



Blockchains and Autonomic Computing

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Introduction

- In November 2008 Satoshi Nakamoto published a white paper that started the phenomenon now known as Bitcoin and the concept of blockchains
- The idea was to create a distributed monetary system
- It has become very successful
 - One bitcoin today is worth almost \$11,000

What is a blockchain?

- A blockchain is a distributed append-only data structure that allows many parties to agree on a common state, consensus
- It works as long as more than half of the computing power is controlled by honest parties
- Since Bitcoin became popular the term “blockchain” has also become a meaningless buzzword
 - “blockchain” in quotes will denote its use as a buzzword

Why use a blockchain?

- Since it can form consensus it can be used as a public bulletin board where anyone can add information
 - For example Bitcoin uses it to keep track of financial transactions
- Blockchains are a good solution when there is no central authority and data need to be agreed upon
- They also excel in ensuring the integrity of the data

Why not to use a blockchain?

- **Blockchains are slow**
 - If you need to synchronize in real time, this is most likely not the solution
- **If there is a central authority**
 - It is much faster to have the central authority create and maintain a traditional database and have all parties synchronize with them
- **Many people misunderstand its purpose and properties**
 - Many people use “blockchain” technology because it is the most popular new thing, mostly for marketing purposes, but apply it inappropriately

Blockchain and Autonomic Computing

- Blockchains are:
 - Self-healing: They recover gracefully after parties fail
 - Self-configuring: They adjust difficulty based on the environment
 - Self-protecting: They are designed to withstand attacks
- Sounds like an autonomic component

The Main Question

Can they be used in the area of
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Yes, but carefully

Case 1: Swarm Robotics

- Swarm robotics is when there are many smaller independent robots all working together to achieve a common goal
- Since all of the robots are independent and may not even be owned by the same company, blockchains can be used to securely synchronize their knowledge base
- Since modern robots have more onboard memory and processing power, this is now feasible

Case 1: Swarm Robotics, Problems

- Latency:
 - Blockchains are slow, but robots might need to make quick decisions
 - This would be better for long-term information and planning
- Bloat:
 - Since blockchains are append-only, they will get bigger over time
 - This is an issue since robot memory is limited and valuable
 - A solution is to keep only vital information
 - It can retrieve more information when needed later

Case 2: Internet of Things (IoT)

- Another popular trend is IoT devices
- It was shown that IoT devices are now powerful enough to run a blockchain
- Although this adds a level of autonomy, there is no practical use
- In the IoT case, in contrast with the swarm robotics case, there is commonly, if not always, a central authority i.e., their owner
- This makes the use of blockchains in this case pointless

Conclusion

- As you have seen there are some good use cases for blockchains and some not so good uses
- Figuring out when blockchain is the correct tool for the job is becoming a difficult task for people not directly in the field
- That is one of the main issues, some others are:
 - Education: People need to understand the technology
 - Scalability: Latency and bloat
 - Standardization: There are no current standards

Questions?

