

# Blockchain as an interoperability layer for Smart cities

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# **Agenda**

Challenges for Smart cities

Technological answers

Use cases



# Challenges for Smart cities



# UK invests millions in micro-robots able to work in dangerous sites

Devices could be deployed in underground pipe networks, reducing need for roadworks



Thousands of micro-robot contributing to underground work.

#### Issues:

- measuring contribution
- automazing rewards

# Challenges

Heterogeneous devices

Dynamic network of devices

Edge computing infrastructures

Zero Trust technologies

Need for **Smart smart cities** = collective intelligence





# **Blockchain**

Off-chain computing

On-chain off-chain protocols

**Trusted Execution Environments** 



# Blockchain



# **Blockchain - key characteristics**

Chain of blocks

Each block is shared

Each block has all the data/events

Decentralized

Distributed

Transparent

**Trustless** 

**Immutable** 



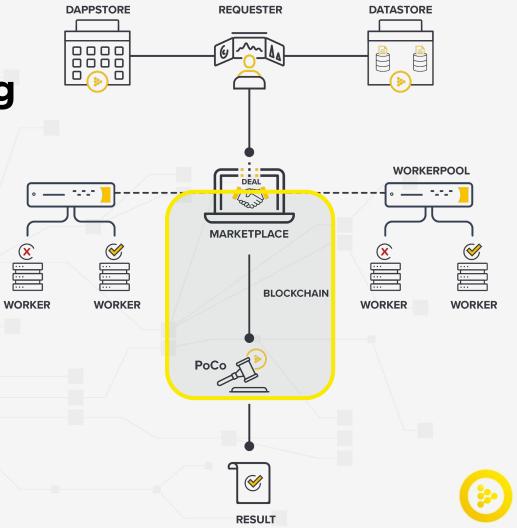
# Off-chain computing



# Off-chain computing

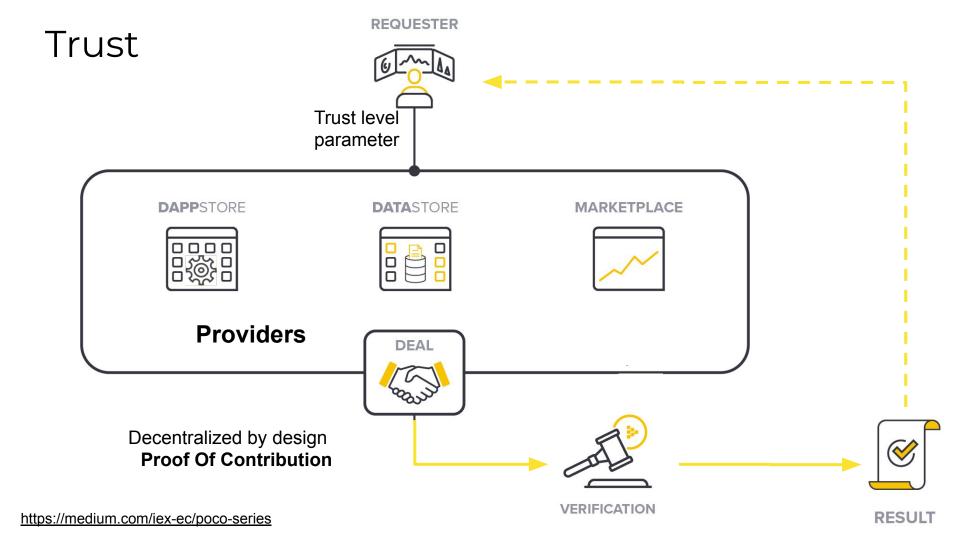
Distributed computing to serve blockchain services

Answer for scalability issue



# On-chain off-chain protocols





# Proof-of-Contribution



# staking + reputation + result certification:

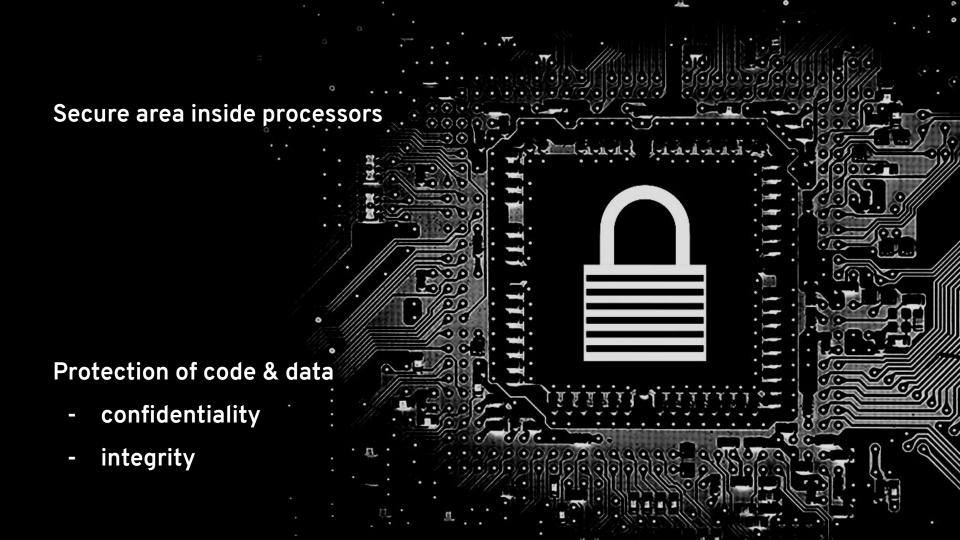
- A confidence threshold is associated with each requested execution
- Workers have a reputation
- Before executing a task, workers commit a security deposit (stake)
- The execution confidence threshold is computed by comparing results and computing a function of the credibility and stake
- Task is duplicated as long as the confidence threshold is not met
- · Workers who computed an erroneous results loose their stake
- Workers who correctly compute gains the payments + the losers' stake
- · Reputation is adjusted

https://medium.com/iex-ec/poco-series



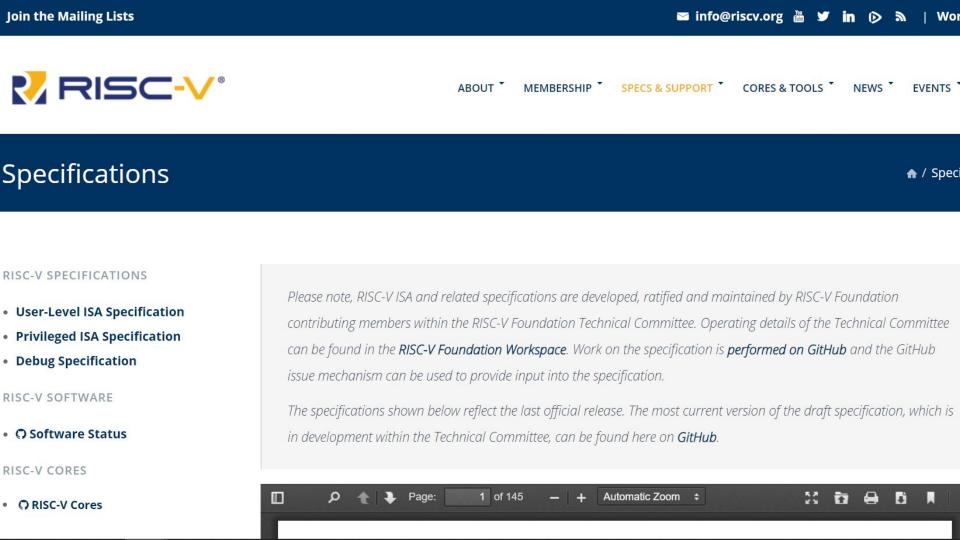
# **Trusted Execution Environments**





# **TEE are mainstream**







PROCESSORS ▼

**GRAPHICS ▼** 

**GAMING ▼** 

SHOP ▼

**DRIVERS & SUPPORT** 

# **Secure Technology**





# Full security solutions that locks you down, not in

Our robust security solutions merge a comprehensive ecosystem of hardware and software, building in trust from the start.





# arm











Resources



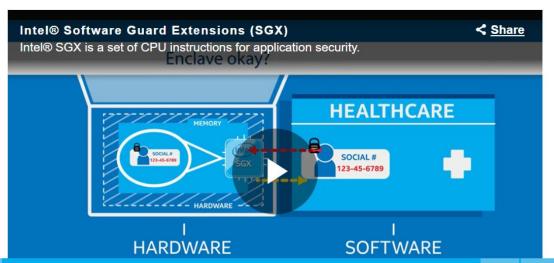
# **TECHNOLOGIES** TRUSTZONE FOR CORTEX-A

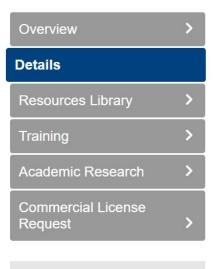
Development of TEE and Secure Monitor Code

# Intel® Software Guard Extensions (Intel® SGX)

An Intel® architecture extension designed to increase the security of application code and data.

## A New Approach













Related Links

# iExec End-to-End Trusted Execution with Intel SGX



Enclaves: Confines execution and data within a encrypted environment: no one can access/tamper the execution

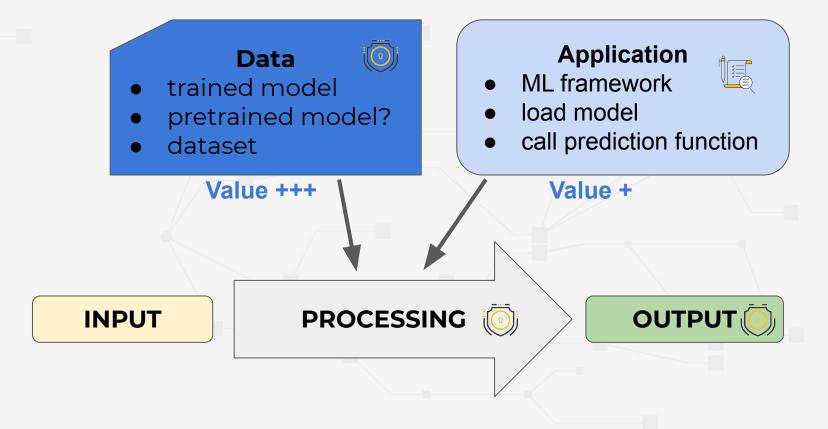
- SDK that provides full end-to-end privacy preserving computation
  - for application/input/results
  - guarantee execution integrity
  - provide on-chain enclave execution attestation





# Use Case 1 Monetize IA trained model in computer vision

# The data renting concept





# Monetize Al model in computer vision

a generic framework?

### Input data



# make a prediction

run an application trained model = dataset



- classification
- score
- object detection

...

in a web application

https://nsfw.app.iex.ec





# Use Case 2 Decentralized Oracle: monetize Web2.0 information on the blockchain

# Doracle

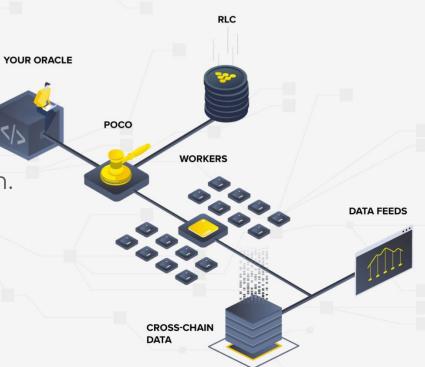
Allows to fetch off-chain information.

**ETHEREUM** 

DAPP

Bridge Web2.0 and Web3.0

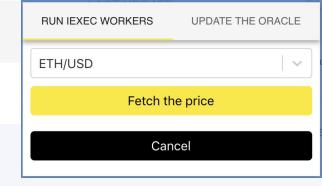
Decentralized: censorship resistant





# Doracle Example: Pricefeed





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## Price Feed by iExec

BASE	PRICE	LAST UPDATE 🗸	TASK	ADD PAIR
1 ETH	251.357640454 USD	3 days ago	0x31b665739d494b9a86d	Update me
1 RLC	0.000067733 BTC	3 days ago	0xf04bb66b76207aa46ad	Update me
1 BTC	8068.674953446 USD	3 days ago	0x684fb3047a26d2075ee	Update me





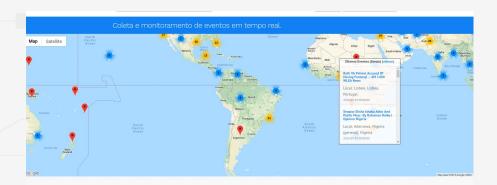
# WebSensors

Application based on machine learning for decision making.

- Use cases:
  - events tracking
  - Insurance

#### Problems solved:

- Stakeholders needs to trust the model, trust the execution and trust the result registration.
- Autonomous application











# SMART TRAFFIC CONTROLS ON EDGE SERVERS

Using iExec Decentralized Cloud Computing POWERED BY SHIFT AND IEXEC.















We are demonstrating our 5G smart city services based on blockchain tech on @Intel booth at #MWC2019 , come to meet @iEx\_ec team.

Traduire le Tweet



11:44 - 25 févr. 2019 depuis Hall 3.10

















# **Smart smart cities**

Layers of trust & interoperability

Stack of decentralized technologies

- Edge computing
- 5G meets blockchain
- End-To-End security

Collective intelligence for connected devices

Economy machine to machine





# Thank you

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https://iex.ec

