An Introduction to 'Oughtomation'

General-Purpose Internet Transmission of MUST, MAY and SHOULD

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Internet 2025: Arm's Length Separation of Data Control, Application Control, and Network Control

"An Internet" enables computer networks and devices to interconnect for transmitting and receiving data. This is made operational by a loosely self-organized global community of technical contributors from competing organizations that collaborate for mutual interest,[1] on the curiously informal basis of "rough consensus and running code." [2]

The Internet is not one thing, rather it is a general arrangement and combination of many techniques, logical methods, ways of working, social relationships and physical systems, all of which are adapted to function with one another to support data packaging and relay patterns serving everyone's mutual interests.[3]

The first 25 years of Internet development (1970s-2000) trended towards technological and institutional diversification. Rapid advances in technical performance and scale, together with breakthroughs in usability, brought an Internet 2.0 (2000-2025), but this also came with a degree of concentration and consolidation by a few dominant suppliers which causes some systemic vulnerabilities such as skewed and restricted markets, research and standards, and the erosion of user autonomy, choice and confidentiality.[4] [5] [6] Therefore many people are now thinking through and designing tomorrow's Internet 3.0 (2025-2050) upon a premise of arms-length separation of data control, application control and network control, leaving no "directly traceable control" across those informatics layers.[7] [8]

In coming years, anyone with prerogative over data will find it simple and straightforward to attach their preferences to that data,[9] [10] independently of application providers, while operators of networks will manage programmable, data-responsive routers independently of application control.[11] [12] [13]

These changes are profoundly controversial because they concern what various parties MUST, MAY, SHOULD, as well as MUST NOT, MAY NOT and SHOULD NOT do, pragmatically and ethically. Everyone understands from a young age that rules guide behaviour with compulsion, option and expectation.[14] [15] *

Normative logic will need to be functionally integrated into computational logic in a manner that is consistently operable across any type of data collection, any use case application and any network transmission component. Rule-makers and rule-takers of all types across diverse jurisdictions, cultures, and schools of thought require a simple, general purpose computational method to give effect to their respective prerogatives and preferences.

To the extent that data is no longer pulled en masse over the network by those who control applications, normative rules will instead need to be discovered and pulled on-demand over the network by anyone who has genuine prerogative to control some set of data. Who holds prerogative is negotiated at the most general level in meta-rules in the form of various Model Laws,[16] [17] and principles.[18] [19] [20]

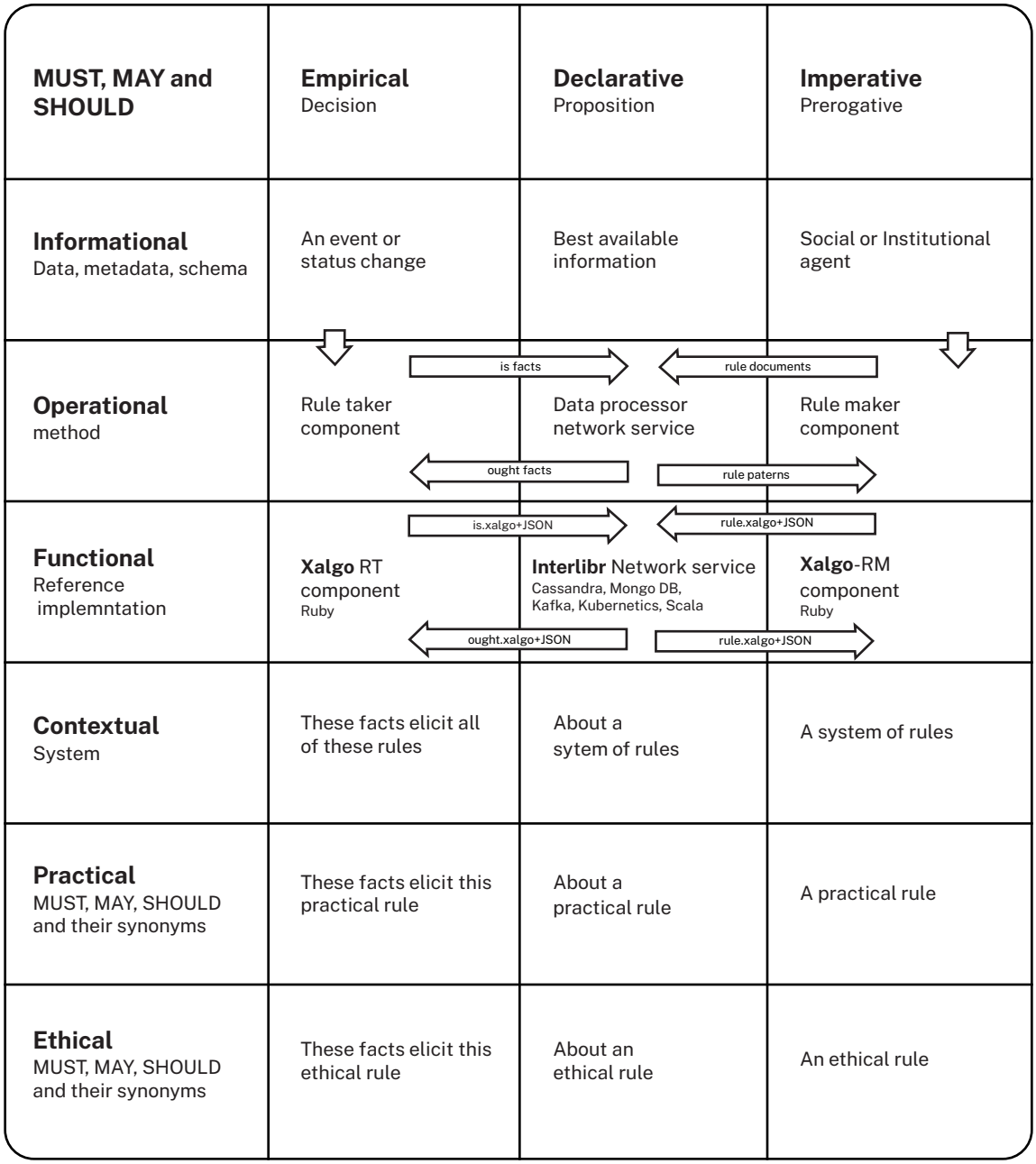
Simple Rules, Nuanced Contexts

Rules arise in each society from shared resolve, contractual requirement and statutory authority. But each person who is subject to a rule retains discretion about whether or not, and to what degree, to act in accordance with it.[21] Unbridled discretion encourages impulsive or opportunistic behaviour, however exces-

* Words such as MUST, MAY and SHOULD are referred to as modal auxiliary verbs, from the Latin modus which means 'disposition'. When they express ethical rules in particular, they are called deontic auxiliary verbs, from the Greek δεον meaning 'appropriate'. An extensive philosophical and linquistic literature on normative logic examines both modal and deontic contexts.

Oughtomation

Oughtomation is any simple, factual, general-purpose computational method that gives effect to MUST, MAY and SHOULD assertions amongst individual and organizational agents.



sive compliance pressure, and rigid technological methods that remove agency from those who would be subject to rules, devolves into a culture of blind obedience.[22] In any society premised upon consent, an optimal policy avoids too much rigidity, and too much discretion. Rules may need to be changed, and often require interpretation. Multiple rules are not alway synergistic; sometimes they contradict one another.

For normative logic to become functionally integrated into computational logic, there's a need for some method of triage relative to each rule's source (de jure authority, de facto origins), subjectivity (degree of commitment of beneficiaries towards fulfilment), and strength (gravity of non-compliance).[23]

Oughtomation: A General-Purpose Method; A Reference Implementation; Compelling Use Cases

A community of contributors convened by Xalgorithms Foundation has formulated a general-purpose method for integrating normative logic into computational logic; has designed a free/libre/open reference implementation to operationalize it; and is advancing several compelling use cases which are enabled with this new capability.

A General-Purpose Method

We propose the term 'oughtomation' to refer to any general-purpose request-response method that, following an event or a status change, gives effect to MUST, MAY and SHOULD assertions of individuals and organizations that are 'in effect' and 'applicable'.

From any node on a network, anyone may publish, discover, fetch, test and triage normative rules which are in effect for given dates/times, identities and jurisdictions, and are applicable when certain facts exhibit. This can be illustrated in a simple table.

The column on the right represents the primary assertion of imperative rules based upon prerogative: social

or institutional authority, agreement or autonomy. The central column represents documentation about these rules. The left column represents empirical facts about events or status changes that may be subject to rules.

This request-response sequence creates, in effect, an Internet of Rules. Primary facts of a circumstance (top left) are used to filter secondary propositions (centre) about primary rules of agents (top right), in order to generate tertiary facts (left) about accessible rules which are 'in effect' and 'applicable' to that circumstance.

A Reference Implementation

We have built and made available under permissive Apache 2.0 licensing, a working reference implementation of the oughtomation method. Its feasibility is demonstrated with three components and a messaging specification:

Xalgo-RM is a rule makers' component with a data exchange API for any rules management system;

Xalgo-RT is a rule takers' component, with a data exchange API for any system with events or states;

Interlibr combines a distributed repository of rules and very fast request-response data processor;

Xalgo is a constrained 'domain-specific language' specification for messaging among the components.

Compelling Use Cases

Categorical Oughtomation encompasses rules in effect across entire jurisdictions, and applicable to entire categories of entity, product, service, event or status. This has applications in the requirements, applicabilities, selections and exceptions of trade policy, fiscal policy, regulatory policy, collective agreements, project management, program management, production management and administration.

Price Oughtomation enables market choice in tabular standards for pricing goods, services, assets and currencies, in various specialized macroeconomic and microeconomic contexts. These are structured as benchmark indices, based on factors such as: market capitalization; market data selections (consumer, industrial, real property); remote sensing data sets (global, regional); and other verifiable public sources.

Data License Oughtomation provides a way for anyone to attach licenses to distributed data over which they maintain prerogative, in order to filter where

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their data is stored and not stored, what queries may and may not view it, and what transformations may and may not be run with it. Tabular declarative licensing facilites portable data control that is autonomous from application control and network control.

Machine Oughtomation is a curated library of standard general-purpose normative control tables and reference tables to facilitate consistent implementation of practical and ethical rules in operational mechatronics, electronics, robotics and networking, across all equipment suppliers according to jurisdictional prerogative, contractual agreement, or voluntary standards adoption

How to Participate

The Xalgorithms Foundation community invites your participation. Commercial, government, scientific, and civil society organizations can get involved in particular use-case working groups. Other free/libre/open technical initiatives working to operationalize Internet 3.0 and Web 3.0 are invited to share know-how and developer resources to help advance the general-purpose oughtomation specification, the Xalgorithms reference implementation, and our online service deployment. To discuss participation options, please contact Joseph Potvin, Executive Director jpotvin@xalgorithms.org.

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