MENTAL MODELS FOR EFFECTIVE SEARCHING

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1 PLAYER GAME
2 PLAYER GAME

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Leveling Up Search

What to search for?

How to search for it?

What to search for?
Asking the Right Question

**Attack Timeline**

- **Attack Starts**
- **Event 1**
- **Event 2**
- **Event 3** (highlighted)
- **Event 4**
- **Attack Ends**

The timeline of events leading your current reference point.

The timeline of events following your current reference point.

Context about the nature of entities or relationships.
Over 95% of case searches involve refinement. The amount of refinement decreases as analysts gain experience, but not a lot. Even highly experienced analysts rely on refinement.
Broad and Narrow Searches

**REFINEMENT**

**Expansion:** Broadening scope
- Time: 1 day to 1 week
- Criteria: 1 host to 10 hosts

**Reduction:** Narrowing scope
- Time: 12 hours to 10 minutes
- Criteria: All ports to 1 port

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Search 1
- Windows EID 4688
- 1 Day
- All Servers

Search 2
- Windows EID 4688
- 1 Day
- All Servers
- Excluding known apps

Search 3
- Windows EID 4688
- 1 Week
- File Server
- Excluding known apps
NARROW SEARCHES
▪ Useful for answering specific questions.
▪ May miss interesting things if they’re too specific.
  ▪ “What HTTP transactions led up to the suspicious download on this host?”

BROAD SEARCHES
▪ Useful when you’ve run out of leads or need to explore a timeline, host, or indicator.
  ▪ “What else has this external IP communicated with on my network?”

Specific searches get specific results.
How to Search for it?

Questions manifest in tools as syntax is search tools. The average security practitioner will use ~4 search syntaxes in a 10 year career.

**Common Query Languages**

- SQL – Osquery
- Lucene – Elastic
- MQL – Mandiant
- EQL – Endgame
- SPL – Splunk
- RegEx – Everything

Once you learn one search tool, it’s easier to learn others.
Learning Search Syntax

PRAGMATICS
SEMANTICS
SYNTAX
MORPHOLOGY
PHONOLOGY
PHONETICS
speech sounds
phonemes
words
phrases and sentences
literal meaning of phrases and sentences
meaning in context of discourse
Learning Search Syntax

[Diagram showing layers of language understanding from phonetics to pragmatics]

- Backend
- Syntax
- Partial Matching
- Features
- Output
Cypher (Graph)
MATCH (p:Person)-[:WORKS_FOR]-(t:Finance)

SQL (Relational)
SELECT * FROM users WHERE dept='Finance'

<table>
<thead>
<tr>
<th>Users</th>
<th>Dept_ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bob</td>
<td>1</td>
</tr>
<tr>
<td>Kim</td>
<td>2</td>
</tr>
<tr>
<td>Sally</td>
<td>2</td>
</tr>
<tr>
<td>Steve</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dept_ID</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Admin</td>
</tr>
<tr>
<td>2</td>
<td>Finance</td>
</tr>
<tr>
<td>3</td>
<td>IT</td>
</tr>
</tbody>
</table>
Search Syntax

**LUCENE**: field:value

**SPLUNK**: field=value

**LUCENE**: src_ip:192.168.1.1 OR dst_ip:192.168.1.1

**SPLUNK**: src_ip=192.168.1.1 OR port=80

**SPLUNK**: src_port=80 src_port=53

**LUCENE**: domain(xyz.com, abc.com, 123.com)

**SPLUNK**: username!=chris (matches when no field exists)

**SPLUNK**: NOT username=chris (field must exist but not have value)
Partial Matching

Matching smaller parts of larger things.

**Wildcards** match one or more characters:
- Single Character: st?ak will match steak, st1ak, or stqak
- Multiple Characters: st*ak will match steak, st1ak, st2983928392ak

**Prefix search** will match a specific value followed by other data.
- csan* will match csanders, csanderson, csan12345

**Suffix search** will match a specific value after other data.
- *ders will match csanders, sanders, esanders, 123ders
Features and Output

**FEATURES**

- **Ranges**: Search between values
  - port:1-1024

- **Exists**: Return results when a field is present
  - `_exists_`:username

- **Regular Expressions**: Complex pattern matching
  - domain:/^[a-zA-Z0-9][a-zA-Z0-9-]{1,61}[a-zA-Z0-9]\.[a-zA-Z]{2,}$/

- **Subsearch**: Search within a search

**OUTPUT**

- Statistical Transforms
- Portable Data Types (JSON, CSV)
# Search Features to Learn

<table>
<thead>
<tr>
<th>Search Backend</th>
<th>Partial Matching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Storage</td>
<td>Wildcards</td>
</tr>
<tr>
<td>Typed Data</td>
<td>Prefix Search</td>
</tr>
<tr>
<td>Filter vs. Query Context</td>
<td>Suffix Search</td>
</tr>
</tbody>
</table>

**Search Syntax**

- Basic Structure
- Compound Queries
- Boolean Operators
- Escaped Characters
- Comparison Operators

**Search Features:**

- Regular Expressions
- Subsearch / Nested Search
- Ranges
- Exists Searches

**Output**

- Transformations
- Formats
THE END

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