GameSS

PHISHING

WHO IS THE MATERIAL FOR?

This material will provide introduction into phishing attacks and countermeasures. It is suitable for a broad range of target groups, such as developers, admins, employees and managers.

WHO MADE THIS MATERIAL?

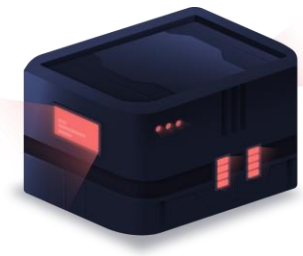
Oksana Kulyk

Associate Professor at IT University of Copenhagen (ITU)

okku@itu.dk

WHAT ARE THE MAIN TAKEAWAYS FOR THIS CONTENT?

- Phishing is a social engineering attack involving impersonation of a trusted entity via email and other remote communication channels. Spear phishing is a targeted variant of the attack.
- Attackers use a variety of tactics to compose phishing emails, in particular, different methods of impersonating the sender and hiding the URL of the phishing website.
- Phishing emails can be detected with automatic and manual inspection, both of which have their strengths and limitations
- Anti-phishing education is challenging to implement correctly and should not be relied on as a sole method of preventing phishing
- A layered approach is recommended for protectiong against phishing



Disclaimer: the tools and techniques in this learning module are described for educational purposes only, so that you can be aware of them to better protect yourself or your company. Using them in real world on targets that don't give you permission to do so can be highly unethical and lead to legal reprecussions.

WHAT IS PHISHING

- A variant of social engineering attack

- Attacker sends emails (or messages via other channels, e.g. SMS) impersonating a trusted entity

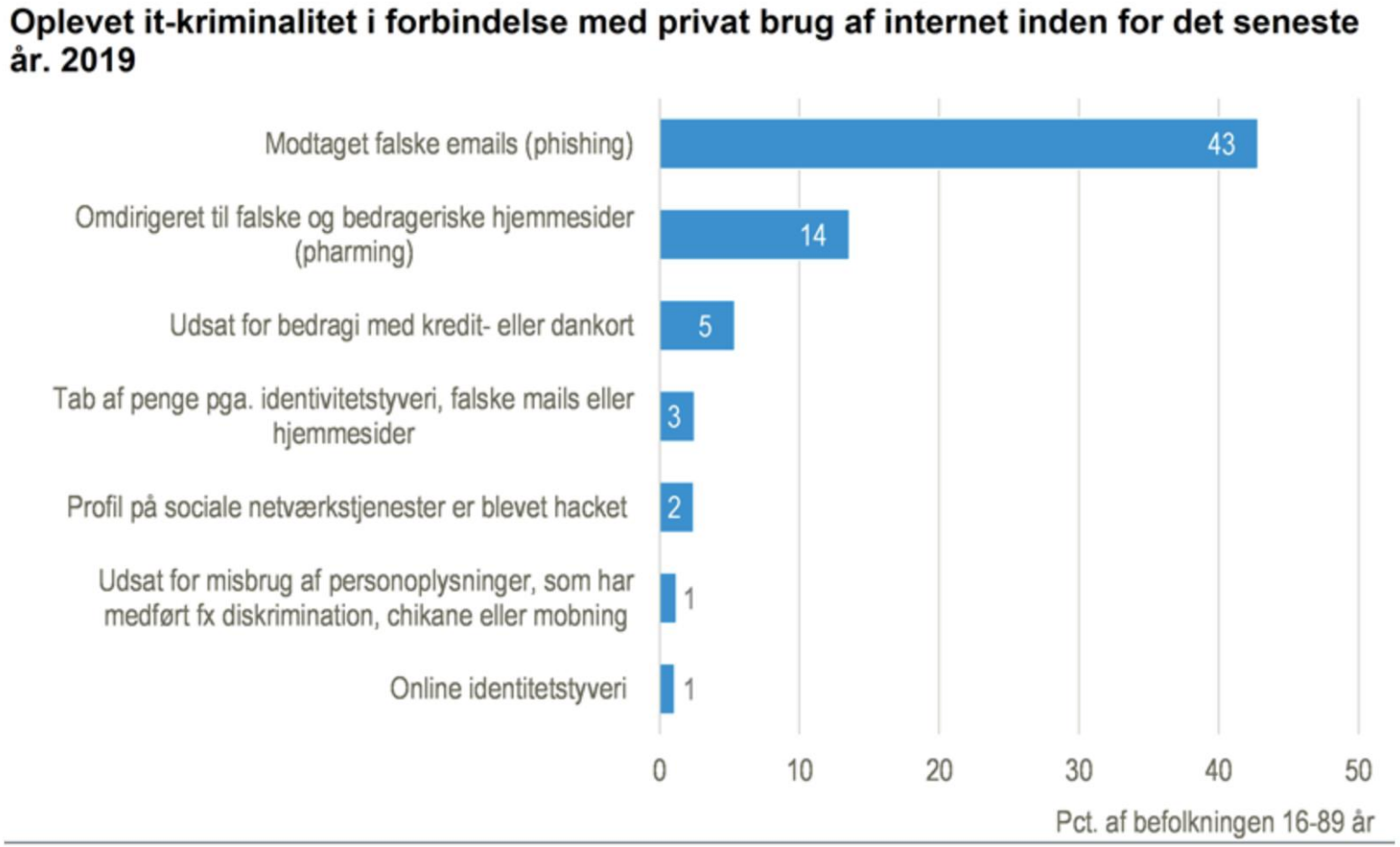
→ How can one tell this is not a real message from Nordea?

WHAT IS PHISHING

→ How can one tell this is not a real message from Nordea?

- Main indicator: link does not lead to the Nordea website
- Other possible indicators
  - Time of message: Saturday evening
  - Spelling mistakes
  - Content invoking sense of urgency

PHISHING IS WIDE-SPREAD



Kilde: www.statistikbanken.dk/bebrit19.

GOAL: STEAL SENSITIVE INFORMATION

CYBERSECURITY

How the Russians broke into the Democrats' email, and how it could have been avoided

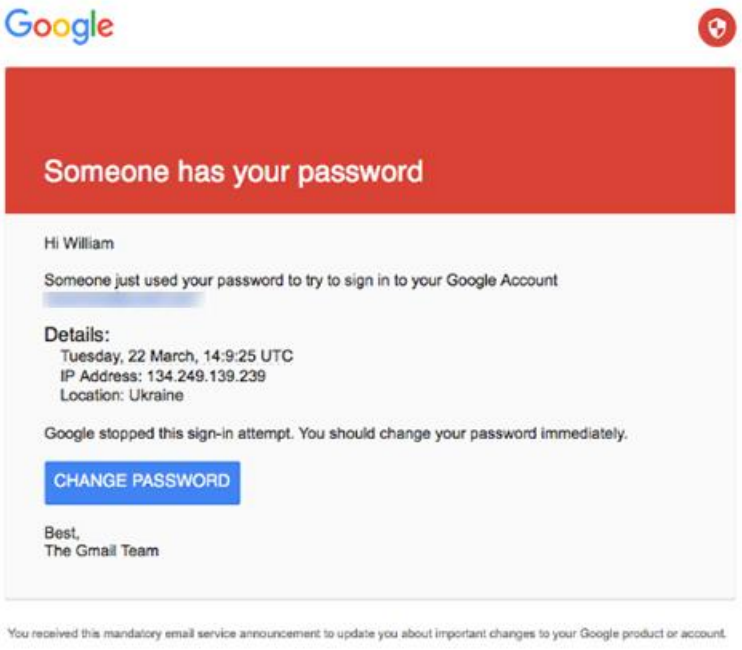
PUBLISHED MON, JUL 16 2018•11:15 AM EDT | UPDATED TUE, JUL 17 2018•AT 11:13 EDT

Kate Fazzini
@KATEFAZZINI

SHARE

According to the Justice Department, the Russians used spear-phishing as one of their primary attack techniques. Spear-phishing refers to an email targeted at an important person — or a "big fish" — who can provide entry to a cache of the most important data. It starts with basic reconnaissance (like looking at Facebook and LinkedIn profiles) to create a portrait of a prominent individual, then using that portrait to create an email that he or she is sure to click on. In the Democratic National Committee hack in 2016, those emails were just spoofed to look like security updates from Google, according to the indictment.

Source: CNBS



Source: Ars Technica

GOAL: IMPERSONATE SPECIFIC PEOPLE

TECH | TWITTER | CYBERSECURITY

Twitter says a spear phishing attack led to the huge bitcoin scam

'This attack relied on a significant and concerted attempt to mislead certain employees'

By Jay Peters | @jaypeters | Jul 30, 2020, 9:29pm EDT

Source: TheVerge

What we know now

The social engineering that occurred on July 15, 2020, targeted a small number of employees through a phone spear phishing attack. A successful attack required the attackers to obtain access to both our internal network as well as specific employee credentials that granted them access to our internal support tools. Not all of the employees that were initially targeted had permissions to use account management tools, but the attackers used their credentials to access our internal systems and gain information about our processes. This knowledge then enabled them to target additional employees who did have access to our account support tools. Using the credentials of employees with access to these tools, the attackers targeted 130 Twitter accounts, ultimately Tweeting from 45, accessing the DM inbox of 36, and downloading the Twitter Data of 7.

Tweet

Source: Twitter blog

GOAL: CONDUCT UNAUTHORISED OPERATIONS

The Lazarus heist: How North Korea almost pulled off a billion-dollar hack

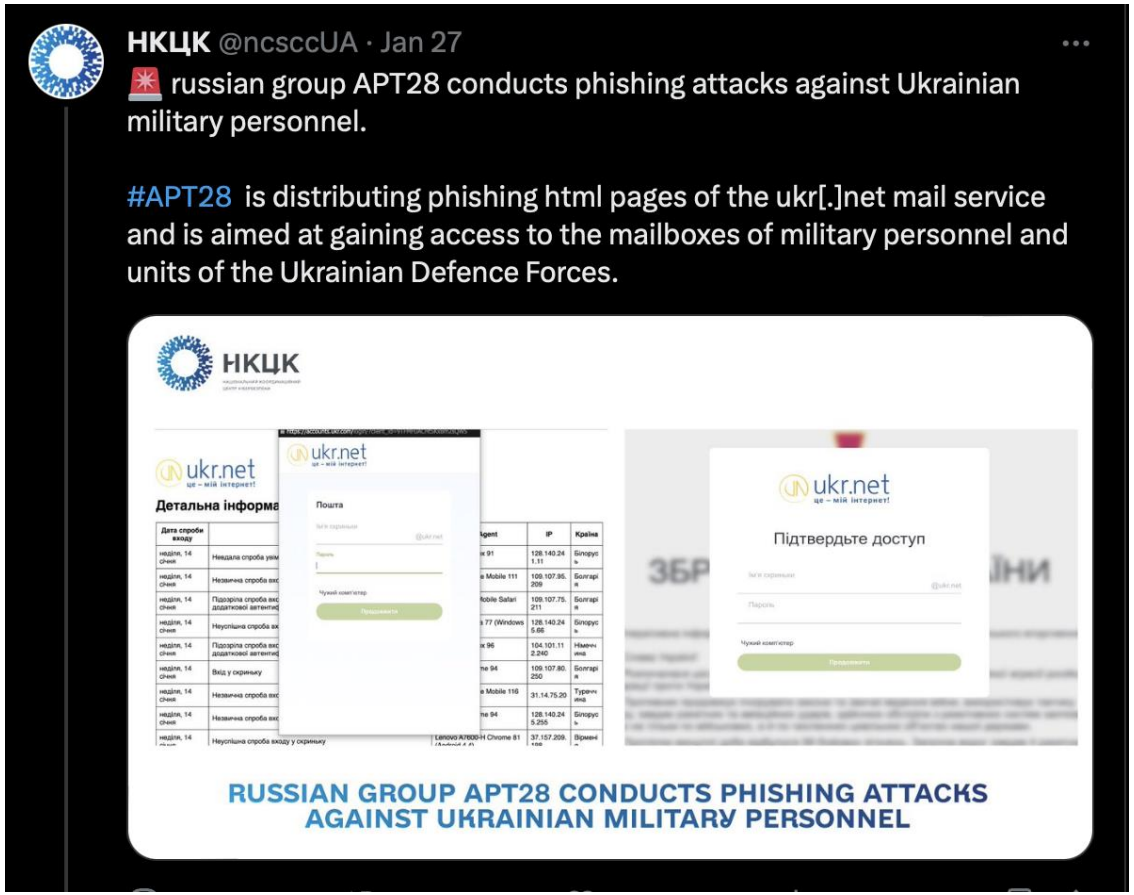
21 June 2021

In January 2015, an innocuous-looking email had been sent to several Bangladesh Bank employees. It came from a job seeker calling himself Rasel Ahlam. His polite enquiry included an invitation to download his CV and cover letter from a website. In reality, Rasel did not exist - he was simply a cover name being used by the Lazarus Group, according to FBI investigators. At least one person inside the bank fell for the trick, downloaded the documents, and got infected with the viruses hidden inside.

Once inside the bank's systems, Lazarus Group began stealthily hopping from computer to computer, working their way towards the digital vaults and the billions of dollars they contained.

Source: BBC

GOAL: INFILTRATE MILITARY INFRASTRUCTURE



Source: Ukraine National Cyber Security Coordination Center

HOW PHISHING WORKS: CREDENTIALS STEALING

1. User get an email with a link to a website of a trusted organisation
2. The link goes to the website that looks like the one from the real organisation but is owned by the attacker
3. User is prompted to enter credentials
4. Credentials forwarded to the attacker
5. Attacker gets full control over user's account

HOW PHISHING WORKS: MALWARE INFILTRATION

1. User gets an email with an attached file
2. User opens the attachment in the email
3. Attachment runs malware script
4. Malware gets control over the users' system (e.g. sending data to the attacker) and/or propagates to other users/devices on the network
5. In rare cases: malware can run even without the user opening the file: clicking the link, or even just reading the email → especially dangerous for systems without security updates

HOW PHISHING WORKS: CEO FRAUD

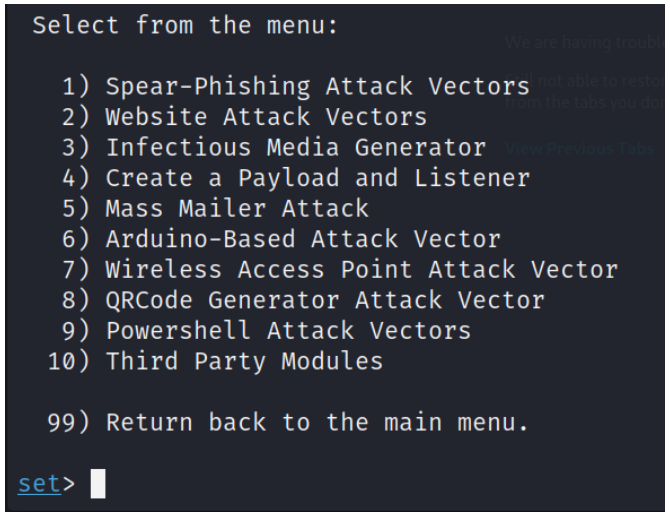
1. User gets an email impersonating a trusted person/authority

2. The email contains instructions: transferring money, sharing sensitive documents…

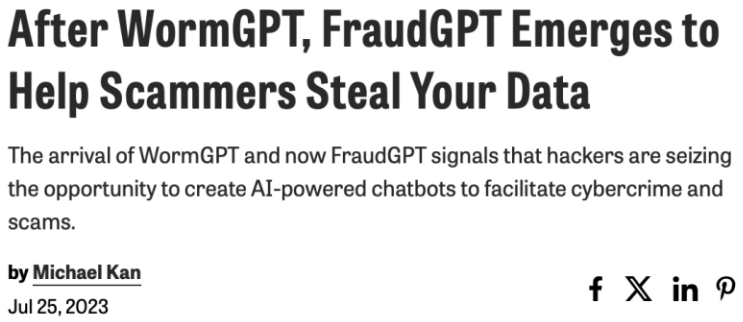
3. User follows the instructions

HOW HARD IS PHISHING: REGULAR PHISHING

- Attacker's investment:
  - Register email addresses to use for phishing mailing
  - Register a website to make it look like the one the attacker wants to impersonate, or:
  - Prepare malware to be attached
  - Send out phishing emails
- Openly available tools incl. generative AI exist to help



Source: Social Engineering Toolkit



After WormGPT, FraudGPT Emerges to Help Scammers Steal Your Data

The arrival of WormGPT and now FraudGPT signals that hackers are seizing the opportunity to create AI-powered chatbots to facilitate cybercrime and scams.

by Michael Kan
Jul 25, 2023

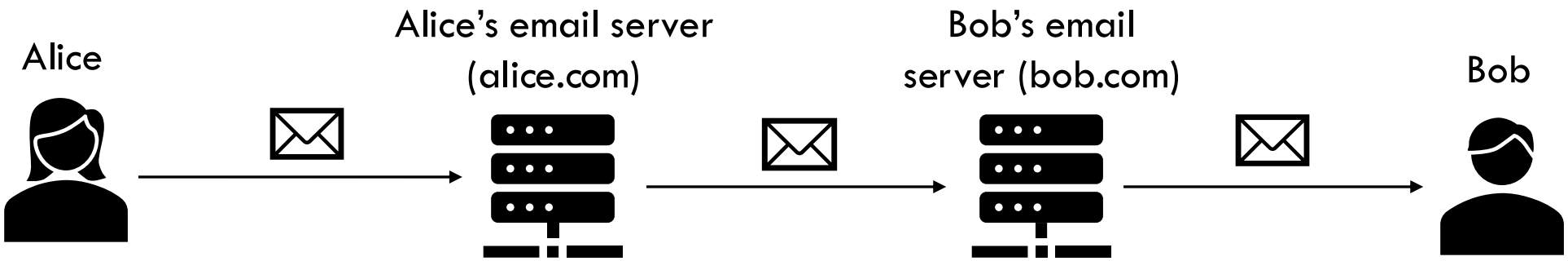
Source: PCmag

HOW HARD IS PHISHING: SPEAR PHISHING

- Additional investment to personalise the attack
  - Identify suitable recepients (e.g. company employees)
  - Learn information about the target
    - Names of their colleagues
    - Facts about the company
    - Personal facts, e.g. recent vacation
    - …
- Prepare a believable phishing email
- Openly available tools exist to help the investigations

How can phishing emails look like?

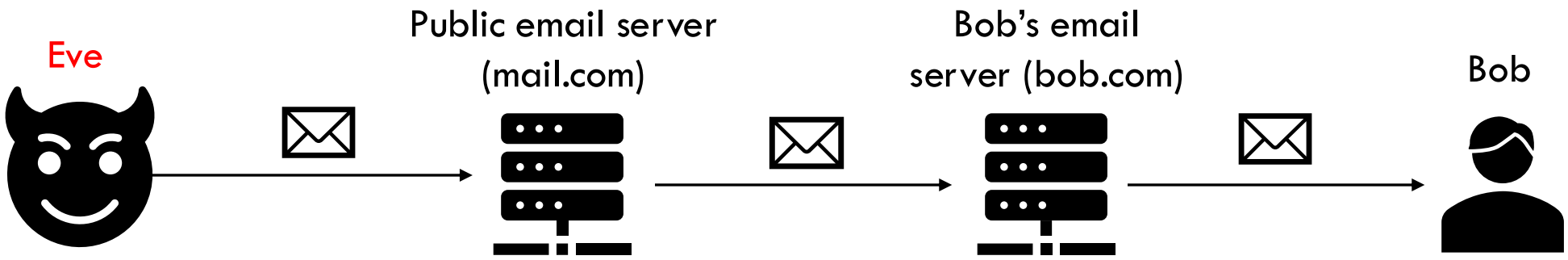
HOW EMAIL WORKS



From: Alice <alice@alice.com>
To: Bob <bob@bob.com>
Subject: Meeting agenda

→ **S**imple **M**ail **T**ransfer **P**rotocol: originally designed in 1980, no initial security considerations in mind

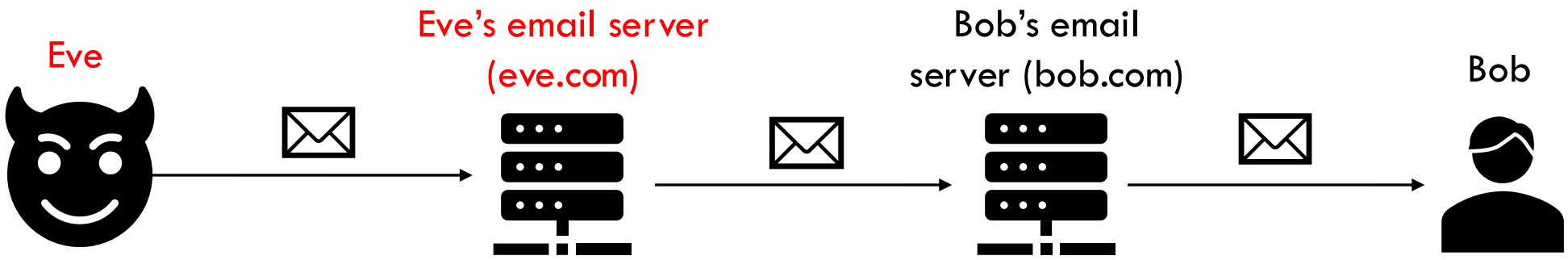
SENDER SPOOFING: SENDER'S NAME



From: Alice <eve@mail.com>
To: Bob <bob@bob.com>
Subject: Meeting agenda

- Sender's name falsifiable
- Sender's address can look similar enough to be believable
  - "alice@mail.com" (if Alice hasn't registered the account at mail.com herself)
  - "alice@eve.com"
  - …

SENDER SPOOFING: SENDER'S ADDRESS



From: Alice <alice@alice.com>
To: Bob <bob@bob.com>
Subject: Meeting agenda

- Senders' email falsifiable if:
  - Attacker controls the server
  - or the email provider's server is incorrectly configured

- Detection measures possible → more on that later

WEBSITE SPOOFING: HIDING THE LINK

From: YourBank <yourbank-service@mail.com>
To: Bob <bob@bob.com>
Subject: Bank account compromised

Dear Bob,

Unfortunately your bank account has been compromised and has therefore been blocked. Please go to our website following this link: https://yourbank.com/account-restore and enter your online banking login and password to restore the account.

- Real link destination can be hidden in email text → visible only via tooltip/hovering on the link
- Further tricks to disguise the actual URL

WEBSITE SPOOFING: HIDING THE LINK

From: YourBank <yourbank-service@mail.com>
To: Bob <bob@bob.com>
Subject: Bank account compromised

Dear Bob,

Unfortunately your bank account has been compromised and has therefore been blocked. Please go to our website following this link: https://yourbank.com/account-restore and enter your online banking login and password to restore the

https://evilhacker.org/phishing

- Real link destination can be hidden in email text → visible only via tooltip/hovering on the link
- Further tricks to disguise the actual URL

TRICK 0: NO TRICK

evilhacker.org

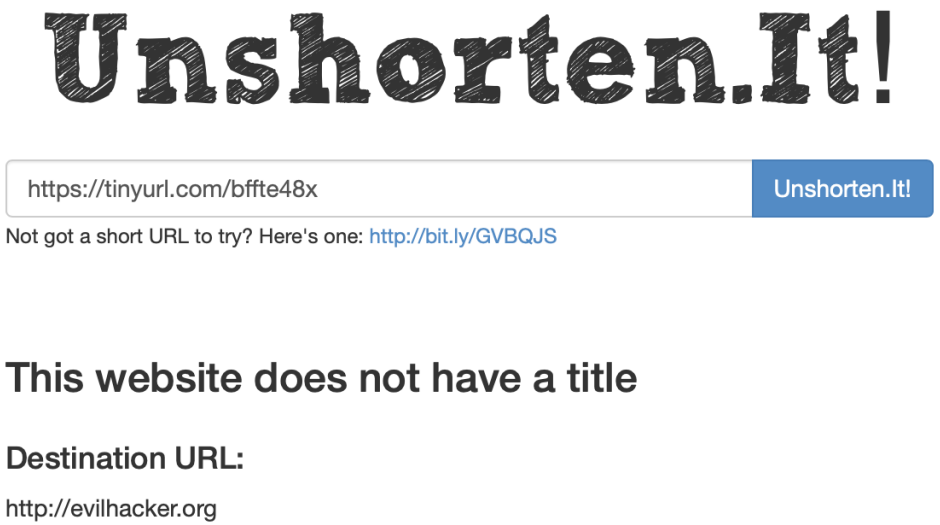
182.15.128.103

- Should be easy to detect
- Still, the user has to pay attention to the URL

TRICK 1: URL SHORTENERS

https://tinyurl.com/bffte48x

- Hard to distinguish without clicking on the link
- Services to check shortened URLs exist → need to be explicitly checked



TRICK 2: LEGITIMATE WEBSITE AS PART OF URL

amazon.com → amazon.com.evilhacker.com

facebook.com → evilhacker.com/www.facebook.com

- A problem if user doesn't know how to identify the website domain
- A problem if only a part of URL is shown (e.g. on mobile devices)

TRICK 3: SIMILAR DOMAINS

amazon.com → amazon-shop.com

- A problem if the user does not know what the real website is

TRICK 4: (ALMOST) INDISTINGUISHABLE DOMAINS

amazon.com → arnazon.com

microsoft.com → mircosoft.com

facebook.com → fácebook.com

apple.com → apple.com

- Especially hard to notice!

TRICK 5: COMPROMISED LEGITIMATE WEBSITES

amazon.com → evilhacker.amazon.com

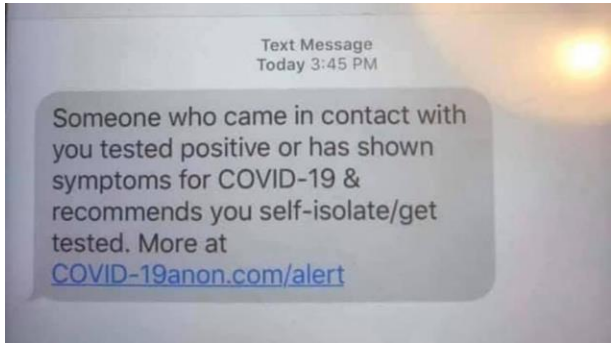
amazon.com → amazon.com/evilhacker

amazon.com → amazon.com/login?redirect=https://evilhacker.org

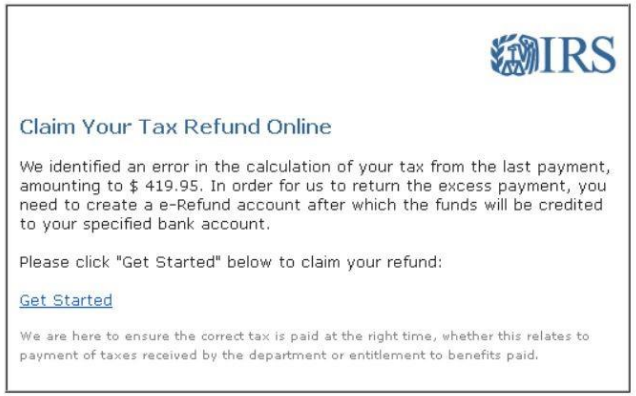
- Impossible to notice based on URL alone – website owners must take measures

CONTENT OF PHISHING MESSAGES

- Exploiting human psychology: fear, appeal to authority, sense of urgency, promising reward…
- Even more effective: personalisation via collecting information about the target



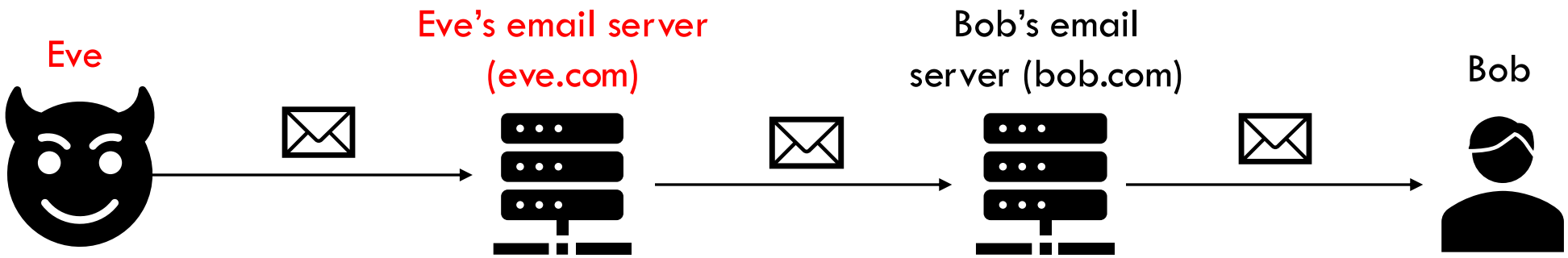
Source: https://wset.com/news/coronavirus/do-not-click-the-link-police-warn-of-scam-covid-19-text-messages



Source: https://us.norton.com/internetsecurity-online-scams-phishing-email-examples.html

Phishing detection

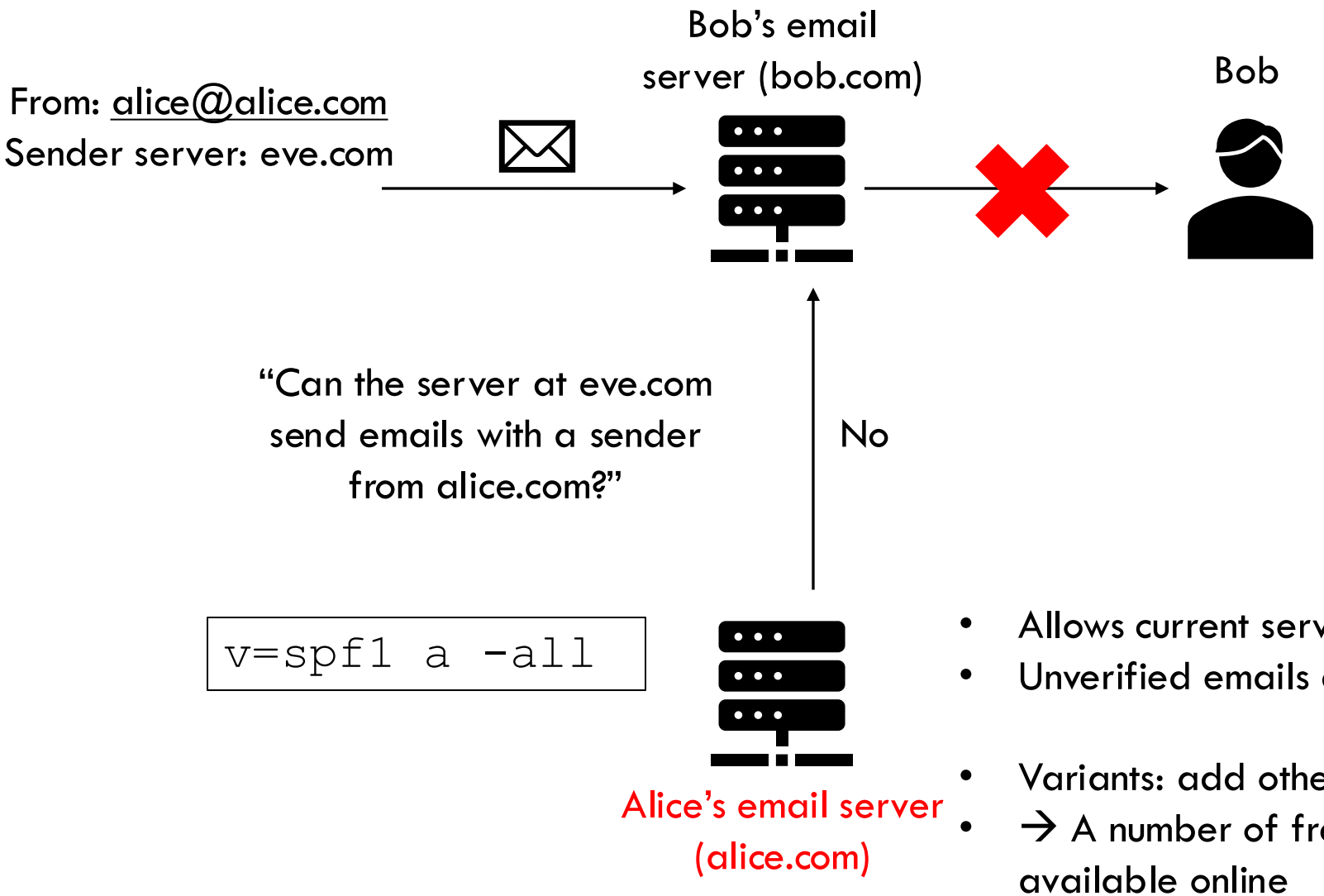
DOMAIN VERIFICATION: SENDER SPOOFING



- Scenario: Eve wants to impersonate Alice
- She uses her own email server (eve.com) to spoof the sender as alice@alice.com

- Solution: Sender Policy Framework (SPF) record
- Idea: check with Alice's email server (alice.com) whether the server sending the email (eve.com) on Alice's behalf is actually allowed to do so
- If not:
  - either soft fail (email delivered to Bob but marked as failed verification)
  - or fail (email not delivered)

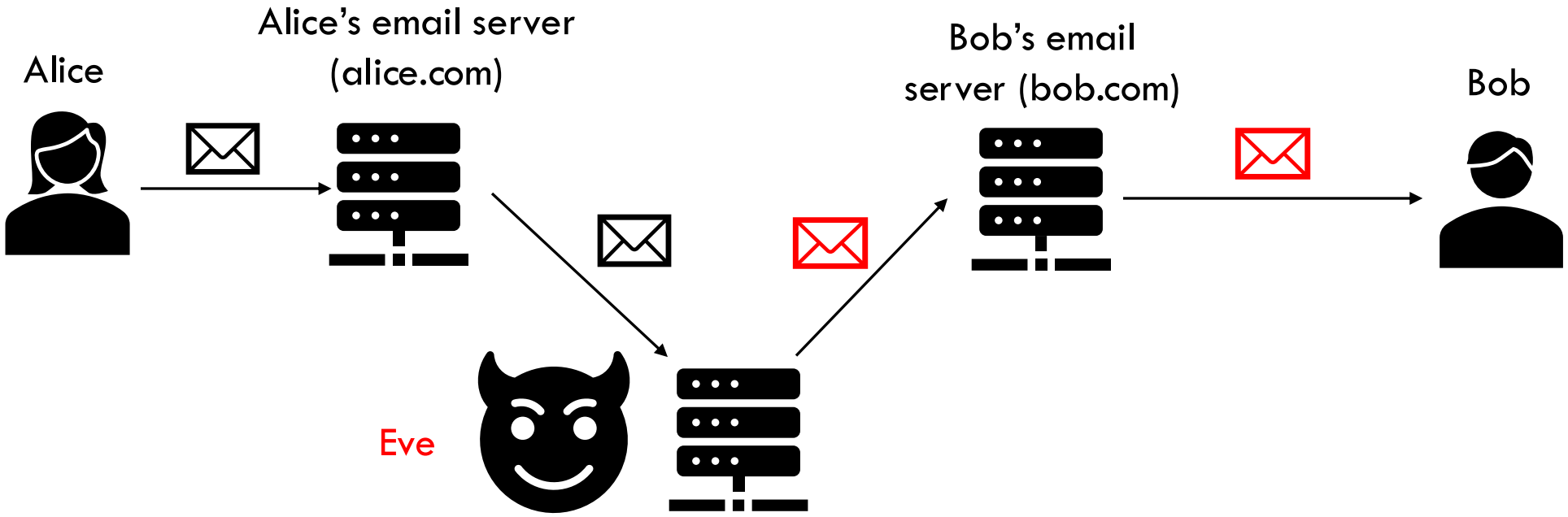
DOMAIN VERIFICATION: SENDER POLICY FRAMEWORK



- Allows current server (alice.com) send emails
- Unverified emails are not delivered

- Variants: add other servers, IP ranges…
- → A number of free SPF record generators available online

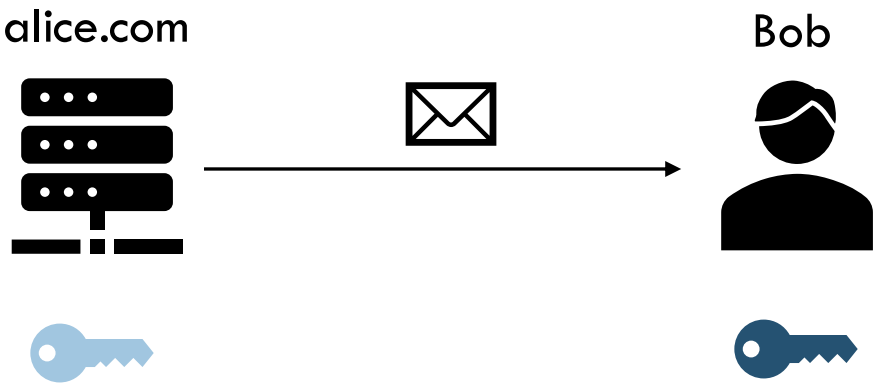
DOMAIN VERIFICATION: MESSAGE SPOOFING



- Scenario: Eve wants to impersonate Alice
- She intercepts the message sent by Alice and changes its content before it gets delivered to Bob

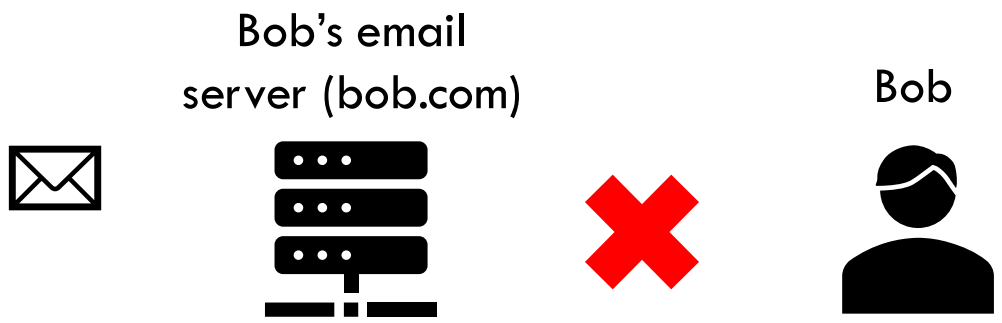
- Solution: digital signatures via DomainKeysIdentified Mail (DKIM)

DIGITAL SIGNATURE: HOW IT WORKS



- The *secret* key of alice.com needed to sign
- The *public key* of alice.com needed to verify the signature
- Signature ensures that
  - The email is sent via alice.com
  - It has not been tampered in transit

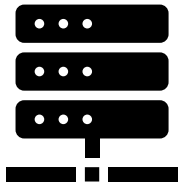
DOMAIN VERIFICATION: DOMAINKEYSIDENTIFIED MAIL



"Has this message been signed with the public key of alice.com?"

No

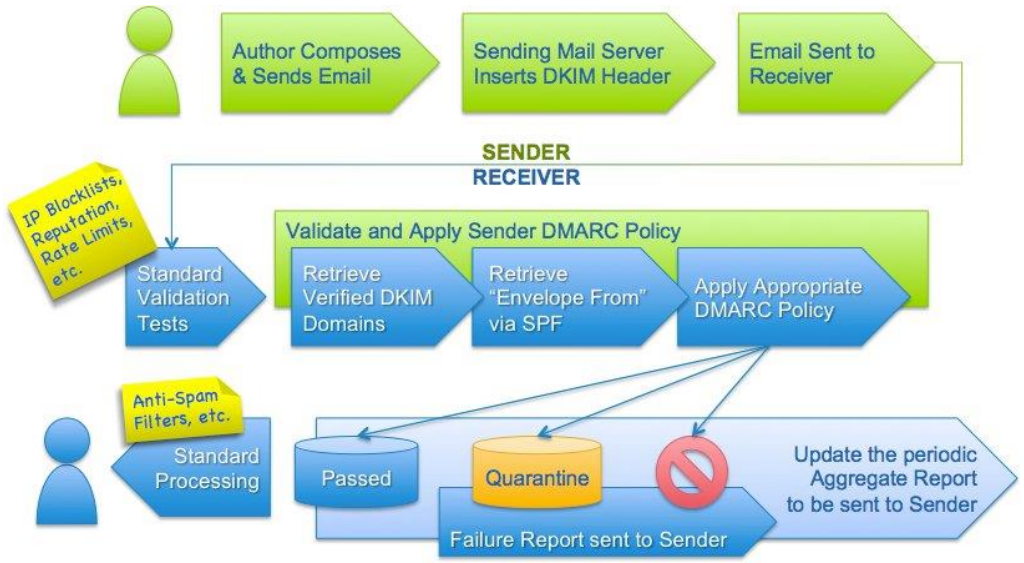
```
v=DKIM1;t=s;p=MIGfMA0GCSqGSIb3DQE
BAQUAA4GNADCBiQKBgQDTQSnWt4zsHrr2
ybQ1gq2L3Kbb035ZaPMKWHIRJ1NAyLIHc
tY8o/u05xMzYkX7opLTbpjJKI77C6z/pu
g8Z/NQntvx1Jam6++6WLuuzHgROBus+bJ
23NFFhAnsEiEW75AhhwPEBWWDSMWqJ9rJ
slEh5FE5KKKVQ8hd88tOhpPzwIDAQAB
```



DNS records

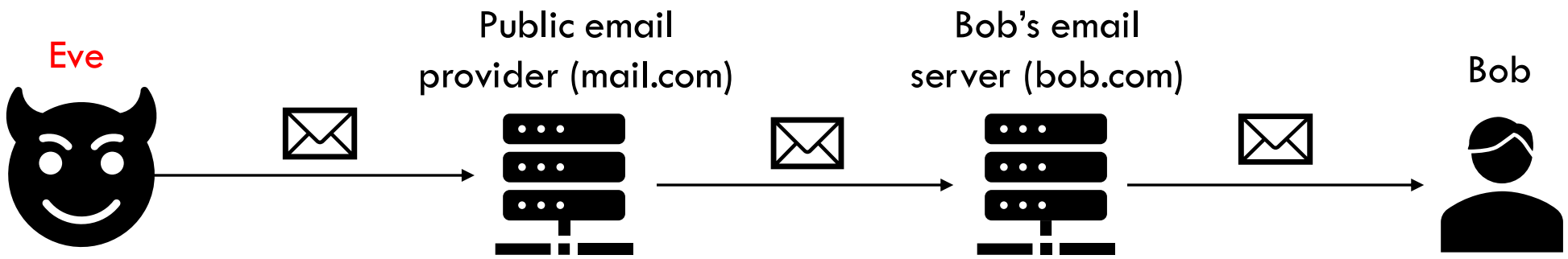
DOMAIN VERIFICATION: DMARC

- **D**omain-based **M**essage **A**uthentication, **R**eporting and **C**onformance email standard
- Integrates records for SPF and DKIM
- Includes policies for how to handle emails based on check results, e.g. quarantine for further inspection or block
- Includes generating reports for senders
- **Currently recommended as a standard for email security** → see dmarc.org for more information on implementation



Source: dmarc.org

SENDER VERIFICATION

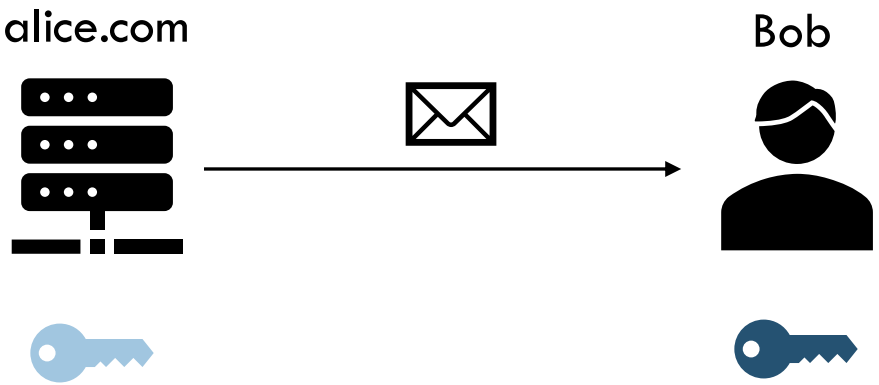


- Scenario: Eve wants to impersonate Alice
- She registers an account "alice-mail@mail.com" to use for sending her emails
- Domain verification would not work → all checks will pass!

- Solution: Alice's identity verification via digital signatures

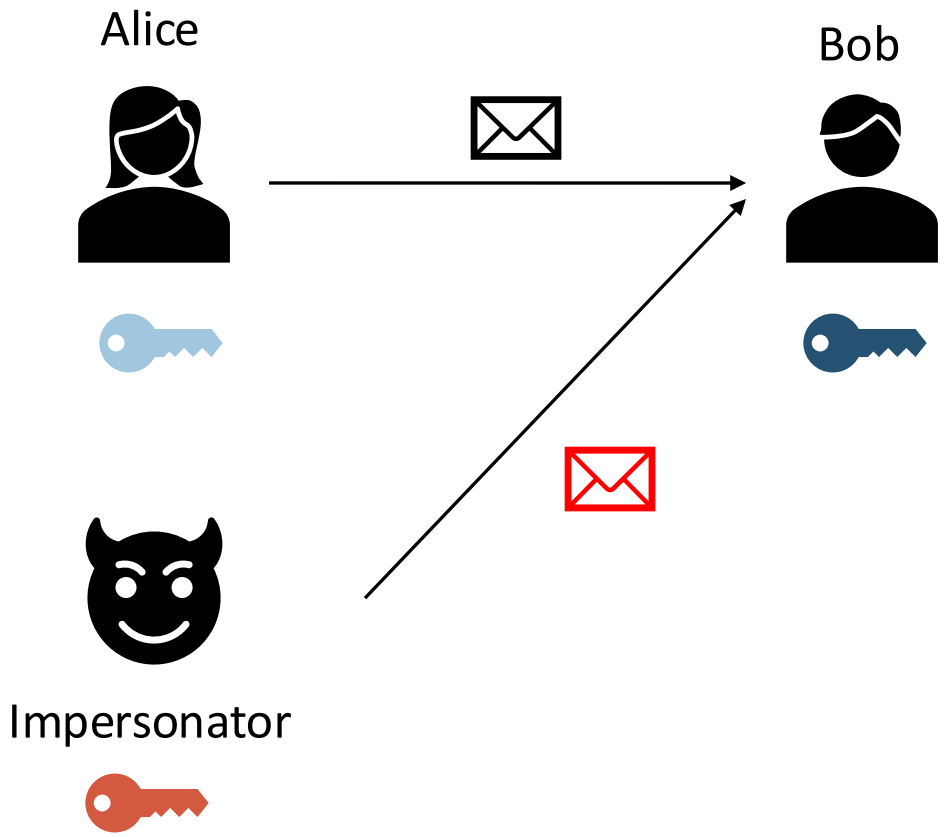
- Difference to DKIM: Alice has her personal private and public key, not necessarily connected to specific email servers

DIGITAL SIGNATURE: SECURITY ASSUMPTIONS



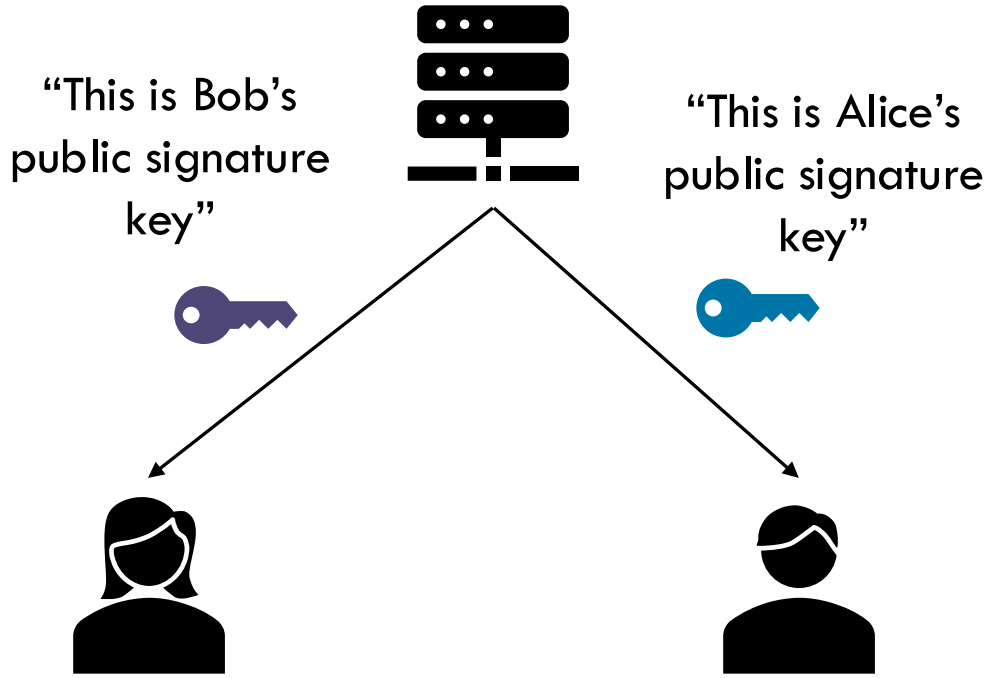
- Alice's secret key needed to sign
- Alice's public key needed to verify the signature
- Signature ensures that the email is by Alice and has not been tampered in transit under the assumptions:
  - Only Alice has access to her secret key
  - The public key Bob uses for verification is actually from Alice

DIGITAL SIGNATURE: PUBLIC-KEY INFRASTRUCTURE



- Main problem: key management
  - Eve uses her own private key to sign a message from ”Alice”
  - Bob uses public key from Eve to verify the signature of ”Alice”
- Assumption: existence of trusted PKI (Public-Key Infrastructure)

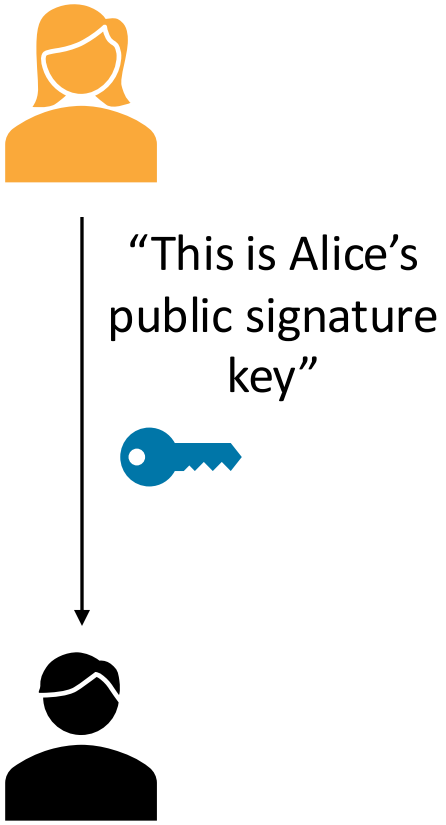
DIGITAL SIGNATURE: CENTRALISED PKI



- Centralised: ownership of public keys confirmed by trusted authority
- Example: Secure/Multipurpose Internet Mail Extensions (S/MIME)
- Problem: only works if the authority is trusted by both Alice and Bob (e.g. internal company certification server)

→ Can be a problem with decentralised nature of email communication

DIGITAL SIGNATURE: DECENTRALISED PKI



- Decentralised ("Web of trust"): Someone *whom Bob trusts* confirms that the public key he has comes from Alice
- Can be a trusted source such as Alice's personal website, social media page…
- Example: Pretty Good Privacy (PGP)

DIGITAL SIGNATURE: PROBLEMS

- Requires technical know-how to setup both for Alice to sign her messages and for Bob to verify them

- Key management becomes complicated
  - Finding correct public keys via decentralised PKI
  - Losing access to secret keys, e.g. due to data storage failure
  - Key revocation
  - Transfer of secret keys e.g. to multiple devices

→ Adoption rates of digital signatures in email is low


MOTHERBOARD
TECH BY VICE

Even the Inventor of PGP Doesn't Use PGP

Security is hard.

By Lorenzo Franceschi-Bicchierai

Source: Vice

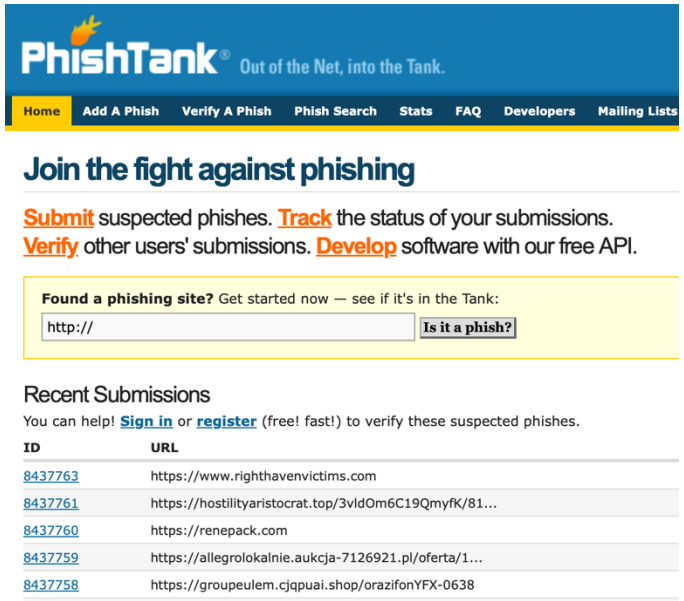
BLOCKING OF MALICIOUS CONTENT

- Known malicious content
  - Known malicious domains (see e.g. PhishTank)
  - Known malware in attachments

- Potentially malicious content
  - Look-alike domains
  - Dangerous file formats in attachments (e.g. .exe)
  - Other suspicious indicators, e.g. certain keywords

- Alternative: only allow content from ”allow-list”, e.g. only internal websites → can be too restrictive

- Alternative: include a warning in a suspicious email instead of blocking it entirely → manual verification needed



AUTOMATIC VERIFICATION ISSUES

- Possible mistakes
  - False positives → legitimate emails are blocked
  - False negatives → phishing emails reach the user

- Technical know-how required for certain methods, e.g. signing and verifying signatures

- Threat intelligence can be lacking or outdated (e.g. in identifying malicious domains)

→ Manual inspection sometimes needed

MANUAL DETECTION INDICATORS

- Look and feel, e.g. spelling mistakes
  - Can be an indicator if the email is poorly made phishing email → might be enough to repel most of the attacks
  - However, professionally-looking phishing emails can be created

- Content of the email, e.g. suspicious requests, unusual wording, ”Nigerian prince” frauds…
  - Can be an indicator in some cases (e.g. banks never asking for customers’ credit card data)
  - However, hard to detect with personalised emails

- Lack of security features (domain verification/lack of signature)
  - Can be an indicator if such features are expected
  - However, false positives possible
  - False negatives not excluded (e.g. if DMARC set up incorrectly)

- URL/attachment check: most reliable indicator, but requires knowledge on behalf of the users

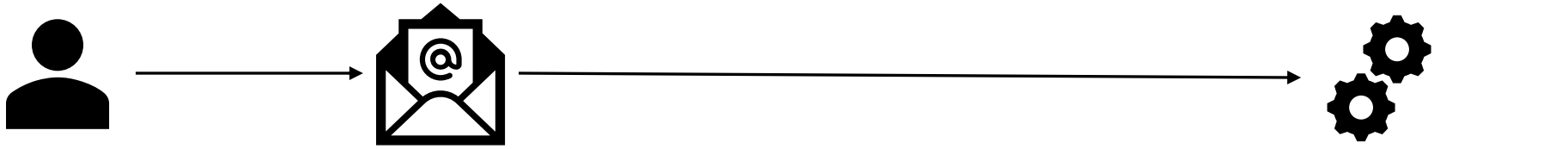
PHISHING DETECTION METHODS: SUMMARY

- Block phishing websites? → not always reliable to detect or fast enough to act
- Register all alike domains → requires resources; what if the attacker comes up with new tactics?
- Protect against sender spoofing (e.g. DMARC) → might work, but what if the recepient doesn't know the valid sender address?
- Use digital signatures → might be too complicated for the users to apply
- Rely on users to detect phishing links → unavoidable, but **can be challenging**

Why teaching users to detect phishing is hard?

TASK: PROCESSING EMAILS

What the user wants to do

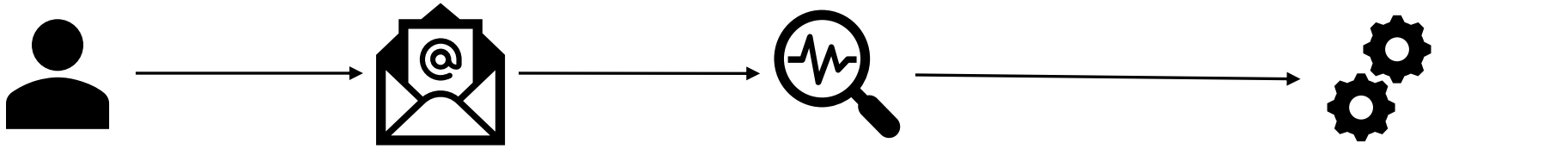


Read email

React to email
(respond, ignore…)

TASK: PROCESSING EMAILS

What the user has to do



Read email

Check whether the email is legitimate

React to email (respond, ignore…)

WHY PHISHING WORKS

- Studies in 2006 and 2015
- Goal: investigate how people deal with phishing emails
- Reasons for failing to detect phishing
  - Lack of awareness (what phishing is)
  - Reliance on non-reliable indicators (website look & feel)
  - Misunderstanding of security indicators (HTTPS)
  - Bounded attention (security is a secondary task)

Why Phishing Works

Rachna Dhamija
rachna@deas.harvard.edu
Harvard University

J. D. Tygar
tygar@berkeley.edu
UC Berkeley

Marti Hearst
hearst@sims.berkeley.edu
UC Berkeley

Why phishing still works: User strategies for combating phishing attacks ☆

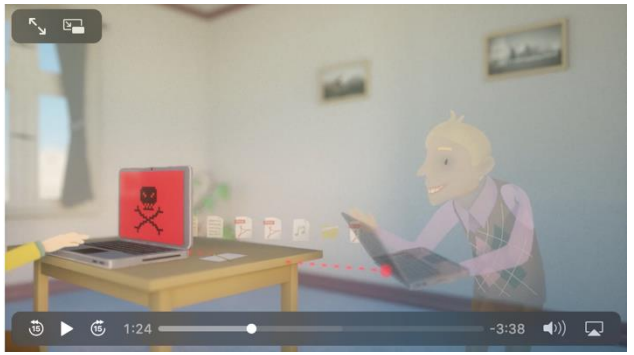
Mohamed Alsharnouby ✉, Furkan Alaca ✉, Sonia Chiasson ✉

ANTI-PHISHING INFORMATION MATERIALS

- Variety of media available: e-learning modules, videos, websites, paper materials…

- Issues to consider
  - Passive learning
  - Need to motivate users to engage with the materials (brevity vs. completeness)
  - Quality of information needs to be ensured

Anti-Phishing materials from Kalrsruhe institute of Technology:
https://secuso.aifb.kit.edu/english/1047.php



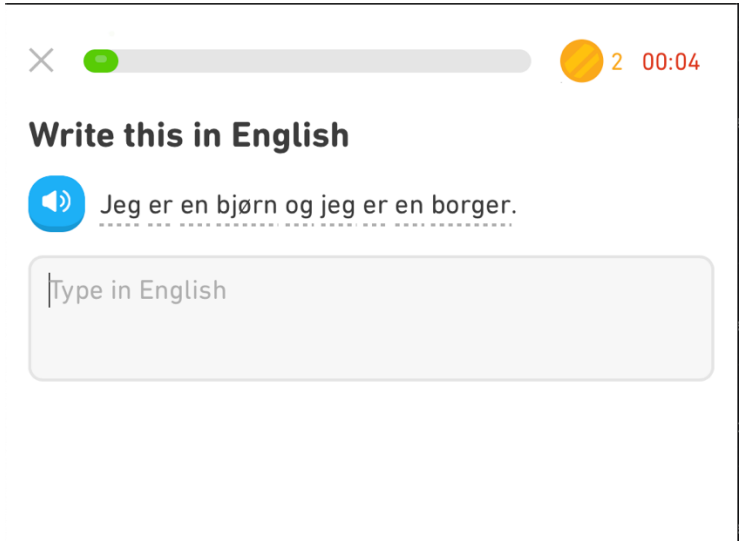
Anti-Phishing materials from Bank of America:
https://bettermoneyhabits.bankofamerica.com/en/privacy-security/how-to-avoid-email-scams

GAMIFICATION

- A common technique in education overall
  - Active learning
  - Motivation
  - Encourages regular repetition

- Application to security education: hacking challenges, CTFs, serious games…

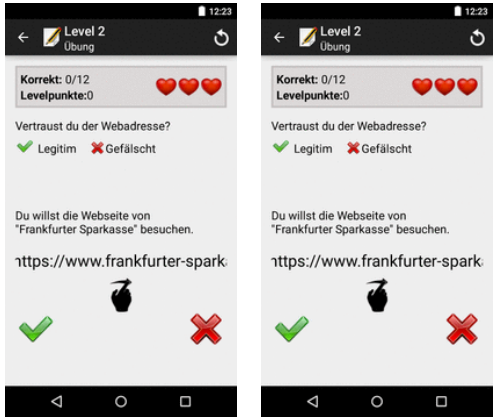
- Potential disadvantages: simplification of contents, perceived to be ”too childish”…



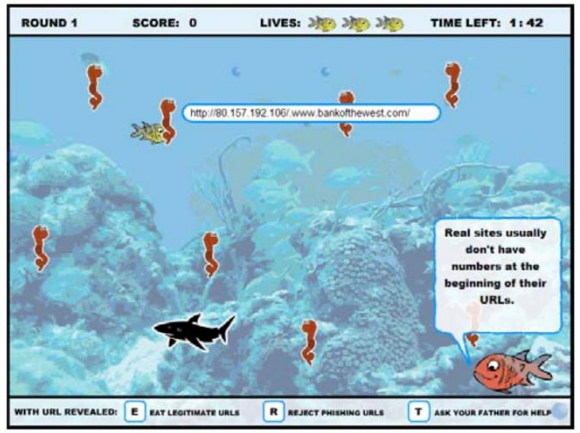
Source: Duolingo app

ANTI-PHISHING GAMES

Example: NoPhish



Example: Anti-Phishing Phil



- Studies show promising results
- However, some issues remain
  - Some users unable to distinguish between phishing and legitimate links
  - Lack of integration in real-world context

EMBEDDED LEARNING: CONCEPT

Source: http://phish-education.apwg.org/r/index.html

- Idea: use *teachable moments*
  - Send simulated phishing emails
  - If recepient clicks on the link, forward them to the landing page
- Learning-by-doing in real-world context
- Can be seen as an industry standard

EMBEDDED LEARNING: SUCCESS EVIDENCE

- A study with CMU students
  - 515 participants opting in
  - Retention study 28 days after the training
  - Three groups: control (no training), one-training and multiple-training

- Results
  - Decreased likelihood to click on phishing emails
  - Effects retain also after 28 days
  - More pronounced with multiple-training

→ **Problem solved?**

School of Phish:
A Real-World Evaluation of Anti-Phishing Training

Ponnurangam Kumaraguru, Justin Cranshaw, Alessandro Acquisti,
Lorrie Cranor, Jason Hong, Mary Ann Blair, Theodore Pham
Carnegie Mellon University
{pkumarag, jcransh, acquisti,
lorrie, jasonhon, mc4t, telamon}@andrew.cmu.edu

EMBEDDED LEARNING: SUCCESS EVIDENCE

- Follow-up study
  - 1,359 employees
  - Participants informed about the real purpose *after* the study
  - Three phases of study with 3-4 months interval

- Two groups
  - Control (landing page with only a warning about being phished)
  - Training (landing page with additional information on how to detect phishing)

Deanna D. Caputo | MITRE
Shari Lawrence Pfleeger | I3P Dartmouth College
Jesse D. Freeman | MITRE
M. Eric Johnson | Vanderbilt University

EMBEDDED LEARNING: SUCCESS EVIDENCE

- Results: no significant improvement
  - No difference between training vs. no training
  - People who did not click on the link in the previous phases were less likely to click again

- Follow-up interviews: people admitting not to read the text on the landing page

- Reported feelings of fear, shame, anger (towards themselves and towards the study)…

→ **Effectiveness of the training method inconclusive**

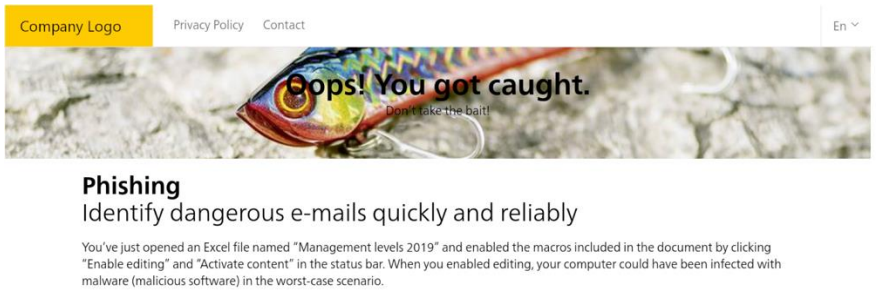
EMBEDDED LEARNING: SUCCESS EVIDENCE

- Follow-up study
  - > 14,000 employees studied for over 15 months
  - Study integrated into company's awareness campaign

- Several conditions
  - Presence or absence of warning within the email
  - Embedded learning with training information on landing page vs. no information
  - Various types of report feedback

Phishing in Organizations: Findings from a Large-Scale and Long-Term Study

Daniele Lain, Kari Kostiainen, and Srdjan Čapkun
Department of Computer Science
ETH Zurich, Switzerland
{daniele.lain, kari.kostiainen, srdjan.capkun} @inf.ethz.ch



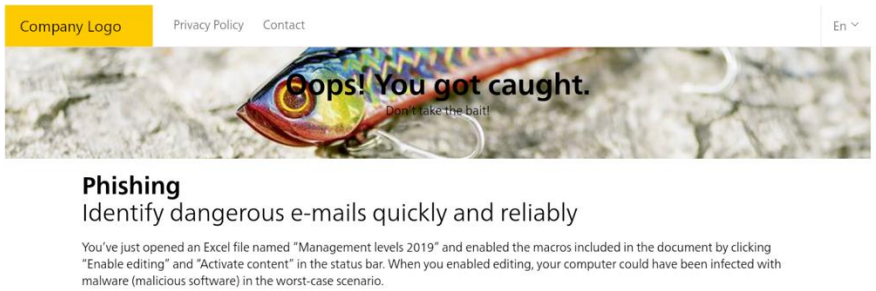
EMBEDDED LEARNING: SUCCESS EVIDENCE

- Results: Embedded training does not improve future phishing detection rate
- Even worse: participants were more likely to click on a phishing link again after being exposed to a training page
- Possible explanations: sense of false security after seeing the landing page: ”my company keeps me safe”

→ **Embedded learning can be harmful under certain conditions**

Phishing in Organizations: Findings from a Large-Scale and Long-Term Study

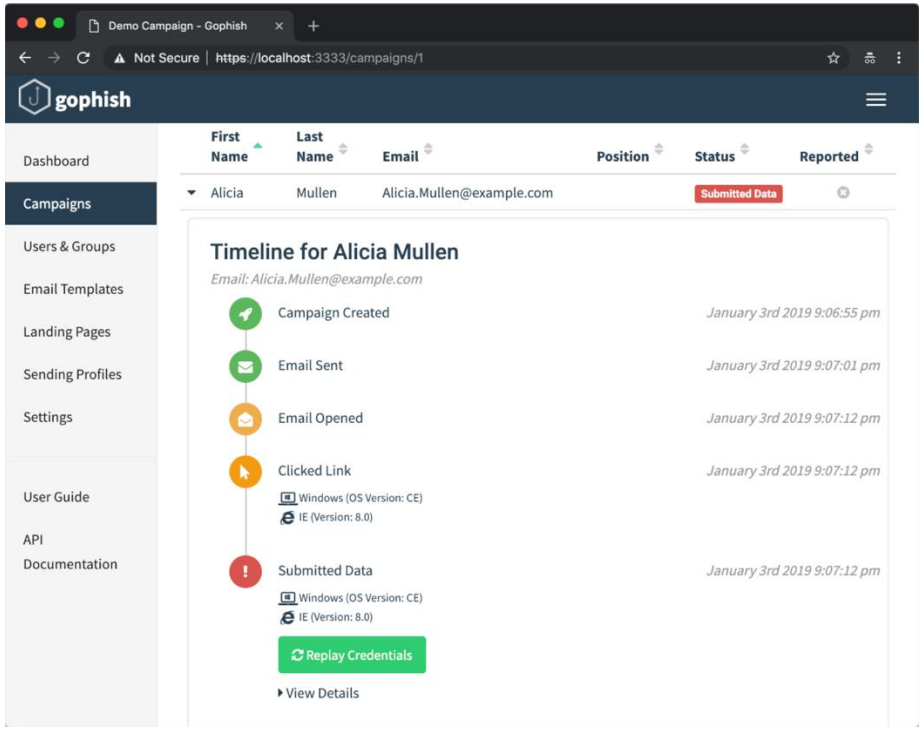
Daniele Lain, Kari Kostiainen, and Srdjan Čapkun
Department of Computer Science
ETH Zurich, Switzerland
{daniele.lain, kari.kostiainen, srdjan.capkun} @inf.ethz.ch



SIMULATED PHISHING CAMPAIGNS

- Goals
  - Evaluation: how many people click on the link/enter their credentials?
    - How vulnerable the organisation is to phishing attacks?
    - How effective the conducted security awareness measures are?
  - Teaching, e.g. combined with additional awareness materials

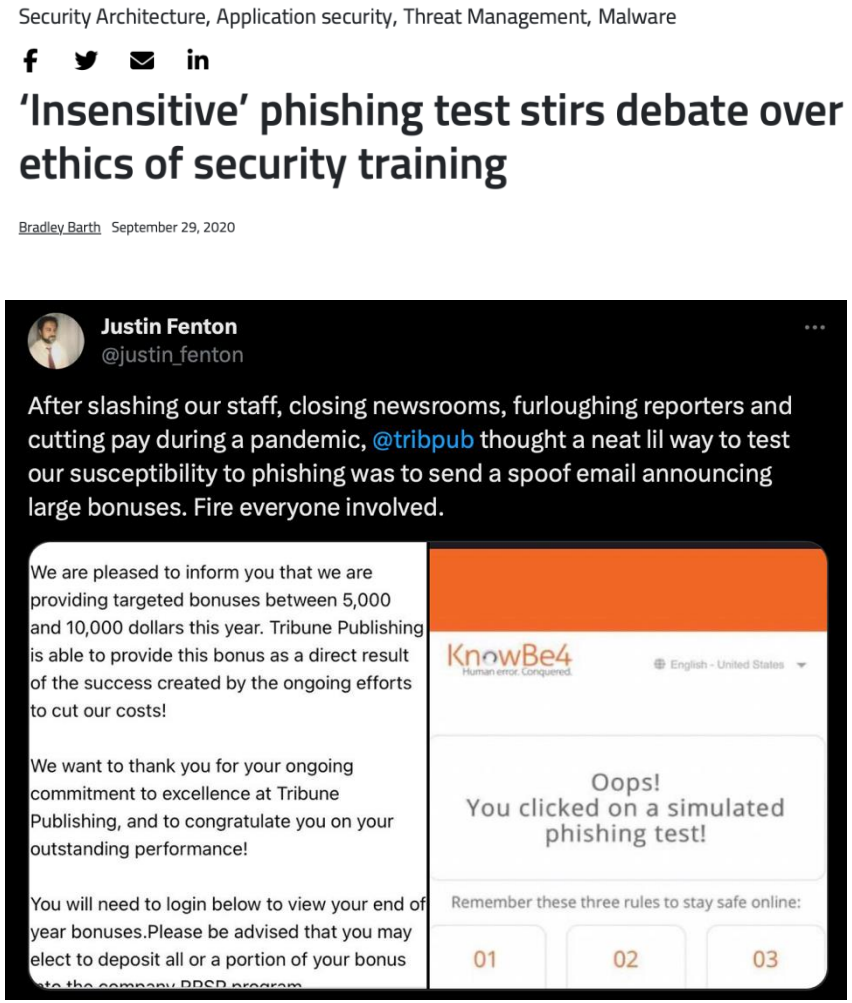
- Collected data
  - Rate of clicks or data entries only
  - Names of people clicking or providing data (e.g. entering passwords) on the website
  - Specific data provided on the website



Source: GoPhish platform blog

SIMULATED PHISHING CAMPAIGNS

- Type of phishing emails: topics, difficulty in detection (e.g. spear phishing vs. more generalised phishing),…
- Time of distribution (e.g. one-off or prolonged campaign)
- Notification of employees in advance
  - Not notifying might lead to a more realistic scenario
  - However, ethical issues might arise
- Notification of employees during or after the campaign
  - Individual notifications e.g. after clicking on the link
  - Announcements at the end of the campaign



ISSUES WITH SIMULATED PHISHING CAMPAIGNS

- Weakening of email filters might be necessary, potentially leading to real phishing attacks coming through
- Attackers might use the campaign as pretext for their attacks
- If employees are informed (before or during the campaign), they might click on actual phishing links believing they are simulated ones (and therefore harmless)
- IT help desk might be overwhelmed with reports of simulated phishing emails and therefore miss the reports of real attacks

Other issues: legal, ethical… → see the study ”Analysing Simulated Phishing Campaigns for Staff” by Volkamer, Sasse and Boehm

ISSUES WITH SECURITY EDUCATION

- One-time measures are not enough
  - Habits take time to change
  - New people come to the organisations
  - Threats change, attackers become more clever etc.

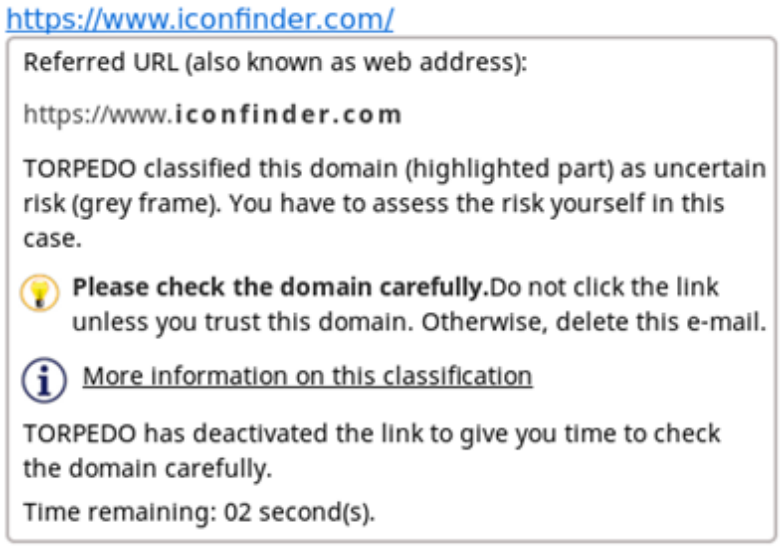
- Putting responsibility solely on the user
  - Are there unreasonable demands on the users?
  - Do the users know how to report a phishing link?
  - Are there consequences for the user of reporting clicking on a phishing link?

- Lack of actionable advice
  - Instructions unclear (”don’t click on suspicious emails”)
  - Instructions unrealistic (”don’t visit websites you don’t know”)

Source: https://takefive-stopfraud.org.uk

FURTHER HELP IN DETECTING PHISHING

- Hints in email clients – warn if the link or the sender look suspicious
- Domain highlighting in browsers – help to identify the actual domain
- Password managers – if the website is not recognised, it might be a phish



Source: TORPEDO email plug-in (https://secuso.aifb.kit.edu/english/TORPEDO.php)

PHISHING DETECTION ISSUES

- Limited attention span, only focusing on unusual emails
- Spear phishing attacks are hard to detect, especially if coming from a compromised account
- Effectiveness of tools hard to evaluate
  - Lab study – conditions different from real-world context
  - Simulated phishing campaigns – issues mentioned earlier

Measures against phishing: recommendations

LAYERED APPROACH FOR ORGANISATIONS, NCSC

- Make it harder for attackers to reach your users
- Help users identify and report phishing emails
- Minimise impact of phishing emails
- Respond to incidents

→ See https://www.ncsc.gov.uk/guidance/phishing for more details

MAKE IT HARDER FOR ATTACKERS TO REACH YOUR USERS

Make it harder for attackers to reach your users

Help users identify and report phishing emails

Minimise impact of phishing emails

Respond to incidents

- Prevent sending out emails from unauthorised senders
  - Blacklisting
  - DMARC

- Consider information available to the attacker
  - Can the attacker learn names and emails of persons they might want to target and/or impersonate?
  - Can the attacker learn information about organisation (e.g. recent organisational changes) they can use to make their attacks more convincing?

→ See ”Social Engineering” lecture for methods of information gathering

HELP USERS IDENTIFY AND REPORT PHISHING EMAILS

Make it harder for attackers to reach your users

Help users identify and report phishing emails

Minimise impact of phishing emails

Respond to incidents

- Use tools and education campaigns to inform users about features of phishing emails
  - Indicators such as sender, URL
  - Common tricks such as sense of urgency
  - Contextual indicators, e.g. does it make sense for this person to make this request?
- Provide reliable ways for users to get support or report phishing emails
  - Ensure communication channels to verify whether an email is legitimate
  - Ensure communication channels to report a suspicious email, including providing feedback
  - Avoid blaming the user

MINIMISE IMPACT OF PHISHING

Make it harder for attackers to reach your users

Help users identify and report phishing emails

Minimise impact of phishing emails

Respond to incidents

- Goal: even if some users fall for phishing, the attacker should not be able to cause too much damange
- Regular updates and good security configuration – no malware infection just by visiting the website or reading the email
- Unique password for every account – leaked credentials will only give access to one account
- 2FA and other alternatives to passwords – stolen credentials are useless by themselves
- Least privilege – compromised accounts should not have too many rights

RESPOND TO INCIDENTS

Make it harder for attackers to reach your users

Help users identify and report phishing emails

Minimise impact of phishing emails

Respond to incidents

- Goals of incident response
  - Timely reaction to ongoing attacks (e.g. by blocking specific senders or compromised accounts)
  - Threat intelligence for future attacks
- How to approach incident response
  - Provide reporting channels for users → security culture important for ensuring that users choose to report incidents
  - Set up monitoring tools for detecting unreported attacks (e.g. via security logging systems)
  - Plan incident response processes

SUMMARY

- Phishing is a serious threat to organisations and end users

- Individual measures are helpful but not sufficient in isolation
  - Technical measures to block phishing emails, e.g. DMARC
  - Educating users how to recognise phishing
  - ..

- A holistic approach is required
  - Combination of prevention, detection, mitigation measures
  - Technical measures integrated with user education
  - Critical to ensure good security culture in an organisation

FIND OUT MORE

https://gamess.dk/

GameSS

WHO IS BEHIND GameSS

Partners behind the project

SDU

DTU

IT UNIVERSITY OF CPH

AALBORG UNIVERSITET

Happy 42

Collaborators

ERHVERVSAKADEMI AARHUS

kea KØBENHAVNS ERHVERVSAKADEMI

Dania ERHVERVSAKADEMI

UCN

UCL Erhvervsakademi og Professionshøjskole

Supported by

Uddannelses- og Forskningsministeriet

Ministry of Higher Education and Science Denmark