Transit Versus All-In-One Systems

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June 2003

Executive Summary

The difference between Transit (a specialist transport planning application) and those transport management functions offered by ERP/Warehouse Management/Supply Chain Integration software vendors is significant and complex. Fundamentally, the difference stems from the fact that the Transit system is developed in cooperation with existing transport suppliers and is designed to minimise the cost of transport operations whilst the All-in-one systems offer transport management as an accessory.

The following is a summary table that identifies (in a general sense, without singling out a particular All-in-one system vendor) the types of differences.

Aspect of Transport Planning	Transit	Generic All-in-one system
Scheduling	Automatic scheduling with manual override	Manual or semi manual process or fixed rota timing
Routing	On-road times and distances Provision of complete GIS Intelligent "best route" derivation	Various, from general locality matrixes to detailed road networks – usually client sourced Shortest route
Optimisation	Extensive, 3 types and 5 methods	Usually licensed or based on manufacture or warehouse optimisation logic
Algorithms	Experience derived heuristics and pure mathematical minimisation	Mathematical minimisation
Constraints	Extensive, operationally based, groups of flexible constraints	Simplified set of constraints Minimal control of schedule
Geographic Information	Long experience in trade-off between data abstraction and required detail Provision of complete GIS	Various, from general locality matrixes to detailed road networks – usually client sourced
Fleet Bias	Minimisation of the number of vehicles required	Minimisation of marginal cost Assumption of infinite vehicle supply without capital cost
Speculative Modelling	Independence to create real operational schedules or what-if schedules on demand Short establishment time	Difficult to create/extract speculative data Difficult to establish modelling base-line
Customisation	Simple, inexpensive, task focused Rapid turn-around	Complex, extremely costly, focus on meeting specification Long delays common
Initial Implementation Cost	Moderate	Marginal
Whole of life cost	Moderate	Substantial
Support model	Specialist	Generalist

Introduction

Transit staff are often asked "Why would anyone use a specialist scheduling system when the all-singing-all-dancing ERP/warehouse/supply chain software packages offer transport scheduling within their application(s)?" The shortest of answers is "optimisation" versus plain scheduling. Transit is an optimisation tool as against a transport planning and scheduling tool available in the unified systems.

The long answer is a bit deeper. With more and more integrated system (All-in one) vendors offering an increasing array of transport planning and modelling services (some of which even offer a degree of optimisation) the short answer is not fully descriptive of the difference between their product offering and Transit's. Differences exist in algorithms, constraints, geographic information, fleet bias, what-if modelling and customisation-ability. Fundamentally the difference is between specialist approach to transport planning and a generalist approach.

Many of the All-in-one systems on the market had their origin in financial/accounting or warehouse/manufacturing systems. Their increasing comprehensiveness has developed in response to market demand for a one-stop solution. While the comprehensive vendor coverage is advantageous in system integration and contract management there is always scope for a specialist vendor to offer more functionality within any particular area of the supply chain. In particular, the operations of transport/distribution divisions are often markedly different to the finance, manufacturing or warehouse divisions covered by All-in-one systems.

Scheduling versus Optimisation

Scheduling is the ordering of tasks chronologically. Routing is the selection of a path across geography. Neither of these actually necessitates optimisation. Optimisation is the minimisation of the number of resources used to achieve a task. Many systems may call themselves routing and scheduling (R&S) systems but few are also optimisation systems.

Even assuming that the system in question makes some effort at minimising the number of resources used there is the question of how it goes about that minimisation (what algorithm does it use) and what are the deciding constraints (what is it trying to minimise).

If a user is supplied with tools to organise their transportation in schedules that have an implied or explicit route information embedded in them, the perception is that the transport is optimised but that belief is far from the truth and the real difference occurs at the bank account where real dollars are paid for operational control systems, compared to savings made by resource optimisation ones.

Algorithms

Algorithms are the "how" of R&S: the decision-making processes, carried out by the computer, which yield the system output. There are many ways to skin a cat, but all cats have several features in common. In the same way there may be a number of optimisation problems but the mathematics of optimisation is common (up to a point). It is that commonality of mathematics that leads manufacturers of All-in-one systems to assume that process-flow optimisation, in use in their warehouse or manufacture control module, is also appropriate for transport operations.

Permutations

The belief that a good process-flow optimisation algorithm is going to perform well in the general transport task is flawed because of the number of permutations available. Permutation is the number of ways that any group of customers can be put together in a schedule. The number of ways that a factory or warehouse can be configured or operated is significantly less than the number of ways goods can be delivered to the marketplace. Algorithms for one type of problem cope poorly with the other.

Heuristics

Heuristic means "rule of thumb" and is an elaborate way of saying a series of operations that, when carried out by the computer or a human, yields a desirable result based on past experience. Heuristics develop by experience. Real transport operators, working with real drivers and real customers in real business environments develop a series of heuristics for what processes lead to the best outcomes. Transit is dependent on these real life heuristics to complement the purely mathematical algorithm outputs. It can be thought of as a sanity check on the mathematical process.

By building the product from customer feedback Transit has been able to ensure that schedules from their system are realistic and workable while still being more efficient than manual planning or purely mathematical modelling. This combination of pure and applied maths is only available to companies that work closely with their customers over an extended time – specialists.

Constraints

There are a number of constraints that define what can and can't be done by an R&S system. Transport, in general, has a more extensive and complex list of constraints because it is at the end of the supply chain and must satisfy the needs of the company and the customer simultaneously.

Scheduling constraints

Allowance has to be made for customer service windows, loading/unloading facility of the customer, access restrictions of vehicles, products that can/cannot go together, customers within a "grouping", priority customers and availability at warehouse. Simple optimisation of vehicle load space is not sufficient to yield a workable schedule when all these constraints bear on the transport operation.

Business constraints

Because transport comes at the end of the supply chain there is often the perception that it should be organised as a necessary cost centre that has little or no impact on the upstream systems. A focus on the transport task often yields surprising savings or operational efficiencies in other parts of the business. A system that focuses on warehouse and finance operations is unlikely to yield these reverse-engineering windfalls.

Geographic Information

All R&S systems are dependent on geographical information to yield reliable schedules. The depth and breadth of this information ranges from rudimentary to exhaustive. Striking the right balance between the depth of information required and the timely production of a workable schedule is a difficult task requiring long experience.

Depth of information

Even with the emerging data standards of GIS (Geographic Information Systems) for in-vehicle navigation, there is a difference between relevant and irrelevant information. The scale of possible combinations of customer services means that time and distance information is required for every pair of origins and destinations (typically hundreds of thousands of pairs); abstraction of the data is required to get workable solutions without sacrificing relevant detail. Transit's long experience in the Australian transport industry has given it a sound appreciation of the GIS requirements.

Density

As the density of customers increases the requirements of the GIS change. The R&S system needs compensatory variables to still provide a workable solution with varying customer density. Most all-in-one systems lack these variables choosing instead to have the client set up the appropriate level of information for their operation. This can mean a great deal of GIS work has to be performed before a schedule can be created and refining the system can take several months to years.

Fleet Make-up

Most R&S systems have vehicle cost models on which relative schedule efficiency is measured. Different systems have different emphasis on fixed and variable cost structures and the relative importance of each. In particular these variables must be reflective of the local fleet practice.

Australian industry model

The Australian transport industry is substantially different to that of Europe and the US, it has a substantially higher percentage of owned-fleet operations. This market bias has also led to contract charging schemes from third and fourth party transport providers that emphasise minimisation of the number of vehicles used. Fleet number minimisation is generally a low priority for US and European systems where an assumed infinite pool of marginal-cost transport is available.

In many, if not most, Australian transport businesses the minimisation of fleet numbers will yield higher efficiencies than infinite-vehicle, short-trip schedules. Since most All-in-one systems come from Germany, the UK and the US their transport scheduling models reflect their local industry bias.

What is cheaper

Even within systems that have the same optimisational bias when it comes to fleet usage there is uncertainty about what represents the cheapest schedule. The use of high-speed roads may reduce travelling time while increasing travelling distance, the trade-off between time, distance and additional vehicle usage is important. Transit has had many years experience in the local marketplace with the best trade-off between these factors. Actual operational feedback offers the heuristics on which this balance has been established.

What-if analysis

While an R&S system can be used in daily operation to minimise the cost of transport operations it should also offer a planning and modelling tool for the analysis of "what-if" scenarios. Changes in fleet make-up, depot location, customer service standards and additional work-flow form a vital part of a business's planning processes.

Speed of setup

As with the establishing of appropriate GIS detail most All-in-one systems require a great deal of setup for any particular operation. This administrative overhead makes "what-if" analysis impractical or too costly. It is often not possible to establish a modelling scenario without weeks of work, which makes the system impractical for any but the largest of business changes. The transit system is able to be up and running scenarios very quickly while offering all the fine control needed to further refine the model as new information and other possible scenarios become available.

Breadth of functionality

What-if scenarios come in many different forms from making changes to fleet, to smoothing of demand and sales/service territory realignment. This breadth of functionality to cope with many different geographic/chronological challenges is offered by Transit because it is what the industry in Australia has demanded. There is little incentive for All-in-one system vendors to offer such breadth of functionality when the sale of individual modules offers a more profitable business model.

Isolation from operations

While All-in-one systems strive for integration of all data streams the type of work required for what-if analysis is the opposite. Modelling requires analysis of not-real data to answer questions on imagined scenarios. Because Transit's business model is one of stand-alone operations it is able to separate the operations of daily scheduling and what-if modelling without having an impact on any other part of the business (creation of dummy demand increase in an All-in-one system is a good example of where system independence is advantageous).

Customisability

Every operation has slightly different transport arrangements and slightly different business rules. It is important that an R&S system reflect these business rules as they form an important part of the organisational culture and competitive advantage of a company. It is important that functionality that does not meet the needs of the client can be changed and additional functionality added. This can prove very difficult and costly to achieve in All-in-one systems that have developed a huge bureaucracy to maintain consistency across applications.

International release dates

International software developers modify their product inline with international release schedules and include modifications of code only if they are perceived to be of benefit to a large portion of the existing customer base (unless a more expensive exclusive development agreement is entered into). Since the decision-makers on such changes do not reside in Australia it is often hard for an Australian company to influence such decisions.

Even assuming that a change to a system is accepted it can be a substantial wait for such modifications to be included in the general release of an All-in-one system and installed at a site (delays in excess of a year are not uncommon). During the interim the client must suffer for the lack of functionality or change their business practices. It is even possible that the client business needs will change before the requested software change is made.

Transit is able to modify its code quickly and efficiently and offer fast turn-arounds on customisation projects. They work with the client to ensure the changes meet the business need, rather than just the change specification.

Who owns the code

Transit owns its code and intellectual property, it does not licence any portion of the code from other vendors who may be reluctant or slow to change for client's needs. All-in-one systems often acquire functionality by licensing it from other vendors. This means that customisation becomes increasingly complex and time-consuming – and thus costly.

Cost of change

Ultimately the cost of a transport planning system is not simply its up-front cost but also its modification, customisation and support for the life of the product. While All-in-one systems may appear to have a very low initial price the real cost of operating such a system may be extraordinarily high. Change to code, specialist support services and maintenance contracts can quickly surpass the entire cost of the transport module implementation.

Transit, by contrast, includes annual upgrades to the software in the maintenance price and always has specialist support on hand as part of that contract. Because Transit is a specialist product provider it has deep knowledge of its product, its likely business impacts, its inputs/outputs and variables. Transit's help desk is exclusively for the support of transport planning software and does not attempt warehouse to serve a specialist area with generalist technicians.