40. RBAC Policy DSL Compiler with Static Security & Privilege Escalation Detection

Course Name: Compiler Design

Course Code: CS1202

Name: Pinikeshi Meghana

Roll No: 24CSB0A54

Sec: CSE-A

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Week 5 - RBAC DSL Grammar Design

1. Activities Completed

- Designed a formal RBAC DSL grammar to support:
    - Role definitions
    - Permission assignments
    - Role inheritance
    - User-role mappings
- Defined invalid policy patterns, e.g., roles inheriting nonexistent roles or users assigned undefined roles.
- Ensured grammar is unambiguous and well-structured.

2. DSL Grammar Specification

```
# Role definition
role <RoleName> {
   permissions = [<Permission1>, <Permission2>, ...]
}

# Role inheritance
role <RoleName> extends <ParentRole> {
   permissions = [<Permission1>, ...]
}

# User-role assignment
user <UserName> {
   roles = [<Role1>, <Role2>, ...]
}
```

Notes:

- <RoleName>: Name of the role (e.g., Admin, Manager)
- <ParentRole>: Role from which permissions are inherited
- <PermissionX>: Specific actions allowed (e.g., read, write, approve)
- <UserName>: Name of the user (e.g., Anu, Barbie)

3. Sample RBAC Policy File (policy.rbac)

```
role Admin {
   permissions = [read, write, delete]
}

role Manager extends Admin {
   permissions = [approve, review]
}

role Developer {
   permissions = [read, commit]
}

role Tester extends Developer {
   permissions = [test, report]
}

role Intern {
   permissions = [read]
}

user Anu {
```

```
    roles = [Manager]
}

user Barbie {
    roles = [Developer]
}

user Claire {
    roles = [Tester]
}

user David {
    roles = [Intern]
}

user Eva {
    roles = [Manager, Tester]
}
```

RBAC Role Inheritance & User-Role Mapping:

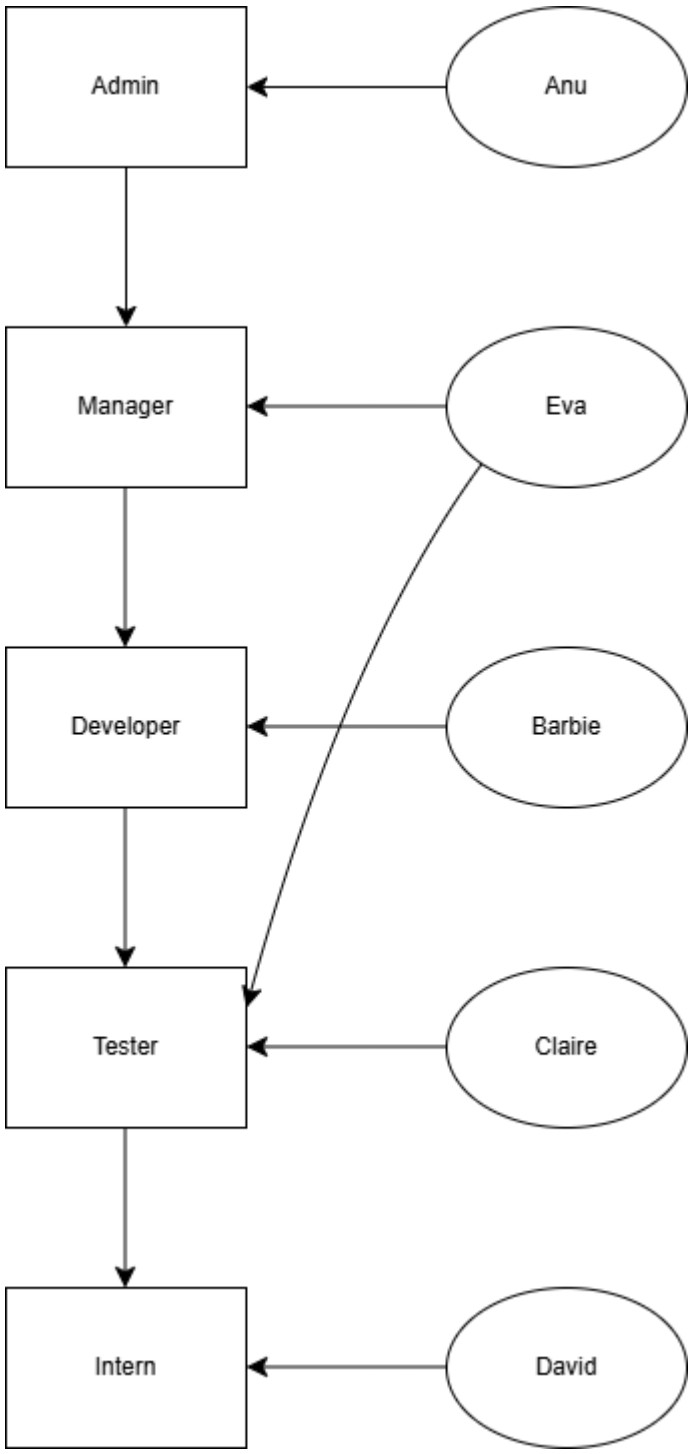
- **Roles & Inheritance:** Boxes show system roles; arrows indicate inheritance of permissions.

  Example: Manager inherits from Admin, Tester inherits from Developer.

- **Users & Role Assignments:** Users are linked to their assigned roles; multiple roles are supported.

  Example: Eva has both Manager and Tester roles.

- **Purpose:** Visualizes role hierarchy and user-role mapping, making the RBAC policy easy to understand.


Admin
Anu
Manager
Eva
Developer
Barbie
Tester
Claire
Intern
David