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A Review of Technology Paradigm for IOT on FPGA

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Abstract: In recent years, the integration of a whole set of technologies, commonly known as the Internet of Things (IOT) activating an ecological system blossoming architectures and platform where objects smart, users and communication infrastructures between act to support smart context - aware services and applications. Smart-grids, medical monitoring, smart cities and teaching of pollution is distributed gust concrete some examples of applications that are gaining attraction between industries and institutions. In this paper the application of IOT is examined in the FPGA platform, production deices Mars. It includes data collection, congeal, automation algorithms along with the implementation of the TCP / IP stack in FPGA with an interface cable or Wi-Fi Ethernet.

Keywords: IOT (Internet of Things), FPGA, Wi-Fi, TCP/IP, Future Internet, Sensor Data Acquisition.

I. INTRODUCTION

1.1 INTERNET OF THINGS

Internet of Things (IoT) is an integrated part of future internet including existing and evolving internet and network developments and could be conceptually defined as a global dynamic network infrastructure with self-configuring capabilities based on standard and interoperable protocols communication where physical and virtual "things" have identities, physical attributes, and virtual personalities, use intelligent interfaces, and are seamlessly integrated into the information network.

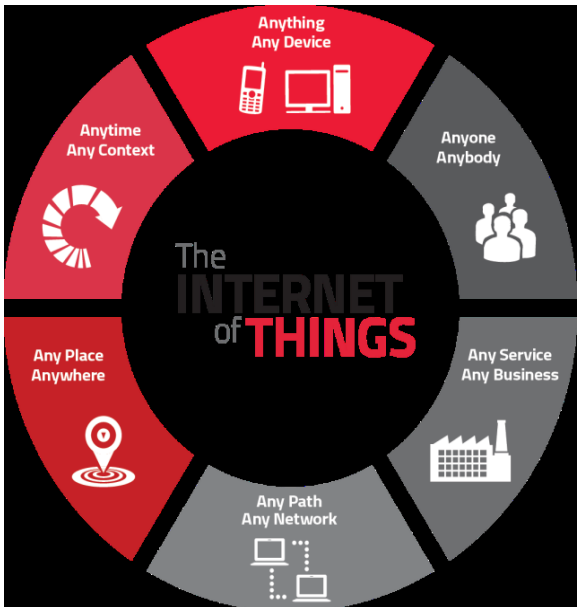

Fig. 1: Internet of Things

In the IoT, "smart things / objects" are expected to become active participants in business, information and social processes where they are enabled to interact and communicate among them-selves and with the environment by exchanging data and information "Sensed" about the environment, while reacting autonomously to the "real / physical world" events and influencing it by running processes that trigger actions and create services without direct human with or intervention.

The IERC definition AIMS to coin the IoT paradigm and concept by unifying the different statements and many visions referred to as a "Things," "Internet," "Semantics," "Object Identification" oriented definitions of Internet of Things promoted by individuals and organizations around the world.

1.2 IOT APPLICATIONS

The major objectives for IoT are the creation of smart environments / spaces and self-aware things (for example: smart transport, products, cities, buildings, rural areas, energy, health, living, etc.) for climate, food, energy, mobility, digital society and health applications. The developments in smart entities will present encourage the development of the novel technologies needed to address the emerging challenges of public health, aging population, environmental protection and climate change, the conservation of energy and scarce materials, enhancements to safety and security and the continuation and growth of economic prosperity.

These challenges will be addressed by:

- Providing reliable, intelligent, self-managed, context aware and adaptable network technology, network discovery, and network management.
- Refining the interaction between hardware, software, algorithms as well as the development of smart things

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and smart interfaces among human-machine / things interfaces, enabling thus smart and mobile software.

- Embedding smart functionality through further developments in the area of Nano electronics, sensors, actuators, antennas, storage, energy sources, embedded systems and sensor networks.
- Developments across disciplines to address the multi-functional, multi-domain communications, information and signal processing technology, identification technology, and discovery and search engine technologies.
  Developing novel techniques and concepts to improve the existing security, privacy and business safety technologies in order to adapt to new technological and societal-challenges.
- Enhancing standardization, interoperability, validation and modularization of the IoT technologies and solutions.

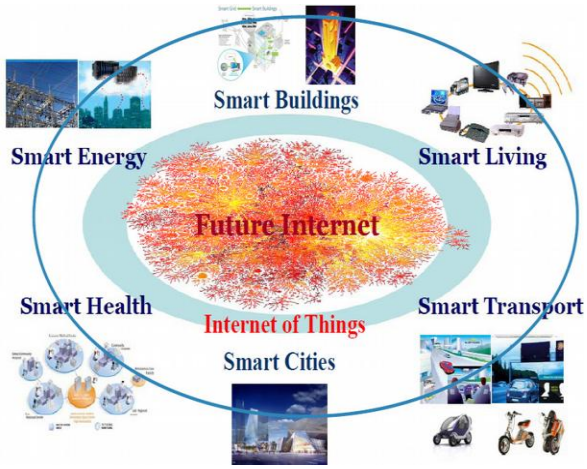

Fig. 2: IoT and smart environments creation

1.3 Internet of Things Conceptual Framework

Internet of Things (IoT) is an integrated part of future internet including existing and evolving Internet and network developments and could be conceptually defined as a global dynamic network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes, and virtual personalities, use intelligent interfaces, and are seamlessly integrated into the information network.

Services will be able to interact with these "smart things / objects" using standard interfaces provide the necessary that will link via the Internet, to query and change their state and retrieve any information associated with them, taking into account security and privacy issues.

1.4 FPGA

FPGA-based hardware web services have already been implemented and described. Their nature embedded allows developers to adapt easily those services to actively interact with their environment, e.g. Real-world to acquire measurement data or controlling various actuators. Such entities can be called environment-aware web services in contrast to classical web services that work on remote physical or virtual machines. Despite the fact that environment-aware web services may be implemented using much less expensive MCUs and sequential code, programmable hardware may perform better where very intensive computational tasks involved.

At times of lower utilization they can be reconfigured to offer additional resources as spare their data-processing web services. Whenever a task is more intensive processing to be performed, their resources can be employed back to the device's original provide functionality. This concept can be applied to regulate past that devices offer no web service compliance. In the latter case, however, we would lose some useful features: such as interoperability or the ability to use the management software tools available already etc.

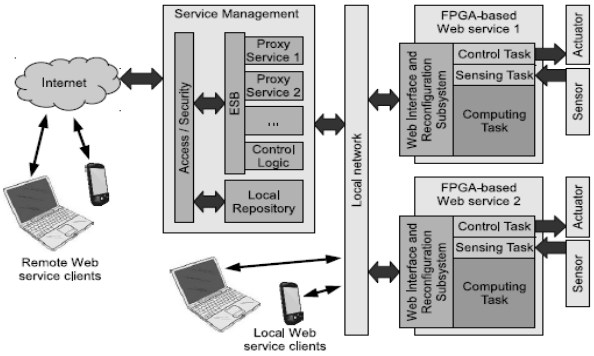

Fig 3: General concept of networked reconfigurable FPGA based web service

Important areas that use the IoT and web service concepts are the Smart Home and Smart Building. In order to provide IoT services in Smart Home / Smart Building environments, in [8] the authors propose a Web-of-Objects in the IoT platform service environment. This platform has-been designed in order to create user-cantered services IoT. In Addition, complex services can be developed by combining elements of existing web services.

II. LITERATURE REVIEW

1.) Internet of Things Revolution toward Smart Life Advantages and Obstacles.

In the recent past, world was not interconnected to this extent, at the present time technological developments introduced many changes to our daily lives, with the spread of smart devices and social networks each of us become to have two worlds, the world of realistic and another virtual one based on communication and information technologies, where it became difficult to live in isolation from the technology and be sufficient with only traditional things & since technology is in a nonstop development and modernization, sometimes it becomes hard to keep up with its rapid development, discovered technologies before few years become old and unsuitable,

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and recently we witness new technical terms keep up on appearing to us just as ordinary users of technology and not necessarily technical specialists.

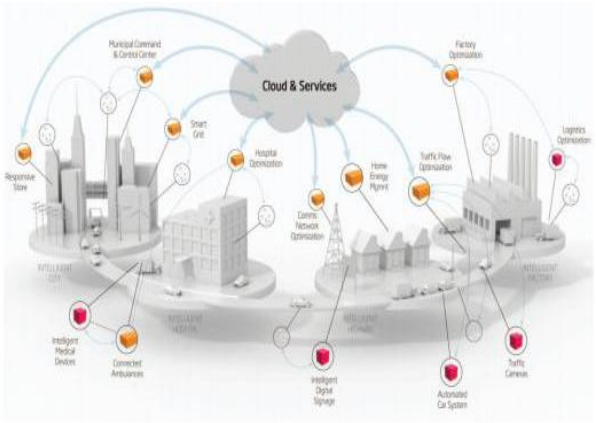

Fig. 4: Services made possible by Cloud IoT paradigm

In spite of the many questions about data privacy in the Internet of things, the problems of use, or mentioned obstacles, experts believe that there is a strong desire among many to adopt the use of this technology on different terms of reference, which refers to the possibility of their growth in spades in the next few years, this might be an opportunity for companies to increase their profits through a real understanding of how customers use those programs and connected devices related to the Internet of things technology.

2.) Reconfigurable FPGA-based embedded Web services as distributed computational nodes.

In this article authors propose a concept for an experimental class of control devices that use both a microcontroller unit (MCU) and a field-programmable gate array (FPGA) circuit. These devices can provide the functionality of full-featured Web services that are compliant with the Service-Oriented Architecture (SOA) paradigm. Despite the fact that FPGA circuits are more expensive than consumer-grade MCUs, they potentially offer much more computational power.

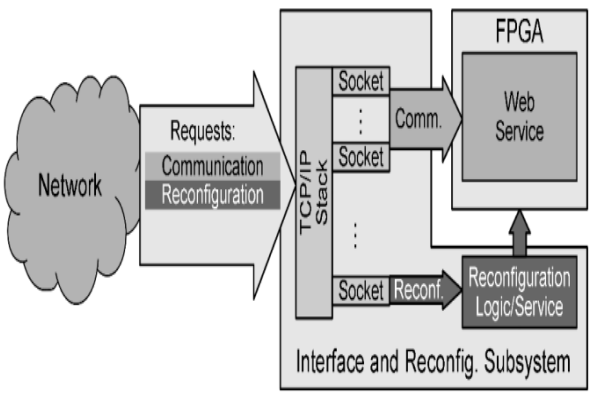

Fig. 5: The idea of multiplexing network hardware between the FPGA-based Web service and the reconfiguration subsystem

In scenarios in which FPGA computational power is required on demand and for short periods only, a large part of such resources might, however, remain unused or disabled. Thus they propose a system architecture and software infrastructure that simplifies the utilization of temporarily unused resources for performing various tasks that can be offered as web services on a commercial basis.

In this article, they present a concept for a better utilization of spare FPGA resources by employing them to perform independent computational tasks. They apply this approach to FPGA-based embedded and environment-aware web services compliant with the SOA paradigm. Additional functional modules have to be provided for each service and special architectural guidelines have to be followed, which they present in this paper as a reference. They attempt to keep additional hardware costs as low as possible. Initially, they applied the concept presented to the FPGA with previously developed hardware software platform designed to run various web services. Future development goals include

1) Automatic service advertising (Which is related to the issue of service repository [12]); and
2) Developing or adapting algorithms available which would allow us to move computations automatically between FPGA based web services and the service management subsystem to ensure web service uninterrupted operation.

III. AUTHOR REVIEW

Design & development of an FPGA based implementation for multi-tier IOT sensor nodes & Control systems. Use of low cost FPGA for Implementation of entire subset IOT including TCP/IP protocol, Control System, Data Acquisition etc. Demonstration of a single FPGA container containing multiple IOT & controlling simultaneously implementations. Design & development in high level VHDL coding so as to facilitate multi-platform portability for our IOT Implementation. Support for Ethernet based wired or Wi-Fi/Bluetooth connectivity to Internet based modules using dedicated hardware. GSM Modem Based Connectivity to Internet Server Using 2G / 3G GSM Networks.

Demonstration by Implementation of a multi sensor control system connected to Internet Server, Application Server & a running on a dedicated IP Control with & data logging facility.

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BIOGRAPHIES

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