Chapter 1
Blockchain and Green Networking Analytics in 5G Networks and Beyond

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ABSTRACT

The objective of green networking is to minimize greenhouse gas emissions while maintaining the same level of performance. Green networking refers to all processes used to optimize networking and internetworking functions to make it more energy efficient. Green networking concepts can be extended to cover any method that reduces latency, save bandwidth, and/or decrease computation time, as a reduction in these factors invariably leads to power savings. These savings can directly translate into lowering greenhouse gas emissions and reduce computing's carbon footprint and its impact on the environment. Energy-awareness is critical in the networking infrastructure, especially in wireless 5G networks and beyond. Research on blockchain for 5G wireless networks is still in its infancy. But it is obvious that blockchain will significantly uplift the shape and experience of future mobile applications and services. Identifying the green networking analytics will lead to sustainable energy policy planning for the future.

INTRODUCTION

With the launch of fifth-generation (5G) network and its services in 2020, the traffic volumes are expected to increase 1000 times and the number of connected devices will be 10-100 times larger than before. Advances in technologies such as artificial intelligence, autonomous Internet of Things, big data analytics, blockchain, and augmented/virtual reality will play a major role in using the high-speed, low-latency, secure 5 G connectivity that is ubiquitous and reliable. Research is underway beyond the 5G networks, to support a greater number of users on higher transmission rate than 5G networks. Hence, the challenges for future networks are set to achieve 10 times the energy efficiency together with spectral efficiency and higher speed compared with today's 4G systems.

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In this article, the concept of green networking is discussed and the objectives for energy saving in future high volume network traffic are clearly outlined. How the digital ledger technology can support the objectives of energy saving in various applications and services are discussed. Identifying green networking analytics for high quality of services and energy efficient solutions are discussed here. Green network analytics leverages the power of Machine. Learning and Machine Reasoning to provide accurate insights that are specific to network deployment and running.

Green Networking

There is an increase in the global use of Information and Communications Technology (ICT). The 2012 data points to 4.7% of the world-wide energy being consumed by ICT industry. A 2% increase discharges more than 830 million tons of CO2 every year. Mobile radio sector is responsible for 9% of that figure and expected to increase further due to exponential traffic increase in networks beyond 5G. Datacenters are the backbone of ICT networks and the second highest leading culprit in greenhouse gas emission, personal computers being the number one source. Every day there are over 2 Quintillion bytes of data created; these data come from unique sources and often need to be routed across the Internet. Currently with the COVID-19 pandemic situation, the traffic demand on wireless networks has reached a peak. Data networks consumed around 250 TWh in 2019, or about 1% of global electricity use, with mobile networks accounting for two-thirds. Based on current efficiency improvement trends, electricity consumption is projected to rise to around 270 TWh in 2022 [1-3].

The objective of green networking is to minimize greenhouse gas (GHG) emissions while maintaining the same level of performance. Green networking refers to all processes used to optimize networking and inter-networking functions, to make it more energy efficient. Green networking concepts can be extended to cover any method that reduces latency, saves bandwidth, and/or decreases computation time, as a reduction in these factors invariably leads to power savings. These savings can directly translate into lowering GHS emissions, and reduce computing's carbon footprint and its impact on the environment. Energy-awareness is critical in the networking infrastructure, especially in wireless 5G networks and beyond.

Blockchain

Blockchain technology has the potential to disrupt and revolutionize many businesses and professions. Blockchain-based cryptocurrency applications have been widely recognized and used, but blockchain applications have expanded to other fields. Many businesses appreciate it and have started to study its potentials. We can now see some blockchain use cases in different areas beyond finance and banking applications such as in supply chain management, advertising verification, energy-saving, and healthcare. In future, it is expected we will see more useful applications with the development of intuitive interfaces and more use cases. Access to information, data integrity, and operation resilience, among many other drivers, motivates businesses and industries to experiment and develop blockchain-based applications (Baoid et al., 2021).

Over the years, Blockchain has increased in popularity partly due to cryptocurrencies. But why is Blockchain such a hugely talked about area within cryptology? This is due to its revolutionary ability to store, validate, authorize, and move digital transactions across the Internet. One of the critical challenges on the Internet is trust. Are you doing business with the person that you think you are? Even with all the