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Putting Privacy on the MAP

A Persona Based Approach to Threat Modeling

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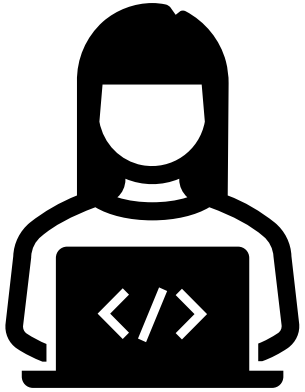

- How does my app work?
- What kinds of data does it collect and process?

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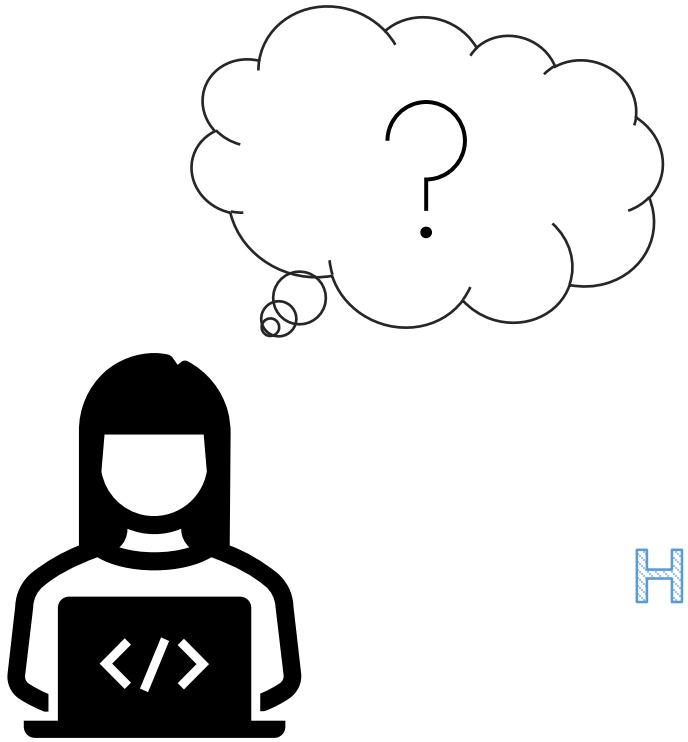

How do I find privacy threats in my application?

A manual privacy threat model is a way to identify these kinds of privacy violations at the design or architecture level.

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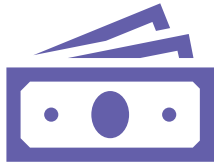
However...

Happens late stage



Resource intensive

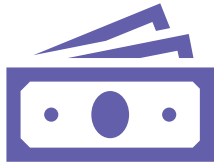
Needs common language

Demands privacy expertise

Privacy Shift Left

Happens late stage

Integrate privacy early by empowering developers



Resource intensive

Reduce overhead for threat modelers by potentially reducing action items and time

Needs common language

Better efficiency due to consistent, repeatable threats across apps

Demands privacy expertise

Use terms that are established and familiar

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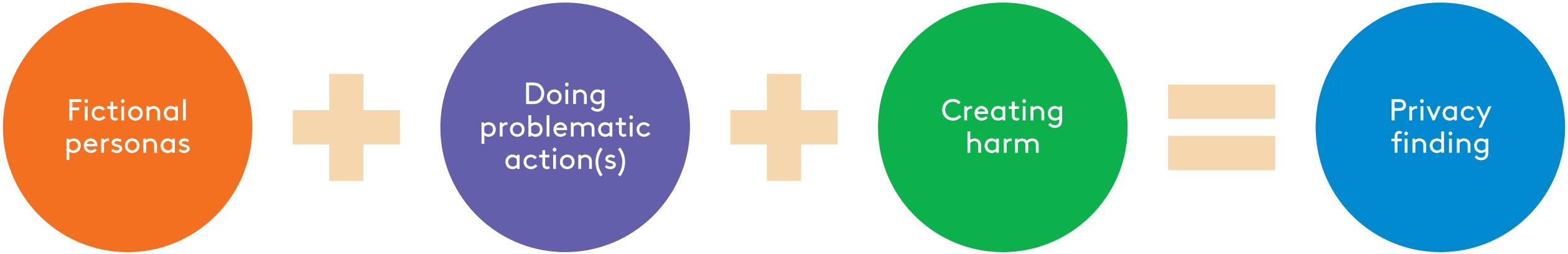
MAP Draws on Existing Frameworks



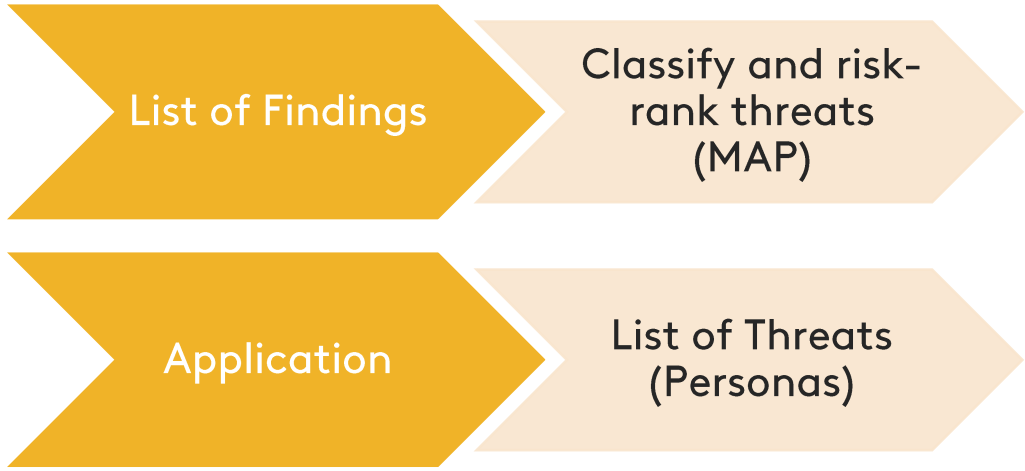
Existing Privacy Frameworks

- OWASP Top 10 Privacy Risks
- MITRE Privacy Threat Taxonomy
- NIST Privacy Risk Assessment Methodology
- LINDDUN

Models of Applied Privacy (MAP)

Holistic framework that builds on existing mechanisms for doing privacy threat modeling

Complements the privacy threat modeling process by guiding developers to **find** and **formalize** threats in the requirement gathering stage



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MAP Structure

There are three components

Actor	Mechanism	Impact
CSAN Threat Actor List + Classify	LINDDUN + PRAM	Citron-Solove Taxonomy + Classify

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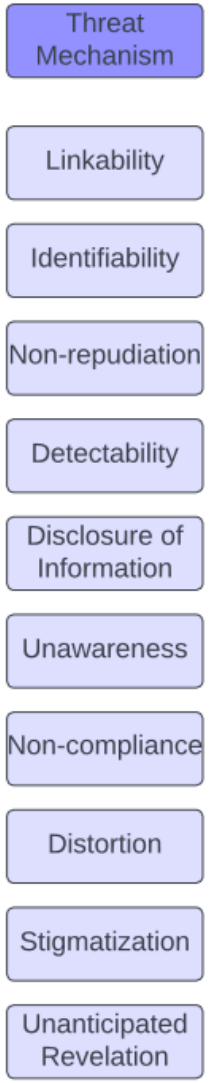
MAP – Privacy Threat Modeling Framework

What threat(s) can occur?



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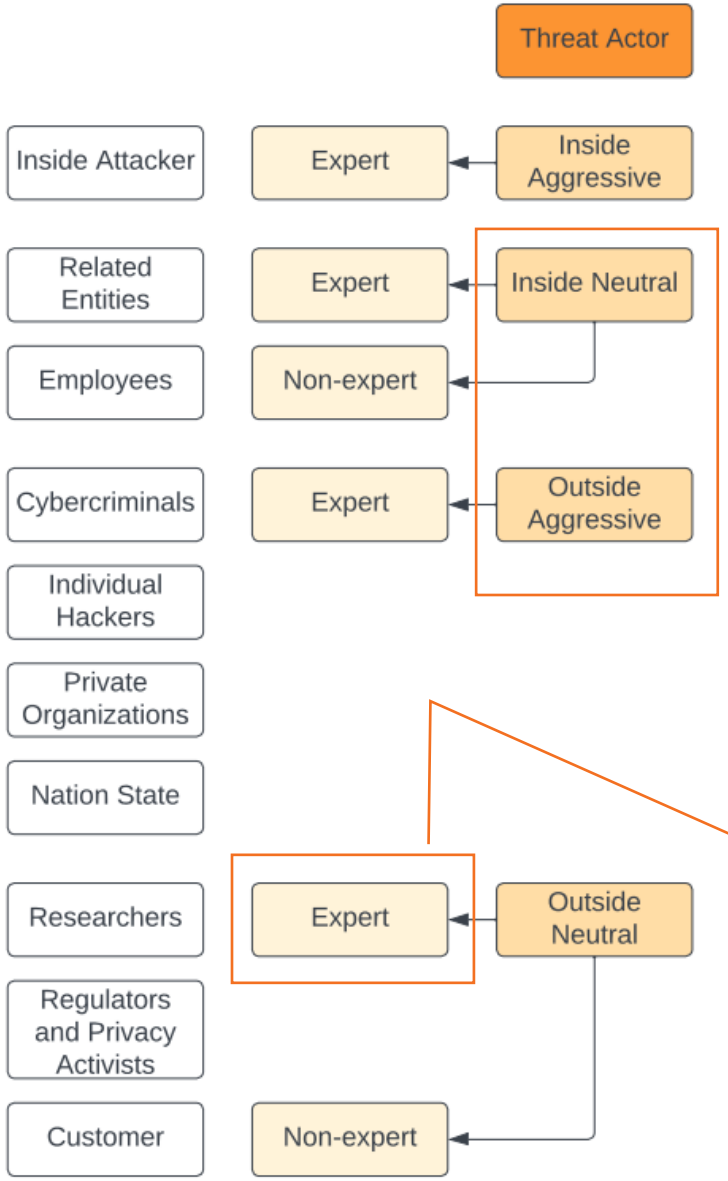
MAP – Privacy Threat Modeling Framework



Who can cause this threat?

Are they present inside the organization?

Do they intend to cause harm to the organization or to a person?

Someone with 5 years of Computer-related experience who uses that skill for a privacy threat

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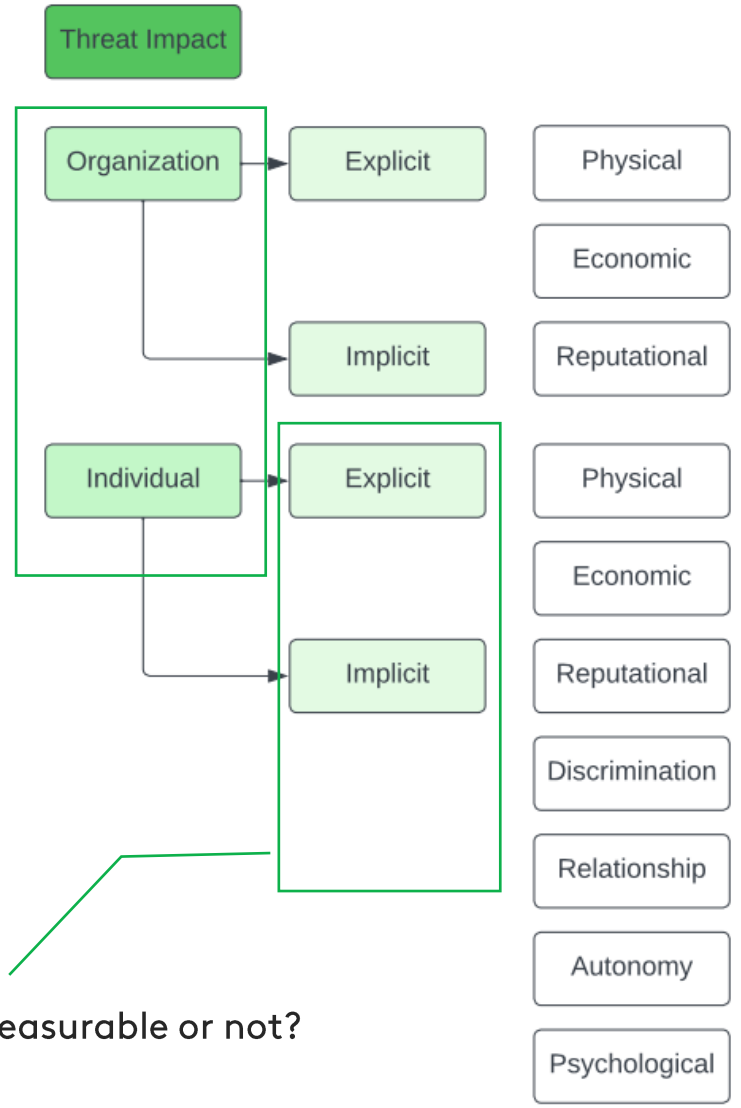
MAP – Privacy Threat Modeling Framework

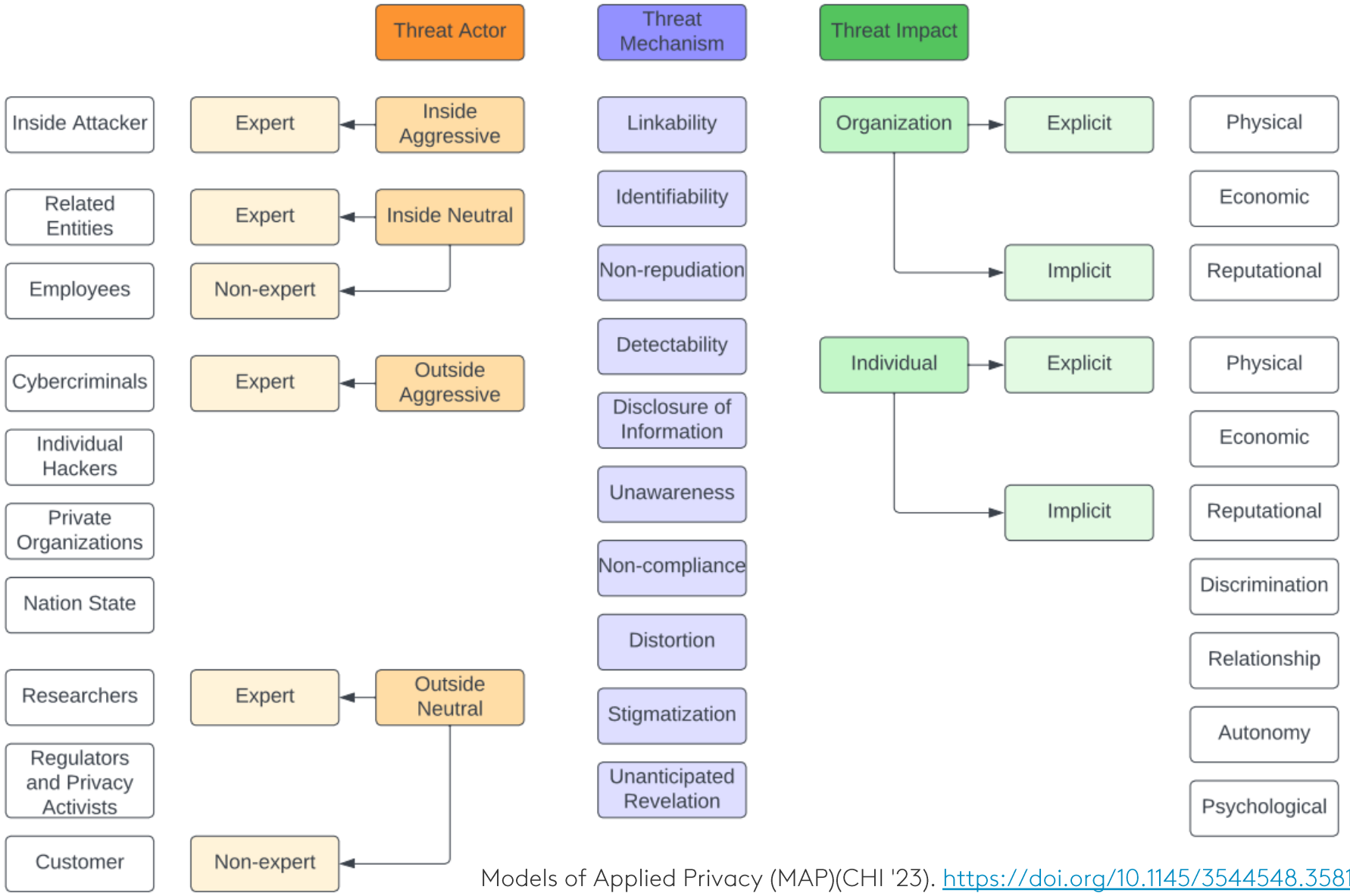
What harm can this threat cause?



Is the harm related to an organization or to a person?

Is the harm measurable or not?

MAP – Privacy Threat Modeling Framework



Models of Applied Privacy (MAP)(CHI '23). https://doi.org/10.1145/3544548.3581484

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Advantages

Flexible

- Makes it easier to add and delete categories as required.

Scalable

- Form a piece-wise architecture that is easy to code.

Customizable

- Independent of industry type and scale.

Moving away from an attacker-only approach

- Accounts for both malicious and benign actors.

How Do I Use MAP?

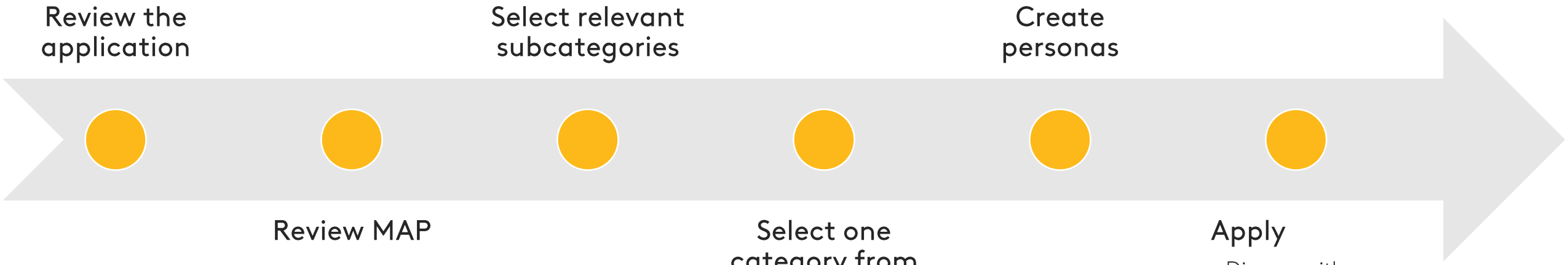
MAP uses personas to go from abstract to concrete visualization of the threat.

Personas are fictional characters, which you create based upon your research to **represent the different user types that might use your service, product, site, or brand in a similar way**.

Personas are commonly used in product development to ensure that the product meets the needs of all potential customers.

How can developers use this?

Note: Security TM is always the first step!



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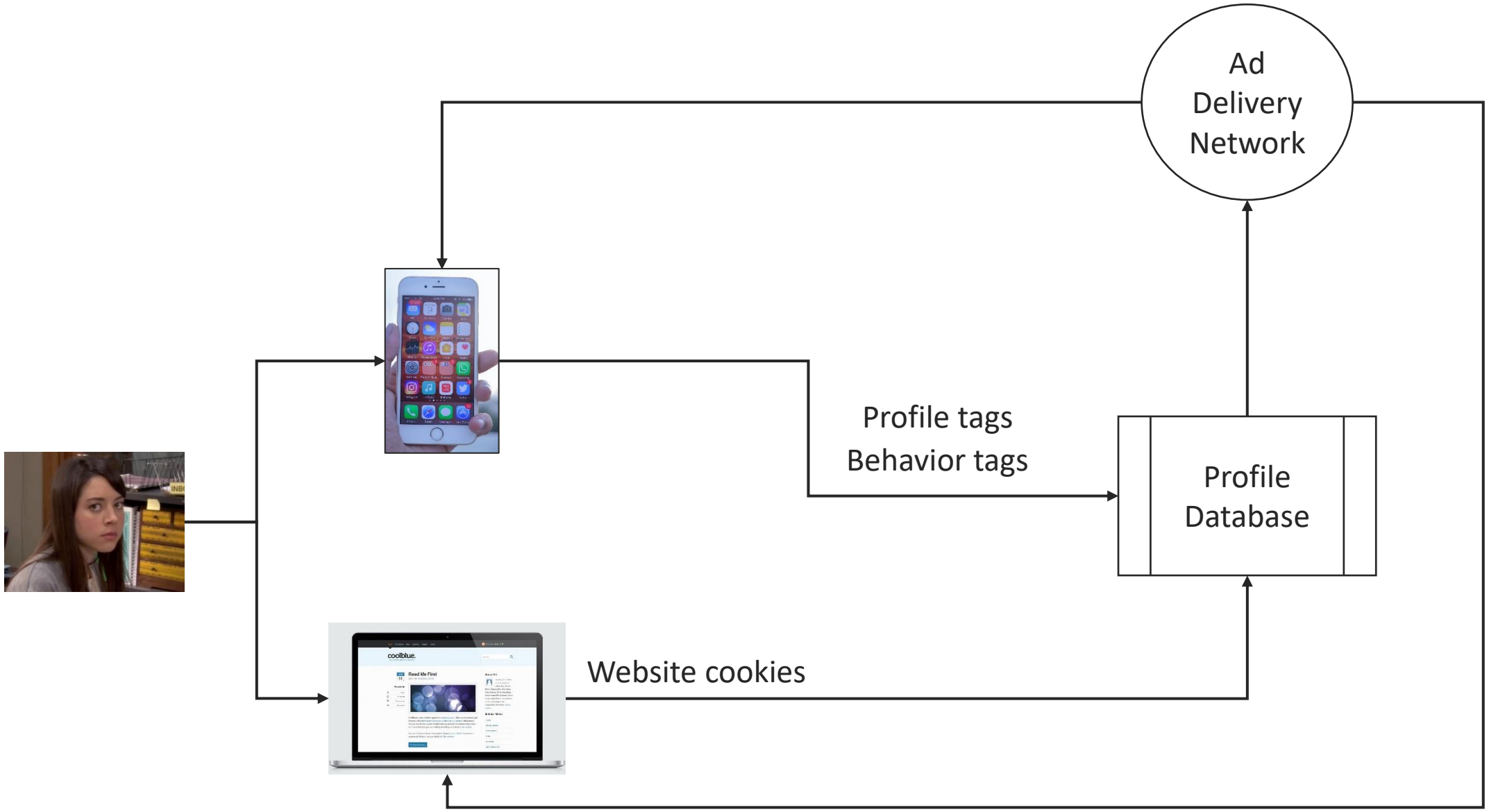
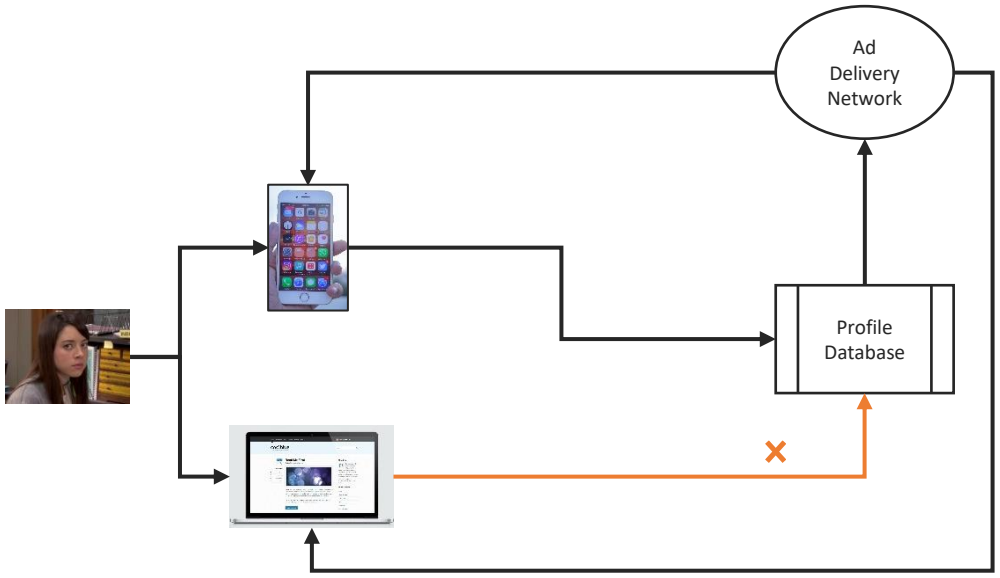
Let’s do an example!

April uses a social media app





Example Persona

Outside Neutral (Expert) - Researchers, Non-compliance

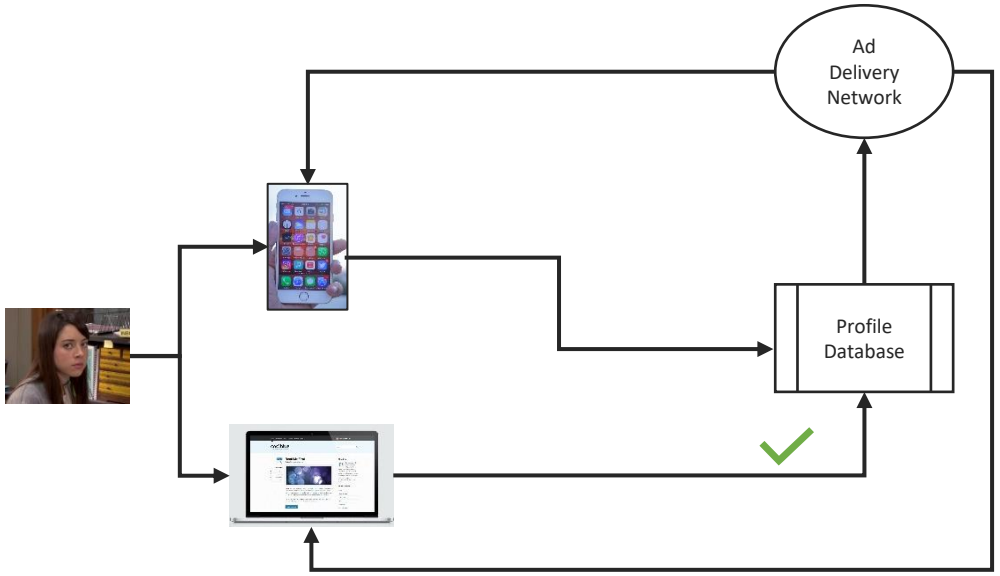
Kiwi is a researcher who recently found company ABC's user data in a large breach. Interestingly, on further investigation, Kiwi found that the types of data released in the breach was a lot more than what ABC had said they collect from users.

Consider this persona for your application.

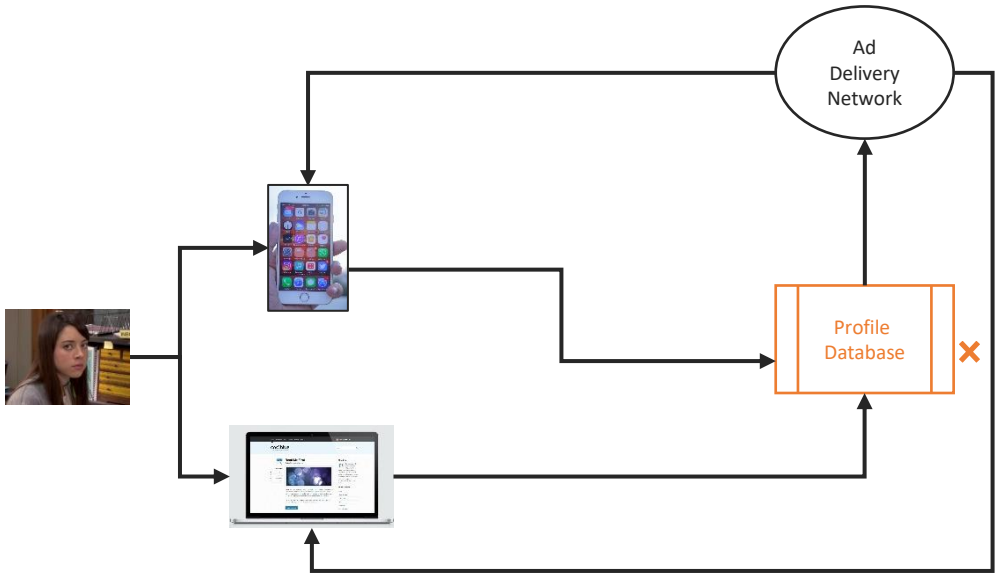
1. Have you documented all the data types collected by your application?
2. Is your application collecting only the minimum data necessary for the app to function?
3. If no, have you documented the reason for collecting additional information?
4. For any information not necessary for the functioning of the is the user aware of the additional data collection and has consent been obtained?

Real World Breach :

https://www.ftc.gov/news-events/news/press-releases/2017/08/uber-settles-ftc-allegations-it-made-deceptive-privacy-data-security-claims



Have an audit process for databases to ensure that minimization and retention policies are followed



Example Persona

Inside Neutral (Non-expert) - Employees, Identifiability

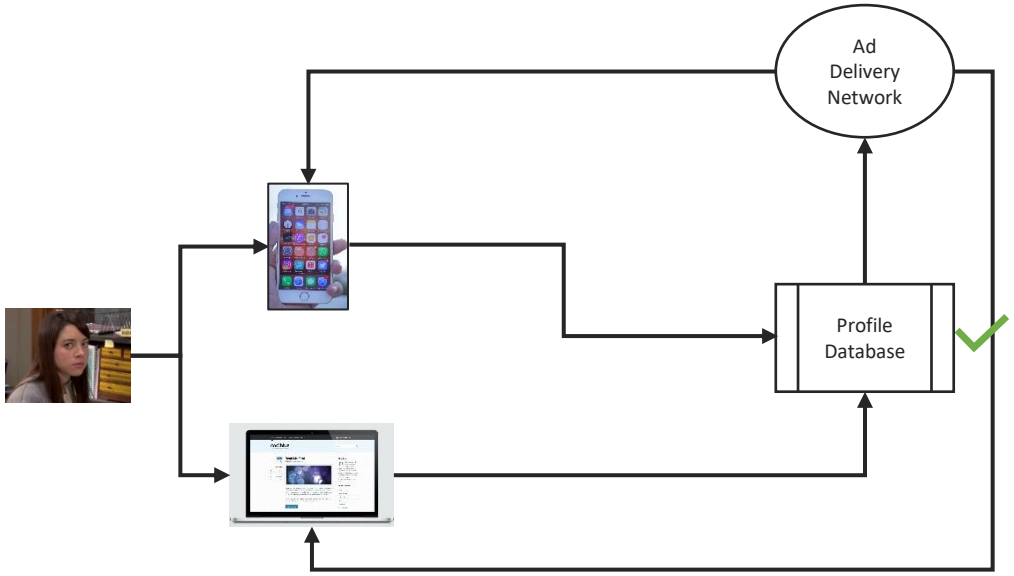
Avocado is a developer at a learning solution provider ABC. They maintain a public database of student information which is de-identified and does not contain personal information directly. However one of the columns in the database contain links and when someone clicks on these links, it redirects to personal documents stored elsewhere, like passport scans, application forms, visas, emails, and even medical information.

Consider this persona for your application.

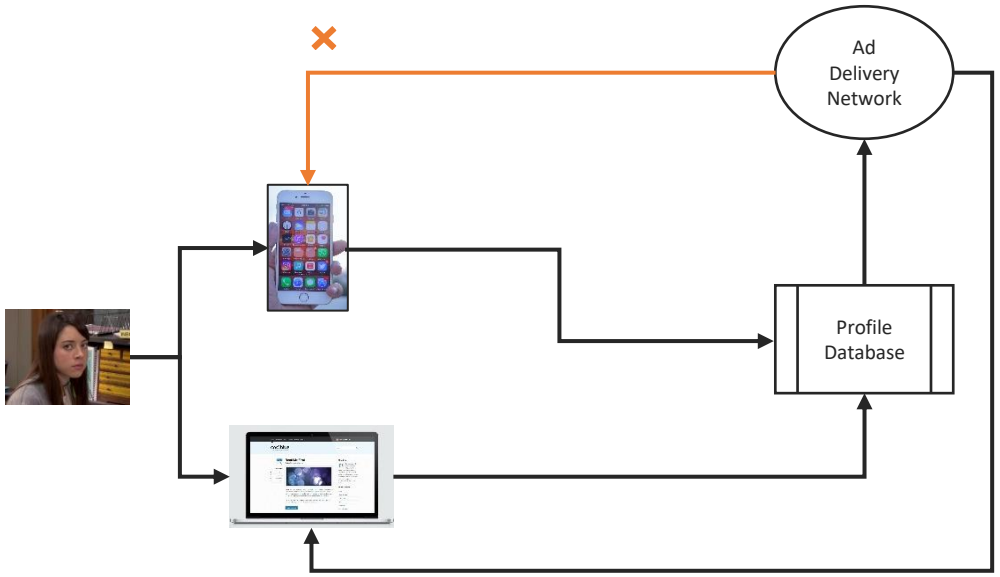
1. Does any component in your application contain links?
2. Do these links redirect to any sensitive information?
3. If yes, is there authentication in place for who can access this information?

Real World Breach :

https://www.infosecurity-magazine.com/news/education-nonprofit-leaks-data/



Anonymize and minimize the amount of personal information viewable by users on need-to-know basis



Example Persona

Inside Neutral (Expert) - Related Entities, Unawareness

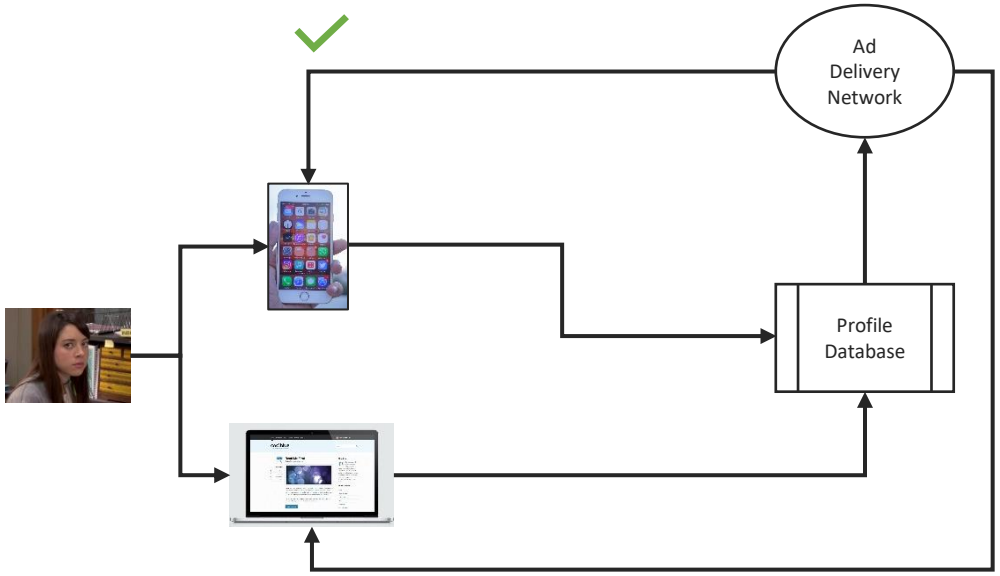
Mango provides identity verification services as a vendor for social media platform ABC. During a breach at ABC, Mango requests personal information from ABC's customers in order to verify their account. However, Mango also sends this data to a marketing company who is now able to target advertisements to customers based on this new information. This purpose was not disclosed to customers and it may cause a privacy issue.

Consider this persona for your application.

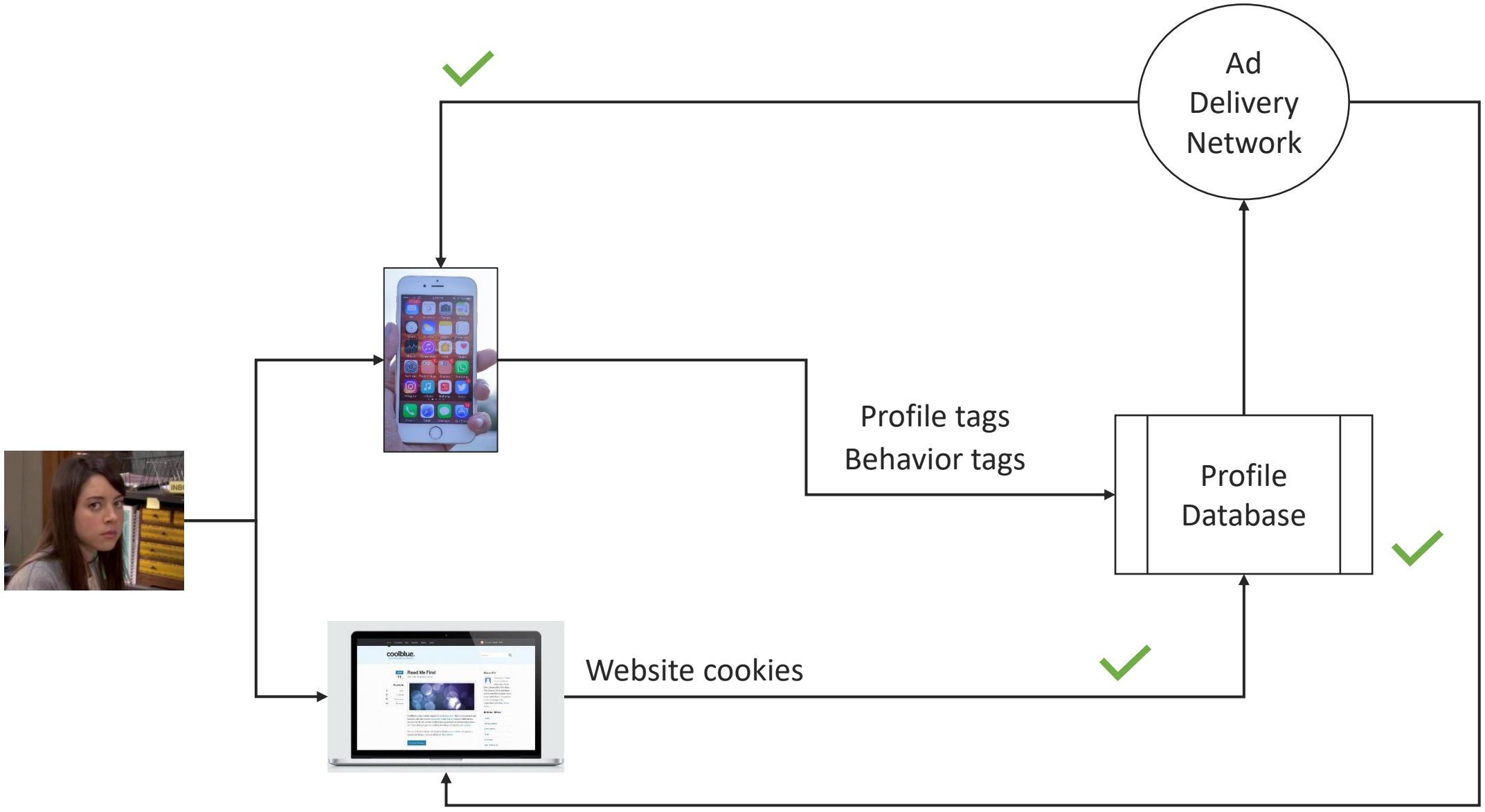
1. If your application has a vendor who uses customer data beyond functionality, do customer know about this in their privacy policy? Have they provided consent to this extended use?
2. Can customers limit their data from being shared by vendors to other applications?
3. Are customers able to access/modify their data that is sent to vendors?
4. Has the vendor gone through TPSA?

Real World Breach :

https://www.ftc.gov/business-guidance/blog/2022/05/twitter-pay-150-million-penalty-allegedly-breaking-its-privacy-promises-again



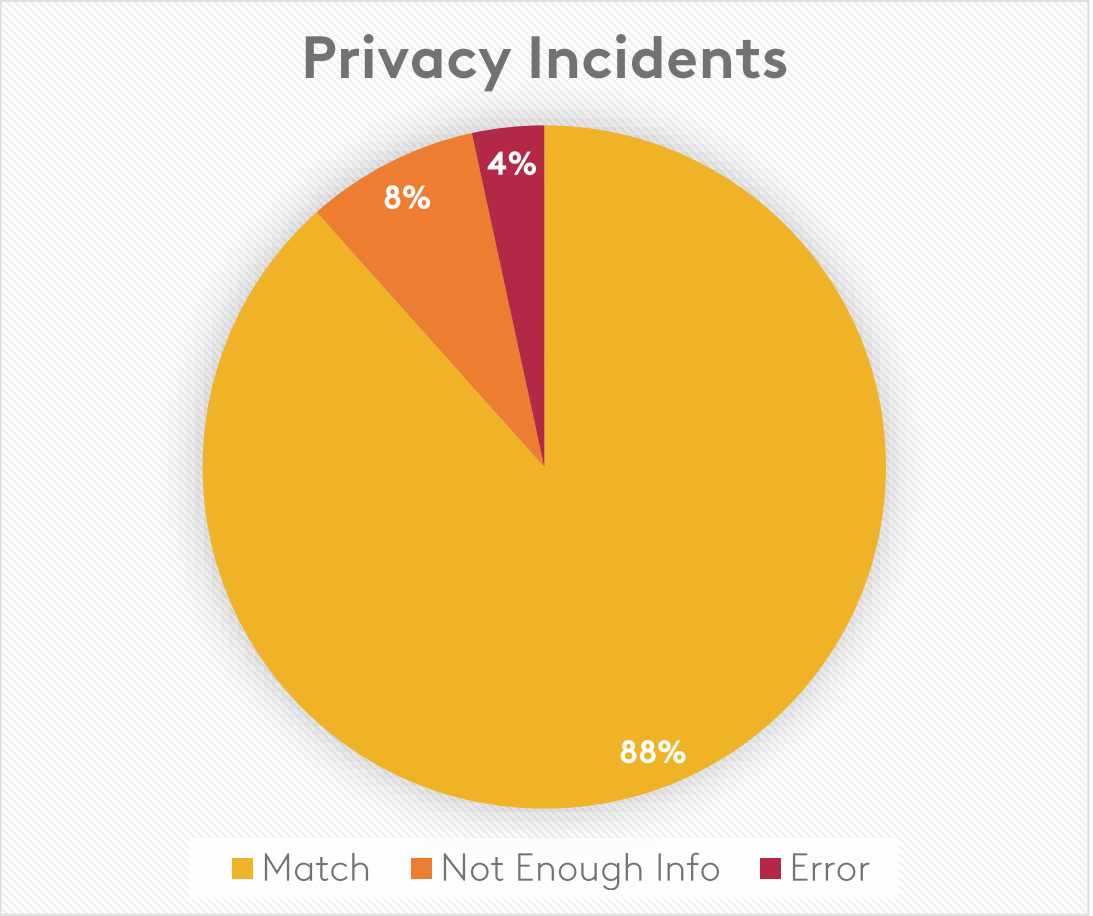
Be transparent with customers – inform the user and give control



Testing on Real-World Incidents

We tested the model against the Verizon Community Data Base for 207 privacy related incidents*

*Note there can be multiple threat impacts



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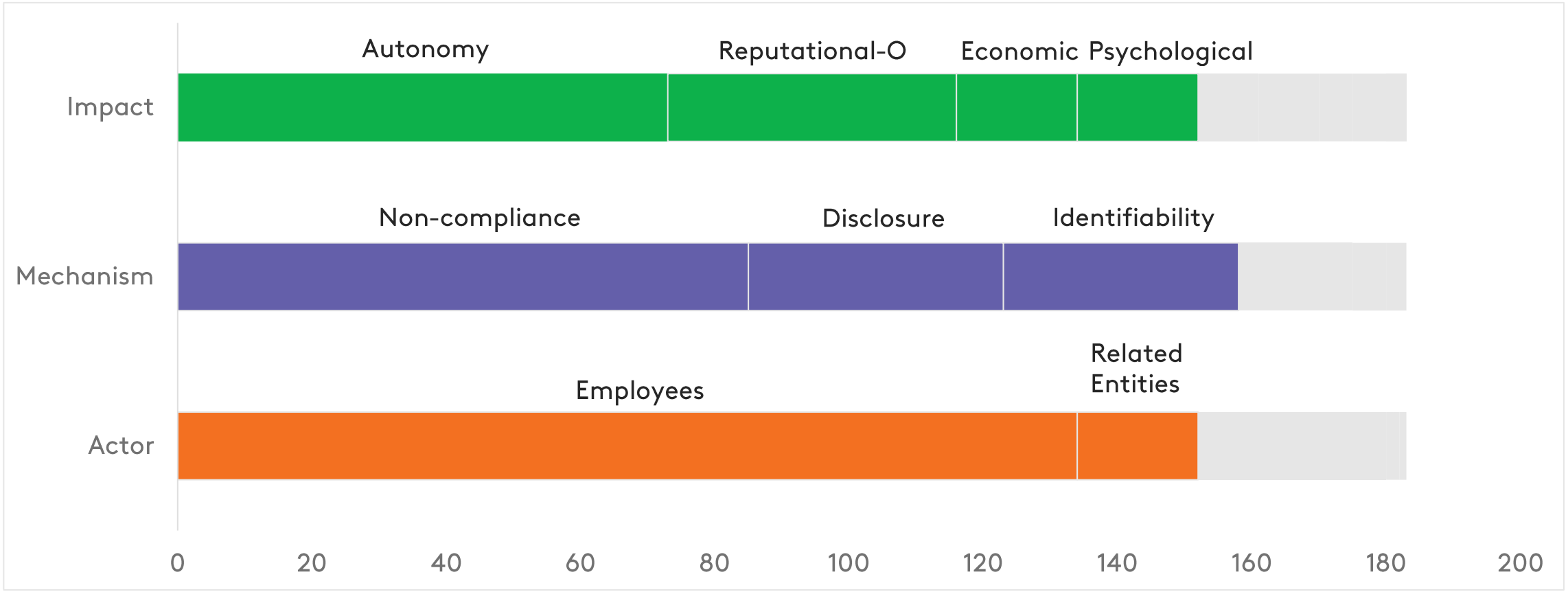
Categorizing Privacy Incidents Using MAP

Frequency of occurrence of the components of the framework in VCDB



Showing categories that account for > 80% of 183 incidents.

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Thank you for Listening!

Key Takeaways

- Unified framework for developers to conduct threat modeling
- Personas help operationalize threats across various sectors
- Use MAP to classify existing findings

Resources

Open-source project on GitHub:
https://github.com/Comcast/MAP

More information on the SPIDER team:
https://corporate.comcast.com/ccs-research

Reach us on LinkedIn:
jayati-dev
bahman-Rashidi
gargvaibhav

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