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FOG COMPUTING AND BLOCKCHAIN TECHNOLOGY FOR MASSIVE IOT DEPLOYMENT

CONTENTS



INTRODUCTION



SYSTEM ARCHITECTURE

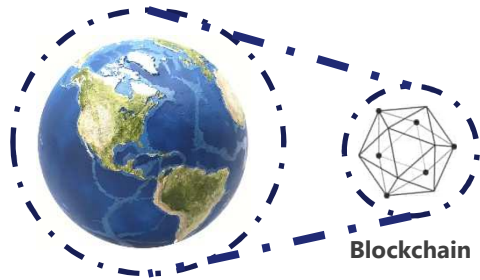


PROOF-OF-CONCEPT EVALUATION



CONCLUSION

INTRODUCTION



The Economist, 2015:The trust machine..... will reshape the world that we know



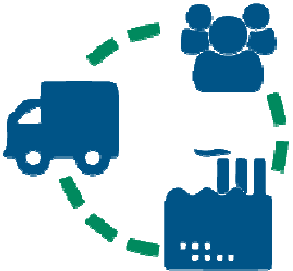
Crowdfunding



Lawmakers



Business leaders



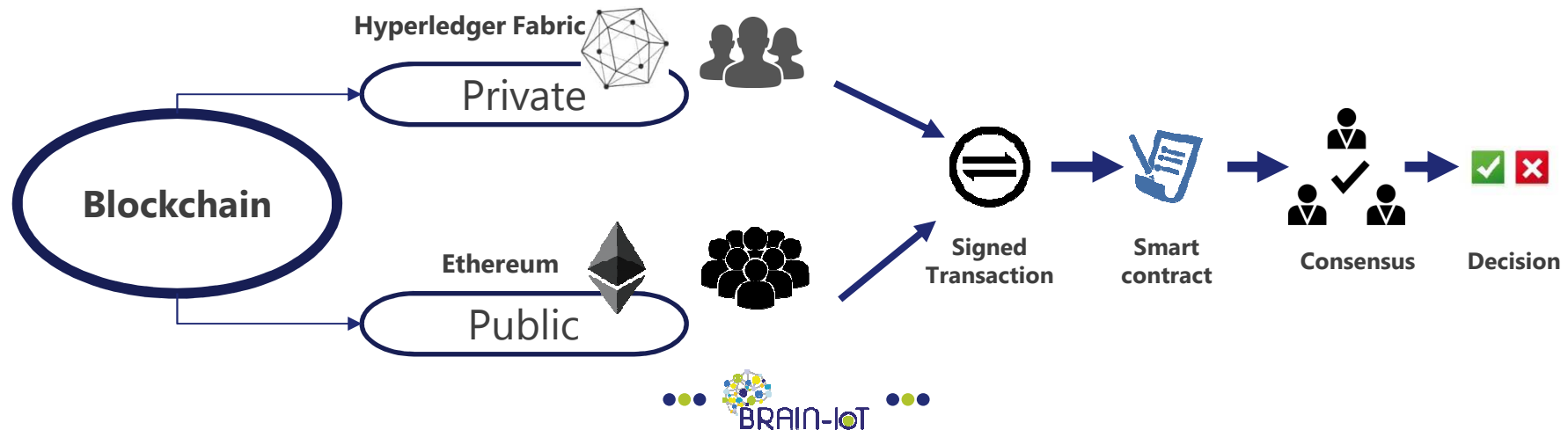
Supply Chain



Record Industry

INTRODUCTION

- **P. cui & al** : Data integrity and reliable access tracking for IoT devices to resolve the device counterfeit problem,
- **X. Wang & al, M. A. Ferrag & al** : Establish trust in IoT.
- **G. Rathee & al** : Trace each worker's activity.
- **M. Debe & al** : Compute device credibility and reputation for a fog node coming after each vote from IoT device.



TOWARDS AN IOT REFERENCE ARCHITECTURE

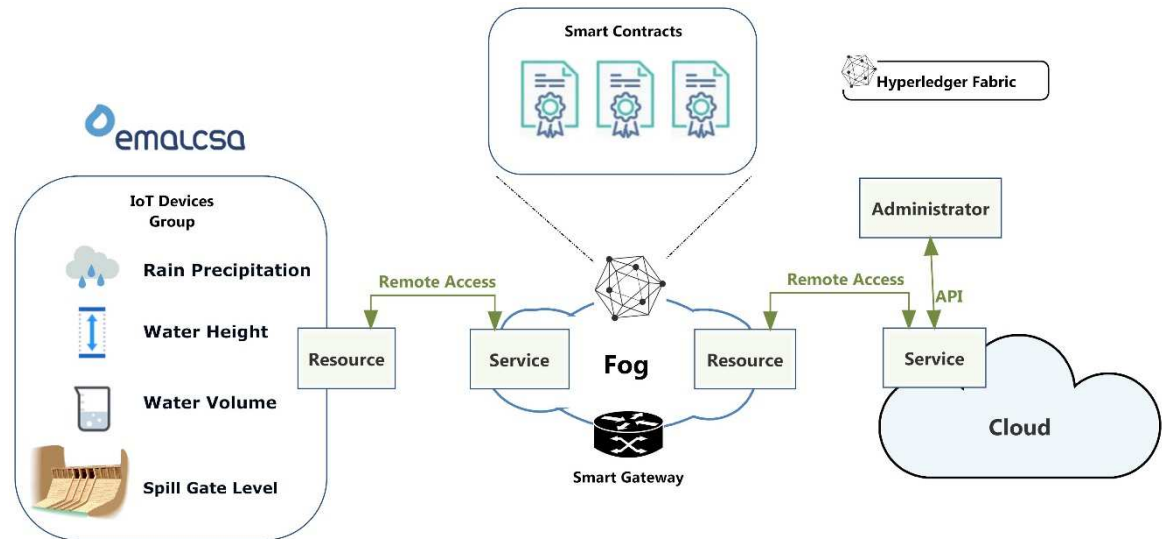
Resource : an executable code available at the device

Service : a standardized interface for interacting with devices

Application : are those available at the fog or the cloud

Smart Gateway: implementing functionalities for orchestrating software-software and software-hardware communication.

Spill gate level management



IOT REFERENCE ARCHITECTURE

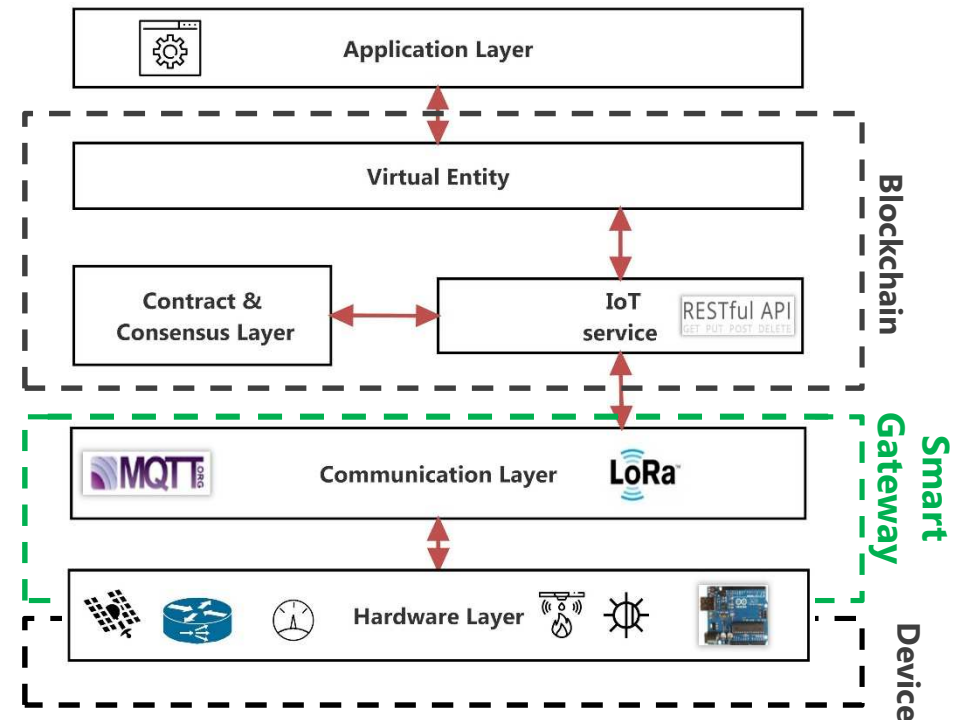
Virtual entities : are digital representations of device entity.

Communication layer : provides connectivity for transaction flow

The **contract layer** includes smart contracts and consensus mechanisms

The **communication layer** includes all protocols for transaction flow

The **hardware layer** includes devices and gateways



DEVICE NOTIFICATION

7

FogID: ID of the interested Fog node.

R : The list of the configuration list sent by the administrator.

deviceList = queryAllDevicesInFog(FogID)

for ioTdevice in deviceList **do**

for config *in* R **do**

if ioTdevice.DeviceID==config.DeviceID

then

 ioTdevice.status = config.request ;

event(ioTdevice);

end

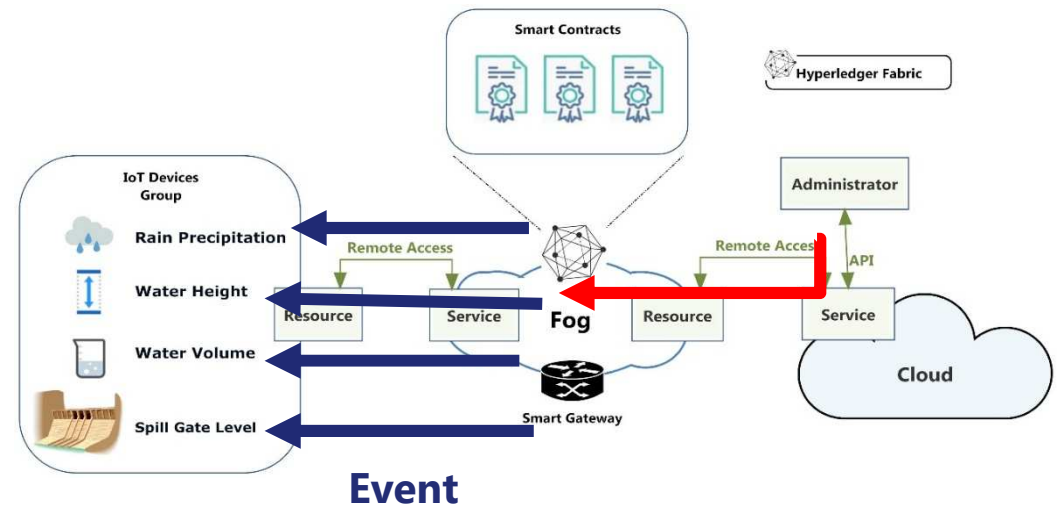
 config= R.next() ;

end

ioTdevice= deviceList.next() ;

end

publish/subscribe mechanism



DEVICE NOTIFICATION

8

DeviceID: ID of the interested device.

SensedData: Sensed Data of the interested device.

FogID: ID of the interested Fog node.

deviceList = queryAllDevicesInFog(FogID)

for ioTdevice *in* deviceList **do**

if ioTdevice.DeviceID == DeviceID **then**

if ioTdevice.status == 'READ' **then**

 ioTdevice.value = SensedData ;

else

if ioTdevice.status == 'WRITE' **then**

 event(ioTdevice, type.write);

else

if ioTdevice.status == 'Enable' **then**

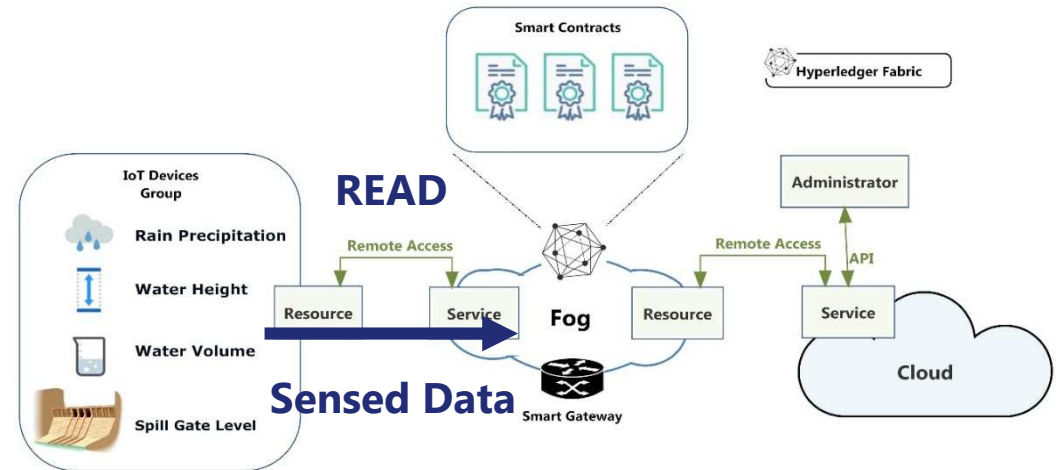
 event(ioTdevice, type.enable);

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publish/subscribe mechanism



DEVICE NOTIFICATION

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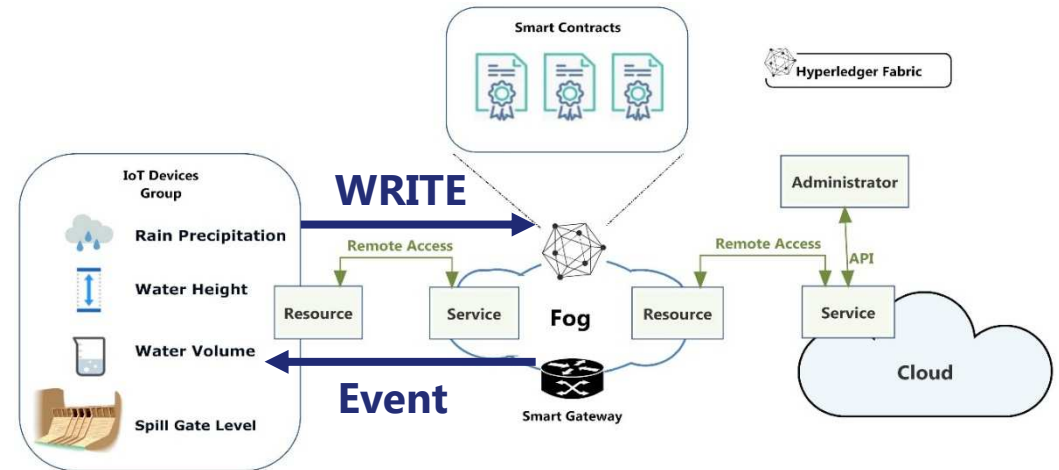
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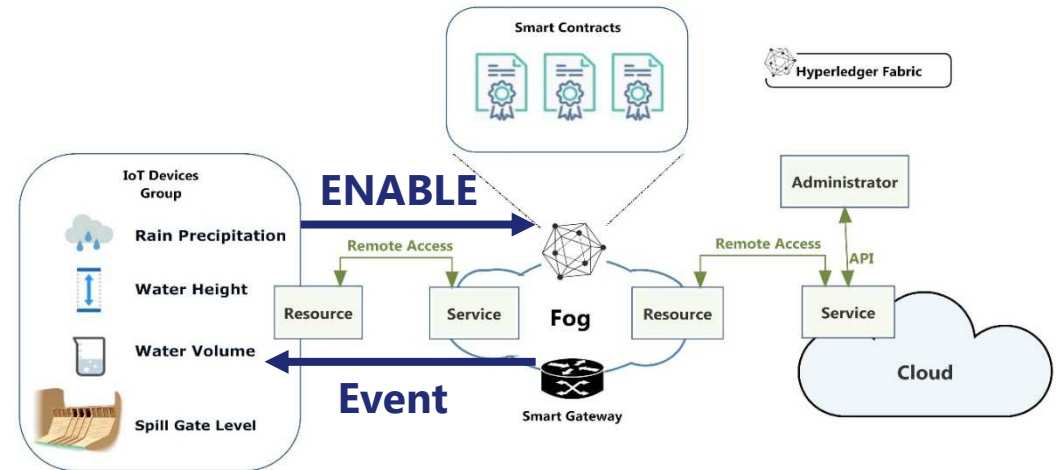
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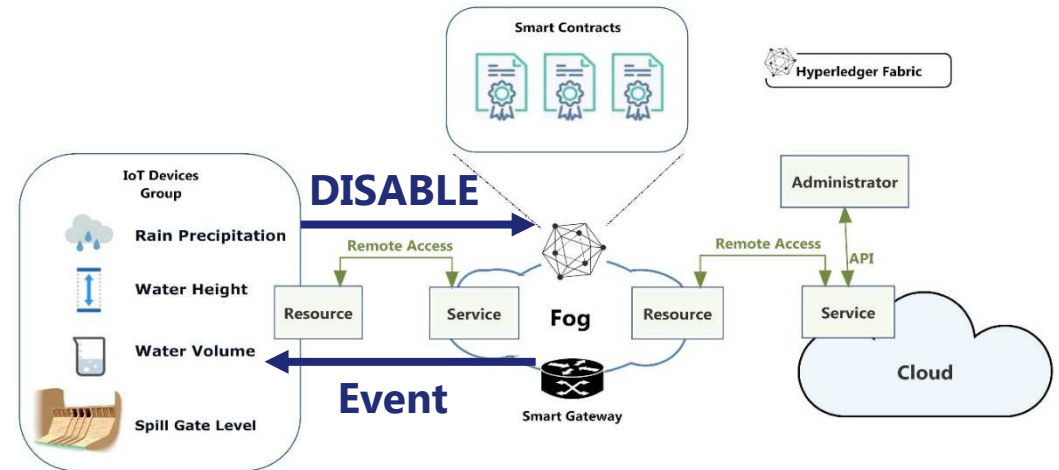
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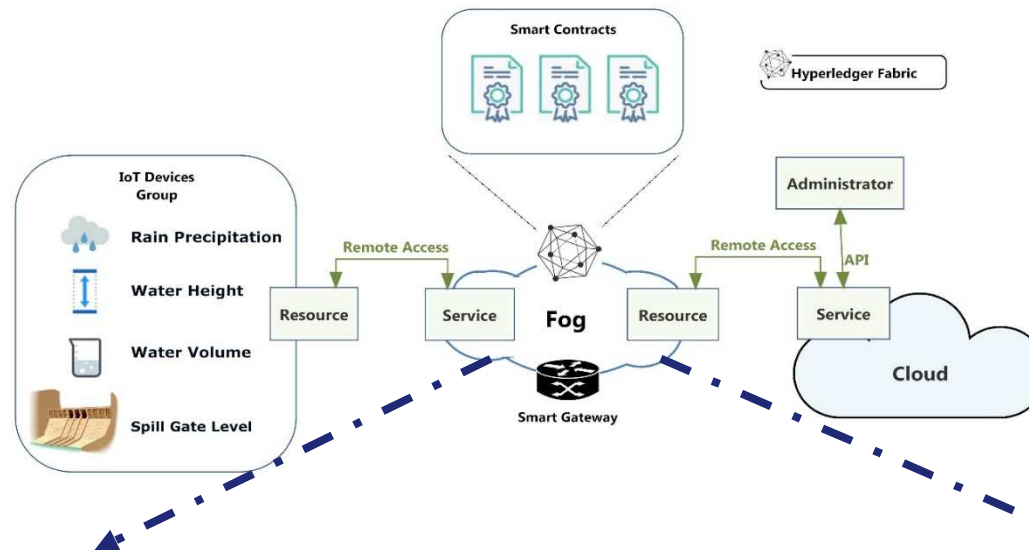
end

publish/subscribe mechanism



PROOF-OF-CONCEPT EVALUATION

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Network utilization

Average	Min	Max
2.36 Bps	3.01 Bps	3.54 Bps

Energy consumption

Average	Min	Max
16.35 J	33.14 J	38.52 J

PROOF-OF-CONCEPT EVALUATION: MASSIVE IOT DEPLOYMENT

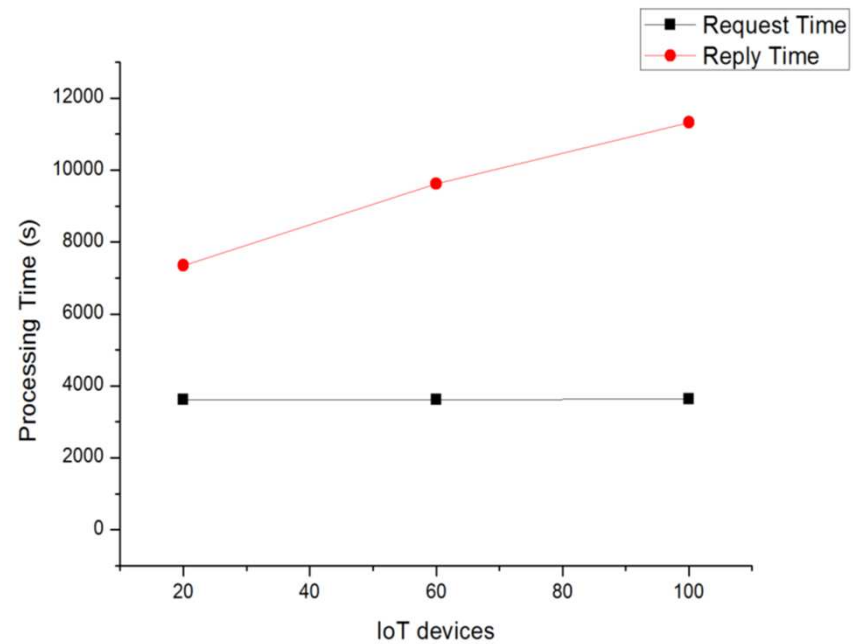


Experiment:

1. 5 Groups with sizes from 20 to 100 IoT devices,
2. The average total processing time is measured as the average time for the administrator requests/replies to all devices in the group.

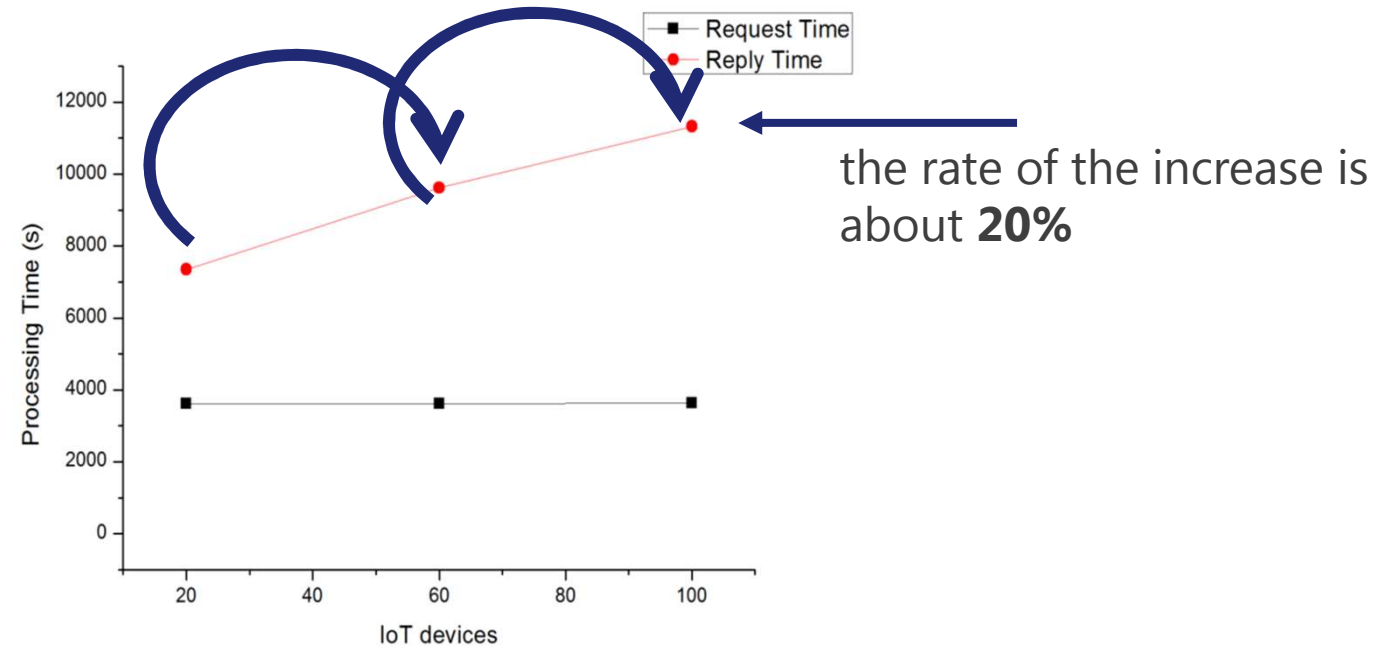


PROOF-OF-CONCEPT EVALUATION: MASSIVE IOT DEPLOYMENT



The average total processing time

PROOF-OF-CONCEPT EVALUATION: MASSIVE IOT DEPLOYMENT



The average total processing time

CONCLUSION

- A Blockchain-based architecture is proposed to enrich a classical fog/cloud architecture,
- Fog node is endowed with an instance of Blockchain in charge of data persistence and continuous ensuring of data veracity,
- IoT reference architecture encompassing Blockchain IoT idiosyncrasy is presented,
- Experimental results indicate that the resource utilization of IoT devices is negligible.

CONTACT

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BRAIN-IoT

model-Based fRamework for dependable sensing
and Actuation in INtelligent decentralized IoT systems

