The Frog v3.0

The Frog, a space explorer vehicle from the Saxion Space Agency (SASA), is about to wrap up a mission and was heading back to the base on the recently discovered asteroid S42, hoping to find precious minerals, as disaster strikes; an avalanche caused rocks to block the entry to the base and also knocked out the navigation software of the Frog (called the Pilot).

In order to retrieve the very expensive Frog, it needs to get back to the base where it will be beamed up with a tractor beam. The only solution appears to be to blow up the obstruction to clear the entry. And luckaly there is still TNT and a Detonator present on the asteroid, but because of the avalanche, we don't know where it is. The Frog has to find and collect it and drop it near the obstruction.

Communication between the base, the Frog and Mission Control, back on earth, is via a satellite orbiting the asteroid, that distributes to all messages. Depending on the transmission distance it may take a longer time for the message to arrive. Therefore transmissions to and from Mission Control, which is back on th earth, have a serious lag. All the other participants have a fast connection, as they are on the asteroid's surface and near the satellite.

Mission control has a detailed map of the asteroids surface and can guide the Frog, although not navigate it directly, because of the formentioned huge lag in the transmission.

The astronaut driver of the Frog suffered some injuries during the avalanche and is not able to drive the Frog for extended times. Therefore it is the task of the software team to write software, called The Pilot, for the navigation computer, so that the Frog can drive mostly autonomous to given locations on the astroid.
The Frog can provide information on the actual location, heading and energy levels through messages send to the satelite (and the Pilot). This communication interface can also be used to drive the Frog and use the Frog's radar to scan the area for obstructions.

When the Frog is near the TNT or the Detonator, these are automatically picked up, which is reported back by the software interface.
When the Frog is near to the obstruction at the base and if it carries both the TNT and the detonator, it will automatically drop both items and the countdown for the explosion begins. The rocks will then be blown away, sky high.

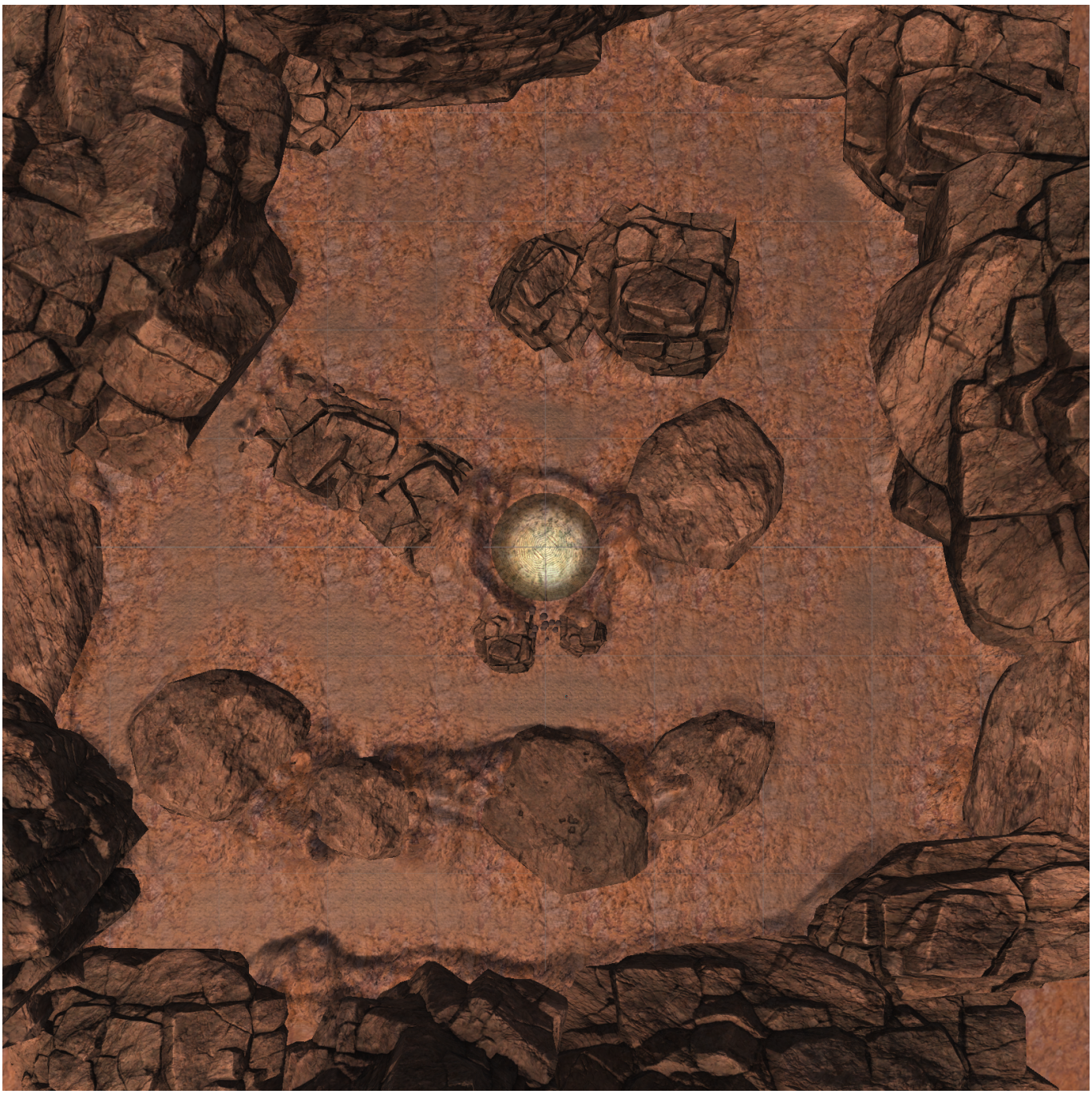
The Frog uses batteries while driving and radar scans also use energy. The batteries are charged by solar panels, but only when it is in direct sunlight.

The Radar provides blibs; obstacle locations relative to the Frog's position and heading. It does a -90° to +90° sweep at the height of the Frog's bottom and at the height of it's roof.

The Communication protocol for the Frog's part is described below. It may be extended for other communication like between Mission Control and the Pilot.

Map

The satelite made an image of the asteroid's surface, covering an area of 1000 x 1000 m, of which location (0, 0) is the center, where the base is.



Coordinate system

The coordinate system used has x from left to right, y from down to up (i.e. height!) and z from back to front.

Protocol Proposal v3.01

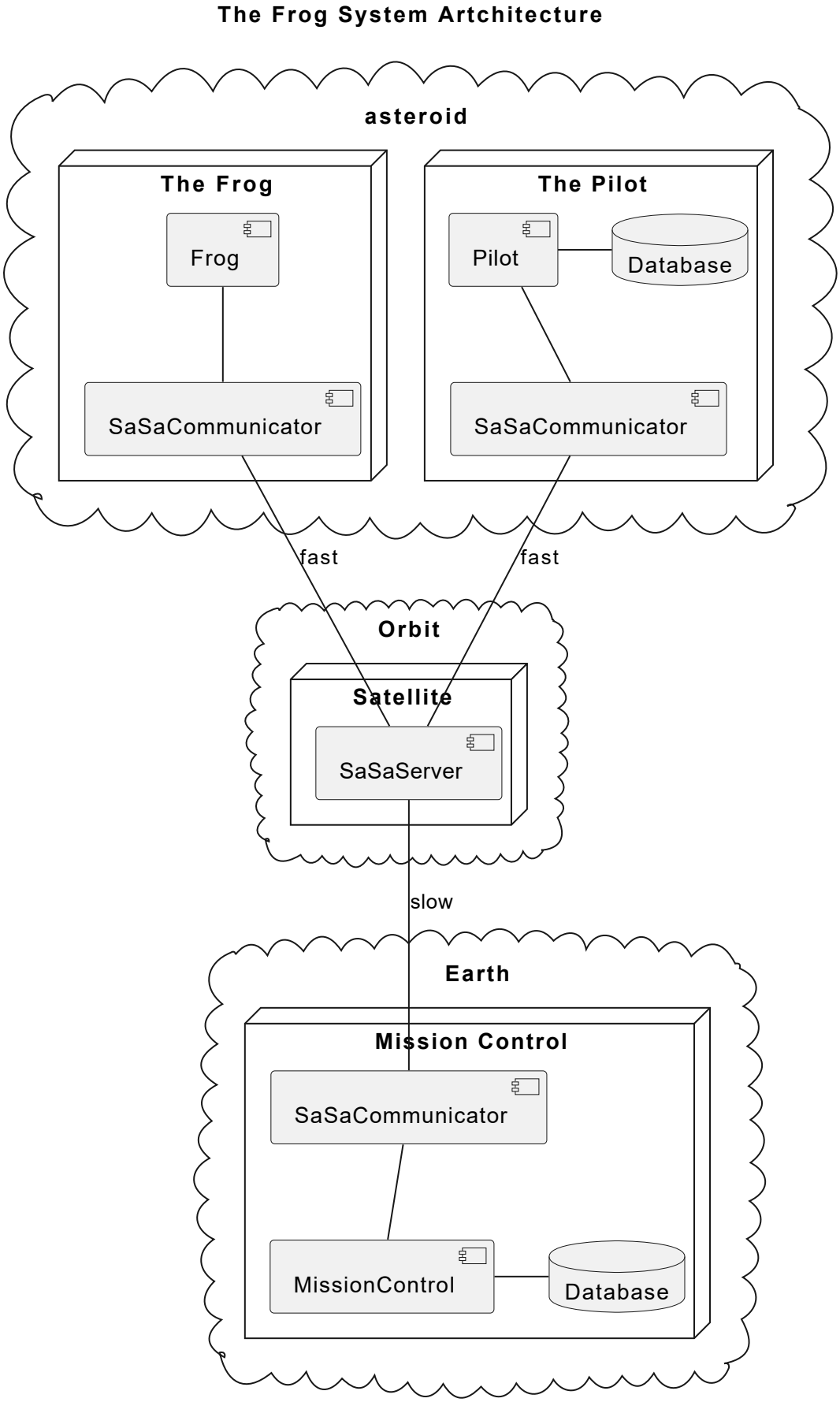
(proposal 2023-04-16)

There are three, must have, roles in the game and two optional:

1. The Frog: the vehicle on the asteroid.
2. The Pilot: located at the asteroid base, navigates/drives the Frog.
3. Mission Control: globally guides the Pilot. (lagged)
4. Terminal (optional): receives, and logs all communication for analysis. It can also send messages. (lagged)
5. Guest (optional): for only viewing the Frogs adventures on earth, receives all messages but does not send any. (lagged)

Note that FROG and PILOT are mandatory role names in this communication system. They have a fast, almost instant, communication speed. The rest of the role names, which are free to choose, experience communication with a serious lag.

Architecture



The databases can be used to make map data persistent and log mission data for analysis and for replay.

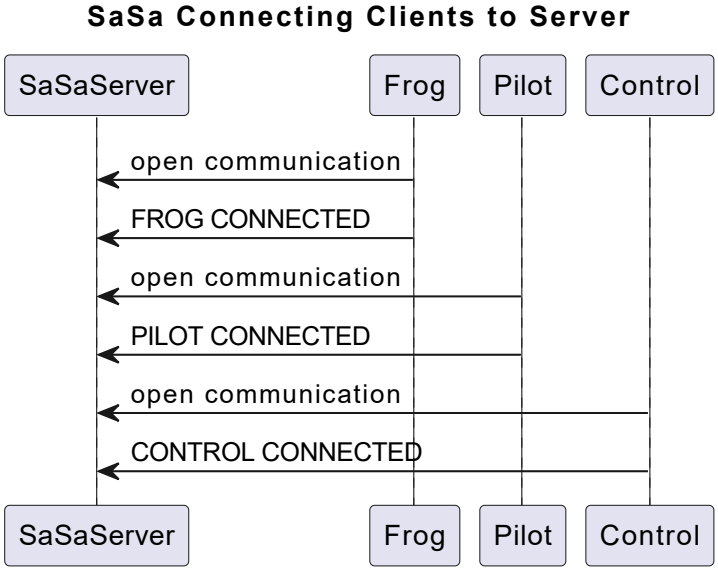
Frog Communications

The SaSaServer is a simple message broker, broadcasting every message to all receivers.

Messages are strings, consisting of two parts; , then a space and then the

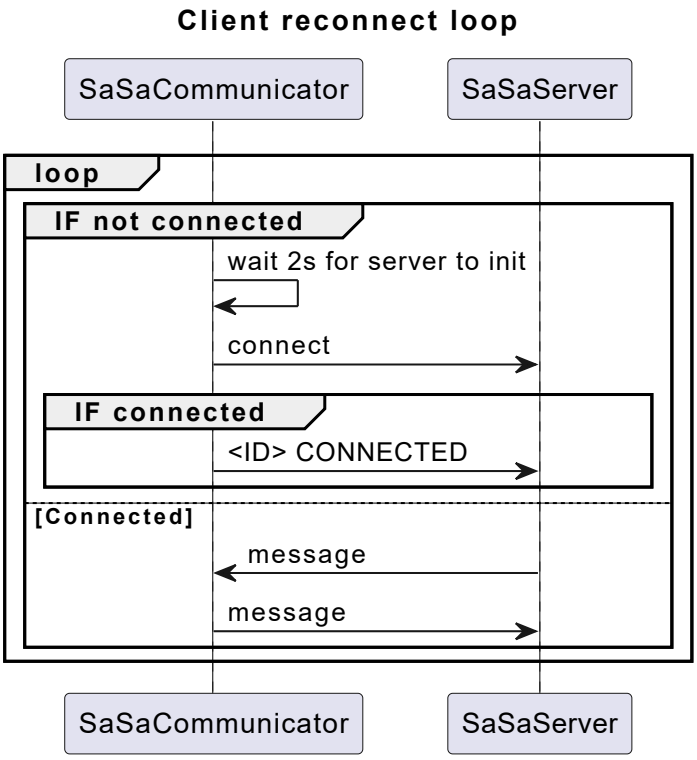
1. ID:
   an unique name for the sender. Like FROG, PILOT, CONTROL, TERMINAL, GUEST_1, GUEST_2 etc. Names cannot have spaces.
2. PAYLOAD:
   the message itself with space separated values with Locale.US and angles in degrees.

The next diagram shows the connection of the three clients to the SaSaServer in the Satellite. After communication is established the client makes itself known by name by sending " CONNECTED". The SaSaCommunicator takes care of this.



Note: there is no acknowledgement returned

When a connection fails, the SaSaCommunicator tries to reconnect every 2 seconds as is shown in the next diagram.



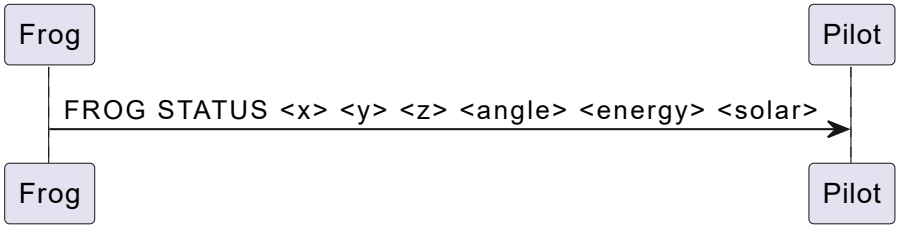
The Frog protocol.

The Frog has a fixed protocol, which is described here. Other communicating participants can define their own protocol, as long as they provide an ID and a message payload (string).

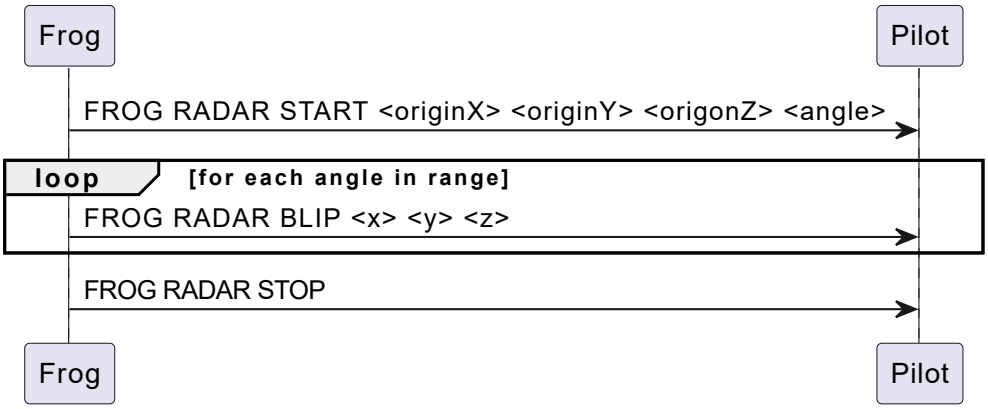
From The Frog

After being connected and named, communication can start. We assume communication between FROG and PILOT here.

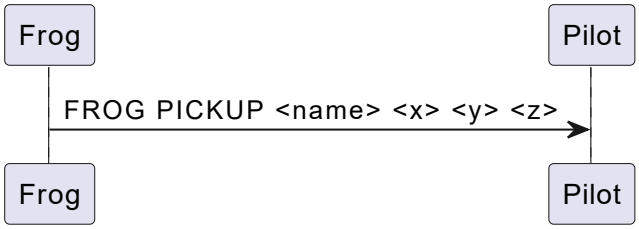
- The Frog sends its status info on an interval basis (0.25s) when enabled by receiving a "STATUS ON" message, or on request.
- The Frog status has it's postion (x, y, z), an angle (in degrees) and a current energy level [0..1] and charging level [0..1].



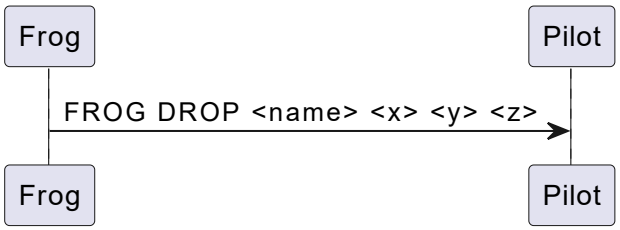
- The Frog sends radar info every 2 seconds when enabled with "RADAR ON" or on request with "RADAR REQUEST".



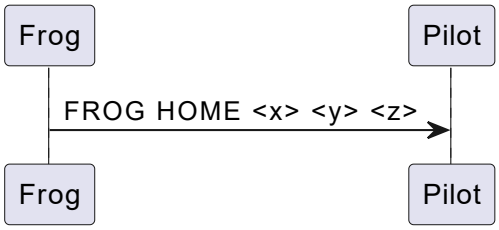
- Receiving Frog's pickup event at the given location including the pickups name (TNT or DETONATOR).



- Receiving Frog's dropping a pickup at a named location (explosion area)



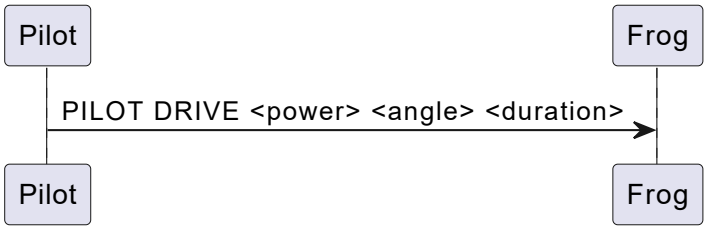
- Receiving the Frog touching it's base center to beam up, mission completed !



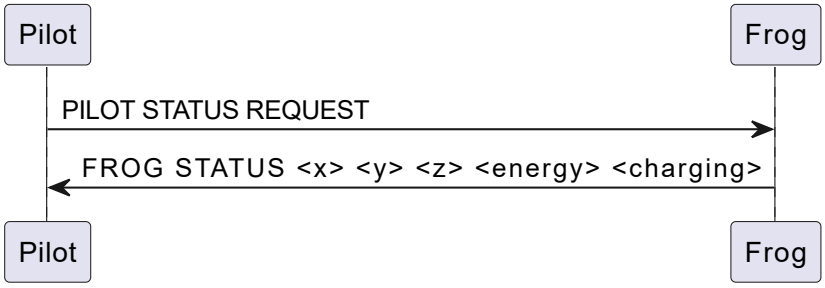
To the Frog

We assume the Pilot sending here, but any SaSaCommunicator can send these for the Frog to process, with or without lag.

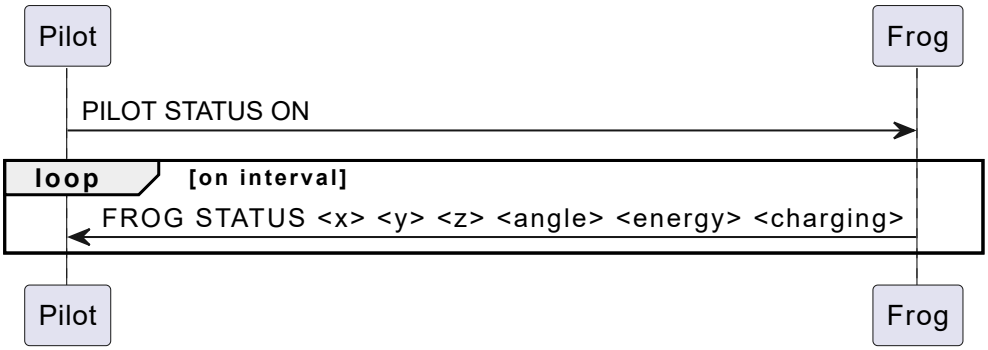
- Driving the Frog. Note that the newer drive command overrules a possibly running one, there is no queue.
    - power is ranged from -1.0..1.0 power factor, where 0 means braking,
    - angle from -30°..30° and
    - duration 0.0..5.0s, where 0 means continue until the next drive command is received.



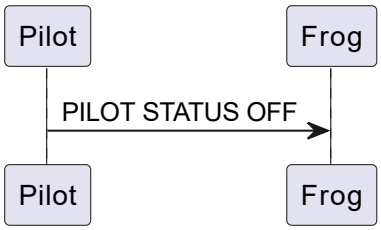
- Request the Frog's status, it's position and energy data.



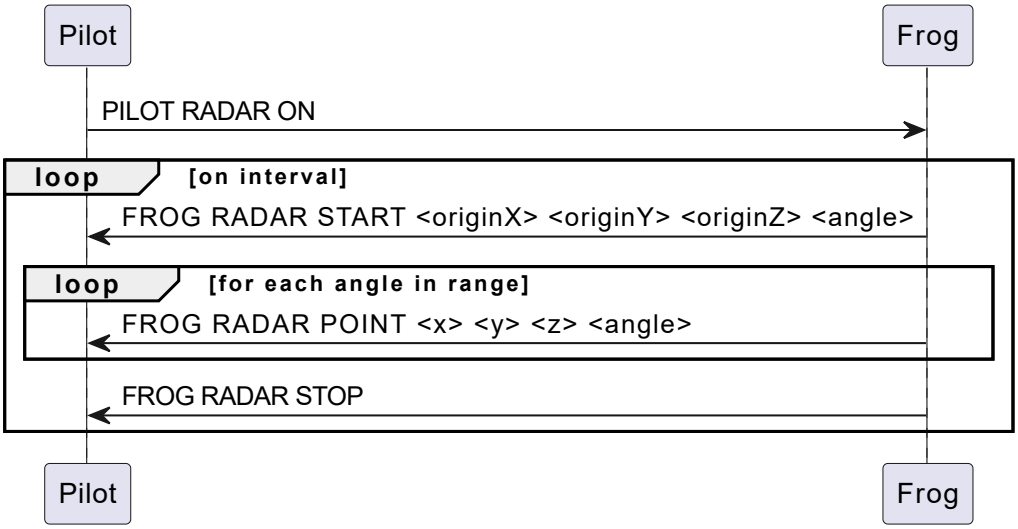
- Enable the Frog's auto status updates, the default is off. When enabled, the Frog send its status with an interval of 0.2s.



- and auto status updates can be disabled again.



- Enable auto radar updates (START, BLIPS, STOP), the default is off. When ON the Frog's radar scans every 0.5s and sends its result.



- When radar off it sends it on request