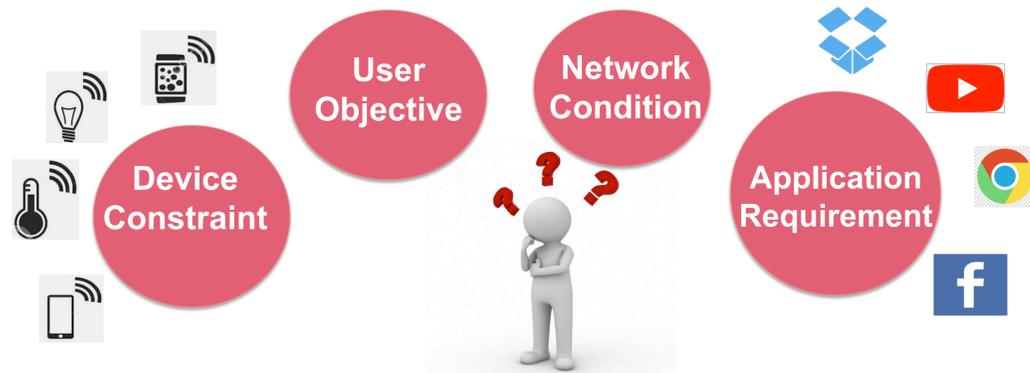


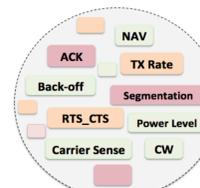
Motivation

- Networking protocols (e.g., Wi-Fi & Bluetooth) are **manually** designed as "general-purpose" protocols through long-time and hard-work human efforts.
- Shift towards a vision of **an intelligent** designing process that **adapts and optimizes network protocols under various environment contexts** such as device characteristics, application requirements, user objectives, and network conditions.



DeepMAC: Benefits & Challenges

- ✓ **Multi-variant optimization tool**
 - Utilize deep reinforcement learning (DRL) in making decisions in complex/dynamic environments.
- ✓ **Generalized approach for protocol design**
 - Augment human intelligence to identify/capture the significance of different protocol functions/parameters.
- ✓ **Tool for synthesizing hybrid protocols**
 - Combine best functionalities/practices of multiple protocols.
- **Challenges:**
 - Granularity level of building blocks.
 - Capture dependencies between blocks.
 - Rewiring optimum blocks in functional protocol.

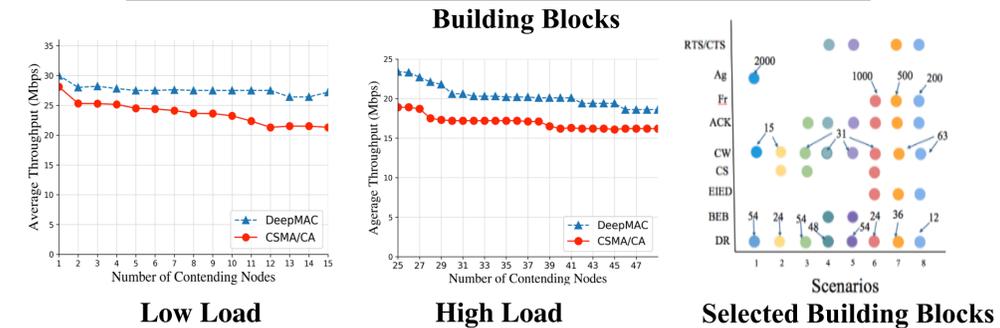


Results

Scenario	Nodes	Load	Noise
1	5	Low	No
2	5	Low	Yes
3	15	Average	No
4	15	Average	Yes
5	20	High	No
6	20	High	Yes
7	50	Saturated	No
8	50	Saturated	Yes

Parameter	Value
Packet Size	1500Byte
Time Slot	0.2 msec
History Length (H_t)	15
Channel Capacity	10 Mbps
Average Packet Generation Rate (Low Load)	8/sec
Average Packet Generation Rate (High Load)	470/sec
Learning Rate (α)	1
Discount Factor (γ)	0.8

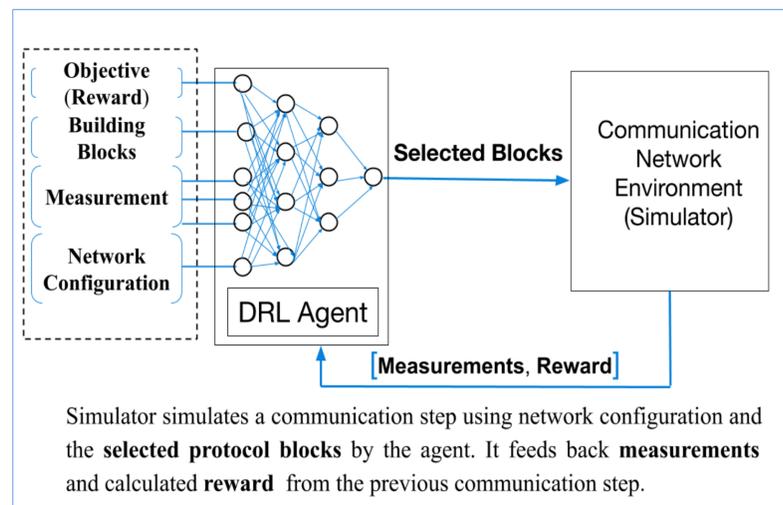
Building Block	Algorithm / Parameter	Default
Backoff	BEB, EIED	BEB
ACK	No ACK, ACK	ACK
Fragmentation (Fr)	Packet Size = 200, 500, 1000 bytes	Packet Size = 1500 bytes
Aggregation (Ag)	Packet Size = 2000 bytes	Packet Size = 1500 bytes
RTS/CTS	Enabled/Disabled	N/A
CW	0-1023	$CW_{min} = 15$
Carrier Sense (CS)	Enabled/Disabled	N/A
Data Transmission Rate (DR)	6/9/12/24/36/48/54 (Mbps)	54 Mbps



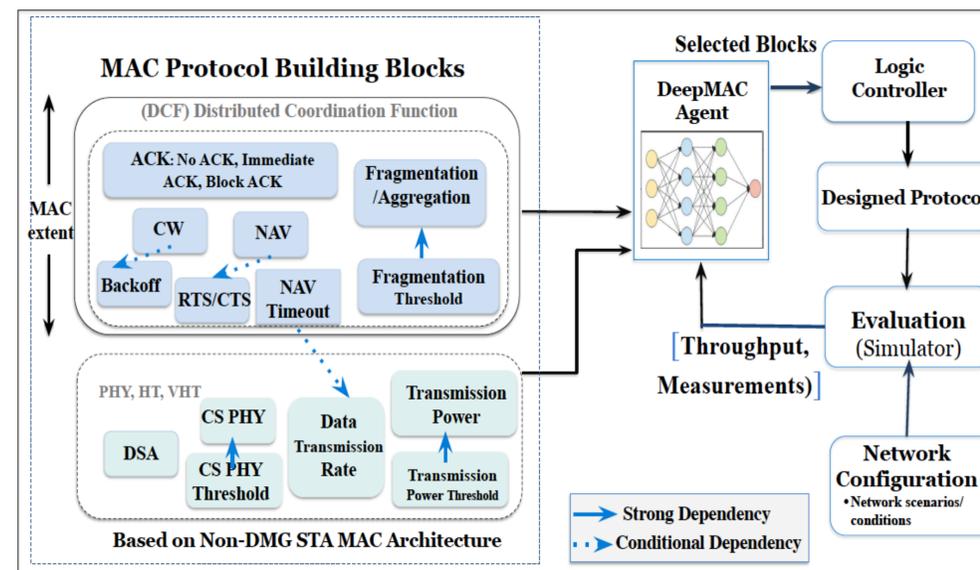
Proposed Approach

Step 1. Decouple a protocol into a set of "Building Blocks" used as input to the intelligent agent.

Step 2. Develop a Deep Reinforcement Learning (DRL) based framework to select the appropriate protocol blocks.



DeepMAC Framework



DeepMAC Promises!

- 👍 Developing a **library of protocol building blocks** to be re-used by the networking community to design, understand, and evaluate custom protocols.
- 👍 Generating novel **autonomous learning architecture**, creating new repository of knowledge and **contributing to the understanding of how ML may advance the future of network communication field.**

Contact Information

✉ Barahouaipash@vcu.edu
 🌐 Lab Website: <https://music.lab.vcu.edu>

