International Journal of Research in Advanced Engineering and Technology
ISSN: 2455-0876
Impact Factor: RJIF 5.44
www.newengineeringjournal.in
Volume 4; Issue 1; January 2018; Page No. 44-47

Cross: Domain devices interoperability

Muhammad Jawad Hamid Mughal, P Amad Ali Shah
Department of Computer Science, University of South Asia, Lahore, Pakistan, India

Abstract
We describe a case study of the behavior of four agents using a space based communication architecture. We demonstrate that interoperability may be achieved by the agents merely describing information about themselves using an agreed upon common ontology. The case study consists of an exercise logger, a game, a mood rendered attached to audio player and phone status observing agents. The desired scenario emerges from the independent actions of the agents.

Keywords: communication architecture, ontology, agents

1. Introduction
This research has striven to describe interoperability among cross domain devices. IoT connects all devices to the internet, so they are able to communicate and exchange information, services. Our principal interest is to analysis different interoperability frameworks that bring all the devices together and provide them a platform to communicate [1-7]. M2M is one way of communication between machines. IoT applications do not interpret data, as they are domains specify and not interoperable due to different set of concept in domain area, domain experts do not share it publically [8-17].
Section 2 contains reviews of pervious papers. In section 3 we designed table – IoT, Cloud Computing and Interoperability as variables and different effecting factors are described which gives easy understanding.

1.1 Cloud Computing
Cloud computing is basically a concept of providing services over the internet. Services include storage, software, databases, servers etc. Basic architecture of CC consists of three layers of services provided by cloud venders. SaaS (Software as a Service), PaaS (Platform as a Service), Infrastructure as a Service) [18-25].

1.2 Internet of Things
IoT is a conceptual system that inter-relates those things which are connected to internet and provides them the ability to share informative data without any human help. Internet of Things moves traditional environment towards smart environment such as: smart houses, smart cities, smart cars etc. Now days there are many solutions that interconnect home appliances to communicate [26-30].

1.3 Interoperability
Interoperability allows systems or applications to share information in meaningful way. The information which is shared you can not only read or write but you know why the information was shared.

2. Background
Our research is basically about reviewing different methods of multiple domain interoperability. For this purpose we studied approaches that allow things to connect, share data and services.

3. Literature
A lot of work is being done in this area around the world. We have studied several research works done in this same field. A few of them are mentionable on the basis that they are related to IoT and interoperability.
Orestis Mavropoulos et al discussed about the security issue in IOT system. As IOT is one of the most wanted interconnected devices network now days, that connects different devices and enable communication between them. Anything connected to the internet must have security issue. Authors proposed a conceptual model “APPARATUS” for IOT security which is architecture oriented model and considers IoT system as cluster of connected networks (nodes) [31-35]. Another research has been done by K.E Psannis has well described about limitations of IoT, Mobile Cloud Computing MCC, advantages of MCC and MCC in business [36-40].
Amelie et al have gently described the importance of semantics and its integration with IoT based architectures. They work hard and designed semantic engine which can help to integrate different constituents of IoT architecture such as: Cloud, smart phones and machine to machine gateways.

4. Methodology
Information about topic is collected through literature approach. This method focuses on review of documents and describes problem.

Table 1: Effecting Factors Comparison

S. No.	Variables	Effecting Factors					
		Diff. Platforms	**Diff. Equipment's**	**Diff. Versions/Time Of Purchase**	**Diff. Operating Systems**	**Diff. Protocols**	**Diff. Programing Languages**
1	IOT [6-11]	Hardware / Software both lies on platform. Thus, platform is so called a combination of Hardware and Software. Platform might be a stage of specific hardware / software, each device has their own platforms which defers from each other.	Equipment's are used in device for a specific purpose. Every device has their brand equipment's.	IOT includes devices all over the universe. People buy them, company's purchase them, all are not purchase at the same time, thus version of device also change with the time [12-19].	All devices which connect to the internet are IOTdevise. Those devices don't use same OS.	Protocols are used for communication purpose in between IOTdevices. Some relies on TCP/IP, some on UDP etc.	Java, C, Python, JavaScript, Swift, PHP, C#.
2	Cloud Computing [20-28]	Many platforms are provided by cloud vender; out of which three are the main platforms. Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS). All of the above are On-Demand Service / Pay as go – per usage.	Distributed data centers are the combination for many Servers, Routers, and Switches etc. Each of them consists of different equipment's depend upon the requirements.	Hardware / Software are not purchase for server rooms at the same time. If required so they are purchased. E.g. data storage space decreasing so vender will purchase a new storage. Purchase date / version will be change.	Cloud computing at the backend is the combination of distributed data centers, consists of many servers, switches, routers etc. All of these have their own separate operating system.	Gossip protocol use for failure detection, messaging, monitoring. Connectionless n/w protocol. State Routing Protocol SRP etc.	SQL, Oracle for Database. Go procedural language created by Google. GFM domain-specific language and many more.
3	Interoperability [29-34]	Computers, mobiles, tablets, sensors, wrist watch, MACbook, iPod, smart watch, IP cameras etc.	RAM, ROM, storage devices, smart touch screen, 3D touchscreen, mic , monitors, camera lenses etc.	Purchasing time will should not affect the inter communication between device unless the latest version supports previous versions [35-42].	Microsoft, MAC, Linux, Unix, Android, IOS.	Interconnectivity between different devices through internet using separate protocols.	Different languages can communicate through cloud but there should a combine storage, rather than even single device having separate language or OS will have separate storage e.g. icloud and android backup.

5. Conclusion

The main novelty and contribution of this paper is that IoT integrates devices through network capabilities. More IoT applications need to be design with built-in frameworks that allows different device to share same platform and give easiness to communicate. Great development in the technology, IoT and device interoperability is highly demanding in industries.

References

1. Khan F, ur Rehman A., Usman M, Tan Z, Puthal D. Performance of Cognitive Radio Sensor Networks Using Hybrid Automatic Repeat ReQuest: Stop-and-Wait. Mobile Networks and Applications, 2018, 1-10. https://doi.org/10.1007/s11036-018-1020-4
2. Alam M, Trapps P, Mumtaz S, Rodriguez J. Context-aware cooperative testbed for energy analysis in beyond 4G networks. Telecommunication Systems, 2016, doi:10.1007/s11235-016-0171-5
3. Khan F, Rahman F, Khan S, Kamal SA. Performance Analysis of Transport Protocols for Multimedia Traffic over Mobile Wi-Max Network Under Nakagami Fading. In Information Technology-New Generations. Springer, Cham, 2018, 101-110.
4. Alam M, Albano M, Radwan A, Rodriguez J. CANDi context-aware node discovery for short-range cooperation. Transactions on Emerging Telecommunications Technologies. 2013; 26(5):861-875. doi:10.1002/ett.2763
5. Khan F, Nakagawa K. Comparative study of spectrum sensing techniques in cognitive radio networks. In Computer and Information Technology (WCCIT), 2013 World Congress on. IEEE, 2013, 1-8.
6. Alam M, Mumtaz S, Saghezchi FB, Radwan A, Rodriguez J. Energy and Throughput Analysis of Reservation Protocols of Wi Media MAC. Journal of Green Engineering. 2013; 3(4):363-382. doi:10.13052/jge1904-4720.341
7. Khan F, Bashir F, Nakagawa K. Dual head clustering scheme in wireless sensor networks. In Emerging Technologies (ICET), 2012 International Conference on. IEEE, 2012, 1-5.
8. Alam M, Yang D, Huq K, Saghezchi F, Mumtaz S, Rodriguez J. Towards 5G: Context Aware Resource Allocation for Energy Saving. Journal of Signal Processing Systems. 2015; 83(2):279-291. doi:10.1007/s11265-015-1061
9. Khan F, Kamal SA, Arif F. Fairness improvement in long

chain multihop wireless ad hoc networks. In 2013 International Conference on Connected Vehicles and Expo (ICCVE). IEEE, 2013, 556-561.
10. Jan MA, Nanda P, He X, Liu RP. PASCCC: Priority-based application-specific congestion control clustering protocol. Computer Networks. 2014; 74:92-102.
11. Khan F. Secure communication and routing architecture in wireless sensor networks. In IEEE 3rd Global Conference on Consumer Electronics (GCCE), IEEE, 2014, 647-650.
12. Jan MA, Nanda P, He X, Liu RP. A sybil attack detection scheme for a centralized clustering-based hierarchical network. In Trustcom/BigDataSE/ISPA, 2015; 1:318-325).
13. Jabeen Q, Khan F, Khan S, Jan MA. Performance Improvement in Multihop Wireless Mobile Adhoc Networks. The Journal Applied, Environmental, and Biological Sciences (JAEBS). 2016; 6(4S):82-92.
14. Jan MA, Nanda P, He X, Tan Z, Liu RP. A robust authentication scheme for observing resources in the internet of things environment. In Trust, Security and Privacy in Computing and Communications (Trust Com), 2014 IEEE 13th International Conference on, 2014, 205-211.
15. Jan M., Nanda, P., Usman, M., & He, X. (2017). PAWN: a payload-based mutual authentication scheme for wireless sensor networks. Concurrency and Computation: Practice and Experience, 29(17).
16. Khattak MI, Edwards RM, Shafi M, Ahmed S, Shaikh R, Khan F. Wet Environmental Conditions Affecting Narrow Band On-Body Communication Channel for WBANs. Adhoc & Sensor Wireless Networks, 2018, 40.
17. Jan MA, Nanda P, He X, Liu RP. Enhancing lifetime and quality of data in cluster-based hierarchical routing protocol for wireless sensor network. In High Performance Computing and Communications & 2013 IEEE International Conference on Embedded and Ubiquitous Computing (HPCC_EUC), 2013 IEEE 10th International Conference on, 2013, 1400-1407.
18. Khan F. Fairness and throughput improvement in multihop wireless ad hoc networks. In Electrical and Computer Engineering (CCECE), IEEE 27th Canadian Conference on). IEEE, 2014, 1-6.
19. Jan MA, Nanda P, He X, Liu RP. A Sybil attack detection scheme for a forest wildfire monitoring application. Future Generation Computer Systems, 2016; 80:613-626
20. Khan F, Jan SR, Tahir M, Khan S. Applications, limitations, and improvements in visible light communication systems. In2015 International Conference on Connected Vehicles and Expo (ICCVE). 2015, 259-262.
21. Jan MA, Nanda P, He X. Energy evaluation model for an improved centralized clustering hierarchical algorithm in WSN. In International Conference on Wired/Wireless Internet Communication Springer, Berlin, Heidelberg, 2013, 154-167.
22. Usman M, Jan MA, He X. Cryptography-based secure data storage and sharing using HEVC and public clouds. Information Sciences. 2017; 387:90-102.
23. Usman M, Jan MA, He X, Nanda P. Data sharing in secure multimedia wireless sensor networks. In Trustcom/BigDataSE/I SPA). IEEE, , 2016, 90-597.
24. Khan F, Khan M, Iqbal Z, ur Rahman I, Alam M., September). Secure and Safe Surveillance System Using Sensors Networks-Internet of Things. In International Conference on Future Intelligent Vehicular Technologies. Springer, Cham, 2016, 167-174.
25. Usman M, Yang N, Jan MA, He X, Xu M, Lam KM. A joint framework for QoS and QoE for video transmission over wireless multimedia sensor networks. IEEE Transactions on Mobile Computing. 2018; 17(4):746-759.
26. Khan F, ur Rahman I, Khan M, Iqbal N, Alam M. CoAP-Based Request-Response Interaction Model for the Internet of Things. In International Conference on Future Intelligent Vehicular Technologies. Springer, Cham, 2016, 146-156.
27. Fida N, Khan F, Jan MA, Khan Z. Performance Analysis of Vehicular Adhoc Network Using Different Highway Traffic Scenarios in Cloud Computing. In International Conference on Future Intelligent Vehicular Technologies. Springer, Cham, 2016, 157-166.
28. Jan MA, Khan F, Alam M, Usman M. A payload-based mutual authentication scheme for Internet of Things. Future Generation Computer Systems, 2017.
29. Usman M, He X, Lam KK, Xu M, Chen J, Bokhari SMM, Jan MA. Error Concealment for Cloud-based and Scalable Video Coding of HD Videos. IEEE Transactions on Cloud Computing, 2017.
30. Yang N, Usman M, He X, Jan MA, Zhang L. Time-Frequency Filter Bank: A Simple Approach for Audio and Music Separation. IEEE Access. 2017; 5:27114-27125.
31. Usman M, Jan MA, He X, Alam M. Performance evaluation of High Definition video streaming over Mobile Ad Hoc Networks. Signal Processing. 2018; 148:303-313.
32. Jabeen Q, Khan F, Hayat MN, Khan H, Jan SR, Ullah F. A Survey: Embedded Systems Supporting By Different Operating Systems. International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Print ISSN, 2016, 2395-1990.
33. Tahir M, Khan F, Babar M, Arif F, Khan F. Framework for Better Reusability in Component Based Software Engineering. In the Journal of Applied Environmental and Biological Sciences (JAEBS). 2016; 6(4S):77-81.
34. Khan S, Babar M, Khan F, Arif F, Tahir M. Collaboration Methodology for Integrating Non-Functional Requirements in Architecture. In the Journal of Applied Environmental and Biological Sciences (JAEBS). 2016; 6(4S):63-67.
35. Usman M, Jan MA, He X, Nanda P. QASEC: A secured data communication scheme for mobile Ad-hoc networks. Future Generation Computer Systems, 2018.
36. Jan MA, Tan Z, He X, Ni W. Moving Towards Highly Reliable and Effective Sensor Networks, 2018.
37. Jan MA, Jan SRU, Alam M, Akhunzada A, Rahman IU. A Comprehensive Analysis of Congestion Control

Protocols in Wireless Sensor Networks. Mobile Networks and Applications, 2018, 1-13.
38. Alam M, Ferreira J, Mumtaz S, Jan MA, Rebelo R, Fonseca JA. Smart Cameras Are Making Our Beaches Safer: A 5G-Envisioned Distributed Architecture for Safe, Connected Coastal Areas. IEEE Vehicular Technology Magazine. 2017; 12(4):50-59.
39. Jan MA, Usman M, He X, Rehman AU. SAMS: A Seamless and Authorized Multimedia Streaming framework for WMSN-based IoMT. IEEE Internet of Things Journal, 2018, doi: 10.1109/JIOT.2018.2848284
40. Jan MA, Jan SR, Usman M, Alam M. State-of-the-Art Congestion Control Protocols in WSN: A Survey, IoT EAI, 2018, DOI: 10.4108/eai.26-3-2018.154379