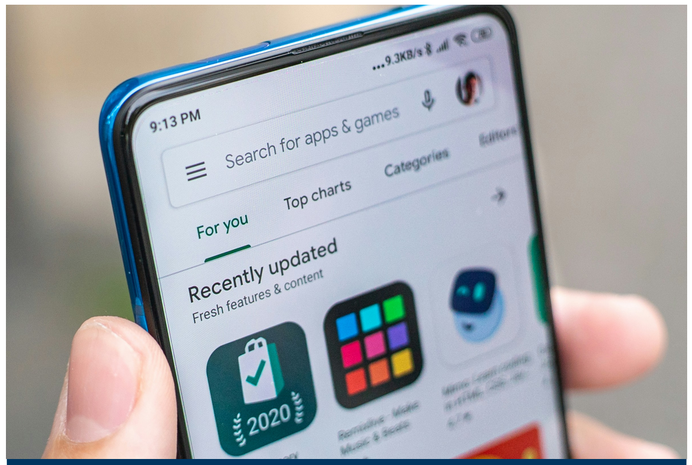

# Vulnerability, Where Art Thou?

## An Investigation of Vulnerability Management in Android Smartphone Chipsets

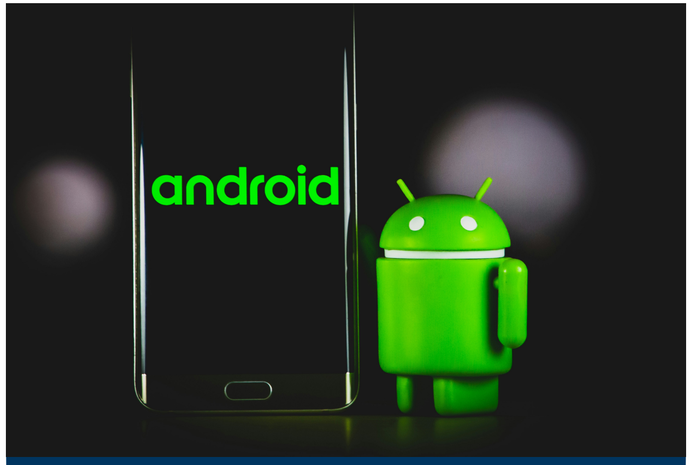
**Daniel Klischies**, Philipp Mackensen, Veelasha Moonsamy

SECURITY AND PRIVACY
OF UBIQUITOUS SYSTEMS

# Smartphone security: Multi-layered complexity

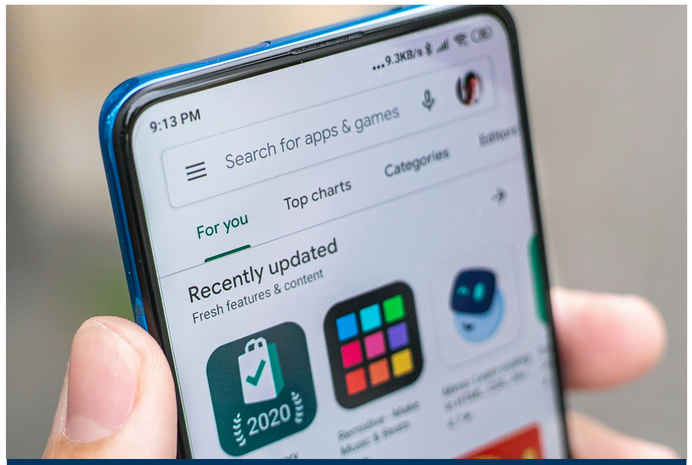



Apps




Android

# Smartphone security: Multi-layered complexity

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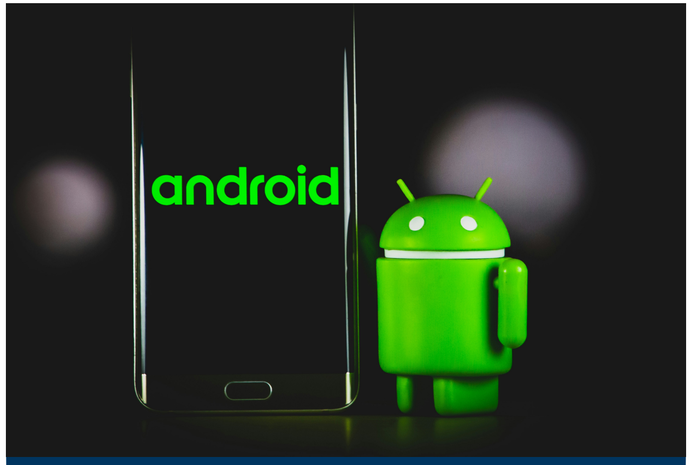



Android

Chipset

# Smartphone security: Multi-layered complexity

**Open questions:**

- Do different chipsets share vulnerabilities?
- Who discovers chipset vulnerabilities?
- What are typical timeframes until vulnerabilities are mitigated?

**And many more**


Chipset

# Smartphone chipsets

## Components

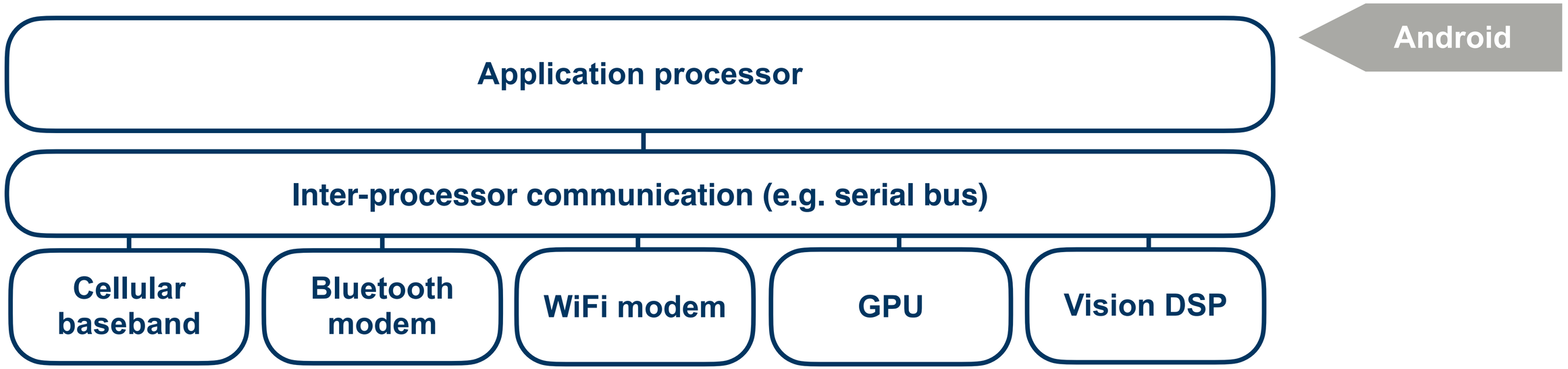

Supplied by:

Chipset manufacturers

Smartphone manufacturers

# Smartphone chipsets

## Components

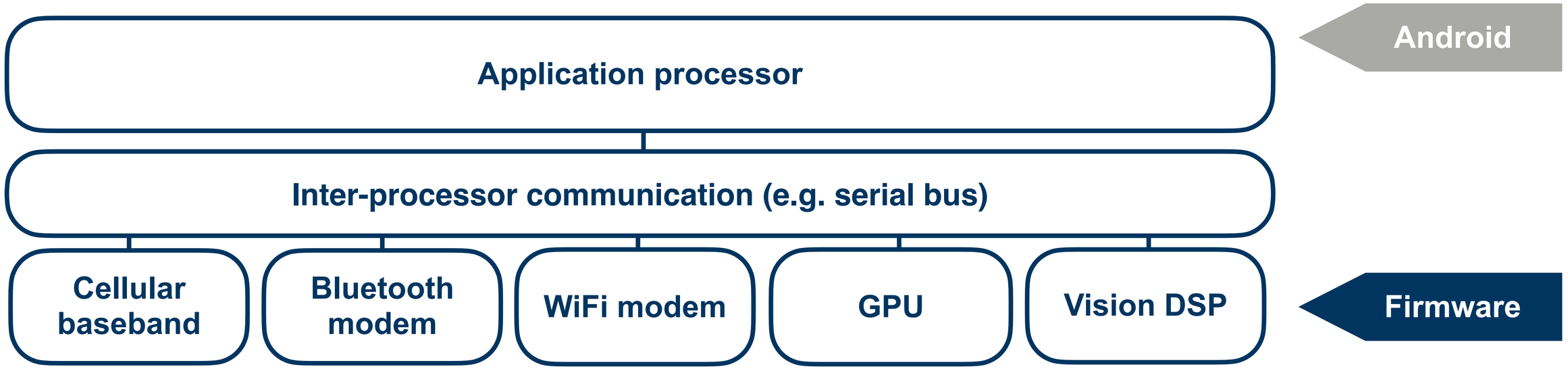



Supplied by:

Chipset manufacturers | Smartphone manufacturers

# Smartphone chipsets

## Components

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# Smartphone chipsets

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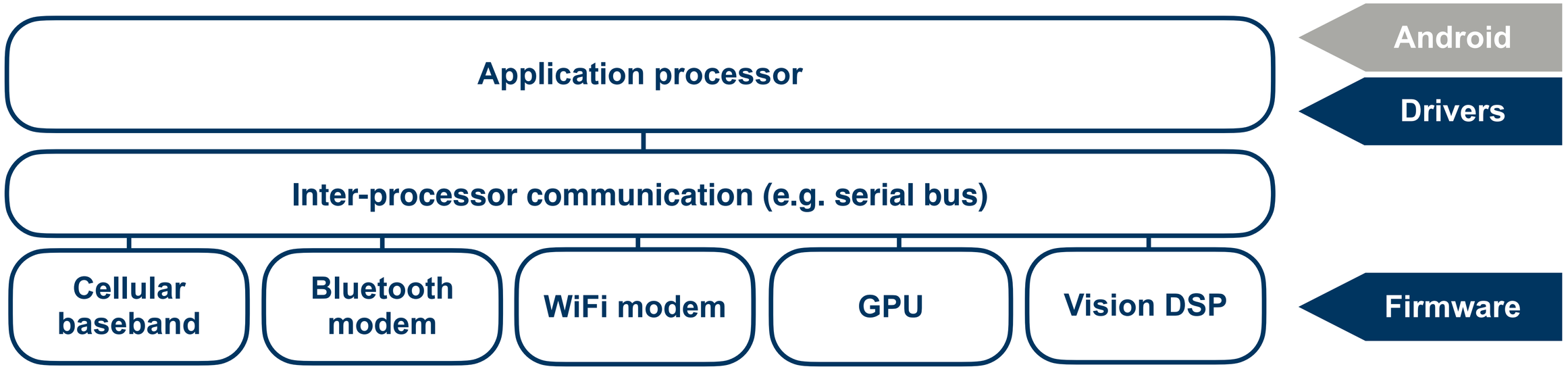


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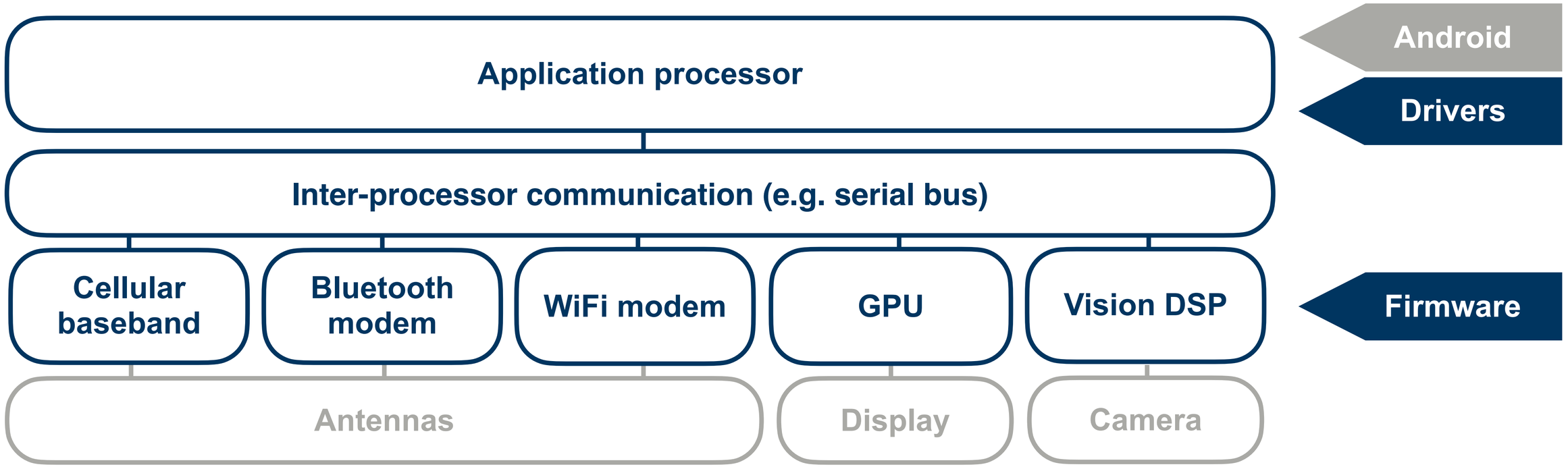
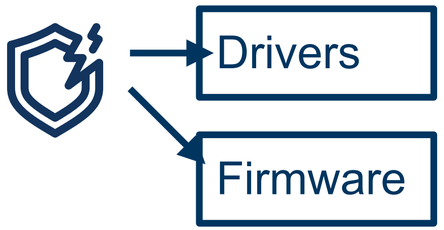



Supplied by:

Chipset manufacturers | Smartphone manufacturers

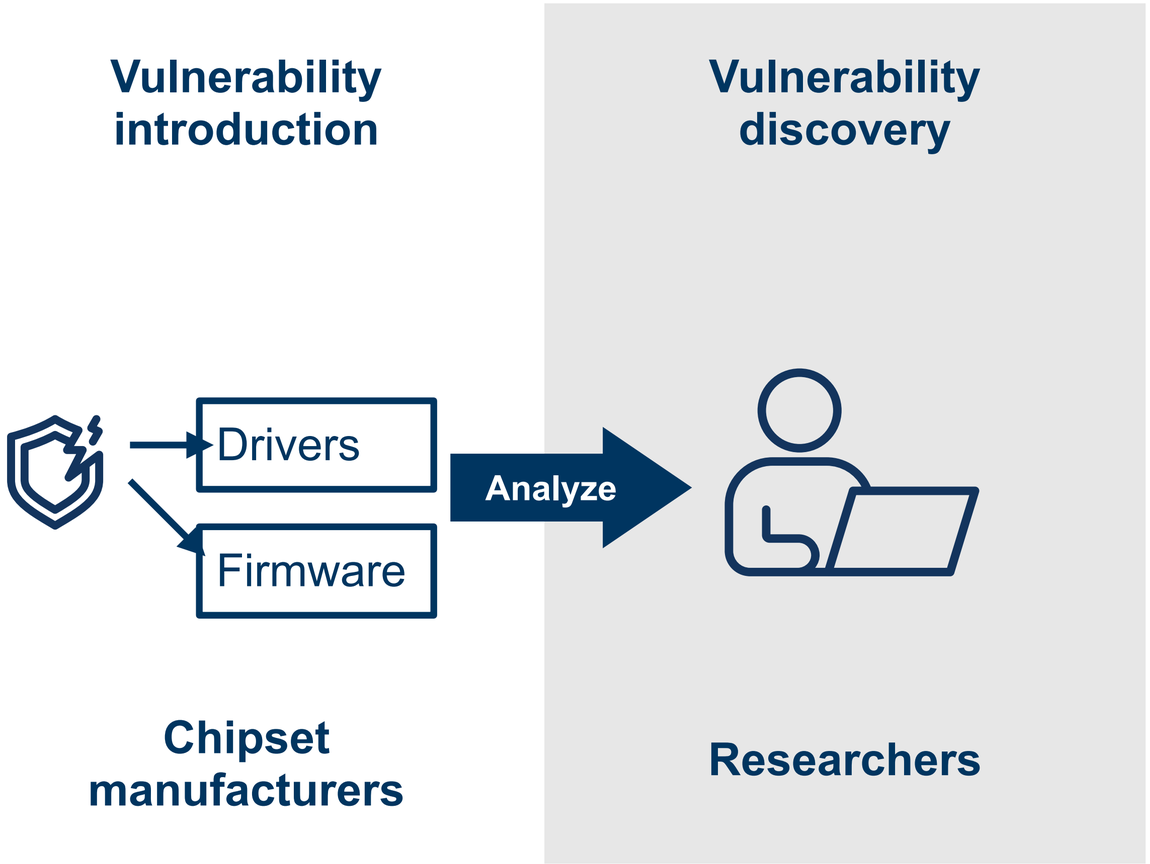
# Chipset vulnerability lifecycle

**Vulnerability introduction**




**Chipset manufacturers**

# Chipset vulnerability lifecycle



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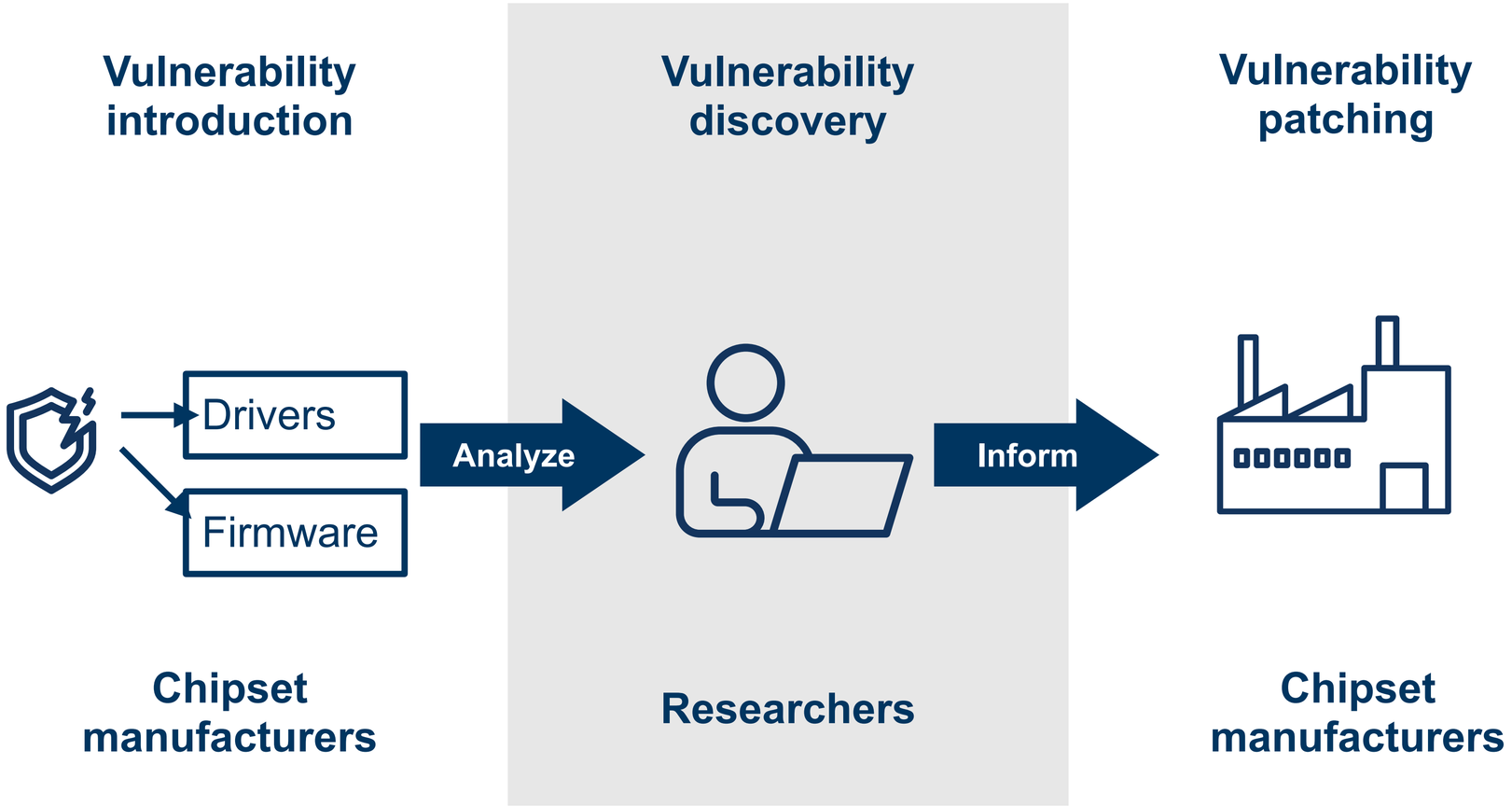

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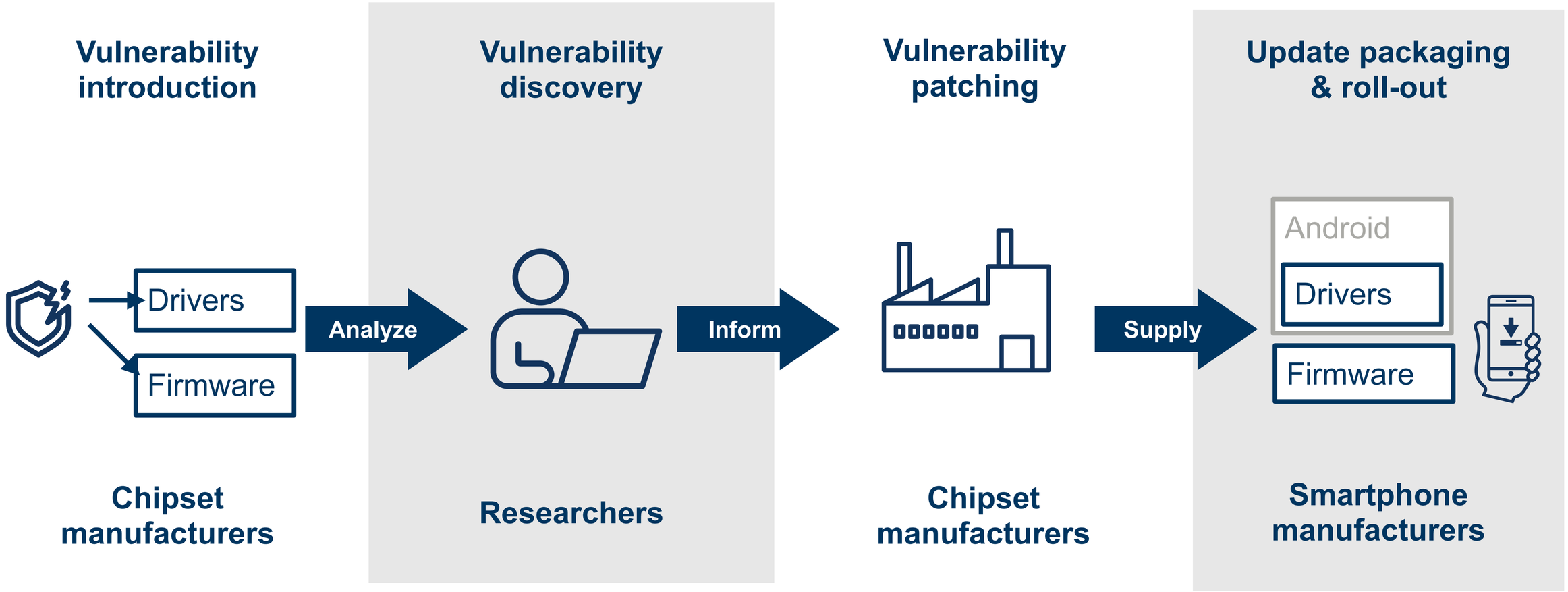

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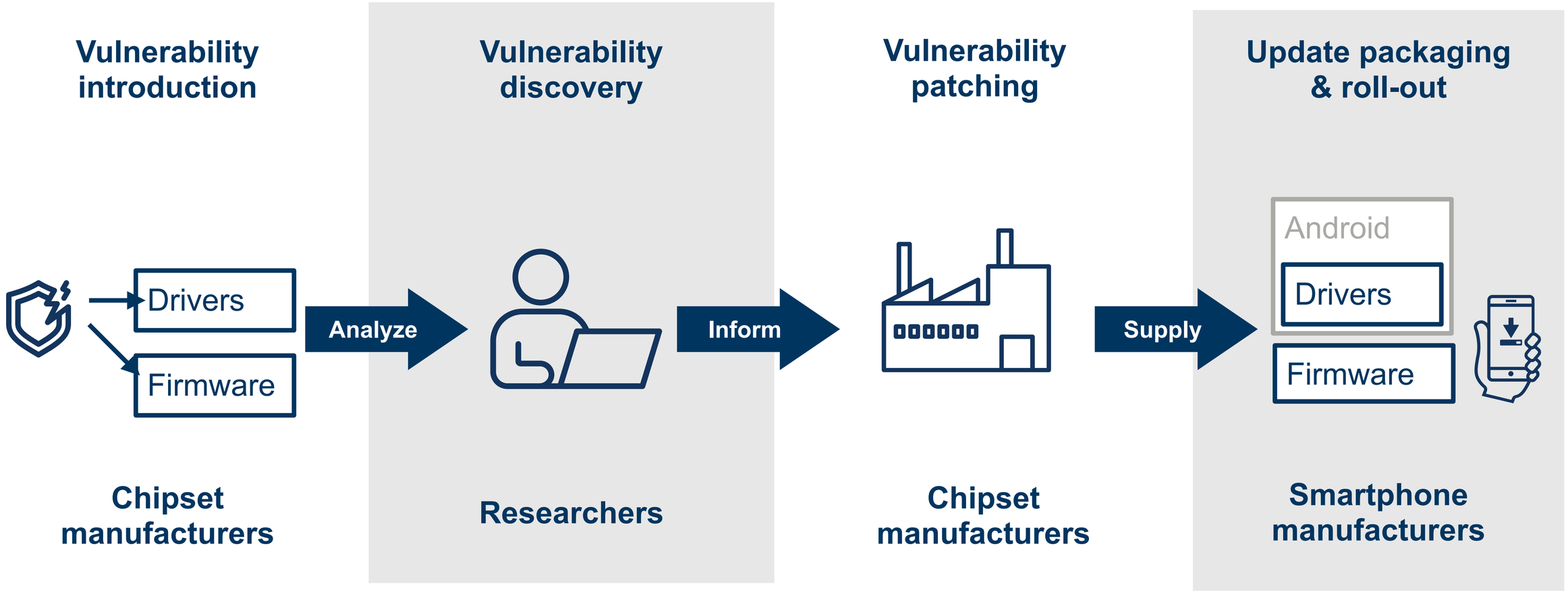


**→ Challenge: Information is scattered across websites of involved companies**

# Our knowledge base

- Android security bulletins
- Chipset manufacturer websites
- National Vulnerability Database
- Smartphone update changelogs
- Product databases

**3,600+**
Vulnerabilities

**18,000+**
Updates

**430+**
Chipset models

Qualcomm, Samsung, MediaTek, Unisoc

**6,800+**
Phone models

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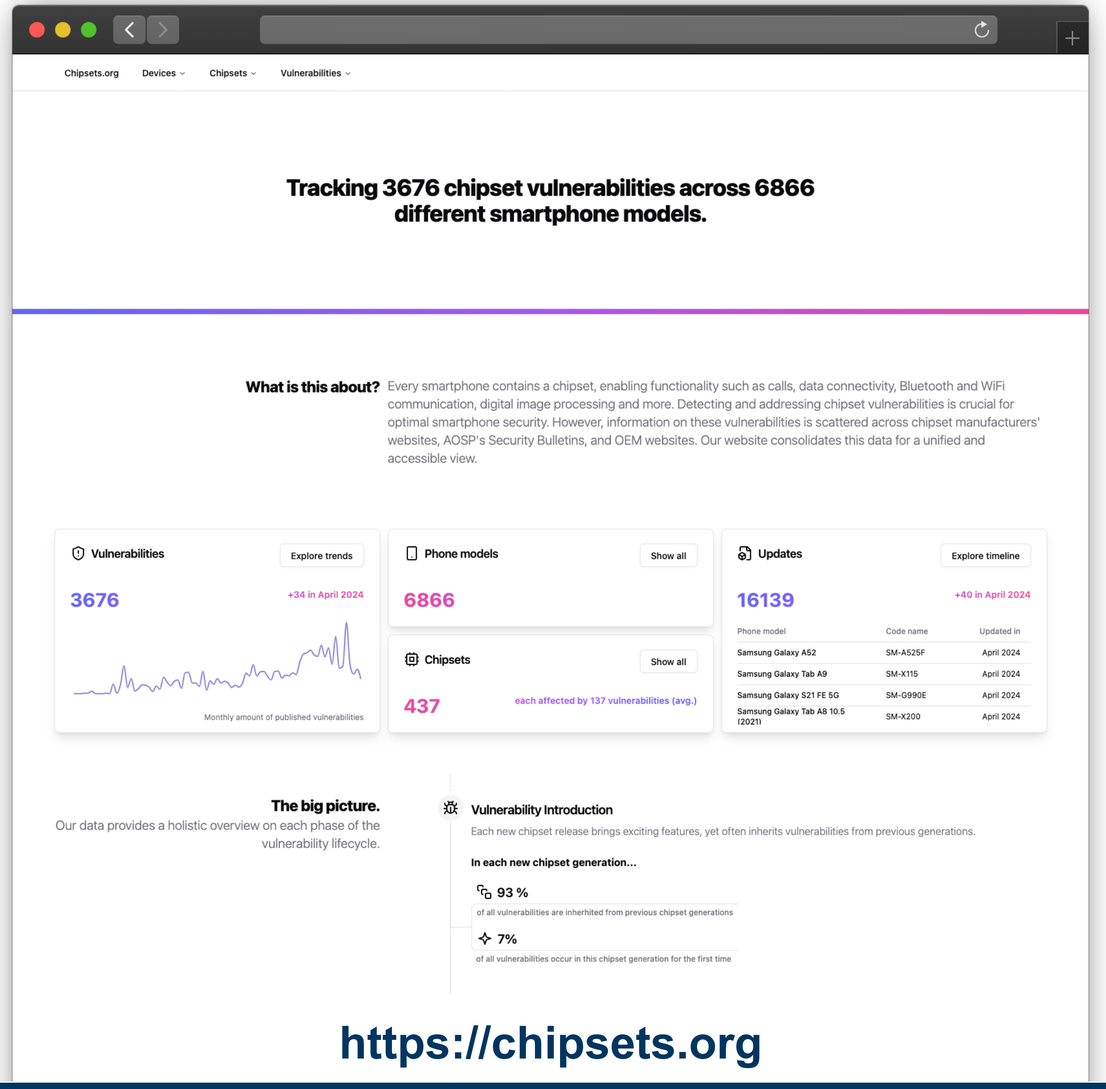


**https://chipsets.org**

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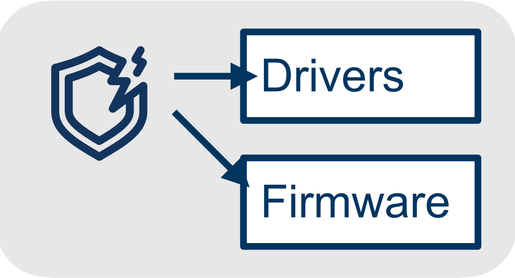


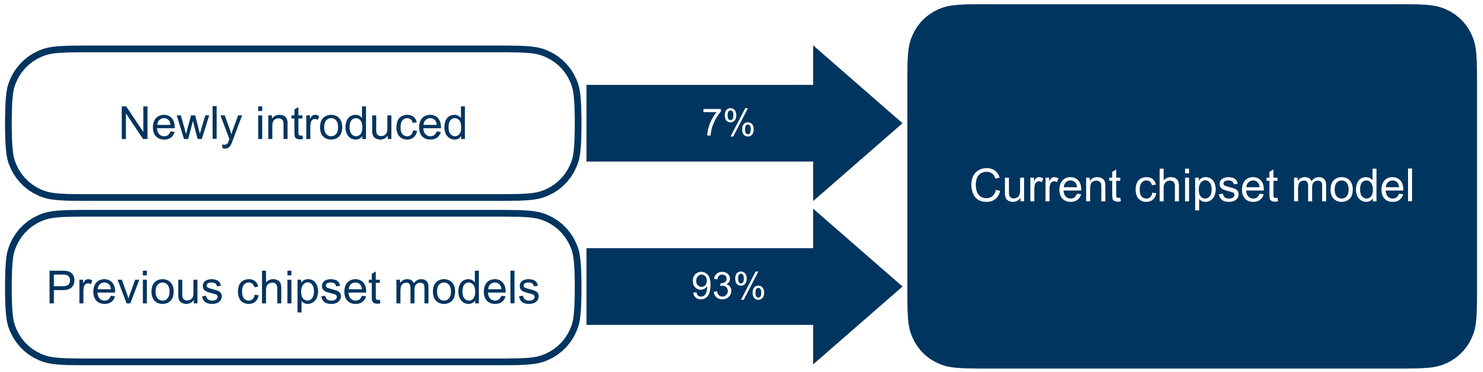

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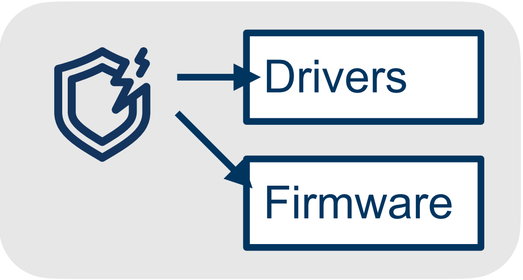


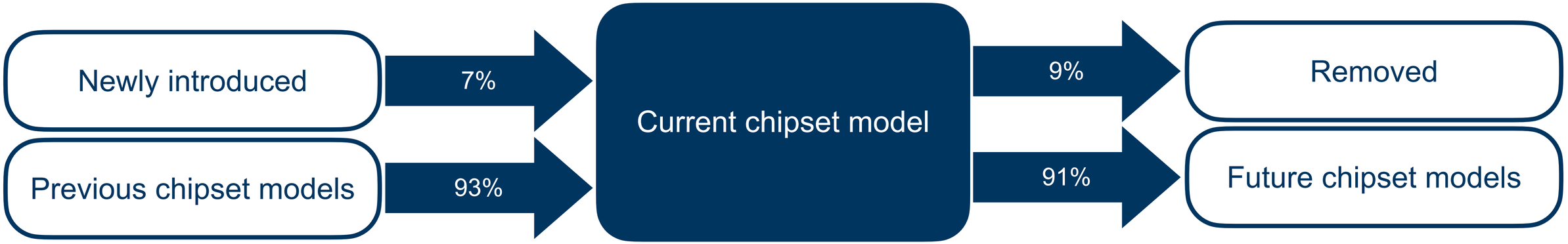

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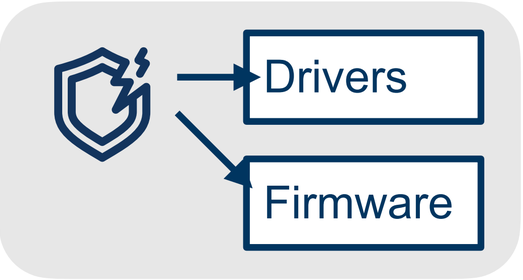
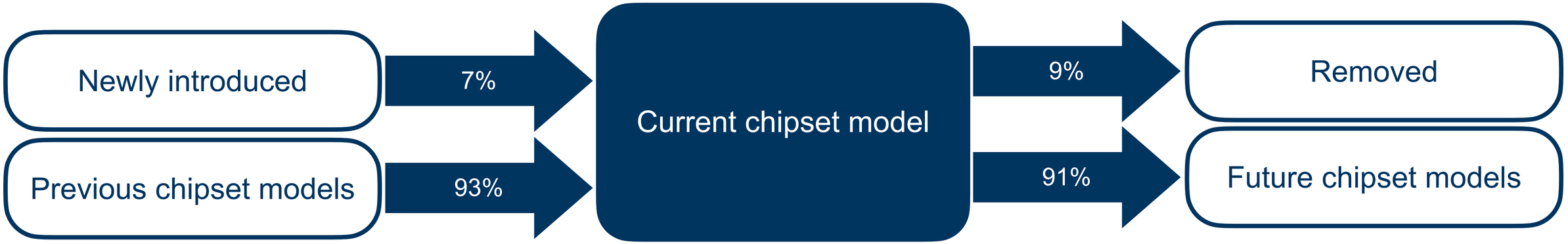


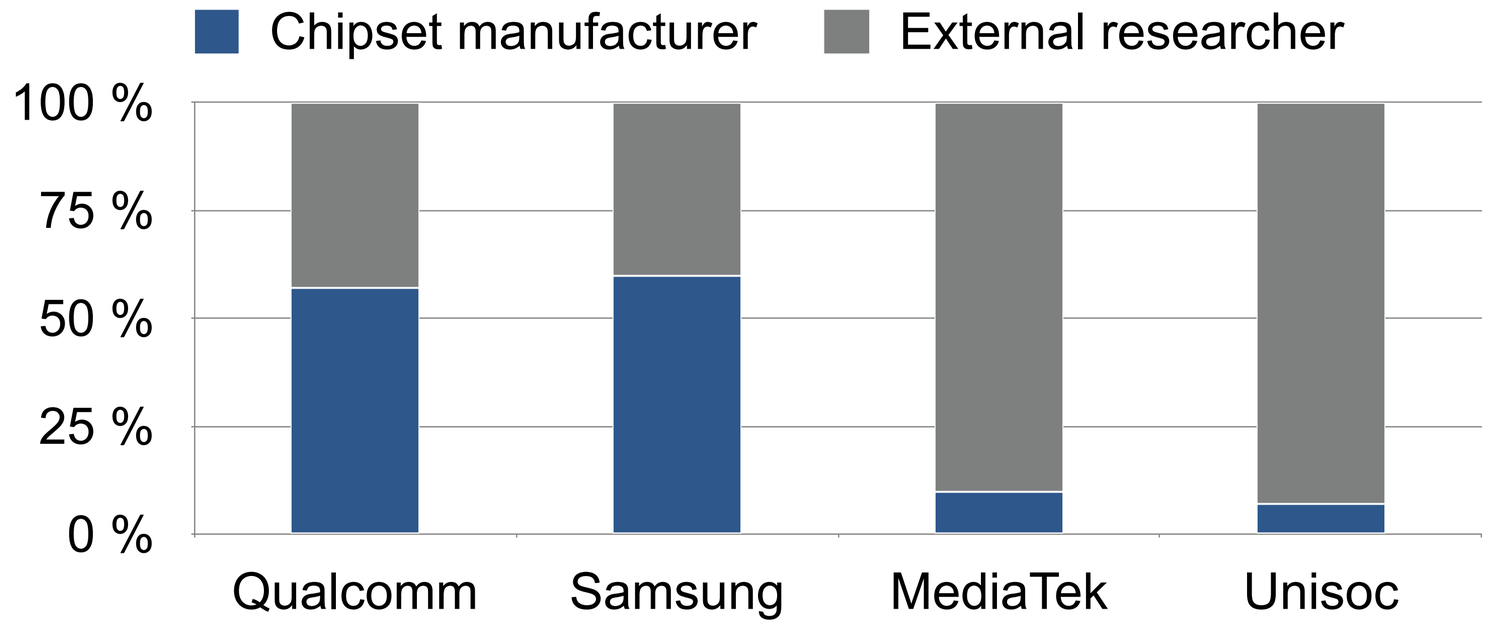




**Takeaways:**

- Analyzing **legacy features** still yields **new vulnerabilities**
- A lot of code is **shared** between chipset models
  - Requires time consuming assessment which models include vulnerable code

# Vulnerability discovery

## Who discovers most vulnerabilities post release (2023)?



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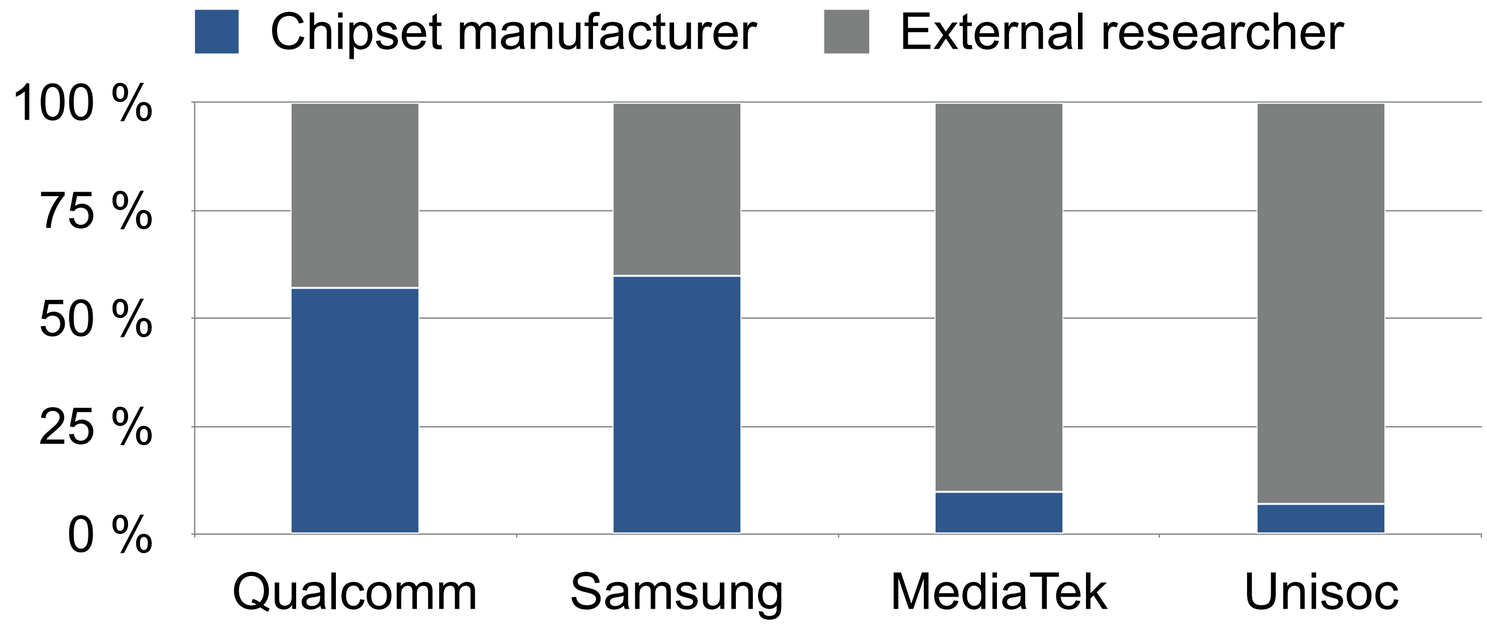
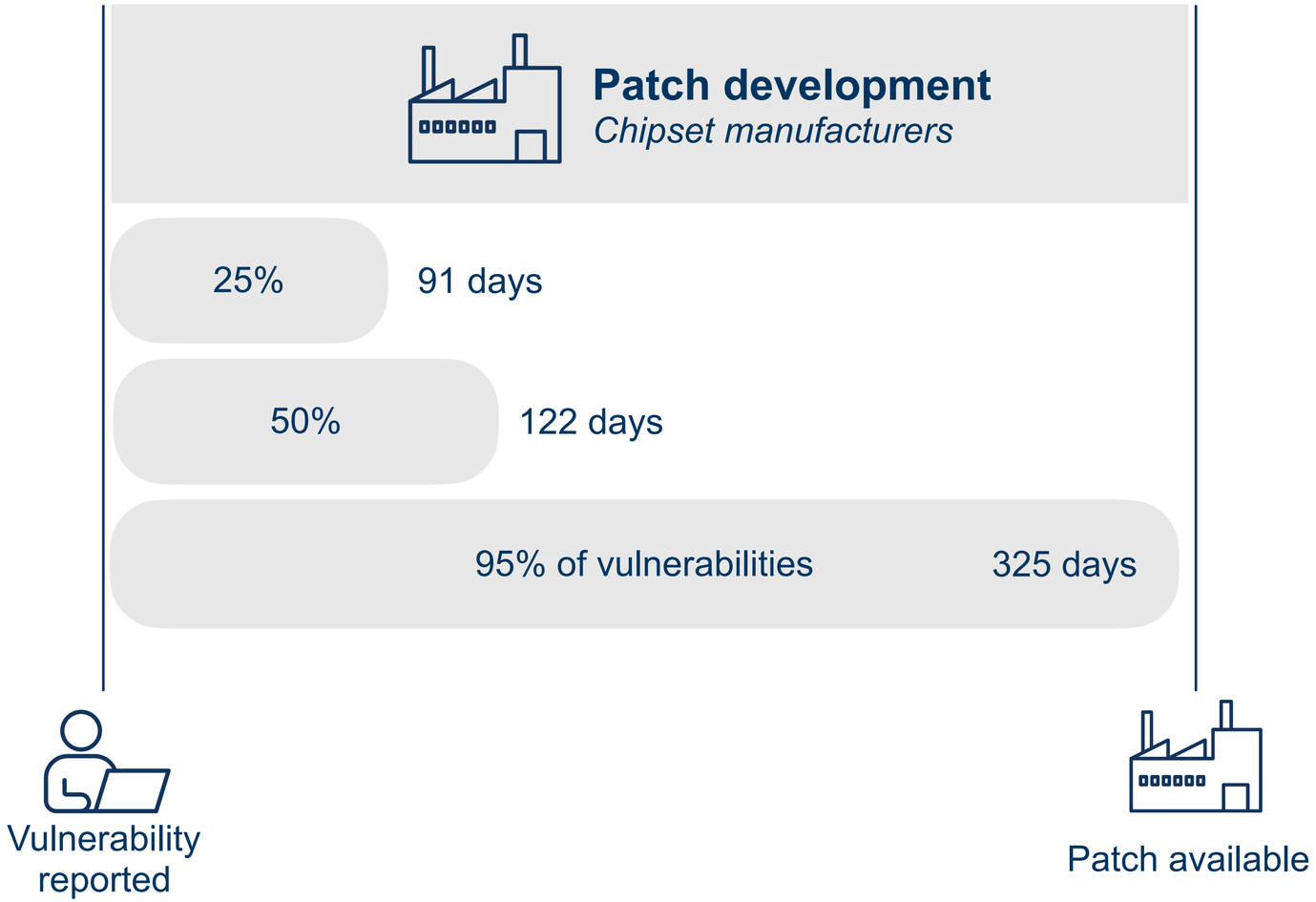



**Takeaways:**

- Generally high reliance on external researchers
- Disclosure processes for external researchers exist & reports are taken seriously

# Patch & Update timeline



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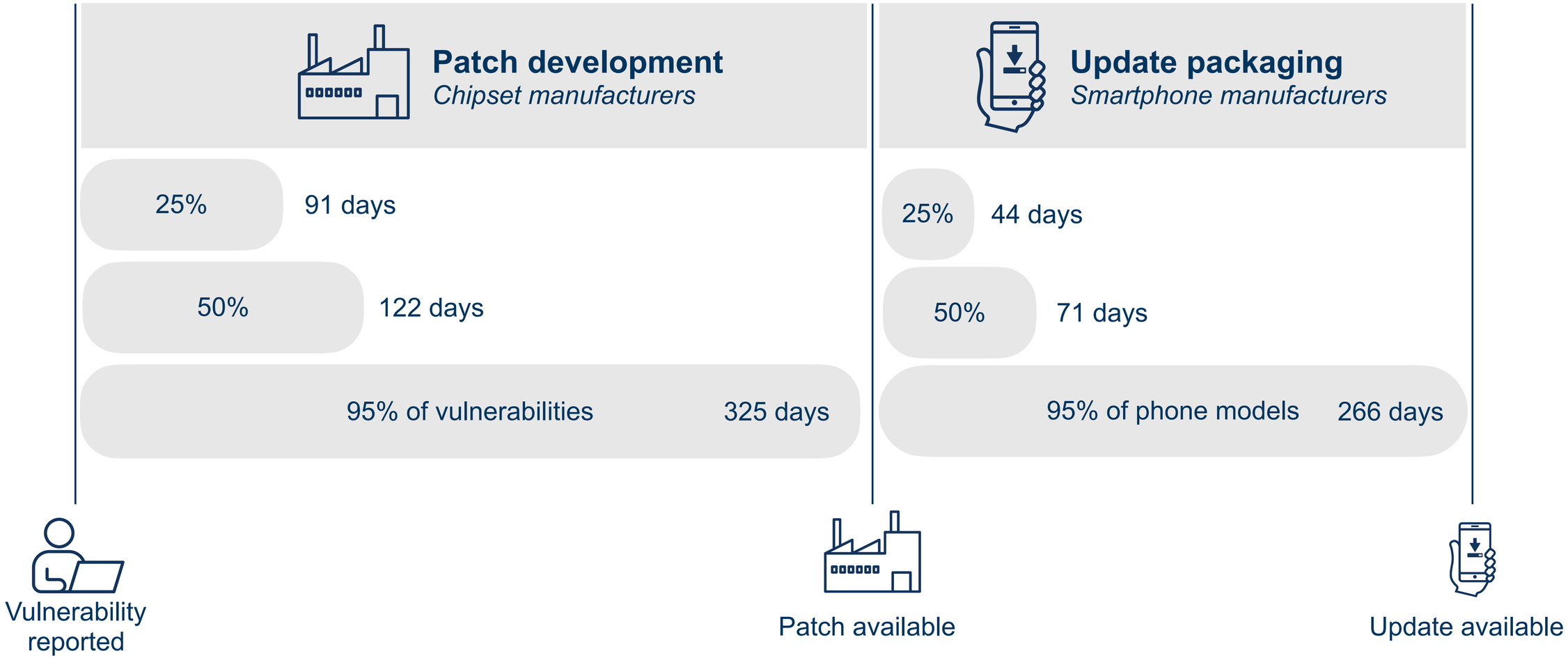
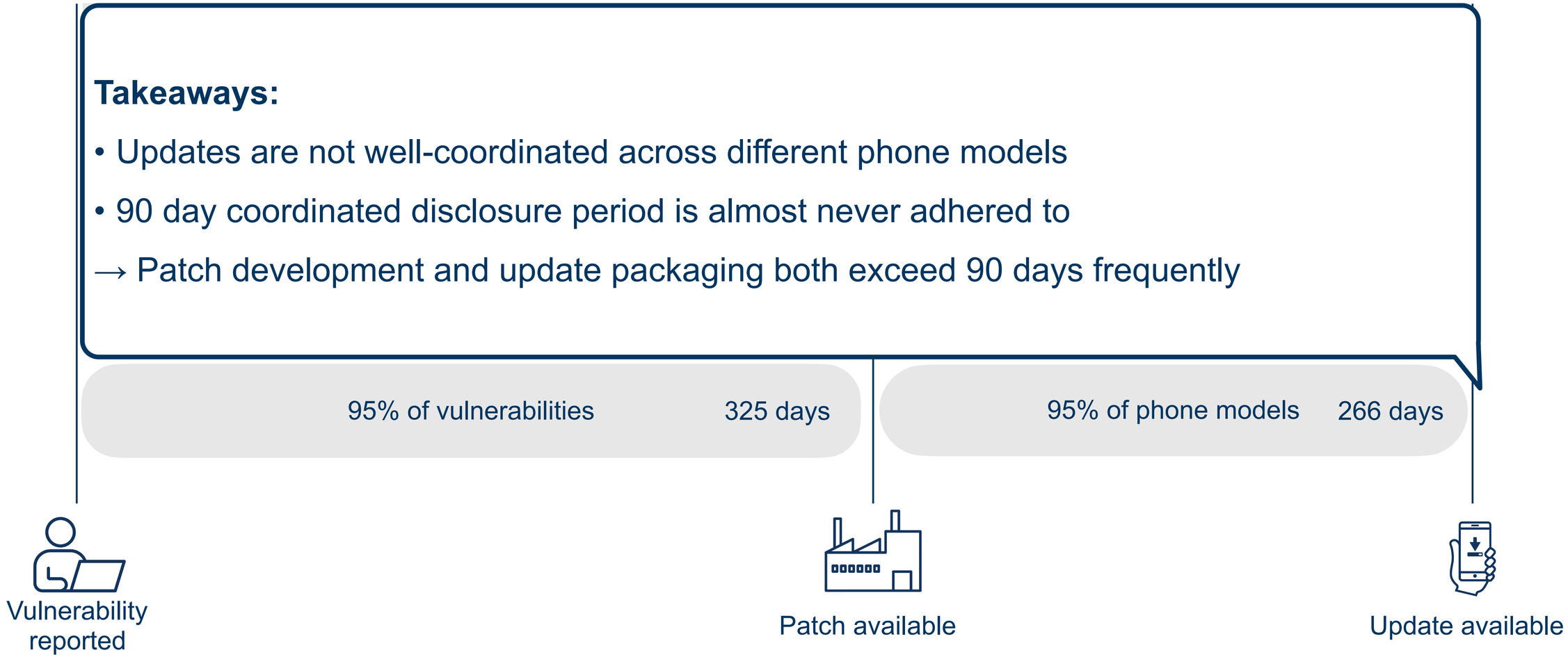


# Patch & Update timeline

**Takeaways:**

- Updates are not well-coordinated across different phone models
- 90 day coordinated disclosure period is almost never adhered to

→ Patch development and update packaging both exceed 90 days frequently



# Additional use cases

**Identify trends and avenues for future research**
→ Which components yield the most severe vulnerabilities?
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**Identify trends and avenues for future research**
→ Which components yield the most severe vulnerabilities?
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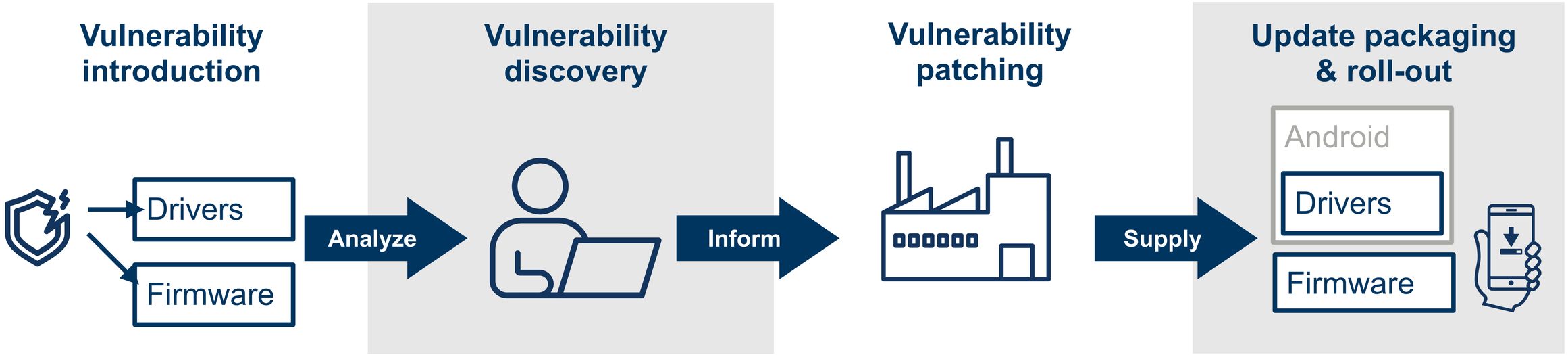
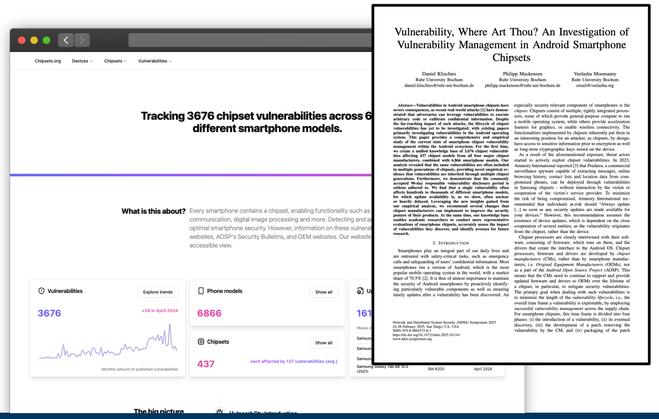
**Make an informed selection of evaluation devices**
→ Many chipsets have almost the same set of vulnerabilities
→ We offer a tool to estimate and select diverse sets of phone models

**Determine how widespread a recently found vulnerability is**
→ List all chipsets and smartphones affected by a vulnerability

# Summary





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**In the paper & on https://chipsets.org:**

What are the most affected components?

Differences between firmware and drivers

Comparison to other ecosystems

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