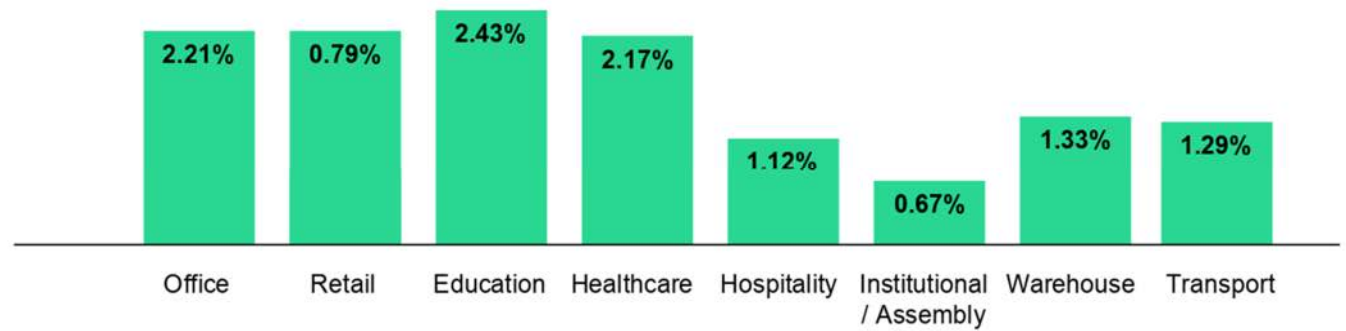


QUALIFIED BLUETOOTH® MESH



Missed
Opportunity

Penetration of Advanced Lighting Controls in Commercial Buildings



Source: DLC, Navigant Consulting 2014

Why the Lack of Controls Adoption

What can accelerate widespread adoption of connected lighting controls?

- Further Technology Improvements (wire-like reliability/responsiveness is a must)
- Standardization
- Cost Reduction
- Clear Value Proposition
- Compliance with Building Energy Codes
- Less Complexity, User-Friendly Tools

Existing Offerings



Barriers to Adoption

- High Investment Required
- Difficult Installation and Commissioning
- Proprietary Systems
- Reliability and Scalability Issues
- Security Concerns
- High Complexity
- Go Backs



Aspects of the Ideal Controls Platform

- Interoperability
- Scalability
- Security
- Reliability
- Robustness
- Ease of Use
- Ease of Set Up
- Affordability



QUALIFIED BLUETOOTH® MESH



Qualified Bluetooth Mesh is a global wireless networking standard which expands the capabilities of the Bluetooth radio communication by introducing a new type of network topology.

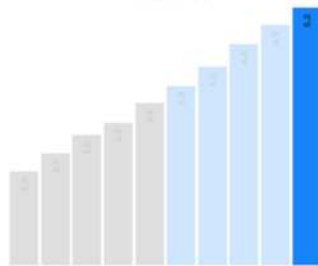
Enabling many-to-many device connectivity, Qualified Bluetooth Mesh is optimized for creating large-scale networks consisting of thousands of devices.

Why Bluetooth is the Right Choice



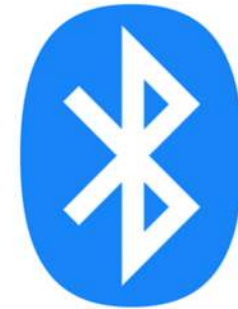
35 000

Bluetooth SIG members

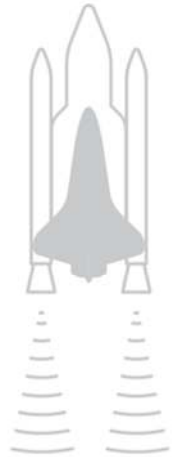


5.4 billion

Bluetooth device shipments in 2023r.



the fastest growing wireless standard



Worldwide brand recognition

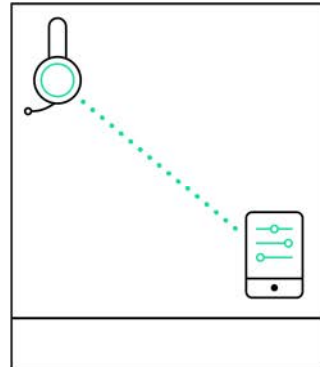
source: Bluetooth Market Update 2018

The Importance of a Standard

- | | |
|---------------|--|
| Universal | Providing a foundation for interoperability |
| Security | Not tied to a proprietary system |
| Robustness | Standard can be checked, improved and expanded as needed |
| Collaborative | Intellectual Property contributed by many companies allow improvements to be quickly adopted |

Evolution of Bluetooth Topology

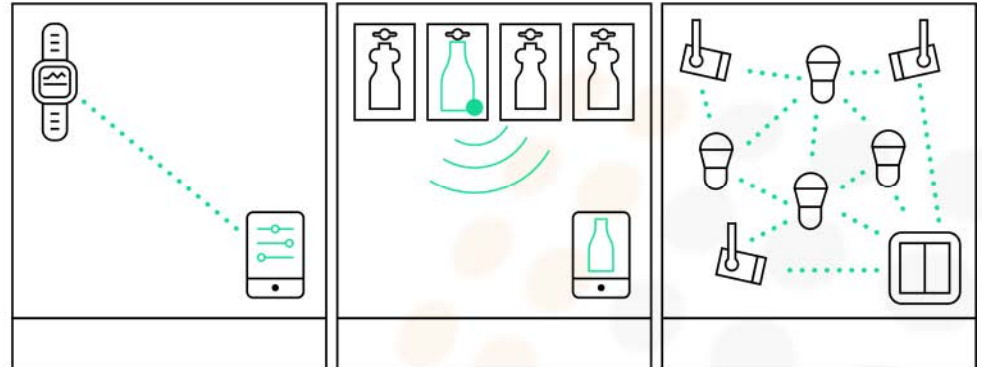
Classic Bluetooth



audio streaming

- wireless headsets
- wireless speakers
- in-car audio

Bluetooth Low Energy (BLE) For Short-Burst Connections



data transfer

- sports & fitness devices
- health & wellness devices
- peripherals & accessories

localized info sharing

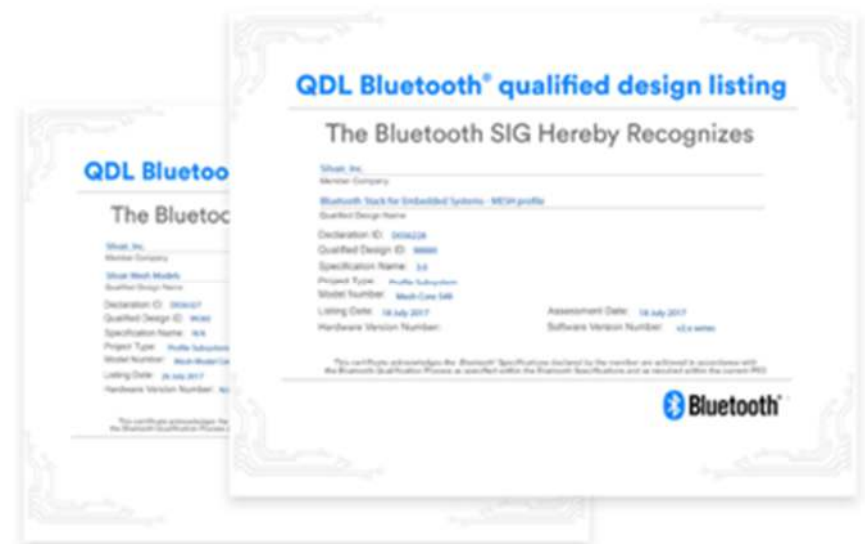
- poll information
- item finding
- way finding

large device networks

- building automation
- sensor networks
- asset tracking

Bluetooth Mesh as a Game Changer

- Adopted and Publicly available since 2017
- 3rd Bluetooth Revolution after Audio and Low Energy
- 100+ qualified products available now



Benefits of Qualified Bluetooth Mesh Controls

- Affordable
- Ease of Set Up
- Government Grade Security
- Interoperability
- Over the Air Updating (with gateway)
- Complete Set of Lighting Control

- Future:
 - IoT Information & Services using QBM Controls installed today

Why Qualified Bluetooth Mesh for Lighting?



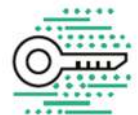
the fastest low-power communication



scalability to thousands of devices



no single point of failure (no central device)



the most advanced encryption standards as well as the cutting-edge device authentication



compatibility with a widely available devices (smartphones & tablets – both with Bluetooth 4.0 and Bluetooth 5)

Lighting Control Features

- ❖ Scheduling
- ❖ Scenes
- ❖ Occupancy sensing
- ❖ Lighting zones / grouping
- ❖ High-end and low-end trim
- ❖ Manual control
- ❖ Timer switch control
- ❖ Vacancy sensing
- ❖ Per zone daylight control
- ❖ Per fixture daylight control
- ❖ Zone linking
- ❖ On power up behavior



Meeting the Needs of Various Applications

Office



- Lower operating costs
- Enhanced well-being of employees
- Significantly reduced energy consumption

School



- Flexible lighting supporting various learning activities
- Increased comfort of students and academics
- Definable lighting scenes for specific teaching purposes

Warehouse



- Increased safety of workers and goods
- New possibilities for optimizing workflow
- Facilitated compliance with energy codes

Parking



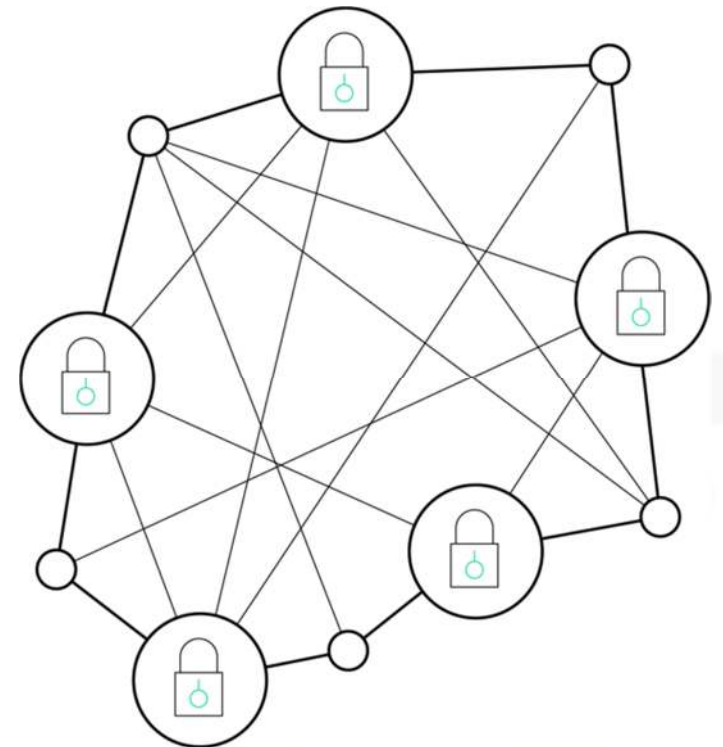
- Improved visibility
- Increased safety of pedestrians and assets
- Reduced maintenance costs

Interoperability

- Open and globally interoperable standard (can drive widespread adoption of connected lighting systems in commercial spaces).
- Globally unified frequency band
- Fully defined yet flexible application layer focused on sensing and lighting (generic, time, scenes, scheduler, sensors, light, ...)
- Time-tested qualification tools and procedures
- Supported by leading chipmakers
- Give customers the freedom to choose from a variety of products across different vendors

Security

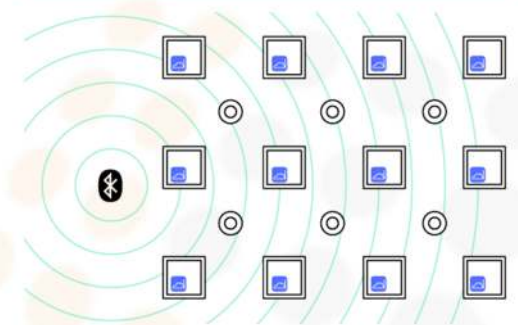
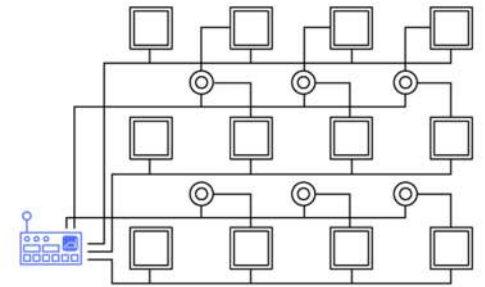
- Open standard
- Secure by design (eavesdropping, brute force attack, replay attack, man-in-the middle attack, ...)
- Separation of device, application and network security
- Long random keys (no passwords)
- Key refresh / blacklisting



Scalability

- Decentralized architecture
- No gateways, hubs, central controllers
- Easy to scale up from small system
- Thousands of devices in the network (32K)
- Many-to-many communication
- Ultra-short messages
- High data transfer rate
- Subnets & other network settings (relays, TTLs)

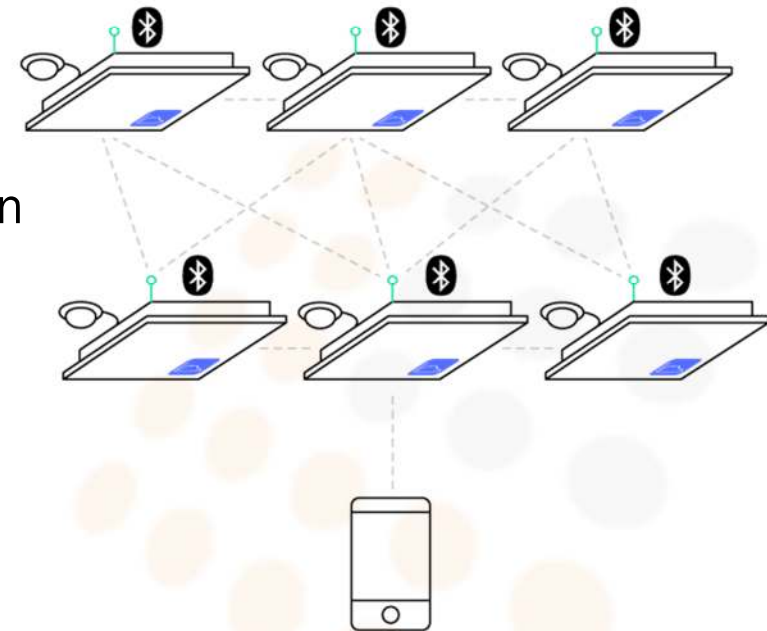
Industry Standard Architecture



Bluetooth Mesh Architecture

Reliability

- No single point of failure
- Each device is autonomous
- Many-to-many communication
- Multi-path delivery
- Retransmissions



Myths

➤ **Bluetooth is for personal / home use**

Not true: **Bluetooth mesh is not "your father's Bluetooth"**. It has been designed with commercial / industrial use cases in mind. Bluetooth mesh is more secure and scales better than competing technologies.

➤ **Delays and popcorning are inherent to wireless**

Not true for Bluetooth mesh: The architecture of Bluetooth mesh addresses precisely these wireless challenges. **Works as well as wired!**

➤ **Bluetooth does not define dimming curves**

Not true: Bluetooth defines both linear and perceptual (logarithmic) dimming curves as well as precise device behaviors WRT the dimming curves. Tests for the curves and their behaviors are covered by the Bluetooth Mesh Test Suite and are part of the Qualification program.

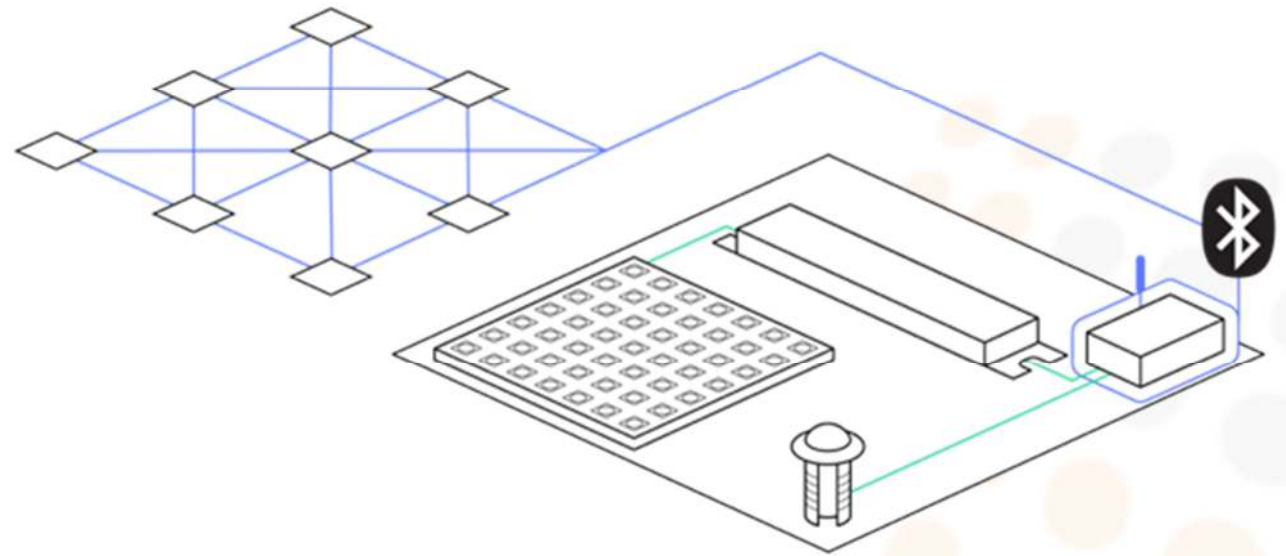
➤ **Bluetooth is easy to hack**

Not true: **security is at the heart of the design of Bluetooth mesh networking** and its use is mandatory. It uses the most advanced encryption standard and device authentication preventing third parties from trying to break into smart lighting infrastructures.

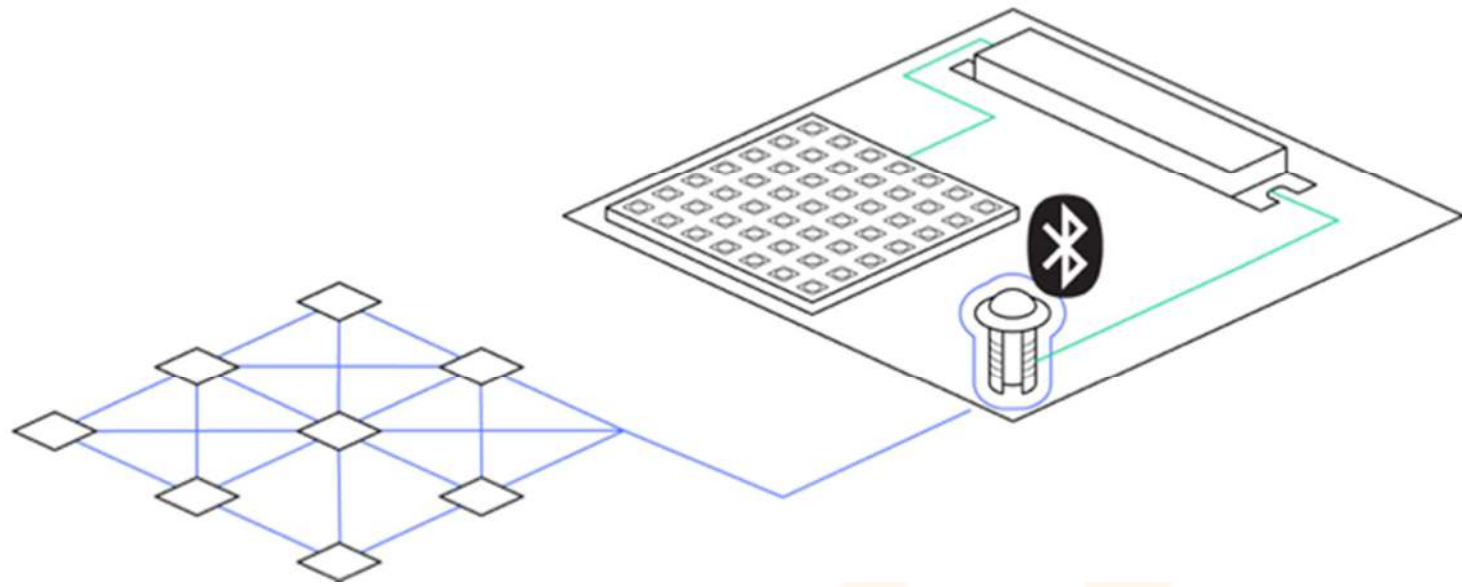
➤ **Bluetooth has a really short range**

Not true: Range depends on surroundings, radio performance and antennas. While the radio performance and antennas are pretty static for a given Bluetooth device, the surroundings can vary a lot. **Outdoors, in an open field, you can get a range of up to a hundred meters. Indoors, in normal condition it's about 30m.** Bluetooth thanks to its mesh topology is able to cover big networks.

Hardware
Integration:
Fixture Controller



Hardware
Integration:
Sensors



3 Steps for Set Up

Step 1

Remote preparation of a retrofit project with the use of our web app. Uploading floor plans, defining individual lighting zones and choosing lighting control scenarios.

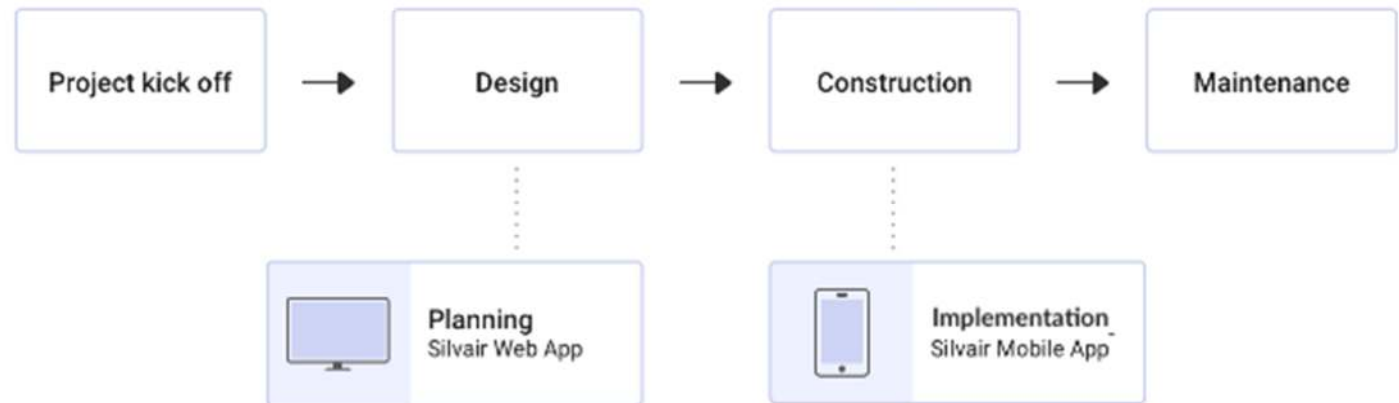
Step 2

Electrical installation of qualified Bluetooth mesh **luminaires and components**. No additional hardware is required.

Step 3

Adding lighting devices to the Bluetooth mesh network on-site with the use of an **iOS app**.

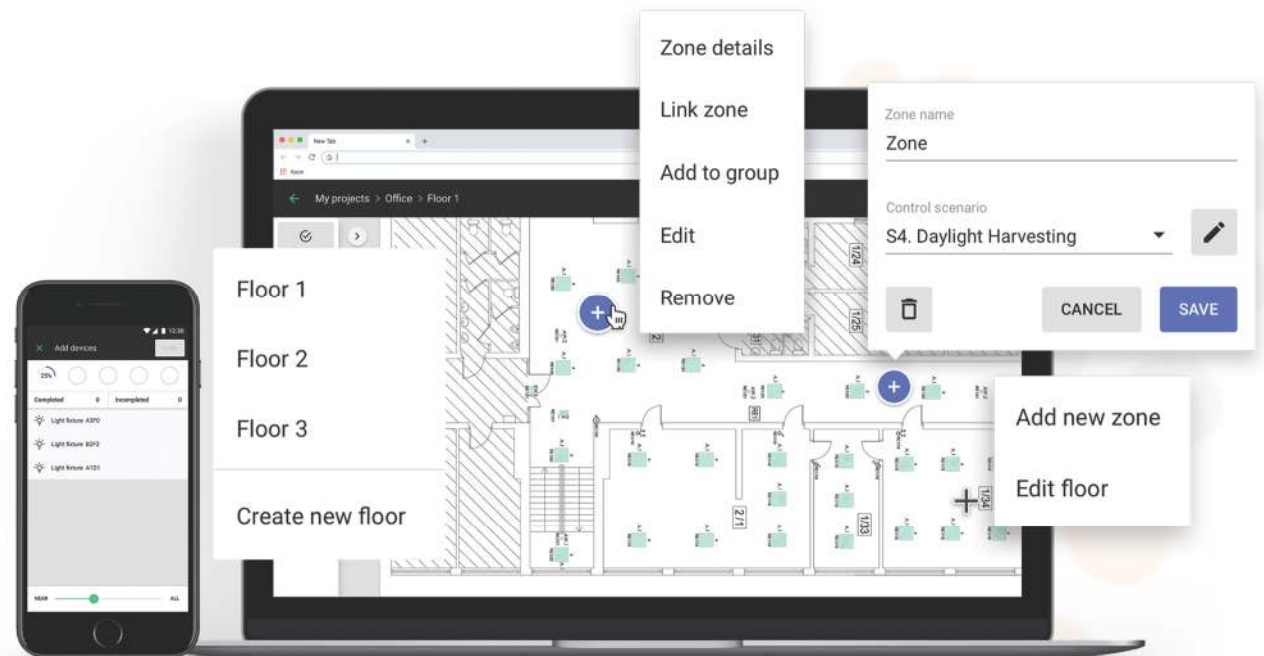
Customization and calibration of lighting control parameters during and after the commissioning process. Defining scenes for specific working activities.



How Does Set Up Work?

Linmore LED Ultra Link App (iOS) software tools for set up and managing connected lighting installations.

The Ultra Link App has been designed to support advanced lighting control strategies, including occupancy sensing, vacancy sensing, daylight harvesting, zoning and task tuning.



Set Up App

- Intuitive and user-friendly Web and iOS apps
- No specialized training or lighting control expertise required
- Optimized for commercial and industrial spaces of any size
- No additional wiring or central control box
- Customizable lighting control parameters





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Thank you!