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CONNECTING DRONE DEVICES USING DIFFERENT CELLULAR TECHNOLOGIES ACROSS GEOGRAPHIES WITH CONTROL CENTER

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ABSTRACT

Techniques are described herein for extending the connectivity and management of the drones across multiple cellular technologies. Traditional control centers can manage connected cars, connected robots, connected vending machines, etc. The mechanisms presented herein enable control centers to manage connected drones using similar cellular technology (e.g., Global System for Mobile Communication (GSM), Code Division Multiple Access (CDMA), etc.).

DETAILED DESCRIPTION

Currently there is no single portal/platform which allows for the control of drones connected through multiple service providers. As a result an entire fleet must be placed onto a single service provider.

A control center connects multiple Subscriber Identity Modules (SIMs) from the same service provider. Service providers offer subscription-based services to end customers (e.g., enterprises). An additional feature that benefits end customers through a control center is connection of multiple drones containing SIMs from multiple service providers and monitoring of the drones on a single portal of the control center**.**

Figure 1 below illustrates a flow from the SIMs to the control center through the service provider network.

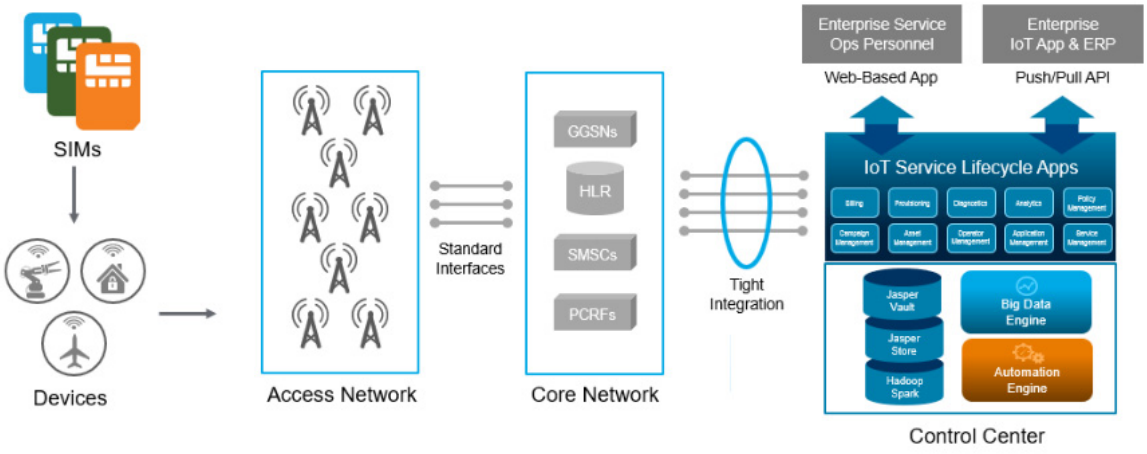

Figure 1

Figure 2 below illustrates an initial step in which multiple drones may be connected through different service providers to the control center.

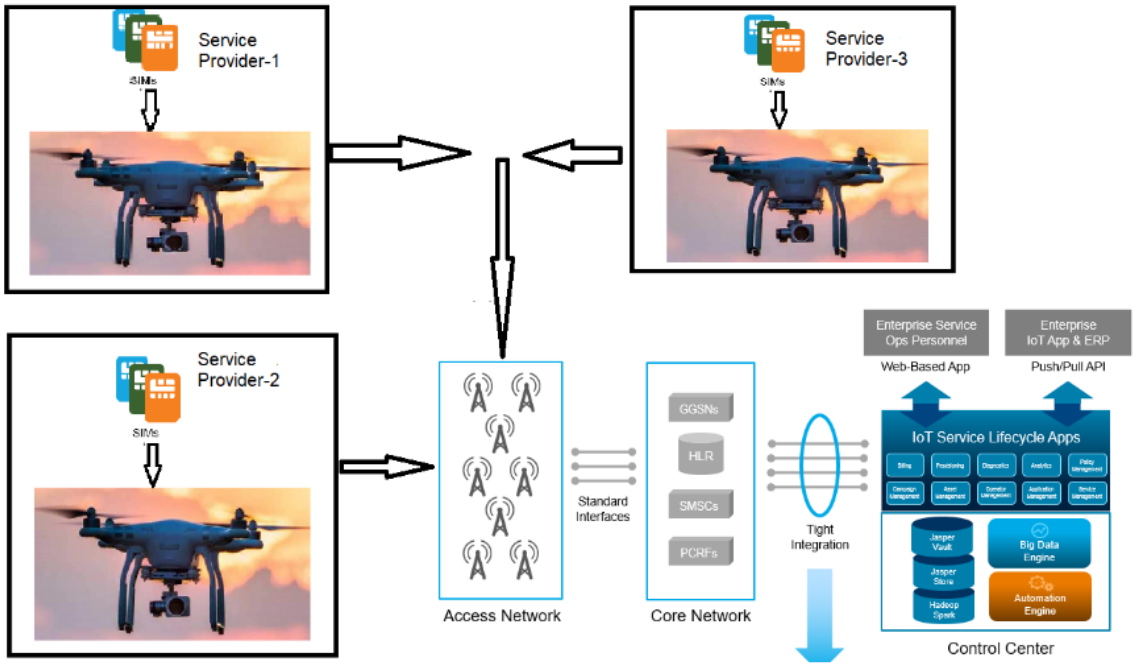

Figure 2

Currently, control centers permit only one service provider to provide services to multiple enterprise customers. Techniques described herein enable the control center to allow one enterprise customer to subscribe to multiple service providers. As shown in

Table 1 below, for example, C1 may simultaneously subscribe to services from SP1, SP2, and SP3.

Service Providers	Enterprise Customers
SP1	C1,C2
SP2	C1,C3
SP3	C1,C4

Table 1

This may be extended to the use case of a single enterprise customer subscribing to multiple service providers utilizing different cellular technologies (e.g., Global System for Mobile Communication (GSM), Code Division Multiple Access (CDMA), etc.).

Table 2 below illustrates an example using a control center employing techniques described herein. In this example, there are roaming partners SP11 and SP12 of a service provider SP1, and roaming partners SP21 and SP22 of a service provider SP2. In North America L1, SP1 is associated with SP11 and SP12. In Europe L2, SP2 is associated with SP21 and SP22. In Asia L3, SP3 is associated with SP31 and SP32.

Service Provider/Roaming Partners association	*L1-North America*	*L2-Europe*	*L3-Asia*
SP1(CDMA)	*SP11, SP12*		
SP2 (GSM)		*SP21, SP22*	
SP3 (CDMA)			*SP31, SP32*

Table 2

Figure 3 below graphically depicts the example shown in Table 2.

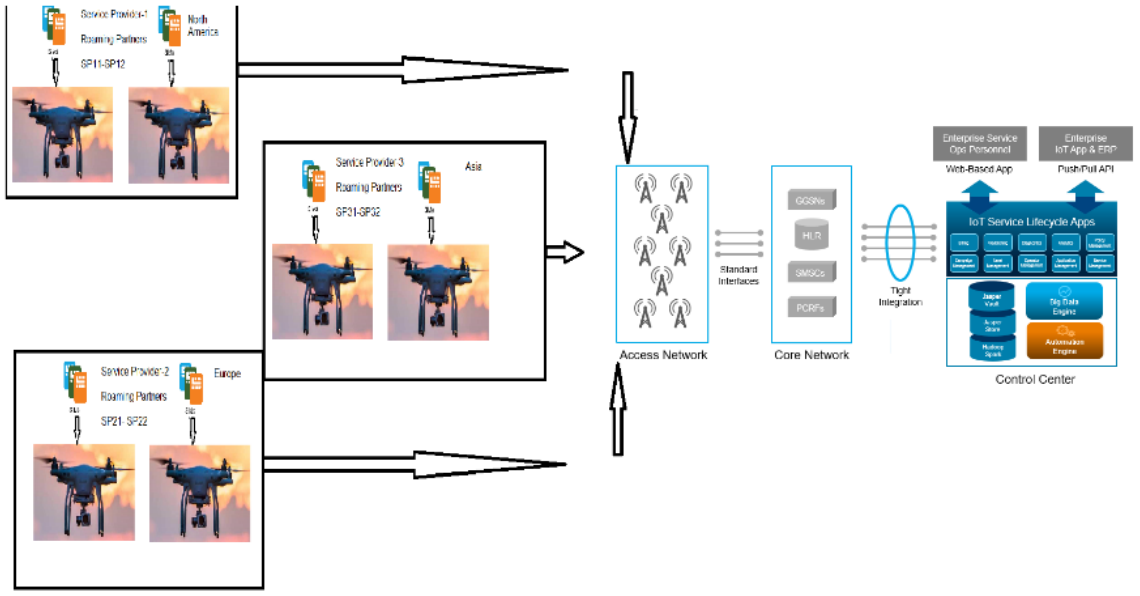

Figure 3

In a further example, an enterprise customer C1 of SP1 in North America (internally using SP11 or SP12) may subscribe to the connected drones service via CDMA technology. The same customer C1 of SP2 in Europe (internally using SP21 or SP22) may subscribe to the connected drones service via GSM technology.

Figure 4 illustrates a user interface viewable by a customer upon log-in to the control center portal. As shown, all devices/drones connected in North America using CDMA and all devices connected in Europe connected using GSM may be listed in a single view.

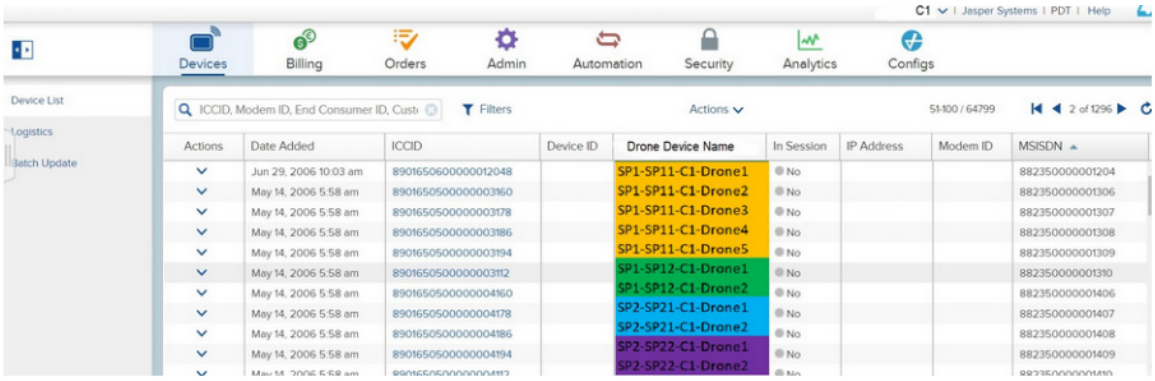

Figure 4

As illustrated in Figure 5 below, a drone is connected through multiple service providers on the left through wireless technology. Services may be offered to the end customers as a Software-as-a-Service (SaaS) offering.

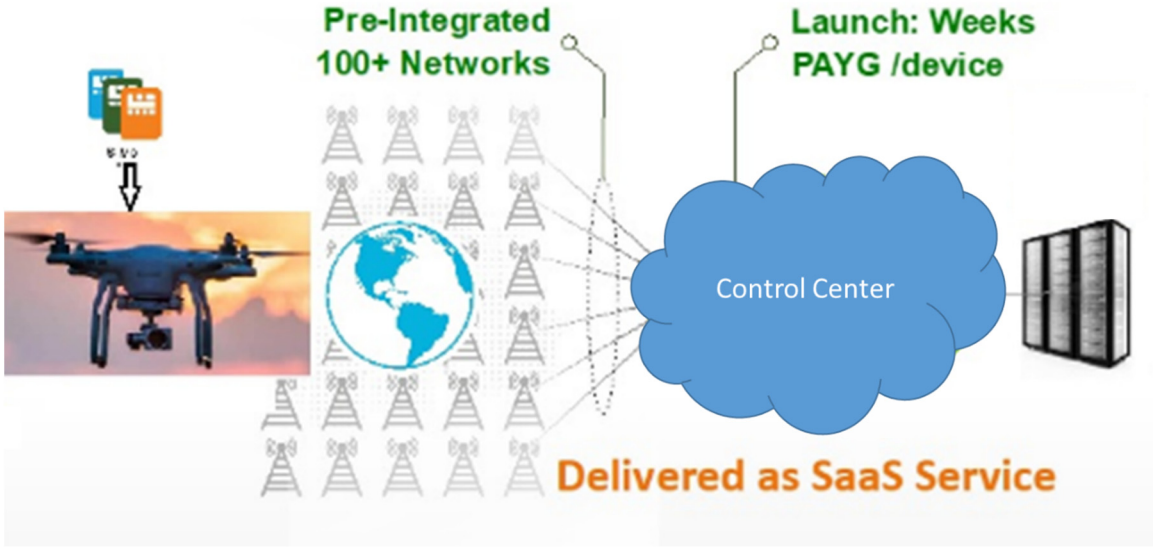

Figure 5

Use cases for connected drones may include a service provider with presence across many geographical areas, service providers with roaming partners across the globe, and service providers that provide the surveillance services. An enterprise customer of a service provider may provide surveillance services to its company locations across geographical areas through the control center connected to drones using different technologies in different countries. This use case may be extended through multiple verticals such as railway monitoring, medical supply delivery, agriculture surveillance, etc. Thus, a control center may be enabled with additional features for supporting multiple service providers on different technologies.

As illustrated in Figure 6 below, connected drones may support multiple use cases, including medical supply delivery, agriculture surveillance, traffic surveillance, on-duty drones for first responders, climate monitoring, factory intralogistics, industrial Internet of Things (IoT), etc.

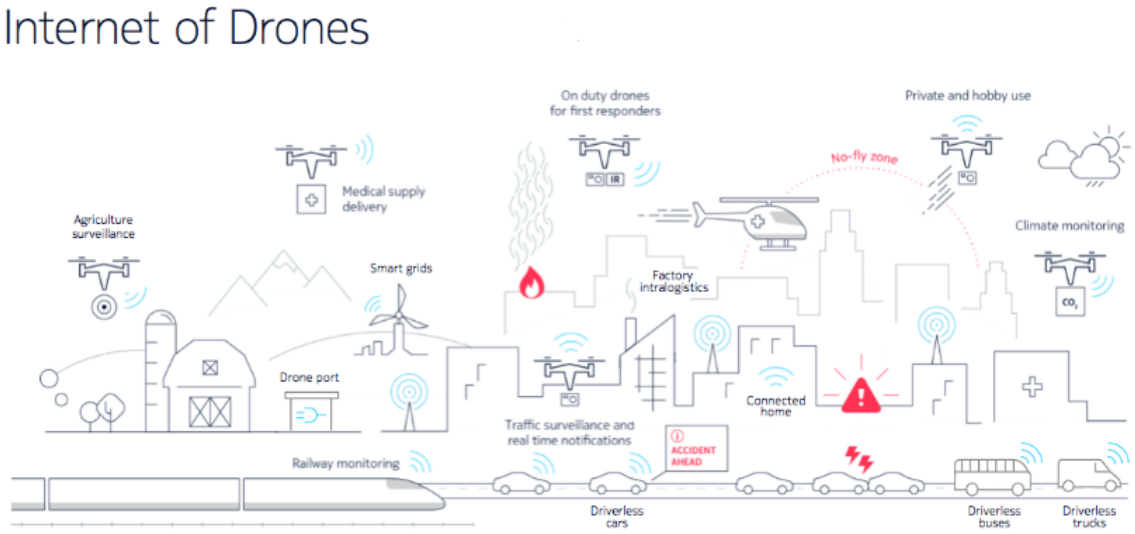

Figure 6

In summary, techniques are described herein for extending the connectivity and management of the drones across multiple cellular technologies. Traditional control centers can manage connected cars, connected robots, connected vending machines, etc. The mechanisms presented herein enable control centers to manage connected drones using similar cellular technology (e.g., GSM, CDMA, etc.).