API Security Project
Top-10 Release Candidate

OWASP Projects' Showcase

Sep 12, 2019

Founders and Sponsors

Project Leaders

Erez Yalon

- Director of Security Research @ Checkmarx
- Focusing on Application Security
- Strong believer in spreading security awareness

Inon Shkedy

- Head of Research @ Traceable.ai
- 7 Years of research and pentesting experience
- I’ve grown up with APIs

Today's Agenda

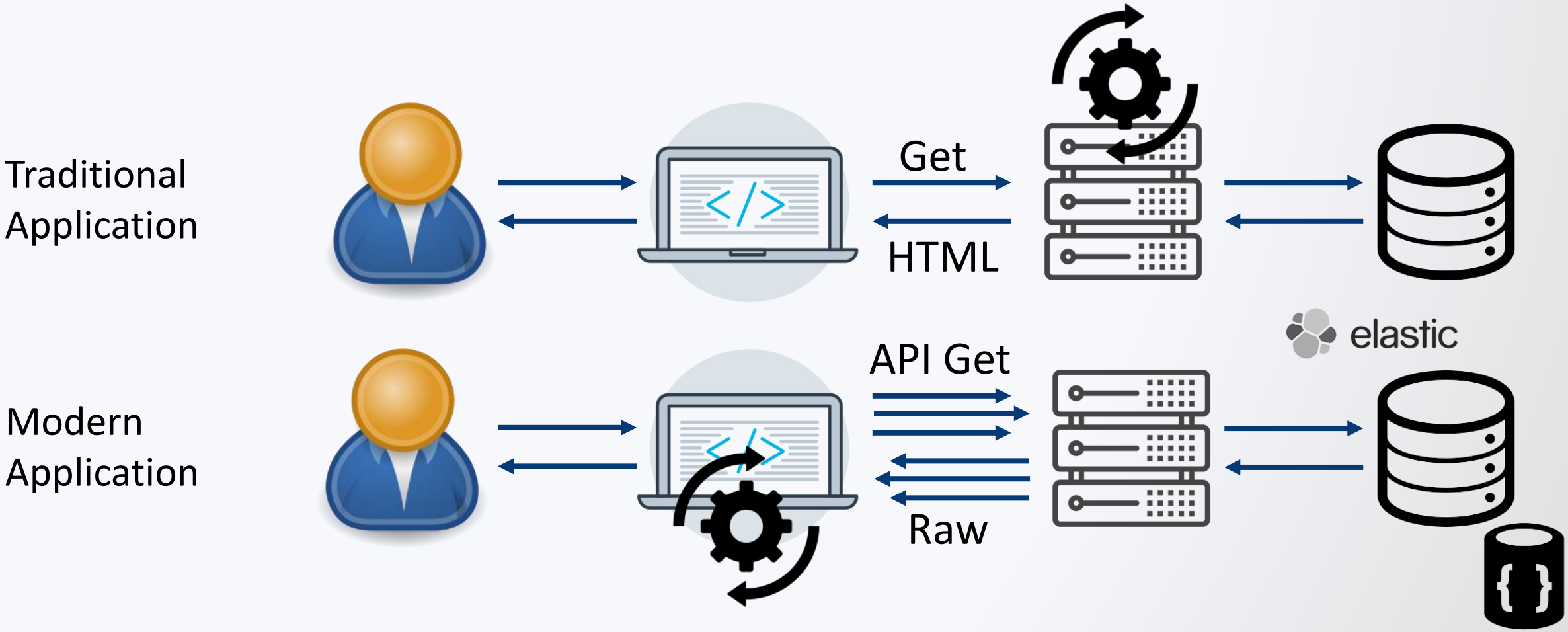
- How APIs-Based apps are different?
  Why deserve their own project?
- Roadmap
- Call for contributors
- **API Security Top 10 RC**
- Acknowledgements
- Call for contributors

How API Based Apps are Different?

Client devices are becoming varied and stronger

Logic moves from Backend to Frontend
(together with some vulnerabilities)

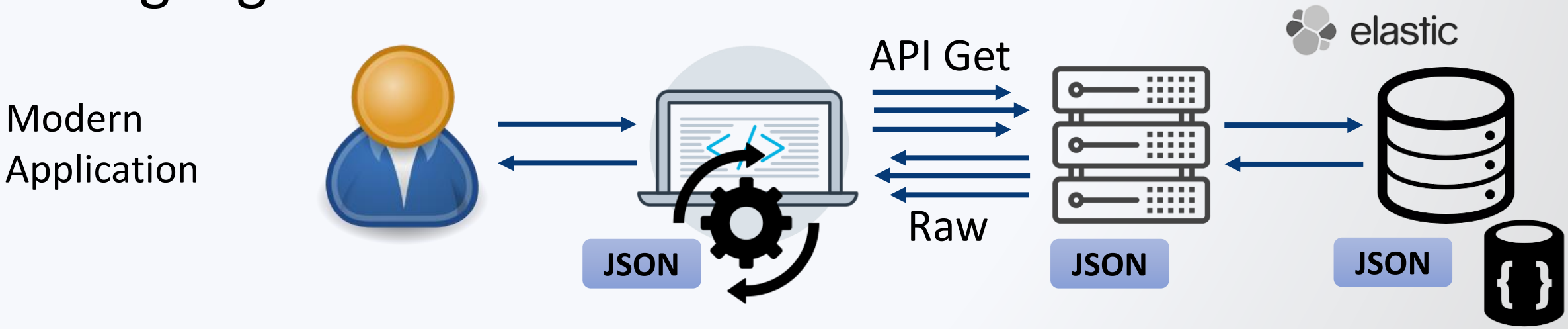
Traditional vs. Modern



Traditional vs. Modern

Less abstraction layers

Client and server (and DB) speak the same JSON language



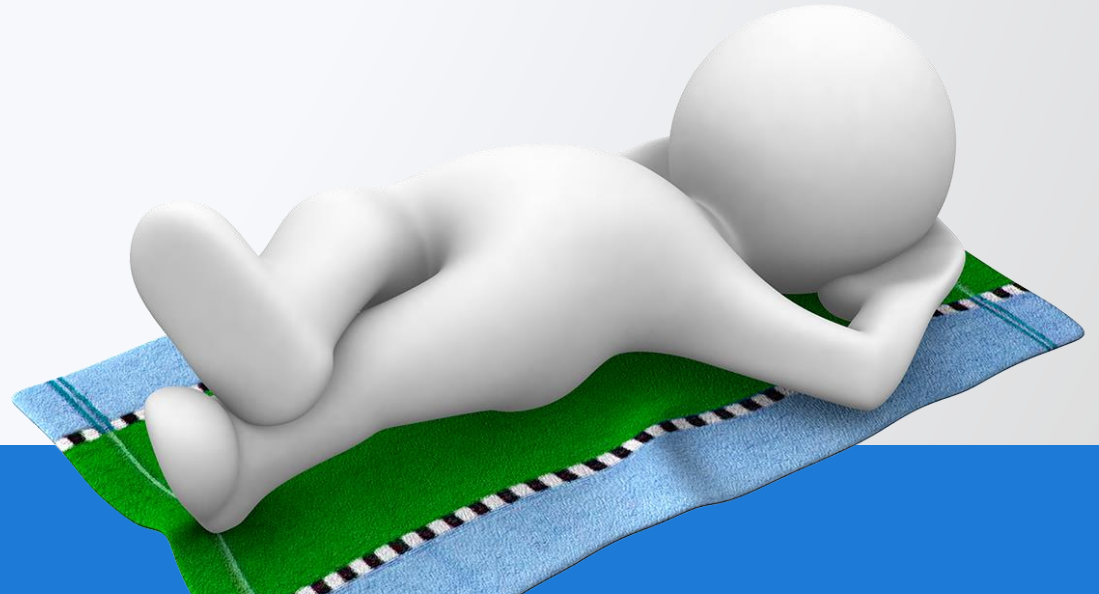
How API Based Apps are Different?

- The server is used more as a proxy for data
- The rendering component is the client, not the server

- Clients consume raw data
- APIs expose the underlying implementation of the app
- The user's state is usually maintained and monitored by the client
- More parameters are sent in each HTTP request (object ID's, filters)

How API Based Apps are Different?

- The REST API standard
  - Standardized & generic
  - Predictable entry points
  - One entry point (URL) can be used for multiple purposes



How API Based Apps are Different?

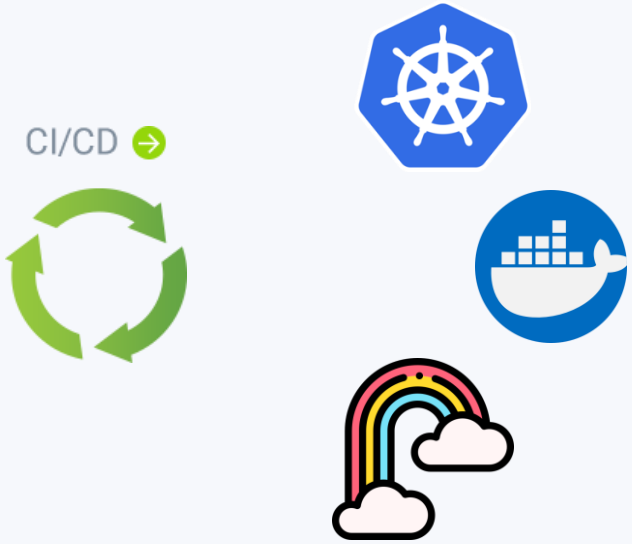
The good news

Traditional vulnerabilities are less common in API-Based apps:

- SQLi – Increasing use of ORMs
- CSRF – Authorization headers instead of cookies
- Path Manipulations – Cloud-Based storage
- Classic IT Security Issues - SaaS

What About Dev(Sec)Ops?

APIs change all the time



It takes just a few clicks to spin up new APIs (hosts). Too easy!

APIs become hard to track:

- Shadow APIs
- Old Exposed APIs

Roadmap – Planned Projects

- API Secrity Top 10
- API Security Cheat Sheet
- crAPI (**C**ompletely **R**idiculous **API**
  - an intentionally vulnerable API project)

Roadmap

	Top 10	Cheat Sheet	crAPI
2019 Q1	Prepare		
2019 Q2	Kick-Off		
2019 Q3	V1.0	Kick-Off	Prepare
2019 Q4		Collaborate	Kick-Off
2020 Q1		V1.0	Collaborate
2020 Q2			V1.0

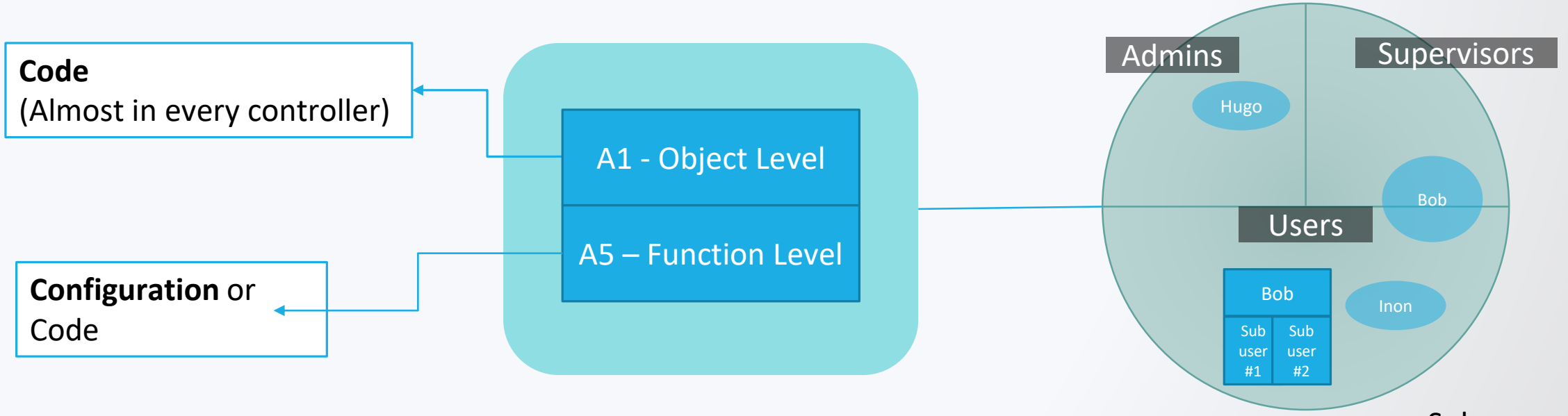
The creation process of the Top10

- Internal knowledge and experience
- Internal data collection (Bug bounties reports, published incidents, etc.)
- Call for Data
- Call for comments

API Security Top 10

- **A1**: Broken Object Level Authorization
- **A2**: Broken Authentication
- **A3**: Excessive Data Exposure
- **A4**: Lack of Resources & Rate Limiting
- **A5**: Broken Function Level Authorization
- **A6**: Mass Assignment
- **A7**: Security Misconfiguration
- **A8**: Injection
- **A9**: Improper Assets Management
- **A10**: Insufficient Logging & Monitoring

Authorization in APIs - The Challenge

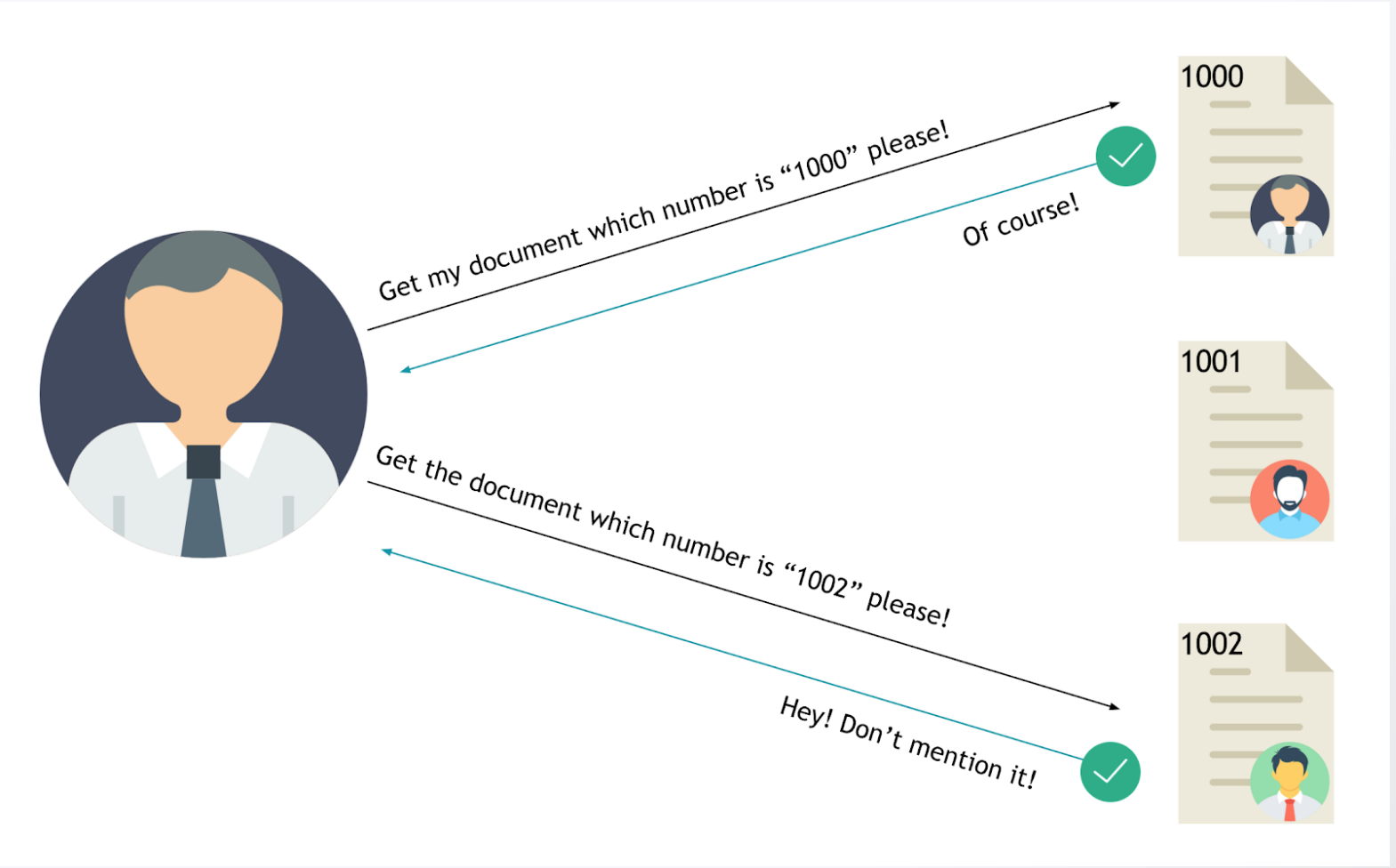


- Sub users
- Users with different roles

Decentralized Mechanism

Complex Hierarchies

A1 – BOLA (Broken Object Level Authorization)



From Sam Houston, Bugcrowd

A1 – BOLA (Broken Object Level Authorization)
Why is it so common?

- The **attack surface** is much **wider**
  - APIs receive more IDs, because clients maintain the user's state

- No security solution that solves the problem

A1 – BOLA
Why not "IDOR"?

- "IDOR" - **I**nsecure **D**irect **O**bject **R**eference is a **cool** name
- It's **not accurate** / indicative enough
- The name "I**D**OR" hints that the object reference (ID) should be indirect (e.g.: a salted hash map)
  - What would happen if you asked your developers to implement “Indirect” mechanism in every place that receives ID?

Illustration – you asked your developers
to implement an “Indirect Object Reference Mechanism”
to solve
IDORs in the code.

- The problem is not the Object Reference, but a lack of authorization -

Accessing 2 million Verizon Pay Monthly contracts

How I could access the personal information of 2 million Verizon Wireless customers due to 1 very simple mistake

verizon

RETAIL INSTALLMENT CONTRACT

RETAIL INSTALLMENT SALE AGREEMENT / RETAIL INSTALLMENT OBLIGATION
SUBJECT TO STATE REGULATION

SELLER (CREDITOR): Verizon Wireless Services, LLC ("Verizon Wireless")
One Verizon Way, Basking Ridge, NJ 07920 (908) 559-7000

INSTALLMENT SALE AGREEMENT #	1[redacted]6
BUYER'S/CUSTOMER'S NAME	[redacted]
BUYER'S/CUSTOMER'S CONTACT MOBILE NUMBER	83[redacted]52
ACCOUNT OWNER'S ADDRESS	957[redacted] TX [redacted]
DESCRIPTION OF GOODS	IPHONE 8 SPACE GRAY 64GB [redacted] **("Device")**
TRANSACTION DATE	09/17/2018

YOUR COMPANY, meaning the Buyer/Company named above, agree to pay US, the Seller/Creditor named above as Verizon Wireless, the Total Sale Price of the goods identified above according to the Terms of this Retail Installment Sale Agreement/ Retail Installment Obligation (referred to below as "Agreement").

ANNUAL PERCENTAGE RATE The cost of Customer's credit at a yearly rate	**FINANCE CHARGE** The dollar amount the credit will cost Customer	AMOUNT FINANCED The amount of credit provided to you; or on your behalf	TOTAL OF PAYMENTS The amount Customer will have paid after all payments are made as scheduled	TOTAL SALE PRICE The total cost of Customer's purchase on credit including your down payment of $0.00
0%	**$0.00**	$599.99	$599.99	$599.99

Your Company's payment schedule will be:

Number of Payments:24; Payment 1:$25.22; Payments 2-24:$24.99

When Payments are Due:

Payments 1 to 6	10/30/2018	11/29/2018	12/30/2018	01/30/2019	02/27/2019	03/30/2019
Payments 7 to 12	04/29/2019	05/30/2019	06/29/2019	07/30/2019	08/30/2019	09/29/2019
Payments 13 to 18	10/30/2019	11/29/2019	12/30/2019	01/30/2020	02/28/2020	03/30/2020
Payments 19 to 24	04/29/2020	05/30/2020	06/29/2020	07/30/2020	08/30/2020	09/29/2020

PAYMENTS RECEIVED 15 OR MORE DAYS AFTER YOUR COMPANY'S DUE DATE MAY INCUR A LATE PAYMENT FEE OF UP TO 5% OR $5, WHICHEVER IS LESS. PLEASE SEE YOUR COMPANY'S AGREEMENT TERMS FOR ANY ADDITIONAL INFORMATION ABOUT NONPAYMENT, DEFAULT, ANY REQUIRED PAYMENT IN FULL BEFORE THE SCHEDULED PAYMENT DATES, AND PREPAYMENT TERMS.

ITEMIZATION OF AMOUNT FINANCED	$599.99
(A) CASH PRICE (excluding tax)	$599.99
(B) DOWN PAYMENT (if applicable)	$0.00
(C) FINANCE CHARGE	$0.00

After a quick check, I learnt that 1310000000 was the lowest contract number that could be viewed and 1311999999 was the highest. That means that there was information of around 2 million Verizon Pay Monthly customers exposed.

Found by Daley Bee

• A2 – Broken Authentication
Why is it so common?

- Authentication endpoints are exposed to anyone by design.

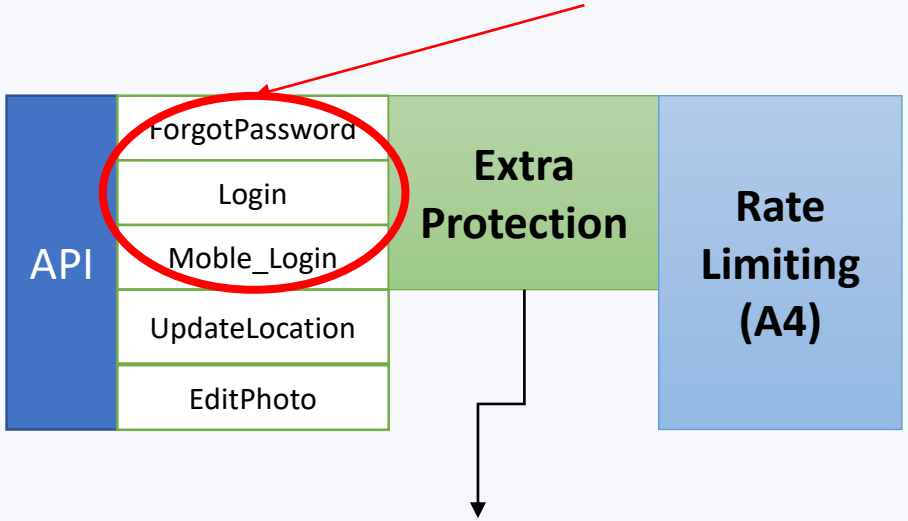
- Software/security engineers have misconceptions.
  - OAuth isn't authentication
  - API keys should not be used for user's authentication

- Multiple authentication flows in modern apps
  - IoT / Mobile / Legacy / Deep links with credentials, etc..

A2 – Broken Authentication

Lack of protection

Assets that need to be protected



- Account lockout mechanism
- Captcha
- Credentials Stuffing Protection

Misimplementation

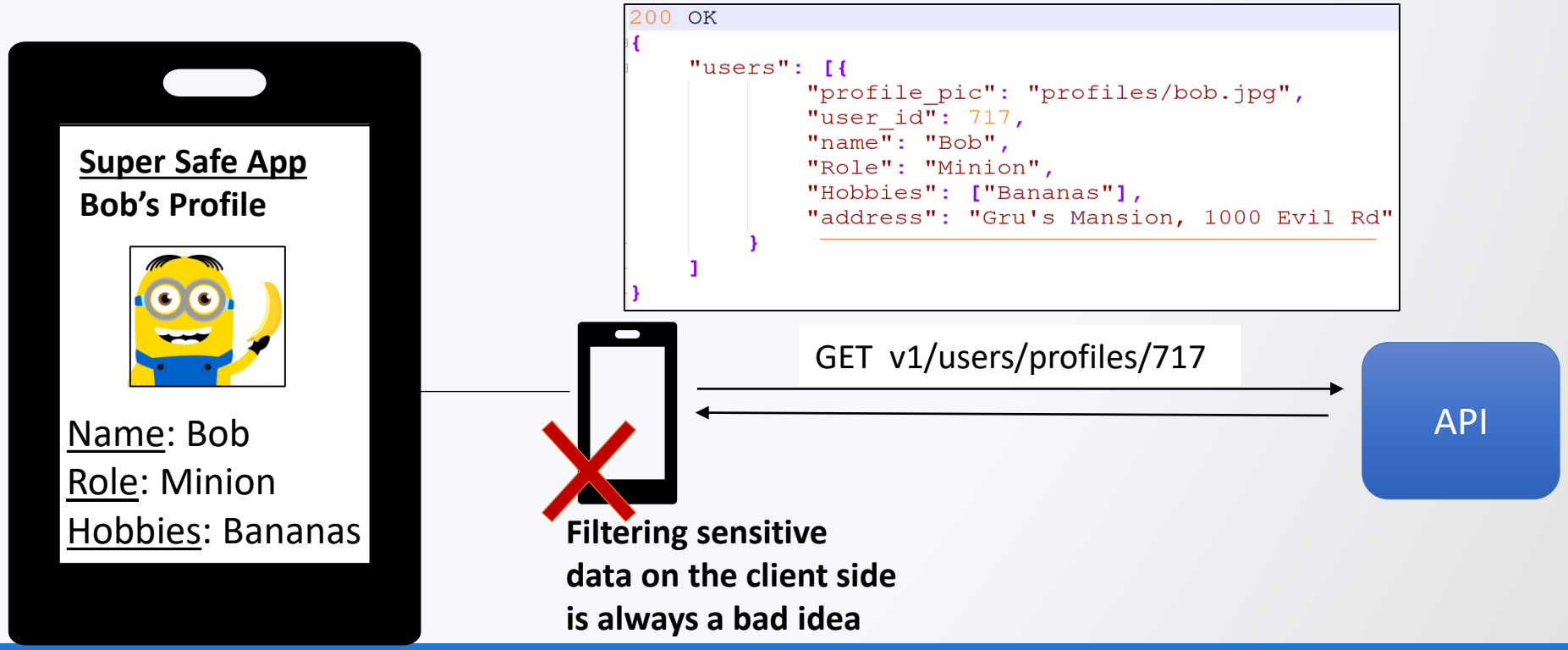
- JWT Supports {“alg”:”none”}
- Service doesn’t validate the Oauth Provider
- Passwords stored without salt
- Etc…

A3 – Excessive Data Exposure

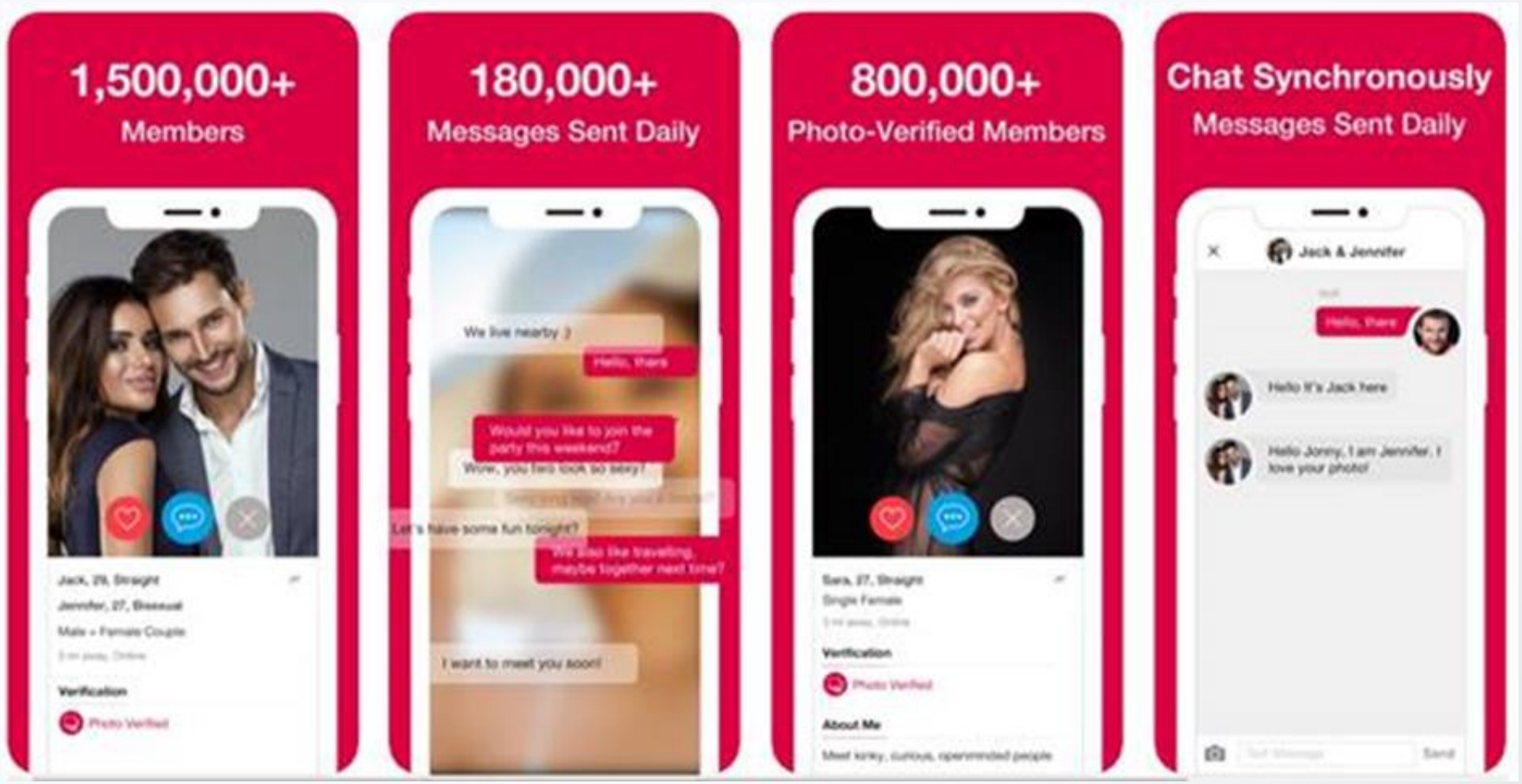
- APIs expose sensitive data of other users by design

- **Why it is so common**?
  - REST Standard & API economy encourage developers to implement APIs in a generic way
  - Use of generic functions as "to_json" from the Model / ORM, without thinking about who's the consumer

A3 – Excessive Data Exposure



A3 - Example from "3fun" app



- Found by Alex Lomas, Pen Test Partners

#	Host	Method	URL	Params	Edited	Status	Length	MIME type
322	https://www.go3fun.co	POST	/account_kit_reg	✓		200	447	JSON
325	https://www.go3fun.co	POST	/user/device_token	✓		200	198	JSON
326	https://www.go3fun.co	POST	/user/update	✓		200	265	JSON
327	https://www.go3fun.co	POST	/reset_push_badge			200	198	JSON
329	https://www.go3fun.co	GET	/match_users?from=0&latitude=51.[redacted]	✓		200	23807	JSON
331	https://www.go3fun.co	GET	/user/refresh			200	788	JSON

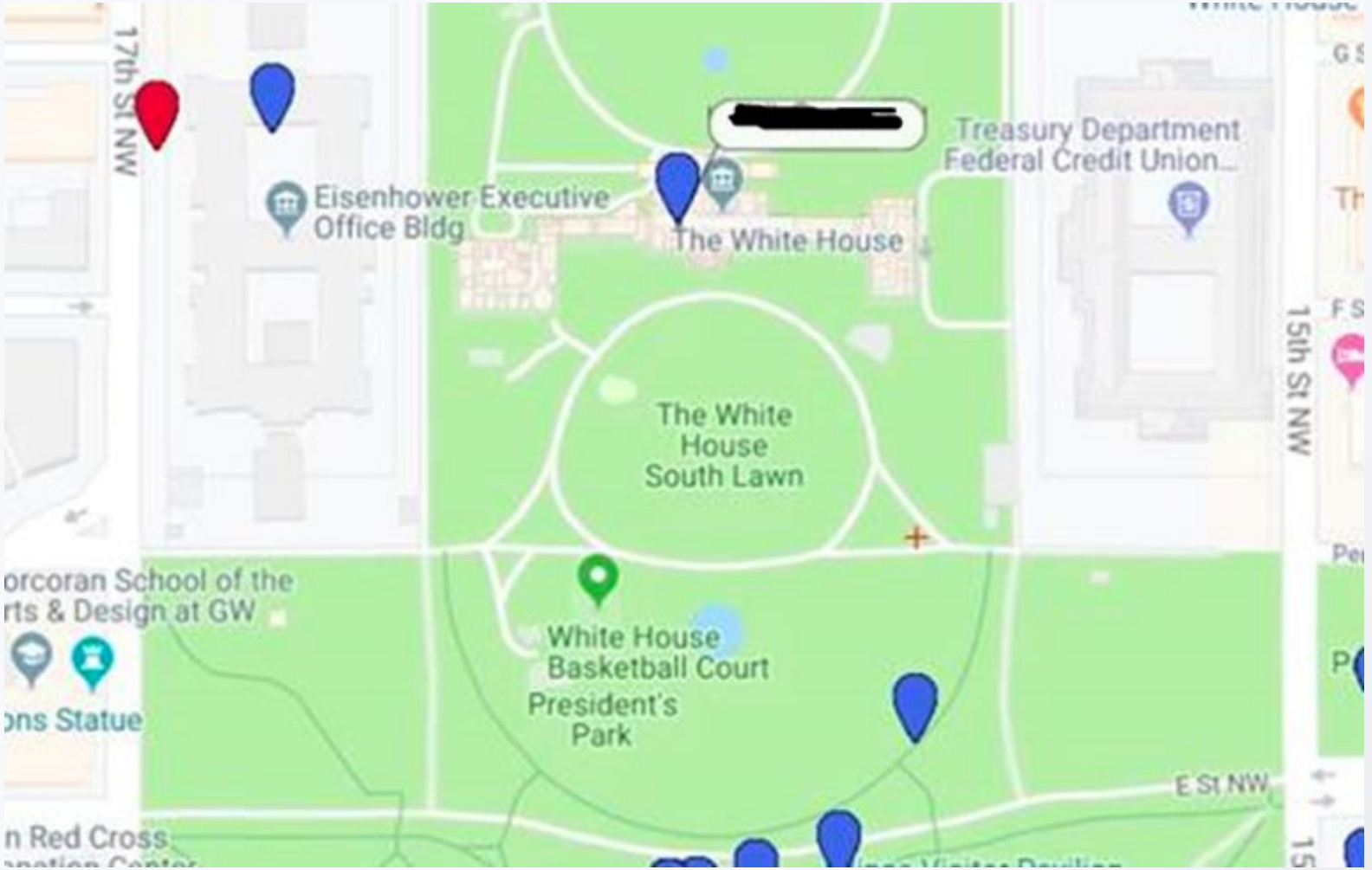
Request | Response

Raw | Headers | Hex | JSON Beautifier


```
    ],
    "latitude": "51.[redacted]",
    "membership": "2",
    "birthday": "1977-[redacted]",
    "sex_orient": "4",
    "gender": "1",
    "longitude": "-0.1[redacted]",
    "photo_verified_status": "1",
    "active": "0",
    "partner_sex_orient": "0",
    "liked_me": "0",
    "settings": {
      "show_online_status": "1",
      "show_distance": "1"
    },
    "username": "[redacted]",
    "usr_id": "17[redacted]",
    "about_me": "Kinky and attractive french financier open to many things ..."
  },
  {
    "last_login": "2019-06-24 20:21:12",
    "private_photos": [
      {
        "icon": "https://s3.amazonaws.com/3fun/821/[redacted]/[redacted]-small.jpg",
        "photo_id": "38[redacted]",
        "py": "500",
        "px": "750",
        "photo": "https://s3.amazonaws.com/3fun/821/[redacted]/[redacted]-big.jpg",
        "descr": null
      }
```


- Found by Alex Lomas, Pen Test Partners

A3 - 3Fun Hack



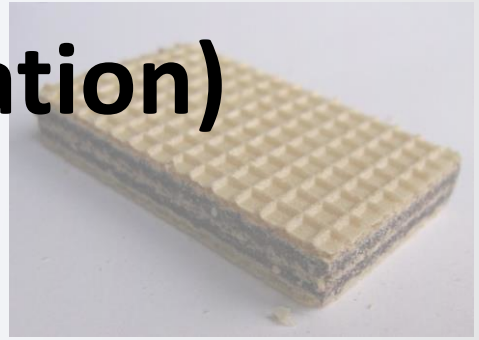
- Found by Alex Lomas, Pen Test Partners

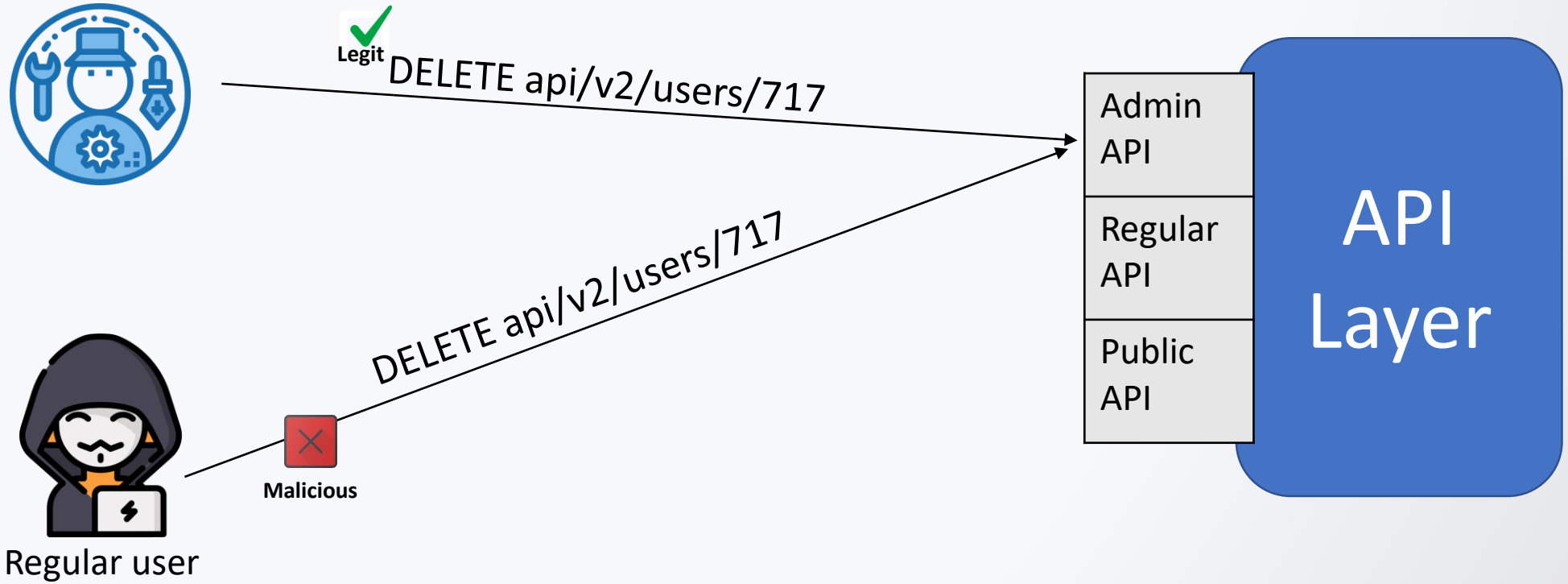
A4 - Lack of Resources & Rate Limiting

- Might lead to DoS, Brute force attacks

- http://socialnetwork.com/api/v1/users?limit=**999999999**

A5 – BFLA (Broken Function Level Authorization)





A5 – BFLA
Why it is common in APIs?

- Function Level Authorization can be implemented in different ways:
  - Code
  - Configuration
  - API Gateway

- Easier to detect and exploit in APIs – Endpoints are more predictable

Action	Get user's profile (Regular endpoint)	Delete user (Admin endpoint)
Traditional Apps	GET /app/users_view.aspx?user_id=1337	POST app/admin_panel/users_mgmt.aspx action=delete&user_id=1337
APIs	GET /api/v2/users/1337	DELETE /api/v2/users/1337

Hard to Predict! ☹

Very Predictable! ☺

A6 – Mass Assignment

- Modern frameworks encourage developers to use “Mass Assignment” functions

NodeJS:

```
var user = new User(req.body);
user.save();
```

Rails:

```
@user = User.new(params[:user])
```

Might contain sensitive params that the user should not have access to

Legit Request

POST /api/users/new

{“username”:”Inon”, ”pass”:”123456”}

Malicious Request

POST /api/users/new

{“username”:”Inon”, ”pass”:”123456”, ”role”:”admin”}

A6 – Mass Assignment

- Easier to exploit in APIs
- Instead of guessing object's properties, just find a GET method that returns them

```
GET /v1/user/video_files
------------------------
200 OK
{
    "id": 371,
    "name": "clip.mp4",
    "conversion_params":"-v codec h264"
}
```

```
PUT /v1/videos/371
{
    "name": "clip.mp4",
    "conversion_params":"-v codec h264 && format C:/"
}
```

A7 – Security Misconfiguration

- Weak encryption
- Unnecessary exposed HTTP methods
- No CSRF protection
- Detailed errors
- Improper CORS

A8 – Injection
Why from A1 to A8?

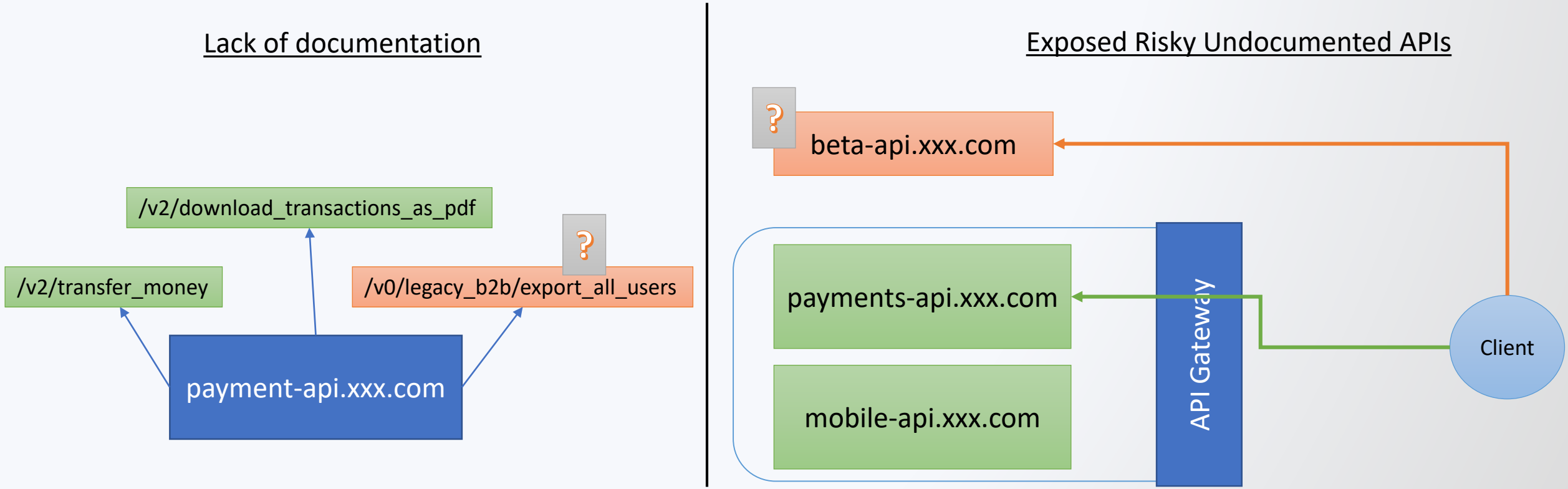
- The main reason that “Injection” is currently #1 (2017), is because of SQL Injections.

- SQL Injection are not very common in modern APIs, because:
  - Use of ORMs
  - Increasing use of NoSQL

- NoSQL injection are a thing, but are usually not as common / severe

A9 – Improper Assets Management

Actually two different things



A9 – Improper Assets Management
Why now ?

- APIs change all the time because of **CI/CD**, developers are focused on delivering and not documenting

- Cloud + deployment automation (k8s) ==
  Way too easy to spin up new APIs and machines
  - API hosts that have been forgotten
  - Complete environments that have been forgotten
    (excuse me mister , but what the heck is “qa-3-old.app.com” ?)

A10 - Insufficient Logging & Monitoring

Same as 2017 A10

Call for Discussions

Mailing List

https://groups.google.com/a/owasp.org/d/forum/api-security-project

Call for Contributions

GitHub Project

https://github.com/OWASP/API-Security/blob/develop/CONTRIBUTING.md

https://www.owasp.org/index.php/OWASP_API_Security_Project

https://github.com/OWASP/API-Security

QUESTIONS?

Rate this Session

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Inon Shkedy

Thank You!