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5G/6G NETWORKS FOR WIRELESS COMMUNICATION AND IOT

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Abstract
"5G/6G he Internet of Things (IoT) turns pervasive computing into a reality of connected everything. IoT connects billions of devices for rapid information sharing, specifically in 5G and 6G but it creates significant issues in privacy, transparency, and security. Block chain has proved to be adaptive and useful for many applications, including those in the automobile sector. The aim of Industry 4.0 is to improve performance while sustaining quality under cost. The paper presents the existing survey of 5G, 6G, and 7G along with block chain. The study proposes the architecture of 6G and an overview of the challenges and possible applications of block chain using 5G, 6G, and 7GNetworks for Wireless Communication and IoT".

Smart services based on the Internet of Everything (IoE) are gaining considerable popularity due to the ever-increasing demands of wireless networks. This demands the appraisal of the wireless networks with enhanced properties as next-generation communication systems. Although 5G networks show great potential to support numerous IoE based services, it is not adequate to meet the complete requirements of the new smart applications. Therefore, there is an increased demand for envisioning the 6G wireless communication systems to overcome the major limitations in the existing 5G networks.

Keywords: 6G Wireless Communications, IOT, Future Applications, Network Security and Privacy.

Introduction

During the past decade, the Internet of Things (IoT) has revolutionized the ubiquitous computing with multitude of applications built around various types of sensors. A vast amount of activity is seen in IoT based product-lines and this activity is expected to grow in years to come with projections as high as billions of devices with on average 6-7 devices per person by year 2020. With most of the issues at device and protocol levels solved during the past decade, there is now a growing trend in integration of sensors and sensor based systems with cyber physical systems and device-to-device (D2D) communications. 5 th generation wireless systems (5G) are on the horizon and IoT is taking the centre stage as devices are expected to form a major portion of this 5G network paradigm. IoT technologies such as machine to machine communication complemented with intelligent data analytics are expected to drastically change landscape of various industries.

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Internet of things: This interdependency, they provide guidelines for radio numerology design and elaborated on the frame design for IoT communications in 5G networks to support massive connection density of low-rate, low-power devices. Massive Internet of Things (IoT) devices working in 5G wireless network. The authors also discussed the interdependence**.** The article concludes with some key research findings and challenges massive IoT in 5G wireless network.

Special issues and sections

- Internet of things,
- Ubiquitous computing,
- Sensors,
- Cyber-physical systems,

- Product development,
- 5Gmobilecommunication,
- Wireless communication,
- Device-to-device communication

Requirements, use cases, and enabling technologies of future 6G networks;

- The evolution of wireless networks from 5G to 6G;
- Measurement frameworks for 5G/6G;
- The role of cloud computing in 6G network applications;
- Edge computing for context awareness in 6G-oriented IoT applications;
- Spectrum sharing in networks beyond 5G;
- Terahertz communications;
- Programmable and virtualized networks for 5G/6G;
- Group communications in 5G/6G;

Programs

Challenges in 5G evaluation are formulated. Additionally, a cloud-based two-level framework of system-level simulator is proposed to validate the candidate technologies and fulfil the promising technology performance identified for 5G.With the popularization of smart devices and rapid development of internet services, it has been predicted that the traffic flow of mobile data traffic will increase a thousand-fold till the year of 2020. On one hand, as video and audio services are becoming more and more popularized nowadays, the high definition and bigger volume characteristics of graphic and voice services appeal for higher data transmission rate. On the other hand, even with substantially higher transmission rate and traffic flow, perfect user experience are expected to be achieved as the same level with fixed Web access service to meet the real-time demands. The explosive increasing trend of mobile data services and traffic flow motivates new technologies bringing higher spectrum efficiency (SE), higher energy efficiency (EE) and denser cell deployment. Under this background, 5G emerges to introduce advanced key technologies aiming at achieving around 1000 times the system capacity, 10 times the SE, EE and transmission data rate.In order to satisfy higher speed, more stable and lower end-to-end delay requirements of future wireless mobile communication systems, new network architecture will be adopted. The emerging new technologies like large scale multi-input multi-output (MIMO), Co-frequency Co-time Full Duplex, and Carrier Aggregation are candidate technologies introduced into 5G. In the future.

Financial Inclusion: Overview on 4G Evaluation-The Evaluation Framework of 4G

According to the evaluation methodologies of ITU the basic evaluation characteristics and assessment methods for 4G are summarized in Table 1among the methods, the simulations, especially system-level simulations, are the most important and complex contents, which cover the largest part of the workload. Figure 1 shows the modular design of system-level simulation.

Skill Development: TABLE 1 Assessment methods for 4G.

Method	Characteristic for evaluation
Simulation	Cell/Cell edge user spectral efficiency VoIP capacity, Mobility
Analytical	Peak spectral efficiency, Control / User plane latency, Intra- / Inter-frequency handover interruption time
Inspection	Bandwidth and channel bandwidth scalability, Deployment possibility in identified IMT bands, Support for a wide range of services, Inter-system handover.

Emerging Technologies in 5G

The evolution from 4G to 5G has not been standardized yet, and industrial and academic have not reach a consensus on the ultimate 5G technologies and how to combine these technologies appropriately. There is some emerging and promising technologies, aiming at significantly improving date rates, realizing green communication and perfect user experience, attract much attention. Moreover, the breakthroughs brought by 5G are not limited to this the explosive growth of mobile traffic data communication implies that the fusion of mobile communication and data transmission will become the mainstream. These technologies can generally be classified into two groups: 1) New air interface characteristics; 2) New network architecture. The emergence of brand new technologies imposes new requirements for 5G simulation and evaluation, next we will begin from analysis of candidate technologies and then give its influence on 5G system-level simulation.

Development

Network Architecture-Small Cells/Ultra Dense Network

Future mobile broadband services render new characteristics with the rapid development of mobile internet and smart devices. Firstly, from the view of service types, future broadband services demonstrate features of high speed and huge volume data transmission, all through IP, more diverse services types. Secondly, according to the statistics, the 60 percent and 70 percent of voice services and data services, respectively, happen indoor or in hot spot. Thirdly, from the view of spectrum, spectrum bands tend to be fragmented below 3GHZ, and 3.4GHZ-3.6GHZ spectrum has been allocated to mobile communication in WRC-07, therefore 5G communications are likely to operate on idle spectrum band higher than 5GHZ.

Security: Software Defined Network

The concept of Software Defined Networking (SDN) is originated by Open Flow (2008) of Stanford University, where network data plane and control plane are isolated through function abstraction. With separable control planes and data planes, network management can be simplified and previously unavailable services and configurations can be introduced conveniently. In this way, the future network can realize dynamic flexible topology control and afford programming ability to deal with “big data,” which is the necessary trend in future communication networks. Although academic and industrial groups have not arrived consensus about the definition of SDN, according to Open Networking Foundation (ONF), SDN is expected to be programmable, open source and flexible. Applying SDN into

mobile wireless communication systems can simplify the management of network for commercial operators and endorse the exponentially increasing data flow in foreseen 5G.

Statement of the Problem

Complex and Diverse Evaluation Scenarios are deployed,5G tends to cover a wide range of network structures to improve the coverage ratio, which makes the evaluation scenarios more complex and diverse. In 4G systems, there are typical 5 deployment scenarios for evaluation, while in 5G the scenarios have to be extended. Currently, the hottest scenarios concentrate on evaluating the performance of ultra-dense network and 3D MIMO system.

Reasons

More Simulation Parameters and Performance Metrics Should be considered,4G evaluations mainly focus on a few performances metric for specific services, such as the capacity of VoIP and the throughput or spectral efficiency under full buffer traffic model. Future services tend to diversify along with each service has its own emphasized metrics and traffic models. For example, explosively increasing mobile service needs large bandwidth and brings a mass of energy consumption.

Review of literature: The Study's objective: Network Architecture

Small Cells/Ultra Dense Network

Future mobile broadband services render new characteristics with the rapid development of mobile internet and smart devices. Firstly, from the view of service types, future broadband services demonstrate features of high speed and huge volume data transmission, all through IP, more diverse services types. Secondly, according to the statistics, the 60 present and 70 present of voice services and data services, respectively, happen indoor or in hot spot. Thirdly, from the view of spectrum, spectrum bands tend to be fragmented below 3GHZ, and 3.4GHZ-3.6GHZ spectrum has been allocated to mobile communication in WRC-07, therefore 5G communications are likely to operate on idle spectrum band higher than 5GHZ. All in all, those new trends of future communication prompt small cell network architecture become a necessary topology evolution direction for future data growth.

Research: Data rate

The overall improvement in the data rate can be enabled by exploring all spectra, i.e., optical frequency bands, sub-6 GHz, mm Wave, and THz. Additionally, the utility of Artificial Intelligence and Machine learning techniques in combination with the 6G networks would ultimately allow the full applicability, automation, and network management of the 6G.

Income Disparities - Qualitative Analysis-Emerging Technologies in 5G

The evolution from 4G to 5G has not been standardized yet, and industrial and academic have not reach a consensus on the ultimate 5G technologies and how to combine these technologies appropriately. There are some emerging and promising technologies, aiming at significantly improving date rates, realizing green communication and perfect user experience, attract much attention. Moreover, the breakthroughs brought by 5G are not limited to this, the explosive growth of mobile traffic data communication implies that the fusion of mobile communication and data transmission will become the mainstream. These technologies can generally be classified into two groups: 1) New air interface characteristics; 2) New network architecture. The emergence of brand new technologies imposes new requirements for 5G simulation and evaluation; next we will begin from analysis of candidate technologies and then give its influence on 5G system-level simulation.

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Results and analysis: **Reliability**

The 6G networks are expected to provide 99.9% reliability. Moreover, 6G will use artificial intelligence (AI) as an integral part which will prove beneficial for the optimization of a wide array of wireless network problems. The deployment of 5G networks has provided a realization of the fact that softwarization pays a cost as the usage of the commercial off-the-shelf (COTS) servers instead of the domain-specific chips in a virtualized radio access network (RAN) implicates a large increase in energy consumption thus, requiring measures for improving the energy efficiency. This can be explained by the fact that in comparison to the 4G networks, the 5G networks deliver a higher bandwidth at the cost of higher power consumption. The BER performance of proposed SVM decoder is simulated by Monte Carlo method. The tool MATLAB R2020b is used for this purpose. The performance of proposed SVM.

Comparative Study: two key technologies in 5G. We believe that the following emerging scenarios will be considered in the evaluation of 5G, as depicted in Fig. 2.

- **Heterogeneous Network***:* Future network will evolve from homogeneous cellular network to the coexistence of Marco-cells with random distributed lower power nodes forming small cells including micro-cells, Pico-cells, femeto-cells.
- **High-Rise Building***:* In urban environment, mobile users are tend to distributed in a three dimensional (3D) environment such as office building or shopping mall, therefore the height of high-rise building should be taken into consideration.
- **D2D Communication***:* In the era of data, several co-located devices would like to connect to each other for the purpose of sharing videos, pictures or files in social-networking or office environment.
- **High-Speed Mobile Environment***:* In 4G communication systems, it's generally perceived that data rates and reliability on fast moving vehicles cannot be guaranteed. It is suggested that mobile relay node can be installed on mobile vehicles as well as distributed MIMO base stations to achieve reliable communication quality by coordinated transmission technologies.
- **Traditional Typical Simulation Scenarios***:* To fulfill the backward compatibility and smooth evaluation of 5G evolved from 4G, it's important that 5G collaborates typical simulation scenario, like the five typical scenarios identified in 3GPP case1, 3GPP case2 adopted in 5G Network.

Policy Recommendations: Full Duplex Radio

Recent advances carried out by researchers at Stanford and Rice attempt to build in-band full duplex radio systems. The implicit improvement in full duplex could be tremendous, due to that the spectrum utilization can be cut down by half or equivalently system capacity achieve twice as before. However, full duplex implementation is predictably difficult due to the unavoidable self-interference since equipment is designed to transmit and receive simultaneously in full duplex radios. Fortunately, recent advances have been made, for examples, NEC labs .presents their innovational design work to realize full duplex by analog and digital interference cancelation techniques. As a promising technology towards 5G realization and standardization, full duplex radio may prove its feasibility.

Considerations: Simulation Efficiency Becomes Bottleneck

As 5G systems tend to merge multiple communication standards and diverse network structures, system-level simulation becomes more complex and difficult to implement. Considering the simulation efficiency, single-machine simulation cannot afford to complete the such a huge task. Therefore, three possible solutions are proposed as follows:

Parallel SimulationMulti-Machine and Multi-Core: A large number of repeated and independent computations can be realized by Multi-machine and multi-core parallel simulation instead of traditional methods to effectively improve the simulation efficiency. Guaranteeing the precision of channel and system model, the parallel simulation methods can greatly reduce the simulation time, thus improving the research efficiency.

Hardware Acceleration*:*

There are huge numbers of matrix operations in channel propagation model as well as data transmission and demodulation model, while the existing CPU is more capable of the one-dimensional string-based computing. Such matrix operations can be assigned to graphic processing units because of the its ability in the Study ensures ethical practices in data collection, ensuring informed consent, maintaining anonymity, and protecting participants' privacy. To ensure the credibility of the Study's findings, strictly adhering to ethical guidelines and protocols is essential. This approach guarantees the highest accuracy and quality of the data collected and analysed. Adherence to these guidelines is vital in maintaining the integrity of the Study and its outcomes.

Suggestions: Propagation Models are needed

On the way towards 4G, different channel models have been discussed and formulated into standardization, among which 3GPP, 3GPP2 and WINNER project have recommended spatial channel model/spatial channel model extended (SCM/SCME) and WINNER+ channel models respectively. As issued by ITU, the widely adopted channel model structure for IMT-Advanced consists of a primary module and an extension module , and the primary module is originated from the WINNER II channel model.

Framework of System-Level Simulator :Throughout the overview of 4G evaluation and emerging challenges brought by new network architecture and key technologies, building a new system-level simulator for 5G system is in urgent need to validate candidate technologies and fulfill the promising performance identified for 5G. Therefore, in this section, a cloud-based two level network simulation framework is proposed.

Immediate Implementation Policies: Overview on 4G Evaluation:

The Evaluation Framework of 4G: According to the evaluation methodologies of ITU, the basic evaluation characteristics and assessment methods for 4G are summarized in Table 1 . Among the methods, the simulations, especially system-level simulations, are the most important and complex contents, which cover the largest part of the workload. Figure 1 shows the modular design of system-level simulation together with two-step calibration.

1. Step 1:System-level, large scale fading calibration;
2. Link-level, link performance in AWGN channel, MIMO fading channel, etc.
3. System-level, with a set of simulation assumptions and parameters which are part of current LTE Release 8.Right before Step 1c, another calibration step, which is the channel model calibration, is implemented among the members of Chinese Evaluation Group.
4. Step 2:System-level, implementing LTE Rel. 8 functionality and its extension to testify whether the ITU requirements could be satisfied and to make steps forward;

Conclusions

In this paper, we present the challenges of building a simulation platform for 5G brought by emerging new technologies and network architectures. With the introduction of new air interface and network architecture, 5G simulation puts forward a very high request to integration and efficiency. To meet the strict requirements, a cloud-based two-level framework of system-level simulator is proposed. By dividing the system function into layers from the view of system, the two-level simulator will perfectly integrate various simulation scenarios and technologies. Moreover, using cloud computing, simulation efficiency can be greatly improved. Although the benefits of the cloud-based two-level framework of system level simulator are clear and reasonable, the implementation in practice still needs in-depth research.

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