Practical Password Recovery on an MD5 Challenge/Response such as APOP *

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* We notified Information-technology Promotion Agency, Japan of the result followed by the Japanese ordinance, December 8, 2006. The notification number is IPA#10155887.

Background of Our Activity 1

- Tomorrow, Leurent will present the almost same result. (Research motivation is different.)

Important point

We have independently done the same research, but not submitted yet.

When did we do? → From October to November. Finished before FSE submission.

Why didn't we submit? → Because we considered security problems.

Background of Our Activity 2

- IPA requests to report some vulnerability of widely used software products.
- We respected the IPA's policy so that we did not submit to conferences.

Collision Impacts the Security of Challenge/Response Authentication

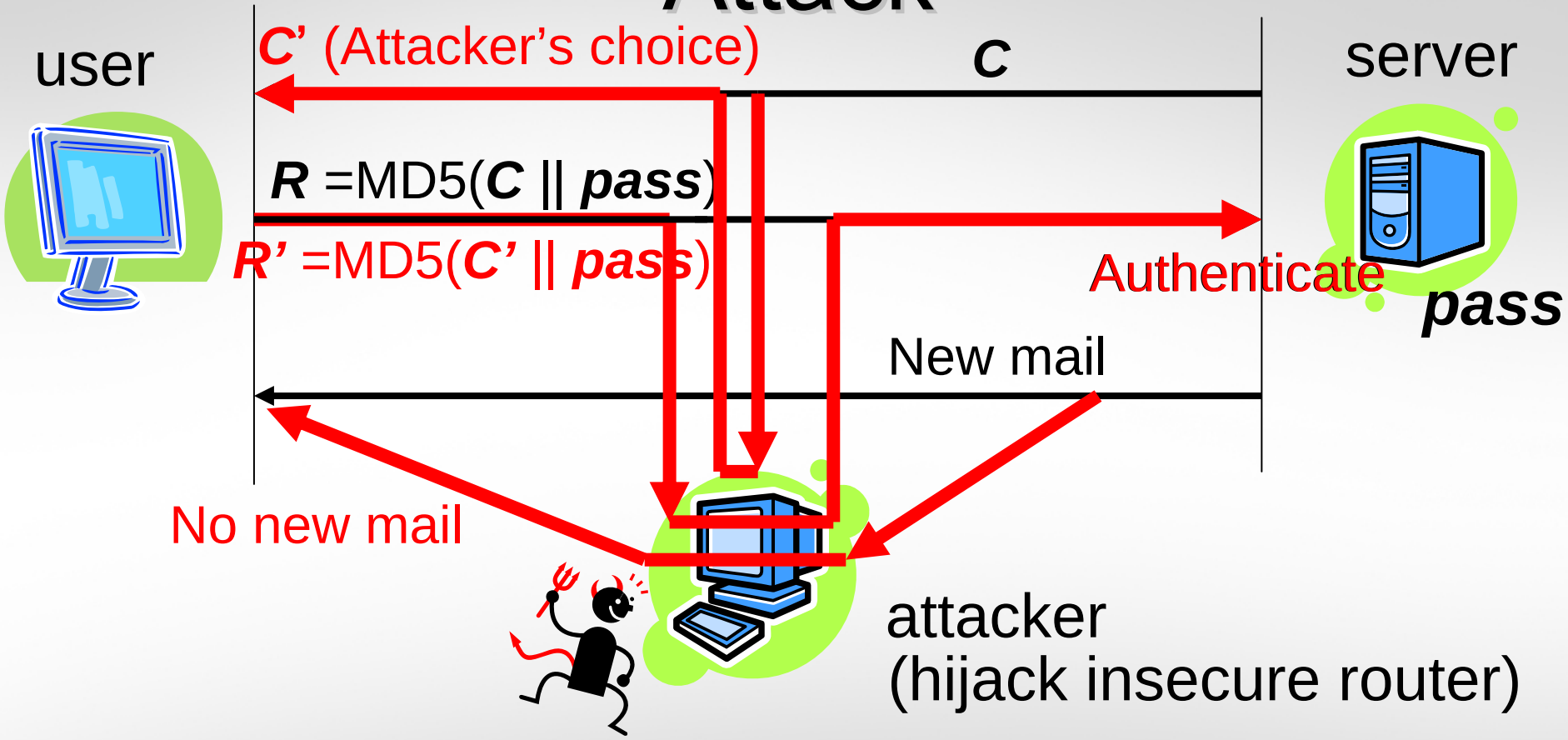
- Recently, collision resistance of several hash functions were broken.
- Some researches apply collision to applications.
- How about challenge/response authentication?

We show collisions are used to recover user's secret information in prefix C/R authentication such as **APOP**.

(Only MD5 is used in APOP)

Challenge : ***C***, Response : MD5(***C***||***Secret***)

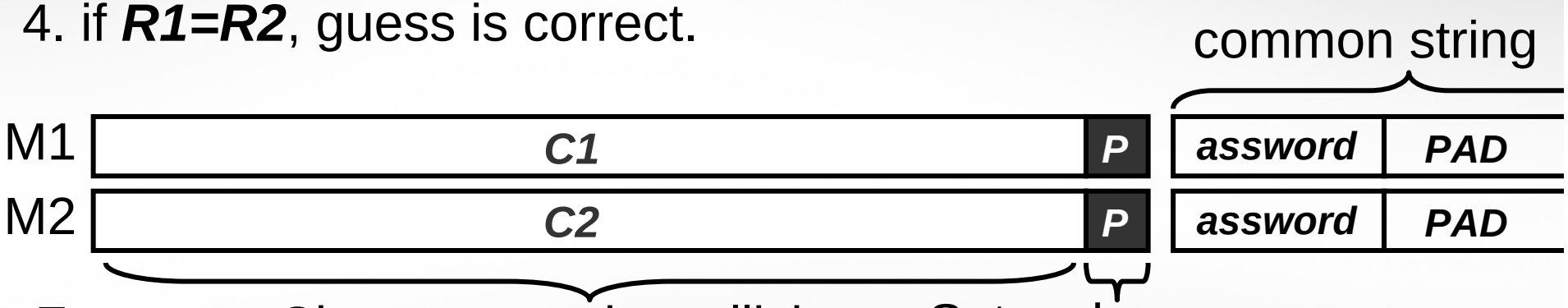
APOP and Chosen Challenge Attack



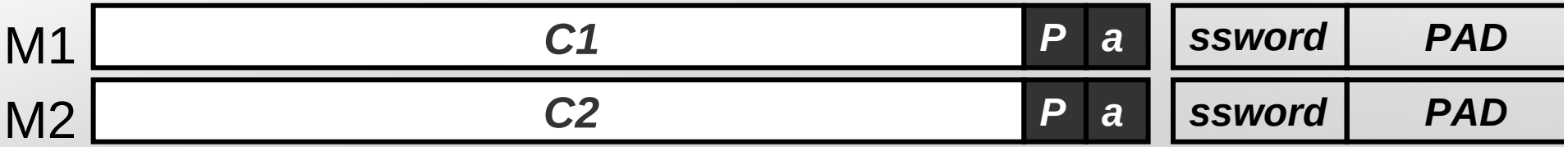
We found, in Man-in-the-Middle environment, attacker can recover the first 3 characters of password.

Attack Procedure

1. Fix the last 8 bits of M to be a character we guess.
2. Choose free part to yield a collision.
3. Send ***C1,C2*** to user, get responses ***R1,R2***.
4. if ***R1=R2***, guess is correct.



When recover more characters, fixed part will be long.



Conclusion and Future Work

- We showed how to recover 3 chars of APOP password.
- By combining exhaustive search, 8-9 chars are recovered.
- This is the first result applying collision to C/R authentication.

Why recoverable number is 3?

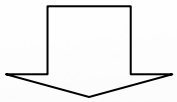
We use Wang's collision attack that has a difference in the latter part of messages.

Can't hold more identical values.

Statement In RFC :

Secrets should be long strings
(considerably longer than 8-character)

Some may say recovering 3 characters is
not enough, it's **not vulnerability**.



We tried extension of APOP Attack.

Continue to next talk.

Thank you for your attention !!