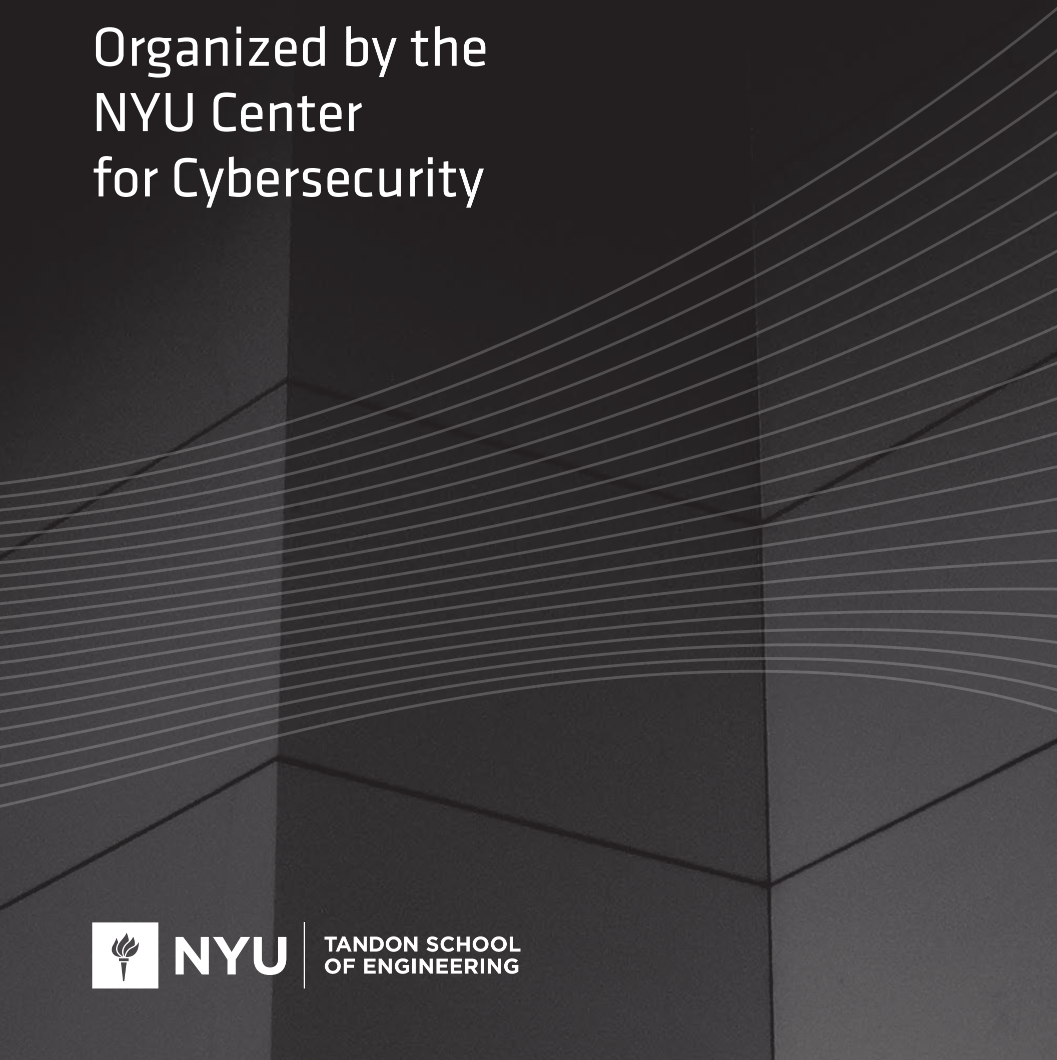
NOVEMBER 6-8, 2019

CSAW'19

Organized by the
NYU Center
for Cybersecurity



NYU | TANDON SCHOOL
OF ENGINEERING

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Welcome

November 6, 2019

Welcome to CSAW'19, our 16th annual cybersecurity games and conference. The scale of CSAW is evident in our global reach: 180 finalist teams from around the world are participating at seven academic centers across four continents to compete in the final rounds. At NYU Tandon alone, we have 65 teams and 164 finalists from the US and Canada competing in 9 events.

I am excited to announce the addition of two news competitions this year. Professors Garg and Dolan-Gavitt, both from the NYU Center for Cybersecurity, are introducing a first-ever machine learning security event, HackML, and my colleagues and I are running the first-ever Logic Locking Conquest. In its second year, the Hack3D competition, organized by Professor Nikhil Gupta and funded by the National Science Foundation, is seeking to explore vulnerabilities in the emerging digital manufacturing supply chain. Events like HackML, Logic Locking, and Hack3D are more than just competitions: they generate new avenues of research leading to innovative approaches to defending devices that we use every day.

Please be sure to take full advantage of the various events happening over the next two days, whether that's attending a session of the C2 Security Workshop, visiting our sponsors at the Industry Fair, or attending a research presentation or competition demo.

I wish you a wonderful time at CSAW'19.

Sincerely,

Ramesh Karri
Professor of Electrical and Computer Engineering
Computer Science and Engineering (affiliated)
Co-founder and co-chair NYU Center for Cyber Security
CSAW Global Faculty Lead

Thank You to our Sponsors

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CAPSULE8

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CTFd

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Raytheon

TIAA

Uber

VECTOR 35

The generous support of our sponsors
makes CSAW'19 possible.

Master Agenda

🟩 Special Event
🟧 Competitions
🟪 Check-in & Information
🟥 Industry Fair & Workshops
🟦 Food

Wednesday, November 6

🟪	**CTF Check-in**	12:00pm - 10:00pm	6 MetroTech Center, Lobby
🟦	**CTF Finalist Dinner**	6:00pm - 7:00pm	6 MetroTech Center, MakerSpace Lobby
🟧	**Security Quiz Qualification Round - Session 1,** Sponsored by IBM	7:00pm - 8:00pm	6 Metro Tech Center, Event Space
🟧	**Capture the Flag Competition Starts**	9:00 pm	6 MetroTech Center, MakerSpace
🟦	**CTF Midnight Pizza**	12:00 am Thursday	6 MetroTech Center, MakerSpace Lobby

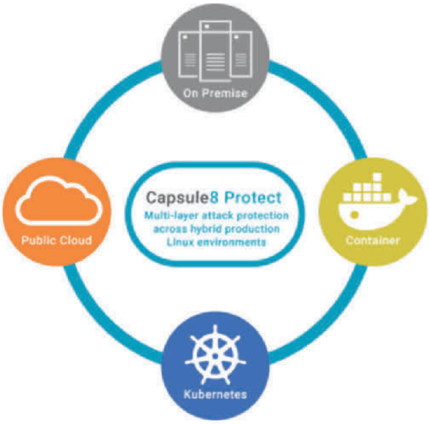
Thursday, November 7

🟧	**Capture the Flag Competition**	All day, cont'd from previous day	6 MetroTech Center, MakerSpace
🟪	**Finalist & Guest Check-in**	8:00am - 10:00pm	6 MetroTech Center, Lobby
🟥	**C2 Security Workshop,** Sponsored by BAE Systems Fast Labs	10:30am - 4:45pm	6 MetroTech Center, Event Space
🟦	**CTF Finalist Lunch**	12:30pm - 1:30pm	6 MetroTech Center, Lobby
🟩	**Competition Meet n Greet** Finalists can come and meet the competition organizers	4:00pm - 5:00 pm	6 MetroTech Center, Lobby
🟩	**CSAW'19 Welcome Gathering** (by invitation)	5:00pm - 6:00pm	**Pick up ID at 6 MetroTech Center Lobby** 5 MetroTech Center, Pfizer Lobby
🟩	**CSAW'19 Welcome Address & Keynote** (by invitation) Neal Ziring, Technical Director, Cybersecurity Directorate, NSA	6:00pm - 7:00pm	5 MetroTech Center, Pfizer Auditorium
🟧	**Security Quiz Qualification Round - Session 2,** Sponsored by IBM	7:10pm - 8:00pm	6 MetroTech Center, Event Space
🟦	**Student Finalist Burritos & Chips**	8:15 pm	6 MetroTech Center, MakerSpace Lobby
🟧	**Hack3D Pre-Competition Training**	8:30pm - 9:30pm	6 MetroTech Center, MakerSpace
🟦	**CTF Midnight Pizza**	12:00 am Friday	6 MetroTech Center, MakerSpace Lobby

Friday, November 8

Finalist Breakfast at Hampton Inn	6:00am - 10:00am	Hampton Inn
Finalist & Guest Check-in	7:00am - 7:00pm	6 MetroTech Center, Lobby
Red Team Competition	8:00am - 4:00pm	6 MetroTech Center, Gym
Capture the Flag Competition Ends	9:00am	6 MetroTech Center, MakerSpace
Embedded Security Challenge Keynotes	9:00am - 10:00am	6 MetroTech Center, MakerSpace
Capture the Flag Breakfast Sponsored by TIAA (for CTF Finalists)	9:15am	Center for Cybersecurity, 370 Jay Street, 10 FL
Industry Fair	9:30am - 2:00pm	6 MetroTech Center, Gym
Hack3D Competition	9:00am - 4:00pm	6 MetroTech Center, MakerSpace
Logic Locking Conquest Poster Session & Demonstrations	10:00am - 12:00pm	6 MetroTech Center, Gym
Embedded Security Challenge Presentations & Demonstrations	10:00am - 12:00pm	6 MetroTech Center MakerSpace & Gym
Applied Research Competition Poster Sessions	10:00am - 12:00pm	6 MetroTech Center, Gym
Policy Competition Presentations	10:30am - 2:30pm with break for lunch	6 MetroTech Center, EventSpace
Student Finalist, Employer & Volunteer Lunch	12:00pm - 1:30pm	6 MetroTech Center, MakerSpace Lobby
Center for Cybersecurity Luncheon (by invitation)	12:30pm - 1:30pm	1 MetroTech, 19 FL, Room 1930/1931 (enter off of Jay Street and proceed upstairs to the security desk)
Embedded Security Challenge Demonstrations continue as needed	1:30pm - 2:30pm	6 MetroTech Center, Gym
Hack ML Competition, Presentations	2:00pm - 3:00pm	6 MetroTech Center, MakerSpace
Hack ML Competition, Demonstrations	3:00pm - 4:00pm	6 MetroTech Center, Gym
Security Quiz Finals, Sponsored by IBM	6:00pm - 7:00pm	5 MetroTech Center, Pfizer Auditorium
Keynote Address from DTCC Award Ceremony, Followed by Closing Reception	7:15pm - 10:00pm	5 MetroTech Center, Pfizer Auditorium

High-performance attack protection for Linux production environments – whether containerized, virtualized, or bare-metal – on-premise or in the cloud.


On Premise
Public Cloud
Capsule8 Protect
Multi-layer attack protection across hybrid production Linux environments
Container
Kubernetes

Capsule8 liberates SecOps from managing a high volume of manual tasks, while being safe for even the busiest workloads, on the busiest networks.

Industry Fair

Friday, November 8
9:30am - 2:00pm
6 MetroTech Center, Gym

Meet representatives from our CSAW'19 sponsoring organizations and learn about potential employment opportunities.

Listed in Alphabetical Order

- Bank of America
- BAE Systems
- Capsule8
- CMU Information Networking Institute
- DTCC
- Facebook
- Flatiron Health
- Haystack Solutions with Cyber Aptitude & Talent Assessment
- IBM
- JPMorgan Chase & Co.
- NYU Cyber Fellows
- Red Balloon Security
- RiskEcon Lab @ Courant Institute NYU & Numerati Partners LLC
- T. Rowe Price

Special Events

C2 SECURITY WORKSHOP

Thursday, November 7
10:30am - 4:45pm

6 MetroTech Center,
MakerSpace Event Space

See online for full schedule:
c2securityworkshop.eventbrite.com

Sponsored by:

BAE Systems
FASTLabs

OPENING KEYNOTE

Thursday, November 7
6:00pm

5 MetroTech Center, Pfizer Auditorium

Neal Ziring, Technical Director,
Cybersecurity Directorate, NSA

Mr. Neal Ziring is the Technical Director for the National Security Agency (NSA)'s Cybersecurity Directorate. In that role, he is responsible for a wide variety of technical assessment, external engagement, workforce developments, and strategic direction issues for NSA's cybersecurity mission. In his past position, he served as the Technical Director of the NSA Capabilities Directorate. In that role, he tracked technical initiatives, promoted the professional health of a diverse technical staff, and served as liaison to various external partners. Prior to the formation of the Capabilities Directorate, Mr. Ziring served as Technical Director of the Information Assurance Directorate for five years. His personal expertise areas include security automation, IPv6, cloud computing, cross-domain information exchange, data access control, and cyber defense. Prior to coming to NSA in 1988, Neal worked at AT&T Bell Labs. He has BS degrees in Computer Science and Electrical Engineering, and an MS degree in Computer Science, all from Washington University in St. Louis. Since then, he has also taken classes from Columbia University, the University of Maryland Baltimore County, and George Washington University.

EMBEDDED SECURITY CHALLENGE KEYNOTE

Friday, November 8
9:00am - 10:00am

6 MetroTech Center, MakerSpace.

Serge Leef, Program Manager, Microsystems Technology Office, DARPA

INDUSTRY FAIR

Friday, November 8
9:30am - 2:00pm

6 MetroTech Center, Gym

This boutique career fair is specifically for students pursuing security-related studies. See page 9 for more details.

CENTER FOR CYBERSECURITY LUNCHEON

Friday, November 8
12:30 - 1:30 pm

1 MetroTech Center, 19 FL, Room 1930/31

CSAW judges and security experts gather over lunch to discuss current trends and challenges in the field.

AWARD CEREMONY & CLOSING KEYNOTE

Friday, November 8
7:15 pm

5 MetroTech Center, Pfizer Auditorium

Keynote presentation from Gold Sponsor, DTCC

DTCC

Inna Amir, Executive Director of Application Development Area for Enterprise Data Solutions, DTCC

Christopher Walsh, Executive Director of Risk Analytics, DTCC

Judges

CSAW judges hail from across the industry and academia, representing some of the most elite experts and researchers in the cyber security community. We are honored to have them participate in our competitions and are grateful for their contributions.

Judges are listed alphabetically by last name.

APPLIED RESEARCH COMPETITION

FINAL JUDGES

Kris Ambrose, Cyber Security Research Scientist, BAE Systems

Omkhar Arasaratnam, Executive Director, Data Management and Protection Technology, JPMorgan Chase & Co.

Gerard Brady, Global Chief Information Security Officer, Distinguished Engineer, Morgan Stanley

Tim Callahan, SVP, Global Chief Security Officer, Aflac

Tim Dierks, Director of Engineering, Google

Brandon Edwards, Co-founder and Chief Scientist, Capsule8

Andrey Kravtsov, Senior Software Engineer II, Uber

David K.A. Mordecai, Lead Investigator, RiskEcon Lab @Courant Institute of Mathematical Sciences, NYU; Co-Managing Member, Numerati Partners LLC

Tom Quinn, Chief Information Security Officer, T. Rowe Price

PROGRAM COMMITTEE/ PRELIMINARY REVIEW JUDGES

Devdatta Akhawe, Director of Security Engineering, Dropbox

Maxwell Matthaios Aliapoulios, PhD Candidate, NYU Tandon School of Engineering

Frederico Araujo, Research Scientist, IBM Thomas J. Watson Research Center, CSAW'14 Finalist

Justin Cappos, Professor, NYU Tandon School of Engineering

Juntao Chen, PhD Candidate, NYU Tandon School of Engineering

Yaohui Chen, Northeastern University, CSAW'17 3rd place

Yizheng Chen, Columbia University, CSAW'17 Finalist

Bill Cheswick, Security & Networking Researcher

Periwinkle Doerfler, PhD Candidate, NYU Tandon School of Engineering

Mohamed El Massad, PhD Candidate, NYU Tandon School of Engineering

Saverio Fazzari, Booz Allen Hamilton

Paul Giura, AT&T Security Research Center; Adjunct Professor, NYU

Yunhan Huang, PhD Candidate, NYU Tandon School of Engineering

Haadi Jafarian, Assistant Professor, University of Colorado Denver

Markus Jakobsson, ZapFraud

Vinayaka Jyothi, NYU Tandon School of Engineering

Trishank Karthik Kuppusamy, Datadog; NYU Tandon School of Engineering

David Kohlbrenner, University of California San Diego, CSAW'16 2nd place

Eugene Kolodenker, Boston University; MITRE, CSAW'17 Finalist

Hyungjoon Koo, Stony Brook University

Jay Koven, PhD Candidate, NYU Tandon School of Engineering

Chris Lamb, Reproducible Builds

Yiwen Li, PhD Candidate, NYU Tandon School of Engineering

Wei Meng, Assistant Professor, The Chinese University of Hong Kong, CSAW'16 Finalist

Maria Mera, PhD Candidate, NYU Tandon School of Engineering

Dimitris Mouris, University of Delaware

Collin Mulliner, Cruise

Theofilos Petsios, Research Scientist, Capsule8, CSAW'17 2nd Place

Rui Qiao, LinkedIn, CSAW'16 Finalist

Güliz Seray Tuncay, University of Illinois at Urbana-Champaign, CSAW'18 Finalist

Hossein Siadati, Google Security Team

Jared Smith, University of Tennessee, Knoxville, CSAW'18 1st Place

Peter Snyder, Brave Software, CSAW'17 Finalist

Deepraj Soni, PhD Candidate, NYU Tandon School of Engineering

Octavian Suciu, University of Maryland, CSAW'18 Finalist

Kejsi Take, PhD Candidate, NYU Tandon School of Engineering

Sai Teja Peddinti, Senior Research Scientist, Google

Santiago Torres, PhD Candidate, NYU Tandon School of Engineering

Tavish Vaidya, Google, CSAW'16 1st Place

Victor van der Veen, Qualcomm Product Security, CSAW'17 1st Place

Terry Wang, Intel

Dongpeng Xu, Assistant Professor, University of New Hampshire, CSAW'17 Finalist

Muhammad Yasin, Texas A&M University

CAPTURE THE FLAG

CHALLENGE WRITERS/JUDGES

Marcus Barbu, OSIRIS Lab

Alan Cao, OSIRIS Lab

Leon Chou, CSAW CTF Lead

Kevin Chung

Joey Chung, OSIRIS Lab

Jules Denardou, Datadog

Doug DePerry, Datadog

Brendan Dolan-Gavitt, NYU Tandon School of Engineering

Josh Ferrell, Vector35

Matt Foley, Cisco

Kyle Fox, Square

Nobel Gautam, OSIRIS Lab

Nick Gregory, Capsule8

Josh Hofing, Trail of Bits

itszn, Ret2 Systems

japesinator, Trail of Bits

krx, River Loop Security

Kent Ma, CSAW CTF Lead

Nilesh Mukherji, OSIRIS Lab

N4T_20, OSIRIS Lab

Will Song, Trail of Bits

Chris Thompson, Uber

Sai Vegasena, OSIRIS Lab

Chenming Xu, Amazon

Roy Xu, OSIRIS Lab

Eric Zhi Liang, Vulnerability Researcher

Mina Zhou, OSIRIS Lab

Somerset Recon

ThirdRepublic

Judges

EMBEDDED SECURITY CHALLENGE

FINAL JUDGES

Sergey Panasyuk, Computer Engineer, Air Force Research Laboratory

Keith Rebello, Program Manager, Microsystems Technology Office, DARPA

Dan Walters, Principal Embedded Security Engineer, The MITRE Corporation

Terry Wang, Security Researcher, Intel Corporation

HACK3D COMPETITION

FINAL JUDGES

Chris Adkins, Chief Scientist, Identify3D

Robert Carter, The Barnes Group Advisors

HACKML COMPETITION

FINAL JUDGES

Brendan Dolan-Gavitt, Assistant Professor, NYU Tandon School of Engineering

Siddharth Garg, Assistant Professor, NYU Tandon School of Engineering

Rachel Greenstadt, Associate Professor, NYU Tandon School of Engineering

Samantha Kappagoda, Co-lead Investigator, RiskEcon Lab @Courant Institute of Mathematical Sciences, NYU; Co-Managing Member, Numerati Partners LLC

David K.A. Mordecai, Lead Investigator, RiskEcon Lab @Courant Institute of Mathematical Sciences, NYU; Co-Managing Member, Numerati Partners LLC

LOGIC LOCKING CONQUEST

FINAL JUDGES

Alric Althoff, Senior Scientist, Leidos

Nicole Fern, Senior Hardware Security Engineer, Tortuga Logic

Matthew French, Research Director, Information Sciences Institute, USC

Peter Gadfort, CCDC Army Research Laboratory

Cayley Rice, Research Mathematician, Leidos

Joe Tostenrude, Technical Program Manager, Boeing Solid State Electronics Development

Michael Vai, Senior Technical Staff, MIT Lincoln Laboratory

OBSERVERS

Andrew Howard, NAVSEA

Peilin Song, Principal RSM & Manager, IBM Thomas J. Watson Research Center

POLICY COMPETITION

FINAL JUDGES

Kimon Keramidas, Clinical Associate Professor, Center for Experimental Humanities, NYU College of Arts & Science

Cecilia Marinier, Program Director, Innovation & Scholars, RSA Conference

PRELIMINARY REVIEW COMMITTEE/JUDGES

Isabella Irtifa, Columbia University

Jane Lee, NYU Graduate School of Arts and Science

Emily Moffa, NYU College of Arts and Science and Wagner School of Public Service

Cole Rabinowitz, Cole Rabinowitz, NYU School of Law

Evan Robinson, NYU College of Arts and Science

Mo Satt, NYU Tandon School of Engineering

Chad Thiemann, Privacy Director, CVS Health & Adjunct Professor, Dallas Baptist University

Yun-Da Tsai, Copywriter & Senior Advisor, The George Washington University Law School (NYU CAS '19)

Helen You, NYU Graduate School of Arts and Science

Terry Zhao, NYU College of Arts and Science

Olivia Zhu, NYU School of Law

RED TEAM COMPETITION

FINAL JUDGES

Amy Batallones, Cyber Security Operations Center Lead, Consolidated Edison Co. of New York

Jason Bevis, VP, Awake Security Labs

Joby Cherian, Senior Security Consultant, IBM Security

Gabriela Ciocarlie, Senior Technical Manager, SRI International

Eric Levenstein, Senior Cyber Security Analyst, Consolidated Edison Co. of New York

CHALLENGE WRITERS

Marcus Barbu, NYU OSIRIS Lab

Richard Callahan, NYU OSIRIS Lab

Ryan Cantor, NYU OSIRIS Lab

Alan Cao, NYU OSIRIS Lab

Crystal Cheung, NYU OSIRIS Lab

Leon Chou, NYU OSIRIS Lab

John Cunniff, NYU OSIRIS Lab

Nobel Gautam, NYU OSIRIS Lab

Nick Gregory, NYU OSIRIS Lab

Kyle Martin, NYU OSIRIS Lab

Logan Semenuk, NYU OSIRIS Lab

Sai Vegasena, NYU OSIRIS Lab

Roy Xu, NYU OSIRIS Lab

Albert Xu, NYU OSIRIS Lab

Mina Zhou, NYU OSIRIS Lab

SECURITY QUIZ BOWL

JUDGES / QUIZ HOSTS

Heather Ricciuto, Academic Outreach Leader, IBM Security

Mike Spisak, Distinguished Engineer & Master Inventor, IBM Security

Competition Organizers

Listed Alphabetically

CHALLENGE LEADS

Nishant Aswani, Hack3D

Marcus Barbu, Red Team Competition

Rasika Bhalerao, Applied Research Competition

Leon Chou, Capture the Flag

Patrick Cronin, Embedded Security Challenge (U. Delaware)

John Cunniff, Red Team Competition

Jaime Danguillecourt, Technical Infrastructure Co-lead

Junaid Farooq, Applied Research Competition

Chaz Gouert, Embedded Security Challenge (U. Delaware)

Michael Linares, Hack3D

Nimisha Limaye, Logic Locking Conquest

Kang Liu, HackML

Kent Ma, Capture the Flag

Gary Mac, Hack3D

Kyle Martin, Technical Infrastructure Lead & C2 Security Workshop lead

Marina Moore, Applied Research Competition

Md Moshiur Rahman, Logic Locking Conquest (U. Florida)

Ben Tan, Logic Locking Conquest & HackML

Sai Vegasena, Security Quiz Bowl

Oskar Wirga, Security Quiz Bowl

Helen You, Policy Competition

FACULTY LEADS & FOUNDER

Ramesh Karri, Electrical and Computer Engineering

Nasir Memon (founder), Computer Science & Engineering, Tandon Online

FACULTY ADVISORS

Brendan Dolan-Gavitt, Capture the Flag & HackML

Siddharth Garg, HackML

Nikhil Gupta, Hack3D

Ramesh Karri, Logic Locking Conquest

Nektarios Tsoutsos, Embedded Security Challenge (U. Delaware)

STUDENT SUPPORT TEAMS

- Center for Cybersecurity PhD Students
- OSIRIS Lab Student Members
- Policy Committee
- Gym Staff
- MakerSpace Staff
- 100+ Student volunteers from across NYU

ADMINISTRATIVE SUPPORT

Stef Daley, Global Competition Coordinator

Yashika Desai, Graduate Assistant

Emerald Knox, Project Manager

Manan Nitin Shah, Graduate Assistant

Amanda Morante Wolin, Art Direction & Graphic Design

Vasudev Vivekanand Nayak, Graduate Assistant

NYU Community Support

CSAW would not be possible without the support of the entire NYU community. Our sincere thanks to the following individuals:

Listed in Alphabetical Order by Last Name

Andrenne Badchkam
Steven Bedoya
Victoria Bill
Judy Brown
Bob Caparez
Adanna Connell
Christopher Cook
Christine Curtis
Valerie Davis
Anthony De Jesus
Liz Ensweiler
Will Figueroa
Susana Garcia-Henriquez
Larry Goldstein
Andre Gomes
Karl Greenberg
Ron Guido
Kathleen Hamilton
Simon Heathcote
Eve Henderson
Lauren Ip
Debbie Joachim
Dean Jelena Kovačević
Christina Lafontaine
Matt Leayr
Cindy Lewis
Al Lindsey
Sayar Lonial
Karine-Frederique Loriot
John Madzy
Nilsa Marin
Ahmed Nassef
Sandra Ordonez
John Petinos
Tameka Roberts
Stephen Sagner
Erick Small
Sheldon Smith
Alan Treitman
Jose Torres
James Um
Bernardo Vasquez
Ronnie West
Karen Worthing
Amy Xu

Global Partners

NYU Tandon School of Engineering is proud to partner with these eight academic and research centers to expand CSAW's reach as an international competition with worldwide impact.

CSAW EUROPE

Grenoble INP - Esisar
(Valence, France)

Grenoble INP
Esisar

CSAW INDIA

Indian Institute of Technology, Kanpur

भारतीय प्रौद्योगिकी संस्थान कानपुर
Indian Institute of Technology, Kanpur

CSAW ISRAEL

IBM Research Haifa
University of Haifa
IBM Cyber Security Center of Excellence
Ben-Gurion University

אוניברסיטת בן-גוריון בנגב
Ben-Gurion University
of the Negev

IBM **Cyber Security**
Center of Excellence
IBM

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UNIVERSITY OF HAIFA
جامعة حيفا

IBM

CSAW MENA

NYU Abu Dhabi

جامعة نيويورك أبوظبي
NYU | ABU DHABI

CSAW MEXICO

University Iberoamericana
(Mexico City)

IBERO
Ciudad de México • Tijuana

CSAW’19

COMPETITIONS

Applied Research Competition

Best Paper Award

This competition assesses the best doctoral research in applied security from the previous year. Eligible submissions include papers published (including camera-ready papers) between September 1, 2018 and August 31, 2019, on any topic related to the design, application, or implementation of security technologies. The judging process evaluates the importance of the problem, the novelty of the solution presented, and the practical impact of the paper, in two rounds. The 10 papers listed here were selected out of 80 total submissions to the US-Canada region.

ORGANIZERS

Rasika Bhalerao, Co-chair, Tandon School of Engineering
Junaid Farooq, Co-chair, Tandon School of Engineering
Marina Moore, Co-chair, Tandon School of Engineering
Benjamin Tan, Post-doctoral Advisor, Tandon School of Engineering

JUDGES

Please see page 12

FINALISTS

(listed alphabetically by team name)

Dangerous Skills: Understanding and Mitigating Security Risks of Voice-Controlled Third-Party Functions on Virtual Personal Assistant Systems

Presented by: Xianghang Mi

Nan Zhang (Indiana University Bloomington), Xianghang Mi (Indiana University Bloomington), Xuan Feng (Beijing Key Laboratory of IOT Information Security Technology, Institute of Information Engineering, CAS), Xiaofeng Wang (Indiana University Bloomington), Yuan Tian (University of Virginia), and Feng Qian (University of Minnesota)

Data Oblivious ISA Extensions for Side Channel-Resistant and High Performance Computing

Presented by: Jiyong Yu

Jiyong Yu, Lucas Hsiung, Mohamad El Hajj and Christopher Fletcher
(all University of Illinois at Urbana-Champaign)

DeepCorr: Strong Flow Correlation Attacks on Tor Using Deep Learning

Presented by: Milad Nasr

Milad Nasr, Alireza Bahramali and Amir Houmansadr (all University of Massachusetts - Amherst)

NEUZZ: Efficient Fuzzing with Neural Program Smoothing

Presented by: Dongdong She

Dongdong She, Kexin Pei, Dave Epstein, Junfeng Yang, Ray Bashakhi and Suman Jana
(all Columbia University)

PeriScope: An Effective Probing and Fuzzing Framework for the Hardware-OS Boundary

Presented by: Dokyung Song

Dokyung Song (University of California, Irvine), Felicitas Hetzelt (TU Berlin), Dipanjan Das (University of California, Santa Barbara), Chad Spensky (University of California, Santa Barbara), Yeoul Na (University of California, Irvine), Stijn Volckaert (Katholieke Universiteit Leuven), Giovanni Vigna (University of California, Santa Barbara), Christopher Kruegel, Jean-Pierre Seifert (TU Berlin), and Michael Franz (University of California, Irvine)

Practical Hidden Voice Attacks against Speech and Speaker Recognition Systems

Presented by: Hadi Abdullah

Hadi Abdullah, Washington Garcia, Christian Peeters, Patrick Traynor, Kevin R. B. Butler, and Joseph N. Wilson (all University of Florida)

ProFuzzer: On-the-fly Input Type Probing for Better Zero-day Vulnerability Discovery

Presented by: Shiqing Ma

Wei You (Purdue University), Xueqiang Wang (Indiana University Bloomington), Shiqing Ma (Purdue University), Jianjun Huang (Renmin University of China), Xiangyu Zhang (Purdue University), XiaoFeng Wang (Indiana University Bloomington), and Bin Liang (Renmin University of China)

The Betrayal At Cloud City: An Empirical Analysis Of Cloud-Based Mobile Backends

Presented by: Omar Alrawi

Omar Alrawi (Georgia Institute of Technology), Chaoshun Zuo (The Ohio State University), Ruian Duan (Georgia Institute of Technology), Ranjita Pai Kasturi (Georgia Institute of Technology), Zhiqiang Lin (The Ohio State University), and Brendan Saltaformaggio (Georgia Institute of Technology)

True2F: Backdoor-resistant authentication tokens

Presented by: Emma Dauterman

Emma Dauterman (Stanford University & Google), Henry Corrigan-Gibbs (Stanford University), David Mazieres (Stanford University), Dan Boneh (Stanford University), and Dominic Rizzo (Google)

VRASED: A Verified Hardware/Software Co-Design for Remote Attestation

Presented by: Ivan De Oliveira Nunes

Ivan De Oliveira Nunes (University of California, Irvine), Karim Eldefrawy (SRI International), Norrathep Rattanavipanon (University of California, Irvine), Michael Steiner (Intel), and Gene Tsudik (University of California, Irvine)

Capture the Flag

Students tackle problems in a series of real-world scenarios modeling various computer security problems. To succeed, teams must demonstrate a profound understanding of the roles and ramifications of cyber security in these situations. Because the challenges are designed to teach, CTF requires competitors to integrate concepts, develop skills, and learn to hack as they go.

ORGANIZERS

Leon Chou,
Co-lead, OSIRIS Lab, Tandon School of Engineering

Kent Ma,
Co-lead, OSIRIS Lab, Tandon School of Engineering

Brendan Dolan-Gavitt,
Faculty Advisor, Tandon School of Engineering

JUDGES

Please see page 13

FINALISTS

Antisice Amigos
Will Gulian, *Georgia Institute of Technology*
Dev Ojha, *University of California, Berkeley*
Neil Thistlethwaite, *Georgia Institute of Technology*
John Walton, *University of Texas at Dallas*

dcua
Will Ingarfield, *University of Texas at Dallas*
Daniel Mancia *(University of Texas at Austin)*
Henry Wang, *The University of Texas at Dallas*
Joshua Wong, *University of Texas at Austin*

GreyHatGT
Georgia Institute of Technology
Varun Iyer
Vishwa Iyer
Gavin Lo
Kevin Park

Kernel Sanders
University of Florida
Owen Flannagan
Joshua Haddad
Blas Kojusner
Nozomi Watanabe

perfect blue
Jasraj Bedi, *University of Waterloo*
Alex Lin, *Purdue University*
Sampriti Panda, *Drexel University*
Stephen Tong, *Georgia Institute of Technology*

PPP
Carnegie Mellon University
Albert Gao
Samuel Kim
Artemis Tosini
Fan Pu Zeng

RPISEC
Rensselaer Polytechnic Institute
Jacques Becker
Kevin Mackenzie
Matt Raneri
Glenn Smith

Sice Squad
Harrison Green, *University of Pittsburgh*
Chris Lambert, *Carnegie Mellon University*
Shwe Patel, *Massachusetts Institute of Technology*
Claude Zou, *University of Maryland*

SIGPWNY
University of Illinois at Urbana Champaign
Matt Dyas
Kuilin Li
Joseph Ravichandran
Ankur Sundara

zero cost abstractions
Jason Lee, *Georgia Institute of Technology*
Kevin Shen, *University of Maryland, College Park*
Justin Wang, *Carnegie Mellon University*
William Wang, *University of California, Los Angeles*

Embedded Security Challenge

ESC is an educational, research-oriented tournament aimed at hacking into the hardware of embedded systems. First run in 2008, it is the oldest hardware security competition in the world. 2019 represents ESC's 12 year anniversary!

The 2019 competition focuses on the security of radio frequency identification (RFID) readers, which are utilized broadly from access control in buildings to user authentication in computing systems. This challenge tasked teams with hacking the firmware of a custom RFID card reader using reverse engineering tools developed by the United States National Security Agency (NSA).

ORGANIZERS

Patrick Cronin, Global Challenge Co-lead, University of Delaware

Charles (Chaz) Gouert, Global Challenge Co-lead, University of Delaware

Nektarios Tsoutsos, Global Faculty Lead, University of Delaware

JUDGES

Please see page 14

FINALISTS

(listed alphabetically by team name)

Chipsters, *New York University*
Akhil Gudge Subramanya, Akhil Wadhwa, Ankit Kumar, and Kartikey Purohit
Faculty Advisor: Matthew Campisi

Hack@UCF, *University of Central Florida*
Andrew Hughes, Daniel Reyes, and Ryan Meinke
Faculty Advisor: Thomas Nedorost

Kernel Sanders, *University of Florida*
Grant Hernandez, Claire Seiler, Owen Flannagan, and Hunter Searle
Faculty Advisor: Kevin Butler

La Corruption des Libellules, *University of Québec At Chicoutimi*
Nicolas Castano, Samuel Gröger, Célien Menneteau, and Benjamin Vignau
Faculty Advisor: Raphaël Khoury

redpwn
Christos Bakis, *Fullerton College*
Aaron Esau, *Portland Community College*
Faculty Advisor: Sean Vidal

pwndevils, *Arizona State University*
Zion Basque, Nathan Smith, Jayakrishna Vadayath, Wesam Alzahir, Akshay Ajayan
Faculty Advisor: Yan Shoshitaishvili

Shellphish, *UC Santa Barbara*
Lukas Dresel, Eric Gustafson, and Nilo Redini
Faculty Advisors: Chad Spensky, Fabio Gritti, and Giovanni Vigna

TallaHACKee, *Florida State University*
Ioannis Zografopoulos, XiaoRui Liu, Darbi Bauer, and Fadi Matloob
Faculty Advisor: Charalambos Konstantinou

TechSec, *Massachusetts Institute of Technology*
Kazi Alom, Baltazar Ortiz, Andrew Fasano, and Dennis Giese
Faculty Advisor: Howard Shrobe

Team Insecurity, *University of Florida*
Jacob Crain and Daniel Hamilton
Faculty Advisor: Yier Jin

VIP-ESCS, *Georgia Institute of Technology*
Allen Stewart, Kia Mauricio, Elias Boyer, and Isaac Webb
Faculty Advisor: Chris Roberts

Wildcats, *University of New Hampshire*
Sandeep Sunkavilli, Matt Beliveau, and Ranuli Abeysinghe
Faculty Advisor: Qiaoyan Yu

Hack3D Competition

The Hack3D competition serves to raise awareness and generate discussion in engineering and research communities about security in the additive manufacturing field. In Hack3D's 2019 Qualifying Round, participants were challenged to reconstruct a corrupted .gcode file, employing skills in graphics programming, file manipulation, and reverse-engineering. In the Final Round, teams will compete in hacking an anti-counterfeiting system designed to protect CAD models.

ORGANIZERS

Nishant Aswani, Challenge Co-lead, NYU Abu Dhabi, Computer Engineering

Michael Linares, Challenge Co-lead, NYU Tandon School of Engineering, Mechanical Engineering

Gary Mac, Challenge Co-lead, NYU Tandon School of Engineering, Mechanical and Aerospace Engineering

Nikhil Gupta, Faculty Lead, NYU Tandon, Mechanical and Aerospace Engineering

JUDGES

Please see page 14

FINALISTS

(listed alphabetically by team name)

AGGIES, *Texas A&M University*
Akash Tiwari, Maccoy Merrell, Griffin Jordan & Mutaz Melhem

bagels, *NYU Abu Dhabi*
Rumail Memon, Barkin Simsek, and Ahmad Nasralla

DesiBoys, *NYU Abu Dhabi*
Sampanna Bhattarai and Muhammad Shehryar Hamid

pwndevils, *Arizona State University*
Alex Manning and Erin Ozcan

SNEKS AD, *NYU Abu Dhabi*
Cole Beasley and Pedro Velasquez

Thank you to the National Science Foundation for their generous support of this competition.

HackML Competition

Recent work has shown that neural networks can contain stealthy backdoors, much like traditional software that allow attackers to trigger malicious behavior. The HackML competition challenged teams to design new, more powerful backdoor attacks on neural networks, and to develop novel defenses and detections.

ORGANIZERS

Kang Liu, Challenge Lead

Benjamin Tan, Challenge Coordinator

Brendan Dolan-Gavitt, Faculty Co-lead

Siddharth Garg, Faculty Co-lead

JUDGES

Please see page 14

FINALISTS

(listed alphabetically by team name)

CCT, *Univerzita Karlova* | *Attack*
Břetislav Hájek

DukeCEI, *Duke University* | *Defense*
Yukun Yang and Ximing Qiao

MoMA, *NYU Abu Dhabi* | *Attack & Defense*
Julie Liu and Estelle Ocran

Mr. Robot, *New York University* | *Attack*
Shihong Fang

SiceML | *Attack*
Harrison Green *(University of Pittsburgh),* Will Gulian *(Georgia Institute of Technology),* Neil Thistlethwaite *(Georgia Institute of Technology),* Chris Lambert (*Carnegie Mellon University),* Ryan Weast *(Penn State University)*, and Spencer Hua *(Georgia Institute of Technology)*

Logic Locking Conquest

Logic Locking is a revolutionary technique for protecting Intellectual Property of Integrated Circuits from myriad security threats, such as reverse engineering, overbuilding, piracy, and hardware Trojan insertion. In this student-led Logic Locking challenge, competitors attempted to attack and defend designs locked with state-of-the-art methods. Participants were provided with a selection of locked combinational and sequential designs (netlists) with varying complexity and key sizes.

ORGANIZERS

Nimisha Limaye, Combinational Locking Blue Team Student Lead, NYU Abu Dhabi

Md Moshiur Rahman, Sequential Locking Blue Team Student Lead, University of Florida

Benjamin Tan, Competition Coordinator, NYU Tandon School of Engineering

Ramesh Karri, Faculty Advisor, NYU Tandon School of Engineering

JUDGES

Please see page 14

FINALISTS

CMU, *Carnegie Mellon University*
Danielle Duvalsaint
Faculty Advisor: Shawn Blanton

Hardest Hammer, *Texas A&M University*
Zhaokun Han, Luciano Brignone, Austin Benedetti, Hao Guo, Eden Llyold
Faculty Advisor: Jeyavijayan Rajendran

IC2rack, *University of Texas Dallas*
Zhen Wang, Jainam Gandhi, and Carissa Pichon
Faculty Advisor: Kanad Basu

IO, *University of California San Diego*
Leon Li
Faculty Advisor: Alex Orailoglu

NuLogiCS, *Northwestern University*
Amin Rezaei and Yuanqi Shen
Faculty Advisor: Hai Zhou

Seal, *Indian Institute of Technology, Kharagpur*
Akashdeep Saha and Siddhartha Chowdhury
Faculty advisor: Debdeep Mukhopadhyay

Terp Hackers, *University of Maryland*
Abhishek Chakraborty, Yuntao Liu, Ankit Mondal, and Mike Zuzak
Faculty Advisor: Ankur Srivastava

Tigers, *Auburn University*
Ayush Jain, Ziqi Zhou, and Yuqiao Zhang
Faculty Advisor: Ujjwal Guin

IITG, *Indian Institute of Technology, Guwahati*
Ramanuj Chouksey
Faculty Advisor: Chandan Karfa

Policy Competition

The Policy Competition challenges contestants to think about the big picture of cyber security policy, economics, law, and governance. The purpose of this competition is to encourage students to think critically about major policy issues affecting society, and to impact the cybersecurity industry by presenting their ideas to leaders within the field. The 2019 competition asked teams to focus on issues pertaining to cyberware, law enforcement investigations, or data security.

ORGANIZERS

Helen You, Competition Chair, NYU Graduate School of Arts & Science

Emily Moffa, NYU College of Arts and Science and Wagner School of Public Service

Evan Robinson, NYU College of Arts and Science

Yun-Da Tsai, The George Washington University Law School; NYU CAS (alum)

Kristina Zheng, NYU College of Arts and Science

Terry Zhao, NYU College of Arts and Science

JUDGES

Please see page 15

FINALISTS

(listed alphabetically by university)

Drexel University
Erika Pleskunas and Beth Karagu

New York University
Jin Choi and Kathy Wang

United States Naval Academy
Kameron Chumley, Cameron Cook, Brendan Reilly, and Brendan Henry

United States Naval Academy
Byron Gallagher, Anthony Perry, Ian Flynn, and Rae-Kelly Hamilton

Wesleyan University
Shuyuan Hung, Quer (Cher) Qin, John Jiang, and Kevin Koech

Red Team Competition

Challenges are designed to encourage learning and skill-building in the areas of reversing, web security, forensics, crypto and pwning. During in-person Finals, high school teams are tasked with infiltrating and analyzing the findings of an operation without getting caught.

ORGANIZERS

Marcus Barbu, Co-Lead, Tandon School of Engineering, OSIRIS Lab

John Cunniff, Co-lead, Tandon School of Engineering, OSIRIS Lab

JUDGES

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FINALISTS

b1c, *Montgomery Blair High School, Silver Spring, Maryland*
Kevin Higgs, Clarence Lam, and Jason An
Mentor: Peter Ostrander

bluepwn
Bellevue, Washington
Robert Chen, Daniel Lu, Sherry Zhang

comet, *Whitefish Bay High School, Whitefish Bay, Wisconsin*
Hye Sung Jung

Count3r Log1c, *Stuyvesant High School, New York, New York*
Greg Zborovsky, Amit Prasad, David Lupea
Mentor: Topher Mykolyk

L Distribution, *Poolesville High School, Poolesville, Maryland*
Rithvik Bhogavilli, Christopher Stallard, Aidan Goettsch
Mentor: Mark Estep

let_down, *West Windsor-Plainsboro High School North, Plainsboro, New Jersey*
Daniel Wang, Eric Yang, Parth Shastri
Mentor: Tom Connolly

Loen Miksen. *Stuyvesant High School, New York, New York*
Ivan Galakhov, Ethan Morgan, Yevgeniy Gorbachev
Mentor: Topher Mykolyk

Niwot, *Niwot High School, Longmont, Colorado*
Davita Bird, Julia Curd, Caitlyn Fong
Mentor: Teresa Ewing

P 0x41414141 PER, *Kimberly High School, Kimberly, Wisconsin*
Jacob Farrell, Isaac Yang, Gavin McGowan
Mentor: Matthew Hoh

SIMple, *Poolesville High School, Poolesville, Maryland*
Ishita Chatterjee, Megha Tummalapalli, Sadhana Lolla
Mentor: Mark Estep

Troy Tech Support, *Troy High School, Fullerton, California*
Rahil Shah, Jimmy Li, Joseph Xu
Mentor: Allen Stubblefield

Security Quiz Bowl

The Qualification Round of this competition is open to CSAW Finalists and local student teams. The Final session is organized as a buzzer-based academic bowl. Teams are tested on a range of topics related to cyber security, including: Hardware, Malware, Software tools, Reverse Engineering, Web, Recon, Languages, Culture, Forensics, File Systems, Protocols, and Software.

ORGANIZERS

Sai Vegasena, Challenge Co-lead, Tandon School of Engineering, OSIRIS Lab

Oskar Wirga, Challenge Co-lead, Tandon School of Engineering, OSIRIS Lab

JUDGES/QUIZ HOSTS

Heather Ricciuto, Academic Outreach Leader, IBM Security

Mike Spisak, Distinguished Engineer & Master Inventor, IBM Security

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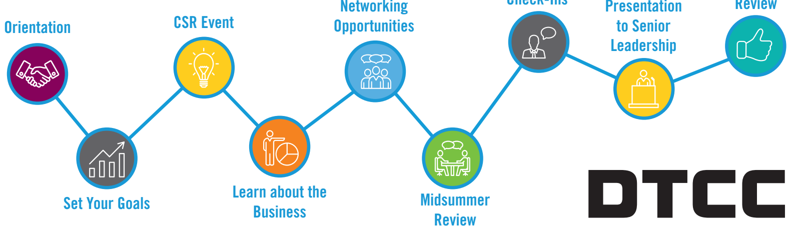
OVERVIEW OF 10-WEEK SUMMER PROGRAM



Orientation

Set Your Goals

CSR Event

Learn about the Business

Networking Opportunities

Midsummer Review

Mentor Check-Ins

Presentation to Senior Leadership

End of Summer Review

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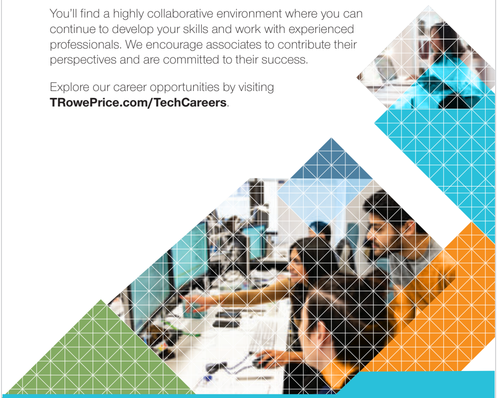

OSIRIS

The OSIRIS Lab is an open lab for undergraduate research and a meeting place for students who are interested in security. CSAW student leaders use the lab's resources to develop the challenges, build the software platforms used for **Capture the Flag, RED Team Competition,** and **Security Quiz Bowl,** and maintain the VMs that host CSAW data files.

Learn more at **osiris.cyber.nyu.edu**

MakerSpace

OUR SINCERE THANKS

TO VICTORIA, CHRISTINA, AND
ALL THE STUDENT STAFF FOR
YOUR SUPPORT OF CSAW’19!

WHAT’S YOUR FAVORITE MOMENT FROM CSAW?

Tweet us

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#CSAW19

THANKS

to the ACSA for their generous support of the top 2 **all-female** RED Teams,

SIMple, Poolesville High School, Poolesville, Maryland
Niwot, Niwot High School, Longmont, Colorado

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Notes & New Contacts

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Do you have feedback for us?
Email us at **csaw-info@nyu.edu**

Do you have questions or need assistance during CSAW'19?

The CSAW Info Desk in the lobby of 6 Metrotech will be staffed throughout CSAW. Alternatively, questions can also be directed here:

General Inquiries

Emerald Knox,
Project Manager
646.997.3845

Stef Daley,
Global Competition Coordinator
646.761.3972

Press Inquiries

Kathleen Hamilton
347.843.9782

Karl Greenberg
646.519.1996

CSAW'19 ADDENDUM

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Sponsor Additions

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Industry Fair Additions

Consolidated Edison Company of New York

Raytheon

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Special Events Updates

Embedded Security Challenge Keynote
Now at 9:30 am - 10:00 am
With speaker: **Keith Rebello,** DARPA/MTO Program Manager

Center for Cybersecurity Luncheon
With speaker: **Ed Amoroso,** CEO, TAG Cyber

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Judge Additions & Corrections

CTF CHALLENGE WRITERS/JUDGES

HRL - IBM Research

Teddy Reed, Facebook

EMBEDDED SECURITY CHALLENGE

Ryan Craven, Program Officer - Cyber S&T, Office of Naval Research

HACK3D COMPETITION

Andy Kangpan, Investor, Two Sigma Ventures

POLICY COMPETITION

Shawn Swartout, Sr. Director of Cybersecurity, Head of Cyber Investigations, TIAA

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Challenge Lead Addition

Akshaj Kumar Veldana, HackML

PAGE 17
NYU Community Support Additions

Nick Jensen

Maey Khaled

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