An industrial perspective on web scraping characteristics and open issues

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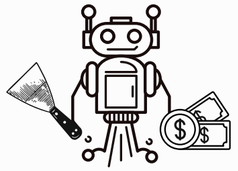
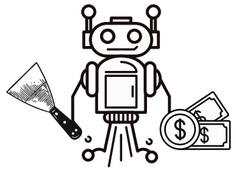
{olivier.thonnard, mohamed.fangar, mattias.mattsson, vincent.rigal}@amadeus.com

29th July 2022



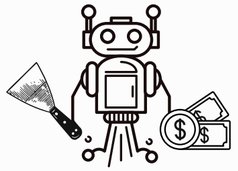
Agenda



Agenda

1

The players



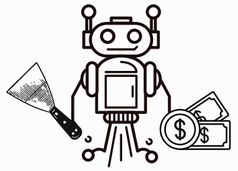
Agenda

1

The players

2

Real-world case study

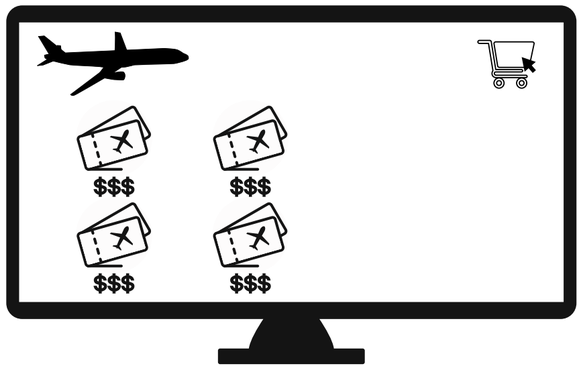


Agenda

1. The players
2. Real-world case study
3. Conclusion

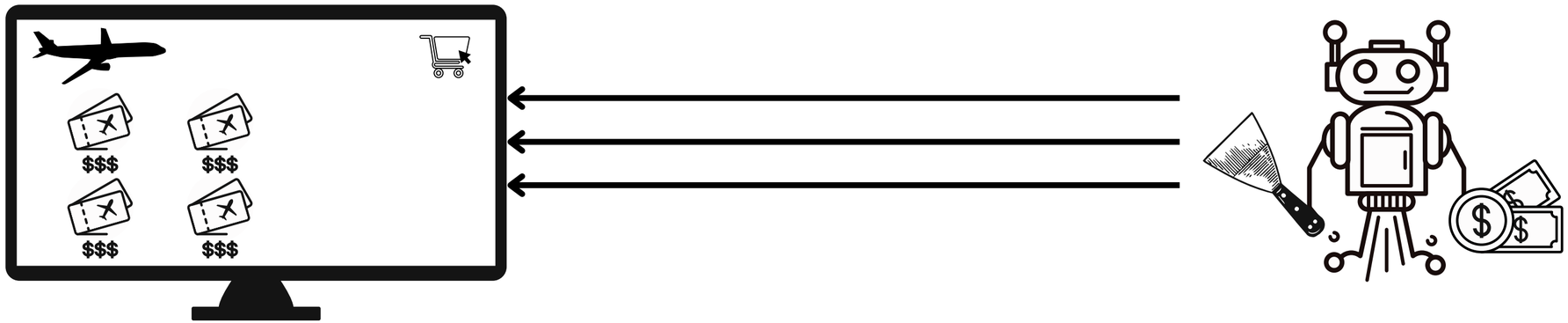
1 The players

The scenario



E-commerce websites

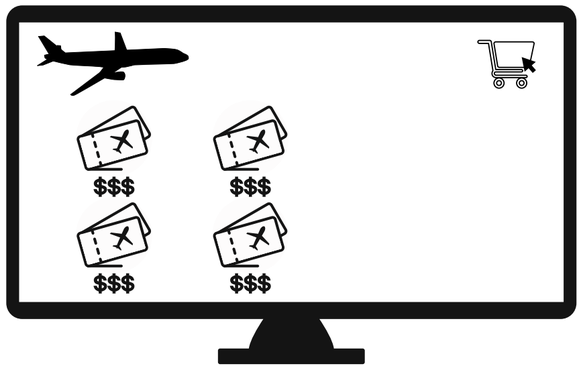
The scenario



E-commerce websites

Scrapers

The scenario



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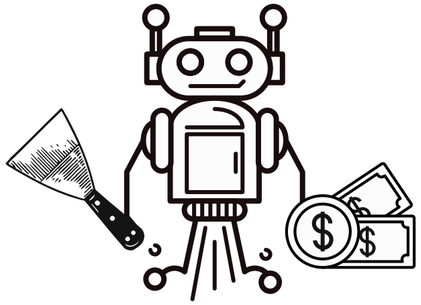

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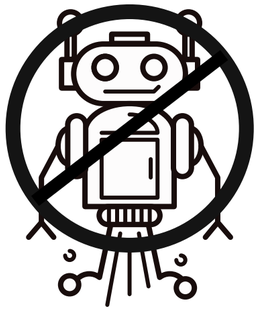
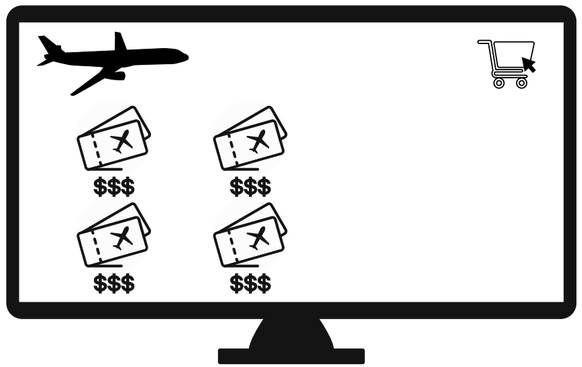


Anti-bot companies

The scenario



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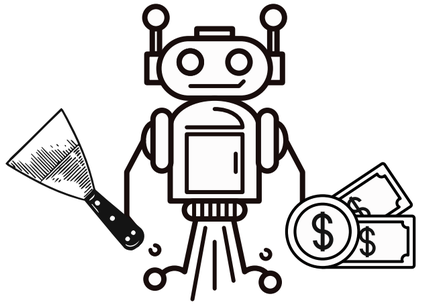

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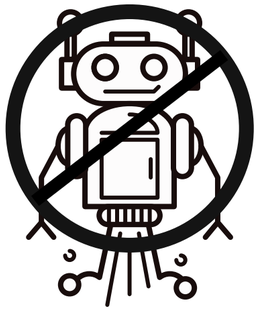
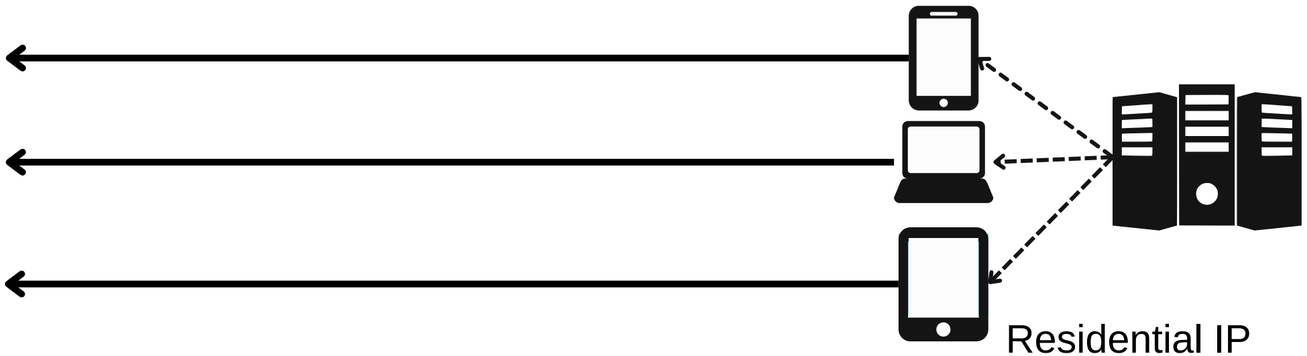
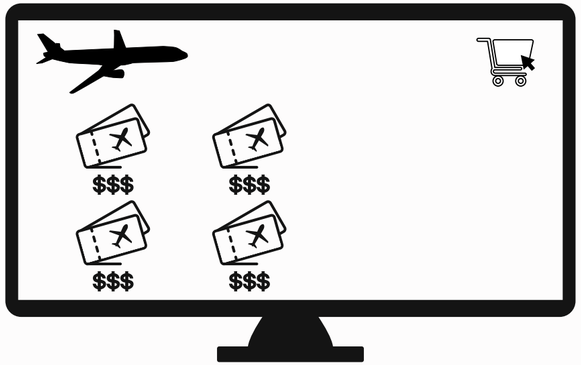


Anti-bot companies



Residential IP
(RESIP) proxy

E-commerce websites



E-commerce websites

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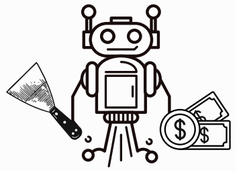
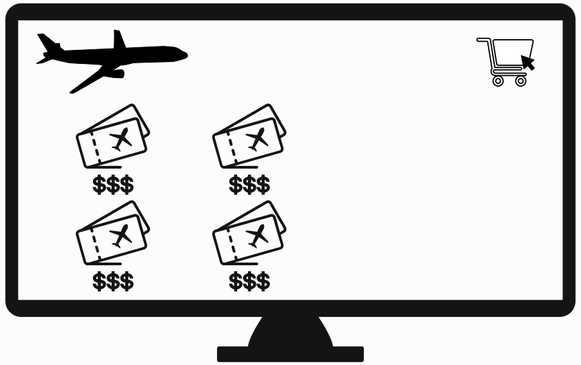


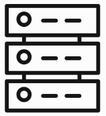
Server maintenance



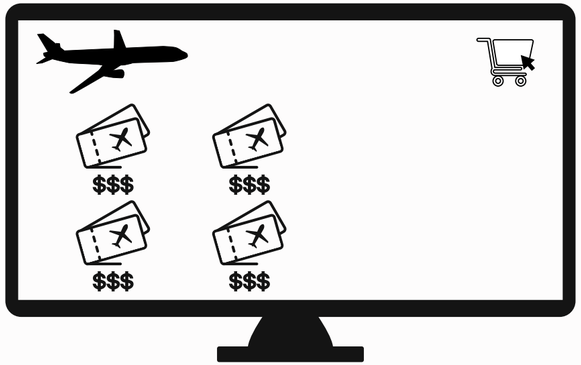
E-commerce websites

E-commerce websites

Rendering



Server maintenance

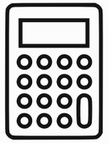


E-commerce websites

E-commerce websites

Rendering

Server maintenance



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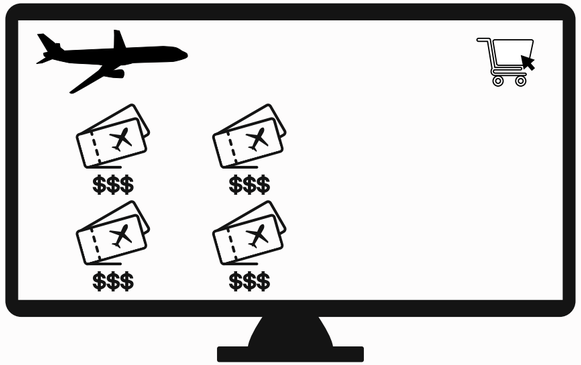

E-commerce websites

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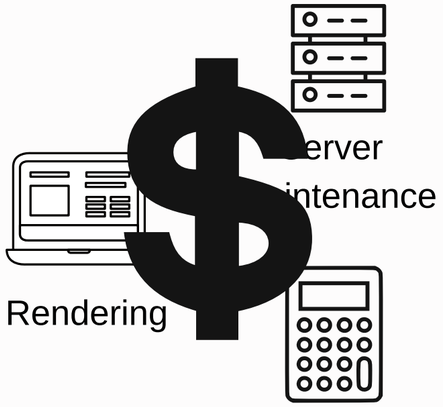

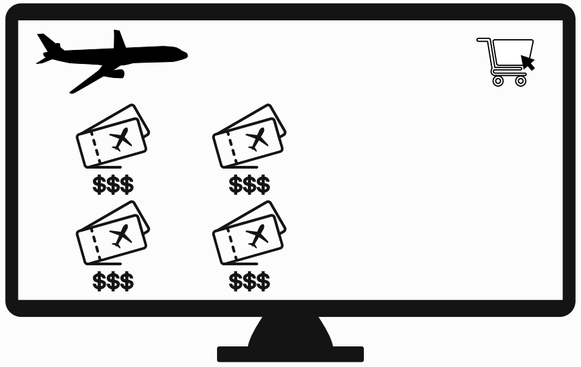

E-commerce websites

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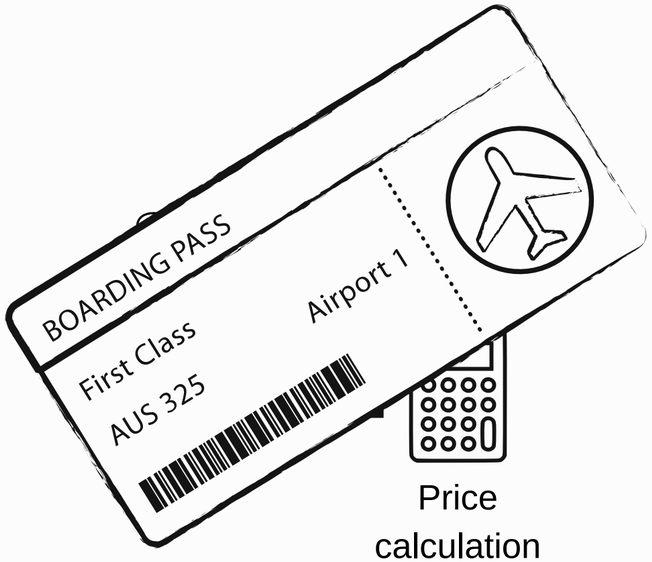
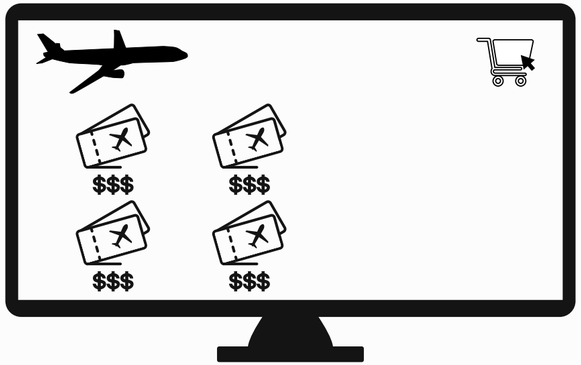


Price calculation



E-commerce websites

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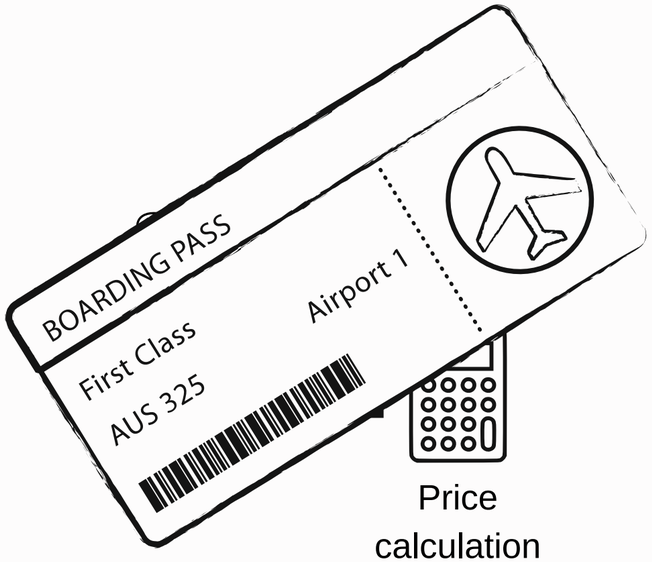
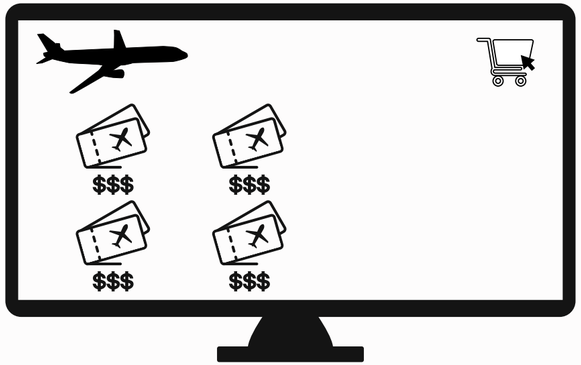


Price calculation



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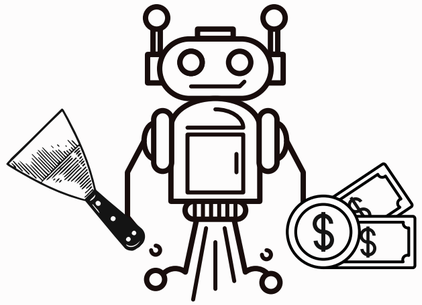
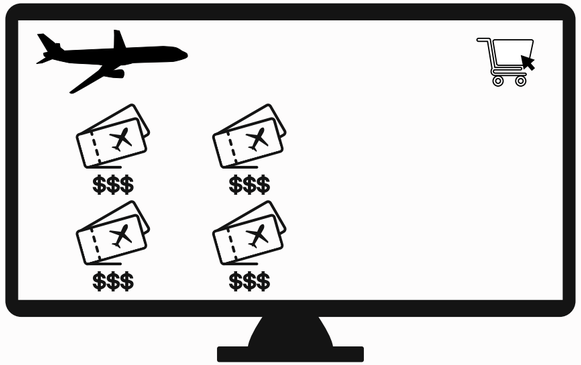


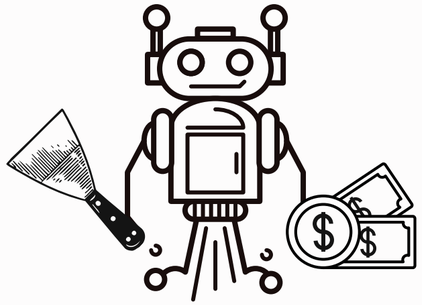
Scrapers

E-commerce websites

Price calculation



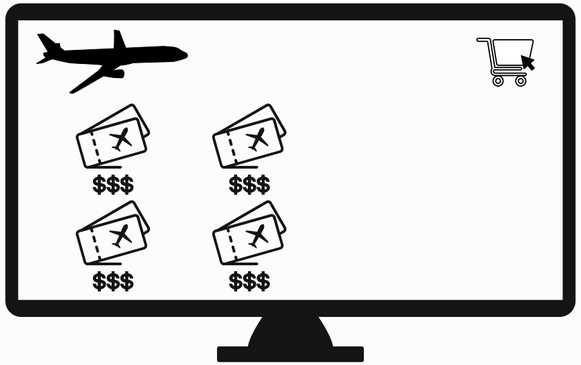
E-commerce websites



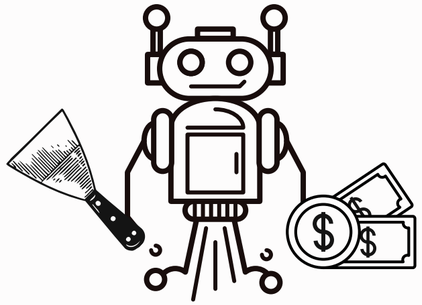
Scrapers

E-commerce websites

Price calculation



E-commerce websites



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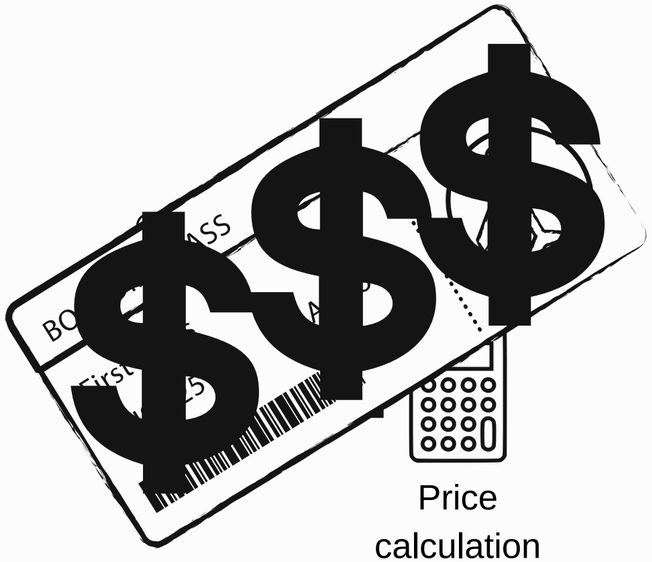

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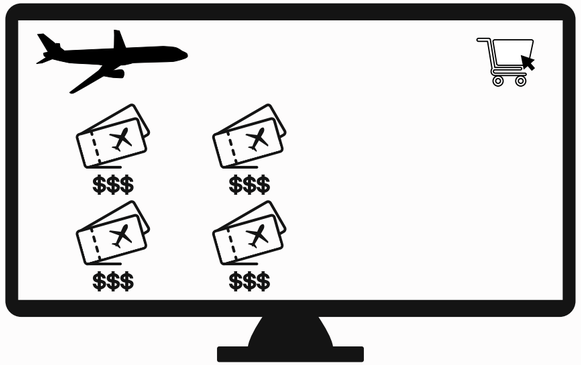

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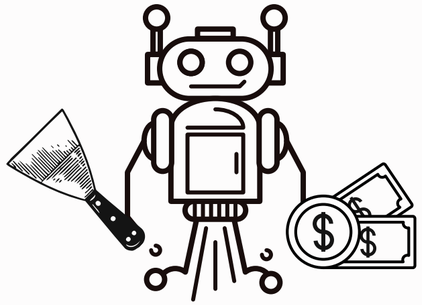

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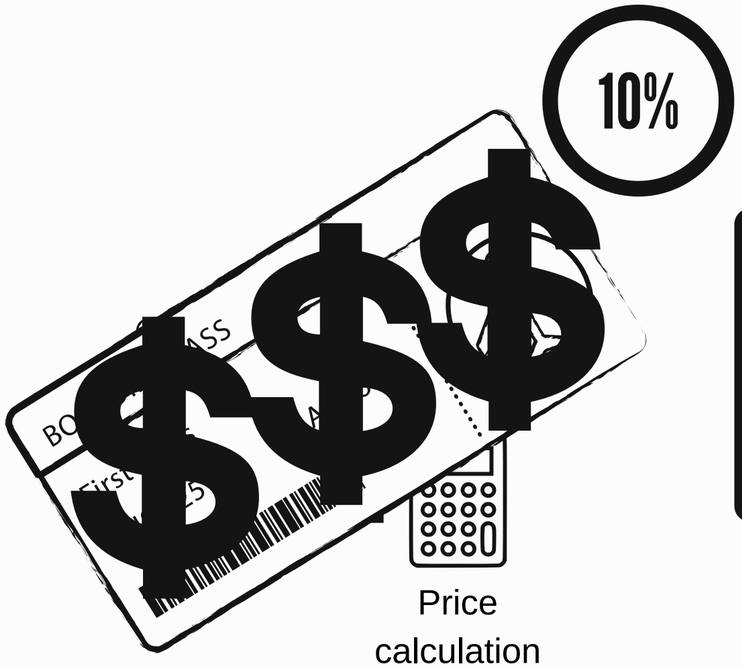
E-commerce websites



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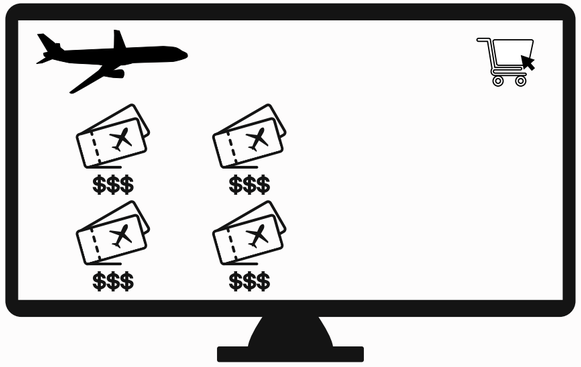

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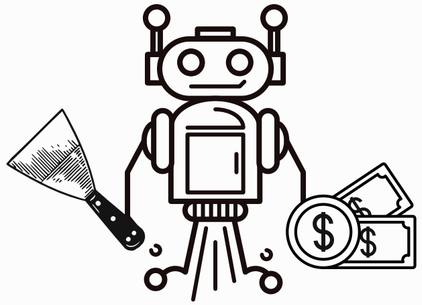
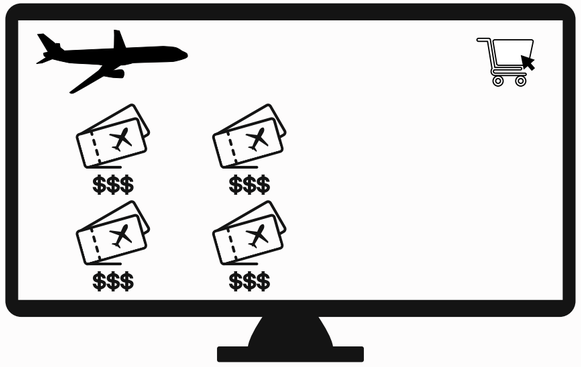


Scrapers

E-commerce websites

Price calculation



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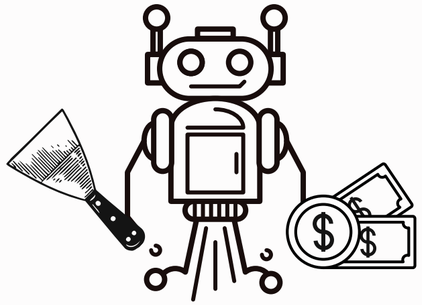

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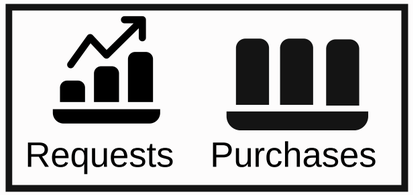

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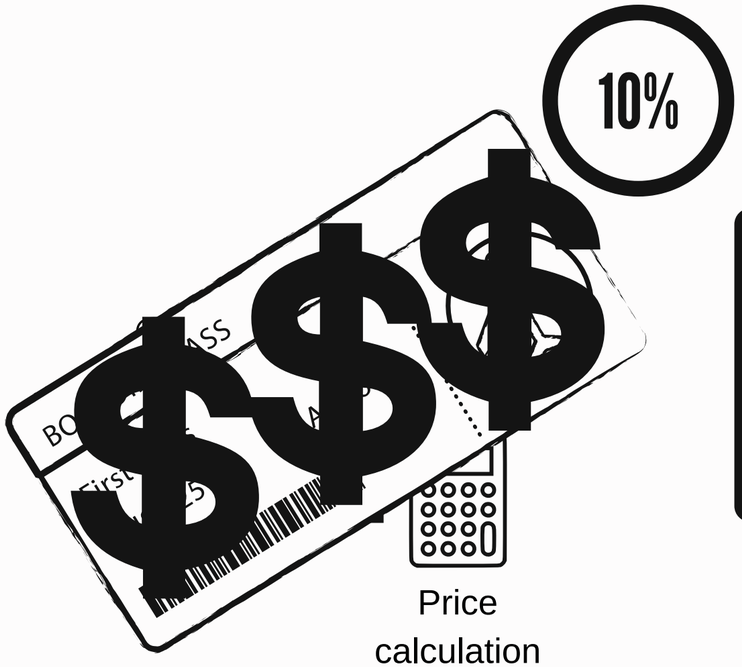
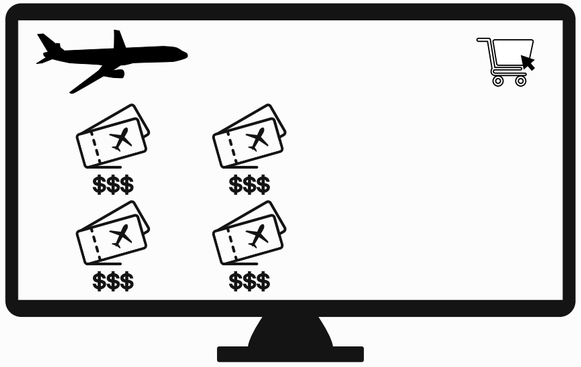


Price calculation



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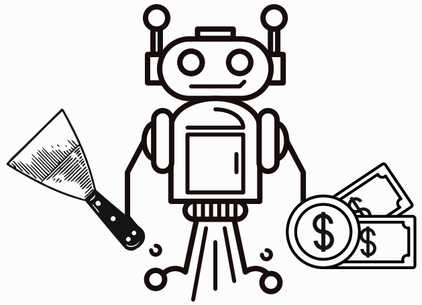

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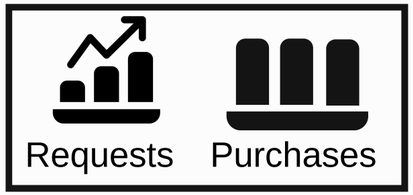
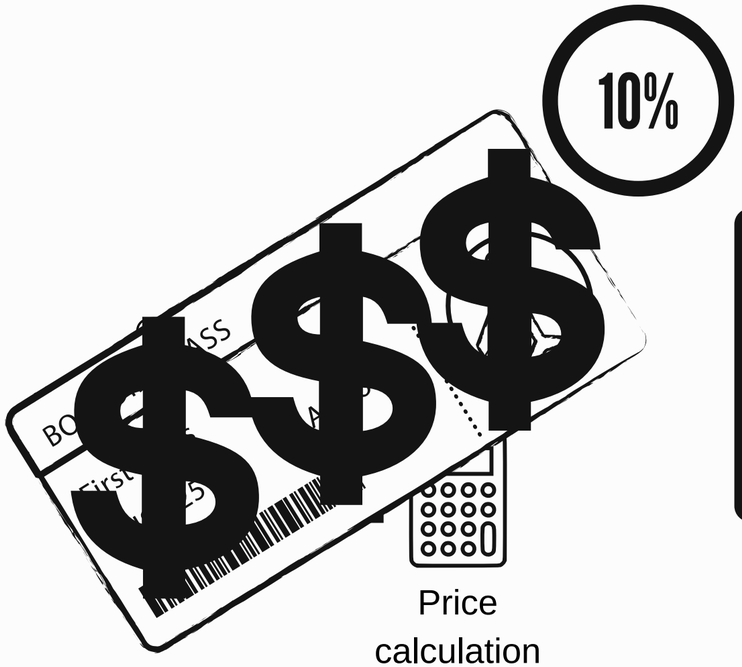
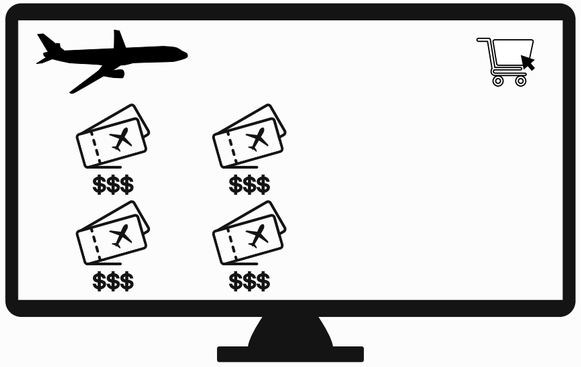


Slow connections

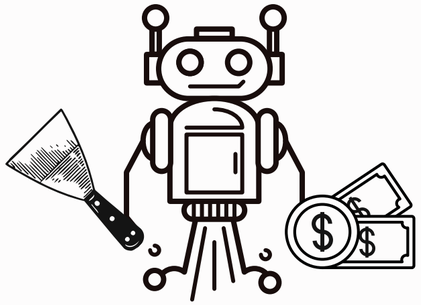
E-commerce websites



Price calculation



E-commerce websites



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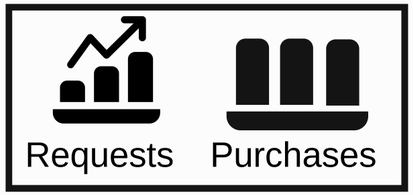
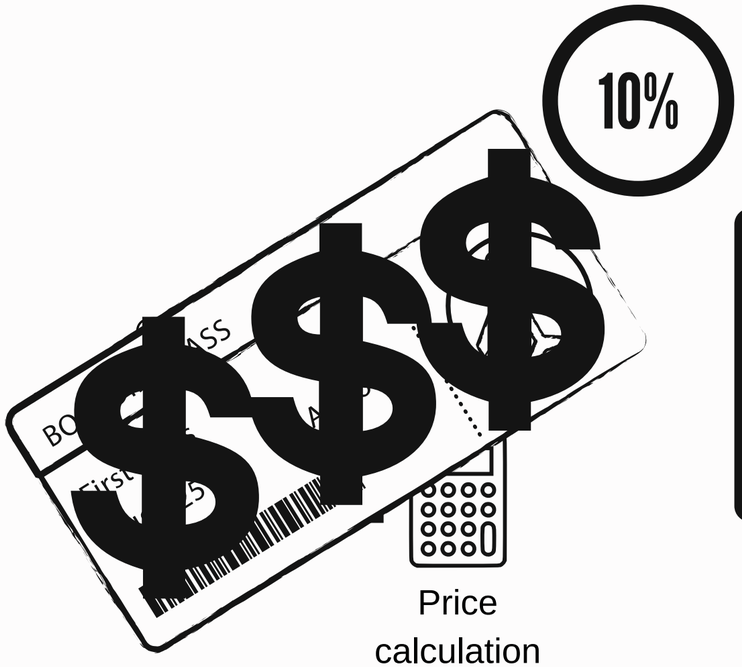


Slow connections

IP blocking

Rate limits

E-commerce websites



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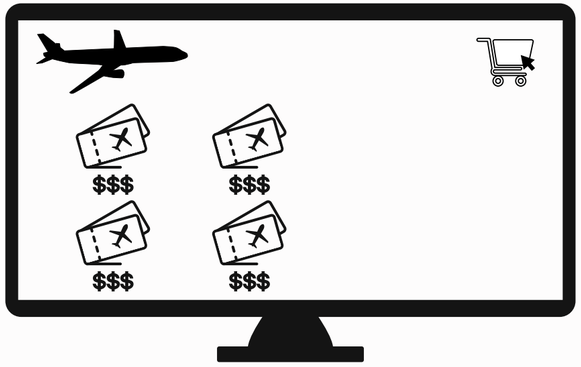

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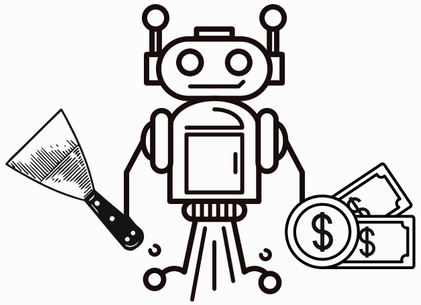
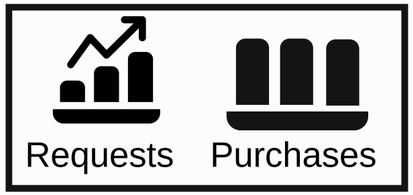


Scrapers



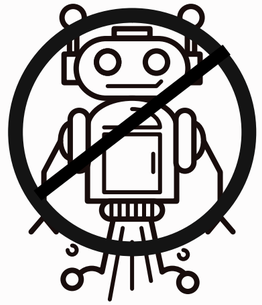
Slow connections

IP blocking

Rate limits

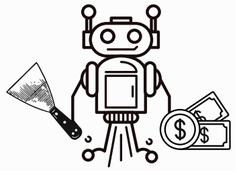
Anti-bot companies

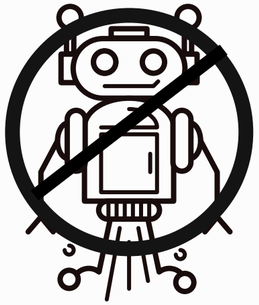
Anti-bot companies



Anti-bot companies

Anti-bot companies



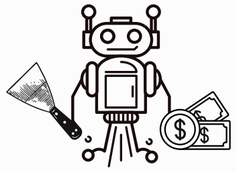


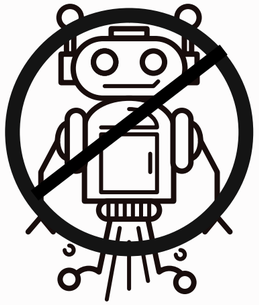
Anti-bot companies

http

HTTP header anomaly detection

Anti-bot companies





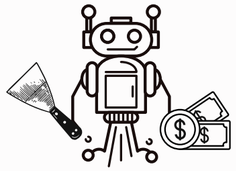
Anti-bot companies

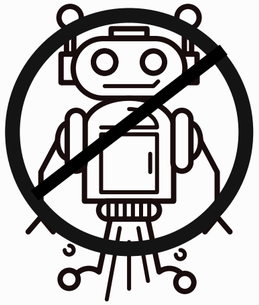
http

HTTP header anomaly detection

Browser fingerprinting

Anti-bot companies



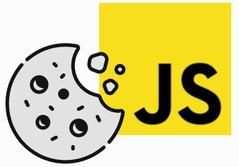


Anti-bot companies

http

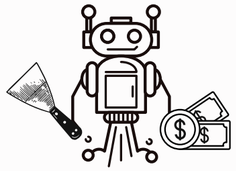
HTTP header anomaly detection

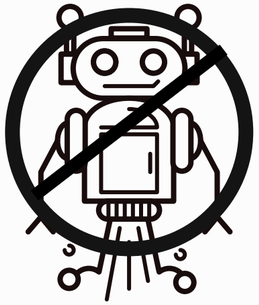
Browser fingerprinting



JS and cookies challenges

Anti-bot companies



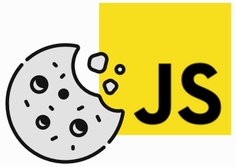


Anti-bot companies

http

HTTP header anomaly detection

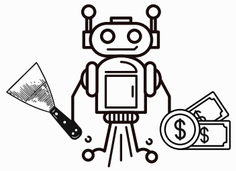
Browser fingerprinting

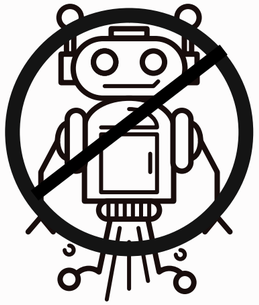


JS and cookies challenges

Human interaction check

Anti-bot companies



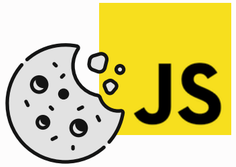


Anti-bot companies

http

HTTP header anomaly detection

Browser fingerprinting

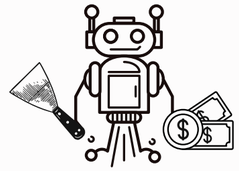


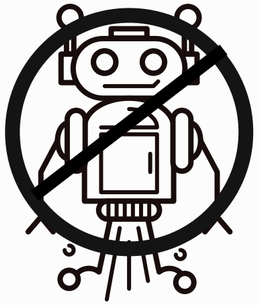
JS and cookies challenges

Human interaction check

CAPTCHAs

Anti-bot companies



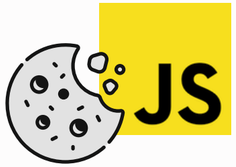


Anti-bot companies

http

HTTP header anomaly detection

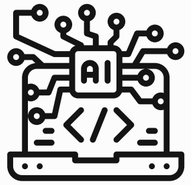
Browser fingerprinting



JS and cookies challenges

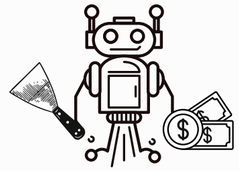
Human interaction check

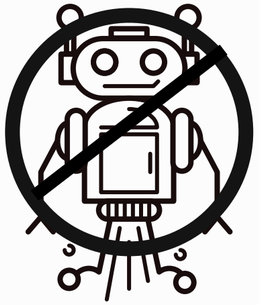
CAPTCHAs



Machine learning

Anti-bot companies



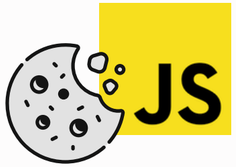


Anti-bot companies

http

HTTP header anomaly detection

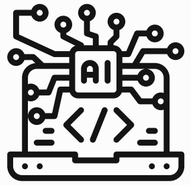
Browser fingerprinting



JS and cookies challenges

Human interaction check

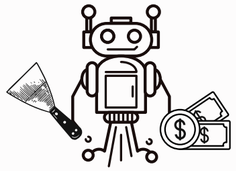
CAPTCHAs

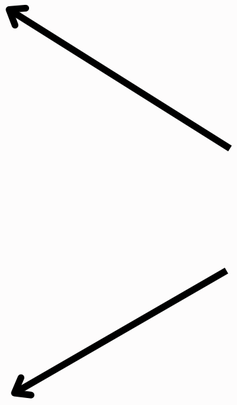


Machine learning

Wasting bots time

Anti-bot companies



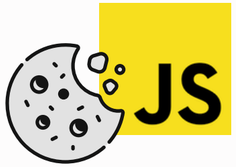


Anti-bot companies

http

HTTP header anomaly detection

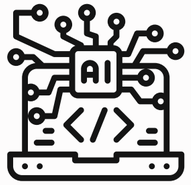
Browser fingerprinting



JS and cookies challenges

Human interaction check

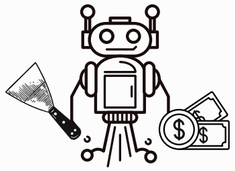
CAPTCHAs



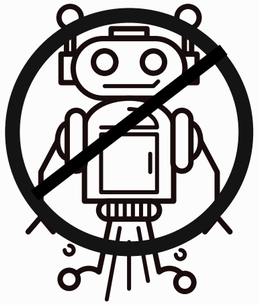
Machine learning

Wasting bots time

Anti-bot companies



Knowledge based

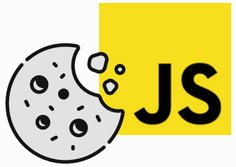


Anti-bot companies

http

HTTP header anomaly detection

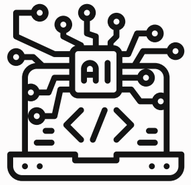
Browser fingerprinting



JS and cookies challenges

Human interaction check

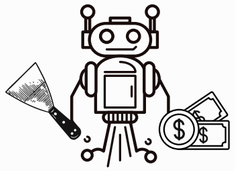
CAPTCHAs



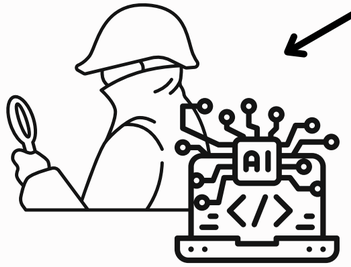
Machine learning

Wasting bots time

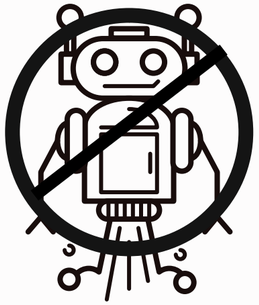
Anti-bot companies



Knowledge based



Behaviour based

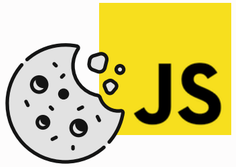


Anti-bot companies

http

HTTP header anomaly detection

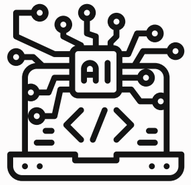
Browser fingerprinting



JS and cookies challenges

Human interaction check

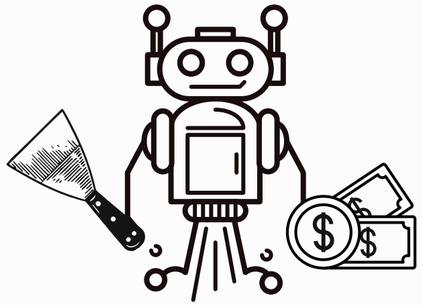
CAPTCHAs



Machine learning

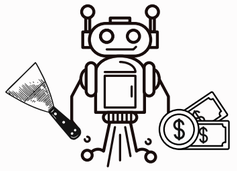
Wasting bots time

Scraping bots

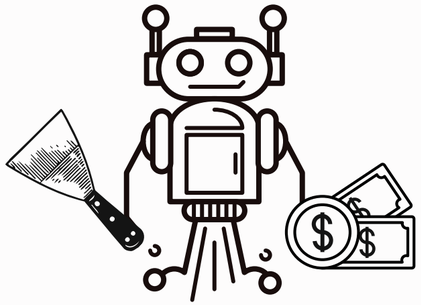


Scrapers

Scraping bots

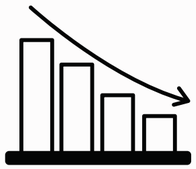


Competitors monitoring



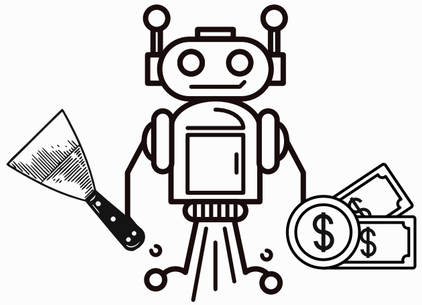
Scrapers

Scraping bots



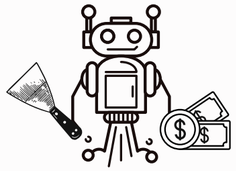
Statistics modification

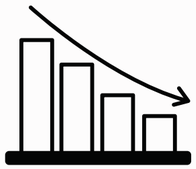
Competitors monitoring



Scrapers

Scraping bots

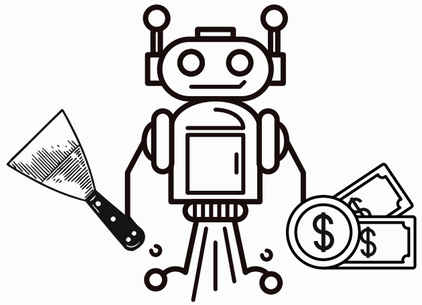




Statistics modification

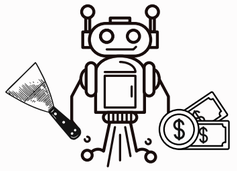
Competitors monitoring

Content reselling



Scrapers

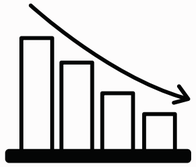
Scraping bots



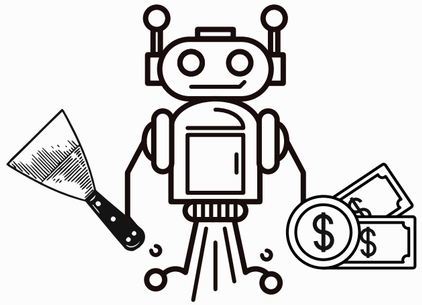
Scrapy PhantomJS

Browser emulation frameworks

Competitors monitoring



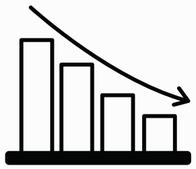
Statistics modification



Scrapers

Content reselling

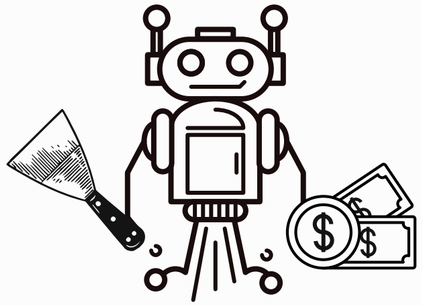
Scraping bots



Statistics modification

Competitors monitoring

Content reselling



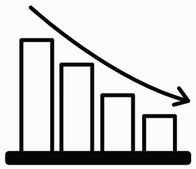
Scrapers

Scrapy PhantomJS

Browser emulation frameworks

Automated browsers, cookies and JS support

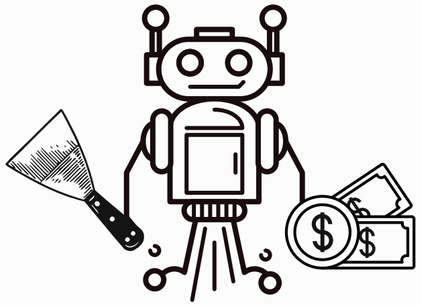
Scraping bots



Statistics modification

Competitors monitoring

Content reselling



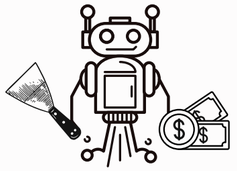
Scrapers

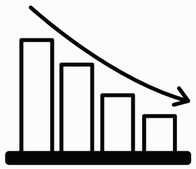
Browser emulation frameworks

Automated browsers, cookies and JS support

CAPTCHA farms

Scraping bots





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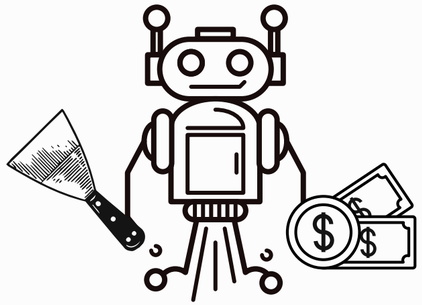

Scrapers

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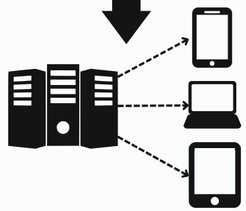
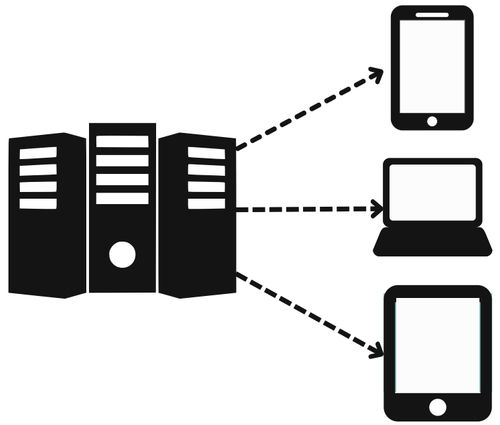


Residential IP (RESIP) proxy

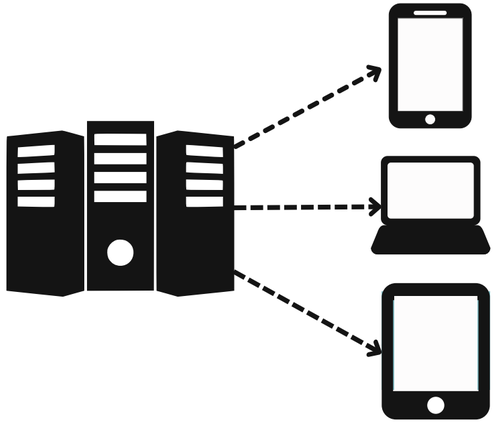
RESIP providers



Residential IP
(RESIP) proxy

RESIP providers

Huge IP pool



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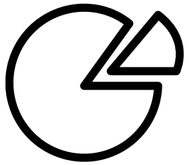
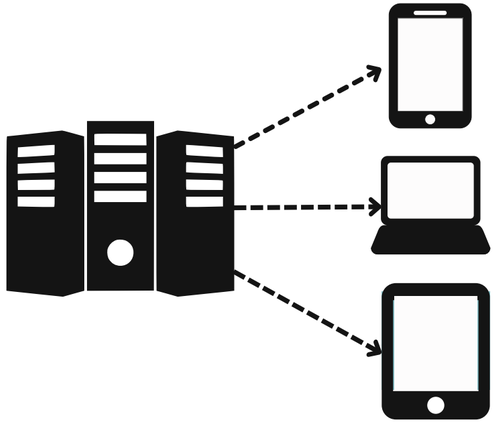


30% of malicious traffic coming from RESIP (DataDome 2019)



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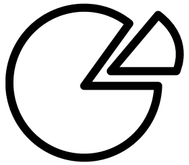

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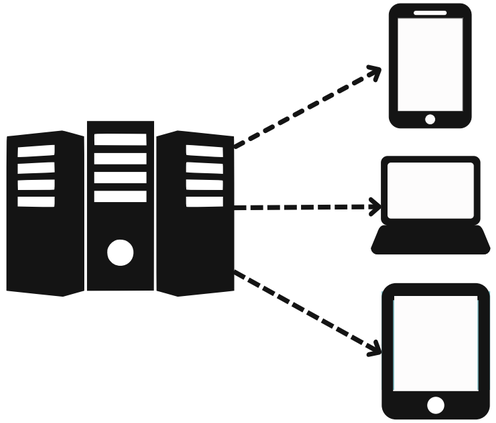
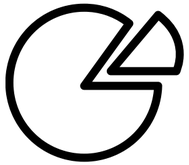


Residential IP (RESIP) proxy

Good reputation IPs

RESIP providers

Huge IP pool



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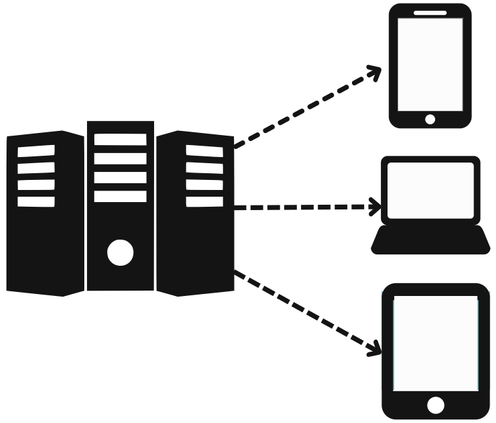

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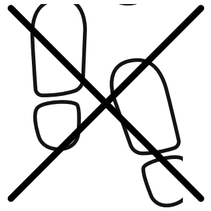
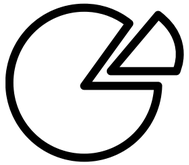
Good reputation IPs



No traceback

RESIP providers

Huge IP pool



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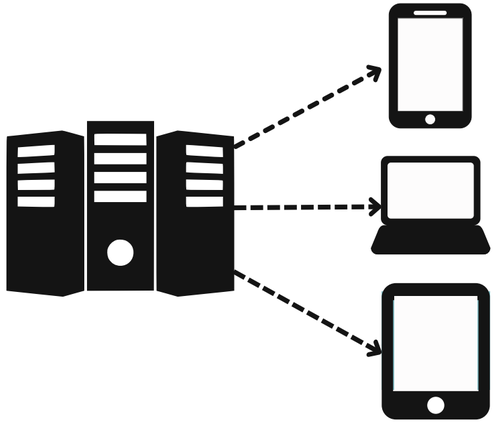

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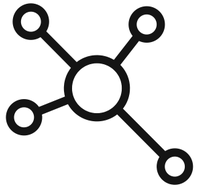
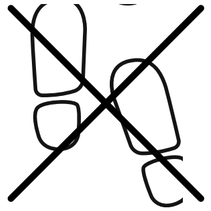


No private distributed infrastructure



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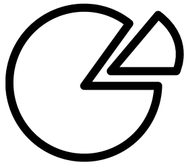
RESIP providers

Huge IP pool



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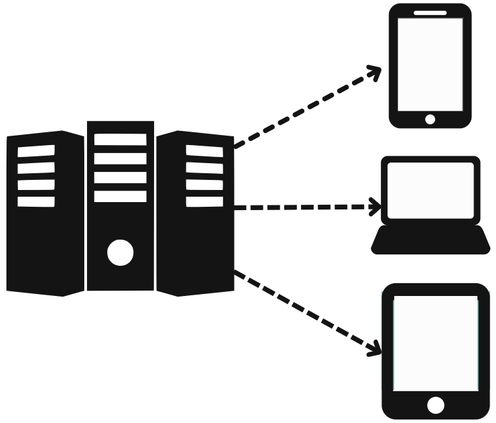

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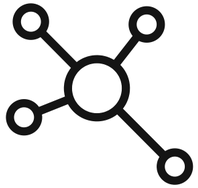

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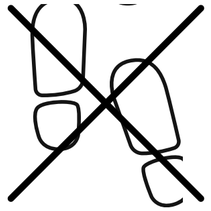
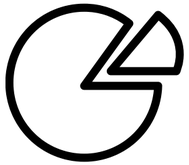


No traceback

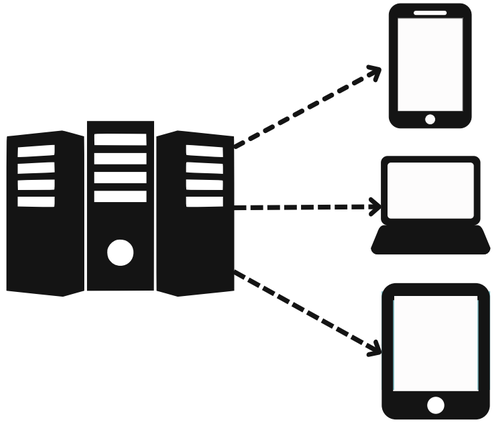
Automated services

RESIP providers

Huge IP pool



30% of malicious traffic coming from RESIP (DataDome 2019)



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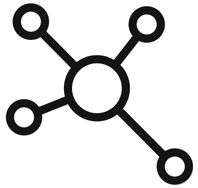

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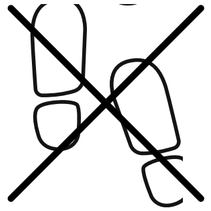


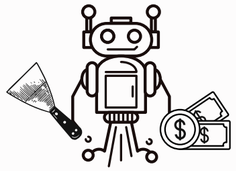
No traceback

Automated services

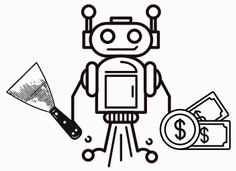
Higher risk to block legittimate users

2 Real-world case study

amadeus

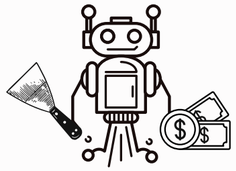


amadeus



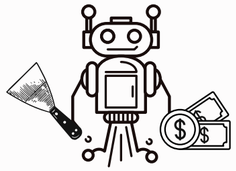
- Global distribution system

amadeus



- Global distribution system
- **World-leading** technology companies for travel and tourism

amadeus



- Global distribution system
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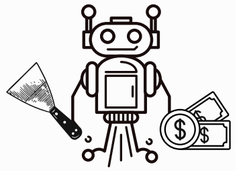
- Airlines fare calculations based on a **large number** of parameters

amadeus



- Global distribution system
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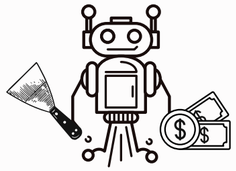
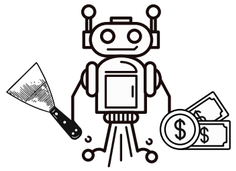


- Global distribution system
- **World-leading** technology companies for travel and tourism
- Airlines fare calculations based on a **large number** of parameters
- Domains heavily **targeted** by scrapers
- 200 websites **protected** by a knowledge-based anti-bot solution

Scrapers vs amadeus: why?



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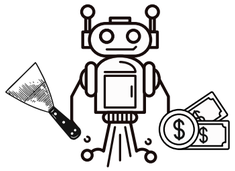
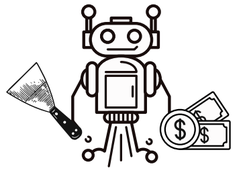


Competitive intelligence companies

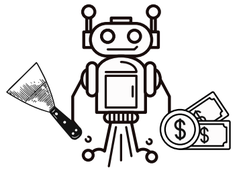
Scrapers vs amadeus: why?



Competitive intelligence companies

Aggregators

Scrapers vs amadeus: why?

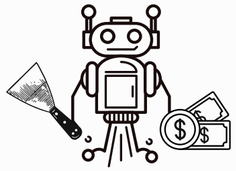


Competitive intelligence companies

Aggregators

Online travel agencies

Scrapers vs amadeus: how much?



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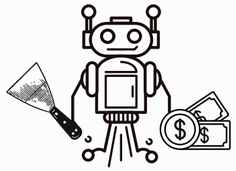
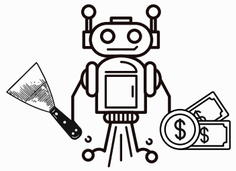


- Every month, anti-bot rules triggered by **140 million** requests

Scrapers vs amadeus: how much?



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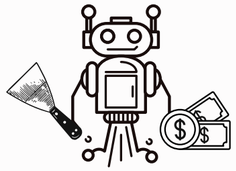
- **41%** of the attempted connections detected as bots (February 2022)

Scrapers vs amadeus: how much?



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- **Constant** bot traffic

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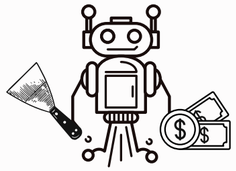

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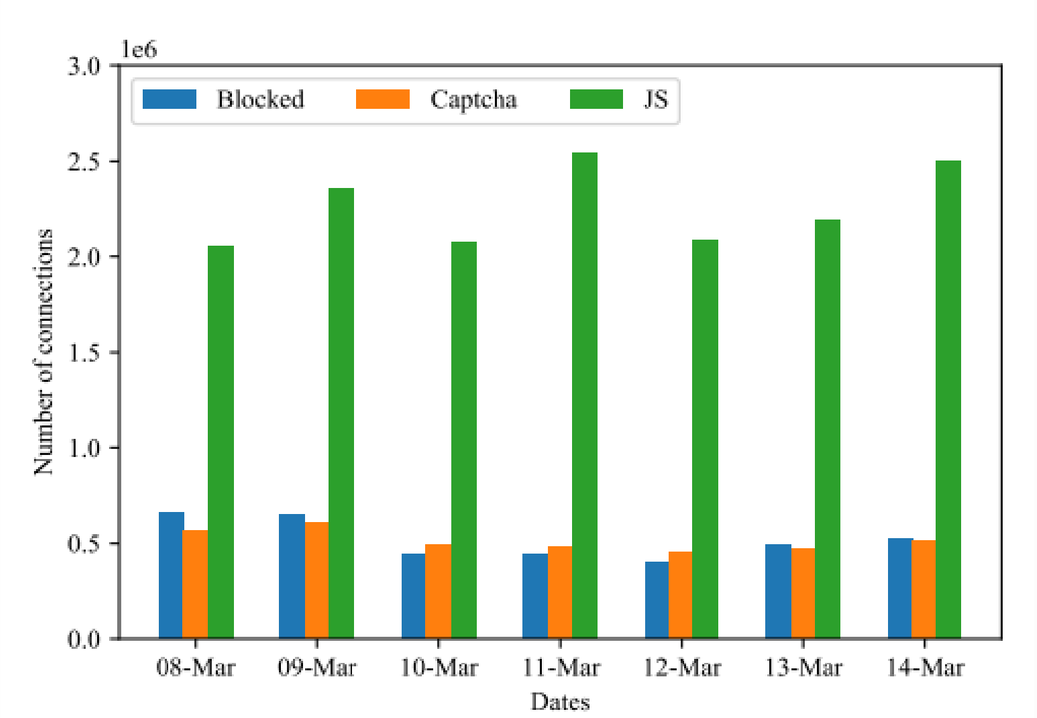
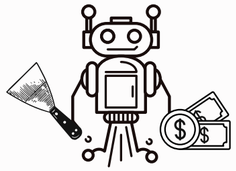
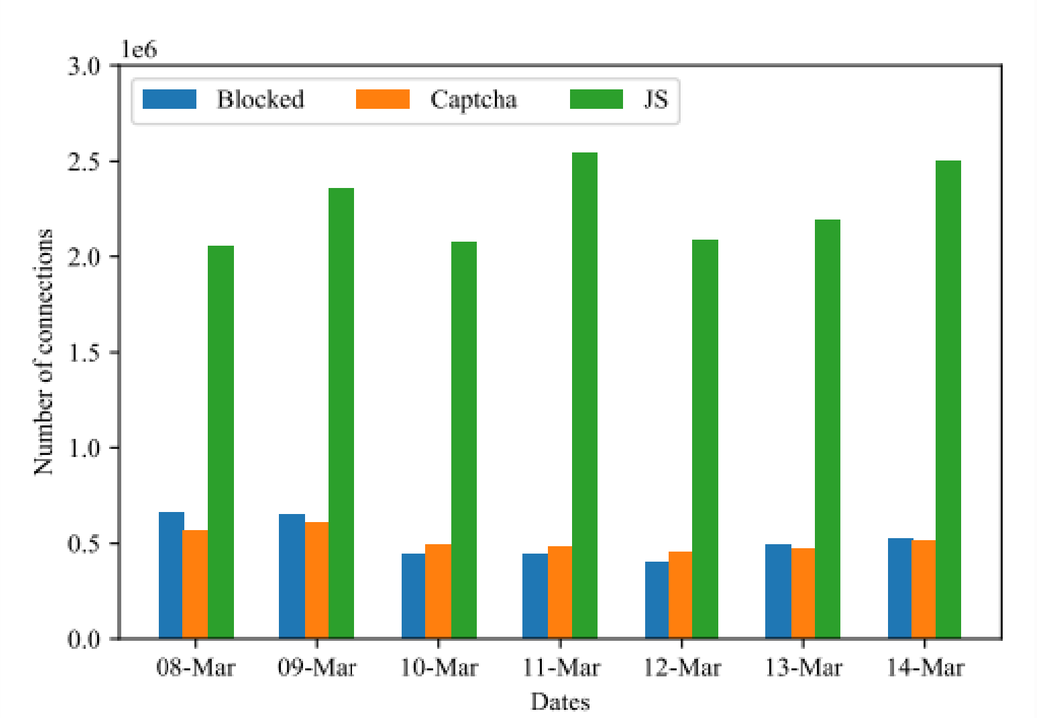


Daily amount of reactions
between 08/03/22 and 14/03/22.

Scrapers vs amadeus: how much?



- Every month, anti-bot rules triggered by **140 million** requests
- **41%** of the attempted connections detected as bots (February 2022)
- **Constant** bot traffic
- Bot reaction to countermeasures: from days (past years) to **hours** (now)



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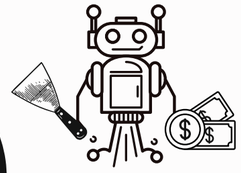
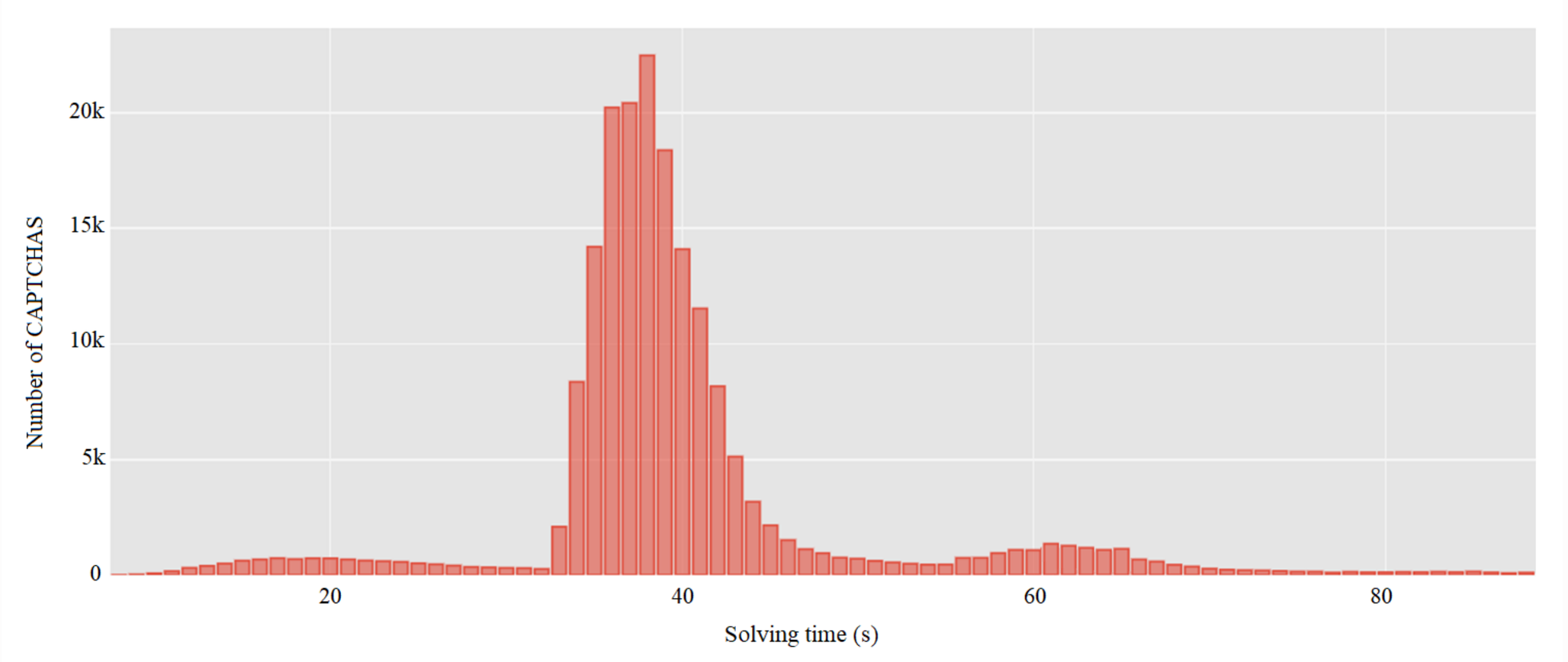
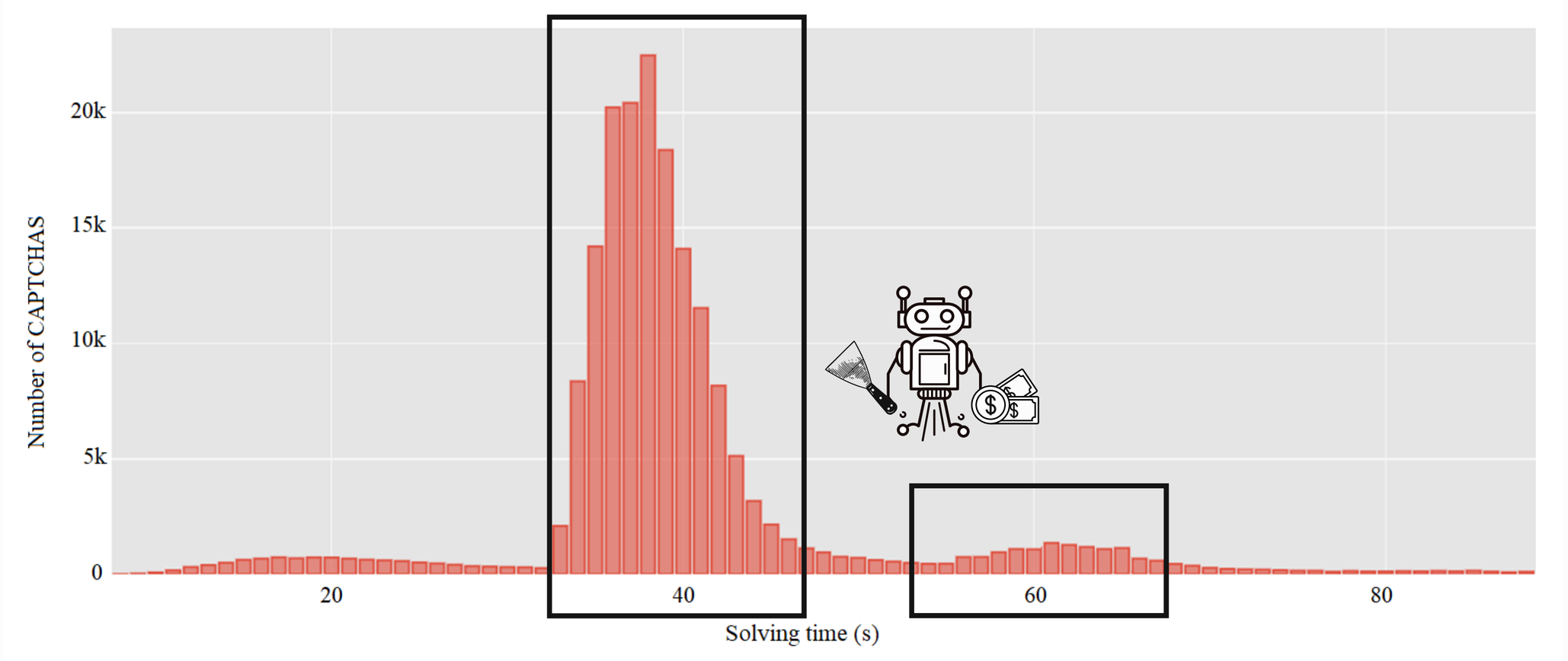
CAPTCHA solving time (2018)





CAPTCHA solving time (2018)



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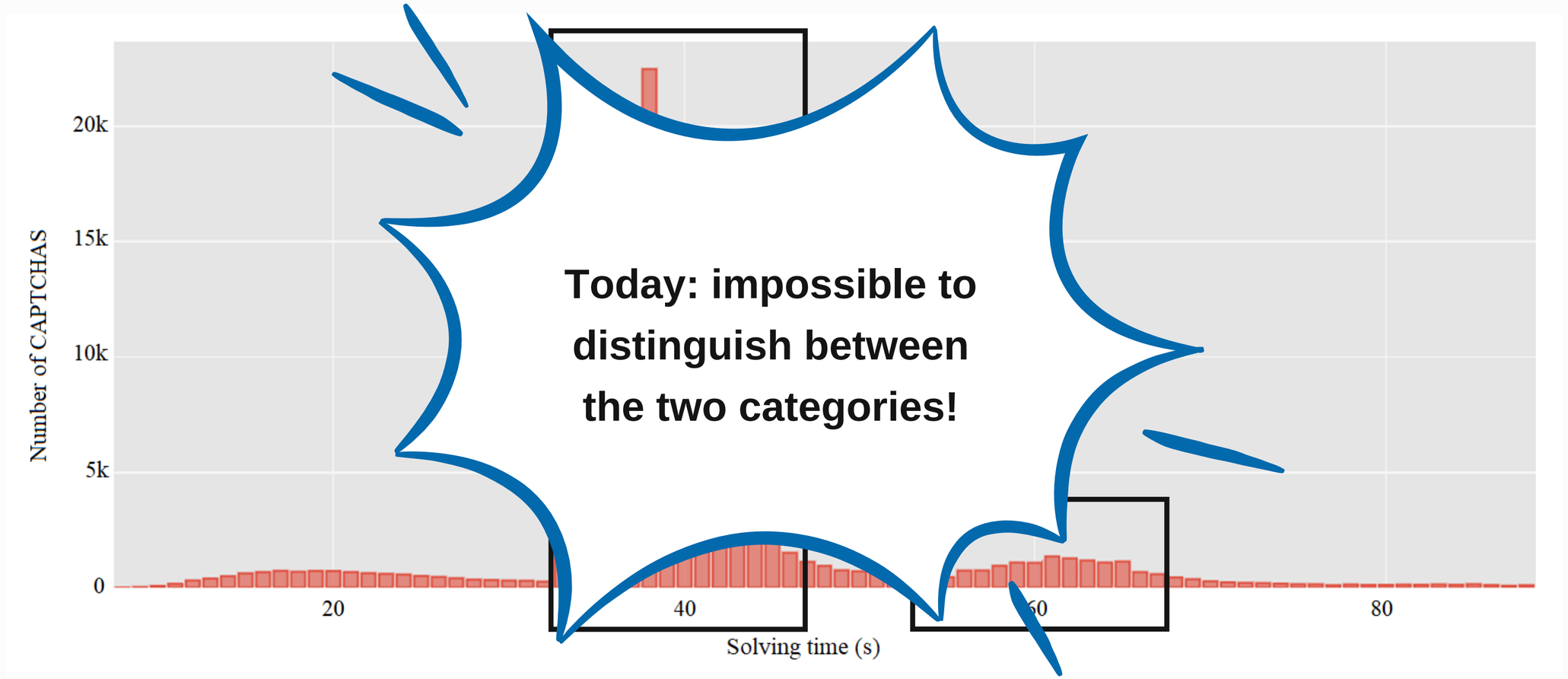
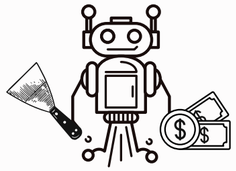


RESIP activities in AMADEUS



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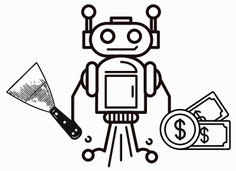
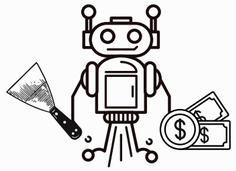


Residential IPs detected as bots in 30 days: **12%**

Goal: reducing false positives

RESIP activities in AMADEUS



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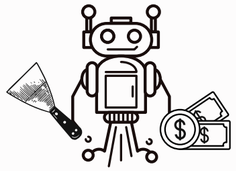

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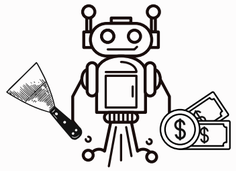
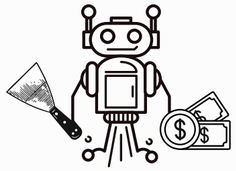
Wide usage of RESIP

RESIP problem

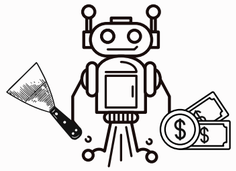


RESIP problem



- Main problem: high risk of **false positives**

RESIP problem



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- **New** specific detection methods are needed

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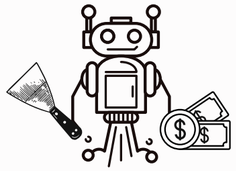

- Main problem: high risk of **false positives**
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- Recent works suggest the RESIP pools of IP addresses are **smaller** than claimed [1]

[1] Chiapponi et al (2021). "Scraping Airlines Bots: Insights Obtained Studying Honeypot Data" in International Journal of Cyber Forensics and Advanced Threat Investigations

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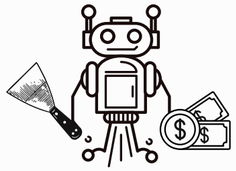

- Main problem: high risk of **false positives**
- **New** specific detection methods are needed
- Recent works suggest the RESIP pools of IP addresses are **smaller** than claimed [1]

If confirmed, **IP blocking** could be used

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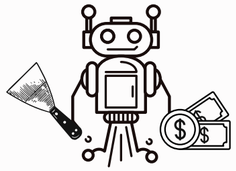
3 Conclusion

Take aways



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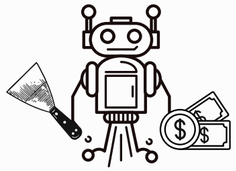
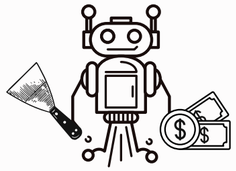


Web scraping **highly** affects e-commerce websites

Take aways



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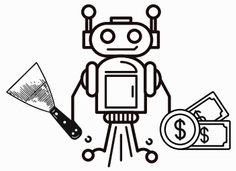
Scrapers techniques keep **evolving** to overcome anti-bot detection

Take aways



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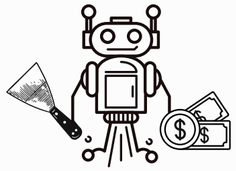

Web scraping **highly** affects e-commerce websites

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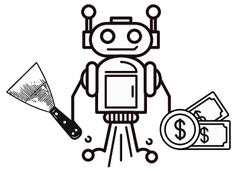
Lately, scrapers take advantage of **RESIP**, increasing the probability of blocking legitimate users

New detection techniques for RESIP are needed



Thank you!
Q&A

More questions? DSN22 Slack or elisa.chiapponi@eurecom.fr

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Sophia Antipolis

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King Abdullah University of Science and Technology

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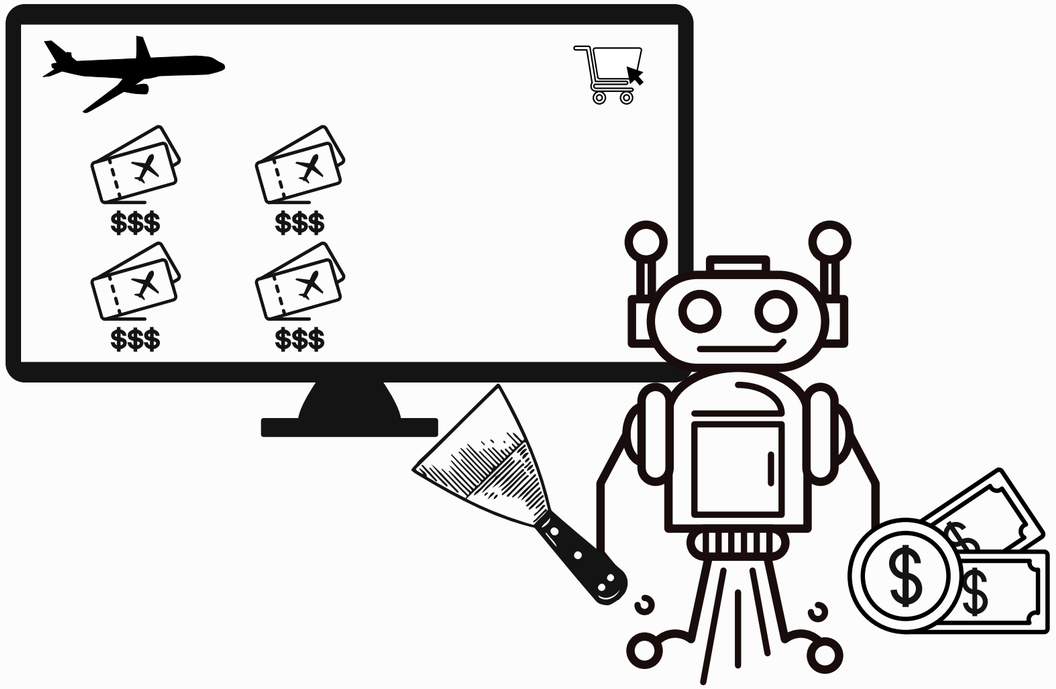
Global Security Operations

An industrial perspective on web scraping characteristics and open issues



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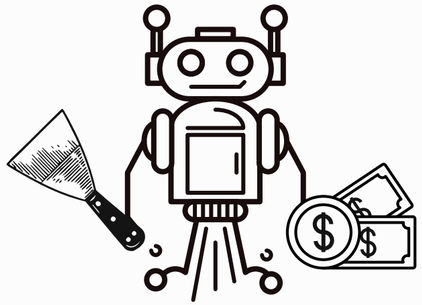
Scraping bots



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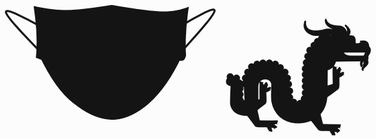
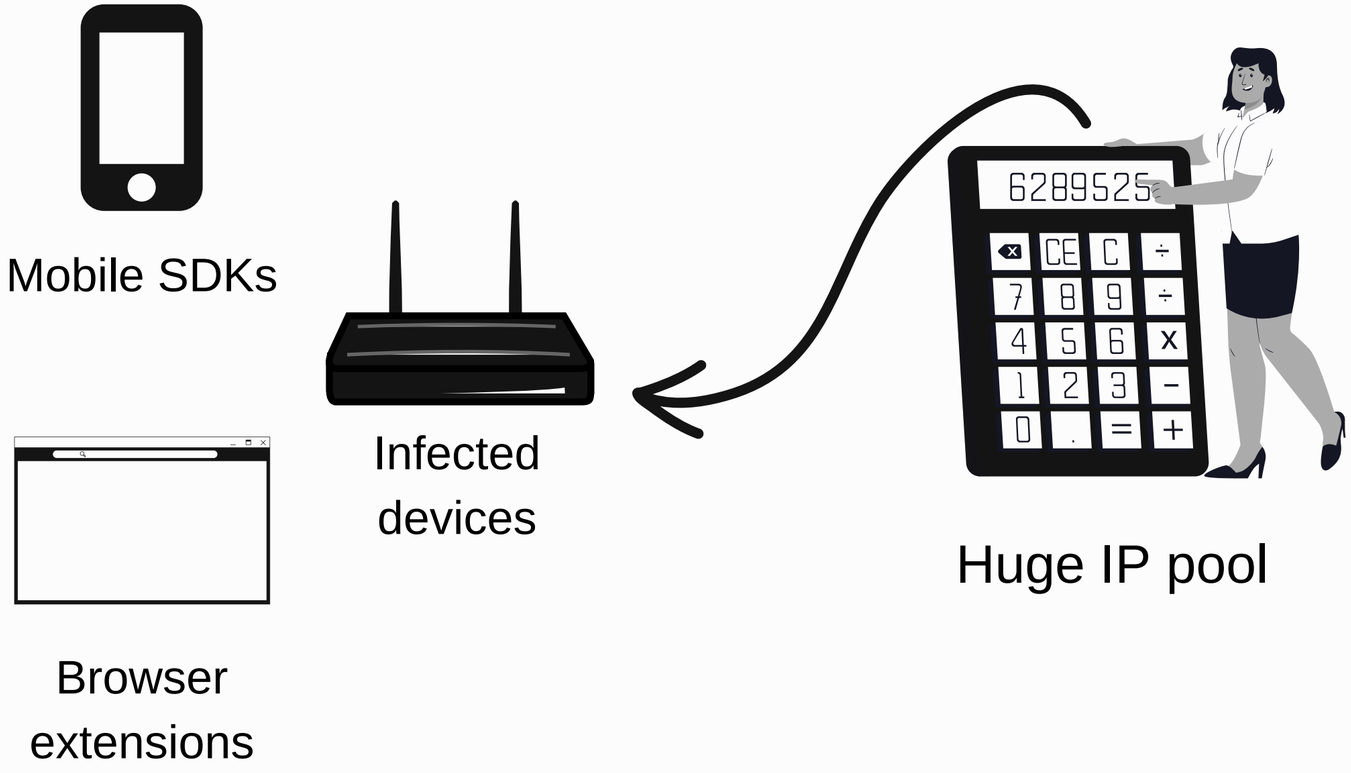
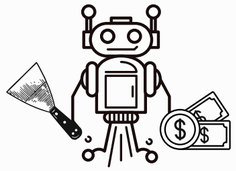


Evolving with market conditions

RESIP devices



Who are we?



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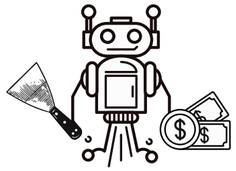
  - Ph.D. student at EURECOM, collaboration with Amadeus IT Group.
- **Marc Dacier**
  - Professor and associate director of RC3, KAUST
- **Olivier Thonnard**
  - Director of Global Security Operations, Amadeus IT Group
- **Mohamed Fangar**
  - Associate Manager at Application Security Operation Center, Amadeus IT Group
- **Mattias Mattsson**
  - Senior Security Analyst, Sentor MSS AB for Amadeus IT Group
- **Vincent Rigal**
  - Head of Application Security Operations Center, Amadeus IT Group



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