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Editorial

We would like to wholeheartedly thank our honorable Chairman, Secretary, Executive Director and Principal for their continuous encouragement and constant support for bringing out the magazine. We profoundly thank our Head of the Department for encouraging and motivating us to lead the magazine a successful one right from the beginning. Ishare serves as a platform for updating and enhancing upcoming technologies in Information and Communication. We are grateful to all the contributors to this magazine so far. The magazine has been sent to almost 60 Institutions in and around Tamilnadu. So far we have received feedbacks and appreciations from various Institutions.

We would be very pleased to receive your feedbacks. Please send your feedbacks to ishare@ksrcas.edu

By,

Editorial Board

CONTENT

1. BLUE BRAIN PROJECT

Chandrasekar Srinivasan

II BCA - C

The **Blue Brain Project** is an attempt to reverse engineer the human brain and recreate it at the cellular level inside a computer simulation. The project was founded in May 2005 by Henry Markramat the EPFL (*École Polytechnique Fédérale de Lausanne)* in Lausanne, Switzerland. Goals of the project are to gain a complete understanding of the brain and to enable better and faster development of brain disease treatments.

The research involves studying slices of living brain tissue using microscopes and patch clampelectrodes. Data is collected about all the many different neuron types. This data is used to build biologically realistic models of neurons and networks of neurons in the cerebral cortex. The simulations are carried out on a Blue Gene supercomputer built by **IBM**. Hence, the name "Blue Brain". The simulation software is based around Michael Hines's NEURON, together with other custom-built components.

As of August 2012 the largest simulations are of mesocircuits containing around 100 cortical columns (image above right). Such simulations involve approximately 1 million neurons and 1 billion synapses. This is about the same scale as that of a honey bee brain. A rat brain neocortical simulation (~21 million neurons) has been achieved by the end of 2014. A full human brain simulation (86 billion neurons) should be possible by 2023 provided sufficient funding is received.

There are three main steps to building the virtual brain:

1) Data acquisition

2) Simulation

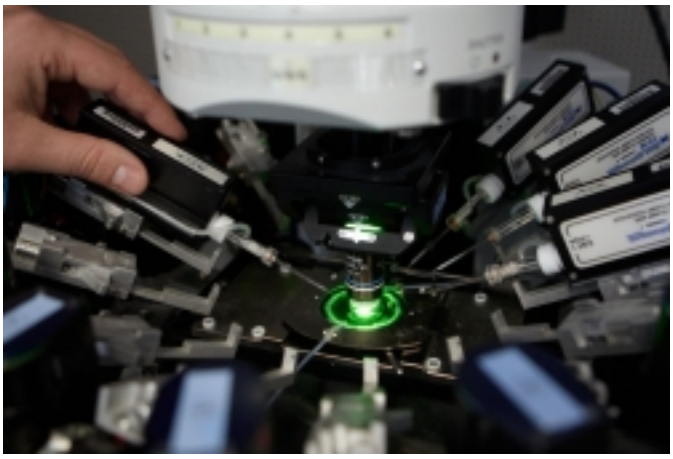
3) Visualization of results.

Data acquisition

Data acquisition involves taking brain slices, placing them under a microscope, and measuring the shape and electrical activity of individual neurons. This is how the different types of neuron are studied and catalogued. The neurons are typed by morphology (i.e. their shape), electrophysiological behavior, location within the cortex, and their population density. These observations are translated into mathematical algorithms which describe the form, function, and positioning of neurons. The algorithms are then used to generate biologically-realistic virtual neurons ready for simulation.

One of the methods is to take 300 μm-thick sagittal brain slices from the somatosensory cortex (SA1) of juvenile Wistar rats (aged 14 to 16 days). The tissue is stained with biocytin and viewed through a bright field microscope. Neuronal 3D morphologies are then reconstructed using the Neurolucida software package (pictured below, far right) which runs on Windows workstations. Staining leads to a shrinkage of 25% in thickness and 10% in length, so the reconstruction process corrects for this. Slicing also severs 20% to 40% of axonal and dendritic arbors, so these are regrown algorithmically.

The electrophysiological behavior of neurons is studied using a 12 patch clamp instrument (pictured below left). This tool was developed for the Blue Brain Project and it forms a foundation of the research. It enables twelve living neurons to be concurrently patched and their electrical activity recorded. The Nomarski microscope enhances the contrast of the unstained samples of living neural tissue. Carbon nanotube-coated electrodes can be used to improve recording.



Simulation

NEURON

Example NEURON cell builder window

The primary software used by the BBP for neural simulations is a package called NEURON. This was developed starting in the 1990s by Michael Hines at Yale University and John Moore at Duke University. It is

written in C, C++, and FORTRAN. The software continues to be under active development and is currently at version 7.2. It is free and open source software, both the code and the binaries are freely available on the website.

Simulation speed

The simulations of one cortical column (~10,000 neurons) run at approximately 300 x slower than real time. So one second of simulated time takes about five minutes to complete. The simulations show approximately linear scaling - that is, doubling the size of the neural network doubles the time it takes to simulate. Currently the primary goal is biological validity rather than performance. Once it's understood which factors are biologically important for a given effect it might be possible to trim components that don't contribute in order to improve performance.

The simulation timestep for the numerical integrations is 0.025 ms and the timestep for writing the output to disk is 0.1 ms.

Workflow

The simulation step involves synthesizing virtual cells using the algorithms that were found to describe real neurons. The algorithms and parameters are adjusted for the age, species, and disease stage of the animal being simulated. Every single protein is simulated, and there are about a billion of these in one cell. First a network skeleton is built from all the different kinds of synthesized neurons. Then the cells are connected together according to the rules that have been found experimentally. Finally the

neurons are functionalized and the simulation brought to life. The patterns of emergent behavior are viewed with visualization software.

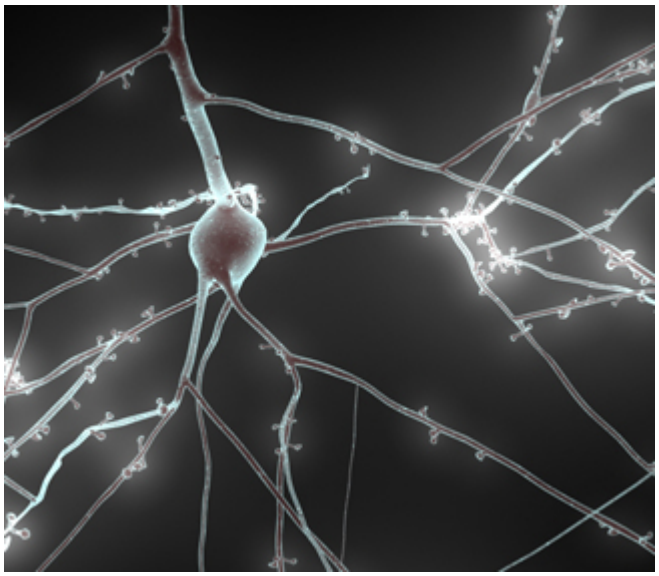
A basic unit of the cerebral cortex is the cortical column. Each column can be mapped to one function, e.g. in rats one column is devoted to each whisker. A rat cortical column has about 10,000 neurons and is about the size of a pinhead. The simulations contain about 100 columns, 1 million neurons, and 1 billion synapses. A real life rat has about 100,000 columns in total, and humans have around 2 million. Techniques are being developed for multiscale simulation whereby active parts of the brain are simulated in great detail while quiescent parts are not so detailed.

Every two weeks a column model is run. The simulations reproduce observations that are seen in living neurons. Emergent properties are seen that require larger and larger networks. The plan is to build a generalized simulation tool, one that makes it easy to build circuits. There are also plans to couple the brain simulations to avatars living in a virtual environment, and eventually also to robots interacting with the real world. The ultimate aim is to be able to understand and reproduce human consciousness.

BBP-SDK

The BBP-SDK (Blue Brain Project - Software Development Kit) is a set of software classes (APIs) that allows researchers to utilize and inspect models and simulations. The SDK is a C++ library wrapped in Java and Python.

Visualization of results



RTNeuron visualisation of a neuron

RTNeuron

RTNeuron is the primary application used by the BBP for visualisation of neural simulations. The software was developed internally by the BBP team. It was written in C++ and OpenGL. RTNeuron is ad-hoc software written specifically for neural simulations, i.e. it is not generalizable to other types of simulation. RTNeuron takes the output from Hodgkin-Huxley simulations in NEURON and renders them in 3D. This allows researchers to watch as activation potentials propagate through a neuron and between neurons. The animations can be stopped, started and zoomed, thus letting researchers interact with the model. The visualizations are multi-scale that is they can render individual neurons or a whole cortical column.

2. THE MAJOR DRAWBACKS OF ANDROID

KALAIARASAN R

II-BCA [D]

While there are several Android phones loaded with gimmicky features, these smart phones still don't make the necessary cut. Initially, the moderate price paid for the various features might seem like a great bargain. But, with time and frequent usage, one will realize they never really ended up using the phone to its complete potential. When it comes to a smart phone, the aspects that really matter are: security, safety, speedy operations, powerful functionality, consistent experience, brisk performance and user-friendliness. Unfortunately, Android phones, thanks to their chaotic OS and messy app store infrastructure, are not up there yet when it comes to the bare essentials.

The following are some of the reasons why Android smart phones bite dust quite often:

Defects in Apps and Play Store

- Not all the apps available in the store are compatible with the different levels or ranges of Android phones.
- While there are several free apps for download, these tend to be replete with marketing material and advertisements, making the user experience jarring and intrusive.
- App-crashing or forced closure is a norm with Android devices and staunch Android phone users have now gotten used to this flaw.

Device Defects

- Overheating is a common issue with Android phones, especially when playing games loaded with heavy graphics or while indulging in hardcore productivity tasks. The overheating tends to be more prevalent during summers than winters. The heating issue not just mars user experience and handling, but it also hurts the phone's battery life.
- Android is a very heavy operating system and most apps tending to run in the background even when closed by the user. This eats up battery power even more. As a result, the phone invariably ends up failing the battery life estimates given by the manufacturers.
- Storage is also an issue, with most phones having minimal internal storage. Consequently, storing large apps, videos and files becomes an issue.
- Adding a micro SD card can be a way out, but that move can hamper the phone's speed.
- Regardless of the high-end specifications and model, Android phones are prone to lag as the ecosystem is not streamlined and integrated.
- Data safety is another problem and the fear of losing data forever always hovers over users. While there are several apps that help backup data, none are tightly knit into the OS.
- Due to cache buildup, the phone's operational speed and experience can reduce and cause severe lags.

- Some phones tend to drastically lose efficiency if dozens of apps are installed.
- The phone's efficiency is bound to take a hit as multiple programs run simultaneously in the background at any given time.

System Defects

- Although seamless data connection is no longer a far cry on mobile phones. Android devices need uninterrupted Internet supply for its efficient functioning. Google is behind Android and the plethora of Google services on offer almost mandates seamless Internet connection.
- While the many Google apps and services are quite useful, they are also very susceptible to hackers and their notorious plans. As a result, these applications get infected even before they get publicly released. In other words, most of the apps on the Play Store are plagued with malware.
- The Android app store is open to every publisher. It's easier to get apps published in the Play Store as the space is not continuously monitored. Therefore, most Android apps are half-baked and also not malware-proof. This nullifies any innovativeness the apps have to offer.
- Android's stability and reliability takes a hit due to the fact that there are several dozens of Android phones with varying specifications and hardware components. As a result, there arises the lack of compatibility between the OS and its hardware partners.
- While Android's open-source nature makes it easy to customize any Android device, the same aspect also turns out to be a negative trait as

hackers don't have to bang their heads for hours together to get through the system and play spoilsport.

- Fragmentation - Google's Android mobile OS is fragmented, meaning not all Android phones run the same version of the operating system. For instance, Gingerbread, or Android 2.3 took nearly six months for it to be adopted by all Android devices. This was all courtesy Android's fragmented character.
- Android OS is decentralized, or there's no apex governing body since the actual versions running on third-party devices are customized. This results in lack of support or assistance for users during glitches or grievances.
- Some updates relating to apps and the OS may happen by themselves, without seeking the consent of the user. This can hog up unnecessary memory space.
- Android phones don't give administrator rights to its users. In other words, the device user cannot directly control what happens on the device, making one feel disconnected with the phone.

Smashing Android from all corners isn't the intent of this piece, and one has to agree it has its share of positives. Otherwise, it wouldn't have reached the popularity it has attained today. But, the fact that the applications aren't built specifically to run on certain devices makes it a less efficient and seamless system. For instance, iOS is created to run solely on iPhones. The

same thing cannot be said about Android or its devices. This results in the various devices not interlocking with the OS, causing a truckload of unsolvable and grave issues.

3. FLIPBOARD

P.Elambharathi

II- BCA [D]

***What is Flipboard*?**

Developed by some of the biggest names in the tech industry, Flipboard is part of social app, and part of magazine and news app. It gathers content from social networks, news publications and blogs. Then the app displays stories, articles, blog posts, videos and other pieces of content in a magazine-like format. The Flipboard app is available on multiple operating systems and devices, including smart phones and tablets. Or access Flipboard in a web browser from your computer. Users have the ability to create their own magazines as well as subscribe to the magazines of other users or brands.

1. Flipboard is a social-network aggregation, magazine-format mobile app localized in more than 20 languages.
2. CEO: Mike McCue
3. Founded: January 2010
4. Founders: Evan Doll, Mike McCue

Flipboard is a social-network aggregation, magazine-format mobile app localized in more than 20 languages. The software collects content from social media and other websites, presents it in magazine format, and allows users to "flip" through their social-networking feeds and feeds from websites that have partnered with the company.

Flipboard is produced by Flipboard, Inc., a United States-based software company founded in 2010 by Mike McCue and Evan Dolland headquartered in Palo Alto, California

History

The app Flipboard was launched in 2010 by former Apple iPhone engineer, Evan Doll, and former Tellme CEO, Mike McCue. The duo set out to create an app that merged the simplicity and feel of a magazine with the accessibility and collaboration that technology provides. The app integrates news from media outlets from around the world and presents it in a magazine format.

Invention

According to McCue and Doll, the idea for the application was invented during a brainstorming session between them, during which they tried to imagine what the web would look like if it were designed from scratch. The design they came up with placed emphasis on the social web and the ability to consume content in a graphical magazine-like format.

Development

Flipboard launched for the iPad and in December 2010 was updated to add support for the iPhone and iPod Touch. On May 5, 2012, it was announced that Flipboard would be released for select Android phones, beginning with the Samsung Galaxy S3. On May 30, 2012, a beta version of Flipboard for Android was released through its website. A final stable release of the Flipboard for Android was released on June 22, 2012 in Google Play while the China version of Flipboard for Android was released on June 26, 2012. The Windows 8 version of the Flipboard app was also unveiled during the Microsoft 2013 Build Conference and also on the official Flipboard blog with video although no release date has been given. On October 22, 2013, it was also announced that Flipboard for Windows 8 will be rolled out to selected devices starting with Nokia Lumia 2520

In February 2015, Flipboard became available on the web. Up until then, Flipboard was 100 percent mobile, only available on users' tablets and mobile phones.

Advantage

1. Cut through the Information Clutter

Flipboard is a customizable content curator. You don’t have to waste time reading hundreds of irrelevant tweets or articles, because this tool organizes your content for you. You choose from Twitter lists, Facebook, FlipTech or other curated sites and limit your viewing to what you want to read and see the most. If you follow a large number of people on Twitter, this

app lets you see the posts of the people you interact with the most, limiting endless Twitter feed scrolling.

2. See More Content

If you're accustomed to Twitter and Facebook, you know that it usually takes additional clicks to see a picture or view an article. Content curation tools usually cull and cut down the amount of information you see. Flipboard curates in a different way, pulling together all article elements so you can quickly scan text and images without extra clicks. In that sense, it feels more like a magazine and less like a series of lists or news feeds.

3. Network Efficiently

You may be looking to network socially or expand your business affiliations. You can use Flipboard to share comments and reply to your network all in one place. When your friends or business contacts post photos on Flickr, you can see their latest posts. If you see an article that would benefit someone in your network, you can quickly email them about it.

4. Share Links

Flipboard creators intended to make Web content sharing more effective. You'll see their vision in this app as it organizes your online experience so that important information and highlights don't get lost in the noise. It lets you share articles by email or retweet them to others to attract readers and comments. When other Flipboard users see the article you've just recommended, the visually appealing layout and mix of content elements attract their attention, allowing them to quickly gauge interest in reading and

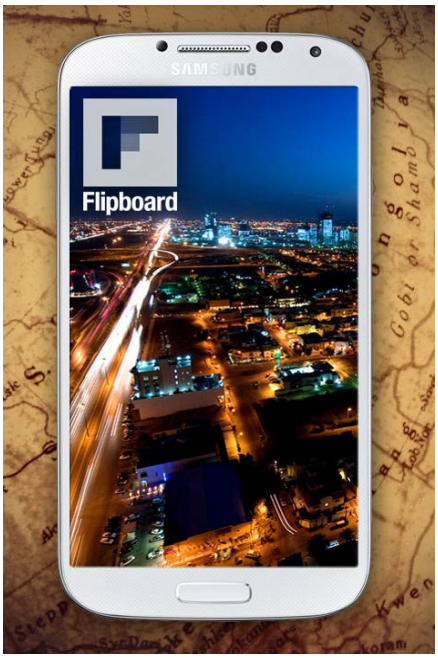
sharing. The app also lets you access the original webpage, which enables readers to visit your own personal site or blog.

5. Read the Important News First

Flipboard has a timeline feature that lets you see how long ago an article or page was posted. If a hurricane is moving in and you must quickly evacuate, you might be looking for the latest tweets about traffic conditions or the latest warnings from officials. A small tech product seller might be interested in the newest reviews on the latest software releases. The built-in timeline helps you save time when searching online.

6. Read for Pleasure

Maybe you're less interested in social media or link sharing and simply want a centralized place to use Google Reader and access Washington Post articles on the go. You can mark articles as favorites and send links to your closest friends. And if you do decide to slowly build a Twitter or Facebook following, Flipboard lets you post status updates and attach photos from your iPad or images from favorite articles to connect with people who share similar interests.



Flipboard is expanding its global reach with the launch of four new editions for Android smart phone users in India, Latin America, Russia and Arabic-speaking nations. So if your phone is set to a country in these regions,

or if you're a new Flipboard reader in these areas, you'll automatically get a new, localized version of Flipboard with its own Content Guide edition.

Each new Content Guide contains a handpicked selection of magazines, newspapers and blogs representing key local voices, as well as global perspectives from publishers such as BBC and Al-Jazeera. The Guides offer hundreds of reading recommendations across 13 categories, including news, business, tech, sports, photos & design, arts & culture, living, style and more. They also surface some of the best reader-curate magazines already created by fans in these regions.

We can explore these new Content Guide editions—or all 19 of them—by tapping on the red ribbon, tapping on "New & Noteworthy" and scrolling down to the Content Guide Edition picker.

4. 5G

Ramesh kumar. A

III-BCA [D]

What is 5G?

It's a term used to describe the forthcoming fifth generation of mobile network technology.

It's not a reference to any specific standard of that technology, in the way that 4G and LTE have become closely entwined. That's because no such 5G standard has yet been fully agreed upon, though a couple of likely technologies are emerging.

4G offers download speeds that are roughly equivalent to your superfast broadband (around 30-40Mbps) at home. 5G will go well beyond that.

5G (5th generation mobile networks** or **5th generation wireless systems)

It denotes the next major phase of mobile telecommunications standards beyond the current 4G/IMT-Advanced standards.

NGMN Alliance or Next Generation Mobile Networks Alliance defines 5G network requirements as:

- Data rates of several tens of Mb/s should be supported for tens of thousands of users.
- 1Gbit/s to be offered, simultaneously to tens of workers on the same office floor.
- Several hundreds of thousands of simultaneous connections to be supported for massive sensor deployments.
- Spectral efficiency should be significantly enhanced compared to 4G.
- Coverage should be improved.
- Signaling efficiency enhanced.
- Latency should be significantly reduced compared to LTE.

Next Generation Mobile Networks Alliance feels that 5G should be rolled out by 2020 to meet business and consumer demands. In addition to simply providing faster speeds, they predict that 5G networks will also need to meet the needs of new use-cases such as the Internet of Things as well as broadcast-like services and lifeline communications in times of natural disaster.

Although updated standards that define capabilities beyond those defined in the current 4G standards are under consideration, those new capabilities are still being grouped under the current ITU-T 4G standards.

Background of 5G

A new mobile generation has appeared approximately every 10th year since the first 1G system, Nordic Mobile Telephone, was introduced in 1981. The first 2G system commercially deployed in 1992, the first 3G system appeared in 2001 and 4G systems fully compliant with IMT Advanced were standardized in 2012. The development of the 2G (GSM) and 3G (IMT-2000 and UMTS) standards took about 10 years from the official start of the R&D projects, and development of 4G systems started in 2001 or 2002.

Predecessor technologies have occurred on the market a few years before the new mobile generation, for example the pre-3G system CdmaOne/IS95 in the US in 1995, and the pre-4G systems Mobile WiMAX in South-Korea 2006, and first release-LTE in Scandinavia 2009. In April 2008, NASA partnered with Machine-to-Machine Intelligence (M2Mi) Corp to develop 5G communications technology.

Mobile generations typically refer to non–backwards-compatible cellular standards following requirements stated by ITU-R, such as IMT-2000 for 3G and IMT-Advanced for 4G. In parallel with the development of the ITU-R mobile generations, IEEE and other standardization bodies also develop wireless communication technologies, often for higher data rates and higher frequencies but shorter transmission ranges. The first gigabit IEEE standard

was IEEE 802.11ac, commercially available since 2013, soon to be followed by the multi-gigabit standard WiGig or IEEE 802.11ad.

Debate

Based on the above observations, some sources suggest that a new generation of 5G standards may be introduced approximately in the early 2020s. However, still no international 5G development projects have officially been launched, and there is still a large extent of debate on what 5G is exactly about.

New mobile generations are typically assigned new frequency bands and wider spectral bandwidth per frequency channel (1G up to 30 kHz, 2G up to 200 kHz, 3G up to 20 MHz, and 4G up to 100 MHz), but skeptics argue that there is little room for larger channel bandwidths and new frequency bands suitable for land-mobile radio. From users' point of view, previous mobile generations have implied substantial increase in peak bitrate (i.e. physical layer net bitrates for short-distance communication), up to 1 Gbit/s to be offered by 4G.

If 5G appears, and reflects these prognoses, the major difference from a user point of view between 4G and 5G techniques must be something else than increased peak bit rate; for example higher number of simultaneously connected devices, higher system spectral efficiency (data volume per area unit), lower battery consumption, lower outage probability (better coverage), high bit rates in larger portions of the coverage area, lower latencies, higher

number of supported devices, lower infrastructure deployment costs, higher versatility and scalability or higher reliability of communications.

GSMHistory.com has recorded three very distinct 5G network visions having emerged by 2014:

A super-efficient mobile network that delivers a better performing network for lower investment cost. It addresses the mobile network operators pressing need to see the unit cost of data transport falling at roughly the same rate as the volume of data demand is rising. It would be a leap forward in efficiency based on the IET Demand Attentive Network (DAN) philosophy.

A super-fast mobile network comprising the next generation of small cells densely clustered together to give a contiguous coverage over at least urban areas and gets the world to the final frontier for true “wide area mobility”. It would require access to spectrum under 4 GHz perhaps via the world's first global implementation of Dynamic Spectrum Access.

A converged fiber-wireless network that uses, for the first time for wireless Internet access, the millimeter wave bands (20 – 60 GHz) so as to allow very wide bandwidth radio channels able to support data access speeds of up to 10 Gbit/s. The connection essentially comprises “short” wireless links on the end of local fiber optic cable. It would be more a “nomadic” service (like WiFi) rather than a wide area “mobile” service.

Research & Development projects

History

- In April 2008, NASA partnered with Geoff Brown and Machine-to-Machine Intelligence (M2Mi) Corp to develop 5G communications technology
- In 2008, the South Korean IT R&D program of "5G mobile communication systems based on beam-division multiple access and relays with group cooperation" was formed.
- On 8 October 2012, the UK's University of Surrey secured £35M for a new 5G research centre, joint funded between the British government's UK Research Partnership Investment Fund (UKRPIF) and a consortium of key international mobile operators and infrastructure providers – including Huawei, Samsung, Telefonica Europe, Fujitsu Laboratories Europe, Rohde & Schwarz, and Aircom International– it will offer testing facilities to mobile operators keen to develop a mobile standard that uses less energy and radio spectrum whilst delivering faster than current 4G speeds, with aspirations for the new technology to be ready within a decade.
- On 1 November 2012, the EU project "Mobile and wireless communications Enablers for the Twenty-twenty Information Society" (METIS) starts its activity towards the definition of 5G. METIS intends to ensure an early global consensus on these systems. In this sense, METIS will play an important role of building consensus among other

external major stakeholders prior to global standardization activities. This will be done by initiating and addressing work in relevant global fora (e.g. ITU-R), as well as in national and regional regulatory bodies.

- Also on November 2012, the iJOIN EU project was launched, focusing on “small cell" technology, which is of key importance for taking advantage of limited and strategic resources, such as the radio wave spectrum. According to Günther Oettinger, the European Commissioner for Digital Economy and Society (2014–19), “an innovative utilization of spectrum” is one of the key factors at the heart of 5G success. Oettinger further described it as “the essential resource for the wireless connectivity of which 5G will be the main driver” iJOIN was selected by the European Commission as one of the pioneering 5G research projects to showcase early results on this technology at the Mobile World Congress 2015 (Barcelona, Spain).
- In February 2013, ITU-R Working Party 5D (WP 5D) started two study items: (1) Study on IMT Vision for 2020 and beyond, and; (2) Study on future technology trends for terrestrial IMT systems. Both aiming at having a better understanding of future technical aspects of mobile communications towards the definition of the next generation mobile
- On 12 May 2013, Samsung Electronics stated that they have developed the world's first "5G" system. The core technology has a maximum speed of tens of Gbit/s (gigabits per second). In testing, the transfer

speeds for the “5G” network sent data at 1.056 Gbit/s to a distance of up to 2 kilometres.with the use of an 8*8 MIMO.

- In July 2013, India and Israel have agreed to work jointly on development of fifth generation (5G) telecom technologies.
- On 1 October 2013, NTT (Nippon Telegraph and Telephone), the same company to launch world first 5G network in Japan, wins Minister of Internal Affairs and Communications Award at CEATEC for 5G R&D efforts
- On 6 November 2013, Huawei announced plans to invest a minimum of $600 million into R&D for next generation 5G networks capable of speeds 100 times faster than modern LTE networks.
- On 8 May 2014, NTT DoCoMo start testing 5G mobile networks with Alcatel Lucent, Ericsson, Fujitsu, NEC, Nokia and Samsung. In June 2014, the EU research project CROWD was selected by the European Commission to join the group of "early 5G precursor projects". These projects contribute to the early showcasing of potential technologies for the future ubiquitous, ultra-high bandwidth “5G” infrastructure. CROWD was included in the list of demonstrations at the European Conference on Networks and Communications (EuCNC) organized by the EC in June 2014 (Italy).
- At the end of September 2014, Dresden University inaugurates a 5G laboratory in partnership with Vodafone.

- On October 2014, the research project TIGRE5-CM (Integrated technologies for management and operation of 5G networks) is launched with the aim to design architecture for future generation mobile networks, based on the SDN (Software Defined Networking) paradigm. IMDEA Networks Institute is the project coordinator.
- In November 2014, it was announced that Megafon and Huawei will be developing a 5G network in Russia. A pilot network will be available by the end of 2017, just in time for the 2018 World Cup.
- On 19 November 2014, Huawei and SingTel announced the signing of a MoU to launch a joint 5G innovation programme.
- On 28 April 2015, President Recep Tayyip Erdoğan announced Turkey might cancel 4G tender and move straight to 5G from 3G directly in two years.

Research

Key concepts suggested in scientific papers discussing 5G and beyond 4G wireless communications are:

The IEEE Journal on Selected Areas in Communications published a special issue on 5G containing a comprehensive survey of 5G enabling technologies and solutions. IEEE Spectrum has a story about millimeter wave wireless communications as a viable means to support 5G in its September 2014 issue.

- Radio propagation and channel models for millimeter wave wireless communications may be found in IEEE papers: Millimeter Wave Mobile

Communications for 5G Cellular: It Will Work!" in IEEE Access, Vol. 1, May 2013; "Broadband Millimeter-Wave Propagation Measurements and Models Using Adaptive-Beam Antennas for Outdoor Urban Cellular Communications, in IEEE Trans. Antennas and Propagation, April 2013, and many other peer-reviewed conference and journal papers. Pearson/Prentice Hall has released a comprehensive text on "Millimeter Wave Wireless Communications," authored by Ted Rappaport, R. W Heath, Jr., Robert Daniels, and James Murdock. This text, over 700 pages in length, covers technical areas regarding potential 5G technologies, including major global 60 GHz wireless local area network (WLAN) and personal local area network (WPAN) standards.

- Massive Dense Networks also known as Massive Distributed MIMO providing green flexible small cells 5G Green Dense Small Cells. A transmission point equipped with a very large number of antennas that simultaneously serve multiple users. With massive MIMO multiple messages for several terminals can be transmitted on the same time-frequency resource, maximizing beam forming gain while minimizing interference.
- Advanced interference and mobility management, achieved with the cooperation of different transmission points with overlapped coverage, and encompassing the option of a flexible usage of resources for uplink and downlink transmission in each cell, the option of direct device-to-device transmission and advanced interference cancellation techniques.

- Efficient support of machine-type devices to enable the Internet of Things with potentially higher numbers of connected devices, as well as novel applications such as mission critical control or traffic safety, requiring reduced latency and enhanced reliability. The usage of millimeter wave frequencies (e.g. up to 90 GHz) for wireless backhaul and/or access (IEEE rather than ITU generations)
- Pervasive networks providing Internet of things, wireless sensor networks and *ubiquitous computing*: The user can simultaneously be connected to several wireless access technologies and seamlessly move between them. These access technologies can be 2.5G, 3G, 4G, or 5G mobile networks, Wi-Fi, WPAN, or any other future access technology. In 5G, the concept may be further developed into multiple concurrent data transfer paths.
- Multi-hop networks: A major issue in beyond 4G systems is to make the high bit rates available in a larger portion of the cell, especially to users in an exposed position in between several base stations. In current research, this issue is addressed by cellular repeaters and macro-diversity techniques, also known as group cooperative relay, where also users could be potential cooperative nodes thanks to the use of direct device-to-device (D2D) communications.
- Wireless network virtualization: Virtualization will be extended to 5G mobile wireless networks. With wireless network virtualization, network infrastructure can be decoupled from the services that it provides, where

differentiated services can coexist on the same infrastructure, maximizing its utilization. Consequently, multiple wireless virtual networks operated by different service providers (SPs) can dynamically share the physical substrate wireless networks operated by mobile network operators (MNOs).

Since wireless network virtualization enables the sharing of infrastructure and radio spectrum resources, the capital expenses (CapEx) and operation expenses (OpEx) of wireless (radio) access networks (RANs), as well as core networks (CNs), can be reduced significantly. Moreover, mobile virtual network operators (MVNOs) who may provide some specific telecom services (e.g., VoIP, video call, over-the-top services) can help MNOs attract more users, while MNOs can produce more revenue by leasing the isolated virtualized networks to them and evaluating some new services

- Cognitive radio technology, also known as smart-radio: allowing different radio technologies to share the same spectrum efficiently by adaptively finding unused spectrum and adapting the transmission scheme to the requirements of the technologies currently sharing the spectrum. This dynamic radio resource management is achieved in a distributed fashion, and relies on software-defined radio.
- Dynamic Adhoc Wireless Networks (DAWN), essentially identical to Mobile ad hoc network (MANET), Wireless mesh network (WMN) or

wireless grids, combined with smart antennas, cooperative diversity and flexible modulation.

- Vandermonde-subspace frequency division multiplexing (VFDM): a modulation scheme to allow the co-existence of macro-cells and cognitive radio small-cells in a two-tiered LTE/4G network.
- IPv6, where a visiting care-of mobile IP address is assigned according to location and connected network.
- Wearable devices with AI capabilities. such as smart watches and optical head-mounted displays for augmented reality
- One unified global standard.
- *Real wireless world* with no more limitation with access and zone issues.
- *User centric* (or *cell phone developer initiated*) network concept instead of operator-initiated (as in 1G) or system developer initiated (as in 2G, 3G and 4G) standards
- Li-Fi is a massive MIMO visible light communication network to advance 5G. Li-Fi uses light-emitting diodes to transmit data, rather than radio waves like Wi-Fi.
- *World wide wireless web* (WWWW), i.e. comprehensive wireless-based web applications that include full multimedia capability beyond 4G speeds.

What's the technology behind it?

We should repeat that no firm 5G standard has been agreed on as yet, and that there may even be multiple standards all operating under a loose 5G banner.

Huawei, for example, believes that "5G radio access will be built upon both new Radio Access Technologies (RAT) and evolved existing wireless technologies (LTE, HSPA, GSM and WiFi)."

That being said, various entities working on potential 5G network standards, including Samsung and researchers at New York University, have come up with the idea of utilizing millimeter-wave frequencies.

This frequency range lies between 3 to 300MHz, which is much higher than current network standards. The main advantage of using this frequency range is that it's scarcely used by other broadcast technologies.

The result is the potential for greater speeds, as well as the capacity for more data to be drawn through it.

Millimeter-wave frequencies don't pass through solid objects very well, and it's difficult to sustain them over long distances, which is why they haven't been used in previous mobile networks. As a result, any 5G networks that adopt this approach will likely use lots of little base stations rather than relatively few large masts.

The increase in spectrum means that these smaller base stations will be able to share data between one another as well as with everyone's phones,

smartly detecting how much data each user needs to access at any one time and doing it out accordingly.

It's also worth noting that use of millimeter-wave frequencies requires approval by various regulatory bodies, so don't start counting those 5G chickens just yet.

When will 5G arrive?

The plan is to get London up and running with 5G by 2020. This should make it among the first areas in the world to receive this next gen network. We're a little far out to speculate on when the rest of the country might get the benefits of 5G, but if the recent switch to 4G is anything to go by, it should start spreading out pretty soon after its capital debut. Of course, the likely need for new antenna installations could see a longer delay.

5. SHARP'S CCD FEATURES 'INDUSTRY'S HIGHEST' VISIBLE LIGHT SENSITIVITY

P. MATHESWARAN

(SYSTEM ADMIN)

Sharp Corp released a 1/3-inch 0.35-Mpixel CCD for cameras used to shoot fast-moving objects.

The CCD is targeted at cameras used for ITS (intelligent transport systems) and FA (factory automation).

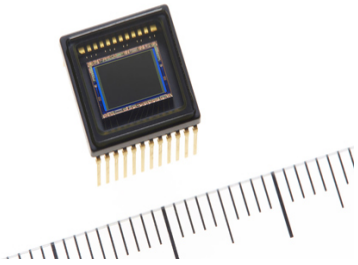
Sharp realized a visible light sensitivity of 3,800mV by expanding the area for converting light to image signals. The company claims that it is the industry's

highest visible light sensitivity. Also, Sharp employed its own high-speed image signal transmission technology and output for up to two channels so that the CCD supports high-speed shooting for outputting 200 images per second.

With those features, when the CCD is used in a camera for FA, it realizes high-speed processing such as positioning and inspection on production lines, contributing to improving production efficiency. Also, by applying a near-infrared light, it becomes possible to take clear images of the license plate of a car traveling at a high speed in the night and an object in the dark, Sharp said.

This time, Sharp will release four models of the CCD. They have different numbers of output channels (one/two) and different color filters (original color/black and white). The price of its sample is ¥8,000 (approx US$64.6, including tax).

For the future, Sharp plans to respond to various needs for image sensors by supplying a wide product line of CCDs with a pixel count of up to 8 Mpixels in addition to the latest 0.35-Mpixel product for ITS and FA cameras.



Sony Mobile, ZMP Tie Up on Drone Business

Sony Mobile Communications Inc and ZMP Inc announced that they will cooperate in the development and provision of industrial business solutions combining drone-based imaging and cloud-based image data processing.

ZMP is a venture firm specialized in robots. In early August 2015, they formed AerosenseInc (Bunkyo-ku, Tokyo), a joint venture to be owned 50.005% by Sony Mobile Communications and 49.995% by ZMP.

Aerosense will develop business solutions such as for measurement, examination, management and inspection based on Sony's technologies in the fields of cameras, sensing, communication networks and robots and ZMP's technologies related to autonomous driving and robots and business experience in the industrial field. It will start services for corporate customers in 2016.

Sony Mobile Communications will engage in the project as a new business targeted at the IoT (Internet of Things) market. ZMP, which has been

running its business "on land" by using, for example, its autonomous driving technology, will expand the business to the sky.

Renesas to Release 16, 32Mb Soft Error-resistant SRAMs

The Advanced Low Power SRAM prevents soft errors from occurring by adding stacked capacitors to the memory nodes of memory cells. Its resistance to soft errors is more than 500 times higher than that of conventional full CMOS memory cells, Renesas said. Renesas Electronics Corp added 16- (RMLV1616A) and 32-Mbit (RMWV3216A) products to its "Advanced Low Power SRAM" series, which features a high resistance to soft errors and latch-ups.

Renesas has already started to mass-produce 4- and 8-Mbit products manufactured using 110nm process technology. This time, the company added larger-capacity products manufactured using the same process technology. The prices of the samples of the 16- and 32-Mbit products are ¥1,800 (approx US$14.5) and 3,400, respectively, per unit.

Stacked capacitors added

Also, the load transistor (p channel) of the SRAM cell is formed with polycrystalline TFTs and stacked on the top layer of the n-channel MOS transistor formed on a silicon (Si) substrate. Because only n-channel MOS transistors are formed directly on the Si substrate, there is no parasitic

thyristor structure in the memory region. Therefore, there is no latch-up in principle.

With those features, the Advanced Low Power SRAM is best suited for industrial equipment such as FA (factory automation) equipment, measuring instruments and smart grid-related devices, which require a high reliability.

The Advanced Low Power SRAM, as its name indicates, has a low power consumption. The standby current of the 16- and 32-Mbit products are 0.5µA (standard value) and 1µA (standard value), respectively, which are less than half those of Renesas' previous products. Also, the minimum power supply voltage at the time of retaining data is 1.5V, which is lower than that of the previous products (2.0V).

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