Using Quality Requirements to Systematically Develop Quality Software

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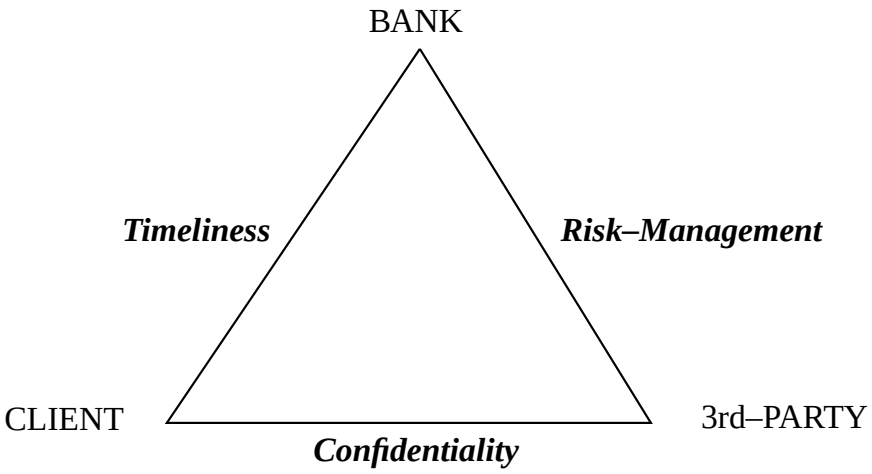
In the Banking World ...

Can we build quality into software?

Update & Display Accounts
(Functional Requirements)
in an Accurate, Secure, fast, user-friendly manner
(Quality Requirements — Non-Functional Requirements)

In the Banking World ...



Can we build quality into software?

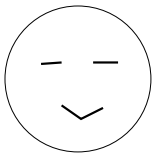
Software Development: *Art* → *Engineering*

Software Crafting →

Requirements
- Ambiguous
- Incomplete
- Inconsistent

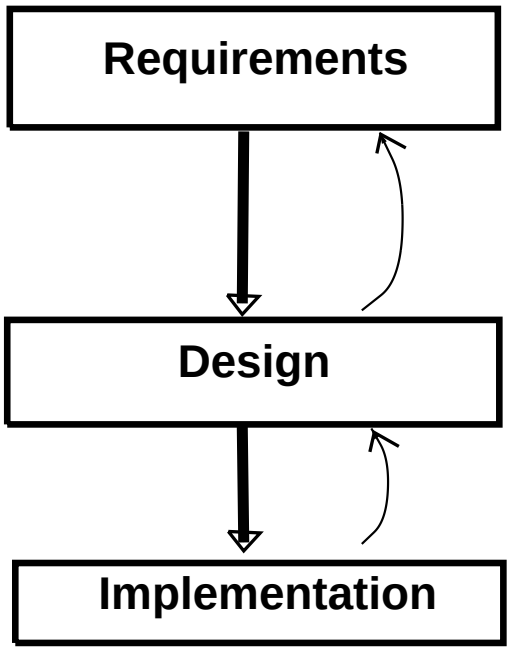
Product
- Inconsistent
- Untraceable
- Unjustifiable
- Unevolvable

Software Engineering →



disciplines, models, methodologies, tools

Software Life-Cycle Includes



Why **Quality Requirements?**

Quality is fitness for use — Juran

freedom from deficiency

Quality is free — Crosby

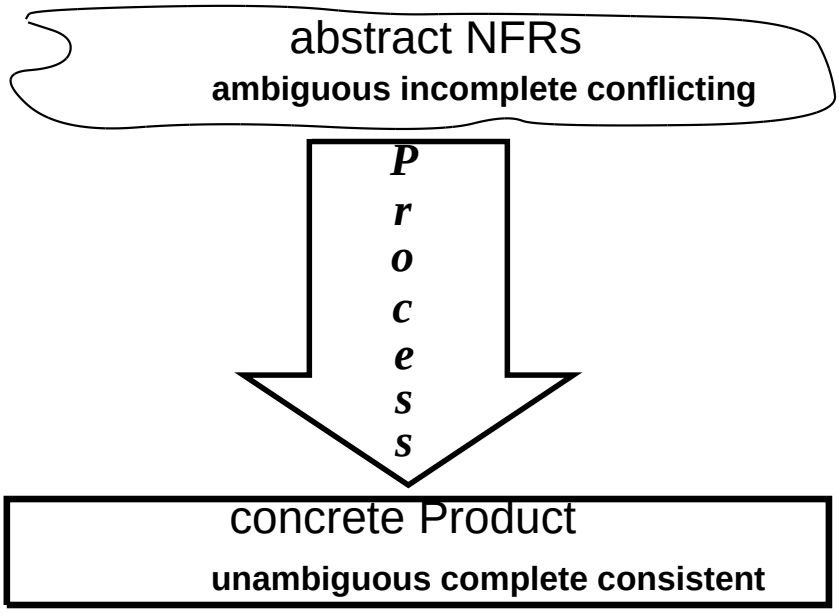
get the "right" requirements &

do it "right" the first time

Defects are costly — Boehm

\$ product errors = 100 × \$ requirements errors

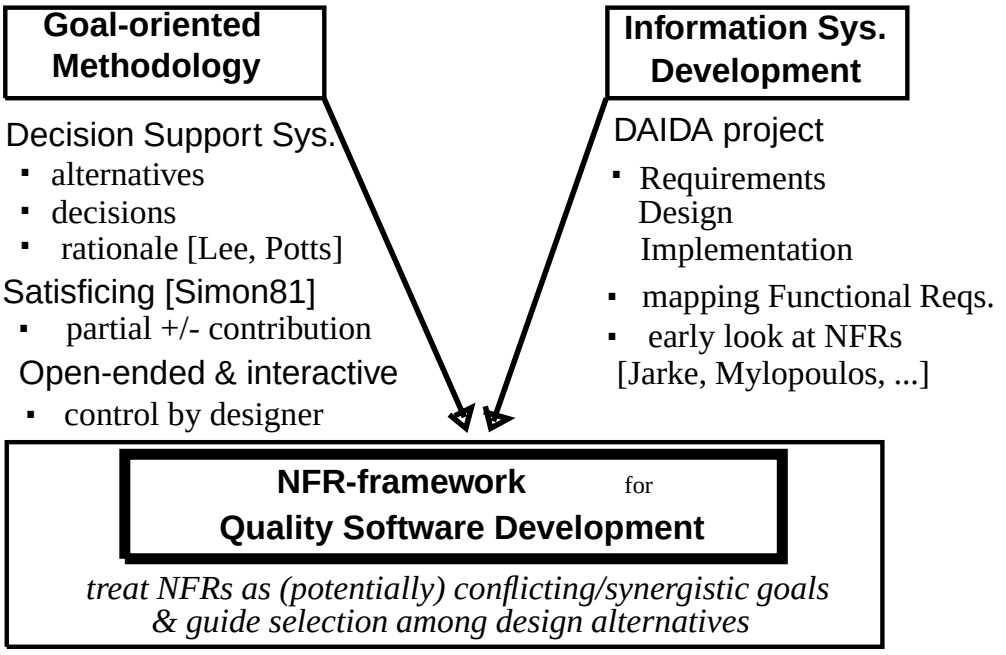
Quality Product — *How?*



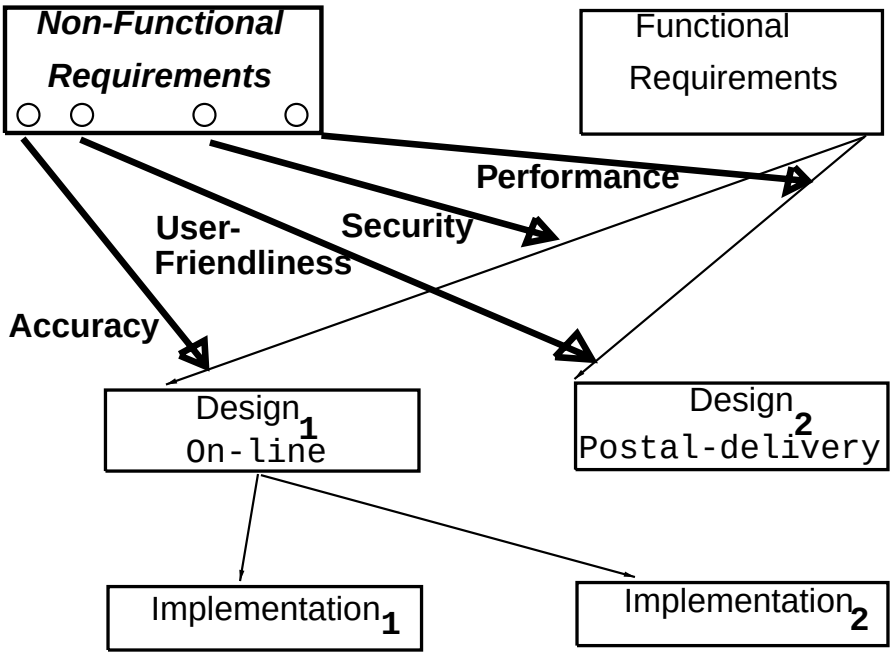
Outline

- Motivation
- **Framework**
- **Development Tool**
- **Three Small Applications**
- Conclusions

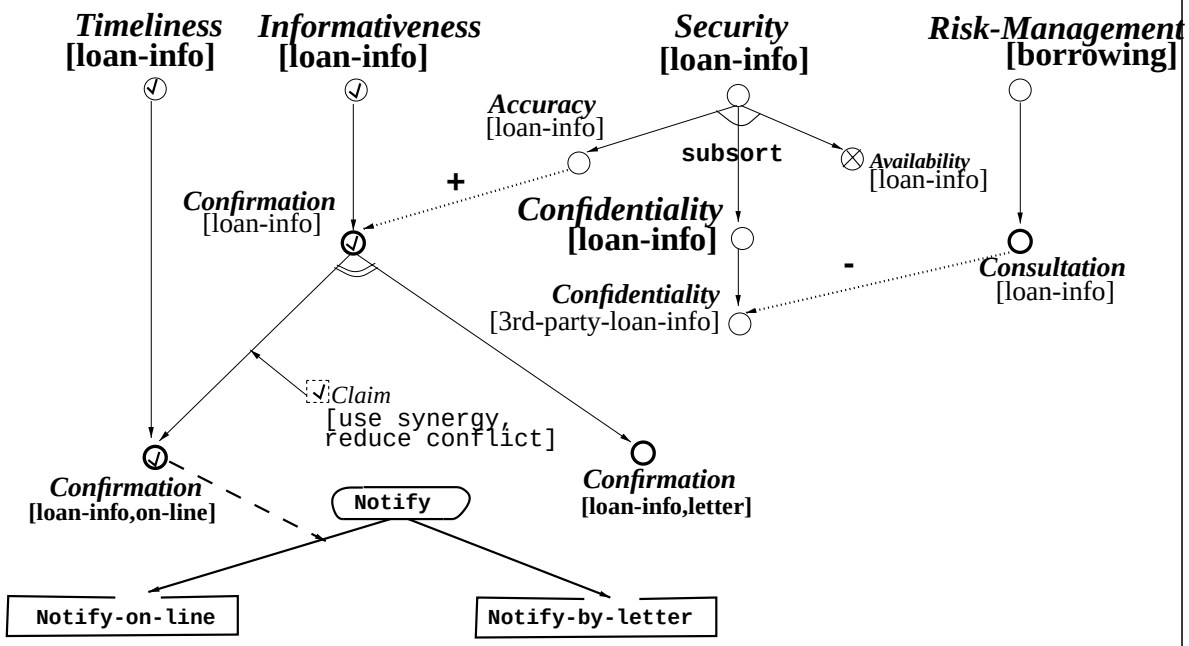
NFR framework: Approach



Goal-driven, Qualitative, Argumentative Process

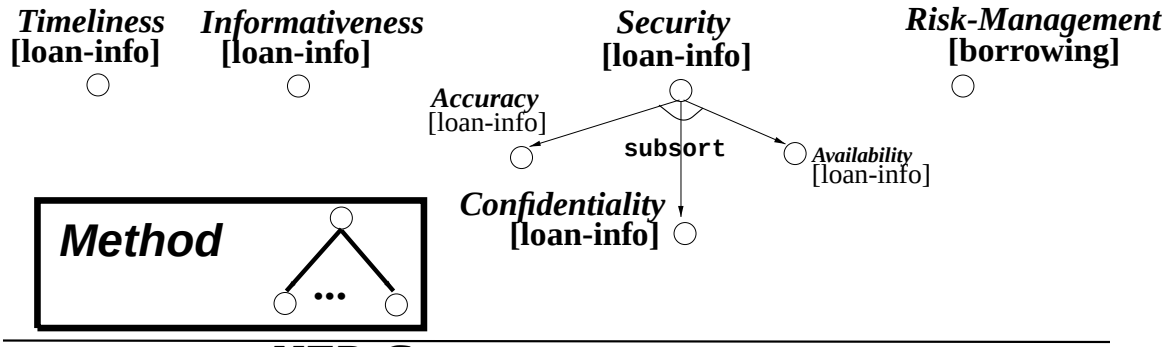


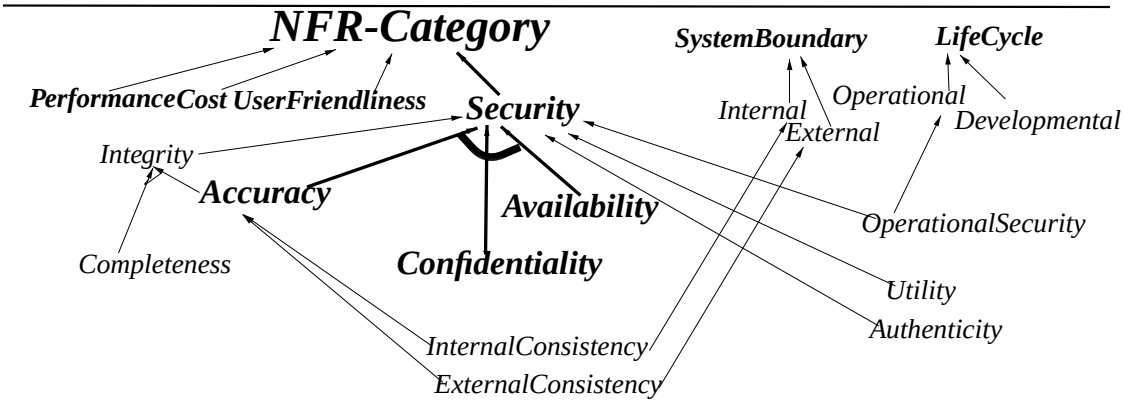
NFR framework ⟶ Systematic Process

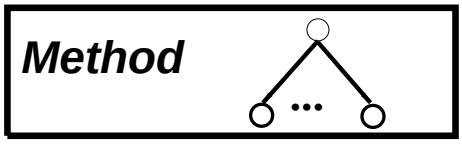


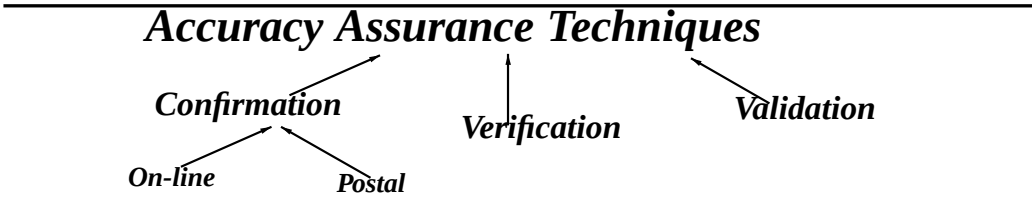
NFR framework ⟶ Systematic Process

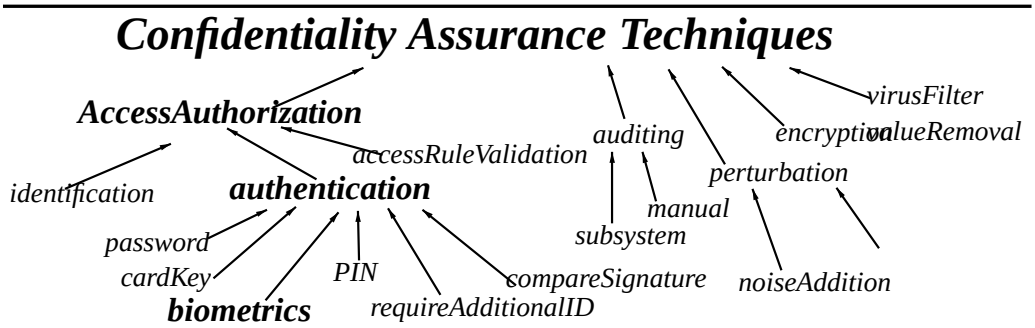
NFR framework ___ Systematic Process











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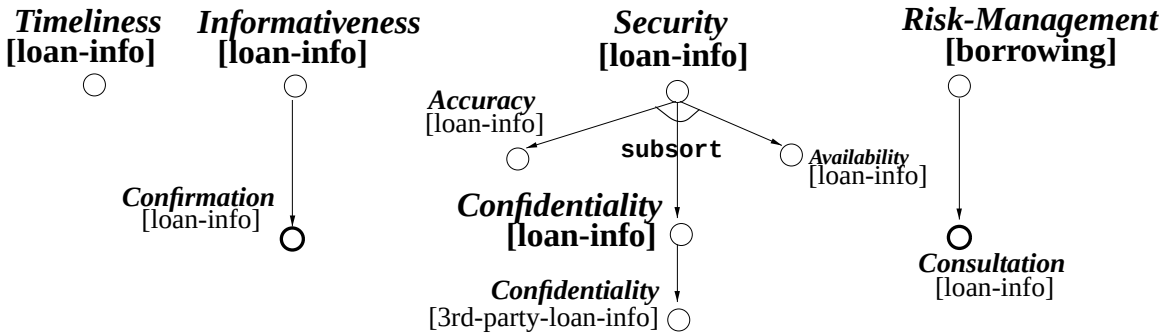

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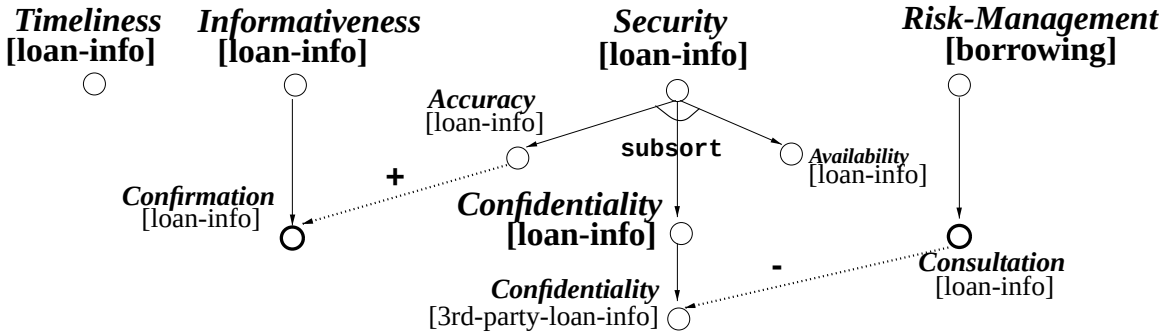
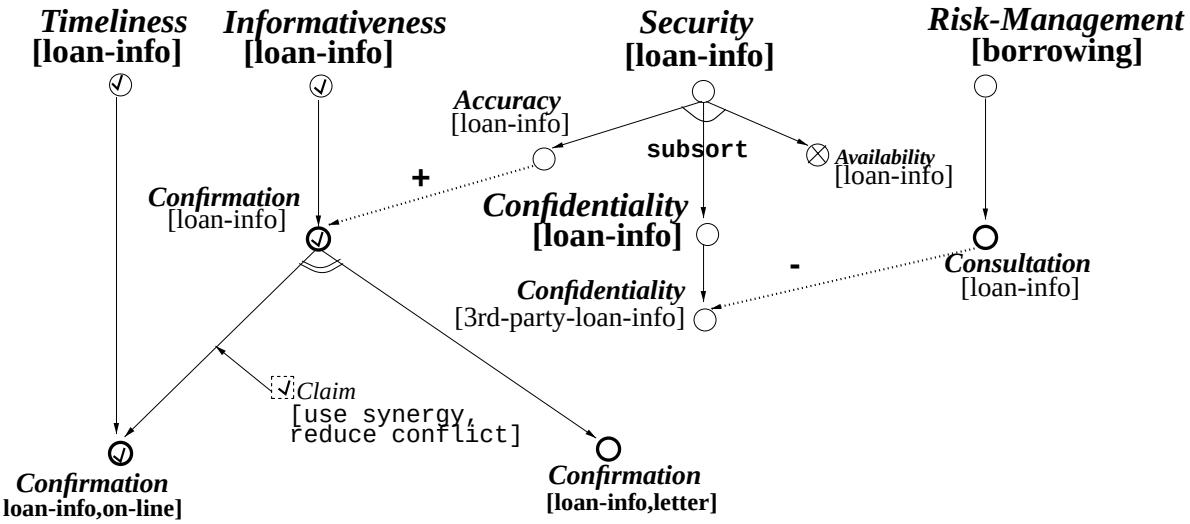
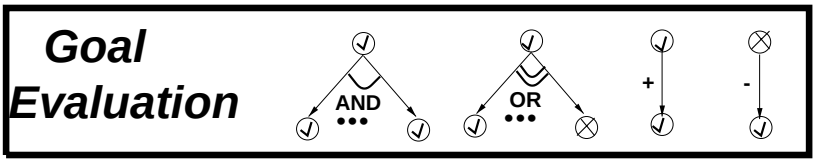


NFRGoal \ Technique	*Confirmation*	*Consultation*	*biometrics*
Accuracy	+	+	+
Confidentiality	+	-	+
UserFriendliness		++	- -
Response Time			- -
Risk-Management	+	+	

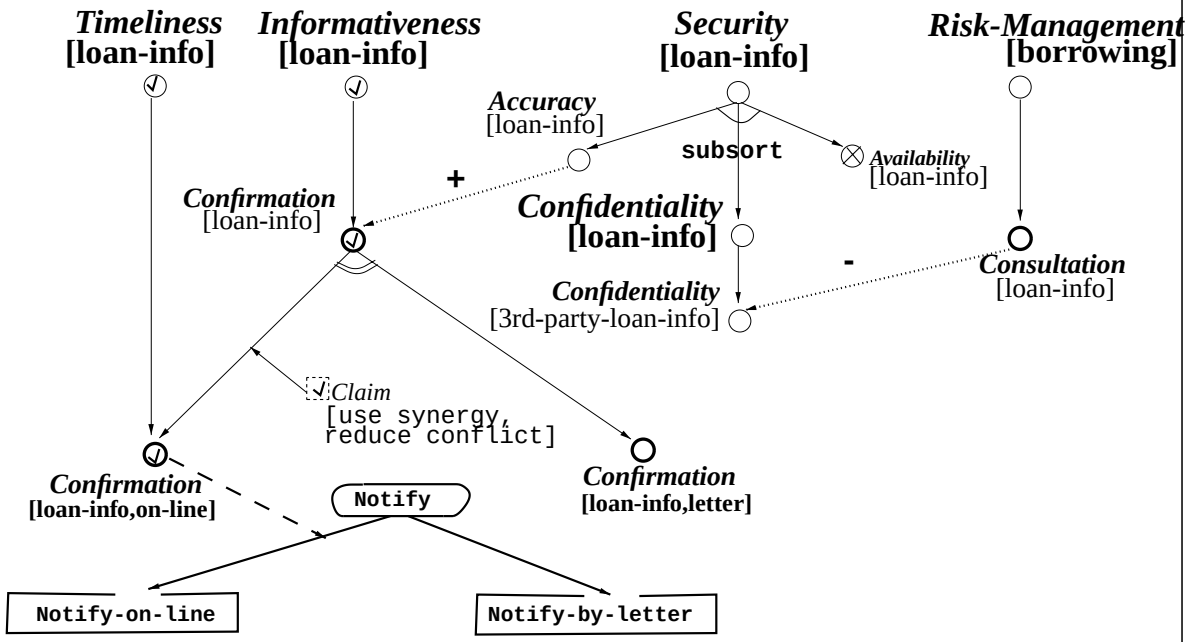
Correlation Rules

NFR framework ⟶ Systematic Process





NFR framework ⟶ Systematic Process

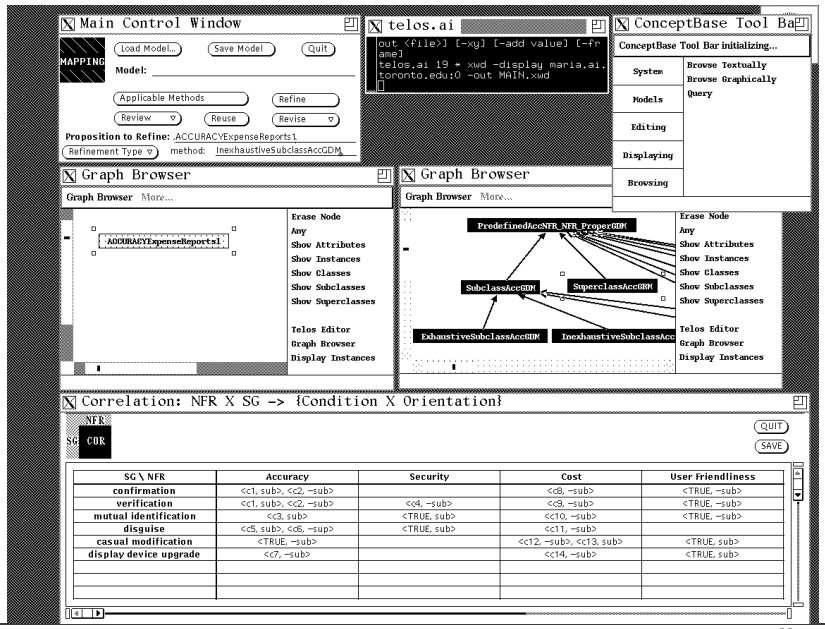


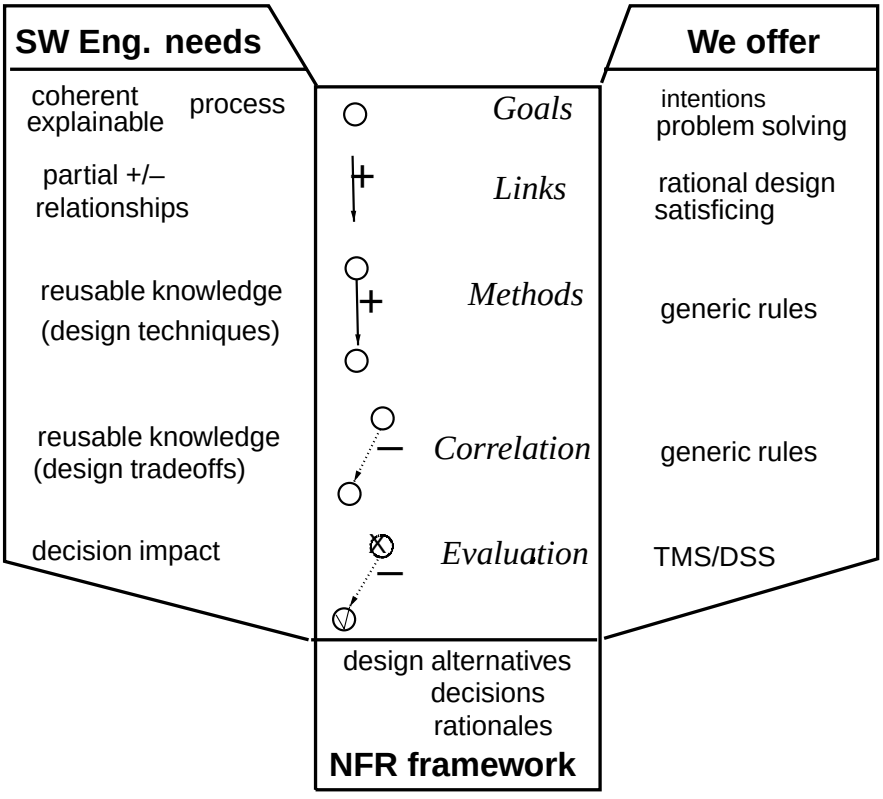
Prototype NFR Assistant

systematic approach $\Longrightarrow$ *assist development process*

Functionality: Goal Structure, Methods, Correlation Rules, Labels

Interface: Main Control, Graph Browser, Correlation Table, Text-editor





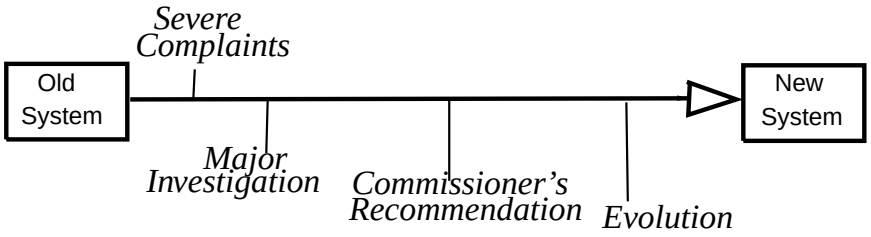
Three Small Applications

1. **Health Insurance**

2. **Credit Card**

3. **Government Administration**

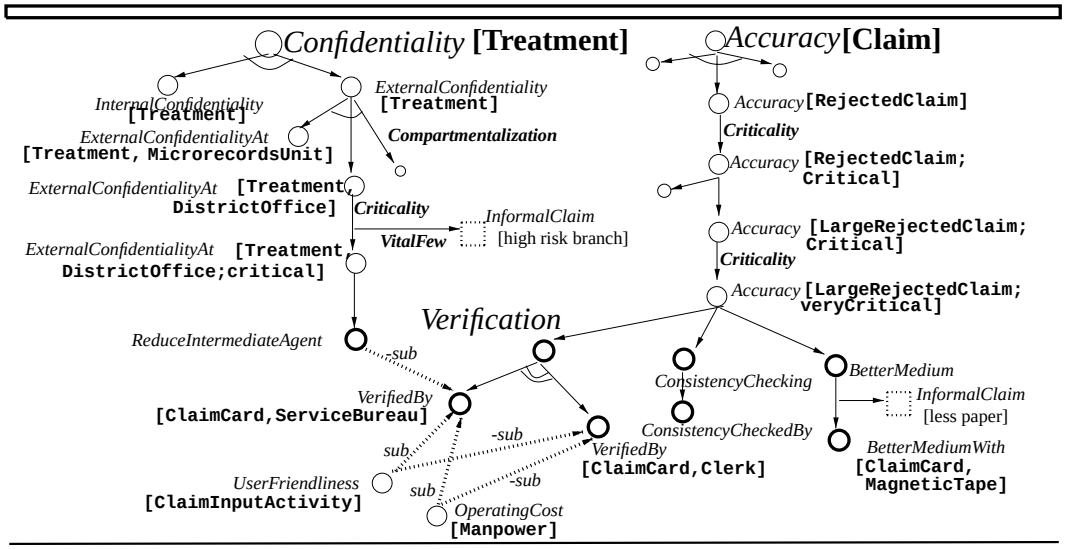
1. Health Insurance System



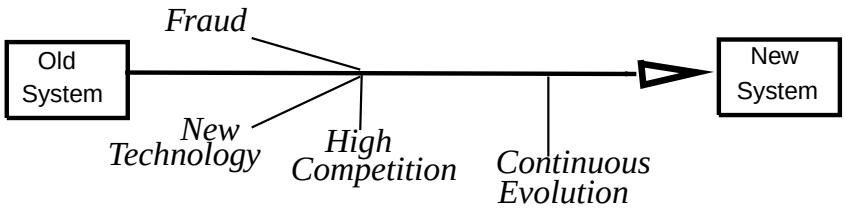
Method	
subsort (implicit)	system boundary, compartments
criticality	control point, discretionary
for accuracy	consistency-check, verify, better medium
for confidentiality	password, encryption (↑ external)
supporting documents	on-site reviews, questionnaires
	for why satisfactory

Correlation	
synergy	√ √
conflict	√ √

1. Health Insurance System



2. Credit Card System



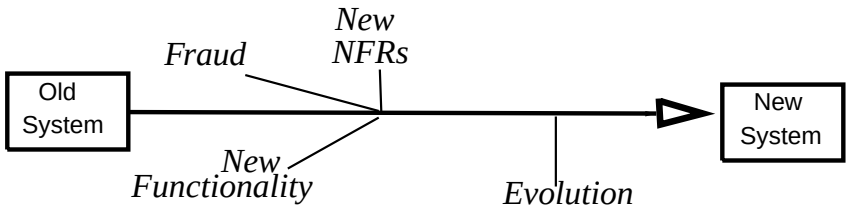
Methods

subsort, criticality (implicit)	√
for accuracy	reduce-trans-time, allow-direct-access
for confidentiality	access authorization (?), bulletin board
supporting documents	reviews & statistics, market survey (?)
	for synergy justififcation

Correlation

synergy	√ √ √
conflict	implicit

3. Government Administration System

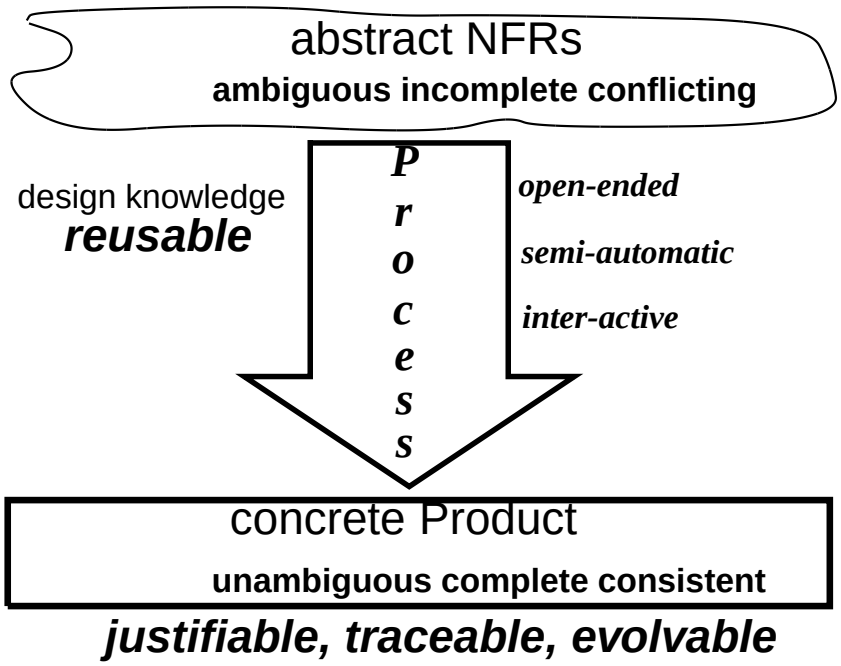


Methods	*subsort* (implicit)	$\surd$, access group
	criticality	implicit
	for accuracy	consistency checking
	for confidentiality	password
	supporting documents	ministry–standards
		for potential conflict
Correlation	*synergy*	implicit
	conflict	implicit

Some Observations

- Need to capture key concepts
  ←– met by framework components
- Framework helps reduce faults
  (ambiguities, omissions, conflicts, redundancies)
- Goal structure helps justify, trace, evolve
- Tool offers methods for vocabulary & subject matter;
  Partial automation reduces errors.

Quality Product — *through NFR framework*



In the Banking World ...

Can we build quality into software?

NOW A *systematic* approach to dealing with
Quality Requirements (Non-Functional Requirements — NFRs)
during software development

Status

Initial Research

- NFR framework
- Application to Accuracy and Security Requirements
- Tool Support, via NFR Assistant
- Small Application to 3 Real Information Systems

Other Applications

- Performance Engineering
- Organizational Modelling
- Project Risk Management
- Requirements Engineering

Future Directions

Improvements to NFR Assistant

- Performance
- User-friendliness
- Extensibility

Extensions to NFR Framework

- Formal Semantics
- Quantitative + Qualitative Reasoning
- Control Structure

Applications

- Life-size Information Systems
- Other Industrial Systems