Privado: Privacy-Preserving Group-based Advertising using Multiple Independent Social Network Providers

Sanaz Taheri Boshrooyeh, Alptekin Küpçü, and Öznur Özkasap

Department of Computer Engineering,
Koç University, İstanbul, Turkey

Online Social Network (OSN)

Advertising

Extract Attributes

Age= 19
Hobbies= Painting, football
Location= Turkey

Advertising

Facebook Ads!

Audience
Define who you want to see your ads. Learn more.

Create New   Use a Saved Audience ▾

Custom Audiences ⊘   Add Custom Audiences or Lookali
Exclude | Create New ▾

Locations ⊘   Everyone in this location ▾

United States
 • United States
 ⊘ Include ▾ | Add locations
Add Bulk Locations...

Age ⊘   18 ▾ - 65+ ▾

Gender ⊘   All Men Women

Languages ⊘   Enter a language...

AD

Age= 19
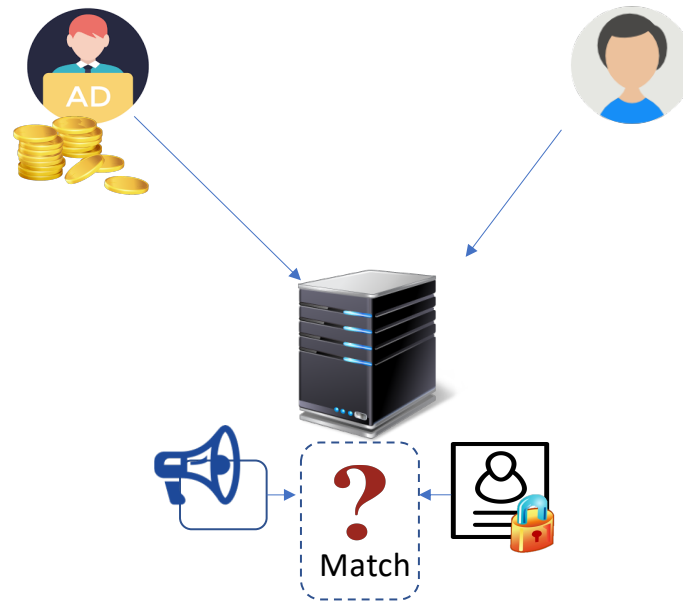Hobbies= Painting, football
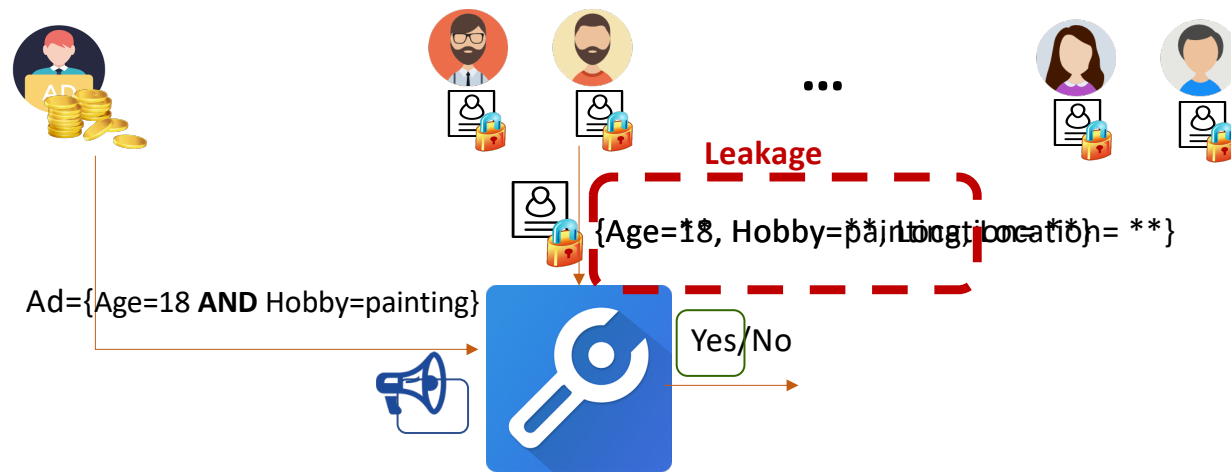Location= Turkey

Lack of advertising in secure OSNs$^{1-5}$

[1] A. Barenghi, M. Beretta, A. Di Federico, and G. Pelosi. Snake: An end-to-end encrypted online social network. In ICESS. IEEE, 2014

[2] S. Jahid, S. Nilizadeh, P. Mittal, N. Borisov, A. Kapadia, DECENT: A decentralized architecture for enforcing privacy in online social networks, in: 2012 IEEE International Conference on Pervasive Computing and Communications Workshops, IEEE, 2012, pp. 326–332.

[3] E. De Cristofaro, C. Soriente, G. Tsudik, and A. Williams, "Hummingbird: Privacy at the time of twitter," in Security and Privacy (SP), 2012 IEEE Symposium on, pp. 285–299, IEEE, 2012.

[4] A. J. Feldman, A. Blankstein, M. J. Freedman, and E. W. Felten, "Social networking with frientegrity: Privacy and integrity with an untrusted provider.," in USENIX Security Symposium, pp. 647–662, 2012.

[5] R. Baden, A. Bender, N. Spring, B. Bhattacharjee, and D. Starin, "Persona: an online social network with user-defined privacy," in ACM SIGCOMM Computer Communication Review, vol. 39, pp. 135–146, ACM, 2009.

Secure Advertising
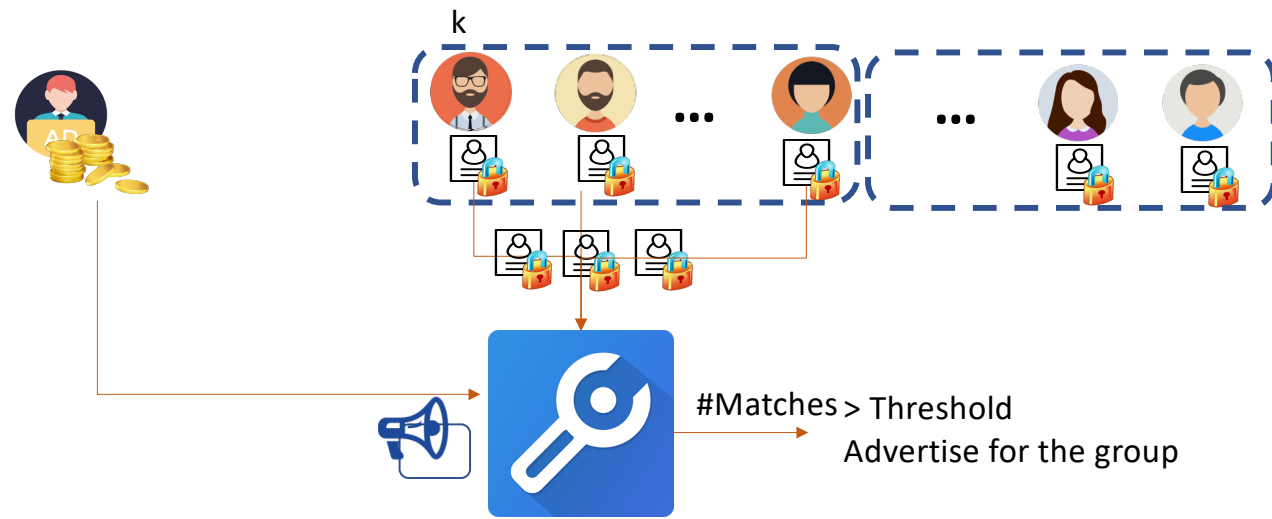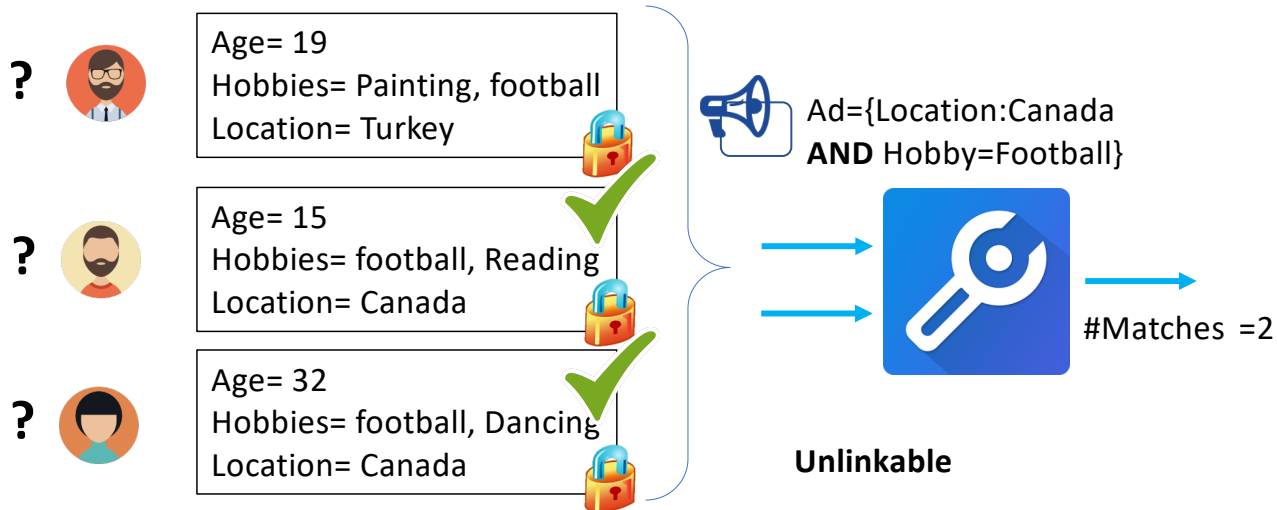
Match

User Privacy: Personalized Advertising

Leakage

{Age=18, Hobby=painting, Long, location = **}

Ad={Age=18 **AND** Hobby=painting}

Yes/No

User Privacy: Group-based Advertising

k

#Matches > Threshold
Advertise for the group

Privacy is the un-linkability of the output to the input

User Privacy: Group-based Advertising

?

Age= 19
Hobbies= Painting, football
Location= Turkey

?

Age= 15
Hobbies= football, Reading
Location= Canada

?

Age= 32
Hobbies= football, Dancing
Location= Canada

Ad={Location:Canada **AND** Hobby=Football}

#Matches =2

Unlinkable

9

Advertising Transparency

Advertisers

...

OSN Users

...

#Matches

The servers execution time must be independent of users/advertisers active time

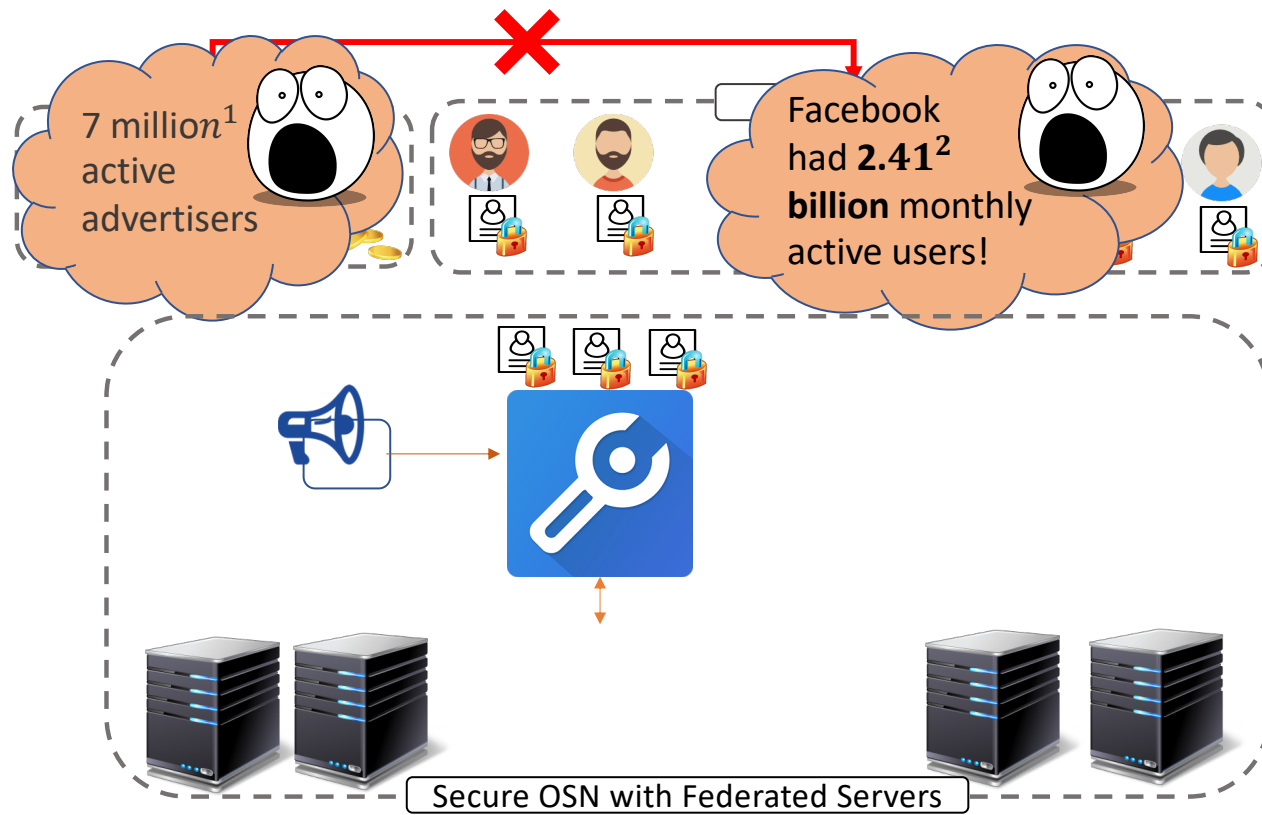# Advertising Transparency

[1] https://www.statista.com/statistics/778191/active-facebook-advertisers
[2] https://www.statista.com/statistics/264810/number-of-monthly-active-facebook-users-worldwide/

Advertising Transparency

7 million[1] active advertisers
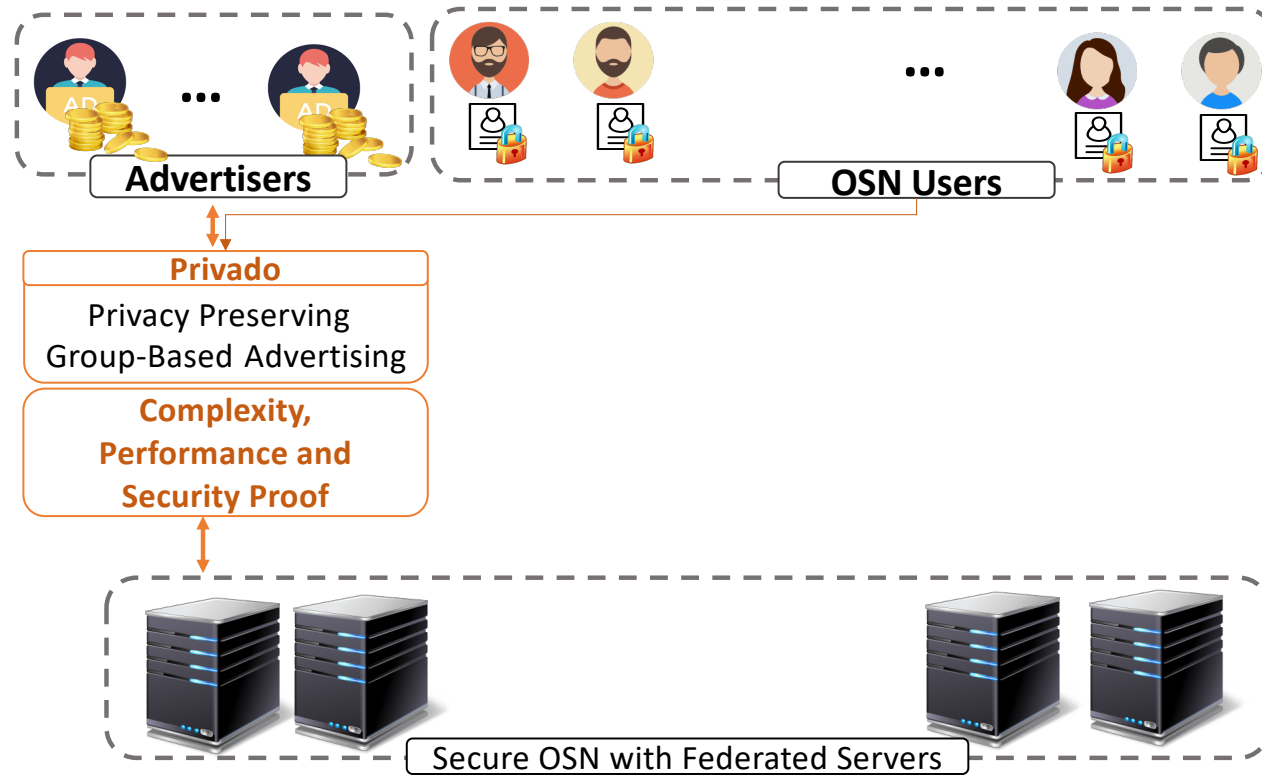
Facebook had **2.41**[2] **billion** monthly active users!

Secure OSN with Federated Servers

[1] https://www.statista.com/statistics/778191/active-facebook-advertisers
[2] https://www.statista.com/statistics/264810/number-of-monthly-active-facebook-users-worldwide/

Privado*

Advertisers

OSN Users

Privado

Privacy Preserving
Group-Based Advertising

**Complexity,
Performance and
Security Proof**

Secure OSN with Federated Servers
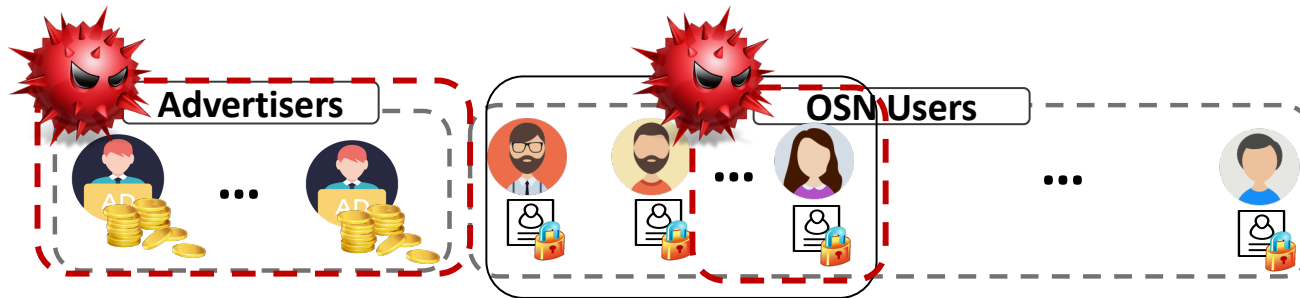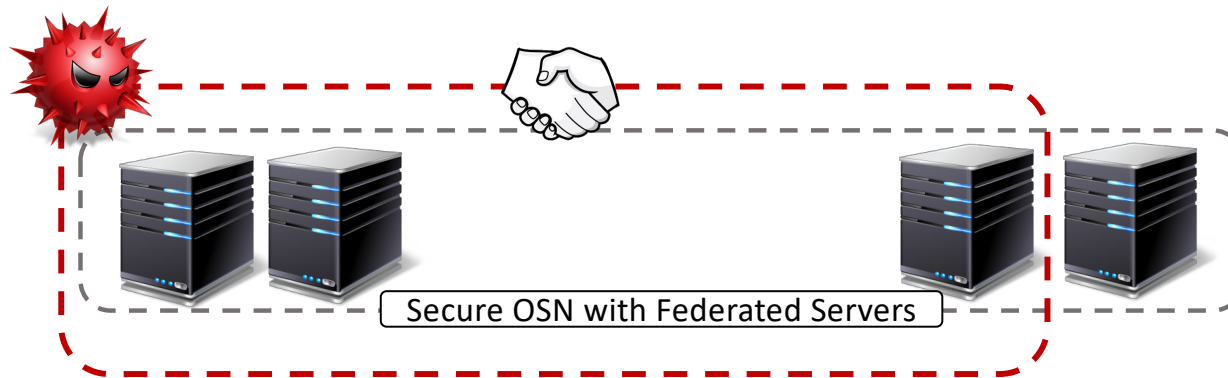
*S. T. Boshrooyeh, A. Küpçü, and Ö. Özkasap, "**Privado**: Privacy-Preserving Group-based Advertising using Multiple Independent Social Network Providers", Accepted in ACM Transactions on Privacy and Security (TOPS)
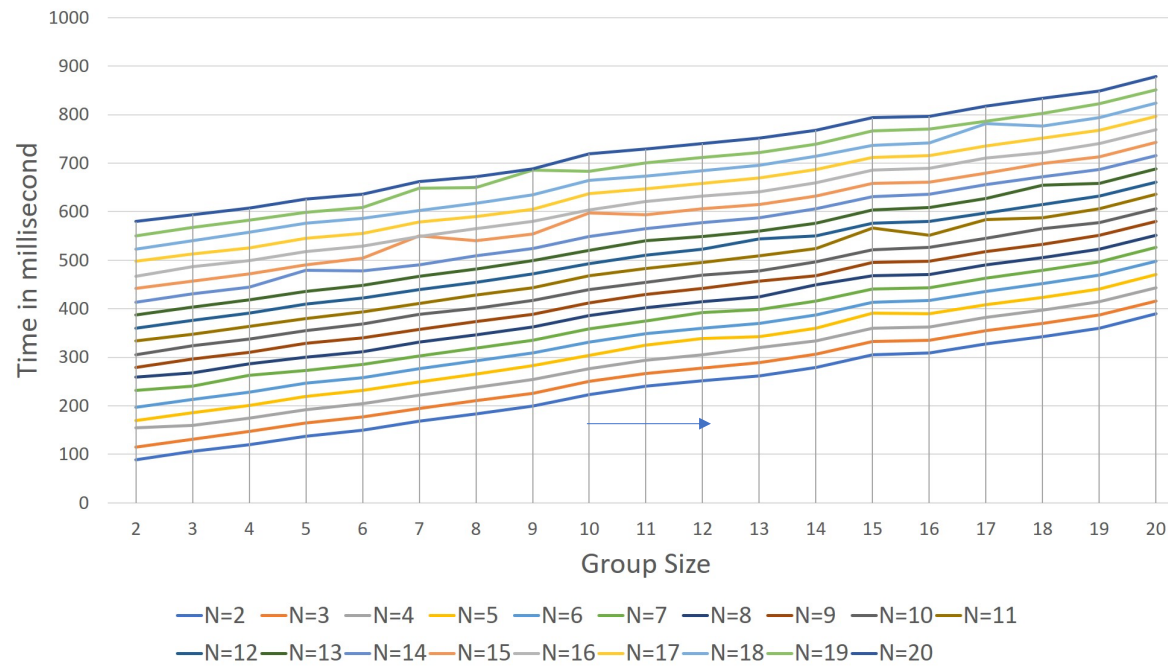
Adversarial Model

Advertisers

OSN Users

Malicious adversary

Secure OSN with Federated Servers

Running Time

THANK YOU!

Conclusion
Privado
Introduction