



Stratus Sagathians

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Objective & Real-World Need

Project Goal

Reduce external lab purchase volume in our Dunwoody department.
Enable personalized lab creation by cloud program faculty.

System Overview Part 1: User Access & Routing

Login Flow

Faculty and students log in through a secure website.

Users are routed to their respective UI dashboards dynamically.

Faculty Capabilities

Clone lab infrastructure from GitHub to EC2 servers.

Configure student view of UI and personalized lab environments.

System Overview Part 2: Student Lab Experience

Student Interaction

Students launch labs from UI, receiving ephemeral users and credentials.

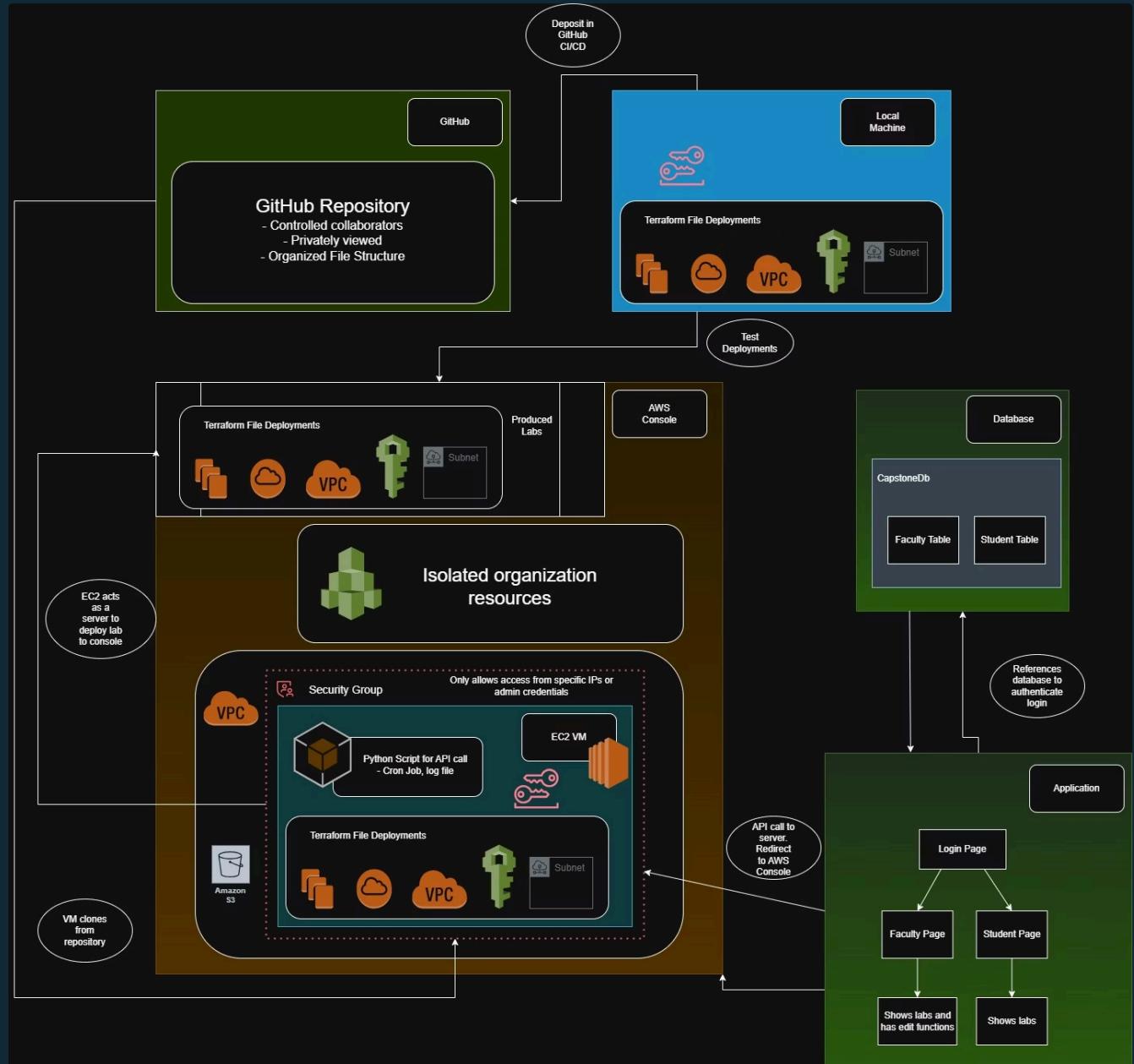
Allows secure, temporary access with resource cleanup after use.

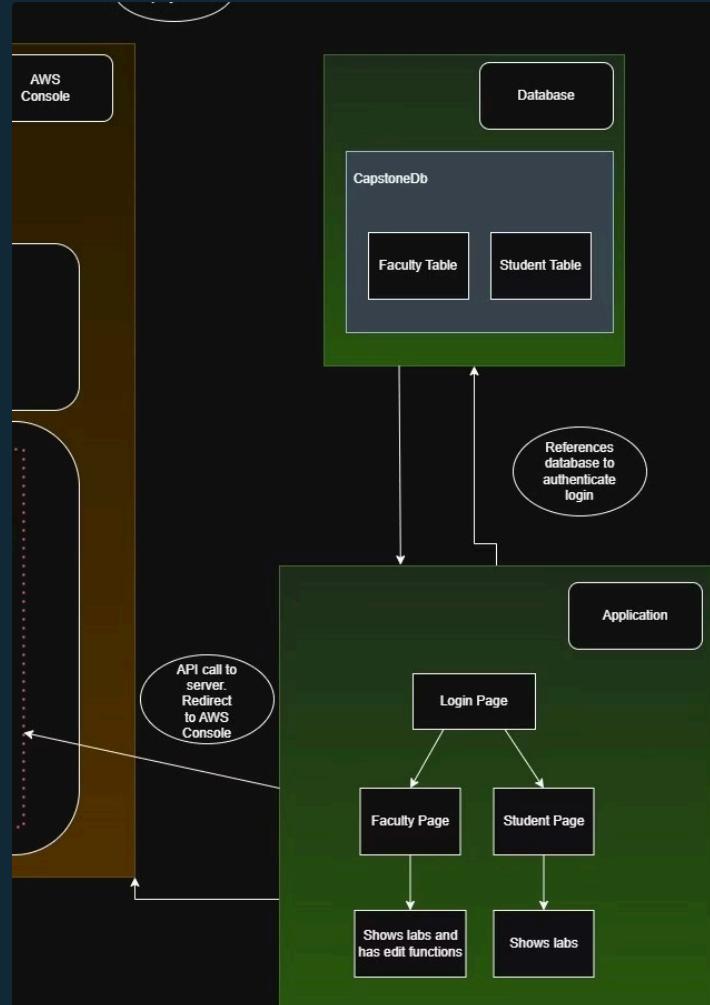
User Value

Personalized labs enhance learning and give personalized instruction.

Empowers faculty to curate lab content tailored to classes.

Architecture Diagram





Architecture & Design Trade-offs

- Database: Two tables for login.
- Login: Two interfaces depending on login credentials.
 - Can not access without login.
- Student and Faculty: Only has the connection button for now.
- Trade-offs: Security vs accessibility, functionality.

Architecture & Design Trade-offs



Ephemeral IAM Users

Each lab generates unique IAM credentials for temporary use.

Trade-off: Inherent threat of creating infrastructure in excess while accessing console.

Security Risk Mitigation

Credentials stored separately but ephemeral nature and required credential login reduces long-term risk.

Resource Deletion

Automated cleanup ensures lab resources don't persist beyond sessions.

Trade-off: Resource deletion doesn't cover resources created by the user during lab.

Hosting & Toolchain



EC2 Server

Runs cloned lab infrastructure from GitHub.



S3 Backend

Supports parallel users in AWS console and concurrent API calls.



GitHub Integration

Facilitates cloning and updating of lab templates and enabled CI/CD.



SQL Server

Stores login credentials.

Demo Setup & Success Criteria

Login Functionality

Users authenticate and access personalized UIs.

Concurrent Users

Multiple users run labs simultaneously via shared backend.

Infrastructure Automation

Cron jobs clean up labs to maintain system hygiene.



IAM Permissions Lab Demo

- Implements Terraform to provision a user with unique identifiers for each lab session.
- Uses AWS security best practices by applying least privilege access policies.
- Integrates with the project's authentication system.
- Created following a unanimous decision to move on from our initial lab.

Live Demo - Troubleshooting EC2

Supported by Dr. Paul Flowers and Louis Kraimer!

Please share your screen with Dominick over teams - a meeting will be started.

Testing Highlights & Challenges

1

EC2 Connectivity

Validating internet accessibility and API responsiveness.

2

IAM Policy Configuration

Ensuring unique, repeatable, and secure access policies.

3

Parallel User Support

Tested simultaneous user activity on shared S3 backend.

4

Database

Tested the hashing for passwords in the tables.

5

Login

Tested the connection and front-end validations.



User Highlights

- **Streamlined Login:** Easy login via routing login info to the UI.
- **Parallel User Access:** Supports multiple users from the same script.
- **Infrastructure Simplification:** Declutters and optimizes backend resources via modular python script.

Cost Analysis Estimation & Alternatives

Current AWS Cost Projection

Running an EC2 instance and VPC with VPN connection costs approximately **\$17,191.80 USD** yearly.

Cost Reduction Options

Implementing in-house virtual machines could significantly reduce expenses.

Leveraging existing department AWS infrastructure could potentially offset costs.

Competitive Analysis

Pluralsight alone costs **\$17,640 USD** yearly for just 30 users at **\$49 USD** monthly.

Our solution provides hands-on labs versus passive training content.

Enhanced Value

Could replace external certification preparation services like Tutorial Dojo.

Offers dynamic practice environments against certification requirements.

Future Work & Infrastructure Improvements

- **Public Accessibility:** Configure app for external, secure public access.
- **IAM Modular Policies:** Restrict temporary users to own lab resources only via organization policies.
- **Infrastructure Cleanup:** Automate removal of user-generated resources during labs.
- **Latency Reduction:** Optimize lab startup and generation speeds post-login.
- **Monitoring & Auto-Grade:** Use CloudWatch to track usage and hopefully enable auto-grading.
- **UI:** Expand on student and faculty pages.
- **Database:** Add students and faculty to the database.

Lessons Learned - Dominick



Deep AWS Understanding

Developing labs requires extensive knowledge of AWS beyond what I currently know.



Complex Temporary Roles

Codifying temporary roles demands careful permission management and testing.



Variable API Behavior

API calls behave variably, requiring adaptive handling for reliability.



Humbling Experience

Once again, in a new discipline, I've discovered the knowledge disparity compared to experts.

Lessons Learned - Nel

Collaborative Development

Effective teamwork and communication streamlined complex lab implementations.

Testing Rigor

Thorough iterative testing uncovered subtle bugs in the code.

User Experience Focus

Prioritizing lab flow simplicity improved student engagement and reduced errors.

Adaptability

Flexibility in design allowed quick adjustments to evolving AWS service behaviors.

Lessons Learned - Emma

Terraform Skills

Gained deeper knowledge of Terraform to better manage AWS resources.

Lab Designing

Complexity vs simplicity outlook on AWS resources required for environments.

Testing Process

Learned to see repeated testing as a normal part of development, not a failure.

Learning Curve

Discovered that working with new tools requires significant time investment.

Questions?



Topic Clarifications

Feel free to ask about any part of the presentation or technical details.



Future Steps

Discuss future progress.



Feedback

Your insights are valuable to improve our approach and outcomes.

Lab Configuration Resources

- All Things IAM – Troubleshooting: [IAM User Management](#), [Login Profiles](#), [Access Keys](#), [Policy Creation](#)
- Cleanup Section: [Terraform Lifecycle Configuration](#), [null_resource](#) and [Provisioners](#)
- Learning APIs: [Introduction to Flask](#), [Basic Flask Setup](#), [Testing API with PowerShell](#)
- S3 Backend: [Using S3 Backend](#)
- Terraform Tools: [local-exec Provisioner](#), [Secrets Manager](#), [Deleting Secrets](#), [Format Function](#), [Count/For Each Meta-Argument](#)
- VPC and Networking: [AWS VPC Resource](#), [AWS Subnet Resource](#), [Route Tables Configuration](#), [Subnet Route Table Associations](#), [Default Route Tables](#), [Explicit Route Tables](#)