Bluetooth® mesh standard

an interoperable foundation for smart lighting

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QUALIFIED BLUETOOTH MESH

What is Bluetooth® mesh?

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, Bluetooth mesh is optimized for creating large-scale networks consisting of thousands of devices.

Aside from its unmatched scalability and wire-like reliability, it enables a globally **interoperable ecosystem** of products that can work with each other out-of-the-box.

DID YOU KNOW?

Supported by both Bluetooth 4.0 and Bluetooth 5, Bluetooth mesh networking standard is perfectly suited for many building automation applications such as smart lighting.

See how Bluetooth® has evolved through the years

1994

The invention of Bluetooth technology by Ericsson

The first iteration of the Bluetooth technology (Bluetooth Classic) allowed for simple, wireless, point-to-point data exchange between two devices. It was considered a breakthrough in the field of wireless communication.

1998

The introduction of Bluetooth Special Interest Group (SIG)

Focused on the development and the licensing of Bluetooth standards, Special Interest Group was founded to provide developers with technical specifications in order to help them create new systems based on the Bluetooth technology.

2010

The release of Bluetooth 4.0 Specification (Bluetooth Low Energy)

Introducing a different network topology, Bluetooth 4.0 enabled one-to-many wireless communication. Providing a wide range of profiles for healthcare and home entertainment applications, this version of Bluetooth has helped to significantly reduce energy consumption.

2016

The official reveal of Bluetooth 5

The new radio version of Bluetooth introduced a greater support for the upcoming IoT applications. Increasing the bandwidth up to 2 Mbit/s, Bluetooth provides major technological improvements making it an even more reliable solution for wireless communication.

2018

Bluetooth mesh standard enabled products available on the market

Due to Bluetooth mesh standard implementation in solutions such as Silvair's lighting control technology, new interoperable lighting products are becoming available on the market. You can finally start to build your own mesh networks.

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2015

The formation of the Mesh Working Group

A development of many Bluetooth-based proprietary mesh solutions around the world caused the foundation of a new subdivision of the Bluetooth SIG. It focused on creating an open mesh networking standard for the Bluetooth technology.

2017

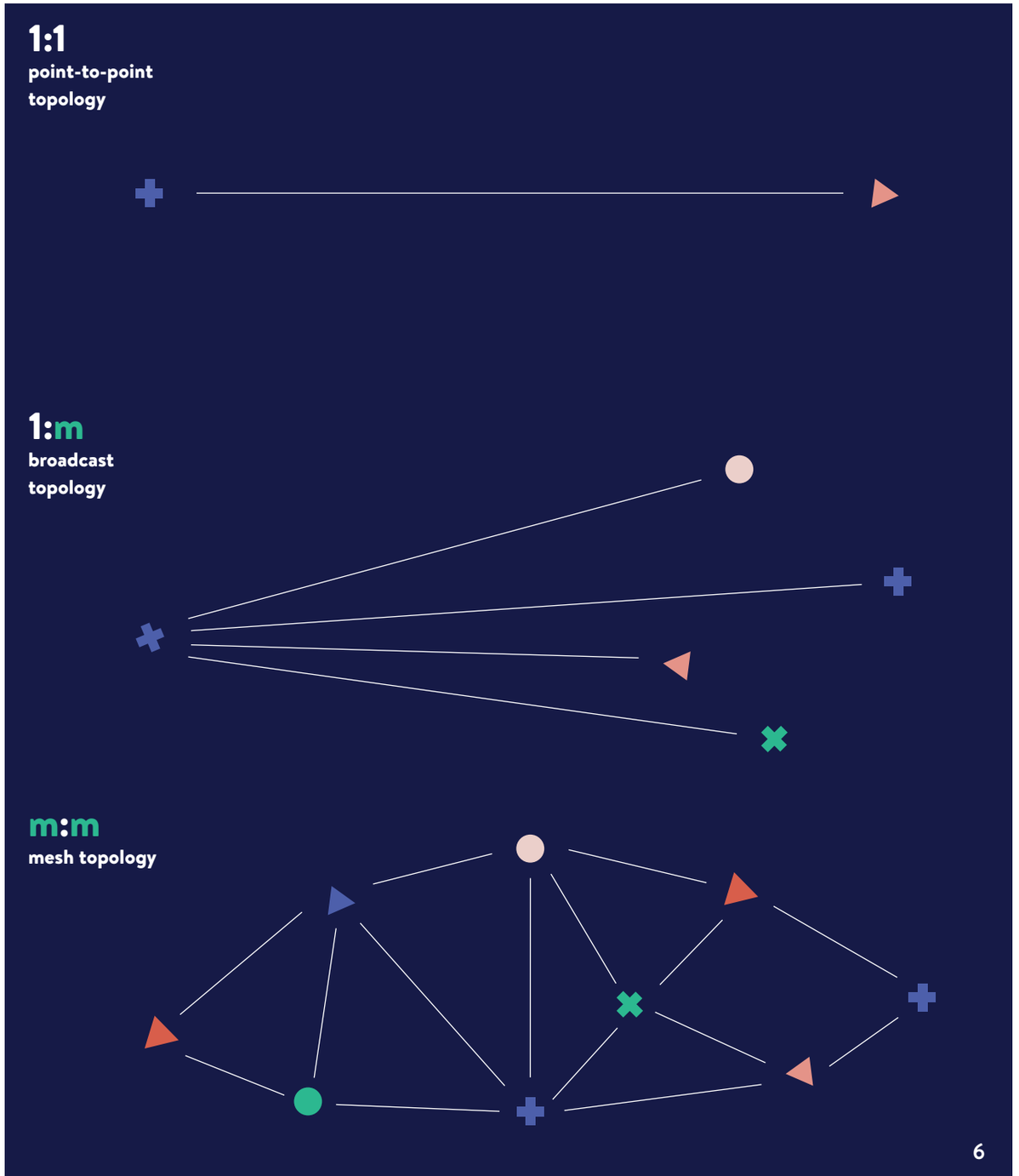
The official adoption of The Bluetooth mesh standard

After two years of development, Bluetooth mesh was officially adopted as a networking standard on July 18, 2017, which allowed companies to join and together build an interoperable ecosystem.

It’s all about network topology

A constant development of Bluetooth networking technologies is driven by a vision of a fully connected world. Back in a day, **point-to-point (1:1)** connectivity allowed to make two separate devices (phones, health monitors, watches and fitness trackers) talk to each other. But as time went by and the number of smart devices increased, we became in need of a more advanced solution that would enable one-to-many communications. A **broadcast topology (1:m)** was, therefore, invented and it became frequently used in applications such as beacons. And though previous 1:1 and 1:m topologies are still suitable for many situations, the progress was inevitable. Being able to start implementing various smart services such as connected lighting, technology providers found themselves in need of a new type of network topology which would become their solid foundation. This is how a mesh topology was born.

In order to provide building occupants with services such as those relating to the Internet of Things, we need **many devices (m:m)** to communicate collectively at the same time. A mesh topology uses its network devices called nodes to enable fast data transmissions over long distances. These devices can be, for example, luminaires distributed throughout a multi-storey commercial building. Once all the connections are established, a mesh network becomes self-sufficient in its activities. Moreover, the same network that was set up for smart lighting applications can be later used for providing value-added services such as asset tracking, space utilization, and occupancy analytics. This is one of the reasons why a combination of Bluetooth technology and mesh networking is thought to be a groundbreaking solution redefining the smart lighting experience.



A backbone for smart lighting

“Addressing the needs of modern lighting control systems was a key requirement in the development of the Bluetooth mesh networking standard. We are delighted to see the rapid adoption of Bluetooth in the lighting industry, which will help accelerate the deployment of interoperable connected lighting systems that will serve as a platform for a variety of IoT services in the future.”

Ken Kolderup
Vice President of Marketing
at Bluetooth SIG

The power of interoperability

The goal of the Bluetooth mesh standard is to allow full cross-vendor interoperability of products so that devices made by different manufacturers could communicate directly out-of-the-box. Bluetooth mesh enables complete interoperability because it defines all protocol layers - from the lowest radio network ones to the top application layer.

Open standards can drive the widespread adoption of lighting control technologies in commercial spaces. Providing customers with the freedom to choose from a variety of products across different vendors, Bluetooth mesh enables markets to grow and helps smart lighting systems become commonly used lighting solutions.

Closed proprietary systems are divisive and risky. Their interoperability is limited to using single brand products which means that if the manufacturer stops supporting that particular solution, it first becomes unavailable and then forgotten. Find out whether a particular solution you're interested in uses the open Bluetooth mesh standard.

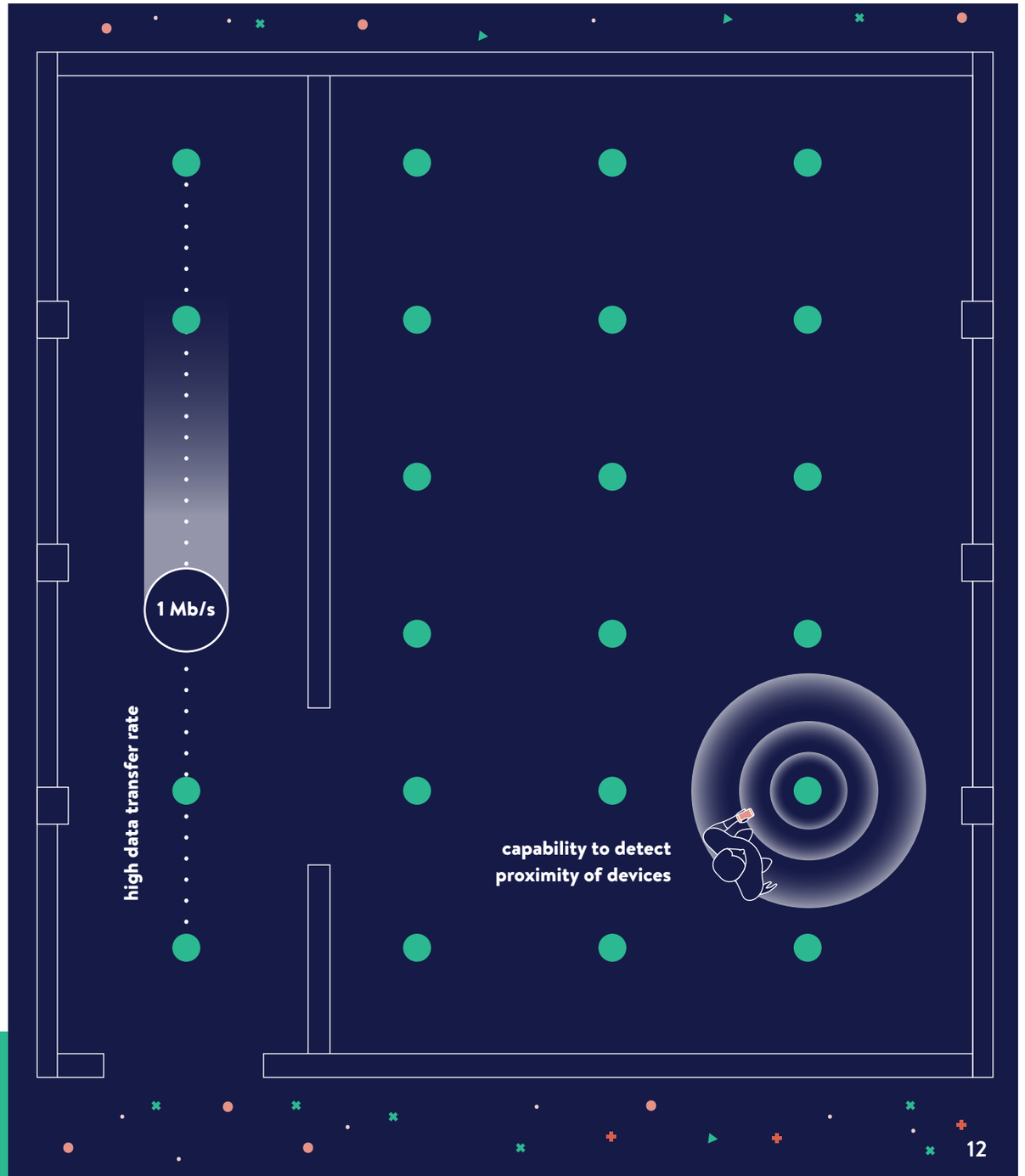
The significance of scalability

The unmatched scalability of Bluetooth mesh guarantees a full-building coverage by connecting thousands of lighting devices in the largest commercial spaces. Having built our own Bluetooth mesh network consisting of a thousand of devices, we know that scale is clearly one of Bluetooth mesh's most valuable advantages.

1. **scalability to thousands of network devices (nodes)**
   supporting high-density multi-service sensory networks
2. **high data transfer rate**
   thanks to Bluetooth radio's transmission rate up to 1 Mb/s, Bluetooth mesh is a fast low-power solution for smart building applications
3. **capability to detect proximity of devices**
   enabling quick and intuitive commissioning process
4. **publish / subscribe architecture**
   for more dynamic and stable communication between nodes

DID YOU KNOW?

Bluetooth mesh technology uses a managed-flooding technique – a routing method where a message is not transmitted along one specific path, but instead is sent to all devices in range and those which are acting as relays retransmit the message to other nodes.



The assurance of reliability

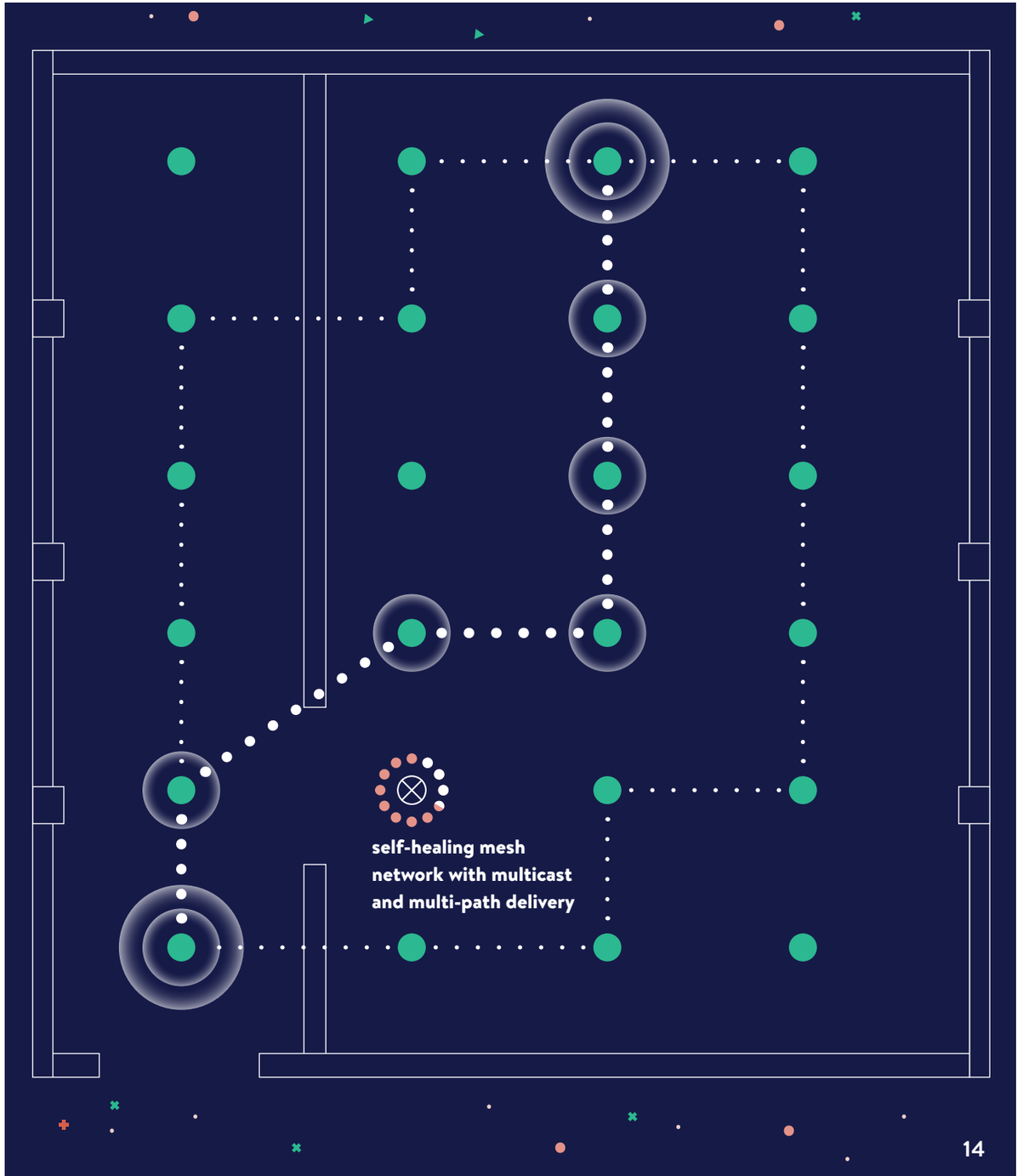
Apart from its impressive architecture, Bluetooth mesh is an extremely reliable solution guaranteeing that your smart lighting system will work efficiently at all times. It does not require any gateways or hubs to be fully operational. This is why there is no single device whose malfunction would affect the entire network.

1. **managed flooding with multicast and multi-path delivery**
   ensuring that each message reaches its recipient

2. **short messages**
   minimizing the probability of radio packet collisions

3. **no hub and no single point of failure**
   a malfunction of a single mesh device has no impact on the rest of the network

4. **compatibility with an enormous installed base of devices (smartphones, tablets, laptops with both Bluetooth 4.0 and Bluetooth 5)**
   so that electronic devices we all use every day can be used as commissioning, control and diagnostic tools



The priority of security

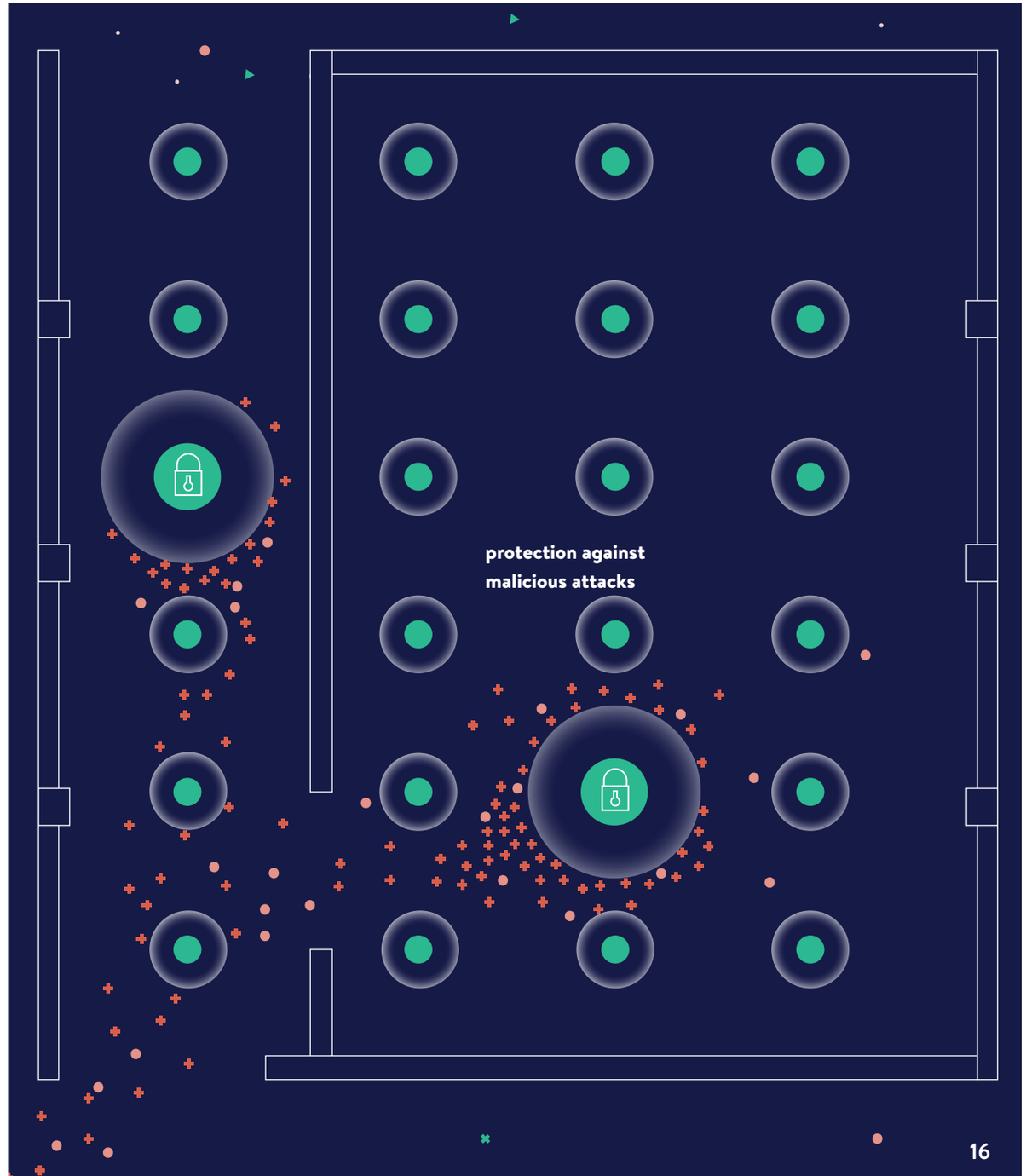
Bluetooth mesh is a highly secure technology that uses the most advanced encryption standard and device authentication preventing third parties from trying to break into your smart lighting infrastructures. You can also divide a Bluetooth mesh network into seperate subnets – each cryptographically distinct and secure from the others.

1. **secure low-power technology**
   using an advanced encryption standard as well as a cutting-edge device authentication

2. **separation of concerns**
   network security, application security, and device security are addressed independently

3. **device authentication**
   a provisioned device outputs a random, single or multi-digit number to the user that is to be entered into the Provisioner for the cryptographic exchange to take place between the two devices

4. **protection against malicious attacks**
   Bluetooth mesh was designed to defend itself from, for example, malicious data transmission repeats and delays (replay attack protection), extracting passwords from a removed network device (trashcan attack protection) and other threats



Why are we confident about the future of Bluetooth® mesh?

The Bluetooth Special Interest Group (SIG) – the body that oversees the development of Bluetooth standards – is a global community transforming the way people and technology connect. With years of expertise in developing globally successful and interoperable standards for wireless communication, it has now delivered a technology which redefines what is possible in professional smart lighting applications. Bluetooth mesh is a result of the constant, market-driven evolution of the Bluetooth radio and has been developed in a collaborative effort of agile innovators and heavyweight tech companies. In the dynamic world of the Internet of Things, Bluetooth's enormous strength is that it's able to develop faster than any other low-power communication protocol, constantly adjusting to current market demands. What is so special about the Bluetooth SIG?

IT'S OPEN

every comapny can become a **member**

no NDA required

specifications are **publicly available**

IT'S MEMBER DRIVEN

33k

members and still **growing**

IT'S INDEPENDENT

The Bluetooth SIG owns the Bluetooth radio throughout all the **7 layers** of the OSI model

- Application
- Presentation
- Session
- Transport
- Network
- Data Link
- Physical

IT'S CREDIBLE AND EXPERIENCED

Bluetooth is the most **globally recognized** wireless protocol

Putting theory into practice

Silvair Lighting Firmware allows you to easily incorporate Bluetooth mesh standard into your products so they could become part of the open ecosystem. Optimized for professional applications, our lighting models support sensor and switch-based lighting functionalities and basic to advanced lighting control scenarios. To facilitate the integration process, we also provide a set of dedicated testing and manufacturing tools.

Silvair gives component manufacturers a head start with a ready-to-use wireless technology, the shortest time to market, and guaranteed compliance with the Bluetooth mesh networking specification.

LIGHTING FEATURE PACKAGES

Our lighting feature packages provide your components with specific smart lighting functionalities. You can flexibly choose features you want to have incorporated into your products in accordance with your customers' needs or targeted applications.

ADDITIONAL FEATURES

We've developed a number of supplementary solutions improving the reliability and robustness of our wireless lighting control technology. These include **over-the-air update** capability or support for **EnOcean switches.**

CORE BLUETOOTH MESH STACK

Our core Bluetooth mesh stack defines the fundamental networking principles that constitute a rock-solid foundation for our wireless lighting control solution. Leveraging the outstanding wireless capabilities of the Bluetooth Low Energy radio, as well as the unique architectural paradigms of Bluetooth mesh networking, this part is responsible for providing unmatched scalability, wire-like reliability and government-grade security of our lighting control technology.

mesh communication / encryption / provisioning / health monitoring / phone connectivity

Start by asking your technology provider these important questions...

Is your product an officially QUALIFIED Bluetooth mesh one?

For a product to become Bluetooth mesh qualified, it needs to go through a detailed certification process. You can check whether a particular company delivers a qualified Bluetooth mesh product on Bluetooth's official website.

Which Bluetooth mesh models are implemented in your firmware?

Bluetooth mesh models define the functionality of a network device. For different products to be truly interoperable, they need to share complementary mesh models. Whether a given device is equipped with these complementary models is defined in a product documentation and on Bluetooth's official website.

Can you show examples of products or components provided by different vendors (that you support) that work together via Bluetooth mesh?

The best way to test the interoperability of a given solution is to see various cross-vendor products working seamlessly together. As many manufacturers are now entering the market with their Bluetooth mesh standard enabled devices, ask your technology provider to help you find out which products will enable you to start exploring the open ecosystem and build your own mesh networks.

What proprietary features have you implemented and how does this affect interoperability?

Numerous companies add proprietary functionalities to enhance the overall system experience. However, some of these functions may not be supported by the Bluetooth mesh specification and, therefore, can compromise the interoperability of Bluetooth mesh on some level or in its entirety. It is crucial to know which functionalities are designed to be interoperable and will work with every Bluetooth mesh standard enabled device.

... and join the interoperable Bluetooth® mesh ecosystem

Products that feature Bluetooth mesh technology must undergo a detailed certification procedure ahead of their release on the market. Using a firmware that is already qualified makes product certification process shorter and easier. These are the steps you must take:

1. Become a **member** of the Bluetooth SIG
2. Create an account and register at **bluetooth.com**
3. Purchase a **Declaration ID**
4. Create a New Listing using the online **Qualification Listing Interface** (QLI)
5. **Sign** a Declaration of Compliance (DoC)
6. **Brand** your Bluetooth Product following the Bluetooth guidelines

Contact

If you would like to learn more about Bluetooth mesh networking or the challenges related to wireless communication in professional lighting applications, take a look at some of our materials:

How to build a wireless sensor-driven lighting control system based on Bluetooth mesh networking

download our white paper at **www.silvair.com**

Mesh standard adapts wireless technology to professional lighting needs

read our article in LEDs Magazine **(Nov/Dec '17 issue or www.ledsmagazine.com)**

A tale of five protocols – the ultimate guide to the IoT wireless communication landscape

2018 edition – updated and expanded!

download our e-book at **www.silvair.com**

Also, don't forget to visit **www.silvair.com** and follow us on **Twitter / LinkedIn** to stay up to date with our latest technological developments, publications and webinars.

If you have any questions, contact us at **business@silvair.com**
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