

SYNTONY Presentation

EU –Japan GNSS Mission TOKYO 2017

CONTROL YOUR SKY

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SYNTONY
GNSS

Content

- Syntony introduction
- Synthetic GPS
- Subwave
- SubWave +: the precision solution
- WLS : Network of GNSS receivers
- Constellator
- Echo : Recorder - Player
- Contacts



SYNTONY

- **2015 Spinoff of a 30 years old company**
 - ▲ 3M€ turnover, 22 people
 - ▲ Core business : GNSS signal processing dedicated to Space, Aeronautics, Defence and Transport applications
- **Headquarter in Toulouse; subsidiaries in the USA (NYC + SF)**
- **Exportation: Europe, USA, India, Korea, China, Japan, Singapore**
- **High skill resources**
 - ▲ Senior staff for finance, exportation, commercial and marketing, coming from leading international groups
 - ▲ expert staff: experienced engineers and PHDs graduated from the best schools in their domains.
- **Forecast of doubled turnover for this current year**
- **Raised € 1million in May 2016 to fuel growth**



SYNTONY

GNSS

Synthetic GPS

Location Needs for Subways professionals

➔ For workers underground:

- ▲ No possibility to detect and locate accident for isolated workers
- ▲ Impossible to locate precisely assets inside long tunnels
- ▲ Improves safety between trains and maintenance agents
- ▲ Optimize agents allocation by tracking them accurately

➔ For train location underground:

- ▲ Unprecise or very expensive
- ▲ No possibility to use GPS receivers adapted for outdoor
- ▲ Track discrimination impossible

Location Needs for public

→ Safety applications:

- ▲ Need: locating 100% of emergency calls, in stations and tunnels
- ▲ Beacon based solutions work but are useless for safety: 90% of the smartphones calling do not have the correct App installed
- ▲ No location capability for most people

→ Passenger guidance

- ▲ Need to guide passengers indoors: show the way, remind when they must get out, optimize their connection by using real time traffic information



Important: must be indoor/outdoor compatible, for multimodal travel (bus, train, subway, etc.)

The Challenge

Challenges:

- ⇒ Tracking precisely and accurately Professional receivers (Tetra^R , P25^R or equiv.)
- ⇒ Locate every receiver, even **without installing an “app”**
- ⇒ Locate trains & other systems with **continuous tracking services** for **indoor and outdoor** situations, as well as for **seamless transition** between outdoor and indoor.
- ⇒ Help tourists to find their way inside metro network



One product, Two versions

SUBWAVE: Zone based location system

SUBWAVE+: precision positioning





SubWave Concept

SubWave makes GPS chipset work indoors:

- Compatible with any PMR, P25, TETRA receivers
- Compatible with any smartphones: no App or map download

SubWave extends GPS coverage indoors:

- SubWave computes specific adapted GPS signal for indoor
- Different from “GPS Repeater”
- GPS receiver of user gets real “Latitude, Longitude, Altitude”
- Positioning resolution: adaptable to operational objectives: discrimination between platforms (right or left), localization inside tunnel (< 15m or less...), floor discrimination (Altitude)

SubWave: How does it work?

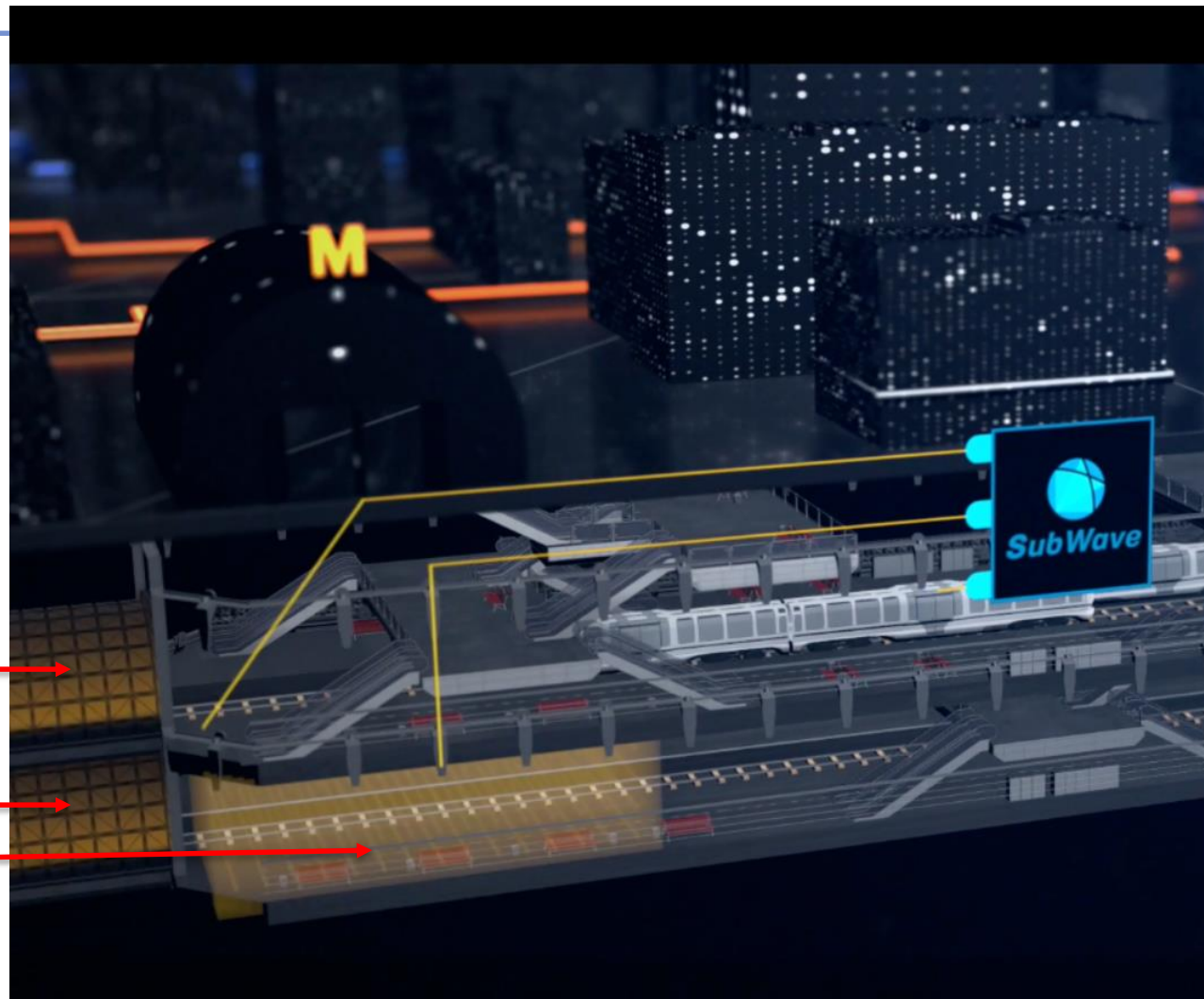
- ➔ We re-create the GPS signal in perfect synchronization with outdoor
 - ▲ Installation of a 4U Industrial PC inside telecom technical room
 - ▲ RF Connection to the existing telecom leaky feeder network:
 - ▲ Zone based: a zone is a leaky feeder segment
 - ▲ Star installation (centered around the SubWave equipment)
 - ▲ Calibration in power & time
- ➔ Bring 100% GPS chipset work indoors!





Safety: discriminate between zones

Tunnel 1
Tunnel 2
Platform

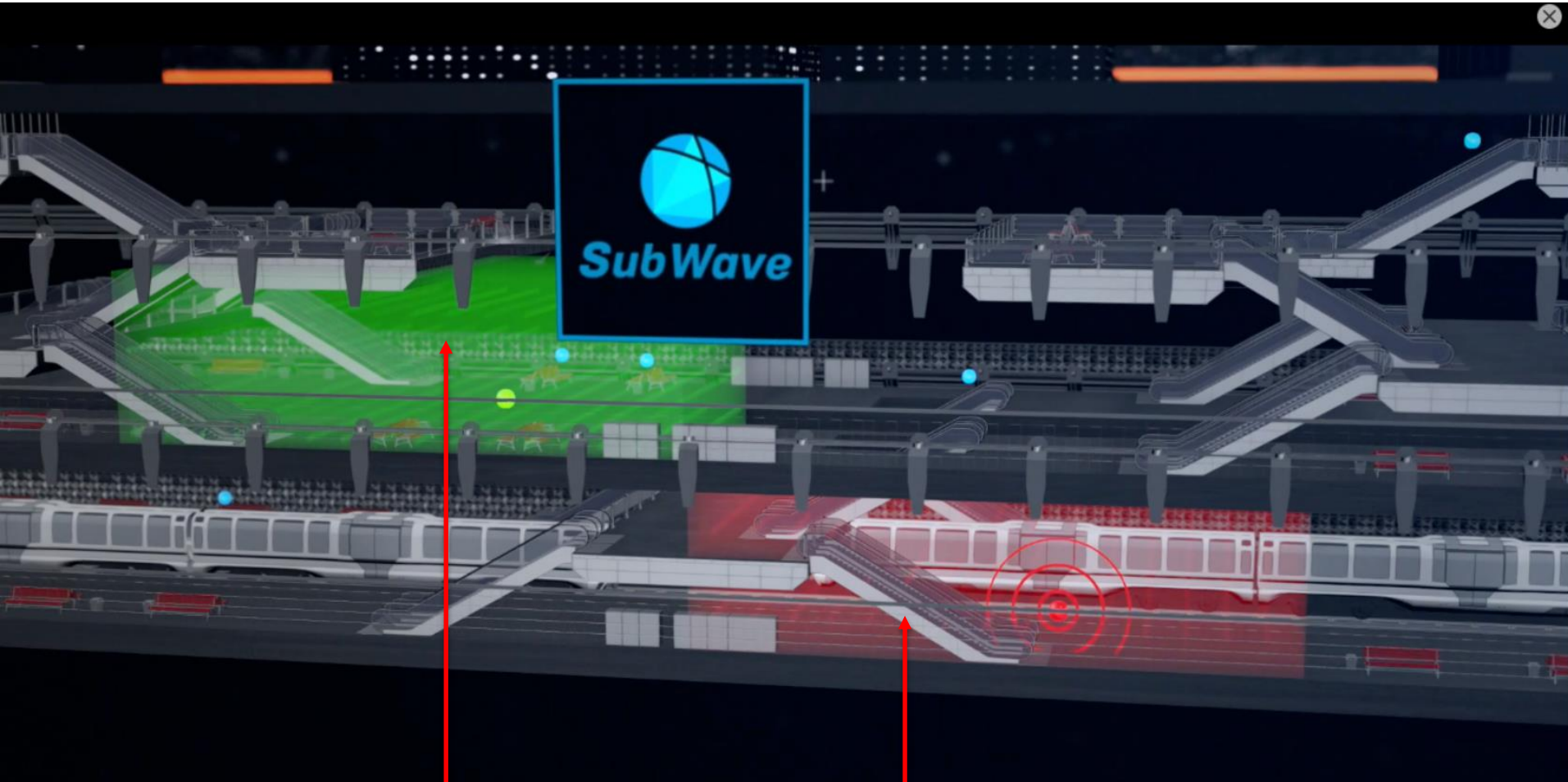


SubWave brings location information inside Stations, Platforms and Tunnels





Zone localization inside station



Platform X

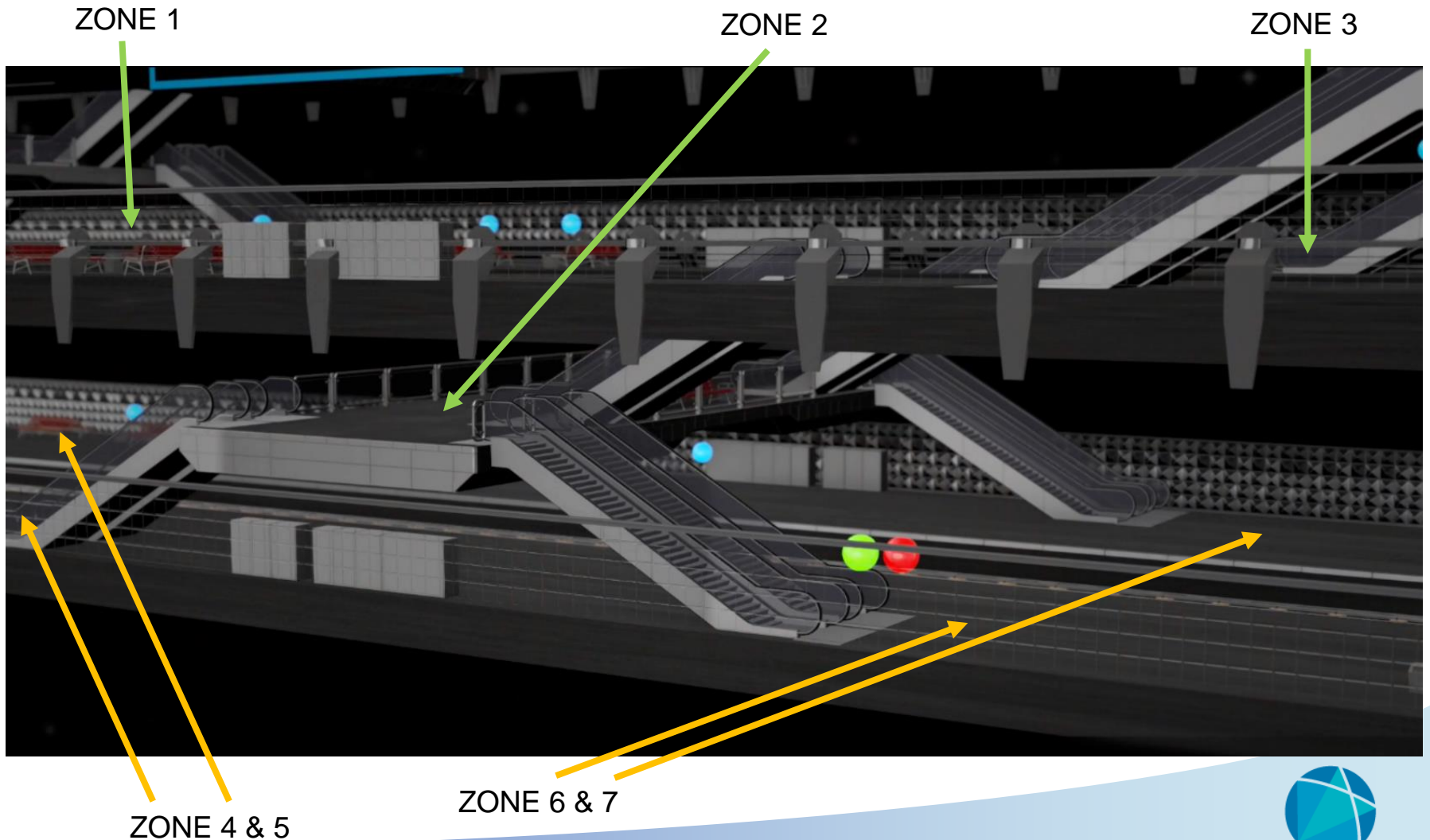
Platform Y

Subwave allows to discriminate where is the receiver inside a station

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Typical underground installation



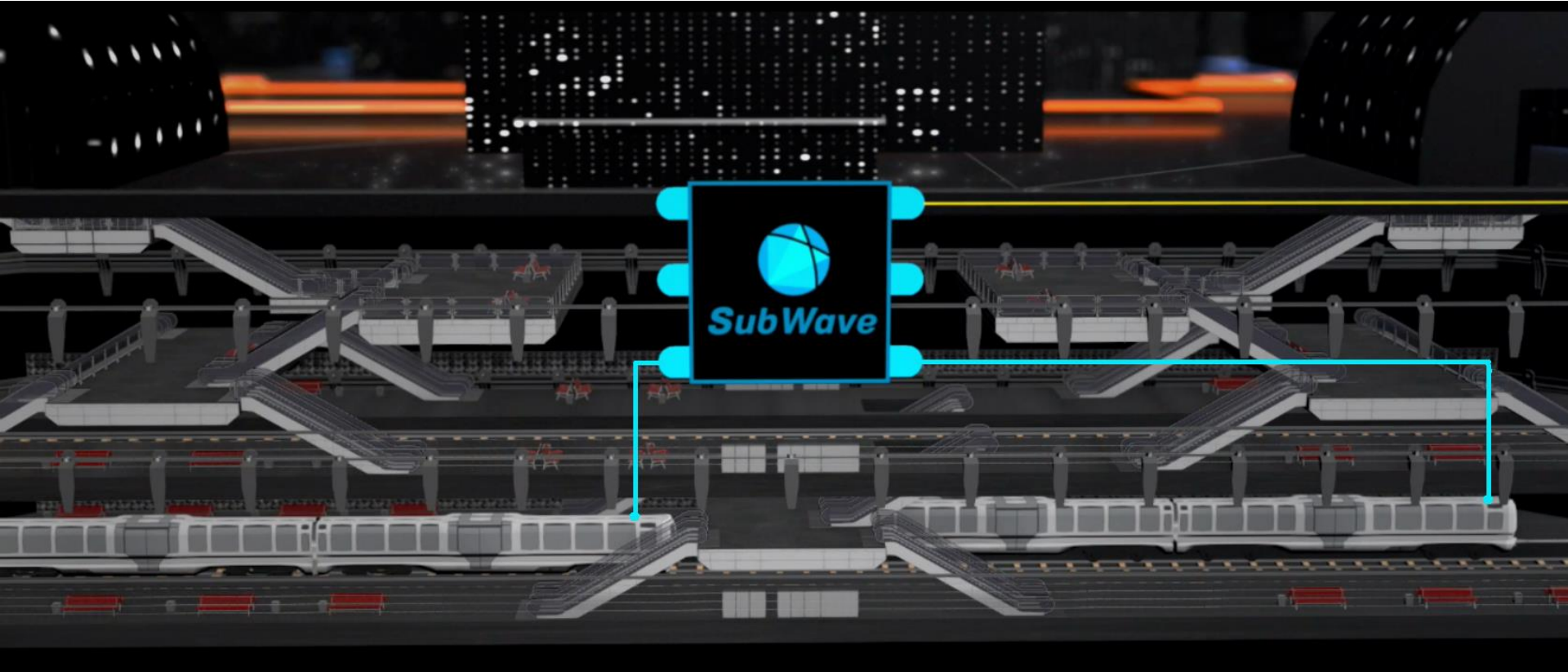
SubWave+: Precise positioning

- ➔ SubWave+ is an Add-on module to SubWave.
- ➔ SubWave+ brings the capability to compute X on each leaky feeder (1 to 10m precision depending on receiver)
- ➔ SubWave+ allows following applications:
 - ▲ Public or professional guidance
 - ▲ Train positioning along the tunnels & tracks
 - ▲ Enhance Safety for trains & agents
 - ▲ And still seamless transition between zones, platform discrimination, like SubWave.





SubWave+: Train localization



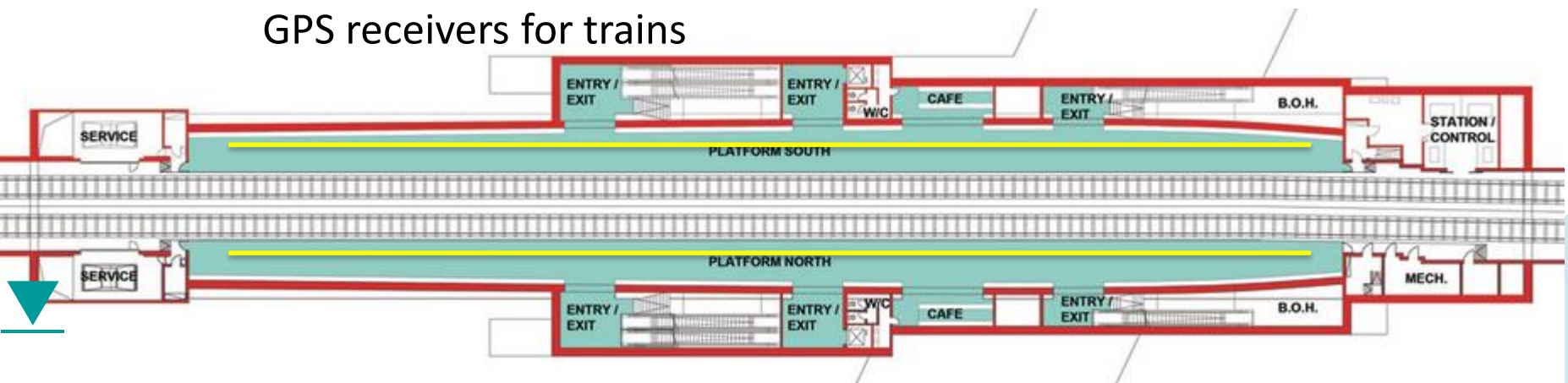
Precise location in Station and in Tunnels, using GPS receiver



SubWave+: How does it work?

➔ Technology used: Measurement of signal characteristics in addition to normal GPS positioning (patented)

- ▲ X abscissa is computed along leaky feeder.
- ▲ X is added to position given by GPS chipset to compute absolute position (lat/long/alt) and exploit it in dedicated application
- ▲ Can be done on Smartphone application, TETRA receivers, specific GPS receivers for trains





SubWave+ vs SubWave

→ Technical changes compared to standard solution:

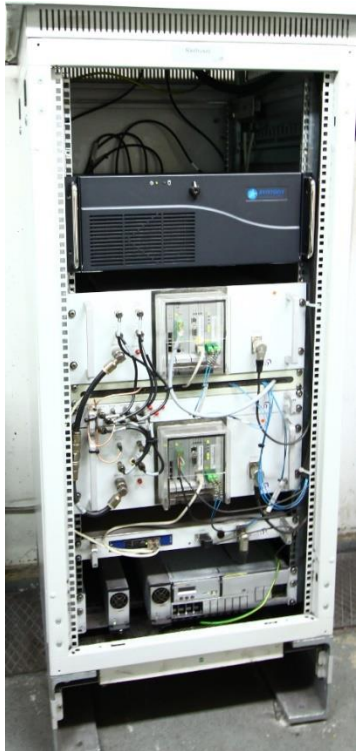
- ▲ No infrastructure change
- ▲ Calibration phase: need about ½ to 1 day of work on site per station, in supplement to normal SubWave installation, to calibrate the precise positioning
- ▲ Software aspect: Syntony delivers either:
 - A software module to be integrated inside the receiver
 - The receiver itself (for train applications) which implements the specific algorithms (in addition to standard GPS)
- ▲ We can eventually provide more application for indoor navigation, on request
- ▲ We can also deliver a train receiver emitting its position in UHF to be received by agents receivers, to prevent collisions



SubWave rack: technical aspects

Benefits for underground infrastructures operators:

- ▲ **Fully compatible with existing infrastructure (e.g. Tetra^R)**
 - No infrastructure modification required: fast installation & setup
 - Scalable over time and infrastructure's complexity
- ▲ **Fully integrated in existing alert and alarm management systems**
 - No specific equipment: easy maintenance
- ▲ **Software based architecture and processing**
 - Fast upgrade and maintenance: 100% operating time
- ▲ **very low RF emission: -100dBm level**





SubWave Value Proposition

Subwave benefits are Human, Financial and Operational

Passenger Service

- ❖ “SmartCity” Enabler : SubWave enables the implementation of multimodal transportation solutions on Smartphones
- ❖ Announce the passenger Exit Station
- ❖ Provide Guidance for station exits and transfers

Train & Device easy location

- ❖ **Locate trains easily and precisely.** With Syntony’s GPS receiver, trains will be located outside and inside the tunnel with the same precision. Brings traffic optimization & smoothing
- ❖ **Optimize resources:** Help maintenance team to find asset locations inside tunnels
- ❖ **Enhance safety:** identify trains position, identify worker position on tracks, communicate each position to the other



SubWave Value Proposition

Subwave benefits are Human, Financial and Operational

Human Lives protection

- ❖ **Safety** : Precise localization of the 1st call and location of the closest safety agent save critical time in emergency situations (1 minute reduction in response time improves the odds of survival by 24% according to EENA report - 2014, EC 112 report – 2014).
- ❖ **Passengers' psychological comfort** : Travelers are confident that wherever they are, they can be located and rescued in case of an emergency, they are not isolated from the outside world.

Financial & operational impact on Operations

- ❖ **Isolated Worker protection**. Operation/Safety agents are accurately tracked and any incident is immediately identified and located in Rail Control Center.
- ❖ **Optimized Allocation and deployment** of rescue teams



Proven efficiency: metro of Stockholm

Syntony delivers the SubWave[©] solution for the Metro of Stockholm (100 stations / 50 underground)

▲ Best solution (unmatched efficiency and reliability) :

- Plug and play installation into Tetra^R infrastructure
- No interference with train control or telecom equipment & systems

▲ 100% coverage of the station, independent from their geometry :

- Proven location precision achieved for every zone
- indoor/outdoor safety of RF signal in all stations



Image credit: Stockholm metro

▲ Fast and unmatched installation time (best solution):

- 1 day of onsite demonstration in test station
- 3 months delivery and deployment time for the 50 underground stations



WLS Technology foundation

→ Our solutions are based on:

- ▲ Standard but versatile RF Chipsets
- ▲ Standard Sensor Chipsets
- ▲ Standard batteries



→ But

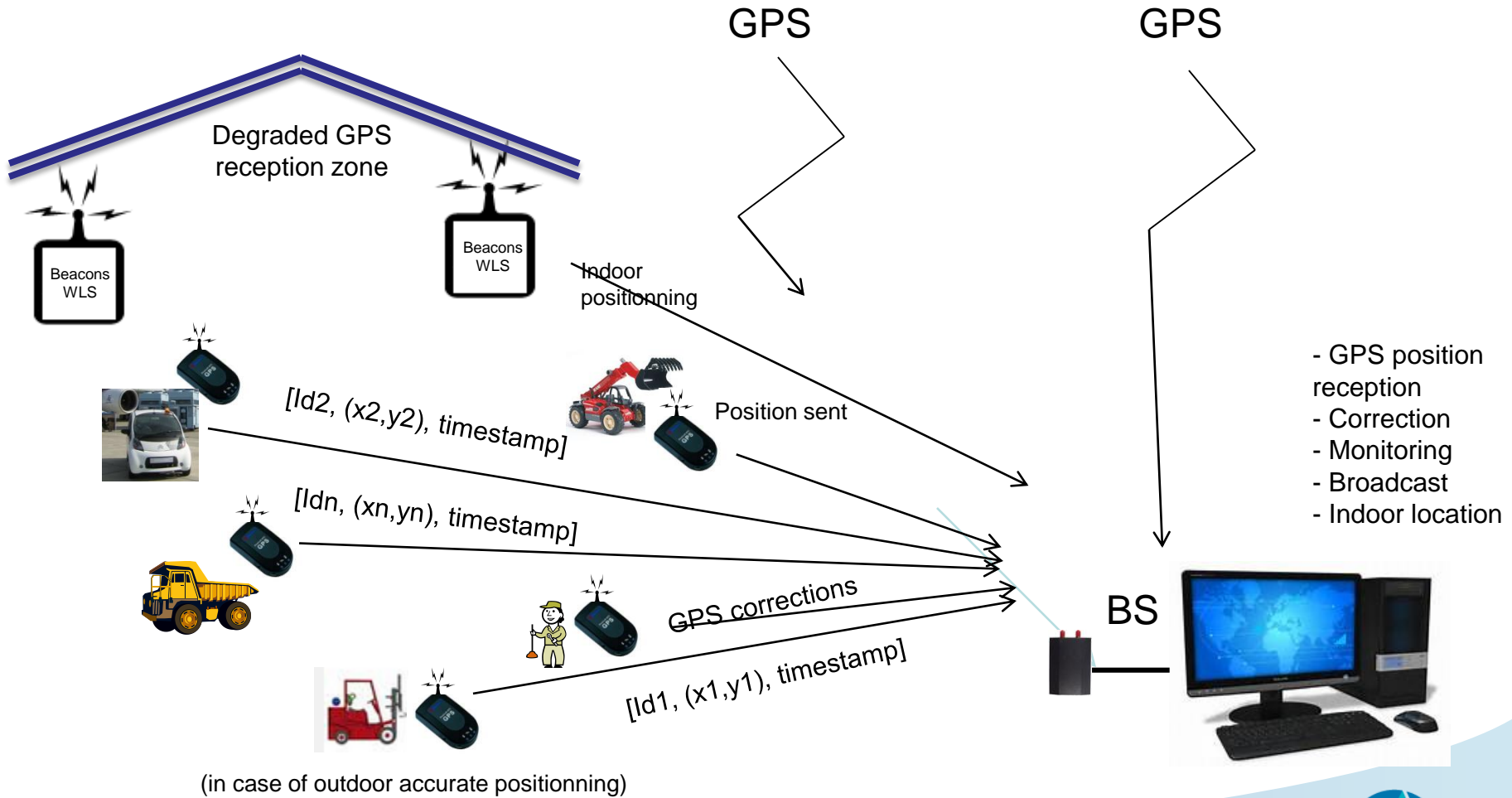
- ▲ We bring the high expertise in Sensor knowledge, integration, characterization
- ▲ We bring also highest expertise in low-consumption electronics
- ▲ Last but not least, we optimize the RF waveform in order to:
 - Adapt the propagation to the environment (and lower the b.e.r.)
 - Use it for synchronization purpose

WLS: Wireless Location System

- ➔ WLS is used to monitor the position of mobiles inside a given perimeter at predefined periodicity (1 sec to several seconds).
- ➔ For outdoor, WLS is available in a standard version (GPS L1C/A) providing typical GPS accuracy (5-10m), and also in a specific high precision version (when using a fixed reference station) bringing better than 1 meter accuracy (typical <20cm) by sending correction data to all mobiles in real time.
- ➔ The WLS portable enclosure includes the following sensors:
 - ▲ GPS sensor
 - ▲ 3 axes Accelerometer
 - ▲ Magnetometer
 - ▲ 3 Gyroscopes



WLS: Wireless Location System



Multi-Constellation simulator: CONSTELLATOR

SYNTONY proposes a multi-constellations simulator: CONSTELLATOR

It aims to:

- ▲ Deliver high precision performance,
- ▲ Be flexible to adapt the simulation to the actual environment of the space applications,
- ▲ Enable the test of dedicated positioning algorithm for each application.

Main characteristics are:

- ▲ Single or multiple constellations simulator,
- ▲ Configurable via user friendly interface ,
- ▲ Perfect signal or choice of errors to simulate (“realistic” signal)
- ▲ Easy upgrades.



ECHO R & P: best in class Record & Replay



ECHO R: RECORD

- ADC 14 bits I/Q
- 100Mhz sampling rate (max)
- AGC 60db + 70db amplification (each channel)
- SSD drive for high data rate transfer

ECHO P: PLAY

- Multiple GNSS Signal Recorder
- 3 channels of 100MHz BW each
- Low / High power signal recording



AIRBUS

Available in Portable housing and Rack

Exists in 2 RF versions:

- 3 channels, 3 frequencies
- 3 channels, 1 frequency, phase synchronization



Thank you...

Syntony, a highly Innovative Tech Company

- ▲ **Engineering-driven solution designer for Location Technologies**
- ▲ **SYNTONY Locations: Toulouse, New York, San Francisco**
- **Makes the most advanced technologies available to you**
- ▲ **Unique and innovative solutions for GNSS data processing**

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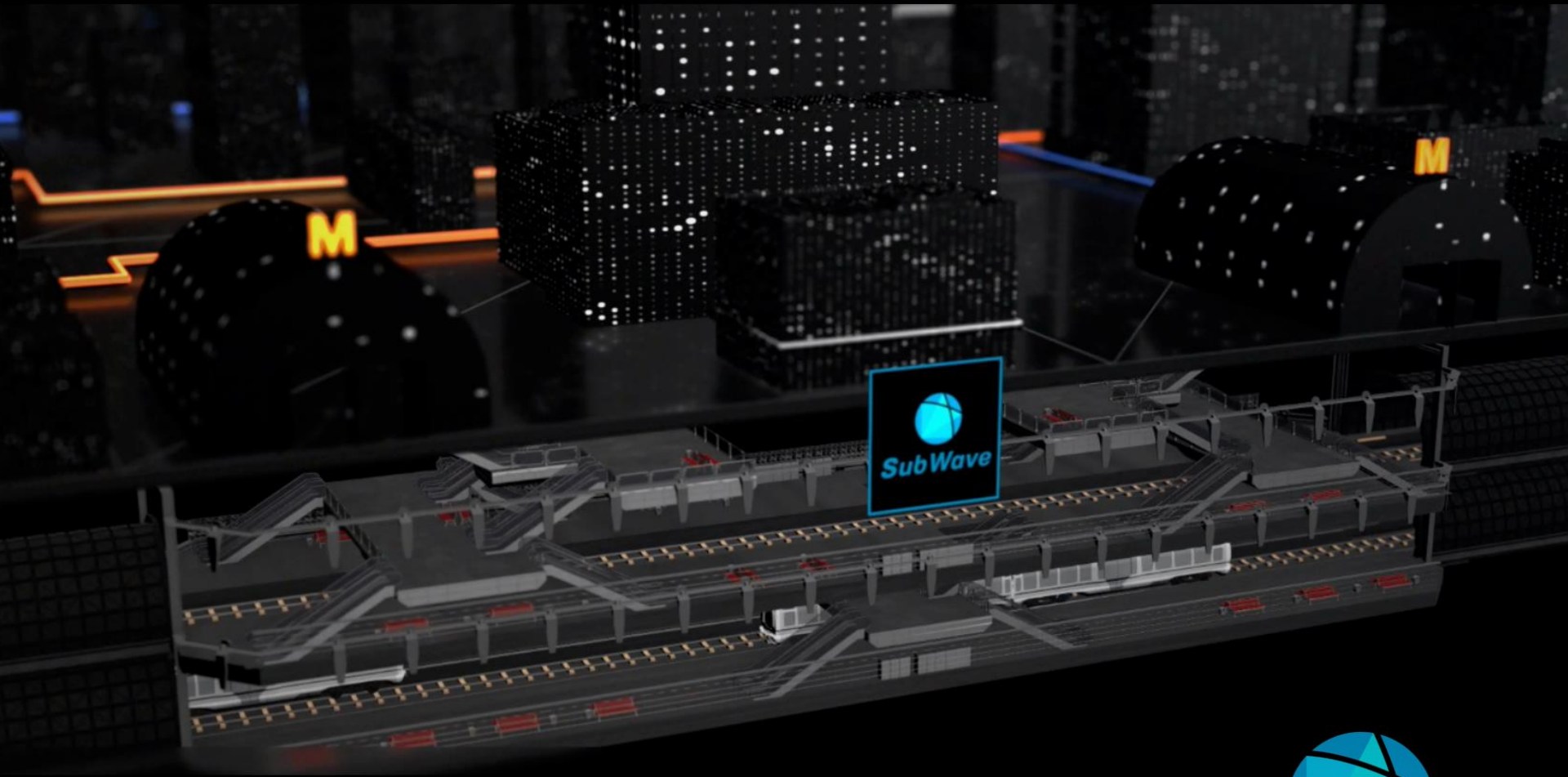
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