Goal Question Metric (GQM) and Software Quality

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Topics

- Relationship to software quality
- GQM in a nutshell
- Types of goals
- Mechanics of GQM
- Summary, important points, suggestions

Purpose

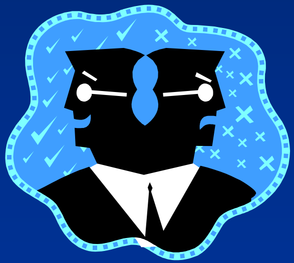
- Communicate information about GQM
- Point you to references
- Ask that you involve the relevant stakeholders if you try this approach

What does GQM have to do with Software Quality?

- **If** successful software development is related to
  - – Appropriate development environments
  - – Using disciplined processes
  - – Defining, collecting – analyzing useful data
  - – Acting on the analysis results
- **Then**
  - – GQM is **a** method to help
- Else
  - – Look elsewhere

History – background

- Victor Basili and David Weiss
  - NASA Goddard Space Flight Center
  - Quantify the (then) proposed methods of “preventing errors” in software
- But …



- Other disciplines have data – what about software
  - Confounding factors
  - Controlled studies are very expensive

More History

- Early 80’s – experimented with ways to collect data
- Tried “solution” at NASA / Goddard Space Flight Center
- 1984 – Victor Basili and David Weiss “A Methodology for Collecting Valid Software Engineering Data”
  - “How to” collect valid AND useful data
- This method “became” GQM

GQM is

- Top down
  - – Goals
  - – Questions related to goals
  - – Define metrics to answer questions

Measurement system

GQM in a nutshell

1) What are the **goals**

2) What **questions** are needed to
   - Define/refine the goals
   - Learn about progress toward goal(s)

3. What **metrics** are needed
   - Answer the questions
   - Determine if the goal has been achieved

BUT WAIT

- There’s more

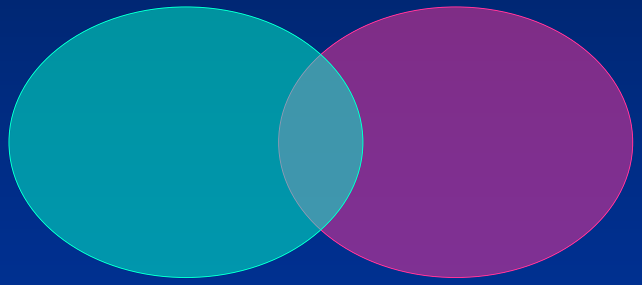
GQM - part 2

4) Define - deploy data collection mechanisms

5) Collect, check, analyze data *in real time*
   - Adjust data collection mechanisms
   - Adjust projects

6) Determine if goal is achieved

Goals – two types



Business

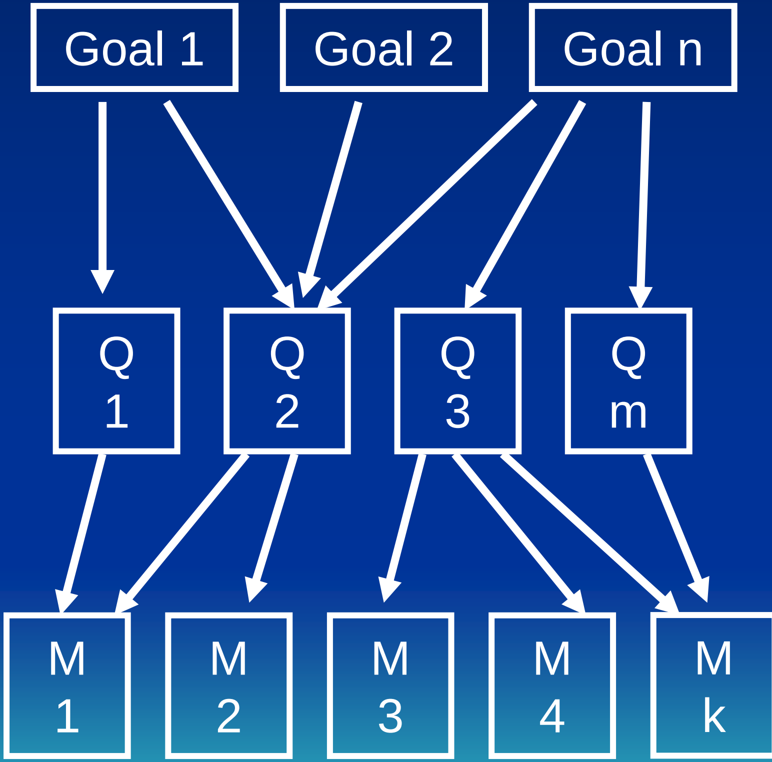
Measurement

May be VERY HARD to differentiate

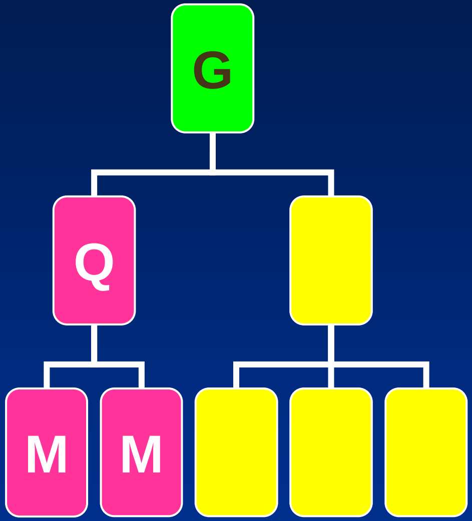
Our focus: Measurement goals

GQM “Tree”

- Three “levels
  - “Conceptual” – Goals
    - What to accomplish
  - “Operational” – Questions
    - How to meet the goal
  - “Quantitative” – Metrics
    - Metrics to answer questions



Recap



- Top down
  - Represented as a tree
- Two phases
  - GQM definition
  - Deployment, analysis, process adjustment and check
- Two types of goals
  - Business
  - Measurement

Mechanics of GQM

1. Determine the goals

2. Create the questions

3. Define the metrics/measures

Determine the Goals

- Each goal addresses
  - Object – what is being examined
  - Purpose – why object is being examined
  - Focus – attribute being examined
  - Viewpoint – perspective of examination
  - Environment – context of scope of examination

Two ways to create goals

- Build a sentence addressing each topic
  - “… object, purpose, quality attribute, perspective/viewpoint, environment…”
- Use a table

Example – sentence format

Analyze the unit test process to understand the impact of adding additional tests to project K from the viewpoint of the project manager.

Example – sentence format

Analyze the unit test process to understand the impact of adding additional tests to project K from the viewpoint of the project manager.

Object – unit test process

Purpose - understand

Focus – impact of adding additional tests

Viewpoint – project manager

Environment – project K

Example – table format

Topic	Response
Analyze (The object to be measured)	
For the purpose of (understanding, controlling, improving …)	
With respect to (The quality attribute of interest)	
From the viewpoint of (who measure the object)	
In the context of (The environment for the measurement)	

Example – table format

Topic	Response
Analyze (The object to be measured)	Unit test process
For the purpose of (understanding, controlling, improving …)	To understand
With respect to (The quality attribute of interest)	Impact of adding additional tests
From the viewpoint of (who measure the object)	Project manager
In the context of (The environment for the measurement)	Project K

Another example – table format

Topic	Response
Analyze (The object to be measured)	Customer call database
For the purpose of (understanding, controlling, improving …)	To understand
With respect to (The quality attribute of interest)	How many user interface defects are reported
From the viewpoint of (who measure the object)	Customer
In the context of (The environment for the measurement)	XYZ Project

Mechanics of GQM

1. Determine the goals
2. Create the questions
3. Define the metrics/measures

Questions

- Move from abstract (conceptual level) to operational level
- “Have we reached the goal?”
- Clarify the goals
- Involves all stakeholders

- Objective – shared understanding

Questions

- Goal: Analyze the unit test process to understand the impact of adding additional tests to project K from the viewpoint of the project manager.

- Q1: What is our test time now?
- Q2: How effective are we at finding defects?
- Q3: What about escapes?
- Q3: What happened when we last added tests?
- Q5: …

Meanwhile …

Goal: Analyze the unit test process to understand the impact of adding additional tests to project.

Is this what I REALLY want? Is this my goal?
Or … Do I want something else?
PM

Goal: Analyze the unit test process to understand the impact of adding additional tests to project.

Goal 1: Analyze the unit test process to understand the impact of adding additional tests to project K from the viewpoint of the project manager.

Q1: What is our test time now?

Q2: How effective are we at finding defects?

Q3: What about escapes?

Q4: What happened when we last added tests?

Mechanics of GQM

1. Determine the goals ☑
2. Create the questions ☑
3. Define the metrics/measures

Define the metrics

- Move from the questions (operational level) to quantitative level
- Objective
  - – Define what data will be collected
  - – Create operational definitions
- Refine questions and (maybe) goals

Critical element

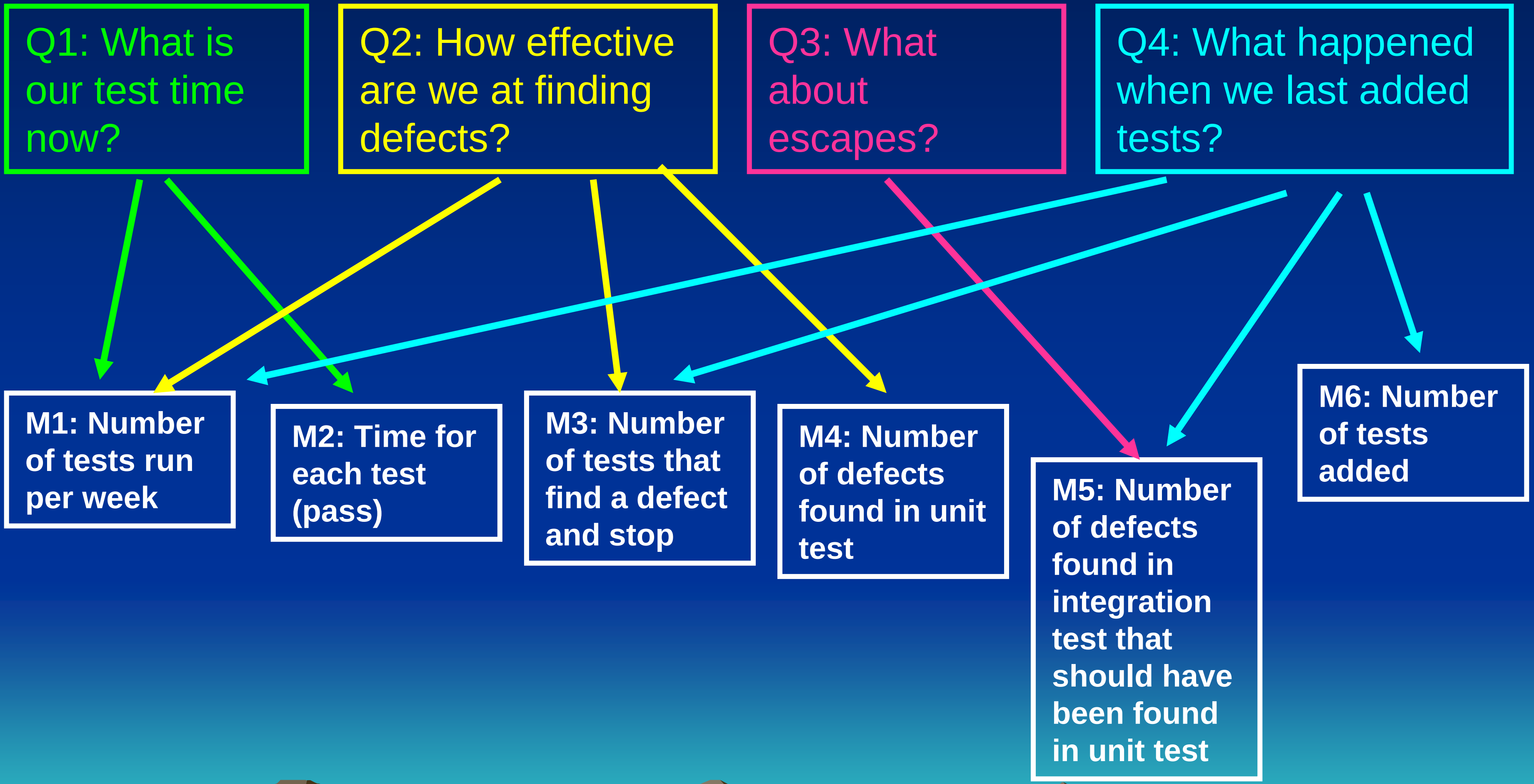
- Involve the people who will collect the data
- Learn
  - What is available
  - How to get it
  - Level of effort to obtain

  - Accuracy - validity

Types of metrics

- Objective - Counts of things or events
- Absolute - Size of something independent of other things
- Explicit - Obtained directly
- Derived - Computed from explicit and/or derived
- Dynamic – related to time
- Static – independent of time

Goal 1: Analyze the unit test process to understand the impact of adding additional tests to project K from the viewpoint of the project manager.



Q1: What is our test time now?

Q2: How effective are we at finding defects?

Q3: What about escapes?

Q4: What happened when we last added tests?

M1: Number of tests run per week

M2: Time for each test (pass)

M3: Number of tests that find a defect and stop

M4: Number of defects found in unit test

M5: Number of defects found in integration test that should have been found in unit test

M6: Number of tests added

Mechanics of GQM

1. Determine the goals ☑
2. Create the questions ☑
3. Define the metrics/measures ☑

Sum up

- **Goal focused, data driven, improvement model**
- Top down approach to define
  - Goals
    - Improvement
    - Characterization
    - Understanding
  - Questions to answer about the goal
  - Metrics to provide answers to the questions
- Has two phases
  - Definition – define the Gs, Qs and Ms
  - Deployment, analysis, process adjustment and checking

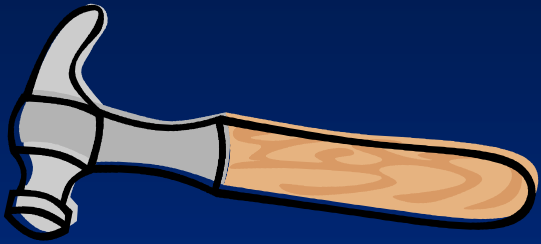
Important points

- Creating the Gs, Qs and Ms is iterative
  - Questions refine goals
  - Metrics refine questions
  - Ability to obtain data refines metrics
- Requires stakeholder involvement
  - Especially those that record/capture the data

Suggestions

- GQM – it’s a project - have a plan
- Iteratively develop and implement
- You can pick the wrong metrics
- Analyze data early and often
- Define a data analysis process
  - – Does the collected data answer the questions and address the goal?
  - – Avoid using the data for things other than the questions and the goal. No data “mining”

Finally



- GQM is a TOOL
- Be cautious – if all you have is a

Food for thought

- “You can observe a whole lot just by watching.” Yogi Berra
- “Effort moves toward whatever is measured.” Tom DeMarco

References and other reading

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Thank you for listening. Questions – comments - suggestions

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