Least Privilege:

Security gain without developer pain

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Least privilege has been around since the 1975.

“The Protection of Information in Computer Systems”
- Saltzer and Schroeder
The idea is simple:
give only permissions that are required to get the job done.
So, everybody has least privilege systems, right?
$250+ million impact
40 million Credit Cards
18.4% of incidents involved privilege misuse*.

*2017 Verizon DBIR
143 million SSNs
29.5% of breaches involved web application attacks*. 

*2017 Verizon DBIR
200+ thousand classified documents
25% of breaches involved internal actors* (intentional or not)
Not knocking these organizations - least privilege is hard!

Why?
We don’t want... permissions to be frozen in time
We don’t want... overprovisioned permissions
We don’t want... permission granting to require this
“Gravity” pulls policies larger over time.
In the physical world, permissions are taken away when no longer required.
My landlord takes my keys when I move out of an apartment.
If I stop working at Netflix, they’ll revoke my badge.
My passport stops working if I don’t renew it.
In software, these status changes are typically silent and not actioned.
Abandoned projects, anybody?
If your environment is small, least privilege may be possible.
The rest of us need a different approach.
At Netflix we automatically remove unused permissions from our AWS policies.

This talk is about how.
AWS implements RBAC via the IAM service.

Applications assume roles.

Roles have attached policies.
Ex: Cloud Based Word Processor
Ex: Cloud Based Word Processor

{
"Effect": "Allow",
"Action": ["*:*"],
"Resource": "*"
}

S3

+
Ex: Cloud Based Word Processor

```json
{
  "Effect": "Allow",
  "Action": ["s3:*"],
  "Resource": "*"
}
```
Ex: Cloud Based Word Processor

```json
{
  "Effect": "Allow",
  "Action": ["s3:GetObject", "s3:PutObject"],
  "Resource": "*
}
```
Ex: Cloud Based Word Processor

```
{
  "Effect": "Allow",
  "Action": ["s3:GetObject", "s3:PutObject"],
  "Resource": "arn:aws:s3:::wp_bucket"
}
```
AWS provides data about service, action, and resource usage.
Example:
My (super) cool new application
We give a base set of **benign** permissions to start with.

s3:GetObject
s3:PutObject
...
...
...
...
...
sqs:ReceiveMessage
We passively watch the application for 90 days to see which permissions are used.
After 90 days we start taking away unused permissions.

s3:GetObject
s3:PutObject
...
...
...
...
...
sqs:ReceiveMessage
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s3:GetObject
s3:PutObject

sqs:ReceiveMessage
Developers make a *simple* request when their application needs more permissions.
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```
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...
...
...
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sqs:ReceiveMessage
```
Developers make a *simple* request when their application needs more permissions.

- `s3:GetObject`
- `s3:PutObject`
- ...
- ...
- `sqs:ReceiveMessage`
When the application isn’t using those permissions anymore they’re removed.
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```c
struct group_info *groups_alloc(int gidsetsize)
{
    struct group_info *group_info;
    int nblocks;
    int i;

    nblocks = (gidsetsize + NGROUPS_PER_BLOCK - 1) / NGROUPS_PER_BLOCK;
    /* Make sure we always allocate at least one indirect block */
    nblocks = nblocks ? : 1;
    group_info = kmalloc(sizeof(*group_info) + nblocks*7);
    if (group_info)
        group_info->blocks[0] = group_info->small_block;
    else {
        for (i = 0; i < nblocks; i++) {
            gid_t *b;
            b = (void *)__get_free_page(GFP_USER);
            if (!b)
                goto out_undo_partial_alloc;
```
When the application isn’t using those permissions anymore they’re removed.

s3:GetObject
s3:PutObject

... ...

sqs:SendMessage
Unused applications are **totally powerless** after 90 days!
At Netflix we removed 80% of permissions the first time we did this.
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Since then we’ve removed far fewer.
But what about...
... infrequently used permissions?
... infrequently used permissions?

Let’s leave those alone
... if we break applications?
... if we break applications?

We’ll detect and put them back - easily
... if an attacker compromises your system and uses permissions the application needs?
This is not a “silver bullet”!

... if an attacker compromises your system and uses permissions the application needs?
What else!?
Can we extend this to mobile application privileges?
Can we extend this to container capabilities?
Closing thoughts
Closing thoughts
Closing thoughts
Closing thoughts
Closing thoughts
Repokid

https://github.com/Netflix/repokid
Thank you. Questions?

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