CSCD27

Computer and Network Security

Thierry Sans

Why security matters?

SECURITY

Back-to-school malware is hiding in those digital textbooks

Kaspersky warns that it found more than 100,000 textbook files with malware lurking inside.

BY RAE HODGE | SEPTEMBER 3, 2019 1:41 PM PDT

Researchers warn that malicious actors are targeting students seeking to escape rising textbooks costs via online alternatives.

Jeff Greenberg/Getty Images

CNET

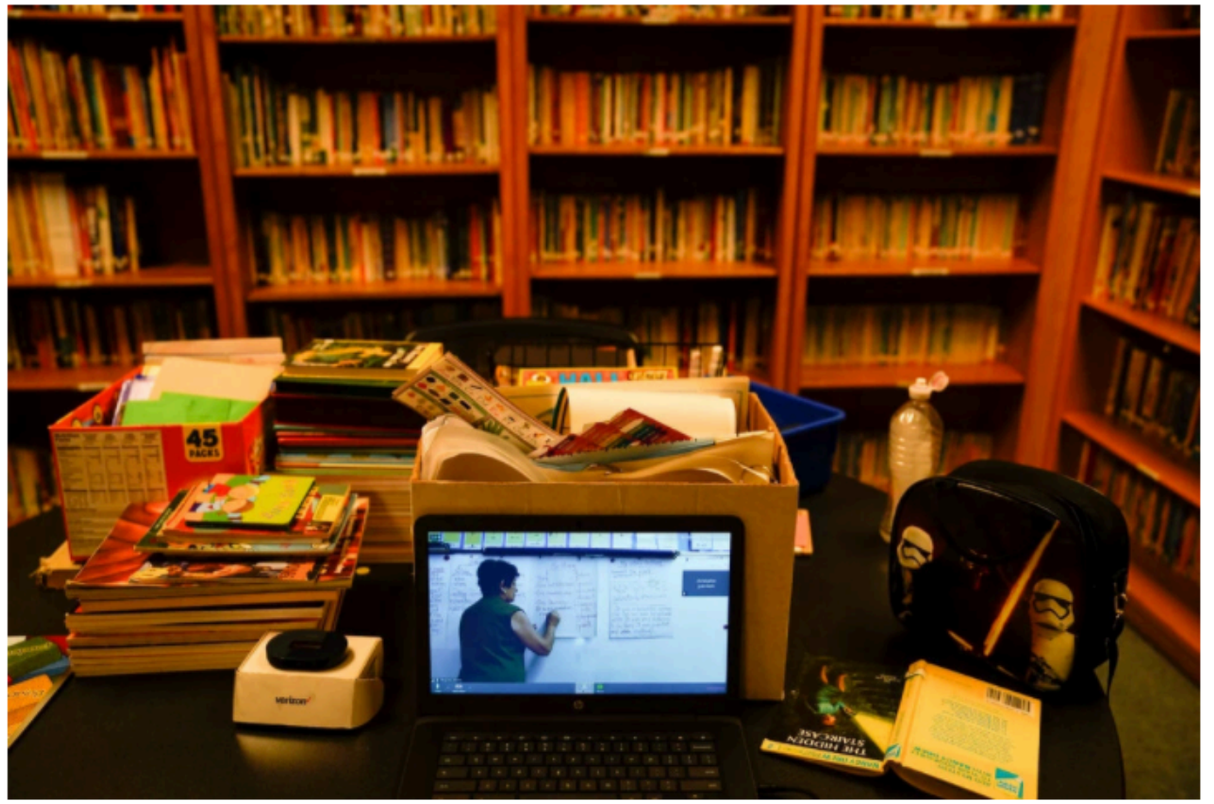
September 2019

New York Times

September 2020

Website Crashes and Cyberattacks Welcome Students Back to School

With many districts across the country opting for online learning, a range of technical issues marred the first day of classes.



Many of the nation's school districts faced technical challenges on Tuesday while starting the academic year remotely. Jae C. Hong/Associated Press

The University of Chicago Medicine Exposed ‘Perspective Givers’ Database With More Than A Million of Records

Security Discovery

June 2019

CREDIT RSS | Tue Dec 29, 2015 2:20pm GMT

Database of 191 million U.S. voters exposed on Internet: researcher

Signs are pictured during a voter registration drive for National Voter Registration Day outside Convention Center in Los Angeles, California September 22, 2015. REUTERS/Mario Anzuoni

By **Jim Finkle** and **Dustin Volz**

An independent computer security researcher uncovered a database of information on 191 million voters that is exposed on the open Internet due to an incorrectly configured database, he said on Monday.

Reuters

September 2015

Identity Force

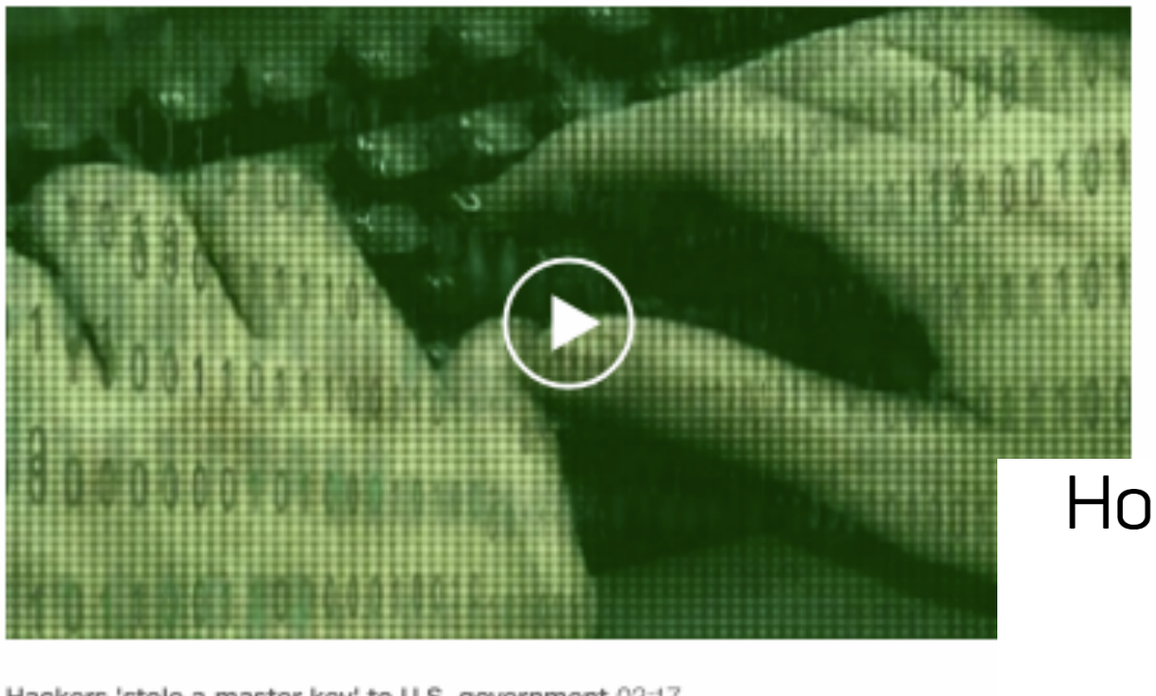
February 2016

IRS Data Breach Update: More Taxpayers Affected

Last year's IRS data breach is continuing to make headlines as the true scope of its damage becomes clearer. The breach, which the IRS believes took place in February 2015, was first announced in May 2015; at the time, it was thought that more than 100,000 American taxpayers had their personal information compromised. However, in August 2015, the agency revealed the discovery of an additional 220,000 victims. Now, about one year since the initial breach, the IRS is saying that the current total number of victims is topping 700,000 — about seven times more than initial estimates.

Hackers publish contact info of 20,000 FBI employees

By Mary Kay Mallonee, CNN
Updated 8:34 PM ET, Mon February 8, 2016



Hackers 'stole a master key' to U.S. government 02:17

Story highlights

Hackers published contact information for 20,000 FBI employees Monday afternoon

The Justice Department is actively investigating the incident

Washington (CNN) — Hackers, making good threat, published contact information for 20,0 employees Monday afternoon, just one day a similar data on almost 10,000 Department of Security employees.

The hackers, tweeting from the account @Dc claim they obtained the details by hacking int Department of Justice database.

CNN

February 2016

Homeland Security breach exposes data on 240,000 employees

Personally identifiable information was discovered in the possession of a former department employee.

BY **STEVEN MUSIL** / JANUARY 3, 2018 6:20 PM PST

CNET

January 2018

Equifax says number of Canadians affected by hack passes 19,000

Signage at the corporate headquarters of Equifax Inc. in Atlanta.

MIKE STEWART/AP

TORONTO
THE CANADIAN PRESS
PUBLISHED NOVEMBER 29, 2017

NEWS

2 Canadian banks hacked, 90,000 customers' data stolen

Two of Canada's largest banks, Bank of Montreal and the Canadian Imperial Bank of Commerce's Simplii Financial, confirmed hackers stole the personal and financial data of thousands of customers.

CSO Online

May 2018

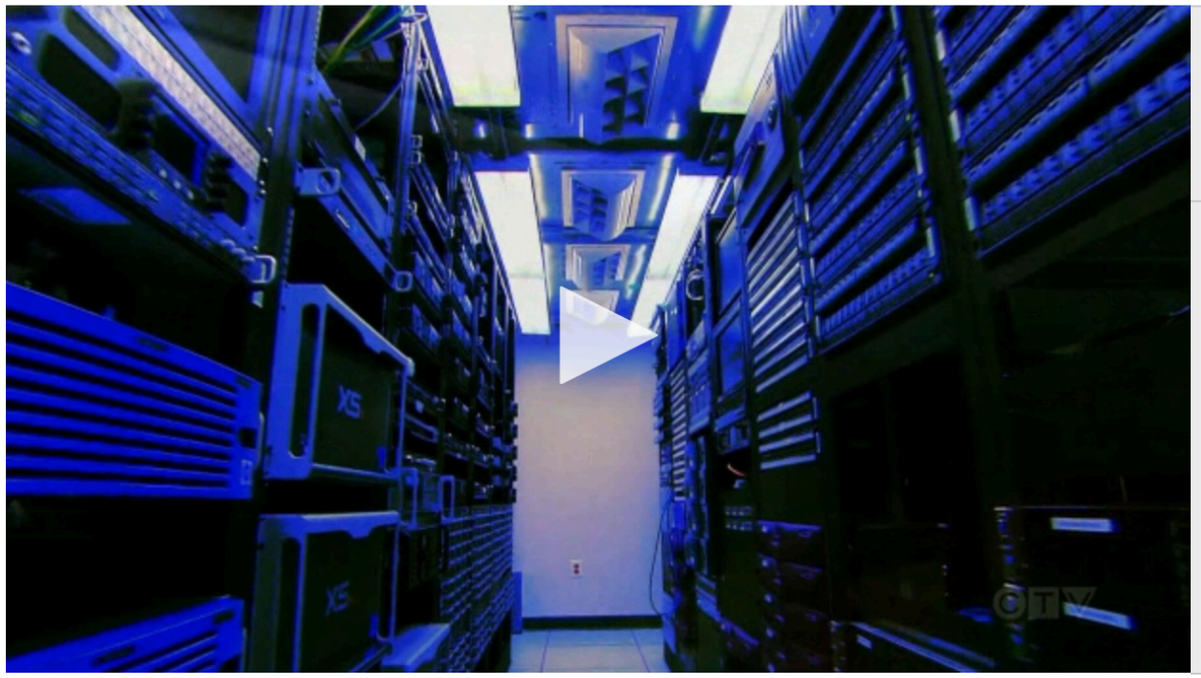
Air Canada locks down 1.7 million mobile app accounts after breach affects 20,000 customers

Aeroplan numbers, passport numbers, birth dates, nationalities and countries of residence could have been accessed

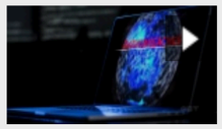
Financial Post

August 2018

19 million Canadians have had their data breached in eight months



CTV National News: Shocking data breach numbers



An exclusive investigation by the podcast 'Attention Control' hosted by Kevin Newman has uncovered disturbing data breach numbers.

913 913

Francesca Fionda, Investigative journalist, Attention Control
@francescafionda

FEATURED POLITICS »

CTV News

September 2019

Global News

October 2022

CANADA

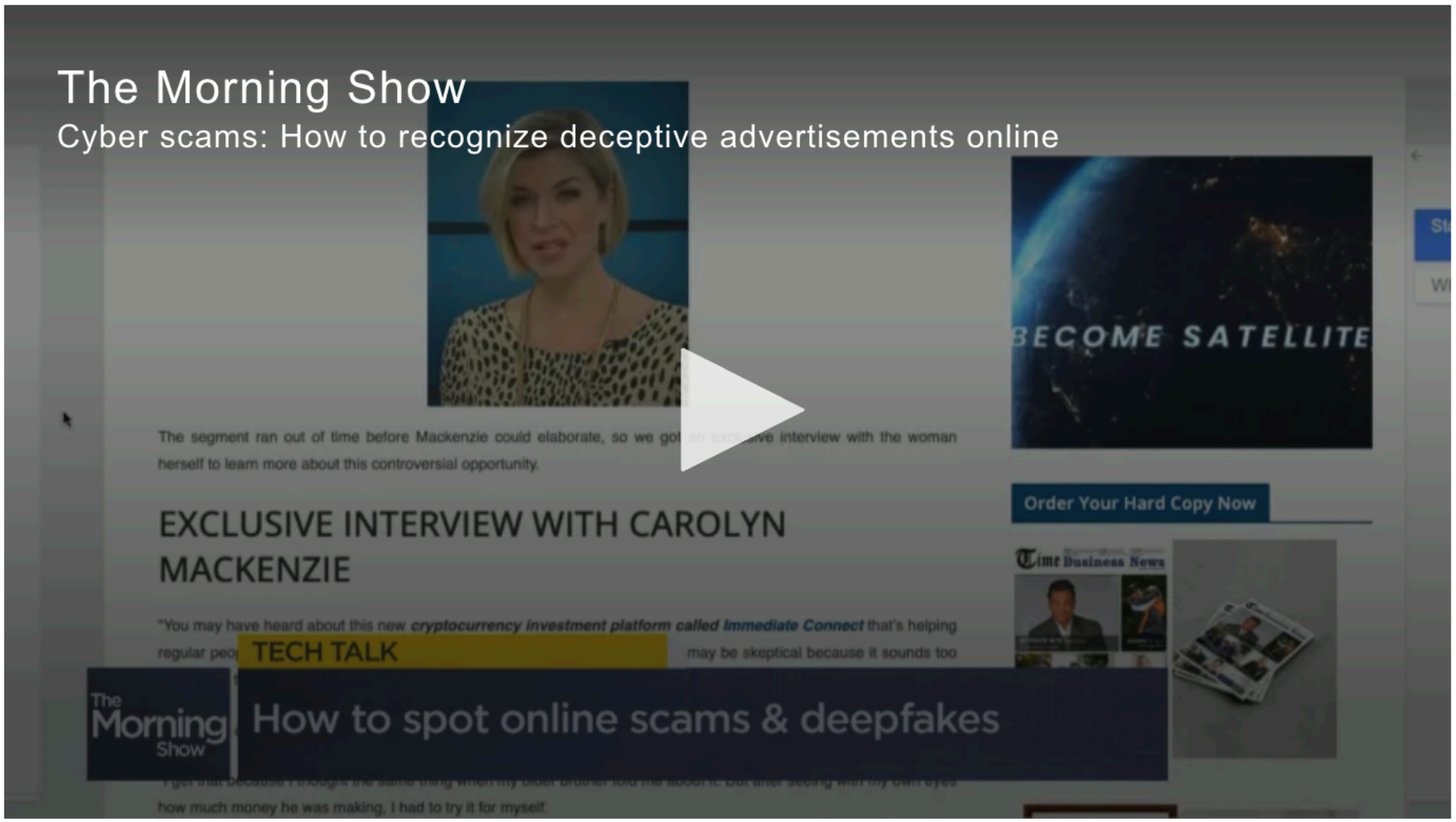
Cybersecurity incidents affected 18% of businesses in Canada last year: StatCan

By Staff • The Canadian Press
Posted October 18, 2022 12:35 pm

CANADA

Ontario’s BORN birth registry breach sees data ‘taken’ from 3.4 million

By **Uday Rana** • **Global News**
Posted September 25, 2023 10:56 am · Updated September 25, 2023 12:49 pm



Global News

September 2023

DDoS attack that disrupted internet was largest of its kind in history, experts say

Posted by Eric Beaudoin

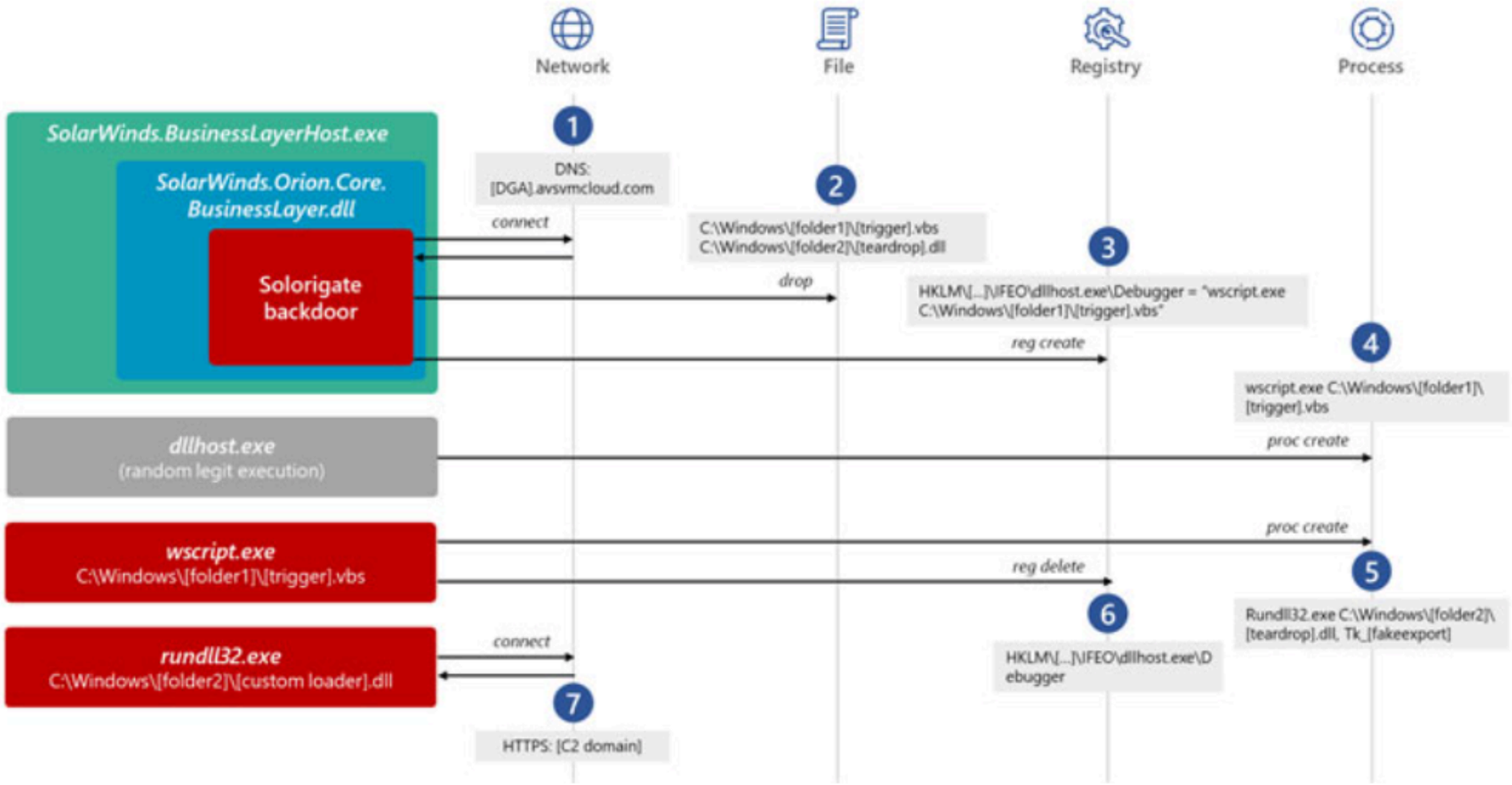
Dyn estimated that the attack had involved '100,000 malicious endpoints', and the company said there had been reports of an extraordinary attack strength of 1.2 terabits (1,200 gigabytes) per second. Photograph: Alamy

AIRS

April 2017

Here's How SolarWinds Hackers Stayed Undetected for Long Enough

January 21, 2021 Ravie Lakshmanan



Microsoft on Wednesday shared more specifics about the tactics, techniques, and procedures (TTPs) adopted by the attackers behind the SolarWinds hack to stay under the radar and avoid detection, as cybersecurity companies work towards getting a "clearer picture" of one of the most sophisticated attacks in recent history.

Top data breach stats for 2023

Number of incidents in 2023: 2,814.

Number of breached records in 2023: 8,214,886,660.

IT Governance

January 2024

Top ten data breaches in 2023

	Organisation name	Sector	Location	Known records breached	Month of public disclosure
1	DarkBeam	Cyber security	UK	>3,800,000,000	September
2	Real Estate Wealth Network	Construction/ real estate	USA	1,523,776,691	December
3	Indian Council of Medical Research (ICMR)	Healthcare	India	815,000,000	October
4	Kid Security	IT services/ software	Kazakhstan	>300,000,000	November
5	Twitter (X)	IT services/ software	USA	>220,000,000	January
6	TuneFab	IT services/ software	Hong Kong	>151,000,000	December
7	Dori Media Group	Media	Israel	>100 TB*	December
8	Tigo	Telecoms	Hong Kong	>100,000,000	July
9	SAP SE Bulgaria	IT services/ software	Bulgaria	95,592,696	November
10	Luxottica Group	Manufacturing	Italy	70,000,000	May

8/29/2016
07:30 AM

Alex Campbell
Commentary

0 COMMENTS
COMMENT NOW

Critical Infrastructure: The Next Cyber-Attack Target

Power and utilities companies need a risk-centric cybersecurity approach to face coming threats.

The way we think about cyber attacks changed in December 2015, when Ukraine experienced the first recorded power outage caused by a cyber attack. It didn't last long—between one and six hours, depending on the area—but it showed the government, industry, and the public how these attacks could affect the physical world. It's not just personal information and other sensitive data that's at stake. Critical infrastructure is now under threat.

Dark Reading
August 2016

Hackers gain access to hundreds of global electric systems

Researchers find that a cyberattack group has been quietly sneaking into the world's power grid control systems over the last six years.

Security

by **Alfred Ng**

6 September 2017 5:56 pm BST

@alfredwkng

Hundreds of po

CNET

September 2017

The Register

March 2016

Water treatment plant hacked, chemical mix changed for tap supplies

Well, that's just a little scary

By John Leyden 24 Mar 2016 at 12:19 82 SHARE ▼

Hackers infiltrated a water utility's control system and changed the levels of chemicals being used to treat tap water, we're told.

Hacker Tried Poisoning Water Supply After Breaking Into Florida's Treatment System

February 08, 2021 Ravie Lakshmanan

Hackers successfully infiltrated the computer system controlling a water treatment facility in the U.S. state of Florida and remotely changed a setting that drastically altered the levels of sodium hydroxide (NaOH) in the water.

Ransomware Cyber Attack Forced the Largest U.S. Fuel Pipeline to Shut Down

May 09, 2021 Ravie Lakshmanan

Colonial Pipeline, which carries 45% of the fuel consumed on the U.S. East Coast, on Saturday said it halted operations due to a ransomware attack, once again demonstrating how critical infrastructure is vulnerable to cyber attacks.

A cyber attack in Saudi Arabia failed to cause carnage, but the next attempt could be deadly

At a time when the world faces a dangerous escalation in cyber warfare, a series of assaults on petrochemical companies in Saudi Arabia – possibly backed by nation states – has caused alarm

Nicole Perlroth , **Clifford Krauss** | Wednesday 21 March 2018 06:00 |

Computers crashed at sites including Sadara Chemical Company, a joint venture between the oil and chemical giants Saudi Aramco and Dow Chemical *(Sadara)*

Independent

March 2018

Energy producer Suncor admits ‘cyber security incident’

HOWARD SOLOMON

JUNE 26, 2023

Image from Petro-Canada

Global News

June 2023

A Patient Dies After Ransomware Attack Paralyzes German Hospital Systems

September 21, 2020 Ravie Lakshmanan

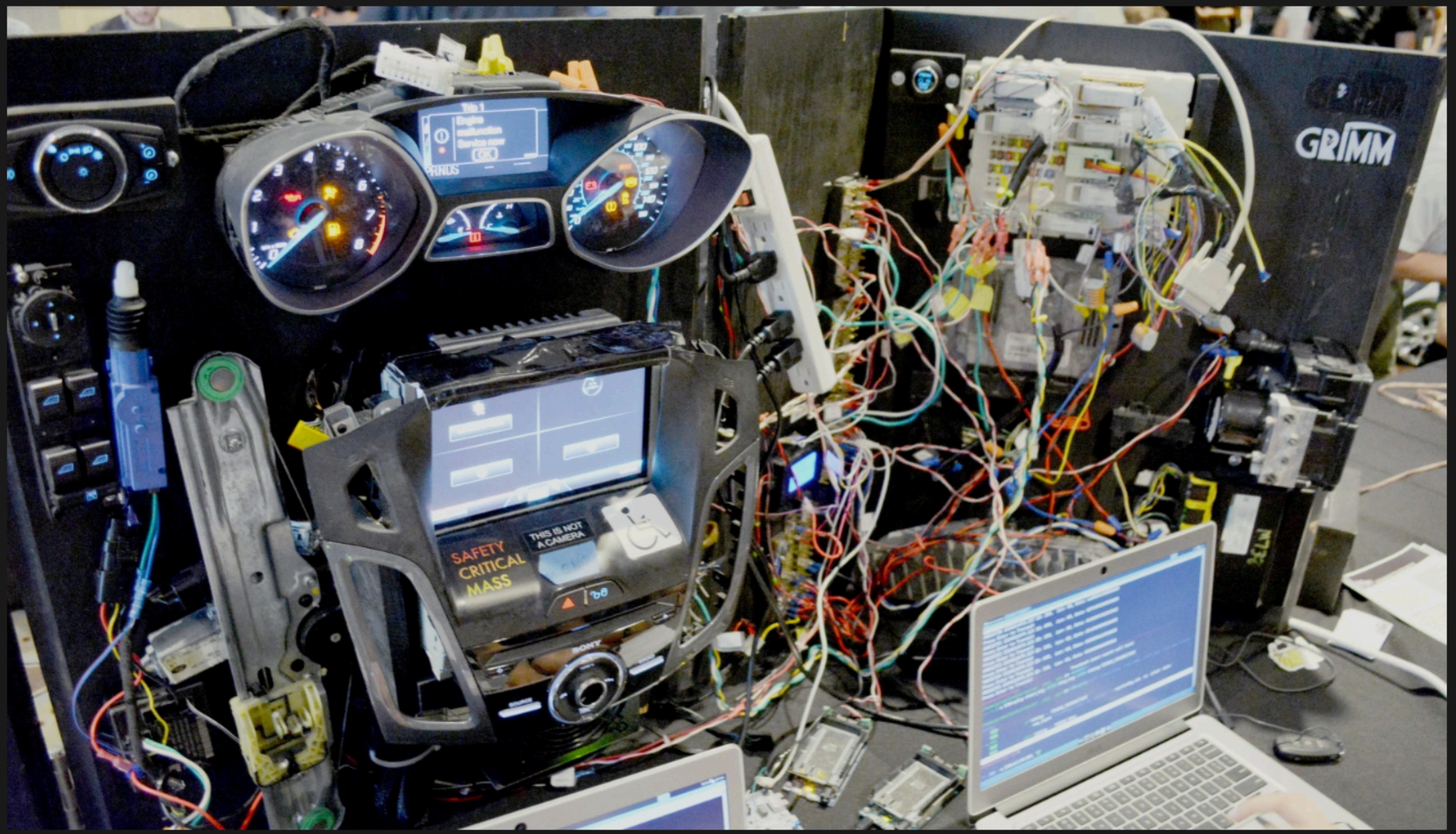
German authorities last week disclosed that a ransomware attack on the University Hospital of Düsseldorf (UKD) caused a failure of IT systems, resulting in the death of a woman who had to be sent to another hospital that was 20 miles away.

CAR HACKING AT DEF CON 26

by: Mike Szczys

9 Comments

August 11, 2018



Hackaday

August 2018

Advanced Cars May Face Greater Risk Of Hacking, Cybersecurity Experts Warn

Ed Garsten Senior Contributor

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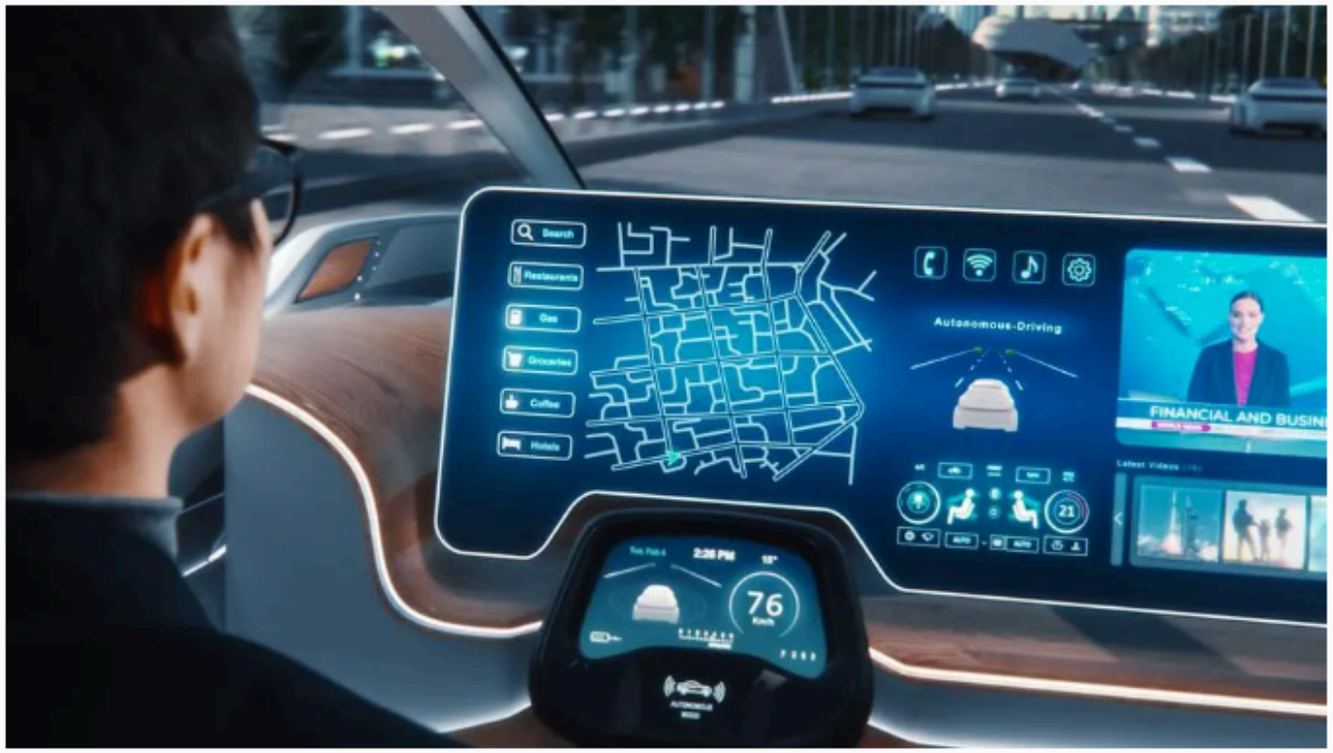
Apr 26, 2023, 08:26am EDT



As automakers add more technology to vehicles, they have become more vulnerable to cybersecurity ... [+] GETTY

Forbes

April 2023

Hackers Steal Over $600 Million Worth of Cryptocurrencies from Poly Network

August 11, 2021 Ravie Lakshmanan

Hackers have siphoned $611 million worth of cryptocurrencies from a blockchain-based financial network in what's believed to be one of the largest heists targeting the digital asset industry, putting it ahead of breaches targeting exchanges Coincheck and Mt. Gox in recent years.

Why do we have security issues?

- **Bugs**
  buffer overflows, cross-site scripting attacks …

- **Insecure configuration**
  improper authorization, incomplete mediation …

- **No security by design**
  most of network protocols running the internet

Why security should matters to you?

➡ Because **you** are going to build the next computer systems, networks and software

Cybersecurity Jobs. PHOTO: Cybercrime Magazine.

Cybersecurity Talent Crunch To Create 3.5 Million Unfilled Jobs Globally By 2021

350 percent growth in open cybersecurity positions from 2013 to 2021

Cybersecurity Ventures

Canada struggling to keep up with demand for cybersecurity talent: report

By Bradly Shankar JUL 4, 2018 | 6:29 PM EDT | 0 COMMENTS

MobyleSyrup

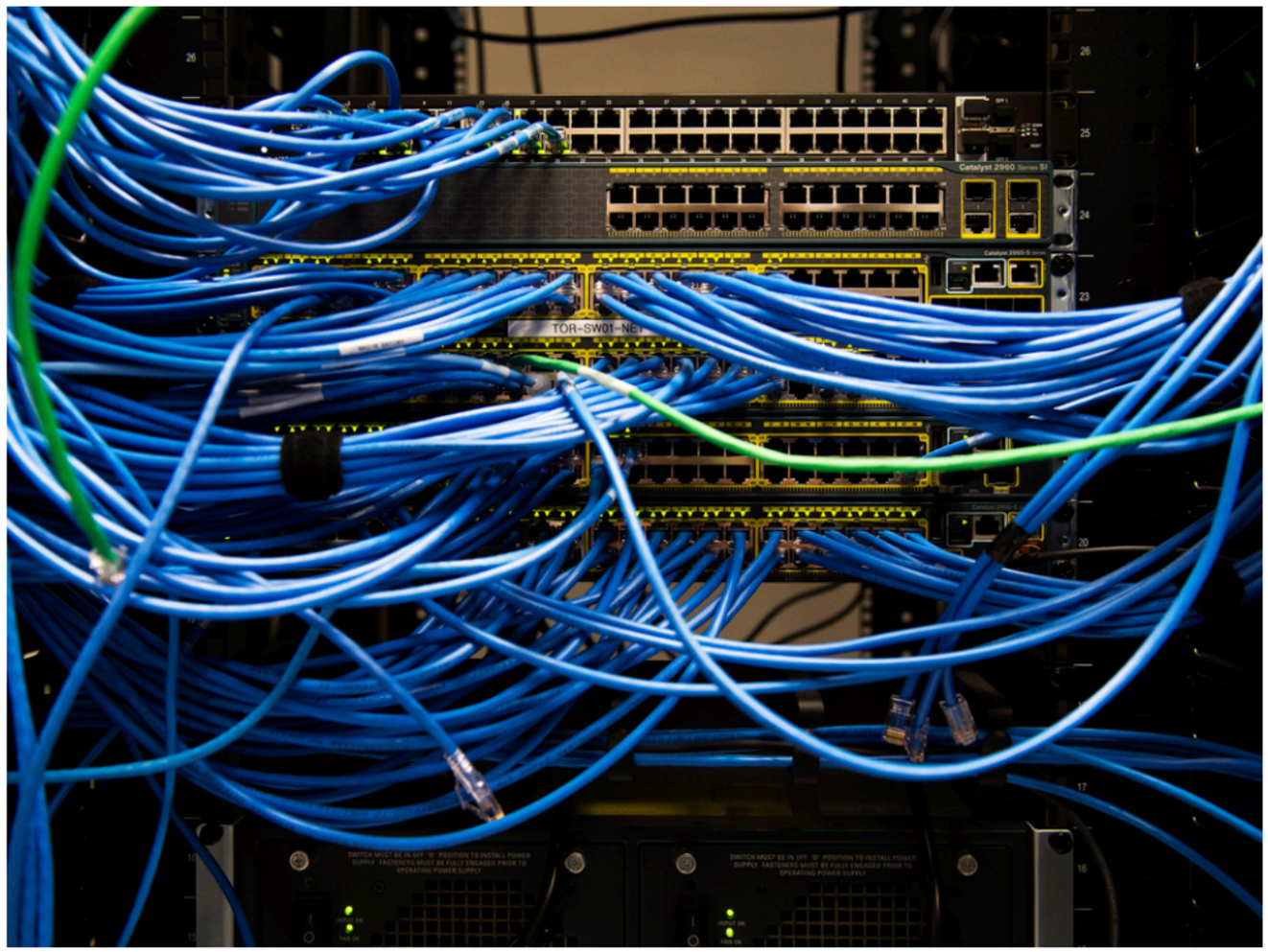
July 2018

Financial Post

July 2018

Canada facing a talent crunch when it comes to cybersecurity experts — and things look likely to get worse

The labour squeeze leaves companies at risk of serious cyberattacks that can go so far as to put them out of business



A new report from Deloitte says demand for cybersecurity professionals in Canada is growing by seven per cent annually, with 8,000 new workers needed by 2022. *Nathan Denette/The Canadian Press*

September 24, 2019

Cybersecurity Workforce Shortage In Canada

Introduction:

A cause-effect relationship is becoming increasingly evident within the cybersecurity world. A shortage of qualified candidates who are capable of tackling cybercrimes and preventing data breaches have resulted in both individuals and corporations being persistently vulnerable to cyber-attacks. As hackers on the dark web attack in waves, it is inevitable that the need for "white hats" to combat this global issue has elevated in importance.

Numbers Put Into Perspective

2.93 Million

Number of unfilled cybersecurity positions worldwide

8,000

Cybersecurity roles to be filled in Canada between now and 2021

News & Events ›

One in Six Canadian Cybersecurity Roles Go Unfilled: New Report Explores Talent Shortage and Solutions

By ICTC · October 13, 2022

Share →

Ottawa, October 13, 2022—A shortage of cyber professionals in Canada sees one in six cybersecurity jobs go unfilled, which represents one of the country's biggest challenges for the digital economy.

The Information and Communications Technology Council (ICTC)

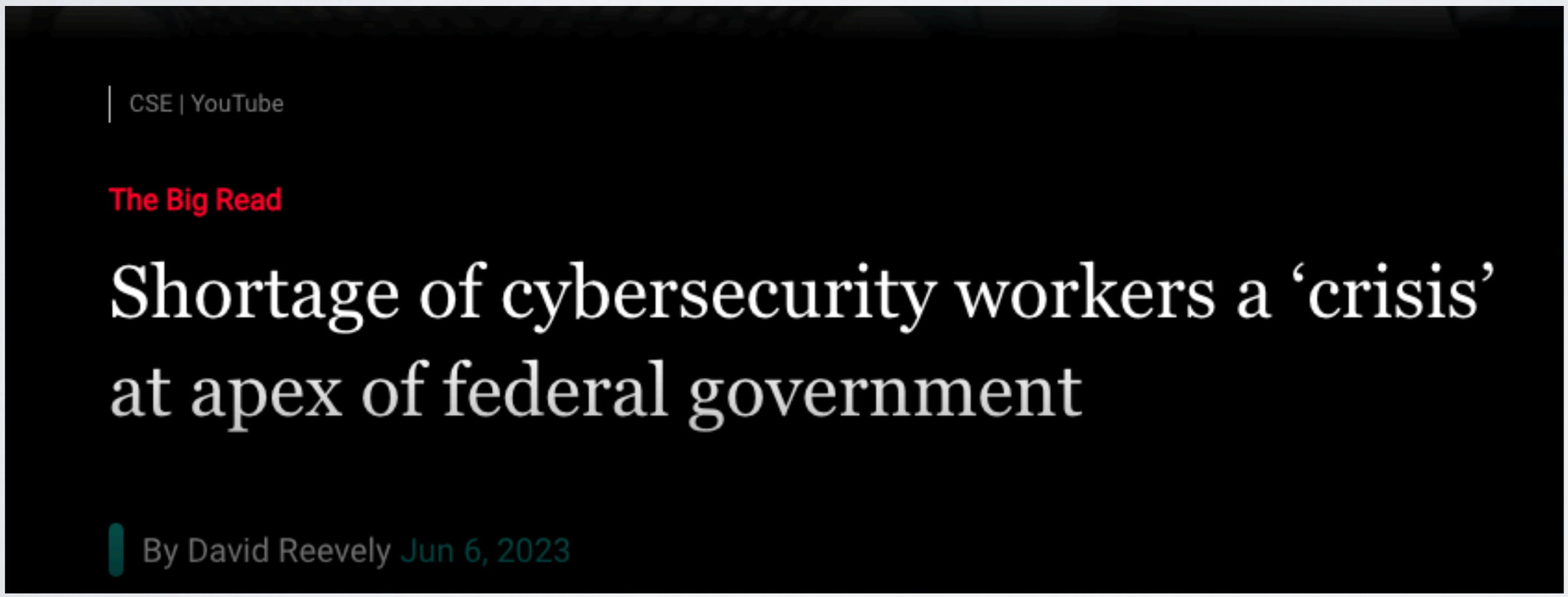
October 2022

Canada faces shortage of cybersecurity professionals amid rising demand

Demand is high amid surge in incidents

Insurance Business

March 2023



The Logic

June 2023

FINANCIAL POST

Cybersecurity

Safety Net: Cybersecurity staff shortage looms if Canada fails to develop homegrown talent

Surging demand means firms need 10% more trained professionals a year for foreseeable future

John Chilibeck, Brunswick News, Special to Financial Post

Published Mar 15, 2023 • Last updated Mar 15, 2023 • 6 minute read

Financial Post

March 2023

Welcome to CSCD27

Legacy

- **CSCD27 Computer and Network Security**

  Alan Rosselet

  University of Toronto Scarborough

- **15-349 Introduction to Computer and Network Security**

  Iliano Cervesato, Khaled Harras and Thierry Sans

  Carnegie Mellon University Qatar

Course Objectives

CSCD27 is an undergraduate course that provides **a theoretical and technical overview** of the field of computer security

Learning goals

1. Acquire a **good understanding of basic concepts** such as
   - applied cryptography
   - networking security
   - software security

2. Acquire a **methodology to design and analyze the security of critical systems**

3. Acquire a **good practice to stay up-to-date** with the field

Course Topics

1. Applied Cryptography
2. Network Security
3. System Security

1. Applied Cryptography

- Classical crypto systems
- Modern crypto systems : symmetric vs asymmetric
- Hash functions and digital signatures
- Cryptography protocols for authentication and encryption

2. Network Security

Vulnerabilities and defense for the network stack

	Protocol	Secure Layer
Application	DNS	DNSsec
Transport	TCP	TLS (a.k.a. SSL)
Internet	IP	IPSec
Link	802.11	WPA2

3. Software Security

- Operating Systems
- Programs
- Malicious code
- Web Security

Course work, evaluation and grading

	Theory	Practice
	Lecture & Tutorials	Labs & Tutorials
Graded Work	Midterm and Final	CTF challenges
Grade weight	40%	60%

A mark of at l**east 40% on the final exam is required** to pass the course

Academic Integrity

- ✓ For CTF challenges you are allowed to discuss problems with your classmates but not solutions
- ◉ For midterm and exams, you are not allowed to discuss problems and solutions with anyone
- ◉ You are not allowed to search online for the solution to the problem
- ✓ But you are allowed to search online for snippets of code that will help you write your solution
- ◉ You are not allowed to share snippets of code with anyone
- ◉ You are not allowed to publish online any snippet of code related this course even after the end of the semester

Ethical Hacking

- You will be exposed to attack methods
- You should uphold to a high standard of **professional and personal ethic**
- **Your knowledge of attack methods does not imply permission to exploit them**

… even if it seems "harmful fun"

- **UofT policies** are strictly enforced
- **Canadian Criminal Code** is strictly enforced

Course website

https://thierrysans.me/CSCD27/

How to succeed in this course

https://thierrysans.me/CSCD27/doc/howtosucceed/

You know the drill ...

- Come to lectures
- Tutorials are important … blah blah blah
- Start to work early … blah blah blah

.... but more specifically to this course

The important is **why** rather than *how*

The skills you must have

- Basic knowledge of computer systems (B09, B58 and C69)
- Good programming skills (especially Python and C)
- Good Linux skills (shell scripting)

➡ Be able to **seek for documentation**
and **learn new materials** on your own

About the lectures

The slides are **not** lecture notes

About the tutorials

The important is **not the solution** to the problems **but the discussion**

About the CTF challenges

For each challenge, there will be a **fair amount of materials to learn and to understand** before being able to start working on a solution

Each challenge is **highly experimental**

Warning - the course load is significant

About the midterm and final exam

You will be tested on your understanding of:

- the content covered in **lectures**
- the content covered during **tutorials**
- the content covered in the challenges including the **handout**, **the commands, and the starter code**
- every **command and line of code** that you have used for producing and running **your solution**

Beyond the course

- Be curious
- Experiment with things (in an ethical hacking way)
- Get yourself up-to-date with the latest security news

Wishing you a fun semester