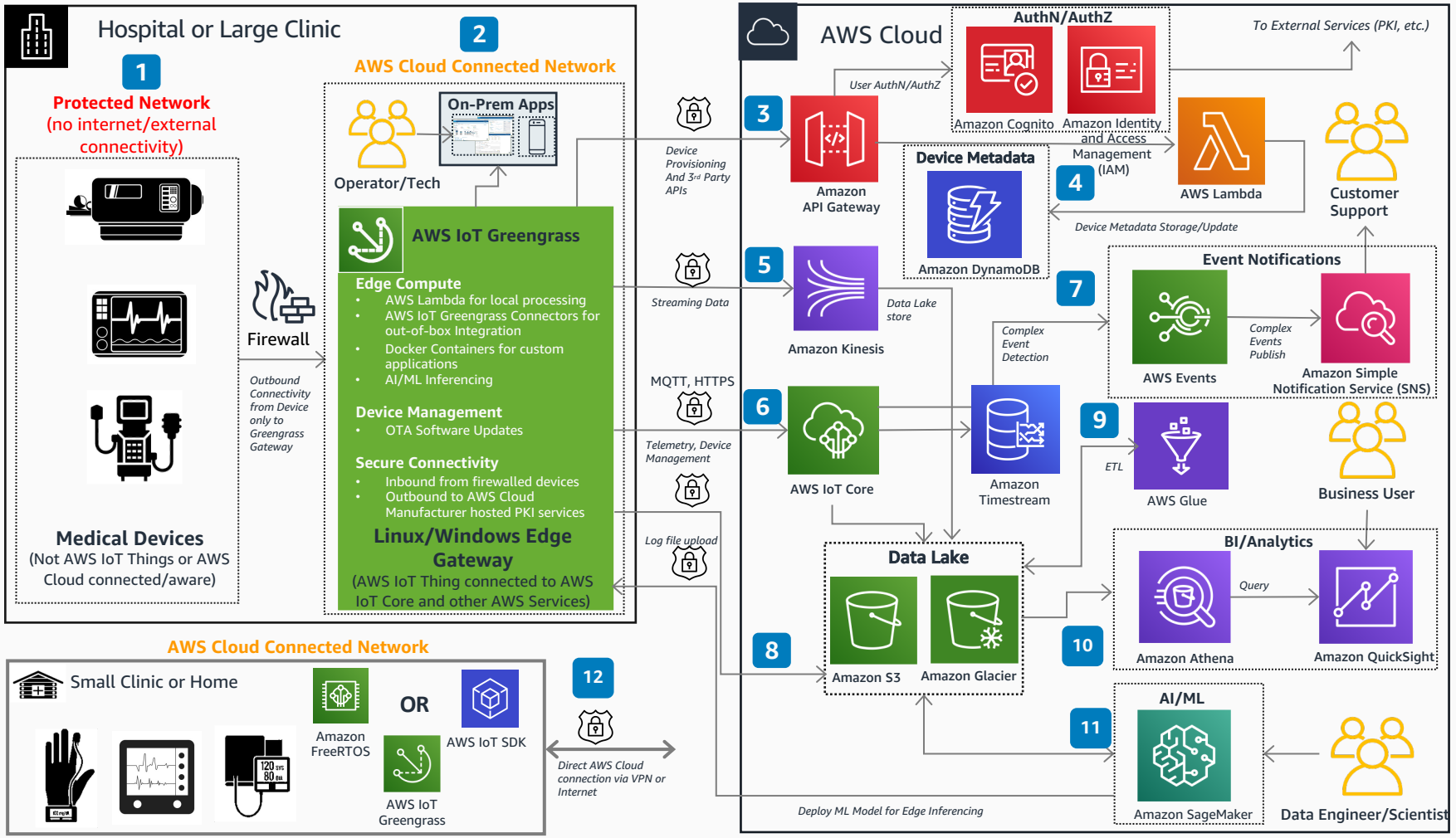
Connected Medical Devices with AWS IoT

Manufacturer managed Medical Devices in hospitals, clinics, and homes

Device Management, data collection, and insights for better patient care, cost savings, and new business models



For HIPAA compliance all protected health information (PHI) and personally identifiable information (PII) data should be redacted from logs and data sent from premises to manufacturer's cloud. **AWS CloudTrail** and **Amazon CloudWatch** are recommended in the architecture for auditability and traceability regulatory requirements.

1. Medical devices are deployed in hospital/clinic network without internet connectivity, and only allowed outbound communication to edge gateway running **AWS IoT Greengrass**.
2. Edge gateway proxies one or more medical devices, and runs local (on-premises) applications for operators/technicians for command and control. Only **AWS IoT Greengrass** cores are created as Things in **AWS IoT Core**. Metadata for medical devices lives in **DynamoDB** and not in **AWS IoT Core**, because command and control is not allowed from the cloud.
3. **Amazon API Gateway** is the single secure endpoint invoked from **AWS IoT Greengrass** for all API calls. APIs include device provisioning, APIs used to access AWS services and 3rd party endpoints.
4. **Amazon DynamoDB** is the central storage for device models, metadata, security certificates, and more. associated with the edge gateway to which the medical devices are connected.
5. Streaming video from medical devices is sent to **Amazon Kinesis** in the **AWS Cloud** and persisted in the **Amazon Simple Storage Service (Amazon S3)** data lake. Implement data and video insights by linking with device metadata in **Amazon DynamoDB**.
6. Telemetry data from devices sent by **AWS IoT Greengrass** to **AWS IoT Core** using MQTT, can be stored in a **Amazon Timestream** datastore for historical analytics.
7. Telemetry data sent via rules for AWS IoT Core to **AWS IoT Events** for complex event detection. Detected events generate alerts for customer support via **Amazon SNS**.
8. Data files generated from medical procedures directly are uploaded to **Amazon S3** and linked with device metadata in **Amazon DynamoDB**. Can be used for artificial intelligence/machine learning (AI/ML).
9. Batch extract, transform, load (ETL) processing on data done using **AWS Glue** and curated data persisted back in **Amazon S3**.
10. **Amazon Athena** and **Amazon QuickSight** provide business intelligence (BI)/visualization for users.
11. Machine learning models trained with **Amazon S3** data for predictive analytics, computer vision, and more.
12. Small clinics and home medical devices connect to AWS using VPN or internet. Steps 1-11 apply here too.

AWS Reference Architecture