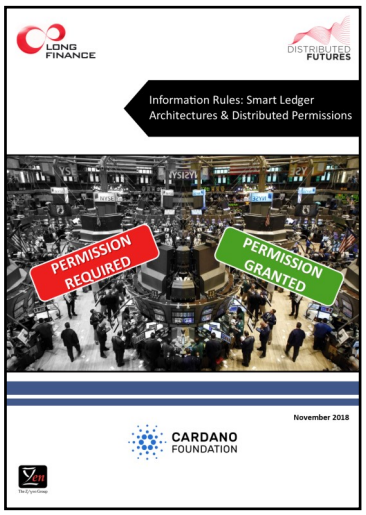
Information Rules

Smart Ledger Architectures & Distributed Permissions

How do you get permission to access a computer system, whilst ensuring hackers don't, or use an asset, whilst preventing thieves from doing so?

Overview



One needs permission from somebody or someone to do pretty much anything these days. Whether it be parking your car, gaining a license, accessing a stock exchange or, more recently and topically, retaining personal data from a client business card, somebody somewhere insists you provide evidence that you have permission.

This paper explores 'permissions', i.e. the actions one is allowed to perform with items, and more specifically, permissions surrounding digital items, which are becoming increasingly complex. In order to effectively manage such permissions in contemporary markets, we believe that a new framework for defining and managing distributed permissions is needed: what one might call a species of 'information rules'.

The goal of this report is to consider how Smart Ledgers could implement such a permissions framework. We intentionally explore new technical approaches, rather than recommending an evolution of current frameworks and technology. We believe that current technical 'architectures', largely based around a central third party and its information technology, are giving way to more distributed architectures. These distributed architectures are based on 'Smart Ledgers', multi-organisational databases with a super audit trail, typically containing some embedded computer code.

Report Extracts

Three Market Layers

Physical Layer		Virtual Layer	Information Layer
Markets		*Exchanges*	*Market Indices*
		Courier Networks	*Algo Trading*
Clocks		*Insurance*	*3D Design Data*
		Joint Stock Companies	*Sharing Economy*
		Telegraph	*Smart Ledgers*
Canals & Railways		*Telephone*	*Permissioning*
		Telex/Fax/Video	
Canning & Refrigeration		*Mobiles/Cellphones*	*Internet*
Containers	*Tracking*	*3D Printers*	*IoT*

At each layer, permissions are a crucial aspect of market rules. However, the nature of permissions differs significantly among the layers, for the simple reason that access to a physical market square and purchases there involves a very different set of issues from transactions by telecommunication at the virtual layer or exchange of information about market function at the information layer.

Report Extracts

Deontic Logic in Practice (for Identity)

What a Human Hears	High-Level Proposition	Propositional Variables	Deontic Proposition
You are an authorised user of this computer system	Person X may access resource R	AR_X = X accesses resource R	$P(AR_X)$
If you are in the finance department, you may access the accounting system	If person X belongs to group G, she may access resource R	AR_X = X accesses resource R G = group G	$If\ X \in G \rightarrow P(AR_X)$
Would Mr. Jones please go to the ticketing desk	If recipient of message is person X, she should take action A	U = recipient of message A_X = X takes action A	$If\ U = X \rightarrow O(A_U)$ $If\ U = X \rightarrow O(A_X)$
Sorry, no admittance for under 18s	If person X is under age K, she may not access resource R	K_X = age of X AR_X = X accesses resource R	$If\ K_X < 18$ $\rightarrow \neg P(AR_X)$
No ID, no entry	If person X cannot prove she is over age K, she may not access resource R	K_X = age of X ID_X = identification documents in X's possession AR_X = X accesses resource R	$If\ (K_X > 18) \neg\vdash ID_X$ $\rightarrow \neg P(AR_X)$

Structure Of Possible Future Permissions Framework

Logical Access Control	Physical Access Control	Privacy	Consumer Financial	Securities Trading	Travel	Government Services	E-commerce
Domain-Specific Permission Libraries							
Deontic Logic API							
Deontic Logic Translation Engine							
Underlying Computing Operating System (*e.g.*, Linux, iOS, MacOS, Windows)							

Conclusions

Smart Ledgers have some inherent advantages over centralised solutions. They start off decentralised, providing advantages such as resilience and availability. They provide tremendous flexibility, perhaps too much. They provide excellent audit trails. But they are complex and harder to understand. A formal 'logic' or 'algebra' for permissions would help to ensure that the basic permissions an individual seeks over their digital 'items' can be expressed and implemented and tested.

The criteria for successful permissioning systems appear to be:

- Precision – ability to accurately convey permissions;
- Breadth – scope to convey any type of permission;
- Applicability – comprehensibility and practicality of application in real-world markets and related interactions.

A genuine area for research is to determine how a formal deontic logic of 'may' and 'ought' can be implemented at the heart of Smart Ledgers to provide intrinsic permission structures similar to the way in which Smart Ledgers provide intrinsic timestamping and audit trails.

To learn more about this and other Distributed Futures projects

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