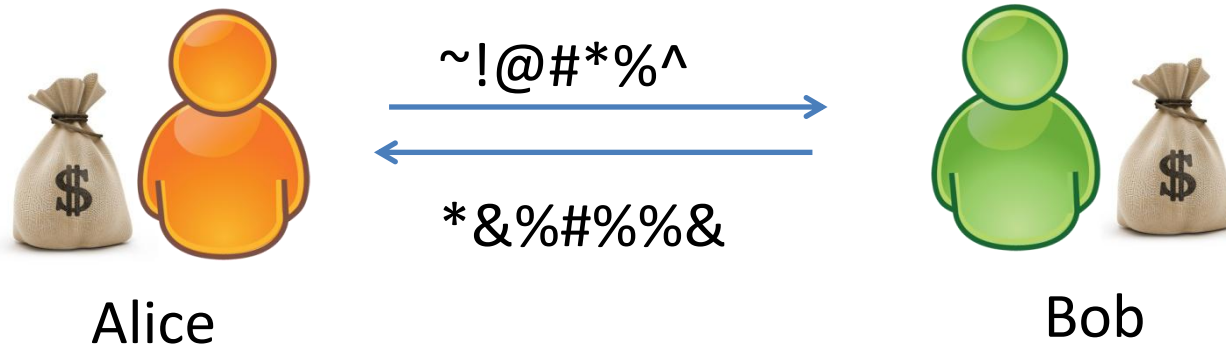


# Privacy-Preserving Computing

--Ming Li

# What Is Privacy-Preserving Computing?

## Millionaires's Problem



How to find out who is richer without revealing their actual wealth?

# Privacy-Preserving Computing



Location privacy in  
location-based services



Info privacy in cloud  
computing systems

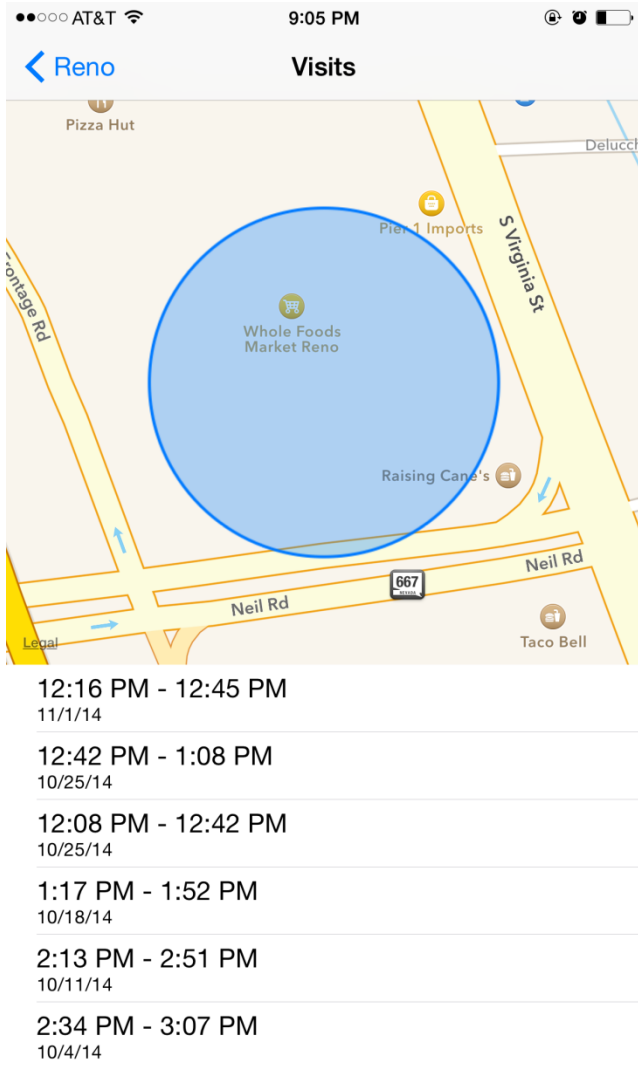
# Location Privacy in Location-Based Services

What does your smartphone know about your location information?



Then System Services → Frequent Locations → History

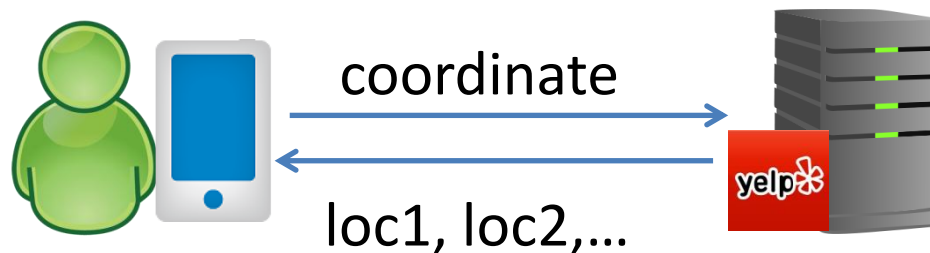
# Location Privacy in Location-Based Services



- Your iphone knows exactly when you were at each location
- If you are going to somewhere you shouldn't be, switch this feature off!
- Does someone else know this info?

# Location Privacy in Location-Based Services

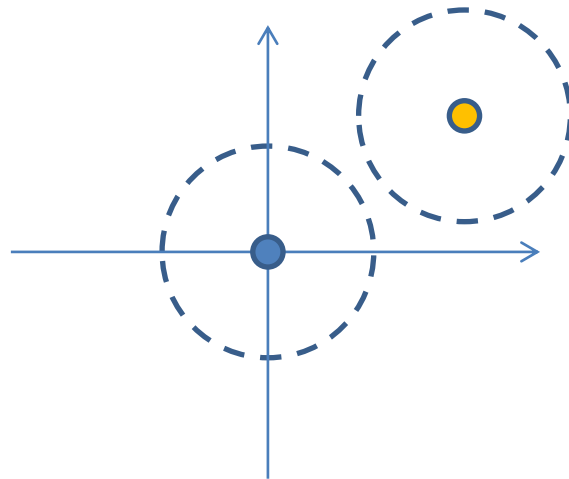
- Does my location privacy known by others?
  - Apple? I hope they will not
  - Other companies? We've already told them the data
    - e.g., Yelp, and other location-based services (LBS)



- User's location privacy is compromised..

# Location Privacy in Location-Based Services

- Object: receive correct POIs while concealing user's location
- One possible approach



Report a changed location

# Information Privacy in Cloud Computing Systems

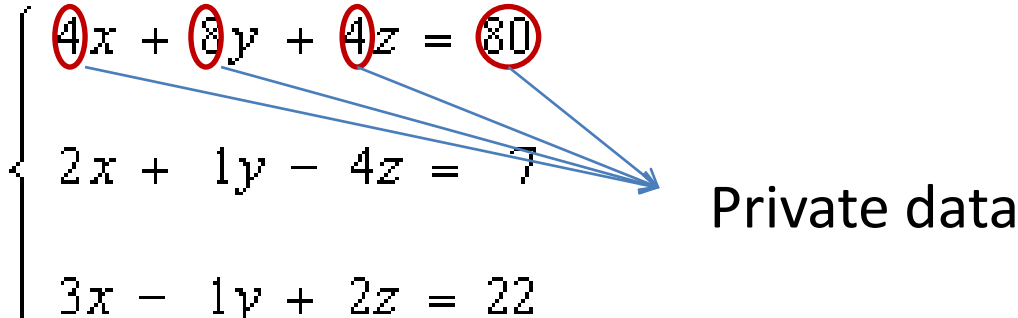


- Outsource heavy-load computing tasks to remote servers
- Amazon EC2, etc.



# Information Privacy in Cloud Computing Systems

- A simple example:

$$\begin{cases} 4x + 8y + 4z = 80 \\ 2x + 1y - 4z = 7 \\ 3x - 1y + 2z = 22 \end{cases}$$


Private data

The diagram illustrates that the coefficients in the first equation (4, 8, 4, and 80) are circled in red. Four blue arrows originate from these circled values and point towards the text 'Private data', indicating that these values represent sensitive information that must be protected in a cloud computing environment.

- How the cloud can solve this equation group correctly without knowing the coefficients?
- More computing problems
  - Average, covariance, LP, NLP, etc.

- Any questions?