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A Call for More Detailed Commercial Aviation Statistics in Media Reports

Francesco D'Amico[1,2]

[1] National Research Council of Italy – Institute of Atmospheric Sciences and Climate (ISAC), I-88046, Catanzaro, Lamezia Terme, Italy. (f.damico@isac.cnr.it).
[2] University of Calabria – Department of Biology, Ecology and Earth Sciences (DiBEST), I-87036, Cosenza, Rende, Italy. (francesco.damico@unical.it)

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Corresponding Author: *Francesco D'Amico*

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Abstract

As passenger figures have been growing for several decades and only remarkable economic crises such as the one induced by Covid-19 have been able to slow down this fast growth, the way commercial aviation statistics have been reported by the media has not adapted to the variety of niches filled by airlines, depending on their business models, fleets, services, and routes. Media reports generally provide one key parameter (number of passengers) and, at times, other relevant parameters (number of flights, cargo tonnage) which alone do not provide exhaustive information on the current variability of commercial air traffic. Statistics showing, for instance, the busiest airlines in the world in terms of pure passenger figures are not funded on the core of commercial aviation statistics, such as PKF (passengers kilometers flown), seat configurations comprised of First/Business and comparable classes, *etc*. Another key factor is a number of vital special services provided by legacy carriers which are pretty much neglected by media reports. Via an *excursus* on the issue and tabled estimates on whether the PKF parameter could be used as a general factor of differentiation between different categories of airlines, this paper is aimed at showing how media reports should include a wider range of parameters and provide extra information on the actual complexity of modern-day air travel. Passenger special services (such as those aimed at people whose mobility is reduced) are among the key parameters analyzed for the purpose of this research.

1. Introduction

Passenger air figures have experienced a nearly constant rise for many decades (Budd, 2011; Oxley & Jain, 2015), challenged only by occurrences such as the COVID-19 pandemic (Albers & Rundshagen, 2020). Long-haul *latu sensu* flights have been a factor in air transportation since the very beginning, where the common tendence to perform flights with multiple stops allowed the exact same aircraft types to be involved in short- and long-haul routes (Davies, 1996; Pirie, 2004). At some point, however, these two sub-branches of aviation have become pretty much independent from each other, and affected the market in such a way that newly introduced airplane designs were conceived with either purpose in mind (Cockshutt, 1976; Lanier Benkard, 2004; Cidell, 2006). Before ETOPS (Extended-range Twin-engine Operational Performance Standards), for instance, transatlantic flights were restricted to four-engine aircraft, a minimum requirement that stood for years (DeSantis, 2013). Though these two airliner categories are now independent in operational terms, they are strictly connected from a commercial standpoint as long-haul flights require short-haul routes to for passenger feeding, and *vice versa*, some short-haul routes may be largely maintained by connecting passengers to/from long-haul flights (Cook & Goodwin, 2008; Pels, 2021). The rise of selected narrow-body long-haul routes may lead to a partial overlap in a subset of the broader market (Soyk et al., 2021), but it's worth noting that the wide-body category is also pushing its limits, as Project Sunrise is now demonstrating (Qantas News Room, 2023, *web page*).

Passenger figures, as well as the number of flights, have been the two dominant key parameters used to define not only the nature and intensity of commercial aviation's growth, but also the broader strategic role of commercial flights in today's society. These two values, especially the former, provide at a glance comprehensive data on the tangible effects of aviation on public mobility so it's not surprising that media reports are generally monopolized by them. Occasionally, these figures have been used as a direct method of comparison between air transportation and other means of public transportation, such as railway systems: a *caveat* on such direct comparison has been highlighted in research decades ago (Hanchet, 1978).

The appearance and consequent success of airlines relying on totally different business models, such as LCCs (Low-Cost Carriers) (Mason, 2005; Warnock-Smith and Morrell, 2008) may have made similar statistics too simplistic to be adequately used as the sole key indicators of air transportation (Graham and Dennis, 2010; Gross and Lück, 2011). By definition, LCCs optimize their flights via lower ticket prices, higher density planes, narrow-body fleets, very high load factors, and networks largely focused on point-to-point short-haul operations (Williams and Baláž, 2009; Vidović et al., 2013). In simple terms, they are set up to be essentially "better" than legacy airlines at carrying higher numbers of passengers (Majerová & Jirásek, 2023). On the other side, legacy carriers have consolidated alliances to counter the direct competition in short-haul markets with expanded networks aimed at feeding towards long-haul routes (Oum and Zhang, 2001). As a direct result of the radical changes experienced by the market in the past few decades, focusing the attention on one parameter that favors one airline category in particular may underestimate the intrinsic complexity of present-day commercial aviation, where different business models exist and fill their own niches. The perception of parameters meant to evaluate airline services has been demonstrated to vary depending on a number of factors (Punel et al., 2019; Zhang et al., 2023).

In addition to the overall optimization aimed at high load factors and high-density seat configurations (Swan, 2002), a considerable change has also occurred in terms of special services, a term that is hereby used to define a number of SSRs (Special Service Requests) which are not universally applied. Many regulations such as the Air Carrier Access Act (ACAA) issued in the United States of America in 1986 added a legal requirement for airlines to allow PRMs (Passengers with Reduced Mobility) to travel. Though the broad category of PRMs is accepted, certain categories of passengers whose mobility is reduced, even today, are allowed – or not – to travel on a per-airline basis (section 3.2), and that in turn leads to an apparent paradox where air connectivity as a whole has increased over the course of several decades (Grubesic et al., 2008; Smyth et al., 2012), but the accessibility of flights to special categories may have not kept the pace with it (Martín-Domingo et al., 2024, *and references therein*). The issue of addressing and reporting the precise percentage of the currently available air transportation network in terms of open accessibility for PRM seems to be a neglected argument in civil aviation (McCarthy, 2011; Warnock-Smith et al., 2023).

A case could be made that some of the above-mentioned issues are the result of airline industry deregulation processes, a significant factor in the general structure of this sector which has been regarded by several authors as not strictly beneficial to the passengers themselves (Thayer, 1982; McHardy & Trotter, 2006; Goetz and Vowles, 2009). Many correlations between the reduction in SSR availability and intense governmental deregulation could potentially be found (Dempsey, 1989), by they're not the primary focus of this research.

This paper is aimed at tackling these issues, which are all but two sides of the same coin, by providing an analysis of the PKF value as well as a review of special services which are generally neglected by a category of airlines, at least among European market leaders. The paper is also aimed at addressing these issues without mentioning directly the airlines that apply certain policies – while this may apparently reduce, at first, the overall amount of content provided by this research and its accuracy, it is deemed a necessary choice meant to maintain this research paper as neutral as possible and allow it to provide insights on commercial aviation which can be applied at all scales from regional to global, even those not covered by this analysis itself.

The implicit goal of this analysis is demonstrating – using the enormous influence of media reports as a *datum* – that their inaccurate description of the civil aviation sector could have deep impacts on society's perception of the aviation market. This assumption is not easy to test – in fact, no clear proof in its favor has been found – but the paper does still provide insights into the real complexity of commercial aviation and the consequent need for media reports to accept a broader range of parameters. What's known for sure is that airlines have learned to use social media as a proper tool to promote their services and provide information to their customers (Heiets et al., 2024), but this is a totally different matter.

Overall, the purpose of this paper is highlighting a gap in academic research on the operational aspects of air transportation and their implications on actual accessibility of air transport for specific categories of passengers, such as PRM. The work is also aimed providing a tangible example of data analysis demonstrating that the parameters normally used for comparisons between airlines in media reports and other contexts may not be representative of the broad complexities of air travel in the global economy. In fact, airlines do have various degrees of popularity depending on their on time performance, customer services, and general figures: this work, although generic in nature, is set to demonstrate that the public may be missing key aspects of the general picture, and that in turn may drive future research to perform additional assessments of these factors which may be used by regulators and policy makers to improve the global airline market.

The article is divided as follows: section 2 describes the methods used in the statistical evaluation; section 3 shows the results of data evaluation and provide an operational review of a number of key services mentioned in the paper; section 4 is aimed at discussing the results.

2. Methods

The true complexity of commercial aviation statistics is hereby analyzed for the purpose of this research, starting from the PKF parameter (Passengers Kilometers Flown) as an overly underrepresented source of differentiation between different types of aircraft operations. In fact, past research has frequently emphasized the importance of these parameters as airline efficiency indicators (Encaoua, 1991; Cui and Li, 2017; Cui and Yu, 2021). One of the intended goals is testing whether the PKF alone is a sufficient tool for airline category differentiation. A nearly identical parameter, RPK (Revenue Passenger Kilometers), is hereby mentioned but will not be discussed any further as its core difference with PKF is the restriction of applicability to revenue passengers (thus excluding positioning crew and similar categories of non-paying pax). Though RPK may be more appropriate, from now on in the article the PKF value alone will be evaluated.

That said, PKF hides an intrinsic sub-differentiation that this article will attempt to underline and remark, as it's strictly connected to the main scopes of this research. In purely mathematical terms, the official definition of PKF for any flight x is the result of multiplication between the number N of passengers carried by flight x and the mileage M of the flight itself, via a straightforward linear equation:

$$PKFx = Nx * Mx \qquad (Eq. 1)$$

The parameter implies that what is normally regarded as the only main factor of commercial transportation by media reports, the number of passengers N, is weighted depending on the mileage of operated routes. Two flights carrying the exact same amount of passengers N, one covering a mileage M_1 of 800 kilometers and the other covering a different mileage M_2

of 6.000 km, will have different PKF values PKF_1 and PKF_2, with $PKF_2 > PKF_1$ by a factor that is proportional to the ratio between M_2 and M_1. For example, provided that $N_1 = N_2 = 200$ pax, the results would be $PKF_1 = 160.000$ and $PKF_2 = 1.200.000$, where the *Y/X* ratio yields the same result as M_2/M_1: *7,5*. Though these calculations seem – and indeed are – extremely basic, they're apparently ignored by the gross majority of public media aviation reports.

A comparison between PKF and N will be used for three distinct scenarios, each covering a generic type of aircraft operation and a fixed number of daily flights, to remark the differences between these values and further analyze differences in the main reported subsets of each category. The values are not randomized via Monte Carlo evaluations as they would have added an unnecessary degree of variability to the calculation – instead, recurring averaged values will be used to simulate one week of operations. The graph (Figure 1) is computed via R v. 4.3.3, using the Gpplot2 package and its respective library.

The second part of section 3 will review a number of special services, each with a brief description of their features and importance, and a remark on their neglection by media reports on commercial air traffic. These services are listed by their IATA codes.

3. Results and Discussion

The paper is aimed at addressing two branches of the proposed issues via multiple approach. Section 3.1 covers PKF and N values, while section 3.2 reviews special services.

3.1. Evaluation of simulated N and PKF values

The direct comparison of the previously described numerical parameters is hereby evaluated. Table 1 provides detailed figures on a number of key parameters, classified by category, while Figure 1 plots these parameters. Table 2 and 3 describe alternate values of selected data compared to Table 1.

Three main families of scenarios have been covered: long-haul operations have been restricted to two daily flights, while short-haul operations cover the range between six and eight daily flights. Six and eight flights are compatible with four routes served on a daily basis; seven flights cover the first scenario, plus an extra flight to an airport distinct from the primary base of operations. Realistically, this could be intended as an average between six and eight daily flights that would propagate over the course of one week or more, as short-haul operations may indeed vary from that point of view.

Narrow-body mileage values have been fixed at a value of 800 km per flight, while narrow-body mileage have been set to 7.000 km. Two hypothetical seat configurations have been considered for each of the two categories: multi-class and high-density single class. These configurations are deemed hypothetical and plausible for the aircraft types falling into each broad category – any reference to an actual configuration used by any airline is to be considered coincidental. In literature, the topic of seat distribution between two or more distinct classes has been a relevant focus of research in the field of airline industry management (Teichert et al., 2008); various optimal configurations have been proposed and tested, and their ratio has been demonstrated to depend on specific factors such as the market these flights are meant to operate in, seasonality, fuel cost and consumption efficiency, *etc.* (Kypasiris & Koulamas, 2018, *and references therein*). In this research paper, plausible two- and three-class configurations are used in data evaluation.

F stands for First Class, J stands for long-haul Business Class, C stands for short-haul Business Class, and Y stands for Economy. Research has highlighted the importance of additional classes such as Premium Economy especially for the long haul sector, however PE is excluded from this evaluation due to its minor impact on cabin density compared to First and Business (Hugon-Duprat and O'Connell, 2015). The four aircraft types have been identified with the letters A through D, as described into the details by Table 1. Load factors have also been fixed at a single value of 87.5%. This value was based on a performance report by IATA issued in 2017, plus an adjustment accounting for load factor optimization in the following years. Furthermore, averages in load factors are frequently used in research to assess the cost efficiency of business models and specific routes (Atasoy et al., 2013, *and references therein*). Three distinct business models are being considered: LCC, Legacy, and "Hybrid" with respect to high-density long-haul operations, as this growing niche of air travel retains characteristics of the other two categories (Albers et al., 2020).

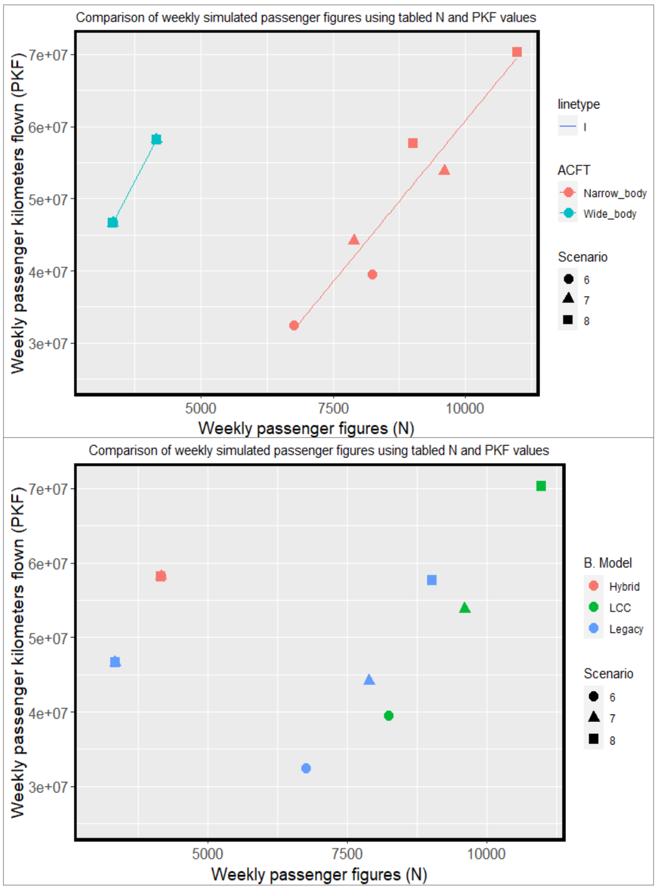

Figure 1. A: Graph showing a direct comparison between N and PKF values over the course of one hypothetical week of operations, using data from Tables 1-3. The colors differentiate between aircraft type while the symbols cover the three reported scenarios of 6, 7, and 8 daily flights operated by narrow-body aircraft (note that in the case of wide-body aircraft, they overlap as they're not affected by these changes). Daily data are not graphically shown because they would retain the exact same patterns. B: same graph, but the main factor of differentiation is the business model.

Table 1. Comparison of passenger values between four distinct categories. A = narrow body, high density seating, c.a. 8 daily flights (4 routes); B = narrow body, multi-class seating configuration, c.a. 8 daily flights (4 routes); C = wide body, multi-class seating, c.a. 2 daily flights (1 route); D = wide body, high density seating, c.a. 2 daily flights (1 route).

Category / Parameters	A	B	C	D
Seats	225Y	20C + 170Y	10F + 20J + 250Y	350Y
Business model	LCC	Legacy	Legacy	Hybrid
Average load factor	87.5%	87.5%	87.5%	87.5%
Daily flights	8	8	2	2
Daily mileage (km)	6400	6400	14000	14000
Daily passengers (N)	1528	1288	476	594
Daily PKF	10035200	8243200	6664000	8316000
Weekly flights	56	56	14	14
Weekly mileage (km)	44800	44800	98000	98000
Weekly passengers	10976	9016	3332	4158
Weekly PKF	70246400	57702400	46648000	58212000

Table 2. Same figures as in Table 1, with the number of daily flights operated by narrow-body aircraft set to 7.

Category / Parameters	A	B	C	D
Seats	225Y	20C + 170Y	10F + 20C + 250Y	350Y
Business model	LCC	Legacy	Legacy	Hybrid
Average load factor	87.5%	87.5%	87.5%	87.5%
Daily flights	7	7	2	2
Daily mileage (km)	6400	6400	14000	14000
Daily passengers (N)	1528	1288	476	594
Daily PKF	7683200	6311200	6664000	8316000
Weekly flights	49	49	14	14
Weekly mileage (km)	39200	39200	98000	98000
Weekly passengers	9604	7889	3332	4158
Weekly PKF	53782400	44178400	46648000	58212000

Table 3. Same figures as in Table 1, with the number of daily flights operated by narrow-body aircraft set to 6.

Category / Parameters	A	B	C	D
Seats	225Y	20C + 170Y	10F + 20C + 250Y	350Y
Business model	LCC	Legacy	Legacy	Hybrid
Average load factor	87.5%	87.5%	87.5%	87.5%
Daily flights	6	6	2	2
Daily mileage (km)	6400	6400	14000	14000
Daily passengers (N)	1528	1288	476	594
Daily PKF	5644800	4636800	6664000	8316000
Weekly flights	42	42	14	14
Weekly mileage (km)	33600	33600	98000	98000
Weekly passengers	8232	6762	3332	4158
Weekly PKF	39513600	32457600	46648000	58212000

Though the reported simulations have a *caveat* due to the variability of the described factors, they fulfill the intended purpose of providing a range of results that help covering the complexity of N and PKF parameters under different circumstances. Figure 1A and B sums up graphically the main differences, while the three tables provide numerically very interesting clues on the intrinsic complexity of commercial aviation figures. Hereby listed are the main results of the simulations:

1) With single flights being taken in consideration, long-haul operations yield higher passenger figures and much higher PKF values compared to their narrow-body counterparts;

2) Cumulative daily figures show fewer passengers being carried by wide-body aircraft under all circumstances. PKF rankings report a shift: with 6 daily narrow-body flights, wide-body aircraft still dominate the cumulative daily PKF; with 7 flights, the long-haul high-density configuration alone (D) maintains that dominance, while the three-class configuration (C) is now ranked 3rd; with 8 flights, A ranks 1st, C ends up 4th, while B and D report similar figures (8.243.200 and 8.316.000, respectively);

3) Weekly performances maintain lower passenger figures for wide-body aircraft, while in terms of PKF, the dominance of wide-body aircraft is limited to the 6-flights scenario, while in the 7-flight scenario category A ranks 2nd behind D. In the 8-flight scenario, A dominates in terms of PKF, but D still ranks 2nd, and C now reports the lowest value.

Therefore, the simulations indicate that intense enough short-haul operations (7-8 daily flights) operated by narrow-body aircraft can indeed compete with long-haul operations operated by wide-body aircraft, even if PKF values are considered, and this adds up to the complexity of commercial aviation figures mentioned at the beginning of the article. One preliminary conclusion of this research is that the PKF value alone is not sufficient as a tool of differentiation.

Also, it's worth noting that no corrections have been applied in order to make up for capacity reductions caused by Business and First class seats, which by definition tend to occupy more volume in the cabin, thus affecting pure passenger figures. Though the capacity to offer such services is indeed a remarkable indicator of an airline's service standards (Brochado et al., 2019), and the average cost of such tickets is demonstrably higher than that of Coach and comparable classes, this paper will not apply any corrections, as the reported differentiation between seat configurations is deemed enough to show how N and PKF performances vary across the market.

3.2. Special services review

This section of the work will focus specifically on a number of key special services that are deemed, for the purpose of this research, of strategic importance, yet they are subject to general neglection in media report coverages as well as by leading LCC airlines in the European market, which in this case is used as a sample of the global aviation market. Furthermore, they appear to be all but neglected even in the context of academic research on commercial aviation, as a search for any papers via the IATA codes of these services, at the time of writing this research paper, yielded no results whatsoever. Please note that these are not the only special services available – the actual list of services is much longer and covers a number of very specific circumstances and requirements. The difference between these services and other services which are generally provided on a global scale by aviation lies on the specificity of their setting, as they normally require precise cabin seat configurations, hold configurations, ground equipment, *etc*. Broadly speaking, their applicability is airline category dependent.

AVIH (Living animal in hold). As more attention is focused globally on animal rights, and pets have gained access to more services thanks to the pressure and effort of entire associations devoted to the topic of enhanced synergy between humans and pets in numerous environments, the aviation sector also frequently covers the need to travel with animals up to the size of large dogs. However, loading a living animal into an aircraft hold requires time, special care, specific equipment, and pressurized hold, all requirements that may not match generic LCC practices, though exceptions can occur. Please note that this service is related to PETC, with the size and nature of the pet being the main difference between the two services and codes.

DEPO category of deportees (divided into DEPA, Accompanied, and DEPU, Unaccompanied). Deportees are passengers whose names are hidden from DCS (*Departure Control Systems*, the programs used at airports for ground handling management and operations, including passenger acceptance procedures), as only law enforcement and similar entities have access to specific details on them. The fact itself that their true identity is hidden is a relevant insight on the security concerns related to them. The difference between DEPA and DEPU could be broadly summarized as a difference in terms of security measures, because the -A deportees require an escort (which is generally equipped with authorized firearms) while the -U deportees don't. This service is of strategic importance, because transportation by air of individuals that need to be transferred from two distinct locations is safer compared to other means of transportation, especially in terms of security concerns.

HUM (Human remains). Another poorly "advertised" service is the transport, as cargo, of human remains that would otherwise require time consuming and logistically challenging alternate means of transport.

PETC (Pet in Cabin). Similar to AVIH in the general sense, but the transportation in cabins instead of holds comes with a different set of issues that may be addressed, such as limitations on the number of PETC allowed onboard, their seating policies and the size of their animal carriers.

STCR (Stretcher). Perhaps the most articulated special services of all, the stretcher service required *ad hoc* adjustment to cabin configurations to take place. In fact, several rows have to be reclined and modified ahead of the flight to accommodate a stretcher, and that requires advance booking as the overall capacity of the cabin in terms of offered seats is lower.

UMNR (Unaccompanied Minor). Children traveling without their families or any individual that is legally authorized to accompany them and take full responsibility throughout the travel, are considered unaccompanied minors and require a special service be implemented, which involves personnel from ground handling companies as well as the airlines themselves. The service increases in complexity should the journey involve one or more connecting flights. Without this service, an authorized family member or tutor would be forced to fly with minors.

4. Conclusions and Perspectives

The performed analyses, though straightforward in their extent and purpose, clearly demonstrate the intrinsic differences between airlines in terms of seat configuration, fleets, served networks, and said differences are not adequately reported by media. Limiting the evaluation to hypothetical seat configurations, routes, and load factors, without indicating specific examples from present-day airline network, has still allowed the paper to provide new insights on aspects of commercial air transport which are generally ignored by academic research. Though the assumption by which regulators may be influenced by limited statistics when making strategic decisions may not be proved unless clear statements going in that direction are issued, it's safe to assume that the broader public is not instructed on the complexity of air transportation and its numerous niches. In particular, it's safe to claim that the media coverage on strategic special services offered to passengers by specific types of airlines is not adequately covered, thus resulting in an incomplete perception of said airline type for the general public.

Media reports could therefore be issued in a more professional way, one that could explain the importance of commercial aviation's variety, which by its very nature goes beyond the mere concept of how many passengers are being carried and how many flights are being operated. With enhanced statistics, it may be possible to differentiate between categories and therefore give proper context to the high variability of commercial air transportation.

Future research, possibly aimed at specific markets, could pinpoint discrepancies in terms of SSR coverage to the general public, especially in the case of passengers whose mobility is reduced (PRMs). These discrepancies could be highlighted at various scales, ranging from specific routes to the entire set of flight connections between two countries. Regulators and policy makers could, at that point, introduce new requirements aimed at a proper balance in the market between reduced ticket prices and accessibility to a wider range of passenger categories.

Appendix

An upscaled version of Figure 1 is issued as Appendix.

Ethical approval

Not applicable.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this paper. Furthermore, the author would like to specify that this research paper is an independent endeavor, unrelated to the affiliated institutions - hereby mentioned only for the sake of completeness – their views, policies and research perspectives.

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