**Influence of the Internet of Things and its Sub-Domains on Development of Architectural and Design Patterns**

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**1. Introduction**

In this paper the correlation between the advancements in the field of the Internet of Things and the development of new architectural and design patterns are examined.

This paper starts, in Section 1, with providing a brief understanding and introduction to what the two major actors in this paper are, patterns and IoT.

The paper moves on, in Sections 2, to discuss various domains of IoT and new patterns that were developed due to the advancement of those domains. The discussion starts with the general domain of IoT and then delves into a few sub-domains. Each section provides an explanation of the domain and then moves on the the issues that the new patterns were invented to solve, finally ending with the new design pattern that were created. Some are more expected than others, such as IoT in general would require new networking patterns but it isn’t as clear the BCI (Brain-Computer Interfaces) would need new ontology patterns without reasonable research done in that field.

In Section 3, the discussion moves on to the thoughts of this paper’s composer about all that has been discovered in the previous two section and speculation on the future of these fields.

Finally, in Section 4, this paper is concluding while going over what the paper covered.

**2. Introduction to Patterns and IoT**

fill in…

**3. Domains of IoT and their effect on Patterns**

fill in…

**4. Composer’s Thoughts**

Throughout the time preparing and writing this paper, the composer has consumed many articles on various fields pertaining to IoT in one way or another. The paper that sparked the original idea for this paper (thought that idea has evolved over time) was [1] where a survey was performed and patterns were examined. The finds most relevant to this paper were the patterns discovered that were new IoT patterns rather than non-IoT patterns in use in IoT development. Some of these patterns are listed in this paper along with details about the sub-domain that spawned them.

The composer’s interests were greatly peaked seeing how new patterns were developed for various fields. After doing research on the new patterns and seeing that they sometimes originated from seemingly unrelated domains of IoT such as ontology patterns being developed due to development in field of BCI (Brain-Computer Interfaces). As one who was familiar with BCI and indeed the NextMind device mentioned in this paper, but not with ontology patterns this connection alone was enough to solidify the composer’s desire to write this paper.

During the research for this paper it was made evident that some of the new patterns that were brought about by the domains of IoT were very similar to existing patterns, many based off parent patterns but altered or combined in a new way creating new patterns that better fit the new domain. In [2] in the description of the new patterns the base patterns are listed. In other papers as well although not as clearly we see that some patterns are extensions or alterations of existing patterns such as both Computational Offloading and Stateless Authentication mentioned in Section 2.c. The core idea behind both exist outside the realm of IoT but the new patterns doctor them making them more compatible for the new use case.

It occurred to the composer that this is to be expected. A fundamental principal of software engineering is that new development is made of build-blocks of existing ideas. It seems that is the principal under which these new patterns were developed when possible. Just a software engineer generalizes and compartmentalized pieced of code for general use, such that these pieces of code may be reused in way that even the original programmer or architect did not image, the same is with the very patterns that govern the best practices of code being programmed.

Another note that the composer found interested though was not directly linked to any of the subjects above was also found in [1]. The paper found that although there are many new IoT patterns, only a select few were mentioned in more that on paper that was used in the survey. This implies that, although new patterns are being developed, it is uncommon for those unfamiliar with the new pattern to find said pattern and use it.

The composer finds this fact as quite unfortunate as many could benefit from the patterns developed by others. That being said, these patterns are new, from a historical standpoint, and it is the opinion of the composer that with time, more and more of the new patterns will make their way around the community of IoT developers and software engineering as a whole. Just as so many patterns have become prevalent throughout the field in the past, it is the opinion of the composer that the same will happen with IoT patters, probably sooner rather than later.

**5. Conclusion**

In this paper it has been shown how, although the Internet of Things, isn’t technically a new technology, its rapid development in the last decade or so has drastically changed the current day landscape of technology. The development revolutionary systems such as Smart Grids and video games or wheelchairs that are literally controlled by the mind will have profound consequences on a variety of sectors.

In this paper, the point was made and demonstrated that development of IoT technologies both in general and in its sub-domains has brought forth new patterns of various fields, from networking to security and more.

Several cases have been shown how, given a problem or problems in a relatively new sector, such as Smart Resource Distribution, or an existing sector with new problems, such as care for the elderly, new patterns have been created to solve said problem. In some cases, the new design patterns were closely related to existing ones, yet altered in a way to better fit the new domain, while other deviate more from establish patterns to work better with new problems that need solving.

In the last section, Section 4, where the composer’s thoughts were given, it was mentioned that although some problems recur, many design patterns developed to solve said problems are not well known throughout the field. It is the composer’s opinion that as time moves on, more information will naturally be shared and the new patterns will become more wide spread. In addition, it is the composer’s opinion that the realm of IoT is the clear path for the future and in fact a great future for IoT and in turn for technology and all who benefit from it is unfurling even now that these words are being written.

**6. Bibliography**

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