INTERNATIONAL JOURNAL OF SCIENCE AND INNOVATIVE ENGINEERING & TECHNOLOGY
MAY 2016 ISSUE VOLUME 1 ISBN 978-81-904760-8-9

Zero Touch Interface: An Advanced Ideological Approach To Human-Computer Interactions

Author: Ashirbad Sahu, CSE 1ST Year, Srm University, Kattankulathur, Chennai
Email: ashirbadsahu3@gmail.com, ashirbadsahu_ma@srmuniv.edu.in

ABSTRACT—

This paper refers to the advanced use of sensors and blob detection techniques. These standards being progressive at present and having wide scope in future prospects of use. The basic idea underlines the fact to take the tangible computational surfaces to a newer level, a level where the user wishes and controls any smooth surface available at any location as per needs and requirements. He can convert it into a feather touch sensitive interface where touchscreens would be available around at all compatible and strategic locations, be it a table or window glass. It aims towards an approach where motion sensors come into play like accelerometers, gyroscopic and gravity sensors which sense movements with a cross network of Infrared-Led sensors to achieve zero-touch at an affordable level making human computer interactions more effective than ever.

INTRODUCTION

The concept all started with Aryabhatta and Bhaskaracharya from India who gave the world the concept of zero. It gave new dimensions to the world of mathematical and logical analysis and brought several theories into the limelight of digital stepwise computations and communications as well. Now the advancing era aims towards a new approach to the process of usage of hardware and software in the most compact and human friendly interactive ways possible. This paper brings about the researched ideas and proposals by the author to make a comprehensive integration of components to create a zero touch interface and other compatible sources and requirements to make the idea more approachable and viable for the masses and hope to bring a generation ahead in the field of computer science.

Zero Touch is a high performance multi-point sensor that detects visual hulls, within a plane. Applications include free-air interaction, person tracking in rooms, automobile windshields, hover sensing (e.g., over capacitive multi-touch), and multi-touch.

ZeroTouch is a virtual in-the-air touchpad computer interface that allows users to literally draw pictures in midair. The technology also allows the user to convert any conventional display, such as big-screen TVs, into an affordable touchscreen panel, opening a world of possibilities for precision gaming, designing and other experiences that rely on touch technology.

OBJECTIVES OF THE PAPER:

- To develop methodologies and present concept of technology, perception and meaning of touch.
- To take Augmented Re ality and virtual reality out into the real human-computer interaction world.
- To determine the particular software and ideas to make Zero Touch Gesture controls a reality.
- To basically define the most improved and compatible hardware requirements to cater the situation of future data storage and efficiency of servers.
- To give a new dimension and progress a step into a generation forward of modern computing.

THEORY:

Zero touch software updations and making roles easier:

Abstraction of the physical network to a broader, network-wide perspective allows for a more efficient approach for several operational uses:

- Centralized representation of distributed network state, allowing for a single point of integration and network-wide visibility and analytics
- Turn-key automation for zero touch provisioning, configuration management and network-wide upgrades and rollback.
- Compliance Dashboard for Security, Audit and patch management.

Projectable Touch

When we go to a restaurant in the near future, we might order your food by poking at icons on your table -- they'll vanish when the plates arrive, and spilled drinks won't do them any harm. It beams a display, which can show photos, videos, Web sites or apps running on its simple interface, and uses an infrared sensor to track our fingers' movements.

Creation of a Touchable Image:

The Light Touch casts a big image from up close by bouncing lasers off a 0.4-inch micro display, using techniques from holography to keep the picture in focus despite the sharp projection angle. Then it covers the image in a horizontal plane of infrared light that lies just above the table. An infrared camera watches for spots where a finger (or similarly sized object) breaks the plane and scatters the light. The machine figures out and executes the action corresponding to that location. It detects fast moves like swipes; an upgrade will sense multiple taps at once. This is an important part of blob formation and detection techniques by an infrared led.

Virtual Reality:

In applications of augmented reality or virtual reality, fiducials are often manually applied to objects in a scene so that the objects can be recognized in images of the scene. For example, to track some object, a light-emitting diode can be applied to it. With knowledge of the color of the emitted light, the object can easily be identified in the picture.

The appearance of markers in images may act as a reference for image scaling, or may allow the image and physical object, or multiple independent images, to be correlated. By placing fiducial markers at known locations in a subject, the relative scale in the produced image may be determined by comparison of the locations of the markers in the image and subject. In applications such as photogrammetry, the fiducial marks of a surveying camera may be set so that they define the principal point, in a process called "collimation". This would be a creative use of how the term collimation is conventionally understood.

Fiducial markers and Blob detection techniques:

It is an object placed in the field of view of an imaging system which appears in the image produced, for use as a point of reference or a measure. It may be either something placed into or on the imaging subject, or a mark or set of marks in the reticle of an optical instrument.

An IR LED, also known as IR transmitter, is a special purpose LED that transmits infrared rays in the range of 760 nm wavelength. Such LEDs are usually made of gallium arsenide or aluminum gallium arsenide. They, along with IR receivers, are commonly used as sensors. The appearance is same as a common LED. Since the human eye cannot see the infrared radiations, it is not possible for a person to identify whether the IR LED is working or not, unlike a common LED. To overcome this problem, the camera on a cellphone can be used. The camera can show us the IR rays being emanated from the IR LED in a circuit. Some barcode readers can estimate the translation, orientation, and vertical depth of a known-size barcode relative to the barcode reader.

Some sets of fiducial markers are specifically designed to allow rapid, low-latency detection of the 2D location, 2D orientation, and identity of hundreds of unique fiducial markers. For example, the "amoeba" reacTIVision fiducials, the d-touch fiducials, or the TRIP circular barcode tags (ringcodes).

'Sixth Sense':

It is a wearable gestural interface that augments the physical world around us with digital information and lets us use natural hand gestures to interact with that information.

We‘ve evolved over millions of years to sense the world around us. When we encounter something, someone or some place, we use our five natural senses to perceive information about it; that information helps us make decisions and chose the right actions to take. But arguably the most useful information that can help us make the right decision is not naturally perceivable with our five senses, namely the data, information and knowledge that mankind has accumulated about everything and which is increasingly all available online. Although the miniaturization of computing devices allows us to carry computers in our pockets, keeping us continually connected to the digital world, there is no link between our digital devices and our interactions with the physical world. Information is confined traditionally on paper or digitally on a screen. Sixth Sense bridges this gap, bringing intangible, digital information out into the tangible world, and allowing us to interact with this information via natural hand gestures. ‗SixthSense‘ frees information from its confines by seamlessly integrating it with reality, and thus making the entire world your computer. The SixthSense prototype is comprised of a pocket projector, a mirror and a camera. The hardware components are coupled in a pendant like mobile wearable device. Both the projector and the camera are connected to the mobile computing device in the user‘s pocket. The projector projects visual information enabling surfaces, walls and physical objects around us to be used as interfaces; while the camera recognizes and tracks user's hand gestures and physical objects using computer-vision based techniques. The software program processes the video stream data captured by the camera and tracks the locations of the colored markers (visual tracking fiducials) at the tip of the user‘s fingers using simple computer-vision techniques. The movements and arrangements of these fiducials are interpreted into gestures that act as interaction instructions for the projected application interfaces. The maximum number of tracked fingers is only constrained by the number of unique fiducials, thus SixthSense also supports multi-touch and multi-user interaction.

The SixthSense prototype implements several applications that demonstrate the usefulness, viability and flexibility of the system. The map application lets the user navigate a map displayed on a nearby surface using hand gestures, similar to gestures supported by Multi-Touch based systems, letting the user zoom in, zoom out or pan using intuitive hand movements. The drawing application lets the user draw on any surface by tracking the fingertip movements of the

user‘s index finger. SixthSense also recognizes user‘s freehand gestures (postures). For example, the SixthSense system implements a gestural camera that takes photos of the scene the user is looking at by detecting the _framing‘ gesture. The user can stop by any surface or wall and flick through the photos he/she has taken. SixthSense also lets the user draw icons or symbols in the air using the movement of the index finger and recognizes those symbols as interaction instructions. For example, drawing a magnifying glass symbol takes the user to the map application or drawing a _@‘ symbol lets the user check his mail. The SixthSense system also augments physical objects the user is interacting with by projecting more information about these objects projected on them. For example, a newspaper can show live video news or dynamic information can be provided on a regular piece of paper. The gesture of drawing a circle on the user‘s wrist projects an analog watch.

The Real Zero Touch deployment:

The Zero Touch screen allows us to make use of 256 infrared sensors and 32 LEDs. Each Light blinks at a specific frequency which is read by a sequence of sensors. The Zero Touch screen is extremely responsive. This is because of the fact that each of the LED blinks at the rate of 2400 times per second. The Zero Touch screen is connected to a computer via USB which also provides power and also collects the Data. The infrared sensors and LED also provides a clear display of each and every object on the screen. The combination of this technology creates a visualization that there is an empty screen of which if we create hand movements there is creation of words and images on the computer screen.

The Zero Touch Screen Technology has many advantages. It can be used by Surgeons to perfect their hand movement and to reduce the risk of any harm to the patient. It is also quite affordable as it is priced around $450 for a prototype. As this product goes for mass production it can be priced comfortably around $300. It can also be used as a guide for complicated machinery. The Technology can also be used by military personals also to improve their skills. This technology was given a presentation in ACM CHI conference in Vancouver. This system was suspended by frame in midair which was used to create strokes and beautiful brushes in air.

The technology is 2 dimensional but it can be further developed into 3 dimensional technologies. The Technology has the advantage that it can provide a platform to other companies like Microsoft which are now facing tough competition from Apple. The Techs are developing new technologies every day but it‘s up to top end industries to identify them and develop this technologies.

Many of us are familiar with the large number of touch-screen technologies which are available in the market. Touchpad, Touch Screen Phones, Multiuser laptops etc., have already made us addicted to the touch screen technology. But a new technology developed by Texas a&M Interface Ecology Lab allows us to make use of a special empty frame with a highly responsive touch screen capabilities. This facility allows us to make use of our hands, legs, elbows or whatever part of your body to create or write images on the touch surface.

Kinect-based prototype multi-touch system that allows users to navigate through Windows 7 applications, simply by moving their hands in the air. While that system utilizes the Kinect unit's RGB camera and depth sensor to track the user's hands, a new technology developed at Texas A&M University's Interface Ecology Lab uses a matrix of infrared light beams to do essentially the same thing.

Unlike the Evoluce system, ZeroTouch incorporates an open picture-frame-like sensing apparatus, which the user reaches into. It can be placed on a desktop, around the computer screen, or it can hang in the air with the screen visible beyond it. Around the frame's four edges are arrays of infrared LED lights, the invisible beams of which shine into and across the inside open area. Mixed in with those lights are 256 modulated infrared sensors, which register the beams of the lights, located across from them.

When a user places one or more fingers or other objects within the frame - intersecting the grid-work of light beams - the system's software is able to calculate the size, shape and location of those objects within the frame, and apply that to equivalents on a Windows 7 computer screen. It's a technology known as point-to-point visual hull sensing, and it can handle over 20 objects at once.

Zero Touch Provisioning (ZTP):

It uses standards-based mechanisms to provide dynamic provisioning and rapid replacement of network elements.

Dynamic provisioning based on user defined template. Standards based no need to implement proprietary platforms. Validating cabling/connectivity.

Maintaining compliance and network integrity. Fully automate network and server provisioning. Provisioning of network can be done dynamically in minutes all without the need to log into any device.

Advanced Event Management (AEM)

Designed with the network operator in mind, Advanced Event Management (AEM) captures critical information about the state of the network at any point in time.

Increased visibility of critical events
Actions based on real-time network conditions

Automate routine tasks
"Playback" network state

Purpose of built is to enhance system up-time through programmatic reaction to network changes and to minimize system outages by simplifying complex troubleshooting tasks.

Smart System Upgrade (SSU)

Accelerate deployment of features and perform network changes with minimal or no downtime. A customizable suite of features Smart System Upgrade (SSU) including:

- Accelerated System Upgrade (ASU), minimizing device downtime
- Intelligent insertion and removal of network elements in the network topology
- Open and programmatic integration to all application and infrastructure components

Move toward a continuous deployment model by minimizing the impact of network changes

Gesture recognition

A topic in computer science and language technology with the goal of interpreting human gestures via mathematical algorithms. Gestures can originate from any bodily motion or state but commonly originate from the face or hand. Current focuses in the field include emotion recognition from face and hand gesture recognition. Many approaches have been made using cameras and computer vision algorithms to interpret sign language. However, the identification and recognition of posture, gait, proxemics, and human behaviors is also the subject of gesture recognition techniques. Gesture recognition can be seen as a way for computers to begin to understand human body language. Gesture recognition enables humans to communicate with the machine (HMI) and interact naturally without any mechanical devices. Using the concept of gesture recognition, it is possible to point a finger at the computer screen so that the cursor will move accordingly. This could potentially make conventional input devices such as mouse, keyboards and even touch redundant. Gesture recognition can be conducted with techniques from computer vision and image processing. The work involves the computer vision field on capturing gestures or more general human pose and movements by cameras connected to a computer.

Pen computing:

Pen computing reduces the hardware impact of a system and also increases the range of physical world objects usable for control beyond traditional digital objects like keyboards and mice. Such implements can enable a new range of hardware not requiring monitors. This idea may lead to the creation of holographic display. The term gesture recognition has been used to refer more narrowly to non-text-input handwriting symbols, such as inking on a graphics tablet, multi-touch gestures, and mouse gesture recognition. This is computer interaction through the drawing of symbols with a pointing device cursor.

IP-Enabled Services

Voice over Internet Protocol (VoIP), is a technology that allows us to make voice calls using a broadband Internet connection instead of a regular (or analog) phone line. Some VoIP services may only allow us to call other people using the same service, but others may allow us to call anyone who has a telephone number - including local, long distance, mobile, and international numbers. Also, while some VoIP services only work over your computer or a special VoIP phone, other services allow us to use a traditional phone connected to a VoIP adapter.

VoIP / Internet Voice:

VoIP services convert your voice into a digital signal that travels over the Internet. If we are calling a regular phone number, the signal is converted to a regular telephone signal before it reaches the destination. VoIP can allow us to make a call directly from a computer, a special VoIP phone, or a traditional phone connected to a special adapter. In addition, wireless "hot spots" in locations such as airports, parks, and cafes allow us to connect to the Internet and may enable us to use VoIP service wirelessly.

Equipment:

A broadband (high speed Internet) connection is required. This can be through a cable modem, or high speed services such as DSL or a local area network**.** A computer, adaptor, or specialized phone is required. Some VoIP services only work over computer or a special VoIP phone, while other services allow us to use a traditional phone connected to a VoIP adapter. If we use computer, we need some software and an inexpensive microphone. Special VoIP phones plug directly into our broadband connection and operate largely like a traditional telephone. If we use a telephone with a VoIP adapter, we'll be able to dial just as we always have, and the service provider may also provide a dial tone. Some VoIP providers offer their services for free, normally only for calls to other subscribers to the service. Our VoIP provider may permit us to select an area code different from the area in which we live. It also means that people who call us may incur long distance charges depending on their area code and service. Some VoIP providers charge for a long distance call to a number outside your calling area, similar to existing, traditional wire line telephone service. Other VoIP providers permit us to call anywhere at a flat rate for a fixed number of minutes. Depending upon services, we might be limited only to other subscribers to the service, or we may be able to call anyone who has a telephone number - including local, long distance,

mobile, and international numbers. If we are calling someone who has a regular analog phone, that person does not need any special equipment to talk to you. Some VoIP services may allow you to speak with more than one person at a time.

Advantages of VoIP:

Some VoIP services offer features and services that are not available with a traditional phone, or are available but only for an additional fee. We may also be able to avoid paying for both a broadband connection and a traditional telephone line.

Disadvantages of VoIP:

If we're considering replacing our traditional telephone service with VoIP, there are some possible differences:

- Some VoIP services don't work during power outages and the service provider may not offer backup power.

Lite-Touch, High-Volume Deployment

The Lite-Touch, High-Volume Deployment strategy is for medium-sized organizations that have an information technology (IT) staff and sometimes use partners to help with technology adoption. Organizations that use this strategy have 200–500 client computers and at least one location with more than 25 users. They usually have managed networks in distributed locations that are running Windows Server.

Medium-sized organizations often assemble their own deployment solutions by using the tools and technologies that Microsoft provides for the Windows operating system. These solutions typically include combinations of answer files, scripts, the Windows Automated Installation Kit (Windows AIK), and so on.

Such organizations can benefit from the Microsoft Deployment Toolkit (MDT) 2010, which is a solution accelerator that is available at no cost. MDT 2010 contains thousands of lines of code that were developed by Microsoft employees, partners, and customers. One can use this code to provide a deployment framework for Windows operating systems, which enables him to focus on business, not on programming.

Zero-Touch, High-Volume Deployment

The Zero-Touch, High-Volume Deployment strategy is for large organizations with an information technology (IT) staff with IT pros that have expertise with deployment, networking, and Configuration Manager 2007 R2. Organizations using this strategy typically have more than 500 client computers and at least one location with more than 25 users. They have managed networks based on Windows Server.

Microsoft Deployment Toolkit (MDT) 2010 is a Microsoft solution accelerator available at no cost for deploying Windows operating systems. Based on the experience of Microsoft employees, partners, and customers, MDT 2010 contains many thousands of lines of code—code that provides a deployment framework so that customers can focus on their business, not on programming. Integrating MDT 2010 with Configuration Manager 2007 R2 helps large organizations use this framework to more easily implement the Zero-Touch, High-Volume Deployment strategy.

Zero Touch Provisioning (ZTP) might be increasingly more common to networking; the concept of automation has existed for years in IT. At its core, ZTP is an automation solution that‘s designed to reduce errors and save time when IT needs to bring new infrastructure online.

This is particularly useful for data center servers, where scale and configuration similarities across systems make automation a necessity. In the server world, for example, Linux has revolutionized on boarding and provisioning. Rather than using command-line interfaces (CLI) to configure systems one at a time, administrators can use automation tools to roll out the operating system software, patches and packages on new servers with a single command, or the click of a mouse.

Advanced scripting capabilities also allow administrators to tailor the boot configuration of these systems with profiles for specific applications. So for example, if we need ten servers for a new cluster, we can load that with one profile, or if we need six new servers for a new web application, we can roll that out using a different profile.

Essentially, automation drastically reduces the amount of time between when we take a server out of the box to when it‘s functioning in a production environment – all while minimizing the risks of manual configuration errors and missed keystrokes, or the additional challenge of knowing which driver or library is the correct one.

About networking and how it makes a difference:

Much like servers, network devices have traditionally been managed via the CLI. Not only have those, network administrators needed to do this manually on each device.

Considering the typical provisioning process of a network switch: switches have been traditionally coupled with pre-loaded proprietary network operating systems. Technicians then use CLI or the manufacturers own tools to provision the device, a process that can be broken down into three basic steps:

Step 1: When the new switch arrives, it already has an OS to help bootstrap the device. It is removed from the box and goes to a staging area. Here the administrator checks the

operating system version and makes any updates - for patches, bug fixes, or any new feature updates as necessary.

Step 2: An initial configuration is made to establish basic network connectivity. This includes parameters such as administrator and user authentication information, the management IP address and default gateway, basic network services (DHCP, NTP, etc.) and enabling the right L2 and L3 network protocols are all examples of the bootstrap process.

Step 3: Once the initial OS and configuration has been verified, the device can be installed into the environment (racked and cabled), where further customized configuration can be made (either locally via the console or through a remote access protocol) that is specific to the application and location within the network.

The details may vary slightly for each environment, but the basics remain the same. Now extrapolating the model to ten network switches. Or twenty. Or one hundred. This can be very time consuming. And when we consider that for each switch there's an opportunity for a configuration error that can bring down the network or create exposure and a security risk, the conclusion is obvious: there has to be a better way.

Bluetooth:

It is a wireless technology standard for exchanging data over short distances (using short-wavelength UHFradio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices and building personal area networks (PANs). Invented by telecom vendor Ericsson in 1994, it was originally conceived as a wireless alternative toRS-232 data cables. It can connect several devices, overcoming problems of synchronization.

The Bluetooth SIG oversees development of the specification, manages the qualification program, and protects the trademarks. A manufacturer must make a device meet Bluetooth SIG standards to market it as a Bluetooth device. A network of patents applies to the technology, which are licensed to individual qualifying devices.

Wi-Fi-The old technology:

Wi-Fi is the name of a popular wireless networking technology that uses radio waves to provide wireless high-speed Internet and network connections. A common misconception is that the term Wi-Fi is short for "*wireless fidelity*," however this is not the case. Wi-Fi is simply a trademarked phrase that means *IEEE 802.11x*.The Wi-Fi Alliance, the organization that owns the Wi-Fi registered trademark term specifically defines Wi-Fi as any "*wireless local area network (WLAN) products that are based on the Institute of Electrical and Electronics Engineers' (IEEE) 802.11 standards.* ―Initially, Wi-Fi was used in place of only the 2.4GHz 802.11b standard; however the Wi-Fi Alliance has expanded the generic use of the Wi-Fi term to include any type of network or WLAN product based on any of the 802.11 standards, including 802.11b, 802.11a, and dual-band and so on, in an attempt to stop confusion about wireless LAN interoperability.

Wi-Fi works with no physical wired connection between sender and receiver by using radio frequency (RF) technology -- a frequency within the electromagnetic spectrum associated with radio wave propagation. When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space.

The cornerstone of any wireless network is an access point (AP). The primary job of an access point is to broadcast a wireless signal that computers can detect and "tune" into. In order to connect to an access point and join a wireless network, computers and devices must be equipped with wireless network adapters. Wi-Fi is supported by many applications and devices including video game consoles, home networks, PDAs, mobile phones, major operating systems, and other types of consumer electronics. Any products that are tested and approved as "Wi-Fi Certified" (a registered trademark) by the Wi-Fi Alliance are certified as interoperable with each other, even if they are from different manufacturers.

Light Fidelity (Li-Fi) - The new one:

It is a bidirectional, high speed and fully networked wireless communication technology similar to Wi-Fi. The term was coined by Harald Haas and is a form of visible light communication and a subset of optical wireless communications (OWC) and could be a complement to RF communication (Wi-Fi or Cellular network), or even a replacement in contexts of data broadcasting. It is so far measured to be about 100 times faster than some Wi-Fi implementations, reaching speeds of 224 gigabits per second.

It is wireless and uses visible light communication or infra-red and near ultraviolet (instead of radio frequency waves) spectrum, parts of optical wireless communications technology, which carries much more information, and has been proposed as a solution to the RF-bandwidth limitations.

NFC:

It is a short-range high frequency wireless communication technology that enables the exchange of data between devices over about a 10 cm distance. NFC is an upgrade of the existing proximity card standard (RFID) that combines the interface of a smartcard and a reader into a single device. It allows users to seamlessly share content between digital devices, pay bills wirelessly or even use their cellphone as an electronic traveling ticket on existing contactless infrastructure already in use for public transportation.

The significant advantage of NFC over Bluetooth is the shorter set-up time. Instead of performing manual configurations to identify Bluetooth devices, the connection between two NFC devices is established at once (under a 1/10 second).Due to its shorter range, NFC provides a higher degree of security than Bluetooth and makes NFC suitable for crowded areas where correlating a signal with its transmitting physical device (and by extension, its user) might otherwise prove impossible. NFC can also work when one of the devices is not powered by a battery (e.g. on a phone that may be turned off, a contactless smart credit card, etc.).

How does ZTP help with this process for the network?

We remove all the manual configuration and steps listed above, and what we have left is ZTP.

In this model, the administrator receives the hardware and the first thing they do is to physically install the device – rack and cable the switch. Once these physical connections are made, the technician no longer has to touch the box – hence the name, zero touch. With ZTP, once the switch is powered on, it uses standard network protocols to fetch everything it needs for provisioning. It can send a DHCP query to get the proper IP address for connectivity and management, and then use Boot/TFTP to get the right operating system image, and then another TFTP request to get the right configuration file based on the application profile.

In this model, once the network administrator sets up the IP address scheme via the DHCP server, and the OS and configuration files on the TFTP server, they can effectively roll out tens, hundreds, and thousands of switches in this way – all fully customizable and without the time consuming and error prone manual configuration process. The first of these is the fact that bringing applications to market faster is the key to gaining competitive advantage. So the faster IT teams are able to bring infrastructure online to support these applications, the better. With ZTP and server virtualization prevalent in the server world, it‘s become critical to automate the network processes as well. No network administrator wants to be the long pole in the tent.

The second is bare-metal switching. If applications are driving the top line, then it‘s the hardware that will help the bottom line. Commoditization of network hardware is the next logical evolution, with the rapid adoption of merchant silicon. More and more customers are seeing less differentiation in the hardware, and more differentiation in the speed, features, and operational simplicity that the software can provide. Today, three manufacturers (Big Switch, Cumulus, and Pica8) are offering Linux-based OSs for bare-metal switches - effectively bringing the efficiency and familiarity of Linux to the network world In light of these trends, it‘s even more important to implement ZTP and network automation practices. As more applications come online, IT teams are being taxed to keep the infrastructure up to date – including provisioning, scaling, troubleshooting, and maintenance. This is not sustainable in any manual based process.

And as hardware and software continues to be decoupled, it‘s critical to find a way to automate the new operational model. If you can purchase hundreds of switches from an OEM or ODM and rack these devices – would you rather install the OS and configure each of these individually, or do this through an efficient methodology using well known, reliable network protocols. Much like the server world before it, the network world is seeing some significant technology shifts. Automation, software defined devices, and bare metal switches are all contributing to a fast-paced and dynamic environment in the data center. With ZTP, the network is leveraging best practices from the server world to drive greater speed and operational efficiency.

In short, it‘s become an essential way to automate the network.

The Prototype:

The development of integrated hardware–software systems for embodied interaction spans diverse fields, including algorithms, electronics, embedded systems, physics, art and cognition. Touch-sensitive frames have enabled interactive surfaces for years, but the size and responsiveness tend to be limited. Enter ZeroTouch, with precise sensing within a specific plane of interaction. ZeroTouch enables real-time sensing of fingers and hands, even in the presence of strong ambient light. Our technology allows for many interactions to be detected, many more than typical multitouch techniques. Our use of wide-angle optoelectronics allows for excellent touch resolution, even in the corners of the sensor." A 27-inch ZeroTouch frame has "smart" edges embedded with 256 infrared sensors and 32 LEDs that each blink about 2,400 times per second, detecting whatever moves around inside it. Fingertips, hands, arms and even inanimate objects pass through an invisible two-dimensional optical web that tracks them. This ZeroTouch sensor has been integrated not only with 1080 pixel displays but also with higher-resolution 1440 pixel, nearing twice as many pixels. This configuration turns a traditional monitor into a low-cost multitouch surface, supporting direction interaction with multiple fingers and hands at one time — much larger and more responsive than an iPad.

ZeroTouch can also be integrated with high-resolution stylus-based tablet computing displays to enable pen-plus-hand interaction. The researchers' initial applications address real-time strategy games and art-exhibit curation. The frame is connected to a computer with USB, which provides power and collects the data. Capable of recognizing up to 20 independent touch points at a time, the sensor not only recognizes that an object has entered the plane but also registers its size. The ZeroTouch sensor can be suspended in free air, enabling precise gestural interaction similar to that seen in the movie Minority Report, in which characters viewed computer screens midair and scrolled through content on the monitor with the touch of a finger.

With the addition of the intangible Canvas application, users can paint on a virtual canvas by gesturing in midair by simply moving a hand across the ZeroTouch plane. The colors are controlled using an iPhone, and the thickness of the brush is controlled by how much enters the frame. If it's just a finger, the brush will be narrow. But the use of an entire arm will make a wider brushstroke. One big advantage to ZeroTouch, the researchers say, is its affordability. The research prototype was made using commercially available sensors usually found in TV remote controls.

ZeroTouch has many potential applications, such as a training guide for surgeons that can track their fine hand movements, as well as for interactive instructions on how to construct and repair complicated machinery. The ZeroTouch technology simply requires the user to break the light beams; activating the sensor doesn't require any force.

Zero – Touch hardware components and scope:

Body-based interfaces:

Humans experience the world through our bodies. We form understandings for how to interact with environments through bodily senses. The advent of new low-cost, low-power sensing technologies create the potential for new modes of interaction and communication. New interface ecosystems can sense, recognize, respond to, and represent nuances in our environments and in our bodies. We should emphasize on processes of human expression, ideation, and social interaction as we develop sensory interfaces that involve embodied awareness of the human body and the physical world.

Body-based diagramming:

We are investigating how body-based interfaces support creativity and expression in design. Design processes are supported by embodied representations, including gestures, tangibles, and diagrams, which have been found to help people think. A *diagram* is a design thinking tool that enables and stimulates imagination, facilitating conceptualization. Diagrams mediate exploration of relationships between concepts, using ambiguous visual representations to foster varied, flexible interpretations. We use a form of diagramming called, information composition.

Developing a new creativity support environment, Body-based, that enables designers to express, collect, organize, and reflect upon ideas using pen + touch interaction. The kinematic chain model for bimanual interaction serves as a basis for the design of new gestural interaction techniques. In the kinematic chain model, interactions with the non-preferred hand function as a frame of reference for actions with the preferred hand. For example, when drawing on paper, the non-preferred hand positions the paper for drawing with a pencil in the preferred hand. We seek to support expression and ideation by enabling designers to fluidly switch between and manipulate parameters of diagram transformations with their hands.

Cross-surface interaction:

We are developing new methods for *cross-surface interaction* that is interaction across multi-touch surfaces. Embodied recognition is key. We inform our designs through the use of *culturally based design*, a method that draws from the embodied experiences of activities embedded in culture. By mimicking these well-established activities, interactions activate people's embodied mental models. This makes the interactions intuitive and familiar, as they draw from prior experiences. Our culturally based designs draw a variety of contexts, ranging from card playing to sharing and exchanging photographs. Our long term objective is to give people interactive experiences in which embodied gestures performed by the human hand are mapped to actions in ways that are natural, meaningful and intuitive.

Google Glass:

Google Glass is an optical head-mounted display that is designed in the shape of a pair of eyeglasses. It was developed with the mission of producing a ubiquitous computer. Google Glass displayed information in a smartphone-like hands-free format. Wearers communicated with the Internet via natural language voice commands.

Microsoft Hololens and Holographic Storage:

Windows Holographic is a mixed reality platform developed by Microsoft, built around the API of Windows 10.

Holographic works by enabling applications in which the live presentation of physical real-world elements is incorporated with that of virtual elements (referred to as "holograms" by Microsoft) such that they are perceived to exist together in a shared environment. A variant of Windows for augmented reality computers (which augment a real-world physical environment with virtual elements) Windows Holographic features an augmented-reality operating environment in which any Universal can run. In addition, with Windows Holographic Platform APIs, which are part of the Universal Windows Platform, and supported as standard in Windows 10 (including versions for mobile devices and Xbox One), mixed reality features can be readily implemented in any Universal Windows App, for a wide range of Windows 10-based devices.

The premier device for Windows Holographic, Microsoft Hololens is a smart-glasses headset that is a cordless, self-contained Windows 10 computer. It uses various sensors, a high-definition stereoscopic 3D optical head-mounted display, and spatial sound to allow for augmented reality applications, with a natural user interface that the user

interacts with through gaze, voice, and hand gestures. Codenamed "Project Baraboo," Hololens had been in development for five years before its announcement in 2015, but was conceived earlier as the original pitch made in late 2007 for what would become the Kinect technology platform.

Microsoft has targeted Hololens for release "in the Windows 10 timeframe," with the Microsoft Hololens Development Edition.. Companies such as Samsung Electronics and Asus had expressed interest in working with Microsoft to produce their own mixed-reality products based on Hololens.

The Microsoft Hololens design is of a visor glasses unit connected to an adjustable padded inner headband. The unit can be tilted up and down, as well as adjusted forward and backward in relation to the headband. To wear the HoloLens, the user uses an adjustment wheel at the back of the headband to secure it around the crown of their head, supporting the weight of the unit. The user then tilts the visor down in front of the eyes.

In the brow of the unit is much of the sensors and related hardware, including the cameras and processors. The visor front is tinted; enclosed in the visor piece is a pair of transparent combiner lenses, in which the projected images are displayed in the lower half. The HoloLens must be calibrated to the interpupillary distance (IPD) of the individual user.

Along the bottom edges of the side arms by wearer's ears are a pair of small red stereo speakers. As opposed to headphones, the speakers do not obstruct external sound, allowing the user to hear virtual sounds together with the real-world environment. Using head-related transfer functions, the HoloLens generates binaural audio, which can simulate spatial effects, such that the user can perceive a sound as coming from a specific location. On the top edge are two pairs of buttons: display brightness buttons above the left ear, and volume buttons above the right ear. Adjacent buttons are shaped differently—one concave, one convex—so that the user can distinguish them by touch.

At the end of the left arm is a power button and row of five tiny LEDs, which together are used to indicate system status, as well as for power management, indicating battery level and setting power/standby mode. A USB 2.0micro-B receptacle is located along the bottom edge. A 3.5 mm audio jack is located along the bottom edge of the right arm.

The HoloLens features an inertial measurement unit (IMU), four "environment understanding" cameras, an energy-efficient depth camera, a 2-megapixel photographic video camera, a four-microphone array, and an ambient light sensor. The inertial measurement unit includes an accelerometer, gyroscope, and a magnetometer.

In addition to a CPU and GPU, HoloLens features a Microsoft Holographic Processing Unit (HPU), a custom coprocessor by Microsoft. The HPU processes and integrates data from the sensors—handling tasks such as spatial mapping, gesture recognition, and voice and speech recognition. The combiner lenses of the HoloLens are optical waveguides consisting of three layers—for blue, green, and red—each with diffractive features. A "light engine" above each combiner lens projects light into the lens, a wavelength that then hits a diffractive element and reflects repeatedly along a layer until it is output to the eye. Similar to that of many other optical head-mounted displays, the display projection for the HoloLens occupies a limited portion of the user‘s field of view (FOV), particularly in comparison to virtual reality head-mounted displays, which typically cover a much greater field of view. Based on preliminary hardware, most observers have characterized the field of view of the HoloLens as small, though subjective estimates vary significantly. From the Build 2015 developer conference in May, one attendee estimated that the display field of view of the demonstration units was 30°×17.5°.The HoloLens contains an internal rechargeable battery. Battery life is rated at 2-3 hours of active use, or 2 weeks of standby time. The HoloLens can be operatedwhile charging. HoloLens features IEEE 802.11ac Wi-Fi and Bluetooth 4.1 Low Energy (LE) wireless connectivity. The headset uses Bluetooth LE to pair with the included Clicker, a thumb-operated finger-sized input device that can be used for interface scrolling and selecting. The Clicker features a clickable surface for selecting, and an orientation which provides for scrolling functions via tilting and panning of the unit. The Clicker features an elastic finger loop for holding the device, and a USB 2.0 micro-B receptacle for charging its internal battery.

Hololens Applications:

As of 2016, a number of augmented-reality applications have been announced or showcased for Microsoft HoloLens.

HoloStudio, a full-scale 3D modelling application by Microsoft with 3D print compatibility

Actiongram, an application for staging and recording short video clips of simple mixed-reality presentations using pre-made 3D virtual assets, will be released in summer 2016 in the United States and Canada.

- An implementation of the Skype telecommunications application by Microsoft
- HoloTour, an audiovisual three-dimensional virtual tourism application Fragments, a high-tech crime thriller adventure game developedby Microsoft and Asobo Studio, in which the player engages in crime-solving
- Young Conker, a platform game developed by Microsoft and Asobo Studio, featuring a young version of Conker the Squirrel
- RoboRaid (previously code-named "Project X-Ray"), an augmented-reality first-person shooter game by Microsoft in which the player defends against a robot

invasion, aiming the weapon via gaze, and shooting via the Clicker button or an air tap

Other applications announced or showcased for HoloLens include:

- An interactive digital human anatomy curriculum by Case Western Reserve University and Cleveland Clinic
- Architectural engineering software tools by Trimble Navigation
- A version of the Mojang video game *Minecraft*
- Extended functionality for the Autodesk Maya 3D creation application
- On Sight and Sidekick, software projects developed by collaboration between NASA and Microsoft to explore mixed reality applications in space exploration.
- Free Form, a joint project between Autodesk and Microsoft integrating HoloLens with the Autodesk Fusion 360 cloud-based 3D development application.
- *Galaxy Explorer*, an educational application about the Milky Way in development by Microsoft Studios, pitched and chosen by the developer community via the *Share Your Idea* campaign, and to be open-sourced upon completion
- A spacecraft design/visualization application in development by NASA's Jet Propulsion Laboratory (JPL)

Developed in collaboration with JPL, On Sight integrates data from the *Curiosity* rover into a 3D simulation of the Martian environment, which scientists around the world can visualize, interact with, and collaborate in together using HoloLens devices. On Sight can be used in mission planning, with users able to program rover activities by looking at a target within the simulation, and using gestures to pull up and select menu commands. JPL plans to deploy OnSight in *Curiosity* mission operations, using it to control rover activities by July 2015.

Interface of holography:

HoloLens features a natural user interface which the user interacts with using gaze, gesture, and voice inputs—sometimes referred to collectively as "GGV". Gaze tracking techniques such as head-tracking allow the user to bring application focus to whatever the user is looking at. Elements can be selected via an "air tap" gesture akin to clicking an imaginary mouse, with the hand raised in a pointing position, and tapping down on the element using the index finger The "tap" can be held for performing a "drag" function. Users can perform various actions via voice command.

The HoloLens shell carries over and adapts many elements from the Windows desktop environment. A "bloom" gesture for accessing the shell (performing a similar function to pressing a Windows key on a Windows keyboard or tablet, or the Xbox button on an Xbox One Controller) is performed by opening one's hand, fingers spread with the palm facing up. Windows can be dragged to a particular position, as well as resized. Virtual elements such as windows or menus can be "pinned" to locations, physical structures or objects within the environment; or can be "carried," or fixed in relation to the user, following the user as they move around. Title bars for application windows have a title on the left, and buttons for window management functions on the right.

Blade Servers:

A blade is literally a self-contained server, which collectively fits into an enclosure with other blades. Sometimes known as a chassis, this enclosure provides the power, cooling, connectivity, and management to each blade server. The blade servers themselves contain only the core processing elements, making them hot- swappable. HP refers to the entire package as a BladeSystem. To get a better idea of what a single blade contains, an HP ProLiant blade holds hot-plug hard-drives, Multiple I/O cards, memory, multi-function network interconnects, and Integrated Lights Out remote management. For additional storage, blades can connect to another storage blade or to a network attached SAN. In other words, blades can be whatever you need them to be. Use the blade savings of time, money, and energy costs to create a competitive advantage over your Competitors to achieve up to 68% reduction in data center costs over traditional rack environment, 90% reduction in downtime and speed delivery of new applications and services. HP BladeSystem is a modular infrastructure platform that converges server, storage and network fabric to accelerate operations and speeds delivery of applications and services running in physical, virtual, and cloud computing environments. Designed to optimize virtually any workload, it is managed by a consumer inspired Management platform that delivers unprecedented ease of use allowing you to deploy and manage your environment faster, at lower cost, and maximize productivity at any scale.

A blade server is a stripped down server computer with a modular design optimized to minimize the use of physical space and energy. Whereas a standard rack-mount server can function with (at least) a power cord and network cable, blade servers have many components removed to save space, minimize power consumption and other considerations, while still having all the functional components to be considered a computer. Unlike a rack-mount server, a blade server needs a blade enclosure.

A blade enclosure, which can hold multiple blade servers, provides services such as power, cooling, networking, various interconnects and management. In a *standard* server-rack configuration, one rack unit or 1U—19 inches (480 mm) wide and 1.75 inches (44 mm) Tall—defines the minimum possible size of any equipment. The principal benefit and justification of blade computing Relates to lifting this restriction so as to reduce size requirements. The most common computer rack form-factor is 42U high, which limits the number of discrete computer devices directly mountable in a rack to 42 components. Blades do not have

this limitation. As of 2014, densities of up to 180 servers per blade system (or 1440 servers per rack) are achievable with blade systems.

Blade servers are designed to overcome the space and energy restrictions of a typical data center environment. The blade enclosure, also known as chassis, caters to the power, cooling, network connectivity and management needs of each blade. Each blade server in an enclosure may be dedicated to a single application. A blade server can be used for tasks such as:

- File sharing
- Database and application hosting
- SSL encryption of Web communication
- Hosting virtual server platforms
- Streaming audio and video content

The components of a blade may vary depending on the manufacturer. Blade servers offer increased resiliency, efficiency, dynamic load handling and scalability. A blade enclosure pools, shares and optimizes power and cooling requirements across all the blade servers, resulting in multiple blades in a typical rack space. Some of the benefits of blade servers include:

- Reduced energy costs
- Reduced power and cooling expenses
- Space savings
- Reduced cabling
- Redundancy
- Increased storage capacity
- Reduced data center footprint
- Minimum administration
- Low total cost of ownership

Blade servers continue to evolve as a powerful computing solution, offering improvements in terms of modularity, performance and consolidation.

Blade enclosure:

Enclosure (or chassis) performs many of the non-core computing services found in most computers. Non-blade systems typically use bulky, hot and space-inefficient components, and may duplicate these across many computers that may or may not perform at capacity. By locating these services in one place and sharing them between the blade computers, the overall utilization becomes higher. The specifics of which services are provided may vary by vendor.

During operation, electrical and mechanical components produce heat, which a system must dissipate to ensure the proper functioning of its components. Most blade enclosures, like most computing systems, remove heat by using fans.

A frequently underestimated problem when designing high-performance computer systems involves the conflict between the amount of heat a system generates and the ability of its fans to remove the heat. The blades shared power and cooling means that it does not generate as much heat as traditional servers. Newer blade-enclosures

Feature variable-speed fans and control logic, or even liquid cooling systems that adjust to meet the systems cooling requirements. At the same time, the increased density of blade-server configurations can still result in higher overall demands for cooling with racks populated at over 50% full. This is especially true with early-generation blades. In absolute terms, a fully populated rack of blade servers is likely to require more cooling capacity than a fully populated rack of standard 1U servers. This is because one can fit up to 128 blade servers in the same rack that will only hold 42 1U rack mount servers.

Blade servers generally include integrated or optional network interface controllers for Ethernet or host adapters for Fibre Channel storage systems or converged network adapter to combine storage and data via one Fibre Channel over Ethernet interface. In many blades at least one interface is embedded on the motherboard and extra interfaces

Can be added using mezzanine cards. A blade enclosure can provide individual external ports to which each network interface on a blade will connect. Alternatively, a blade enclosure can aggregate network interfaces into interconnect devices (such as switches) built into the blade enclosure or in networking blades.

While computers typically use hard disks to store operating systems, applications and data, these are not necessarily required locally. Many storage connection methods (e.g. FireWire, SATA, E-SATA, SCSI, SAS DAS, FC and iSCSI) are readily moved outside the server, though not all are used in enterprise-level installations. Implementing these connection interfaces within the computer presents similar challenges to the networking

Interfaces (indeed iSCSI runs over the network interface), and similarly these can be removed from the blade and presented individually or aggregated either on the chassis or through other blades. The ability to boot the blade from a storage area network (SAN) allows for an entirely disk-free blade, an example of which implementation is the Intel Modular Server System.

Since blade enclosures provide a standard method for delivering basic services to computer devices, other types of Devices can also utilize blade enclosures. Blades providing switching, routing, storage, SAN and fibre-channel access can slot into the enclosure to provide these services to all members of the enclosure.

Systems administrators can use storage blades where a requirement exists for additional local storage.

With Great Software, comes Really Large Hardware Storage:

Cloud computing:

Cloud computing enables companies to consume compute resources as a utility -- just like electricity -- rather than having to build and maintain computing infrastructures in-house. Cloud computing promises several attractive benefits for businesses and end users. Three of the main benefits of cloud computing includes:

• Self-service provisioning: End users can spin up computing resources for almost any type of workload on-demand.

• Elasticity: Companies can scale up as computing needs increase and then scale down again as demands decrease.

• Pay per use: Computing resources are measured at a granular level, allowing users to pay only for the resources and workloads they use.

Cloud computing services can be private, publicor hybrid.

Private cloud services are delivered from a business' data center to internal users. This model offers versatility and convenience, while preserving management, control and security. Internal customers may or may not be billed for services through IT chargeback.

In the public cloud model, a third-party provider delivers the cloud service over the Internet. Public cloud services are sold on-demand, typically by the minute or the hour. Customers only pay for the CPU cycles, storage or bandwidth they

consume. Leading public cloud providers include Amazon Web Services (AWS), Microsoft Azure, IBM/Soft Layer and Google Compute Engine.

Hybrid cloud is a combination of public cloud services and on-premises private cloud – with orchestration and automation between the two. Companies can run mission-critical workloads or sensitive applications on the private cloud while using the public cloud for bursty workloads that must scale on-demand. The goal of hybrid cloud is to create a unified, automated, scalable environment which takes advantage of all that a public cloud infrastructure can provide, while still maintaining control over mission-critical data.

Although cloud computing has changed over time, it has always been divided into three broad service categories: infrastructure as a service (IaaS), platform as a service (PaaS) and software as service (SaaS).

IaaS providers such as AWS supply a virtual server instance and storage, as well as application program interfaces (APIs) that let users migrate workloads to a virtual machine (VM). Users have an allocated storage capacity and start, stop, access and configure the VM and storage as desired. IaaS providers offer small, medium, large, extra-large, and memory- or compute-optimized instances, in addition to customized instances, for various workload needs.

In the PaaS model, providers host development tools on their infrastructures. Users access those tools over the Internet using APIs, Web portals or gateway software. PaaS is used for general software development and many PaaS providers will host the software after it's developed. Common PaaS providers include Salesforce.com'sForce.com, Amazon Elastic Beanstalk and Google App Engine.

SaaS is a distribution model that delivers software applications over the Internet; these are often called Web services. Microsoft Office 365 is a SaaS offering for productivity software and email services. Users can access SaaS applications and services from any location using a computer or mobile device that has Internet access.

On-demand computing is a kind of Internet-based computing that provides shared processing resources and data to computers and other devices on demand. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources. Cloud computing and storage solutions provide users and enterprises with various capabilities to store and process their data in third-party data centers. It relies on sharing of resources to achieve coherence and economies of scale, similar to a utility over a network.

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort.

Proponents claim that cloud computing allows companies to avoid upfront infrastructure costs, and focus on projects that differentiate their businesses instead of on infrastructure. Proponents also claim that cloud computing allows enterprises to get their applications up and running faster, with improved manageability and less maintenance, and enables IT to more rapidly adjust resources to meet fluctuating and unpredictable business demand. Cloud providers typically use a "pay as you go" model. This can lead to unexpectedly high charges if administrators do not adapt to the cloud pricing model.

The present availability of high-capacity networks, low-cost computers and storage devices as well as the widespread adoption of hardware virtualization, service-oriented architecture, and autonomic and utility computing have led to a growth in cloud computing. Companies can scale up as

computing needs increase and then scale down again as demands decrease.

Cloud computing has become a highly demanded service or utility due to the advantages of high computing power, cheap cost of services, high performance, scalability, accessibility as well as availability. Some cloud vendors are experiencing growth rates of 50% per annum, but due to being in a stage of infancy, it still has pitfalls that need proper attention to make cloud computing services more reliable and user friendly.

BladeUPS

It is a modular three-phase UPS system consisting of individual 6U 12 kW UPS units which can be paralleled together to create up to a 60 kWN+1 redundant UPS. A feature of the BladeUPS is that the 6U cabinet houses both the UPS electronics and batteries; other modular systems house them separately. The high power density and 6U form factor of the BladeUPS are targeted at the growing power demands of IT servers and equipment, especially blade servers.

The BladeUPS does not fall into a defined category for UPS type as it is a hybrid of a line interactive and online architecture, which Eaton calls Double Conversion on Demand. During normal operation the BladeUPS operates as a line interactive UPS allowing it to be energy efficient. When power conditions fluctuate outside preset standards, the unit switches into online mode (also known as double conversion). Software upgrades by Eaton have allowed BladeUPS owners to defeat this hybrid architecture and force the unit to operate entirely in online (double conversion) mode.

Mouseless:

It is an invisible computer mouse that provides the familiarity of interaction of a physical mouse without actually needing a real hardware mouse. As the computer mouse has remained largely unchanged over the last decades, we have become increasingly proficient at operating the two-button mouse. Recently, various multitouch and gestural interaction technologies have been explored as means to implement alternative methods to interact with a computer. Despite these advances in computing hardware technologies, the two-button computer mouse has remained the predominant means to interact with a computer. The Mouseless invention removes the requirement of having a physical mouse altogether but still provides the intuitive interaction of a physical mouse that we are familiar with. Mouseless consists of an Infrared (IR) laser beam (with line cap) and an Infrared camera. Both IR laser and IR camera are embedded in the computer. The laser beam module is modified with a line cap and placed such that it creates a plane of IR laser just above the surface the computer sits on. The user cups their hand, as if a physical mouse was present underneath, and the laser beam lights up the hand which is in contact with the surface. The IR camera detects those bright IR blobs using computer vision. The change in the position and arrangements of these blobs are interpreted as mouse cursor movement and mouse clicks. As the user moves their hand the cursor on screen moves accordingly. When the user taps their index finger, the size of the blob changes and the camera recognizes the intended mouse click.

As we improve our computer vision algorithms, an extensive library of gestures could be implemented in addition to mouse movement and mouse clicks. Typical multitouch gestures, such as zooming in and out, as well as novel gestures, such as balling one‘s fist are all possible. In addition, the use of multiple laser beams would allow for recognition of a wider range of free hand motions, enabling novel gestures that the hardware mouse cannot support.

Nintendo Wii-mote:

The system the Wii Remote controller, which can be used as a handheld pointing device and which detects movement in three dimensions. Another notable feature of the console isWiiConnect24, which enables it to receive messages and updates over the Internet while in standby mode. It also features a game download service, called "Virtual Console", which features emulated games from past systems. Since its release, the Wii has spawned many peripheral devices, including the Wii Balance Board and Motion Plus, and has had several hardware revisions. The *Wii Family Edition* variant is identical to the original model, but is designed to sit horizontally and removes the GameCube compatibility.

Microsoft Kinect:

It is a line of motion sensing input devices by Microsoft forXbox 360 and Xbox One video game consoles and Windows PCs. Based around a webcam-style add-onperipheral, it enables users to control and interact with their console/computer without the need for a game controller, through a natural user interface using gestures and spoken commands. The first-generation Kinect was first introduced in November 2010 in an attempt to broaden Xbox 360's audience beyond its typical gamer base. A version for Windows was released on February 1, 2012. Kinect competes with several motion controllers on other home consoles, such as Wii Remote Plus for Wii and Wii U, PlayStation Move/PlayStation Eye for PlayStation 3, and PlayStation Camera for PlayStation 4.

Microsoft released the Kinect software development kit for Windows 7 on June 16, 2011. This SDK was meant to allow developers to write Kinecting apps in C++/CLI, C#, or Visual Basic .NET.

Kinect builds on software technology developed internally by Rare, a subsidiary of Studios owned by Microsoft, and on range camera technology by Israeli developer PrimeSense, which developed a system that can interpret specific gestures, making completely hands-free control of electronic devices possible by using

an infrared projector and camera and a special microchip to track the movement of objects and individuals in three dimensions. This 3D scanner system called *Light Coding* [1] employs a variant of image-based 3D reconstruction.

Kinect sensor is a horizontal bar connected to a small base with a motorized pivot and is designed to be positioned lengthwise above or below the video display. The device features an "RGB camera, depth sensor and multi-array microphonerunning proprietary software" which provide full-body 3D motion capture, facial recognition and recognition capabilities. At launch, voice recognition was only made available in Japan, United Kingdom, Canada and United States. Mainland Europe received the feature later in spring 2011. Currently voice recognition is supported in Australia, Canada, France, Germany, Ireland, Italy, Japan, Mexico, New Zealand, United Kingdom and United. Kinect sensor's microphone array enables Xbox 360 to conduct acoustic source localization and ambient noise suppression, allowing for things such as headset-free party chat over Xbox Live.

The depth sensor consists of an infrared laser projector combined with a monochrome CMOS sensor, which captures video data in 3D under any ambient light conditions. The sensing range of the depth sensor is adjustable, and Kinect software is capable of automatically calibrating the sensor based on gameplay and the player's physical environment, accommodating for the presence of furniture or other obstacles.

Described by Microsoft personnel as the primary innovation of Kinect, the software technology enables advanced gesture recognition, facial recognition and voice recognition. According to information supplied to retailers, Kinect is capable of simultaneously tracking up to six people, including two active players formations analysis with a feature extraction of 20 joints per player. However, PrimeSense has stated that the number of people the device can "see" (but not process as players) is only limited by how many will fit in the field-of-view of the camera.

Because the Kinect sensor's motorized tilt mechanism requires more power than the Xbox 360's USB ports can supply, the device makes use of a proprietary connector combining USB communication with additional power. Redesigned Xbox 360 Smodels include a special AUX port for accommodating the connector, while older models require a special power supply cable (included with the sensor) that splits the connection into separate USB and power connections; power is supplied from the mains by way of an AC adapter.

Xbox 360:

It is a home video game console developed by Microsoft. As the successor to the original Xbox, it is the second console in the Xbox series. The Xbox 360 competes with Sony's PlayStation 3 and Nintendo's Wii as part of theseventh generation of video game consoles. The Xbox 360 was officially unveiled on MTV on May 12, 2005, with detailed launch and game information divulged later that month at the Electronic Entertainment Expo (E3).

The Xbox 360 features an online service, Xbox Live, which was expanded from its previous iteration on the original Xbox and received regular updates during the console's lifetime. Available in free and subscription-based varieties, Xbox Live allows users to: play games online; download games (through Xbox Live Arcade) and game demos; purchase and stream music, television programs, and films through the Xbox Music and Xbox Video portals; and access third-party content services through media streaming applications. In addition to online multimedia features, the Xbox 360 allows users to stream media from local PCs.
Several peripherals have been released, including wireless controllers, expandedhard drive storage, and the Kinect motion sensing camera. The release of these additional services and peripherals helped the Xbox brand grow from gaming-only to encompassing all multimedia, turning it into a hub for living-room computing entertainment.

Launched worldwide across 2005–2006, the Xbox 360 was initially in short supply in many regions, including North America and Europe. The earliest versions of the console suffered from a high failure rate, indicated by the so-called "Red Ring of Death", necessitating an extension of the device's warranty period. Microsoft released two redesigned models of the console: the *Xbox 360 S* in 2010 and the *Xbox 360 E* in 2013. As of June 2014, 84 million Xbox 360 consoles have been sold worldwide, making it the sixth-highest-selling video game console in history, and the highest-selling console made by an American company. Although not the best-selling console of its generation, the Xbox 360 was deemed by TechRadar to be the most influential through its emphasis on digital media distribution and multiplayer gaming on Xbox Live

MATHEMATICAL MODEL:

TABLES, PROGRAMS AND SAMPLE APP ANALYSIS

A. No touch Networking:

For automated network deployment to work, there needs to be some form of networking already in place so the new switches can download their updated code and grab their configuration template.

As a result, a small part of the network still does need to be built by hand. This is typically a small-ish firewall connected to what we call our ―out of band‖ (OOB) internet link, plus a few switches to provide connectivity to the management ports of our switches. These devices have a very basic configuration, so it's easy to copy and paste it and get some initial connectivity.

Additionally, we need to know the MAC address of each switch, which is printed on the side of the chassis. Fortunately, we have a fantastic datacenter team that flies all over the world to do all the physical labor involved with deploying a new location. These folks have racking and stacking down to a fine art and part of their process is to note down the MAC address of each switch they are racking into a file for use later on.

B. The Fast Way, Zero Touch Provisioning

The actual automation of the building process is known as Zero Touch Provisioning (ZTP). Most major networking vendors have some form of ZTP support, and the process is pretty simple. There are a few specific configurations needed on the ZTP server to make everything work.

1) Setting up DHCP

First, we need a DHCP server. We use good old ISC DHCP running on a Ubuntu server, and configure it to give the switch the information it needs once it boots up. This is the top of our

Dhpcd.conf FILE:

Option ztp-file-server code 150 = {ip-address};

Option space ZTP;

Option ZTP.image-file-name code 0 = text;

Option ZTP.config-file-name code 1 = text;

Option ZTP.image-file-type code 2 = text;

Option ZTP.transfer-mode code 3 = text;

Option ZTP-encap code 43 = encapsulate ZTP;

Option ztp-file-server 10.126.1.1;

Option ZTP.image-file-name "/software/switch-image-file.tgz";

Option ZTP.transfer-mode "http";

This basically tells a switch what it needs to know to grab its template and where to grab its updated software.

The next bit of the Dhpcd.conf file looks similar to this:

```
Group {
    Host tor1-spine1 {
    Hardware Ethernet          5C:45:27:23:2F:01;
    Fixed-address              10.200.72.138;
    Option routers             10.200.72.129;
    Option subnet-mask         255.255.255.192;
    Option ZTP.config-file-name "/tor1-spine1.config";
    }
}
```

This is where the MAC address from the side of the switches' chassis comes into play. We need each switch to pull down the correct configuration template, so the MAC address is used to identify the switch. The Dhpcd.conf file will have an entry like the one above for every single switch that we want to ZTP.

Because creating a entry for 50 or so switches would be pretty annoying, we also automate this using simple Python script which spits out the appropriate Dhpcd.conf file containing all the correct MAC addresses and IP addresses.

2) Configuration Templates

For this process to be fully automated, each new switch needs to have a configuration template ready to go. To make this happen, we use the Jinja2 templating software and some

Python, which makes it easy to create a whole bunch of templates quickly. We create a template for every device that is going to be deployed and upload the templates to the ZTP server.

C. Voila!

The switch boots up and sends out a DHCP request, which the OOB firewall relays to the ZTP server. The switch then grabs its config template, downloads its software, and that‘s it!

Here is the console output from a real Juniper QFX switch going through the process:

Root>

Auto Image Upgrade: DHCP Client Bound interfaces:

Auto Image Upgrade: DHCP Client Unbound interfaces: irb.0 vme.0 et-0/0/0.0 e

t-0/0/1.0 et-0/0/2.0 et-0/0/3.0 et-0/0/4.0 et-0/0/5.0 et-0/0/6.0 et-0/0/7

.0 et-0/0/8.0 et-0/0/9.0 et-0/0/10.0 et-0/0/11.0 et-0/0/12.0 et-0/0/13.0

et-0/0/14.0 et-0/0/15.0 et-0/0/16.0 et-0/0/17.0 et-0/0/18.0 et-0/0/19.0

et-0/0/20.0 et-0/0/21.0 et-0/0/22.0 et-0/0/23.0 et-0/1/0.0 et-0/1/1.0 et-

0/1/2.0 et-0/1/3.0 et-0/2/0.0 et-0/2/1.0

Auto Image Upgrade: No DHCP Client in bound state, reset all enabled DHCP clients

Auto Image Upgrade: DHCP Options for client interface vme.0:

ConfigFile: /nyc3-spine3.config

Image File: /jinstall-qfx-5-13.2X51-D35.3-domestic-signed.tgz

Gateway: 10.198.73.129

File Server: 10.1.2.3

Options state: All options set

Auto Image Upgrade: DHCP Client Bound interfaces: vme.0

Auto Image Upgrade: Active on client interface: vme.0

Auto Image Upgrade: Interface: "vme"

Auto Image Upgrade: Server: "10.1.2.3"

Auto Image Upgrade: Image File: "jinstall-qfx-5-13.2X51-D35.3-domestic-signed

.tgz"

Auto Image Upgrade: Config File:: "nyc3-spine3.config"

Auto Image Upgrade: Gateway:: "10.198.73.129"

Auto Image Upgrade: Protocol:: "http"

Auto Image Upgrade: Start fetching nyc3-a1-spine3.config file from server 10.1.2.3 through vme using http

Auto Image Upgrade: File nyc3-spine3.config fetched from server 10.1.2.3 through vme

Auto Image Upgrade: Start fetching jinstall-qfx-5-13.2X51-D35.3-domestic-signed

.tgz files from server 10.1.2.3 through vme using http

On successful image installation, system will reboot automatically with the old process, it would take a full day of work to build 50 switches. With the new process, it takes 5 minutes, and the longest part is just waiting for the switch to reboot for its software update.

Instead of manually logging into each device, we now set up a ZTP server, upload the configuration templates, then sit back and watch the network build itself.

Single module		Runtime in minutes				
Load kW	**Load %**	**Internal battery**	**+1 EBM**	**+2 EBM**	**+3 EBM**	**+4 EBM**
12	100	4.7	9.5	17	27	34
11	92	5.4	10.9	20	30	38
10	83	6.2	13	22	33	42
9	75	7.3	15	24	38	48
8	67	8.7	18	28	43	55
7	58	10.7	23	32	50	64
6	50	13.6	27	42	60	76
5	42	18.5	33	51	73	94
4	33	23	42	66	94	120
3	25	30	56	89	128	165
2	17	44	85	137	199	258

Table 1.1: Up to four extended battery modules can be connected to each BladeUPS providing additional runtime to Zero touch supporting computers:

ReactiVision deployments in music tables and usage of fiducial markers statistics:

MixiTUI

It is a tangible sequencer that allows electronic musicians to import and perform electronic music. MixiTUI is developed in collaboration with electronic musicians, with a focus on live arranging, on visualizations of music, on tokens that represent key elements in live performances, and on how the audience experiences the tangible interface.

Dubtable

The Dubtable is an interactive tactile mixing table. It's an intuitive interface that invites the user to twist, crush and mash sounds together to make all new music. Anyone can participate and mix a track, dub out with delays and make a toon! Influenced by the simple but strange mixing techniques of early dub pioneers such as Lee Scratch and King Tubby, The Dubtable is based on reggae sounds, and provides a raw interface to explore and develop the making of song through mixes.

SoundStrukt:

The Soundstrukt project evolved around the concept of sound motifs, each form corresponds to a sound with a sonic and graphical identity. Through the tangible media the user is thus led to create extensible sound patterns, by using the "loop" object these sound patterns may overlap. This set of sonic layers makes it possible to construct complex music from simple sound structures. The control surface becomes both a visual and audible moving picture.

Blues Machine:

The blues machine is a multitouch, tangible interface for blues lovers. The interface features a multitouch surface with an attached string controller, which allows the simplified performance of music within the blues scale. The redundant string interface provides useful additional haptic feedback to the player.

Molekül3000:

Molekül3000 is a tangible live-midi-sequenzer in the shape of an interactive table. It is possible to connect up to 16 sound generators to the table, which then can be controlled using clip and controller objects, which are placed, turned or moven on the table surface. Clip objects, which are placed on the table, can be programmed with melodies using the built in keyboard. Programmed clip objects can be triggered using a push-button and then send their note sequence to the sound generator. The controller objects allow changing parameters such as loudness, filter cutoff or pitch of each clip. Molekül3000 allows the musician a new way to interact

with loop-based live music and should invite to experimentation.

Noteput:

Note put is an interactive music table with tangible notes that combines all three senses of hearing, sight and touch to make learning the classical notation of music for children and pupils more easy and interesting. All basic clefs, note values and accidentals exist as single wood elements. Whole, half, quarter and eighth notes differ not only in their form, but also in their weight: Long note values are heavier than short ones. The table has two modes: A standard mode, where you can place notes on the table in a playful and experimental way and explore the related music outcome. And exercise modes, where exercises and tutorials sort by topic and difficulties have to be mastered.

Other such tangible musical interfaces:

Bricktable

―Weather Report‖ is the first piece of custom software to explore the uses of the Brick Table. It is a sonification piece intended to take some sort of data, and use it in a meaningful and musical way. When you look at Brick Tables screen, you will see a colorful map of the U.S., which is showing the current surface temperature of the United States. Split sectionally/regionally across the screen is 9 different audio loops. The user has three puck-like objects that can be used in different ways to create music.

Looplex

LOOPLEX is a tangible user interface prototype for live sound interaction based on reacTIVision, MaxMSP, Ableton Live and Arduino. The generated tracking data is received by the MaxMSP TUIO-Client and converted into Midi NoteOn/Off and Midi CC-Data depending on the object angle. This Midi-Data is mapped within Ableton Live for triggering Audio-Loops or Effects. While triggering an Audio-Clip in Ableton Live a Midi-Clip containing Note-On/Off and Pitchbends is triggered simultaneously and routed to MaxMSP. This information controls 6 coloured LEDs (2xRGB) connected to the 6 digital PWM-Ports on the Arduino board, allowing simple on/off states, smooth colour changes and additive colour processing.

Cheesynthesis:

Chessynthesis is a performance project. It consists in a classical chess game, with a chessboard and 32 pieces, but a captation system analyzes the position and the evolution of the gameplay, and transcode it to sound. At the start of the game, you can see two players in the front of a chessboard, and you hear a little and soft sound. When the first player starts to move a piece, you can hear the dynamic variation of his moving. The goal is to reinterpret each tactical and strategical position in a sonic and harmonic way.

DasReactbal:

"There is no absolute control, but rather a small dose of chaos which stimulates creativity". Institut FATIMA applies this idea to "The Reacball System," in which a football, a camera, a computer and a MIDI controller generate a remix of sounds, samples and slips. The ball generates random sequences of MIDI notes which de-control a musical arrangement. The MIDI controller rearranges the chaos dialectically.

Dominotes:

Dominotes is an interactive multi-user installation that adds a musical dimension to a traditional game transporting it to a new level. The game of dominoes is a classic that instills a sense of nostalgia in people. Although it may be a new game for some, it is its simplicity and familiarity that appeals to us. Everyone plays it in their own way.

Harmonia:

Harmonia came from Pythagorean principle of Harmonia believed that each element was structured by a different harmony: earth is a cube, fire a pyramid, water an icosahedron, air a triangle. The world was not dominated by forces, but rather arranged in an orderly and structured (mathematical) way. Basically everything has a mathematical form. That principle can certainly be applied to my sound visualization's fundamental concept. There are two versions of Harmonia: Each object in version one has its own center in circle and this means it does not produce any change of speed. However, every object in version two have one unchangeable center in one big circle and velocity can be changed depending on their objects' existences on x, y axis.

Wave Table:

An audio waveform editor that can be operated in real time through a tabletop interface. The system combines multi-touch and tangible interaction techniques in order to implement the metaphor of a toolkit that allows direct manipulation of a sound sample. The resulting instrument is well suited for live performance based on evolving loops.

Live Composer:

Physical blocks (with Fiducial Symbols) are moved around on a table and they correlate to time and pitch. Moving the blocks creates a visual in flash which notates and plays back the composition in real-time. Moving vertically changes the pitch, while moving horizontally changes the order of these notes over time

Etiquette:

Etiquette is an ambitious interactive audio installation commissioned by the Edinburgh Sculpture Workshop (ESW)

ExploraTune:

ExploraTune is a musical toy that allows you to create fun and meaningful compositions. It helps you to recognize new musical instruments and to learn how they interact with one another. ExploraTune can be played alone or with friends. ExploraTune is easy to use! You simply pick an instrument tile and place it on the table. When the music reaches your column it will play the tile you placed. The light indicates which column the table is currently playing. The table plays all tiles in the same column. Each column represents 1 beat in a 4 beat measure. There are 16 columns on the table. The table plays 1 column at a time, from left to right, and repeats when it reaches the end.

SocialSoundmachine:

The Social Sound machine is an interactive multi-touch installation, which connects people by enabling them to collaborate on music. Using a clear user interface with tangible objects, they create a unique musical track from a variety of samples and sound effects.

I.M. Table:

Interactive media table is a multiuser musical instrument that helps multiple artists to create music by moving special markers on the table's surface.

FINDINGS FROM THE STUDY AND CONCLUSION:

There needs to be very specific hardware-software compatibility for any human-computer interaction to be made possible.

The present focus is only on upgrading present technologies and no larger improvements just to keep the economy of tech companies rolling superficially by phasing about upgrades year after year and frustration of customers leading to piracy.

There needs to be a drastic changeover in the present human-computer interactions and progression towards a new and different dimension and generation of computing is highly required.

The author proposes existing as well as upcoming ideas and principles relating to technological developments in all the tangible computer components and computational surfaces to progress into a new era of touch and then further progress to the near future with the excitement and convenience of ZERO-TOUCH, multiple gesture control mechanisms making such systems more human friendly, feasible and affordable for wider public use.

The idea underlines detail study and analysis to integrate foldable, projectable, multi touch platforms, with integration of augmented and virtual reality components, supported by hi-tech hardware components, cloud storage, blade servers, power systems, and a new dimensioning to the creation of music which serves as a vital source of entertainment all over.

The topic is worth reading with great detail with combinations of every proposed solution to develop the most interactive computer ever made in human history with zero touch surfaces, cloud stores, and wearable gadgets all functioning at one go, well integrated to show what the new dimension of computing has plenty in it to amaze us out of our senses.

References

[1] http://www.polycom.co.in/products-services/voice/applications/polycom-zero-touch-provisioning

[2] https://technet.microsoft.com/en-us/library/dd919178(v=ws.0).aspx

[3] http://www.networkworld.com/article/2876096/ethernet - switch/zero-touch-provisioning-can-help-the-network-world-catch-up-to-server-advances.html

[4] http://www.juniper.net/documentation/en_US/junos14.1 /topics/concept/software-image-and-configuration-automatic-provisioning-understanding.

[5] http://ecologylab.net/research/bodyBased/

[6] https://www.arista.com/en/products/eos/automation

[7] http://www.exceedgulf.com/pdf/zero-touch.pdf

[8] Webb, A.M., Pen + Touch Diagramming to Stimulate Design Ideation, Proc. ACM Creativity and Cognition 2015, Graduate Symposium, 331-332.

[9] http://dx.doi.org/10.1145/2757226.2764766

[10] Stenner, J., Kerne, A., Williams, Y., Playas: Homeland Mirage, Proc ACM Multimedia 2005, 1057-1058.

[11] Schiphorst, T., Kozel, S., Andersen, K., Jaffe, N., Mah, S., Kerne, A., Lovell, R., Tolmie, J., whisper. Dutch Electronic Arts Festival (DEAF) 2003, Rotterdam, The Netherlands.

[12] Lupfer, N., Hamiliton, W. Webb, A.M., Linder, R., Edmonds, E., and Kerne, A., The Art.CHI Gallery: An Embodied Iterative Curation Experience, Interactivity Exhibit, Proc CHI 2015 EA.

[13] http://dx.doi.org/10.1145/2702613.2725457

[14] Alley, E. Cooper, T., Graeber, R., Kerne, A., Overby, K., Toups, Z., Censor Chair: Exploring Censorship and Social Presence through Psychophysiological Sensing, Proc ACM Multimedia 2005, 922-929.

[15] Stenner, J., Kerne, A., Williams, Y., Playas: Homeland Mirage, ISEA/Zero One, Aug 2006: San Jose.

[16] Webb, A.M. and Kerne, A., Embodying Diagramming through Pen + Touch Gestures, CHI 2014 Workshop: Gesture Interaction Design: Communication and Cognition, Toronto, Canada.

[17] Fei, S., Webb, A.M., Kerne, A., Qu, Y., and Jain, A., Peripheral Array of Tangible NFC Tags: Positioning Portals for Embodied Trans-Surface Interaction, Proc. Interactive Tabletops and Surfaces 2013, [29%].

[18] http://dx.doi.org/10.1145/2512349.2512820

[19] Hamilton, W., Kerne, A., and Robbins, T., High-Performance Pen + Touch Modality Interactions: A Real-Time Strategy Game eSports Context, Proc. UIST 2012, Cambridge, MA, USA, OCT 2012.

[20] Kerne, A., Hamilton, W., Toups, Z. Culturally Based Design: Embodying Trans-Surface Interaction in Rummy Proc CSCW 2012, in press [top 9%].

[21] Damaraju, S., Kerne, A., Comparing Multi-Touch Interaction Techniques for Manipulation of an Abstract Parameter Space, accepted to Proc. International Conference on Multimodal Interaction (ICMI) 2011.

[22] Moeller, J. and Kerne, A., ZeroTouch: A Zero-Thickness Optical Multi-Touch Force Field, CHI Interactivity -- Extended Abstracts of the 29th International Conference on Human factors in computing systems, May 7-12, 2011, Vancouver, BC, CA.

[23] Moeller, J., Lupfer, N., Hamilton, B., Lin, H., Kerne, A., intangible Canvas: Free-Air Finger Painting on a Projected Canvas , CHI Works-in-Progress -- Extended Abstracts of the 29th International Conference on Human factors in computing systems, May 7-12, 2011, Vancouver, BC, CA.

[24] Moeller, J. and Kerne, A., Scanning FTIR: Unobtrusive Multi-Touch Sensing through Waveguide Transmissivity Imaging, Proceedings of the 4th International Conference on Tangible, Embedded and Embodied Interaction, Cambridge, MA, Janurary 25-27 2010.

[25] Damaraju, S., Kerne, A. Multitouch Gesture Learning and Recognition System. , Extended Abstracts of IEEE Workshop on Tabletops and Interactive Surfaces, Amsterdam, Netherlands, 1-3 October 2008.

[26] Webb, A., Kerne, A., Koh, E., Joshi, P., Park, Y., Graeber, R., Choreographic Buttons: Promoting Social Interaction through Human Movement and Clear Affordances, Proc ACM Multimedia 2006, 451-460 [16%].

[27] http://dx.doi.org/10.1145/1180639.1180731

[28] Toups, Z., Overby, K., Kerne, A., Graeber, R., Cooper, T., Alley, E., Censor Chair, ACM SIGCHI Intl Conf on Advances in Computer Entertainment

[29] J. Williams, ―Narrow-band analyzer (Thesis or Dissertation style),‖ Ph.D. dissertation, Dept. Elect. Eng., Harvard Univ., Cambridge, MA, 1993.

[30] N. Kawasaki, ―Parametric study of thermal and chemical nonequilibrium nozzle flow,‖ M.S. thesis, Dept. Electron. Eng., Osaka Univ., Osaka, Japan, 1993.

[31] J. P. Wilkinson, ―Nonlinear resonant circuit devices (Patent style),‖ U.S. Patent 3 624 12, July 16, 1990.

[32] *IEEE Criteria for Class IE Electric Systems* (Standards style), IEEE Standard 308, 1969.

[33] *Letter Symbols for Quantities*, ANSI Standard Y10.5-1968.

[34] R. E. Haskell and C. T. Case, ―Transient signal propagation in lossless isotropic plasmas (Report style),‖ USAF Cambridge Res. Lab., Cambridge, MA Rep. ARCRL-66-234 (II), 1994, vol. 2.

[35] E. E. Reber, R. L. Michell, and C. J. Carter, ―Oxygen absorption in the Earth‘s atmosphere,‖ Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (420-46)-3, Nov. 1988.

[36] (Handbook style) *Transmission Systems for Communications*, 3rd ed., Western Electric Co., Winston-Salem, NC, 1985, pp. 44–60. *Motorola Semiconductor Data Manual*, Motorola Semiconductor Products Inc., Phoenix, AZ, 1989.

[37] (Basic Book/Monograph Online Sources) J. K. Author. (year, month, day). *Title* (edition) [Type of medium]. Volume(issue). Available: http://www.(URL)

[38] R. J. Vidmar. (1992, August). On the use of atmospheric plasmas as electromagnetic reflectors. *IEEE Trans.*