



ICRMS HIGH LEVEL DESIGN

in Reference to

DELIVERABLE D2
for the
ABU DHABI CUSTOMS



INTEGRATED CUSTOMS RISK MANAGEMENT
SYSTEM PROJECT

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1 INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

The purpose of this comprehensive high-level design document is to provide a detailed blueprint and holistic understanding of the system architecture for the Integrated Customs Risk Management System (ICRMS). This document serves as a guiding reference for stakeholders, architects, developers, and other relevant parties involved in the system's conception, development, implementation, and maintenance phases. It outlines the structural components, functionalities, interactions, and integration points within the system, explaining how different elements come together to fulfil business objectives and meet technical requirements.

By encapsulating application, infrastructure, network, security, data, performance, deployment strategies, compliance considerations, and more, this document offers a clear and cohesive overview of the system to facilitate informed decision-making, streamlined collaboration, and effective communication among teams throughout the system's lifecycle.

1.2 OVERVIEW OF THE SYSTEM

The purpose of this Risk Management System is to identify various threats using a complex sophisticated set of business rules. It is also to provide a system that meets the requirements of the World Customs Organization (WCO) and incorporates modern practices from Customs administrations in developed countries like the United States of America, Australia, New Zealand, and the European Union.

The system contains an Intelligence Analysis system that includes a defined sources of information internal and external, and provides the ability to manage, analyse and correlate the available information. The system also evaluates and enhances the quality of the outputs of the risk system so that it becomes a source of compliance monitoring mechanisms and can manage various Customs risk indicators such as regulatory risks, compliance risks, Customs clearance risks, traveller risks, means of transport risks and other risks that may affect the security of the country and the economy.

The system main modules are:

1. **Risk Assessment Engine:** The risk assessment engine is the core module responsible for performing calculations and analysing data to determine the level of risk. It takes inputs from the user and applies predefined algorithms, formulas, or models to calculate the risk score.
2. **Reporting and Visualization:** The reporting and visualization module generates reports and visual representations of risk assessment results. It may include charts, graphs, or summary reports that help users understand and communicate the calculated risks effectively.
3. **Data Storage and Management:** This module manages the storage and retrieval of data related to risk assessments. It includes a database or data repository to store user inputs, risk scores, historical data, and other relevant information.

The following section will describe the high-level aspects of the Risk Assessment Engine architecture and its main components.

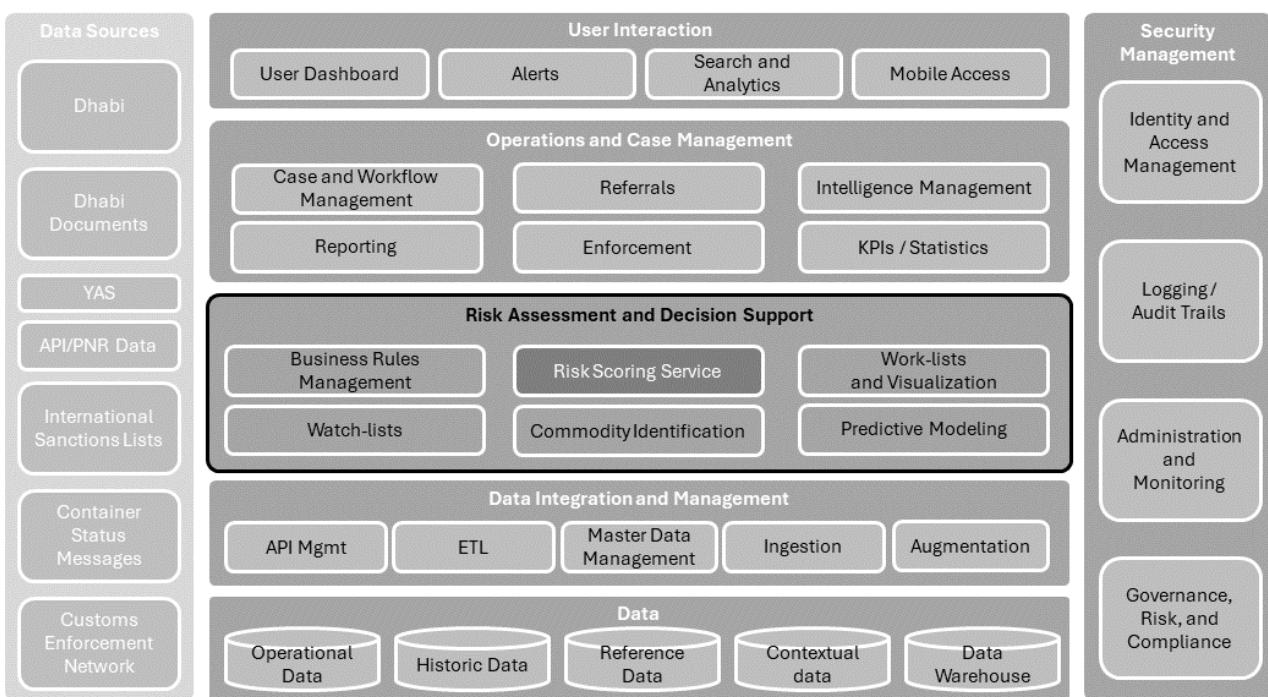
2 APPLICATION ARCHITECTURE

2.1 ARCHITECTURE OVERVIEW

This design document will provide the architecture that will achieve the following:

- Manage, analyse, and correlate all available sources of information internal and external; and
- Evaluate and enhance the risk system outputs such that it becomes a source of compliance monitoring mechanisms and can manage various Customs risk indicators such as regulatory risks, compliance risks, Customs clearance risks, traveller risks, means of transport risks and other risks that may affect the security of the country and the economy.

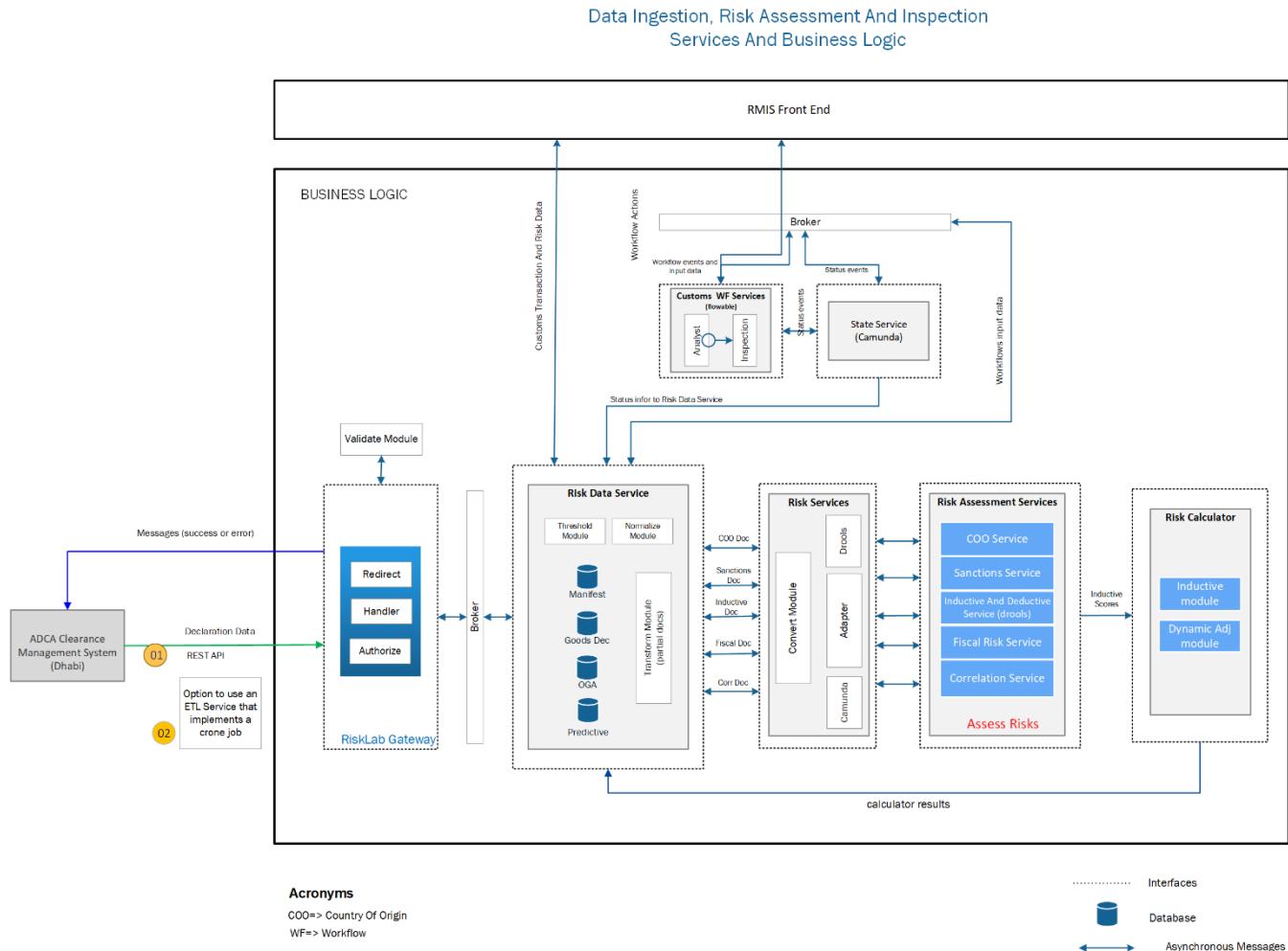
From an overall perspective, the ICRMS can be viewed as groups of components that interact in various layers, each layer providing a specific focused area of business functionality. The following diagram visualizes this layered architecture:



Of these layers, the most interesting one from a technical perspective is the **Risk Assessment and Decision Support**, which is decomposed further in the following sections.

2.2 RISK ASSESSMENT HIGH-LEVEL APPLICATION ARCHITECTURE

The following diagram decomposes the risk assessment engine into its main components.



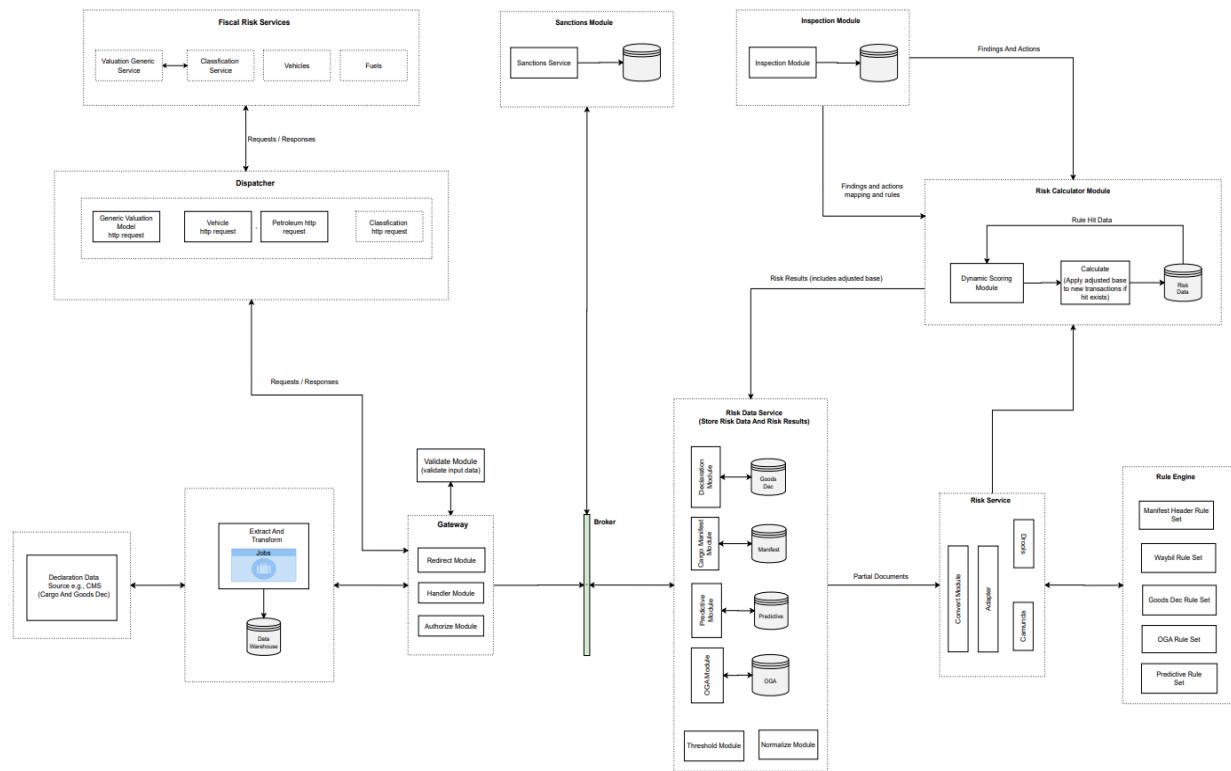
- **ICRMS Gateway:** This gateway will be the initial point for ICRMS to acquire data for its services. It will interface to the ADC Dhabi API through ADCA SOA integration layer for declaration data as well as manifest data. It can either be REST API or any ETL Service.
- **Risk Data Service:** This service stores the risk data as well as the risk scores after the interaction with all the micro services involved. As such, this interfaces with all the other services as well as with the user interface. The risk assessed data provided on ICRMS user interface is provided by this service.
- **Risk Service:** This service ensures that the incoming data (e.g., JSON, XML, etc) is converted to the right format based on the rules engine in use. The reverse process occurs after execution of drools rules.
- **Workflow and state services:** Risk Analysts and Risk Supervisors are two primary users of ICRMS. Their workflow and state of each declaration through their workflow processes are

managed by these services. ICRMS is designed to include OGA workflows as well if required and in case of Abu Dhabi Customs, it will be configured to interface with the ADCA Inspection module to initiate and receive inspection status data. These services interface with the Customs frontend for the workflow interaction.

- **Risk Assessment Service:** These micro services are the core of risk assessment. The services include Country of Origin, Sanction, Inductive and Deductive services, Fiscal Risk and Correlation.
- **Risk Calculator:** This is a separate module for calculating inductive scores using the predictive model. It uses specially designed AI model that provides risk scores based on trained historical data.

2.3 RISK ASSESSMENT COMPONENTS

The following diagram decomposes the Risk data, Risk services and Risk calculator into its main components.

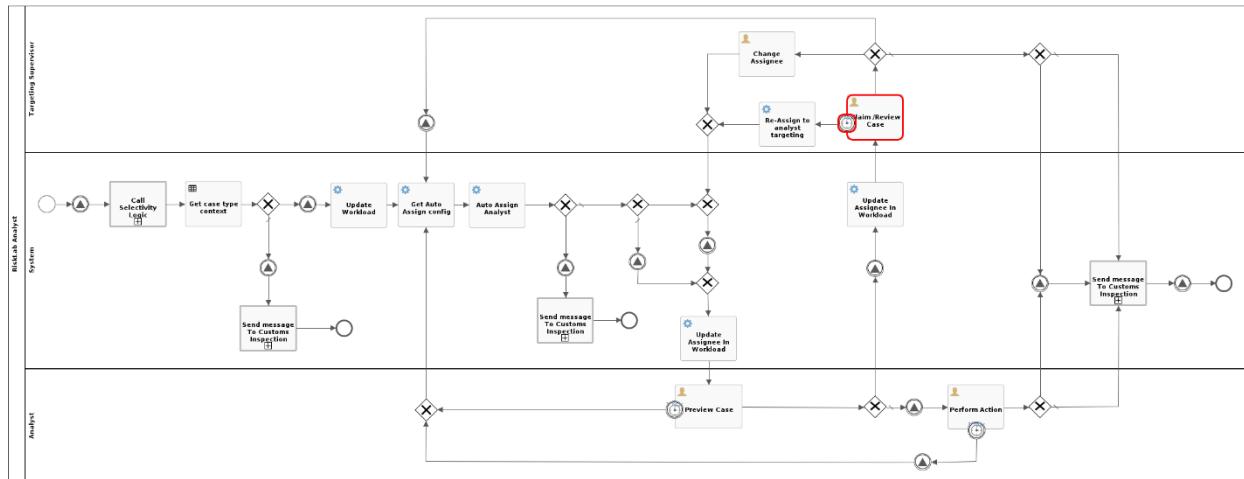


2.4 TECHNOLOGY STACK

The ICRMS utilizes a robust technology stack tailored to its diverse functionalities. At its core functionality, VueJs powers the frontend while Java Spring and Java Cloud handle backend operations, supported by PostgresSql for database management. Message-queueing tasks are efficiently managed through Kafka. The Drools serves as the rule engine and predictive model uses Python libraries like Bert and Pytorch etc... The Reporting capabilities are facilitated by Power BI, offering comprehensive insights. The internal application Integration is seamless with the utilization of Elixir or Java, ensuring efficient communication across systems. This comprehensive technological framework ensures the robustness and scalability of the ICRMS, enabling effective risk mitigation and decision-making processes.

Function	Technology	Description	Version	Additional Info
Frontend	VueJs	User Interface Framework	2.6.10	
Backend	Java Spring	Backend Framework	Greenwich.SR1	
Database	PostgresSql	Relational Database	15.5	
Message-Queueing	Kafka	Distributed Message Broker	2.2.6	
Rule Engine	Drools	Business Rule Management	7.73.0	
Reporting	Power BI	Business Intelligence Tool	Latest	
Integration	Elixir or Java	Backend Integration Framework	11	
Predictive Model	Python	AI Tools	2.1.2	

2.5 EXAMPLE WORKFLOW



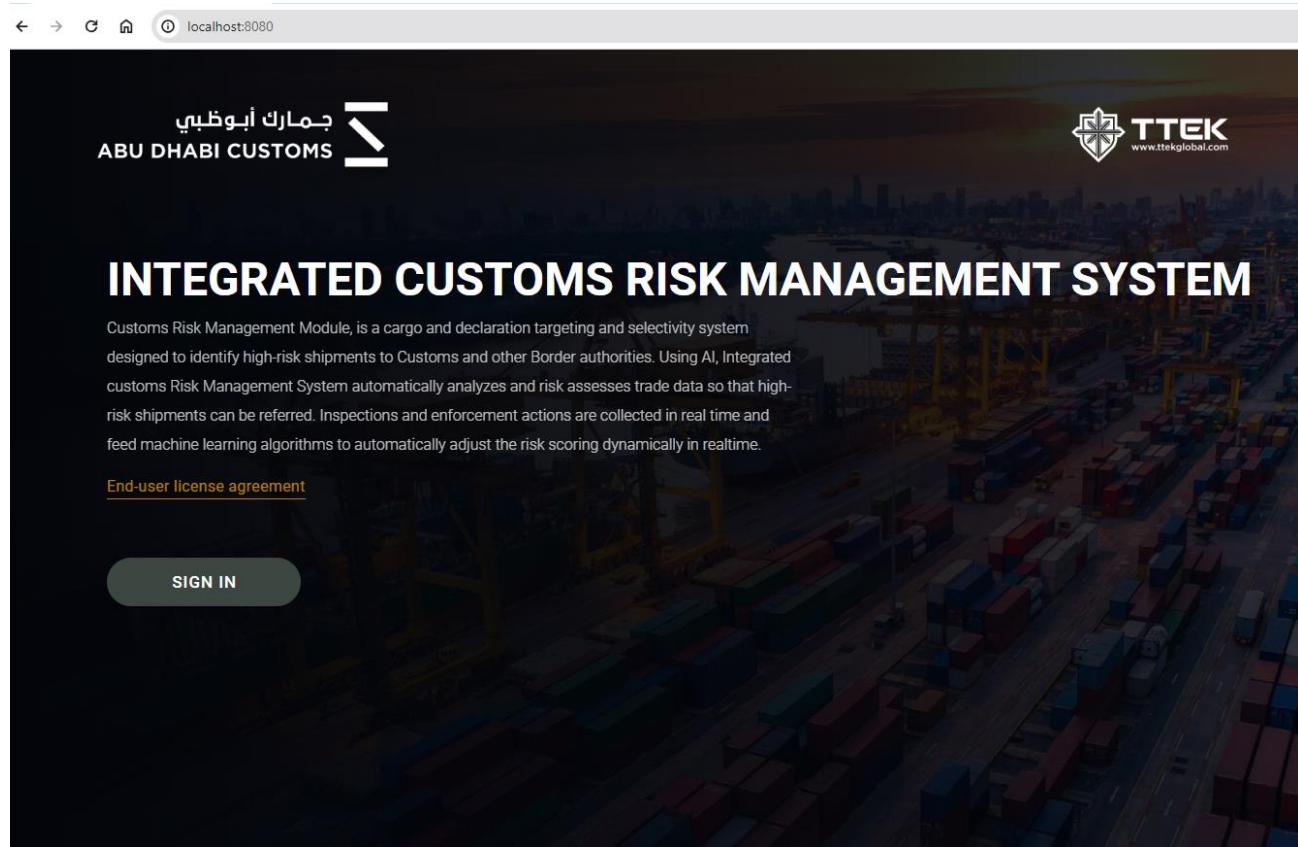
This is a standard BPMN (Business Process Model and Notation) diagram describing one complete workflow from the reception of declaration data in ICRMS until the completion of assessment takes place. Upon arrival of post arrival risk data, it goes through the Risk Assessment sub process at the beginning, then goes to Targeting Analyst processes as well as the Inspection processes (which will, in the ICRMS, be encapsulated within separate systems, e.g., YAS).

3 USER INTERFACES

In this section, screenshot samples of ICRMS user interface (UI) are presented for both the Arabic and English interfaces. This section focuses on the screen content and transactional elements (i.e., visual elements that depend upon the data from a source system like Dhabi), to ensure consistency and coherence in both languages.

The UI design is structured to maintain uniformity, where the screen content and transaction details remain unchanged when switching between Arabic and English. This bilingual approach aims to provide users with a seamless experience, allowing them to navigate effortlessly between accessing information, conducting transactions, or making decisions in either language without encountering discrepancies or alterations in content. The UI design prioritizes accuracy, clarity, and user-friendliness to cater to a diverse user base proficient in both Arabic and English languages.

3.1 ENGLISH USER INTERFACE



localhost:8080

جمارك أبوظبي
ABU DHABI CUSTOMS

INTEGRATED CUSTOMS RISK MANAGEMENT SYSTEM

Customs Risk Management Module, is a cargo and declaration targeting and selectivity system designed to identify high-risk shipments to Customs and other Border authorities. Using AI, Integrated customs Risk Management System automatically analyzes and risk assesses trade data so that high-risk shipments can be referred. Inspections and enforcement actions are collected in real time and feed machine learning algorithms to automatically adjust the risk scoring dynamically in realtime.

[End-user license agreement](#)

SIGN IN

localhost:8080/declarations?page=8&itemsPerPage=10&type=INSPECTION_REFERRAL

DECLARATIONS

- MY WORKLIST - PRIMARY SORT (64)
- TEAM WORKLIST - PRIMARY SORT
- ALL SHIPMENTS - TRIAGE (4,998)
- INSPECTION REFERRALS (81)
- CLASSIFICATION (3,263)
- VALUATION (55)
- SANCTION (36)

PENDING ACTION (81) EXAMINATION RESULTS ON FILE (0) IN PROGRESS (1) CLEARED FOR RELEASE (0)

Type	Shield	Bag	Cannabis	Declaration Reference	Inserted Date / Time	Submitted Date	Case Status	Action Types	Version	Checkpoint	Regime
SA				DECDEV-29-12-2023-NR	29-12-2023, 08:01	29-12-2023, 08:01	ASSESSMENT COMPLETE	Analyst Clear	v2	BSNAS	Import
PR				DECDEV-29-12-2023-GN	29-12-2023, 08:01	29-12-2023, 08:01	UNDER INSPECTION	Document Check, Physical Check, X-ray Scan	v1	BSNAS	Import
PR				DECDEV-28-12-2023-GP	28-12-2023, 00:00	28-12-2023, 00:00	UNDER INSPECTION	Document Check, X-ray Scan, Physical Check	v2	BSNAS	Export
PR				DECDEV-25-12-2023-CY	25-12-2023, 08:05	25-12-2023, 08:05	ASSESSMENT COMPLETE	Analyst Clear	v3	BSNAS	Import
PR				DECDEV-25-12-2023-FO	25-12-2023, 08:05	25-12-2023, 08:05	UNDER INSPECTION	Document Check, Physical Check, X-ray Scan	v2	BSNAS	Import
PR				2023DEC0001352440	29-12-2023, 09:54	29-12-2023, 08:53	ASSESSMENT COMPLETE	Analyst Clear	v1	BSGGT	Import
PR				DECDEV-29-12-2023-ET	29-12-2023, 08:01	29-12-2023, 08:01	UNDER INSPECTION	Document Check, X-ray Scan, Physical Check	v2	BSNAS	Export
PR				DECDEV-25-12-2023-ZM	25-12-2023, 08:05	25-12-2023, 08:05	UNDER INSPECTION	X-ray Scan, Physical Check, Document Check	v2	BSNAS	Export
IN				DECDEV-IUD173my	29-12-2023, 11:22	27-12-2023, 21:46	UNDER INSPECTION	Document Check, X-ray Scan, Physical Check	v1	BSNAS	Import
IN				DECDEV-SlkBdswgA	29-12-2023, 11:31	27-12-2023, 21:46	UNDER INSPECTION	Document Check, X-ray Scan, Physical Check	v1	BSNAS	Import

localhost:8080/declarations?page=1&itemsPerPage=10&type=scenario-PREDICTIVE_CLASSIFICATION&totalMissclassificationLoss=UNDER_MISSCLASSIFICATION

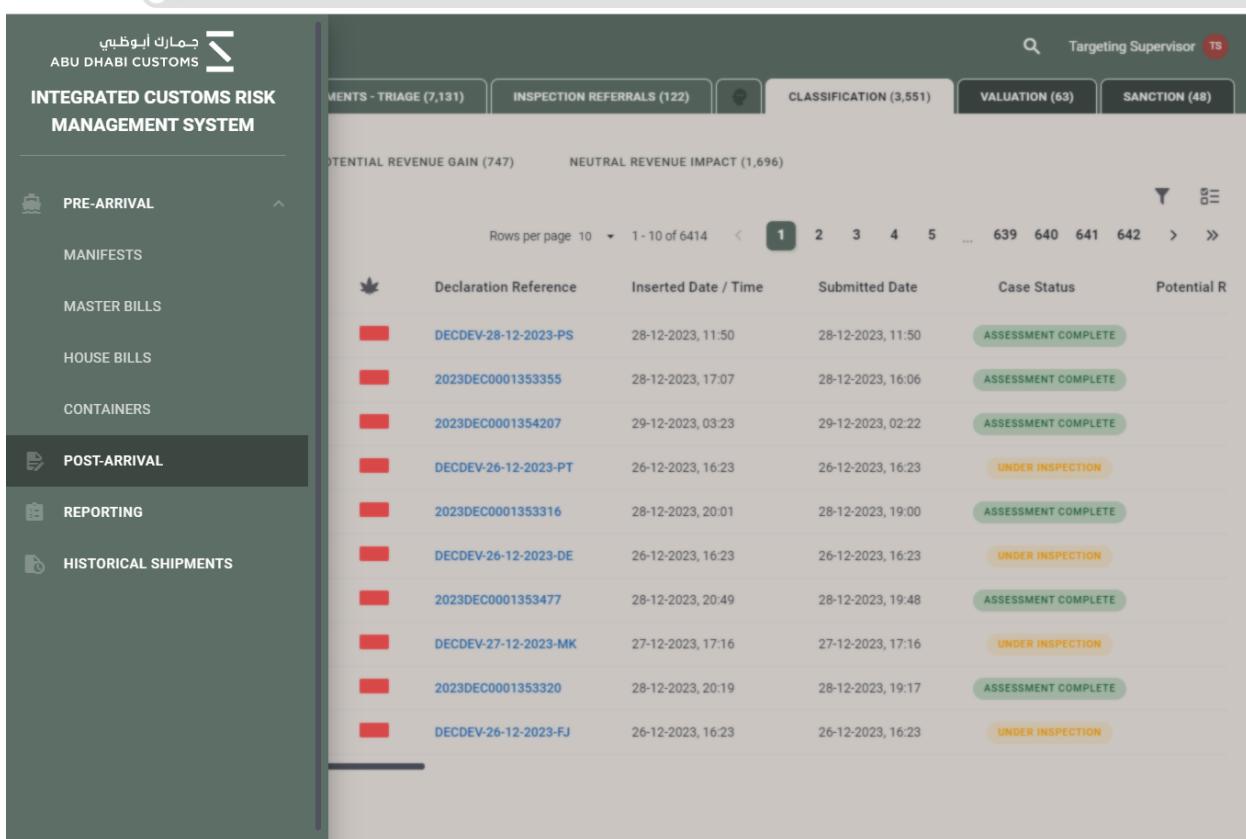
DECLARATIONS

- WORKLIST - PRIMARY SORT (65)
- TEAM WORKLIST - PRIMARY SORT (1,945)
- ALL SHIPMENTS - TRIAGE (7,131)
- INSPECTION REFERRALS (122)
- CLASSIFICATION (3,551)
- VALUATION

POTENTIAL REVENUE LOSS (1,108) POTENTIAL REVENUE GAIN (747) NEUTRAL REVENUE IMPACT (1,696)

Type	Shield	Bag	Cannabis	Declaration Reference	Inserted Date / Time	Submitted Date	Case Status	Potential R
PR				DECDEV-28-12-2023-PS	28-12-2023, 11:50	28-12-2023, 11:50	ASSESSMENT COMPLETE	
PR				2023DEC0001353355	28-12-2023, 17:07	28-12-2023, 16:06	ASSESSMENT COMPLETE	
IN				2023DEC0001354207	29-12-2023, 03:23	29-12-2023, 02:22	ASSESSMENT COMPLETE	
PR				DECDEV-26-12-2023-PT	26-12-2023, 16:23	26-12-2023, 16:23	UNDER INSPECTION	
IN				2023DEC0001353316	28-12-2023, 20:01	28-12-2023, 19:00	ASSESSMENT COMPLETE	
PR				DECDEV-26-12-2023-DE	26-12-2023, 16:23	26-12-2023, 16:23	UNDER INSPECTION	
PR				2023DEC0001353477	28-12-2023, 20:49	28-12-2023, 19:48	ASSESSMENT COMPLETE	
PR				DECDEV-27-12-2023-MK	27-12-2023, 17:16	27-12-2023, 17:16	UNDER INSPECTION	
PR				2023DEC0001353320	28-12-2023, 20:19	28-12-2023, 19:17	ASSESSMENT COMPLETE	
PR				DECDEV-26-12-2023-FJ	26-12-2023, 16:23	26-12-2023, 16:23	UNDER INSPECTION	

localhost:8080/declarations?page=1&itemsPerPage=10&type=scenario-PREDICTIVE_CLASSIFICATION&totalMissclassificationLoss=UNDER_MISSCLASSIFICATION



The screenshot shows the Abu Dhabi Customs Integrated Customs Risk Management System. The left sidebar has sections for PRE-ARRIVAL (Manifests, Master Bills, House Bills, Containers), POST-ARRIVAL (Reporting, Historical Shipments), and a collapsed section. The main area shows a table of declarations with the following columns: Declaration Reference, Inserted Date / Time, Submitted Date, Case Status, and Potential R. The table includes navigation for rows per page (10), page numbers (1-642), and sorting icons.

	Declaration Reference	Inserted Date / Time	Submitted Date	Case Status	Potential R
DECDEV-28-12-2023-PS	28-12-2023, 11:50	28-12-2023, 11:50		ASSESSMENT COMPLETE	
2023DEC0001353355	28-12-2023, 17:07	28-12-2023, 16:06		ASSESSMENT COMPLETE	
2023DEC0001354207	29-12-2023, 03:23	29-12-2023, 02:22		ASSESSMENT COMPLETE	
DECDEV-26-12-2023-PT	26-12-2023, 16:23	26-12-2023, 16:23		UNDER INSPECTION	
2023DEC0001353316	28-12-2023, 20:01	28-12-2023, 19:00		ASSESSMENT COMPLETE	
DECDEV-26-12-2023-DE	26-12-2023, 16:23	26-12-2023, 16:23		UNDER INSPECTION	
2023DEC0001353477	28-12-2023, 20:49	28-12-2023, 19:48		ASSESSMENT COMPLETE	
DECDEV-27-12-2023-MK	27-12-2023, 17:16	27-12-2023, 17:16		UNDER INSPECTION	
2023DEC0001353320	28-12-2023, 20:19	28-12-2023, 19:17		ASSESSMENT COMPLETE	
DECDEV-26-12-2023-FJ	26-12-2023, 16:23	26-12-2023, 16:23		UNDER INSPECTION	

localhost:8080/declaration/8069c233-8ad1-45e3-b2d1-929807ba9a5f

DECLARATIONS > 2023DEC0001354207

RISK ASSESSMENT SUMMARY DECLARATION RELATED DOCUMENTS TARGETING TIMELINE CUSTOMS INSPECTION TIMELINE

Targeting Supervisor TS

DECLARATION HEADER

HEADER DETAILS HEADER RISK

Declaration Reference:	2023DEC000135 4207	Mode:	Air transport	Exporter:	TROPIXAIR LIMITED	Total invoice amount:	3455.01
Case Status:	ASSESSMENT COM	Office Of Entry:	BSNAS	Export Country:	US	Total gross weight:	167 LB
Procedure:	Direct Import	Office Of Exit:	USOPK	Agent Name:	anitatreco	Total net weight:	
Regime:	Import	Lines:	1	Importer:	The Ocean Club A Four Season Resorts	Total containers:	—
ST:	No	Waybill Reference:	—	Country of Destination:	Bahamas	Total packages:	10
		Submitted Date:	29-12-2023				

DECLARATION ITEMS

Type	Commodity classification	Valuation Potential Loss/Gain	Classification Potential Loss/Gain
□	62089990		

PERFORM ACTION ▾

3.2 ARABIC USER INTERFACE

جمارك أبوظبي ABU DHABI CUSTOMS

النظام المتكامل لإدارة المخاطر الجمركية

وحدة إدارة المخاطر الجمركية، هي نظام إلكتروني مصمم لاستهداف الصنائع والبيانات الجمركية تضمن التسويق على المخاطر إلى الجمارك والسلطات الحكومية الأخرى. باستخدام النطاق الاصطناعي، يقوم النظام المتكامل لإدارة المخاطر الجمركية تقليديًا بتحليل البيانات التجارية ويتبع المخاطر بحيث يمكن إغاثة التسويق حالية المخاطر. يتم جمع صلوات التقى، وإجراءات التنفيذ في الوقت الفعلي وتحديث خوارزميات التعلم الآلي لضبط درجة المخاطر تقليديًا تدريجيًا في الوقت الفعلي.

انفاق ترخيص المستخدم النهائي

تسجيل الدخول

البيانات المحرّكة

نوع البيانات	نقطة تعيين	الإصدار	أنواع الإجراءات	المكتب/المنسق المختصة لتأثيرات	الحالة	تاريخ تقديمها	تاريخ الإنشاء	الرقم المرجحى للبيان	النوع			
استيراد	BSNAS	v1		BSN 386.36 قد المراجعة	00:00,28-12-2023	00:00,28-12-2023	DECDEV-28-12-2023-QA	☒	☒	☒	PR	□
استيراد	BSNAS	v2	خفض الإنبعاث، فحص بدني	BSN 386.36 قد التفتيش	17:16,27-12-2023	17:16,27-12-2023	DECDEV-27-12-2023-MK	☒	☒	☒	PR	□
استيراد	BSNAS	v4	تفتيش الوثائق، فحص بدني	BSN 386.36 قد التفتيش	00:00,28-12-2023	00:00,28-12-2023	DECDEV-28-12-2023-TM	☒	☒	☒	PR	□
استيراد	BSNAS	v1		BSN 386.36 قد المراجعة	17:16,27-12-2023	17:16,27-12-2023	DECDEV-27-12-2023-CK	☒	☒	☒	PR	□
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استيراد	BSNAS	v2		BSN 386.36 قد المراجعة	17:16,27-12-2023	17:16,27-12-2023	DECDEV-27-12-2023-BG	☒	☒	☒	SA	□
استيراد	BSNAS	v2		BSN 386.36 قد المراجعة	00:00,28-12-2023	23:59,27-12-2023	DECDEV-28-12-2023-NG	☒	☒	☒	PR	□
استيراد	BSNAS	v2	تفتيش الوثائق، فحص بدني	BSN 386.36 قد التفتيش	00:00,28-12-2023	00:00,28-12-2023	DECDEV-28-12-2023-TT	☒	☒	☒	PR	□

دبي مارك أبوظبي

ABU DHABI CUSTOMS

INTEGRATED CUSTOMS RISK MANAGEMENT SYSTEM

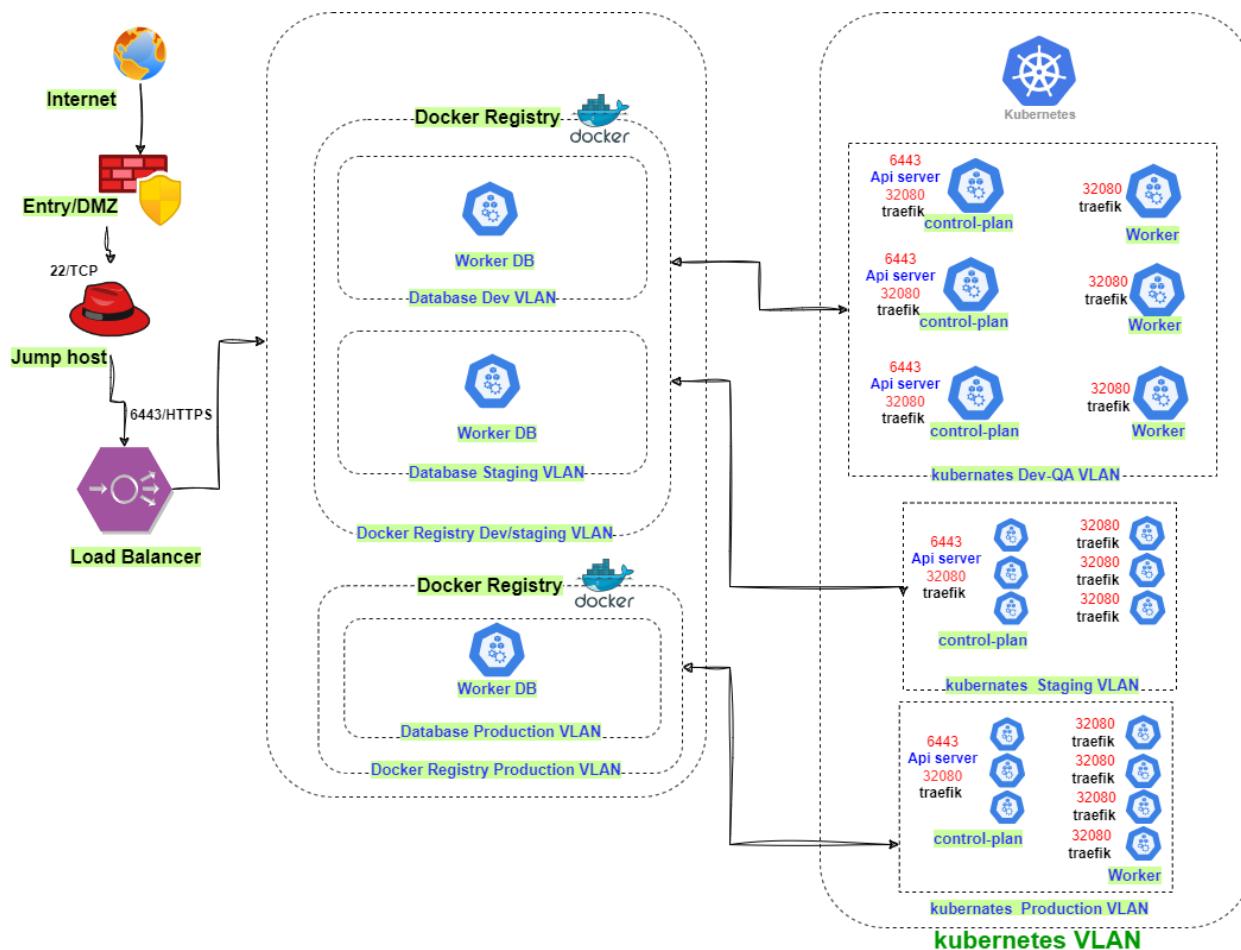
نوع البيانات	نقطة تعيين	الإصدار	أنواع الإجراءات	المكتب/المنسق المختصة لتأثيرات	الحالة	تاريخ تقديمها	تاريخ الإنشاء	الرقم المرجحى للبيان	النوع		
خفض الإنبعاث، فحص بدني				BSN 386.36 قد المراجعة	00:00,28-12-2023	00:00,28-12-2023	DECDEV-28-12-2023-QA	☒	☒	☒	□
خفض الإنبعاث، فحص بدني				BSN 386.36 قد التفتيش	17:16,27-12-2023	17:16,27-12-2023	DECDEV-27-12-2023-MK	☒	☒	☒	□
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تفتيش الوثائق، فحص بدني				BSN 386.36 قد المراجعة	17:16,27-12-2023	17:16,27-12-2023	DECDEV-27-12-2023-SZ	☒	☒	☒	□
تفتيش الوثائق، فحص بدني				BSN 386.36 قد المراجعة	17:16,27-12-2023	17:16,27-12-2023	DECDEV-27-12-2023-BG	☒	☒	☒	□
تفتيش الوثائق، فحص بدني				BSN 386.36 قد المراجعة	00:00,28-12-2023	23:59,27-12-2023	DECDEV-28-12-2023-NG	☒	☒	☒	□
تفتيش الوثائق، فحص بدني				BSN 386.36 قد التفتيش	00:00,28-12-2023	00:00,28-12-2023	DECDEV-28-12-2023-TT	☒	☒	☒	□

4 INFRASTRUCTURE ARCHITECTURE

The ICRMS is deployed using a Kubernetes architecture with multiple environments.

4.1 SERVER ARCHITECTURE

The following diagram visualizes the deployment architecture of the system showing how key components are interconnected and accessed.



Here's a breakdown of main components of the deployment architecture:

Internet: The internet is the entry point for external traffic to the system.

Load balancer: The load balancer distributes traffic across the different worker nodes in the Kubernetes cluster.

Entry/DMZ: The entry/DMZ is a demilitarized zone that separates the public internet from the internal network. It contains security gateways and firewalls to protect the internal network from unauthorized access.

Jump host: The jump host is a server that allows authorized users to access the internal network from the outside. It is used for administrative tasks such as troubleshooting and maintenance.

Kubernetes: Kubernetes is an open-source system for managing containerized applications. It is used to automate the deployment, scaling, and management of containerized applications.

Kubernetes registry: The Kubernetes registry stores Docker images that are used to deploy applications in the Kubernetes cluster.

Docker registry: The Docker registry is a registry for Docker images. It is used to store private Docker images that are not available on the public Docker Hub.

Worker nodes: The worker nodes are the nodes in the Kubernetes cluster that run containerized applications.

Control plane: The control plane is the brains of the Kubernetes cluster. It is responsible for managing the worker nodes and scheduling containerized applications.

Databases: The databases store the data for the system. There are separate databases for development, staging, and production environments.

Traefik: Traefik is an edge router and reverse proxy that manages ingress traffic for Kubernetes clusters.

ADFS: ADFS is an Active Directory Federation Services server that provides single sign-on (SSO) for the system.

4.1.1 SCALABILITY AND HIGH AVAILABILITY

ICRMS system architecture harnesses the power of Kubernetes, a container orchestration platform renowned for its unparalleled scalability. This enables the system to dynamically adapt to evolving workloads, ensuring robust performance and cost-efficiency regardless of traffic fluctuations.

Kubernetes empowers the ICRMS with several key features that unlock scalability. Horizontal Pod Autoscaling (HPA) automatically adjusts the number of containerized replicas based on resource demand, dynamically scaling up during peak loads and down during calmer periods. This optimized resource allocation prevents bottlenecks and wasted resources, ensuring a cost-effective infrastructure. Furthermore, Vertical Pod Autoscaling (VPA) fine-tunes resource allocation within individual pods, optimizing resource utilization without over-provisioning.

In essence, this Kubernetes-powered architecture offers dynamic scalability ensuring the system thrives in the ever-evolving digital landscape.

4.1.2 DATABASE OPTIONS

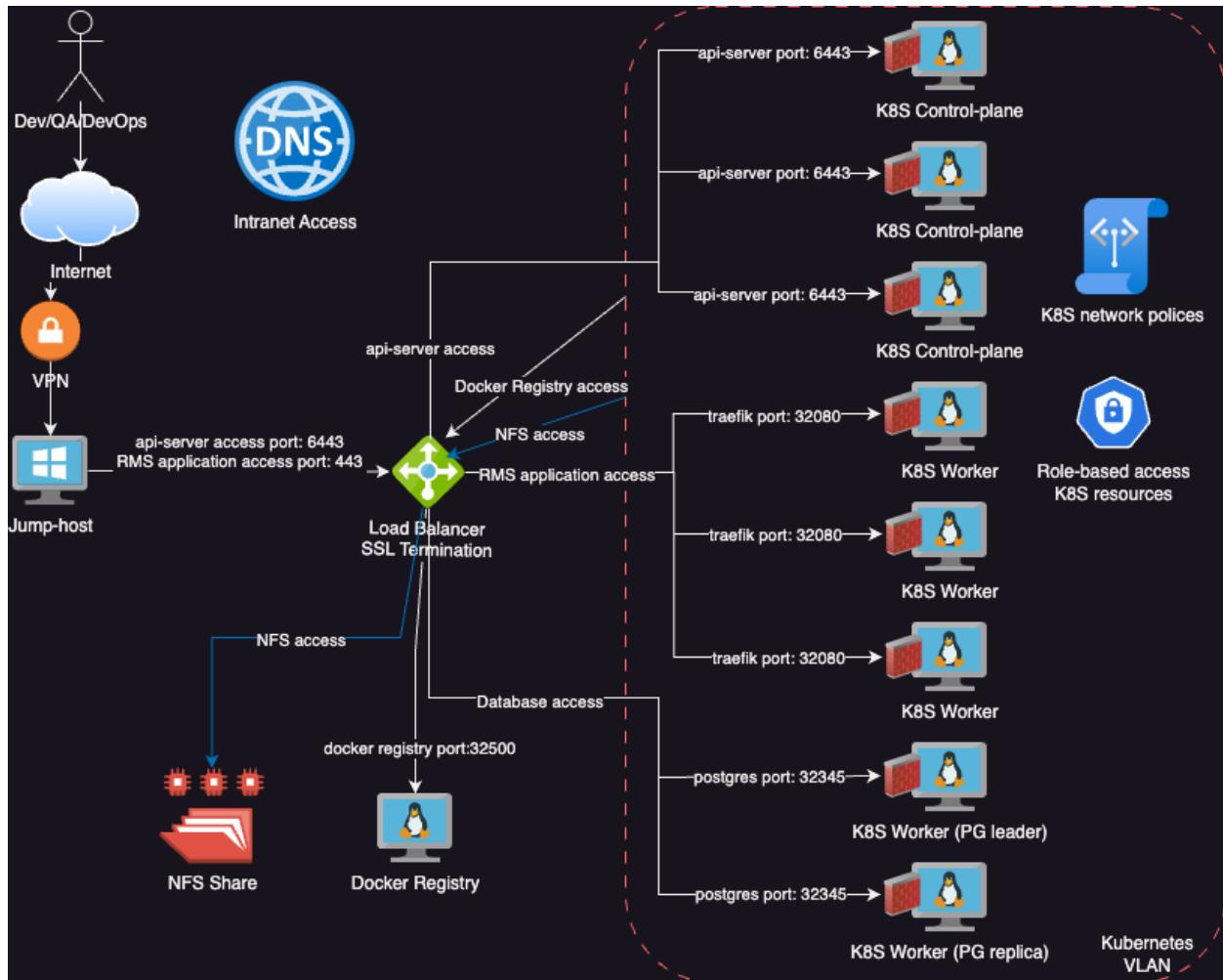
The ICRMS utilizes PostgreSQL as its tested database that is known to support the high-availability and zero down-time goals of a modern Customs system. In discussions with the ADCA Infra team, it was suggested that the preferred database in the ADCA infra environment is MS SQL, given the existence of an already-established MS SQL cluster managed by the ADCA Infra team.

TTEK agreed to evaluate the required efforts to seamlessly integrate ICRMS with MS SQL and is pursuing that activity in parallel with project initiation. To not impact the schedule, the project will continue using

PostgreSQL until such analysis is concluded. A final decision as to which database will be used, is expected before User Acceptance Testing.

4.2 NETWORK & SECURITY

The following diagram visualizes the components and firewall restrictions expected in the ICRMS:



Control Family	Control	Description/Control Specifics
Network Security	Network Firewall	Firewalls are implemented between environments or sites to filter and restrict the traffic
	Segmentation	Networks are segmented to contain the risks and limit issues related to network performance
	Site-to-Site VPN	S2S VPN is implemented to ensure secure connectivity between distinct sites as mentioned in the diagram
Access Control	DevOps Access Management	A role based access management is implemented throughout the software lifecycle to mitigate the risks related to excessive access rights
	Identity Manager	A centralized identity provider to centralize access management and streamline the provisioning, deprovisioning and rights configurations for identities, services, or systems
	Application Access Control	Same as above
Security Monitoring	SIEM solution	A SIEM solution is deployed to ensure that all security events are captured in real-time, correlated and incidents are timely addressed.
Application Security	Source Code Review	Source code reviews are conducted as part of the QA and SDLC processes
	Static Application Scanning	Code is being scanned against well-known vulnerabilities. Found vulnerabilities are addressed before the code is deployed into production environment.

	Red Team activities	Periodic or on demand red teaming activities to identify potential vulnerabilities and timely addressing them.
	Dynamic Application Scanning	Existing or future applications are dynamically tested as part of the SDLC process.
	Web Application Penetration Test	Internal and External pen testing activities are regularly conducted to identify vulnerabilities and timely addressing them.
Vulnerability Management	VA testing	Continuous VA assessments/patching and software updates deployment

4.3 VIRTUAL RESOURCES

The ICRMS will be implemented in three separate environments within ADCA, each of which has its resources orchestrated by Kubernetes. The operating system for each node should be RedHat v9.

4.3.1 DEV

Env	Virtual Service	CPU Vcores	RAM (GB)	HDD
dev	Kubernetes Maste node 1	8 CPU	32 GB	30 GB
dev	Kubernetes Maste node 2	8 CPU	32 GB	30 GB
dev	Kubernetes Maste node 3	8 CPU	32 GB	30 GB
dev	Kubernetes worker node 1	8 CPU	32 GB	30 GB
dev	Kubernetes worker node 2	8 CPU	32 GB	30 GB
dev	Kubernetes worker node 3	8 CPU	32 GB	30 GB
dev	Docker Registry	4 CPU	8 GB	270GB
dev	Kubernetes worker node PostgreSQL	8 CPU	16 GB	1.2 T
Total		60 CPU	216 GB	1.5 T

4.3.2 STAGING

The following estimates are preliminary and may be reduced if the actual data volumes received in DEV are lower than expected.

Env	Virtual Service	CPU Vcores	RAM (GB)	HDD
STG	Kubernetes Maste node 1	32 CPU	64 GB	500 GB
STG	Kubernetes Maste node 2	32 CPU	64 GB	500 GB
STG	Kubernetes Maste node 3	32 CPU	64 GB	500 GB
STG	Kubernetes worker node 1	224 CPU	414 GB	3,000 GB
STG	Kubernetes worker node 2	224 CPU	414 GB	3,000 GB
STG	Kubernetes worker node PostgreSQL	48 CPU	128 GB	12,000 GB
STG	Docker Registry	4 CPU	8 GB	270 GB
	Total	528 CPU	1,020 GB	18,500 GB

4.3.3 PRODUCTION

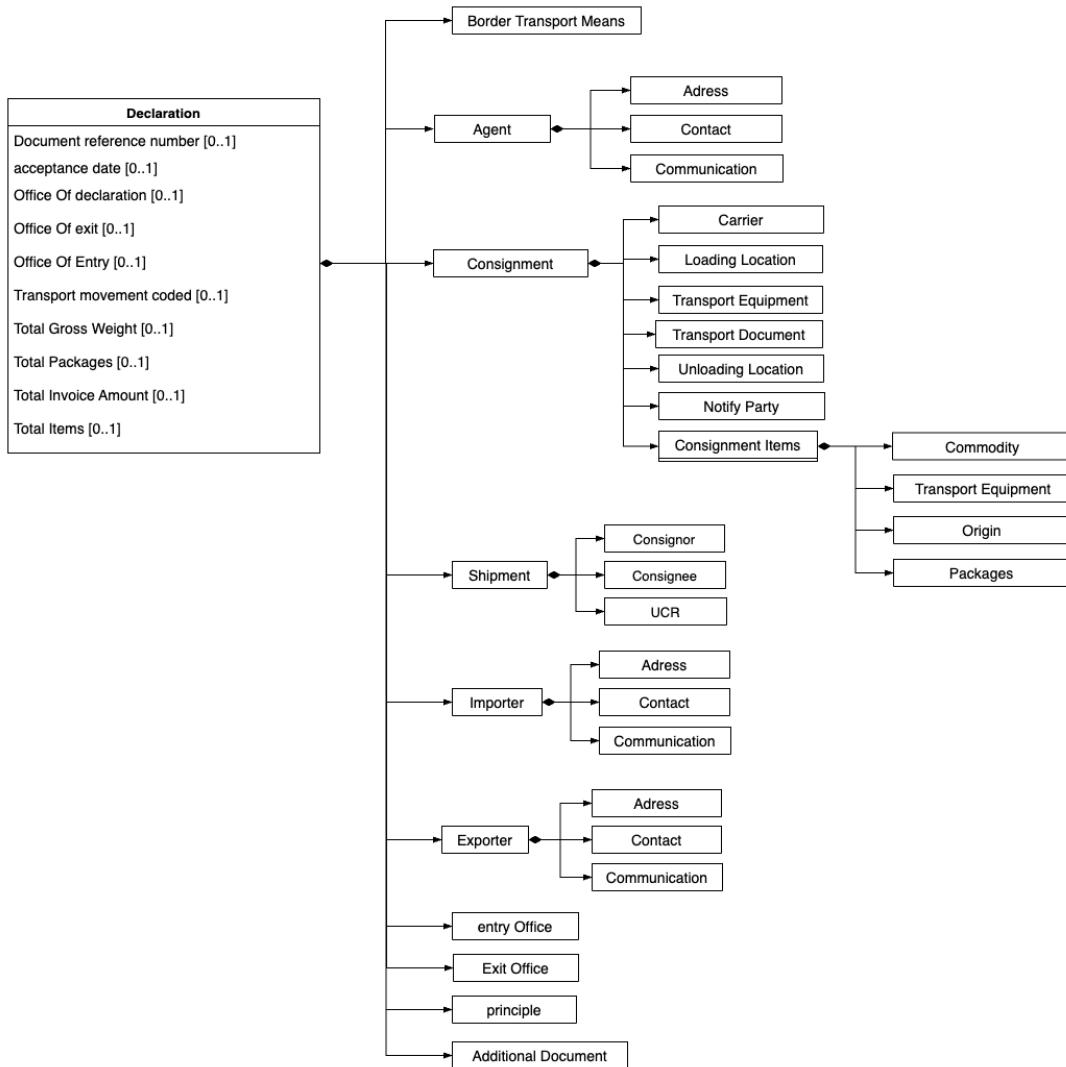
The following estimates are preliminary and may be reduced if the actual data volumes received in DEV are lower than expected. This environment will also be handling the high-availability requirements using inherent Kubernetes features as described in section 4.1.1

Env	Virtual Service	CPU Vcores	RAM (GB)	HDD
PRD	Kubernetes Maste node 1	32 CPU	64 GB	500 GB
PRD	Kubernetes Maste node 2	32 CPU	64 GB	500 GB
PRD	Kubernetes Maste node 3	32 CPU	64 GB	500 GB
PRD	Kubernetes worker node 1	224 CPU	414 GB	3,000 GB
PRD	Kubernetes worker node 2	224 CPU	414 GB	3,000 GB
PRD	Kubernetes worker node 3	224 CPU	414 GB	3,000 GB
PRD	Kubernetes worker node PostgreSQL 1	48 CPU	128 GB	12,000 GB
PRD	Kubernetes worker node PostgreSQL 2	48 CPU	128 GB	12,000 GB
PRD	Docker Registry	4 CPU	8 GB	270 GB
	Total	768 CPU	1,562 GB	21,500 GB

5 DATA ARCHITECTURE

5.1 DATA MODEL CONFORMING TO THE WCO

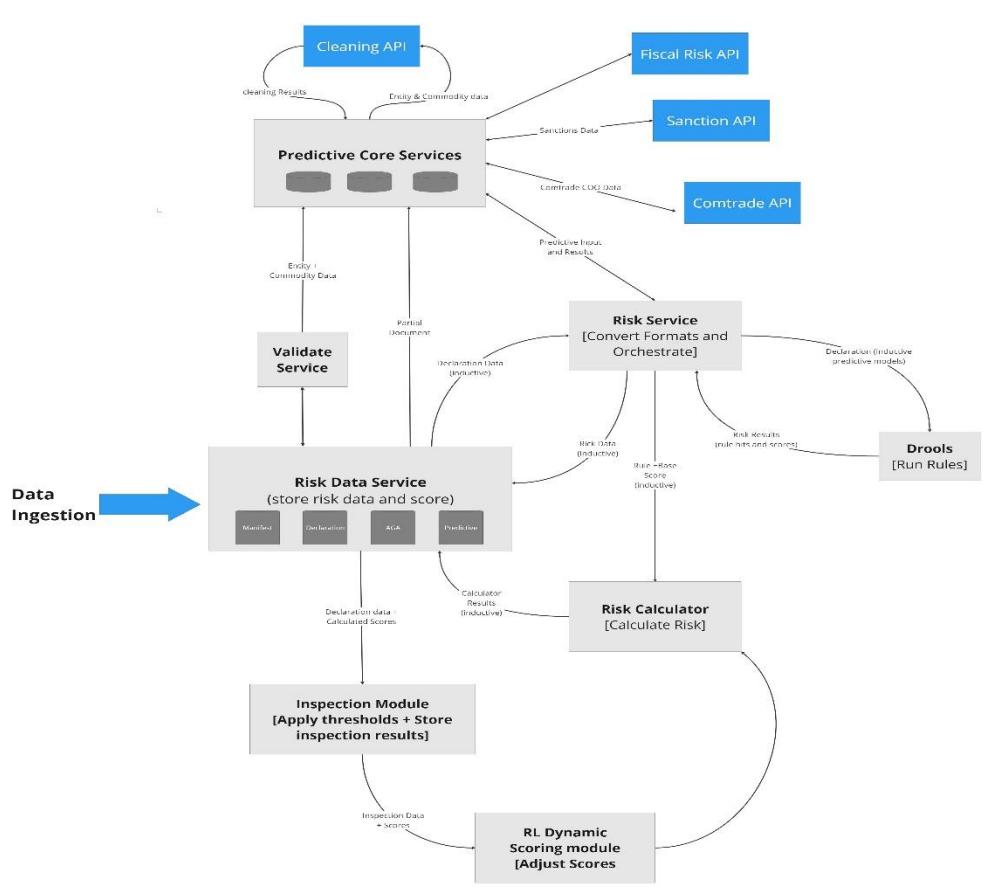
To support interoperability among systems, the ICRMS follows the WCO data model which helps to simplify and harmonize data flow and integration of business data. Data element relationships and usage are implemented as specified in the WCO data model version 3.8 functional DM and UML specifications.



The above diagram is the WCO derived UML model that contains part of the structure of the data mode that is implemented in RMS, that depicts the cardinality between different element groups based on the WCO UML modelling standards.

5.2 HIGH LEVEL DATA ECOSYSTEM

The below diagram visualizes the movement of data amongst components of the ICRMS:



5.3 REFERENCE DATA

Reference data are exported from ADCA Dhabi system using XML files. The XML reference data files will be imported in ICRMS database as bulk data at first. Subsequent updates will be performed by Dhabi pushing reference data updates to the ICRMS' reference data APIs.

5.4 TRANSACTIONAL DATA

ICRMS will focus on using the declaration and manifest transactional data in the ADCA Dhabi System to drive the risk assessment decision, but the analysis and determination will be augmented with the use of any appropriate LPCOs linked to a commercial shipment. Transactional data APIs will be used to push the transactional data into ICRMS.

5.5 DATA MANAGEMENT

When developing ICRMS TTEK adopted a design philosophy which; if adopted by the member state; largely resolves the historical challenges that Customs has traditionally faced with respect to data lifecycle management.

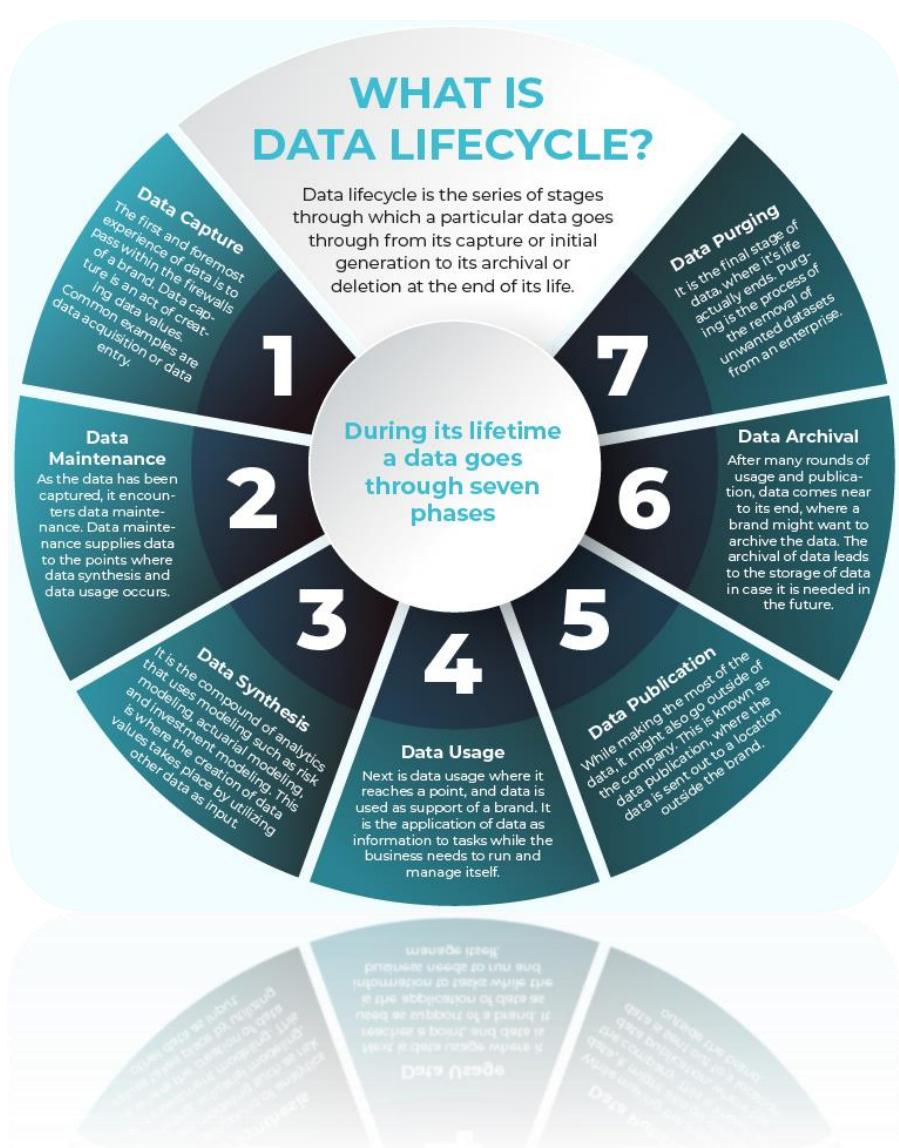
The key design philosophy includes seven key steps as shown in the diagram below. Our philosophy and mechanisms for implementing the seven steps in the context of the CMS are also described.

Data Capture

Make it easy to ingest and process electronic data from any source. Make it easy to integrate such that electronic data stays electronic; it does not revert to a scanned image or similar. This falls within the Data Acquisition process. Provide the facility for agencies to upload and store scanned images; pdf attachments etc. but discourage this practice in favour of storing the electronic information wherever and whenever possible; apart from cargo scanner integrations. Validating information at the point of entry. If the data has already been entered and the document is considered 'lodged' the system will use mathematical models to establish the trustworthiness of each data element in comparison to its peers within the same transaction, and historical trends based on similar transactions. This allows us to up or down-weight various data elements based on our level of confidence in their accuracy. Codify information wherever and whenever possible to simplify reporting and analytics (analysing trader generated content and descriptions that does not adhere to a framework is technically more challenging) Codifying data where possible is our recommended approach.

Data Maintenance

Store the information once in the most appropriate module and re-use it wherever possible across all modules and systems. Never request a user to re-key information that the system already knows.



Ensure there is a clear delineation across the various integrated systems with respect to master data management and which system manages the ‘authoritative data set’ for each type of information. Data is shared using an Enterprise Services Bus with robust message queues with strong error and exception handling. Point to point data transfers are discouraged.

Data Synthesis

Where possible, create improved information that has been cleaned, and various decision rules and business logic operations have been run against it. The results of these business operations are pre-processed and stored in the database and synthetic data; associated with the declared data. Synthetic data strengthens nearly all decision-making processes. We use AI and Machine Learning models to achieve some of these goals.

Data Usage (Data Governance)

Provide facilities and controls to ensure “permitted use of data” i.e. ensuring that data is viewable and used in ways that are legally permissible; and in the ways that businesspeople want. This is largely achieved through our implementation of attribute-based role-based access control mechanisms across all our products.

Data Publication

All externally facing API’s and reports are protected by some universal controls to reduce the risk of accidental data breaches. This prevents the accidental leakage of company information; financial information or other highly sensitive data points being made available to an organization or entity outside of Customs. The Data Usage process plays a part in managing this; however, we consider external API’s and Reporting to be a special case, as they are generally handled using a different data security method than role-based access control.

Data Archival

Transactional Data archival processes are managed at the database layer and are fully automated. Transactional data that has reached the end of its lifecycle is stored in ‘sharded’ tables for retrieval performance considerations. The ‘working data set’ is deliberately kept as small as possible for performance reasons; noting that retrieving transactional information from archives is near instantaneous. All transactional and Reference tables are subject to a fully mature and robust version control process.

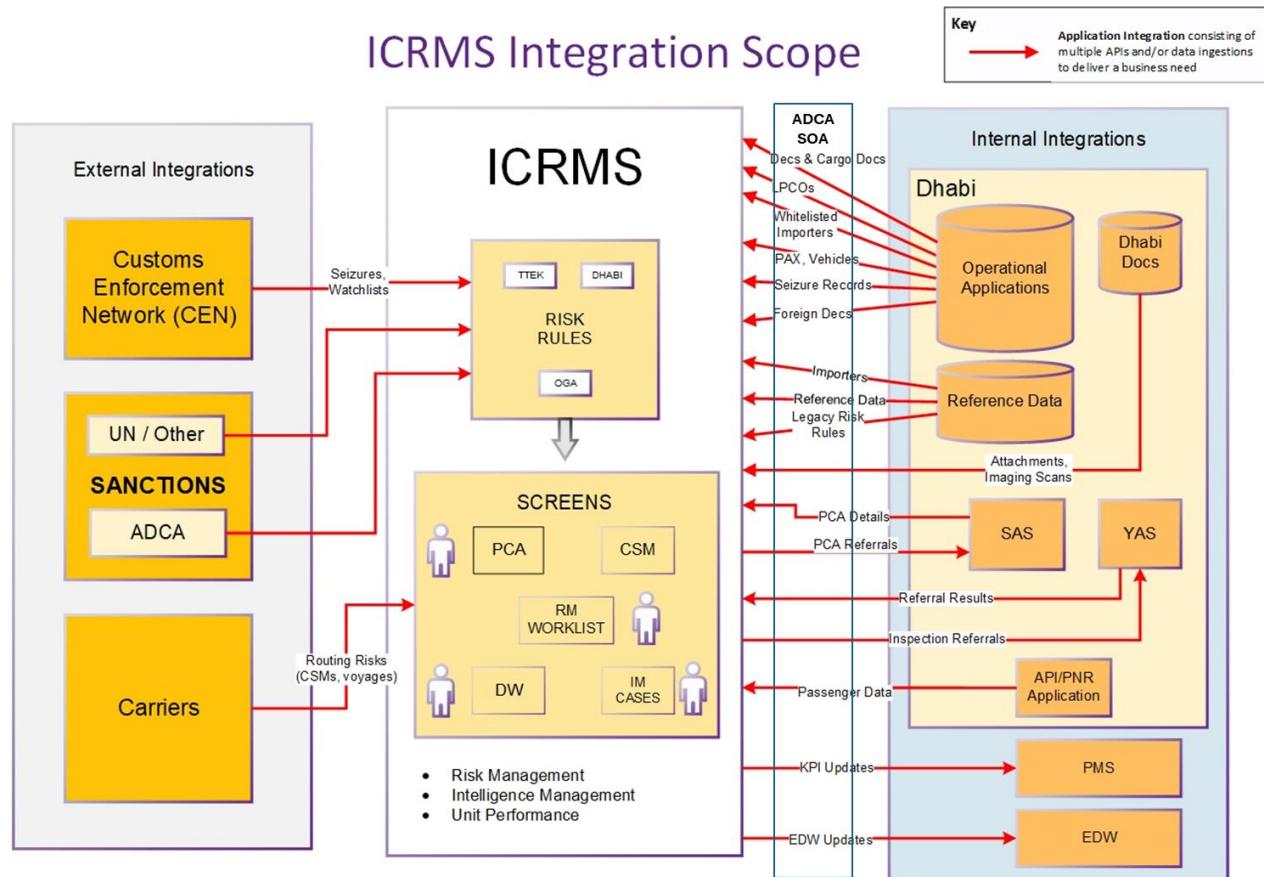
Data Purging

No data is purged from the archive except based on a request from the customer. With modern databases and storage arrays being inexpensive to setup and maintain; we see minimal benefits to data purging of electronic data. We strongly encourage the periodic purging of scanned documents, however, based on a customer’s data retention policy.

6 INTEGRATION AND APIs

6.1 INTEGRATIONS OVERVIEW

The following diagram describes the system internal and external integration components:



6.2 APPLICATION INTEGRATION APPROACH

There will be internal integrations with ADCA applications and external integrations. The following section will summarize in high level all integration parts.

6.2.1 INTERNAL INTEGRATIONS

The Integrated Risk Management System (IRMS) will need to integrate with several Abu Dhabi Customs internal sub-systems / systems. ADCA SOA integration layer will serve as intermediary between ICRMS and all internal AD Customs systems. These will both be on the input side, and output side of the ICRMS. The following integration points are in scope:

Business Integration Points	IT Endpoint Description
1. Declaration and Cargo Documents 2. Electronic Licenses (References Only) 3. Other Reference Data 4. Fully Licensed (Whitelisted) Declarants 5. Importer Registrations 6. Passenger and Vehicle Information 7. Seizure Records 8. Foreign Customs Declarations 9. PCA Audit Details 10. PCA Referrals/Channeling 11. Legacy Risk Rules	<p>Dhabi static extracts and dynamic data updates being provided by push to APIs that TTEK specifies. Multiple endpoints will be required to be constructed by both ADCA and TTEK to achieve this, at least 7 and possibly up to 20.</p> <p>There is significant complexity in these integrations due to the breadth and complexity of Dhabi's storage.</p> <p>With respect to PCA, the SAS (Smart Audit System) details will be provided through Dhabi as well as receiving the referrals made to PCA from the ICRMS.</p> <p>Legacy risk rules are delivered by static extract – once at beginning of project and another two weeks before UAT.</p>
12. Inspection Referrals 13. Referral Results	<p>Connectivity to the Yas subsystem will provide these. There are existing APIs used for Manafth that it may be possible to re-use. End-points will need to be adapted from the TTEK perspective.</p> <p>The existing response loop (referral results) is likely deficient in meeting ICRMS needs and will need to be improved. TTEK will provide technical requirements for this.</p>
14. Attachments 15. Imaging Scans	<p>For declaration attachments it will be delivered by fetching against an existing API and are in one document store.</p>
16. Passenger Data	<ul style="list-style-type: none"> • It is currently unknown what information is available; • ADCA is actively working to get the API and PNR data; • It is acknowledged that TTEK cannot integrate with a data feed that does not exist and even implementing a traveler targeting system without the data feed in place is problematic; • TTEK will implement a traveler targeting module with demo data; and • Actual data integration will be subject to the timing of the actual data feed
17. Performance (Channeling) Details	<p>Integrations exist for the PMS¹ system that may be possible to reuse. The ICRMS will push data to this system, with the exact details to be defined in a BRD.</p>
18. Data Warehousing	<p>The Data Management team currently reviews/assesses declarations post-arrival for logical inconsistencies. In the</p>

¹ Performance Management System

Business Integration Points	IT Endpoint Description
	<p>ICRMS these are treated as revenue risks at-arrival. In addition, there is a parallel Enterprise Data Warehouse (EDW) project currently in the initial stages of implementation.</p> <p>For this integration point, the ICRMS will:</p> <ul style="list-style-type: none"> • Utilize internal (operational) data for reporting initially, and consider using the EDW once that is available; • Implement a separate worklist for the Data Management team to receive data quality risks within; and • Implement an output mechanism to provide data to the EDW. Will use direct Database connection to provide DW with the required <i>Risklab</i> database.

6.2.2 EXTERNAL INTEGRATIONS

The external integrations for the ICRMS will consist of the following as listed in the table below:

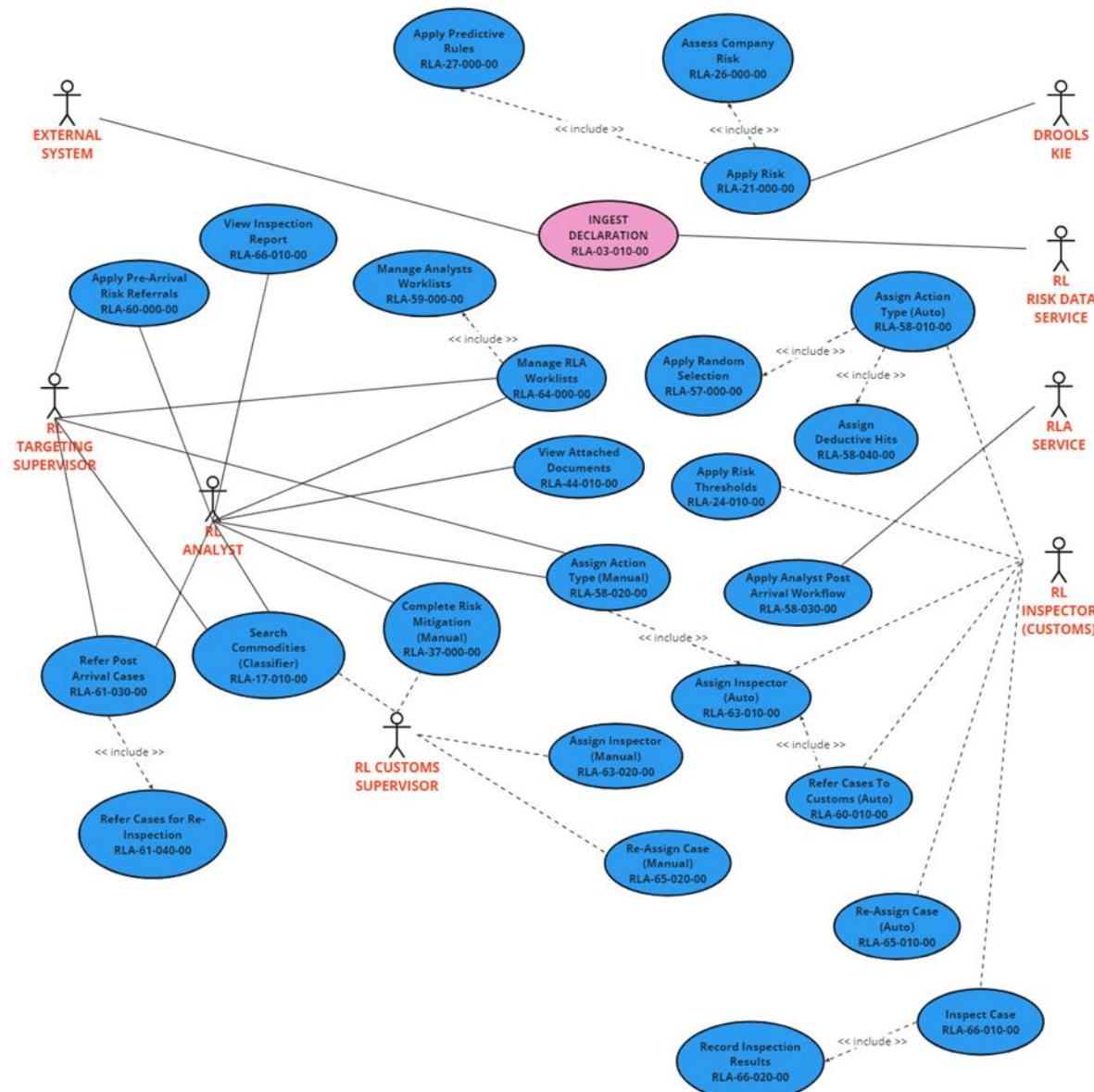
Business Application Integration	IT Endpoint Description
<ul style="list-style-type: none"> • Customs Enforcement Network 	<p>ADCA will provide authorization and access through its internal network to the ICRMS application space to pull in global seizure information from this international network.</p> <p>This information will form part of the ICRMS seizure historical research and can be incorporated into risk rule modifications.</p>
<ul style="list-style-type: none"> • Sanctions 	<p>The ICRMS will include risk rules based upon approximately 50 open sources of data on people, conveyances, entities, and commodities involved in national threats. One-third of these are updated dynamically and two-thirds manually. TTEK will provide the dynamically updated URLs during design. An up-to-date 2023 import on all will be performed before go-live.</p>
<ul style="list-style-type: none"> • ADCA Desired Sanction List 	<p>An additional dynamic sanctions list will be added to the ICRMS risk rules from the Office of Non-Proliferation via the UAE Office of Foreign Affairs. The exact URL to be provided by ADCA, and contains 3 levels of terrorism threats, updated every month on people, companies, groups and organizations.</p>
<ul style="list-style-type: none"> • Container Status Messages 	<p>The ICRMS will include a customized screen displaying the routing of containers for use in determining the risk of a shipment, that is, performing a Secondary Sort on a document</p>

	within a Risk Management worklist, or when preparing an Intelligence Case.
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7 USE CASES

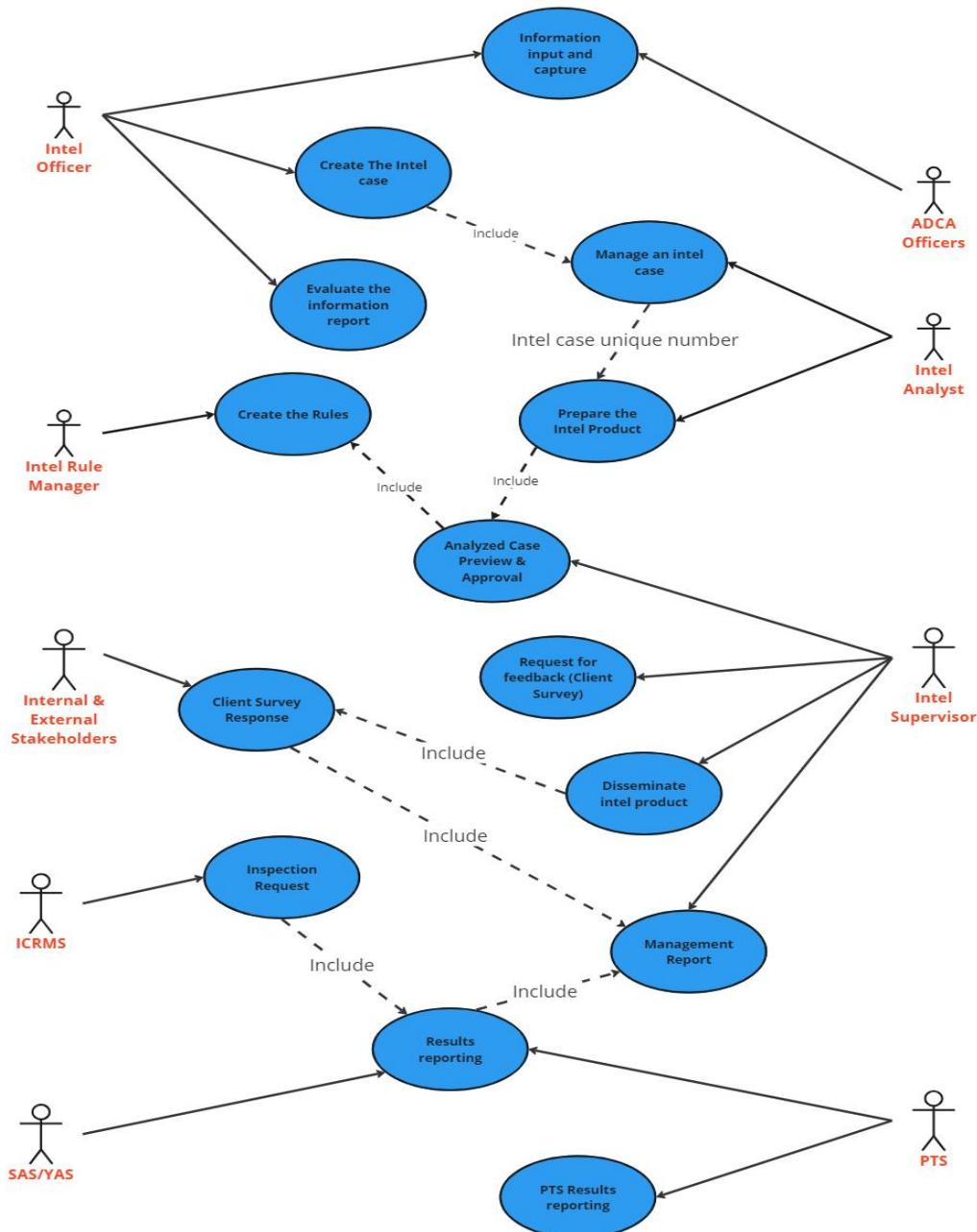
7.1 CORE USE CASES

The following use case diagram for the ICRMS provides a visual representation of the system's functionalities and the interactions between various actors and components. This diagram aims to depict the key use cases or scenarios where the risk rule system is utilized to manage and mitigate risks effectively. It outlines the primary actors involved and the specific actions they perform within the system.



7.2 INTEL USE CASES

These following use cases diagram demonstrate the versatility and power of the intelligence module in processing and extracting valuable insights from various data sources, enabling organizations to make informed decisions and provide enhanced user experiences.



8 COMPLIANCE AND REGULATIONS

8.1 REGULATORY COMPLIANCE REQUIREMENTS

The WCO provides guidelines and standards for risk management in customs operations. Member organizations should ensure that their risk management system aligns with the WCO's compendium on Customs Risk Management. Each country has its own customs laws and regulations that govern international trade and customs operations. The risk management system should facilitate compliance with these specific laws and regulations, including import/export controls, duty calculations, customs declarations, tariff classification & valuation, and documentation.

The ICRMS implementation aligns with the above vision and will provide ADCA with an effective system for meeting WCO compliance goals.

8.2 DATA MODEL STANDARDS

The ICRMS complies with the following international standards:

- WCO Data Model Version 3.10
- WCO 'Harmonized System' for Tariff Management. Reference data compliant with WCO HS2017 and HS2022 tariff at six-digit level is pre-loaded into the ICRMS .
- The UAE/GCC tariff will additionally be loaded to supplement the Global HS6 tariff.
- United Nations Directories for Electronic Data Interchange for Administration, Commerce and Transport sets a variety of data standards, of which the ICRMS can transmit/receive the following:
 - CUSCAR (Cargo Control Documents)
 - CUSDEC (Cargo Declaration Documents)
 - SANCRT (LPCO applications and processing)
 - BAPLIE (Bayplan/ Stow plan)
 - COPRAR (Container discharge/ loading instruction)
 - UN/LOCOD (UN Standard for Location Codes)
 - ISO 3166 (Country and subdivision codes)
 - BANSTA (Banking Status Message)
 - CUSEXP (Customs express consignment declaration message)
 - IFTDGN (Dangerous Goods Notification Message)
 - PAXLST (Passenger API/PNR messages)

8.3 ADDITIONAL STANDARDS

The ICRMS complies with the following standards (local, regional, and international) for the processing and handling of Customs and Intelligence Risk Assessment:

#	Description
1.	GCC Common Customs Law
2.	GCC Unified Guide for Customs Procedures
3.	WCO Customs Intelligence Guide
4.	WCO Risk Management Compendium
5.	United Nations Convention Against Corruption
6.	GATT Article VII: Valuation for Customs Purposes Recommendation #25 on Use of the United Nations Electronic Data Interchange for Administration, Commerce and Transport (UN/EDIFACT).
7.	WCO revised Kyoto convention on the simplification and harmonization of Customs procedures.
8.	WCO SAFE framework of standards to secure and facilitate global trade (SAFE Framework).
9.	C-TPAT's Five Step Risk Assessment Process (from US customs).
10.	WCO Trade Facilitation Agreement
11.	WTO Valuation Agreement