



## SYSTEM ON CHIP

<sup>1</sup>Nisarg Dave, <sup>2</sup>Prof Parita Oza

Institute of Technology, Nirma University

Ahmedabad, Gujarat, India

Email: <sup>1</sup>dnisarg13@icloud.com, <sup>2</sup>parita.prajapati@nirmauni.ac.in

### Abstract

System on chip is now more important thing in system modelling. In this Paper discussion, I have discussed the system model extraction approach & it's analysis & How it's introduced to describe system behavior at the highest abstract level. This approach unveils some features like control/data flow and computation & storage, critical task features based on automatically generated system models.(it improves efficiency and correctness of system modelling)as we know that system on chip has many application in various fields and other important applications (SoC[Wire] Reconfigurable, Design in space technology,[network on chip]multiprocessor so(multiplatform library configuration),voltage regulation on SoC, System on Chip design for linear system solver.so SoC as an application driven Model extraction approach is discussed here. The Advantages over power, Architecture, developing models and other extraction & efficient technique for multi-domain & multipurpose programmed chips for general uses. Here we have taken some case studies and innovation in the Computer industry (some companies which has revolutionize the technology by extreme use of SoC).Here also the Architecture & Working Process of SoC is discussed. Architecture, Working & Process analysis of SoC in various Field, NoC, System modelling & SoC frame-work, System on

Chip(Wire):reconfigurable space technology phenomena & also Born of SystemC & Chip Planner, RF SoC, usage, limitation disadvantages and scope is Enlighten and centrally focused in this review.

### Keywords

System-on-Chip, system-modelling, system level designing. CMOS(complementary metal oxide semiconductor chip),NoC(network on chip),CNN(cellular neural networks).

### I. Introduction

The designing on the system level has some main components like modelling of system and their architecture and hardware and software designing. Here the main and the first step is modelling and designing of the system. There are two types of this level that is based on their operation mode(manual/automatic). There are main in-tension behind this is to by automation the work and the task of the developer is reduced. This require special language by this we can do our task. control functions and data flows are also important for any this kind of approach and we need some specific languages. And we also take back to the efficiency of system, analysis of features which is based on some applications. We also have to design and analyze hierarchical CU(control unit) and flow of process. SoC is also used in on chip network chip and it's also used in the Applications on Space. we have outlined the solution based on advantages and also solutions are introduced in

terms of network on chips. For the space technology missions and other space application level stuff there are many uses and significant importance of the so configuration. this so approach allows us the enhancement of system performance which is based on system on board. Today's many technology uses logic boards, on chip sys-tem or we can say system which is integrated or built on a single chips. Here the discussions based on several applications of SoC & newly redesigned network chip & abstraction of Applications on configurable chipsets and it's applications and uses in some other domain are discussed the modelled structure of system can be treated as system generator and it is programmed in SystemC and then compile, debug and just do in manner of developing or coding but only this is not sufficient because this is the our ancient or we can say basic approach now we will analyse the system Application, aim and devices, eligibility & efficiency and finally finalise our optimised, integrated and inbuilt approach which is on chip for us to use now power and battery are very important key-word in this dynamic and advanced developing world for our daily and personal use(voltage regulations are discussed into this for on chip system)it has many micro and nano scale circuits based on operation. the computing power of this system requires very very high architecture/methodology and integration of more cores and arrangement of high caches (improved the deficiencies in power and thermal aspects)and in this System On chip concept the internal components and multi-cores are integrated into only one common chip for all purpose. Which is also reliable and also low in cost(basically CMOS)and also energy/power efficient.so here plans for energy/power integration & performance of this on chip systems are analysed.

### **Architecture, Working & Process Analysation of SoC in various Field**

NoC:law in this field given by Moore tells that the all required components for computer to run it have to be integrated into sin-gle silicon chip(CMOS).software also integrated into the chip, So SoC is a small logic board which runs whole computer processes and it makes the whole computer processes very very rapid than ever and also cheaper than other and it's more

reliable. There are many cores on single chip so they are distributed for several computer tasks (storage & process delivery all etc.) There are several challenges for that concern about power consumption, delay, and efficiency.

### **System Modelling & SoC Framework**

SystemC code extraction analysation and processing of model of the system architec-ture.in the stage of this process first thing is that the initial analysation of code and then keep the control flow tracking & creates the model which give features of the system in detail to study and to help to extract it out. Framework has major parts like computation and storage feature and the timeliness of tasks. We can analyse control functions and related instruction information by the graph which is drawn based upon the control to data flow of the SoC's process task. We will take the i/p of the programme first and then we will represent it in analytic terms. When analysis is finished, all the results are stored and then installed in some place.in this storage is also needed to be analysed by data-flow.so the life of the each node of process has to be indicate that this particular node is live or dead. The time complexity of the algorithm also should be known by some how.so the function has to be generated for measuring time complexi-ty.as we know that the memory resources are scarce so we have to take care about memory problems and storage specification in SoC design for each and every application.

### **System on Chip (Wire):Reconfigurable Space Technology Phenomena**

for the so made for space applications are usually programmed and controlled for special defined functions and high scale image applications for transmission and compression based approach for efficient user satisfaction. The high scale integrated systems have flexibility and also the re-usable non-conventional approach so it's good for high end use. The main or key terms of the system is price, efficiency, usability, power consumption, processing power, mass storage requirement satisfaction. There are many space operations and missions that have used this technology and succeed their jobs so SoC has made open windows for many domain and

generally for all streams related to computer science. The current approach (VMC) is the good but what about future? The addition demand is maintenance during execution of mission means it should be auto reconfigurable for some circumstances. That's called partial updation. Now we come to the point of discussion on SoC [Wire] which is basically the internal communication of structure (layered architecture). data and strobe are basic components of this thing. Jitter variation in pack-age time arrival is also important factor of technology. (XORing can retain timing signals) its like a continuous formation between links depends upon time arrival difference, implemented technology etc.

### Born of SystemC

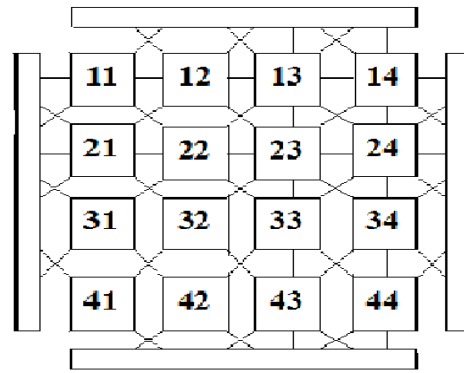
We can create this model from any existing model (let say HDL) there are 2 approaches

[1] top to bottom is good for developing components for the application which we demand. and here the prerequisite is the optimised and efficient code in SystemC language for the target platform. The case studies in the worst algorithmic time complexity so the application must be tested and judged again and again for better performance.

[2] bottom to top way first create extracted existing model and then create exact and parallel SystemC model and false point is in this method we can't develop software simultaneously with the hardware creation and innovation. so this system lags in this point.

How voltage regulated on SoC platform?

We all know that on chip integration of this type of devices is not easy. Voltage has to be regulated between source and load. so challenge is to regulate input voltage level. It's somehow very tedious task that to place regulator between load on a single silicon chip. Now we will see how the task is as-signed to SoC in different stages and levels and the methodology of the same. Term on chip network communication is related to point to point mapping and the process of designing the same. The micro networks used to implement the same and It is a way for differentiate computation & communication process NoC: interconnected Block structure for this is as below. CNN type Structure of Nodes



This is also entitled as most chosen research topic in world. the main advantage is the non-conventional property of re-usability due to the anonymous structure (highly complex). block and mesh are the most common and basic structural topologies for the same. Now building of system on programmable chip is also most important thing and also wide useful in all are. Software integrated with less complex, compact, cheap hardware is like a new born infant. so it's just amazing combination for embedded, complex, general systems. plan for logic, implementation stages and resources and timing complexity estimation, routing between different process of blocks and all.

### Chip Planner

Before considering any of the system's model we have to plan chip. How it will be? How it will work? What is the main target? What can be the architecture which is highly extracted, efficient and more useful as it would be. so now planning comes. Planner concern about process to process task, timer, complexity, analysis, efficiency and all.

### SoC USES

Embedded systems and SoC's are the most important phenomena that causes the attraction in various fields military and space re-search Centre and all. Embedded systems are designed not only for general purpose but it has some special functions for doing some special tasks and it's implemented for doing the same as a perfect task runner. SoC has many components of computer system integrated within itself, but when the technology changes, system requirement also get updated, so we have to change the point of view for the maintenance and

updatation of system in modern manner so it can be cheaper. We have to take care about lifespan and so on we can make more flexible system that has ever been made. Power supply noise is known through the traffic on NoC. Power model (grid) can be integrated on chip. This is very big alternative of the interconnected bus topology. This is also used to connect elements on chip systems. Adaptivity of this is on the traffic identifying algorithms and also routing algorithms. to understand effect of each in several circumstances we have to take several cases electric circuit like on chip bus we have seen before but third method is also there like compartmental paradigm.

#### RF SoC

multilevel and multi band actions are now using the integration in smartphones with the internet generation (latest Long term evaluation) enabled Ics. in which at one end very low band should be realized and other hand data of large amount should be handled (100 of megabits/sec) for giving good service in the real time system diagnostics is needed very strongly.

Power consumption and estimation of power want for the SoC networks is more important thing. On chip component like processor for processes and caches and controller bus system should be power efficient for total efficiency of power in system usage. Several technics for minimizing the power consumption is used for this. The encoding of the system of bus is also good for the same and used as one of the technics for the same purpose. Partitioning the buses is also possible for the same (like for particular purpose particular bus line so and so) and the management of power is also the main concern for the same. Timed-out based techniques are also nice and efficient for the same purpose. so we have seen the application of chips and programmable silicon chip now we can say that the SoC sets in when compact, more efficient, new era and new technology requires and when we require updatation of hardware or reconstruction or re-usability in non conventional way than it's best option we can integrate any software or larger OS's on the same by set of instructions we can make our system for working via chipsets in only one compact, small and efficient architecture. Use of hardware and software together can make magnificent combination and can run system. Information & technology's this modern age

SoC is dominating the computer science by it's own high importance and multipurpose uses. SoC has changed the way we design the computer architecture or computer designs today we can see the design of any hardware component of computer is changed. The way in which we design our logic boards for the computer system or the way in which we use less space or less hardware or just the extraction of any system level design can be done very easily and also not only just easily very efficiently than ever can be done by this. The multiple system or programmes or logical task that we want to implement in any system in any domain for any purpose can be done on single small chip of silicon. (especially CMOS) we can see it's already implemented in processor area or graphics processing unit area or the logic board of the world's thinnest computers (Apple Mac's & notebooks and all) or camera chip, motion processor chip or camera autofocus and auto detection integrated CMOS SoC. We can take any space applications or any image processing which is done on chips or any processing purpose or high level super computer simulations and tasks, integration on chip software purpose for any area and for any use and for any domain in any form (hardware integrated with software or just hardware (programmed or non Programmed) this domain has opened up many closed window like programming integration in hardware chip or compaction of computer systems or modern notebooks in magnificent manner and also some embedded systems also this chips have changed the way for designing cameras and not changing pixel capacity how we can make our camera best by using aperture and focal length how we can design camera for better performance and better than ever. From the use of SoC we can process our image capture performance on chip via CNN and other interconnection for better resolution. the displays like everything we see is vivid and lifelike they also uses the same sheet (very thin sheet like hardware for pixel processing, more density, ultra high screen performance) for examples we can say retina display which is invented by Apple and latest words best display is used in iMac (resolution 5k) so the top most product lineup is using this type of SoC architecture we can say the high end mobile devices also has ARM based SoC for system processing at low RAM requirement so

we can say SoC can replace many things in computer hard-ware sectors now a day many high techno-logical mobiles give their best performance worldwide in CPU & GPU. We can take ex-ample of ARM based chipset invented by Apple for its iPhone(A8 & M8 latest chips), iPad, Mac, iPod, Apple Watch(S series chips) technology.so these is implemented by 2008 later in USA's multinational com-panies.so here we have seen some tremendous use of SoC in real world and also it's advantages and architectural behavior.

### Research Gap

Now in this most advanced world CMOS based only one chip integrated ICs are very common and very useful and it's very interesting that how they work, how they function & how it can be made much complex and much useful ever. Comparison and analyzed the SoC(& it's different applications) and this drawn me to this task. and also i was just inspired by the some companies varies computer industry product line up which uses this things and just wonderfully recreated the way we create & the way we think & do(IBM, Intel Mobile, high end PCs, tablet & desktop/laptop processors, AMD/NVIDIA GPU's, Apple ARM based iOS device chips(A8,M8...)Watch OS( S series chips)and previous Desktop based ARM chips for Macs.

### Critical Analysis

From the above talk we can say that SoC is cheap than other hardware because we can afford that much money for hardware integrated on 1 component with software which can do our work which can process tasks and also which can extract our code and from which we can model our system efficiently in nice energy and power ratings and also in most efficient manner than the other conventional systems so SoC is said to be this era's most advanced and multi purpose multi platform hardware component through which we can rule over industry known only for innovative and new edge technology.

### Conclusion

As we know that for less power consumption and for more architecture and art of programming on Chip as a only one control-ler of all system of modelling.so we can say as the one of the great programmable multi-purpose architecture and

also energy(power)efficient and cheap and best also in usage. It's also stands for green nature means it doesn't harm too much to nature so it's also eco-friendly in some cases. . We can use CNN network model & templates in the other conceptual computer science work and the quality high speed SoC architecture for better performance, best quality.so basically via SoC we can do many task by this in multitasking & transformation of information technology capitalize era.so usage and advantages of SoC are very much than their limitations so here at last for some decades SoC will rule the technology with proper combination and simultaneous optimised usage of software with respect to hardware for make our hardware usage at its maximum strength. SoC is the best ex-ample of most efficient and strong integration and working of software with hardware for making our device most powerful ever. They are connected internally as a one communication system(Moore's law) and it creates/develops one very complex but important and useful network within negligibly small area as such as amazingly.so we can reduce hardware, space and also some other complexity by making only one chip which do everything and anything from Graphics processes to any work which we want to do. And also from professional, personal, high end computing purpose or any other use. The embedded system which are made for specific special systems can be run by SoC over the conventional way so SoC is the term or the thing which has made computer science's era to the very new & modern age in terms of battery/power efficiency or Analytical performance of the Programs or Software on single chip Architecture or Advanced user interaction, visual age(new processing power of anything),extraction of components(less components and combinations of alternatives for new hardware technology which work more efficiently but costs less and also multipurpose or multi domain technology(personal, professional for 21st century's human age).

### References

- [1].Application Driven SoC (System model extraction Approach) by Zhao, li, Wang, Yan
- [2]SoCwire: SoC design in space application (network on chip) Osterloh, Kotarowski, fiethe
- [3]Multiprocessor so on multiplatform library configuration by ADAMEC & Fryza

- [4].SoC voltage regulation higher scheme, Gjanci, Masud
- [5]Network on chip (efficient run time task) by suganya, Scholar, Nagarajan.
- [6]Analysis of SoC on full digital engine control by Wang, Min Xu
- [7]Models for network on chip (communication centric power grid) by Dahir, Yakovlev
- [8]Asynchronous logic design for research reliable on chip. Jianlan, Yijun
- [9]System diagnostics by on chip (RF-IC In band interfaces) by Azuma, Makita, Nagata
- [10]Chip-Interconnect model. Dai, Patrick, Yu, Fang
- [11]NoC design techniques & test. By santanu IITK
- [12]System on chip designer for linear system solver.by bucek, Lorencz, Tomas
- [13]On chip network, System Design Paradigm. Wayne Wolf, Srimat Chakra Dhār. [14].design space exploration for optimizing on chip communication architecture by Lahiri, Raghunathan.
- [15]Power analysis for system level on chip architectures. lahiri, Anand
- [16].Spidergon: on chip communication network. Coppola, Riccardo, Lorenzo, alberto
- [17]Packet switched on chip network for SoC. By lee, hoijun, Seong
- [18].Low power NoC-high performance SoC Design. By Kangmin, Sejoong, Yoo
- [19]Highly robust throughput on chip communication network by Coopla
- [20]Functional verification of system on chip. Adamov, Inna, Alexey.

Here some other references and key terms used for example of SoC & it's innovation as an example for Apple Inc. technology and some other multinational companies products of computer industry.so we give special thanks to them and also some internet sources like wikipedia, IEEE for giving basic and general understanding to us.