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Empower the Warfighter: Harness Oracle Cloud to deliver actionable intelligence derived from F-35 data analysis

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Introduction

The F-35 Lightning II is designed with advanced sensor technology to collect more information to influence the battlespace than any other fighter aircraft in history. Many countries announced plans for F-35 adoption and there could be 450 F-35s across NATO by 2030. This presents NATO countries with the challenge to translate large, complex F-35 data streams into battlefield insights.

Timely data collection and accurate processing is crucial to the warfighter. Although systems such as the fifth-generation F-35 are equipped with remarkable data collection capabilities, the issue that armed forces face today is the amount of time that's needed for systems to process massive data streams to produce intelligence that can be used on a modern battlefield. Valuable time is lost in the moments it takes for systems to retrieve, enrich, and send the data back to the warfighter.

Oracle Cloud Infrastructure (OCI) solves these data collection problems using large-scale data processing and streaming architectures that process terabytes of data in near real-time. OCI enables the use of secure, in-theatre deployable cloud infrastructure close to the operational units, which can use artificial intelligence (AI) and machine learning (ML) models to produce meaningful, decisive, and timely insights. Field-deployable Roving Edge Cloud solutions enable this process to take place on the flight line, providing a solution to minimize delays and help ensure sensor data is rapidly processed and analyzed. The net result accelerates how ministries of defense globally can use data for actionable decision making.

This technical brief showcases the OCI value proposition and high-level architecture that brings agility to the battlespace and modernizes analytical capabilities to process large-scale streaming data insights from the F-35.

OCI Value Proposition

Cloud technology has evolved from an innovative concept into a disruptive force over the past decade. Today, cloud computing is a rapid growth industry in which organizations and researchers continue to push the boundaries of the possible with artificial intelligence, machine learning, and data science to provide new and improved solutions to critical problems. OCI is a deep and broad platform of cloud services that enables you to build and run a wide range of applications in a scalable, secure, highly available, and high-performance environment. OCI is built with layers of security that are architected to help you protect the most sensitive and valuable data. A combination of features and secure-by-design initiatives helps provide automated security with OCI's built-in security services.
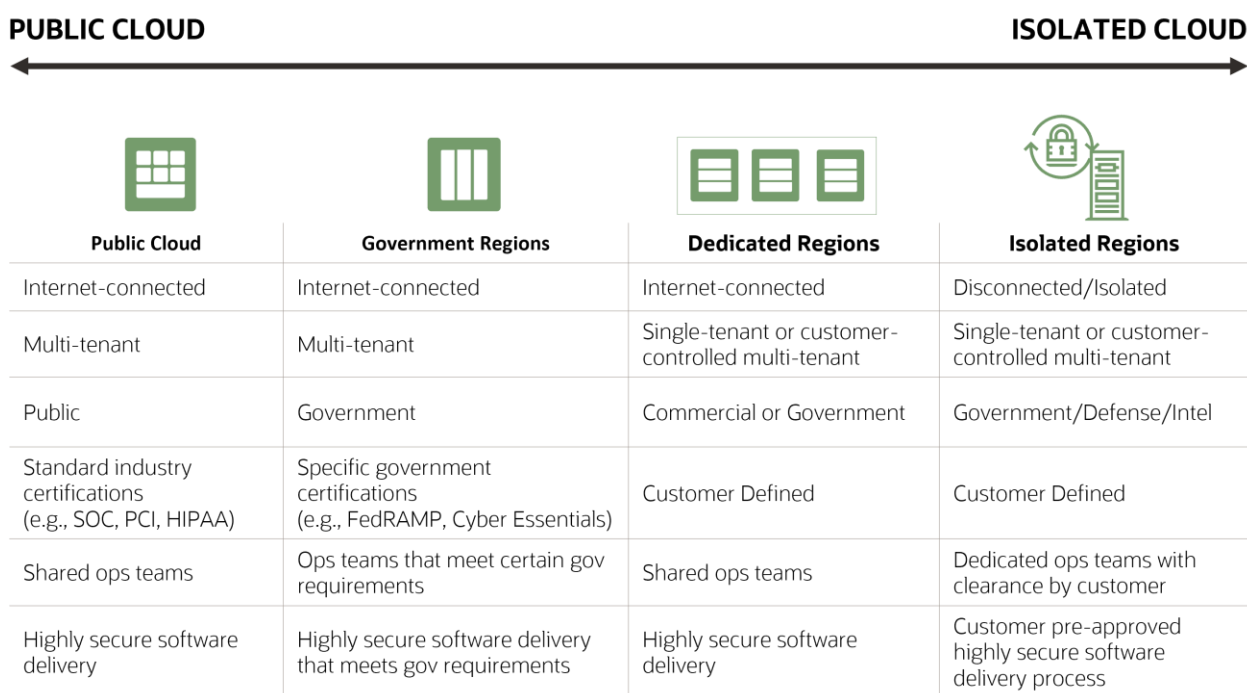
OCI was developed with a consistent pricing model across all regions to simplify adoption. Compared to other cloud vendors, OCI private network connectivity charges cost 74% less, delivers over 3x better price-performance for compute, and provides similar performance for HPC, but is 44% less expensive[1]. OCI services are backed with comprehensive service level agreements (SLAs) describing the availability, manageability, and performance of your cloud environment. Oracle's approach to service design makes development

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[1] https://www.oracle.com/cloud/economics/

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resilient, reliable, and scalable with native OCI platform services and a robust ecosystem of development services partners.

OCI is designed to support a wide range of customer needs with over 40 regions worldwide including public cloud, dedicated regions, and specialized regions built for governments. In the US, Oracle Cloud for Government has achieved Department of Defense Impact Level 2, 4, and 5 accreditations in addition to FedRAMP High accreditation for federal, state, and local governments. In the UK, Oracle Cloud is the first and only sovereign, dedicated dual-region cloud for UK Government and Defence customers.

Oracle offers a variety of cloud region deployment models as outlined in the diagram below, all offering the same products and services. The primary differences between the region types are internet connectivity, who can access them, who performs operations, where they are located, and how they are accredited.

PUBLIC CLOUD ←————————————————————————————————→ **ISOLATED CLOUD**

Public Cloud	Government Regions	Dedicated Regions	Isolated Regions
Internet-connected	Internet-connected	Internet-connected	Disconnected/Isolated
Multi-tenant	Multi-tenant	Single-tenant or customer-controlled multi-tenant	Single-tenant or customer-controlled multi-tenant
Public	Government	Commercial or Government	Government/Defense/Intel
Standard industry certifications (e.g., SOC, PCI, HIPAA)	Specific government certifications (e.g., FedRAMP, Cyber Essentials)	Customer Defined	Customer Defined
Shared ops teams	Ops teams that meet certain gov requirements	Shared ops teams	Dedicated ops teams with clearance by customer
Highly secure software delivery	Highly secure software delivery that meets gov requirements	Highly secure software delivery	Customer pre-approved highly secure software delivery process

Oracle also has a unique sovereign cloud offering—**Oracle Cloud Isolated Region** that is designed for supporting secret and top-secret classified data to meet the needs of ministries of defense globally.

Oracle Cloud Isolated Regions are dedicated, isolated cloud regions designed to run in an air-gapped environment isolated from the internet. These regions provide the Everything Everywhere® commitment to offer all the same OCI services (IaaS/PaaS/SaaS) available in public regions. An Oracle Cloud Isolated Region's data center is located within the customer's country, staffed and operated by individuals who meet the customer's requirements for citizenship and security clearance level. This cloud offering also provides both data and operational sovereignty. Customers retain full control of their data and applications to meet the highest security, regulatory, low latency, and data residency requirements. With services at the same price in every OCI region, Oracle Cloud Isolated Region brings best-in-class price performance for your classified mission-critical workloads.

The below diagram depicts a sample of OCI services that are available for government regions along with specific services that are used to support Oracle Cloud Isolated Regions.
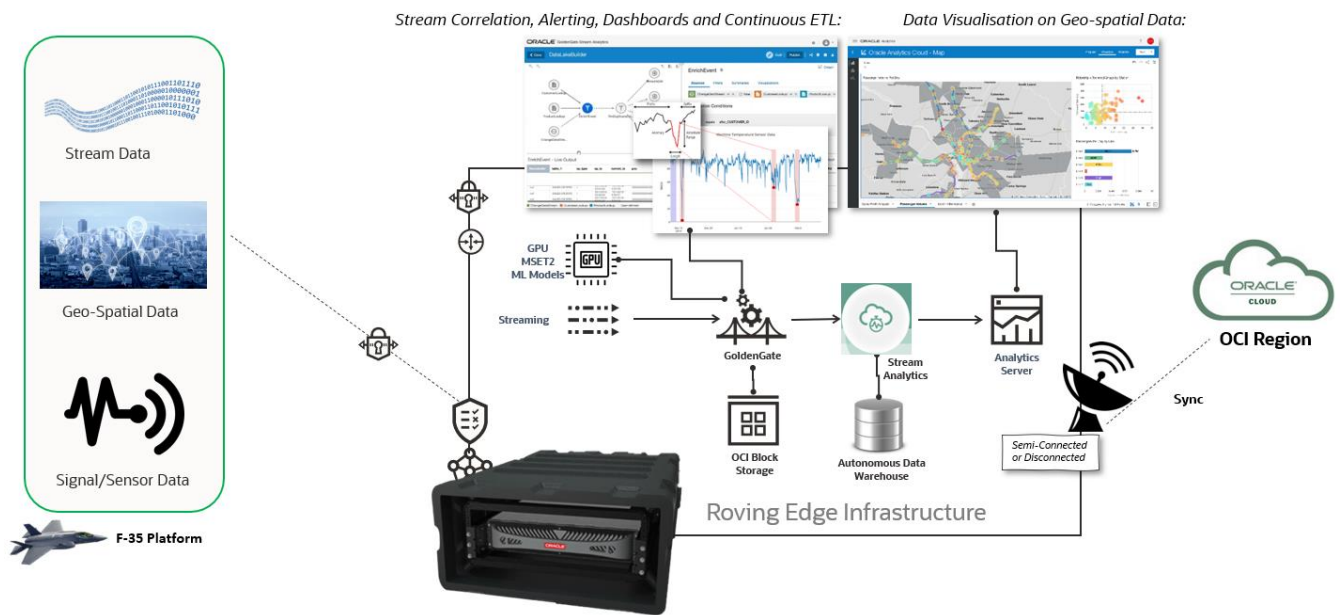
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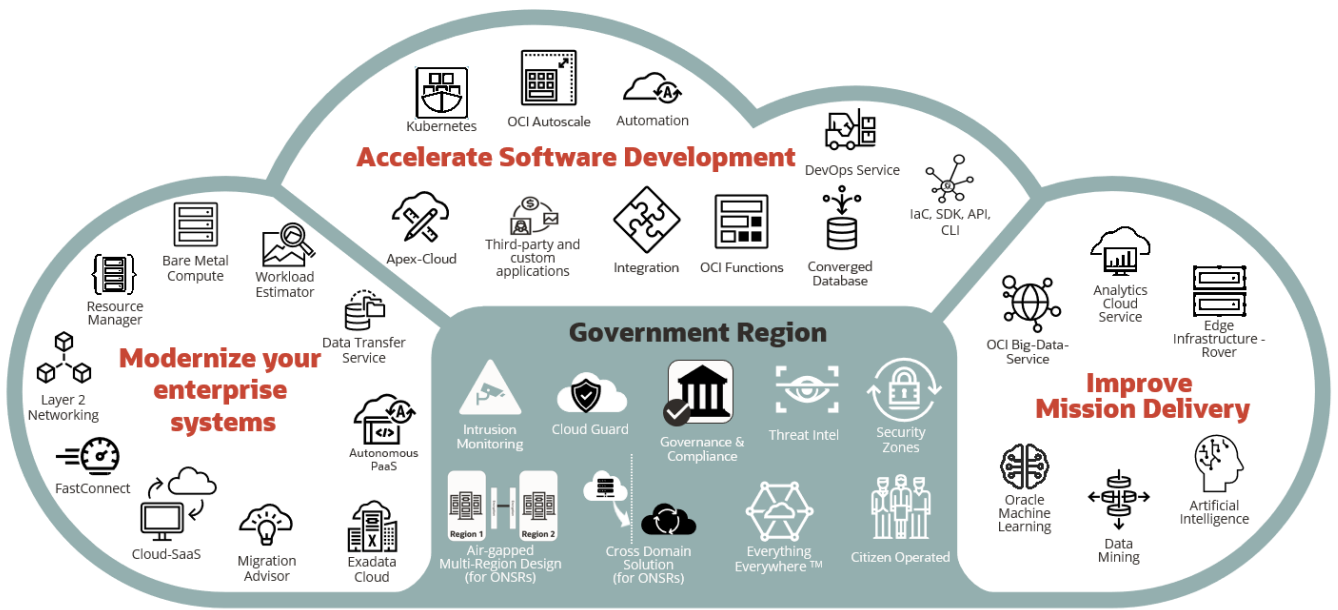
Reference Architecture

OCI provides a breadth of services with leading price-performance and built-in security that can be deployed to support ministries of defense. The architecture described in this section could be deployed to any OCI region as the same cloud services are offered across all regions.

As F-35s produce large data sets, there is a need to ingest and analyze this streaming data near the source (far edge) locally when disconnected and push/sync it to a central cloud (like OCI Region) when connected. This challenge can be addressed by using enterprise-grade OCI services such as **Stream Analytics** running on **Roving Edge devices** that leverage custom ML models.

F-35 stream data can be ingested using Stream Analytics features with sophisticated correlation patterns, enrichment, and machine learning models. This data will be examined and analyzed by creating data pipelines. A data pipeline can query data using time windows, look for patterns, and apply conditional logic while the data is still in motion. Once the data is analyzed and a pattern is detected, the pipeline would trigger actions to push the data to other systems or save results into a data lake for deeper insights and intelligence using Oracle Analytics Cloud. Oracle Stream Analytics can be deployed on Roving Edge Infrastructure to process and analyze data near the source locally for optimal performance in disconnected mode.

The diagram below illustrates a high-level architecture to address this F-35 data streaming use case with various OCI services.

Stream Correlation, Alerting, Dashboards and Continuous ETL: *Data Visualisation on Geo-spatial Data:*

The quantity and speed of raw infrastructure and sensor events are **exponentially increasing the complexity of streaming data** for ministries of defense, which presents a significant challenge to processing in real-time. Oracle Stream Analytics addresses this challenge by empowering users to create and implement robust data solutions that embrace real-time, instant insights from multiple sources—like streaming infrastructures and big data. Oracle Stream Analytics can also ingest and analyze large and varied types of data, ranging from highly structured to unstructured data sets.

Oracle Stream Analytics provides functionality to build location-aware applications and detect events, such as entry and exit from observed areas as well as the proximity and speed of traced objects. Map views allow users to graphically define areas of interest by defining geofences and tracking an object's location over time. Maps can be color-coded based on statistical data and visualize proportions based on size.

Scoring and **predictions based on machine learning models** enable users to decide on an action, for example, by predicting troop movement probability based on multiple sensor inputs that initiate an alert to an analyst. Streaming analytics can identify anomalies, trends, and patterns that a human analyst might miss. Oracle Stream Analytics allows importing ML models such as classifiers, regression models, clustering models, neural networks, decision trees, and other models using the PMML industry standard. Users can reuse models, created by data scientists, by leveraging common ML tools within streaming pipelines, which enables users to take advantage of proven ML models with limited effort.

OCI Roving Edge Infrastructure accelerates the deployment of cloud workloads outside the data center. Ruggedized devices deliver cloud computing and storage services at the edge of networks in disconnected locations. Roving Edge devices provide faster processing close to the data source enabling faster insights into the data collected. Leverage Roving Edge Infrastructure devices with powerful computing capabilities for **ingesting and processing large amounts of streaming data** from sensors in remote locations. Enable seamless deployment of applications for organizations such as embassies and consulates, **government offices, forward operating bases, and remote campuses**. Use built-in GPUs or attached VPU/TPU accelerators for faster processing of AI and ML workloads without relying on network connectivity to Oracle Cloud Infrastructure.

Roving Edge Hardware is available in high-performance, scalable, ruggedized devices in two form factors:

* Roving Edge Device (RED) with 40 cores, 512 GB RAM, and 61 TB storage with embedded GPU for AI/ML processing.

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- Roving Edge Ultra is a lightweight, ultraportable, battery-operated device with a 12-core Xeon D–based CPU, 96 GB of memory, and 7.68 TB of storage. Ultra measures 7.4" x 6.3" x 2" and weighs 3.75 lb. without batteries

The below diagram showcases how Roving Edge Infrastructure extends Oracle Cloud core regions.
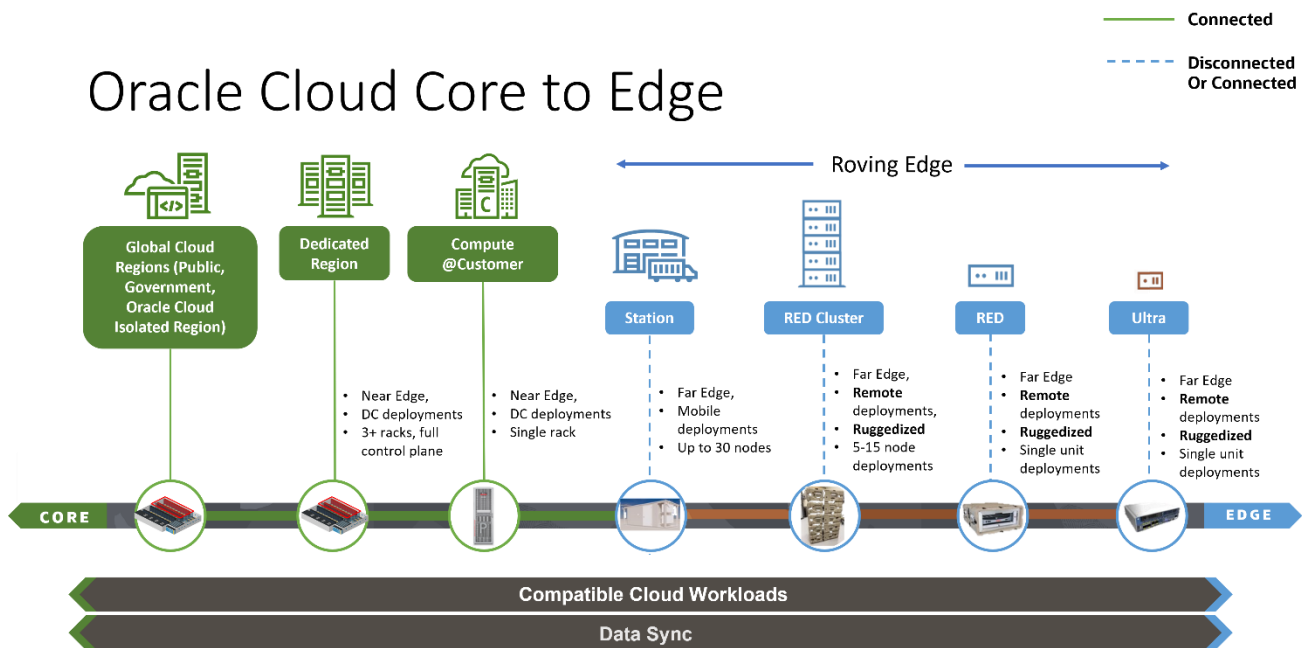
At OCI, security was designed into the core Oracle Cloud experience. All Oracle Cloud Infrastructure security capabilities have been designed with one goal in mind, allowing you to run your mission-critical workloads in the cloud with complete control and confidence. Enterprise customers get maximum control of and transparency in their applications running in the cloud.

Oracle demonstrates its ongoing commitment to global compliance and security standards through third-party audits, certifications, and attestations. Oracle partners with defense and military community customers to demonstrate compliance readiness to internal security and compliance teams, and to their customers, auditors, and regulators. Some Oracle Cloud attestations[2] include DoD DISA SRG, FedRAMP, C5, CSA STAR, IRAP, and achieving Authority to Operate to host DoD Top Secret/SCI Special Access Program missions[3].

Conclusion

To address the complex big data challenges presented by the F-35 platform, Oracle Cloud Infrastructure (OCI) provides a breadth of services with leading price performance and built-in security. Ministries of defense can run mission-critical workloads deployed to OCI public clouds, dedicated Cloud@Customer, and isolated air-gapped classified environments—like Oracle Cloud Isolated Region. The ability to ingest and analyze terabytes of F-35 streaming data near the source (far edge) locally when disconnected and push/sync it to a central classified cloud (like Oracle Cloud Isolated Region) when connected, can be easily achieved by using enterprise-grade OCI services such as Stream Analytics and leveraging custom machine learning (ML) models running on Roving Edge Infrastructure.

The F-35 Lighting II produces massive terabyte-sized streams of data that need to be processed—during flight and post-flight. This data influx needs to be ingested and analyzed to produce timely actionable insights to influence battlespace decisions. By embracing a cloud-centric approach like OCI, which leverages proven streaming and big data analytic technologies, ministries of defense can cost-effectively create actionable

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[2] https://www.oracle.com/corporate/cloud-compliance/
[3] https://www.oracle.com/id/news/announcement/dod-accredits-oracle-cloud-infrastructure-for-top-secret-missions-2022-02-15/

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intelligence at scale from the F-35. This same approach could be used in many other use cases to enable your latency and connectivity-sensitive applications to process large data sets generated in edge locations, lowering communications infrastructure load, reducing data transmission costs, and improving overall application responsiveness.

The proposed OCI solutions can also be applied to data generated by other platforms across the battlespace, such as air defense systems, and signals and electronic intelligence collection platforms. The expected proliferation of sensor systems, such as drones and other autonomous platforms, will continue to significantly increase the volume of time-sensitive data, which requires a performant cloud solution for customers to perform data analysis at scale. Choosing a cloud-based platform and services offered by OCI is a way to future-proof mission-critical systems and empower your teams to process massive amounts of data being collected and to win the battlespace.

Want to know more?

We know that every use case is different. The best way to know if Oracle Cloud Infrastructure is right for you is to try it. You can select the Oracle Cloud free tier to get started with a range of services, including compute, storage, and networking. If you prefer the Oracle Dedicated Region Cloud@Customer (or) Oracle Sovereign Cloud, including Oracle Cloud Isolated Region, consult your Oracle sales representative for a proof of concept in the appropriate region.

For more information, please refer to:

- https://www.oracle.com/middleware/technologies/stream-processing.html

- https://www.oracle.com/cloud/roving-edge-infrastructure/

- https://docs.oracle.com/en-us/iaas/logging-analytics/

- https://www.oracle.com/industries/government/govcloud/isolated/

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