

Deriving Requirements Using E3value and E3fraud Techniques

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Take-home message

- IT requirements must be justified by a business model

Motivation

- IT requirements must be justified by a business model
 - Modern business is e-business
 - IT networks, sensors, big data, AI, machine learning, robots, ...
 - IT requirements are business requirements
 - Software engineering is part of business engineering
 - Business engineering includes software engineering
 - → Value engineering

Business models

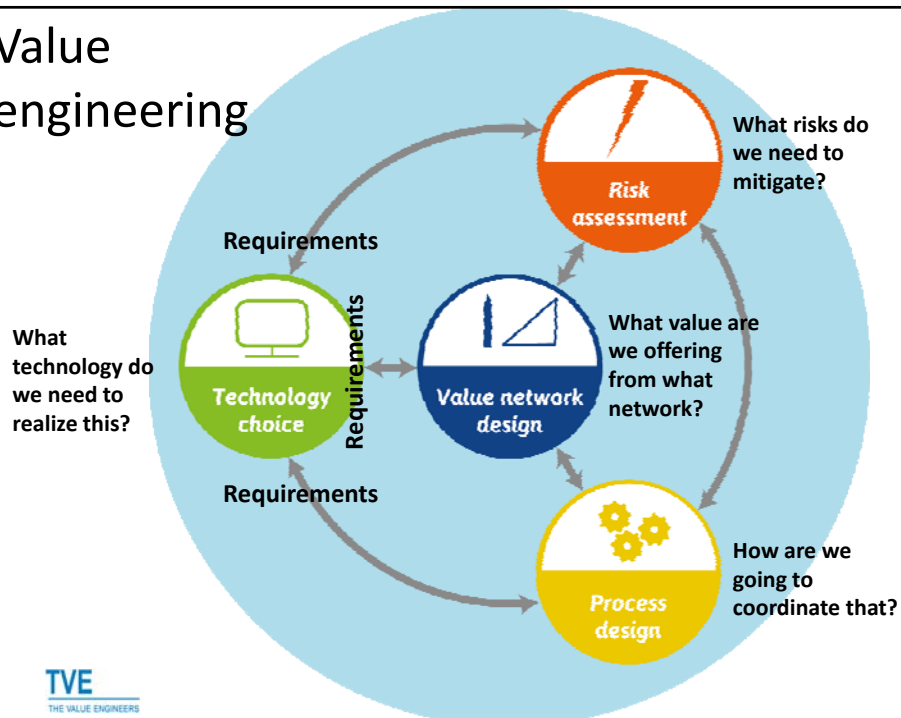
Wikipedia:

- A business model describes ... how an organization creates, delivers, and captures value ...

We:

- Expand a business model to a value network model
- Quantify: expenses and revenues
- Design: explore and analyse

Value engineering



Outline

1. Value network design
2. Technology choice
3. Process design
4. Risk assessment

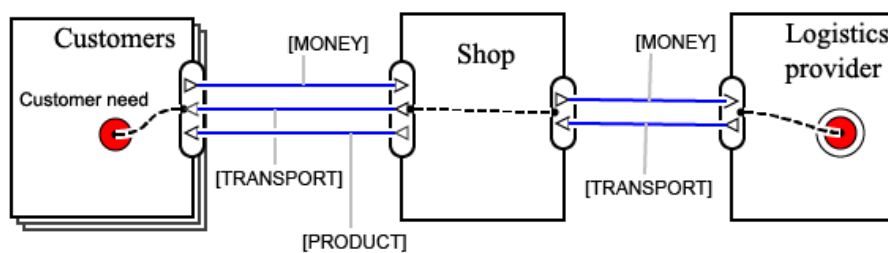
1. Value network design

- A **value network** is a set of interacting actors that produce value together
- Examples:
 - Cisco Systems
 - Dell
 - Electricity supply
 - Ikea
 - Online news provision
 - Uber
 - AirBnB
 - Spotify
 - Expedia
 - Bitcoin
 -

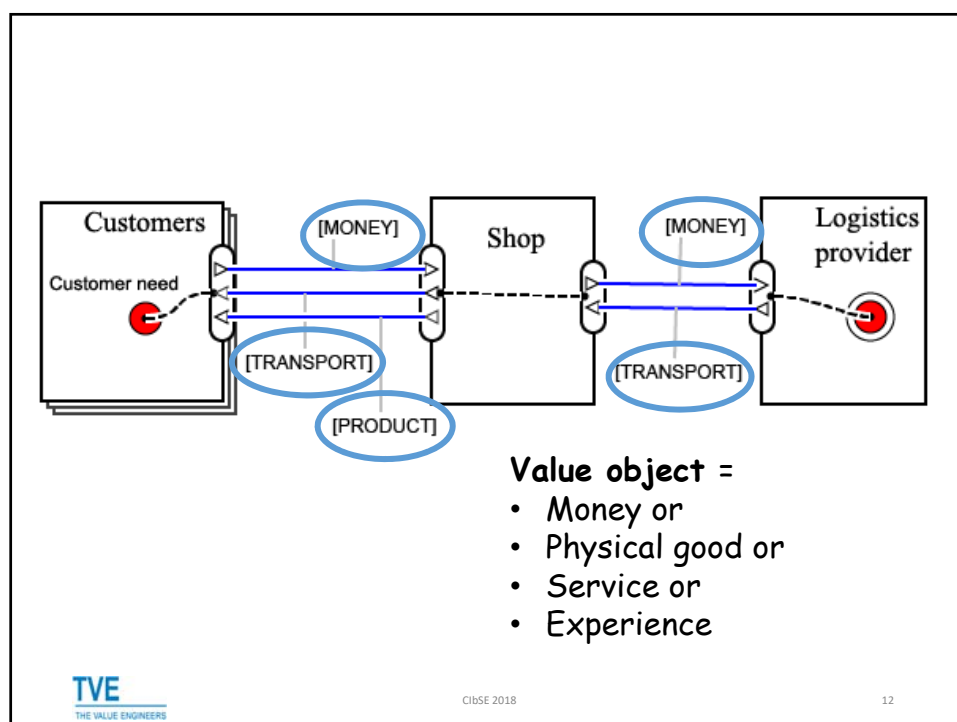
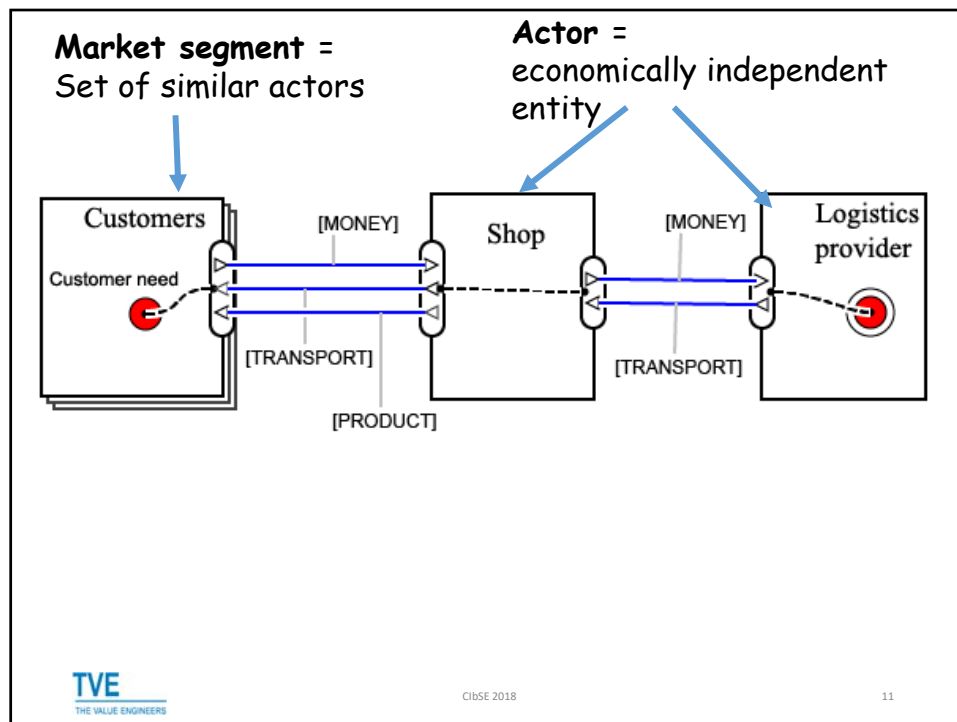
Problems of value network design

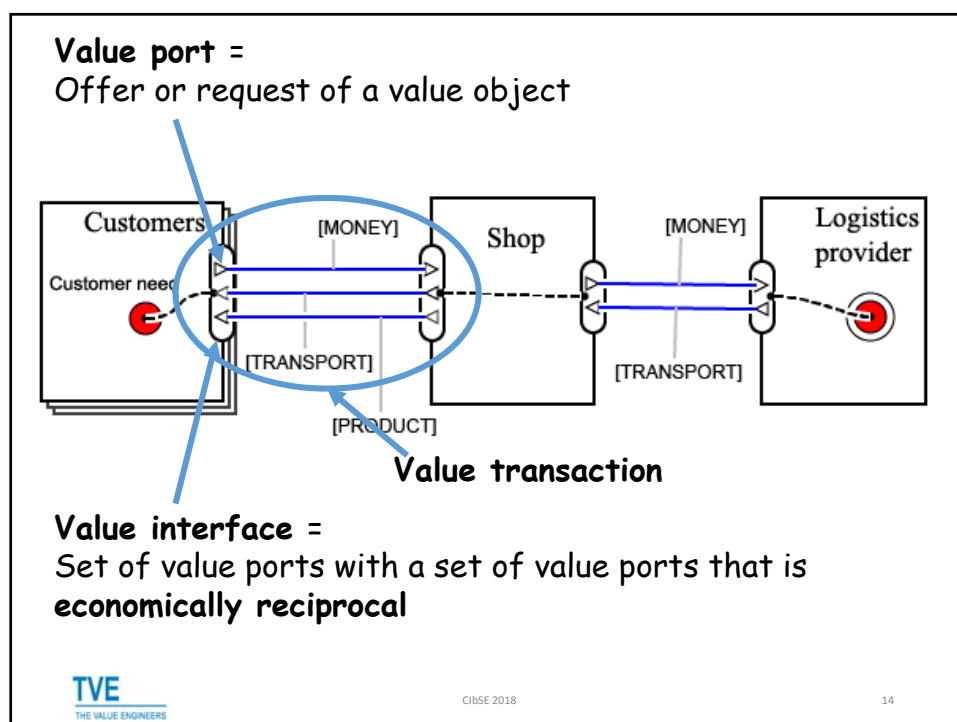
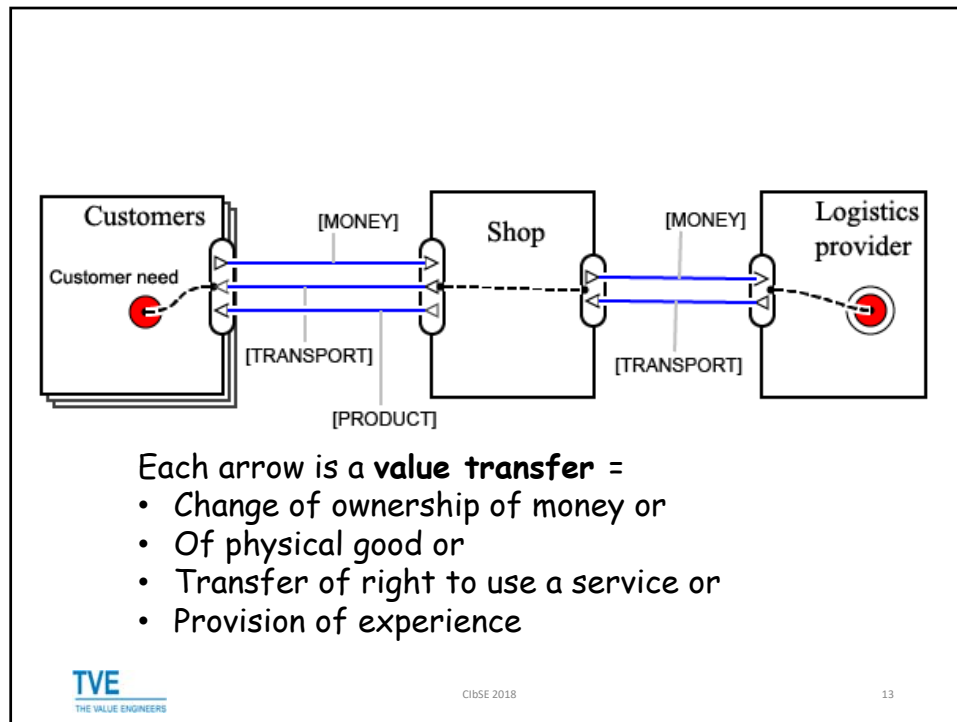
- Independent actors with independent, possibly conflicting goals
- Confusion about who delivers what to whom and what they get in return
- Economic feasibility
- Vulnerabilities introduced by network
- Coordination
- Technical feasibility
-
- → Need a shared understanding of the value network

An e3value model

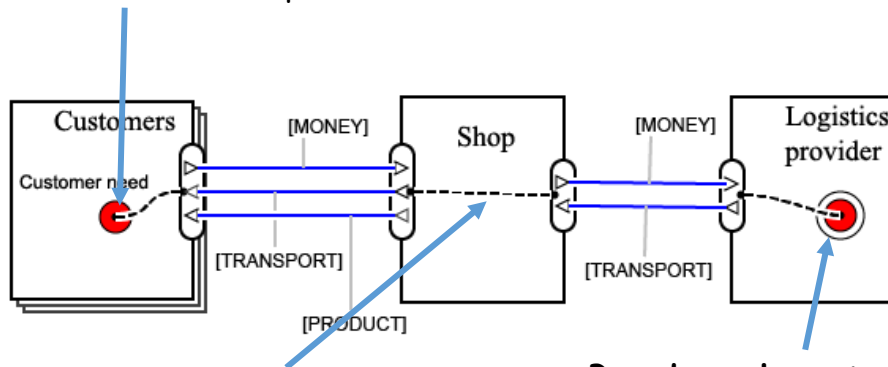


- Customers buy product and transport from a shop.
- To provide the transport service, the shop buys this service from logistics provider



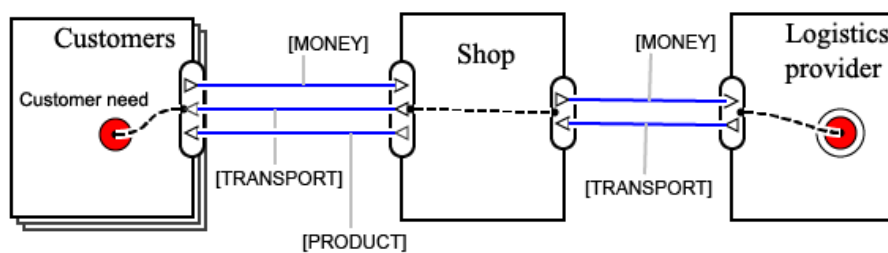


Consumer need =
a state of felt deprivation of some basic satisfaction



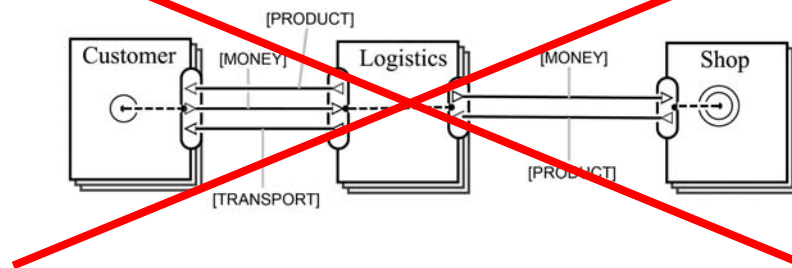
Dependency path =
And/or graph that connects all transactions needed to satisfy a consumer need

Boundary element =
Indication that we are not interested in other transactions

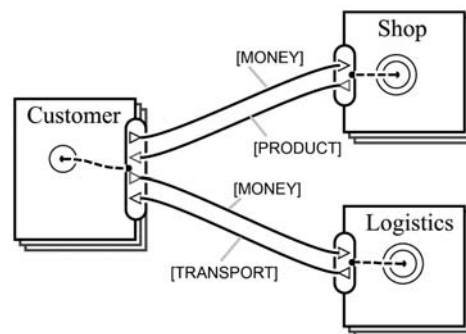


In reality, the logistics provider interacts with the shop and the customer!

- E^3 value models show only commercial transactions.
- No processes.

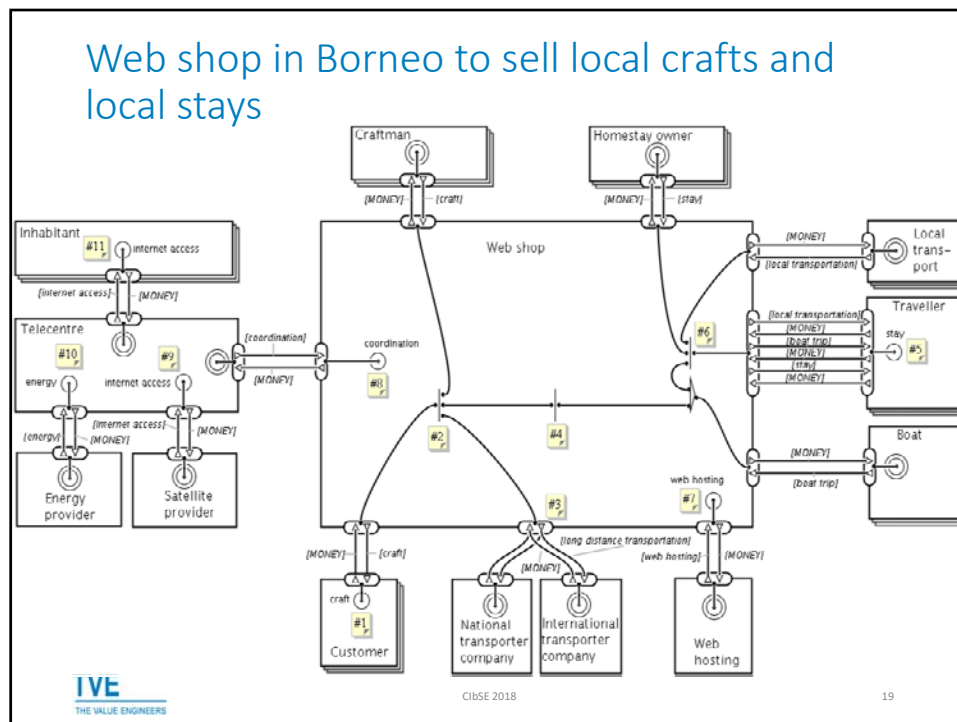


- Here the customer buys the transport and the product from the logistics company

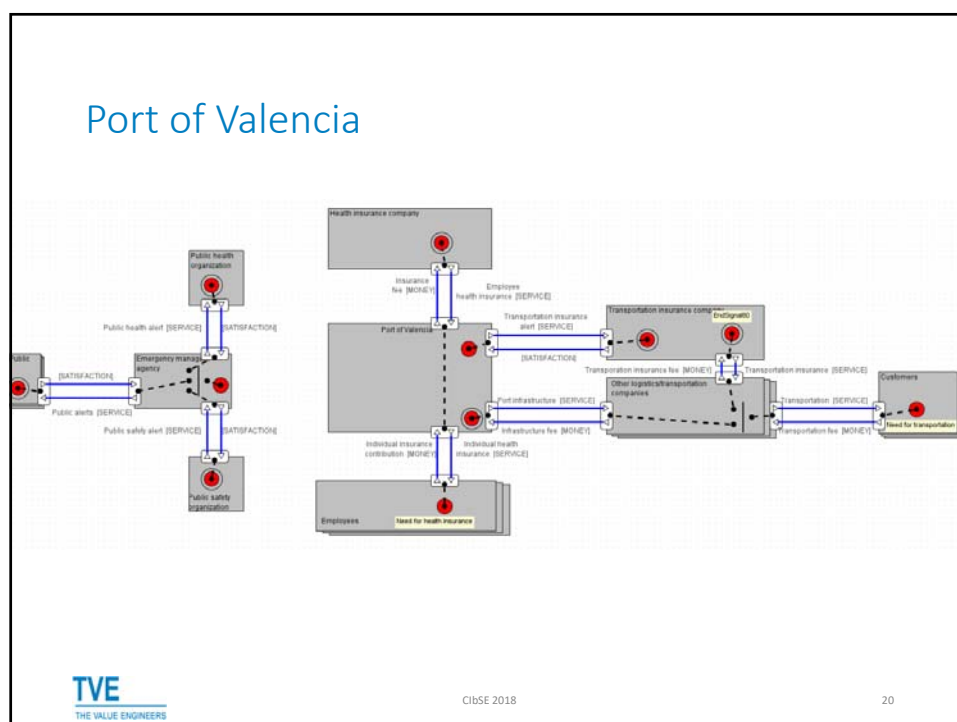


- Here the customer selects the product

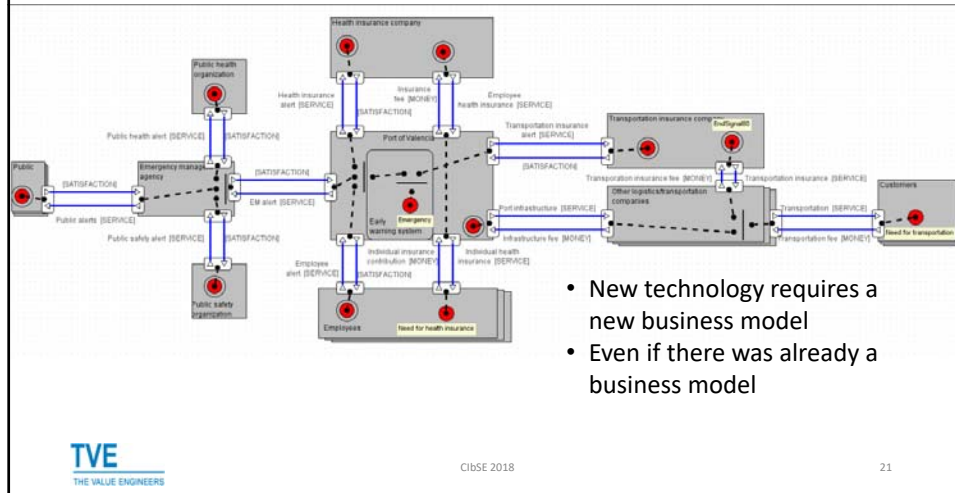
Web shop in Borneo to sell local crafts and local stays



Port of Valencia



Introducing a sensor-based early-warning system



Analysis capabilities: Is a value network economically sustainable?

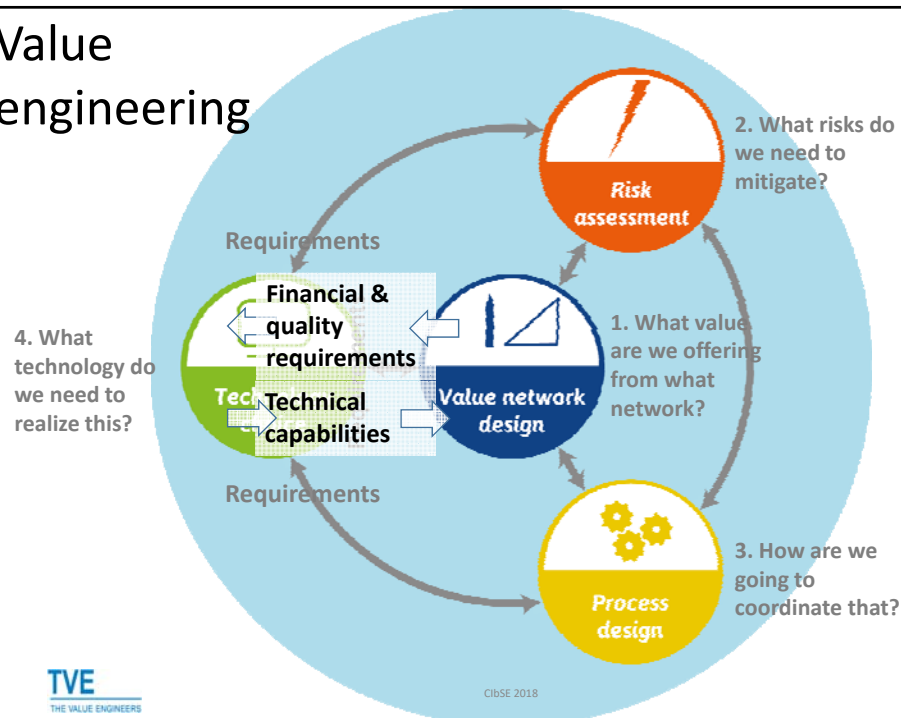
An *e3value* model represents how actors do business with each other during a **contract period**.

- To do a financial analysis:
 - Make assumptions about number of occurrences of consumer need
 - Attach values to money transfers
 - Optional: estimate investments
- Kinds of financial analyses:
 - Net revenue for each actor
 - Sensitivity to changes in assumptions
 - Net present value flow analysis for a sequence of models

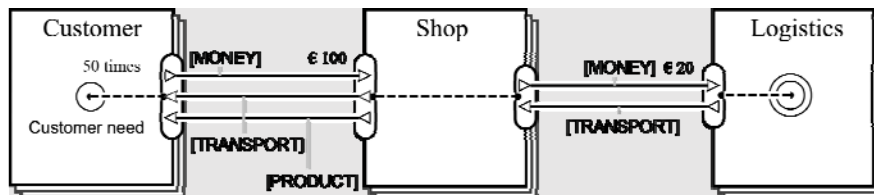
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Value engineering

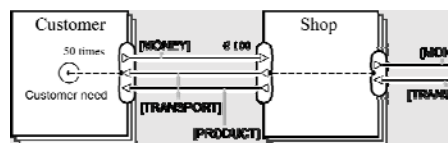


Example



What technological capabilities are available?

Example



Option 1

- **Technology:** bricks and mortar, shelves, physical layout
- **Business model:** may have to be extended by a provider of window dressing services for the shop.

Option 2

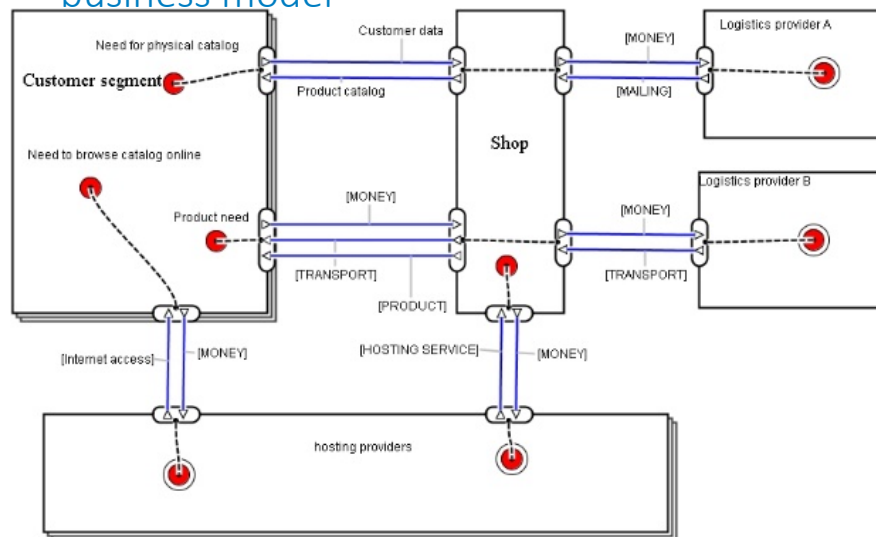
- **Technology:** paper catalog, printer, mail distribution
- **Business model:** May need extension with providers of layout, printing services, logistics provider

Option 3

- **Technology:** web shop, access device for user.
- **Business model:** Need web shop hosting, a web shop designer, software maintenance, and a helpdesk for customers; some of this by external providers.

What technological capabilities are available?

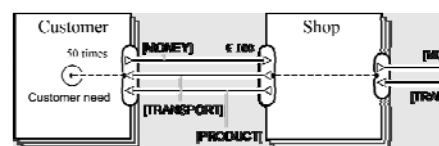
Technology-motivated additions to the business model



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Technology options for the shop:

1. Accept cash in paper money; this requires a cash register in a brick-and-mortar shop.
2. Accept debit cards; this requires some equipment, as well as a payment service from a payment provider such as a bank.
3. Accept credit cards; this requires some equipment, as well as a payment service from a payment provider such as a bank.
4. Accept a cryptocurrency; this requires an interface with e-wallets and a connection to the internet.

Additions to the business model: options 2 and 3 require payment providers

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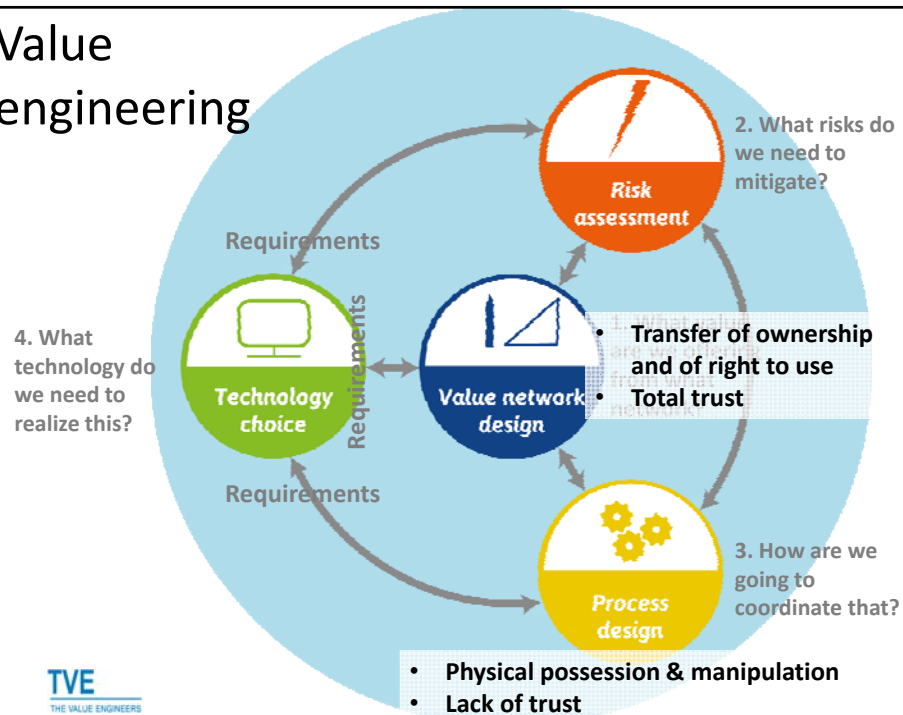
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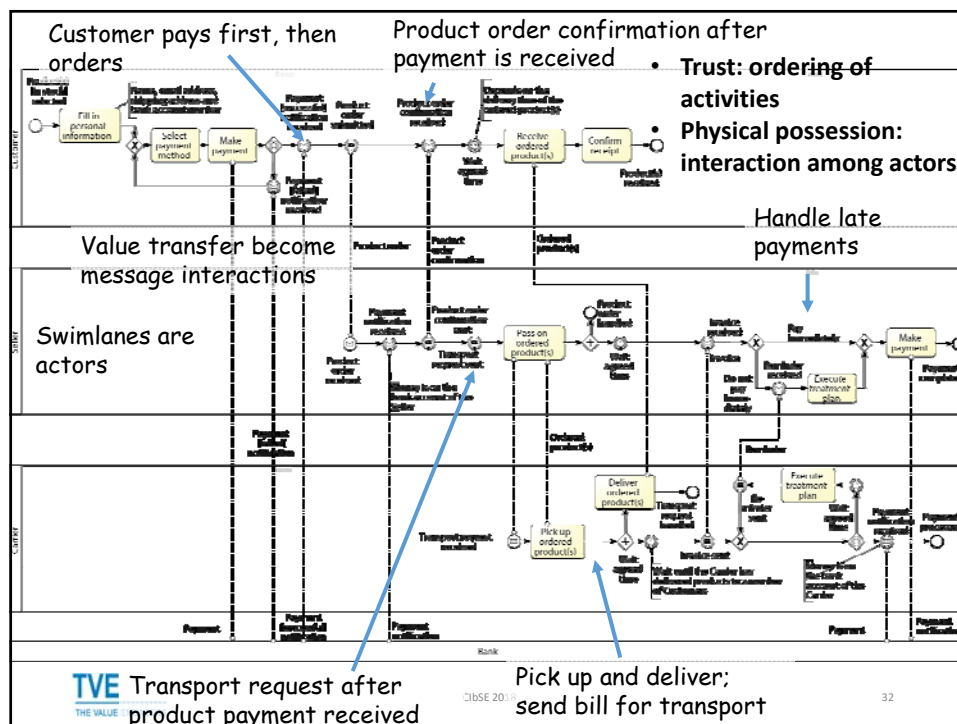
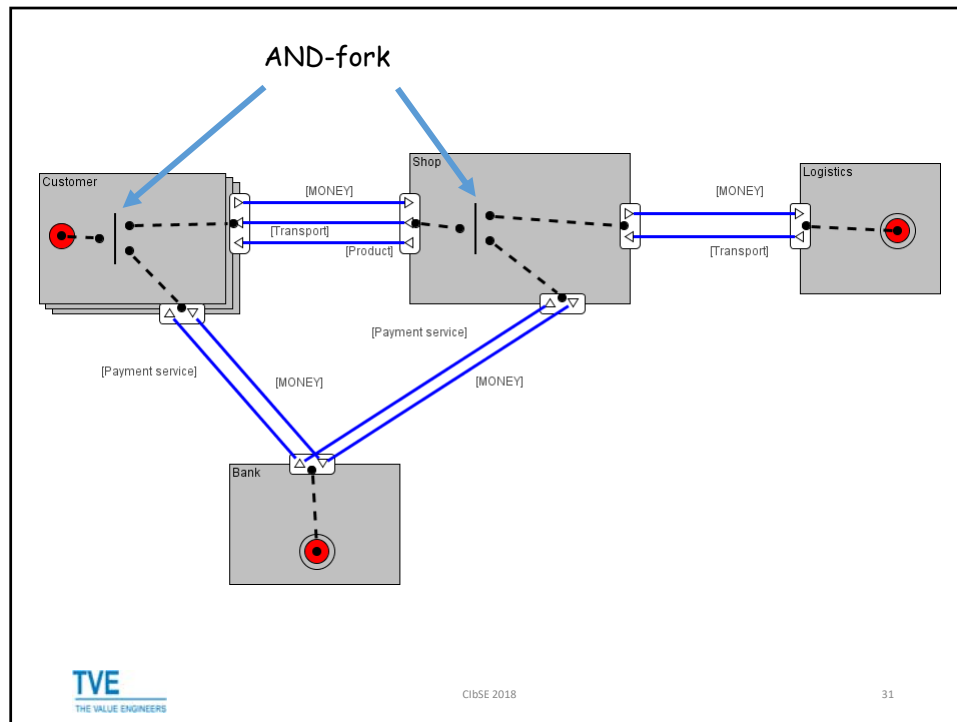
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Value engineering

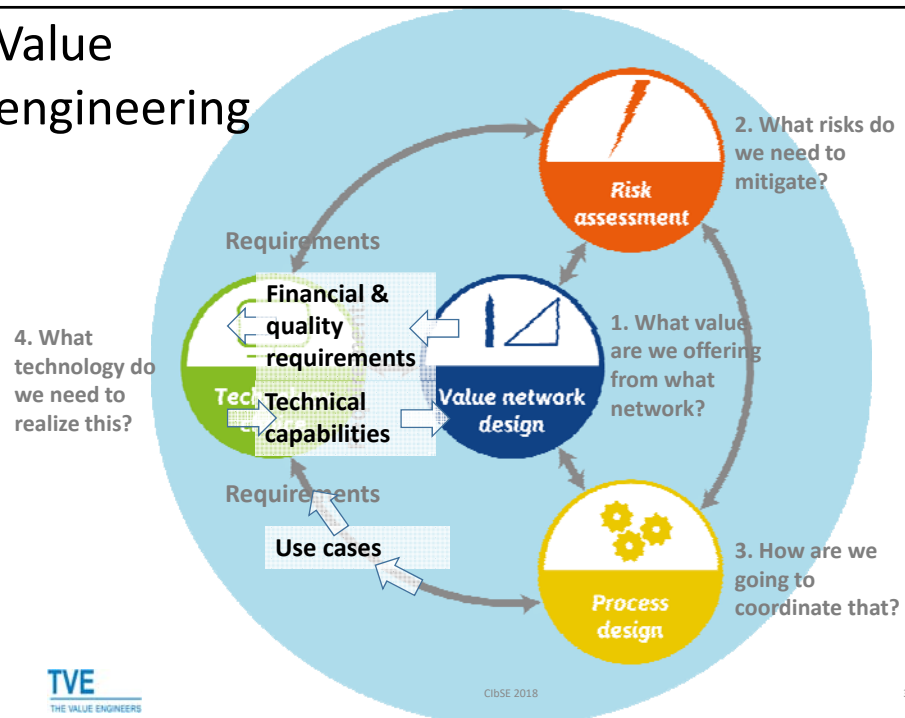




Requirements from a process model

- Automated activities in a process model become use cases

Value engineering

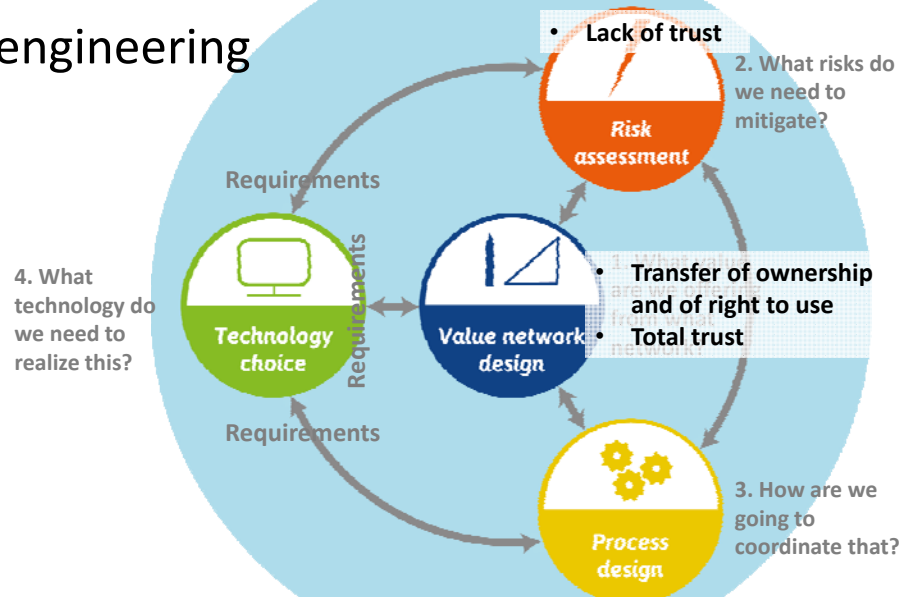


Outline

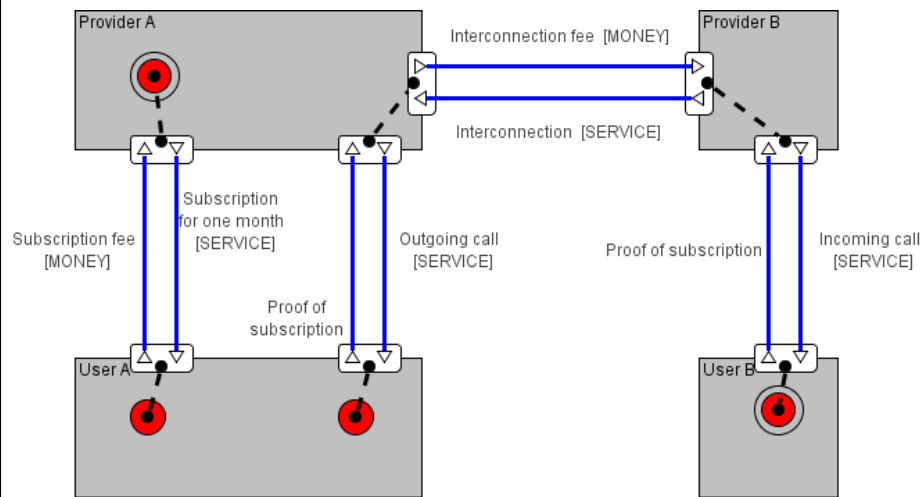
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Value engineering



Flat rate telecom subscription

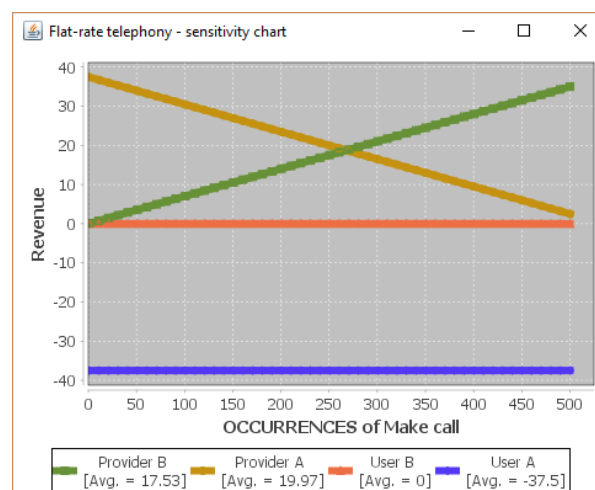


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Sensitivity analysis in the ideal case



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Fraud scenario generation

Flat-rate telephony - Fraud scenario generation

Fraud generation

Trusted actors:

Generate

Showing 14/19 results (show all)

Advanced settings...

Loss of 37.5 for Provider A due to:
Colluding actors "User B" and "User A"
1 Non-occurring exchange Subscription fee
Hidden transfer of value 0.0467 (out of 0.07) per occurrence from "Provider B" to "User B + User A"

Loss of 37.5 for Provider A due to:
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Loss of 37.5 for Provider A due to:
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3 Non-occurring exchange Subscription fee
5 other models with similar results (ordered by complexity)

Loss of 37.5 for Provider A due to:
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4 Non-occurring exchange Subscription fee
Hidden transfer of value 0.0233 (out of 0.07) per occurrence from "Provider B + User A" to "User B"

Loss of 37.5 for Provider A due to:

Sorting and grouping

Sort by: highest loss

Group by: financial result

Filters

Loss between: 0 -

Gain between: 0 -

Apply

Model preview <double click to open in editor>

Provider A: Interconnection fee [MONEY], Subscription for one month [SERVICE], Outgoing call [SERVICE], Proof of subscription

Provider B: Interconnection fee [MONEY], Subscription for one month [SERVICE], Outgoing call [SERVICE], Proof of subscription

User A: Subscription for one month [SERVICE], Outgoing call [SERVICE], Proof of subscription

User B: Subscription for one month [SERVICE], Outgoing call [SERVICE], Proof of subscription

Profitability

Actor	Result	Expected result	Loss/Gain
Provider B	0.023333333134...	0.07	-0.04666666686...
Provider A	-0.07	37.43	-37.5
User B + User A	0.046666666865...	-37.5	37.5466666668...

Run sensitivity analysis

Fraud scenario generation

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Fraud generation

Trusted actors:

Showing 14/19 results (show all)

[Advanced settings...](#)

Sorting and grouping

Sort by: highest loss

Group by: financial result

Fraud scenarios, order by loss for the victim, Or gain for the fraudster

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Fraud scenario generation

Flat-rate telephony - Fraud scenario generation

Fraud generation

Trusted actors:

Showing 14/19 results (show all)

[Advanced settings...](#)

Sorting and grouping

Sort by: highest loss

Group by: financial result

Filters

Loss between: -

Gain between: -

Model of the selected scenario

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Fraud scenario generation

Flat-rate telephony - Fraud scenario generation

Fraud generation

Trusted actors:

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Model preview <double click to open in editor>

Model of the selected scenario

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Model diagram: The diagram shows the flow of money and services between Provider A, Provider B, User A, and User B. It includes components like Subscription fee, Interconnection fee, Outgoing call, and Proof of subscription.

Results list:

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Run sensitivity analysis

Fraud scenario generation

Flat-rate telephony - Fraud scenario generation

Fraud generation

Trusted actors:

Generate

Showing 14/19 results (show all)

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Loss for the victim, gain for the fraudster in this scenario

Run sensitivity analysis

Fraud scenario generation

Flat-rate telephony - Fraud scenario generation

Fraud generation

Trusted actors:

Generate

Showing 14/19 results (show all)

[Advanced settings...](#)

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(i) - 5 other models with similar results (ordered by complexity)

Model preview <double click to open in editor>

Provider A (Interconnection fee [MONEY])

Provider B (Interconnection [SERVICE])

User A (Subscription fee [MONEY])

User B (Subscription fee [MONEY])

Subscription for one month [SERVICE]

Outgoing call [SERVICE]

Proof of subscription

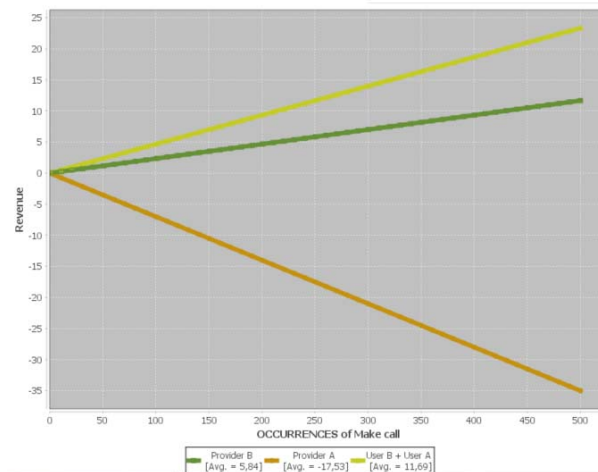
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Sensitivity analysis

[Run sensitivity analysis](#)

Sensitivity analysis in the fraudulent case



Risk mitigations

Change the technology

- Use identifiers
- Share information across providers
- Include monitoring
- ...

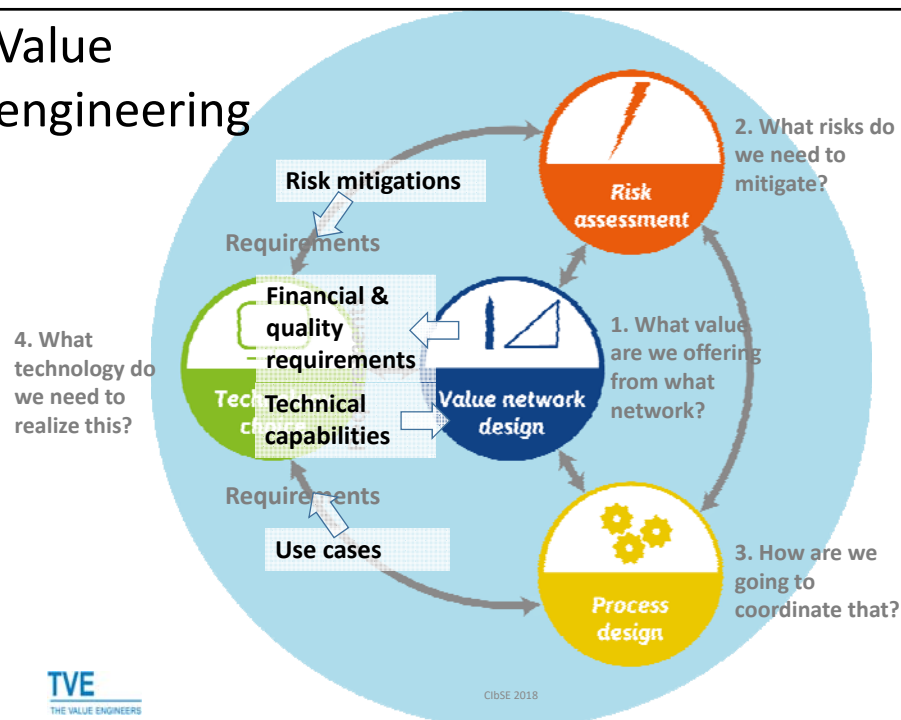
Change the business model

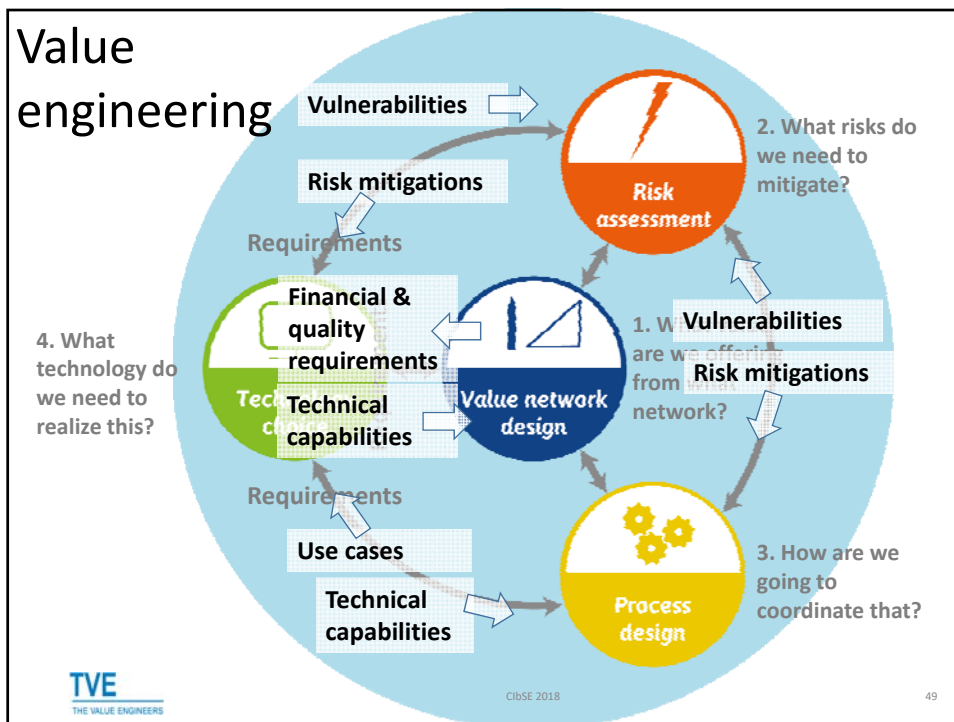
- Include a trusted third party
- Include an insurance
- Pre-contract screening
- ...

Change the process model

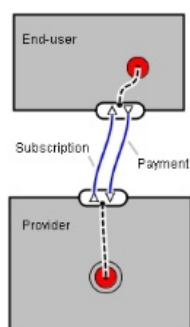
- Include verification actions
- Include identification actions
- Change the ordering of activities
- ...

Value engineering

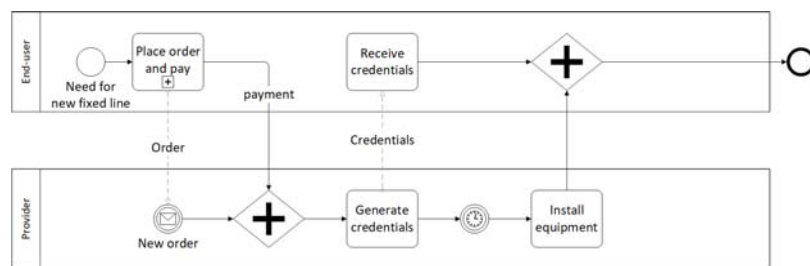




Vulnerabilities in a process: New land line subscription



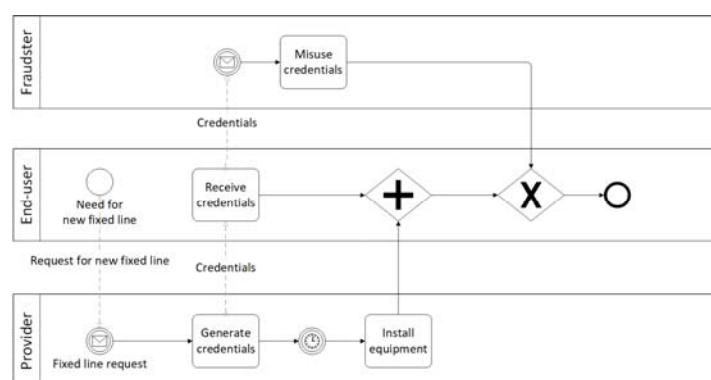
Ideal process with a vulnerability



Fraudulent process that exploits the vulnerability

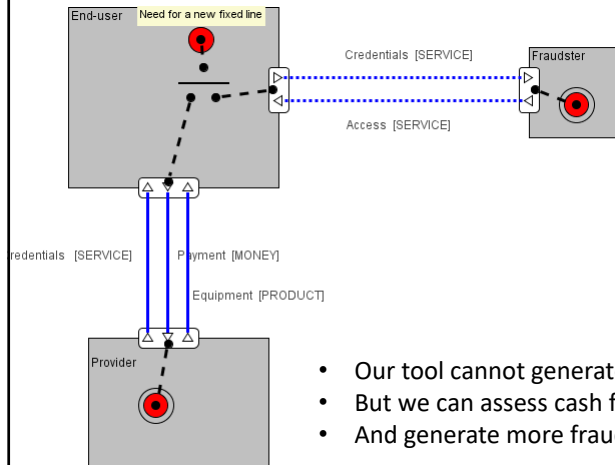
This process also has a business model

Our tool cannot generate that model automatically



Mitigation: change order of activities

Business model of the fraudulent process











- Our tool cannot generate this model automatically
- But we can assess cash flow
- And generate more frauds from this

Outline

1. Value network design
2. Process design
3. Process design
4. Risk assessment



The big picture

Requirement viewpoint	Stakeholders involved	Requirement viewpoint focus	Requirement viewpoint representation
Business value viewpoint	 C*O's Marketeers Customers	 Values, actors, exchanges	 <i>e²-value</i> ontology and UCM scenarios
Business process viewpoint	 Tactical marketer, Operational management	 Processes, workers, information, goods, and control flows	 UML • Activity diagrams • Sequence diagrams • Interaction diagrams High-level Petri Nets
System architecture viewpoint	 IT department	 Hard/software, components, data and control flows, code organization	UML • Class diagrams • State transition diagrams • Sequence diagrams • Interaction diagrams • Deployment diagrams Architecture description languages

Value engineering

- Value network design is intertwined with technology choice
- Value network design drives the other design processes
- We can derive a value model from a technology model or process model
- Design ideal models first, drop idealizing assumptions later
- This is standard engineering practice
- Do monetary assessment of each design option
- This is standard engineering practice too

***e*³value assignment**

In the country *SomewhereAPlaceOnEarth*, there is a company called MyBiscuit.com. This company offers customers the possibility to compose their own biscuit box. Customers can choose from a variety of biscuits and boxes. In order to provide custom made biscuit boxes, MyBiscuit.com has relationships with a number of biscuit sellers. Also, MyBiscuit.com is obtaining empty boxes from a variety of box sellers. For a custom made biscuit box, a number of biscuits are needed and one box. Biscuits can be obtained from multiple sellers. There is also a logistics provider involved. This provider transports the biscuit box, as bought by the customer, from the MyBiscuit.com to the customer. The customer chooses the logistics provider from a list and also pays this provider. Obviously, the customer is only interested in a biscuit box, which is transported to his/her home. The customer needs to pay a certain amount of money for the biscuit box. For this reason, MyBiscuit.com has deals with a number of payment providers. For the payment service, MyBiscuit.com has to pay a certain amount of money to the payment provider.

Assignment: Construct an *e*³value for the case study as described above

By following the steps below, you can gradually draw your *e*³value diagram.

- a. State the customer need by a few words.
- b. Make a list of value objects by
 1. Considering which value objects are directly required to satisfy the customer need.
 2. Considering which value objects are needed to produce earlier found value objects (note you can do this recursively).
- c. Make a list of actors and market segments.
- d. For each value object found in step b, find one or more reciprocal value objects (usually money).
- e. For each actor/market segment, find value ports offering/requesting value objects, value offerings and value interfaces:
 1. Group equally directed ports which are offering value objects as a bundle into one offering. Note: the minimal bundle contains at least one value port.
 2. Group reciprocal offerings into one interface, and assign this interface to the relevant actor.
- f. Relate the relevant ports of different actors by value transfers.
- g. Assign the customer need(s) to the relevant actor(s).
- h. Find the boundary element(s) and assign the element(s) to the relevant actors
- i. For each actor, relate its value interfaces by means of dependency paths. Use AND/OR forks/joins/explosion/implosion elements whenever appropriate.