Halys

LoRaWAN Virtual roaming Lora Hub

LoRa is a popular standard for low power M2M, popular because the specification is open and may be used for hundred of devices from the electricity, temperature or water flow probes to positioning devices used for baggage tracking which are essentially mobile and may roam from one country to an other. It is not the business of an airline or a truck fleet to negotiate LoRa roaming agreements in the various countries visited by their LoRa objects. Hence the need for national LoRa Virtual roaming operators which act as single stop for all Lora Network operators to extend or provide their roaming coverage. LoRa class A only low power devices may be used, as well as class B with scheduled receive windows are supported. Class C with nearly permanent receive windows but with more power consumption are available for a wide range of applications.

Charging: the Applications are charged by their Home Network Sever, which are charged by a Lora Virtual roaming Hub carrier which is charged by the various national LoRa networks which they have built with a network of agreement.
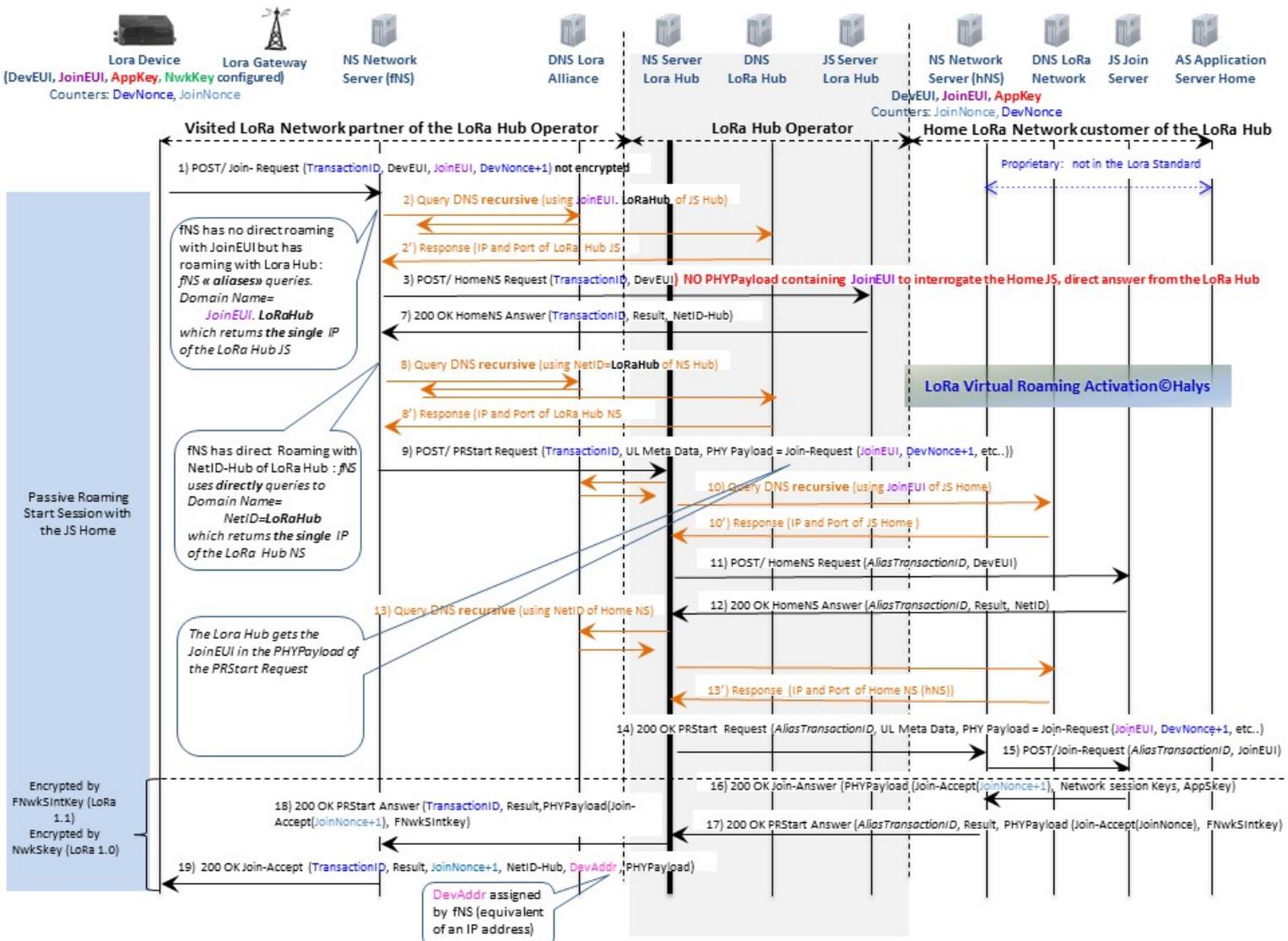

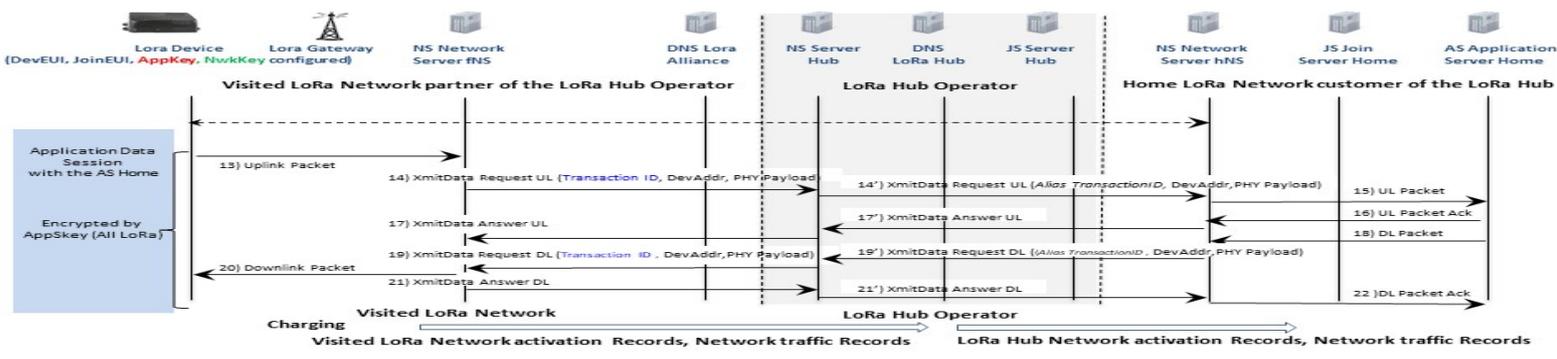*Fig 1 – Setup of sessions through the Halys virtual roaming LoRa Hub*

Fig 2 – Encrypted data exchanges with the Halys virtual roaming LoRa Hub

1- Roaming Support[1]

"Passive roaming" is used to allow all LoRa V1.0 devices. Using the same idea as used in the Halys GTP Hubs, "aliasing" is used for Transaction Ids and DNS requests in the case of LoRa Hubs[2]. The LoRa Hub is a transparent proxy for the HTTP or HTTPs session establishment and the exchange of DevNonce and JoinNonce counters allowing the encryption to be established end-to-end between the Device on the left and the Home Network Server on the right of the above Figures.

2- Flexible accounting, reporting and tracing

Activation and Traffic records[2] are created to allow the charging of the Home Network Servers.

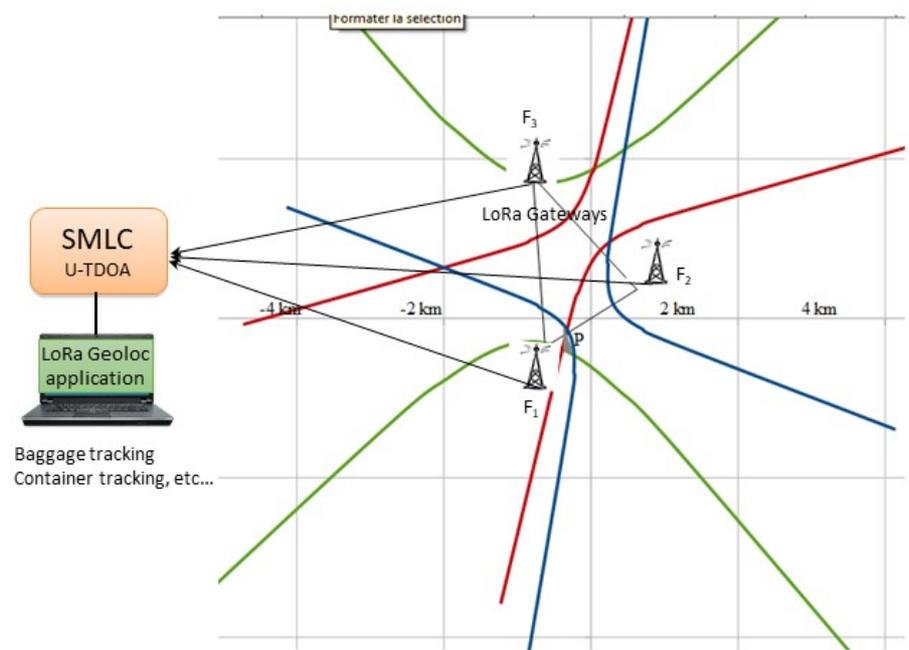## 3- Geo- localisation in LoRa: Containers or baggages tracking

Fig 3– LoRa geo-localisation with U-TDOA and a SMLC LoRa

Halys provides a LoRa SMLC which with several Gateways gives an accuracy of a few ten meters. It works for class A devices without a GPS.

[1] LoraWAN, "Backend interfaces 1.0 specification", Oct 11 2017, *description of the passive and handover roaming architecture, the document which explains roaming, beware there are errors in Table 13. Figure 10.4 of this book is more correct.*
[2] "Service et Système de roaming virtuel des objets LoRa", S.Cruaux, A. Henry-Labordère, B.Mathian, brevet FR.