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BROADBAND SATELLITE TECHNOLOGY

On planes, trains, ships, and automobiles, from consumer living rooms to corporate boardrooms, the advent of 30-100 Gbps connectivity via satellite will redefine broadband access. Indeed, more than half of the world's satellite operators have ordered (or plan to order) high-capacity satellites, and 14 million households and 50% of enterprise terminals are predicted to be using high-capacity satellite platforms by 2020. Part of this is due to pure economics associated with the cost of such services.

For example, some broadcasters have seen the price of satellite news feed slide from more than $100,000 to less than $20,000 an 80% reduction in price. The other driving factor, however, is the desire by various market segments to access any service, anytime, anywhere. From this perspective, satellite boasts some significant advantages.

Emergency responders have powerful new options to deploy after disasters. Wireless operators are broadening their footprint and tapping markets that were previously unreachable through satellite back haul. And for consumers in particular, this is all good news as well. These days, regardless of proximity to major population centers, affordable broadband connectivity is within reach of everyone.

High Throughput Satellite (HTS)

A high throughput satellite (HTS) is a classification for communications satellites that provide at least twice (and often 20 times or more) the nominal throughput of a classic satellite in the same amount of orbital frequency spectrum. Packing more bits into the same frequency spectrum significantly reduces the cost per bit. Leading-edge technologies such as ViaSat-1 and EchoStar XVII (also known as Jupiter-1) are capable of providing more than 100 Gbit/s of carrying capacity. Stated another way, this technology represents more than 100 times the capacity offered by a conventional Ku-band satellite.

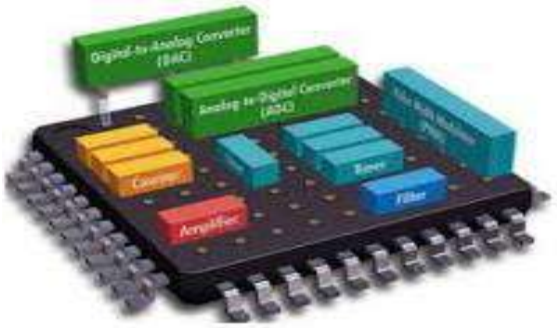
HTS opens up a wealth of opportunity for a wide range of applications, often in locations that were previously unreachable. Consider the Internet service that you like to access while on a long flight. United Airlines is in fact discussing plans to use Ka and Ku-band satellite for in-flight connectivity. International consulting firm Euro consult cites such connectivity as strong growth. Many other applications are already benefiting from HTS based on the ability to get wide bandwidth, anywhere. In the consumer market, HTS provides broadband access where otherwise

there just isn't any, as well as a competitive alternative to existing broadband services.

S.GOKUL

II B.Sc. (Computer Technology)

EMBEDDED SYSTEM



An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today. Ninety-eight percent of all microprocessors are manufactured as components of embedded systems.

Typically embedded computers when compared with general-purpose counterparts are low power consumption, small size, rugged operating ranges, and low per-unit cost. This comes at the price of limited processing resources, which make them significantly more difficult to program and to interact with. However, by building intelligence mechanisms on top of the hardware, taking advantage of possible existing sensors and the existence of a network of embedded units, one can both optimally manage available resources at the unit and network levels as well as provide augmented functions, well beyond those available. For example, intelligent techniques can be designed to manage power consumption of embedded systems.

Modern embedded systems are often based on microcontrollers (i.e. CPU's with integrated memory or peripheral interfaces), but ordinary microprocessors (using external chips for memory and peripheral interface circuits) are also common, especially in more-complex systems. In either case, the processor(s) used may be types ranging from general purpose to those specialized in certain class of computations or even custom designed for the application at hand. A common standard class of dedicated processors is the digital signal processor (DSP).

Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

Embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, and largely

complex systems like hybrid vehicles, MRI, and avionics. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

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HACK (PROGRAMMING LANGUAGE)

Hack is a programming language for the HipHop Virtual Machine (HHVM), created by Facebook as a dialect of PHP. The language implementation is open-source, licensed under the BSD License. Hack allows programmers to use both dynamic typing and static typing. This kind of a type system is called gradual typing, which is also implemented in other programming languages such as ActionScript. Hack's type system allows types to be specified for function arguments, function return values, and class properties, types of local variables are always inferred and cannot be specified.

History

Hack was introduced on March 20, 2014. Before the announcement of the new programming language, Facebook had already implemented the code and "battle tested" it on a large portion of its web site.

Features

Hack is designed to interoperate seamlessly with PHP, which is a widely used open-source general-purpose scripting language that was designed for web development and can be embedded into HTML. A majority of valid PHP scripts are also valid in Hack; however, numerous less frequently used PHP features and language constructs are not supported in Hack. Hack extends the type hinting available in PHP 5 through the introduction of static typing, by adding new type hints (for example, for scalar types such as integer or string), as well as by extending the use of type hints (for example, for class properties or function return values). However, types of local variables cannot be specified. Since Hack uses a gradual typing system, in the default mode, type annotations are not mandatory even in places they cannot be inferred; the type system will assume the author is correct and admit the code. However, a "strict" mode is available which requires such annotations, and thus enforces fully sound code.

Syntax and Semantics

The basic file structure of a Hack script is similar to a PHP script with a few changes. A Hack file starts with <?hh as opposed to <?php for a PHP script:

```
<?hh
echo 'Hello World';
```

The above script, similar to PHP, will be executed and the following output is sent to the browser:

Hello World

An important point to note is that unlike PHP, Hack and HTML code do not mix. Normally you can mix PHP and HTML code together in the same file, like this:

```
<html>
  <head>
    <title>PHP Test</title>
  </head>
  <body>
    <!-- hh and html do not mix -->
    <?php echo '<p>Hello World</p>'; ?>
  </body>
</html>
```

This type of code is not supported by Hack, either XHP or another template engine needs to be used.

Functions

Hack allows types to be specified for function arguments and function return values. Functions in Hack are thus annotated with types like the following:

```
<?hh
// Hack functions are annotated with types.
function negate(bool $x): bool {
  return !$x;}
```

K.NISHANTHAN

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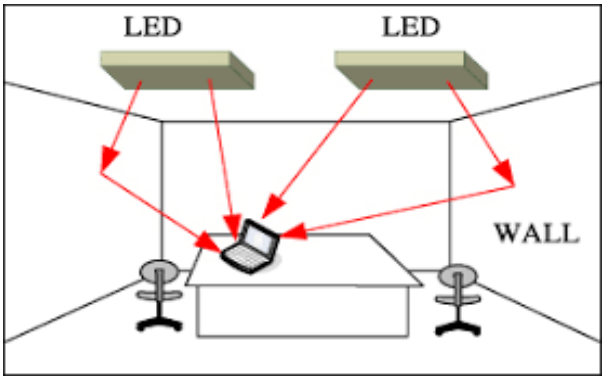
OPTICAL WIRELESS COMMUNICATIONS



Optical wireless communications (OWC) is a form of optical communication in which unguided visible, infrared (IR), or ultraviolet (UV) light is used to carry a signal. OWC systems operating in the visible band (390–750 nm) are commonly referred to as visible light communication (VLC). VLC systems take advantage of light emitting diodes (LEDs) which can be pulsed at very high speeds without noticeable effect on the lighting output and human eye.

VLC can be possibly used in a wide range of applications including wireless local area networks, wireless personal area networks and vehicular networks among others. On the other hand, terrestrial point-to-point OWC systems, also known as the free space optical (FSO) systems, operate at the near IR frequencies (750 - 1600 nm). These systems typically use laser transmitters and offer a cost-effective protocol-transparent link with high data rates, i.e., 10 Gbit/s per wavelength, and provide a potential solution for the backhaul

bottleneck. There has also been a growing interest on ultraviolet communication (UVC) as a result of recent progress in solid state optical sources/detectors operating within solar-blind UV spectrum (200 - 280 nm). In this so-called deep UV band, solar radiation is negligible at the ground level and this makes possible the design of photon-counting detectors with wide field-of-view receivers that increase the received energy with little additional background noise. Such designs are particularly useful for outdoor non-line-of-sight configurations to support low power short-range UVC such as in wireless sensor and ad-hoc networks.

B.NAGARATHINAM

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MARKETING TOOLS TO IMPROVE THE BLOGGING EFFORTS

The year 2017 will be a big year for content marketing, with brands focusing on better ways to reach a wide audience. Marketers have spent enough time honing their content marketing strategies over the past few years and they now look for more sophisticated ways to drive traffic. As brands prepare to step up their marketing games in 2017, it's more important than ever that they have the right tools for the job. There are 20 tools that will help to improve the business blog to the next level in 2017.

HubSpot's Blog Topic Generator

If you try to generate consistent blog content, you may find ideas are the biggest challenge. HubSpot provides this Blog Topic Generator to help.

Feedly

Another way to come up with ideas is to keep an eye on what's trending. Feedly gives the regular helping of the latest news specific to your subject matter interests.

WordPress Editorial Calendar

Top content marketers use editorial calendars to plan and manage posts. WordPress's plugin is a free tool that can help.

Guestpost

In 2017, marketers that win at content marketing will have the tools necessary to amplify their messages. Guestpost helps brands find influencers to help spread the word.

Brandpoint Hub

If your content marketing efforts feel chaotic, Brandpoint Hub may be the best tool.

The platform lets you plan, create, and publish content, monitoring the results.

Google Suggested Content

If you use Google Docs, check out its Suggested Content feature, which offers Google search results related to the content on your page.

Chartbeat

You'll never meet your blog readers in person, but with Chartbeat you can learn more about how they're interacting with your content.

StockSnap.io

Images are essential to capture audience attention. StockSnap.io helps you locate high-resolution images you can use for free.

Contactually

Your blogging efforts will be far more effective if you can turn readers into contacts. Contactually helps you organize the leads that come through your website and blog.

Outbrain

If you're willing to pay to amplify your message, Outbrain is a resource to consider. Your blog posts will appear as suggested content on many popular sites.

Long Tail Pro

Each blog post should be carefully strategized for optimum placement in Google search rankings. Long Tail Pro will help you come up with the perfect long tail keywords.

Readability Test Tool

One of the biggest challenges for professionals is breaking down concepts in an easy-to-understand way. The Readability Test Tool gives feedback on the grade level of each piece of content.

Portent Content Idea Generator

Coming up with great titles can be challenging, but the Portent Content Idea Generator makes it slightly fun.

Synthesis

Once your traffic begins to build, you'll need a web host that can manage high traffic volumes without a glitch. Synthesis promises to handle twice the traffic while using only one-eighth of the bandwidth.

Headline Analyzer

Even the best blog post won't get clicks without a compelling title. Headline Analyzer takes a look at your potential headlines and helps you improve them.

Jetpack

Keeping up with your WordPress stats is a must. Jetpack provides insight into your blog, including visitor numbers and post popularity.

Polldaddy

You can make your blog posts more interactive by conducting polls, using the results to come up with additional content. Polldaddy makes it easy to create polls and share them on your site.

WordPress Theme Detector

If you've ever seen a WordPress site with a theme you want, WordPress Theme Detector is your tool.

Focus Booster

Focus Booster is the perfect tool if you have trouble staying on track when you're creating content for your blog. As a bonus, it tracks the time you spend working if you need the information for billing.

Add from Server

If you regularly need to import media and files into your WordPress blog, Add from Server is a must-have solution. Using this tool, you can import files you've uploaded to your server directly into WordPress.

Whether you're starting a new blog or taking an existing blog to the next level, these content marketing tools can help. As businesses of all sizes grow more knowledgeable, it will be more important than ever for brands to use the best tools available to push their content ahead of the competition.

T. DHARINI
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DIGITAL INTELLIGENCE IN THE DIGITAL AGE

The IT world has changed remarkably since the 1960s. Back then, IT focused primarily on automation and reducing costs. IT was its own department squirreled away in another part of the building. It was not well integrated with business functions, and did not matter as much strategically to overall business operations.

Now, IT permeates every level of business operations, requiring well-structured integration and synchronization, says Sunil Mithas of the Robert H. Smith School of Business and F. Warren McFarlan of Harvard Business School.

"Digital intelligence is more than being able to work with computers or IT. It involves an understanding of how to synchronize business and IT strategies, govern IT, and execute IT projects and enterprise systems," Mithas writes.

Envision IT

IT can have a significant impact on an organization. Companies can thrive or implode based on how they manage their IT. "CEMEX, Zara, Capital One, and Amazon all demonstrate how IT and information-based capabilities helped firms create sustainable value in widely differing industries and ways. Conversely, companies such as FoxMeyer Drug, Blockbuster, and Borders had significant difficulties managing IT and dealing with IT-enabled transformations. Xerox's failure to

capitalize on the innovations of its PARC lab demonstrates the importance of this point," write the authors.

Information technology not only expedites, streamlines, and enhances business operations, it turns business on its head. The introduction of the personal computer, the smart phone, and various forms of multimedia have changed drastically the way business is conducted. The dualities of IT refer to the idea that technology can be both sustaining and disruptive, enable adaptation to and shape competition, provide new competitive advantages, even if such advantages are highly visible and replicable.

Explore new IT

The digital age stops for no one, and only the most successful companies will keep up. Managers and entrepreneurs need to repeatedly scan new technologies to assess their significance and use them to stay relevant and transform their organizations. This should not be a one-time exercise, these actions should become part of a manager's routine because exploration of newer technologies can often facilitate new and more effective ways of doing business.

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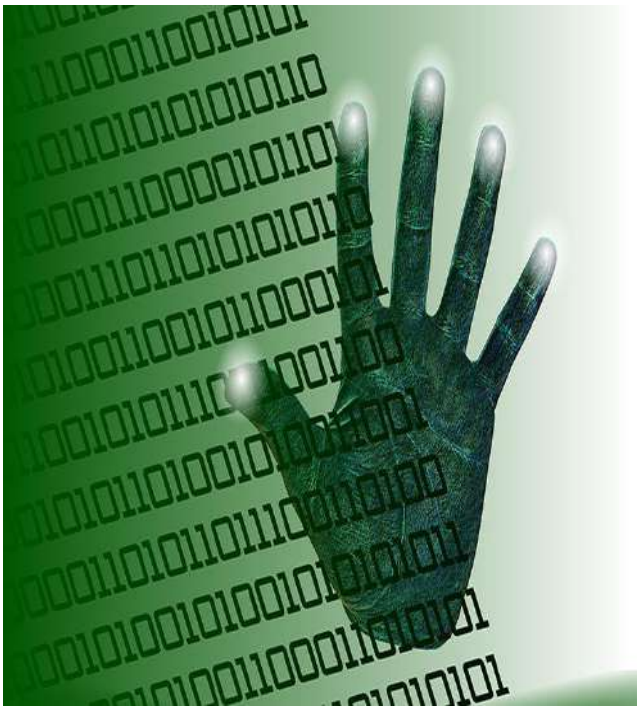
CLOUD: CHALLENGES AND FUTURE RESEARCH DIRECTIONS



Although it is popular with companies and private users, cloud computing can be abused or targeted by criminals. This can range from stealing personal information stored and outsourced to the cloud, to frauds that are more sophisticated, and to attacks that are disruptive, such as compromising a company's day-to-day operations. Cloud storage services can also be abused by criminals, who use it to store and hide incriminating and illegal materials or to distribute copyright materials.

There have been several concerted efforts by cloud service providers to prevent their services from being criminally exploited. For example, Dropbox has implemented a child abuse material detection software, whose details are not publically available, which allows searching within the files stored on

Dropbox to identify breaches of the Terms of Use and Acceptable Use Policy. Similarly, Microsoft's PhotoDNA is designed to identify child abuse materials from the files stored by companies on their servers, and used in its cloud storage product.

Another commonly seen criminal exploitation of the cloud is to support the execution of large-scale and distributed attacks, for example by compromising some instances of virtual machines within a cloud infrastructure to launch Distributed Denial-of-Service (DDoS) attacks against third-party websites, portals or platforms. In 2012, a group of cyber-criminals exploited the CVE-2014-3120 Elasticsearch 1.1.x vulnerability, in order to compromise virtual machines within Amazon EC2, and launched a UDP based DDoS attack. Predictably, most cloud service providers have platform-wide DDoS protection systems that monitor incoming and outgoing traffic in order to prevent DDoS attack against their platform or to avoid being used to launch such attacks.

A number of other security solutions have been proposed for the cloud in the literature, ranging from access control to crypto primitives to intrusion detection to privacy-preserving, and so forth. Despite the existence and deployment of various security solutions, there will be times where digital investigation is needed. As noted in a previous column, to successfully prosecute individuals who commit crimes involving digital evidence, one must be able to gather evidence of an incident or crime that has involved cloud servers as well as the client devices that have been used to access the cloud services, a process known as digital forensics (or cloud forensics).

Cloud Forensics

In a cloud forensic investigation, it is necessary to analyze the data flow, commonly at three main stages, data-at-rest on the client device(s), data-in-transit, and data-at-rest on the server(s). Therefore, it is important to conduct static analysis and dynamic (binary code) analysis of apps installed on the client device, analysis of data communication and exfiltration channels and techniques, and investigation and validation of techniques to locate and recover public and private keys, authentication tokens, encrypted blocks, and other data of interest in the network traffic and on the client device and server (e.g. memory dumps). For example, a number of researchers have examined the potential to recover data remnants from client devices, such as Android and iOS devices, that have been used to access cloud services (such as the potential to recover forensic artefacts from an OS X PC after it had been used to access Apple's iCloud).In a recent investigation of the implementation of the OAuth protocol, a commonly used token-based authentication system in mobile apps, the researchers demonstrated how one can intercept and recover security tokens (e.g. access and refresh tokens used to authenticate the user) from the

device's memory heap. This would allow forensic investigators having obtained the security tokens to access a user account even after the user has changed his/her password-based credentials (depending on the service provider's implementation).

Data may not initially be in a format appropriate for collection as digital evidence, and as such, it becomes necessary to "decode" the protocol used by the application or operating system for data storage and/or transit. Thus, it is important to conduct a comprehensive, empirical investigation of a range of client devices and cloud servers against existing techniques and commercial and open source digital forensic tools, in order to make a detailed determination of the limitations of existing techniques and forensic tools when collecting data from client devices and cloud servers.

It is expected that such technical investigations will clearly demonstrate the strengths and weaknesses of current techniques and the various forensic tools in terms of their evidential data collection and analysis capabilities. It may also identify types of evidence available on computing devices that forensic investigators would not have otherwise known were available.

However, existing techniques may not be applicable in cloud forensics. For example, investigators may not have physical access to the evidence, and a corrupted insider from the cloud service provider can easily alter the evidence. The use of traditional forensic tools results in acquisition and analysis is inherently incomplete''. Infrastructure such as distributed file systems can support Infrastructure as a Service (IaaS) and other cloud computing environments by providing data fragmentation and distribution, potentially between countries and within data centers. This results in significant technical, jurisdictional and operational challenges in the collection of evidential data for analysis in both criminal investigations and civil litigation matters. For example, a British barrister and a Senior Policy Advisor and Crown Advocate with UK Government Crown Prosecution Service predicted that the evidence obtained from the cloud will play a more significant role in the foreseeable future.

Dykstra and Sherman described a method to collect forensic artifacts from Amazon's EC2 service. They also used Eucalyptus (which operates similarly from a client point of view to EC2) for the purposes of injecting forensic tools into running VMs via the hypervisor layer. Using conventional forensic tools (such as Guidance Software EnCase and AccessData FTK), the authors were successful in collecting evidence from EC2 and Eucalyptus. The level of trust required to execute each of the collection procedures was also reported in the study. In a latter work, the same authors contributed a forensic toolkit

for the OpenStack cloud platform – FROST. FROST allows a remote user to collect an image of the users' VMs hosted in OpenStack, and retrieve log events for all API requests made by the user and firewall logs for all of the users' VMs. FROST is integrated with several OpenStack Dashboard and Compute components.

Martini and Choo presented a four-stage cloud forensic framework, and used it to guide their server and client analysis of the ownCloud private Storage. The authors successfully recovered a range of artifacts, including file data, metadata and authentication credentials. Then they analyzed the server component of ownCloud. In addition to locating a range of metadata and uploaded files (including previous versions), they were able to use the authentication credentials collected from the client to decrypt files stored on the server. This demonstrated the utility of the client followed by server forensic investigation approach. In another work, the same authors designed a process for remote programmatic collection of evidence from an IaaS cloud service, which would provide forensic researchers and practitioners a tool (for instance collecting data via API) to collect evidential data using a repeatable and forensically sound process.

Forensic-by-Design and Forensic-as-a-Service

There has also been research into offering forensic-as-a-service. Conceptually, forensic-as-a-service is similar to software-as-a-service where forensic applications and services are being moved to the cloud. For example, Castiglione and colleagues presented a cloud-based methodology to acquire forensic evidence from online services, such as webpages, chats, documents, photos and videos. A cloud-based solution hosts a network trusted service used to acquire evidence for subsequent analysis. Such an acquisition can be undertaken using a HTTPS proxy (capable of recording activities at the network level, such as IP, when an online service is accessed), or a software agent for the collection of information obtained by the targeted online service in a What You See Is What You Get (WYSIWYG) manner.

Along with his colleagues, van Beek proposed a cloud-based approach which allows one to process and investigates the large volume of seized digital materials, typically of a criminal investigation. This was also coined big data forensics by Quick and Choo. Specifically, digital evidence obtained during the investigation are outsourced to the cloud by creating forensic copies, and later examined using a standard set of tools. Thus, evidence copies can be created and stored in a centralized and accessible location. Fu and his colleagues presented a cloud-based distributed

solution for tracing Internet criminals using high-bandwidth sentinels within anonymous networks. This allows the capturing of (criminal) communications for analysis.

Harnessing technological advances for various aspects of policing has been a key operational objective in many governments and law enforcement agencies. Examples include modernizing communications between field investigators, such as crime scene analysis personal and investigators, forensic laboratories, and the digital archives, using cloud computing. For example, Schiliro and Choo presented a cloud-based interactive constable on patrol system, which allows a law enforcement agency (or any other private sector organization) to deliver the organization's capabilities to the frontline officer via a mobile app. This includes the capability to connect and pull/push information and intelligence from a wide range of public and private databases (for example CCTV systems in a particular city, such as San Antonio), employing data-mining and other big data analytical technologies, and so on.

As cloud and related technologies advance, forensic investigators will find it challenging to keep pace, in the sense of identifying new forensic artifacts. Thus, there is a need for ongoing research into identifying new forensic artefacts in the cloud and related environment (for example multi-cloud and federated cloud, fog computing, edge computing, and Internet of Things, such as Internet of Battlefield Things), considering both data-at-rest and data-in-transit, as well as developing new forensically sound data collection techniques.

Current forensic techniques generally make use of vendor data communication facilities built into the mobile devices (such as iTunes backups for iOS devices) for the purpose of forensic extraction. Often this limits the potential for data extraction. For example, current tools would not be able to collect evidence from devices that are encrypted using strong passwords. Therefore, it is crucial to develop, validate and refine novel evidence-based data collection techniques to obtain evidential data from cloud computing (and other computing) devices in crimes that make use of sophisticated and secure technologies, for example, the use of strong encryption to secure both data-at-rest and data-in-transit, as well as anti-forensic techniques. These novel evidence-based data collection techniques need to be designed to circumvent advanced security features (such as developing low-level exploits and undertaking physical hardware analysis) and obtain evidential data from cloud computing devices, without compromising the evidence's integrity. These techniques will enhance “guardianship” and the “deterrent” effect in policing.

A recent literature survey also shows that there is a need for effective visualization of

evidential data for forensic practitioners and investigators, as pointed out by the authors "while many researchers have made progress towards a model for visualizing forensic data, there continue to be gaps in this research area which need to be addressed".

When designing cloud forensic techniques, it is also important to balance the need for a secure mobile telecommunications system and the rights of individuals to privacy against the need to protect the community from serious and organized crimes and cyber and national security interests. This issue has serious implications on the ability of governments to protect their citizens against serious and organized crimes. However, it remains an under-researched area due to the interdisciplinary challenges specific to cloud (and digital) forensics. Thus, it is important to bring together approaches from different disciplines to address the major contemporary challenges associated with cloud forensics. For instance, to ensure individual privacy, the techniques developed by forensic researchers should focus on individual suspect devices under direct judicial oversight (for example under a search warrant), as opposed to broad spectrum surveillance, such as the NSA incident revealed by Snowden in 2013.

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VIRTUAL MUSICAL INSTRUMENTS

Virtual reality (VR), augmented reality (AR), and mixed reality (MR) systems present users with realistic simulations. The most common application is gaming, but do you know that VR/AR/MR can also create virtual musical instruments (VMIs)?

VMIs may or may not mimic traditional physical musical instruments. Physical instruments can produce beautiful music, but they can also be hard to learn and are bound by physical and acoustic constraints. By removing many of these constraints, VMI designers can focus on new challenges such as

- Making the instrument easy to learn
- Adapting to different performers

- Producing new electronic sounds, operating at the phrase or composition level rather than the note level
- Supporting performers with musical intelligence
- Allowing collaboration among multiple players

Although some VMIs are still in the preliminary design stage, these instruments show great potential in the areas of musical games, music education, and live music performance.

VMI Technical Challenges

Even when a VMI imitates a traditional instrument, users cannot always play it in exactly the same way. Technical challenges include:

- Precise finger tracking and mapping to note markers. Most VMIs use only hand gestures. Although advanced sensors can track fingers, tracking multiple fingers in 3D free space is still difficult. In addition, sensor capacity limits the number of note markers (for example, it's hard to represent all of a piano's keys).
- Trigger and gesture strategies. Most physical instruments have mechanisms both to trigger notes and to control them continuously. Even with reasonable 3D finger tracking mechanisms, offering effective control over multiple parameters in real time is difficult.
- Hardware device setup. Positions and directions of video sensors need to avoid finger occlusion to achieve precise tracking and note triggering. Sometimes, multiple cameras are required (for example, tracking a violin player's left and right hands might require two cameras).
- Haptic feedback. Most musicians rely on force feedback on a particular physical musical instrument to control musical expressions such as volume and vibrato. Force feedback is difficult to implement in VMIs. Although audio feedback is helpful, interfaces without some haptic feedback can be difficult to use.
- Sound resource selection. Most VMIs use a musical instrument digital interface (MIDI) with off-the-shelf sound libraries. This offers limited control and range of sound. However, it's possible to develop sound synthesis algorithms that offer better control.

Future technological advancements will undoubtedly address many of these challenges. With VMIs, digital control and audio signal processing allow us to explore musical instruments and interactions in exciting new ways. As with the evolution of physical instruments, VMI designers will undoubtedly incorporate new technologies into future

designs, creating opportunities for better sensors, haptic feedback, displays, acoustic transducers, and sound synthesis methods.

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THREE-DIMENSIONAL (3D) SPATIAL USER INTERFACE TECHNOLOGIES

Three-dimensional (3D) spatial user interface technologies have the potential to make games more immersive and engaging and thus provide a better user experience. Although 3D user interface (3DUI) technologies such as stereoscopic 3D display, head tracking, and gesture-based control are available for games, it is still unclear how their use affects gameplay and if there are any user performance benefits. A systematic study of these technologies in game environments is necessary to understand how they affect gameplay and how we can use them to optimize the gameplay experience.

Stereoscopic 3D

Stereoscopic 3D is not a new technology, but it has not been readily available to consumers until recently. Most recent video games are designed in 3D game engines, so the 3D data is already present in games. A stereoscopic driver (such as Nvidia 3D Vision or Tridef Ignition) uses this 3D data to create stereoscopic images that can be rendered on a stereoscopic display. However, the overall experience is not optimal when the games are not designed with stereoscopic 3D viewing in mind. Therefore, it is important to study how stereoscopic 3D affects the gameplay experience and how to improve gameplay in general.

Head Tracking

Head tracking is commonly used in virtual and augmented reality applications, and it has potential to be a useful approach for controlling certain gaming tasks. Recent work in head tracking and video games has shown some potential for this type of gaming interface. In addition, previous studies have shown that users experience a greater sense of presence (the illusion of being in the virtual environment) and satisfaction when head tracking is present. It is important to understand how head tracking affects the

gameplay experience and what kind of games make better use of this technology.

Systematically explored head tracking as an interaction technique in games to be able to help game designers better utilize head tracking. We chose NaturalPoint's TrackIR 5 as our head-tracking device because it is natively supported in many commercially available games (about 130 at the time of our experiment). We chose four games that we thought could benefit from being played in a head-tracked environment . All these games support alternate control methods, such as using a joystick or buttons on the Xbox 360 controller, when head tracking is not.

Gestural Menus

Menu techniques also play an important role in video games. Because a menu system's response time and ease of use can significantly affect the user experience, it is essential that they are fast and efficient so as not to become a burden on the user during setup and gameplay.

People often use fingers to count or enumerate a list of items. Past studies have investigated using such finger-counting strategies for interaction with multitouch surfaces and distant displays. A gestural input system based on finger-count gestures (such as holding up two fingers) also has the potential to be a natural and intuitive approach for menu selection in gesture- and motion-based games. Menus designed to accommodate finger count are easy to understand, and finger-count gestures are fast to perform. Therefore, it is interesting to explore finger-count menus for video games. These menus could be useful for some in-game tasks (switching modes from first- to third-person view and vice versa in a racing game, selecting weapons in a FPS game, and so on).

Thus, we explored the utility of four menu techniques:

- Hand-n-hold: In this technique, users control a cursor by moving a hand in the air (see Figure 3a). The cursor's position on the screen is directly related to the 2D position of the user's hand in a virtual plane. Users select a menu item by holding the cursor over the desired item for a short duration (about one second).
- Thumbs up: A user holds a fist in front of the input device . The user then has to move the fist either horizontally, vertically, or radially in a virtual plane, depending on the layout, to highlight an item corresponding to the fist position and then give a thumbs-up gesture to confirm the selection.
- Finger count: All the menu items are numbered, and the user has to extend a corresponding number of fingers to select a given item. Items can be arranged in any layout and submenus appear in place. This option supports

eyes-free selection because visual feedback is not needed as long as the user knows the corresponding number of the desired item.

- 3D marking: The 3D marking menu design we selected is based on the multistroke marking menu because of its high selection accuracy. In this technique, the user performs a series of simple gestures instead of a compound stroke. Menu items are always presented to the user in a circular layout. To select an item, the user positions a fist in the center of the menu and moves it toward the desired item and then gives a

Scalable Agility for Critical Systems

Business models in software-driven systems have evolved to flexible eco-systems. The classic functional split demanded by legacy-driven architectures is replaced by a more service-oriented architecture and delivery model. Recent technology trends such as three-tier cloud architectures, adaptive component frameworks, and connectivity for Internet of Things (IoT) and Internet of Services (IoS) facilitate new business models and scalable reuse across companies and industries.

Development in the future will be a continuous process which will fully decouple the rather stable hardware from delivered services driven by continuous software upgrades. Agile service delivery models combining DevOps, micro-services and cloud solutions will allow functional changes far beyond the traditional V approach. Hierarchic modeling of business processes, functionality and architecture from a systems perspective allows early simulation while ensuring robustness and security. Development processes across the entire life-cycle from vision to concept to operations and service will follow this trend to fluid delivery models. Agility finally has arrived in real development, beyond mere software applications.

Agile practices have evolved over the past thirty years at a steady pace. Microsoft invented most practices in the early nineties. Driven by the fast growing complexity in their Windows and Office suites, Microsoft very early advanced concepts such as continuous build, feature-driven teams, and a close connect of business needs with requirements and architecture flexibility. A key milestone was the Internet Explorer which was fully re-developed in the late nineties to allow for flexible and scalable evolution. These practices later found their way to the early agile frameworks. The initial agile manifesto which based on this experiences of Microsoft, IBM and others primarily collected practices and added the label “agile”.

Agility in its early years was rather a label and almost religious dogma, than a coherent useful framework. At times some of

the so-called gurus preferred to fight processes for the sake of revolution, rather than delivering to industry needs. Even today developers and managers are puzzled by themes such as “customer on board” or “software before documentation”. Soon industry realized that critical systems need more meat to work in a flexible mode and not discard product liability and governance needs. Today we have several scalable agile approaches which are blended to address real industry needs.

Today need for process is not questioned anymore. This allows addressing the real big issues:

- Business model: from building to composing.
- Governance: from encapsulated critical functions to interwoven quality assurance ensuring product liability, functional safety, cyber security, privacy, and availability.
- Competences: from silos of functional know-how to IT as a core competence of all engineers.
- Development: from components and functions to services.
- Hardware architecture: from distributed electronic controllers to three-tier architecture connecting cyber-physical embedded peripherals, high-performance middleware, and flexible cloud services.
- Software architecture: from localized features to service-oriented patterns with the convergence of embedded electronics and open IT systems.
- Technology: from proprietary building blocks and communication stacks to open systems with off-the-shelf adaptive software components connected by state-of-the-art IP over Ethernet and mobile networks.
- Process: from the classic V model with rather heavy release cycles to scalable agile processes.

Since quality, deadlines and cost are pivotal to mitigate liability and governance risks, the push for even better processes and project management is continuing at a high pace. Demands are rising towards more agility and flexibility. Users expect the same adaptive behaviours and continuous delivery models as they are used to from their mobile devices. Rapid advances towards open and flexible connectivity in IoT are straining standardization as they struggle to keep up with issues of legal and ethical responsibility, cyber security, and short-cycle re-certification after OTA software updates.

Here are some practical recommendations for developers:

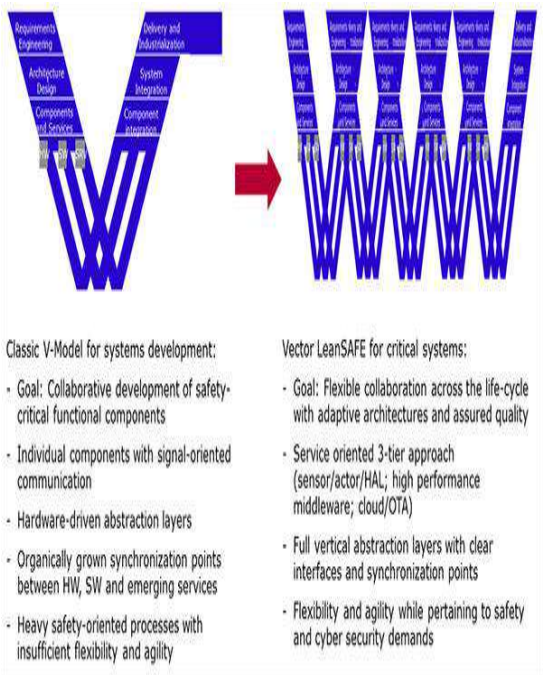
- Move from classic embedded design to distributed IT. Grow methodologies and underlying technologies from

embedded engineering to comprehensive systems engineering. Understand the methods and solutions of modern IT systems, such as SOA, cyber security etc.

- Enhance the life-cycle towards agility and post-delivery continuous development. Using concepts of DevOps and agility change the classic V towards agile cyclic W. Focus on speed, synchronization and integrity. Establish flexible synchronization points between HW and SW along the life-cycle to facilitate fast adaptations.
- Evolve embedded architectures towards the 3-tier model: (1) sensor/actor preprocessing, (2) high performance computing and (3) cloud services. Introduce service-oriented embedded architectures and adequate service delivery models, such as predictive maintenance for better reliability or continuous delivery for flexibility. Enhance with the relevant design and testing approaches.
- Approach novel technologies on system level: Systems-on-chip, microservices, augmented reality and cloud solutions for innovative products and for engineering.
- Focus on horizontal integration of embedded systems complementary to vertical integration towards active IoT solutions of networked embedded systems. Introduce integrated processes and a systematic methodology based on a model-driven PLM tool-chain.
- Enhance reuse across platforms, products and markets. Manage variants and master system complexity by means of concepts such as product line engineering. Evolve from classic portability and maintainability to Self-X type architectures and technologies such as self-aware adaptive systems to cope with fast changing components and environments. Current challenges in automotive, aerospace and railways demand cost-efficient solutions while at the same time mastering the fast increasing system complexity.
- Thoroughly ensure robust system level design. Master relevant quality requirements to critical systems. Cyber security, functional safety, service-orientation and usability must be designed and achieved on the systems engineering level.

The following figure shows how to establish agile development of critical systems. The classic V-abstraction is evolving to a W of continuous deliveries, starting at the bottom with design and integration, growing with service-oriented architectures, and moving upwards to DevOps with over-the-air software updates to each single vehicle. LeanSAFE (Lean Scaled Agility for Engineering) Framework is Vector Consulting's

implementation of the W model for critical systems.



Each of these changes alone would already be perceived as heavy. All these trends combined, although not impossible to manage, illustrate one thing clearly: Industrial software engineering is the most challenging endeavor you can imagine. It's the place to be and to work, especially for young people looking for real challenges and fast innovation cycles.

SUVETHA S
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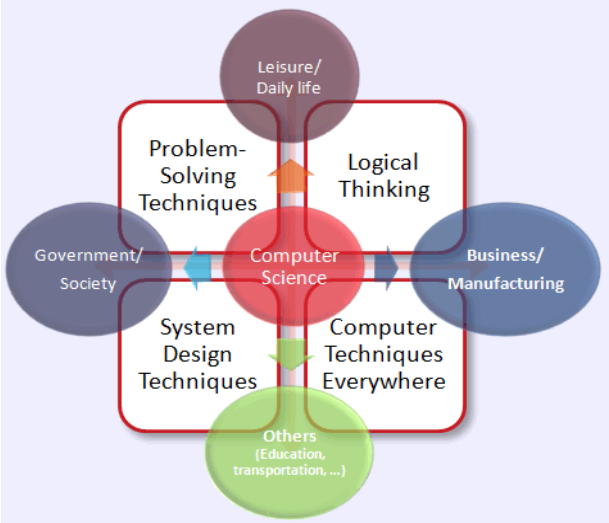
USEFUL TECHNOLOGIES MADE POSSIBLE BY COMPUTERS

People joke about disk drives that were once the size of washing machines. Except it's not really a joke it's true. With a fresh coat of white paint, the RP04 disk drive could easily infiltrate any laundry room and blend right in. With a 92MB capacity, you could almost store the photos of your dinner you posted to Instagram last night.



Today, this technology once considered cutting-edge has become obsolete. Large, clunky, slow machines have been replaced with lightning fast, smart technology that does more than just sit in a corner and collect dust.

1. Thunderbolt 3

If you've purchased or used a new Macbook Pro, you may have noticed the lack of familiar ports and the addition of a strange, new port called Thunderbolt 3. You may be wondering what Apple was thinking when they eliminated the standard USB port. This move, like many of Apple's moves, has created frustration among users who just want to be able to plug in their USB devices without an adapter. But don't get frustrated yet. There is a purpose to this future-forward move.

Thunderbolt 3 is a high bandwidth technology that operates at 40Gb/second, as

opposed to the USB 3 you're used to operating at just 5Gb/second. This means you can plug your smartphone into your Macbook and it will charge much faster than before. Gone are the days of waiting all night for your devices to charge via your computer's USB port. But Thunderbolt 3 does more than just quickly charge your devices.

Superior technology

Thunderbolt 3 is a superior technology that leaves standard USB in the dust. With Thunderbolt 3, you can copy 14 hours of high definition video in less than a minute. You can also copy 25,000 photos or 10,000 songs in less than a minute. Thunderbolt 3 also connects to all displays and monitors using the standard DisplayPort and even Mini DisplayPort. And, by using an adaptor, Thunderbolt will support HDMI and VGA as well.

2. Solid state hard drives

For decades, most laptops and desktops came equipped with a traditional hard drive that spun, using an arm to access the data, much like a record player. At the time of its inception, this was the most practical way to store data when power to the unit was cut off.

A solid state hard drive serves the same function as a hard drive with moving parts, but operates differently by storing data on flash memory chips that retain their data, even when there's no power. This is significant because it wasn't previously easy to get memory chips to retain their data when the power supply was cut off. For example, RAM (random access memory) only stores data temporarily, when the power supply is cut off, all stored data is erased.

Although they're a bit more expensive, solid state hard drives are much faster than their predecessors, allowing computers to boot up in less than a minute and sometimes even seconds. If you grew up with older technology running on operating systems like Windows 95 and 2000, you'll appreciate this quick boot time.Another benefit to solid state drives is they can't become fragmented, meaning you won't have to spend nights of torture defragmenting your hard drive. They're also extremely durable. Now that solid state drives have become mainstream, more computer manufacturers are offering new desktop and laptop computers that come with a solid state drive as a standard option. This means they're becoming more affordable, which is great news for everyone.

3. 3D printing

The term "printing" has come to be associated with putting ink on paper a seemingly 2D surface. However, technology has advanced to where 3D printing has become a huge trend. 3D printing is achieved with a computer program that allows you to create a 3D model of an object, and feed the data to a machine that constructs the model by compiling layers of melted plastic.

3D printing is not just limited to people who can afford expensive equipment. You can buy small 3D printers for your home computer that let you design 3D objects, and print them out right in your office.

In 2014, a 3D printed roadster called the Strati was made onsite at the International Manufacturing Technology Show in Chicago, IL. This 3D printed car was so cool, Popular Mechanics took it for a test drive and gave it a great review.

4. Smart objects for home

Smart objects in the home can be a luxury, but they can also be useful. Take the Kohler Numi toilet, for example. This is a toilet that has a motion-activated lid mechanism that allows you to open and close it without touching anything. With an air dryer, deodorizer, and heated seat, it's definitely practical. To add luxury to practicality, this device comes with an MP3 docking station. This toilet could be a dream for germophobes.

Lock your deadbolt remotely

Another useful smart object is called Lockitron. This device fits over your deadbolt and allows you to operate your deadbolt from your smartphone. This device would be a perfect solution for AirBnB hosts who can't always be present to deliver keys to their guests.

Driverless cars

The ultimate smart object that seems to outdo any other gadgets is the driverless car. At first glance, it may seem alarming to have an unmanned vehicle something that can be very dangerous at high speeds strolling down busy neighborhood streets. But when Google began testing its driverless electric cars in Mountain View, CA, they discovered they are actually pretty safe. Possibly even safer than cars with human drivers.

The important question is if driverless cars are safer for pedestrians and cyclists, two road hazards human drivers often have a difficult time seeing. The answer appears to be yes driverless cars seem to be safer for pedestrians and cyclists because they're programmed to perceive surroundings as predictable data.

In fact, during one test drive, a driverless car was able to perceive a pedestrian about to step into the street and the car hesitated to make sure the person didn't start crossing the street before turning.

The future of technology is unlimited

Twenty years ago, it wasn't likely that anyone was thinking about connecting an MP3 player to their toilet. It's somewhat of an unnecessary luxury, but the fact that it's possible is a great indication of where technology is headed.

If a fully functioning car can be printed from plans created in a computer program, the height of what can be achieved with computers is only limited to what we can create in our minds.

V. MOHANAPRIYA
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FUTURE OF CYBERSECURITY

New Technologies on the Horizon

There are some of the most promising technologies coming to keep our digital information and communications safer:

1. **Quantum key distribution.** It sounds like some kind of superpower, but as WIRED writes, quantum key distribution could be the future of encryption technology. Quantum physics involves the study of subatomic particles, which behave strangely, against our intuitions on small scales. We're already using quantum computers, which take advantage of particles that can exist in two states at the same time (as a particle in a wave). Quantum entanglement involves two particles that affect each other's position, even at a distance. Conventional encryption involves a lock-and-key method of creating and then cracking a code but these can be easily copied and cracked. Quantum key distribution relies on quantum entangled particles that are virtually uncopiable and tremendously hard to crack but it's still a new technology that demands refinement.

2. **Blockchain tech.** Blockchain isn't a term familiar to many, but it's associated with a technology that most have heard of Bitcoin. Blockchain is a system of collaborative information storage, exchange, and retrieval that maintains a public record of ownership. It's how Bitcoin transactions are able to take place, and remain consistent, without any single institution defining or monitoring those transactions, and without any outside interference to commit digital theft. Shaping Tomorrow predicts that within a few years, most major banks (as well as other financial-related companies like insurance institutions) will be using blockchain to greater secure their financial transactions.

3. **DUST.** One reason Snapchat became so popular is its ability to have messages self-destruct; this guarantees, to some degree, that your message won't spread or be committed to

public memory, therefore enhancing both privacy and security. Security organization PARC is now working on Disintegration Upon Stress-release Trigger, or DUST technology, that mirrors this effect. Instead of photos and videos no longer being viewable, computer chips will self-destruct after conveying their requisite information.

4. **Biometrics.** In the public eye for decades, biometric technology uses unique personal identifiers to ensure proper identification. For example, your phone may take a thumbprint scan before allowing you to access the data inside, or a device may scan your retina before permitting you access to a building. Since these personal identifiers are incredibly hard to mimic, especially remotely, they could greatly enhance security in a number of different areas. However, there are still a number of important hurdles to overcome before the technology can be adopted on any wide scale.

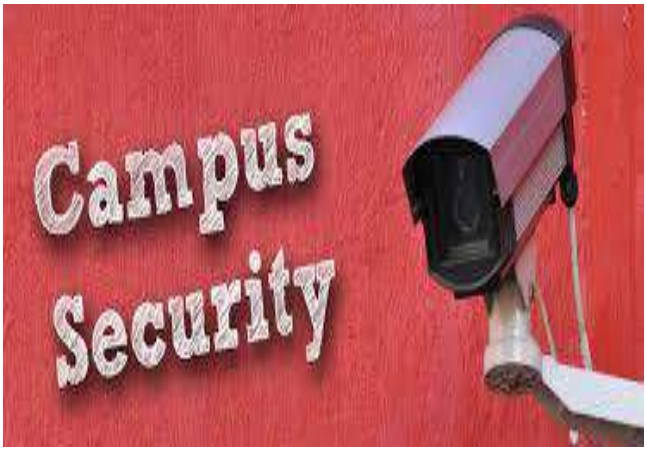
Projecting a Timeline

It's hard to say when these developments might actually become main stream. Some of them sound like technology straight out of science fiction, but the reality is that scientists and engineers are already working on these futuristic solutions and probably some even more advanced technologies that's being kept from the headlines.

Some of the biggest challenges include the cost of developing these technologies, which should improve over time, and convincingly demonstrating the reliability of these protocols. We could be as close as a few months away for some of these technologies but others may never come to fruition. Only time will tell.

R. RANJITHKUMAR
III B.Sc. (Information Technology)

Campus Security



Emergency communication protocols

Not all crimes can be prevented. In the event of a violent attack or a natural disaster, communication is key to keeping as many people as safe as possible, and with smartphones in almost every student's pocket, there are more ways than ever to spread that information. Colleges today have the ability to send out mass text messages or mass phone calls alerting students to emergency situations (along with instructions on what to do or where to go). Collecting and transmitting this information quickly, and in a way that all

students can access, has become a top priority for colleges everywhere.

Anonymous crime reporting

Anonymous crime reporting online is becoming more popular on college campuses, as well as public encouragement of the use of these types of systems. Anonymous reporting spares victims or friends of victims the intimidation, fear, guilt, or trauma of reporting a crime formally. Overall, it can lead to a greater number of incident reports, and more justice or protection for the victims of those crimes.

Monitoring in public areas

Monitoring is another major institution for college security, both for preventing incidents and responding to them quickly. Security cameras have been around for decades, but today's high-tech world gives us access to smart cameras, which can turn in response to various types of activity, and can be remotely accessed by any personnel with the authority to view live feeds.

Device-based security

Colleges are dependent on interconnected systems, from the mobile devices students carry on a daily basis to library computers and online grade reporting systems. Keeping those systems up-to-date and protected from potential vulnerabilities is a full-time effort, and many colleges employ data security personnel for the sole purpose of keeping those systems as well-protected as possible.

Identity checks

Ensuring positive identification when going from building to building can't prevent all crimes, but it can help keep track of people in the event of an emergency, and ensure non-students and non-faculty members can't access college buildings without permission. New technology, such as mobile device-based recognition and smarter ID cards, is making it easier for colleges to keep track of their students and who enters their buildings.

Barriers to Widespread Adoption

With all these new technologies available and moderately in circulation, why aren't all colleges tightly secured? The truth is, it's hard for colleges to universally adopt all these new security standards, for at least the following reasons:

Cost

New technology tends to be expensive, and instituting a new system across the entire campus can run in the tens of thousands to hundreds of thousands of dollars. Not all colleges can spare this money, especially for technology that's yet unproven.

Logistics

Training new personnel on how to use the new technology, putting the systems in place, and making students aware of the new

regulations can all be a logistical nightmare. It takes hundreds of man-hours to create this new system, which not all security teams can spare.

Choices and bureaucracy

There are hundreds of choices when it comes to specific tech, brands, and institution methods and most colleges make decisions slowly thanks to bureaucratic proceedings. This makes it difficult for most colleges to adopt new security standards quickly.

This is only the beginning of the growth in security technology. Colleges can't become invulnerable overnight, but the better our technology becomes, the safer our students and staff members will be on America's campuses. Future technology will be even better at overcoming the main barriers to widespread adoption, and safe campuses will be a mainstay all across the country.

G.LOKESHWAR
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SEAGATE LAUNCHES 12TB ENTERPRISE CAPACITY HDD FOR NEXT-GENERATION DATA CENTERS

Seagate has announced a new 12TB helium enterprise drives are now shipping to cloud providers for evaluation, and plan to start volume shipments for production availability in the June quarter of 2017. The Seagate Enterprise Capacity 3.5 HDD 12TB hard drive incorporates several technology advancements developed to address a critical requirement hyperscale customer's face in this age of exponential data growth: the ability to locate and organize the increasing amount of unstructured data they possess and make it available quickly and reliably for customers.

Seagate's new 12TB Enterprise Capacity 3.5 HDD is precision engineered to accommodate 550TB workloads annually. It has a market leading MTBF (Mean Time Between Failure) of 2.5 million hours and is designed to operate 24/7 for five years in the most rigorous enterprise data center

environments, delivering far greater reliability and the lowest total cost of ownership (TCO) for enterprise storage products in the industry.

"Cloud Service Providers, Telecoms and Enterprises utilize high density storage for the mountains of unstructured data they must manage, driven by an increasing proliferation of connected endpoint devices and sensors. Seagate's new 12TB hard drive is an ideal component for our OCP-based solutions, and the integration of these innovative new drives will offer our customers the reliable and efficient storage they need," said Mike Yang, senior vice president and general manager of Quanta Computer Inc. and president of Quanta Cloud Technology (QCT).

Understanding The Data Management Challenges Of Top Cloud Providers

Seagate's engineers have worked closely with the world's largest cloud providers and OEMs to gain a deeper understanding of the data management challenges they face. This insight led our engineering team to implement several new firmware and hardware innovations to the helium-filled hard drives, resulting in the following key improvements:

- Highly scalable hard drive storage that is rapidly deployable for maximum performance and energy efficiency for Open Compute Project (OCP) platforms.
- 50 percent higher capacity, which enables hyperscale customers to deploy over 10PB of high performance storage in a single 42U rack for the first time - maintaining current space, weight, and power consumption profiles.
- 21 percent increase in IOPs performance/watt perfect for next generation eco-friendly infrastructures.
- 20 percent increase in enhanced caching performance, which results in faster access to unstructured data.

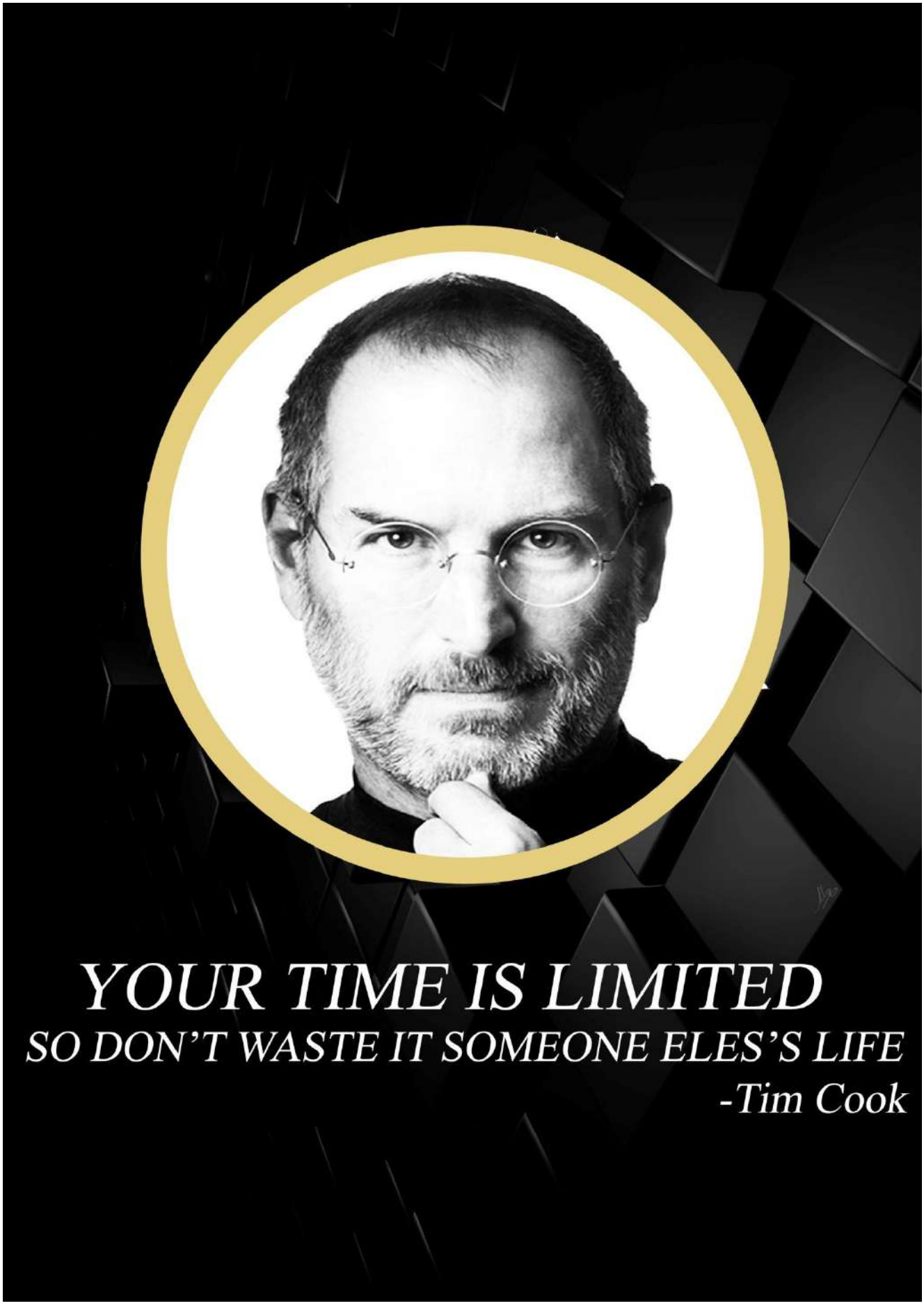
These innovations enable customers to gain more control over unstructured data, store vastly more information and retrieve it more quickly than ever before without expanding the storage footprint in the data center. By offering the lowest power consumption and lowest weight in the industry, the drop-in upgrade 12TB drive translates to a groundbreaking TCO for hyperscale customers.

Data storage innovations have led to dramatically improved business results. For example, Cloud companies are storing massive amounts of videos and images in hyperscale infrastructures for search and social applications. Our 12TB drive helps solve the proliferation of data both enterprise and cloud service customers must manage and move, while improving response times, said John Morris, vice president of products at Seagate.

Seagate's new 12TB high density, enterprise-class hard drive will be a great addition to our OCP-compliant storage product family. As a major OCP solution provider, it's important to ensure compatibility of this innovative, high density hard drive with our OCP solutions that meet the needs of this growing market, said Steven Lu, chief of product marketing of Wiwynn Corp.

NIVEDHA N

I1I B.Sc. (Computer Technology)


YOUR TIME IS LIMITED
SO DON'T WASTE IT SOMEONE ELES'S LIFE
-Tim Cook