# Measuring Effectiveness of Test Design

**Plenary Session @ QUEST 2009**

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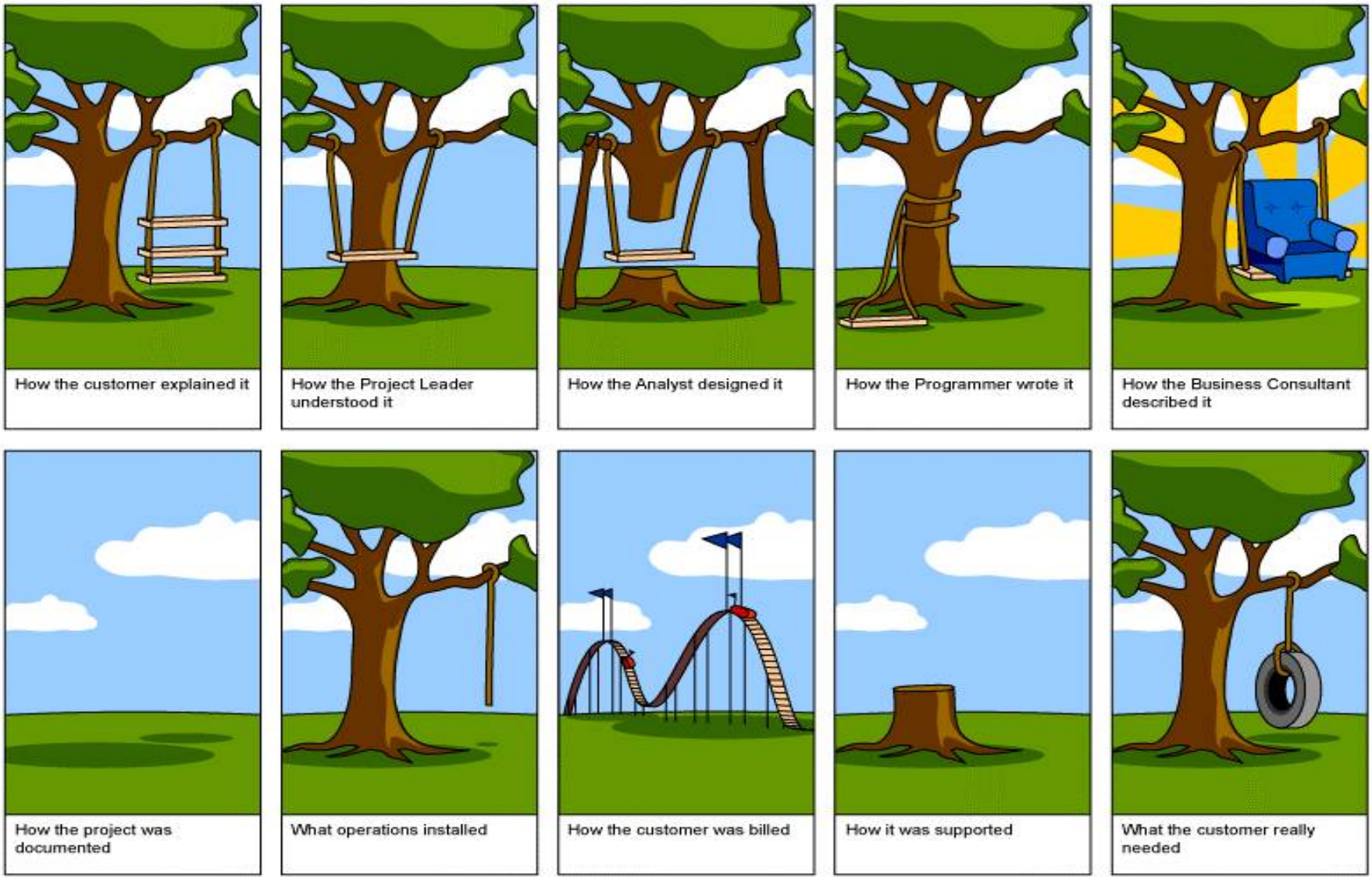
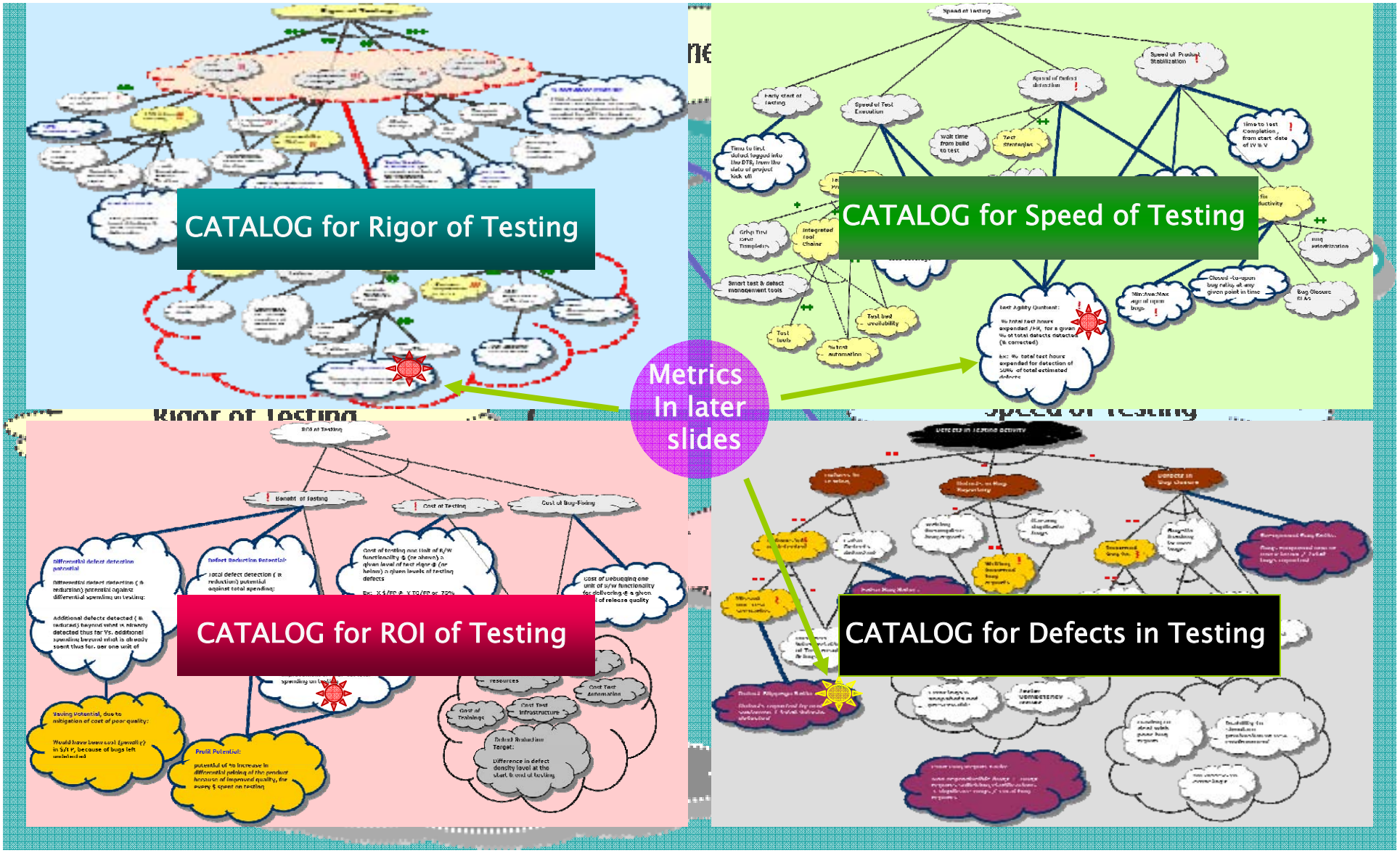
# The World of Software Development



# Effectiveness..?

# NFR catalog for "Test Effectiveness"

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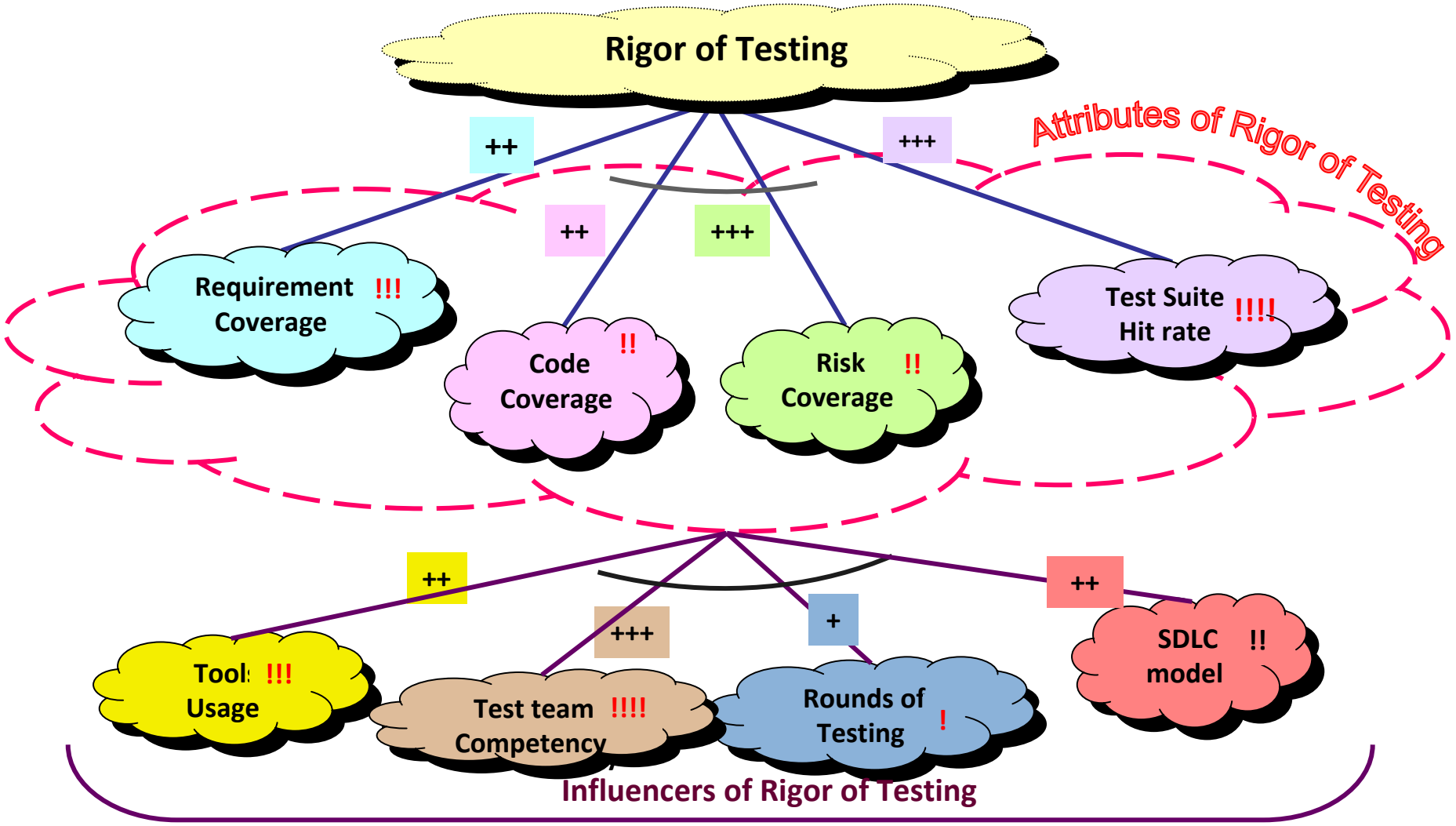
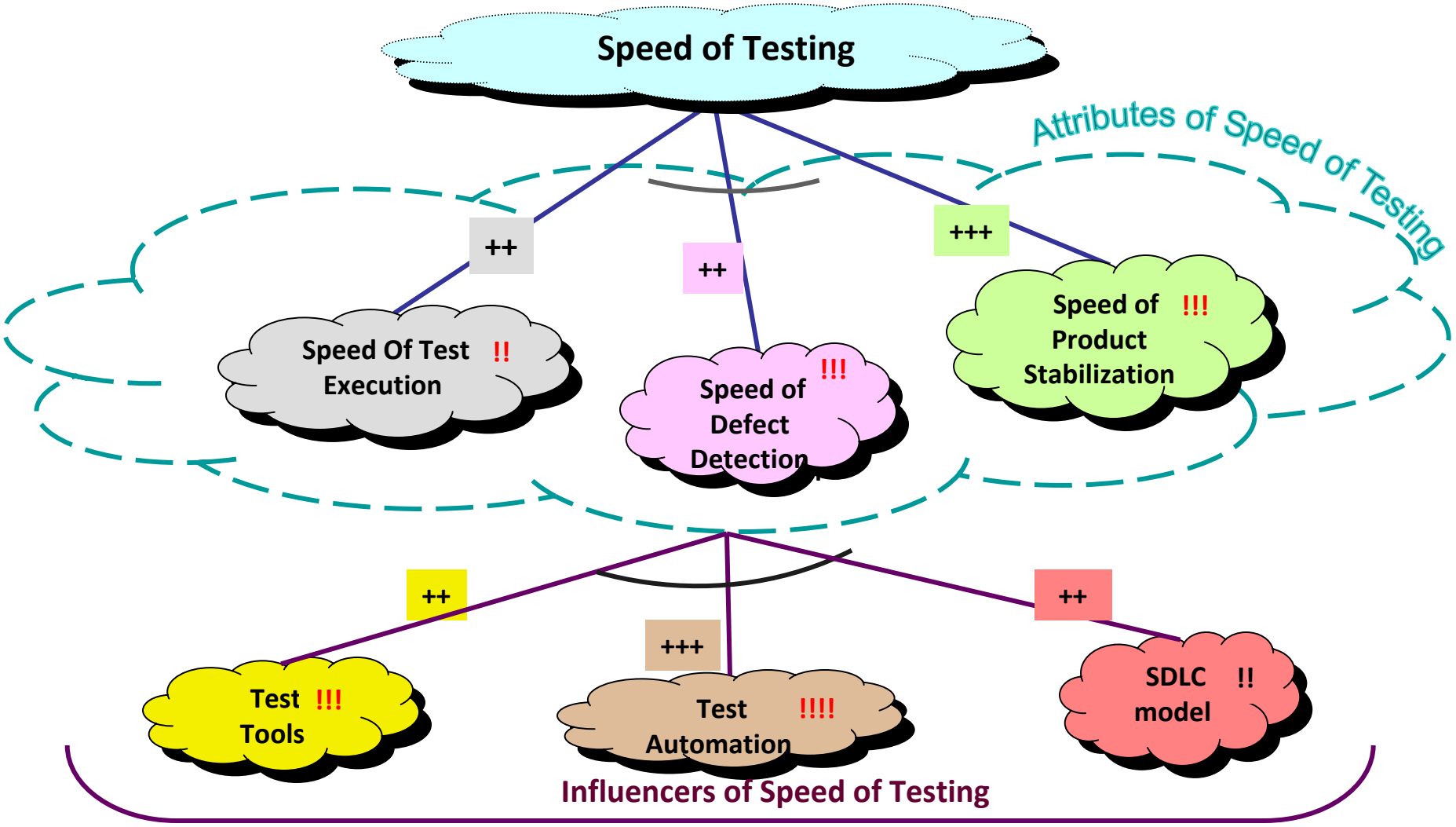
# Exploding the "Rigor Of Testing"




It is important to define metrics for attributes of Test Rigor & study impact of influencers on them

# Exploding the "Speed Of Testing"




**As delayed defect detection increases the cost of correction, speed of testing directly impacts ROI**

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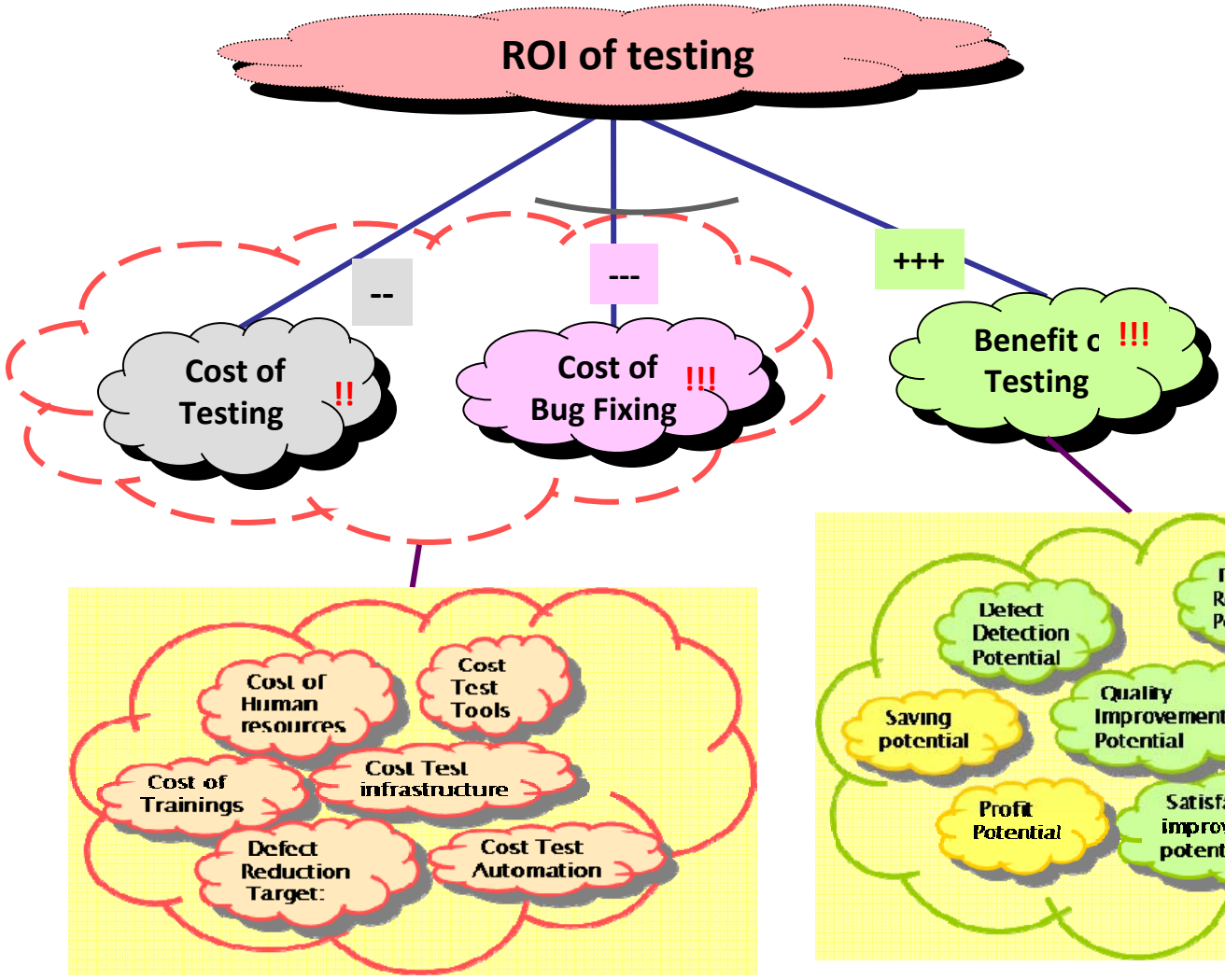
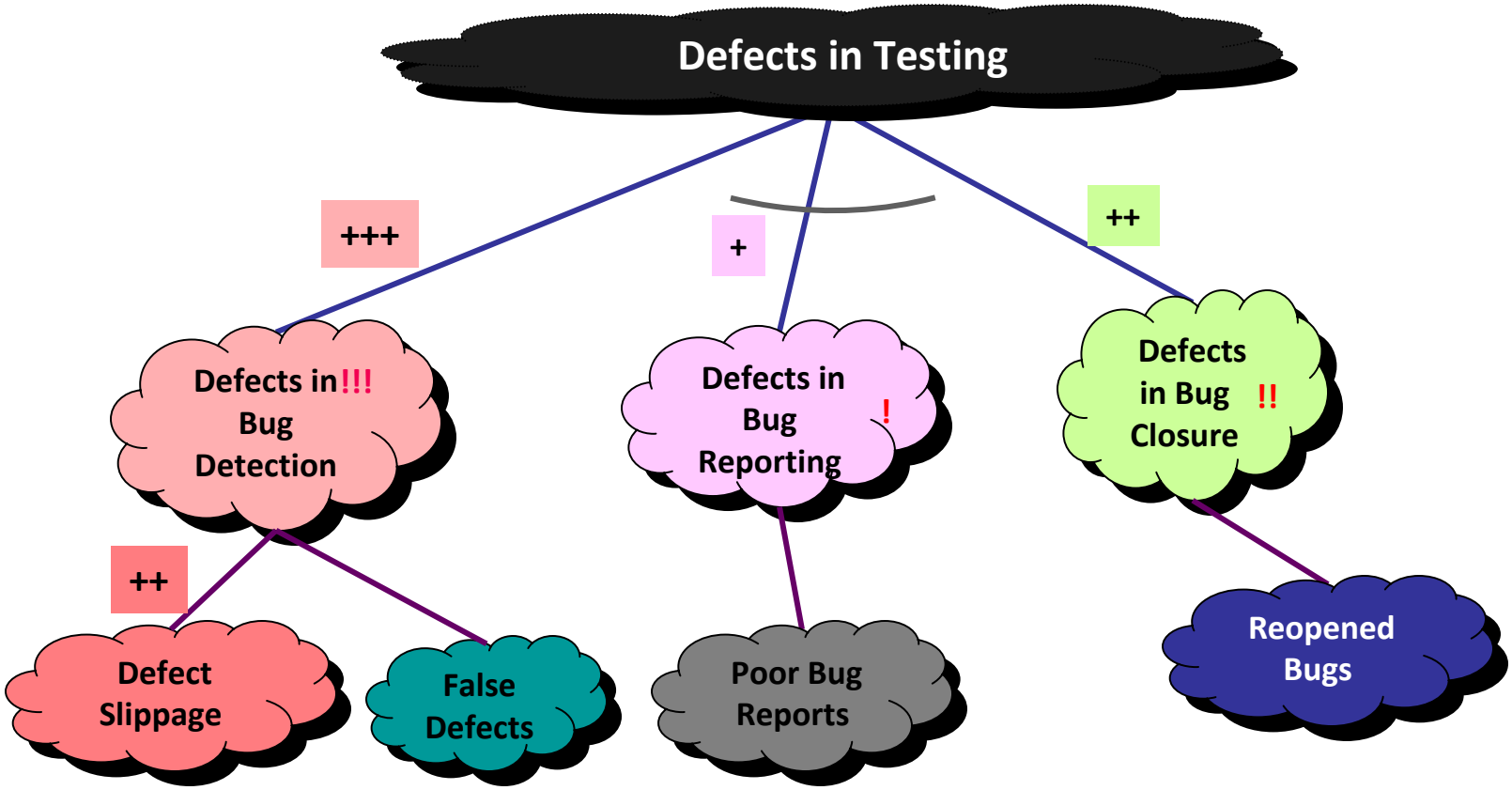
# Exploding the "ROI of Testing" Sub-Goal




**Testing contributes to immediate, long term, tangible and soft benefits**

# Exploding the "Defects in Testing"




Impacts of testing defects may range from mere overheads to major lapses

# Indicative Metrics for Test Effectiveness

**RIGOR**

- Test Case Density
- Test Case Granularity
- % Code Coverage
- Static Analysis Reports
- Structural Analysis Reports
- Risk Mitigated & Risk Balance
- Rounds of Testing
- Test Hit rate
- Defect Density Reduction Scores
- Degree of MTBF improvement

**SPEED**

- Testing Productivity
- Test Agility Quotient
  - Defect Hibernation duration
  - Time to first defect
  - DI-DD delay
  - DD-DR delay
  - (Age of Open Bugs)
  - Open-to-Closed bug ratio
- Time To Test Completion

**COMMON**

- Test Tools Usage Index
- % Test Automation
- Management Tools Usage Index
- Collaboration Tools Usage Index
- SDLC model Fitment Index
- Test Team Competency Index

**DEFECTS**

- Field defects Ratio
- Bug Slippage Ratio
- False Bug Ratio
- Poor Bug Report Ratio
  - " not –reproducible"
  - "need-more-info"
  - " duplicate"
- Reopened Bug Ratio

**ROI**

- Cost of Testing
- Overall Defect Reduction cost
- Differential Defect Reduction cost
- ROI of Test Automation
- Defect detection potential
- Defect reduction potential
- Differential defect reduction potential
- Saving potential due to test
- Profit potential due to test

**An assorted combination of these metrics, with appropriate representation for each dimension, would do a good measurement of Test effectiveness**

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# Test Hit Rate

**Test Hit Rate : % failed test cases vs. total test cases**

**or**

**defects per unit test effort (or cost) per FP**

- **Hit Rate measures the combined contributions from various aspects of coverage**
- **To be measured against a reasonable sized group of related test cases**

  **or**
- **To be measured at appropriate points of effort/cost consumption**
- **Hit Rate tends to drop in later rounds of testing as the product matures**
- **Dropping hit rate indicates one of the two: "stop testing" or "innovate"**
- **Innovations could be …**
  - Test suite refactoring
  - Use of OA
  - Test Strategy change (Ex: brief exploratory test, risk based test, new tools)
- **Monitoring & managing reasonable hit rate all through testing is important**
- **A genuine drop in hit rate after sufficient testing is an indication to "STOP TESTING"**

While requirement & code coverage based testing yield a somewhat uniform hit rate over time, exploratory & risk based testing can yield bursts of high hit rates

# Test Agility Quotient

- **Test Agility Quotient is an Important measure of Speed of Testing**
- **It is a collection of a bunch of metrics as below**
- **Defect Hibernation Duration**
  - Time to first defect (from the project start)
  - DI-DD delay ( min:avg:max delay between defect introduction & defect detection)
  - DI-DR delay ( min:avg:max delay between defect introduction & defect removal)
  - Age of Open defects (min:avg:max duration of bug fixing)
  - Open-to-Closed bug ration, at any point in time
- **Rate of Test Effort Consumption in time**
- **Rate of Defect Detection in time**
- **Rate of Defect Detection vs.**
- **Rate of Test Effort consumption**

**Example:** **First 30% defects detected @ 5% of test effort spend point**
**Next 30% defects detected @ 25% of test effort spend point**
**Next 30% defects detected @ 65% of test effort spend point**
**Last 10% defects detected @ 100% of test effort spend point**

**Speed of testing is less about how many test cases can be executed per unit time, but more about how many defects can be detected per unit test effort.**

**Going one step further, it is about how soon the product can be debugged, stabilized & released to the market.**

**Test agility quotient is a good measure of how closely the defect removal trend line chases the defect introduction trend line**

# Defect Reduction Cost & Potential

- **Defect Reduction Potential: total defects removed / $ spent on testing**

- **Differential Defect Reduction Potential:**
  - additional defects removed (beyond what is already removed) Vs.
  - additional $ spent on testing (beyond what is already spent)

- **(Estimated) Defect Density reduction potential:**
  - defects/FP@ start of testing – defects/FP@ end of testing vs. total $ spent on testing

- **Differential Defect reduction Cost :**
  - additional testing $ needed to detect & remove new defects from system under test

**Example: $/FP, for First 30% defects detection & reduction**
**$/FP for Next 30% defects detection & reduction**
**$/FP for Next 30% defects detection & reduction**
**$/FP for Last 10% defects detection & reduction**

**Differential defect reduction cost increases exponentially. Test Suite optimization & test strategy innovation become important ROI drivers, particularly towards later stages of testing**

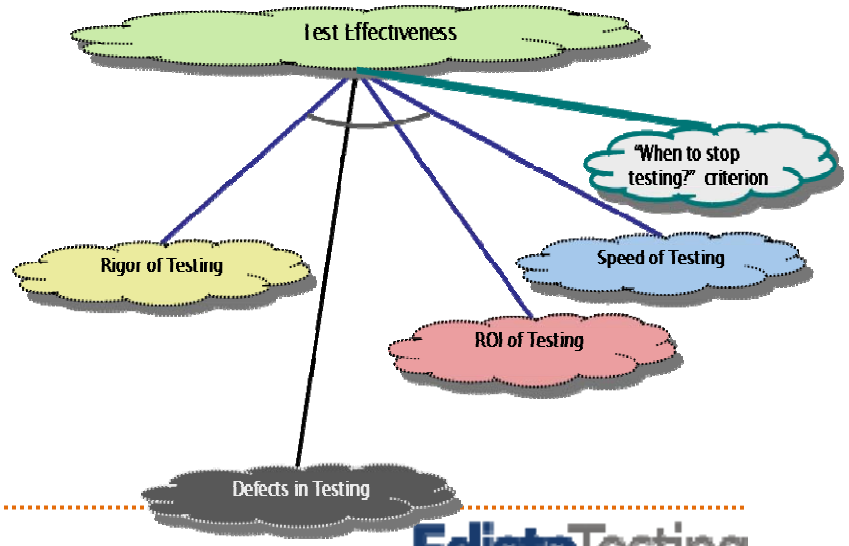
# Rigor or Speed or ROI – Which One?

- **All are important. However, relative importance of each might depend on some of the following:**
  - Nature of the product/ project (mission critical or not)
  - Non-Functional requirements of the product
  - Expected user community & usage pattern for the product
  - Certification requirements for the product
  - Quality Promise made to the customers of the product
  - SLAs signed for services provided using the product
  - Penalty clauses against failure in meeting quality Promise

**It is useful to set the "When to Stop Testing" criteria before strategizing testing.**

**"When to Stop Testing" criteria could tilt the balance towards any of the three sub-goals.**

**It can help decide the right balance.**



# Some "When To Stop Testing" criteria

How deep to dig? OR
"When to stop testing?"

**Ex 1: Testing for a pre-defined duration :** Something like ..
"Testing stops after 6 weeks irrespective of how many defects get detected"

Speed

**Ex 2: Testing with a pre-fixed budget :** Something like ..
"Testing stops when the testing budget of $XXX is exhausted"

Cost

**Ex 3: Executing a pre-defined set of test cases :** Something like ..
" Testing stops when the 2700 standard test cases are executed".

Coverage

**Ex 4: Testing till average failure rate drops below a certain level:** Something like .. "no matter what the cost/effort/time be, testing & debugging must continue till average failure rate drops below N defects per one execution hour".

Rigor

**Examples above are all practical & useful strategies. They make the activity of testing that much more deterministic.**

# Learn..and be Lean


**"Most dinosaurs were vegetarians and they never smoked tobacco or drank alcohol — and where are *they* now?!"**

# Thank you for Listening…

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