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Quantitative evaluation of Cloud-based network virtualization mechanisms for IoT

Merlino G., Longo F., Distefano S., Bruneo D., Puliafito A.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

Copyright © 2016 EAI. Integration of the Internet of Things (IoT) with the Cloud may lead to a range of different architectures and solutions. Our efforts in this domain are mainly geared towards making IoT systems available as service-oriented infrastructure. Under Infrastructure-as-a-Service (IaaS) scenarios, network virtualization is a core building block of any solution, even more so for IoT-focused Cloud providers. Enabling mechanisms are required to support virtualization of the networking facilities for IoT resources that are managed by the Cloud. This work describes an approach to network virtualization based on popular off-the-shelf tools and protocols in place of application-specific logic, acting as a blueprint in the design of the Stack4Things architecture, an OpenStack-derived framework to provide IaaS-like services from a pool of IoT devices. We quantitatively evaluate the underlying mechanisms demonstrating that the proposed approach exhibits mostly comparable performance with respect to standard technologies for virtual private networks, or at least good enough for the kind of underlying hardware, e.g., smart boards, whilst still representing a more flexible solution.

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Keywords

Cloud, IoT, Network virtualization, OpenStack, Performance evaluation, Reverse tunneling, VPN

References

[1] D. Bruneo, S. Distefano, F. Longo, and G. Merlino. An IoT testbed for the Software Defined City vision: The #SmartMe project. In 2016 IEEE International Conference on Smart Computing (SMARTCOMP), pages 1-6, May 2016.

[2] N. M. K. Chowdhury and R. Boutaba. A survey of network virtualization. Computer Networks, 54(5):862-876, 2010.

[3] S. Distefano, G. Merlino, and A. Puliafito. Device-centric Sensing: an alternative to data-centric approaches. IEEE Systems Journal, 2015.

[4] I. Fette and A. Melnikov. The WebSocket protocol. RFC 6455.

[5] A. Fischer, J. Botero, M. Till Beck, H. de Meer, and X. Hesselbach. Virtual network embedding: a survey. Communications Surveys Tutorials, IEEE, 15(4):1888-1906, Fourth 2013.

[6] T. Kelly. Scalable TCP: improving performance in highspeed Wide Area Networks. SIGCOMM Comput. Commun. Rev., 33(2):83-91, Apr. 2003.

[7] F. Longo, D. Bruneo, S. Distefano, G. Merlino, and A. Puliafito. Stack4Things: a Sensing-and-Actuation--s-a-Service framework for IoT and Cloud integration. Annals of Telecommunications, pages 1-18, 2016.

[8] R. Mahy, P. Matthews, and J. Rosenberg. Traversal Using Relays around Nat (turn): Relay extensions to Session Traversal Utilities for Nat (stun). RFC 5766.

[9] G. Merlino, D. Bruneo, S. Distefano, F. Longo, and A. Puliafito. Enabling mechanisms for Cloud-based network virtualization in IoT. pages 268-273, 2015.

[10] G. Merlino, D. Bruneo, S. Distefano, F. Longo, and A. Puliafito. Stack4Things: Integrating IoT with OpenStack in a Smart City context. 2015.

[11] G. Merlino, D. Bruneo, F. Longo, A. Puliafito, and S. Distefano. Software Defined Cities: a novel paradigm for Smart Cities through IoT clouds. pages 909-916, 2015.

[12] J. Romkey. Nonstandard for transmission of IP datagrams over serial lines: SLIP. STD 47, RFC Editor.

[13] P. Srisuresh, B. Ford, and D. Kegel. State of Peer-to-Peer (P2P) communication across Network Address Translators (NATs). RFC 5128.

[14] A. Tirumala, F. Qin, J. Dugan, J. Ferguson, and K. Gibbs. iPerf: the TCP/UDP bandwidth measurement tool. http://software.es.net/iperf/, 2005.