Fog Computing – Paper Review

1. An Object Store Service for a Fog/Edge Computing Infrastructure based on IPFS and Scale-out NAS
2. The Cloud is Not Enough: Saving IoT from the Cloud

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Background

This Presentation aim to justified the following challenge: which of the two approaches described in

1. An Object Store Service for a Fog/Edge Computing Infrastructure based on IPFS and Scale-out NAS (Paper 06a)
2. The Global Data Plane described in “The Cloud is Not Enough: Saving IoT from the Cloud“(Paper 06b)

- is better suited for Fog Computing?
- and rationale why the selected approach is better?

Paper 6a Key Concept – Inter Planetary File System (IPFS)

IPFS Motivation

1. Deploy dedicated servers in micro/nano datacenters geographically spread at the Edge of the network, that is close to the end-users [1].

IPFS – System Offer

2.
1. Data locality (enabling low access time).
2. Network containment between sites.
3. Support for users mobility.
4. Possibility to access data in case of service/network partitioning.
5. Scalability with a large number of sites, users and objects stored.

Empirical Analysis

3.
1. Reliable Autonomic Distributed Object Store (RADOS), Cassandra, Inter Planetary File System (IPFS).
2. Provide software abstractions that enable the definition of areas that can be mapped to geographical sites, and thus may be adapted to a Fog Context [1].

IPFS Solution

4.
1. IPFS can be seen as an object store service built on top of the BitTorrent protocol and the Kademlia DHT [1].
2. IPFS supports the mobility of data in a native fashion (one of Fog Object Store Service Properties) [1].

Issue & Challenge

5.
1. The main issue of using a DHT for the metadata management in IPFS is that each time a user wants to access an object, it involves the DHT to locate the object if it is not available on the requested node.
2. Object store should be designed to deal with and take the advantage of Fog/Edge component specifics [3].

Summary and Future Work

6.
1. Deploying on each site a local Scale-out Network Attached Storage system (NAS)
2. Allows nodes to access any object stored locally on the site without using the global DHT
3. Related work - **Performance Analysis of Object Store Systems** and **IPFS - Content Addressed, Versioned, P2P.**

Paper 6b Key Concept – Global Data Plane (GDP)

GDP Motivation

1

1. Introduce distributed platform, called the Global Data Plane (GDP) [2].
2. Disadvantages and argue that fundamental properties of the IoT prevent the current approach from scaling [2].
3. Focused on the transport, replication, preservation, and integrity of streams of data for locality and QoS [2].

GDP System Offer

2

1. We call the resulting infrastructure the Global Data Plane (GDP) [2].
2. Offers Common Access APIs (CAAPIs) [2].
3. Servers act as intelligent gateways or proxies for data flowing into and out of the cloud [4].

Empirical Analysis

3

1. Proposed Global Data Plane (GDP) focused around the distribution, preservation, and protection of information.
2. Single-writer time-series logs, Location-independent Routing, Pub/Sub and multicast tree [2].

GDP Solution

4

1. Utilizing heterogeneous computing platforms such as small gateway devices, moderately powerful nodes in the environment, and the cloud, in a distributed manner.
2. A log is a time-series, append-only data structure addressed using a flat 256-bit identifier [2].

Issue & Challenge

5

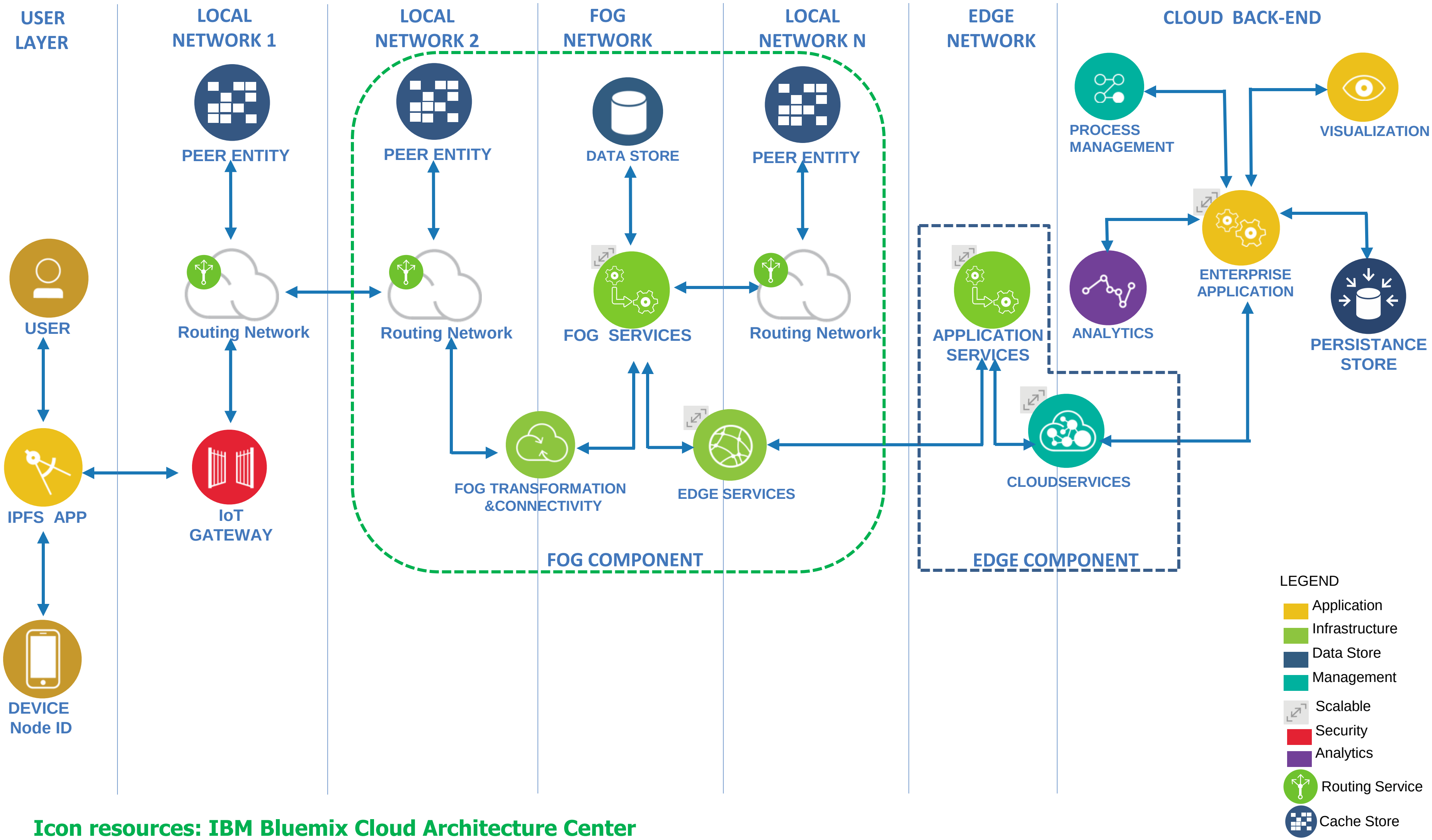
1. Accelerate adoption with tools, services and 5G Network.
2. A log is an authenticated data structure stored on potentially untrusted infrastructure [2].
3. Key management. Because security and privacy in the GDP relies upon encryption [4]

Summary and Future Work

6

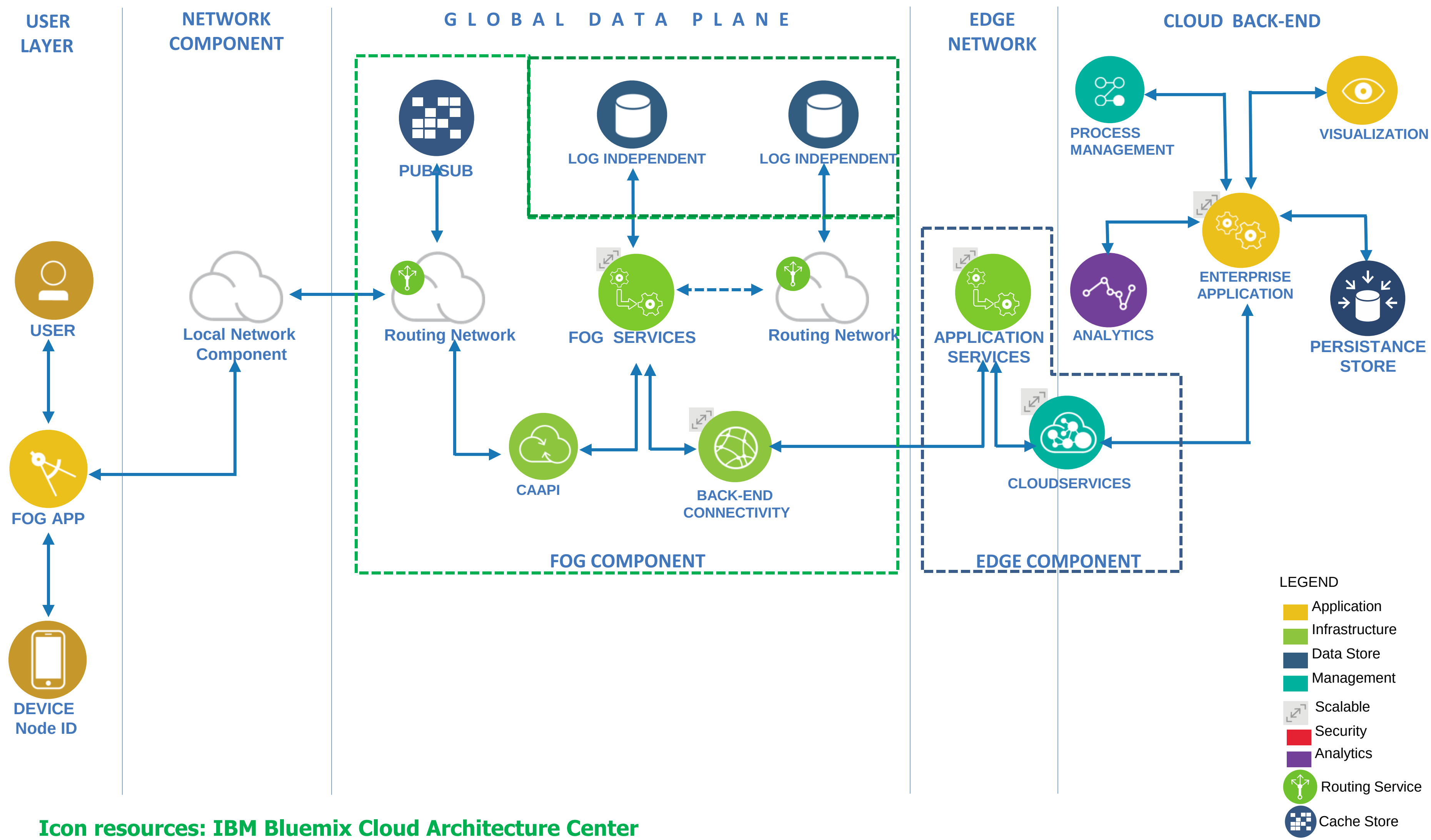
1. Decentralized data storage and delivery platform is apparently absent.
2. EdgeComputing from Akamai, Intel’s Intelligent Edge, and Microsoft’s Cloudlet.
3. Related work - **Toward a Global Data Infrastructure**

Paper 6a – IPFS Architecture Approach



Icon resources: IBM Bluemix Cloud Architecture Center

Paper 6a – GDP Architecture Approach



Icon resources: IBM Bluemix Cloud Architecture Center

Evaluation – IPFS with NAS Solution Justification

IPFS with Scale out NAS is better suited for Fog Computing.

Our rationales:

1. IPFS enable permanent replica withhin LAN or geo distributed -data is store in multiple geographic location- [1].
2. IPFS is not just a protocol. It is also a toolset. IPFS implementations include various tools for working with the merkledag, how to publish something, how to name something, network containment between sites, support for users mobility [3].
3. Three type of data characteristic (i) low access time (by favoring data locality), (ii)availability of data in case of service partitionning , (iii) data (log) can be distributed just like the Bitcoin network is distributed [3].

Evaluation – GDP Solution Justification

GDP is not yet fit for Fog Computing approach.

Rationale on this:

1. Routing overhead, high I/O Data throughput (all device will trigger data) [4].
2. Some sensor data is ephemeral (temporary), naive overlay implementation can severely affect the performance, especially roundtrip latencies [4].
3. Security risk related with data in transit [2].
4. Use case for GDP will be work if 5G Network in-placed [4].

Reference

- Paper resources:
  1. B. Confais, A. Lebre and B. Parrein, "An Object Store Service for a Fog/Edge Computing Infrastructure Based on IPFS and a Scale-Out NAS," 2017 IEEE 1st International Conference on Fog and Edge Computing (ICFEC), Madrid, 2017, pp. 41-50. doi: 10.1109/ICFEC.2017.13
  2. Ben Zhang, Nitesh Mor, John Kolb, Douglas S. Chan, Nikhil Goyal, Ken Lutz, Eric Allman, John Wawrzynek, Edward Lee, and John Kubiatowicz. 2015. The cloud is not enough: saving iot from the cloud.
- Related work
  3. B. Confais, A. Lebre and B. Parrein, "Performance Analysis of Object Store Systems in a Fog/Edge Computing Infrastructures," 2016 IEEE International Conference on Cloud Computing Technology and Science (CloudCom), Luxembourg City, 2016, pp. 294-301. doi: 10.1109/CloudCom.2016.0055
  4. N. Mor et al., "Toward a Global Data Infrastructure," in IEEE Internet Computing, vol. 20, no. 3, pp. 54-62, May-June 2016. doi: 10.1109/MIC.2016.51
- IBM BlueMix Reference Architecture
  https://www.ibm.com/cloud/garage/architectures/private-cloud/reference-architecture