SOFTWARE ENGINEERING RETHOUGHT

MaxKompetens Telia Handelsbanken QTEMA FORTNOX Småföretagens bästa vän ERICSSON SONY Tolpagorni product management CGI TimePeopleGroup

SERT Profile Project

Software•Engineering ReThought

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BLEKINGE TEKNISKA HÖGSKOLA · BTH ·

SERL Sweden
LEADING SOFTWARE ENGINEERING

KK-stiftelsen

background/introduction

(Tony Gorschek)

→ Engineer (first) / Problem Solver / Researcher

- Professor, PhD (Tekn. Dr.) Software Engineering, M.Sc. Computer Science + B.Sc. Business Administration
- 14 years in industry (6 start-ups, CTO, Senior Executive Consultant, Chief Architect, Technical Advisor, Developer, Product Manager/Business Analyst, Investor)
- 12 years in research (Technology Product Management, Requirements Engineering, Quality Assurance, Process Assessment and Improvement, Lean Product development, Value based product development)

AXIS COMMUNICATIONS DXC.technology Spotify VOLVO DOLBY ERICSSON ABB DAIMLER SPM International Software Product Management Board telenor Swedbank VOLVO IBM TRAFIKVERKET

blekinge institute of technology

SERL Sweden
LEADING SOFTWARE ENGINEERING

- Karlskrona/Blekinge/Sweden
- Pioneering software engineering education and research in Sweden
- 50+ researchers in software engineering
- BTH is **ranked 6th** in the world in the area of “systems and software engineering” (JSS-147-2019) **1st within EU**
- Wide range of competences – 10+ nationalities (4+ Brazilians!) ;)
- Empirical research (in collaboration with industry)
- Ongoing projects with 30+ companies continuously

software engineering

"standards" HCI continuous delivery "lean" "agile" ISO test-driven specification

test cases SAFe models automation machine learning SOA value-based

specification DevOps **"WAYS of WORKING"** ***code*** implementation proposals

algorithms "put in your [hype] here" methods visualization

documentation backlog frameworks

tools compliance

EFFECTIVE

EFFICIENT

SCALABLE

requirements engineering development

configuration portfolio business analysis architecture

verification & validation design **coding** analysis planning & leading

estimation integration technology

commissioning tendering & acquisition governance maintenance & evolution

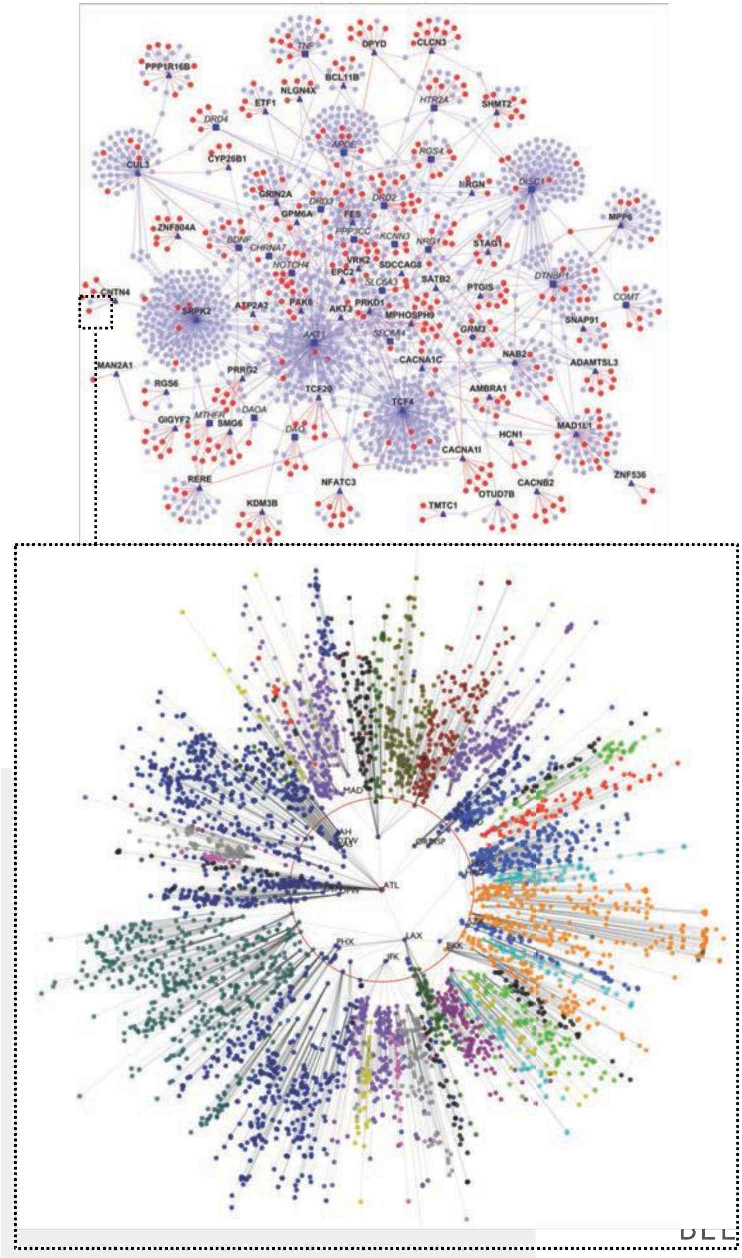
human factors

(pic: Paranay/Wallgren)

Challenges

when we create or use products and services

challenges software based products and services



6 Macro-challenges in software engineering

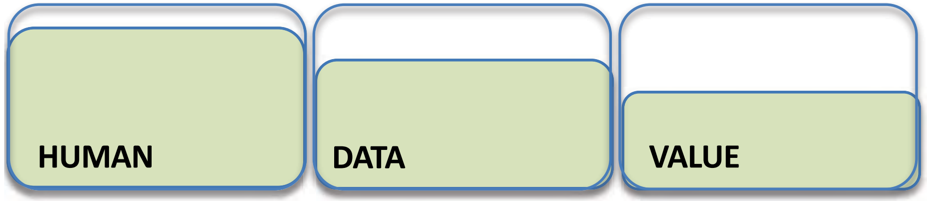
- → Size and Complexity (CH1)
- → Product Development and Release Speed (CH2)
- → Product Emergent Properties (CH3)
- → Product Lifespan (CH4)
- → Product Non-functional Aspects (CH5)
- → Product and Process Value (CH6)

→ Future SW = ***MORE*** → *defects, requirements, systems, size, complexity, technical debt, coordination and communication, challenges, security, compliance, threats, maintenence, complex development organizations, larger teams, more dependencies between organizations…*

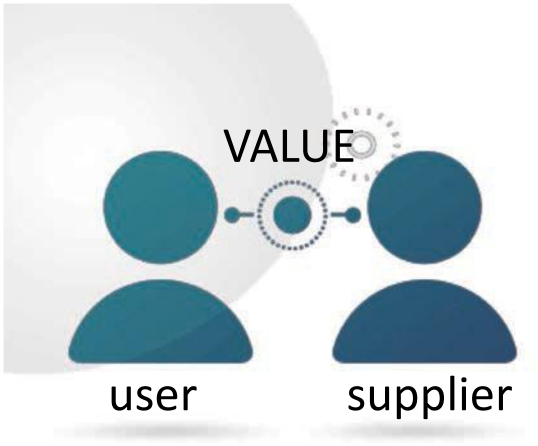
We need to **change** the way we **engineer Software** in a **radical** way to **meet the challenges** of the next 20y

research agenda

preparing the solutions for tomorrow (first three directions...)



human and user based software development



→ Use **massive** user and system to system **data** (interaction, measurement, behaviour, activity, telemetrics) **to guide**:

- Feature SELECTION
- Quality NEEDS
- Define VALUES (priority)

→ Continous experimentation and learning (next gen. continous delivery)

→ Establish **VALUE based testing** (move from code to value focus in testing)

→ Requirements **AUTOMATION** (verification and validation)

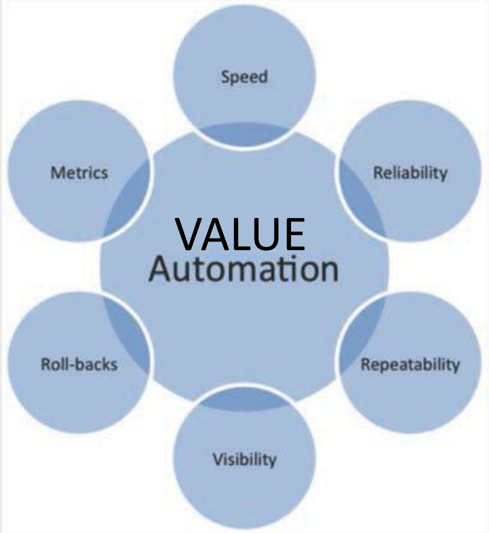
→ STANDARDs/**COMPLIANCE** automation and VALUE measurement

→ Feature REMOVAL strategies and acceptance

→ Preventive planning for product evolution and total cost of ownership including **asset VALUE** (Technical debt management)

HUMAN DATA VALUE

scalable and value based engineering



→ Quantify and qualify VALUEs

- Ability to TEST both INTERNAL and EXTERNAL **Value types**

→ **Value based testing and AUTOMATION** (selection and prioritization of WHAT to test based on VALUE impact)

→ Develop ACCEPTANCE CRITERIA for:

- Learning systems with **emergent properties**
- Un-planned massive systems interaction
- Complex requirements – SAFETY/SECURITY/COMPLIANCE

→ Automate testing for complex requirements

→ **Human – Automation interface** (assuring new techniques for trust, human understandability in complex systems development and development automation)

→ Analysis tools for Automation (test) results

→ **Human-Machine/Automation symbiosis** in engineering

HUMAN

DATA

VALUE

elastic lean engineering

- → **CONTEXT AWARE** Agile/LEAN/DevOps/SAFe (next generation of flexible management of engineering)
- → Active and continous WASTE identification and removal
  - Waste metrics
  - Separate Waste from *Overhead*
  - Waste warning automation
  - Waste based process change (**evidence based**)
- → **ASSET Value control** (measure, control and correct “technical debt” during product evolution)
- → Total cost of ownership (TCO)
- → **Human based** engineering (productivity of engineers)
- → END – to – END software engineering
- → Organization – Team – System architecture optimization to manage interfaces and interface overhead
- → **LeaGile 2.0**… **SCALABILITY**
- → What works over ”cook-book” recepie

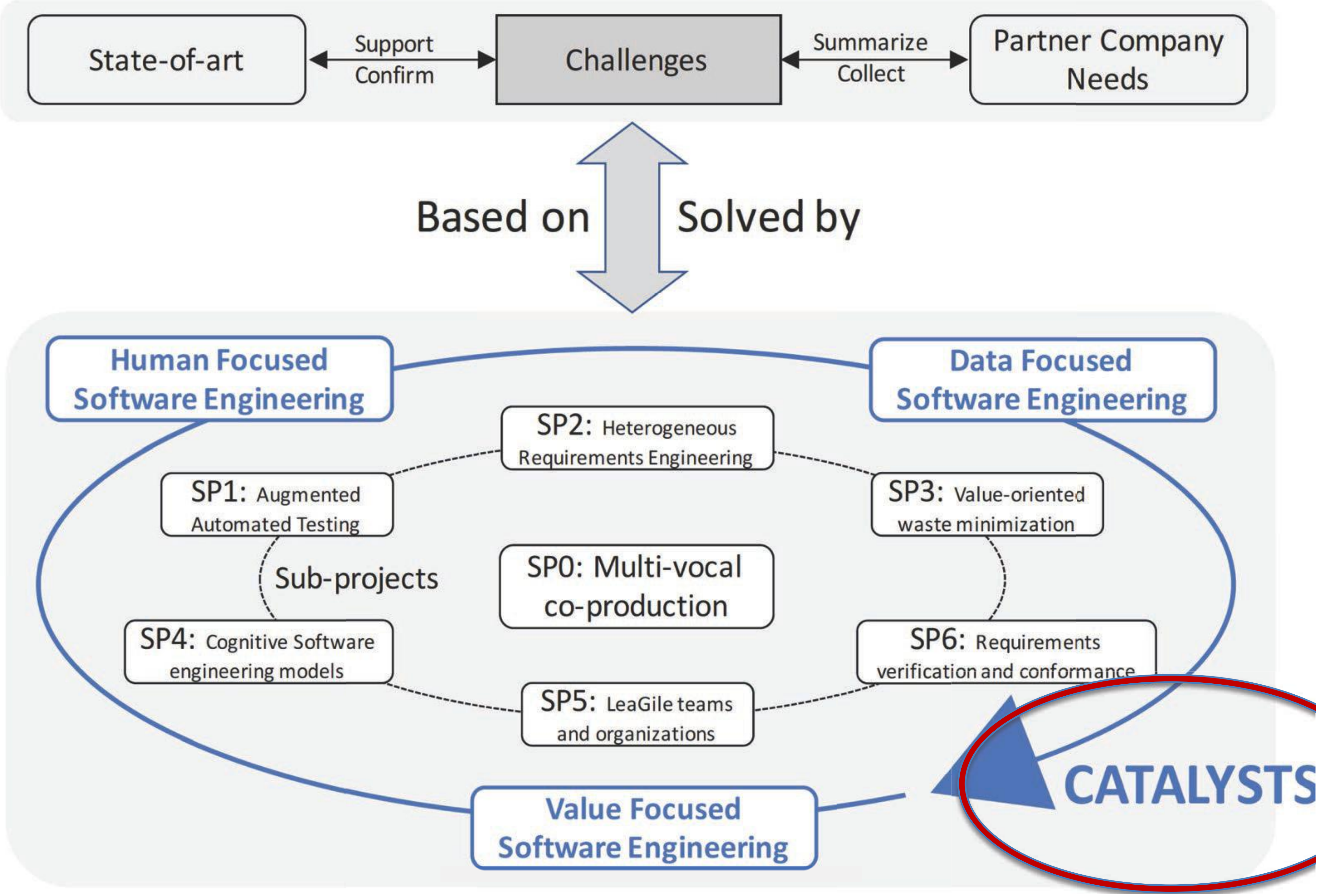
”SERT = Software Engineering ReThought”

… so… what are we “rethinking”

SERT Profile

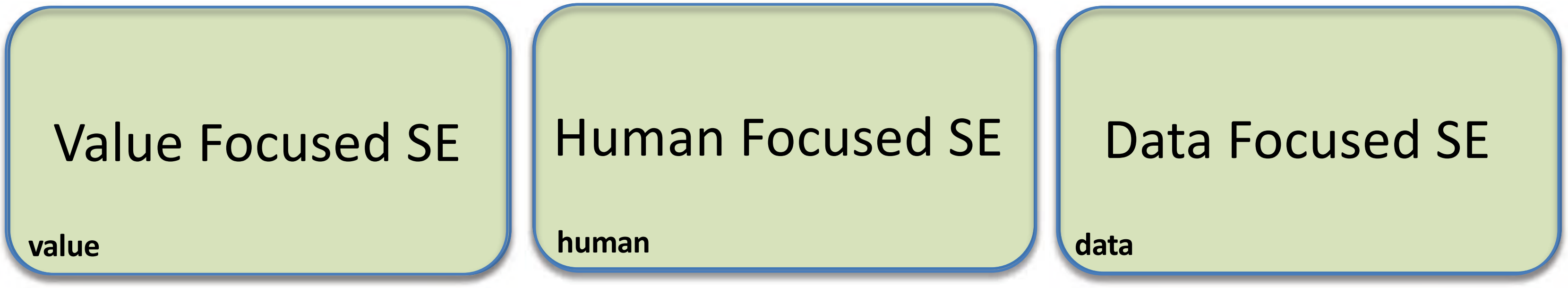
SUB-PROJECTS – Concrete start…

Challenges for the Next Generation Software Engineering


State-of-art
Support
Confirm
Challenges
Summarize
Collect
Partner Company Needs
Based on
Solved by
Human Focused Software Engineering
Data Focused Software Engineering
SP2: Heterogeneous Requirements Engineering
SP1: Augmented Automated Testing
SP3: Value-oriented waste minimization
Sub-projects
SP0: Multi-vocal co-production
SP4: Cognitive Software engineering models
SP6: Requirements verification and conformance
SP5: LeaGile teams and organizations
CATALYSTS
Value Focused Software Engineering

Software Engineering is an applied engineering science and needs to adapt to solve future challenges

CATALYSTS



Value Focused SE

value

Human Focused SE

human

Data Focused SE

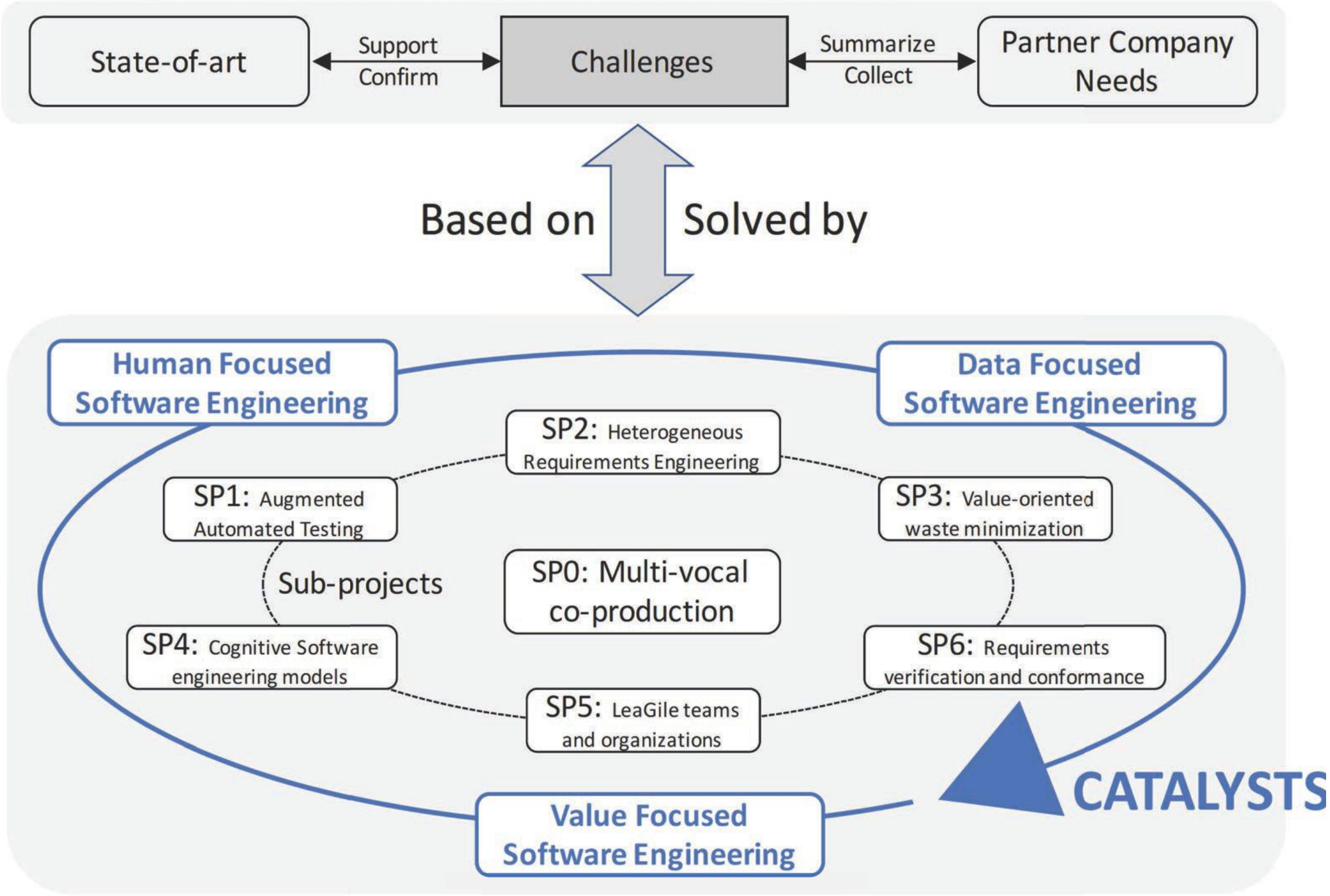
data

Value/Waste
Business Economy
Measurement
Lean
VBSE
Non-functional asp.

Cognition
Psychology
Org./Team
Arch. vs Org.
Non-functional asp.

Application of ML on SE challenges
Data-driven
Continuous
Evidence based

Challenges for the Next Generation Software Engineering



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CATALYSTS

Value Focused Software Engineering

(initial) Sub-projects

SP1 : Augmented Automated Testing: leveraging human-machine symbiosis for high-level test automation.

Meaningful automation
Automation ROI
Human-Automation optimization

SP2: Heterogeneous multi-source continuous requirements engineering.

ML/AI based harvesting of req./data/ intelligence irt product development

SP3: Value-Oriented Strategy to Detect and Minimize Waste. **[BASE]**

WASTE identification, Real Lean
Technical debt / Asset degradation mngmt

SP4: Cognitive software engineering development models. **[BASE]**

Maximize human potential in engineering
Human – machine symbiosis

SP5: Study and Improve LeaGile handling of organizational and team interfaces.

Real™ LeaGile! WASTE – VALUE – OH
SCALABILITY // VALUE BASE // Tech/org…

SP6: Verification of Software Requirements in Dynamic, Complex and Regulated Markets.

Applied human augmentation through meaningful automation (applied compliance…)

(selected) planned new projects start 2018

SP1 : Augmented Automated Testing: leveraging human-machine symbiosis for high-level test automation.

Meaningful automation
Automation ROI
Human-Automation optimization

High-level test and automation of the same. Possibilities to automate in the case of “value based” testing, i.e. how to actually test the “value”/”benefit” of a feature vs. today’s “is it there” and “does it work as intended”…
How do we ensure that the the right thing is automated in the right way to maximize the developer’s potential?

SP2: Heterogeneous multi-source continuous requirements engineering.

ML/AI based harvesting of req./data/ intelligence irt product development

How do we ensure that we use DATA-driven (less subjective) interpretations of requirements and needs with regard to a product or service? How do we perform a scalable analysis that actually yields useful information about WHAT to do/deliver in a product/service with regard to many data sources that look different, how can this be ”automated” and which parts need to be manual, as well as addressing interfaces between automation and human…

(selected) planned new projects start 2018

SP3: Value-Oriented Strategy to Handle Software Asset Degradation

WASTE identification, Real Lean
Technical debt / Asset degradation mngmt

Technical debt or, for a better concept, ”management of assets/results”, is a fundamental problem. Everything, from code to test cases, to competence, knowledge, and organisation, as assets/resources. How should these be constructed, which should be maintained and when, when is it ok that they degenerate considering the product lifecycle… How can this be measured and how can hidden degradation be avoided…

SP4: Cognitive software engineering processes

Maxmize human potential in engineering
Human – machine symbiosis

The human (developer) is extremely capable in certain areas (analysis, context, interpreting needs/meaning) but not very capable at tasks that cognitively taxing (repetitiveness, large amounts, etc). We must take the next step i tools, HCI, automation, where we take this into account and scale away things that humans are not good at in order to free resources for things where humans perform well!

(selected) planned new projects start 2018

SP5: Study and Improve LeaGile handling of organizational and team interfaces.

Real™ LeaGile! WASTE – VALUE – OH SCALABILITY // VALUE BASE // Tech/org…

Many good initatives and thinking around ”agile” (e.g. devops, safe)… but there are fundamental challenges that no-one has solved regarding scalability and having ”agility” at the whole organisation level (from CEO to support of a technical module). The solution lies in not only considering organisation and ways of working, but also architecture, technical and virtual APIs – we need to proceed to the next scalable generation of ”agile” …

SP6: Verification of Software Requirements in Dynamic, Complex and Regulated Markets

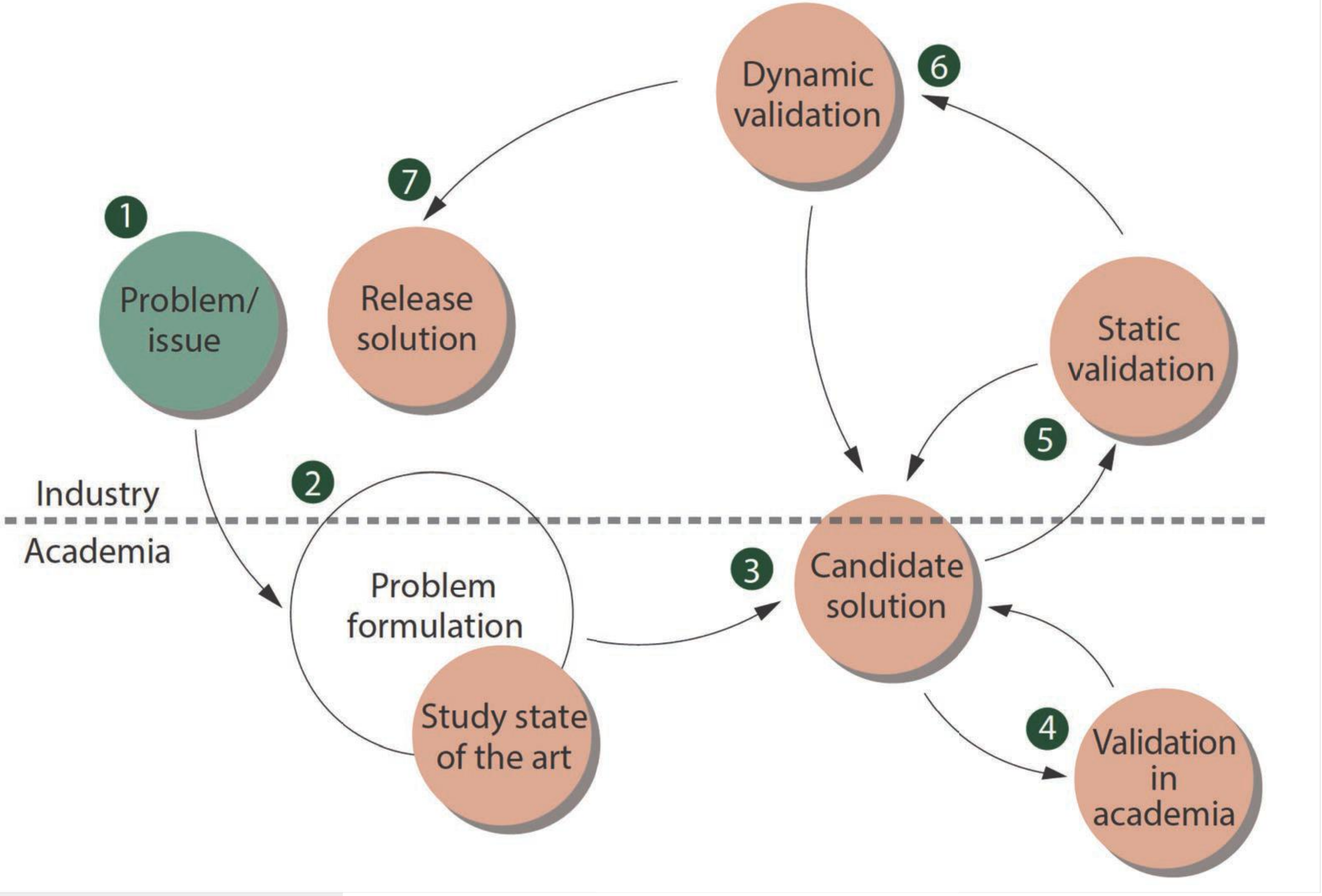
Applied human augmentation through meaningful automation (applied compliance…)

How can we handle quality assurance in complex environments where it is central to follow laws/regulations/standards/etc without overloading develpers and analysts with large manual effort. To what extent can we scale away and provide decisions support and automation for concepts like ”compliance”

”Software Engineering ReThought”

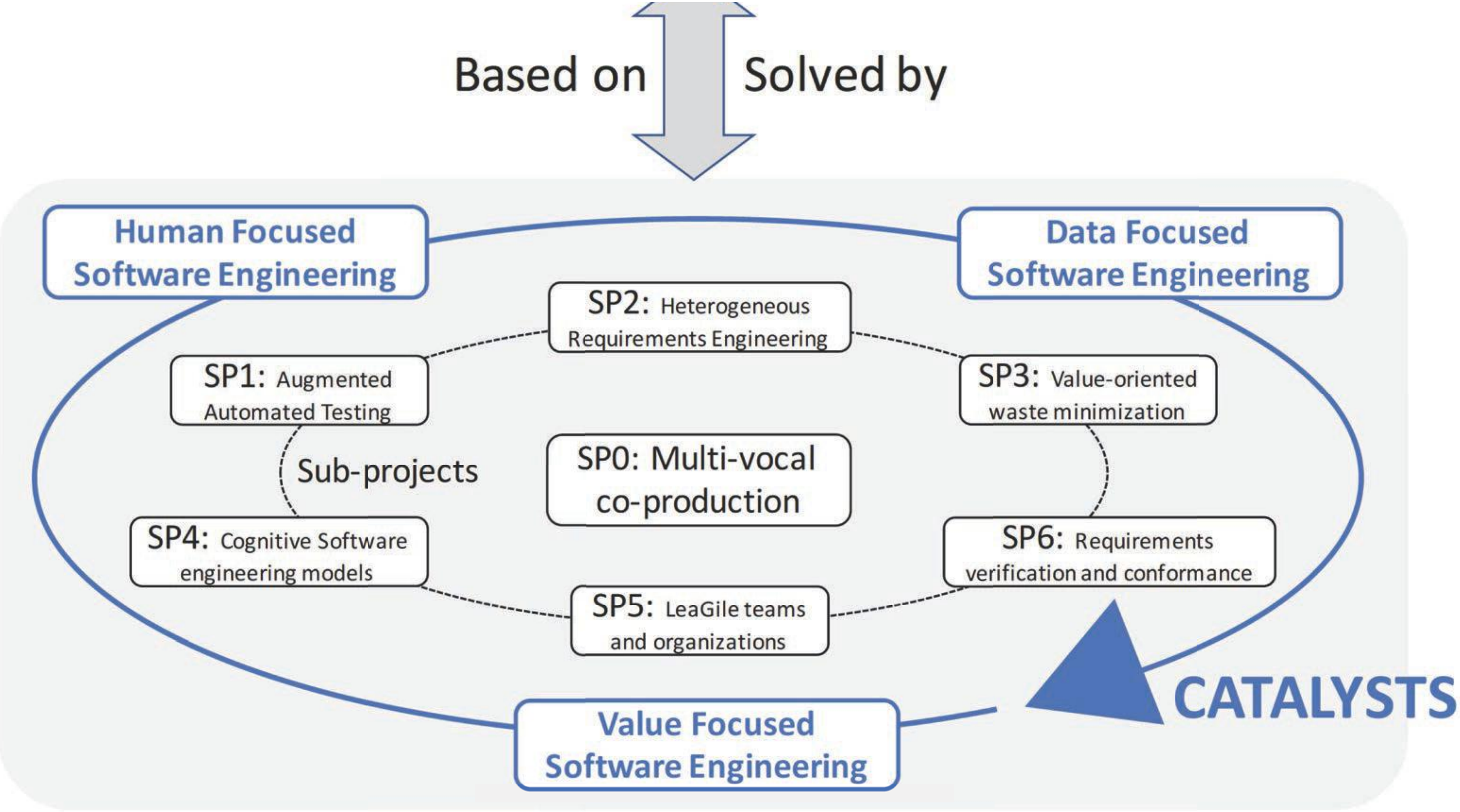
… what are we “rethinking” PART II

(how we do research) 3rd gen empirical SE



<u>RESEARCH PROFILE</u> consisting of individual sub-projects that run and adapt over time…

8y running, 12 industrial partners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want to hear more?

Currently we are looking for people to join out TEAM.
(now and over a 5y period)

PhD Students (5y, great salary and benefits)

PostDocs (1-3y, 80% research)

Junior Associates (tenure track)

Senior Associates (tenure)

If interested send me an email: **tgo@bth.se**