



works with
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VIRTUAL CONFERENCE

SEPTEMBER 14-15, 2021



LOC-201: Locate your Things with Bluetooth Direction Finding

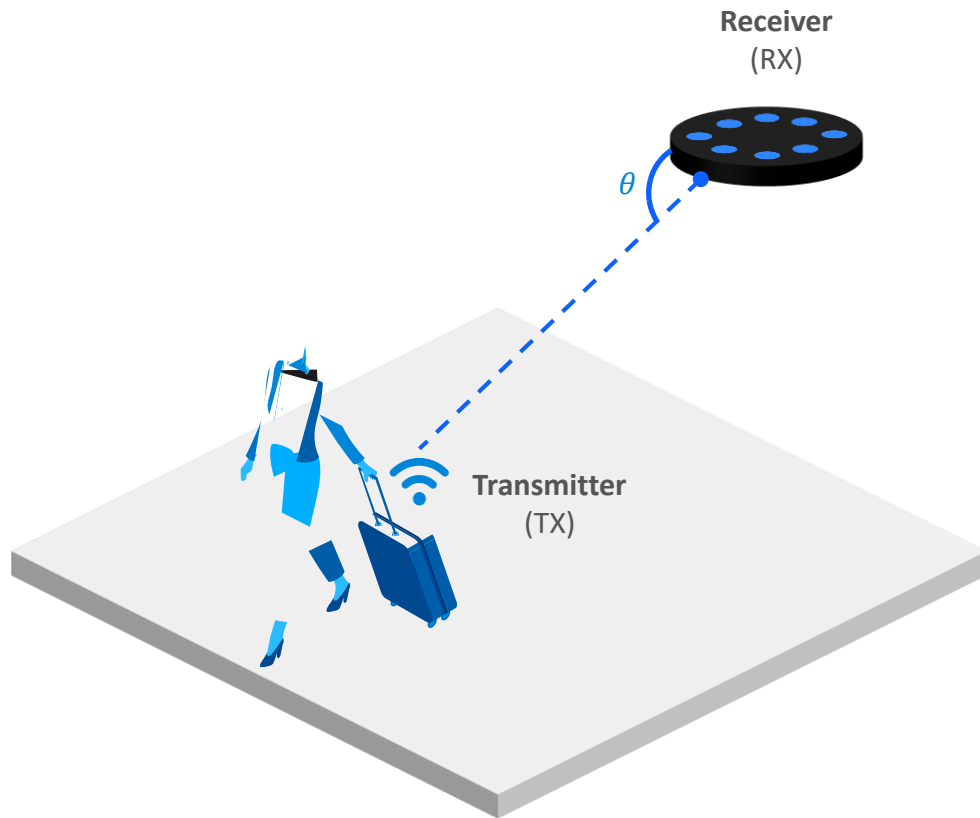
Sami Kaislasuo | September 2021



Introduction

- **Bluetooth Angle-of-Arrival Technology and system overview**
- **Real-world demonstration of locating assets in an office setting**
- **Silicon Labs offering**

Bluetooth Direction Finding: Angle of Arrival (AoA)



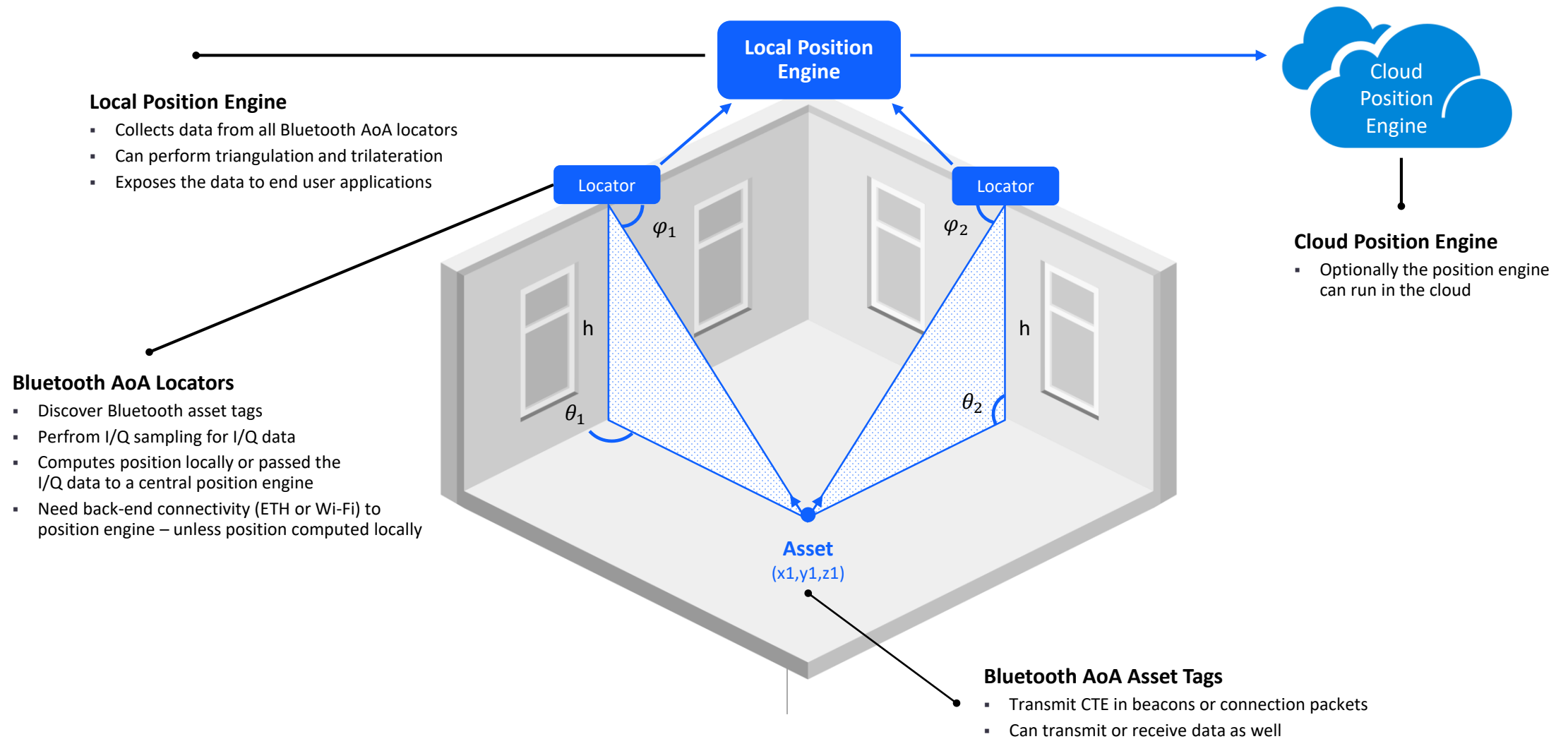
■ An asset wants to broadcast its location

- Continuous tone extension (CTE) is added to the end of a Bluetooth advertisement or connection packet
- Asset can support other Bluetooth functions while being tracked as CTE does not use the payload
- Asset can be a single antenna Bluetooth device supporting Bluetooth 5.1 and AoA

■ A locator wants to find the asset

- A locator listens for CTE packets and measures IQ data from the CTE payload
- Can perform spherical azimuth and elevation calculation, or pass the IQ data forward to back-end processing
- Locator needs an antenna array, RF switches and Bluetooth 5.1 AoA capable radio

Bluetooth Angle-of-Arrival Improves Asset Tracking



Bluetooth Angle-of-Arrival System Components



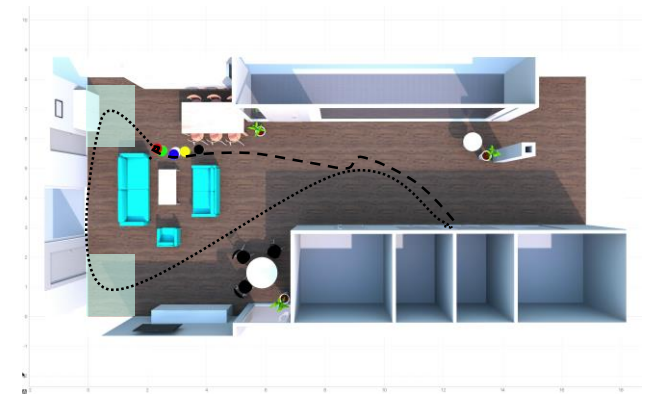
Asset tag

- Battery powered, mobile
- Various use cases



Locators

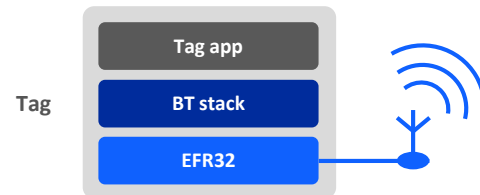
- Stationary
- Mains powered
- Stand-alone, or integrated (i.e. access points)



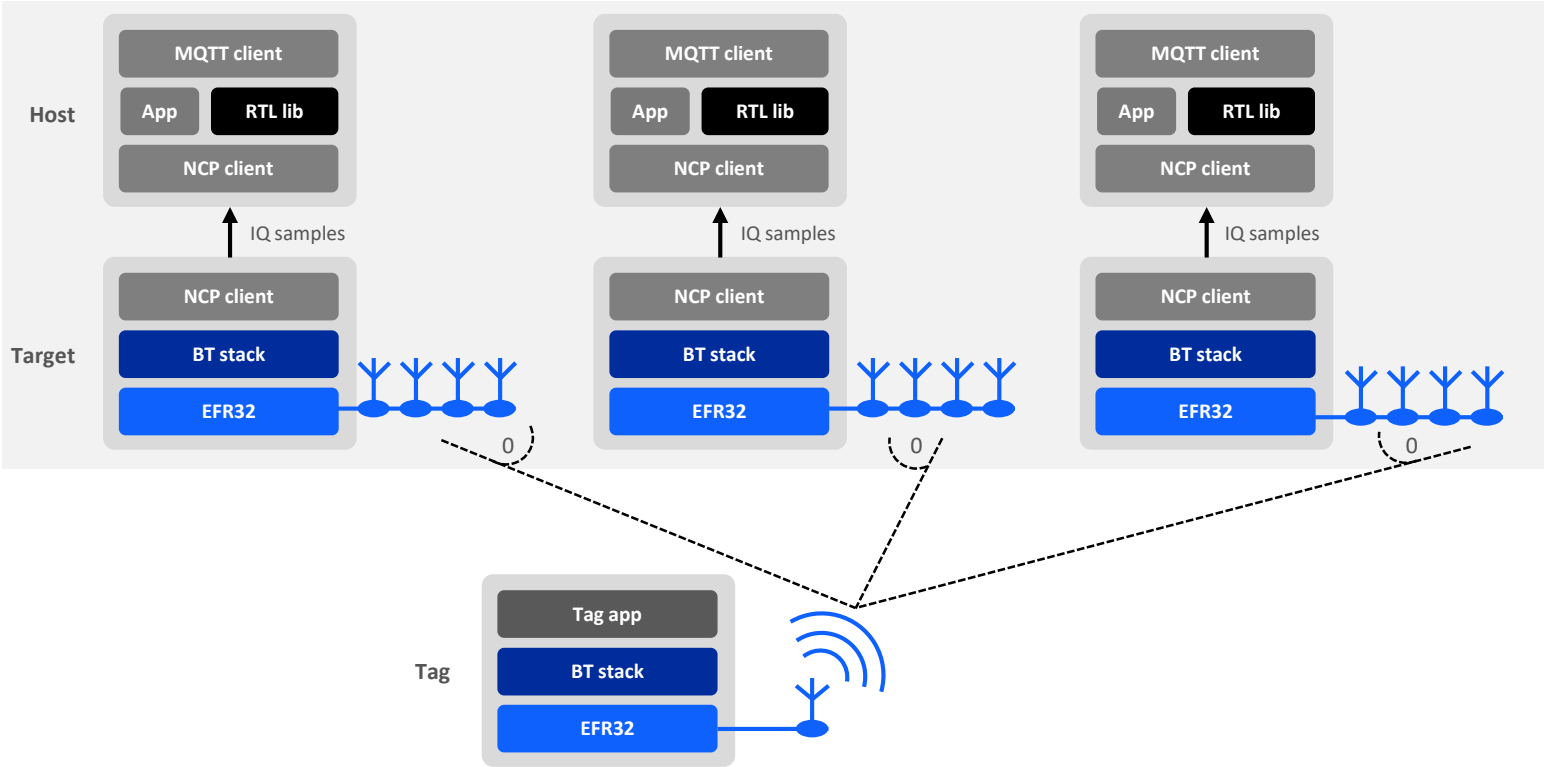
Positioning Engine & Tools

- Combining tag position information as location
- Asset Tracking
- Tools, System Deployment
- Heatmaps, Zones
- System Maintenance

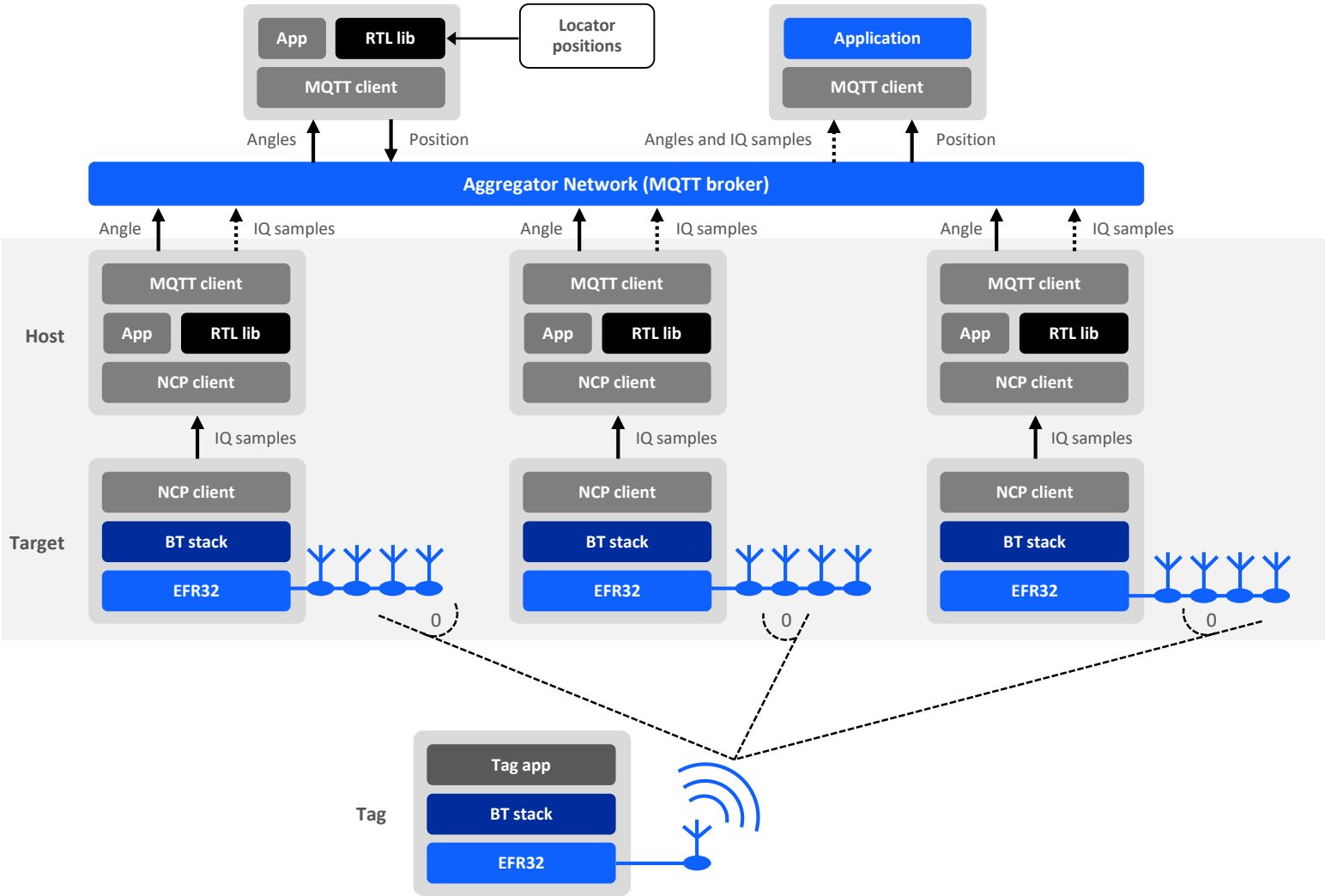
System Architecture – Angle and IQ data



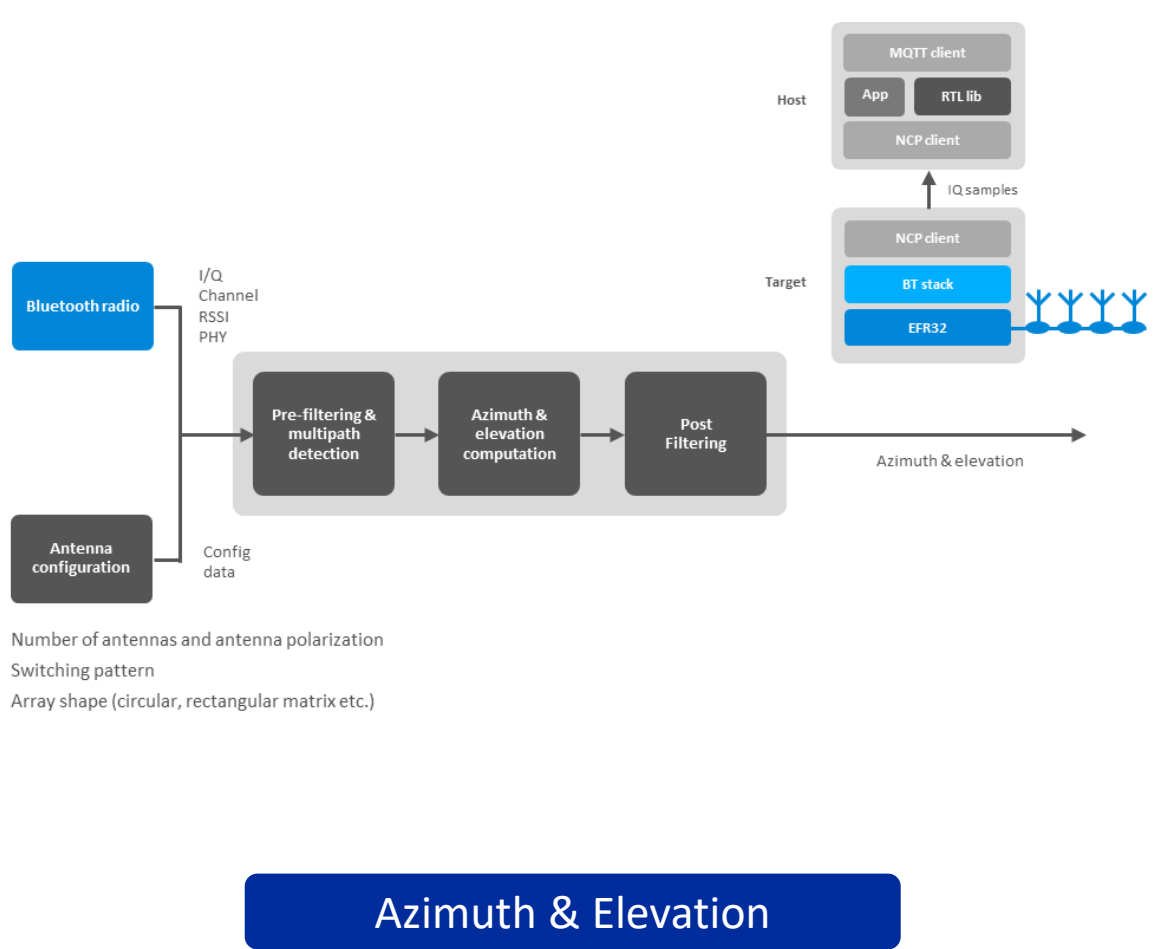
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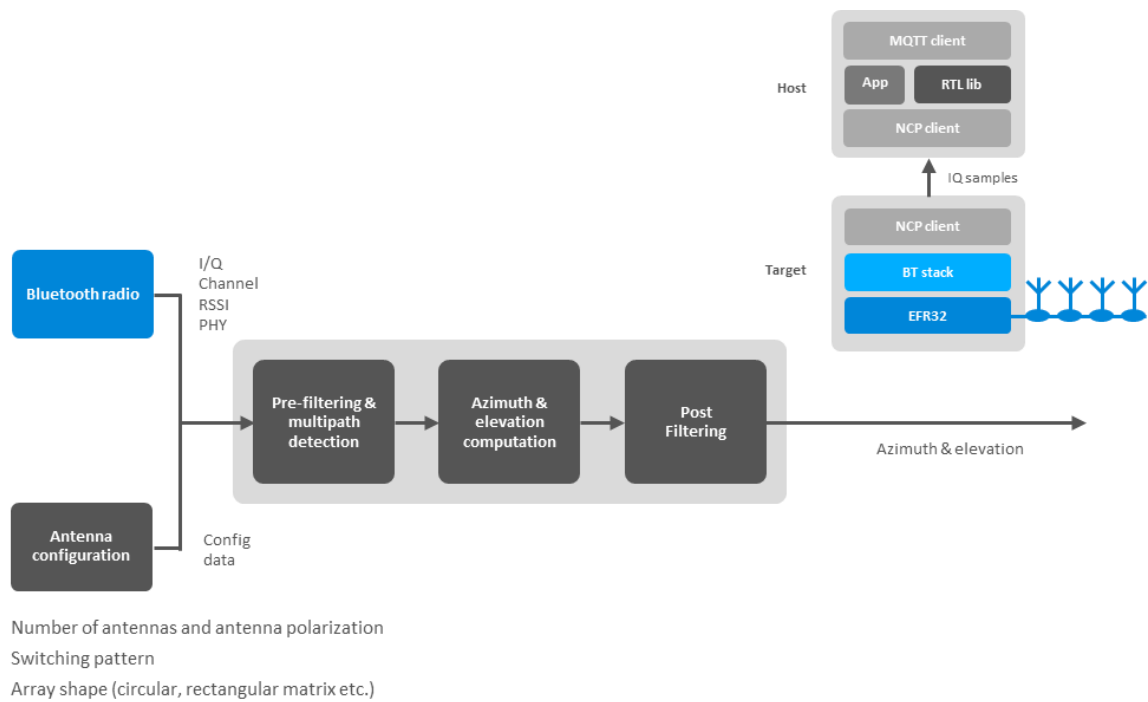
System Architecture – Angle and IQ data



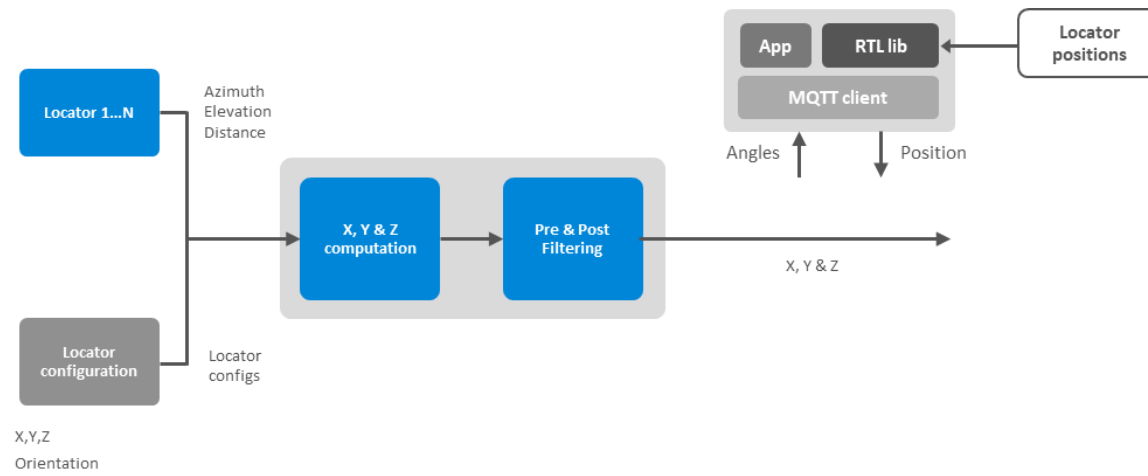
Silicon Labs Real-Time Location Library - Overview



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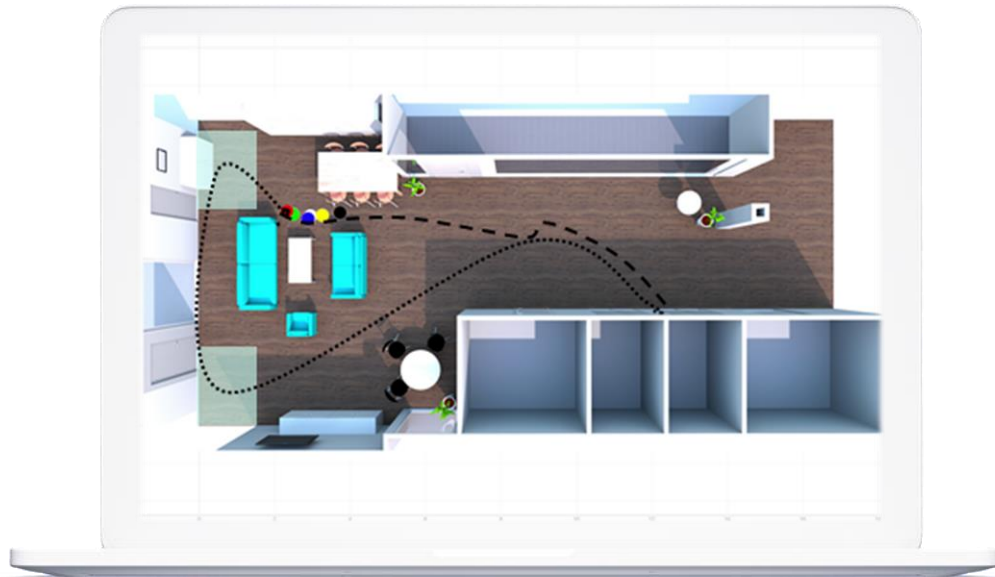


Azimuth & Elevation



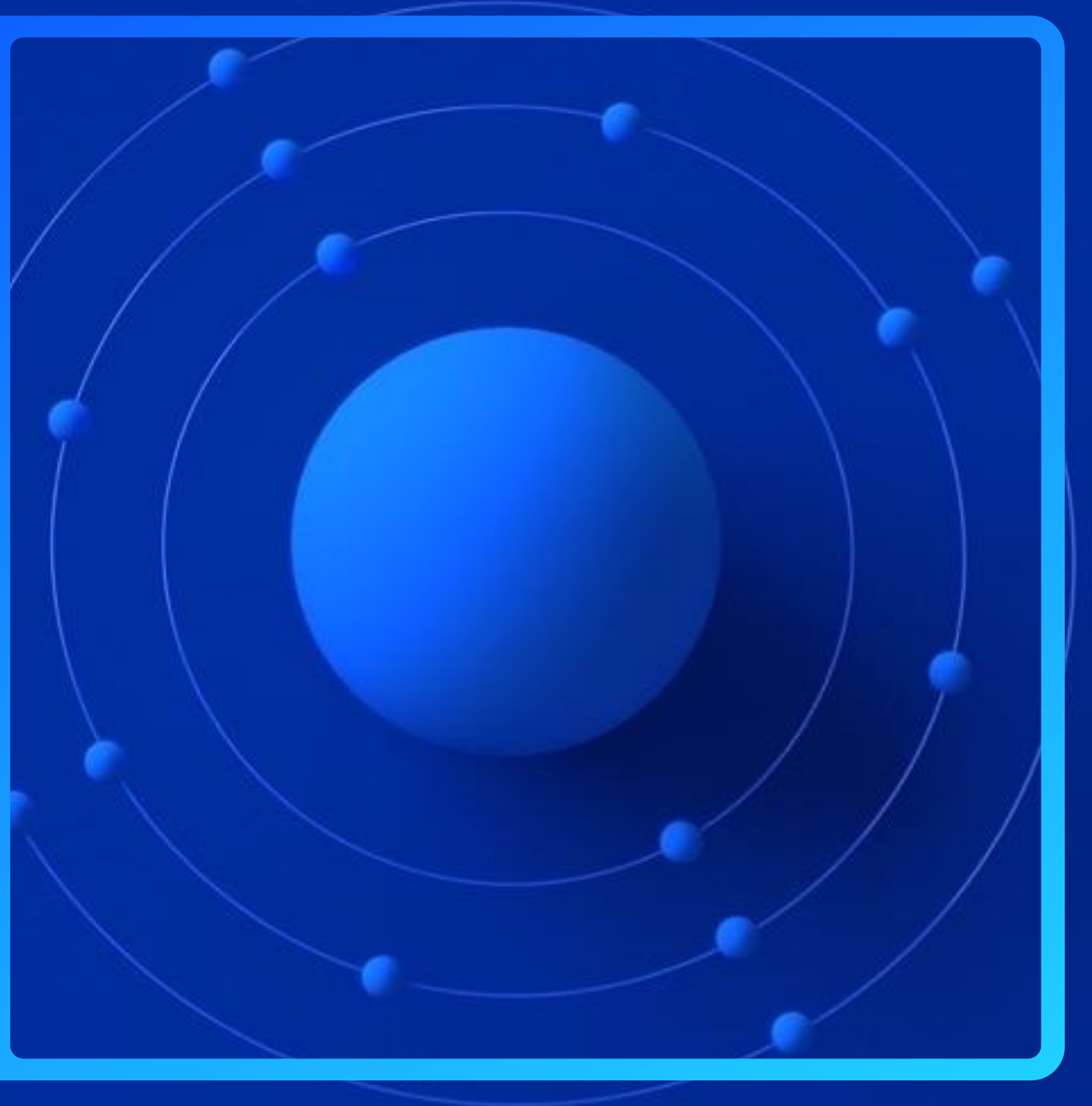
Calculating x,y,z-coordinates

Video – Locate your Things with Bluetooth Direction Finding



- Short intro to Direction-Finding
- Demonstrator – package tracking in an office setup with Silicon Labs reference hardware and software used
- Evaluation tools, demonstrator setup and Direction-Finding deployment

Silicon Labs Offering



Performance

Tag

Battery lifetime (CR2032)	~3.5y	2s interval, Silicon Labs enhanced
COGS	As low as <\$1.0	In volumes
RTL library		
Tags	Up to thousands	Silicon Labs enhanced
Angle computation	Cortex-A class recommended, RAM 40kB	2s interval, Silicon Labs enhanced
Accuracy – Angle	+3 degrees	GSDK v3.4
Accuracy - Elevation	+5 degrees	GSDK v3.4

Distance between locators	Area	Accuracy [m] SLWRB4185A 4 locators *
5m	25m ²	< 0.4 m
10m	100m ²	< 0.6 m
15m	225m ²	< 0.8 m

*) inside the area between locators excluding the locations within 1m distance from any locator

Availability

- **Software available now**

- Download GSDK for access to Silicon Labs Bluetooth stack with Direction Finding support and examples and the RTL library

- **Tag hardware**

- EFR32BG22 SoCs and Modules
- Reference designs available at silabs.com

- **Infrastructure hardware**

- Circular-Polarized Antenna Array Reference (Order code: SLWRB4185)
 - ▶ For availability contact Silicon Labs sales

Thank you

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