Development and Cloud-Native Migration of a Complaint Management System for GE Healthcare

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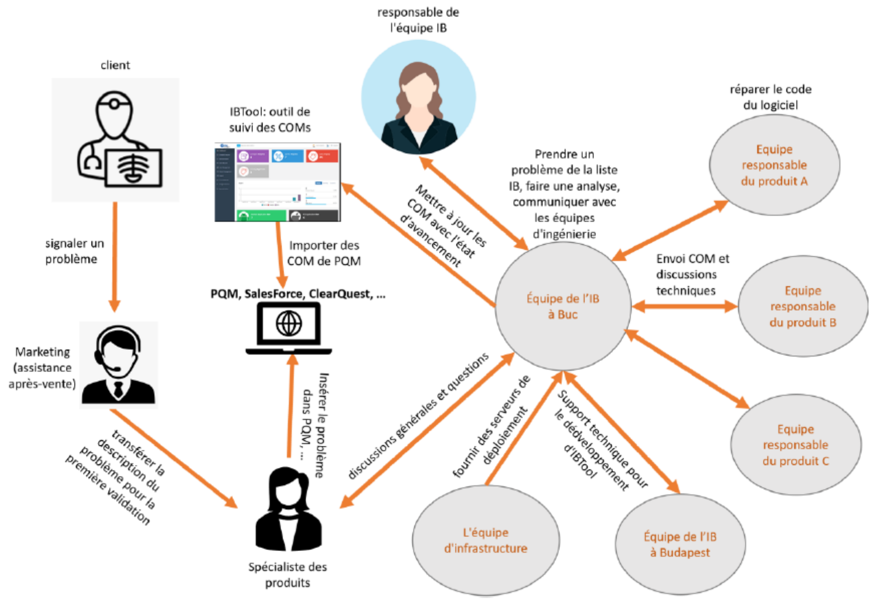
Agenda

- Introduction and Context
- Problem Statement
- Methodologies
- IBTool Development
- Cloud Migration
- CI/CD Pipeline
- Security and Performance
- Results and Benefits
- Challenges and Lessons
- Future Improvements and Conclusion

Introduction and Context

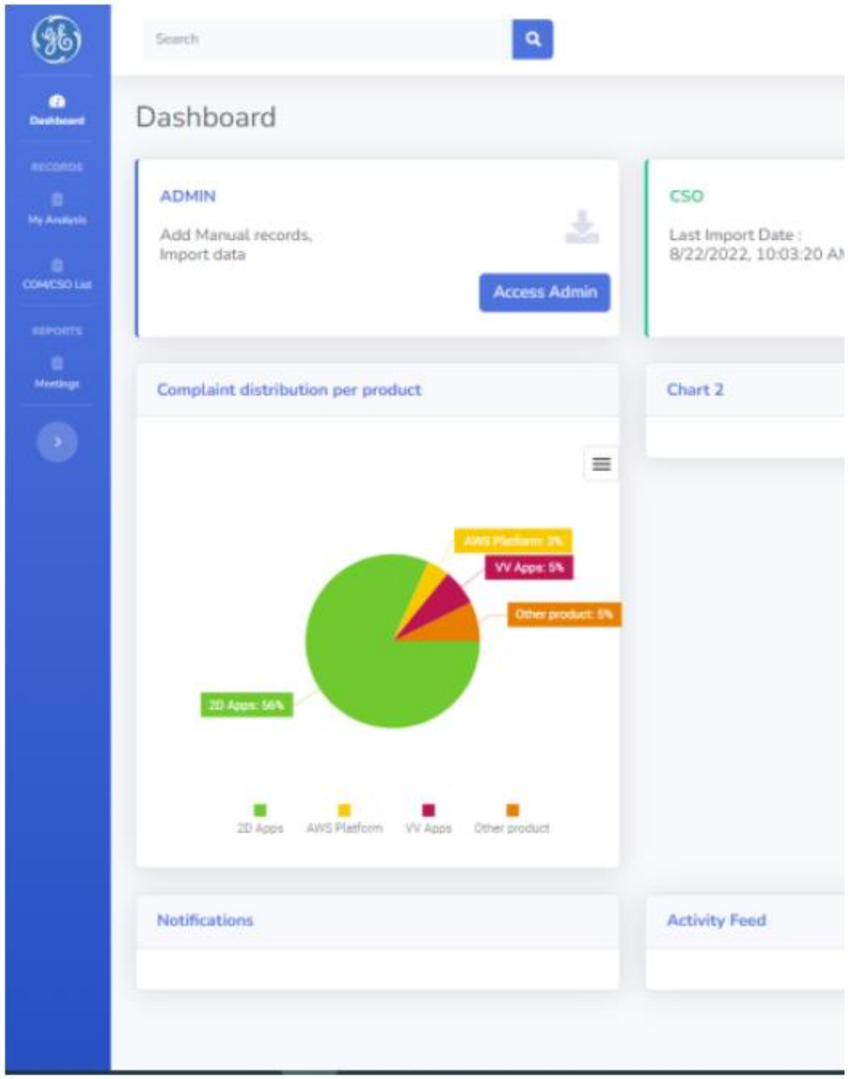
- Context:
  - GE Healthcare provides medical technology solutions, including devices and software that require efficient customer complaint management.
  - Problem: The previous system was fragmented across multiple tools, leading to inefficiencies and slow responses to customer complaints.
- Objective:
  - Develop a centralized complaint management system (**IBTool**) to streamline workflows.
  - Migrate IBTool to the cloud to improve scalability and performance.



client
signaler un problème
Marketing (assistance après-vente)
transférer la description du problème pour la première validation
Spécialiste des produits
Insérer le problème dans PQM, ...
PQM, SalesForce, ClearQuest, ...
Importer des COM de PQM
IBTool: outil de suivi des COMs
responsable de l'équipe IB
Mettre à jour les COM avec l'état d'avancement
Prendre un problème de la liste IB, faire une analyse, communiquer avec les équipes d'ingénierie
Équipe de l'IB à Buc
réparer le code du logiciel
Equipe responsable du produit A
Envoi COM et discussions techniques
Equipe responsable du produit B
Equipe responsable du produit C
discussions générales et questions
fournir des serveurs de déploiement
L'équipe d'infrastructure
Support technique pour le dédveloppement d'IBTool
Équipe de l'IB à Budapest

Project Overview

- IBTool: A web-based platform developed to centralize and streamline GE Healthcare’s customer complaint management.
  - Before: Complaints managed through multiple disconnected systems (TWD, PQM, SFDC, ClearQuest).
  - After: All complaints handled within a single, unified interface.
- Key Contributions:
  - Development of IBTool: Addressed fragmented data and inefficient workflows.
  - Cloud Migration: Improved scalability, reduced operational costs, and enhanced performance.



Dashboard

ADMIN

Add Manual records, Import data

CSO

Last Import Date : 8/22/2022, 10:03:20 A

Complaint distribution per product

Problem Statement

- Challenges:
  - Fragmented Data: Spread across multiple systems.
  - Manual Processes: High error rates and inefficiencies.
  - Scalability Issues: On-premises couldn’t handle variable loads.
  - Limited Visibility: Real-time tracking challenges.
- Solution Needed: Unified system to streamline, automate, and scale complaint management.
- Placeholder for Image: [Fragmented Data/Systems Illustration]

Problem Details

Why It Matters:

- Delayed product improvements and compliance risks.
- Efficiency impacts quality, compliance, and satisfaction.

Core Issues:

- Data Fragmentation: Need for unified system.
- Manual Workflows: Automate for efficiency.
- Scalability: Dynamic scaling required.

Methodology Overview

Two Key Methodologies:

IBTool Development: Centralized, web-based platform.	Cloud Migration: Address scalability and cost using AWS.

Agile Approach: Iterative development, continuous feedback, ongoing testing.

Agile Development Process

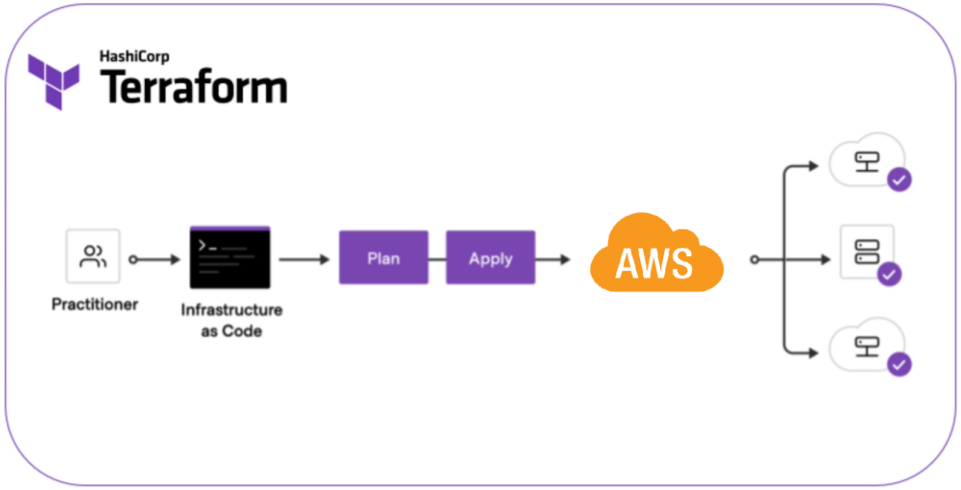
- Agile Process:
  - Iterative Development: Based on feedback.
  - Phases:
    - Planning: Core features.
    - Sprints: Feature-specific cycles.
    - Testing: Continuous integration.
    - Feedback: Regular reviews.
- Outcome: Continuous incremental improvements tailored to GE Healthcare's needs.
- Placeholder for Image: [Agile Process/Sprint Cycle Image]

Cloud Migration Methodology

- Cloud Migration:
  - Lift and Shift: Initial migration to AWS.
  - Post-Migration: Optimize with auto-scaling and managed services.
- Steps:
  - Assessment: Evaluate components.
  - Containerization: Docker for easy deployment.
  - ECS Deployment: Orchestration and scaling.

Infrastructure as Code with Terraform

- Terraform for IaC:
  - IaC: Automate consistent infrastructure deployment.
  - Why Terraform: Cross-cloud, version control, and efficient provisioning.
- Key Elements:
  - EC2: Automate VM provisioning.
  - ECS: Manage Docker containers.
  - Networking: Manage security groups, VPCs.
- Benefits: Faster, consistent, and collaborative deployments.



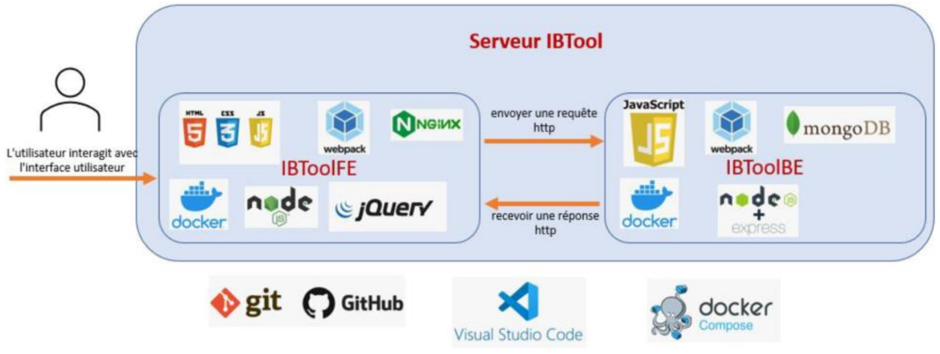
Overview of IBTool Architecture

- On-Premises Setup: Hosted on local servers using Docker containers for frontend, backend, and database.
- Monolithic Design: All services running together.
- Tech Stack:
  - Frontend: HTML, CSS, JS (DevExtreme).
  - Backend: Node.js, Express.js.
  - Database: MongoDB.

Key Features of IBTool

- Core Functions:
  - Complaint Management: Centralized tracking.
  - CRUD Operations: Create, read, update, delete complaints.
  - Automated Workflows: Notifications based on complaint status.

Technical Stack and Components



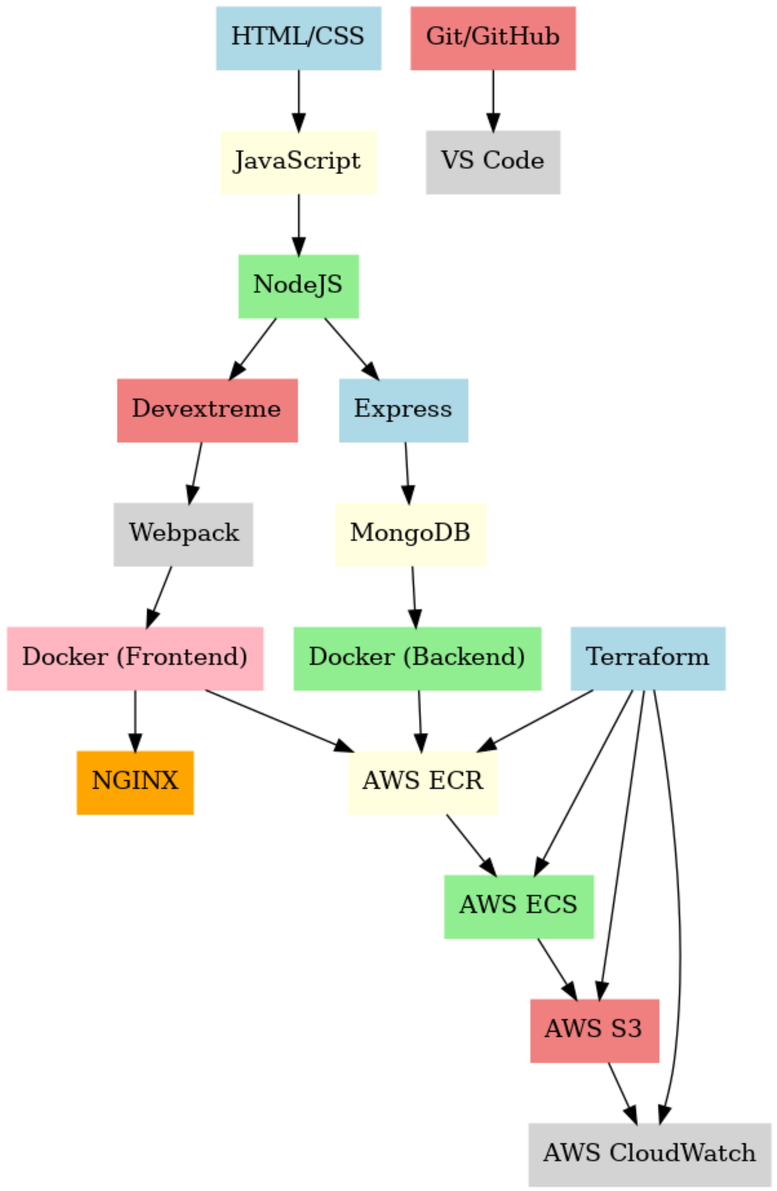
- Frontend:
  - Initial: HTML, CSS, JS (DevExtreme).
  - Improvement: Migrated to React for better performance.
- Backend:
  - Node.js, Express.js handling API requests.
  - Enhancements: Middleware, caching (Redis).
- Database:
  - MongoDB for scalable data storage.
  - Improvements: Indexing for faster queries.
- Placeholder for Image: [Technical Stack Diagram or Component Architecture Diagram]

Motivation for Cloud Migration

- On-Premises Challenges:
  - Scalability Issues: Difficulty handling spikes.
  - High Costs: Fixed infrastructure expenses.
  - Maintenance Overhead: Resource-heavy monitoring.
- Cloud Benefits:
  - Dynamic Scaling: Auto-scaling resources.
  - Cost Efficiency: Pay-per-use model.
  - Resilience: Improved fault tolerance.

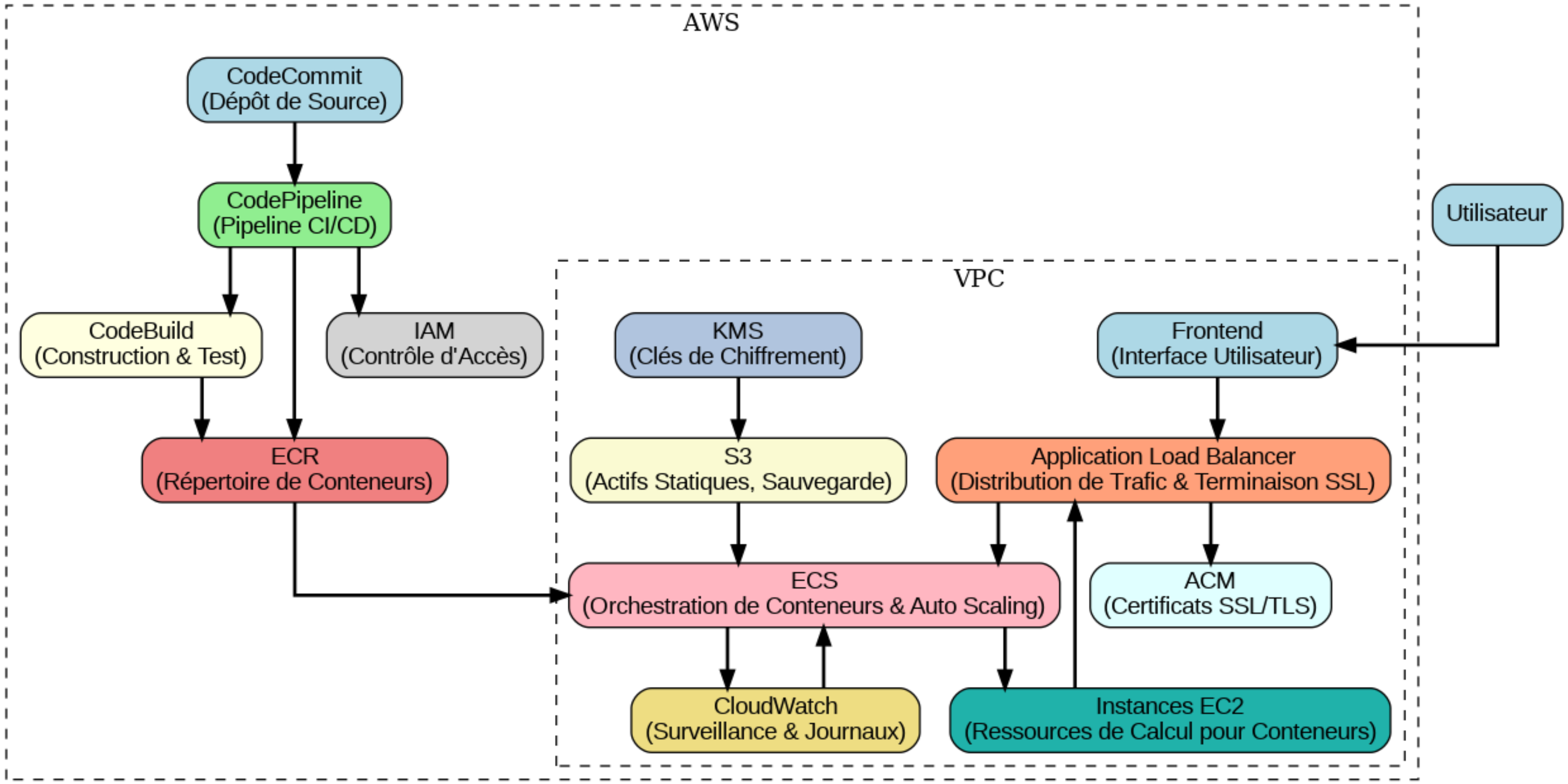
Cloud-Native Architecture Overview

- New Setup:
  - Frontend: S3 + CloudFront for fast content delivery.
  - Backend: Dockerized services on AWS ECS.
  - Database: Managed MongoDB (AWS).
  - Load Balancer: ALB for traffic distribution.
- Placeholder for Image: [Cloud-Native Architecture Diagram]



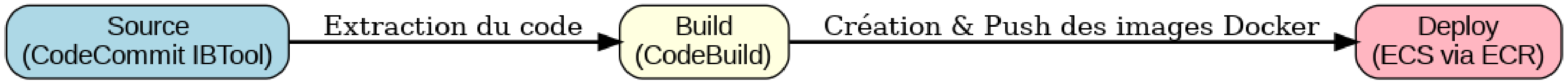
AWS Services Used

- Key AWS Services:
  - S3: Static file storage for frontend.
  - ECS: Container orchestration for backend.
  - RDS: Managed MongoDB.
  - ALB: Distributes traffic.
  - IAM: Access control.


AWS
CodeCommit (Dépôt de Source)
CodePipeline (Pipeline CI/CD)
CodeBuild (Construction & Test)
IAM (Contrôle d'Accès)
ECR (Répertoire de Conteneurs)
Utilisateur
VPC
KMS (Clés de Chiffrement)
Frontend (Interface Utilisateur)
S3 (Actifs Statiques, Sauvegarde)
Application Load Balancer (Distribution de Trafic & Terminaison SSL)
ECS (Orchestration de Conteneurs & Auto Scaling)
ACM (Certificats SSL/TLS)
CloudWatch (Surveillance & Journaux)
Instances EC2 (Ressources de Calcul pour Conteneurs)

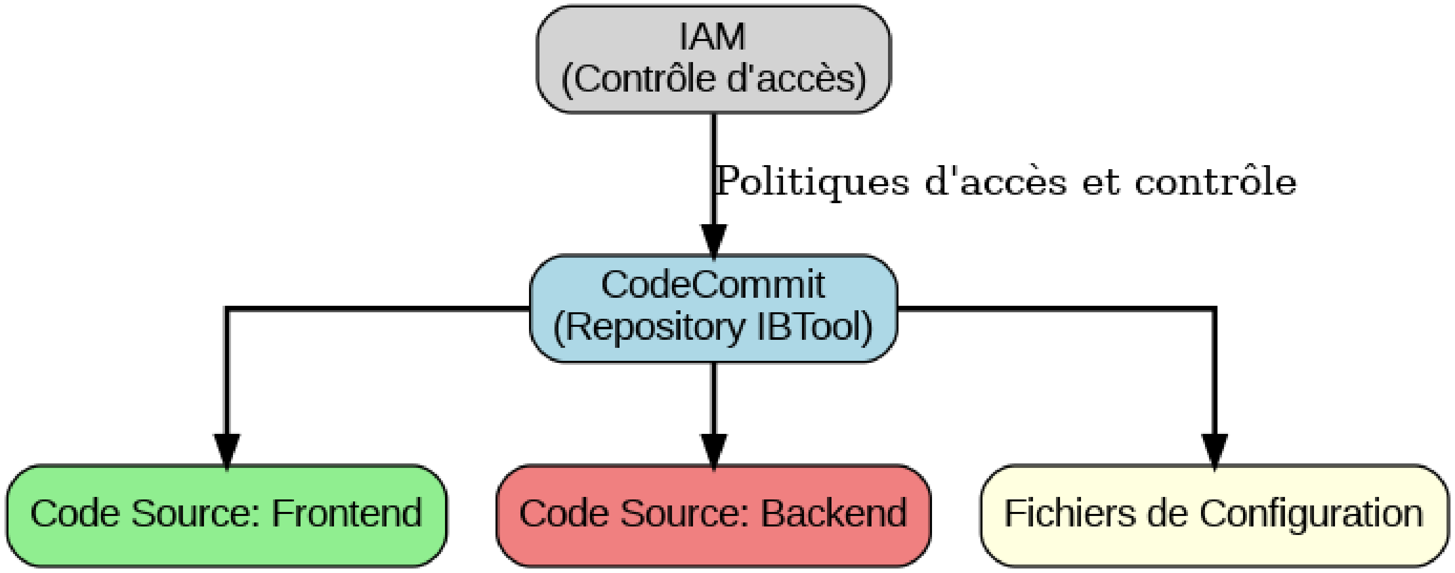
CI/CD Pipeline Overview

- CI/CD:
  - CI: Automate testing/builds after code changes.
  - CD: Automate deployment to production.
- Goal: Faster, more reliable updates through automated pipelines.



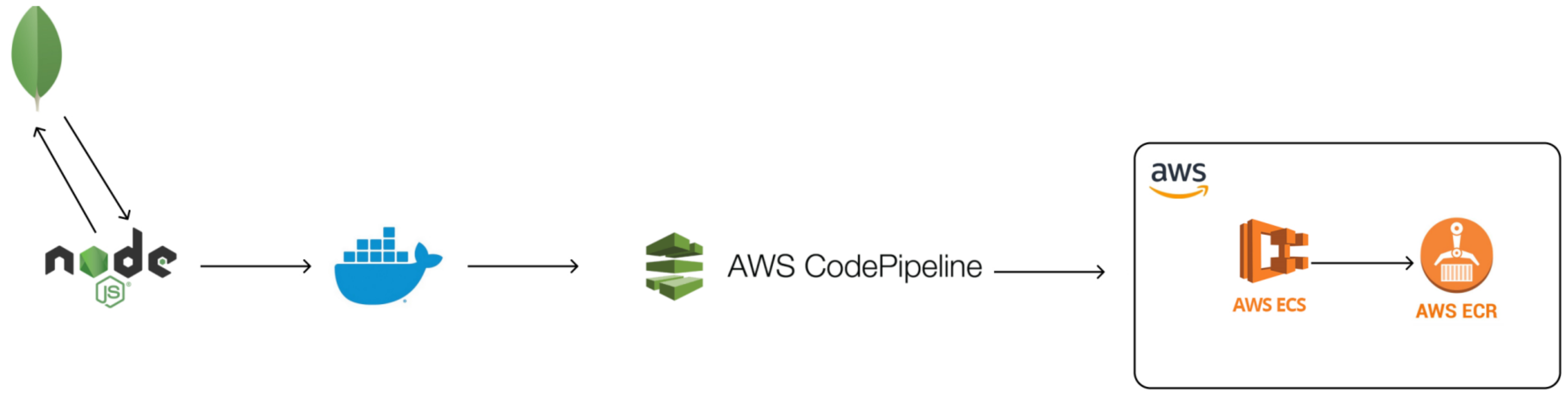
CodeCommit and CodeBuild

- CodeCommit: Secure Git repository for code management.
  - Benefits: Version control, collaboration, AWS integration.
- CodeBuild: Managed build service for compiling, testing, and producing Docker images.
  - Process: Fetch code → Test → Build Docker images.



CodePipeline and Deployment

- CodePipeline: Automates the deployment workflow.
  - Steps:
    - Code pushed to CodeCommit.
    - CodeBuild compiles and tests.
    - Successful builds are deployed to ECS.
- Benefits: Reduces manual effort, ensures reliable deployments.
- Placeholder for Image: [CI/CD Pipeline Diagram or Workflow Image]



Automated Testing in CI/CD

Automated Testing:

Unit Tests: Test individual components.

Integration Tests: Test interactions between services.

E2E Tests: Simulate real-world scenarios.

Tools:

Backend: Mocha, Chai.

Frontend: Jest, Enzyme.

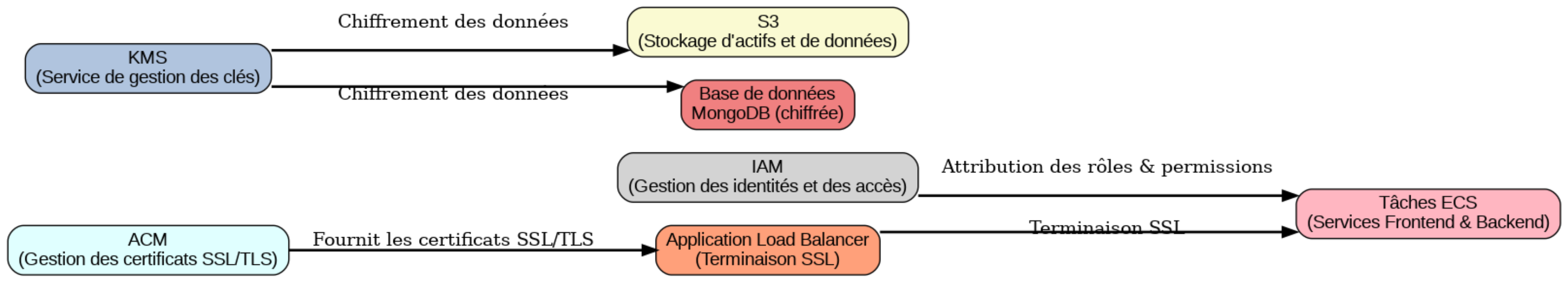
E2E: Cypress.

CI/CD Pipeline Benefits

- Benefits of CI/CD:
  - Faster Delivery: Continuous updates without downtime.
  - Reduced Risk: Automated tests validate changes before deployment.
  - Scalability: Pipeline scales with project needs, ensuring up-to-date environments.

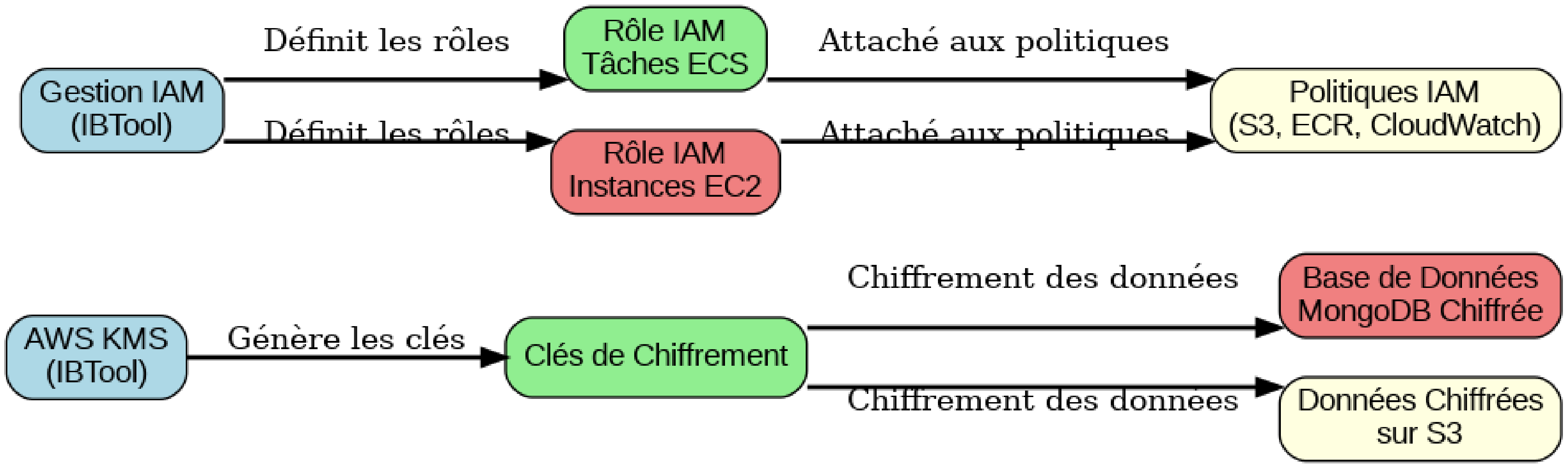
Security Overview

- Cloud-Native Security:
  - Objective: Protect sensitive data and ensure compliance with GDPR, HIPAA.
  - Practices:
    - Role-based access control.
    - Data encryption (in transit and at rest).


KMS
(Service de gestion des clés)
Chiffrement des données
S3
(Stockage d'actifs et de données)
Chiffrement des données
Base de données
MongoDB (chiffrée)
IAM
(Gestion des identités et des accès)
Attribution des rôles & permissions
Tâches ECS
(Services Frontend & Backend)
ACM
(Gestion des certificats SSL/TLS)
Fournit les certificats SSL/TLS
Application Load Balancer
(Terminaison SSL)
Terminaison SSL

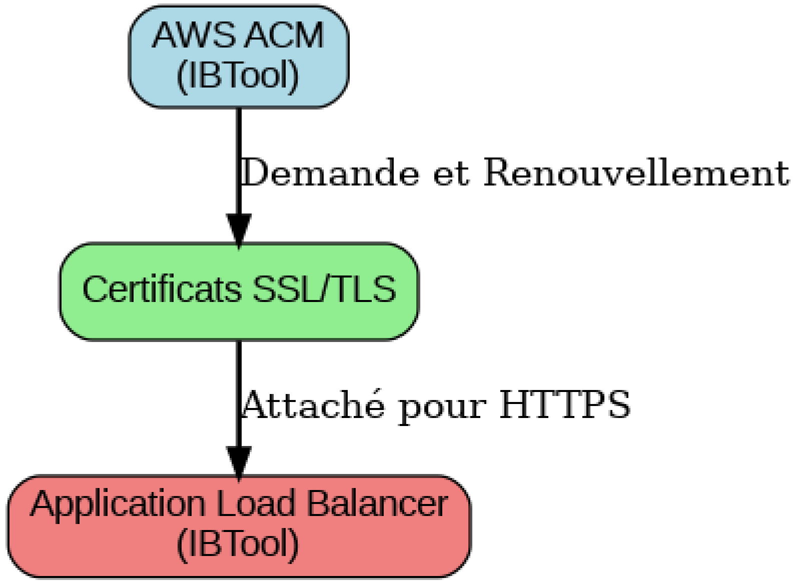
IAM, KMS, and Encryption

- AWS IAM: Fine-grained permissions to control resource access.
- AWS KMS:
  - Encryption: Protect data in MongoDB and S3.
  - Key Rotation: Automated, ensuring long-term security.
- Placeholder for Image: [IAM and KMS Flow Diagram]



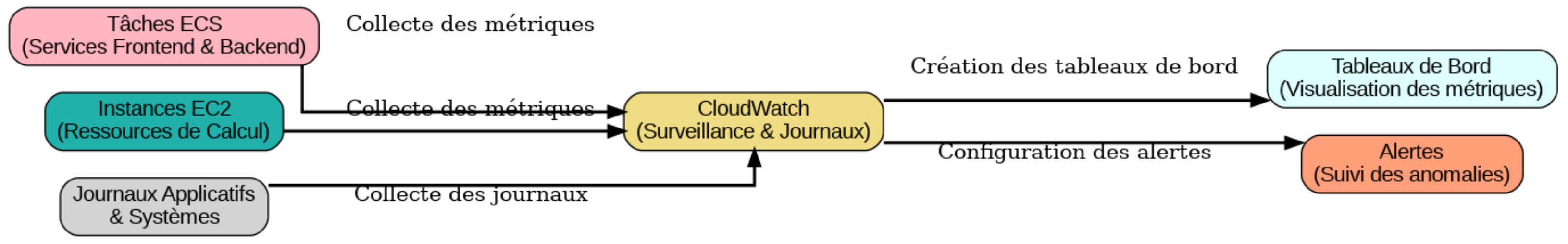
SSL/TLS and ACM

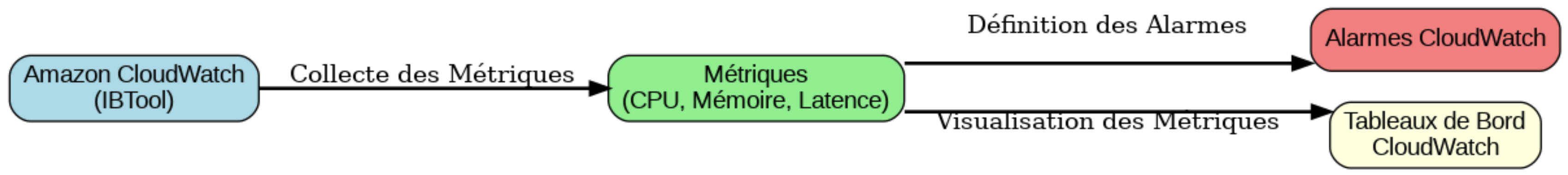
- SSL/TLS Encryption: Encrypts all traffic between clients and the backend.
- AWS ACM: Manages SSL certificates, automating renewals.
- Placeholder for Image: [SSL/TLS Certificate Diagram]



Performance Monitoring with CloudWatch

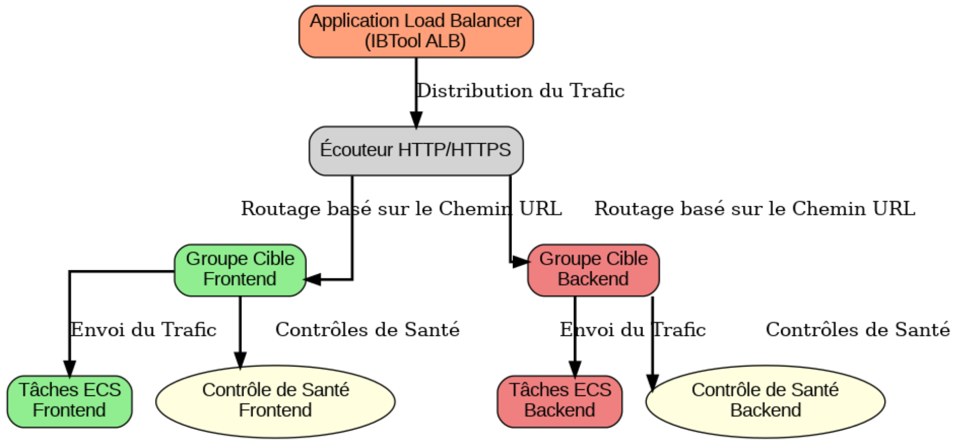
- CloudWatch:
  - Monitoring: Real-time performance metrics.
  - Alerts: Triggered by thresholds (e.g., high CPU usage).
- Use Case: Proactively monitoring latency and error rates.
- Placeholder for Image: [CloudWatch Metrics Dashboard]

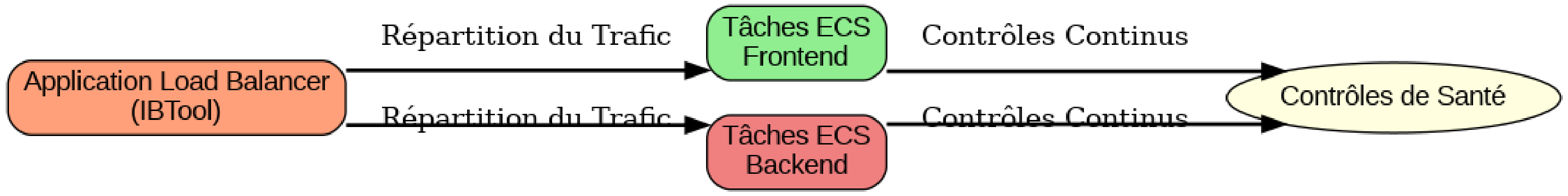




Auto-Scaling and Elasticity

- AWS Auto Scaling:
  - Elasticity: Adjusts resources based on traffic.
  - Scaling Scenarios:
    - Scale Up: Auto-add resources during traffic spikes.
    - Scale Down: Auto-remove resources during low activity.
- Placeholder for Image: [Auto-Scaling Flow Diagram]





Key Benefits from Development

- Development Outcomes:
  - Improved Management: Centralized, automated complaint workflows.
  - Better UX: React-based frontend for better performance.
  - Error Reduction: Automation minimizes human errors.

Key Benefits from Cloud Migration

- Cloud Migration Benefits:
  - Scalability: Dynamically adjusts resources to demand.
  - Cost Savings: Pay-per-use model reduced operational expenses.
  - High Availability: Better uptime and disaster recovery.
- Placeholder for Image: [Cloud Migration Benefits - Uptime, Scalability, Costs]

Quantitative Improvements

- Performance Gains:
  - Latency: 30% reduction from backend optimization and load balancing.
  - Cost: 25% operational cost savings via auto-scaling.
  - Uptime: 99.9% uptime due to cloud architecture.
- Placeholder for Image: [Performance Metrics Dashboard]

Key Challenges

- Challenges:
  - Cloud Migration Complexity: Integrating AWS services (ECS, ALB, RDS, S3) required expertise.
  - Security and Compliance: Balancing performance with HIPAA, GDPR compliance.
  - Data Migration: Safely migrating large, sensitive data to the cloud.
- Placeholder for Image: [Challenges Flowchart - Cloud, Security, Data Migration]

Lessons Learned

- Lessons:
  - Automate: Infrastructure, CI/CD pipelines, and monitoring reduce errors and improve efficiency.
  - Continuous Monitoring: Proactive management through alerts and performance insights.
  - Agile Development: Iterative improvements based on real-time feedback improved outcomes.
- Placeholder for Image: [Lessons Learned Diagram - Automation, Monitoring, Agile]

Future Improvements

- Potential Enhancements:
  - Serverless: AWS Lambda to reduce costs and simplify scaling.
  - Predictive Analytics: Use machine learning to predict complaint trends.
  - CI/CD: Blue/green deployments for safer, smoother updates.
- Placeholder for Image: [Future Roadmap - Serverless, Machine Learning, CI/CD]

Conclusion

- Summary:
  - IBTool: Centralized complaint management with automated workflows.
  - Cloud Migration: Enhanced scalability, security, and efficiency.
  - CI/CD: Faster, reliable deployments with minimal downtime.
- Final Thought: Cloud-native architecture provides a strong foundation for healthcare application innovation.
- Placeholder for Image: [Key Achievements Visualization]

THANK YOU

Open for Questions.