Censorship Arms Race: Research vs. Practice

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Censorship

forbidden.com

forbidden.com

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forbidden.com

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Censorship

forbidden.com

Public Tor relay

forbidden.com

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Public Tor relay

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Censorship

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Public Tor relay

Non-public Tor relay

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Censorship

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Public Tor relay

Non-public Tor relay

forbidden.com

Censorship

forbidden.com

Public Tor relay

Non-public Tor relay

forbidden.com

We want to know

- How well a circumvention system works in practice?
- How does it compare to other systems?

Practical attacks on Tor

1. Using properties of the endpoints

Domain name
IP : Port

Does not possess

Practical attacks on Tor

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Domain name
IP : Port

Does not possess

Happened in: Iran, China, Syria, Saudi Arabia, …

15 of the 32 known cases

Practical attacks on Tor

2. Using properties of the protocol

Cipher suite
SSL certificate lifetime
Is this SSL?

Does not possess

Practical attacks on Tor

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Cipher suite
SSL certificate lifetime
Is this SSL?

Does not possess

Happened in: Iran, China, Syria, UAE, …

14 of the 32 known cases

Practical attacks on Tor

3. By unplugging the Internet

Happened in: Egypt 2011, Libya 2011, Syria 2012.

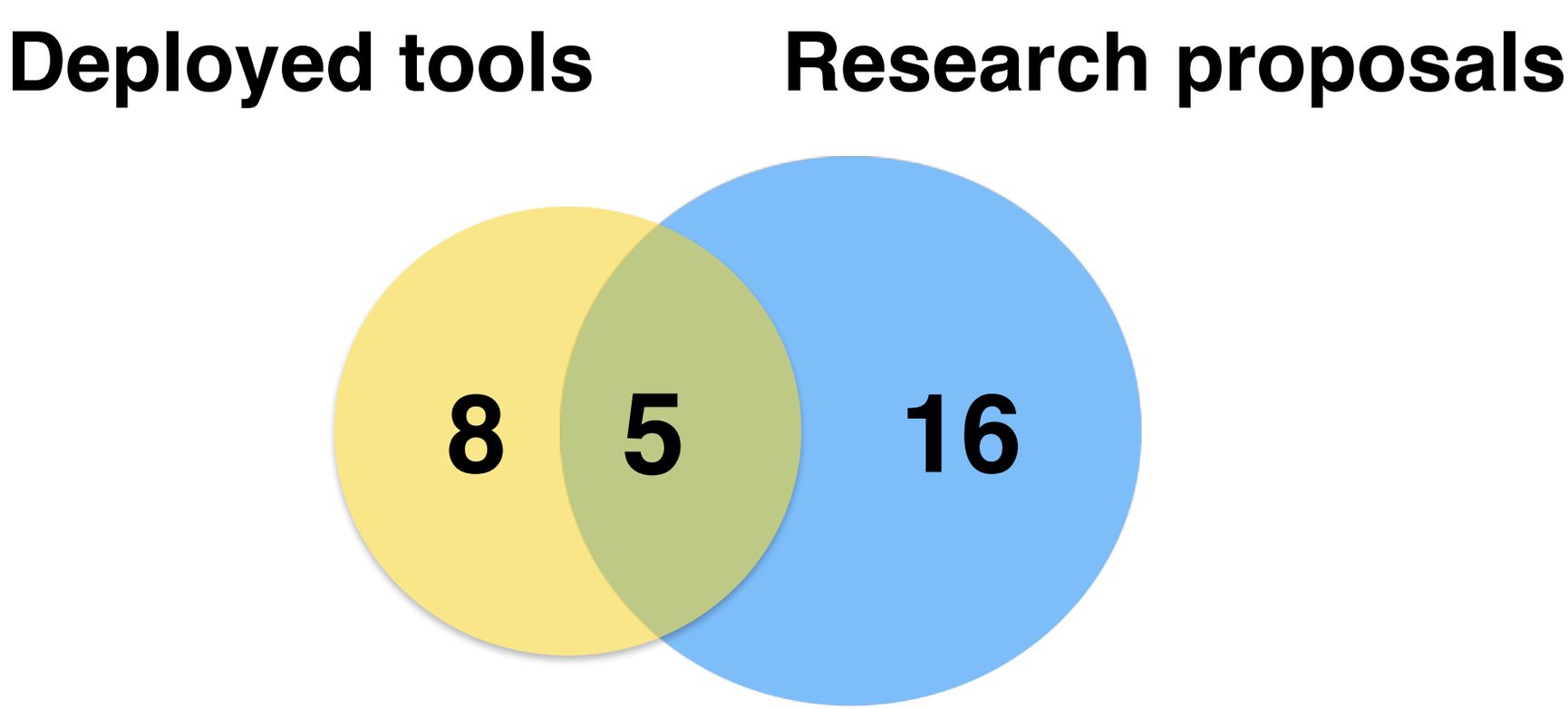
3 of the 32 known cases

Censor in real attacks

- Looks for the simplest features for blocking
    - scalable
    - low operational cost
    - low collateral damage
- Discovering the feature needs manual effort

Research in censorship circumvention

- Surveyed 34 academic and practical censorship circumvention approaches



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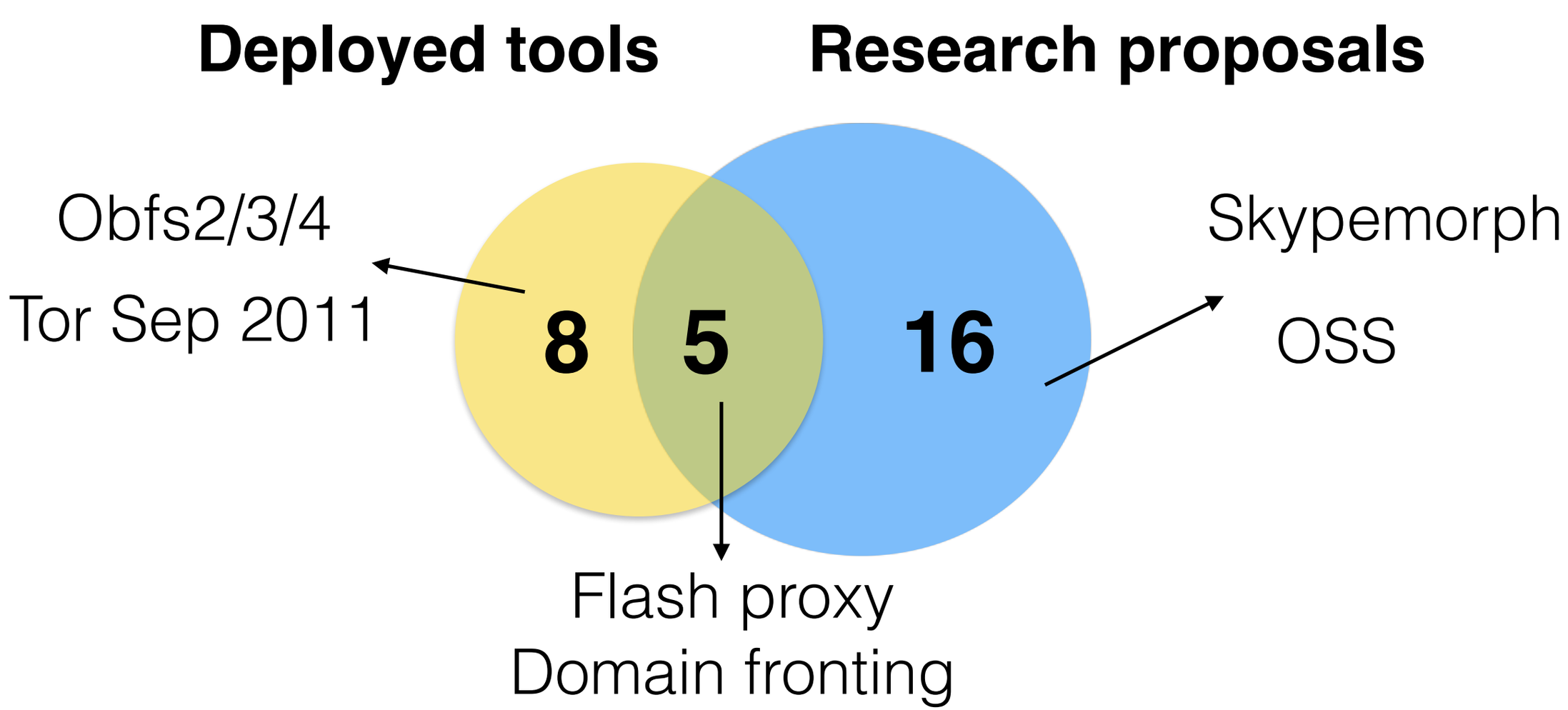


Research in censorship circumvention

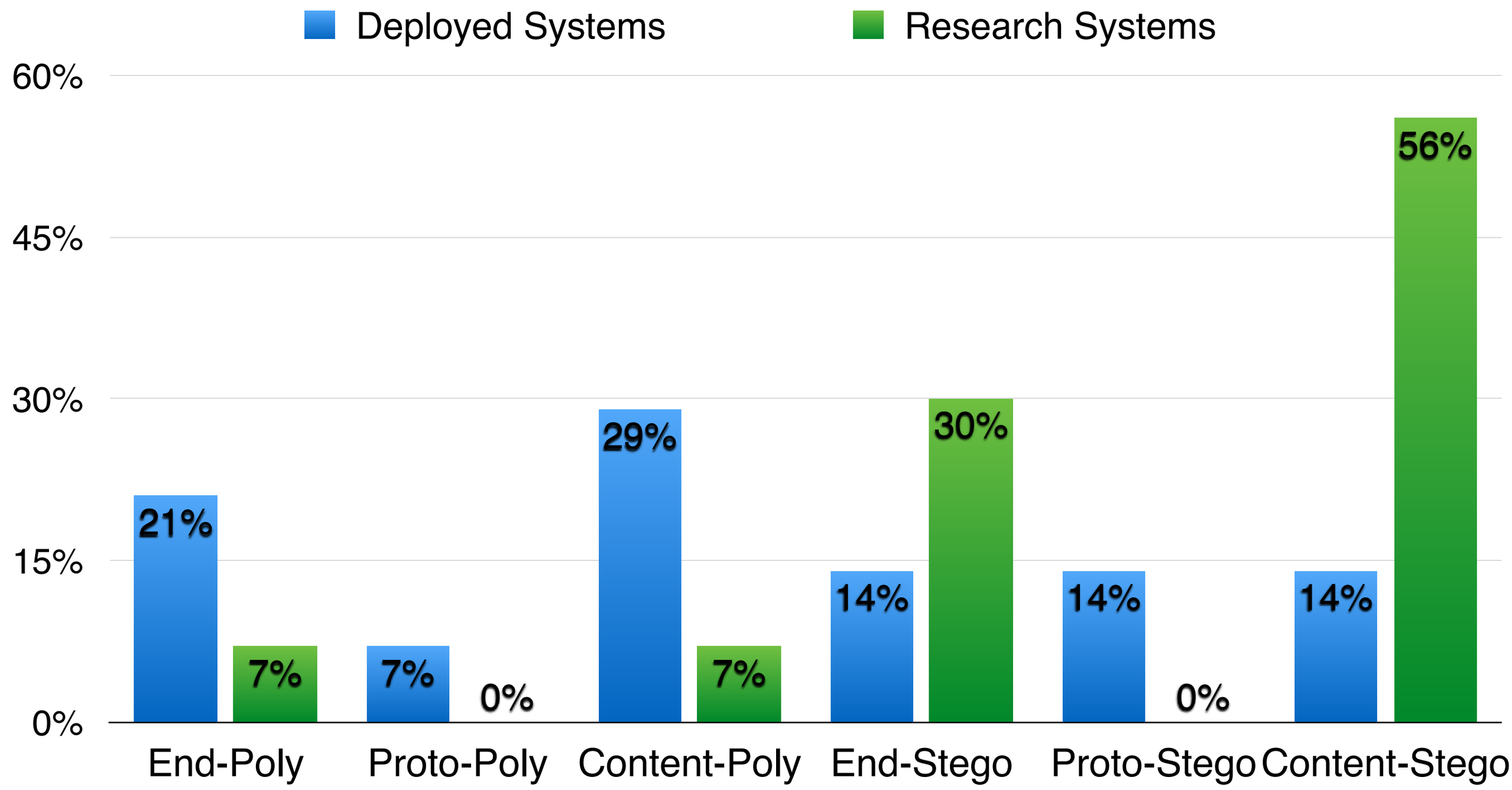
- What kind of attacks it defends?

- How?

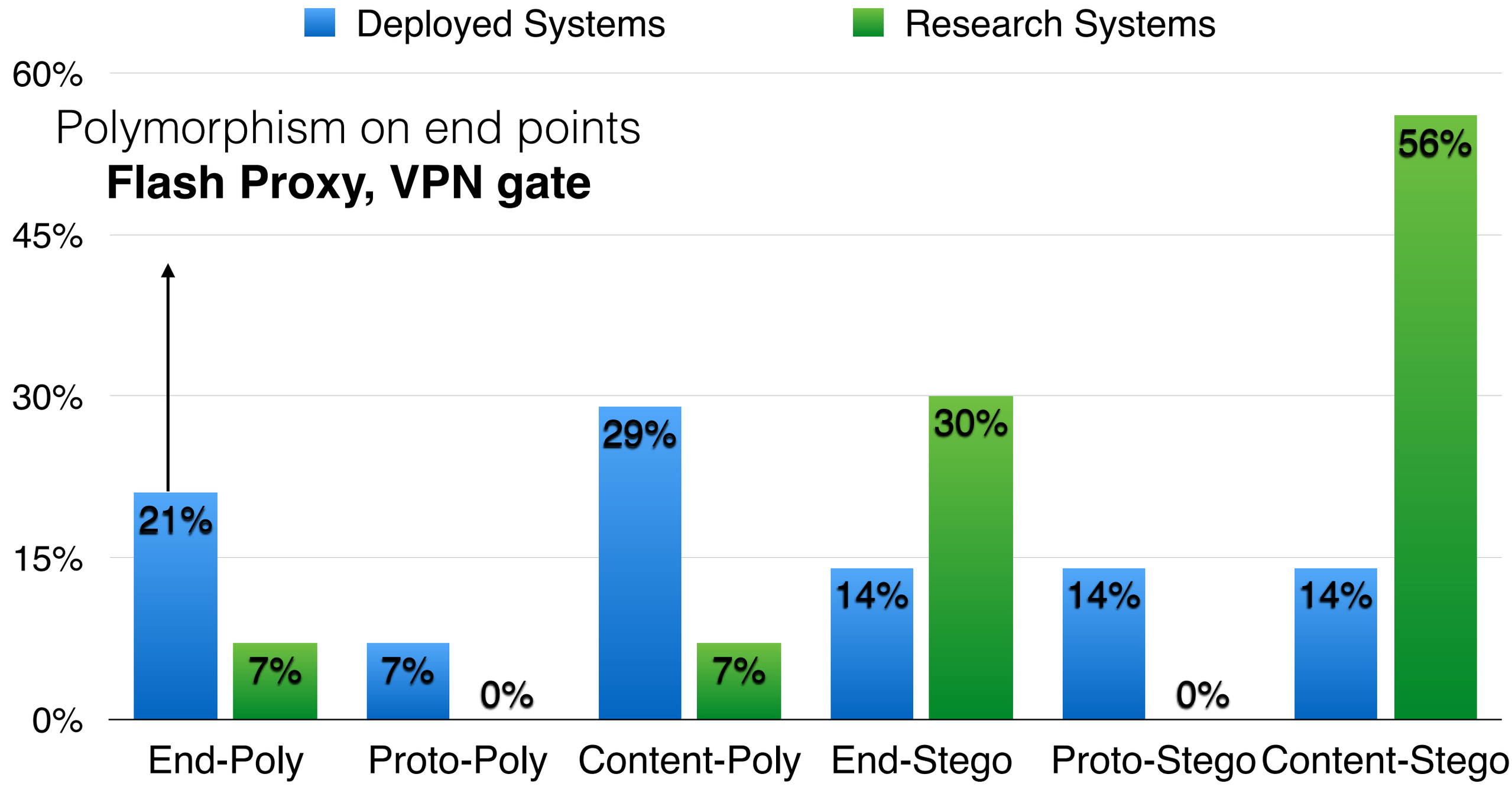
Research in censorship circumvention

- What kind of attacks it defends?
    - end points, protocol, content
- How?
    - Polymorphism: Looking different
    - Steganography: Looking like something

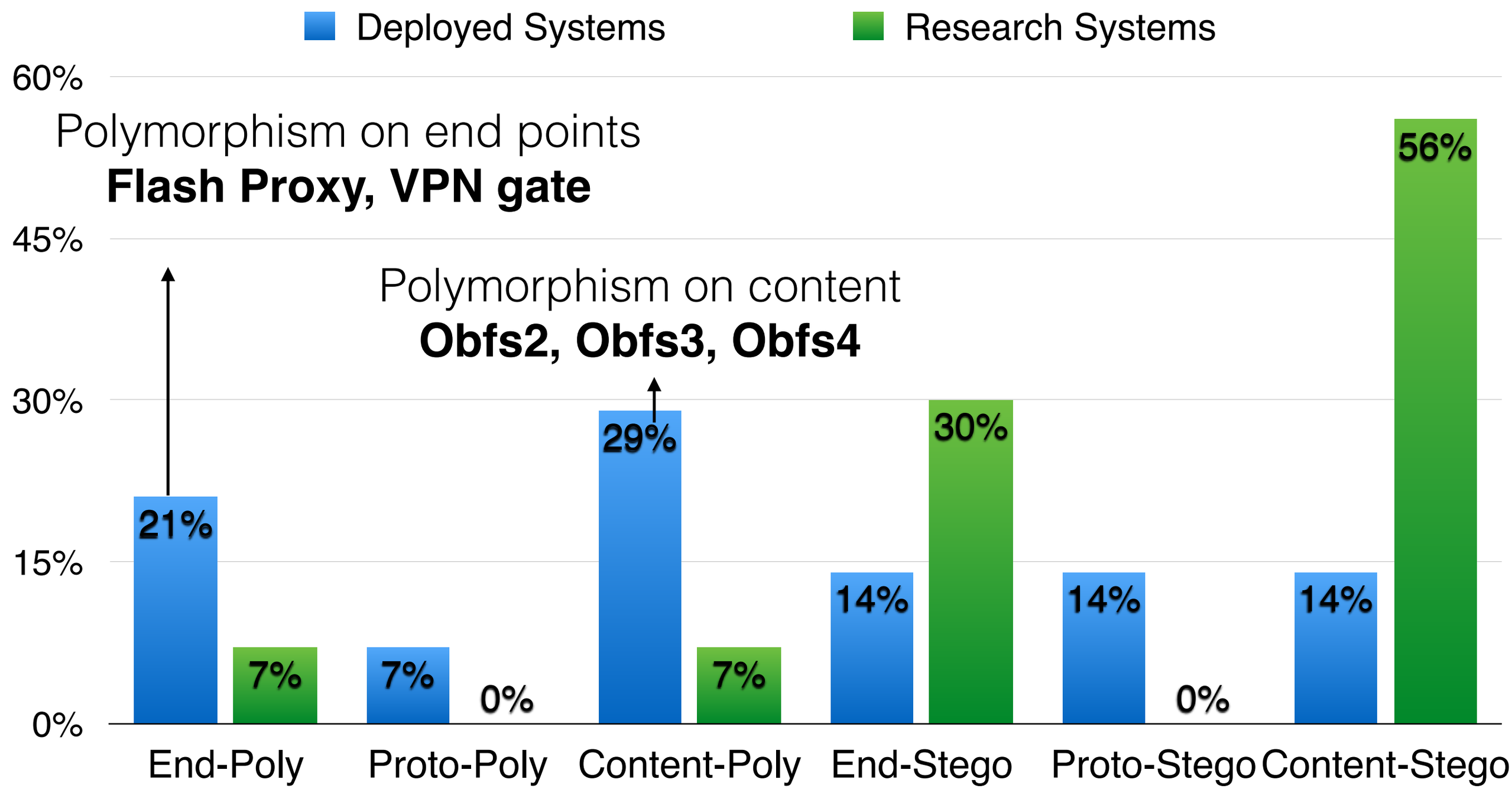
Research Vs. Practice



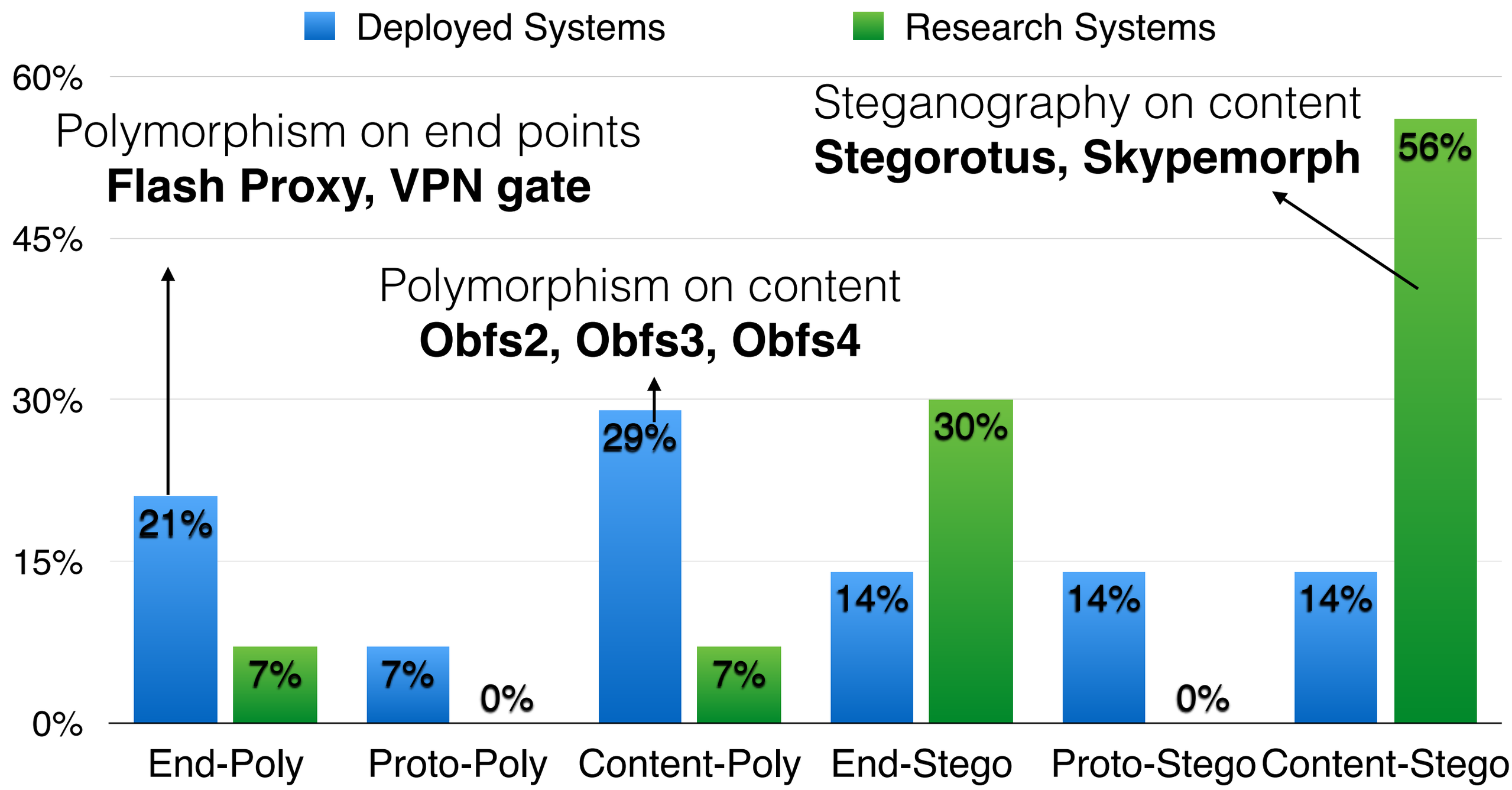
Research Vs. Practice



Research Vs. Practice



Research Vs. Practice



Research Vs. Practice

- Development cost
- End game

- Operational cost
- Arms race

How to mitigate this gap?

- Practical evaluation criteria
- We found 60 different evaluation criteria
- Different papers use different evaluation criteria

Current evaluation criteria

The criteria fall under the following broad categories:

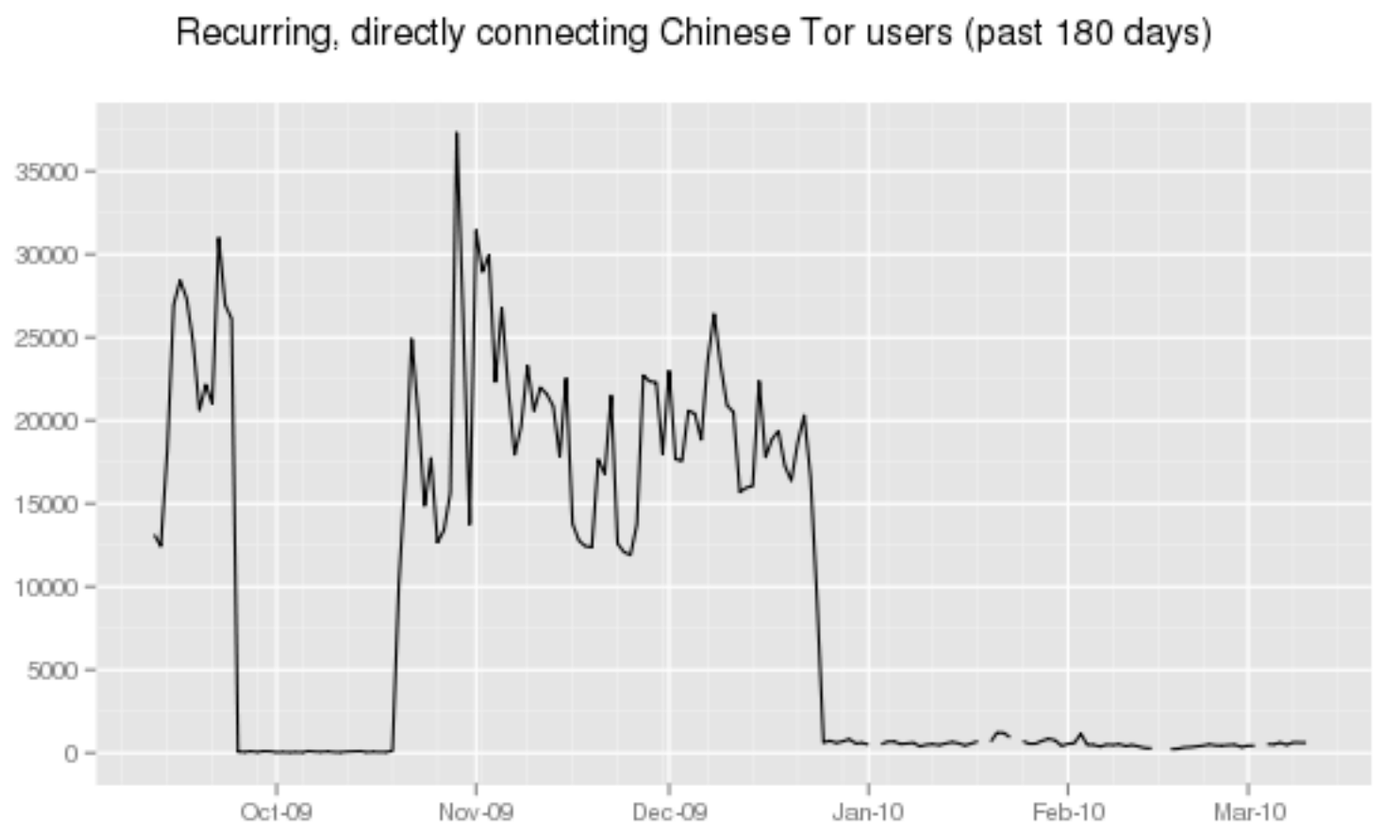
1. resistance to known attacks (e.g., address blocking, active probing),
2. cost of the evaders
3. collateral damage of the censor
4. performance,
5. traffic analysis,
6. usage.

New evaluation criteria

- **Total cost** of a system:
    - censor's cost, user's cost, system maintainer's
- **Goodput**, how much productive traffic it enables

How to find censor's cost?

- Check how long it takes to discover how to block a system



Blocking happens either before some major events or as soon as an event occurs

Discussion

- What should be the effective evaluation criteria?
- Any known blocking events that we missed?
- List of attacks:

  http://eecs.berkeley.edu/~sa499/tor_timeline.pdf

- Researchers: expect email from us!