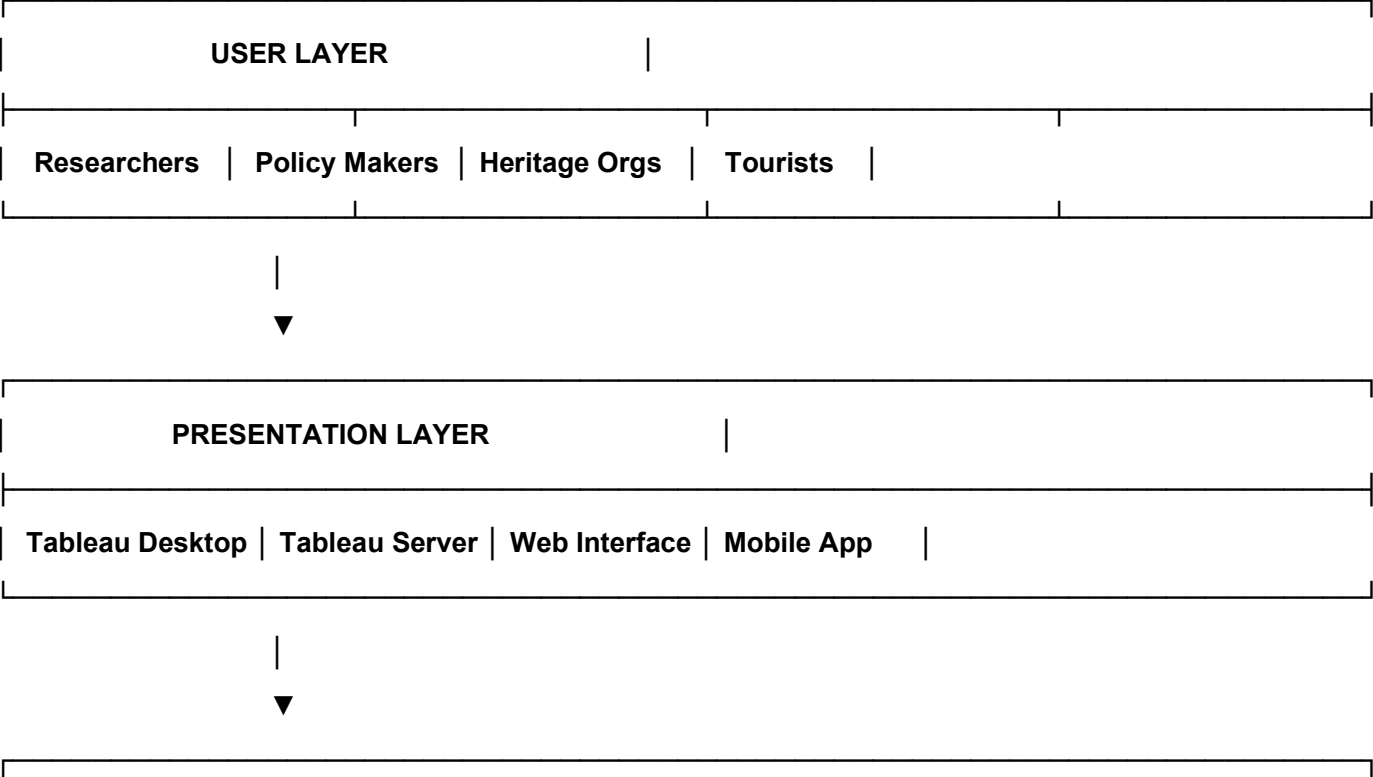


Technology Stack (Architecture & Stack)

Date	21 feb 2026)
Team ID	LTVIP2026TMIDS41964 2
Project Name	Heritage Treasures: An in-depth analysis of UNESCO World Heritage Sites In Tableau

Technical Architecture:



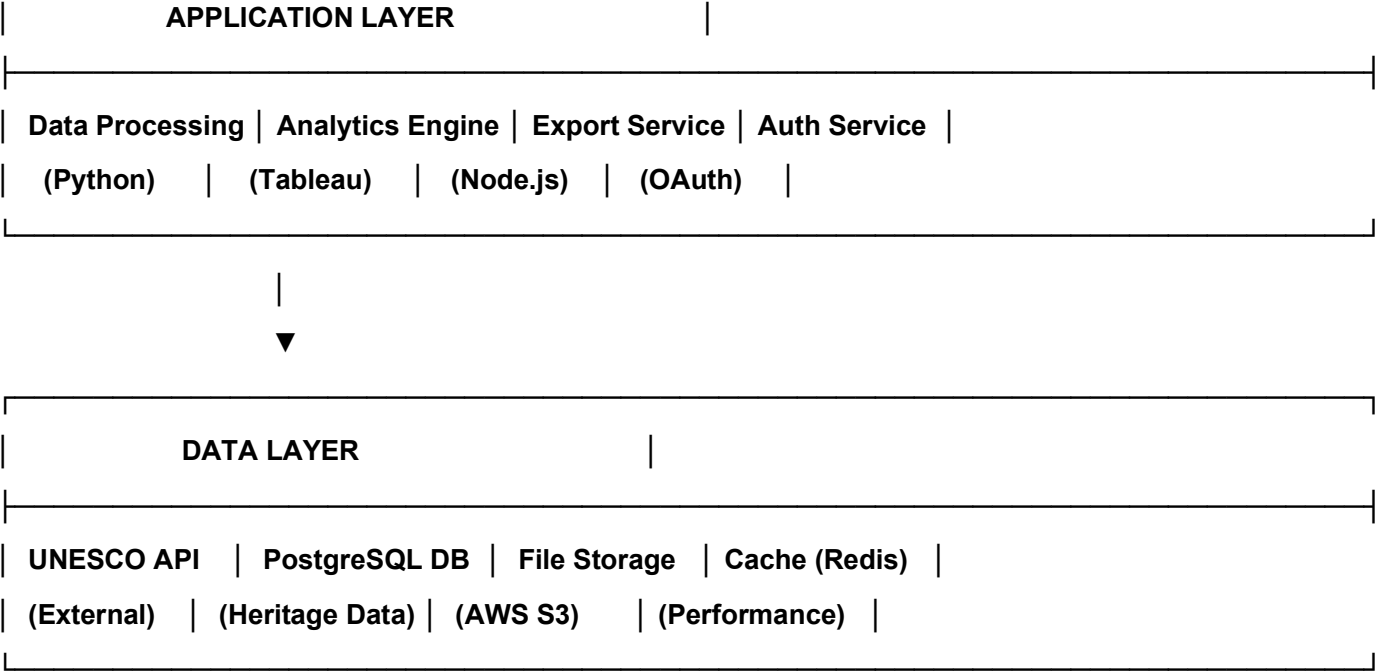


Table-1: Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Interactive dashboard interface for data visualization and analysis	Tableau Desktop/Server, HTML5, CSS3, JavaScript
2.	Data Ingestion	Automated data extraction and processing from UNESCO sources	Python with pandas, requests libraries, Apache Airflow
3.	Data Processing	Data cleaning, transformation, and validation logic	Python (pandas, numpy), SQL, Tableau Prep
4.	Analytics Engine	Core visualization and analytical processing	Tableau Desktop/Server, R integration, Statistical functions

5.	Web Application	Web-based interface for dashboard access and user management	Node.js, Express.js, React.js for admin portal
6.	Database	Primary data storage for heritage site information	PostgreSQL with PostGIS extension for geographic data
7.	Cache Layer	Performance optimization for frequently accessed data	Redis for caching, Tableau Server cache
8.	File Storage	Storage for exported reports, images, and backup data	Amazon S3 or Azure Blob Storage
9.	External API	UNESCO World Heritage API for real-time data updates	UNESCO API, REST services
10.	Authentication	User authentication and authorization system	OAuth 2.0, JWT tokens, Active Directory integration
11.	Infrastructure	Cloud-based hosting and deployment platform	AWS EC2/Azure VMs, Docker containers, Kubernetes
12.	Monitoring	System monitoring and performance tracking	Tableau Server monitoring, CloudWatch, Grafana

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Utilizes open-source components for cost-effectiveness and flexibility	Python (pandas, numpy), PostgreSQL, Redis, Apache Airflow, Node.js, React.js
2.	Security Implementations	Comprehensive security measures for data protection and access control	- SSL/TLS encryption for data in transit - AES-256 encryption for data at rest - OAuth 2.0 and SAML for authentication - Role-based access control (RBAC) - API rate limiting and token-based security - Regular security audits and penetration testing
3.	Scalable Architecture	Three-tier architecture supporting horizontal and vertical scaling	- Presentation Layer: Tableau Server cluster - Application Layer: Microservices with Docker containers - Data Layer: PostgreSQL with read replicas - Load balancing with NGINX - Auto-scaling groups in AWS/Azure

4.	Availability	High availability design with redundancy and failover capabilities	- Multi-zone deployment across AWS/Azure regions - Load balancers with health checks - Database clustering with automatic failover - CDN integration (CloudFront/Azure CDN) - 99.5% uptime SLA with disaster recovery
5.	Performance	Optimized performance for handling large datasets and concurrent users	- In-memory caching with Redis - Database indexing and query optimization - Tableau Server performance tuning - CDN for static content delivery - Asynchronous processing for data updates - Support for 100+ concurrent users

Detailed Technology Stack:

Frontend Layer:

- Tableau Desktop/Server: Primary visualization platform
- HTML5/CSS3/JavaScript: Custom web interfaces
- React.js: Admin portal and user management
- Bootstrap: Responsive UI framework

Backend Layer:

- Python: Data processing and ETL operations
- Node.js: Web application backend
- Express.js: RESTful API framework
- Apache Airflow: Workflow orchestration

Database Layer:

- PostgreSQL: Primary relational database
- PostGIS: Geographic data extension
- Redis: Caching and session storage

Integration Layer:

- REST APIs: Service communication
- UNESCO API: External data source
- OAuth 2.0: Authentication protocol

Infrastructure Layer:

- AWS/Azure: Cloud hosting platform
- Docker: Containerization
- Kubernetes: Container orchestration
- NGINX: Load balancing and reverse proxy

Monitoring & DevOps:

- CloudWatch/Azure Monitor: Infrastructure monitoring
- Grafana: Dashboard monitoring
- Git: Version control
- Jenkins/GitHub Actions: CI/CD pipeline

Deployment Architecture:

Production Environment:

- └─ **Load Balancer (NGINX)**
- └─ **Tableau Server Cluster (3 nodes)**
- └─ **Application Servers (Auto-scaling group)**
- └─ **Database Cluster (Master + 2 Replicas)**
- └─ **Redis Cluster (3 nodes)**

└─ **File Storage (S3/Azure Blob)**

Development Environment:

└─ **Single Tableau Server instance**

└─ **Application Server (Docker)**

└─ **PostgreSQL Database**

└─ **Redis Cache**

└─ **Local file storage**