IFPUG
Function Point Analysis (FPA) v4.2
Quick Guide

ENGINEERING

Software Process Improvement, Measurement & Quality

www.eng-it.it/spimq – luigi.buglione@eng.it

FPA Objectives

- Measure functionality that the user requests and receives
- Measure software development and maintenance independently of technology used for implementation

Note: A functional software size measurement method measures exclusively functional issues in a software solution; ISO version of IFPUG CPM 4.1 (IS 20926:2003) explicitly excludes the usage of GSC and VAF.

Possible Types of Count

- Development Project (**DFPC**): It measures the functions provided to the users with the first installation of the software delivered when the project is complete.
- Enhancement Project (**EFPC**): it measures the modifications to the existing application that add, change, or delete user functions delivered when the project is complete. When the functionality from an enhancement project is installed, the application function point count must be updated to reflect changes in the application's functionality.
- Application Project (**AFPC**): it is associated with an installed application. It is also referred to as the baseline or installed function point count. This count provides a measure of the current functions the application provides the user. This number is initialized when the development project function point count is completed. It is updated every time completion of an enhancement project alters the application's functions.

Counting procedure - Steps

1. Determine the type of count
2. Identify the Counting Scope and Application Boundary
3. Count Data Functions
4. Count Transactional Functions
5. Determine Unadjusted FP (UFP)
6. Determine Value Adjustment Factor (VAF)
7. Calculate Adjusted FP (AFP)

User View

It represents a formal description of the user's business needs in the user's language. Developers translate the user information into information technology language in order to provide a solution. A function point count is accomplished using the information in a language that is common to both user(s) and developers. A user view:

- Is a description of the business functions
- Is approved by the user
- Can be used to count function points
- Can vary in physical form (e.g., catalogue of transactions, proposals, requirements document, external specifications, detailed specifications, user handbook)

Elementary Process (EP)

- It is the smallest unit of activity that is meaningful to the user(s)
- It must be self-contained and leave the business of the application being counted in a consistent state

Purpose, Scope, Application Boundary

- Purpose of the count: to provide an answer to a business problem
- Counting Scope: it defines the functionality which will be included in a particular function point count
- Application Boundary: it indicates the border between the software being measured and the user
- Boundary Rules:

1. The boundary is determined based on the user's view. The focus is on what the user can understand and describe.
2. The boundary between related applications is based on separate functional areas as seen by the user, not on technical considerations.
3. The initial boundary already established for the application or applications being modified is not influenced by the counting scope.

Note: There may be more than one application included in the counting scope. If so, multiple application boundaries would be identified. When the application boundary is not well-defined (such as early in analysis), it should be located as accurately as possible.

Transactions (EI, EO, EQ)

Counting Rules – EI

- **Primary Intent**: to maintain 1+ ILFs and/or to alter the behaviour of the system
  - The data or control information is received from outside the application boundary
  - At least one ILF is maintained if the data entering the boundary is not control information that alters the behaviour of the system.
  - For the identified process, one of the following three statements must apply:
    - Processing logic is unique from the processing logic performed by other EI for the application
    - The set of data elements identified is different from the sets identified for other EI for the application
    - The ILFs or EIFs referenced are different from the files referenced by other EI in the application.
- **FTR Rules for EI**:
  - 1 FTR for each ILF maintained
  - 1 FTR for each ILF/EIF read
  - Only 1 FTR for each ILF both read and maintained
- **DET Rules for EI**
  - 1 DET for each user recognizable, non-repeated field that enters or exits the application boundary and is required to complete the EI
  - Do not count fields that are retrieved or derived by the system and stored on an ILF during the elementary process if the fields did not cross the application boundary
  - Only 1 DET for the capability to send a system response message outside the application boundary to indicate an error occurred during processing, confirm that processing is complete or verify that processing should continue
  - Only 1 DET for the ability to specify an action to be taken even if there are multiple methods for invoking the same logical process

Counting Rules – EO/EQ

- **Primary Intent**: to present information to a user
  - The function sends data or control information external to the application boundary.
  - For the identified process, one of the following three statements must apply:
    - Processing logic is unique from the processing logic performed by other EO or EQ for the application.
    - The set of data elements identified is different from the sets identified for other EO and EQ in the application.
    - The ILFs or EIFs referenced are different from the files referenced by other EO and EQ in the application.
- **Additional EO Counting Rules (at least 1)**:
  - The processing logic of the elementary process contains at least 1 math formula or calculation
  - The processing logic of the elementary process creates derived data
  - The processing logic of the elementary process maintains at least one ILF
  - The processing logic of the elementary process alters the behaviour of the system
- **Additional EQ Counting Rules (all)**:
  - The processing logic of the elementary process retrieves data or control information from an ILF or EIF
  - The processing logic of the elementary process does not contain a mathematical formula or calculation.
  - The processing logic of the elementary process does not create derived data
  - The processing logic of the elementary process does not maintain an ILF
  - The processing logic of the elementary process does not alter the behaviour of the system.
- **FTR Rules for EO/EQ**:
  - 1 FTR for each ILF/EIF read
  - 1 FTR for each ILF/EIF maintained (only EO)
  - Only 1 FTR for each ILF both read and maintained (only EO)
- **DET Rules for EO/EQ**:
  - 1 DET for each user recognizable, non-repeated field that enters the application boundary and is required to specify when, what and/or how the data is to be retrieved or generated by the elementary process
  - 1 DET for each user recognizable, non-repeated field that exits the boundary
  - If a DET both enters and exits the boundary, count it only once for the elementary process
  - Count 1 DET for the capability to send a system response message outside the application boundary to indicate an error occurred during processing, confirm that processing is complete or verify that processing should continue
  - Count 1 DET for the ability to specify an action to be taken even if there are multiple methods for invoking the same logical process
  - Do not count fields that are retrieved or derived by the system and stored on an ILF during the elementary process if the fields did not cross the application boundary
  - Do not count literals as DETs
  - Do not count paging variables or system-generated stamps

Processing Logic – Possibile Forms

Forms of Processing Logic	EI	EO	EQ
1. Validations are performed	c	c	c
2. mathematical formula and calculations are performed	c	m*	n
3. equivalent values are converted	c	c	c
4. data is filtered and selected by using specified criteria to compare multiple sets of data	c	c	c
5. conditions are analyzed to determine which are applicable	c	c	c
6. at least 1 ILF is updated	m*/ip	m*	n
7. at least 1 ILF is referenced	c	c	o
8. data or control information is retrieved	c	c	o
9. derived data is created	c	m*	n
10. behaviour of the system is altered	m*/pi	m*	n
11. prepare and present information outside the boundary	c	m/pi	m/pi
12. capability to accept data or control information that enters the application boundary	m	c	c
13. re-sorting or re-arranging a set of data	c	c	c

Legend: **pi** = primary intent; **c** = can perform; **m** = mandatory; **m*** = mandatory at least 1 of these forms; **n** = cannot perform

EI Complexity Table

FTR\DET	1-4	5-15	16+
0-1	**L** (3)	**L** (3)	**A** (4)
2	**L** (3)	**A** (4)	**H** (6)
3+	**A** (4)	**H** (6)	**H** (6)

EO/EQ Complexity Table

FTR\DET	1-5	6-19	20+
0-1	**L** (4/3)	**L** (4/3)	**A** (5/4)
2-3	**L** (4/3)	**A** (5/4)	**H** (7/6)
4+	**A** (5/4)	**H** (7/6)	**H** (7/6)

Data (ILF, EIF)

- **ILF Definition**
  - The group of data or control information is logical and user identifiable
  - The group of data is maintained through an elementary process within the application boundary being counted
- **EIF Definition**
  - The group of data or control information is logical and user identifiable
  - The group of data is referenced by, and external to, the application being counted
  - The group of data is not maintained by the application being counted
  - The group of data is maintained in an ILF of another application
- **RET Rules for ILF/EIF**
  - 1 RET for each optional or mandatory subgroup of the ILF or EIF **or**
  - If there are no subgroups, count the ILF or EIF as 1 RET
- **DET Rules for ILF/EIF**
  - 1 DET for each unique user recognizable, non-repeated field maintained in or retrieved from the ILF or EIF through the execution of an elementary process
  - When 2 applications maintain and/or reference the same ILF/EIF, but each maintains/references separate DETs, count only the DETs being used by each application to size the ILF/EIF
  - 1 DET for each piece of data required by the user to establish a relationship with another ILF or EIF

EIF/ILF Complexity Table

RET\DET	1-19	20-50	51+
1	**L** (5/7)	**L** (5/7)	**A** (7/10)
2-5	**L** (5/7)	**A** (7/10)	**H** (10/15)
6+	**A** (7/10)	**H** (10/15)	**H** (10/15)

General Systems Characteristics (GSC)

1. **Data Communication**: *describes the degree to which the application communicates directly with the processor*

0. Application is pure batch processing or a stand-alone application
1. Application is batch but has remote data entry or remote printing
2. Application is batch but has remote data entry and remote printing
3. Application includes on-line data collection or TP (teleprocessing) front end to a batch process or query system
4. Application is more than a front-end, but supports only one type of TP communications
5. Application is more than a front-end, and supports more than one type of TP communications protocol

2. Distributed Data Processing: *describes the degree to which the application transfers data among physical components of the application.*

0. Data is not transferred or processed on another component of the system
1. Data is prepared for transfer, then is transferred and processed on another component of the system, for user processing
2. Data is prepared for transfer, then is transferred and processed on another component of the system ,not for user processing
3. Distributed processing and data transfer are on-line and in one direction only
4. Distributed processing and data transfer are on-line and in both directions
5. Distributed processing and data transfer are on-line and are dynamically performed on the most appropriate component of the system

3. Performance: *describes the degree to which response time and throughput performance considerations influenced the application development.*

0. No special performance requirements were stated by the user
1. Performance and design requirements were stated and reviewed but no special actions were required.
2. Response time or throughput is critical during peak hours. No special design for CPU utilization was required. Processing deadline is for the next business cycle.
3. Response time or throughput is critical during all business hours. No special design for CPU utilization was required. Processing deadline requirements with interfacing systems are constraining
4. In addition, stated user performance requirements are stringent enough to require performance analysis tasks in the design phase
5. In addition, performance analysis tools were used in the design, development, and/or implementation phases to meet the stated user performance requirements

4. Heavily Used Configuration: *describes the degree to which computer resource restrictions influenced the development of the application.*

0. No explicit or implicit operational restrictions are included
1. Operational restrictions do exist, but are less restrictive than a typical application. No special effort is needed to meet the restrictions
2. Operational restrictions do exist, but are typical for an application. Special effort through controllers or control programs is needed to meet the restrictions
3. Stated operational restrictions require special constraints on one piece of the application in the central processor or a dedicated processor
4. Stated operational restrictions require special constraints on the entire application in the central processor or a dedicated processor
5. In addition, there are special constraints on the application in the distributed components of the system.

5. Transaction Rate: *describes the degree to which the rate of business transactions influenced the development of the application*

0. No peak transaction period is anticipated
1. Low transaction rates have minimal effect on the design, development, and installation phases
2. Average transaction rates have some effect on the design, development, and installation phases
3. High transaction rates affect the design, development, and/or installation phases.
4. High transaction rate(s) stated by the user in the application requirements or service level agreements are high enough to require performance analysis tasks in the design, development, and/or installation phases.
5. High transaction rate(s) stated by the user in the application requirements or service level agreements are high enough to require performance analysis tasks and, in addition, require the use of performance analysis tools in the design, development, and/or installation phases

6. Online Data Entry: *describes the degree to which data is entered or retrieved through interactive transactions*

0. All transactions are processed in batch mode.
1. 1% to 7% of transactions are interactive.
2. 8% to 15% of transactions are interactive.
3. 16% to 23% of transactions are interactive.
4. 24% to 30% of transactions are interactive.
5. More than 30% of transactions are interactive.

7. End-User Efficiency: *describes the degree of consideration for human factors and ease of use for the user of the application measured*

0. None of the above
1. 1-3 of the above.
2. 4-5 of the above.
3. 6+ of the above, but there are no specific user requirements related efficiency.
4. 6+ of the above, and stated requirements for user efficiency are strong enough to require design tasks for human factors to be included
5. 6+ of the above, and stated requirements for user efficiency are strong enough to require use of special tools and processes in order to demonstrate that the objectives have been achieved.

16 capabilities:

- Navigational aids (e.g., function keys, jumps, dynamically generated menus, hyper-links)
- Menus
- On-line help and documents
- Automated cursor movement
- Scrolling
- Remote printing (via on-line transmissions)
- Pre-assigned function keys (e.g., clear screen, request help, clone screen)
- Batch jobs submitted from on-line transactions
- Drop down List box
- Heavy use of reverse video, highlighting, colours, underlining, and other indicators
- Hard-copy documentation of on-line transactions (e.g., screen print)
- Mouse interface
- Pop-up windows
- Templates and/or defaults
- Bilingual support (supports 2 languages: count as 4 items)
- Multi-lingual support (supports more than two languages: count as 6items)

8. Online Update: *describes the degree to which internal logical files are updated on-line.*

0. None.
1. On-line update of one to three control files is included. Volume of updating is low and recovery is easy.
2. On-line update of four or more control files is included. Volume of updating is low and recovery is easy.
3. On-line update of major internal logical files is included.
4. In addition, protection against data loss is essential and has been specially designed and programmed in the system.
5. In addition, high volumes bring cost considerations into the recovery process. Highly automated recovery procedures with minimum human intervention are included.

9. Complex Processing: *describes the degree to which processing logic influenced the development of the application.*

Possible issues to evaluate (1 point for each selected item):

- Sensitive control and/or application-specific security processing.
- Extensive logical processing
- Extensive mathematical processing
- Much exception processing, resulting in incomplete transactions that must be processed again.
- Complex processing to handle multiple input/output possibilities.

10. Reusability: *describes the degree to which the application and the code in the application have been specifically designed, developed, and supported to be usable in other applications*

0. No reusable code.
1. Reusable code is used within the application.
2. Less than 10% of the application code developed is intended for use in more than one application.
3. 10% or more of the application code developed is intended for use in more than one application.
4. The application was specifically packaged and/or documented to ease reuse, and the application is customized at the source code level.
5. The application was specifically packaged and/or documented to ease reuse, and the application is customized for use by means of user parameter maintenance.

11. Installation Ease: *describes the degree to which conversion from previous environments influenced the development of the application.*

0. No special considerations were stated by the user, **and no** special setup is required for installation
1. No special considerations were stated by the user, **but** special setup is required for installation
2. Conversion and installation requirements were stated by the user, and conversion and installation guides were provided and tested. The impact of conversion on the project **is not** considered to be important
3. Conversion and installation requirements were stated by the user, and conversion and installation guides were provided and tested. The impact of conversion on the project **is** considered to be important.
4. In addition to 2 above, automated conversion and installation tools were provided and tested
5. In addition to 3 above, automated conversion and installation tools were provided and tested.

12. Operational Ease: *describes the degree to which the application attends to operational aspects, such as start-up, back-up, and recovery processes*

0. No special operational considerations other than the normal back-up procedures were stated by the user

1 - 4 One, some, or all of the following items apply to the application. Select all that apply. Each item has a point value of one, except as noted otherwise.

- Start-up, back-up, and recovery processes were provided, but human intervention is required
- Start-up, back-up, and recovery processes were provided, but no human intervention is required (count as two items)
- The application minimizes the need for tape mounts and/or remote data access requiring human intervention
- The application minimizes the need for paper handling

5. The application is designed for unattended operation. Unattended operation means *no human intervention* is required to operate the system other than to start up or shut down the application. Automatic error recovery is a feature of the application

13. Multiple Sites: *describes the degree to which the application has been developed for different hardware and software environments..*

0. The needs of only one installation site were considered in the design
1. The needs of more than one installation were considered in the design, and the application is designed to operate only under identical hardware and software environments
2. The needs of more than one installation site were considered in the design, and the application is designed to operate only under similar hardware and/or software environments.
3. The needs of more than one installation site were considered in the design, and the application is designed to operate under different hardware and/or software environments
4. Documentation and support plan are provided and tested to support the application at multiple installation sites and the application is as described by 2
5. Documentation and support plan are provided and tested to support the application at multiple installation sites and the application is as described by 3.

14. Facilitate Change: *describes the degree to which the application has been developed for easy modification of processing logic or data structure*

The following characteristics can apply for the application:

- Flexible query and report facility is provided that can handle **simple** requests (count as 1 item)
- Flexible query and report facility is provided that can handle requests of **average** complexity. (count as 2 items)
- Flexible query and report facility is provided that can handle **complex** requests. (count as 3 items)
- Business control data is kept in tables that are maintained by the user with on-line interactive processes, but changes take effect only on the **next** business cycle. (count as 1 item)
- Business control data is kept in tables that are maintained by the user with on-line interactive processes, and the changes take effect **immediately**. (count as 2 items)

Formula – TDI, VAF, UFP

$$TDI = \sum_{i=1}^{14} GSC_i \qquad VAF = TDI * 0.01 + 0.65 \qquad UFP = \sum_{i=1}^{5} TE_i * w_i$$

Formula – DFPC, EFPC, AFCP

- Development: $DFPC = (UFP + CFP) * VAF$
- Enhancement: $EFPC = [(ADD + CHGA + CFP) * VAFA] + (DEL * VAFB)$
- Application: $AFPC = [(UFPB + ADD + CHGA) - (CHGB + DEL)] * VAFA$

Legend

- **ADD**: UFP of those functions that were or will be added by the enhancement project
- **CFP**: UFP of those functions added by the conversion
- **CHGA**: UFP of those functions that were/will be modified by the enhancement project
- **CHGB**: UFP of those functions that were changed by the enhancement project
- **DEL**: UFP of those functions that were deleted by the enhancement project
- **VAF**: Value Adjustment Factor
- **VAFA**: VAF *after* the enhancement project is complete
- **VAFB**: VAF *before* the enhancement project begins
- **UFP**: Unadjusted Function Points
- **UFPB**: UFP *before* the enhancement project begins