The Economics of Its & Bits

Digital Identity

Freedom Privacy Control Security

Nonconformist Innovation Summit
2020/07/02
Samuel M. Smith Ph.D.
sam@samuelsmith.org
some graphics from flatiron.com or freepik.com

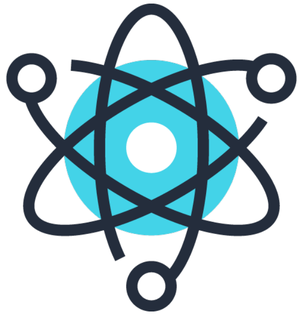
Economics

value — creation and capture

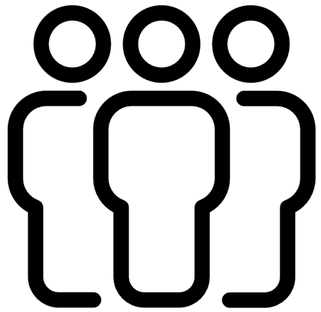
extraction, exchange, and exploitation

$$\frac{\text{control}}{\text{value}}$$ — security

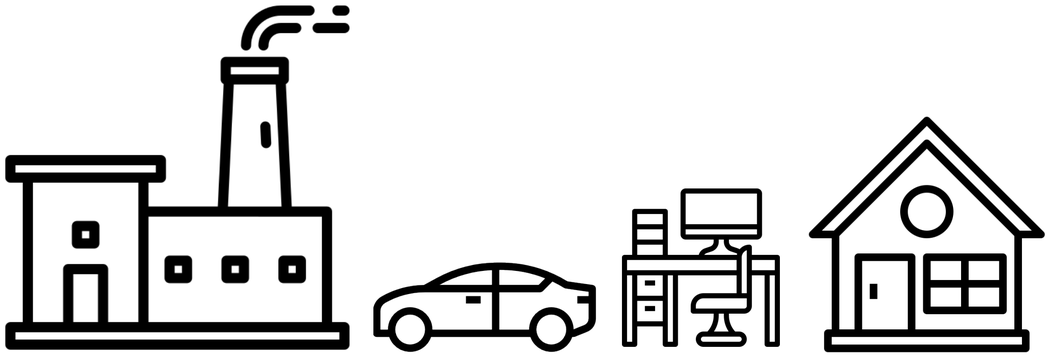
its



atoms



physical security



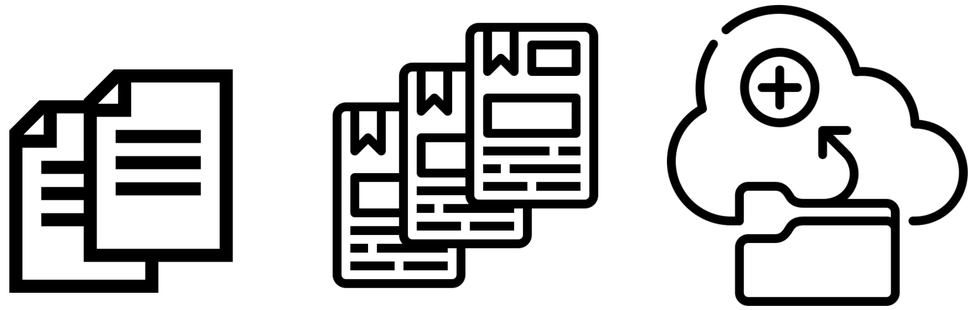
control

value

bits

digital information

Informational security



60 Years of Its & Bits

Revenue

1960

1960 Fortune 20 Revenue

Rank	Company	Revenues ($ millions)
1	General Motors	11,233
2	Exxon Mobil	7,911
3	Ford Motor	5,357
4	General Electric	4,350
5	U.S. Steel	3,643
6	Mobil	3,093
7	Gulf Oil	2,713
8	Texaco	2,678
9	Chrysler	2,643
10	Esmark	2,476
11	AT&T	2,315
12	DuPont	2,114
13	Bethlehem Steel	2,056
14	Amoco	1,957
15	CBS	1,911
16	Armour	1,870
17	General Dynamics	1,812
18	Shell Oil	1,810
19	Boeing	1,612
20	Kraft	1,606

1980

1980 Fortune 20 Revenue

Rank	Company	Revenues ($ millions)
1	Exxon Mobil	79,107
2	General Motors	66,311
3	Mobil	44,721
4	Ford Motor	43,514
5	Texaco	38,350
6	ChevronTexaco	29,948
7	Gulf Oil	23,910
8	IBM	22,863
9	General Electric	22,461
10	Amoco	18,610
11	ITT Industries	17,197
12	Atlantic Richfield	16,234
13	Shell Oil	14,431
14	U.S. Steel	12,929
15	Conoco	12,648
16	DuPont	12,572
17	Chrysler	12,002
18	Tenneco Automotive	11,209
19	AT&T	10,964
20	Sunoco	10,666

2000

2000 Fortune 20 Revenue

Rank	Company	Revenues ($ millions)
1	General Motors	189,058
2	Wal-Mart Stores	166,809
3	Exxon Mobil	163,881
4	Ford Motor	162,558
5	General Electric	111,630
6	IBM	87,548
7	Citigroup	82,005
8	AT&T	62,391
9	Altria Group	61,751
10	Boeing	57,993
11	Bank of America Corp.	51,392
12	SBC Communications	49,489
13	Hewlett-Packard	48,253
14	Kroger	45,352
15	State Farm Insurance Cos	44,637
16	Sears Roebuck	41,071
17	American Intl. Group	40,656
18	Enron	40,112
19	TIAA-CREF	39,410
20	Compaq Computer	38,525

2020

2020 Fortune 20 Revenue

Rank	Company	Revenues ($ millions)
1	Walmart	523,964
2	Amazon.com	280,522
3	Exxon Mobil	264,938
4	Apple	162,558
5	CVS Health	256,776
6	Berkshire Hathaway	256,776
7	UnitedHealth Group	242,155
8	McKesson	214,319
9	AT&T	181,193
10	AmerisourceBergen	179,589
11	Alphabet	161,857
12	Ford Motor	155,900
13	Cigna	153,566
14	Costco Wholesale	152,703
15	Chevron	146,516
16	Cardinal Health	145,534
17	JPMorgan Chase	142,422
18	General Motors	137,237
19	Walgreens Boots Alliance	136,866
20	Verizon	131,868

Market Value

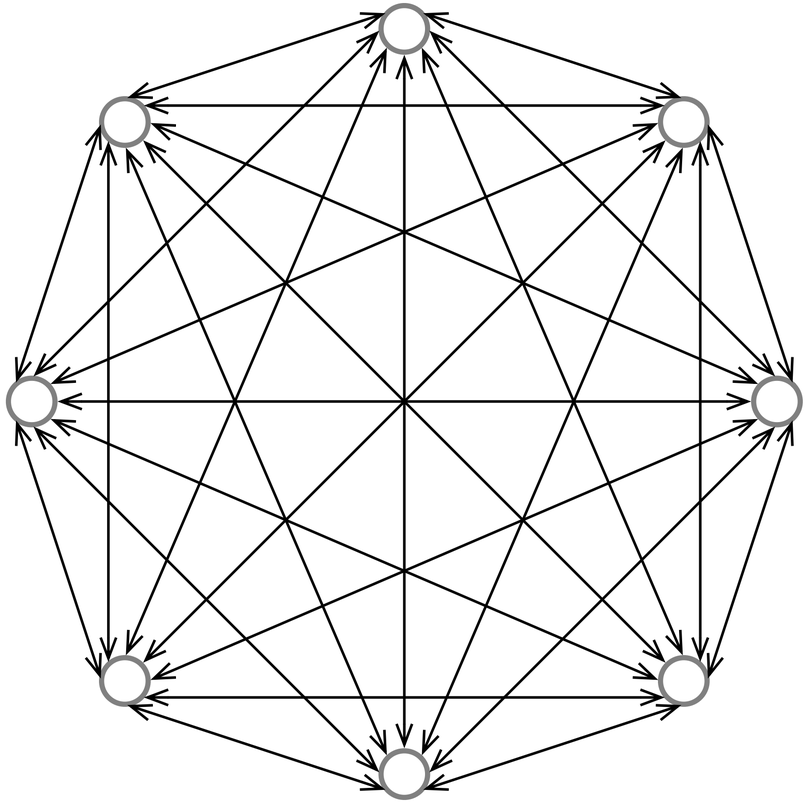
2020

2020 Fortune 20 Market Value

Rank	Company	Market Value ($ millions)
1	Microsoft	1,199,550
2	Apple	1,112,641
3	Amazon.com	970,680
4	Alphabet	798,905
5	Facebook	475,455
6	Berkshire Hathaway	442,897
7	Johnson & Johnson	345,705
8	Walmart	321,803
9	Visa	316,199
10	JPMorgan Chase	276,750
11	Procter & Gamble	271,640
12	Mastercard	242,794
13	UnitedHealth Group	236,555
14	Intel	231,662
15	Verizon	222,220
16	AT&T	209,388
17	Home Depot	200,665
18	Merck	195,141
19	Coca-Cola	189,983
20	Bank of America	185,227

Networks Effects

Network scaling law: How network value scales with number of participants.



Metcalfe's Law

$$v = a \cdot N$$

$$V = a \cdot N \cdot N = a \cdot N^2$$

Value = Reach

Metcalfe's Law Validation

Madureira A., F. den Hartog, H. Bouwman *et al.*, "Empirical validation of Metcalfe's law: How Internet usage patterns have changed over time," *Information Economics and Policy*, vol. 25, no. 4, pp. 246–256, 2013

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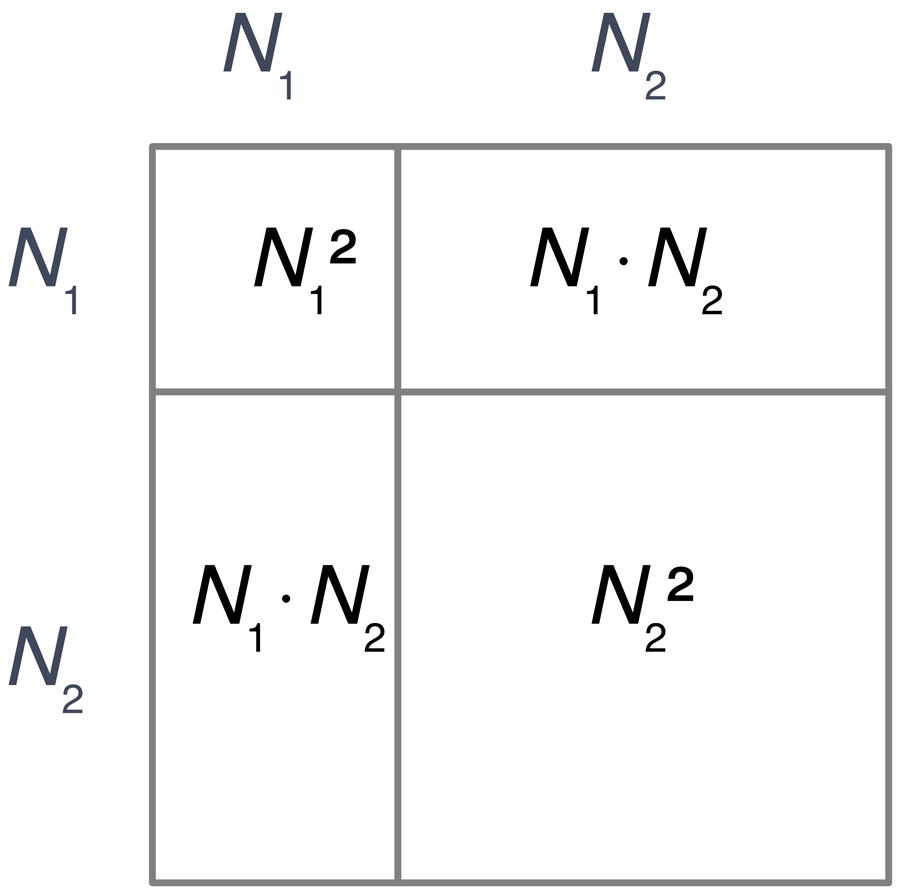
Xie, J. and Sirbu, M., "Price competition and compatibility in the presence of positive demand externalities," *Management science*, vol. 41, no. 5, pp. 909-926, 1995

How do we recapture the value in our data?

1- Leverage cooperative network effects
2- Retake control of our data

Cooperating Networks

What happens to value when two smaller networks combine?



$$v_1 = v_2 = a \cdot (N_1 + N_2)$$

$$V_1 = a \cdot N_1 \cdot (N_1 + N_2) = a \cdot N_1^2 + a \cdot N_1 \cdot N_2$$

$$V_2 = a \cdot N_2 \cdot (N_1 + N_2) = a \cdot N_2^2 + a \cdot N_1 \cdot N_2$$

$$V = V_1 + V_2 = a \cdot N_1^2 + 2 \cdot a \cdot N_1 \cdot N_2 + a \cdot N_2^2 = a \cdot (N_1 + N_2)^2$$

$$a \cdot N_1 \cdot N_2.$$

Cooperating Network Lifetime Value

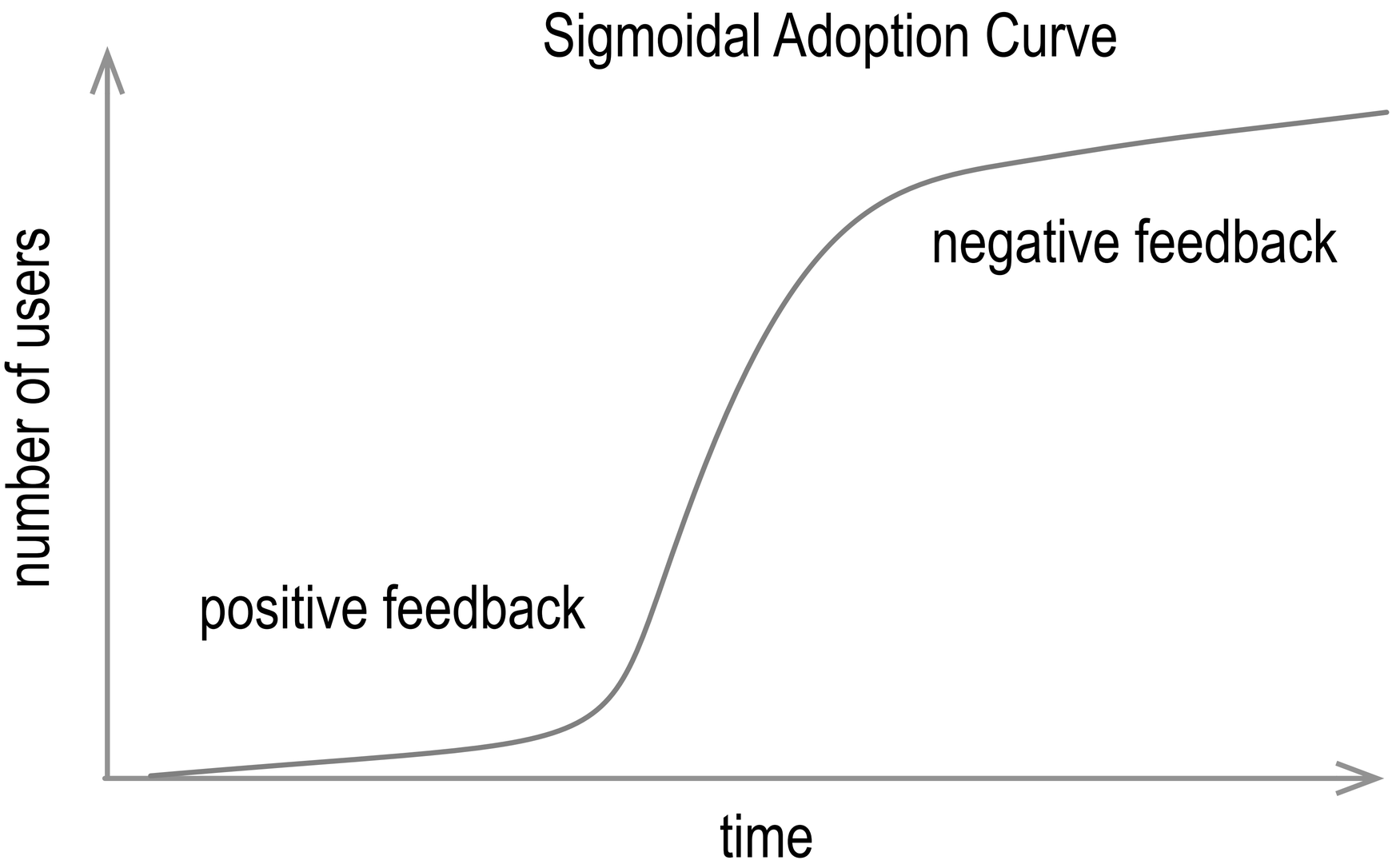
Xie, J. and Sirbu, M., "Price competition and compatibility in the presence of positive demand externalities," *Management science*, vol. 41, no. 5, pp. 909-926, 1995

When the two networks are value symmetric then it is always more profitable for both to combine.

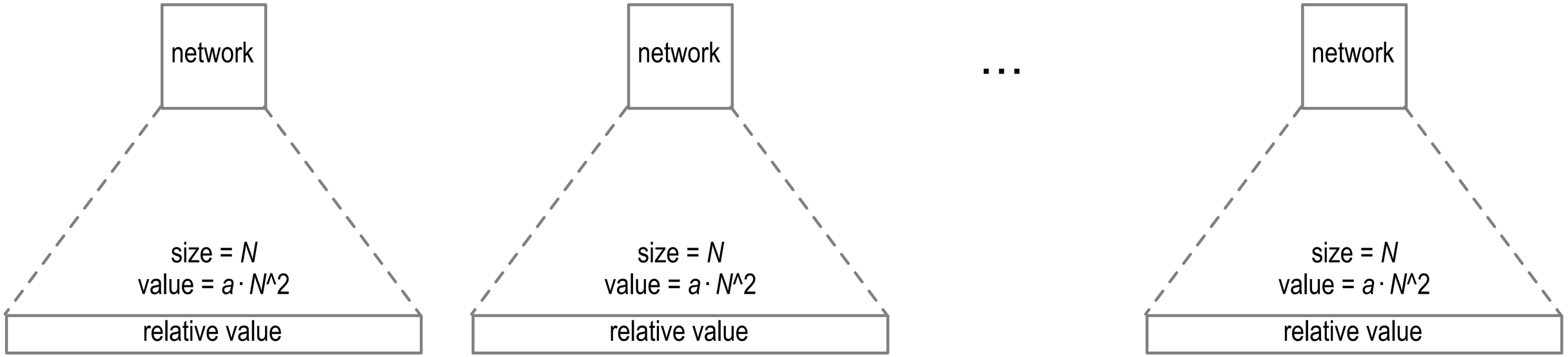
When the two networks are value asymmetric then it is always more profitable for the smaller network to combine.

When the two networks are value asymmetric and when the larger network's size is below a threshold then it is also always more profitable for the larger network to combine.

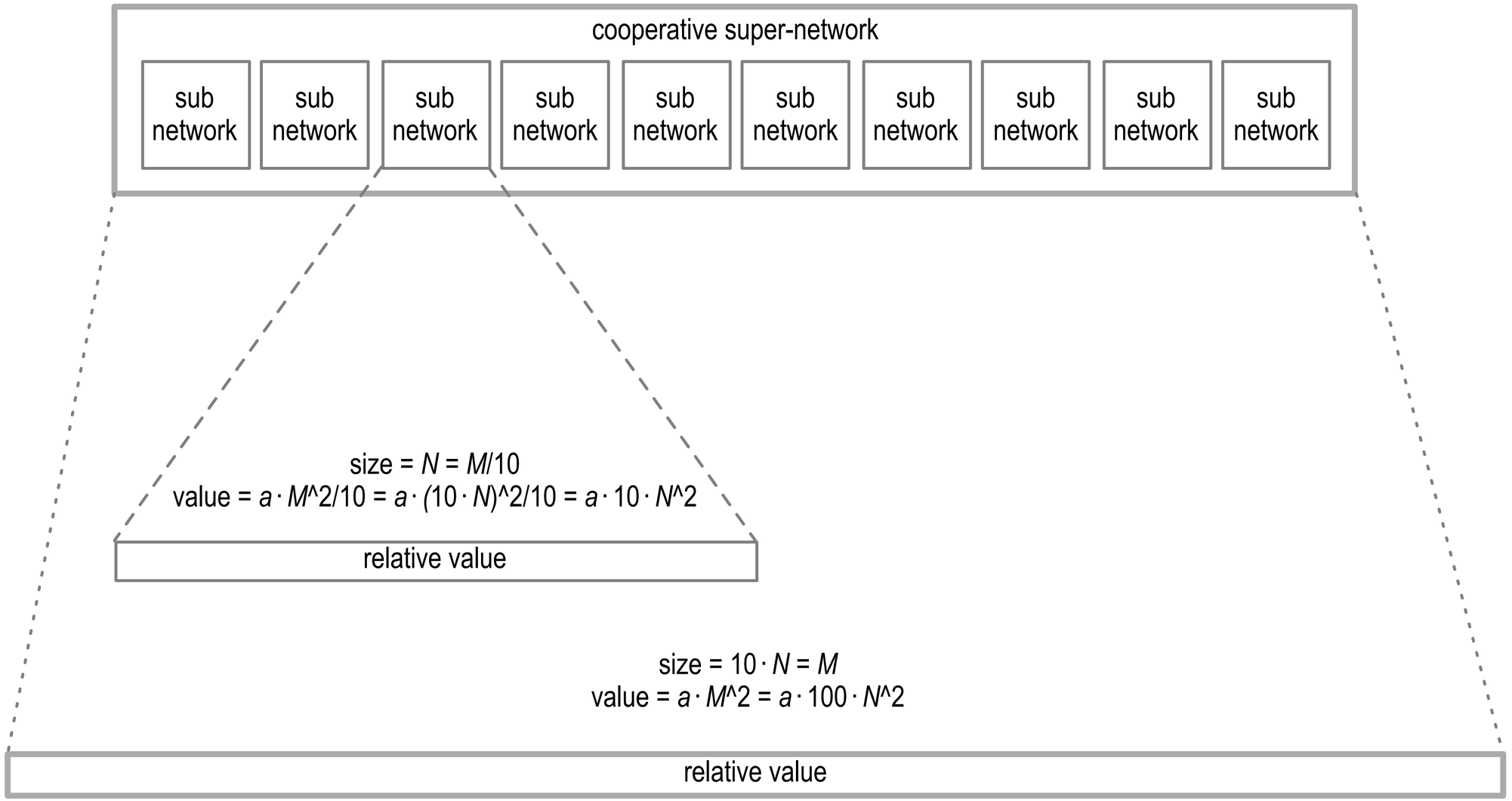
Feedback and Adoption Growth Rate



Competing Small Networks



Super-Network of Cooperating Small Networks



Cooperative Network of Networks Effect

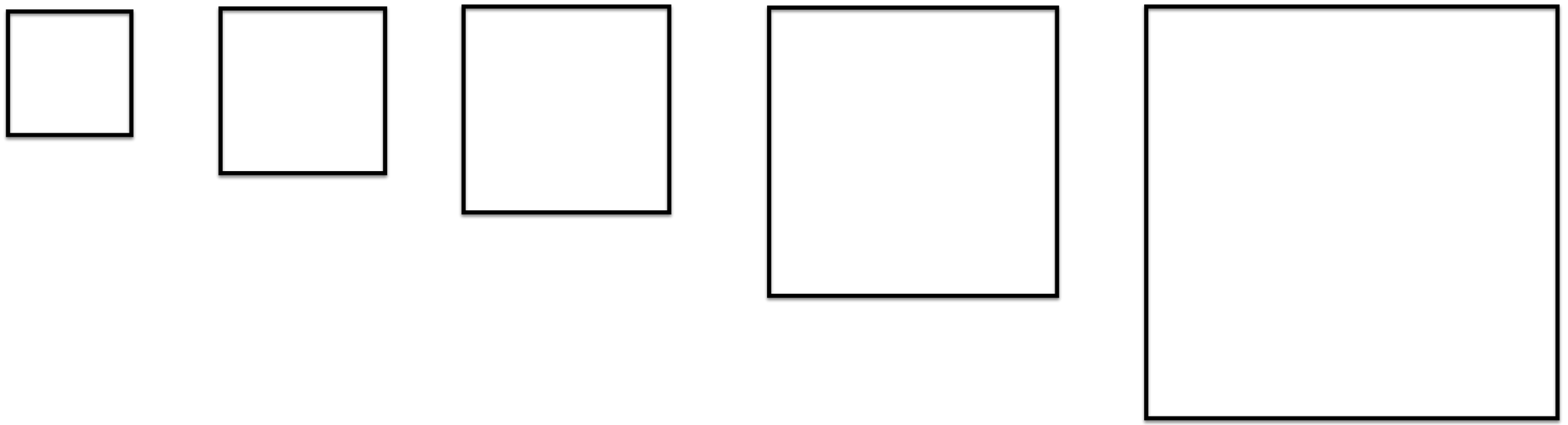
$$V(N{:}M)/V(N) = ((N/M)\cdot a\cdot M^2)/(a\cdot N^2) = M/N$$

$$V(N{:}M) = (M/N)\cdot V(N)$$

The network effect resulting from sub-network joining a cooperating super-network is that the sub-network's value is increased by the ratio of super-network to sub-network size.

Cooperation Advantage

Small Network Strategy



Cooperative Network Cascade

How to remove primary barrier to cooperation?

Different value contexts = not directly competitive.

Find value that is transferrable between contexts.

Trans-contextual value creation and capture.

Use *trans-contextual* value creation and capture to *fuel cooperative* network effects.

Participant controlled

trans-contextual value creation and capture

= *virtual* participant centric network

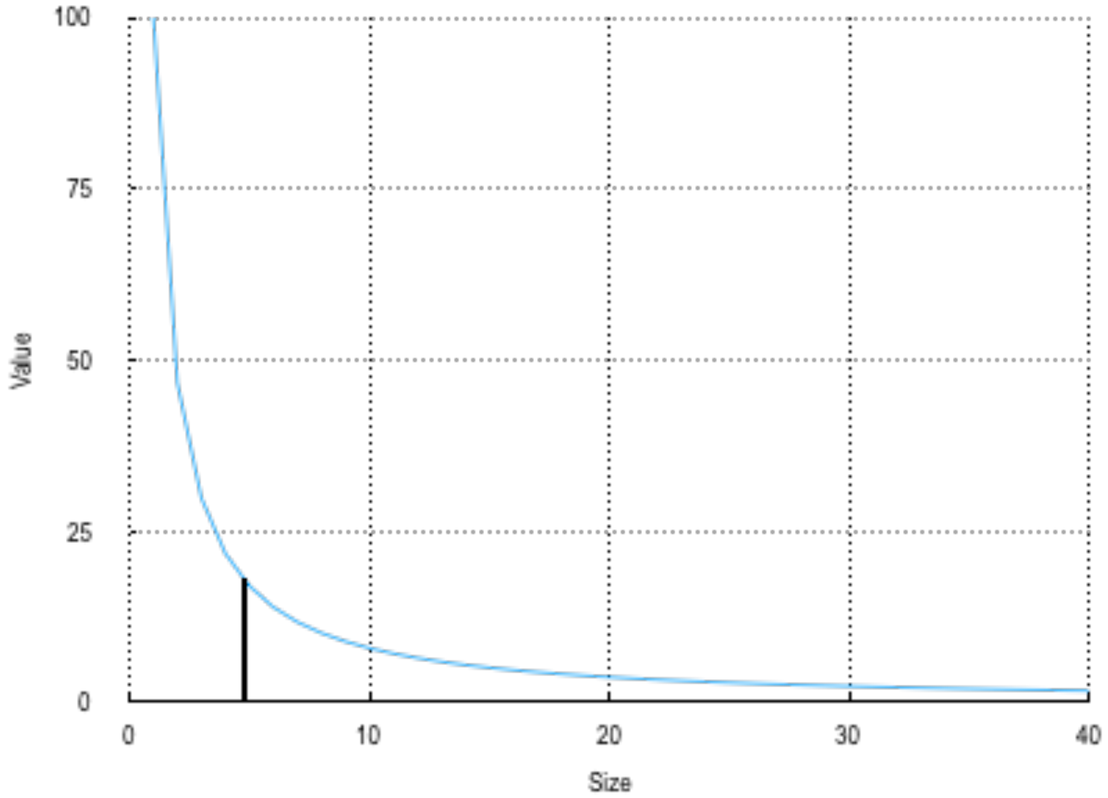
Enables participant to *amplify* own value

across multiple contexts

= maximum adoption *pull*

= fastest spin-up of *cooperative* network effects.

Cooperative long-tail network effects



Treat long-tail as effective set of different contexts

Q: Where to find trans-contextual value?

A: Transaction Costs?

Triangulation: Connection, Find, Filter, Match

Transfer: Facilitation,Transport, Delivery, Payment

Trust: Security, Competency, Reliability, Privacy, Liability

Platforms/Networks sell reductions in transaction costs.

To a consumer, all costs look like transaction costs.

Principal super aggregator pull is reduced trust transaction costs.

Trust may be highly transferable between contexts!

Reduction of trust transaction costs

is a

primary network effect value from cooperation.

Transitive Value Virtual Network Scaling Law

Set of trans-contextual cooperating networks **n**.

average transitivity factor, *t*,

$0 \le t \le 1$.

$$\mathbf{s} = \begin{bmatrix} a_1 N & a_2 N_2 & \dots & a_m N_m \end{bmatrix}$$

$$\mathbf{T} = \begin{bmatrix} t_{11} & t_{12} & \dots & t_{1m} \\ t_{21} & t_{22} & \dots & t_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ t_{m1} & t_{m2} & \dots & t_{mm} \end{bmatrix} \qquad t_{ij} = 1 \Big|_{i=j}$$

$$\mathbf{v} = \begin{bmatrix} v_1 & v_2 & \dots & v_m \end{bmatrix}$$

$$\mathbf{v}^{\mathrm{T}} = \mathbf{T} \cdot \mathbf{s}^{\mathrm{T}}$$

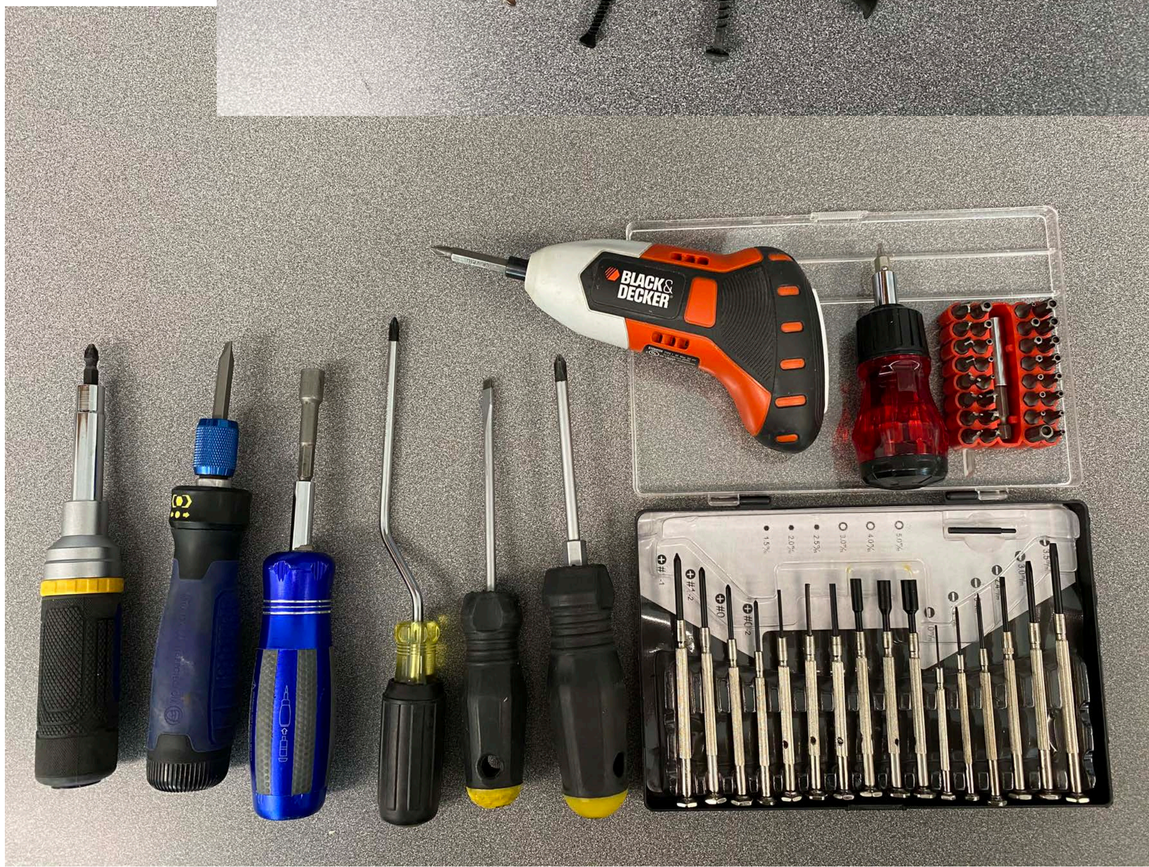
$$\mathbf{n} = \begin{bmatrix} N_1 & N_2 & \dots & N_m \end{bmatrix}$$

$$V = \mathbf{n} \cdot \mathbf{v}^{\mathrm{T}} = \mathbf{n} \cdot \mathbf{T} \cdot \mathbf{s}^{\mathrm{T}}$$

https://medium.com/selfrule/meta-platforms-and-cooperative-network-of-networks-effects-6e61eb15c586

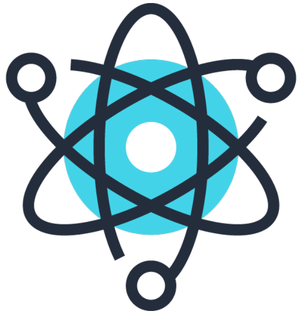
Retake control of our data

Toolkits

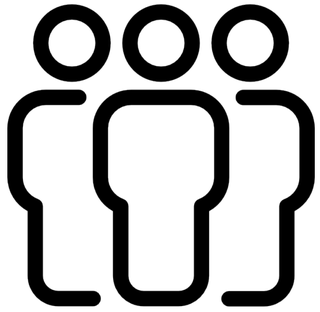


Only have one set of tools for truly secure data control!

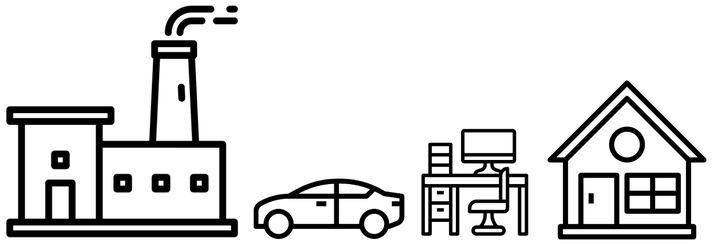
its



atoms



physical security



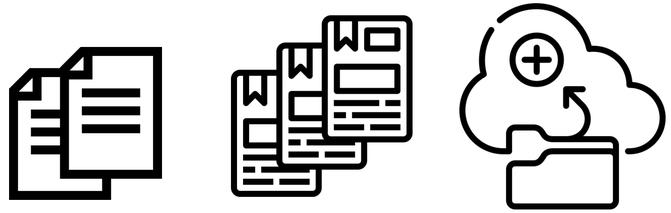
control

value

bits

digital information

Informational security



digital uniqueness

Entropy

Entropy Derived Tools

Cryptographic one-way functions …

hashes, ECC scalar multiplication…
digital signatures, ZKPs …

Information uniqueness from captured entropy

To retake control of our data we must first retake control of our identifiers.

self-certifying pseudonymous identifiers

Key Event Receipt Infrastructure (KERI)

https://arxiv.org/abs/1907.02143

Four A's of Secure Data Control

Author: creator, source-of-truth
Authentic: provable origin, root-of-trust
Authorized: consent, loci-of-control
Authoritative: accurate, reputable

A^4 data control securely established via self-certifying pseudonymous identifiers

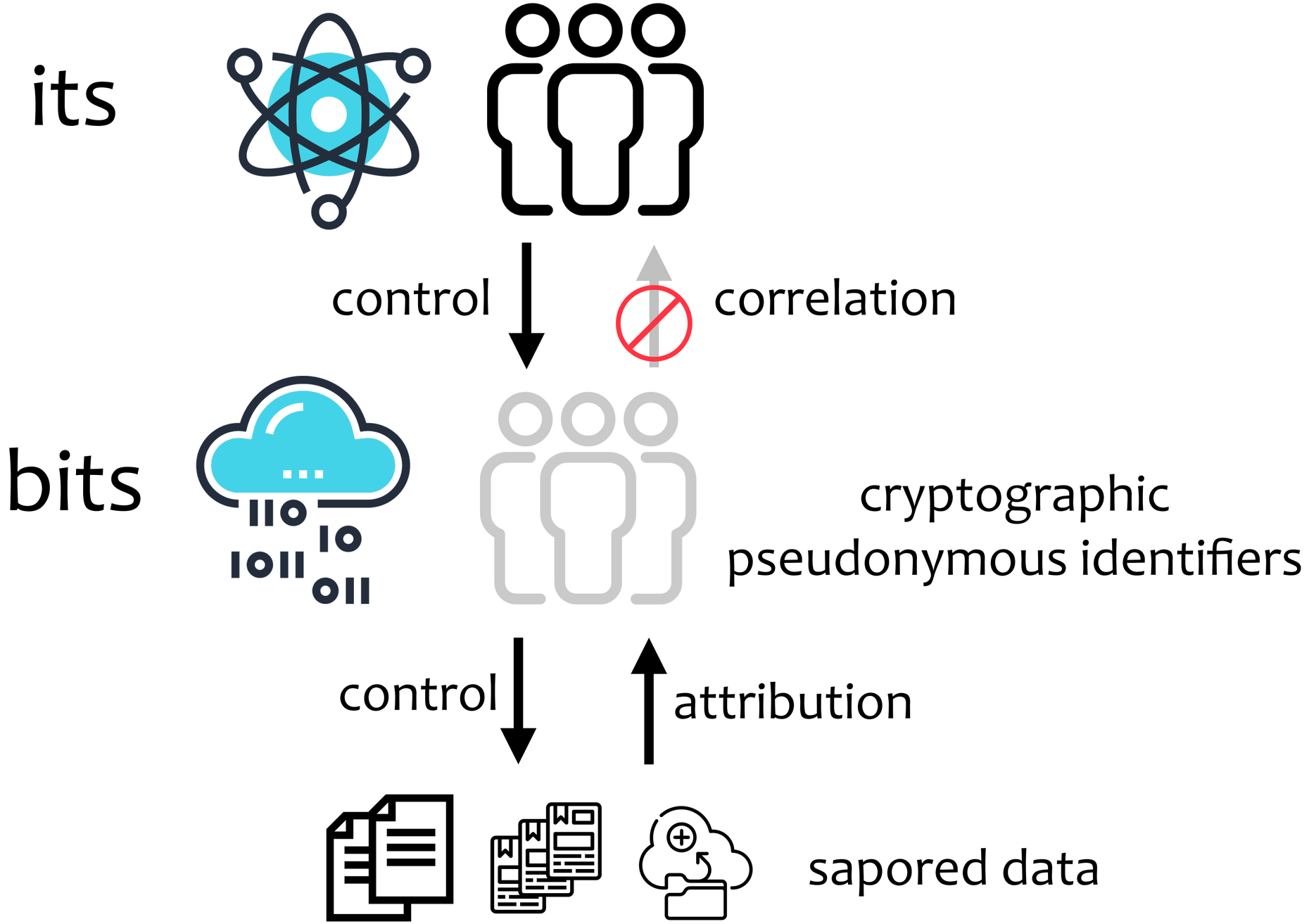
Sapored Data

Sapor: *noun*

the quality in a substance that affects the sense of taste; savor; flavor.

Sapored data may be securely provenanced to its author(s).
Sapored data value extraction may be securely attributed to its authors.

Sapored data supply chains.
Enable consumer pull in addition to regulatory push.
Conscious consumers of *Sapored data*.


its
control
correlation
bits
cryptographic
pseudonymous identifiers
control
attribution
sapored data

Strong

Weak

Privacy?

Weak

Strong Privacy

un-correlated interactions over unbounded time and space.

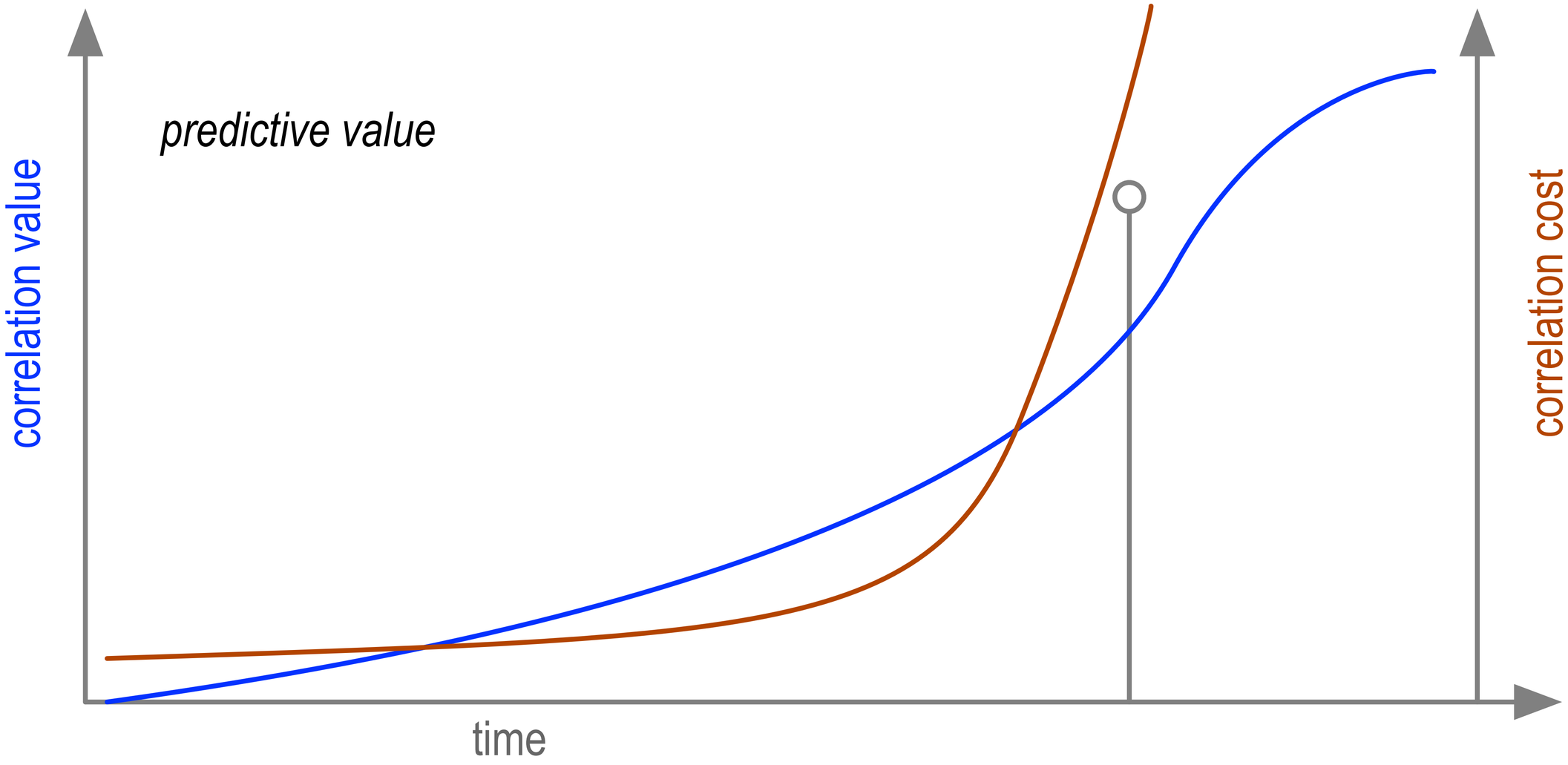
Super aggregators and state actors have effectively unlimited storage and compute capacity. Eventually all disclosed data will be at least statistically correlatable.

Weak Privacy

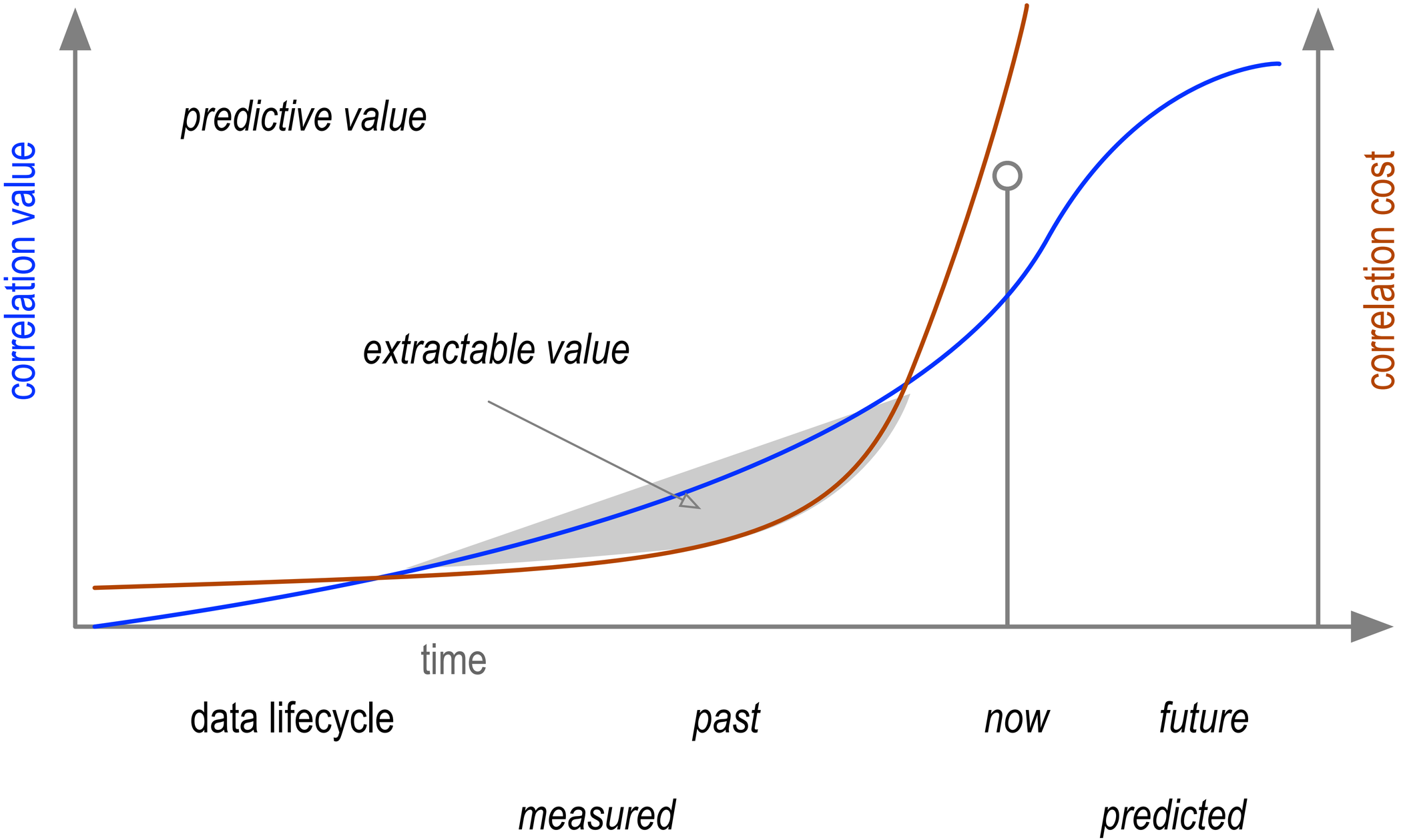
un-correlated interactions over bounded time and space.

When the cost of correlation exceeds the value of correlation the data will be un-correlated.

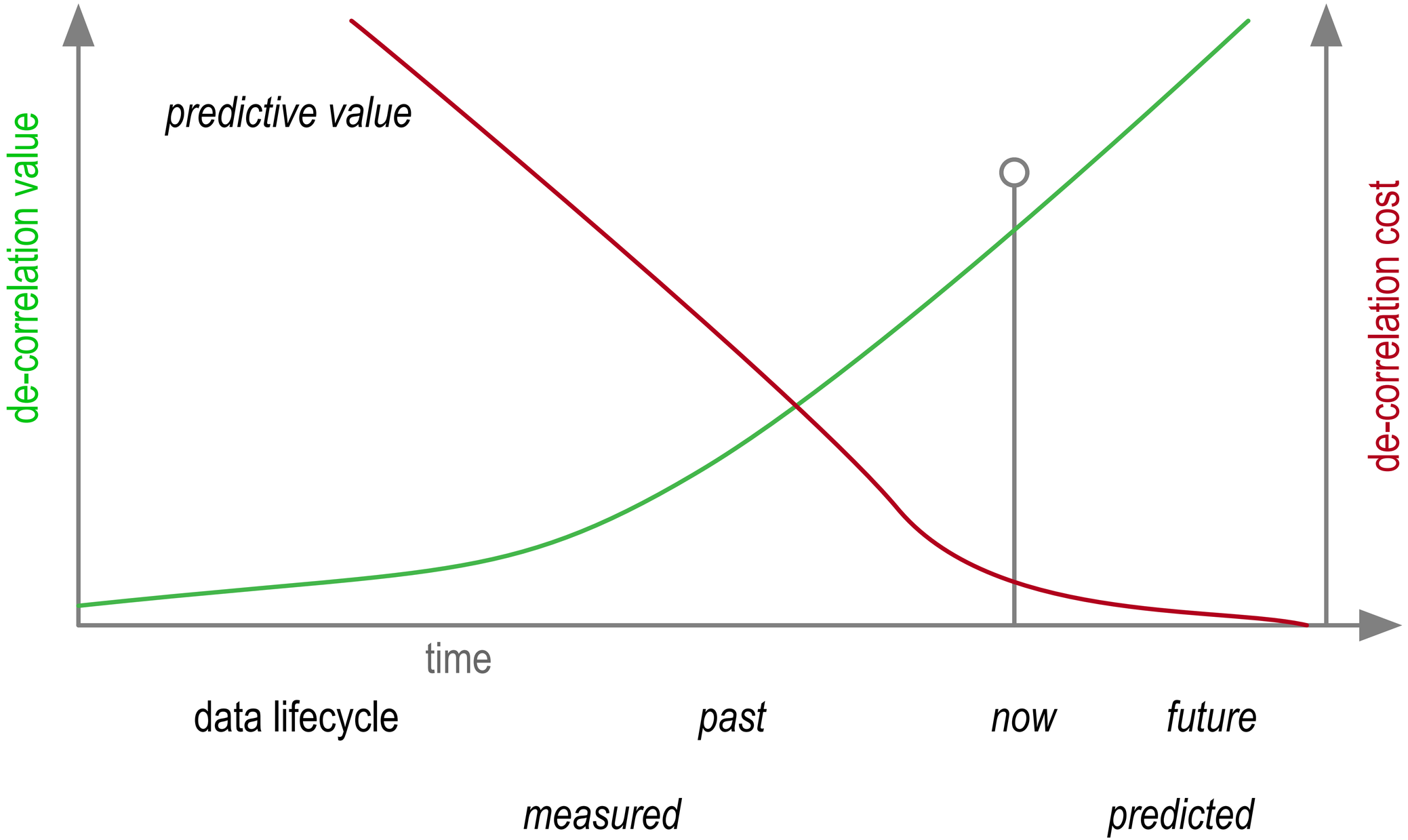
Economics of Correlator



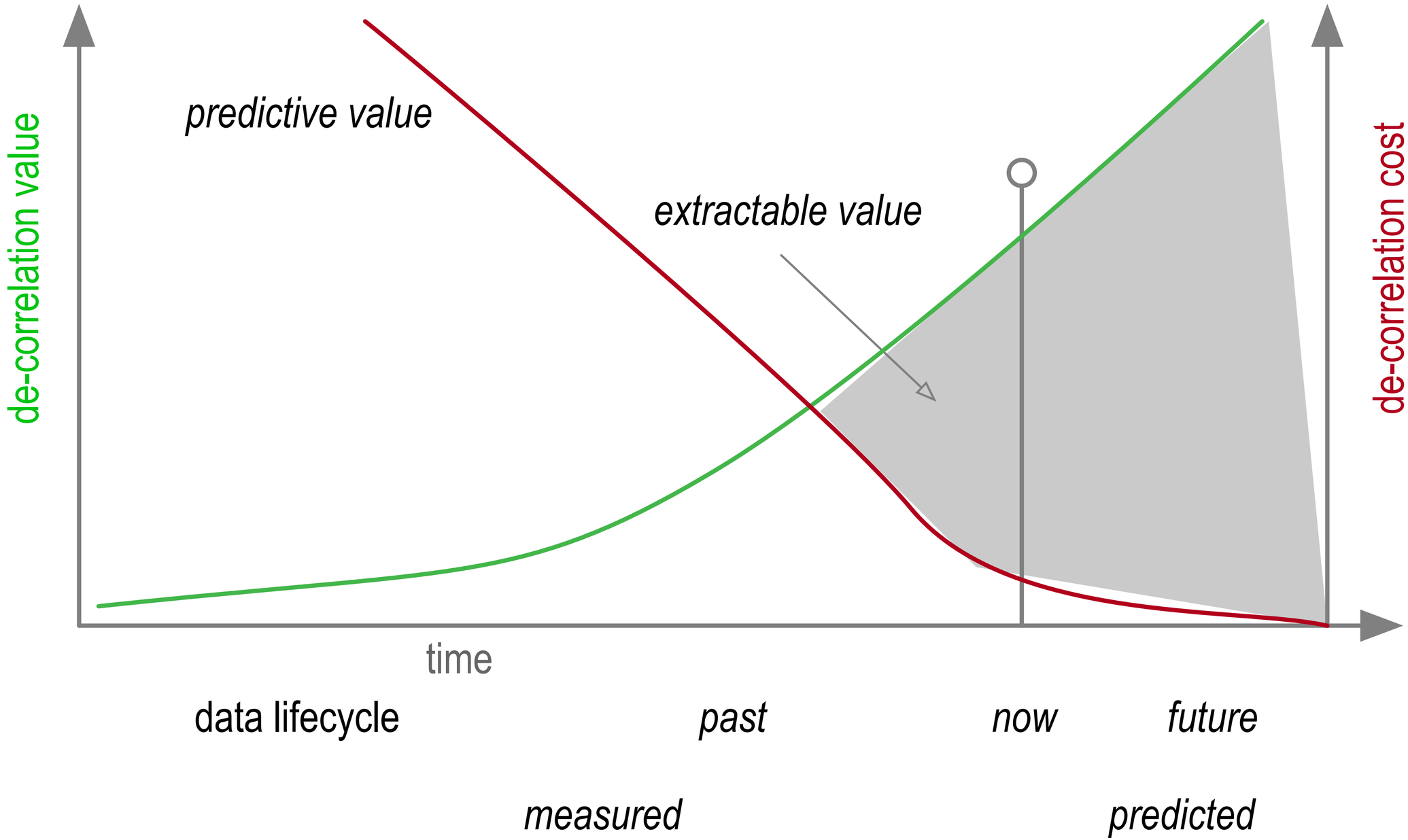
Economics of Correlator: Value Extraction



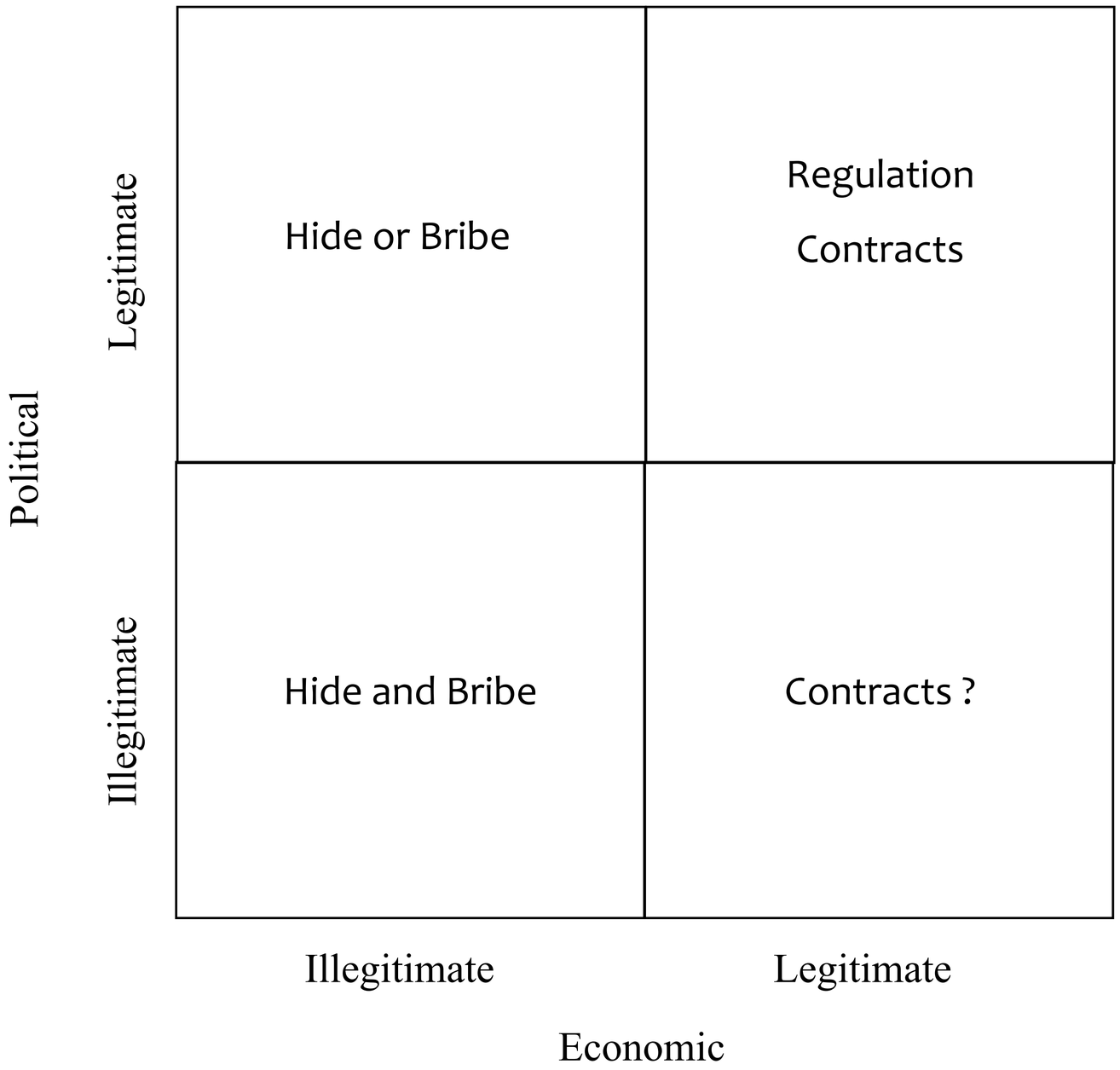
Economics of De-correlator



Economics of De-correlator: Value Extraction



Operating Regimes



Freedom

balanced

Freedom from …	Freedom to …
exploitation (commercial)	extract value(commercial)
intimidation (political)	build relationships (social)
censorship (political)	build community (political)

possibility of erasure = possibility of censorship

anonymity = loss-of-value from attribution

fairness = requires data attribution

Class-Based (A^4) Pseudonymity

Separable Identifier Trust Bases

KERI

CONCLUSION

Q&A

https://medium.com/selfrule/meta-platforms-and-cooperative-network-of-networks-effects-6e61eb15c586

GitHub

SmithSamuelM

Papers

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KERI

Key Event Receipt Infrastructure

A Secure Identifier Overlay for the Internet

Samuel M. Smith Ph.D.

version 2.31

Resources

sam@prosapien.com

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