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Cost Estimation

Prepared for

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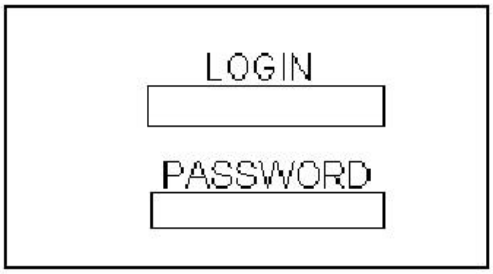
Introduction

This is the first report in the Software Economics, DAD408 and Organisationsprocesser och informationssystem, EFE309 given at the University of Karlskrona/Ronneby. The authors of this report have different backgrounds. The authors are business administration and software engineering students.

The report assignment is to create cost estimations for an internet portal. The size estimations and cost estimations are derived from the requirements specification. Two different estimations are done. The first estimation is done with a COCOMO software tool and the other estimation is done with help of TIC templates described in [Wel92]. Assumptions and pitfalls for the estimations are described.

Description of Internet Portal

THE #1 NEWS AGENCY is the corporate name. Next to the company name are the commercial advertisements (ads). The news agency has six different newsgroups: computer, economy, entertainment, sports, weather and world news. Each news will last for 24 hours and will then be transferred into the filing system, where the reader can search for old articles. In the center of the first page there are headline news that cover the most important news in each area. The commercial advertisements will totally finance this portal.



The company has reporters all over the world, who is covering the news. They report them into a specific web page, where they also edit them. That requires high demands of every reporter employed by the company, because they are themselves responsible for the end result. When the reporters think they are ready, they submit the news to the portal's database. This, in it self, is very cost effective because the number of editors is kept to a minimum. The only editor required, as far as we can see, is the editor for the first page.

We realize that a portal should, probably, cover more than just news but we believe that this would make this assignment too extensive. The number of pages for every news group is kept to a minimum due to the requirements of speed.

Requirements for the Internet Portal

By studying different internet portals we have come up with the functional and non-functional requirements described in the sections below.

Functional Requirements

News Input

NEWSINPUT.LOGIN	
Description:	A reporter should be able to login with username and password on a web page.
Purpose:	The reporter should be able to login and write a news story wherever in the world s/he is.

NEWSINPUT.WRITE	
Description:	A reporter should be able to write a news article and publish it (store it in a database) online on a web page.
Purpose:	The reporter should be able to write a news article wherever in the world s/he is.

NEWSINPUT.SUBMITT	
Description:	The news written by the reporter should be submittal to the news database.
Purpose:	The news article should be submitted and inputted into the news database over the internet.

News Output

NEWSOUTPUT.AUTOMATICALLY	
Description:	The list of news should be automatically retrieved form the database and shown.
Purpose:	This is to make the internet portal flexible and automated as much as possible.

NEWSOUTPUT.LISTS	
Description:	There should be a list of recent and old news.
Purpose:	News that was published the last 24 hours is recent news. The other news is old.

NEWSOUTPUT.LISTNING	
Description:	The portal should be able to list recent or old news.
Purpose:	News should be listed so that the reader can easily choose which news s/he wants to read.

NEWSOUTPUT.NEWS	
Description:	Specific listed news should be able to be shown for the reader.
Purpose:	News should be listed so that the reader can easily choose which news s/he wants to read.

AD

AD.AUTOMATICALLY	
Description:	The appropriate ads should be automatically retrieved form the database and published.
Purpose:	This is to make the internet portal flexible and automated as much as possible.

AD.PUBLISHING	
Description:	Ads of various sizes should be published together with the news on the internet portal.
Purpose:	The portal will be financed by the ads. Various sizes of the ads will be supported due to different needs for advertisements.

AD.RANDOMIZE	
Description:	The ads should be published according to their publishing time and type of ad. The ads should be randomized each time a new web page is loaded.
Purpose:	The publishing time should be evenly distributed across time depending on how much the advertising company has paid.

Non-Functional Requirements

INTERNET_PORTAL.SWEDISH	
Description:	The internet portal should be in Swedish.
Purpose:	The portal should serve Swedish people.

NEWSOUTPUT.NEWS.RELIABILITY	
Description:	The news published should be from a reliable source.
Purpose:	The reader should not distrust the published news on the internet portal.

NEWSOUTPUT.FAST	
Description:	The list of news and the news should be published fast.
Purpose:	The reader should not have to wait noticeable long time for the server to generate the list of news or a single news.

NEWSOUTPUT.AVAILABILITY	
Description:	The internet portal must be available all the time.
Purpose:	The more the internet portal is down the more money is lost.

Assumptions made

Following assumptions were made while doing the estimations:

- The lines of code are estimated without comments.
- Costs are only estimated for development. There are no estimations made for what it would cost to maintain the internet portal.
- Experienced developers will develop the internet portal. Therefore there is no cost for learning about new technology.
- All needed resources are available. That is computers, human resources, software tools and other tools. Resources needed specifically for the project are not available, for example a license for the database.
- The technology for supporting the development is available. No new or newly invented technology needs to be used.
- Reporters edit and add their news to the news database. No editing is needed when the news web pages are generated.

- No generated code is estimated. Instead the code that generates the generated code is estimated.
- The estimate is not a bidding estimate. We assume that we got the assignment to build an internet portal and that we have to estimate it for planning and costing purposes.
- Every project member that develops the internet portal has the same wage, that is 32000 SEK per month.

Cost Estimate

Size Estimation

This size estimation was derived from the design and the requirements specification of the internet portal. The analog method was used when estimating the lines of code for the web pages. The analog project used was the framed Links section at [Buc].

Pages	Size	Bounds
log-in screen	2	+/- 1
first page	4	+/- 0
sub-pages	12	+/- 0

Lines of code	Number	Bounds
top frame page	50	+/- 15
top page	50	+/- 10
news links list (left)	200	+/- 20
headline news	50	+/- 10
login verification	200	+/- 20
news input	100	+/- 15
Server CGI generator		
generate list of news	500	+/- 50
generate specific news	20	+/- 5
Misc. (open/close db, etc)	200	+/- 50

COnstructive COst MOdel

We used the [COSMOS98] COCOMO tool to estimate the cost in time. The data on the size estimations were inputted to the tool and the cost drivers were adjusted to suit the internet portal project. The tool produced this information:

Software Cost Modeling System COCOMO Report

Title:	Internet Portal	
Prepared By:	David Vallata	
Description:	Estimation of an internet portal.	
Sensitivity Analysis Type:	Source Lines of Code (SLOC)	
Source Lines of Code:	1370.0	(1205.6 - 1534.4)
Nominal Effort:	4.5 person months	(3.9 - 5.0)
Adjusted Effort:	3.5 person months	(3.1 - 3.9)
Time to Develop:	4.0 calendar months	(3.8 - 4.2)
Phase Distribution		
Product Design Phase		
Adjusted Effort:	0.6 person months	(0.5 - 0.6)
Schedule:	0.8 calendar months	(0.7 - 0.8)
Average Staff:	0.7 FSP	(0.7 - 0.8)
Programming Phase		
Adjusted Effort		
Detailed Design:	0.9 person months	(0.8 - 1.0)
Code and Unit Test:	1.5 person months	(1.3 - 1.7)
Schedule:	2.5 calendar months	(2.4 - 2.7)
Average Staff:	0.9 FSP	(0.9 - 1.0)
Integration and Test Phase		
Adjusted Effort:	0.6 person months	(0.5 - 0.6)
Schedule:	0.7 calendar months	(0.7 - 0.8)
Average Staff:	0.8 FSP	(0.7 - 0.8)

The results from the tool may not be correct. The tool uses the first version of the COCOMO model and the constants used for the cost drivers are not adapted for developing internet portals.

Total Install Cost

We use the results that the COCOMO tool produced and assume that it will take about 4 person months to develop the internet portal. To decrease the development time we assume that we will have 4 persons working on it. This would decrease the development time to one month. We further assume that each person will have 32000 SEK salary per month. The total labor cost is then 1280000 SEK. The project will cost more than that. We have not taken in account other costs of the project. To do this we use the Total Install Cost (TIC) described in [Wel92].

Using the TIC model produced this cost profile:

Cost Profile					Total
Primary cost elements	1	2	3	4	
Assessments	11200				11200
Requirements definition	22400				22400
Software tools	410	410	410	410	1640
H/W facilities for development					
Design	32000	3200			35200
Development			29700	21600	51300
Implementation				3200	3200
Training				1600	1600
Project management and administration	2800	2800	2800	2800	11200
Operational software					
Total installed costs (TIC)	68810	6410	32910	29610	**137740**

The total cost is about 138000 SEK. The 10000 SEK (138000-128000 SEK) is for software tools and for working 2 hours overtime per person and week.

Cost Drivers

Requirements Specification

The main cost drivers from the requirements specification are these three non-functional requirements:

- NEWSOUTPUT.NEWS.RELIABILITY – This is hard to fulfill since the developers of the internet portal have nothing to do with the reliability of a specific news. The only thing they can do is to make it mandatory for the reporters to include a link to the source of the news.
- NEWSOUTPUT.FAST – This may be hard to fulfill when the list of old news grows. The maintenance of the internet portal should create a database for each month of news.
- NEWSOUTPUT.AVAILABILITY – This is a very critical cost driver. To insure that the internet portal is up and running all the time, it is probably needed to have redundant computer systems.

COCOMO Tool

The cost drivers according to the COCOMO tool are:

- Required software reliability – The internet portal relies on generating the news and ads. If this fails, the whole internet portal fails.
- Programming language experience – The developers must know several programming languages and technologies to build the portal.
- Use of software tools – To increase the productivity it is a good idea to use software tools for developing the portal. Some of these tools may cost some money.

TIC method

The cost drivers derived from using the TIC method are:

- Software design and specification – This cost item costs about 8000 SEK. The reason for this is primarily because there are two activities in this cost item. The other reason is that designing and specifying the software detailed is important, this because it will take less time to code it later.
- Software coding and unit testing – This cost item costs about 13700 SEK. The reason for this is also that two activities are combined into one cost item. The unit testing and debugging of the unit is very time consuming.
- User documentation – This cost item costs about 8000 SEK. The user documentation must be user friendly because non-technical people will use it, like reporters and surfers.
- System documentation - This cost item costs about 20000 SEK. Developing an internet portal is a new field of development. It also integrates different technologies in a new way. It is important to describe the portal in detail to be able to maintain and support it.

Additional

Some other cost drivers that we think may apply to the project are:

- The internet portal must be developed fast. This because it has to get out on the market fast.
- The pitfalls below may develop into large cost drivers.

Pitfalls

We came up with following possible pitfalls with our cost estimations:

- The non-functional requirements are hard to estimate exactly. These estimations may be somewhat wrong.
- Due to the fact that it is a new development, previous data on which the estimation could rely on is missing.
- There is an uncertainty of how many pages each individual topic may produce.
- There is an uncertainty of the number of ads that can be shown on the portal.
- The upper and lower bounds may be wrongly estimated.
- The COCOMO tool used was version 1. It is not adapted to develop internet portals. The figures it produces may not be valid.

Conclusion

The COCOMO model and the TIC method complement each other. The COCOMO model calculates the estimated time and the TIC method calculates the estimated cost in money. We have used the COCOMO model to get a hint of how long time the project would require. We used this estimate to do a weekly planning and distribution of cost with help of the TIC method. It showed that the time estimate that the COCOMO model produced corresponded to the plan done with the TIC method.

There are not so many portals, especially not Swedish, on the internet. We do not have any experience data on developing internet portals. Therefore it is hard to make cost estimates for time and money. Even though the cost driver constants in the COCOMO model were not based on experience data from developing internet portals, it produced useful results.

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