

Managing The Insider Threat: What Every Organization Should Know

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Best Practices and Controls for Mitigating Insider Threats



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Agenda

- Introduction
- Common Sense Guide to Mitigating Insider Threats, 4th Edition
 - 19 Best Practices
- Technical Demonstration(s)



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CERT Insider Threat Center—Mission

Assist organizations in identifying indications and warnings of insider threat by

- performing vulnerability assessments
- assisting in the design and implementation of policies, practices, and technical solutions

based on our ongoing research of hundreds of actual cases of insider IT sabotage, theft of intellectual property, fraud, and espionage



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Definition of Insider Threat

The CERT Program's definition of a malicious insider is a current or former employee, contractor, or business partner who meets the following criteria:

- has or had authorized access to an organization's network, system, or data
- has intentionally exceeded or intentionally used that access in a manner that negatively affected the confidentiality, integrity, or availability of the organization's information or information systems



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Methods

- Research
- Empirical Evidence
- Control Hypothesis
- Control Implementation and Testing
- Control Pilot
- Revisions
- Release



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Common Sense Guide to Mitigating Insider Threats, 4th Edition



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Who does the CSG apply to?

- Information Technology / IT Security
- Physical Security
- Software Engineering
- Data Owners
- Legal
- Human Resources
-everyone across the organization



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New Features

- Mappings to other best practices / standards
 - NIST 800-53
 - ISO 27002
 - CERT RMM
- Quick wins & High Impact Solutions
- Quick reference guide



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Practices you are familiar with

Consider threats from insiders and business partners in enterprise-wide risk assessments.

Clearly document and consistently enforce policies and controls.

Institute periodic security awareness training for all employees.

Monitor and respond to suspicious or disruptive behavior, beginning with the hiring process.

Anticipate and manage negative workplace issues.

Track and secure the physical environment.

Implement strict password and account management policies and practices.

Enforce separation of duties and least privilege.

Consider insider threats in the software development life cycle.

Use extra caution with system administrators and technical or privileged users.

Implement system change controls.

Log, monitor, and audit employee online actions.

Use layered defense against remote attacks.

Deactivate computer access following termination.

Implement secure backup and recovery processes.

Develop an insider incident response plan.



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New Best Practices

- Practice 9: Define explicit security agreements for any cloud services, especially access restrictions and monitoring capabilities.
- Practice 16: Develop a formalized insider threat program.
- Practice 17: Establish a baseline of normal network device behavior.
- Practice 18: Be especially vigilant of emerging social media trends.
- Practice 19: Close the doors to unauthorized data exfiltration.



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Practice 9

Define explicit security agreements for any cloud services, especially access restrictions and monitoring capabilities.

- Conduct a Risk Assessment before entering into any agreement.
- Chose a cloud service provider that meets or exceeds the organization's own levels of security.
- Understand how the cloud provider protect data and other assets.



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Practice 16

Develop a formalized insider threat program.

- Work with Legal Counsel.
- Requires involvement from various departments across the organization.
- Share information.

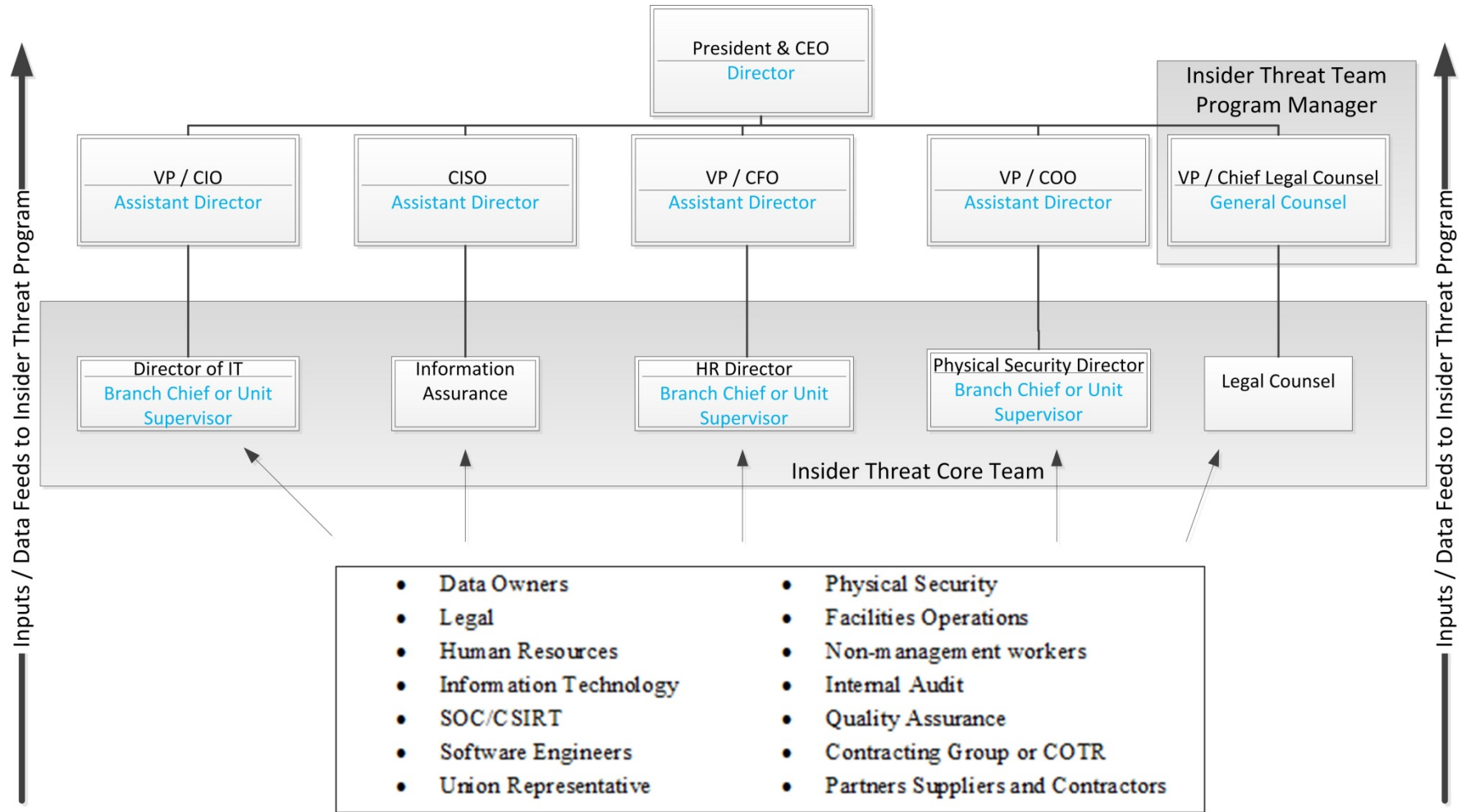


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Insider Threat Team



Note: Text below the separator in each box notes the federal government's equivalent position



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Practice 17

Establish a baseline of normal network device behavior.

- Know what is normal and abnormal for a given system.
- Excessive traffic, Insufficient traffic
- Store logs for 60 days or longer



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Practice 18

Be especially vigilant regarding social media.

- Train users to be aware of what they post
- Small disclosures of information can create bigger problems
- Develop a social media policy



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Practice 19

Close the doors to unauthorized data exfiltration.


- Understand how data can leave the organization.
- Control removable media.
- Watch for “old school” methods: printers, copiers, etc.



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Technical Controls: Preventing Data Exfiltration



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The Problem

- Organizations need to use web based services on a daily basis for business needs. However, services that offer the ability to upload attachments present an opportunity for sensitive data to leave the organization.
- Communications that are secured with SSL encryption are difficult to inspect and therefore it is difficult to detect and prevent sensitive data from leaving the organization.



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Data Loss Through the Web

Difficult problem

Perfect exfiltration channel

- Encrypted
- Appears “normal”
- Send many files at once
- Possibly essential to operations



What can be done to prevent this?

Options:

1. Implement policies regarding how sensitive information is disseminated
2. Full packet capture of all Internet traffic for further analysis
3. White listing
4. Block all webmail services
5. Allow all webmail services and cross your fingers
6. Or...



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CERT's Solution

- Allow proxied Internet access to any website
- Inspect encrypted communication sessions for sensitive documents
- Block sensitive attachments from being uploaded to the Internet



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Blocking Documents

Documents can be stopped based on three methods:

1. Block all attachments
2. Keywords
3. Tags



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The Proxy Server

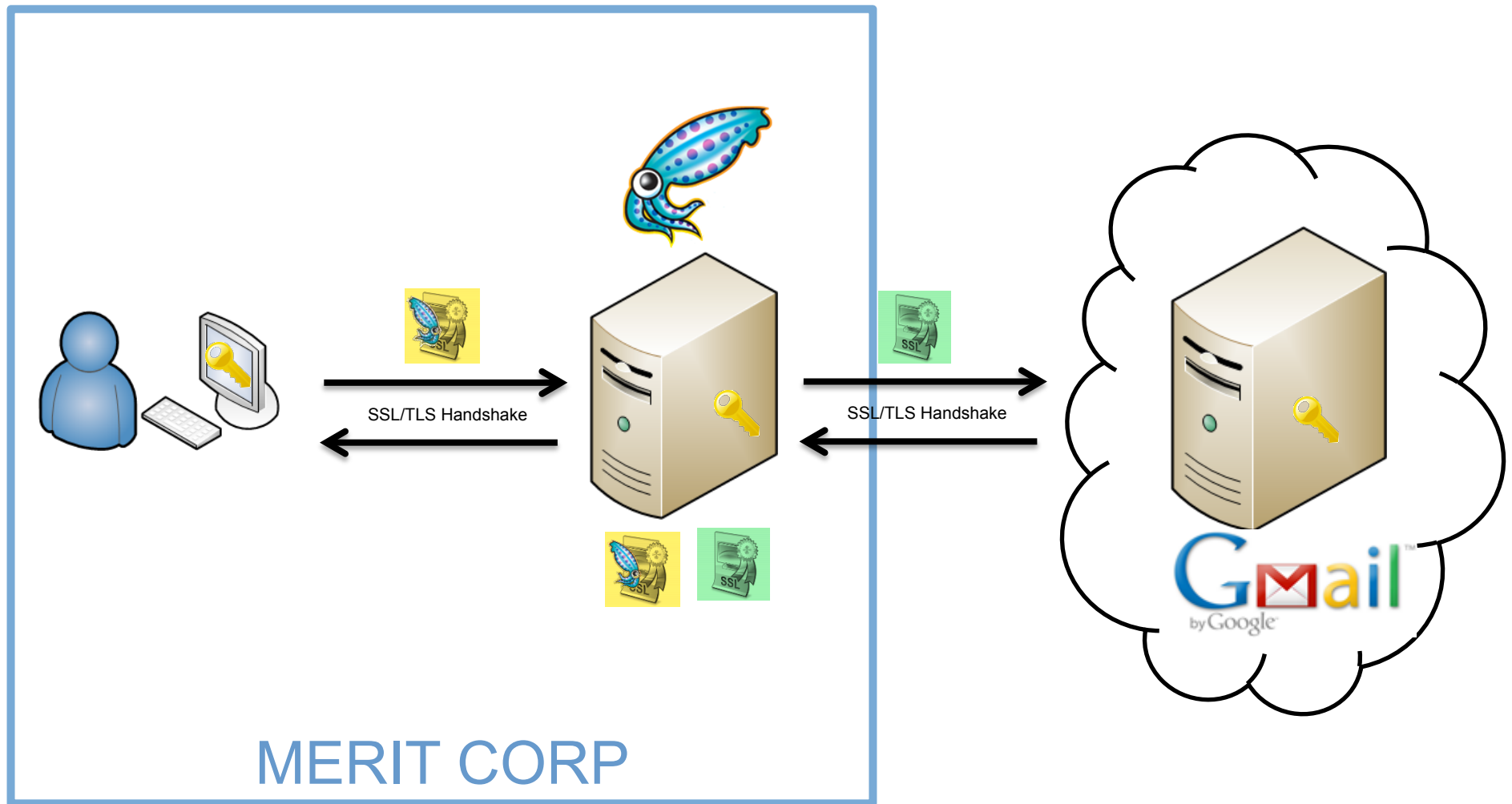


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Man-in-the-Middle (MITM) Proxy



The Proxy Server Main Components

- Ubuntu Linux Version 10.04 LTS
- Squid Version 3.1.19
- C-ICAP
- Clam Antivirus (ClamAV)



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Client Configuration

- The Organization's Certificate needs installed in the Trusted Root Certificate Store on each client
- Internet Explorer needs to be configured to use the proxy on port 3128 for HTTP/S traffic

Both of these settings can be configured using
Group Policy



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itlab.testuser@gmail.com ▾

Gmail ▾

SEND

Save Now

Discard

Labels ▾



COMPOSE

Inbox (3)

Starred

Important

Sent Mail

Drafts (16)

Personal

Travel

More ▾

Chat

Search people...

● ITLAB User

Set status here ▾

☎ Call phone

To



[Add Cc](#) [Add Bcc](#)

Subject

[Attach a file](#)

B *I* U **T** **↶** **↷** **A** **T** [Plain Text](#)

[Check Spelling](#) ▾



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+You Search Images Maps YouTube News Gmail Documents Calendar More -

Google itlab.testuser@gmail.com

Gmail - **SEND** Saved

COMPOSE

Inbox (3)
Starred
Important
Sent Mail
Drafts (17)
Personal
Travel
More -

Chat
Search people...
● ITLAB User
Set status here -
☎ Call phone

To: someuser@co
Add Cc Add
Subject:
Attach a file

B *I* U **T** - **TT** -

Here's the documents yo
Sincerely,
Joe User

Spelling -

Select file(s) to upload by mail.google.com

Look in: Intellectual Property

Name	Date modified	Type
Business Plans - FY2012	3/21/2012 12:52 PM	Microsoft

Recent Places
Desktop
Libraries
Computer
Network

File name: Business Plans - FY2012
Files of type: All Files (*.*)

Open Cancel



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URL	Status	Domain	Size	Remote IP	Timeline
⊕ POST ServiceLoginAuth	302 Moved Temporarily	accounts.google.com	649 B	10.64.22.15:8080	145ms
⊕ GET SetSID?ssdc=1&sidt...Dr0I71t5NtKDNvgzl	302 Moved Temporarily	accounts.youtube.com	212 B	10.64.22.15:8080	112ms
⊕ GET ?auth=DQAAAIAAAAf...Dr0I71t5NtKDNv	302 Moved Temporarily	mail.google.com	0	10.64.22.15:8080	152ms
⊕ GET ?shva=1	200 OK	mail.google.com	21.8 KB	10.64.22.15:8080	432ms
⊕ GET ?ui=2&view=js&name...k1HFMewXo6MJ	200 OK	mail.google.com	343 KB		37ms
⊕ GET ?ui=2&view=bsp&ver=ohhl4rw8mbn4	200 OK	mail.google.com	62 B		35ms
⊕ GET ?ui=2&view=bsp&ver=ohhl4rw8mbn4	200 OK	mail.google.com	62 B		238ms
⊕ GET ?ui=2&view=bsp&ver=ohhl4rw8mbn4	200 OK	mail.google.com	62 B		239ms
⊕ GET ?ui=2&view=ss&mset...MewXo6MJQhTjE	200 OK	mail.google.com	55.2 KB		134ms
⊕ GET ?ui=2&view=jsm&nam...k1HFMewXo6MJ	200 OK	mail.google.com	5.4 KB		766ms
⊕ GET ?ui=2&view=ss&mset...MewXo6MJQhTjE	200 OK	mail.google.com	55.2 KB		688ms
⊕ GET sem_8e56e5be46cb600be9ba1b375de5d	200 OK	ssl.gstatic.com	12.1 KB		598ms
⊕ POST ?ui=2&ik=19011efaa...&rt=j&search=ii	200 OK	mail.google.com	1.7 KB	10.64.22.15:8080	862ms
⊕ GET cleardot.gif?zx=1qmlhw87jnu	200 OK	mail-attachment.googleusercontent.com	43 B	10.64.22.15:8080	44ms
⊕ GET setgmail?zx=pc36swyh8rif	204 No Content	google.com	0	10.64.22.15:8080	70ms
⊕ GET ?s=gmail&a=viewinb...s&zx=1md35xr0y	200 OK	clients2.google.com	35 B	10.64.22.15:8080	475ms
⊕ GET ?ui=2&ik=19011efaa...k=W1UHOX3tnF9K	200 OK	mail.google.com	890 B	10.64.22.15:8080	159ms



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Clear	Persist	All	HTML	CSS	JS	XHR	Images	Flash	Media
+	GET test?VER=8&at=AF6b...x=ys5Uu0guqp	200 OK	mail.google.com	5 B	10.64.22.15:8080				
+	POST bind?VER=8&at=AF6b...x=2i93fbrqqyt	200 OK	mail.google.com	214 B	10.64.22.15:8080				
+	GET ?view=sjs&name=wih&ver=yqaglnk19n7	200 OK	mail.google.com	95 B					
+	GET bind?VER=8&at=AF6b...x=tcv447xmhpzl	200 OK	mail.google.com	0 (1.1 KB)					
+	POST bind?VER=8&at=AF6b...x=c71pgzmizhv	200 OK	mail.google.com	11 B	10.64.22.15:8080				
+	POST ?ui=2&ik=19011efaa...83&pcd=1&mb=	200 OK	mail.google.com	444 B	10.64.22.15:8080				
+	GET ?ui=2&view=em&pcd=1&mb=0&rt=j	200 OK	mail.google.com	1.1 KB					
+	POST bind?VER=8&at=AF6b...x=8uz1s4vp39>	200 OK	mail.google.com	11 B	10.64.22.15:8080				
+	POST bind?VER=8&at=AF6b...x=49b31j1vjg4	200 OK	mail.google.com	11 B	10.64.22.15:8080				
+	GET c.gif?zx=5lg29vvh5mv	200 OK	mail.google.com	43 B	10.64.22.15:8080				
+	https://mail.google.com/mail/ota?zx=24i9nkai14gs	200 OK	mail.google.com	45 B	10.64.22.15:8080				
+	POST ?ui=2&ik=19011efaa...9d7N6AwXMcvsī	200 OK	mail.google.com	333 B	10.64.22.15:8080				
+	GET ?ui=2&ik=19011efaa...k1HFMewXo6MJQ!	200 OK	mail.google.com	4.6 KB					
+	POST bind?VER=8&at=AF6b...x=5ei88tsqn8ie	200 OK	mail.google.com	11 B	10.64.22.15:8080				
+	POST bind?VER=8&at=AF6b...x=4cb8zpg57rc	200 OK	mail.google.com	11 B	10.64.22.15:8080				
+	GET ?ui=2&ik=19011efaa...k1HFMewXo6MJQ!	200 OK	mail.google.com	4.5 KB					
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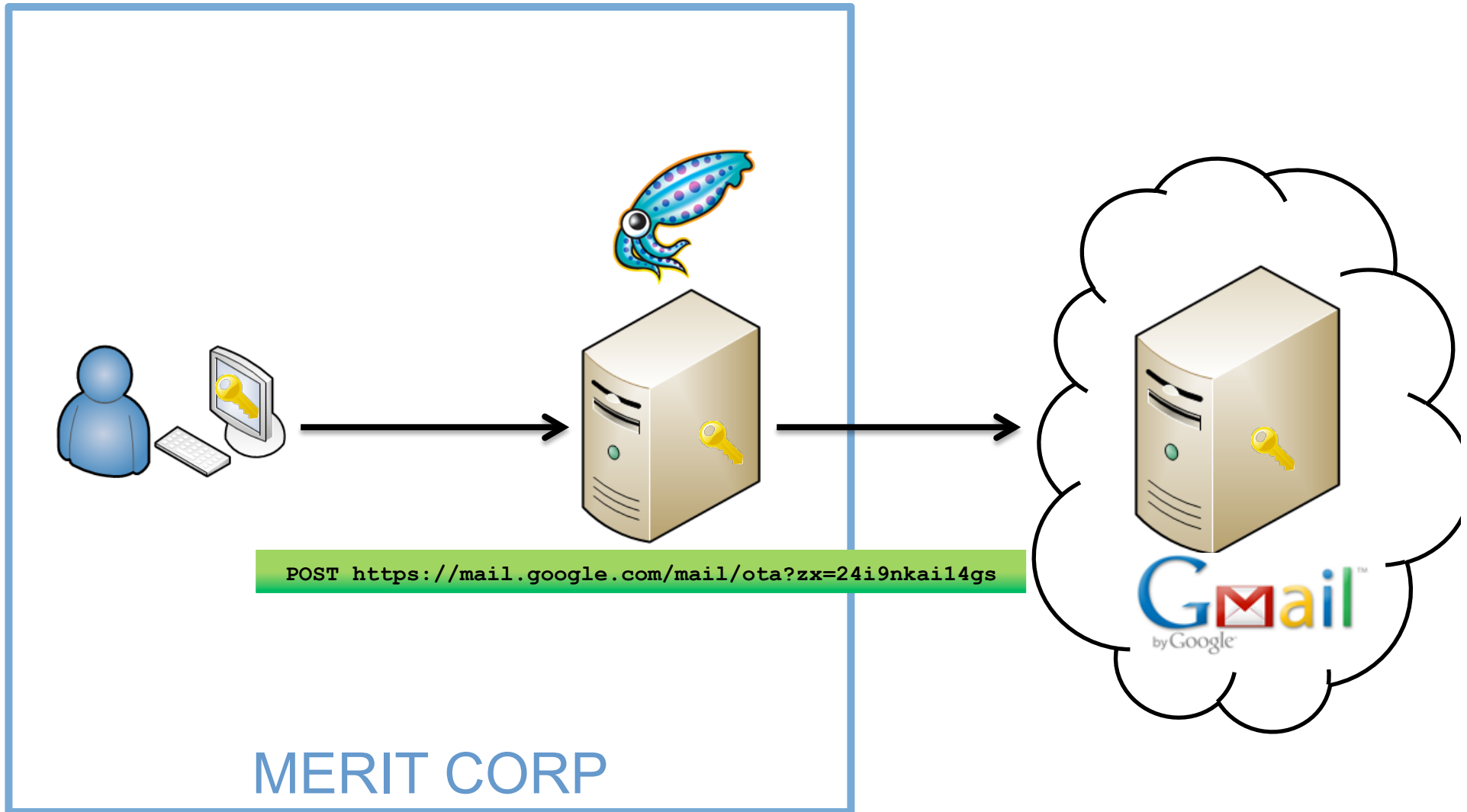


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Man-in-the-Middle (MITM) Proxy



Squid's HTTP Request Logging

```
image/gif
1331070430.915 101 10.0.3.100 TCP_MISS/200 491 GET https://mail.google.com/mail/images/c.gif? - DIRECT/74.125.225.86 image/gif
1331070432.096 160 10.0.3.100 TCP_MISS/200 502 POST https://mail.google.com/mail/ota? - DIRECT/74.125.225.86 text/plain
1331070432.894 2115 10.0.3.100 TCP_MISS/200 485 GET https://mail.google.com/mail/channel/test? - DIRECT/74.125.225.86 text/plain
1331070433.281 166 10.0.3.100 TCP_MISS/200 650 POST https://mail.google.com/mail/channel/bind? - DIRECT/74.125.225.86 text/plain
1331070433.948 226 10.0.3.100 TCP_MISS/200 930 GET https://mail.google.com/mail/channel/bind? - DIRECT/74.125.225.86 text/plain
1331070433.950 225 10.0.3.100 TCP_MISS/200 439 POST https://mail.google.com/mail/channel/bind? - DIRECT/74.125.225.86 text/plain
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1331070434.181 114 10.0.3.100 TCP_MISS/200 665 GET https://mail.google.com/mail/channel/bind? - DIRECT/74.125.225.86 text/plain
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1331070436.859 171 10.0.3.100 TCP_MISS/200 441 POST https://mail.google.com/mail/channel/bind? - DIRECT/74.125.225.86 text/plain
1331070438.694 166 10.0.3.100 TCP_MISS/200 501 POST https://mail.google.com/mail/ota? - DIRECT/74.125.225.86 text/plain
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1331070605.601 328 10.0.3.100 TCP_MISS/200 441 POST https://mail.google.com/mail/channel/bind? - DIRECT/74.125.225.85 text/plain
1331070608.375 24891 10.0.3.100 TCP_MISS/200 521 GET https://mail.google.com/mail/channel/bind? - DIRECT/74.125.225.86 text/plain
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1331070665.453 167 10.0.3.100 TCP_MISS/200 441 POST https://mail.google.com/mail/channel/bind? - DIRECT/74.125.225.85 text/plain
1331070685.258 26205 10.0.3.100 TCP_MISS/200 521 GET https://mail.google.com/mail/channel/bind? - DIRECT/74.125.225.86 text/plain
1331070686.760 145 10.0.3.100 TCP_MISS/200 906 POST http://safebrowsing.clients.google.com/safebrowsing/downloads? - DIRECT/74.125.225
```

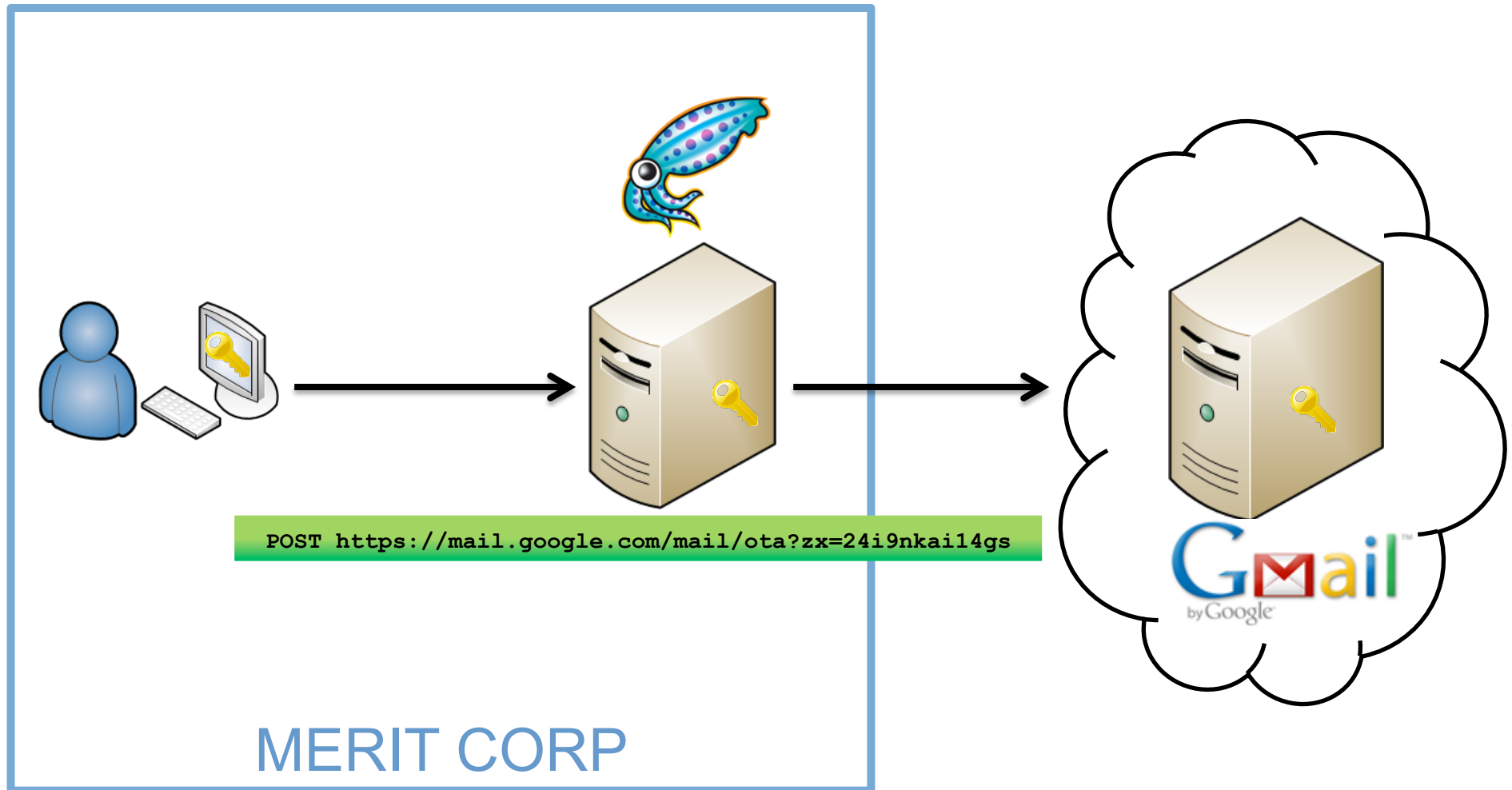


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RegEx: `mail.google.com/mail/ota*`

`POST https://mail.google.com/mail/ota?zx=24i9nkai14gs`



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Success!

The screenshot shows a Gmail draft email interface. At the top, there is a navigation bar with links for '+You', 'Search', 'Images', 'Maps', 'YouTube', 'News', 'Gmail', 'Documents', 'Calendar', and 'More'. Below this is a search bar and a blue button. The main header area includes a 'Gmail' dropdown, a red 'SEND' button, and buttons for 'Save Now', 'Discard', and 'Labels'. A status message indicates 'Draft autosaved at 10:10 AM (0 minutes ago)'. On the left sidebar, there are folders for 'COMPOSE', 'Inbox (3)', 'Starred', 'Important', 'Sent Mail', 'Drafts (21)', 'Personal', 'Travel', and 'More'. Below these is a 'Chat' section with a search bar and a contact 'ITLAB User' with a 'Try now' link. The email body shows the recipient 'someuser@competitor.com' and the subject 'Business Plans - FY2012.docx 10.00K - Attachment failed. Retry Remove Help Attach another file'. The email content reads: 'Here's the documents you wanted. Now hire me! Sincerely, Joe User'. A 'Plain Text' link is visible at the bottom right of the email body.



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Shortcomings

- Not very granular
- Doesn't account for the scenario where text is copied and pasted into an email



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Detection using ClamAV

testSig:0:*:

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Detection using ClamAV

```
klasjdfho9w38ryi3ubsdkvjlaw3oy5423uihtgi  
eaufsdlair78230895r82375g2389q7r834789hf  
kld3938fnf-  
;33437383968666b  
bcb433393338b66e66za1I
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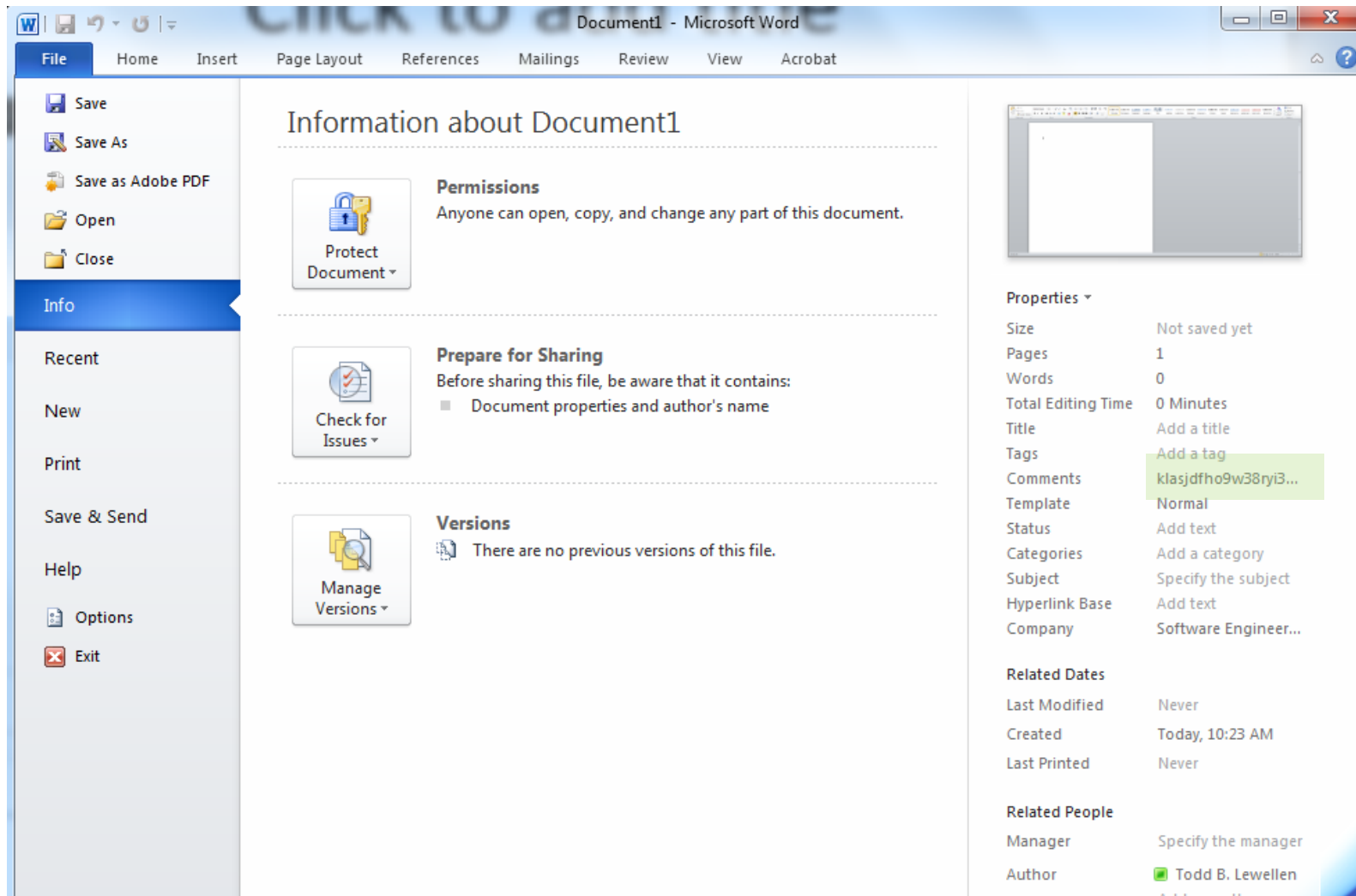


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Detection using ClamAV





Plagiarism Detection & DLP



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Solution:

- What if we could inspect all text flowing through the network?
- Rather than look for 'tags' or keywords, look for *similarity*
- How do we test document similarity?
- **Cosine similarity algorithms**
 - Laymen's terms: Plagiarism Detection
 - Even though we're not checking for plagiarism in academic papers, the process is virtually identical



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The Plagiarism Detection Method

- Rather than asking
 - “Does any text in this document sufficiently match anything within its cited references?”
- We’re asking
 - “Does any text in this outgoing network traffic sufficiently match anything within our repository of intellectual property?”
 - **If not** – send it through
 - **If so** – create an alert *and/or* actively block the traffic from leaving the organization’s perimeter

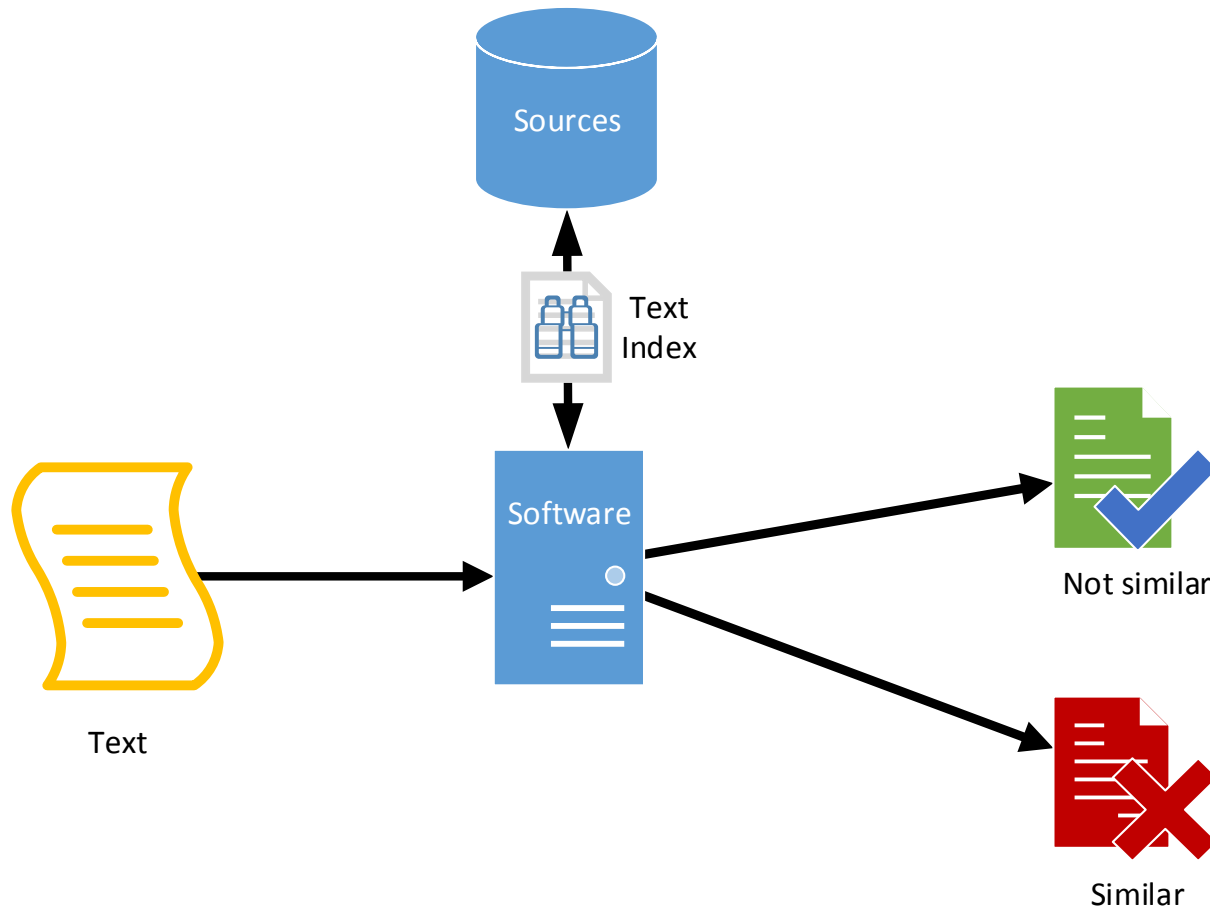


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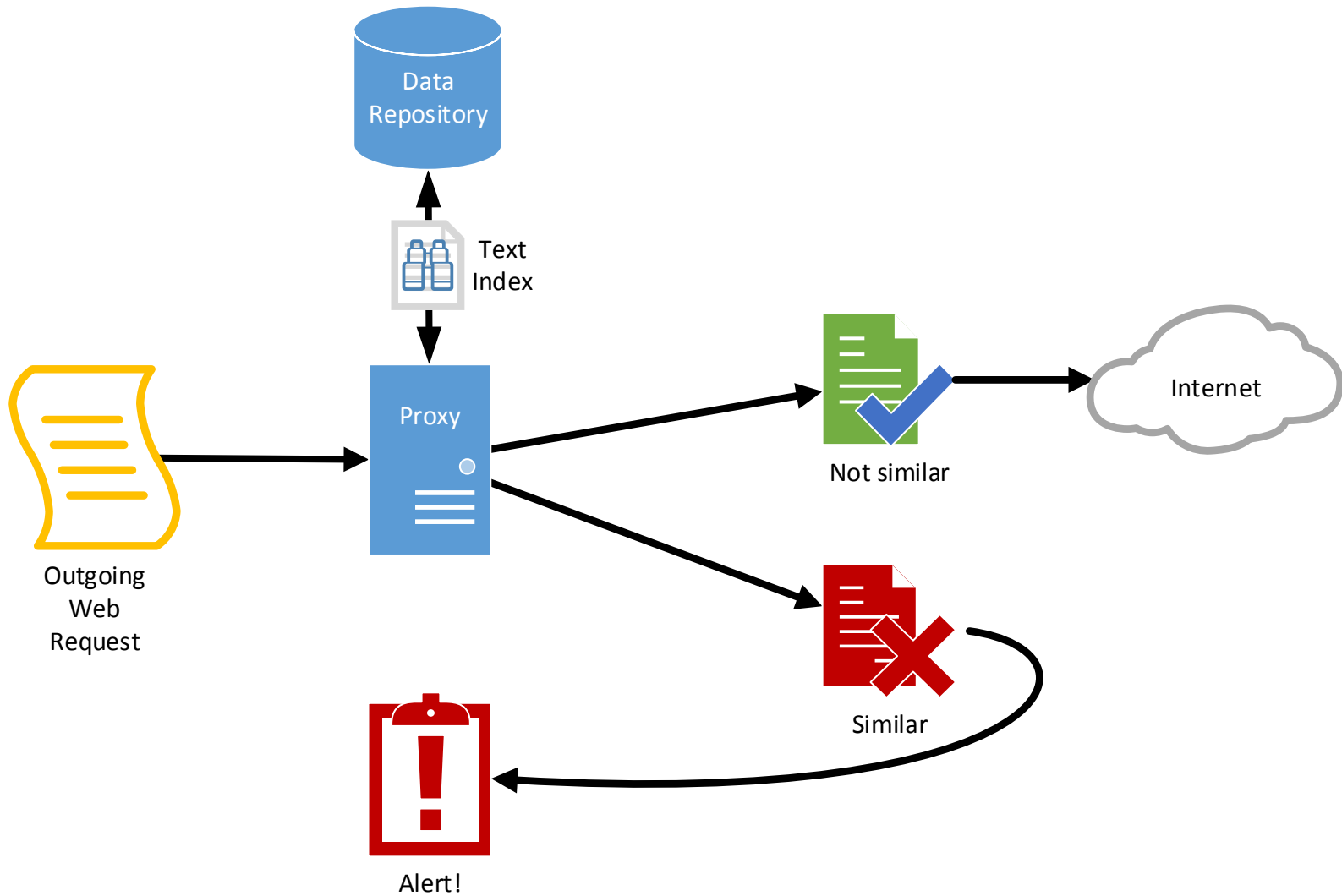
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Plagiarism Detection



Plagiarism Detection in DLP



Open Source Tools

- Squid proxy server
- Apache Lucene
- Apache Tika
- GreasySpoon ICAP server



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Apache Lucene

- Powerful open-source text indexer and search engine
- Used in IBM's famous Watson AI system
- Scalable, fast, and mature
- Perfect for our needs

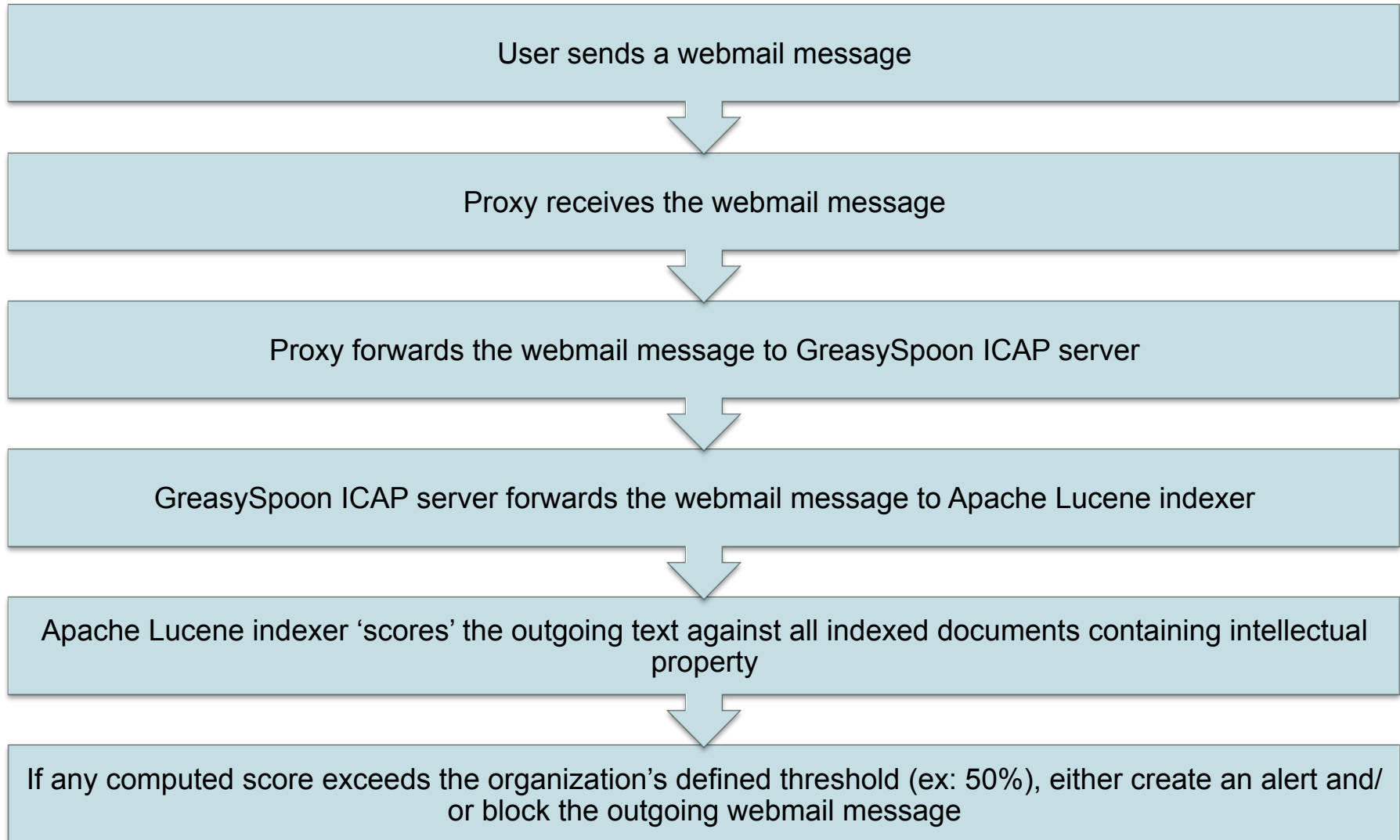


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Order of Events



Shortcomings

- Tuning the threshold is difficult
- Does not detect encodings other than ASCII or Unicode
- Processing intensive
- Large index (lots of duplicated data)
- Index contains sensitive information



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Future Work

- Create an efficient open-source DLP framework for correlating any given input data with any set of data, regardless of their type (i.e. text, image, raw)
- Tagging network traffic with usernames and other attribution information
- Improving our “Tagger” tool to automatically store file usage information within documents when they are created/accessed/modified



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Upcoming Control Topics

- Two Man Control For Operating Systems
 - Why is it so hard?
- Better Forensics for Insider Threat Indicators
 - How to use what we know more effectively



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