

## FAQs

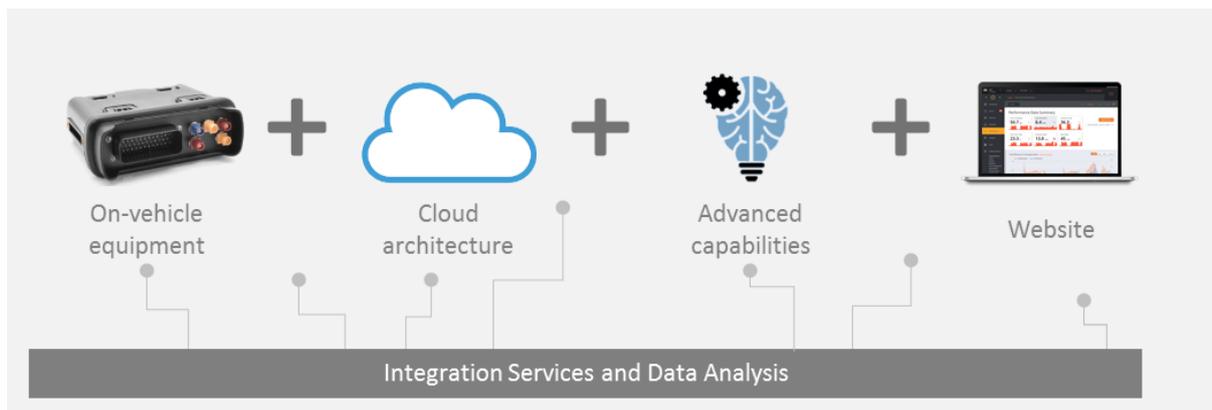
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## 1. What is VPVision?

**Ans:** It's a low-cost next-generation telemetry platform that has streamlined and delivered new capabilities in heavy-duty vehicle operation and maintenance, as well as providing strategic benefits to OEMs, tier 1 and 2 organisations.

Primarily through a browser-based web interface, VPVision will connect your devices via a 2-way connection with cutting-edge cloud-based data storage and analysis tools, delivering new and novel capabilities. VPVision is an end-to-end solution and is available with a suite of additional engineering and support services.



## 2. What will it cost?

**Ans:** Cost is dependent on:

- Number of data channels
- Data frequency
- Method of communication
- Cloud based computational analysis

Based on experience and deployment volumes we can provide an indicative price range early on when assessing a proposal.

The architecture has been built to minimise cost and maximise capability and scalability. With no expensive legacy hardware to support we will be able to estimate cost when we know what is needed.

Because VPVision is completely cloud based, the upfront cost of connecting can be as low as £0, and the cost of scaling up the hardware to support more vehicles is £0.

## 3. How flexible is the cost?

**Ans:** The cost of connecting different systems or vehicles depends on the customers' requirements. During the integration and trial phase your solution will be optimised to your requirements. Since VPVision is built from the ground up and is fully customisable there is a lot of scope to control the cost. The main scope to effect cost includes:

- Data transmission rate - a slower rate means less data, a cheaper SIM plan and reduced back-end costs.
- Data channels - only transmit data that you need and reduce unnecessary transmissions.
- Data transmission mechanism – 2 methods are available: streaming low latency bi-directional method for your “live” critical data and for all other data types use compressed batched log data.

- Feature control - we only provide access to the features you want, customised for different users, lowering unnecessary processing and data storage costs.
- We don't have the cost burden of standing up and maintaining our own servers and the staff to support them. VPVisions's cloud-based architecture is paid for based on usage only.
  - Upfront cost in creating the back-end hardware = £0
  - Costs associated in scaling up back-end hardware for more vehicles = £0

#### 4. How much data can be transmitted?

**Ans:** We haven't found a limit yet.

An existing application communicates over 6,000 channels every 2 Hz (twice every second) with ease, this is much more than most typical applications require.

#### 5. How is data transmitted?

**Ans:** 2 ways.

Streaming data. This is an encrypted, persistent and bi-directional data stream that opens a connection with the cloud and maintains the connection. This method would typically communicate the "live" data. The number of data channels in this stream can be customised to your requirements and the frequency data is sent can also be customised, which enables cost control.

Batched log data. This is uploaded by establishing a temporary secure connection that allow the telemetry to upload a large dataset quickly and cheaply. This method can be utilised to upload compressed log files which can contain vast quantities of data if required. The data channels and frequency these log files are uploaded is customisable to your requirements, or they can be triggered when a Wi-Fi connection is established, allowing for further cost control.

#### 6. What data is transmitted?

**Ans:** VPVision comes with a standard interface detailing what data should be transmitted from a connected device including the frequency and format. However, every device and customer is different so the standard interface can be modified.

Data can be streamed live, meaning a data connection is opened, maintained and data is sent at frequent intervals to the cloud. Alternatively, data can be batched up, compressed, a connection is established and data is sent less frequently – this is known as batched log data.

By having two mechanisms to transmit data an optimal combination of performance, security and cost can be achieved.

#### 7. With so much data how can you ensure users don't get overwhelmed?

**Ans:** We approach this in 3 ways:

- 1.) We can help define the requirements. We support our own vehicles and have helped many clients support theirs, so we know what data is important, how to present it and what the trade-offs are.
- 2.) Functionality to manage data and notifications is already built in. For example, fault codes can have rules applied that prevent them being displayed unless a criteria is met, so not to burden users with information overload.

3.) The right data gets to the right people. With different user account types available, access to data and features can be customised by your own administrators. This ensures the information presented to different users is targeted to their individual needs.

#### 8. What software is required to run VPVision?

**Ans:** None.

VPVision is based on an html interface – basically a website. It is optimised for Google Chrome, Microsoft Edge, android and safari mobile web browsers.

#### 9. How many new servers are provisioned to support a fleet?

**Ans:** None – perfect!

VPVision operates on a cloud computing platform called Amazon Web Services (AWS). This means that no servers or back-office hardware is required to run VPVision. All data storage and processing requirements are provided by AWS, so the number of servers you need for your fleet is 0.

#### 10. What telemetry hardware is provided?

**Ans:** Edge 1.0 is a rugged, on-board unit that provides the hardware and software necessary to connect a vehicle, machine or component to the VPVision cloud platform. Multiple inputs and outputs in combination with a full integration service enable the hardware to deliver maximum flexibility. With an IP67 enclosure, the industrial grade protection ensures it can be deployed in harsh environments including engine bays.

Cutting-edge architecture and a robust set of configurable software modules mean the functionality can be modified and rapidly integrated into new applications. This unit is well suited for data processing and condition monitoring of mobile or static applications. The large memory and processing power ensure Edge 1.0 can leverage the latest software advances such as machine learning to perform fault prognostics. Features include:

- Ability to read CAN messages via contactless sensor to keep the CAN read-only and isolated.
- Multiple CAN channels (up to 4x)
- Multiple Digital Inputs and Outputs (up to 10x)
- Multiple analogue Inputs (up to 4x)
- GPS
- On-board datalogging with 32GB of storage
- Optional features:
  - Li-ion battery backup module
  - Accelerometer, gyroscope and magnetometer
  - Bluetooth / WiFi
  - Internal antennas

CAN bus integration is the most common, but we can also integrate with other communication systems. For example, if you have a lithium-ion battery, super capacitors, an exhaust gas after treatment system, IC engine or almost any data producing system on your vehicle, we pull data from it and start providing useful insights on VPVision.

#### 11. Does the VPVision telemetry hardware have to be used?

**Ans:** No.

We need to look in to this on a case by case basis. Guidelines on how existing on-vehicle hardware needs to communicate with VPVision can be provided to ensure your data gets to where its required.

## 12. Can Vantage Power integrate the telemetry hardware?

**Ans:** Yes.

If we're providing the hardware we can integrate it for you on to CAN and non-CAN based communication systems.

If the on-vehicle hardware is not provided by us, then we need to look at the integration on a case by case basis. If required, we can provide guidelines that will allow your engineers to integrate the hardware and open communication to VPVision.

## 13. Does raw data have to be transmitted or just the result of calculations performed onboard?

Running analysis on-vehicle and only transmitting the result is an option – but not always the best. Before taking decisions on this subject consider how useful having the raw data would be, whether the analysis is likely to change and what actual benefits are derived from only transmitting the result.

To date, we have deployed versions of VPVision that do both – in some instances all the raw data is transmitted to the cloud and any analysis is performed there. In other cases, analysis is performed on the telemetry hardware and only the result is transmitted.

Performing calculations on the telemetry can be cheaper, however it can also reduce flexibility if the analysis needs to be changed and inhibit future-proofing if the raw data is required for other reasons. All options are available and can even be changed at any moment using remote over-the-air software updates.

## 14. Can I change how the web interface works?

**Ans:** Yes.

VPVision supports different systems and as you'd expect, different systems produce different data. We provide a standard interface to simplify integration but this can't always be complied with.

So, the first step to a VPVision implementation is to understand your requirements and what modifications are required to get the functionality desired.

Developing good requirements isn't always an easy thing to do. We've designed and manufactured our own hybrid drivelines including lithium ion batteries, so we can provide insight and analysis of your requirements from the beginning.

## 15. Can I change the styling and logo on the interface?

**Ans:** Yes.

The website is customisable. Should you want your own look and style, something unique to you, we can work with your branding guidelines to update logos, fonts, icons and colours.

## 16. Is there a risk vehicle data might get lost?

**Ans:** You're well covered.

Our cloud based data storage facility offers 99.999999999% durability (yes it is that many 9's), data is stored in the world's largest global cloud infrastructure. As standard, your data will be stored across a minimum of 3 geographically separated locations. Your data is safe!

Data shelf-life customisable by you. When data is ingested in to the cloud we associate metadata to it that governs how the data is handled. We attach an expiry date which is used to ensure it is automatically disposed of or archived at the right time.

#### 17. Is the data connection and the website secure?

**Ans:** Yes. The VPVision website utilises a SHA-2 2048-bit encryption, the strongest encryption on the market.

The IoT communication between the telemetry and the cloud authenticates all connections before sending or receiving data. This ensures data is never exchanged between devices without a proven identity. When a connection is established the data is encrypted end-to-end.

AWS's secure IoT protocol is also utilised to establish the connection for batched log file uploads. This secondary method benefits from the security of IoT but offers a much more economical method to transmitting data, providing a combination of security and value.

#### 18. Can I access the data directly without going through the VPVision website?

**Ans:** Yes.

If you're interested in more complex data analysis there are already specialist tools on the market that can provide some amazing insights. The problem we have seen many companies experience is amalgamating the data into one place, making sure its good quality data and having enough processing power to run through big data sets – with our AWS back-end, that's all sorted.

We can set you up with a data analysis tool that will enable you to access your cloud based data, run queries and visualise this data yourself – we'll even provide some training....or we can run analyses for you and give you the results!

Alternatively, if you have an existing toolset you wish to continue using we can look in to enabling this toolset to work with the cloud-based data. Not every data analysis tool lends itself to operating big datasets stored in the cloud, so we'd have to review existing tools on a case by case basis.

#### 19. Can VPVision anticipate faults before they happen?

**Ans:** Yes.

Also known as prognostics, this is an incredibly useful feature within VPVision. Not only can VPVision reach deeper in to vehicle systems and extract more useful data it can also analyse it to identify emerging issues.

There are 5 ways VPVision can assist with prognostics, starting with the most basic:

**1. Access to up-to-date vehicle data:** VPVision is a single source for live odometer, engine on time, mileage readings and can be customised to provide other data important to you. This kind of data is critical to ensure maintenance, repairs, service bulletins are timed correctly.

**2. Fault Code Management:** All fault codes from a vehicle are captured and stored in one place allowing for easy access. It's common for less severe fault codes to precede major fault events – if these can be captured and reviewed, major faults can be prevented. A mechanism for faults to be categorised is provided, these categories act as a knowledge base where details of known causes and resolutions are provided.

**3. Data visualisation and comparison:** Reviewing how a vehicle performs in specific areas compared to similar vehicles can provide useful analysis. If for example we see an air compressor

working twice as hard or getting hotter than the others in the fleet, we know there's an air leak to investigate.

4. **Analysis of data:** Failures can often be anticipated by trends or step changes in vehicle sensor data. VPVision has the ability to automatically look for these clues and notify users within seconds. Data can be analysed live as it's received or it can conduct analyses over large spans of time covering weeks, months or years to identify trends.

5. **Machine learning:** The most complex of the prognostic options but an emerging trend across multiple industries, machine learning on AWS provides access to a framework of machine learning services that are already integrated with other AWS features. Machine learning is an emerging technology to watch out for, not only in areas such as prognostics but also in areas such as vehicle optimisation.

## 20. Can user access be customised?

**Ans:** Yes.

VPVision has 3 types of organisation:

1. Primary
2. Customer
3. Transport authority

The Primary account is the owner of the VPVision subscription. Their users can see all Operators, all vehicles and all locations and can have access to all VPVision capabilities as well as editing content. The admin of the Primary account has authority to set up multiple Customer accounts.

The Customer account: Their users will only see vehicles assigned to their depot(s). Users are restricted in what applications they can access and what information they can edit.

The Transport authority: Users can have read-only access to multiple vehicles from multiple customer accounts, but their access to data and applications is restricted.

So user access is determined in 3 ways: What organisational account type they belong to, what depots they have access to and what admin rights they have.

## 21. How do you know VPVision can support thousands of connections?

**Ans:** It's all about the architecture!

Traditional vehicle telemetry companies, and many of the current market leaders, have dedicated servers running bespoke software that supports the services they provide. As they scale their services, adding new features or adding more connections, the hardware and software needs to scale with it. This adds a huge degree of complexity and cost on top of the services they provide and inhibits their ability to innovate.

One of the core principles of our selected architecture is scale, rapidly scaling up or down as demand fluctuates. Our device register can accommodate over 1 billion vehicle connections and the data processing and data storage capacity is unparalleled – in fact, it's the largest in the world.

## 22. Can VPVision exert authority over a connected device in any way?

**Ans:** Bi-directional communication to and from a connected device or vehicle is an exciting area and offers huge scope to bring in new technologies and capabilities.

The hybrid vehicles we've designed and put in to service exploit this new technology by providing a predefined level of authority over the vehicle. This can be used to do things like, provide over-the-air

software updates, implement new geo-fenced zones, reset latched faults and even start or disable the vehicle remotely.

To fully exploit this capability the on-vehicle control software needs to be compatible with the remote access that's required. At VP we can provide a lot of help in this area providing guidelines and reviewing proposals on how to construct compatible vehicle software.

As with all AWS IoT communications, security is a top priority and robust processes are required when conducting any over-the-air updates. But even if you don't desire remote access or authority over your vehicles today, this capability comes as standard with VPVision and can be accessed in the future if required.

### 23. Can data from systems that are not on the CANbus be obtained?

**Ans:** Yes.

With the ability to have multiple CAN bus channels, you will be able to read data if it's on a different CAN bus than the primary vehicle CAN.

The hardware has multiple on-board digital inputs and analogue input channels, you would also be able to read the most common sensors and switches directly if required.

If additional channels or different types of input are required, we have available various external hardware units that will read and process the signals then communicate this with the primary hardware. These external modules can be anything from additional digital inputs, analogue inputs, thermocouple signals, thermistor temperature sensors, and similar low complexity devices.

### 24. How live is the data on VPVision?

**Ans:** This is dependent on factors like the signal strength and the speed of your internet connection. Like many features of VPVision, the speed data is presented can be tailored to your requirements. Our standard implementation of VPVision presents streaming data that is between 1 and 7 seconds old, that's based on the vehicle being located in the UK and the website being viewed in the UK.

We recently fitted one of our systems to a bus in China and connected it to VPVision. From a UK computer, the streaming data being presented from China was 20 to 30 seconds old. There are options available to us to reduce this latency but for our purposes this was sufficient.

### 25. What makes VPVision better than typical telemetry systems?

**Ans:** 5 main reasons:

- The back-end architecture is cutting edge which enables new capabilities others cannot replicate.
- We don't have the burden of the back-end management that non-cloud based organisations have, which means our focus is on delivering capabilities, not on managing servers.
- We know drivelines, batteries and vehicle control software better than anyone in the market, because we've designed and put in to service our own heavy-duty vehicles.
- We use VPVision to support our own vehicles and our own customers. This gives us first hand insight and a real-world testing capability.
- Our focus is not just on data reporting like normal telemetry systems, it's a whole lot more interactive and provides a technology path that will not only support, but lead the way on emerging trends within the industry.

26. What technology does VPVision open me up to?

**Ans:** VPVision is built on new market-leading AWS cloud based architecture, the architecture is so powerful it enables capabilities and services not previously possible. Today's implementation of VPVision does not yet exploit all the opportunities this architecture enables, that journey has just begun and we have a very exciting technology roadmap!

The AWS architecture also continues to develop its technology roadmap. New services being developed here are industry firsts in fields such as machine learning and artificial intelligence and access to these incredible capabilities is permitted since VPVision operates within the AWS environment. This provides a second tier of technology development which you are joining simply by utilising the VPVision platform.