

Improving e-commerce fraud investigations in virtual, inter-institutional teams:

Towards an approach based on Semantic Web technologies

MASTER THESIS

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Abstract

There is a dramatic shift in credit card fraud from the offline to the online world. Large online retailers have tried to establish countermeasures and transaction data analysis technologies to lower the rate of fraudulent transactions to a manageable amount. But as retailers will always have to make a trade-off between the *performance* of the transaction processing, the *usability* of the web shop and the overall *security* of it, we can assume that e-commerce fraud will still happen in the future and that retailers have to collaborate with relative parties on the incident to find a common ground on and take coordinated (legal) actions against it.

Combining information from different stakeholders will face issues due to different wordings and data formats of the information, competing incentives of the stakeholders to participate on information sharing as well as possible sharing restrictions, that prevent making the information available to a larger audience. Additionally, as some of the information might be confidential or business-critical to one of the involved parties a *centralized* system (e.g. a service in the cloud) could **not** be used.

This Master thesis is therefore looking into the topic of how far a computer supported collaborative work system based on peer-to-peer communication technologies and shared ontologies can improve the efficiency and effectivity of e-commerce fraud investigations within an inter-institutional team.

Keywords: Peer-To-Peer Communication, Semantic Web, CSCW

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1 Introduction

Introduction of chapter, overview, ...

1.1 Motivation

“When it comes to fraud, 2015 is likely among the riskiest season retailers have ever seen, [...] it is critical that they prepare for a significant uptick in fraud, particularly within e-commerce channels.”

This statement from Mike Braatz, senior vice president of Payment Risk Management, ACI Worldwide in (Reuters 2015) shows the dramatic shift in credit card fraud from the offline to the online world, that retailers are starting to face nowadays.

In general credit card fraud can occur if a consumer has lost her credit card or if the credit card has been stolen by a criminal. This usually results in an **identity theft** by the criminal, who is using the original credit card to make financial transactions by pretending to be the owner of the card. Additionally, a consumer might hand over her credit card information to an untrustworthy individual, who might use this information for her own benefit. In the real world scenario there is usually a face-to-face interaction between both parties. The consumer, wanting to do business with a merchant or interacting with an employee of a larger business, has to hand over her credit card information explicitly and can deny doing so if she faces a suspicious situation. The criminal on the other hand must get access to the physical credit card first, before she is able to make an illegal copy of it — a process called **skimming**. The devices used to read out and duplicate the credit card information are therefore called skimmers. These can be special terminals, that the criminal uses to make copies of credit cards she gets her hands on, or they can be installed in or attached to terminals the consumer interacts with on her own (Consumer Action 2009). All of these so-called *card-present transaction* scenarios have seen a lot of improvements in security over the last years. Especially the transition from magnetic swipe readers to EMV chip-based credit cards makes it more difficult for criminals to counterfeit them (Lewis 2015).

As of this criminals are turning away from these card-present transaction scenarios in the offline world. Instead they are focusing on transactions in the online and mobile world, in which it is easy to pretend to own a certain credit card. Most online transactions (either e-commerce or m-commerce) rely *only* on credit card information like card number, card holder and security code for the card validation process – as of this these interactions are usually called *card-not-present transactions*. This credit card information can be obtained by a criminal in a number of ways. First she might send out **phishing emails** to consumers. These emails mimic the look-and-feel of emails from a merchant or bank, that the consumers are normally interacting with, but instead navigating the consumers to a malicious web site with the intend to capture credit card or other personal information (Consumer Action 2009). Additionally, criminals can **break into the web sites** of large Internet businesses with the goal of getting access to the underlying database of customer information, that in most cases also hold credit card data (Holmes 2015). Additionally, some of the online retailers are not encrypting the transaction information before transmitting them over the Internet; a hacker can easily start a **man-in-the-middle attack** to trace these data packages and get access to credit card and/or personal information in this way (Captain 2015).

Based on this it should come not as a surprise that the growth rate of online fraud has been 163% in 2015 alone (PYMNTS 2016). This results in huge losses for the global economy every year and it is expected that retailers are losing \$3.08 for every dollar in fraud incurred in 2014 (incl. the costs for handling fraudulent transactions) (Rampton 2015). These fraudulent transactions also impact the revenue of the online retailers. Here we have seen a growth of 94% in revenue lost in 2015. Overall it is estimated that credit card fault results in \$16 billion losses globally in 2014 (PYMNTS 2016) (Business Wire 2015).

While it is possible to prevent fraudulent transactions in the card-present real-world scenario (mainly due to introducing better technology and establishing organizational countermeasures in the recent past), it is more difficult to do so in the card-not-present online- and mobile commerce scenarios, which are lacking face-to-face interactions and enable massive scalability of misusing credit card information in even shorter time frames (Lewis 2015). Large online retailers have tried to establish countermeasures and transaction data analysis technologies to lower the rate of fraudulent transactions to a manageable amount. But this is still an expensive and inefficient solution to integrate into the retailers' business processes, and is largely driven by machine-learning techniques and manual review processes (Brachmann 2015). Additionally, it can be assumed, that the online retailers are getting into a Red Queen race with the criminals

here: with every new technology or method introduced they might just be able to safe the status quo. This is largely due to the facts, that there will be no 100% security for such a complex and interconnected system like an e-commerce or m-commerce shop, the criminals will also increase their efforts and technology skills to adapt to new security features and most importantly retailers will always have to make a trade-off between the *performance* of the transaction processing, the *usability* of the web shop and the overall *security* of it.

1.2 Problem Definition

1.3 Related Works

1.4 Thesis Outline

2 Context Analysis

2.1 Scenario Description

2.2 Stakeholder Analysis

2.3 Objectives

2.4 Scope

3 Theoretical Foundations

3.1 Computer Supported Collaborative Work

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3.3 Peer-to-peer communication technologies

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Bibliography

Brachmann 2015

BRACHMANN, Steve: *In the face of growing e-commerce fraud, many merchants not prepared for holidays - IPWatchdog.com |patents & patent law.* <http://www.ipwatchdog.com/2015/11/22/growing-e-commerce-fraud-merchants-not-prepared-for-holidays/id=63271/>. Version: 11 2015

Business Wire 2015

BUSINESS WIRE: Global card fraud losses reach \$16.31 Billion — will exceed \$35 Billion in 2020 according to the Nilson report. In: *Business Wire* (2015), 08. <http://www.marketwatch.com/story/global-card-fraud-losses-reach-1631-billion-will-exceed-35-billion-in-2020-accor>

Captain 2015

CAPTAIN, Sean: These are the mobile sites leaking credit card data for up to 500, 000 people A day. In: *Fast Company* (2015), 12. <http://www.fastcompany.com/3054411/these-are-the-faulty-apps-leaking-credit-card-data-for-up-to-500000-people-a-day>

Consumer Action 2009

CONSUMER ACTION: Questions and answers about credit card fraud A Q & consumer aCtion A consumer action publication. Version: 2009. http://www.consumer-action.org/downloads/english/Chase_CC_Fraud_Leaders.pdf. http://www.consumer-action.org/downloads/english/Chase_CC_Fraud_Leaders.pdf, 2009. – Forschungsbericht

Holmes 2015

HOLMES, Tamara E.: *Credit card fraud and ID theft statistics.* <http://www.creditcards.com/credit-card-news/credit-card-security-id-theft-fraud-statistics-1276.php>. Version: 09 2015

Lewis 2015

LEWIS, Len: *More vulnerable than ever?* <https://nrf.com/news/more-vulnerable-ever>. Version: 12 2015

PYMNTS 2016

PYMNTS: *Hackers and their fraud attack methods.* <http://www.pymnts.com/fraud-prevention/2016/benchmarking-hackers-and-their-attack-methods>. Version: 02 2016

Rampton 2015

RAMPTON, John: How online fraud is a growing trend. In: *Forbes* (2015), 04. <http://www.forbes.com/sites/johnrampton/2015/04/14/how-online-fraud-is-a-growing-trend/#16ffc0ec349f>

Reuters 2015

REUTERS: *Fraud rates on online transactions seen up during holidays: Study.* [http://www.reuters.com/article/us-retail-fraud-idUSKCN0T611T20151117?feedType=RSS&feedName=](http://www.reuters.com/article/us-retail-fraud-idUSKCN0T611T20151117?feedType=RSS&feedName=technologyNews) technologyNews. Version: 11 2015

Appendix