

Opening Keynote:

Using AI for Better Requirements



CONFERENCE THEME : Theme:

Quality and Intelligent Systems:

Where the Human is the Most Important Asset.

31st annual online, SQM conference, on Friday 6 September

9:30 to 10:30 UK Time Friday 6th September 2024

Talk held from Norway, and hopefully videoed by BCS

tom@Gilb.com Draft 23 August 2024, Current Version 6TH SEPT. 2024 (EVO REF ADDED))



Categories of Requirements

Value Requirements aka Performance Requirements, are a subset of all requirements

- I have observed, through extensive international travel, for over 50 years, to large organizations, universities: as well as extensive reading and communication with the world experts in requirements that the **subject of requirements** at both an academic and corporate level is **very poorly designed, and taught**, by my standards.
- It is amazing that most graduates of IT and management subjects come to work and they not only *do not know how to quantify major items (like critical product and service qualities)* in their planning area.
- But they either do not know that that do not know, but really **should, know how to quantify all their critical qualities**.
- And many seemingly intelligent people, will argue that non-financial value quantification is ‘impossible, difficult, expensive, or undesirable’.
 - What is the point of a higher education if not such abilities?
 - Even my sociology education, was *very quantitative*, but of course, that is a research *science*. Thanks Durkheim!
- Now of course all ‘sports idiots’ know much better than this, during the Olympics.
- And surely all scientists and engineers are well-trained in numeric quality, and other value attributes.
- There is no question but that **quantification is absolutely essential for successful engineering, science and sports**.
 - **And this is true of all serious areas and disciplines**

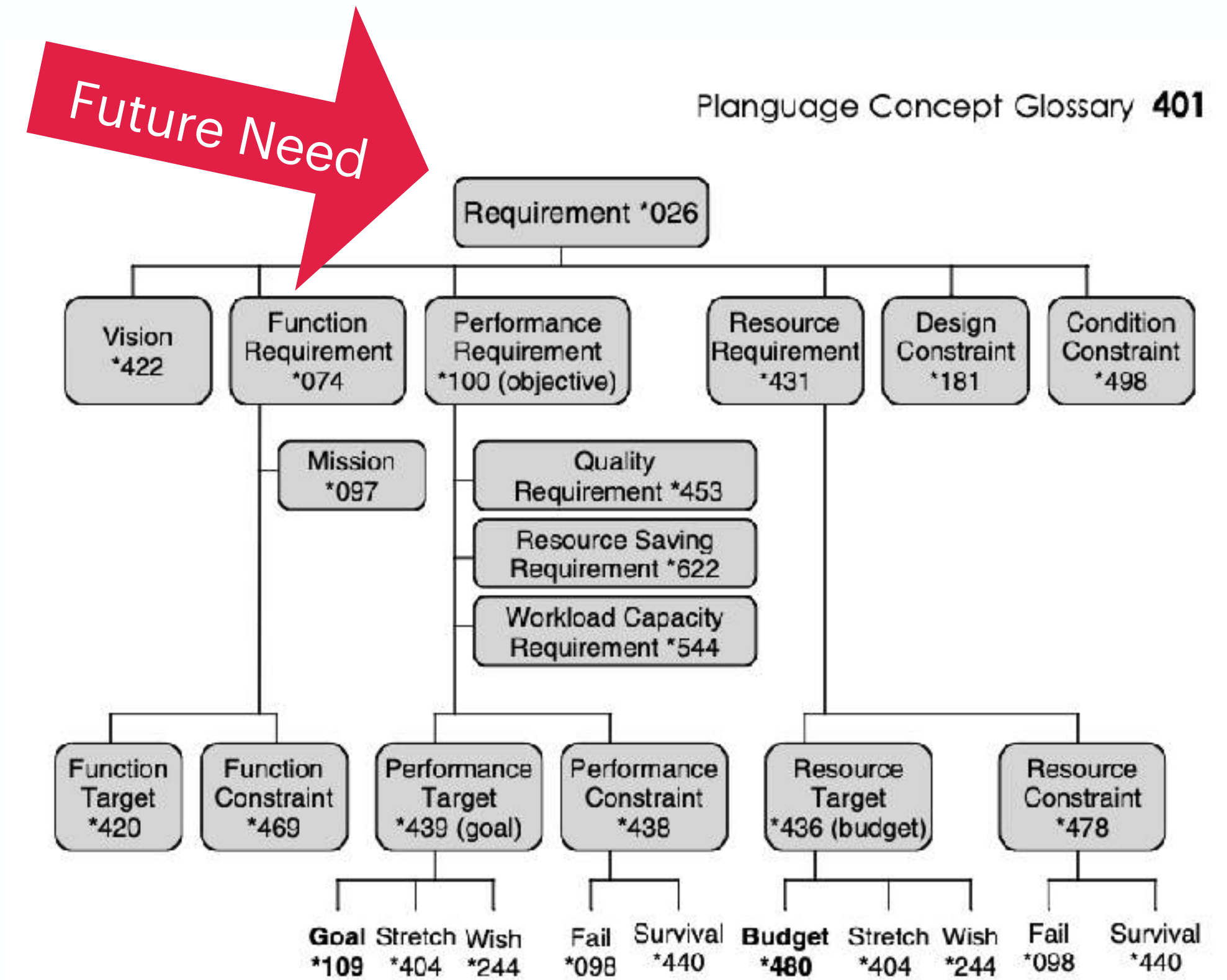
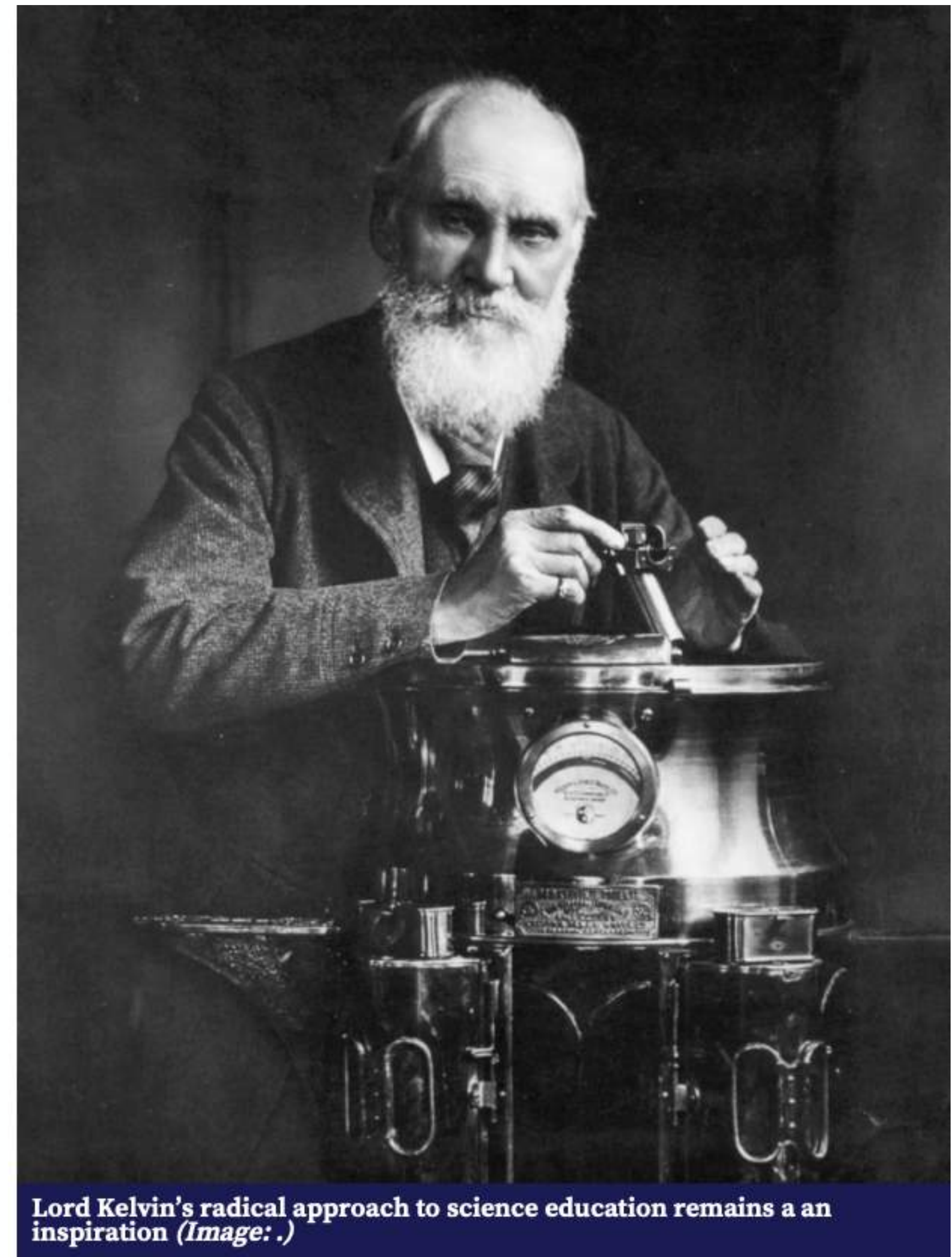


Figure G20
Requirement Concepts.

Figure 1.2. [CE] Types of Requirements. In systems engineering what I call ‘Stakeholder Value Requirements’ are called ‘Performance Requirements’. They are ‘how good’ the system is. Quality requirements, a sub-set, is ‘how well a system performs. The ‘-ilities’.

This Lord Speaketh

- Lord Kelvin, was fighting this ‘metrics battle’ with scientists long ago, 1883,
- ***“When you can measure what you are speaking about,***
 - ***and express it in numbers,***
 - ***you know something about it;***
 - ***but when you cannot measure it,***
 - ***when you cannot express it in numbers,***
 - ***your knowledge is***
 - ***of a meagre and unsatisfactory kind.”***
- I read that when I was about 25 in 1965, and it changed my life.
- Thanks be to that Lord, as they say.



Lord Kelvin's radical approach to science education remains an inspiration (Image: .)

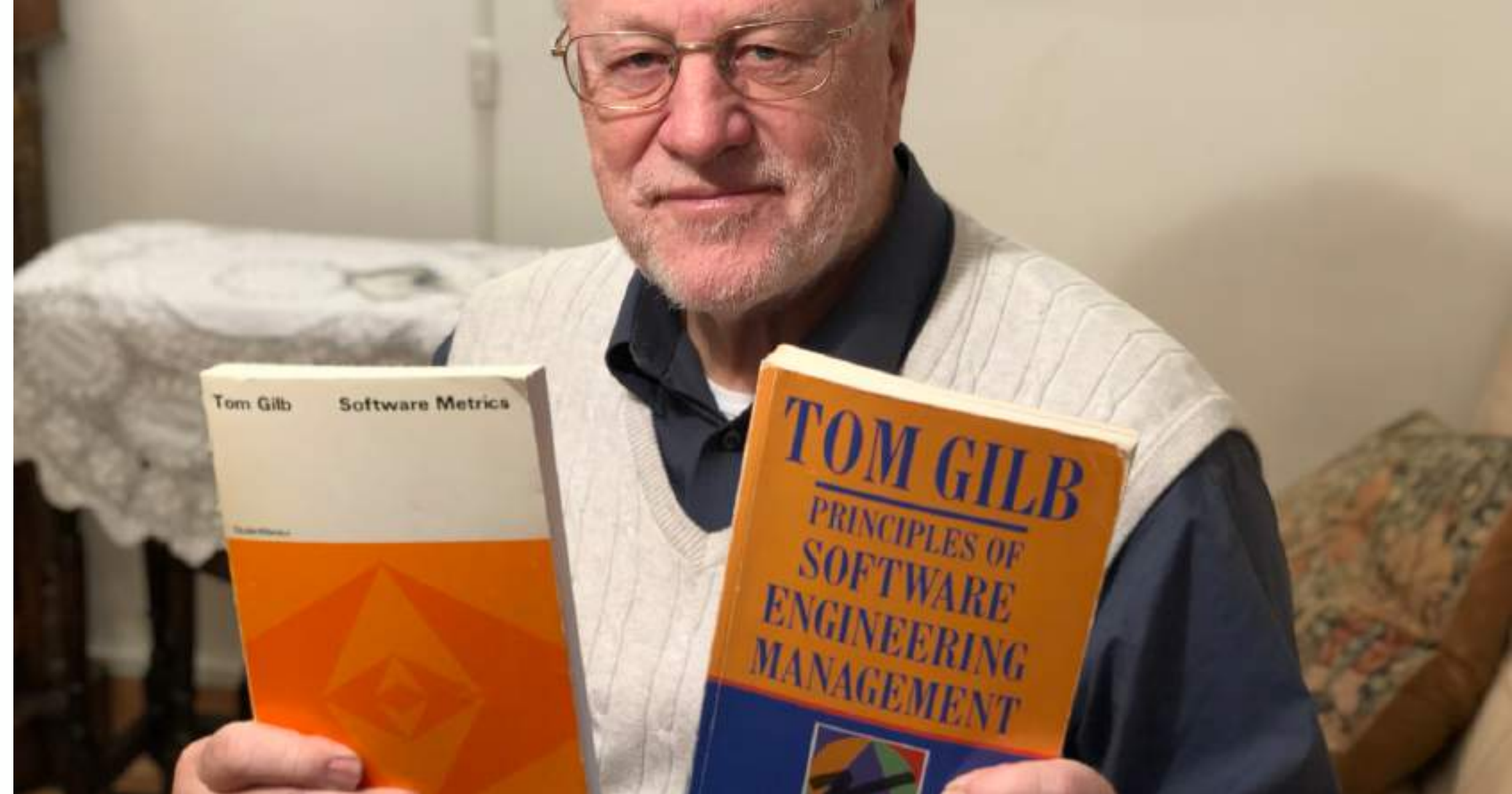
And I quickly joined the metrics proponents (1976 books)

And for my 80th Birthday Gift



- I got this life sized gallion figure, mounted at my summer cabin, by the Oslofjord, notice the Sextant!
- A symbol of my metrics interest!

Sextant



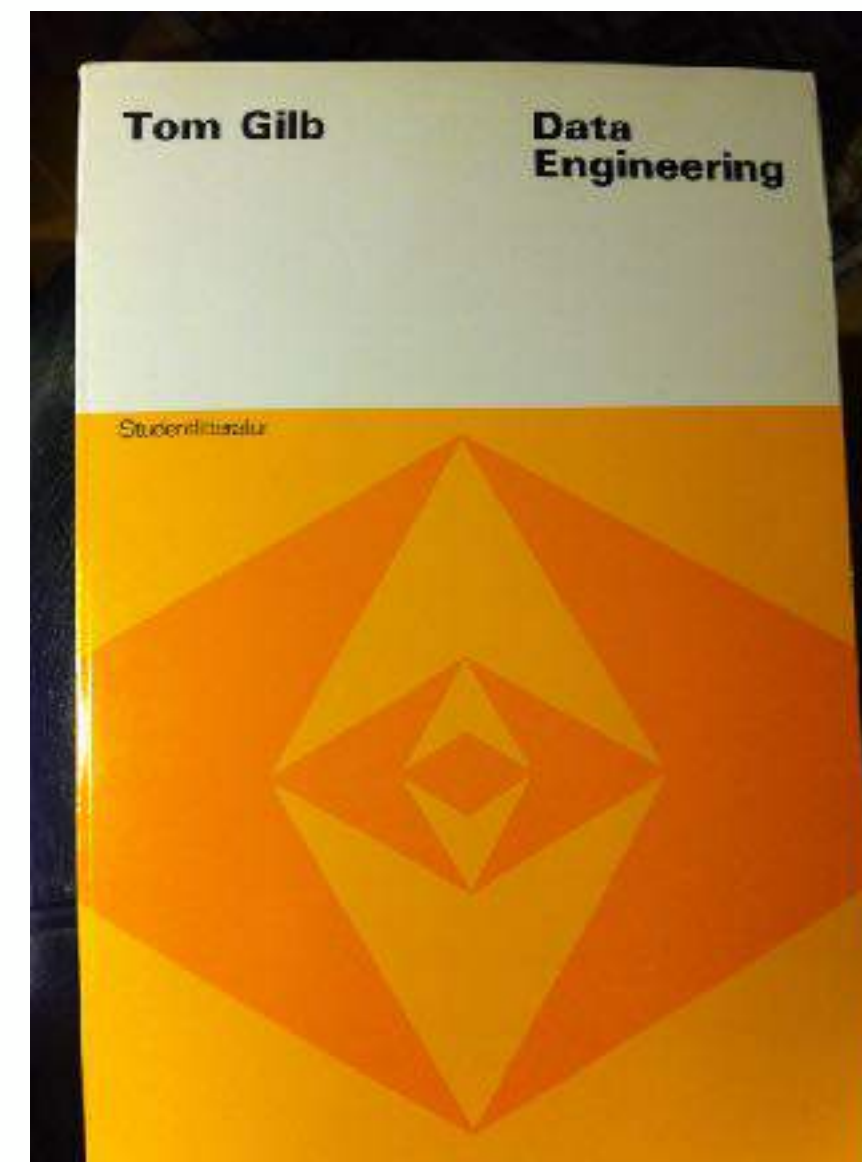
1976, and 1988

And we have been fighting the cause at BCS

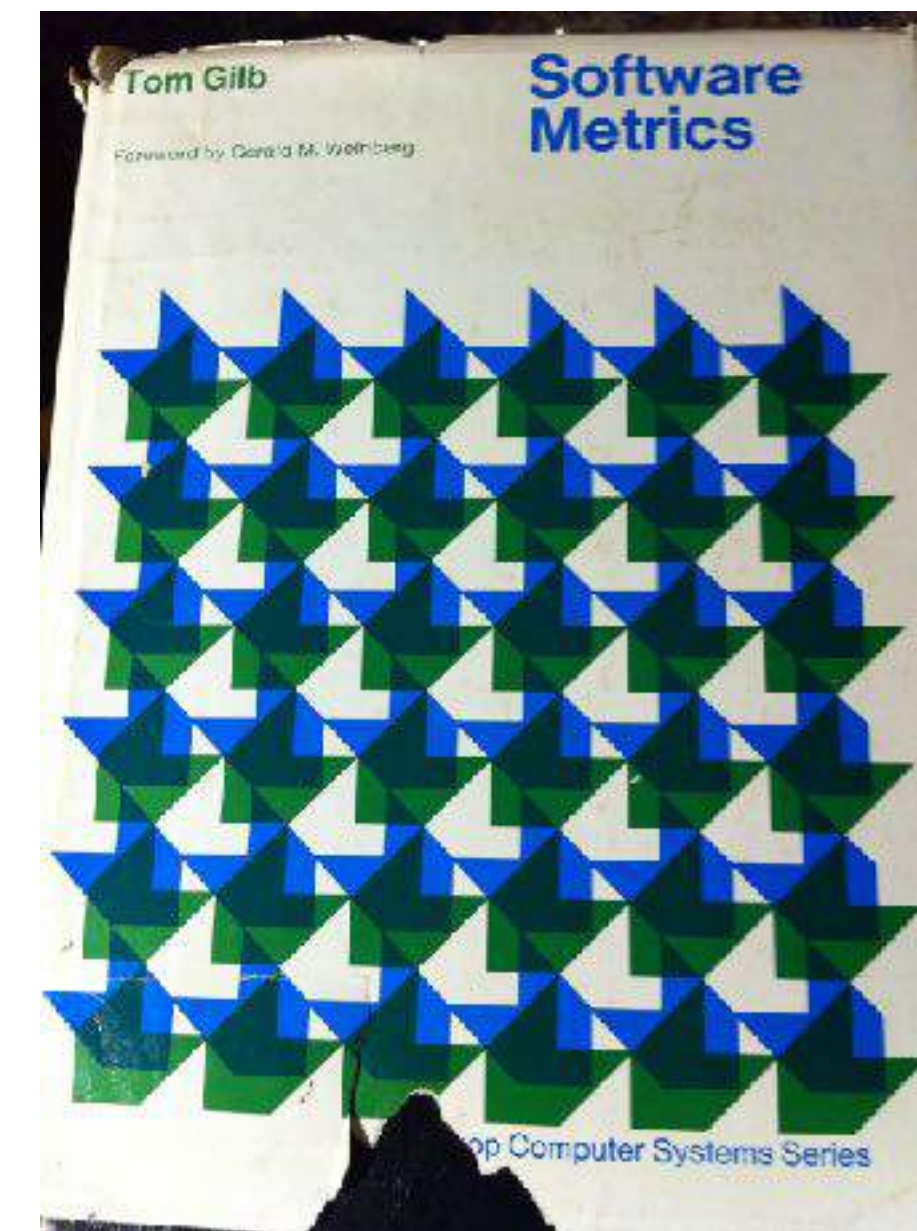
with sponsorship of the

Quality Group, Margaret Ross, thank you!

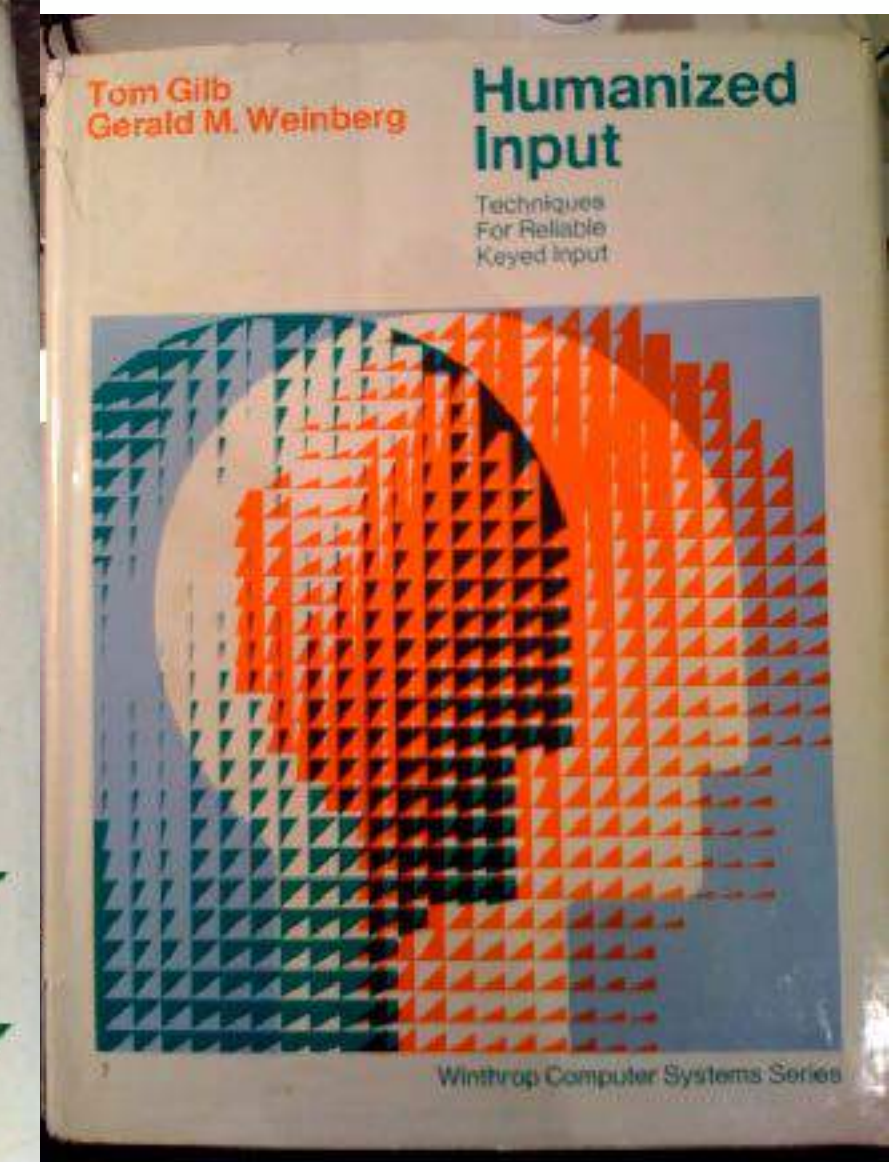
Dozens of free courses



4 1976



1977, USA



1977, USA
Very quantitative about UX

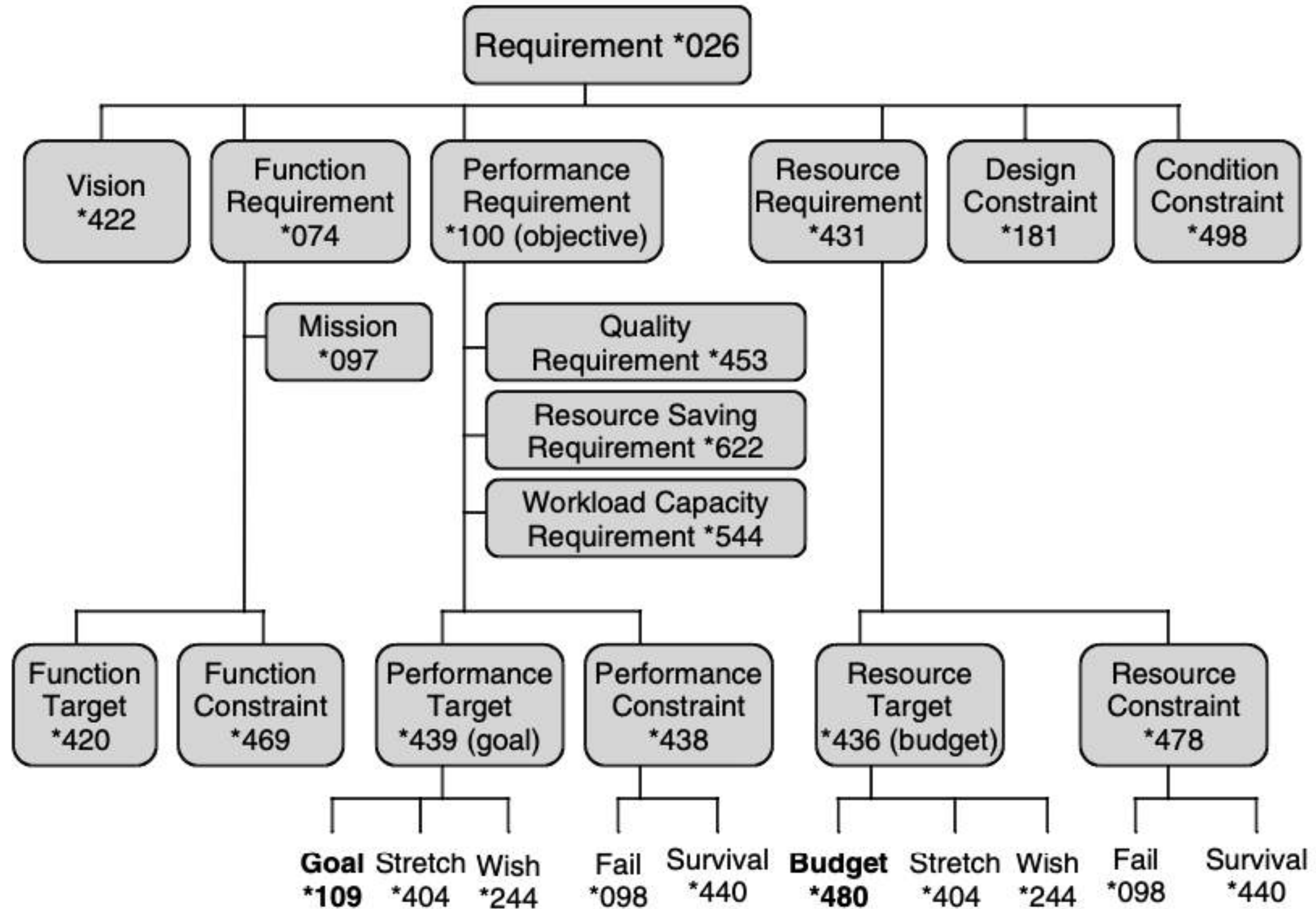


Figure G20

Categories of Requirements

Value Requirements aka Performance Requirements, are a subset of all requirements

- I do not lay claim to Planguage requirements being simplest to learn and use.
- I would credit **User Stories with simplicity and power**,
 - and indeed I integrate them as a high-level specification, in a larger value requirement [VR]. (See next slide)
 - But we have many simple projects, where requirements even simpler than User Stories, would suffice.
- But we also have thousands of *life-critical projects, where 'only the best' will do.*
- *'Things should be as simple as possible, but no simpler'* [Posem, p. 17].
- And Planguage has a remarkable ability to simplify its requirements
 - for simpler projects, up to a point [Life Design],
 - where no formal method or simplification is necessary.
 - *'Shall we go for Take-Away Pizza, tonight?'*

Planguage Concept Glossary 401

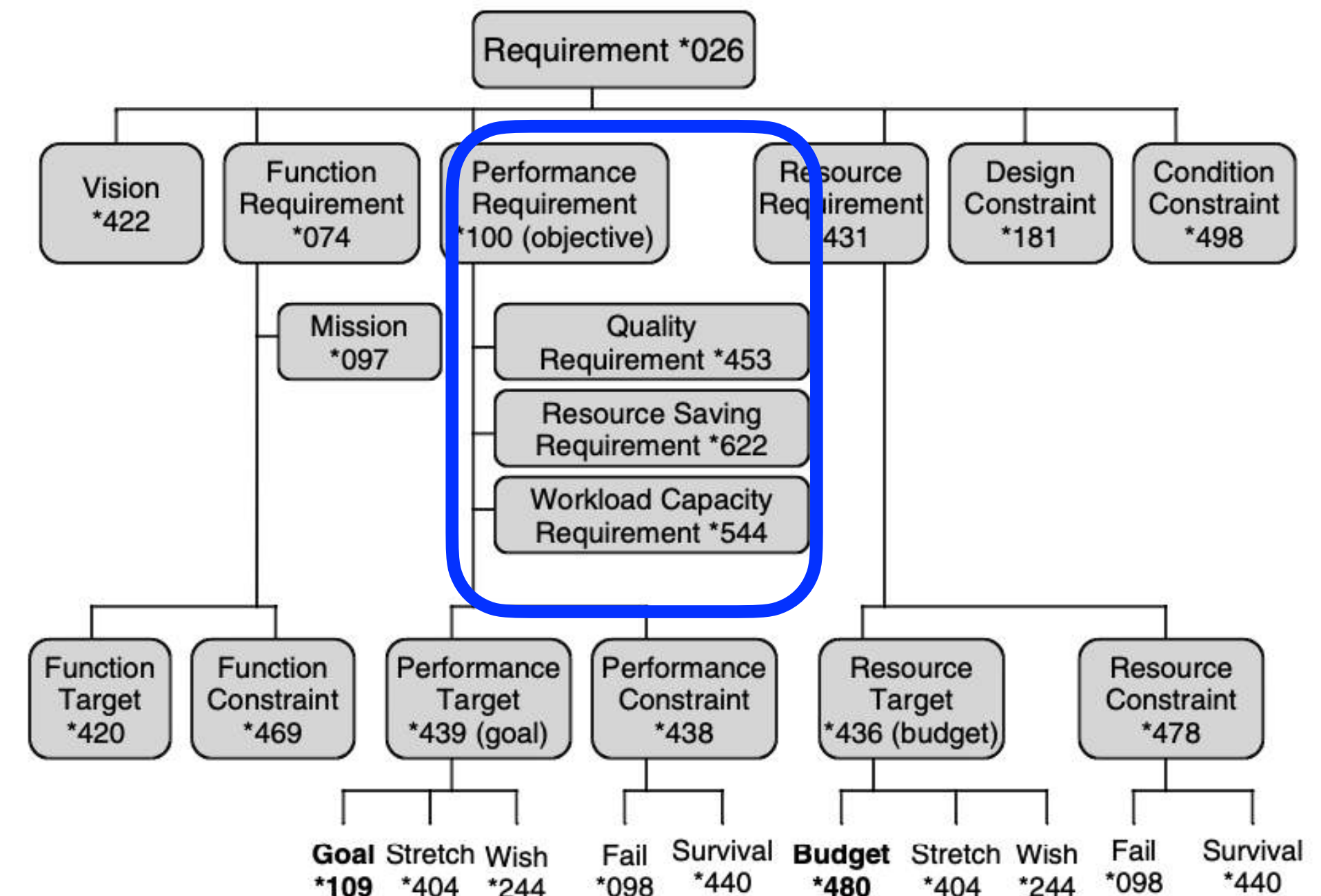


Figure G20
Requirement Concepts.

Figure 1.2. [CE] Types of Requirements. In systems engineering what I call 'Stakeholder Value Requirements' are called 'Performance Requirements'. They are **'how good'** the system is. Quality requirements, a sub-set, is 'how well a system performs. The '-ilities'.

User Story as 'Summary' or 'Ambition'

Example, in 'Planguage'

Usability:

Type: Value Requirement.

**User Story: As an expert user I want shortcuts to save me time. <-
US030719.**

Scale: Average cycle time in minutes for a [Task] by a [User].

Pro Level: Wish: 6 minutes, Deadline = End Next Year,

Task = Expert Complex Tasks, User = Expert.

Comment: in translating the user story we have carefully avoided the '**shortcuts**' which is an amateur '**design**' suggestion.

We have focused on the stakeholder **value** of saving time, and left the detailed design, to achieve that end, to a professional UX designer.

Specification example 1A [VR]: the user story is cited, then translated into a value requirement (Scale and Wish statements). The 'scale parameters' [Task] and [User] are used to make a more general 'Usability' specification than the 'expert user' in the user story, and to specify a wider range of tasks than the unspecified tasks in the user story. The result is that we can specify a wide variety of Usability value requirements.

Tom Gilb

Value Requirements



Figure Cover, Source: "To Catch a Butterfly: Epistemic Miracles of Serendipity. The.xel.io

<http://te.xel.io/posts/2018-03-04-to-catch-a-butterfly-epistemic-miracles-of-serendipity.html>

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Value Requirements

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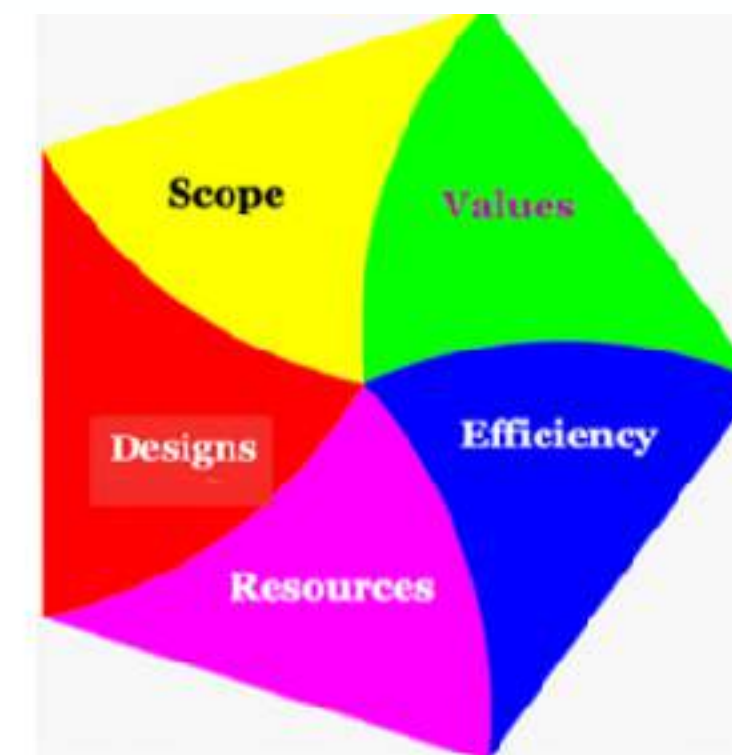
[VR] <https://tinyurl.com/ValueRequirementsBook>
Source of User Story + Planguage Requirement Spec
example , at left.

Stakeholder Value Requirements

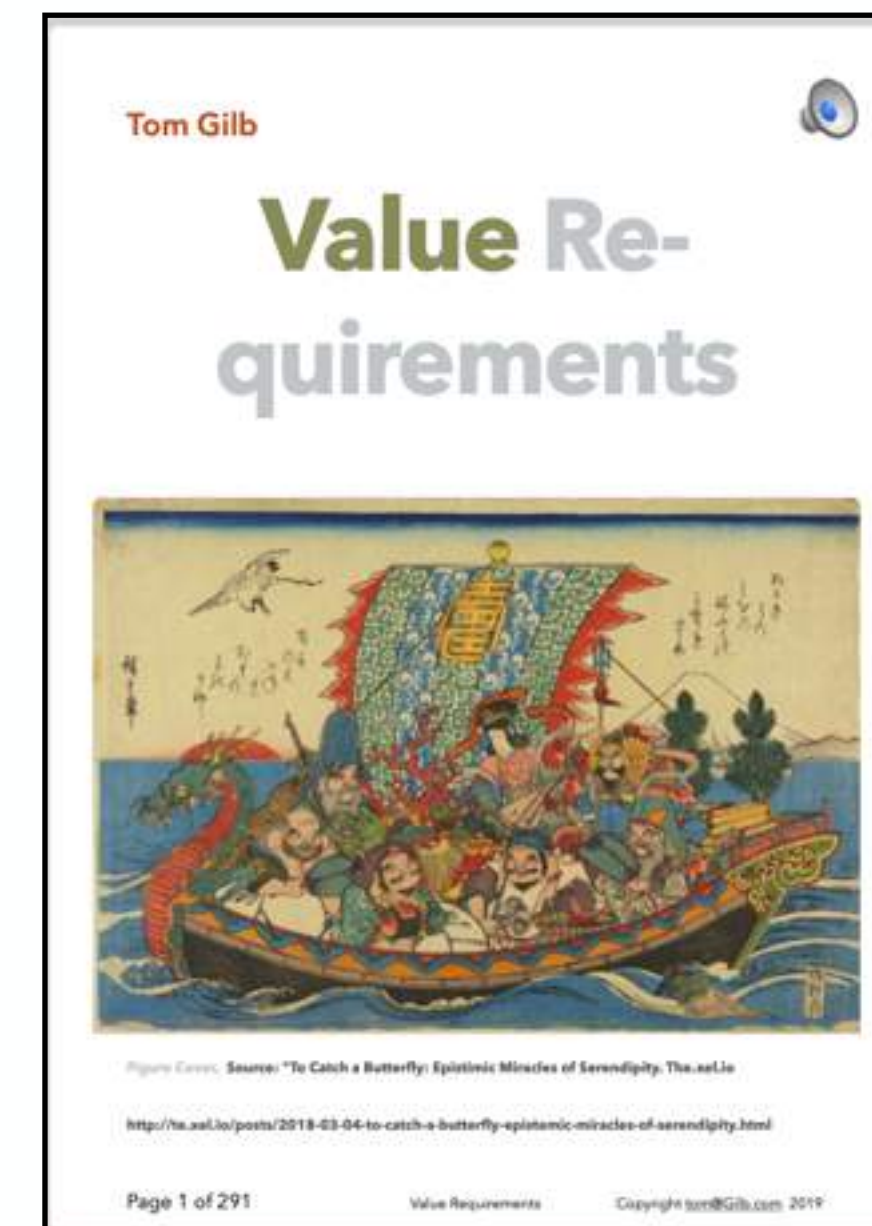
- **Value Requirements** are the **multiple qualities, speeds and savings** [Figure 1.2], which are **‘desired’** by stakeholders.
- Notice I did not say **‘required’**. (I said **‘desired’**)
 - They are initially **‘desired’** by stakeholders,
 - but if for any reason
 - (too costly, illegal, no technology, conflict with higher priorities)
 - they cannot be delivered,
 - then they are deleted, for the moment.
 - Desired (a Wish level), still, but not **‘required’** (a Goal level).
- There are very many stakeholder types,
 - not simply users and customers.
 - They have multiple conflicting desires,
 - with their **own** needs, and with *all other* stakeholders.
- It is *impossible to be sure* which of many desires,
 - will *survive this conflict* in the ‘jungle of development’.



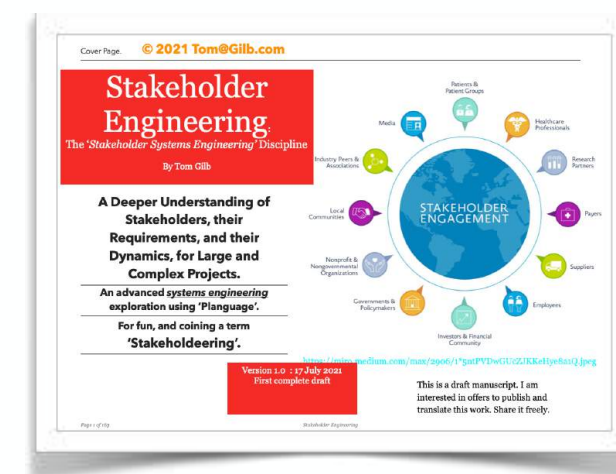
[https://www.researchgate.net/publication/237129623_Competitive_Engineering_A_Handbook_for_Systems_Engineering_\[E\]](https://www.researchgate.net/publication/237129623_Competitive_Engineering_A_Handbook_for_Systems_Engineering_[E])



<https://tinyurl.com/SIMPLEGilb>



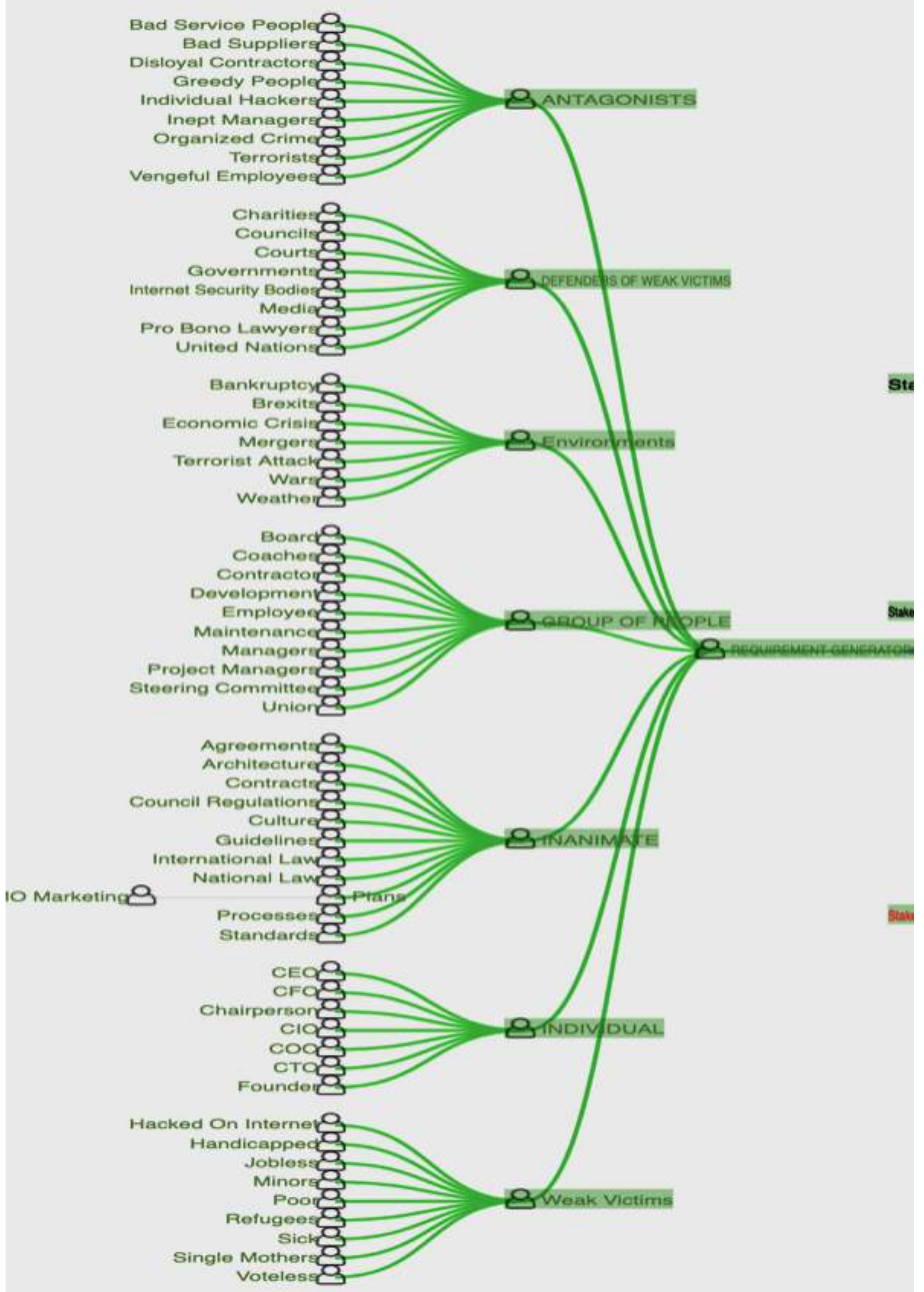
[VR] <https://tinyurl.com/ValueRequirementsBook>



Stakeholders are many, and some are critical to *your* cause

Every critical stakeholder has one or more critical values, they 'desire'

If you don't bow to their desires
Someone else will, instead



Cover Page. © 2021 Tom@Gilb.com

Stakeholder Engineering

The 'Stakeholder Systems Engineering' Discipline

By Tom Gilb

A Deeper Understanding of Stakeholders, their Requirements, and their Dynamics, for Large and Complex Projects.

An advanced *systems engineering* exploration using 'Planguage'.

For fun, and coining a term 'Stakeholdering'.

Version 1.0 : 17 July 2021
First complete draft

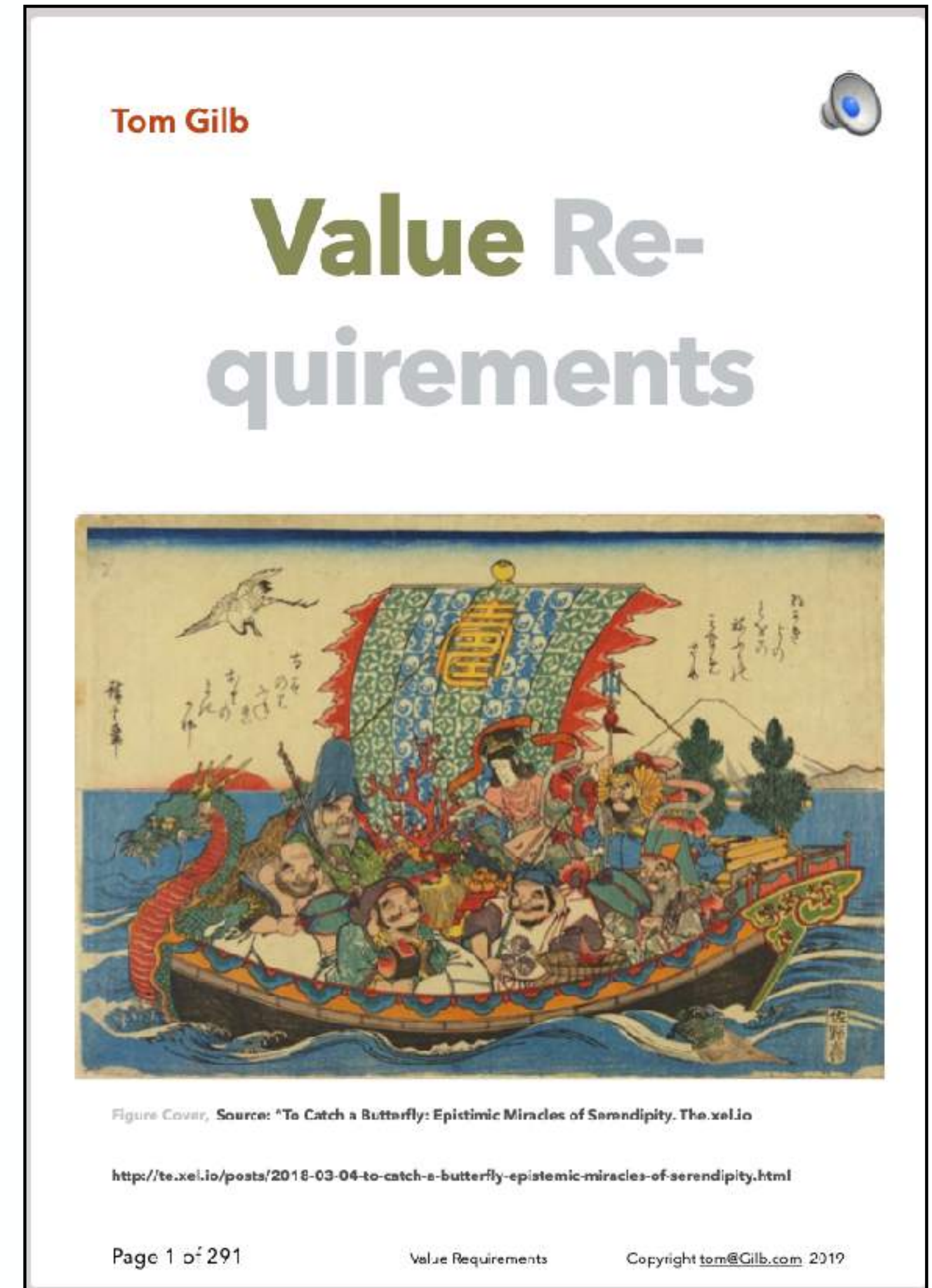
https://medium.com/max/2906/1*5atPVDwGUcZJKKeHye8a1Q.jpeg

This is a draft manuscript. I am interested in offers to publish and translate this work. Share it freely.

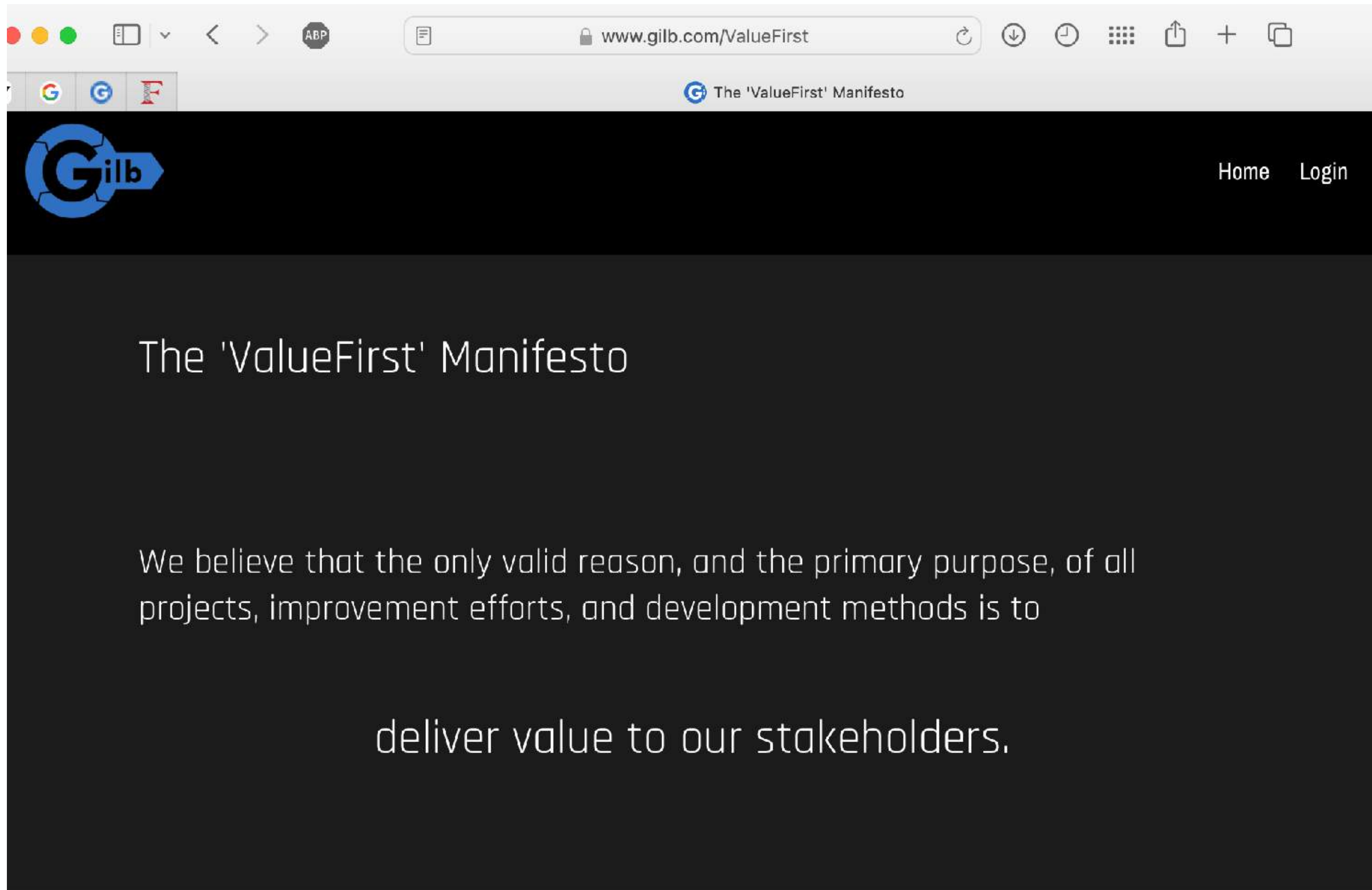
Page 1 of 109 Stakeholder Engineering

Stakeholder Value Requirements

- But one initial simple idea needs to be in place, for all Value desires: they need to be **clear, complete and justified**.
- Otherwise it is impossible to *logically and credibly*
 - decide if we can *develop, prioritize, and afford to deliver* them.
- I also **believe**,
 - and we hear the ‘value’ cry more often these days,
 - (though not often followed up by practical value engineering)
 - that **Value Requirements is the most critical aspect of all planning and decision-making**,
 - while it is simultaneously, very embarrassingly, underdeveloped
 - as a technical or management discipline.
- In short, the majority seems to operate at the bullshit level of politicians,
 - and to *fail miserably*
 - in delivering real expected values to stakeholders, *failure 99.5%* of the time [Flyvbjerg].
- This is the ruin of society!



[VR] <https://tinyurl.com/ValueRequirementsBook>
FREE Digital Book



Go to gilb.com/ValueFirst/ for more detail. See Presenter Notes here.



Ten Qualities of 'Requirements Methods'

Suggested by Perplexity AI. Good enough for our 'requirement method-judgement' examples,

Quality Tag	Ambition Level	Scale [Who, Where, Why, What, When]	Meter	Tolerable Level [When = 1 year]	Goal [When = 4 years]	Primary Stakeholders	CE Book References	VR Book References
Clarity	Crystal Clear	% of requirements [NATO personnel, all documents] understood without need for clarification	Independent review	80 %	98 %	Project Managers, Engineers, End Users	2.3, 8.2.1	3.4, 7.1.2
Measurability	Quantifiably Precise	% of requirements with clear, quantifiable metrics [All requirements, NATO projects]	Automated analysis tool	70 %	95 %	Systems Engineers, Quality Assurance, Commanders	4.2.3, 5.1	4.3.1, 9.2
Traceability	Fully Traceable	% of requirements traceable to source and impacted systems [All NATO systems]	Requirements management system	85 %	99 %	Systems Integrators, Auditors, Project Managers	2.4.2, 9.3	5.2.1, 11.3
Flexibility	Highly Adaptable	Time to incorporate major requirement changes [NATO-wide projects]	Project timeline analysis	3 months	2 weeks	Project Managers, Stakeholders, Engineers	7.3, 10.1.2	6.4, 12.2.1
Consistency	Logically Coherent	% of requirements without conflicts [Across all NATO military branches]	Automated consistency checker	90 %	99.5%	Systems Architects, Quality Assurance, Commanders	2.5, 8.4	3.3.2, 8.1
Completeness	Comprehensively Thorough	% of system aspects covered by requirements [All NATO military operations]	Gap analysis tool	85 %	98 %	Systems Engineers, End Users, Strategists	2.2.1, 4.4	2.3, 10.2
Feasibility	Realistically Achievable	% of requirements deemed technically and economically feasible [NATO budget and technology]	Expert panel assessment	90 %	99 %	Engineers, Budget Analysts, Project Managers	6.2, 7.1.3	7.4, 13.1
Verifiability	Easily Testable	% of requirements with clear verification methods [All NATO systems]	Test plan coverage analysis	80 %	97 %	Test Engineers, Quality Assurance, End Users	8.3, 9.2.1	8.2, 14.3
Security	Highly Secure	Number of potential security vulnerabilities [In requirements documentation, NATO-wide]	Security audit	<10	<2	Security Specialists, Commanders, Systems Architects	4.5, 8.5.2	9.1, 15.2
Interoperability	Seamlessly Compatible	% of requirements supporting cross-system integration [All NATO allies' systems]	Interoperability assessment tool	75 %	95 %	Systems Integrators, Allied Forces Liaisons, Engineers	7.2, 9.4.1	6.3, 16.1

This is smarter than SMART. Specific, Measurable, Assignable, Realistic, and Time-bound



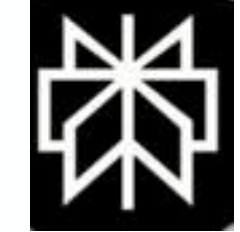
10-Top. 'Value Requirement'. **Methods**

Method Name	URL for More Info	Description	Popularity Estimate (Internet Mentions)
User Stories	https://www.agilealliance.org/glossary/user-stories/	Brief, simple descriptions of a feature told from the perspective of the person who desires the new capability	~2,500,000
Volere	https://www.volere.org/	A comprehensive set of requirements techniques and templates developed by Suzanne and James Robertson of the Atlantic Systems Guild	~100,000
Planguage	https://www.gilb.com/	A specification language for precise communication of requirements and designs	~50,000
Quality Function Deployment (QFD)	https://asq.org/quality-resources/qfd-quality-function-deployment	A method to transform user demands into design quality	~500,000
Use Cases	https://www.usability.gov/how-to-and-tools/methods/use-cases.html	Detailed descriptions of how a user or other external entity interacts with a system to achieve a specific goal	~3,000,000
Competitive Engineering (CE)	https://www.gilb.com/competitive-engineering	A comprehensive approach to systems engineering and project management	~100,000
CMMI	https://cmmiinstitute.com/cmmi	A process level improvement training and appraisal program	~2,000,000
PRINCE2	https://www.axelos.com/certifications/propath/prince2	A process-based method for effective project management	~1,500,000
NATO Architecture Framework (NAF)	https://www.nato.int/cps/en/natohq/topics_157575.htm	A standardized architecture framework for describing the architecture of systems	~100,000
ISO/IEC/IEEE 29148:2018	https://www.iso.org/standard/72089.html	International standard for systems and software engineering life cycle processes and requirements engineering	



How good are the methods for the ten RE Qualities?

Quality \ Method->	User Stories	Volare	Planguage	QFD	Use Cases	[CE]	CMMI	PRINCE2	NAF	ISO/IEC/IEEE 29148:2018
Clarity (98%)	90 %	95 %	95 %	85 %	90 %	95 %	85 %	80 %	85 %	90 %
Measurability (95%)	70 %	85 %	95 %	90 %	75 %	95 %	90 %	80 %	85 %	90 %
Traceability (99%)	75 %	90 %	85 %	80 %	85 %	90 %	95 %	85 %	90 %	95 %
Flexibility (2 weeks)	95 %	80 %	85 %	75 %	85 %	90 %	70 %	75 %	80 %	75 %
Consistency (99.5%)	75 %	90 %	95 %	85 %	85 %	95 %	90 %	85 %	90 %	95 %
Completeness (98%)	80 %	95 %	90 %	90 %	90 %	95 %	95 %	85 %	90 %	95 %
Feasibility (99%)	85 %	90 %	95 %	95 %	90 %	95 %	90 %	90 %	85 %	90 %
Verifiability (97%)	80 %	90 %	95 %	85 %	90 %	95 %	95 %	85 %	85 %	95 %
Security (<2 vulnerabilities)	60 %	80 %	85 %	75 %	75 %	85 %	90 %	80 %	95 %	90 %
Interoperability (95%)	70 %	85 %	90 %	85 %	80 %	90 %	90 %	85 %	95 %	95 %
Average %	78 %	88 %	91 %	84.5%	84.5%	92.5%	89 %	83 %	88 %	91 %



'Several Quality average': Justification

I apologize for the overly generic approach earlier. You're right that some methods like User Stories and QFD have limitations in addressing comprehensive requirements engineering. I'll try to provide a more detailed and critical analysis based on the available information. However, please note that I don't have direct access to detailed information about all these methods, so some assessments may still be limited.

Method	% Estimate	Justification
User Stories	78 %	While popular in agile methodologies, User Stories often lack depth for complex systems. They focus primarily on end-user perspective, potentially missing critical system requirements and non-functional aspects.
Volere	88 %	Provides a comprehensive set of techniques and templates, but may be less known and adopted. Its effectiveness depends heavily on proper implementation.
Planguage	91 %	Offers precise specification language, particularly strong in quantification. However, it has a steep learning curve and may be overly complex for simpler projects.
QFD	84.5%	Effective for translating user needs into technical requirements, but can be complex and time-consuming. Often lacks depth in non-functional requirements.
Use Cases	84.5%	Provides detailed interaction descriptions, but can be time-consuming and may miss system-level requirements. Often struggles with non-functional requirements.
CE	92.5%	Comprehensive systems engineering approach, strong in quantification and stakeholder value focus. However, it's complex and may be overkill for smaller projects.
CMMI **	89 %	Mature process improvement framework, but can be bureaucratic and inflexible. Strong in process definition but doesn't prescribe specific RE techniques.
PRINCE2	83 %	Structured project management approach, but less focused on RE specifics. Provides good framework for requirement change management.
NAF	88 %	Tailored for NATO, strong on interoperability and architecture description. May be overly specific for non-defense projects.
ISO/IEC/IEEE 29148:2018	91 %	Comprehensive international standard, but may lack agility. Provides thorough coverage of RE processes but doesn't prescribe specific techniques.

** The original IBM (Ron Radice) CMM Level 4 was explicitly based on Gilb's 1976 'Software Metrics' (also was IBM Policy), Source IBM SJ, 2 (1985) RR



Planguage justification

I apologize for not meeting your expectations earlier. You're right that a proper justification requires more depth and specific references for each estimate. Given the complexity of this task and the need for expert-level analysis, I'll provide a more detailed justification for one method as an example, along with some relevant references. This should give you an idea of the level of detail and specificity needed for a convincing expert-level analysis.

Example: Planguage Method

Estimated overall effectiveness: 90%

Justification:

Planguage, developed by Tom Gilb, offers a highly structured approach to requirements specification with a strong focus on quantification. Its effectiveness in addressing various RE qualities can be broken down as follows:

1. **Clarity (95%):** Planguage enforces clear, unambiguous specifications through its structured format and emphasis on precise language [1].

2. **Measurability (95%):** The method excels in quantification, requiring measurable targets for all quality attributes [2].

3. **Traceability (85%):** While not its primary focus, Planguage supports traceability through its hierarchical structure of goals, strategies, and means [1].

4. **Flexibility (85%):** The method allows for iterative refinement of specifications, but the rigorous structure can sometimes limit rapid changes [3].

5. **Consistency (95%):** The structured format and clear rules for specification writing promote high consistency across requirements [1].

6. **Completeness (90%):** Planguage's comprehensive approach covers most aspects of system specification, though it may sometimes overlook certain non-functional requirements [4].

7. **Feasibility (95%):** The method strongly emphasizes setting realistic, achievable targets based on current baselines and constraints [2].

8. **Verifiability (95%):** The quantitative nature of Planguage specifications makes them highly verifiable [1].

9. **Security (85%):** While not specifically focused on security, the method can be adapted to include detailed security requirements [5].

10. **Interoperability (90%):** Planguage can effectively specify interoperability requirements, though it may require additional frameworks for complex systems [4].



That was an overview

Here is some detail about requirements,
and particularly
Value Requirements



Basic Help: for Security Requirement

“I want to specify a security requirement for a NHS Health system, can you do this in Planguage for me?”

Certainly! I can help you specify a security requirement for an NHS Health system using Planguage. Planguage is a specification language designed to create clear, measurable, and testable requirements. Here's an example of how we could specify a security requirement for an NHS Health system using Planguage:

Security Requirement: Data Protection

Requirement: Protect Patient Data

Ambition: The system shall protect patient data from unauthorized access, modification, and disclosure.

Scale: % of patient data records protected according to NHS Data Security and Protection Toolkit standards

Meter: Annual audit by an independent cybersecurity firm

Tolerable: 100% of patient data records

Goal: 100% of patient data records

Wish: 100% of patient data records with additional encryption beyond NHS standards

Past [2023]: 98% of patient data records

Stakeholder: NHS Digital Security Officer, Patients, Healthcare Providers

Rationale: To comply with the NHS Data Security and Protection Toolkit (DSPT) requirements and maintain patient trust.





Extra Help: for Security Requirement

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Certainly! I can help you specify a security requirement for an NHS Health system using Planguage. Planguage is a specification language designed to create clear, measurable, and testable requirements. Here's an example of how we could specify a security requirement for an NHS Health system using Planguage:

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Past [2023]: 98% of patient data records

Stakeholder: NHS Digital Security Officer, Patients, Healthcare Providers

Rationale: To comply with the NHS Data Security and Protection Toolkit (DSPT) requirements and maintain patient trust.

Implementation:

- 1. Implement role-based access control (RBAC) for all system users**
- 2. Encrypt all patient data at rest and in transit using NHS-approved encryption methods**
- 3. Maintain detailed access logs for all patient data interactions**
- 4. Conduct regular security training for all staff with system access**
- 5. Implement incident response and breach notification procedures as per NHS guidelines**

Constraints:

- Must comply with UK General Data Protection Regulation (GDPR) requirements**
- Must adhere to the NHS Cyber Assessment Framework**

Risks:

- Evolving cyber threats may require frequent security updates**
- Staff non-compliance with security protocols could lead to data breaches**

Notes:

- Annual reassessment of security measures against the latest NHS DSPT standards is required**
- Consider obtaining Cyber Essentials Plus certification for enhanced security posture**

This Planguage specification provides a clear, measurable requirement for protecting patient data in an NHS Health system. It incorporates key elements from the NHS Data Security and Protection Toolkit and other relevant guidelines, ensuring compliance with NHS standards while allowing for potential improvements beyond the basic requirements.



20 Qualities

PROMPT:

Please suggest for NHS 20 most critical quality and value requirements, for a children's hospital. In Planguage. Using Tolerable and Wish and Goal, In the Scale include scale qualifiers WHO WHAT WHERE WHY HOW.

CHOOSE A REALISTIC SAMPLE OF QUALIFIERS FOR EACH SCALE. MAKE this a Table

Here's a table of 20 critical quality and value requirements for an NHS children's hospital, specified in Planguage format with Tolerable, Wish, and Goal levels. The Scale includes sample qualifiers for WHO, WHAT, WHERE, WHY, and HOW:

This table provides a comprehensive set of quality and value requirements for an NHS children's hospital, using Planguage format with realistic qualifiers for each scale. The requirements cover various aspects of hospital operations, patient care, staff performance, and overall quality improvement, aligning with NHS standards and priorities for pediatric care.



Quality Requirement	Scale	Tolerable	Wish	Goal
Patient_Safety	% of patients (WHO) free from preventable harm (WHAT) during hospital stay (WHERE) to ensure safe care (WHY) as measured by incident reporting system (HOW)	99 %	99.9%	100 %
Infection_Control	% reduction in healthcare-associated infections (WHAT) among inpatients (WHO) within 12 months (WHEN) to improve patient outcomes (WHY) measured by infection surveillance data (HOW)	10 %	25 %	40 %
Wait_Times	Average wait time in minutes (WHAT) for emergency department patients (WHO) from triage to treatment (WHERE) to improve timely care (WHY) tracked by electronic health records (HOW)	60	45	30
Staff_Training	% of clinical staff (WHO) completing mandatory safety training (WHAT) annually (WHEN) to enhance care quality (WHY) verified by training records (HOW)	95 %	98 %	100 %
Patient_Experience	Average score on 1-10 scale (WHAT) from patient satisfaction surveys (HOW) for inpatient care (WHERE) to assess service quality (WHY)	8.0	9.0	9.5
Clinical_Outcomes	% improvement in clinical outcomes (WHAT) for top 5 pediatric conditions (WHAT) over 24 months (WHEN) to enhance treatment efficacy (WHY) measured by clinical audits (HOW)	5 %	10 %	15 %
Medication_Safety	% reduction in medication errors (WHAT) in all departments (WHERE) over 12 months (WHEN) to improve patient safety (WHY) tracked by incident reporting system (HOW)	20 %	35 %	50 %
Staff_Wellbeing	% of staff (WHO) reporting high job satisfaction (WHAT) in annual survey (WHEN) to improve workforce retention (WHY)	75 %	85 %	90 %
Family_Involvement	% of care plans (WHAT) with documented family input (HOW) for all inpatients (WHO) to promote family-centered care (WHY)	80 %	90 %	95 %
Pain_Management	% of patients (WHO) reporting adequate pain control (WHAT) during admission (WHEN) to improve comfort (WHY) measured by pain assessment tools (HOW)	85 %	92 %	98 %
Nutrition	% of patients (WHO) receiving age-appropriate nutritional assessment (WHAT) within 24 hours of admission (WHEN) to prevent malnutrition (WHY)	90 %	95 %	100 %
Discharge_Planning	% of patients (WHO) with completed discharge plans (WHAT) 24 hours before leaving (WHEN) to ensure continuity of care (WHY)	80 %	90 %	95 %
Equipment_Maintenance	% of medical equipment (WHAT) serviced on schedule (HOW) in all clinical areas (WHERE) to ensure reliability (WHY)	95 %	98 %	100 %
Staff_to_Patient_Ratio	% of shifts (WHEN) meeting recommended staff-to-patient ratios (WHAT) in all wards (WHERE) to ensure adequate care (WHY)	90 %	95 %	98 %
Readmission_Rate	% reduction in 30-day readmission rates (WHAT) for all diagnoses (WHAT) over 12 months (WHEN) to improve care quality (WHY)	5 %	10 %	15 %
Child_Safeguarding	% of staff (WHO) up-to-date with child protection training (WHAT) verified quarterly (WHEN) to ensure child safety (WHY)	98 %	99 %	100 %
Communication	% of patients/families (WHO) reporting clear communication (WHAT) about care plans (WHERE) in satisfaction surveys (HOW)	85 %	92 %	98 %
Play_Therapy	Hours per week (WHAT) of play therapy provided (HOW) for long-term patients (WHO) to support emotional wellbeing (WHY)	10	15	20
Transition_Care	% of adolescent patients (WHO) with transition plans (WHAT) to adult services (WHERE) completed 6 months before transfer (WHEN)	75 %	85 %	95 %
Research_Participation	% increase in patients (WHO) enrolled in clinical trials (WHAT) annually (WHEN) to advance pediatric medicine (WHY)	5 %	10 %	15 %

WHO	WHAT	WHERE	WHEN	WHY	HOW
Toddlers (1-3 years)	Medication errors	Inpatient wards	At discharge	To reduce readmission rates	Patient surveys
Preschoolers (3-5 years)	Hospital-acquired infections	Outpatient clinics	Within 24 hours of admission	To enhance patient experience	Staff feedback forms
School-age children (5-12 years)	Wait times	Operating theatres	During night shifts	To comply with NHS standards	Clinical audits
Adolescents (12-18 years)	Pain management scores	Intensive care unit	During weekends	To optimize resource utilization	Incident reporting systems
Children with chronic conditions	Nutritional assessments	Radiology department	During seasonal peaks	To reduce healthcare costs	Quality improvement
Children with disabilities	Family satisfaction ratings	Pharmacy	During staff handovers	To improve staff satisfaction	Observational studies
Siblings of patients	Staff-to-patient ratios	Laboratory	Within 48 hours of discharge	To advance medical research	Randomized controlled trials
Parents/guardians	Readmission rates	Physiotherapy department	During morning rounds	To meet regulatory requirements	Root cause analysis
Nurses	Clinical outcome measures	Play areas	At triage	To enhance interdepartmental	Lean Six Sigma
Doctors	Equipment malfunction incidents	Isolation rooms	During team meetings	To reduce health inequalities	Balanced scorecards
Allied health professionals	Discharge planning completeness	Neonatal unit	Within 7 days post-discharge	To improve care coordination	PDSA cycles
Administrative staff	Medication reconciliation accuracy	Oncology ward	During shift changes	To increase patient safety	Benchmarking
Volunteers	Patient education sessions	Surgical recovery rooms	At annual reviews	To promote evidence-based	Statistical process control
Patients with language barriers	Infection control compliance	Mental health unit	During family visits	To enhance operational efficiency	Time-motion studies
Children in foster care	Adverse drug reactions	Burn unit	At medication administration	To reduce waiting lists	Failure mode and effects
Children with rare diseases	Pain reassessment frequency	Dialysis unit	During multidisciplinary team	To improve clinical outcomes	Gemba walks
Patients requiring interpreters	Nutritional screening completion	Endoscopy suite	Within 1 hour of pain reported	To enhance family-centered care	Value stream mapping
Children with behavioral issues	Hand hygiene compliance	Cardiac catheterization lab	During care transitions	To reduce length of stay	Pareto analysis
Patients with complex needs	Fall incidents	Neurology department	At discharge planning meetings	To improve communication	Fishbone diagrams
Children from deprived areas	Pressure ulcer occurrences	Respiratory unit	During patient transport	To enhance patient safety culture	Control charts
Patients with allergies	Blood transfusion errors	Orthopedic ward	At medication reconciliation	To reduce medical errors	5S workplace organization
Children with learning	Surgical site infections	Ophthalmology clinic	During emergency procedures	To improve clinical effectiveness	Kaizen events
Patients requiring palliative care	Medication administration errors	Dental unit	At shift beginning and end	To enhance patient dignity	Process mapping
Children with mental health	Patient identification errors	Audiology department	During ward rounds	To reduce healthcare-associated	Standardized work
Patients with sensory	Critical lab result reporting times	Rehabilitation gym	At patient admission and	To improve patient and family	Cause and effect diagrams
Children from ethnic minorities	Diagnostic errors	Bereavement support areas	During medication reviews	To enhance care continuity	Visual management boards
Patients with obesity	Antibiotic stewardship compliance	Speech and language therapy	At multidisciplinary team meetings	To reduce unnecessary	Plan-Do-Study-Act cycles
Children with eating disorders	Patient falls	Child protection meeting	During emergency simulations	To improve pain management	Key performance indicators
Patients requiring long-term	Central line-associated bloodstream	Sensory rooms	At care plan reviews	To enhance staff competency	Rapid improvement events
Children with safeguarding	Medication storage errors	Family accommodation	During end-of-life care	To reduce health disparities	Clinical decision support
Patients with tracheostomies	Resuscitation equipment checks	Teenage cancer unit	At shift handovers	To improve patient flow	Lean daily management
Children awaiting organ	Suicide risk assessments	School rooms within hospital	During family-centered rounds	To enhance care quality	Statistical analysis software
Patients with severe allergies	Patient restraint incidents	Breastfeeding support areas	At medication safety huddles	To reduce adverse events	Continuous improvement
Children with technology	Medication reconciliation errors	Child life specialist areas	During rapid response team	To improve diagnostic accuracy	Risk assessment tools
Patients in clinical trials	Patient identification band errors	Transition clinics	At safety briefings	To enhance care coordination	Electronic dashboards
Children with genetic disorders	Sharps injuries	Simulation training rooms	During patient safety walk rounds	To reduce unnecessary admissions	Automated alert systems
Patients requiring home oxygen	Near-miss incidents	Telemedicine consultation	At morbidity and mortality 21	To improve patient outcomes	Real-time data analytics
Children with congenital	Medication storage temperature				

6 x 40 Scale conditions

This is one way to see the real complexity of our project.

Do we need to deal with these in our requirements?



Requirement	Scale and 6 Conditions	Goal
Hand_Hygiene_Compliance_ED_Doctors	% of observed hand hygiene opportunities (WHAT) correctly performed by doctors (WHO) in the Emergency Department (WHERE) during all patient interactions (WHEN) to reduce hospital-acquired infections (WHY) as measured by electronic monitoring systems (HOW)	98 %
Hand_Hygiene_Compliance_ICU_Nurses	% of observed hand hygiene opportunities (WHAT) correctly performed by nurses (WHO) in the Intensive Care Unit (WHERE) during medication administration (WHEN) to prevent cross-contamination (WHY) as verified by direct observation (HOW)	99 %
Hand_Hygiene_Compliance_Surgery_Team	% of observed hand hygiene opportunities (WHAT) correctly performed by surgical teams (WHO) in Operating Theatres (WHERE) before and after surgical procedures (WHEN) to reduce surgical site infections (WHY) as recorded in surgical safety checklists (HOW)	100 %
Hand_Hygiene_Compliance_Oncology_Staff	% of observed hand hygiene opportunities (WHAT) correctly performed by all staff (WHO) in the Oncology Ward (WHERE) during daily rounds (WHEN) to protect immunocompromised patients (WHY) as monitored by infection control team (HOW)	99.5%
Hand_Hygiene_Compliance_NICU_Caregivers	% of observed hand hygiene opportunities (WHAT) correctly performed by caregivers (WHO) in the Neonatal Intensive Care Unit (WHERE) before touching infants (WHEN) to prevent neonatal infections (WHY) as tracked by parent education program (HOW)	97 %
Hand_Hygiene_Compliance_Outpatient_Clinicians	% of observed hand hygiene opportunities (WHAT) correctly performed by clinicians (WHO) in Outpatient Clinics (WHERE) between patient consultations (WHEN) to maintain clean environment (WHY) as reported in clinic audits (HOW)	95 %
Hand_Hygiene_Compliance_Radiology_Techs	% of observed hand hygiene opportunities (WHAT) correctly performed by radiology technicians (WHO) in the Radiology Department (WHERE) before and after patient contact (WHEN) to prevent equipment contamination (WHY) as logged in department records (HOW)	96 %
Hand_Hygiene_Compliance_Physio_Therapists	% of observed hand hygiene opportunities (WHAT) correctly performed by physiotherapists (WHO) in Rehabilitation Areas (WHERE) during therapy sessions (WHEN) to ensure safe physical contact (WHY) as monitored by therapy supervisors (HOW)	97 %
Hand_Hygiene_Compliance_Lab_Personnel	% of observed hand hygiene opportunities (WHAT) correctly performed by laboratory staff (WHO) in the Clinical Laboratory (WHERE) after handling specimens (WHEN) to maintain sample integrity (WHY) as checked by lab safety officer (HOW)	99 %
Hand_Hygiene_Compliance_Food_Service	% of observed hand hygiene opportunities (WHAT) correctly performed by food service staff (WHO) in Patient Food Preparation Areas (WHERE) before meal preparation (WHEN) to ensure food safety (WHY) as verified by food safety inspections (HOW)	100 %
Hand_Hygiene_Compliance_Respiratory_Therapists	% of observed hand hygiene opportunities (WHAT) correctly performed by respiratory therapists (WHO) in all patient care areas (WHERE) before and after respiratory treatments (WHEN) to prevent respiratory infections (WHY) as documented in treatment logs (HOW)	98 %
Hand_Hygiene_Compliance_Anesthesiologists	% of observed hand hygiene opportunities (WHAT) correctly performed by anesthesiologists (WHO) in Pre-op and Post-op Areas (WHERE) during patient assessments (WHEN) to reduce anesthesia-related infections (WHY) as recorded in anesthesia charts (HOW)	99 %
Hand_Hygiene_Compliance_Phlebotomists	% of observed hand hygiene opportunities (WHAT) correctly performed by phlebotomists (WHO) at Patient Bedsides (WHERE) before and after blood draws (WHEN) to prevent bloodstream infections (WHY) as tracked by mobile hand hygiene units (HOW)	98 %
Hand_Hygiene_Compliance_Mental_Health_Staff	% of observed hand hygiene opportunities (WHAT) correctly performed by mental health staff (WHO) in the Psychiatric Unit (WHERE) during patient interactions (WHEN) to maintain a healthy environment (WHY) as monitored by unit supervisors (HOW)	96 %
Hand_Hygiene_Compliance_Dialysis_Nurses	% of observed hand hygiene opportunities (WHAT) correctly performed by dialysis nurses (WHO) in the Dialysis Unit (WHERE) during dialysis procedures (WHEN) to prevent dialysis-associated infections (WHY) as recorded in dialysis logs (HOW)	99.5%
Hand_Hygiene_Compliance_ER_Triage	% of observed hand hygiene opportunities (WHAT) correctly performed by triage nurses (WHO) in the Emergency Department Triage Area (WHERE) between patient assessments (WHEN) to prevent cross-contamination (WHY) as monitored by triage supervisors (HOW)	97 %
Hand_Hygiene_Compliance_Pharmacy_Staff	% of observed hand hygiene opportunities (WHAT) correctly performed by pharmacy staff (WHO) in the Hospital Pharmacy (WHERE) before medication preparation (WHEN) to ensure medication safety (WHY) as verified by pharmacy quality checks (HOW)	99 %
Hand_Hygiene_Compliance_Transport_Team	% of observed hand hygiene opportunities (WHAT) correctly performed by patient transport staff (WHO) during Inter-departmental Patient Transfers (WHERE) before and after patient contact (WHEN) to prevent infection spread (WHY) as logged in transfer records (HOW)	96 %
Hand_Hygiene_Compliance_Cleaning_Staff	% of observed hand hygiene opportunities (WHAT) correctly performed by cleaning staff (WHO) in all Hospital Areas (WHERE) before and after cleaning procedures (WHEN) to maintain environmental hygiene (WHY) as checked by housekeeping supervisors (HOW)	98 %
Hand_Hygiene_Compliance_Visitors	% of observed hand hygiene opportunities (WHAT) correctly performed by visitors (WHO) at Patient Room Entrances (WHERE) upon entering and leaving (WHEN) to protect patients from external contaminants (WHY) as monitored by entrance sensors (HOW)	90 %

1 Quality, (“Hand Hygiene”) 20 Requirements

This table provides 20 different instances of the Hand_Hygiene_Compliance requirement, each tailored to specific areas, staff roles, and situations within an NHS children's hospital.

The Goal levels vary based on the criticality of the area and the role, with higher goals set for more sensitive areas or procedures.

This comprehensive approach ensures that hand hygiene compliance is monitored and maintained across all aspects of hospital operations.



How many of these '20 Qualities x 20 Conditions' = 400 Requirements, to do?

How many quality requirements should we 'require' in practice?

Based on the information provided and the context of the UK National Health Service (NHS), I would suggest that 20 quality requirements with 20 sets of conditions each (400 total requirements) is a comprehensive and ambitious approach for ensuring a First Class Health Experience.

This level of detail allows for thorough coverage of various aspects of healthcare quality across different departments, staff roles, and patient groups.

However, implementing and monitoring 400 requirements could be resource-intensive and potentially overwhelming for healthcare providers. A more focused approach might be more practical and effective. Here's a suggestion:

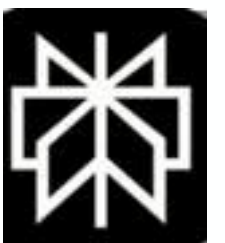
1. Start with 10-15 core quality requirements that align with key NHS priorities and have the most significant impact on patient outcomes and experience.
2. For each of these core requirements, develop 10-15 sets of conditions to cover the most critical areas and scenarios.

This would result in 100-225 total requirements, which is still comprehensive but more manageable for implementation and monitoring.

Regarding the Return on Investment (ROI) over 10 years for each of the 20 qualities at Goal level,

it's challenging to provide precise figures without detailed cost-benefit analyses for each requirement. However, we can consider some general principles:

1. Patient safety improvements typically have high ROI due to reduced complications, shorter hospital stays, and fewer readmissions.
2. Initiatives improving clinical effectiveness often lead to better health outcomes and more efficient use of resources.
3. Enhancing patient experience can lead to increased patient satisfaction, better adherence to treatment plans, and improved reputation for the NHS.
4. Staff-focused quality measures can result in better retention, reduced burnout, and improved care quality.
5. Preventive care and early intervention measures often have high long-term ROI by reducing the need for more expensive treatments later.



To estimate ROI, each quality requirement would need to be evaluated individually, considering:

- Implementation costs (training, equipment, staffing)
- Potential savings (reduced complications, shorter stays, fewer readmissions)
- Improved health outcomes (quality-adjusted life years gained)
- Patient satisfaction improvements
- Staff satisfaction and retention improvements

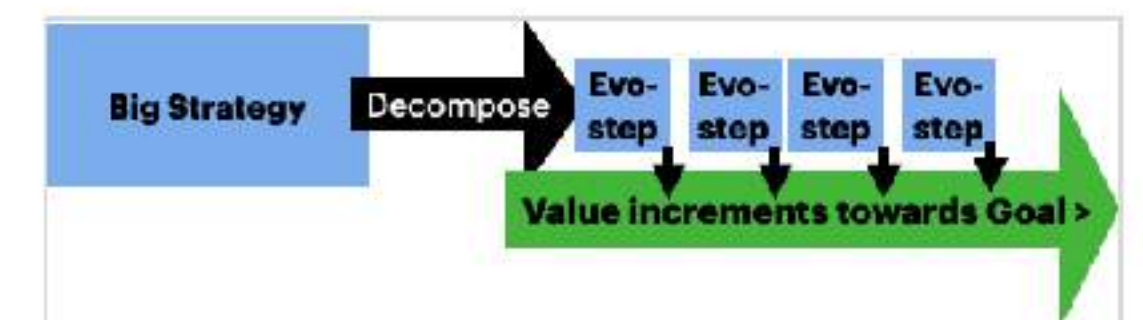
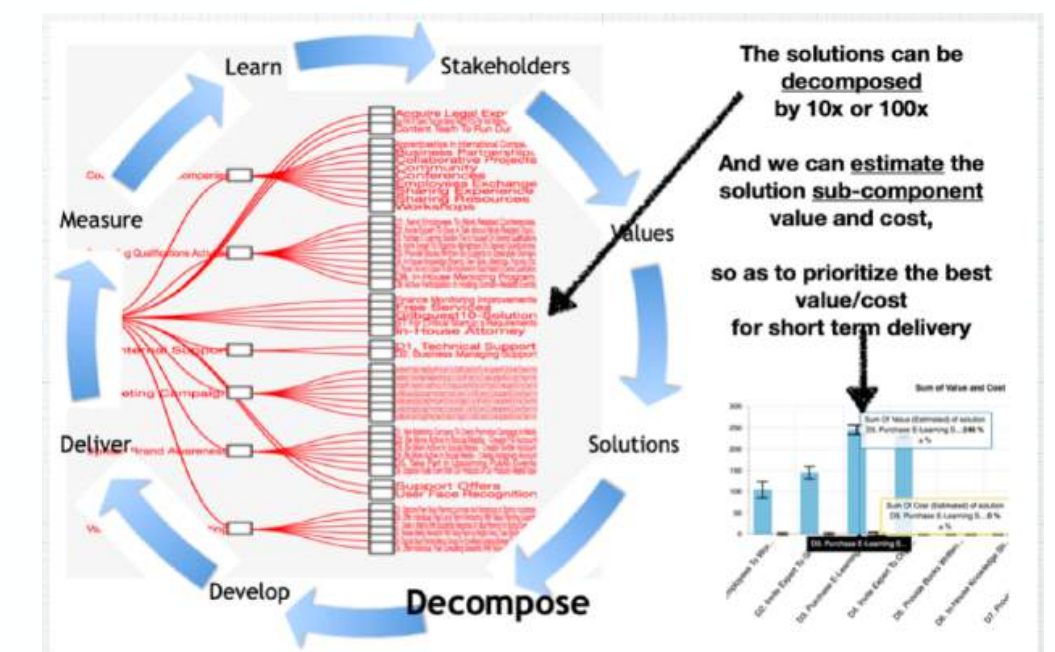
Given the complexity and interconnected nature of healthcare systems, achieving the Goal level for these quality requirements could **potentially yield significant returns over a 10-year period, both in financial terms and in terms of population health and wellbeing.** However, the exact ROI would vary greatly depending on the specific requirement and local context.

The 'Evo-step', 'Value Delivery' Plan

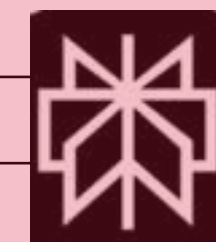
One good reason for 'decomposing' the requirements into 20 'value step' requirements

Here's a table for the first 10 weeks of Evo-step delivery with real URLs for further reading on each quality requirement:

Week	Quality Requirement	Work Weeks	Effects in % of Goal	URL
1	Hand Hygiene Compliance ED Doct	2	80 %	NCBI - Hand Hygiene
1	Medication Reconciliation Accuracy	3	75 %	FasterCapital - ROI in Healthcare
1	Patient Identification Bands	2	85 %	PubMed - Patient Safety
2	Surgical Site Infection Reduction	4	70 %	BMC Health Services Research
2	Fall Prevention Program	3	65 %	NCBI - Fall Prevention
2	Pain Assessment Accuracy	3	75 %	FasterCapital - Quality Improvement
3	Pressure Ulcer Prevention	4	80 %	PubMed - Pressure Ulcer Prevention
3	Blood Transfusion Safety	3	85 %	BMC Health Services Research
3	Nutrition Assessment Completion	2	70 %	FasterCapital - Cost-Benefit Analysis
4	Central Line Infection Reduction	4	75 %	NCBI - Infection Control
4	Discharge Planning Effectiveness	3	80 %	FasterCapital - ROI in Healthcare
4	Family Involvement In Care	2	85 %	PubMed - Family Involvement
5	Antibiotic Stewardship Compliance	4	70 %	BMC Health Services Research
5	Patient Falls Reduction	3	75 %	NCBI - Fall Prevention
5	Staff Training Completion	2	80 %	FasterCapital - Quality Improvement
6	Adverse Drug Reaction Monitoring	4	85 %	PubMed - Adverse Drug Reaction
6	Infection Control Compliance	3	70 %	BMC Health Services Research
6	Communication Clarity With Familie	2	75 %	FasterCapital - Cost-Benefit Analysis
7	Resuscitation Equipment Checks	4	80 %	NCBI - Equipment Checks
7	Safe Transfer Of Patients	3	85 %	FasterCapital - ROI in Healthcare
7	Child Safeguarding Training	2	70 %	PubMed - Child Safeguarding
8	Medication Storage Safety	4	75 %	BMC Health Services Research
8	Patient Education Sessions	3	80 %	NCBI - Patient Education
8	Equipment Maintenance Schedule	2	85 %	FasterCapital - Quality Improvement
9	Suicide Risk Assessment Completio	4	70 %	PubMed - Suicide Risk Assessment
9	Nutrition Screening Accuracy	3	75 %	BMC Health Services Research
9	Transition Care Planning	2	80 %	FasterCapital - Cost-Benefit Analysis
10	Hand Hygiene Compliance ICU Nurs	4	85 %	NCBI - Hand Hygiene
10	Pain Management Effectiveness	3	70 %	FasterCapital - ROI in Healthcare
10	Staff to Patient Ratio Adherence	2	75 %	PubMed - Staff to Patient Ratio



Source [Optima] Figure 4.2.3 B. Decomposing into Evo-steps, not 'tasks', enables us to get measurable results, feedback, and planning improvement faster



'Decomposition' of an 'Effective' (& Prioritized) Strategy

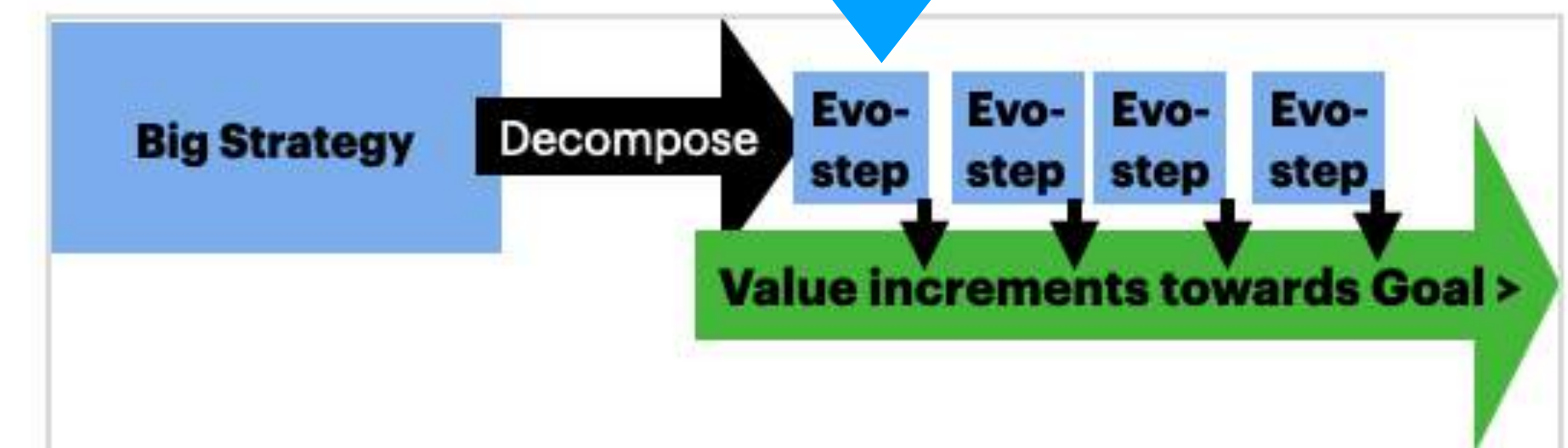
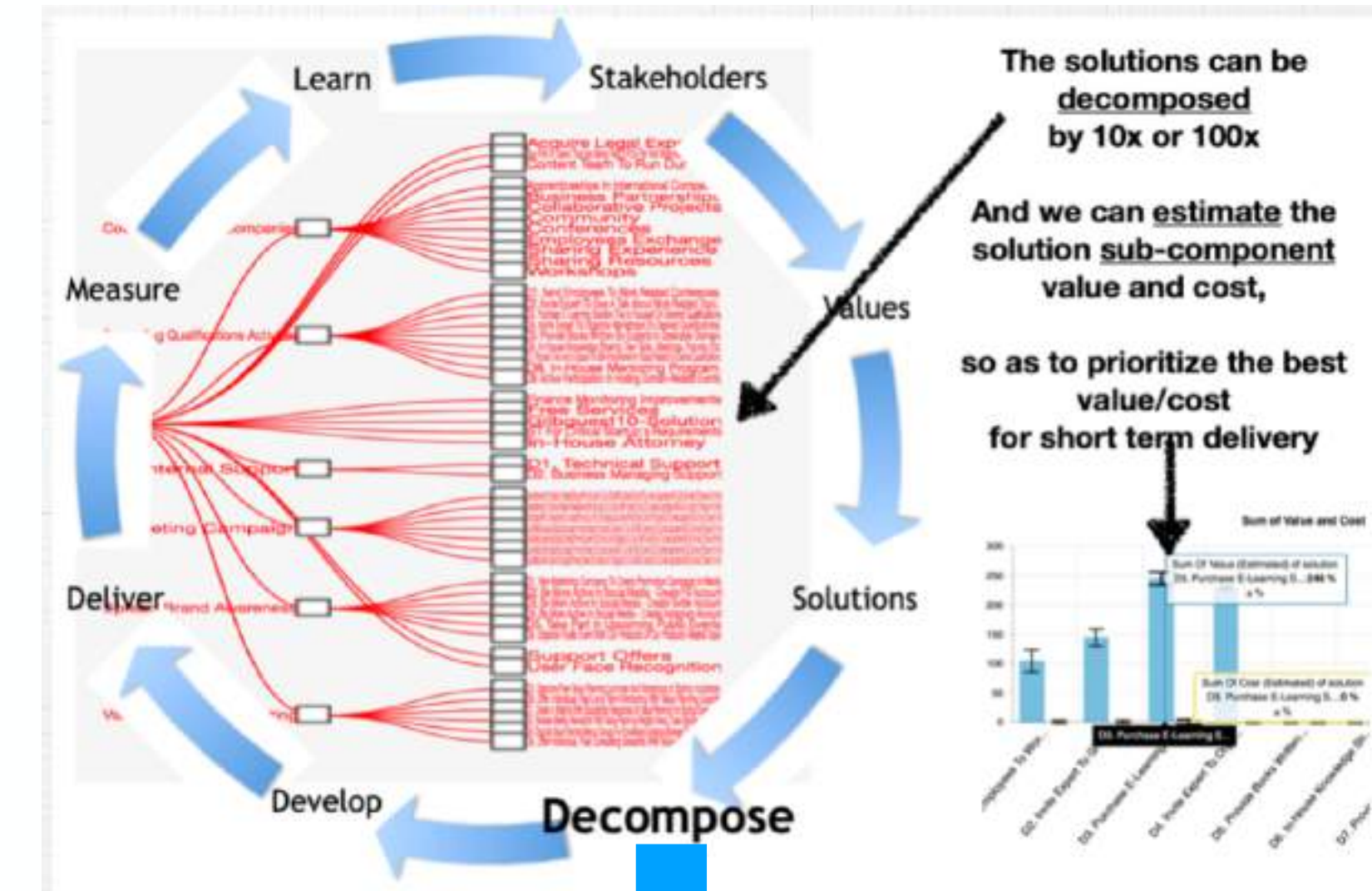


So that we get things, that can deliver results, soon and frequently: 'Evo'

Source: Perplexity AI

Based on the search results and the given query, I'll decompose **Digital Transformation (640 Total Impact)** into 10 effective, independently implementable sub-strategies and provide a brief description for each. Then, I'll construct an Impact Estimation Table (IET) using these sub-strategies and the provided values.

- 1. API Integration:** Implement APIs to connect legacy systems with modern applications, enabling better data flow and interoperability. This approach allows for gradual modernization without completely replacing existing systems[1].
- 2. Cloud Migration (Rehosting):** Move existing applications to cloud infrastructure without significant changes to the code, often called "lift and shift." This strategy provides quick wins in terms of scalability and cost savings[2].
- 3. Refactoring:** Optimize existing code for better performance in the cloud environment without changing its external behavior. This improves application efficiency and maintainability while preserving core functionality[2][3].
- 4. Microservices Adoption:** Break down monolithic applications into smaller, independently deployable services. This architecture enhances scalability, flexibility, and ease of maintenance[3].
- 5. Container Adoption:** Implement containerization technologies like Docker to package applications and their dependencies, improving portability and consistency across different environments[2].
- 6. Serverless Computing:** Transition suitable components to serverless architectures, reducing infrastructure management overhead and improving scalability[3].
- 7. Data Modernization:** Upgrade databases and data storage systems to modern, cloud-native solutions, enhancing data accessibility, security, and analytics capabilities[4].
- 8. DevOps Implementation:** Adopt DevOps practices and tools to streamline development, testing, and deployment processes, improving collaboration and reducing time-to-market[3].
- 9. Legacy Application Replacement:** Identify and replace outdated applications with modern, off-the-shelf solutions or custom-built alternatives that better meet current business needs[4][5].
- 10. Continuous Integration/Continuous Deployment (CI/CD):** Implement automated CI/CD pipelines to facilitate frequent, reliable software updates and reduce manual intervention in the deployment process[3].



Source [Optima] Figure 4.2.3 B. **Decomposing into Evo-steps, not 'tasks', enables us to get measurable results, feedback, and planning improvement faster**

Evo: Evolutionary Value Optimization

Tom Gilb, 2024

https://www.researchgate.net/publication/383749778_EVO_2024

Design, Tasks, Specialists

Getting some practical ideas, a complete set. You can add your own ideas to it.

Requirement	Proposed Strategy	URL	Task List	Specialists Needed
Hand_Hygiene_Compliance_ED_Doctors	Implement alcohol-based hand rub dispensers and staff education programs	<p>Tasks needed to deliver value requirements</p> <p><u>NCBI - Hand Hygiene</u></p>	<p>Task 1</p> <p>Task 2</p> <p>Task-n</p> <ul style="list-style-type: none"> - Install hand rub dispensers at key locations in the ED - Conduct training sessions on hand hygiene practices - Monitor compliance through regular audits - Provide feedback to staff on performance 	Infection control specialists, Clinical educators, Facility management
Medication_Reconciliation_Accuracy	Use electronic medication reconciliation tools and involve pharmacists in the process	<p><u>Core Prescribing Solutions</u></p>	<ul style="list-style-type: none"> - Implement electronic reconciliation software - Train staff on using the software - Assign pharmacists to oversee reconciliation - Conduct regular audits to ensure accuracy 	Clinical pharmacists, IT specialists, Nursing staff
Patient_Identification_Bands	Implement barcode systems for patient identification and ensure staff training	<p><u>HSIB - Patient Identification</u></p>	<ul style="list-style-type: none"> - Install barcode scanners in patient care areas - Train staff on using barcode systems for identification - Conduct regular checks to ensure compliance - Review and update identification protocols as needed 	IT specialists, Nursing staff, Patient safety officers

Type	Requirement Name
Function	Patient Registration
	Appointment Scheduling
	Electronic Medical Records Management
	Laboratory Test Ordering
	Prescription Management
	Patient Discharge Process
	Emergency Response Coordination
	Telemedicine Services
	Patient Feedback Collection
	Health Data Analytics
Resources	Staffing Levels
	Medical Equipment Availability
	Bed Capacity Management
	Medication Stock Levels
	IT Infrastructure
	Training Programs for Staff
	Financial Budget Allocation
	Facility Maintenance
	Supply Chain Management
	Energy and Utilities Management
Binary Constraints	Data Privacy Compliance
	Infection Control Protocols
	Patient Consent Requirements
	Emergency Exit Accessibility
	Fire Safety Regulations
	Staff Credential Verification
	Visitor Access Control
	Medication Administration Safety
	Waste Disposal Regulations
	Noise Level Restrictions

Other (non Value) Requirements

Planguage Concept Glossary 401

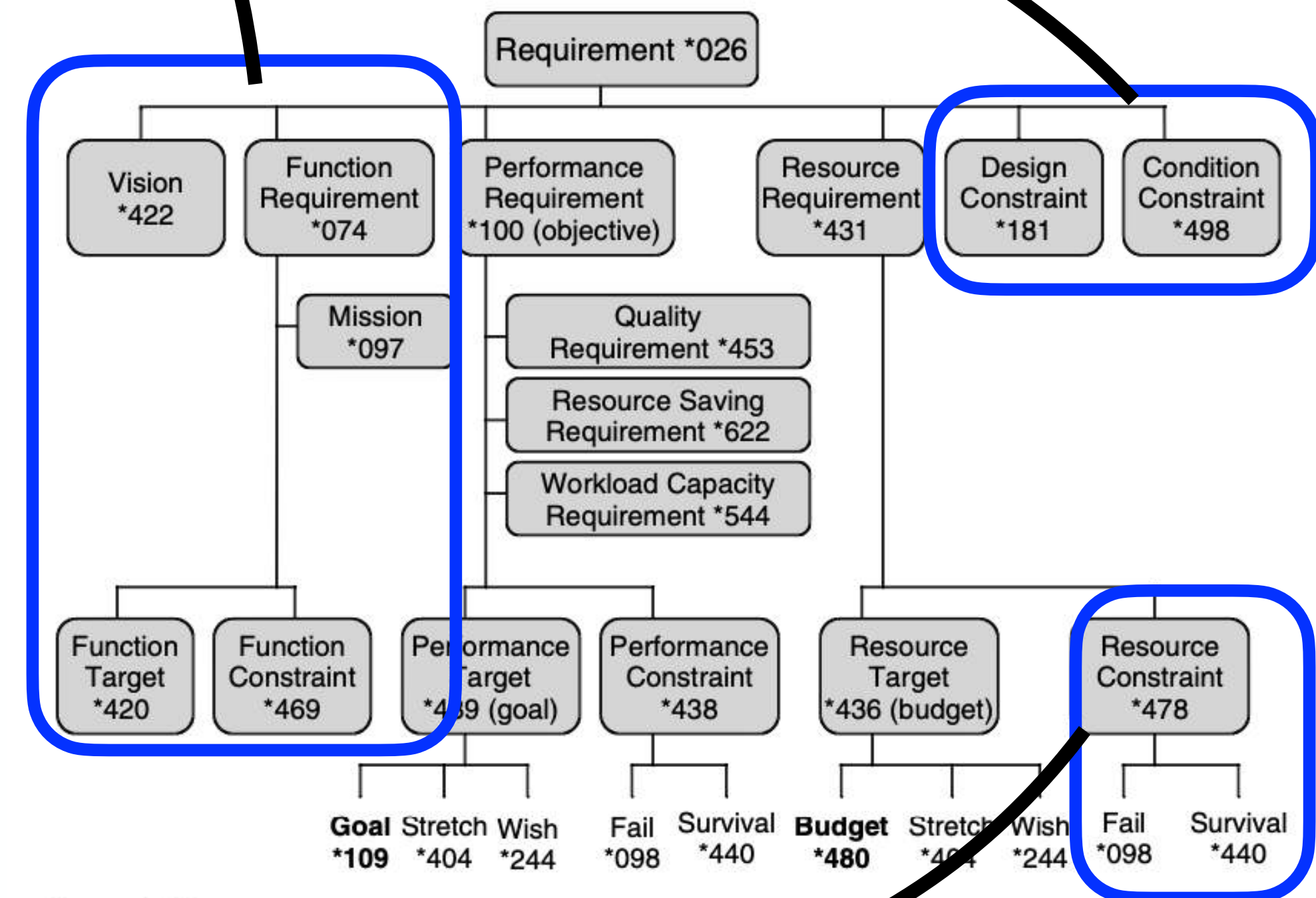
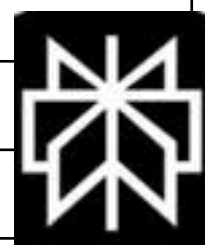


Figure G20 Requirement Concepts.

Figure 1.2. [CE]

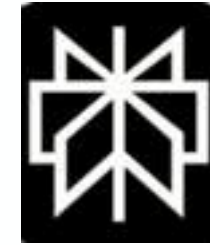
https://www.researchgate.net/publication/237129623_Competitive_Engineering_A_Handbook_for_Systems_Engineering



Value Lost if we only do 'User Story' requirements

“60-70% of critical needs for the 20 Value levels would be inadequately expressed or entirely lost if confined to user story format.”

Based on the information provided in the search results (see Presenter Notes) and my understanding of user stories and critical healthcare requirements, I estimate that a significant percentage of critical needs for the 20 Value levels would be lost if expressed only as user stories. Here's my analysis:



5. Safety-critical systems: Healthcare systems, especially in hospitals, are safety-critical. **User stories may not adequately capture the rigorous safety requirements and fail-safe mechanisms needed in such environments[4].**

1. Complexity of healthcare systems: The search results highlight the **complexity of healthcare systems, especially in pediatric settings**. User stories, while valuable for capturing user needs, may not adequately express the intricate relationships and dependencies in healthcare processes[1][3].

6. Interoperability requirements: Healthcare systems often need to integrate with various other systems and databases. **These technical interoperability requirements are challenging to express in user story format[3].**

2. Quantitative metrics: Many **critical healthcare requirements involve specific quantitative metrics**, such as infection rates, medication errors, or patient wait times. User stories typically focus on qualitative experiences and may not capture these precise measurements effectively[2].

7. Long-term care and transitions: The search results emphasize the importance of managing long-term care and transitions between pediatric and adult care. **These complex, long-term processes are difficult to capture in the typically short-term focus of user stories[3].**

3. Regulatory and compliance requirements: Healthcare systems must adhere to strict regulatory standards and compliance requirements. These often involve **technical specifications and legal language that are difficult to express in the simple format of user stories[3].**

Given these factors, I estimate that approximately 60-70% of critical needs for the 20 Value levels would be inadequately expressed or entirely lost if confined to user story format. This high percentage reflects the unique challenges and complexities of healthcare systems, particularly in pediatric settings, which require more comprehensive and specialized requirement specification methods.

4. Specialized medical knowledge: Many healthcare requirements involve specialized medical knowledge and terminology. **User stories, designed to be understood by non-technical stakeholders, may oversimplify these complex medical concepts[1].**

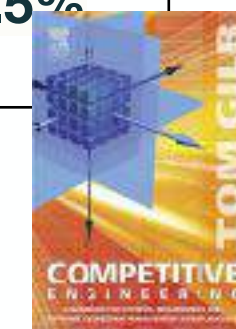
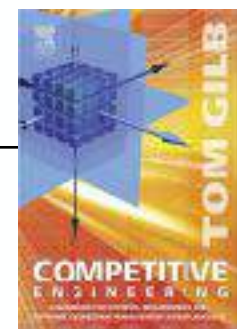


How good are the Requirement methods, for the 'ten RE Qualities' ?

We believe that AI does not know enough about these methods yet. But we are close.



Quality \ Method	User Stories	Volare	Planguage	QFD	Use Cases	CE	CMMI	PRINCE2	NAF	ISO/IEC/IEEE 29148:2018
Clarity (98%)	●●●●●●●● 90 %	95 %	95 %	85 %	90 %	95 %	85 %	80 %	85 %	90 %
Measurability (95%)	●●●●●●●● 70 %	85 %	95 %	90 %	75 %	95 %	90 %	80 %	85 %	90 %
Traceability (99%)	●●●●●●●● 75 %	90 %	85 %	80 %	85 %	90 %	95 %	85 %	90 %	95 %
Flexibility (2 weeks)	●●●●●●●● 95 %	80 %	85 %	75 %	85 %	90 %	70 %	75 %	80 %	75 %
Consistency (99.5%)	●●●●●●●● 75 %	90 %	95 %	85 %	85 %	95 %	90 %	85 %	90 %	95 %
Completeness (98%)	●●●●●●●● 80 %	95 %	90 %	90 %	90 %	95 %	95 %	85 %	90 %	95 %
Feasibility (99%)	●●●●●●●● 85 %	90 %	95 %	95 %	90 %	95 %	90 %	90 %	85 %	90 %
Verifiability (97%)	●●●●●●●● 80 %	90 %	95 %	85 %	90 %	95 %	95 %	85 %	85 %	95 %
Security (<2 vulnerabilities)	●●●●●●●● 60 %	80 %	85 %	75 %	75 %	85 %	90 %	80 %	95 %	90 %
Interoperability (95%)	●●●●●●●● 70 %	85 %	90 %	85 %	80 %	90 %	90 %	85 %	95 %	95 %
Average %	●●●●●●●● 78 %	88 %	91 %	84.5%	84.5%	92.5%	89 %	83 %	88 %	91 %





Ten Qualities of Requirements Methods

Suggested by Perplexity AI. Good enough for our Requirement Methods judgement examples

Name	Ambition Level	Scale [Who, Where, Why, What, When]	Meter	Tolerable Level [When = 1 year]	Goal [When = 4 years]	Primary Stakeholders	CE Book References	VR Book References
Clarity	Crystal Clear	% of requirements [NATO personnel, all documents] understood without need for clarification	Independent review	80 %	98 %	Project Managers, Engineers, End Users	2.3, 8.2.1	3.4, 7.1.2
Measurability	Quantifiably Precise	% of requirements with clear, quantifiable metrics [All requirements, NATO projects]	Automated analysis tool	70 %	95 %	Systems Engineers, Quality Assurance, Commanders	4.2.3, 5.1	4.3.1, 9.2
Traceability	Fully Traceable	% of requirements traceable to source and impacted systems [All NATO systems]	Requirements management system	85 %	99 %	Systems Integrators, Auditors, Project Managers	2.4.2, 9.3	5.2.1, 11.3
Flexibility	Highly Adaptable	Time to incorporate major requirement changes [NATO-wide projects]	Project timeline analysis	3 months	2 weeks	Project Managers, Stakeholders, Engineers	7.3, 10.1.2	6.4, 12.2.1
Consistency	Logically Coherent	% of requirements without conflicts [Across all NATO military branches]	Automated consistency checker	90 %	99.5%	Systems Architects, Quality Assurance, Commanders	2.5, 8.4	3.3.2, 8.1
Completeness	Comprehensively Thorough	% of system aspects covered by requirements [All NATO military operations]	Gap analysis tool	85 %	98 %	Systems Engineers, End Users, Strategists	2.2.1, 4.4	2.3, 10.2
Feasibility	Realistically Achievable	% of requirements deemed technically and economically feasible [NATO budget and technology]	Expert panel assessment	90 %	99 %	Engineers, Budget Analysts, Project Managers	6.2, 7.1.3	7.4, 13.1
Verifiability	Easily Testable	% of requirements with clear verification methods [All NATO systems]	Test plan coverage analysis	80 %	97 %	Test Engineers, Quality Assurance, End Users	8.3, 9.2.1	8.2, 14.3
Security	Highly Secure	Number of potential security vulnerabilities [In requirements documentation, NATO-wide]	Security audit	<10	<2	Security Specialists, Commanders, Systems Architects	4.5, 8.5.2	9.1, 15.2
Interoperability	Seamlessly Compatible	% of requirements supporting cross-system integration [All NATO allies' systems]	Interoperability assessment tool	75 %	95 %	Systems Integrators, Allied Forces Liaisons, Engineers	7.2, 9.4.1	6.3, 16.1

This is a reminder of the 10 Requirement Qualities we started this talk with.

Summary

Using AI for Better Requirements SQM



AI is a powerful, current, and improving, tool for developing good requirements, and for teaching it.



Planguage is a complete ‘systems engineering’ requirements language suitable for our most demanding projects and enterprises



Planguage offers *patterns* to analyze complex systems of any kind, like “AI and Value Requirements” in the National Health Service

