5 Levels of Autonomous Dispatch and Routing

Introduction

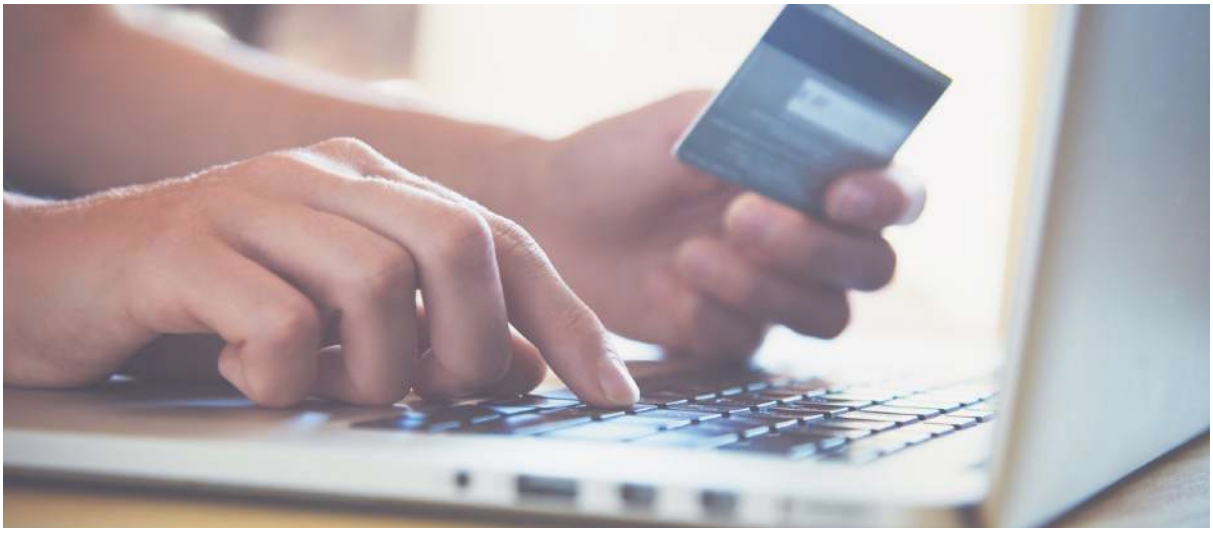
For most transportation operations, the challenges of deliveries are multiplying exponentially. The combination of increasing customer expectations, smaller order volumes, and larger numbers of order destinations – the Amazon effect – is exerting immense pressure on organizations and their bottom lines.

In this 'new normal,' any delivery – a restocking order, auto parts, or printer cartridges – may need to be delivered immediately, regardless of distance to be traveled, local traffic, and other hurdles. A recent Capgemini report, **The last-mile delivery challenge | Giving retail and consumer product customers a superior delivery experience without impacting profitability**, found that as delivery becomes increasingly popular, the cost of providing last-mile services accounts for 41% of overall supply chain costs – more than double any other category of spend, such as parceling or warehousing.

For organizations committed to adapting to and succeeding in this new environment, traditional route optimization software is no longer sufficient to meet aggressive operational performance or economic goals. In this paper, we look closely at the future of transportation operations and explore how Autonomous Dispatch and Routing software – built upon a foundation of sophisticated algorithms, artificial intelligence (AI), and machine learning (ML) technologies – is emerging to support the industry's rapidly evolving needs.

Behind the Scenes | What It Really Takes to Fulfill Orders

For consumers and businesses, the ease of ordering goods and services completely obscures the challenges that the logistics industry faces as it works to rapidly respond to increasing order volumes. For most operations, an order is received and the scramble begins. Items or resources need to be located, picked, packed, assigned, and delivered as quickly as possible to meet promised time windows. Each new order has to be integrated, managed, and delivered alongside the others already in the system. It's a stressful race that's repeated millions of times per day, and the logistics industry is barely keeping pace – largely because most organizations continue to operate with legacy models that involve lots of manual work by dispatchers and drivers. These teams simply cannot keep up with the growing business volumes.



Meanwhile, modes of fulfillment are also changing. Rather than fleets of traditional vehicles, savvy managers are looking at all options and employing strategies to both optimize efficiency and reduce costs, but these new options add complexity. Smaller vehicles and EVs are increasingly used to reach dense urban areas to lower fulfillment costs, and the gig economy offers new opportunities to quickly fulfill tasks or orders with crowdsourced drivers. Automated vehicles and drones will soon offer cheaper ways to get certain types of goods to where they are needed, but adding these new options will require smart and dynamic technology to quickly determine which mode makes the most sense for which orders.

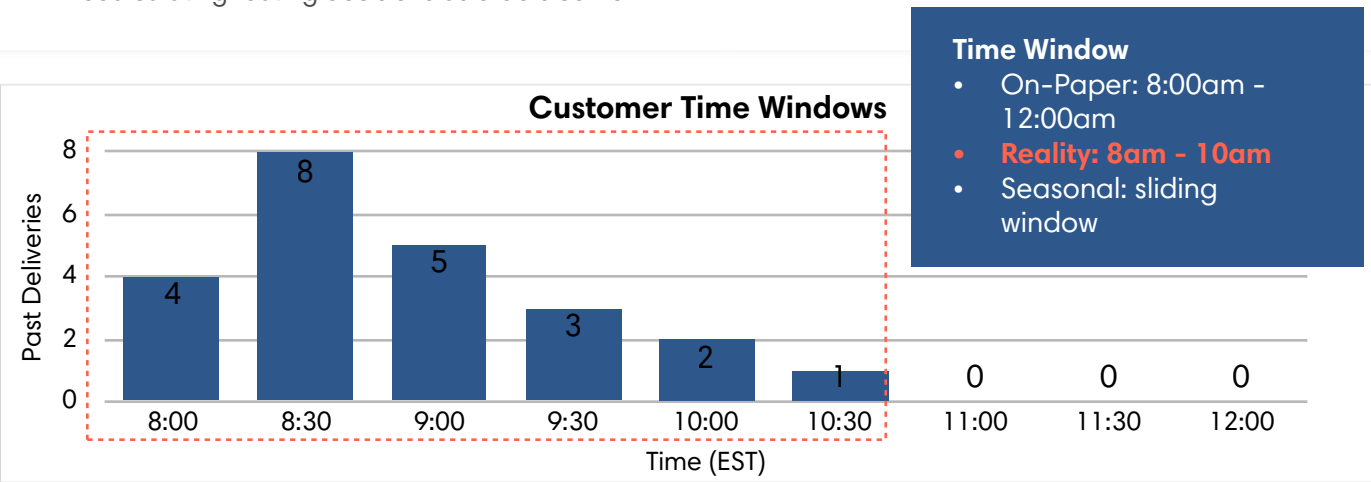
The increasing number of orders combined with delivery-speed expectations and the range of possible delivery options are making traditional planning and dispatching mathematically impossible to perform without sophisticated software and algorithms. And that is where Autonomous Dispatch and Routing comes into play, automating the complex and dynamic decision-making this new operational landscape requires. Traditional route optimization software creates static plans within fixed territories and leaves a tremendous amount of manual work to dispatchers and drivers. Many organizations are finding that this approach isn't sufficient to support the operational velocity they need to achieve, but emerging Autonomous Dispatch and Routing software is.

Autonomous Dispatch and Routing | Next-Generation Route Optimization

Autonomous Dispatch and Routing – a system for seamlessly coordinating the movement of goods, people, and services – sounds futuristic. But the technology is already familiar to most consumers, with early implementations powering popular ride-sharing systems and meal delivery applications. These services take customers' orders via mobile app, automatically assign tasks to the most suitable vehicles, factor in business rules (whether riders want to carpool to save money, or if they prefer a premium car, for example), and fulfill the order. This is Autonomous Dispatch and Routing at work.

For commercial fleets, the future of Autonomous Dispatch and Routing will include fully automated ordering, packing, and routing – with connected systems – that seamlessly take orders, identify the optimal vehicle type, operate within all known order constraints, then prepare and deliver the order for any industry and any scenario. While that fully automated future isn't here yet, today's Autonomous Dispatch and Routing solutions are already in use across a variety of industries – from food and beverage to business services.

Autonomous Dispatch and Routing systems apply high-performance, software-based logic and machine learning to orders, and rapidly make intelligent, data-driven decisions that optimize fleet performance for both efficiency and customer service. These systems process millions of data points and make thousands of real-time decisions that would be impossible for even the most experienced human dispatcher. And, in some applications, the systems are continuously re-optimizing and recalculating routing decisions as orders come in.



These systems also manage route execution throughout the day, monitoring driver progress with real-time traffic against time windows and – where necessary and permitted – re-sequencing stops to ensure on-time arrivals, while giving dispatchers, customers, and others involved with the delivery full visibility into the process. As the route is being performed, the system constantly monitors every single variable and builds an ever-growing database of key performance information that can be leveraged with sophisticated machine learning tools to continuously improve future route recommendations. The system can be precise, predictive, and prescriptive about the best sequences, choice of drivers, and even the best times to deliver to customers as it builds future route plans.

For example, if service times vary significantly for a particular retail location based on time of day or driver, the system will analyze all existing data and recommend a specific delivery time and driver that executes the delivery as quickly as possible, while meeting the customer's specified time window. So rather than just ensuring arrival between 8:00 a.m. and 12:00 p.m., the system prioritizes arriving at 9:00 a.m. because that is the optimal time to arrive within that 4-hour window – a piece of information dispatchers and drivers likely would never have known. The impact of this optimization is that companies are able to dramatically improve fleet utilization.

In logistics operations where service is the currency that earns customers' business and loyalty, Autonomous Dispatching and Routing is the quantum leap forward that positions any logistics team to compete successfully with industry giants. The question for most teams is how to design and implement a strategy that fits their organization's long-term goals without sacrificing near-term productivity. With Autonomous Dispatch and Routing, there's a logical progression of capabilities, as well as multiple entry points.

Scalability & Efficiency | The Autonomous Dispatch & Routing Dividends

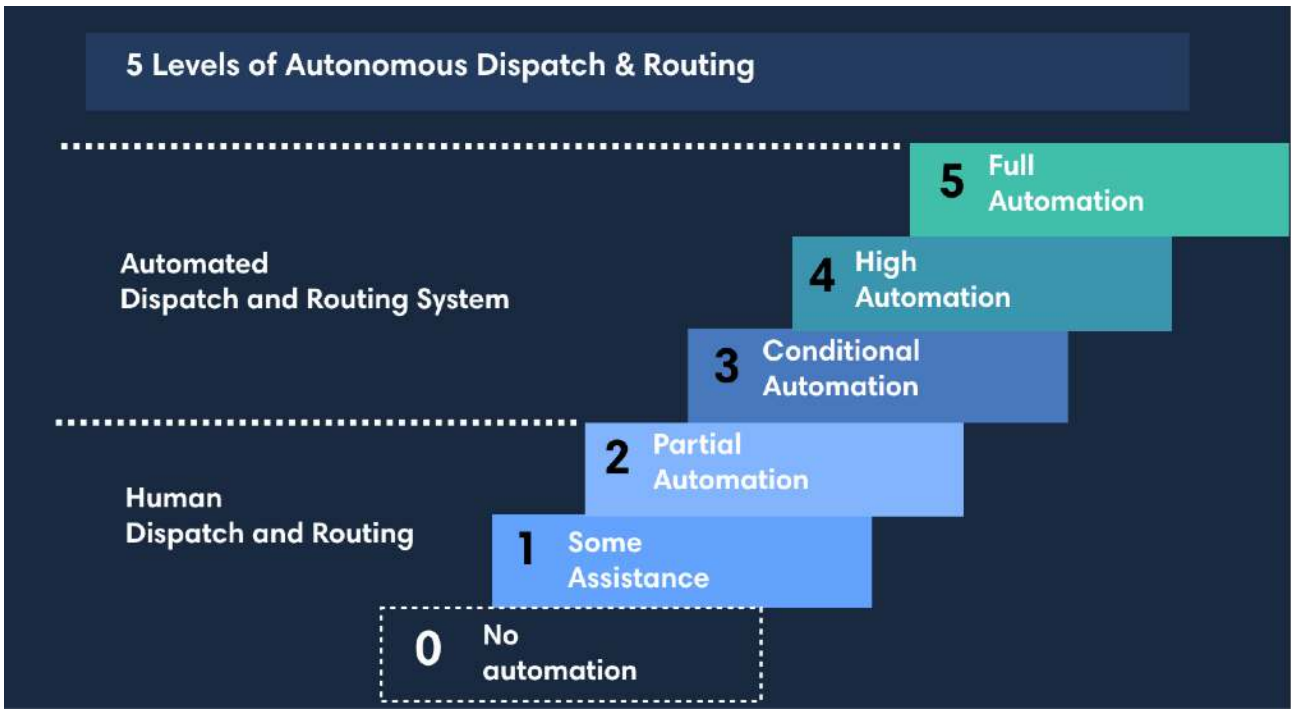
One of the most tangible benefits of Autonomous Dispatch and Routing is scaling the dispatching function. These next-generation systems can dramatically increase the speed and dispatching capacity of transportation operations and lessen the load on individual dispatchers, enabling logistics providers to be more efficient and strategic in their use of resources for exception handling and customer service. Autonomous Dispatching and Routing systems also offer efficiencies that:

- **Reduce time required for route planning** since the system automatically reviews and allocates stops to routes, enabling routing and dispatching teams to review plans, rather than painstakingly building each one.
- **Reduce dependence on territory planning;** instead, automatically create optimized sequences that meet customer time windows and other defined constraints.
- **Improve on-time arrivals** to drive customer service improvements.
- **Improve fleet utilization** to ensure that fleet capacity is well used and, sometimes, take vehicles off of the road.
- **Reduce fleet miles** with optimized route plans.
- **Reduce late deliveries**.
- **Support the full range of dispatching models,** enabling teams to operate in the way that works best for them.
- **Improve overall fleet efficiency and customer service**.
- **Optimize** future routes.

5 Levels of Autonomous Dispatch and Routing

While the fully automated implementation of Autonomous Dispatch and Routing is not yet viable, the foundations are being constructed, and there's a logical progression for the industry. Just as autonomous vehicles (AVs) are characterized by five clearly defined levels of progressively sophisticated automation, so is Autonomous Dispatch and Routing. In the case of AVs, the range spans from Level 0, meaning no automation and described as 'your parents' station wagon,' to Level 5, where fully autonomous vehicles can adapt to every possible driving scenario and condition just as a human does, including extreme conditions.

In Autonomous Dispatch and Routing software, Level 0 refers to traditional, fully manual planning and route building, where drivers manage their own sequences and dispatchers have no visibility into their drivers' performance. At Level 5, scheduling and dispatching is fully autonomous, with all orders automatically scheduled and dispatched optimally without any human involvement required in any scenario or use case. The interesting ground is in between, as the solutions take shape and organizations apply them to their industries.



Level 0 | No Automation; Fully Manual

At Level 0, there is no automation or optimization, and all planning is 100% manual. Dispatchers and/or route planners create and modify initial route plans using pen/paper or perhaps a spreadsheet. Drivers manage their own routes and determine any in-route changes, using own navigation technology. Dispatchers have no visibility into drivers' performance -- current location, progress or customer ETAs. Orders arrive when they arrive and dispatchers handle customer service issues that might arise. Any/all communication with drivers and customers is by phone or text. All paperwork, signatures and account notes are handled manually.

Level 1 | Software Assisted Annual Planning

Level 1 is where many organizations are today. These teams plan routes on an annual or semi-annual basis based on historical customer volumes and other available data. There is some automation built into the planning process (e.g., known constraints such as vehicle type are incorporated into the annual plan), but there's a heavy daily planning burden, including daily manual rebalancing for volume. Plans are not optimized daily, drivers decide how to adapt to customer demands and unexpected circumstances, and dispatchers have little visibility into drivers' performance or issues unless they call or text the driver, or receive calls from customers. Further, the amount of actual data gathered and available to the organization is minimal.

On the business side, there are modest efficiencies in the annual planning process, but the inability to gather and use a variety of different data types to refine and manage plans means that organizations miss opportunities to improve fleet utilization and day-of delivery efficiency, and they're unable to scale the business and support more dynamic business models.

Level 2 | Partial Automation Using Daily Business Rules

Level 2 is a near-term and very achievable goal for many organizations. At this level, software can automatically plan business critical functions daily, managing fleet constraints (availability of vehicles, vehicle types, drivers, and capacity) against customer time windows and delivery expectations with intervention as needed to manage exceptions. There's minimal daily planning, and drivers are given daily schedules in optimal order based on efficiency and known time windows. Route plans are updated daily based on learned data and are driver-, customer-, time-of-day-, weather-, day-of-week-, and product-specific. Drivers have a mobile application where they receive their routes and can access turn-by-turn directions and re-sequence stops, if needed. Dispatchers have full visibility into drivers' progress and on-time performance, and the system provides automated texts or email based on events. The system is gathering data about routes and performance, creating a foundation for using machine learning for future optimizations. Occasional calls may be required between drivers and dispatchers to manage exceptions.

On the business side, Level 2 offers significant improvements in fleet utilization and dramatic increases in on-time percentages. In addition, the system is able to gather and use a variety of data types to further improve future performance. At Level 2, organizations position themselves to embrace more dynamic models and greater capacity, but do not have access to automated dispatching capabilities.

Level 3 | Conditional Automation Using Real-time Business Rules and Dynamic Routing

Available today for more advanced organizations and business models, Level 3 can automate the entire experience – from order acceptance, inventory picking, driver assignment, vehicle loading, and delivery – and only requires a dispatcher to manage exceptions. It supports automated dispatching of individual and bulk orders, as well as the ability to continuously re-optimize across the entire fleet in real time. With immediate response time and real-time decision making, Level 3 systems automatically adjust drivers' schedules to account for delays, real-time traffic, and changes made by the driver. Drivers manage exceptions and handle adjustments, as needed.

Customers can have automated ordering based on efficiency and business rules, as well as same-day

delivery and real-time visibility into order status. In many scenarios, there's no interaction needed between a customer placing an order and receiving their delivery, because automated delivery status notifications keep customers apprised of the projected delivery arrival.

On the business side, there are significant daily efficiencies in fleet utilization, dramatic improvements in on-time percentages, as well as increased order capacity. In addition, the system gathers and uses a variety of data types to further improve future performance with machine learning. At Level 3, organizations can dynamically manage much of the dispatch and routing process.

Level 4 | Highly Autonomous for Fully Known Use Cases *(including Real-time Dynamic Routing of All Vehicle Types)*

At Level 4, dispatching and routing systems operate autonomously with little or no human involvement and are able to resolve most exceptions without dispatcher intervention. Orders come in from various sources, are automatically accepted, and are seamlessly assigned and dispatched to the optimal vehicle type and driver. Fleets can be comprised of traditional vehicles, or autonomous vehicles and drones. The system understands the capacity and constraints of all delivery vehicle options and builds daily routes dynamically based on volume and fleet capacity.

The system is able to manage all scenarios and circumstances, including driver hours, reloads, and multiple trips, and can accommodate owned and third-party assets. The system learns order patterns and route performance, and continuously uses the data it accumulates for hyper-accurate future plans. Assignment and optimization includes prediction and forecasting based on driver behavior, customer demand, product type, time of day, day of the week, weather, and more. Recommendations are made in real time based on given circumstances and historical data. Dispatchers in Level 4 systems spend zero minutes per day to build plans or manage plans, and the system can adjust and adapt in real time.

In the field, the system knows what inventory is available in each vehicle, what has been removed or reloaded, and is aware of customer availability (e.g., loading dock capacity and staff work hours). It also knows instantly when new orders are placed and can adjust and adapt in real time to any updates. Because the system is always learning from a growing data set, it continues to provide better solutions over time.

For the business, a Level 4 system enables cost-effective on-demand delivery, which can be combined with dynamic pricing in order to adapt to resource constraints and demand from customers. For example, on-demand orders with tight delivery timeframes can have surge pricing built in. Exception management can be handled autonomously, as well, based on artificial intelligence learnings.

Level 5 | Fully Autonomous Scheduling and Dispatching for Any Use Case Using AI

At Level 5, the system is completely autonomous and able to support any industry with no human involvement to manage exceptions. While Level 4 covers most scenarios, Level 5 covers every use case.

As in Level 4, orders come in from various sources throughout the day and are seamlessly accepted, assigned, and dispatched to the optimal vehicle in the fleet (traditional vehicles, or autonomous vehicles and drones). The system understands the capacity and constraints of all delivery vehicle

options and dynamically builds daily routes based on volume and fleet capacity. In addition, the system manages driver hours, reloads, and multiple trips and can accommodate owned and third-party assets. Level 5 systems also learn order patterns and route performance, and they continuously use the data accumulated for hyper-accurate future predictions, while being prescriptive, as well.

Exception management is autonomous.

Beyond Level 5

Beyond Level 5, Autonomous Dispatch and Routing systems are able to manage and dispatch all orders, as well as coordinate across fleets, functioning as virtual 'air traffic control' for smart cities to minimize congestion and traffic and optimize performance across all fleets.

Conclusion | Increasing Complexity Requires New Solutions

The reality for most businesses is that increasing customer demands will drive adoption of progressive levels of autonomy in transportation operations. This is necessary to support the growing order volumes that are mathematically impossible to accommodate without automation.

Consider the implications for a business that wants to offer on-demand delivery. If that business is operating with a Level 1 system, offering on-demand capabilities will drive huge increases in operational costs and overwhelm dispatchers, while risking customer service. The same is true if that business tries to offer next-day delivery built on that same Level 1 foundation, or even with a Level 2 system. To offer the service levels that customers expect, organizations need to build upon an Autonomous Dispatching and Routing foundation that supports the organization's progression through the various levels of autonomy.

If Autonomous Dispatch and Routing systems will part of your operations roadmap, answering these questions is critical:

- Where is your organization today in its operational maturity?
- Where is your organization today in its technical maturity ?
- Which level of Autonomous Dispatch and Routing is your operation running at today?
- What level of Autonomous Dispatch and Routing does your business need to achieve?
- What is your timeline for adopting next-generation technology?
- What does change management look like for your team?

About Wise Systems

Trusted by the world's largest brands, Wise Systems builds Autonomous Dispatch and Routing software with machine learning to continuously improve fleet efficiency and performance for last-mile operations. Wise's cloud-based application automatically schedules and monitors deliveries and adapts in real time to delays and challenges on the ground, offering complete visibility for dispatchers and customers. Founded out of MIT, Wise Systems can be used as a standalone platform or integrated with existing systems to revolutionize transportation operations with data science and machine learning.

The Wise Systems platform supports all routing strategies along the spectrum from static routing to real-time dynamic routing, and customers using Wise's cloud-based system typically see significant efficiencies:

- Up to 15% reductions in mileage,
- Fleet utilization increases of 20%, and
- Reductions in late deliveries by up to 80%.

For more information, please contact Wise Systems at info@wisesystems.com or visit www.wisesystems.com.

Appendix

Wise Systems' 5 Levels of Autonomous Dispatch

	Autonomous Vehicles' Capabilities	Autonomous Dispatch & Routing	Dispatcher Experience	Driver Experience	Customer Experience
Level 0	**No automation** -- Driver Controls it all (example: your parents' station wagon)	**No automation/fully manual** -- Planning is fully manual. Drivers manage their own routes/sequences. Dispatchers have no visibility about drivers' locations or progress throughout their days. Customers receive orders when they arrive.	**Dispatcher builds and manages everything.** 100% manual. Initial plans are created by dispatcher or route planner. Plans are modified, adjusted and updated exclusively by route planner. Tools include pen/paper, Excel. Dispatchers give drivers orders, have no visibility into drivers' progress throughout the day, and have to deal with late arrivals and other customer service issues. Route plans are periodically updated manually to accommodate new customers or to remove customers. Any/all communication with drivers and customers is by phone or text.	**Driver decides everything.** Driver creates initial plan and manages in-day changes. Driver receives stack of orders and makes their own daily route sequences using own navigation technology. No optimization. All paperwork, signatures and account notes are handled manually.	**Orders received same day every week.** Customers receive orders when they receive orders. No visibility.
Level 1	**Driver assistance** -- Cruise Control or Steering by car (example: Any car with such features as Adaptive Cruise Control)	**Software-assisted annual planning (no daily automation/optimization)** -- Can automate specific functions on an annual or semi annual basis. Annual territory planning and automated planning (w/in route sequencing) with manual rebalancing for volume (daily). Build routes once/year and then run. Drivers run own sequences. No visibility.	**Dispatcher spends 3-4 hours/day making manual changes.** With territory-planning model, routes don't change daily and all stops are static. Adjustments are made manually by route planner who spends 3-4 hours/day planning. Route plans are not driver-specific and are updated annually or semi annually based on historical customer volumes and in depth reviews.	**Driver decides most everything.** Driver creates initial plan and manages in-day changes. Drivers are given the same route every Monday, Tuesday, etc. Routes may or may not be optimal, but some optimization processes applied. Does not necessarily consider time windows. Drivers decide how to adapt to customer demands or unexpected circumstances. Coordination among drivers and customers involves phone calls, text messages, or email initiated by a person.	**Orders received same day every week.** Customers receive orders when they arrive, and have no visibility.
Level 2	**Partial automation** -- Driver ready to take control. Hands off of steering wheel & gas pedal at same time (example: General Motors Super Cruise, Mercedes-Benz Drive Pilot, Tesla Autopilot, Volvo Pilot Assist, Nissan ProPilot Assist)	**Partial automation using daily business rules (no real-time capability)** -- Can automate business-critical functions daily with dispatcher intervention to manage exceptions.	**Dispatcher spends 30 mins/day adjusting routes and manages all real-time requests (can take hours).** Route Plans are updated daily using business rules and customer constraints, and are specific to driver, customer, time of day, weather, day of week, and product type. Plans are 85% accurate, leaving dispatchers to spend approximately 30 minutes/day on refining plans. Dispatchers need to communicate with customers periodically to manage exceptions/issues.	**Driver starts w/ static day plan and then manages in-day changes.** Drivers' routes are built each day for efficiency and customer service. Drivers are given a daily schedule in pre-planned order based on efficiency and time windows. Drivers have a mobile app showing route sequences and key customer/delivery details. Drivers apply past experiences and make real-time changes.	**Orders can be received any day of the week.** Customers also receive real-time updates about delivery/driver and ETA.
Level 3	**Conditional automation** -- "Safety Critical functions shifted to vehicle" Driver doesn't need to respond immediately. (example: Audi Traffic Jam Pilot in A8 Sedan)	**Conditional automation using real-time business rules and dynamic routing** -- For some scenarios, system can autonomously manage end-to-end process from order acceptance, inventory picking, driver assignment, vehicle loading and delivery. Dispatcher & driver manage exceptions using past experiences. Sub-second response time allows for real-time decision making.	**Dispatcher spends 30 mins/day adjusting plan and 5 mins managing real-time requests (exceptions).** Almost all tasks are managed by system both in prescheduled and real-time scenarios. System supports dynamic planning, on-demand dispatching, carpooling, and cross fleet optimization. Dispatcher only manages exceptions for planning and real-time requests. Dispatcher uses past experiences to manage exceptions and improve solution.	**Driver manages exceptions.** The driver's app provides comprehensive optimization and routes, as well as expanded customer-delivery capabilities, and uses real-time optimization to avoid delays and improve on-time performance. Driver uses past experiences to manage exceptions and improve solution.	**Customers can have same day delivery and real-time visibility.** Customers have automated ordering based on efficiency, business rules etc. For many scenarios, no interaction needed between customer placing order and receiving a delivery. Customers can also self-schedule deliveries.
Level 4	**High automation** -- Fully autonomous, but does not cover every driving scenario. Limited to the Operational Design Domain (ODD) (example: Google/Waymo's test cars)	**Highly autonomous for fully known use cases (learned & predicted), including real-time dynamic routing of all vehicle types.** Highly autonomous and able to schedule and dispatch with no human involvement. Learning and prediction, order placement, cancellation, etc. Dynamically builds daily routes based on volume and fleet capacity. Automated order acceptance.	**Dispatcher spends 0 minutes/day to build/manage plan for given for industry does not need to respond to any real-time requests.** For multiple scenarios, system knows what's on each vehicle, what has been removed or reloaded, is aware of customer availability (loading docks, staff availability, etc.), knows instantly when new orders are placed. System can adjust and adapt in real time to any of the above. Can dispatch any type of delivery vehicles (traditional trucks, drones, AVs).	**Driver simply navigates and drives.** Every aspect of the driver's day is fully optimized, from the initial route plan to all aspects of the customer interaction. On-demand orders are automatically accommodated. System adjusts plans based on prediction and learned data.	**Customers have on-demand delivery, with surge pricing.** Rapid order fulfillment and precise arrival windows with full visibility. Customer can change pickup location or time availability in real time and the driver's schedule is automatically updated.
Level 5	**Full automation** -- Fully autonomous can adapt to every scenario as a human does including extreme conditions. (example: none currently)	**Fully autonomous scheduling and dispatching for any use case using AI** -- Automatically scheduled and dispatched with no human involvement. Any scenario. Anywhere. Anytime. Not limited to specific industries.	See above - applied across any industry or scenario	See above - applied across any industry or scenario	See above - applied across any industry or scenario