A FIRST LOOK AT BROWSER-BASED

CRYPTOJACKING

Shayan Eskandari*, Andreas Leoutsarakos*, Troy Mursch†, Jeremy Clark*

**Concordia University, †Bad Packets Report*

UNIVERSITÉ Concordia UNIVERSITY

Cryptojacking

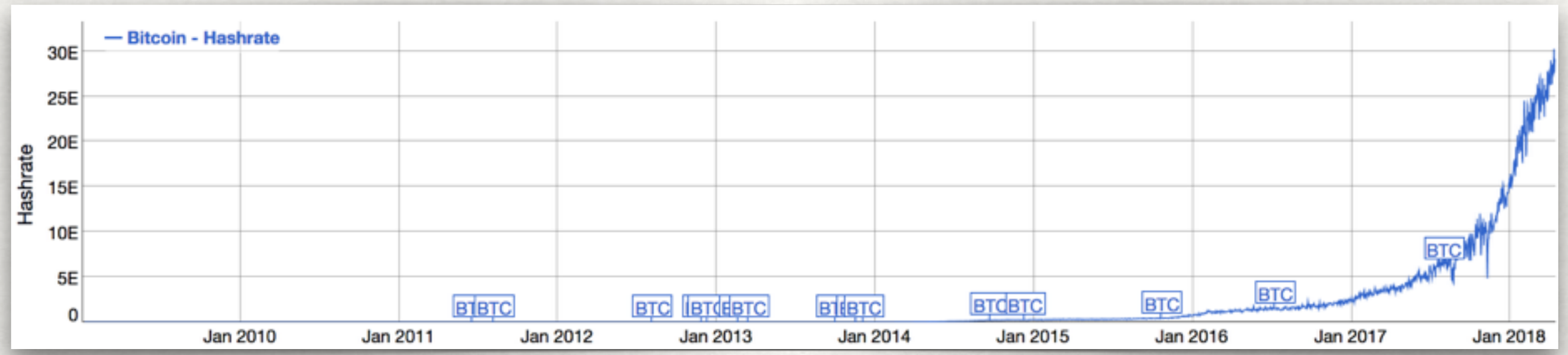
[krɪptoʊdʒækɪŋ], verb

THE INVISIBLE USE OF ONE'S RESOURCES TO MINE CRYPTOCURRENCY FOR SOMEONE ELSE'S PROFIT

INTRODUCTION

HISTORY OF BITCOIN MINING

- **Bitcoin**
  - Mining algorithm(PoW): SHA-256
  - Net hashrate: 30,035.96 Ph/s



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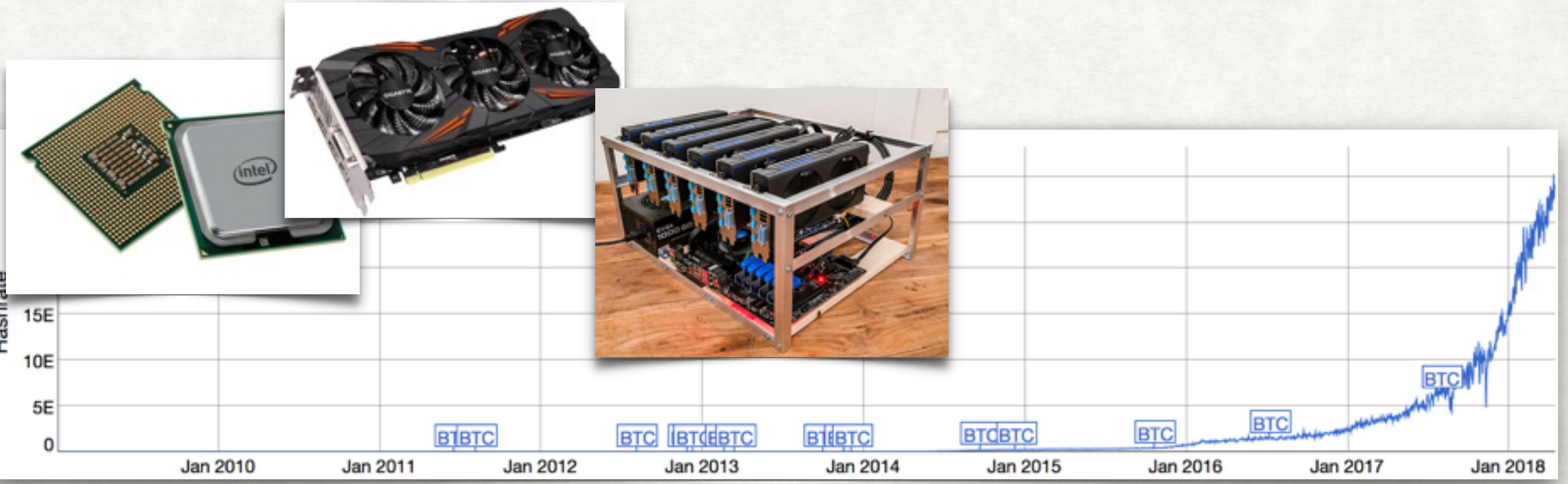

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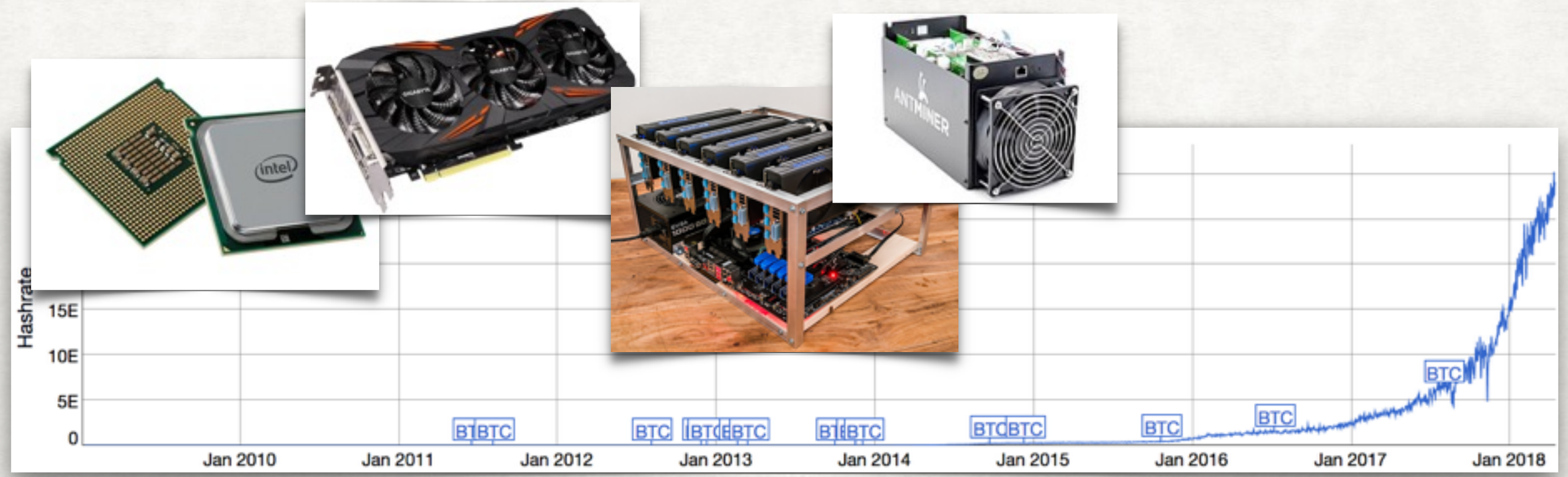

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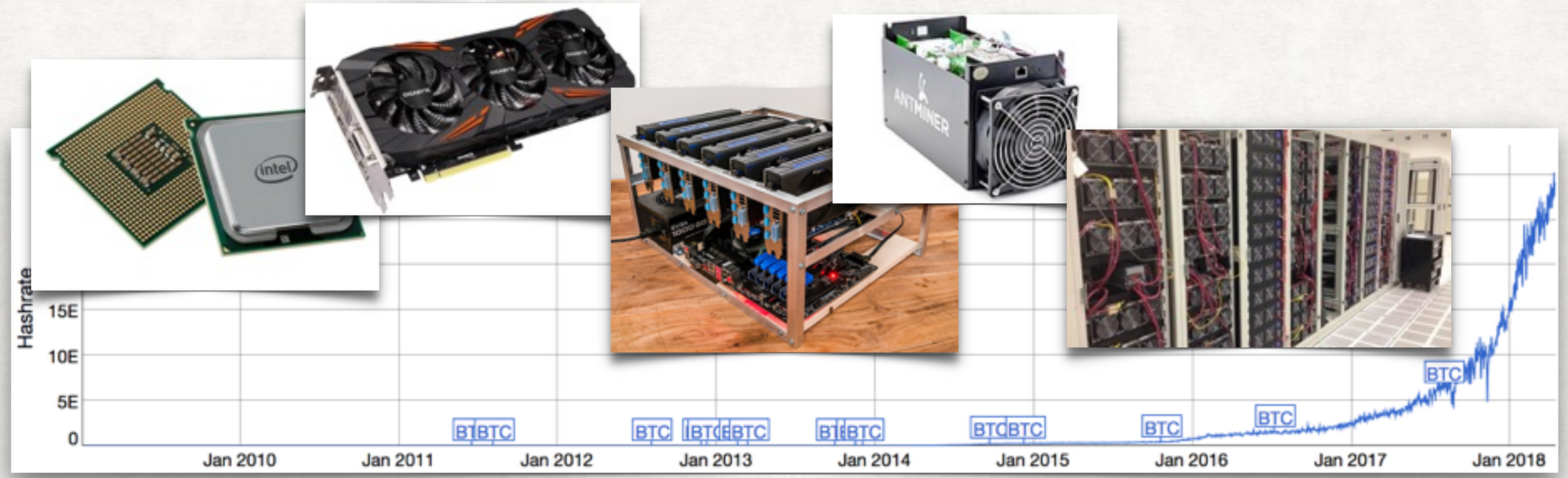
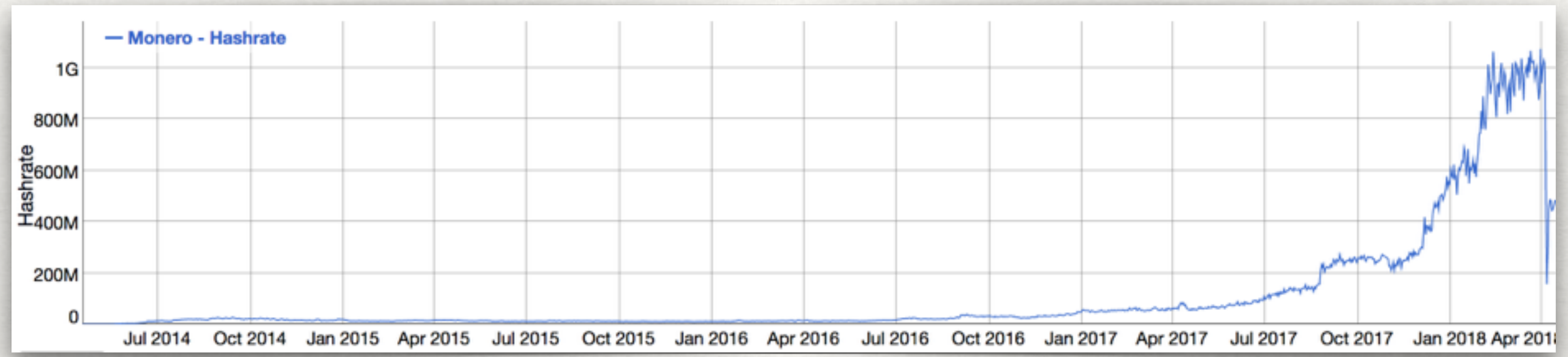


INTRODUCTION

MONERO

- **Monero**
  - Privacy Preserving Cryptocurrency, Launched in April 2014
  - Mining algorithm (PoW): CryptoNight
  - Net hashrate: 488.50 Mh/s



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BROWSER BASED MINING

- **Browser based mining** (website using visitor's CPU to mine Bitcoin):
  - **Replace online ads**
  - More decentralization on the Cryptocurrency network
    - Bitcoin Plus (2011), JSMiner (2011), **MineCrunch** (2014), Tidbit (2014)

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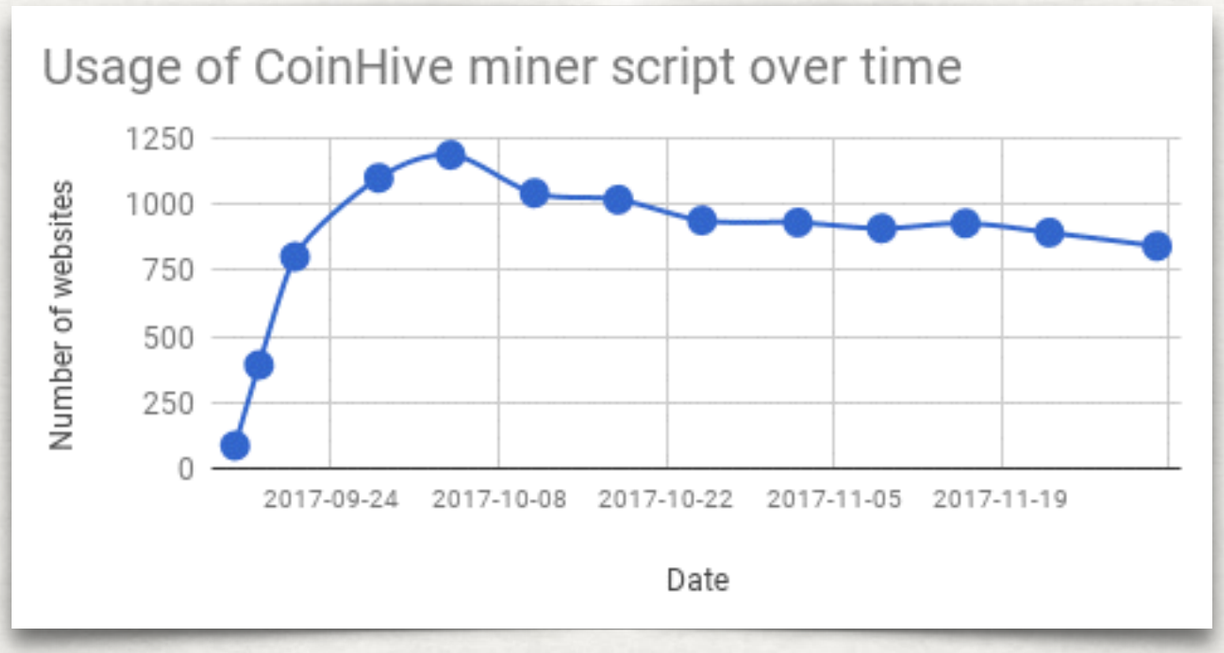
    - Bitcoin Plus (2011), JSMiner (2011), **MineCrunch** (2014), Tidbit (2014)
- **Why it didn't work?**
  - **Bitcoin network hash rate increased exponentially**
  - Slower than native applications (1.5x slower)
  - Legal issues

BROWSER BASED MINING REVIVED

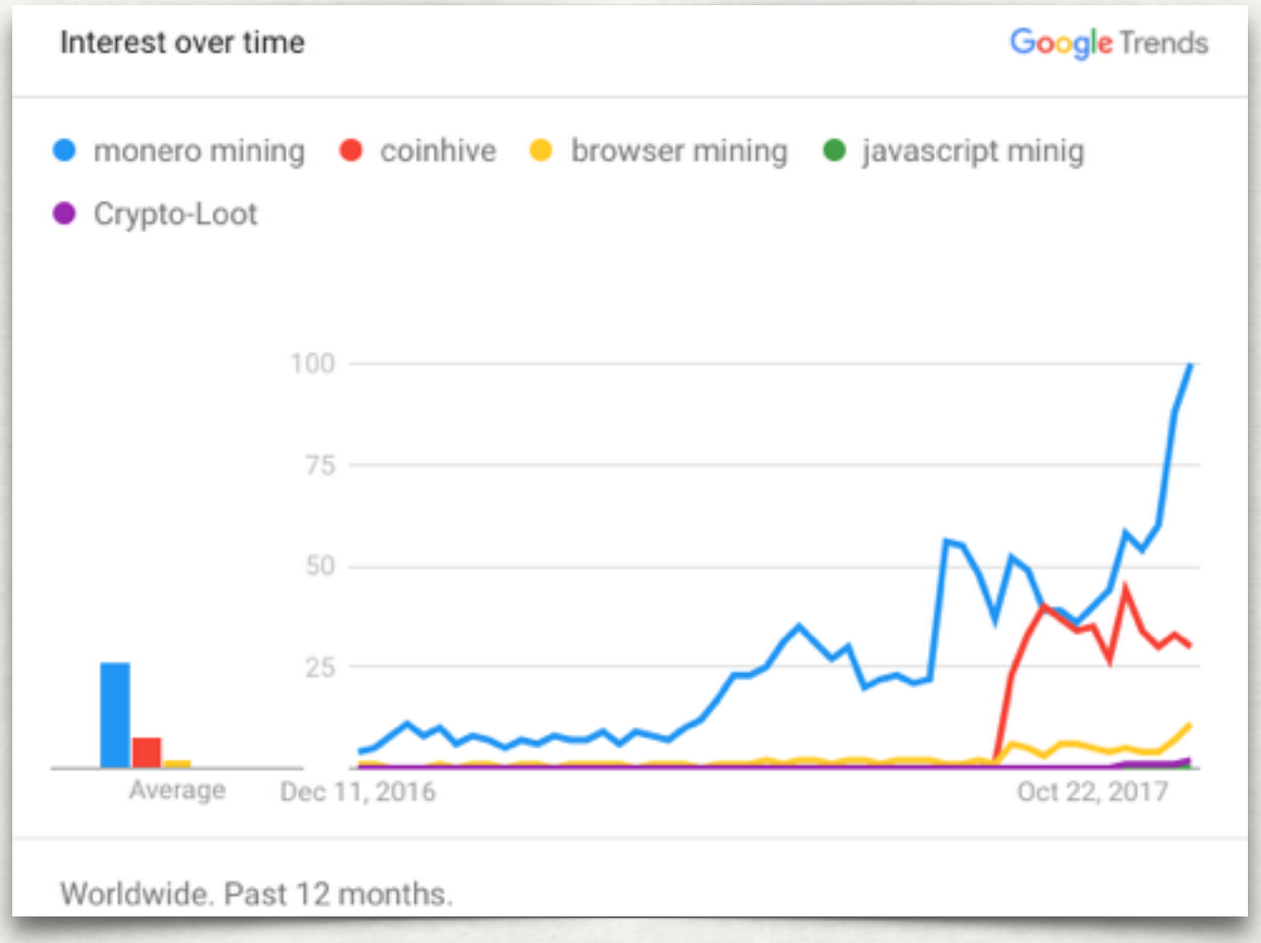
- **Coinhive**
  - Launched in September 2017, as a service to replace ads
    - Also offered CAPTCHA and short-links services
  - Soon after several copycats appeared (Crypto-Loot, PPoi, Coin-Have, …)



BROWSER-BASED CRYPTOJACKING

IN-BROWSER MINING WITHOUT USER CONSENT

- Also known as "*Drive-by Mining*"
- Websites started testing this new revenue model, such as ThePirateBay, Showtime and UFC.com



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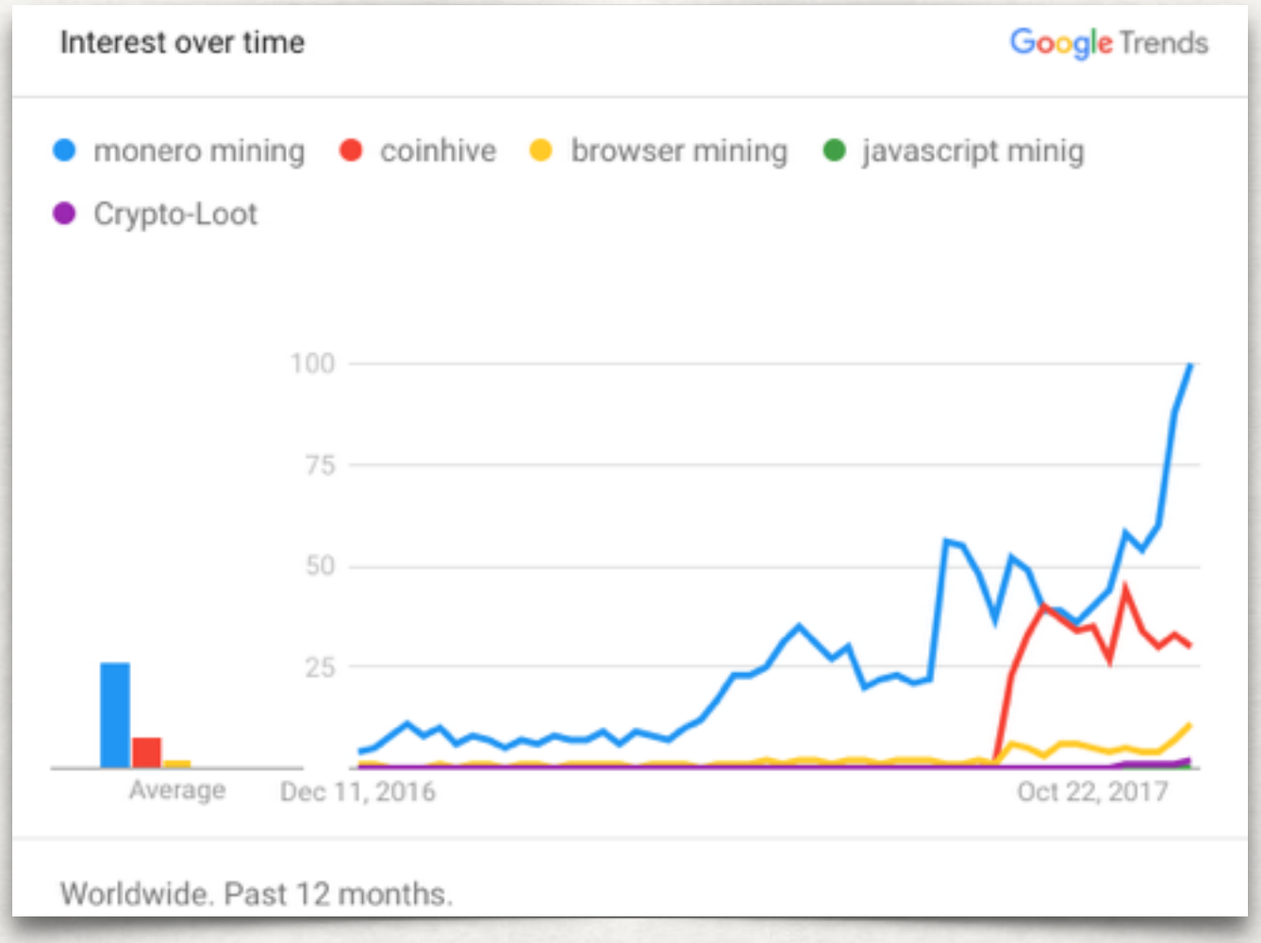
- Hackers started to turn access to "money"
- Interest from "grey" websites



CRYPTOJACKING

THE NEXT BIG CYBERSECURITY THREAT

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YAHOO! FINANCE

Why Cryptojacking Is The Next Big Cybersecurity Threat

FORTUNE

Robert Hackett

Fortune October 23, 2017

Meet the Internet's latest menace. Hackers and penny-pinching website hosts are hijacking people's computers to “mine” cryptocurrency. And we're not talking about coal and canaries.

Cryptocurrency is mined, or produced, by

CRYPTOJACKING

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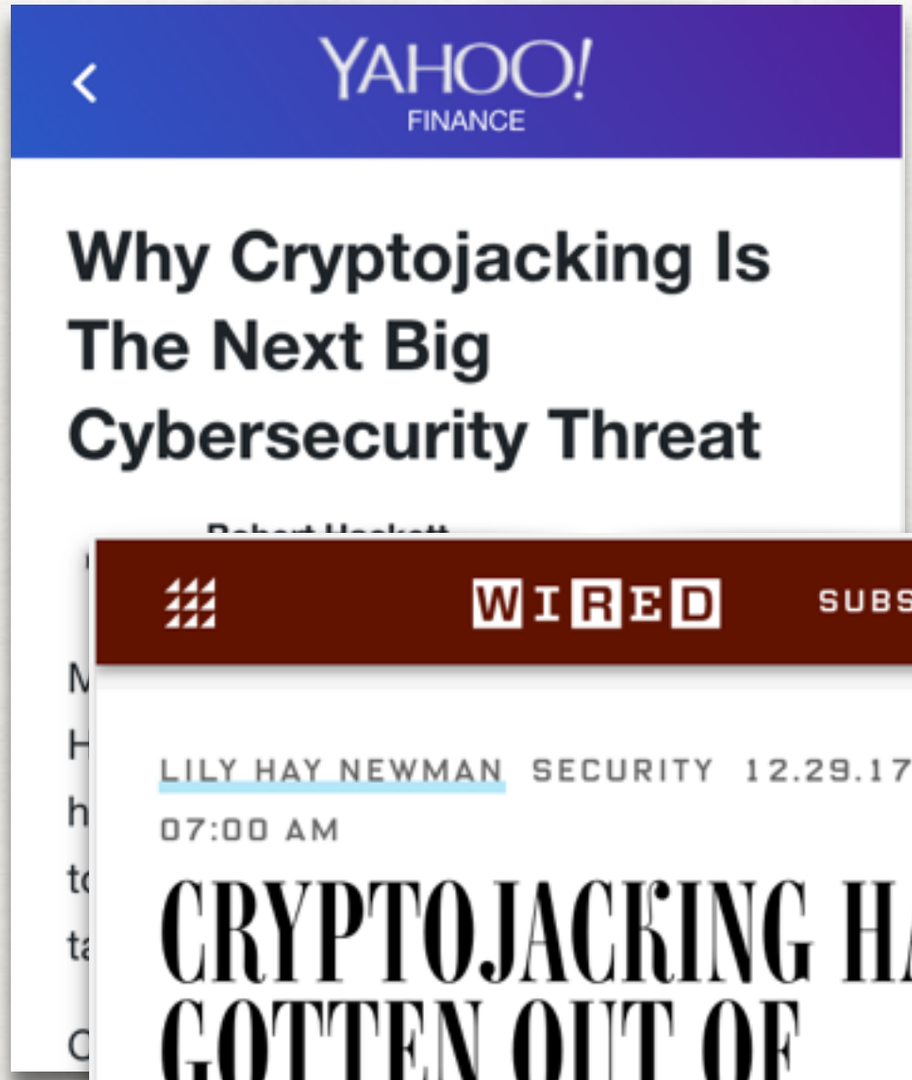

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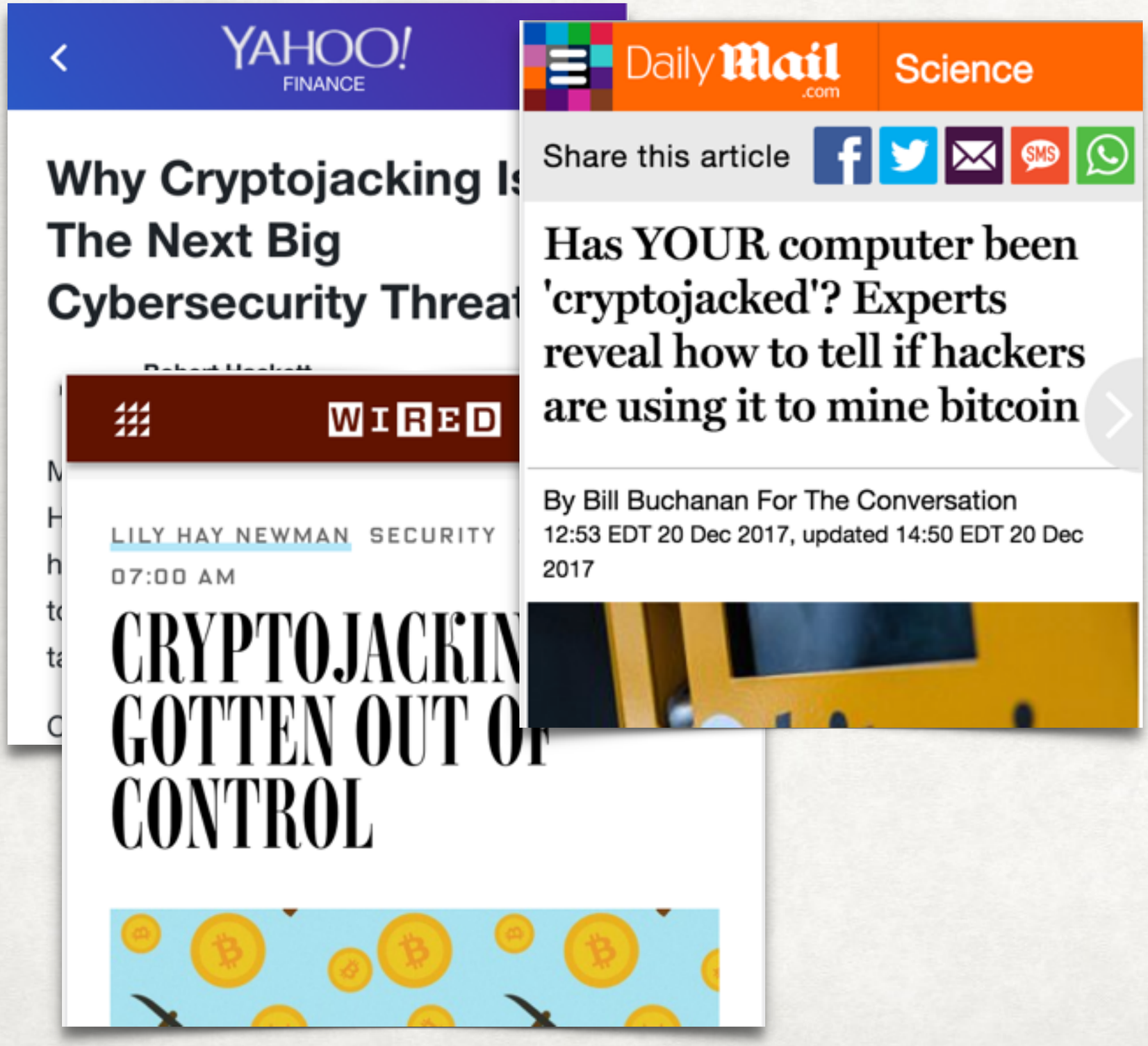

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Why Cryptojacking Is The Next Big Cybersecurity Threat

Daily Mail .com | Science

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Has YOUR computer been 'cryptojacked'? Experts reveal how to tell if hackers are using it to mine bitcoin

WIRED

LILY HAY NEWMAN SECURITY

07:00 AM

CRYPTOJACKIN GOTTEN OUT OF CONTROL

NATIONAL POST SHARE

The rise of cryptojacking: How hackers hog computer CPUs to make money

THE CANADIAN PRESS ALEKSANDRA SAGAN

November 19, 2017 10:02 AM EST

Last Updated November 19, 2017 10:02 AM EST

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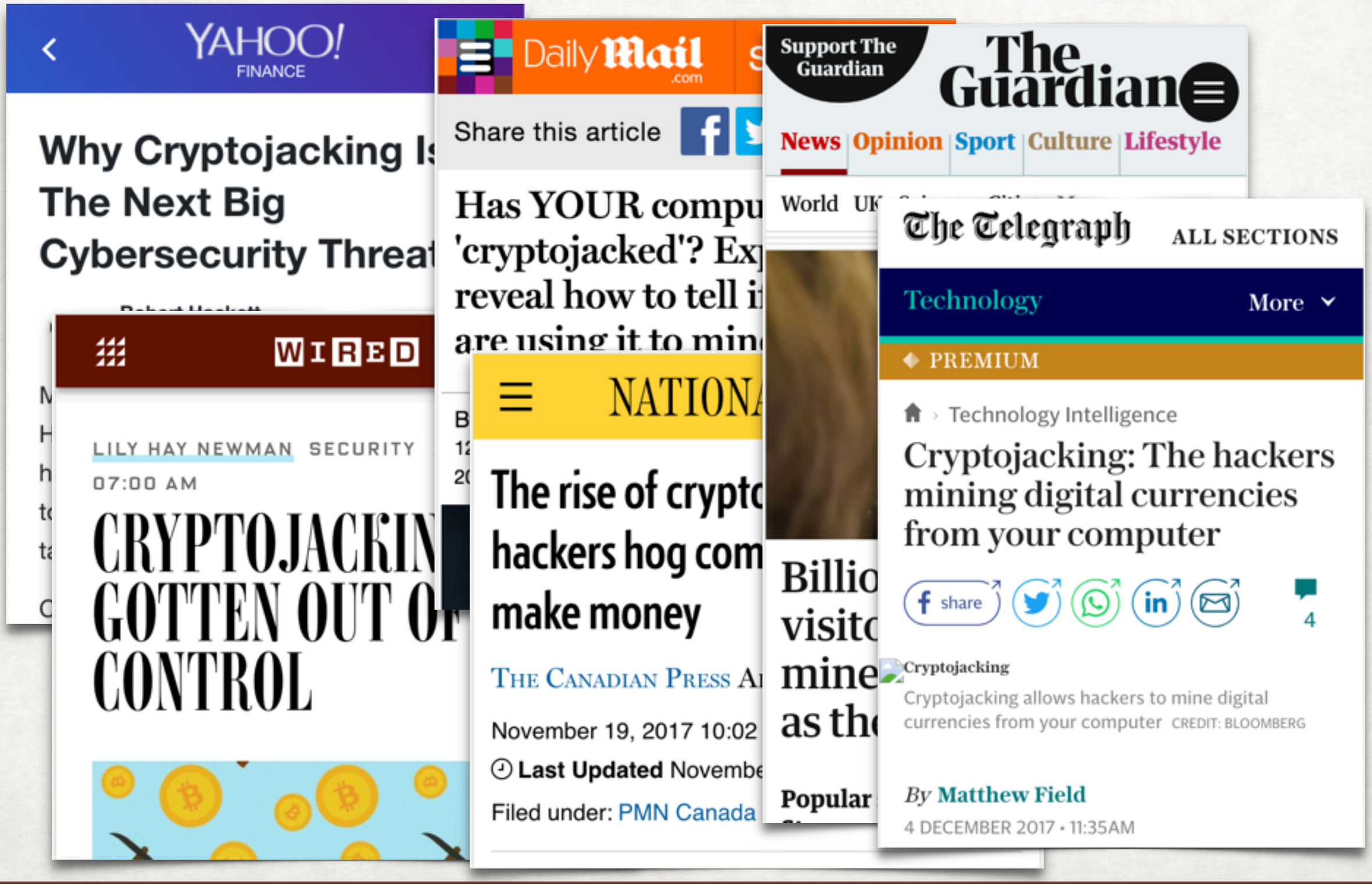

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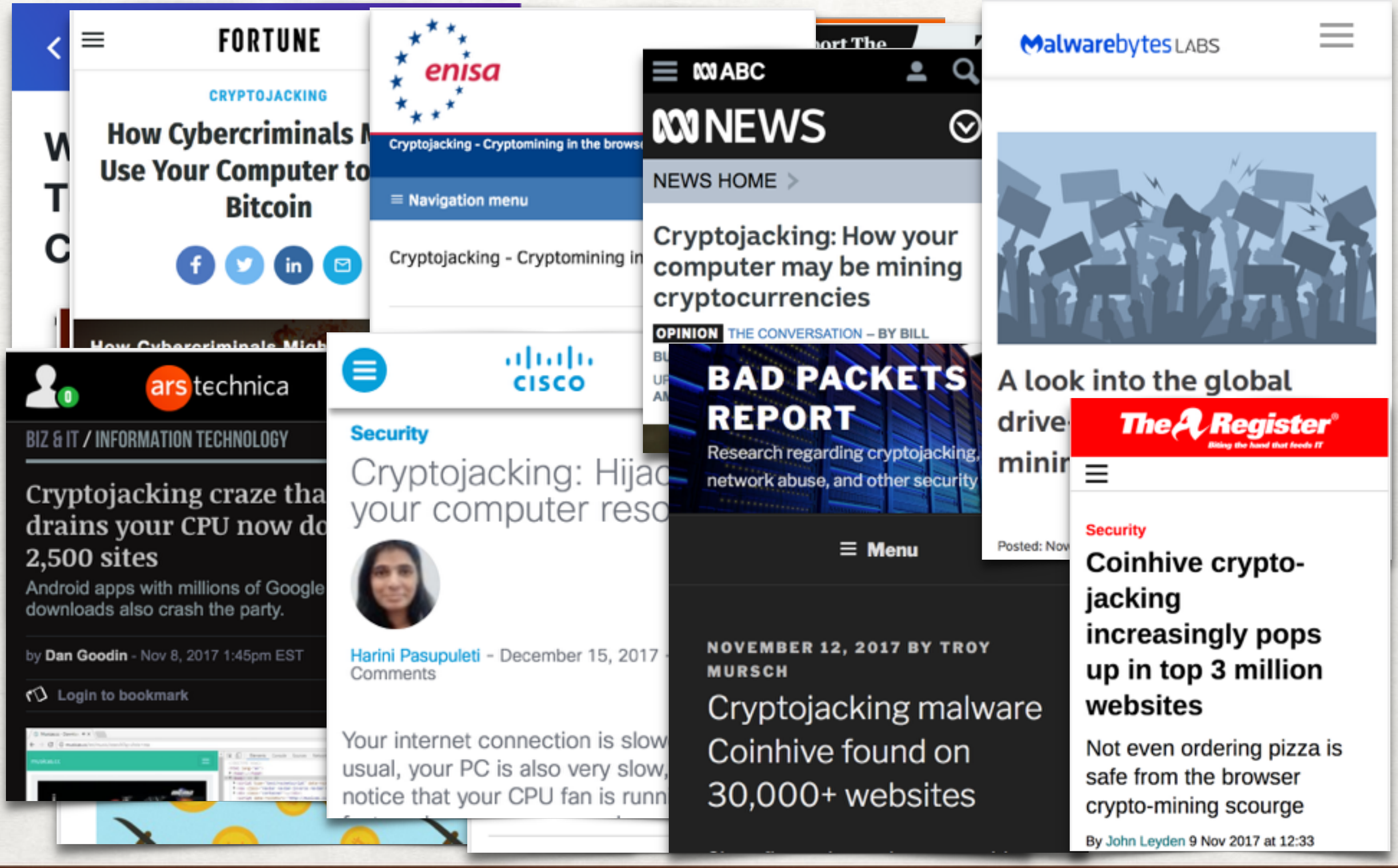

CRYPTOJACKING

UK ONLY

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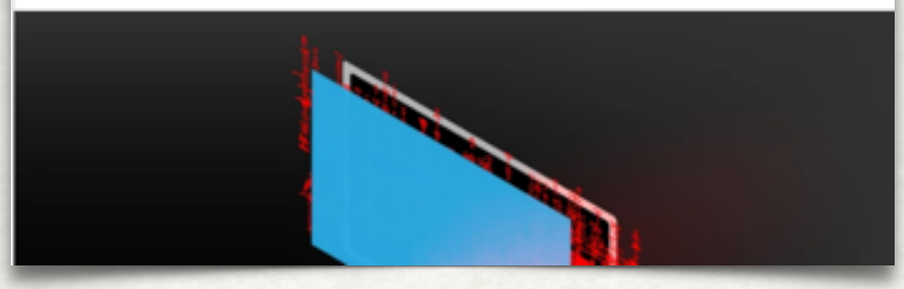
UK ONLY

Cryptojacking attack hits ~4,000 websites, including UK's data watchdog

Natasha Lomas

@riptari / Feb 12, 2018



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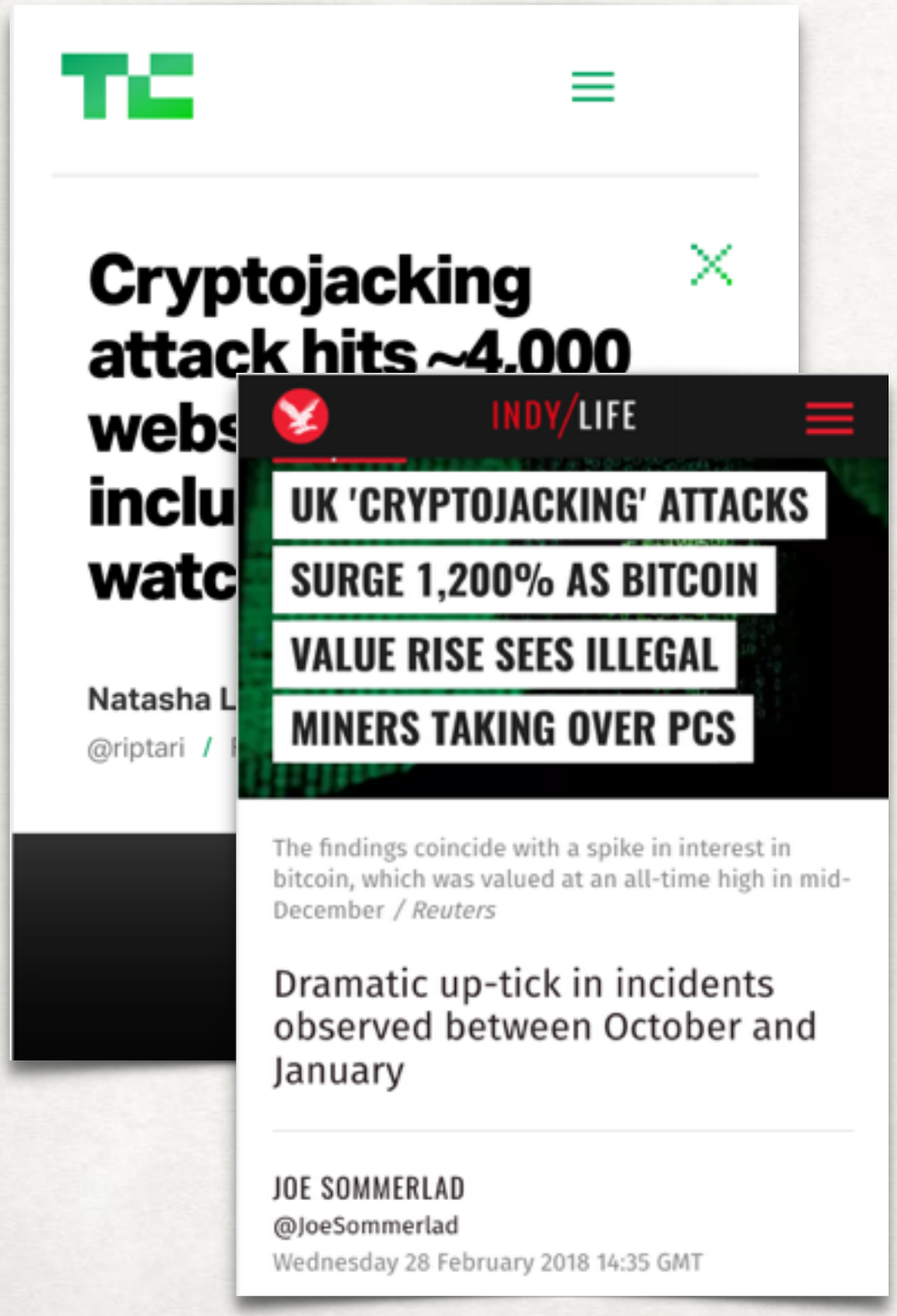

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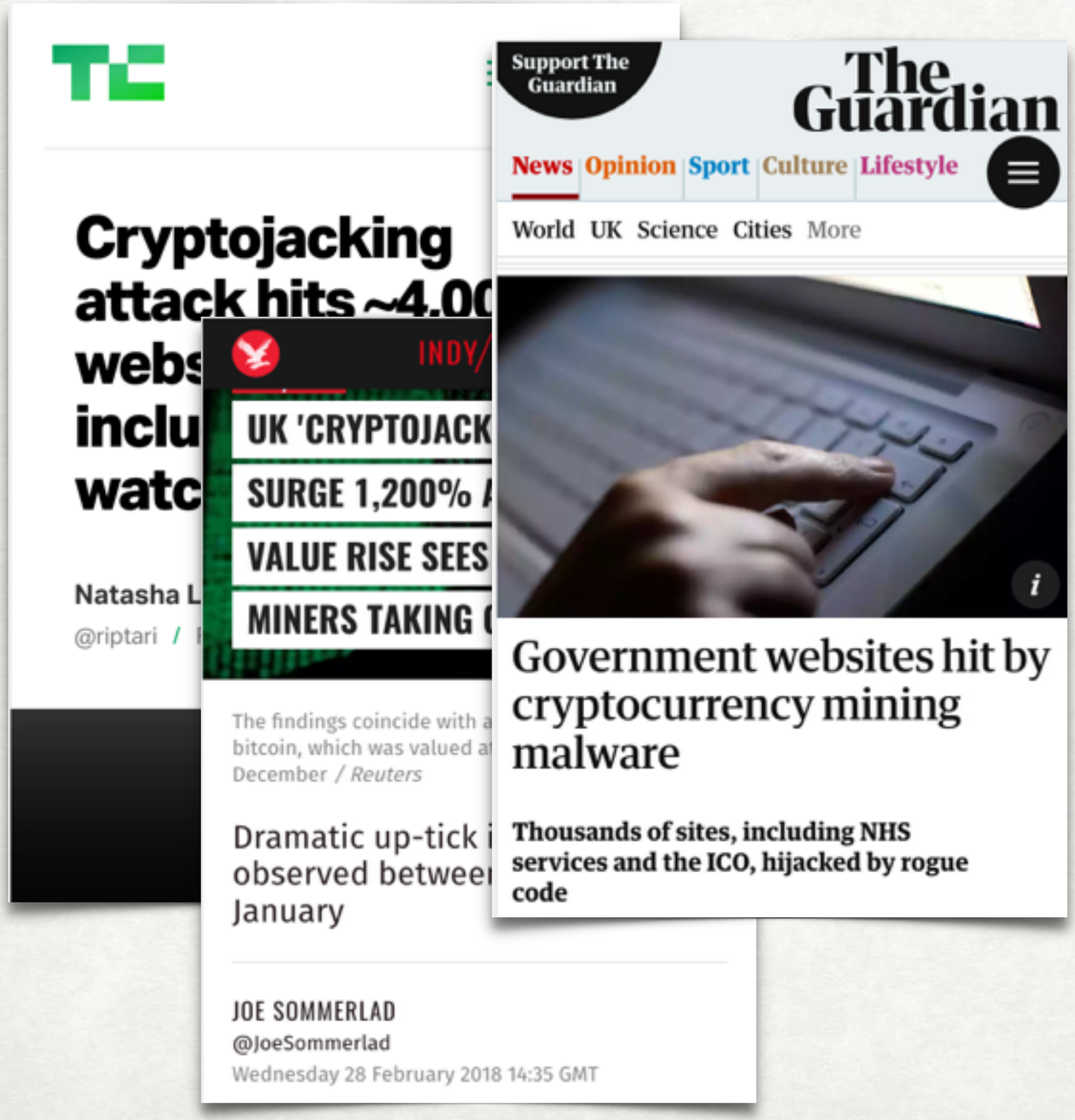

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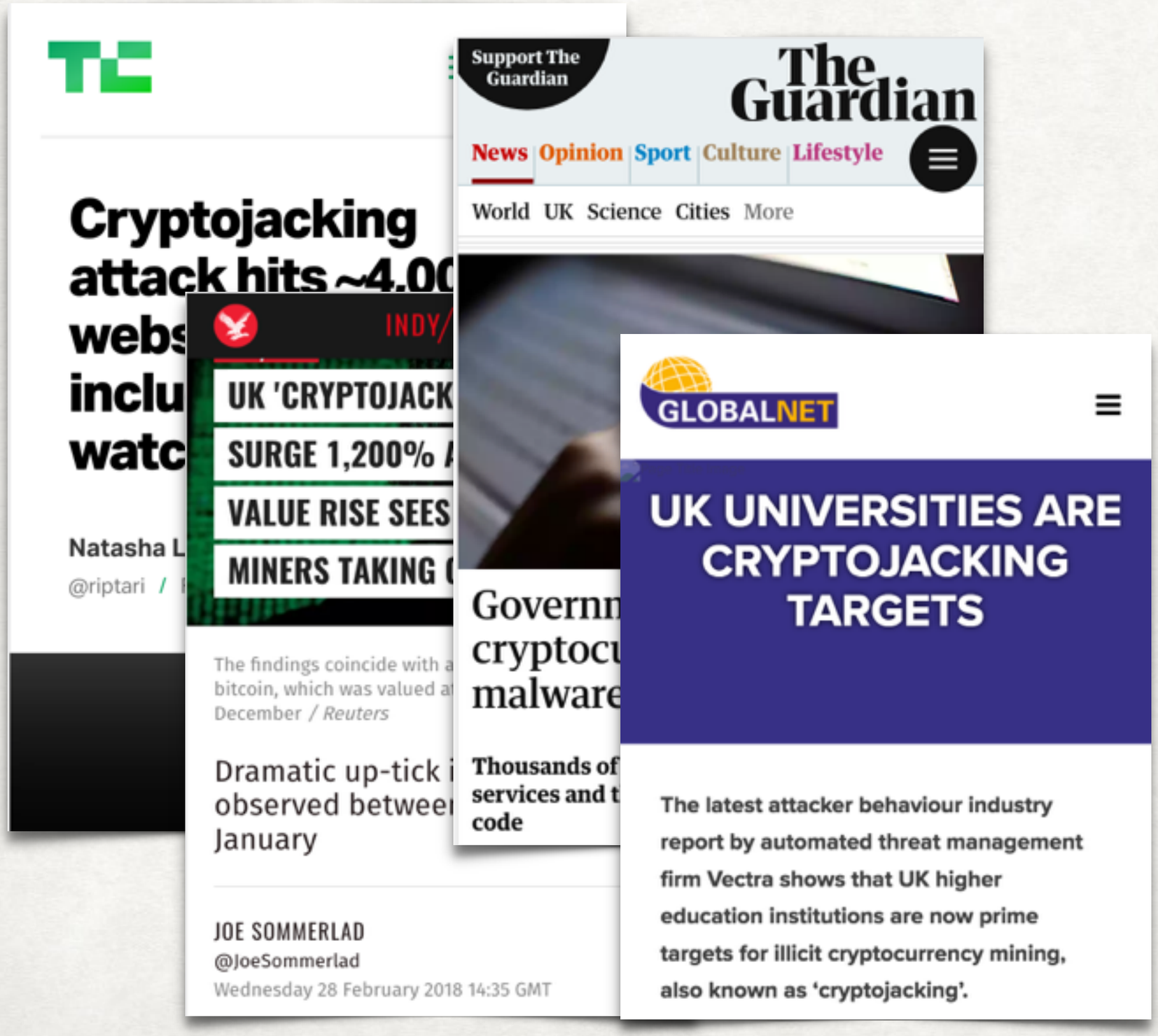

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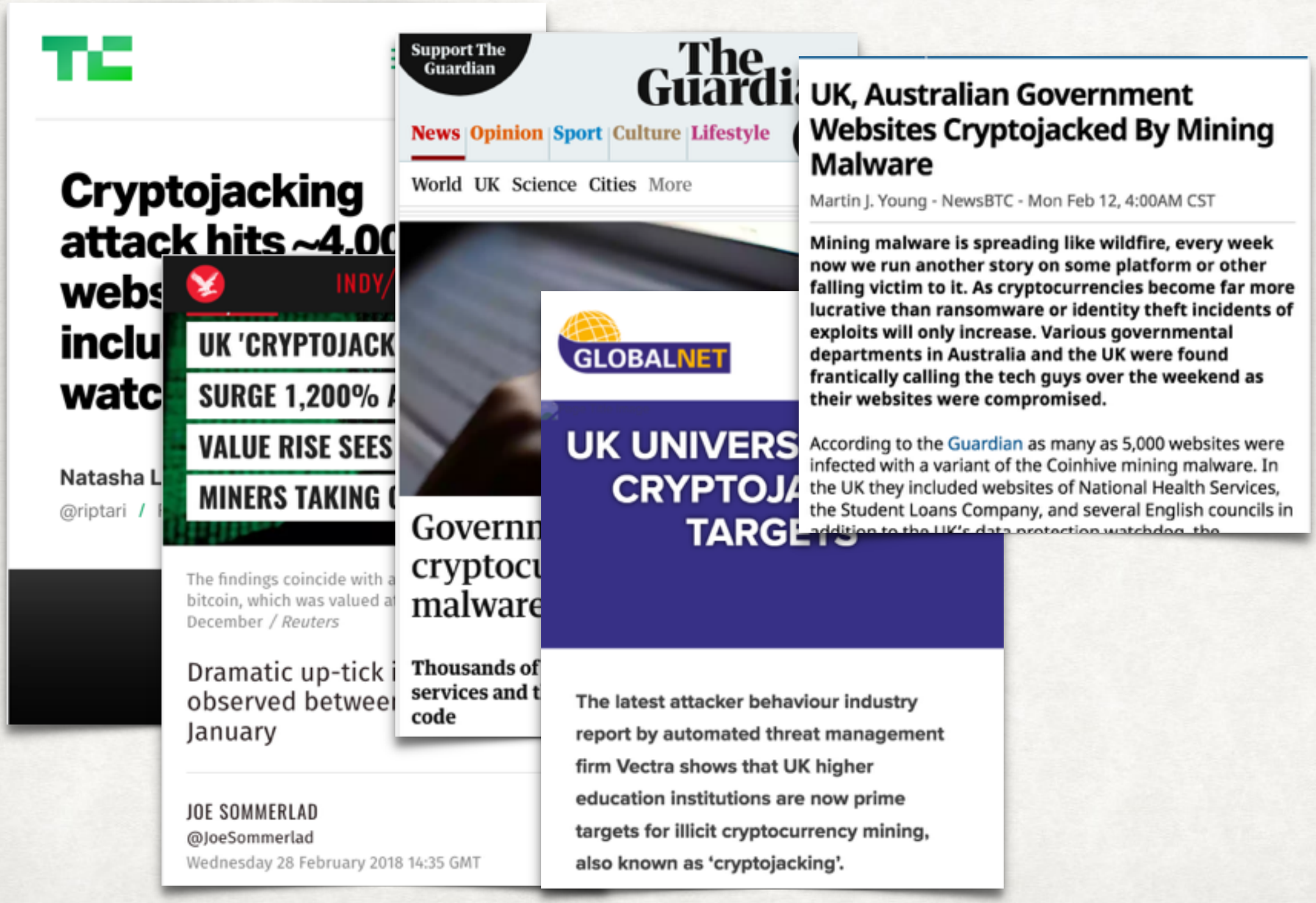

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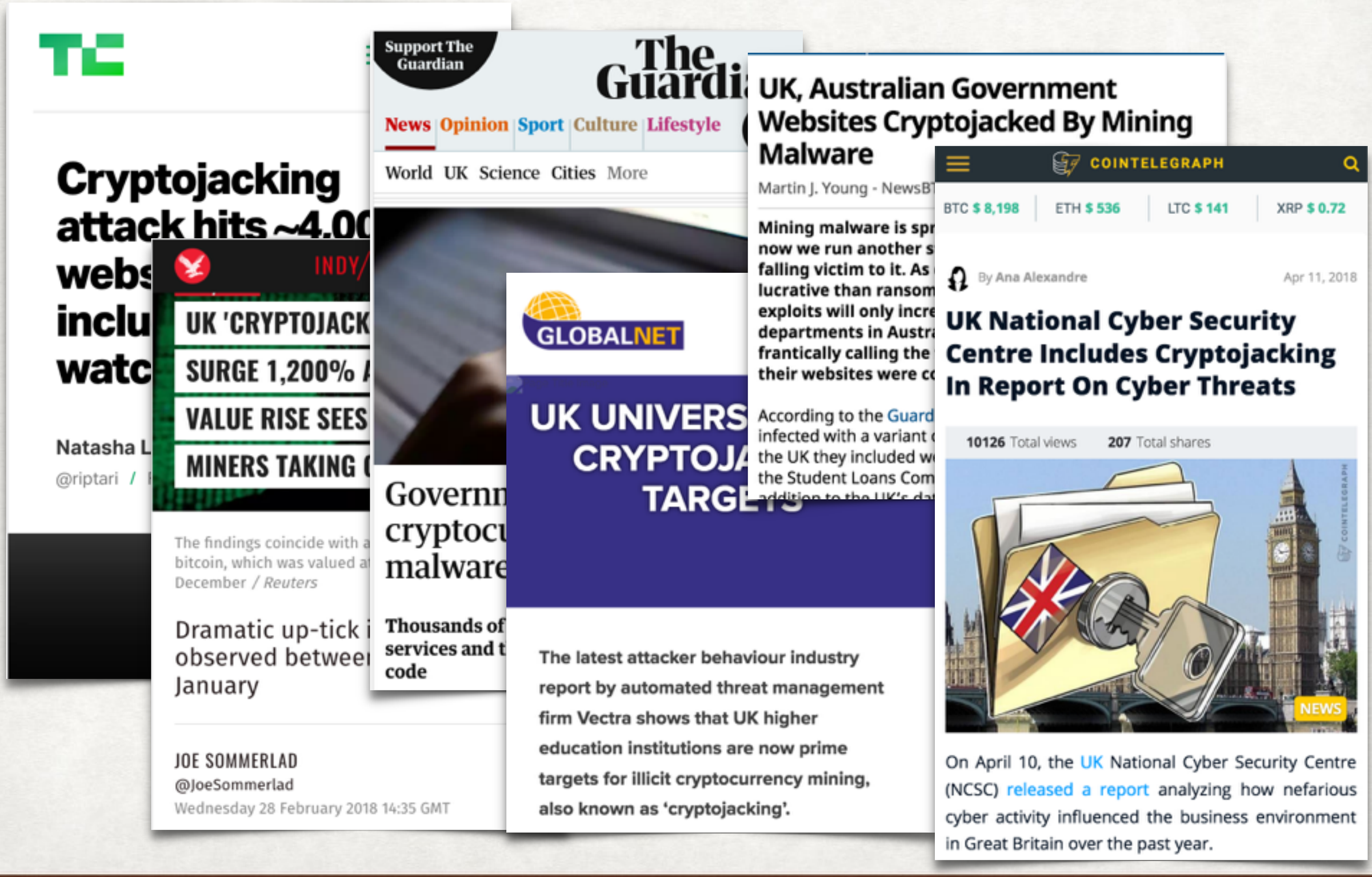
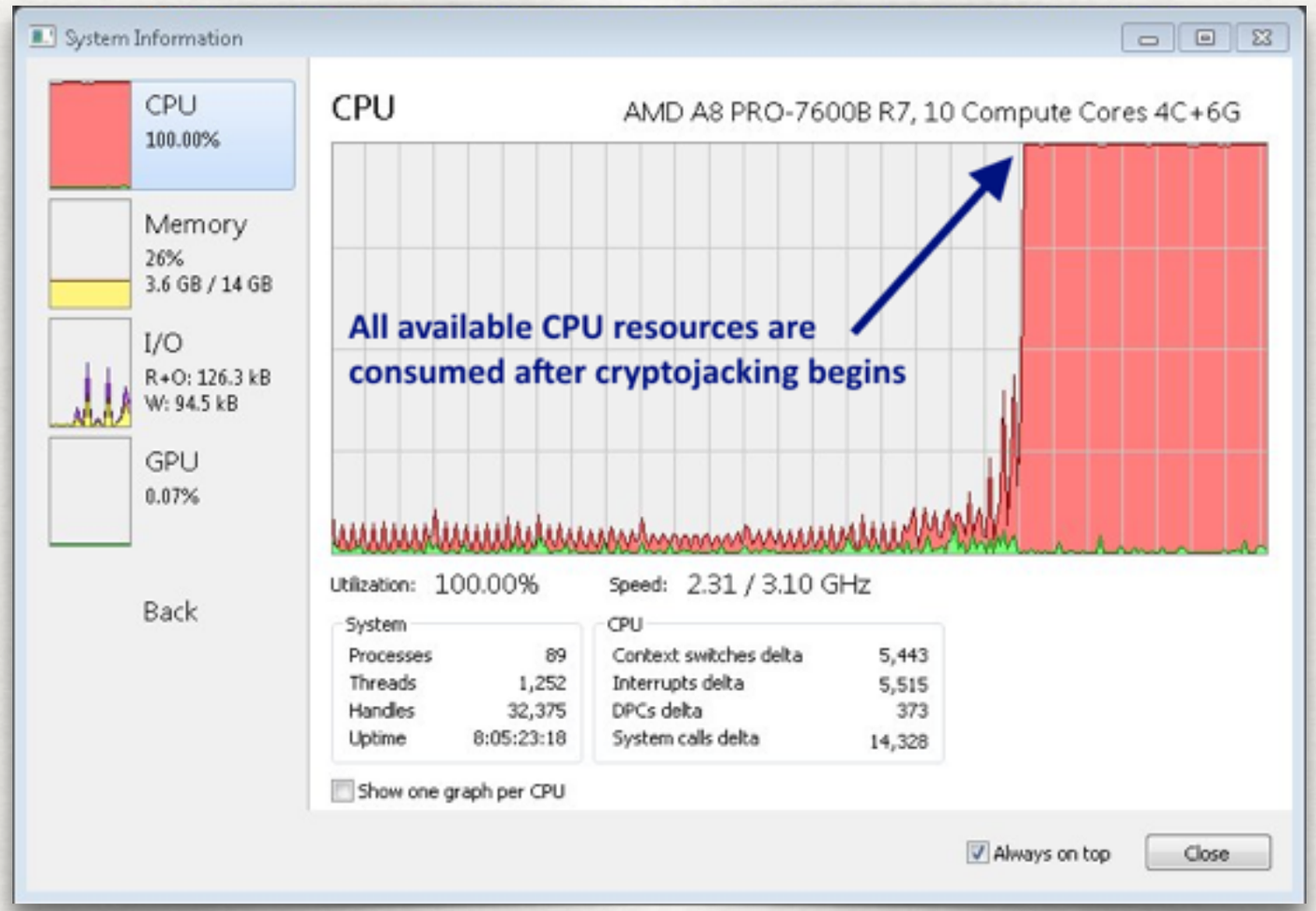


CLIENT IMPACT

USER EXPERIENCE

- A spike in CPU usage, increase in fan speed and noise
- Possibility of browser and/or computer crash



DATA GATHERING

STATE OF AFFAIRS

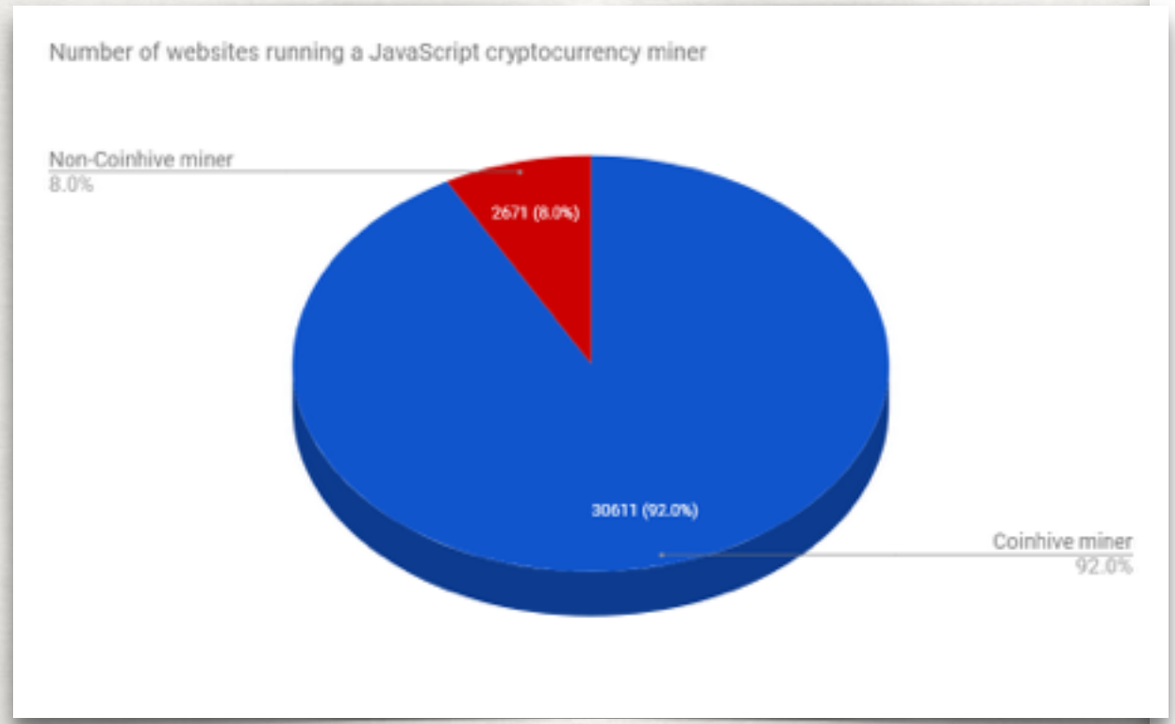
- Censys.io BigQuery dataset (Top 1 Million websites)
- PublicWWW's dataset (~200 Million indexed websites)

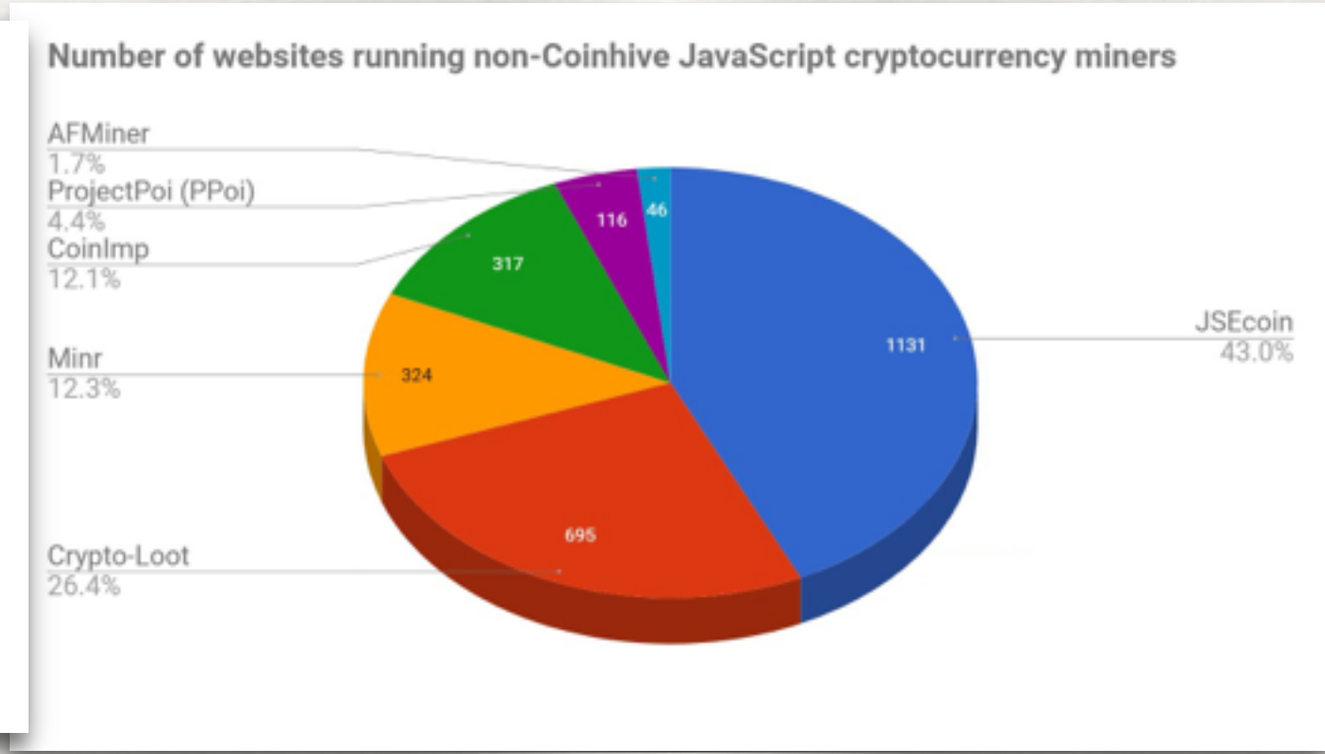
Website	Results	Query Parameter
Coinhive	30611	'coinhive.min.js'
JSEcoin	1131	'load.jsecoin.com'
Crypto-Loot	695	'CryptoLoot.Anonymous'
Minr	324	'minr.pw','st.kjli.fi', 'abc.pema.cl','metrika.ron.si', 'cdn.rove.cl','host.d-ns.ga', 'static.hk.rs','hallaert.online', 'cnt.statistic.date','cdn.static-cnt.bid'
CoinImp	317	'www.coinimp.com/scripts/min.js', 'www.hashing.win'
ProjectPoi (PPoi)	116	'projectpoi.min'
AFMiner	46	'afminer.com/code/miner.php'
Papoto	42	'papoto.com/lib/papoto.js'

DATA GATHERING

STATE OF AFFAIRS (JANUARY 2018)

- Coinhive being the first and the lead in the market share
- JSEcoin and Crypto-loot followed after

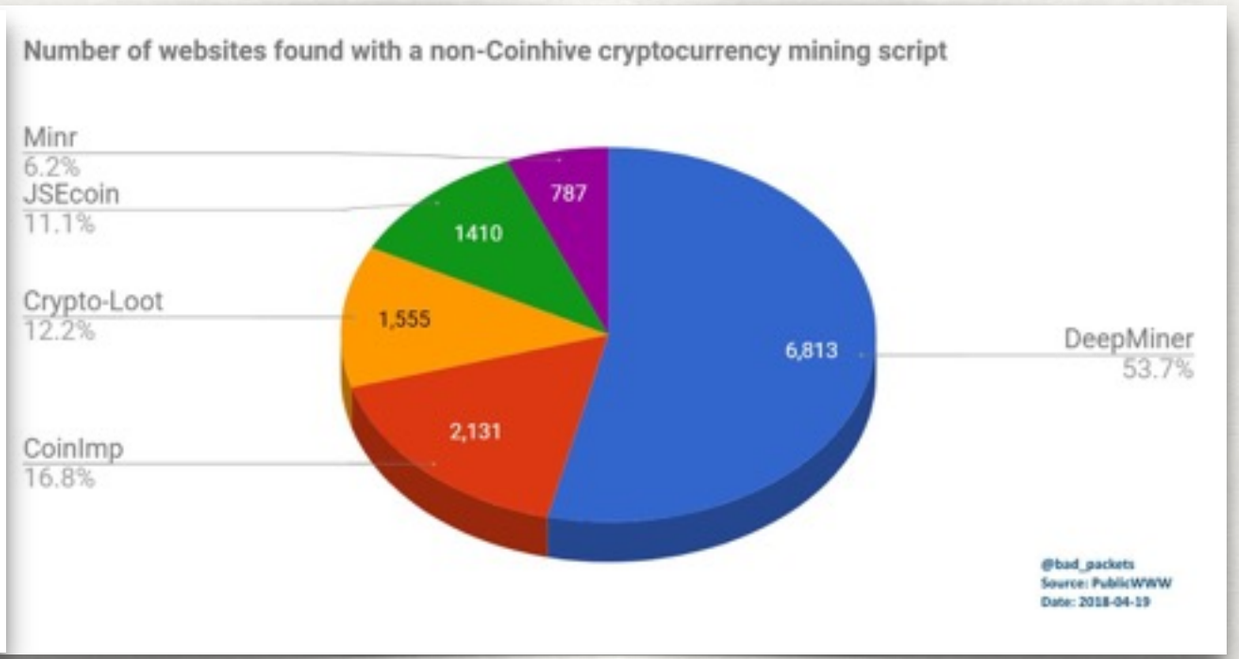




DATA GATHERING

STATE OF AFFAIRS (APRIL 2018)

- Due to Coinhive popularity, ISP and adblockrs started to blacklist their domains
- DeepMiner and Minr, use obfuscation methods to bypass these blockages



EXPERIMENT

PROFITABILITY

- 11,000 Parked domains over 3 months (October - December)
- 105,580 user sessions - Average of 24 seconds per session
- Revenue of 0.02417 XMR (~$7.69)

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- 11,000 Parked domains over 3 months (October - December)
- 105,580 user sessions - Average of 24 seconds per session
- Revenue of 0.02417 XMR (~$7.69)

- More profitable on long sessions (e.g Streaming websites)
- Not significant compared to online advertisement profitability

THREAT MODEL

WHERE CRYPTOJACKING CAN BE INJECTED

1. **Webmaster initiated**

   - **Add new revenue model** or remove ads/premium content

   - **Banned websites from official revenue models**: e.g Large Russian website offering child pornography to users

2. **Third-party services**

   - e.g. Google Tag Manager code injection on Movistar, Globovision

   - **Advertisement script injections**: YouTube users in Japan, France, Taiwan, Italy, and Spain for nearly a week

THREAT MODEL

WHERE CRYPTOJACKING CAN BE INJECTED

3. Browser extensions

    - e.g. Chrome extension *"Archive Poster"* (100,000+ users)

4. Breaches

    - LiveHelpNow's SDK: 1500 websites using their chat support service such as retail store chains Crucial and Everlast

    - Browsealoud: United Kingdom governmental websites such as Information Commissioner's Office, UK NHS services, Manchester City Council and around 4200 other websites

5. Man-in-the-middle

    - Public wireless routers: Starbucks free Wi-Fi hotspots in Argentina (October 2017)

MITIGATION

TO BLOCK OR NOT TO BLOCK?

- **To Block (Through Browser, ISP, …)**
  - Extensions: CoinBlockerLists, Adblockr
  - Opera Browser “NoCoin” blacklist
    - Is this the answer? What about the good usages of this new model?

- **Not to Block (User Consent)**
  - Authedmine service from Coinhive
  - Regulations similar to user tracking cookies (EU Cookie Law)

DISCUSSION

ETHICAL SCENARIOS

1. The use of Cryptojacking on a breached website

   - **Unethical!**

2. The use of Cryptojacking by the website owner with an attempt at **obtaining user consent**

   - Controversial, unclear if users understand what they are consenting to

3. The use of Cryptojacking by the website owner **without obtaining user consent.**

   - Considered unethical and illegal, *invisible abuse*

DISCUSSION

ETHICAL QUESTIONS

- *The use of Cryptojacking by the website owner with an attempt at obtaining user consent*
  - How to communicate what is happening to user, EU Cookie Law style policy is not sufficient
    - Potential harm to users of cryptojacking:
      - Higher electricity bills / battery usage
      - Accelerated device degradation
      - Slower system performance
      - Poor web experience
- New online revenue eco-system, needs regulation and policies

FUTURE WORK

INTERESTED IN COLLABORATION?

- Technical analysis of Monero hashing rate
  - How much of the processing power comes from these Cryptojacking campaigns? Is there a way to identify the platforms/pools through block headers or other data?
  - How this new monetization model can work? User education and UX design to get proper user consent
  - Policy making and Ethical discussions

THANK YOU

QUESTIONS?

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