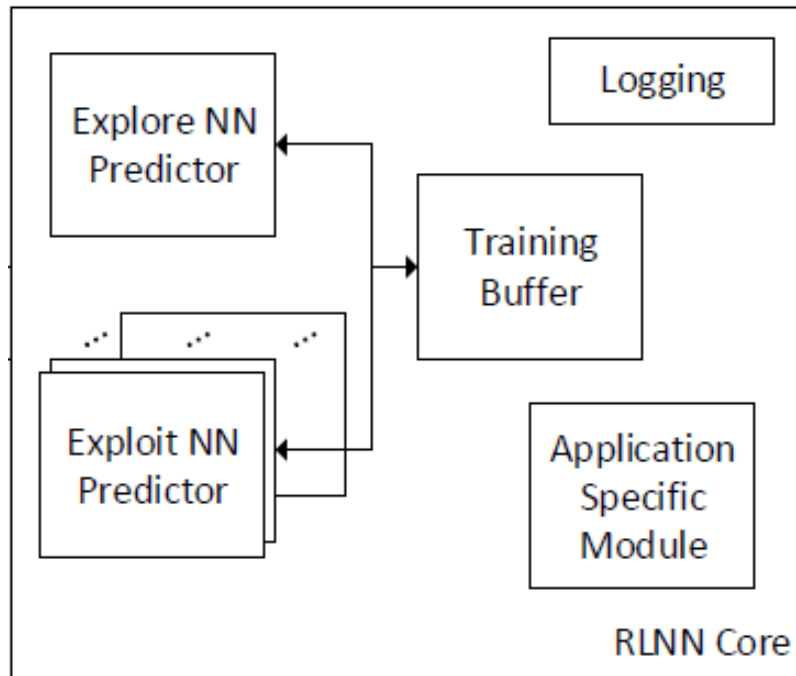


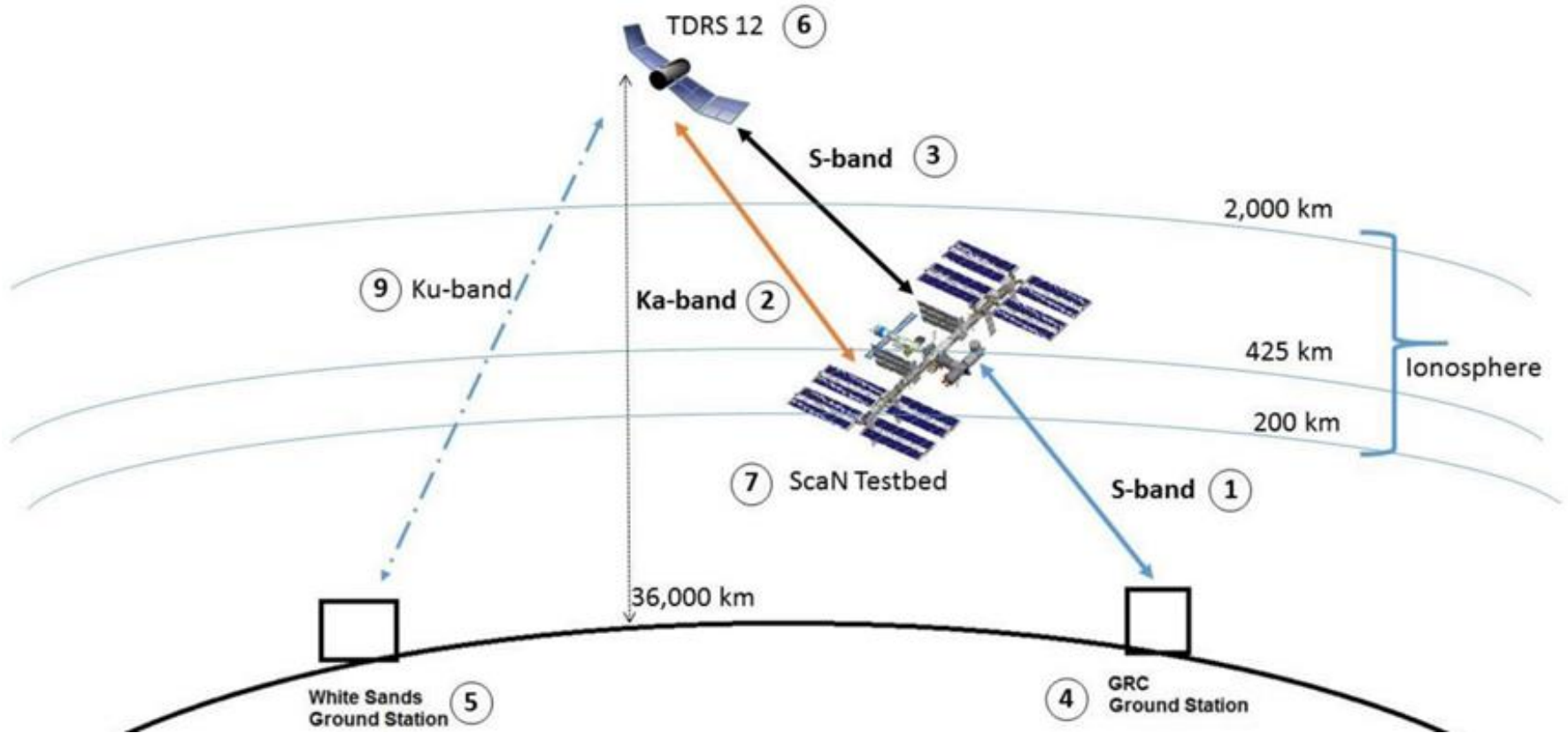
Implementation of a Space Communications Cognitive Engine



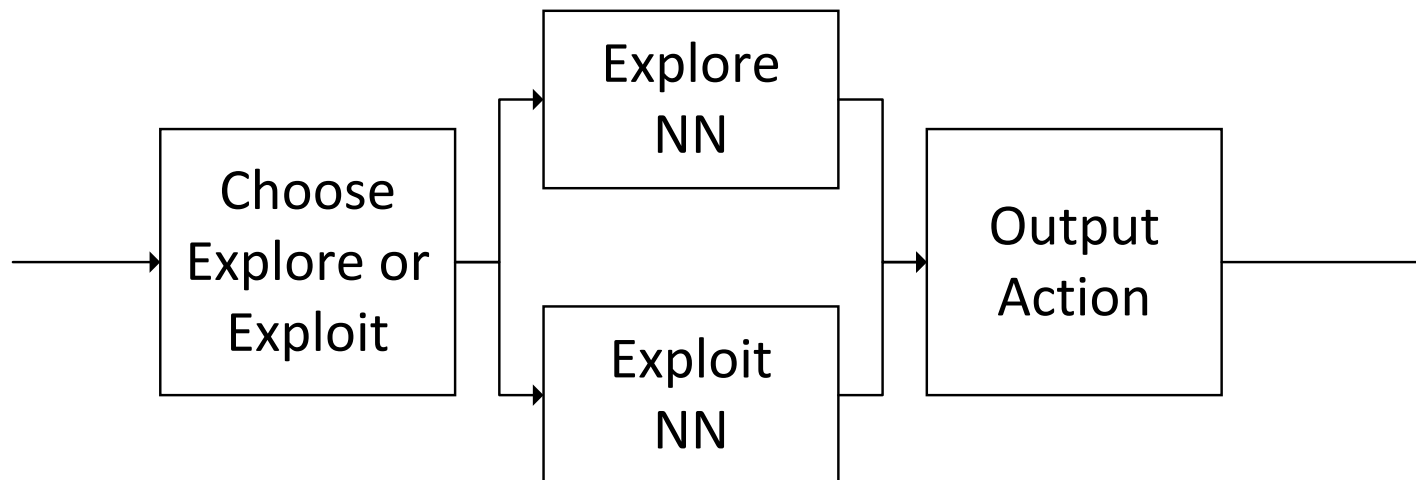
Timothy M. Hackett, PSU
Sven G. Bilén, PSU
Paulo Victor R. Ferreira, WPI
Alexander M. Wyglinski, WPI
Richard C. Reinhart, NASA GRC

28 June 2017

Overview of Research



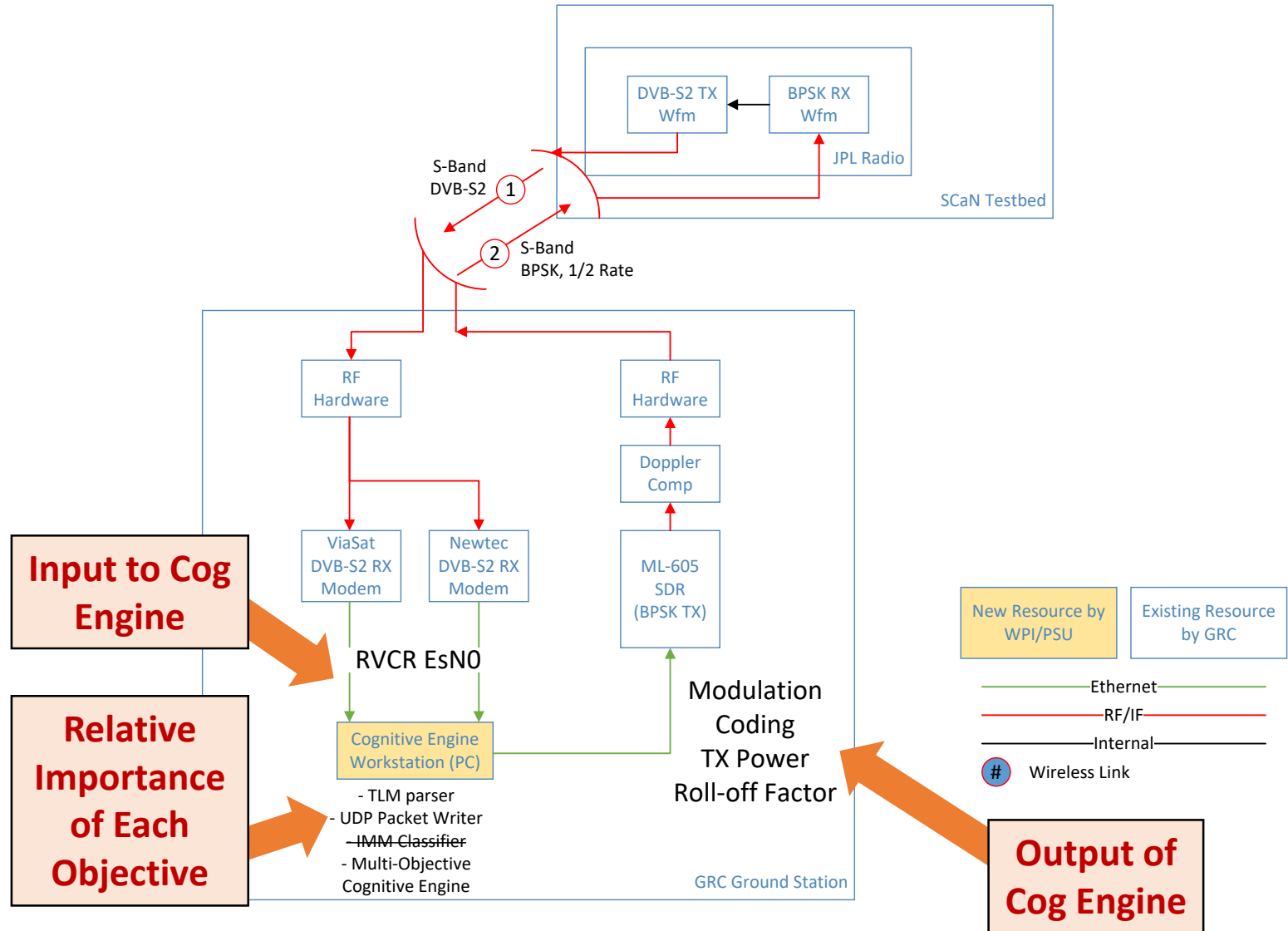
High Level Algorithm Block Diagram



Multi-Objective Values:

Throughput
Bit/Frame/Packet Error Rate
Target Bandwidth
Spectral Efficiency
TX Power Efficiency
DC Power Consumption

Full System Architecture



Software Libraries



Curtin, R. et al., *Journal of Machine Learning Research*, 2013



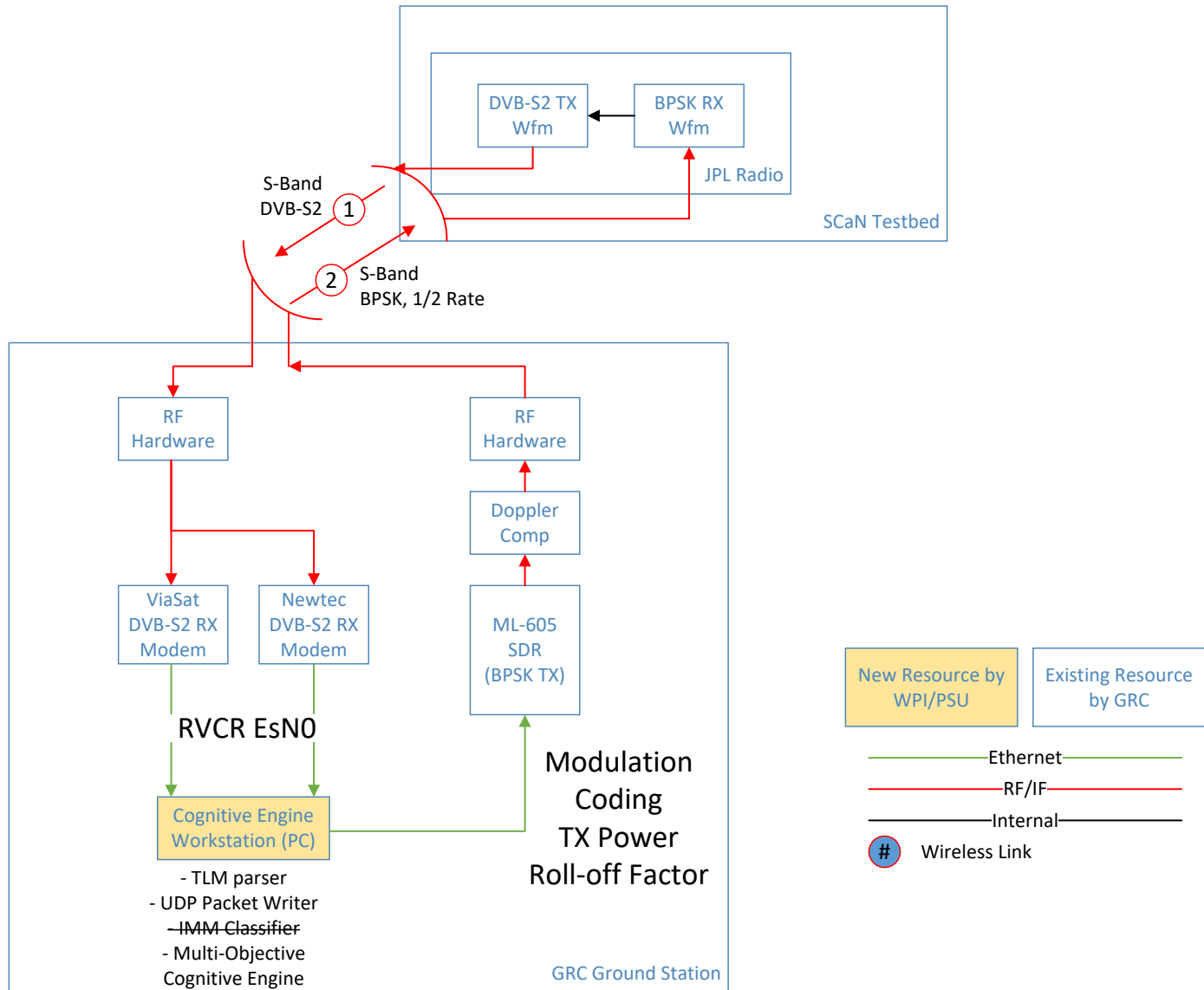
Boost.ASIO: C. Kohlhoff, *boost.org*, 2016
Boost.Serialization: R. Ramsey, *boost.org*, 2004



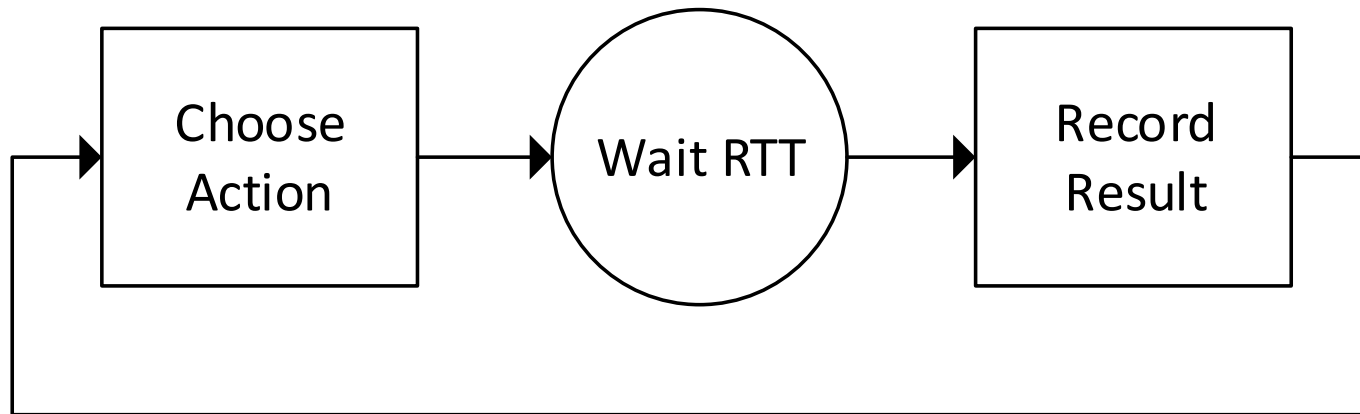
Armadillo
C++ linear algebra library

Curtin, R. et al., *arma.sourceforge.net*, 2013

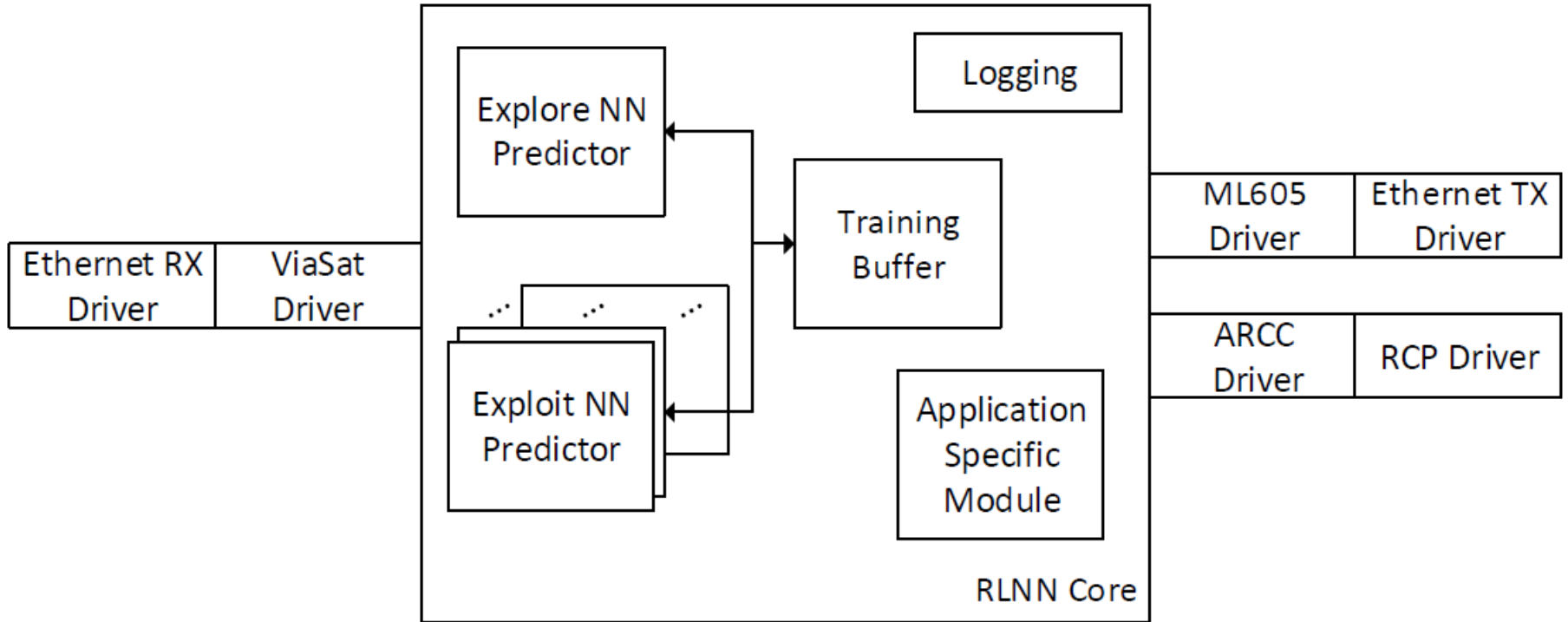
Timing Trade Study



Timing Trade Study



Implemented Software Architecture



Implemented Software Architecture

```
fitObserved: 0.822323
1259: Choosing Action
Exploiting
1259: Action Chosen: 578
1259: Symbol Rate Idx: 0
1259: TX Power Idx: 8
1259: ModCod Idx: 0
1259: Roll Off Idx: 2
1259: ModCod: 1
1259: Transmitting Action
1259: measurementVec:
  -9.7071e-01  -3.5000e+00   2.0000e+06   2.0000e-01   4.0000e+00   2.5000e-01

1259: Recording Response
fitParams:
   0  1.0000   0  0.0139  0.2060  0.6730

fitObserved: 0.822323
1260: Choosing Action
Exploring
Random Explore
1260: Action Chosen: 817
1260: Symbol Rate Idx: 0
1260: TX Power Idx: 11
1260: ModCod Idx: 8
1260: Roll Off Idx: 1
1260: ModCod: 9
1260: Transmitting Action
```



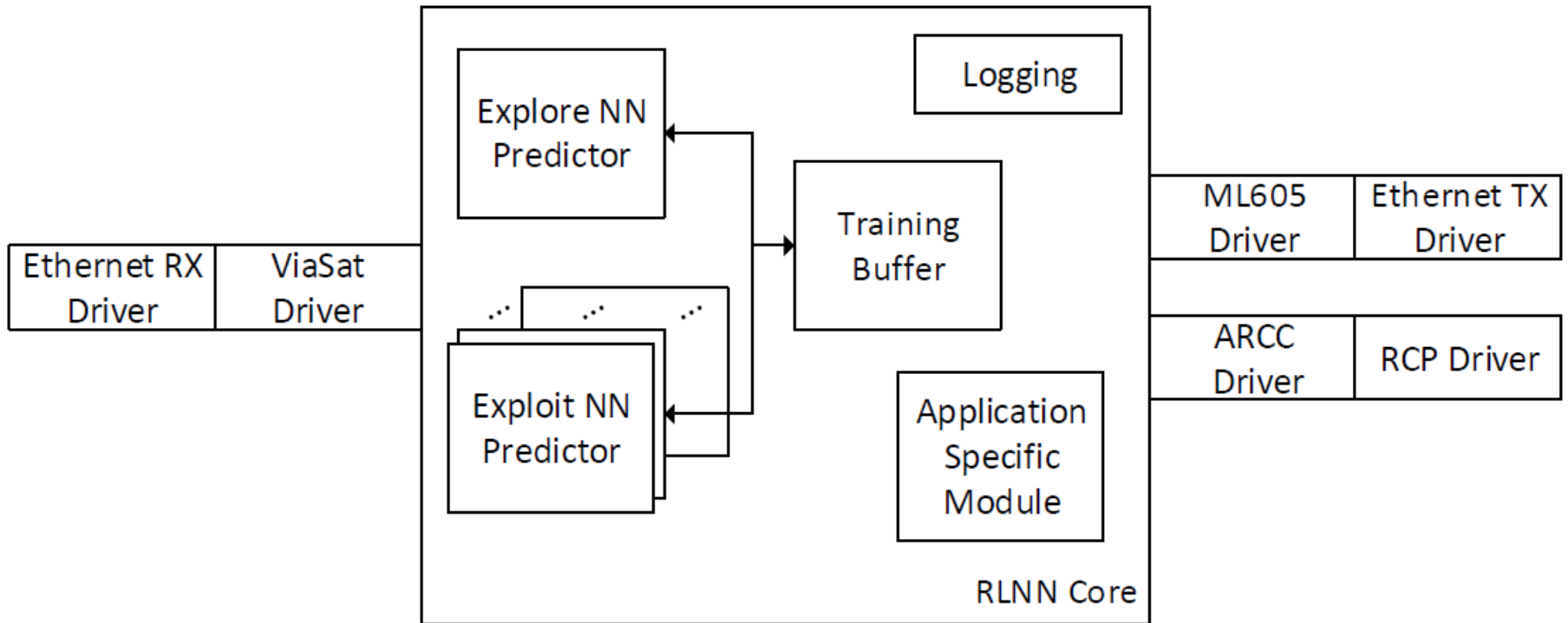
Implemented Software Architecture

```
::Iteration: 108
::Start Time: 2017-May-12 10:59:23.298397
::Action Type: Exploiting
::Action Chosen: 2017-May-12 10:59:23.298978
::Action ID: 663
::Action Params: 1e+06 -3 2 0.35 4 0.666667
::Action Sent: 2017-May-12 10:59:23.299160
::Action Received: 2017-May-12 10:59:23.339594
::Receive Lock: 1
::Measurement Received: 3.6000e+00 -3.0000e+00 1.0000e+06 3.5000e-01 4.0000e+00 6.6667e-01
::Objective Fitnesses Observed: 0.2113 1.0000 1.0000 0.1852 0.4273 0.6067
::Fitness Observed: 0.586339
::Training: Yes
::End Time: 2017-May-12 10:59:23.340308

::Iteration: 109
::Start Time: 2017-May-12 10:59:23.340349
::Action Type: Exploiting
::Action Chosen: 2017-May-12 10:59:23.341028
::Action ID: 663
::Action Params: 1e+06 -3 2 0.35 4 0.666667
::Action Sent: 2017-May-12 10:59:23.341177
::Action Received: 2017-May-12 10:59:23.381552
```



Summary



If you're interested, contact me at:

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