FiSMA 1.1

A Functional Size Measurement Method with continuous scale:

Basic principles and practical examples

FiSMA Functional Size Measurement Method Version 1.1 (referred to as FiSMA 1.1) is a general, parameterised functional size measurement method for all types of software.

Introduction

FiSMA 1.1 is a mature and rigorous Functional Size Measurement (FSM) method. Since its first introduction as “Laturi method” over 15 years ago, FiSMA 1.1 has evolved based on scientific research and user company responses.

When practitioners familiar with other popular FSM methods first encounter FiSMA 1.1 they may notice that this method measures more concrete manifestations of Functional User Requirements (FUR) and takes a different approach than any of the first generation FSM methods.

The reader is reminded that FiSMA 1.1 measurement data have been independently validated by no less than five internationally respected researchers and size measurement results have been found to correlate extremely well with productivity, estimate accuracy etc.

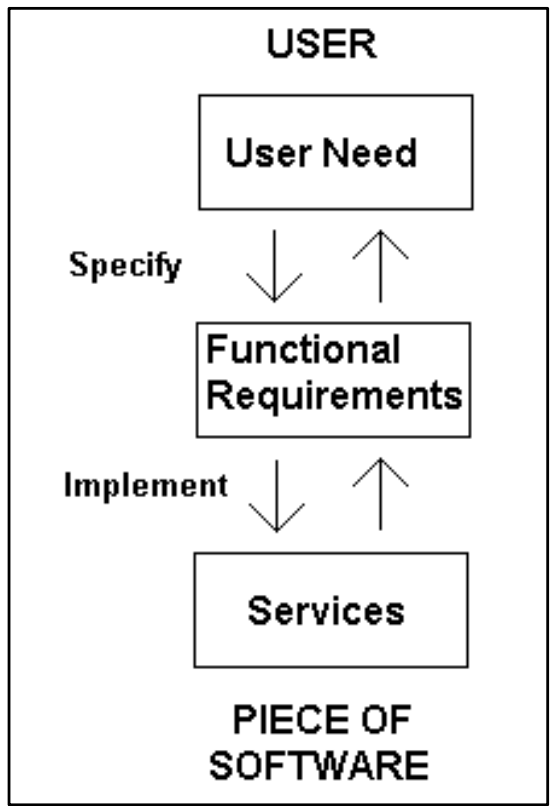
This presentation is intended to:

- Introduce the basic principles and all measurement procedures and formulas of FiSMA 1.1.
- Provide real life examples of each Base Functional Component (BFC) type in FiSMA 1.1.
- Include sample FFP counts for the example BFC:s.
- Increase knowledge transfer and understanding of FiSMA 1.1.

The reader can find more details about the use and the related research of FiSMA 1.1 method in another document: FiSMA_PAS_Explanatory report, 17.1.2007.

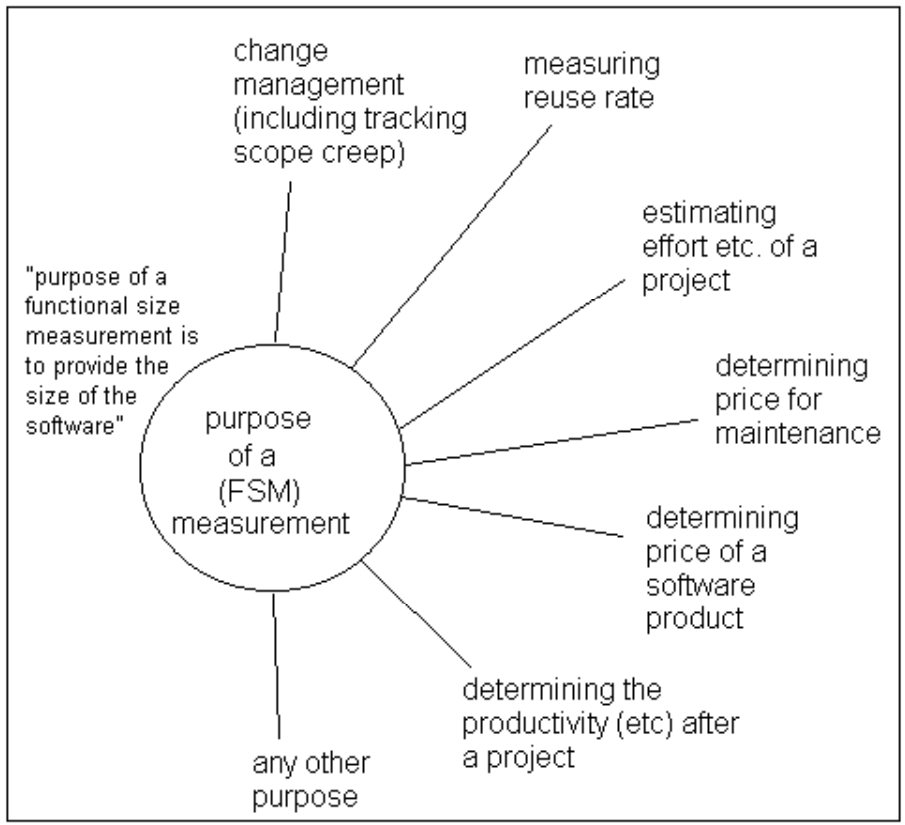
Main features of FiSMA 1.1

- Based purely on Functional User Requirements
- Service oriented
- Requires identification of all different *services* provided by the piece of software



Purpose and Scope

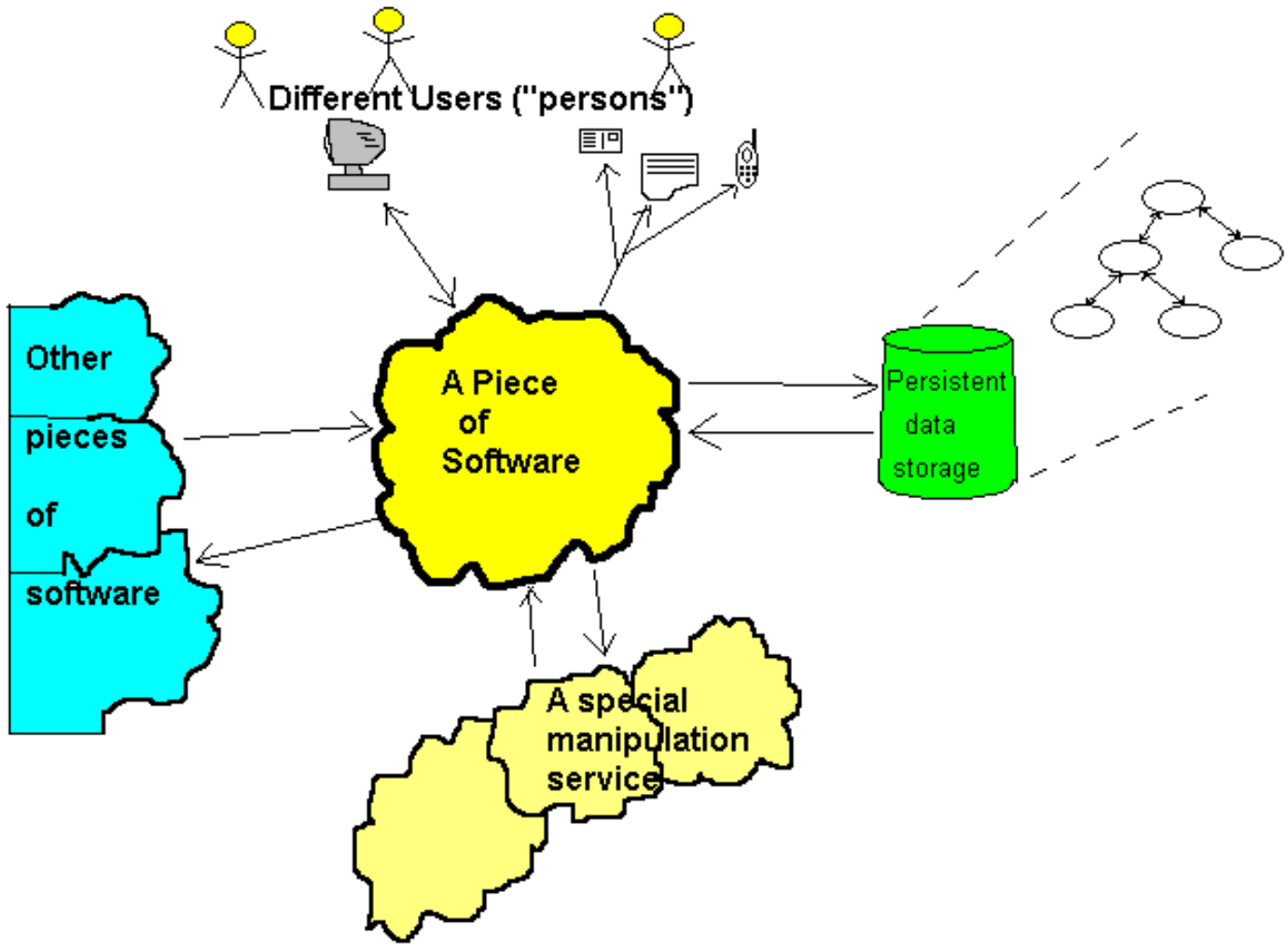
- Functional size is an essential measure for all software comparisons
- Main uses are estimating and productivity analysis
- Proven to be useful in project planning, tracking, control and contracting.



FiSMA 1.1 terms and definitions

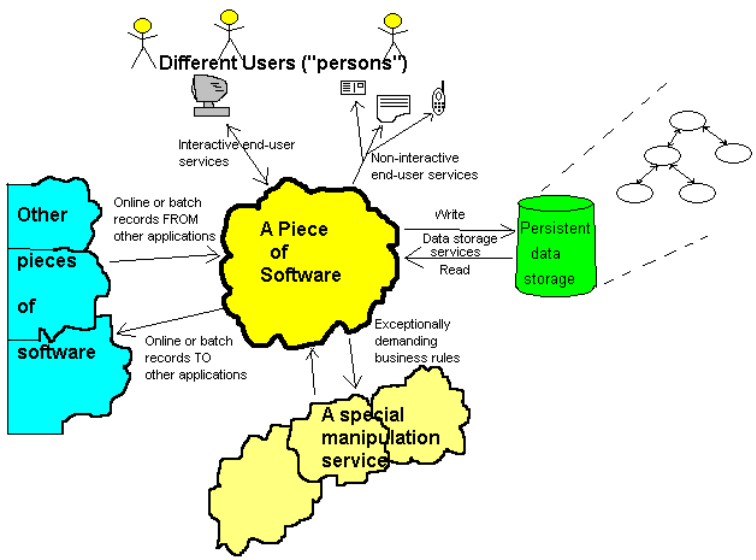
- User is any person or thing that communicates or interacts with the software at any time
- End-user is any person that communicates or interacts with the software at any time
- Functional User Requirements (FUR's) are specified as functions or functional services
- Base Functional Component (BFC) is an elementary unit of the FUR, i.e. a functional service
- BFC classes (7) and BFC types (28)
- + all ISO/IEC 14143-1 definitions

How people see functional services of software

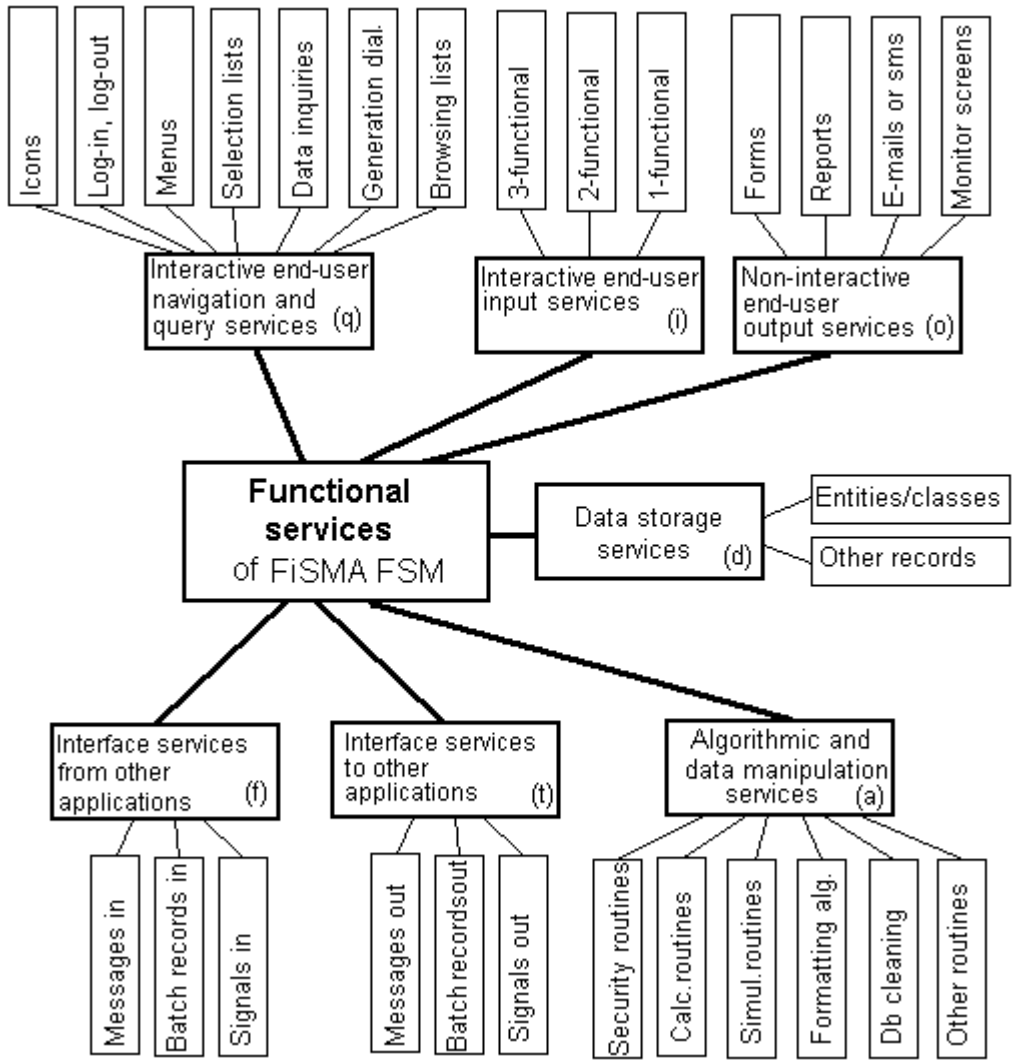


Seven FiSMA 1.1 BFC classes

- Interactive end-user navigation and query services (q)
- Interactive end-user input services (i)
- Non-interactive end-user output services (o)
- Interface services to other application (t)
- Interface services from other applications (f)
- Data storage services (d)
- Algorithmic and manipulation services (a)

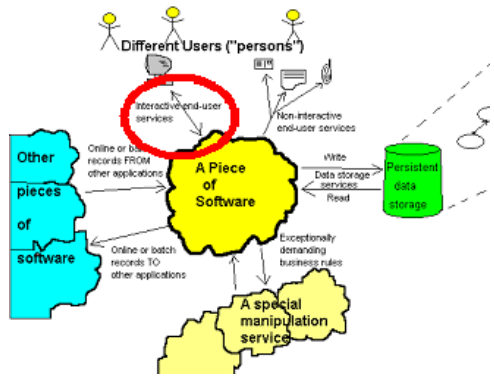


28 FiSMA 1.1 BFC types



Counting rule for navigation and query services (q1-q7)

- **Input**: Number of data elements displayed (n) AND number of reading references needed to provide them (r).
- **Process**: 0,2 + n/7 + r/2
- **Output**: Functional size of the navigation or query BFC

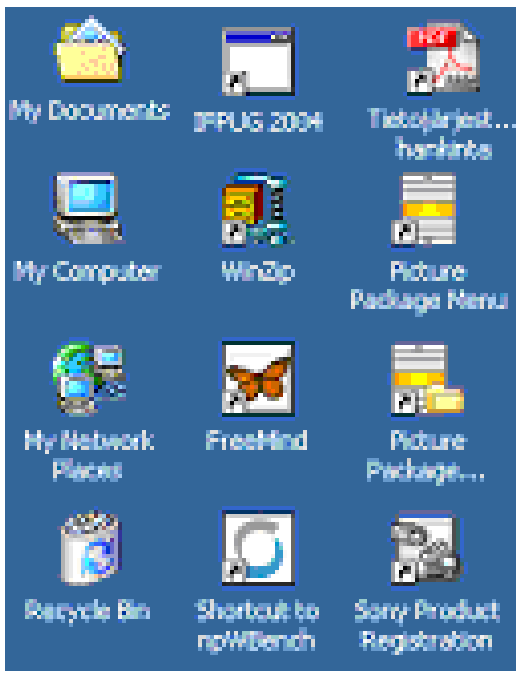


Icon (q1)

- an object that initiates a service or the piece of software

FUR: ”I want to find my new application and get it started .”

Examples of different icons:

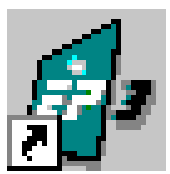


Adobe Reader 6.0.lnk

A BFC with 2 data elements and 1 reading reference (=system parameters) => 1,0 FFP

Skype.lnk

A BFC with 2 data elements and 1 reading reference (=system parameters) => 1,0 FFP



Experience Pro 3.14.lnk

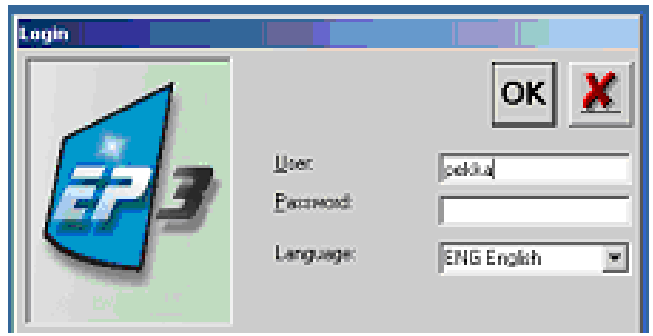
A BFC with 2 data elements and 1 reading reference (=system parameters) => 1,0 FFP

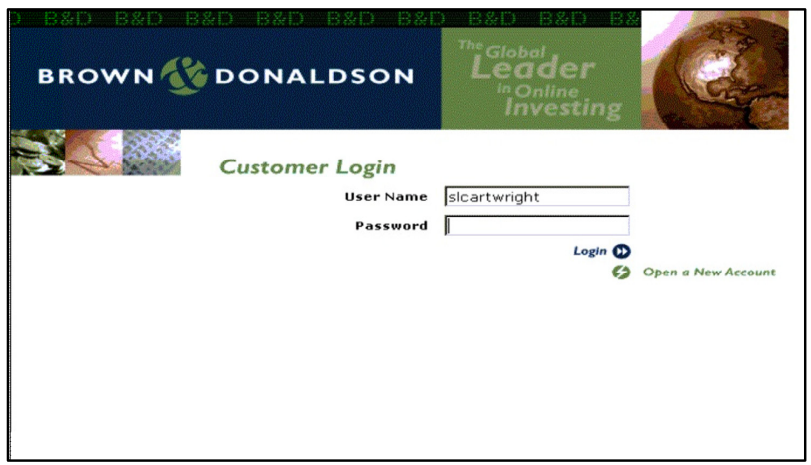
Log-in and log-out dialogs (q2)

- parts of interactive end-user navigation and query services that control users access and prevent illegal use

FUR: ”I want to control and authenticate the access to my application.”

A BFC with 8 data elements and 2 reading references => 2,3 FFP



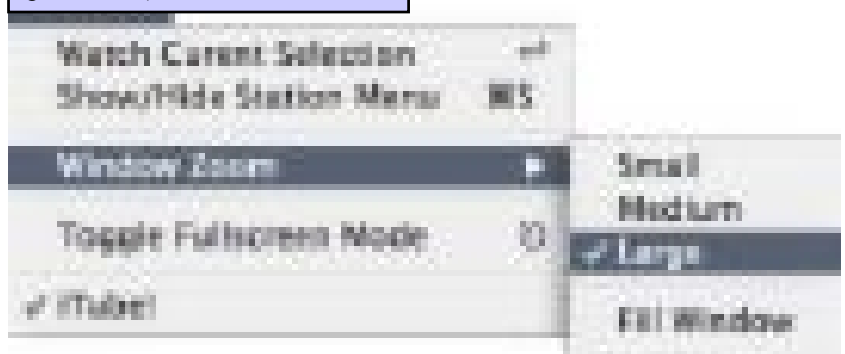


A BFC with 6 data elements and 1 reading reference => 1,6 FFP

Menus (q3)

- common parts of interactive end-user navigation and query services that are made for selecting the next operation

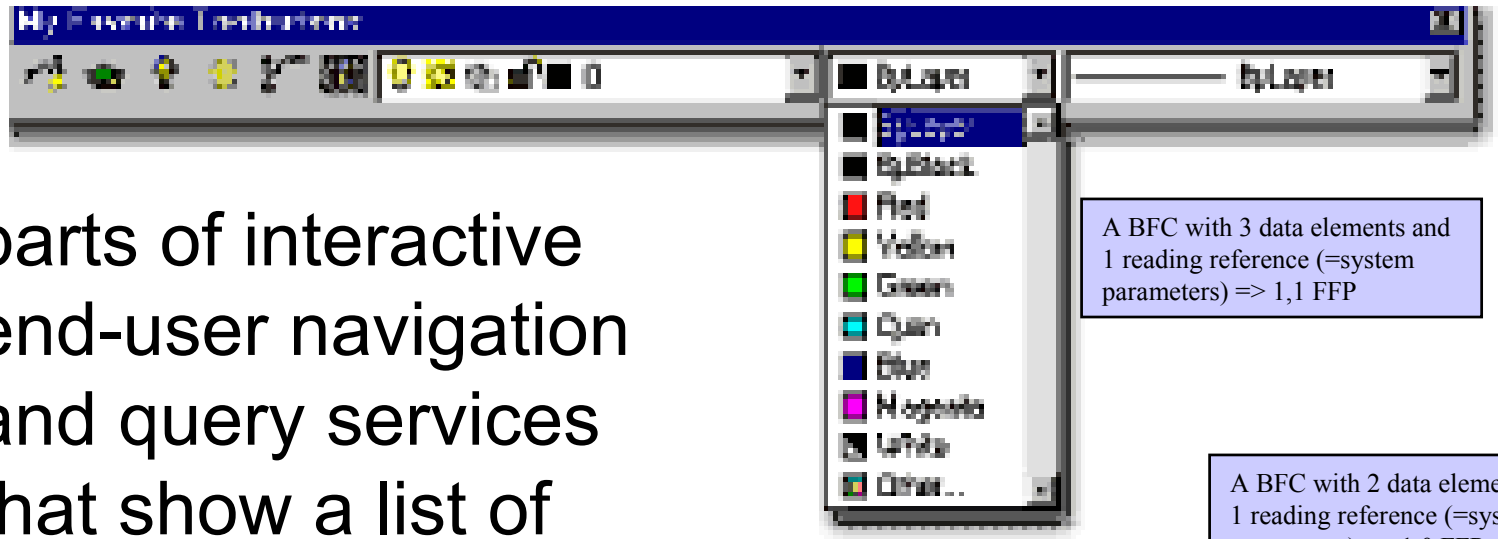
A BFC with 5 data elements and 1 reading reference (=system parameters) => 1,4 FFP



A BFC with 4 data elements and 1 reading reference (=system parameters) => 1,3 FFP

FUR: ”I want to be able to select which task will be activated or to which part of the system to navigate next.”

Selection lists (q4)

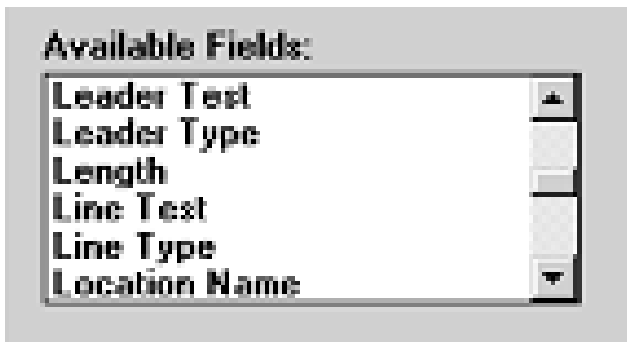


A BFC with 3 data elements and 1 reading reference (=system parameters) => 1,1 FFP

A BFC with 2 data elements and 1 reading reference (=system parameters) => 1,0 FFP

- parts of interactive end-user navigation and query services that show a list of acceptable parameter values to the end-user

FUR: ”I want to find all available values of the parameter.”

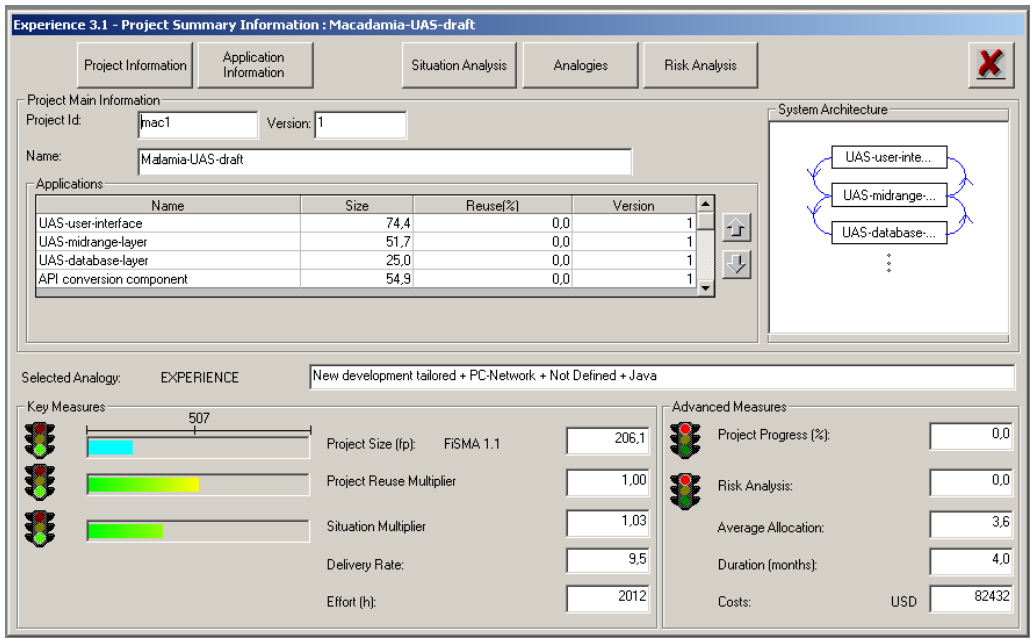


A BFC with 2 data elements and 1 reading reference (=system parameters) => 1,0 FFP

Data inquiries (q5)

- parts of interactive end-user navigation and query services that show the content of data store(s) to the end-user

FUR: ”I want to see detailed information about the object of my interest.”

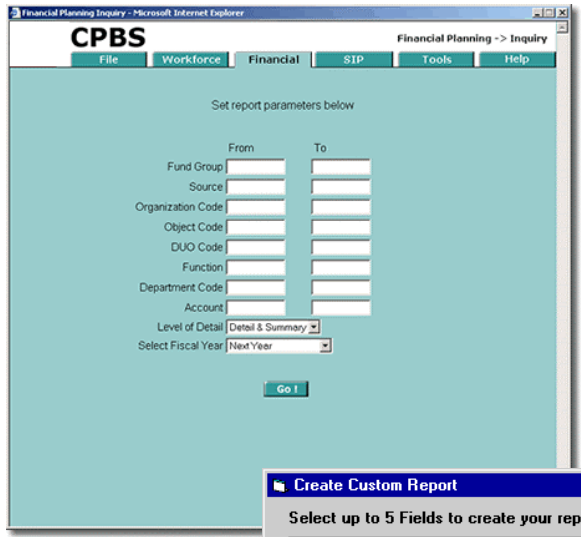


A BFC with 40 data elements and 4 reading references => 7,9FFP

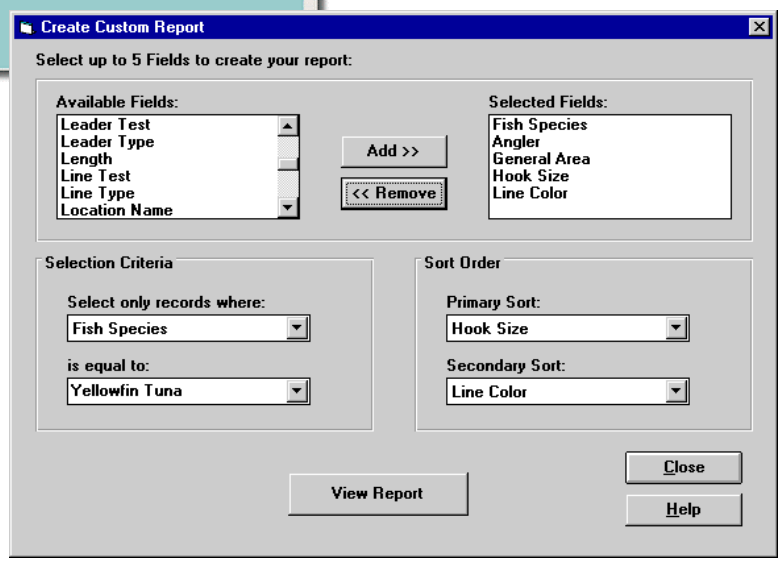
Generation dialogs (q6)

- parts of interactive end-user navigation and query services that help the end-user to initiate the production of a report or a manipulation routine

FUR: ”I want to have control to initiate a particular sub-process.”



A BFC with 21 data elements and 2 reading references => 4,2 FFP



A BFC with 13 data elements and 2 reading references => 3,1 FFP

Browsing lists (q7)

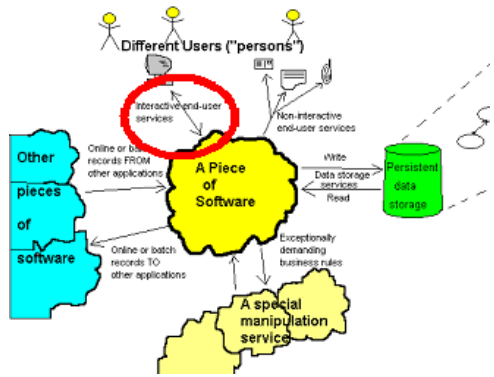
- are parts of interactive end-user navigation and query services. They show a list of similar data elements, typically the most important details to help filter the entities for further operations.

FUR: ”I want to see a high-level list of the data on which I can further filter results or check the details.”

A BFC with 18 data elements and 3 reading reference => 4,3 FFP

Summary of navigation and query services (q1-q7)

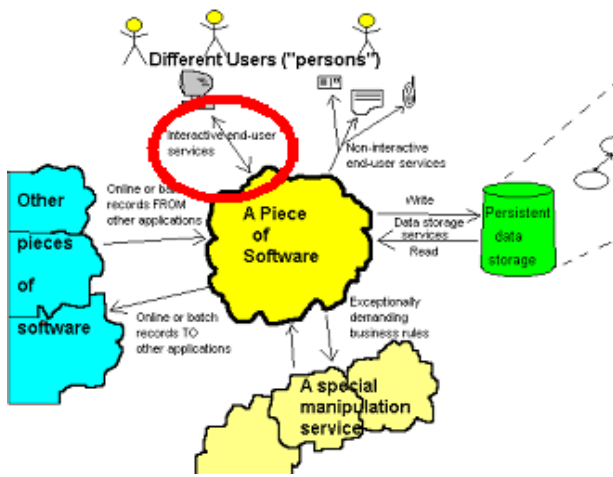
- Total size of the presented 14 sample navigation and query services from 7 previous slides:



$$S_q = 3*1,0+2,3+1,6+1,4+1,3+1,1+2*1,0+7,9+4,2+3,1+4,3 = 32,2 \text{ FFP}$$

Counting rule for interactive input services (i1-i3)

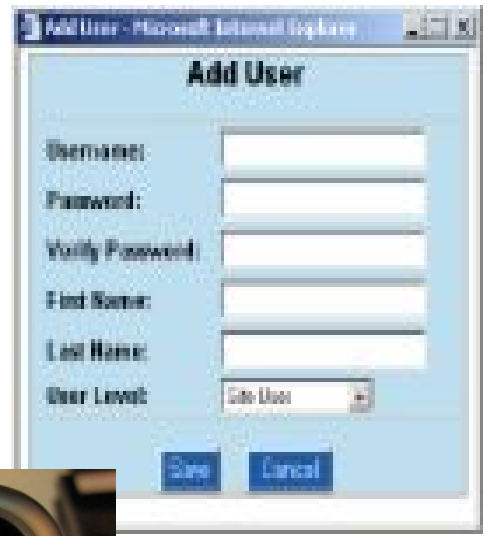
- **Input**: Functionality multiplier (m), number of data elements displayed (n) AND number of writing references (w) AND number of other reading references needed to provide them (r). The value of (m) is 1,2 or 3, depending on how many of functions create, update and delete the service incorporates.
- **Process**: m*(0,2 + n/5 +w/1,5 + r/2)
- **Output**: Functional size of the interactive input BFC

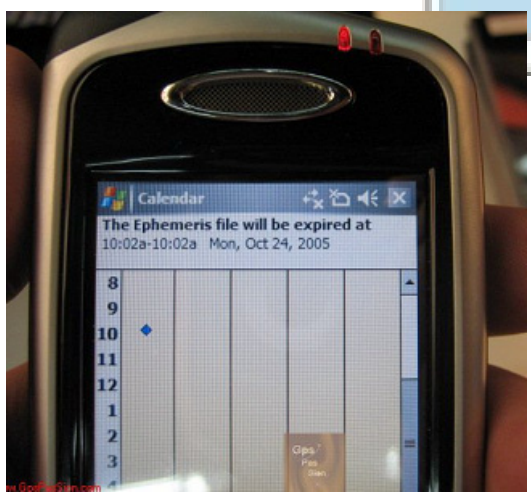


1-functional input dialogs (i1)

- support only one of the three maintenance types create, update or delete

A BFC with 10 data elements, 1 writing reference and 1additional reading reference (=system parameters) => 3,4 FFP





A BFC with 8 data elements, 1 writing reference and 1additional reading reference (=system parameters) => 3,0 FFP

FUR: ”I want to be able to create (or update or delete) data to be stored in the application.”

2-functional input dialogs (i2)

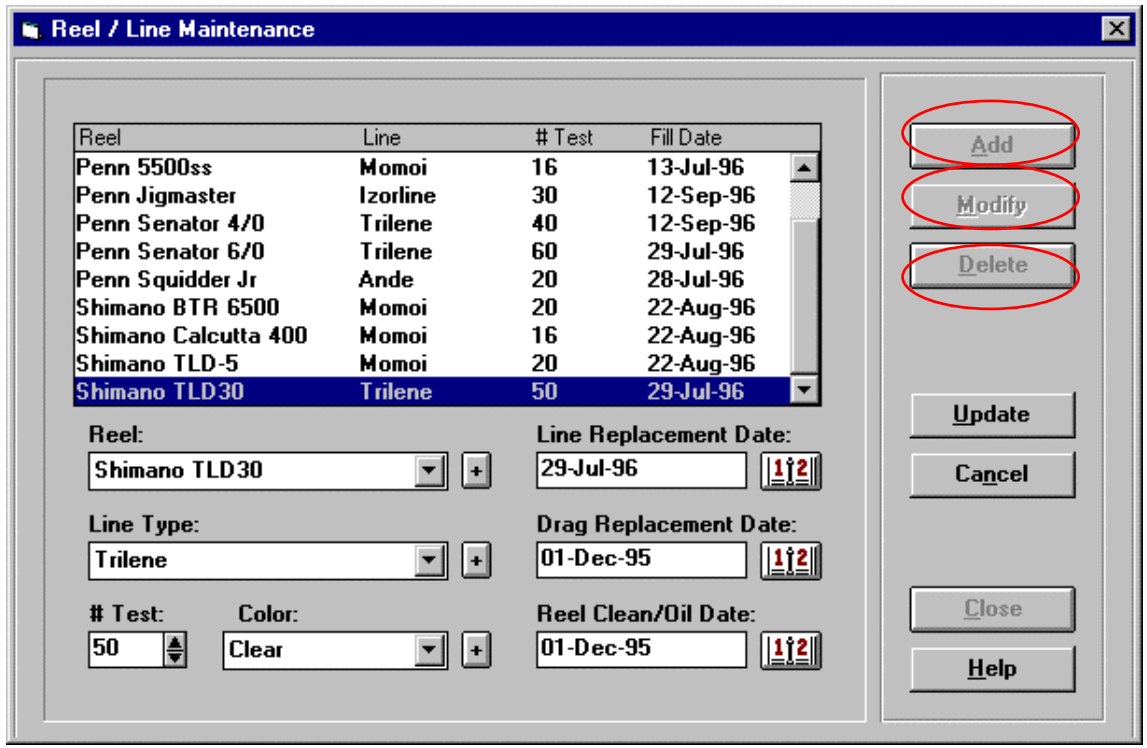
- support two of the three maintenance types create, update or delete

A BFC with 19 data elements, 1 writing reference and 1additional reading reference (=system parameters) => 10,3 FFP

FUR: ”I want to create and update data stored in the application ”

3-functional input dialogs (i3)

- support all three maintenance types create, update or delete

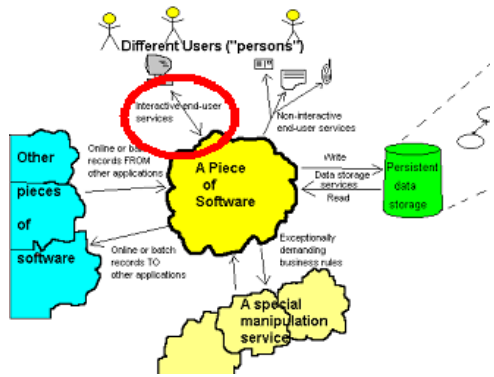


FUR: ”I want to create and update and delete data stored in the application ”

A BFC with 26 data elements, 1 writing reference and 3 additional reading references => 22,7 FFP

Summary of interactive input services (i1-i3)

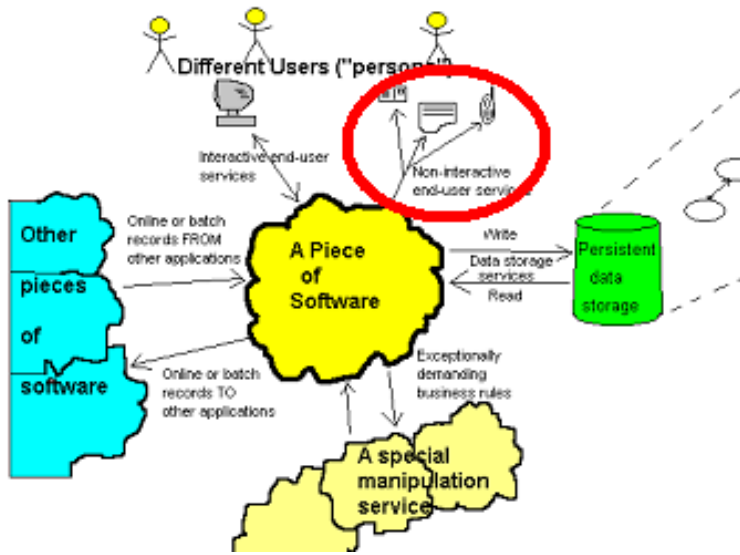
- Total size of the 4 presented sample input services from 3 previous slides:



$$S_i = 3,4+3,0+10,3+22,7 = 39,4 \text{ FFP}$$

Counting rule for non-interactive output services (o1-o4)

- **Input**: Number of data elements on the output (n) AND number of reading references needed to provide them (r).
- **Process**: 1 + n/5 + r/2
- **Output**: Functional size of the non-interactive output BFC

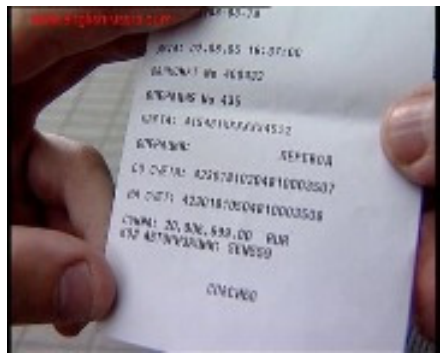


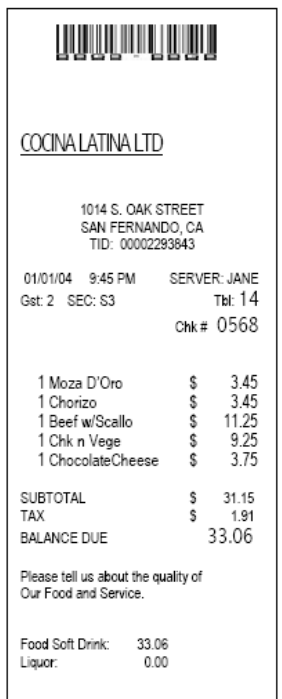
Output forms (o1)

- are services resulting in printed or displayed documents, which always present the same layout (e.g a receipt)

FUR: ”I want to be able to see data from the application in a standard report ”

A BFC with 24 data elements, and 2 reading references => 6,8 FFP





COCINA LATINA LTD

1014 S. OAK STREET
SAN FERNANDO, CA
TID: 00002293843

01/01/04 9:45 PM SERVER: JANE
Gst: 2 SEC: S3 Tbl: 14
Chk # 0568

1 Moza D'Oro	$	3.45
1 Chorizo	$	3.45
1 Beef w/Scallo	$	11.25
1 Chk n Vege	$	9.25
1 ChocolateCheese	$	3.75
SUBTOTAL	$	31.15
TAX	$	1.91
BALANCE DUE		33.06

Please tell us about the quality of
Our Food and Service.

Food Soft Drink: 33.06
Liquor: 0.00

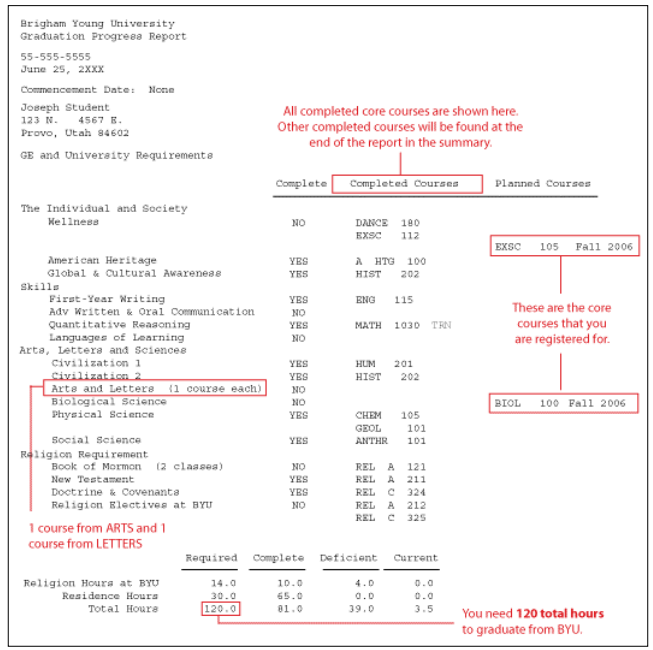
A BFC with 31 data elements, and 3 reading references => 8,7 FFP

Reports (o2)

- are services resulting in printed or displayed documents, whose layout may vary within the specified framework according to the presented data (e.g. product list or sales report).

FUR: ”I want to see the data from the application displayed in a standard report for which the data drives the format ”

A BFC with 37 data elements, and 5 reading references => 10,9 FFP



Brigham Young University
Graduation Progress Report

55-555-5555
June 25, 2XXX

Commencement Date: None

Joseph Student
123 N. 4567 E.
Provo, Utah 84602

All completed core courses are shown here. Other completed courses will be found at the end of the report in the summary.

GE and University Requirements

	Complete	Completed Courses	Planned Courses
The Individual and Society			
Wellness	NO	DANCE 180	
		EXSC 112	
			EXSC 105 Fall 2006
American Heritage	YES	A HTG 100	
Global & Cultural Awareness	YES	HIST 202	
Skills			
First-Year Writing	YES	ENG 115	
Adv Written & Oral Communication	NO		
Quantitative Reasoning	YES	MATH 1030 TRN	
Languages of Learning	NO		
Arts, Letters and Sciences			
Civilization 1	YES	HUM 201	
Civilization 2	YES	HIST 202	
Arts and Letters (1 course each)	NO		
Biological Science	NO		
Physical Science	YES	CHEM 105	
		GEOL 101	
Social Science	YES	ANTHR 101	
Religion Requirement			
Book of Mormon (2 classes)	NO	REL A 121	
New Testament	YES	REL A 211	
Doctrine & Covenants	YES	REL C 324	
Religion Electives at BYU	NO	REL A 212	
		REL C 325	

These are the core courses that you are registered for.

BIOL 100 Fall 2006

1 course from ARTS and 1 course from LETTERS

	Required	Complete	Deficient	Current
Religion Hours at BYU	14.0	10.0	4.0	0.0
Residence Hours	30.0	65.0	0.0	0.0
Total Hours	120.0	81.0	39.0	3.5

You need **120 total hours** to graduate from BYU.

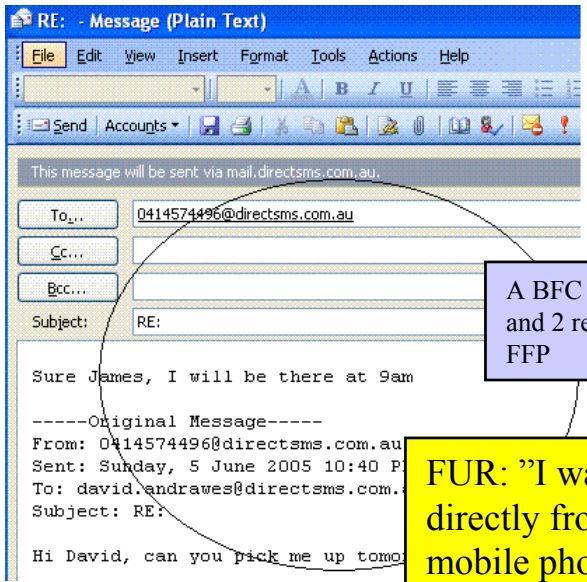
View Holdings

Symbol	Last Trade	Holdings			Today's Chg		Gain/Loss		Market Value
	Price	Qty	Paid	Acquired	$	%	$	%	
CSX	42.57	100	42.48	06/04/2002	1.02	2.43%	9.00	.21%	4,257.00
CSX	42.57	200	42.70	05/20/2002	1.02	2.43%	(26.00)	(.30%)	8,514.00
Totals:		**300**	---	---	---	---	**(17.00)**	---	**12,771.00**
SR	30.01	50	29.78	08/07/2001	.77	2.61%	11.50	.77%	1,500.50
Totals:		**50**	---	---	---	---	**11.50**	---	**1,500.50**

Cash Remaining in your account: $35,526.84

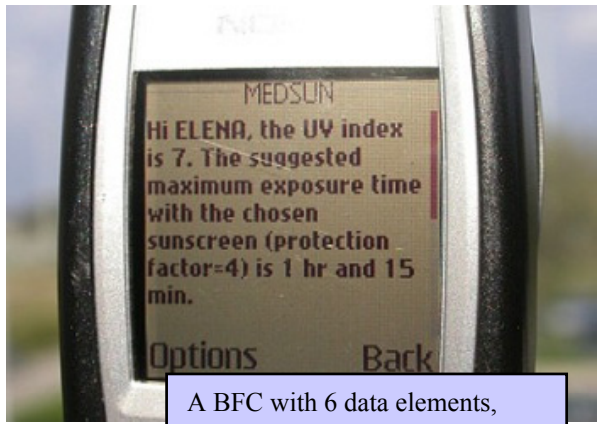
A BFC with 15 data elements, and 3 reading references => 5,5 FFP

E-mails and text messages (o3)



A BFC with 5 data elements, and 2 reading references => 3,0 FFP

FUR: ”I want to send this information directly from my application to the users mobile phone or e-mail box”

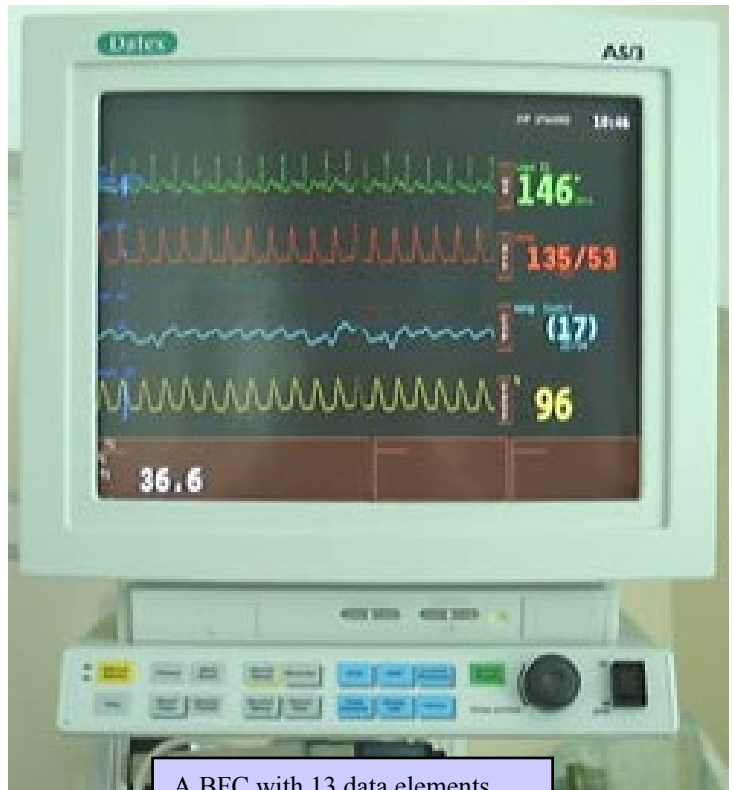


A BFC with 6 data elements, and 2 reading references => 3,2 FFP

- are services resulting in electronically transmitted output documents, which have a standardised structure. The structure often contains title fields, data fields and optional attachments.

Monitor screen output (o4)

- service involves continuously displayed documents, which are updated regularly in consequence of data changes (e.g. measurement display of a process).

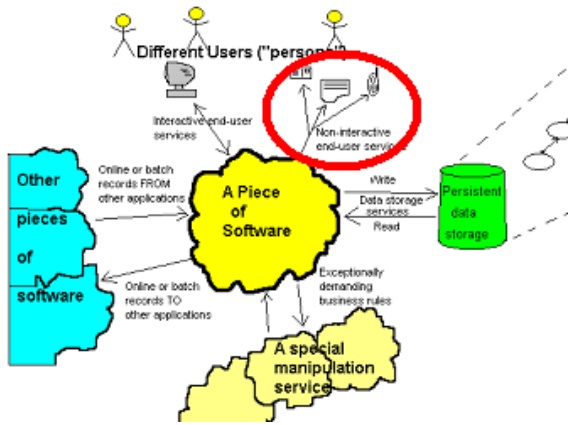


A BFC with 13 data elements, and 5 reading references => 6,1 FFP

FUR: ”I want to see up to the minute values of particular data in the application ”

Summary of non-interactive output services (o1-o4)

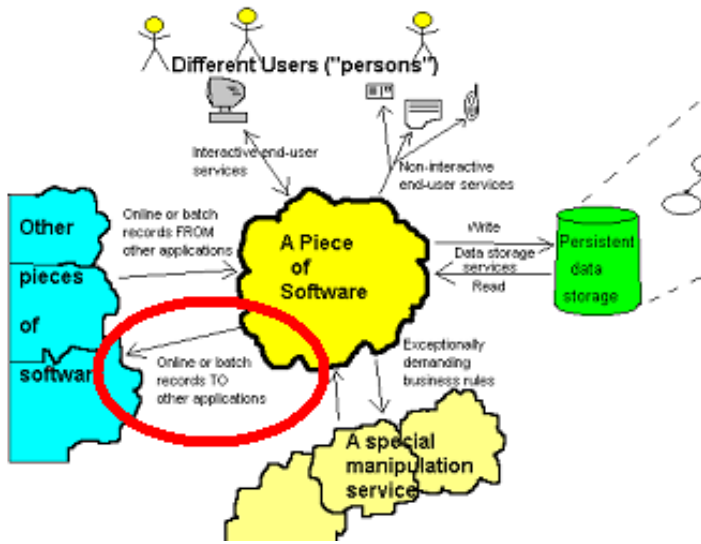
- Total size of the 7 presented sample output services from 4 previous slides:



$$\mathbf{S_o} = 6{,}8+8{,}7+10{,}9+5{,}5+3{,}0+3{,}2+6{,}1 = 43{,}2 \text{ FFP}$$

Counting rule for out going interface services (t1-t3)

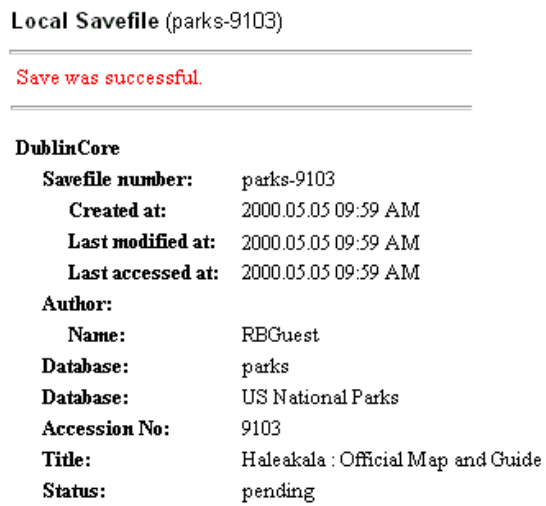
- **Input**: Number of data elements on the interface record (n) AND number of reading references needed to provide them (r).
- **Process**: 0,5 + n/7 + r/2
- **Output**: Functional size of the out going interface BFC



Messages to other applications (t1)

- are services where data groups are sent on-line, usually in real-time, to any other application.

FUR: ”I want my application to send data real-time to other applications”



Local Savefile (parks-9103)

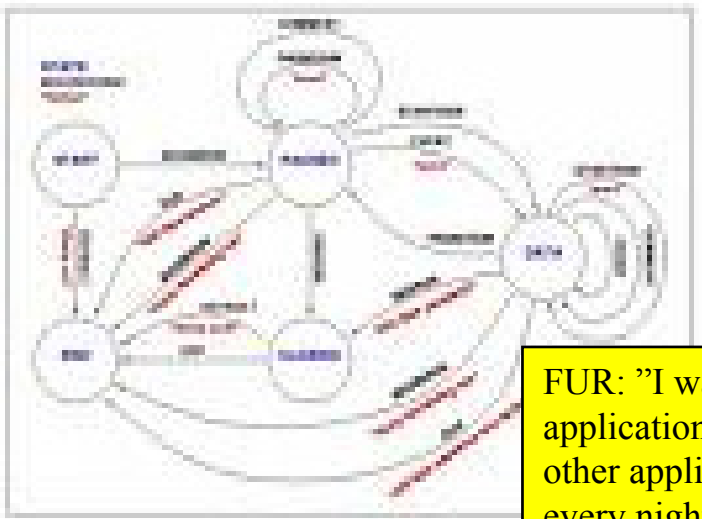
Save was successful.

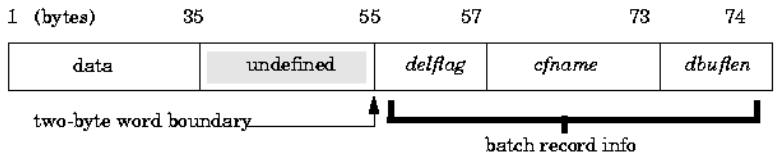
DublinCore

Savefile number:	parks-9103
Created at:	2000.05.05 09:59 AM
Last modified at:	2000.05.05 09:59 AM
Last accessed at:	2000.05.05 09:59 AM
Author:	
Name:	RBGuest
Database:	parks
Database:	US National Parks
Accession No:	9103
Title:	Haleakala : Official Map and Guide
Status:	pending

A BFC with 14 data elements, and 2 reading references => 3,5 FFP

Batch records to other applications (t2)





FUR: ”I want my application to send data to other applications ... e.g. every night”

A BFC with 5 data elements, and 2 reading references => 2,2 FFP

- are services where data groups are written to a temporary file for transfer to another application.

Signals to devices or other applications (t3)

- are services where data strings or single pieces of information are sent to any other application or a device (e.g., a LED).

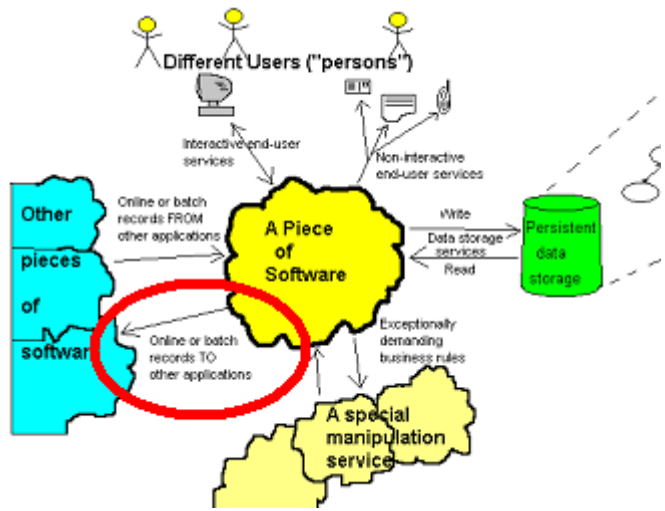
FUR: ”I want my application to change the status of a device”

A BFC with 1 data elements, and 1reading reference (=system parameters) => 1,1 FFP

A BFC with 2 data elements, and 1reading reference (=system parameters) => 1,3 FFP

Summary of out going interface services (t1-t3)

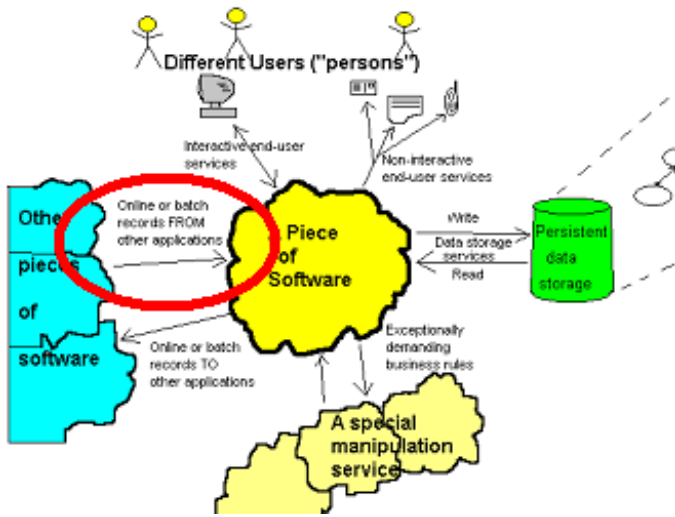
- Total size of the 4 presented sample out going interface services from 3 previous slides:



$$S_t = 3,5+2,2+1,1+1,3 = 8,1 \text{ FFP}$$

Counting rule for in coming interface services (f1-f3)

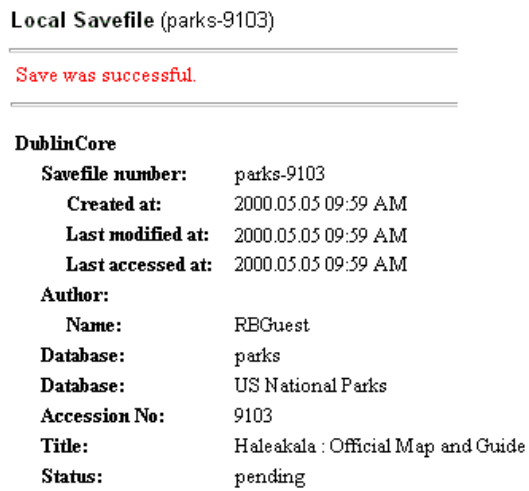
- **Input**: Number of data elements on the interface record (n) AND number of writing references (w) AND number of other reading references needed to provide the service (r).
- **Process**: 0,2 + n/5 + w/1,5 + r/2
- **Output**: Functional size of the in coming interface BFC



Messages from other applications (f1)

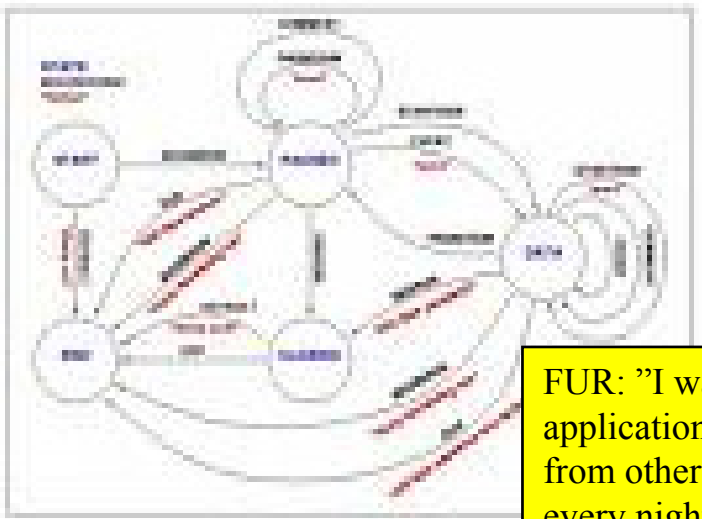
- are services where data groups are received on-line, usually in real-time from any other application.

FUR: ”I want my application to receive real-tima data from other applications”

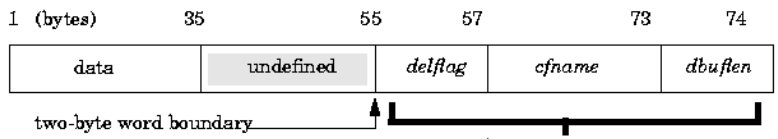


A BFC with 14 data elements, and 1 writing reference and 1 reading reference (=system parameters) => 4,2 FFP

Batch records from other applications (f2)



FUR: ”I want my application to receive data from other applications every night”



A BFC with 5 data elements, 1 writing reference and 2 additional reading references => 2,9 FFP

- are services where data groups are received off-line from any other application.

Signals from devices or other applications (f3)

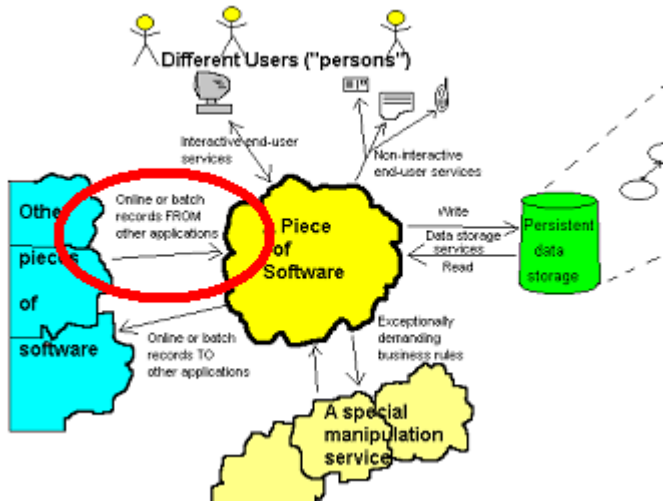
A BFC with 3 data elements, 1 writing reference and 1 reading reference => 2,0 FFP

FUR: ”I want my application to receive signals from for example a card reader”

- are services where strings or single pieces of information are received from any other application or device (e.g., a sensor).

Summary of in coming interface services (f1-f3)

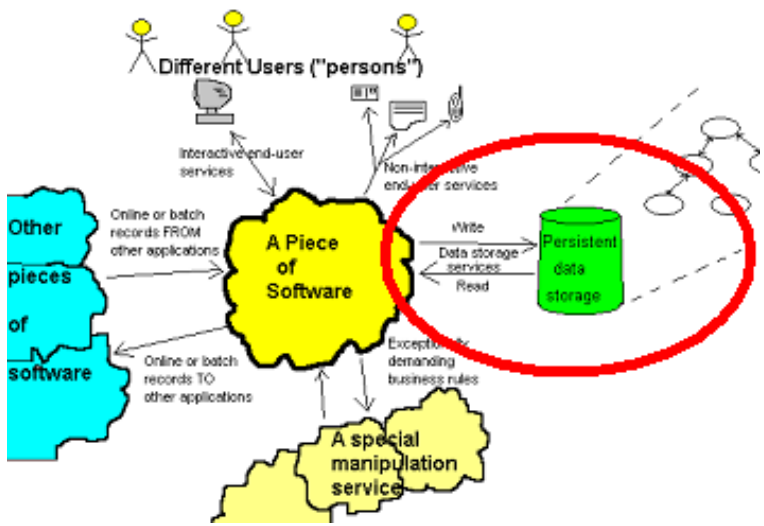
- Total size of the 3 presented sample in coming interface services from 3 previous slides:



$$\mathbf{S_f} = 4{,}2+2{,}9+2{,}0 = 9{,}1 \text{ FFP}$$

Counting rule for data storage services (d1-d2)

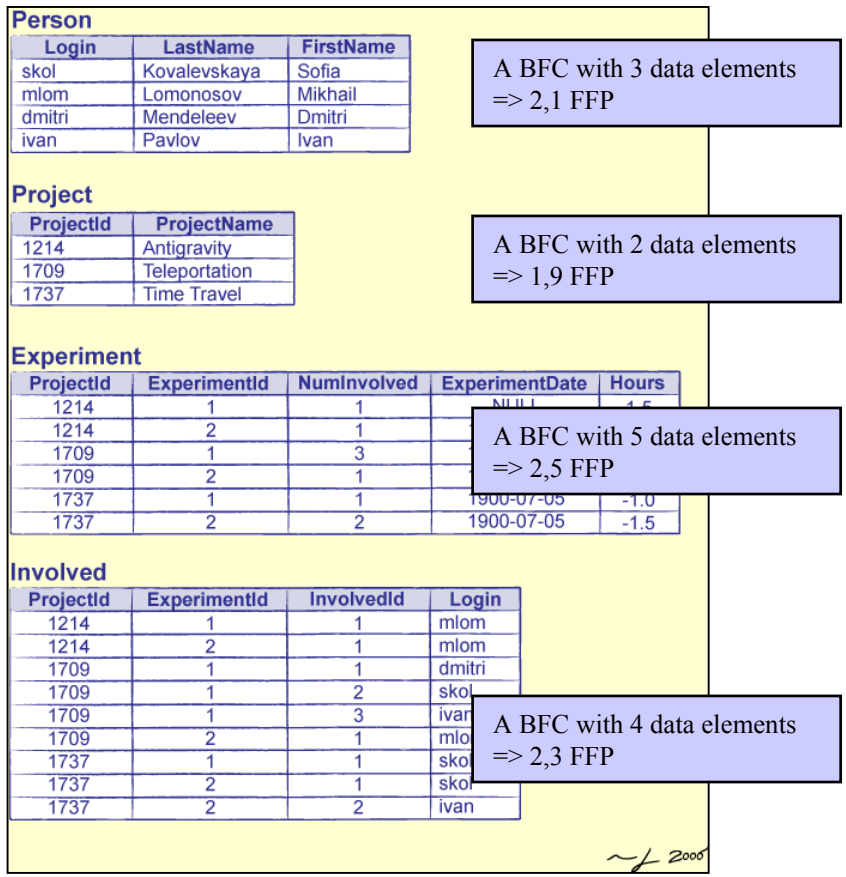
- **Input**: Number of data elements i.e. attributes of an entity (n).
- **Process**: 1,5 + n/4
- **Output**: Functional size of the data storage BFC



Entities or classes (d1)

- are data storage services resulting in persistent logical data representing fundamental things of relevance to the user, and about which persistent information is stored.

FUR: ”I want my application to store data about ...”



Person

Login	LastName	FirstName
skol	Kovalevskaya	Sofia
mlom	Lomonosov	Mikhail
dmitri	Mendeleev	Dmitri
ivan	Pavlov	Ivan

A BFC with 3 data elements
=> 2,1 FFP

Project

ProjectId	ProjectName
1214	Antigravity
1709	Teleportation
1737	Time Travel

A BFC with 2 data elements
=> 1,9 FFP

Experiment

ProjectId	ExperimentId	NumInvolved	ExperimentDate	Hours
1214	1	1		
1214	2	1		
1709	1	3		
1709	2	1		
1737	1	1	1900-07-05	-1.0
1737	2	2	1900-07-05	-1.5

A BFC with 5 data elements
=> 2,5 FFP

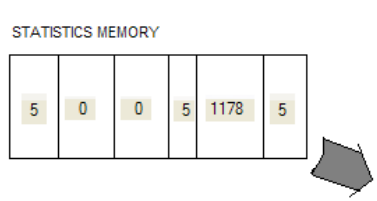
Involved

ProjectId	ExperimentId	InvolvedId	Login
1214	1	1	mlom
1214	2	1	mlom
1709	1	1	dmitri
1709	1	2	skol
1709	1	3	ivan
1709	2	1	mlo
1737	1	1	sko
1737	2	1	sko
1737	2	2	ivan

A BFC with 4 data elements
=> 2,3 FFP

Other record types (d2)

- are the other type of data storage services and result in the persistent logical data besides that which is counted as entities or classes.

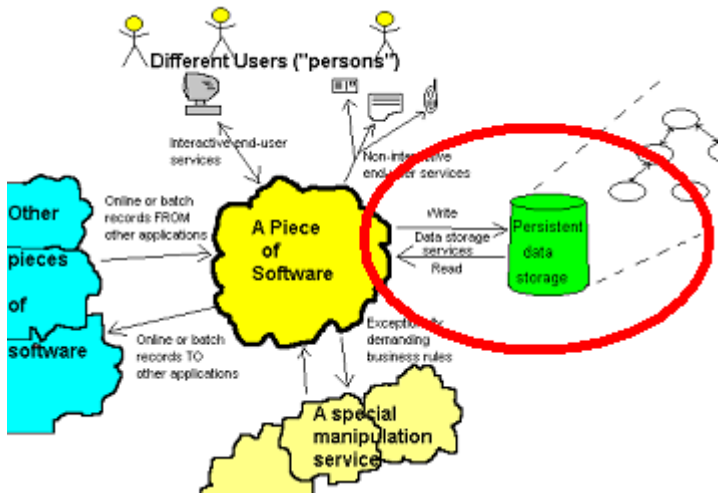


A BFC with 6 data elements
=> 2,7 FFP

FUR: ”I want my application to store data about ... game statistics”

Summary of data storage services (d1-d2)

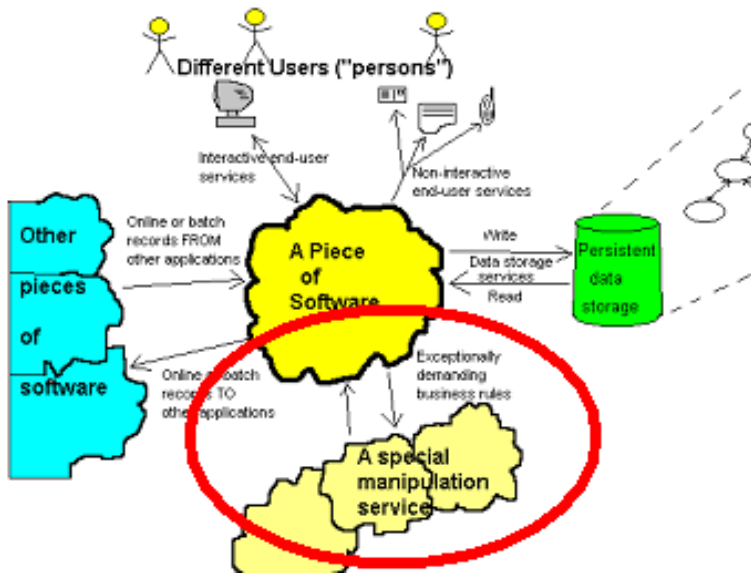
- Total size of the 5 presented sample data storage services from 2 previous slides:



$$S_f = 2{,}1+1{,}9+2{,}5+2{,}3+2{,}7 = 11{,}5 \text{ FFP}$$

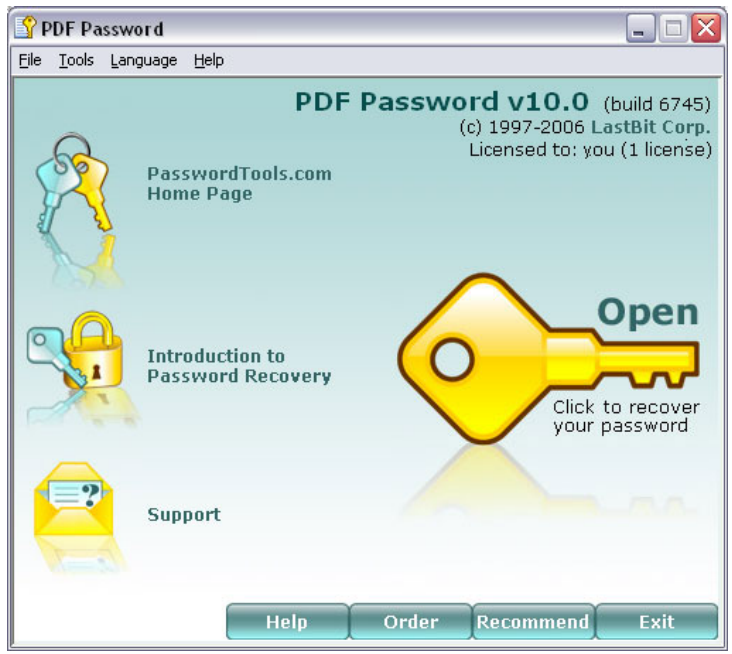
Counting rule for algorithmic and manipulation services (a1-a6)

- **Input**: Number of data elements i.e. different variables (n) AND maximum number of operations needed (r).
- **Process**: 0,1 + n/5 + r/3
- **Output**: Functional size of the manipulation BFC



Security routines (a1)

- are manipulating services providing security features such as encryption, decryption, advanced authorization, etc.



FUR: ”I want my application to check the authentication of a user using a certain type of algorithm ...”

A BFC with 5 data elements, and 4 operations => 2,4 FFP

Calculation routines (a2)

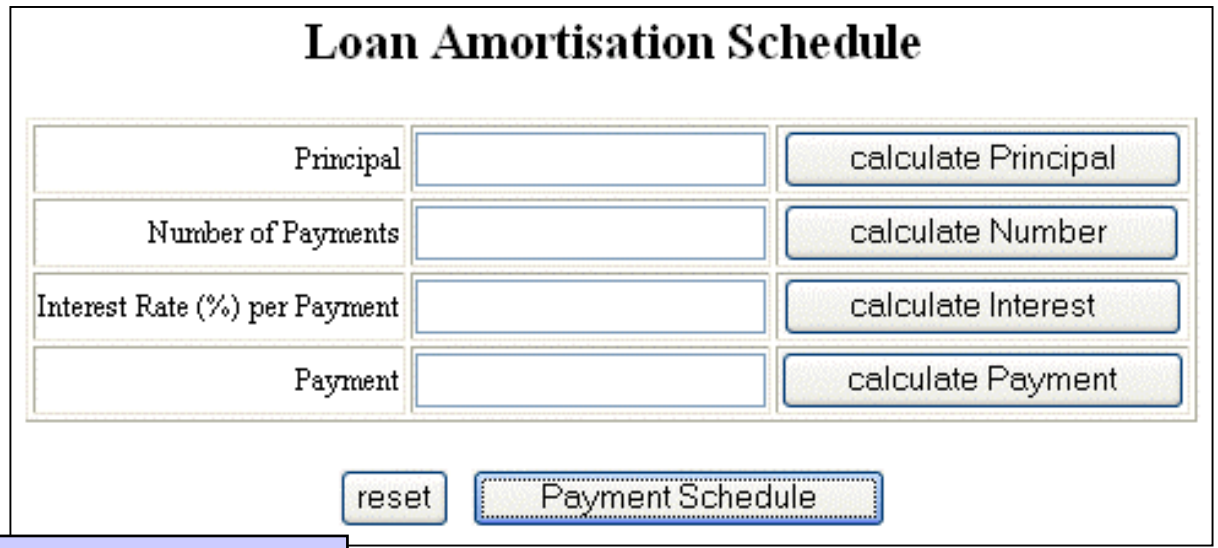
- are manipulating services providing arithmetic or logical counting services.

FUR: ”I want my application to calculate the size of a piece of software using a certain type of algorithm ...”

Count the **Functional-Size** using **Number-of-data-elements** on the interface record (n) AND **Number-of-writing-references** (w) AND **Number-of-reading-references** (r) using the formula: A + n/B + w/C + r/D where **A**,**B**, **C** and **D** are constraints given by the FiSMA 1.1 method.

A BFC with 8 data elements, and 7 operations => 4,0 FFP

Simulation routines (a3)



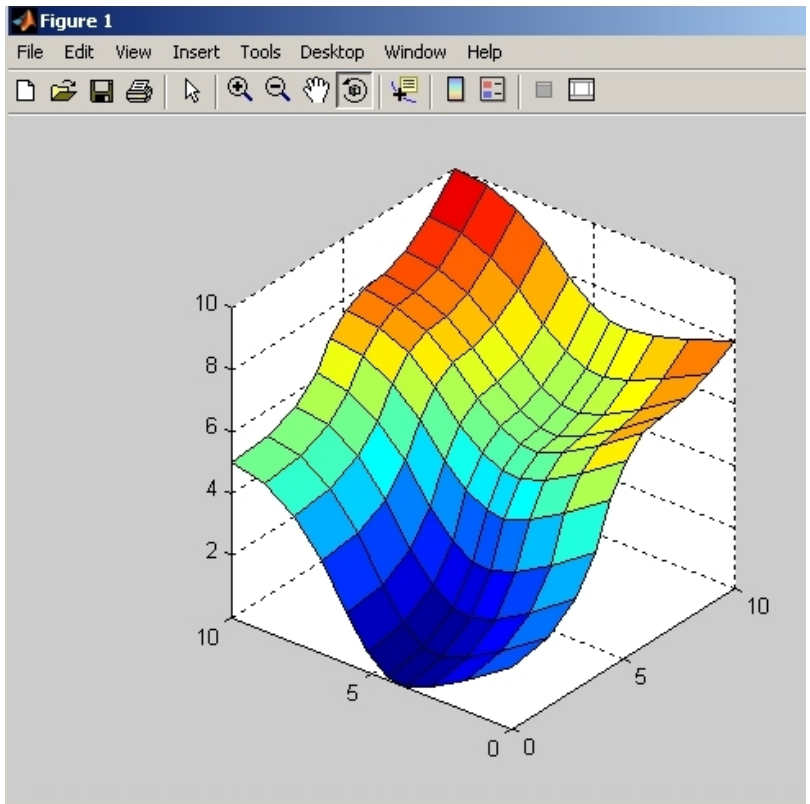
A BFC with 12 data elements, and 14 operations => 7,2 FFP

- are manipulating services providing simulative calculating services.

FUR: ”I want my application to count the missing value if I know any other three parameters of ... e.g. loan simulation algorithm ...”

Formatting routines (a4)

- are manipulating services providing special format conversion services (i.e. beyond typical, simple editing). An example of a formatting routine could be changing table rows into graphics.



FUR: ”I want my application to draw a colourful surface from the values of the table ... using a certain type of algorithm ...”

A BFC with 11 data elements, and 8 operations => 5,0 FFP

Database cleaning routines (a5)

- are manipulating services supporting data storage maintenance, such as removing unnecessary records and combining or cumulating data elements based on user-defined rules.

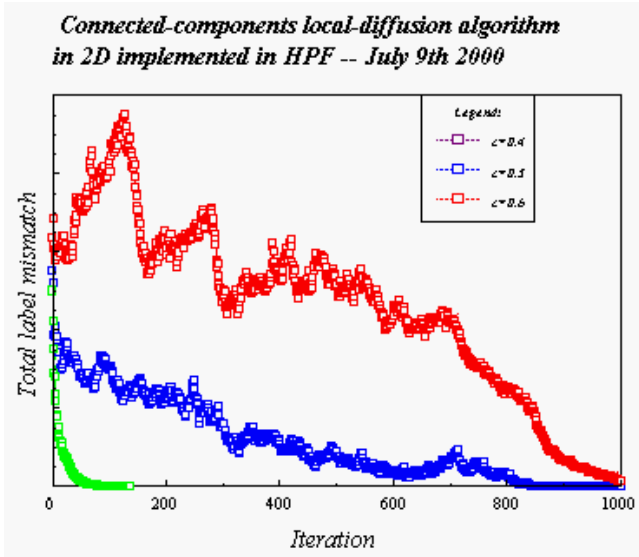
FUR: ”I want my application to maintain the data contents automatically following the next rules ...”

”If **start-date** of record *is older* than **age-limit**, then *add* **a-number** to **history-a-number**, *add* **b-number** to **history-b-number** and *delete* record.”

A BFC with 6 data elements, and 4 operations => 2,6 FFP

Other manipulation routines (a6)

- include all independent user-defined data manipulation services, which are not counted as any other algorithmic and manipulation BFC type functions.

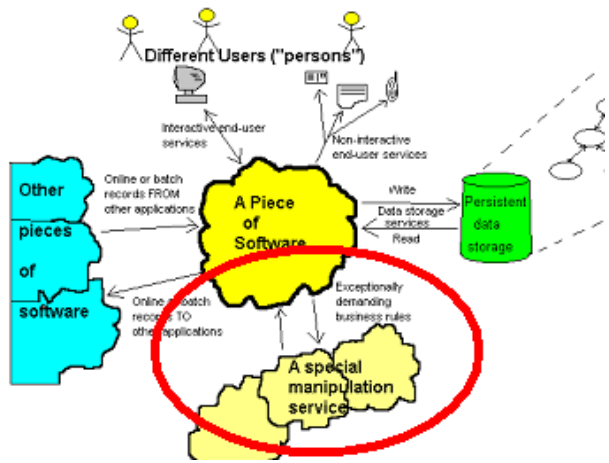


FUR: ”I want my application to do something very domain specific manipulation using certain type of algorithm ...”

A BFC with 11 data elements, and 1reading reference (=system parameters) => 3,4 FFP

Summary of algorithmic and manipulation services (a1-a6)

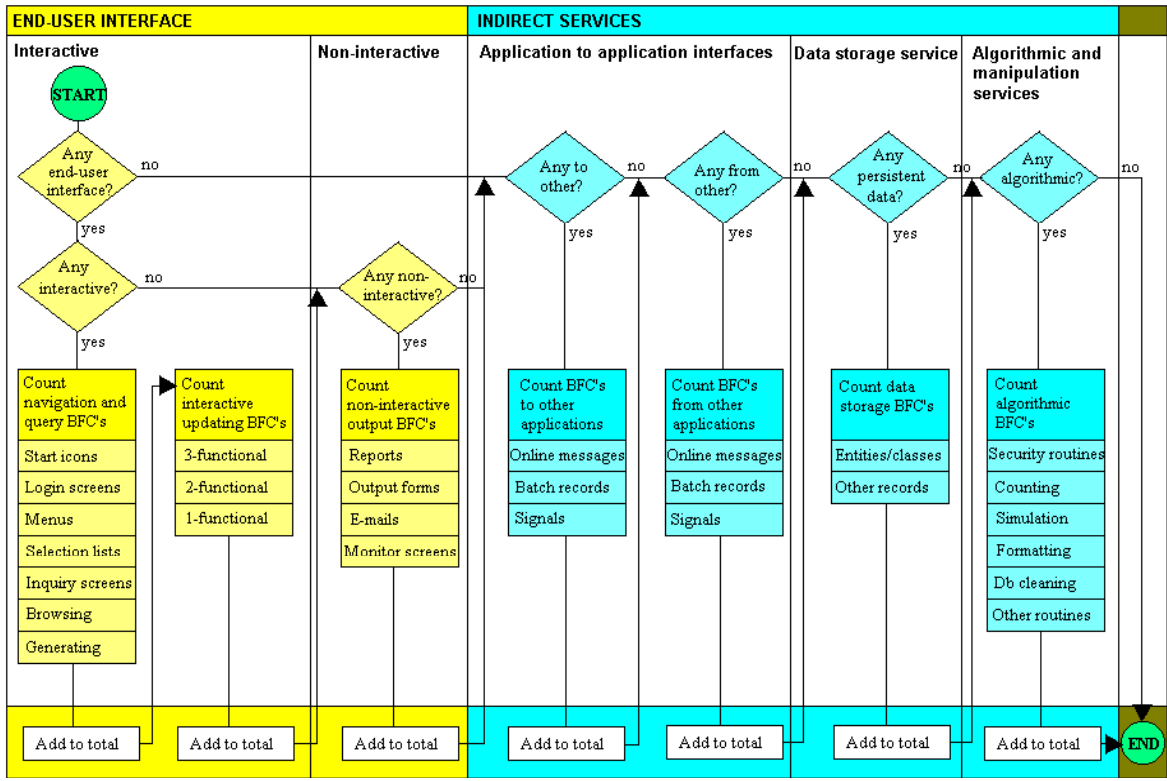
- Total size of the 6 presented sample algorithmic services from 6 previous slides:



$$S_a = 2,4+4,0+7,2+5,0+2,6+3,4 = 24,2 \text{ FFP}$$

FiSMA 1.1 measurement process

1. How many each type of BFC's do you have in your piece of software?
2. What are they? Identify them all.
3. What are they like? Give the numbers of details for each BFC.

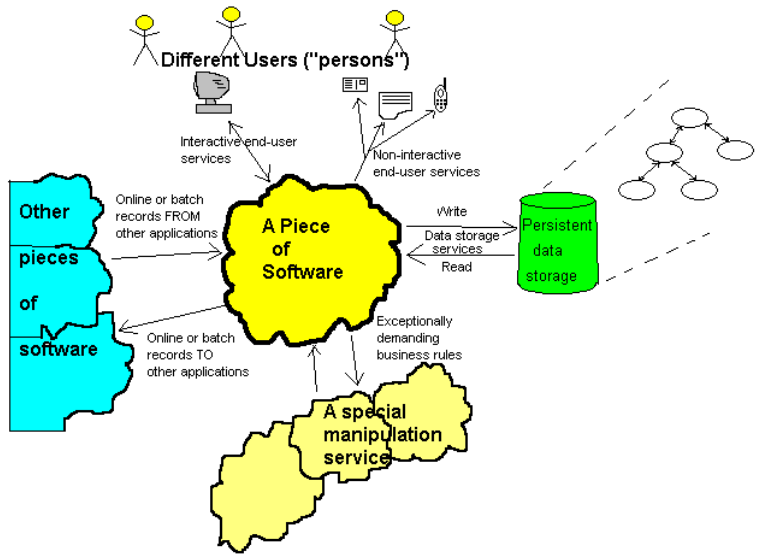


Size of a piece of software

- $S = S_q + S_i + S_o + S_f + S_t + S_d + S_a$
- Measurement unit = 1 FFP (or fp if the method is obvious or reported separately)
- Reporting the measurement results at detailed level is highly recommended
- The functional size of a multi-component software is the sum of the functional sizes of the components

Summary of FiSMA 1.1 size measurement

- Total size of all presented sample functional services from all previous slides:



$$\mathbf{S} = 32{,}2+39{,}4+43{,}2+8{,}1+9{,}1+11{,}5+24{,}6 = 168{,}1 \text{ FFP}$$