

# Cloudification of Drones: Accelerating Time-to-Value while Enhancing User Experience and Safety

## Abstract

With drone technology poised to take off in the commercial world, the 'drone-as-a-service' model holds tremendous promise for extending agile, on-demand, pay-per-use services across industries. Current commercial unmanned ariel vehicles (UAVs) or drone platforms are evolving to meet the need for customized services in industries such as retail, healthcare, telecommunications, transportation, media and entertainment.

Today, businesses can leverage autonomous drones, high-speed networks, and automation, to deliver superior outcomes including accelerated processing, better quality of service, and enhanced user experience. This paper presents a viable approach for an agile drone-as-a-service model by leveraging the next-generation ecosystem of remote gateways for Beyond Line of Sight (BVLOS) drones, automation for off-drone data processing, and real-time interconnection to cloud infrastructure.

## The Dawn of Drone-as-a-Service

A report by Markets and Markets Research estimates that the drone services market will be worth over USD 18,022 million by 2022.<sup>1</sup> Given its robust growth potential, ICT companies and UAV service suppliers (USS) are vying for a share of the evolving drone market space. New approaches are being evaluated to enable differentiated and agile drone-as-a-service models.

Currently, drone services are challenged by the lack of an approach that supports autonomous drones flying BVLOS to transmit data for remote real-time processing (see Figure 1). Implementing such an approach would enable a better user experience and improve security, as drones can be autonomously controlled in case of emergencies.

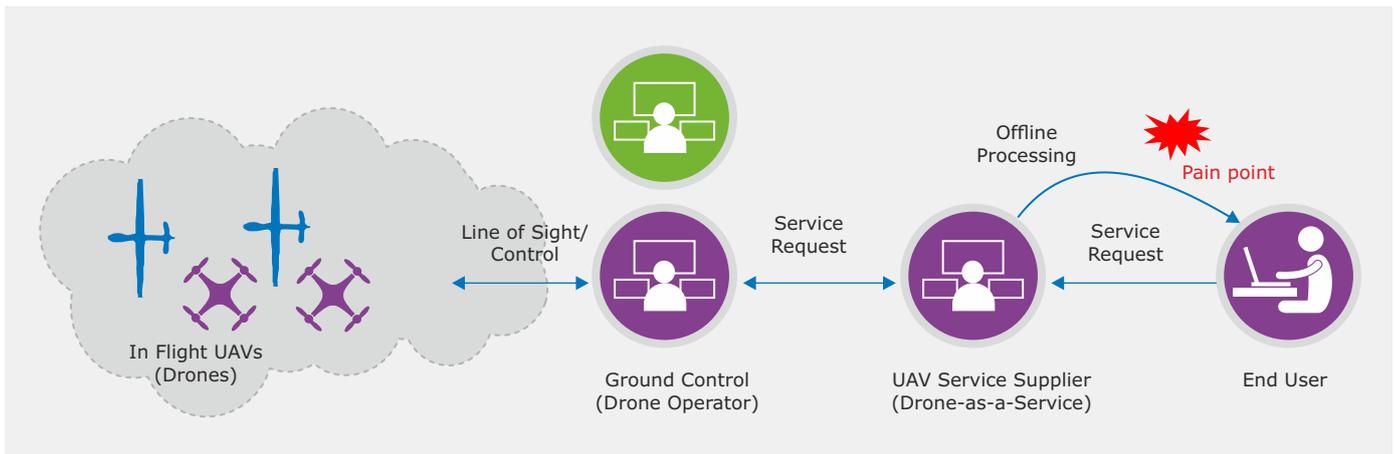


Figure 1: Current operational challenges in transmitting data for real-time processing

Additional challenges include new traffic management guidelines, which mandate situational awareness of the airspace to enable Detect, Sense, and Avoid (DSAA) mechanisms and handle emergencies. Agencies such as UAV Traffic Management (UTM) for U.S. airspace and Urban-Space (U-Space) for European airspace have already defined the requirements for companies to qualify as a USS in their sectors.

As USS players race to enable on-demand, pay-per-use, and customized drone services, they are partnering with key product engineering firms and working with regulatory bodies including:

- Drone platform providers such as semiconductor or devices companies dealing with traffic management client stack and inter-working to third-party services
- Drone communication providers such as telecom equipment manufacturers offering drone-to-drone or network communication in BVLOS autonomous drones
- Service suppliers such as telecom and cloud service providers customized drone services, e-market place, and service portals
- Ecosystem of regulatory bodies for end-to-end alignment with UTM guidelines

## Using Cloudified Drones to Create Digital Twins: A Compelling Use Case

Moving drone operations to the cloud and enabling drone-as-a-service is the answer to reducing time-to-value and scaling the technology's applicability to multiple businesses across industries. It can help create high fidelity, digital twins of business landscapes by capturing data to build high resolution models of assets and processes, and enable real-time analytics to solve unique business problems.

One way to assess the potential of drone-as-a-service is to implement it as a proof-of-concept with an in-house USS reference platform, developed and integrated with the drone ecosystem. The implemented USS reference platform supports the guidelines of drone registration, and flight path validation and verification with reference to other flight plans, weather, and regulatory data.

The setup (as illustrated in Figure 2) includes BVLOS drone (in Hardware in the Loop – HITL mode) integrated with wireless networks (WiFi), remote gateway (enabling autonomous inter-connect upload and control), and cloud infrastructure (supporting hosted application processing and analysis).

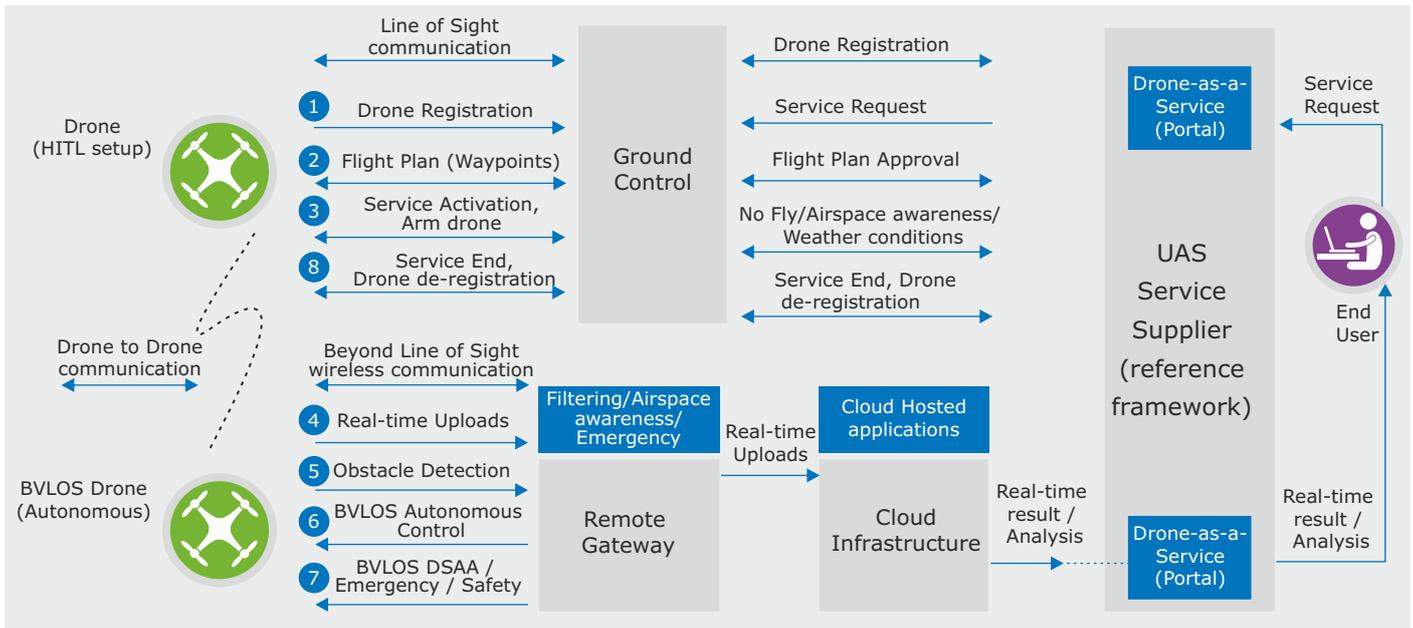


Figure 2: Proposed approach for drone-as-a-service setup

Consider a survey service request from a business with the objective of creating a digital twin in an urban area. Certain areas may need a more detailed survey as compared to other parts of the landscape. During a BVLOS flight, a drone connected through 4G or 5G can offload the sensor, telemetry, and other critical data securely (digital transformation) to the nearest remote gateway.

Once the data is offloaded, the gateway takes over processing with the help of pre-specified instructions to process, filter, and upload real-time information to the cloud. The gateway can also conduct initial validation in case there are inconsistencies in the survey data. The cloud hosted application processes, analyzes, and maps the survey data while the drone is still in-flight. With the cloudification of drone- as-a-service, the user can visualize the creation of the digital twin in real time.

Consider an additional implication in the urban survey scenario - it is highly likely that other drones (commercial, hobby, or emergency) or planes might be flying in the area(s) of interest. While the UTM framework is expected to ensure situational awareness to ensure safety, some cases may need immediate triage. The remote gateway has the capability to sense the drones and manned aircrafts in the coverage area, and autonomously direct DSAA and other emergency remedial actions, as needed.

## Drone Services take 'Flight' in the Cloud

Cloudification of drone services can help businesses rapidly increase market share by extending next-generation agile drone applications and differentiated services for superior user experience. It enables the perfect integration of productized analytics and digital twins, providing decision makers with access to unique operational data in real time, for a holistic picture.

For USS companies, the proposed solution could open the door for evaluating other potential approaches aimed at offering customized services such as service portals and integration to cloud services. By leveraging such services, businesses can significantly reduce the time-to-value by gaining a real-time view of the requested service results and analysis.

The booming drone services market also opens up opportunities for semiconductor and device manufacturers to design on-board modems that enable drone-to-drone and drone-to-network communication during BVLOS flights. Likewise, telecom equipment manufacturers can create new revenue streams by supporting the communication protocol for BVLOS drone-network communication while service providers evaluate the infrastructure ecosystem of remote gateways, cloud infrastructure, hosted applications and inter-linking with USS.

With drones set to rapidly integrate with commercial and industrial applications, companies that leverage cloudification of drone technology today will gain a distinct competitive edge tomorrow.

## References

[1] MarketsandMarkets, Drone Services Market worth 18,022.7 Million USD by 2022 (Jan 2017), accessed 21 July 2017, <http://www.marketsandmarkets.com/PressReleases/drone-services.asp>

## About The Authors

### Partha Datta

Partha Datta is the Domain Head of NextGen R&D group of TCS' Technology business unit. He has over 18 years of experience across leading telecom equipment vendors in the U.S. and Europe. Datta advocates a holistic view of solutions from business and technical perspectives to enable value added transformation leveraging next-generation technologies, specifically in the areas of SD-WAN, NFV, drones, robotics, and AI.

### Saloni Jain

Saloni Jain is a Lead Solutions Engineer with TCS' Technology business unit. Jain has over eight years of experience in the fields of drones and robotics, and is an avid contributor to the open-source community. She specializes in the implementation of proofs-of-concept and solution enablers leveraging the drone ecosystem.

### Shilpa Mandara

Shilpa Mandara is part of the NextGen R&D group of TCS' Technology business unit. Mandara focuses on developing drone related solution accelerators to enable differentiated services in the drone ecosystem. With more than three years of experience, she is responsible for the implementation of drone based proofs-of-concept and use cases to address industry challenges.

Experience certainty. IT Services  
Business Solutions  
Consulting

## Contact

Visit the [Communication, Media & Technology](#) page on [www.tcs.com](http://www.tcs.com)

Email: [Marketing.TechBU@tcs.com](mailto:Marketing.TechBU@tcs.com)

Subscribe to TCS White Papers

TCS.com RSS: [http://www.tcs.com/rss\\_feeds/Pages/feed.aspx?f=w](http://www.tcs.com/rss_feeds/Pages/feed.aspx?f=w)

Feedburner: <http://feeds2.feedburner.com/tcswhitepapers>

## About Tata Consultancy Services Ltd (TCS)

Tata Consultancy Services is an IT services, consulting and business solutions organization that delivers real results to global business, ensuring a level of certainty no other firm can match. TCS offers a consulting-led, integrated portfolio of IT and IT-enabled, infrastructure, engineering and assurance services. This is delivered through its unique Global Network Delivery Model™, recognized as the benchmark of excellence in software development. A part of the Tata Group, India's largest industrial conglomerate, TCS has a global footprint and is listed on the National Stock Exchange and Bombay Stock Exchange in India.

For more information, visit us at [www.tcs.com](http://www.tcs.com)

All content / information present here is the exclusive property of Tata Consultancy Services Limited (TCS). The content / information contained here is correct at the time of publishing. No material from here may be copied, modified, reproduced, republished, uploaded, transmitted, posted or distributed in any form without prior written permission from TCS. Unauthorized use of the content / information appearing here may violate copyright, trademark and other applicable laws, and could result in criminal or civil penalties. Copyright © 2017 Tata Consultancy Services Limited