SDPS CONFERENCE 2016 Orlando

DATA TRANSMISSION STRATEGIES FOR UAV: AN OVERVIEW AND FUTURE PERSPECTIVES

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2016/12/5

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- Datalinks
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- Conclusion

- A literature review
- Unmanned Aerial Vehicle (UAV)
- Former Data transmission strategies
- Signal UAV and control station
- Latest wireless networks
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- Hypothesis

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ONE

Military

- Remote strike
- Network relay
- Battlefield surveillance

THREE

Civil

- Agriculture
- Mapping
- Aerial photography
- Disaster rescue
- Cellular network reinforce
- Wi-Fi internet access
- Video surveillance
- Sensor network data collection

TWO

New Tech

- 5G
- 802.11ay
- Bluetooth 5

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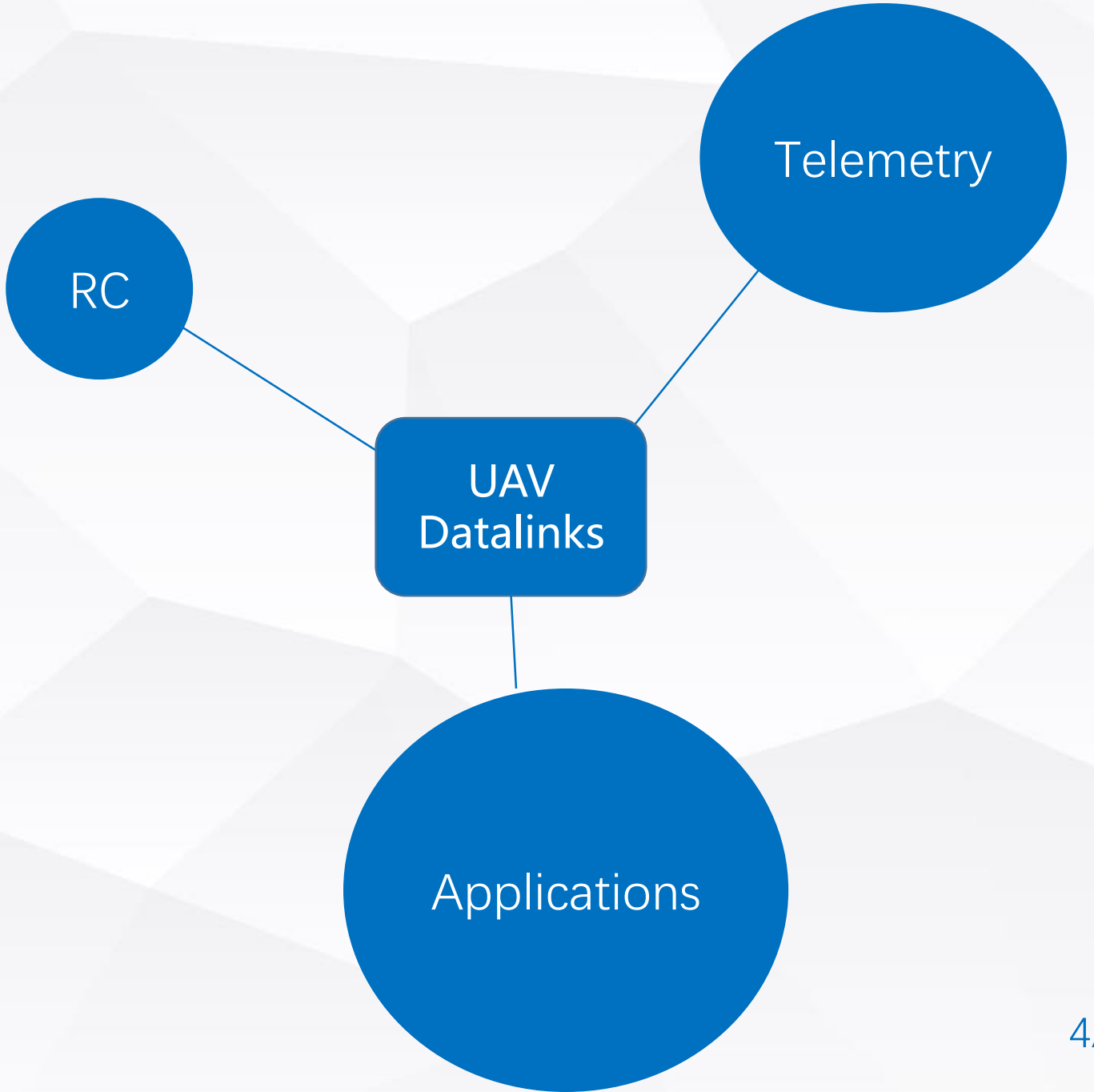

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RC Datalink

The flight path of a UAV is controlled from the ground control station remotely. The commands used to control the direction, altitude, flying modes of UAV are called flight control data. A wireless remote control data link for UAV should be dependable, fast, supporting long-rang communication, no legal issue, et al. Radio frequency can totally meet these requirements, so it is widely used on small to middle-sized UAV remote control, this kind of data link is commonly referred as radio control (RC).

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Telemetry Datalink

During the flight of UAV, lots of flight status data are created by different sensors inside UAV. These data are very important and normally will be translate back to grand station to help the operator aware the flight status, so the data link transmitting flight status is also called telemetry data. UAV with autopilot controller often include the flight statues data into autopilot processing. There are a variety of data acquisition system and flight control systems that log and process telemetry sensor data.

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Applications Datalink

As a floating platform on the sky, many applications, e.g. live onboard video stream, Wi-Fi access, Cellular network reinforcement, are implemented on UVA. Transmitting application data from UAV has became a hot topic. Except traditional radio frequency transmission, wireless networks has become the best solution for small-sized UAV application data transmission. Wi-Fi, Bluetooth, Cellular network are options on this list.

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UAV data link comparison

	RC Data Link	Telemetry Data Link	Application Data Link
Frequency	35MHz (EU)	433MHz (EU)	See wireless network comparison
	72MHz (US)	915MHz (US)	
	2.4GHz (Global)	2.45GHz (Global)	
Bandwidth	Slow	Medium	Fast
Distance	Long	Medium	Vary with solutions

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Wireless network data link comparison

	802.11n	802.11ac	Bluetooth 4	4G-LTE
Frequency	2.4GHz, 5GHz	5GHz	2.4GHz	2-8GHz
Bandwidth (theoretical)	150Mbps	450Mbps	25Mbps	1 Gbps
Distance (max)	250m	250m	60.96m	3-5km
Latency (average)	200ms	200ms	100ms	5ms
Power Consumption	High	High	Low	Medium
Security	Medium	Medium	Low	High

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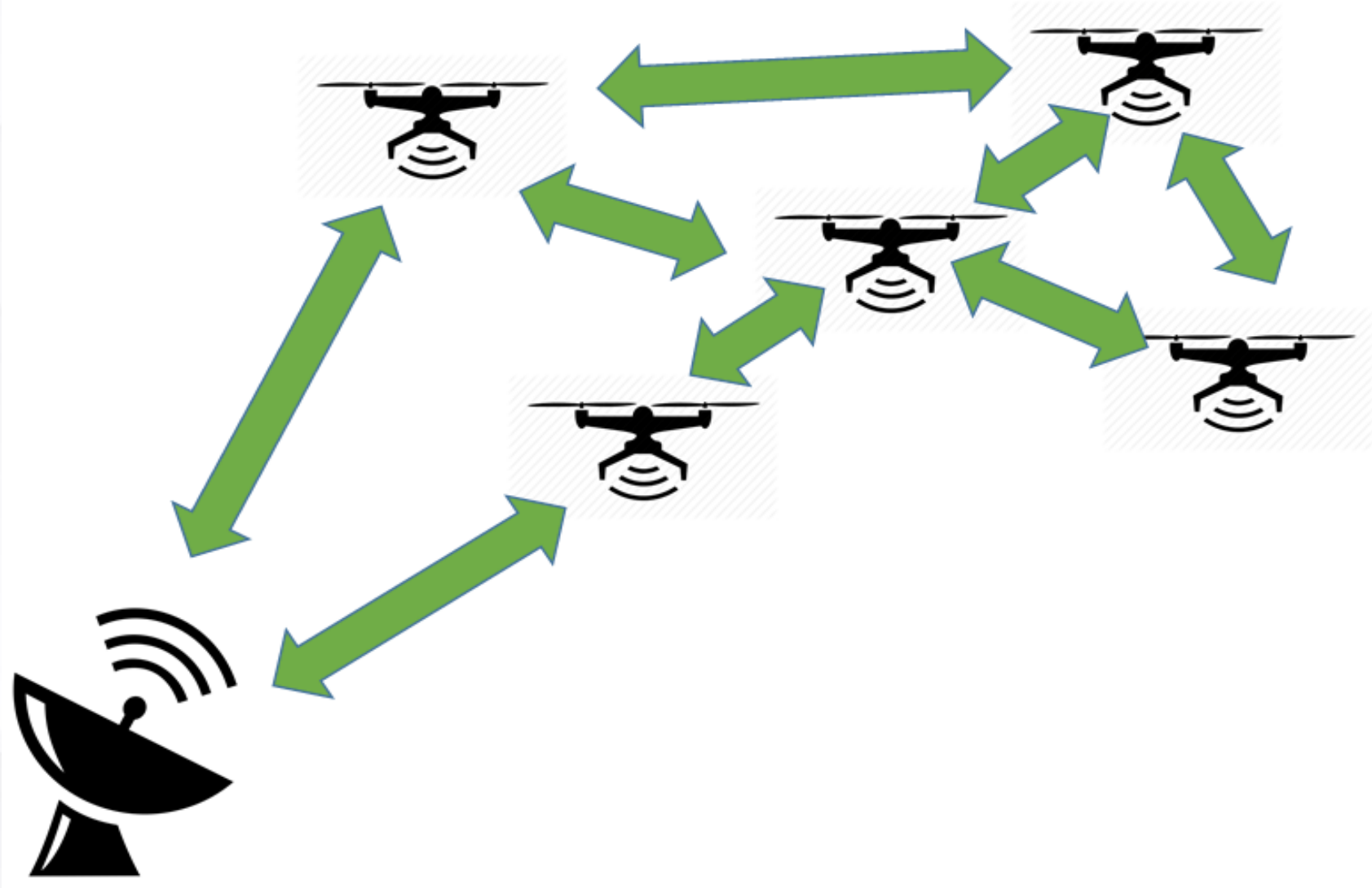

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Multi-UAV

- At least two UAVs
- Direct connections
- Indirect connections

Advantages

- Reduced cost
- Increased reliability
- Decrease task time

Applications

- Surveying
- Reconnaissance
- Monitoring
- Search and rescue

FANET

- Ad-Hoc
- Decentralized
- Without infrastructure
- Restricted environment

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1. RC data link and Telemetry data link can be substituted by Application data link if it can support a stable, low latency data transmission service even at low speed.
2. Application data link as a general data transmission link should be implemented on a universal data transmission protocol e.g., TCP/IP, UDP, MAVLink.
3. The reinforced Wi-Fi based application data link will be main stream and more 4G or 5G based data link will be used for time-sensitive, large data flow, long distance applications using small-sized UAVs as platform.

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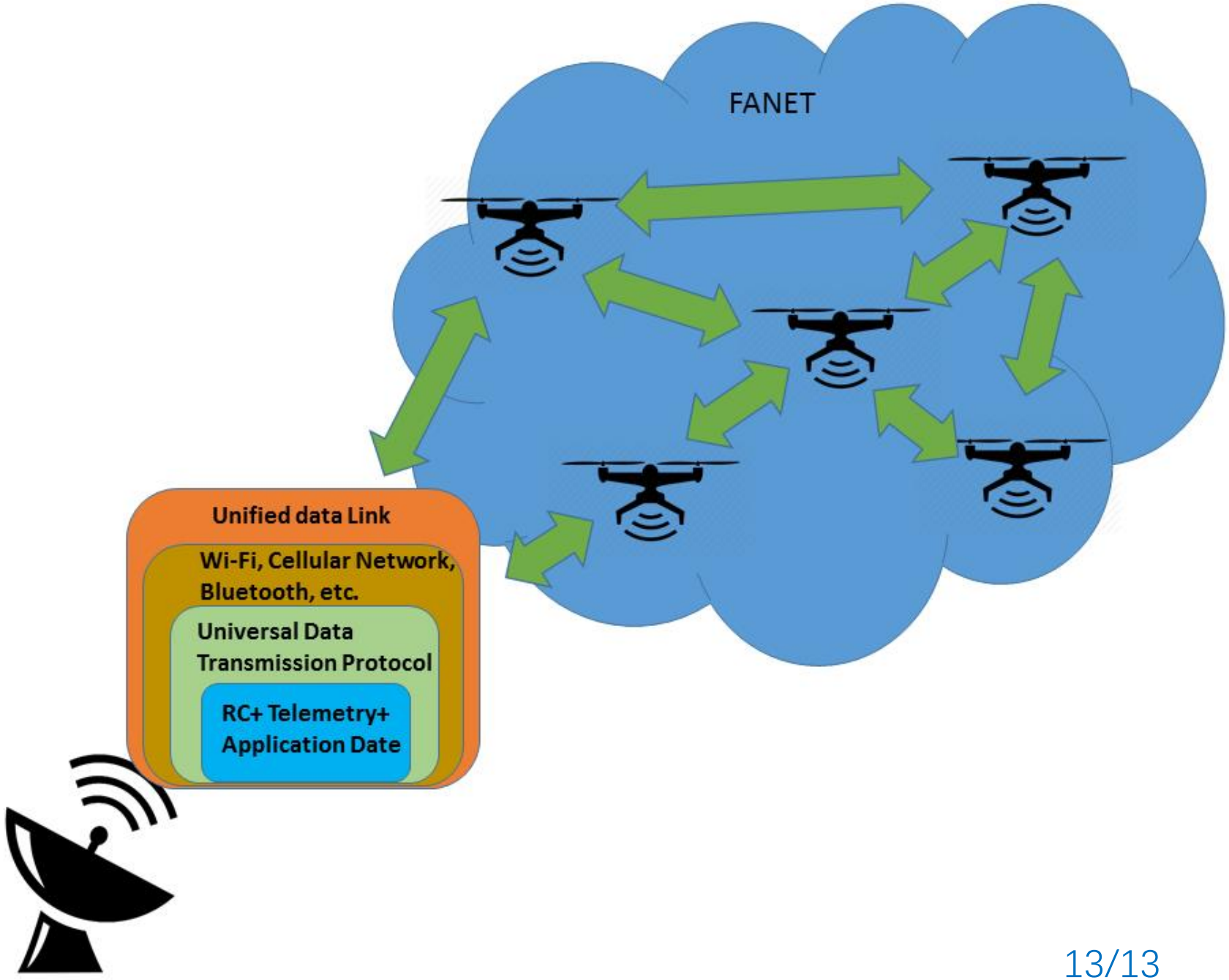

Q&A