SPECIAL FEATURE

GREEN IT:
An approach towards greening the IT Industry

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The Science & Technology Magazine

Digital Digest

Silicon Institute of Technology Vol. 16 • Issue 1 • March - May 2017

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Wondrous Drones

Drones are autonomous remote operated flying equipment and have lately been making news. These unmanned aerial vehicles (UAVs), are one of the technological wonders of our age. Drones are a perplexing amalgamation of engineering mechanics, hardware and software. The body of a drone comprises of a fuselage, plane wings, tail rotor and canopy, multi-rotor frame and arms. The installed software in the drone not only enables it to land safely but also guides its navigation. Smaller drones usually fly on batteries while the larger ones use fuel or even solar energy. A drones' equipment package is constantly being modified, specialized, and innovated at a brisk pace, making it useful in several domains.

Amazon has launched its "Prime Air," a delivery system, which it says will eventually allow the company to "to safely get packages into customers' hands in 30 minutes or less" using small drones. Last year DHL Parcel has started the use of autonomous drone flights to a sparsely inhabited German island in the North Sea for scheduled deliveries of medications and "other urgently needed goods" to the local community.

These UAVs can document the aftermath of disasters without putting human life at risk. Drones provide air support which helps keep emergency workers out of direct danger when information needs to be collected. Moreover, they assist in providing security and monitoring the public by getting a view from above. Drones provide tremendous support in research by reaching out to inaccessible locations. They are used in defence for surveying, monitoring, inspection, aerial imaging, search and rescue operations and in research and science.

But the affordability and availability of drones are also prompting some serious legal, financial and practical questions. Governments and companies across the globe are struggling with the fast-evolving technology and the capabilities of drones.

A growing number of drones have flown perilously close to commercial aircrafts leading to risk. A drone hovering above a wildfire in California forced officials there to ground fire-fighting aircraft due to safety concerns.

Individuals need to be protected from drone-related privacy invasion and safety issues. Recently a video published in July 2015 depicted a handgun being fired from a flying drone in the USA. In spite of the fact that no one was harmed yet it puts a genuine question mark on security risk posed by these flying objects wielding weapons.

Drones are also creating new questions for the insurance industry, especially when it comes to property damage and liability. The corporate sector, primarily the big delivery and service companies, already have big plans for turning drone technology into new sources of revenue. It might lead to over usage of drones in crowded cities resulting in crowded skies!

Flying drones can move along the ground, adhere to the side of a building, glide in a waterway, dive under water, hop onto a building, attach themselves like parasites to the sides of trains, ships, and airplanes. They can be hovering in front of us for few seconds and in the next moment they can fly off at the speed of sound, disappearing into the sky. Combining every one of these abilities, into one single gadget will open up a universe of unprecedented potential outcomes.

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GREEN IT: An approach towards greening the IT Industry

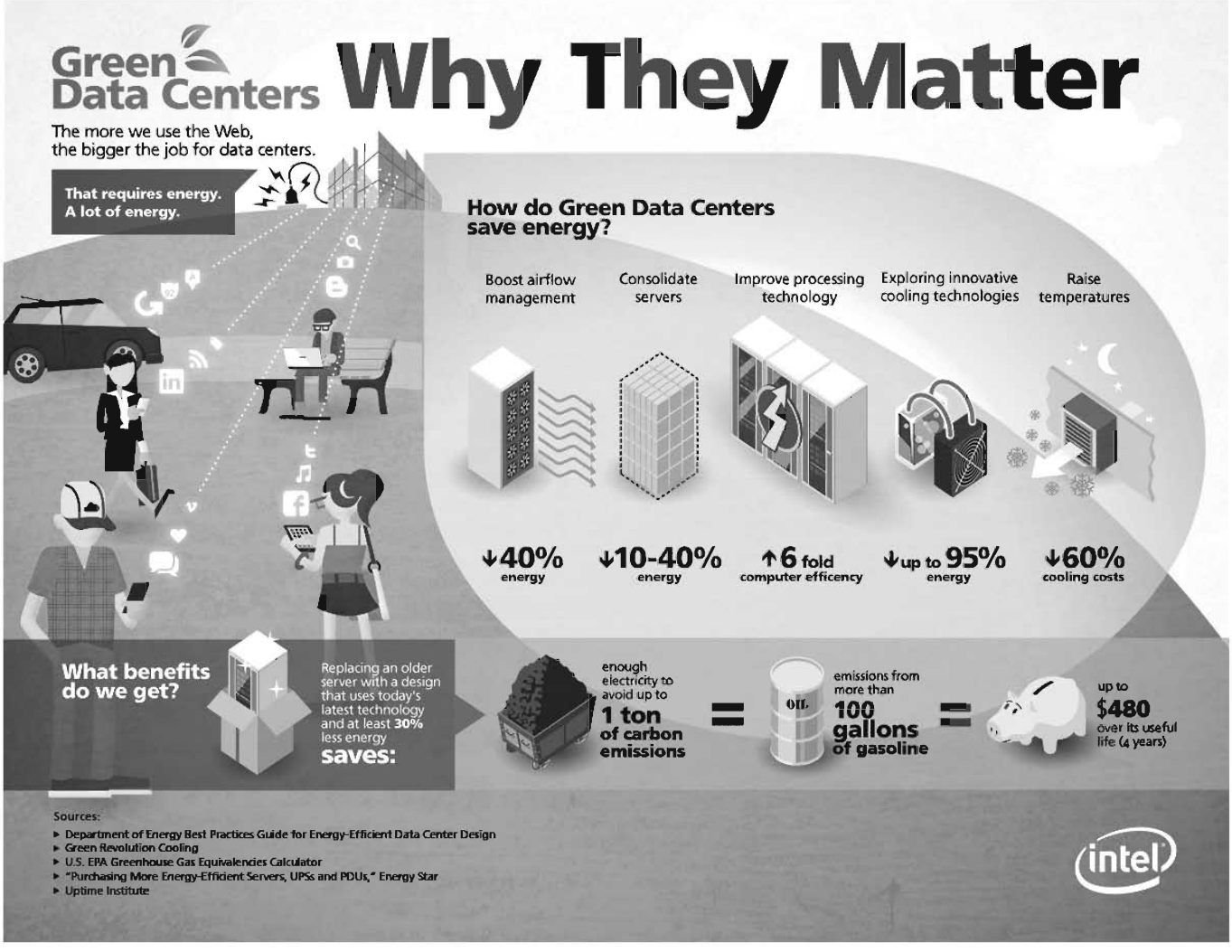
Abstract: *The following article is about rapid growth of Information technology industry & its environmental effects. Here we have focused on adverse effects caused due to IT industry by implementing eco-friendly & environmentally sustainable development techniques which in terms will help mankind for greening the IT industry.*

Introduction

Green IT (green information technology) is the practice of environmentally sustainable computing. "Green" refers to eco-friendly. Green IT aims to minimize the negative impact of IT operations on the environment by designing, manufacturing, operating and disposing of computing products in an environmentally-friendly manner. The motives behind Green IT practices include reducing the use of hazardous materials, maximizing energy efficiency during the product's lifetime and promoting the biodegradability of unused and outdated products.

Aspects of Green IT:

1. Green Data Centres: A green data center is a repository for the storage, management, and dissemination of data in which the mechanical, lighting, electrical and computer systems are designed for maximum energy efficiency and minimum environmental impact.



The construction and operation of a green data center includes advanced technologies and strategies. Here are some examples:

- Minimizing the footprints of the buildings
- The use of low-emission building materials, carpets and paints
- Sustainable landscaping
- Waste recycling
- Installation of catalytic converters on backup generators
- The use of alternative energy technologies such as photovoltaic's, heat pumps, and evaporative cooling
- The use of hybrid or electric company vehicles

Building and certifying a green data center or other facility can be expensive up front, but long-term cost savings can be realized on operations and maintenance. Another advantage is the fact that green facilities offer employees a healthy, comfortable work environment. In addition, green facilities enhance relations with local communities.

There is growing pressure from environmentalists and, increasingly, the general public for governments to offer green incentives: monetary support for the creation and maintenance of ecologically responsible technologies.

2. Green buildings

With new technologies constantly being developed to complement current practices in creating greener structures, the benefits of green building can range from environmental to economic to social. By adopting greener practices, we can take maximum advantage of environmental and economic performance. Green construction methods when integrated while design and construction provide most significant benefits. Benefits of green building include.

Environmental Benefits:

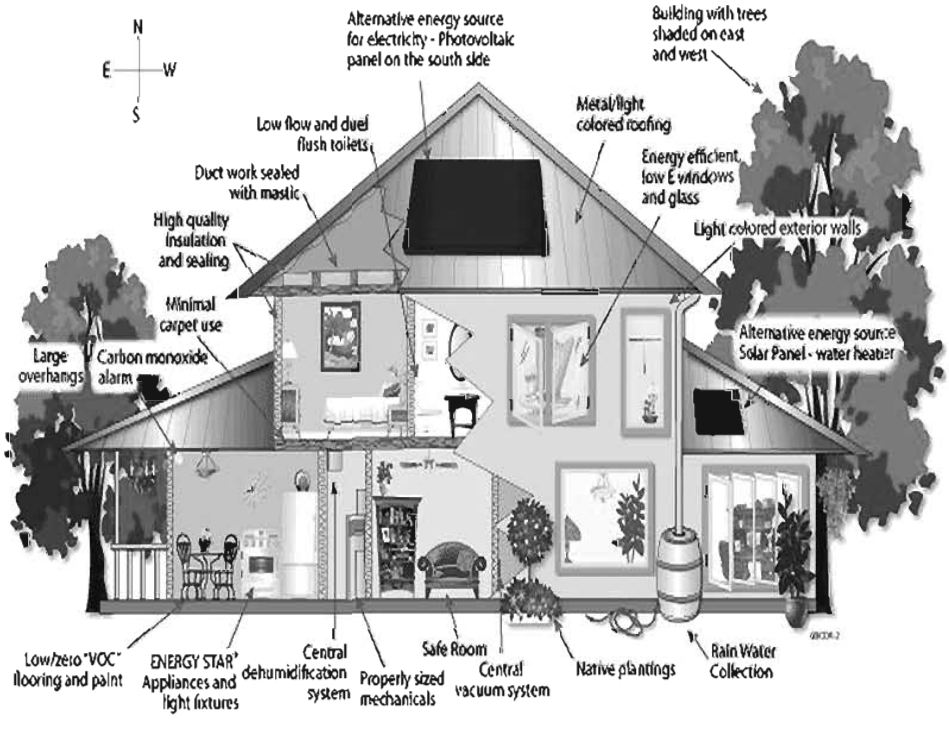
- Reduce wastage of water
- Conserve natural resources
- Improve air and water quality
- Protects biodiversity and ecosystems

Economic Benefits:

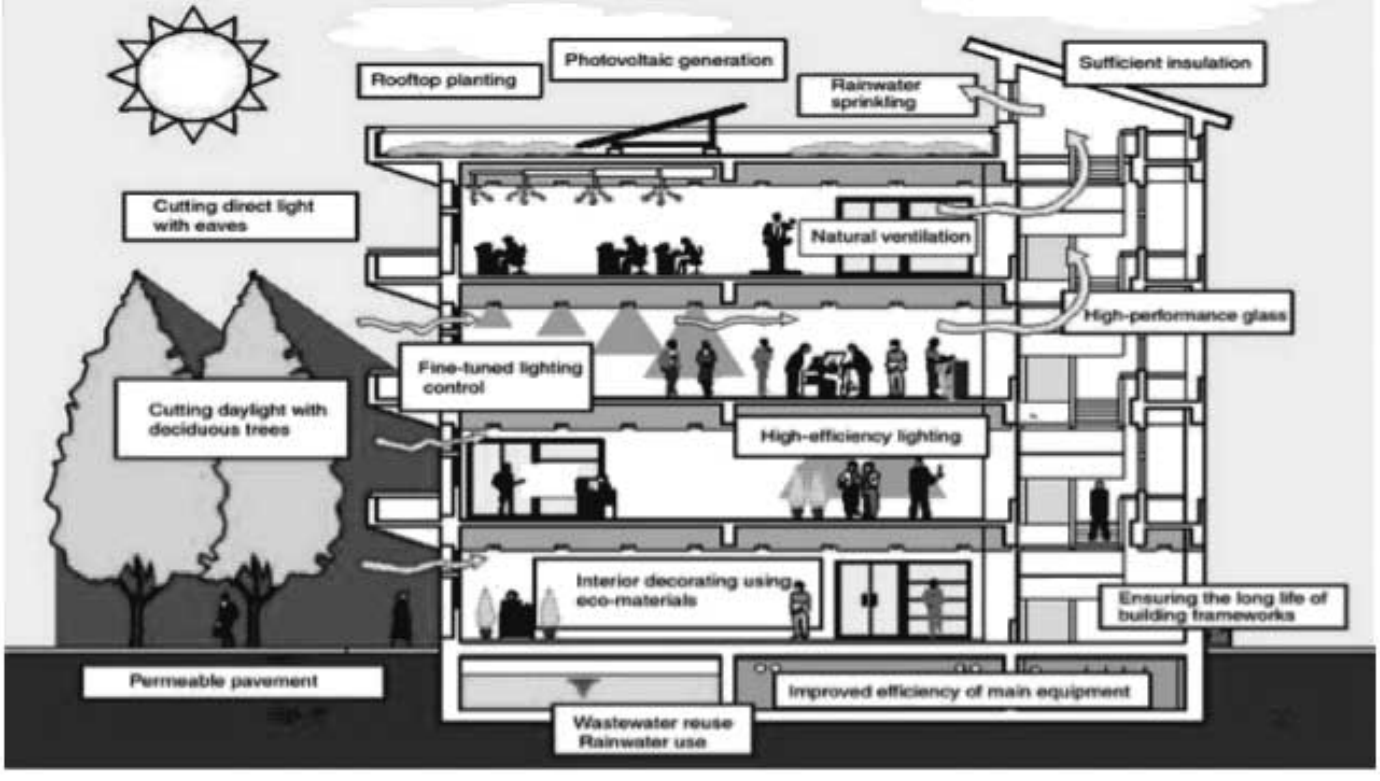
- Reduce operating costs
- Improve occupant productivity
- Create market for green product and services

Social Benefits:

- Improve quality of life
- Minimize strain on local infrastructure
- Improve occupant health and comfort



Typical Layout Of Green Building



4. Virtualization

Virtualization refers to the act of creating a virtual (rather than actual) version of something, including virtual computer hardware platforms, storage devices, and computer network resources.

Virtualization creates fast path to green data centers

- **Improves server and storage utilization which:**
  - Reduces the number of devices and associated environmental
  - Allows for targeted thermal solutions for efficiencies
  - Allows for more efficient power distribution, backup, and regulation
- **Enables dynamic resource management for:**
  - Deployment and Operational Optimizations

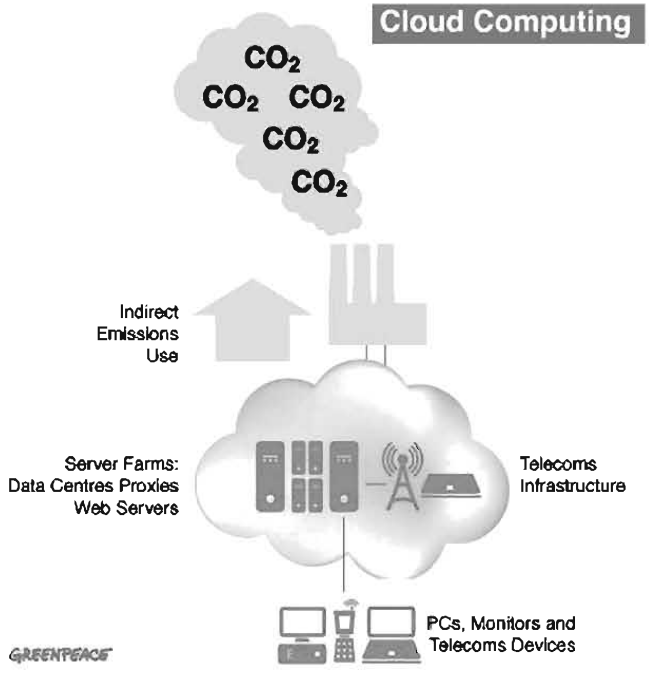
5. Carbon footprint

The IT industry is one of the most rapidly growing emitters of greenhouse gas pollution and industrial consumers of electricity. Without a significant increase in the use of renewable energy, the IT sector's carbon footprint will continue to grow at a concerning rate, increasing the demand for electricity produced from coal and other forms of dirty. Rapid growth of IT industry requires more amount of energy. The energy consumption as a result increases carbon footprint of respective IT equipments which sum up to a large mount.

5. E-waste recycling

E-waste recycling means modifying the gadgets to make it usable for the same or some other purpose. Phones, TV, computers, washing machines, DVD can be considered e-wastes after their life ends.

We make a lot of e-waste. When electronics end up in landfills, toxics like lead, mercury, and cadmium leach into the soil and water. The electronic waste problem is huge: More than 20 million tons of e-waste are produced every year.



- it is important that we create a national framework for the environmental friendly management of e-waste including public awareness and education.
- We should conduct detailed inventories of e-waste.
- Initiate pilot schemes on collection and sorting of e-wastes, including take back schemes and schemes for repair refurbishment and recycling.

Conclusion:

Since the IT industry has a significant carbon footprint, new concepts of study of environmentally sustainable development should be carried out. If we do not take necessary steps to reduce the adverse effects caused due to the Information Technology industry, there is no doubt our future generations will suffer. So we all have to pitch in steps towards greening the Information Technology industry.

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Design and Implementation of different types of Full adders in ALU and leakage minimization

Abstract: *In the era of nanotechnology, leakage current, active power, delay, area bear an important metric for design and analysis of complex arithmetic logic circuits. In this paper major work has been done in determining leakage current, power and their analysis. Different full adders such as 28T, 14T, 11T and 10T have been designed and implemented in ALU. The 10T full adder has been designed by using optimal sleep transistors in reverse bias which can minimize leakage power as compared to other full adders. A comparison has been made among all these adders and the most efficient adder is obtained. We have performed full adder simulations in cadence virtuoso 180nm technology and simulations have been compared for low leakage power. The article not only concentrates on the design but also implementation of the arithmetic logic unit block.*

Keywords-ALU, 28T, 14T, 11T Full adder and 10T self-reverse bias Full adder using sleep transistors.

1. Introduction

Arithmetic Logic Unit(ALU) forms an integral part of digital circuits [1]. It is the fundamental building block of the central processing unit of any computing devices. It carries out mathematical, logical, and decision making operations in a computer. Adders are the most essential component of computational circuits. Most of the complex arithmetic circuits are based on the addition. Adders play a major role in the functioning of an ALU [2, 3].

Designing of any digital circuit in transistor level, there occurs a problem of tradeoff between the three parameters power dissipation, chip area and speed of operation. Chip area is affected by the number and size of transistors. Operating speed depends on propagation delay of transistors. Factors like dynamic power due to switching activities, static power due to static and leakage currents cause an increase in power dissipation. Hence optimization of the circuits in terms of speed and/or power consumption is essential. In this article 4 different Full adders are designed and implemented in ALU. The Leakage Power consumed by each of the full adders is calculated and compare [4].

II. Full Adder Designs

A. 28T Full Adder

The designed 4 bit 28T Full adder has three inputs and two outputs. The 4 bit inputs A and B are to be added and the carry bit Cin, is the calculation of the previous digits. The 4 bit outputs S and Cout are computed using the following expressions [5].

$S = A \oplus B \oplus Cin$ ..... (1)

$Cout = A.B + B.Cin + C.inA$ ..... (2)

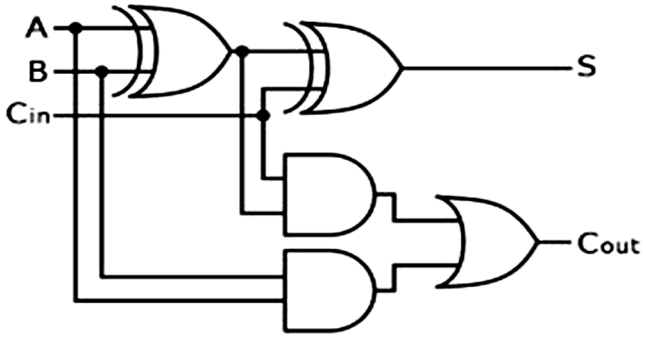

Fig. 1: Logic Diagram of basic Full Adder circuit

Table I : Truth Table Full Adder

A	B	Cin	SUM	COUT
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Fig. 2: CMOS level 28T Full Adder

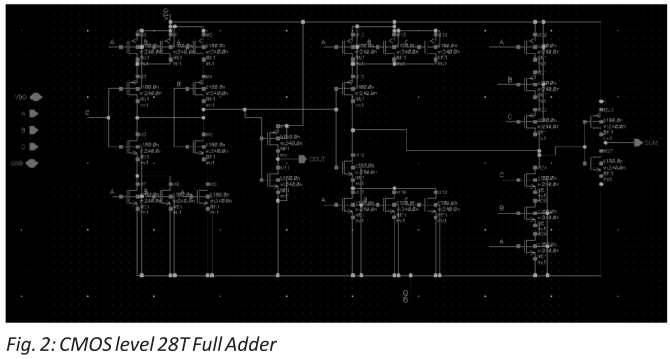

Fig. 2: CMOS level 28T Full Adder

The 1-bit CMOS full adder cell is shown in Fig2. The 1-bit full adder cell consists of 28 transistors. Designing of logic gates with such large no of transistors makes the design area inefficient, increases power consumption, reduction in speed. Dynamic power dissipation and larger delay is caused due to large PMOS transistors in pull up network that results in high input capacitances [8].

B. 14T FULLADDER

This adder is realized using 14 transistors. It results in low loss of threshold current, increase in speed and consumes less power. The reduced loss in threshold current is achieved by using XNOR gate. Basically the design consists of XOR gates using 4 transistors with an extra inverter at its output. The XOR gate schematic is shown below in Fig 3.

As seen in the circuit, when both inputs A and B are zero, the transistors P1 and P2 will be switched ON whereas transistors N1 and N2 will be switched OFF. Thus low input at B passes through P2 transistor. Hence at the output we get a low signal. When A=0 and B=1, transistor N1 and P2 will be on and Transistor P1 and N2 will be off. Hence high input at input B will pass through transistor P2 and we get high signal at the outpu [9]t.

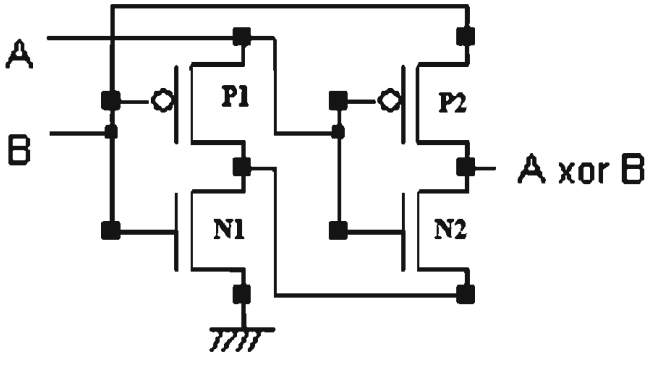

Fig. 3: 4T XOR Gate Schematic

When A=1 and B=0, transistor N2 and P1 will be on and Transistor P2 and N1 will be off. At the output we get high signal from Input A through transistor P1 and N2. When A=1 and B=1, transistor N1 and N2 will be on and transistor P1 and transistor P2 will be off, thus we get low signal at the output. Circuit diagram for 14T full adder circuit using 4 transistors XOR gate is as shown below in fig.4 and the schematic diagram for is shown in fig. 5.

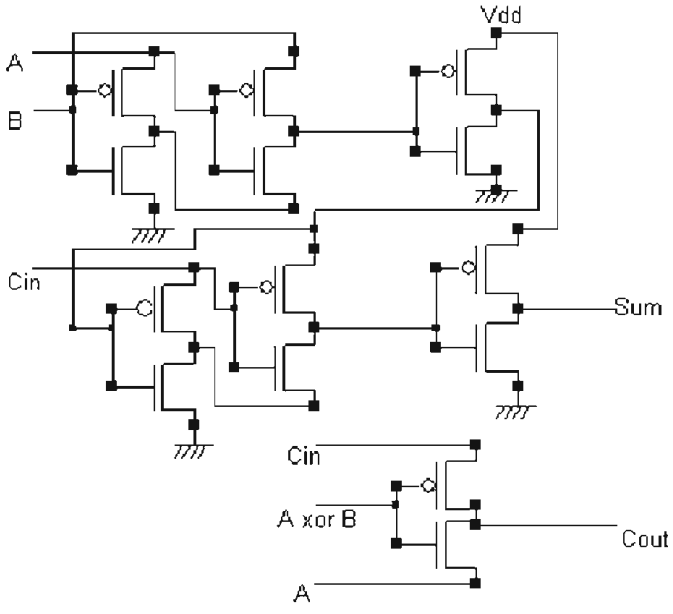

Fig. 4: Circuit diagram for 14T full adder

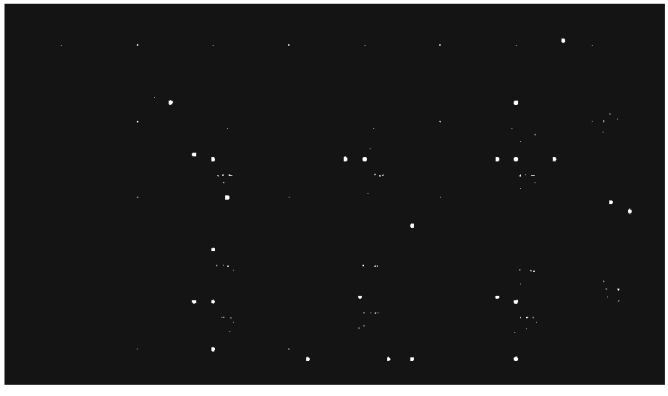

Fig. 5: schematic of 14T Full Adder

C. 11T FULLADDER

The circuit of 11T adder is a one-bit full adder and having three inputs (A, B, Cin) and two outputs (Sum S and Carry Cout). The adder is made of three CMOS inverters. Input A is connected to the first inverter & Input B to the PMOS network. The output generated from the first inverter is the compliment of the Carry Cout. The Cout is fed as input to the second inverter to generate the SUM compliment. The third input Cin is fed to the third inverter to generate SUM as its output. The second and third inverters are stacked with another transistor to reduce the leakage power dissipation in the circuit. Also the speed of the circuit

increases due to reduction in power consumption in this circuit. The schematic of the 11 bit adder is shown in Fig 6 below [10].

D. 10T FULL ADDER WITH SELF REVERSE BIAS

10-transistor one bit full adder circuit using self-reverse bias technique is shown in Fig.7. The circuit consists of three inputs i.e, A, B, C and two outputs i.e, sum and Cout. A single VDD is given to the entire circuit. For minimization of power consumption, the number of direct connections from VDD and ground is reduced in this design. In the design, body of five nMOS transistors is connected to an external voltage supply. This behaves as a sleep transistor. These sleep transistors cause an increase in threshold voltage due to which the nMOS transistors go to sleep mode. In active mode of operation [2] the high Vth transistors are turned off whereas the logic gates consisting with transistors having low Vth operate with low switching power dissipation and smaller propagation delay. In standby mode the high Vth transistors are turned off thereby cutting off the internal low Vth circuitry.

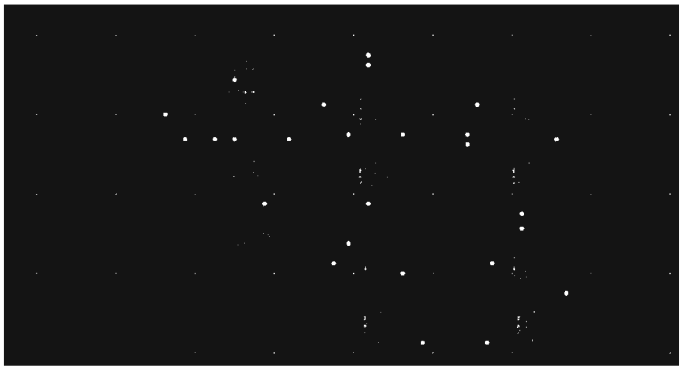

Fig. 7: Schematic of 10T Full adder

Due to creation of negative voltage at the body and increasing Vth by body bias, the transistors go to cutoff state and as there is no conduction in reverse bias mode, flow of leakage current will be reduced.

$$V_{TN} = V_{TO} + \gamma(\sqrt{|V_{SB} + 2\phi_F|} - \sqrt{|2\phi_F|})$$

Where V_{TN} is the threshold voltage when substrate bias is present, V_{SB} is the source-to-body substrate bias voltage, $2\phi_F$ is the surface potential, and VTO is threshold voltage for zero substrate bias,

$$\gamma = (t_{ox}/\epsilon_{ox})\sqrt{2q\epsilon_{si}N_A}$$

is the body effect parameter, t_{ox} is oxide thickness ϵ_{ox}, is oxide permittivity, E_{si} is The permittivity of silicon, N_A is a doping concentration, q is the charge of an electron [7].

Self-Reverse Biasing

By applying an external negative voltage, body effect is introduced. The body effect leads to an increase in threshold voltage. A smaller depletion layer width causes a lowering in the threshold voltage VT. The reverse biasing of CMOS transistor increases VT while on forward biasing of the CMOS transistor VT decreases [9,10]. Threshold voltage increases with increase in doping of the channel but decreases with application of forward bias. Hence, the leakage current or the current in the sub threshold region can be partially reduced by reverse biasing. Equation (4) gives the expression for body effect as function of the oxide capacitance and substrate doping.

III. ALU Design

The ALU we have designed performs both arithmetic and logical operations [8]. The arithmetic operations include both addition and subtraction operation, while the logic operations include logical OR and logical AND. The ALU we have designed is a 4bit ALU. The other components of ALU are 4 bit 2:1 MUX and an inverter. Three MUX are used named as MUX1, MUX2 and MUX3. The MUX1 helps in selection of either the arithmetic block or the logical block depending on the select lines. When the select pin S is 1 it selects the logical operation i.e the logical operation is performed. When the select pin S is 0 it selects the arithmetic operation i.e. the arithmetic operation is to be performed Further inside the arithmetic block, MUX2 is used for selecting between addition or subtraction operation. MUX3 is used inside the logical block for selection of either AND or OR operation depending on the select lines [11, 12].

To perform the arithmetic operations, we have to give input to the MUX2 and to the inverter. To perform

addition, the input is given to the full adder. The output of the full adder gives the sum and carry of the operation. The subtraction is done using 1's complement addition method. For this an inverter is used which inverts one of the input. The output of INVERTER is fed as one of the input to the MUX2. This inverted output is then added to the other input for subtraction operation. Different types of adders such as 28T, 14T, 11T and 10T are used to perform the arithmetic operations [5,6].

The logical block performs the logic operations. The MUX3 selects whether to perform the AND operation or OR operation. When the select pin S is 1 it selects the logical operation i.e the logical operation is performed. When the select pin S is 0 it selects the arithmetic operation i.e. the arithmetic operation is to be performed [11]. The schematic of ALU using 28T adder is showing Fig. 8

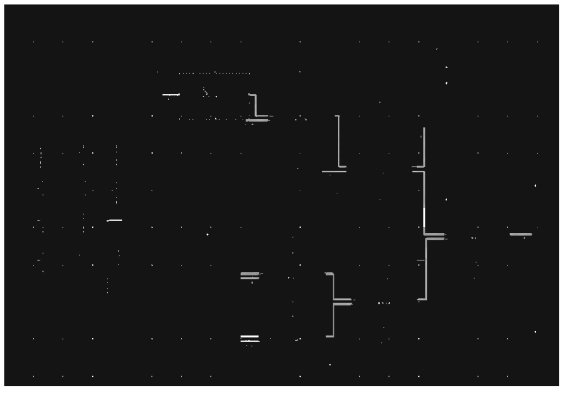

Fig. 8: Schematic of ALU using 28T Full adder

IV. Results and Analysis

The ALU has been designed with implementation of all the adders one by one. The simulation has been done. Waveforms showing the simulation of ALU using all adders and the waveforms showing leakage power in each of the adders is plotted as shown in fig. 9 & 10.

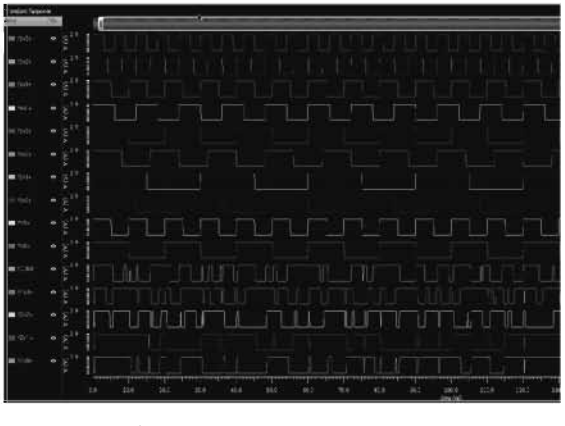

Fig. 9: Output of ALU using 28T Full adder

The figure shown below in fig.10 is the waveform of ALU using 10T with self-reverse bias.

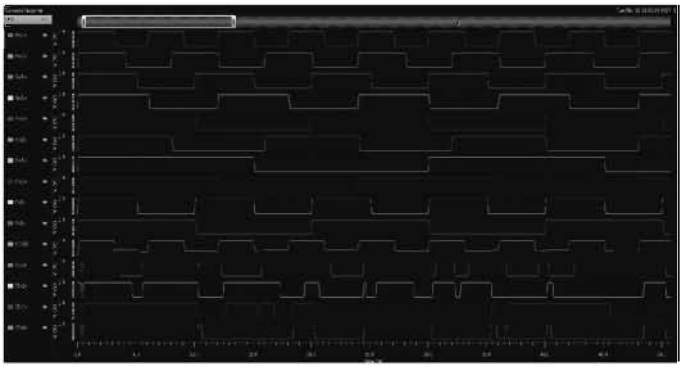

Fig. 10: Output of ALU using 10T Full Adder

Simulated Power Analysis of ALU:

Simulations	Leakage Power (in µW)
ALU using 28T Full Adder	19.18
ALU using 14T Full Adder	9.04
ALU using 11T Full Adder	6.05
ALU using 10T Full Adder with self-reverse bias	2.03

These simulation results include ALU using 28T full adder, 14T full adder, 11T full adder, 10T full adder with self-reverse bias.

V. Conclusion

In this paper, analysis of all the adders has been individually carried out. The adders were compared on the basis of leakage power consumption. It was observed that by using optimal sleep transistors and transistor resizing technique in 10T full adder, leakage current is greatly reduced thereby power dissipation is reduced as compared to the other adders. Using this technique, active power reduction is achieved in the ALU with low leakage. Hence it is concluded that the 10T Full Adder with self-reverse bias is the most efficient among all the compared adders both in terms of speed and power consumption.

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Some Scientists Said So....

We will always have STEM with us. Some things will drop out of the public eye and will go away, but there will always be science, engineering, and technology. And there will always, always be mathematics.

~ Katherine Johnson

There's nothing I believe in more strongly than getting young people interested in science and engineering, for a better tomorrow, for all humankind.

~ Bill Nye

A good scientist is a person with original ideas. A good engineer is a person who makes a design that works with as few original ideas as possible. There are no prima donnas in engineering.

~ Freeman Dyson

Energy Efficient Routing Protocol in SDN

Abstract: *Software Defined Networking (SDN) is a new networking paradigm that separates the network control plane from the packet forwarding plane. It provides applications for an abstract centralized view of the distributed network state. A logically centralized controller that has a global network view is responsible for all the control decisions. It communicates with the network-wide distributed forwarding elements via standardized interfaces. This is enabled by Open Flow, represents a paradigm shift from traditional network of the future Internet. Modern high-traffic websites must serve hundreds of thousands, if not millions, of concurrent requests from users or clients and return the correct text, images, video, or application data, all in a fast and reliable manner. To cost-effectively scale to meet these high volumes, modern computing best practice is to add more servers.*

The continuous growth of traffic and the energy consumption of network equipment's can limit the deployment of large-scale distributed infrastructure. Current networks are inefficient both environmentally and economically (i.e. CO2 emission, operational costs, etc.) and hence they should be reconfigured. In the past, research scope of the Information and Communication Technology (ICT) was mainly based on performance and cost. The research community puts sufficient effort in order to minimize the energy consumed by ICTs and their impact on the environment. Our project aims to improve the energy efficiency of networks by dynamically adjusting the number of active links according to network load.

Keywords—SDN, Open Flow, Traffic Engineering, Energy Efficiency

1. Introduction

Networks are essential to today's highly instrumented and connected society. Currently responsible for a fraction of the energy the IT sector consumes, networks rely on equipment's often use a constant amount of power regardless of their utilization; a worsening scenario as traffic is expected to increase by a factor of three in the next few years. Backbone or core networks, for instance, employ devices that consume several kilowatts of power even when idle [1].

Several techniques have been proposed for reducing the energy consumed by backbone networks, including traffic re-routing and using low power-consumption modes. By rerouting data over alternative paths, it is possible to offload a subset of links, or make them completely idle since operators generally over-provision their networks in order to handle peak demands and provide clients with high quality of service (QoS). Even during peak hours, many links rarely use more than 50%. The link utilization computed from traffic matrices of the Géant network where most links are <25% utilized even at peak hours.

This work tackles the challenge of reducing the energy consumed by backbone networks by changing the status of router ports and transponders on the extremities of links. The status of these components is set to sleep mode whenever a link is not used for transferring data, and they are brought back to an operational state when required. This process of activating and deactivating network links is also termed as switching links on and off, respectively.

The rest of the paper is structured as follows. Section II describes about software defined networking. Section III discusses on on related work. Section IV explains about SPRING protocol. Section V gives an idea about work to be done. Section VI concludes the paper.

II. Software defined networks

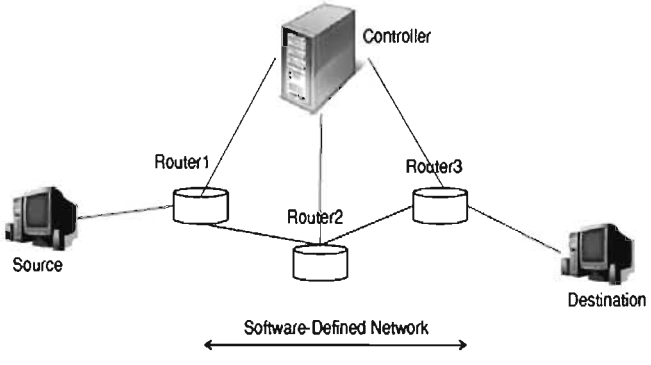


Fig. 1: SDN

Software define Networking (SDN) shown in Fig. – 1 simply provides a (logically) centralized control point in the network [1]. In an SDN architecture, control plane - the plane that understands the network and decides the flow paths, and data plane - the plane responsible for the transmission of packets, are separated. Separation of the control layer from the data layer enables programmability, increases functionality, and provides remote management between infrastructures using a single open protocol. This structure allows the network and business applications to work together with the help of analytics and to reconfigure the network policies,

according to the changing user experience and application performance. In this context, network design and architecture remain the same while applications and system's progress to an advanced level [2].

An SDN[2] architecture shown in Fig. – 2 contains six major components as shown in figure 1. First is the management plane, which is a set of network applications that manage the control logic of a software defined network. Rather than using a command line interface, SDN-enabled networks use programmability to give flexibility and easiness to the task of implementing new applications and services, such as routing, load balancing, policy enforcement, or a custom application from a service provider. It also allows orchestration and automation of the network via existing APIs . Second is the control plane that is the most intelligent and important layer of an SDN architecture. It contains one or various controllers that forward the different types of rules and policies to the infrastructure layer through the southbound interface. Third, the data plane, also known as the infrastructure layer, represents the forwarding devices on the network (routers, switches, load balancers, etc.). It uses the southbound APIs to interact with the control plane by receiving the forwarding rules and policies to apply them to the corresponding devices. Fourth, the northbound interfaces that permit communication between the control layer and the management layer are mainly a set of open source application programming interfaces (APIs). Fifth, the east-west interfaces, which are not yet standardized, allow communication between the multiple controllers. They use a system of notification and messaging or a distributed routing protocol like BGP and OSPF. Sixth, the southbound interfaces allow interaction between the control plane and the data plane, which can be defined summarily as protocols that permit the controller to push policies to the forwarding plane. The OpenFlow protocol is the most widely accepted and implemented southbound API for SDN-enabled networks.

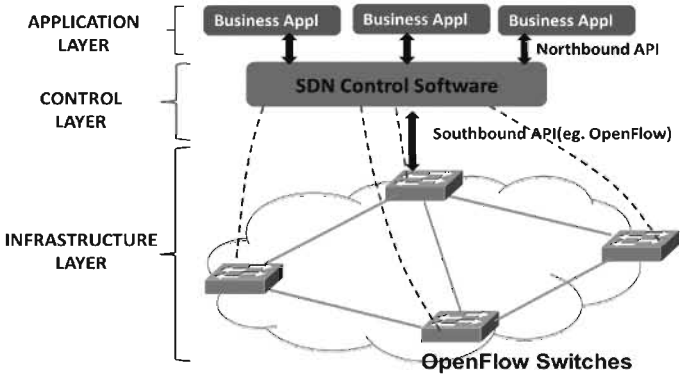


Fig. 2: SDN Architecture

A. OpenFlow Architecture

In an OpenFlow-enabled network, flow can be represented as a transmission control protocol (TCP) connected. Floss can also be packets with a matching MAC address, an IP address, a VLAN tag, or a switch port. The OpenFlow switch has one or more flow tables. A flow table is a set of flow entries. A flow entry is used to match and process packets. It consists of many matching fields to match packets, a set of encounters to track packets, and instructions to apply .The OpenFlow switch uses an OpenFlow channel to communicate with the OpenFlow controller. The OpenFlow channel is a secure channel between the OpenFlow switch and the OpenFlow controller. It permits communication by allowing the control plane to send instructions, receive requests, or exchange information. All messages are encrypted, using transport layer security (TLS). The OpenFlow channel has three types of messages. The controller/switch mes8sage is initiated by the controller and may not require a response from the switch. The asynchronous message informs the controller about a packet arrives, a switch state change, or an error. The symmetric message can be sent in both directions for other purposes.

III. Related Work

A distributed network-wide solution has been provided by Vasi´c et al.[1] for changing flow paths and thus reduces link utilisation, allowing up to 21% of links of real networks to be put into sleep mode. Such a solution, however, is a concept whose implementation is not fully disclosed. Another distributed approach considers that every node locally monitors the utilization of adjacent links and decides whether to switch them off. Machine learning mechanisms are used to avoid switching off links that have previously caused congestion. Such a solution relies heavily on the Interior Gateway Protocol Traffic Engineering (IGP-TE) extensions, and after a detailed analysis, we observed that its communication overhead is highly underestimated. In a 30-node network authors estimate that Open Shortest Path First Traffic Engineering (OSPF-TE), the protocol used by their solution, floods the network six times per second. The proposed algorithm adds a couple more flooding per minute. However, an analysis of OSPF-TE revealed that flooding will happen only once every 10 seconds, even under stress traffic patterns with lots of variations. After correcting the assumptions, the obtained overhead of 0.52%will increase resulting in a 30% improvement in OSPF-TE flooding, which is non-negligible as flooding is costly both in the number of required messages and

processing demands. Another proposed centralized solution using MPLS and RSVP-TE relies on estimation of traffic matrices, which later was proven in-efficient. The authors also provide a hybrid solution where MPLS and RSVP-TE is used in parallel with shortest path routing. Our work uses the SPRING protocol with the same advantages, but with less complexity.

According to GWATT [3], the total energy consumption for ICT during 2013 was 109 GW which represents 6% of the world electricity consumption. Accordingly, network energy bills of telecom operators represent more than 10 percent of their operational expenses. The majority of this consumption (69 GW) was on infrastructure equipment such as access network (21.2 GW), service, core and data centers (37.1 GW) and other networks (1.6 GW). Remaining major chunk was on devices (39 GW) which included consumption on Personal Computers (36.9 GW), Smart phones and mobile phones (0.6 GW each), and printers and tablets (1.1 GW). Worldwide energy consumption of ICT equipment exhibits the urgent need for energy efficiency in networking. Authors state that although the initial Gartner Report has an alarmist perspective, and the potentially explosive growth of energy consumption by ICT has not been substantiated, worldwide ICT energy consumption and CO2 emissions still continue to grow. Authors also mention that the improving energy efficiency of ICT equipment leads to a slower growth of these metrics than the increase of the worldwide usage of ICT. In this con- text, ICT can also contribute to a reduction in energy consumption and CO2 emissions in other sectors, utilizing efficient networking and communication strategies. Despite many differences between mobile and fixed networks in terms of their design, implementation, maintenance, monitoring, and operation, there is a trade-off between energy consumption and performance in both networks. This trade-off, the level of which varies in mobile and fixed environments, should be taken into account during system design. For instance, energy-efficient operation may necessitate the sending of additional control messages, such as sleep messages from the SDN controller to the switches, and this additional control traffic decreases the band- width efficiency. In mobile wireless networks, energy-efficient operation implies reduced power consumption of network devices, which in turn decreases the transmission data rate since data rate and transmission power are related to each other due to Shannon's formula. The sleeping of nodes in both wired and wireless net- works may increase the transmission delay not only because of the reduction in data rate, but because in some situations the packets need to be queued while waiting for the device (or other devices) to wake up.

Energy optimization can be applied at different components of the SDN. The hardware-based solutions are applied on the forwarding switches and Software-based solutions are applied to the controller. Energy efficiency methods in SDN can be divided into four categories-

(i) Traffic aware,

(ii) Compacting TCAM,

(iii) Rule placement, and

(iv) End host aware

A. Traffic Aware Solutions

With traffic aware energy efficiency approaches, energy consumption can be reduced by turning off some forwarding switches during low traffic load, or putting CPUs or ports at sleep mode. The solutions in this group have the potential to significantly improve energy efficiency in SDN. Elastic tree is a power manager, which dynamically adjusts the set of active network elements –links and switches to satisfy changing traffic loads. It consists of three logical modules- optimizer, router and power control as shown in Figure 3.

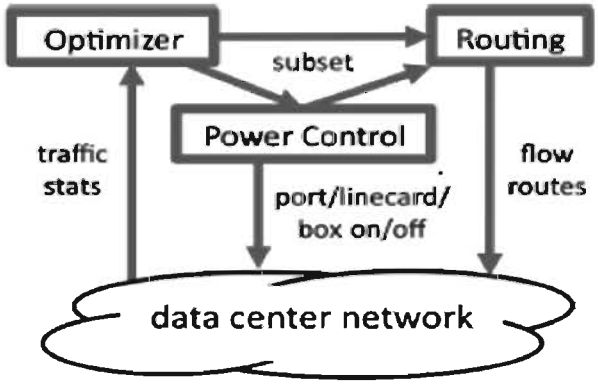


Fig. 3: System Diagram

The role of the optimizer is to find the minimum power network subset which satisfies current traffic conditions. Its inputs are the topology, traffic matrix, a power model for each switch, and the desired fault tolerance properties (spare switches and spare capacity). The optimizer outputs a set of active components to both the power control and routing modules. Power control toggles the power states of ports and entire switches, while routing chooses paths for all flows, then pushes routes into the network. The role of this solution is to find the minimum power network subset which satisfies current traffic conditions. One of the existing work is SPRING Protocol, which offers an online

method for switching the links off/on dynamically according to the network load.

IV. SPRING PROTOCOL

SPRING [4], also known as segment routing, is currently an IETF draft started in 2013 that aims to replace MPLS+RSVPTE for traffic engineering. It combines the power of source routing, allowing for the flexible traffic engineering, with shortest path routing, which requires less signalling or header overhead. The data plane used by SPRING utilizes the same concept of label switching of MPLS, but its control plane has been completely redesigned. The distribution of labels is done via an extension to the IGP instead of using special protocols such as LDP/RSVP-TE. Moreover, unlike MPLS, labels, called Segment Identifiers (SID) in SPRING, have a global scope. In the present work, we are interested in two types of SIDs, namely "nodal" and "adjacency" as shown in Fig 4(a).

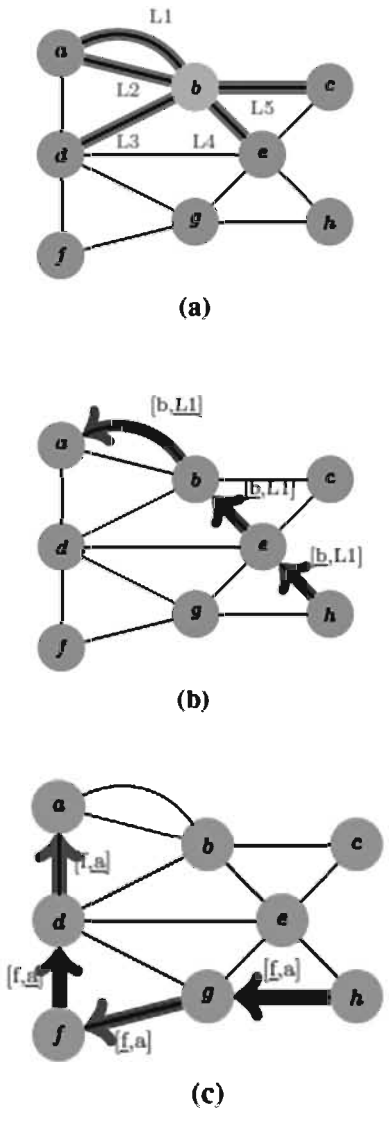
– A nodal SID is globally unique and identifies a node (*a, b, c, ...,h*).

– An adjacency SID is local to a node and identifies an outgoing interface (node *b* has the adjacency SIDs *L*1, *L*2, *L*3, *L*4 and *L*5).

After network discovery, sending a packet to node *a* through the shortest path requires encapsulating it into a packet with destination *a*. Unlike in IP, much more flexible traffic engineering is possible:

– If node *h* wants to send a packet to node *a* while forcing it over link *L*1, it adds the header [*b*, *L*1] (Fig. 4b). – If *h* wants to send a packet to *a* via *f* (Fig. 4c), it uses the header [*f, a*].

Being a source routing protocol, SPRING enables fast flow set-up and easy reconfiguration of virtual circuits with minimum overhead since changes must be applied only to the ingress devices. No time and signalling are lost reconfiguring the midpoint devices. The policy state is in the packet header and is completely virtualized away from midpoints along the path. This means that a new flow may be created in the network by contacting only one network device: the ingress router. This comes in contrast with Open-Flow where the forwarding tables of all the devices along the path must be reconfigured. The agility in updating the paths of flows is essential in solutions that intend to perform link switch-off and improve energy efficiency.



(a)

(b)

(c)

Fig. 4: Spring Protocol

Being a source routing protocol, SPRING enables fast flow set-up and easy reconfiguration of virtual circuits with minimum overhead since changes must be applied only to the ingress devices. No time and signalling are lost reconfiguring the midpoint devices. The policy state is in the packet header and is completely virtualized away from midpoints along the path. This means that a new flow may be created in the network by contacting only one network device: the ingress router. This comes in contrast with Open-Flow where the forwarding tables of all the devices along the path must be reconfigured. The agility in updating the paths of flows is essential in

solutions that intend to perform link switch-off and improve energy efficiency.

A. The STREETE framework

This section provides a formal description of the energy efficient traffic engineering problem. It divides the overall problem into sub-problems for easier discussion and then presents an analysis of centralized and distributed solutions. Finally, we present details of our solution.

B. Steps of STREETE algorithm

The problem of energy-efficient traffic engineering can be divided into the following three steps:

– Selecting links to switch off/on: this step selects candidate links to be switched off/on and is referred to as

SelectLinksToOff/On.

– Computing new routes to avoid/reuse links: prior to switching off/on the links selected by *SelectLinksToOff/On*, the algorithm must compute new paths for the flows traversing the network. Switching off a subset of links reduces network capacity, and thus flows must be intelligently rerouted to avoid congestion. In fact, congestion may occur even when a turned-on link provides a better path for a large number of flows. We refer to this step as *ComputeNewRoutes*.

– Rerouting and switching off/on the links (Reroute-AndSwitchOff/On): once new routes for flows are computed, the decision must be enforced on the network devices. This step triggers rerouting and the actual link switch-off.

Algorithm 1 illustrates how the steps above fit together. The algorithm searches for links that can be switched on or off, and after that, executes RerouteAndSwitchOn or Reroute-AndSwitchOff.

```
1  while Energy Efficient Traffic Engineering is active
   do
2  |  List-Of-Links = SelectLinksToOn();
3  |  if ComputeNewRoutes(All-links-that-are-ON ∪
   |  List-Of-Links) then
4  |  |  RerouteAndSwitchOn(List-Of-Links);
5  |  end
6  |  List-Of-Links = SelectLinksToOff();
7  |  if ComputeNewRoutes(All-links-that-are-ON \
   |  List-Of-Links) then
8  |  |  RerouteAndSwitchOff(List-Of-Links);
9  |  end
10 end
```

Algorithm 1: Main loop

SelectLinksToOff/On

Distributed approaches do not allow for optimizing this step. There are essentially two ways to choose the links for switch-off; either each node independently decides to switch off a directly attached link, or coordination between nodes is used to elect a link. Under the former, special measures must be taken by *RerouteAndSwitchOff* to ensure that the *Connectivity Constraint* is respected. As a result, coordination between nodes is necessary in both cases. Distributed N-to-N coordination means flooding the network with control messages, known to be costly in the IGP protocols. In contrast, a centralized solution can take complex decisions after collecting and analyzing the traffic matrices, requiring only an N-to-1 communication.

ComputeNewRoutes

In a distributed solution, every node must calculate its own routes. From a computational complexity perspective, this is better than having a unique entity calculating all routes for the entire network domain. However, missing information about global network state can limit the optimization of route selections. Although it is possible to distribute this information across all nodes, the information can take minutes to converge, which can in turn result in long periods of network instability. Distributed solutions are limited to reactively rerouting the flows to avoid disabled links. A resource reservation protocol may be used to reserve new paths and avoid network congestion. However, the use of such protocol increases the time needed to set up the flows and reduces the network convergence speed. Better energy efficiency and congestion avoidance are possible under centralized solutions. Centralized solutions can compute new routes by collecting traffic matrices and using them to solve either an approximation of the "Multi-commodity Flow Problem" in order to optimize the distribution of load, or a K-shortest path problem to optimize delay.

RerouteAndSwitchOff/On

When considering a distributed scenario, nodes need to synchronize their actions in order to avoid switching off a set of links that can disconnect the network. This risk is minimized when a central entity takes all decisions on links to switch off; it does not risk to switch off simultaneously two badly chosen links and violate the *connectivity constraint*. Networks are increasingly relying on centralized architectures, with SDN becoming commonplace in many data centers and its use being largely studied in optical networks. Therefore, we focus on an SDN solution. Although we agree that a distributed solution has the advantage of avoiding a single point of failure, several techniques exist to make SDN more robust.

We are interested in using SDN for energy-efficient traffic engineering, and the controller can be made optional for other operational activities. If the controller becomes unreachable, our solution can turn on the links and roll back to a fully functional distributed network without energy efficiency features.

V. Conclusions

Different aspects of SDN and SDN architecture was studied. Various issues of SDN were addressed but focus was mainly on the area of energy efficiency. Further, we are planning to do work on energy efficiency issues in SDN in control and application layers. Algorithm on energy-aware traffic engineering technique for reducing energy consumption in backbone networks will be designed.

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Latest News in Different Areas of Science and Technology

1.International solar alliance to support setting up 1000 GW of solar energy capacity

As US touts coal, Prime Minister Narendra Modi's sunshine club gets ambitious. Just weeks before it is recognized as a United Nations treaty organization, the International Solar Alliance announces a target to support setting up 1000GW of solar energy capacity by 2030 across its member countries.

This initiative by India to harness the untapped resource of sunshine-rich countries between the Tropics of Cancer and Capricorn was backed by the France, and was launched at the Paris climate talks in 2015. Sixteen countries have ratified the framework agreement of the International Solar Alliance (ISA) and it will come into force on December 6, when it will recognized as a UN treatybody.

The ambitious target that will help move countries, especially developing countries, on a low carbon energy path was announced on the day that the United States touted the value of coal as a energy source at an official programme organized by the US government at the UN-sponsored climate talks.

2. Engineers develop filters that use nanoparticles to prevent slime build-up

Researchers at the University of Pennsylvania's School of Engineering and Applied Science have a new way of making polymer filters out of bijels, or bicontinuous interfacially jammed emulsion gels, that allow functional nanoparticles to adhere to the surface of the polymer. They tested their method with nanoparticles that prevent the build-up of biofilms.

They have demonstrated this new process with membranes that block bacteria- and virus-sized contaminants without letting them stick, a property that would vastly increase the efficiency and lifespan of the filter.The "antifouling" membranes they have tested would be immediately useful in relatively simple applications, like filtering drinking water, and could eventually be used on the oily compounds found in fracking wastewater and other heavy-duty pollutants. Credit:UniversityofPennsylvania

An Approach to Design an Efficient Linear Phase FIR Window Using Particle Swarm Optimization Technique

Abstract: *In this article we have found out a new window called as 'proposed windo', which is a mixture of rectangular and Hanning window. A rectangular window proves to be the best in lower order case and Hanning proves to be the best in case of higher order when compared with digital characteristics it provides less repulsion in case of pass band and stop band and sharp transition, it provides to be the best as it shows sharp cut off characteristics than others. Finally another filters mechanism is proposed where the average of every p and q variable is taken of lowpass, highpass and bandpass and considered as one in order to design proposed window. In order to reduce the ripple and to make the proposed window more suitable the PSO algorithm is used. This algorithm is used for solving problems of FIR filters.*

Keywords*-FIR filter, window, proposed window, PSO, parameters optimization*

1. Introduction

Finite Impulse Response (FIR) filters are the most powerful types of filters implemented in the software. Filters are signal conditioners [1]. Each functions by accepting an input signal, blocking prespecified frequency components and passing the original signal minus those components to the out [2,3]. FIR filters are digital filters with finite impulse response. They are also known as **non-recursive digital filters** as they do not have the feedback (a recursive part of a filter), even though recursive algorithms can be used for FIR filter realization.

Linear phase is the property of a filter where phase response of the filter is a linear function of frequency. The result is that frequency components of the input signal are shifted in time by the same amount of time, which is refered to as the phase delay. In fir filter exact linear phase can be easily designed .Round off error is small in fir filter, because of these advantages fir filter is more preferred over fir filter. In fir filter exact linear phase can be easily designed. There are three methods for design of FIR filter:- 1) Window method, 2) Frequency sampling method, 3) Optimal filter design method.

II. Window

The main purpose of windowing is to obtain the finite impulse response with minimal computational effort. Windows are widely used because of its simplicity and ease of use [4]. Windows are finite duration sequences used to modify the impulse response of the FIR filter in order to reduce the ripples in the passband and stopband and also to achieve the desired transition from passband to stopband. windows are used to shape the response of the filter.

The basic idea behind the windows design is to choose a proper ideal frequency selective filter and then to truncate its impulse response to obtain a linear phase and causal FIR filter. The different types of window sequences which we have considered are 1) Rectangular window (Wr(n) 2) Hanning window (Wc(n)) 3) Hamming window(Wh(n)) 4) Blackman window (Wb(n))

III. Proposed Window

Proposed window that when compared with digital characteristics it provides less repulsion in case of pass band and stop band and in transition band, it provides to be the best as it shows sharp cut off characteristics than others [5,6]. In the experiment we have compared the result of hanning, hamming, blackman and rectangular and have found that hanning proves to be the best in the higher order of window and rectangular in the lower order of window as when compared with digital characteristics it provides less repulsion in case of pass band and stop band and in transition band, it provides to be the best as it shows sharp cut off characteristics than others. Our aim that revolves around to provide the best window than hanning window in the higher window order and the best window than rectangular window technique in the lower window order. So we drew two conclusion here, where the proposed window proves to be the best taken individually when compared to the blackman, hanning, hamming and rectangular but fails to prove itself best as compared to average of the same function.

The equation of proposed window is

h_mag=p*h_mag1+q*h_mag2
whereh_mag=magnitude of proposed window
h_mag1=magnitude of rectangular window
h_mag2=magnitude of hanning window
p and q are called as tunning variables

IV. Particle Swarm Optimization(PSO)

It is a population based search algorithm and is inspired by the observation of natural habits of bird flocking. PSO is initiated by a swarm of arbitrary solution vectors called as particles. A group of particles move with different velocities through an L dimensional search space. PSO can search the optimum value easily for the nonlinear objective function such as FIR. Each particle of the population changes its position by updating its velocity. In every iteration the velocity of i-th particle is updated considering its current velocity, its acquired personal/individual best position, and acquired group best position of the entire population [7,8].

Suppose there are a flock of birds flying in the sky. Each bird represent particles. The role of these birds is to fly around and reach to a specified location and that location is the optimum value. The sky in which they are flying represents L dimension search space. Our work in this project that include searching for the element or the particle. The particle that consists of 0.5 taken from the hanning and the final value of p and q (multiplication factor). These particles are then added, subtracted, multiplied or divided with a random value to produce an optimum value in which the proposed window doesn't show any error [9].

V. Simulation Results

The PSO algorithm has been implemented to solve filter related problems. we did the comparison of normal windows which we have taken into considerations are rectangular, hanning,hamming and blackman window .we have taken lower order(N=7), middle order(N=21), higher order(N=51) and did the comparison at cut off frequency 0.5 and found out that hanning proves to be the best in higher order and rectangular window proves to be the best in lower order but in middle order all the windows show conflicting nature ,so its difficult to obtain best window in middle order.

So we have taken hanning and rectangular window and combined these two with two tunning variables `p` and `q` and found out a new window called as propose window and then the comparison of proposed window is made with different windows with four different cut off frequency that are 0.3, 0.5 ,0.7 and 0.9 and proposed window found to be the best in all respect but still there is some distortion and ripples in proposed window which can be reduced by PSO algorithm.

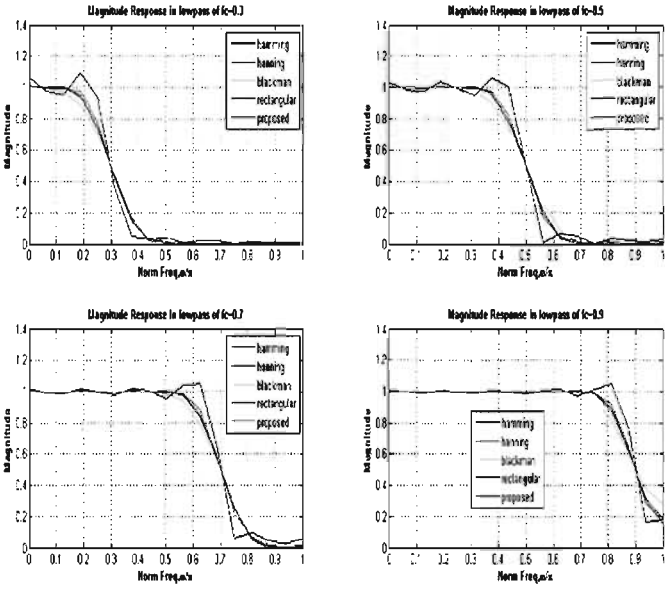

Fig. 1: Comparison of different windows with proposed window in lowpass

In fig 1& 2 results for comparison different windows with proposed window in low pass & high pass filter are shown.

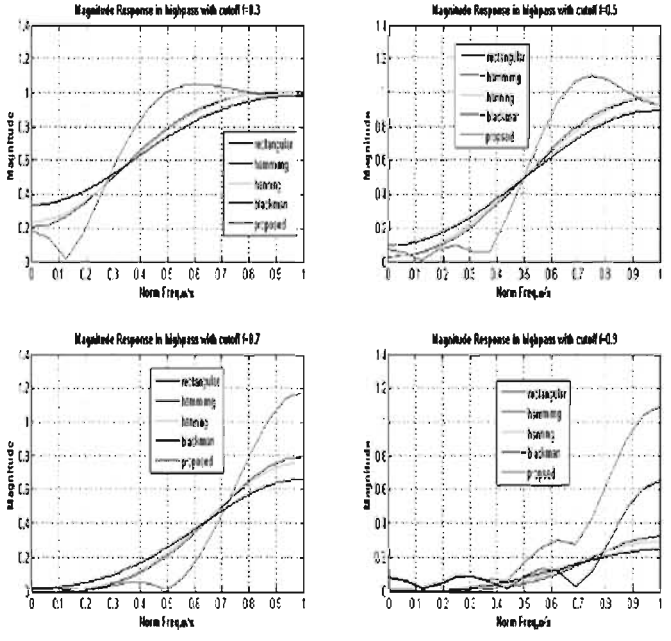

Fig. 2: Comparison of different windows with proposed window in highpass

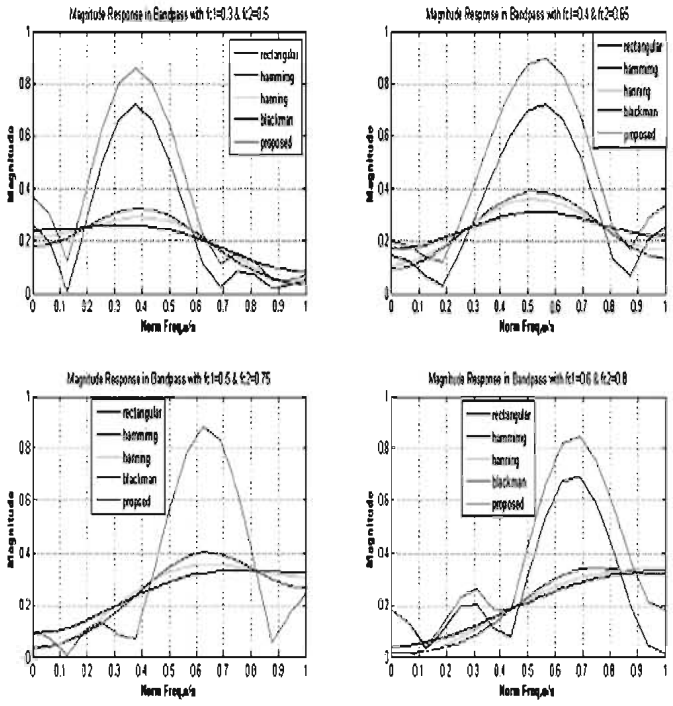

Fig. 3: Comparison of different windows with proposed window in bandpass

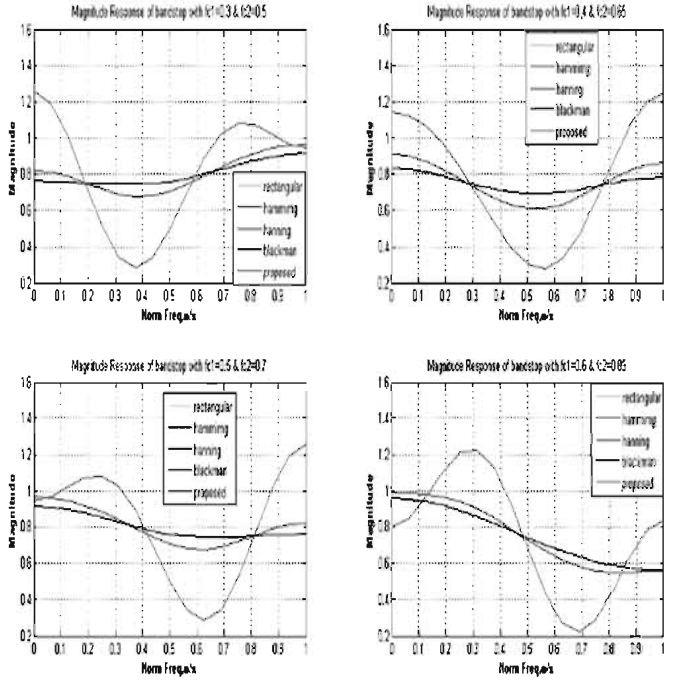

Fig. 4: Comparison of different windows with proposed window in bandstop

In fig 3. and fig 4. the comparison of proposed window with other windows is done in bandpass and bandstop filter where the lower cut off frequencies are 0.3 ,0.4,0.5,0.6 and higher cut off frequencies are 0.5,0.65,0.7 and 0.85.

In lowpass filter ,proposed window doesn't show any kind of distortion but little amount of distortion is associated with proposed window in highpass at cut off frequency 0.9 and bandpass filter which can be reduced by using the PSO algorithm where all the parameters are optimized [8].

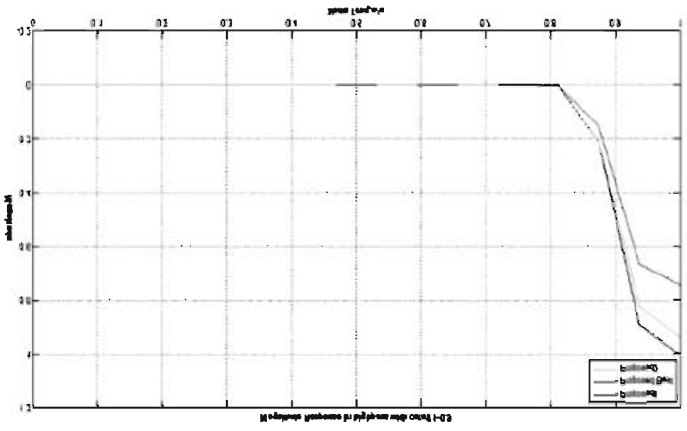

Fig. 5: Proposed window using PSO in highpass

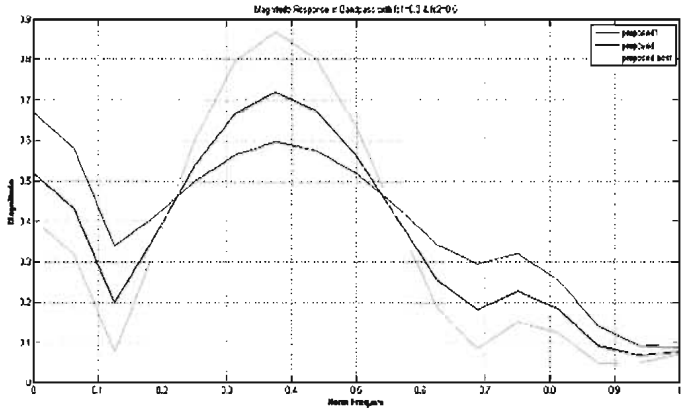

Fig. 6: Proposed window using PSO in bandpass

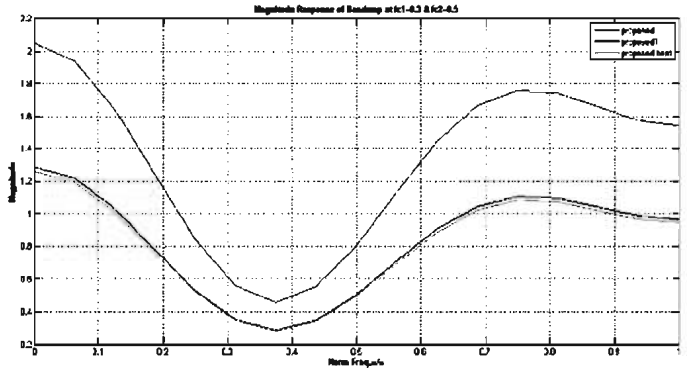

Fig. 7: Proposed window using PSO in bandstop

In fig 5,fig 6 and fig 7 we compared the normal proposed window with our best proposed window which is implemented using PSO [9].

IV. Conclusion

In this article a Proposed window is designed in which all the characteristics gets satisfied as like it merges with the rectangular window in the lower window and it provides to be the best in higher window as it merges with the hanning window. The ripple and distortion associated with the proposed window can be eliminated by using PSO algorithm which will provide best results.Although proposed window is the best among the existing windows but still it contains ripples and distortions over its passbands and stopbands

Thus the efficiency of the proposed window is improved further it requires its parameters to be optimized using modern evolutionary algorithms like PSO algorithm which will provide the best result. Thus, it is concluded that the PSO can be considered as a global optimization tool for the solution of FIR filter coefficients

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Latest News in Different Areas of Science and Technology

3. Gravitational waves from merging supermassive black holes will be spotted within 10 years, study predicts

Galaxies of similar size to the Sombrero Galaxy may offer astronomers their first glimpse of a pair of supermassive black holes merging. This hat-shaped galaxy is large enough that its merging black holes would yield detectable gravitational waves, but not so large that the black holes would merge too quickly. Astronomers won't have to wait much longer for their first glimpse of one of the biggest types of unions in the cosmos. New research published November 13 in *Nature Astronomy* predicts that gravitational waves generated by the merger of two supermassive black holes will be detected within 10 years. The study is the first to use real data, rather than computer simulations, to predict when such an observation will be made.

Credit: NASA/Hubble Heritage Team

Data Security in Cloud Computing

Cloud computing is one of the most emerging computing tools in which resources are accessed as a service over Internet on pay per use basis. Cloud service provider provides IT services in cloud infrastructure as service over internet. It is a great challenge for the cloud service provider to attract customers to store sensitive information in cloud storage and Data Security has been one of the major concerns for the cloud users. Cloud service provider allow data owners to store their data on a cloud server for sharing and provide 24/7/365 access to authorized uses. Cloud data are stored and accessed from a remote server anywhere and anytime using handheld devices having internet connectivity. Most of the files stored in the cloud are highly sensitive for example medical data. The user should authenticate him/her before performing any operation on the stored data in cloud. Also a cloud server should not tamper with the outsourced data. A Cloud service provider is accountable for the services it provides to the user. Once data owner uploads their data he or she does not have any control over the uploaded data. Cloud servers are geographically distributed in various locations. Even the data owner does not know in which server the data is going to store. To ensure data security data owner has to encrypt data before storing data in cloud. Traditional cryptographic algorithm is not applicable for cloud because cloud server and user are on the different security domain. For any application to process data, that data must be in unencrypted form. An organization data cannot be stored in encrypted form if it is going to be processed by the cloud server.

Homomorphic encryption is a technique in which data to be processed without being decrypted. Homomorphic encryption is a technique to ensure that the cloud server is not able to read the data while performing computation on the data. Cloud server performs operation on store encrypted data and returns the encoded result to the user. To perform efficient search operation on the outsourced encrypted in the cloud is one of the important factor for any data security algorithm for cloud. The cloud server should be able to return the records that satisfy the query by the user without knowing the query and result.

Performing search operations on the encrypted data without knowing the query is known as searchable encryption. To perform **searchable encryption** encrypted keywords are cloud and cloud returns the result without knowing the actual keyword for the search.

Accountability of the operation performed in the outsourced data in the cloud is a very important factor for cloud data security. Neither cloud server nor users should deny any operation performed by the cloud server or requested by the user. The Cloud service provider must maintain a log of the transaction performed on the user data.

To share the sensitive data in the cloud only to the dynamic authorized group of users is one of the major areas of research. In cloud users are dynamic in nature. Data access control is one of the major area of concern in cloud computing. Access control is a technique that allows only the authorized user to access the data. Cloud service provider must ensure that sensitive information stored by data owner should be accessed only by the authorized user. Access control mechanism allows data owner to specify access control policy based on different attributes to control the access of their uploaded sensitive information. Access control mechanism is broadly classified into three types

1) Role Based Access control (RABC)

2) User Based Access Control (UABC)

3) Attribute Based Access control (ABE).

User based access control method uses an access control list that contains the list of authorized uses to access data. This method is not applicable for cloud because in cloud users are dynamic. In roles based access control users are classified based on the role they play. Authorized users have matching roles with the data. Attribute based access control method is one of the most suitable methods for access control over encrypted data in cloud. There are two types of attribute based encryption

1. Key Policy Attribute Based Encryption(**KPABE**)

2. Cipher Text Policy Attribute Based Encryption(**CPABE**)

In Key Policy Attribute Based Encryption method data were encrypted with attribute set. User secret key contains access policy assigned by the Key Distribution Centre. A user will be able to decrypt the cipher-text if and only if cipher-text attribute is satisfied by his or her access control policy. In Key Policy Attribute Based Encryption method access control policy is defined by the Key Distribution Centre not by the Data Owner.

Cipher Text policy Attribute Based Encryption is one of the most widely used techniques for access control in un-trusted server. In Cipher Text Policy Attribute Based Encryption Method cipher-text associated with access control policy where as user's secret key is associated with attributes. Attributes and secret key are assigned to the user based on his or her credentials by the Key Distribution Centre. A user will be able to decrypt cipher-text if and only if access control policy in the cipher-text is satisfied by the user attributes specified in his or her secret key. In Cipher Text Policy Attribute Based Encryption access control policy is defined by the data owner. In Cipher Text Attribute Based encryption group, users share some attributes. Cipher Text Attribute Based Access Control is more suitable for access control for encrypted data stored in the cloud. In Fine grained access control, user that requests access to data must provide his / her credentials for verification.

A popular Cloud service provider must choose efficient fine grained access control model for data sharing in cloud computing environment. An access control model should have efficient encryption and decryption algorithms so that users can use these services with their low power handheld devices. Any good access model should support dynamic users and their dynamic roles.

Kasturi Dhal
Dept. of CSE

PhD Synopsis

Novel Techniques for SRAM Based Memory Performance Enhancement

Digital computation has penetrated a diversity of applications such as audio visual communication, biomedical applications, industrial applications, defense applications, entertainment industries and remote sensing and control. Electrical systems having digital computing capability have become an integral part of our daily lives. This puts a thrust to design the systems with utmost portability. Portability of an electronic system not only depends on the physical size of computation blocks embedded inside it but also on the energy consumption by it. Thus, reduction of size of a computing block along with the reduction of energy consumption has become a prime necessity.

As per ITRS (International Technology Roadmap for Semiconductors 2011, http://www.itrs.net/Common/2011ITRS/Home2011.htm.) the SRAM occupies more than 70% area of the SoC(System on a Chip). Hence, the performance of the SRAM predominates the overall performance of the SoC. The basic operation of SRAM cells is simple and well-known. But the diversity among various applications requires different objectives to be achieved based on the field of application.

Energy consumption, speed of operation, cell stability and area occupancy are the most important aspects of SRAM which need to be optimized for various applications. These parameters are commonly interdependent among each other. Thus improving one performance can potentially degrade the other one. Hence the objective which is most important for a particular application may be enhanced by compromising another performance index, which may not be so critical for that particular application. In the current thesis the focus is on various techniques to improve the performance of SRAM based memory.

Debasish Nayak
Dept. of AEI

The pursuit of knowledge carried on by scientists for the past several centuries has produced results which have had different reactions in various sections of society. There are lay people who consider science to be the fore runner of all comfort, progress and prosperity. On the other hand there are many good people who look upon science as the chief cause of the sufferings of humanity today. The debate has been raging for a long time. But while people talk and argue, science goes on taking long strides, blissfully ignorant of the praises or the abuses heaped on its head.

Now, we get to explore the incredibly fascinating life of one such renowned scientist, Sir Homi Jehangir Bhabha. An Indian born scientist who played an important part in contribution to The Quantum Theory was born on October 30, 1909 in Bombay. He was the first person to become the Chairman of Atomic Energy Commission of India in 1948.

Bhabha belonged to a wealthy Parsi family that was very influential in the west of India. He got a doctorate degree from the University of Cambridge in 1934 after he had completed his studies from the Elphinstone College and from the Royal Institute of Science in Bombay. All this time he worked along with Neils Bohr that led them to do pioneering work in quantum Theory. Bhabha also did some work with Walter Heitler and they made a breakthrough in the cosmic radiation's understanding by working on the cascade theory of electron showers. In 1941, Bhabha got elected to the Royal Society for his work.

It was due to his prominence, devotion, wealth and comradeship with Jawaharlal Nehru, PM of India that he was able to gain a leading position for allocating the scientific resources of India. It was under his direction that the scientists of India made their way into making an atomic bomb. Bhabha also led the first UN Conference held for the purpose of Peaceful Uses of Atomic Energy in Geneva, 1955. It was then predicted by him that an almost limitless power of industries would be found through nuclear fusion's control. He promoted nuclear energy control and also prohibition of atomic bombs worldwide. Bhabha got many awards from Indian as well as foreign universities and he was an associate of various societies of science including a famous one in the US known as National Academy of Sciences. Bhabha was killed in an air crash accident on January 24, 1966 in Switzerland.

He is a tremendous inspiration for the youth to dream big and achieve high!

Nivedita Mahapatra
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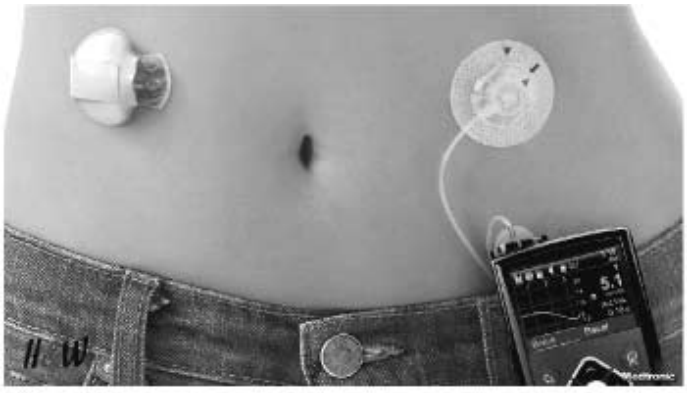
1. The Artificial Pancreas



In order for people with diabetes to stay healthy, they must continually check their blood sugar and adjust it with insulin or snacks. Medtronic aims to render this tedious process obsolete with its Mini Med 670G, a.k.a. the "artificial pancreas," which has been in development for years but was only recently approved by the FDA. (It will be commercially available next year.)

Once users attach the iPod-size device to their body, it measures their blood-¬sugar levels every five minutes, providing more insulin or withholding it as needed. For now, they still need to manually request a dose after they eat. But Medtronic is working on a fully automated version. it will help the 1.25 million people living with Type 1 diabetes to spend less time managing their disease and more time enjoying life.

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2. Gesture Recognition

This gesture recognition bracelet is one of the cool new gadgets that let us control devices by moving our hands.

Invented by Stephen Lake, Matthew Bailey and Aaron Grant, the MYO armband (derived from the prefix "myo" meaning related to muscle) can identify hand gestures by interpreting biometric signals in the arm.

When making a particular hand motion such as pointing, the armband it can identify the gesture, which allows the pointing motion to be associated with a specific command for a digital device.

One can use hand signals to interact with televisions, computers, phones or any smart technology system. The importance of this technology is that it enables us to interact more naturally with devices by reducing the need for input peripherals like mice, keyboards or touchscreens.The MYO technology does not require positioning coordinates and therefore allows greater freedom of movement.Gestures are identified by muscular and electrical activity in the forearm. This detection occurs without any electrodes touching the skin, and the recognition is instantaneous. Myo currently recognizes about 20 gestures. For example, it recognizes the swiping motions we use to scroll a page on a touchscreen. MYO is designed as a one-size-fits-all device. It uses Bluetooth 4.0, features on-board, rechargeable lithium-ion batteries and works out-of-the-box with your Mac or Windows PC.

3. Talking with the Appliances

One of the cool new gadgets to hit the market is a touch screen device that allows us to communicate with anything consuming energy in your home. This new invention has been named one of the "best new gadgets" and "breakthrough ideas of the year" by Time Magazine. The Energy Hub Dashboard is a device that allows us to wirelessly communicate with all our appliances. The touch screen device receives wireless information from "plug-ins" in our electrical sockets and provides details of usage for every energy consuming product in the home - everything from our furnace and air conditioner to a specific light bulb, cell phone or alarm clock. It even tracks leak current (the power used by devices that are plugged-in but not being used).Although many of the people are motivated to reduce our carbon footprint and power consumption by changing our lights or upgrading to Energy Star appliances, this doesn't tell exactly what's happening with consumption. The utility bills give total power usage but nothing about what would happen if thermostat was reduced by a few degrees or if a specific appliance was replaced, shut-off or used on a certain schedule. The Energy Hub provides this type of information and allows you to control and schedule the energy usage of anything in the home.

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4. Vibrations Relieve Pain

Can we get the name an orthopaedic surgeon has invented a cool new gadget for relieving lateral epicondylitis - commonly known as tennis elbow.Vibration therapy has proven to be the most effective method for treating tennis elbow as supported by research published in medical literature. However, the treatment has required large and expensive equipment which is only available in hospitals. It is a portable, strap-on device that can generate the same low frequency vibrations generated in much larger machines used for treating lateral epicondylitis. The device, known as Tenease, stimulates blood flow to an afflicted area, which stops pain and promotes healing. Tenease has been rigorously tested and awarded approval as a medical invention by the MHRA (Medicines and Healthcare Products Regulatory Authority), a government regulatory agency of the U.K. Department of Health.

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5. Solar Panels That Don't Stick Out

The Solar Roof helps the environment, saves us some money—and litters our roof with bulky metal boxes. That's the dilemma home-solar-panel buyers like us have faced for years. Tesla's response: the Solar Roof, a series of tiles designed to blend together while also harnessing the power of the sun. The product line, which will be available next year, is a result of collaborative effort between Tesla and Solarcity, a longtime provider of traditional solar panels. (The former is set to acquire the latter.)

Tuhin
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Burj Al Arab Hotel—Dubai, United Arab Emirates

Burj Al Arab is the tallest and most luxurious hotel in the world. It was constructed by WS Atkins Partners Overseas, with concept architect Mr Thomas Wills Wright, and the interior design was handled by a team from KCA International, led by **Ms Kuan Chew**.

Its design depicts the billowing sail of an Arabian ship. The "mast" consists of two wings in a "V" shape. A gold-framed atrium occupies the space between the wings.

Even more impressive than the hotel's amenities is its architecture. The hotel rests on an artificial island constructed 280 m (920 ft) offshore. Engineers created a ground/surface layer of large rocks, which is circled with a concrete honeycomb pattern, which serves to protect the foundation from erosion.

The pile foundation isn't secured by bedrock. It's built on sand and held in place by the friction of silt. Above the foundation is a surface layer of rock. The concrete protects the wood from rot and the sand from erosion. Inside the building, the atrium is 180 m (590 ft) tall. Burj Al Arab is the world's third tallest hotel. The diagonal frames on the side of the building have the weight of 20 buses. The long spine forming the "mast" transfers most of the building's vertical load. The look and feel of this futuristic hotel is almost magical.

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Contents

Editorial	2
DD Feature	3
Profile of a Scientist	24
Technology Updates	25
Engineering Marvel	27

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