Knowledge Ingestion Stack - Deployment Guide

This CDK stack deploys a comprehensive document processing and compliance analysis system with AI-powered knowledge extraction capabilities.

Components

This stack deploys a comprehensive intelligent document processing (IDP) system with two main components:

1. Regulation Question Generation Module

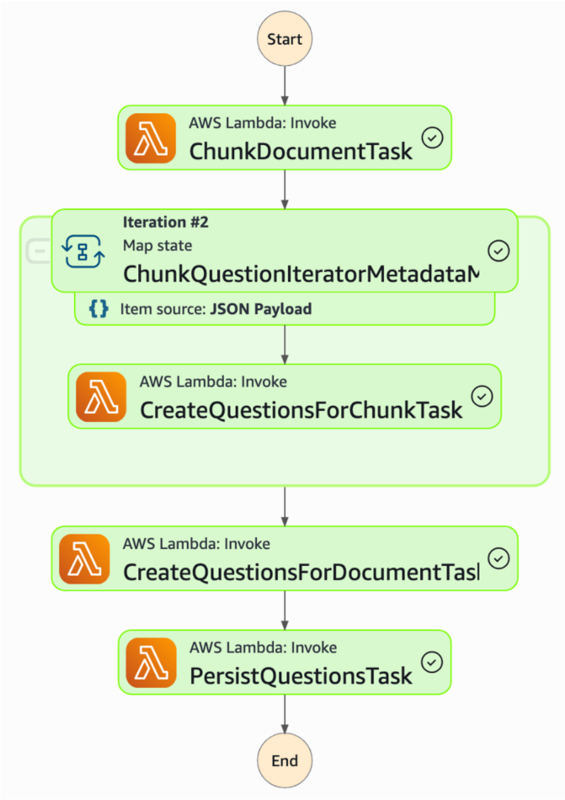
Generates targeted compliance questions from regulation documents.

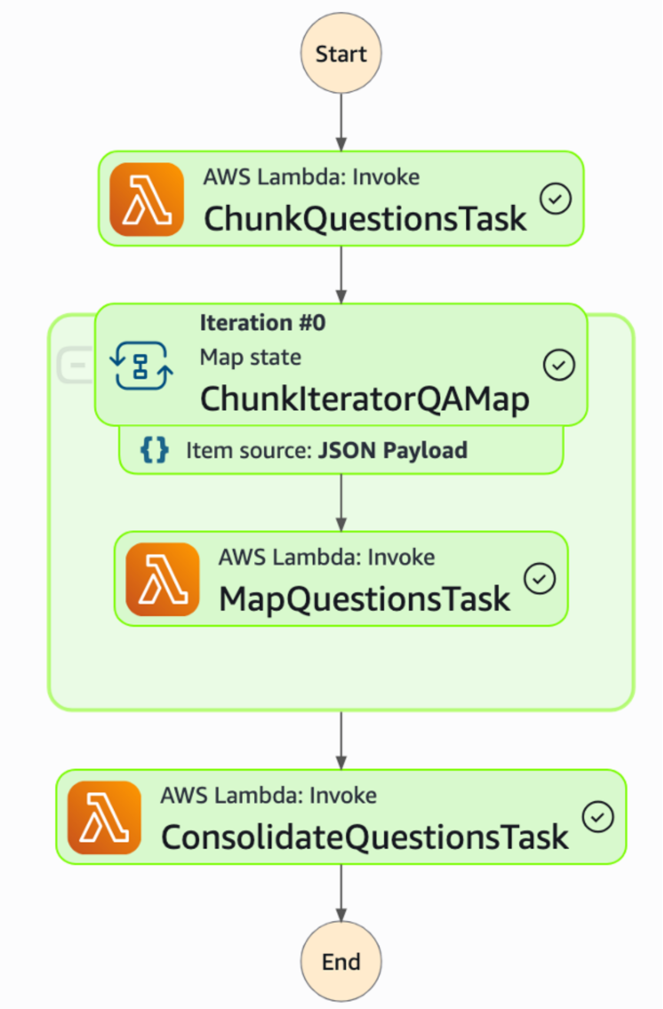
Document Processing Pipeline

- Partitions regulation documents into manageable chunks
- Generates compliance-focused questions for each partition
- Consolidates questions into comprehensive question sets
- Groups questions by compliance sections using user-defined templates

Question Alignment with Reflexion Technique The system uses the Reflexion method to ensure questions probe specific organizational processes rather than general regulatory concepts:

1. **Initial Generation**: AI generates preliminary questions from regulation text
2. **Self-Evaluation**: System evaluates question quality and relevance
3. **Reflection**: AI identifies improvements needed for better process-focused questions
4. **Refinement**: Questions are revised to target specific organizational compliance aspects
5. **Iteration**: Process repeats until questions effectively probe business processes





This approach generates questions that uncover actionable compliance information rather than theoretical regulatory knowledge.

2. Advanced Knowledge Base Implementation

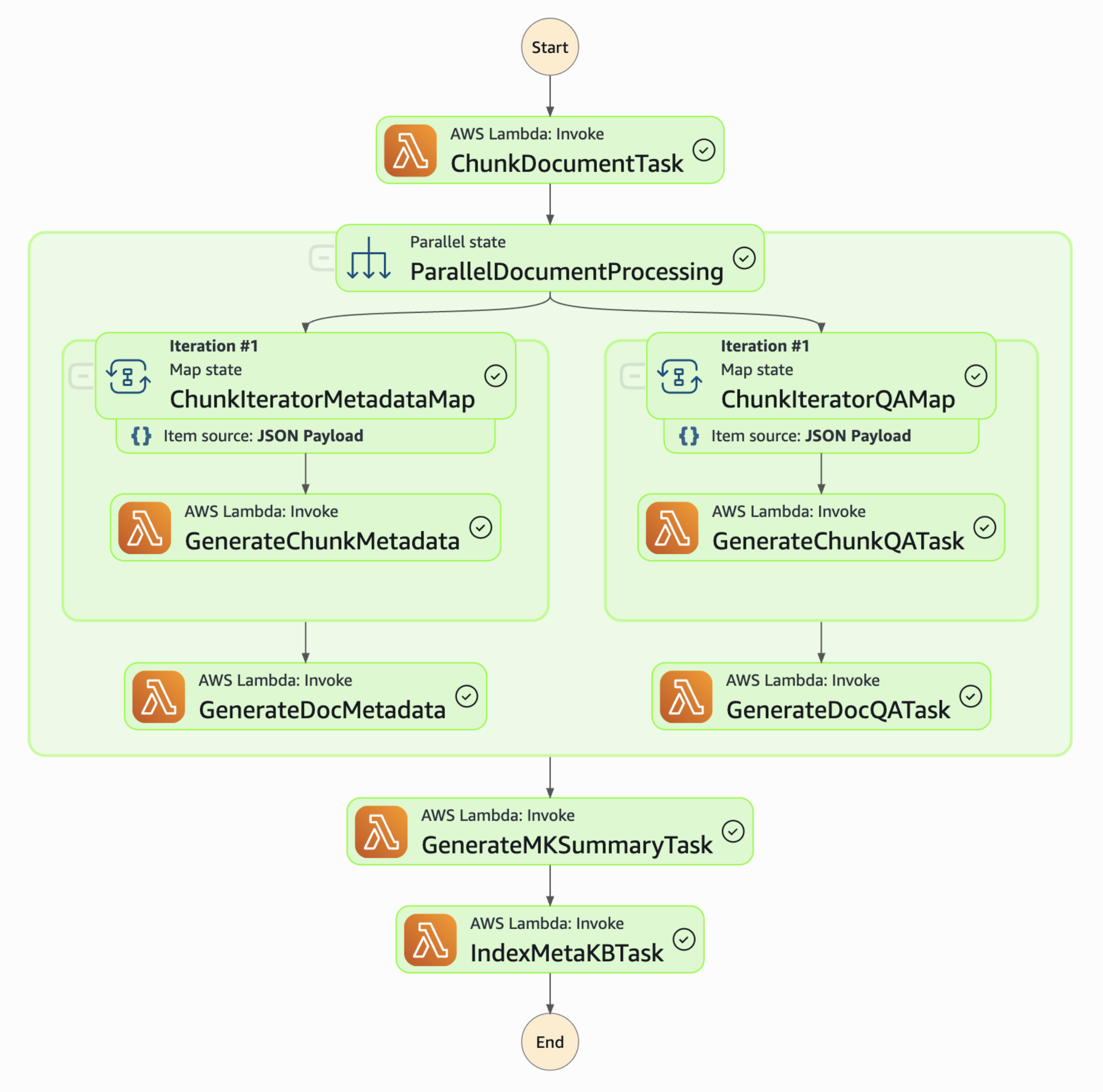
Implements a sophisticated RAG system using Meta-Knowledge Retrieval for enhanced document understanding:

Enhanced RAG Architecture

- Uses "prepare-then-rewrite-then-retrieve-then-read" framework
- Creates multiple perspective-based knowledge bases to reduce noise
- Generates synthetic Q&A pairs and metadata for each document chunk
- Implements Meta Knowledge Summaries (MK Summary) for document clusters

Processing Pipeline

1. Documents are partitioned into semantic chunks
2. Synthetic question-answer pairs are generated for each chunk
3. Metadata is extracted to enable perspective-based retrieval
4. All data is consolidated into searchable vector embeddings



This approach enables domain expert-level understanding and personalized query responses based on user perspective and role.

Deploy the Stack

Prerequisites

Before deploying, ensure you have:

- **AWS CLI** configured with appropriate permissions
- **Docker** installed and running
- **Python 3.12+** with pip
- **A CDK bootstrapped** AWS account
- **A Python virtual environment** with the dependencies installed
- **A Bedrock AgentCore execution role ARN** stored in the environment variable $AGENT_CORE_ROLE_ARN

Deployment with default parameters

```
# Deploy with required parameters
cdk deploy dataIngestionBackend \
  --parameters IAMAgentCoreExecutionRoleARN=$AGENT_CORE_ROLE_ARN \
  --require-approval=never
```

Configuration Parameters

Parameter	Default	Description
`PagesChunk`	5	Pages per chunk for regular documents
`QuestionsChunk`	20	Max questions per chunk for regular docs
`RegulationPagesChunk`	30	Pages per chunk for regulation documents
`RegulationQuestionsChunk`	20	Max questions per chunk for regulations
`IAMAgentCoreExecutionRoleARN`	**Required**	ARN of the AgentCore execution role

Deployment with custom configuration

```
cdk deploy dataIngestionBackend \
  --parameters IAMAgentCoreExecutionRoleARN=$AGENT_CORE_ROLE_ARN \
  --parameters PagesChunk=10 \
  --parameters QuestionsChunk=15 \
  --parameters RegulationPagesChunk=50 \
  --parameters RegulationQuestionsChunk=25 \
  --require-approval=never
```

Stack Outputs

After successful deployment, you'll receive:

- **API Endpoints** - Document indexing, question generation, compliance reports
- **S3 Bucket ARNs** - Document storage and reports
- **DynamoDB Table Names** - Job tracking and metadata storage
- **OpenSearch Collection Endpoint** - Vector search capabilities
- **Cognito User Pool** - Authentication service

Verify Deployment Status

```
aws cloudformation describe-stacks --stack-name dataIngestionBackend
```

Troubleshooting

Common Issues

CDK Bootstrap Required

```
cdk bootstrap
```

Docker Not Running

- Ensure Docker is running for Lambda packaging
- Check Docker daemon status

IAM Permissions

- Verify AWS credentials have sufficient permissions
- Check CloudFormation, Lambda, S3, DynamoDB, OpenSearch permissions

AgentCore Role Missing

- Deploy AgentCore stack first
- Verify the IAM role ARN is correct

Region Consistency

- Ensure all resources deploy to the same AWS region
- Check AWS CLI default region: `aws configure get region`

Resource Limits

Be aware of these AWS service quotas:

- OpenSearch Serverless collections per account
- Lambda concurrent executions
- API Gateway request limits
- DynamoDB read/write capacity

Support

For issues or questions:

1. Check CloudFormation events for detailed error messages
2. Review CloudWatch logs for Lambda function errors
3. Verify all prerequisites are met
4. Ensure AgentCore dependencies are deployed first

Cleanup

To remove all resources:

```
cdk destroy dataIngestionBackend
```