

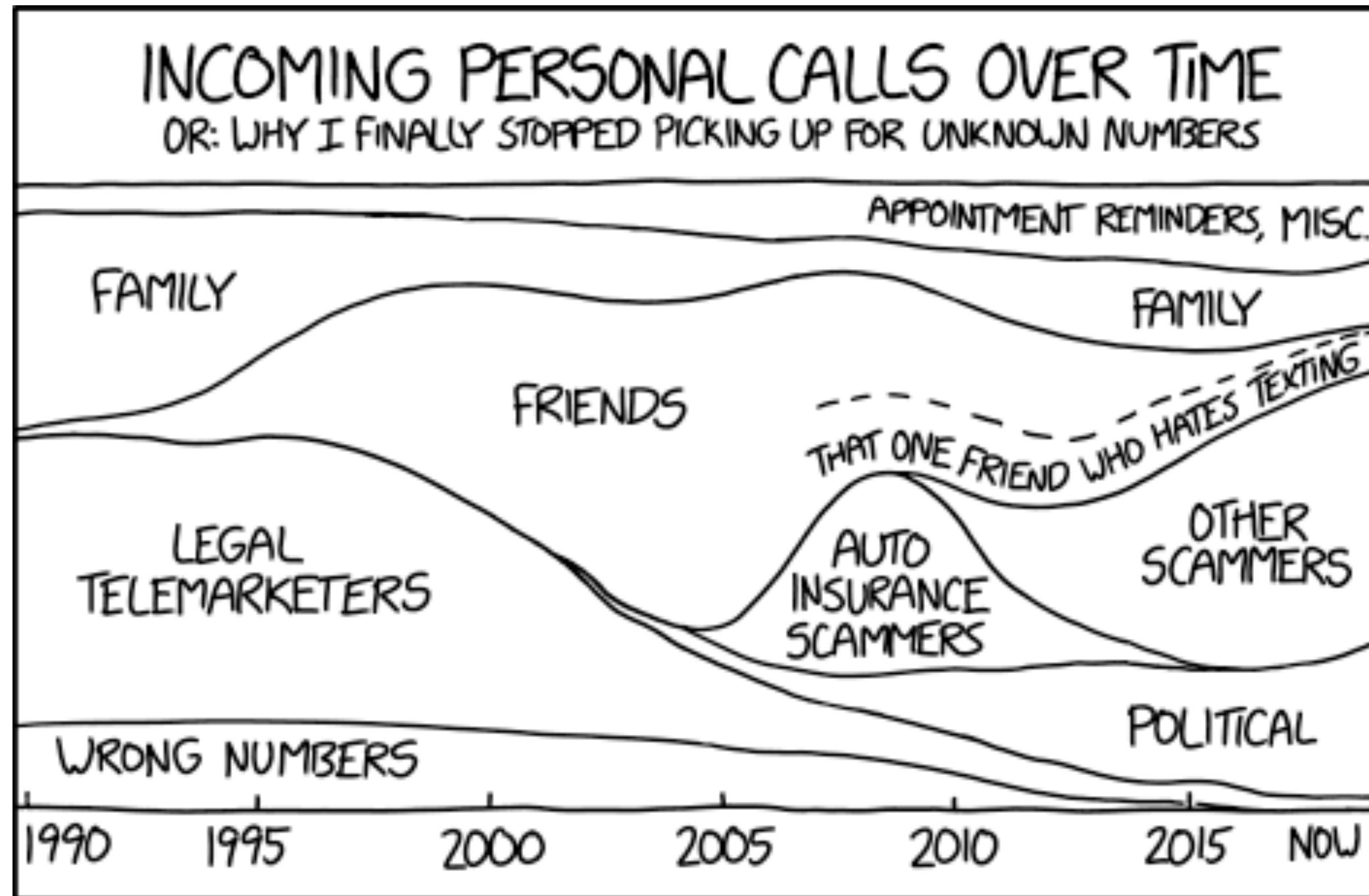
Who's Calling?

Characterizing Robocalls through Audio and
Metadata Analysis

Sathvik Prasad, Elijah Bouma-Sims, Athishay Kiran Mylappan, Bradley Reaves
North Carolina State University

Everyone Hates Robocalls

Some are annoying

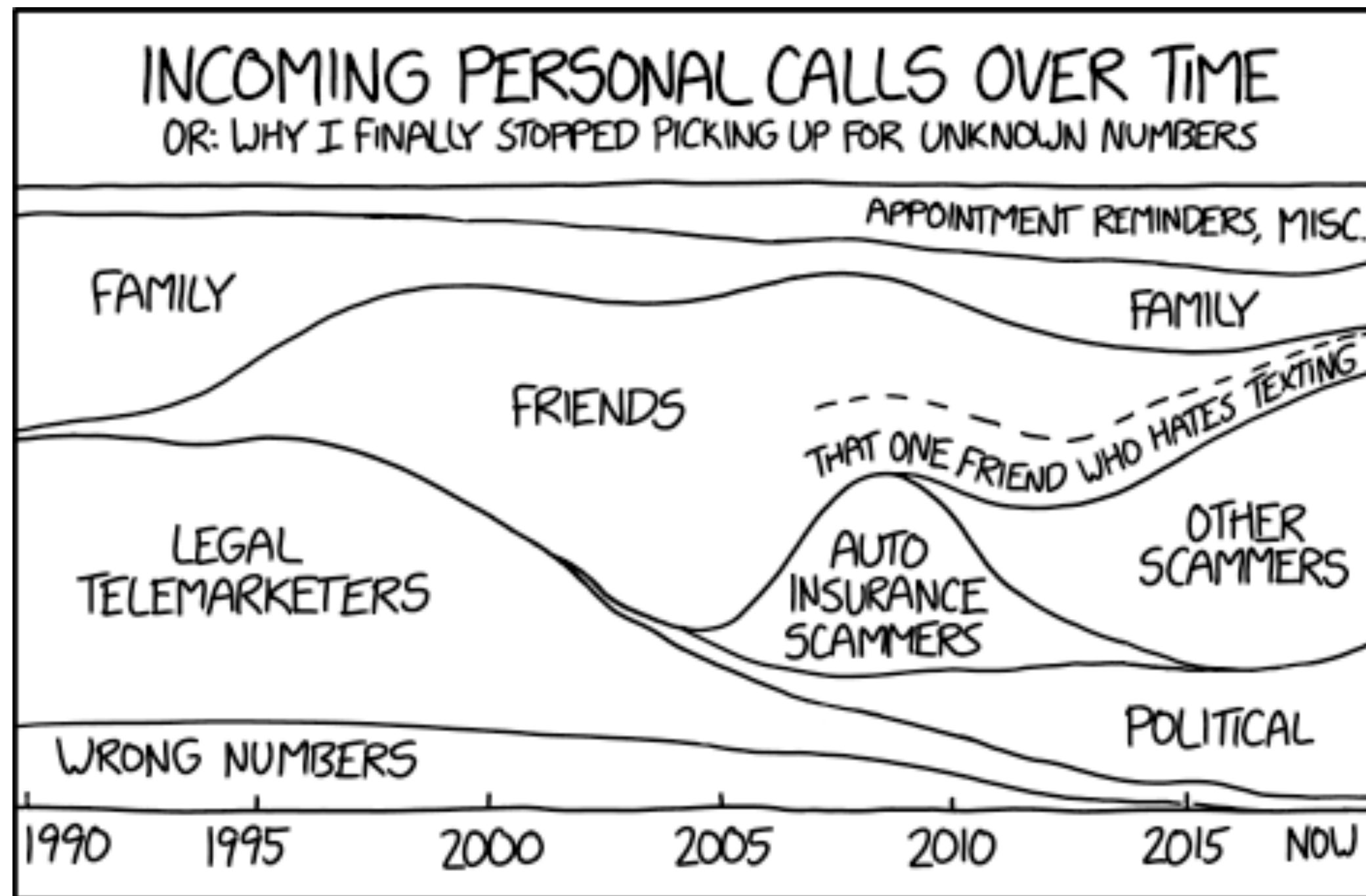


<https://xkcd.com/2053/>

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Some can cause serious harm!



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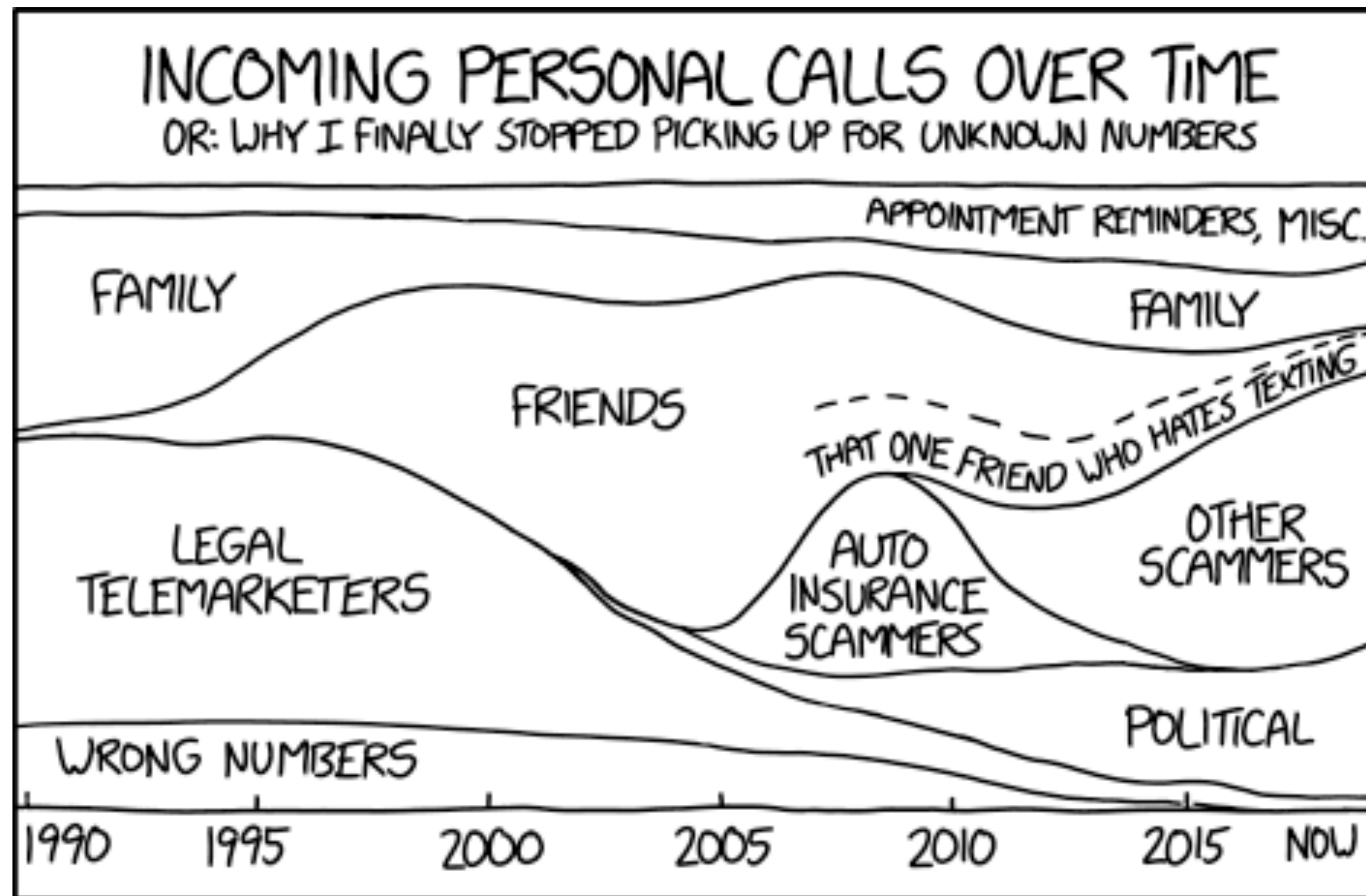


‘That can actually kill somebody’: Scam robocalls are pitching fake coronavirus tests to vulnerable Americans

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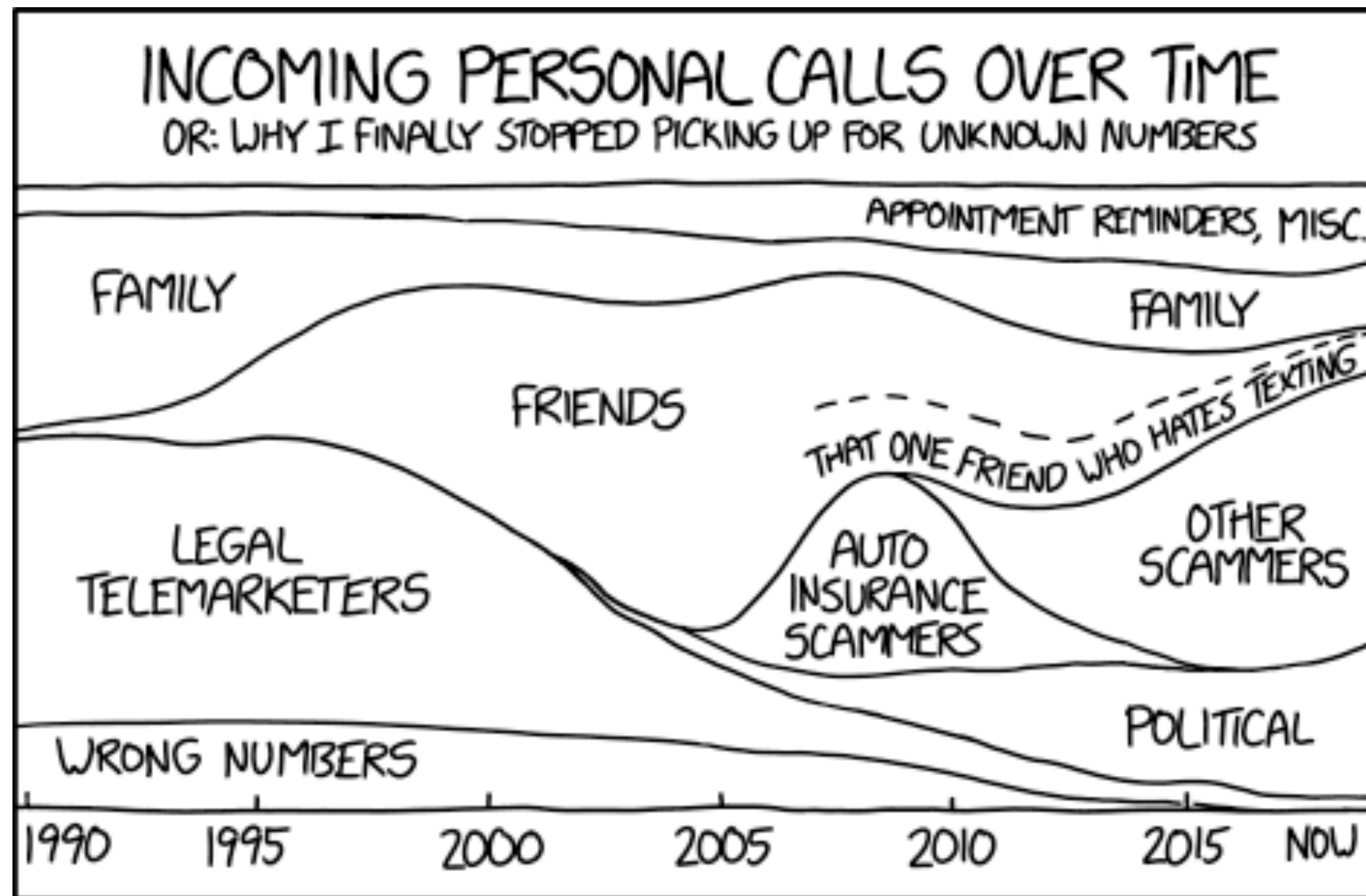


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FCC Seeks \$225 Million Fine From Telemarketer Accused of Making 1 Billion Robocalls

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<https://www.washingtonpost.com/technology/2019/11/19/suspicious-robocalls-pitching-health-insurance-surged-october-now-feds-are-scrambling-act/>
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Primary Questions

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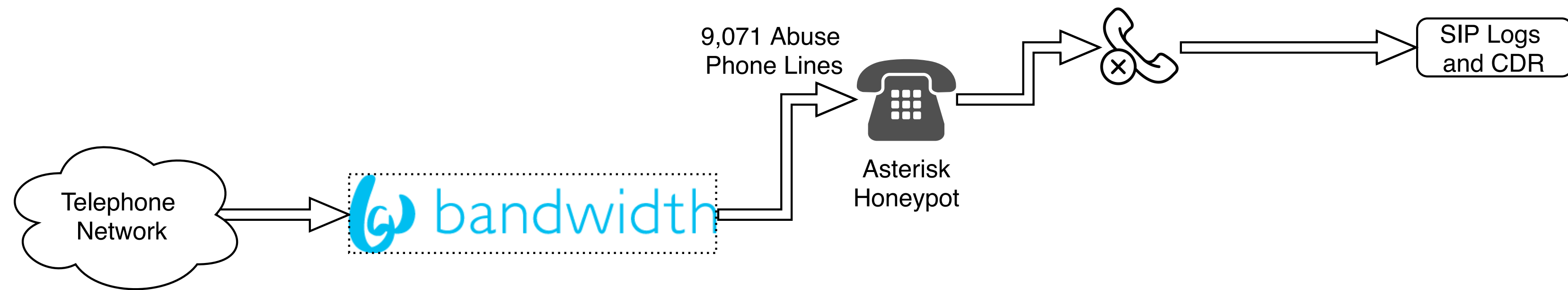
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4. What strategies do robocalls use to entice their victims?

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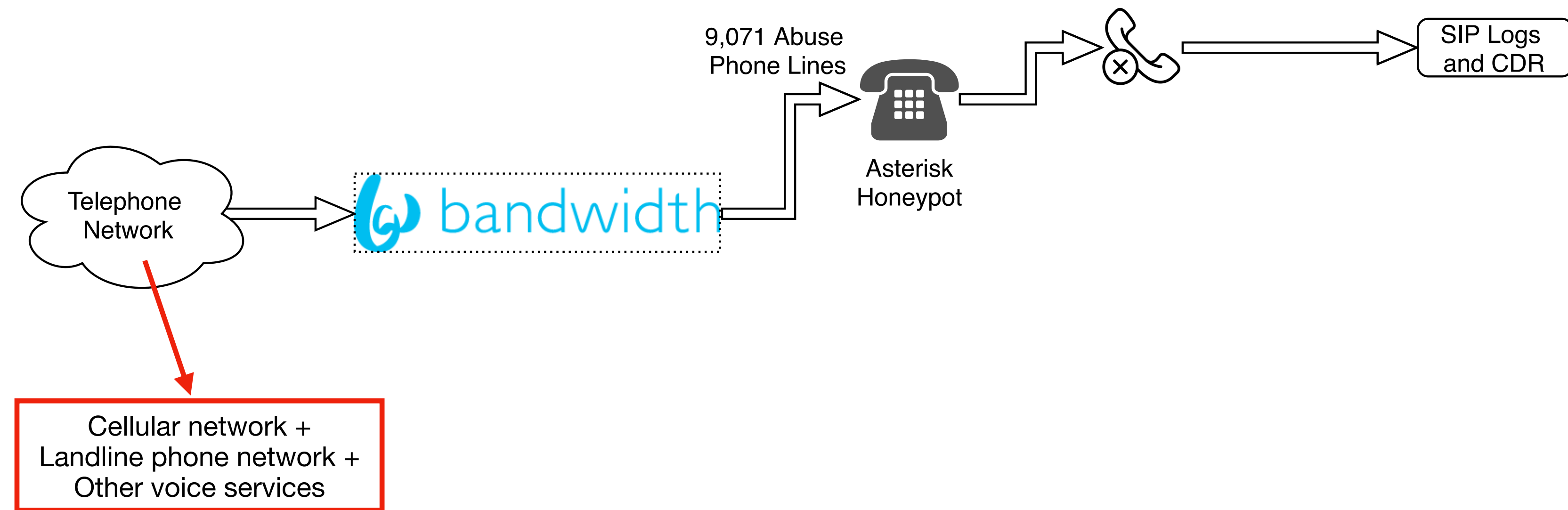
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Feb 2019

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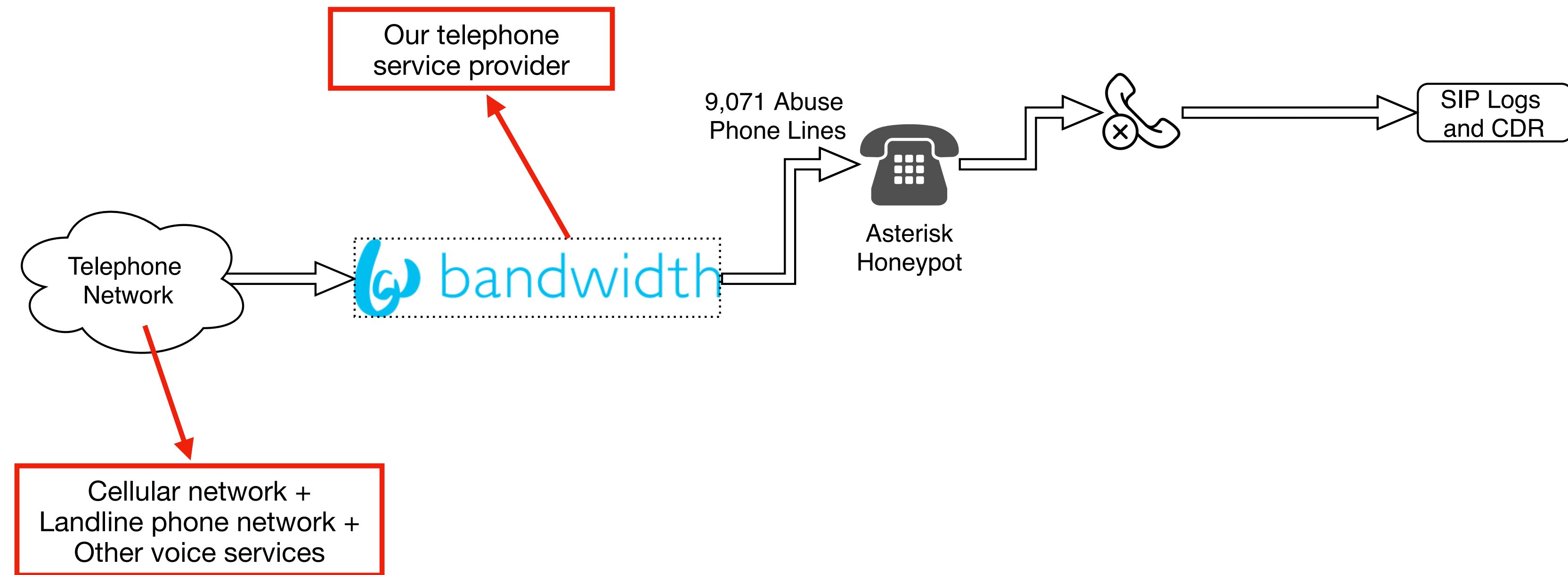
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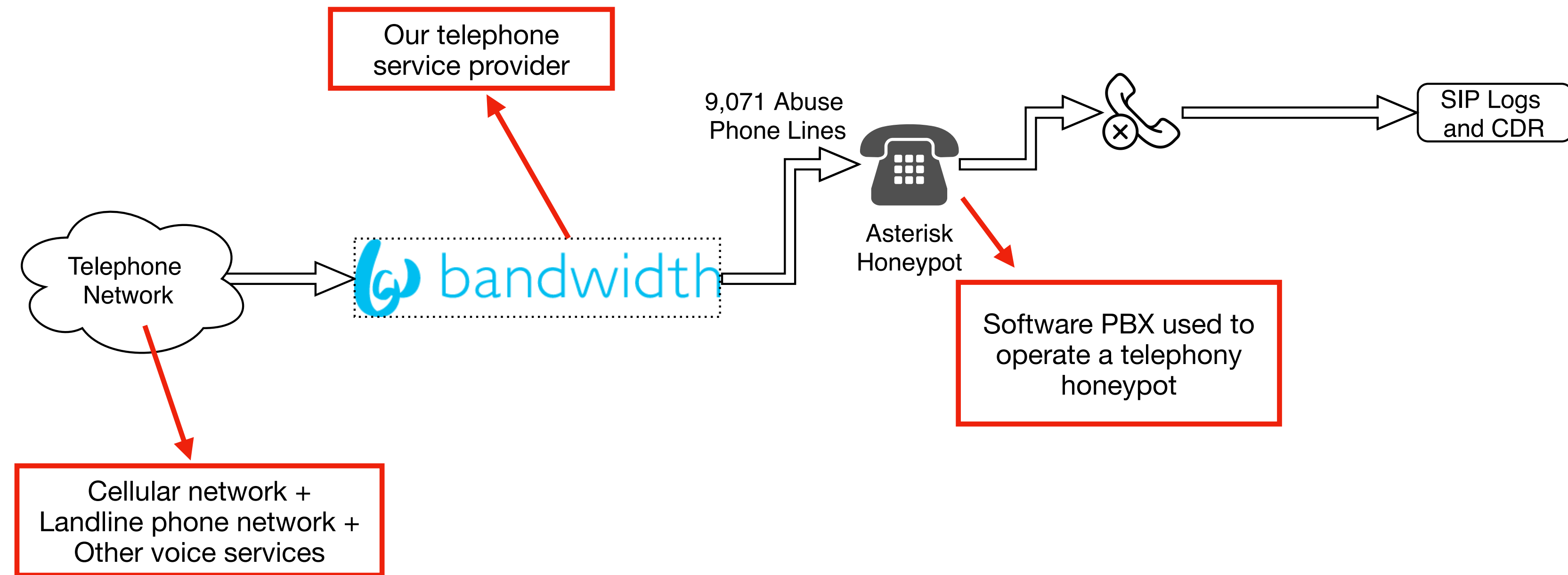
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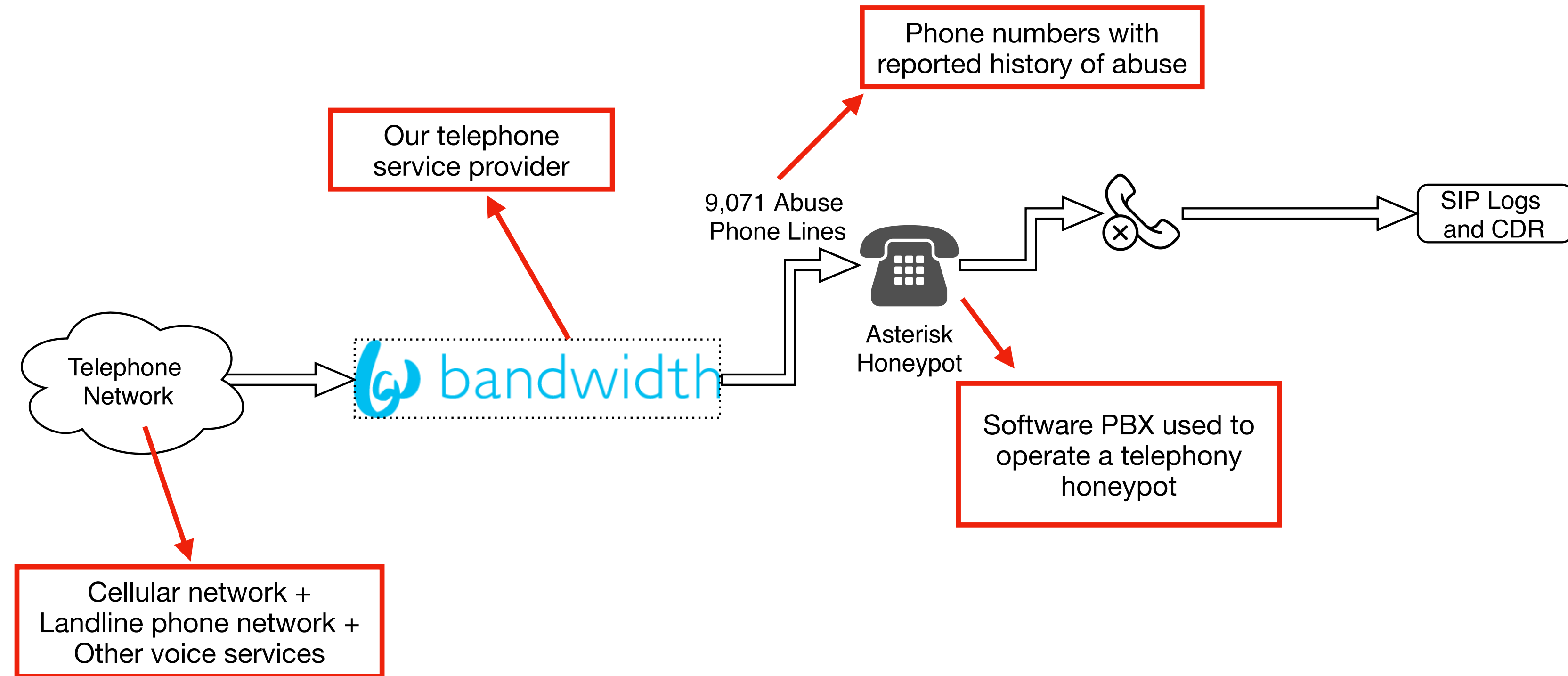
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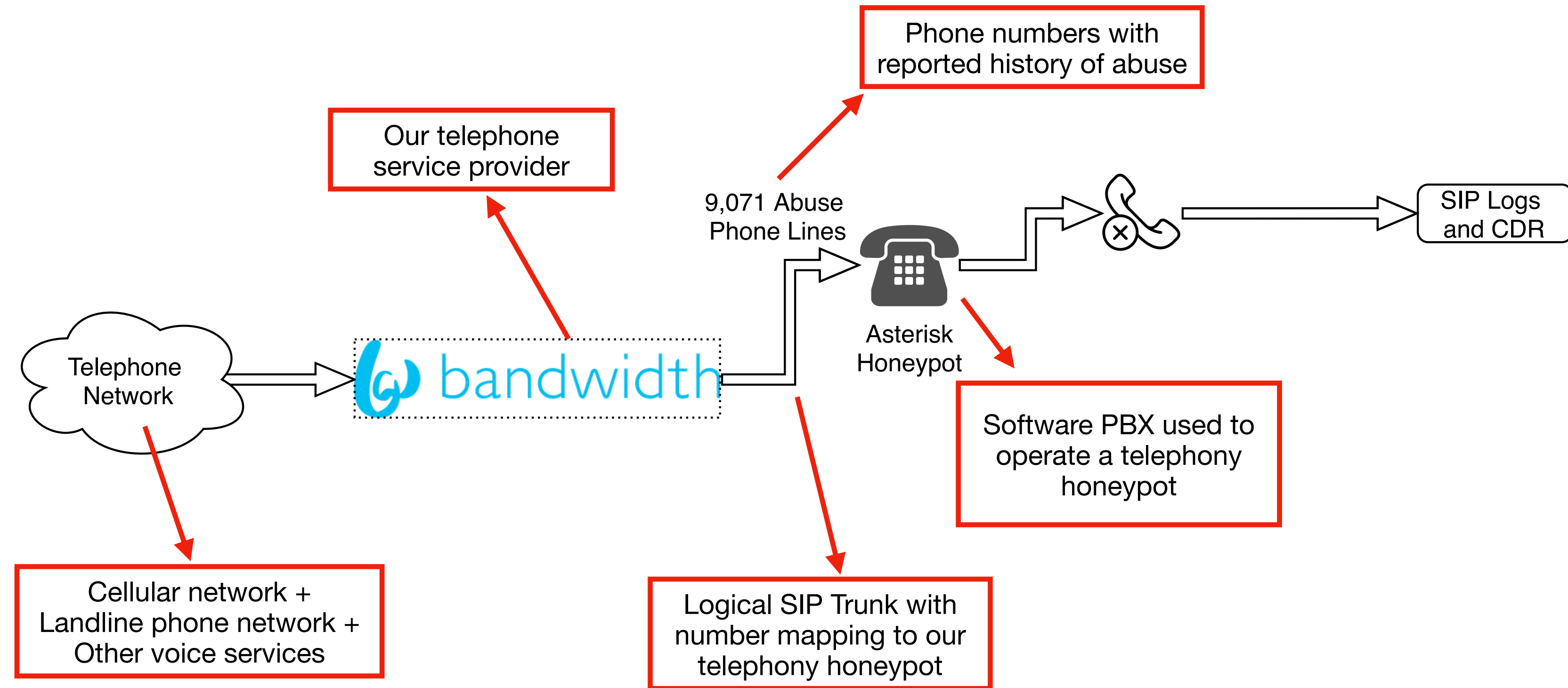
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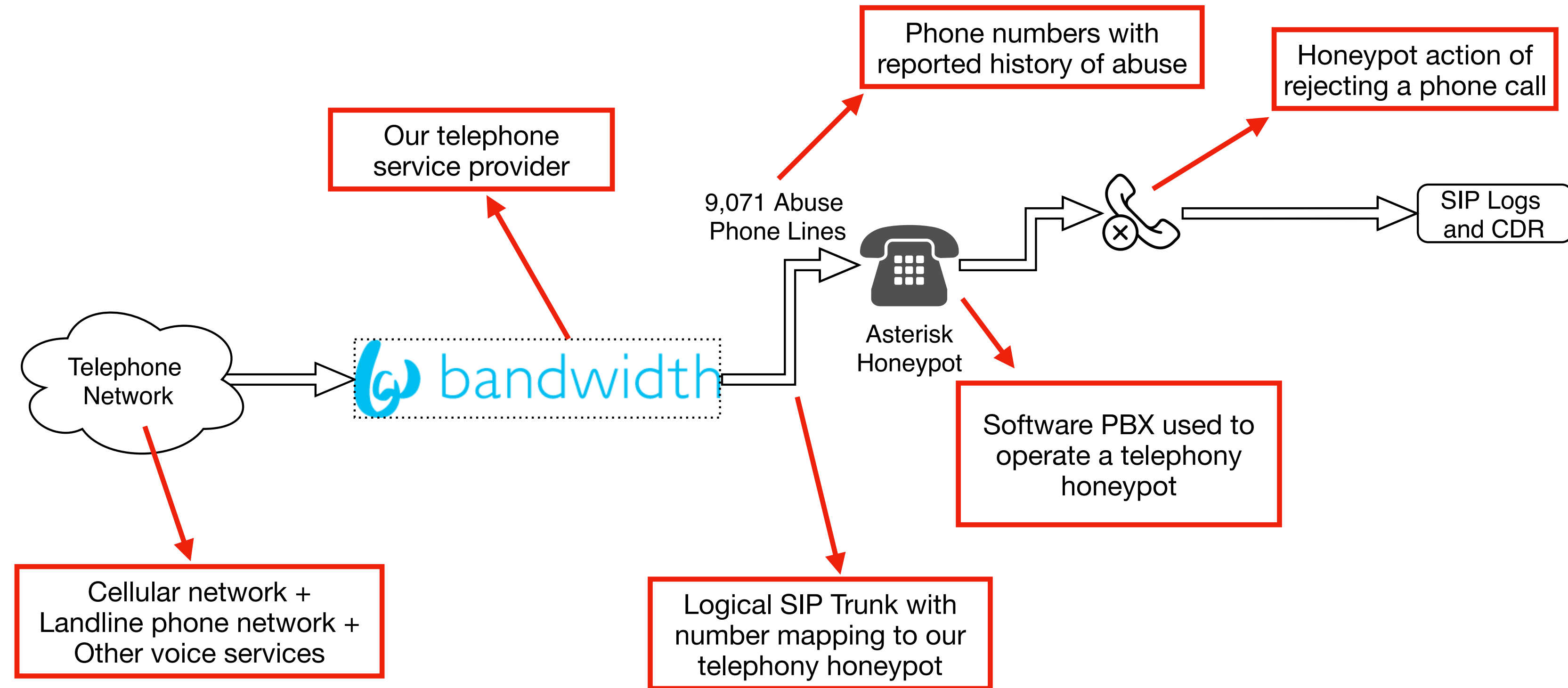
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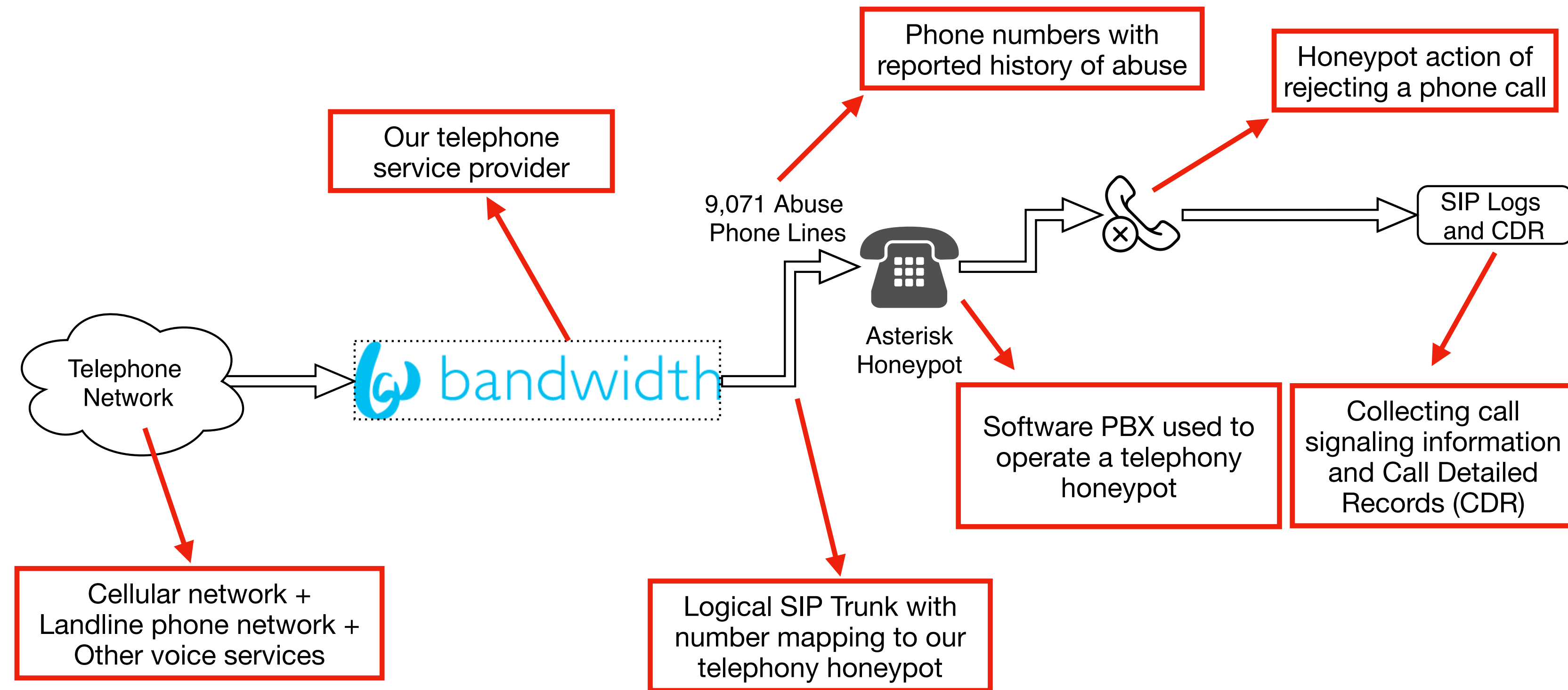
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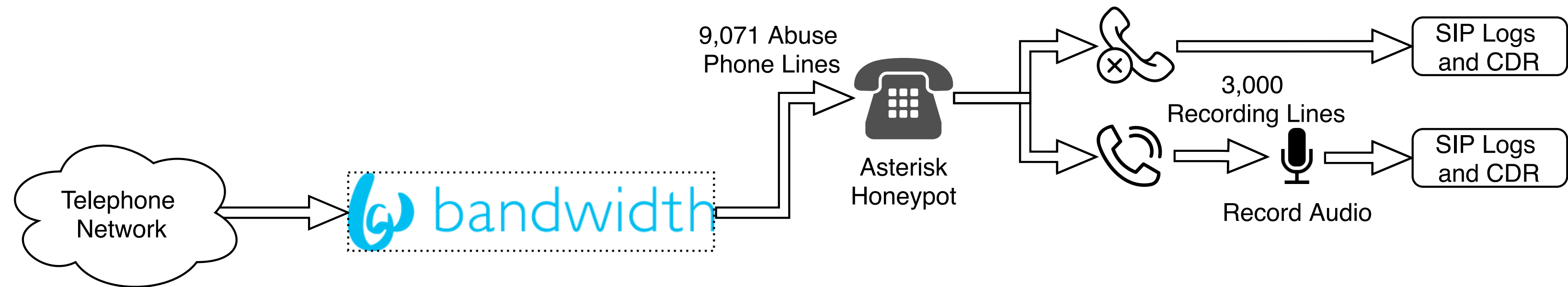
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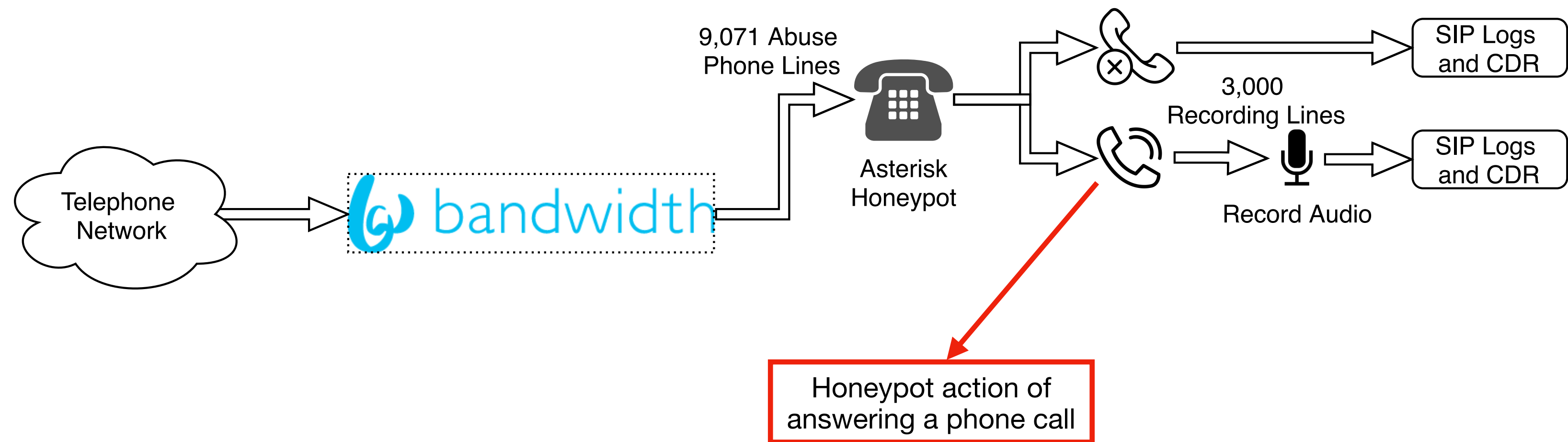
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Feb 2019 → **April 2019**

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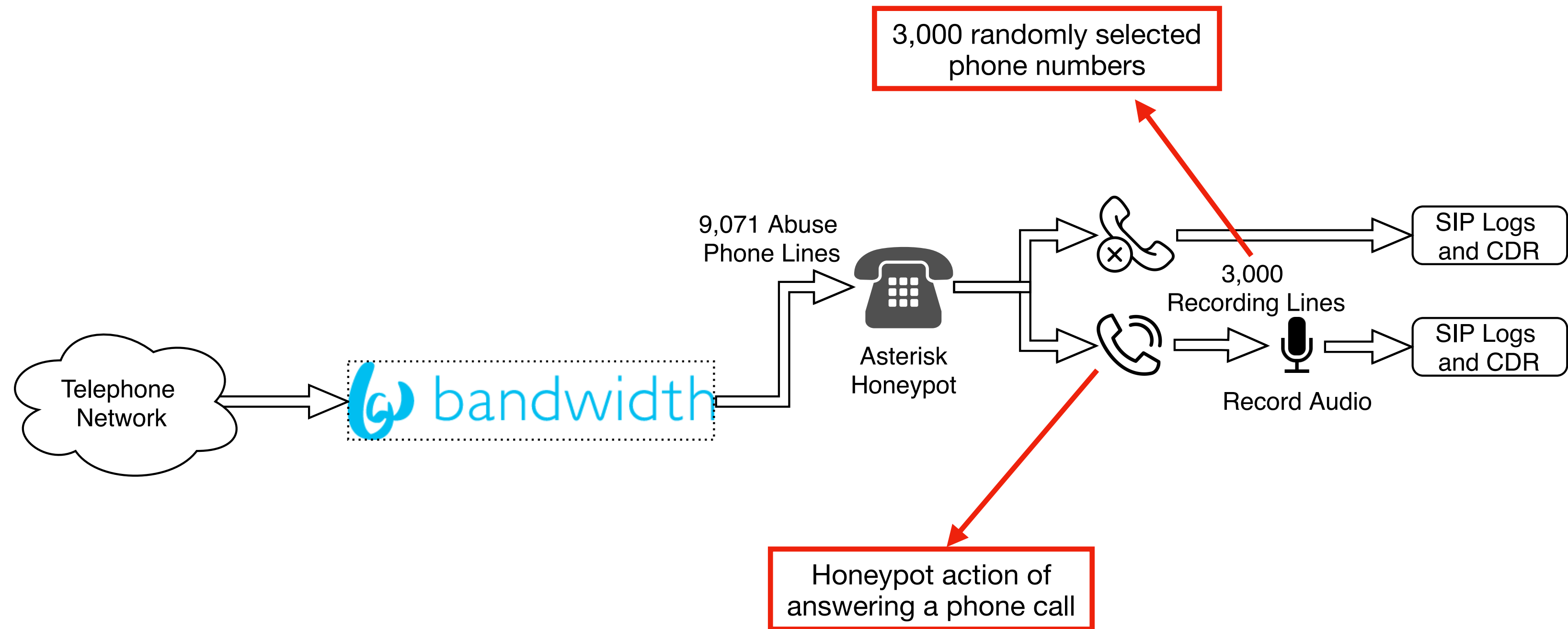
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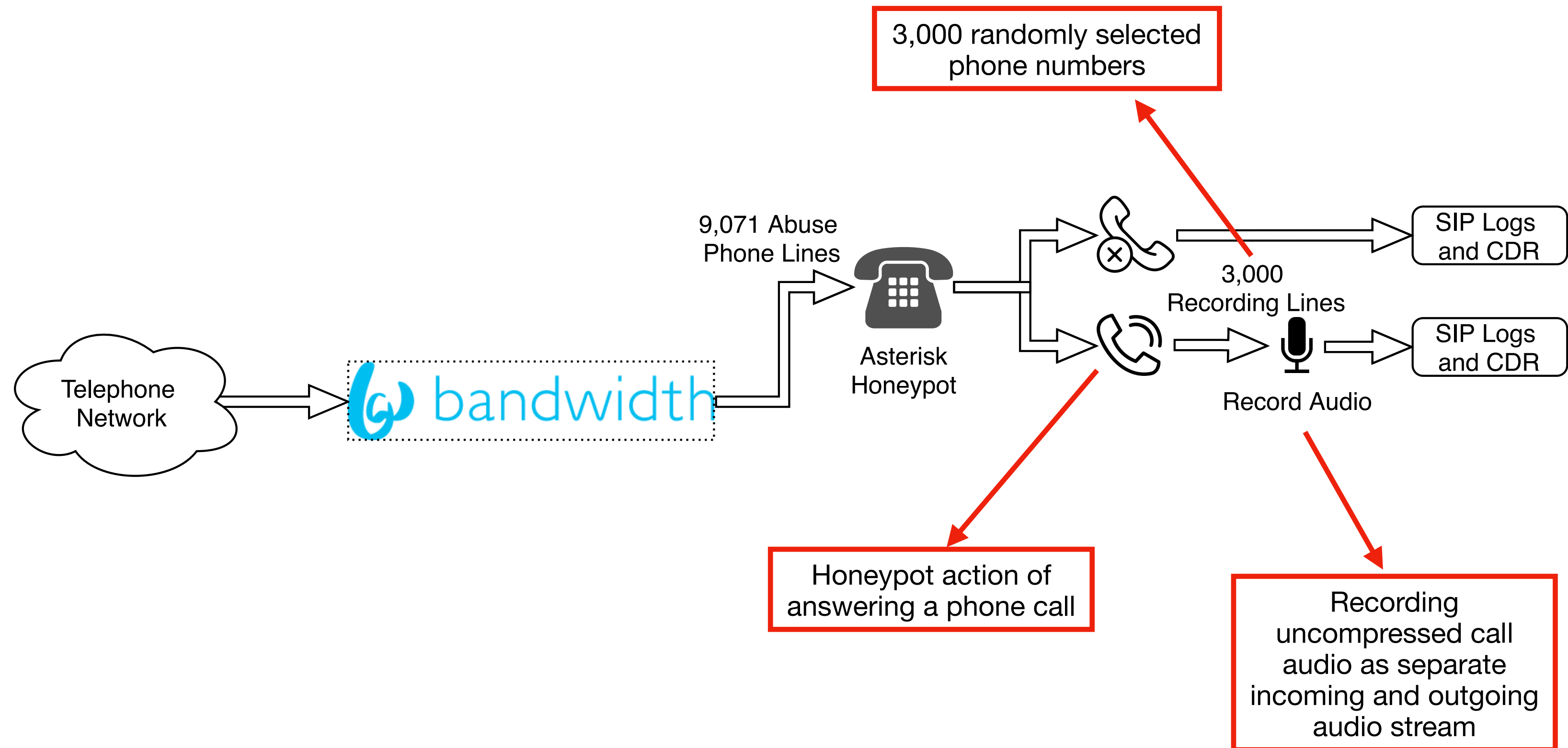
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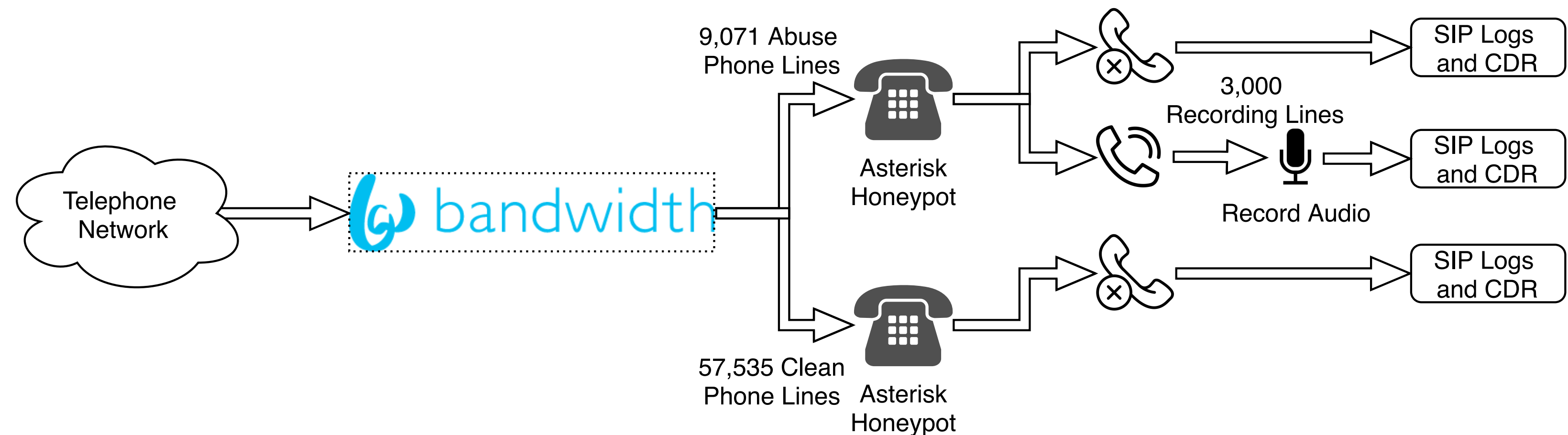
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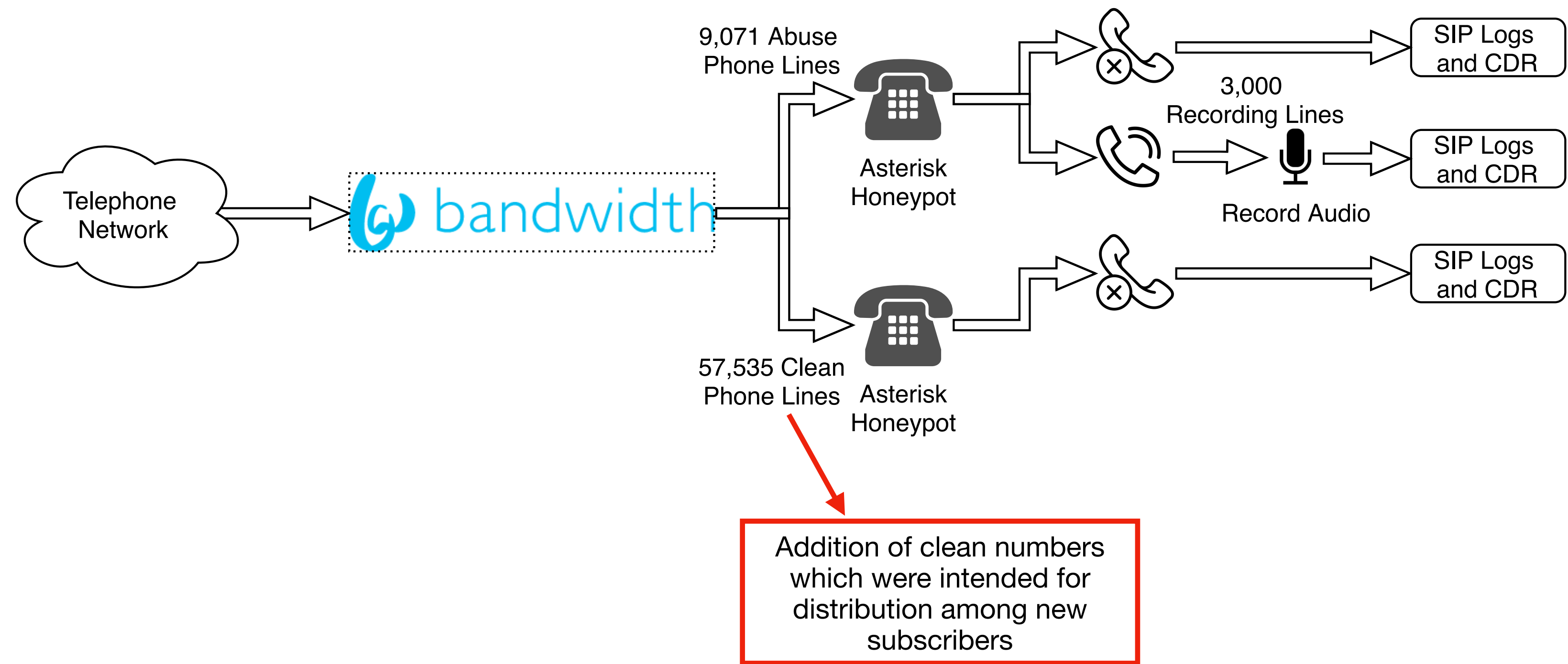
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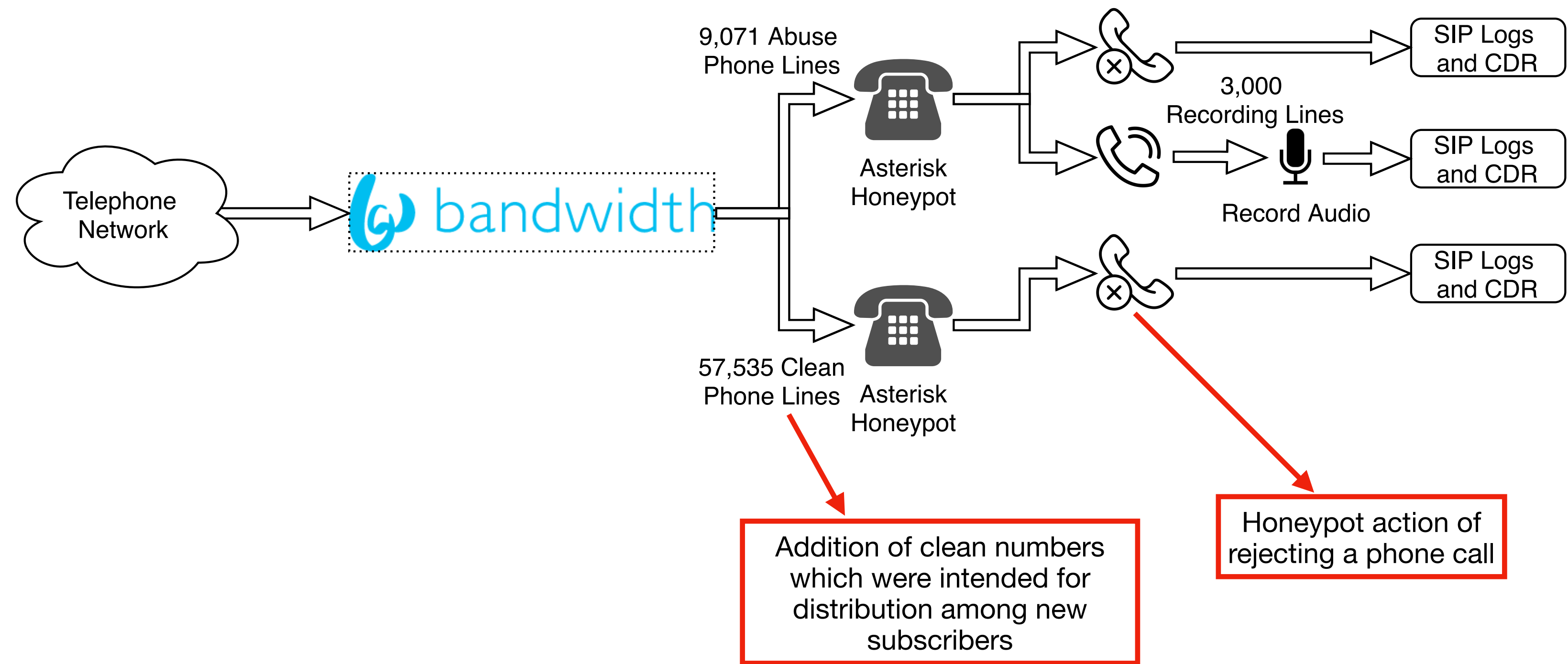
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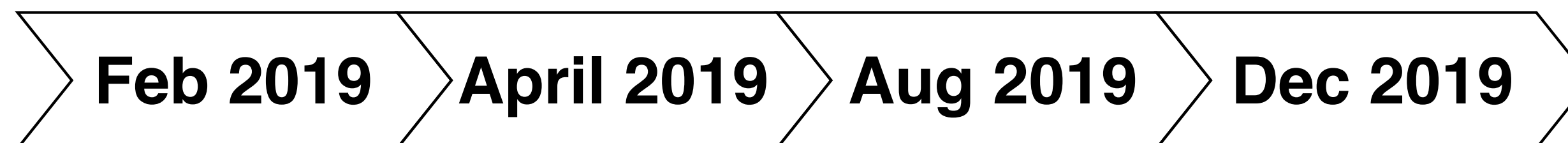
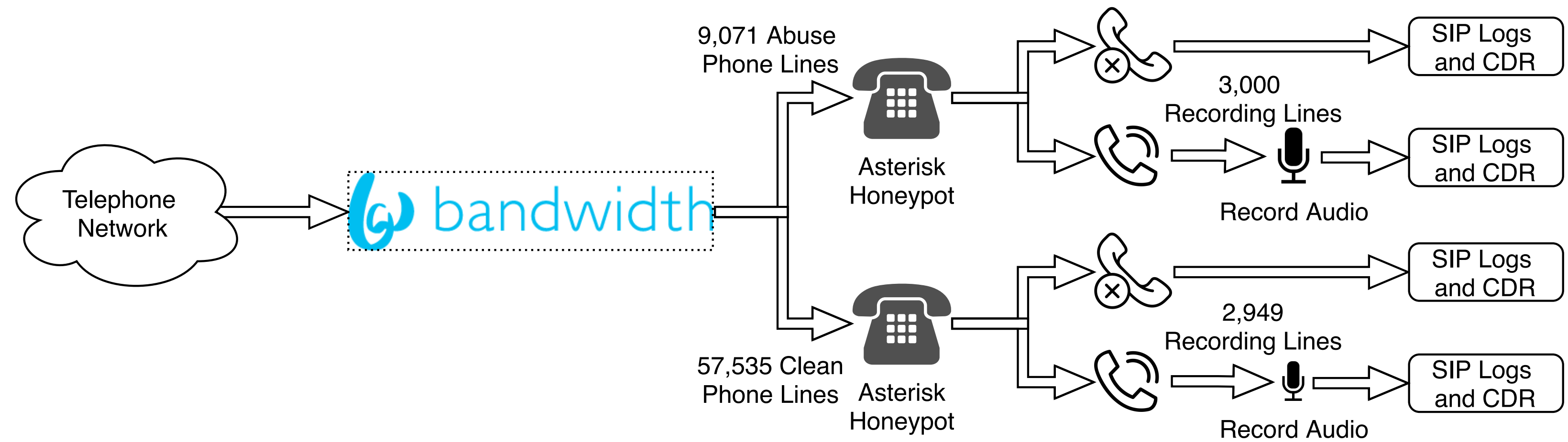
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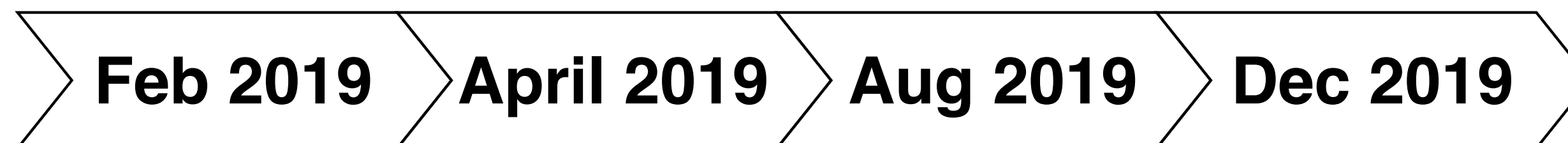
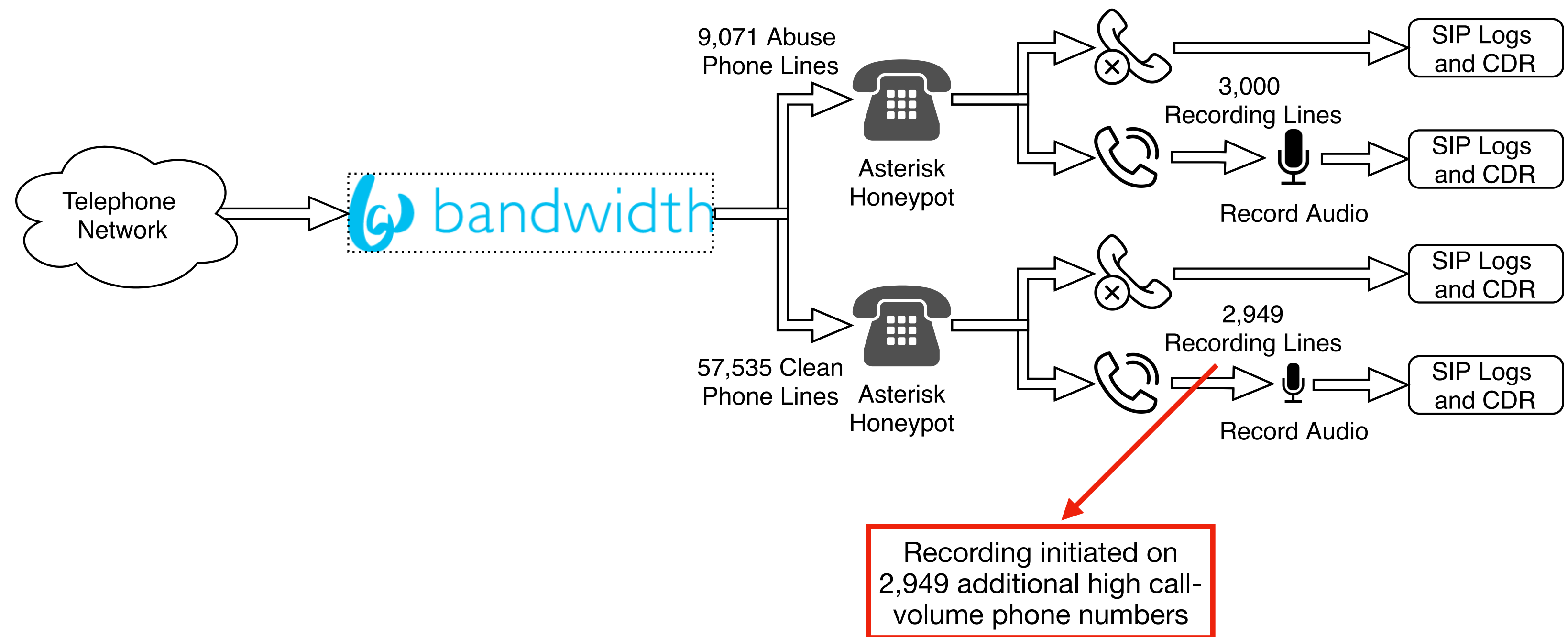
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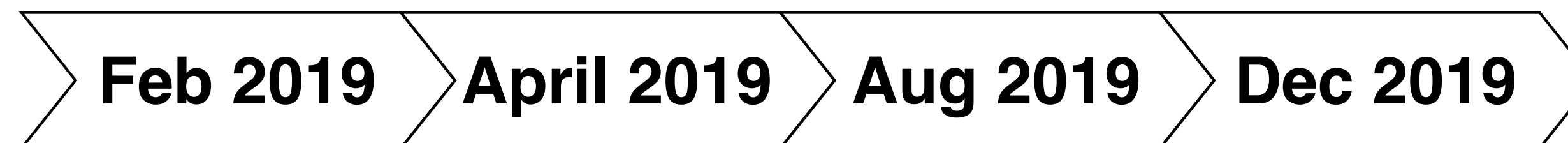
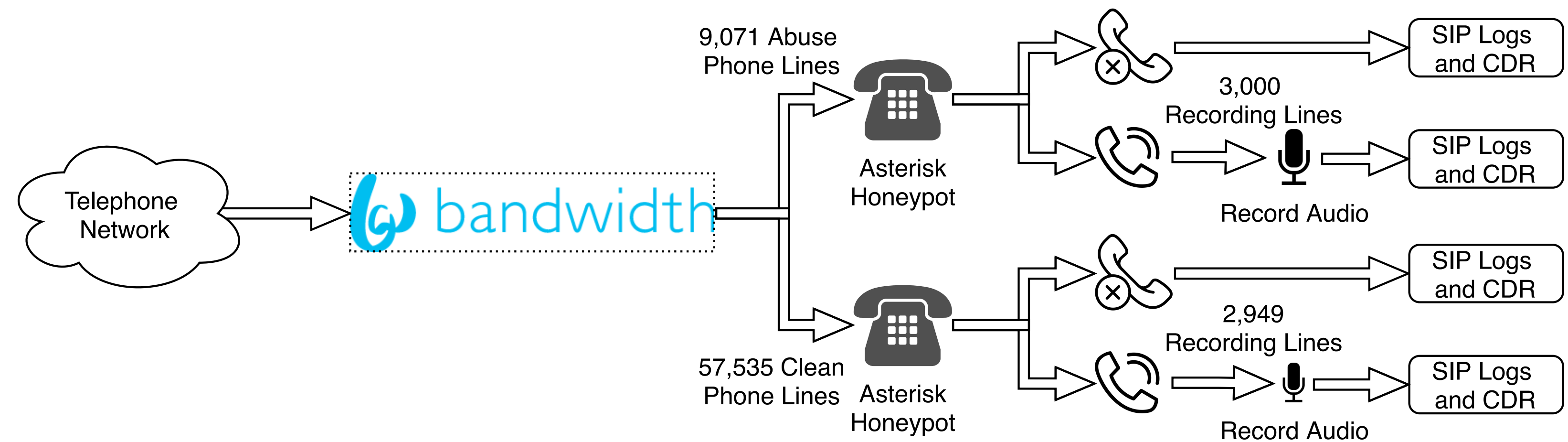
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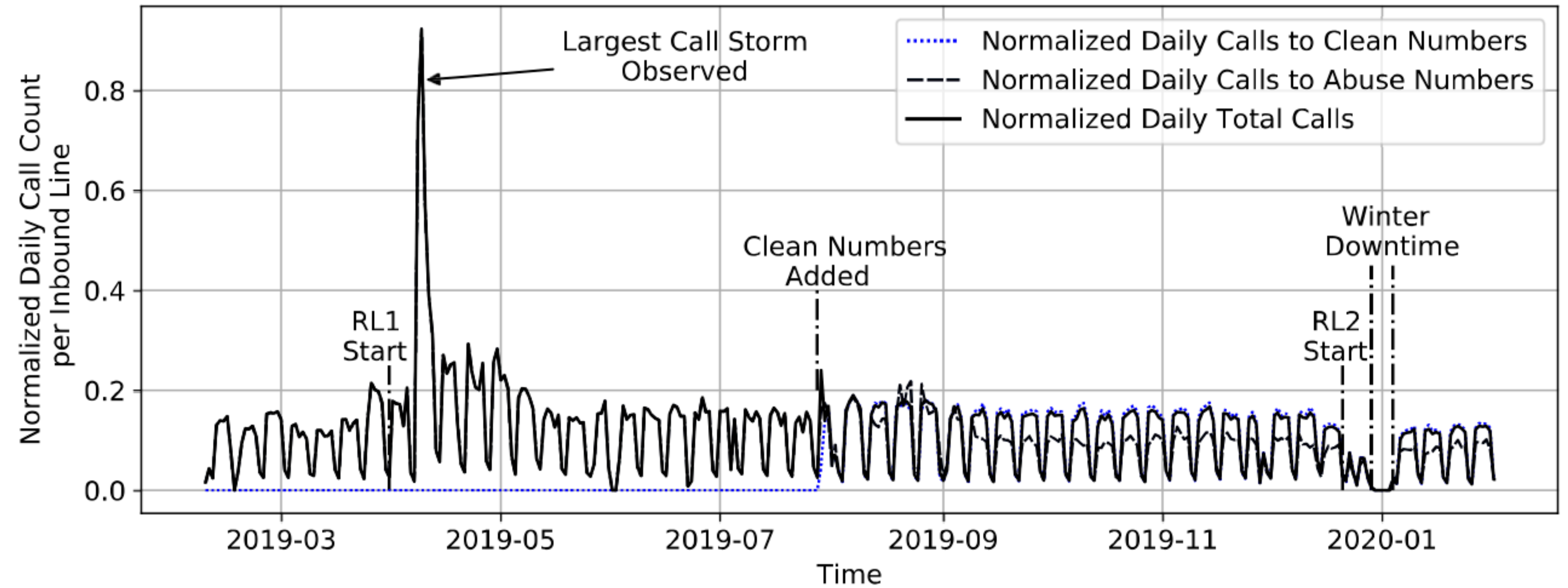
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11 Months
66,000 Phone numbers
145,000 Call recordings
1.48 Million phone calls

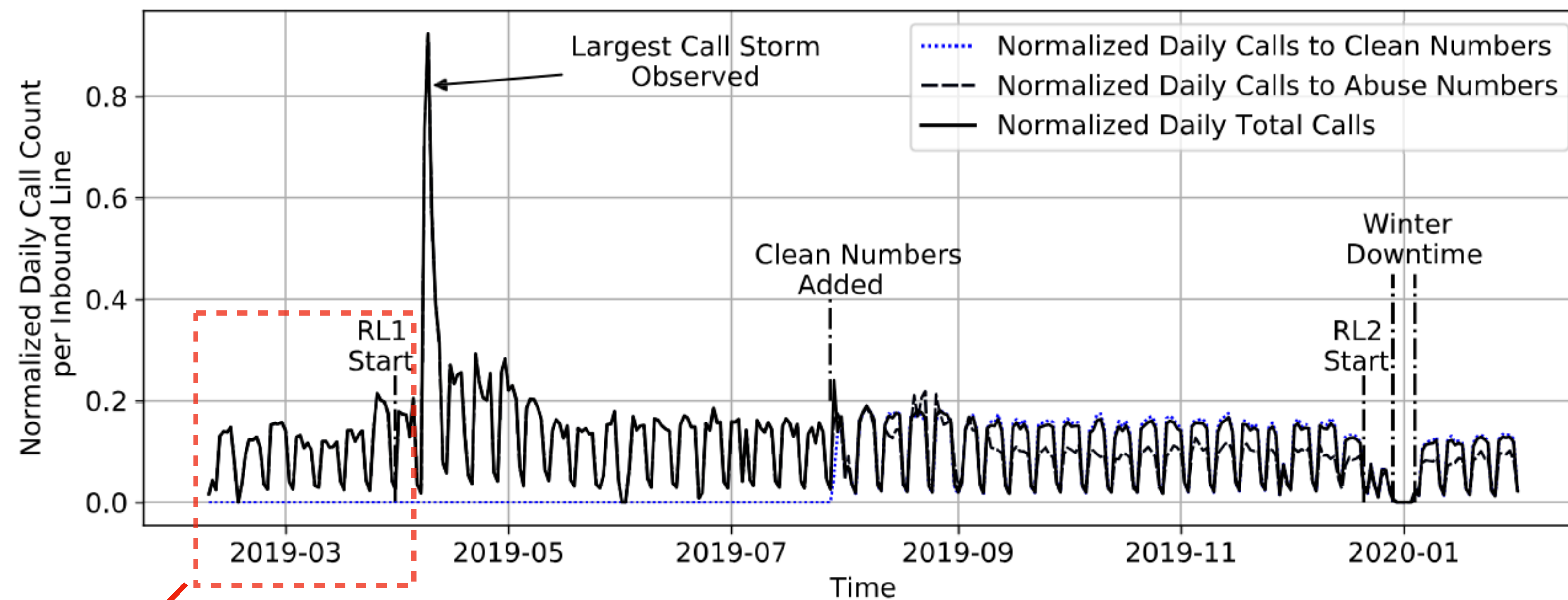


* A detailed discussion of ethical and legal considerations of our data collection and experiments can be found in Section 3.4 of our paper

Robocalls by the Numbers

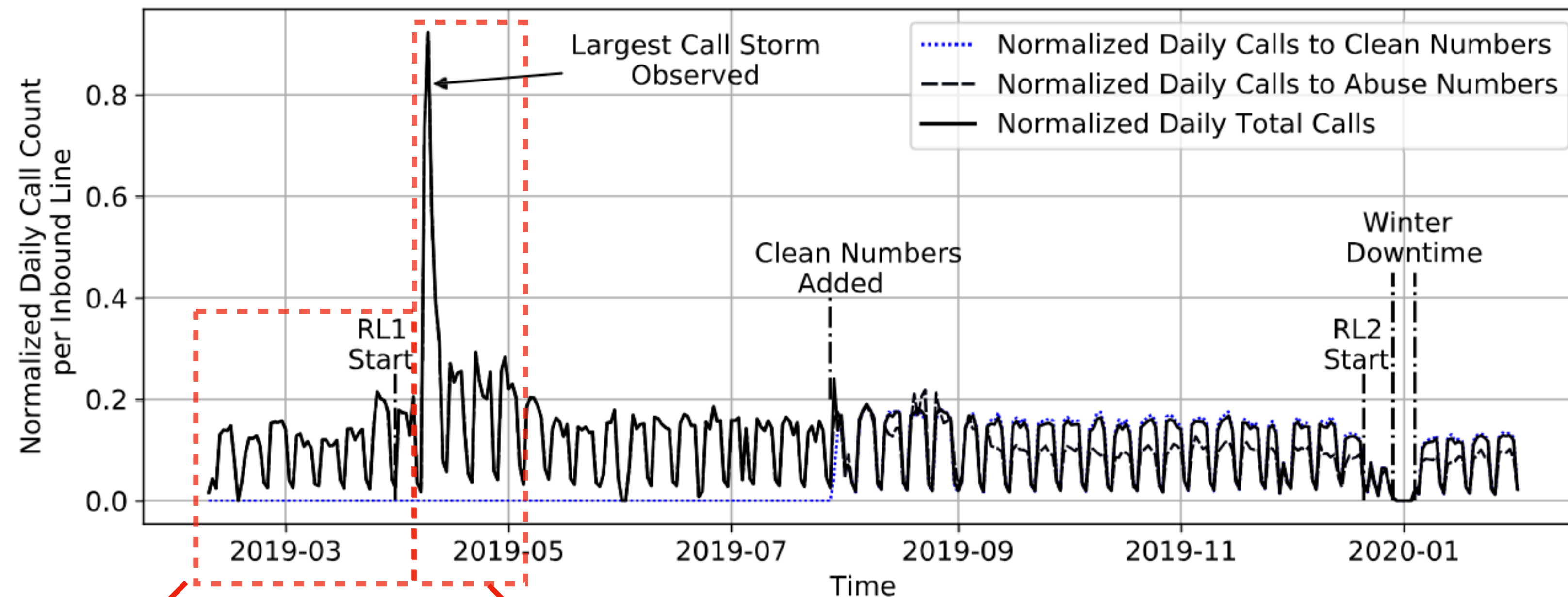


Robocalls by the Numbers



Constant call volume over the the first few weeks

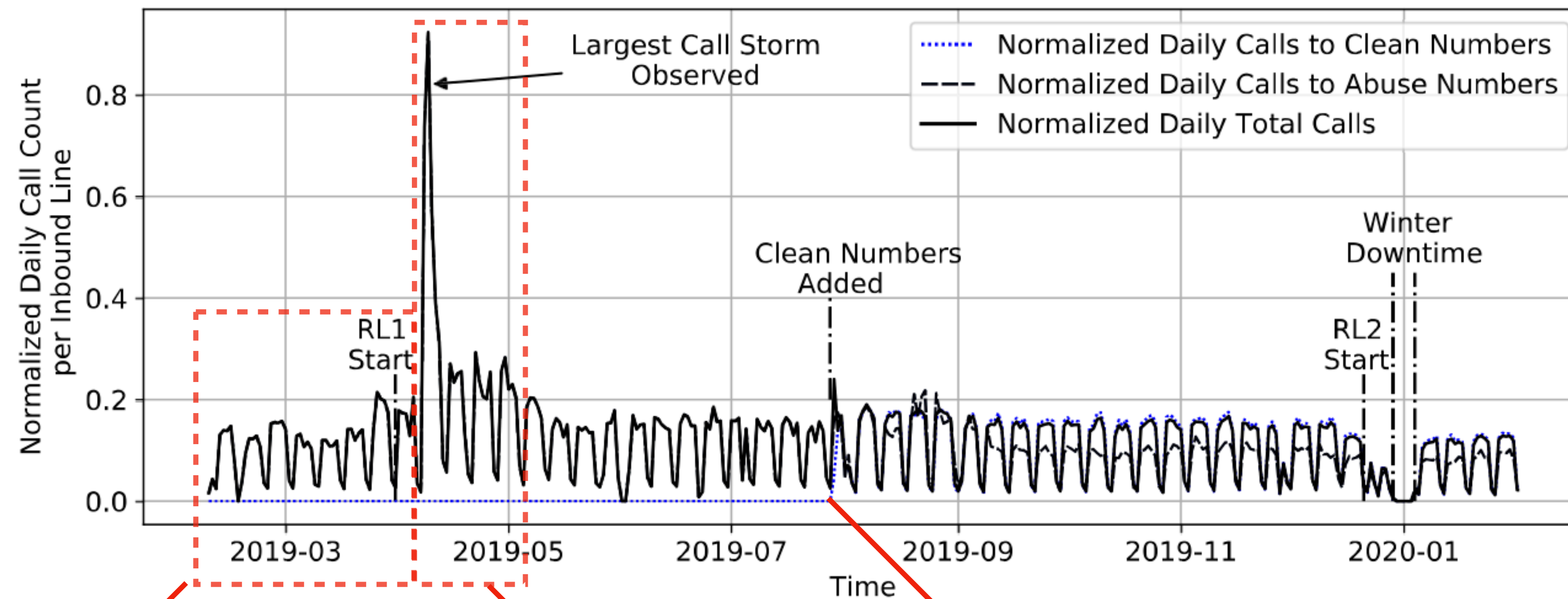
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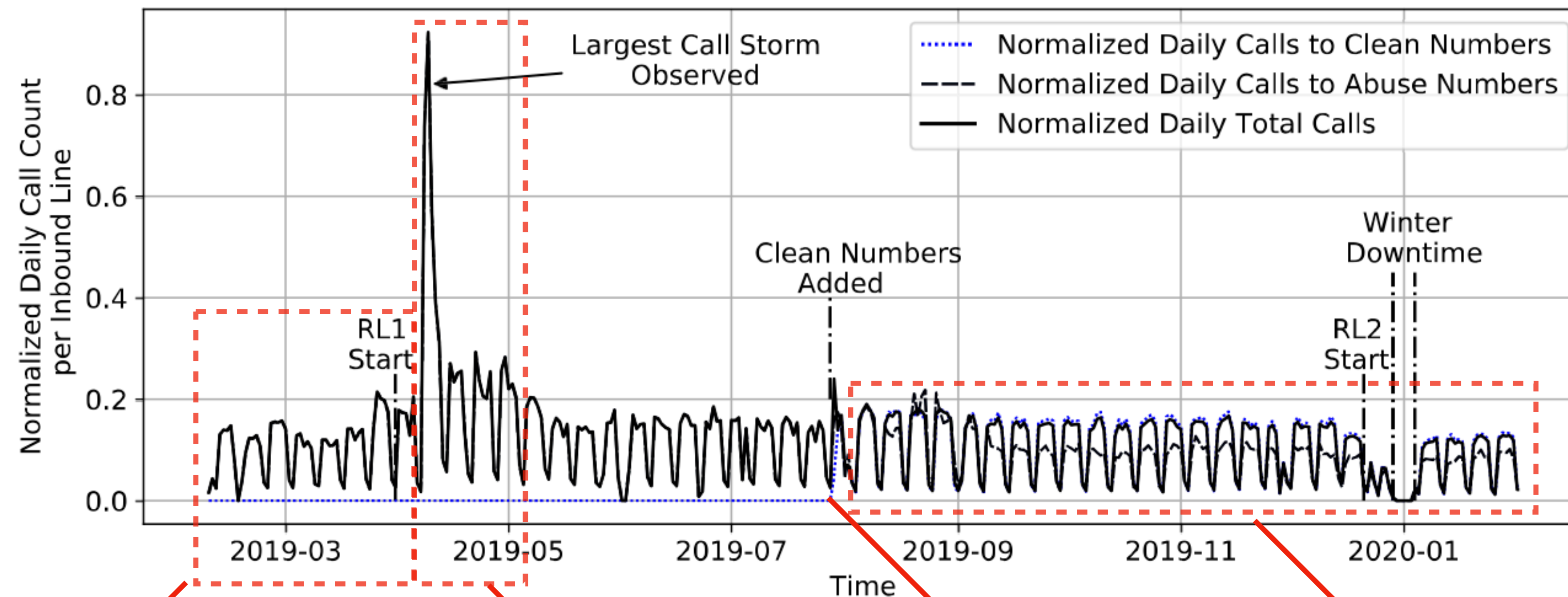


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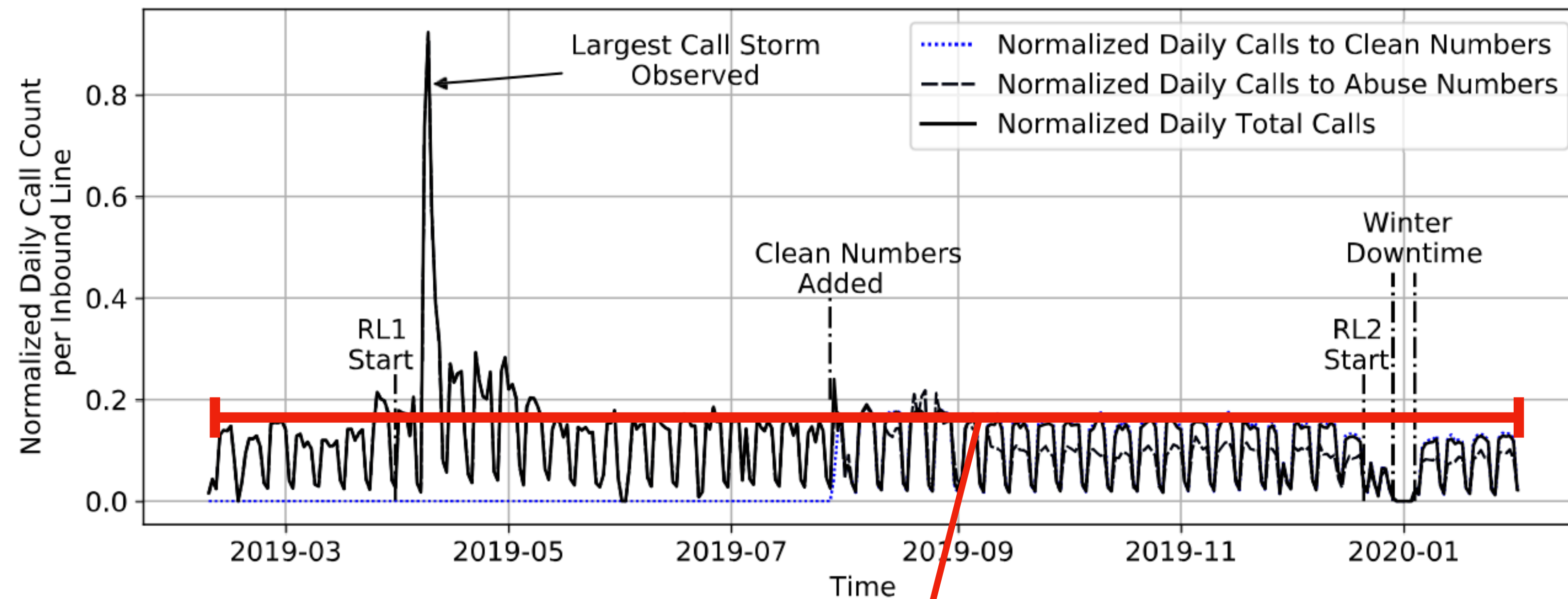
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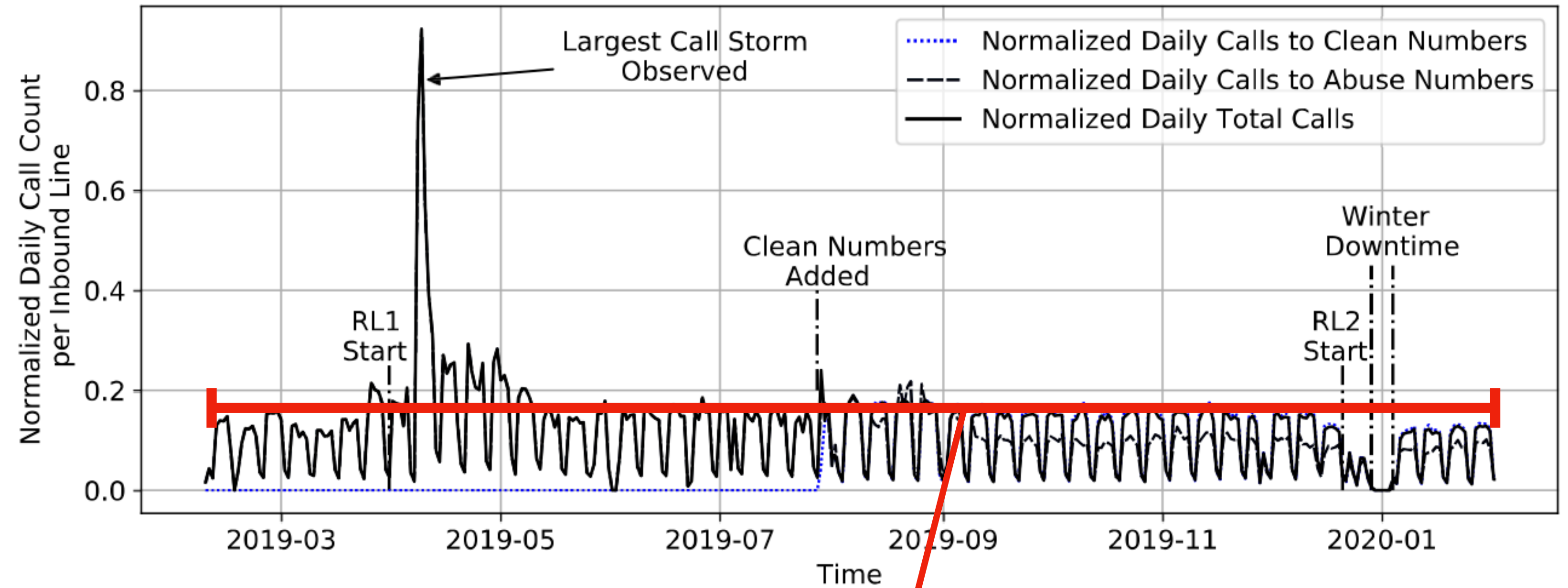
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Linear model fit over weekly call volume with a slope of -9×10^{-5}

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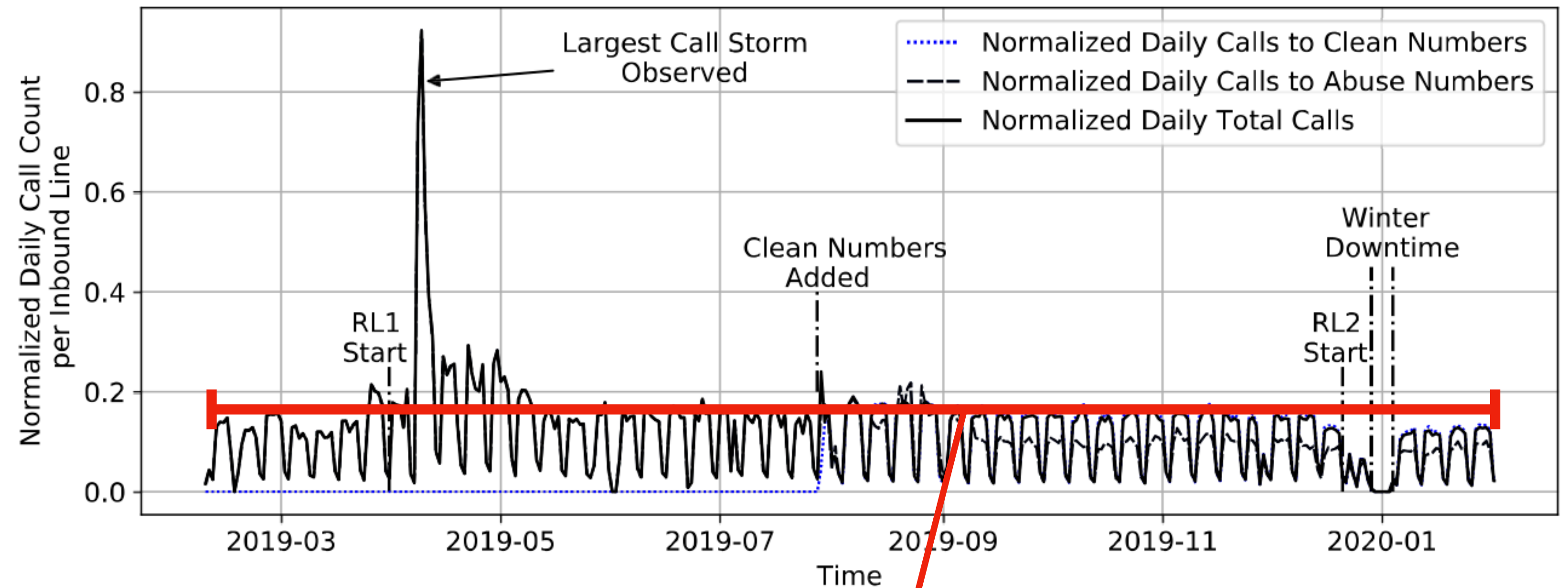
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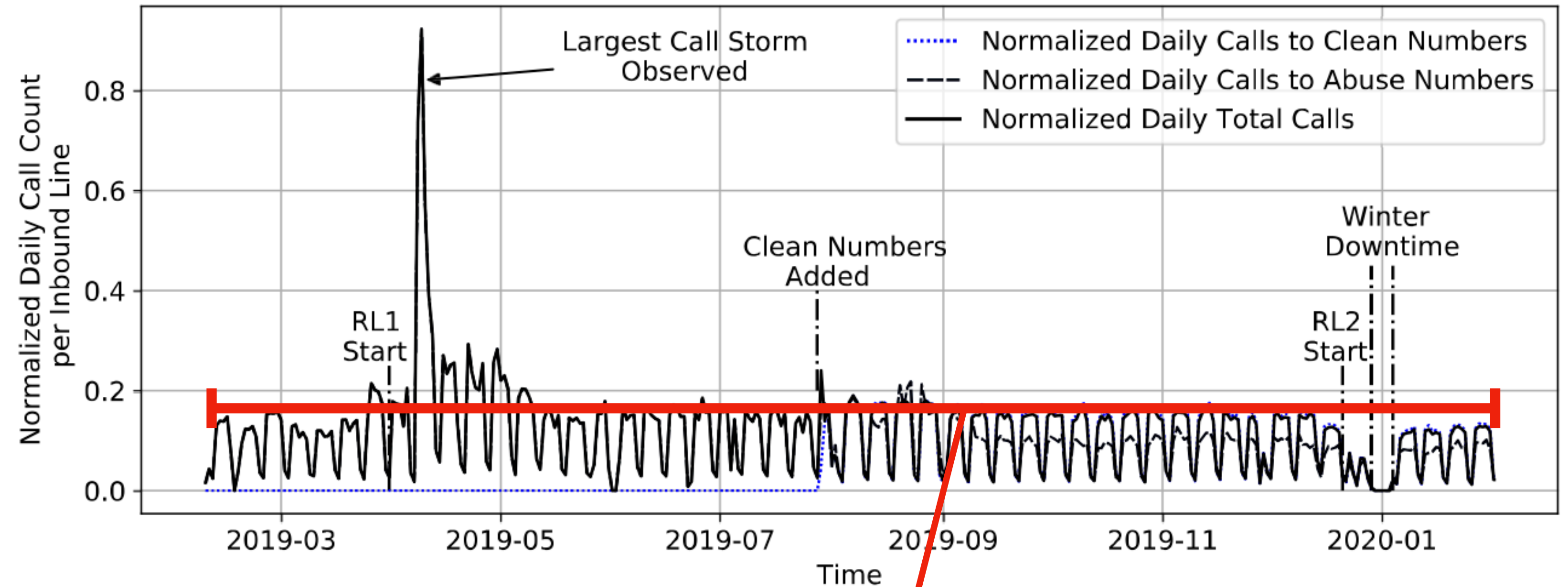
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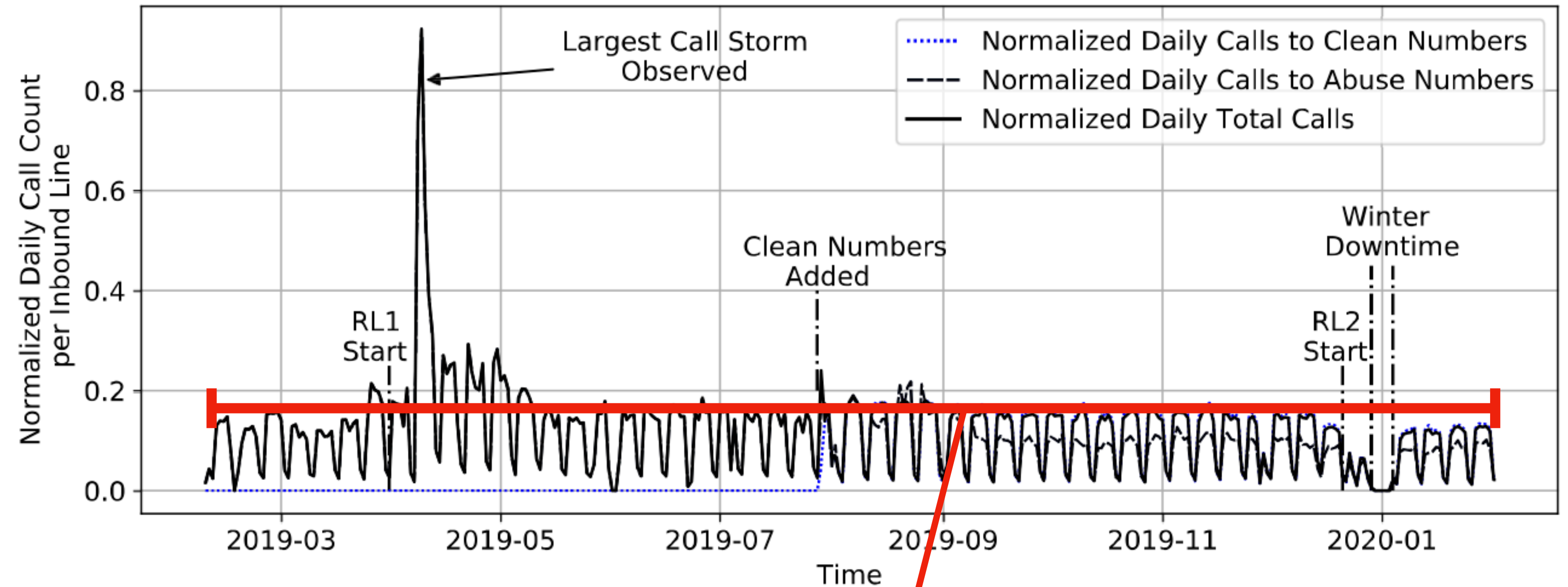
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- Robocalls are a major problem in the United States with no signs of decline!



Linear model fit over weekly call volume with a slope of -9×10^{-5}

Will You Receive More Robocalls if You Answer them?

* How-to Geek: <https://www.howtogeek.com/413873/tired-of-robocalls-stop-answering-your-phone/>

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Tired of Robocalls? Stop Answering Your Phone



ANDREW HEINZMAN  @andrew_andrew__

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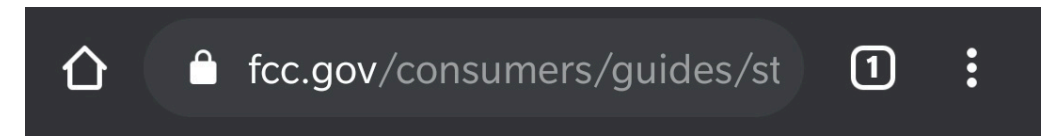
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Consumer Tips to Stop Unwanted Robocalls and Avoid Phone Scams

Tip Card



(Download PDF)

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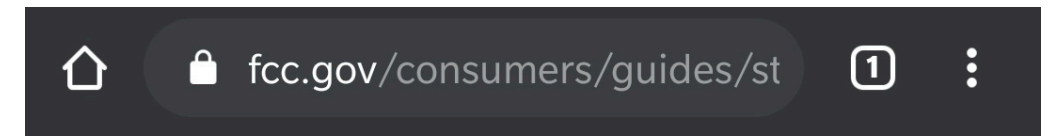
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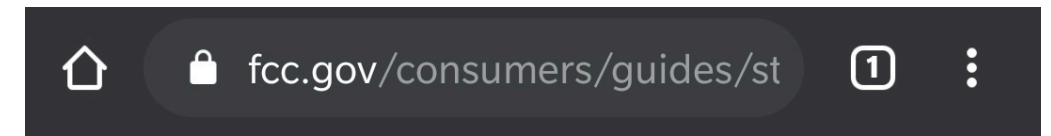
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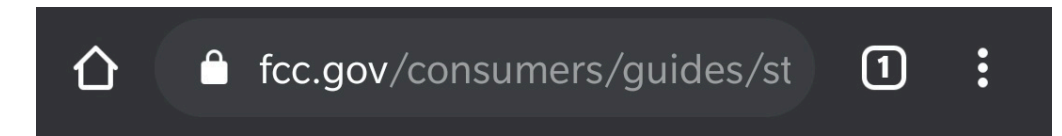
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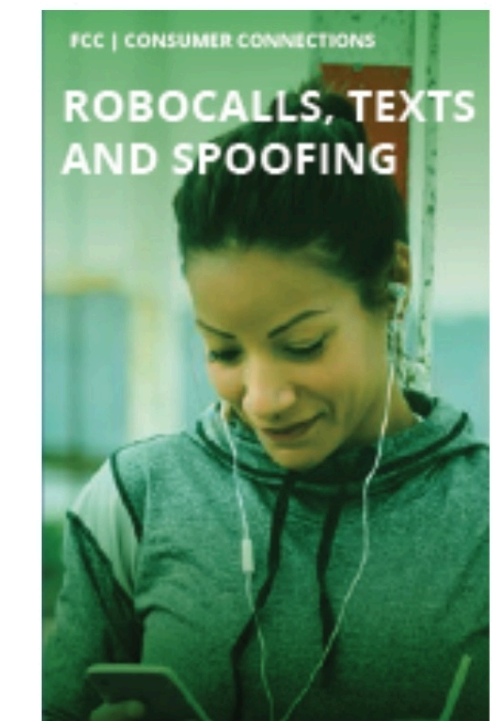
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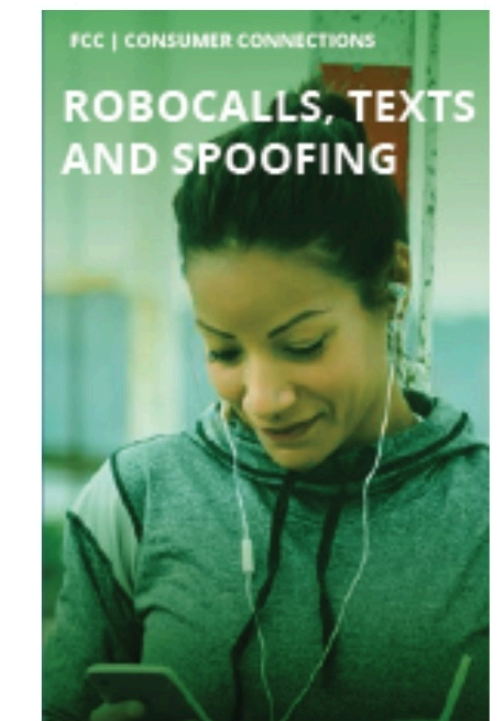
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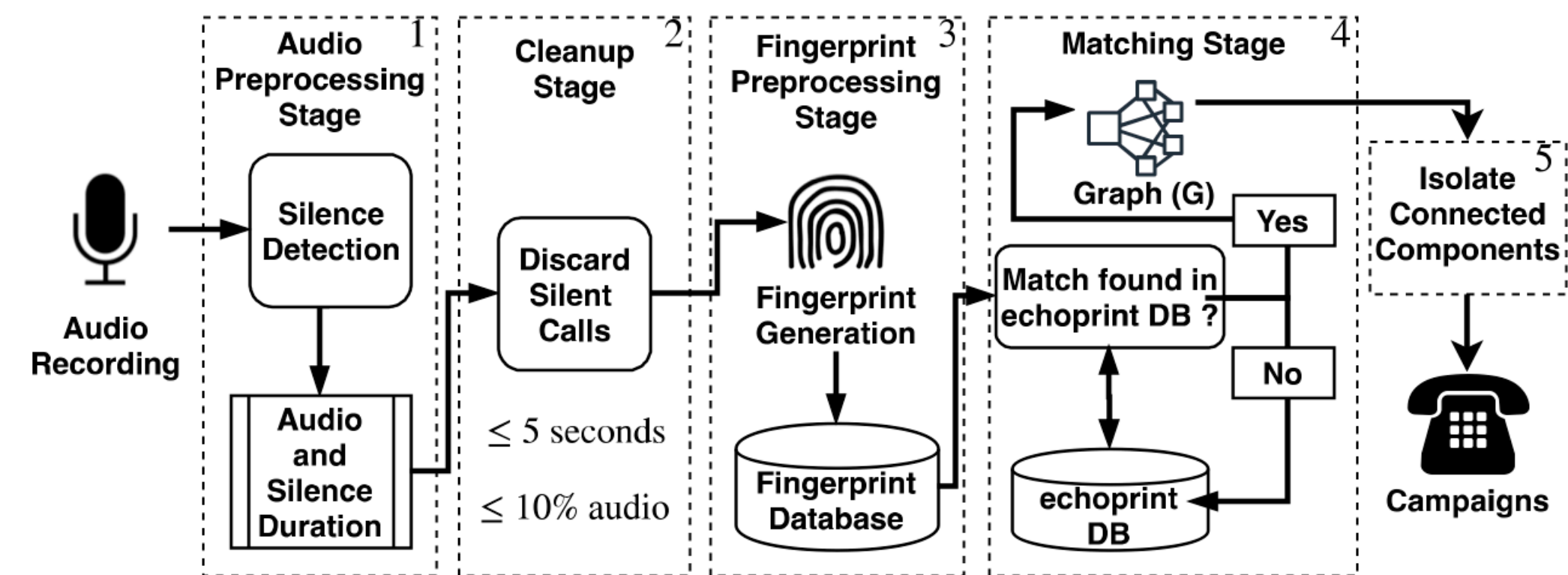
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(Cluster Perfection rate = 93.33% and overall Intra-cluster Precision = 96.66%)

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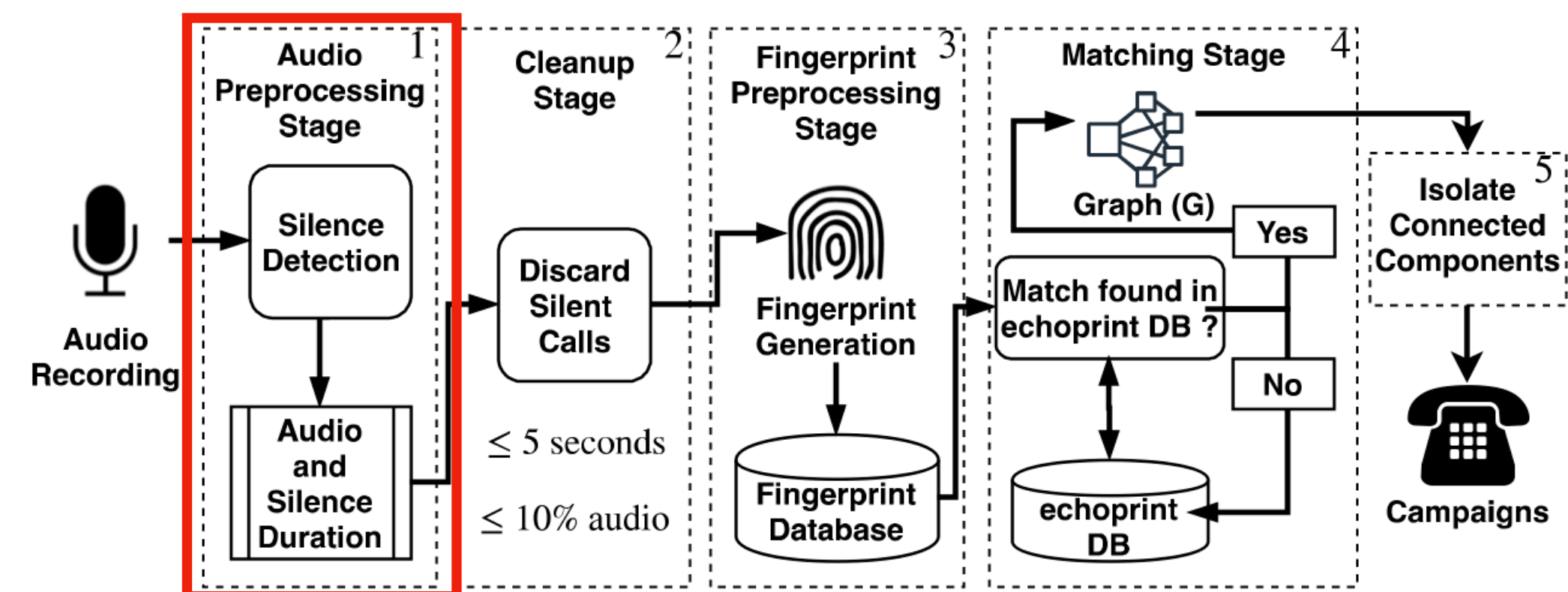
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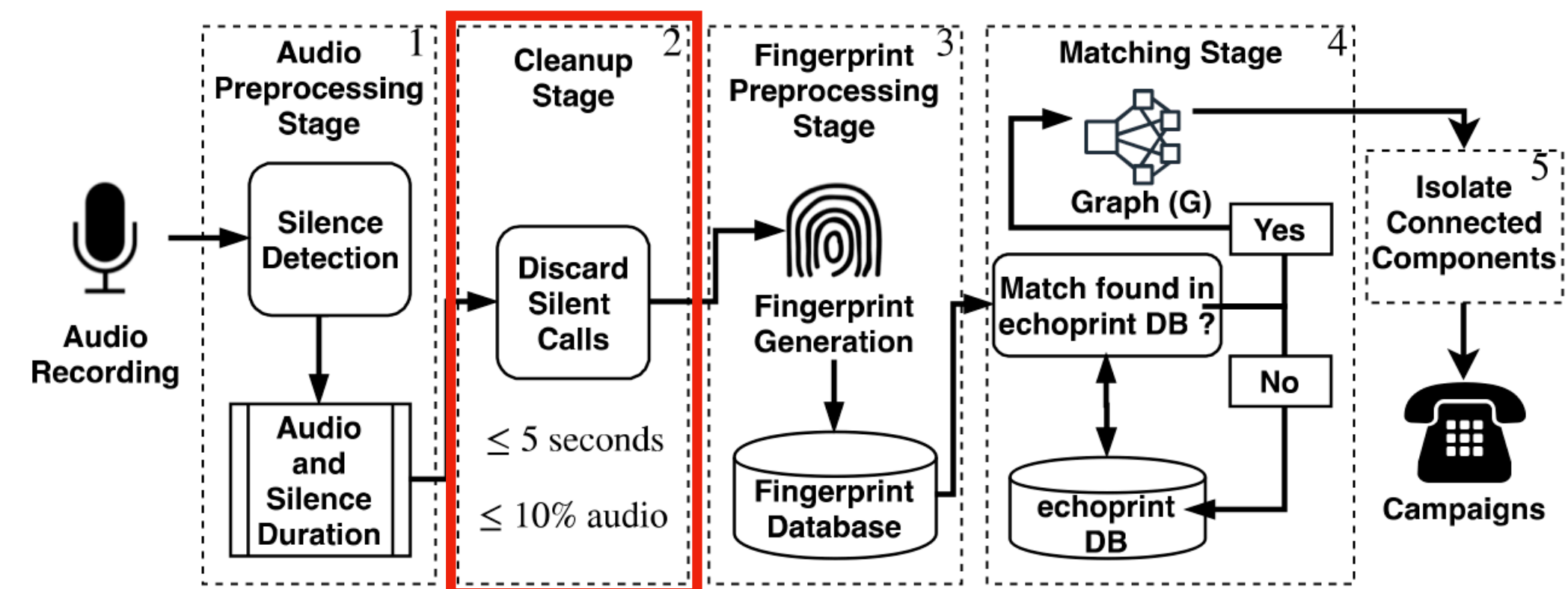
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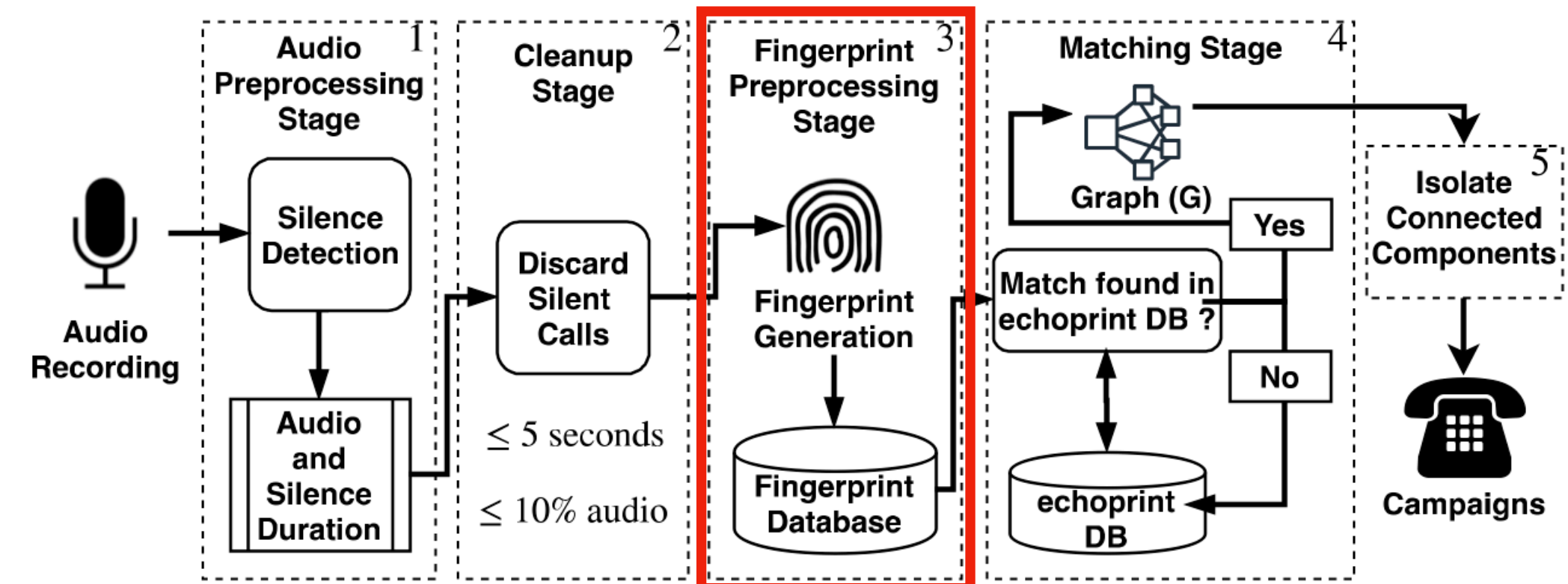
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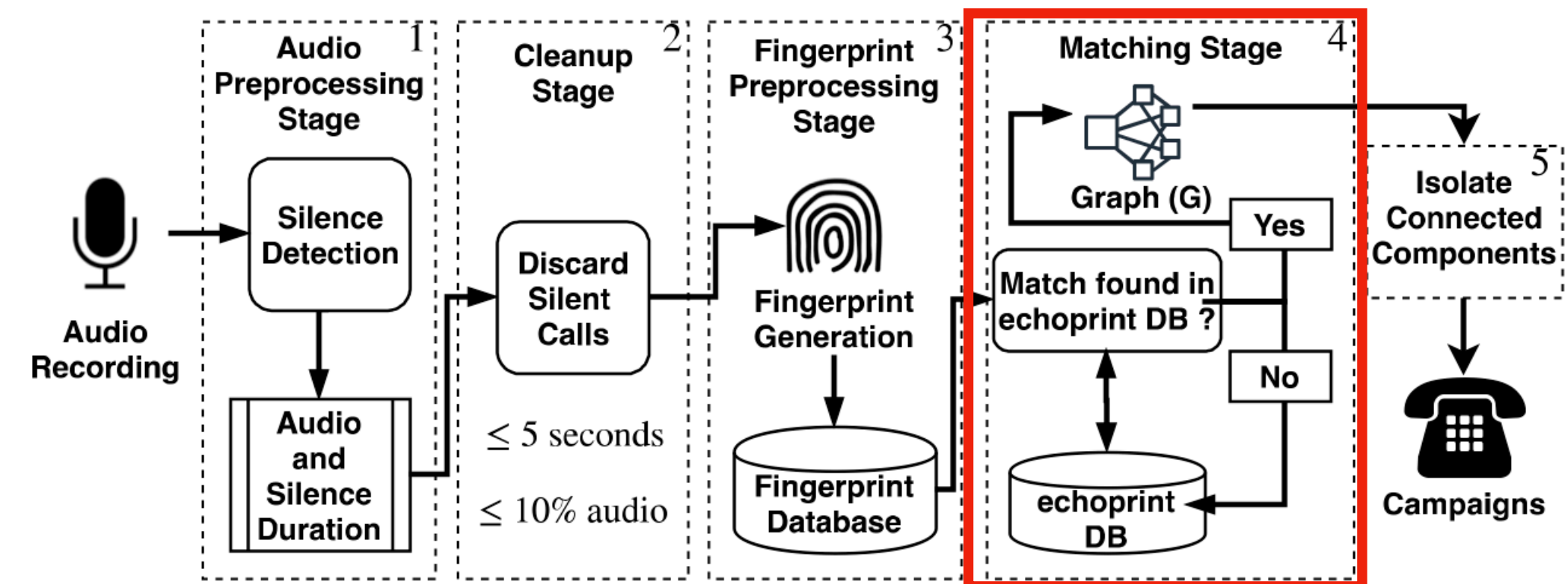
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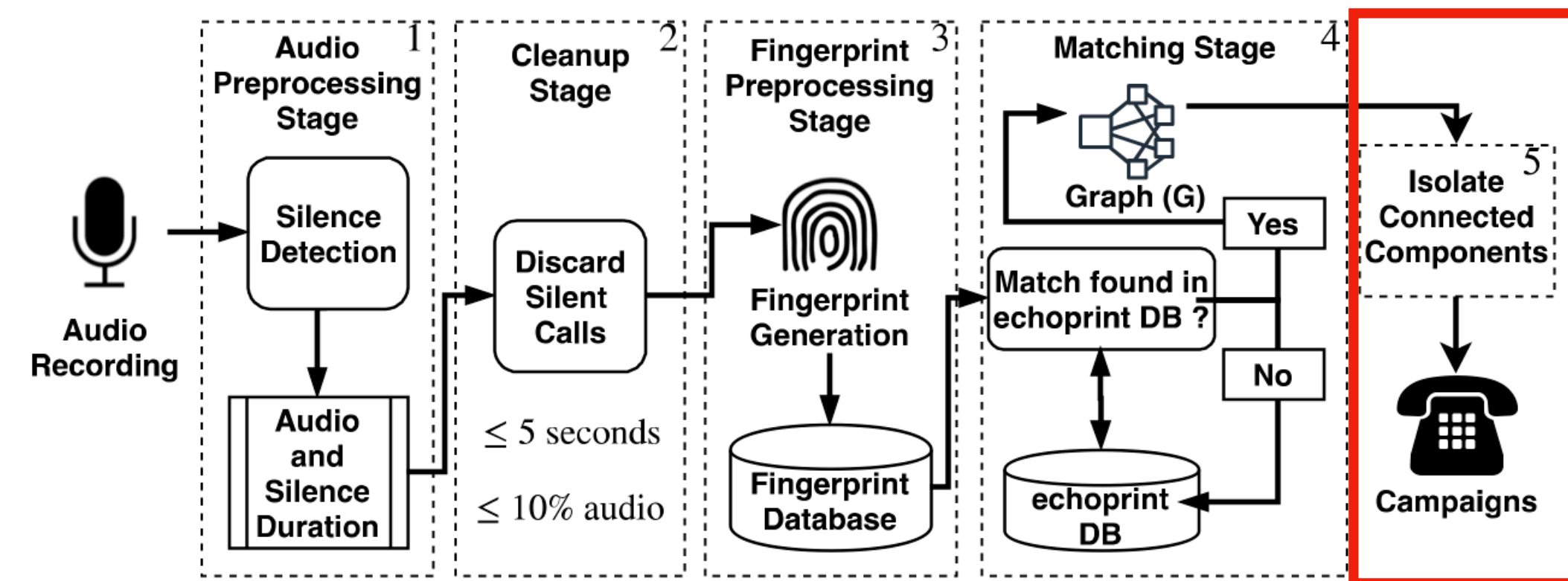
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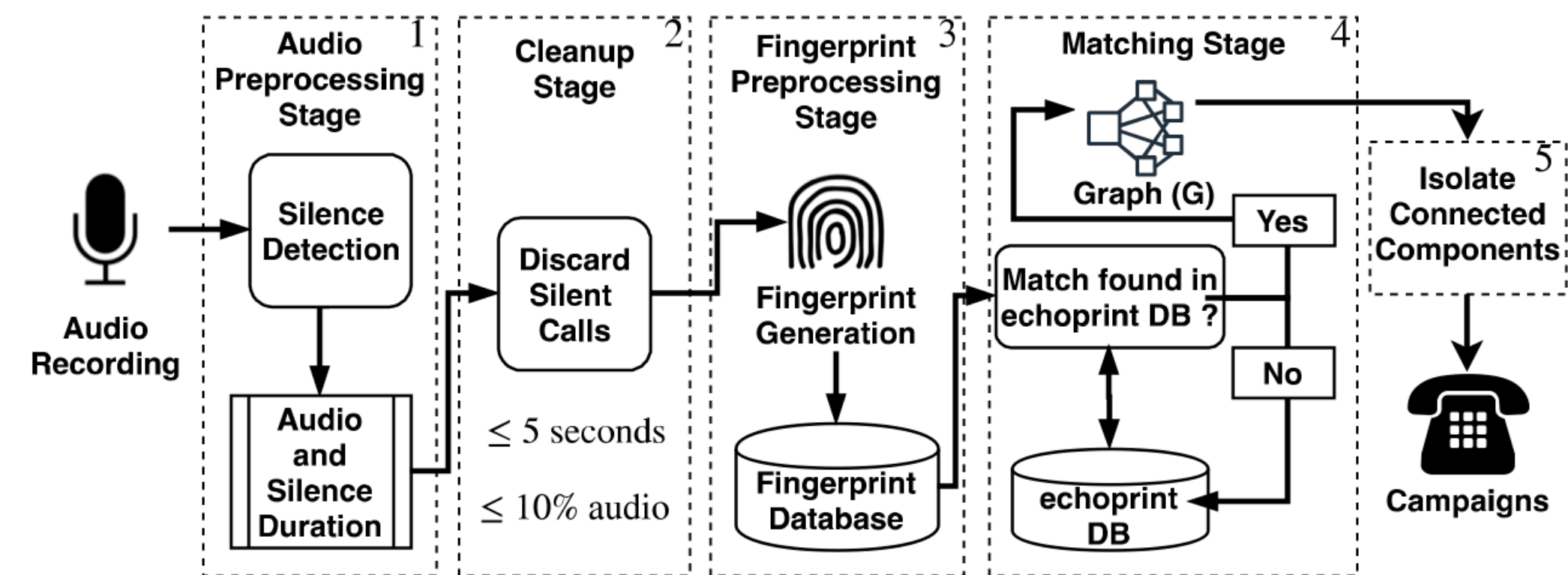
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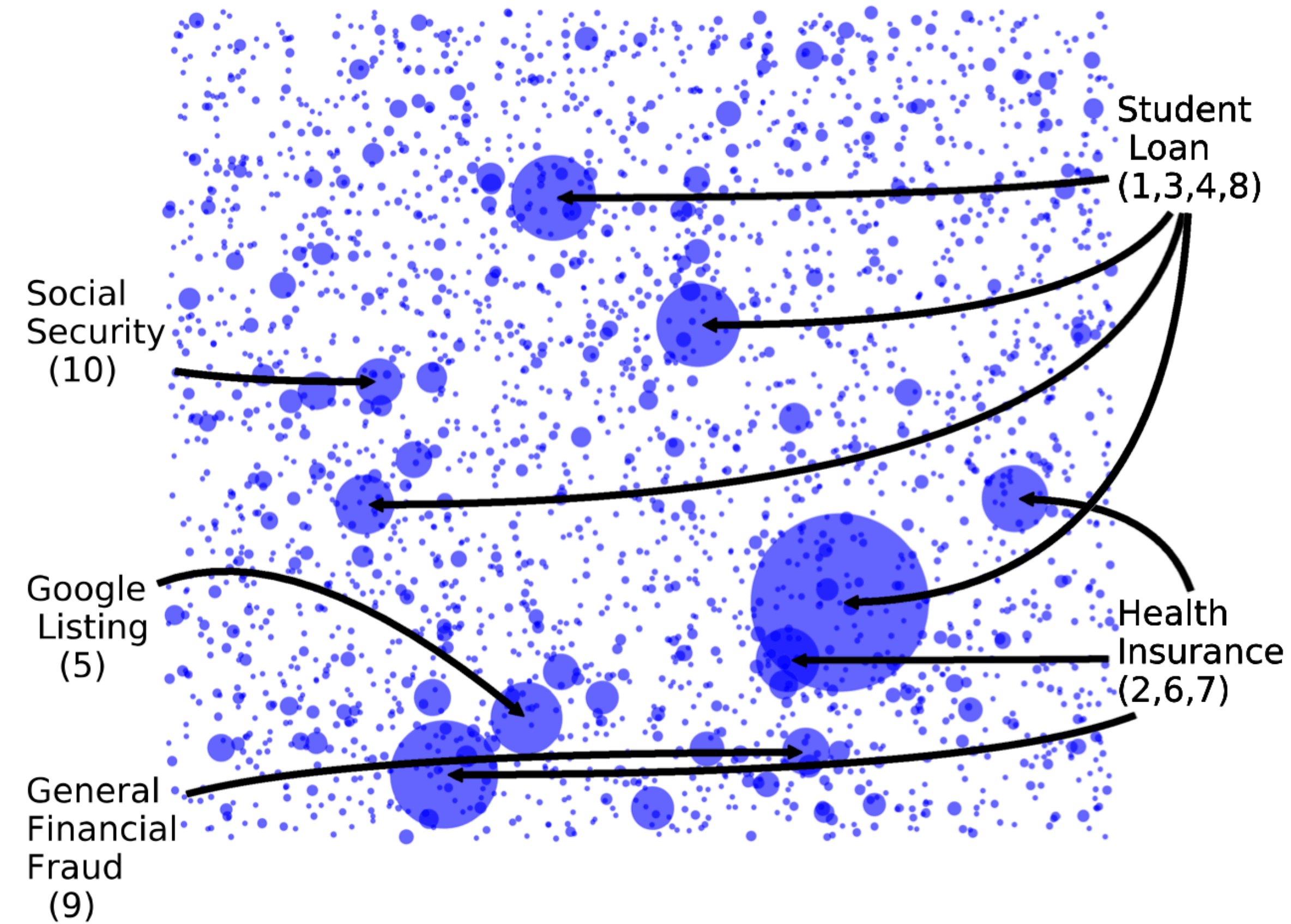
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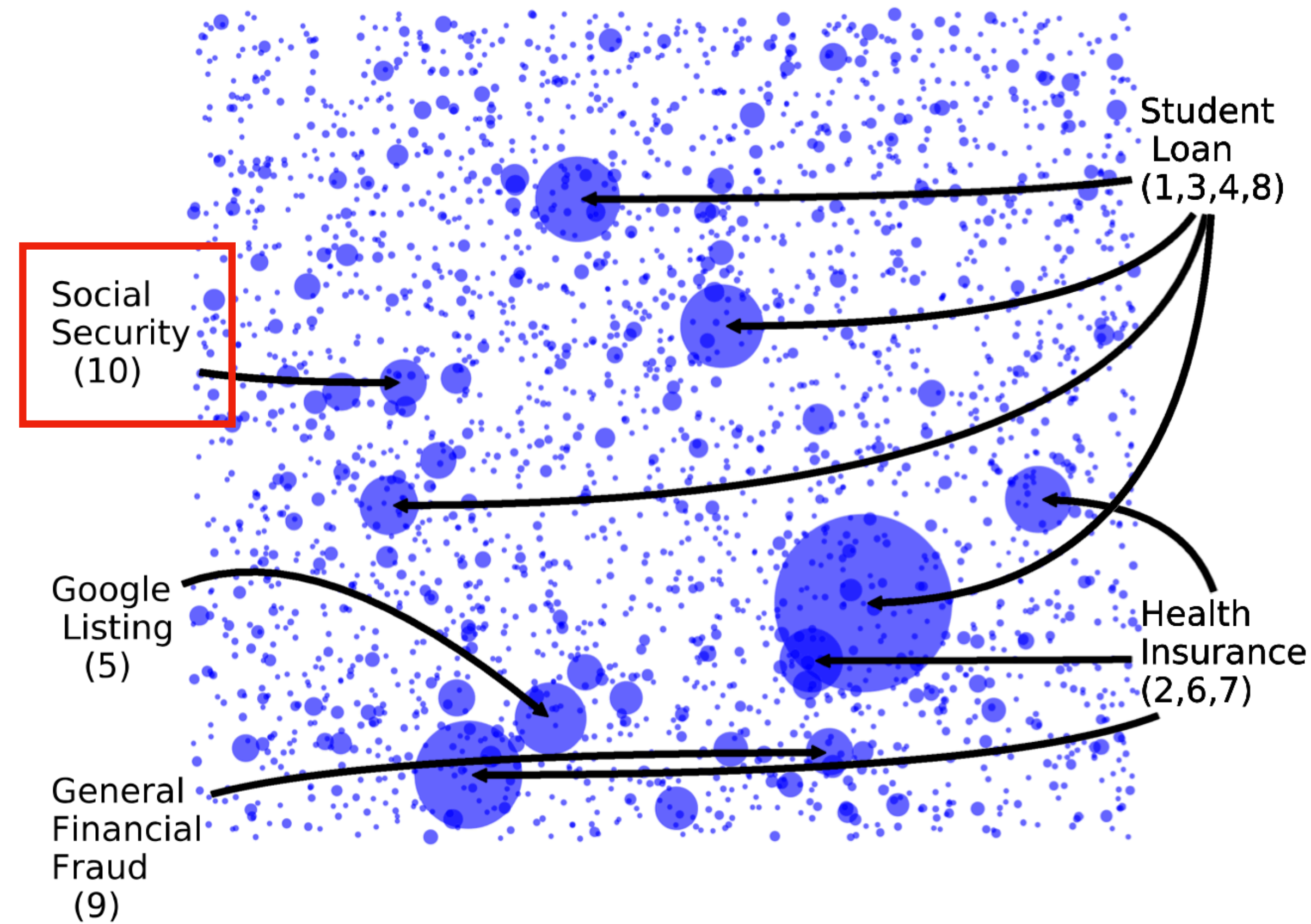
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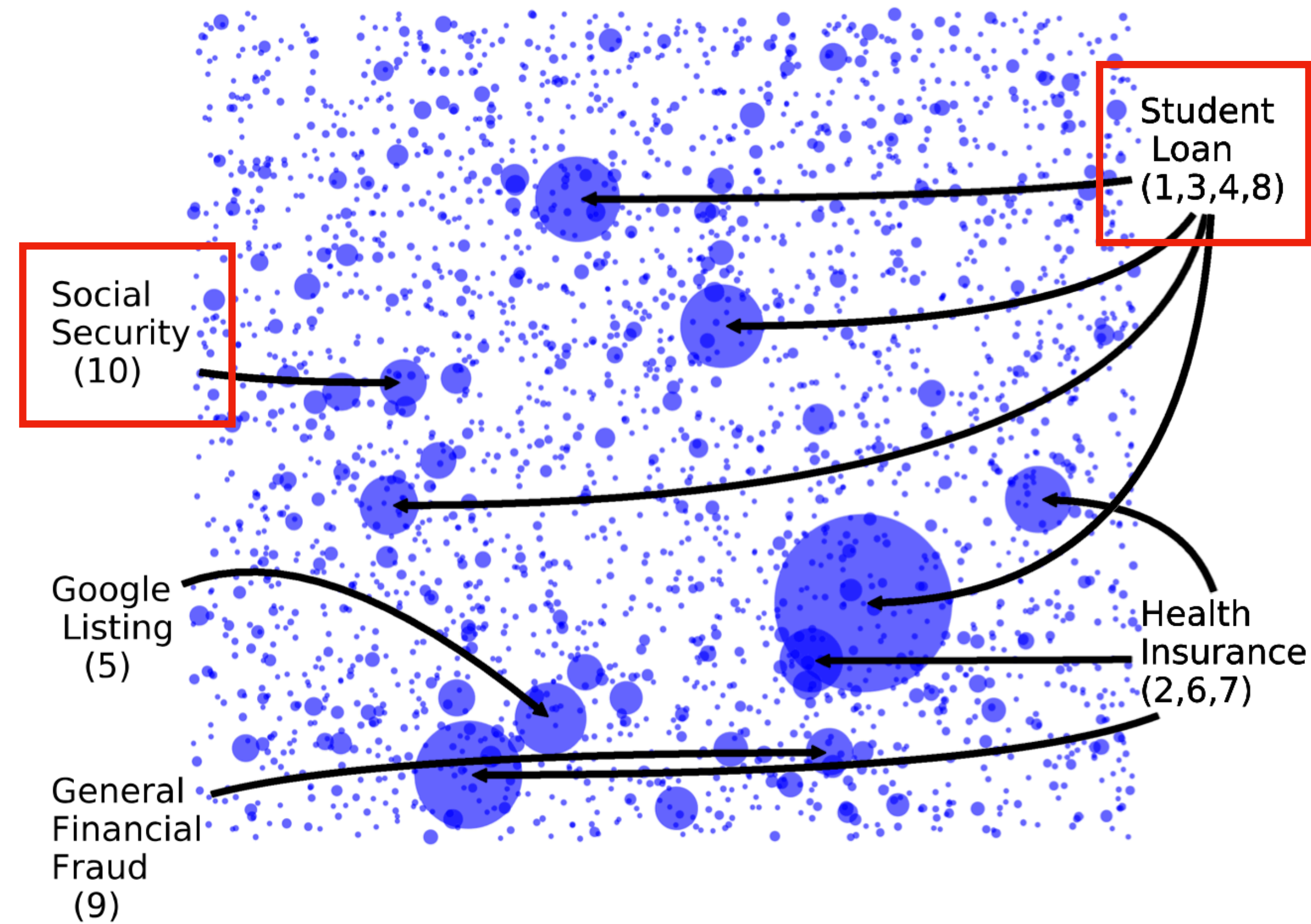
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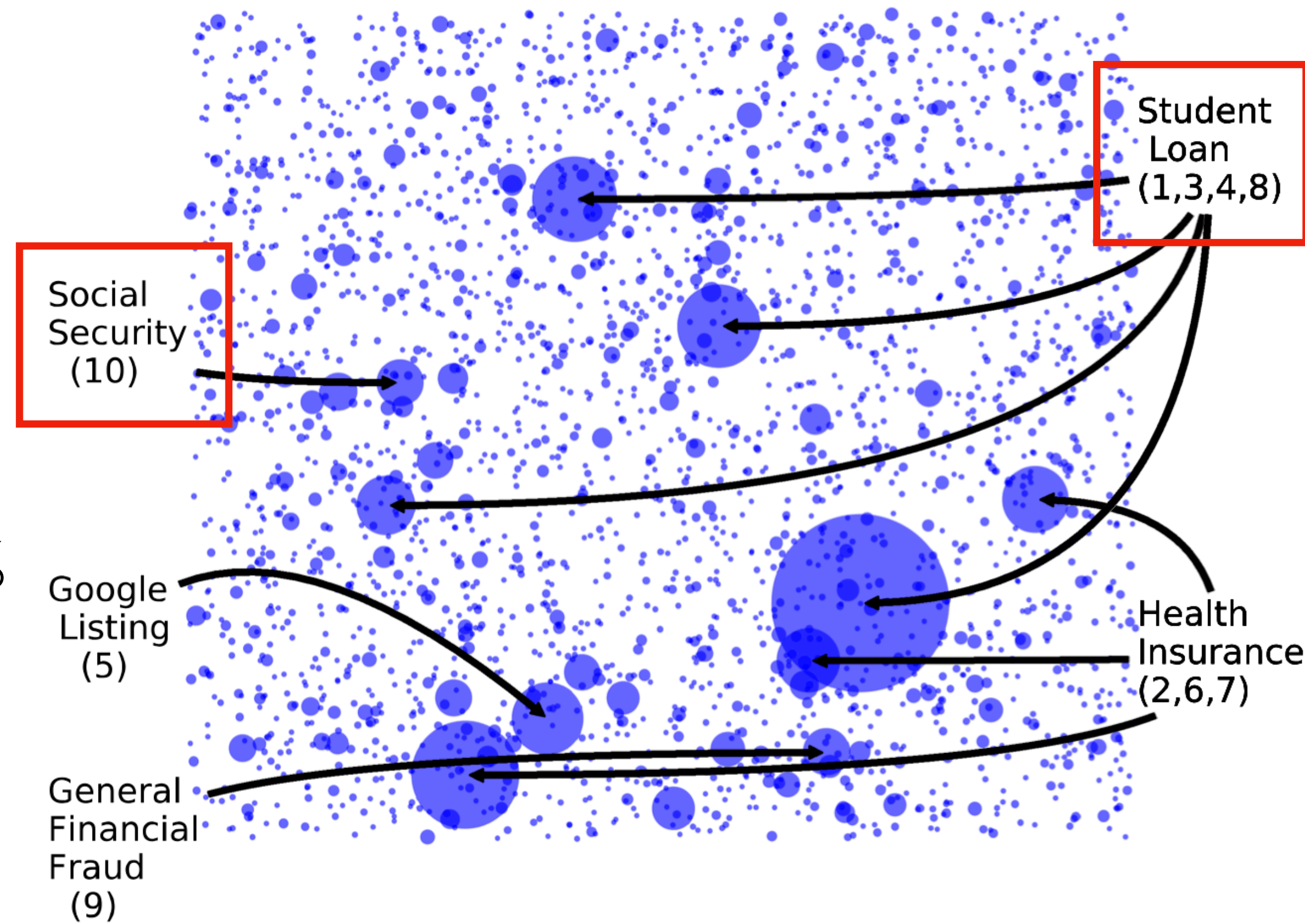
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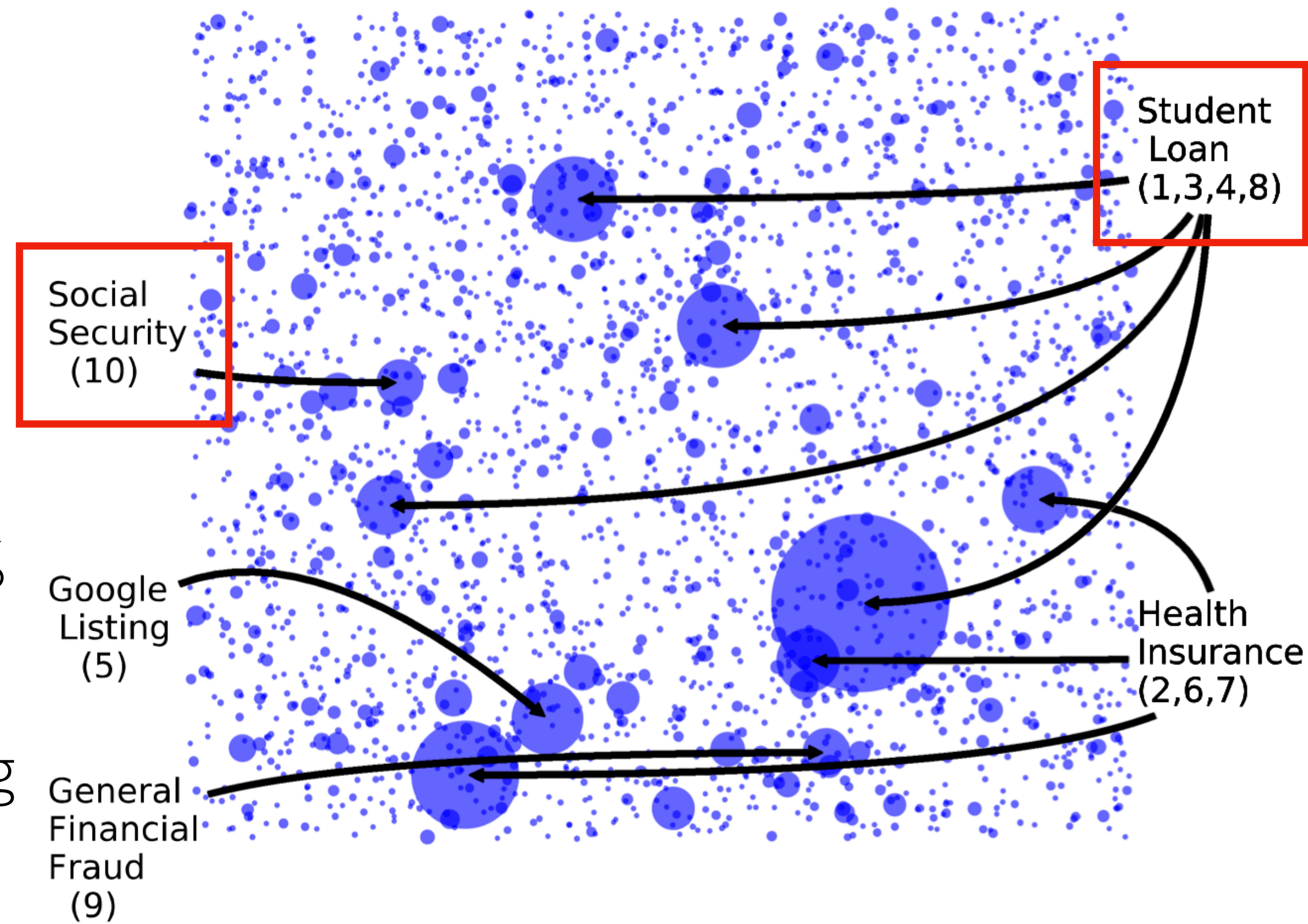
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- Campaign identification through audio clustering allowed us to study campaign specific behaviors which were previously impossible to measure



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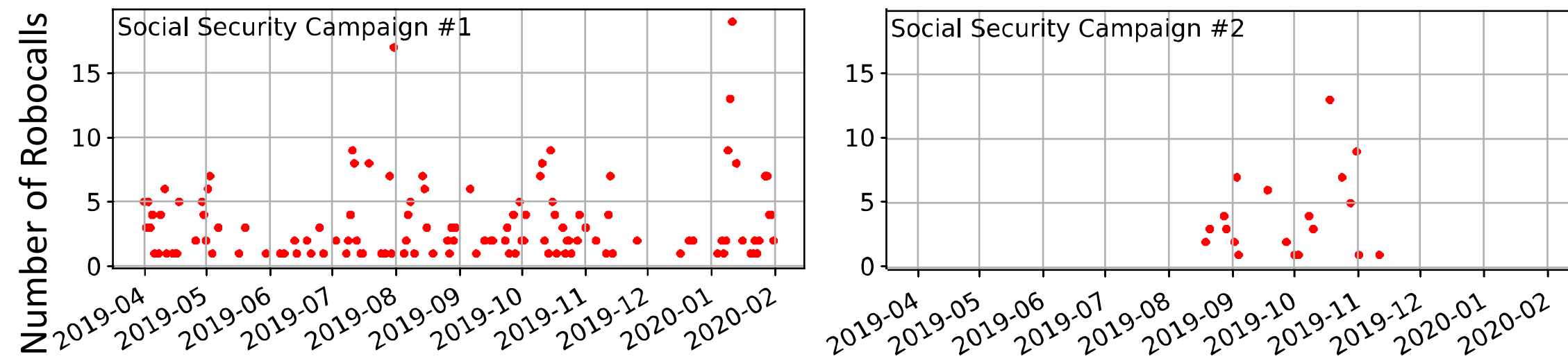
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Adversarial Campaigns Target the Vulnerable Population

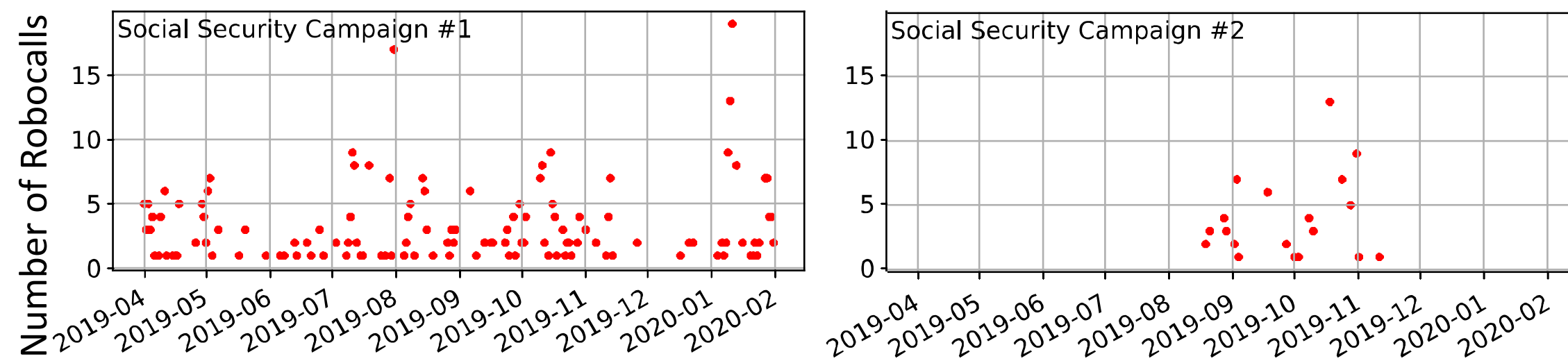
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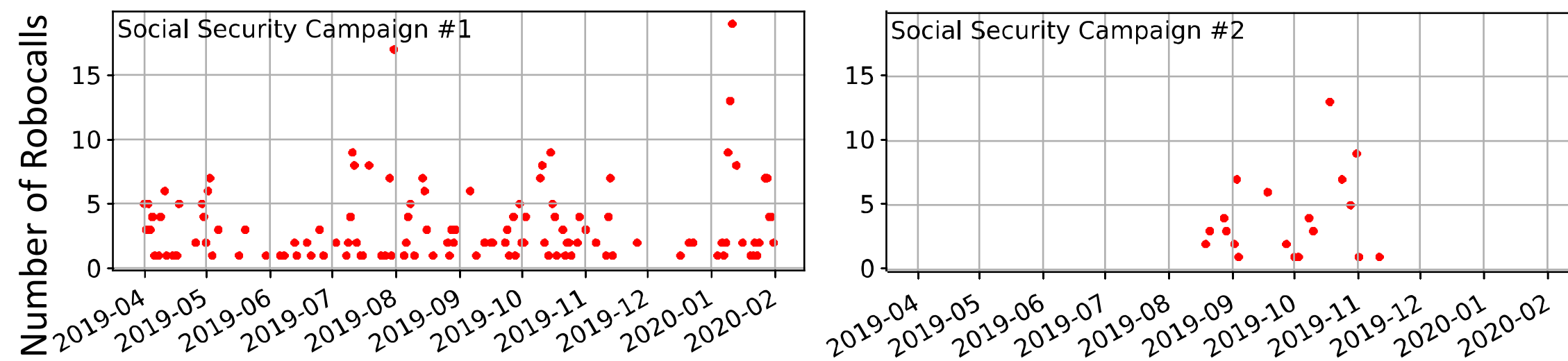
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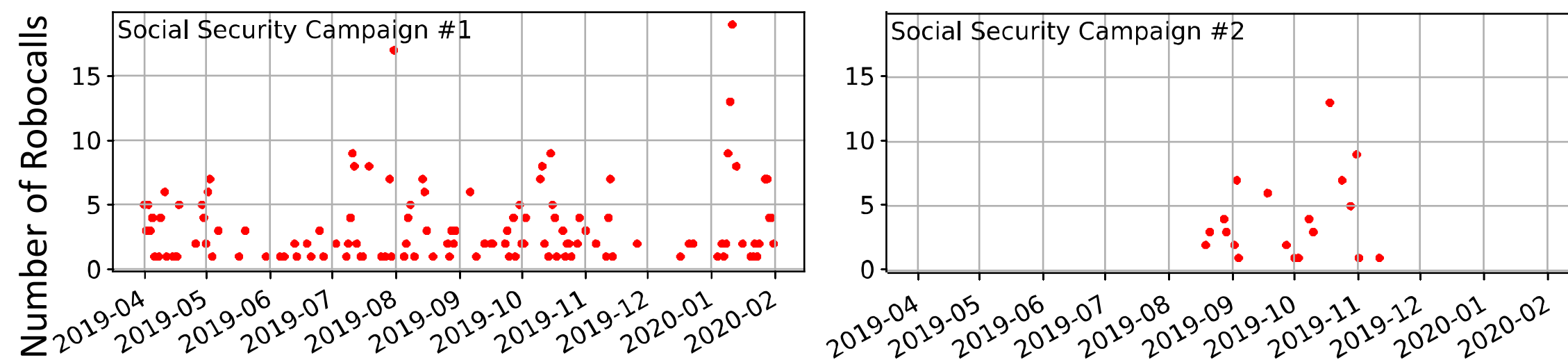
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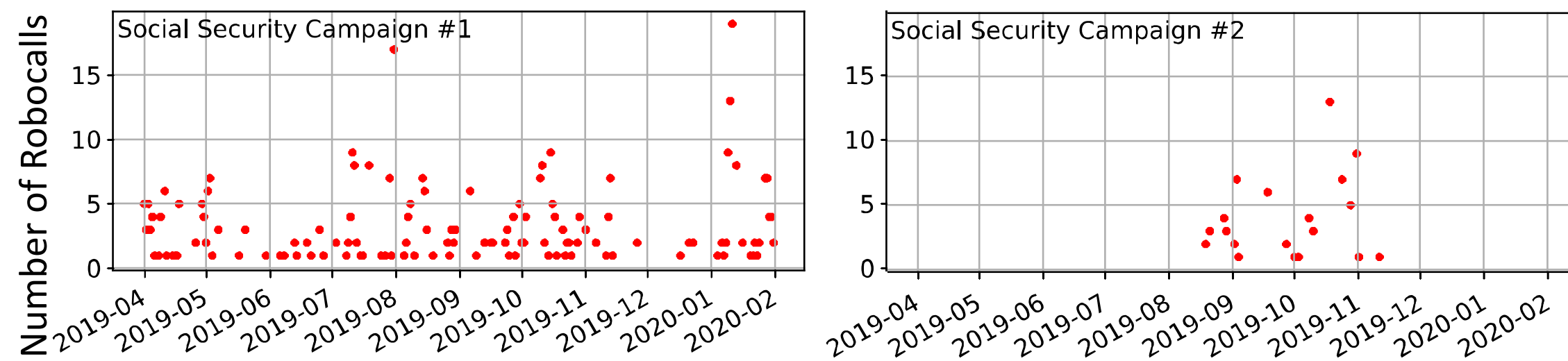
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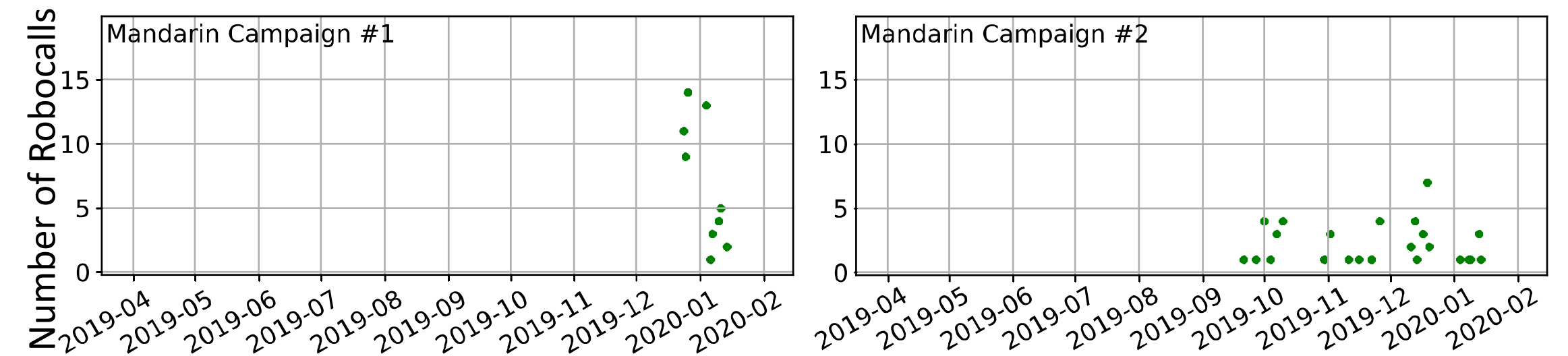
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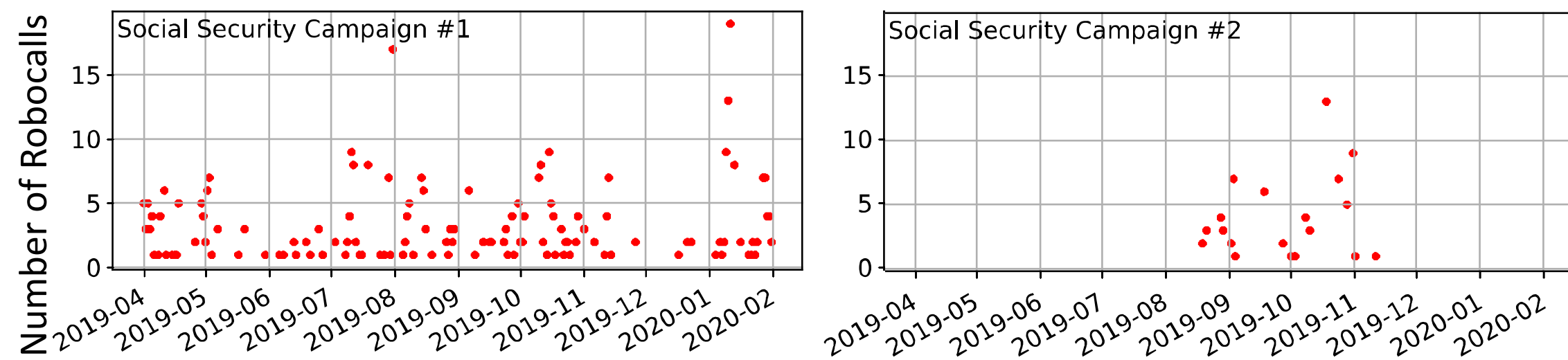
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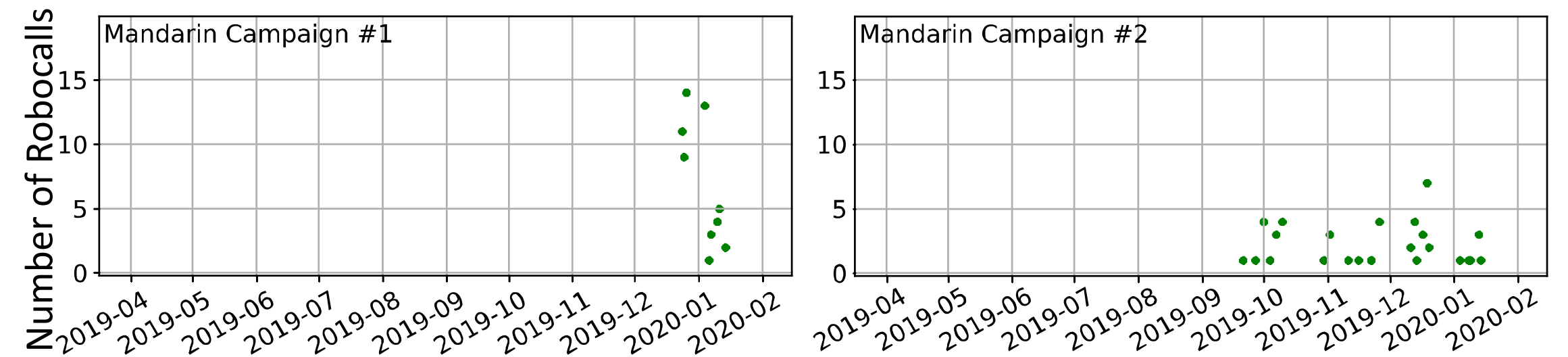
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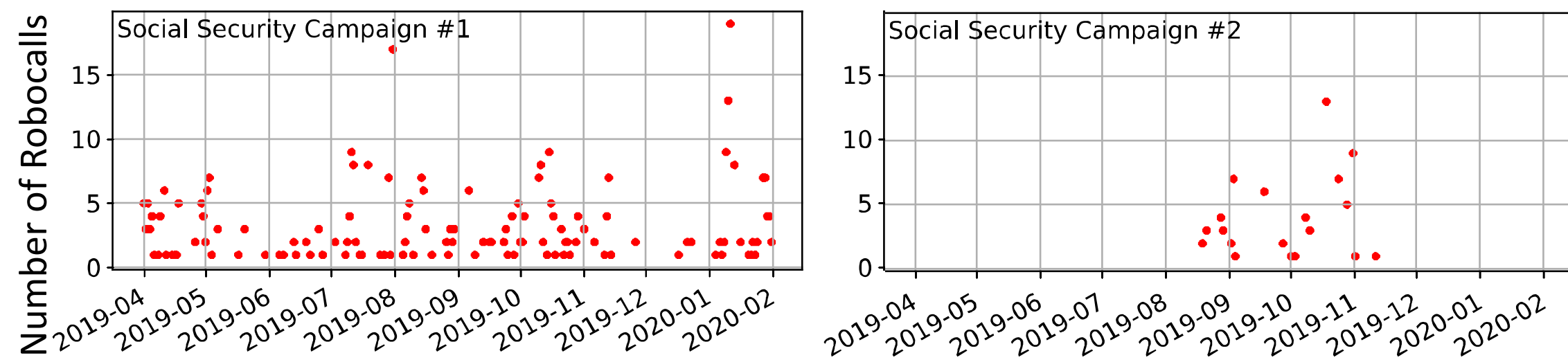
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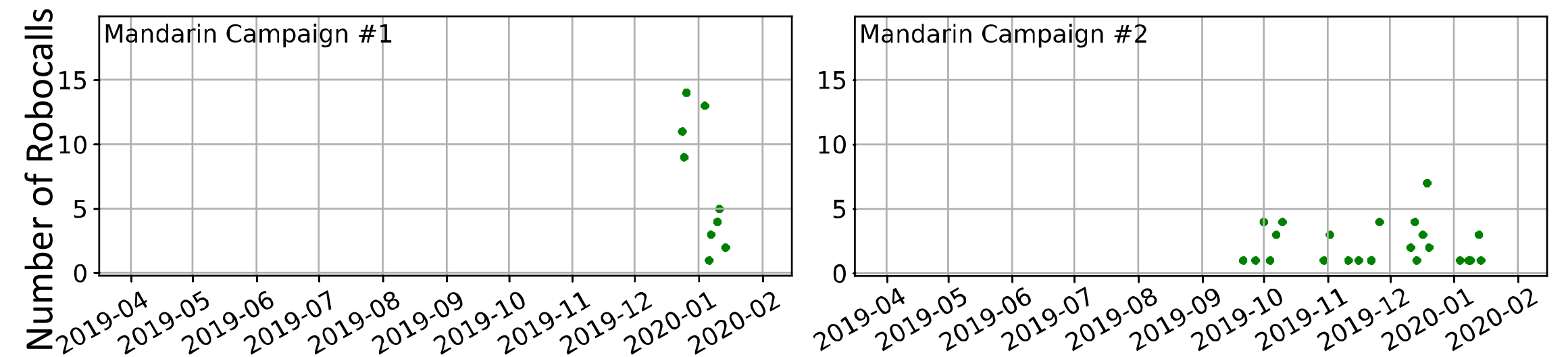
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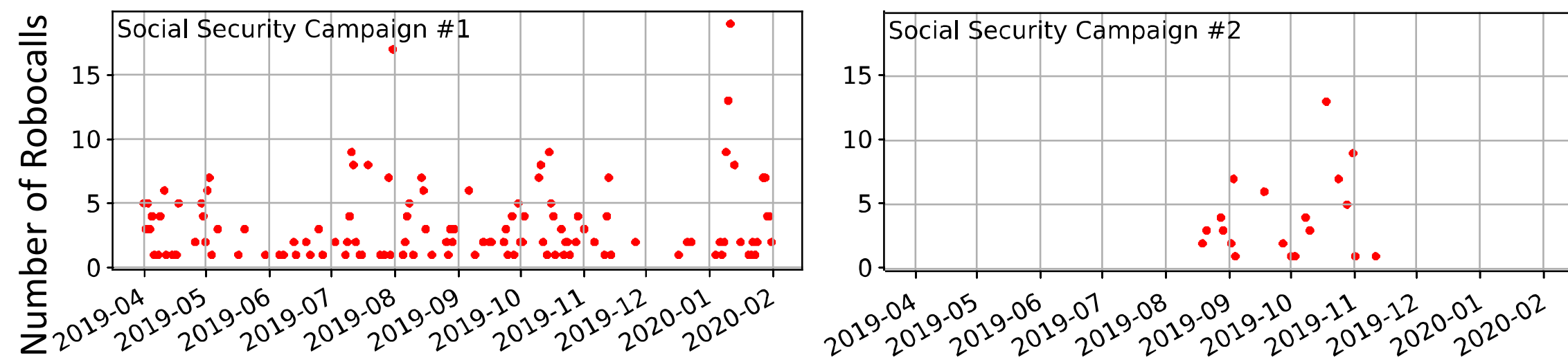
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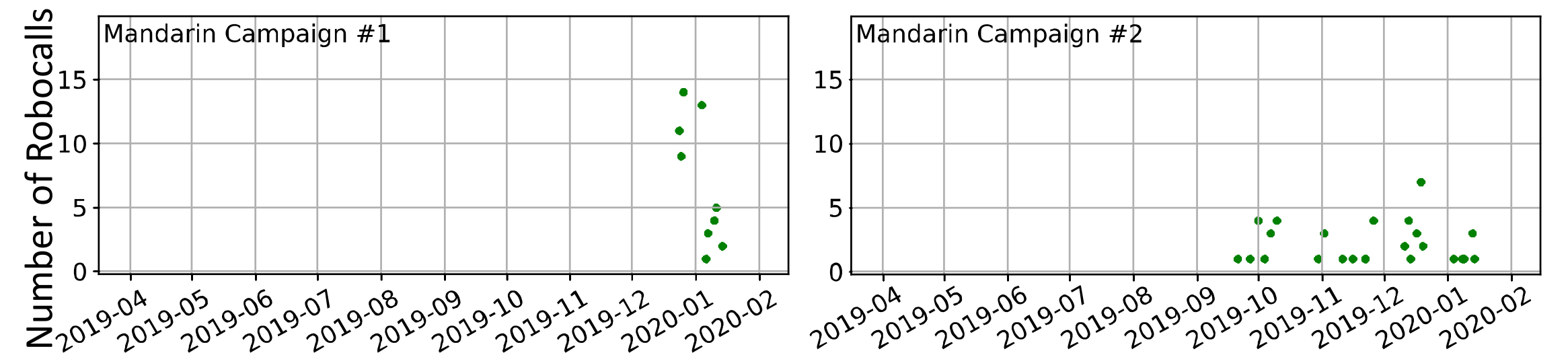
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- Adversaries impersonate government agencies to gain the victim's attention and boost their credibility

But wait, there's more!

- Heuristics to detect and measure voicemail spam and Wangiri scams
- How unsolicited phone calls abuse CNAM (Caller ID Name)
- How callers use “*67” to mask their true caller ID and remain anonymous
- How to systematically characterize “Storms” — high call volume events
- Discussion on language-agnostic and noise-resistant audio clustering pipeline
- An in-depth discussion of ethical and legal consideration of our study
- How can our techniques help service providers combat fraudulent robocalls

Key Takeaways

- Robocalling is a major security issue in the United State. We desperately need effective solutions to combat robocalls and protect phone users
- Even though we suggest users to be cautious when answering calls from unknown numbers, answering a robocall does not necessarily increase the number of robocalls
- Illegal robocalls are highly targeted. They regularly spoof caller ID or rotate between numbers and perform neighbor spoofing to entice victims
- Fraudulent robocalls can operate for long durations without being detected. They are designed to target vulnerable population

Acknowledgements

- We would like to thank Bandwidth Inc. and Nomorobo for their support
- Link to the paper: <https://robocallobservatory.org>
- Contact: Sathvik Prasad (snprasad@ncsu.edu)