



B E T S Y

Deliverable D1d  
Evaluation Criteria  
Version 1.0

Public





<b>Project Number</b>	:	IST-004042
<b>Project Title</b>	:	BETSY
<b>Deliverable Type</b>	:	Report

<b>Deliverable Number</b>	:	D1d
<b>Title of Deliverable</b>	:	Evaluation criteria
<b>Nature of Deliverable</b>	:	Report, Public
<b>Internal Document Number</b>	:	betsy-phr-d1d-v0_1.doc
<b>Contractual Delivery Date</b>	:	28 February 2005
<b>Actual Delivery Date</b>	:	25 February 2005
<b>Contributing WPs</b>	:	WP1
<b>Author(s)</b>	:	P. van der Stok (Philips) M. Joosten (C-lab) C. Koulamas (ISI)

## Abstract

This document describes the evaluation criteria for the technologies developed during the BETSY project.

## Keyword list

Energy consumption, end-to-end QoS chain, resource constraint, evaluation criteria

# Table of Contents

<b>Table of Contents.....</b>	<b>3</b>
<b>1 Introduction.....</b>	<b>4</b>
<b>2 Scenario analysis .....</b>	<b>5</b>
<b>2.1 Home network scenario.....</b>	<b>5</b>
2.1.1 Problem analysis.....	5
<b>2.2 Hot spot scenario .....</b>	<b>5</b>
2.2.1 Problem analysis.....	5
<b>3 Evaluation criteria .....</b>	<b>6</b>
<b>3.1 Point 1 is the subject of WP2, while point 2 is the subject of WP3. Point 3 should emerge naturally from both WP2 and WP3. End-to-end QoS chain partitioning</b>	<b>6</b>
<b>3.2 Limited capacity of resources.....</b>	<b>6</b>
<b>3.3 Energy consumption .....</b>	<b>7</b>
<b>4 Conclusions .....</b>	<b>8</b>
<b>References .....</b>	<b>9</b>

# 1 Introduction

This document describes evaluation criteria derived from the scenarios used for the BETSY project [1]. The criteria will be used to decide the conditions under which the resource management- and energy saving techniques, developed during the BETSY project, can be applied to Consumer Electronic devices. They also serve as basis for the reference implementation objectives of WP4. Although not always welcome, a negative outcome of an evaluation criterion can be a very useful result, because it prevents a lot of unnecessary efforts and clearly identifies where the developed resource management- and energy saving techniques do not apply. Care must be taken not confuse the results of the application of the evaluation criteria with a judgment on the value of the BETSY project.

A judgment on the BETSY project is done during the BETSY review process, in which reviewers and partners together evaluate the scientific validity and applicability of the BETSY results. During review, other aspects like dissemination, exploitation also come into play.

## 2 Scenario analysis

Two scenarios of D1a [1] address two application domains (1) the home network, and (2) hot spots outside the home but connected to the home. Each one is discussed in a separate subsection.

### 2.1 Home network scenario

Three user scenarios of home network applications involving video streaming are given:

**Scenario1.** This scenario assumes that all Ethernet connected series of equipment do not influence each other. Demands on the wired network are relatively low. Demands over the wireless are high.

**Scenario2.** In this scenario two access points are introduced with handover due to the mobility of the tablet.

**Scenario3.** In this scenario additional interference from the microwave in the kitchen is introduced.

#### 2.1.1 Problem analysis

Deliverable D1a, states the following conclusion:

*Any stream in a (wireless) network will be subject to external factors that could negatively impact the resulting video quality. It is necessary to appropriately address these issues while at the same time meeting deadlines to assure rendering without delays. Typical causes leading to varying circumstances are (1) interference, (2) a device fluctuating between being in- and out-of-range, (3) new streams entering the network, and (4) handovers. A management and control model that deals with these kinds of problems will have to be based on the specific characteristics of those perturbations.*

### 2.2 Hot spot scenario

In this section two user scenarios of hot spot applications are given that involve video streaming. Subsequently, these scenarios are analyzed with respect to stream combination and technical issues.

**Scenario4.** The spacing of the access points limits the bandwidth and the required hand-over frequency.

**Scenario5.** The energy consumption of the camera is managed with a direct relation to the bit-rate of the video stream.

**Scenario6.** The available bandwidth is the limiting factor.

#### 2.2.1 Problem analysis

The following conclusions are expressed in deliverable D1a:

*Three issues come on top of the conclusions of the home network scenario: (1) Seamless handover at higher mobility, (2) Bandwidth limitations arising from a higher number of users per AP, and (3) Energy consumption limitations at the mobile device*

## 3 Evaluation criteria

The scenarios show how energy consumption and resource management are perceived by the users. The scenarios show that they are relevant subjects for the ease with which we can use the video streaming devices. A set of techniques is needed to effectively manage the resources and save energy. The BETSY DOW describes the techniques that are envisaged. Of course other techniques may pop up in a later stage. Under such an occurrence this document needs to be adapted.

In this section the evaluation criteria are derived from the scenario analysis. The criteria can be classified in three classes according to the Description of Work (DOW) [2]:

1. End-to-end QoS chain partitioning
2. Limited capacity of resources
3. Energy consumption

### 3.1 Point 1 is the subject of WP2, while point 2 is the subject of WP3. Point 3 should emerge naturally from both WP2 and WP3. End-to-end QoS chain partitioning

**Criterion1.** A set of stream parameters can sufficiently describe the display quality.

**Criterion2.** For the functions selected and specified for the BETSY project, mathematical functions describe the effect of a given BETSY function on the stream parameters.

**Criterion3.** It is possible to express for a chain of functions, the effect on the stream parameters as a composition of the mathematical functions, which describe the BETSY functions.

**Criterion4.** It is possible to formulate perceived display quality optimisation criteria to optimise the chain of functions with respect to resource usage, delay, display quality, and video quality.

**Criterion5.** It is possible to optimise a given chain of functions with respect to perceived video quality and the display quality.

### 3.2 Limited capacity of resources

**Criterion6.** It is possible to define criteria, which determine whether a new stream can be accepted with the specified quality. The transport of a refused stream should lead to unwanted quality degradation in the transported stream. An accepted stream can be streamed and displayed with the specified quality

**Criterion7.** It is possible to determine at which quality level a stream can be accepted with the given resource occupation by other streams.

**Criterion8.** It is possible to determine at which quality level a stream can be continued while either the source or the destination is mobile. The quality level is calculated when a stream needs to change resource usage during movement (e.g. hand-over from one AP to another, different path over network, etc.)

**Criterion9.** It is possible to calculate the new resource consumption for an existing stream after a quality change of the video

**Criterion10.** It is possible to relate codec settings to display qualities, such that the display quality can be optimised by changing the codec settings.

**Criterion11.** It is possible to estimate resource consumption fluctuations under bandwidth fluctuations.

**Criterion12.** It is possible to embed the models into systems, which have to use also proprietary components (e.g. OS, NIC drivers, etc.).

### 3.3 Energy consumption

**Criterion13.** Criteria exist to decide energy consumption settings.

**Criterion14.** Relations between energy consumption and display quality can be quantified.

**Criterion15.** It is possible to determine power consumption costs of different mappings between the BETSY functions and the resources.

**Criterion16.** It is possible to estimate the impact of changes in the mapping or in the parameter values of the BETSY functions on the battery lifetime.

**Criterion17.** It is possible to correlate the power or energy costs of a number of functions with the power or energy cost of an application/steam composed of these functions.

**Criterion18.** It is possible to extend the lifetime of the battery by the usage of the information embedded into the models.

**Criterion19.** When estimations are used, it is possible to determine the degree of confidence in the accuracy of estimations.

Criteria 5-8, 10,12, 15-16 should also apply on the reference implementation as envisaged in WP4.



## 4 Conclusions

A set of criteria has been defined for the acceptance of the technology developed during the BETSY project.

## References

- [1] Harmke de Groot et al., *Deliverable D1a, Scenario and use cases*, BETSY project, November 2004
- [2] BETSY project, *Description of Work*, May 2004