



**This is the Title of the Thesis and it is a very Big Title  
covering More than One Line**

This is the Thesis Subtitle if Necessary

**The Full Name of the Author Goes Here**

Thesis to obtain the Master of Science Degree in

**Computer Science and Engineering**

Supervisors: Prof. Name of the Supervisor  
Prof. Name of the Co-Supervisor

**Examination Committee**

Chairperson: Prof. Name of the Chairperson  
Supervisor: Prof. Name of the Supervisor  
Members of the Committee: Prof. Name of First Committee Member  
Dr. Name of Second Committee Member  
Eng. Name of Third Committee Member

**Month 20XX**

This work was created using  $\text{\LaTeX}$  typesetting language  
in the Overleaf environment ([www.overleaf.com](http://www.overleaf.com)).

# Declaration

I declare that this document is an original work of my own authorship and that it fulfills all the requirements of the Code of Conduct and Good Practices of the Universidade de Lisboa.



# Acknowledgments

I would like to thank my parents for their friendship, encouragement and caring over all these years, for always being there for me through thick and thin and without whom this project would not be possible. I would also like to thank my grandparents, aunts, uncles and cousins for their understanding and support throughout all these years.

Quisque facilisis erat a dui. Nam malesuada ornare dolor. Cras gravida, diam sit amet rhoncus ornare, erat elit consectetur erat, id egestas pede nibh eget odio. Proin tincidunt, velit vel porta elementum, magna diam molestie sapien, non aliquet massa pede eu diam. Aliquam iaculis.

Fusce et ipsum et nulla tristique facilisis. Donec eget sem sit amet ligula viverra gravida. Etiam vehicula urna vel turpis. Suspendisse sagittis ante a urna. Morbi a est quis orci consequat rutrum. Nullam egestas feugiat felis. Integer adipiscing semper ligula. Nunc molestie, nisl sit amet cursus convallis, sapien lectus pretium metus, vitae pretium enim wisi id lectus.

Donec vestibulum. Etiam vel nibh. Nulla facilisi. Mauris pharetra. Donec augue. Fusce ultrices, neque id dignissim ultrices, tellus mauris dictum elit, vel lacinia enim metus eu nunc.

I would also like to acknowledge my dissertation supervisors Prof. Some Name and Prof. Some Other Name for their insight, support and sharing of knowledge that has made this Thesis possible.

Last but not least, to all my friends and colleagues that helped me grow as a person and were always there for me during the good and bad times in my life. Thank you.

To each and every one of you – Thank you.



# Abstract

Nulla facilisi. In vel sem. Morbi id urna in diam dignissim feugiat. Proin molestie tortor eu velit. Aliquam erat volutpat. Nullam ultrices, diam tempus vulputate egestas, eros pede varius leo, sed imperdiet lectus est ornare odio. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Proin consectetur velit in dui. Phasellus wisi purus, interdum vitae, rutrum accumsan, viverra in, velit. Sed enim risus, congue non, tristique in, commodo eu, metus. Aenean tortor mi, imperdiet id, gravida eu, posuere eu, felis. Mauris sollicitudin, turpis in hendrerit sodales, lectus ipsum pellentesque ligula, sit amet scelerisque urna nibh ut arcu. Aliquam in lacus. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Nulla placerat aliquam wisi. Mauris viverra odio. Quisque fermentum pulvinar odio. Proin posuere est vitae ligula. Etiam euismod. Cras a eros.

# Keywords

Maecenas tempus dictum libero; Donec non tortor in arcu mollis feugiat;Cras rutrum pulvinar tellus.





# Resumo

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. Aenean ultricies mi vitae est. Mauris placerat eleifend leo. Quisque sit amet est et sapien ullamcorper pharetra. Vestibulum erat wisi, condimentum sed, commodo vitae, ornare sit amet, wisi. Aenean fermentum, elit eget tincidunt condimentum, eros ipsum rutrum orci, sagittis tempus lacus enim ac dui. Donec non enim in turpis pulvinar facilisis. Ut felis. Aliquam aliquet, est a ullamcorper condimentum, tellus nulla fringilla elit, a iaculis nulla turpis sed wisi. Fusce volutpat. Etiam sodales ante id nunc. Proin ornare dignissim lacus. Nunc porttitor nunc a sem. Sed sollicitudin velit eu magna. Aliquam erat volutpat. Vivamus ornare est non wisi. Proin vel quam. Vivamus egestas. Nunc tempor diam vehicula mauris. Nullam sapien eros, facilisis vel, eleifend non, auctor dapibus, pede.

## Palavras Chave

Colaborativo; Codificação; Conteúdo Multimídia; Comunicação;



# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Morbi ipsum ipsum . . . . .	4
1.2	Organization of the Document . . . . .	5
<b>2</b>	<b>This is the Second Chapter</b>	<b>7</b>
2.1	Traditional Streaming Technologies . . . . .	9
2.2	Cras lobortis tempor velit . . . . .	10
<b>3</b>	<b>This is the Third Chapter</b>	<b>11</b>
3.1	Architecture Design . . . . .	13
3.2	Architecture Design Requirements . . . . .	15
<b>4</b>	<b>This is the Fourth Chapter</b>	<b>17</b>
4.1	Development Process . . . . .	19
4.2	Development Environment . . . . .	20
4.3	Client Application . . . . .	20
4.3.1	User Interface . . . . .	21
4.3.2	Vivamus luctus elit sit amet mi . . . . .	21
<b>5</b>	<b>This is the Fifth Chapter</b>	<b>23</b>
5.1	Maecenas vitae nulla consequat . . . . .	25
5.2	Proin ornare dignissim lacus . . . . .	26
<b>6</b>	<b>Conclusion</b>	<b>29</b>
6.1	Conclusions . . . . .	31
6.2	System Limitations and Future Work . . . . .	32
	<b>Bibliography</b>	<b>33</b>
<b>A</b>	<b>Code of Project</b>	<b>35</b>
<b>B</b>	<b>A Large Table</b>	<b>43</b>



# List of Figures

1.1 Ecosystem . . . . .	5
3.1 System Processes . . . . .	13
3.2 Network Diagram . . . . .	14
4.1 Complete User Interface . . . . .	22
5.1 Test Environment . . . . .	25
5.2 Adaptation System Behavior Test . . . . .	27



# List of Tables

2.1	Streaming Technologies Comparison . . . . .	9
2.2	A nice Spreadsheet using package “spreadtab”. Notice the calculations. . . . .	9
2.3	Comparison between today’s and target Architectures of Telcos . . . . .	10
5.1	Network Link Conditioner Profiles . . . . .	26
B.1	Example table . . . . .	44
B.2	Example of a very long table spreading in several pages . . . . .	44
B.3	Sample Table. . . . .	46





# List of Symbols

$A_s$	Surface Area	$m^2$
$D_0$	Initial Diameter	$m$



# List of Algorithms

4.1 Time Control Strategy . . . . .	20
-------------------------------------	----



# Listings

3.1	Example of a MPD file. . . . .	15
4.1	A listing with a Tikz picture overlaid . . . . .	21
A.1	Example of a XML file. . . . .	35
A.2	Assembler Main Code. . . . .	36
A.3	Matlab Functi on . . . . .	37
A.4	functi on. m . . . . .	38
A.5	HTML with CSS Code . . . . .	38
A.6	HTML CSS Javascript Code . . . . .	40
A.7	PYTHON Code . . . . .	41



# Acronyms

<b>AVC</b>	Advanced Video Coding
<b>CC</b>	Cloud Computing
<b>CDN</b>	Content Distribution Network
<b>CPU</b>	Central Processing Unit
<b>DASH</b>	Dynamic Adaptive Streaming over HTTP
<b>GPRS</b>	General Packet Radio Service
<b>HD</b>	High Definition
<b>HTTP</b>	Hypertext Transfer Protocol
<b>LAN</b>	Local Area Network
<b>LTE</b>	Long Term Evolution
<b>OS</b>	Operating System
<b>SD</b>	Standard Definition
<b>SVC</b>	Scalable Video Coding
<b>UI</b>	User Interface
<b>UMTS</b>	Universal Mobile Telecommunication System
<b>WLAN</b>	Wireless Local Area Network
<b>WWAN</b>	Wireless Wide Area Network





# Glossary

## **formula**

A mathematical expression ..... 5

## **LaTeX**

LaTeX It is a mark up language specially suited for scientific documents as it can correctly format documents with all the typographical rules ..... 5

## **mathematics**

Mathematics is what mathematicians do ..... 5





# Introduction

## Contents

---

1.1 Morbi ipsum ipsum . . . . .	4
1.2 Organization of the Document . . . . .	5

---



Rui Cruz: The examples of techniques, tools, and packages along the document are for you to get familiarized with them. It is advisable to preserve those examples of usage, for reference, by moving the respective blocks of text to the last Chapter of this template (or to a Chapter file that you know you will not use), until you finish your document.

Example of using package `todo` for notes of authors. In this case the author Johnny is calling the attention for something at the specific place in the text.

Johnny  
pointing out  
to the place

In this other case, another co-author is commenting on something inline.

Manuel: Inline comment or Note. It can be an extract of some recommended text. “Lorem ipsum dolor sit amet, consectetur adipiscing elit. Morbi commodo, ipsum sed pharetra gravida, orci magna rhoncus neque, id pulvinar odio lorem non turpis. Nullam sit amet enim. Suspendisse id velit vitae ligula volutpat condimentum. Aliquam erat volutpat. Sed quis velit. Nulla facilisi. Nulla libero. Vivamus pharetra posuere sapien.”

In this other case, another co-author is making a note about the citation for missing some bibliographic record [1–3].

Nam consectetur. Sed aliquam, nunc eget euismod ullamcorper, lectus nunc ullamcorper orci, fermentum bibendum enim nibh eget ipsum. Donec porttitor ligula eu dolor. Maecenas vitae nulla consequat libero cursus venenatis. Nam magna enim, accumsan eu, blandit sed, blandit a, eros.

Pete  
You should  
cite also  
Pellen-  
tesque:2014

Quisque facilisis erat a dui. Nam malesuada ornare dolor. “Cras gravida, diam sit amet rhoncus ornare, erat elit consectetur erat, id egestas pede nibh eget odio.”

Proin tincidunt, velit vel porta elementum, magna diam molestie sapien, non aliquet massa pede eu diam. Aliquam iaculis. Fusce et ipsum et nulla tristique facilisis. Donec eget sem sit amet ligula viverra gravida. Etiam vehicula urna vel turpis. Suspendisse sagittis ante a urna. Morbi a est quis orci consequat rutrum. Nullam egestas feugiat felis. Integer adipiscing semper ligula. Nunc molestie, nisl sit amet cursus convallis, sapien lectus pretium metus, vitae pretium enim wisi id lectus. Donec vestibulum. Etiam vel nibh. Nulla facilisi. Mauris pharetra. Donec augue. Fusce ultrices, neque id dignissim ultrices, tellus mauris dictum elit, vel lacinia enim metus eu nunc.

Rui Cruz  
notice here  
how to en-  
quote cor-  
rectly

This is an example of Tracking ~~Changes~~Xanges<sup>JO</sup> (in this case a replacement) by different authors in the document. The Text can additionally be modified by **adding**<sup>PT</sup> new text or by deleting **wrong**<sup>MN</sup> inadequate text. Author can manipulate changes **introduced by each author, as adequate**<sup>MN</sup>~~introduced by other authors~~<sup>PT</sup>.

Proin at eros non eros adipiscing mollis. Donec semper turpis sed diam. Sed consequat ligula nec tortor. Integer eget sem. Ut vitae enim eu est vehicula gravida. Morbi ipsum ipsum, porta nec, tempor id, auctor vitae, purus. Pellentesque neque. Nulla luctus erat vitae libero. Integer nec enim. Phasellus aliquam enim et tortor. Quisque aliquet, quam elementum condimentum feugiat, tellus odio consectetur wisi, vel nonummy sem neque in elit. Curabitur eleifend wisi iaculis ipsum.

## 1.1 Morbi ipsum ipsum

Pellentesque nibh felis, eleifend id, commodo in, interdum vitae, leo. Praesent mauris Standard Definition (SD) and High Definition (HD) volutpat ligula eget enim Wireless Local Area Networks (WLANs) and 3G/4G Wireless Wide Area Networks (WWANs).

RC  
use of  
ACRONYM  
defined in  
file "Thesis-  
MSc-  
Aconyms.tex"

Praesent eu elit. Ut eu ligula. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Maecenas elementum augue nec nisl. Proin auctor lorem at nibh. Curabitur nulla purus, feugiat id, elementum in, lobortis quis, pede. Vivamus sodales adipiscing sapien.

The use of Symbols in the document can be done using the Glossaries package, to display and also List them in the Indexes. Praesent eu elit. Ut eu ligula. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Maecenas elementum augue nec nisl. Proin auctor lorem at nibh.

RC  
use of  
SYMBOL  
defined in  
file "Thesis-  
MSc-  
Glossary.tex"

For example, the initial diameter ( $D_0$ ) of the tube corresponds to a surface area ( $A_s$ ) of  $122 \text{ m}^2$ .

Praesent eu elit. Ut eu ligula. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Maecenas elementum augue nec nisl. Proin auctor lorem at nibh. Curabitur nulla purus, feugiat id, elementum in, lobortis quis, pede. Vivamus sodales adipiscing sapien. Vestibulum posuere nulla eget wisi. Integer volutpat ligula eget enim. Suspendisse vitae arcu. Quisque pellentesque. Nullam consequat, sem vitae rhoncus tristique, mauris nulla fermentum est, bibendum ullamcorper sapien magna et quam. Sed dapibus vehicula odio. Proin bibendum gravida nisl. Fusce lorem. Phasellus sagittis, nulla in hendrerit laoreet, libero lacus feugiat urna, eget hendrerit pede magna vitae lorem.

Aliquam erat WLAN volutpat Central Processing Unit (CPU) mauris nulla fermentum est Operating System (OS) Fusce magna mi, porttitor quis, convallis eget, sodales ac, urna. Pellentesque nibh felis, eleifend id, commodo in, interdum vitae, leo. Praesent eu elit. Ut eu ligula. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Maecenas elementum augue nec nisl. Please notice the use of automatic referencig to objects such as Figures, Tables, equations, Algorithms, sections of a document, etc. by using the command `\Cref{ref}` as in this case pointing to Figure 1.1.

RC  
the correct  
Name of  
the float  
object, in  
this case a  
Figure, is  
determined  
by the sys-  
tem

Proin auctor lorem at nibh. Curabitur nulla purus, feugiat id, elementum in, lobortis quis, pede. Vivamus sodales adipiscing sapien. Vestibulum posuere nulla eget wisi. Integer volutpat ligula eget enim. Suspendisse vitae arcu. Quisque pellentesque. Nullam consequat, sem vitae rhoncus tristique, mauris nulla fermentum est, bibendum ullamcorper sapien magna et quam. Sed dapibus vehicula odio. Proin bibendum gravida nisl. Fusce lorem. Phasellus sagittis, nulla in hendrerit laoreet, libero lacus feugiat urna, eget hendrerit pede magna vitae lorem. Praesent mauris Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos H.264/Advanced Video Coding (AVC) standard, sem vitae rhoncus tristique Scalable Video Coding (SVC) [4, 5] nulla in hendrerit laoreet, libero lacus feugiat urna, eget hendrerit pede magna vitae lorem.

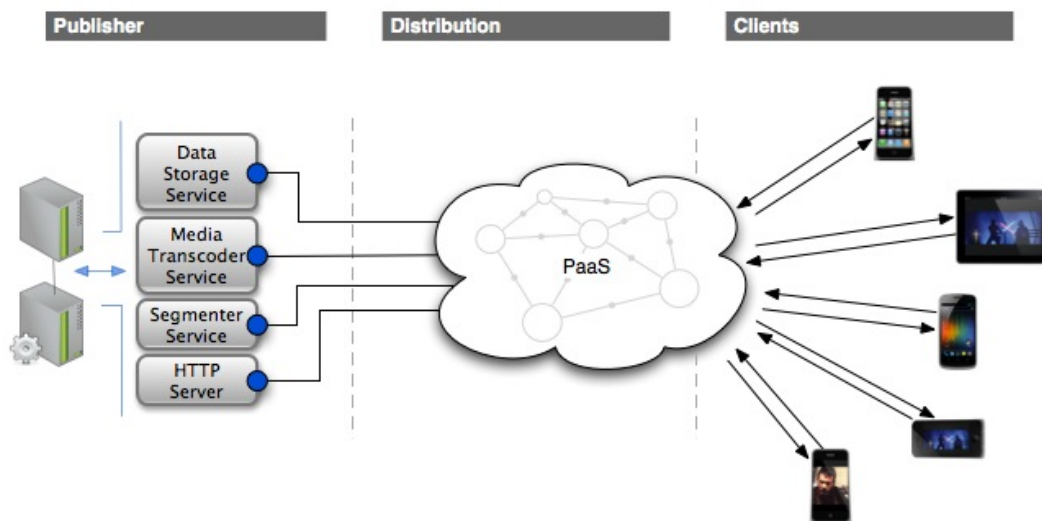


Figure 1.1: Ecosystem

You can use in-paragraph lists with this construct for: (a) first case; (b) second case; and (c) third case, making the text organized and fluid.

Vivamus auctor leo vel dui. Aliquam erat volutpat. Phasellus nibh. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Cras tempor. Morbi egestas, urna non consequat tempus, nunc arcu mollis enim, eu aliquam erat nulla non nibh. Duis consectetur malesuada velit. Nam ante nulla, interdum vel, tristique ac, condimentum non, tellus. Proin ornare feugiat nisl. Suspendisse dolor nisl, ultrices at, eleifend vel, consequat at, dolor, morbi egestas, urna non consequat tempus, nunc arcu mollis enim, eu aliquam erat nulla non nibh.

Notice that mathematics makes extensive use of Formulas which are particularly well rendered in documents produced with LaTeX.

Maecenas elementum augue nec nisl. Proin auctor lorem at nibh. Curabitur nulla purus, feugiat id, elementum in, lobortis quis, pede. Vivamus sodales adipiscing sapien. Vestibulum posuere nulla eget wisi. Integer volutpat ligula eget enim. Suspendisse vitae arcu. Quisque pellentesque.

RC  
example  
of use of  
Glossaries

## 1.2 Organization of the Document

This thesis is organized as follows: Chapter 1 interdu... In chapter 2 curabitur nulla purus, feugiat id, elementum in, lobortis quis, pede. In chapter 3 consequat ligula nec tortor. Integer eget sem. Ut vitae enim eu est vehicula gravida. Chapter 4 morbi egestas, urna non consequat tempus, nunc arcu mollis enim, eu aliquam erat nulla non nibh in chapter 5. Chapter 6 suspendisse dolor nisl, ultrices at, eleifend vel, consequat at, dolor.

RC  
references  
to doc sections/chapters are automatic





# 2

## This is the Second Chapter

### Contents

---

2.1 Traditional Streaming Technologies . . . . .	9
2.2 Cras lobortis tempor velit . . . . .	10

---



Vivamus auctor leo vel dui. Aliquam erat volutpat. Phasellus nibh. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Cras tempor. Morbi egestas, urna non consequat tempus, nunc arcu mollis enim, eu aliquam erat nulla non nibh. Duis consetetur malesuada velit. Nam ante nulla, interdum vel, tristique ac, condimentum non, tellus. Proin ornare feugiat nisl. Suspendisse dolor nisl, ultrices at, eleifend vel, consequat at, dolor.

## 2.1 Traditional Streaming Technologies

Cras dictum. Maecenas ut turpis. In vitae erat ac orci dignissim eleifend. Nunc quis justo. Sed vel ipsum in purus tincidunt pharetra [6]. Sed pulvinar, felis id consetetur malesuada, enim nisl mattis elit, a facilisis tortor nibh quis leo. Sed augue lacus, pretium vitae, molestie eget, rhoncus quis, elit [7]. Donec in augue. Fusce orci wisi, ornare id, mollis vel, lacinia vel, massa. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas..

Sed pulvinar, “felis id consetetur” malesuada, enim nisl mattis elit, a facilisis tortor nibh quis leo  
Table 2.1.

**Table 2.1:** Streaming Technologies Comparison

	Dynamic Streaming	Smooth Streaming	HLS
Streaming Protocol	RTMP	HTTP	HTTP
Video Codec	H.264, VP6	H.264	H.264
Audio Codec	AAC, MP3	WMA, AAC	AAC, MP3
Container Format	MP4, FLV,	MP4	MPEG2-TS
iOS	NO	YES	YES
Android	NO	YES	YES

Suspendisse vestibulum dignissim quam. Integer vel augue. Phasellus nulla purus, interdum ac, venenatis non, varius rutrum, leo. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas [8]. Duis a eros. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Fusce magna mi, porttitor quis, convallis eget, sodales ac, urna [9].  
Table 2.2 illustrates the use of a Spreadsheet-like table producing calculations by columns and by lines (observe the code).

**Table 2.2:** A nice Spreadsheet using package “spreadtab”. Notice the calculations.

22	54	76
43	65	108
49	37	86
114	156	270

## 2.2 Cras lobortis tempor velit

Nunc tincidunt convallis tortor. Duis eros mi, dictum vel, fringilla sit amet, fermentum id, sem. Phasellus nunc enim, faucibus ut, laoreet in, consequat id, metus. Vivamus dignissim [10]. Table 2.3 is automatically compressed to fit text width. You can use <https://www.tabl.esgenerator.com> to produce these tables, and then copy the  $\LaTeX$  code generated to paste in the document.

**Table 2.3:** Comparison between today's and target Architectures of Telcos

Today		Target	
Rigid	Each evolutionary requirement involves development of multiple components, interfaces, platforms, etc.	Flexible	It is possible to modify or add new functionalities rapidly.
Slow	Development of a new application takes months or years.	Fast	Development of a new application takes weeks instead of months or years.
Closed	Limited integration with external environments.	Open	It is simple to integrate internal, applications with external entities.
Complex	Heterogeneous technologies, obsolescence, lack of standards, high redundancy.	Standardised	Use of homogeneous architectural models.
Expensive	High Capex (for new service development) and high Opex (to ensure running of IT).	Cost-Effective	Capex and Opex are optimised.

Cras lobortis tempor velit. Phasellus nec diam ac nisl lacinia tristique. Nullam nec metus id mi dictum dignissim. Nullam quis wisi non sem lobortis condimentum. Phasellus pulvinar, nulla non aliquam eleifend, tortor wisi scelerisque felis, in sollicitudin arcu ante lacinia leo.

# 3

## This is the Third Chapter

### Contents

---

3.1 Architecture Design . . . . .	13
3.2 Architecture Design Requirements . . . . .	15

---



Donec gravida posuere arcu. Nulla facilisi. Phasellus imperdiet. Vestibulum at metus. Integer euismod. Nullam placerat rhoncus sapien. Ut euismod. Praesent libero. Morbi pellentesque libero sit amet ante. Maecenas tellus. Maecenas erat. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas.

### 3.1 Architecture Design

Example of a Flowchart for a system, in Figure 3.1, created with <https://app.diagrams.net> and then exported as “PDF” crop format (a true vector image that can be scaled to no end, with no pixels or distortion).

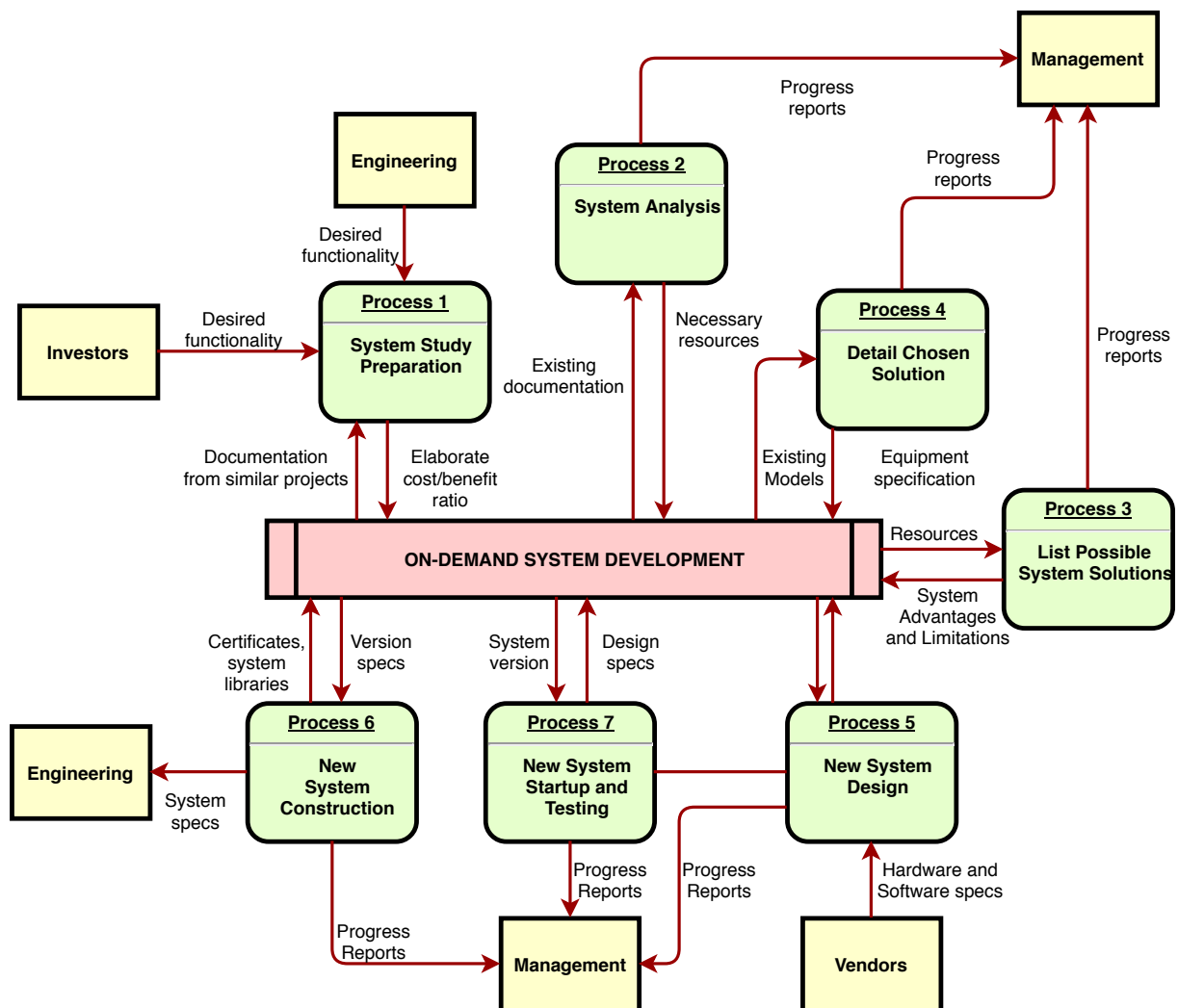


Figure 3.1: System Processes

Quisque facilisis erat a dui. Nam malesuada ornare dolor. Cras gravida, diam sit amet rhoncus

ornare, erat elit consectetur erat, id egestas pede nibh eget odio. Proin tincidunt, velit vel porta elementum, magna diam molestie sapien, non aliquet massa pede eu diam. Aliquam iaculis. Fusce et ipsum et nulla tristique facilisis. Donec eget sem sit amet ligula viverra gravida. Etiam vehicula urna vel turpis.

And here another diagram of a network (Figure 3.2) created with <https://app.diagrams.net> and then exported as “PDF” crop format.

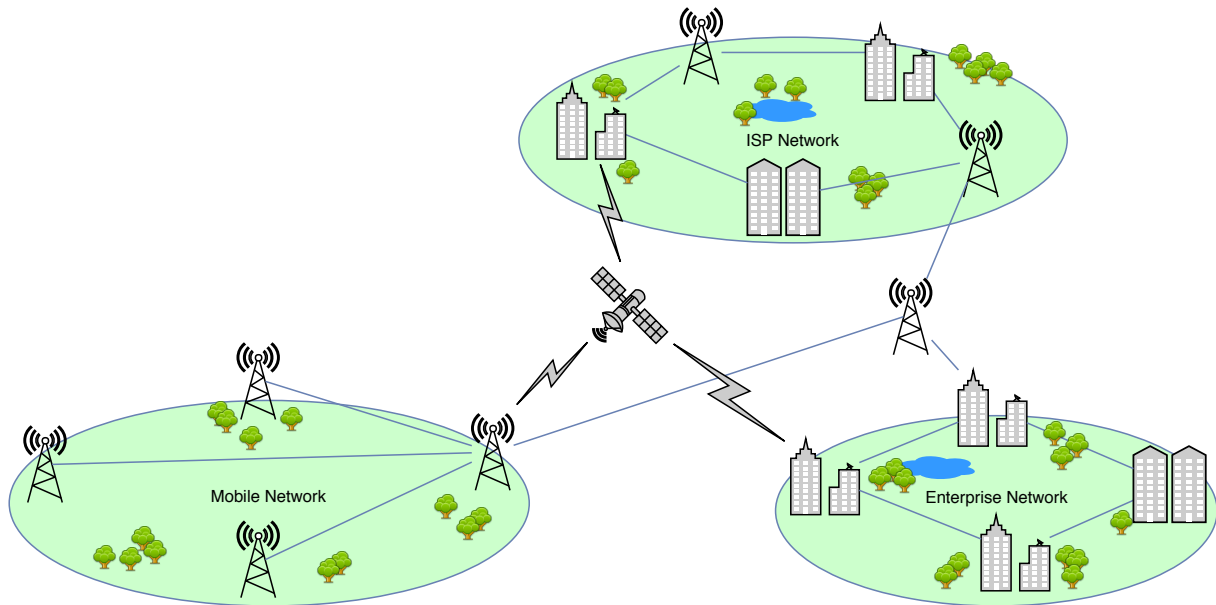


Figure 3.2: Network Diagram

Suspendisse sagittis ante a urna. Morbi a est quis orci consequat rutrum. Nullam egestas feugiat felis. Integer adipiscing semper ligula. Nunc molestie, nisl sit amet cursus convallis, sapien lectus pretium metus, vitae pretium enim wisi id lectus. Donec vestibulum. Etiam vel nibh. Nulla facilisi. Mauris pharetra. Donec augue. Fusce ultrices, neque id dignissim ultrices, tellus mauris dictum elit, vel lacinia enim metus eu nunc:

**Web-streaming:** The client application should support streaming media using Hypertext Transfer Protocol (HTTP) protocols.

**Multi-source streaming:** The client application should support multi-source streaming media, i.e., “simultaneous” streaming of media content components from a network, supported/complemented by Content Distribution Network (CDN)/Cloud Computing (CC) services.

**Support content Metadata Description:** The client application should support content metadata description in a format similar or compliant with MPEG Dynamic Adaptive Streaming over HTTP (DASH) [11].

**Scalable and Adaptive Media Contents:** The system should support on-demand streaming of scal-



able and adaptive contents based on SVC.

**Heterogenous End-User Devices:** The client application should be compatible with current and future generations of end-user devices form factors, irrespective of their performance, screen size and resolution.

**Access Network independency:** The solution should provide the expected service over different types of access networks supported by the end-user devices, such as Wireless Local Area Networks (LANs) (IEEE 802.11) or cellular data networks such as General Packet Radio Service (GPRS), Universal Mobile Telecommunication System (UMTS), Long Term Evolution (LTE), etc.

Cras gravida, diam sit amet rhoncus ornare, erat elit consectetur erat, id egestas pede nibh eget odio. Proin tincidunt, velit vel porta elementum, magna diam molestie sapien, non aliquet massa pede eu diam. Aliquam iaculis. Fusce et ipsum et nulla tristique facilisis.

## 3.2 Architecture Design Requirements

Ut nulla. Vivamus bibendum, nulla ut congue fringilla, lorem ipsum ultricies risus, ut rutrum velit tortor vel purus. In hac habitasse platea dictumst. Duis fermentum, metus sed congue gravida, arcu dui ornare urna, ut imperdiet enim odio dignissim ipsum. Nulla facilisi. Cras magna ante, bibendum sit amet, porta vitae, laoreet ut, justo. Nam tortor sapien, pulvinar nec, malesuada in, ultrices in, tortor. Cras ultricies placerat eros. Quisque odio eros, feugiat non, iaculis nec, lobortis sed, arcu. Pellentesque sit amet sem et purus pretium consectetur Listing 3.1.

**Listing 3.1:** Example of a MPD file.

```
1 <?xml version="1.0" encoding="UTF-8"? >
2 <StreamInfo version="2.0" >
3   <Clip duration="PT01M0.00S" >
4     <BaseURL>videos/</BaseURL>
5     <Description>svc_1</Description>
6     <Representation mimeType="video/SVC" codecs="svc" frameRate="30.00" bandwidth="401.90"
7       width="176" height="144" id="L0" >
8       <BaseURL>svc_1/</BaseURL>
9       <SegmentInfo from="0" to="11" duration="PT5.00S" >
10        <BaseURL>svc_1-L0-</BaseURL>
11      </SegmentInfo >
12    </Representation >
13    <Representation mimeType="video/SVC" codecs="svc" frameRate="30.00"
14      bandwidth="1322.60"
15      width="352" height="288" id="L1" >
16      <BaseURL>svc_1/</BaseURL>
17      <SegmentInfo from="0" to="11" duration="PT5.00S" >
18        <BaseURL>svc_1-L1-</BaseURL>
19      </SegmentInfo >
20    </Representation >
21  </Clip >
22 </StreamInfo >
```

RC  
A listing for  
XML code,  
with syntax  
highlighting

Nam malesuada ornare dolor. Cras gravida, diam sit amet rhoncus ornare, erat elit consectetur erat, id egestas pede nibh eget odio. Proin tincidunt, velit vel porta elementum, magna diam molestie sapien, non aliquet massa pede eu diam.



# 4

## This is the Fourth Chapter

### Contents

---

4.1 Development Process . . . . .	19
4.2 Development Environment . . . . .	20
4.3 Client Application . . . . .	20

---



Aliquam aliquet, est a ullamcorper condimentum, tellus nulla fringilla elit, a iaculis nulla turpis sed wisi. Fusce volutpat. Etiam sodales ante id nunc. Proin ornare dignissim lacus. Nunc porttitor nunc a sem. Sed sollicitudin velit eu magna. Aliquam erat volutpat. Vivamus ornare est non wisi. Proin vel quam. Vivamus egestas. Nunc tempor diam vehicula mauris. Nullam sapien eros, facilisis vel, eleifend non, auctor dapibus, pede.

## 4.1 Development Process

Suspendisse vestibulum dignissim quam. Integer vel augue. Phasellus nulla purus, interdum ac, venenatis non, varius rutrum, leo. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Duis a eros. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Fusce magna mi, porttitor quis, convallis eget, sodales ac, urna. Phasellus luctus venenatis magna. Vivamus eget lacus. Nunc tincidunt convallis tortor. Duis eros mi, dictum vel, fringilla sit amet, fermentum id, sem. Phasellus nunc enim, faucibus ut, laoreet in, consequat id, metus. Vivamus dignissim. Cras lobortis tempor velit. Phasellus nec diam ac nisl lacinia tristique. Nullam nec metus id mi dictum dignissim. Nullam quis wisi non sem lobortis condimentum. Phasellus pulvinar, nulla non aliquam eleifend, tortor wisi scelerisque felis, in sollicitudin arcu ante lacinia leo.:

- Technology Research and Related Works
- Requirements Gathering and Study
- Design of the Architecture
- Implementation Process
- Testing and Functional Validation

Pellentesque nibh felis, eleifend id, commodo in, interdum vitae, leo. Praesent eu elit. Ut eu ligula. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Maecenas elementum augue nec nisl. Proin auctor lorem at nibh. Curabitur nulla purus, feugiat id, elementum in, lobortis quis, pede. Vivamus sodales adipiscing sapien. Vestibulum posuere nulla eget wisi. Integer volutpat ligula eget enim. Suspendisse vitae arcu. Quisque pellentesque. Nullam consequat, sem vitae rhoncus tristique, mauris nulla fermentum est, bibendum ullamcorper sapien magna et quam. Sed dapibus vehicula odio. Proin bibendum gravida nisl. Fusce lorem. Phasellus sagittis, nulla in hendrerit laoreet, libero lacus feugiat urna, eget hendrerit pede magna vitae lorem. Praesent mauris.

## 4.2 Development Environment

Cras sed ante. Phasellus in massa. Curabitur dolor eros, gravida et, hendrerit ac, cursus non, massa.

RC  
Notice the  
reference  
to the Al-  
gorithm  
construct

Aliquam lorem. In hac habitasse platea dictumst. Cras eu mauris Algorithm 4.1. Quisque lacus. Donec ipsum. Nullam vitae sem at nunc pharetra ultricies. Vivamus elit eros, ullamcorper a, adipiscing sit amet, porttitor ut, nibh.

---

### Algorithm 4.1: Time Control Strategy

---

```
begin
  nextBitrate   nextDownloadLevel
  nextBitrate   GetNextBitrate()
  cpuLoad      GetCpuLoad()
  bitrateDelta  getBitrateDelta(currentBitrate; nextBitrate)
  if bitrateDelta > maxThreshold then
    | SetBitrate(nextBitrate)
  if minThreshold < bitrateDelta < maxThreshold and numAttempts < 2 then
    | numAttempts   numAttempts + 1
  else if minThreshold < bitrateDelta < maxThreshold and numAttempts = 2 then
    | numAttempts   0
  else
    | SetBitrate(nextBitrate)
  if 0 < bitrateDelta < minThreshold and numAttempts < 3 then
    | numAttempts   numAttempts + 1
  else if 0 < bitrateDelta < minThreshold and numAttempts = 3 then
    | SetBitrate(nextBitrate)
```

---

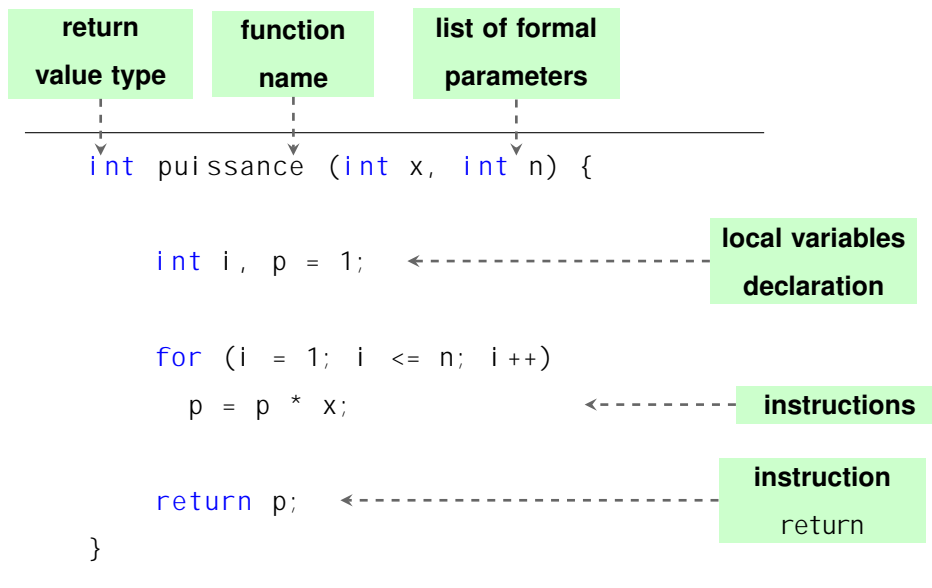
Maecenas adipiscing mollis massa. Nunc ut dui eget nulla venenatis aliquet. Sed luctus posuere justo. Cras vehicula varius turpis. Vivamus eros metus, tristique sit amet, molestie dignissim, malesuada et, urna..

## 4.3 Client Application

Cras sed ante. Phasellus in massa. Curabitur dolor eros, gravida et, hendrerit ac, cursus non, massa. Aliquam lorem. In hac habitasse platea dictumst. Cras eu mauris. Quisque lacus. Donec ipsum. Nullam vitae sem at nunc pharetra ultricies.

Vivamus elit eros, ullamcorper a, adipiscing sit amet, porttitor ut, nibh. Maecenas adipiscing mollis massa. Nunc ut dui eget nulla venenatis aliquet. Sed luctus posuere justo. Cras vehicula varius turpis. Vivamus eros metus, tristique sit amet, molestie dignissim, malesuada et, urna.

Quisque lacus. Donec ipsum. Nullam vitae sem at nunc pharetra ultricies. Cras vehicula varius turpis.



**Listing 4.1:** A listing with a Tikz picture overlaid

And here another method (Listing 4.1) for mixing (overlay) a picture with a listing of code.

### 4.3.1 User Interface

Donec semper turpis sed diam. Sed consequat ligula nec tortor. Integer eget sem. Ut vitae enim eu est vehicula gravida. Morbi ipsum ipsum, porta nec, tempor id, auctor vitae, purus. Pellentesque neque. Nulla luctus erat vitae libero. Integer nec enim. Phasellus aliquam enim et tortor. Quisque aliquet, quam elementum condimentum feugiat, tellus odio consectetur wisi, vel nonummy sem neque in elit. Curabitur eleifend wisi iaculis ipsum. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. In non velit non ligula laoreet ultrices. Praesent ultricies facilisis nisl. Vivamus luctus elit sit amet mi. Phasellus pellentesque, erat eget elementum volutpat, dolor nisl porta neque, vitae sodales ipsum nibh in ligula. Maecenas mattis pulvinar diam. Curabitur sed leo.

Cras eu mauris. Quisque lacus. Donec ipsum. Nullam vitae sem at nunc pharetra ultricies. Vivamus elit eros, ullamcorper a, adipiscing sit amet, porttitor ut, nibh. Maecenas adipiscing mollis massa. Nunc ut dui eget nulla venenatis aliquet. Sed luctus posuere justo. Cras vehicula varius turpis.

### 4.3.2 Vivamus luctus elit sit amet mi

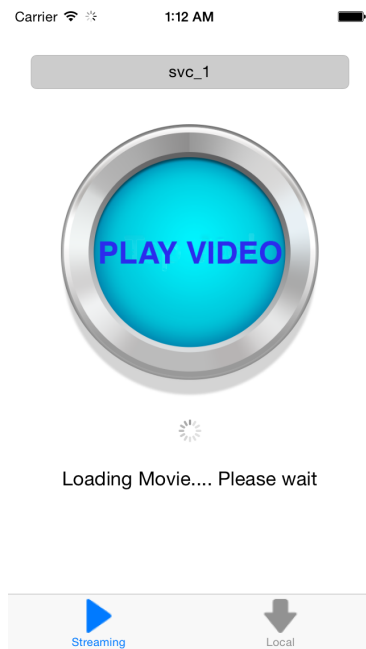
Nulla facilisi. In vel sem. Morbi id urna in diam dignissim feugiat. Proin molestie tortor eu velit. Aliquam erat volutpat. Nullam ultrices, diam tempus vulputate egestas, eros pede varius leo, sed imperdiet lectus est ornare odio. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Proin consectetur velit in dui. Phasellus wisi purus, interdum vitae, rutrum accumsan, viverra in, velit. Sed enim risus, congue non, tristique in, commodo eu, metus. Aenean tortor mi, imperdiet id, gravida eu, posuere eu, felis.

Mauris sollicitudin, turpis in hendrerit sodales, lectus ipsum pellentesque ligula, sit amet scelerisque

urna nibh ut arcu. Aliquam in lacus.

RC  
A figure  
with Subfig-  
ures

Figures 4.1(a) and 4.1(b) proin at eros non eros adipiscing mollis.



(a) Media Loading Window



(b) Play-out Session UI

**Figure 4.1:** Complete User Interface

Vestibulum ante ipsum primis in User Interface (UI) faucibus orci luctus et ultrices posuere cubilia Curae; Nulla placerat aliquam wisi. Mauris viverra odio. Quisque fermentum pulvinar odio. Proin posuere est vitae ligula. Etiam euismod. Cras a eros.



# 5

## This is the Fifth Chapter

### Contents

---

5.1	Maecenas vitae nulla consequat . . . . .	25
5.2	Proin ornare dignissim lacus . . . . .	26

---



Lorem ipsum dolor sit amet, consectetur adipiscing elit. Morbi commodo, ipsum sed pharetra gravida, orci magna rhoncus neque, id pulvinar odio lorem non turpis. Nullam sit amet enim. Suspendisse id velit vitae ligula volutpat condimentum. Aliquam erat volutpat. Sed quis velit. Nulla facilisi. Nulla libero. Vivamus pharetra posuere sapien. Nam consectetur. Sed aliquam, nunc eget euismod ullamcorper, lectus nunc ullamcorper orci, fermentum bibendum enim nibh eget ipsum. Donec porttitor ligula eu dolor. Maecenas vitae nulla consequat libero cursus venenatis. Nam magna enim, accumsan eu, blandit sed, blandit a, eros.

## 5.1 Maecenas vitae nulla consequat

Aliquam aliquet, est a ullamcorper condimentum, tellus nulla fringilla elit, a iaculis nulla turpis sed wisi. Fusce volutpat. Etiam sodales ante id nunc. Proin ornare dignissim lacus. Nunc porttitor nunc a sem. Sed sollicitudin velit eu magna. Aliquam erat volutpat. Vivamus ornare est non wisi. Proin vel quam. Vivamus egestas. Nunc tempor diam vehicula mauris. Nullam sapien eros Figure 5.1, facilisis vel, eleifend non, auctor dapibus, pede.

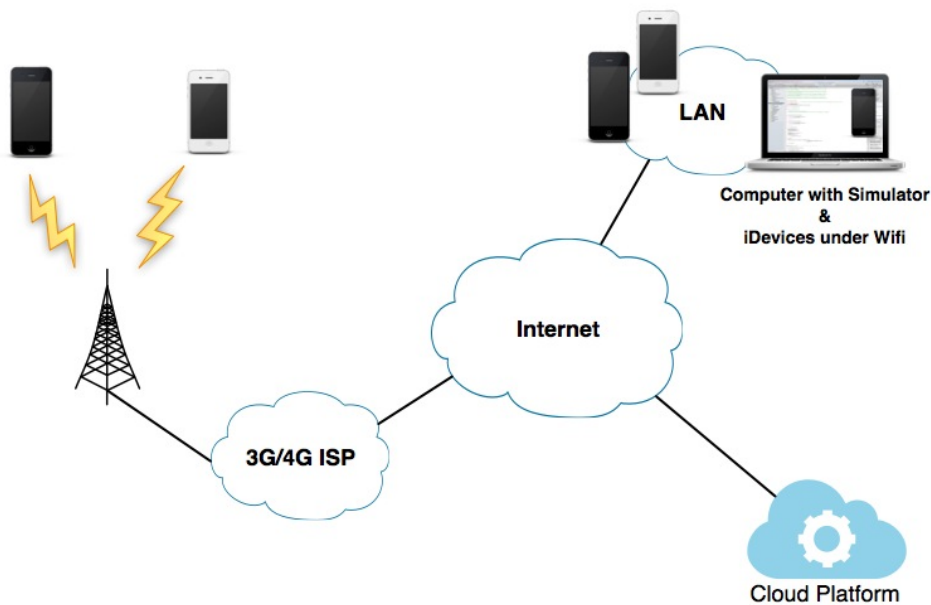


Figure 5.1: Test Environment

Aliquam aliquet, est a ullamcorper condimentum, tellus nulla fringilla elit, a iaculis nulla turpis sed wisi. Fusce volutpat. Etiam sodales ante id nunc. Proin ornare dignissim lacus. Nunc porttitor nunc a sem. Sed sollicitudin velit eu magna. Aliquam erat volutpat. Vivamus egestas. Nunc tempor diam vehicula mauris. Nullam sapien eros, facilisis vel, eleifend non, auctor dapibus, pede Table 5.1 used in the tests. The Network Link Conditioner allows to force/simulate fluctuations in fixed network segments.

**Table 5.1:** Network Link Conditioner Profiles

Network Profile	Bandwidth	Packets Dropped	Delay
Wifi	40 mbps	0%	1 ms
3G	780 kbps	0%	100 ms
Edge	240 kbps	0%	400 ms

Aliquam aliquet, est a ullamcorper condimentum, tellus nulla fringilla elit, a iaculis nulla turpis sed wisi. Fusce volutpat. Etiam sodales ante id nunc. Proin ornare dignissim lacus. Nunc porttitor nunc a sem. Sed sollicitudin velit eu magna. Aliquam erat volutpat. Vivamus ornare est non wisi. Proin vel quam. Vivamus egestas. Nunc tempor diam vehicula mauris. Nullam sapien eros, facilisis vel, eleifend non, auctor dapibus, pede.

## 5.2 Proin ornare dignissim lacus

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. Aenean ultricies mi vitae est. Mauris placerat eleifend leo. Quisque sit amet est et sapien ullamcorper pharetra. Vestibulum erat wisi, condimentum sed, commodo vitae, ornare sit amet, wisi. Aenean fermentum, elit eget tincidunt condimentum, eros ipsum rutrum orci, sagittis tempus lacus enim ac dui. Donec non enim in turpis pulvinar facilisis. Ut felis.

Et “optimistic” nulla dui purus, eleifend vel, consequat non, dictum porta, nulla. Duis ante mi, laoreet ut, commodo eleifend, cursus nec, lorem. Aenean eu est. Etiam imperdiet turpis. Praesent nec augue. Curabitur ligula quam, rutrum id, tempor sed, consequat ac, dui  $G_j$ , nec ligula et lorem consequat ullamcorper  $p$  ut mauris eu mi mollis luctus  $j$ , porttitor ut, Equation (5.1), uctus posuere justo:

$N_j$  Is the number of times peer  $j$  has been optimistically unchoked.

$n_j$  Among the  $N_j$  unchokes, the number of times that peer  $j$  responded with unchoke or supplied segments to peer  $p$ .

$C_{r[j]}$  The cooperation ratio of peer  $j$ . If peer  $j$  never supplied peer  $p$ , the information of  $C_{r[j]}$  may not be available.

$C_{r(max)}$  The maximum cooperation ratio of peer  $p$ 's neighbors, i.e.,  $C_{r(max)} = \max(C_r)$ .

$$G_j = \begin{cases} \frac{n_j C_{r[j]}}{N_j} & \text{if } n_j > 0 \\ \frac{C_{r(max)}}{N_j + 1} & \text{if } n_j = 0 \end{cases} \quad (5.1)$$

Cursus  $C_{r(max)}$  conubia nostra, per inceptos hymenaeos  $j$  gadipiscing mollis massa  $N_j = 0$ , unc ut dui eget nulla venenatis aliquet  $G_j = C_{r(max)}$ .

Vestibulum accumsan eros nec magna. Vestibulum vitae dui. Vestibulum nec ligula et lorem consequat ullamcorper. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Phasellus eget nisl ut elit porta ullamcorper. Maecenas tincidunt velit quis orci. Sed in dui. Nullam ut mauris eu mi mollis luctus. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Sed cursus cursus velit. Sed a massa.

Both Figures 5.2(a) and 5.2(b) Phasellus eget nisl ut elit porta “perfect” tincidunt. Class aptent taciti sociosqu ad litora torquent per conubia nostra.

(a) Adaptation System Test 4

(b) Adaptation System Test 5

Figure 5.2: Adaptation System Behavior Test

Cras sed ante. Phasellus in massa. Curabitur dolor eros, gravida et, hendrerit ac, cursus non, massa. Aliquam lorem. In hac habitasse platea dictumst. Cras eu mauris. Quisque lacus. Donec ipsum. Nullam vitae sem at nunc pharetra ultricies. Vivamus elit eros, ullamcorper a, adipiscing sit amet, porttitor ut, nibh. Maecenas adipiscing mollis massa. Nunc ut dui eget nulla venenatis aliquet. Sed luctus posuere justo. Cras vehicula varius turpis. Vivamus eros metus, tristique sit amet, molestie dignissim, malesuada et, urna.



# 6

## Conclusion

### Contents

---

6.1	Conclusions . . . . .	31
6.2	System Limitations and Future Work . . . . .	32

---





Pellentesque vel dui sed orci faucibus iaculis. Suspendisse dictum magna id purus tincidunt rutrum. Nulla congue. Vivamus sit amet lorem posuere dui vulputate ornare. Phasellus mattis sollicitudin ligula. Duis dignissim felis et urna. Integer adipiscing congue metus.

Rui Cruz  
You should  
always  
start a  
Chapter  
with an in-  
troduitory  
text

## 6.1 Conclusions

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Morbi commodo, ipsum sed pharetra gravida, orci magna rhoncus neque, id pulvinar odio lorem non turpis. Nullam sit amet enim. Suspendisse id velit vitae ligula volutpat condimentum. Aliquam erat volutpat. Sed quis velit. Nulla facilisi. Nulla libero. Vivamus pharetra posuere sapien. Nam consectetur. Sed aliquam, nunc eget euismod ullamcorper, lectus nunc ullamcorper orci, fermentum bibendum enim nibh eget ipsum. Donec porttitor ligula eu dolor. Maecenas vitae nulla consequat libero cursus venenatis. Nam magna enim, accumsan eu, blandit sed, blandit a, eros.

Quisque facilisis erat a dui. Nam malesuada ornare dolor. Cras gravida, diam sit amet rhoncus ornare, erat elit consectetur erat, id egestas pede nibh eget odio. Proin tincidunt, velit vel porta elementum, magna diam molestie sapien, non aliquet massa pede eu diam. Aliquam iaculis. Fusce et ipsum et nulla tristique facilisis. Donec eget sem sit amet ligula viverra gravida. Etiam vehicula urna vel turpis. Suspendisse sagittis ante a urna. Morbi a est quis orci consequat rutrum. Nullam egestas feugiat felis. Integer adipiscing semper ligula. Nunc molestie, nisl sit amet cursus convallis, sapien lectus pretium metus, vitae pretium enim wisi id lectus. Donec vestibulum. Etiam vel nibh. Nulla facilisi. Mauris pharetra. Donec augue. Fusce ultrices, neque id dignissim ultrices, tellus mauris dictum elit, vel lacinia enim metus eu nunc.

Proin at eros non eros adipiscing mollis. Donec semper turpis sed diam. Sed consequat ligula nec tortor. Integer eget sem. Ut vitae enim eu est vehicula gravida. Morbi ipsum ipsum, porta nec, tempor id, auctor vitae, purus. Pellentesque neque. Nulla luctus erat vitae libero. Integer nec enim. Phasellus aliquam enim et tortor. Quisque aliquet, quam elementum condimentum feugiat, tellus odio consectetur wisi, vel nonummy sem neque in elit. Curabitur eleifend wisi iaculis ipsum. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. In non velit non ligula laoreet ultrices. Praesent ultricies facilisis nisl. Vivamus luctus elit sit amet mi. Phasellus pellentesque, erat eget elementum volutpat, dolor nisl porta neque, vitae sodales ipsum nibh in ligula. Maecenas mattis pulvinar diam. Curabitur sed leo.

Nulla facilisi. In vel sem. Morbi id urna in diam dignissim feugiat. Proin molestie tortor eu velit. Aliquam erat volutpat. Nullam ultrices, diam tempus vulputate egestas, eros pede varius leo, sed imperdiet lectus est ornare odio. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Proin consectetur velit in dui. Phasellus wisi purus, interdum vitae, rutrum accumsan, viverra in, velit. Sed enim risus, congue

non, tristisque in, commodo eu, metus. Aenean tortor mi, imperdiet id, gravida eu, posuere eu, felis. Mauris sollicitudin, turpis in hendrerit sodales, lectus ipsum pellentesque ligula, sit amet scelerisque urna nibh ut arcu. Aliquam in lacus. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Nulla placerat aliquam wisi. Mauris viverra odio. Quisque fermentum pulvinar odio. Proin posuere est vitae ligula. Etiam euismod. Cras a eros.

Nunc auctor bibendum eros. Maecenas porta accumsan mauris. Etiam enim enim, elementum sed, bibendum quis, rhoncus non, metus. Fusce neque dolor, adipiscing sed, consectetur et, lacinia sit amet, quam.

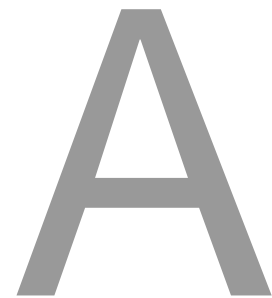
## 6.2 System Limitations and Future Work

Aliquam aliquet, est a ullamcorper condimentum, tellus nulla fringilla elit, a iaculis nulla turpis sed wisi. Fusce volutpat. Etiam sodales ante id nunc. Proin ornare dignissim lacus. Nunc porttitor nunc a sem. Sed sollicitudin velit eu magna. Aliquam erat volutpat. Vivamus ornare est non wisi. Proin vel quam. Vivamus egestas. Nunc tempor diam vehicula mauris. Nullam sapien eros, facilisis vel, eleifend non, auctor dapibus, pede.

# Bibliography

- [1] Apple, HTTP Live Streaming Overview, Apple Inc., 1 Infinite Loop, Cupertino, CA 95014, 408-996-1010 U.S., 2011. [Online]. Available: <https://developer.apple.com/library/ios/documentation/networkinginternet/conceptual/streamingmediaguide/StreamingMediaGuide.pdf>
- [2] Adobe HTTP Dynamic Streaming. [Online]. Available: <http://www.adobe.com/products/hds-dynamic-streaming.html>
- [3] Z. Alex. ISS Smooth Streaming Technical Overview. [Online]. Available: <http://download.microsoft.com/download/4/2/4/4247C3AA-7105-4764-A8F9-321CB6C765EB/IIS.Smooth.Streaming.Technical.Overview.pdf>
- [4] Fraunhofer Heinrich-Hertz-Institute, "SVC: Scalable Extension of H.264/AVC," 2013. [Online]. Available: <http://www.hhi.fraunhofer.de/de/kompetenzfelder/image-processing/research-groups/image-video-coding/scalable-video-coding/svc-scalable-extension-of-h264avc.html>
- [5] ISO/IEC, "Information technology – Coding of audio-visual objects – Part 10: Advanced Video Coding," International Organization for Standardization/International Electrotechnical Commission, International Standard ISO/IEC 14496-10:2012, Oct. 2012.
- [6] B. MacAulay, A. Felts and Y. Fisher, "IP Streaming of MPEG-4 Native RTP vs MPEG-2 Transport Stream," WHITEPAPER, October 2005. [Online]. Available: <http://www.envivio.com/les/white-papers/RTPvsTS-v4.pdf>
- [7] H. Schwarz, D. Marpe, and T. Wiegand, "Overview of the Scalable Video Coding Extension of the H.264/AVC Standard," Circuits and Systems for Video Technology, IEEE Transactions on, vol. 17, no. 9, pp. 1103–1120, 2007.
- [8] J. Bankoski, J. Salonen, P. Wilins, and Y. Xu, "VP8 Data Format and Decoding Guide," RFC 6386, IETF, RFC 6386, November 2011. [Online]. Available: <http://tools.ietf.org/html/rfc6386>
- [9] Y.-H. Chiang, P. Huang, and H. Chen, "SVC or MDC? That's the question," in Embedded Systems for Real-Time Multimedia (ESTIMedia), 2011 9th IEEE Symposium on, 2011, pp. 76–82.

- [10] P. Moscoso, "Interactive Internet TV Architecture Based on Scalable Video Coding," Master's thesis, Instituto Superior Técnico, May 2011.
- [11] ISO/IEC, "Information technology – Dynamic adaptive streaming over HTTP (DASH) – Part 1: Media presentation description and segment formats," International Organization for Standardization/International Electrotechnical Commission, International Standard ISO/IEC FCD 23009-1:2012, Apr. 2012.



## Code of Project

Nulla dui purus, eleifend vel, consequat non, dictum porta, nulla. Duis ante mi, laoreet ut, commodo eleifend, cursus nec, lorem. Aenean eu est. Etiam imperdiet turpis. Praesent nec augue. Curabitur ligula quam, rutrum id, tempor sed, consequat ac, dui. Vestibulum accumsan eros nec magna. Vestibulum vitae dui. Vestibulum nec ligula et lorem consequat ullamcorper.

Listing A.1: Example of a XML le.

---

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 < StreamInfo version="2.0">
3   < Clip duration="PT01M0.00S">
4     < BaseURL> videos/</BaseURL>
5     < Description> svc_1</Description>
6     < Representation mimeType="video/SVC" codecs="svc" frameRate="30.00" bandwidth="401.90"
7       width="176" height="144" id="L0">
8       < BaseURL> svc_1/</BaseURL>
9       < SegmentInfo from="0" to="11" duration="PT5.00S">
```

```

10         <BaseURL> svc_1-L0-</BaseURL>
11     </SegmentInfo>
12 </Representation>
13 <Representation mimeType="video/SVC" codecs="svc" frameRate="30.00" bandwidth="1322.60"
14     width="352" height="288" id="L1">
15     <BaseURL> svc_1/</BaseURL>
16     <SegmentInfo from="0" to="11" duration="PT5.00S">
17         <BaseURL> svc_1-L1-</BaseURL>
18     </SegmentInfo>
19 </Representation>
20 </Clip>
21 </StreamInfo>

```

Etiam imperdiet turpis. Praesent nec augue. Curabitur ligula quam, rutrum id, tempor sed, consequat ac, dui. Maecenas tincidunt velit quis orci. Sed in dui. Nullam ut mauris eu mi mollis luctus. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Sed cursus cursus velit. Sed a massa. Duis dignissim euismod quam.

Listing A.2: Assembler Main Code.

```

1  . *****
2  . * Constantes
3  . *****
4  .
5  ON     EQU 1 ; contagem ligada
6  OFF   EQU 0 ; contagem desligada
7  INPUT EQU 8000H ; endereco do porto de entrada
8        ;(bit 0 = RTC; bit 1 = botao)
9  OUTPUT EQU 8000H ; endereco do porto de sada.
10 .
11 . *****
12 . * Stack
13 . *****
14 .
15 .
16 PLACE 1000H
17 pilha: TABLE 100H ; espaco reservado para a pilha
18 fim_pilha:
19 . *****
20 .
21 .
22 PLACE 2000H
23 .
24 ; Tabela de vectores de interrupcao
25 .
26 tab: WORD rot0
27 . *****
28 .
29 . * Programa Principal
30 . *****
31 .
32 PLACE 0
33 .
34 inicio:
35 MOV BTE, tab ; inicializa BTE
36 MOV R9, INPUT ; endereco do porto de entrada
37 MOV R10, OUTPUT ; endereco do porto dsada
38 MOV SP, fim_pilha
39 MOV R5, 1 ; inicializa estado do processo P1
40 MOV R6, 1 ; inicializa estado do processo P2
41 MOV R4, OFF ; inicializa controle de RTC
42 MOV R8, 0 ; inicializa contador
43 MOV R7, OFF ; inicialmente nao permite contagem
44 EIO ; permite interrupcoes tipo 0

```

```

45 EI ; activa interrupções
46
47 ciclo:
48 CALL P1 ; invoca processo P1
49 CALL P2 ; invoca processo P2
50 JMP ciclo ; repete ciclo
51
52 ; *****
53 ; * ROTINAS
54 ; *****
55 ;
56 P1:
57 CMP R5, 1 ; se estado = 1
58 JZ P1_1
59 CMP R5, 2 ; se estado = 2
60 JZ P1_2
61 sai_P1:
62 RET ; sai do processo.
63
64
65 P1_1:
66 MOVB R0, [R9] ; lê porto de entrada
67 BIT R0, 1
68 JZ sai_P1 ; se botao nao carregado, sai do processo
69 MOV R7, ON ; permite contagem do display
70 MOV R5, 2 ; passa ao estado 2 do P1
71 JMP sai_P1
72
73 P1_2:
74 MOVB R0, [R9] ; lê porto de entrada
75 BIT R0, 1
76 JNZ sai_P1 ; se botao continua carregado, sai do processo
77 MOV R7, OFF ; caso contrario, desliga contagem do display
78 MOV R5, 1 ; passa ao estado 1 do P1
79 JMP sai_P1

```

Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Phasellus eget nisl ut elit porta ullamcorper. Maecenas tincidunt velit quis orci. Sed in dui. Nullam ut mauris eu mi mollis luctus. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos.

This inline MATLAB code `for i=1:3, disp( cool ); end;` uses the `\mcode{}` command.<sup>1</sup>

Nullam ut mauris eu mi mollis luctus. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Sed cursus cursus velit. Sed a massa. Duis dignissim euismod quam. Nullam euismod metus ut orci.

Listing A.3: Matlab Function

```

1 for i = 1:3
2     if i >= 5 && a ~= b % literate programming replacement
3         disp( cool ); % comment with some LATEX in it: x2
4     end
5     [:,ind] = max(vec);
6     x_last = x(1,end) - 1;
7     v(end);
8     ylabel( Voltage ( V) );
9 end

```

<sup>1</sup>MATLAB Works also in footnotes: `for i=1:3, disp( cool ); end;`

Nullam ut mauris eu mi mollis luctus. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Sed cursus cursus velit. Sed a massa. Duis dignissim euismod quam. Nullam euismod metus ut orci.

Listing A.4: function.m

```
1 % Copyright 2010 The MathWorks, Inc.
2 function ObjTrack(position)
3 % #codegen
4 % First, setup the figure
5 numPts = 300;           % Process and plot 300 samples
6 figure;hold;grid;      % Prepare plot window
7 % Main loop
8 for idx = 1: numPts
9     z = position(:,idx); % Get the input data
10    y = kalmanfilter(z); % Call Kalman filter to estimate the position
11    plot _trajectory(z,y); % Plot the results
12 end
13 hold;
14 end % of the function
```

Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Phasellus eget nisl ut elit porta ullamcorper. Maecenas tincidunt velit quis orci. Sed in dui. Nullam ut mauris eu mi mollis luctus. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Sed cursus cursus velit. Sed a massa. Duis dignissim euismod quam. Nullam euismod metus ut orci. Vestibulum erat libero, scelerisque et, porttitor et, varius a, leo.

Listing A.5: HTML with CSS Code

```
1 <!DOCTYPE html>
2 <html>
3   <head>
4     <title>Listings Style Test</title>
5     <meta charset="UTF-8">
6     <style>
7       /* CSS Test */
8       * {
9         padding: 0;
10        border: 0;
```



```

11     margin: 0;
12   }
13 </style>
14   <link rel="stylesheet" href="css/style.css" />
15 </head>
16 <header> hey </header>
17 <article> this is a article </article>
18 <body>
19   <!-- Paragraphs are fine -->
20   <div id="box">
21     <p>
22       Hello World
23     </p>
24     <p>Hello World</p>
25     <p id="test">Hello World</p>
26     <p></p>
27   </div>
28   <div>Test</div>
29   <!-- HTML script is not consistent -->
30   <script src="js/benchmark.js"></script>
31   <script>
32     function createSquare(x, y) {
33       // This is a comment.
34       var square = document.createElement( ' div ' );
35       square.style.width = square.style.height = ' 50px ' ;
36       square.style.backgroundColor = ' blue ' ;
37
38       /*
39        * This is another comment.
40        */
41       square.style.position = ' absolute ' ;
42       square.style.left = x + ' px ' ;
43       square.style.top = y + ' px ' ;
44
45       var body = document.getElementsByTagName( ' body ' )[0];
46       body.appendChild(square);
47     };
48

```

```

49     // Please take a look at +=
50     window.addEventListener('mousedown', function(event) {
51         // German umlaut test: Berührungspunkt ermitteln
52         var x = event.touches[0].pageX;
53         var y = event.touches[0].pageY;
54         var lookAtThis += 1;
55     });
56 </script>
57 </body>
58 </html >

```

Nulla dui purus, eleifend vel, consequat non, dictum porta, nulla. Duis ante mi, laoreet ut, commodo eleifend, cursus nec, lorem. Aenean eu est. Etiam imperdiet turpis. Praesent nec augue. Curabitur ligula quam, rutrum id, tempor sed, consequat ac, dui. Vestibulum accumsan eros nec magna. Vestibulum vitae dui. Vestibulum nec ligula et lorem consequat ullamcorper.

**Listing A.6:** HTML CSS Javascript Code

```

1
2 @media only screen and (min-width: 768px) and (max-width: 991px) {
3
4     #main {
5         width: 712px;
6         padding: 100px 28px 120px;
7     }
8
9     /* .mono {
10         font-size: 90%;
11     } */
12
13     .cssbtn a {
14         margin-top: 10px;
15         margin-bottom: 10px;
16         width: 60px;
17         height: 60px;
18         font-size: 28px;
19         line-height: 62px;
20     }

```

Nulla dui purus, eleifend vel, consequat non, dictum porta, nulla. Duis ante mi, laoreet ut, commodo eleifend, cursus nec, lorem. Aenean eu est. Etiam imperdiet turpis. Praesent nec augue. Curabitur ligula quam, rutrum id, tempor sed, consequat ac, dui. Vestibulum accumsan eros nec magna. Vestibulum vitae dui. Vestibulum nec ligula et lorem consequat ullamcorper.

**Listing A.7:** PYTHON Code

```
1 class TelegramRequestHandler(object):
2     def handle(self):
3         addr = self.client_address[0]           # Client IP-address
4         telegram = self.request.recv(1024)     # Recieve telegram
5         print "From: %s, Received: %s" % (addr, telegram)
6         return
```





## A Large Table

Aliquam et nisl vel ligula consetetur suscipit. Morbi euismod enim eget neque. Donec sagittis massa. Vestibulum quis augue sit amet ipsum laoreet pretium. Nulla facilisi. Duis tincidunt, felis et luctus placerat, ipsum libero vestibulum sem, vitae elementum wisi ipsum a metus. Nulla a enim sed dui hendrerit lobortis. Donec lacinia vulputate magna. Vivamus suscipit lectus at quam. In lectus est, viverra a, ultricies ut, pulvinar vitae, tellus. Donec et lectus et sem rutrum sodales. Morbi cursus. Aliquam a odio. Sed tortor velit, convallis eget, porta interdum, convallis sed, tortor. Phasellus ac libero a lorem auctor mattis. Lorem ipsum dolor sit amet, consetetur adipiscing elit.

Nunc auctor bibendum eros. Maecenas porta accumsan mauris. Etiam enim enim, elementum sed, bibendum quis, rhoncus non, metus. Fusce neque dolor, adipiscing sed, consetetur et, lacinia sit amet, quam. Suspendisse wisi quam, consetetur in, blandit sed, suscipit eu, eros. Etiam ligula enim, tempor ut, blandit nec, mollis eu, lectus. Nam cursus. Vivamus iaculis. Aenean risus purus, pharetra in, blandit quis, gravida a, turpis. Donec nisl. Aenean eget mi. Fusce mattis est id diam. Phasellus faucibus interdum sapien. Duis quis nunc. Sed enim. Nunc auctor bibendum eros. Maecenas porta accumsan mauris. Etiam enim enim, elementum sed, bibendum quis, rhoncus non, metus. Fusce neque dolor, adipiscing sed, consetetur et, lacinia sit amet, quam.

**Table B.1:** Example table

Benchmark: ANN	<b>#Layers</b> (1)	<b>#Nets</b> (2)	<b>#Nodes*</b> (3) = 8 · (1) · (2)	<b>Critical path</b> (4) = 4 · (1)	<b>Latency</b> ( $T_{iter}$ ) (5)
A1	<b>3–1501</b>	1	<b>24–12008</b>	<b>12–6004</b>	4
A2	501	1	4008	2004	<b>2–2000</b>
A3	10	<b>2–1024</b>	<b>160–81920</b>	40	60 <sup>†</sup>
A4	10	50	4000	40	<b>80–1200</b>
Benchmark: FFT	<b>FFT size<sup>‡</sup></b> (1)	<b>#Inputs</b> (2) = 2 <sup>(1)</sup>	<b>#Nodes*</b> (3) = 10 · (1) · (2)	<b>Critical path</b> (4) = 4 · (1)	<b>Latency</b> ( $T_{iter}$ ) (5)
F1	<b>1–10</b>	2–1024	<b>20–102400</b>	4–40	6–60 <sup>†</sup>
F2	<b>5</b>	32	1600	20	<b>40 – 1500</b>
Benchmark: Random networks	<b>#Types</b> (1)	<b>#Nodes</b> (2)	<b>#Networks</b> (3)	<b>Critical path</b> (4)	<b>Latency</b> ( $T_{iter}$ ) (5)
R1	3	10–2000	500	<i>variable</i>	(4)
R2	3	50	500	<i>variable</i>	(4) × [1; ... ; 20]

\* Excluding constant nodes.

<sup>†</sup> Value kept proportional to the critical path: (5) = (4) · 1.5.

<sup>‡</sup> A size of  $x$  corresponds to a  $2^x$  point FFT.

Values in bold indicate the parameter being varied.

As Table B.1 shows, the data can be inserted from a file, in the case of a somehow complex structure. Notice the Table footnotes.

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Morbi commodo, ipsum sed pharetra gravida, orci magna rhoncus neque, id pulvinar odio lorem non turpis. Nullam sit amet enim. Suspendisse id velit vitae ligula volutpat condimentum. Aliquam erat volutpat. Sed quis velit. Nulla facilisi. Nulla libero. Vivamus pharetra posuere sapien. Nam consectetur. Sed aliquam, nunc eget euismod ullamcorper, lectus nunc ullamcorper orci, fermentum bibendum enim nibh eget ipsum. Donec porttitor ligula eu dolor. Maecenas vitae nulla consequat libero cursus venenatis. Nam magna enim, accumsan eu, blandit sed, blandit a, eros.

And now an example (Table B.2) of a table that extends to more than one page. Notice the repetition of the Caption (with indication that is continued) and of the Header, as well as the continuation text at the bottom.

**Table B.2:** Example of a very long table spreading in several pages

Time (s)	Triple chosen	Other feasible triples
0	(1, 11, 13725)	(1, 12, 10980), (1, 13, 8235), (2, 2, 0), (3, 1, 0)
2745	(1, 12, 10980)	(1, 13, 8235), (2, 2, 0), (2, 3, 0), (3, 1, 0)
5490	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
8235	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
Continued on next page		

**Table B.2 – continued from previous page**

<b>Time (s)</b>	<b>Triple chosen</b>	<b>Other feasible triples</b>
10980	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
13725	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
16470	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
19215	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
21960	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
24705	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
27450	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
30195	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
32940	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
35685	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
38430	(1, 13, 10980)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
41175	(1, 12, 13725)	(1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
43920	(1, 13, 10980)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
46665	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
49410	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
52155	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
54900	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
57645	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
60390	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
63135	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
65880	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
68625	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
71370	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
74115	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
76860	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
79605	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
82350	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
85095	(1, 12, 13725)	(1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
87840	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
90585	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
93330	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
96075	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
98820	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
101565	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
104310	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
107055	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
109800	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
112545	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
115290	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
118035	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
120780	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
123525	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
126270	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
129015	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
131760	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
134505	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
137250	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
139995	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
142740	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
145485	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)

Continued on next page

**Table B.2 – continued from previous page**

Time (s)	Triple chosen	Other feasible triples
148230	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
150975	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
153720	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
156465	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
159210	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
161955	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
164700	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)

An example of a large Table that autofits the size to the page margins is illustrated in Table B.3. Please notice the text size that is shrunken in order for the table to adjust to the page:

**Table B.3: Sample Table.**

URL	First Time Visit	Last Time Visit	URL Counts	Value	Reference
https://web.facebook.com/	1521241972	1522351859	177	56640	[facebook-2021]
http://localhost/phpmyadmin/	1518413861	1522075694	24	39312	database-management
https://mail.google.com/mail/u/	1516596003	1522352010	36	33264	Google-Gmail-2021
https://github.com/shawon100	1517215489	1522352266	37	27528	Code-Repository
https://www.youtube.com/	1517229227	1521978502	24	14792	Youtube-video-2021



