Antonio Matencio Escolar
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Overview

"Antonio Matencio Escolar has a degree in Computer Engineering from the University of Murcia (Spain). Currently, He is a researcher and PhD candidate at the University of the West of Scotland in UK where he is actively involved in the H2020 5G-PPP Slicenet project. His main research interests include network slicing, software datapath, SDN, 5G mobile networks and network control and management, among others."

Employment

Doctor of Philosophy, Research - Eng &Computing
School of Computing, Engineering and Physical Sciences
University of the West of Scotland
1 Oct 2018 → 1 Jan 2023

Research outputs

1. **Adaptive network slicing in multi-tenant 5G IoT networks**

The Fifth Generation (5G) mobile networking coupled with Internet of Things (IoT) can provide innovative solutions for a wide range of uses cases. The flexibility of virtualized, softwarized and multi-tenant infrastructures and the high performance promised by 5G technology are key to cope with the deployment of the IoT use cases demanded by various vertical businesses. Such 5G IoT use cases incur challenging Quality of Service (QoS) requirements especially connectivity for millions of IoT devices to achieve massive Machine-Type Communication (mMTC). In addition, network slicing is a key enabling technology in 5G multi-tenant networks to create logical virtualized networks for delivering customised solutions to meet diverse QoS requirements. This work presents a 5G IoT framework with network slicing capabilities able to manage a vast number of heterogeneous IoT network slices dynamically on demand. The proposed solution has been empirically tested and validated in five realistic vertical-oriented IoT use cases. The achieved results demonstrate a excellent stability, isolation and scalability while being able to meet extreme QoS requirements even in the most congested and stressful scenarios.

General information

Publication status	Published
Organisations	School of Computing, Engineering and Physical Sciences, University of Murcia
Corresponding author	Contributors
Matencio Escolar, A., Alcaraz Calero, J. M., Salva-Garcia, P., Bernabe, J. B., Wang, Q.	Number of pages
22	Pages
14048 - 14069	Publication date
Peer-reviewed	Yes
Early online date	18 Jan 2021

Publication information

Journal	IEEE Access
Volume	9
Article number	3051940
ISSN (Print)	2169-3536
Original language	English
Keywords	5G, Internet of Things (IoT), network management, network slicing, quality of service (QoS), software defined networks (SDN)
Electronic versions	2021 01 04 Escobar et al Adaptive published
DOIs	10.1109/ACCESS.2021.3051940

2. **SliceNetVSwitch: definition, design and implementation of 5G multi-tenant network slicing in software data paths**

Network slicing is a primary Fifth-Generation (5G)mobile networking technology to create virtualised and soft-warised logical networks for various vertical businesses withdiverging Quality of Service (QoS) requirements. Meanwhile,there is a clear gap in providing network slicing capabilitiesin 5G multi-tenant networks to enable guaranteed QoS in termsof well-defined network metrics for the multiple tenants sharingthe same physical infrastructure. This paper designs and imple-ments novel software data path architecture that enables suchnetwork slicing with assured QoS in 5G multi-tenant networks.Highly flexible and customisable definition of network slicingis also allowed to be aligned with different existing definitionson demand and at run time. The proposed architecture hasbeen prototyped based on the popular Open Virtual Switch(OVS), and empirically validated to demonstrate the deploymentand management of network slices with the above capabilities.Intensive scalability results are provided where more than 8,192network slices are achieved simultaneously with warranted QoSthrough performance isolation in terms of bandwidth and delayin a real softwarised 5G multi-tenant infrastructure at speeds ofup to 10 Gbps

General information

Publication status	Published
Organisations	School of Computing, Engineering and Physical Sciences
Corresponding author	Contributors
Matencio Escolar, A., Wang, Q., Alcaraz Calero, J. M.	Number of pages
14	Pages
2212-2225	Publication date
Peer-reviewed	Yes
Early online date	8 Oct 2020

Publication information

Journal	IEEE Transactions on Network and Service Management
Volume	17
Issue number	4
ISSN (Print)	1932-4537
Original language	English
Keywords	5G, network slicing, network management, network control
Electronic versions	2020 09 06 Matencio-Escolar et al SlicenetVSwitch accepted
DOIs	10.1109/TNSM.2020.3029653

3. **Highly-scalable software firewall supporting one million rules for 5G NB-IoT networks**

There is a significant lack of software firewalls for 5G networks especially when the support for the Internet of Things (IoT) technologies such NB-IoT are considered. The main contribution of this research work is an advanced software firewall based on the Open Virtual Switch (OVS), which is able to provide firewall capabilities over these 5G IoT devices. The proposed software firewall is able to significantly scale up the number of rules to fulfill the 5G Key Performance Indicator of controlling 1 million IoT devices per square kilometer. Intensive experimental results are achieved in this work, validating the suitability of the proposed architecture for this remarkable level of scalability. In the most demanding conditions, where more than 1 million of firewall rules are installed and 1 million NB-IoT devices are sending traffic, yielding a total of 4 Gbps, the system shows only 8% of packet loss and 4 ms delay.

General information

Publication status	Published
Organisations	School of Computing, Engineering and Physical Sciences
Contributors	Matencio Escolar, A., Alcaraz Calero, J. M., Wang, Q.
Number of pages	6
Publication date	27 Jul 2020

Host publication information

Title of host publication	ICC 2020 - 2020 IEEE International Conference on Communications (ICC)
Place of publication	Piscataway, NJ
Publisher	IEEE
ISBN (Print)	9781728150901
ISBN (Electronic)	9781728150895

Publication series

Name	IEEE Conference Proceedings
Publisher	IEEE
ISSN (Print)	1550-3607
ISSN (Electronic)	1938-1883
Keywords	5G, NB-IoT, OpenVSwicth, software datapath, firewall
Electronic versions	2020 03 02 Escolar et al Highly accepted
DOIs	10.1109/ICC40277.2020.9149152

4. **An analysis of multicast inefficiencies in multi-tenant MEC infrastructures for 5G networks**

Communication and data networks require the efficient and timely delivery of packets with little or negligible latency in the transmission. This is especially important of 5G mobile networks where mission critical communications and applications are reliant on fast and efficient communications. It has long been understood that using multicasting, as a method of sending multiple packets simultaneously, over a medium will improve the efficiency of a communication. This is achieved by only transmitting multicast packets once to multiple recipients who will then receive the (multicast) packets. This paper identifies the inherent inefficiencies of multicasting when having to encapsulate packets in overlay networks such as those in the Multi-Access/Mobile-Edge to Core 5G infrastructure networks and demonstrate such inefficiencies empirically.

General information

Publication status	Published
Organisations	Database and Knowledge Management Research Group, School of Computing, Engineering and Physical Sciences, Artificial Intelligence, Visual Communications and Networks Research Centre
Contributors	Eager, S., Matencio Escolar, A., Alcaraz Calero, J. M.
Number of pages	6
Publication date	21 Jul 2020

Host publication information

Title of host publication	2020 IEEE International Conference on Communications Workshops (ICC Workshops)
Place of publication	Piscataway, NJ
Publisher	IEEE
ISBN (Print)	9781728174419
ISBN (Electronic)	9781728174402

Publication series

Name	IEEE Conference Proceedings
Publisher	IEEE
ISSN (Print)	2474-9133
ISSN (Electronic)	2474-9133
Keywords	multicast, unicast, encapsulation, cloud, multi-tenant, core, 5G
Electronic versions	2020 06 01 Eager et al Multicast accepted
DOIs	10.1109/ICCWorkshops49005.2020.9145140

5. **Multi-domain orchestration of 5G vertical services and network slices**

This paper presents an orchestration framework for the delivery of 5G vertical services and end-to-end network slices in a multi-domain scenario. The proposed architecture relies on a business model where verticals and service providers take the roles of digital service consumers, digital service providers and network service providers, each acting in its administrative domain. The interactions and delivery procedures among these entities leverage on standard solutions for interfaces and information models defined by ETSI and 3GPP. The paper also presents proof-of-concept applications of the proposed architecture in two H2020 European research initiatives.

General information

Publication status	Published
Organisations	School of Computing, Engineering and Physical Sciences, Polytechnic University of Catalonia, Altice Labs, Nextworks s.r.l., Creative Systems Engineering Monoprosopi Epe
Contributors	Bernini, G., Giardina, P. G., Spadaro, S., Agraz, F., Pagès, A., Cabaça, J., Neves, P., Koutsopoulos, K., Matencio, A.
Number of pages	6
Publication date	21 Jul 2020

Host publication information

Title of host publication	Proceedings of the 2020 IEEE International Conference on Communications Workshops (ICC Workshops)
Publisher	IEEE
ISBN (Print)	9781728174419
ISBN (Electronic)	9781728174402

Publication series

Name	IEEE Conference Proceedings
Publisher	IEEE
ISSN (Print)	2474-9133
ISSN (Electronic)	2474-9133
Keywords	5G, orchestration, vertical services, network slices
Electronic versions	2020 03 02 Bernini et al Orchestration accepted
DOIs	10.1109/ICCWorkshops49005.2020.9145221

6. **Scalable software switch based service function chaining for 5G network slicing**

Service Function Chaining (SFC) is a key enabler for network slicing in the Fifth-Generation (5G) mobile networks. Despite the ongoing standardisation activities and open source projects in addressing SFC, built-in 5G network support for SFC has not been sufficiently addressed on 5G Multi-tenant infrastructures. This paper proposes an Service Function Forwarder (SFF) and Classifier which is able to provide network slicing capabilities to the Service Data Plane in this type of infrastructures. The proposed prototype has been implemented as an extension of the popular Open Virtual Switch (OVS). The results of the empirical validation demonstrate that the proposed prototype is able to deal simultaneously with up to 8192 network slices with a maximum delay of 11 microseconds and 0% packet loss processing traffic at speeds up to 20 Gbps in a 5G architecture. The performance values achieved in this work are compliant with the 5G KPI expectation.

General information

Publication status	Published
Organisations	School of Computing, Engineering and Physical Sciences
Contributors	Matencio Escolar, A., Alcaraz Calero, J. M., Wang, Q.
Number of pages	6
Publication date	21 Jul 2020

Host publication information

Title of host publication	2020 IEEE International Conference on Communications Workshops (ICC Workshops)
Publisher	IEEE
ISBN (Print)	9781728174419
ISBN (Electronic)	9781728174402

Publication series

Name	IEEE Conference Proceedings
Publisher	IEEE
ISSN (Print)	2474-9133
ISSN (Electronic)	2474-9133
Electronic versions	2020 03 02 Matencio-Escolar et al Scalable accepted
DOIs	10.1109/ICCWorkshops49005.2020.9145067

7. **Toward hardware-accelerated QoS-aware 5G network slicing based on data plane programmability**

The diverging requirements from various vertical industries have driven the paradigm shift in the next-generation (5G) mobile networks, where network slicing has emerged as a major paradigm for this purpose by sharing and isolating resources over the same 5G physical infrastructure. To truly fulfill the different quality-of-service (QoS) requirements imposed by different network slices for different vertical applications, it is essential to introduce a programmable data plane that is aware of QoS and is configurable to enforce the QoS commitments. In this paper, we focus on designing, prototyping, and evaluating a novel QoS-aware data-plane network slicing framework for the edge and core network segments of a 5G network. The proposed framework is capable of dealing with differentiated services through hardware-based traffic classification, priority configuration, and traffic scheduling. By leveraging the latest open-source field-programmable gate array platform, we prototype the proposed framework and empirically evaluate the performance of the prototyped system. Experiment results demonstrate the capabilities of the proposed framework in terms of achieving QoS-aware network slicing at the data plane.

General information

Publication status	Published
Organisations	School of Computing, Engineering and Physical Sciences, Construction Innovation and Built Environment Research Group, Artificial Intelligence, Visual Communications and Networks Research Centre, Database and Knowledge Management Research Group, UPM
Contributors	Sanchez, R., Malagonb, P., Matencio Escolar, A., Wang, Q., Alcaraz Calero, J. M.
Number of pages	19
Publication date	28 Aug 2019
Peer-reviewed	Yes

Publication information

Journal	Transactions on Emerging Telecommunications Technologies
ISSN (Print)	2161-3915
Original language	English
Electronic versions	2019_07_19_Ricart_Sanchez_et_al_QoS. Embargo ended: 28/08/20
DOIs	10.1002/ett.3726