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Chapter 1
APM Server Driver

Abstract In order to make accesible to `JdeRobot` the command sets of `MAVLink` a driver is needed. The `APM Server driver` "translates" the `JdeRobot` interfaces objects in `MAVLink's` commands an viceversa, giving access to sensors and actuators of the robot. With the typical `JdeRobot` architecture applications can run in different machines (not necessarily aboard) and can be writen in different programming languages. In our case this driver run in a `Raspberry Pi3` with `raspbian OS` aboard the plane

1.1 Design

The driver has to fullfil the following features:

- Have to be able to connect to a physical devices like APM 2.8 but as well as to a simutator.
- Have to access to sensors measures of the aereal robot and interpreting the data and serve its as ICE interfaces objects.
- Have to be able to recieve incoming commands as ICE interfaces objects and send its to the devices as `MAVLink's` commands.

In order to adress it, a Python in `JdeRobot` component has been developed who implements all of above features called `APM Server`. `APM Server` is organized in three logical layers.

- Comunication's layer with APM's devices. ensures the establishment and maintenance the comunication with the APM device through `MAVLink's` commands.
- Bussiness Layer. In this layer the driver convert form `MAVLink's` commands to ICE interfaces objects and viceversa.
- `JdeRobot comunication's layer` This layer create all the ICE servers needed and handle incoming and outgoing ICE interfaces objects.

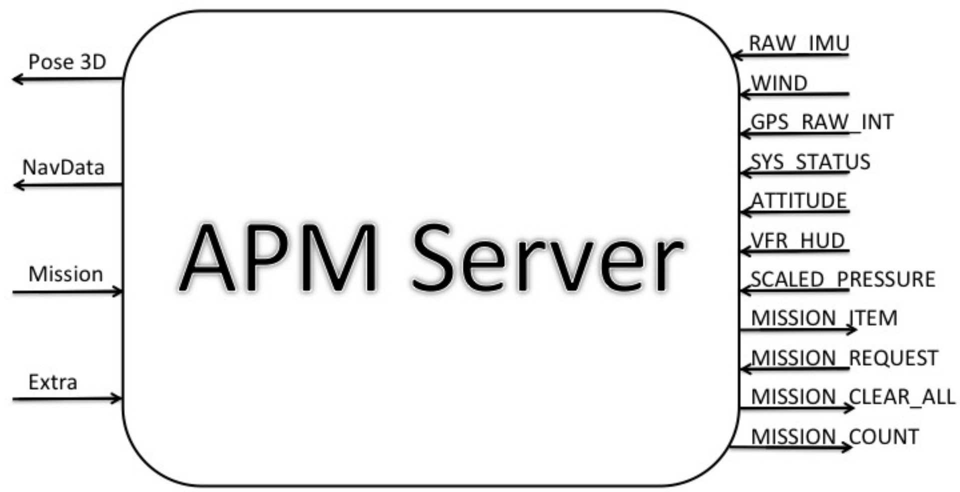

Fig. 1.1 Diseo de entradas y salidas de `APM Server`

1.2 Comunication's layer with APM's devices

In this layer the driver send the `MAVLink's` commands and recieve the `MAVLink's` messages which conform the comunication with the APM device. The driver have to understand the APM device's messages received in `MAVLink` protocol as well as build this commands and send it to the APM.

1.2.1 MAVLink's message

The driver handle 11 commands of the full set of `MAVLink's` commands (see Figure 3.1) to allow the `JdeRobot` integration. Below it's described one of them in order to know this protocol.

```
<message id="33" name="GLOBAL_POSITION_INT">
<description>The filtered global position
(e.g. fused GPS and accelerometers). The
position is in GPS-frame (right-handed, Z-up).
```

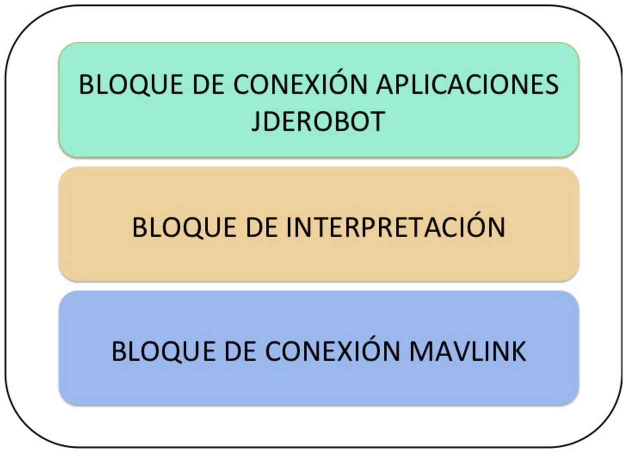

Fig. 1.2 Bloques del driver `APM Server`

```
It is designed as scaled integer message
since the resolution of float is not
sufficient. </description>
<field type="uint32_t" name="time_boot_ms" units="ms">
Timestamp (milliseconds since system boot)</field>
<field type="int32_t" name="lat" units="degE7">Latitude,
expressed as degrees * 1E7</field>
<field type="int32_t" name="lon" units="degE7">Longitude,
expressed as degrees * 1E7</field>
<field type="int32_t" name="alt" units="mm">Altitude in
meters, expressed as * 1000 (millimeters)</field>
<field type="int32_t" name="relative_alt" units="mm">
Altitude above ground in meters, expressed as
* 1000 (millimeters)</field>
<field type="int16_t" name="vx" units="cm/s">Ground X
Speed (Latitude, positive north), expressed as
m/s * 100</field>
<field type="int16_t" name="vy" units="cm/s">Ground Y
Speed (Longitude, positive east), expressed as
m/s * 100</field>
<field type="int16_t" name="vz" units="cm/s">Ground Z
Speed (Altitude, positive down), expressed
as m/s * 100</field>
<field type="uint16_t" name="hdg" units="cdeg">Vehicle
heading (yaw angle) in degrees * 100, 0.0..359.99
degrees. If unknown, set to: UINT16_MAX</field>
</message>
```

One example of this incoming message is:

```
GLOBAL_POSITION_INT {time_boot_ms : 480614, lat : -
353632612, lon : 1491652301, alt : 584110,
relative_alt : -179, vx : 0, vy : 0, vz : 0, hdg :
35608}
```

1.2.2 Setup and APM connection

As has been showed the APM comunication is under `MAVLink` so the setup and conection have its own commands in this protocol. To help us to build and understand these messages the driver uses `pymavlink`.

The connection is established in the server object creation, in the __init__() method of the class. The connection command needs two parameters: the device and the connection speed in bauds.

```
classServer:
        def__init__(self ,port ,baudrate ):
                self.master=mavutil.mavlink_connection(port ,
                                baudrate , autoreconnect=True)
                self.master.wait_heartbeat()
                ...
__init__()
#test=Server("/dev/ttyUSB0",57600)#ConnectiontotherealAPMdevice
test=Server("udp:192.168.1.133:14558",57600)#ConnectiontoSITL
```

The last two sentences shows an example of a real device connection and SITL's connection respectively.

Once the connection is made, the AMP `MAVLink's` messages start to be stored in a buffer, and we can setup it. The incoming messages rate and the set of these command we need are configurable parameters. Set up it is easy as is showed in the following lines.

```
RATE=50
self.master.mav.request_data_stream_send(self.master.target_system ,
                                         self.master.target_component ,
                                         mavutil.mavlink.MAV_DATA_STREAM_ALL,
                                        RATE,1)
```

The available set connections are:

```
MAV_DATA_STREAM_ALL Enable all data streams
MAV_DATA_STREAM_RAW_SENSORS Enable IMU_RAW,
        GPS_RAW, GPS_STATUS packets.
MAV_DATA_STREAM_EXTENDED_STATUS Enable GPS_STATUS,
        CONTROL_STATUS, AUX_STATUS
MAV_DATA_STREAM_RC_CHANNELS Enable RC_CHANNELS_SCALED,
        RC_CHANNELS_RAW, SERVO_OUTPUT_RAW
MAV_DATA_STREAM_RAW_CONTROLLER Enable
        ATTITUDE_CONTROLLER_OUTPUT,
        POSITION_CONTROLLER_OUTPUT,
```

```
          NAV_CONTROLLER_OUTPUT.
MAV_DATA_STREAM_POSITION Enable LOCAL_POSITION,
          GLOBAL_POSITION/GLOBAL_POSITION_INT messages.
MAV_DATA_STREAM_EXTRA1 Dependent on the autopilot
MAV_DATA_STREAM_EXTRA2 Dependent on the autopilot
MAV_DATA_STREAM_EXTRA3 Dependent on the autopilot
```

And the RATE value depends of the choosed device.

1.2.3 APM data reading

In order to retrieve the APM sensors measures, a thread is ejecuting a message handler all the time. In this handler the method search for seven types of messages (like GLOBAL_POSITION_INT) which contains the needed data to fill the two ICE interfaces that the server serves: `Pose3D` y `NavData`.

1.2.4 Sending missions to APM

This is the most important part of the driver. The driver recieve two ICE interfaces, one developed in this project called `mission` with the waypoints to follow and the `Extra` interface with the take off and land maneuvers. Once a mission is received through these interfaces objects, `APM Server` build the `MAVLink's` commands needed to sent it to the APM. To perform it, a new thread with a listener was developed in order to know if there is a incominf mission. Once this listener detects an incoming mission, call to `setMission(self, mission)` who build the `MAVLink's` commands and sent it as the Figure 3.3 diagram shows. The `setMission(self, mission)` method read througth the list of waypoints and if `takeOffDecision` and `landDecision` of `Extra` object are seted to True add the `MAVLink's` commands of take off and land at first and last of the list of commans whitch is sended to the APM.

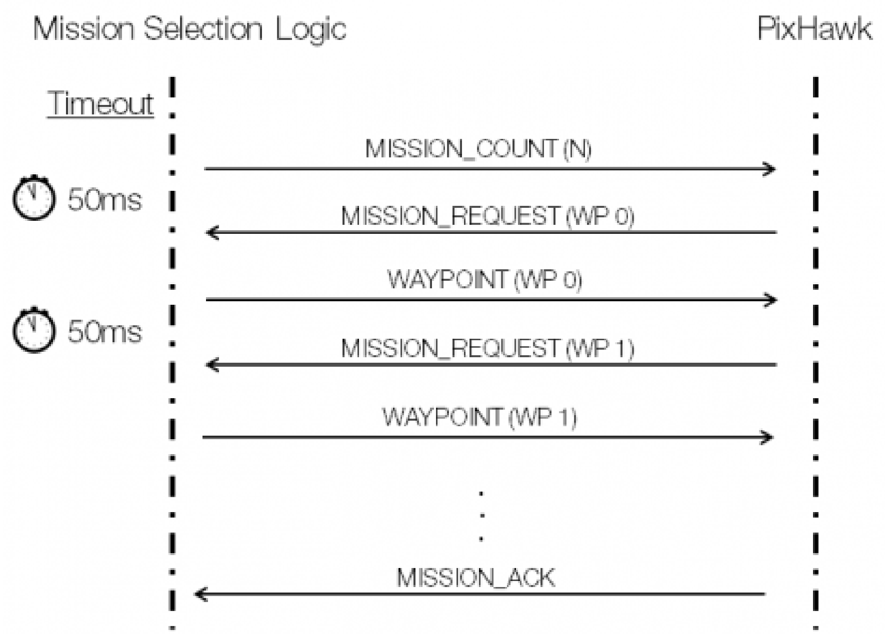

Fig. 1.3 `MAVLink's` missions sending protocol

1.3 JdeRobot's conection layer

In this layer all the ICE interfaces objects are handled. The driver uses four interfaces. Two of there are served (outgoing), `Pose3D` and `NavData` and the rest are received: `mission` and `extra`. Each interfaces has its own thread with its own ICE server (note that ICE servers communication are bidirectional, so in this case "server" word don't refer to the side of the data). In the following lines an ICE server implementation are showed.

```
def openPose3DChannel(self, pose3D):
    status = 0
    ic = None
    Pose2Tx = pose3D
    try:
        ic = ICE.initialize(sys.argv)
        adapter = ic.createObjectAdapterWithEndpoints("Pose3DAdapter",
                                    "default -p 9998")
        object = Pose2Tx
        adapter.add(object, ic.stringToIdentity("ardrone_pose3d"))
        adapter.activate()
        ic.waitForShutdown()
    except:
        traceback.print_exc()
        status = 1
    if ic:
        try:
            ic.destroy()
```

```
        except:
            traceback.print_exc()
            status = 1
    sys.exit(status)
```

Interpretation layer

This layer makes all the needed data's tranformation. So once the `MAVLink's` message is located, this layer makes it fit in the corresponding ICE interfaces and the same in opposite side communication. The `setMission(self, mission)` and the `refreshAPMPose3D()` and `refreshAPMnavdata()` are the most important methods involved in this layer.

References

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1. Broy, M.: Software engineering — from auxiliary to key technologies. In: Broy, M., Dener, E. (eds.) Software Pioneers, pp. 10-13. Springer, Heidelberg (2002)
2. Dod, J.: Effective substances. In: The Dictionary of Substances and Their Effects. Royal Society of Chemistry (1999) Available via DIALOG. http://www.rsc.org/dose/title of subordinate document. Cited 15 Jan 1999
3. Geddes, K.O., Czapor, S.R., Labahn, G.: Algorithms for Computer Algebra. Kluwer, Boston (1992)
4. Hamburger, C.: Quasimonotonicity, regularity and duality for nonlinear systems of partial differential equations. Ann. Mat. Pura. Appl. **169**, 321–354 (1995)
5. Slifka, M.K., Whitton, J.L.: Clinical implications of dysregulated cytokine production. J. Mol. Med. (2000) doi: 10.1007/s001090000086

6. J. Dod, in *The Dictionary of Substances and Their Effects*, Royal Society of Chemistry. (Available via DIALOG, 1999), http://www.rsc.org/dose/title of subordinate document. Cited 15 Jan 1999
7. H. Ibach, H. Lüth, *Solid-State Physics*, 2nd edn. (Springer, New York, 1996), pp. 45-56
8. S. Preuss, A. Demchuk Jr., M. Stuke, Appl. Phys. A **61**
9. M.K. Slifka, J.L. Whitton, J. Mol. Med., doi: 10.1007/s001090000086
10. S.E. Smith, in *Neuromuscular Junction*, ed. by E. Zaimis. Handbook of Experimental Pharmacology, vol 42 (Springer, Heidelberg, 1976), p. 593

11. Calfee, R. C., & Valencia, R. R. (1991). *APA guide to preparing manuscripts for journal publication.* Washington, DC: American Psychological Association.
12. Dod, J. (1999). Effective substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG. http://www.rsc.org/dose/Effective substances. Cited 15 Jan 1999.
13. Harris, M., Karper, E., Stacks, G., Hoffman, D., DeNiro, R., Cruz, P., et al. (2001). Writing labs and the Hollywood connection. *J Film* Writing, 44(3), 213–245.
14. O'Neil, J. M., & Egan, J. (1992). Men's and women's gender role journeys: Metaphor for healing, transition, and transformation. In B. R. Wainrig (Ed.), *Gender issues across the life cycle* (pp. 107–123). New York: Springer.
15. Kreger, M., Brindis, C.D., Manuel, D.M., Sassoubre, L. (2007). Lessons learned in systems change initiatives: benchmarks and indicators. *American Journal of Community Psychology*, doi: 10.1007/s10464-007-9108-14.

16. Alber John, Daniel C. O'Connell, and Sabine Kowal. 2002. Personal perspective in TV interviews. *Pragmatics* 12:257–271
17. Cameron, Deborah. 1997. Theoretical debates in feminist linguistics: Questions of sex and gender. In *Gender and discourse*, ed. Ruth Wodak, 99–119. London: Sage Publications.
18. Cameron, Deborah. 1985. *Feminism and linguistic theory.* New York: St. Martin's Press.
19. Dod, Jake. 1999. Effective substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG. http://www.rsc.org/dose/title of subordinate document. Cited 15 Jan 1999
20. Suleiman, Camelia, Daniel C. OConnell, and Sabine Kowal. 2002. 'If you and I, if we, in this later day, lose that sacred fire...': Perspective in political interviews. *Journal of Psycholinguistic Research*. doi: 10.1023/A:1015592129296.

21. Brown B, Aaron M (2001) The politics of nature. In: Smith J (ed) The rise of modern genomics, 3rd edn. Wiley, New York
22. Dod J (1999) Effective Substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG.
http://www.rsc.org/dose/title of subordinate document. Cited 15 Jan 1999
23. Slifka MK, Whitton JL (2000) Clinical implications of dysregulated cytokine production. J Mol Med, doi: 10.1007/s001090000086
24. Smith J, Jones M Jr, Houghton L et al (1999) Future of health insurance. N Engl J Med 965:325–329
25. South J, Blass B (2001) The future of modern genomics. Blackwell, London

Appendix A
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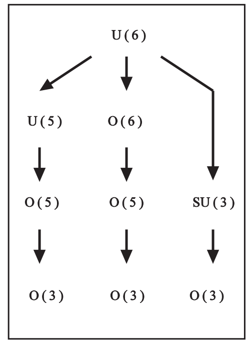

Fig. A.1 Please write your figure caption here

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Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

Table A.1 Please write your table caption here

Classes	Subclass	Length	Action Mechanism
Translation	mRNA[a]	22 (19–25)	Translation repression, mRNA cleavage
Translation	mRNA cleavage	21	mRNA cleavage
Translation	mRNA	21–22	mRNA cleavage
Translation	mRNA	24–26	Histone and DNA Modification

[a] Table foot note (with superscript)

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Solutions

Problems of Chapter ??

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