

Test Effort Estimation

Ruud Teunissen
Polteq IT Services BV – The Netherlands

Antwerpen – September 13th 2007

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How do you estimate your effort,...

- ... if you don't know what to do
- ... if you don't know how to do it
- ... if you don't know who will do it
- ... if you don't know where to do it
- ... if you don't know with what to do it
- ... if you don't know when to do it
- ... if you don't know what to do first, last, ...
-

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Test Effort Estimation - Approaches

- Experiences in similar/previous projects
- Historical data
- Predefined budget
- Intuition of the experienced tester
- Extrapolation
- Bottom up from work breakdown structure
- Testing best practice
-

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Historical data related to:

- Time spent in design and realisation phases
- Size of test basis
 - e.g. number of user requirements, number of pages, function points
- Data model
 - e.g. number of entities, fields
- Number of screens or fields
- Size of test object
 - e.g. KLOC

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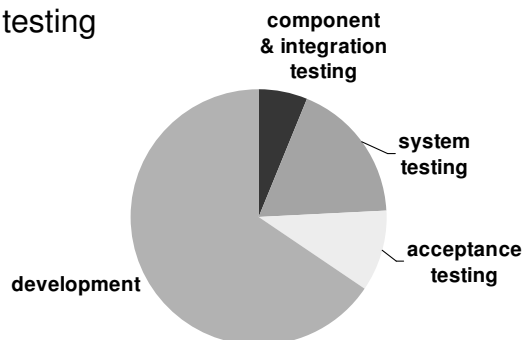
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Testing best practice – “Industry Standard”

On average 35% of the hours spent on the total development project is reserved for testing

- 5-7% for component and integration testing
- 18-20% for system testing
- 10% for acceptance testing

development =
FD + TD + RE



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The “average” or “similar” project

- Is a myth...
- There are always differences, no matter how small, that have an influence on the required effort



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Question

**What makes a test
effort estimate
reliable?**

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You need to know what to test...

- the software, including documentation
- the infrastructure, including procedures
- the organization, user and operation

... and how it is designed and built!!

- traditional waterfall
- V-model
- iterative, incremental, ...

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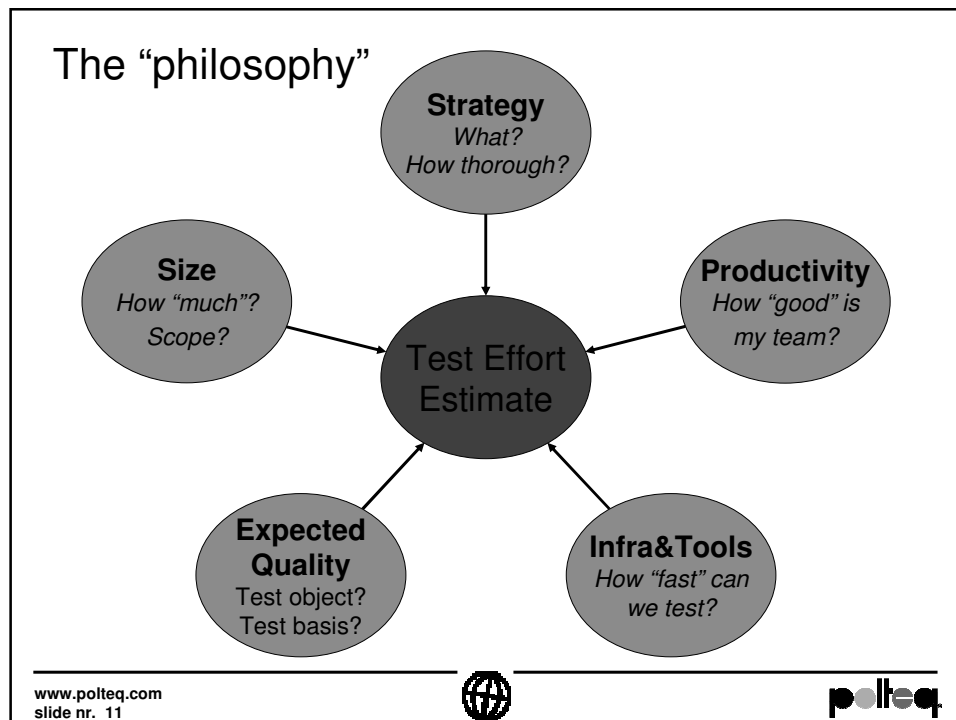
...and what stage of the project you're at.

- Project initiation
 - global estimate ($\pm 30\%$?)
- High level tests
 - insight into "Functional" solution ($\pm 10\%$?)
- Low level tests
 - insight into "Technical" solution ($\pm 10\%$?)

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“It’s better to be honest than to have to admit you did not tell the whole truth at the start”

- Developers
 - say there are no “weak areas” in the software
 - ... act “surprised” by the number of bugs found and start disputing bugs when reported...
- Testers
 - create beautiful test plans and strategies, but...
 - ... are unable to execute them efficiently by lack of time, resources, knowledge and/or experience...

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Global Effort Estimate

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Try to find the “right” questions for your situation!

- *Business risk:*
 - What is the priority of your project? What is the impact on the business process?
- *Technology:*
 - Are we using proven technology or is it something new (that might even be considered experimental)?
- *Complexity:*
 - The degree of complexity within the application we need to test as well as the interfacing with other applications.
- *Development team:*
 - How experienced is your development team?
- *Test team:*
 - And what about your test team? And do they have testware available?

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Define the possible answers...

- High → an increase of the required effort
- Medium → no impact
- Low → a decrease of the required effort

Answer	Description
High	The project is using new technology, that has not been used in your organisation yet. <i>So you are running the risk of having to face all child diseases... It might even be considered experimental?</i>
Medium	The project is using technology, that has been used before (hopefully successful). <i>It's not experimental anymore and there is some experience with it, but it's not proven technology yet.</i>
Low	The project is using proven technology. <i>Every discipline within the project is familiar with the environment.</i>

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Define the impact

- Start of with two categories – relative to each other
 - Major impact
 - Minor impact

Question	Category
1. Business risk	Major
2. Technology	Minor
3. Complexity	Major
4. Development Team	Minor
5. Test Team	Major

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Calculation model

- “proven technology”
 - just look at the way insurance companies define the premium you have to pay for your car insurance (at least how they say they do it ☺)
 - **Major**
 “high” : “medium” : “low” = 8 : 4 : 2
 - **Minor**
 “high” : “medium” : “low” = 4 : 2 : 1



Question	Priority	Answer	Factor
1. Business risk	Major	High	8
		Medium	4
		Low	2
2. Technology	Minor	High	4
		Medium	2
		Low	1
3. Complexity	Major	High	8
		Medium	4
		Low	2
4. Development Team	Minor	High	4
		Medium	2
		Low	1
5. Test Team	Major	High	8
		Medium	4
		Low	2



Calculation model continued

Question	Answer	Factor
1. Business risk	High	8
2. Technology	Medium	2
3. Complexity	High	8
4. Development Team	Low	1
5. Test Team	Medium	4
Σ Factors	23	
<i>Risk Indicator (Σ Factors / 16)</i>	<i>1,44</i>	



Test Effort Estimate

- Risk Indicator = multiplying factor
 - Minimum budget = 17,5%
 - Maximum budget = 70%
 - Test Budget = 35% * 1,44 = 50 %
- Risk indicator → ranges

Risk Indicator	% Test Budget
< 0,7	25%
0,7 - 0,9	30%
0,9 - 1,1	35%
1,1 - 1,3	40%
> 1,3	45%





Project Risk Indicator

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Project Risk Indicator

Business point of view:

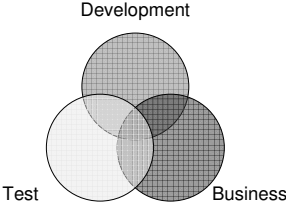
- Business risks
- Technology in operation

Design and development point of view:



- Expertise Design and Development team
- Complexity of the application
- Development method
- New build / maintenance

Test point of view:

- Expertise test team
- Level of re-usability testware



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Business point of view:

- F1 Business risks

2	The priority of the project relative to other projects is low
4	The priority of the project relative to other projects is normal
8	The priority of the project relative to other projects is high

- F2 Technology in operation

4	The technology has already been used several times within the organization
8	The technology is new, but similar to others within the organization
16	The project uses a technology which is totally new to the organization



Design and development point of view:

- F3 Expertise Design and Development team

2	An experienced design and development team
4	A mixture of experienced and non-experienced design and development team
8	A non-experienced design and development team

- F4 Complexity of the application

2	The degree of complexity of the processing (simple, standalone) of the application relative to other applications is low
4	The degree of complexity of the processing (medium complexity, medium interfaces) of the application relative to other applications is normal
8	The project is focussing on (a) complex application(s) with many interfaces to other applications.



Design and development point of view:

- F5 Development method

2	The project development method for the application has been commonly used within the organization for several times in the past
4	The project is to be developed using a new development method, similar to others within the organization
8	The project is to be developed using a new development method, which is considerate experimental within the organization

- F6 New build / maintenance

4	The project is primarily a maintenance project, involving only updates on the current applications
8	The project is a combination of a changes project and new build
16	The application is primarily new build



Test point of view:

- F7 Expertise test team

2	An experienced test team
4	A mixture of experienced and non-experienced test team
8	A non-experienced test team

- F8 Level of re-usability testware

4	A usable, general initial data set (tables, etc.) and specified test cases are available for the test
8	A usable general initial data set (tables, etc.) is available for the test
16	No re-usable testware is available



Project Risk Indicator

$$PRI = (F1+F2+F3+F4+F5+F6+F7+F8) / 44$$

Project Risk Indicator	% Project time spent on testing
< 0.70	29%
0.70 – 0.90	32%
0.90 – 1.10	36%
1.10 – 1.30	41%
> 1.30	45%



Project Risk Indicator - Extended

$$PRI = (F1+F2+F3+F4+F5+F6+F7+F8) / 44$$

Project Risk Indicator	% Project time spent on testing	UT	ST	PAT	UAT
< 0.70	29%	5%	14%	3%	7%
0.70 – 0.90	32%	5%	16%	3%	8%
0.90 – 1.10	36%	5%	18%	4%	9%
1.10 – 1.30	41%	6%	20%	5%	10%
> 1.30	45%	7%	22%	5%	11%



Detailed Effort Estimate

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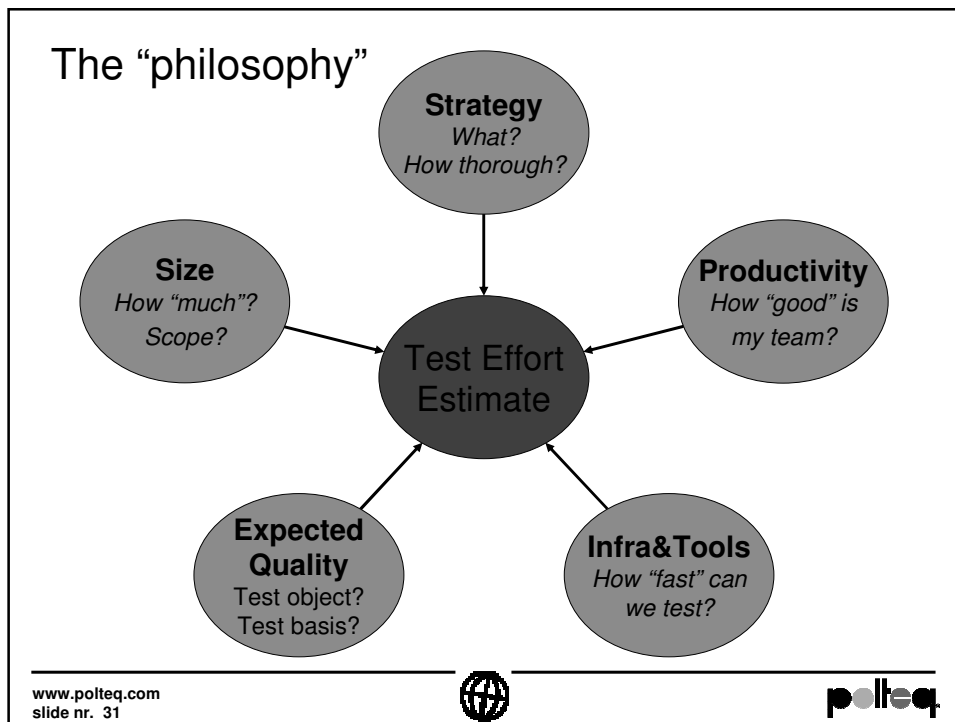



Context

- System Test
 - Functional and Non-Functional Tests
- Experience from previous projects
 - Functional Design 1
 - Realisation 2
= Technical Design + Code + UT + UIT
 - System Test 2
 - = 85% Test + 15% Test management
 - *Quality Aspects Covered* *Average*
 - Functionality 75%
 - Performance 10%
 - Security 10%
 - Continuity 5%

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Strategy

1. Functionality	High	1,13
	Average	0,75
	Low	0,50
	Out of scope	0,00
2. Performance	High	0,13
	Average	0,10
	Low	0,08
	Out of scope	0,00
3. Security	High	0,13
	Average	0,10
	Low	0,80
	Out of scope	0,00
4. Continuity	High	0,08
	Average	0,05
	Low	0,03
	Out of scope	0,00
Strategy = 1. + 2. + 3. + 4.		

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Expected Quality

5. Complexity	H	12
	M	6
	L	3
6. Quality Functional Design	H	3
	M	6
	L	12
7. Quality Previous Tests	H	2
	M	4
	L	8
8. Experience Development Team	H	2
	M	4
	L	8
Expected Quality = (5. + 6. + 7. + 8.) / 20		

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Infra & Tools + Productivity

9. Test Environment	"Test Unfriendly"	12
	"Usable"	6
	"Test Friendly"	3
10. Tool Support	Defect and Time Management	1
	Defect or Time Management	2
	"Sorry"	4
11. Test data	Available and Described	2
	Available	4
	"Sorry"	8
Infra & Tools = (9. + 10. + 11.) / 12		
12. Productivity	Experienced (Test and System)	0,7
	Experienced (Test or System)	1,0
	Inexperienced	1,5

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Test Effort Estimate – experience from previous projects	
Functional Design	200 hrs
Realisation	400 hrs
System Test	400 hrs
Test Effort Estimate - Calculated	
Strategy Functionality High, Performance Out of Scope, Security Average, Continuity Out of Scope	1,23
Expected Quality Complexity Average, Quality Previous FD and Test High, Experience High	0,65
Infra & Tools Test Environment "Usable", Test Tools "Defect Management", Test Data "Sorry"	1,33
Productivity Experienced (Test and Matter)	0,70
System Test = Strategy * Expected Quality * Infra & Tools * Productivity	298 hrs

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User Acceptance Test

Another Real Life Case by Ruud Teunissen
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User Acceptance Test – Context

- Test Process Improvement
- Professionalize the UAT team
- Improve Test Management
 - *including Test Effort Estimation*
- “Best practice”
 - Design & Develop : Test Engineering = 5 : 2



1st group of “influencing factors” – T.E.E.1

1. Complexity	H	12
	M	6
	L	3
2. Quality Requirement Documentation	H	3
	M	6
	L	12
3. Quality Previous Tests	H	2
	M	4
	L	8

$$T.E.E.1 = (1. + 2. + 3.) / 16$$



2nd group of “influencing factors” – T.E.E.2

4. Functionality	M	1,00
	S	0,75
	C	0,50
	W	0,00
5. Reliability	M	0,06
	S	0,05
	C	0,04
	W	0,00
6. Usability / Suitability	M	0,15
	S	0,10
	C	0,08
	W	0,00
7. Efficiency	M	0,15
	S	0,10
	C	0,08
	W	0,00
T.E.E.2 = 4. + 5. + 6. + 7.		

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3rd group of “influencing factors” – T.E.E.3

8. Productivity	Senior	1,00
	Medior	1,20
	Junior	1,80

T.E.E.3 = 8.

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Test Management Estimate

Test Management Estimate	
Monitoring & Control	0,1 * Final Test Engineering Estimate
Reporting	0,1 * Final Test Engineering Estimate

Project type	Create Test Plan
Project	4,0 days
Light Project	3,0 days
Request for Change	2,0 days



Test Effort Estimate - Example

Test Engineering Estimate Calculation	
Design & Develop	1000 hrs
Initial Test Engineering Estimate (T.E.E.I)	400 hrs
Final Test Engineering Estimate = T.E.E.I * T.E.E.1 * T.E.E.2 * Productivity	

Test Engineering Estimate Calculation - Example	
Final Test Engineering Estimate = $400 * (22/16) * 1,16 * 1,2$	766 hrs
Test Management Estimate Calculation - Example	
Final Test management Estimate = $0,2 * 756,6 \text{ hrs} + 4 \text{ days}$	186 hrs



Test Point Analysis

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Quality Characteristics

Dynamic explicit

- Functionality
- Performance
- Suitability
- Security

Static

- security
- continuity
- traceability
-

Dynamic implicit

- Performance
- User friendliness
- Maintainability
- Traceability
-

Test Strategy !!

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Influencing Factors

(Sub)System Factor

- Interfacing
- Complexity
- Uniformity
- User importance
- Usage intensity

Environmental Factor

- Test tools
- Development tests
- Product documentation
- Development environment
- Test environment
- Testware



Productivity Factor

- Typical range: 0.7 - 2.0

Management overhead

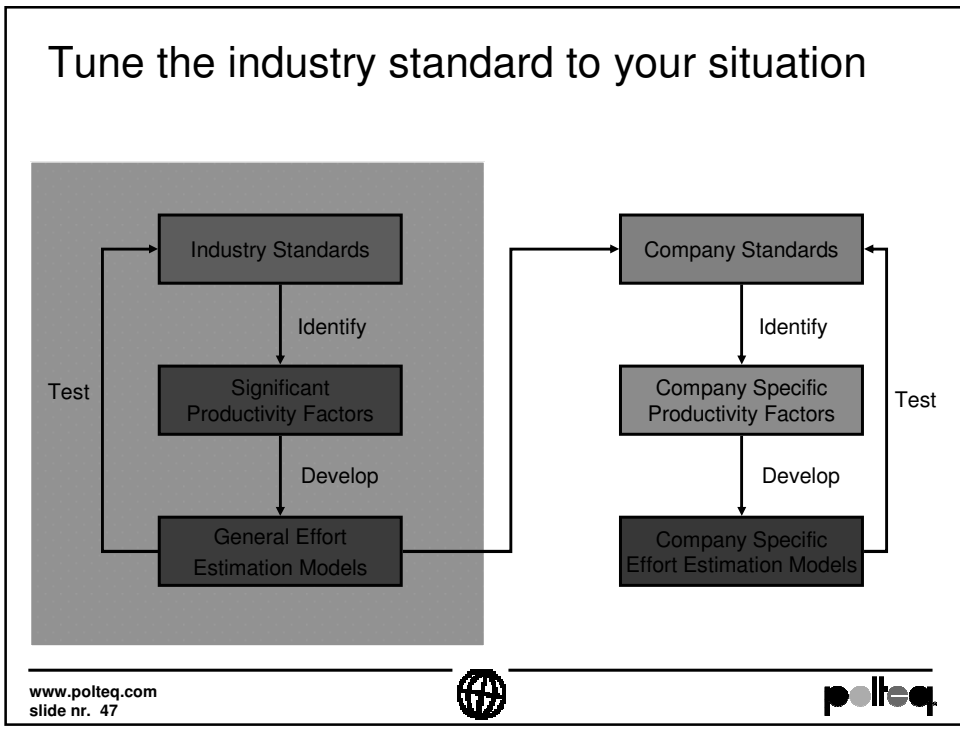
- Team size
- Management tools



Pro's and Con's

- Pro's
 - Interacting with test strategy
 - "Absolute" numbers
 - Not related to other estimates (e.g. RQMS, design, development)
 - Transparent
 - Test process and design techniques according to TMap
- Con's
 - High level tests only
 - Function Point Analysis is required
 - Requirements need to be available at "FD" level
 - Test process and design techniques according to TMap





Questions?

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Thank you very much for your attention!

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About the speaker

Ruud Teunissen

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In the testing world since 1989, Ruud Teunissen has held numerous test functions in different organizations and projects: tester, test specialist, test consultant, test manager, etcetera. Ruud is co-author of Software Testing - A Guide to the TMap® Approach and is a frequent speaker at (inter)national conferences and workshops. He was a member of the program committee for Quality Week Europe and EuroSTAR. Ruud is currently International Test Consultant at Polteq IT Services BV.



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