scats™

SCATS Priority Engine (SPE)

NSW GOVERNMENT

SCATS Priority Engine

SCATS Priority Engine (SPE) is a software application that enables the prioritisation of designated vehicles within SCATS controlled traffic networks.

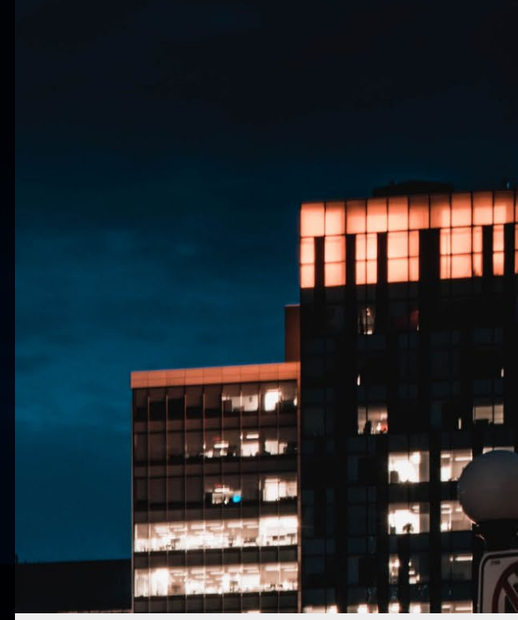
SPE receives priority requests from external vehicle tracking systems and communicates these to the SCATS controller to ensure the enabled vehicle receives appropriate priority when moving through the road network.

SPE provides a unified signal priority function to vehicles including:

- Emergency vehicles
- Freight vehicles
- Mass public transport vehicles such as buses, trackless trams, and light rail
- VIP vehicles

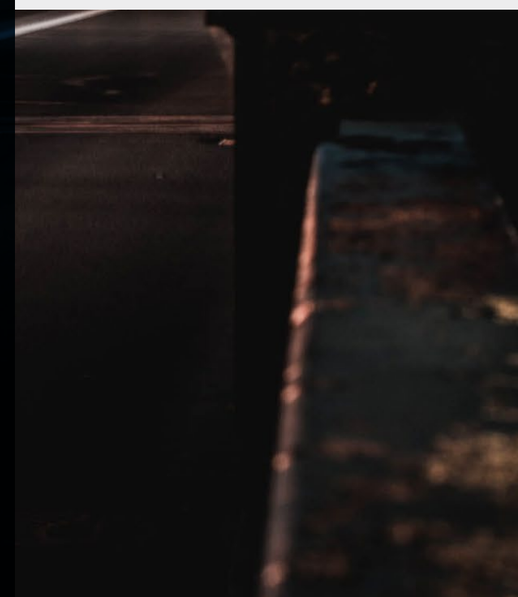
SPE implements a set of rules that govern:

- Whether to accept or reject a given priority request
- How to combine priority requests for mutual benefit, where possible
- How to determine which vehicles have priority
- How to interact with SCATS to enact the priority request



Key features

- Easy integration with SCATS core technology
- Highly configurable options that can be tailored to the needs of individual cities
- The ability to predefine which vehicles get priority when multiple requests are received
- An interactive map and tables for real-time visibility of priority requests
- Access to data for detailed analytics

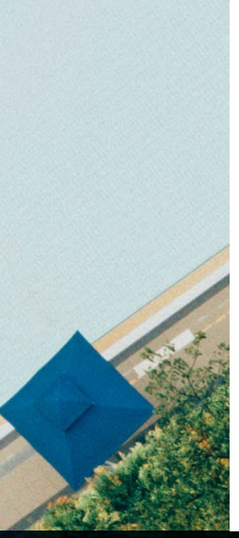


How does SCATS Priority Engine work?

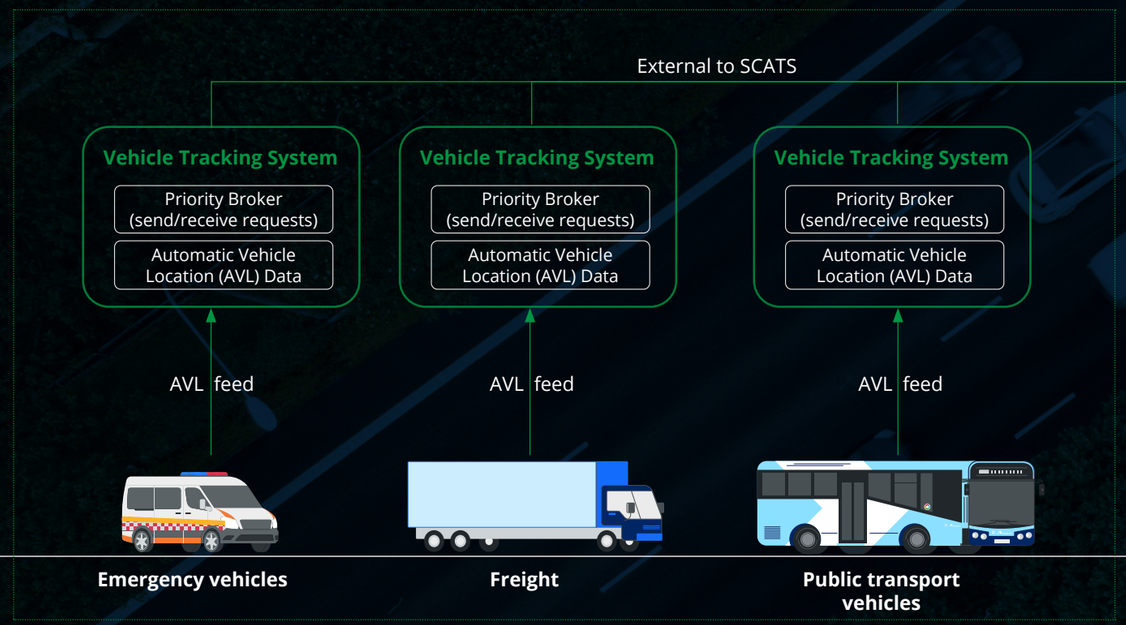
SCATS Priority Engine (SPE) is a highly configurable software that provides cities the ability to prioritise the movement of vehicles.

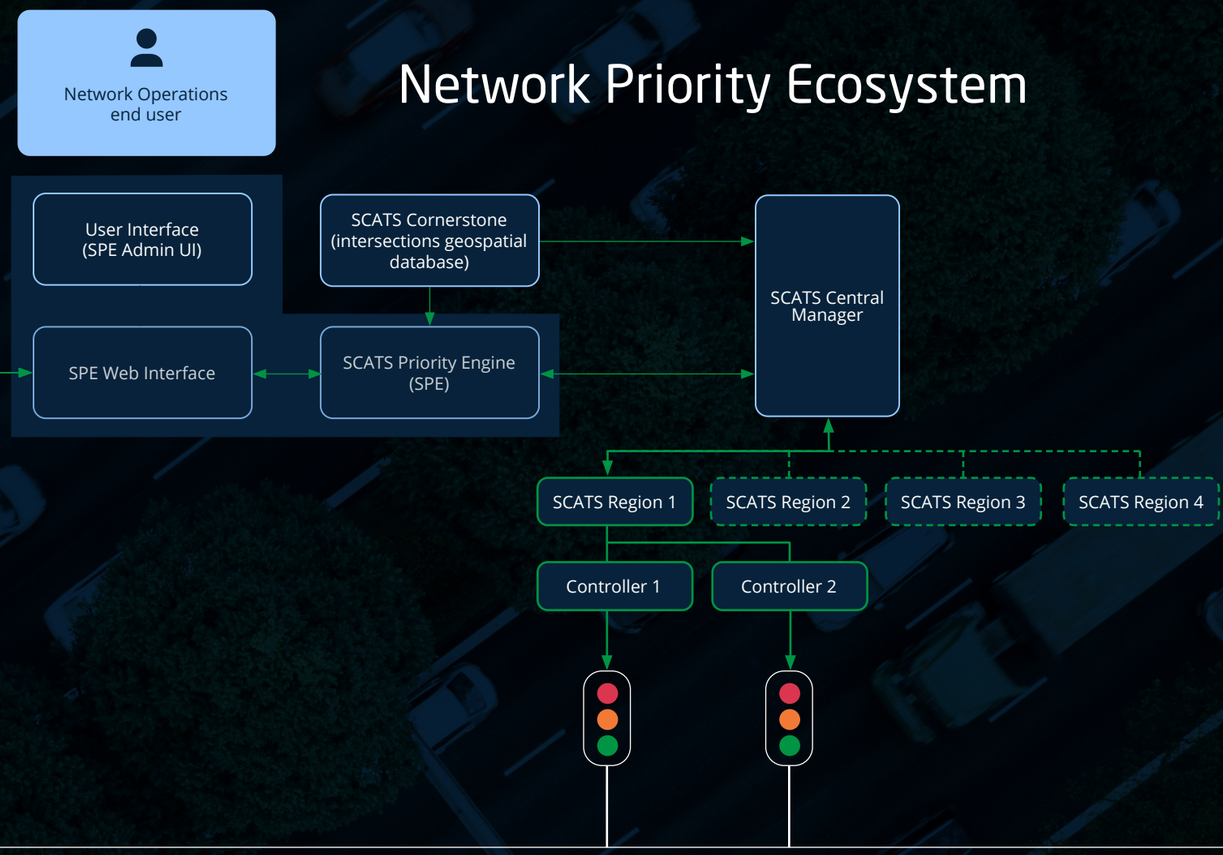
It provides a standardised interface to allow external vehicle tracking systems to issue requests on behalf of priority-designated vehicles. SPE receives the vehicles' estimated arrival time, entry lane, and departure lane, and then communicates with SCATS to ensure signals along the route remain green or change to green based on the estimated arrival time of the priority vehicle.

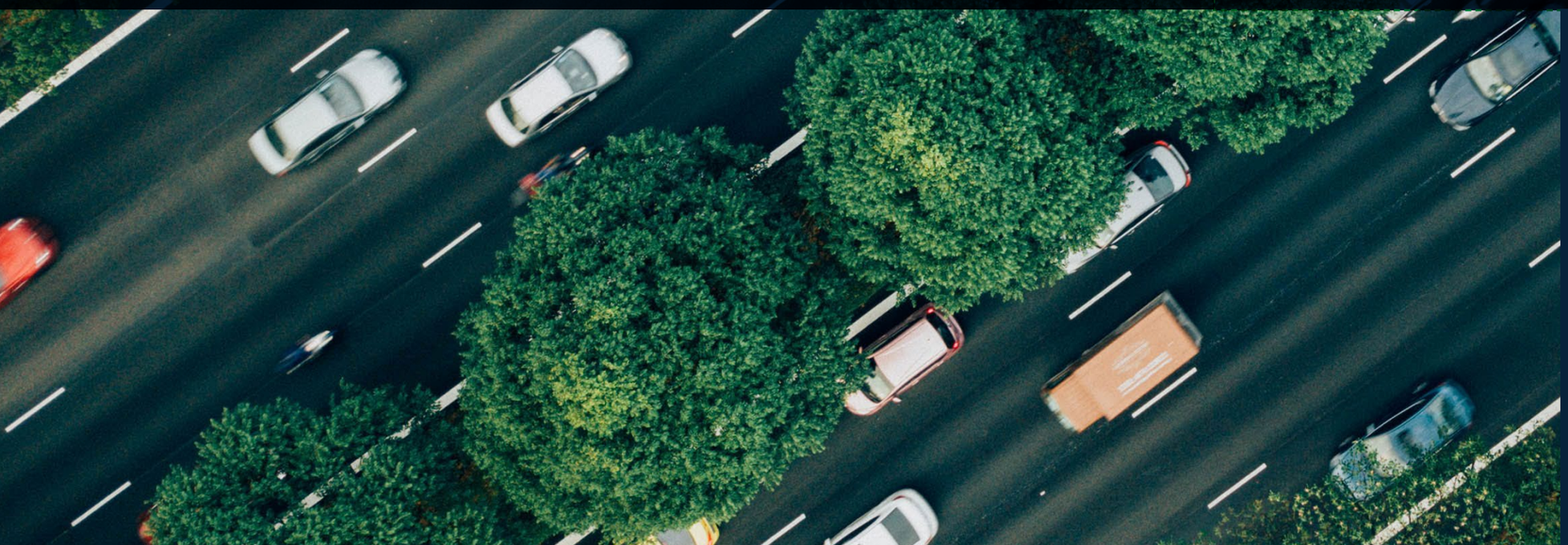
Should more than one vehicle request priority, SPE uses priority levels and scores to determine the order of priority and/or reject requests.



Network Priority Ecosystem







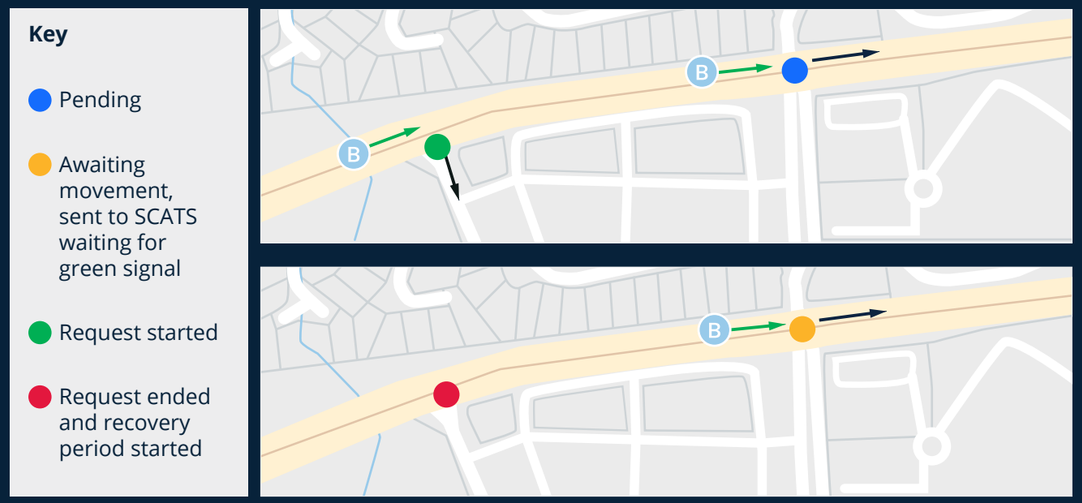
Modes of operation

SCATS Priority Engine (SPE) offers four modes of operation:

1. **Dwell No Skip:** attempts to reach the requested phase quickly by running intermediate phases to a minimum.
2. **Dwell Allow Skip:** attempts to reach the requested phase faster by skipping one or more of the intermediate phases, where possible.
3. **Phase Insertion:** inserts the requested phase (that is not part of the cycle) immediately after the current phase.
4. **Signal Group:** starts a specific signal group that is associated with one or more phases at a given site.

How can you use SCATS Priority Engine (SPE)?

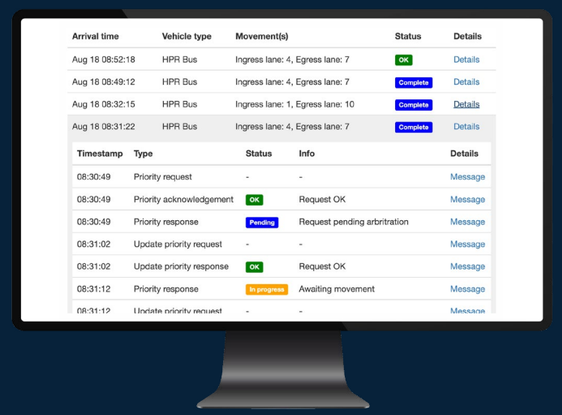
- Priority can be applied to any intersection that is controlled by SCATS. This automatically creates a profile for priority features which defines constraints and/or privileges associated with vehicle types across different times of the day and different day types. Network operators can easily decommission (remove) or recommission priority managed intersections.
- Intersections can be configured by enabling priority, editing the profiles, or creating new profiles for the intersection.
- Vehicle types can be easily created and assigned a priority level.
- The progress of priority requests can be tracked using the map screen in SPE. The request status is displayed as coloured circles on the map.



Priority statistics can be viewed for all successful (not rejected) requests for three time periods, displayed as 24 Hours, Today, and Last Hour. These statistics show the priority requests per intersection.

Other functions include:

- Adding new users, editing users, editing user passwords, and assigning profiles to users based on their authorisation to perform certain functions in SPE.
- Viewing active sessions to see which clients are active in the application.
- Creating a request explorer report which provides request information based on your designated filter criteria. This report can be exported as a CSV file.
- Viewing request information for a specific intersection. The Operations tab on the Intersection screen shows the last ten priority requests and continues to update as new requests are received. The intersection diagram will continually update according to the request Status for this intersection.
- Viewing the details of a specific priority request



Priority features

A priority feature is a privilege or a constraint that applies to different priority levels at different times of the day and different day types.

SCATS Priority Engine (SPE) has two types of priority features:

- **Privileges** apply to a given priority level and all levels **above** it.
- **Constraints** apply to a given priority level and all levels **below** it.

There are currently three identified priority features in SPE:

- **Priority Enabled** is a privilege that enables a priority at a site for a given (minimum) priority level and all priority levels above it.
- **Override Recovery** is a privilege that allows requests for vehicles with a priority level equal or larger than the minimum level to override the recovery interval. The recovery interval is the period at the end of a priority request at a site during which SPE will reject subsequent priority requests to allow the site to revert to normal operation.
- **Disabled Movements** is a constraint that disables priority on one or more movements at a site for vehicle types with priority levels at or below the maximum priority level. Priority will be enabled for that site for all other movements for the vehicle types configured for the first feature; Priority Enabled.

Priority scenarios

SCATS Priority Engine (SPE) handles four key scenarios:

- **Basic:** SPE grants priority to a single request for a priority enabled vehicle.
- **Complementary:** SPE grants priority to two or more vehicles when there is at least one common phase that supports all required movements.
- **Conflicting:** SPE simultaneously receives requests from two or more vehicles at a given site along movements which do not share a common phase. SPE determines which vehicle to grant priority to, based on priority levels and scores.
- **Coupled:** a more sophisticated scenario where the vehicle tracking client can issue coupled requests at 2 or more subsequent intersections when the predictability of the travel time in the resulting path is high. This is usually the case when the path between the successive intersections is relatively short (150m or less) and there are no possible stoppages (e.g. bus stops) in between.

SCATS Priority Engine (SPE) Architecture

SPE is comprised of three components

1

SPE

SPE or the 'Priority Engine' contains all of the logic for priority processing. It arbitrates incoming requests from multiple clients and issues requests to run a particular phase or a signal group to SCATS.

- SPE reads the Config Database to retrieve configuration during start-up.
- Incoming priority requests and responses issued by SPE are logged in the Log Database.
- SPE maintains a local cache of site geometries and site priority configuration.
- SPE requests site geometries and site priority configuration for all sites with active C-ITS (Co-operative Intelligent Transport Systems technology) in SCATS Cornerstone. The response received from Cornerstone is serialised and written to the local file system.
- SPE maintains a live connection with Cornerstone to retrieve data into the cache. Every time a site is updated in Cornerstone, SPE receives a notification over the live ITS connection, which is then used to query the latest data for the site and update the cache.

2

SPE Web

SPE Web provides a standard, JSON-based, web socket interface for clients to connect, authenticate, and issue priority requests and other types of requests to SPE. SPE Web passes these requests to SPE and relays back responses to the client through the same interface.

3

SPE Admin UI

The Admin UI is the user interface for configuring and administrating the SPE. It includes reporting and monitoring capabilities and can be used to check the status of requests in real time. Admin UI uses SPE Web to access priority requests exchanged between SPE and its clients. Configuration is stored in the Configuration Database, and reports are generated from priority requests/responses logged in the Log Database.

SCATS Priority Engine also uses two separate Microsoft SQL databases

1

SPE Configuration Database

The Configuration Database is used for recording SPE configuration, with any changes made using the Admin UI recorded in this database. SPE reads this database during start-up to load initial configuration. All writes to this database are performed by the Admin UI.

2

SPE Log Database

The log database records priority requests from clients as well as the responses sent back to clients by SPE. All writes to this database are done by SPE. The Admin UI reads from this database for reporting purposes.

SCATS Priority Engine (SPE) can operate from the cache directly and does not need a live connection with Cornerstone to function. SPE can operate in offline mode provided there is data in the cache.

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