

Reputation Algorithms for Self-Sovereign Data

Issues and Technical Directions

Samuel M. Smith Ph.D.

Founder

Xaltry

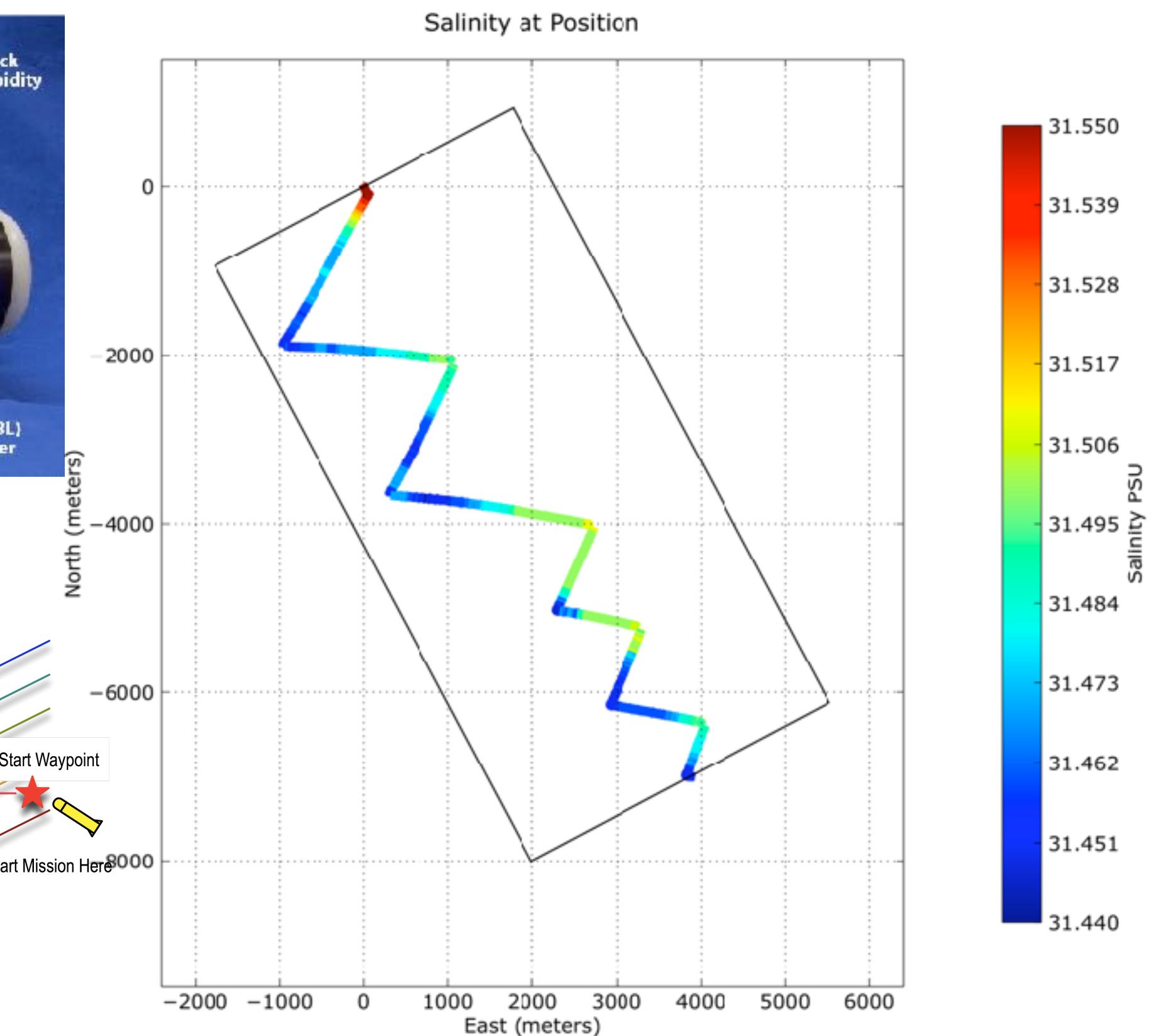
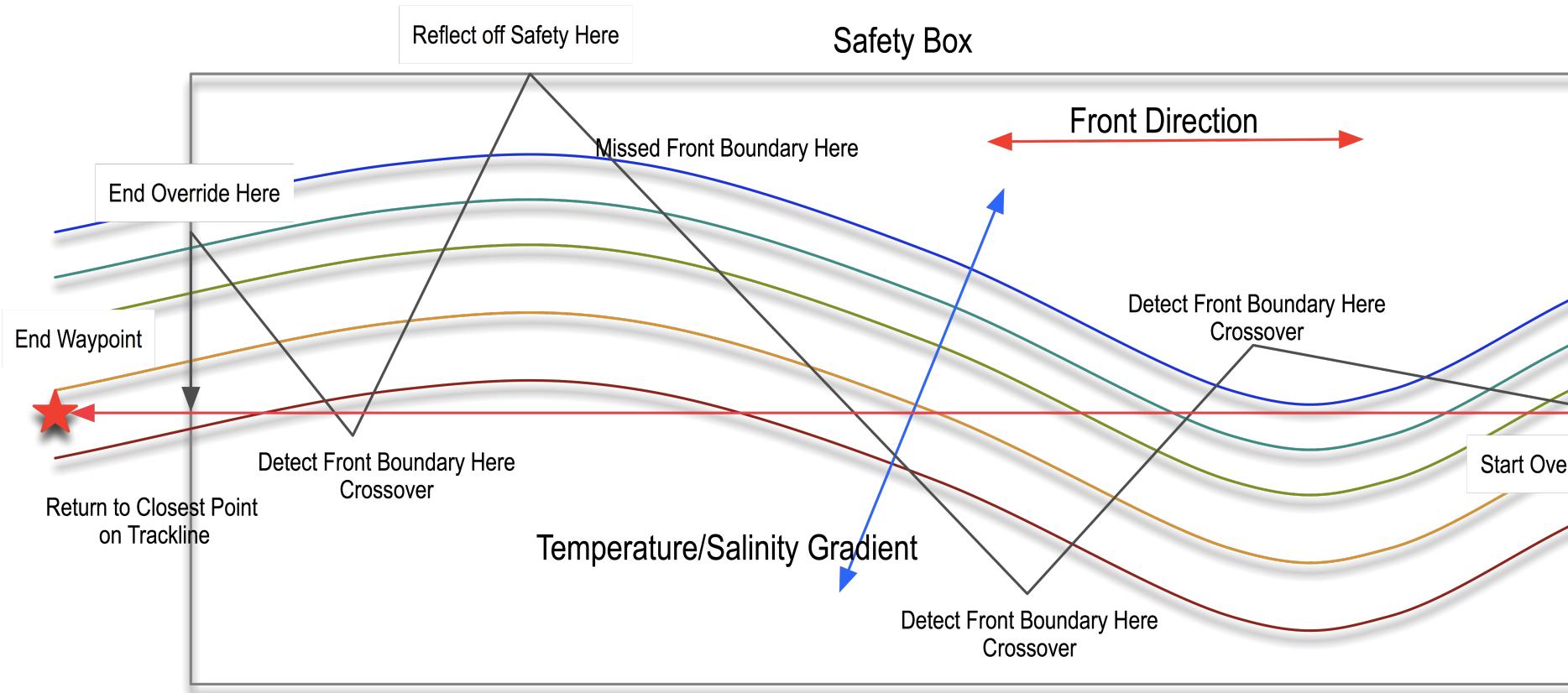
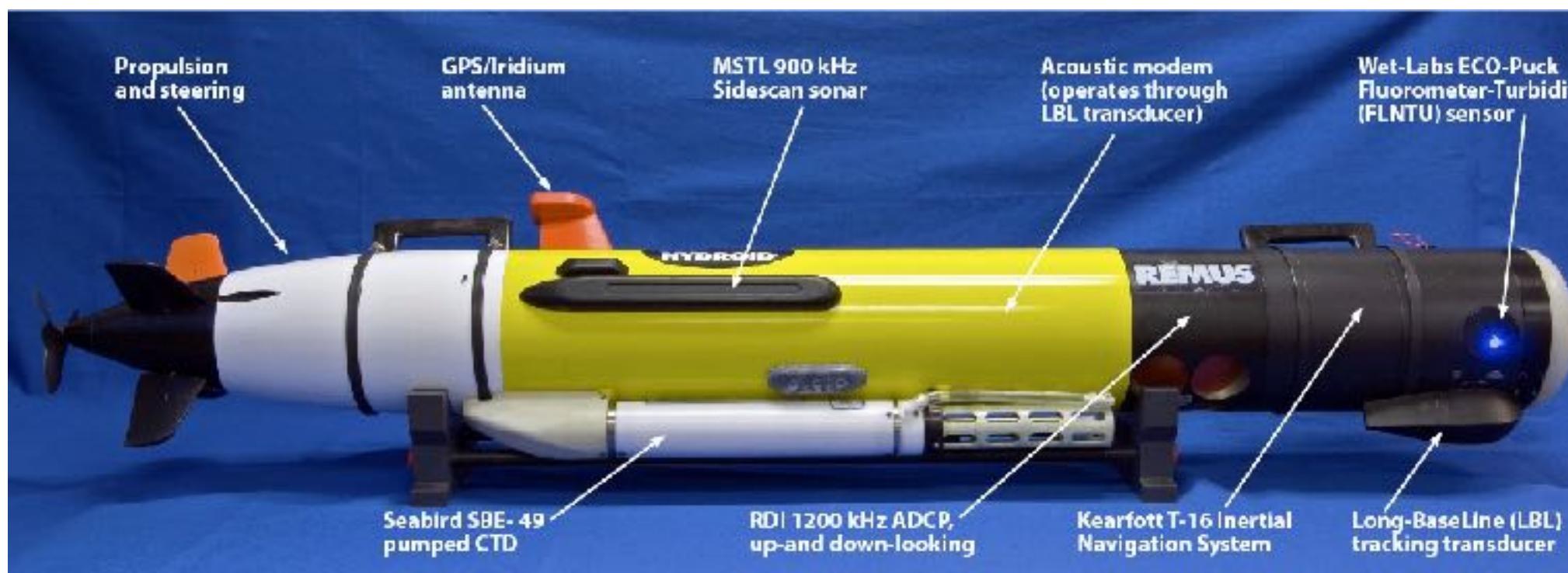
sam@xaltry.com



Autonomous Underwater Vehicles



Autonomous Underwater Vehicles



Shipboard & Building Automation



What is Self-Sovereign Data

User Controlled and Managed

Portable Identifiers & Attributes

Decentralized (not in a silo)

What is Reputation

Contextual Behavior Based Predictor of Future Behavior

Measurement

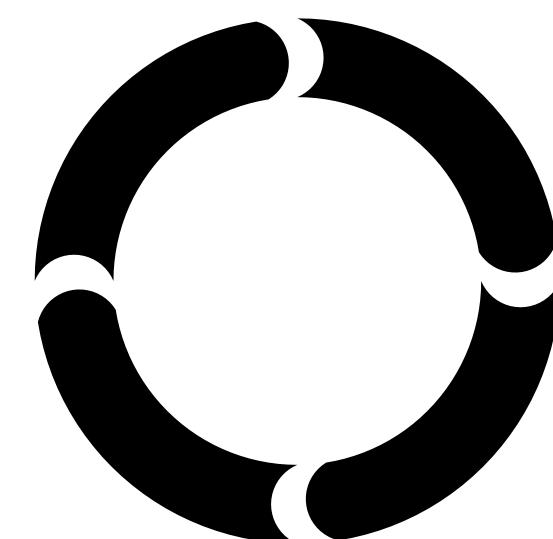
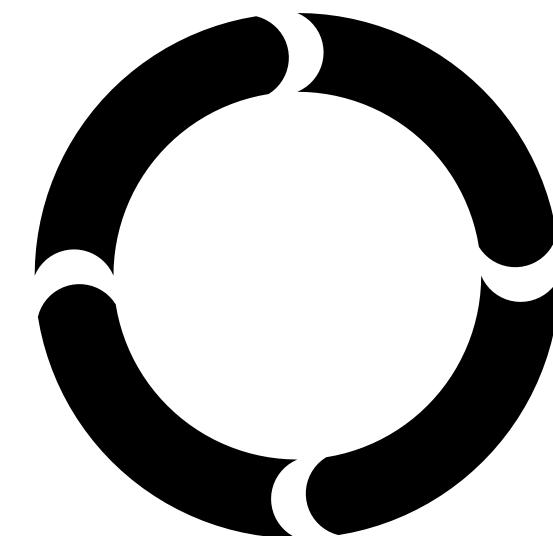
Scoring, Rating and Ranking

Static vs Dynamic

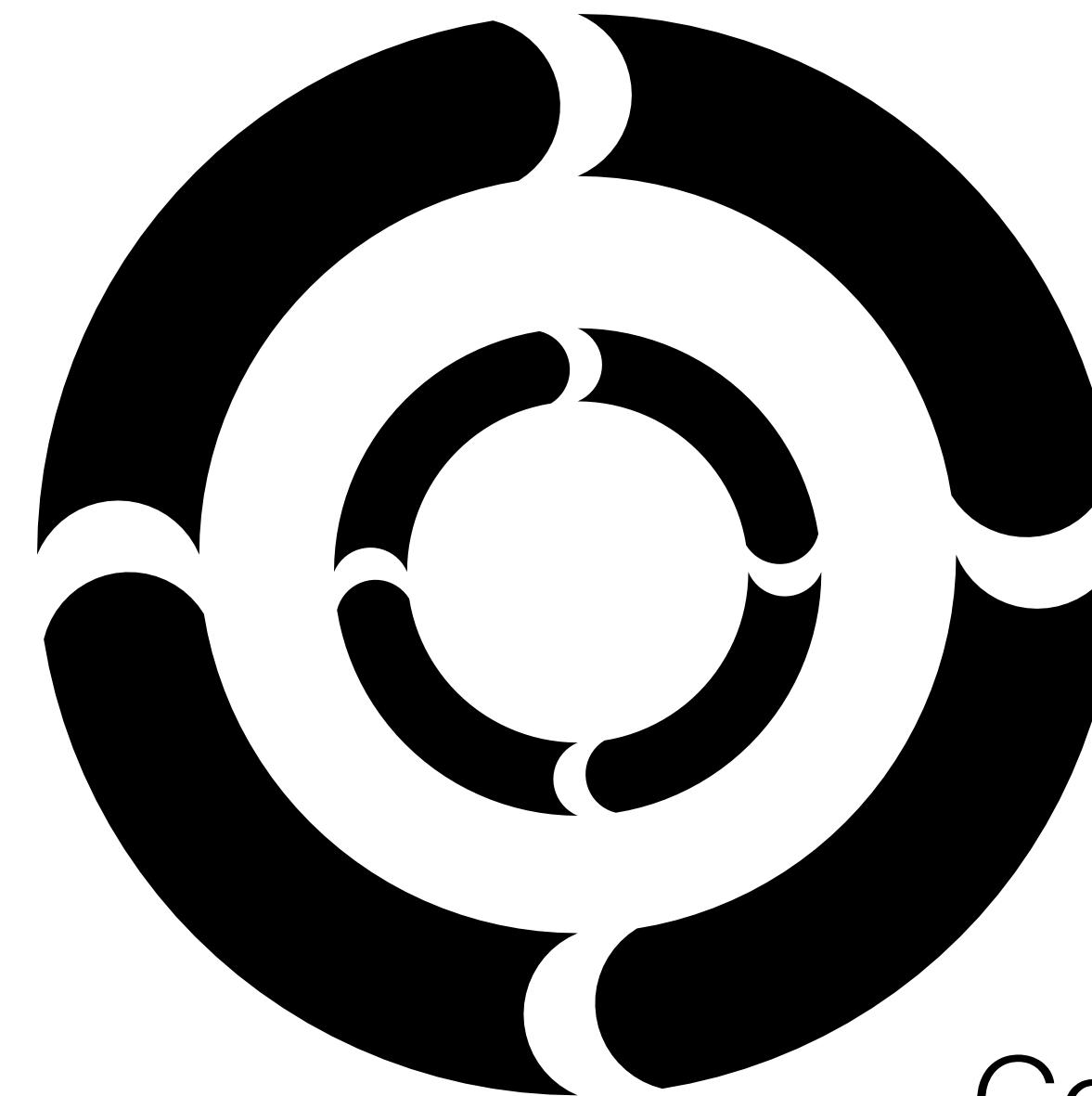
Feedback effects

Real persistently automated systems can have complex feedback loop topologies

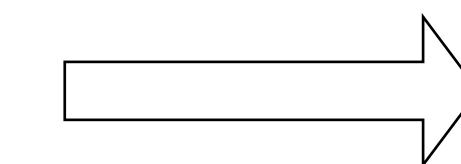
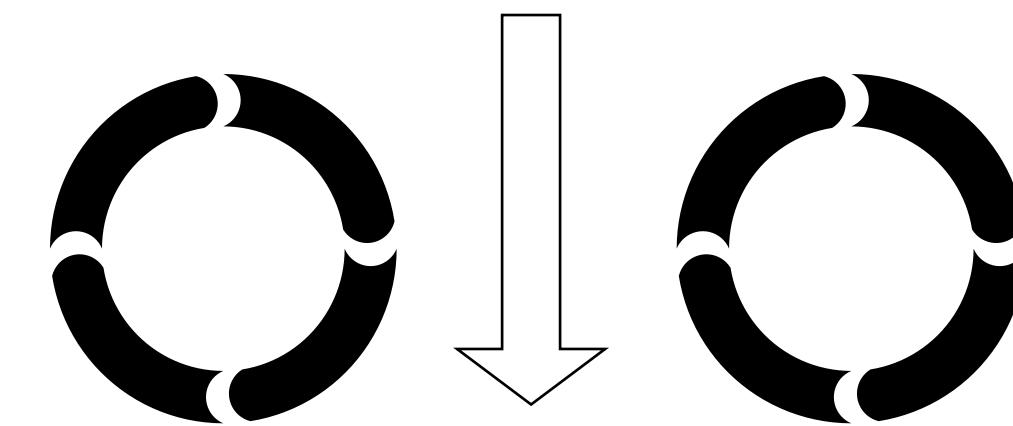
Sequenced loops



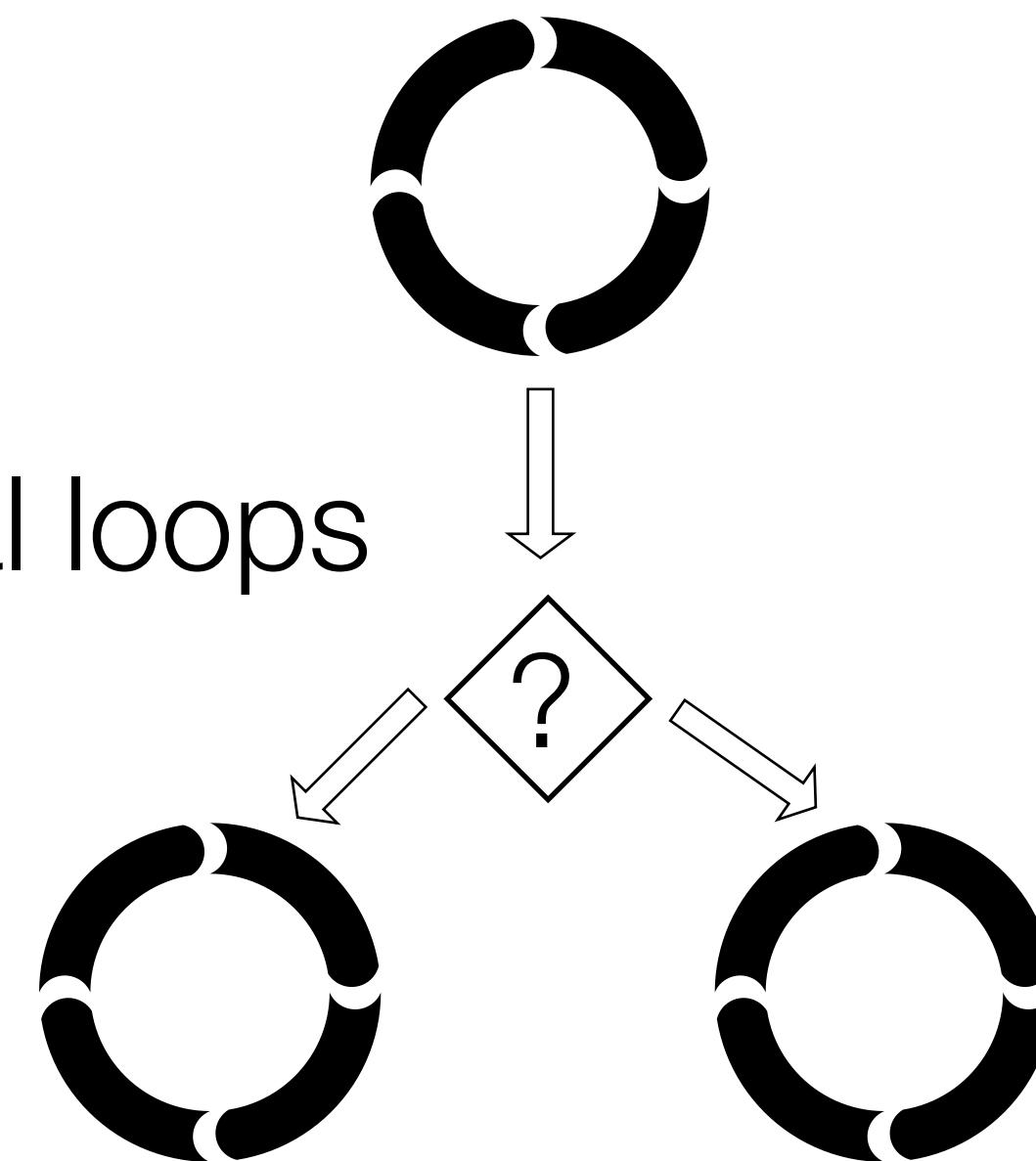
Loops within loops



Concurrent loops



Conditional loops



Measurement Theory

Scales

Nominal (Labeled but not ordered)

aggregation operations: none

Ordinal (Labeled and Ordered)

aggregation operations: median, mode

Interval (Ordered with Distance)

aggregation operations: median, mode, mean and moments about mean, std)

Ratio (Distance with True Zero)

aggregation operations: all

Uncertainty

Imprecision (Possibility Measures and operators)

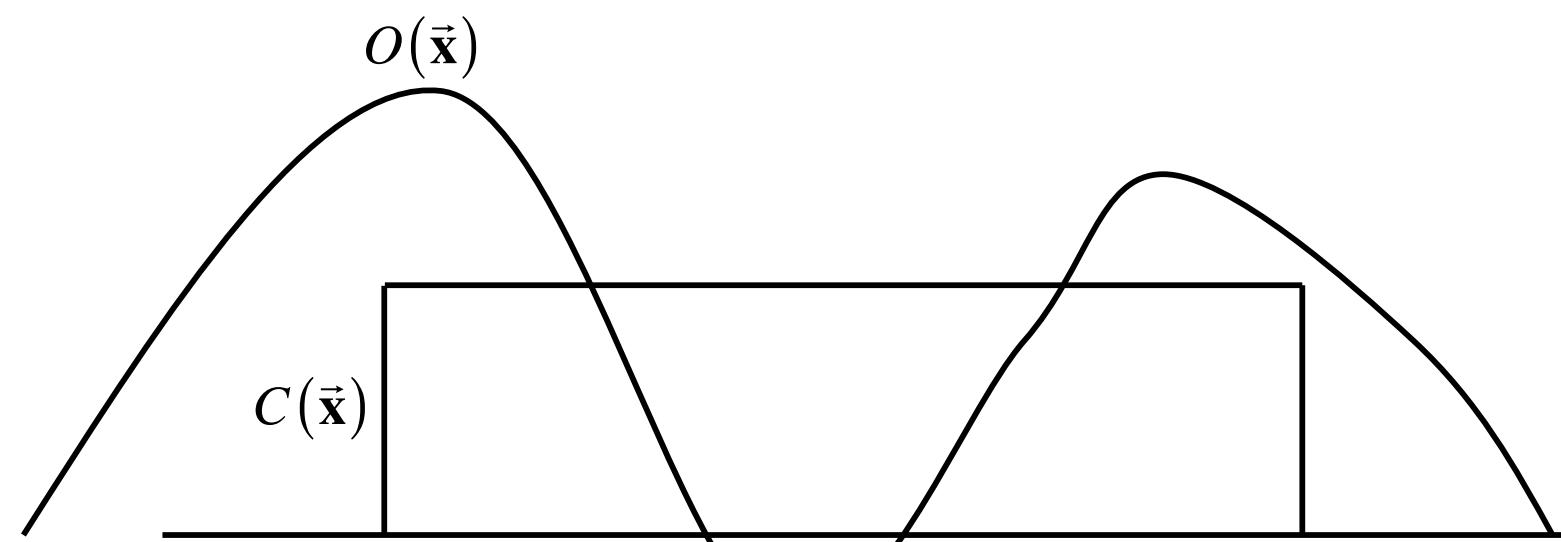
Randomness (Probability Measures and operators)

Ambiguity (Similarity Measures and operators)

Hybrid (mixtures of imprecision, randomness, and ambiguity)

Symmetric Multiple Elastic Constraints

Conventional
Crisp constraints (intervals) plus objective function(s).
Maximize objective function(s) in area allowed by crisp constraints

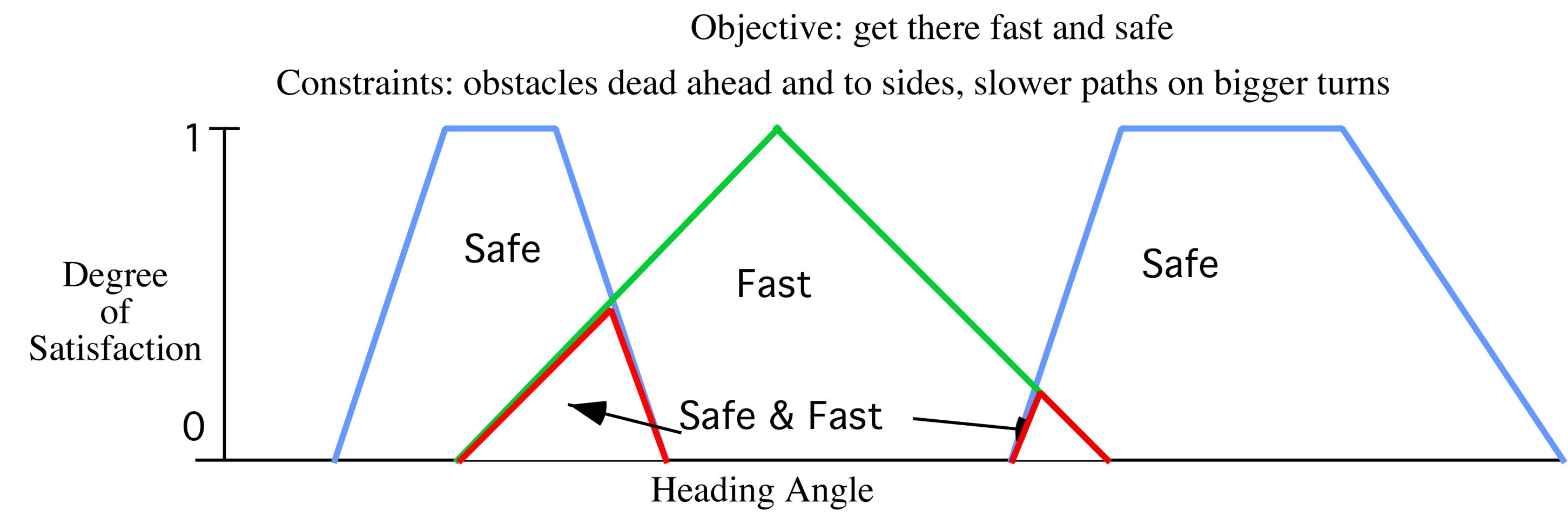


$$O(\vec{x}) = f(x_1, \dots, x_n)$$

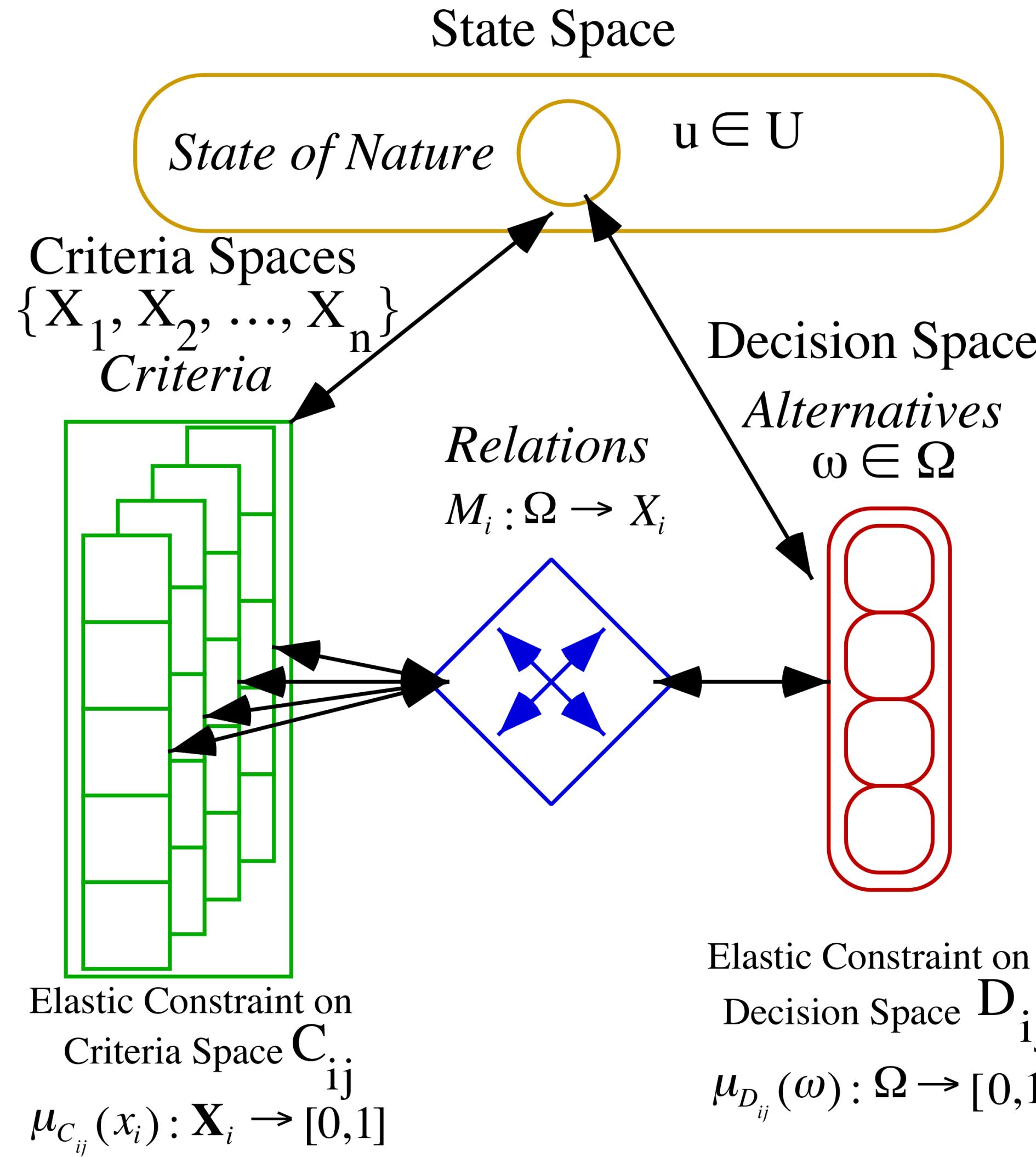
$$C(\vec{x}) = \{x_{1low} \leq x_1 \leq x_{1high}, \dots, x_{nlow} \leq x_n \leq x_{nhigh}\}$$

$$\max_{C(\vec{x})} O(\vec{x})$$

Symmetric
Both goals and constraints are expressed with elastic constraints.
Decision-making consists of finding the confluence of goals and constraints by aggregating the respective membership functions.



SMEC



state of nature $u \in U$ state space

decision alternative $\omega \in \Omega$ decision space

set of criteria \mathbf{C} defined on $\mathbf{X} = \{X_1, \dots, X_m\}$ criteria spaces

elastic constraint $C_{ij} = j^{th}$ constraint on i^{th} criteria space

membership function $\mu_{C_{ij}}(x_i) : X_i \rightarrow [0,1]$

$M_i : \Omega \rightarrow X_i$ relation between decision space and i^{th} criteria space

C_{ij} induces a constraint D_{ij} on Ω through M

If $M_i \equiv m_i(\omega)$ s.t. $x_i = m_i(\omega)$ Then

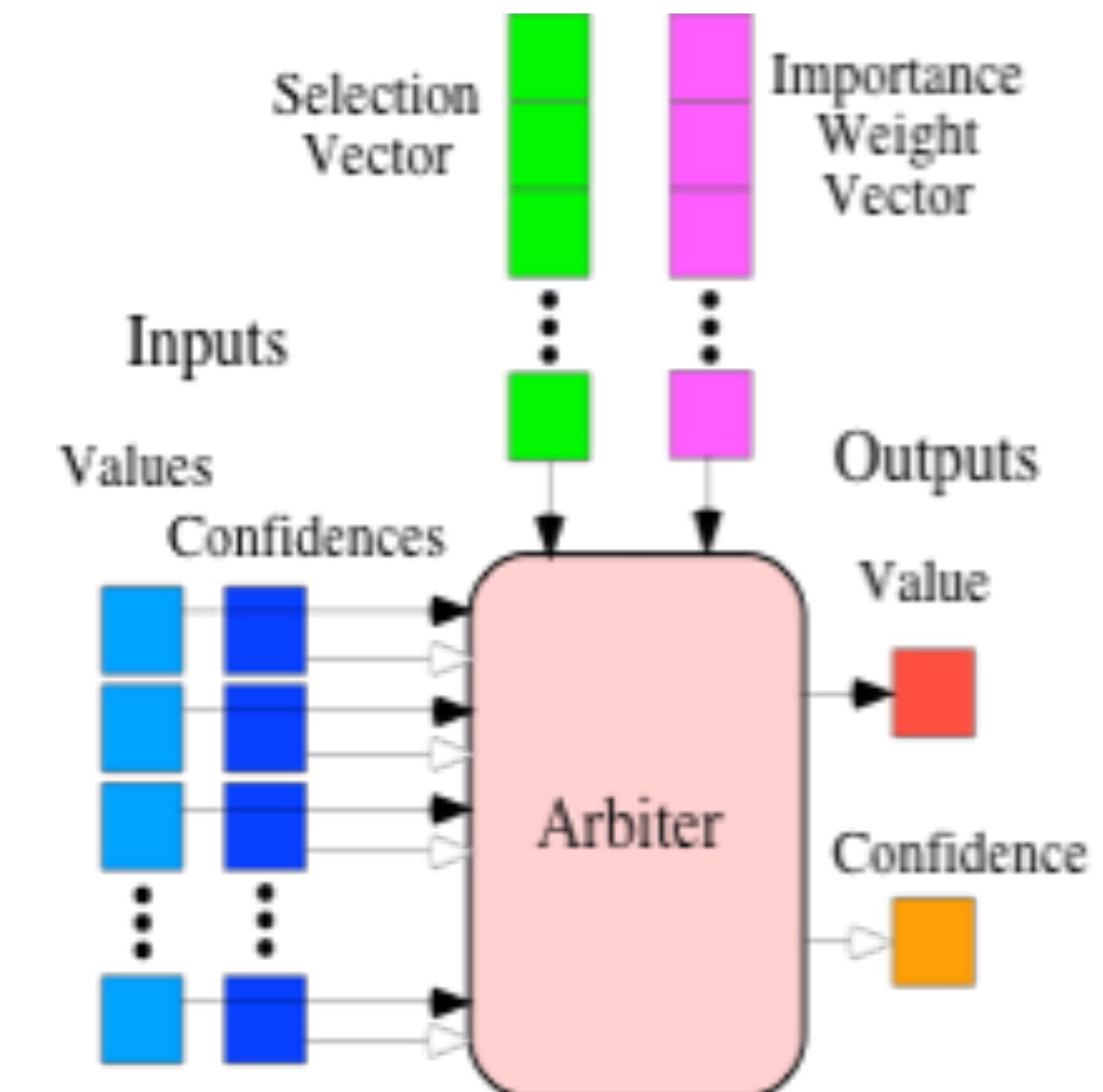
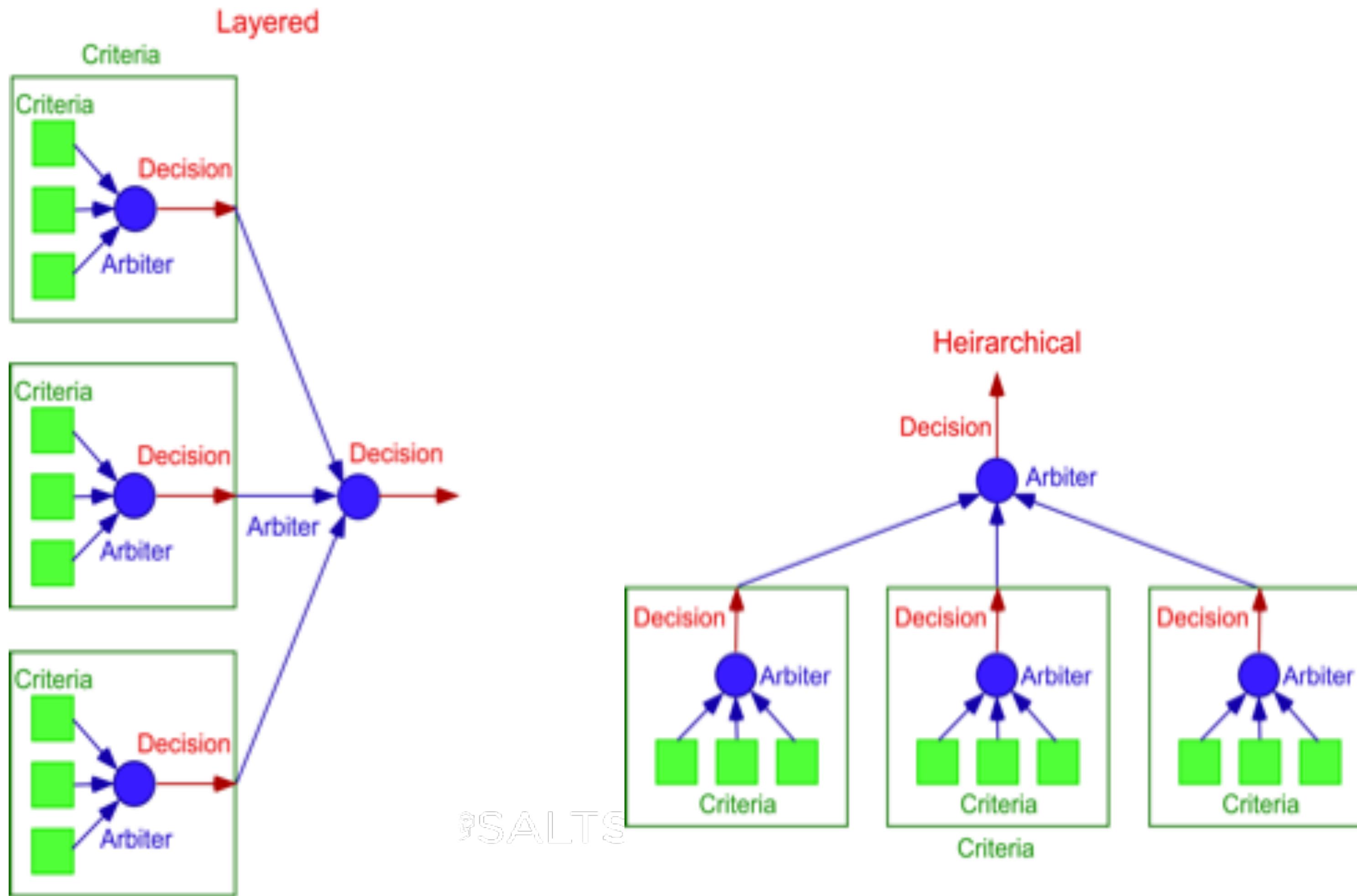
$\mu_{D_{ij}}(\omega) = \mu_{C_{ij}}(x_i) = \mu_{C_{ij}}(m_i(\omega)) \quad \forall \omega \in \Omega$

$\mu_{D_{ij}}(\omega) : \Omega \rightarrow [0,1] \quad \mu_{C_{ij}}(x_i) : X_i \rightarrow [0,1]$

Final decision by aggregating constraints

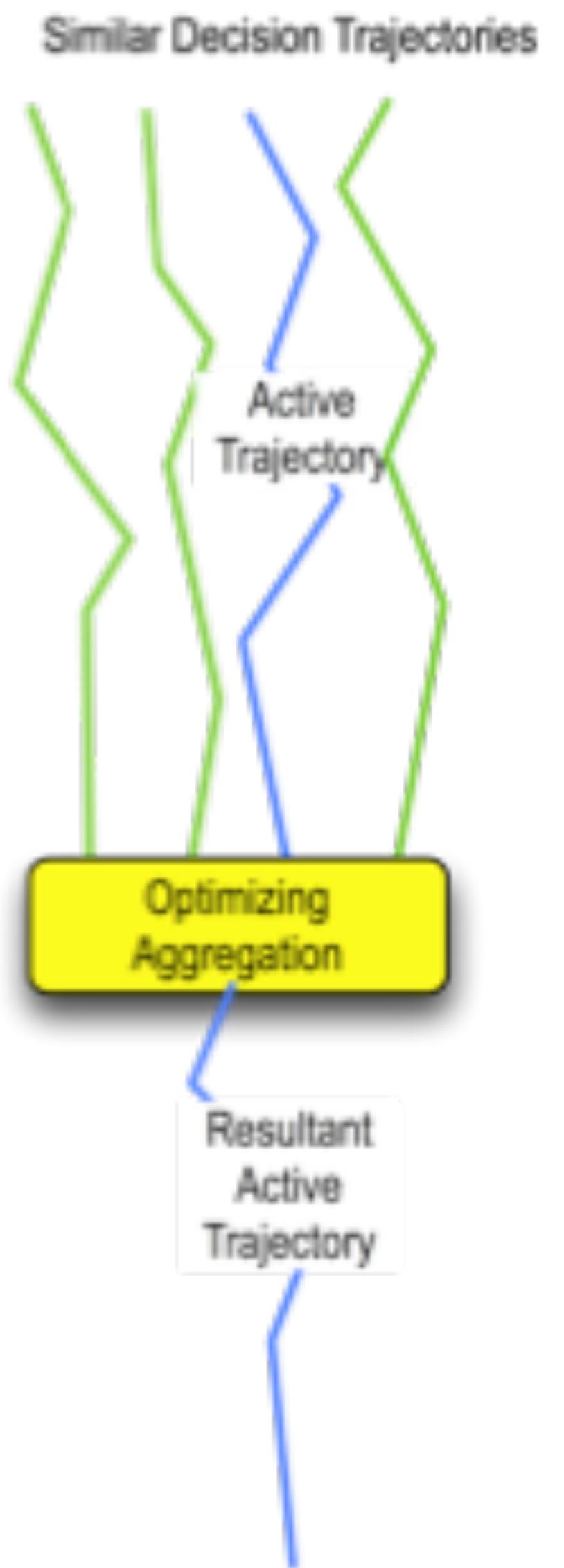
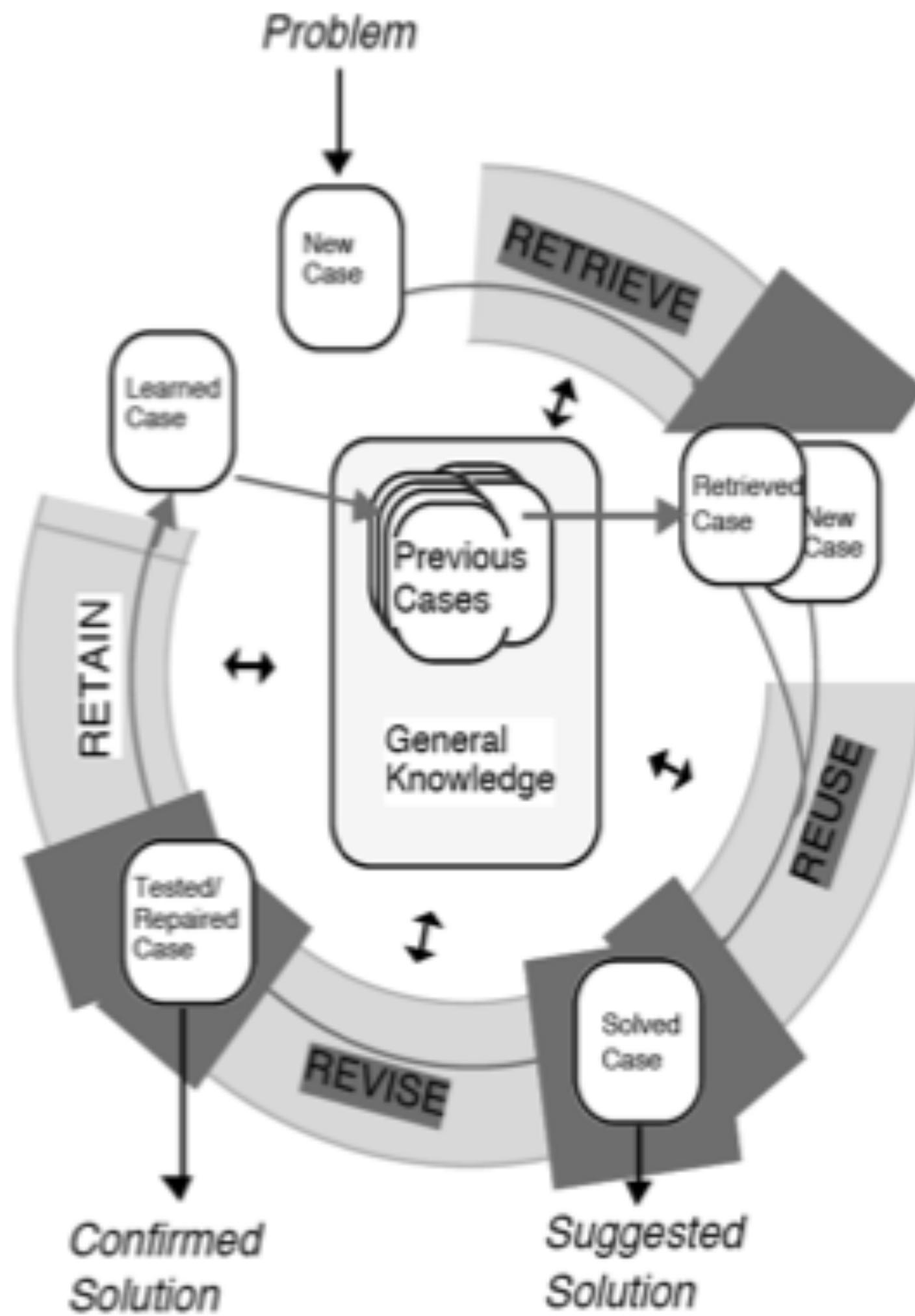
$\mu_D(\omega) = \text{Agg}(\mu_{D_{11}}(\omega), \mu_{D_{12}}(\omega), \dots, \mu_{D_{21}}(\omega), \dots, \mu_{D_{mn}}(\omega))$

Symmetry Enables Networks of Elastic Constraints



Decision Trajectory Based Optimization

Predictive discrete event simulation with machine learning to encode high level reasoning, strategy and tactics.



Openness

Open Data

Open Algorithms

Platform Business Models

A **platform** is a business based on enabling value-creating **interactions** between **external** producers and consumers.

A platform provides an open, participative **infrastructure** and sets **governance** conditions for these interactions.

A platform consummates **matches** among users that facilitate the exchange of goods, services, or social currency, thereby enabling value creation or co-creation for all participants.

A **platform** is the antithesis of a **pipeline**.

(See Platform Revolution 2016, Platform Scale 2015)

Platforms vs Pipelines

A pipeline is a business that directly creates and moves value from ...

producers at one end to consumers at the other end.

Platforms eat pipelines because platforms unlock new sources of value creation and supply
not-even-mine replaces just-in-time

Primary activity shifts from ...

internal mechanisms of control of the value chain

to ...

external orchestration/coordination of interactions between third parties

Enablement

Platforms **disintermediate** pipelines

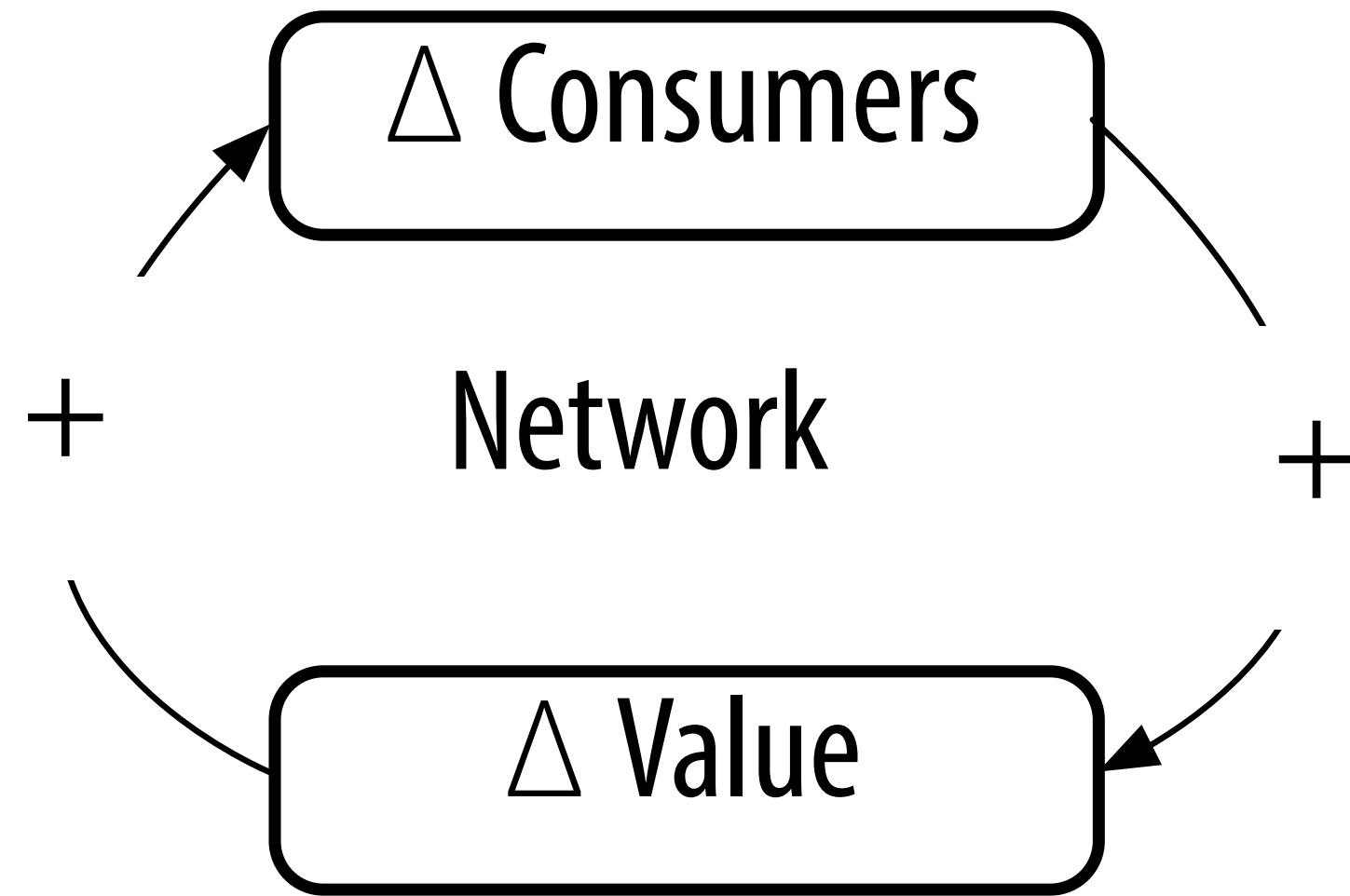
Distributed network computation **enables** platforms

Distributed **consensus** **enables** **trustworthy** platforms

Governance matters

Super-efficient **re-intermediation** with **distributed AI** for platform scaling

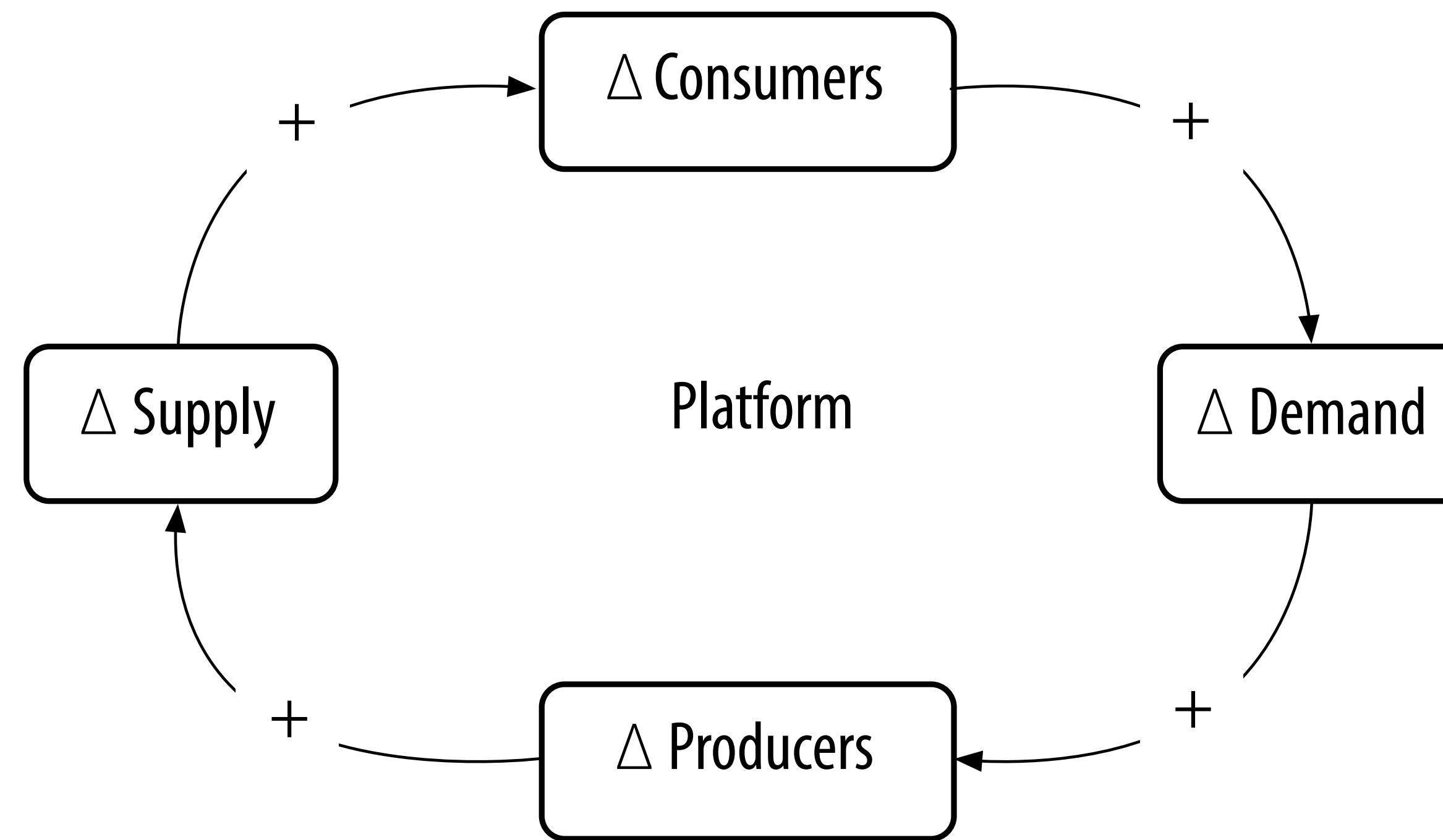
Single-Sided Network Effect



More consumers **increases** value which **attracts** more consumers

Demand side driven

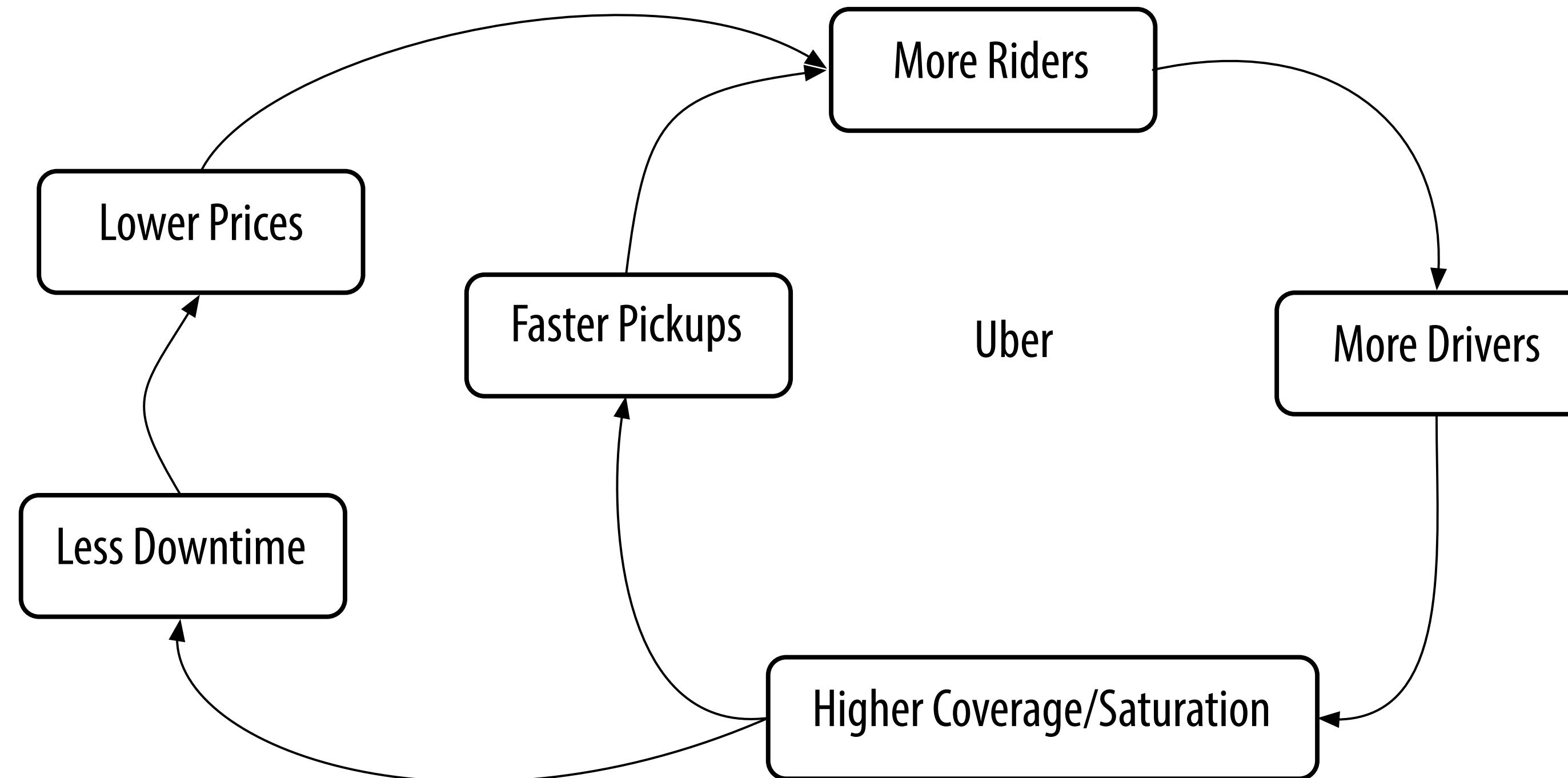
Two-Sided Network



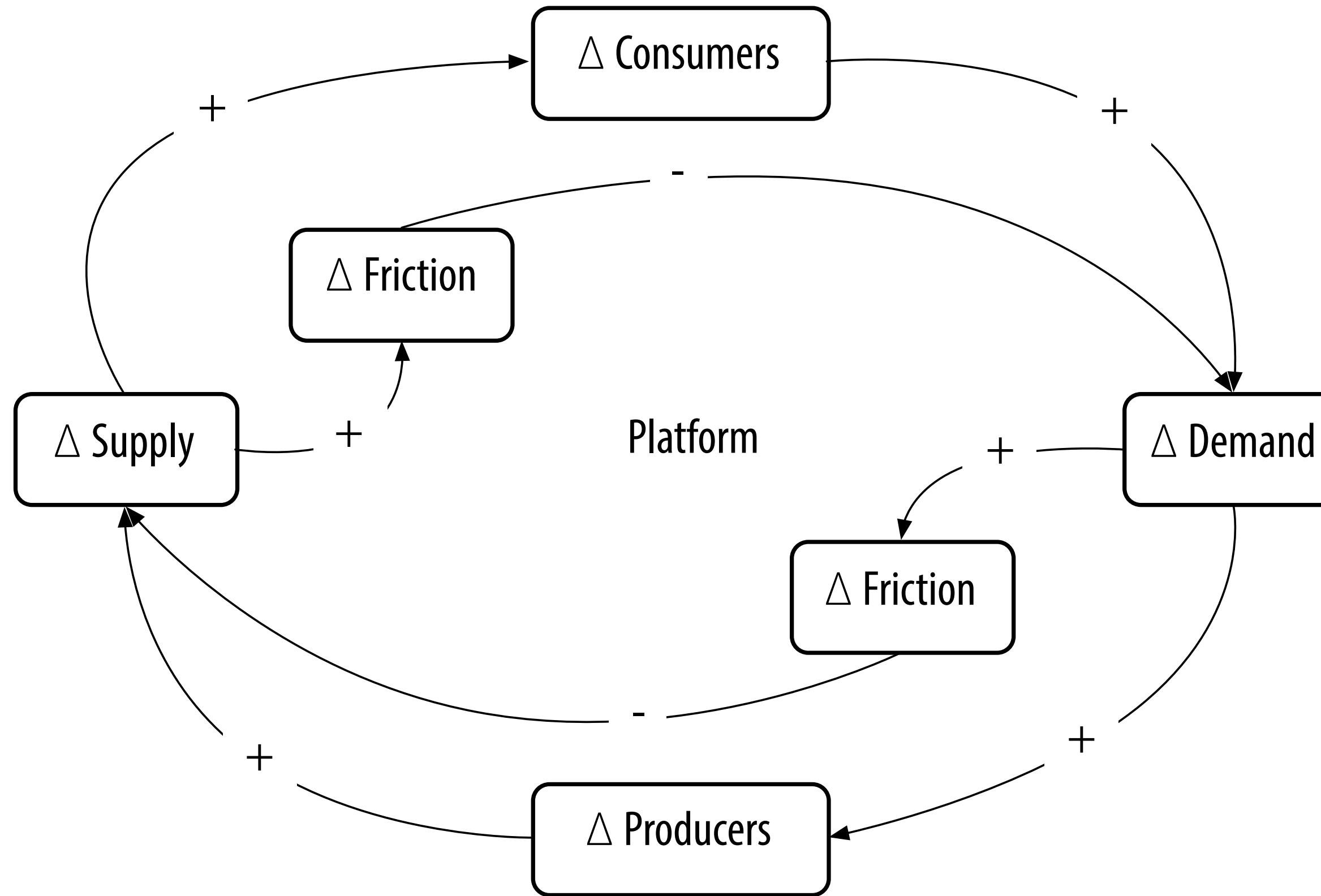
more consumers **drive demand** which **attracts** more producers

more producers **drive supply** which **attracts** more consumers

Example



Negative Cross Network Effects

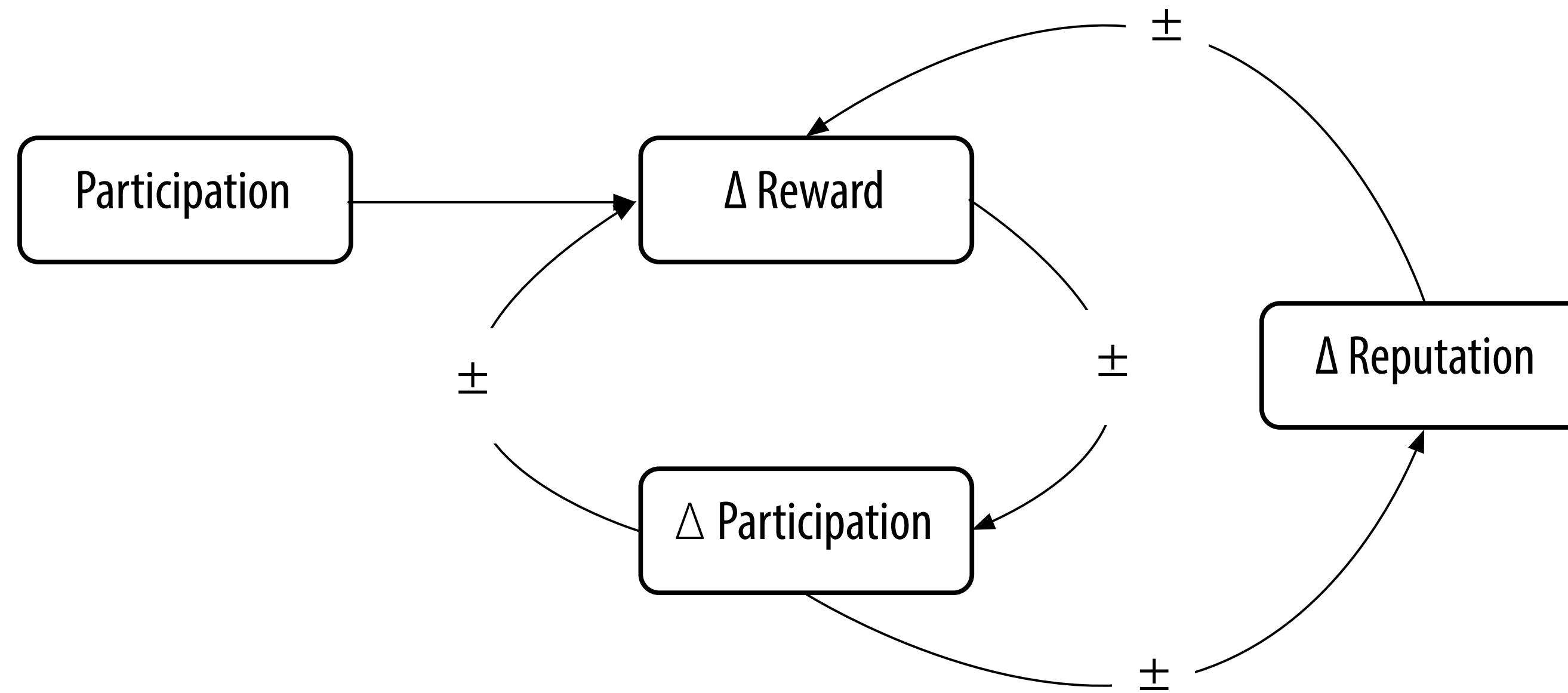


More supply choice increases friction e.g. customer confusion in producer selection thereby decreasing demand

More demand choice increases friction e.g. producer failure in customer satisfaction thereby decreasing supply

Reputation Driven Interaction

Graduated Participation Interfaces



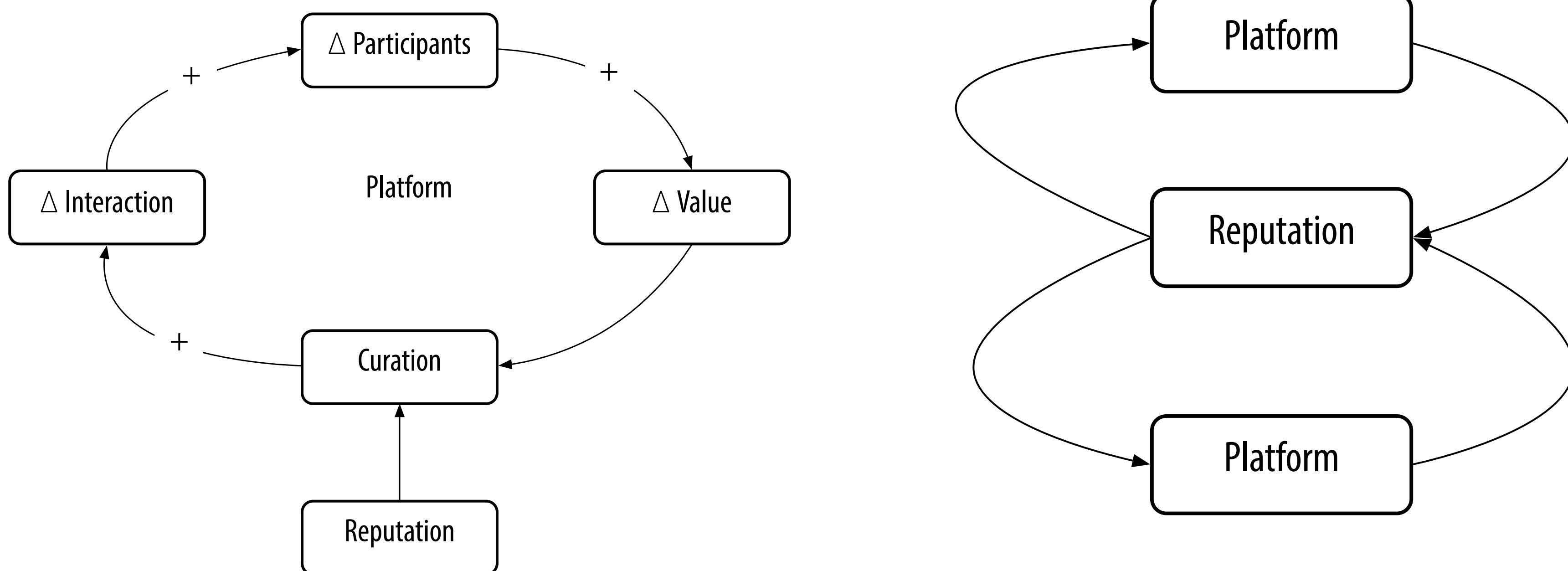
Meta-Platform

Platform that facilitates two-sided network effects across and amongst other platforms

Portable **Reputation** is a candidate meta-platform

Contextual

Transitive



Curation

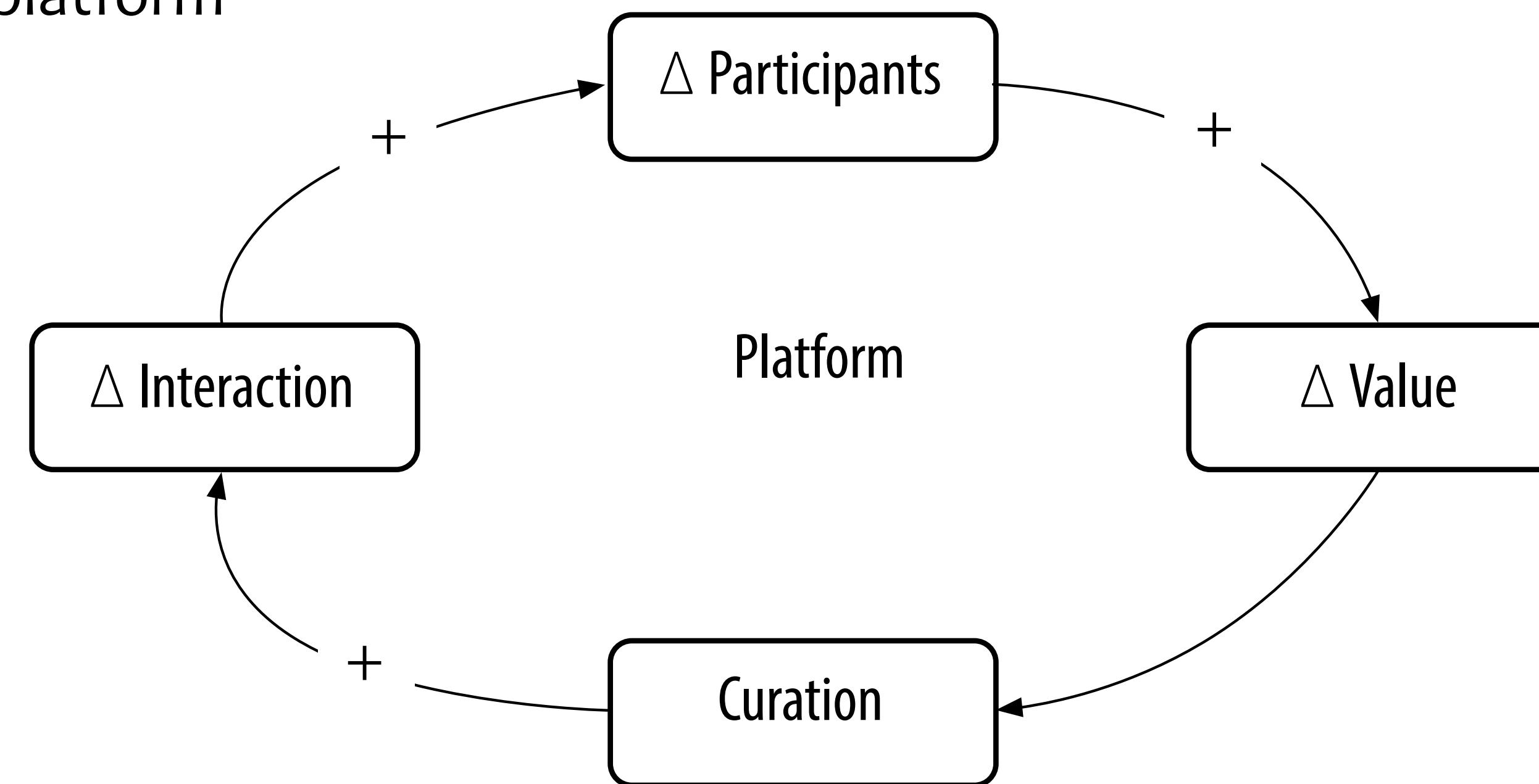
Match + Filter = Curation

Reduces negative cross network effects

Enhances positive cross network effects

Essential enabling capability for any platform

Curation is applied reputation



Platform Business Model

Supply economies of scale (production efficiency)

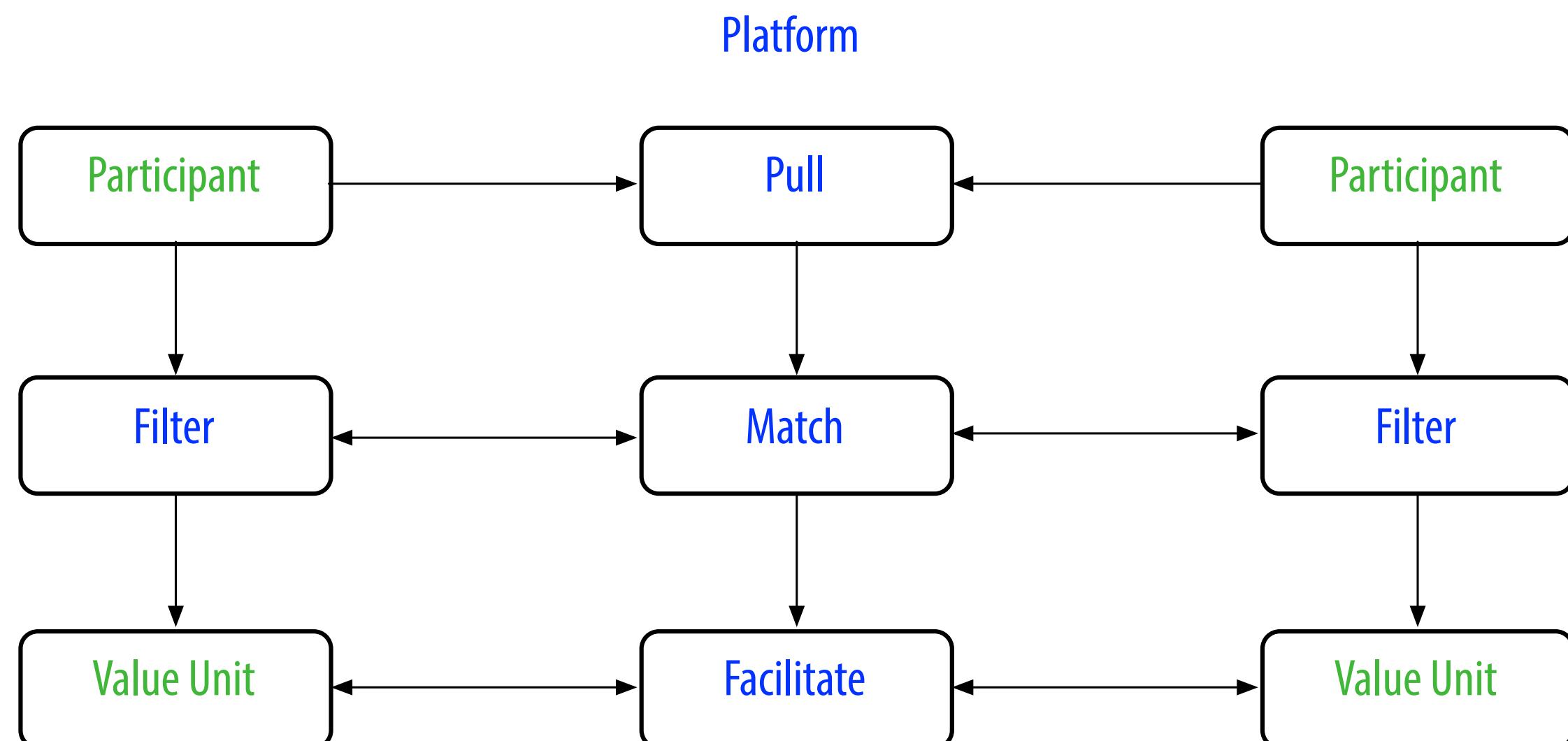
replaced with

Demand economies of scale (network effect multipliers of value)

Two-sided network effects

Core Interaction = Participants + Value unit + Filter

Platform = pull + match + facilitate



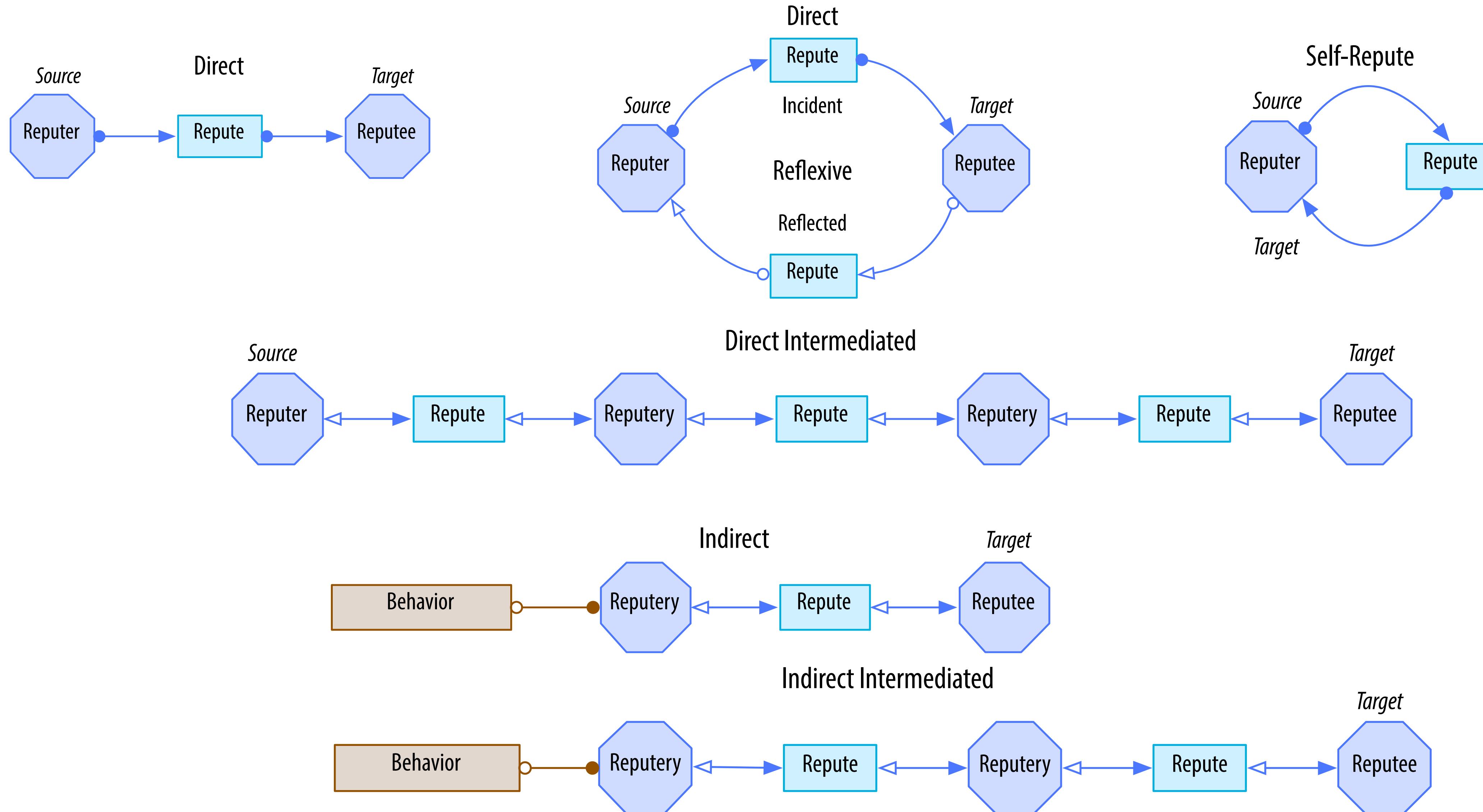
Meta-Platform

Two Sided Network Effects

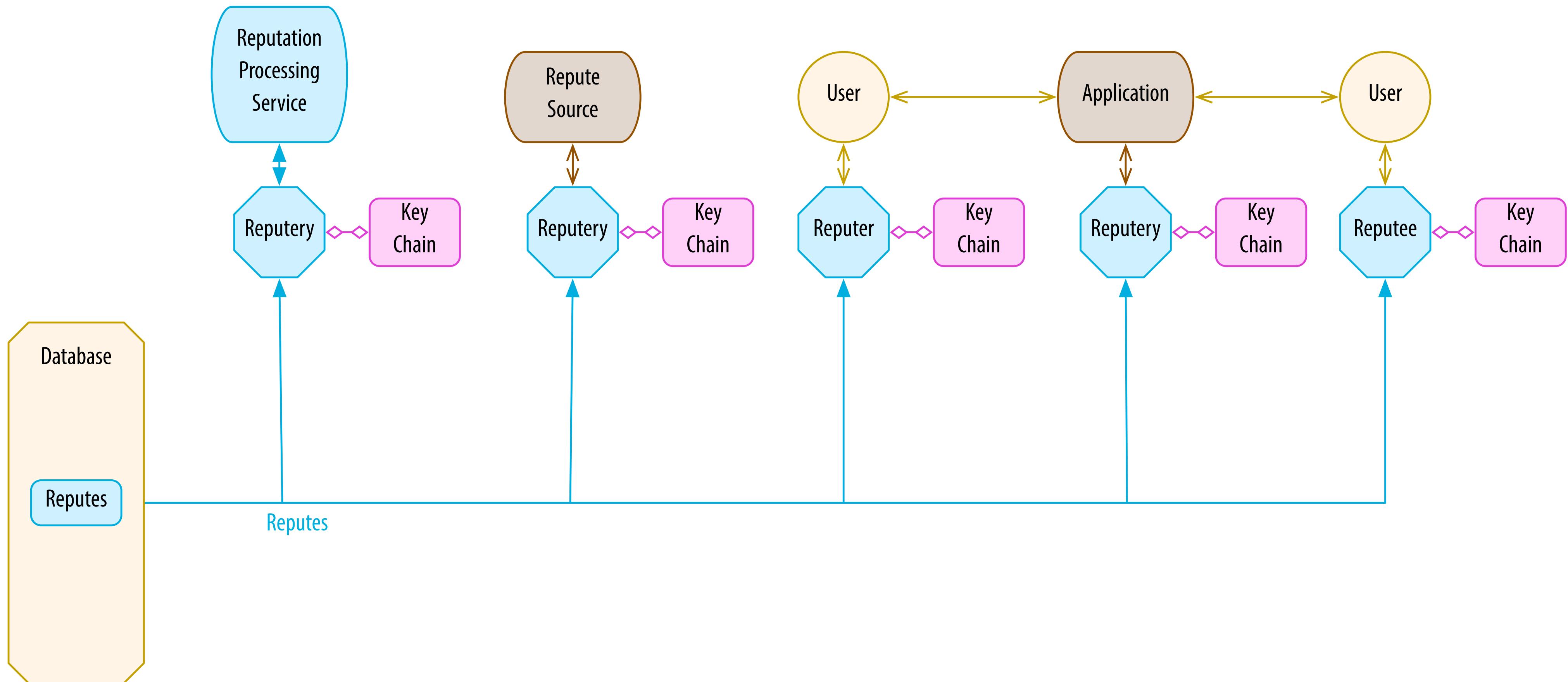
Curation, Filtering, Modulation

Optimal Control

Reputing



Basic Reputation



DISTRIBUTED AUTONOMIC SERVICE

DAS = service based on distributed consensus + autonomic computing algorithms on decentralized computing infrastructure = *distributed AI*

Reputation as a Service (RAAS)

RAAS on a DAS