



A framework for attack patterns' discovery in honeynet data

Olivier Thonnard^{a,*}, Marc Dacier^b

^aRoyal Military Academy, Polytechnic Faculty, Brussels, Belgium

^bInstitut Eurecom, 2229 Route des Cretes, Sophia Antipolis, France

ABSTRACT

Collecting data related to Internet threats has now become a relatively common task for security researchers and network operators. However, the huge amount of raw data can rapidly overwhelm people in charge of analysing such data sets. Systematic analysis procedures are thus needed to extract useful information from large traffic data sets in order to assist the analyst's investigations. This work describes an analysis framework specifically developed to gain insights into honeynet data. Our forensic procedure aims at finding, within an attack data set, groups of network traces sharing various kinds of similar patterns. In our exploratory data analysis, we seek to design a flexible clustering tool that can be applied in a systematic way on different feature vectors characterizing the attacks. In this paper, we illustrate the application of our method by analysing one specific aspect of the honeynet data, i.e. the time series of the attacks. We show that clustering attack patterns with an appropriate similarity measure provides very good candidates for further in-depth investigation, which can help us to discover the plausible root causes of the underlying phenomena. The results of our clustering on time series analysis enable us to identify the activities of several worms and botnets in the collected traffic.

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Keywords:

Honeypot forensics
Traffic analysis
Attack patterns
Security data mining
Knowledge discovery

1. Introduction

1.1. Collecting malicious traffic

The experimental study of attacks on the Internet is a very active research domain, and it has gained a lot of attention in recent years. Many valuable initiatives exist for capturing or monitoring malicious activities. Broadly speaking there are three approaches used to monitor unsolicited traffic. The first approach uses low- or high-interaction honeypots (Leuridan et al., 2006; Provos, 2004; Bascher et al., 2006; Werner); in the second approach the so-called Internet telescopes, or darknets (Moore et al., 2004; Internet Motion Sensor; Team Cymru), are used in order to monitor all traffic directed to unused subnets within a locally allocated address space. The last class of techniques for gathering

information about computer attacks aims at collecting and sharing firewall and IDS logs collected from a very large number of heterogeneous sources (DSShield).

Collecting data related to Internet threats has thus become a relatively common task for security researchers or network operators. However, effectively analysing the vast amounts of data collected using these above-mentioned sensors can prove challenging. The volume and the diversity of the raw data can rapidly overwhelm people in charge of analysing those datasets. As a result, deciding which samples or which attack patterns should be investigated first is a difficult task.

1.2. Towards a systematic analysis framework

This research develops a systematic analysis framework for exploring the malicious Internet traffic obtained from a distributed

* Corresponding author.

Patterns Of Discovery

Yunmook Nah, Chulyun Kim, Seon-Young Kim, Yang-Sae Moon, Steven Euijong Whang

Patterns Of Discovery:

Patterns of Discovery Norwood Russell Hanson, 1979

Patterns of Discovery Norwood Russell Hanson, 1958

Patterns of Discovery in the Social Sciences Paul Diesing, Social scientists are often vexed because their work does not satisfy the criteria of scientific methodology developed by philosophers of science and logicians who use the natural sciences as their model. In this study Paul Diesing defines science not by reference to these arbitrary norms delineated by those outside the field but in terms of norms implicit in what social scientists actually do in their everyday work. *Patterns of Discovery in the Social Sciences* is a detailed and systematic report on the full range of methods and procedures as they are actually practiced. Neither a how to do it handbook nor a lofty philosophical treatise, this is a truly interdisciplinary study of the basic modes of procedure in scientific inquiry with a special emphasis on normative politics. Diesing treats scientific methods as inductive logics of discovery in continuous evolution. He emphasizes the variety of methods available, discusses the advantages and disadvantages of specific methods, and in particular provides an account of mathematical modeling and of participant observation. The book will be of immense interest to all working social scientists, graduate students in any of the social science disciplines, and philosophers of science. It can also be employed as a text or supplement in courses in sociological methods and philosophy of science. This book is also a noteworthy companion to Diesing's major work on *Science and Ideology in the Policy Sciences*. Paul Diesing is professor emeritus of political science at the State University of New York at Buffalo. He did his graduate studies in philosophy from the University of Chicago and has taught at that university, the University of Illinois, and the University of Colorado. Diesing has also been a faculty associate at the Buffalo Center for International Conflict Studies, where he participated in the Center's program of researching in bargaining theory and international crises. He is the author of *Reason in Society: Five Types of Decisions and Their Social Conditions* and *Science and Ideology in the Policy Sciences*.

Connections H. Peter Alesso, Craig F. Smith, 2008-01-14. In their fascinating analysis of the recent history of information technology, H. Peter Alesso and Craig F. Smith reveal the patterns in discovery and innovation that have brought us to the present tipping point. A generation from now, every individual will have personally tailored access to the whole of knowledge; the sooner we all begin to think about how we got here and where we're going the better. This exciting book is an essential first step. From the Foreword by James Burke. Many people envision scientists as dispassionate characters who slavishly repeat experiments until eureka; something unexpected happens. Actually, there is a great deal more to the story of scientific discovery, but seeing the big picture is not easy. *Connections: Patterns of Discovery* uses the primary tools of forecasting and three archetypal patterns of discovery: Serendipity, Proof of Principle, and 1% Inspiration and 99% Perspiration, to discern relationships of past developments and synthesize a cohesive and compelling vision for the future. It challenges readers to think of the consequences of extrapolating trends such as Moore's Law to either reach real machine intelligence or retrench in the face of physical limitations. From this perspective, the book draws the big

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Patterns of HCI Design and HCI Design of Patterns Ahmed Seffah,2015-05-28 As interactive systems are quickly becoming integral to our everyday lives this book investigates how we can make these systems from desktop and mobile apps to more wearable and immersive applications more usable and maintainable by using HCI design patterns It also examines how we can facilitate the reuse of design practices in the development lifecycle of multi devices multi platforms and multi contexts user interfaces Effective design tools are provided for combining HCI design patterns and User Interface UI driven engineering to enhance design whilst differentiating between UI and the underlying system features Several examples are used to demonstrate how HCI design patterns can support this decoupling by providing an architectural framework for pattern oriented and model driven engineering of multi platforms and multi devices user interfaces Patterns of HCI Design and HCI Design of Patterns is for students academics and Industry specialists who are concerned with user interfaces and usability within the software development community

Database Systems for Advanced Applications. DASFAA 2020 International Workshops Yunmook Nah,Chulyun Kim,Seon-Young Kim,Yang-Sae Moon,Steven Euijong Whang,2020-09-21 The LNCS 12115 constitutes the workshop papers which were held also online in conjunction with the 25th International Conference on Database Systems for Advanced Applications in September 2020 The complete conference includes 119 full papers presented together with 19 short papers plus 15 demo papers and 4 industrial papers in this volume were carefully reviewed and selected from a total of 487 submissions DASFAA 2020 presents this year following five workshops The 7th International Workshop on Big Data Management and Service BDMS 2020 The 6th International Symposium on Semantic Computing and Personalization SeCoP 2020 The 5th Big Data Quality Management BDQM 2020 The 4th International Workshop on Graph Data Management and Analysis GDMA 2020 The 1st International Workshop on Artificial Intelligence for Data Engineering AIDE 2020 Intelligent Data Analysis for Real-Life Applications: Theory and Practice

Magdalena-Benedito, Rafael,2012-06-30 With the recent and enormous increase in the amount of available data sets of all kinds applying effective and efficient techniques for analyzing and extracting information from that data has become a crucial task Intelligent Data Analysis for Real Life Applications Theory and Practice investigates the application of Intelligent Data Analysis IDA to these data sets through the design and development of algorithms and techniques to extract knowledge from databases This pivotal reference explores practical applications of IDA and it is essential for academic and research libraries as well as students researchers and educators in data analysis application development and database management

Patterns of Information Management Mandy Chessell,Harald C. Smith,2013 In the era of Big Data effective information management has become crucial to the success of virtually all organizations Unfortunately few IT practitioners know today s

best practices for successfully managing enterprise information resources Patterns for Information Management offers the solution a multi disciplinary patterns based approach that reflects where information comes from how it is distributed protected governed monitored and ultimately utilized *Data Mining Patterns: New Methods and Applications* Poncelet, Pascal, Masseglia, Florent, Teisseire, Maguelonne, 2007-08-31 This book provides an overall view of recent solutions for mining and explores new patterns offering theoretical frameworks and presenting challenges and possible solutions concerning pattern extractions emphasizing research techniques and real world applications It portrays research applications in data models methodologies for mining patterns multi relational and multidimensional pattern mining fuzzy data mining data streaming and incremental mining Provided by publisher **Local Pattern Detection** Katharina Morik, Jean-Francois Boulicaut, Arno Siebes, 2005-07-11 Introduction The dramatic increase in available computer storage capacity over the last 10 years has led to the creation of very large databases of scientific and commercial information The need to analyze these masses of data has led to the evolution of the new field knowledge discovery in databases KDD at the intersection of machine learning statistics and database technology Being interdisciplinary by nature the field offers the opportunity to combine the expertise of different fields into a common objective Moreover within each field diverse methods have been developed and justified with respect to different quality criteria We have to investigate how these methods can contribute to solving the problem of KDD Traditionally KDD was seeking to find global models for the data that explain most of the instances of the database and describe the general structure of the data Examples are statistical time series models cluster models logic programs with high coverage or classification models like decision trees or linear decision functions In practice though the use of these models often is very limited because global models tend to find only the obvious patterns in the data which domain experts already are aware of What is really of interest to the users are the local patterns that deviate from the already known background knowledge David Hand who organized a workshop in 2002 proposed the new field of local patterns

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Table of Contents Patterns Of Discovery

1. Understanding the eBook Patterns Of Discovery
 - The Rise of Digital Reading Patterns Of Discovery
 - Advantages of eBooks Over Traditional Books
2. Identifying Patterns Of Discovery
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Patterns Of Discovery
 - User-Friendly Interface
4. Exploring eBook Recommendations from Patterns Of Discovery
 - Personalized Recommendations
 - Patterns Of Discovery User Reviews and Ratings
 - Patterns Of Discovery and Bestseller Lists
5. Accessing Patterns Of Discovery Free and Paid eBooks
 - Patterns Of Discovery Public Domain eBooks
 - Patterns Of Discovery eBook Subscription Services
 - Patterns Of Discovery Budget-Friendly Options
6. Navigating Patterns Of Discovery eBook Formats

- ePub, PDF, MOBI, and More
- Patterns Of Discovery Compatibility with Devices
- Patterns Of Discovery Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Patterns Of Discovery
 - Highlighting and Note-Taking Patterns Of Discovery
 - Interactive Elements Patterns Of Discovery
- 8. Staying Engaged with Patterns Of Discovery
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Patterns Of Discovery
- 9. Balancing eBooks and Physical Books Patterns Of Discovery
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Patterns Of Discovery
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Patterns Of Discovery
 - Setting Reading Goals Patterns Of Discovery
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Patterns Of Discovery
 - Fact-Checking eBook Content of Patterns Of Discovery
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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mengenal beberapa unsur kimia yang terkandung dalam - Jul 31 2023

pemanfaatan kotoran sapi biasanya digunakan sebagai pupuk kandang di berbagai tempat di dunia kotoran sapi yang dikeringkan digunakan sebagai bahan bakar kotoran sapi juga

analisis kandungan unsur hara pada kotoran sapi - Apr 15 2022

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