New Business Model for EDA Industry in Internet of Everything Future

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***Abstract* - Internet of everything (IoE) is the newest concept transforming industries. Through this paper we aim to bring a clear understanding on how this driving force is transforming and reshaping electronic design automation (EDA) industry and how companies within industry are trying to find new strategies to adapt and profit in this technological disruption. New approaches and the features of a new business model for EDA industry in IoE are discussed.**

Keywords – **EDA industry, Internet of Everything, Business model.**

I. INTRODUCTION

EDA industry consists on companies designing and producing advanced design electronic tools and systems which can be used in different industries such as healthcare, automotive, defense, aerospace, etc.

For years, since its beginning EDA was a closed industry with traditional approaches at designing. With the latest developments and advancements in technology, the industry is experiencing changes, unknown fields and new challenges. The pressure is so high that businesses inside industry need to adjust, transform and create new business models and philosophies if they want to survive in this disruptive market. Cadence, one of the leaders in EDA, in 2010 released a paper, called EDA360, presenting its own vision on how the industry needs to cooperate and collaborate in order to deal with these innovations [1]. Other companies in EDA, like Synopsys and Mentor Graphics, are trying to find new products to extend their markets [2].

One driving force behind innovations and new products in EDA is the so called, Internet of Everything. IoE is used to describe the connection of all the things, processes, data and people through internet and automatic data exchange [3]. IoE is the extended version of Internet of Things (IoT) including Internet of People and wearable technologies. The term, first introduced by CISCO, 2013, covers not just the technological changes but at the same time explores the economic and strategic implications of IoE innovations for companies [3]. Complex technologies behind IoE bring huge advantages and changes to different industries and economies [4] [5]. IoE transforms existing electronic products and gives rise to new systems and products. At the same time, there are lots of challenges, especially in privacy, security, management of big data, cloud computing and new business models for users, developers, organizations and governments [6][7]. In the continuing sections we try to bring a clear view on how IoE is driving companies at EDA to explore new business models and opportunities.

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II. TRENDS AND CHALLENGES

Cisco estimates that 99.4% of physical objects that may one day be part of the IoE are still unconnected. With only about 10 billion out of 1.5 trillion things currently connected globally, there is vast potential to “connect the unconnected” [7][3]. These devices need the right technology, with different specifications on what are used until now. They need to be specialized for specific applications, to be secured, power efficient and to be connected to networks with different types of components and features. The IoT-devices market will require not only a single type of chip but a diverse of them.

Semiconductor devices will be needed for different aspects, especially in cloud, integration and connectivity including computing, sensors, communications and interactivity [8]. Their size must not be a problem and at the same time they need to be as expensive as mass-production devices. The market requires these devices to be produced in small batches with a low price and Moore’s Law may not be anymore the main driving force [9].

The range of applications within IoE go beyond customer electronics and include: wearable devices such as fitness or health accessories, smart home applications like heating, lighting, connected cars, smart cities and especially industrial automation. All these advanced will bring improvement to human life, safety and quality. The demand will grow for EDA and semiconductor industry and this indicates that companies will be more aggressive to find new ways to take advantage from these markets and products [3]. At the same time there is a need for privacy and security, weaknesses, that companies are still working on to fix.

These devices require complex integration. As Cadence, predicted, the market is hunger for integrated systems and for right sophisticated tools to design these systems [1]. The traditional methodologies, where each component is designed, analyzed and produced independently do not give to these companies’ competitive advantages. These methodologies can result in products with higher cost, poor quality and delay [10]. Industries need a more integrated system approach and tools where engineers can carry out an early system prototyping and analyze the interaction of each component while achieving the optimal design. The electronic industry depends on the efficiency of these EDA tools that could help build smaller,

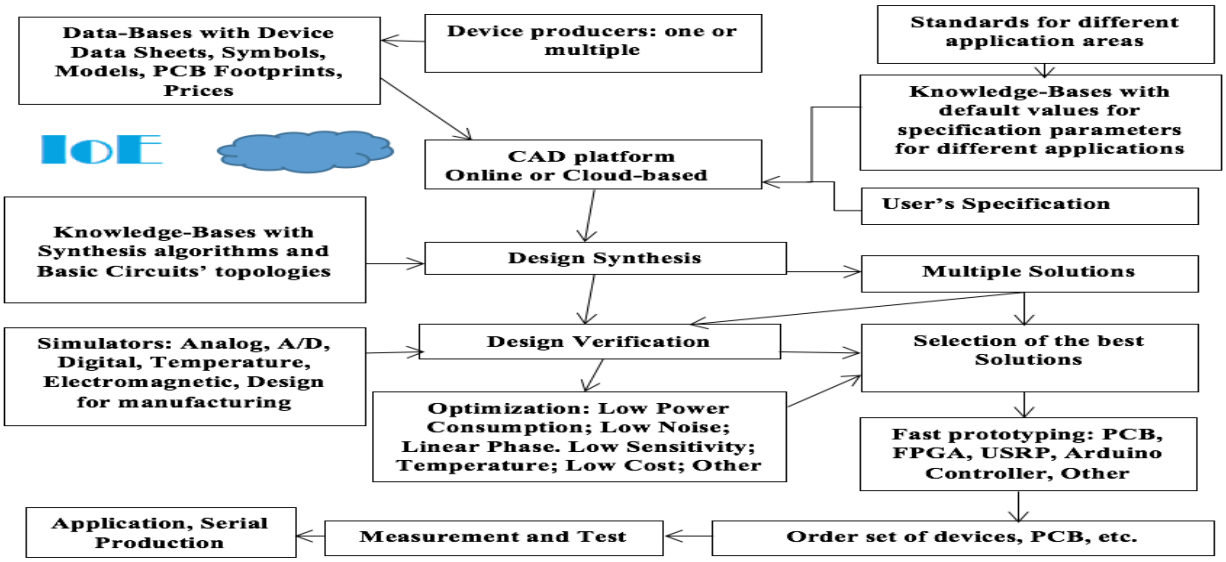

Fig. 1 Integration in EDA industry, Product-oriented design, Cloud and online exposition, IoE environment

faster, cheaper and more intelligent next generation products [10]. Semiconductor and EDA industries are the ones who will provide the necessary baseline for all the successful connectivity through electronic devices. They need to merge and cooperate together because the challenge of building the right infrastructure is a difficult one and industries responsible for this cannot realize it by their own work [10].

Providing connectivity for these small size devices, requires new standards of communications with higher speed and with more intelligence in reacting. That will lead to intelligent and heterogeneous networks [11].

III. A NEW BUSINESS MODEL FOR EDA INDUSTRY

After reading and analyzing the general situation of the industry, and especially the philosophies of the three main EDA companies, Cadence, Synopsys and Mentor graphics, we came up with some approaches for companies to follow and with a business model proposal for the industry. We will use business model canvas, created by Alexander Osterwalder [12] [13].

System integration. IoE includes drastic changes in the core technology and calls to think out of the box for new models and new products. According to Tom Beckley senior vice president of Cadence's Custom IC & PCB Group, the industry must focus in new tools and technologies because it is not anymore about "the chip", but about "the product" [14].

Vic Kulkarni, Director at Global Product Supply, Direct Supply, states that EDA tool providers must think of market opportunities from a perspective of a user, new licenses and pricing model for "mass market", like: low-cost and low-touch technical support, data and IP security. There is a call for companies to go beyond their comfort zone and to exploit new opportunities for providing big data analytics, security stack, etc [14]. Vendors in EDA industry need to unify the solutions and to consider "development of the software stack". Customers have a longer list of requirement and functionality safety comes as an important part where EDA vendors must fulfill it. IoE is a world of hardware and software co-development. Most of the companies must focus on producing new trusted tools for verification and validation, for a secure product. Companies like Synopsys and Cadence are unveiling new simulators for System-on-chip design to be more up to date with the latest verification challenges [15].

Devices produced by the industry will have to fulfill application requirements like, high-power, high performance, application processing, low cost and ultra-power integrated sensors that support sufficient functionality and autonomous device operation. To achieve this level of design flexibility, semiconductor players must rethink their approach to product development model. EDA solutions for designing these devices are critical for the ecosystem [16]. Figure 1 illustrates the approach of system integration in EDA industry which leads to new financial policy for CAD tools providers – costs are mainly taken by device producers instead of users. Further development is focused on CAD tools integration. Research on CAD tools integration through standard passports for CAD tools is presented in [35]. These trends will be reinforced by IoE perspective.

New markets. EDA is well positioned to re-purpose the expertise into new markets, e.g., mechanical design, IP, embedded software and vertical market like automotive and perhaps to seek to expand markets by focusing on design data management, says Laurie Balch, chief analyst at GSEDA [17]. Many companies are working on innovative ideas in home automation, medical devices, automotive and other industries [18]. Thanks to IoT, IP has taken on new importance as a way to deal with complexity and cost [19]. According to Lip-Bu-Tan, CEO and President at Cadence, there is an emerging IP business that is growing rapidly, providing for the company's costumers highly differentiated IP [20] [21]. Other market opportunities include, Mentor Graphics entering the business of selling intelligent IoT gateways, Synopsys focusing on software development and CADENCE getting deeper into embedded vision [9].

The need for collaboration. In its vision EDA360, Cadence, predicted the need for a friendly and cooperative ecosystem inside and outside industry. According to Cadence, the design

Business model canvas for EDA industry businesses.	Designed by: Galia Marinova & Aida Bitri	Date: April 10, 2018.	Version: 1.0
Customer Segments Different sizes of customers, small & big companies. Different industries: Aerospace & Defence, Automotive, industrial, medical, Consumer electronics, telecommunications, commercial electronic industry and manufactures of semiconductors and others. Different customers around the world Different segments for different type of products sensors, microcontrollers, systems, IP, connectivity and memory	**Channels** Direct channels (websites or sales) Partner channels (due to partnerships and merges & acquisitions) Other new sale channels and geographies Academic Network	**Key partners** Foundry Partners Universities Start ups Other industries (automotive, smart homes and cities) Library and Intellectual property partners Industry members	
Value propositions Innovation. Partnerships (Merge and Acquisitions). Systems integration and integrated circuits. Security and privacy protection solutions. Application oriented. Low cost and fast production. Quick access to EDA tools. Building an ecosystem business model. Cloud connectivity and SasS. Low power innovations. Reducing time to market for IoT devices. Software quality and integrity. Smart devices. Brand recognition. Variety of products. Trust. Big data analytics.	**Key activities** Selling EDA tools for semiconductors. Maintain a collaborative approach toward other organizations within industries. Research, development and innovation. New product updates to adjust to changes. Quality & security checks. Production management (cooperation with other start ups). New Marketing, customer and low costs strategies. Problem solving and new design solutions. New Cloud Platform strategies.	**Revenue Streams** New flexible licensing models, different prices from different customers based on their size (seats use at the same time). Intellectual properties, systems and software integrity services. Manufacturing solutions. Leasing emulation hardware technology. Collecting maintenance revenue for software, emulation hardware, and IP Revenues from providing engineering services. Earning royalties from the use of IP. Revenues from Big data analytics. IC physical design & verification. Printed circuit board and multi-chip module revenues.	
Customer Relationships Direct contact with costumers offering support. Analysing data and improving services in real time.	**Cost structure** Research and development Administrative costs Costs on device producers not users.	**Key resources** IP resources New Technology used for designing (cloud-based) Human resources (innovation) Partnerships (academia and start ups)	

Fig. 2: Business model canvas for EDA industry

process is a complex process that needs guidance and companies need new ideas and strategies [1]. Cooperation with academia has been always an important part of the main EDA companies. Cadence, Synopsys, Mentor Graphics, are examples on how industry should do research and exchange ideas with universities to provide new strategies for solving problems [22] [23] [24] [25]. Anupam Bakshi, CEO of Agnisys, InC, says that small companies generate code for the big companies within industry. If big companies want to provide to the customer a product with no mistakes and to fulfill the customer satisfaction, these second-tier companies must have access to tools provided by these big companies. This leads to a strong collaboration between the two of them [26].

Merge & Acquisitions is another technique used by companies to strengthen their position in the industry. The most famous one was the acquisition of Mentor Graphics from Siemens. According to them, Mentor Graphics will help to a new level of offering mechanical, thermal, electrical, electronic and embedded software design capabilities on a single integrated platform [27].

A. Business model canvas for EDA industry

After gathering all the findings, we decided to propose a new business model for EDA. This is the first version and in order to have a clear and concentrated view on our proposal, we have used the business model canvas created by Alexander Osterwalder [12]. There are nine business components in this canvas. These components describe the infrastructure of a company, like key activities, key resources and key partners; the activities and the collection of products and services that bring value to companies in order to distinguish from other companies in the market. Other components like, customer segments, channels, customer relationships describe the type of customers it tries to reach [28] [29] [30] [31] [32] [33] [34]. Figure 2 presents details for each component in the business model canvas for EDA businesses in an IoE future.

IV. CONCLUSION

At the end we can conclude that IoE is bringing a new wave of changes for EDA. There are a lot of challenges and unknown paths but at the same time huge opportunities. If businesses find ways to cooperate and to use these challenges in their advantage, the profits and the opportunities for the industry will grow and transform the ecosystem. At the business model canvas, we identify the need of organizations to find solutions through discovering new business models, new products and services for their new customers, new strategies on how to handle this huge innovation and how to deal both on the technological and economic aspects and at the same time developing a strong collaborative ecosystem.

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