



# TITAN

## **T**urnaround **I**ntegration in **T**rajectory **A**nd **N**etwork

**Project Number: 233690**

## Technical Requirements Document

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## EXECUTIVE SUMMARY

This document sets the high level requirements on which the TITAN models design (*Single Aircraft Turnaround Model* and *TITAN Model*) will be based.

The technical requirements apply to both, the *Single Turnaround Model* and the *TITAN model* which are oriented to serve as validation tools for TITAN validation activities.

The document describes the main characteristics that the models will have. These characteristics will allow the model developers implement the validation model according to the listed validation objectives. The high level requirements of the models are also presented including their rationale.

The result is a set of high level requirements describing a service-oriented model architecture that expresses what should be satisfied when designing and developing the TITAN models.

# 1. INTRODUCTION

## 1.1 Purpose

This document sets the high level requirements on which the TITAN models design (*Single Aircraft Turnaround Model* and *TITAN Model*) will be based.

TITAN Validation Strategy (defined in D3.1) considers the development of two models to support the validation activities:

- *Single Turnaround Model:* it will model the TITAN Operational Concept for an isolated aircraft.
- *TITAN model*: it will be an aggregated model of several *Single Turnaround Models* in the correct way to reflect the global performance of the TITAN Operational Concept in an airport operation context.

The high level model requirements set, according to the validation strategy, the required TITAN Operational Concept aspects which will be modeled and the proper mechanisms that the models will contain to allow for the performance measurement.

**All the requirements, assumptions, definitions of processes and any description presented in this document apply to both models (*Single Aircraft Turnaround Model* and *TITAN Model*), nevertheless to simplify the terminology the term "model" is used to refer to both models.**

## 1.2 Document Structure

The document firstly presents an overview of the model where the success conditions for the model and the high level characteristics have been identified. Thereafter, the high level model requirements are listed and represented in a box diagram.

## 1.3 Intended audience

This document is public and may be distributed freely, both within and outside the TITAN consortium.

## 1.4 Associated documentation

[1] TITAN_Annex_1_version 0.4, September 2009

[2] TITAN_WP1_ISD_DEL_03_v1.0_ TITAN Performance Framework , ISDEFE version 1.0, October 2010

[3] TITAN_WP1_INE_DEL_04_v1.0_TITAN Operational Concept (Issue 1), INECO, version 1.0, November 2010

[4] TITAN_WP1_SLO__DEL__01_v1.0_Analysis of the current situation. , SLOT CONSULTING, version 1.0 13/05/2010

[5] TITAN_WP1_SLO__DEL__02_v1.0_ High Level Requirements., SLOT CONSULTING, version 1.0 18/07/2010

[6] TITAN_WP3_ISD_DEL_01_v0.3_ Validation Strategy, ISDEFE, version 0.3, 27/12/2010.

## 1.5 Abbreviations and acronyms

| | |
|---|---|
| A-CDM | Advanced Collaborative Decision Making |
| BT | Business Trajectory |
| ANSP | Air Navigation Service Provider |
| CHILL | Collaborative Human In the Loop Laboratory |
| DOW | Description Of the Work |
| HMI | Human Machine Interface |
| KPI | Key Performance Indicator |
| RAMS | Reorganized ATC Mathematical Simulator |
| TITAN | Turnaround Integration in Trajectory and Network |
| UML | Unified Modelling Language |
| WP | Work Package |

# 2. MODEL OVERVIEW

***Customer***

*European Commission and TITAN Consortium*

***Problem /Opportunity***

TITAN Concept requires being validated at V1 and V2 (see [6] . TITAN Concept requires a validation tool which allows to measure expected results (using its performance targets) as well as to transfer changes in the concept to the model. Currently no commercial tool supports this kind of validation. TITAN Operational Concept is expressed in a service-oriented approach and develops new IT services. TITAN model will include software to simulate the turnaround services described in the Concept (see [3] ).

***Project vision***

The *Single Aircraft Model* and *TITAN Model* will be interactive simulation software that will allow its users to design and model the services, processes, resources, actors and scenarios of the turnaround for one (*Single Aircraft Model*) or several (*TITAN model*) aircraft. When designing airport turnaround processes the user will have access to graphical process design tools in the model. When executing a turnaround simulation, key information and indicators relating to the various elements involved in the turnaround process will be displayed on a screen, where the airport, the aircraft and the processes are visualized in a user-friendly way. It will also provide updated information about the state of each process, resource or actor. Through this information, the user will be aware of the status of the turnaround for each flight during simulation.

The model will also enable the user to interact with the simulation, (through user-defined interaction points or triggers) allowing them to modify the course of the turnaround when a decision must be taken.

In case of an unplanned event happening, TITAN model will inform the user and allow them to respond to the event in different ways in order to help address it.

TITAN model will allow KPIs measurement and generate suitable output data to support the production of analysis reports based on the simulation results, which can be assessed to check its compliance with the project objectives.

***Success Conditions***

***Provide a model that communicates effectively to the EC and the users[1] the behaviour of the TITAN Operational Concept:***

- Establish a clear, visual language & identity (layout, typography, animations...) which allow the users during and after the simulation to:
  - Follow the process flow (showing the relevant milestones defined in D1.4 (see [2] ) as they take place for the turnaround processes modeled.
  - Be alerted when certain events happen during the simulation of TITAN validation

scenarios (events as defined in D3.2 Validation Exercise Plan).
  - Get results (as established in D3.2 Validation Exercise Plan) to help validate the TITAN Operational Concept.
- Provide suitable simulation outputs to support quantitative measurements of the benefits provided by TITAN Concept through the comparison between the baseline (the current turnaround scenarios) and TITAN scenarios.
  - A set of KPIs is selected according to the validation strategy for each exercise (in the exercise definition within TITAN WP3.2) from the ones defined in TITAN deliverable D1.3 (see [2] ).
  - Those output data will allow the user to produce a report at the end of each exercise for each of the selected KPIs[1].

***Provide a model that supports a V1 and V2 maturity level validation of the TITAN Operational Concept.***

- TITAN model will provide suitable simulation modeling features and simulation outputs and results to allow the user to produce evidence of the coherence of TITAN Operational Concept with SESAR.
  - Conceptual coherence will be supported by the capability of assessing compliance of the services and milestone definition.
  - Operational coherence will be supported by the capability of modelling a set of KPIs taken from the TITAN performance framework (see [2] ).

  These KPIs will be selected according to the validation scenarios objectives.
  - The simulation exercise will be considered to provide a positive outcome[2] if the KPI values are between certain limits as defined in the validation exercise description. In the event that the model reveals KPI's outside the target range(s) this will represent a negative outcome.
- TITAN model will provide suitable outputs and results to allow the user to make quantitative assessments of the potential improvements resulting from the TITAN concept (looking to fulfill TITAN objectives) in terms of efficiency, flexibility and predictability
  - Efficiency: TITAN target for the reduction in the number of delayed flights is 9%. Delayed flights are defined as the flights with departure delay (AOBT) higher than 15 minutes. The model shall therefore provide suitable outputs to allow users to determine the number of delayed flights using this definition of delay.
  - Predictability: TITAN target for the reduction in the standard deviation of the Scheduled Off-Blocks Time (SOBT) is from 18 to 3 minutes. The model shall therefore provide suitable outputs to allow the SOBT variation to be measured.
  - Flexibility: TITAN aims to ensure that the turnaround remains compliant with objectives defined for Efficiency and Predictability even under unexpected

[1] Model users are considered to be the technicians that will perform the concept validation using the model in TITAN WP3r by a post-processing tool that will produce the metrics based on simulation outputs

conditions.

TITAN model will therefore provide features for modeling unexpected conditions (as defined in the validation scenarios in TITAN deliverable D3.2) and record outputs that support the measurement of the recovery delay factor of the turnaround process (by using the Disruption validation scenario defined in D3.1 (see [6] ).

- TITAN model will provide outputs that allow the analysis of conditions which are considered of great importance to different stakeholders (user requirements collected in D1.2, see [5] )
  - TITAN model will allow the user to create validation scenarios and to measure the concept performance for:
    - Different levels of traffic growth.
    - Different rates of late passengers (late passenger rate = Number of Passengers arriving late to the boarding gate/ total number of passengers).
    - Different amounts of lacking resources.
    - Different rates of delayed flights.
  - TITAN model will provide suitable modeling features and outputs to support comparisons between baseline turnaround performance (i.e. without TITAN) and TITAN Operational Concept performance in the specific validation scenarios.
    - Comparison will be achieved by means of a set of pre-defined KPIs in each specific scenario.

*The exercise definition is included within the D3.2 Validation exercise plan and includes a list of the KPIs.*

***Added value***

TITAN model could be used, according to the project DOW (see [1] ), to simulate the turnaround process for later studies.

TITAN model will encourage the understanding of the close relation between information flows and reaction to events.

TITAN model will enable the user to test new airline policies[3] regarding the turnaround. Airline policies will be included into the model by defining a set of rules or input parameters.

- During exercise definition, different airline policies will be modeled based on what is interesting to analyze during concept validation.

***Hypothesis***

TITAN concept will consider A-CDM fully implemented, therefore processes will know the status and performance of the other services.

[3] The airline policy is the specific processes and typical service values implemented for a specific airline as well as the prioritization rules to allocate resources to its flights. Each single aircraft model and an additional tag associated to it defining the priority of the flight will represent the airline policy.

| | |
|---|---|
| | The model must be able to model a standard airport configuration previously defined in D3.2 Validation exercise plan. This standard airport configuration will represent a real medium-sized (an airport is considered medium-sized if it has between 20,000 to 50,000 departures per year) European airport.<br>The model will use traffic samples, compatible with existing tools such as RAMS or CHILL, based on either traffic distributions or real-life traffic data if suitable data in a compatible format is available. |
| | Today's operations will be used as the baseline (via current turnaround scenarios). The model must be able to model standard operations (e.g. services are not aware about the status or the performance of other services). |
| ***High quality characteristics and performances*** | |
| | TITAN model shall provide suitable output information to allow the user to measure the TITAN Operational Concept Performance (KPI, estimated times…) as defined in the TITAN Operational Performance Framework (D1.3) |
| | In support of concept presentation, marketing and stakeholder communication, the TITAN model shall be visually attractive and easy to understand. |
| | TITAN model shall be web enabled. |
| | TITAN model shall allow the user to configure the turnaround process thus allowing the modification of predefined processes, services or rules during scenario preparation. |
| | TITAN model shall allow the user to interact with the turnaround process while it is being simulated in order to make decisions (e.g.: incorporate different airline policies; prioritize resource assignment or processes execution). |
| | TITAN model shall simulate unplanned events occurring in the turnaround (e.g. lack of resources) |
| ***Architecture*** | |
| | TITAN model is service oriented. It is composed of two types of services: services for turnaround and services in support of processes.<br>The first services represent the turnaround operations and comprise processes, resources, actors and scenario.<br>The second type, “services in support of processes” represents the added value of the operational Concept and provides information required for the proper execution of the turnaround process.<br>The following figure shows the high level model architecture. |

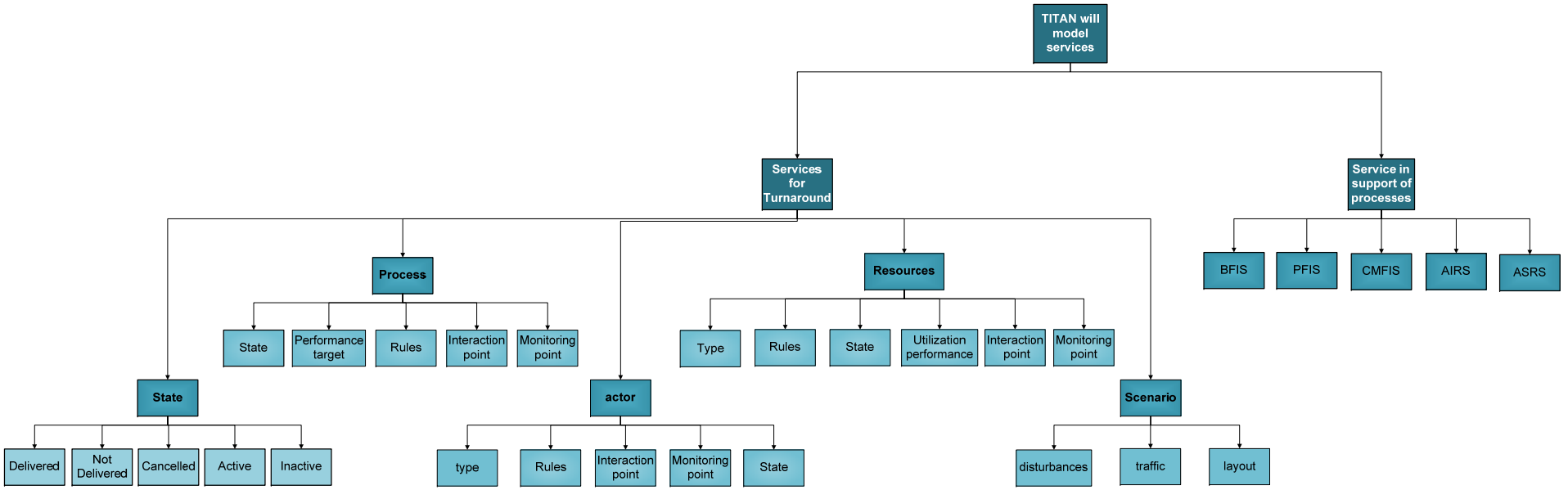



**Figure 1: Service oriented Model Architecture**

### *Issues and Risks*

The following figure shows the risks and issues that have been taken into account in the definition of the requirements, as well as their possible effect on the model design and development.

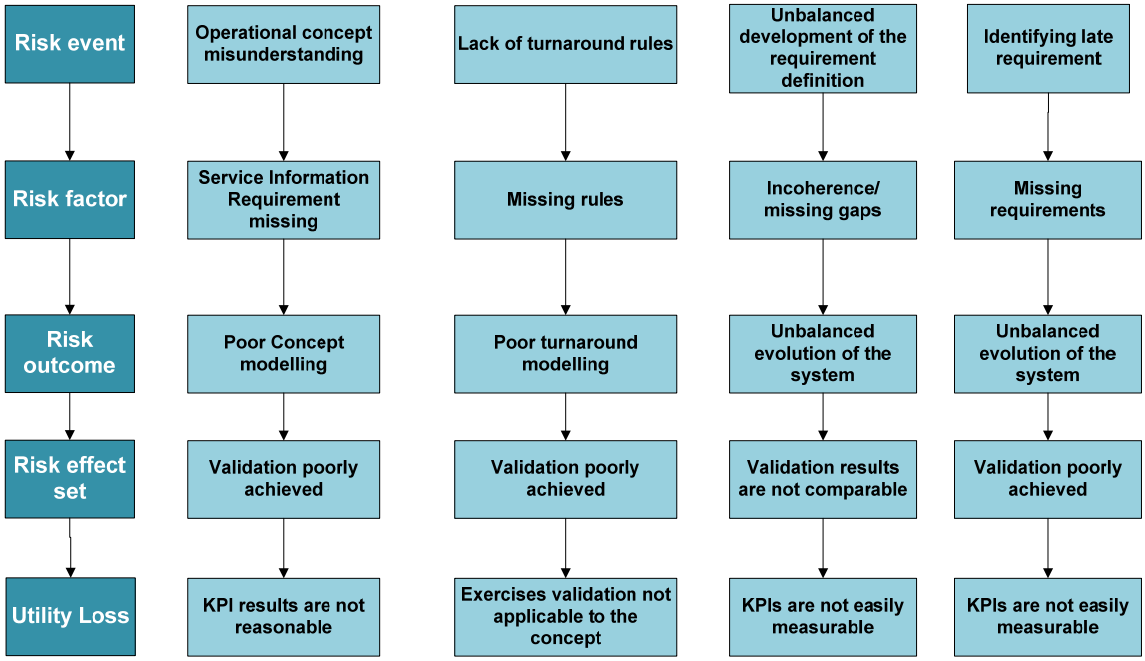



**Figure 2: Model Issues and Risks**

# 3. HIGH LEVEL MODEL REQUIREMENTS

## 3.1 Introduction

The high level model requirements have been developed following a service-oriented architecture. They give information regarding how the services will be modeled using suitable model entities to characterize them, their interactions and the user intervention. The requirements can be summarized in a box tree showing a hierarchy from the high level definition of the requirements towards lower levels.

Requirements are labeled into groups of three characters (letters) identifying a group of requirements dealing with a common topic. Within the same group each requirement is labeled by a different three-digit number. These are the groups of requirements considered:

- SER: Services definition requirements.
    - SFT: Services for turnaround definition requirements.
        - STT: States
        - PRO: Processes
        - ACT: Actors
        - SCE: Scenarios
        - RES: Resources
    - SIP: Services in support of processes definition requirements.

The lower the requirement is situated within the High Level Requirement Hierarchy (represented in**¡Error! No se encuentra el origen de la referencia.**), the more groups of three characters its name has.

In this document the requirements are presented in tables identified by the requirement number and its associated module/application. The following figure shows the structure of the tables used to describe the requirements.

| Number | XXX-XXX-999 | Module/ Application | |
|---|---|---|---|
| **Title** | *Descriptive name of the requirement* | | |
| **Description** | **Why:** Explanation about why this requirement is needed.<br>**What:** *Requirement description*. | | |
| **Conceptual Information Model** | *Figure to allow the position of the requirement within the service oriented architecture.* | | |
| **Date:** *date of the change* | **Change Reason:** *explanation about why this requirement has changed (this will be filled only for requirements which may need a change)* | **Module / Application:** *associated module where the change applies.* | |

**Figure 3: Requirement definition structure**

## 3.2 High Level Model Requirements

| Number | SER-001 | Module/ Application | |
|---|---|---|---|

| | |
|---|---|
| **Title** | TITAN model shall simulate services. |
| **Description** | **Why**<br>TITAN model will be service-oriented.<br><br>**What**<br>Service is something that is needed for the process to proceed; the subsequent delivery of services contributes towards the overall aircraft turnaround process completion. Services in the TITAN concept of operation context include operational services but exclude technical/IT services. |
| **Conceptual Information Model** | TITAN will model services |
| **Date** | **Change Reason** / **Module / Application**<br><br># / # |

| Number | SER-001-001 | Module/ Application | |
|---|---|---|---|

**Title**

TITAN model considers two types of services:

- Services for turnaround
- Services "In support of processes."

**Description**

**Why**

TITAN model shall be service-oriented and considers two kind of services:

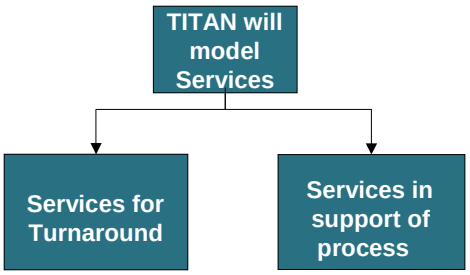
- TITAN services for turnaround which serve for defining the turnaround concept of operation.
- TITAN services "in support of processes" which are the information services considered in TITAN operational concept.

**What**

- Services for turnaround are those contributions of actors or processes (usually by means of resource provision) to the turnaround processes which directly contribute to the turnaround process consecution. These services can be oriented to passenger, baggage or aircraft service.
- "Services in support of processes" are described in the D1.4 "Operational Concept" (see [3] ). They provide updated information on the state of processes, resources or turnaround actors.

#

**Conceptual Information Model**




| Date | Change Reason | Module / Application |
|---|---|---|

| Number | SER-001-SFT | Module/ Application | |
|---|---|---|---|

**Title**

Services for turnaround shall be characterized by these elements:

- Actors
- Resources
- Processes
- Scenario
- State

**Description**

**Why:**

Actors, resources and processes in the turnaround must be considered in the concept validation. As a service-oriented architecture is being used; the actors' roles, use of resources and involved processes associated to each service must be identified.

State will serve to set up the interrelation between services and to follow the process flow during the simulation.

Several scenarios will serve to consider different situations in order to completely evaluate the concept.

**What:**

Actors are the main organizations defined as actors in D1.4 TITAN operational concept (see [3] ); they can trigger processes (ground handlers, airport…)

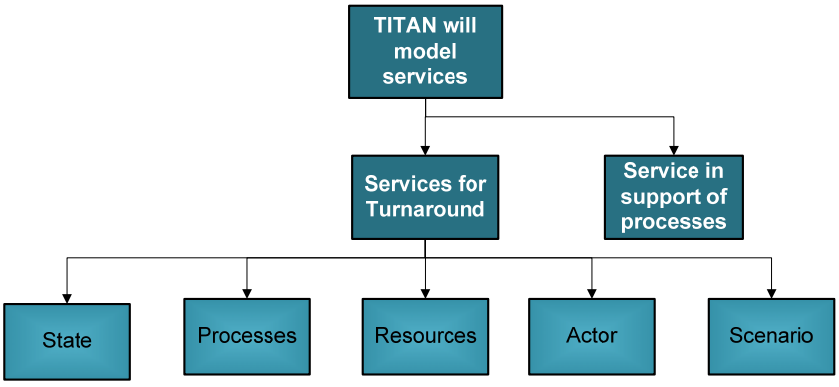
Resources are elements required to carry out a process, for example a fuel truck, or a baggage belt. These resources are used by several actors in different processes, therefore a lack of a specific resource may occur when all the resources available in the defined scenario are being used at the same time.

Processes are the "series of actions" towards a particular result, as an example, to load mail/cargo.

Scenario is the physical place and conditions where services take place, e.g. different-size terminals or platforms.

State describes what is currently happening to a given service.#

**Conceptual Information Model**




| Date | Change Reason | Module / Application |
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## 3.2.1 Services for turnaround Requirements

### 3.2.1.1 States Requirements

| Number | SER-001-SFT-STT | Module/ Application | |
|---|---|---|---|

**Title**

Services shall be defined by the following states:

- Active#
- Inactive#
- Delivered
- Cancelled
- Not delivered#

**Description**

**Why**

It is necessary to be aware of what is happening to each service at any moment in order to control the turnaround flow and general status. According to the service definition, at any moment, each service has or has not been delivered to its corresponding process.

Some expected services can be cancelled under some conditions, either by means of predefined rules or by the user. For example catering service can be cancelled for short-haul flights, depending on the airlines' policies, when some conditions occur. Services cancelled due to a flight cancellation could also be an example.

**What**

Active: The service will be available during the simulation.

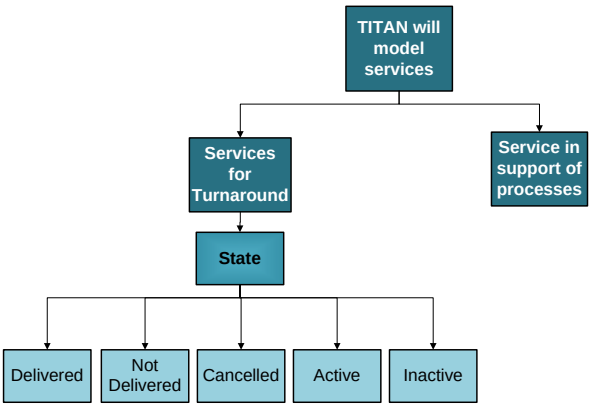
Inactive: The service has been disabled before starting the simulation and it will not be available during it.

Delivered: The service has been carried out using the required resources and actors' involvement, contributing to the completion of one or several processes.

Not Delivered: The service has not been carried out yet.

Cancelled: the service has not been carried out and it is not applicable any more.

**Conceptual Information Model**




| Date | Change Reason | Module / Application |
|---|---|---|

### 3.2.1.2 Processes Requirements

| Number | SER-001-SFT-PRO | Module/ Application |
|---|---|---|

**Title**

Processes shall be characterized by the following elements:

- Rules
- State
- Objective
- Interaction Point
- Monitoring Point

**Description**

**Why:**

The list above contains the characteristics which allow defining the process aspects interesting from TITAN validation point of view. Rules, state, and performance target define the turnaround process flow and interactions. Interaction and monitoring points serve (to the user and the system) to interact with the process and monitor it.

The model shall use the monitoring/interaction points as the identified points of the process where recording information/allowing an interaction to make a decision is required (e.g. AOBT update, EIBT update, decide if a flight must wait for a missed passenger, decide if a flight must be reallocate to a stand different from the scheduled one, decide the number of check-in desk assigned to a flight, decide if catering is carried out or not, in case of lack of resources prioritize them…).

**What**:

Processes are considered as “series of actions” towards a particular result, as an example, to load mail/cargo.

Rule: Specific procedure defining the process flow. For example, a junction (decision) point could exist that depends whether the passenger is going to a domestic or international flight. This could be tested using the (input-property: international) rule, which will return TRUE if international and FALSE otherwise.

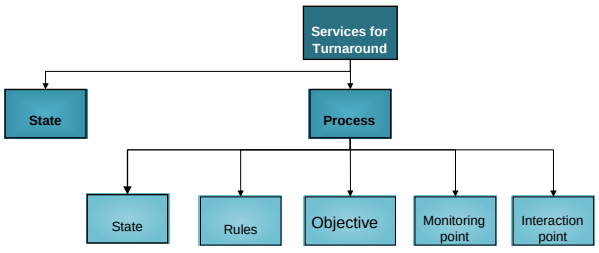
State: describes what is currently happening to a given process.

Objective: Describes the operational objectives when the process is being executed, it considers the airline policies (e.g. to minimize the time at gate or to minimize the resources consumed)

Interaction point: Events requiring a decision from the user or the system.

Monitoring point: Informative event displayed on the model screen or stored in a data base

**Conceptual Information Model**




| Date | Change Reason | Module / application |
|---|---|---|

| Number | SER-001-SFT-PRO-001 | Module/ Application |
|---|---|---|

**Title**

Processes shall be characterized by one of the following states:

- Blocked
- Cancelled
- Waiting
- Ready
- In progress
- Completed

**Description**

**Why:**

It is necessary to reflect what is happening to each process at any moment in order to control the turnaround flow and general status. According to the process definition, at any moment, each process may or may not be executing. If it is not executing, it may be blocked due to another process or resource/actor unavailability; it may have already been executed and finished; it may have been cancelled or it may simply be waiting to be executed. In any case, all the possible states must be identified and defined in the model.

**What**:

Blocked: Process that cannot be performed due to an unexpected event (fuelling hydrant is broken, this event has blocked the loading process) but will continue when the unexpected event is solved.

Cancelled: A process that is no longer considered (e.g. due to a delay, the catering loading process has been cancelled)

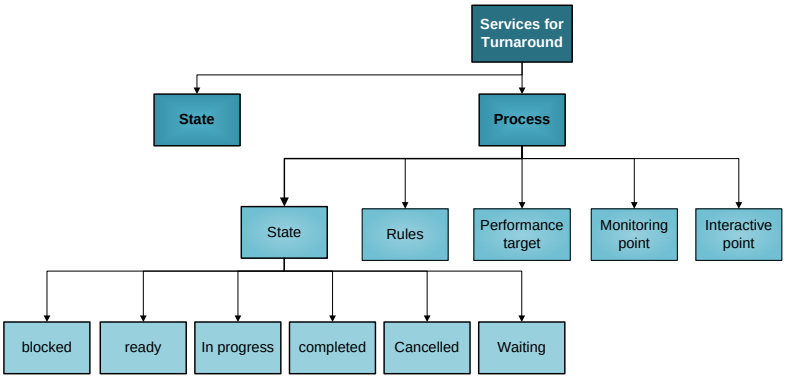
Waiting: Process that cannot be carried out until other actions are performed (i.e. boarding process waiting for passenger to arrive at the gate)

Ready: Process ready to be carried out.

In progress: The process is currently being executed and therefore the associated resources are being used.

Completed: The process has been finished and the associated resources consumed or freed up.

**Conceptual Information Model**




| Date | Change Reason | Module / Application |
|---|---|---|

| Number | SER-001-SFT-PRO-002 | Module/ Application |
|---|---|---|

**Title**

Two types of rules shall be considered:

- Static
- Dynamic

**Description**

**Why:**

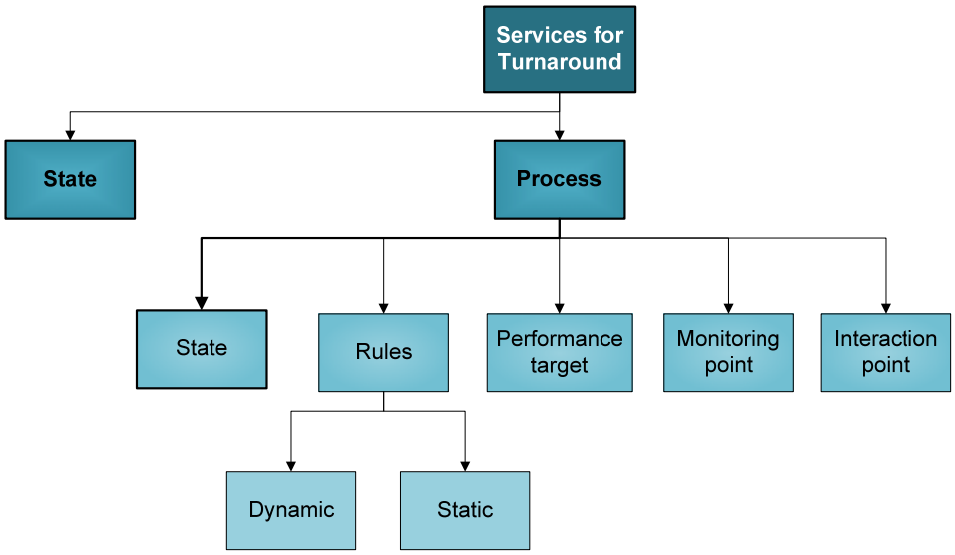
The rules define the process flow, which depends on general turnaround procedures but that may also change when external events impact it. For this reason different kind of rules need to be defined.

**What:**

Static: Static rules refer to fixed procedures. Static rules may concern safety or airline policies (catering process shall be carried out for long-haul flights)

Dynamic: Rules whose application depends on external events (if late passenger rate is above 5% boarding process shall not start)

**Conceptual Information Model**

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| | # | # |

| Number | SER-001-SFT-PRO-003 | Module/ Application | |
|---|---|---|---|

**Title**

Dynamic rules shall consider:

- Conditions
- Actions

**Description**

**Why:**

One of the model objectives is to assess the benefit of the information availability. To this aim two mechanisms will be useful:

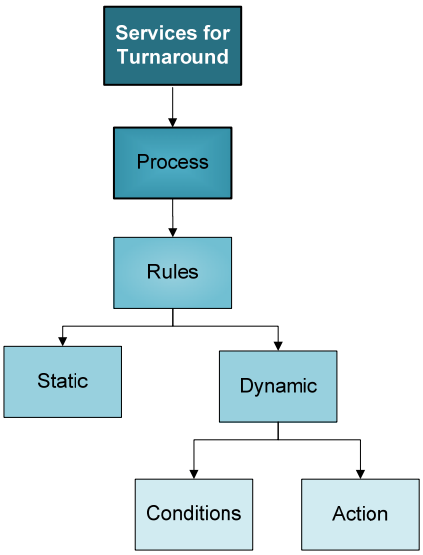
- To define rules to use the available information and implement them into the model.
- To provide the user with the available information and allow him/her to make decisions regarding the turnaround process through an interaction point.

**What:**

Conditions: Premise upon which the rule will be activated. e.g. "i late passenger rate is above 5%"

Actions: Depending on the condition premise, presents one or several options for the process. If there are several options, the user will be able to chose one, e.g. Begin, Pause, Continue, Cancel.

**Conceptual Information Model**




| Date | Change Reason | Module / Application |
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| Number | SER-001-SFT-PRO-004 | Module/ Application | |
|---|---|---|---|

**Title**

Performance target shall be characterized by one or several of these elements:

- Time target
- Throughput target
- Resource utilization target

**Description**

**Why:**

Objective describes the specific operational objectives for individual processes. Several kinds of performance targets can be more or less suitable for a specific process according to the specific process nature and its impact on the global operational concept performance. Different kinds of performances targets must be taken into account in the model to assess their contribution to the achievement of the operational concept objectives (regarding predictability, flexibility, efficiency and cost effectiveness).

Airline policies are performance targets only applicable to processes carried out for the specific companies following them.

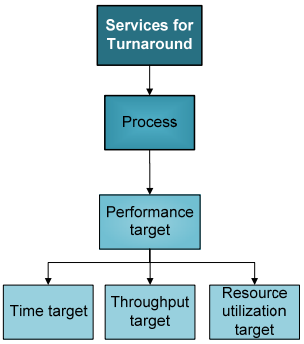
**What:**

Time target: It it used for those processes that need to be carried out in a target time. For example, in order to meet EOBT (Estimated Off Block Time), it is necessary that several processes are completed on time, and these times will be called "target times"

Throughput target: Some processes cannot be simply characterized by a target time because the process execution depends highly on external factors. In this case, it is more reasonable to define a throughput target. For example, the security process depends on the passenger arrival rate, but the security process can be carried out with an efficient throughput, for example, 2 passengers per minute.

Resource utilization target: Airlines may possibly decide to weight the economic target, in this case a resource utilization target. For example the maximum number of check in desk used for a flight check-in process.

**Conceptual Information Model**




| Date | Change Reason | Module / Application |
|---|---|---|

| Number | SER-001-SFT-PRO-005 | Module/ Application | |
|---|---|---|---|

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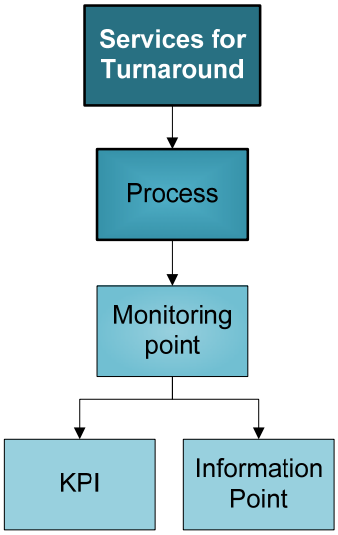
|---|---|
| **Title** | Two types of monitoring points shall be considered:<br>• KPI<br>• Information Point |
| **Description** | **Why**<br>The monitoring of all the KPIs is required as defined in performance framework (see [2] ). The model will also need to register other kinds of information (e.g. process state updates, scenario updates, milestone timing or estimated times)<br>**What**<br>KPI: relevant information defined as KPI, which may require the use of a formula.<br>Information point: Relevant information point not defined as KPI. |
| **Conceptual Information Model** |  |

| Date | Change Reason | Module / Application |
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| Number | SER-001-SFT-PRO-006 | Module/ Application | |
|---|---|---|---|

**Title**

Two types of information points shall be considered:

- Milestones
- User information point

**Description**

**Why**

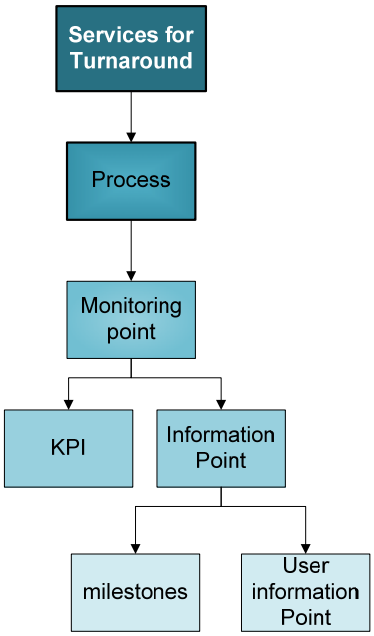
There is information, in addition to the KPIs, which should be monitored by the model. This information can be classified as Milestones and any other information required by the user.

**What**

Milestones: These information points are common to every turnaround process and monitor the general status of the turnaround. TITAN milestones will be used as defined in TITAN operational concept (see [3] )

User information point: User will define special information points for each simulation at which he/she wants to be informed about the general status of the turnaround and its processes, the status of a specific Milestone or about the value of an indicator due to the nature of the exercise. The TITAN model will expose an agreed set of internal data points which the user can choose to display if required.

**Conceptual Information Model**




| Date | Change Reason | Module / Application |
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| Number | SER-001-SFT-PRO-007 | Module/ Application | |
|---|---|---|---|

**Title**

Two types of interaction points shall be defined:

- TITAN service interaction
- User interaction

**Description**

**Why:**

One of the model objectives is to assess the benefit of the information availability and use. To this aim two mechanisms will be useful:

- To define rules to use the available information and implement them into the model. This implies defining interaction points where the model will make decisions using the information and applying the rules.
- To provide the user with the available information and allow him/her to make decisions regarding the turnaround process. This implies defining interaction points where the model will allow the user to make decisions using the information.

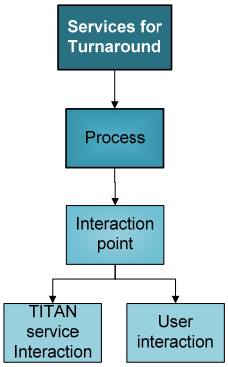
**What**

TITAN service interaction: the model will take decisions based on the rules previously defined. These decisions will be based on the information provided by the previous information point. (e.g. If the planned stand to be used by an arrival flight is estimated to be unavailable for more than 10 minutes from planned EIBT and the planned EIBT time is more than 30 minutes from now, a new available gate will be assigned to the flight)

User interaction: Interaction points, previously defined by the user, providing the user with the required information for executing an action. (e.g. the user configured the model to inform him, during the model simulation, each time when a planned stand to be used by a flight is estimated to be unavailable and allow him to make the decision about carrying out a gate reallocation or not). Associated to the user interaction will be a user information point which will also be configured by the user at the beginning of the exercise.

The TITAN model will expose an agreed set of internal interaction points which the user can choose to monitor and trigger decision points during simulation.

**Conceptual Information Model**




| Date | Change Reason | Module / Application |
|---|---|---|

### 3.2.1.3 Actors Requirements

| Number | SER-001-SFT-ACT | Module/ Application | |
|---|---|---|---|

**Title**

Actors shall be characterized for the following elements:

- Rules
- Interaction point
- Monitoring point
- State
- Type

**Description**

**Why:**

The above list contains the required elements to model the actors' role in TITAN operational concept and also link them to their associated services within the established model architecture.

**What:**

Rule: Specific procedure defining the actors' role in the process.

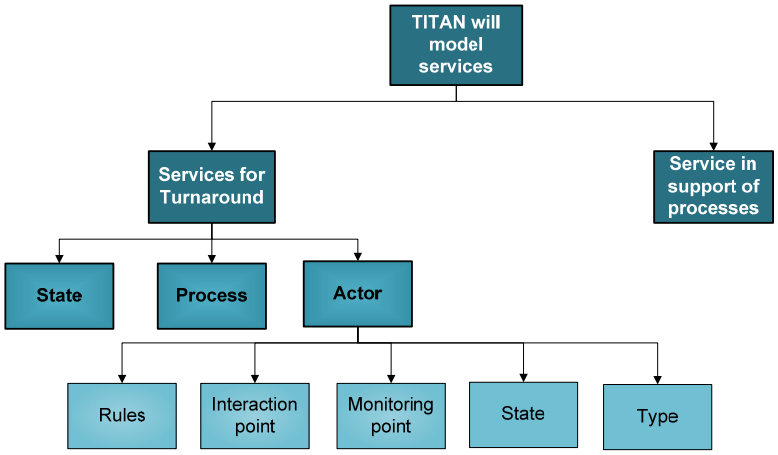
Interaction point: Events requiring a decision from the user or the system.

Monitoring point: Informative event displayed on the model screen or stored in a data base.

State describes what is currently happening to an actor, specifying if it is available to take part in a process or not.

Type: It refers to the actor's nature (ground handler, airport…), different types will be characterized by different elements (see following requirements)

**Conceptual Information Model**




| Date | Change Reason | Module / Application |
|---|---|---|

| Number | SER-001-SFT-ACT-001 | Module/ Application | |
|---|---|---|---|

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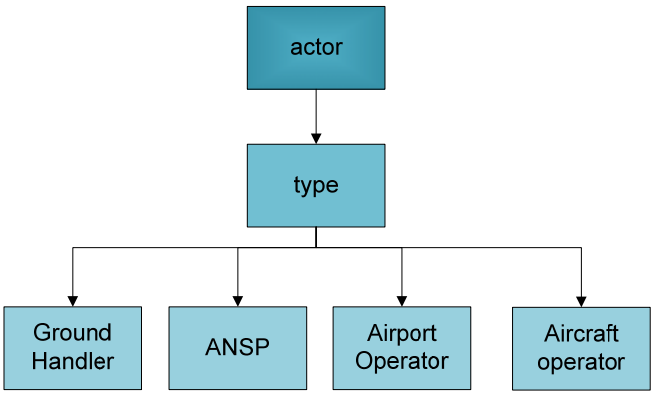
|---|---|
| **Title** | Types of Actors considered shall be:<br>• Aircraft operator<br>• ANSP<br>• Airport operator<br>• Ground handlers |
| **Description** | **Why:**<br>The model must include the actors considered in TITAN operational concept and their roles.<br><br>**What:**<br>• Aircraft operator: Comprises the persons/institutions associated with the Aircraft operator organization as defined in TITAN operational Concept (see [3] )<br>• ANSP: Comprises the persons/institutions associated with the ANSP organization as defined in TITAN operational Concept (see [3] )<br>• Airport operator: Comprises the persons/institutions associated with the Airport operator organization as defined in TITAN operational Concept (see [3] )<br>• Ground handlers: Comprises the persons/institutions associated with the Ground handler organization as defined in TITAN operational Concept (see [3] ) |
| **Conceptual Information Model** |  |
| **Date** | **Change Reason** **Module / Application** |

### 3.2.1.4 Scenario Requirements

| Number | SER-001-SFT-SCE | Module/ Application | |
|---|---|---|---|

**Title**

Scenario shall be characterized by:

- Disturbances
- Traffic
- Layout

**Description**

**Why:**

To consider different situations in order to widely evaluate the concept.

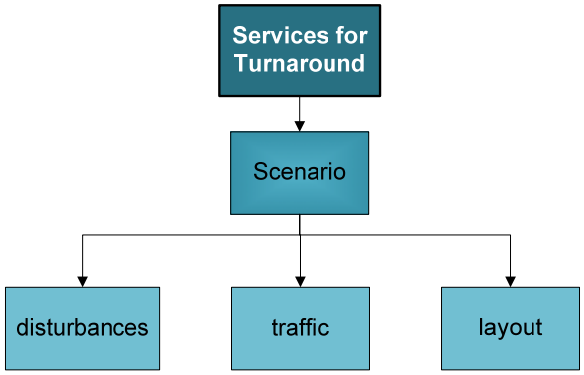
**What:**

Disturbances: Events that may occur due to the scenario configuration (These disturbances or possible unexpected events will be defined for each scenario)

Traffic: Set of flights that will be simulated during a run of the mode.

Layout: Physical description of the airport configuration, position of stands, gates etc.

**Conceptual Information Model**




| Date | Change Reason | Module / Application |
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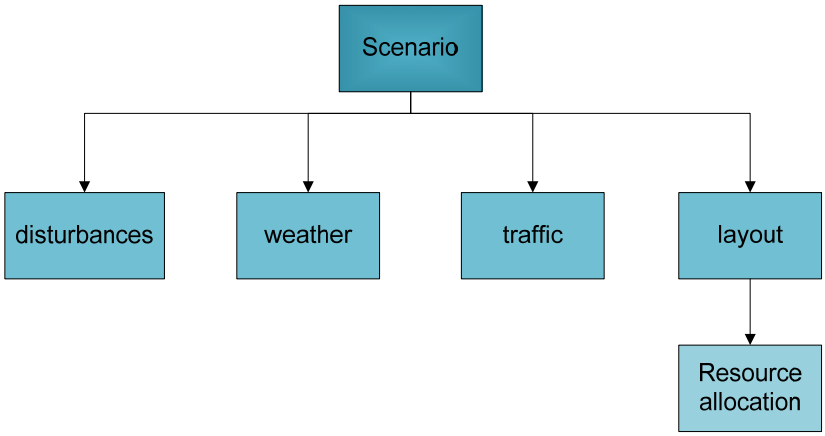
| Number | SER-001-SFT-SCE-001 | Module/ Application | |
|---|---|---|---|

| | |
|---|---|
| **Title** | Layout shall be characterized by the total number of resources available, and their estimated average travel times. |
| **Description** | **Why:**<br>Because the resource availability needs to be known (that is provided by the state of the resource) as well as the time needed from the resource is requested until it can be used.<br><br>**What:**<br>Resource allocation is understood as:<br>- Number of the resources not being used and their corresponding travel times.<br>- Quantity of Resources in any position.<br>Knowing a position implies knowing the travel time from/to any stand of the airport or any point.<br>Every time a resource is required or freed up the layout shall be updated. |
| **Conceptual Information Model** |  |
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| **Date** | **Change Reason** **Module / Application** |

### 3.2.1.5 Resources Requirements

| Number | SER-001-SFT-RES | Module/ Application |
|---|---|---|

**Title**

Resources shall be characterized by the following elements:

- Rules
- Type
- State
- Utilization Performance
- Interaction Point
- Monitoring point

**Description**

**Why :**

These are the required elements to model the resources in TITAN operational concept and also link them to their associated services within the established model architecture.

**What**:

Rule: Specific procedure defining the resource involvement in the process.

Type: It refers to the resource nature (fixed or mobile). Different types of resources will be characterized by different elements (see following requirements)

State describes what is currently happening to a resource, specifying if it is available to take part in a process or not.

Utilization Performance: describes the usage of a resource.

Interaction point: Events requiring a decision from the user or the system.

Monitoring point: Informative event displayed on the model screen or stored in a file.

**Conceptual Information Model**

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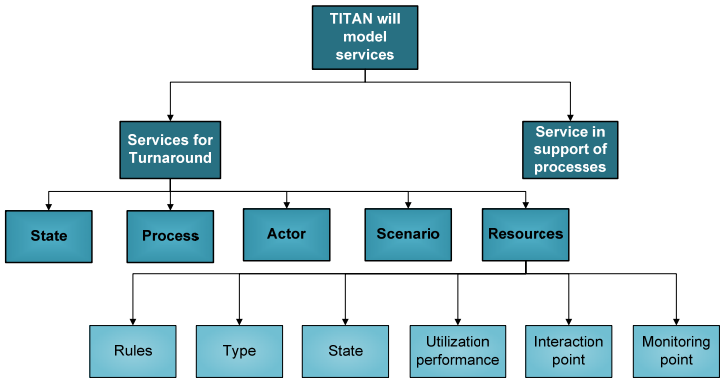
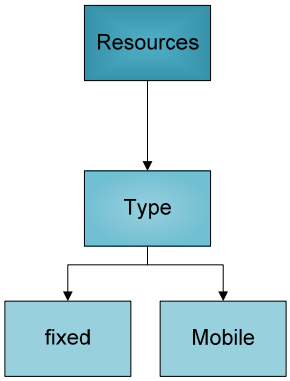



| Date | Change Reason | Module / Application |
|---|---|---|

| Number | SER-001-SFT-RES-001 | Module/ Application | |
|---|---|---|---|
| **Title** | Two types of resources shall be considered:<br>• Mobile<br>• Fixed | | |
| **Description** | **Why:**<br>The resources can be usually located at the stand or in another place. If the resource is not located at the stand it will need some travel time to arrive to it . That is why mobile and fixed resources are modelled in a different way.<br><br>**What:**<br>Fixed: The resources located at the stand, for example the fuelling hydrant, cannot be used by any actor outside that stand .<br>Mobile resources, such as the fuelling truck, can be shared by several actors and the location on the platform may be far away from the aircraft requiring it. | | |
| **Conceptual Information Model** |  | | |
| **Date** | **Change Reason** | **Module / Application** | |
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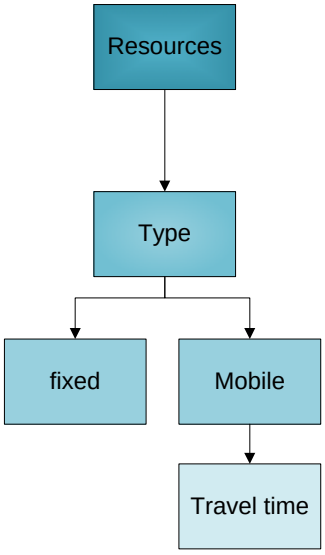
| Number | SER-001-SFT-RES-002 | Module/ Application | |
|---|---|---|---|
| **Title** | Mobile resources shall be characterized by the “travel time” | | |
| **Description** | **Why:**<br>Mobile resources are usually not located at the stand where they are needed and therefore the model will need to take into account the travel time to arrive to the stand.<br><br>**What:**<br>Travel time is the time required for any mobile resource to arrive from its location to the stand in question. | | |
| **Conceptual Information Model** |  | | |
| **Date** | **Change Reason** | **Module / Application** | |
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| Number | SER-001-SFT-RES-003 | Module/ Application | |
|---|---|---|---|

**Title**

Two states shall be considered for resources:

- Available
- Not available

**Description**

**Why:**

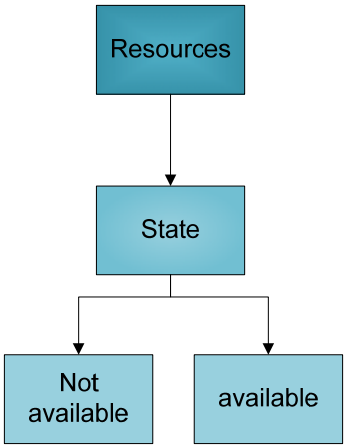
Resource unavailability may cause delays and TITAN operational concept intends to avoid this problem by improving the airport resource allocation through its information system, by monitoring the resources. For this reason the model must consider the resource monitoring.

**What:**

Available: There are resources available to satisfy the resource request. The layout contains information regarding resource locations and their travel time to the stand where they are needed.

Not available: All the resources are being used and therefore the resource request cannot be satisfied.

**Conceptual Information Model**

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| Number | SER-001-SFT-RES-004 | Module/ Application | |
|---|---|---|---|

**Title**

Resource Utilization performance shall be characterized by:

- Failure rate
- Quantity
- Resource utilization velocity

**Description**

**Why**

We need to model how TITAN Concept impacts the resource utilization.

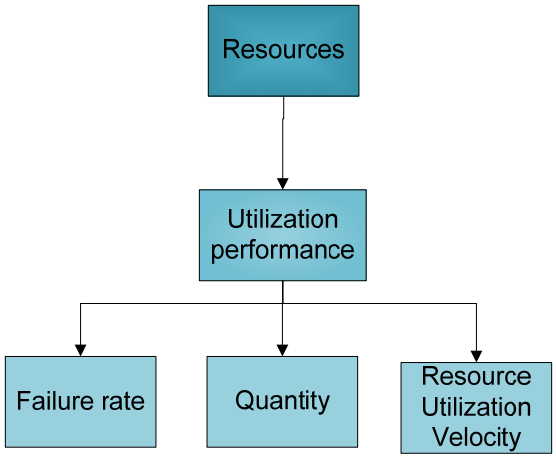
**What:**

Failure rate is a user defined rate for any resource to be unavailable for a period of time during the simulation. If no failure rate is defined, failure rate = 0.

Quantity: Quantity of resources required to carry out a process

Resource Utilization Velocity: Different airline policies affect the performance of the resource usage, for example, low cost airline can achieve quite a fast check-in with few check-in desks.

**Conceptual Information Model**




| Date | Change Reason | Module / Application |
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### 3.2.2 Services in support of processes Requirements

| Number | SER-001-SIP | Module/ Application |
|---|---|---|

**Title**

Services considered as "Services in support of processes" shall be:

- Passenger Flow Information Service - PFIS
- Baggage Flow Information Service - BFIS
- Cargo/Mail Flow Information Service - CMFIS
- Aircraft Status Report Service - ASRS
- Airport Information Report Service – AIRS

**Description**

**Why**

Because these are the services in support of processes presented in TITAN operational concept.

**What**

PFIS: This service provides information about passenger flow

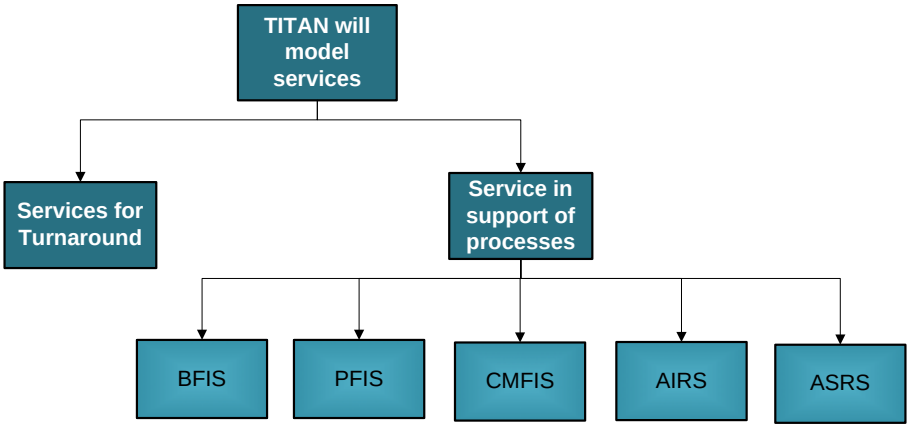
BFIS: This service provides information about baggage flow

CMFIS: This service provides information about cargo/mail flow

ASRS: this service provides information about aircraft status

AIRS: This service provides information about availability and location of airport facilities

**Conceptual Information Model**

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