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IEEE Standard for Adoption of OpenFog Reference Architecture for Fog Computing

IEEE Communications Society

Sponsored by the
Edge, Fog, Cloud Communications with IOT and Big Data Standards Committee

IEEE
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USA

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IEEE Standard for Adoption of OpenFog Reference Architecture for Fog Computing

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Edge, Fog, Cloud Communications with IOT and Big Data Standards Committee
of the
IEEE Communications Society

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Abstract: OpenFog Consortium—OpenFog Reference Architecture for Fog Computing is adopted by this standard. OpenFog Reference Architecture [OPFRA001.020817] is a structural and functional prescription of an open, interoperable, horizontal system architecture for distributing computing, storage, control and networking functions closer to the users along a cloud-to-thing continuum of communicating, computing, sensing and actuating entities. It encompasses various approaches to disperse Information Technology (IT), Communication Technology (CT) and Operational Technology (OT) Services through information messaging infrastructure as well as legacy and emerging multi-access networking technologies.

Keywords: adoption, communication technology IEEE 1934™, information technology, OpenFog™, operational technology

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Introduction

This introduction is not part of IEEE Std 1934-2018, IEEE Standard for Adoption of OpenFog Reference Architecture for Fog Computing.

This IEEE standard adopts OpenFog Consortium™—OpenFog Reference Architecture for Fog Computing [ID: OPFRA001.020817].

That document offers a structural and functional prescription of an open, interoperable, horizontal system architecture for distributing computing, storage, control, and networking functions closer to the users along a cloud-to-thing continuum of communicating, computing, sensing, and actuating entities. It encompasses various approaches to disperse Information Technology (IT), Communication Technology (CT), and Operational Technology (OT) Services through a unifying information messaging infrastructure as well as legacy and emerging multi-access networking technologies.

The adoption of this OpenFog™ document will help to lay down a foundation for the Fog Computing and Networking Architecture Framework, which will be developed in this working group.

IEEE is adopting this document "as is" and in its entirety with the acknowledgement of an error in Line 18 on Page 106 in Section 7.1.3.1. Users should update the sentence as follows: "we push both the ~~both the~~ topology and the corresponding weights to target ~~or~~ classification system." Additional changes to this standard have been included in Annex A.

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OpenFog Reference Architecture for Fog Computing

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Acknowledgements

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OpenFog Overview

Digital innovation from the Internet of Things (IoT), Artificial Intelligence, Virtual Reality, Tactile Internet and 5G applications is transforming the way we work, commute, shop and play. Data from newly-connected factories, homes, communities, cars, hospitals and more is expected to grow from 1.1 zettabytes (or 89 exabytes) per year in 2016 to 2.3 zettabytes (or 194 exabytes) per year by 2020.[1] Current "cloud-only" architectures cannot keep up with the volume and velocity of this data across the network, thereby reducing the value that can be created and captured from these investments.

Fog computing provides the missing link in the cloud-to-thing continuum. Fog architectures selectively move compute, storage, communication, control, and decision making closer to the network edge where data is being generated in order solve the limitations in current infrastructure to enable mission-critical, data-dense use cases.

Fog computing is a:

> ***A horizontal, system-level architecture that distributes computing, storage, control and networking functions closer to the users along a cloud-to-thing continuum.***

Fog computing is an extension of the traditional cloud-based computing model where implementations of the architecture can reside in multiple layers of a network's topology. However, all the benefits of cloud should be preserved with these extensions to fog, including containerization, virtualization, orchestration, manageability, and efficiency. In many cases, fog computing works with cloud. Pillars, which are common themes of the OpenFog reference architecture include security, scalability, openness, autonomy, RAS (reliability, availability and serviceability), agility, hierarchy, and programmability. In addition to the pillars, we describe the roles of each stakeholder in the fog value chain from silicon creator to the Operating System and application developer through a composite architectural description

Fog computing also is often erroneously called edge computing, but there are key differences. Fog works with the cloud, whereas edge is defined by the exclusion of cloud. Fog is hierarchical, where edge tends to be limited to a small number of layers. In additional to computation, fog also addresses networking, storage, control and acceleration.

The OpenFog Consortium was formed on the principle that an open fog computing architecture is necessary in today's increasingly connected world. Through an independently run open membership ecosystem of industry, end users and universities, we can apply a broad coalition of knowledge to these technical and market challenges. We believe that proprietary or single vendor solutions can limit supplier diversity and ecosystems, resulting in a detrimental impact on market adoption, system cost, quality and innovation. It is our intent to ensure the OpenFog reference architecture results in fully interoperable and secure systems, supported by a vibrant supplier ecosystem.

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1.1 OpenFog Reference Architecture Overview

The OpenFog Consortium was founded by ARM, Cisco, Dell, Intel, Microsoft and Princeton University in November 2015. Through its global membership of leading technology & networking players, fog computing entrepreneurs and university researchers, the Consortium is helping to enable game-changing innovation enabled by fog computing through an open architectural framework.

We are guided by the OpenFog Board of Directors and the OpenFog Technical Committee. The technical committee is the technical governing body of all of the working groups of the Consortium. The chair of this group is elected by a vote of the OpenFog Board of Directors and reports directly to the board.

The OpenFog Reference Architecture (OpenFog RA) is intended to help business leaders, software developers, silicon architects, and system designers create and maintain the hardware, software and system elements necessary for fog computing.

Many different technical workgroups in the Consortium are responsible for the different aspects of this reference architecture, including: Communications, Software-Infrastructure and Security. The Architecture Framework workgroup is tasked with the creation and maintenance of this document and other technical publications of the Consortium. All new technical topics requiring investigation are assigned to this group. The charter of each group is managed and approved by the technical committee and Board of Directors.

For further information on these groups or how to participate, please reference www.openfogconsortium.org.