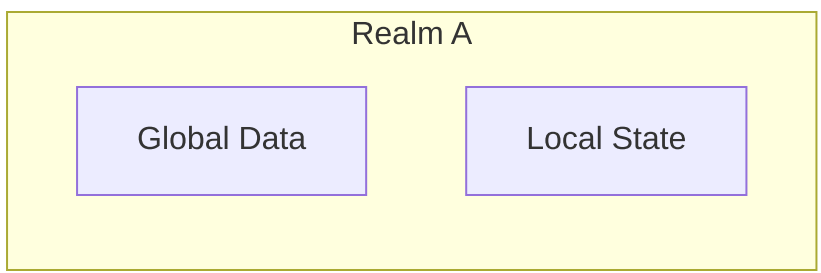
# Interrealm in Gno 🌐

A deep dive into Gno’s realm system and rules

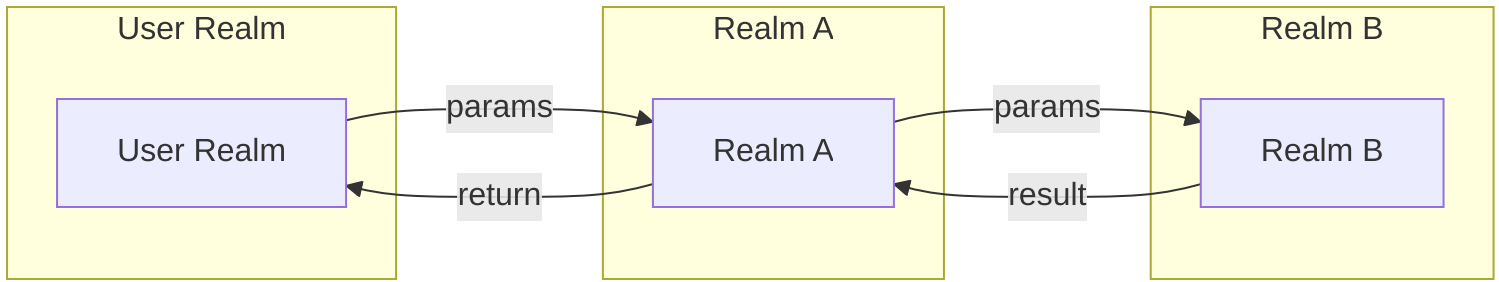
# What is a Realm?

- A **realm** is an isolated execution and storage context 🌍
- Each realm has:
  - Its own **state and authority**
  - Rules for **entry** and **data modification**
- Realms enforce:
  - **Security**, **Traceability** and **Isolation**



# Interrealm Flow

## Realm method call

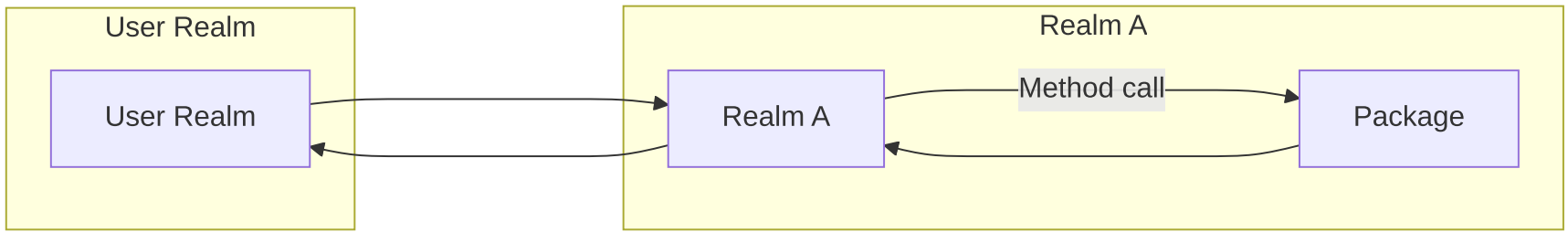



Provenance stack

- Current Realm: **B**
- Called from: **A**
- Origin: **User Realm**

# Interrealm Flow

## Package method call

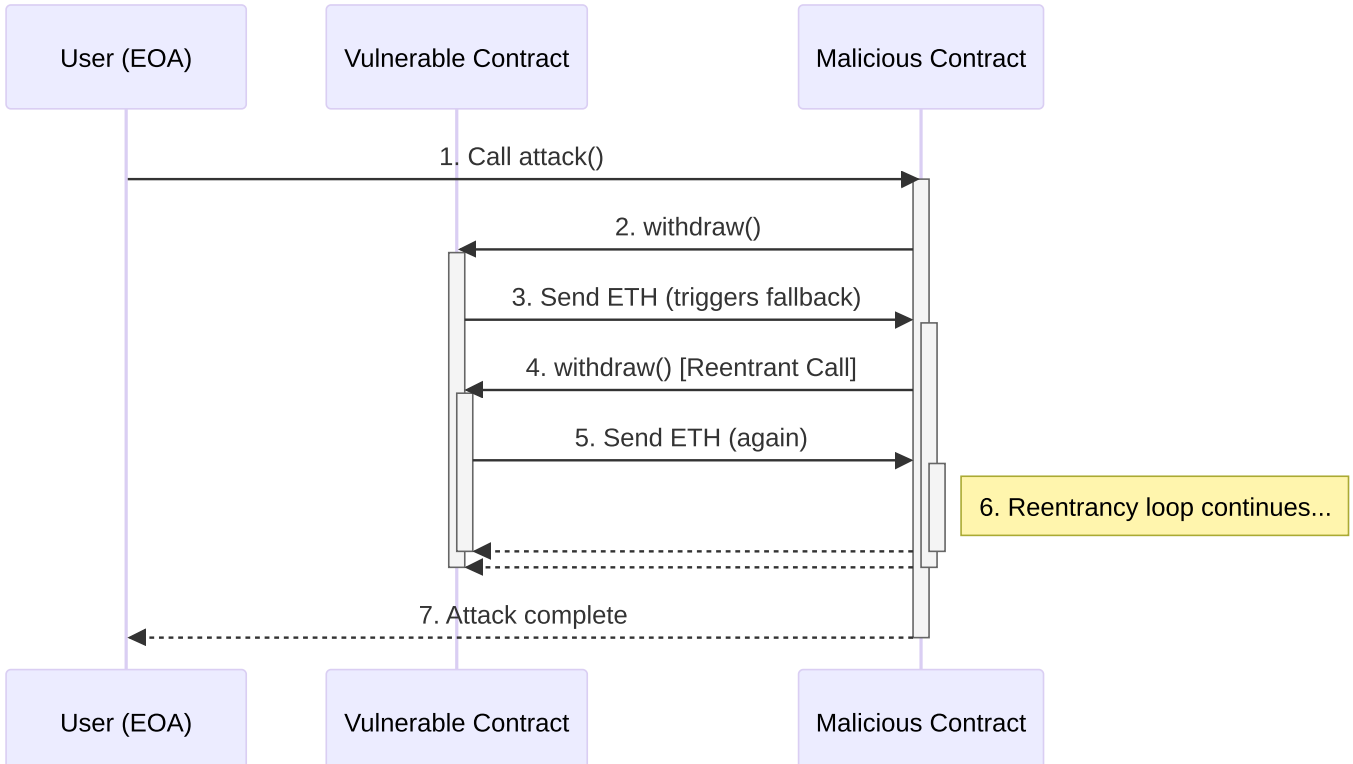



Provenance stack

Current Realm: **A**

Origin: **User Realm**

# But it instaure crucial flaw - Reentrency attack

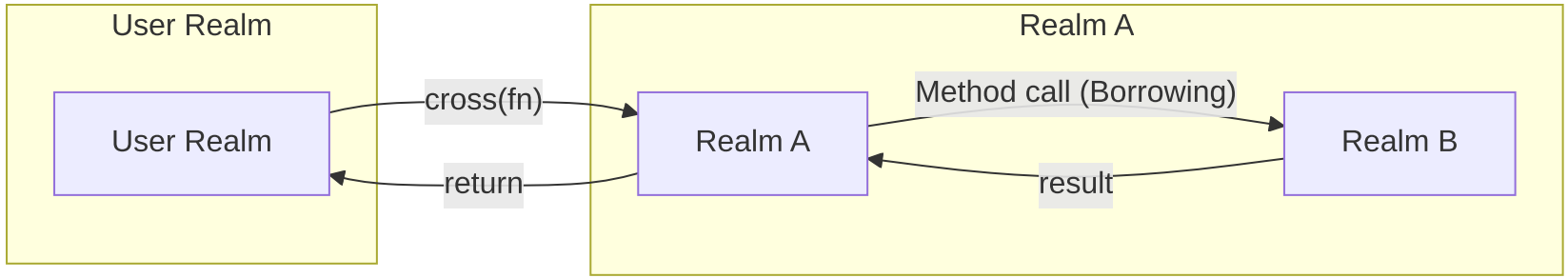


# Let’s introduce **Borrowing**

Less permissive call for a more secure environment.

- **Borrowing** = calling a method on an object in another realm.
- You **implicitly visit** the object’s realm for that method call.
- You can **read and modify** the receiver and its reachable state.
- **Limit**: You cannot freely create new root-level objects.

# Interrealm Flow (Borrowing)




Provenance stack

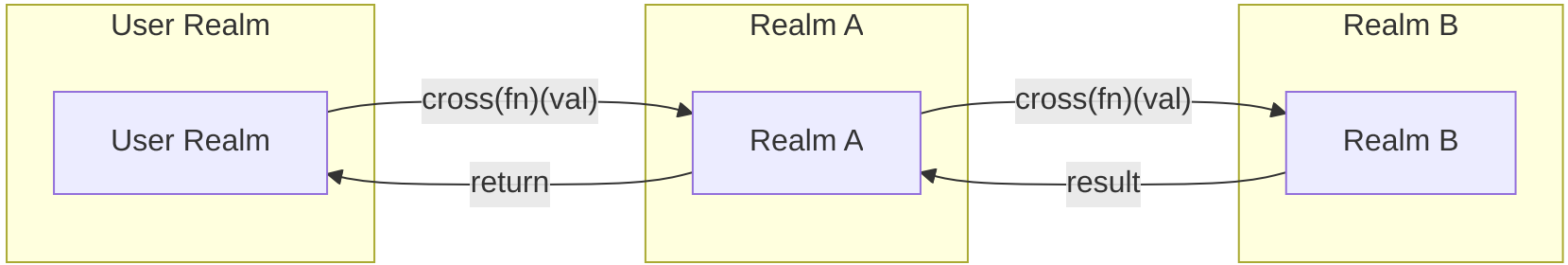
Current Realm: **A**

Origin: **User Realm**

# Crossing

- **Explicitly switch** into another realm.
- **Crossing** = `cross(fn)(...)` or functions marked with `crossing()`.
- Gain full **write access** to the realm's global storage like it used to.
- Use for **creating new objects** or performing realm-specific logic.

# Interrealm Flow (Crossing)




Provenance stack

- Current Realm: **B**
- Called from: **A**
- Origin: **User Realm**

# Inter-realm Flow (Crossing)

## Realm A

```
func CallCreatePost(title, content string) {
    cross(CreatePost)(title, content)
}
```

## Realm B

```
func CreatePost(title, content string) {
    newPost := Post{
        Title: title,
        Content: content,
    }
    Posts = append(Posts, *newPost)
}
```

# Rules Summary

| Action | Borrowing | Crossing |
| --- | --- | --- |
| Modify existing object | ✅ via method call | ✅ |
| Create new unattached object | ❌ | ✅ |
| Implicit realm context change | No (temporary for method) | Yes (permanent inside fn) |
| Method syntax | `obj.Method()` | `cross(fn)(...)` + `crossing()` |

# Code Example: Borrowing

```
// In realmB
func (b *Book) SetTitle(new string) {
  b.Title = new  // Allowed: borrowing b's realm
}

// In realmA
book := &realmB.Book{}
book.SetTitle("Hello Gno")
```

# Code Example: Crossing

```
// In realmB
func CreateUser(name string) {
  crossing()
  user := &User{Name: name}
  users[name] = user  // Global storage in realmB
}

// In realmA
cross(realmB.CreateUser)("alice")
```

# Best Practices

1. Default to **non-crossing** methods.
2. Use **borrowing** for object-specific ops.
3. Reserve **crossing** for realm-level state changes.
4. Always mark public crossable functions with `crossing()`.

# Summary

- **Realms** = isolated worlds.
- **Borrowing** = temporary, object-scoped access.
- **Crossing** = explicit realm switch for full access.
- Choose the right approach for **security** and **clarity**.