maximize your overall fleet & crew profitability

SchedUnified™

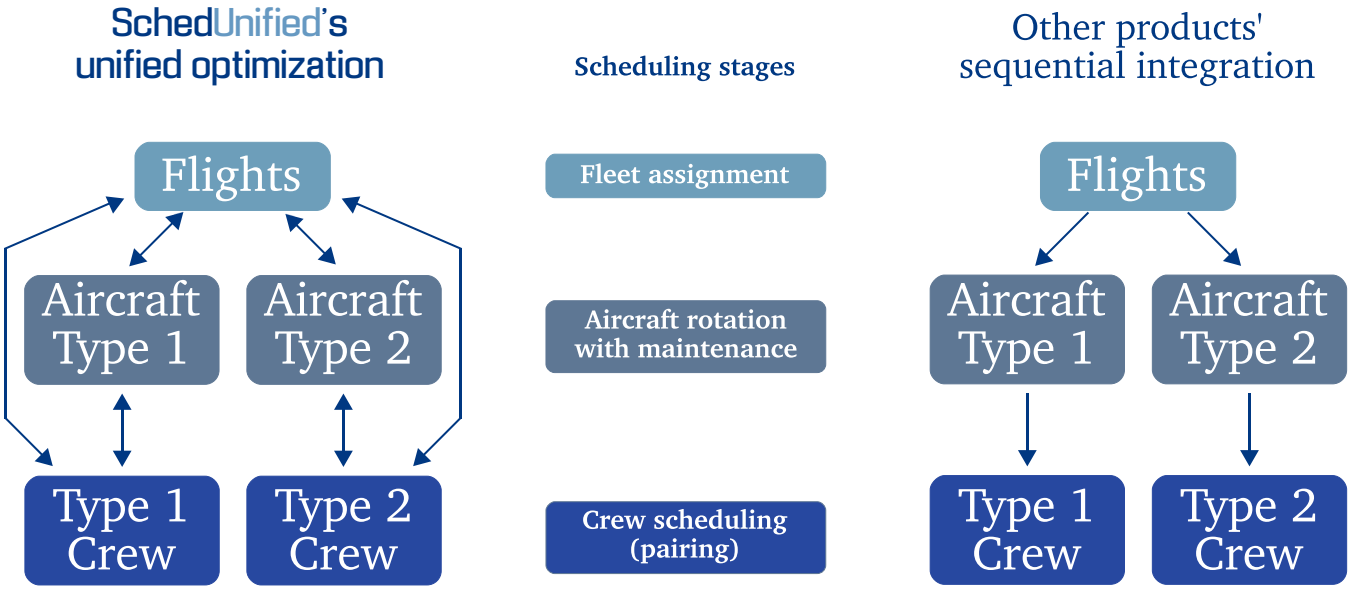
unified optimization™

decisal™

making decisions optimal™

unified optimization

Figure 1. Comparison of airline schedule optimization methods



The above hold true for any number of fleets an airline may have

SchedUnified unifies the **optimization** of all airline scheduling stages and considers their mutual interaction. This results in an optimal overall schedule, with resource balance (of aircraft and crew) across the schedule. Such a unification is not trivial, and is achieved for the first time through the novel mathematical algorithms we have invented.

In contrast, **other systems available today** perform **only sequential integration**. This breaks apart the scheduling optimization, conveying the results of one stage to the next, disregarding the downstream consequences. Each stage is therefore optimized independently, resulting in an overall suboptimal schedule, and lacking flexibility in resource balance.

unique benefits

SchedUnified's benefits are unique due to its revolutionary Unified Optimization. No other system can perform such a complex optimization!

Maximized overall profitability

SchedUnified unifies the assignment of fleets to flights with aircraft and crew scheduling, while considering their costs and so maximizing the overall profit. In contrast, other systems available today freeze the fleet assignment solution, and then compute independently the aircraft and crew schedules for each fleet. As a result, **in comparison with existing systems, SchedulUnified increases the profit by 50-150 US$ per flight** (e.g. an airline with 100 flights per day can gain 2-5 million US$ per year). This holds for different network structures, different crew regulations and costs (fixed or variable), and various fleet compositions.

Maximized overall resource utilization

SchedUnified's fleet assignment explicitly considers the constraints of both crew and aircraft (e.g. unavailability due to maintenance), thereby maximizing the overall resource utilization. As a result, SchedulUnified's aircraft and crew utilization is superior to that of other systems, whose fleet assignment disregards the consequences on aircraft and crew schedules.

Robust schedules

SchedulUnified achieves schedule robustness by minimizing delay propagation in the network. Typically flight delays stay with crew and aircraft for as long as they fly together. However, if after a delay crew are scheduled to change aircraft, that delay propagates to the subsequent flights of both the crew and the aircraft, creating a schedule bottleneck. Fortunately, SchedulUnified combines aircraft and crew schedule optimization, and minimizes such bottlenecks by detecting when they may occur. SchedulUnified further amplifies this benefit by additionally considering the influence of fleet assignment on bottlenecks.

Improved collaboration between and within departments

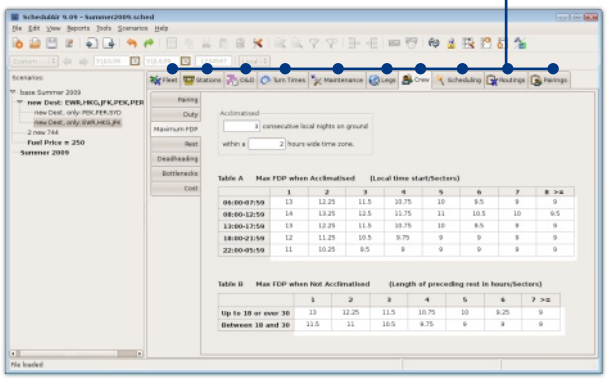
SchedulUnified simultaneously complies with the constraints and optimization goals set by different departments within an airline. This is more efficient than the sequential integration of other products, where different departments often have to go through several iterations to remove constraint violations and achieve a mutually agreed schedule.

Additionally, SchedulUnified offers multi-user features to distribute work among different schedulers and departments. Users can therefore experiment with different scenarios, as well as develop, compare, and merge schedules in parallel.

Unified scheduling tools and scenario analysis

SchedulUnified offers tools which unify the analysis of flight, aircraft, and crew scheduling, all within the same application (Figure 2). For instance, you can view whether crew continue with the same aircraft for their next scheduled flight or if they change to another. SchedulUnified likewise provides unified scenario evaluation for all these stages, enabling you to experiment with new routes or explore changes of: passenger demand, maintenance constraints, crew costs and regulations, fuel costs, etc.

Figure 2. All scheduling stages at your fingertips
flights, aircraft, and crew costs & constraints easily accessible through dedicated tabs



powerful features

Variety of scheduling methods

SchedUnified offers various scheduling methods to best fit the needs of different airlines. You can optimize your schedule using the **daily**, **weekly**, or **fully dated** methods. These methods can be combined to attain the best results, while covering any schedule exceptions (e.g. weekends or special events). The fully dated method considers initial and final aircraft positions, as well as maintenance constraints.

Unified constraint satisfaction and cost consideration

Due to its unique Unified Optimization, SchedulUnified is the only system available today enabling you to simultaneously account for the constraints and costs of:

- **Aircraft**, such as initial and final positions, daily availability, utilization limits, fleet mixing, maintenance costs and constraints, number of seats, range, block and turn times, fuel and oil costs.
- **Airports**, for example landing fees, runway and curfew constraints.
- **Passengers**, including revenue from forecasted demand and through-flights, minimum connection times, spill, and recapture.
- **Crew**, customized to your needs and based on several regulation families (e.g. CAO-48, CAP-371, EU/JAR OPS 1, and FARs) and crew costs such as utilization, wages, per diems, allowances, standby, deadhead, and hotels.

You can easily modify all of these constraints and further experiment with various changes in order to evaluate different scenarios and their impact on your schedule and profits. Additional constraints can also be tailored to your individual needs.

Accounting for UTC, local times, and DST

With SchedulUnified it is easy to switch between local time and Universal Time Coordinated for all views, reports and file exports. Likewise, arrival and departure times are automatically adjusted for the Daylight Saving Time offsets of each station, and flight legs automatically split to reflect such adjustments.

Figure 3. Table view example: flight legs

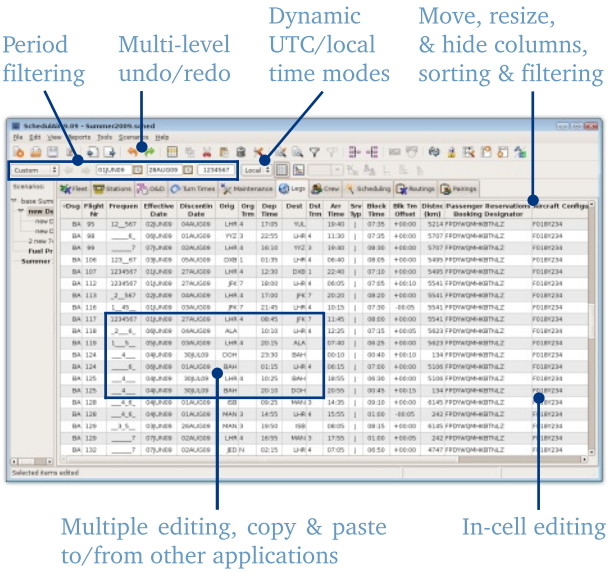


Figure 4. Flight legs split and compressed

modern tools

Table views

SchedulUnified includes table views **for constraints, costs, and flight legs** (Figure 3). The data are presented and edited in a tabular form similar to Microsoft Excel. You can make more complex changes affecting multiple entries, for example to re-time multiple flights by adjusting them to all be 10 minutes earlier. Likewise it is easy to compress or split selected flights for a period of your choice (Figure 4). Furthermore, you can globally select or filter bulk data. SchedUnified complies with IATA's Standard Schedules Information Manual (SSIM), so you can display, import or export any relevant data.

Station activity views

SchedulUnified offers station activity views **for aircraft, crew, or unified aircraft and crew** (Figure 5). Each station activity view depicts the arrivals and departures for a chosen station. The aircraft and/or crew connections can be displayed as links between the flights, with the corresponding connection times shown. With SchedulUnified's unique combined aircraft and crew activity view you can inspect and manipulate when crew change aircraft, thereby controlling the potential bottlenecks (which can lead to flight delay propagation). It is furthermore a powerful tool for solving flight-balance problems, as well as manipulating the distribution of operations at a station and connections to other stations. The station activity view inherits all the tabular facilities of the table views so you can select, view, filter, and edit all data in the same manner.

Flow views

SchedulUnified provides flow views **for aircraft and crew** (Figure 6). Each flow view is a Gantt chart displaying lines of flying with user-customizable bars depicting the flights, turns, and connections. It can also display the potential schedule bottlenecks (which can lead to propagation of flight delays). You can easily choose which data to display on the Gantt bars or the status bar. Other viewing and filtering options are also available such as zooming, period selection, and fleet hiding. A modern and user-friendly interface assists manual editing (e.g. swapping, merging, canceling) of the flow views by highlighting which possibilities are within the given constraints.

Figure 5. Station activity view example: unified aircraft & crew

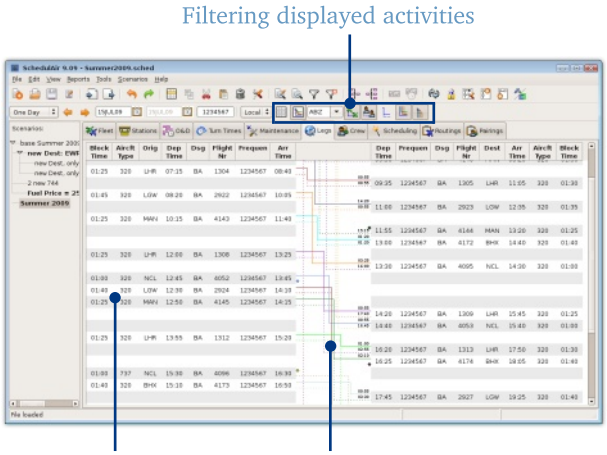
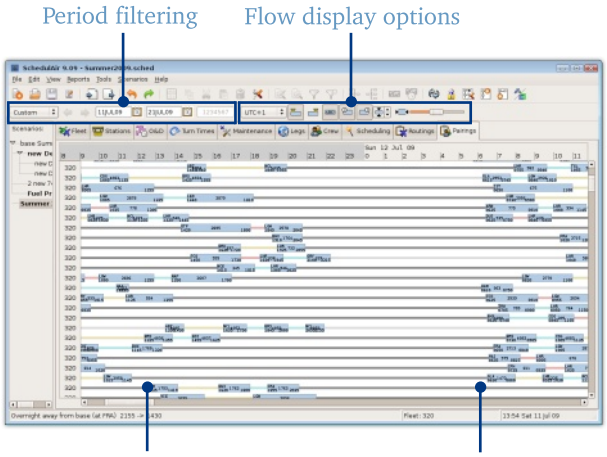


Figure 6. Flow view example: crew



advanced functionality

In SchedUnified a scenario is defined as:

- *a candidate schedule, and*
- *the corresponding constraints & costs.*

Unified what-if scenario analysis and management

SchedUnified offers unified analysis of flight, aircraft, and crew scheduling scenarios. For instance, you may examine the profitability of certain new flights or new aircraft types. Likewise, you can simultaneously assess the effects of different maintenance or crew constraints or costs on your schedule. You may therefore experiment with all these scenarios and thoroughly analyze their consequences. You may also restrict other users from viewing or editing such experiments.

SchedUnified provides a scenario management tree (Figure 6) displaying the history of various scenarios and their evolution throughout experimentation or schedule development. A scenario can be named, copied, deleted, hidden, annotated, and edited. While users edit a scenario, SchedUnified tracks the different versions and which users performed them. It is easy to undo or redo any changes made.

Unified scenario comparison and merging

A scenario comparison and merging environment is also offered, using the familiar SchedUnified views of each scheduling stage (Figure 7). In the comparison environment, all differences between two scenarios are highlighted. This includes differences between the constraints, costs or the legs (either by flight number or by Origin & Destination pair). With the differences marked, it is easy to select the legs or constraints you want to keep and merge them into a new scenario or the final schedule version.

Unified schedule development

SchedulUnified assists schedule development between and within departments by including multi-level rights of user and group access for the scenarios, restricting unauthorized view and edit. Therefore, multiple schedulers of different departments can work in parallel and develop distinct parts of the same schedule. These can then be compared and merged into the final schedule version.

Codeshare and competition analysis

SchedUnified can enhance your profitability by considering codeshare flights, based on the forecasted demand and revenue, while respecting passenger minimum connection times.

The schedules of partner and competitor airlines can be imported using IATA's SSIM file format, and stored for future analysis. Such an analysis may include the examination of other airlines' schedules, and exploring important markets, as well as codeshare, or passenger connection opportunities.

Report customization

SchedUnified provides a report generator (Figure 8) with which you can adapt reports to fit the needs of different departments in your airline. It is easy to filter which data to include in a report (e.g. periods, stations, O&Ds, fleets, legs), and to customize the format of text or graphics.

You can produce customized schedule or constraints reports of data including: aircraft rotations, crew pairings, fleets, stations, O&D pair information, maintenance, flight legs, as well as block, turn, and taxi times.

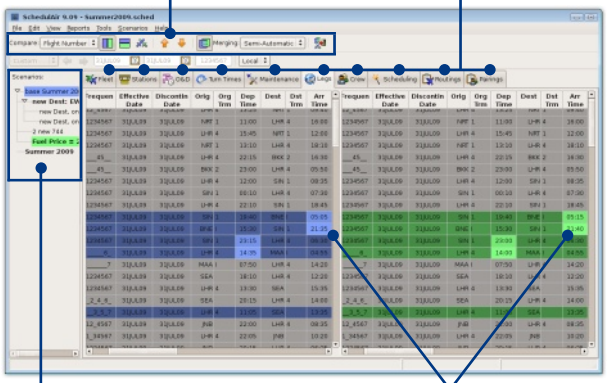
You can also customize statistics and marketing reports of: station or aircraft activity, aircraft or crew utilization, O&D statistics, and your overall schedule.

All these reports include industry standard data such as Available/Revenue Seats per Miles/Kilometers, as well as costs, revenue, and profit. Finally, all reports can be exported in several formats e.g. html, pdf, Microsoft Word or Excel.

seamless integration

Figure 7. Scenario comparison of flights, aircraft, and crew costs and constraints in their dedicated tabs

Conflicts' view and navigation options



Scenario evolution tree, where you can choose which scenarios to compare

Automatic marking of differences between legs, constraints, or costs, helping you with merging

Smooth transition of your scheduling process

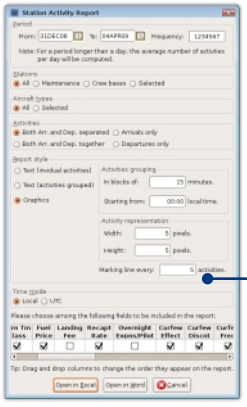
In case you wish to keep your existing aircraft or crew scheduling systems, SchedulUnified can still be used to improve your scheduling. We offer a smooth transition of your scheduling process to the adoption of SchedUnified. This may involve some or all of the following phases, depending on your specific requirements.

1. **Fleet assignment – ONLY.** Instead of fully substituting your current systems you can use SchedUnified to obtain only a more optimal fleet assignment solution, which can then be fed into your existing systems to compute aircraft or crew schedules. This solution is superior to that of other available products because SchedulUnified will explicitly consider the implications of subsequent scheduling stages (aircraft and crew).

2. **Fleet assignment and aircraft rotations – ONLY.** Likewise, you can use SchedUnified's unified fleet assignment and aircraft rotations to obtain a more optimal solution and then use your existing systems for crew scheduling.

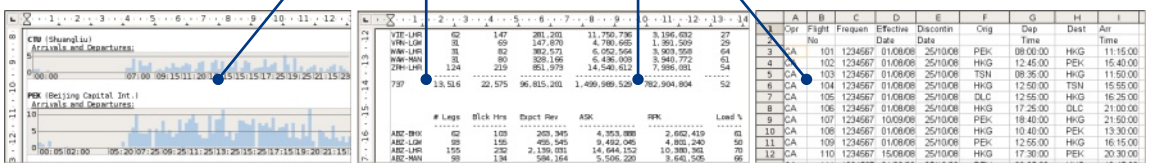
3. **ALL stages.** We can incorporate our full system to completely unify your scheduling process.

Figure 8. Customizable reports



With the report generator you can:

- customize each report's graphics or text
- open reports in external programs e.g. Microsoft Word or Excel



Integration with other systems

SchedUnified can be smoothly integrated within your current scheduling process, your internal applications, and your external partners' systems, thereby maximizing the benefits you obtain. This includes the ability to automatically or manually send data in customized or industry standard formats (e.g. IATA SSIM).

cutting-edge product

Questions & Answers

Q: Has anyone else thought of Unified Optimization?
A: There has been intensive research in the area for decades, however due to the advanced mathematics involved we are the first to discover an algorithm that performs Unified Optimization. This algorithm was published in peer-reviewed journals as a unique invention and is Patent Pending. Others will therefore still have to invent alternative methods in order to potentially achieve the same results.

Q: Other products have crew-friendly constraints, is this not enough?
A: No, the crew-friendly constraints of other products are only fleet constraints that have potential impact on crew. Since at this time the crew schedules are not yet known, these are only approximations. SchedUnified's fleet assignment achieves something better: it simultaneously generates crew schedules and therefore knows the impact of each decision.

Q: We already have aircraft and crew scheduling systems, do we need to change them?
A: No, you do not have to. We offer a *smooth transition of your scheduling process* (see page 7), where you can change some or all of your systems.

Q: How can we assess the benefits of Unified Optimization for our company?
A: We can provide:

- **Demonstrations**, where we will process a current or historic sample of your schedule using SchedUnified and then demonstrate the potential alterations you could make and the resulting improvements.
- **Commitment-free evaluations**, where we offer a commitment-free hands-on experience of SchedUnified for you to analyze the advantages of Unified Optimization and its impact on your schedule.

System requirements

SchedUnified is platform-independent and has already been rigorously tested in Microsoft Windows, UNIX, and Linux environments. Other platforms can be catered for on request.

Research and development

Research and development of this product was performed jointly by Imperial College London and Decisal Ltd. The Intellectual Property Rights of SchedUnified are fully owned by Decisal Ltd.

Customer support

Decisal provides the highest level of customer support including:

- user training customized to your needs,
- 24/7 help desk and on-line support,
- upgrades each year.

Tailor-made solutions

Your business has special needs which differ from others, we will therefore work with you to configure SchedUnified solutions to match your specific requirements.

Consulting services

It is not necessary to buy SchedUnified to take advantage of Unified Optimization. We offer consultancy services providing you new schedules or advice based on current data you supply, either on a bespoke or periodic basis. This allows you to optimize your schedules with the changing requirements of your business.

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