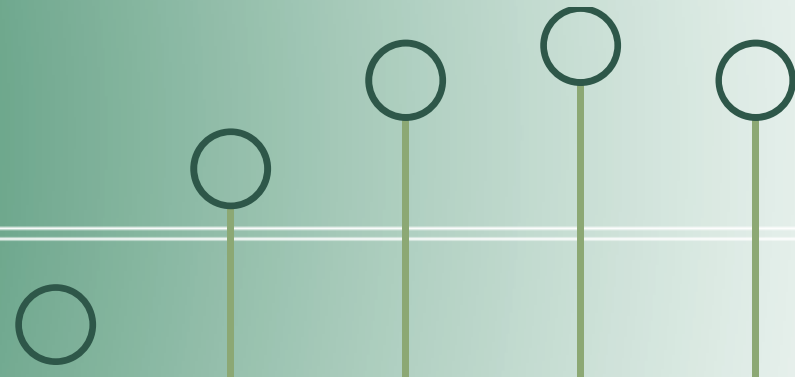


Simple TDMA + ARQ MAC using GNURadio and USRPs

Presentation and framework - Josh Blum

MAC layer and protocol blocks – John Malsbury

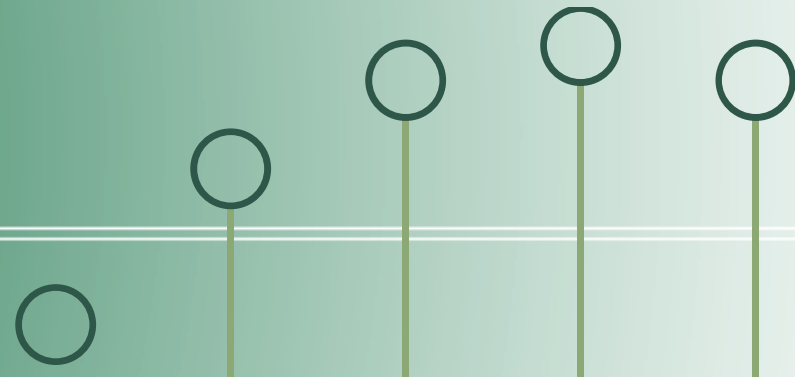
@ Ettus Research



Intro to John's MAC work

- TODO Introduce Malsbury...
- Motivation:
 - Want a cool two-way comms example for USRP
 - Demonstrate proper usage (tags, timed bursts etc)
 - Easy to comprehend and change (all in python and GRC)
- Note to self:
 - Say bad things about tunnel.py if we didn't already

Now, lets build this presentation up one layer at a time – I promise that it will all make sense



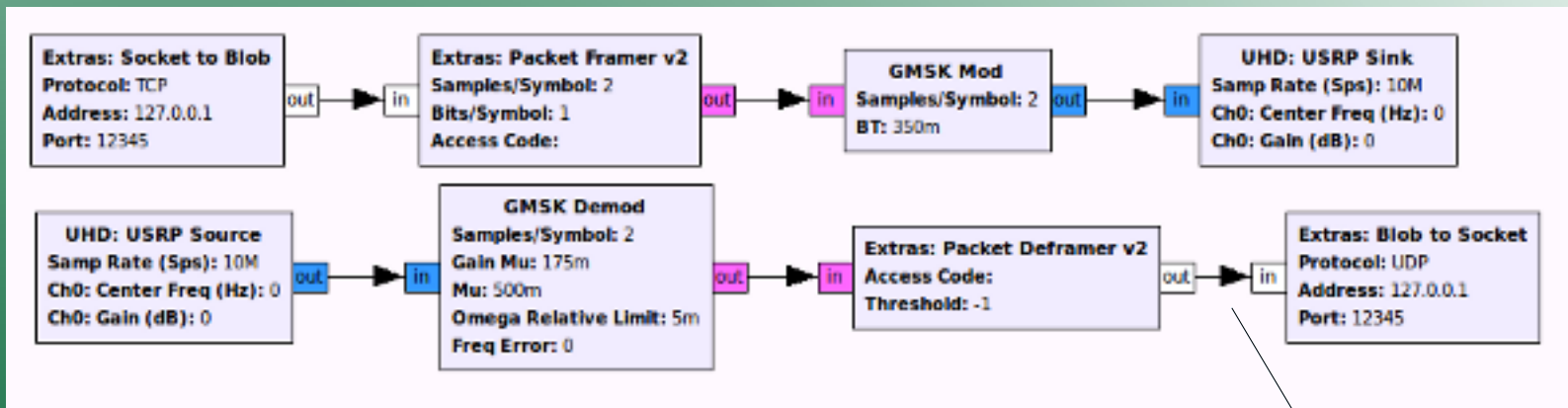
The GR Extras Project

- Message passing API
 - Implemented on top of stream tags/builds on a stock gnuradio
 - Use messages to preserve packet boundaries (aka pmt_blob)
 - Use messages for a control plane or MAC layer
- Write blocks in python
 - Overload work function in python!
 - Bridges the gap between python/C++
- Misc blocks in Extras
 - May make use of the message passing feature
 - (can totally make a templated adder with a volk specialization)
- See wiki page below and link to coding guide



<https://github.com/guruofquality/grextras/wiki>

Message passing, a quick visual

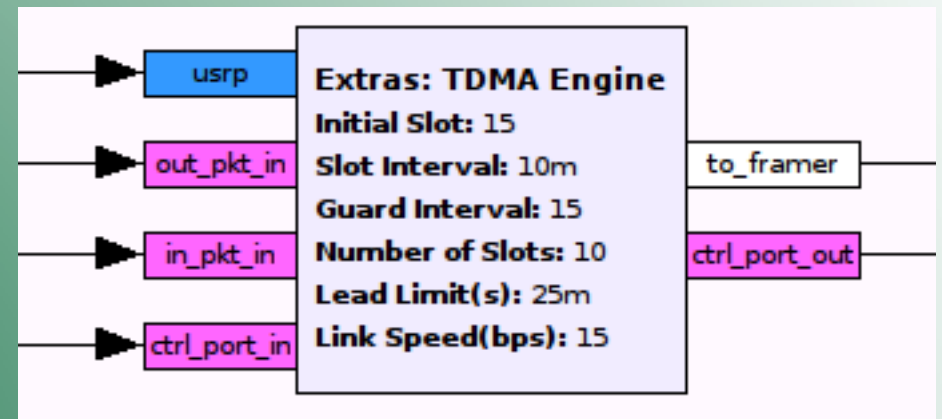


- Some of these blocks pass PMT “blob” types
- Whats a blob?
 - PMT library primitive
 - Polymorphic type that holds `std::vector<char>`
 - Its just a memory pointer and a length in bytes

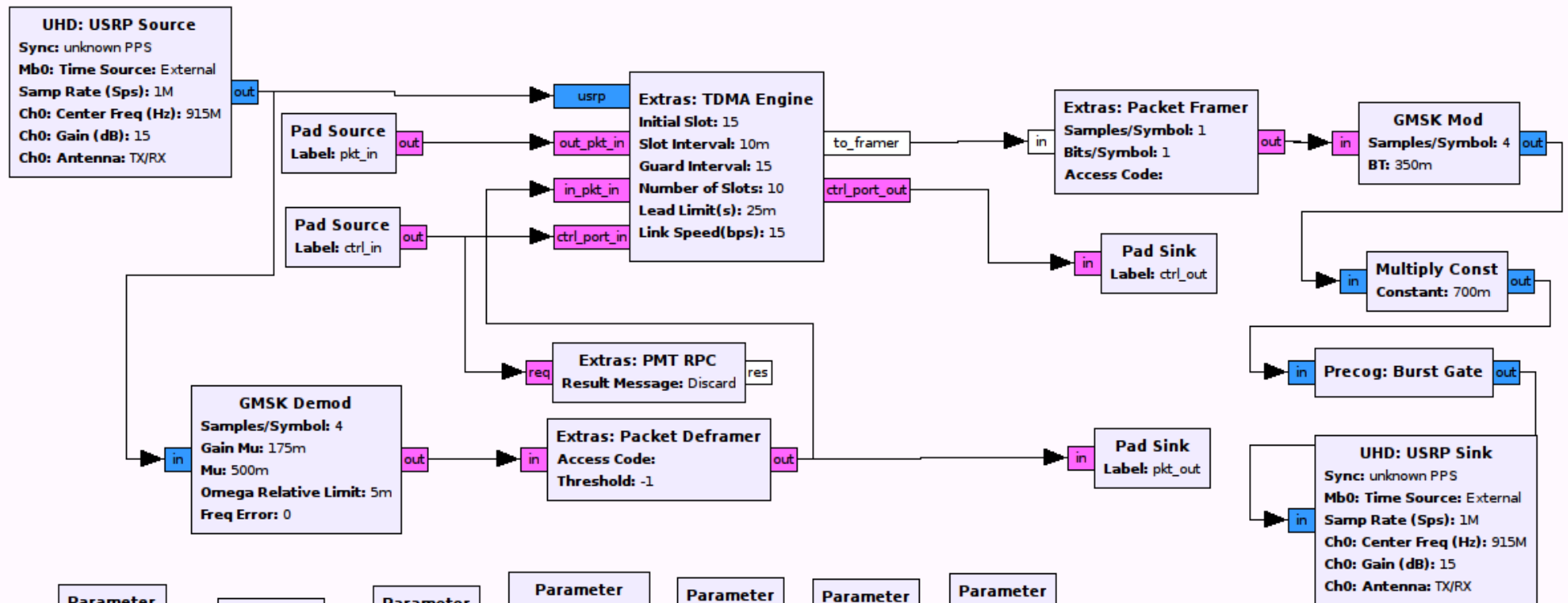
Packet boundaries
are preserved
into the socket!

Simple TDMA Engine

- TDMA Engine - this block will monitor a USRP receiver stream to determine the time. Based on the assigned slot, specified guard interval, and number of slots in the TDMA frame, this block will hold back all incoming blobs until it's assigned slot (plus guard interval) approaches. It will output these msg's as blobs after its next slot interval - lead limit passes.



Integrating the TDMA Engine w/ Mod and Demod chains



Parameter
 ID: ampl
 Label: a
 Value: 700m
 Type: Float

Parameter
 ID: tx_gain
 Value: 15
 Type: Float

Parameter
 ID: rate
 Label: S
 Value: 1M
 Type: Float

Parameter
 ID: samp_per_sym
 Label: sps
 Value: 4
 Type: Int

Parameter
 ID: rx_gain
 Value: 15
 Type: Float

Parameter
 ID: freq
 Value: 915M
 Type: Float

Parameter
 ID: args
 Value:
 Type: String

Parameter
 ID: initial_slot
 Label: Initial Slot
 Value: 15
 Type: Int

Parameter
 ID: slot_interval
 Label: Slot Interval(s)
 Value: 10m
 Type: Float

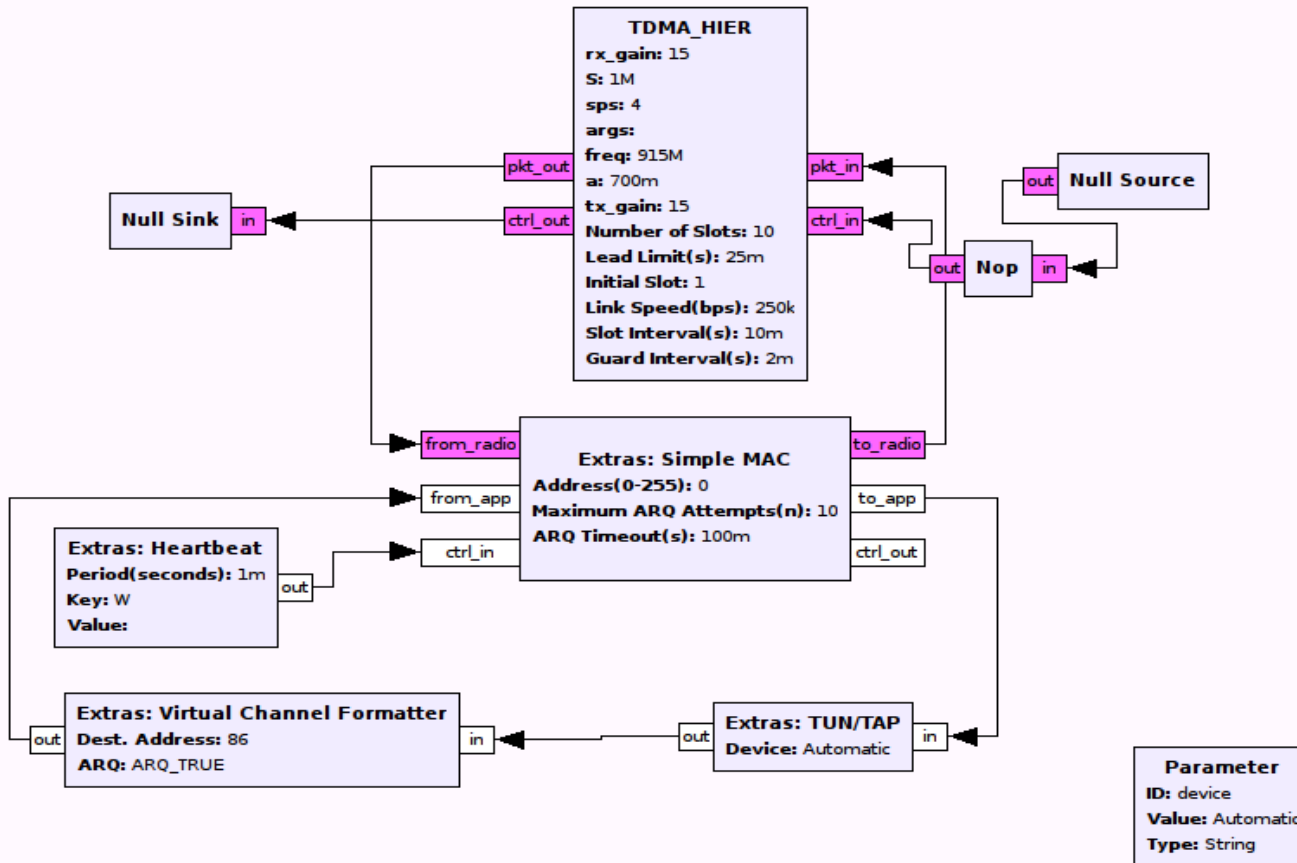
Parameter
 ID: guard_interval
 Label: Guard Interval(s)
 Value: 15
 Type: Float

Parameter
 ID: number_of_slots
 Label: Number of Slots
 Value: 10
 Type: Int

Parameter
 ID: lead_limit
 Label: Lead Limit(s)
 Value: 25m
 Type: Float

Parameter
 ID: link_speed
 Label: Link Speed(bps)
 Value: 15
 Type: Float

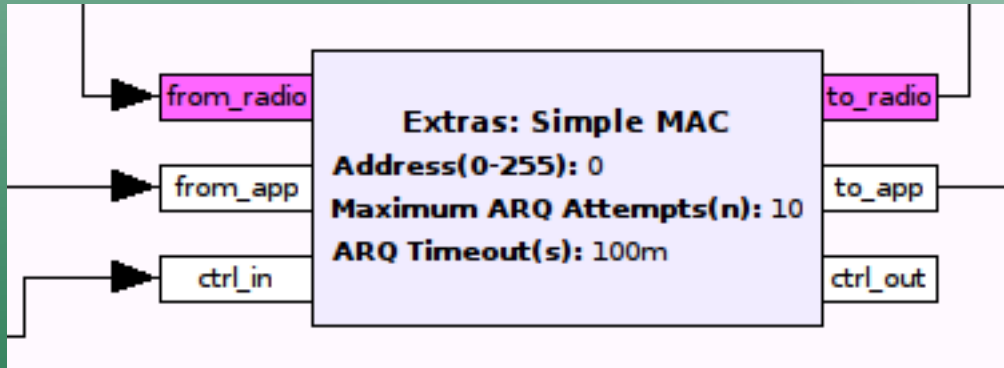
A top level use case



- External entry and exit points to the flow graph is the tun/tap block. But this can be anything really...

* Parameter blocks not shown

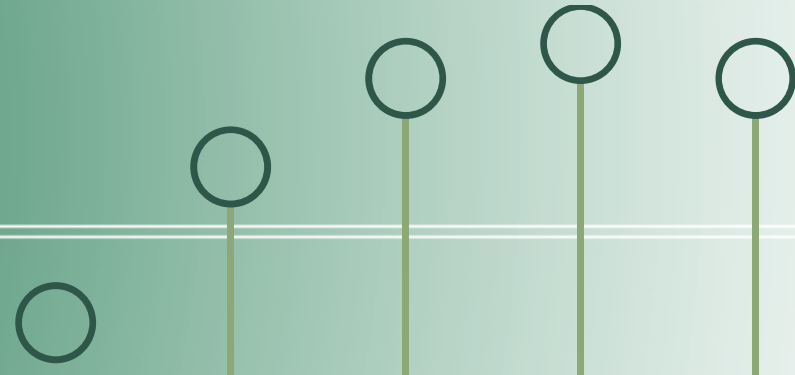
The Simple ARQ MAC



- Simple ARQ - accepts msg blobs on the "app in" msg port. It will add a header that includes a sequence number, destination address, source address, and a couple of control words. Source address is the address of the MAC itself. The source address is the address of the radio we want to send the message to. This address is encoded into the key of the incoming blob so you can have multiple streams to multiple radios. The ARQ selection is also encoded into the key of the incoming blob. Currently, this block supports simple stop-and-gait ARQ. Blobs with header are exchanged on the "radio" ports. Ctrl ports also provided, but do nothing useful at the moment.

Where is the code?

- GRExtras main wiki page:
 - <https://github.com/guruofquality/grextras/wiki>
- GitHub URL
 - `$ git clone https://github.com/guruofquality/grextras.git`
- Check out this branch:
 - `$ git checkout pre_cog`
- GRC flowgraphs are here:
 - `<src dir>/examples/*.grc`
- Contact
 - josh@ettus.com
 - john@ettus.com



Conclusion

- TODO
 - Improve/polish code & testing
 - More examples for specific use cases
 - Merged into gr extras master
 - Better/more helpful wiki page
- Questions?

