Measurement in the Software Process

Outline

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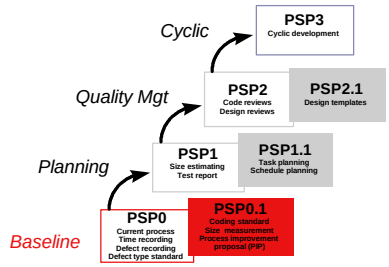
Review of PSP Levels (Humphrey, 1995, p. 11)



Introduction (cf. Humphrey, 1995, p. 207)

- This chapter covers:
  - Principles of process measurement
  - The GQM Paradigm

Why Make Measurements?

(cf. Humphrey, 1995, p. 207-208)

- To gain a quantitative understanding
- To evaluate a product, process, or organization
- To control a product or process
- To make an estimate or plan

Principal Measurement Categories (cf. Humphrey, 1995, p. 208)

- Objective / Subjective
  - count vs. judgment
- Absolute / Relative
  - invariant vs. change wrt others
  - Ex: program size vs. average
- Explicit / Derived
  - primary vs. secondary
- Dynamic / Static
  - time dimension vs. final result
  - Ex: To date vs. total
- Predictive / Explanatory
  - in advance vs. after the fact

Mental Models (cf. Humphrey, 1995, p. 208, 209)

- Definition
  - A defined process
  - A defined context for data gathering
- Conclusion
  - "At least a basic process definition should always precede data gathering."
  - Each task should have explicit entry/exit criteria… (This is very difficult at times, especially for Analysis & Design.)
- Start general and refine
- Benefits:
  - Provides useful data
  - Ex: how long tests take
  - Ex: # of defects found in each type
  - Ex: Whether additional cost to find each defect is worth it
  - ...

Fundamental Process Measures (cf. Humphrey, 1995, p. 209-210)

- Start with objective, absolute, explicit measures.
- Build derived ones upon these.
- Three categories of process measures:
  - Product
  - Process
  - Resource

Fundamental Process Measures (cont.) (cf. Humphrey, 1995, p. 209-210)

- Product
  - Volume of product produced
  - Ex: system capability (throughput, …), complexity, …
- Process
  - Process behavior
  - Objective, absolute, explicit, dynamic
  - Event counts & time measures

Fundamental Process Measures (cont.) (cf. Humphrey, 1995, p. 209-210)

- Resource
  - Labor hours are the primary resource.
  - Secondary resources are tools & systems, support, …
  - You probably need to track time are the minute level
  - Many types of "interruptions" reduce "productive" time:
    - meetings
    - lack of clerical service
    - poor support
    - phone calls
    - …
  - Three costs of these "interruptions":
    - lost time
    - additional time to get going again
    - increased likelihood of error
  - Conclusion:
    - Track time to determine where and how to improve

The GQM Framework (cf. Humphrey, 1995, p. 211-214)

- GQM = Goals, Questions, Metrics
- Define primary (business related) goals for the activity (and for those above you in the organization).
  - What are you / they trying to achieve?
- Create questions, answer to which will help achieve these goals.
- Define / gather data necessary for answering the questions.

GQM: The Goals Hierarchy (cf. Humphrey, 1995, p. 212)

- Attempt to identify a hierarchy of organizational goals and relate your goals to the broader set.
  - What, how, when, how much, & improvement.
- cf. Fig. 7.1, p. 212, Goals Hierarchy

GQM: Questions

(cf. Humphrey, 1995, p. 213)

- You are starting with rather vague goals and would like to end up with useful numbers (data collected, metrics).
- Questions are the connection between the two.
- Questions tell what you want to know about each goal.
- Ex:
  - For each process goal, where did I start, where am I now, and where do I want to go?
  - What is the best that has been achieved against this goal?
  - Is there a limit above which this goal cannot be improved?
  - cf. Manager/Developer GQM paper

GQM: Metrics

(cf. Humphrey, 1995, p. 213)

- Metrics are the precise, exact ways you will collect the data.
- Start, be precise, recognize the need for additional data, and refine or add to the metrics you are collecting.
- Designing forms facilitates the data collection. It:
  - Is precise
  - Makes data collection easier
  - Improves the data-gathering efficiency
  - Helps point out weaknesses in the process
  - ...

General PSP Objectives / Goals

(cf. Humphrey, 1995, p. 214)

- The overall PSP data-gathering goals are:
  - Understand how personal SW development works
  - Determine steps to improve product quality
  - Determine the impact of process changes on your productivity
  - Establish benchmarks to measure process improvement
- You should:
  - Set more explicit goals
  - Start with learning about your process

General PSP Questions, Metrics, and Process

(cf. Humphrey, 1995, p. 214)

- Questions:
  - What aspects of my performance are important?
  - How could I measure them?
  - What is the best performance I have achieved?
  - What can I learn from them?
  - What are others achieving?
  - What methods do they use that could help me?
- Metrics:
  - Define measures for the questions
  - Gather data on these measures
- Process:
  - Refine & improve

Some Examples

(cf. Humphrey, 1995, p. 215-217, and Turk, 1994)

- Book's example:
  - Goal: Produce defect-free programs.
  - Question: How can you produce SW of such quality such that no defects will be found in later testing or use?
  - Note: There is no way to guarantee this, but we can take steps to minimize it.
  - cf. Table 7.1, p. 218,219, on how to update a Project Plan Summary when defects are found after development is completed - running it later or using it as the base for another program.
- My Mgr/Dev GQM paper examples
  - Look at paper

Gathering Data (cf. Humphrey, 1995, p. 217-226)

- There are three issues with respect to gathering data, since you will probably not have special tools:
  - Forms
    - You will need to create forms to facilitate the collection process.
  - Place to keep the data
    - You will need to decide on a place to store the data.
  - Engineering notebook
    - You will want a convenient place to record many kinds of thoughts and information, and log it for later reference.

Gathering Data Manually

(cf. Humphrey, 1995, p. 217-219)

- Tools would be nice, but personal judgment is necessary:
  - What category of activity are you engaged in right now? You need to log this. The computer cannot know this all the time.
  - Counting defects from code changes.
  - Determining where a defect was injected.
  - cf. Orlikowski
- Therefore, gather data manually.
- You can automate some of the analysis.
- There are readily-available tools:
  - Logs
  - Forms
  - Databases
  - Spreadsheets
  - Summary reports
  - ...

Gathering Data: Forms & Templates

(cf. Humphrey, 1995, p. 219-220)

- Definitions:
  - Forms = for fixed amount of data
  - Template = for unpredictable volume of data - expandable
- How to develop forms & templates
  - Use a test & modify cycle
  - Create the form and do a dry run with prior project data
  - revise and do another dry run
  - Finally test on a real project
  - Revise...

Gathering Data: The Defect Database

(cf. Humphrey, 1995, p. 220-221)

- Look at Table 7.2, p. 221, Defect Database Example
- Sample Uses:
  - Number of defects injected & removed by phase
  - Number & types of defects found in a specific phase
  - Number of defects in the product at phase entry, but which were not found during that phase
  - Time to fix a defect as a function of phase removed
- Suggestions:
  - Enter data promptly (post-mortem is a good time)
  - DBMS is a good method (spreadsheet could be used too)

Gathering Data: The PSP Spreadsheet

(cf. Humphrey, 1995, p. 221-225)

- The spreadsheet has places for all Project Summary form data
- Walk through Table 7.3, p. 222-4
- Some potential analyses:
  - Regression - use spreadsheet
  - Yield = % defects removed in phase X...
  - Productivity
    - Development
    - Defect-finding in phase X
  - Charts - graphs, plot progress

Gathering Data: The Engineering Notebook

(cf. Humphrey, 1995, p. 219-220)

- Uses & Value
  - record thoughts (ideas)
  - document ideas (patents, ...)
  - prove competency (liability)
- Practice: combine notebook & time log
  - Page 1 = index
  - Notebook from front and onward
  - Log from back and forward

Impact of Data Gathering

(cf. Humphrey, 1995, p. 226-227)

- It takes time
  - Time consuming and tedious
  - You must be convinced of its value
  - You must understand your goals, questions, and how you'll use the data
  - This will guide your choice of what to keep / change about the PSP
- It can affect your performance
  - When you gather data for yourself - you can be objective
  - When you gather data for your boss - you make the results look as good as possible
  - Be careful / sensitive / private about how you share your personal data

Establishing Your Baseline

(cf. Humphrey, 1995, p. 227-228)

- You need a good volume of data to tell if you are improving.
- Bolstering = Selectively remembering good results
- Clutching = Results are so important that your performance is effected.
  - Ex: you must do well, and you don't, even though you usually do.
- Pressure introduces unknown factors which change your performance.
- Personal performance data can be discouraging, so focus on changing behavior, not simply on trying harder.

Homework #6

- Program 6A
  - Enhance 4A linear regression to calculate prediction interval
  - See p. 757-758, and Assignment Kit #6