Blessings

Prof. B. S. Sonde
Former Vice Chancellor, Goa University & Professor of ECE,
Indian Institute of Science

I am very pleased to learn that the Institution of Electronics and Telecommunication Engineers (IETE), Bengaluru Centre is bringing out a quarterly Magazine entitled IETE Bengaluru Magazine beginning from September 2018. As I understand, the objective of the Magazine will be to provide an overview of technical programmes and related activities being conducted by the Centre and its achievements, successes and future plans in the service of IETE members and other technical professionals in Bengaluru. This is indeed a praiseworthy activity which deserves full encouragement.

Having been closely associated in different capacities with the IETE Bengaluru Centre for over five decades, it is a great pleasure for me to see that the Centre has earned the admiration, gratitude and respect of technical professionals in the Country for the quality, standard and usefulness of its programmes and activities. Besides, the Centre has been following the fine traditions set by its Founders and the growth path shown by the technical leaders who succeeded them in later years. And, the Centre has been able to fulfill the professional needs of IETE members in Bengaluru and elsewhere in each passing decade through its wide range of technical programmes and activities many of which being innovative, contemporary and stimulating to its membership in different age groups, This has indeed helped the Centre in continuing to retain its leading positions among the Centres of the Institution in India for a long time.

It is a matter of considerable satisfaction for me that the Centre has decided to launch the IETE Bengaluru Magazine from now onwards. I have no doubt that this will help the Centre to disseminate useful information on the technical events and other activities conducted by it for the benefit of IETE members and technical others. This can also be helpful in stimulating other IETE Centres to launch similar publications at their end and for the overall progress of the Institution in the Country. I wish the Executive Committee of IETE Bengaluru Centre and the Editors of the Magazine a grand success.

Bangalore   **(B. S. Sonde)**
6th September 2018

From President's Desk

I am very glad to know IETE Bengaluru Centre is starting a quarterly magazine to share information about the activities and also disseminate knowledge through topical and state-of-art technical articles.

IETE Bengaluru is one of the very active centers involved in organizing many programs; one such upcoming event is an international confrerence being organised under the aegis during Dec 2018.

It is therefore very appropriate that a magazine is started which helps in showcasing its multifaceted activities.

IETE HQ has always supported and encourages all initiatives by its centres in the pursuit of sharing and knowledge.

I wish the magazine all the success.

Prof (Dr.) K.T.V. Reddy

CONTENTS

IETE BENGALURU

Mr. H. Ramakrishna
Former Executive Director, CRL, BEL

IETE Bangalore has become a hub of activity with the existence academic institutions like IISc and numerous engineering colleges, R&D institutions like ISRO, DRDO and Industries like BEL While IETE has been collaborating with these institutions for conducting technical courses and seminars it was felt necessary to bring out a IETE BLR magazine. This will provide a platform for professionals and students to contribute articles of interest to the Electronics and Telecommunication Community.

I wish this initiative all success in years to come.

H. Ramakrishna

From the Chairman

Dear IETE Members,
It is brought to your kind notice that the present Executive Committee took over charge on 30th June 2018. One of the tasks that the previous Committee had set out to do was to publish a quarterly News Letter with the aim of improving the connectivity among all IETEians at Bangalore and keep them well informed about the technical ventures of the centre. We are sure of its fruits in the form of enhanced active participation of our distinguished members to further our name and fame in the engineering profession.

The very first issue of the Magazine is in your hands and it is my honour to express my sincere thanks to the Editorial Board for their excellent efforts and contribution to make our long cherished dream a reality. I would also like to thanks BEL for their support and advertisement.

As Chairman of IETE Bangalore, I urge each one of you to participate actively in all programs of the Centre and I invite you to visit us as often as you can and strengthen our hands to raise our institution to greater heights of glory. I am confident of your continued support.

With warm regards,

HS Bhatia
Chairman
IETE Bengaluru

From the Hon. Secretary

The Magazine has long been in the making, in our minds, and now it is out there. It was initially conceived as a News Letter, a chronicle of technical activities and 'happenings' at the Centre, together with photographs, indicating also details of our plans for the year. But then, it occurred to us that we could perhaps make it more useful and readable if we added articles, news and views and thus raised it to a 'news magazine'. We rather wanted it to be a platform for IETE members to come closer together and showcase their creativity. We wanted all to participate in its making, while being readers as well.

I hope the Magazine will achieve this aim and you will help us realise our dream. We invite your write-ups, your ideas, anecdotes, snippets of information and all that you would like to see in a house magazine of yours. We encourage criticism and even rebuke so that we will be on our toes, and will strive to make the magazine better and better in its subsequent issues.

Thank you all for your encouragement and involvement.

C. Satyanandan
Hon. Secretary
IETE Bengaluru

FROM THE EDITOR'S DESK

Welcome to *ieteBengaluru Magazine!* The buzz word now is IMMERSIVE EXPERIENCE. It may be in the context new technologies like AI, Augmented Reality and like. However we would like borrow it here to give you a similar comprehensive view of everything that is happening at IETE Bengaluru and also in the Technology World. Yes, there are lot of exciting things happening in Bangalore IETE! It is our endeavor to not only unravel the exciting events but also involve and encourage you to be creators of many more events. Of course, this quarterly magazine will inform you of technical and other events, introduce the committee and other important people, recognize achievers, announce new plans and events, identify technology trends and provide some in-depth technical articles. We propose to add a lot more exciting sections in the subsequent issues.

It is your magazine and the most important charter of this magazine is to expose your talent. We need you to be part of this. So please send your contributions and also your valuable suggestions in any aspect of this magazine to improve it.

Looking forward to your contributions / suggestions / critical views!

We deeply acknowledge Prof B S Sonde, Mr H Ramakrishna and Dr K T V Reddy for their kind support & blessings and all the authors for their valuable contributions.

Have a great immersive experience of the first issue of *ieteBengaluru Magazine!!*

Dr M H Kori
On behalf of Editorial Board

IETE Bengaluru Magazine Editorial Board: Shri. H Ramakrishna, Prof. HS Bhatia, Shri. C Satyanandan, Shri Jagannatha Rao, Prof. PN Sharada & Dr. M H Kori

iici-18

IETE INTERNATIONAL CONFERENCE INDIA-2018 (IICI-2018)
ON
TECHNOLOGICAL ADVANCES & APPLICATIONS IN IOT, DATA ANALYTICS & 5G
DECEMBER 13-15, 2018   BANGALORE, INDIA

Technology is changing the world around us. The future will be defined by advances in autonomous IoT, big data analytics, artificial intelligence, machine learning and augmented/virtual reality, supported by high-speed, low-latency, secure connectivity. Many of these technological developments will come to maturity in the 5G era.

'IETE International Conference India - 2018' (iici-18), on "Technological Advances & Applications in IOT, Data Analytics & 5G" attempts to string together all the above technologies and attempts to closely report the interplay and benefits. iici-18 creates a platform for experts to come together and exchange their research and developments, provide opportunities for industries and startups to exhibit their new and innovative products at this conference. Internationally renowned experts will be sharing their expertise in these domains in the pre-conference Tutorials and in the Plenary / Invited Talks.
iici-18 is going to be a technically rich and rewarding experience and a great opportunity to be associated with.

Please come and participate in this exciting technical conference.
**Contact: Email: bangalore@iete.org; iiciblr2018@gmail.com; rgieteb@gmail.com;
Phone: +91-80-23331133, Mob : 9663399311**

Know Your Executive Committee

Prof. HS Bhatia
Chairman
Served LRDE for 35 years. After retirement he was Prof & HOD (Dept. of ITE) in KNSIT Bangalore for 10 yrs. He has B Sc, BE Sc (TCE) and M. Tech from IIT Delhi in Radar Systems.

Mr. G Ramesh
Immediate Past Chairman
Division Head,
CSD/CMG/CMMA/ U R Rao Satellite Centre, Bengaluru

Mr. C Satyanandan
Honorary Secretary
Retired Chief Engineer (Re-designated Addl. Director General-Engg.), Doordarshan & AIR (South Zone), Chennai. Graduate in Electrical Engg.

Mr. BN Jagannatha Rao
Honorary Treasurer
Former Scientist/Engineer-SG I, heading Quality Control Division and Electronic Fabrication Division in System Engineering Group ISRO Satellite Center. During 1977 to 2017 he was responsible for project activities as Project Engineer, Project Manager, Deputy Project director etc.,

Mr. CL Gangaprasad
Vice Chairman
Scientist G and Executive Director at C-DAC Bangalore. He has a Master's Degree in Electronics & Communications from National Institute Technology, Suratkal.

Mr. CP Dwivedi
Vice Chairman
Engineer (R&D) Crypto Group ITI Ltd. Bangalore M.Tech. (VLSI Technology),
MBA (Operation Management). Pursuing PhD in
Electronics & Telecom Engineering

Mr. GK Venkatesh
Member Executive Committee
Professor at SJCIT Chickballapur. He has BE from Bangalore Institute of Technology, M.Tech from Dr MGR University, Pursuing PhD in Electronics Engineering.

Mr. Shrishail Angadi
Member Executive Committee
Head – IT IS Project Delivery. Tata Consultancy Service, Bangalore. Working for TCS over 25 years in various capacity and responsibilities including Software Products Management, IT- Operation Management, and Country Head etc. He has PhD in Management from Jain University, Masters in Management from University of Pondicherry and Graduate Degree from IETE.

Mr. Doddamani Govind Rao
Member Executive Committee
Senior Scientist in Electronics and Radar Development Establishment (LRDE), DRDO, Bangalore. He has Bachelor of Engineering Degree in Electronics and Communication from Gulbarga University, M.Tech in VLSI System Design from NIT Warangal.

Mr. Ranjeet Kumar
Member Executive Committee
Graduate from IETE in 2006. MBA in information technology. Audio Video solution consultant in Godrej

Prof. GS Raveendra
Member Executive Committee
Assistant Professor, School of Electronics and Communication Engineering, REVA University, Bengaluru. B.E. in Electronics and Communication Engineering and M. Tech in Signal Processing from VTU, Belagavi.

Prof. CG Raghavendra
Co-opted Member
Assistant Professor at Ramaiah Institute of Technology, Dept of E&C, Bangalore
B.E., M.Tech. in Electrical & Communications Engg.

Mr. KS Ravi
Co-opted Member
Senior Dy General Manager, Central D&E, CADDS, Bharat Electronics Ltd. He is a Graduate in Mech Engineering with Specialization in Concept of Design for Manufacturing.

Mr. D Rajagopal
Governing Council Member
Completed Advanced Electronics and System Engg. Course (AESE) with distinction from Military College of Telecom Engg. (MCTE), Mhow, Was deputed to LRDE, DRDO. Obtained Post Diploma in Computer Engineering from Board of Technical Examinations, Karnataka and completed AMIETE. Retired from LRDE as Scientist-D in 2006.

Dr. DC Pande
Governing Council Member
Was Outstanding Scientist & Associate Director at Electronics & Radar Development Establishment (LRDE) and presently is Dr. Raja Ramanna DRDO Distinguished Fellow. Bachelor and Master Degrees in Electronics from Garhwal University, Ph.D in Applied Physics from University of Allahabad.

AN EVENTFUL QUARTER

Annual General Body Meeting of IETE Bangalore was held on Saturday, 30th June 2018 at 4.30 pm.

June 2018

Nagaraja Memorial
Lecture
following AGM
30th June 2018

July 2018

Meeting first- 7th July '18.
The first meeting of the
Executive Committee
2018-2020

A Faculty Development Program on "RF Circuits and Systems" was jointly organized by the Departments of Telecommunication Engineering and Electronics & Communication Engineering at Ramaiah Institute of Technology, Bangalore during 23rd to 28th July 2018. It was technically supported by IETE Bangalore Centre, IEEE Sensor Council, Bangalore chapter, and IMAPS India.

SVCE organized a one day technical seminar on "Introduction to Human Values" at SVCE, Bengaluru campus on Monday, 30th July 2018. The objective of this program was to enlighten on the human values in technical education. The seminar helped the students personality development on a large scale. This program was organized for the benefit of a large number of faculty members from various colleges

Aug 2018

Meeting with Ms. Manjula
DG (ECS) DRDO

President IETE presented the Triveni Devi Memorial award for 2016 to Ms. Manjula, Director General (ECS) DRDO on 10th Aug. 2018 at her office in Bangalore. President Prof. KTV Reddy was accompanied by Prof. HS Bhatia Chairman, Shri. G Ramesh Immediate Past Chairman and Shri. C Satyanandan Hon. Secretary of IETE Bangalore.

IETE-IRSI Awards Committee meeting in progress 11th Aug. 2018

Independence Day 2018 was celebrated at IETE Bangalore. Padmashri. AS Kiran Kumar Former Chairman ISRO was the Chief Guest and hoisted the Flag.

Dr. Kiran Kumar inspires IETE members on Independence Day

Kuppam Engineering College now in IETE Bangalore family. IETE Students Forum was inaugurated at Kuppam Engineering College, Kuppam on 17th Aug. '18. Sri. C.Satyanandan Hon.Secretary IETE Bangalore inaugurated the ISF. Prof. C. Murali Past Chairman was the Guest of Honour and gave a talk on IoT.

Activities for September– November Quarter:

| 01 | 27-08 to 01-09-18 | : | Modern Radar Course for BEL Executives (6 Day) |
02	15-09- 2018	:	Engineers' Day
03	17 to 19-09-2018	:	APAR course for BEL Executives (3 Day)
04	30-09-2018	:	1 Day Workshop on Network Analysis
05	02-10-2018	:	Ayudha Pooja Celebration
06	06-10-2018	:	1 Day Workshop on Basic Electronics
07	07-10-2018	:	MATLAB/SIMULINK
08	14-10-2018	:	Adv. FPGA Design
09	14-10-2018	:	I Day course on Cyber Security Awareness
10	15to17-10-2018	:	2 Day Technical Workshop on Internal Auditing
11	17to19-10-2018	:	2 Day Internal Auditor training
12	20-10-2018	:	1 Day Workshop on Basic Electricals
13	21-10-2018	:	Java & Android Applications
14	28-10-2018	:	1 Day Workshop on Electromagnetics
15	02-11-2019	:	IETE Foundation Day
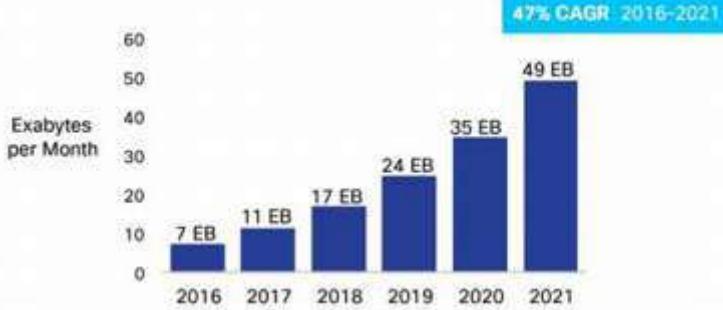
Demystifying 5G! - A primer

Dr M H Kori

It is almost impossible to imagine a modern-day life without a mobile phone. Everyday a new and better feature, app, facility, camera is added. Mobile is the past, present and future.

Mobile is well on course to become the significant provider of data traffic, thanks to the never-ending growth of connected devices. Within the next four years, global mobile traffic will have increased seven-fold. Most of this growth—especially in emerging or developing markets—can be attributed to the ubiquitous computer in the pocket – the Mobile Phone.

In June 2018, more than 8.19 billion GSM-HSPA-LTE connections were in effect—greater than the world's 7.49 billion population. By the end of 2022, the global mobile broadband market is expected to include nearly 9.3 billion subscribers.

With global mobile data traffic expected to grow eight times by the end of 2023, there is a need for a more efficient technology, higher data rates and spectrum utilization. New applications such as 4K/8K video streaming, virtual and augmented reality and emerging industrial use cases will also require higher bandwidth, greater capacity, security, and lower latency.

Previous generations of mobile networks addressed consumers predominantly for voice and SMS in 2G, web browsing in 3G, and higher-speed data and video streaming in 4G. The transition from 4G to 5G will serve both consumers and multiple industries. Equipped with these capabilities, 5G will bring new opportunities for people, society, and businesses.
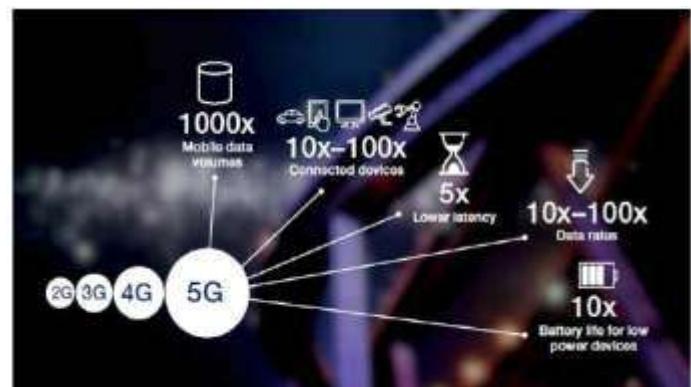
5G is more than just a generational step; it represents a fundamental transformation of the role that mobile technology plays in society. As demand for continuous connectivity grows, 5G is an opportunity to create an agile, purpose-built network tailored to the different needs of citizens and the economy.

5G will naturally evolve from existing 4G networks but will mark an inflection point in the future of communications, bringing instantaneous high-powered connectivity to billions of devices. It will be designed specifically for the way we want to live and provide a platform on which new digital services and business models can thrive. It will enable machines to communicate without human intervention in an Internet of Things capable of driving a near-endless array of services. It will facilitate safer, more efficient and cost-effective transport networks. It will offer improved access to medical treatment, reliably connecting patients and doctors all over the globe. From low-power, sensor-driven smart parking to holographic conference calls, 5G will enable richer, smarter and more convenient living and working. It is a giant step forward in the global race to digitize economies and societies.

The 5G standardization has been accelerated with first 5G New Radio (NR) standard finalized in Dec 2017 and completed in June 2018. First commercial 5G networks and devices based on the 3GPP standards are expected towards the end of 2019. It is estimated that the number of subscriptions will be reaching one billion by the end of 2023. 5G wireless networks will support 1,000-fold gains in capacity, connections for at least 100 billion devices, and a 10 Gb/s individual user experience capable of extremely low latency and response times. Deployment of these networks will emerge between 2020 and 2030.

There is a common misperception that 5G has already been commercially deployed in advanced countries and in India is lagging. It is not true. No commercial mobile services using 5G is available anywhere in the world. Extensive field trials are being done and some pre-standard limited operations are available. India is very active in 5G preparations and is likely to roll out almost concurrently along with rest of the world.

From 1G to 4G, major emphasis has always been in addressing the insatiable demand for higher data rates. Though 5G continues to address this ever increasing demand, but 5G charter is not limited only this requirement. It is also giving equal emphasis on the new developments like massive machine to machine communications including IOT and high reliability and low latency applications. Hence in these dimensions there is a paradigm shift in the progress to 5G.

The ITU, in its 5G recommendations, divides use cases into three main categories:

1. Enhanced Mobile Broadband (eMBB). eMBB is the most obvious extension of LTE capability, providing higher speeds for applications such as streaming, Web access, video conferencing, and virtual reality. Highest speeds will occur in small cells with limited movement speed of end users, such as with pedestrians.

2. Massive Machine-Type Communications (mMTC). Massive machine-type communications extends LTE Internet of Things capabilities—for example, NB-IoT— to support huge numbers of devices with lower costs, enhanced coverage, and long battery life. As shown in the ITU objectives, below, 5G will support ten times as many devices in an area as LTE.

3. Ultra-Reliable and Low-Latency Communications (URLLC). Of the three categories, URLLC enables wireless applications never before possible. Driven by high dependability and extremely short network traversal time, URLLC, also referred to as "mission-critical" communications, will enable industrial automation, drone control, new medical applications, and autonomous vehicles. This category is also referred to as critical machine-type communications (cMTC).

Some fascinating technologies have facilitated meeting the above requirements. We will be covering these technologies in subsequent issues!

Ref:
1. LTE to 5G - 5G Americas / Rysavy Research White Paper
2. 5G Era – GSMA
3. 3GPP Reports

C4ISR – An overview and Challenges to implementation

By
D.A.Mohan
CEO, DAC Intl, Formerly, Executive Director (Strategy), Bharat Electronics Ltd.,

Abstract

C4ISR (Command, Control, Communication, Computers, Intelligence, Surveillance and Reconnaissance) has become one of the most important features of the military theater pursued by all major defence forces of the world today. Improved precision strike capability, efficient and fast decision making between commanders and operational units, real time data capture, dissemination, analysis overlaid on GIS and cartographic maps and enhanced situational awareness at all levels are some of the advantages perceived from C4ISR implementation.

However C4ISR poses its own challenges. Threat of system malfunction and failure at critical times due to Cyber hacking, too much dependence on machines, technological difficulties of handling and processing terabytes of data and extraction of valuable intelligence in real time, interoperability with legacy systems as well as friendly forces, and huge cost are some of the challenges that defence forces are grappling with and attempting to solve.
This paper discusses some of the above issues and possible ways ahead for C4ISR on which global militaries are estimated to spend a whopping USD 125 Billion by 2020.

1.0   Introduction:

Conflict between groups of people has existed since time immemorial. In earlier times it was the physically strong who dominated over the weak. As human mind developed newer and newer ideas the nature of conflicts has changed over the years. Conflicts became battles and progressed to wars. Lethality and destructive power increased and vast number of casualties resulted extending to civilian populations as well. Till the First World War the focus was on how to enhance the accuracy and lethality of small arms and artillery. The later part of the First World War saw the introduction of battle tanks and submarines for the first time. The Second World War saw major movement towards the maturing of technology with Submarines, aircraft and more sophisticated battle ships being used extensively. Electronics started to play an important part with introduction of such major systems like Radars and Communication equipment. This phase of evolution can be termed "Platform dependent warfare". The Second World War ended with the dropping of atomic bombs and was a major departure in the nature of warfare. Platform dependent warfare had progressed to "Nuclear Warfare". Fortunately for mankind, no country has resorted to usage of Nuclear weapons again, so far. Some

countries developed chemical and biological warfare capability with horrendous results.

Till about 1995, most countries focused on developing more and more advanced platforms like different types of fighter aircraft, Aircraft carriers, Silent Submarines, Helicopter Gunships, missile systems, Long range artillery and so on. Meanwhile electronics was becoming pervasive in military systems and a new form of warfare called "Electronic Warfare" evolved. The aim of EW was to disable enemy's electronic and communication systems by denial of spectrum through use of Jammers, Cyber-attack etc. and protection of own systems through Electronic Counter measures.

The year 1995 saw the introduction of the "Internet" that forever changed the way wars were conceptualized and fought.

2.0 Evolution of Network Centric Warfare:

The high level of sophistication of platforms with deadly accuracy and lethality forced military planners to think about how to reduce the exposure of own military manpower to danger and minimise loss of life. "Situational awareness" at all levels about the terrain and location of friendly and enemy troops and equipment was extremely important.

Collection of intelligence about the enemy locations and deployment, relaying the data to command centers over secure and fast communication media, quick and efficient processing of received data and extraction of useful information, displaying that information with an overlay of geographic picture, assisting the commanders in decision making and completing the loop by relaying the commands to the front lines for action would dramatically enhance the efficiency of operations. It would result in reduction of what is called "Sensor to Shooter" cycle time (OODA - Observe, Orient, Decide and Act - Loop) in a major way and enhance accuracy of strike.

In addition to direct battlefield tactical operations, other functions like supply chain management, evacuation of casualties, foreseeing changes in battle scenario due to enemy actions and many other such important activities needed to be addressed dynamically as the situation on the ground unfolded. Realisation of such a system required that the various elements taking part were inter connected with each other with capability of fast and efficient flow of information.

Mid-nineties saw the wide spread adoption of the Internet and the information exchange process among a network of computer systems and users became much easier. Defence planners were quick to realise the importance of this new technology and immediately got to work to realise their dream on situational awareness and OODA loop optimisation. Initial implementations started towards the last part of the nineties. Large scale deployment happened during the Gulf war of 2003 and the efficacy of "Network Centric Warfare" was proven beyond doubt.

3.0 Constituents of Network Centric Systems (NCS):

The core concept of Network Centric Warfare involves tight integration and Networking between Sensors, Fail safe Transverse Communication Media, Command & Control centers and Land, Air, Naval platforms and Tactical units. The highly mobile environment of modern warfare makes Situational Awareness a critical success factor for perfect Synchronisation between sensors and shooters. Realisation of this concept requires extensive use of Surveillance & Reconnaissance, Computers, Communication, Command centers, Control and Intelligence. Industry has coined the acronym C4ISR to this developing concept. C4ISR is now being applied to a wider context including civilian applications than just the military NCW application.

The Network Centric Systems or C4ISR systems are constituted by the following:

a.   Important Network Elements – Sensors:

Sensors are the "eyes and ears" of NCS. They play the role of observing / monitoring, recording and to some extent relaying data on enemy positions and movements. Important sensor elements are the following:
- Optical cameras – For daytime operation
- Night vision devices – for observation in darkness
- Radars of different types
- Unmanned Aerial Vehicles
- Reconnaissance Aircraft
- Surveillance Satellites
- Aerostats – Tethered Balloon based observation systems
- Airborne Early Warning and Control Systems (AWACS)
- Signal Intelligence systems – Direction Finding, Monitoring and Interception

It is beyond the scope of this brief article to go into the details of each sensor type and describe their operation.

The widely diverse sensor elements as listed above generate vast amounts of audio, video and data using different coding standards and formats. It is indeed a challenge to process the sensor signals and harmonise them to be able to establish the time and location stampings and extract useful actionable information.

b.   Important Network Elements – Integrated Communications infrastructure

Network Centric architecture is a sharable one where all data is available to all users at all times subject to access controls. The network operates in a "User pull" mode. Robust, reliable and disruption protected redundant seamless communication is the backbone of NCS. It is built using the following:
- Point-to-point, Point-to-multipoint Radios
- Powerful data routers
- Mobile ad-hoc networking (MANET),

- Multi-media encryption
- Combination of HF/VHF/UHF/Microwave /SD Radio networks with IP-based LAN and WAN networks, Fixed & mobile Telephone networks and Satellite
- Backbone Network with auto rerouting to avoid jammed pathways

Radios used in NCS networks should have the following features:
- Capable of independent Voice & Data Communications
- High Data Rates & Low Spectrum usage
- Embedded GPS capability
- Net capability- Multi hop & MANET (Mobile Adhoc Net)
- Operational range in all environmental conditions
- Electronic Protection – Encryption & Anti Jam

Software Defined Radio meets most of the above requirements and is widely used for NCS.
Software Defined Radios provide the following advantages in tactical communication:
- Embedded routing mechanisms
- Reconfiguration of the network in a fast and automatic way;
- Seamless connectivity
- Radio based positioning capability (Triangulation) – alternative to GPS
- Electronic warfare functionalities
- Security of communications
- Easy interoperability among different military forces
- Gradual replacement of legacy radios and interoperability with them

Internet Protocol (IP), IPV6 has been adopted by most users as an Adhoc standard. Upgrading legacy systems to make them compatible with IPV6 is a major challenge

c.   Important Network Elements – Routers:
A router operating at layer 3 of OSI's seven layer network (which is the network layer) provides layer management protocols such as routing, multicast group management, network layer information and error and network layer address assignment. A layer 3 router can control which user gets what data using access control lists and filters that optimize bandwidth and cure network congestion.
Core and edge routers (that are quite often embedded in other systems like radios) are extensively used in NC/C4ISR systems. Data flows between any two access networks through a core network that automatically finds less congested routes and alternative pathways for damaged segments, in a tactical battlefield situation.

d.   Important Network Elements – The Satellite:
Satellite communications networks satisfy military network centricity requirements over entire hemispheric areas. High power X, Ku & Ka-band satellites are ideally suited for ISR requirements. L-Band and S-Band systems are used for small narrowband terminals.

Role of Military Satellites
Static arena applications,
• High command, Strategic fixed network & Territorial command posts
Deployed arena applications,
• Divisional command posts, Brigade command posts and Special Forces
Maneuvering arena applications,
• Battalion command posts and Special Forces

e.   Multi Sensor Data Fusion & Decision Support:
With multitudes of sensor elements gathering data continuously the task of receiving, analysis, filtering incoming data is a tough task indeed. Tera bytes of data (Voice, Video streams, Raw data) need to be filtered, combined, time stamped and stored using complex data base systems.

Sophisticated algorithms analyse incoming data, compare with existing data bases and extract information out. This information is to be further analysed with reference to user interest, current requirement, redundancy etc. Ultimately, useful and actionable information is to be presented to decision makers and commanders. Situational awareness demands that geographical and cartographic data has to be superimposed and information flagged on them dynamically. The commanders should be able to cope with the massive amount of information pouring in which is manually impossible. Computerized decision support systems aid the process that can be either on line or off line.
Huge wall to wall digital displays are employed to present the fused picture of the battle field.

Technologies for Data Fusion:
- Very complex process, Handle Terra Bytes of data
- Data Compression / Decompression
- Sophisticated computer algorithms, Data bases, Data base management, Data mining
- Knowledge systems, Pattern identification, Geographical Information Systems (GIS)
- Very high performance computing, Computer Networking, SENSOR interface technologies
- Display technologies, Decision Support Systems, High speed Communications, Overlay on GIS
- Immunity from Cyber attacks

4.0 Indian Network Centric Programs:
India has realised the importance of C4ISR for countering threats in its neighborhood. At the heart of the network is CIDSS to which various individual networks are connected.

CIDSS – Command Information & Decision Support System
BSS – Battlefield Surveillance System
AWAN – Army Wide Area Network
ASCON- Army Strategic Communication Network
BMS- Battle Field Management System
TCS – Tactical Communication System
NFS – Network For Spectrum
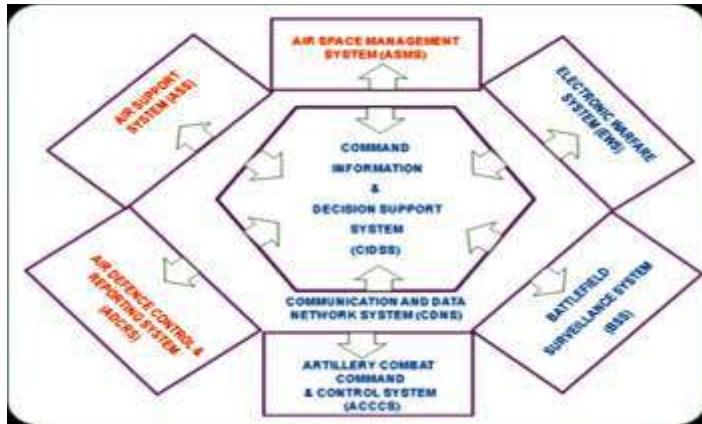
ACCCS – Artillery Command & Control System
AFNET – Air Force Network
        Navy Net – Naval Network

List of programs is given below:

While some of the modules have been implemented others are still evolving. A number of sensor elements have been procured and are operational. However a majority of them are functioning on a standalone basis with limited networking. A completely functioning C4ISR system seems to be some time away.

5.0 Drawbacks of NCS/C4ISR and Challenges in implementation:
Even though C4ISR has numerous advantages in enhancing situational awareness and speeding up the command and control processes, it is not without its own limitations. Some of the more important ones are listed below:

•   NCW - Computer centric instead of Human centric
•   Heavy reliance on complex technology, particularly

infrastructure - primary centre of gravity for opponents to exploit
•   Any disruption to networks could be catastrophic
•   GPS - Core asset for NCW to work - GPS jammers can block GPS signals
•   Cyber attack susceptibility
•   Interoperability - Major challenge in Network Centric Systems
        Interoperability between:
•   Different types of Hardware & Software used in various electronic systems
•   Equipment used by Infantry soldier, Tanks & other Ground fighting vehicles
•   Ground to Air, Air to Air, Air & Sea communication
•   Ship to Ship, Ship to shore, Ship to Air communication
•   Massive quantities of video and imagery can strain the ability of a network to supply the right information, at the right place, at the right time
•   Enemy could deliberately induce disturbances designed to push the NCW system into chaos. Overload sensor and shooter network grids with multitude of small weapon systems like a swarm of birds

Possible Mitigation steps could include Intensive training at different levels, Built in redundancy against node failures, Fall back option in case of Network degradation, Prevent information overload at different operational levels especially tactical level and Hardening against Cyber-attacks and localizing malware.

6.0 Conclusion:
The above paper gives a brief overview of C4ISR/NCW. Various elements constituting a typical network has been explained. Advantages and limitations have been brought out.

Television in India -The Early Days   - C Satyanandan

My association with Television started with the SITE (Satellite Instructional Television Experiment) program of the Govt. of India as an engineer with Doordarshan (then part of All India Radio) when we were still struggling to grapple with the complexities of the new medium, the technology still in its nascent stage. The experimental satellite TV started on 1st August1975 and ended on 31st July1976. The television programmes prepared by Doordarshan at the three studios at Delhi, Cuttack and Hyderabad, and an ISRO studio located in Mumbai were uplinked by Indian Space Research Organisation (ISRO) at 6 GHz to the satellite ATS 6* from one of two ground stations located in Delhi and Ahmedabad.

These signals were then re-transmitted at 860 MHz by the satellite, which were directly received in 2400 villages in Orissa, Madhya Pradesh, Rajasthan, Bihar, Karnataka and Andhra Pradesh by community television receivers with 3 m parabolic antennas. Regular television stations also received the signals and broadcast them to another 3000 villages in the standard VHF television band.
At Cuttack, where I was in charge of the Upagraha Doordarshan Kendra, we originated Oriya language programmes and also contributed programmes for Hindi speaking rural viewers of Madhya Pradesh. Nearly 600 Community TV sets (Direct Reception Sets – DRS) were installed in three districts of Orissa by ISRO. The success of SITE led to an increased focus on satellite broadcasting in India. As a follow up, in six states where people had the

benefit of the Direct Reception Sets, terrestrial* transmitters were installed in view of the enthusiasm of the viewers in some of the most backward regions of the country, some of which got electricity for the first time as a fringe benefit in order to watch TV
.
However, many major cities had been enjoying television even much earlier. In fact TV in India was introduced on September 15, 1959 in Delhi with a small transmitter and a makeshift studio. This was followed by stations in Srinagar and Amritsar (1973), and Calcutta, Madras and Lucknow in 1975. But many other cities were deprived of it until much later. Bangalore got its first station, a relay# centre in 1982 and I happened to be its first Station Engineer.

The transmitter radiated programmes from the highest floor of Visweswaraya Tower with the antenna tower installed atop the building. A temporary studio was set up a little later on two adjoining top floors.

The arrangement continued until a high Power Transmitter was installed at the present location in J C Nagar in 1985 which was followed by the establishment of the present full-fledged TV Studios in 1988.

National telecasts (DD National) were introduced in 1982. In the same year, colour TV was introduced to India with the live telecast of the Independence Day speech by the Prime Minister Indira Gandhi, on 15 August 1982. This was followed by the colour telecast of 1982 Asian Games held in Delhi which marked our transition from the Black & White Era.

Another breakthrough in the history of Bangalore television came on March 1st 1990, when we uplinked our programmes on the S-band transponder of INSAT 1B (and later on C-Band of INSAT 1D) and all the transmitters (Low Power) in the State started relaying them.

Globalisation policy of the government and the emergence of private satellite TV channels around the year 1991 paved the way for the end of an era in Indian Television. I was fortunate to be part and parcel of that exciting period.

Notes:
*ATS-6 was launched on May 30, 1974, by a Titan III-C launch vehicle. The spacecraft was inserted directly in the geosynchronous orbit.

* Terrestrial television is television broadcasting in which the television signal is transmitted from the terrestrial (Earth based) transmitter to a TV receiver having an antenna.

#During this period Bangalore transmitted programmes from Bombay and Madras using the Microwave telecom link of Dept. of Telecom. connecting the three cities.

Mentoring vs. Coaching

By Prof.C.Murali

These two words are quite commonly interchanged in use. But they are different and distinct, though both involve influencing, helping, instructing, motivating and improving the performance of the mentee or the one who is being coached. In coaching, the focus is on performance improvement of the individual in a particular field, say, sports, business or other specific areas whereas in mentoring, the focus is on the overall development and success of the individual in life. Coaching is comparatively a short term activity while mentoring is a long term operation.

Coaching has to be structured while mentoring generally doesn't have a structure. Hence, coaching has a set agenda and a goal while mentoring may not have either. The mentor is considered to be a friend, philosopher and guide in all matters, in which his advice is sought. Relationship between mentor and mentee is based upon mutual respect and trust.
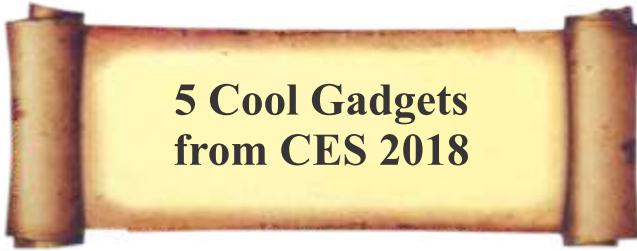
It is important to choose a mentor as the mentor impacts the character of the mentee. While selecting a coach is also very important, it is only for a specific art, sports or business trait. A wrong choice of coach may only result in only failure in that area, loss of time, money and opportunity or substandard performance. But the wrong choice of mentor can ruin your life.

In Mahabharta, the coach for all Pandavas and Kauravas was Dronacharya. His coaching was identical for all his pupils. But, each one of them acquired expertise at different levels in different areas depending upon their individual interest, commitment and dedication. Arjuna chose Lord Krishna as his mentor while the mentor chosen by Duryodhana was Shakuni, the wily manipulator. And all of us know the result.

You may seek mentoring in different areas and at different stages of life by different mentors. At schools and colleges, the children are like raw clay and a great teacher can mentor them and mould them to be great scientists, great managers, great sportsmen and even great leaders, and in fact good human beings.

A coach or mentor should have excellent communication skills. He/she should be highly motivated, enthusiastic and goal oriented. Creativity and patience are his/her ornaments. He/she should obviously be technically competent in the area of coaching or mentoring and set an example for his/her pupils.

Feedback is an important part of mentoring and coaching.

5 Cool Gadgets from CES 2018

The Consumer Electronics Show in Las Vegas is an annual trade show that hosts presentations of new products and technologies in the Consumer Electronics Industry. My penchant for gadgets has kept me glued to the announcements made at this event every year.

What I found particularly interesting and rich in tech this year were - Aflac Duck : An interactive toy created to comfort children diagnosed with cancer, Vuzix Blade AR Glasses : Wearers can see weather forecast and direc-tions instantly with voice command requests, Byton Concept Car : A car that feels more like your living room rather than just a means of transportation,

Philips SmartSleep : A headband that is meant to help you get the most out of your sleep, Samsung's "The Wall" : A TV whose size and shape can be altered by the user.

Here's a closer look :
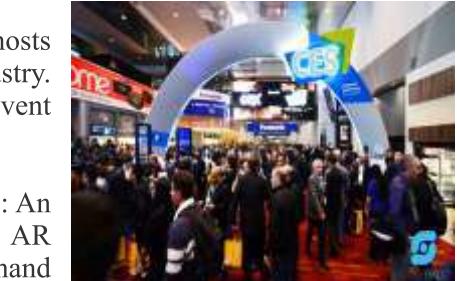
My Special Aflac Duck - Smart robotic toys are generally designed with education in mind. My Special Aflac Duck, though, has a very different but nonetheless important job: The interactive toy, developed by Sproutel, an R&D workshop, was created to provide comfort to children diagnosed with cancer. Children can mirror their care routines on the duck and can express their feelings through the toy by holding a circular token to its chest that prompts it to assume the corresponding emotion. Holding a token with a smil-ing happy face or a frowning angry face to the duck, for example, will enable it to react accordingly. This is meant to provide a sense of companionship to children as they undergo treatment and therapy. The duck is expected to be available for children diagnosed with cancer at no cost in late 2018 or early 2019. In early 2018, it will be shipping to children at the Aflac Cancer and Blood Disorders Center of Children's Healthcare of Atlanta to undergo addi-tional testing.

Vuzix Blade Augmented Reality Glasses - The digital assistant for Smart Glasses has arrived. The Vuzix Blade Augmented Reality glasses will support Amazon Alexa assistant so that wearers can ask for things like the weather and directions. The Vuzix Blade's display also sits more prominently in the wearer's field of view than Google Glass and looks much more crisp and colorful. If developers create compelling apps that blend Alexa's capabili-ties and augmented reality, the Blade AR glasses could have some promising potential.

Byton Concept Car : Byton wants your car to feel more like your living room rather than a just a means of transportation. That's the idea behind its concept car, which the company says will be launching in the U.S. in 2020. The concept vehicle's most striking characteristic is its gigantic screen, which stretches across the entire dashboard. The car will also include facial recogni-tion so that it can identify the driver and load his or her settings as he or she enters the vehicle.

Philips SmartSleep : Philips' headband isn't designed to help you get more sleep. Rather, it's meant to help you get the most out of your sleep. The headband emits a tone that the company says improves slow wave sleep, the stage in the sleep cycle at which brain waves and breathing slow to their lowest levels. Philips says this type of sleep can help boost alertness and the ability to maintain focus. Two sensors on the headband detect when you fall asleep and can identify when you enter deep sleep. Then, an algorithm customizes the volume and level of the tone being emitted in a way that the company claims will boost slow wave activity in the brain.

Samsung's "The Wall" TV - According to Samsung, TVs shouldn't have to be just one size. That's the idea behind its new 146-inch TV called The Wall, which the company is positioning as the first "modular TV." Sam-sung says users can alter the size and shape of The Wall so that it can function as a multipurpose display. In a demo on the showroom floor, the TV dis-played what looked like a smaller TV in the center of the screen, while the sur-rounding area was set to blend in with the wall the TV was mounted on. And since the TV uses MicroLED technology, it should be able to produce even deeper black tones and potentially infinite contrast.

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TECH TRENDS

Internet of Thinking

Intelligence is everywhere. Welcome to the Internet of Thinking. Across industries, the next generation of intelligent solutions are moving into physical environments. Improving traffic flows in smart cities, telemedicine that continuously analyzes a patient's condition, and disaster analysis that prevents oil field catastrophes before they start are all possible with intelligent solutions. IT Infrastructures need to be developed to reach into the dynamic physical environments they want to serve–and it needs to happen now.

Conversational Platforms

Conversational platforms will drive the next big paradigm shift in how humans interact with the digital world. The burden of translating intent shifts from user to computer. The platform takes a question or command from the user and then responds by executing some function, presenting some content or asking for additional input. Over the next few years, conversational interfaces will become a primary design goal for user interaction and be delivered in dedicated hardware, core OS features, platforms and applications.

Cloud to the Edge

Edge computing describes a computing topology in which information processing, and content collection and delivery, are placed closer to the sources of this information. Connectivity and latency challenges, bandwidth constraints and greater functionality embedded at the edge favors distributed models. Enterprises should begin using edge design patterns in their infrastructure architectures — particularly for those with significant IoT elements.

While many view cloud and edge as competing approaches, cloud is a style of computing where elastically scalable technology capabilities are delivered as a service and does not inherently mandate a centralized model.

Digital Twin

A digital twin refers to the digital representation of a real-world entity or system. Digital twins in the context of IoT projects is particularly promising over the next three to five years and is leading the interest in digital twins today. Well-designed digital twins of assets have the potential to significantly improve enterprise decision making. These digital twins are linked to their real-world counterparts and are used to understand the state of the thing or system, respond to changes, improve operations and add value. Organizations will implement digital twins simply at first, then evolve them over time, improving their ability to collect and visualize the right data, apply the right analytics and rules, and respond effectively to business objectives.

EUV & 7nm

Long-delayed and extremely complex, extreme ultra-violet (EUV) lithography technology is now being readied for the high-volume manufacturing (HVM) of commercial semiconductor integrated circuits (IC). EUV is a revolutionary new production process that will allow 7nm CPU production to offer higher yields, with lower complexity, and potentially lower costs too. It's been the holy grail of chip manufacturers for years and is about to become a genuine reality. Intel and AMD's 7nm CPU revolution is very important to the future of PCs. Samsung and TMSC are also in fray for 7nm technology.

Dueling Neural Networks

Artificial intelligence is getting very good at identifying things: show it a million pictures, and it can tell you with uncanny accuracy which ones depict a pedestrian crossing a street. But AI is hopeless at generating images of pedestrians by itself. If it could do that, it would be able to create gobs of realistic but synthetic pictures depicting pedestrians in various settings, which a self-driving car could use to train itself without ever going out on the road.

The solution first occurred to Ian Goodfellow, then a PhD student at the University of Montreal, during an academic argument in a bar in 2014. The approach, known as a generative adversarial network, or GAN, takes two neural networks—the simplified mathematical models of the human brain that underpin most modern machine learning—and pits them against each other in a digital cat-and-mouse game. Both networks are trained on the same data set. One, known as the generator, is tasked with creating variations on images it's already seen—perhaps a picture of a pedestrian with an extra arm. The second, known as the discriminator, is asked to identify whether the example it sees is like the images it has been trained on or a fake produced by the generator—basically, is that three-armed person likely to be real? Over time, the generator can become

so good at producing images that the discriminator can't spot fakes. Essentially, the generator has been taught to recognize, and then create, realistic-looking images of pedestrians. The technology has become one of the most promising advances in AI in the past decade, able to help machines produce results that fool even humans.

Babel-Fish Earbuds

In the cult sci-fi classic The Hitchhiker's Guide to the Galaxy, you slide a yellow Babel fish into your ear to get translations in an instant. In the real world, Google has come up with an interim solution: a $159 pair of earbuds, called Pixel Buds. These work with its Pixel smartphones and Google Translate app to produce practically real-time translation.

One person wears the earbuds, while the other holds a phone. The earbud wearer speaks in his or her language—English is the default—and the app translates the talking and plays it aloud on the phone. The person holding the phone responds; this response is translated and played through the earbuds.

Google Translate already has a conversation feature, and its iOS and Android apps let two users speak as it automatically figures out what languages they're using and then translates them. But background noise can make it hard for the app to understand what people are saying, and also to figure out when one person has stopped speaking and it's time to start translating. Pixel Buds get around these problems because the wearer taps and holds a finger on the right earbud while talking. Splitting the interaction between the phone and the earbuds gives each person control of a microphone and helps the speakers maintain eye contact, since they're not trying to pass a phone back and forth.

Genetic Fortune-Telling

One day, babies will get DNA report cards at birth. These reports will offer predictions about their chances of suffering a heart attack or cancer, of getting hooked on tobacco, and of being smarter than average.

The science making these report cards possible has suddenly arrived, thanks to huge genetic studies—some involving more than a million people. It turns out that most common diseases and many behaviors and traits, including intelligence, are a result of not one or a few genes but many acting in concert. Using the data from large ongoing genetic studies, scientists are creating what they call "polygenic risk scores."

Though the new DNA tests offer probabilities, not diagnoses, they could greatly benefit medicine. For example, if women at high risk for breast cancer got more mammograms and those at low risk got fewer, those exams might catch more real cancers and set off fewer false alarms. Pharmaceutical companies can also use the scores in clinical trials of preventive drugs for such illnesses as Alzheimer's or heart disease. By picking volunteers who are more likely to get sick, they can more accurately test how well the drugs work. The trouble is, the predictions are far from perfect.

ACHIEVEMENTS:

1. Bangalore Centre - Awarded with 2nd Best Centre for the year 2017-18

2. Dr D C Pande – Elected for the Governing Council for 2018-2021

3. Prof C Murali – Awarded B R Batra Memorial Award for 2017-18

4. Dr M H Kori – Elected as Distinguished Fellow in the year 2017-18

CONGRATULATIONS & BEST WISHES TO ALL THE ACHIEVERS!

❖ IETE Bangalore offers Technical support to Engineering Colleges and Organizations to conduct workshops, seminars and symposia.

❖ IETE rents out its auditorium and halls for conducting technical or education-related activities.