# Global Dispatcher - Requirement Catalogue

| Document Control | | | |
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| **Version** | **Date** | **Author** | **Changes** |
| 0.1 | 18/01/2018 | Jonathan Beebe | First Draft |
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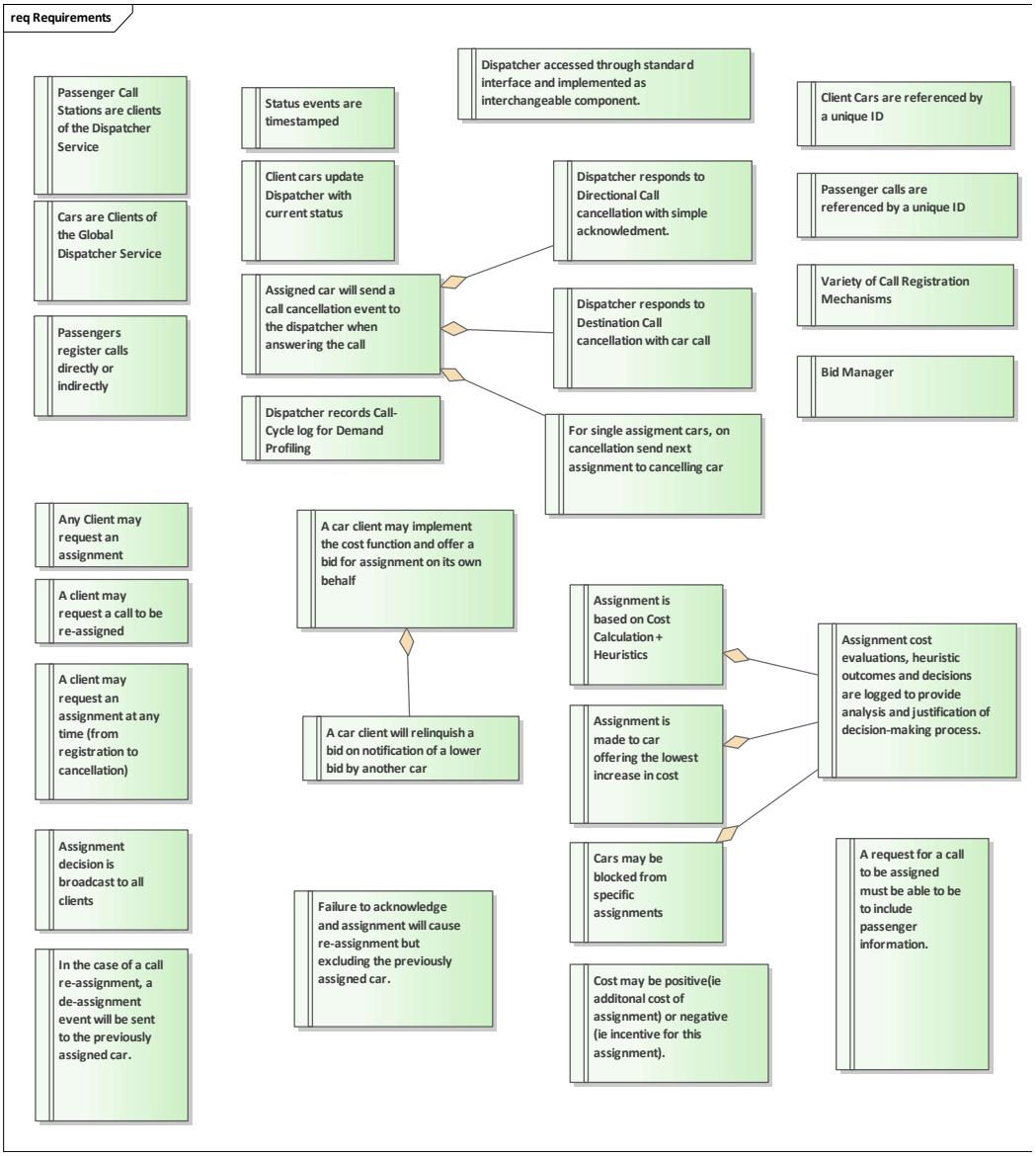
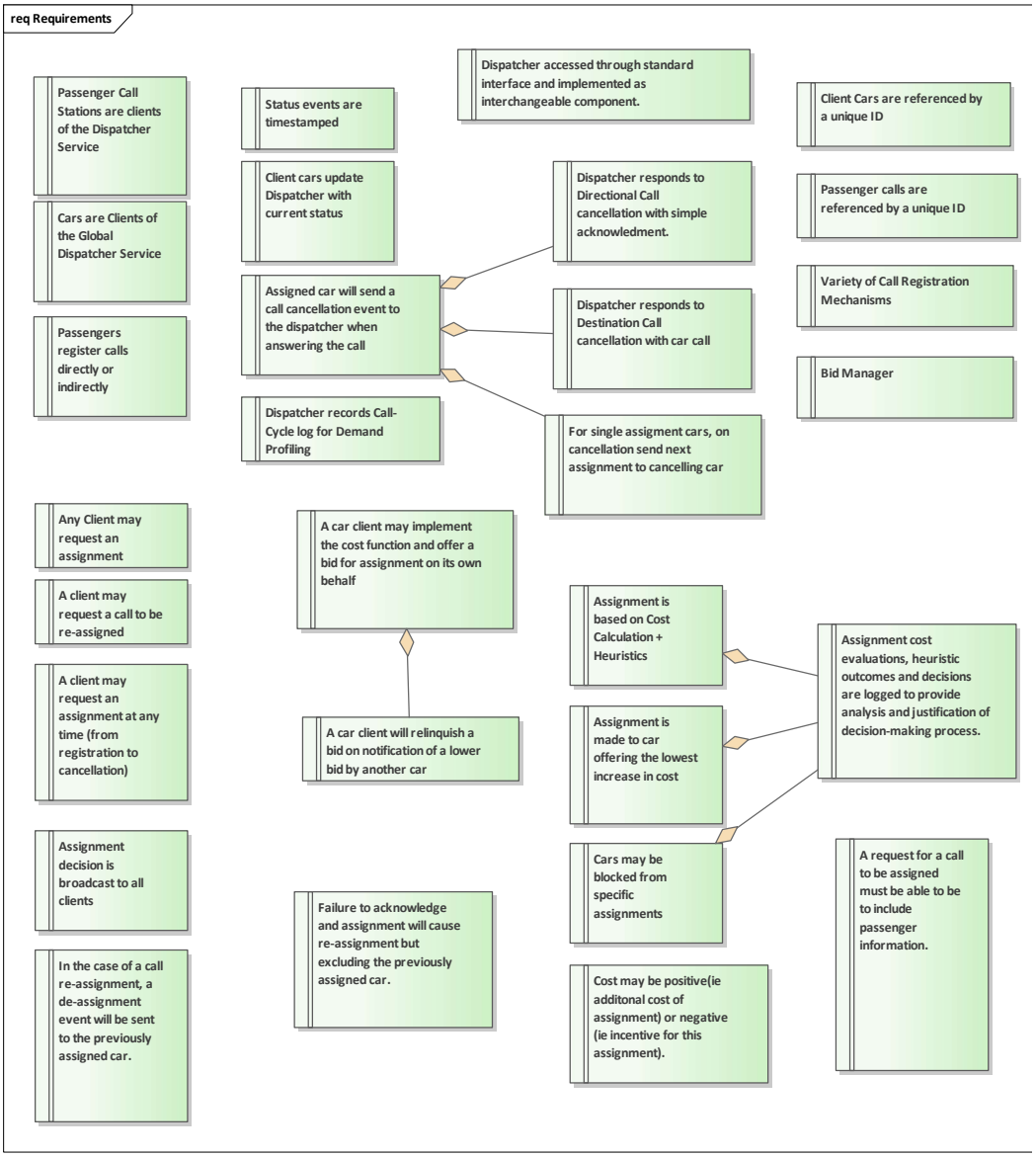
# Introduction

This document is the catalogue of requirements for the Global Dispatcher Service. The requirements were derived from....



# Requirements




**A car client may implement the cost function and offer a bid for assignment on its own behalf:**
*{Introduced in: ph1.0 v1.0}*
**A car client will relinquish a bid on notification of a lower bid by another car:**
*{Introduced in: ph1.0 v1.0}*
**A client may request a call to be re-assigned:**
*{Introduced in: ph1.0 v1.0}*

**A client may request an assignment at any time (from registration to cancellation):**
*{Introduced in: ph1.0 v1.0}*
**A request for a call to be assigned must be able to be to include passenger information.:** Passenger information may be significant for certain Dispatcher algorithms and therefore it must be possible to include this in the assignment request. Such information includes:

- The number of passengers to whom the request relates (eg a host conducting several guests on a tour).
- A reference to the requestor's personal profile, though not the profile itself (eg access rights to different floors in the building, privileged service /VIP status, etc)

*{Introduced in: ph1.0 v1.0}*
**Any Client may request an assignment:**
*{Introduced in: ph1.0 v1.0}*
**Assigned car will send a call cancellation event to the dispatcher when answering the call:**
*{Introduced in: ph1.0 v1.0}*
**Assignment cost evaluations, heuristic outcomes and decisions are logged to provide analysis and justification of decision-making process.:**
*{Introduced in: ph1.0 v1.0}*
**Assignment decision is broadcast to all clients:**
*{Introduced in: ph1.0 v1.0}*
**Assignment is based on Cost Calculation + Heuristics:** Regardless of the technology being used, whether -

- software emulation of relay logic
- calculation of estimated journey or system response times
- auto-learning neural network
- etc, etc

the decision process to select the best assignment can be represented with a cost function supported by heuristics.
For each call being considered:

- the cost function evaluates the relative merit of each possible assignment while
- the heuristics offer a more coarse-grained analysis where cars can be totally blocked from consideration and tie-breaker rules allow conflict resolution where two or more costs are equal.

*{Introduced in: ph1.0 v1.0}*
**Assignment is made to car offering the lowest increase in cost:**
*{Introduced in: ph1.0 v1.0}*
**Bid Manager:** The assignment process is handled by the Bid Manager. There may be multiple concurrent instances of Bid Manager which may (but not necessarily so) run in separate asynchronous processes.

The Bid Manager has two modes:

1. Centralised control (*from Figure 9.5 CIBSE Guide D: 2015*)
   Bid Manager requests costed bids from all registered car clients and sends an assignment request to the car with the preferred bid.
2. Distributed control (from Figure 9.6 CIBSE Guide D: 2015)
   Each one of multiple instances of the Bid Manager obtains a costed bid from its associated car which it broadcasts to all other Bid Manager instances. It then "listens" for the bid responses from each of the other Bid Manager instances and, only if it has the minimum cost bid, broadcasts its car's assignment. If it does not have the winning bid it relinquishes (ie does nothing further with) the assignment.

*{Introduced in: ph1.0 v1.0}*

**Cars are Clients of the Global Dispatcher Service:** Each car must register with the Global Dispatcher Service to be eligible to receive assignments.

*{Introduced in: ph1.0 v1.0}*

**Cars may be blocked from specific assignments:**

*{Introduced in: ph1.0 v1.0}*

**Client Cars are referenced by a unique ID:**

*{Introduced in: ph1.0 v1.0}*

**Client cars update Dispatcher with current status:**

*{Introduced in: ph1.0 v1.0}*

**Cost may be positive(ie additonal cost of assignment) or negative (ie incentive for this assignment).:**

*{Introduced in: ph1.0 v1.0}*

**Dispatcher accessed through standard interface and implemented as interchangeable component.:** A standard "universal" interface is required to the dispatcher so that many combinations of different lift system with different assignment algorithm (cost function + heuristics) may be evaluated and any operating parameters tuned for the buildings and traffic demands under which they will operate.
The dispatcher interface must support interchangeability of both lift systems and assignment algorithms.
Whilst the interface may be implemented in a variety of technologies (e.g. .dll, TCP sockets, web-services, etc) the semantics of the interface operations and their data signatures must be standard and compatible. This requirement is key to enabling the dispatcher to work with lifts from many different manufacturers and to allow designers to compare the effectiveness of different assignment algorithms.

*{Introduced in: ph1.0 v1.0}*

**Dispatcher records Call-Cycle log for Demand Profiling:**

*{Introduced in: ph1.0 v1.0}*

**Dispatcher responds to Destination Call cancellation with car call:**

*{Introduced in: ph1.0 v1.0}*

**Dispatcher responds to Directional Call cancellation with simple acknowledment.:**

*{Introduced in: ph1.0 v1.0}*

**Failure to acknowledge and assignment will cause re-assignment but excluding the previously assigned car.:**

*{Introduced in: ph1.0 v1.0}*

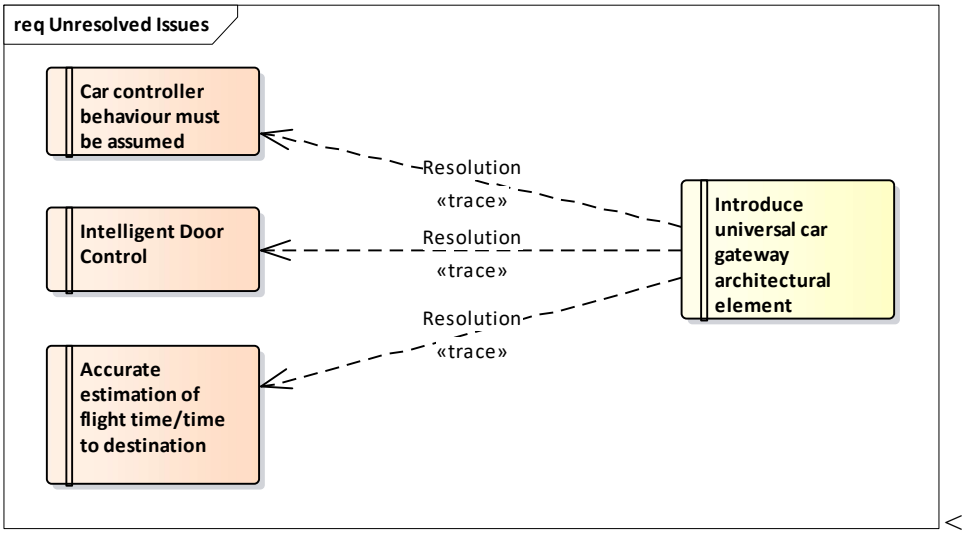
**For single assigment cars, on cancellation send next assignment to cancelling car:**

*{Introduced in: ph1.0 v1.0}*

**In the case of a call re-assignment, a de-assignment event will be sent to the previously assigned car.:**
*{Introduced in: ph1.0 v1.0}*
**Passenger Call Stations are clients of the Dispatcher Service:**
*{Introduced in: ph1.0 v1.0}*
**Passenger calls are referenced by a unique ID:** The ID field is a vector which when combined with Floor, Direction and RegistrationTime generates a completely unique identifier.
*{Introduced in: ph1.0 v1.0}*
**Passengers register calls directly or indirectly:**
*{Introduced in: ph1.0 v1.0}*
**Status events are timestamped:**
*{Introduced in: ph1.0 v1.0}*
**Variety of Call Registration Mechanisms:**
*{Introduced in: ph1.0 v1.0}*

# Unresolved Issues

<ModelRef Name="Unresolved Issues" UID="{6B460F98-6344-43a3-AF07-E7E599E8D589}" Type="Package" Content="Children, Both "> There remain a number of unresolved issues mostly relating to the non-standard nature of car control systems and the interface (electrical connection plus inconsistencies in the meaning and accuracy of the signals obtained). These issues were summarised by Peters [ref:???].

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**Change: Introduce universal car gateway architectural element**
These issues could be resolved by the introduction of a "Universal Gateway" (after:A.T.P. So; 2005) element to provide:
1. Low level control of car systems:

- - Initiate travel
- - Initiate door close
- - Mask/expose calls to achieve appearance of Simplex Collective operation

2. Report accurate timings of:
flight times for each car/departure-floor/arrival-floor triplet.

3. Other possible processed information potentially not available from electrical connections to the car equipment.

**Issue: Accurate estimation of flight time/time to destination**
How can the dispatcher obtain accurate information for each car on its flight times between different floors.
Also, at what point is a floor change signalled by the car controller in relation to the point at which slowdown must be initiated for a safe/normal stop at the floor?

**Issue: Car controller behaviour must be assumed**
*see linked document p18-1*

Dispatcher must make assumptions about
- the behaviour of the lift:
  - It follows a simplex collective algorithm

or

  - once a destination is set the lift will continue to that floor regardless of subsequent updates to its assigned/registered set of calls.

- whether passenger reversals (lift departs in opposite direction to passengers' requested destination) are supported/permitted.

These and other similar concerns affect the efficiency of assignment decisions, particularly for destination calls.

**Supposing Global Dispatcher algorithm included standard tests to discover these characteristics?**

**Issue: Intelligent Door Control**
How can the dispatcher modify car door operation (dwell time) in a uniform manner across a variety of car controller implementations?