#BluetoothAsia2019#

BluetoothAsia
探索、创新、开拓

TELEDYNE LECROY
Everywhereyoulook™

介绍标题

Don’t Get Lost Debugging Bluetooth Direction Finding Services

名称 ，标题

presented by Heng Wei

TELEDYNE LECROY
Everywhereyoulook™

#BluetoothAsia2019#

Don’t Get Lost Debugging Bluetooth Direction Finding and Location Based Services

探索、创新、开拓

TELEDYNE LECROY
Everywhereyoulook™

#BluetoothAsia2019#

New in the Spec:
Bluetooth Direction Finding

探索、创新、开拓

New in the Spec

The latest adopted Bluetooth spec features the following updates and enhancements:

- GATT Caching Enhancements
- Advertising Enhancements
  - Randomized Advertising Channel Indexing
  - Periodic Advertising Sync Transfer
- Angle of Arrival/Angle of Departure

New in the Spec: GATT Caching Enhancements

GATT devices (all Bluetooth low energy devices us GATT) contain a database of attributes; the services, characteristics and values in this attribute table are “discovered” by the GATT client from the remote GATT server device and allow these devices to function.

This service discovery takes time and energy.

The new release introduces an enhancement that allows the GATT client to skip service discovery when nothing has changed.

New in the Spec: GATT Caching Enhancements

You'll find two new characteristics in this release; **Database Hash** and **Client Supported Features**.

The Client Supported Features characteristic accommodates a flag that marks a client as supporting the new Database Hash characteristic.

The Database Hash characteristic allows the client to ask the server if anything about the GATT attributes table has changed.

New in the Spec: GATT Caching Enhancements

In the case of a Bluetooth smart lock, the user may encounter a small delay the first time his client device interacts with the lock.

Subsequent interactions can now eliminate service discovery, thereby eliminating that delay and responding almost instantaneously.

New in the Spec: Advertising Enhancements

Random Advertising Channel Indexing

In Bluetooth 5.0, advertising events use channels 37, 38 and 39. When all three are in use, advertising uses these channels in order.

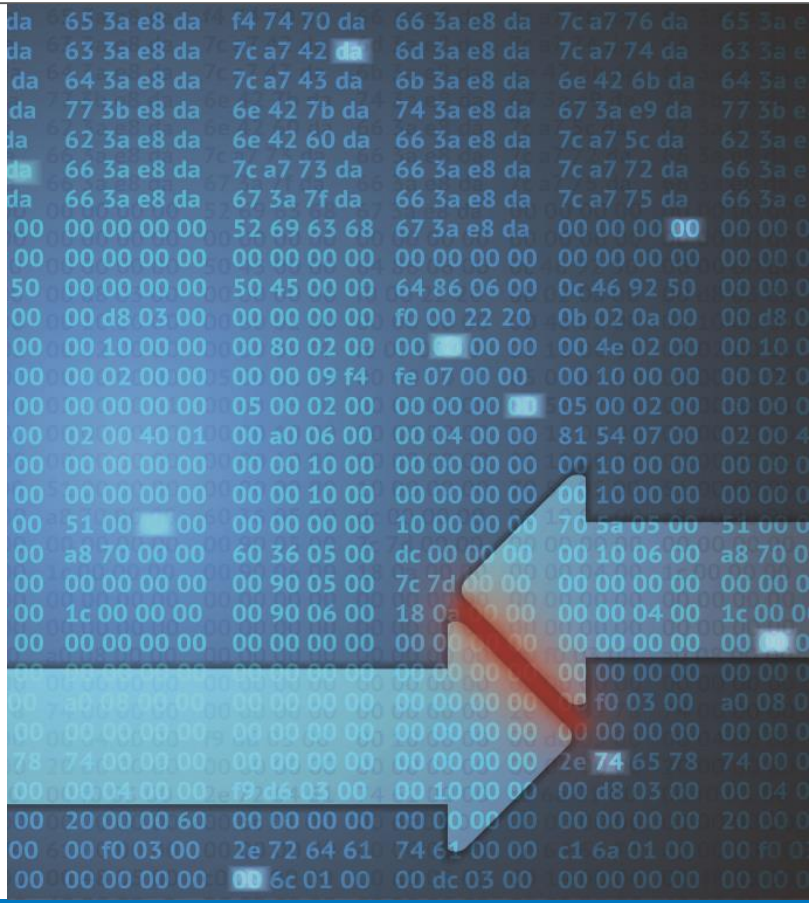
To minimize collisions, 5.0 also demands a random delay in advertising events.

New in the Spec: Advertising Enhancements

Random Advertising Channel Indexing

This release removes the restriction that advertising events have to use advertising channels in strict sequence.

This ability to randomize minimizes the packet collisions, and results in improved reliability, particularly in noisy environments.



New in the Spec: Advertising Enhancements

Periodic Advertising Sync Transfer

Bluetooth 5.0 provided for a device to be able to synchronize the timing of its scanning and advertising events with another device's schedule.

This helped the scanning device to be more energy efficient, and provided benefits when precision timing was required in the exchange of data.

Some devices may not be able to afford the energy costs or other limitations, making this synchronization undesirable.

New in the Spec: Advertising Enhancements

Periodic Advertising Sync Transfer

This release allows a less constrained device to perform the synchronization, then pass those details to the other constrained device.

For example, a smartphone could scan for packets from a TV, then pass them over a connection to an associated smart watch.

New in the Spec: Bluetooth Direction Finding

Bluetooth Direction Finding is:

- the major new feature of this release
- designed to enhance location services
- can detect location in 2D or 3D
- used for Real Time Location Systems (RTLS) for asset tracking and proximity-based information applications

10x

growth in annual volume of Bluetooth location services devices by 2022

Source: ABI Research

New in the Spec: Bluetooth Direction Finding

Angle of Arrival (AoA) and Angle of Departure (AoD)

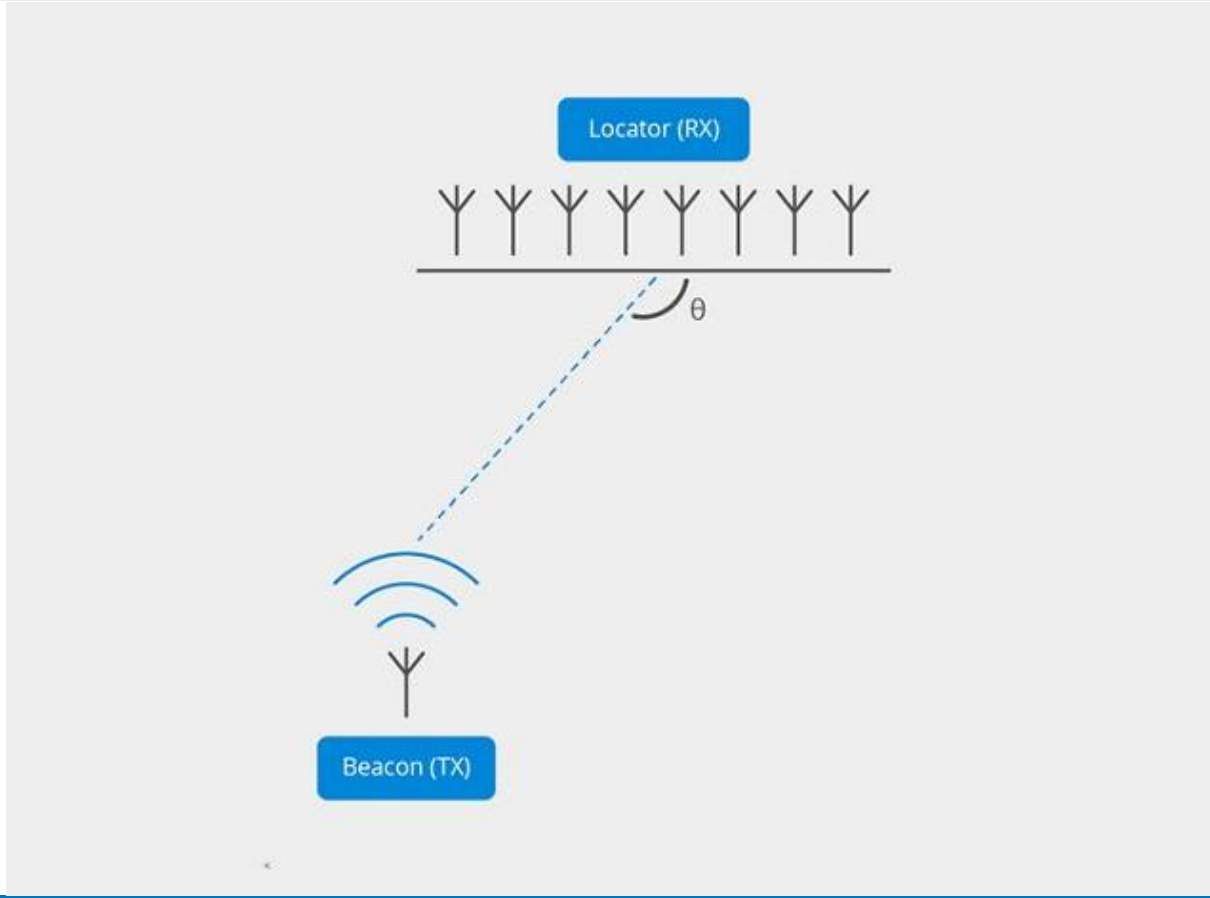
Bluetooth direction finding is based around the two key concepts of Angle of Arrival (AoA) and Angle of Departure (AoD).

This is accomplished through the use of antenna arrays at either side of the communication link and uses phase shift data to calculate location.

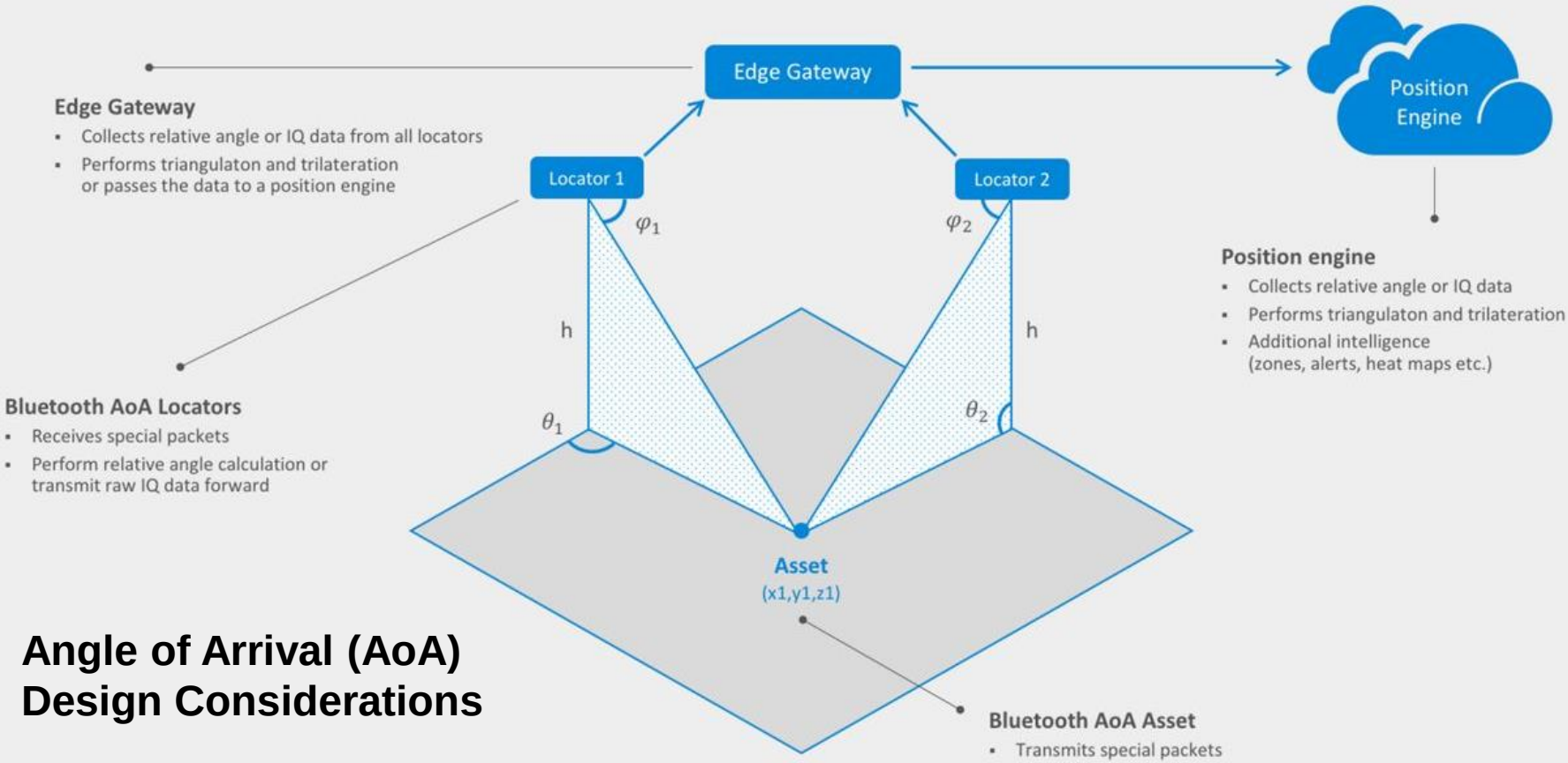
New in the Spec: Bluetooth Direction Finding

Angle of Arrival (AoA)

Assets broadcast their location to an AoA locator such as a wireless access point, and locators measure the signal's arrival angle.



New in the Spec: Bluetooth Direction Finding

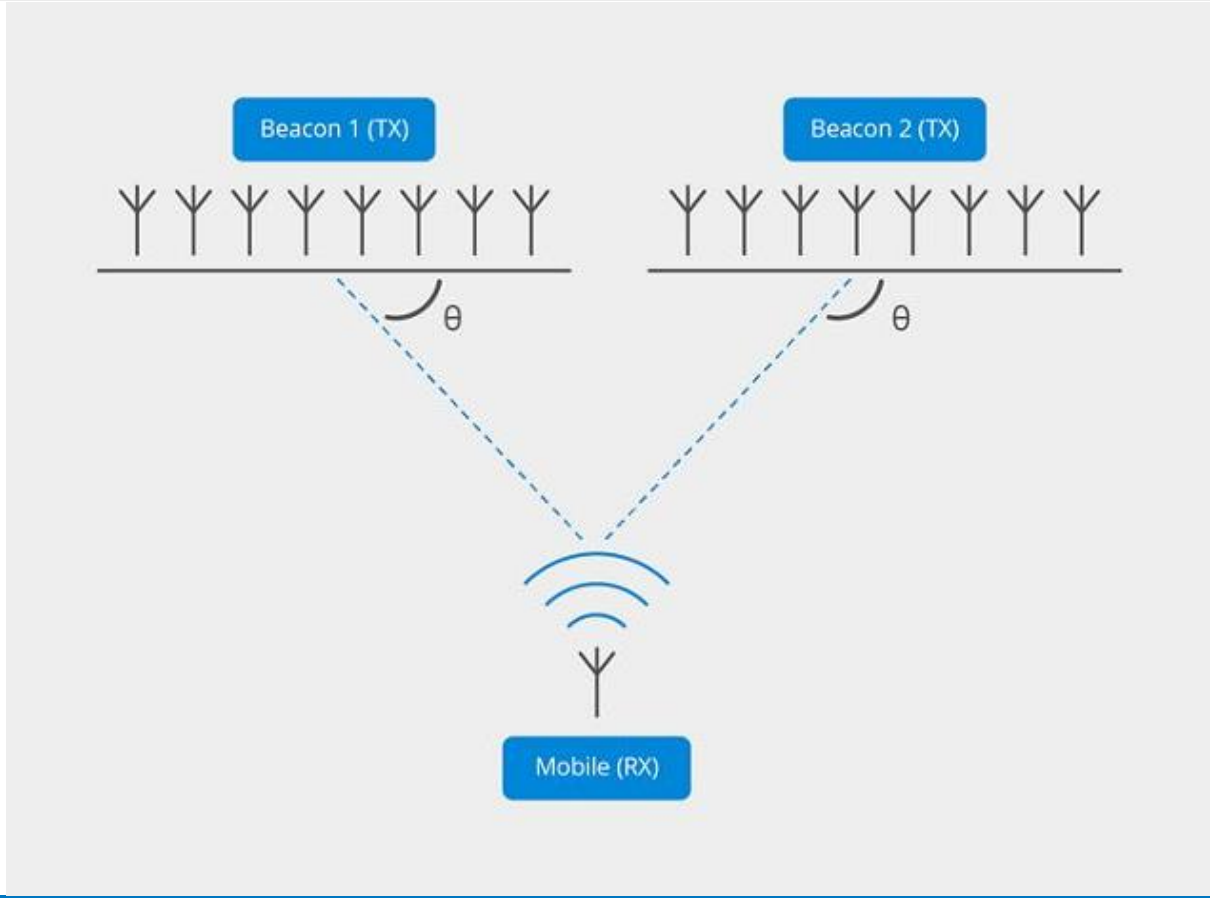


Angle of Arrival (AoA) Design Considerations

New in the Spec: Bluetooth Direction Finding

Angle of Departure (AoD)

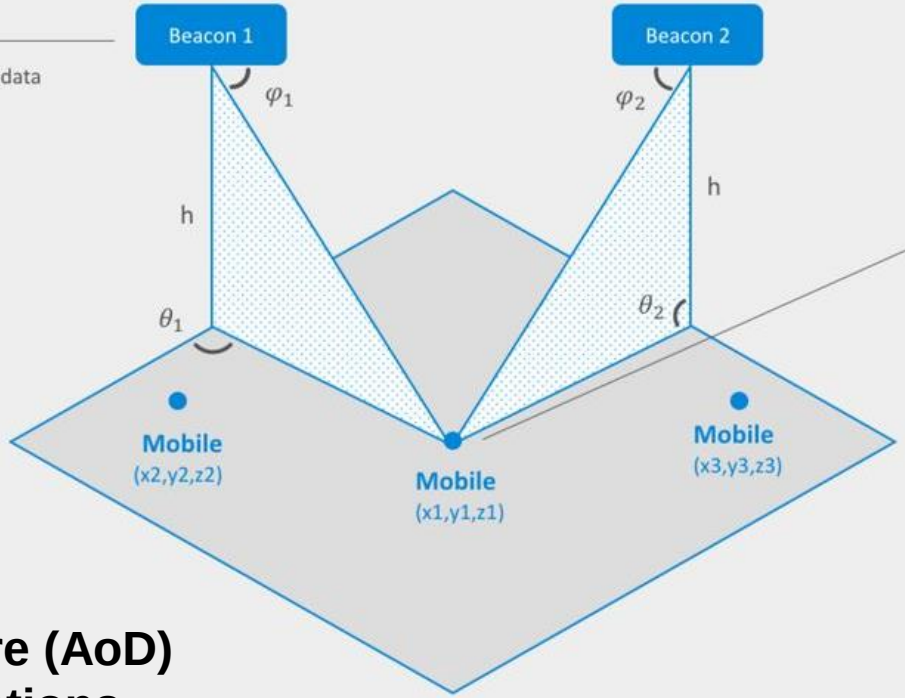
Beacons transmit AoD information such as coordinates using multiple antennas, while mobile devices receive the beacons and calculate position.



New in the Spec: Bluetooth Direction Finding

Bluetooth AoD Beacons

- Transmits AoD beacons and additional data such as absolute coordinates
- Use AoD connectionless profile



Bluetooth AoD Mobile

- Receives AoD beacons and additional data
- Perform relative angle and position calculation

Angle of Departure (AoD) Design Considerations

TELEDYNE LECROY
Everywhereyoulook™

#BluetoothAsia2019#

Bluetooth Direction Finding in Use

探索、创新、开拓

Bluetooth Direction Finding in Use

Angle of Arrival (AoA)

Use cases might include:

- Asset tracking in warehouses
- Value asset tracking in hospitals, govt. establishments etc.
- ID location of people and staff

Bluetooth Direction Finding in Use

Angle of Departure (AoD)

Use cases might include:

- Wayfinding in large spaces such as airports, hospitals etc.
- Point of interest assistance in shopping malls, exhibitions etc.
- Search and finding of items such as keys, remote controls etc.

TELEDYNE LECROY
Everywhereyoulook™

#BluetoothAsia2019#

Bluetooth Direction Finding: Challenges and Debugging

探索、创新、开拓

Bluetooth Direction Finding: Challenges and Debugging

A number of physical and implementation-related challenges can impact the signal, which in turn affects the accuracy of Bluetooth enhanced location services:

- Signal noise
- Signal reflection
- Clock jitter
- Signal propagation delays
- Switching timings
- Data buffer problems
- Configuration errors

Bluetooth Direction Finding: Challenges and Debugging

Let’s explore a trace that captures mesh-enabled light fixtures. We’ll look for issues and, using a powerful Bluetooth protocol analyzer, figure out how to resolve them.

TELEDYNE LECROY
Everywhereyoulook™

#BluetoothAsia2019#

Don’t Get Lost Debugging Bluetooth Direction Finding and Location Based Services

探索、创新、开拓

Thank you!

Location services and Bluetooth Direction Finding are predicted to grow exponentially over the next few years, demanding flawless and expert implementations. Teledyne LeCroy can help you make them happen.

#BluetoothAsia2019#

BluetoothAsia
探索、创新、开拓

TELEDYNE LECROY
Everywhereyoulook™

谢谢

Thank you!