Cyber Security

The art of cyber security: the threat landscape and tactics

Dr Chris Willcocks

Lecture Content

Crossover with
Sun Tzu “The Art of War”

- Know your enemy
- Know your terrain
- Know your economy (waging warfare)
- What are the common tactics?
- Planning strategies
- Spies: Can “we” (or they) truly be anonymous?
- Intelligent threat analysis
- Case study: typical medium-sized corporate spending

Who really are the adversaries?

"Know your enemy"

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Professional Criminal Gangs £££

- Make it so hacks are not cost-effective

Lone Hackers, Cyber Criminals, Script Kiddies

- Lone hackers are often not worth worrying about, script kiddies are more numerous

Foreign Governments
Political Activists
Insiders
Competitors
ISPs? Companies? The University?

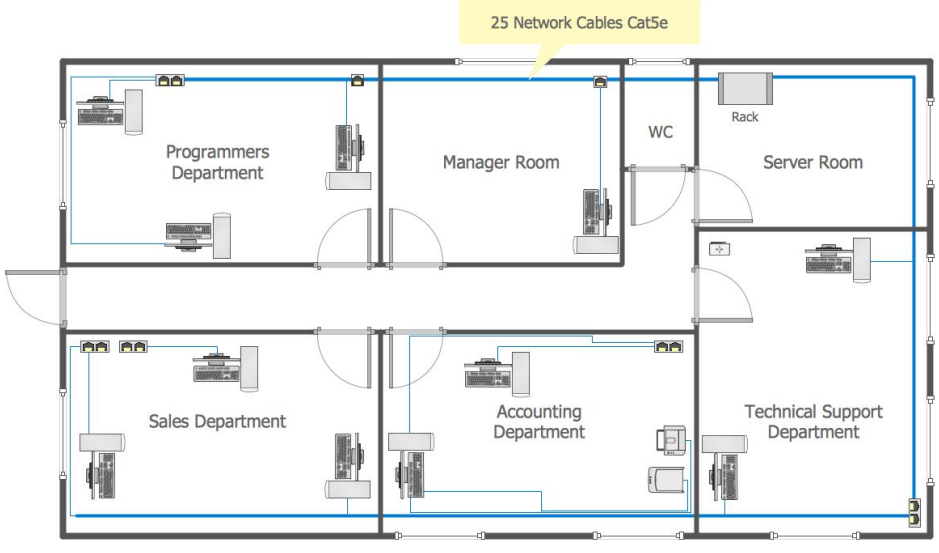
- May or may not be attackers
- Humans default to a position of trust (helps us survive in complex environments)

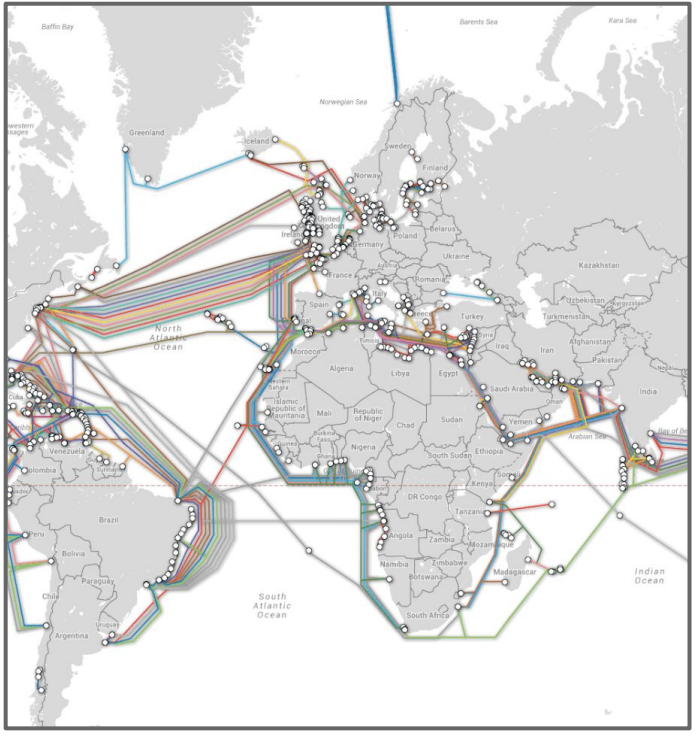
...depending on who the enemy is, different skills are required

Know the battlefield

With the internet, the battlefield is much larger and more complex than in traditional warfare.

- Think hierarchically





https://www.submarinecablemap.com

Know the most common tactics

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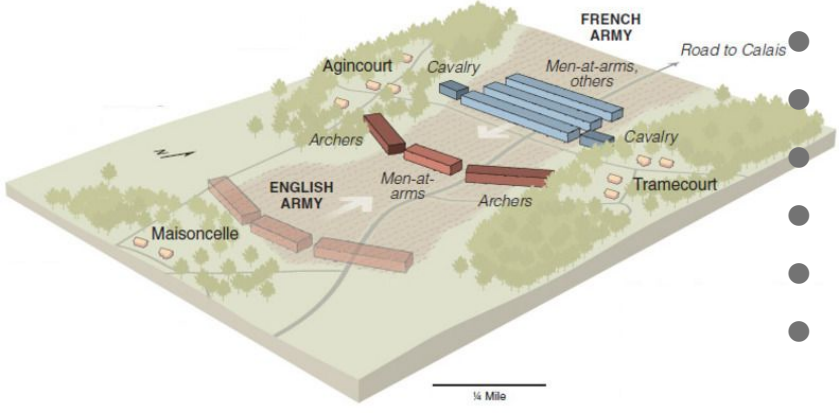
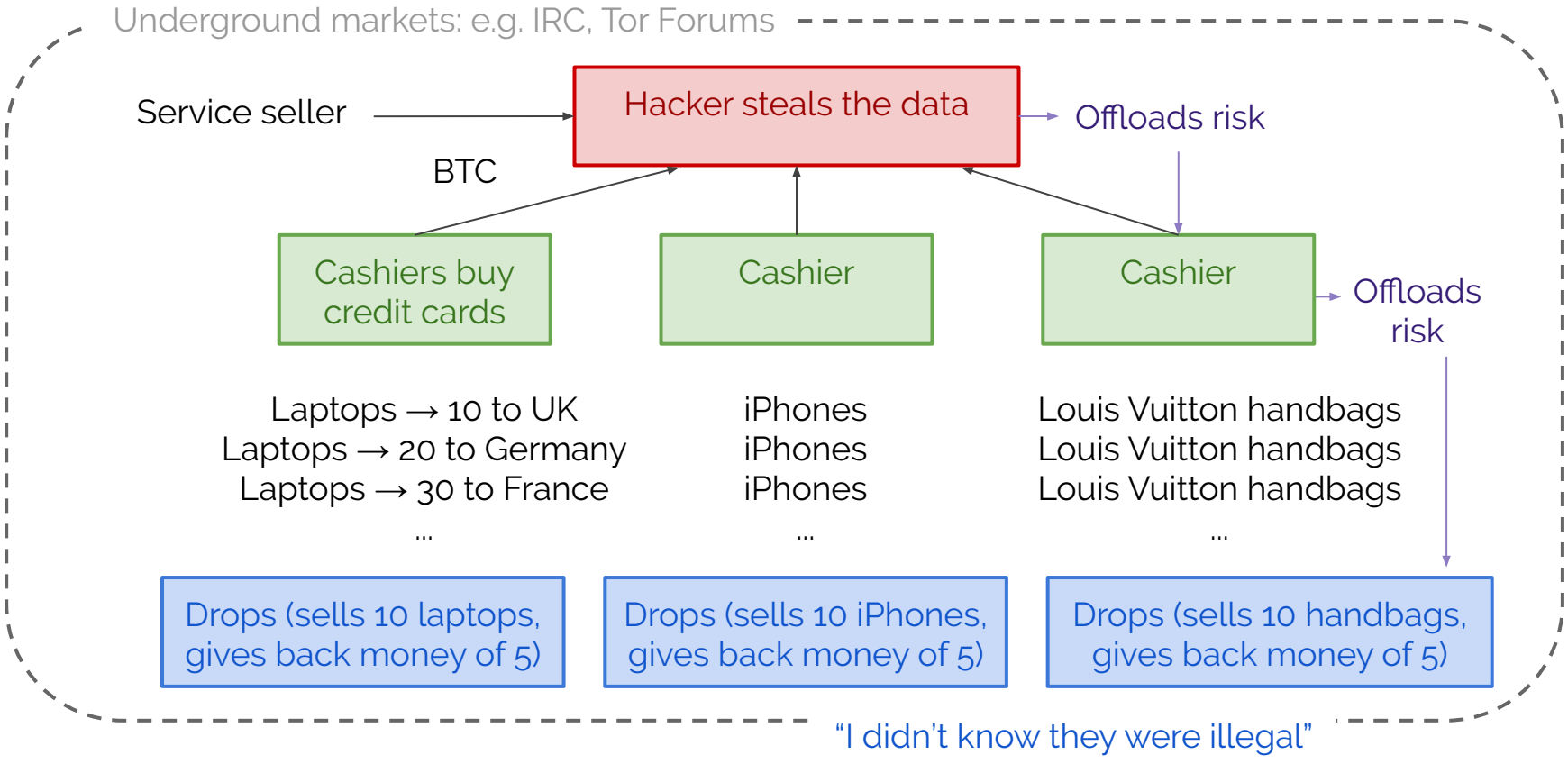
What is the motivation of most hackers? £££ +

- Steal credit cards, paypal logins, …
- Ransomware
- Industrial espionage (steal some sensitive information to sell to someone else)



- Database breach, DoS attacks (use worms)
- Botnets, Fast flux, Domain flux
- Spam
- Keyloggers
- Rootkits
- Man-in-the-browser

Tactics: What do hackers do with 1,000,000 credit card numbers?



Tactics: What do hackers do with 1,000,000 credit card numbers?

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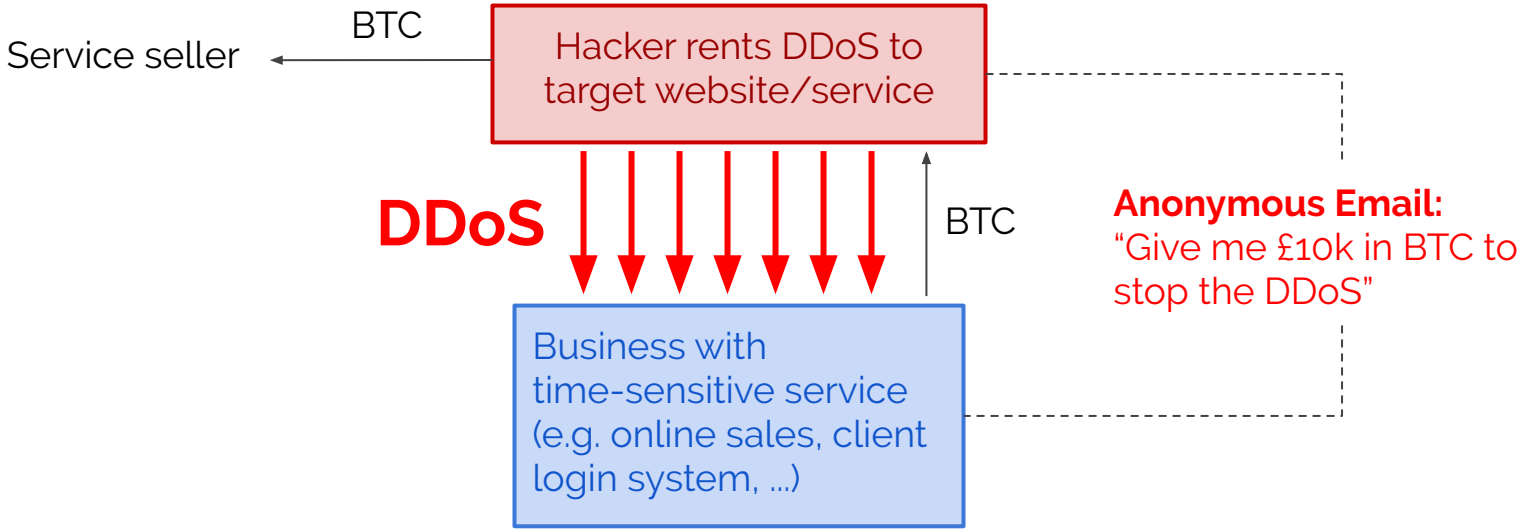
Recording of underground market I captured last week

...more common tactics

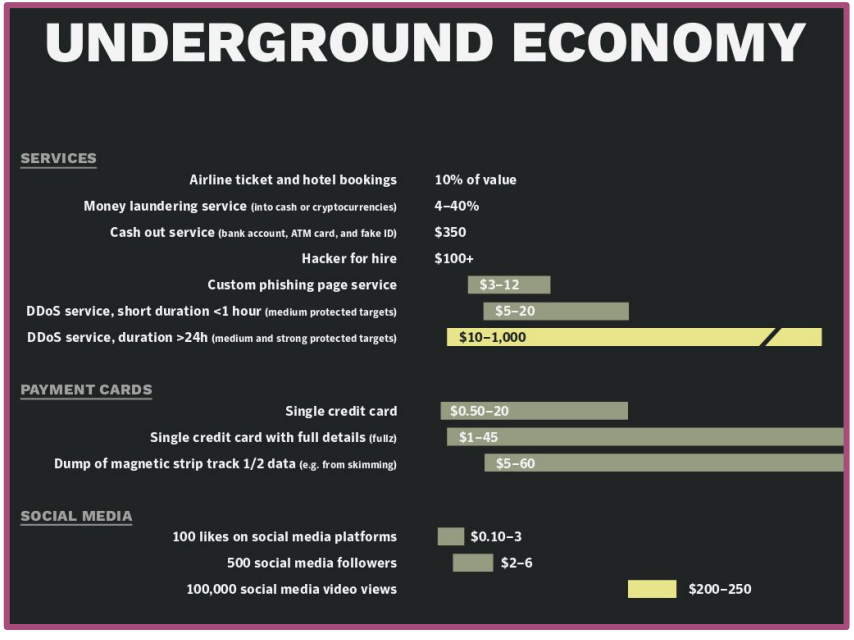


Know the economy

- Bitcoin transactions changes cyber landscape by enabling anonymous transactions

Economy can have fairly deep Hierarchies, for example:

- Hacker steals 1000 *Fullz* (credit card & CCV & name & address)
- Sells on Tor forum for 1 BTC (~£5k)
- Buyer sells groups of 20 to cashiers



Annual report by symantec:

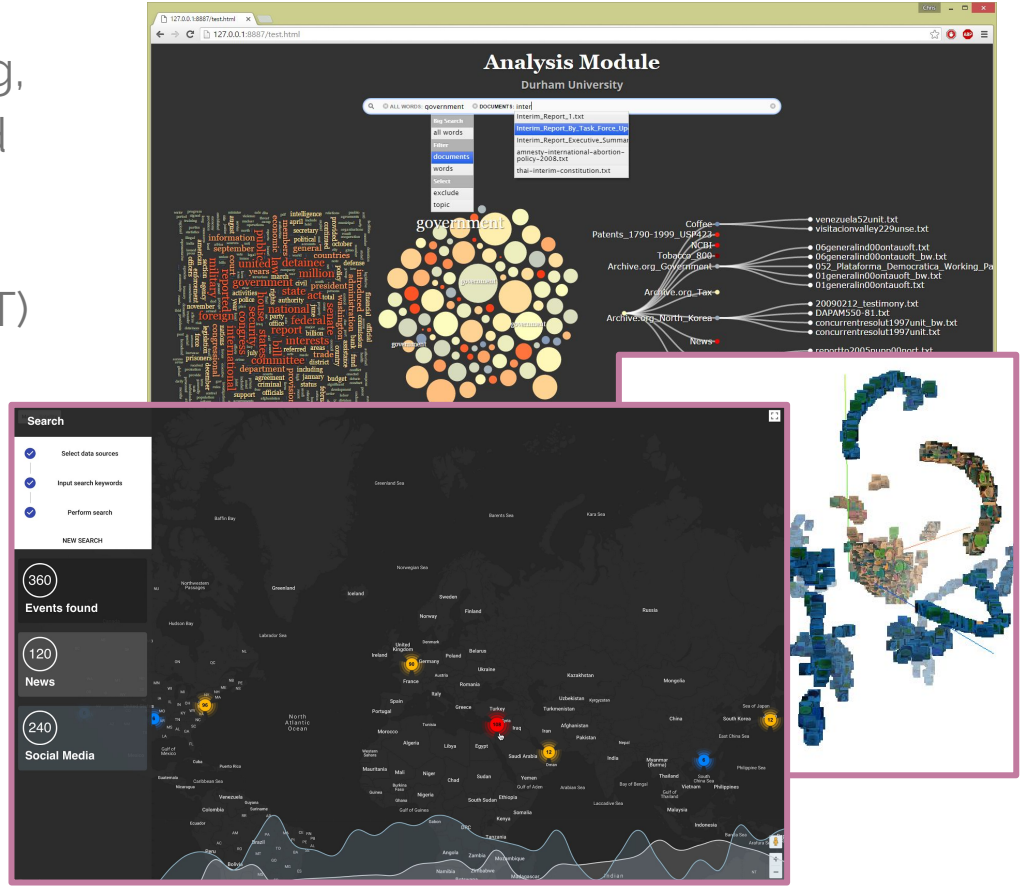
https://www.symantec.com/content/dam/symantec/docs/reports/istr-24-2019-en.pdf

Planning strategies

With the advent of Machine Learning, strategies are more intelligent based on large-scale analytics

- Open source intelligence (OSINT)
- Sentiment analysis
- Targeted advertising
  - Targeted political campaigns
- Identifying criminals
  - Identifying threats

… positive and negative applications

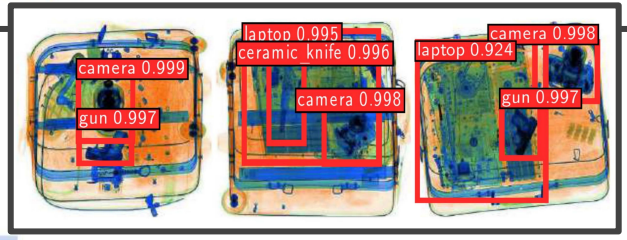


Planning strategies

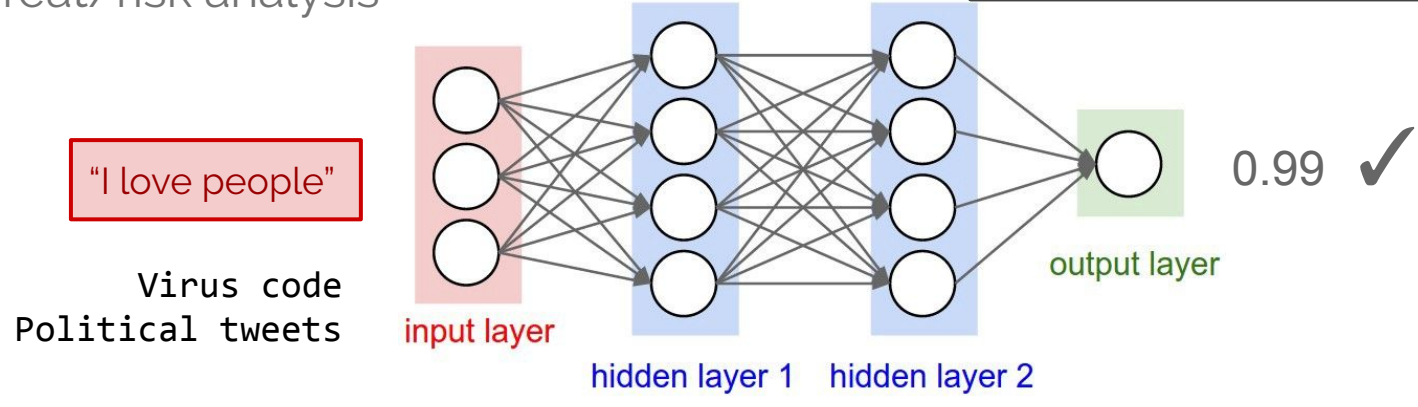
Machine Learning techniques

```
[ ] predict_sentiment(model, tokenizer, "This film is terrible")
    0.02264496125280857

[ ] predict_sentiment(model, tokenizer, "This film is great")
    0.9411056041717529
```



- Classifiers
- Sentiment analysis
- Threat/risk analysis



https://github.com/bentrevett/pytorch-sentiment-analysis

https://colab.research.google.com/github/bentrevett/pytorch-sentiment-analysis/blob/master/6 - Transformers for Sentiment Analysis.ipynb

Planning strategies

Machine Learning techniques

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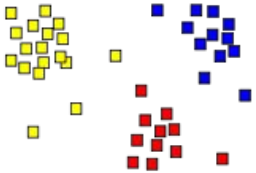
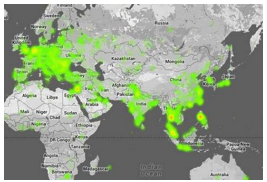
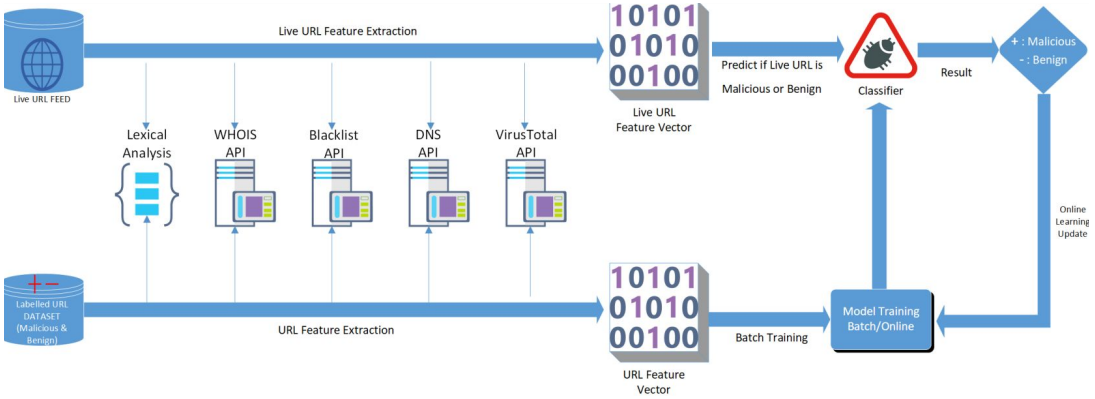
1. Automatic Classification ✓ ✓ ✗ ✗ ✓

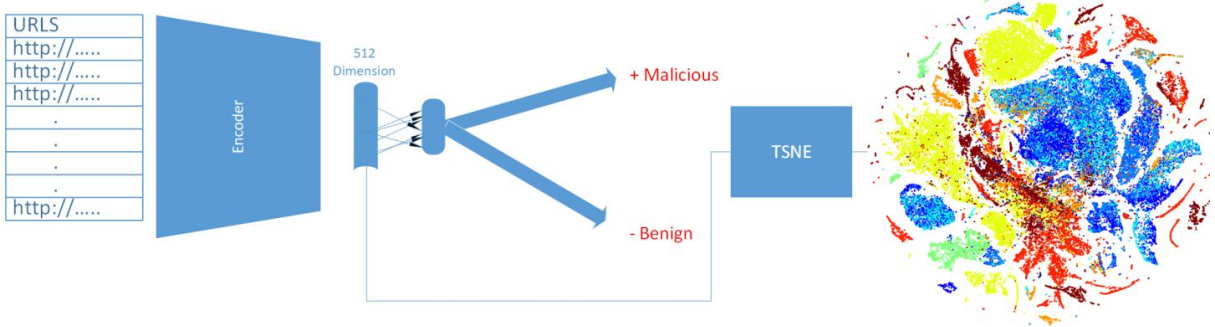
2. Automatic Clustering



3. Automatic Localisation







State-of-the-art: https://umap-learn.readthedocs.io/en/latest/supervised.html

Spies - Can "we" stay anonymous?

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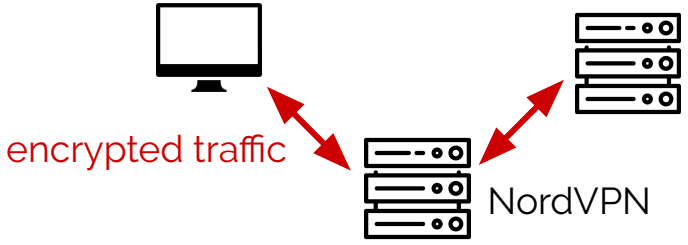
IPs → ISP → identify you

https://whatismyipaddress.com/

Public WiFi → MITM/identify you
University Wired/Wireless → identify you



VPNs (Virtual Private Networks)

- Free VPNs log your information and sell them to 3rd parties.
- This is how they make money & survive
- Carefully check the T&C of the VPN
- Nice phone App & browser extension

Spies - Can “we” stay anonymous?

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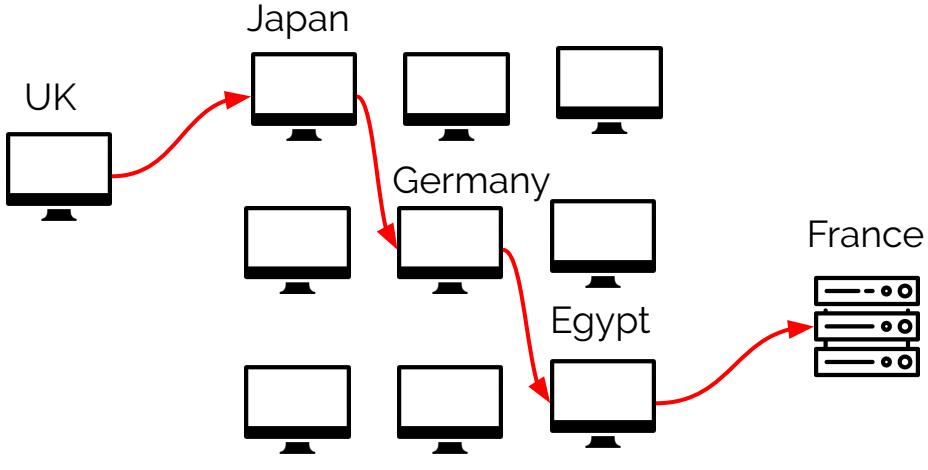
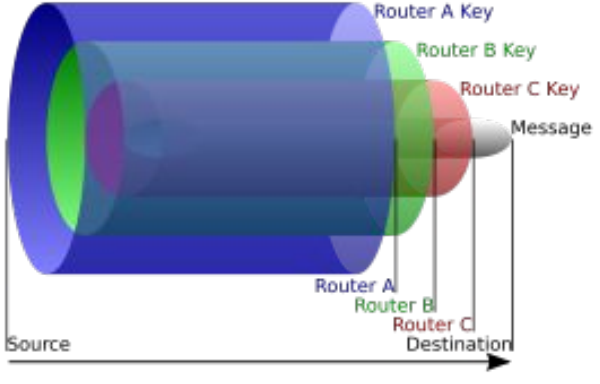
Tor enables *mostly* “anonymous” communication by onion routing

- Tor browser gives properly configured web browser (doesn’t collect your history or cache your results). Javascript can be disabled easily.



Tor network “routers”

Onion routing encapsulates packets with layers of encryption



Case study: typical medium-sized corporate spending (brands not examined)

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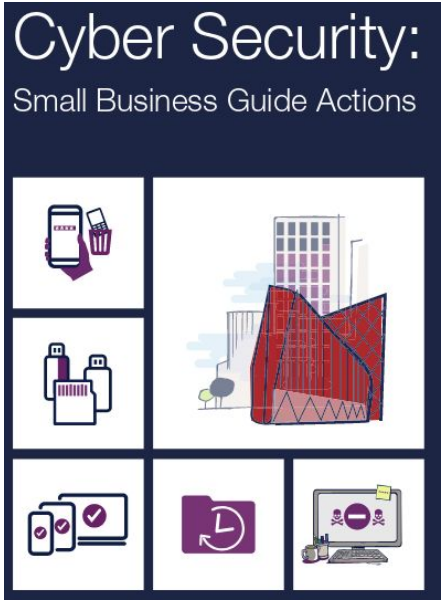
The remaining slides cover a small case study, which is the result of interviewing a local NE SME on appropriate Cyber Security budget & official guidance from the NCSC.

National Cyber Security Centre
a part of GCHQ

More links:

https://www.ncsc.gov.uk/guidance/security-operations-centre-soc-buyers-guide

https://www.ncsc.gov.uk/files/small_business_guide_actions.pdf



Security Operations Center (SOCs)

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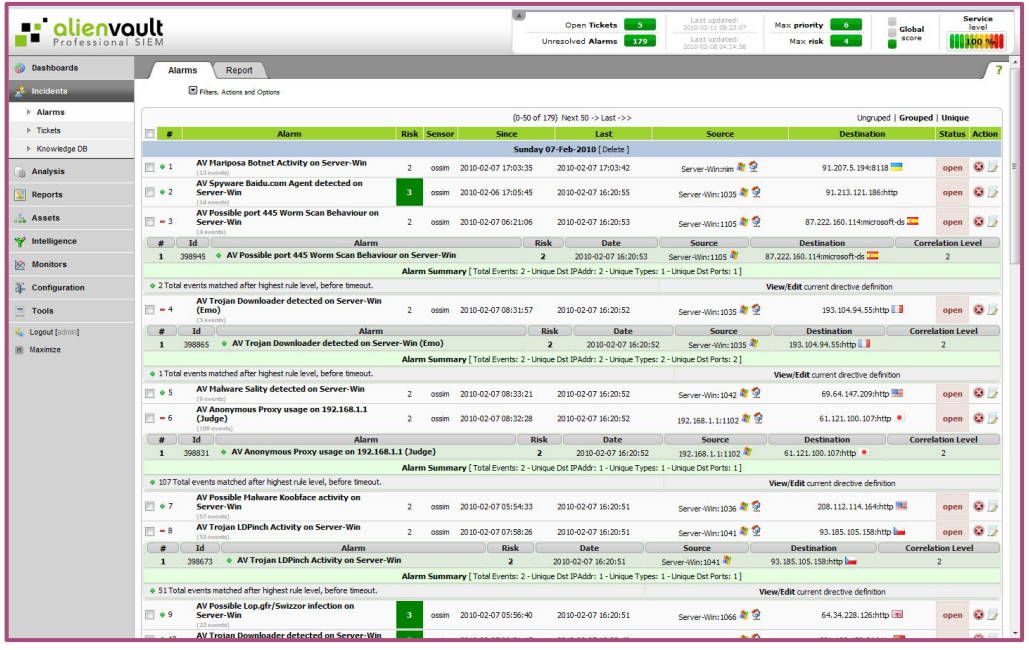
Teams proactively monitor the infrastructure

Tools/communities:

- Alien Vault
- Snort
- SNAIL
- OSEC
- OTX
- Logrhythm



Security Information & Event Management

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Third party monitoring (£8k per year)

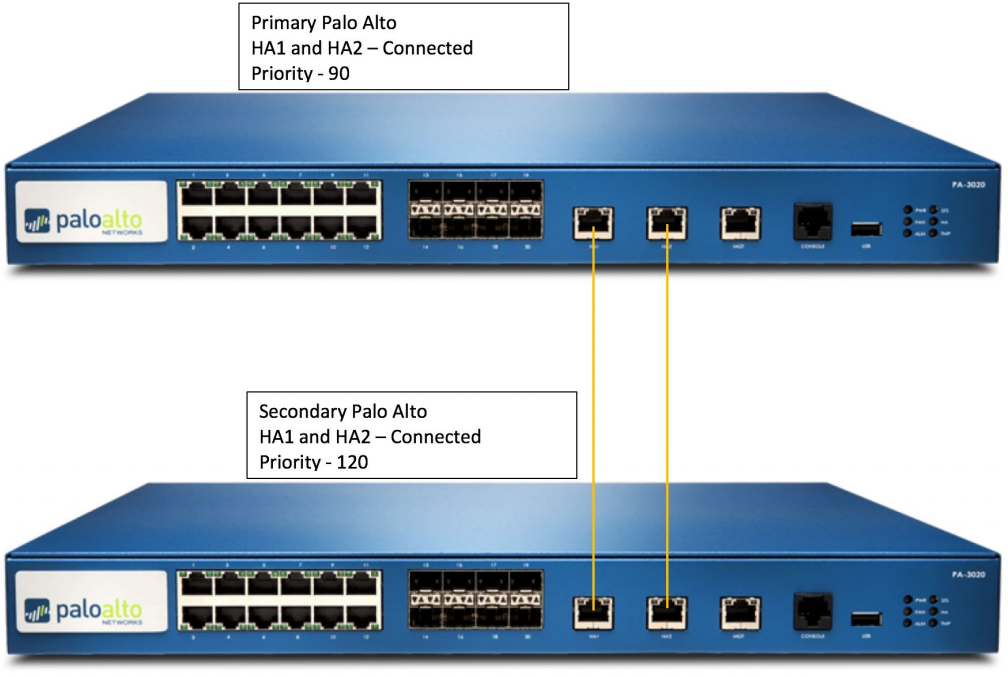
Log rhythm

- Create rules for alert types
- People review alerts & report back.
- ~**£5k per year** (standard package, what they choose)
- (~£70k per year for 24/7 package)

High Availability Pair

2 firewalls in active-active pair (means e.g. VOIP availability during updates)
Network/switches updated out-of-hours

1. Verify HA functionality before an upgrade
2. Confirms update on first device before updating the 2nd
3. Rollback w/o downtime
4. When finish the state will be unchanged.



https://www.thepacketwizard.com/blog/2018/02/08/palo-alto-upgrade-high-availability-ha-pair/

Automated Patch Management

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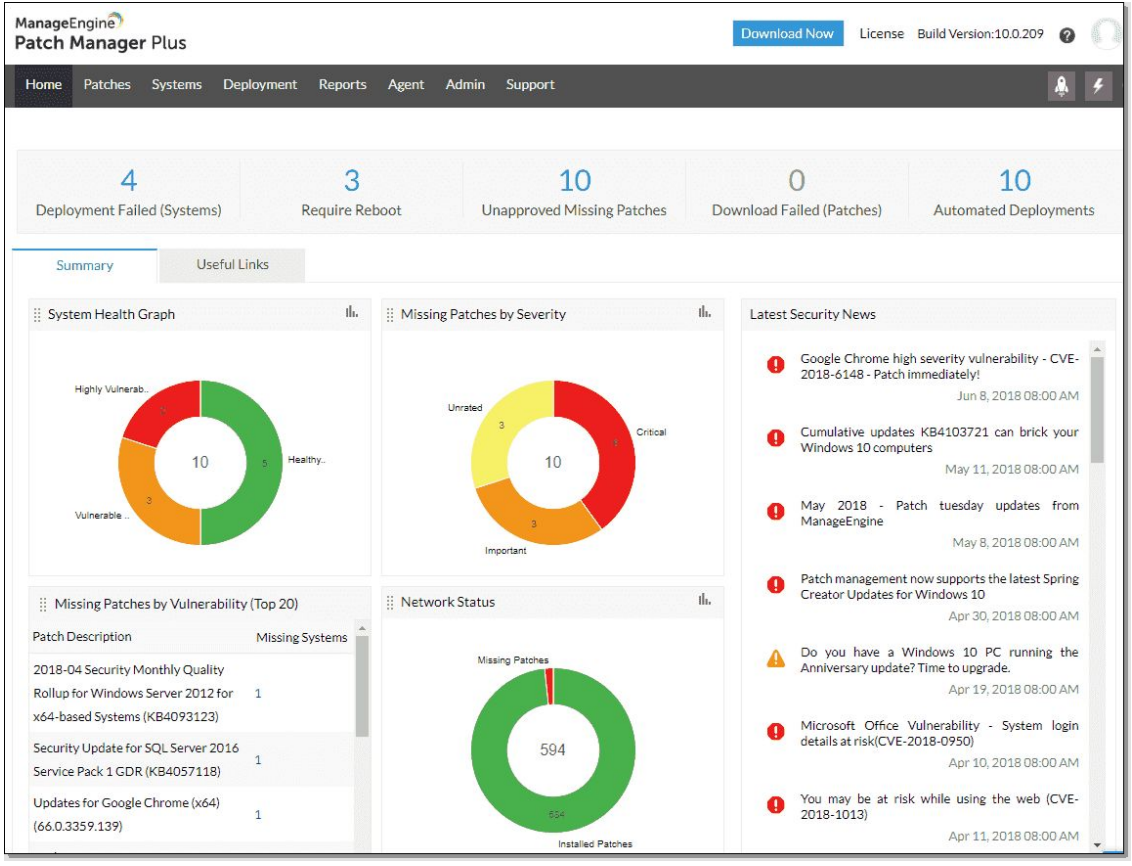
Patch manager plus pro (**£2k per year**)

Windows updates at appropriate times

- Adds control

Keeps software up to date but maintains compatibility

Includes third party (java, flash etc)



Protection of endpoints, NG firewalls and full disk encryption

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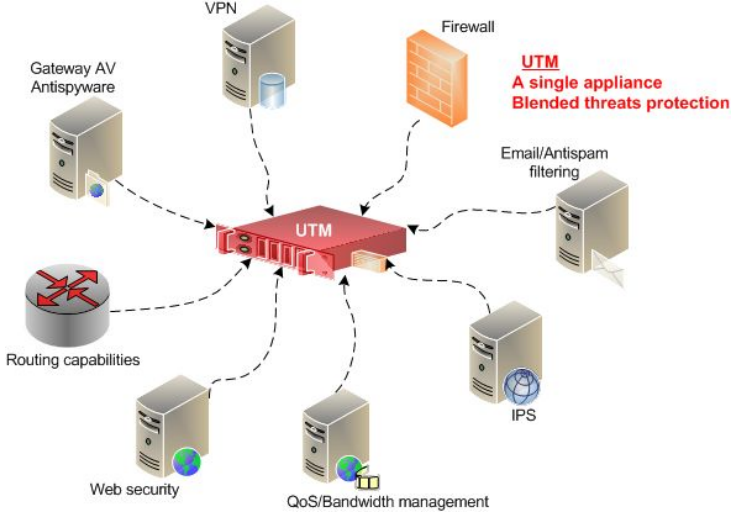
Safend data protection suite (DPS) endpoint protection

- e.g. locks down USBs ~**£20k+£2k** per year

UTM firewall (next-generation NG firewall, inspects packets in flight) …simple ones just blocks a port.

In-line antivirus, web filtering - ensure the firewalls don't slow e.g. uploading to Dropbox, advanced ones use AI to analyse threats

Hard drive encryption (TrueCrypt was compromised) - VeraCrypt



Falcon sandbox analysis

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Suspicious file?

Spins up a VM, executes, sends screenshots/report of what it does

(balancing confidentiality - e.g. do we want to send personal details to third party?)

There are automated sandbox analysis such as Cuckoo, but can be a lot of effort to set up

Human Training

Training, e.g. “Junglemap NanoLearning”

- Delivers bite sized learning schedules, sends a link to half a dozen slides, reports back how many people and how long people spend on it - also does phishing exercises (e.g. new Costa shop example)