Modelling the Contribution Structure
Underlying Requirements

Orlena Gotel & Anthony Finkelstein

To Avoid Initial Questions (1)...

“Requirements Traceability (RT) refers to the ability to describe & follow the life of a requirement in both a forwards & backwards direction”

(i.e., From its origins, through its development & specification, to its subsequent deployment & use, & through all periods of on-going refinement & iteration in any of these phases)
To Avoid Initial Questions (2)...

“Post-RS Traceability is concerned with those aspects of a requirement’s life that result from its inclusion in the RS”
(i.e., Requirement deployment)

“Pre-RS Traceability is concerned with those aspects of a requirement’s life prior to its inclusion in the RS”
(i.e., Requirement production)

To Avoid Initial Questions (3)...

“Software Quality (SQ) is the:
- Totality of features & characteristics of a sw product that bears on its ability to satisfy given needs
- Degree to which sw possesses a desired combination of attributes
- Degree to which a customer or user perceives that sw meets his/her composite expectations
- Composite characteristics of sw that determine the degree to which the sw in use will meet the expectations of the customer”
Relation between RT & SQ:
- How post-RS traceability can improve SQ
- How pre-RS traceability can improve SQ

Requirements Contribution Structure:
- What it is
- Potential for quality improvement

Workshop questions (sort of) answered

Relation Between RT & SQ

Quality-oriented development:
- Specify reqs
- Use to drive, control & evaluate process

Quality assurance/conformance checks:
- Meets user needs & adheres to quality attributes
- Supported by methods/techniques/paradigms/practices
- Approaches depend on some form of RT
- RT is primary quality-enabling technique

SQ influenced by techniques/tools used for RT
Post-RS Traceability & SQ (+)... 

reqs artifacts produced (related to reqs deployment process)

Quality reqs can permeate development

Can check quality conformance at each phase

Effects of changing quality reqs can be analysed/propagated

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Post-RS Traceability & SQ (-)... 

Why does sw still fail to meet anticipated levels of SQ?

Defn SQ supported - “meeting the RSD” - no guarantee

Problems:

- User satisfaction subjective/collective/few metrics
- Defn SQ/metrics change/constructed downstream

Reasons:

- Deals with restricted phases of a reqs life
- Poor foundation to achieve/assess SQ
Pre-RS Traceability & SQ (+)

- reqs artifacts produced (related to reqs production process)
  - Quality-oriented approaches built in from onset
  - Foundation to achieve & assess SQ
  - Change from source & re-propagate through ALL phases

Pre-RS Traceability & SQ (-)

2 aspects of QA activities
- Documentation-related
  - Info about RE process documented/structured/maintained/navigable
  - Done out of context
  - Subject of much work
- Organisation-related
  - Identify those in a position to assess quality/address defects
  - Done by other parties
  - Loss of commitment
  - Basic working practice

Impact on SQ not accounted for
Traceability of Requirements
Contributors & Contributions...

Model social infrastructure of RE process - as quality:

Socially defined
Socially evaluated
Socially accepted

I can trace personnel
I can identify sources of reqs-related work
We can identify sources of reqs
I can trace personnel
I can identify sources of reqs-related info
We can locate personnel

Basic
Our Work (1)...

Concepts

Model Contribution Structure underlying reqs artifacts

Augment with agent details:
- Schema of analytical capacities in which contribute
- Defined through interactive mark-up

Development of CS:
- Infer finer-grained social capacities & commitments
- Impact of taxonomy of intra/inter-artifact relations

Requirements:
- Ongoing definition & re-definition
- Evolvable & emergent
- Inference & interrogation
(A) Define contribution format of artifact

P: agent whose position or belief is established by the information the artifact expresses
A: agent responsible for choosing & organising the content & structure of the artifact
D: agent responsible for physical manifestation of the artifact (i.e., captures or records it)
Our Work (4)... General Approach

(B) Infer contribution roles of agents wrt artifact
Contribution roles of agents

Examples:

1. P = Olly
   A = Olly
   D = Olly
   Olly is: True Author

2. P = Olly
   A = Olly
   D = Dave
   Olly is: Deviser
   Dave is: Relayer

3. P = Olly
   A = Paddy
   D = Paddy
   Olly is: Sponsor
   Paddy is: Representative

(C) Infer agent commitment to artifact

Who to involve/inform in queries/changes:

True Author:
- ✓ Physical appearance
- ✓ Structural form
- ✓ Anticipated/realised effect
- ✓ Semantic content

Deviser:
- × Physical appearance
- ✓ Structural form
- ✓ Anticipated/realised effect
- ✓ Semantic content

Relayer:
- ✓ Physical appearance
- × Structural form
- × Anticipated/realised effect
- × Semantic content
Our Work (7)...

Infer more about types/degrees of commitment:

- Principal status (signatory-related)
  - approved/pending/not approved

- Authorial status (related to inter/intra artifact links)
  - primary - creator
  - n-ary - adopter/adapter/referencer

- Documentor status (mood-related)
  - assumptive/emphatic
  - quotative/reportive
  - indefinite/questioning

Current Directions

Markup to overlay contribution format, etc.

Supporting CS evolution & maintenance:
- Augment artifact-based traceability to deal with associated CS at each step
- Rules to recompute & update CS

Meeting traceability reqs:
- Use of layers for selective traces
- Priority structs for change handling

Tool to evaluate & refine approach
Summarising Quality Implications...

Quality depends on post-RS & pre-RS Traceability

Further leverage if tie people into the traceability equation

Modelling CS provides traceability of contributors & their contributions:
- Fine/rapid location of personnel to perform QA activities, address quality defects, etc.
- Continuous defn, redefn, assessment & re-assessment of SQ throughout a project’s life

Questions (1)...

Q: What is the "right" data to be made traceable?

Traceability

Of what (informational requirements) & In what way (access & presentational requirements)

<table>
<thead>
<tr>
<th>Depends on</th>
<th>Depends on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who wants it (user characteristics)</td>
<td>Why they want it (task characteristics)</td>
</tr>
</tbody>
</table>

When they want it (project & contextual characteristics)
Answers (1)...

A: No such thing as “right” data - only required data

More pertinent questions we should ask:

(1) How can we identify required data?
   - More empirical studies with project-specific selection

(11) How can we deal with absence of required data?
   - Provide potential for informal communication

Questions (2)...

Q: How should trace data be recorded?
   - Manually - Automatically

Q: Who/what should record trace data?
   - Those involved/others/forms - Technology

Q: When should trace data be recorded?
   - During process - Later reviews
Answers (2)...

A: Automatically record all that is practical as by-product of mainstream activities
  - Supplement with manual input

A: Use technical solutions (forms, etc.) to record where possible as reqs for provider/end-user conflict
  - Consolidate with participants

A: Do eager & lazy recording as complimentary
  - Balances objective & subjective

Q becomes how best to combine approaches?
- RT = a team-shared effort
- RT = a computer-assisted activity

Questions (3)...

Q: How can all this improve quality?

Q: Where are the examples of quality improvement?
Answers (3)...

With RT - Quality can be built in from project onset

Examples?
- Repeated calls for RT improvements by industry indicates RT must impact SQ positively

Why no/few examples?
- The vital first step of education is only just beginning

& that’s our job!

More Questions...

How can we rescue those projects in which RT info has not been managed & maintained?

RT solutions assume a centralised info base - will these solutions apply if the info base is distributed?

When is our next coffee break?