Process Measurement

Process Measurement: Principles

- To be useful, measurements should be
  - gathered for a specific purpose
  - explicitly defined
  - properly managed
  - properly used

- Measuring your process will not improve it. You must make process changes to achieve lasting improvement.

Process Measurement: Purposes

We measure to

- understand and manage change
- predict or plan for the future
- compare one product, process, or organization with another
- determine adherence to standards
- provide a basis for control

Process Measurements: Types

- We generally need objective and explicit measures
- To be useful, we need relationships that correlate
  - program size versus development hours
  - cost distributions
  - defect densities
- We also seek a controlling or predictive capability
  - actions to reduce test defects
  - steps to improve review quality
  - means to improve productivity

Process Measurements: in PSP

- The basic PSP data are
  - program size
  - time spent by phase
  - defects found and injected by phase
- Both actual and estimated data are gathered on every item
- Measures derived from these data
  - support planning
  - characterize process quality

PSP Size Measures

- The goals of the PSP size measures are to
  - define a consistent size measure
  - establish a basis for normalizing time and defect data
  - help make better size estimates

- Some of the questions these data can help to answer are
  - What size program did I plan to develop?
  - How good was my size estimate?
  - What was the completed size of the finished program?

PSP Time Measures

- The goals of the PSP time measures are to
  - determine how much time you spend in each PSP phase
  - help you to make better time estimates

- Typical questions these data can help answer are
  - How much time did I spend by PSP phase?
  - How much time did I plan to spend by PSP phase?

PSP Defect Measures

- The goals of the PSP defect measures are to
  - provide a historical baseline of defect data
  - understand the numbers and types of defects injected
  - understand the relative costs of removing defects in each PSP phase

- Some questions these data can help answer are
  - How many defects did I make in each phase?
  - How many defects did I remove in each phase?
  - How much time did it take to find and fix each defect?

Size Versus Development Effort

- The principal requirement: If the size measure is not directly related to development cost, it is not worth using
- There are many possible measures
  - database elements
  - lines of code (LOC)
  - function points
  - pages, screens, scripts, reports
- The size measure should be sensitive to language, design, and development practice.

Relationship to Development

- Pages are often an acceptable measure for document development
- LOC is usually a good measure for developing source programs like C, C++, Java, Python.
- Other possible measures are function points, screens, modules, database elements, and maintenance fixes

Measurement Precision

- When two people measure the same thing, will they get the same result?
- To do so requires a precise measurement definition
- The measure must also be properly applied.
  - Different people will likely have different definitions of database elements.
  - C++ LOC do not equate to assembler LOC
  - New LOC are not the same as modified LOC
  - Logical LOC do not equate to physical LOC
  - One person's C++ LOC may not relate to someone else's C++ LOC

Machine Countable

- Manual size counting is time-consuming and inaccurate
- Automated counters will only work for defined product characteristics
- Counters can be complex, depending on the
  - size definition selected
  - counting method used

Suitable for Early Planning -1

- For making initial project plans, measures are needed that you can visualize at the beginning of the job.
  - For a house, square feet predicts cost.
  - Few people can visualize a house in terms of square feet of living space.
  - Numbers of rooms is more intuitive.

- Intuitive size measures are usually needed for initial plans

Suitable for Early Planning -2

- Unfortunately, popular intuitive measures are not often measurable, and popular measurable measures are often not intuitive
- Function points
  - intuitive
  - not directly measurable
- LOC
  - not intuitive
  - directly measurable

LOC Measurement

- The suggested PSP LOC measure uses logical (versus physical) lines of code
- Statement specifications
  - executable
  - nonexecutable
  - counted statement types
- Application
  - language and code type
  - origin and usage

Counting Program Size -1

- Logical lines
  - invariant to editing changes
  - correlate with development effort
  - uniquely definable
  - complex to count

- Physical lines
  - are easy to count
  - are not invariant
  - must be precisely defined for each case

Counting Program Size -2

- The PSP uses a coding standard and a physical counter for LOC size measures
  - defined coding standard
  - physical line for each logical line
- This standard must be faithfully followed
- Then, physical line counting equals logical line counting

A LOC Counting Example

```
procedure ISet.Set(var N: int; var inc: boolean);
    begin
        inc := false;
        SearchPtr := SetStart;
        while (SearchPtr<>nil) and (inc == false) do
            if SearchPtr^.ThisN == N
                then
                    inc := true
                else
                    SearchPtr:=SearchPtr^.NextN;
    end;
```

PSP's LOC Counting Standard

- Count all statements. This includes
  - begin, end, if, then, else,
  - {, }, ;, .,
  - declarations, directives, headers, etc.

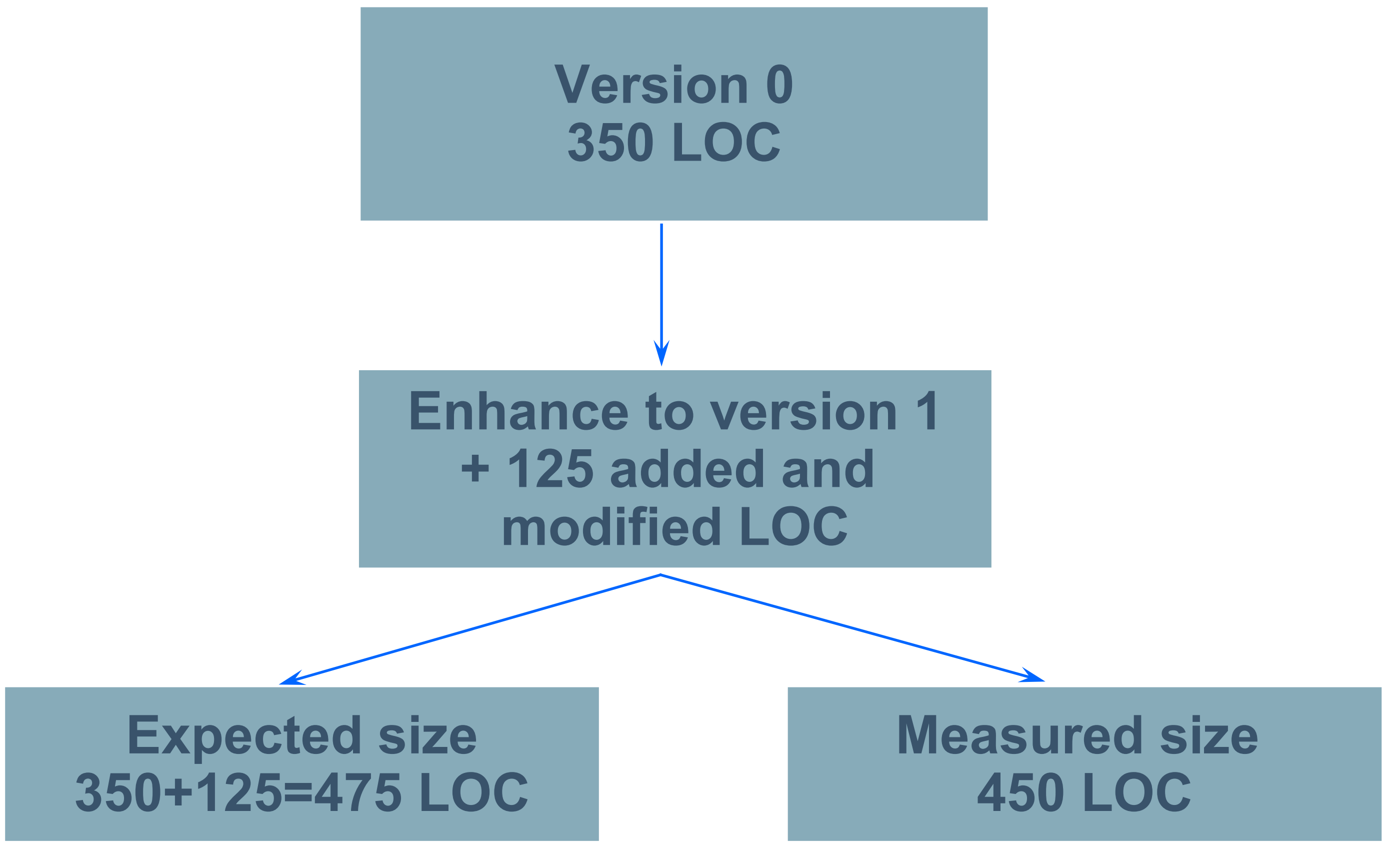
- Do not count blanks, comment lines, or automatically generated code

- Count added and modified code for measuring and estimating development productivity

Size Accounting

- For small products, size tracking can be done manually, but it requires care
- For larger products, size tracking requires an accounting system
- Size accounting provides an orderly and precise way of tracking size changes through multiple product versions

Example of Size Accounting - 1



What happened?

Example of Size Accounting - 2

	Added	Subtracted	Base
Base V0			0
Deleted		0	
Modified	0	0	
Added	350		
Base V1	350	-0	350
Deleted		0	
Modified	25	25	
Added	100		
V1 Product	125	-25	450
Total Added and Modified LOC			475

Messages to Remember

- To effectively plan and manage your work, you must measure product size
- For different types of work, use different size measures
- For each measure, size must correlate with development time
- If the size measure does not correlate or is not automatically countable, it will not be very useful
- Every size measure should be precisely defined and automatically countable.