Accounting Value Effects for Responsible Networking

ACM SIGCOMM 2021 Workshop on Technologies, Applications, and Uses of a Responsible Internet (TAURIN 2021), 23 August 2021

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University of Amsterdam

Why responsible computing?

the more we delegate activities to machines,

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the more we delegate activities to machines,
the more we need machines to behave "responsibly"

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Today, focus on this issue is mostly on ML-based AI, however, any technology -- because it has effects on the world -- should fulfill the same requirement.

Why responsible computing?

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the more we need machines to behave "responsibly"

Today, focus on this issue is mostly on ML-based AI, however, any technology --
because it has effects on the world -- should fulfill the same requirement.

Including the *Internet and networking*!

Looking at application level, data-sharing has practical effects

because having access to relevant information has value for agents!

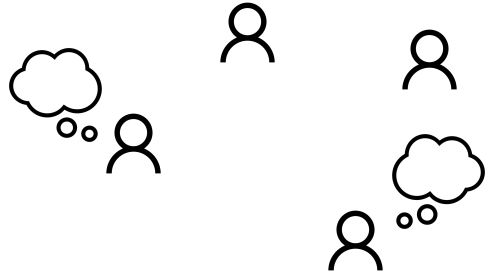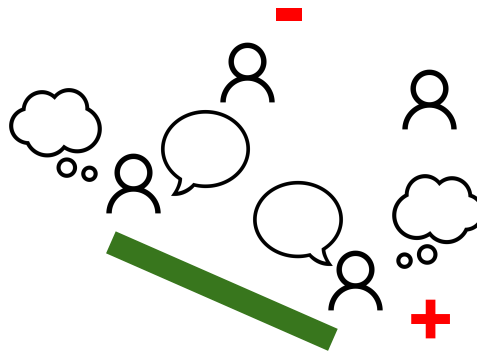# Looking at application level, data-sharing has practical effects

because having access to relevant information has value for agents!

people, organizations, systems which act to achieve certain purposes

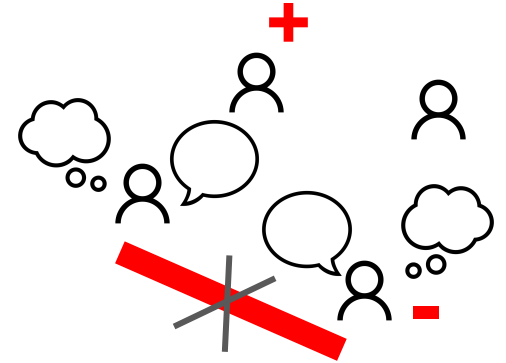# Looking at application level, data-sharing has practical effects

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no exchange

exchange enabled/allowed

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Looking at application level, data-sharing has practical effects

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- technologies provide new abilities

e.g. Internet with new forms of knowledge sharing, aggregation, making business, etc.

ability (power) dimension

Looking at application level, data-sharing has practical effects

because having access to relevant information has value for agents!

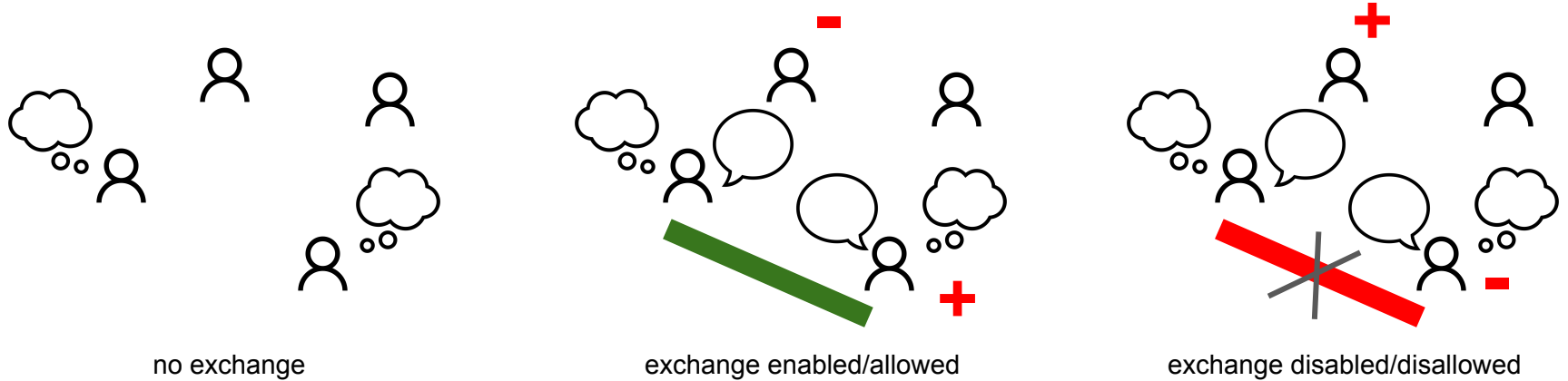no exchange   exchange enabled/allowed   exchange disabled/disallowed

- societies introduce checks & balances

➡ **e.g. norms on privacy, data regulation (e.g. GDPR), competition laws, etc.**

ability (power) dimension   **permission** dimension

Looking at application level, data-sharing has practical effects

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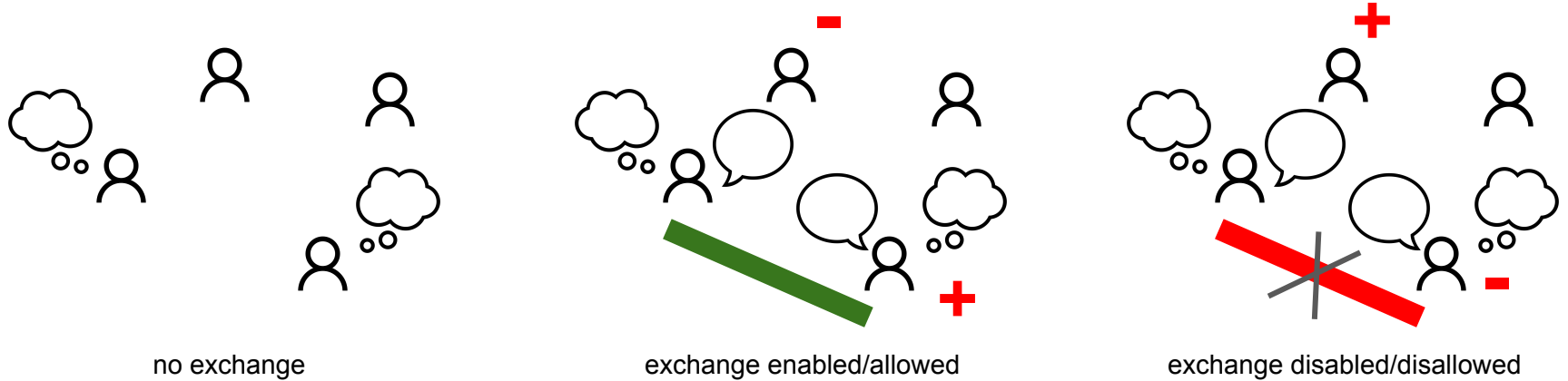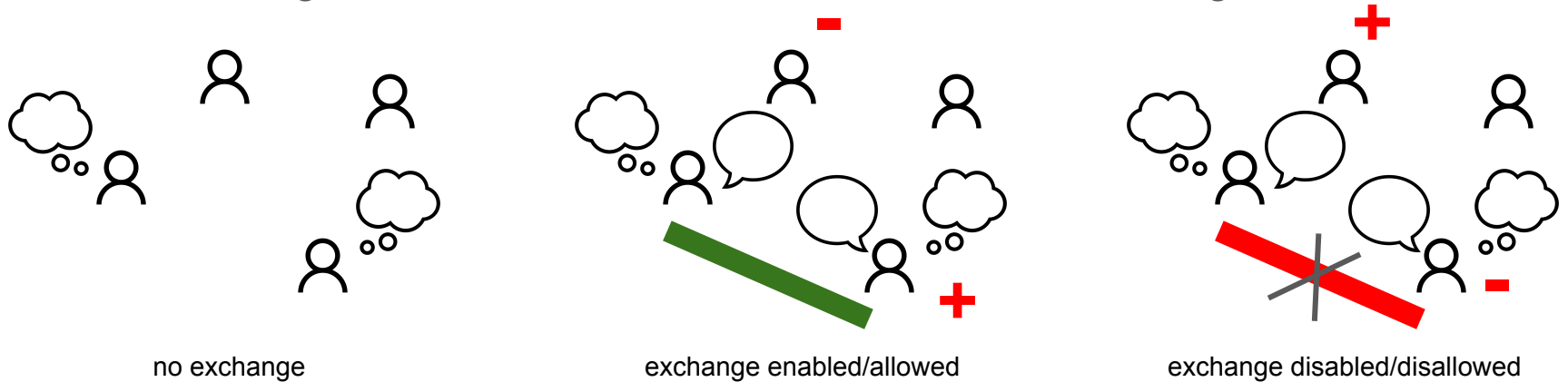no exchange   exchange enabled/allowed   exchange disabled/disallowed

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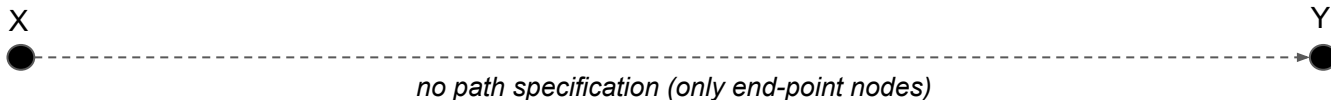 e.g. norms on privacy, data regulation (e.g. GDPR), competition laws, etc.

How these checks and balances are reflected at infrastructural level?

Data transmission as "logistic" task

How to transport data from node X to node Y?

X   Y

no path specification (only end-point nodes)

Data transmission as "logistic" task

How to transport data from node X to node Y?

X   Y
●- ●
no path specification (only end-point nodes)

- Enabling transmission from X to Y requires the network to provide some form of **routing services.**

X   Y
●- - - - - - - - - - - ●- - - - - - - - - - - ●- - - - - - - - - - - ●
partial path specification (with intermediary steps)

X   Y
●→ ●→ ●→ ●→ ●→ ●→ ●
full specification (all intermediary steps as "primitive" actions)

Data transmission as "logistic" task

How to transport data from node X to node Y?

X   Y
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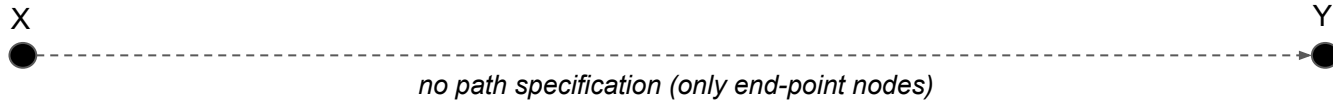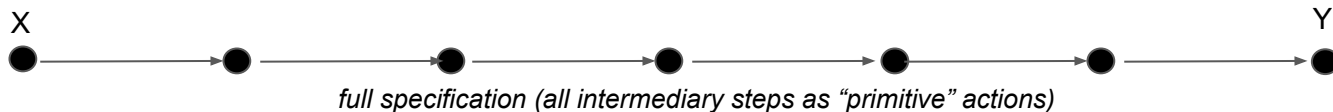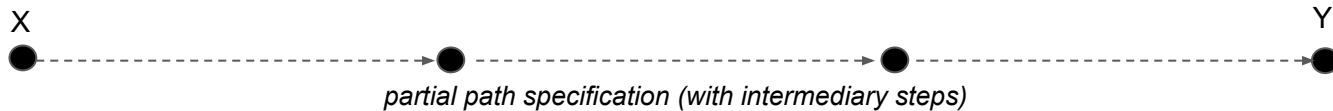
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For ***inter-domain routing***, network operators typically rely on BGP policies and community tags.
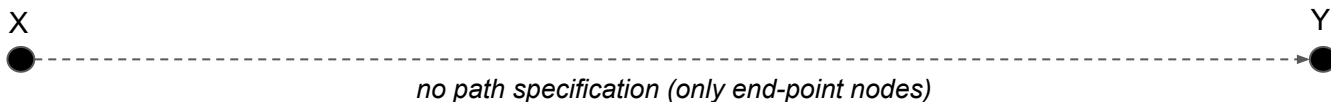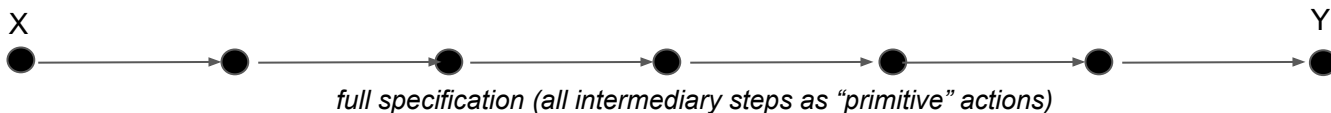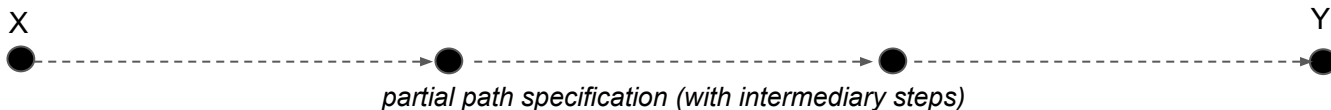
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●——→●——→●——→●——→●——→●——→●

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Data transmission as "logistic" task

Main issues possibly occurring at network level:

faulty transmission

X   Y

abusive
transmission
(e.g. data-leak)   Z

X   Y

inefficient or expensive transmission (in terms of
resources load/usage, environmental impact, etc.)

X

Data transmission as "logistic" task

Main issues possibly occurring at network level:

Intuitively, a 'responsible' networking should reduce these issues.

faulty transmission

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abusive transmission (e.g. data-leak)

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but...

inefficient or expensive transmission (in terms of resources load/usage, environmental impact, etc.)
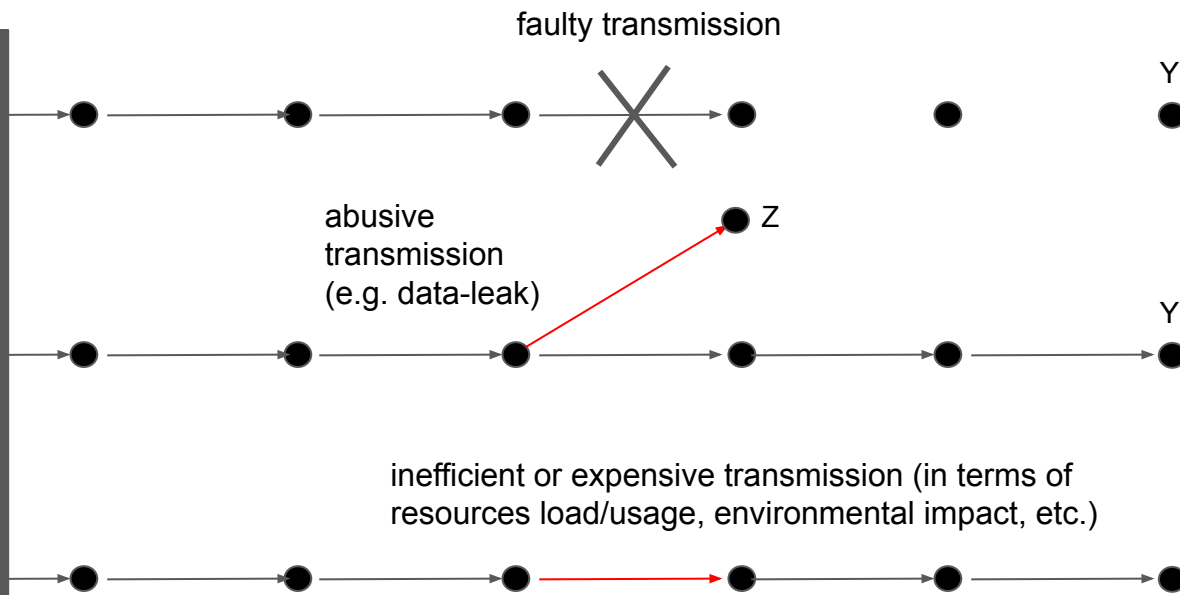
who defines what is faulty, abusive, expensive?
  who monitors? who prevents (predicts) or reacts to failures?

Data transmission as "logistic" task

Main issues possibly occurring at network level:

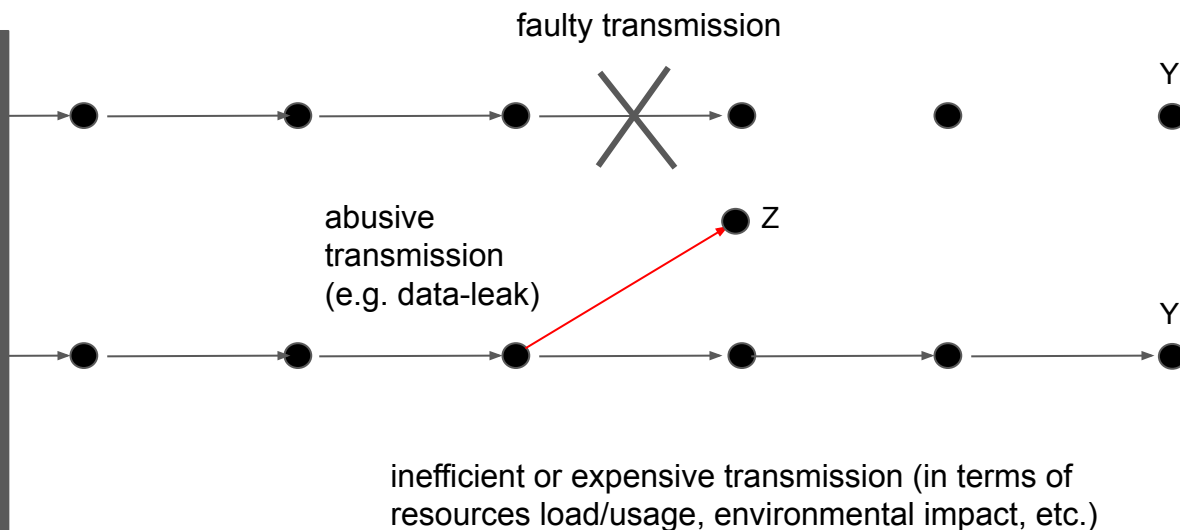Intuitively, a 'responsible' networking should reduce these issues.

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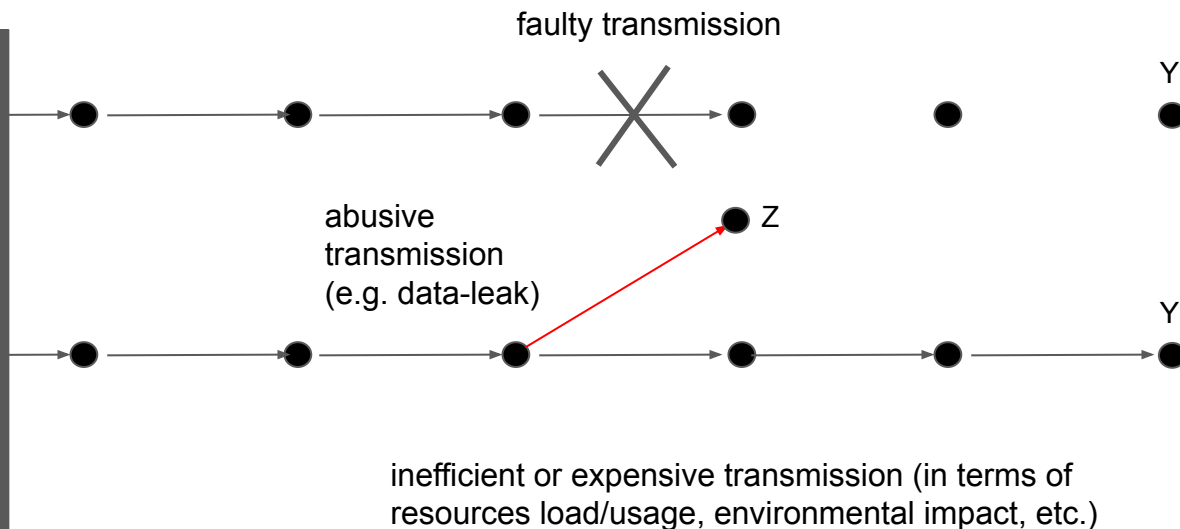
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who defines what is faulty, abusive, expensive?
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"responsibility" is a matter of **social coordination** policy

Internet social structure

Three main roles can be recognized around Internet's activities:
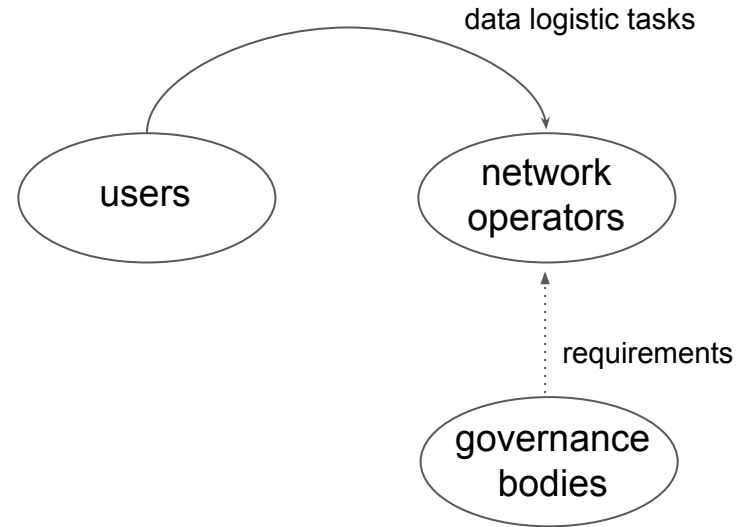
- users (applications, software agents, etc.)
- network operators
- governance bodies

Responsible Internet social structure

The Responsible Internet proposal
(Hesselman et al., 2020) essentially envisions
to **redistribute** control and monitoring abilities
to *users*, supported by regulations issued by
relevant societal stakeholders.

data logistic tasks

NCP

NIP

users

network
operators

POL

requirements

governance
bodies

Cristian Hesselman, Paola Grosso, Ralph Holz, Fernando Kuipers, Janet Hui Xue, Mattijs Jonker, Joeri de Ruiter, Anna Sperotto, Roland van Rijswijk-Deij, Giovane C.M. Moura, Aiko Pras, and Cees de Laat. *A Responsible Internet to Increase Trust in the Digital World.* Journal of Network and Systems Management 28, 4 (2020), 882–922.
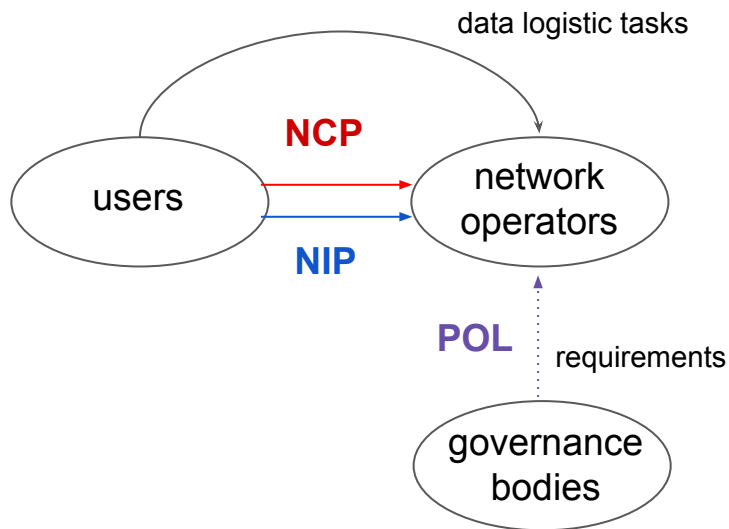
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open-source programmable networks
(e.g. for routing, via BGP policies)

large-scale measuring techniques

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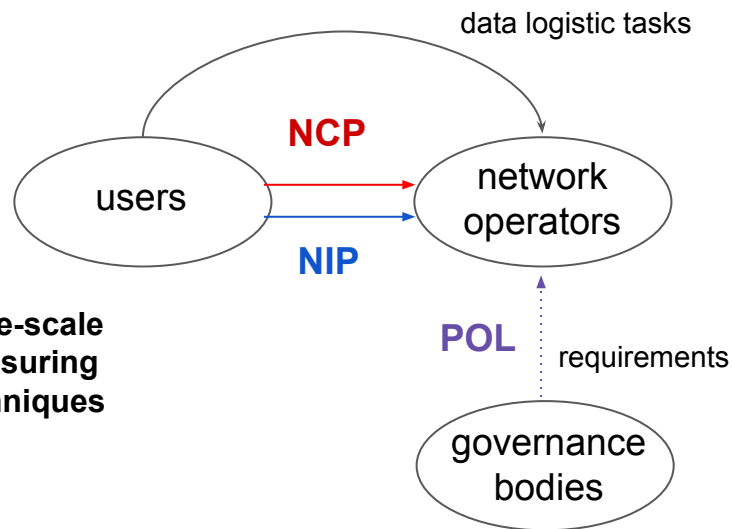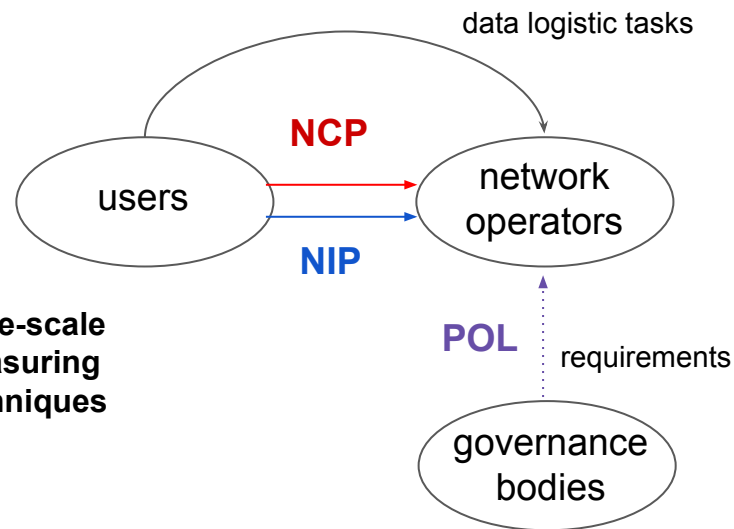
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informed policy-making

large-scale measuring techniques

Cristian Hesselman, Paola Grosso, Ralph Holz, Fernando Kuipers, Janet Hui Xue, Mattijs Jonker, Joeri de Ruiter, Anna Sperotto, Roland van Rijswijk-Deij, Giovane C.M. Moura, Aiko Pras, and Cees de Laat. *A Responsible Internet to Increase Trust in the Digital World.* Journal of Network and Systems Management 28, 4 (2020), 882–922.

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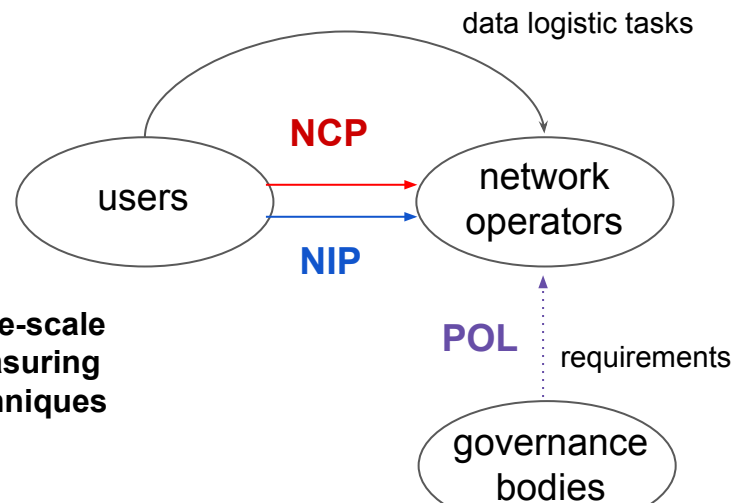policy-making**

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IS THIS COMPLETE?

Cristian Hesselman, Paola Grosso, Ralph Holz, Fernando Kuipers, Janet Hui Xue, Mattijs Jonker, Joeri de Ruiter, Anna Sperotto, Roland van Rijswijk-Deij, Giovane C.M. Moura, Aiko Pras, and Cees de Laat. *A Responsible Internet to Increase Trust in the Digital World.* Journal of Network and Systems Management 28, 4 (2020), 882–922.

Our paper raises two critiques

- **RESPONSIBILITY GAP**: Low-level programmability (e.g. for routing, via BGP policies) is not sufficient to capture and behaviourally operationalize the value structure of users.

- **REGULATIVE CONTINGENCY:** Power-relationships between roles should not be hard-coded (that is, should be partially programmable).

Requirements for responsibility
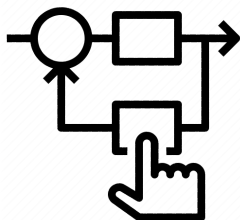
An agent has (agentive) *responsibility* if it:

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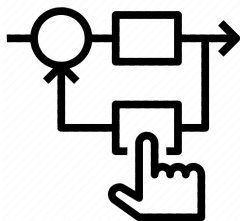has the ability to **foresee** the associated outcomes

has the ability to **assess** actions according to a certain preference/value structure

Sileno, G., Boer, A., Gordon, G., Rieder, B., Like Circles in the Water: Responsibility as a System-Level Function. Proceedings of 3rd XAILA workshop: Explainable and Responsible AI and Law, in conjunction with JURIX 2020 (2020)

Requirements for responsibility

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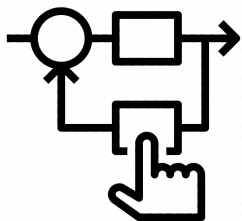
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Requirements for responsibility

An agent has (agentive) *responsibility* if it:

necessary e.g. to inhibit wrong behaviour

necessary e.g. to identify wrong behaviour

has the ability to **control** its own behaviour

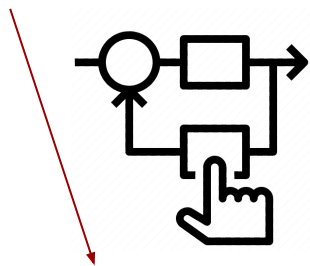has the ability to **foresee** the associated outcomes

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In the *Responsible Internet* proposal, users gain *controllability* by low-level programmability (via the NCP).

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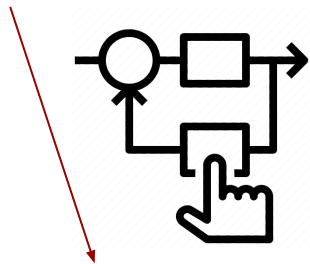has the ability to **foresee** the associated outcomes

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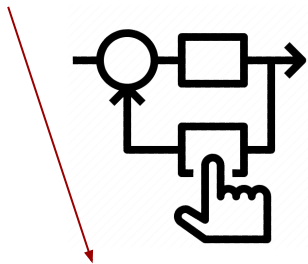has the ability to **foresee** the associated outcomes

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HOW CAN WE REPAIR THIS?

Reducing the responsibility gap

[1] We need a model of how the world functions.

➡ **EXPECTATIONS artefact**

has the ability to **control** its own behaviour

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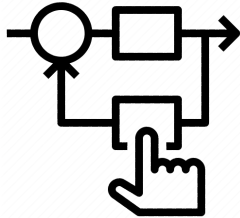has the ability to **assess** actions according to a certain preference/value structure

Reducing the responsibility gap

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➡ **EXPECTATIONS** artefact

[2] We need a model of what is valuable in the world.

➡ **high-level POLICY artefact**

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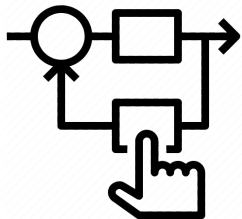**[1] We need a model of how the world functions.**

EXPECTATIONS artefact

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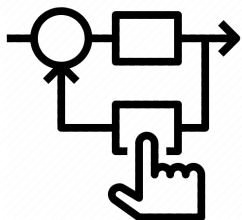**[1] We need a model of how the world functions.**

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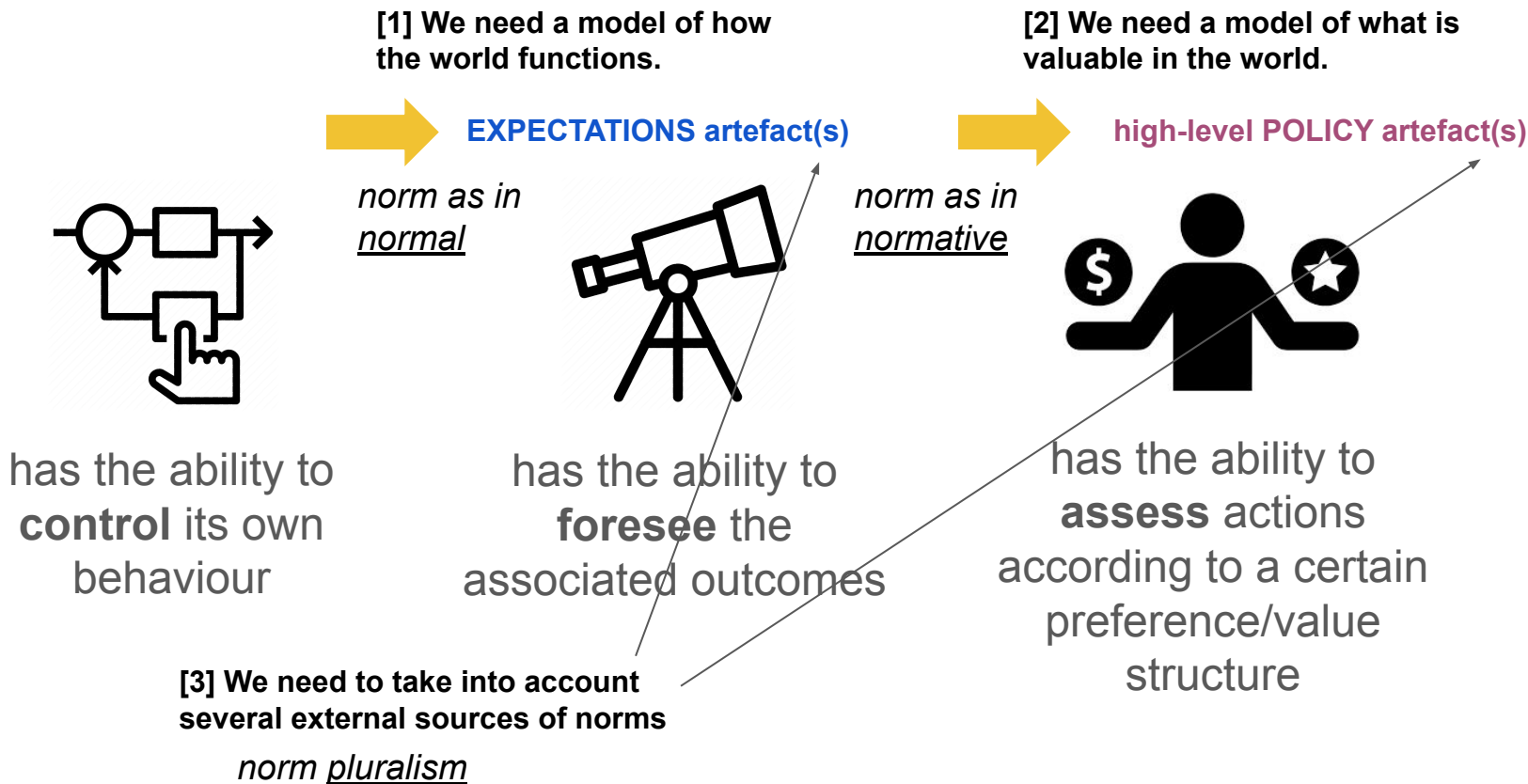
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[3] We need to take into account several external sources of norms

norm pluralism

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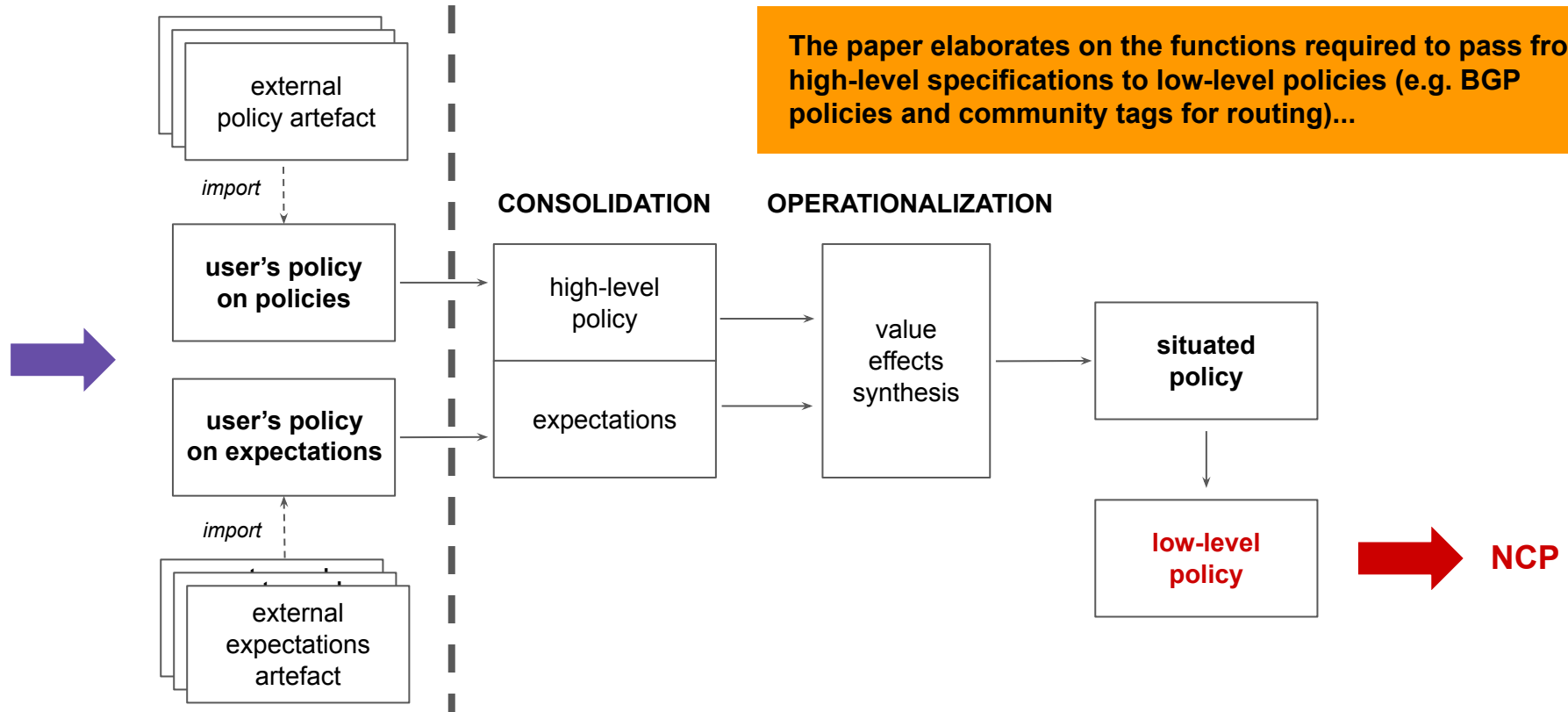has the ability to **assess** actions according to a certain preference/value structure

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norm pluralism

need for "normware" technology

From higher-level to lower-level policies

external policy artefact

import

user's policy on policies

user's policy on expectations

import

external expectations artefact

The paper elaborates on the functions required to pass from high-level specifications to low-level policies (e.g. BGP policies and community tags for routing)...

CONSOLIDATION

OPERATIONALIZATION

high-level policy

expectations

value effects synthesis

situated policy

low-level policy

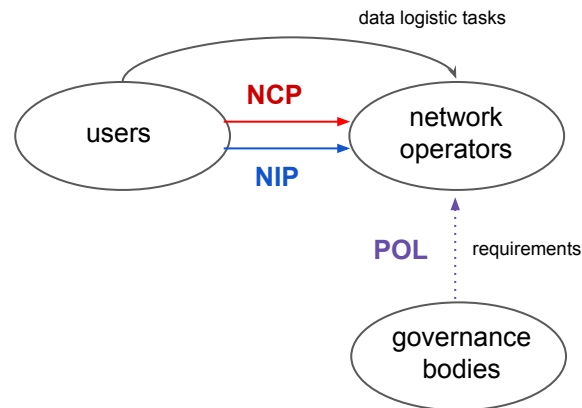**NCP**

Regulative contingency

Users, network operators, and the various governance bodies have all legitimate interests to play a role in policy-making.

Prototypical conflictual design choice: *anonymity vs accountability*.
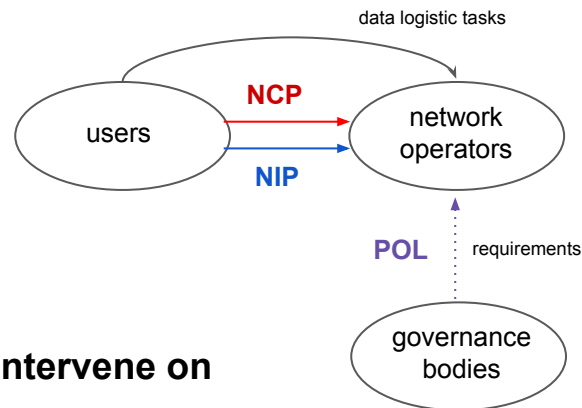
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Governmental, public agencies are users of the infrastructure, and play a role in the infrastructure governance bodies.

The Responsible Internet proposal says that POL

- should **be informed** by NIP and
- should **drive** the NCP.

data logistic tasks

users — NCP → network operators

NIP

POL — requirements

governance bodies

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but how? to what extent regulators can intervene on users' activity on the infrastructure?
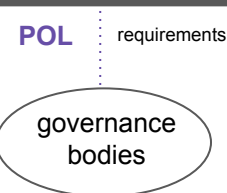
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There is no definitive, global solution: checks & balances vary on a local basis.

- Power-relationships between roles should not be hard-coded, but programmable.

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- Power-relationships between roles should not be hard-coded, but programmable. → *an additional use case for a policy-based technology*

- should ***drive*** the NCP.

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POL ┊ requirements

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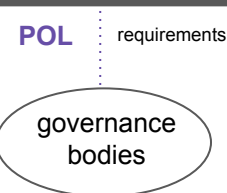
Conclusions (1a)

"give me eyes, and I'll know where I'll go" Computation cannot be "responsible" if the computational agent has no means to evaluate the effect of its actions, and then to prevent wrong outcomes.

Conclusions (1b)

"give me eyes, and I'll know where I'll go" Computation cannot be "responsible" if the computational agent has no means to evaluate the effect of its actions, and then to prevent wrong outcomes.

"pipes are dumb, water drinkers are not" Networks are supposed to operate blindly with respect to the content they transport, by making decisions on packets and unaware of the value of the whole transactions. *But this information is (to some extent) available at the users' endpoints!*

In full control, users should be able to provide some artefact specifying their preference/value structure and their expectations. Network operators should operate, still blindly, just according to these directives.

Conclusions (2a)

"do not hard-code what is soft-coded" It is premature, if not wrong, to aim to a definitive solution concerning power-relationships (e.g. full-control for users and full-blindness for network operators). Too many local contextual factors intervene to set which are the "right" checks and balances. We need ***programmability*** also at this level*. But what to program?*

Conclusions (2b)

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"what works, it may work" For a global network like the Internet, possible starting points would be normative constructs and frameworks developed in non-computational contexts, as in international law, or most plausibly in *international private law*, already operative across very diverse jurisdictions.

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