Usable Security and User Training

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Think about it:

Is the Doodle link to the right secure?

Sign up for tutorial sessions

`http://doodle.com/poll/t7ia4mbv9vk8ekec`

Link is also available on the website, which is at:

`http://www.inf.ed.ac.uk/teaching/courses/cs/`

First, the news…

- And someone messes up SSL certs again…
  - http://arstechnica.co.uk/security/2016/09/firefox-ready-to-block-certificate-authority-that-threatened-web-security/
  - http://www.theregister.co.uk/2011/08/29/fraudulent_google_ssl_certificate/
  - http://arstechnica.com/security/2015/10/still-fuming-over-https-mishap-google-gives-symantec-an-offer-it-cant-refuse/
  - http://arstechnica.com/security/2015/02/lenovo-pcs-ship-with-man-in-the-middle-adware-that-breaks-https-connections/

Quick explanation of SSL
We will cover this in more detail later

Slides with this background are from a talk given at the Royal Society Frontiers of Science event on why encryption is not adopted at scale

Encryption (in transit) properties we want:

1. The communication between you and the other party is **confidential** and has **not been changed**
   - *No one can read what you sent*
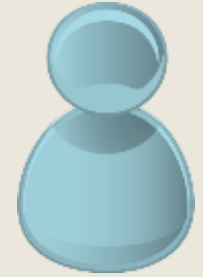   - *No one can change what you sent*

2. **Knowing who** you are communicating with
   - *You are talking to who you think you are talking to and not someone else*

Alice wants to talk securely with Bob

She can encrypt the connection (1)

Alice
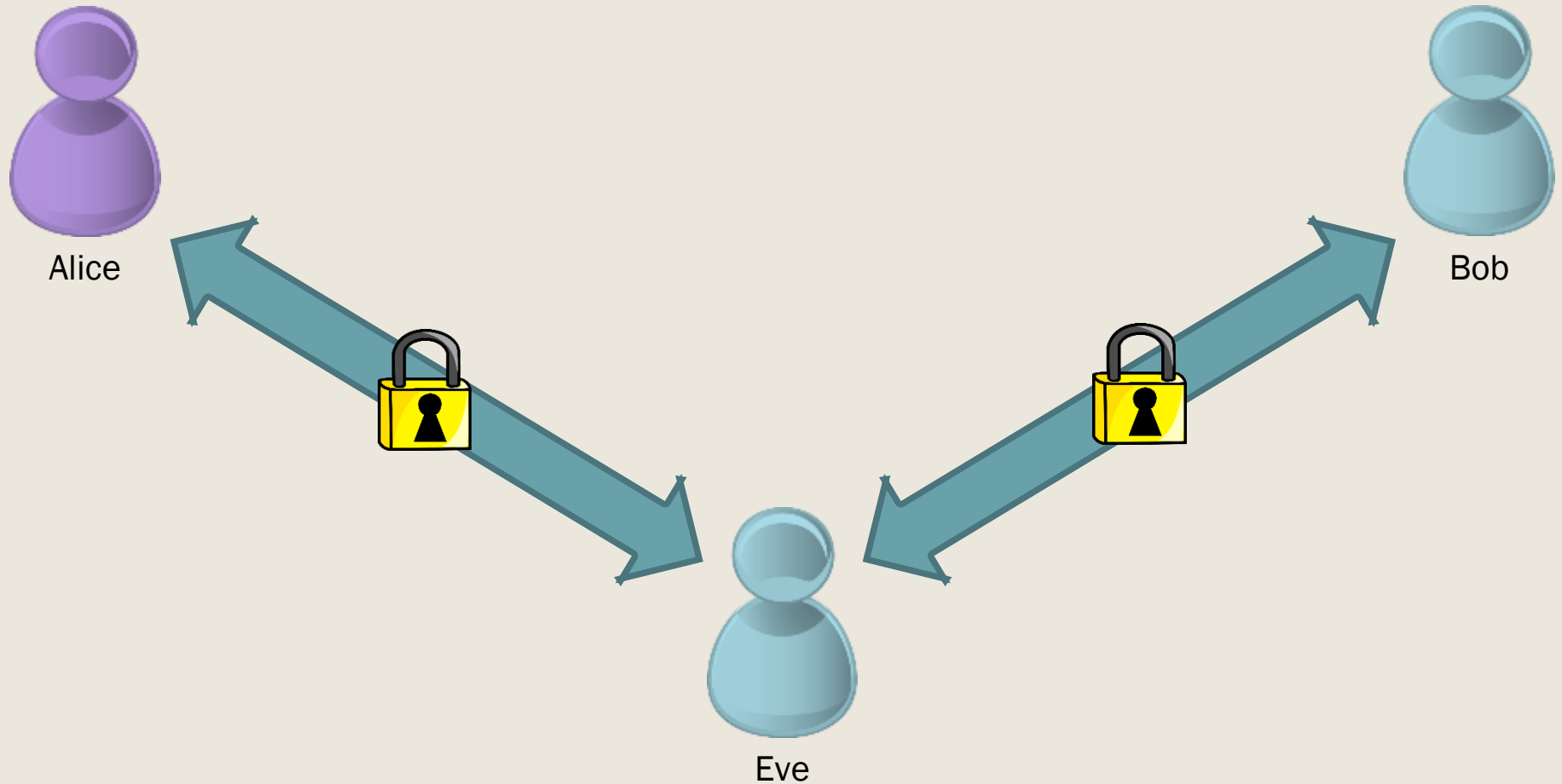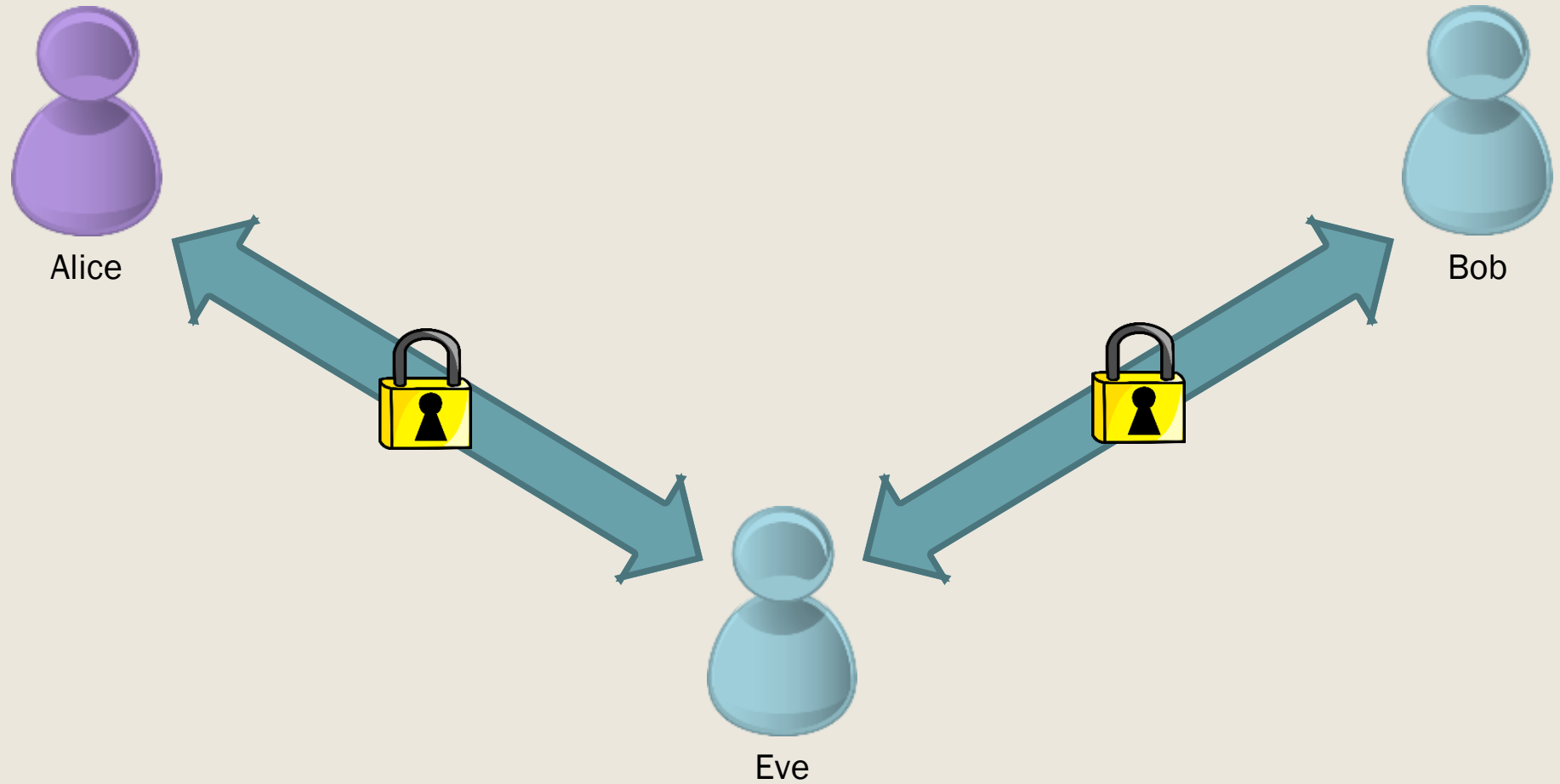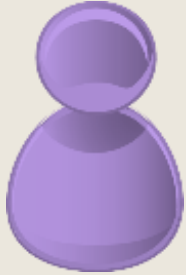
Bob

But how can Alice know she is talking to Bob and not talking to Eve? (2)

Alice

Bob

Eve

Man in the middle attack

Alice goes to her favorite coffee shop and tries to visit BBC News

Alice

Benign Main-in-the-Middle

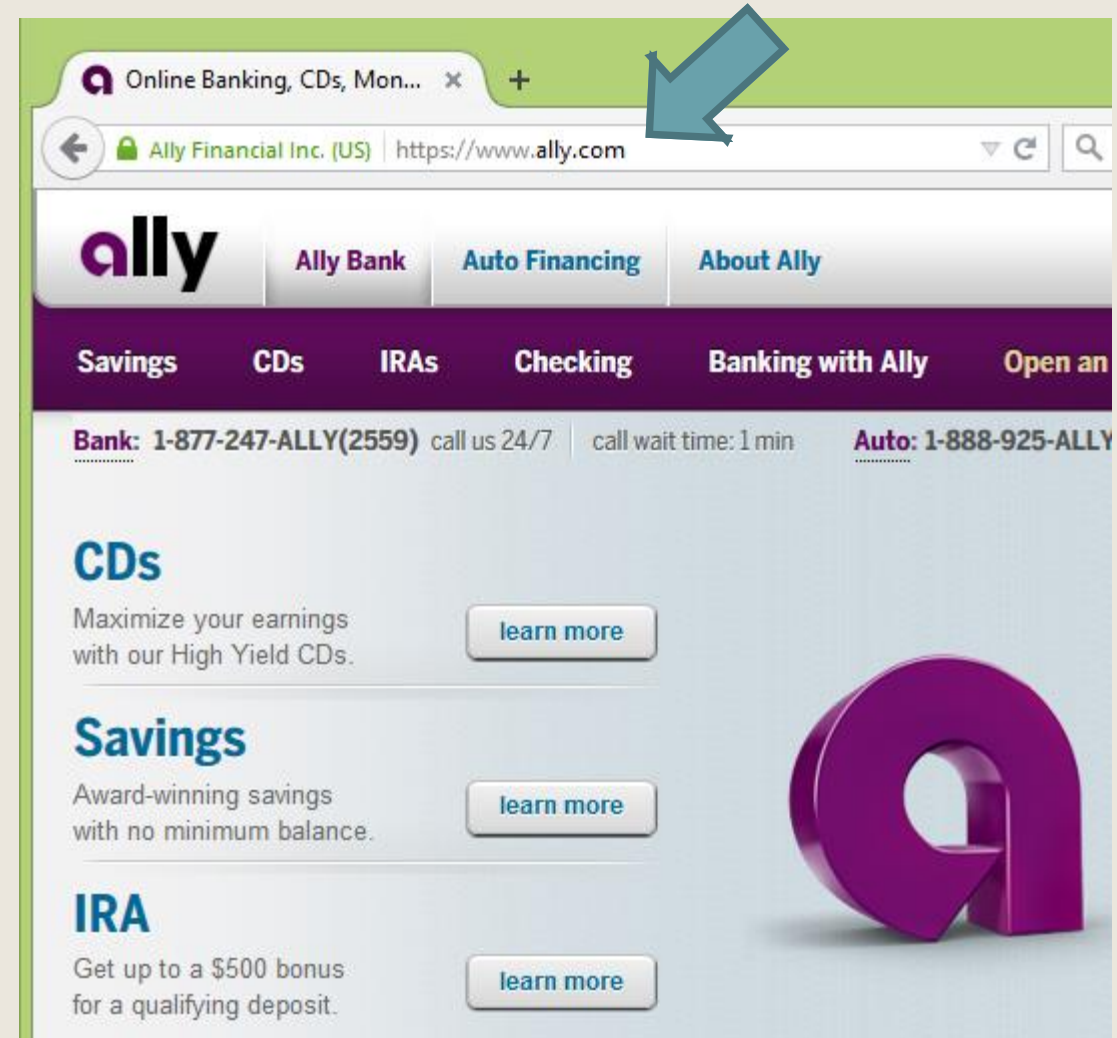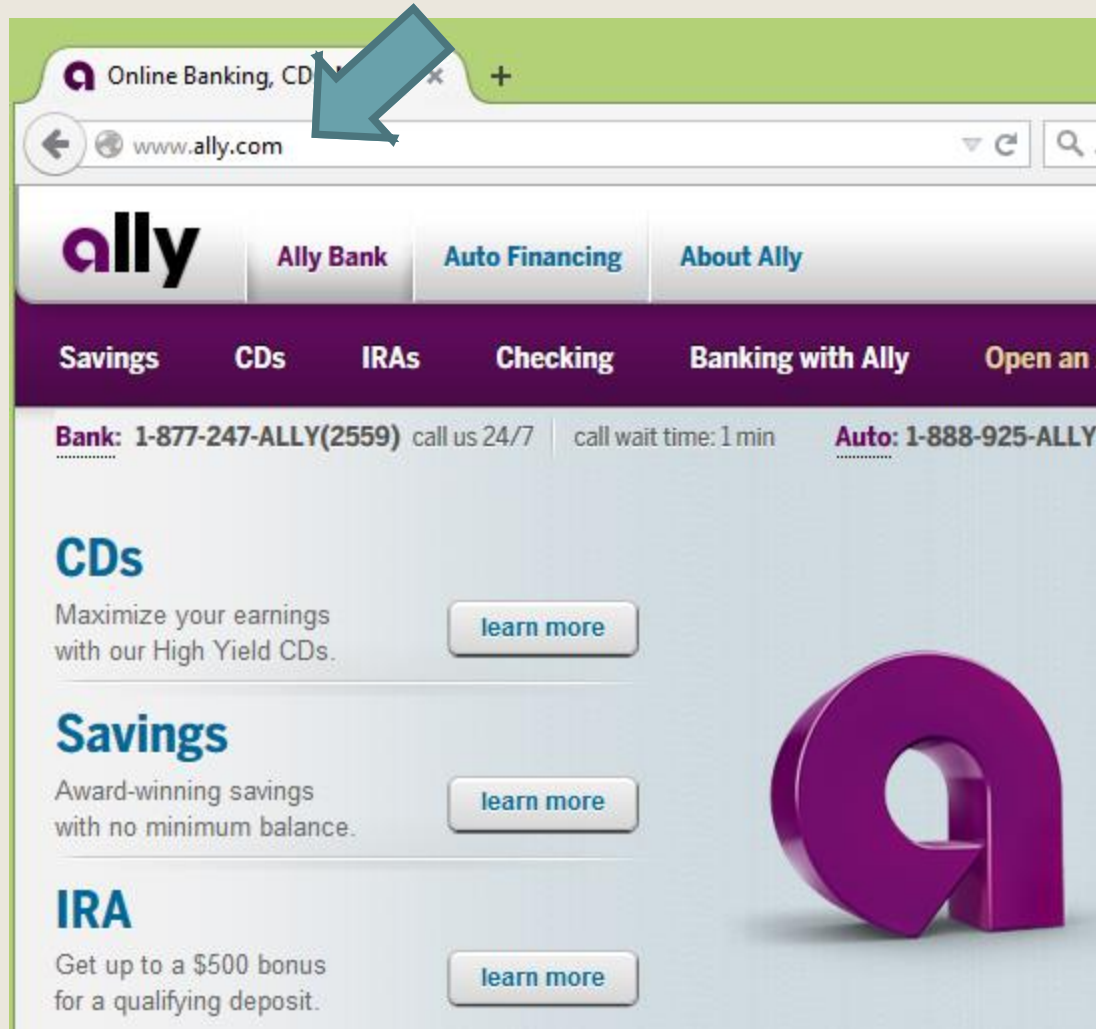https://ally.com

versus

http://ally.com

http versus https

Encryption properties we want:

1. The communication between you and the other party is **confidential** and has **not been changed**
   - *No one can read what you sent*
   - *No one can change what you sent*
2. **Knowing who** you are communicating with
   - *You are talking to who you think you are talking to and not someone else*

Key management

- Public/private key pairs
  - *Give public keys to other people*
  - *Keep private keys private*
  - *Verify other people's public keys*
- Keys are linked to identities
- A private key should NEVER be shared, so only one entity theoretically has access to it
- Possession of a private can be cryptographically proven when starting a communication IF you have the public key

My public key

-----BEGIN PGP PUBLIC KEY BLOCK-----
Version: GnuPG v2

mQENBFHMcgABCAC9WrYDO6K2L3VHyi4eHN6suHLqMpJ+SO+IUTuLEVnUzIoXAUXH
KozHejfV/9XoG8j933ZtszXKCog3aMESe0E0z6fNGfolvaCe5B4jwqoJt8NHwb5L
B2dnqOCpIgXcN2GJxfEHHUaf27COSobCJxPMeshUh4ZHke+g6DatmiEtBpVp41Ot
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BwMCAQYVCAIJCgsEFgIDAQIeAQIXgAAKCRCTdsxl9/HZffG+CACShuKxje3QAqew
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lZ6zOEpf6A18iFXx3JgQZdwPD0jtBiWNpOyMeBGTglvEYG3so2VueQoeXcq3dbYp
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YiGr5weIMFwAvxZOaRxEa9Vf48jiWvrxuJ8YfHWSOhEScNOcYC2P8q20IJwwE26T
lpdtrwCqtB1LYW1pIFZhbmllYSA8a2FtaUB2YW5pZWEuY29tPokBQgQTAQIALAIb
IwUJCWYBgAcLCQgHAwIBBhUIAgkKCwQWAgMBAh4BAheABQJWCmMeAhkBAAoJEJN2
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XBYib1A5uHaatLfyjeXaD3qMEoZnQHoYMGE0GKu00wWsbhfoQzHPgwzRLkD1i75M
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9wb9uUsu9+/P8pz4JILMDSevjfT7zSRSl/YP3fOfZ6N4bc+KOdwPM7u5Iyoeu9zh
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bFBpsUuBGaYZTSS05x1RdXHqpEbgap8dtuHhVvJw9QYDQBJr0K4aKyG9qqMD8cta
PI/FAdyAqwH8Nw9efqAK+RQxSVUaue9BYEnbIRpsDK6MkP3YMFmu5ki5AQ0EUcxy
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42c7i/WRVxE1BJTiarKGsEvCi94TTXSIUKAt3T1oGBtXmGvqbGBq8IjSGI1UTwdF
5yu50JyRSf2fqRND6P/2eHNXejDUtdvhUXIUt8h9MuUO/ipD0DnwIvMnAATJHA+R
Zqw6oNpyjRGzvr3iuWUwe4PtyJDI3ELAFkbp/NAc5TIuVHRHNOWNplcIJhM5zHuB
QQb3G/EsCn2PQZ5w5SDzavF2SpvQfDqxYpDaTLAXtF+wsJL5iaUjxwRgJPOdbCZf
2Tozd7h9MXtGJDlPKJ8eLG8ogcMAEQEAAYkBJQQYAQIADwUCUcxyAAIbDAUJCWYB
gAAKCRCTdsxl9/HZfS+hB/9BJqSmIgcoHFXnb1PVIKxekzL8+WVm5Pk/EgMQSLZ2
HX4p3iaI5PEPcYgUw9YnaG4i00dwJGw5/daTWRrTzcnKd8YqoP+DU0t96HZDSu3m
mCzE9NVAQYboFbVmGOx0eo627UBSvFqaXvAxBDYkoR8B0TnKhrQFwXkZVb30hKwD
TgAFjOGlZiE6uAdST231tFaq0bizYfe5AVXRqro20xBqNbaJNqs3SW0D831Syvdv
lIOBx83/ROgg7hUkI6F2vzXicWmUwFSXRrggCSbLosHsP6isBWwvIHeRmna/aQab
YKG3gbV9iyczAS31gbogVLAZqNSWhp8vVIEE28Fyf/Ed
=x5FK
-----END PGP PUBLIC KEY BLOCK-----

Idea: Certificate Authorities can do the verification instead of users

ars technica

MAIN MENU ▾   MY STORIES: 2 ▾   FORUMS   SUBSCRIBE   JOBS   ARS CONSORTIUM
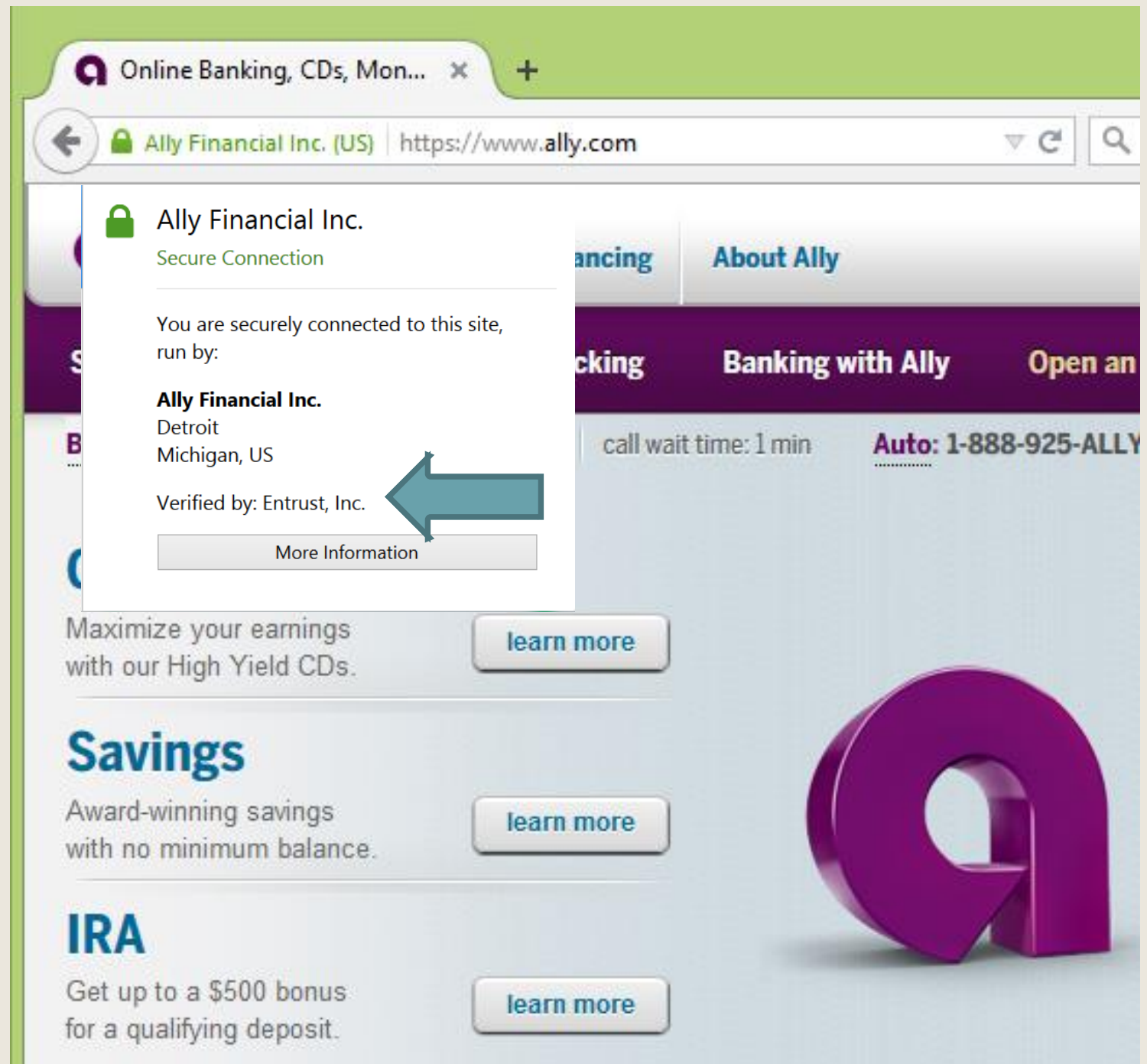
RISK ASSESSMENT / SECURITY & HACKTIVISM

Lenovo PCs ship with man-in-the-middle adware that breaks HTTPS connections [Updated]

Superfish may make it trivial for attackers to spoof any HTTPS website.

by Dan Goodin - Feb 19, 2015 11:36am EST
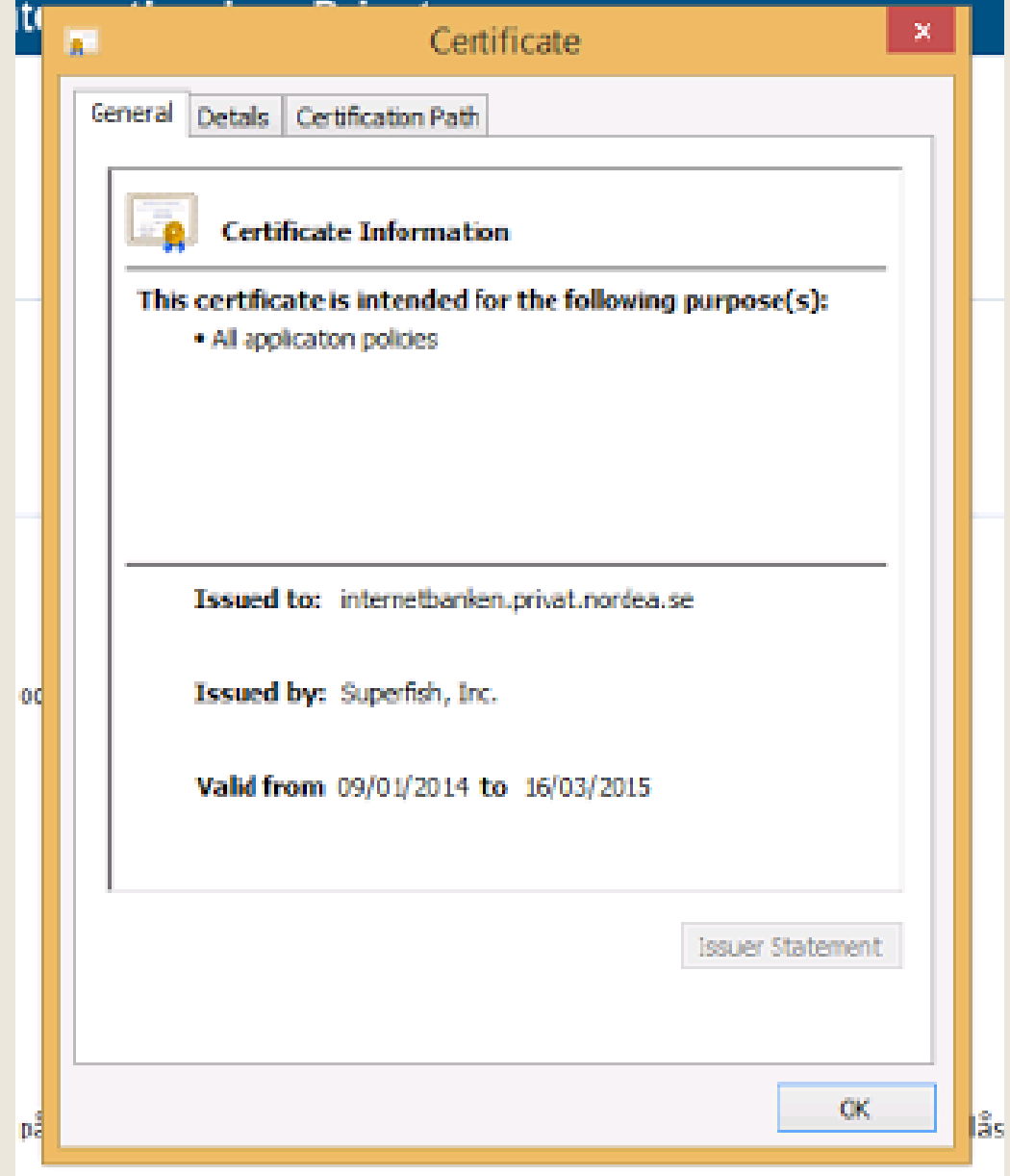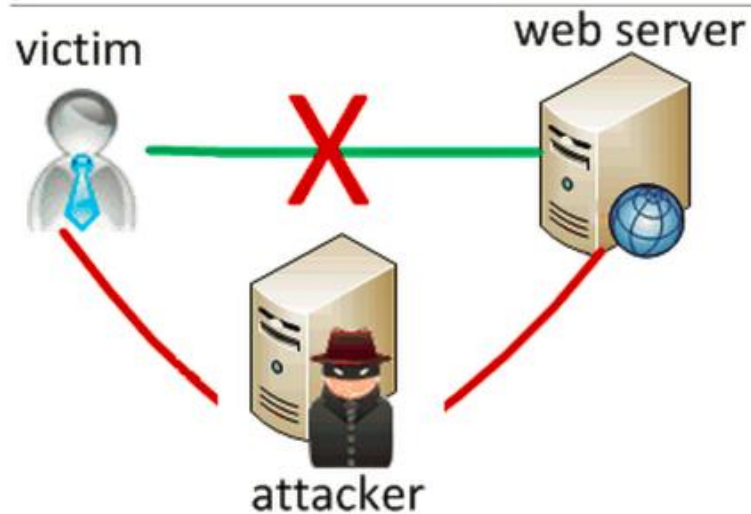
f Share   🐦 Tweet   333

victim   web server

attacker

📷 Web Programming Step by Step, 2nd Edition

Certificate

General | Details | Certification Path

Certificate Information

This certificate is intended for the following purpose(s):

- All application policies

Issued to: internetbanken.privat.nordea.se

Issued by: Superfish, Inc.

Valid from 09/01/2014 to 16/03/2015

Issuer Statement

OK
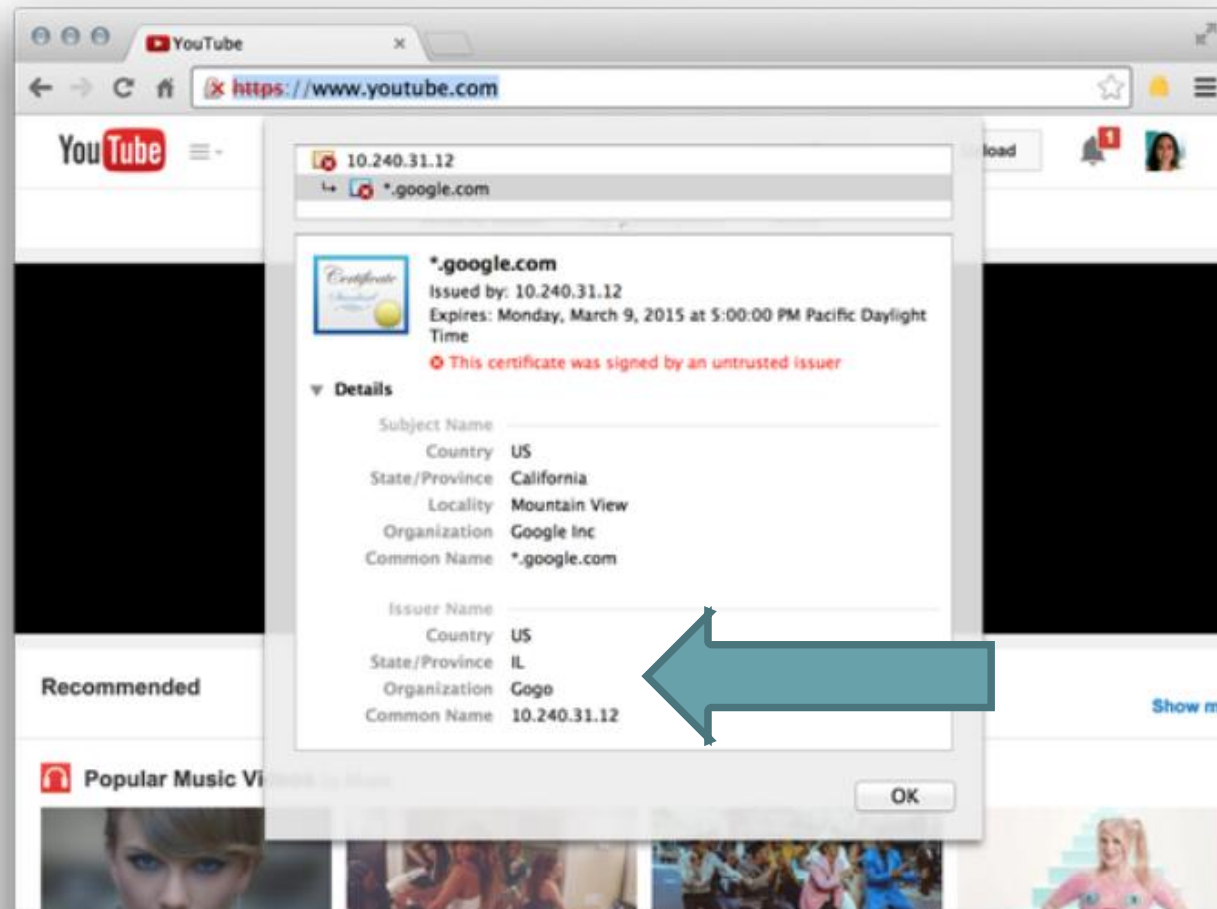
Real world click-through rates

■ Studied the click-through rate for malware and HTTPS warnings

■ Malware
  – *Firefox 7.2%*
  – *Chrome 23.2%*

■ Phishing
  – *Firefox 9.1%*
  – *Chrome 18.0%*

■ HTTPS
  – *Firefox 33.0%*
  – *Chrome 70.2%*
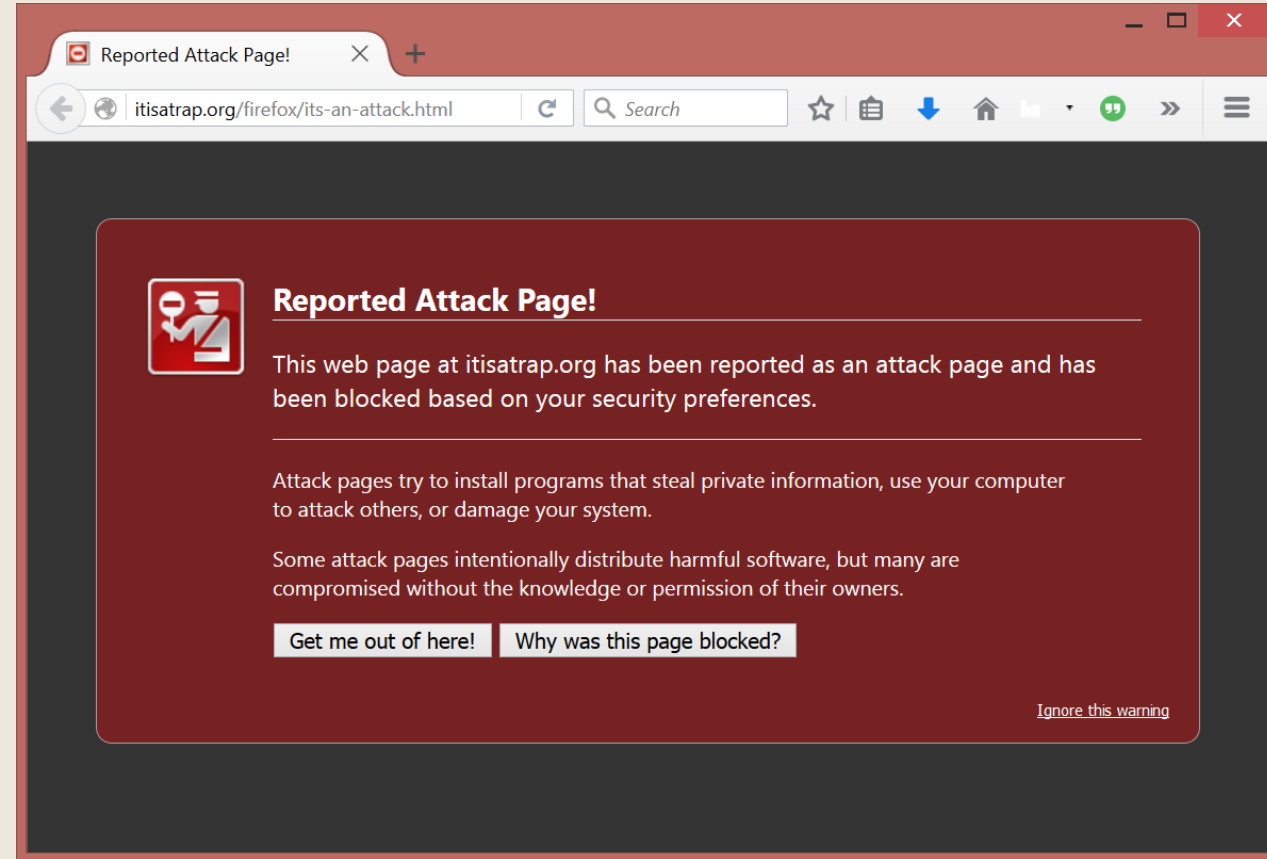
Almuhimedi, Hazim, et al. "Your Reputation Precedes You: History, Reputation, and the Chrome Malware Warning." Symposium on Usable Privacy and Security (SOUPS). 2014.

Click through rates based on if the user had visited the site in the past
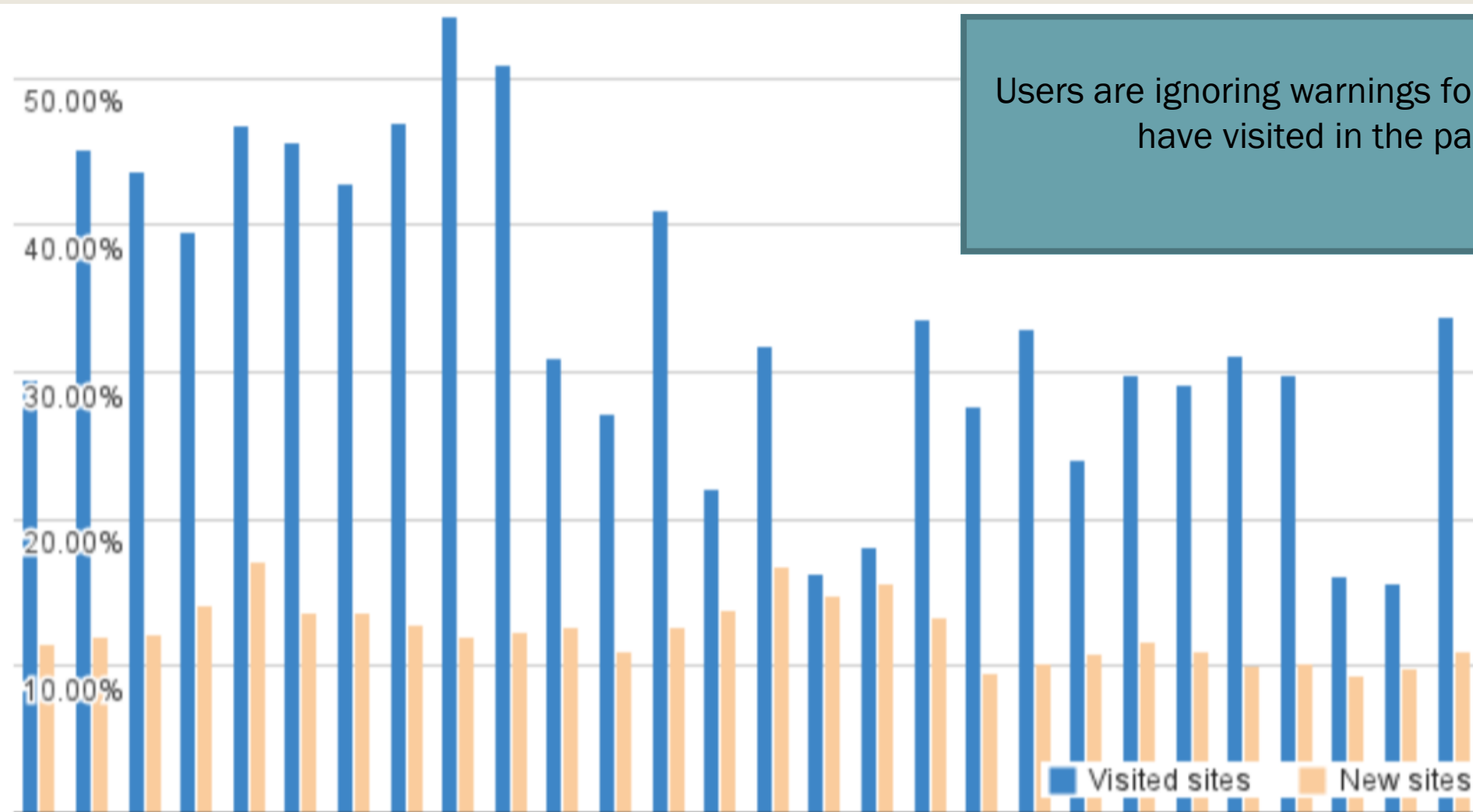
Users are ignoring warnings for sites they have visited in the past

Almuhimedi, Hazim, et al. "Your Reputation Precedes You: History, Reputation, and the Chrome Malware Warning." Symposium on Usable Privacy and Security (SOUPS). 2014.

Why do people click through the warnings?

- The site is used often and trusted
  - *"YouTube is a well known website. I'd assume that the malware block is in error."*

- The person who posted the link is trusted
  - *"I find it harder to believe [the warning] when my facebook friend just posted it and had no problems."*

- The site where the link is assumed to have good security
  - *"I presume that visiting youtube from a facebook link would be safe."*

- They think they are safe
  - *"I use Linux I'm not afraid of anything."*
  - *"I have an anti virus"*

Why people don't use privacy protections

1. People don't really care about privacy
2. People are not aware of the privacy issues
3. People are not aware of how to protect themselves
4. People are aware, but are unable to use the privacy protections

Communication-Human Information Processing Model (C-HIP)

- Developed to model why people do or don't understand road signs
- We adapted it to computer security
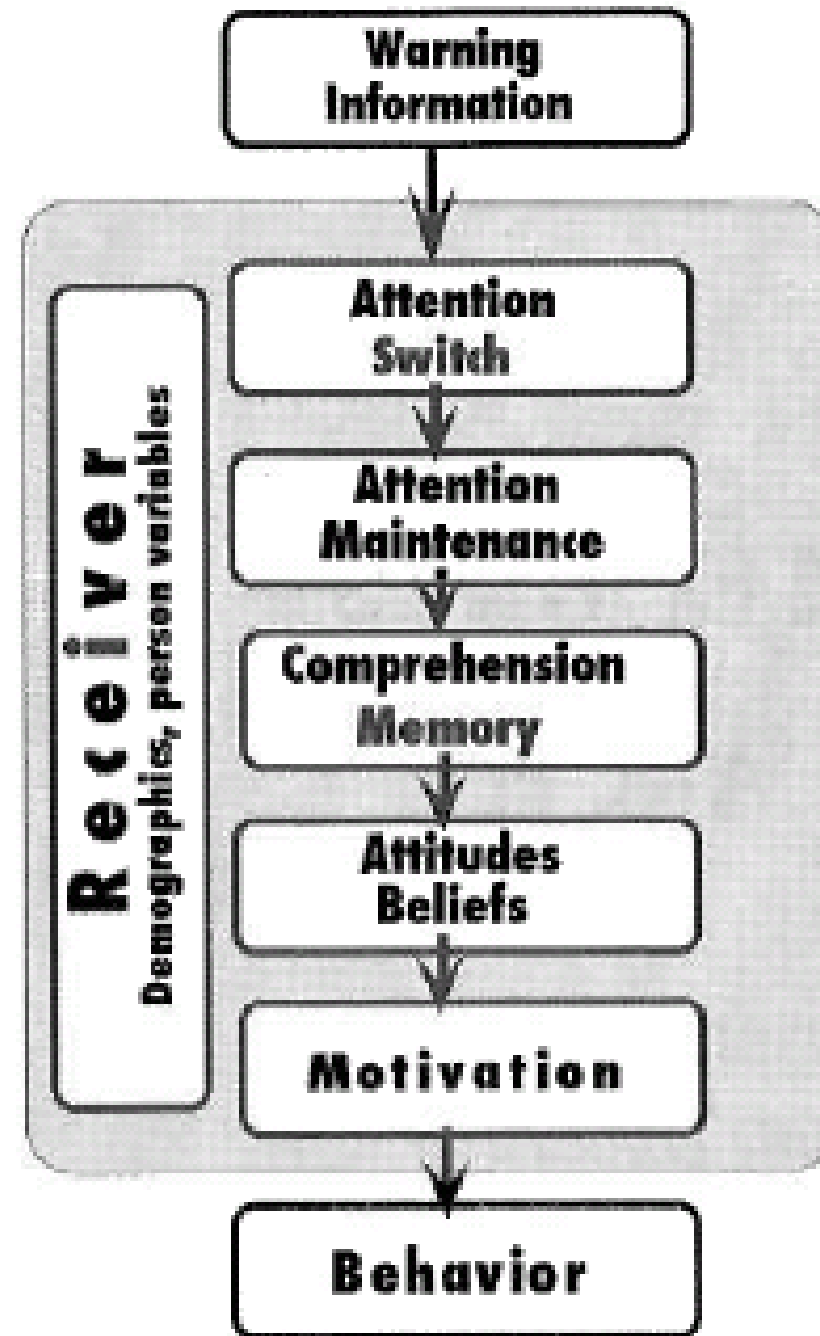
Human In the Loop Framework
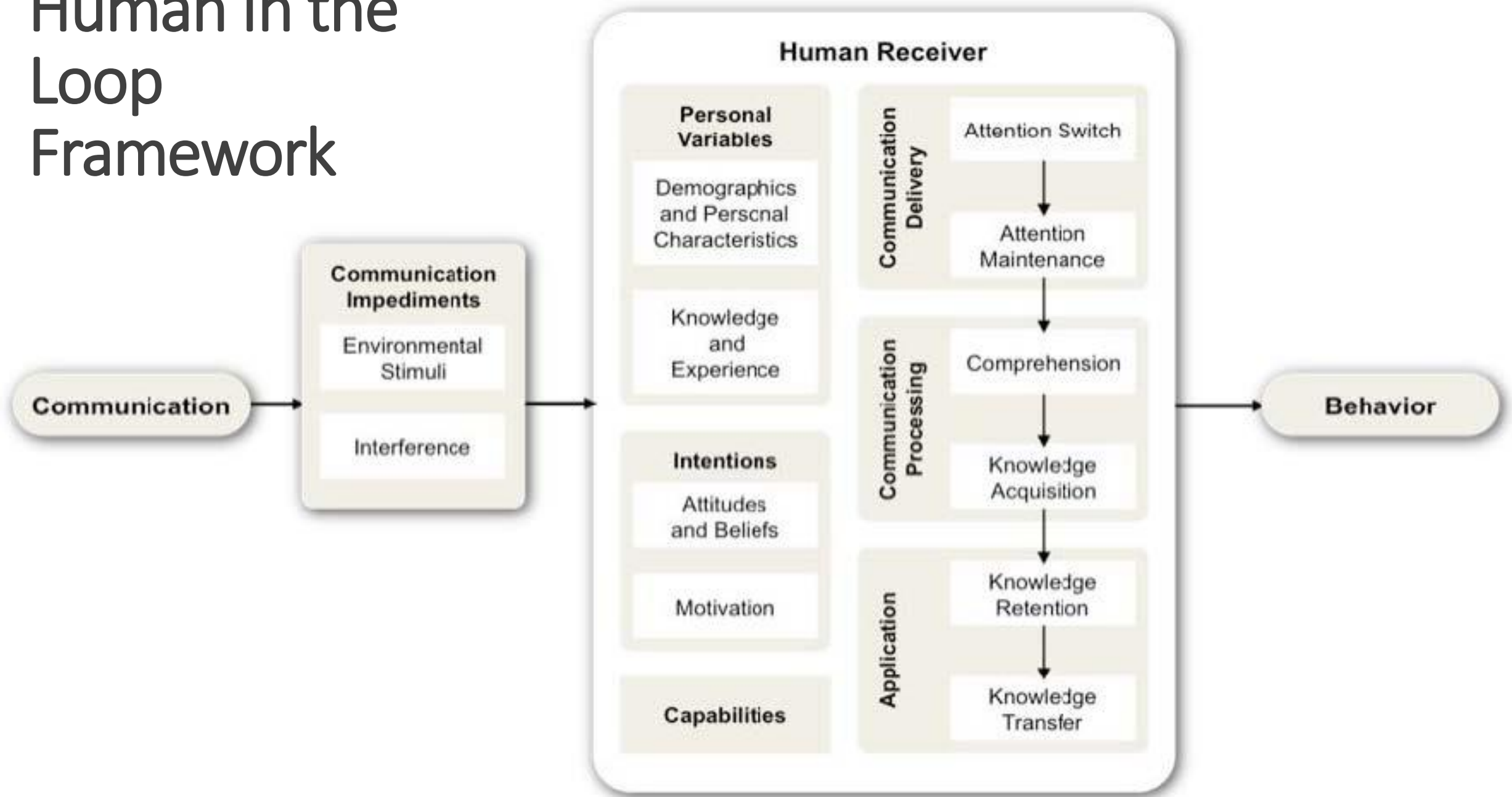
We are now going to use the framework to figure out why people are ignoring SSL warnings…

What level of the framework does this fail at?

Human Receiver

Personal Variables	Communication Delivery
Demographics and Personal Characteristics	Attention Switch → Attention Maintenance
Knowledge and Experience	

Communication Processing: Comprehension → Knowledge Acquisition

Intentions: Attitudes and Beliefs, Motivation

Application: Knowledge Retention → Knowledge Transfer

Capabilities

And this one?

And this one?

Reported Attack Page!
itisatrap.org/firefox/its-an-attack.html

Reported Attack Page!

This web page at itisatrap.org has been reported as an attack page and has been blocked based on your security preferences.

Attack pages try to install programs that steal private information, use your computer to attack others, or damage your system.

Some attack pages intentionally distribute harmful software, but many are compromised without the knowledge or permission of their owners.

Get me out of here!   Why was this page blocked?

Ignore this warning

Human Receiver

Personal Variables
- Demographics and Personal Characteristics
- Knowledge and Experience

Intentions
- Attitudes and Beliefs
- Motivation

Capabilities

Communication Delivery
- Attention Switch
- Attention Maintenance

Communication Processing
- Comprehension
- Knowledge Acquisition

Application
- Knowledge Retention
- Knowledge Transfer

Any better?

http://www.youtube.com/watch?v=2WQAI5nJWHs

chrome

The Website Ahead Contains Malware!

Google Chrome has blocked access to youtube.com for now.

Even if you have visited this website safely in the past, visiting it now is very likely to infect your computer with malware.

Malware is malicious software that causes things like identity theft, financial loss, and permanent file deletion. Learn more

Go back   Details about problems on this website   Proceed at your own risk   «

☐ Improve malware detection by sending additional data to Google when I encounter warnings like this. Privacy policy

Human Receiver

Personal Variables	Communication Delivery
Demographics and Personal Characteristics	Attention Switch
	Attention Maintenance
Knowledge and Experience	

	Communication Processing
	Comprehension
Intentions	Knowledge Acquisition
Attitudes and Beliefs	

	Application
Motivation	Knowledge Retention
Capabilities	Knowledge Transfer

And this one?

- The site is used often and trusted
  - "YouTube is a well known website. I'd assume that the malware block is in error."
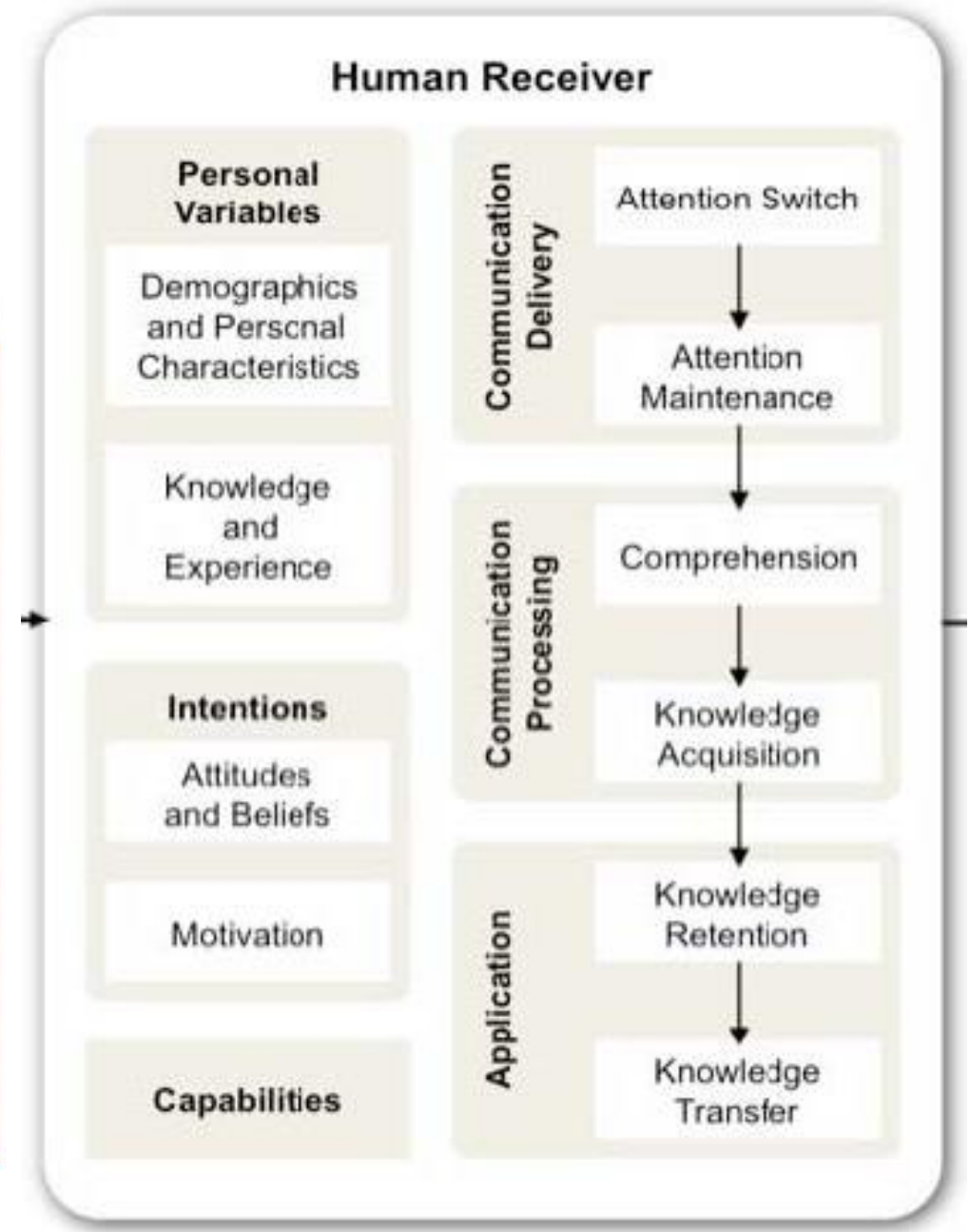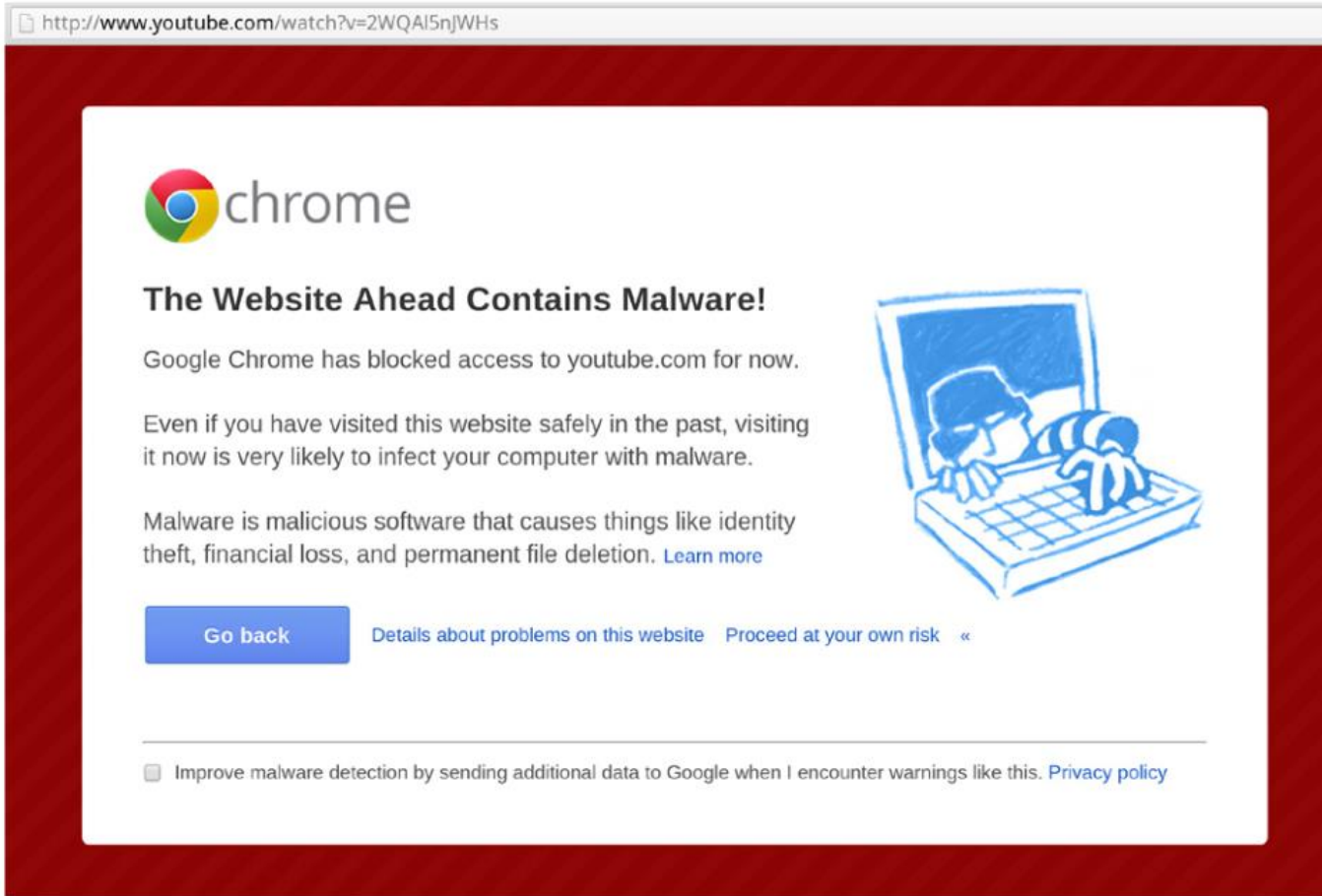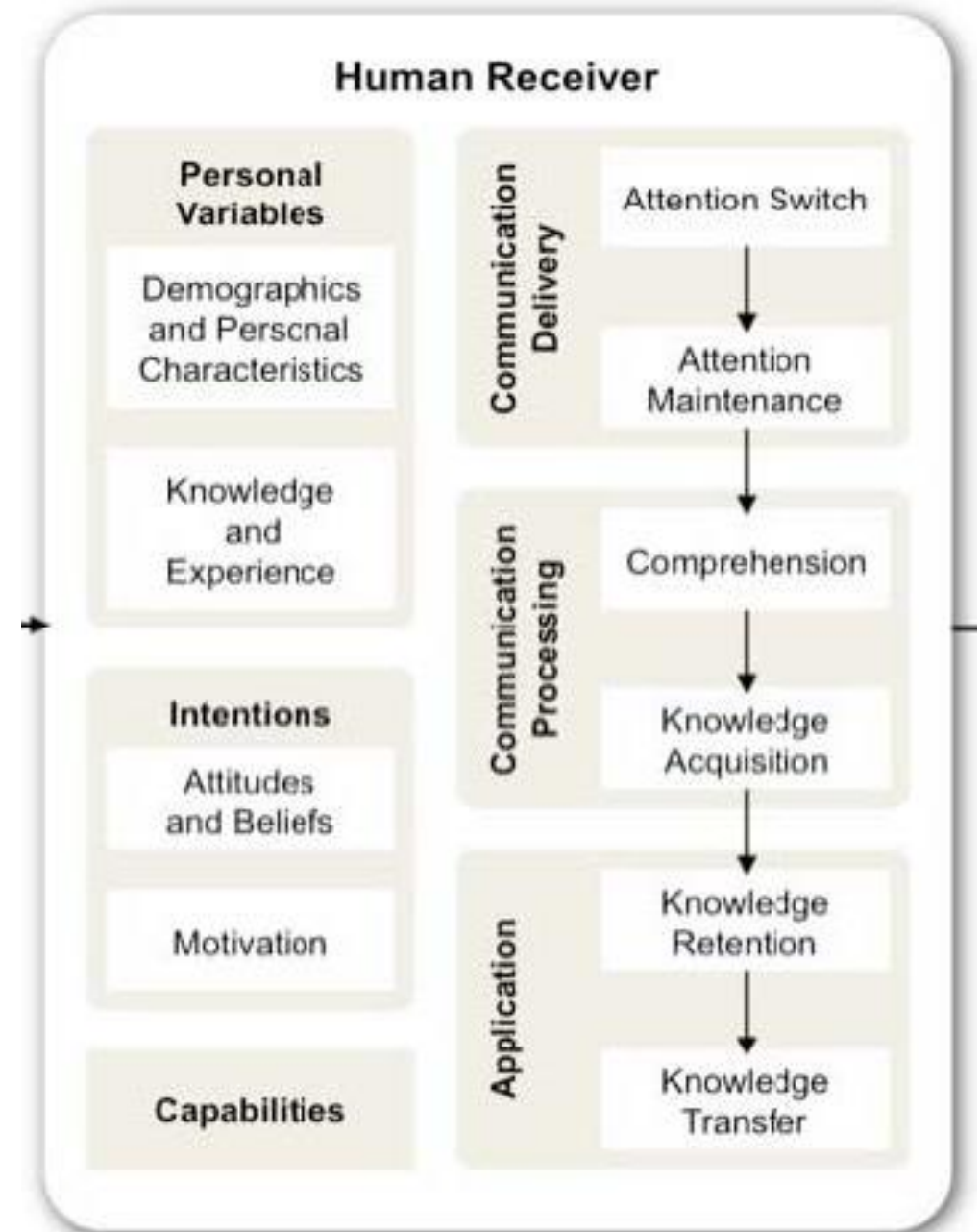- The person who posted the link is trusted
  - "I find it harder to believe [the warning] when my facebook friend just posted it and had no problems."
- The site where the link is assumed to have good security
  - "I presume that visiting youtube from a facebook link would be safe."
- They think they are safe
  - "I use Linux I'm not afraid of anything."
  - "I have an anti virus"

Human Receiver

Personal Variables
- Demographics and Personal Characteristics
- Knowledge and Experience

Intentions
- Attitudes and Beliefs
- Motivation

Capabilities

Communication Delivery
- Attention Switch → Attention Maintenance

Communication Processing
- Comprehension → Knowledge Acquisition

Application
- Knowledge Retention → Knowledge Transfer

Users

Users are not the enemy

- Malicious actors are the enemy

- Users are a partner in keeping the system secure

- Like any partner:
  - They have skills you don't have
  - They are missing skills you do have

- Think about what skills they have that you need

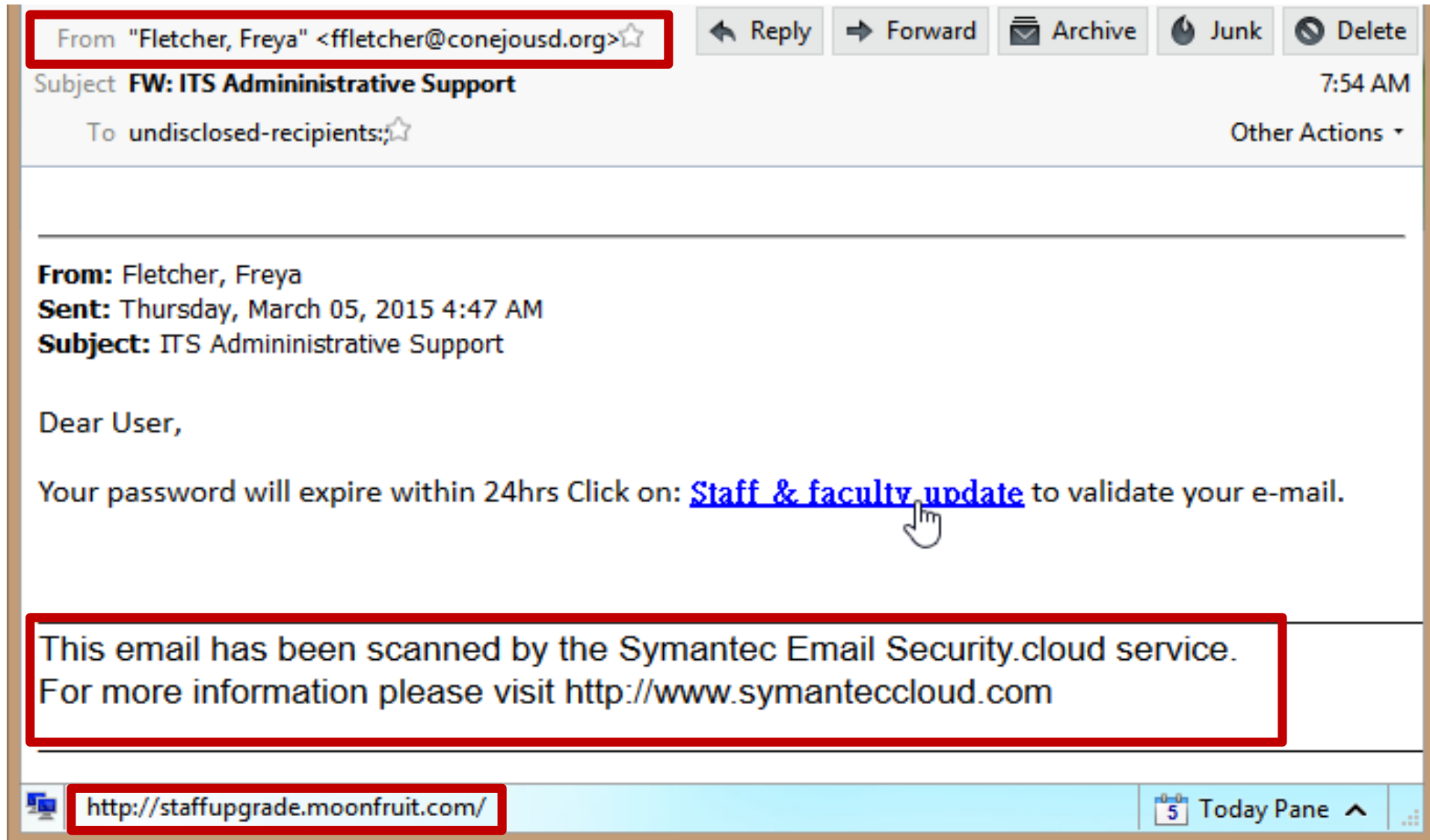- Use the skills you have to make good decisions on users' behalf

Phishing attacks and training

Phishing

- Phishing – Attempting to trick someone into taking the "bait" and interacting in a why they should not.
  - Typically involves the impersonator pretending to be someone else that the person trusts
  - Interactions: Clicking a link, opening a file, replying with information, transferring money, ect.
- Spear phishing – Phishing, but with a small number of targets and each email is crafted for that individual
- Whaling – Phishing for people with a lot of money, i.e. CEO
- QRishing – Phishing attacks through QR codes

What on this email can be trusted?

From "Fletcher, Freya" <ffletcher@conejousd.org>
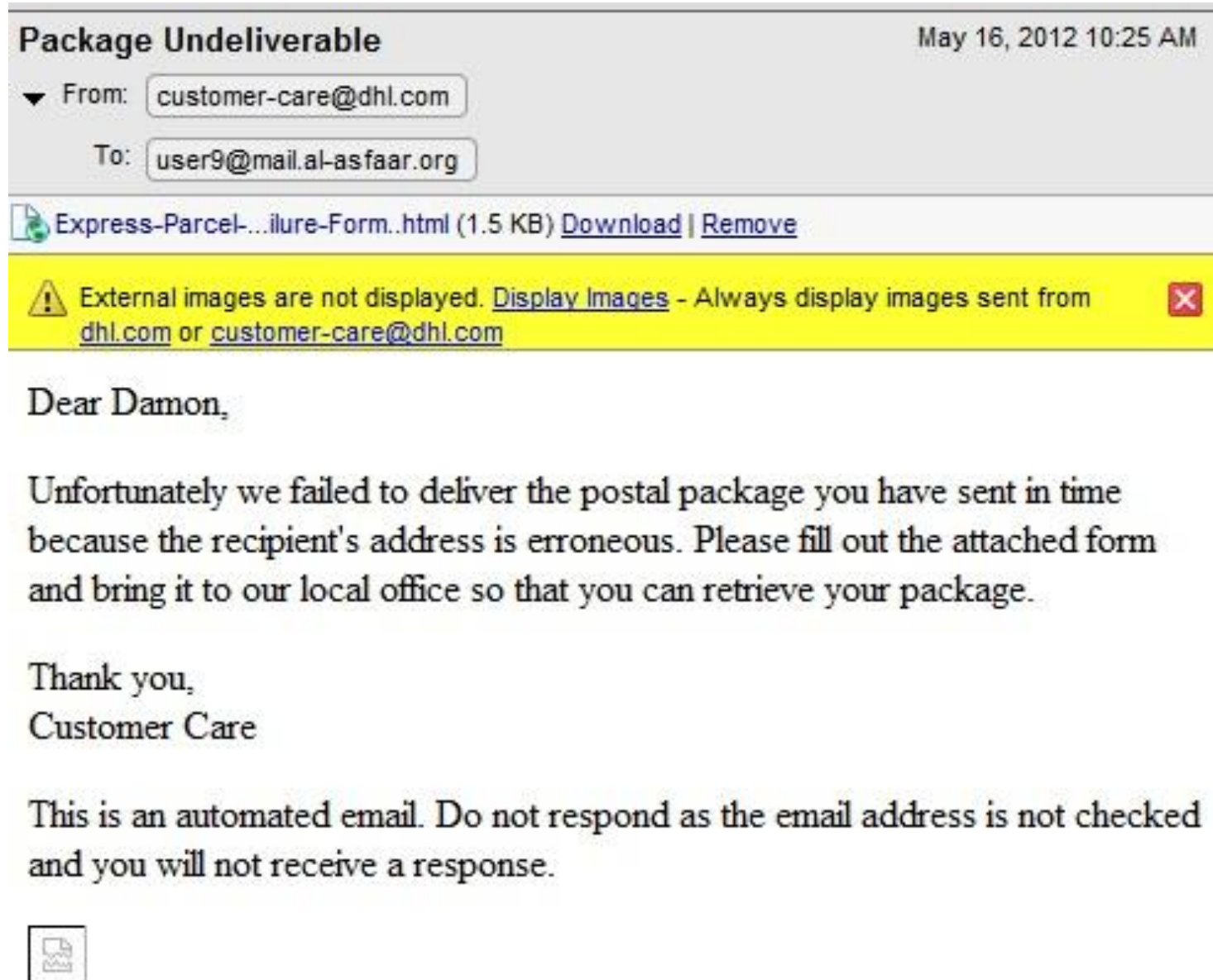
↩ Reply   → Forward   🖃 Archive   🔥 Junk   ⊘ Delete

Subject **FW: ITS Admininistrative Support**   7:54 AM

To undisclosed-recipients;   Other Actions ▾

From: Fletcher, Freya
Sent: Thursday, March 05, 2015 4:47 AM
Subject: ITS Admininistrative Support

Dear User,

Your password will expire within 24hrs Click on: <u>**Staff & faculty update**</u> to validate your e-mail.

This email has been scanned by the Symantec Email Security.cloud service.
For more information please visit http://www.symanteccloud.com

---

http://staffupgrade.moonfruit.com/   📅 Today Pane ∧

(Wrong) Trust indicators

From "Fletcher, Freya" <ffletcher@conejousd.org>

Reply | Forward | Archive | Junk | Delete

Subject **FW: ITS Admininistrative Support**

7:54 AM

To undisclosed-recipients:;

Other Actions

Authority figure that often sends emails to do things

From: Fletcher, Freya
Sent: Thursday, March 05, 2015 4:47 AM
Subject: ITS Admininistrative Support

Dear User,

Your password will expire within 24hrs Click on: **Staff & faculty update** to validate your e-mail.

Clear threat to recipient's ability to log in

This email has been scanned by the Symantec Email Security.cloud service.
For more information please visit http://www.symanteccloud.com

(False) statement saying the email has been scanned and is safe

http://staffupgrade.moonfruit.com/

Today Pane ⌃

Sneaky email to get the recipient to open the attachment, which is an html document

Package Undeliverable   May 16, 2012 10:25 AM

From: customer-care@dhl.com

To: user9@mail.al-asfaar.org

Express-Parcel-...ilure-Form..html (1.5 KB) Download | Remove

⚠ External images are not displayed. Display Images - Always display images sent from dhl.com or customer-care@dhl.com ✖

Dear Damon,

Unfortunately we failed to deliver the postal package you have sent in time because the recipient's address is erroneous. Please fill out the attached form and bring it to our local office so that you can retrieve your package.

Thank you,
Customer Care

This is an automated email. Do not respond as the email address is not checked and you will not receive a response.

Problem: Users click on links and attachments

- Scan all incoming attachments and links for blacklisted content
- Teach users
  - Only click if you are expecting the email
  - Do not open attachments unless you are expecting them
  - If you are not sure, contact the person or company separately and ask if they sent the email
  - If you are not sure, contact the IT department
  - Banks and credit card companies will never contact you this way

Anti-Phishing Phill

- Serious game to help people learn to spot dangerous URLs
- Training sometimes works
- But it takes time
- And people forget
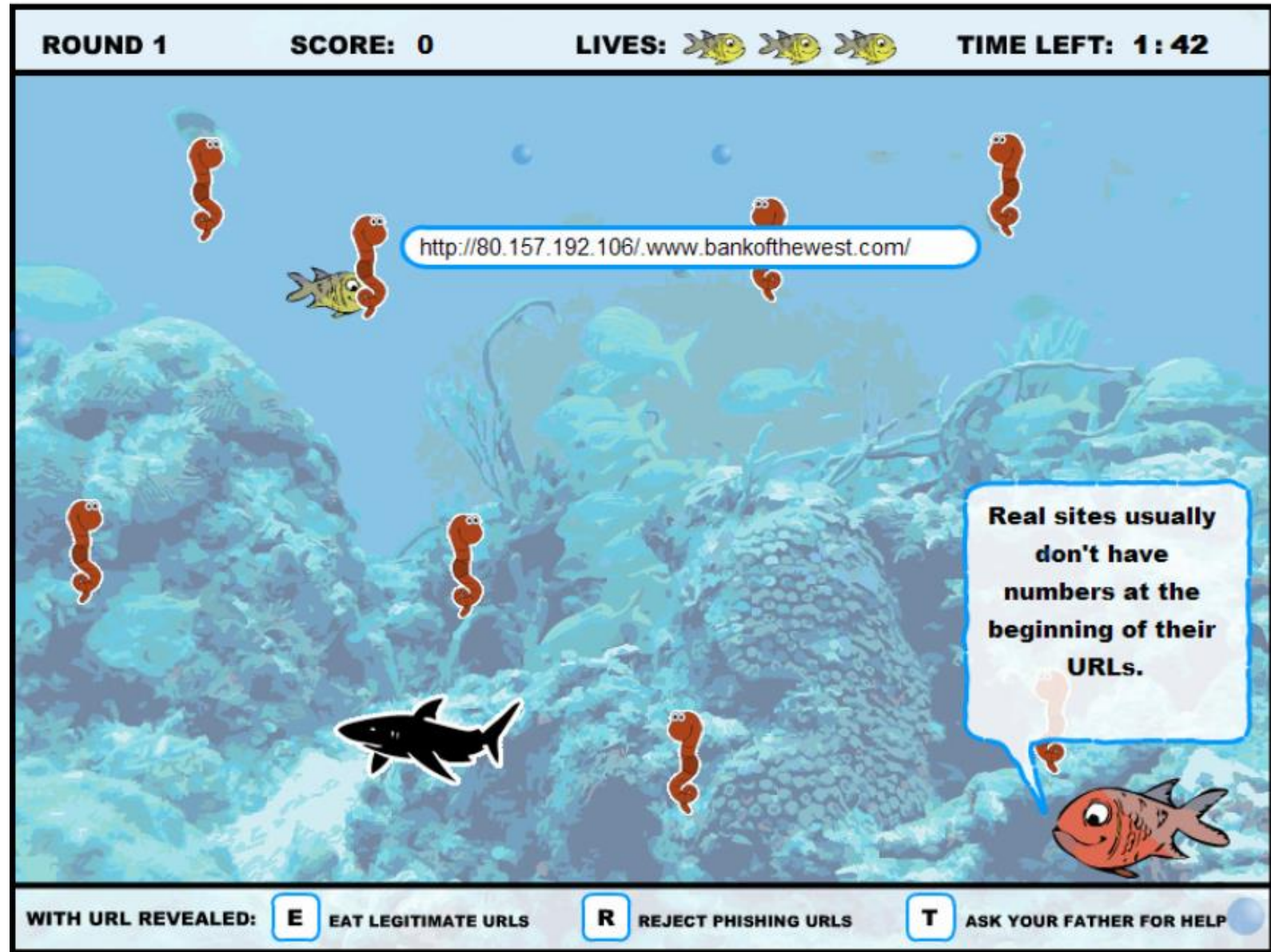
PhishGuru

- Comic to train people to spot phishing attacks
- Best time to train is after a users has already fallen for an attack
- Send out fake attacks and train those who click on them

Give users options that make sense and work for them

PhishGuru

- Users know what they are expecting
- Users know who the email looks like it is from
- Users can do an out-of-band contact (phone call)
- Users do not want to ignore a serious issue

In Summary…

- Academics say in-the-moment training works

- Chief Security Officers (CSOs) have mixed opinions

- Everybody thinks that users clicking on links and attachments is a big problem

Why show warnings at all?

- Determined users might disable Safe Browsing. Which would prevent future warnings.

- User could also open the website in another browser that is less safe and does not block the website.

  ◦ America Online users used to go to a friend's house to open malicious sites because the ISP blocked malicious sites.

  ◦ Different browsers block different sets of sites, we don't want to teach users to use less safe browsers.

Questions