ICTDLab

PAUL G. ALLEN SCHOOL
OF COMPUTER SCIENCE & ENGINEERING

Meta-analysis: Examining Security and Privacy Research in Developing Regions

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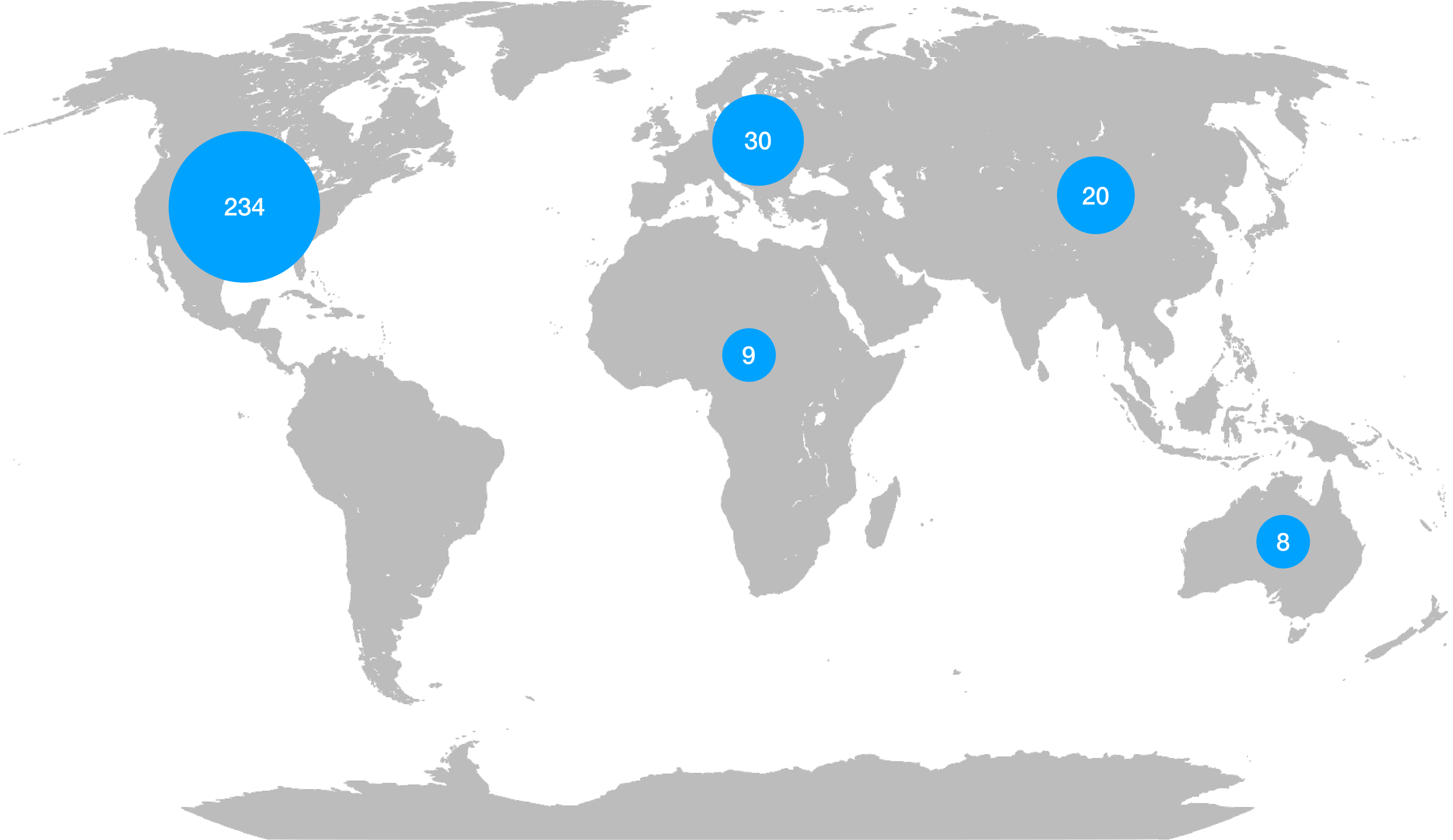
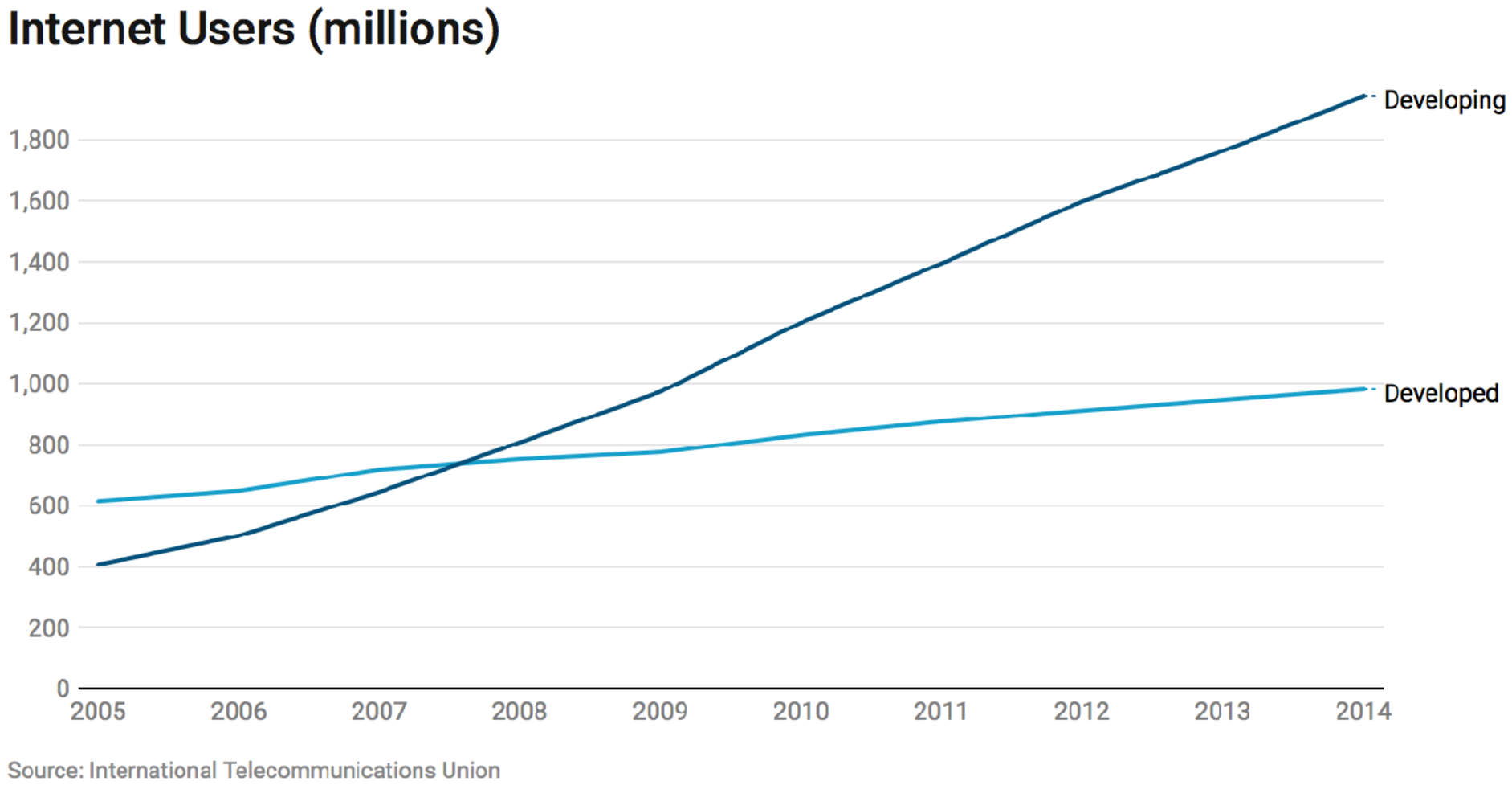
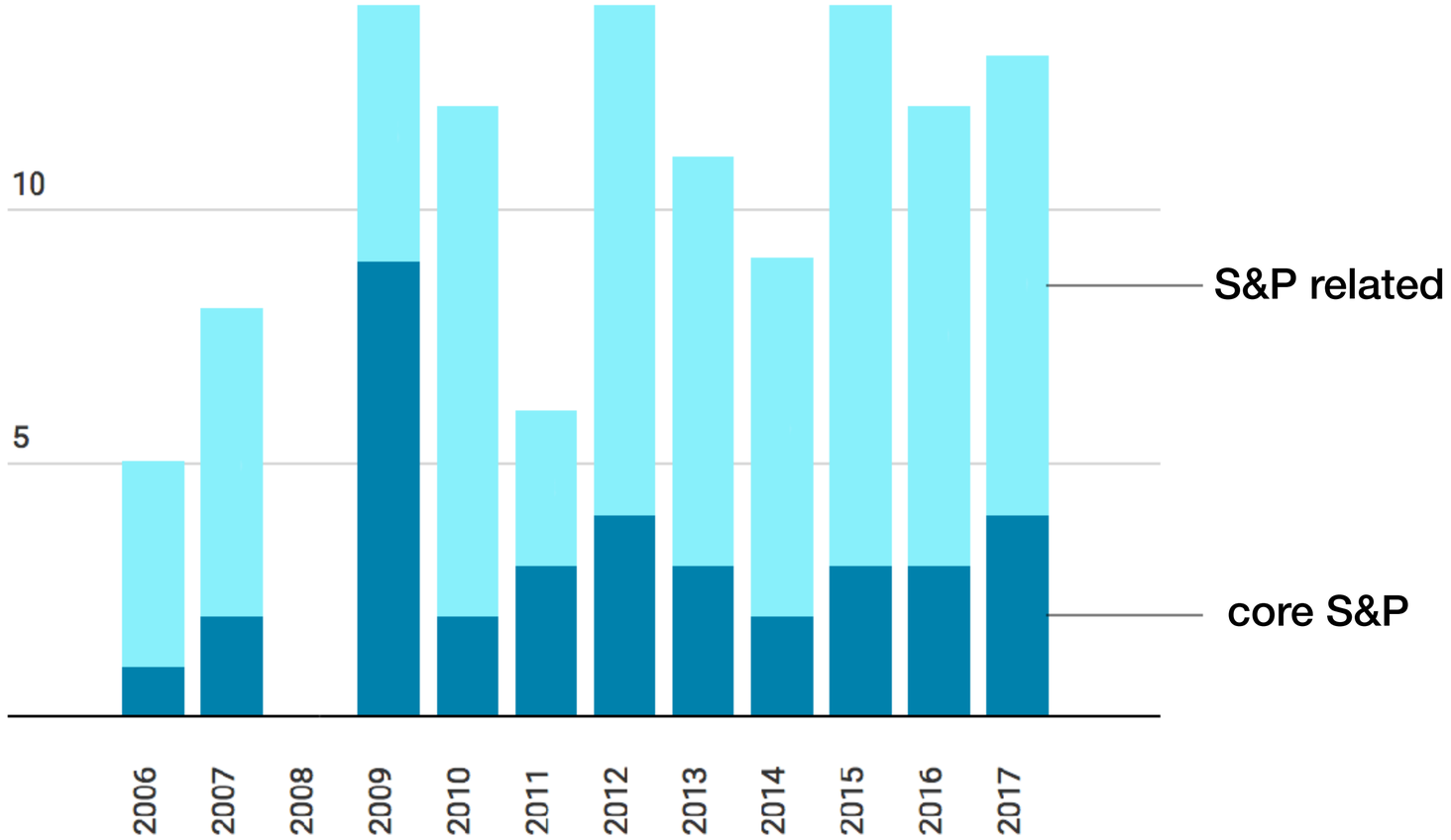

234
30
20
9
8

Internet users in developing regions



Source: International Telecommunications Union

S&P papers in developing regions



Goal

- Identify factors that shape people's security & privacy behavior in developing regions.

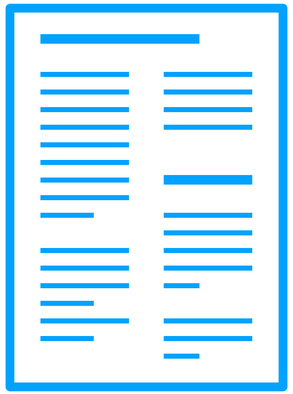
- Draw design considerations and future research directions.

Prior meta-analysis work in HCI4D

Publication year	Authors	Venues surveyed	Analyzed	Focus
2009	Ho et al.	10+	65 papers + interviews with experts	Review of HCI4D field
2009	Patra et al.	-	50 interviews with experts	Trends in ICTD & experts' views
2012	Gomez et al.	7	948 papers	Research trends in ICTD
2016	Dell & Kumar	11	259 papers + 11 interviews with experts	Overall HCI4D field
2018	**Our work**	**24**	**114 papers**	**Security & Privacy in HCI4D**

Methodology (1): Venues and Search Terms

- 24 Venues
  - HCI Venues: ICTD, DEV, ITID, CHI, CSCW, …
  - Security Venues: SOUPS, IEEE S&P, CCS, USENIX Security, …
- Searched for HCI4D papers with some discussion about security or privacy



HCI4D term

AND

Security or Privacy term

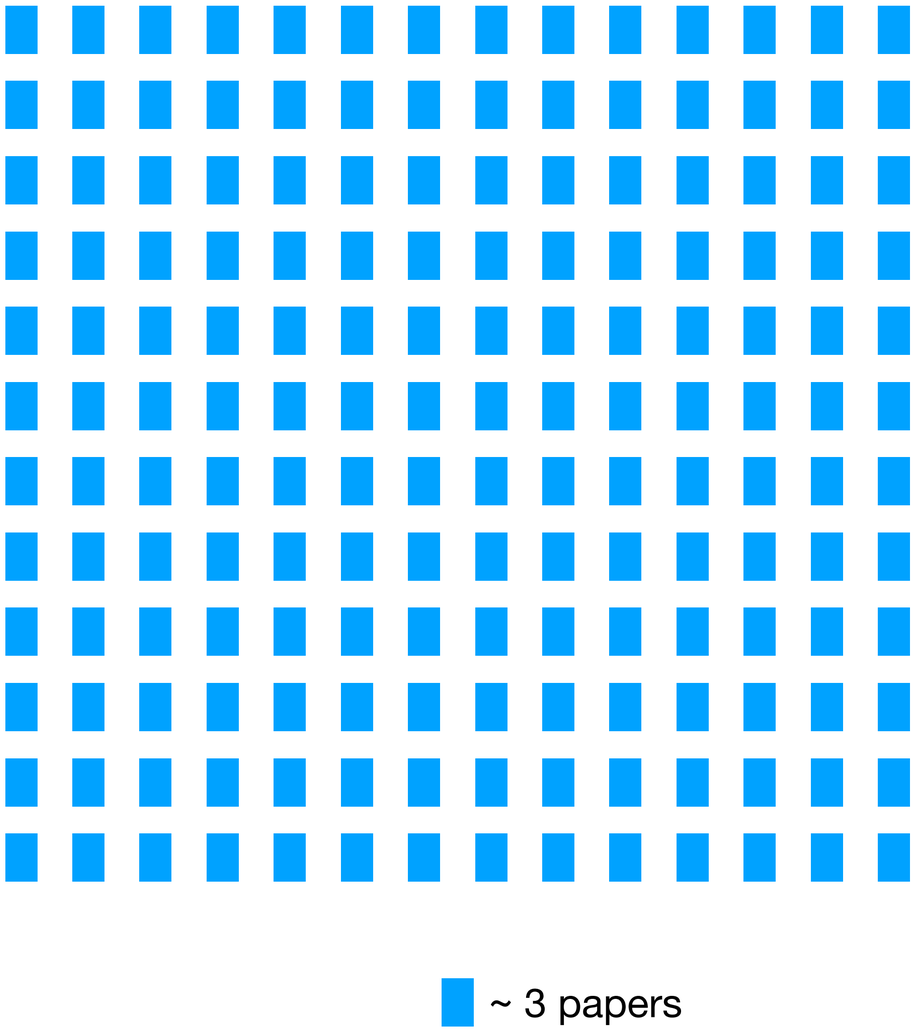
ICTD, HCI4D, developing regions, resource-constrained settings, …

security, privacy, secure, securing, private, sensitive

Searched in paper text, not just keywords

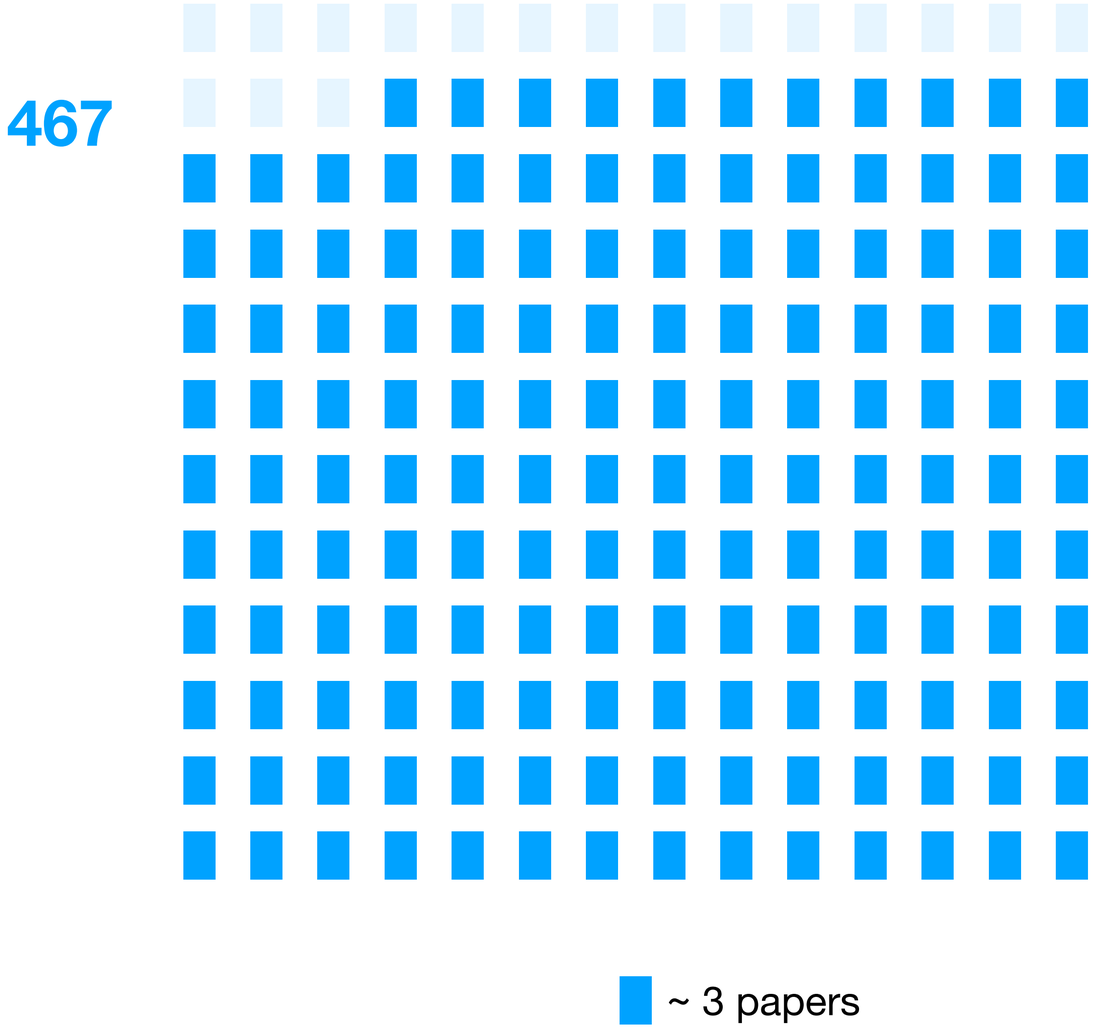
Methodology (2): Filtering

- Pass 0: Initial search yielded 517 papers



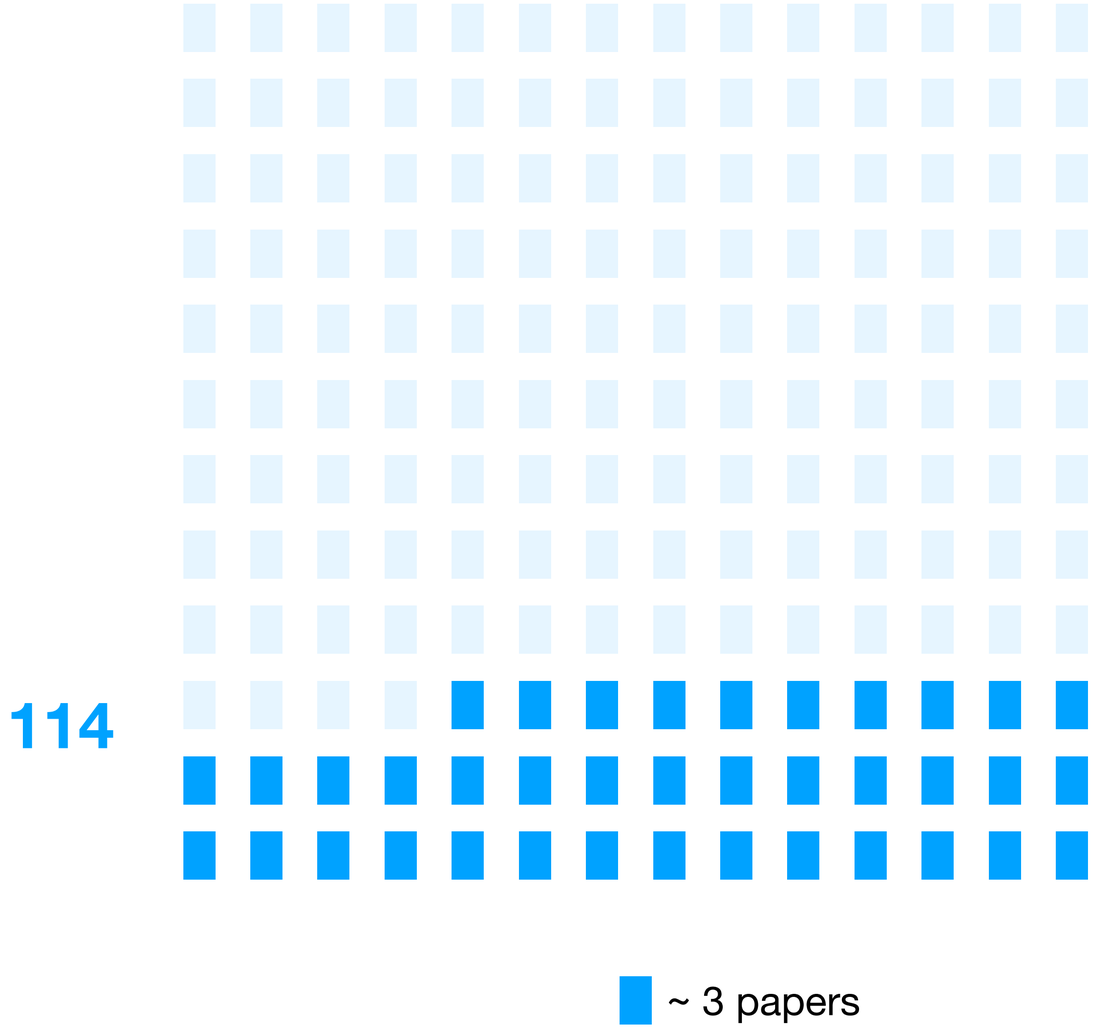
Methodology (2): Filtering

- Pass 0: Initial search yielded 517 papers
- Pass 1 (removed 50 papers)
  - Removed notes and posters
  - Removed papers that have the search terms only in References



Methodology (2): Filtering

- Pass 0: Initial search yielded 517 papers
- Pass 1 (removed 50 papers)
  - Removed notes and posters
  - Removed papers that have the search terms only in References
- Pass 2 (removed 353 papers)
  - Removed papers that did not provide any considers about S&P
- Final set: 114 papers



Methodology (3): Coding

Rubric

Domain	Type of Contribution	S&P Focused	Methodology	Summary of S&P Related Findings
Access Communication Finance Agriculture	Understanding users Proposing a solution Evaluating a prototype	Yes Somewhat No	Interviews Observations Survey	Our summary

Factors that shape S&P attitudes

- Culture
- Knowledge gaps
- Unintended use of technology
- Usability and Cost Considerations
- Context

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1) Culture: Gender

- Access with privacy trade-off
  - Grameen Telecom Phone Program [Boettiger et al.'12]
  - Access monitored by family members or community actors [Dodson et al.'13]
  - Asymmetrical spousal rights to privacy [Mottin-Sylla'16, Sambasivan et al.'18]
  - Different risks for sharing PII (e.g., sharing phone number for Wi-Fi access [Sambasivan & Aoki'17])

No Access

Shared Access

Phone owner

2) Knowledge gaps

- Insufficient knowledge about a system results in an incomplete or incorrect mental models, which may lead to
  - risky behavior [Chen et al.'14]
  - accepting avoidable privacy-utility trade-off [Dodson et al.'13]
  - avoiding a useful service all together [Buku'17]
- Problem: Assumption that users have basic technical knowledge

3) Unintended Use: Sharing

- Unintended use: Use technology in ways unintended by the designers
- Phone Sharing [Doke & Joshi'15, Rangaswamy & Sambasivan'11]
  - 'borrowing' vs. 'mutual use' [Walton et al.'12]
  - Ad-hoc measures (e.g., folder lock, SD card) do not work well
  - Multi-user accounts do not work well [Ahmed et al.'17]

4) Usability and Cost Considerations

- Examples of security-utility trade-offs
  - Sharing PII for free service access (e.g., Wi-Fi [Sambasivan & Aoki’17])
  - Using a low-effort insecure service over a secure one [Kumar et al.’11]
  - Ignoring security updates to save data usage [Chetty et al.'12, Mathur et al.’15]
- Usability and cost are central when designing for marginalized user group [Panjwani and Cutrell’10]

5) Context

- Who, where, when, for what, who is the designer, accompanying user(s)
- Perceptions on paper vs. digital device for record keeping
  - Users see paper as more reliable and secure [Anokwa et al.'12, Panjwani et al.'13, Chen et al.’16]
  - System architects see digital device as more secure [Cobb et al.’16]

Design Considerations and Research Directions

Studying S&P Behavior at Scale

- Many different settings:
  - diverse user groups (e.g., low-literate, low-income, women)
  - use of technology in different domains (e.g., health, education, finance)
  - geographical locations
- Moving target: Behavior changes with time and technology

Replication studies

- Helpful to Identify concrete differences in S&P attitudes of users
- Encourage replication studies
  - Awards (e.g., ACM SIGMOD reproducible paper awards)
  - Workshops focused on replication studies (e.g., RepliCHI)
  - Include replication studies in CFPs (e.g., SOUPS since 2016)

Designing with Users

- Designing for local context (e.g., Ahmed et al.’17)
- Leveraging social values (e.g., Rifat et al.’17)

Supporting developers

- Incentivize developers
- Support developers with appropriate tools
- Draft policies to motivate developers to follow best S&P practices

Summary

- Meta-analysis of S&P research in developing regions
- Surveyed 24 venues; in-depth analysis of 114 papers
- Factors that shape people S&P attitudes: Culture, Knowledge gaps, Unintended use, Usability & Cost, Context
- Design considerations and outline research directions

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