

MOTIVATION FOR METRICS

- Effort prediction
- Quality improvement
- Project tracking

COMPLEXITY METRICS

- Program length (lines of code)
- Intraprocedural control flow complexity
- Interprocedural control flow complexity
 - Fan-in/fan-out
 - Module coupling/cohesion
 - (Use of inheritance)

PROGRAM LENGTH

- Single best estimator of effort, bugs, etc.
- Lines
- Whitespace/comments
- Statements
- KLOC - de facto standard; correlated with everything else

CONTROL FLOW COMPLEXITY

- Loop/conditional nesting
- Knots, structure violations (goto's)
- McCabe (Cyclomatic complexity)
 - One plus the number of program predicates
 - Equals the number of linearly independent control flow graphs

OTHER FACTORS

- All show slight advantages
 - Use of mnemonic variable names
 - Use of whitespace/indentation
 - Use of comments

GQM

- Goal, Question, Metric
- Basili *et al.*
- Framework for establishing a metrics program

Use of Measurements

- Project planning
- Process/product assessment
- Rationale for change
- Progress assessment and correction

Requirements

- A metrics program must ...
 - be focused on specific goals
 - be applied to products, processes and resources
 - interpreted via organizational, context, and environmental goals
- This implies a top-down process

Approach

- Start with organizational information needs and produce a measurement system
 - Conceptual level (goals)
 - Operational level (questions)
 - Quantitative level (metrics)

Conceptual Goals

- For an object
 - Objects of measurement: products, processes or resources
- For reasons
- With respect to a quality model
- From various points of view
- Relative to an environment

Questions

- Characterization of object wrt a goal

Metrics

- Associated data
- Objective or subjective (depending on point of view)

Example

- Change request processing
- Goal: purpose (improve); process (change request handling)
- Viewpoint: project manager
- Quality issue (timeliness)
- Questions: current speed? improvement?
- Metrics: average cycle time, standard deviation, % out of range, ratio wrt baseline, subjective

The GQM Process

- Data collection mechanisms
- Validation
- Data analysis

Sources of Goals

- Organizational strategy documents
- Process/product descriptions
- Model of the organization

Groups of Questions

- How to characterize wrt goal
- How relevant is an attribute
- How to evaluate characteristics

Factors for Metrics

- Quality of data
- Availability of data
- Maturity of object of measurement
- How much can we learn from the data
- What is its applicability to a goal