



# Value-driven Requirements Engineering for the 21<sup>st</sup> Century

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# Outline

- 21st Century?
- Requirements
  - from value
  - from network transactions
  - from network relations
- Tech transfer

# 21st Century? What's the problem?

- **Fragile value chains:** Single points of failure, chokepoints
  - **Economic inequality:** Big Tech, the super rich
  - **Energy use:** Fossil fuels, locations for solar cells and windmills
  - **Pollution:** Rare-earth materials mining, greenhouse gas exhaust, waste
- 
- These phenomena pose requirements for products & services!
  - How?
- 
- ➔ Network phenomena
  - ➔ Economic phenomena
  - ➔ Physical phenomena



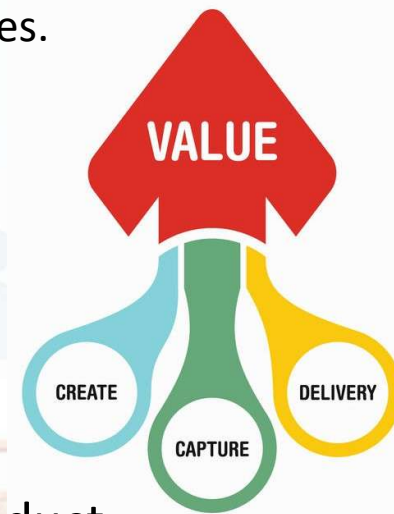
# Requirements Engineering



- RE is the activity of matching product properties with stakeholder desires.
- Eliciting desires
  - Always hypotheses
  - Stated, unstated, unknown desires
- Specifying properties for a matching product
  - Always hypotheses
  - update as data from tests and experience becomes available

# Creating a product business model

- Matching product properties with stakeholder desires is the core of economics:
  - How to match supply and demand in a world of infinite desires and finite resources.
- Each product has a business model: a conceptual model of
  - how the product **creates** value for the user,
  - how this value is **delivered** to the user, and
  - how the provider **captures** value from this.
- → Product requirements must align with the business model of the product.



# Example



- Spotify

- Value creation: music streams, podcasts, recommendation
- Value delivery: Content Delivery Network, user devices
- Value capture: ad fees, subscription fees, rich data

→ Requirements on

- Streaming speed,
- Data formats,
- Sampling rate,
- Rec algorithms, ...

(nonlinear process)

- Any counterexamples?

- Any requirements not at the interface of supply and demand?

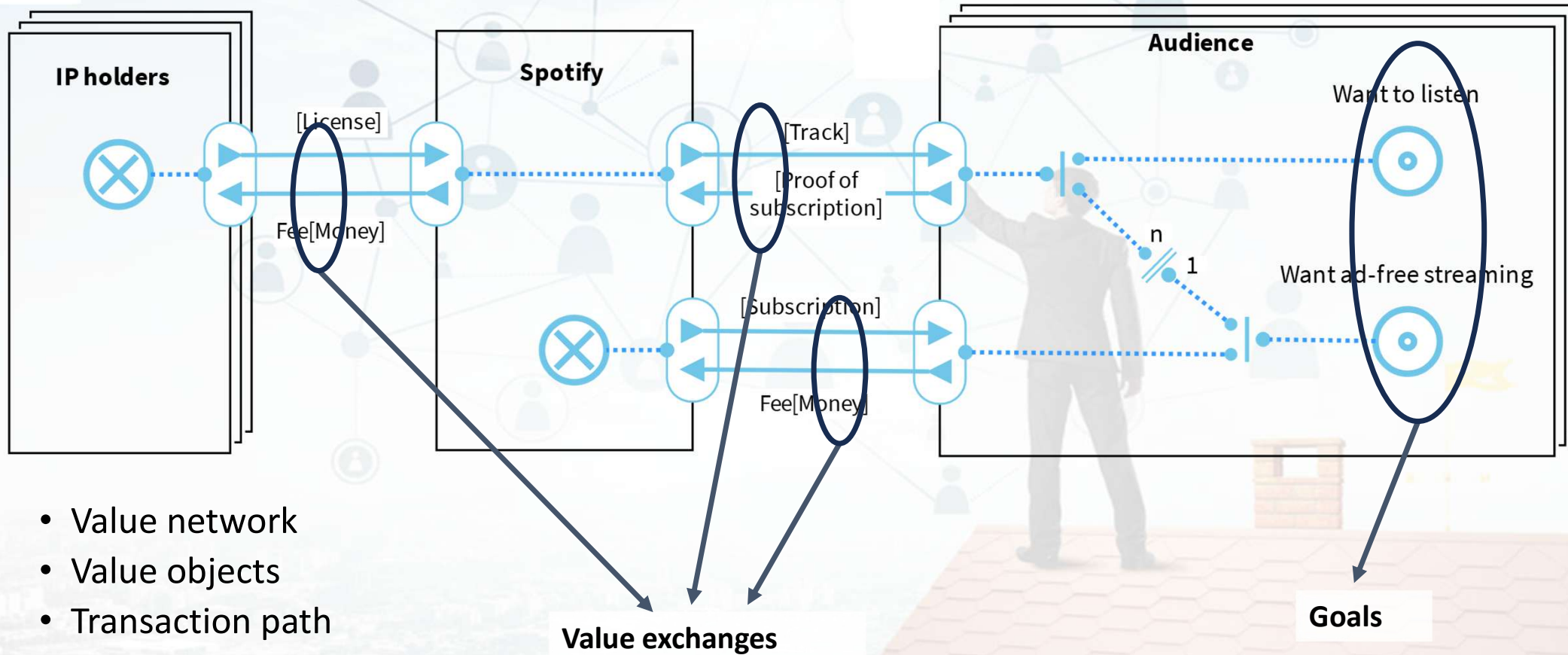
- Count to 10 ...

# Some terminology: Values and goals

- **Value** = desirability
- Product **requirements** = product properties that support stakeholder goals
- **Goal** = desire for which the stakeholder wants to sacrifice something
  - This enables economic exchanges
  - You may form the goal to purchase a product before or after seeing the product
- The buyer having a goal is one of the conditions for an economic exchange
- Let's focus on these exchanges first

# Requirements from value exchanges

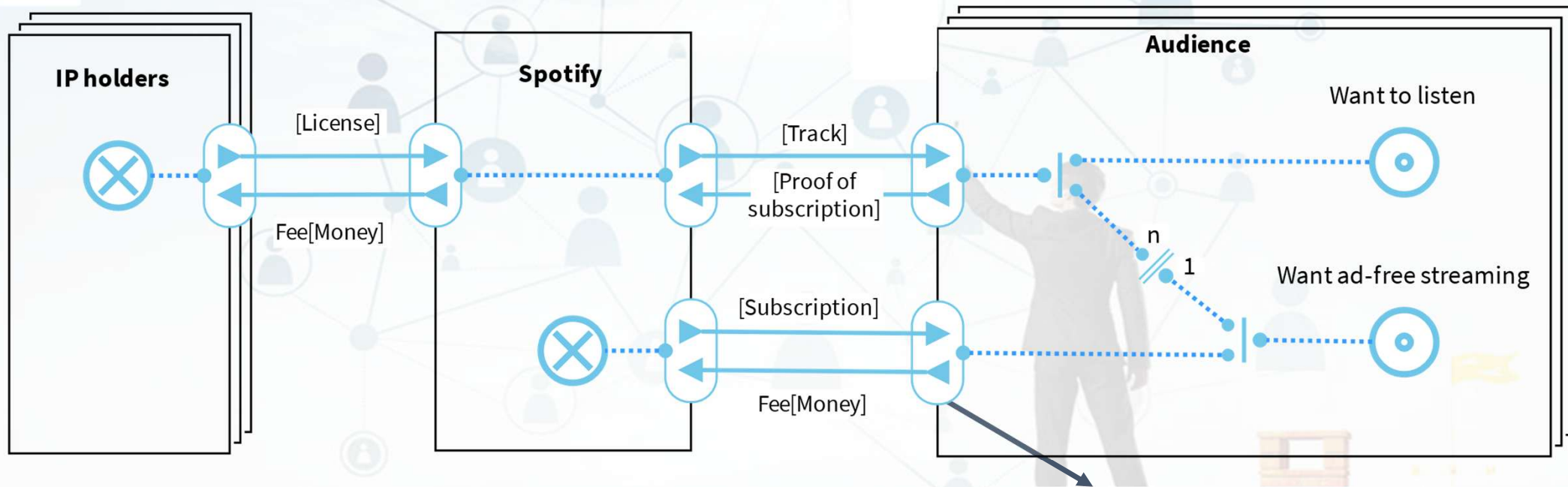
*E3value* notation



- Value network
- Value objects
- Transaction path

# Requirements from value exchanges

*E3value* notation

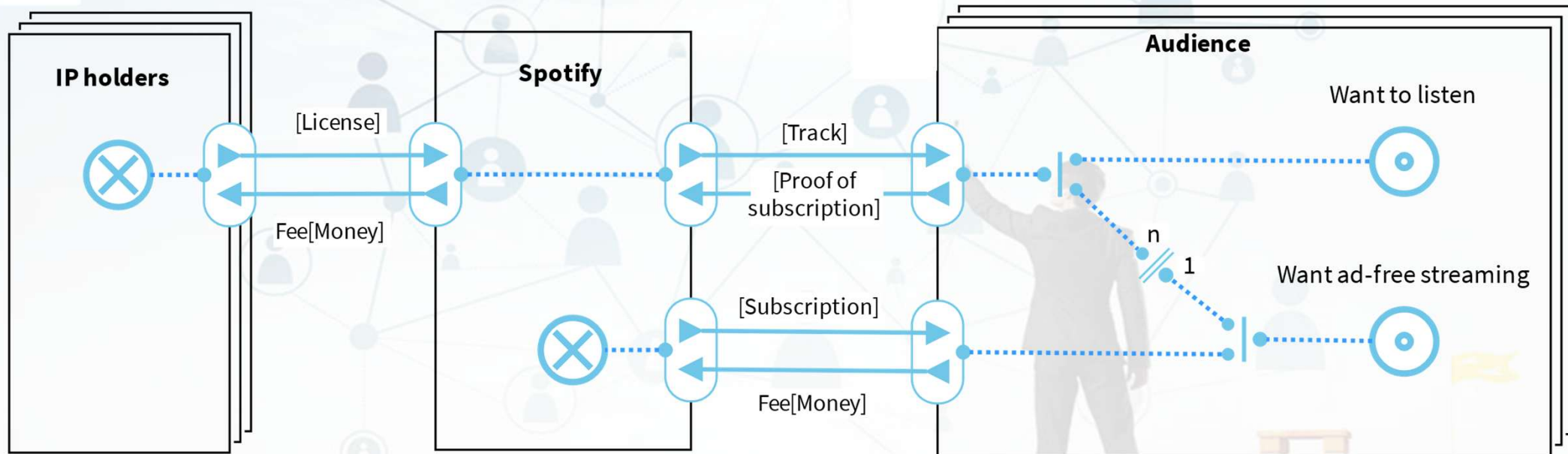


- Measurement of value objects
- Consistency across transaction path

**Business value interfaces**

**Can be described as use cases. Basis for data model, APIs, coordination protocols.**

# Value analysis



- Specify investments, fixed & variable expenses, revenues
- Market size, frequency of transactions
- ➔ Investment analysis

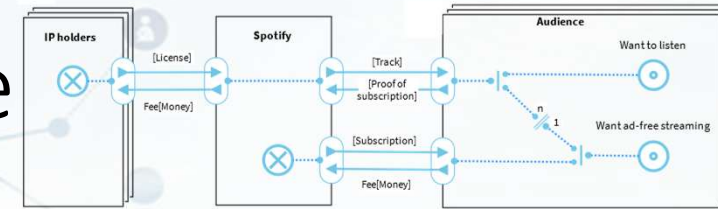
# *E3value* is for nerds

- Software engineers
- Electrical engineers
- Systems engineers
- Requirements engineers

Engineers

A man in a dark suit stands on a rooftop with a brick floor, pointing his right hand towards a large, complex network diagram. The diagram consists of numerous blue and grey human icons connected by thin lines, representing a network of people. The background shows a cityscape under a bright sky. The word 'Engineers' is written in black text below the man.

# Speak the language of your audience



## For architects:

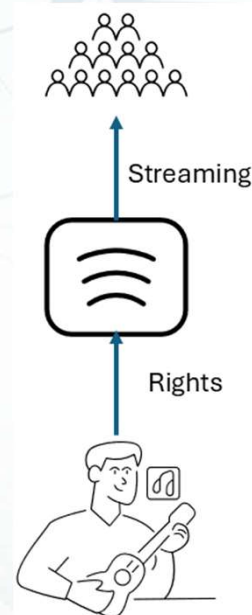
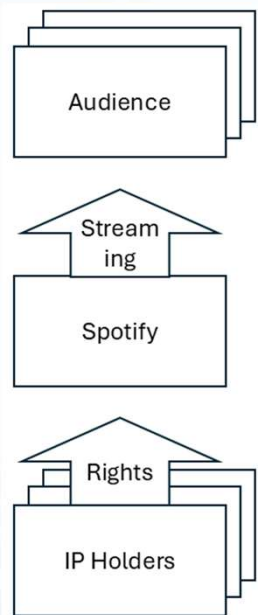
- Who participates
- What business services

## For managers:

- What are we talking about?
- Stakeholder interests?

## For decision makers:

- Required investment?
- Fixed, variable expenses, revenues?
- Market size?
- Payback period?



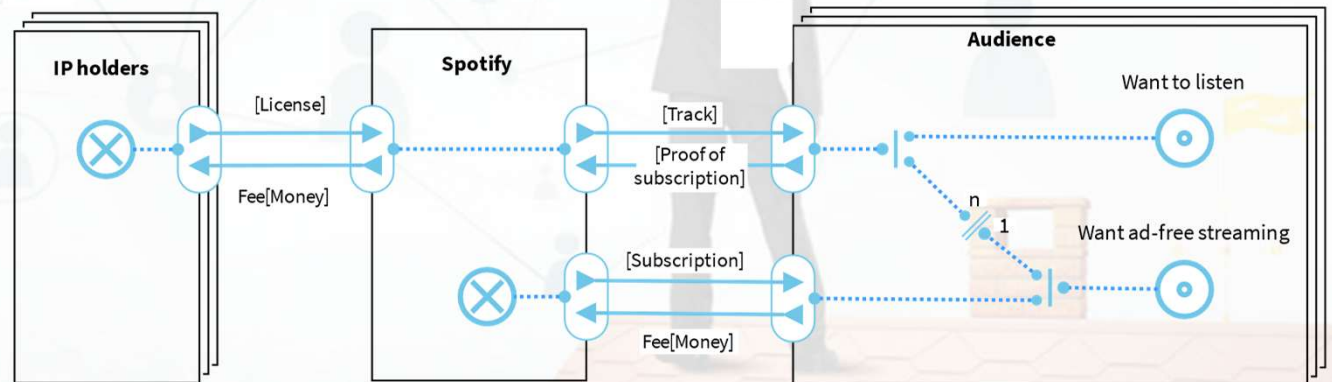
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
<b>Audience</b>							
size		24000	48000	75000	100000	125000	150000
Subscriptions/subscriber		1	1	1	1	1	1
Subscription fee/year		120	120	120	120	120	180
<b>Spotify</b>							
Royalties		3000000	6000000	9000000	12000000	20000000	30000000
Net revenue		-120000	-240000	0	0	-5000000	-3000000

# Speak the language of your audience

## For all stakeholders:

- “Spotify pays IP holders a fee for streaming their music.”
- “Subscribers pay a yearly fee for streaming as much music as they want.”

Remember  
Bertrand Meyer – “On formalism in  
specifications”, IEEE Software 1985.



# Companies are networks



- Requirements do not exist in a vacuum. Neither do businesses.
- Modern companies are networks of value exchanges
  - Amazon, Google, Microsoft
  - Shell, Ikea, Walmart
  - SMEs and freelancers collaborate & compete in networks
- And they are embedded in even larger value networks

# Requirements must be network-oriented

- The products or services we specify the requirements of are exchanged in value networks.
- If they are to be successful, it must support the **survival and well-being of at least some stakeholders** in these networks...
- and should not make other stakeholders miserable or extinct.

# Some terminology: Business ecosystems

- **Value network** = economic entities that exchange value (physical, digital, conceptual, experiential, monetary) with each other
  - **Business ecosystem** = entities that depend on each other for their survival and well-being. Contains:
    - Innovation networks
    - Standardization networks
    - Value networks
    - Governance networks
- } This talk

# 21st Century? What's the problem?

- Fragile value chains: Single points of failure, chokepoints
- Economic inequality: Big Tech, the super rich
- Energy use: Fossil fuels, rare materials
- Pollution: Greenhouse gas exhaust, waste
- These phenomena pose generic requirements for any product!
- How?

**Can we develop requirements techniques for any of these domains?**

## **Here is a generic starting point:**

- ➔ Network phenomena
- ➔ Economic phenomena
- ➔ Physical phenomena

- **Map the value network in which your product is/will be exchanged**
- **Identify value objects: physical, digital, conceptual, monetary**
- **Define measurement units for these**
- **Simulate the network**
- **Assess distribution of value**
- **Adapt (required) product properties**

# 21st Century? What's the problem?

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## Research problems:

- **Patterns in value networks?**
- **Value object ontology?**
- **Which measurement units?**
- **Tools? Uncertainty?**
- **Fairness?**
- **Specification techniques?**

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# Not all value is transactional

- Purely economic actors are psychopaths.
  - Mafia economics: I do something for you; you do something for me.
  - Trumponomics: Optimize your own interest.
- *E3value* economics
  - Entities in a value network **collaborate to provide value** to customers. E.g. stakeholder capitalism.
  - But also: They collaborate to **extract** value from customers. E.g. Big Tech.
- What's missing from the transactional view of *e3value*: Relational value!
  - If there were no **people**: would there be morality? No. There must be actors who can be held responsible for their actions.
  - If people had no **relationships**: would there be morality? No. It would be a war of all against all.

# From transactional to relational value

- Some non-transactional value **can** be molded in the transactional frame:
    - Altruism: in exchange for mission compliance
    - Pollution: negative value
  - The following values **cannot** be molded in the transactional frame
    - Public goods & bads
    - Moral values: fairness, justice, trust, ...
    - Existential values: identity, reputation, brand loyalty
    - Cultural values: unspoken expectations, norms
- Relational values.**
- Not represented in transactional business models
  - Important source of requirements.

# Governance models manage relationships



- A **governance model** constrains and guides the evolution of a business ecosystem.
  - Entry requirements
  - Norms for participants, Quality norms, standards, laws
  - Rights of participants. Property rights, data access rights
  - Conflict resolution mechanisms
- **No business model without a governance model**
  - Business models need governance models that allocate interests so that the sum of egocentric actions adds up to a collective good.
- No requirements without a governance model

# The future of RE

A sunset over the ocean with a small boat on the horizon. The sun is low on the horizon, casting a golden glow across the sky and reflecting on the water. The water is a deep blue with gentle ripples. The sky transitions from a pale yellow near the sun to a soft blue at the top.

- Focus on **value**
  - Monetary value: expenses, revenue
  - Negative and positive value
  - Individual and collective value
  - Network value: transactional, relational
  - Normative: Rights, obligations
- Focus on **domains**

# Tech transfer

TVE are transferring the *e<sup>3</sup>value* business modeling methodology plus supporting tool *e<sup>3</sup>web* from academia to practice.

- What did not work

- Cold acquisition
- Complexity
- Evangelism for a technique

Conditions for a  
value exchange

- What works

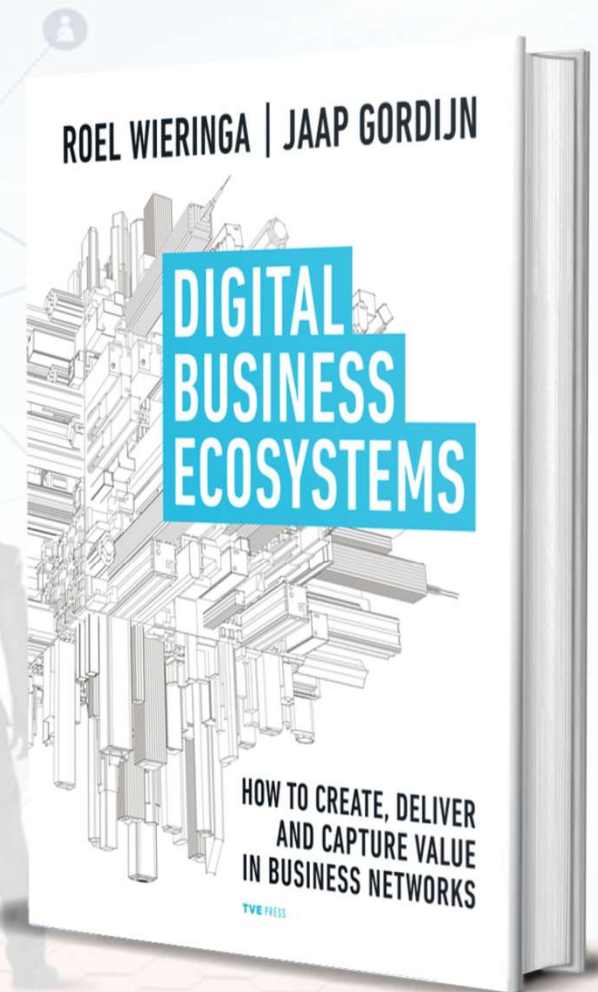
- A prior relation with potential customer
- Plus a felt problem (≠ we see a problem)
- Plus felt importance
- Plus budget
- Plus felt urgency by budget holder
- Plus perceived solution capability (our reputation)

Research results may take less than five years to produce, transfer to practice will take more than five years.



# Nutshell

- Requirements should be motivated by a business model
- Business models should describe a value network
- If this is not yet part of your teaching ... it should!
- There is an excellent textbook that you could use. We'll even give you the slides, case studies and exam questions!



<https://www.thevalueengineers.nl/>