Account Recovery – Authentication's Dirty Secret?

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Managing Online Presence

- Many accounts
- Different interfaces
- Too much information
- Too many passwords
- Frequent updates
- A challenge to effectively manage

Managing Online Presence

- *Actual presentation included more than a dozen slides demonstrating the online presence of the presenter. For privacy reasons, these have not been posted. Contact the presenter directly to see the full presentation.*

Why so many Accounts?

- I do different things with different people
- Used for
  - Storing information
  - Sharing information
  - Receiving information
  - Communicating information
  - Collaborating with others
  - Learning, Teaching, Living
- Used with colleagues, friends, family, ...

What do Accounts want from Me?

- Information, information, information
- Why?
  - Help me store, share, communicate, …
  - Improve my online experience
  - Ensure controlled access to my account
  - Market to me, e.g. advertise
  - Share my information with others

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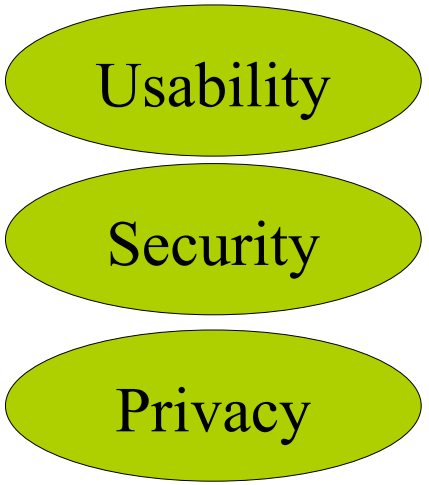
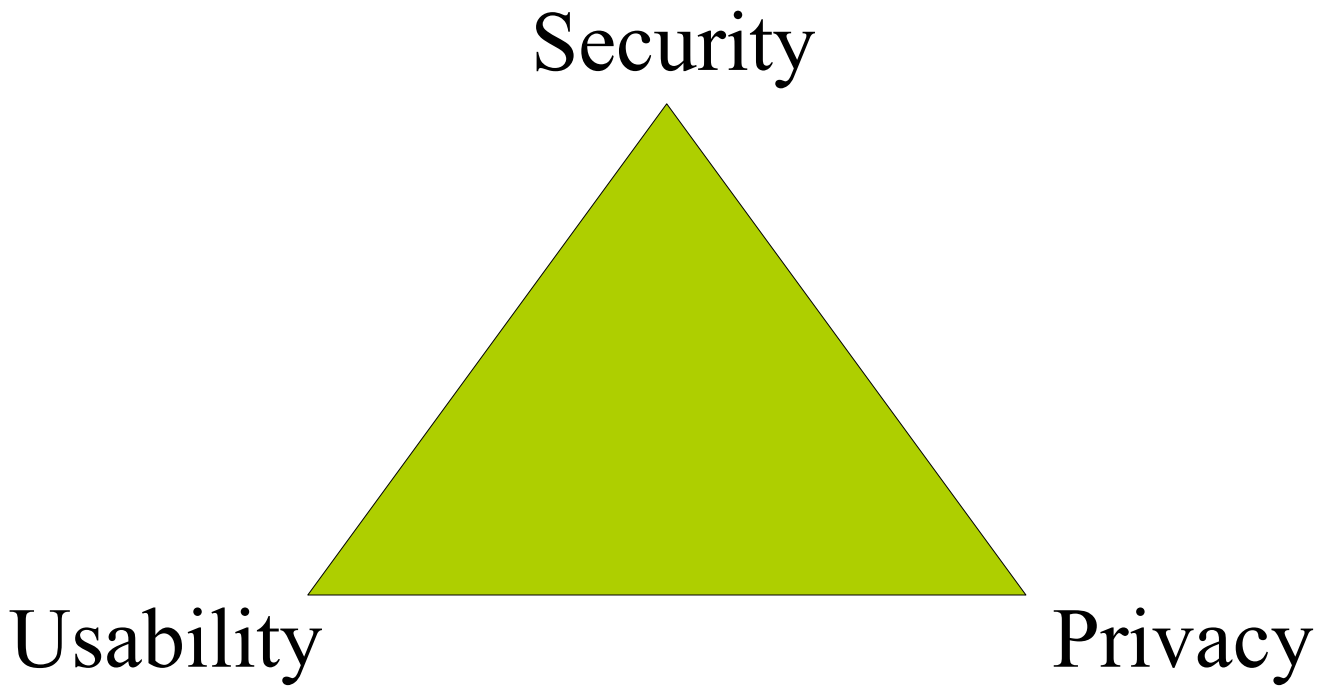
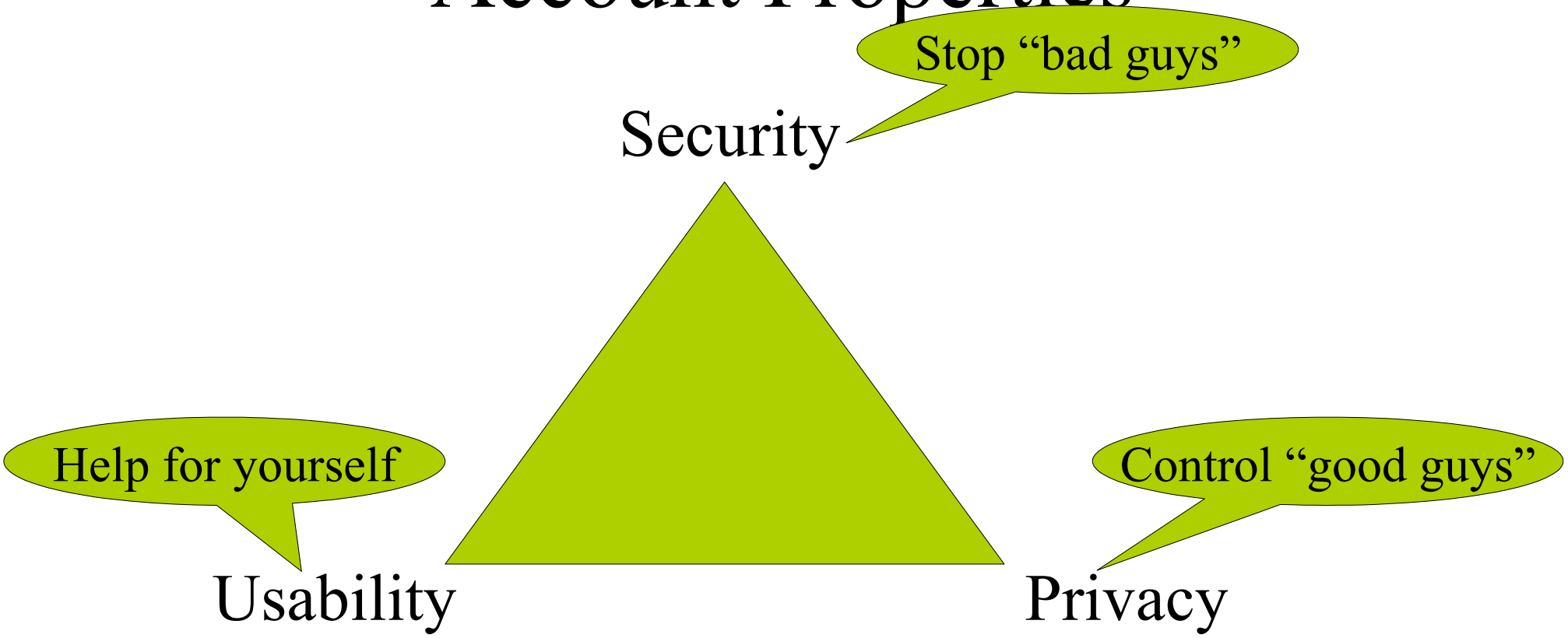


Account Properties

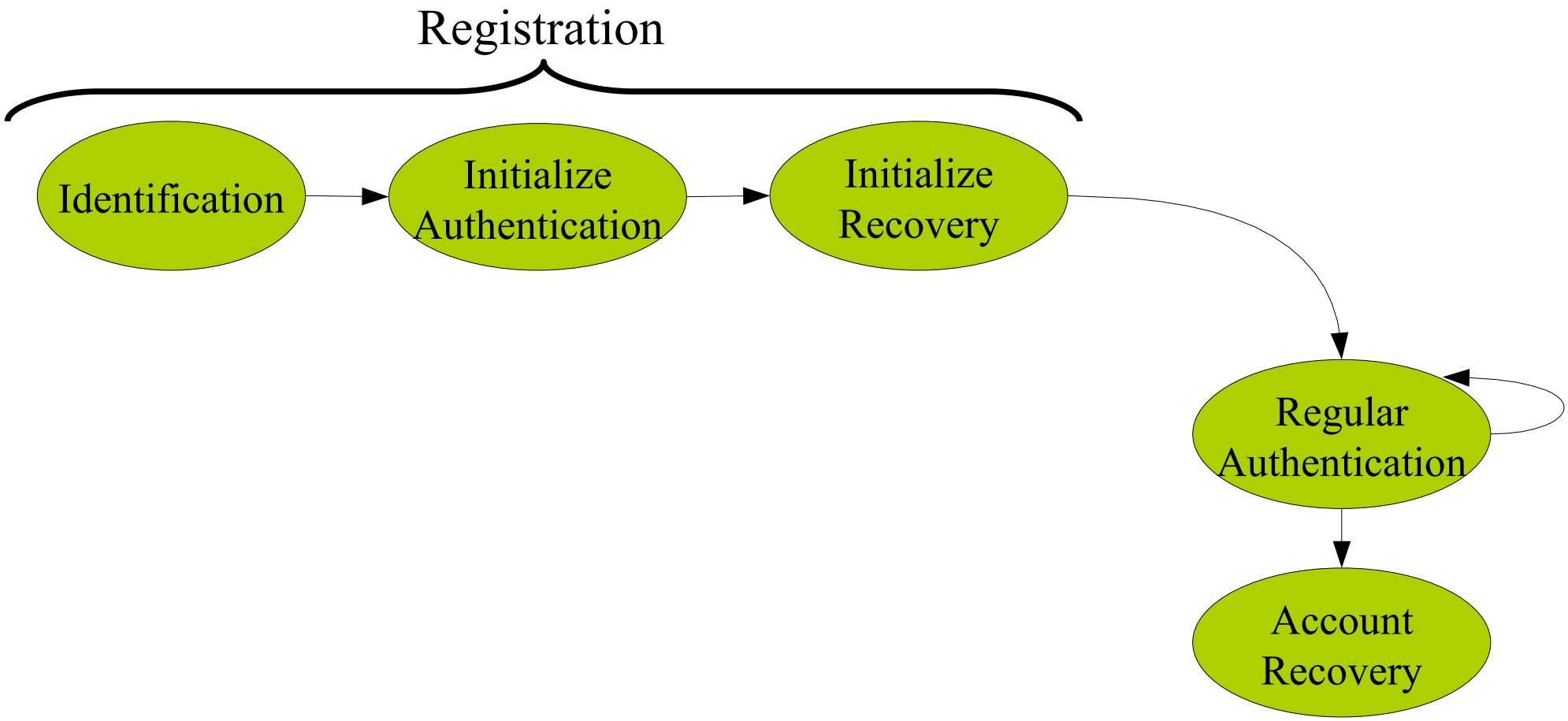


Account Properties

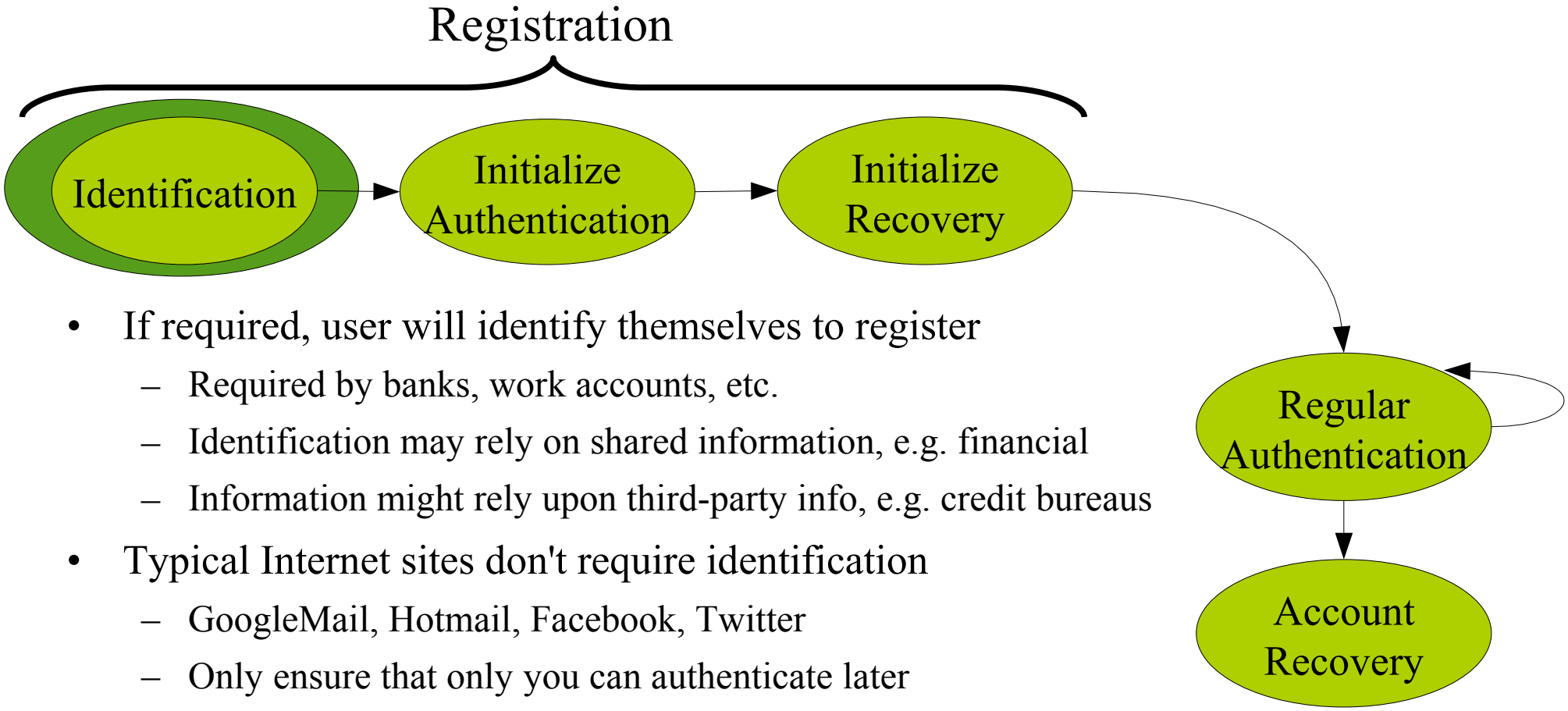


Protection vs Control vs Convenience ...

Identification and Authentication

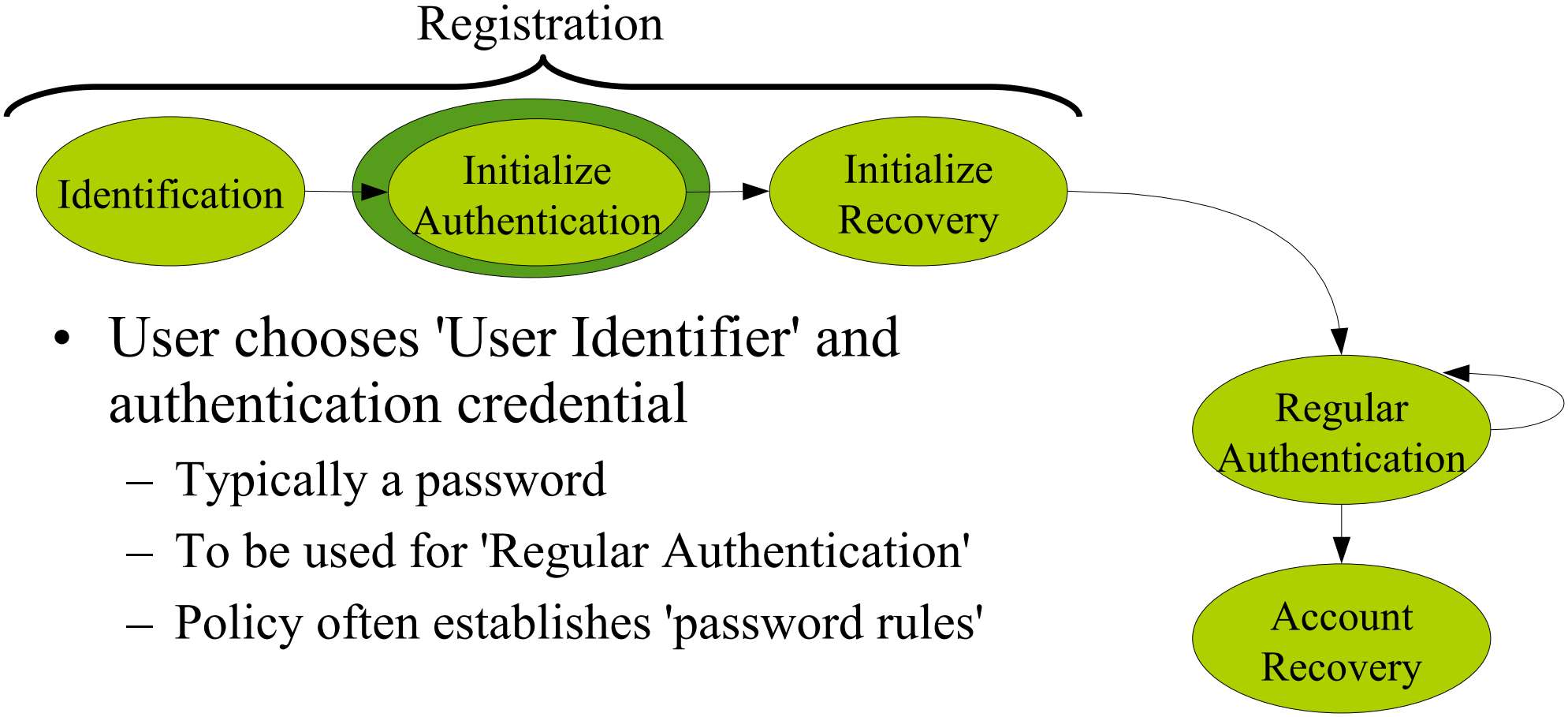


Identification and Authentication



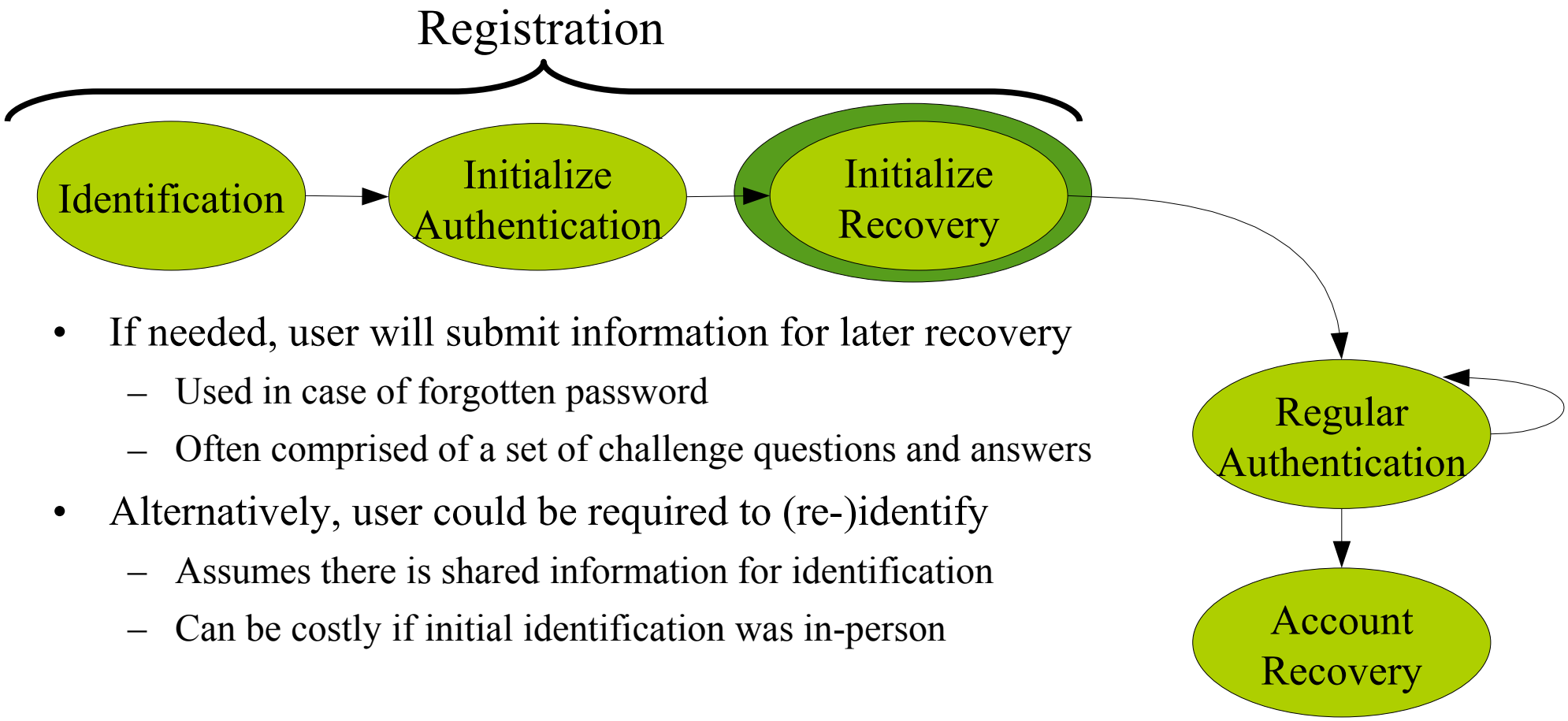
- If required, user will identify themselves to register
  - Required by banks, work accounts, etc.
  - Identification may rely on shared information, e.g. financial
  - Information might rely upon third-party info, e.g. credit bureaus
- Typical Internet sites don't require identification
  - GoogleMail, Hotmail, Facebook, Twitter
  - Only ensure that only you can authenticate later

Identification and Authentication



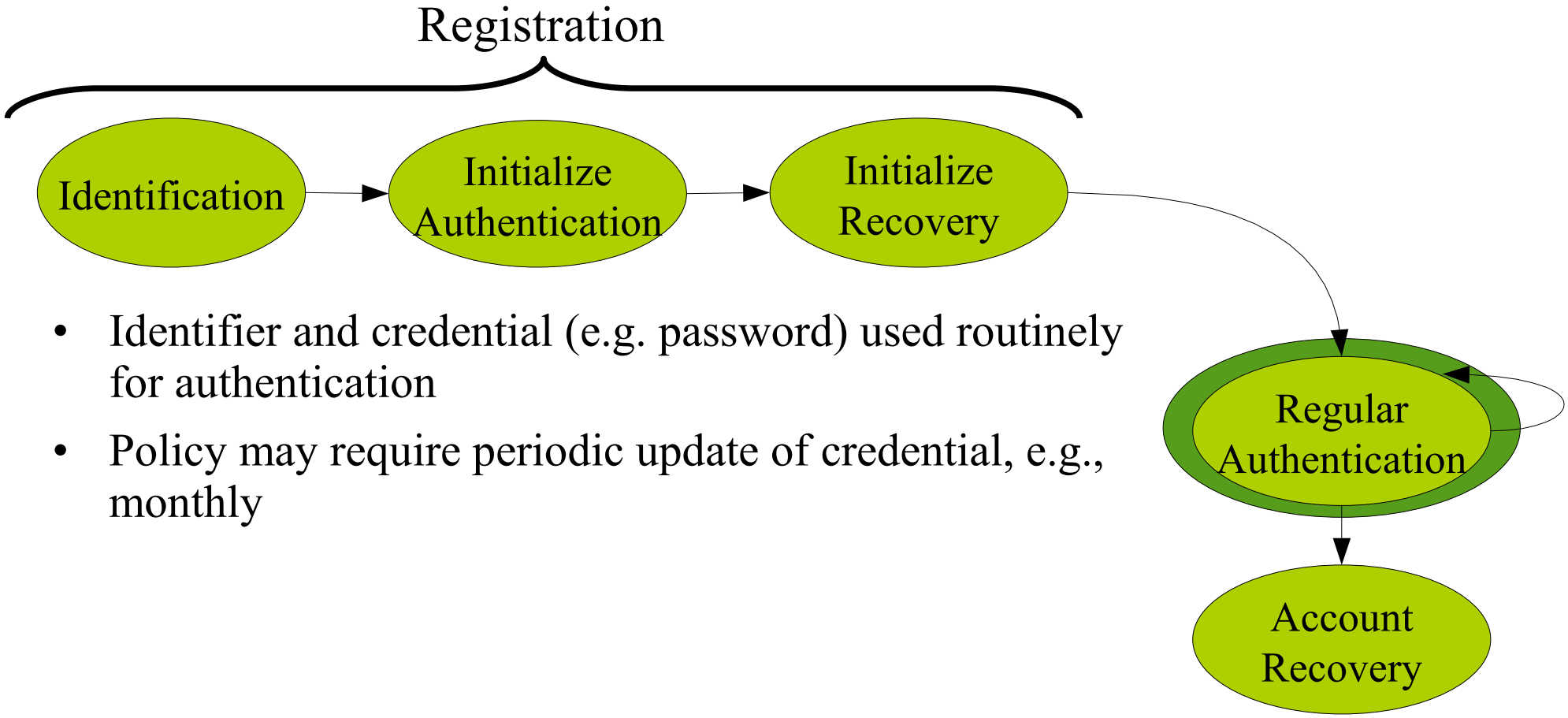
- User chooses 'User Identifier' and authentication credential
  - Typically a password
  - To be used for 'Regular Authentication'
  - Policy often establishes 'password rules'

Identification and Authentication



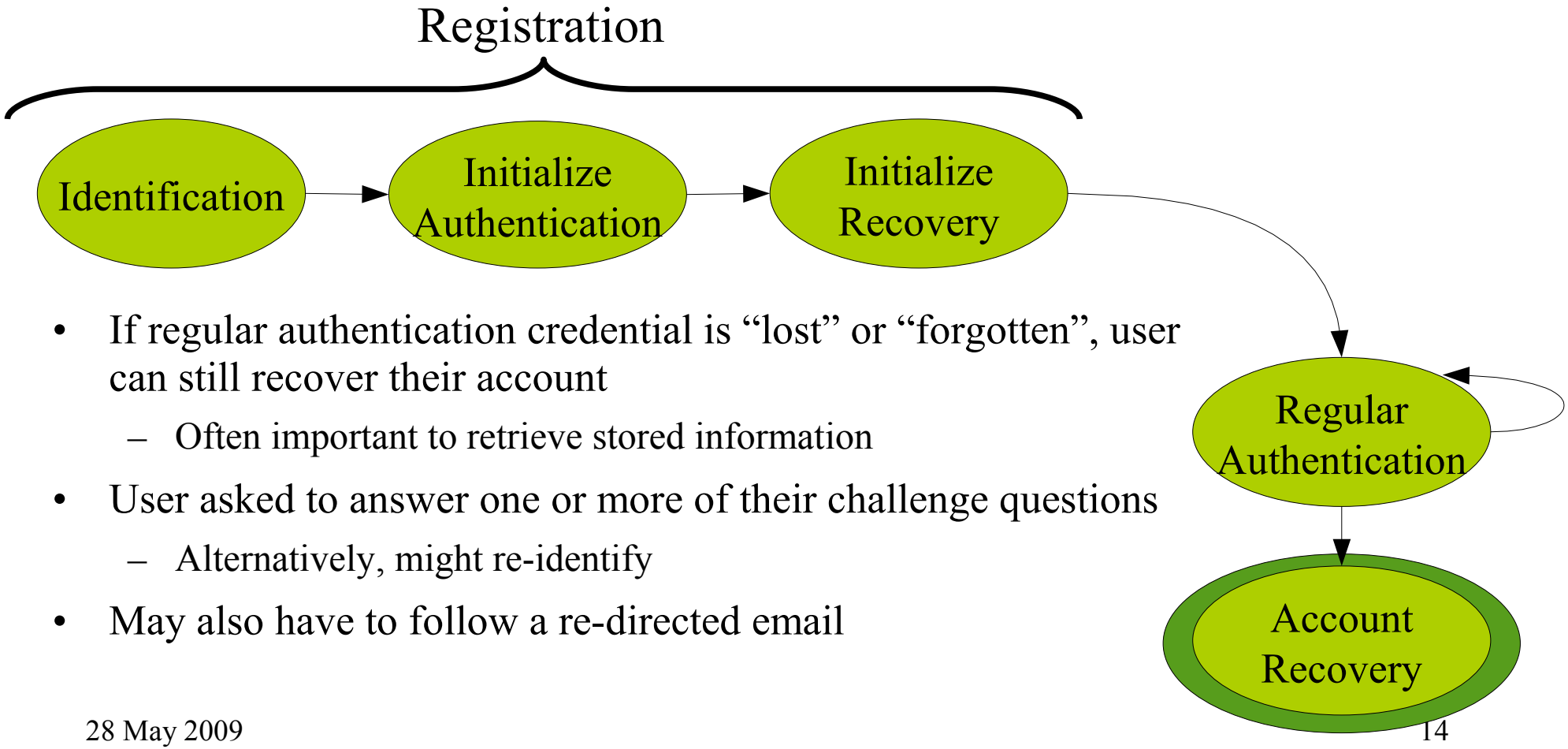
- If needed, user will submit information for later recovery
  - Used in case of forgotten password
  - Often comprised of a set of challenge questions and answers
- Alternatively, user could be required to (re-)identify
  - Assumes there is shared information for identification
  - Can be costly if initial identification was in-person

Identification and Authentication



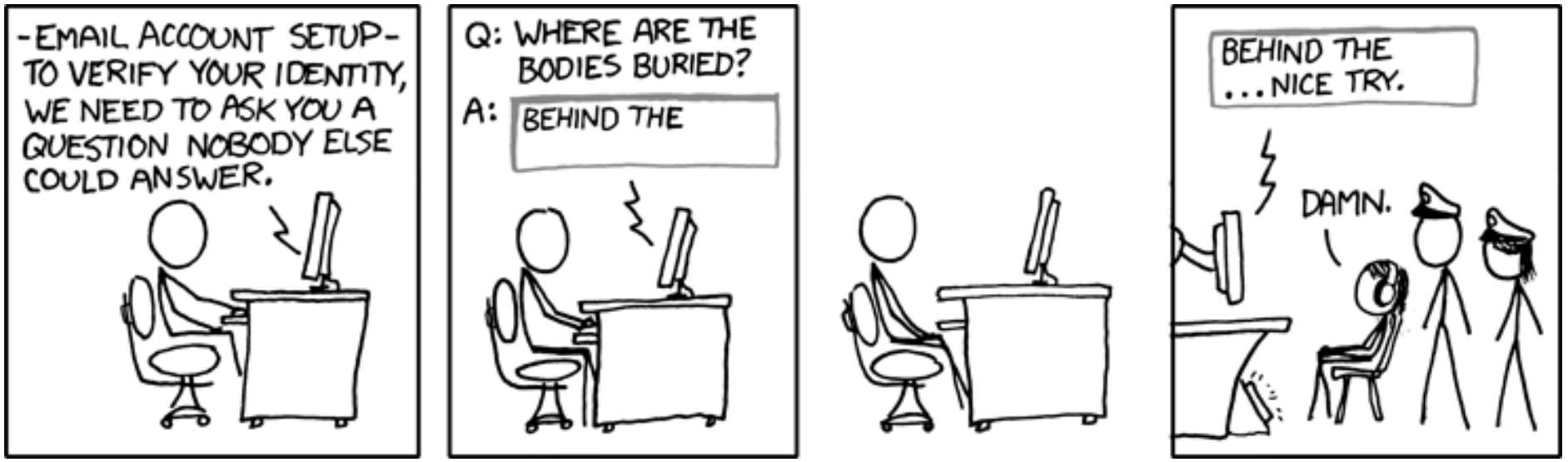
- Identifier and credential (e.g. password) used routinely for authentication
- Policy may require periodic update of credential, e.g., monthly

Identification and Authentication



- If regular authentication credential is “lost” or “forgotten”, user can still recover their account
  - Often important to retrieve stored information
- User asked to answer one or more of their challenge questions
  - Alternatively, might re-identify
- May also have to follow a re-directed email

Account Recovery with Challenge Questions

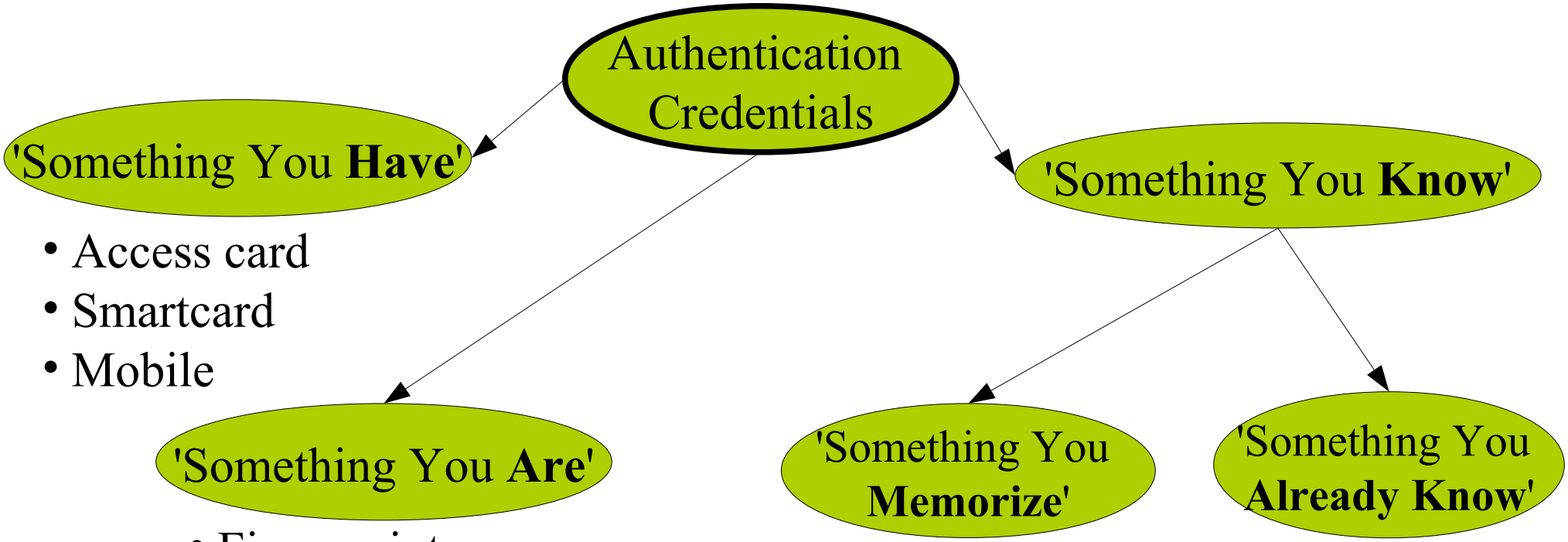


Source: http://xkcd.com/565/

Account Recovery with Challenge Questions

- *"What is my Mother's Maiden Name?"*
- *"What was the name of my first pet?"*
- *"What was the name of my first school?"*
- *"Who is my favourite actor?"*
- *"Where did I spend my honeymoon?"*

Account Recovery with Challenge Questions



Account Recovery with Challenge Questions

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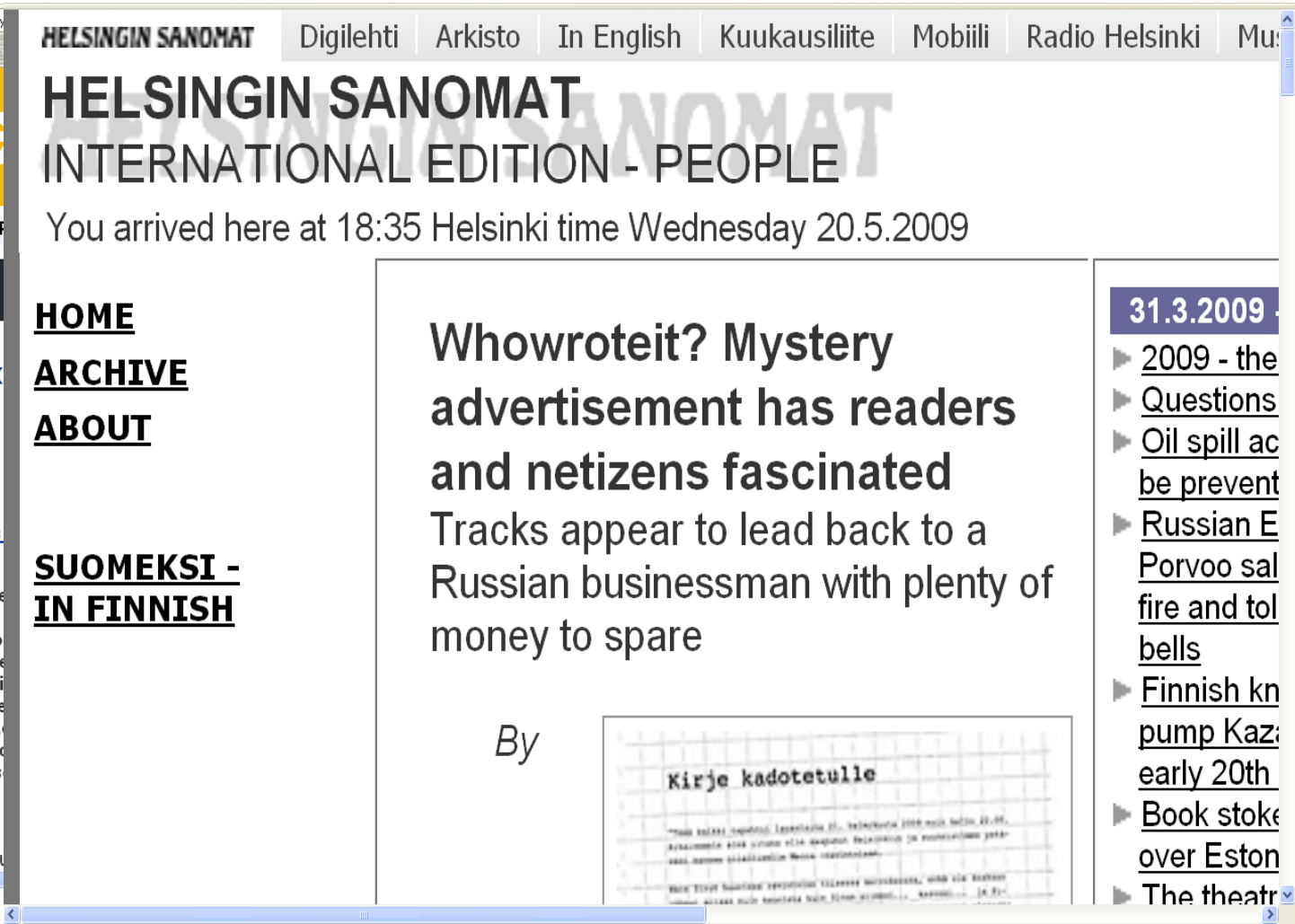

Account Recovery with Challenge Questions

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NICOLE BAUTE
STAFF REPORTER

Twitterers twittering into the great abyss should be careful about the games they play, Canada's privacy commissioner warned this week after catching on to a new trend.

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BOOKMARK

Account Recovery with Challenge Questions

- Ubiquitous use of challenge question authentication
- Very little published research as to whether it's
  - Usable
  - Secure
  - Privacy-friendly
- For remainder of this presentation
  - Recent research results
  - Best practices for challenge question authentication

Challenge Question – Recent Research

Rabkin (2008)

Schechter et al. (2009)

Just & Aspinall (2009)

Challenge Question – Recent Research

- Security analysis of challenge questions used by 20 US banks
- Result
  - Many questions found to provide low security

Challenge Question – Recent Research

Rabkin (2008)

Schechter et al. (2009)

Just & Aspinall (2009)

- Security and usability analysis of challenge questions used by Microsoft, Yahoo!, Google
- Results
  - High rates of successful guessing by friends, acquaintances
  - High rate of users unable to recall their answers

Challenge Question – Recent Research

- Security and usability analysis of 500 user-chosen challenge questions
- Results
  - Most questions were insecure
  - High rate of users unable to recall their answers

Challenge Question – Recent Research

- What does these results mean?
  - There are serious questions for the security and usability of authentication with challenge questions
  - Partially due to increased information availability
- However,
  - This verdict is for current implementations
  - Some improvement possible with improved guidance and tools
- And the research continues ...

Challenge Questions – Usability

Three criteria to assess usability

- Applicability
  - How widely applicable is the given question?
- Memorability
  - How easy is it for the user to recall the answer?
- Repeatability
  - How accurately can the answer be replayed, without syntactic or semantic ambiguity?

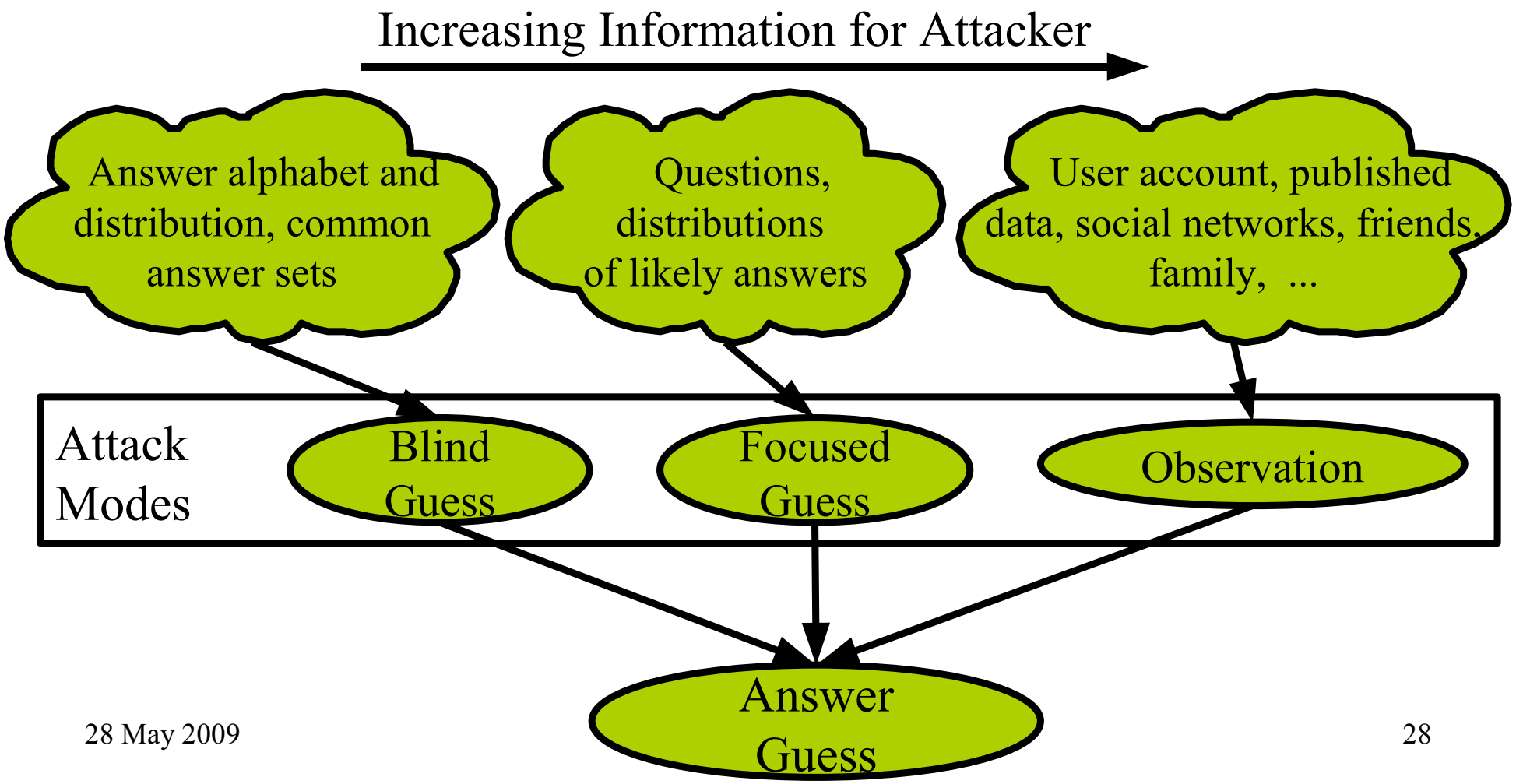
What was your first pet's name?

What was my high school locker combination?

Street vs Avenue

Favourites

Challenge Questions – Security



Challenge Questions – Security

Three criteria to assess security

- Length of answers
  - Helpful when dynamically assessing user answers
  - Can't force longer answers, but can ask multiple questions
- Size of answer space
  - Can "filter out" obviously small questions
  - Can measure others

Too few possibilities!

What's my favourite colour?

What's my best friend's last name?

Only 10^5 in US (2000)

Challenge Questions – Security

- Observability of answers
  - Subjective assessment
  - Known to friends or family?
  - Obtainable by strangers?
    - Public records, social networks, physically observable, ...

Recall earlier web examples

Challenge Questions – Privacy

- Is the information being asked, too sensitive?
  - Does it reveal overly personal beliefs, preferences, ...
- Some questions might be particularly sensitive to one culture, more than others
  - Religion, politics, relationships, …
- Can be difficult to balance between information that is private (known only to a user), personal (memorable to user), but not sensitive

Other Considerations

- Number of questions to ask
  - Recent research suggests more than one question/answer required
  - More 'entropy' for an attacker to have to guess
  - Can also help to increase difficulty of Observation attack
  - User might register 3-4 questions and answers, and is required to answer *at least* 2 questions at authentication
  - For Government of Canada solution, users registered 3 questions and answers, and were asked all 3 at recovery

Other Considerations ...

- To '*' or not to '*'
  - What was my first school's name? **********
  - What was my first school's name? *St. James IV*
- Use of '*' can limit effectiveness of “shoulder surfing” attacks
- But, use of '*' can make entering of answer difficult
- If we assume that questions are rarely used (only for recovery), then shoulder surfing may be less of a concern
  - For Government of Canada solution, we did not use '*'s, and thus opted for improved usability whereby users see what they type

Other Considerations ...

- Normalization of answers
  - Is the answer “John Carter” = “john carter” = “johncarter”?
  - Is the answer “St. James” = “St James”?
- Unlike with passwords, capitalization and punctuation locations are very predictable with answers
  - Thus offering little to improve security
  - Recent research shows users have difficulty with consistent capitalization
- For Government of Canada solution, answers were normalized to remove capitalization and punctuation

Other Considerations ...

- System-generated versus user-generated questions
  - Users can choose unique, secure questions
  - However, users will also often choose very insecure questions
  - For Government of Canada solution, we used one system-generated question, and two user-generated questions
- Complementary security measures
  - Email a recovery link to the user

Conclusion

- When passwords are forgotten, we rely upon *known* information to authenticate
- A risky proposition, since this information is often *more widely known* than we would like
- Usability – Security – Privacy
- Improved practices and further research are required

Further Information

- Other presentations, research publications, at
  - http://homepages.inf.ed.ac.uk/mjust/KBA.html
- Email: mike.just@ed.ac.uk