Software Project Management

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Project Estimation Techniques cont…

- **Parametric models**
  - **Some more examples on Albrecht/IFPUG function points**
  - **Symons/Mark II function points**
  - **COSMIC function points**

Parametric models for Size

1. Albrecht/IFPUG function points
2. Symons/Mark II function points
3. COSMIC function points
4. COCOMO 81 and COCOMO II

Example on Albrecht/IFPUG FP

Consider a project with the following functional units:

- 50 user inputs, 40user outputs, 35 user enquiries, 6 user files, 4 external interfaces. Assume all complexity adjustment factors and weighting factors are average.
- Compute the function points for the project.
- Suppose that program needs 70 LOC per FP.
- Find out the size of complete project.

Solution

- UFP= 50 * 4 + 40 * 5 + 35 * 4 + 6 * 10 + 4 * 7
  = 200+200+140+60+28 = 628
- VAF=0.65 + 0.01 (14 * 3) = 1.07
- AFP= UFP *VAF=628 * 1.07 = 672
- Size = FP * (LOC per FP) = 672 * 70 = 47040 LOC

Another example

- Compute the function-point value for a project with the following information-domain characteristics.
  - Number of user Inputs: 32
  - Number of User Output: 60
  - Number of User Inquiries: 24
  - Number of Files: 8
  - Number of External interface:2
- Assume that all complexity adjustment values are average.

Solution

- UFP = 32x4 + 60x5 + 24x4 + 8x10 + 2x7 = 128 + 300 + 96 + 80 + 14 = 618
- VAF = 0.65 + 0.01x(14x3) = 0.65+0.42 = 1.07
- AFP = UFP x VAF = 618x1.07 = 661.26

Example: super market

Determine the function point measure of the size of the following supermarket software. A supermarket needs to develop the following software to encourage regular customers. For this, the customer needs to supply his/her residence address, telephone number, and the driving license number. Each customer who registers for this scheme is assigned a unique *customer number* (CN) by the computer. Based on the generated CN, a clerk manually prepares a customer identity card after getting the market manager's signature on it. A customer can present his customer identity card to the check out staff when he makes any purchase. In this case, the value of his purchase is credited against his CN. At the end of each year, the supermarket intends to award surprise gifts to 10 customers who make the highest total purchase over the year. Also, it intends to award a 22 caret gold coin to every customer whose purchase exceeded Rs. 10,000. The entries against the CN are reset on the last day of every year after the prize winners' lists are generated. Assume that various project characteristics determining the complexity of software development to be average.

Solution of Example: super market

Step 1: From an examination of the problem description, we find that there are two inputs, three outputs, two files, and no interfaces. Two files would be required, one for storing the customer details and another for storing the daily purchase records.

Now we get:

- UFP = 2 × 4 + 3 × 5 + 1 × 4 + 10 × 2 + 0 × 7 = 47

Ref:
UFP= # inputs*4+ # outputs*5+ # inquiries*4+ # files*10+ # interfaces*7

Solution of Example: super market cont…

Step 2: All the parameters are of moderate complexity, except the output parameter of customer registration, in which the only output is the CN value. Consequently, the complexity of the output parameter of the customer registration function can be categorized as simple. By consulting the table, we find that the value for simple output is given to be 4.

The UFP can be refined as follows:

- UFP = 3 × 4 + 2 × 5 + 1 × 4 + 10 × 2 + 0 × 7 = 46

Therefore, the UFP will be 46.

External user types	Low complexity	Medium complexity	High complexity
External input type	3	4	6
External output type	4	5	7
External inquiry type	3	4	6
Logical internal file type	7	10	15
External interface file type	5	7	10

Solution of Example: super market cont…

- **Step 3:** Since the complexity adjustment factors have average values, therefore the total degrees of influence would be: DI = 14 × 4 = 56
- TCF = 0.65 + 0.01 + 56 = 1.21

Therefore, the adjusted FP=46*1.21=55.66

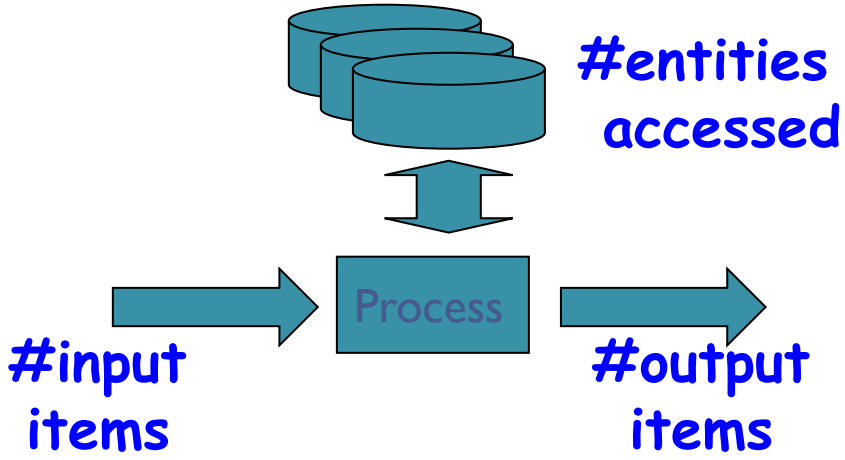
Function points Mark II

- Developed by Charles R. Symons
- 'Software sizing and estimating - Mk II FPA', Wiley & Sons, 1991.
- Builds on work by Albrecht
- Developed in parallel to IFPUG FPs
- A simpler and more usable method

Function points Mk II cont…

- For each transaction, count
  - data items input (N_i)
  - data items output ($N_{o)}$
  - entity types accessed (N_e)

Function points Mk II cont…



- Simpler than FP
- Widely used in UK

FP count = N_i * 0.58 + N_e * 1.66 + N_o * 0.26

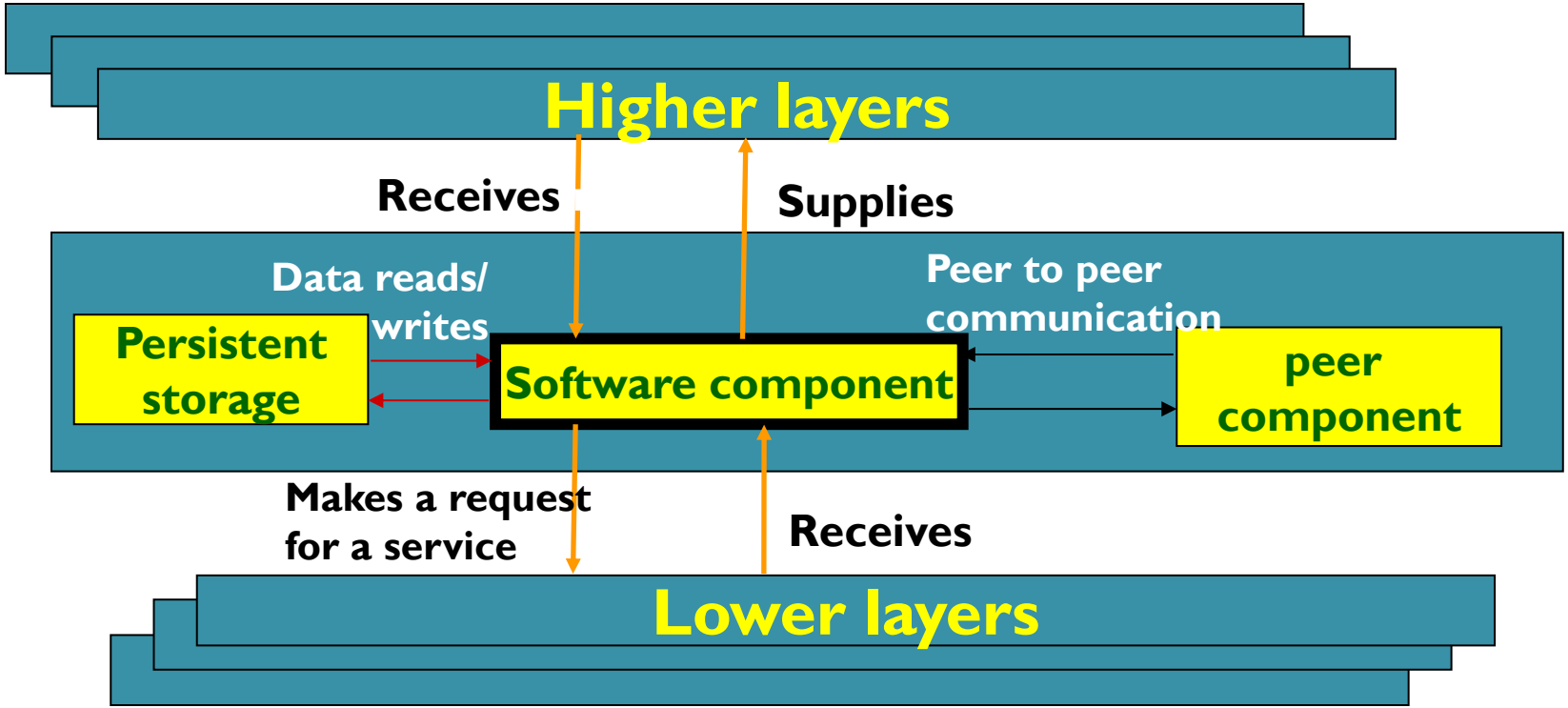
Function points for embedded systems

- Mark II and IFPUG function points were designed for information systems, and not suitable for embedded systems:
  - Dominated by input and output operations
- COSMIC Full FPs attempt to extend the concept to embedded systems
- In an embedded system, its features will be hidden, because the software's user will probably not be a human,
  - it will be hardware device or another software component

Function points for embedded systems cont...

- COSMICS deals with this by decomposing the system architecture into a hierarchy of software layers.
- Embedded software is seen as being in a particular ‘layer’ in the system
  - Communicates with other layers and also other components at same level
- The software component to be sized, can receive requests for services from layers above and can request services from those below it.

Layered software



Function points for embedded systems cont...

- This identifies the boundary of the software component to be accessed and thus the points at which it receives inputs and transmits outputs.
- Inputs and outputs are aggregated into data groups, where each group brings together data items that relate to the same object of interest.

COSMIC FPs

Data groups can move about in 4 ways as follows.

- Entries: movement of data into software component from a higher layer or a peer component
- Exits: movements of data out
- Reads: data movement from persistent storage
- Writes: data movement to persistent storage

Each counts 1 'COSMIC functional size unit' (Cfsu).

COSMIC FPs cont ...

- The overall FFP count is derived by simply adding up the counts for each of the 4 types of data movement.
- COSMIC FFPs have been incorporated into ISO standard.

COSMIC FPs cont ...

Cons:

- Does not take into account any processing of the data groups once they have been moved into the software component.
- Not recommended for use in systems involving complex mathematical algorithms.

Function Points: Pros and Cons

- Pros:
  - Language independent
  - Understandable by client
  - Simple modeling
  - Hard to fudge
  - Visible feature creep
- Cons:
  - Labor intensive
  - Extensive training
  - Inexperience may result in inaccuracy
  - Weighted to file manipulation and transactions
  - Errors may be introduced by single person, multiple raters advised…
  - Does not consider algorithmic complexity of a function.

Feature Point Metric

- FP metric Suffers from a major drawback:
  - the size of a function is considered to be independent of its complexity.
- In order to overcome this problem, an extension to the function point metric, called feature point metric has been proposed.
  - considers an extra parameter:
    - Algorithm Complexity.

Feature Point Metrics cont ...

- This parameter ensures that
  - the computed size using the feature point metric reflects the fact that
    - higher the complexity of a function, the greater the effort required to develop it
- Therefore, it should have larger size compared to a simpler function.

Critical comments on the function point and feature point metrics

- Proponents of function point and feature point metrics claim that these two metrics are language-independent and can be easily computed from the SRS document during project planning stage itself.
- On the other hand, opponents claim that these metrics are subjective and require a sleight of hand.
- An example of the subjective nature of the function point metric can be that the way one groups input and output data items into logically related groups can be very subjective.

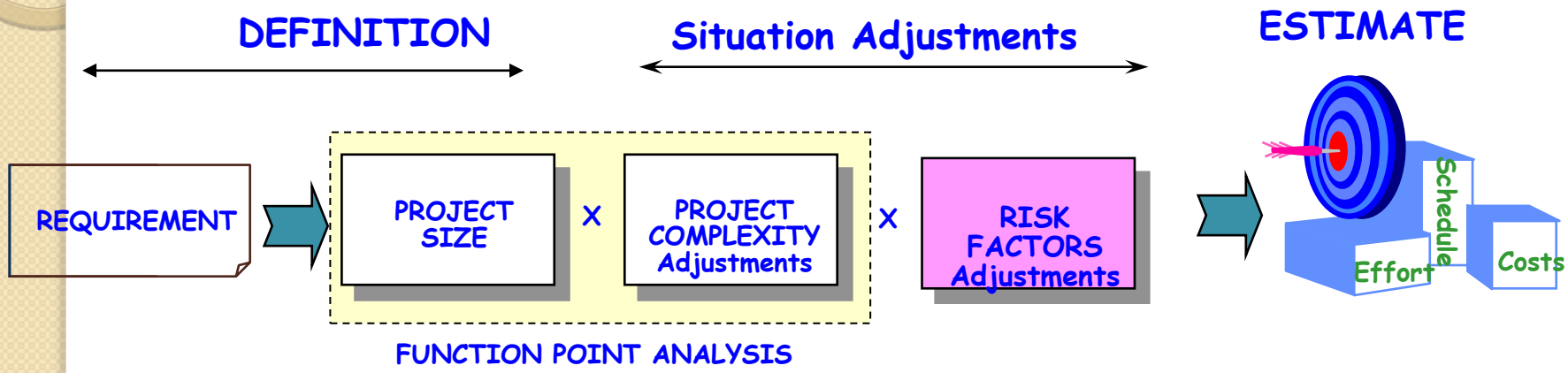
Critical comments on the function point and feature point metrics cont…

- For example, consider that certain functionality requires the employee name and employee address to be input. It is possible that one can consider both these items as a single unit of data, since after all, these describe a single employee. It is also possible for someone else to consider an employee's address as a single unit of input data and name as another.
- Such ambiguities leave sufficient scope for debate and keep open the possibility for different project managers to arrive at different function point measures for essentially the same problem.

FP/SLOC Conversion

Language	Median SLOC/function point
C	104
C++	53
HTML	42
JAVA	59
Perl	60
J2EE	50
Visual Basic	42

Accurate Size Estimation



Object Points

- Object points has nothing to do with object-oriented programming
- Number of object points is estimated based on
  - Number of separate screens displayed
  - Number of reports that are produced
  - Number of modules in the code
- Object points are simpler to estimate & GUI into account

Summary

- Solved some more examples on Albrecht/IFPUG function points
- Discussed Symons/Mark II function points and COSMIC function points.
- Also, discussed the concepts feature points and object points.

References :

1. B. Hughes, M. Cotterell, R. Mall, *Software Project Management*, Sixth Edition, McGraw Hill Education (India) Pvt. Ltd., 2018.
2. R. Mall, *Fundamentals of Software Engineering*, Fifth Edition, PHI Learning Pvt. Ltd., 2018.

Thank you