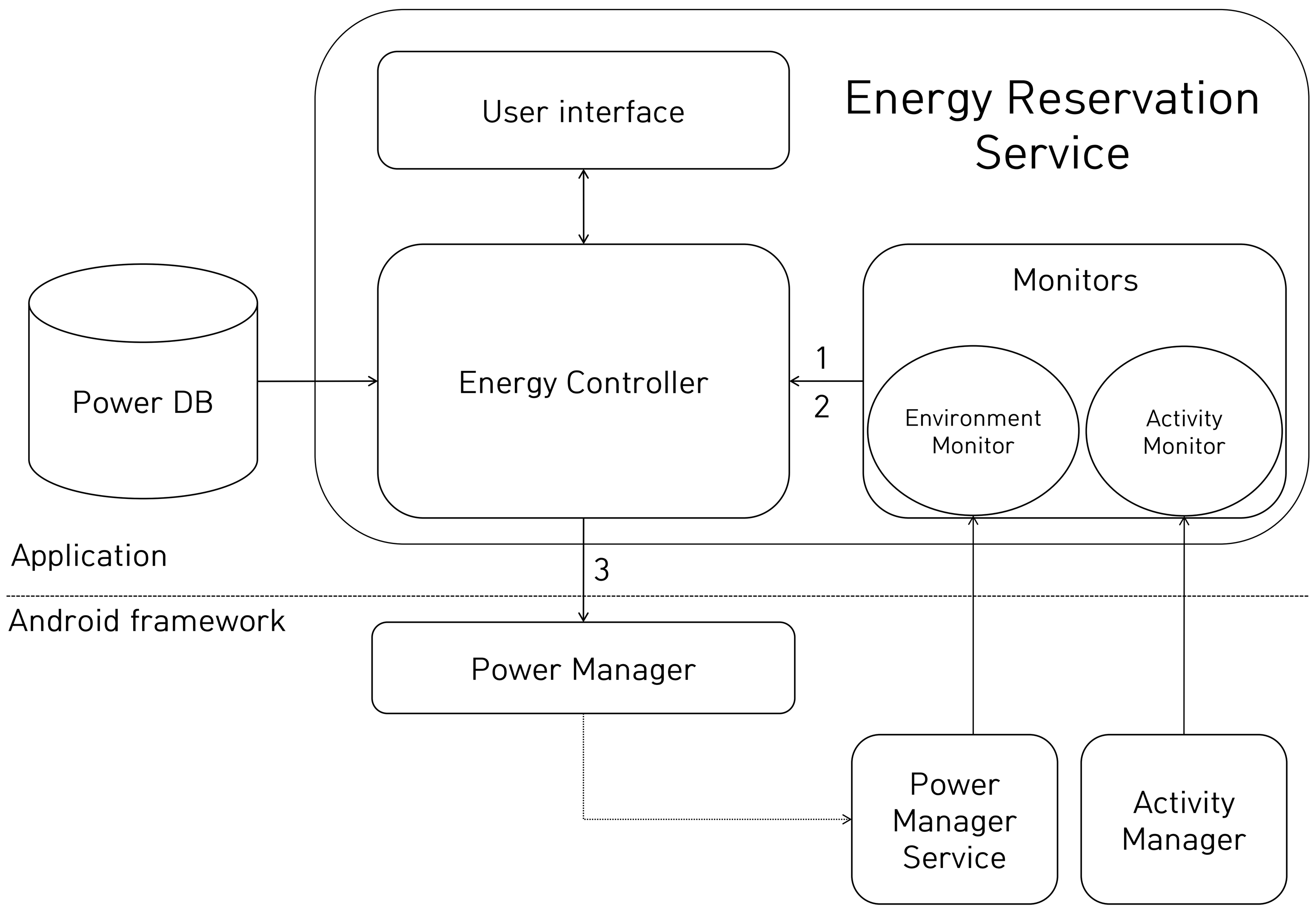


Figure 2: Architecture of the Energy Reservation Service

Reserved energy

- It represents the minimum energy needed to reach the critical time and the energy needed to run the critical applications
- The **energy schedulability constraint** states that the remaining energy must always be superior to the reserved energy until the critical time and is verified when :
  - a new application is executed (Fig 2 – 1)
  - the environment is changing (Fig 2 – 2)
  - the **application time limit** is over (Fig 2 – 1)
- The system may enter a low power state to save energy until the critical time (Fig 1 – b, Fig 2 – 3, Fig 3 at t_5)

Application time limit

- For guaranteeing the energy schedulability (Fig 3 at t_5).
- The time limit is computed each time an application is executed

Environment Change

- As the environment (screen brightness, Wi-Fi, ...) may influence the power consumed by applications, the service must reevaluate the energy need of the critical applications (Fig 3 at t_2).

Experimentations and Results

Energy schedulability verifications

- Each event (at t_x) represents the energy schedulability verification: the remaining energy (blue curve) must be over the reserved energy (green curve). The pink curve represents the prediction of the power consumed by the system.

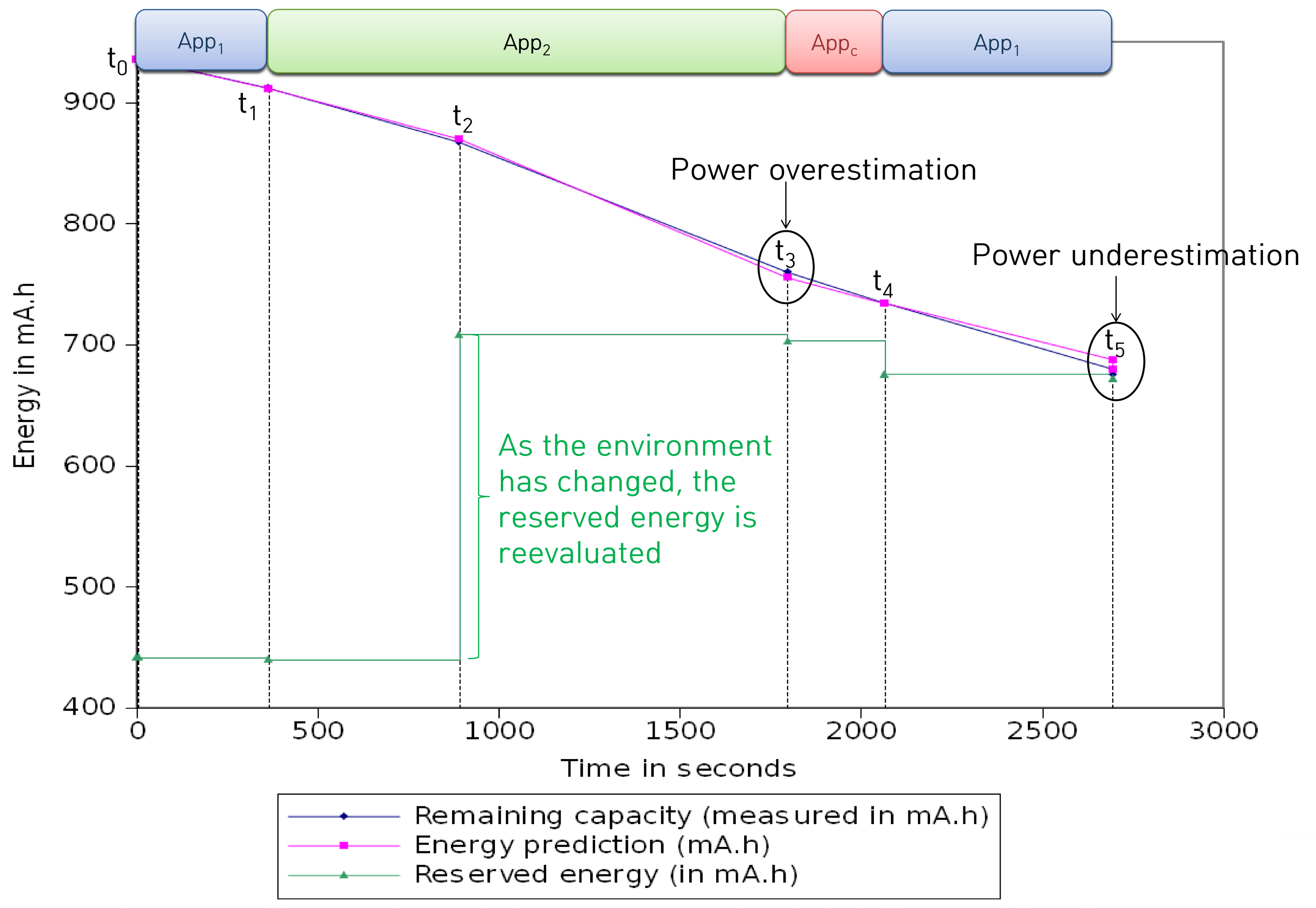


Figure 3: illustration of the energy schedulability verifications

Guaranteeing energy schedulability

- Is hard, especially when the power is understimated (Fig 3 at t_5)!
- **Solution: increasing the energy schedulability verifications by divided the application time limit by a factor superior to 1**
- Figure 4 represents the difference between the remaining energy and the reserved energy (prediction error, x axis) after the execution of an application (video streaming) whose power is voluntary underestimated (y axis).

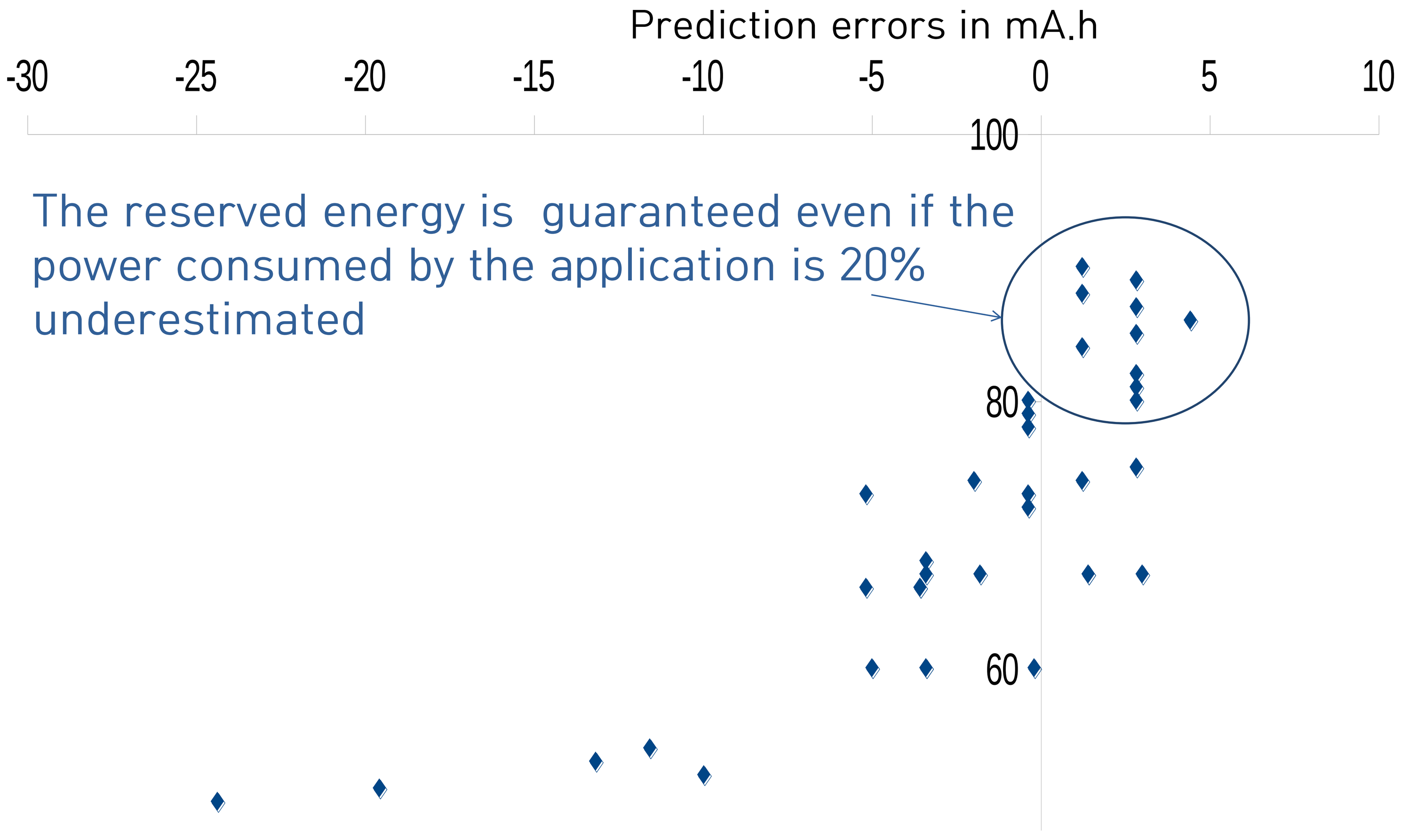


Figure 4: guaranteeing the energy schedulability with a 1.5 factor