



CMMI and FPA

– the link and benefit of using FPA when rolling out CMMI

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IFPUG - Certified Function Point Specialist

Objectives

- How Function Point Analysis can be used to cover multiple requirements from the CMMI.
- Explain the difference between Function Point Analysis (FPA) and Function Point Size
- To give examples of outputs from an FPA that can be used to back up CMMI goals
- To show why it is recommended to use FPA as an important part of the CMMI focus.



EDS employs more than 33,000 people maintaining and developing applications in more than 90 solution centres in 60 countries, on six continents and with more than 50 spoken languages

Function Points

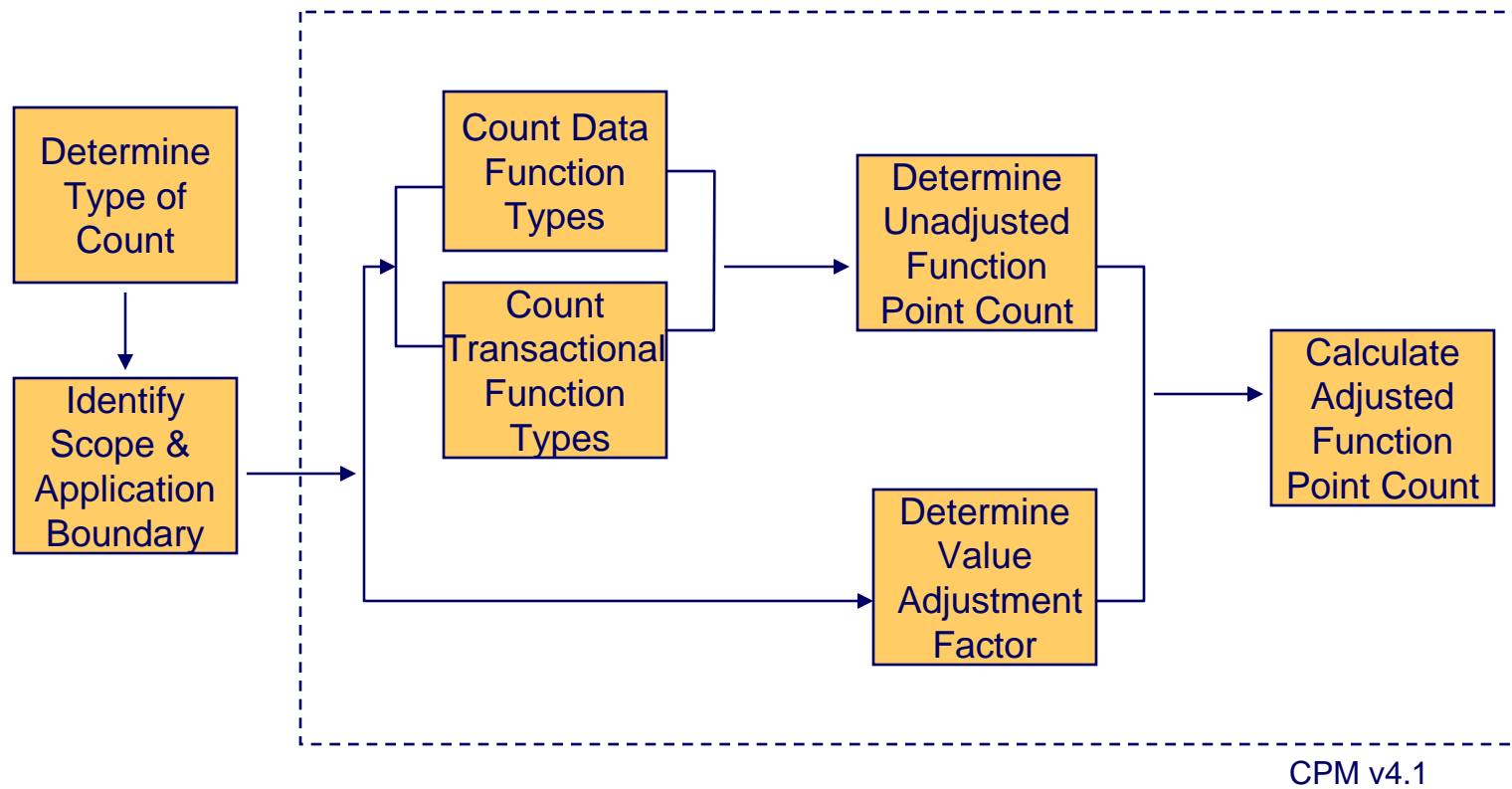
Function Point = Size ?

This is true – but not the whole truth

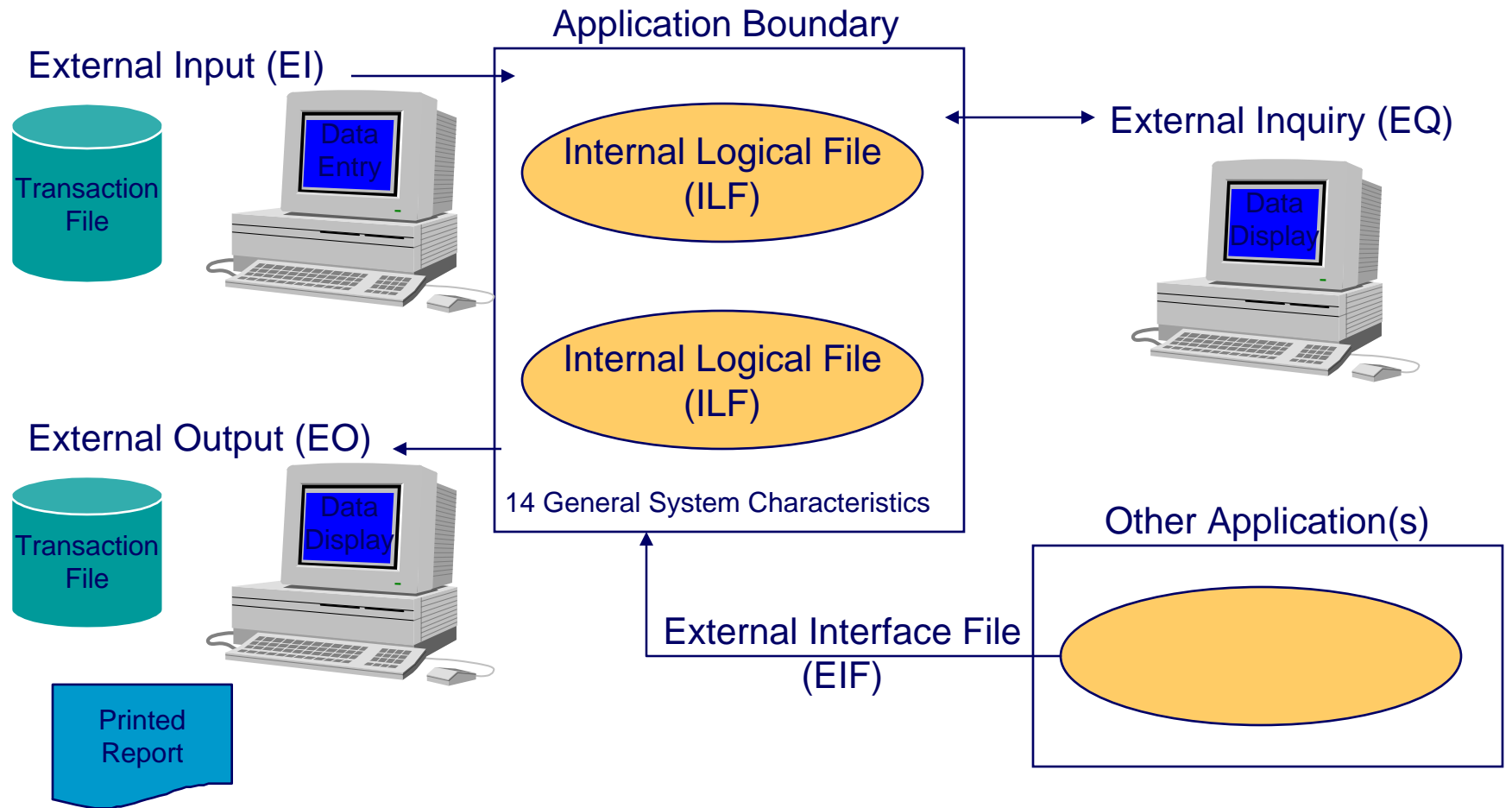
Function Point Analysis is the interesting part



Function Point Counting Process



Function Point Analysis



Function Point Analysis – The Method

The Method

- Measuring software size, independently of underlying language and technology, from the user's logical perspective.
- Breaking down functionality defined by Client
- Evaluation during Software Life Cycle against work products
- Evaluation of work products against Requirements documentation
- Definition of Functionality Scope and size
- Definition of Scope changes and size of changes
- Independent Peer Review of Requirement method defined over +300 pages incl. examples

The Output

- A overview diagram
- Identification of affected applications
- Important input to Top-Down Estimating tool
- Requirement Scope control
- Peer Review of Design – in respect of requirements
- Test checklist
- Implementation checklist
- "Object" checklist
- Assumption and constraint information
- Requirement traceability list
- Link work product to requirements

AND SIZE

Function Point – The Size

- Output from a Function Point Analysis
- Recognized size in benchmark and in many companies – such as EDS
- A size measure
- Size as accurate as possible
- Input for estimation tools
- A size of scope
- A size of scope changes

Count Type	Accuracy (+/-)	Cost
IFPUG FP	5%	1-3 Days
IFPUG - Limited	25%	1-3 Days
Approximation	35%	½ Day
Ratio	50%	<½ Day
Expert	50%	< ½ Day
Delphi	100%	< 1/4 Day
Backfire	100-400%	Varies

Source: The David Consulting Group, Inc.

Function Point Analysis – Resource

Expected skill-set

- Business awareness
- Knowledge about Requirement notation techniques
- Trained and skilled people
- Communication Skills
- Project Management Skills
- Change Management Skills
- Development and design experience

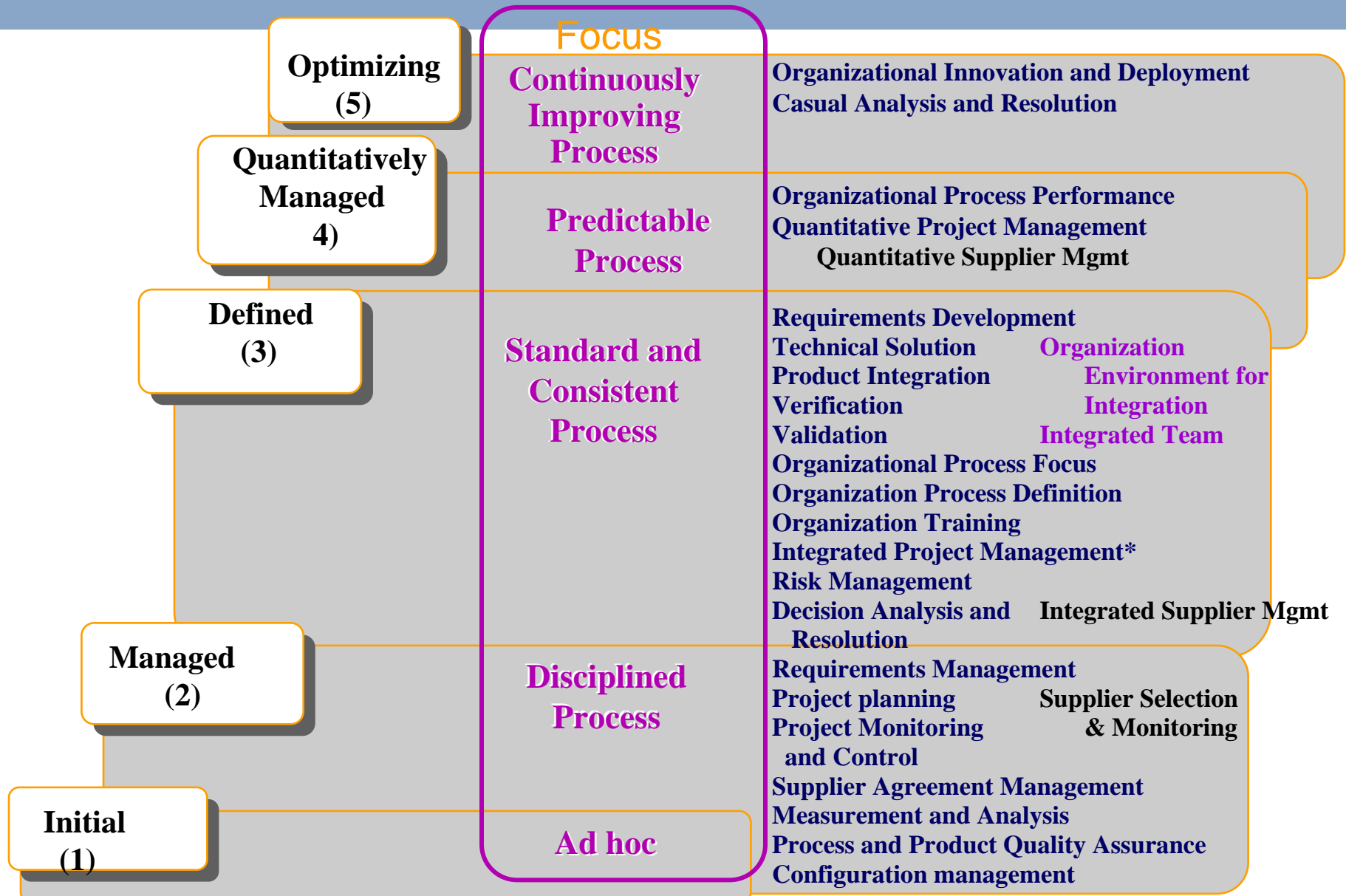
Remember that Function point is just the size – Function Point Analysis is the method

FPA specialist

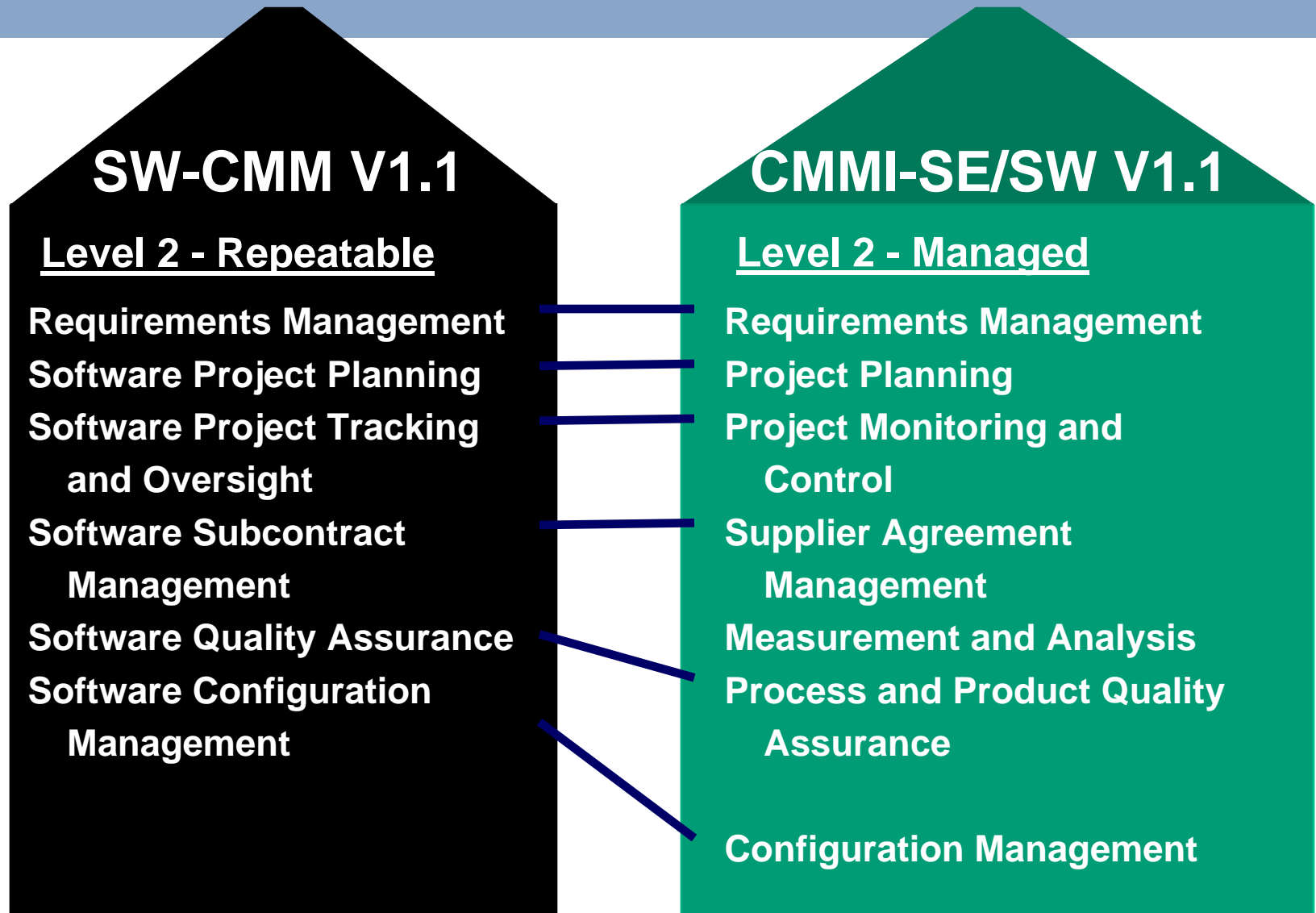
- Independent peer review specialist
- Business Analyst
- Estimator on software projects
- Bench marker on software projects
- Constraint/assumption expert
- Quality review on documentation
- Consistent use of documentation

FPA specialist is not a bean counter!

∴∴∴ CMMI-SE/SW/IPPD/A - Staged View



∴ SW-CMM to CMMI Model Relationships





PAs Associated With the Managed Level

Level	Characteristic	Process Areas	Result
5 Optimizing	Continuous process improvement	Causal Analysis and Resolution Organizational Innovation and Deployment	Productivity & Quality
4 Quantitatively Managed	Process measured and controlled	Quantitative Project Management Organizational Process Performance	
3 Defined	Process characterized for the organization and is proactive	Requirements Development Technical Solution Product Integration Verification Validation Organization Process Focus Organization Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis and Resolution	
2 Managed	Process characterized for projects and is often reactive	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Product and Process Quality Assurance Configuration Management	
1 Initial	Process unpredictable, poorly controlled, reactive		

Requirements Management

- Project Planning
- Project Monitoring and Control
- Supplier Agreement Management
- Measurement and Analysis
- Product and Process Quality Assurance
- Configuration Management

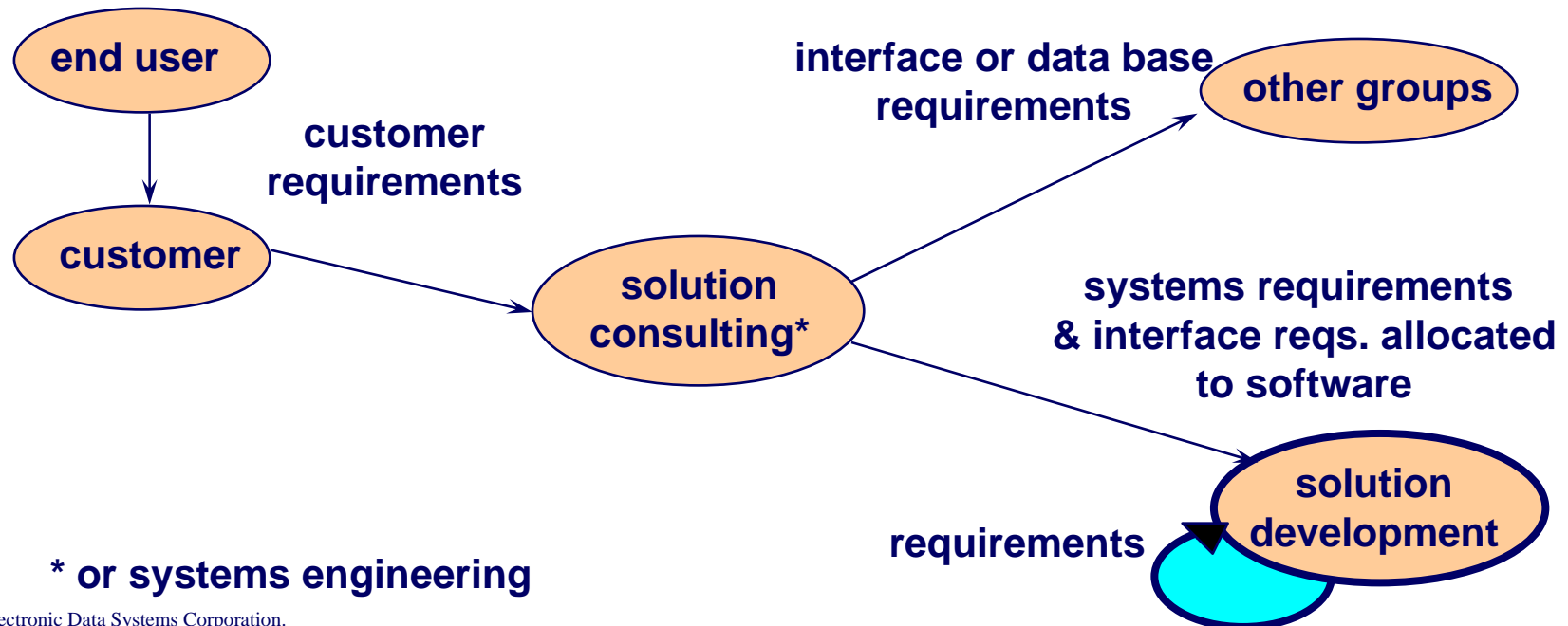
Requirements Management

Purpose

To manage the requirements of the project's products and product components and to identify inconsistencies between those requirements and the project's plans and work products.

Specific Goal:

Requirements are managed and inconsistencies with project plans and work products are identified



* or systems engineering

⋮⋮⋮ Requirements Management & FPA

- **This PA involves:**

- Manage Requirements
 - Obtain an Understanding of Requirements
 - Obtain Commitment to Requirements
 - Manage Requirements Changes
 - Maintain Bi-directional Traceability of Requirements
 - Identify Inconsistencies between Project Work and Requirements

- **FPA can provide:**

- FPA drawing equals a context diagram
- FPA transaction and data element list
- Link to Client documentation
- FPA link to phases, work products and Changes
- FPA link to Change requests – added, deleted, re-use, change
- Requirement status
 - Planned, incorporated, designed, etc.
- Requirement traceability matrix

Project Planning

Purpose

To establish and maintain plans that define project activities

Level	Characteristic	Process Areas	Result
5 Optimizing	Continuous process improvement	Causal Analysis and Resolution Organizational Innovation and Deployment	Productivity & Quality R
4 Quantitatively Managed	Process measured and controlled	Quantitative Project Management Organizational Process Performance	
3 Defined	Process characterized for the organization and is proactive	Requirements Development Technical Solution Product Integration Verification Validation Organization Process Focus Organization Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis and Resolution	
2 Managed	Process characterized for projects and is often reactive	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Product and Process Quality Assurance Configuration Management	
1 Initial	Process unpredictable, poorly controlled, reactive		

Specific Goals:

- Estimates of project planning parameters are established and maintained
- A project plan is established and maintained as the basis for managing the project
- Commitments to the project plan are established and maintained

Project Planning & FPA

This PA involves:

- Establish Estimates
 - Estimate the Scope of the Project
 - Establish Estimates of the Project Attributes
 - Define the Project Life Cycle
 - Determine Estimates of Effort and Cost

FPA can provide:

- Size input for benchmark estimate
- Size of objects – such as requirements documentation
- No. of transactions
- No. of data elements
- Size tracking against lifecycle – using object references
- Size of scope changes during life cycle
- Approximation FP early in the life cycle – direct the project to make the right decisions

Project Monitoring and Control

Purpose

To provide an understanding of the project's progress so that appropriate corrective actions can be taken when the project's performance deviates significantly from the plan

Specific Goals:

- Actual performance and progress of the project is monitored against the project plan
- Corrective actions are managed to closure when the project's performance or results deviate significantly from the plan

Level	Characteristic	Process Areas	Result
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1 Initial	Process unpredictable, poorly controlled, reactive	Measurement and Analysis Product and Process Quality Assurance Configuration Management	

Project Monitoring and Control & FPA

This PA involves:

- Monitor Project Against Plan
- Monitor Project Planning Parameters
- Monitor Commitments
- Monitor Project Risks
- Monitor Data Management
- Monitor Stakeholder Involvement
- Conduct Progress Reviews
- Conduct Milestone Reviews

FPA can provide:

- Monitoring of Scope against requirements
- Monitoring of the project risk associated with scope changes
- Monitoring of project quality – defects expected compared to defects found
- Progress and milestone review – by review of FPA against current phase documentation

Measurement and Analysis

Purpose

To develop and sustain a measurement capability that is used to support management information needs.

Level	Characteristic	Process Areas	Result
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1 Initial	Process unpredictable, poorly controlled, reactive	Measurement and Analysis Product and Process Quality Assurance Configuration Management	

Specific Goals:

- Measurement objectives and practices are aligned with identified information needs and objectives
- Measurement results that address identified information needs and objectives are provided

Measurement and Analysis & FPA

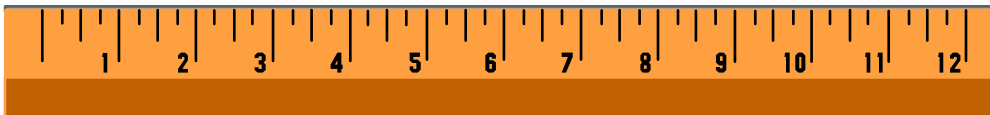
This PA involves:

- Align Measurement and Analysis Activities
- Establish Measurement Objectives
- Specify Measures
- Specify Data Collection and Storage Procedures
- Specify Analysis Procedures

FPA can provide:

- Size – and a very accurate size
- No. of units with a size
- No. of designs with a size
- No. of requirements, etc.
- Size of projects, application and portfolio

Size is used in most analysis to ensure comparison between applications, projects and organisations and to ensure comparison to industry and historical information



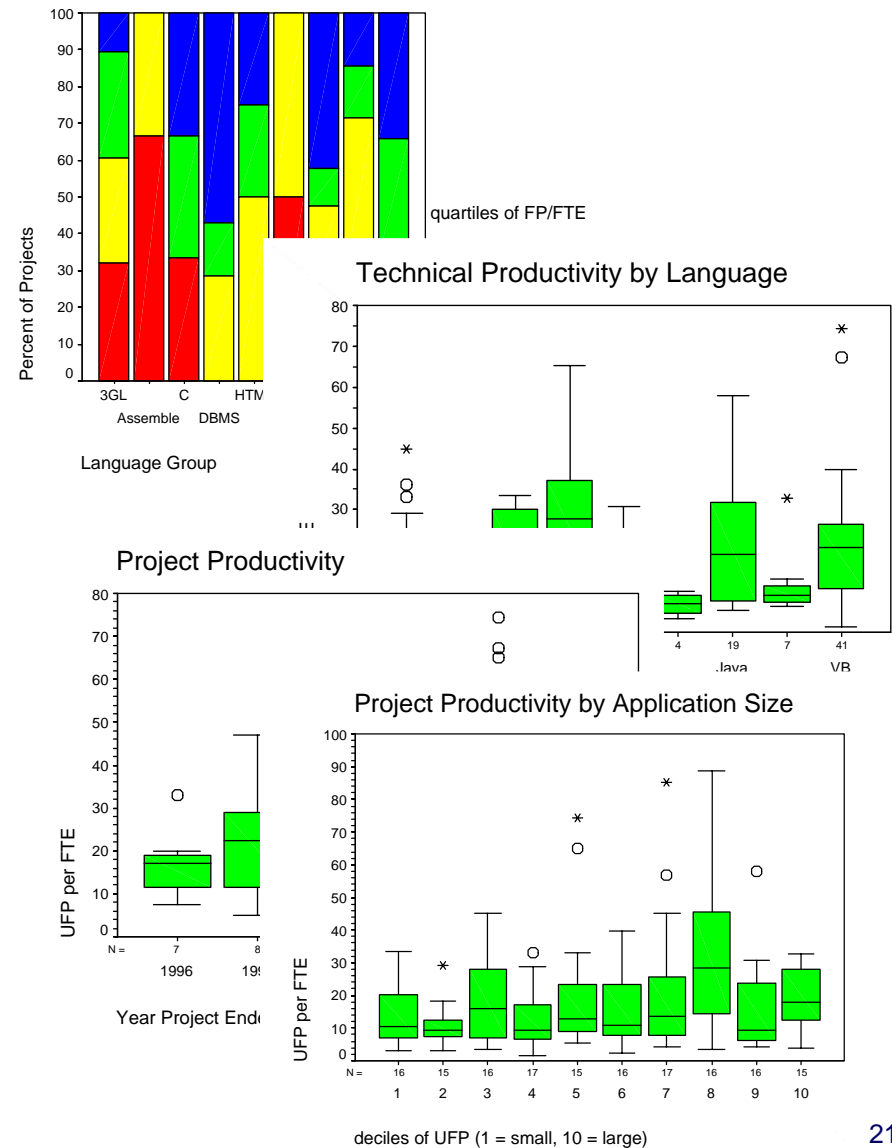
Measurement and Analysis

This PA involves:

- Provide Measurement Results
 - Collect Measurement Data
 - Analyze Measurement Data
 - Store Data and Results
 - Communicate Results

FP can provide:

- Consistency across industry
- Comparison between language, applications, organisations, country, etc.



Configuration Management

Purpose

To establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits

Level	Characteristic	Process Areas	Result
5	Optimizing	Causal Analysis and Resolution Organizational Innovation and Deployment	Productivity & Quality
4	Quantitatively Managed	Quantitative Project Management Organizational Process Performance	
3	Defined	Requirements Development Technical Solution Product Integration Verification Validation Organization Process Focus Organization Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis	
2	Managed	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Product and Process Quality Assurance	
1	Initial	Process unpredictable, poorly controlled, reactive	

Requirements Management
Project Planning
Project Monitoring and Control
Supplier Agreement Management
Measurement and Analysis
Product and Process Quality Assurance
Configuration Management

Specific Goals:

- Baselines of identified work products are established and maintained
- Changes to work products under configuration management are tracked and controlled
- Integrity of baselines is established and maintained

Configuration Management

This PA involves:

- Establish Baselines
 - Identify Configuration Items
 - Establish a Configuration Management System
 - Create or Release Baselines

FPA can provide:

- A list of all work products that are tracked against requirements
- A list of latest formal reviewed and baseline version of all work products



Verification

Purpose

To assure that selected work products meet their specified requirements.

Specific Goals:

- Preparation for verification is conducted.
- Peer reviews are performed on selected work products.
- Selected work products are verified against their specified requirements.

Level	Characteristic	Process Areas	Result
5	Optimizing	Causal Analysis and Resolution Organizational Innovation and Deployment	Productivity & Quality
4	Quantitatively Managed	Quantitative Project Management Organizational Process Performance	
	Process characterized	Requirements Development Technical Solution Product Integration Verification Validation Organization Process Focus Organization Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis and Resolution	
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Requirements Development
 Technical Solution
 Product Integration
Verification
 Validation
 Organization Process Focus
 Organization Process Definition
 Organizational Training
 Integrated Project Management
 Risk Management
 Decision Analysis and Resolution





Requirements Development

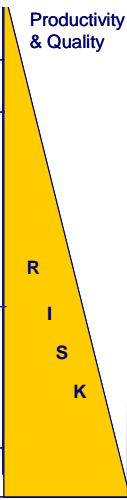
Purpose

To produce and analyze customer, product and product component requirements.

Specific Goals:

- Stakeholder needs, expectations, constraints, and interfaces are collected and translated into customer requirements.
- Customer requirements are refined and elaborated to develop product and product component requirements for the product life cycle.
- The requirements are analyzed and validated, and a definition of required functionality is developed.

5	Optimizing	Continuous process improvement	Customer Analysis and Resolution Organizational Innovation and Deployment	Productivity & Quality
4	Quantitatively Managed	Process measured and controlled	Quantitative Project Management Organizational Process Performance	
		Process characterized	Requirements Development Technical Solution Product Integration Verification Validation Organization Process Focus Organization Process Definition Organizational Training	
			Integrated Project Management Risk Management Decision Analysis and Resolution	
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Requirements Development

- Technical Solution
- Product Integration
- Verification
- Validation
- Organization Process Focus
- Organization Process Definition
- Organizational Training
- Integrated Project Management
- Risk Management
- Decision Analysis and Resolution

⋮⋮⋮ Requirements Development

- This PA involves:

- Development of Customer Requirements
- Development of Product Requirements
- Analyze and Validate Requirements

FPA can provide:

- Develop a list of affected applications
- Identify needed design and test scenarios
- Analyse Requirements from requirement documentation to data elements and transactions
- Identify affected groups and projects by boundary

Verification

This PA involves:

- Prepare for Verification
- Establish a Verification Strategy
- Establish the Verification Environment
- Define Detailed Verification Procedures

FPA can provide:

- Verification strategy and preparation by the timing of FPA and plan for FPA
- Verification procedure by the way FPA is documented



Verification

This PA involves:

- Perform Peer Reviews
 - Prepare for Peer Reviews
 - Conduct Peer Reviews
 - Analyze Peer Review Data
- Verify Selected Work Products
 - Perform Verification
 - Analyze Verification Results and Identify Corrective Action
 - Perform Re-Verification

FPA can provide:

- Independent peer review
- A list of assumptions and issues found during FPA
- Planning and strategy of peer review

Note that the FPA strategy and planning becomes the independent Peer review strategy and planning

Validation

Purpose

To demonstrate that a product or product component fulfills its intended use when placed in its intended environment.

Specific Goals:

- Preparation for validation is conducted.
- The product or product components are validated to ensure that they are suitable for use in their intended operating environment.

Level	Characteristic	Process Areas	Result
5	Optimizing Continuous process improvement	Causal Analysis and Resolution Organizational Innovation and Deployment	Productivity & Quality
4	Quantitatively Managed Process measured and controlled	Quantitative Project Management Organizational Process Performance	
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Requirements Development
 Technical Solution
 Product Integration
 Verification
Validation
 Organization Process Focus
 Organization Process Definition
 Organizational Training
 Integrated Project Management
 Risk Management
 Decision Analysis and Resolution

Validation

This PA involves:

- Prepare for Validation
 - Establish a Validation Strategy
 - Establish the Validation Environment
 - Define Detailed Validation Procedures
- Validate Product or Product Components
 - Perform Validation
 - Capture and Analyze Validation Results

FPA can provide:

- Identification of all requirements into transactions and data elements



Verification versus Validation

Although “verification” and “validation” at first seem quite similar in CMMI models, on closer inspection you can see that each addresses different issues.

Verification

Verification confirms that work products properly reflect the requirements specified for them. In other words, verification ensures that “you built it right.”

Validation

Validation confirms that the product, as provided, will fulfill its intended use. In other words, validation ensures that “you built the right thing.”

This in connection to FPA means

To perform a FPA verifies that the product that you give the client is what the Client requested in their requirements

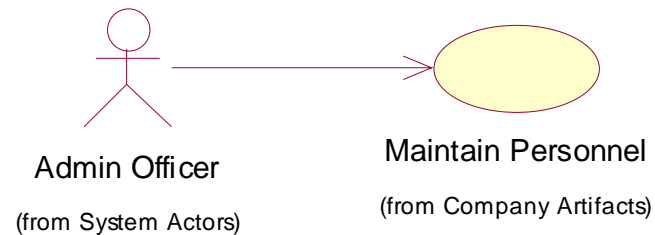
The FPA output and a completed list of design’s against all identified transactions and data elements – Validates that you have completed a design for all the requirements agreed with the Client

Validate transactions and data elements against requirements to identify missing or mismatch. Such as missing search.

Project Example

- Project to maintain Audit of Sub-suppliers for major company
- All documentation is done using UML
- All detail requirements created using Use Case notation
- All detail requirements broken down to only one Actor – or if multiple they are identifying the function as the same function.

Use Case example



Maintain Personnel

- Four alternatives
 - Find company unit
 - Cancel
 - Delete
 - Update
- View/Search is not mentioned
- Number of fields identified in the basic flow is 10



FPA on Use Case

Peer review, initial size and analysis

<i>Enh.</i>	<i>Description</i>	<i>*</i>	<i>Type</i>	<i>FTR/RET</i>	<i>DETS</i>	<i>Comment</i>	<i>Requirement</i>
	Maintain Personnel						
<i>Del</i>	Find Company Unit					other use case	Maintain personel 1.0
<i>Add</i>	<i>Personnel - show</i>		<i>EQ</i>	<i>2</i>	<i>15</i>	<i>Company unit</i>	<i>Maintain personel 1.1</i>
	<i>Personnel - New</i>		EI	1	13		Maintain personel 1.0
	<i>Personnel - Cancel</i>					not uniq	Maintain personel 1.0
	<i>Personnel - Update</i>		EI	1	13		Maintain personel 1.0
	<i>Personnel - Delete</i>		EI	1	3		Maintain personel 1.0
	<i>Personnel</i>		ILF	1	11	added ID	Maintain personel 1.0

- The Use case does not enable to find/show Personnel – Add
- The function Find Company Unit is a separate use case and therefore not defined as a unique elementary process - Duplicate requirements

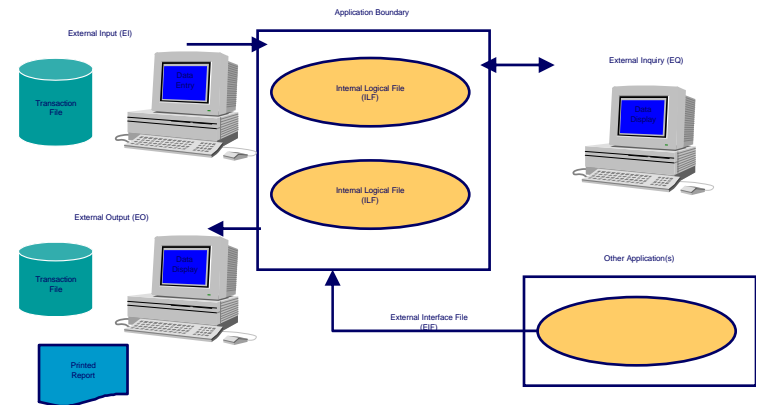
❖❖❖ FPA on the Project – SIZE +

<i>Type</i>	<i>LOW</i>		<i>AVG</i>		<i>HIGH</i>		<i>TOTAL</i>
	#	WT	#	WT	#	WT	
<i>ILF</i>	0	7	0	10	15	15	225
<i>EIF</i>	0	5	0	7	2	10	20
<i>EI</i>	0	3	0	4	23	6	138
<i>EO</i>	5	4	0	5	0	7	20
<i>EQ</i>	2	3	0	4	21	6	132
					UFP =	349	

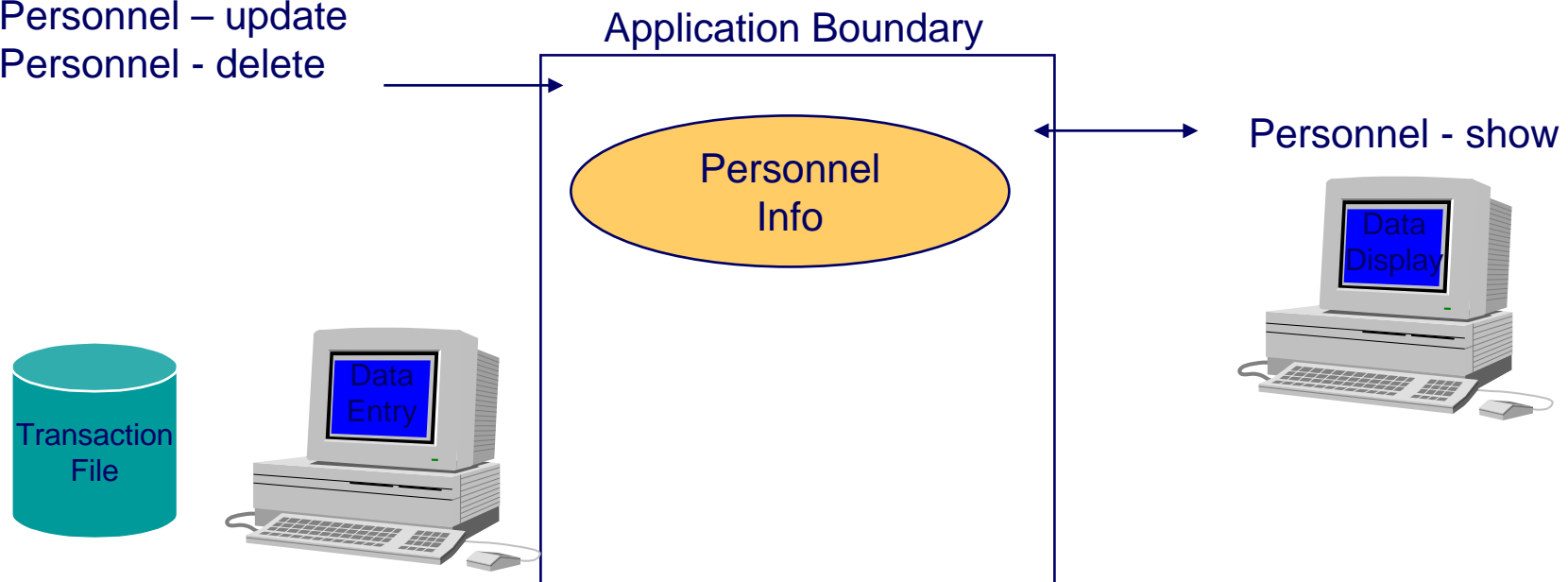
- Overview diagram
- Assumption and constraint list
Independent peer review of all requirements
- Identification of transactions and data elements incl. type and complexity
- Requirement traceability matrix started incl. size of requirements documentation

Function Point Analysis – graphical overview

- A Project context diagram
- An analysis overview



Personnel – new
 Personnel – update
 Personnel - delete

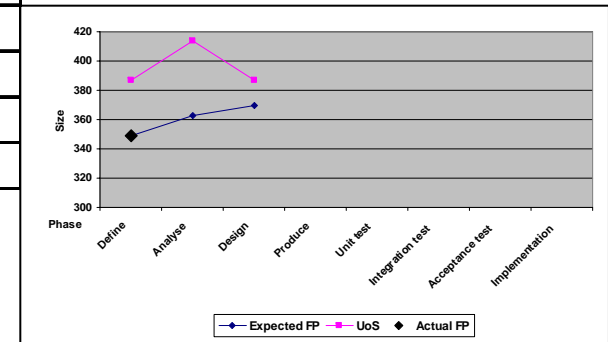


❖❖❖ FPA – Possible other Feedback information

- In this Project the boundary diagram was in the High-level Scope diagram and therefore was easy to describe – if this is not the case – walk through the boundary diagram to ensure that scope is correctly defined.
- The Notes describe the assumptions that have been made – validate this with Client
- The output from the FPA identifies the information that is duplicated and what is added. Look for add and deletes in the initial FPA – don't forget to delete this when the FPA is baselined
- The difference between the FPA of requirements documentation and the FPA of the design document is more than 50%. It is therefore highly recommended to do a re-planning of this requirement – the project is still aligned.
- No Average ILF/EIF's was found – therefore no average transactions – ensure that this fits into the feeling of the application – either small or big tables, etc.

Tracking using the FP and UoS

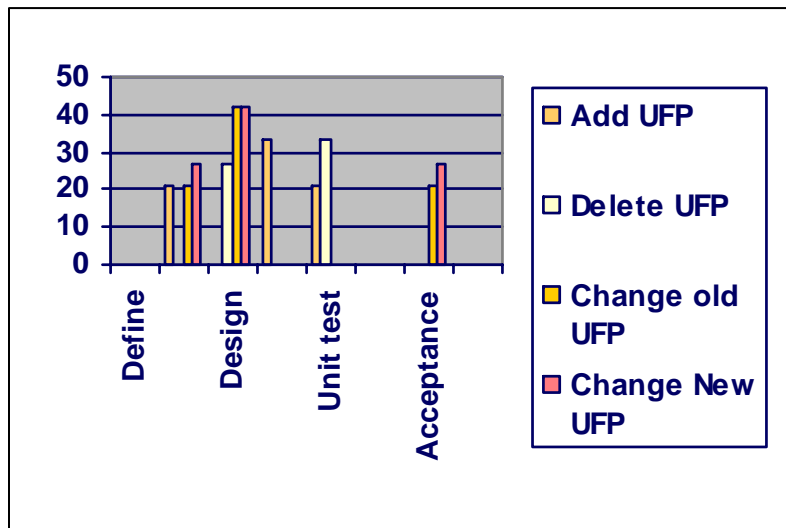
<i>Phase</i>	<i>Project FP</i>	<i>Enhance % expected</i>	<i>FPA Est</i>	<i>FPA after review</i>
<i>Define</i>	349	0%	387	448
<i>Analyse</i>	363	4%	414	490
<i>Design</i>	370	2%	387	
<i>Produce</i>	378	2%		
<i>Unit test</i>	381	1%		
<i>Integration test</i>	385	1%		
<i>Acceptance test</i>	393	2%		
<i>Implementation</i>				



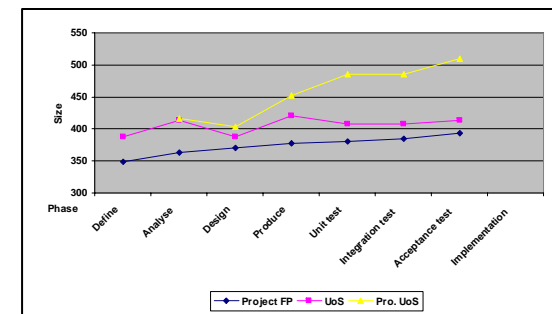
- Added an expected FP scope change – use historical information if possible – otherwise use benchmark
- Track estimate against actual
- Create thresholds for when to re-estimate – based on est./act.

••• FPA used for impact analysis

<i>Phase</i>	<i>add FP</i>	<i>delete FP</i>	<i>Change old FP</i>	<i>Change New FP</i>	<i>Add %</i>	<i>delete %</i>	<i>change %</i>
<i>Define</i>							
<i>Analyse</i>	21		21	27	110%	20%	105%
<i>Design</i>		27	42	42	130%	30%	110%
<i>Produce</i>	33				150%	60%	120%
<i>Unit test</i>	21	33			170%	90%	130%
<i>Integration test</i>						95%	150%
<i>Acceptance test</i>			21	27		100%	170%



- Reflect time and price to change compared to phases
- Size of project – impact of changes





FPA on Use Case Traceability, verification and validation

	Maintain Personnel					
<i>Del</i>	Find Company Unit	Maintain personel 1.0	0	0	Personnel 1.0	0
Chg	Personnel - show	Maintain personel 1.2	7	4	Personnel 1.0	7
Chg	Personnel - New	Maintain personel 1.2	4	3	Personnel 1.0	4
	Personnel - Cancel	Maintain personel 1.2	0	0	Personnel 1.0	0
Chg	Personnel - Update	Maintain personel 1.2	4	3	Personnel 1.0	4
	Personnel - Delete	Maintain personel 1.2	3	3	Personnel 1.0	3
Chg	Personnel	Maintain personel 1.2	10	7	ERD Diagram 1.0	10
Add	Personnel- summary report	Print - summary personnel 1.0	5	0	Personnel 1.0	5

- Personnel – CR – added 9 fields, additional personnel info detail – 2 RET
- The design includes a monthly report with names and total number of employees – a separate use case

❖❖❖ FPA summary – When?

- FPA for baseline of requirements
- FPA as the independent peer review
- FPA for reconciliation of requirements against work products in checkpoint/verification
- FPA for reconciliation of delivered against what was expected and what is needed.
- FPA for re-planning and re-baseline of requirements
- **FP Size**
 - FP for estimating and tracking
 - FP for threshold to do re-planning
 - FP for application size
 - FP as a price/re-work indicator



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