



ITU Workshop on Distributed Ledger Technology Scalability and Interoperability Geneva, Switzerland, 2 August 2019



THINK BLOCKCHAIN. EXPERIENCE BLOCKCHAIN.





Functioning Solutions to DLT and non- DLT Interoperability

WHAT IS INTEROPERABILITY



Interoperability: the ability of computer systems or software to exchange and make use of information.

WHY DOES IT MATTER WITH BLOCKCHAIN?



DLT and blockchain protocols are not inherently compatible with one another or with legacy systems, resulting in friction or incompatibility when dealing with other businesses.

Furthermore, some smart contract platforms like Ethereum, give you the complete flexibility to custom code your own processes on the blockchain, but since everyone is custom coding their own functionalities the resulting tokens or digital assets are not necessarily compatible with others in the same ecosystem. Hence, for example, efforts to standardize Ethereum tokens through ERCs.

TYPES OF INTEROPERABILITY

Per ITU-T FG DLT D1.1:

Inter ledger interoperability – ability of two or more distributed ledger protocols to exchange information and to use information that has been exchanged with one another.

Intra ledger interoperability - ability of two or more tokens within distributed ledger platform to operate with one another.

OBSTACLES FOR DLT MAINSTREAM ADOPTION

Energy Waste



Scalability



Blockchain
Bloat



Transaction
Fee Payment



Smart Contracts
Are Cumbersome



ENVIROMENTALLY SUSTAINABLE:



PIONEERS ON PROOF OF STAKE

Nxt Blockchain

- Born in 2013
- First blockchain coded from scratch after Bitcoin
- First **100% Proof-of-Stake** blockchain using 99% less energy than Bitcoin's Proof-of-Work.
- Built in Java + API



SCALABLE ARCHITECTURE

A new parent-child chain architecture that addresses the most relevant problems of the sector.



Parent chain that maintains
the
Proof of Stake consensus of
the network



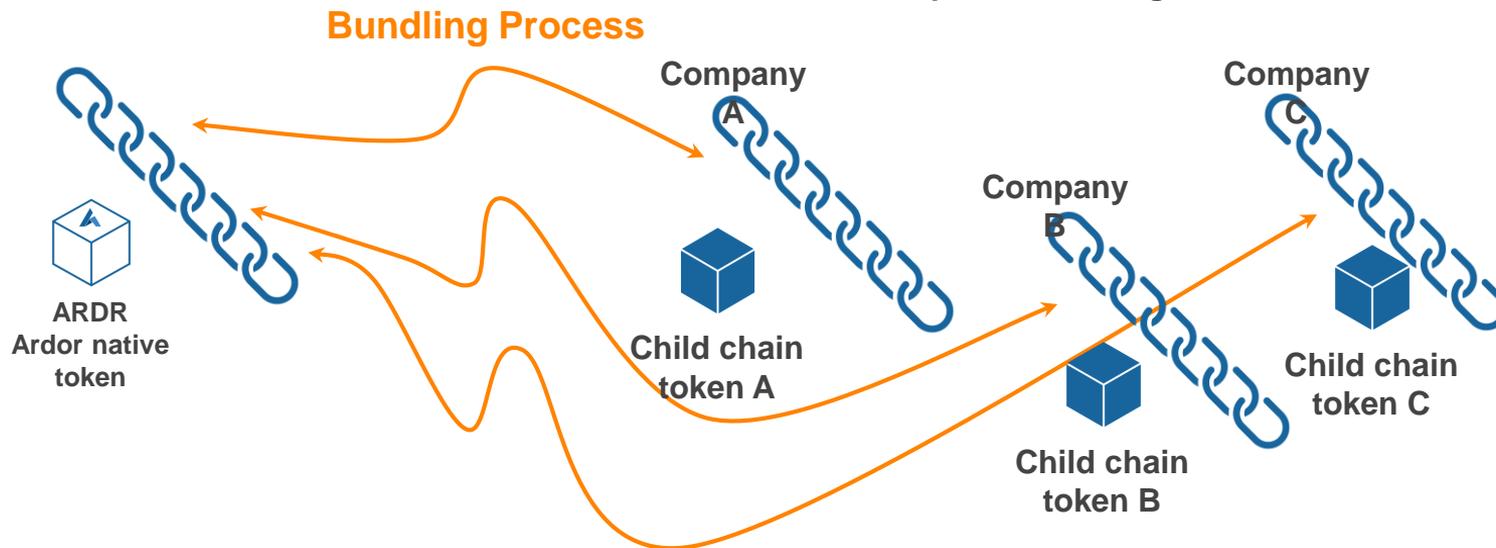
Child chains implementing
decentralised applications

- **Scalability problem:** Allows higher capacity of transactions
- **Bloat problem:** Remove transactions when they are no longer needed

ONE PARENT CHAIN AND MULTIPLE CHILD CHAINS OR VIRTUAL BLOCKCHAINS

ARDOR PARENT CHAIN

ARDOR CHILD CHAINS
Companies building DAPPS



ARDOR BUNDLING ALLOWS CHILD CHAINS TO ACCESS PoS CONSENSUS



bundling

/ˈbʌnd(ə)lɪŋ/ 

noun

1. the selling of different items, typically of hardware or software, together as a package.
"the bundling of the browser and the operating system"



ARDOR BUNDLING ALLOWS SCALABILITY



YES

**PROOF OF STAKE
CONSENSUS**



1 TX

ARDOR PARENT CHAIN

This packaging
process is called
“bundling”.



100 TX

NO
**PROOF OF STAKE
CONSENSUS**

Company



ARDOR CHILD CHAIN

ARDOR PRUNING KEEPS THE DATABASE SMALL

Pruning is a feature that **enables the removal of transactions** while maintaining the network security and the cryptographic proof that these transactions existed in the past.



REMOVING DATA



CRYPTOGRAPHIC PROOF
THAT THE DATA EXISTED

PRE-PROGRAMMED SMART CONTRACTS ALLOWS LAUNCHING dAPPS WITHOUT BEING A BLOCKCHAIN DEVELOPPER



Built-in Features



MESSAGIN
G



ACCOUNT
PROPERTIE
S



DATA
CLOUD



PHASED
TRANSACTIONS



ACCOUNT
CONTROL

Built-in Smart Contracts



ASSET
EXCHANGE



VOTING
SYSTEM



TOKENS



MARKETPLAC
E

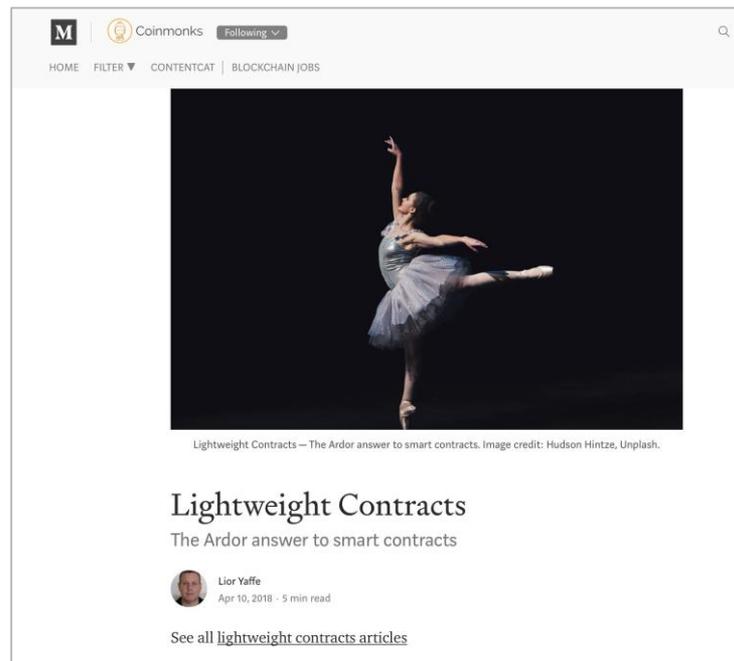


PRIVACY

LIGHTWEIGHT SMART CONTRACTS GIVE YOU THE POWER OF TURING COMPLETE dAPPs



- Code is stored in the blockchain
- Processed only by some nodes
- Stateless
- Written in Java
- Turing-complete



Ardor has a complete software client (wallet)



The screenshot displays the Ardor software client dashboard. The top navigation bar includes the Ardor logo, a menu icon, and links for 'Send IGNIS' and 'Send Message'. The dashboard is titled 'Dashboard' and shows 'NRS Version: 2.1.2'. On the left, a sidebar contains 'Your Account' information, including the address 'ARDOR-YMZX-V4ND-2BY7-EUTJT', account details, and a search bar. The main area features eight summary cards: Account Balance (988.994), Assets Value (0), Currencies Value (0), Purchased Products (0), Pending / Completed Sales (0/0), Messages (0), Aliases (0), and a clock showing '25/10/2018 18:25'. Below these is a 'Recent Transactions' table with columns for Date, Type, Amount, Fee, Account, Height, and Confirmations. The table lists four transactions, including an Ask Order Placement and two Ordinary Payments.

Date	Type	Amount	Fee	Account	Height	Confirmations
22/10/2018 12:42:26	Ask Order Placement	1,000	You	Asset Exchange	436304	1.440+
22/10/2018 12:17:40	Asset Issuance	10,006	You	Asset Exchange	436282	1.440+
22/10/2018 12:10:25	Ordinary Payment	500	0,001	ARDOR-FCU8-F2SK-Z8WV-4JT94	436274	1.440+
22/10/2018 12:08:48	Ordinary Payment	500	0,101	ARDOR-FSLC-JS9R-KUAQ-AAAT5	436271	1.440+

Ardor has a complete API for rapid integration



The screenshot shows a web browser window with the URL `https://testardor.jelurida.com/test?requestTag=BLOCKS`. The page title is "Ardor http API". There are navigation buttons for "Full Node", "/test", and "Search", along with a "Wiki Docs" link. On the right, there are buttons for "Show Non-Empty Fields" and "Show Open Tabs".

A sidebar on the left lists various API categories: ALL, SELECTED (0), Accounts, Account Control (highlighted), Aliases, Asset Exchange, Blocks (highlighted), Coin Exchange, Create Transaction, Digital Goods Store, Forging, and Messages.

The main content area displays a "getBlock" test form with the following fields:

- block:
- height:
- timestamp:
- includeTransactions:
- includeExecutedPhased:
- requireBlock:
- requireLastBlock:

A "submit" button is located below the form fields.

To the right of the form, the "Response" section shows the JSON output of the API call:

```
{
  "previousBlockHash": "8b3e33e360406cd1a1a742850ae07",
  "generationSignature": "e7a0bf206a43b1028b034e56886",
  "generator": "17599793494812669214",
  "generatorPublicKey": "27c4fa81aaf58d41775287d86ed5",
  "baseTarget": "746366466",
  "payloadHash": "e3b0c44298fclc149afb4c8996fb92427a",
  "generatorRS": "ARDOR-NPAY-XYBA-SZ4G-H8SHA",
  "nextBlock": "17044516471096706029",
  "requestProcessingTime": 1,
  "numberOfTransactions": 0,
  "blockSignature": "4894896414e1cf875a82f5b4fd07b77c",
  "transactions": [],
  "version": 3,
  "previousBlock": "15090507236284513931",
  "cumulativeDifficulty": "1067066668697768",
  "totalFeeFOT": "0",
  "block": "11671777613177711138",
  "height": 10000,
  "timestamp": 590693
}
```



INTEROPERABILITY

SOLUTION TO INTEROPERABILITY



Intra chain solutions

- Pre-code dozens of template smart contracts that mirror common business processes and build them into the core of the platform and make available with simple APIs
- Allow users to code their own lightweight smart contracts as a stateless automation layer on top of the APIs
- All underlying polls, assets, monetary systems, messaging applications, etc are inherently compatible but can be permissioned or permissionless as desired
- The result is an ecosystem of child chains and digital assets that can interact with one another seamlessly without any custom coding

-

INTEROPERABILITY



Built-in decentralized coin exchange

ardor
Send MPG
Send Message

Your Account

ARDOR-HBFW-XBTE-WXPV-DZPAG

Set Account Info Details

Switch Account

212,883,999 MPG

Connected @ Unknown

MPG

Height 373437

Search By ID...

Dashboard

Coin Exchange

Coin Exchange

Coin Exchange History

My Coin Orders

Assets

Voting System

Messages

Plugins

Coin Exchange

AEUR
Amount: 0

ARDR
Amount:
231,252,81069507

BITS
Amount: 623,49449992

IGNIS
Amount:
1,483,520,85784419

IGNIS

Total Available: 999,449,694,9960005 | Coin Decimals: 8 | Coin Name: IGNIS

Buy IGNIS with MPG +

Switch to chain IGNIS to buy MPG with IGNIS

Sell Orders

Account	MPG per IGNIS	IGNIS	MPG	Sum
• You	3.33333333	0.0000	0.0001	0.0001
• ARDOR-PJ4S-PSMU-LFBV-6ARBY	6.66666666	15,000,0000	100,000,0000	100,000,0001
• ARDOR-RNCR-YXDZ-V866-8S5RX	7.14285714	1,993,6000	14,240,0000	114,240,0001
• ARDOR-RLAQ-3EBB-232L-344MG	7.69230769	6,5000	50,0000	114,290,0001
• ARDOR-3HCK-844R-TASU-8899W	8.33333333	120,0000	1,000,0000	115,290,0001
• ARDOR-3HCK-844R-TASU-8899W	9.09090909	110,0000	1,000,0000	116,290,0001
• ARDOR-RLAQ-3EBB-232L-344MG	10.00000000	49,0000	490,0000	116,780,0001
• ARDOR-S45T-527F-WAR3-6JEK4	100.00000000	10,000,0000	1,000,000,0000	1,116,780,0001

Buy Orders

Account	MPG per IGNIS	IGNIS	MPG	Sum
• ARDOR-PJ4S-PSMU-LFBV-6ARBY	2.00000000	4,000,0000	8,000,0000	8,000,0000
• ARDOR-WVLE-7H66-PMF5-94U4B	1.10000022	3,000,0000	3,300,0006	11,300,0006
• ARDOR-J3DP-2QXB-2XJD-6X4GE	0.86956522	23,0000	20,0000	11,320,0006
• ARDOR-T6WS-KJME-A2SK-GW8XR	0.70000010	2,000,0000	1,400,0002	12,720,0008
• ARDOR-SW24-KUZS-HF9Y-HZS2	0.40000000	2,500,0000	1,000,0000	13,720,0008
• ARDOR-SUGC-LMS2-6UKC-CZFYE	0.33003301	50,000,0000	16,501,6505	30,221,6513
• ARDOR-7GVG-JFDD-8KN4-GCTDB	0.33003300	24,0000	7,9207	30,229,5721
• ARDOR-7GVG-JFDD-8KN4-GCTDB	0.33003300	24,2400	7,9999	30,237,5721
• ARDOR-7GVG-JFDD-8KN4-GCTDB	0.33003300	15,1500	4,9999	30,242,5721

Trade History

Date	MPG Bid	IGNIS Ask	Account	MPG per IGNIS	IGNIS	MPG
30/01/2019 10:33:22	17930373143282907460	7430452431818314511	ARDOR-US2T-9Q78-K6LB-EC8G5	3.33333333	30,000,0000	99,999,9999
30/01/2019 7:21:17	13668662743743801475	17120620978599849000	ARDOR-US2T-9Q78-K6LB-EC8G5	3.33333333	870,0000	2,899,9999
30/01/2019 7:21:17	13668662743743801475	4395196080397280442	ARDOR-US2T-9Q78-K6LB-EC8G5	2.77777777	1,080,0000	2,999,9999
30/01/2019 7:21:17	13668662743743801475	273661698706802823	ARDOR-US2T-9Q78-K6LB-EC8G5	2.70270270	4,0000	10,8108
30/01/2019 7:21:17	13668662743743801475	15355265226143038957	ARDOR-US2T-9Q78-K6LB-EC8G5	2.70262965	1,110,0300	2,999,9999
30/01/2019 7:21:17	13668662743743801475	8345304749889101239	ARDOR-US2T-9Q78-K6LB-EC8G5	2.50000000	4,000,0000	10,000,0000
30/01/2019 7:21:17	13668662743743801475	1565407021982965978	ARDOR-US2T-9Q78-K6LB-EC8G5	2.49999993	2,400,9000	6,002,2499
27/01/2019 21:40:27	5281588960033061273	1565407021982965978	ARDOR-WVLE-7H66-PMF5-94U4B	2.49999993	1,1000	2,7499

SOLUTION TO INTEROPERABILITY

Inter chain solutions

- Lightweight Smart Contracts execute in the Java Virtual Machine of the desired nodes, they do not participate in the consensus.
- This allows the use of existing libraries to interact with external oracles or other blockchain platforms.
- Deploying a blockchain connector for generating new addresses and token atomic swaps as a java add-on is quite simple.
- Each blockchain connector could be deployed in a different child-chain



THINK BLOCKCHAIN. EXPERIENCE BLOCKCHAIN.

LET'S TALK!

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