

# IEEE FOOTHILL SECTION

*Serving to Enhance the Community*

(<http://www.ieee-foothill.org/>)

Monthly Newsletter

## *In this Issue*

### Summer 2020 COMSOC Virtual Meetings

by Dr. Frank Freyne  
pages 1-3

*Review of IEEE Virtual COMSOC Presentation held June 18, 2020 titled "Leveraging Economics In Wireless Multimedia Communications: From Game Theory to Machine Learning"*

pages 1-2

*Subject of Presentation: Security in SDN/NFV and 5G Networks – Opportunities and Challenges*

pages 2-3

### Consultant Network Meeting

by Cash Sutton III, P.E  
page 3

### Foothill OpCom Meeting

by Scott Wedge  
page 4

### IEEE Foothill Section and Region 6 Awards and Recognitions - Call for Nominations

by Alberto Tam Yong  
page 4

## Newsletter made Possible by:



**Panatron, Inc.**

(<https://panatron.com/>)

### Become a Corporate Sponsor

Contact David E. González ([DavidGonzalez@ieee.org](mailto:DavidGonzalez@ieee.org))

or Scott Wedge ([wedge@ieee.org](mailto:wedge@ieee.org))

## Summer 2020 COMSOC Virtual Meetings

by Dr. Frank Freyne

### Review of IEEE Virtual COMSOC Presentation held June 18, 2020 titled "Leveraging Economics In Wireless Multimedia Communications: From Game Theory to Machine Learning"

Our presenter was Wei Wang, Ph.D. Associate Professor and Graduate Advisor, San Diego State University.

This presentation addressed two important areas that will have major effects on the current 4G/5G and future wireless communication activities. What does the user want with the quantity and quality of programming that he/she could receive on their mobile device? Our speaker pointed out that these will vary immensely. A nightly video broadcast of the daily news can receive only minimal attention. However, a unique event like a World Cup match in the knockout rounds may deserve and receive careful attention. The desire for video and audio quantity is a function of the QoE (Quality of Experience) set by the user and his user equipment features and achieved requirements.

With this information, can the provider team adjust its capital spending and resources in getting the video/audio desired to the use on the best path. If so, can he devise a method to maximize his profits?

Our presenter formulated the problem in these two compact statements:

(1) What should be the optimal cost charged per bit of multimedia data by the wireless carrier and content provider such that their net utility is maximized?

(2) How much data should the user request at the given cost such that their QoE is maximized?

With a few parameters, a mathematical model can be developed, as shown in this presentation slide.

The equation for UPC describes for this preliminary model, what the profit would be. See the equation for UPC in the next page.

*cont'd on p.2*

### Utility of Provider-Carrier

The operational cost of the provider  $\psi_{provider}$  is a function of source coding control as shown below, where  $\alpha$  is the cost per bit of source coding control

$$\psi_{provider} = \alpha \sum_{j=1}^m q_j l_j$$

The operational cost of the carrier  $\psi_{carrier}$  is modelled logarithmic function of successful transmission probabilities of the ancestor frames

$$\psi_{carrier} = \beta \sum_{j=1}^m \log \prod_{k \in \pi_j} (1 - P_k)$$

The overall utility of the provider-carrier is defined as

$$U_{PC} = \psi_{user} - \psi_{provider} - \psi_{carrier}$$

$$u_{pc} = \sum_{j=1}^m y_j l_j - \sum_{j=1}^m q_j l_j - \sum_{j=1}^m \log \prod_{k \in \pi_j} (1 - P_k)$$

$\rightarrow$  Source coding control  
 $\rightarrow$  PER of dependent ancestor frames  
 $\rightarrow$  Cost paid by user

*st.*  $U_{PC} \geq 0$

Department of Computer Science

This can be understood as the cost that the user would be willing to pay for a video / audio message of so many bits duration, with a specified quality factor, and with a minimum probability of dropouts. The latter two are the negative quantities in this equation. Just think of what a dropped signal occurred, just as a winning G-O-A-L was scored in a World Cup game. How would the user rate his QoE? Would there calls in the 4G / 5G networks provider? Quite probable.

After the presenter introduced Stuckelberg Game Theory, the next step is the maximize the operating profit UPC to the Content Provider and 4G/5G internet provider Telecommunications system. Proceed to maximize the equation for UPC , noting that it must always be positive. There are a number of parameters that can be varied and examined as the profit is maximized. However there are boundaries as to the numbers of bits, image quality in colors and bit resolution, and measured drop out BERs that must be measured and verified by the telecommunication system supplier's equipment. These will dictate reasonable numbers to use in these profit equations. (Keep this away from the marketing staff until reasonable numbers are obtained. These will feed into the costs for backhaul stations antennas, etc. This simplified model must have realistic system build out costs included). Certainly, there will be different QoEs that will be experienced by a fixed site as compared to a mobile user.

We thank Professor Wei Wang for his interesting talk. It contributes another piece of the puzzle in developing an optimal 4G/5G telecommunications system.

### Security in SDN/NFV and 5G Networks – Opportunities and Challenges

This “Virtual Briefing” was given (with attendees from East Coast to West Coast) to IEEE COMSOC Chapters on Monday evening July 20, 2020. Our online presenter was Ashutosh Dutta, Ph.D., who is a Senior Scientist at Johns Hopkins University Applied Physics Lab (JHU/APL), an IEEE Communications Society member-At-Large as well.

Of course, we began with the standard 5G pictorial view of the generic goals, as would be provided by the Marketing Group of a telecommunications company.



The main emphasis of this talk was to give a view of the topics in communication security that will arise as the 5G stand is developed and deployed. These are the working topics that we in IEEE COMSOC should familiarize ourselves with. They include these grouping: Threat Taxonomy, Security Use Cases and Industry Standards Activities and Testbeds.

The new areas of interest for 5G Security arise from the change in telecommunications from a Traditional Network approach to a Software Defined Network (SDN) / (Network Function Virtualization) NFV Network approach. This change is driven by the use of computer storage “cloud” resources.

As described by our speaker, Traditional Networks were (1) Built using purpose-built hardware coupled with physical connectivity (Ethernet cable connectivity), (2) Control logic largely coordinated and implemented by layers of OSSs, (3) Control, Forward (User) and Data Planes are tightly integrated in Network Elements, and (4) OA & M, inventory views and operational controls managed in OSSs to avoid negative impact to service performance.

In turn, now Virtualized Networks are planned with (1) General purpose cloud-based components, (2) Software-based virtual network components and services, (3) Dynamic real-time configuration to support internal or customer activity, and (4) Programmable network management. This means that algorithms must be developed to control service, network usage, and capacity requests by digesting the real time data accumulated analytics.

Now our speaker plunged into a detailed list of security challenges in 5G. All of these areas need to be examined and catalogued. They serve as a reference of what situations were proposed. Some of the items listed for attention were: hypervisor vulnerability, API security, orchestration vulnerability, virtual monitoring of virtualized firewalls, maintain security while booting, maintain secure when crashing(now this can expand to a semi-infinity of tests!), user/tenant authentication (probably several hurdles with both static passwords and dynamic passwords that change hourly or daily), topology validation and enforcement, authenticated time service,

cont'd on p.3

and private keys within cloud images (presumably encryption within encryption with additional authentication).

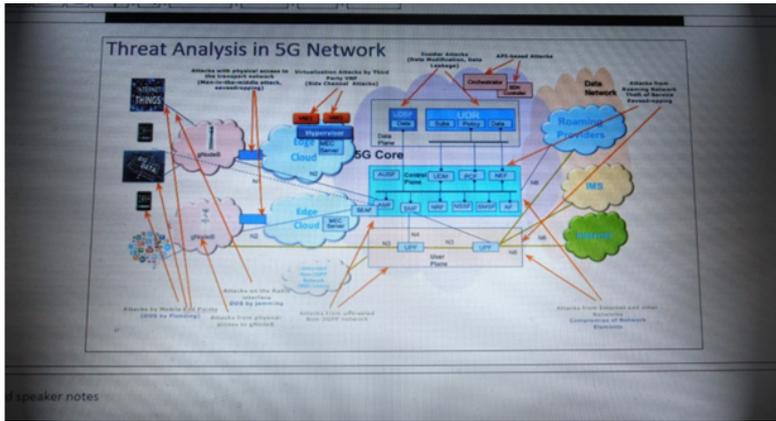


Chart # 17 of Dr A Dutta's Briefing shows some Initial Threats to a 5G network.

Multiple security attacks potentially envisioned by an adversary are sketched on this busy chart #17. Another set of attacks may be due to accidental vulnerabilities in the system that were not uncovered in earlier testing.

Looking at this chart, we can gather a number of potential weaknesses and attach points that an adequate security checklist must examine:

- (1) Attacks from multiple end points, such as User Equipment and parts of the multiple of devices that comprise the Internet of Things. Denial Of Service by flooding or overloading of requests could result. Continuing inability to authenticate that is a legitimate user from the data stream. Attackers crash a network element by sending malformed or garbage packets.
- (2) Attacks on the Radio Access Network RAN interface; DOS by jamming within the matched power receiver band using masked signals.
- (3) Attacks from access to the physical interface gNodeB (Global Node Base)
- (4) Attacks from nodes which have physical access to the transport network. This could involve "eavesdropping" and recording selected filter information that would identify a particular user that an adversary would query. Attackers compromise a network element via a administrative or management interface.
- (5) Virtualization Attacks by Third Party VNF (Side Channel Attack)
- (6) Attacks from untrusted non-3GPP standardized networks
- (7) API-based Attack; APIs are the interfaces defining the communication between applications, controllers and network systems; the API attackers attempt to control the network by searching for a protocol or implementation flaw.
- (8) Attacks from Roaming Network; attempts for theft of service; Eavesdropping

The remainder of the talk dug deeper into similar anticipated attack-security protection with proposing generic security design modifications. The emphasis was that one needs to design a comprehensive review and testing program before one can claim that your 5G system is "secure".

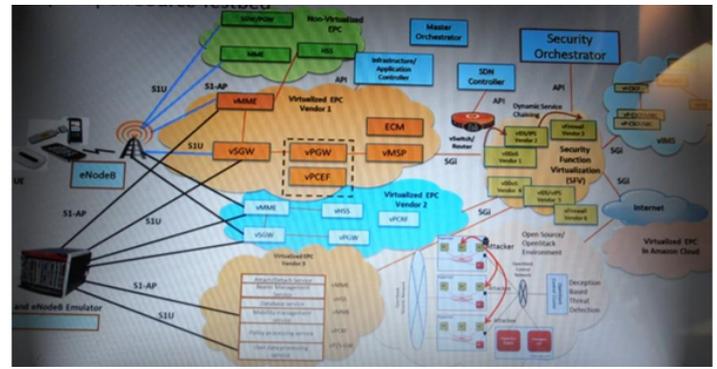


Chart #38 of Dr A Dutta's briefing shows a sample open source testbed.

A discussion on what test beds had been developed, and what the multiple organizations are concentrating their security investigations followed. Lastly, the presenter touched on the related ambitious IEEE Future Networks effort. IEEE members are invited to join and contribute. Contact Dr. Ashutosh Dutta directly (ashutosh.dutta@ieee.org) for more information.

We thank Dr. Ashutosh Dutta for an excellent presentation in sketching out several areas necessary for a 5GPP system security review. If you are planning to work in this area prepare a detailed roadmap; roll up your sleeves for work; and prepare to present you work to the 5G system developers. Dr. Dutta has given you many ideas on security issues that need to be examined.

## Consultant Network Meeting

by Cash Sutton III, P.E

Our seventh meeting was held on July 1, 2020. Items discussed included the following:

- \*Small Business Agency Loans - <https://www.sba.gov>
- \*SBA Express Loans - <https://www.sbaexpress.loans/california-small-business-loans>
- \*NASA SBIR/STTR - <https://sbir.nasa.gov/solicit/63012/detail?data=ch9>
- <https://www.sbir.gov/node/1657359>
- \*Sun Hydrogen - [www.sunhydrogen.com/green-hydrogen-video](http://www.sunhydrogen.com/green-hydrogen-video)
- \*Dept of Energy Solar - <https://www.sbir.gov/node/868695>
- <http://science.energy.gov/sbir/funding-opportunities/fy-2016/>
- \*CHERP: Program to manufacture solar panels in US with facility planned in Pomona
- \*Solar Panel Issue: Interconnection agreements
- How does that work?
- Riverside Michelle G. Pierce was responsible for implementing solar contracts when she worked with the City of Riverside and gave some remarks on warranty and other details.
- \*Solar Cell Microcracks are Inevitable; Ideal PV FOZHS [http://www.idealpv.com/Solar\\_Cell\\_Microcracks\\_Are\\_Inevitable\\_And\\_idealPV\\_FOZHS\\_Makes\\_Them\\_Irrelevant.pdf](http://www.idealpv.com/Solar_Cell_Microcracks_Are_Inevitable_And_idealPV_FOZHS_Makes_Them_Irrelevant.pdf)
- <http://www.idealpv.com/>
- Typical warranty on the solar panels is 20 years. Potential solution, Inspect Solar Panel in the 19th year.
- \*<https://foothill.ieee-bv.org/category/consultnet/>
- Open for advertisements from consultants.

# Foothill Section July OpCom Meeting

by Scott Wedge

Our Operations Committee Meeting was a virtual event held July 14, 2020 via Zoom. Twenty-one (21) members were in attendance. Announcements included new details regarding the NavyX TechBridge program through NSWC Corona, which could provide several new opportunities to small businesses within our Section. Also announced was that IEEE Foothill is now officially a part of the IEEE Southern California Council (ISCC). ISCC may assist with our Section's planned cybersecurity summit in the future. The International Security Conference (ISC) West and IEEE Sections Congress are going virtual, as is the International Microwave Symposium (IMS2020) which will be a virtual event held August 4-6.

Kimberly Mosley reported 29 new IEEE members in our Section, as well as four recent senior elevations. They include:

- Fadi Muheidat
- Heng Yin
- Christopher Clark
- Osman Ceylan

Dr. Ceylan, our Section's Educational Activities Chair, discussed his recent work on developing remote STEM workshops for grades K-12.

New Student Branch Chairs Montana Williams (CSUSB) and Trinh Nguyen (UCR) discussed their difficulties in moving all student activities online for the upcoming school year. These include fall quarter workshops on professional development, game nights, tech talks, and UCR's annual CitrusHack. They were also enthusiastic about participating in the upcoming IEEEExtreme Hackathon event. Foothill Section Women in Engineering (WiE) and Young Professional groups discussed having similar challenges as they move all their planned activities to virtual events.

## IEEE Foothill Section and Region 6 Awards and Recognitions - Call for Nominations

by Alberto Tam Yong

Awards and recognitions are a large part of the IEEE organization. Awards and recognitions celebrate the efforts, successes, and outstanding contributions of members and organizations. This is an opportunity to share the value of IEEE by recognizing a colleague, highlighting the commitments of corporations and institutions, and the excellent services and programs developed by our fellow volunteers and the local chapters. As an IEEE member, you can nominate candidates for IEEE awards.

You should have received an IEEE Region 6 Summer Newsletter last month. Among the many announcements, there was a call for nominations for IEEE Region 6 Awards. I would like to take this opportunity to also offer awards and recognitions to our IEEE Foothill Section members and organizations. Nominations submitted for the Regional Awards will be taken into consideration for local awards selection.

I'm inviting all members to review and submit nominations for the IEEE Foothill Section Awards and IEEE Region 6 Awards. Nominations are due Sept 15, 2020, but please submit your nominations early to avoid any complications. As the local IEEE Foothill Sections Awards and Recognition Chair, I would appreciate it if you could let me know of any Nomination Submissions so I can also track them from my end. Email me at [alberto.tamyong.us@ieee.org](mailto:alberto.tamyong.us@ieee.org).

If there are any outstanding members or organizations that you would like to nominate but don't fit in any of the Regional Award categories, just let me know. I can help you identify which awards we can nominate them for or even evaluate special local awards and recognitions.

More details on the award categories and nomination form at: <https://ieee-region6.org/2020/call-for-nominations-ieee-region-6-awards-now-open/>.