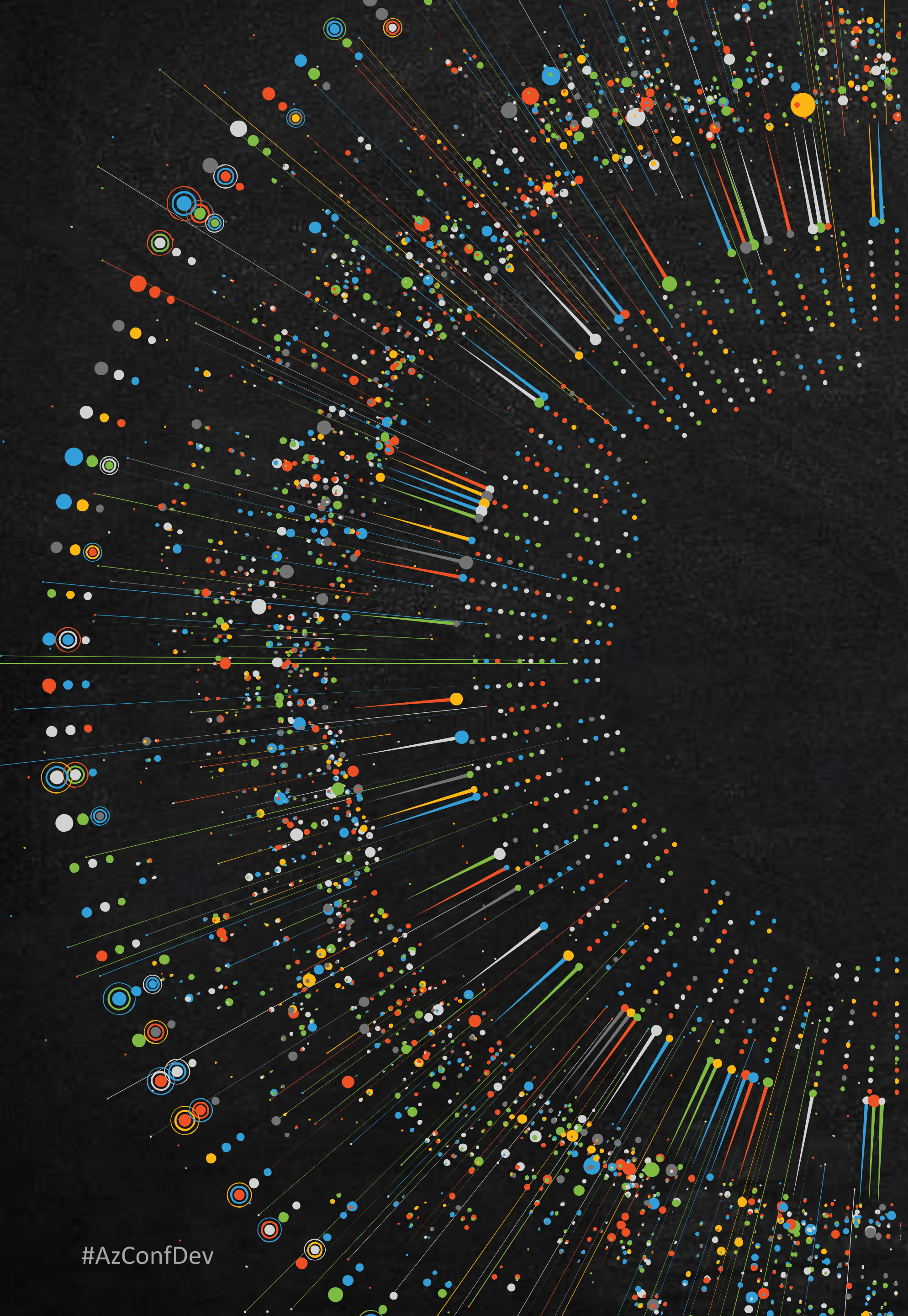

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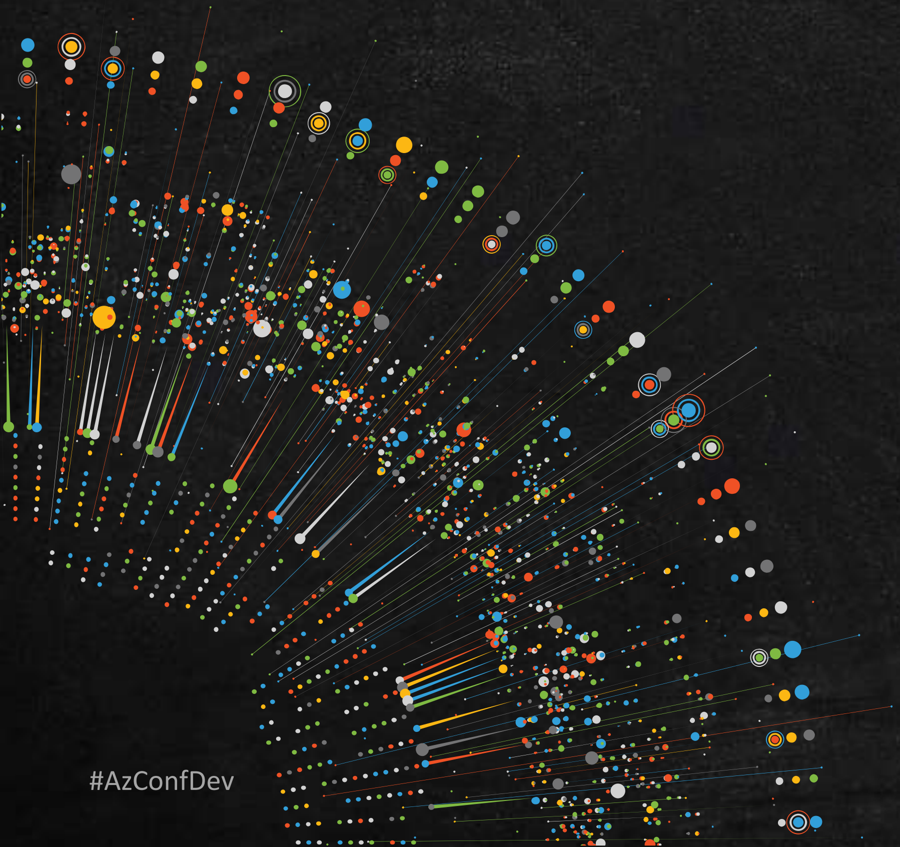
Building better security for your API platform

Using Azure API Management



#AzConfDev

Eldert Grootenboer

Motion10

MVP Microsoft® Most Valuable Professional

@egrootenboer

Why API security?

APIs are everywhere

API calls represent 83 percent of web traffic, according to an October 2018 Akamai traffic review detailed in the report.

[Akamai press release]

APIs are vulnerable

Reports suggest that by 2022, API abuses will be the vector most responsible for data breaches within enterprise web applications.

Erez Yalon

API security breaches

I Scraped Millions of Venmo Payments. Your Data Is at Risk

Facebook Security Breach Exposes Accounts of 50 Million Users

Major US Postal Service data breach exposes 60m users

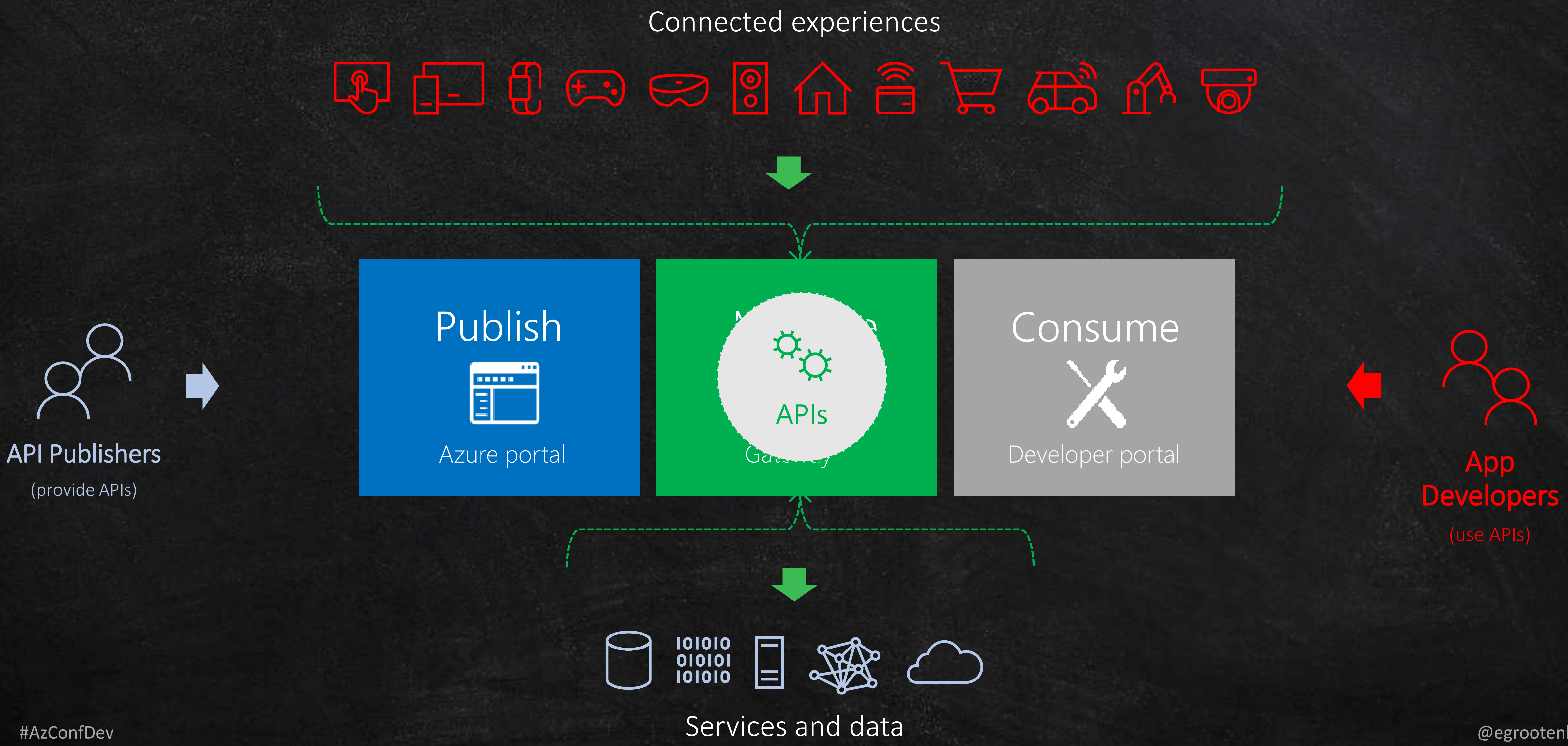
Data breach at JustDial leaks 100 million user details

Security should be of prime importance

Better security with Azure

API Management

Solving our API strategy challenges



Connected experiences

API Publishers

(provide APIs)

Publish

Azure portal

APIs

Consume

Developer portal

App Developers

(use APIs)

Services and data

Smarter services with policies

Security

Caching

Throttling

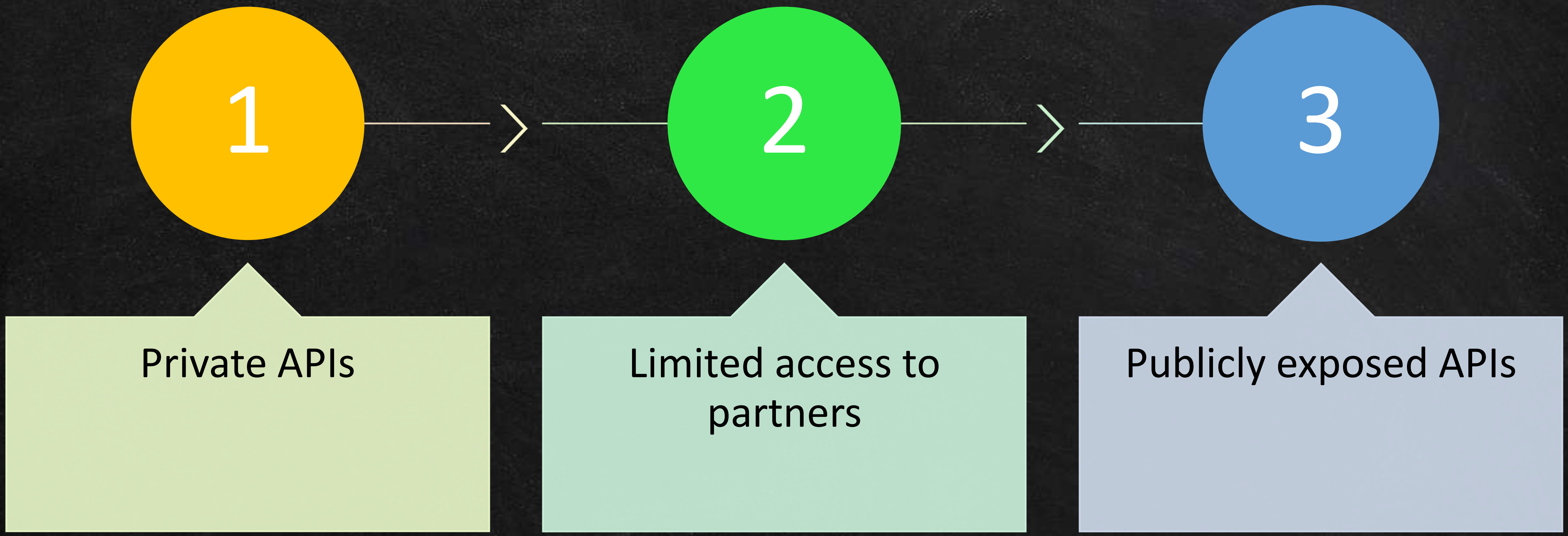
Transformations

Mocking

And many more…

Creating an API strategy

The different stages of an API strategy



1

Private APIs

2

Limited access to partners

3

Publicly exposed APIs

More open, more risks

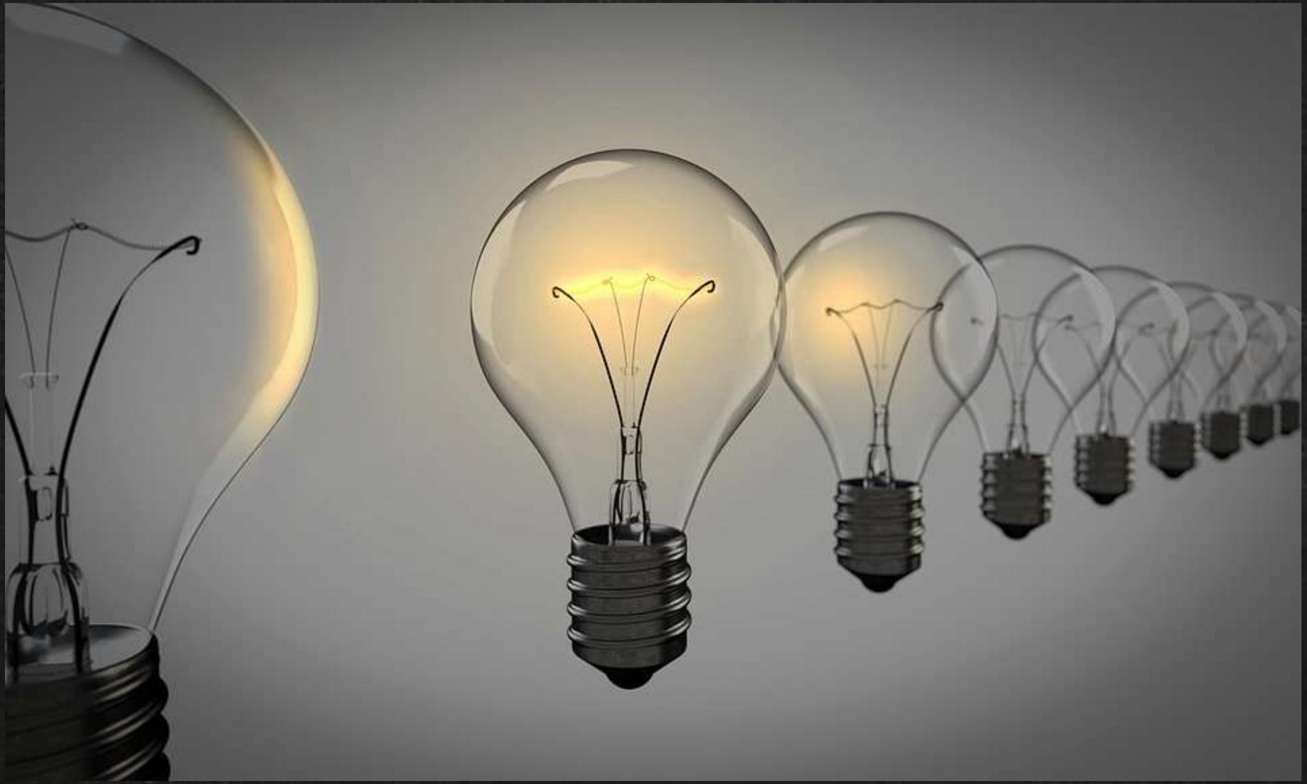
Exposing valuable data

Easily accessible infrastructure

Inadequate authentication or authorization

Not following best practices

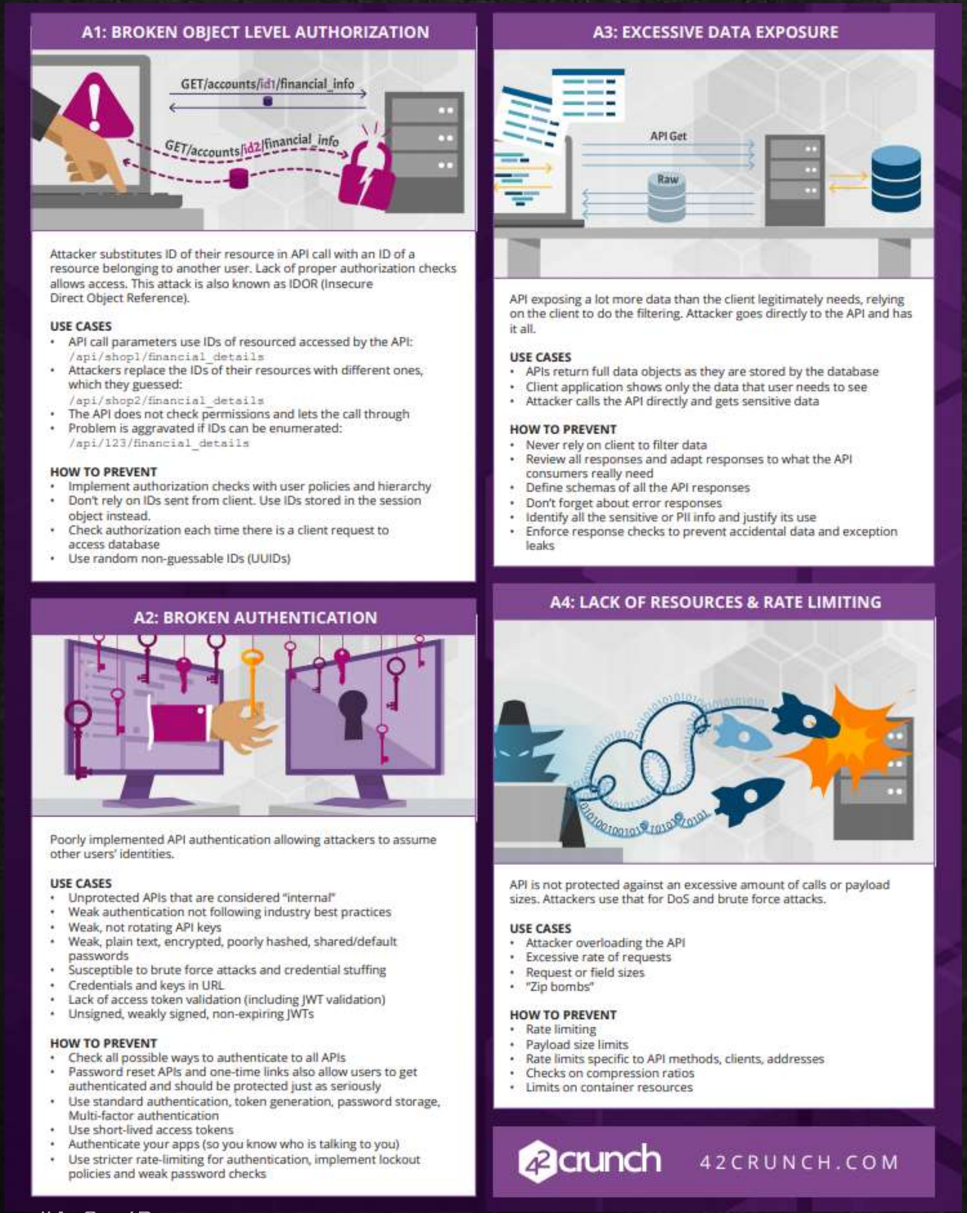
API security best practices



Best practices for securing APIs

- Encryption
- Authentication
- OAuth & OpenID Connect
- Call Security Experts
- Audit, Log and Version
- Share as Little as Possible
- System Protection with Throttling and Quotas
- Data Validation
- Infrastructure
- API Firewalling
- API Gateway
- OWASP top 10

OWASP API Security Top 10



A1: BROKEN OBJECT LEVEL AUTHORIZATION

GET/accounts/id1/financial_info
GET/accounts/id2/financial_info

Attacker substitutes ID of their resource in API call with an ID of a resource belonging to another user. Lack of proper authorization checks allows access. This attack is also known as IDOR (Insecure Direct Object Reference).

USE CASES

- API call parameters use IDs of resourced accessed by the API: `/api/shop1/financial_details`
- Attackers replace the IDs of their resources with different ones, which they guessed: `/api/shop2/financial_details`
- The API does not check permissions and lets the call through
- Problem is aggravated if IDs can be enumerated: `/api/123/financial_details`

HOW TO PREVENT

- Implement authorization checks with user policies and hierarchy
- Don't rely on IDs sent from client. Use IDs stored in the session object instead.
- Check authorization each time there is a client request to access database
- Use random non-guessable IDs (UUIDs)

A2: BROKEN AUTHENTICATION

Poorly implemented API authentication allowing attackers to assume other users' identities.

USE CASES

- Unprotected APIs that are considered "internal"
- Weak authentication not following industry best practices
- Weak, not rotating API keys
- Weak, plain text, encrypted, poorly hashed, shared/default passwords
- Susceptible to brute force attacks and credential stuffing
- Credentials and keys in URL
- Lack of access token validation (including JWT validation)
- Unsigned, weakly signed, non-expiring JWTs

HOW TO PREVENT

- Check all possible ways to authenticate to all APIs
- Password reset APIs and one-time links also allow users to get authenticated and should be protected just as seriously
- Use standard authentication, token generation, password storage, Multi-factor authentication
- Use short-lived access tokens
- Authenticate your apps (so you know who is talking to you)
- Use stricter rate-limiting for authentication, implement lockout policies and weak password checks

A3: EXCESSIVE DATA EXPOSURE

API exposing a lot more data than the client legitimately needs, relying on the client to do the filtering. Attacker goes directly to the API and has it all.

USE CASES

- APIs return full data objects as they are stored by the database
- Client application shows only the data that user needs to see
- Attacker calls the API directly and gets sensitive data

HOW TO PREVENT

- Never rely on client to filter data
- Review all responses and adapt responses to what the API consumers really need
- Define schemas of all the API responses
- Don't forget about error responses
- Identify all the sensitive or PII info and justify its use
- Enforce response checks to prevent accidental data and exception leaks

A4: LACK OF RESOURCES & RATE LIMITING

API is not protected against an excessive amount of calls or payload sizes. Attackers use that for DoS and brute force attacks.

USE CASES

- Attacker overloading the API
- Excessive rate of requests
- Request or field sizes
- "Zip bombs"

HOW TO PREVENT

- Rate limiting
- Payload size limits
- Rate limits specific to API methods, clients, addresses
- Checks on compression ratios
- Limits on container resources

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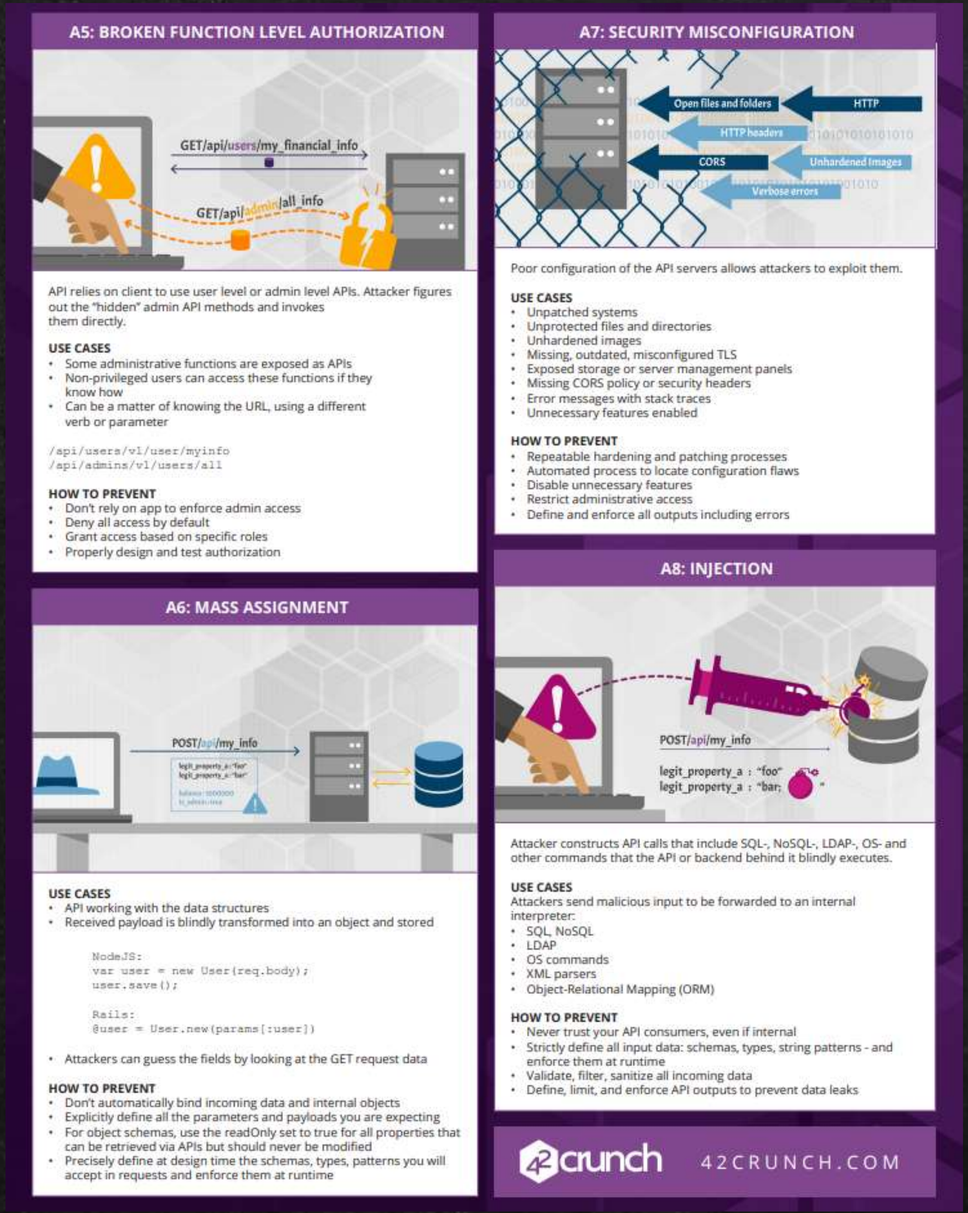

A5: BROKEN FUNCTION LEVEL AUTHORIZATION

GET/api/users/my_financial_info
GET/api/admin/all_info

API relies on client to use user level or admin level APIs. Attacker figures out the "hidden" admin API methods and invokes them directly.

USE CASES

- Some administrative functions are exposed as APIs
- Non-privileged users can access these functions if they know how
- Can be a matter of knowing the URL, using a different verb or parameter

```
/api/users/v1/user/myinfo
/api/admins/v1/users/all
```

HOW TO PREVENT

- Don't rely on app to enforce admin access
- Deny all access by default
- Grant access based on specific roles
- Properly design and test authorization

A6: MASS ASSIGNMENT

USE CASES

- API working with the data structures
- Received payload is blindly transformed into an object and stored

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

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

- Attackers can guess the fields by looking at the GET request data

HOW TO PREVENT

- Don't automatically bind incoming data and internal objects
- Explicitly define all the parameters and payloads you are expecting
- For object schemas, use the readOnly set to true for all properties that can be retrieved via APIs but should never be modified
- Precisely define at design time the schemas, types, patterns you will accept in requests and enforce them at runtime

A7: SECURITY MISCONFIGURATION

Poor configuration of the API servers allows attackers to exploit them.

USE CASES

- Unpatched systems
- Unprotected files and directories
- Unhardened images
- Missing, outdated, misconfigured TLS
- Exposed storage or server management panels
- Missing CORS policy or security headers
- Error messages with stack traces
- Unnecessary features enabled

HOW TO PREVENT

- Repeatable hardening and patching processes
- Automated process to locate configuration flaws
- Disable unnecessary features
- Restrict administrative access
- Define and enforce all outputs including errors

A8: INJECTION

Attacker constructs API calls that include SQL-, NoSQL-, LDAP-, OS- and other commands that the API or backend behind it blindly executes.

USE CASES

Attackers send malicious input to be forwarded to an internal interpreter:

- SQL, NoSQL
- LDAP
- OS commands
- XML parsers
- Object-Relational Mapping (ORM)

HOW TO PREVENT

- Never trust your API consumers, even if internal
- Strictly define all input data: schemas, types, string patterns - and enforce them at runtime
- Validate, filter, sanitize all incoming data
- Define, limit, and enforce API outputs to prevent data leaks

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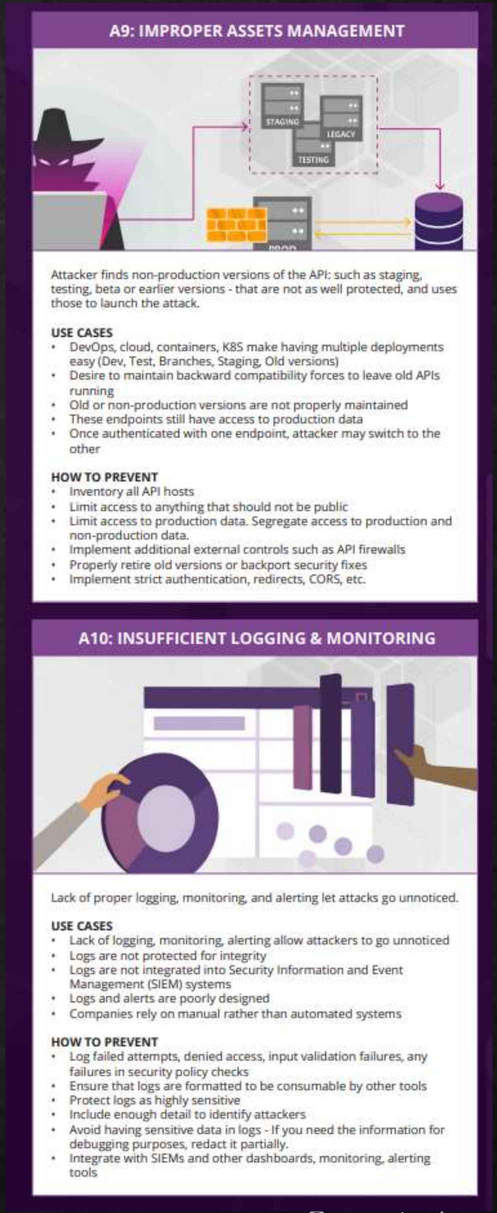

A9: IMPROPER ASSETS MANAGEMENT

STAGING
LEGACY
TESTING
PROD

Attacker finds non-production versions of the API: such as staging, testing, beta or earlier versions - that are not as well protected, and uses those to launch the attack.

USE CASES

- DevOps, cloud, containers, K8S make having multiple deployments easy (Dev, Test, Branches, Staging, Old versions)
- Desire to maintain backward compatibility forces to leave old APIs running
- Old or non-production versions are not properly maintained
- These endpoints still have access to production data
- Once authenticated with one endpoint, attacker may switch to the other

HOW TO PREVENT

- Inventory all API hosts
- Limit access to anything that should not be public
- Limit access to production data. Segregate access to production and non-production data.
- Implement additional external controls such as API firewalls
- Properly retire old versions or backport security fixes
- Implement strict authentication, redirects, CORS, etc.

A10: INSUFFICIENT LOGGING & MONITORING

Lack of proper logging, monitoring, and alerting let attacks go unnoticed.

USE CASES

- Lack of logging, monitoring, alerting allow attackers to go unnoticed
- Logs are not protected for integrity
- Logs are not integrated into Security Information and Event Management (SIEM) systems
- Logs and alerts are poorly designed
- Companies rely on manual rather than automated systems

HOW TO PREVENT

- Log failed attempts, denied access, input validation failures, any failures in security policy checks
- Ensure that logs are formatted to be consumable by other tools
- Protect logs as highly sensitive
- Include enough detail to identify attackers
- Avoid having sensitive data in logs - If you need the information for debugging purposes, redact it partially.
- Integrate with SIEMs and other dashboards, monitoring, alerting tools

https://apisecurity.io/encyclopedia/content/owasp-api-security-top-10-cheat-sheet-a4.pdf

Demo time!

Broken authentication

Unprotected APIs

Weak authentication

Lack of access token validation

Security misconfigurations

Misconfigured HTTP headers

Unnecessary HTTP methods

Verbose error messages

Excessive data exposure

Full data objects returned

Filtering on client

Secure information exposed

Lack of resources and rate limiting

Brute force attacks

Denial of Service

Excessive request size

Insufficient logging and monitoring

Lack of logging, monitoring, alerting

Logs not integrated

Relying on manual checks

Almost done…

API Management to the rescue

#	OWASP API Top 10 (2019)	Mitigations and preventive measures
1	Broken Object Level Authorization	Area of investment
2	Broken Authentication	Key/token/certificate-based authentication Request transformation
3	Excessive Data Exposure	Filtering or masking sensitive data
4	Lack of Resources & Rate Limiting	Throttling and quota limit Backend concurrency
5	Broken Function Level Authorization	Key/token-based authorization Custom authorization
6	Mass assignment	Area of investment
7	Security misconfigurations	TLS enforcement and configuration CORS Sanitization of response headers and error messages
8	Injection	Area of investment
9	Improper Assets Management	Up-to-date API catalog API lifecycle management
10	Insufficient logging and monitoring	Logging

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