Configuration Manual

MSc Research Project
Masters in Cloud Computing

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Project Submission Sheet
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Configuration Manual

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1 Introduction

This setup guide gives you all the directions you need to set up and deploy the academic research project for adaptive multi-cloud container orchestration with machine learning driven predictive scaling. The research uses a hybrid orchestration engine that automates workload distribution between AWS Fargate containers and Lambda Functions based on predictions made through LSTM neural network.

2 Environment Requirements

2.1 Development Environment

- Operating System: Windows 10/11, Ubuntu 20.04
- Python Version: 3.9 or higher
- Memory: Minimum 8GB RAM (16GB recommended)
- Storage: 20GB available free disk space for models and datasets

2.2 AWS Requirements

- Active AWS Account with AWS Credentials
- AWS CLI configured with credentials (aws configure)
- IAM permissions for ECS, Lambda, ECR and CloudWatch
- Support for us-east-1 region

2.3 Software Dependencies

For running the orchestration engine:
```
boto3==1.26.137        # AWS SDK
botocore==1.29.137      # AWS SDK core
numpy==1.24.3           # Numerical computing
pandas==1.5.3          # Data manipulation
scikit-learn==1.3.0     # For ML
tensorflow==2.7.4       # LSTM implementation
```

3   Installation and Setup

3.1   Project Structure

```
project-root/
├── src/
│   ├── final_multicloud_orchestration_v3.py     # Main orchestration engine
│   │   enhanced_fargate_service.py
│   ├── data_collection
│       model_training
│       preprocessing
│
├── setup/
│   ├── week3_setup_final.py                # Infrastructure deployment
│   └── week3_requirements.txt              # Python dependencies
├── models/
│   └── lstm/
│       └── final_model.h5                  # Trained LSTM model
│
└── data/                                   # dataset and processed data
```

3.2   Environment Setup

Install Dependencies:

cd multicloud-orchestration
python -m venv venv
source venv/bin/activate # On Windows: venv\Scripts\activate
pip install -r requirements.txt

Configure AWS Credentials:

aws configure
Enter AWS Access Key ID
Enter AWS Secret Access Key
Default region: us-east-1
Default output format: json

4   AWS Infrastructure Components

4.1   VPC Configuration

- CIDR Block: 10.0.0.0/16
- Subnets: Minimum 2 subnets across different availability zones
- Internet Gateway: Required for external connectivity
- Security Groups: Configured for inter-service communication

4.2 ECS Fargate Cluster

```python
python

cluster_config = {
    'cluster_name': 'orchestration-cluster-v3',
    'capacity_providers': ['FARGATE', 'FARGATE_SPOT'],
    'default_capacity_provider_strategy': [
        {'capacityProvider': 'FARGATE', 'weight': 1, 'base': 0}
    ]
}
```

4.3 Lambda Functions

- orchestration-analyzer-v3: Workload analysis (512MB, 300s timeout)

- workload-executor-v3: Task execution (1024MB, 300s timeout)

- metrics-collector-v3: Performance monitoring (256MB, 60s timeout)

4.4 CloudWatch Metrics

Custom Namespace: Orchestration/V5/

5 Execution

python src/final_multicloud_orchestration_v3.py

Validation Metrics for Success criteria:

- Lambda Selection Rate: 40-60% for balanced distribution
- Decision Confidence: Minimum 0.6 average confidence score