

Computer Science @ CI

Michael Soltys
Professor and Chair of Computer Science

November 27, 2018

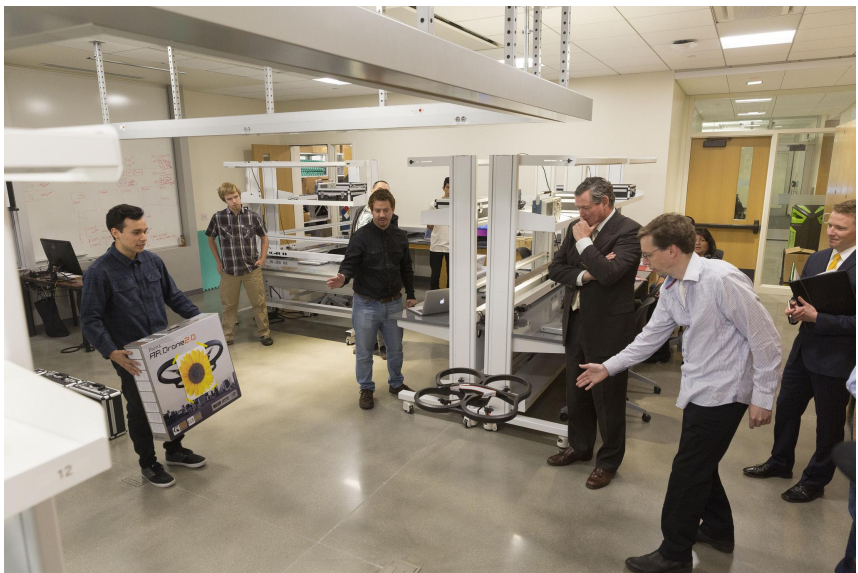
**Workforce Education Coalition
IT Guild X**



Outline

1. The story of us
2. Mechatronics
3. Cybersecurity

California State University at Channel Islands: Department of Computer Science





AJ Bieszczad
CI Rainbow Project



Houman Dallali
Mechatronics



Jason Isaacs
Embedded Systems &
UAVs



Brian Thoms
Social Media, online
teaching



Michael Soltys
Algorithms & Security



ACM Regional Competitions 2018



ACM Regional Competitions 2018



The 2018 World Finals



ACM Regional Competitions 2018



The 2018 World Finals

1. Moscow State University
2. Moscow Institute of Physics and Technology
3. Peking University
4. The University of Tokyo
5. Seoul National University
6. University of New South Wales
7. Tsinghua University
8. Shanghai Jiao Tong University
9. St. Petersburg ITMO University
10. University of Central Florida

<https://icpc.baylor.edu/regionals/finder/world-finals-2018>

Why so few engineers when everybody needs one?

- NSB: engineering degrees dropped 20% since 1985
- ACT: less than 6% high school seniors plan to take engineering
- AFS: 0.8% students plan to major in math
- Intel Science Fair: 6million Chinese students applied; 65K US students did (~100:1)
- 50% of US Engineering PhDs go to foreign students
- In next decade, 90% of world scientists & engineers will reside in Asia

COMPUTER SCIENCE PROGRAM



Computer Science and Information Technology is a fast-growing and vibrant program at CSU Channel Islands. Our faculty specialize in algorithms, artificial intelligence, security, social media, and robotics.

[Learn more »](#)

NEWS & EVENTS

[MORE »](#)

Prof. Soltys will be giving an invited talk at [LDS&LAW2016](#) in London, February 2-4, 2016.

Prof. Thoms' co-authored paper, "Task Oriented Reading of Instructional Materials and Its Relationship to Message Scores in Online Learning Conversations," to be presented at the Hawaiian Conference on System Sciences on January 6, 2016.

Prof. Claveau to present his paper, "System of 3-D Printed Components for the Rapid Prototyping of Legged Robots," at the 4th International Conference on Robot Intelligence, Technology and Applications in Bucheon, Korea on December 12-15, 2015.

Prof. Thoms' co-authored paper, "Instructor versus Peer Attention Guidance in Online Learning Conversations," was published in *AIS Transactions on Human-Computer Interaction*, Volume 7, Issue 4.

[Meet our faculty and staff](#)

[Course Listings](#)

[Apply Now](#)

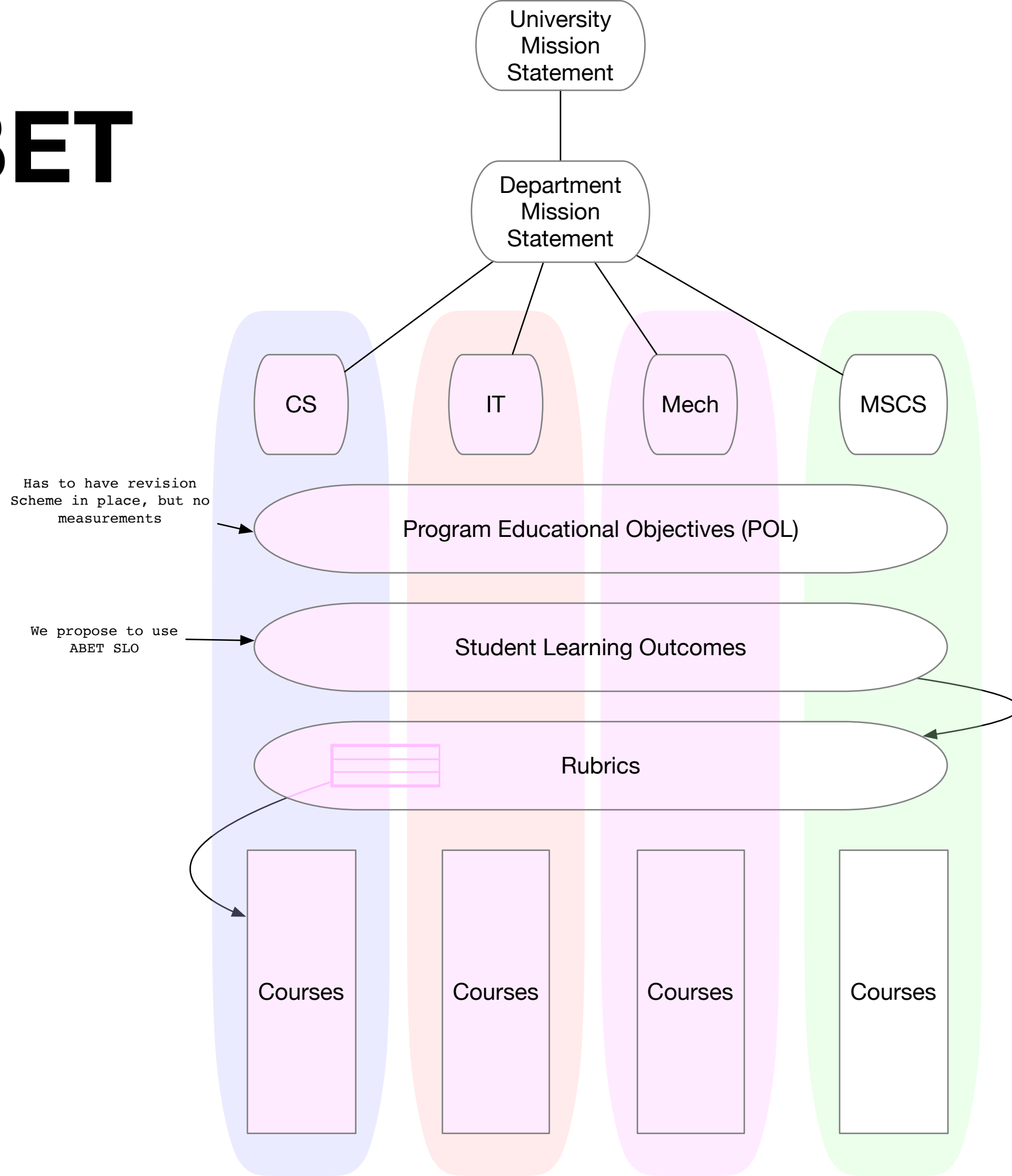
[Seminars](#)

compsci.csuci.edu

We collaborate with

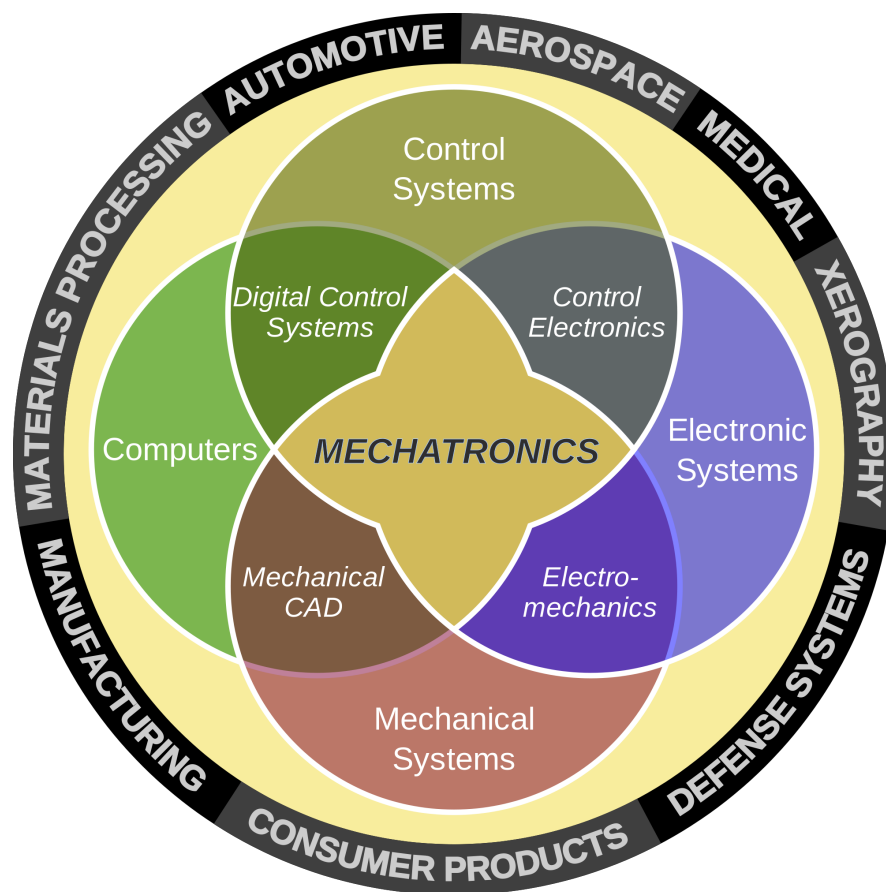
- Local Companies: Advisory Board
- Navy
- HTTF
- VCCC
- VCOE

ABET



Mechatronics =
Mechanics + Electronics

- Mechatronics is a modern multi-disciplinary field of Engineering, combining Computer Hardware, Electronics and Mechanical Engineering in one.



A lot of Employment Opportunities!

×



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Engineers Get Top Pay

Industry	Median Entry-Level Salary ¹	Mean Annual Salary ²
Geological and Mining Engineering and Sciences National Labor Stats	Data Not Provided	\$100,970
Materials Science and Engineering National Labor Stats	\$65,979	\$91,150
Mechanical Engineering National Labor Stats	\$61,523	\$87,140

6 more rows, 1 more column



2015 Engineering Salary Statistics | College of Engineering

www.mtu.edu/engineering/.../salary/ Michigan Technological University ▼

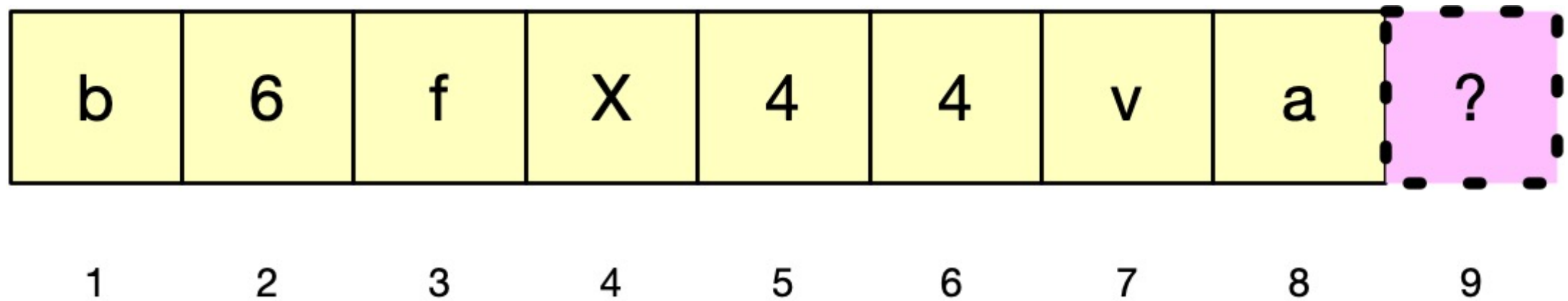
Swarmathon



Cybersecurity

Example

Buffer Overflow



Outline

Cybersecurity at CI

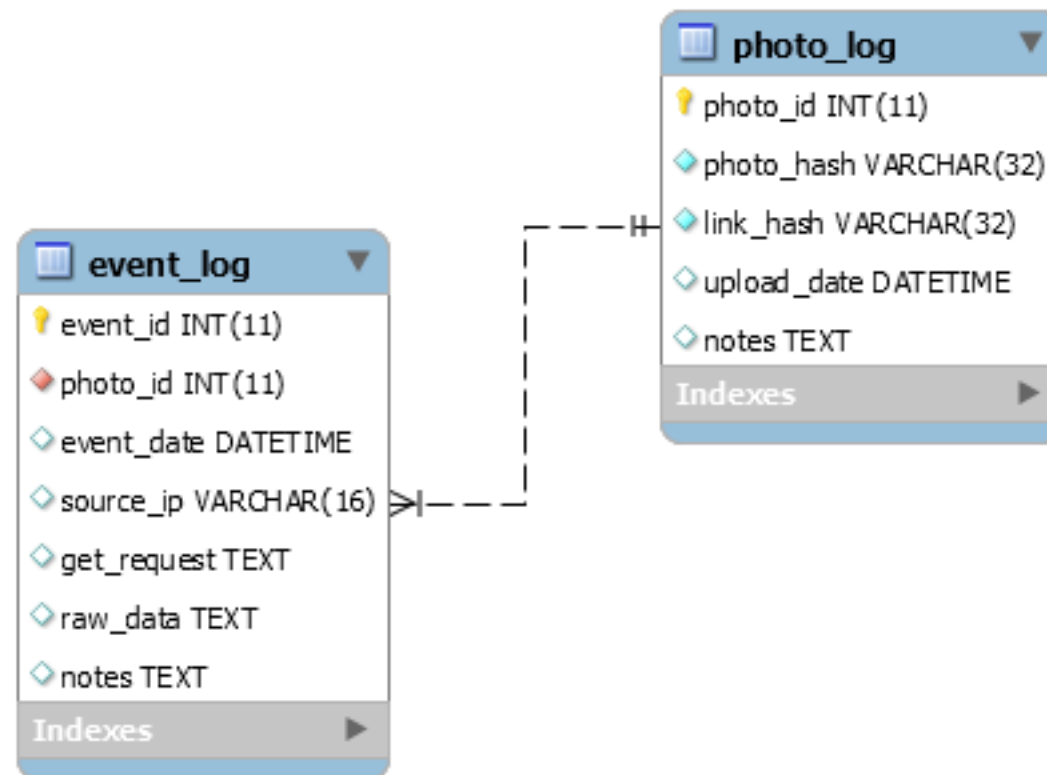
Digital Forensics
Collaboration with HTTF

Penetration Testing

SEAKER



Voyager



Password Beast



Virus Total



COMP 424/524

3 Klein's attack on RC4

Suppose w key streams were generated by RC4 using packet keys with a fixed root key and different initialization vectors. Denote by $K_u = (K_u[0], \dots, K_u[m]) = (IV_u || Rk)$ the u th packet key and by $X_u = (X_u[0], \dots, X_u[m-1])$ the first m bytes of the u th key stream, where $1 \leq u \leq w$. Assume that an attacker knows the pairs (IV_u, X_u) – we shall refer to them as *samples* – and tries to find Rk .

In [5], Klein showed that there is a map $\mathcal{F}_i: (\mathbb{Z}/n\mathbb{Z})^i \rightarrow \mathbb{Z}/n\mathbb{Z}$ with $1 \leq i \leq m$ such that

$$\mathcal{F}_i(K[0], \dots, K[i-1], X[i-1]) = \begin{cases} K[i], & \text{with Prob} \approx \frac{1.36}{n} \\ a \neq K[i], & \text{with Prob} < \frac{1}{n} \text{ for all } a \end{cases}$$

If the first i bytes of a packet key are known, then the internal permutation S_{i-1} and the index j at the $(i-1)$ th step of the RC4 key setup algorithm can be found. We have

$$\mathcal{F}_i(K[0], \dots, K[i-1], X[i-1]) = S_{i-1}^{-1}[i - X[i-1]] - (j_{i-1} + S_{i-1}[i]) \bmod n$$

The attack is based on the following properties of permutations.

Theorem 1 For a random permutation P , and random number $j \in \{0, \dots, n-1\}$, we have

$$\begin{aligned} \text{Prob}(P[j] + P[P[i] + P[j] \bmod n] = i \bmod n) &= \frac{2}{n} \\ \text{Prob}(P[j] + P[P[i] + P[j] \bmod n] = c \bmod n) &= \frac{n-2}{n(n-1)} \end{aligned}$$

where $i, c \in \{0, \dots, n-1\}$ are fixed, and $c \neq i$.



AWUS 036 ACH

Course Outline

1. Crypto: basics
2. Crypto: symmetric ciphers,
Assignment: break a MAC
3. Crypto: DES, IDEA, AES,
htpasswd; case study: break
WEP
4. Crypto: blocks & hashes
5. Crypto: public key: D-H,
ElGamal, RSA, elliptic curves
6. Authentication: kerberos
7. Tools:
 - I. OpenSSL & GnuPG
 - II. Hashcat & John Ripper
 - III. Kali Linux, Wireshark &
Palo Alto Firewalls
 - IV. Malware

Cryptoanalysis

How to break a code

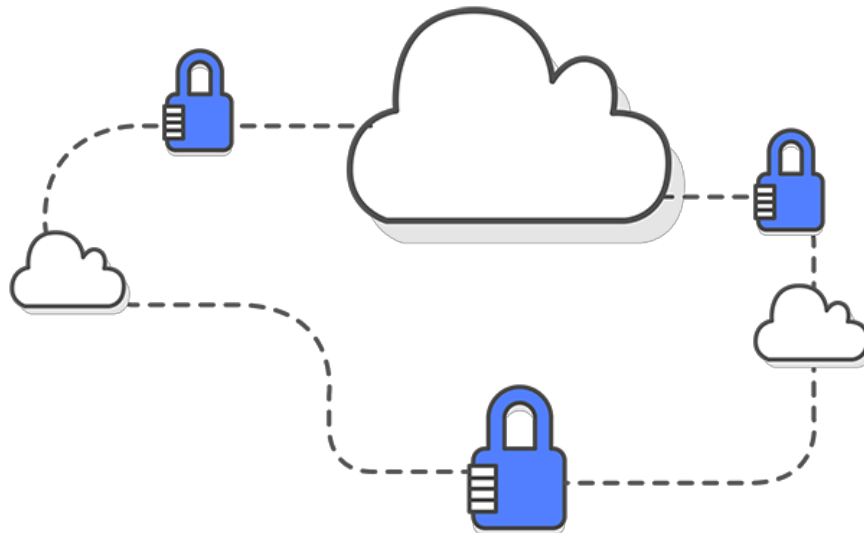
Encoding vs Encryption

Base 64 Encrypted String:
oZ04bYkMsJoFV3csbYwcmXEcjnHzj3EUlHndV4kMsJoFbYkMsJ
oFeVUlwqcBtpM6bZcFtpw7wVDzV34Bbak7slU5uKc4vKkGbZQ5
bak7slUBtpw7wW/zV4w7rqjztpIAuKcHrpDztZYBSVUCv1U4xp
n/bT8WuKo/sVU5v5YAslUHta3zs5o0v5sIuVUGxpIAsqkFxmPz
Vz8culUKtZYHbZk8vKk0u6jzsZo4vafzuKbzbvJA8sqfBbT8Vwq
cBwVUHtZnzs54FslUCs1UHtZ4BslU4xpoGiFTdmJLzwJ00wVUK
tpM6vFU3rqc4bZ04bZYGvZ4FsmPzV4w7rqjzwZ04bZ00u5j/bZ
k0v5nzvJo8x5nzwZ04bZs8v5nSbT7djpM3baw7rqjzvJ0Cwpe3
sqb/bVrzvJ00wVU0v6j/bT8WuKo/sVUHwJ4GwVUHtZnzbvJ4BsQ
wGbZQ5bak7xlU7spYFwWPzV3YBSVUKtZoBbak7xlU7spYFwVU1
spw0u1UHUFU1spYHeVTdoJ00wVU3v5o0sVU7rpM3iFT5baw7rq
jzsac4rpjzs5o4wWPzVz8qtZYHbak7slU7rpIAsqbSbaw7rqjz
wZ04bZg7rp4BeVTdlpLzwJ00wVU5wqcBrpg4baw0vFUHta3zr6
c0tpLSbT8qtZYHbak7slU0u6s8uWPzwJ00wVU3v5o0sVU6v5YG
vVDzV3k0v5nztqkGbZk4rpK/xlUHsqcFuKcGbZg/rqgDb1TdV4
w7spLzwZ04bagHrqcGbak7v5oKbZkCwJLzwZ04tqbzbvKU4rqcG
bT8Uu5jzwJYHsqb6sVU7spYJspLzwJ4HtVUHtZo8v1UHspYFvG
7zV3k8sVU7slUGup4/slU7tqfzwJQFtFUHuFUGspnSbT8Xtpjz
tZnzwJ0CbZI0sZnzwZ04bXE0upbzupY+slUHtZo4iFTdV4kMsJ
oFbYkMsJoFbZcIv5M8u5vzr6c8sJ0HeVTdlpLzwZ04bZsCv5oG
wafzuJrzwZ04bZM8sJ0Hh1TdoJ00wVU8upICv6k0uVU7rpM3bZ
QFbZoMslDzV3k0v5nzs6c0upnzwZ0MbZs4rqc5wpDzvK4AupoH
v63SVz==

8. CompTIA Security+



9. AWS security



10. Another assignment, usually coding in Python

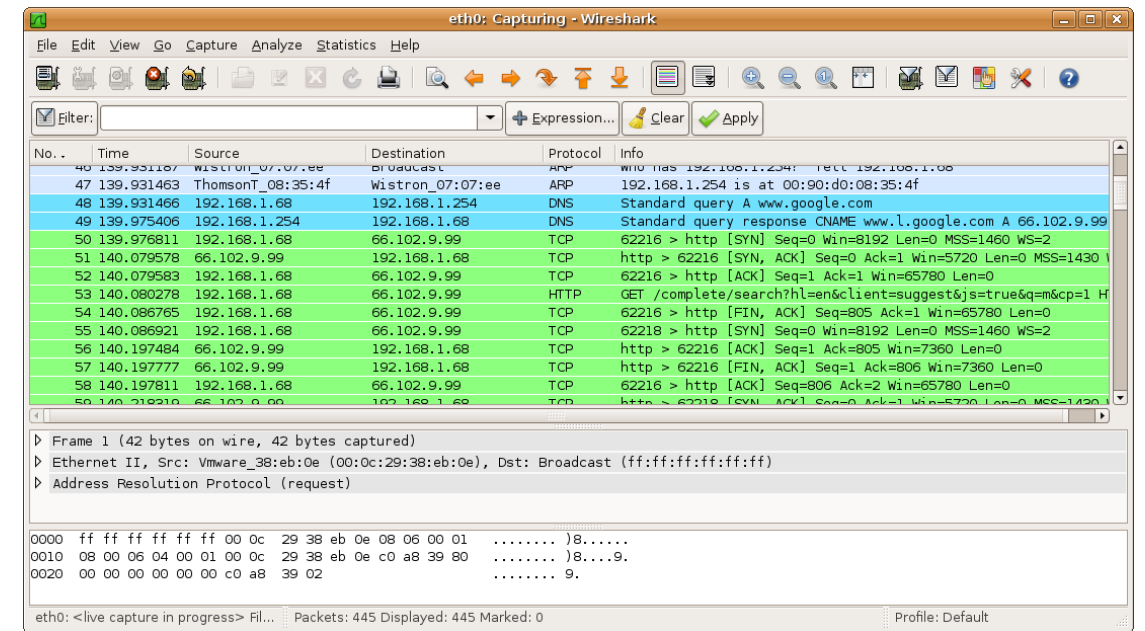
11. Presentations

- I. Long list of articles (articles more current than textbooks)
- II. Ability to articulate ideas about security

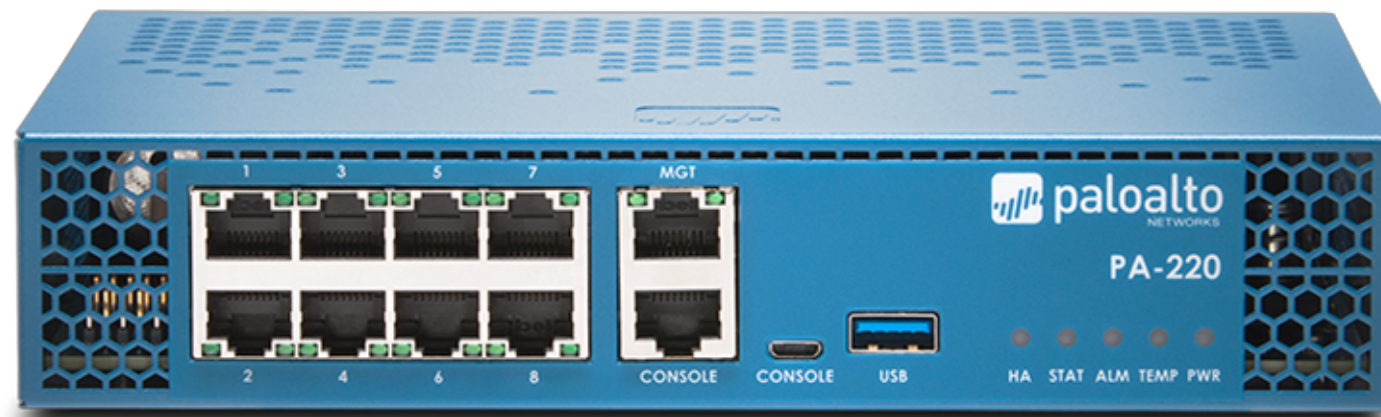
Penetration Testing



Kali Linux



Wireshark



Palo Alto Firewall

Capstone Showcase

**November 29, 2018
3:00 - 5:00**

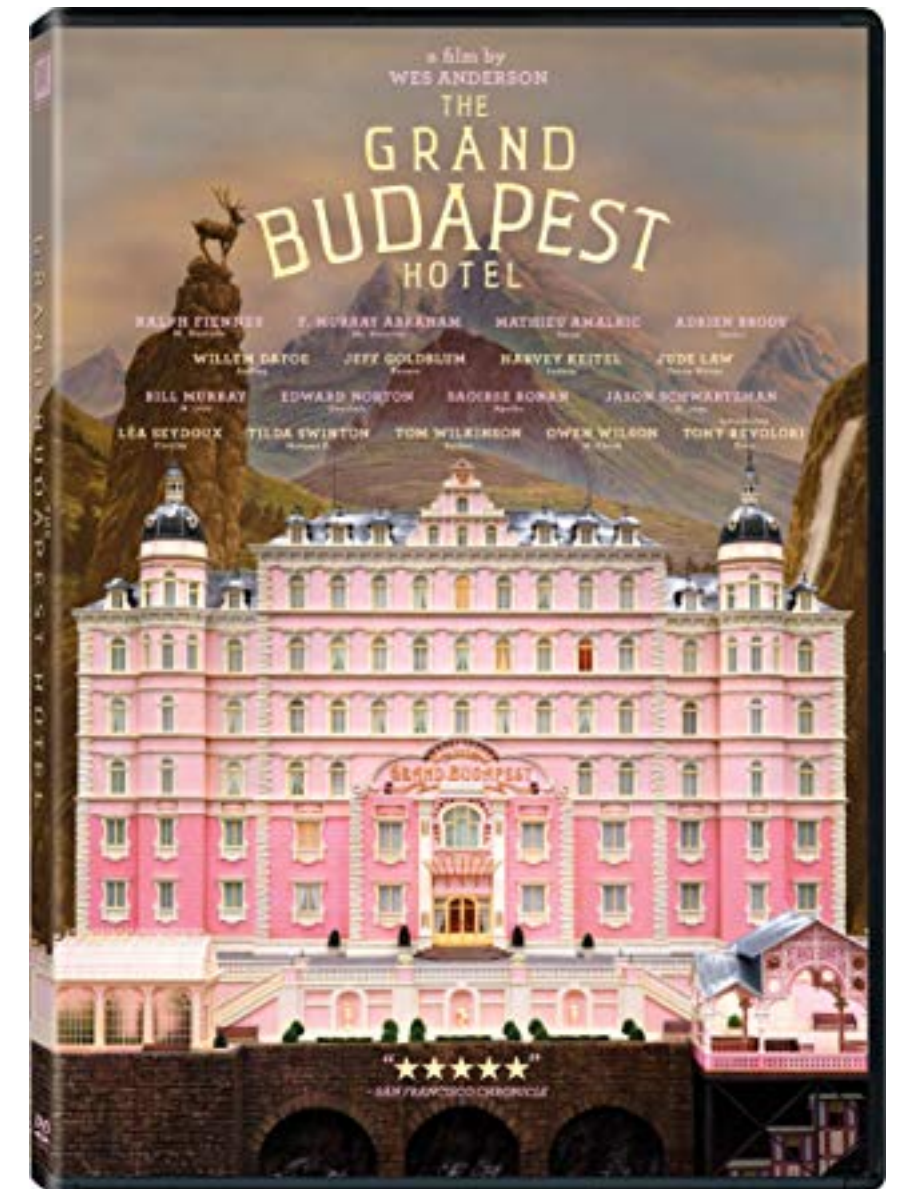
**Sierra Hall
CSU CI**



23rd International Conference on Knowledge-Based and Intelligent Information & Engineering Systems



<http://kes2019.kesinternational.org>



Questions?

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