

FUNCTION POINT ANALYSIS

Counting Function Points Reference Guide

IFPUG CPM Version 4.2



SOFTWARE
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User View

A user is any person that specifies Functional User Requirements and/or any person or thing that communicates or interacts with the software at any time.

A *user view* 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., catalog of transactions, proposals, requirements document, external specifications, detailed specifications, user handbook)

User Identifiable is a defined requirement for processes and/or groups of data that are agreed upon, and understood by both the user and the software developers.

Counting Boundary

The application boundary defines what is external to the application; is the conceptual interface between "internal" application and "external" user world; acts as a "membrane" through which data passes into and out from the application; encloses the logical data maintained by the application; assists in identifying logical data referenced by, not maintained within,

this application; and is dependent upon the user's external business view of the application.

Boundary Rules:

- The boundary is determined based on the *user's point of view*. The focus is on what the user can understand and describe.
- The boundary between related applications is based on separate business functions as seen by the user, not on technological concerns.
- For enhancement projects, the initial boundary must conform to the boundaries already established for the application or applications being modified.

Internal Logical File (ILF)

An internal logical file (ILF) is a user identifiable group of logically related data or control information maintained within the boundary of the application. The primary intent of an ILF is to hold data maintained through one or more elementary processes of the application being counted.

Internal Logical Files Identification Rules

- The group of data or control information is a logical and user identifiable.
- The group of data **is maintained** through an elementary process **within** the application boundary being counted.

ILF & EIF Data Element (DET) Type Identification Rules

- Count a 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 two 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.
- Count a DET for each piece of data required by the user to establish a relationship with another ILF or EIF.

ILF & EIF Record Element Type (RET) Identification Rule

- Count an RET for each optional or mandatory subgroup of the ILF; *OR*
- If there are no subgroups, count the ILF as one RET.

ILF Weights Low=7 Average=10 High=15

Record Element Types	Data Element Types		
	1 – 19	20 - 50	51+
1	L	L	A
2 - 5	L	A	H
6+	A	H	H

External Interface File (EIF)

An external interface file (EIF) is a user identifiable group of logically related data or control information referenced by the application, but maintained within the boundary of another application. The primary intent of an EIF is to hold data referenced through one or more elementary processes within the boundary of the application counted. This means an EIF counted for an application must be in an ILF in another application.

External Interface Files Identification Rules

- The group of data or control information is a 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.

Data Element Type and File Type Referenced Identification Rules, and Complexity Matrix: SAME AS ILF

EIF Weights Low=5 Average=7 High=10

External Input (EI)

An external input (EI) is an elementary process that processes data or control information that comes from outside the application boundary. The primary intent of an EI is to maintain one or more ILFs and/or to alter the behavior of the system.

External Inputs Identification Rules

- 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 behavior of the system.
- For the identified process, one of the following three rules must apply:
 - Process logic is unique from other external inputs for the application. Processing logic is defined as any of the requirements specifically requested by the user to complete an elementary process, such as validations, algorithms, or calculations, and reading or maintaining a file.
 - The set of data elements identified is different from the sets identified for other external inputs for the application.
 - The ILFs or EIFs referenced are different from the files referenced by other external inputs in the application

EI File Type Referenced (FTR) Rules

- Count an FTR for each ILF maintained.
- Count an FTR for each ILF or EIF read during the processing of the EI
- Count only one FTR for Each ILF that is both maintained and read by the EI.

EI Data Element Type Rules

- Count one DET for each user recognizable, non-repeated field that enters or exits the application boundary and is required to complete the external input.
- 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
- Count one 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 one DET for the ability to specify an action to be taken even if there are multiple methods for invoking the same logical process.

EI Weights Low=3 Average=4 High=6

File Types Referenced	Data Element Types		
	1 – 4	5 - 15	16+
0 or 1	L	L	A
2	L	A	H
3+	A	H	H

External Output (EO)

An external output (EO) is an elementary process that sends data or control information outside the application boundary. The primary intent of an external output is to present information to a user through processing logic other than, or in addition to, the retrieval of data or control information. The processing logic must contain at least one mathematical formula or calculation, or create derived data. An external output may also maintain one or more ILFs and/or alter the behavior of the system.

External Output Identification Rules

- The function sends data or control information external to the application boundary.
- For the processing logic of the elementary process one of the following four statements must also apply:
 - It contains at least one mathematical formula or calculation
 - It creates derived data
 - It maintains at least one ILF
 - It alters the behavior of the system
- One of the following three statements must apply:
 - Processing logic is unique from the processing logic performed by other EOs for the application.
 - The set of data elements identified is different from the sets identified for other EOs for the application.
 - The ILFs or EIFs referenced are different from the files referenced by other EOs in the application

EO/EQ File Type Reference Rules

- Count one file type reference for each ILF or EIF read during the processing of the EO or EQ

Additional File Type Reference Rules for EO only

- Count one FTR for each ILF maintained during the processing of the elementary process
- Count only one FTR for each ILF that is both maintained and read during the elementary process

EO/EQ Data Element Type Rules

- Count one 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
- Count one 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 one 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 one 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.

EO Weights Low=4 Average=5 High=7

File Types Referenced	Data Element Types		
	1 – 5	6 - 19	20+
0 or 1	L	L	A
2 - 3	L	A	H
4+	A	H	H

External Inquiry (EQ)

An external inquiry (EQ) is an elementary process that sends data or control information outside the application boundary. The primary intent of an external inquiry is to present information to a user through the retrieval of data or control information from an ILF or EIF. The processing logic contains no mathematical formulas or calculations, and creates no derived data. No ILF is maintained during the processing, nor is the behavior of the system altered.

External Inquiry Identification Rules

- The function sends data or control information external to the application boundary
- The processing logic of the elementary process:
 - retrieves data or control information from an ILF or EIF
 - does not contain a mathematical formula or calculation
 - does not create derived data
 - does not maintain an ILF
 - does not alter the behavior of the system
- One of the following three statements must apply:

- Processing logic is unique from the processing logic performed by other EQs for the application
- The set of data elements identified is different from the sets identified for other EQs for the application
- The ILFs or EIFs referenced are different from the files referenced by other EQs in the application

FTR and DET Rules – Same as External Output Rules

EQ Weights Low=3 Average=4 High=6

File Types Referenced	Data Element Types		
	1 – 5	6 - 19	20+
0 or 1	L	L	A
2 - 3	L	A	H
4+	A	H	H

Function Point Calculations

Development Project Function Point =

$$(UFP + CFP) * VAF$$

Enhancement Project Function Point =

$$[(ADD + CHGA + CFP) * VAFA] + (DEL * VAFB)$$

Initial Application Function Point =

$$ADD * VAF$$

Revised Application Function Point after Enhancements =

$$[(UFPB + ADD + CHGA) - (CHGB + DEL)] * VAFA$$

Where

ADD = unadjusted FP added to application

CFP = conversion FPs

CHGA = unadjusted FP modified by the enhancement project. Reflects the functions *after* the modifications.

CHGB = unadjusted FP modified by the enhancement project. Reflects functions *before* the modifications.

DEL = unadjusted FP deleted by the enhancement project.

UFP = unadjusted FP count

UFPB = unadjusted FP *before* the enhancement project

VAF = value adjustment factor

VAFA = value adjustment factor after enhancement project

VAFB = value adjustment factor *before* enhancement project

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General System Characteristics

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1. Data Communications

Degree to which the application communicates directly with the processor. The *data* and *control* information used in the application are sent or received over communication facilities. Devices connected locally to the control unit are considered to use communication facilities. Protocol is a set of conventions that permit the transfer or exchange of information between two systems or devices. All data communication links require some type of protocol.

Score As:

- 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

Degree to which the application transfers data among physical components of the application. Distributed data or processing functions are a characteristic of the application within the application boundary.

Score As:

- 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

Degree to which response time and throughput performance considerations influenced the application development. Application performance objectives, stated or approved (or implied) by the user, *in either* response or throughput, influence (or will influence) the design, development, installation, and support of the application.

Score As:

- 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

Degree to which computer resource restrictions influenced the development of the application. A heavily used operational configuration may require special considerations when designing the application. For example, the user wants to run the application on existing or committed equipment that will be heavily used.

Score As:

- 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

Degree to which the rate of business transactions influenced the development of the application. The transaction rate is high, and it influences the design, development, installation, and support of the application. Users may require what they regard as normal response time even during times of peak volume.

Score As:

- 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

Degree to which data is entered or retrieved through interactive transactions. On-line User Interface for data entry, control functions, reports, and queries are provided in the application.

Score As:

- 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

Degree of consideration for human factors and ease of use for the user of the application measured. The on-line functions provided emphasize a design for user efficiency (human factor/user friendliness). The design includes:

- 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, colors, 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 two languages: count as four items)
- Multi-lingual support (supports more than two languages: count as six items)

Score As:

- 0 None of the above.
- 1 One to three of the above.
- 2 Four to five of the above.
- 3 Six or more of the above, but there are no specific user requirements related to efficiency.
- 4 Six or more of the above, and stated requirements for user efficiency are strong enough to require **design tasks** for human factors to be included
- 5 Six or more of the above, and stated requirements for user efficiency are strong enough to require **use of special tools and processes**

8. Online Update

Degree to which internal logical files are updated on-line. The application provides on-line update for the internal logical files.

Score As:

- 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

Degree to which processing logic influenced the development of the application. The following components are present:

- 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.

Score As:

- 0 None of the above.
- 1 Any one of the above.
- 2 Any two of the above.
- 3 Any three of the above.
- 4 Any four of the above.
- 5 All five of the above.

10. Reusability

Degree to which the application and the code in the application have been specifically designed, developed, and supported to be usable in **other** applications.

Score As:

- 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 Ten percent (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

Degree to which conversion from previous environments influenced the development of the application. Conversion and installation ease are characteristics of the application. A conversion and installation plan and/or conversion tools were provided and tested during the system test phase.

Score As:

- 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

Degree to which the application attends to operational aspects, such as start-up, back-up, and recovery processes. Operational ease is a characteristic of the application. The application minimizes the need for manual activities, such as tape mounts, paper handling, and direct on-location manual intervention.

Score As:

- 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

Degree to which the application has been developed for different hardware and software environments.

Score As:

- 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

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:

A. Flexible Query

1. Flexible query and report facility is provided that can handle **simple** requests. (count as 1 item)
2. Flexible query and report facility is provided that can handle requests of **average** complexity. (count as 2 items)
3. Flexible query and report facility is provided that can handle **complex** requests. (count as 3 items)

B. Business Control Data

1. 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)
2. 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)

Score As:

- 0 None of the above.
- 1 A total of one item from above.
- 2 A total of two items from above.
- 3 A total of three items from above.
- 4 A total of four items from above.
- 5 A total of five items from above.