



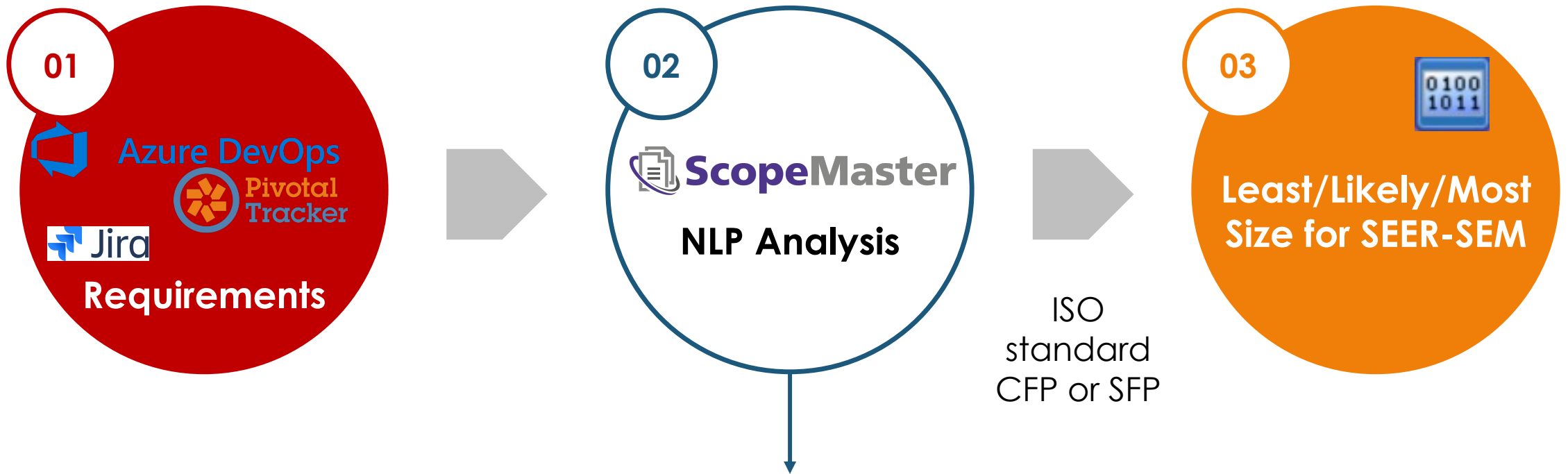
Software Estimation Using Functional Size Derived from User Stories

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Abstract

30,000 foot view of sizing from stories



Requirements, in the form of stories can be analyzed by ScopeMaster and offer suggestions to improve requirements for clarity, consistency and testability. It also computes functional size that can be used for estimation. SEER-SEM has leveraged this capability and offers an approach to use the generated functional size, considering the uncertainty around the results.

The Challenge

Agile sizing is associated with story points... but they have issues



Stories are team specific

Lack of Standardization occurs when each team defines what is meant by a story. It can be helpful for project implementation, but there is no practical way to compare stories from one team to the next.



Difficult to measure and learn

Loss of learning The lack of non-standard metrics leads to the lack of historical perspective. Benchmarking and measuring improvement become nearly impossible, even within an organization.

The Opportunity

Natural Language Processing of Requirements to Generate Standard Size

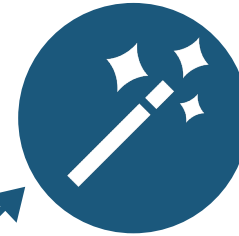
Evaluates Stories

Review requirements/stories to identify users, objects and their functional relationships.



Improves Quality

Feedback on requirements offers improvements in consistency, completeness, clarity, and testing.

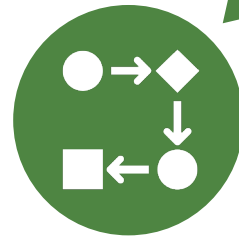


NLP with ScopeMaster

analyzes requirements, offers improvement and provides a quantitative summary of the results

Generates Functional Size

Evaluation of objects and users and data movements enables automated sizing for Cosmic Function Points and Simple Function Points which can be the input to the software estimate.



Leverages Popular Tools

Stories can be linked from Jira, Pivotal and Azure DevOps. Also offers CSV import REST API for easy access to your data.



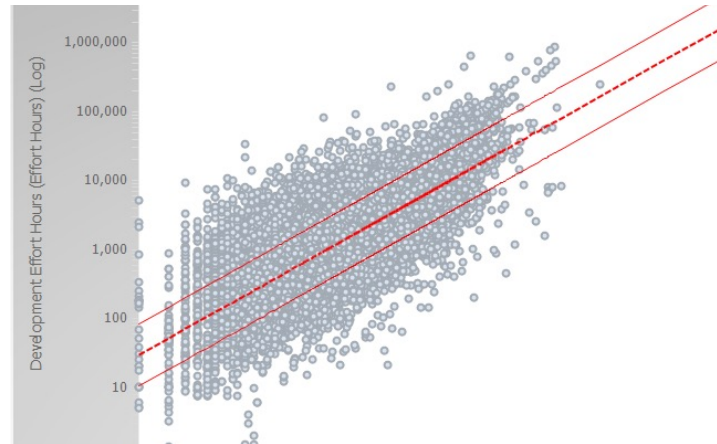
Using Functional Size for Estimation

Would you like me to give you a formula for success? It's quite simple, really: Double your rate of failure. You are thinking of failure as the enemy of success. But it isn't at all. You can be discouraged by failure or you can learn from it, so go ahead and make mistakes.



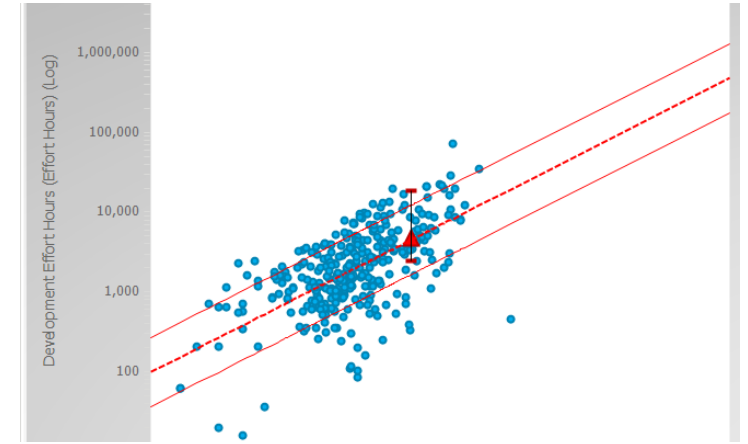
Mature and ISO standard

Functional size metrics have been around for years and several are ISO standard. They have been successfully used for estimation for decades.



Correlated with Effort

Functional size metrics have been shown to be a strong predictor of effort.



Enables Benchmarking

A standard size makes it easier to compare projects and to keep a meaningful historical record. (ISBSG)



General Function Size Challenges

Use of manual counting methods



Error Prone

Manual counting introduces the possibility of human error.



Time Consuming

Manual counting involves review of requirements (or as-is system) and can be time consuming



Requires Judgement

Discernment is needed to classify requirements and, in some cases, relative complexity levels.



Ambiguous Requirements

All of the above issues are compounded when requirements are ambiguous or incomplete.



ScopeMaster for Sizing

- Web-based tool
- Requirements analysis and refinement
- #1 goal was to automate functional sizing
- Outputs COSMIC, IFPUG/Simple Function Points
- Consistent results
- Supports a custom vocabulary
- Transparent use of AI (NLP)
- Fast. Estimate 100 user stories in less than 5 minutes, no setup
- Create stories in ScopeMaster or import CSV or via REST API.

Size and Uncertainty

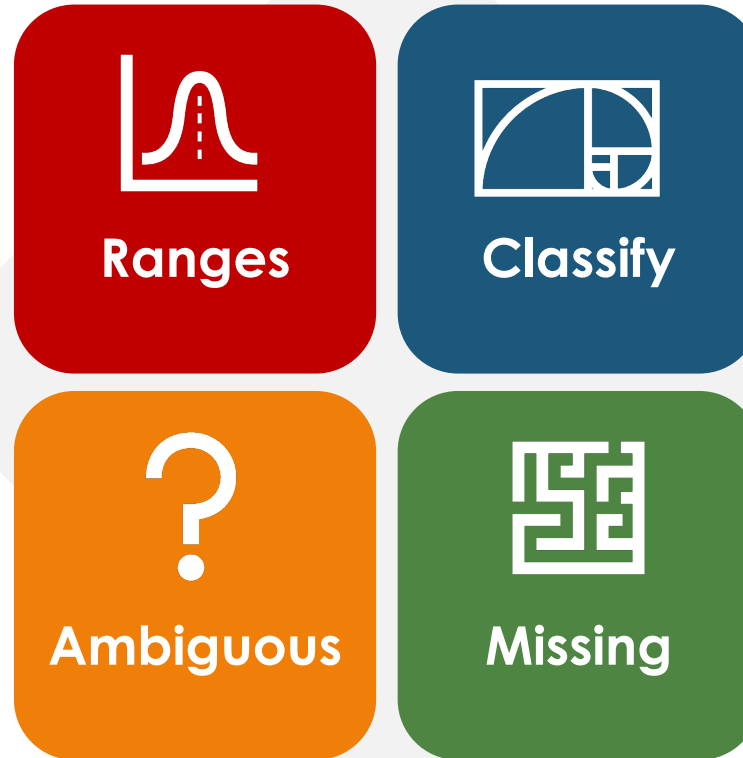
Uncertainty is part of the estimating fabric

Size Ranges

Uncertainty around the size is considered a software estimation best practice. Thus, any automated sizing should consider a range of outcomes.

Embracing Imperfection

Feedback and Improvement is key to the ScopeMaster process and should be embraced. Because estimators are not the ones to be refining stories/requirements they need to consider the ambiguity in the sizing.



Sizing Metric

Functional Size Metrics using either COSMIC or Simple Function Points can be used.

Known Unknowns

Missing Functions can be detected using CRUD analysis and should be part of the sizing.

Terminology

- Requirement – aka a story, usually specifies a requirement from a user perspective
 - **“As a [persona], I [want to], [so that].”**
- Sized Requirement – a requirement for which functional intent is detected
- Ambiguous Requirement – a requirement no functional intent is detected.
- Missing – fills in transactional functions that might be missing (see CRUD)

Missing Requirements

- CRUD – Create, Read, Update, Delete
 - Four basic function types
- Each object ideally would have at least one C, R,U and D function specified as par of the requirements.
- If an object does not have the full CRUD, the missing add transactions

Detected Objects (34)

Name <small>click to confirm</small>	Jump to CRUD Table	Search
account	C R U D	view (5)
announcement	C R U D	view (1)
answer	C R U D	view (2)
badge	C R U D	view (1)
bio	C R U D	view (4)
catalog	C R U D	view (1)

Interpreting the Uncertainty



Sized

Requirements where functions are identified and are counted based on transactional scope. This is usually the headline size.



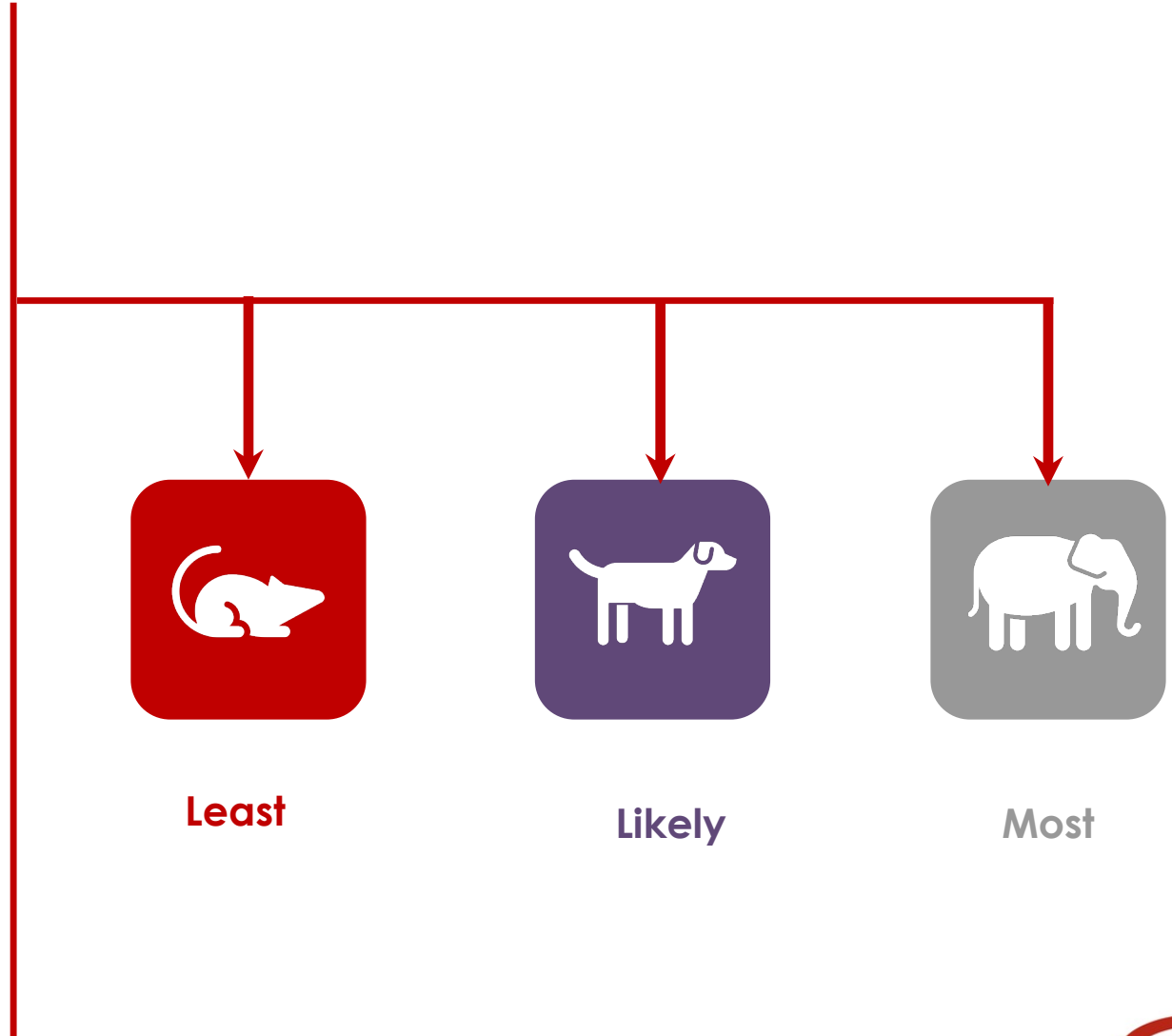
Ambiguous

Uncertain Functional Intent
Requirements where functional intent is not detected. Ideally these requirements can be refined.



Missing

Extrapolated Functions based on potential missing CRUD



Establishing a Size Range

The screenshot shows the 'SEER for Software ScopeMaster Integration' interface. The breadcrumb trail is 'Project Setup > Classify > Size Range > Results'. The 'Size Range' section includes the following settings:

- Simple Function Points:
 - Least: Sized
 - Likely: Sized + Ambiguous
 - Most: Sized + Ambiguous + Missing
 - Percent of Missing: 75%

	Requirements	SFP
Sized / Sizeable:	55	766 SFP
Unsize / Ambiguous:	43	599 SFP
Missing CRUD events:	134	616 SFP
Total:	232	1981 SFP

Only count data groups with more than one occurrence



Sized Requirements

Minimum Size established from analyzing requirements. This size is likely to be optimistic unless requirements have been refined .



Ambiguous

Uncertain Size that should be considered as part of the likely input, if not also the least.



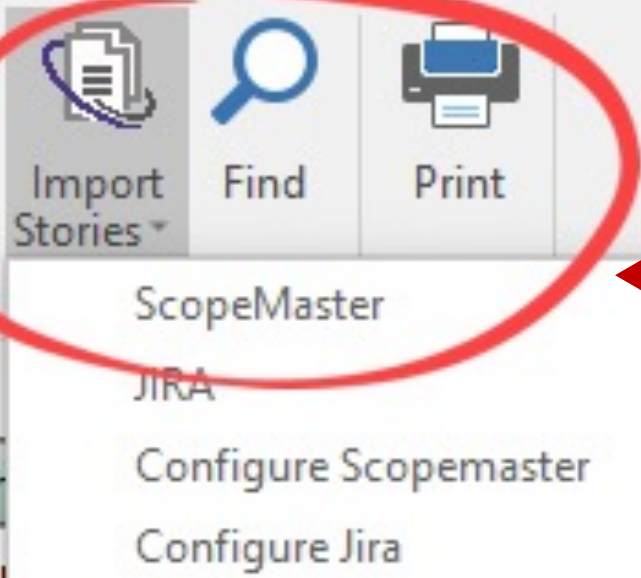
Missing

Missing Transactions are based on CRUD analysis. Uses the idea that each object should have at least 1 CRUD transaction. If not in the requirements, missing transactions are added.

01

Choose Import Stories

Import Stories offers the option to import from ScopeMaster or directly from JIRA. Minor configuration is required.



02

Choose the Project

And **size approach** to be estimated. Cosmic Function Points (CFP) and Simple Function Points (SFP) are offered. You can import to an existing element or create a new estimate.

SEER for Software ScopeMaster

Project Setup

Remote Applications

Video Training Website

Remote Data

Creation Date	Modification Date
<input type="text" value="09 January 2023 11:13:37"/>	<input type="text" value="09 January 2023 11:25:55"/>

Size Approach

Cosmic Function Points
 Simple Function Points

Create New WBS Element

Project Data

Name Video Training Website	
Requirements	Users
72	14
Objects	Quality Score
34	53.56

Guidance

Select Remote Application

Loads selected Scopemaster application into wizard

are ScopeMaster Integration

Classify Size Range Results

Version 1.3.3.0

03

Size Range Method

Specify how Least/Likely and Most Sizes determined.

Sizes are cumulative to include sized, ambiguous and missing. You can specify a % of missing to be included.

SEER for Software ScopeMaster

Generic Function Points

Least

Likely

Most

Percent of Missing

Sized Requirements:	224 CFP
Ambiguous Requirements:	119 CFP
All Functional Requirements:	343 CFP
Potential Missing Requirements:	276 CFP
Total Potential Size:	619 CFP

Name
[Video Training Website](#)

Requirements	Users
72	14
Objects	Quality Score
34	53.56

Guidance
Size Range Page

Pending Help

Project Setup > Classify > Size Range > Results

Version 1.3.3.0

Results

Requirements Summary

Requirements Included as part of the functional size estimate		
Functional	Ambiguous	Missing
47	25	85
Requirements not included as part of the functional size estimate*		
Non-Functional	Task	Constraint
0	0	0

*These should be considered when setting parameters or adding other pass-through estimates

Testing

Tests	Scenarios
422	139

Project Data

Name	Video Training Website
Requirements	Users
72	14
Objects	Quality Score
34	53.56

Guidance
Results Page

Show final estimated results from Scopemaster that are going to be used by SEER for Software

04

Results In SEER-SEM

Size range inputs are entered and notes are added documenting the size assumptions.

Data Movements

Notes:

Least	Likely	Most
<input type="text" value="224"/>	<input type="text" value="343"/>	<input type="text" value="550"/>

OK
Cancel
Prev
Next
KBase
More Help

Use Expression Editor

Based on summary estimate from Scopemaster:

47 sized requirements: 224 CFP
85 missing requirements: 276 CFP
25 ambiguous requirements: 119 CFP
Missing requirements allocation factor: 75%

Examples

Planning Poker Webapp

Data Imported from Jira into ScopeMaster

53

Requirements

Total number of stories or stated requirements.

22

Sized

Requirements that could be counted in the functional size.

19

Ambiguous

Requirements where functional intent is not detected. Ideally these requirements can be refined.

12

Non-Functional

Non-functional requirements are not sized. They may relate to technology, security, performance or other non-user requirements

33

Missing Requirements

Based on CRUD analysis, fills in transactions for which an object does not have all CRUD.

11/
14

Users/Objects

Detected users and objects.

- 4 PPW-1 Game - As a moderator, I want to create a
- 7 PPW-2 Game - As a moderator, I want to invite e
- 7 PPW-3 Game - As an estimator, I want to join a
- ? PPW-4 Game - As a moderator, I want to start a
- ? PPW-5 Game - As an estimator, I want to see the
- ? PPW-6 Game - As an estimator, I want to see all
- ? PPW-7 Game - As a moderator, I want to see all
- 3 PPW-8 Game - As a moderator, I want to select a
- 4 PPW-9 Game - As a moderator, I want to add an i
- 3 PPW-10 Game - As a moderator, I want to edit an
- 3 PPW-11 Game - As a moderator, I want to delete a
- ? PPW-12 Game - As a participant, I want to immedi
- ? PPW-13 Game - As a participant, I want to be sho
- 9 PPW-14 Game - As a participant, I want to be abl
- ? PPW-15 Game - As a participant, I want to be abl
- ? PPW-16 Game - As a moderator, I want to show all
- ? PPW-17 Game - As a participant, I want to see wh
- ? PPW-18 Game - As a participant, I want to be abl
- ? PPW-19 Game - As a participant, I want to have t
- 3 PPW-20 Game - As a moderator, I want to accept t
- ? PPW-21 Game - As a moderator, I want to have the
- ? PPW-22 Game - As a moderator, I want to enter th
- ? PPW-23 Game - As a participant, I want to scroll
- ? PPW-24 Game - As a moderator, I want to estimate
- ? PPW-25 Game - As a participant, I want to always

Game PPW-19

Ambiguous functional size

As a participant, I want to have the two-minute timer reset itself as soon as we all play an estimate so that it's ready for use on the next round.

Edit Functions Quality **D** Comments

Short title*

Labels ↗

Links ↗

Game

Save & Analyse

Functional requirement*

Tips ↗

Add

As a participant, I want to have the two-minute timer reset itself as soon as we all play an estimate so that it's ready for use on the next round.

Reference (external : PPW-19)

PPW-19

Requirement type

Functional

⚠ Ambiguous "want...have" use recommended verbs ↗

30 words

More fields: Triggering event > Benefits > Notes >

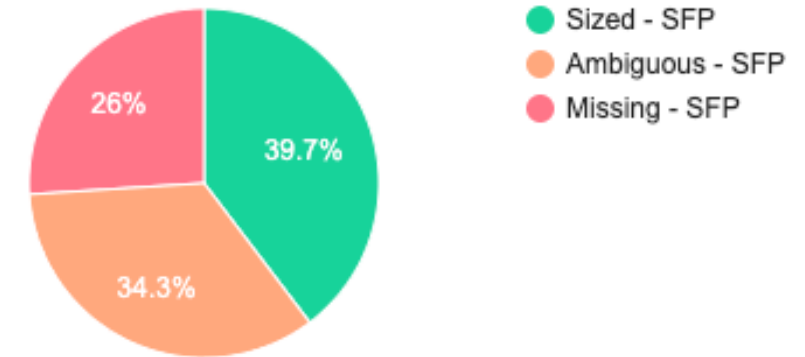
What the requirements look like

Simple Function Point Estimate

Planning Poker Webapp Example

Requirements Analysis	Count	SFP Estimate
Sized / Sizeable	22 (of 41)	231.4 SFP (40%)
Unsized / Ambiguous	19 (of 41)	200 SFP (34%)
Missing CRUD events	33	151.8 SFP (26%)
Total:		583.2 SFP

Estimates - Simple Function Points



SFP Summary

Data functions and transactions are enumerated and mapped to requirements to develop a SFP count.

Allocation of Size

Quality of Requirements can result in large portions of ambiguous or missing. Not considering these as part of the size can under-estimate effort. As quality improves, ambiguous and missing will become a smaller portion of the size.

Mapping Data

How to translate into a SEER-SEM estimate

Size Range

Simple Function Points

Least

Likely

Most

Percent of Missing

	Requirements	SFP
Sized / Sizeable:	22	231 SFP
Unsize / Ambiguous:	19	200 SFP
Missing CRUD events:	33	152 SFP
Total:	74	583 SFP

Only count data groups with more than one occurrence



Least/Likely/Most

Size Ranges are generated based what to include. Recommend that all aspects of size should be considered. The more refined the requirements, the tighter the range will become.



Missing

Including Missing is important. However, this can be tempered by a percent to be included. Recommend 50%-75%.



Data Group Counting

SFP includes Data Functions and we found that data objects (aka Logical Files) that were only referenced once inflates the SFP count. Refinement of the requirements will generally reduce this.

Results in SEER-SEM

Inputs

Parameters Function Based Sizing Economic Factors Project Monitor & Control Snapshots Maintenance Labor Category Allocation

PROGRAM: Planning Poker SFP Sized + Ambig... Least Likely Most Note

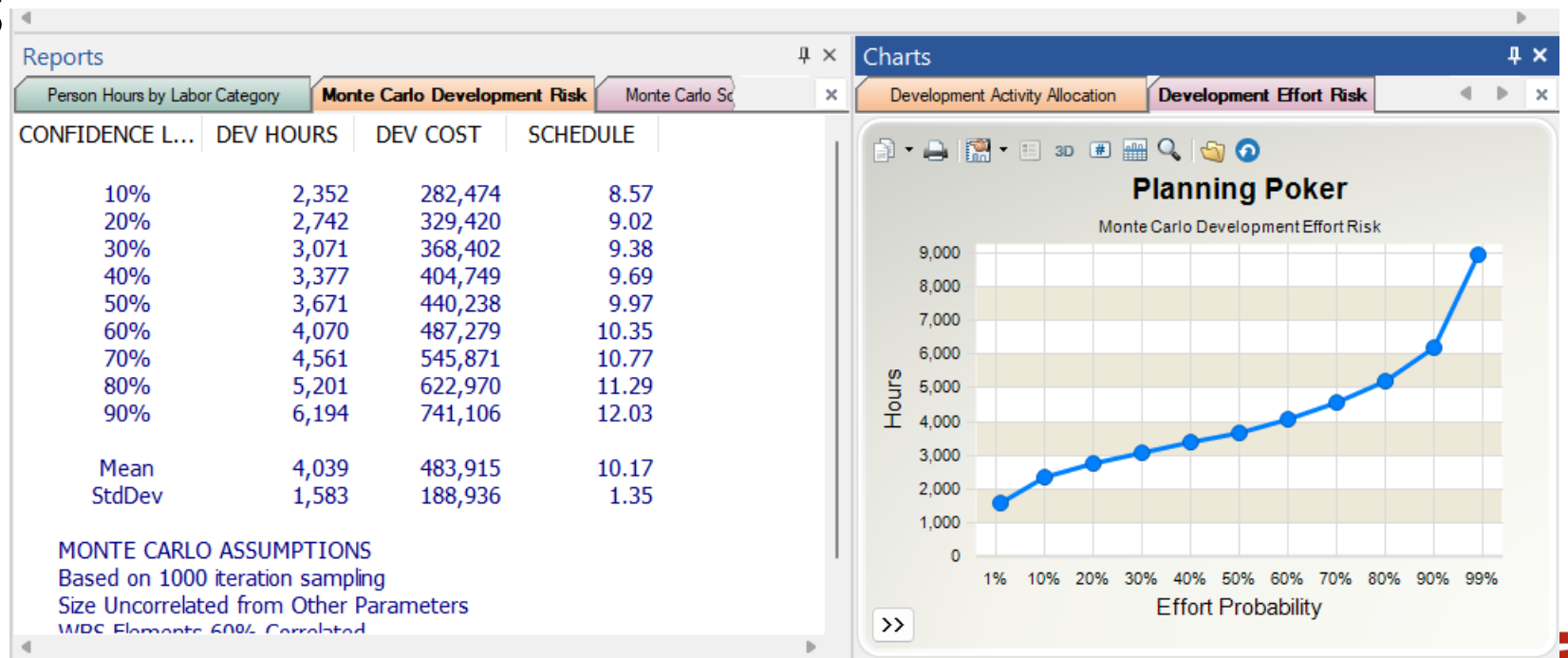
SIZE METRIC

Size Metric Description	Simple Function Points			Based on summary estimate fro
NEW				
Elementary Processes (EP)	29	54	71	Transactions Count: 29Least usi
Logical Files (LF)	7	13	13	Data Groups Count: 7Least usin
Software phase at estimate	Requirements			
Pre-existing not designed for				

Inputs and Outputs

SFP inputs for EP and LF are specified as a range. Risk assessment of the estimate range generated.

Size assumption details are logged in the notes.



Video Training Application

Data Imported from Jira into ScopeMaster

72

Requirements

Total number of stories or stated requirements.

47

Sized

Requirements that could be counted in the functional size.

25

Ambiguous

Requirements where functional intent is not detected. Ideally these requirements can be refined.

0

Non-Functional

Non-functional requirements are not sized. They may relate to technology, security, performance or other non-user requirements

85

Missing Requirements

Based on CRUD analysis, fills in transactions for which an object does not have all CRUD.

14/
34

Users/Objects

Detected users and objects.

Cosmic Function Point Estimate

Video Training Application Example

Total Functional Size Estimate

Sized requirements	47	224 CFP
Ambiguous requirements (ie. no functionality detected)	25	119 CFP <i>Estimated</i>
All functional requirements (sized + ambiguous)	72	343 CFP <i>Estimated</i>
Potential missing requirements (from CRUD analysis)	85	276 CFP <i>Estimated</i>
Total Potential Size (sized + ambiguous + missing)	157	619 CFP <i>Estimated</i>

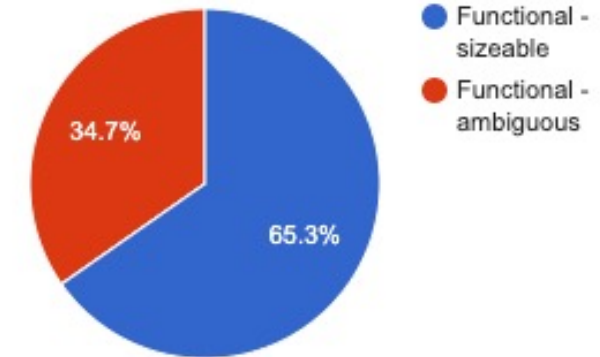
📘 CFP = COSMIC Function Points

CFP Summary

Each Requirement is evaluated for functions and data movements for each function are determined.

Requirements

Requirement Types



Allocation of Size

Quality of Requirements can result in large portions of ambiguous or missing. Not considering these as part of the size can under-estimate effort. As quality improves, ambiguous and missing will become a smaller portion of the size.

Setup ▶ Classify ▶ Size Range ▶ Results

Size Range

Cosmic Function Points

Least

Likely

Most

Percent of Missing

Sized Requirements: 224 CFP

Ambiguous Requirements: 119 CFP

All Functional Requirements: 343 CFP

Potential Missing Requirements: 276 CFP

Total Potential Size: 619 CFP

Mapping Data

How to translate into a SEER-SEM estimate



Least/Likely/Most

Size Ranges are generated based what to include. Recommend that all aspects of size should be considered. The more refined the requirements, the tighter the range will become.



Missing

Including Missing is important. However, this can be tempered by a percent to be included. Recommend 50%-75%



Size Summary

CFP range is displayed but does not include % missing adjustment.

Results in SEER-SEM

Inputs

Parameters | Function Based Sizing | Economic Factors | Project Monitor & Control Snapshots | Maintenance | Labor Category Allocation

PROGRAM: Video Training | Least | Likely | Most | Note

SIZE METRIC

Size Metric Description: **Cosmic FP Data Movements**

NEW

Data Movements	343	343	481	Based on summary estimate from...
Software phase at estimate	Requirements			
Pre-exists, not designed for ...				
Pre-exists, designed for reuse				

Based on summary estimate from Scopemaster:
 47 sized requirements: 224 CFP
 85 missing requirements: 276 CFP
 25 ambiguous requirements: 119 CFP
 Missing requirements allocation factor: 50%

PERSONNEL CAPABILITIES & EX...

Analyst Capabilities	Low	Nom	Hi
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Inputs and Outputs

Input range for CFP Data Movements are assigned. Risk assessment of the estimate range generated.

Size assumption details are logged in the notes.

Reports

Person Hours by Labor Category | **Monte Carlo Development Risk** | Monte Carlo Sc...

CONFIDENCE L...	DEV HOURS	DEV COST	SCHEDULE
10%	2,593	311,352	9.04
20%	2,901	347,987	9.39
30%	3,169	380,047	9.68
40%	3,482	417,584	10.00
50%	3,807	456,289	10.31
60%	4,244	508,265	10.74
70%	4,905	587,859	11.27
80%	5,513	659,597	11.75
90%	6,814	815,852	12.68
Mean	4,336	519,427	10.62
StdDev	1,838	219,378	1.46

MONTE CARLO ASSUMPTIONS
 Based on 1000 iteration sampling
 Size Uncorrelated from Other Parameters
 WBS Elements 50% Correlated

Charts

Development Activity Allocation | **Development Effort Risk**

Video Training
 Monte Carlo Development Effort Risk

Effort Probability	Hours
1%	~2,000
10%	~2,500
20%	~3,000
30%	~3,500
40%	~4,000
50%	~4,500
60%	~5,000
70%	~5,500
80%	~6,500
90%	~7,500
99%	~10,500

Benefits of automated sizing

In addition to quality improvements



Rapid sizing and estimation

Rapid

Quickly generate size and estimates. Evaluate risk and uncertainty embodied by requirements.



Size mapped to requirements

Traceability

Understand how requirements drive cost.



Opportunity improve requirements and sizing

Iterate

More time for in depth evaluation of the estimate for different team sizes/sprint length.



Standard size metrics used

Standard Size

ISO standard size metrics means project data can be used for historical reference, benchmarking and learning

How ScopeMaster Sizes

- Foreach User Story
 - Detects functional phrases
 - Detects users
 - Detects objects
 - Detects multiple functional steps within each user story
 - Encourages refinement until the functional interpretation matches your intent
- Sets of user Stories
 - Cross references them all (up to 3000 user stories)
 - Many reports and visualizations to accelerate improvement of story quality and size precision.