System Administrators Prefer Command Line Interfaces, Don’t They?
An Exploratory Study of Firewall Interfaces

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Before we start...

What we knew

Towards Understanding IT Security Professionals and Their Tools

David Bolts, Rodrigo Weringer, Andrei Gagné
Konstantin Bezruchko, Leo Iverson, Sidney Foro, Brian Fisher
University of British Columbia, Vancouver, Canada.

Design Guidelines for System Administration Tools
Developed through Ethnographic Field Studies

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Trust as an Underlying Factor of System Administrator Interface Choice

Survey of System Administrator Work Practices
Did we miss anything? Please feel free to add any thoughts, opinions, or suggestions you may have for us here:

I know what I'm doing. Please

NO MORE GUI!

15 people need GUIs. They never thought to be doing whatever they are doing to do.

from Takayama and Kandogan 2006
Before we start...

What we knew

! What we see
Research Questions

Q1 What firewall interfaces do sysadmins use?
Q2 What firewall interfaces do they prefer?
Online Survey

up to 14 Questions (4 open-ended) - skip logic

- avg time working with firewalls
- which interface was mainly used and which interface was the preferred one
- which tasks are easier with each interface
- what are their strengths and limitations
- demographics

- Time to answer: avg 177 sec SD=106

228
148
101
Recruitment

- Sysadmin Volunteers
  no financial compensation

  *very hard* to recruit

- Sysadmin forums and email lists +

  - 300 participants *with firewall experience*
  
  ![Reddit](https://www.reddit.com)

  *r/sysadmin/*
Demographics I

Age:
- 35-44: 86 (29%)
- 45-54: 25 (8%)
- 55-64: 9 (3%)
- 18-24: 34 (11%)

Gender:
- Male: 285 (95%)
- Female: 11 (4%)
- Other: 3 (1%)
- Prefer not to answer: 11 (4%)

Prefer not to answer: 4 (1%)
Demographics II

- **Time per week on managing firewalls**
  - < 1 h: 106 (35%)
  - 1–3 years: 46 (15%)
  - 4–6 years: 64 (21%)
  - 7–9 years: 39 (13%)
  - 10+ years: 145 (49%)
  - 9–12 h: 11 (4%)
  - 5–8 h: 35 (12%)
  - 1–4 h: 117 (39%)
  - 13+ h: 21 (7%)

- **Experience as system administrator**
  - < 1 year: 6 (2%)
  - 1–3 years: 46 (15%)
  - 4–6 years: 64 (21%)
  - 7–9 years: 39 (13%)
  - 10+ years: 145 (49%)
  - Do not manage firewalls: 10 (3%)
Demographics III

Proficiency with firewalls

- Expert: 52 (17%)
- Intermediate: 114 (38%)
- Advanced: 114 (38%)
- Basic knowledge: 20 (7%)
# Preferred and Primarily Used Interfaces

<table>
<thead>
<tr>
<th>Primarily used</th>
<th>Preferred interface</th>
<th>Total</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CLI</td>
<td>GUI</td>
<td>API + Other</td>
</tr>
<tr>
<td>CLI</td>
<td>61</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>GUI</td>
<td>30</td>
<td>169</td>
<td>10</td>
</tr>
<tr>
<td>API + Other</td>
<td>4</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>95  (31.7%)</td>
<td>179 (59.7%)</td>
<td>26 (8.6%)</td>
</tr>
</tbody>
</table>
The Good of CLI

“CLIs have a high signal-to-noise ratio, and are therefore preferable to everything else”

“100% coverage of all firewall functionality supported by the OS kernel, unlike GUIs...”

CLI strengths

- Flexibility and efficiency of use (106 votes, 33%)
- Functional suitability (62 votes, 20%)
- Usability (30 votes, 9%)
- Performance efficiency (22 votes, 7%)
- Other (99 votes, 31%)
The Bad of CLI

“CLI may be scary / overwhelming for a beginner / untrained user”

“CLIs are terrible at generating visual inform. that is comprehensible by non-experts...”

- Match between system and real world: 22 (25%)
- Usability: 22 (26%)
- Recognition rather than recall: 10 (12%)
- Error prevention: 8 (9%)
- Other: 24 (28%)
“it allows me to have a better understanding of a firewall’s configuration while having that information displayed in a more organized manner when compared to a CLI.”

“because of my responsibilities as a general sysadmin, management of the firewall takes up only a small part of my time, and having using the GUI for management means that I do not have to remember CLI commands.”
The Bad of GUI

“missing a lot of features/settings, so that you have to use CLI to make changes”

“documenting a GUI is mostly useless and defeats most of the purpose of a GUI”

- Other 153 (38%)
- Performance efficiency 34 (8%)
- Match between system and real world 38 (9%)
- Functional suitability 56 (14%)
- Flexibility and efficiency of use 125 (31%)
Discussion

a shift towards GUI

- Interfaces getting better? (supported by our data)
- More sys admins with limited expertise? (inconclusive)
- Sys admins are doing much more than they used to do? (supported by our data)
Design Recommendations

Better GUls

- Lighter to run, not bloated
- Simplify setup and installation
- Customization of shortcuts (scripting)

Better CLIs

- Syntactical verification of commands
- Integrated knowledge base of examples
Thank You!

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## Preferred and Proficiency

<table>
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<tr>
<th>Proficiency</th>
<th>Preferred interface</th>
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<tbody>
<tr>
<td></td>
<td>CLI</td>
<td>GUI</td>
</tr>
<tr>
<td>Basic</td>
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<tr>
<td>Intermed.</td>
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<td>Advanced</td>
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<td>65</td>
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<tr>
<td>Expert</td>
<td>17</td>
<td>28</td>
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