



**TITAN**  
**Turnaround Integration in Trajectory And Network**

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**Turnaround Tool Interface Document**

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Review	SLO	Noémi Král	31/10/2012
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## ***EXECUTIVE SUMMARY***

This document discusses the TITAN System Messaging Architecture and the types of messages required for TITAN to operate. This document also describes the messaging and communication interfaces which work together to create the TITAN system. It discusses the required messages from internal and external systems which allow the flow of information and the state update of services and objects within the TITAN missing passenger scenario.

The TITAN System Messaging Architecture discussed in this document is with reference to the TITAN non-commercial demonstrator developed as part of TITAN WP4.3. The TITAN non-commercial demonstrator is a software demonstrator that proves the ideas and concepts from earlier TITAN work packages can be implemented as a real system. Unless otherwise noted, all references to “the tool” refer to the subset of a production strength TITAN tool required to meet the Missing Passenger Scenario; i.e. the “non-commercial demonstrator”.



## 1. INTRODUCTION

### 1.1 Purpose of document

This document identifies all of the communications between the different parts of the TITAN system including messages from external systems.

### 1.2 Intended audience

This public document may be distributed freely both within and outside the TITAN consortium. However, it is primarily a technical document intended to be of use to the development team writing the tool. Beyond the scope of WP4, this document may also be useful for interface designers who may be charged with investigating how the interface of a future production strength TITAN tool might look like.

### 1.3 Partners involvement

The initial version of the document was prepared by JEP. It was then reviewed by SLO and RWT.

SLO took responsibility for updating the document according to feedback received.

JEP prepared the final version for release.

### 1.4 Glossary of terms

A-CDM	Airport Collaborative Decision Making
Acft	Aircraft
AIRS	Airport Information Report Service
AOBT	Actual Off-Block Time
API	Application Programmable Interface
ASRS	Aircraft Status Report Service
ATC	Air Traffic Control
Bag	Baggage
BFIS	Baggage Flow Information Service
Cont	Container
GWT	Google Web Toolkit
JSON	JavaScript Object Notation
Pax	Passenger
PFIS	Passenger Flow Information Service
RPC	Remote Procedure Call
SOAP	Simple Object Access Protocol
TIS	TITAN Information Sharing
TITAN	Turnaround Integration in Trajectory and Network
WebApp	Web Application

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WP            Work Package  
XML         Extensible Mark-up Language



## 2. COMMUNICATIONS OVERVIEW

Figure 1 shows an overview of the data communications within the TITAN tool.

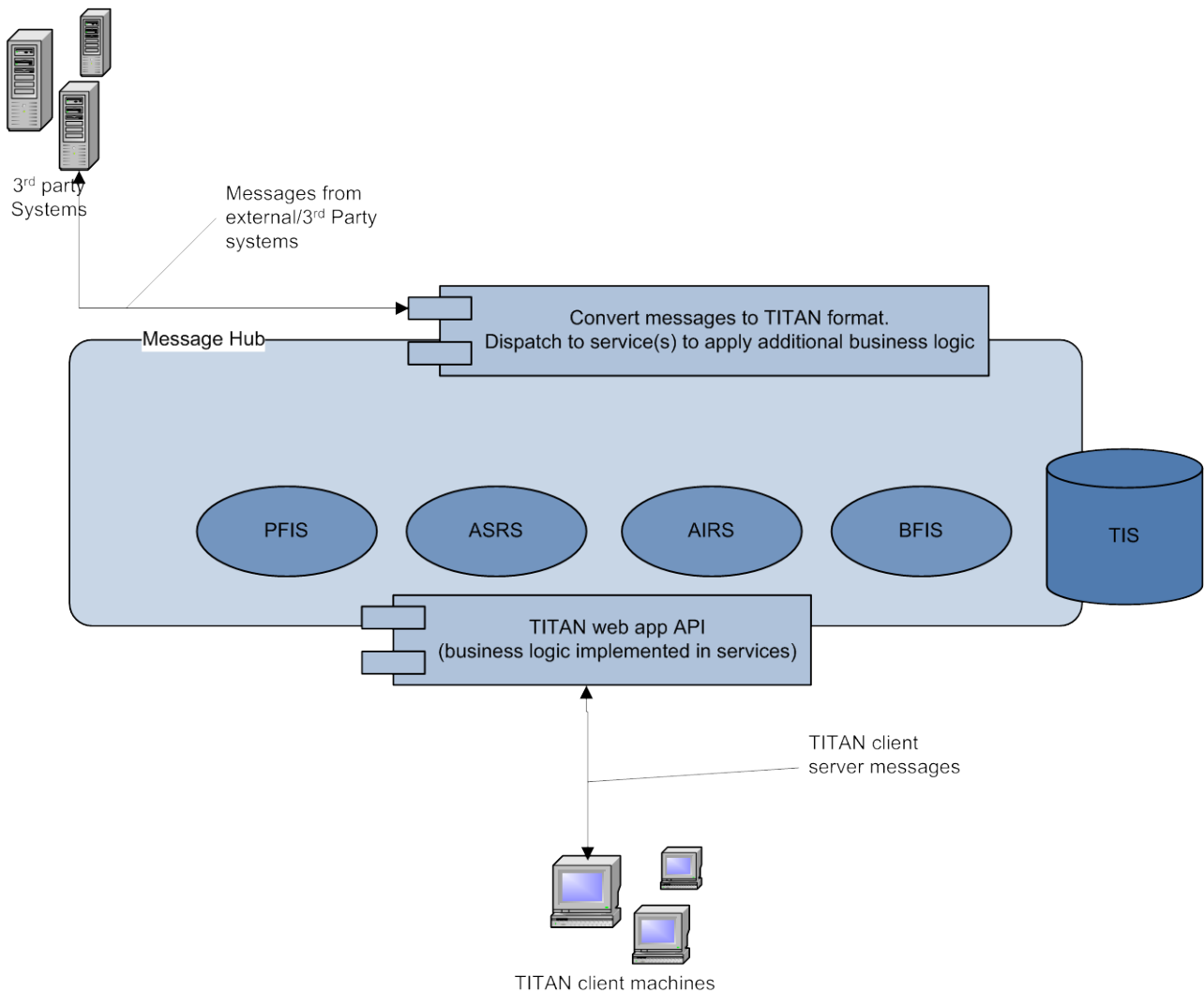


Figure 1. TITAN communications overview

### 2.1 Messages from 3<sup>rd</sup> Party systems and External Sources

A focus of this document is to identify the messages that TITAN would be expected to receive from external systems (typically A-CDM), which are often developed by 3<sup>rd</sup> Parties (3<sup>rd</sup> party systems).

The format and content of messages from 3<sup>rd</sup> party systems will often be dictated by a customer's existing message infrastructure. A TITAN tool implementation will need to translate existing A-CDM (or other 3<sup>rd</sup> party system) messages into a format usable by a future production strength TITAN tool implementation. Note that there is also the possibility

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for messages or interaction into TITAN to come from external stimulus such a conversation to a non-TITAN client, or information received over a phone call. These sources are external to TITAN, but the information may need to be used within the TITAN context; while the message source is considered to be external (to TITAN) the message format remains TITAN-compatible.

Section 3 of this document discusses these messages in more detail.

## 2.2 Message Hub

Once messages from external systems enter the TITAN Message Hub, they may need to be sent to one or more TITAN services and so TITAN business logic can be applied. The data from the messages may also be sent to TIS for persistent storage. These messages are all “internal” to a TITAN tool implementation, but would typically use a common messaging infrastructure (i.e. common messaging code used for all services).

The actual messages required on the server side will depend on the technology choices made for a TITAN tool implementation. Options range from simple to complex, as illustrated in Table 1.

Sample technology	Advantages	Disadvantages
Remote procedure calls	Simple to implement No cost / licensing issues	Least robust solution Not scalable
Industry messaging hub	Standardised system Robust and scalable	Cost May require installation and support at customer site

**Table 1. Summary of server side messaging technologies**

The actual messages required on the server side are defined by the functionality required. The non-commercial demonstrator uses Remote Procedure Calls (RPCs) – that is, the message receiving component calls methods within the services directly (taking into account that there are potentially multiple threads running at the same time).

## 2.3 Client-server messages

Client-server messages are the data sent back and forward between the TITAN client applications and the TITAN server. These are internal TITAN tool messages. For instance, when a user logs into a client page, the user’s name and password must be sent to the server for validation. As the state of a flight changes on the server side, updates must be sent back to the client so that the display can be updated.

The messages between the client and the server are unique to the actual TITAN tool implementation and exist only to support the tool (i.e. no 3<sup>rd</sup> party systems need to produce or consume these messages).

There is a selection of message formats and transports that can be used, as illustrated in Table 2.

Sample technology	Advantages	Disadvantages
Google Web Toolkit Remote Procedure Calls (GWT RPC)	Simple to implement	Not “open” – difficult to allow non GWT clients to connect to server
SOAP/XML WebApp	Standard format – allows use of standard tools  Open - simplifies creation of heterogeneous clients	Coding is more complicated  Messages may be of larger size (longer transmission times)
JSON WebApp	Standard format – allows use of standard tools  Open - simplifies creation of heterogeneous clients	Coding is more complicated  Messages may be of larger size (longer transmission times)

**Table 2. Summary of client server messaging technologies**

The non-commercial demonstrator is implemented using GWT, so all client-server communications are implemented using GWT-RPC.

### 3. TITAN SYSTEM MESSAGES

Messages in the TITAN system are required to change the state of TITAN objects. These messages may not correspond 1 to 1 to industry messages (e.g. some information communicated here by messages may actually be data included in multiple message sources, internal or external to TITAN). The information and triggers given by messages may come from systems external to TITAN, e.g. information that is coming from A-CDM systems embedded at an airport. There are also internal messages which are TITAN and TIS specific and are used only to trigger events and updates for TITAN client- server interactions.

External messages send status information and inputs from external systems which can then automatically update TITAN objects and give status information to the Message Hub. There would be no need to duplicate any of the data that is provided by these messages in TIS, as it should be retrievable from the external systems on demand, and the external systems should automatically update TIS when required.

Many of the system messages and updates in the TIS come from the clients who are connected to TIS. The clients are the decision makers in the process, and each time an action or decision is made at the client level it is required for an internal message to come back to the Message Hub, updating the objects and allowing TITAN to use the information to trigger other Message Hub related messages. Internal messages that are generated by the Message Hub combine notifications from 3<sup>rd</sup> party systems and the client messages to trigger events based on TITAN business logic.

As an example, a passenger bus driver is likely to send TITAN a message from his client to say that he has arrived at a particular stand. In the context of TITAN WP4, these messages were simulated from a “client” to emulate the decisions being made in the non-operational environment.

#### 3.1 External Messages

External messages entering and exiting the system can come from a variety of different external sources. Some external messages may be generated by 3<sup>rd</sup> party systems which the current system is connected to; however other messages may have triggers such as a human action on an external client (of 3<sup>rd</sup> party systems) which then send updated messages to the TITAN Message Hub.<sup>1</sup>

##### 3.1.1 ASRS Messages

<b>EnterAirport</b>	<i>From</i>	<i>To</i>
ASRS	External (A-CDM; ATC)	Aircraft object
Sent when an aircraft enters the airspace around the airport. For the purposes of the tool, this effectively means that the aircraft is now “in TITAN” – i.e. TITAN should be including the aircraft in its turnaround calculations.		

<sup>1</sup> In this context clients can be either internal or external to TITAN. Internal clients are directly connected to TIS, i.e. when a turnaround stakeholder logs into TITAN with one of the pre-defined roles through the GUI of the TITAN tool. On the other side, external clients have no direct access to TIS, i.e. a client of the A-CDM system through which milestone information necessary for TITAN is supposed to be sent.

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<b>On</b>	<i>From</i>	<i>To</i>
ASRS	External (A-CDM; ATC)	Aircraft object
Sent when an aircraft actually lands at the airport.		

<b>Stand</b>	<i>From</i>	<i>To</i>
ASRS	External (A-CDM; airport operator)	Aircraft object
Sent to tell the aircraft which stand to taxi to. This message may also contain information such as predicted time to stand or stand availability.		

<b>Out</b>	<i>From</i>	<i>To</i>
ASRS	External (A-CDM; aircraft or airport operator)	Aircraft object
Sent when the aircraft leaves its parking position (= AOBT).		

<b>Off</b>	<i>From</i>	<i>To</i>
ASRS	External (A-CDM; ATC)	Aircraft object
Sent when the aircraft takes off.		

<b>In</b>	<i>From</i>	<i>To</i>
ASRS	External (A-CDM; ATC)	Aircraft object
Sent when the aircraft is "in blocks". This is the official start of the turnaround process.		

### 3.1.2 AIRS Messages

<b>Reserve</b>	<i>From</i>	<i>To</i>
AIRS	External (stand/gate allocation system)	Object
Sent to indicate that a stand/gate/mobile object is reserved for an incoming flight.		



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### 3.1.3 BFIS Messages

The following BFIS messages (i.e. when a bag is checked in) would be scanned and taken from a security/monitoring (3<sup>rd</sup> party) system considered to be external to TITAN compared to the internal BFIS messages coming from the TITAN tool client (see section 3.2.3).

	<i>From</i>	<i>To</i>
<b>AtHolding</b>		
BFIS	External (security/monitoring system)	Bag object
Sent when a checked bag enters the baggage holding area.		

	<i>From</i>	<i>To</i>
<b>ToBelt</b>		
BFIS	External (security/monitoring system)	Bag object
Sent when an incoming passenger's bag is put onto the baggage belt.		

	<i>From</i>	<i>To</i>
<b>Pack</b>		
BFIS	External (security/monitoring system)	Container object
Sent when bag loading into a container begins.		

	<i>From</i>	<i>To</i>
<b>BagIn</b>		
BFIS	External (security/monitoring system)	Container object
Sent when a bag has been put in the container.		

	<i>From</i>	<i>To</i>
<b>BagOut</b>		
BFIS	External (security/monitoring system)	Container object
Sent when a bag has been removed from the container.		

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### 3.1.4 PFIS Messages

<b>PaxCheckin</b>	<i>From</i>	<i>To</i>
PFIS	External <sup>2</sup>	Passenger object
Sent when a passenger is known to TITAN as checked in; the check in type (desk, kiosk check-in, on-line) is a parameter.		

## 3.2 TITAN TIS Internal Messages

Messages within the TIS can be loosely related to the services which are being serviced by the TIS. However, the “Location Update” is a TIS internal or external message which is not exclusively associated to a specific service. Note that the “Location Update” message may have triggers such as a human action on the client side (internal), rather than only coming from an 3<sup>rd</sup> party system.

<b>LocationUpdate</b>	<i>From</i>	<i>To</i>
All services	External or Internal	Object
This message can be sent by any mobile object in the system e.g. Aircraft, Ground resources, even passengers and staff.		

### 3.2.1 ASRS Messages

<b>DeBoardPax</b>	<i>From</i>	<i>To</i>
ASRS	TITAN Client (ground handling)/TIS	Aircraft object
Sent to tell when to start the passenger de-boarding process.		

<b>UnloadHold</b>	<i>From</i>	<i>To</i>
ASRS	TITAN Client (ground handling) /TIS	Aircraft object
Sent to tell when to start the hold unloading process, including baggage, mail and cargo.		

<sup>2</sup> In case check-in is done by the passenger either on-line or at a check-in kiosk at the airport, the message comes from the relevant 3<sup>rd</sup> party system. The external nature of the message source does not change though, even if check-in is done by the check-in/passenger agent at a check-in desk at the airport, where the message is sent by an automated 3<sup>rd</sup> party monitoring system.

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<b>BoardPax</b>	<i>From</i>	<i>To</i>
ASRS	TITAN Client (ground handling)/TIS	Aircraft object
Sent to tell when to start the passenger boarding process.		

<b>LoadHold</b>	<i>From</i>	<i>To</i>
ASRS	TITAN Client (ground handling)/TIS	Aircraft object
Sent to tell when to start the hold loading process.		

<b>AllDoorsClose</b>	<i>From</i>	<i>To</i>
ASRS	TITAN Client (ground handling)/TIS	Aircraft object
Sent when the aircraft door has closed, including cargo and passenger doors.		

### 3.2.2 AIRS Messages

<b>To</b>	<i>From</i>	<i>To</i>
AIRS	TITAN Client (airport operator or ground handling)/TIS	Mobile objects (e.g. stairs)
Sent to tell a mobile object to travel to a particular stand/ gate/depot/ etc.		

<b>At</b>	<i>From</i>	<i>To</i>
AIRS	TITAN Client (airport operator or ground handling)/TIS	Mobile objects (e.g. stairs)
Sent to inform when a mobile object arrives at a stand/ gate/ depot/ etc.		



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<b>BoardBus</b>	<i>From</i>	<i>To</i>
AIRS	TITAN Client (ground handling)/TIS	Bus object
Sent to tell a bus (driver) to commence boarding passengers (either at the gate or at a remote stand).		

<b>BusFull</b>	<i>From</i>	<i>To</i>
AIRS	TITAN Client (ground handling)/TIS	Bus object
Sent to inform that a bus being loaded at a remote stand/gate has a full load of passengers.		

<b>DeBoardBus</b>	<i>From</i>	<i>To</i>
AIRS	TITAN Client (ground handling)/	Bus object
Sent to tell the bus to de-board its complement of passengers.		

### 3.2.3 BFIS Messages

<b>Dropped</b>	<i>From</i>	<i>To</i>
BFIS	Check-in desk operators/airline operator	Bag object
<p>Sent when a bag is checked in (basically when the bag enters the system). This message can be considered internal; however there are a number of ways it can be generated. For example:</p> <ul style="list-style-type: none"> <li>- An existing A-CDM message may be received.</li> <li>- It can be generated for an existing airline/check-in desk operator message.</li> <li>- A new message can be generated as check-in staff scans a baggage tag.</li> </ul>		

<b>BagLoaded</b>	<i>From</i>	<i>To</i>
BFIS	TITAN Client (ground handling)/TIS	Bag object
Sent to notify when a bag is loaded into the aircraft.		

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<b>BagUnLoaded</b>	<i>From</i>	<i>To</i>
BFIS	TITAN Client (ground handling)/TIS	Bag object
Sent to notify when a bag is unloaded from the aircraft.		

<b>Load</b>	<i>From</i>	<i>To</i>
BFIS	TITAN Client (ground handling)/TIS	Bag/Container object
Sent to inform that a bag/container can be loaded on the aircraft.		

<b>ContLoaded</b>	<i>From</i>	<i>To</i>
BFIS	TITAN Client (ground handling)/TIS	Container object
Sent to notify when a container has been loaded on the aircraft.		

<b>Unload</b>	<i>From</i>	<i>To</i>
BFIS	TITAN Client (ground handling)/TIS	Bag/Container object
Sent to inform that a bag/container can be unloaded from the aircraft.		

<b>ContUnloaded</b>	<i>From</i>	<i>To</i>
BFIS	TITAN Client (ground handling)/TIS	Container object
Sent to notify when the container has been unloaded from the aircraft		

<b>ContToHolding</b>	<i>From</i>	<i>To</i>
BFIS	TITAN Client (ground handling)/TIS	Container object
Sent to tell when to transport the container to the holding area.		



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<b>ContAtHolding</b>	<i>From</i>	<i>To</i>
BFIS	TITAN Client (ground handling)/TIS	Container object
Sent to notify when a container has arrived at the holding area.		

<b>ContToAcft</b>	<i>From</i>	<i>To</i>
BFIS	TITAN Client (ground handling)/TIS	Container object
Sent to tell when to transport the container to the aircraft.		

<b>ContAtAcft</b>	<i>From</i>	<i>To</i>
BFIS	TITAN Client (ground handling)/TIS	Container object
Sent to notify when a container has arrived at the aircraft.		

### 3.2.4 PFIS Messages

<b>BagDropped<sup>3</sup></b>	<i>From</i>	<i>To</i>
PFIS	TITAN Client (airport or aircraft operator)/TIS	Passenger object
Sent to inform when a passenger has dropped bags.		

<b>PaxSecurity</b>	<i>From</i>	<i>To</i>
PFIS	TITAN Client (airport operator)/TIS	Passenger object
Sent to inform when a passenger has passed security.		

<sup>3</sup> This message is to distinguish from the external BFIS message "Dropped". The internal PFIS message "BagDropped" links the baggage with its owner (passenger) making his bag information available for use within TITAN; otherwise a new BFIS message (i.e. "find bag") would be needed.

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<b>PaxBoarded</b>	<i>From</i>	<i>To</i>
PFIS	TITAN Client (passenger agent)/TIS	Passenger object
Sent to inform when a passenger has boarded.		

<b>PaxStatus</b>	<i>From</i>	<i>To</i>
PFIS	TITAN Client (passenger agent)/TIS	Passenger object
Sent when TITAN has identified a passenger as missing/Found/MissedFlight. If there is no status tag, the passenger is OK.		