



LED offers an exciting new option for lighting in public spaces, but deploying LED without considering adaptive control strategies may be wasting much of the technology's potential.

Traditional fixed intensity public lighting solutions are usually designed around the trade-off between meeting minimum safety requirements and the cost of operation. This can result in lighting systems designed for the middle ground – wasting energy when the light isn't required, and not really as bright as they could be when the light is required.

LED technology has matured to the point where it is now seeing wide scale deployment in high-intensity applications like public lighting. Energy cost savings of up to 50% (and even greater) can be achieved with a straightforward like-for-like replacement with LED technology.

Installing LED lighting technology with this old "fixed intensity" mindset is wasting much of its potential. With an ability to come on instantly and respond quickly to dimmer controls, LED opens the door to a whole new way of thinking about lighting in public spaces. Designers can now specify lights that provide brilliant light that's well suited to human vision requirements, without having to carry the full operating costs of these lights at all hours of the night. A single light source can be both economical and bright.



How it Works

The Firefly controller is a small dimming controller that can be installed in a wide range of new or existing public lights. It doesn't require any additional cabling, or rely on power supply lines for signalling. Instead it uses a secure, self-healing wireless mesh network to enable the lights to communicate with one other, and operate either autonomously in response to local sensors, or by remote control.

Groups of lights are arranged in "control groups" with master nodes providing a communications gateway back to the command and control platform. For large-scale urban deployments these can use the cellular network, while smaller installations may integrate with existing campus, factory, precinct or building networks.

The wireless mesh can also be leveraged to integrate with other sensing, data acquisition or control devices such as energy metering (AMI), break beams, light or environmental sensors.

Applications

Pedestrian Lighting

Pedestrian lighting has traditionally been deployed in terms of minimum lighting levels, based on a range of subjective parameters, such as predicted traffic levels, risk of crime, prestige of the area (NZ/AS1158.3 “P1” to “P5”). Every judgement is a compromise between efficacy and cost to run, and the situation often changes through the life of the light.

VRT’s Firefly system addresses these challenges by enabling a light to adapt to varying demand using on-board presence detection. Pedestrian and cycle traffic is always provided with bright, clean usable light, and areas of low use are dimmed to save energy when there is no traffic – the best of both worlds.

The control strategies and settings are all manually adjustable on a per-light basis, and the platform provides a range of analytics tools to optimise settings automatically (e.g. automatically adjusting the time in the evening when lights switch from “full on” to “auto” modes by learning the time of day that traffic drops below certain levels, on a light-by-light basis, night-by-night, on work days, weekends and public holidays).

In addition to lighting control, VRT are able to offer options for public safety “Duress Points” integrated with the Firefly control system. These required an upgraded network connection, integrating CCTV and VOIP call station electronics into the lighting base. On activation of a duress point, surrounding lights immediately ramp up to 100%, and the call is routed through to the network operating centre.

Roadway Lighting

The use of adaptive lighting controls presents similar opportunities to those found in pedestrian lighting, although implemented with consideration for the needs of road users. Controllable LED allows lighting designers to over-provision, then dim back to required levels. This provides a reserve capacity that can be called upon in adverse driving condition to improve safety.

A key benefit of controllable lighting in roadway applications is the improved asset monitoring, providing an ability to detect failures and schedule replacements.

Additional safety may be afforded to pedestrian users by increasing intersection illumination when crossing signals are activated late at night, or on the approaches to railway crossings when trains are approaching.

Public Transportation Lighting

Railway stations, bus stations, airports, outdoor car parks, ports and rail yards all have their own unique requirements, however the flexible and programmable nature of the Firefly control system presents opportunities to optimise lighting control to maximise visibility for safety and security, while minimising running costs.

In some cases, presence detection may be sufficient alone, while in others there may be opportunities to tie in with operational and scheduling systems – synchronising lighting controls to transport schedules, or controlling public safety (CCTV) camera systems from lighting presence detection systems.



REMOTE CONTROL



SECURE



WIRELESS



SELF-HEALING NETWORK



ALL WEATHER



REDUCE RUNNING COSTS



24/7 CONTROL & MONITORING

Commercial Lighting

Shopping centres, business parks and integrated residential communities all have a the need for outdoor public lighting, and in many cases, the provision of effective lighting is not only necessary for public safety, but contributes positively to the experience of customers and residents.

The control options available with the Firefly control system support presence detection as well as integration with building management and security systems.

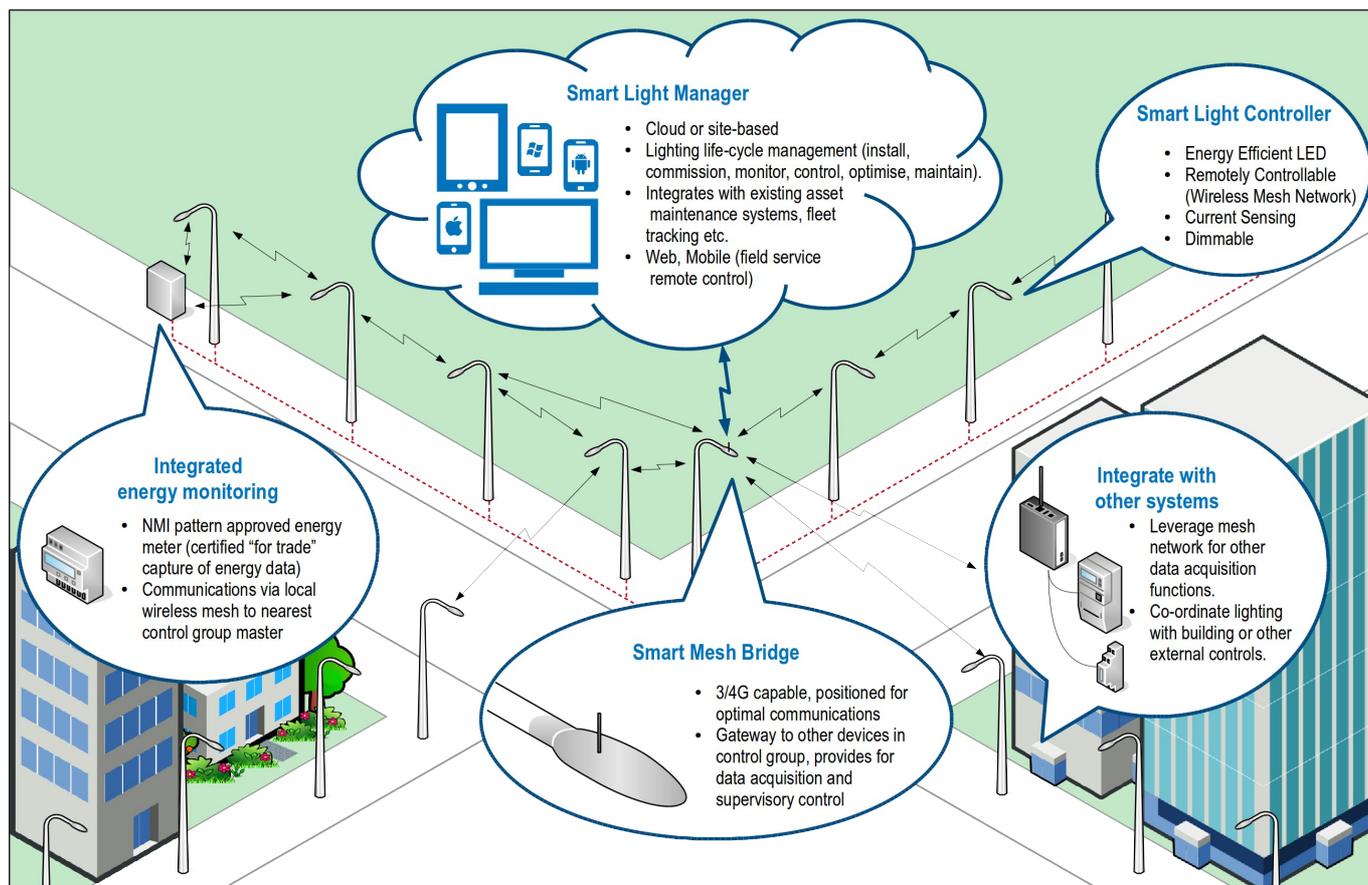
Industrial Lighting

Industrial plants make extensive use of outdoor lighting to provide a safe working environment for staff at night. By combining LED lighting with adaptive controls, facilities have the opportunity to provide a safer working environment, without wasting energy.

Plants with large storage or holding yards (stockpiles, tank farms, settlement ponds) can ensure that workers are provided with a safe working environment, without illuminating large areas at high levels of brightness unnecessarily (simply by dimming lights in areas where people aren't working). Local presence detection can be supplemented by signals from the plant control system – for example when areas of plant are shut down for overhaul; during start-up or shut-down sequences; in response to known stacking, reclaiming or loading activities.



Image courtesy of Walmart Corporation (CC-BY)



Solution Elements

Luminaire

The Firefly solution can work with virtually any LED light fitting. We can retrofit to existing lights, or provide controllers pre-integrated with luminaires from leading LED lighting providers. Some luminaires are of a suitable design to enable the controllers to be mounted internally. A NEMA7 version is also available. Controllers have been tested with several leading manufacturers of high-quality LED Public Light fittings including [Lemnis Public Lighting](#) and Gerard (Sylvania). However, we are a lighting agnostic business and are prepared to work with any suitable LED lighting supplier.

Firefly Controller

The Firefly Controller is a small dimming controller that can be installed in a wide range of new or existing public lights. It doesn't require any additional cabling, or rely on power supply lines for signalling. Instead it uses a secure, self-healing wireless mesh network to enable the lights to communicate with one other, and operate either autonomously in response to movement (on board presence detection), or by remote control.

Firefly Mesh Bridge

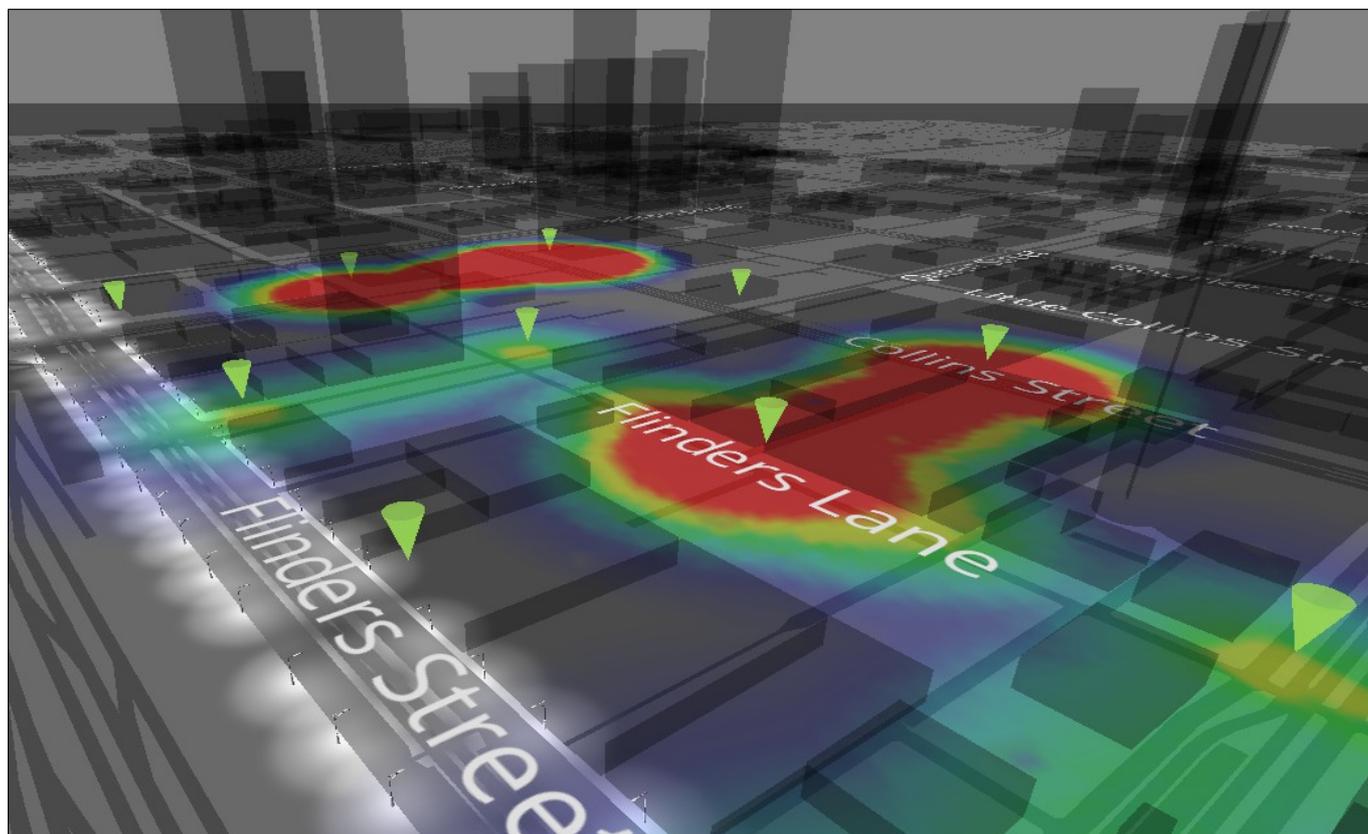
Groups of lights are connected via a wireless mesh, with a Firefly Mesh Bridge providing a link to the upstream data network. This approach reduces data and integration requirements, and provides for maximum flexibility in the design of the communications network:

- **Cellular:** A variant of our standard Firefly Controller has a cellular modem on board, allowing selected lights to be designated as bridge nodes, to provide the back-haul communications link via 3G/4G networks.
- **Wired:** In cases where the lighting needs to be integrated with a local plant control system, building or precinct management system, we have the option of installing wired bridges that provide fibre or Ethernet communications options.

Firefly Light Manager

The Firefly Light Manager provides:

- **Monitoring and Control:** Real-time data acquisition and control capabilities allow for remote control of lights on an individual or mass basis (e.g. override automatic control of large numbers of lights for functions and special events).
- **Alarms and Alerting:** In addition to critical alarms generated by the light controllers themselves, additional alerts can be configured on any threshold exceeded (run hours, electrical disturbances etc.)
- **Historical Storage:** Key light performance data is logged and kept online for long-term storage and analysis.



- **Analytics:** Algorithms learn patterns of normal use for the lights, factoring in traffic levels, calendar events, weather conditions, and can then adapt control strategies accordingly, and detect anomalous events.
- **User Interface:** The software provides a range of user interface options tailored to the needs of different users. The primary interface is a modern web interface with dashboards, maps and charts. We have a mobile application for field workers performing installation and maintenance activities. For scenarios where we are integrating a number of services (lighting, duress, CCTV etc.) in a dense urban environment, we integrate with VRT's [Visual Workplace™](#) technology to provide a rich, interactive 3D environment.

The management interface is delivered as a complete hosted service (SaaS) on the WideSky platform, and can be integrated with 3rd party integration platforms. For applications where the lighting control needs to be interfaced with site-based control or management systems, an Ethernet gateway device is available.



Firefly Control Gateway

Higher-level lighting management functions are implemented in control software. Depending on the solution architecture, this may be hosted within the Firefly Light Manager application, or can be delivered in an appliance form depending on project requirements.

The control functionality provided by the gateway provides scheduling functions and the ability to control lights in operational groupings that are unrelated to the topology of the network. These groupings can be based on operational requirements or by geographical regions.

Firefly Duress Point

A key driver for improved public lighting is often safety, and simply improving lighting levels can lead to measurable improvements. In addition, we are also able to offer a duress station that integrates with the Firefly control system. The duress station can be mounted at the base of a light pole, and incorporates:

- Duress button with VOIP speaker phone and CCTV camera (to identify caller).
- Control of nearby lighting (surrounding lights ramp to 100% light output when duress is activated).
- Additional CCTV cameras mounted in nearby lights provide additional coverage for feed to network operating centre.

Features & Benefits

Full life-cycle management – install, commission, monitor, control, optimise, maintain:

- Mobile app and work flow for field technicians to manage light install/replacement, testing and commissioning.
- Track utilisation, energy use and performance of lights.
- Analytics – learning algorithms monitor usage patterns on a light-by-light, night-by-night basis to learn patterns of use. This

can be used to optimise and automate control strategies, as well as for detecting changes in usage patterns or anomalous light behaviour.

- Web and Mobile Apps – Modern HTML5 web management application, cross-platform, desktop, tablet, smart phone.
- Open interfaces – integrate with other IoT platforms, energy management systems, asset maintenance systems, plant control systems.
- Compatible with VRT's Visual Workplace software – deploy sophisticated 3D monitoring applications for incident response in densely populated urban environments.
- Easy-to-reconfigure light network - reset and optimise a multi 10k light network from a single interface.

The benefits that flow from this increased flexibility are similar to those that resulted over 40 years ago when electromechanical relays were replaced with PLCs (Programmable Logic Controllers). Smart Lighting is a similar “game changer”, and in the medium future, the use of smart lighting will also be looked on as a “no-brainer”:

- **Reduced energy consumption** – LED delivers up to 50-60% saving on like-for-like replacement, adaptive control can deliver a further 20-30% more.
- **Increased light lifetime** – reduced light utilisation can extend the luminaire lifetime.

- **Reduced asset maintenance costs** – much lower spot failure rate (traditional light sources as much as 10% p.a. failure, LED can achieve as low as 0.5% p.a.); addition of monitoring enables automated scheduling of maintenance, failure prediction (condition-based maintenance).
- **Increased Utility** – because lighting levels are not compromised by the “fixed intensity” trade-off between brightness and cost, lighting levels can be designed for the best case, instead of the medium case.
- **Increased Safety** – LED already provides a much cleaner, whiter light. Introducing adaptive control enables light levels to be increased in times of need, improving safety and security.
- **Responsive or Customer-service** – give your citizens or workers the light they need when they need it.
- **NMI pattern-approved meters** provide check metering to validate/negotiate with your power provider.
- **Situational Response** – Smart Lights become part of your community or business tools e.g. lights can respond to sensors, distress points, camera video-analytics, emergency services etc.

