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Information Technology and Analytics

Jonny Karlsson & Magnus Westerlund (Eds)

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# Editorial foreword

Jonny Karlsson, Magnus Westerlund

The use of computers is expanding rapidly and will inevitably continue to do so, often replacing humans in performing manual repetitive tasks. The amount and type of data amassed is also becoming more versatile and comprehensive, so giving researchers new approaches to understand the world around us. The increase of small wireless and mobile computing devices has inspired researchers to develop new network communication technologies and protocols that enable the effective and secure exchange of information between devices. Such emerging technologies are providing new business opportunities and driving the creation of new media, but at the same time, these opportunities bring for example legal and security challenges.

The papers included in this series are intended to give a broad overview of current research on these topics and were presented during the 5th annual Arcada IT research seminar. This year, the seminar had a broader scope than in previous years, which was reflected in its title: “Seminar on Current Topics in Business, Information Technology and Analytics” (BITA’13).

Karlsson, Dooley and Pulkkis focus on how to overcome some of the security challenges involved in realizing infrastructure-less wireless networks. Grahn describes how anonymity may be preserved on the Internet by using software referred to as *The Onion Router* (Tor). Westerlund and Enkvist present some of the legal challenges in data protection, when companies use disparate and unstructured data to create highly detailed profiles of their users. Pulkkis, Westerlund and Karlsson identify a research opportunity for the use of Big Data tools and methods that can analyze network traffic for threats against information security. Rosenbröijer describes three perspectives of customer relationship management (CRM) and combines this with analysing how different types of analytics will affect CRM issues. Forss, Liu and Björk look at how to perform social media content analysis and how people’s hobby and interest information may be extracted from Facebook content. Finne outlines a conceptual framework for risk management to identify, measure and control uncertain and unwanted events. Enkvist and Andersson look at how 3D printing can be adopted and protected in a legal sense. Nylund outlines a conceptual framework for differentiating general management from media management, by looking at two key strategic areas in media management: creativity and technological change. Gopalkrishnan looks at how new technology drives the creation of new media. Finally, von Boguslawski and Mildén study the visual search and decision process involving a multi-alternative choice situation, using head mounted Eye Tracker technology.



# Research Findings on Wormhole Attack Detection in Mobile Ad Hoc Networks

Jonny Karlsson<sup>1,2</sup>, Laurence S. Dooley<sup>2</sup> and Göran Pulkkis<sup>1</sup>

## Abstract

The Internet is moving from the traditional desktop network paradigm to a ubiquitous paradigm where a multitude of small computing devices such as computer chips and smart sensors are involved in daily activities and routines. This means that a rapidly growing amount of devices are connected to the Internet. At the same time, infrastructure-less and self-configuring systems like Mobile Ad hoc Networks (MANET) are gaining popularity since they provide a possibility for mobile devices to share information with each other without being dependent on a core infrastructure. Routing security in MANETs is, however, a significant challenge to wide scale adoption. One of the most severe security threats to MANET routing is the wormhole attack due to its ability to disrupt a significant proportion of network traffic, while simultaneously being difficult to detect. This paper provides an overview of recent research findings on wormhole attack detection in MANETs collected from a joint research project with Arcada University of Applied Sciences in Finland and The Open University, UK.

## 1. Introduction

A Mobile Ad hoc Network (MANET) is a self-configuring arrangement of mobile devices interconnected by wireless links, with no fixed infrastructure like base stations and dedicated routers. Examples of MANET implementations are wireless sensor networks, vehicular networks, military communication networks, and Internet connectivity networks where some of the nodes are located out of the radio range of an Internet connection point, as for example in underground transport systems.

Due to their self-configuring nature, each MANET node participates in the routing process, in addition to its other activities. Several routing protocols have been proposed for MANETs, such as Ad Hoc On Demand Distance Vector (AODV) (Perkins & Royer 1999) and Dynamic Source Routing (DSR) (Johnson & Maltz 1996), but security has typically not been a priority in routing protocol development. In a large scale MANET integrated in the future world of an 'Internet of Things' (IoT) where lots of devices dynamically enter and leave the network, it is difficult to establish trust relationships among nodes. Therefore, routing in a MANET is especially vulnerable to malicious node activities leading to a potentially severe disruption in network communications (Karlsson, Dooley & Pulkkis 2012, Agrawal, Jain & Sharma 2011). Such disruption can range from deliberately ignoring the routing protocol, through to tampering with routing packets. For example, to save energy a selfish node may simply not take part in the routing process, leading to packet loss. A malicious node however, can launch serious network attacks such as rerouting packets from their original path to an erroneous destination node or even stealing the identity of another node.

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The wormhole attack (Hu, Perrig & Johnson 2003) is one of the most severe MANET routing threats since it is easy to launch, difficult to detect and can cause significant communication disruption. Two collaborating malicious nodes create a fictive shortcut link in the network by forwarding routing packets to each other with the intention of attracting more data packets to traverse the wormhole link. Once the wormhole has been successfully established, the malicious nodes can disrupt network operation by either dropping packets or launching more serious attacks, such as eavesdropping and packet sniffing.

A wormhole attack can be launched in either hidden mode (HM) or participation mode (PM) (Khabbazian, Mercier & Bhargava 2006). In the former, malicious nodes capture and forward routing packets to each other without modifying the actual packets, so the wormhole nodes never appear in routing tables. In contrast, PM nodes process routing packets as any pair of legitimate nodes and then appear in a wormhole infected route as two contiguous nodes.

The malicious nodes can forward routing packets to each other using either an in-band (I-B) or out-of-band (O-B) wormhole link. I-B links tunnel packets between the malicious nodes via genuine network nodes and are therefore easy to launch, while the O-B link is more complex because it requires an external communication channel, i.e., network cable or directional antenna, to establish a direct link between the wormhole nodes.

Various wormhole detection strategies have been proposed (e.g. Hu, Perrig & Johnson 2003, Khabbazian, Mercier & Bhargava 2009, Song, Wu & Choi 2012, Khurana & Gupta 2008), but most solutions have some recurring limitations including the inability to detect all wormhole types, the requirement for dedicated hardware, a reliance on particular MANET environments, and imposing high computational overheads and/or bandwidth loads upon the network.

This provided the motivation to design and analyse a new wormhole detection scheme called Traversal Time and Hop Count Analysis (TTHCA) (Karlsson, Dooley & Pulkkis 2011) which is designed as a security extension to the AODV (Perkins & Royer 1999) routing protocol. It combines the benefits of Round Trip Time (RTT)-based approaches such as Wormhole Attack Prevention (WAP) (Choi et al. 2008), Transmission Time-based Mechanism (TTM) (Tran et al. 2007) and Delay Per Hop Indication (DelPHI) (Chiu & Lui 2006) with Multi Hop count Analysis (MHA) (Jen, Lai & Kuo 2009), to provide improved detection for several wormhole attack conditions and in a wide range of network scenarios.

RTT based approaches offer low overhead solutions in terms of hardware, computation and throughput, but have the limitation that variations in a node's packet processing time, must be small. In a real MANET, nodes can exhibit high packet processing time variations resulting in that a route with only a few hops can often have a higher RTT than a route with many hops. MHA on the other hand relies on a wormhole infected route always having a significantly lower Hop Count (HC) compared to a healthy route which has been proven to be false through simulations.

## 2. Traversal Time and Hop Count Analysis (TTHCA)

The original idea of TTHCA (Karlsson, Dooley & Pulkkis 2011) is to let a source node estimate the PTT of a routing packet instead of the RTT, since the PTT is close to constant for a certain distance whilst RTT can vary due to fluctuations in queuing delay at intermediate nodes. In TTHCA, PTT is calculated by first letting the source node measure the RTT of the AODV route discovery packets, which is the time between sending the RREQ packet and receiving the RREP packet. Each intermediate node measures the processing time of the RREQ and RREP packets and this value ( $\Delta T_i$ ) is added to a new parameter of the RREP packet. Hence, once an RREP packet is received by the source node, the source can estimate PTT by simply reducing the sum of all  $\Delta T_i$  from the RTT. Finally, a wormhole is suspected if the PTT in relation to the route HC is unrealistically high.

### 2.1 Preventing Time Tampering in TTHCA

Malicious wormhole nodes can, however, potentially prevent TTHCA from detecting infected routes by adding a fictive packet processing time value parameter to the RREP packet. Such a time tampering attack is not a modification attack, as the wormhole node never alters any routing packet parameters, but instead produces false measurement information. This means that schemes designed to prevent packet alteration by, for example, encrypting all routing packet parameters, will be ineffectual against a TTHCA time tampering attack. So, a malicious node can prevent the wormhole from being detected if

it presents a higher  $\Delta T_i$  than the actual packet processing time. By increasing  $\Delta T_i$  the source node will calculate a smaller PTT/HC and therefore the wormhole can potentially go undetected. However, from the attackers' point of view, time tampering is not a trivial task since it has to increase the  $\Delta T_i$  within a strict time window which is difficult for the attacker to be aware of. For example, if a malicious node provides a  $\Delta T_i$  that is too high, the source node will calculate a negative PTT/HC. If however the malicious nodes are aware of the exact delay of the wormhole link (which is technically possible), a successful time tampering attack is conceivable.

To minimize this threat we have proposed an extension to TTHCA requiring each intermediate node to store its  $\Delta T_i$  in a separate element of a new  $\Delta T_i$  Vector parameter of the RREP packet. As a result, when receiving the RREP, the source node can apply a statistical outlier detection mechanism for checking the validity of each  $\Delta T_i$  in the vector. If one or more of the  $\Delta T_i$  values are statistically significantly higher than the average, a time tampering attack is suspected and the route is omitted.

The time tampering problem, an analysis of its impacts on TTHCA wormhole detection performance, and the  $\Delta T$  Vector extension is presented in detail by (Karlsson, Dooley & Pulkkis 2013).

### 3. Performance analysis

The performance of both TTHCA and the  $\Delta T$  Vector extension has been rigorously tested through simulation. This section provides an extract of the simulation results previously published (Karlsson, Dooley & Pulkkis 2011; 2013).

#### 3.1 TTHCA Wormhole Detection

TTHCA was tested and compared with MHA (Jen, Lai & Kuo 2009) and DelPHI (Chiu & Lui 2006) in a MANET simulation environment developed in NS-2 (The Network Simulator 2013). The environment consisted of 300 nodes with identical hardware, and random node placements for each simulation run. The network was infected by a single wormhole with different lengths. The simulations showed that TTHCA can detect all wormholes in the simulation environment, either when the wormhole is launched in HM and/or using an I-B channel.

A PM O-B wormhole is the most challenging to detect for TTHCA and RTT-based wormhole detection schemes since the malicious nodes tunnel packets through each other over a low delay communication link, for instance by using a directional antenna or network cable. The simulation results revealed that TTHCA still provides significantly improved wormhole detection performance compared to both MHA and DelPHI, see Figure. 1.

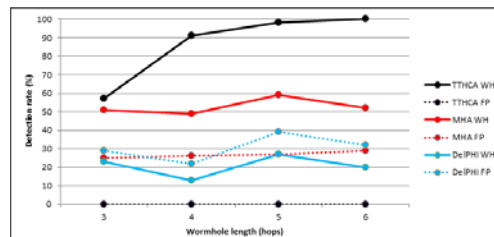


Figure 1. PM O-B wormhole (WH) detection and false positive (FP) occurrence performance (Karlsson, Dooley & Pulkkis 2011)

#### 3.2 Time Tampering Detection Performance of the $\Delta T$ -Vector Mechanism

Time tampering detection performance was simulated with the underlying assumption that each wormhole node was always aware of the required time tampering windows, meaning that they were able to prevent every wormhole from being detected by the original TTHCA algorithm. A custom tool was developed to generate different  $\Delta T_i$  values for traffic loads and packet service times at the nodes. Dixon Q-test (Dean & Dixon 1951) was applied for identifying tampered  $\Delta T_i$  values. The time tampering detection performance assumed the source node had a track record of at least 15 earlier measured  $\Delta T_i$  values and the MANET was infected by a PM I-B wormhole, is shown in Figure 2. Different wormhole lengths and variability in both node traffic load and packet service time were tested.

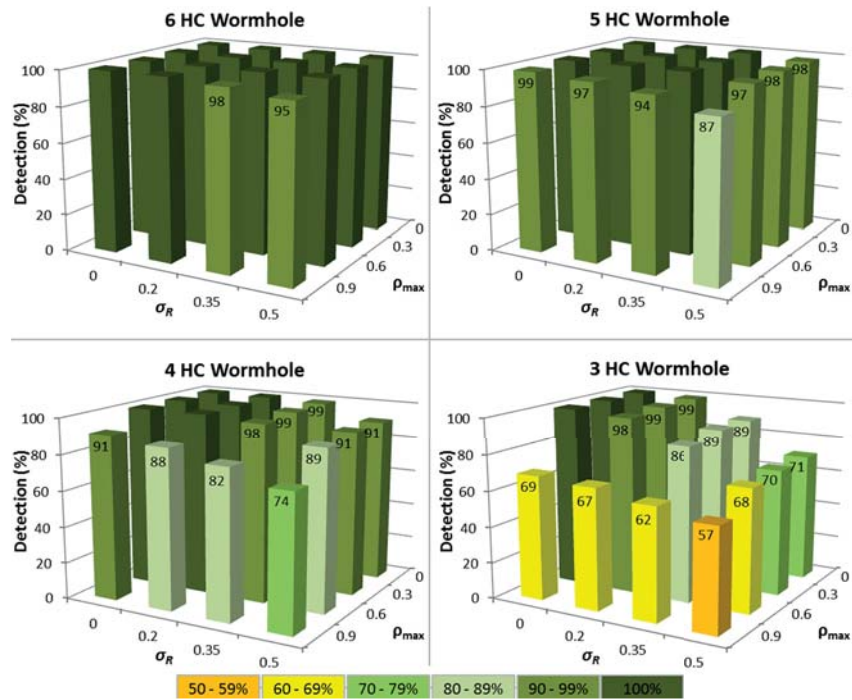


Figure 2. Time tampering detection performance for different wormhole hop count (HC) for variable network traffic loads ( $\rho_{max}$ ) and routing packet service times ( $\sigma_R$ ) (Karlsson, Dooley & Pulkkis 2013)

## 4. Conclusions and future research

Wormhole attacks are one of the most severe threats to MANET routing and are difficult to detect as they can be launched in several modes, each enforcing its own distinct requirements on the detection mechanism employed. Most wormhole attack detection schemes presented in the literature have limitations, such as a lack of ability to detect all wormhole types, the requirement for additional hardware such as GPS, or a requirement for a certain network condition in order to be effective. We have proposed a wormhole detection algorithm called Traversal Time and Hop Count Analysis (TTHCA) which by way of simulations has been proven to be effective on all types of wormholes and in a wide range of network conditions, incurring neither significant computational nor network costs.

We have also identified a limitation of TTHCA which is the possibility for malicious nodes to tamper with the packet processing time measurements and hence potentially prevent the wormhole from being detected. The conditions for a time tampering attack have been thoroughly analysed and a new security mechanism called the  $\Delta T$  Vector extension has been proposed for detecting false time values.

In terms of future research, an important aim for the TTHCA algorithm is to make the threshold used for defining the maximum allowed packet traversal time per hop count, adaptive to its surroundings. TTHCA among many other proposed wormhole detection solutions assumes constant radio ranges which does not reflect a real world scenario that consists of a variable set of obstacles (such as walls) between MANET nodes and different hardware, both causing a variability in radio ranges. Therefore, the need is to generate a threshold for TTHCA that can adapt to both its surroundings and also to a rapid change of environment such as moving from outdoors to indoors, since such a situation can momentarily cause a significant decrease of wormhole detection performance.

An experimental network is also planned for testing the time measurement accuracy on different hardware and the propagation speed of wireless signals in different environments, factors which are important for making TTHCA applicable in a real MANET implementation.

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# TOR-nätverket

Kaj Grahn

Arcada

## Sammandrag

Den här artikeln beskriver kort hur tjänster på internet kan användas så att klienten förblir anonym. Till grund för analysen ligger nätverksprogrammet Tor (The Onion Router). Artikeln behandlar även programmets funktionssätt och tekniska egenskaper. Dessutom ges ett förslag på hur Tor-nätverket kunde förbättras.

## 1. Inledning

Tor är ett anonymiseringsnätverk som möjliggör användning av tjänster på internet utan att användarens identitet avslöjas. I många länder råder internetcensur. Dessa länder försöker blockera anslutningen till vissa förbjudna webbplatser såsom t.ex. Twitter och Facebook. Tor ger här medborgarna möjlighet att kringgå denna censur.

Tor utvecklades 1996 som ett projekt inom USA:s flotta av U.S. Naval Research Laboratory. År 2012 finansierades projektet till 80 % av USA:s regering medan återstoden betalas av den svenska staten, icke-vinstbringande organisationer och privata sponsorer. Sveriges bidrag har i huvudsak kanaliserats via Sida (Swedish International Development Cooperation Agency). Sidas totala satsning för att försöka hålla de digitala vägarna (internet) öppna i diktaturländer uppgick 2011 till omkring 150 miljoner kronor. Länder som berörs idag är t.ex. Kina, Iran, Libyen, Egypten och Syrien.

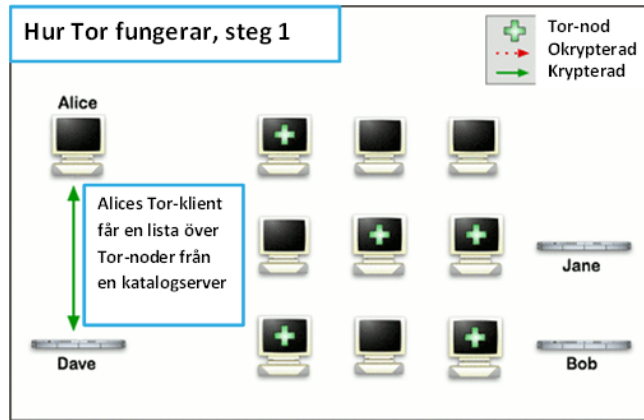
I juni 2013 läckte Edward Snowden sekretessbelagd information om NSAs (National Security Agency) topphemliga övervakningsprojekt såsom PRISM. PRISM är ett signalspanings-program som används av amerikansk underrättelseverksamhet för att samla uppgifter om stora amerikanska leverantörer av internetjänster. Hans dokument visade också att USA och Storbritannien genomför hackingattacker mot datorer över hela världen. Snowden skickade sina dokument till pressen med hjälp av Tor-programmet. (NyTeknik, 2011) (Framsteg & Forskning, 2012)

## 2. Tors funktionssätt

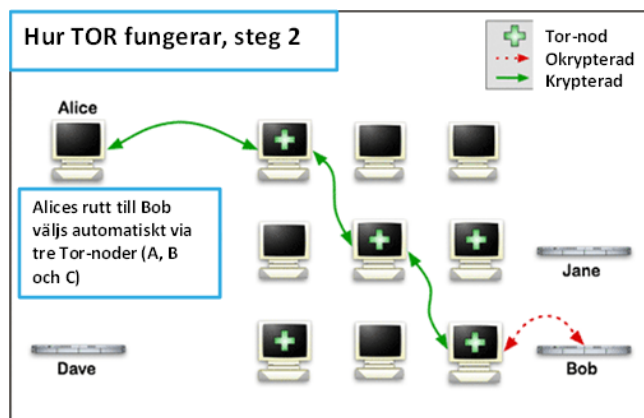
Här följer en generell beskrivning av hur Tor fungerar:

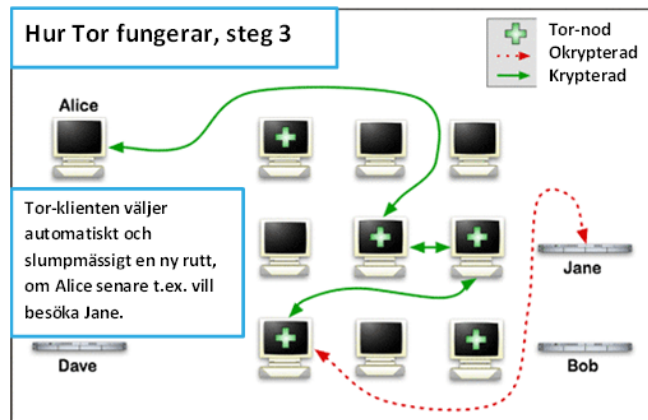
Alice vill kontakta Bob, men en brandvägg spärrar trafiken till webbplatsen. Alice beslutar sig för att använda Tor-programmet i sin dator. (Tor Project, 2013), (Wikipedia, 2013)

- Alices Tor-program kontaktar Tor-nätverket och får en lista över alla datorer i världen som för tillfället omfattas av nätverket. År 2012 bestod nätverket av ca 3200 datorer. Därefter väljer programmet ut tre av datorerna (noderna) på listan.



- Alices dator förhandlar i tur och ordning fram kryptonycklar med de tre utvalda datorerna.
- Alice får sin anonymitet via de tre noderna A, B och C. Nod A vet varifrån trafiken kommer men känner inte destinationen, nod B fungerar som buffert och nod C känner till destinationen men inte varifrån trafiken kommer.
- Trafiken krypteras tre gånger. Krypteringen börjar med nyckeln för nod C, sedan för B och slutligen för A.
- Det krypterade datapaketet skickas först till A som avlägsnar sitt kryptolager, därefter skickas det till B för samma åtgärd och slutligen till C. När alla kryptolager har tagits bort skickas datapaketet till slutdestinationen, det vill säga till Bob. Trafiken till Alice sker i omvänd ordning. Den här avskalningsmetoden har gett projektet dess namn (Tor The Onion Project). På svenska kallas datapaketet ibland även "kryptolöken".
- Tor-klienten (programmet) väljer hela tiden nya rutter för att minska risken för att identiteten ska avslöjas.
- "Kryptolöken" som lämnar Alices dator har tre krypteringslager, ett för varje nod. Innerst inne ligger datapaketet som ska levereras till destinationen. Även det ska krypteras. Krypteringen sker t.ex. med hjälp av https för webbplatser. Annars finns det en risk för att den sista noden, C, ska kunna avlyssna trafiken.





### 3. Tekniska egenskaper

Den största delen av Tor-programmet är skrivet i programmeringsspråket C och innehåller ungefär 146 000 rader av kod. Koden är öppen källkod och kan köras med Windows, Mac OS X, Linux/Unix och Android. (Tor Project, 2013)

Tor-programmet arbetar på TCP (Transmission Control Protocol)-nivå. Till applikationerna vars trafik i allmänhet ska vara anonym hör t.ex. Internet Relay Chat IRC), Instant Messaging (IM, text i realtid över internet) och www-sökning. Tor Browser (sökmotor) lämpar sig för säker sökning på internet. Den är en version av Mozilla Firefox som är förkonfigurerad att hantera anonymitet.

När en Tor-klient ansluter till ingångsnoden sker först en s.k. handskakning där man kommer överens om vilka kryptoalgoritmer som ska användas. Den försvarande brandväggen försöker känna igen de teckensekvenser som skickas. I de nya versionerna av Tor strävar man till att teckensekvenserna ska se likadana ut som i annan trafik. Introduktionen av Obsfproxy har varit ett steg i den här riktningen. Obsf kommer från ordet obfuscate som betyder förvilla. Det här sker på ett slumpartat sätt. En liknande lösning är SkypeMorph. Då förändras utseendet på Tor-trafiken så att den ser ut som ett Skype-samtal.

### 4. Slutledning

Tors nuvarande nätverkstopologi och aktuella tekniska lösningar tillåter inte en omfattande tillväxt. Orsaken är att varje nod slutligen kommer att ha en öppen förbindelse till alla de övriga noderna i nätverket. Tusentals öppna förbindelser blir för tunga för en vanlig persondator att bära. Enligt vissa bedömningar ligger gränsen vid ca 10 000 noder. I den närmaste framtiden kommer det att ställas krav på en starkare fokusering på nätverksarkitekturen.

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# Profilering – några synpunkter ur ett juridiskt och ett tekniskt perspektiv

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## Sammandrag

Profilering har blivit ett allt viktigare redskap för marknadsförare. Genom att bygga upp och skapa profiler av enskilda individer kan marknadsföraren rikta skräddarsydd och beteendebaserad reklam till enskilda mottagare. All behandling av personuppgifter förutsätter i regel förtida samtycke av den som uppgifterna berör. Den föreslagna EU- förordningen kommer att ge Internetföretag en möjlighet att profilera kunderna även utan deras samtycke, så länge kunderna inte direkt eller indirekt är identifierbara med rimliga medel.

## 1. Inledning

Internet är en av de få mediekanaler som har kunnat upprätthålla en kontinuerlig ökning av mängden marknadsföring. Förutom att mängden marknadsföring har ökat på Internet så har det även med jämna mellanrum uppkommit nya marknadsföringstekniker (Enkvist-Gauffin 2006). En bidragande orsak till den stora populariteten Internet har beträffande marknadsföring, är den att Internet, och med Internet förknippade tekniker, har gjort det möjligt att skräddarsy reklam för den enskilde mottagaren. Genom att skräddarsy reklamen för den enskilde mottagaren, så kan marknadsföringen uppnå en betydligt högre genomslagskraft än vad fallet är med ”traditionell” marknadsföring. En viktig del i processen med att skräddarsy marknadsföring är att samla in stora mängder information. Informationen fås vanligtvis från de s.k. elektroniska fotspår som lämnas vid surfande på Internet. Trots att Internet är den viktigaste källan för insamling av elektroniska fotspår, så uppkommer fotspår även på många andra håll till följd av den ökade digitaliseringen av vårt samhälle (Ström 2013). För närvarande pågår en förhållandevis livlig debatt i Finland beträffande ändring av systemet med bilskatt. Ett förslag har lagts fram om att bilskatt i framtiden skall erläggas på basis av körda kilometer. Genomförandet av ett sådant system skulle innebära att alla bilar förses med GPS-sändare. Det skulle i sin tur medföra att det lämnas elektroniska fotspår varje gång en person åker bil.

Den insamlade informationen kan sedan bearbetas, och på så sätt är det möjligt att utarbeta noggranna profiler över enskilda personer (Enkvist & Westerlund 2013). Allt detta kan medföra betydande ingrepp i den personliga integriteten hos enskilda personer. Lagstiftaren har därför ansett det vara nödvändigt att reglera insamlingen/bearbetningen av information i ett antal lagar. De två mest centrala lagarna inom området är personuppgiftslagen (1999/523) och lagen om dataskydd vid elektronisk kommunikation (2004/516). Den nationella lagstiftningen baserar sig på den EU-reglering som finns på området. Gällande EU-reglering (personuppgiftsdirektivet) är från år 1995 och utsatt för vissa förändringsbehov som har uppkommit till följd av den snabba tekniska utvecklingen under de senaste åren. Det är framförallt utvecklingen inom den digitala miljön som den senaste tiden har orsakat nya typer av faror med tanke på skyddet av personuppgifter. Därför har kommissionen framlagt ett förslag till en förordning (General Data Protection Regulation, 25.01.2012, COM (2012), final) som skall ersätta det gällande personuppgiftsdirektivet.

Syftet med detta bidrag är att lyfta fram vissa juridiska frågeställningar kring gällande och föreslagna reglering av personuppgifter. Även vissa frågor ur ett tekniskt perspektiv kommer att lyftas fram.

## 2. Juridiska frågeställningar

*Personuppgifter.* All information faller inte innanför tillämpningsområdet för personuppgiftslagen. För att nämnda lagstiftning skall bli tillämpbar förutsätts det att uppgifterna kan klassificeras som personuppgifter. Begreppet personuppgifter har dock givits ett omfattande innehåll i lagen, och täcker i princip alla uppgifter som berör en fysisk person (RP 96/1998). Det har ingen betydelse i vilket format uppgifterna förekommer, eller hur informationen lagras. Uppgifterna kan med andra ord vara i t.ex. numerisk, grafisk eller akustisk form lagrade på t.ex. papper eller usb-minne. Det saknar även betydelse huruvida personen som uppgifterna berör är identifierad eller ej. Det finns emellertid ett krav på att en fysisk person direkt eller indirekt skall kunna identifieras med stöd av uppgifterna, för att uppgifterna kan anses vara personuppgifter. Det är dock inte tillräckligt att det föreligger en hypotetisk möjlighet att kunna identifiera en person på basis av uppgifterna, utan avgörande är vad som är möjligt när man beaktar alla hjälpmedel som rimligen kan komma att användas. Samma lösning har valts i den föreslagna förordningen. En sådan lösning kan med fog kritiseras, eftersom det bakomliggande syftet med personuppgiftslagstiftningen är att skydda fysiska personer; särskilt rätten till privatliv. För många företag som skapar profiler av Internetanvändare är det inte av någon större betydelse att reda ut vem som är den fysiska personen bakom insamlad information. I stället för den fysiska personen är det den virtuella personen bakom en viss profil som är det intressanta för företaget. Bakom den virtuella personen finns dock alltid en fysisk person som bör kunna åtnjuta samma skydd som andra fysiska personer.

*Samtycke.* All behandling av personuppgifter förutsätter i regel förtida samtycke av den som uppgifterna berör. För att samtycket skall anses vara giltigt måste det dessutom vara frivilligt, särskilt, informerat och uttryckligt. Kravet på frivillighet innebär att det inte får förekomma tvång eller påtryckningar, samt att det bör finnas en reell valmöjlighet att ge samtycke eller låta bli. Det har emellertid inte ansetts vara förbjudet att påföra vissa konsekvenser ifall samtycke inte ges. I en sådan situation bör dock nämnas vilka konsekvenserna blir om man låter bli att lämna samtycke (Petersson & Reinholdsson 2007). För att kravet på frivillighet inte skall urholkas helt och hållet bör konsekvenserna inte vara allt för hårda. Svaret på frågan hur allvarliga konsekvenser ett utelämnat samtycke får medföra, är en mycket svår bedömningsfråga, som lagstiftningen tyvärr inte ger något svar på (Dahlström & Karlsson 2000).

Kravet på att samtycket skall vara särskilt och informerat innebär att ett allmänt samtycke inte är godtagbart och att den som ger sitt samtycke är medveten om vad han eller hon samtycker till (Öman & Lindblom 2007). Ett giltigt samtycke kan ges såväl skriftligt som muntligt.

*Profiler.* Profiler har blivit ett allt viktigare redskap för marknadsförare. Genom att bygga upp och skapa profiler av enskilda individer kan marknadsföraren rikta skräddarsydd och beteendebaserad reklam till enskilda mottagare, s.k. one-to-one-marknadsföring. I och med att personer i dagens allt mer digitaliserade samhälle lämnar mer och mer elektroniska fotspår efter sig, har det uppkommit förbättrade möjligheter att utarbeta detaljerade profiler av enskilda personer. Enligt lagstiftningen har varje person rätt att inte bli föremål för profilering, ifall profileringen enbart grundar sig på automatisk behandling av uppgifter. All profilering omfattas dock inte av förbudet, utan det gäller endast sådan profilering som har rättsliga följder för den profilerade eller som märkbart påverkar den profilerade. Profiler är emellertid tillåtet ifall den person som profileringen berör har gett sitt samtycke.

## 3. Vissa tekniska aspekter

Profilering på basen av digitala uppgifter om användare/kunder utgör stora möjligheter för företag. Utvecklingen och tillämpningen av användarprofiler syns än så länge främst vid användningen av tjänster på Internet, men insamlingen av användardata har redan pågått länge även i detaljhandeln. Finland, med sina två stora handelskedjor (S- och K-kedjan) täcker tillsammans in den stora majoriteten av all dagligvaruhandel. Med användningen av bonuskort har man redan länge samlat in data om kundernas vanor. Utöver det har exempelvis S-kedjan utvidgat sitt tjänsteutbud till bland annat bank- och försäkringsverksamhet, vilket ger dem ännu mer ingående uppgifter om sina kunder. Då kunden i allmänhet ger sitt samtycke för processerande av den insamlade informationen så öppnas det potentiellt upp en möjlighet att inte enbart ge beteendeorienterad reklam, utan kan även ge butikskedjorna en möjlighet att skräddarsy priset för att maximera sin egen vinst i relation till vad kunderna är villi-

ga att betala. I USA har utvecklingen redan gått så långt att varje kund får personliga rabatter och butikerna försöker kontinuerligt få en insikt i exempelvis förändringar i kundbeteendet. Den amerikanska detaljhandelskedjan Target har i medier rapporterats analysera förändringar då bonuskorthållare övergår från att köpa parfymade hudkrämer till neutrala oparfymade. Target har funnit ett samband med förändringen i inköpsbeteendet och sannolikheten för att en kvinna i hushållet är gravid. Således kan de i ett mycket tidigt skede påverka handelsvanorna hos konsumenterna. (Duhigg 2012)

Den föreslagna förordningen kommer att ge Internetföretag en möjlighet att profilera kunderna även utan deras samtycke, så länge kunderna inte direkt eller indirekt är identifierbara med rimliga medel. Det betyder att all profilering där företaget inte befattar sig med fysiska identifierare gällande användarna, är tillåten. Det är något oklart vad gäller uppgifter som kodifierats för att inte innehålla uppgifter som identifierar användaren. Ifall det är tillåtet att använda uppgifter som kodifierats så leder det till att exempelvis en kodifierad statisk IP-adress även kan användas för att identifiera användare över flera sessioner, trots att den statiska IP-adressen i sig anses utgöra en personuppgift. Även uppgifter som företaget erhåller vid bearbetning av data kan utgöra en fysisk identifierare. Trots att det inte finns direkt omnämnt bör det anses utgöra en personuppgift. En annan oklarhet är profilering som utförs på kundens egen enhet. Eftersom skyddet mot profilering baserat på personuppgifter grundar sig på om användarna direkt eller indirekt är identifierbara med rimliga medel, så torde det vara tillåtet att profilera användare så länge processeringen sker på användarens egna enheter, utan några begränsningar. Kravet är då att inga personuppgifter lagras på servern. Med tanke på den tekniska utveckling som sker i webbvärlden är detta inte längre osannolikt. Exempelvis kommer WebRTC (Web Real Time Communication)-tekniken att möjliggöra realtidskommunikation mellan webbläsare utan att kräva att trafiken sänds via en server. Då kan avancerade profileringstjänster byggas in i webbläsare eller till och med i webbsidor. Det här vore en oönskad utveckling då man beaktar de kontinuerliga hoten på Internet, samt hur lite vanliga användare förstår sig på datasäkerhet.

## 4. Några sammanfattande synpunkter

Insamling och bearbetning av stora mängder med information, samt skapande av profiler med hjälp av denna information innebär stora faror med tanke på den personliga integriteten hos enskilda personer. Därför är det av synnerligen stor vikt att det finns en effektiv och omfattande lagstiftning som reglerar detta. Förslaget till en gemensam EU-förordning om skydd för personuppgifter är för närvarande under behandling inom EU. Behovet av en revidering av gällande regleringen är stort och förslaget till en förordning är mycket omfattande. I det här bidraget har endast tre mindre delfrågor i den föreslagna förordningen behandlats; personuppgifter, samtycke och profilering. Såsom förslaget är utformat i skrivandets stund kan viss kritik riktas mot samtliga tre delfrågor.

Beträffande delfrågan samtycke kan förslaget kritiseras med att kravet på frivillighet inte har preciserats desto noggrannare. På denna punkt borde det ges betydligt klarare riktlinjer kring frågan hur svåra konsekvenserna får bli, ifall samtycke inte lämnas. Den senaste tidens utveckling i fråga om populära webbtjänster är den att de småningom köps upp och centraliseras till ett fåtal bolag som får närapå fullständig dominans på marknaden. En stor del av de populära tjänsterna förutsätter att samtycke till behandling av personuppgifter lämnas, för att man skall kunna använda sig av tjänsterna. När tjänsterna centraliseras till endast ett fåtal bolag med stor dominans på marknaden kan ett sådant krav på samtycke ifrågasättas, huruvida det baserar sig på frivillighet.

När det gäller ordalydelsen i det föreslagna förbudet mot profilering så uppkommer vissa tolkningsproblem. Det är i synnerhet ordalydelsen »märkbart påverkar» som är oklar och förorsakar tolkningsproblem. För att skyddet mot oönskad profilering skall bli tillräckligt starkt bör förbudet ges en vid tolkning. Profilering bör alltid anses utgöra ett så stort ingrepp i den enskilda personens privata sfär att det uppfyller ordalydelsen »märkbart påverkar». En sådan vid tolkning av förbudet skulle innebära att all profilering kräver samtycke av den som blir föremål för en sådan.

Den allvarligaste kritiken kan dock riktas mot det centrala begreppet personuppgifter. Förslaget till förordning om skydd för personuppgifter är begränsat till fysiska personer som direkt eller indirekt är identifierade, eller är identifierbara med rimliga medel. För det första är det synnerligen oklart vad som avses med rimliga medel. Nya och mer effektiva tekniker för att reda ut olika identiteter uppkommer med jämna mellanrum. Det innebär att det är mycket svårt att ge en noggrann definition av vad rimliga medel innebär. Det som i dag ur ett ekonomiskt perspektiv är helt orimligt, kan genom en framtida teknisk utveckling bli rimligt. En annan sak som bör hållas i åtanke är att den verkliga identiteten ofta är förhållandevis ointressant. Betydligt mer intressanta är den virtuella identiteten och profiler uppbyggda kring den. Även den virtuella personen bör åtnjuta ett skydd. Det skall inte vara av avgöran-

de betydelse om man kan utreda vem som i verkligheten är bakom den virtuella identiteten eller inte. Samtliga personer bör ha ett skydd.

Det är viktigt att EU strävar efter att på den globala spelplanen få till stånd en motsvarande reglering. Ifall EU ensam genomför stränga regleringar på området finns det en risk för att utländska tjänsteleverantörer låter bli att erbjuda sina tjänster åt personer som är bosatta inom EU.

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# Information Analytics Methods for Network and Information Security

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## Abstract

This paper is motivated by the need of tools, solutions and services based on information analytics for network and information security. It briefly describes the common principles of intrusion management and presents a range of intrusion management methods based on information analytics. These methods include activity monitoring, database processing, alerting, learning methods for decision support in anomaly identification, and forensics after intrusion. The capability of an analytics based malware identification tool is also presented.

## 1. Introduction

Network and information security means the protection of networks and network hosts against threats like intrusion, eavesdropping, phishing, malicious programs, malicious communication etc. The traditional network and information security tools, solutions, and services scale insufficiently, when protection against such threats requires management of very large unstructured datasets. As current networks are becoming rapidly more pervasive and ubiquitous, the amount of data to be managed by security solutions is also growing. Therefore information analytics based security tools, solutions, and services are needed.

The international network and information security company RSA has introduced the concept of Security Analytics for describing the use of information analytics to manage network and information security threats (RSA 2013). A similar concept is Security Intelligence with Big Data, introduced by IBM (IBM 2013; Extending 2013). A highly significant network security threat is intrusion into a network or network host. Intrusion management consists of intrusion prevention, registration and analysis of all intrusion attempts, intrusion detection, recovery from intrusion, as well as the required forensic investigations after intrusion and intrusion attempts. The relevance of intrusion management solutions based on information analytics methods is motivated by the fact that successful intrusion management may require real time processing of a huge amount of unstructured data. Another highly significant security threat to networks and to network hosts is malware. Information analytics methods are therefore also needed to identify malware in huge scalable datasets.

## 2. Intrusion Management Principles

Intrusion sources comprise:

- data communication to networks and network hosts
- malicious and/or infected programs on memory disk devices like USB sticks
- malicious use of user interfaces to network hosts and other network devices.

The intrusion management focus should be on intrusion prevention, which can be achieved by physical security solutions, system architecture features, and features of installed Intrusion Detection Systems (IDS).

### 2.1 Intrusion Prevention

Physical security solutions should minimize the malicious use of user interfaces with the proper physical placement of and with access restrictions to network hosts and other network devices. System architecture features for intrusion prevention should minimize any vulnerability to malicious network communication and also to any malicious programs on connected memory disks. This is achieved with installed up-to-date antivirus software, with up-to-date vulnerability patching, and with proper file encryption solutions.

A typical IDS monitors and registers the data communication to and activity in a network and its hosts. It also makes real-time decisions and alerts on any assumptions of intrusion or intrusion attempts with the aid of a decision support database and a database with registered information of monitored network traffic and monitored network host activity. An IDS is never perfect. IDS implementation criteria are minimization of vulnerability and maximization of detection efficiency. A measure of IDS vulnerability is the relation between detected and undetected intrusion events/attempts. An IDS efficiency measure is the relation between correctly detected intrusion events/attempts and false positives (erroneous assumptions of intrusion or of intrusion attempts). An intrusion prevention feature of an IDS is prevention of malicious data communication from entering a network or a network host. This feature has however the drawback, that a false positive can prevent legitimate data communication from reaching a network or a network host (Intrusion 2009).

### 2.2 Intrusion Detection Methods

The main detection types are signature based detection, anomaly based detection, and stateful protocol analysis. Signature based intrusion detection is based on the identification of known patterns of data communication and network/network host activity in earlier recognized intrusion incidents/attempts. This intrusion detection method is straightforward and fast since it is based on matching of predefined patterns and on applying predefined rules. However, earlier unknown intrusion attempts and slightly modified known intrusion attempts cannot be detected with signature based methods.

Anomaly based intrusion detection identifies deviations from normal and typical user activity, data communication patterns, application behavior, etc. Different users can have different profiles of normal activity. Normal behavior in a network or in a network host must be learned from a training dataset or from monitoring the data communication and activity in a network or in a network host. The benefit of anomaly based detection is the ability to detect previously unknown intrusion attempt types.

In stateful protocol analysis, the use of a network protocol is compared in each protocol state to predefined specifications on how the protocol should/should not be used. For example, the same protocol activity can be determined as benign for an authenticated user and suspicious for an unauthenticated user. Stateful protocol analysis is quite complex and therefore resource intensive. Another drawback of this detection type is that intrusion attempts based on acceptable protocol behavior are not detected (Scarfone & Mell 2007).

## 2.3 Implementation of Intrusion Detection Systems

Typical IDS components are:

- sensors for monitoring data communication in network segments
- agents for monitoring activity in network hosts
- management servers for receiving information from sensors/agents, for making decisions on alerts to be transmitted, and for producing and transmitting reports
- a database server for storing
  - monitoring information from sensors/agents,
  - decisions and reports of management servers, and
  - decision making support information
- a console with an administrator interface for configuring and monitoring the status of the IDS.

Many commercial solutions to detection of host and network based intrusion are currently available. A drawback of practically all these tools is however the large number of false positives in anomaly based intrusion detection (Intrusion 2009; Scarfone & Mell 2007).

## 2.4 Recovery from Intrusion

The state of a network and a network host, timed as closely as possible before the time of a detected intrusion event, should be restored. Usually this means the restoration of the last backup before the event. All information stored in the network/network host after this backup will however be lost. Bacs et al. (2012) present a recent network host disk memory recovery solution DiskDuster, which restores a disk memory to a pre-intrusion state with a minimal loss of data stored before the intrusion incident.

## 2.5 Forensics after Intrusion and Intrusion Attempts

In forensics, the network traffic and host activity is captured, recorded, analyzed in order to discover the source and features of security attacks. Intrusion forensics can reveal how a network was attacked, the path of an intrusion attack, which intrusion techniques were used in an attack, and any trace and evidence associated with an intrusion attack. Many automated tools are available for forensic investigation, but none of these tools is able to deliver 100% reliable result information (Computer 2009).

# 3. Information Analytics for Intrusion Detection

This chapter outlines analytics methods for implementing the functionality of intrusion management.

## 3.1 Monitoring, Database Processing, and Alerting

Processing of the vast amount of monitoring information from agents and sensors in an IDS, updating a database with this information, correlating this information with this rapidly growing database, and applying a decision support database for real-time alerting, requires the use of technologies for processing unstructured big data in agents, sensors, and management servers. Available technologies are the open source tools Hadoop (Welcome to Apache Hadoop 2013) and PIG (Welcome to Apache Pig 2013), which extend the MapReduce programming model (Dean & Ghemawat 2004). MapReduce decomposes data into smaller pieces, which are processed on the network hosts in which they reside, instead of moving the data pieces to other network nodes for processing.

## 3.2 Learning Methods for Decision Support

The learning methods for alert decision support in anomaly based intrusion detection must be scalable for unstructured datasets of arbitrary size. Learning methods based on Support Vector Machines (SVM) and on neural networks have previously been used (Mukkamala et al. 2002). Recent neural network based learning methods for intrusion detection are Extreme Learning Machine (ELM) (Cheng et

al. 2012; Jaiganesh & Sumathi 2012) and Self-Organizing Feature Maps (SOM) based methods (Kayacik et al. 2007). Using machine learning in combination with Hadoop often consists of the following steps:

- Store data in Hadoop.
- Run data preprocessing in order to vectorize input data (applying filters and/or feature extraction methods).
- Start training jobs, learning at least one model per input vector (only applied during the training phase).
- Execute models - a model classifies an input vector as a threat or not as a threat (the decision is not necessarily a binary decision).

Most of the learning methods described above, try to find a non-linear mapping of the input vector into a high-dimensional feature space. Connecting the high-dimensional feature space to an output layer can then be performed through linear mapping. The decision support system can be implemented as a recommender system, either requiring manual interaction or as a fully automated expert system (Haykin 2009).

### 3.3 Forensic Analytics

Forensic investigations after intrusion/intrusion attempts must manage at least the same dataset that was processed before an intrusion alert. Thus, information analytics tools are also needed for forensics. Nigrini (2011) offers a thorough presentation of forensic analytics methods. Forensic capabilities are also included in the commercial RSA Security Analytics (RSA 2013) and Security Intelligence with Big Data (Extending 2013) solutions.

## 4. Malware Analytics

A recently designed open source malware analytics tool BinaryPig, based on Hadoop and PIG, is available for malware identification in huge datasets (Trost et al. 2013). Hanif et al. (2013) characterize BinaryPig as:

*“... [hoping] to provide a solution to the scalability problem represented by this influx of malware. It promotes rapid iteration and exploration through processing non trivial amounts of malware at scale using easily developed scripts. It was also built to take advantage of preexisting malware analysis scripts.”*

In a demo, BinaryPig has detected about 20 MB of malware samples inserted in a 9.5 TB binary dataset (Hanif et al. 2013). Malware analytics capabilities are also included in the RSA Security Analytics solution (RSA 2013).

## 5. Conclusions

Current networking is rapidly developing towards increased wireless connectivity and mobility in a pervasive environment. A myriad of sensors, actuators and other smart devices are being connected to the Internet. Therefore network and information security tools, solutions and services with big data capacities are required. Both open source and commercial information analytics methods for intrusion management and malware identification are already available. A challenge for future development of intrusion analytics based on anomaly identification is to combine maximal detection of intrusion with as small as possible amount of false positives.



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# Immateriellrättsliga utmaningar i samband med 3D-printning

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## 1. Inledning

3D-tekniken är en teknik som har vunnit stor uppmärksamhet de senaste åren, trots att själva tekniken bakom 3D redan är mycket gammal. Redan år 1844 introducerades stereoskopet som gjorde det möjligt att ta bilder i 3D-format. Det dröjde dock ända fram till 1950-talet innan 3D-tekniken började tillämpas inom TV. 3D-programmen på TV blev emellertid ingen långvarig succé. Situationen har emellertid förändrats radikalt under de senaste åren.

Fotografiska verk och filmverk är inte de enda områdena där 3D har blivit vanligare. Ett mycket betydelsefullt område inom vilket 3D har haft ett stort genombrott den senaste tiden är printning. 3D-printning innebär att man skriver ut olika typer av föremål i 3D-format. I dag forskas och skrivs det mycket om 3D-printning, men själva tekniken har redan använts i ca 25 år. Orsaken till att 3D-printning har förblivit ett förhållandevis obekant fenomen för merparten är att tekniken främst har använts endast av laboratorier, bil- och flygplanstillverkare och på andra verksamhetsområden där det krävs mycket design (Guth 2007). 3D-tekniken lämpar sig bäst för printning av mindre föremål, men det har även skapats jättelika konstruktioner med hjälp av 3D-printning (Hsu 2010). Ett område inom vilket 3D-printning förväntas medföra stora förändringar är hälso- och sjukvården. Det har redan tagits fram en 3D-bioskrivare med vars hjälp artärer kan skrivas ut. Med hjälp av 3D-bioskrivare förväntas man i framtiden kunna printa ut komplexare organ, såsom t.ex. hjärta och tänder (Quick 2009, Wang 2013a).

Det förekommer emellertid även vissa risker med utvecklingen och förbättringen av 3D-skrivarna. Ett exempel på en sådan risk är piratkopieringen av nycklar. Det har redan bedrivits forskning som visar att det är möjligt att med hjälp av 3D-skrivare kopiera säkerhetsnycklar. I framtiden finns det alltså en överhängande risk för att någon på långt avstånd kan ta ett foto av en nyckel som någon håller i sin hand för att sedan skapa en egen kopia av nyckeln (Wang 2013b). En annan oroväckande utveckling är att 3D-printning gör det möjligt för enskilda personer att tillverka egna dödliga skjutvapen (Anthony 2012).

Det är naturligtvis omöjligt att förutspå på vilket sätt 3D-printning kommer att förändra världen i framtiden. Troligtvis kommer 3D-printning dock att få stora konsekvenser för många företag inom tillverkningsindustrin när 3D-skrivare blir vanliga i hushåll. I dag består konsumtionen till stor del av konsumtionen av masstillverkade produkter (Barnatt 2013). Masstillverkning är ekonomiskt lönsam eftersom enskilda personer inte har tekniska kunskaper eller ekonomiska förutsättningar för att själva producera varor. Det är speciellt här som 3D-printningen troligtvis kommer att medföra revolutionerande omdaningar inom tillverkningsindustrin. Ifall enskilda konsumenter snabbt, enkelt och billigt kan tillverka samma produkter hemma som affärerna bjuder ut är det inte sannolikt att de köper produkterna i affärerna.

Syftet med detta papper är att lyfta fram vilka immateriellrättsliga utmaningar 3D-printningen medför. Innebär t.ex. printning av byggklossar i plast (t.ex. byggklossar identiska med de som tillverkas av Lego®) intrång i någon immateriellrätt? I uppsatsen behandlas immateriellrätterna upphovs-, mönster-, varumärkes- och patenträtt, eftersom det främst är dessa immateriellrätter som står inför betydande utmaningar i samband med 3D-printning. Avsikten är att uppsatsen skall fungera som en språngbräda för en mer omfattande vetenskaplig artikel i ämnet.

## 2. 3D-printning och upphovsrätt

Föremålet för upphovsrätten är litterära och konstnärliga verk. Vad som avses med litterära och konstnärliga verk framgår av 1 § upphovsrättslagen (URL, 1961/404). I paragrafen ingår en förteckning över vilka slags verk upphovsrätten skyddar. Förteckningen inkluderar bl.a. musikaliska och sceniska verk, filmverk, alster av byggnadskonst och konsthantverk. Förteckningen över verkstyper i 1 § URL är emellertid inte avsedd att vara uttömmande.

Den som innehar upphovsrätt har en uteslutande rätt att framställa exemplar av verket och göra verket tillgängligt för allmänheten i ursprungligt eller ändrat skick, i översättning eller bearbetning, i annan litteratur- eller konststart eller i annan teknik (2 § URL). Upphovsmannens ensamrätt är emellertid begränsad och en av de mest betydelsefulla inskränkningarna finns intagen i 12 § URL. Enligt nämnda paragraf har var och en rätt att framställa enstaka exemplar för sitt enskilda bruk. Ett exemplar som har framställts på det här sättet får inte användas för andra ändamål. Exemplaret får t.ex. inte säljas vidare eller utnyttjas i näringsverksamhet. Därutöver förutsätts att förlagan är lovlig, därmed är det alltså inte tillåtet att skapa en kopia av en piratkopia. Rätten att framställa enstaka exemplar för enskilt bruk har långa traditioner, och man brukar säga att upphovsrätten stannar vid hemmets dörr (Levin 2007).

Upphovsrätten torde vara den immaterialrätt som till följd av den tekniska utvecklingen har hårdast utsatts för krav på förändring. Det är framförallt övergången från analog till digital teknik som har gjort det betydligt enklare, snabbare och billigare att skapa högklassiga kopior av verk.

Nedan följer ett fiktivt exempel som belyser de frågor som kan bli aktuella vid printning av upphovsrättskyddade verk:

*A ser en vacker bild av en skulptur på Internet och besluter sig för att skriva ut bilden. Upphovsrätten till skulpturen innehas av företag X. Utgör printningen intrång i upphovsmannens (X:s) ensamrätt?*

Först kan vi konstatera att det då bilden av skulpturen togs skedde en dimensionsövergång från 3D till 2D. Upphovsrätten täcker även dimensionsövergångar, d.v.s. övergången från 3D till 2D eller tvärtom (Levin 2007). Det här innebär att A har rätt att med stöd av 12 § URL skapa en kopia för enskilt bruk, ifall bilden lades ut på Internet med samtycke av X. Ifall bilden av skulpturen däremot har lagts ut på Internet utan X:s samtycke, har A till följd av 11 § 5 mom. i URL inte rätt att göra en enskild kopia av skulpturen ens för eget bruk. A gör sig däremot inte skyldig till upphovsrättsintrång så länge A endast tittar på bilden som lagts ut på Internet utan upphovsrättsinnehavarens tillstånd.

Det är emellertid skäl att poängtera att det 2006 intogs det bestämmelser i URL som förbjuder kringgående av effektiva tekniska åtgärder (50a § URL). För att förbudet inte skall få allt för negativa följder har den som lagligen skaffat eller i sin besittning fått ett exemplar av ett verk rätt att kringgå en teknisk åtgärd för att lyssna eller se på verket. Denna begränsning har främst utarbetats för kopiering av musikaliska verk och filmverk och torde inte bli aktuell i samband med 3D-printning.

## 3. 3D-printning och varumärkesrätt

Ett varumärke kan bestå av vilket tecken som helst som kan återges grafiskt. Enligt 1 § 2 mom. i varumärkeslagen (VML, 1964/7) kan märket i synnerhet bestå av ord, inbegripet personnamn, figurer, bokstäver, siffror eller formen på en vara eller dess förpackning. Typiskt för moderna varumärken är att de inte består enbart av text och bild, utan att även färger och former har fått en allt större betydelse. Det innebär att tredimensionella varumärken har blivit allt viktigare (Levin 1990).

Ensamrätten till ett varumärke innebär att ingen annan än innehavaren får i näringsverksamhet använda ett därmed förväxlingsbart kännetecken för sina varor, vare sig på varan eller dess förpackning, i reklam eller affärshandlingar eller på något annat sätt, inbegripet muntlig användning (4 § VML). Varumärken anses förväxlingsbara endast om de avser varor av samma eller liknande slag (6 § VML). Ensamrätten utsträcker sig med andra ord enbart till näringsverksamhet.

Nedan följer ett fiktivt exempel som belyser vilka frågor som kan bli aktuella vid printning av skyddade varumärken:

*A äger en motorcykel tillverkad av företag X. På tanklocket finns företag X:s tredimensionella varumärke. Eftersom tanklocken är dyra att köpa skapar A ett 3DPDF-dokument av tanklocket och skriver ut ett par tank-*

*lock i reserv. A sätter även ut 3DPDF-dokumentet på Internet så att andra kan ladda ned dokumentet och skriva ut egna tanklock. Dokumentet laddas ned av B som äger en verkstad för reparation av motorcyklar. B skriver ut ett tiotal tanklock för användning vid kommande reparationer. Innebär dessa handlingar varumärkesintrång?*

När A skapar ett 3DPDF-dokument och skriver ut tanklocket inklusive det skyddade varumärket kan det inte anses vara fråga om varumärkesintrång, eftersom ensamrätten till varumärken utsträcker sig enbart till näringsverksamhet.

När A lägger ut 3DPDF-dokumentet på Internet innebär det att vem som helst kan ladda ned och skriva ut X:s registrerade varumärke. Enligt gällande rätt torde A inte anses göra sig skyldig till varumärkesintrång när 3DPDF-dokumentet läggs ut på Internet. Ifall varumärket samtidigt anses vara ett upphovsskyddat verk är situationen emellertid en annan. Då gör A nämligen intrång i X:s ensamrätt när han lägger ut dokumentet på Internet.

B:s förfarande kan däremot eventuellt anses uppfylla kriterierna för varumärkesintrång, eftersom B använder varumärket i näringsverksamhet.

## 4. 3D-printning och mönsterrätt

Mönsterrätten regleras i mönsterrättslagen (1971/221) och kan beskrivas som ett skydd för utseende (design). Enligt 1a § avses med mönster en produkts eller produktfels utseende, som bestäms av de detaljer som finns på själva produkten eller i dess ornament, såsom linjer, konturer, färger, former, ytstrukturer eller material. Ensamrätten innebär att ingen får utnyttja mönstret kommersiellt utan innehavarens lov.

Enligt 5b § ML omfattar mönsterrätt inte enskild användning av mönstret utan kommersiellt syfte. För att undantaget skall bli tillämpligt förutsätts det att utnyttjandet sker både enskilt och utan kommersiellt syfte. Det innebär att även en privatperson kan göra intrång i mönsterrätt. En 3D-printning som utförs för privat bruk kan därför vara olaglig om den sker i kommersiellt syfte.

## 5. 3D-printning och patenträtt

Ensamrätt till uppfinningar kan beviljas med stöd av patentlagen (1967/550). Ensamrätten till ett patent innebär enligt 3 § i patentlagen att det bl.a. inte är tillåtet att tillverka, bjuda ut eller släppa produkter på marknaden utan patenthavarens tillstånd. Ensamrätten omfattar inte utnyttjanden som inte sker yrkesmässigt.

*Antag att A besöker databasen över beviljade patent på patent- och registerstyrelsens webbplats. I databasen hittar A ritningar/bilder över byggklossar av plast. Patentet innehas av företag X. A skapar ett 3DPDF-dokument av bilderna och skriver ut ett hundratal klossar.*

Patenthandlingarna är offentliga och rätten att ta del av dem är inte begränsad. A kan därför inte anses begå patentintrång när han skapar 3DPDF-dokument med stöd av bilderna i patenthandlingarna. A begår inte heller patentintrång när byggklossarna skrivs ut, eftersom utnyttjande som inte är yrkesmässigt inte omfattas av ensamrätten.

## 6. Sammanfattande slutord

3D-printning är inte ännu så vanlig i privata hushåll, men tekniken går snabbt framåt. Därför är det ingen utopi att 3D-skrivare i framtiden kommer att bli lika vanliga i hemmen som 2D-skrivare är i dag. Det finns redan användarvänliga 3D-skrivare på marknaden avsedda för privat bruk (miniFactory). På nätet för 3D-printning (Thingiverse, MakerBot) finns det tillgång till färdiga och även kostnadsfria elektroniska 3D-modeller. Man kan också beställa en egen elektronisk modell som 3D-printad form av valt material (i.materialise).

Troligtvis kommer 3D-skrivare mest att användas för att skriva ut mindre föremål i plast och metall. Det innebär att i synnerhet föremål såsom t.ex. leksaker, smycken och bestick kommer att skrivas ut i

stor omfattning. Men även försäljningen av reservdelar till t.ex. bilar och båtar kommer sannolikt att sjunka drastiskt när privatpersoner kan skriva ut delarna själv. Det här kommer troligtvis att leda till att näringsidkare lägger fram önskemål om lagändringar. Hur är dagens immaterialrättsliga reglering anpassad med tanke på den framtida 3D-printningen? När det gäller näringsverksamheten torde lagstiftningens skydd vara tillräckligt. Men för handlingar av privat karaktär som inte kan betraktas som näringsverksamhet är situationen en annan. I dagens läge är det främst upphovsrätten som har ett relativt starkt skydd med tanke på 3D-printning i privata hem. Den immaterialrätt som torde stå inför de största utmaningarna när det gäller 3D-printning i privata hem är mönsterrätten. Patentskyddade alster kan även i viss mån bli föremål för 3D-printning.

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# Extracting People's Hobby and Interest Information from Social Media Content

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## Abstract

Analyzing and summarizing social media data such as a Facebook profile can be challenging in a number of ways. Not all of the information available is relevant to the person subject to summarization or even created by that person. The text content is often short, informal and none grammatical. In this paper we discuss text summarization techniques that can be used for analyzing social media content and extracting tags indicating a user's hobbies and interests. We built a system that based on term frequency and inverse document frequency can extract hobbies and interests from social media content.

## 1. Introduction

Social media content analysis has been undertaken in several studies on shorter information snippets such as the 'tweets' on Twitter (Shamma, Kennedy & Churchill 2010, Yang, Ghoting, Ruan & Parthasarathy 2012). Much less research has been done on analyzing and summarizing relatively larger amounts of text data from social media sources like Facebook, LinkedIn, Diaspora and Google+. The challenge in analyzing a person's social media presence lies in that not all information available is relevant to the person subject to the summarization or even created by that person. Additionally, the content can be fragmented and not necessarily structured like normal text or written in a grammatical way. When we gather data, we normally don't have a flowing text, for example like that seen in a news article. Instead the format depends upon how the site or platform in question stores the data.

In this paper we present our work on extracting people's hobby and interest information from Facebook content. An extract consists of sentences, paragraphs or words from the original text without modification (Lindroos 2006). The goal of sentence extraction is to select the most relevant sentences and create a paragraph summary. The goal of key words/phrase extraction is to select individual words/phrases that are central to the information in the text. In this article some word weighting methods and extractive text summarization techniques that can be applied are introduced. We will also discuss ways to keep input data relevant, and how we can increase the significance of parts of the data to make it more relevant to the subject of the summarization.

## 2. Method and tools

In text summarization, the length of a summary is specified by a compression ratio and defines how long the summary should be, compared to the source document. In addition to a compression ratio we need to define the width and depth of information in the document. Width refers to the scope of the text, i.e. whether several subjects are discussed. Depth refers to what level of detail the subjects are discussed in the text (Lindroos 2006). Each sentence in the text is given a value according to its significance. The significance factor can be calculated based on term frequency and the relative position within a paragraph of a document (Luhn 1958).

Key word/phrase extraction is defined as extracting a small set of words from a text (Csomai 2008), like a document, or in our case the sum total of one person's activity on a social media site. The strength of key phrase extraction is to find information that does not encompass personal names or locations, but still represents something important in the text (Csomai 2008). In the simplest case, key words can be determined using word weighting methods.

We apply statistical text summarization techniques and heuristic rules in determining the most representative terms indicating people's hobbies and interests (see Figure 1). We make use of an open source multilingual text summarization tool, MEAD (Radev et al. 2004; Lindroos 2006), in implementing our application.

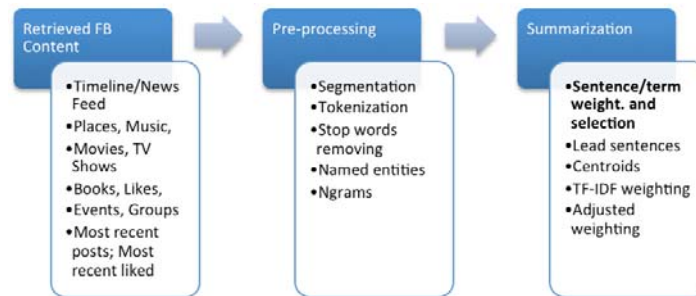


Figure 1. Determining the most representative terms indicating people's hobbies and interests.

### 2.1 Tf-Idf word weighting

Tf-Idf is one of the most popularly used and robust word-weighting methods. It combines consideration of term frequency with inverse document frequency, to determine the importance of words. This value is known as the tf-idf ( $wd$ ). The formal calculations can vary for different implementations, but in-line with Salton & Buckley (1988) the normal approach is as follows: If we have a collection of documents  $D$ , a word  $w$ , and an individual document  $d \in D$ , we can calculate the following:

$$wd = fw, d * \log(|D|/fw, D)$$

$fw, d$  (above) represents the number of times that  $w$  appears in  $d$ , and  $|D|$  represents the size of the collection of texts.  $fw, D$  represents the amount of documents that  $w$  is found in (Salton & Buckley 1988). This method automatically gives a low Tf-Idf value to common words like pronouns and prepositions that are normally neither relevant to a summary nor should be counted as key phrases. However, a word with a high term frequency ( $fw, d$ ) in the document we are trying to summarize and a low  $fw, D$  value (which represents the amount of times the word  $w$  is found in the collection of documents) would give us a high Tf-Idf value and represent a word that is important but not found in many different texts (Salton & Buckley 1988).

### 2.2 Targeting relevant text portion

In addition to the Tf-Idf weighting of word informativeness, Luhn (1958) suggested taking into consideration the positioning of sentences in texts. A sentence at the beginning of a paragraph or at the end of a text has a higher chance of being of high importance in the text (Luhn 1958). However, this is not necessarily true for texts gathered from social media sites due to the following reasons: 1) the informa-

tion will be structured according to whatever database model the company uses, 2) the information will be a collection of different areas such as personal information, communication with friends, interests and other issues which do not necessarily have anything in common, 3) the data in question can include dialects, multiple languages, intentionally misspelled words etc.

As sentence ordering can be usefully taken into account in analyzing Facebook content, we suggest firstly: Publishing dates, and secondly: Site specific counts, as new criteria for determining relevant data. By limiting publishing to recent dates we can either leave out old information from social media profiles or decrease the significance of Tf-Idf values for posts older than the specified date by a pre-determined factor. By using site specific counts (for example increasing the significance of content that has received a higher amount of "likes" on Facebook), we can increase the content relevance. In addition, we can also try to make good use of semi-structured nature of pages such as those on Facebook and target content under different interest categories such as Places, Music, Movies, Books, Events, Groups and so on.

### 3. Results and future work

As sentence ordering is not reliable in social media summarization and taking into account the fact that longer sentences generally hold greater significance than shorter sentences in summaries (Radev et al. 2004), we expect sentence extraction to give a less than satisfactory result in the social media context. Key word extraction takes into account neither sentence ordering nor length. As such, key word extraction is perhaps more important to the analysis of social media content than a sentence based summary. An example the output of tags extracted from an author's Facebook account is given below (Figure 2).

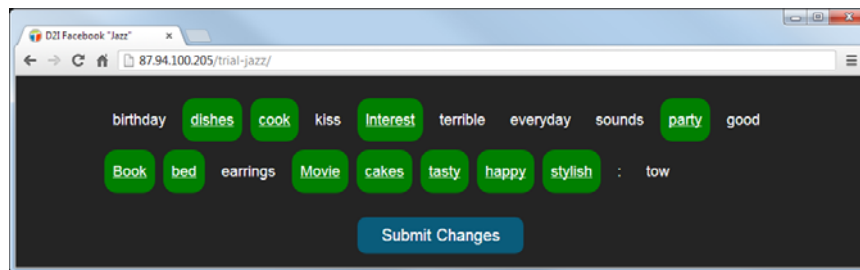


Figure 2. An example the output of tags extracted from a Facebook account.

Our current system is still limited to English content. We have conducted a pilot test among international students and researchers and collected helpful feedback and observations concerning the type of useful tags we may use and system performance issues. The system has been integrated into a larger tag-extractor service platform. Currently, we are updating and further improving the tag extraction methods. We will also work on extending the analysis to content in other languages.



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# Managing Media in the Digital Realm: A case study of an emotional economy – India

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## Abstract

This qualitative study aims to understand the role of media managers in the Indian media (TV, Print, Radio, New Media, Gaming, Publishing, Advertising, Films and Production Houses). It looks to delve deeper into the competencies required to perform efficiently in a highly complex work environment. The study discusses the key drivers of the ongoing transformation of Indian media and highlights the factors that are redefining the roles of media managers. It also tries to decode the importance of creativity, both in their day-to-day decisions and wider managerial judgments.

## 1. Introduction

Studies of Media Management have so far been led by reports based on Western or European media. This study moves away from these markets and explores media in an emerging economy – India, which is also one of the few countries that has drawn the interest of media investors in recent years (Sylvie et al. 2008). Indian media is on the cusp of significant change, driven by the advent of digitization, technological development, a growth in regional markets, cross integration across sectors and the introduction of new media (FICCI-KPMG 2013). What makes it a peculiar case is the short span of time (5-8 years) within which it has experienced these changes, unlike the US or Europe where the pace of change has been gradual and spread over decades. It is this rapidly changing structure and the nature of the media industry that makes the job of leading media organizations exceptionally challenging (Sylvie et al. 2008).

Indian media managers have to cater to the needs of a ballooning consumer base (with diverse media consumption habits) and so constantly alter the nature of content and offer creative ways to sync the internal and external prerogatives of their business. This study explores the working dynamics of media managers in India and tries to understand and highlight the nature of the additional layers of responsibilities in their role. It also explores the connection between creativity and media management in the Indian context. As this research is currently in its first phase of analysis, the potential for the further discovery of influential results is highly possible. This paper presents an overview of the research in progress.

## 2. Methodology

For this qualitative research we decided to conduct in-depth interviews with media managers in India to personally witness and understand how their roles have changed in the last decade. I traveled to Mumbai (the financial capital of India and a hub for most media houses) and conducted 21 interviews

over a period of three weeks with those at the helm of affairs with India's leading English media networks, across a range of media sectors (TV, Print, Radio, New Media, Gaming, Publishing, Advertising, Films and Production Houses).

Our sources of information include primary (recorded interviews), secondary (data on Indian media industry) and observational in nature (observing media managers at work; their ability to multi-task, the needs of multiple platforms, think on their feet, address issues across verticals [markets within markets], platforms and people, and to generate content and ideas relentlessly). The interviews were on an average about 25 minutes in length and addressed issues covering broad industry dynamics and specific aspects of media management. We selected only those media companies that dealt with content in the English language as including a sample size from the several hundred fragmented regional language media companies to be found would widen the scope and timeframe of the research beyond the limits available for this study. The findings of this research however, serve to throw light on the emergence of multi-faceted media managers in India.

### 3. The Indian media context & technological growth

The role of media in India (the largest democracy in the world) today is not merely restricted to disseminating information and entertainment (Dutta 2011), but is a lot more complex and challenging. Until a decade ago, a media manager in an Indian media company had a bracketed role and was required to have a skill set with a specialization. So a creative or editorial person was in charge of content and a technical head was responsible for production. Now however, that line of distinction is beginning to blur. Managing media in today's India is a complicated network of processes, people, technologies, content, competition, organizational structures and market dynamics, thus making it a convergence of sorts. This convergence comes in different forms and affects most, if not all of the practitioners in the way that they work (Deuze 2008). For instance with the rise of the internet, the advancement in technology and the growing popularity of new media, media managers have become a one-stop-shop for a gamut of responsibilities. It is therefore crucial for media managers to understand these developments and consider the economic and social impacts of new technologies on the media industry and its products (Mierzejewska 2011). Media managers in India no longer only operate within the framework of their organizations, and news organizations in particular (the press) have become instrumental in setting the political, economic, social and cultural agenda of the country (Ray 2009).

While analyzing the interviews, we noticed five common factors influencing the transformation of the role of media managers (across forms of media) in India:

1. Change (in industry dynamics)
2. Growth (in scale and scope of work)
3. Rise of multiple platforms (for media content delivery)
4. Need for innovative business models (for revenue generation)
5. People skills (to deal with ballooning human resources)

Another highlight was the role of a crucial resource – Creativity, which potentially enables media companies to adapt to changing environments (Przybylski et al). As a starting point, it is important to understand three important phases in India that led to this sudden barrage of changes in the role of media managers. They are: 1) the boom in television, 2) the rise of the internet and the digitization of television, 3) the influx of digital/new/social media. Our research aims at studying the evolution of Indian media and media managers, by means of this cause and effect equation.

#### 3.1 Cause and Effect

According to the Indian Information and Broadcast Ministry, India currently broadcasts over 800 media and entertainment channels - a huge leap from the 100 or so channels broadcast in 2003. This boom in television was followed by digitization. Indian television switched from analog to digital in 2012, starting with metropolitan areas like Mumbai, Delhi and Kolkatta. Most media managers interviewed highlighted the offshoot of this phase as being a starting point of change in their roles. Digitization has led to an increased reliability on audience measurement systems, like that of TAM (Television Au-

dience Measurement - run by A.C. Nielsen). This places increasing pressure on media managers to perform, and to generate both 'ratings' and 'revenue' in television. Sridharan Ramakrishnan, an Executive Editor of the news channel, ET NOW says: "10 years ago, during the boom of television, no one really bothered much about revenues, but today, revenues and costs are significant even to the editor." Tarun Katial, CEO of the Reliance Broadcast Network Ltd (Radio Station - Big FM) says: "My role in the organization has moved from doing a start-up 5-6 years ago to building long-term sustenance, long term value and looking at a better business matrix."

### 3.2 Rise of New Media

This dichotomy is further highlighted by the rise of new media, which has altered the functioning of media managers across all forms of existing media. With 65% of India's population under the age of 35, it is needless to say that the youth are quickly responding to technological breakthroughs and are not only consuming media in a myriad of ways, but also creating media content. There has been a general shift in power away from professional content creators, to users and owners (Deuze 2011). This has pushed managers into uncharted territories and broadened their scope of work. They are now experimenting by co-creating with the new breed of content creators and engaging them with differentiated content. KV Sridhar, the National Creative Director for Leo Burnett (an advertising agency) says: "Earlier, we used co-create only with photographers or film producers for the production of a film or commercial. Today we work with content creators on a reality show, or soaps, co-create with student communities etc." This is a good sign, because in such a media-orientated world where consumers decide what news they want to get and how they want to get it, the future will belong to those who understand the public's changing behavior and can target content and advertising to fit the interests of each individual user (Rosenstiel & Mitchell 2011). Such an ability to anticipate and adapt is crucial as every media company is looking for a profitable and viable business model. There is however no fool-proof way to ensure success, as given the diversity in media platforms, content and user dynamics, a 'one size fits all' approach is unlikely to ensure media survival (Macnamara 2010). The best way forward (as suggested by Carr 2010), may be a hybrid model involving multiple revenue streams developed to suit each medium and its operations. Our research found that Indian media managers are also diversifying into multiple platforms and tapping regional markets to ensure a sustainable business model. For instance, a leading television media network in India, Network 18 launched a news portal called Firstpost.com in May 2011, in order to make the best of both TV and digital media. It's Editor-in-Chief, R. Jaganathan is responsible for the content of the digital and print products of Network 18, and is now also gearing up to generate content for mobile web. He says: "People are going to watch and read your content on handheld devices and smartphones. We have to learn new things to see how we write for handheld device readers/viewers." In a span of just two years, this media house has adapted to changing technologies, ventured into both the digital and mobile web fields and is trying to tap multiple revenue streams. After all, the limit on revenue potential of new technologies primarily depends on the innovation and branding awareness of the manager (Sylvie et al. 2008). Amar Chitra Katha, the oldest publication in India is also diversifying its portfolio of products from comic books to Apps, TV shows and games to tell stories in the most interesting format. "Radical innovation based on the need of the hour is our motto," says its editor Vijay Sampath.

### 3.3 The Creative Streak

Our research also aims to understand the pulse of innovation among media managers in India, as facilitating and enhancing creativity is an important part of the media manager's work (Nylund 2013). It is though easier said than done in the Indian context as media managers handle much larger teams today than they did a few years ago. Sridharan Ramakrishnan (the Editor of ET NOW) used to handle a team of 60 - today his team comprises of 240 personnel. Senthil Kumar, the National Creative Director of the JWT advertising agency says his work involves overseeing the work and creative output from more than 1000 people on a daily basis. People mail him about 20-25 ideas per day on an average from all over the country and he then further channelizes these thoughts. Managing this massive flow of ideas is a huge responsibility, as people in leadership positions underline the importance of motivating the team members, and have to themselves be motivated in order for the team to evolve (Przybylski et al. 2013).

## 4. Growing need for people or social skills

Little wonder then that many media managers today dub their roles as that of a 'Chief Motivating Officer', because according to Vishal Gondal, Founder and CEO of Indiagames: "When the chips are down, how you motivate the groups is a key thing". This emphasizes the fact that Indian media is in a 'people' business and thus the need for excellent social skills is felt more now than ever before. Media managers in India function in a relatively 'emotional' economy, making effective communication their key to a productive and creative process. Our research indicates that managers are successfully breaking the communication barriers that existed a decade ago. K.V. Sridhar nails it jokingly: "I get paid an obscene amount of money and my only qualification is that I understand people."

## 5. Discussion

Our research throws light on some emerging patterns in which the role of media managers has changed across all forms of media. They are no longer a mere conduit between the editorial team and the management. Instead, they don hats of various skills and their job descriptions today include a dash of several specialties, amongst others; editorial, technical/digital, marketing, PR, branding, finance, production, administration, human resources and legal). We intend to study the data further to make pertinent observations, as managers in every form of media perform within their own context and therefore present a new perspective on the daunting challenges they face. We aim to note innovative case studies to add value to our knowledge of the growing complexities in the Indian media industry.

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# Customer Relationship Management and Business Analytics

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## Abstract

This paper makes an exploratory combination of customer relationship management (CRM) and business analytics (BA). The paper identifies three perspectives of CRM, i.e. the strategic, the process and the operative approaches. Based on Delen and Demirkan (2012), the three categories of business analytics (descriptive, predictive and prescriptive) are then related to the three CRM perspectives. The combination results in an exploratory framework that imply possibilities to increase our understanding of different critical CRM based questions that management need to address on both a strategic and operative level.

## 1. Introduction

The marketing discipline has gone through a substantial change in perspective over the last 20 years. This perspective has changed from a product and production focus, to a customer and user centric approach (see e.g. Grönroos, 2000; Storbacka and Lehtinen, 2001; Payne, 2006). Another change in focus is the change from the transaction approach which has been dominant in traditional marketing, to a customer relationship approach. This shift in perspective has mobilized academics to conduct research and increase our understanding of the customer as the most central component in business, and to explore concepts and create models that describe and analyze the customer relationship. Three separate approaches to customer relationship management (CRM) can be identified in existent literature. First, a strategic approach to CRM that stresses the identification, analysis and understanding of different types of customers and customer relationships. The strategic approach has created models for customer base portfolios and customer profitability (e.g. Lehtinen and Storbacka, 2001). Second, a process perspective to CRM where the focus has been a relationship lifecycle model, based on establishing, enhancing and ending relationships. Related to this perspective, the concept of value has been critical. Third, the operative perspective has focused on the management of customer relationships. This approach has been more traditional in nature, i.e. focusing on the supplier or seller and their ambition to manage customer relationships efficiently. The approach has tight correlations to the literature of sales, campaign and service management. Apart from these theoretical marketing fields, the operative CRM approach has been developed by the strong progress in information technology. Especially, software vendors like Oracle, Microsoft, Siebel, Salesforce etc., have systemized and automated the sales and campaign processes in companies, by developing and launching IT systems for CRM.

Business analytics is a field with its roots in management information systems, business intelligence and artificial intelligence. The past 20 year's development of the fixed and now mobile internet infrastructure and the explosion of user and customer generated data has increased the need to develop agile and service oriented decision support systems (see e.g. Delen and Demirkan, 2012). A convergence of the information technology ecosystem is taking place, in which service oriented architectures (SOA), Web 2.0 (3.0) and cloud computing are creating new opportunities for more efficient analytics.

However, the user generated data is often highly unstructured and therefore complex in nature, which thus poses a challenge to the data, information and analytics process. According to Delen and Demirkan (2012), business analytics as a service can be divided in three categories; descriptive analytics, predictive analytics and prescriptive analytics.

## 2. Aim

The aim of this paper is to present the three perspectives (strategic, process and operative) to customer relationship management and business analytics. CRM and BA are then combined to present a framework that explores the two areas.

## 3. Customer Relationship Management - three perspectives

### 3.1 The strategic perspective of CRM

Academics in the Nordic countries have been especially active in developing this approach (see e.g. Grönroos, 2000; Gummesson, 2002; Storbacka and Lehtinen, 2001). The starting point of this perspective is the notion that CRM is about a shift in leadership and management thinking, where the customer becomes the focus of a company's activities. Payne (2006) see CRM "... as a holistic strategic approach to managing customer relationships in order to create shareholder value". This view indicates that CRM is on the agenda of the highest executive level of management in a company, i.e. the executive management group, the board of directors and even the owners; in all, the shareholders of the company. Such an approach is understandable due to the fact that the customers generate the short and long term turnover and cashflow of the company, through their purchases. This necessarily affects the company's economic results and subsequent growth.

A central aspect of a company's strategy is growth. Growth has traditionally been tightly related to product development, R&D and lately to innovation capability, and naturally, this is critical for a company's growth potential. However, the strategic CRM approach has emphasized the role of the customer in the growth process. An invention on its own is not enough for successful economic growth; instead there has to be a relevant customer problem that the invention solves. Customer oriented problem solving becomes key in seeking future and especially long term growth. An interesting hierarchy of a strategic approach to CRM is presented by Payne (2006) (figure 1).

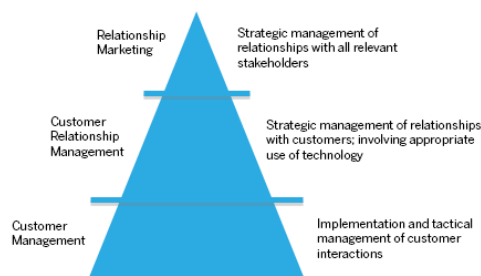


Figure 1. Relationship marketing, CRM, and customer management (Payne, 2006, p. 22)

By dividing the strategic perspective on three levels, Payne (2006) highlights three managerial challenges. Two of these are strategic (relationship marketing and customer relationship management), whereas the third level is an implementation at the customer management level. Payne (2006) also identifies five critical cross-functional CRM-processes. These are:

- The strategy development process
- The value creation process
- The multi-channel integration process

- The information management process
- The performance assessment process

Based on these five processes, Payne presents a holistic strategic framework for CRM. This framework illustrates the central areas of a company when it comes to a customer oriented and holistic approach to strategic business operations. The strategy development process focuses on the one side on business strategy (i.e. the business vision and the industry and competitive characteristics), and on the other side, on customer strategy (i.e. customer choice and customer characteristics). The value creation process is divided into the value the customer receives and the value the organization receives. The multi-channel integration process deals with the challenges of managing the different channels through which a company interacts with existing and potential customers. The information management process deals with how the company should organize and analyze data concerning customers. The performance assessment process focuses on shareholder results and performance monitoring. All together, this framework contributes to our understanding of a company's strategic challenges when it comes to CRM.

A notable part of research within CRM related to the strategic perspective, has focused on grouping the customer base and analyzing the profitability of the company's different customer relationships. Storbacka and Lehtinen (2001) argue that the main purpose of analyzing customer bases is to determine the reasons for profitable and unprofitable relationships. The three most important dimensions for developing customer relationship profitability are (according to Storbacka and Lehtinen, 2001), increasing relationship revenue, decreasing relationship costs and lengthening the duration of relationships. This approach requires CRM based business metrics and key performance indicators. These metrics involve all those CRM-activities that should be measured, for example the acquisition rate, acquisition cost and retention rate (for more, see Kumar and Petersen, p.8, 2012). Key performance indicators are those high level measures monitored closely by the top management and board of directors. The CRM based metrics and key performance indicators are part of the performance assessment process of Payne's (2006) strategic framework.

### 3.2 The process perspective of CRM

The process perspective is related to the notion that CRM is a relationship approach and a relationship is by nature something dynamic that changes over time. Dynamic (i.e. changing and developing) processes can be described through a life-cycle model. The customer relationship life-cycle model has three specified phases (figure 2):

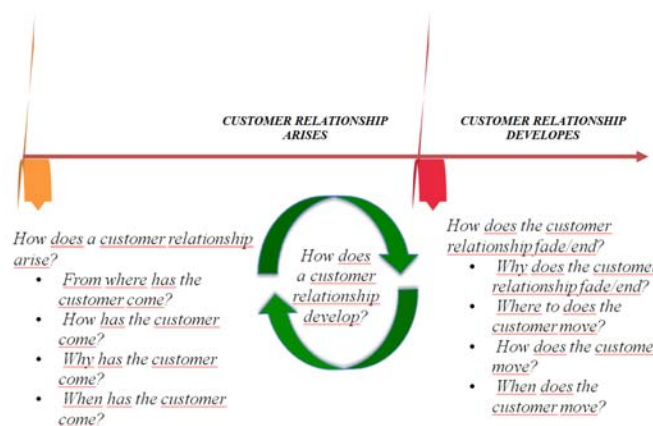


Figure 2. The customer relationship life-cycle model

The first phase is where the relationship starts. Relevant questions for this phase are from where, how, why and when has the customer come? This phase is one that marketing has traditionally emphasized due to the strategic goal of growing the business, i.e. acquiring new customers and establishing new customer relationships. The second phase is based on existing customer relationships and how they develop. Here, the emphasis in a business-to-consumer context, the focus has been on cre-



ating customer loyalty, based on customer perceived value (see e.g. Reicheld, 1996). In a business-to-business context, the focus has been on interaction and especially, the exchange of goods or services, technical, economic or organisational information, financial issues, or social contacts (Håkansson, 1982; Möller and Wilson, 1995).

Interaction is a key concept in customer relationships and by using this concept, Holmlund (1997) created a model for different interaction levels in a relationship. The lowest level of interaction in a relationship is action, which can be characterized by for example a phone call or plant visit. The second level consists of episodes, that is interconnected actions. An episode is for example, a negotiation process or shipment process consisting of many actions. The third level is a sequence of interrelated episodes that are grouped into a sequence. This can for example be a project conducted in a customer relationship. The highest level of interaction is the relationship level which refers to the level of analysis of the whole customer relationship. These four levels of interactions enable us to analytically explore the complexity of customer relationships over time (Holmlund, 1997).

The basic assumption for customer loyalty and trust in customer relationships is that the customer perceives the product, service and relationship as creating value (Normann and Ramirez, 1993). The value concept is based on the customer's perception of the relation between benefit and cost for the product, and service or some other aspect of the supplier-customer relationship. This is a complex relation that is tightly connected to an activity based process approach, where the activities that the customer undertakes are in focus. There is therefore an increasing need for academics and managers to understand and focus on the customers' value creation process, irrespective if the customer is a consumer or company (see e.g. Storbacka and Lehtinen, 2001; Payne, 2006).

### 3.3 The operative perspective of CRM

This perspective of CRM has mainly focused on the efficient management of customer relationships and is related primarily to sales management literature. The traditional core in sales management is the sales process approach. This approach focuses on the sales process, from a sales opportunity being generated to an order being placed, i.e. the whole sales pipeline and the central operative activities related to it. Another central area of literature is campaign management which focuses on planning, launching and evaluating different marketing campaigns to potential or existing customers. A third area of literature which is important for the operative approach, is that of service management. Service management literature tends to focus on the process of creating services as an interaction between the service provider and the customer. This is clearly evident in the definition of a service given by Grönroos (2002);

*"A service is a process that consist of activities that are more or less tangible. The activities are usually but not necessarily always taking place in the interaction between a customer and service personnel, and/or physical resources or products and/or the system of the service provider. The service is a solution to a customer's problem."*

When theories of sales management, campaign management and service management are combined, applied and used in the analysis of a practical customer relationship context, certain managerial challenges arise. The common denominator of these challenges is managing the data related to the sales process, campaign management and field service encounters. In the beginning of the 1990's, software vendors identified these critical business challenges and started to develop CRM software to deal with them (Dyche, 2002). The big difference with these management information systems was that they did not focus on data structured from a production or product perspective, but instead structured from a customer perspective, i.e. creating customer based information concerning the sales process, campaign management and field services.

## 4. Business analytics

Management information systems and business intelligence has for years created decision support systems (DSS) to help top and middle management to control and assess business processes, and to support decision making. The rapid developments in IT infrastructure and software have created new opportunities to organize and implement decision support systems. According to Demirkan and Delen (2012), there is clear need for a shift from a system development methodology which is product

oriented (i.e. focusing on application acquisition, installing, configuration and maintaining), to a service-oriented platform focusing on agile, dynamic, value creating and rented service solutions. A service oriented architecture (SOA) is emerging that is tightly connected with cloud computing. The rapid development of IT infrastructure, and increased and cheaper data storage capacity has created challenges for organizations to manage the large amount of data, i.e. big data. Gartner (2012) define big data as high volume, high velocity, and/or high variety information assets that require new forms of processing to enable enhanced decision making, insight discovery and process optimization. IBM research has also identified a need to evaluate the veracity of data, i.e. the truth of data (Rometty, 2013).

Approaching cloud computing as a combination of software-as-a-service, infrastructure-as-a-service and platform-as-a-service, requires companies to start to focus on the decision maker. If a service approach is applied instead of a product approach, then a critical step is to identify the decision makers concerns and needs (i.e. problems and opportunities), to support efficient and innovative decision making.

Delen and Demirkan (2012) have developed a conceptual framework for service oriented decision support systems (SODSS). In this framework, the input data for decision making comes from the business processes and external data. This data is then managed and structured to provide information and eventually processed by analytic models in an SOA. As a result of utilizing the SOA, the decision maker will acquire information and knowledge that enhances their possibility to solve problems more efficiently and to identify value creating business opportunities.

4.1 Analytics-as-a-service

According to Demirkan and Delen (2012), analytics aim at reaching business objectives through reporting data and analyzing trends, creating predictive models to foresee future problems and opportunities, as well as analyzing or optimizing business processes to improve performance. They divide business analytics in three categories, i.e. descriptive, predictive and prescriptive (figure 3).



Figure 3: Business analytics (Demirkan and Delen, 2012)

Descriptive analytics answer the questions "what happened?" and "what is happening?". This type of analytics is traditionally periodic, ad-hoc or interactive business reporting which aims at identifying business problems and opportunities. Predictive analytics answer questions like "what will happen?" and "why will it happen?". The enablers for predictive analytics are data mining, text mining, web mining and forecasting, with the objective of making accurate projections of the future. Prescriptive analytics searches for answers to questions like "what should I do?" and "why should I do it?". To be able to address these questions we need mathematical algorithms to conduct optimization, simulation, and decision modeling, and to create expert systems with the aim of identifying the best possible business decisions and transactions.

# 5. CRM and business analytics

This paper has considered CRM literature in three perspectives: strategic, process and operative. The business analytics perspective is likewise divided in three categories: descriptive, predictive and prescriptive. To make an exploratory relation between CRM and business analytics, we have combined these in a single table (table 1).

Table 1: CRM and business analytics

	DESCRIPTIVE ANALYTICS	PREDICTIVE ANALYTICS	PRESCRIPTIVE ANALYTICS
<b>STRATEGIC CRM</b>	What is happening in our business / industry? What is happening with our customers?	What will happen in our business / industry and with our customers? Why will it happen?	What should we do to drive growth and profitability, and why should we do it?
<b>PROCESS CRM</b>	What is happening in our customer relationships? What is happening with our customers perception of value regarding the product or service?	What will happen with our customer relationships, their perception of value, and why?	What should we do to make our customer relationships more efficient? What should we do to increase the customers' value perception of our products and services?
<b>OPERATIVE CRM</b>	What is happening with our sales pipeline, campaigns and field services?	What will happen with our sales, campaigns and field services?	What should we do to increase our sales? What should we do to make the sales, campaign and service processes better?

In table 1, critical questions are asked for all three perspectives of CRM. By stating these questions, the aim is to identify what type of data, metrics and KPIs would be needed when engaging in descriptive, predictive and prescriptive business analytics.

# 6. Conclusions

It is important to note that these are only exploratory steps to combine CRM and business analytics, and therefore the enablers and outcomes cannot yet be discussed. This however implies that there are interesting possibilities to widen the scope of CRM in relation to the existing three CRM approaches and introduce new insight in decision making on both the strategic and operative management levels.

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# Mapping Challenges in Media Management

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## Abstract

During the last 20 years, digitization and internet has changed the fundamentals of the media industry. What are the challenges facing and competencies needed by media workers, managers and entrepreneurs in this brave new world? This paper will outline a conceptual framework for the research, including an outlook of recent changes in the media and a comparison between general management and media management. It will also introduce two key strategic areas in media management, creativity and technological change.

## 1. Introduction

Today, content is everywhere, content is free and everybody can be a content creator. This has profoundly changed how people (e.g. readers, viewers, listeners, costumers) use and relate to media. The digital media environment is characterized by increased competition, a massive oversupply of content, and a corresponding shortage of receiver attention. It has been argued that the old saying “content is king” is no longer valid. Chris Bilton (2011, 31) proposes that attention has shifted from the what of content, to the how of delivery, branding and customer relationship - in Bilton’s words, towards management.

Alternatively, you could also argue that “content is king”, now more than ever before, in that you need to create great content in order to differentiate your products and to attract audiences that are perhaps more fragmented, discriminating and disloyal than in previous times. However, focussing on content creation alone is hardly a sustainable strategy for a media company, and the same is increasingly true for individual media workers. In the old world, the content creators’ work centred on producing pieces of content for one specific medium. Annet Aris (2011, 271) describes the changes in media work as a shift from a “soloist” to a “director”. Today, content has to be cascaded across different media and platforms. The very notion of content includes besides words, pictures and sounds and increasingly digital applications. Modern media workers need to find their way in an avalanche of content and match the right output to the right media, platform and audience segment. The nature of media work is now less orientated towards the individual, and more towards teamwork, networks and crowd work.

In media studies there has been a strong tendency to emphasize the unique nature of the media industry. According to this view, the primary tasks for media organizations have been to create cultural, social and public value, rather than just business value or profit. Although media companies in many respects are cultural and political institutions, they are currently largely run as business enterprises. Even state owned public service media and publicly financed media (e.g. film production in most European countries) are subject to more financial discipline than previously, and operate in highly competitive environments.

Furthermore, the media industry displays very high rates of new firm formation (Davis 2011, 165). There are a growing number of start-ups and other small media companies that also operate, by and large, on business premises. To be sure, there are important industry-specific features in media that need to be acknowledged, however, there are also important similarities compared to other industries. In fact, when you look at media from the perspective of management and organizational theory, the upshot is that the media industry is not all that different when compared to other industries. The similarities between media and other industries are accentuated by larger societal changes. In post-industrial, knowledge intensive societies in which the economy is based on service production and inno-

vation, people in general increasingly work with information and symbols and even with creative problem solving. More people than ever before “think for a living”.

## 2. Competencies and strategies in media management

It is said that we have reached a stage where everything that can be digitized will be digitized. For good or worse, digitization in media is accelerating, and moreover, the effects and relevance of this development go far beyond the media industry. Yet, people still read books, magazines and newspapers, they still watch film and television, and they still listen to radio.

Management can be defined as planning, organizing, leading and controlling the allocation of human, material, financial and knowledge resources in pursuit of the organization’s goals (Hellriegel et al. 1999, 7-8). This is basically applicable to media management as well, albeit in a media setting. Figure 1 provides a glimpse of the key issues in management in general and media management in particular. The left column describes six key managerial competencies (according to Hellriegel et al. 1999). The right column describes the six key strategic issues in media management, as identified by Küng (2008).

Key competencies in management	Key strategic issues in media management
Strategic action	Industrial development
Planning and administration	Technological change
Communication	Creativity and innovation
Self-Management	Cognition and culture
Global awareness	Organizational behaviour
Teamwork	Leadership

Figure 1. A comparison of key competencies in (general) management and strategic areas in media management (based on Hellriegel 1999 and Küng 2008).

General management competencies are obviously also relevant in a media context. Strategic action is based on knowledge about the industry and the organization. To lead and administer organizations requires knowledge about how human cognition and culture operate on an organizational level and beyond. Global awareness competency also relates to (inter-) cultural understanding and sensitivity. Thus, all managers need leadership skills, in which communication and self-management competencies are crucial. As has already been indicated, teamwork is also a crucial management skill in media companies. The strong reliance on technology, creativity and innovation as strategic areas go beyond the media industry, but they can to some extent be seen as especially characteristic for media.

## 3. From ideas to creativity management

Product and service development is a basic function in every company. In the old days, success or failure in media was seen to be to depend on a compelling idea. However, an idea is only a starting point. As one executive in the television industry we interviewed said: “Ideas as such have only limited value”. In other words, ideas need to be refined and developed into viable products and services. Therefore, success in the media industry is based on the ability to develop creative environments and production systems that serve to support and enhance a worker’s creative resources.

Today, there are research-based theories and a growing number of empirical studies that provide practical tools for creativity management (Nylund 2013). Creativity is the ability to produce work that is novel, appropriate, useful and adaptive to task restraints (e.g. Sternberg and Lubart 1999, 3). Research indicates that explicit encouragement, appropriate levels of challenge and resources, variety (both in general and especially in team composition), together with autonomy at work can have a direct positive effect on organizational creativity.

Hence, creativity can be developed and managed, but too much managerial control and too many assessments can have detrimental effects on a worker’s creativity. It is acknowledged that creativity is a complex and multi-dimensional notion, but it is not that vague or mystical that it would be beyond

systematic approach. Variety comes from a wealth of opinions, knowledge and experience and these in turn bring a divergence of opinions and an exchange of ideas. A blend of people with different sex, nationality, skills, background and experience is important because it allows the organization to look at a problem from many different perspectives.

Management and media work is increasingly about working with people outside your own organization in larger networks. Media organizations have been successful in building variety by using freelance workers in addition to their own employees. More recently there has been a strong tendency to outsource production to subcontractors. Many of these subcontractors are relatively newly established small companies. These new media firms also operate in networks with each other, exchanging expertise, skills and resources (Nylund and Mildén 2012), and these network relations add to variety, and hence to creativity in media production.

## 4. Technological change

The fast-changing nature of media industries relates in most cases to developments in technology. However, media has always been about technology. The pen, paper and the earliest print machines were once new communication technologies even though they have become naturalized over the centuries. This is what tends to happen to technology when it becomes established and people get used to it and start to take such innovations for granted. However, modern media is one of a handful of industries facing the emergence of potentially disruptive technology; technology that may be defined as science-based innovations that can radically transform an industry or even create completely new ones (Mierzejewska 2011, 19).

Digitization, internet and social media have been key drivers of the recent changes in media industries and can all be considered as disruptive technologies. To some extent however, technological convergence has brought different media sectors closer together. Newspapers, broadcasting, film, books etc., are increasingly struggling with similar challenges and problems - in fact, some predict that in the near future the news industry will be dominated by a dozen multinational companies whose products will be rather similar, regardless of whether they come from the broadcasting and newspaper industries or online media (Doctor 2010).

New technological devices such as smart phones and tablets, together with audience fragmentation have led media companies to develop various multiplatform strategies (e.g. Doyle 2013). Business models that blend free basic web-services with paid premium services are also a growing trend in the media industry. Some refer to this model as “freemium”. The rise of social media has brought some highly successful entrants into the media industry. Companies like Facebook, YouTube and Twitter have transformed how we perceive and use media. Meanwhile, traditional media companies struggle to develop consistent social media strategies and to integrate social media into their business models. User generated content (UGC) such as discussion forums and blogs are an important and rather cost effective way to add value to traditional media products. According to a recent study, newspaper readers value UGC as attractive and important content, although not as much as newspaper workers tend to think (Ihlström Eriksson and Åkesson 2013).

Social media is also a powerful tool regarding marketing and customer relationships. An increasing number of companies in the media industry and beyond use social media to widen their innovation potential, and to bring the customer into their production system to create value and develop products. Some refer to this tendency as customer co-creation (Liedtka and Ogilvie 2011), whilst others talk about open innovation systems or crowd intelligence.

## 5. Conclusions

In this paper I have traced recent changes in media, compared key issues in general management and media management. I have also discussed two key strategic areas in media management, creativity and technological change.

## 6. Acknowledgements

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# Outlining a Social Media for Risk Management

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## Summary

In risk management (RM), the aim is to identify, measure and control uncertain events. Risk management is not a separate process or action, but is strongly integrated into the normal daily practice of business and management. We cannot approach risk management in an 'ad-hoc' way but we should deal with the areas and risks in a processed way – a way based on communication and team-work.

If we approach the areas too narrowly we might overlook something. Thus it is necessary to have a conceptual RM framework. In order to develop RM, it is proposed that the framework should be constructed and pursued in the form of a web-based tool. This paper explores using the newest technology and ways of solving problems to create a social media platform - a social media for RM.

The aim of this study and applied R&D effort is: To update RM with a new process and system which is basically social and communicative, where the organizational structure is also taken into consideration. However this system also has the possibilities for example, to carry out quantitative and qualitative risk analysis, identify risk scenarios and assist in risk monitoring. The envisaged process and system prototype will hold a palette and users can decide what modules they wish to use, and combine them to fit their RM processes and ways of working.

Key-words: Company, controls, governance, process, risk management (RM), prototype, security, social media, system.

## 1. About risk management

The area of Risk Management is extensive and has during recent years become increasingly important. The threats and risks to a company are multiple, and in a rapidly developing world it is increasingly difficult for a global enterprise to deal with these threats and risks in a systematic and timely way. Furthermore, a company's risk management is strongly connected with its business processes, information security and internal controls. All three of these aspects are usually areas that pose challenges to an organisation.

In risk management the aim is to identify, measure and control uncertain events. There are three main drivers for managing risks. Firstly, the global business environment is increasingly risky and thus the overall risk tolerance has decreased. Secondly, the external demand for RM has increased among customers, partners and shareholders, that is, all stakeholders. Thirdly, RM constitutes an essential part of corporate governance.

For any company (organisation) it is necessary to take risks in order to achieve growth, competitive advantage and deliver shareholder returns: no risks - no gain. Overall, the contribution of risk management is to reflect the organisation's strategic intent, key objectives, values and processes. It also ensures that the material risks to the achievement of targets are clearly defined, their potential impacts are clearly understood and communicated, and that management action is taken according to

the organisation's appetite for risk (risk taking). Of course, it is recognized that in some areas risk taking is not acceptable, for example when relating to work or product safety. Risk management helps to achieve a view of risks affecting business cross-functionally, risks that are inter-linked, and risks that have external linkages. As pointed out by Finne: "By managing the risks (risk management) we can safeguard the company's activities [Finne, T. A decision support system for improving information security, p18]". RM is still something of a pioneering field and an area that is undergoing continuous change. It is necessary to have an interdisciplinary approach to be able to handle this huge and demanding area. We define risk as: "Any uncertainty that affects the organization's objectives, values and the achievement of the optimum results."

A company that does not emphasize risk management and the opportunities that RM provides will face growing problems in surviving in today's turbulent world. The risk that such a company will sooner or later be forced out of business is extremely high. Moreover, this also raises a question about the risk management chain and means that the collaborators and subcontractors of an enterprise should also emphasize matters of risk management and in some cases link them to the company. An example of such a linkage could be in business continuity planning.

The management of risk is also a part of corporate governance. We all remember the huge corporate scandals from early 2000s, (e.g. Enron). One can argue that if the internal audit and risk management in such corporations would have functioned correctly, then these scandals would either not have occurred, or at least to a lesser magnitude. It must however be acknowledged that no RM or control structures can fully control a top executive team, in the case they want to be dishonest. Whatsoever excellent risk management tools and processes we have at our disposal, the individual/s is always the most important factor. Individuals identify and bring to attention existing and emerging risks. There is no automated corporate risk management, and it is always the individual and/or team that undertakes the work of risk mitigation.

As pointed out, risk management is not a separate process or action but is strongly integrated into the normal daily practices of business and management. We cannot approach risk management in an 'ad-hoc' way, but rather, we should address such areas and risks in a processed and systematic manner. There are many risk areas, for example computer security, physical security, business risks, finance & accounting, strategic risks, HR, IPR, production, information systems security, and also many sub-areas such as privacy, legal, data transfer, risks in various systems, specific business risks etc. Therefore it is important to get as many viewpoints as possible and this points towards the adoption of a collaborative approach. Quoting Clayton: "Risk management is impacted by the strength or vulnerability of people, processes, and technology". [Clayton, Daniel. How management views risk. Internal Auditor Journal, p62].

The use of social media has heavily increased during recent years. Social media is also increasingly used by business enterprises and will constitute a major process in a modern enterprise's activities and renewal in the future. "Given its ease of use and measurement and its ability to reach large populations almost instantly, social media is becoming a powerful force in the way businesses reach, attract and engage their customers, employees and other stakeholders." [ISACA, Social Media: Business Benefits and Security, Governance and Assurance Perspectives, White Paper, 2010]. Examples of social media are: LinkedIn, Facebook, Twitter, Flickr, YouTube, Instagram and MySpace.

## 2. Issues supporting a renewed risk management system and process

### **Companies becoming their own risk management consultant**

We believe that organizations already possess a large amount of expertise in the area of risks and how to manage them. What is needed however is a tool and methodology that a company can use internally as a source of support, a source of knowledge and as a gathering place of expertise in the company. We believe that supported by a tool (software prototype) like SARM<sup>1</sup>, a company can (to a rather large extent) independently deal with their own risks and thus avoid new risks such as those introduced by external personnel and concurrently reduce the need to hire expensive external consultants. The company can also use such a system to suit their own timeframe and schedules.

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<sup>1</sup> SARM: Social Media for Managing Risks. Made by & Copyright: T.Finne.

## **Supporting busy managers in a positive and constructive way**

Most managers are perhaps far too busy to read through large manuals on risk. As such, they need a professional management support tool that is easy to adapt and use. The social media system will primarily be made for use at management level, e.g. CFO, CTO, risk managers, security officers, auditors, project managers, group managers and others that work with or are responsible for RM.

### **Managing risks is basically a social process**

If we do not get people involved in risk management in a social way, we are unlikely to find and deal with all the risks in an organization. As pointed out by Graham et al: "The challenge for risk management is to provide the framework to help management deal with uncertainty, and the associated risk and opportunity to agreed levels of acceptability, with managing risk embedded as part of an organization's strategic and operational management processes" [Graham, Julia et al. A Risk Management Approach to Business Continuity, p5]. Managing risks is a tough fact-based area. Therefore we believe getting people involved by way of a social media approach is a viable solution, especially as it serves to get people involved from various organizational levels and backgrounds.

### **The right to the management of risk**

Every company has the right to manage its own risks and this right should not be stopped or hindered by the existence or non-existence of any tool or process. In an investigation carried out by Socialtimes [www.socialtimes.com], it was found that: "The annual survey of nearly 1,600 senior executives in 56 countries found that just 42 percent of businesses plan to spend more over the next year on security awareness and training, and just 34 percent of those plan to include updates on the risks associated with social networking in their trainings". This is a worrying survey result for any risk/security/audit professional. Therefore we need to improve the communication about risks.

### **The right to participate in risk management**

Most employees in a company possess valuable information that should be used in their company's risk management. This is primarily not an obligation, but may also be considered as a right - a right to participate in the safe-keeping of jobs and to participate in the development of the company. Naturally there are exceptions from this, for example those who hold executive positions in listed companies. Persons in such positions possess information of a high confidentiality level and need to ensure that, e.g., SEC<sup>2</sup> rules are not violated.

### **Shared Responsibility**

Risks that do not have specific ownership will stay and perhaps increase in magnitude. Risk owners must be appointed, and as well other responsible persons, take the necessary steps to manage risk. Attitudes towards risk can vary to a high degree. Quoting Segerstahl: "The way people perceive, order and react to risks is often a mystery both to scientists trained in the natural sciences and to decision makers with a professional involvement in the control and management of a crisis." [Segerstahl, Boris. Risk Assessment and Multi-criteria Decision-making, p8]. The senior management is responsible for the organization and therefore we need to increase the risk transparency of senior managers.

We want to strongly emphasize that we live in a time of great change and turbulence. Gartner [Gartner Newsroom. August 4, 2010] summarized those changes into the 10 following themes: De-routinization of Work, Work Swarms, Weak Links, Working with the Collective, Work Sketch-Ups, Spontaneous Work, Simulation and Experimentation, Pattern Sensitivity, Hyper-connected Work, and 'My Place'. We see a social media for RM as providing a tool for dealing with the risk in times of change and turbulence. RM is also shown as an urgent issue, among other ways, by great number of 'hits' that can be found on Google.

### **The Planning Process and RM**

One significant use of a social media approach, we believe, is that of using the materials gathered through a social RM media will aid the planning process. Such planning processes might, in a large enterprise, take place several times a year, and through the system of social RM media we can provide RM materials that may be of direct organizational benefit. However, this is naturally a company-specific issue.

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<sup>2</sup> SEC = Securities and Exchange Commission.

## 3. Conclusions

The Scope of this short Study, of an operational nature, was to outline some of the reasons for an improved risk management system, what the expectations of such a system could be, and to outline some of the key requirements associated with such an approach. The next steps of this applied R&D effort will be to further develop the concept, link and develop it to a theoretical framework and to construct a prototype which may subsequently be evaluated.

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# Visual Search Patterns and Consistency in Multi-Alternative Consumer Choice

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## Abstract

A visual search and decision process involving a multi-alternative choice situation may be studied and recorded using head mounted eye tracker technology. For this investigation participants were asked, in two separate trials, firstly to order 16 chocolate packages from best to worst and, in the following trial, asked to score these packages on a scale from 0 (worst) to 100 (best) with no time constraint on either trial. The following questions are addressed: Which search patterns are identified prior to initial choice, and do the participants choose consistently with their rankings? We find that participants to a large extent do not choose consistently nor, despite an overall consistent trend. Initial fixations prior to first choice are mostly efficient, i.e., participants tend to fixate more on the desirable than the less desirable objects, but not on all available alternatives. This paper discusses part of a work in progress.

## 1. Introduction

In a multiple choice situation at, say, a supermarket containing some 40 000 articles, the consumer, when searching for a particular type of product, will typically observe both desirable and undesirable alternatives before making a choice. Recent research shows that approximately 73% of consumer purchases are made in-store (Clement, 2007). This emphasizes the communicative function of the package. Several studies have been made to determine the functions of package properties (shape, colour, material etc.) for example in (Kauppinen-Räsänen & Luomala, 2010).

In some instances, a situation requires that the consumer selects a number of items which all belong to the same category of products (e.g. a set of three or four different types of chocolate cookies for an evening get-together.) This means that the consumer is required not only to pick the most desirable product, but perhaps the second and third (and so on) best options as well. But for how many items is this process efficient and consistent, i.e., the most desirable remaining alternative chosen, and do the visual search patterns display different dynamics during this selection process? One could assume that all alternatives are evaluated prior to selection. Furthermore, one may assume that the participants order the products during the selection process from best to worst.

For this investigation, we wanted to ascertain the degree to which participants choose packages in an order that consistently reflects the (decreasing) value of the packages when these have been given a points ranking in a separate trial. We also wanted to investigate the search pattern leading up to the first choice. The selection trial was recorded with eye tracker glasses in order to identify whether participants tended to focus on the best available alternatives (i.e., those given the highest points in the second trial) for each choice, and whether different visual search patterns were displayed during different phases of the trial.

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A similar experiment using a table mounted eye tracker was conducted in (Reutskaja et. al., 2011), however restricted to the first choice and imposing a severe time constraint. Various decision models correlating eye movement patterns with decision making have previously been proposed, such as (Krajbich, et. al., 2010), while a separate study by Levy et. al. (2011) showed that neuron activity and visual stimuli can be correlated with choice behaviour (even when no choice takes place).

## 2. Methods

The participants were second and third year Arcada UAS students participating in a scientific method course and participated in this study as part of their training. Participation was voluntary, however participants were awarded extra course points for participation. The total number of students participating (N) was 87 (the data for three participants was lost during the recording phase, and data for 29 participants was only partially usable.) Of these, 37% were male and 63% female, which reflects the overall gender distribution within the degree program.

To assess the familiarity with the product (chocolate) the consumption of chocolate was ascertained using a separate questionnaire: 15% were heavy users, 54 % medium users, 25% light users, and 6% non-users. Overall, the group displayed a good familiarity with the product, and an average use of it.

The chocolate packages were specifically designed for this trial, varying only four properties: Colour (blue, red, brown, white), shape (rectangular, square, oblong), font of logo text (Scriptina Pro, Cochin Regular, and Avenir Black.), and presence of an image of chocolate. The combination of properties was defined using an SPSS orthogonal procedure. This resulted in 16 different packages which are thus sufficient for our analysis. The colours, shapes, fonts, and image, resemble commercially available chocolate products, but due to copyright reasons such packages were not used.

The participants were asked to stand in front of a table with the package images printed on white A4 office paper arranged in a 4 x 4 grid, identically for each trial, (see appendix I for images of the packages.) Participants wore a head mounted Tobii Glasses eye tracker (fixed data rate, 30 Hz), and were asked to progressively remove packages from the table proceeding from best to worst. Subsequently, after a short pause, the participants were handed a questionnaire with images of the packages and asked to score each package from 0 (terrible) to 100 (excellent) with no restriction on the use of the scale. There was no time constraint for either trial. The recorded eye tracker data was manually analysed frame-by-frame. For each person, the total duration and choice intervals for each choice were recorded, and special attention was given to the search process prior to the first choice, by recording which products were fixated on before the choice was made. Thus, we were able to ascertain the length and extension of the search process leading up to the first choice.

As the participants ranked the packages from 0-100, we standardized the score following Reutskaja et. al. (2011) in order to be able to directly compare the participants' ratings expressed as the efficiency,  $e$  of a fixation on item  $i$  or  $j$  in the set  $S$  of package alternatives in the following way:

$$e(i | S) = \frac{V_i - \text{mean}\{V_j | j \in S\}}{\max\{V_j | j \in S\} - \text{mean}\{V_j | j \in S\}}$$

$V$  denotes the value of products as measured in the second trial, and  $\text{mean}$  is the standard function for the arithmetic mean value. A positive  $e$ -value indicates a choice above the participant's mean value, and a negative value indicates a choice below the participant's mean value.

## 3. Results

Figure 1 shows the search patterns for males and females, and displays the number of products fixated on before the first choice is made. A t-test for the difference of the means (males  $M_1=8.7$ , females  $M_2=6.8$ ) gives a t-value of 1.805 (df=56) resulting in a p-value of 0.077 indicating, with a 10% error level, a significant difference between male and female search patterns. No significant different could be observed in the participants' chocolate consumption levels.

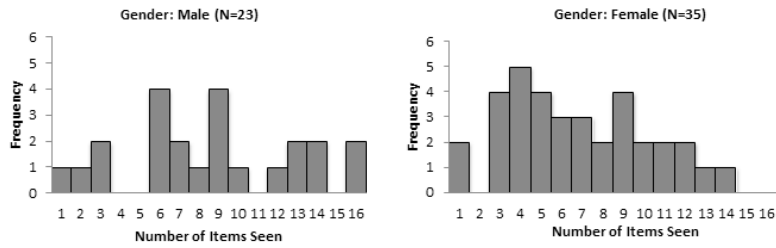


Figure 1. Number of products fixated on (excluding refixations) prior to first choice.

The mean efficiency of the initial fixations, excluding refixations, up to the first choice of the whole test group is shown in Figure 2. Note, that because choices are being made by participants during the process, N for each choice instance diminishes so that  $N = \{58, 55, 54, 48, 43, 39, 32, 27, 24, 16, 13, 11\}$  respectively for each choice instance 1–16.

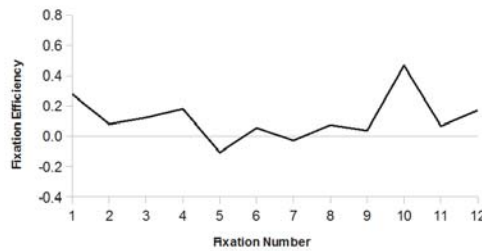


Figure 2. Mean efficiency of initial fixations before the first choice is made.

The figure shows that participants tend to fixate on generally the better products, but no clear ranking can be determined. Thus, it is clearly a search process. Glimcher (2011: 152-161) describes how a particular eye movement (saccade-to-fixation) is triggered by a biophysical ‘burst’ of neuronal activity in the superior colliculus. Furthermore, this burst inhibits other possible eye movements, so that a specific burst constitutes the final ‘threshold’ (and point of no return) for a particular eye movement. For eye tracking research, this entails that only a minimal amount of fixations are random for particular trial.<sup>1</sup>

Next, we wanted to determine the extent to which participants chose the highest ranked products in an order consistent with their personal e-values. We define a consistent choice as one in which the e-value (defined as before) of which is smaller or equal to that of the previous choice, and, thus, an inconsistent choice as such a one where (with  $i = \{1, 2, \dots, 16\}$ , i.e., the choice instance, and  $e_0 \text{ def.} = e_1$ ). Figure 3 shows the mean efficiency of each choice as a function of the choice number.

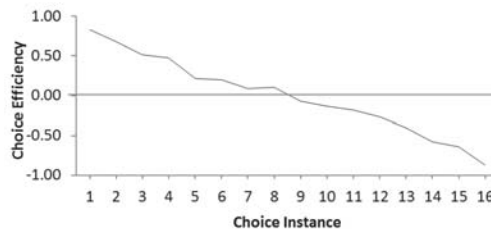


Figure 3. Choice efficiency as a function of the corresponding choice instance.

We noted overall that only one inconsistent choice (Choice Instance 8) instance was found, whereas, on an individual level, only one participant actually chose consistently over the whole range of pro-

<sup>1</sup>This is assuming they are sufficiently focused on the trial. Furthermore, ‘not random’ should not be interpreted as ‘deterministic’ or as saying that each individual’s search pattern would be identical in a repeated trial.

ducts. Figure 4 shows the average time taken for each choice, measured from the previous choice instance along with the standard deviation for each instance. We observe trends for diminishing choice time and standard deviation, except in the middle of the choice process.

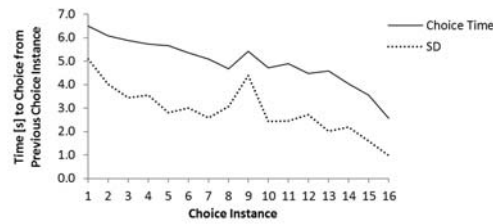


Figure 4. Time until each choice is made, as measured from the previous choice instance, with standard deviation.

Figure 5 shows how the probability of participants making an efficient choice (i.e., choosing the highest ranked available package) tends to decrease when the number of fixations on packages fixated on (excluding refixations) after the previous best one, is increasing. That is, the greater number of packages fixated on after the one with the highest e-value, the smaller the probability of actually choosing that package.

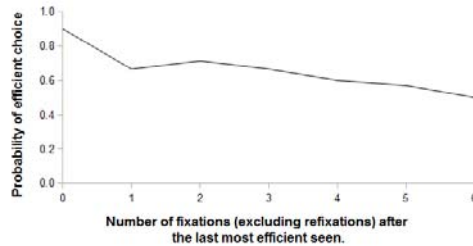


Figure 5. Probability that the participant chooses the best available package, as a function of the number of items fixated on, excluding possible refixations, after the previous best item has been seen.

## 4. Discussion and conclusion

The main findings of this study show that, prior to the first choice, participants do not evaluate all the alternatives. Rather, a smaller subset of the available options is considered. However, this evaluation phase is mostly restricted to those options with a positive e-value, which indicates that participants are able to quickly identify the subjectively more desirable alternatives. Males were shown to have a slightly longer search process on average, evaluating a larger subset, while females made a slightly quicker decision based on an averagely smaller subset.

We can observe from the data (Figure 4) that the diminishing decision time between choices does not on average affect the slope of choice efficiency (Figure 3) - participants chose faster with unaltered efficiency as the trial progressed (of course, acceleration in selection is to be expected due to the constantly decreasing number and desirability of the remaining packages). Generally, we observed that the differences in individual choice consistency even out on average (Figure 3). However, at choice instance 9 (Figure 4), we can observe a 'spike' both in the time taken for the choice and for the corresponding standard deviation. Interestingly, the previous choice (Figure 3, choice instance 8), was on average the only inconsistent choice instant (keeping in mind that only one participant chose consistently), while choice instance 9 is consistent both with respect to instances 8 and 7. We also found that an increased number of fixations after the last most efficient, increased the probability of making an inefficient (suboptimal) choice (Figure 5). This is consistent with the findings in (Reutskaja et. al., 2011). It is interesting when compared with the average consistency of the choice process, five 'extra' fixations suffice to lower the probability of optimal choice below 0.6. Additionally, and in accordance with (Kauppinen-Räsänen & Luomala, 2010) and (Gofman et. al., 2009) packages with visually more salient design



features draw attention, thus emphasizing the need for attractive package design.

The use of eye tracker glasses for the task provides more detailed information related to the participants' decision process as the saccades and fixations are recorded objectively. As this is a work in progress, several issues concerning the decision making and observation patterns in the data remain to be investigated. A suggestion for further research is the investigation of the degree to which specific observation patterns reoccur if the trial is repeated several times across participants from the same population.

Eye tracking glasses are still a product with some technical issues, a fact which was clearly seen in the number of participants whose data had to be discarded. The analysis and recording processes are more time consuming than, for example, a standard questionnaire, as the analysis has to be performed manually, the recording carefully set up and the glasses calibrated.

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# Appendix 1

## Chocolate Packages Used in the Experiment





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