HoPLA: a Honeypot PLatform to Lure Attackers

Elisa Chiapponi - EURECOM
Onur Catakoglu - Amadeus IT Group
Olivier Thonnard - Amadeus IT Group
Marc Dacier- EURECOM

EURECOM
Sophia Antipolis

amadeus
Global Security Operations

Who are we?

Elisa Chiapponi

- Ph.D. student at EURECOM, collaboration with Amadeus IT Group
- Analysis and mitigation of the new generation of botnet

Dr. Onur Catakoglu

- Information Security Architect, GSO Amadeus IT Group

Dr. Olivier Thonnard

- Senior Security Expert, Tech Lead GSO Amadeus IT Group

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Our Agenda

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1. Introduction
and motivations

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2. Experimental setup

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3. Results and discussion

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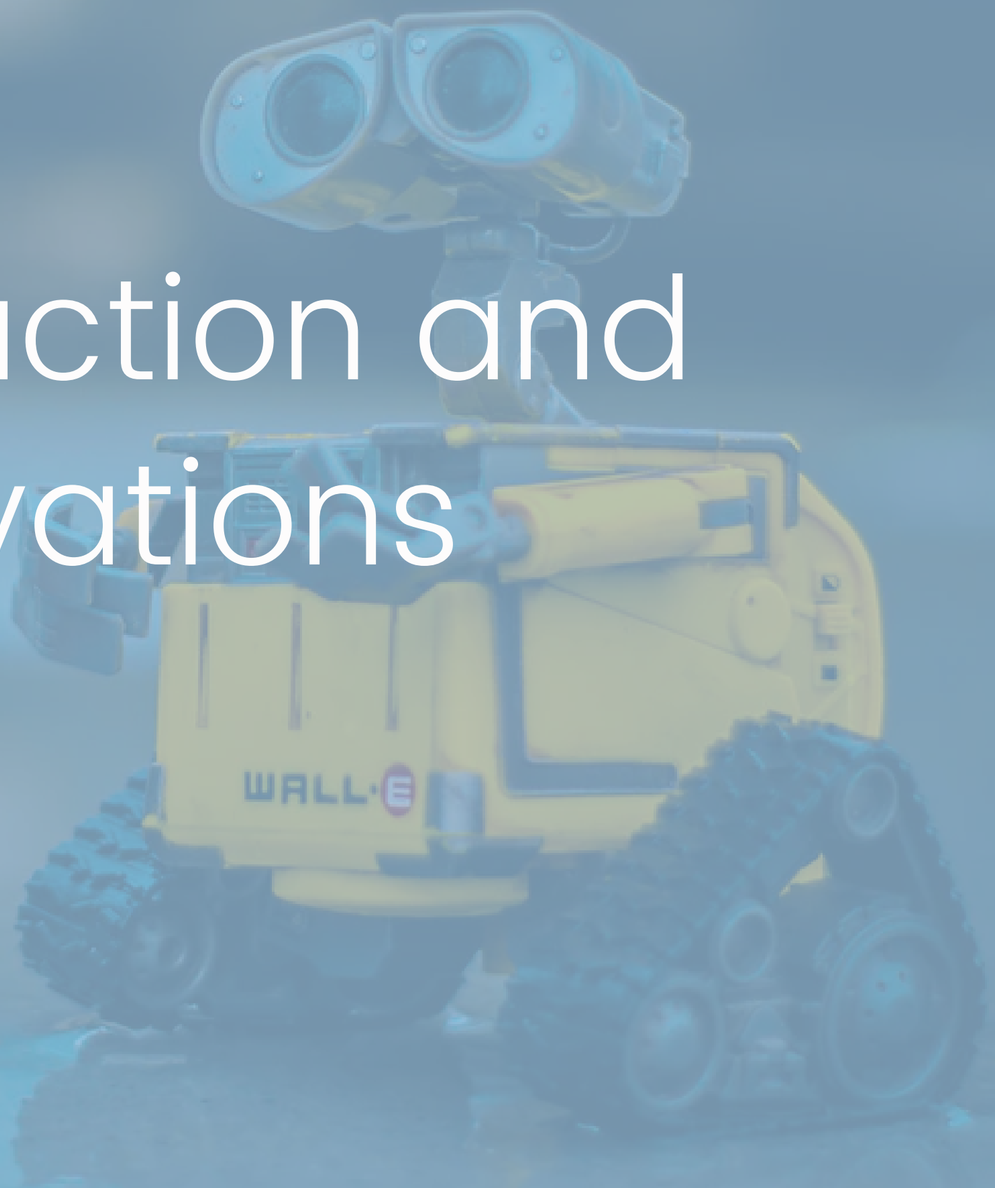
2. Experimental setup

3. Results and discussion

4. Conclusions and future works

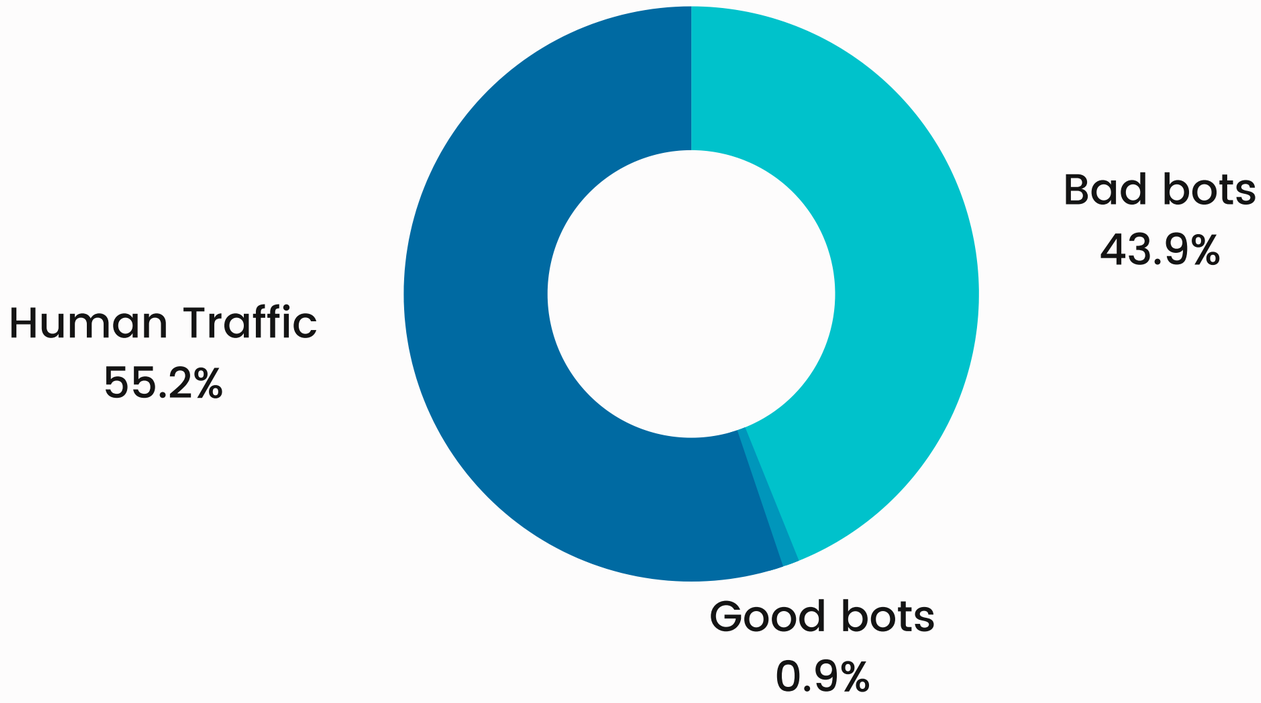
1. Introduction and motivations



Web scraping

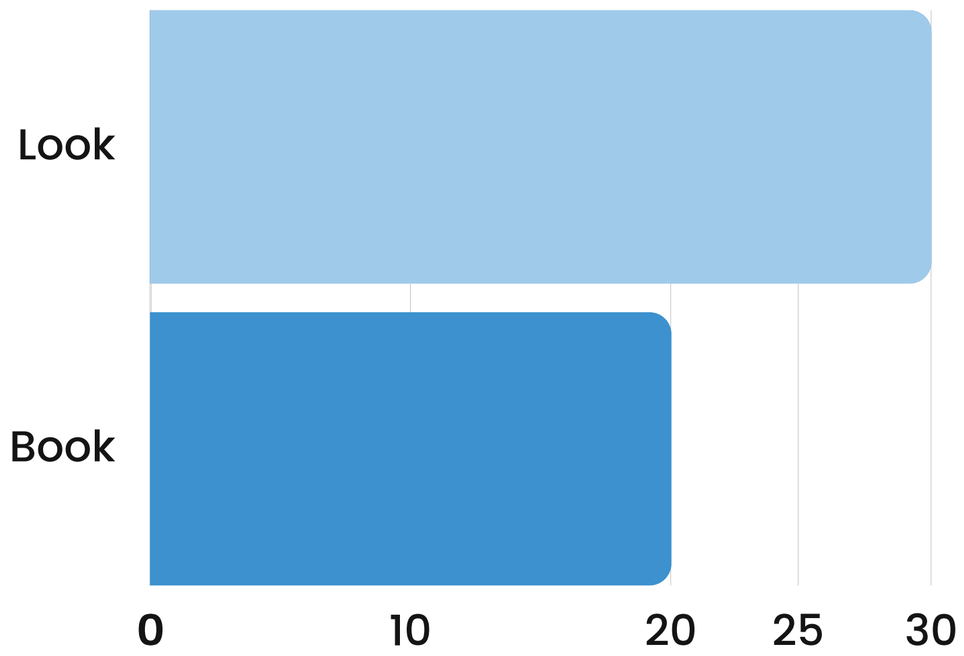
Web scraping is the periodical or continuous retrieval of accessible data and/or processed output contained in web pages.

Scraping bots and airlines



How bots affect airlines - Imperva 2019

Look-to-book ratio



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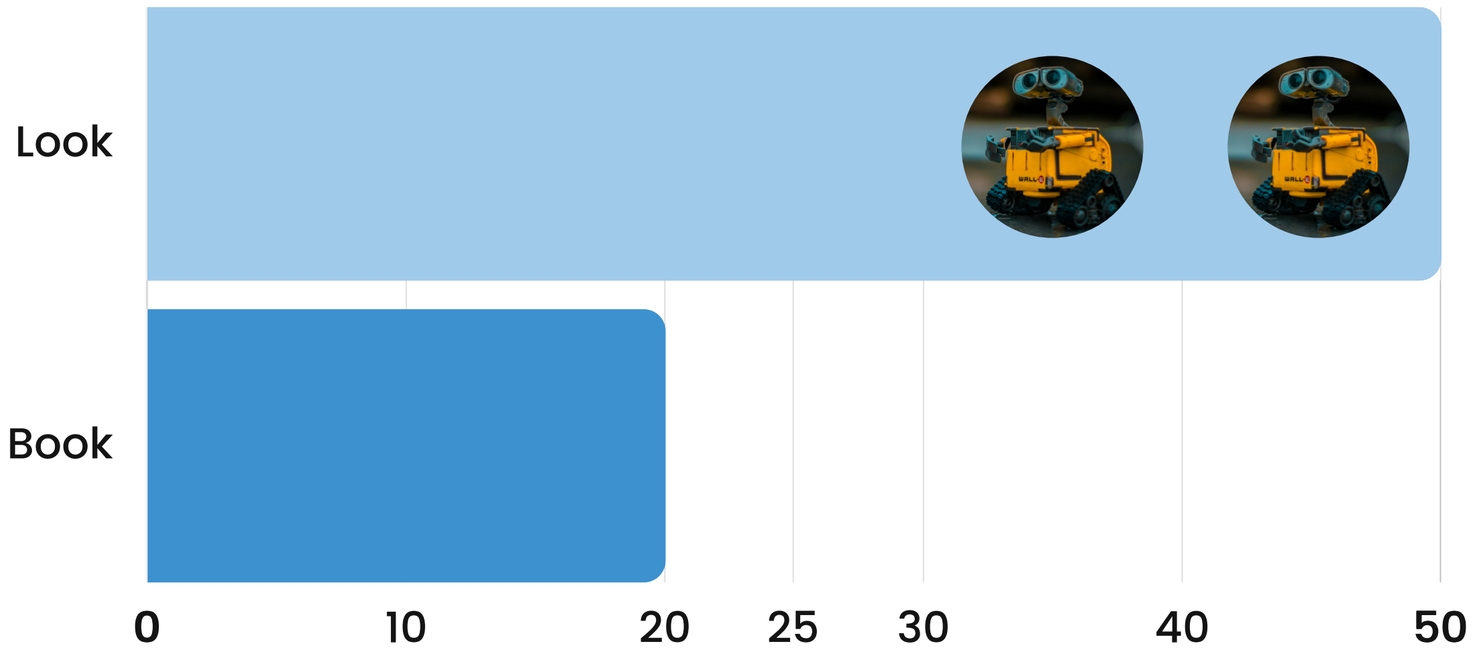

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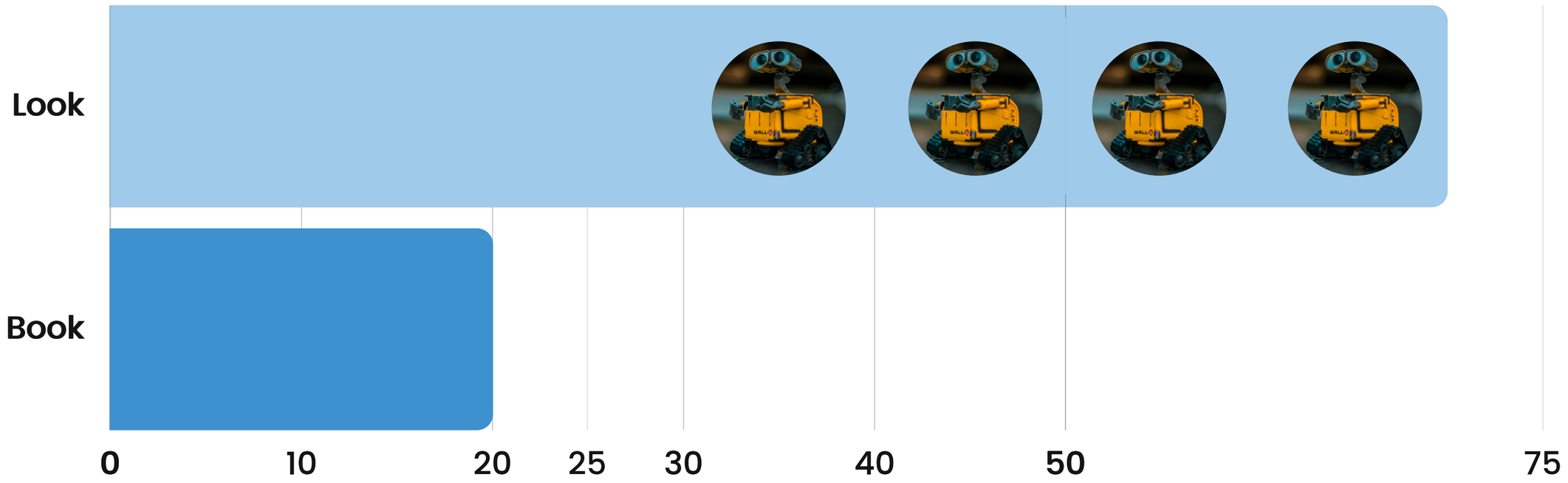

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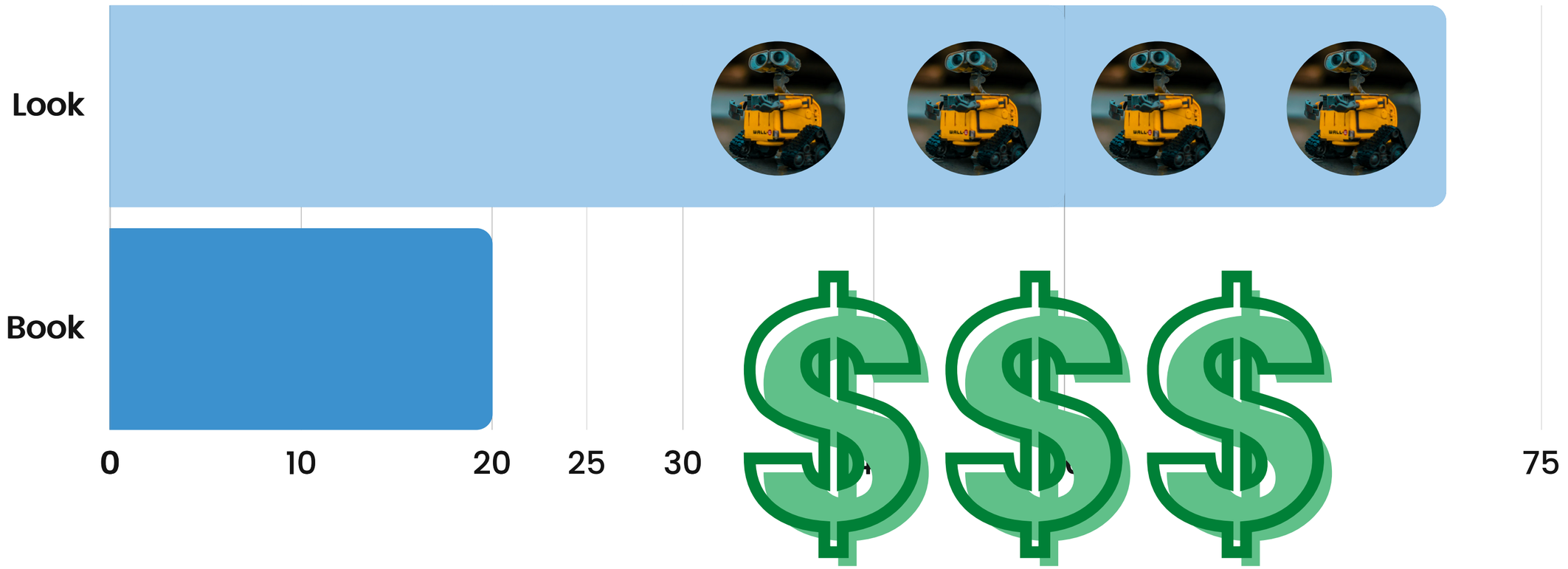
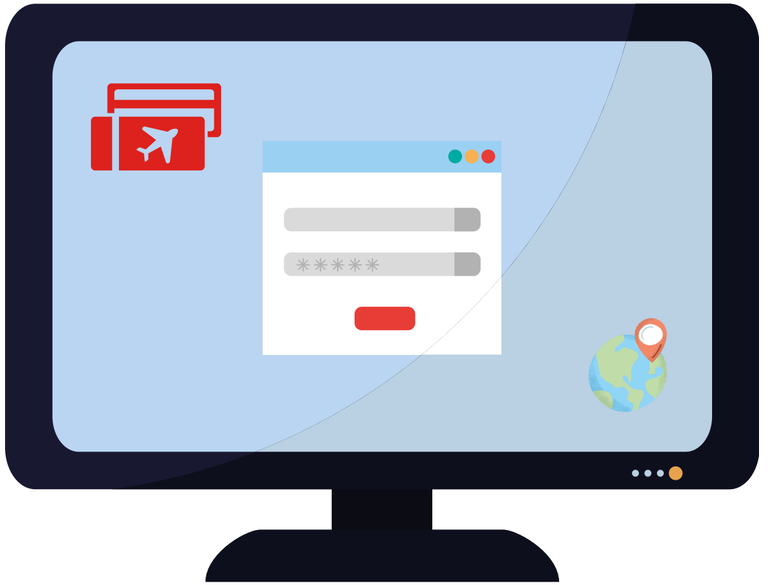
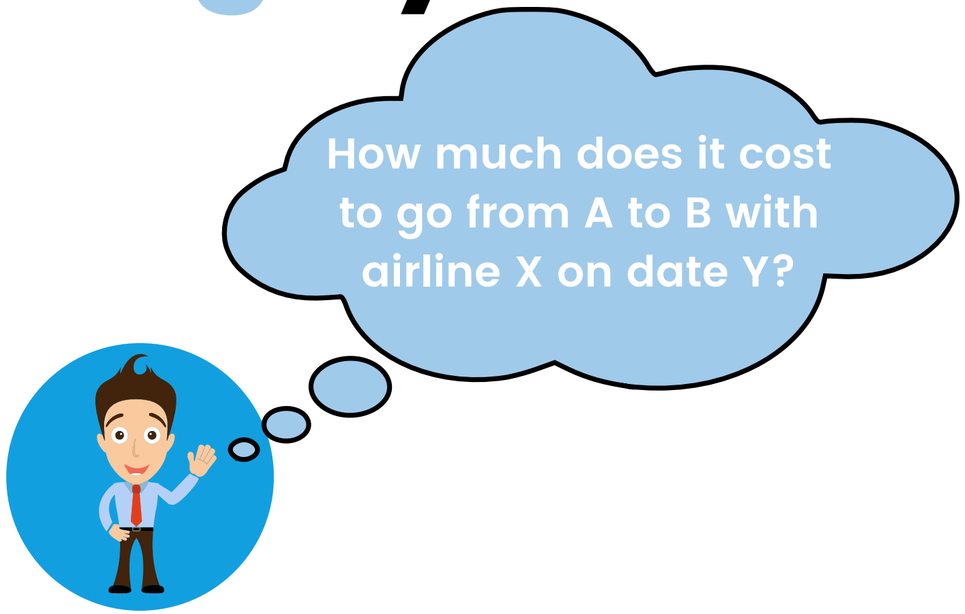


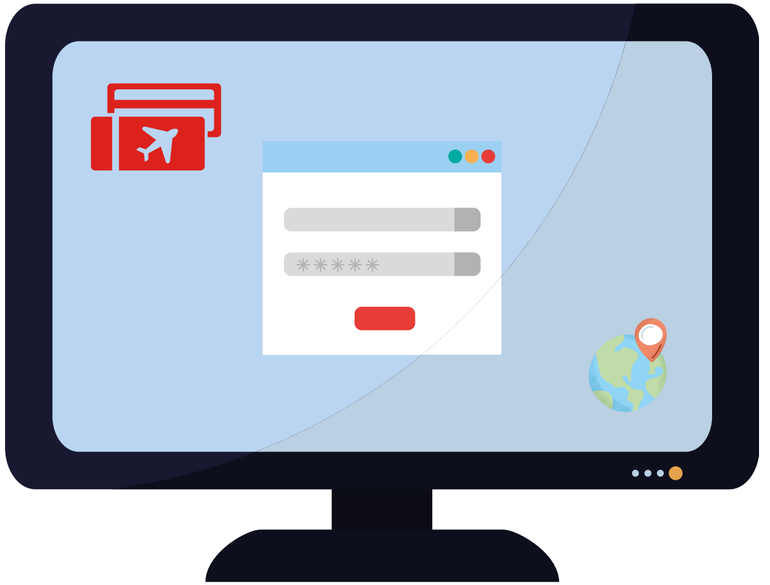
Booking systems



Booking domain
of airline X

Booking systems





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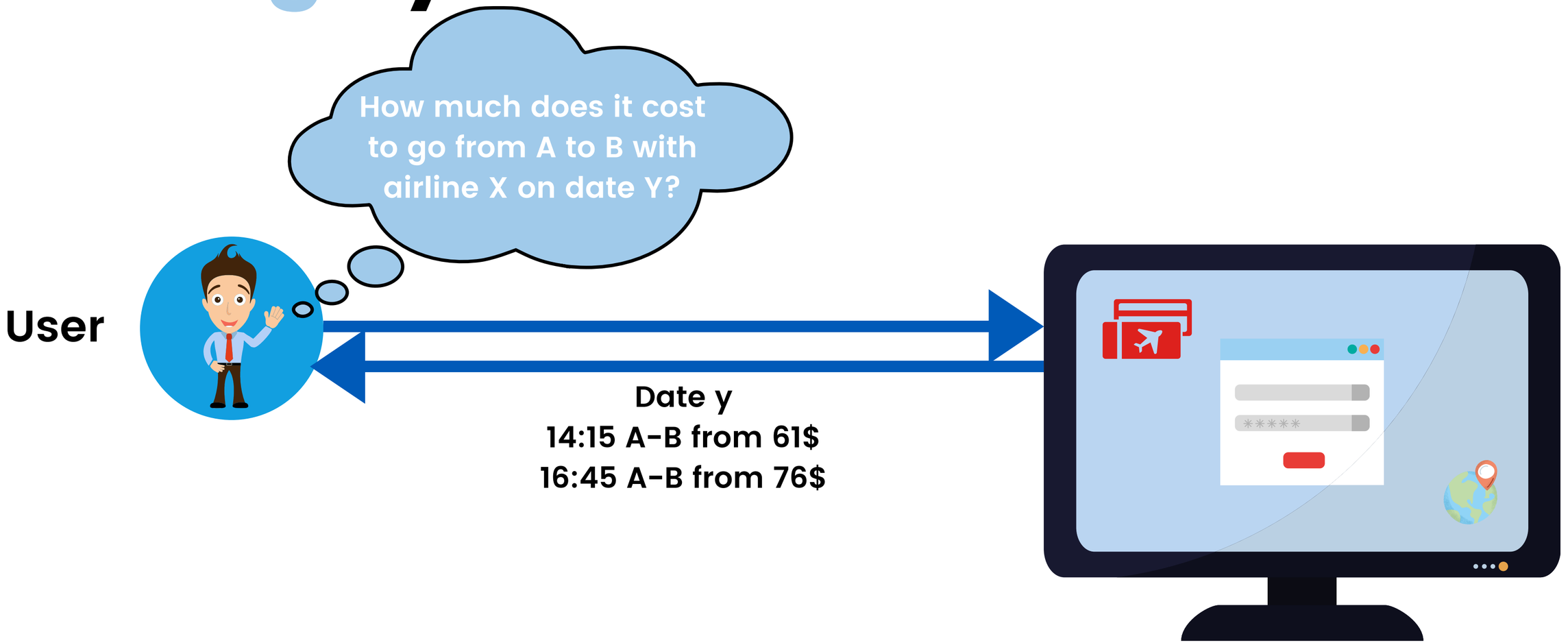
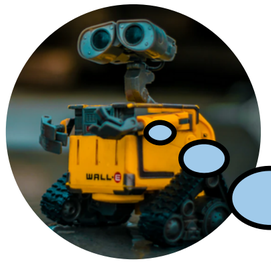


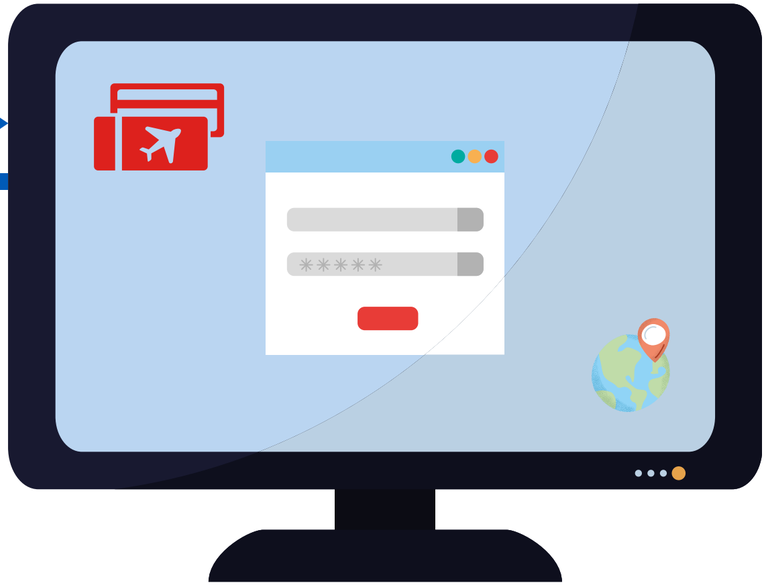
Booking systems

User

Bot



Obtain all the fares of the week J from A to B for airline X to find the best price



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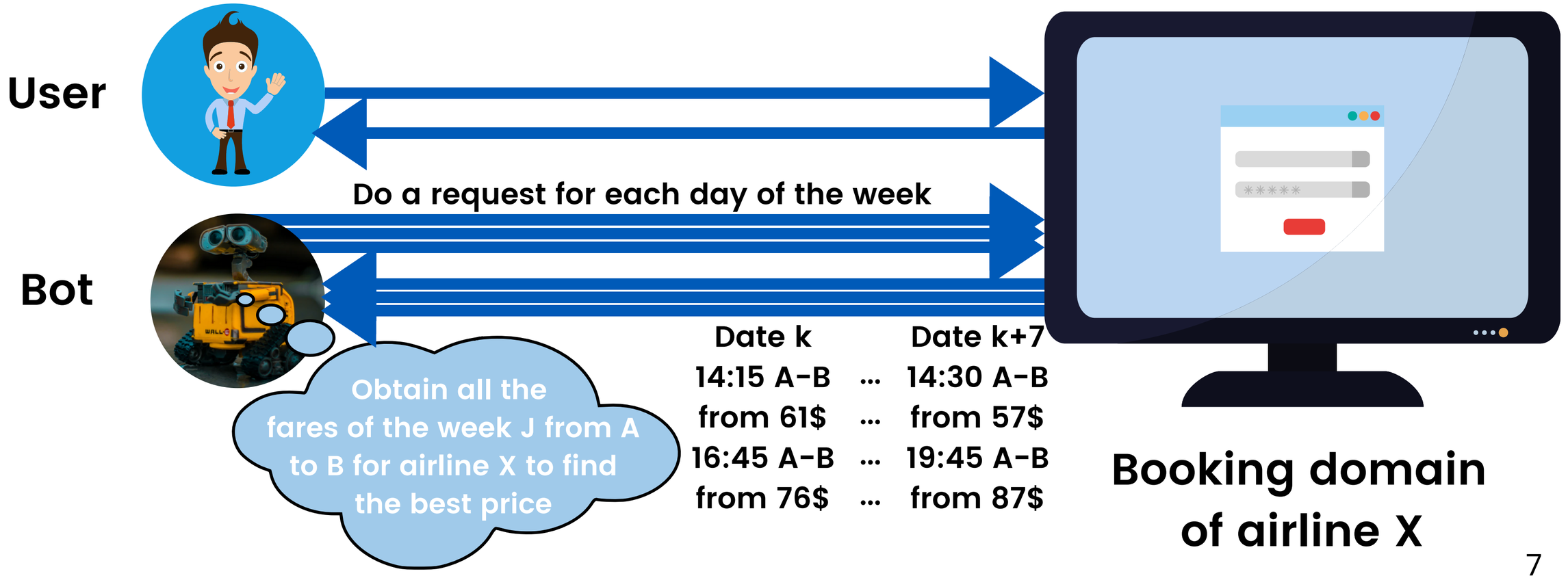
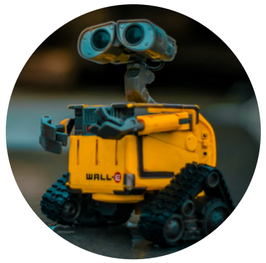
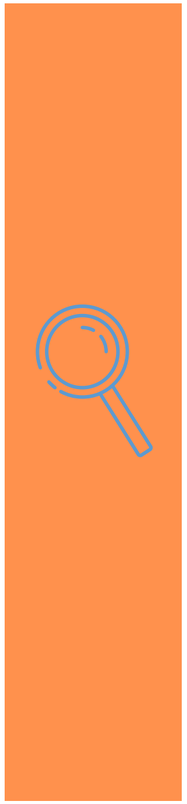


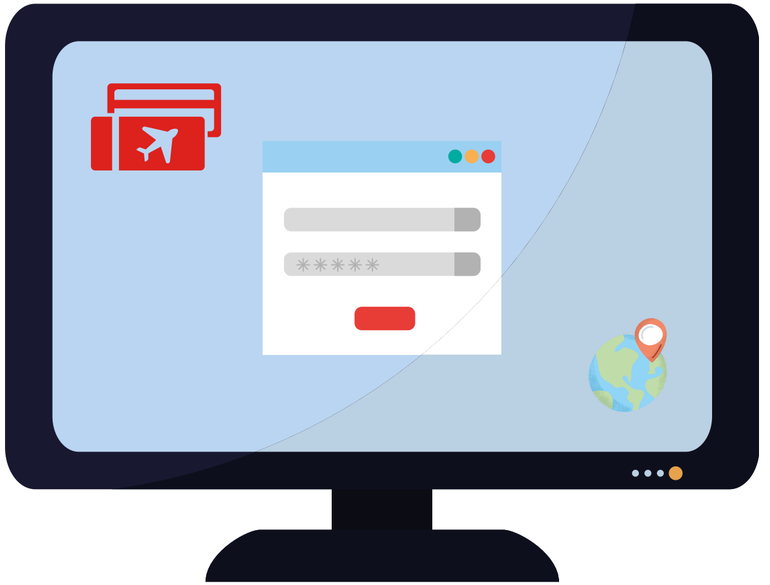
Anti-bot solutions

User

Bot







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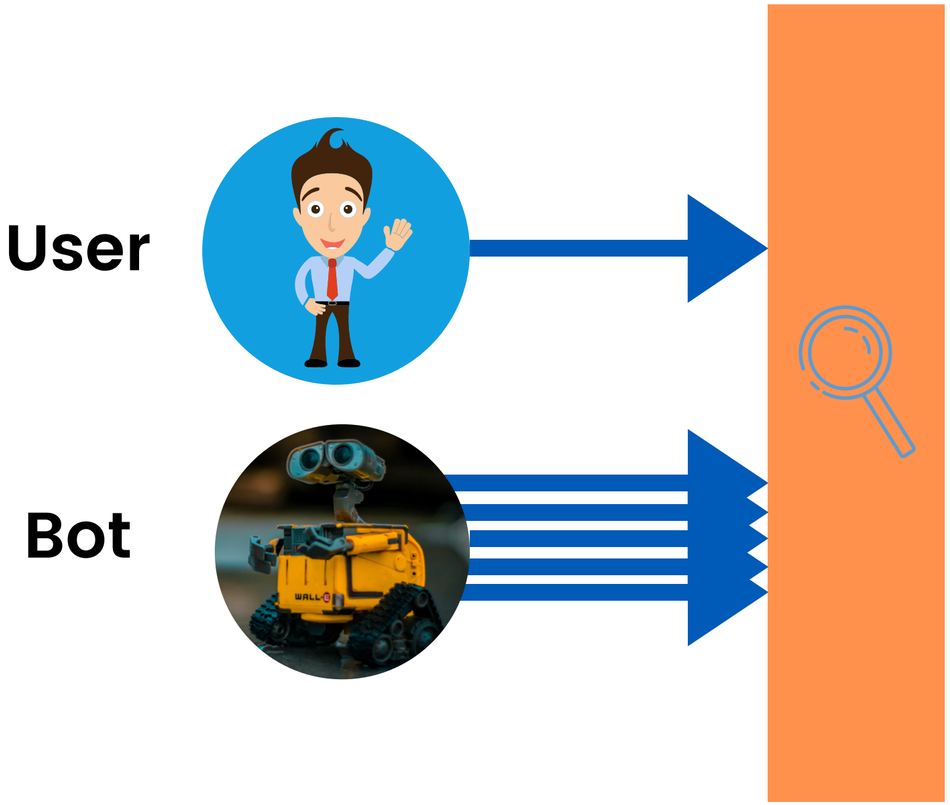

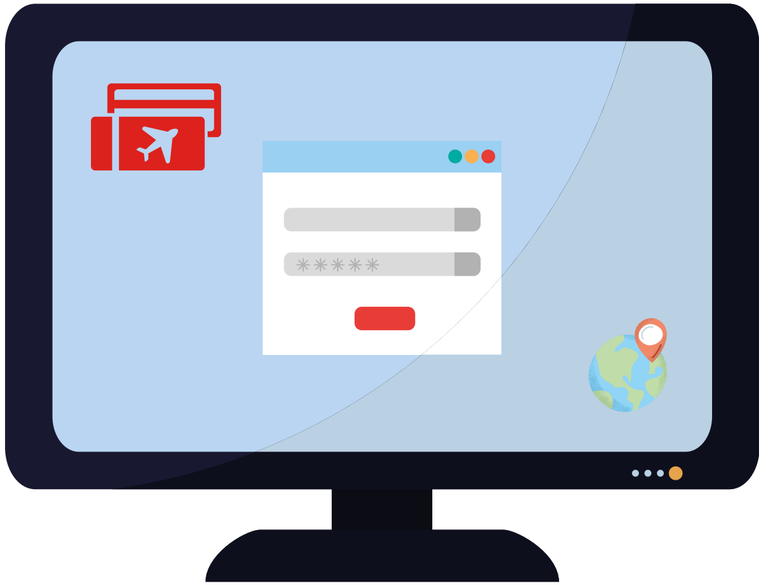

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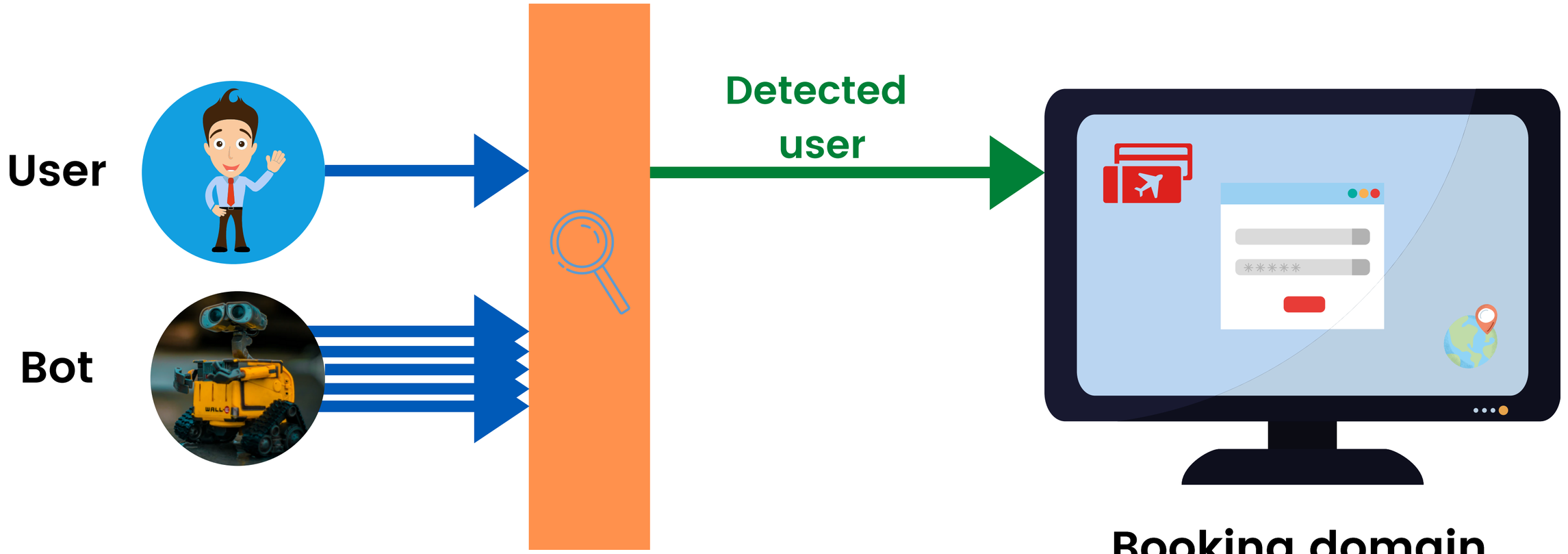

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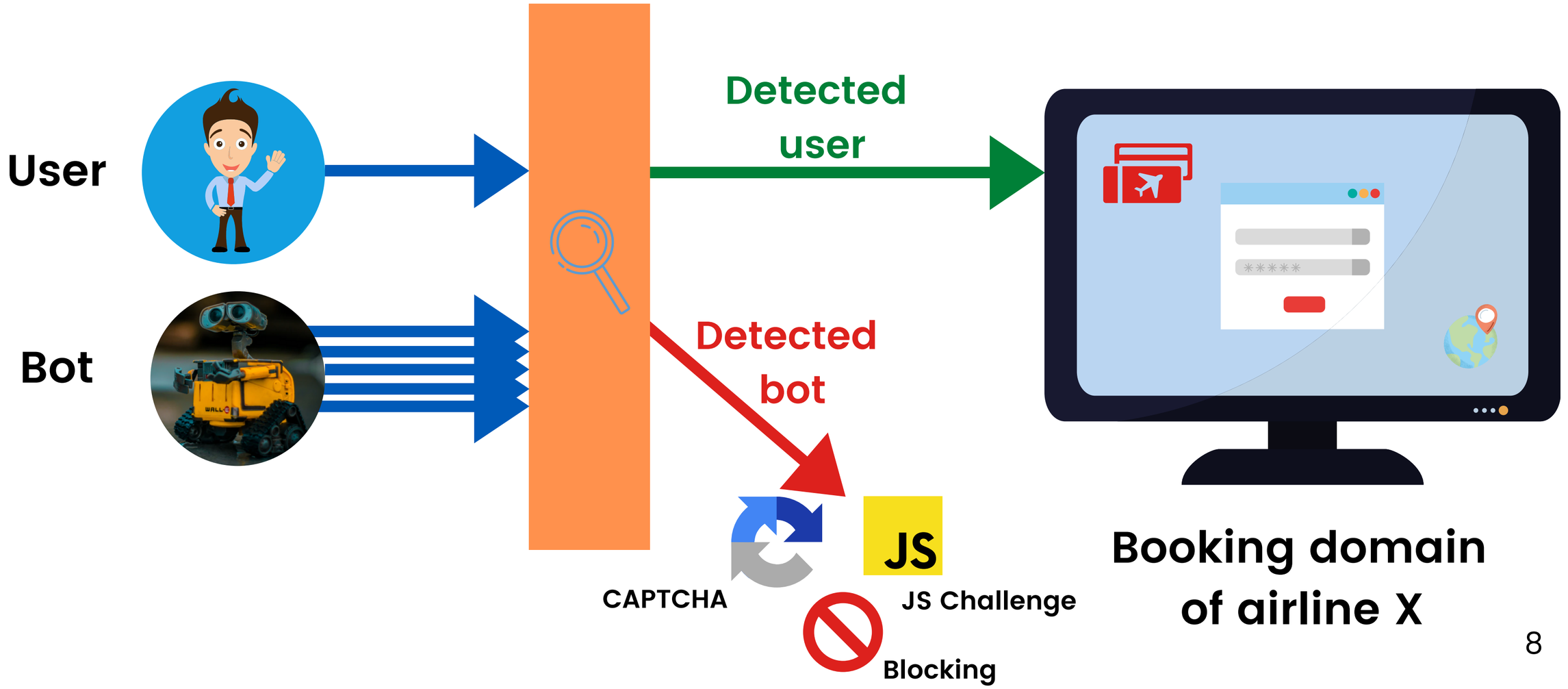

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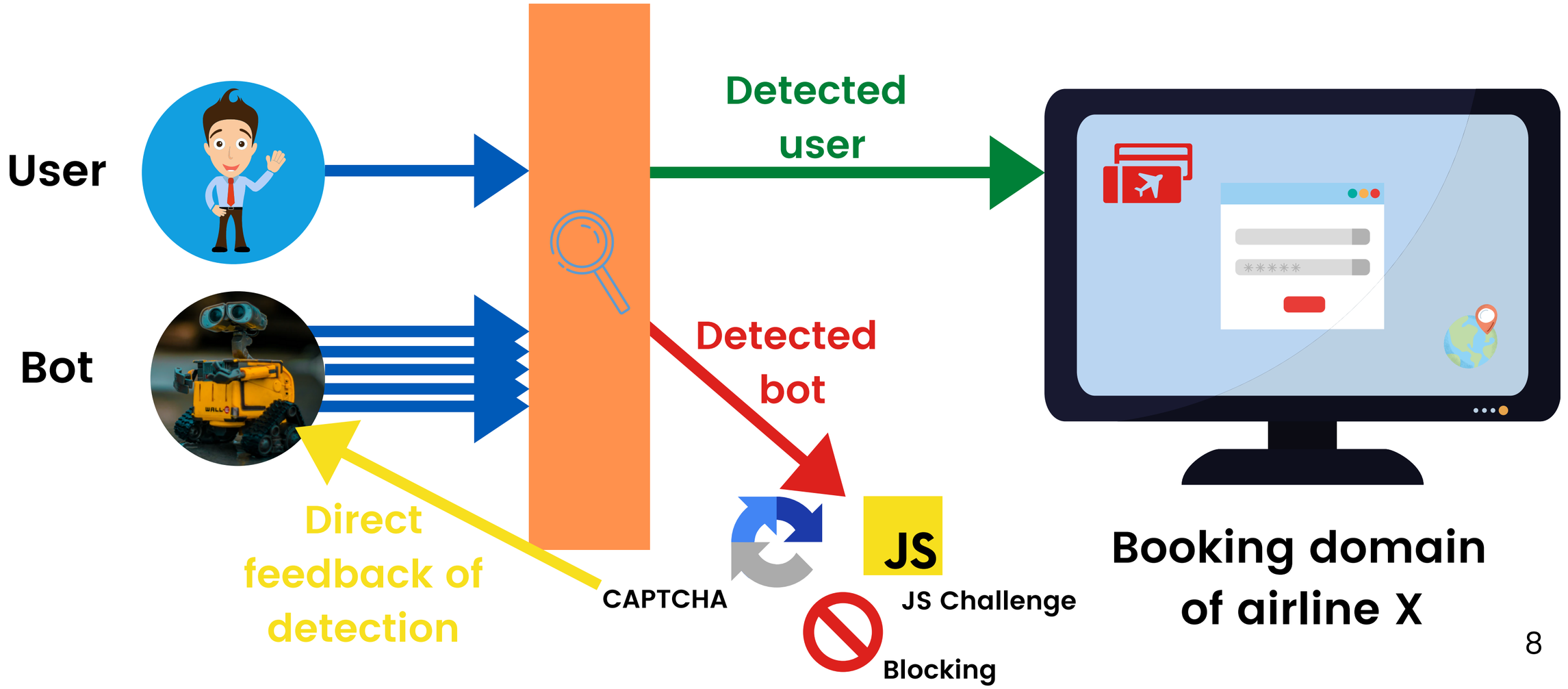

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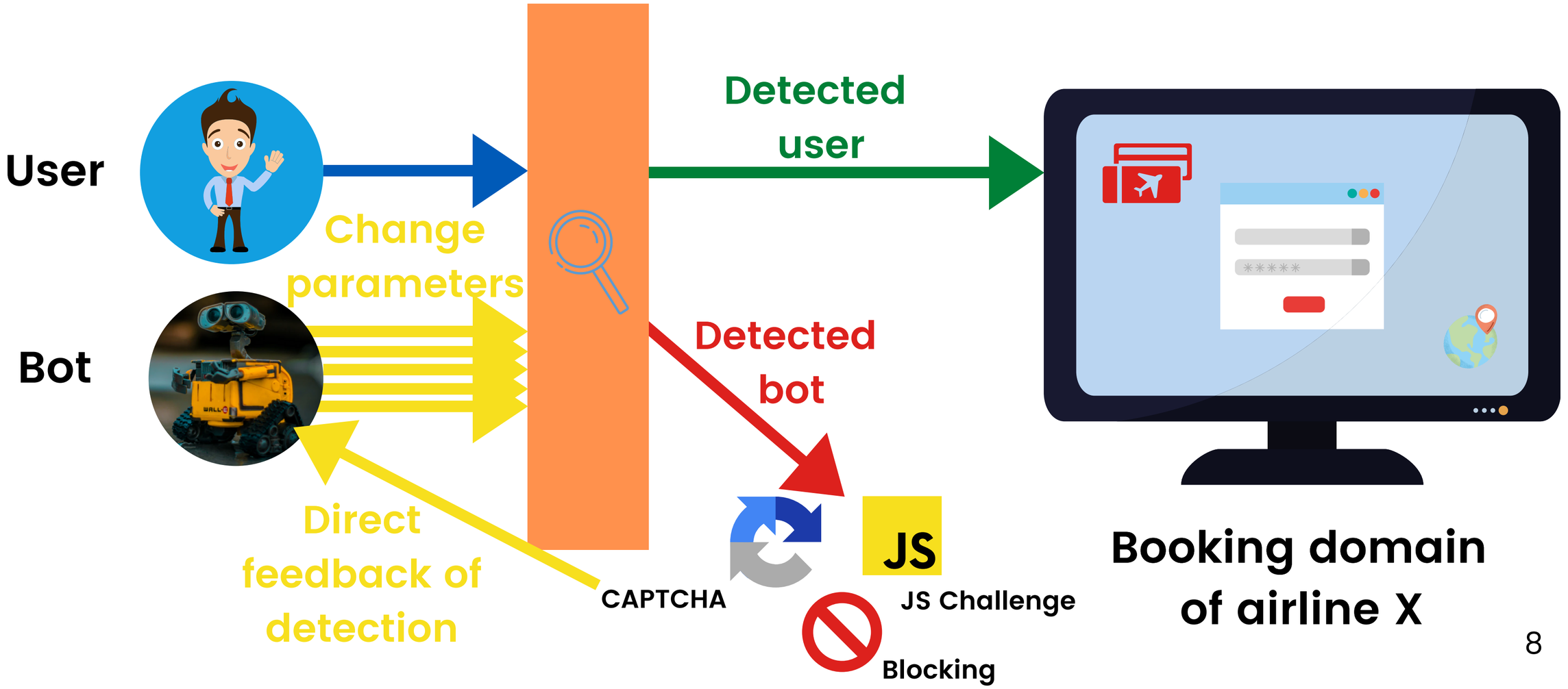

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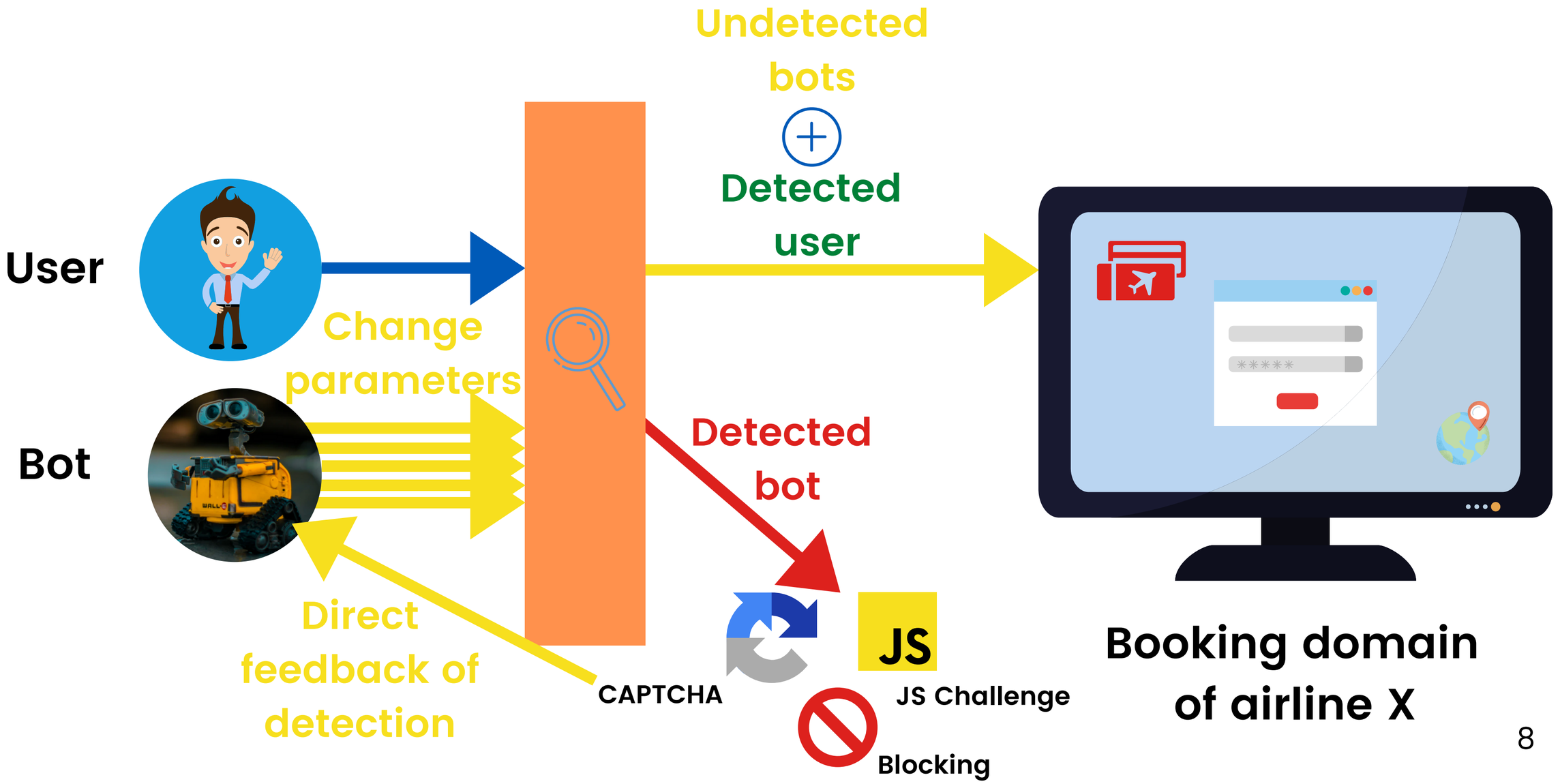

What 3rd parties works tell us

Blocked bots die

- Continuous verification of stealthiness and efficacy of the bots
- Rapid modification to avoid detection

Harnessed information is verified

- Continuous verification of the correctness of the information
- Incorrect information is a direct feedback they have been detected

New approach

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Prevent bots to know they have been detected & save costs for the provider

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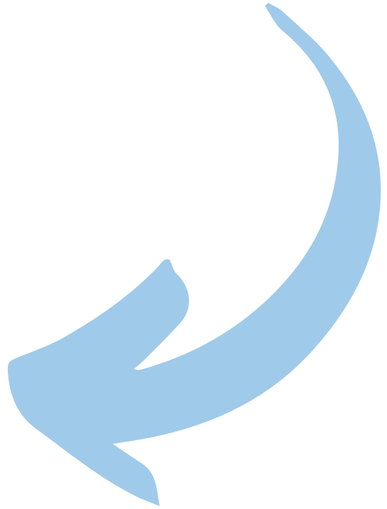

Provide bots incorrect but plausible answers

Our discoveries

1. Identification of specific super stealthy bots, with extreme distribution of activity (one request per IP in most cases)

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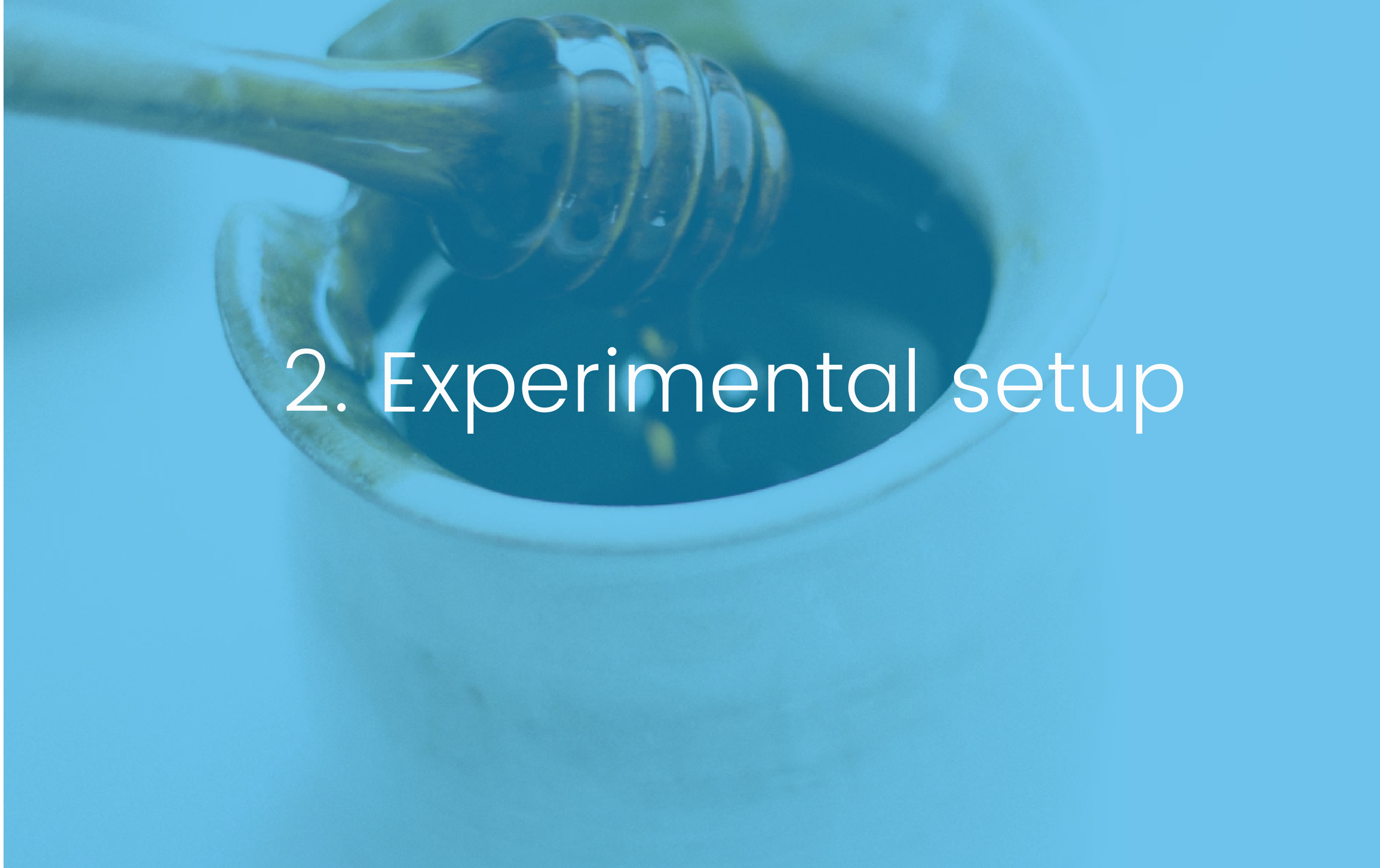
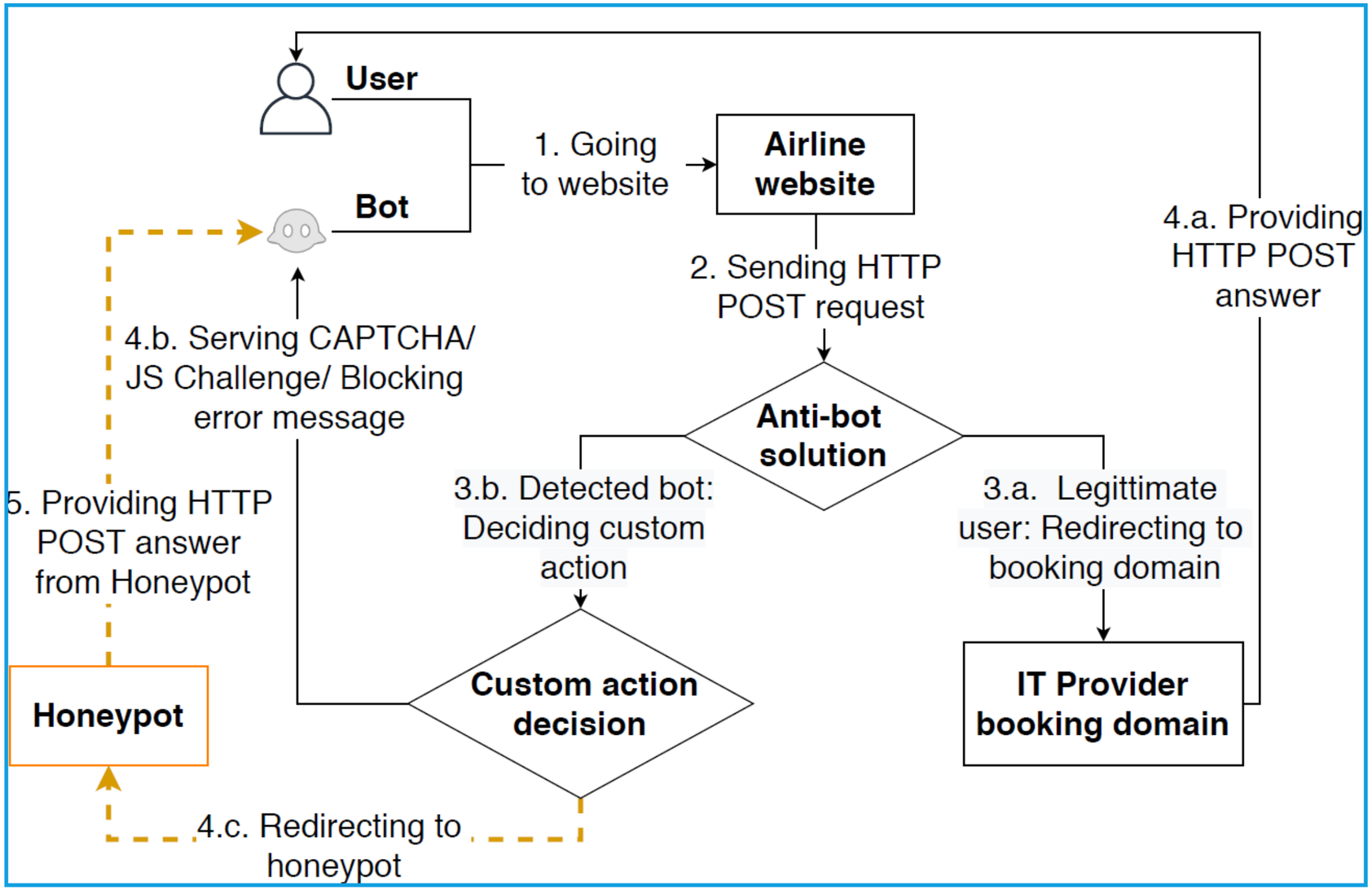
3. Success in providing inaccurate information without being detected



2. Experimental setup

The architecture



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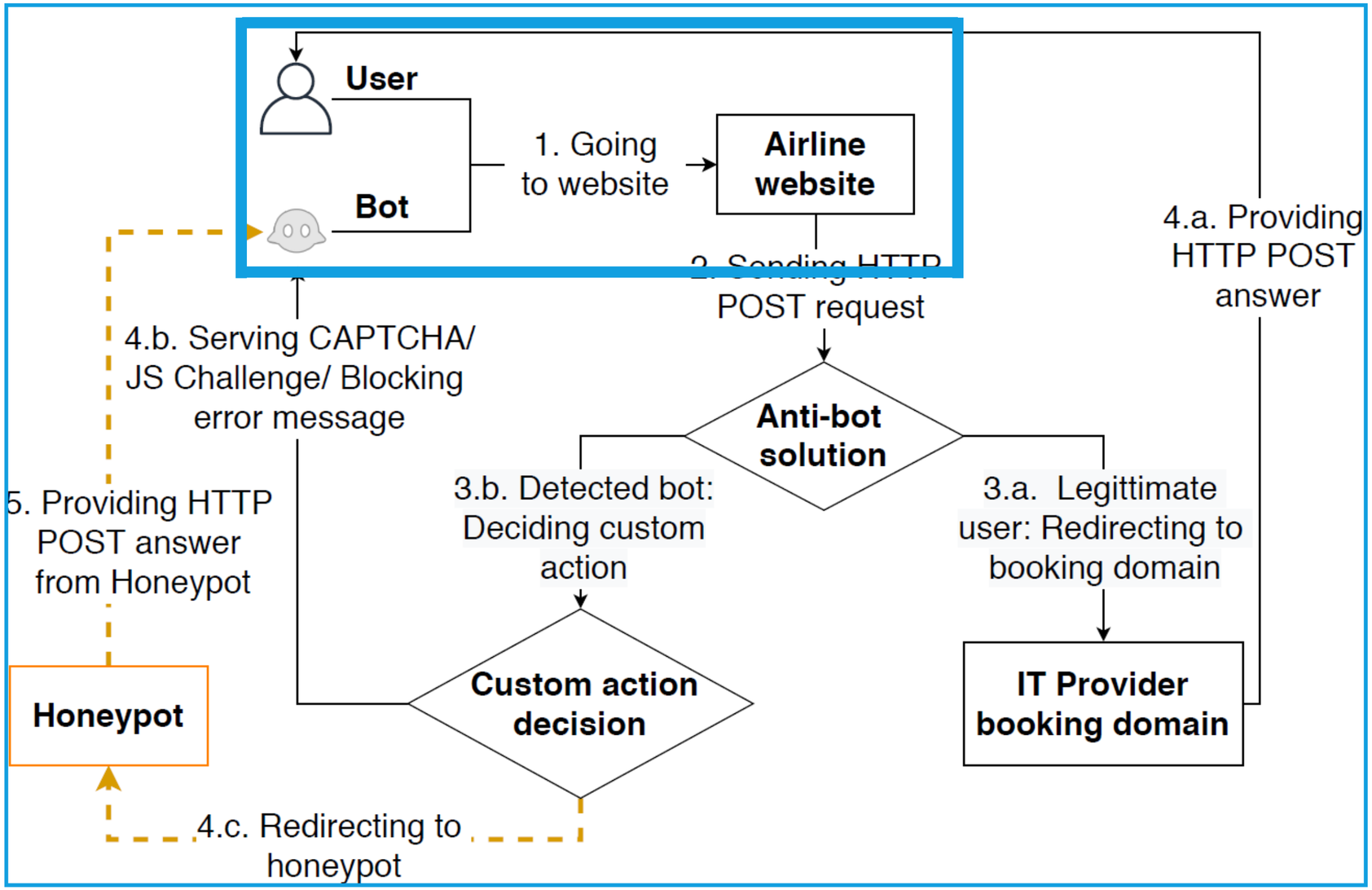

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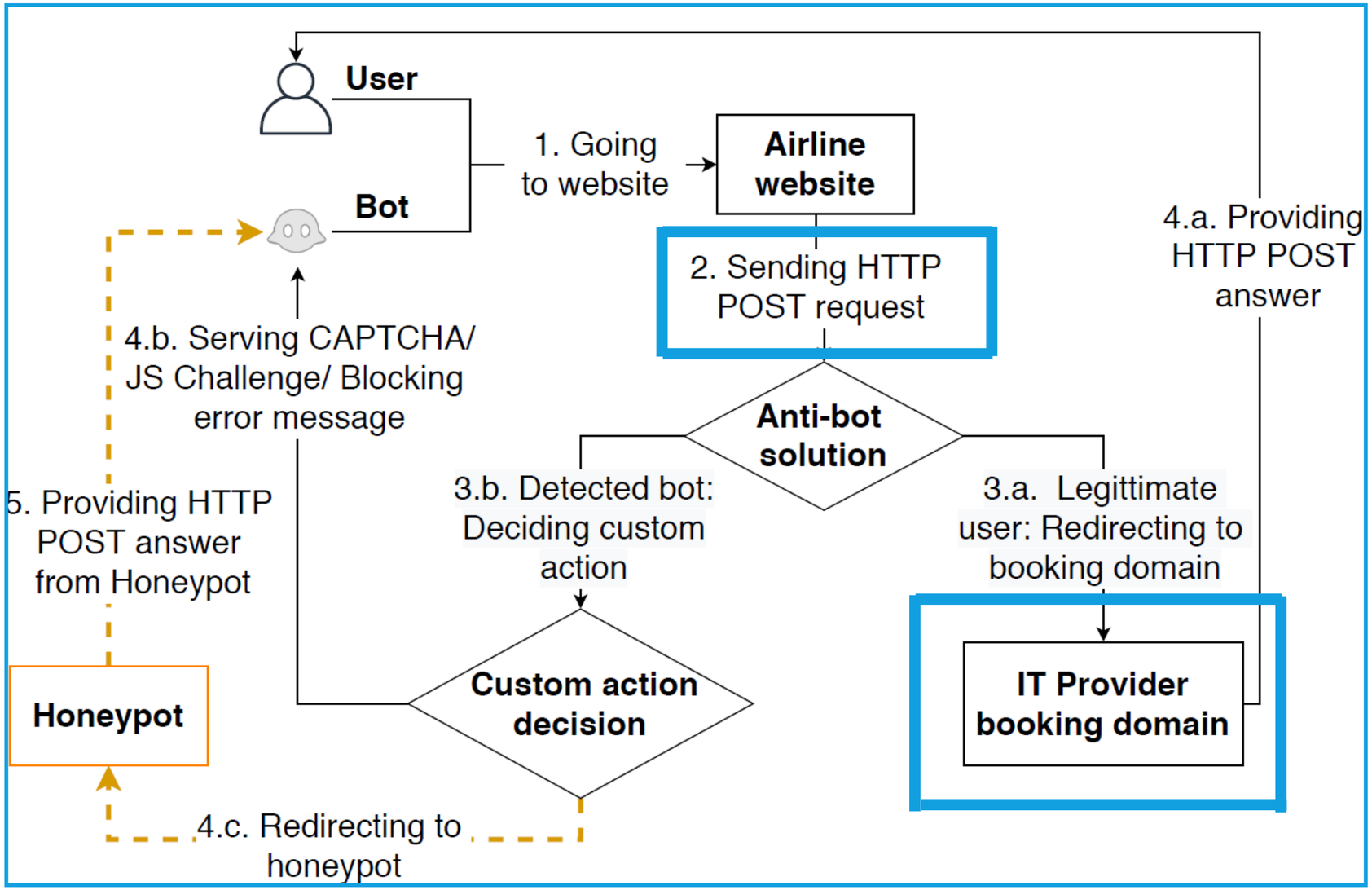

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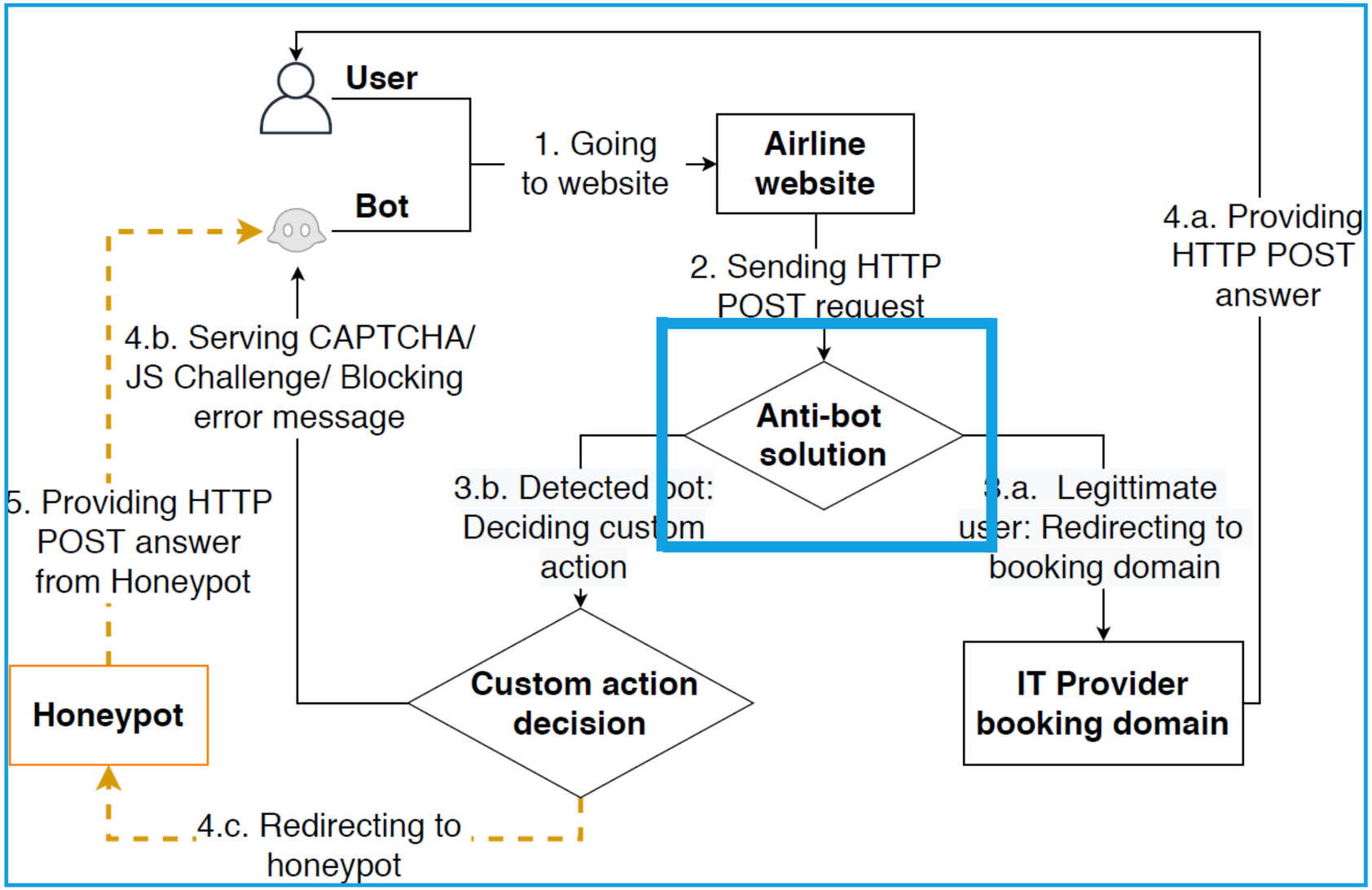

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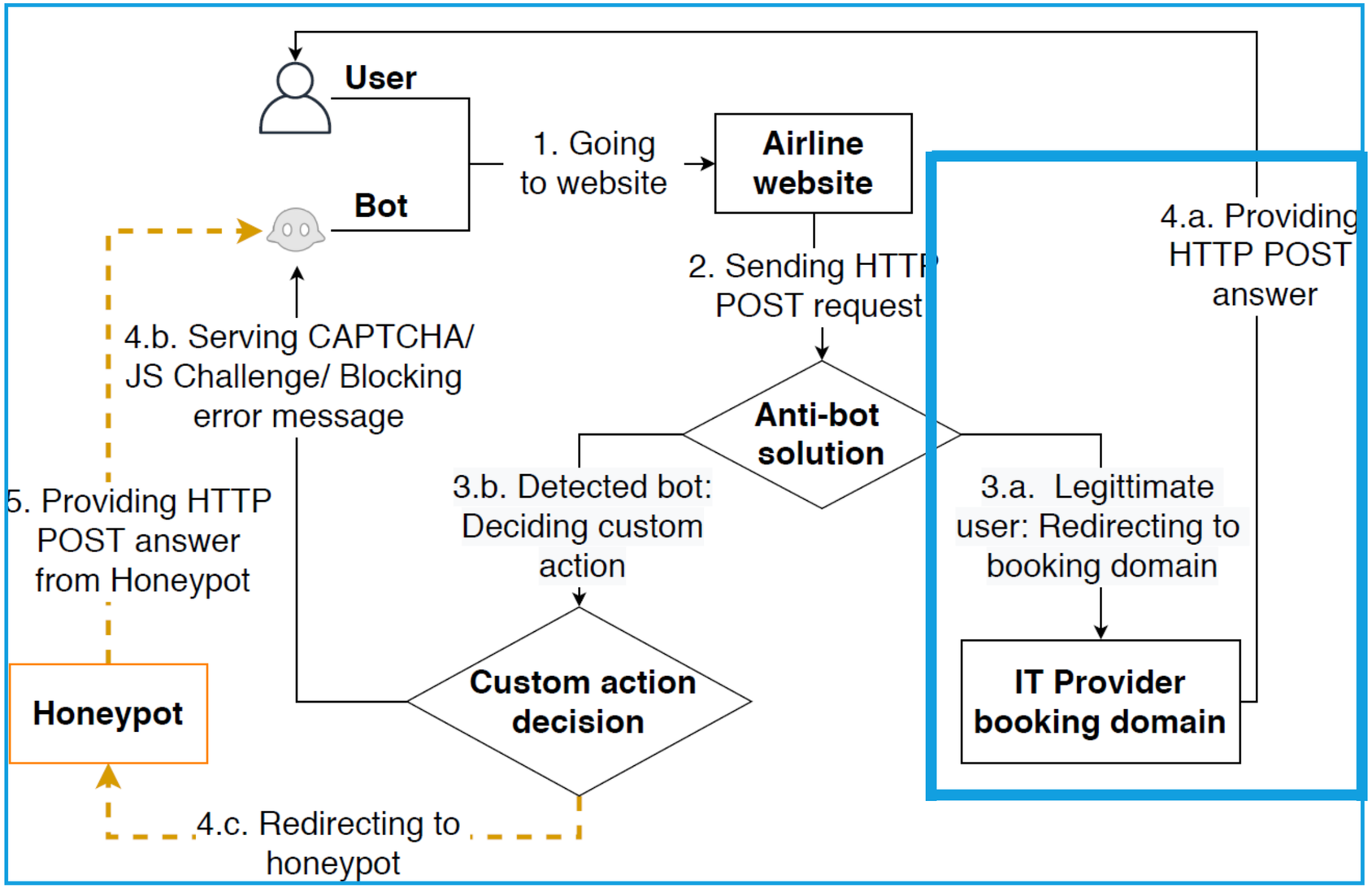

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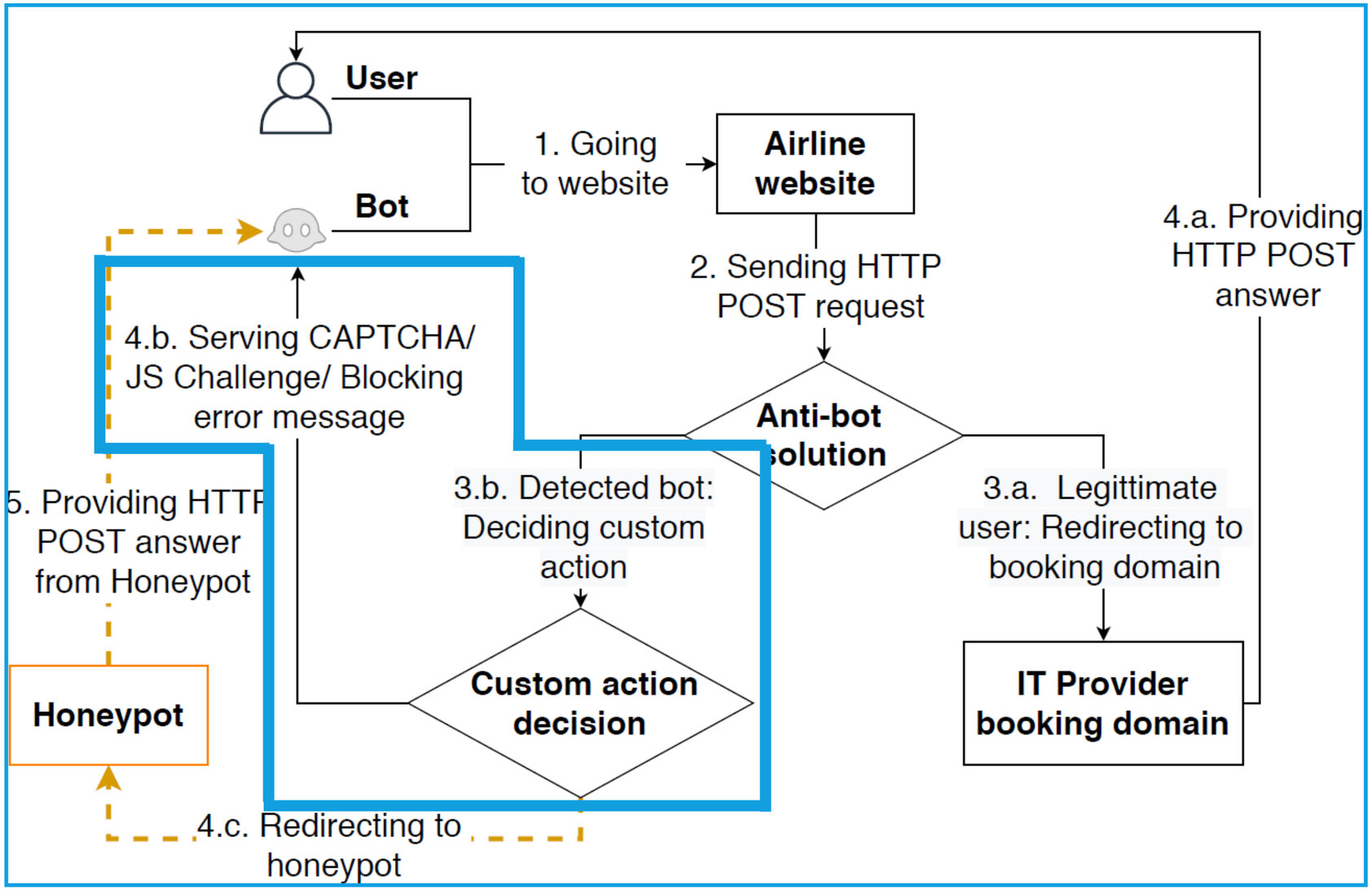

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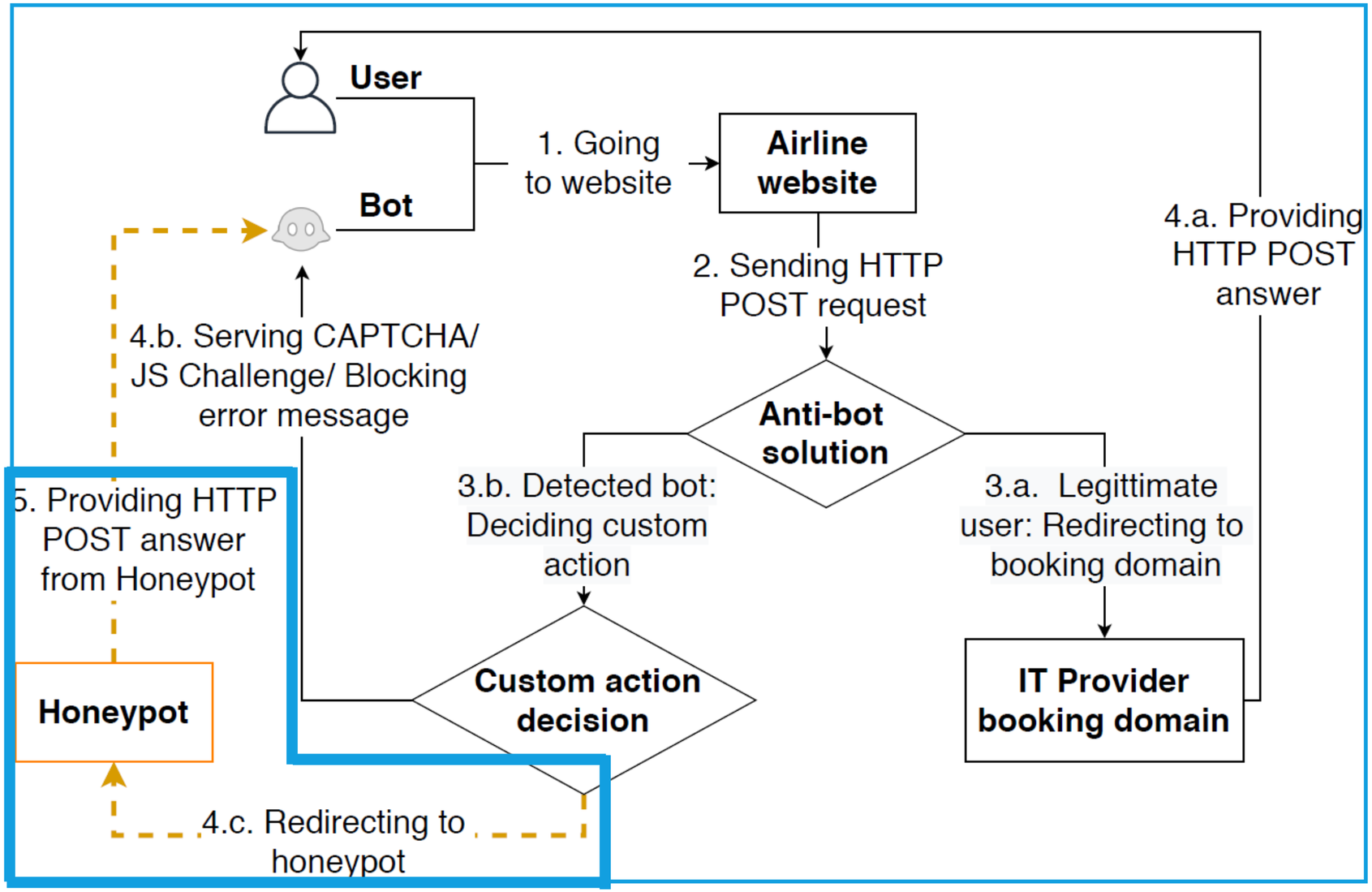

Some numbers...

Pilot airline

Ticketing system: 1 million requests per day, 40% detected as coming from bad bots

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Chosen bot

40-minutes daily time window of activity, no bookings, 400-500 requests per day

Pricing strategy

After 3 days, modification of fares: increase 10% of the requests by 5%

Goal: understanding if the bot master was checking for anomalies in the price

3. Results and discussion

General analysis

- Experiment running for 56 days (interruption linked with COVID-19 restrictions on flights)

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- Reception of 22,991 HTTP request at the Honeypot

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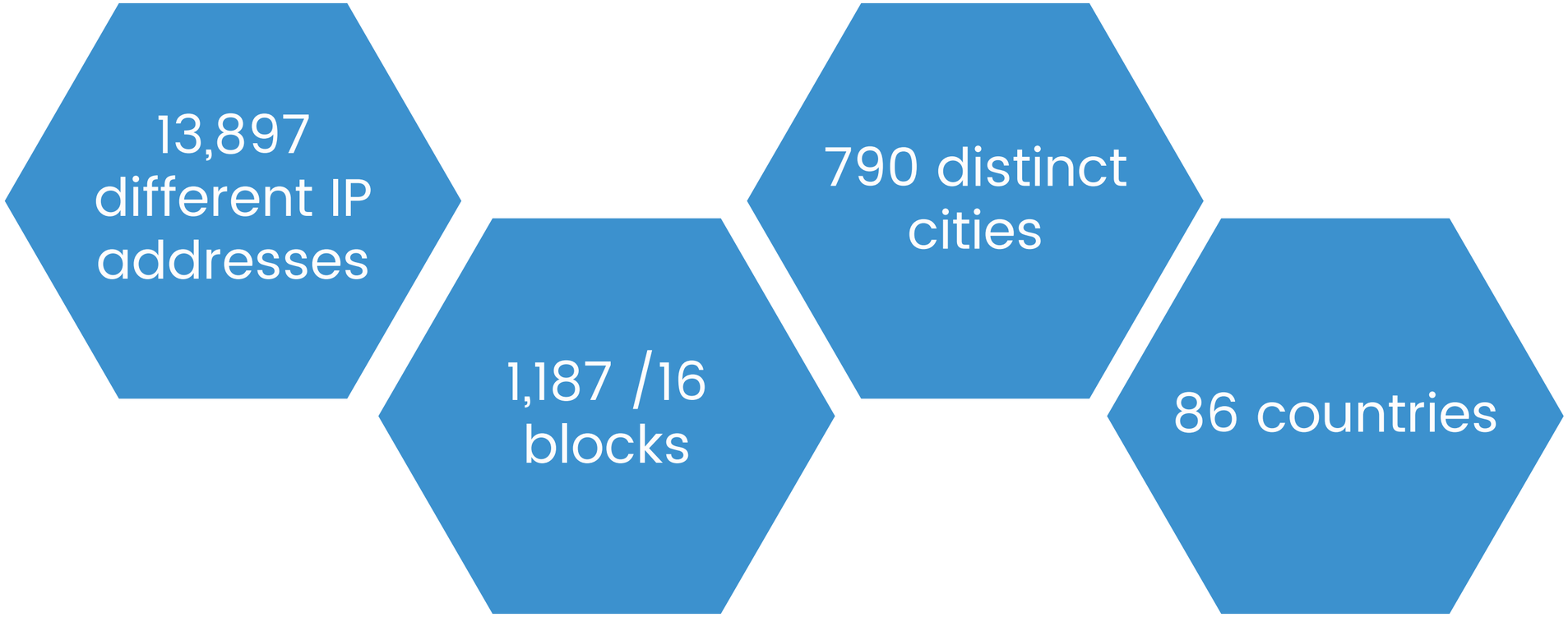
- Reception of 22,991 HTTP requests at the Honeypot
- No change of behavior from before and during the experiment

Lessons learned modifying values

No ground truth to compared returned values

Plausibility check not sophisticated enough for small changes

IP addresses study



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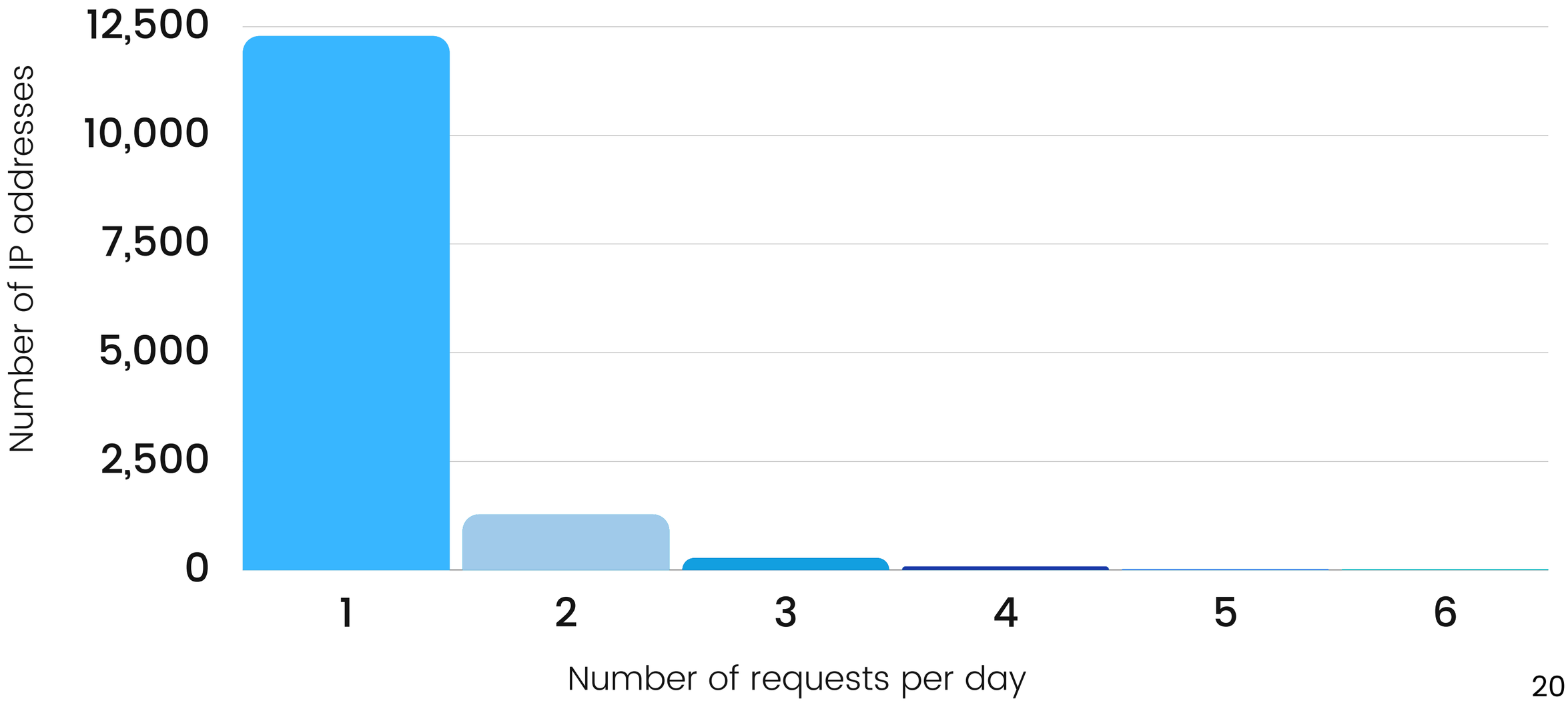

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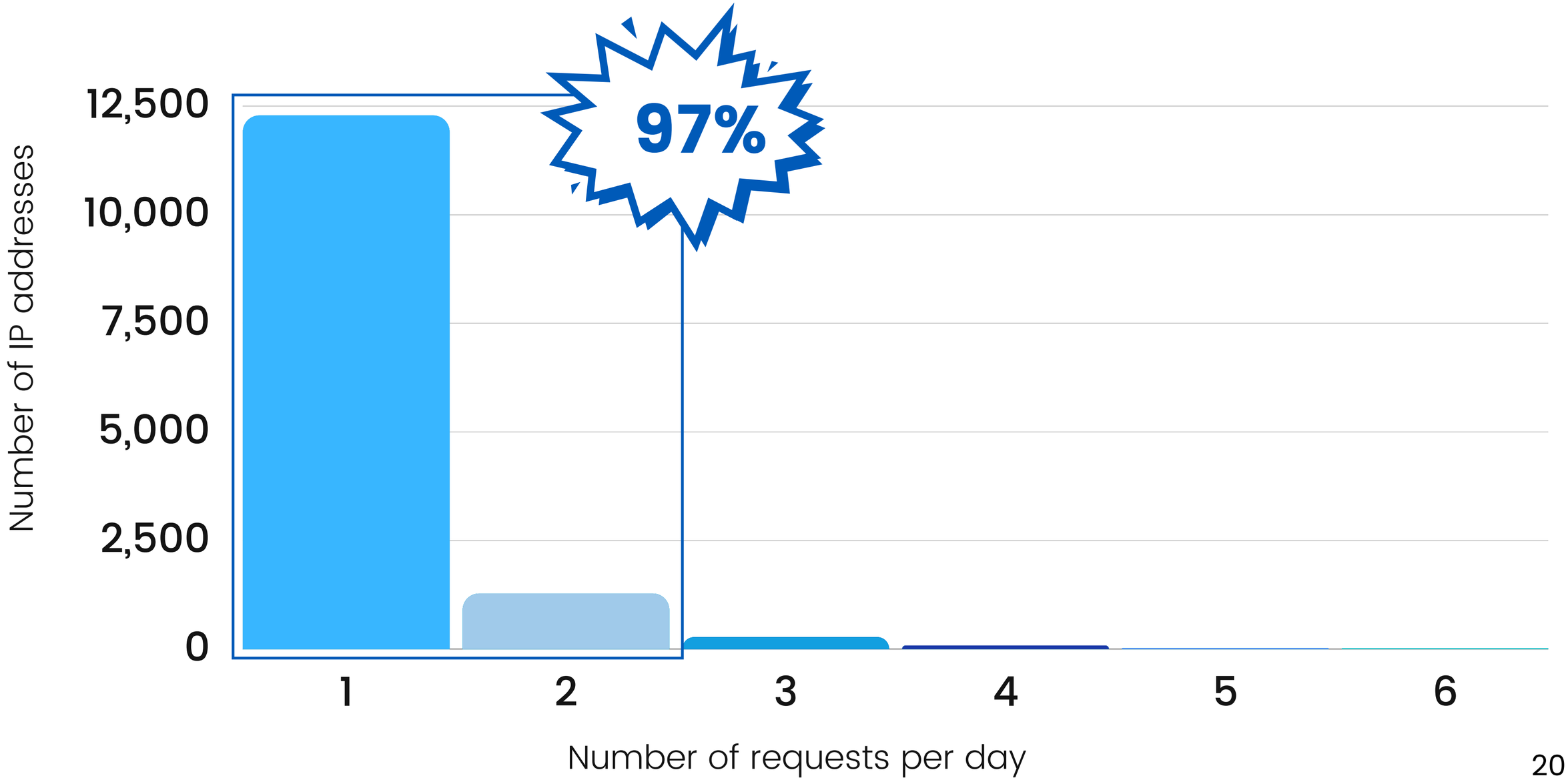
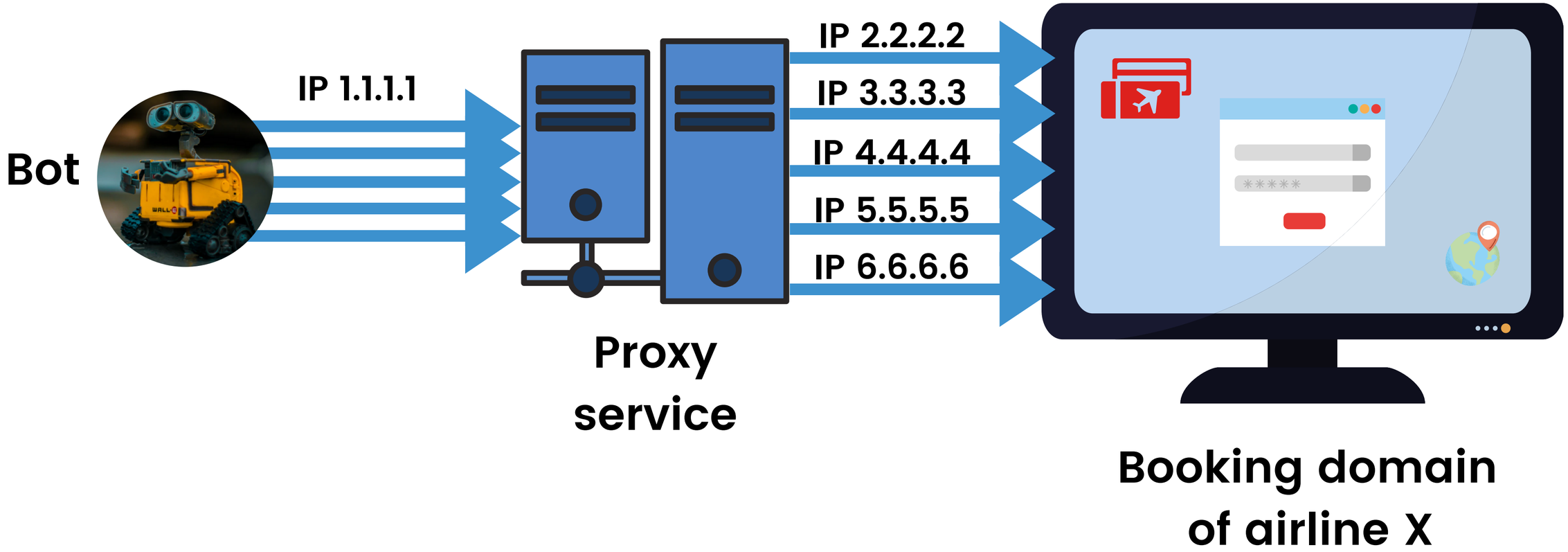


Residential proxy as a service



Proxy services IPs

Proxy services offer millions of IP addresses

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BUT

Proxy services IPs

Proxy services offer millions of IP addresses

BUT

32% of the IPs appeared on more than one day!

TOR network

Date	Number of TOR IPs
2020-02-14	12
2020-02-15	24
2020-02-18	20
2020-02-19	40
2020-02-24	12

TOR network

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Bots tried to take advantage of TOR nodes but they did not continue

Behavioral analysis

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- Return flights: 7 days period

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- Return flights: 7 days period
- Only 25 combination of departure and arrival airports, small fraction of the airline's offer

Time interval

- Time Interval=Departure date - Date of the request

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- Value between 0 and 14 days or 21, 30, 45, 60, 90, 120 days

Time interval

- Time Interval=Departure date - Date of the request
- Value between 0 and 14 days or 21, 30, 45, 60, 90, 120 days
- Only 0.2% of the requests exhibit different values but out of the 40 minutes daily time window

Distribution among segments

Segment=combination of one way/return flight, departure and arrival location

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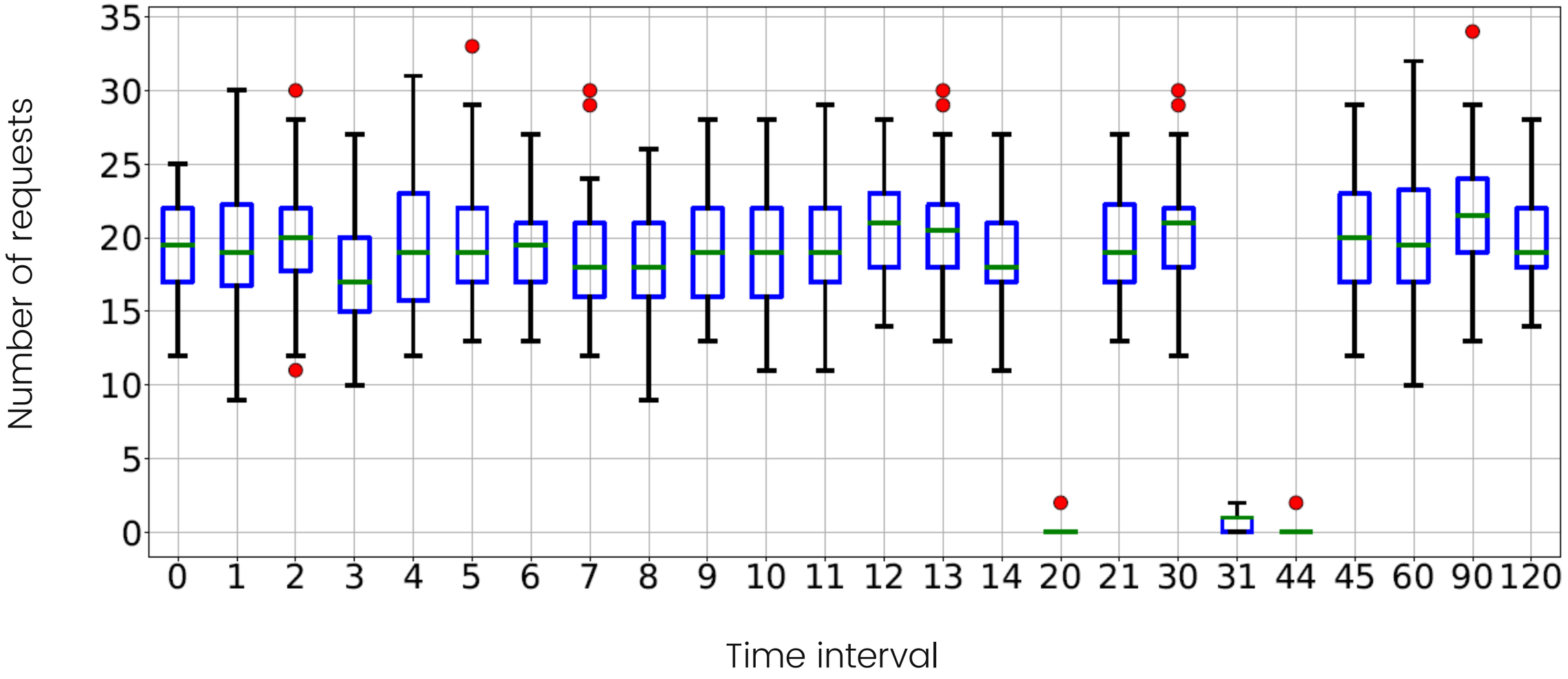

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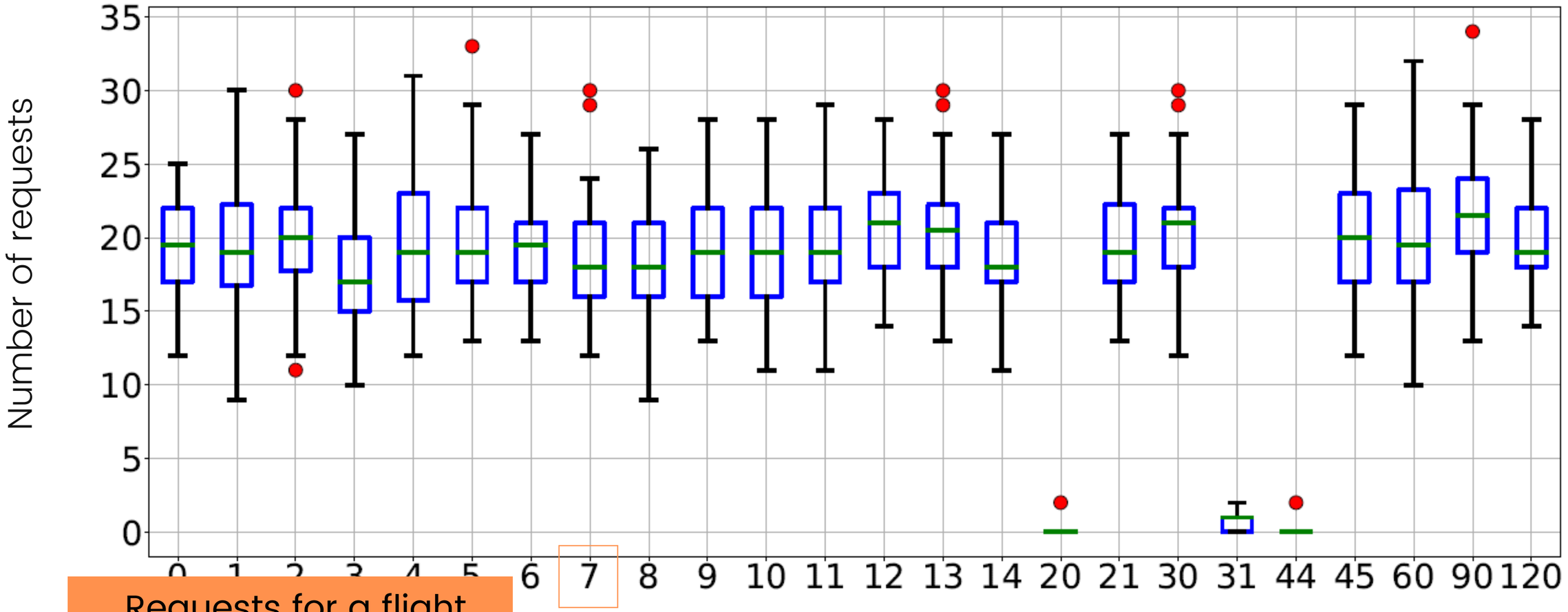
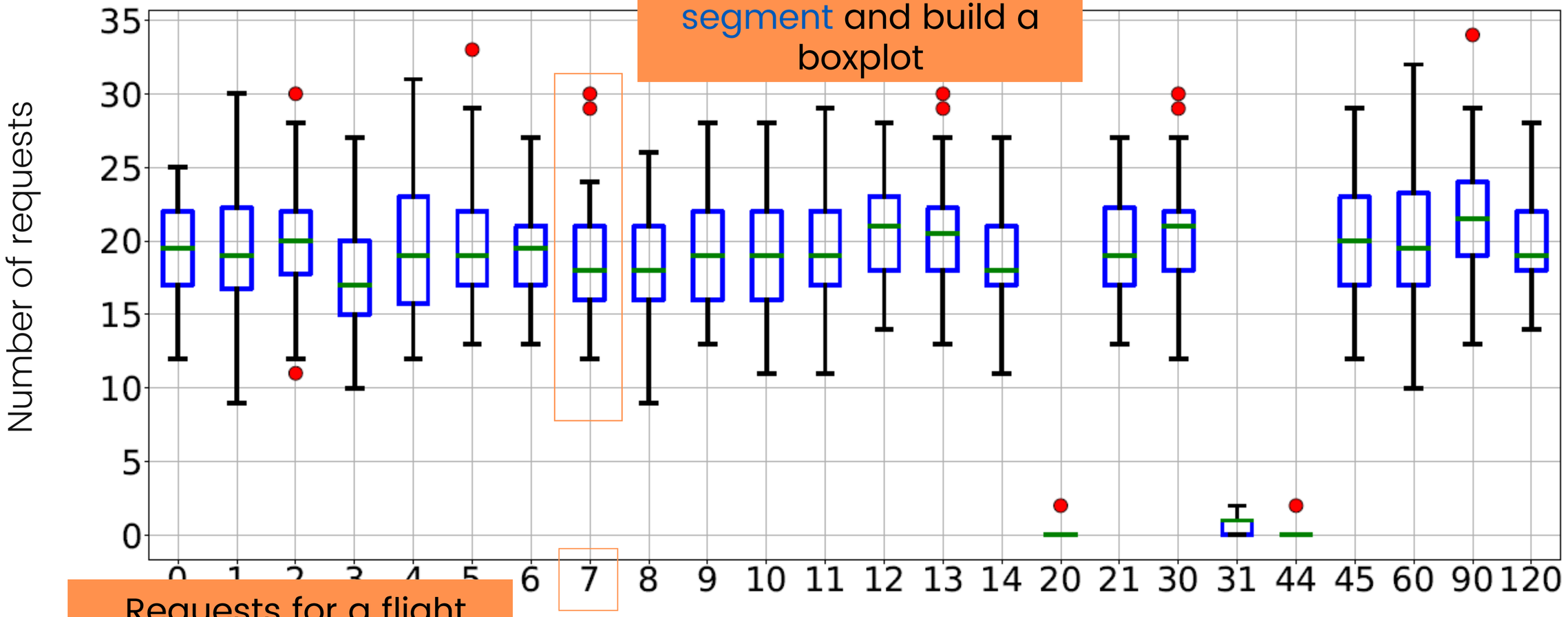


Requests for a flight departing 7 days after the request date

Distribution among segments

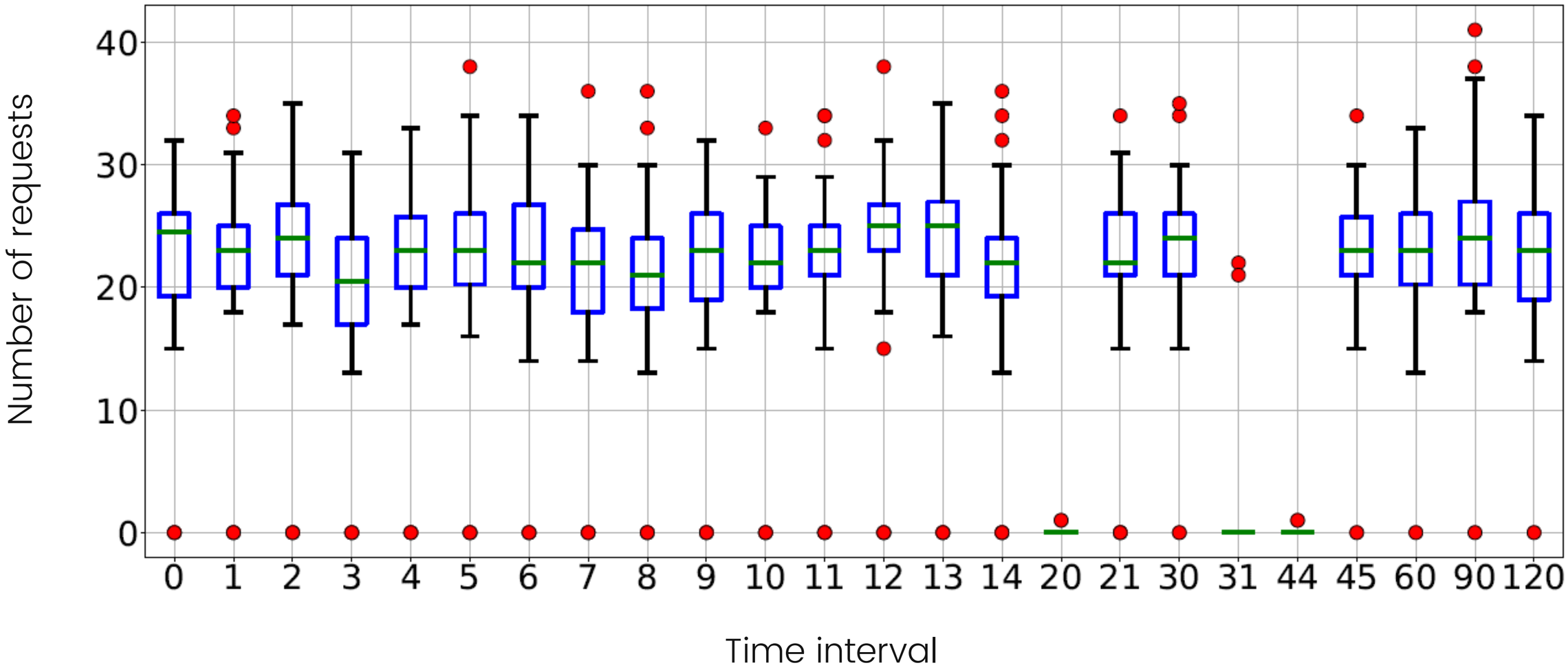
Segment=combination of one way/return flight, departure and arrival location

Divide them for each segment and build a boxplot



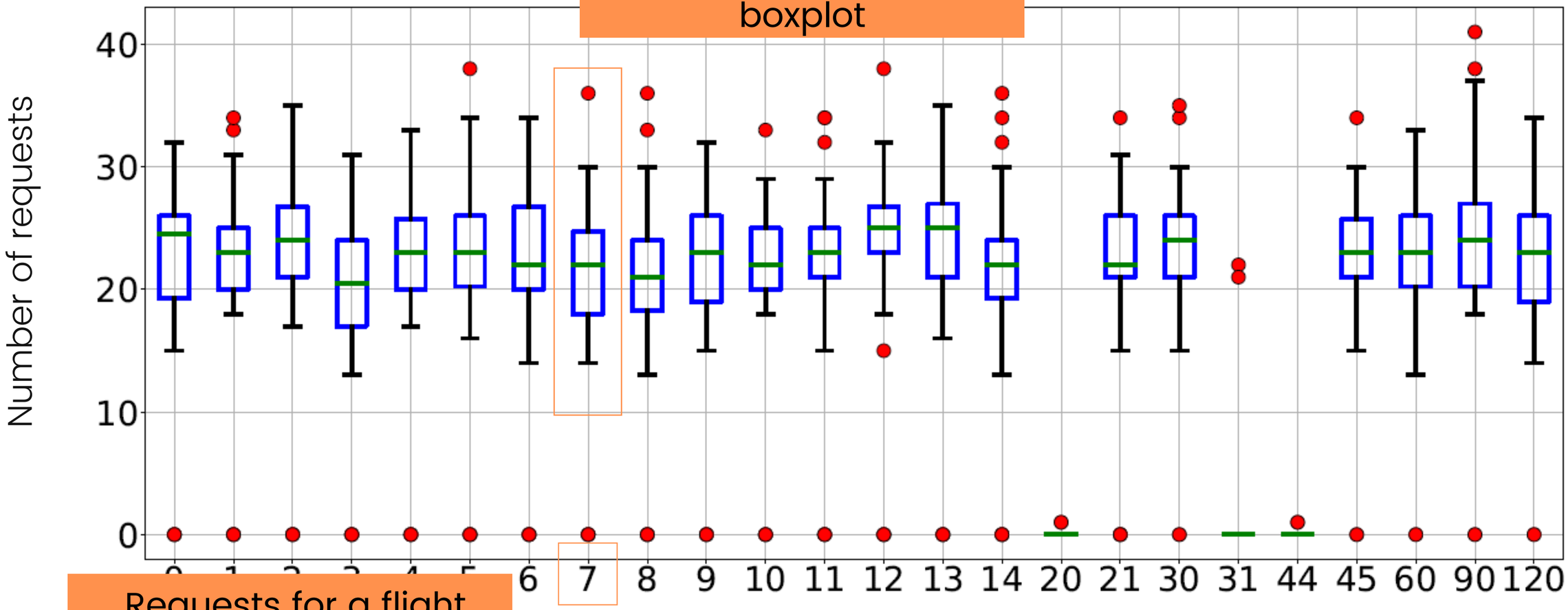
Requests for a flight departing 7 days after the request date

Distribution for request date



Distribution for request date

Divide them for date in which the request was made and build a boxplot



Requests for a flight departing 7 days after the request date

Tuples statistics

- 4-tuples made of:
  - Departure airport
  - Arrival airport
  - Time interval
  - Type of flight (one way/return)

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  - Departure airport
  - Arrival airport
  - Time interval
  - Type of flight (one way/return)
- 982 distinct tuples vs 410 average daily requests

Tuples statistics

- Each tuple is asked on average 23.41 times

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- Average number of days a tuple was requested: 22.85 days

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Check for consistency, but not sophisticated enough

4. Conclusions and future work

What we have done

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Found behavioral pattern that gives confidence they are all under the same bot master

Future works

Serve bot with cached prices

Because of:

- Repetition of requests
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To do:

- Sensitivity analysis

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Because of:

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To do:

- Sensitivity analysis

New method to block IPs

To do:

- Longitudinal large-scale analysis of suspicious IPs exhibiting the same behavior

Thank You

How to reach us

Elisa Chiapponi - elisa.chiapponi@eurecom.fr

Onur Catakoglu - onur.catakoglu@amadeus.com

Olivier Thonnard - olivier.thonnard@amadeus.com

Marc Dacier - marc.dacier@eurecom.fr