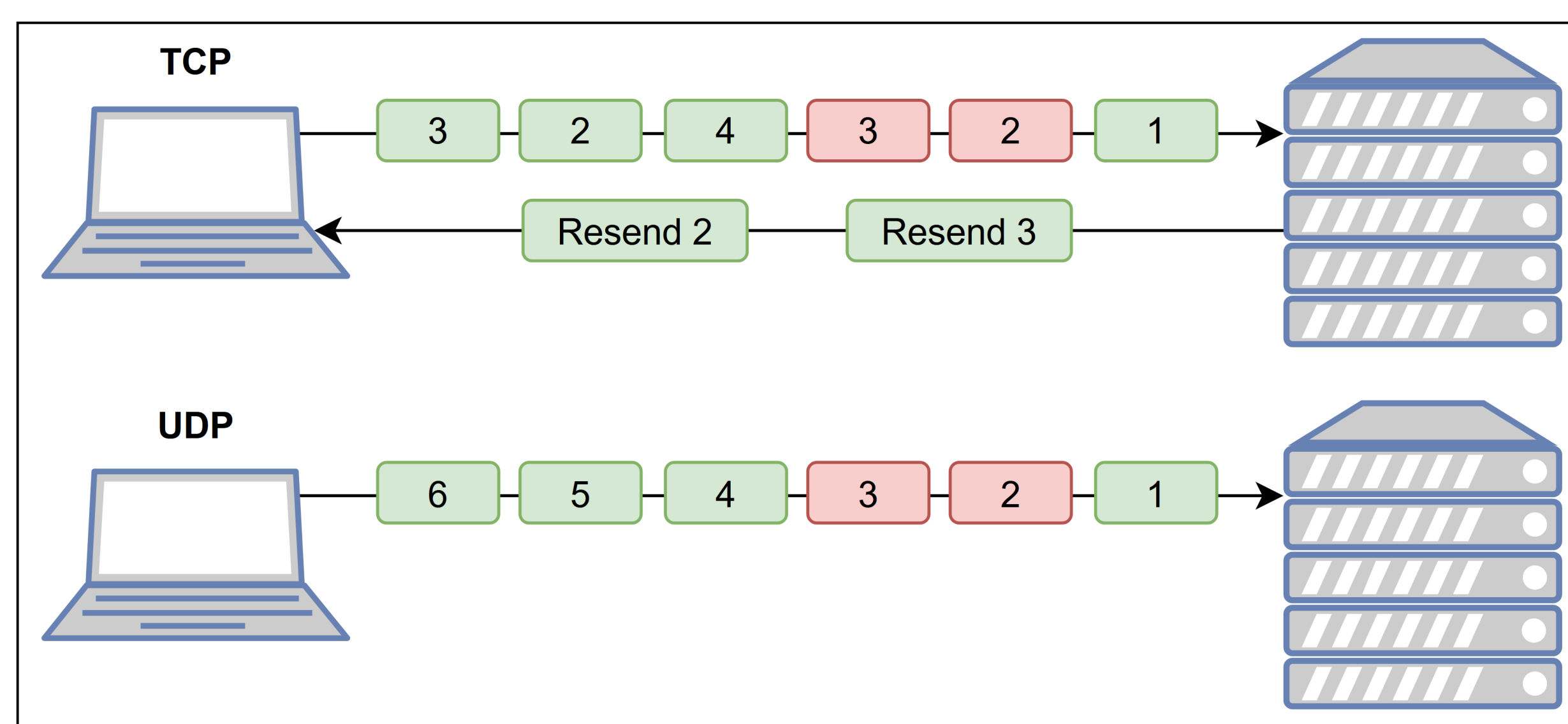


Evan Gossling, Elisabeth Permatasari, Md Nadim, Sarath Babu, Daji Qiao, Hongwei Zhang,
Mike Luby, Lorenz Minder, Pooja Aggrawal, and John Byers
Iowa State University, BitRipple Inc., Boston University
evang@iastate.edu

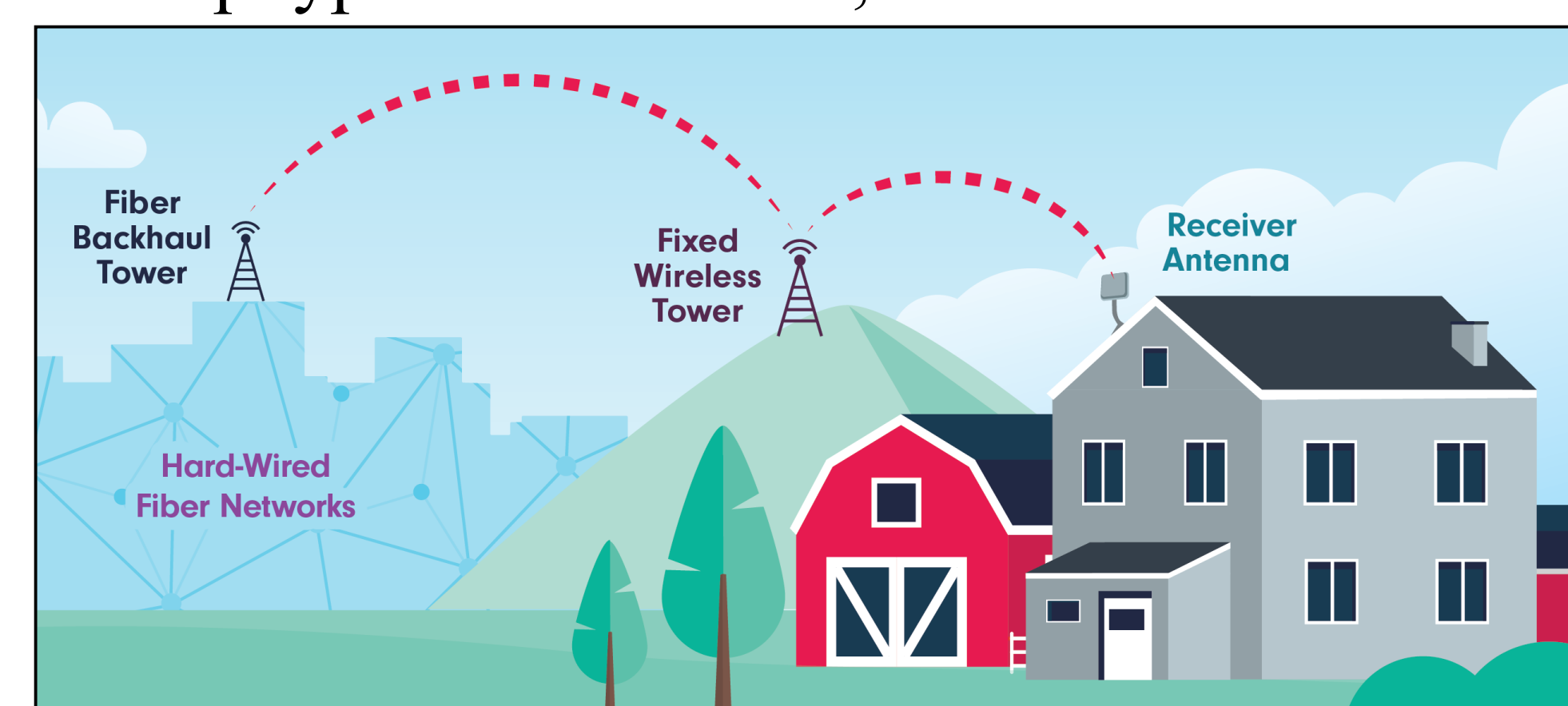
Real-Time and Rural Challenges



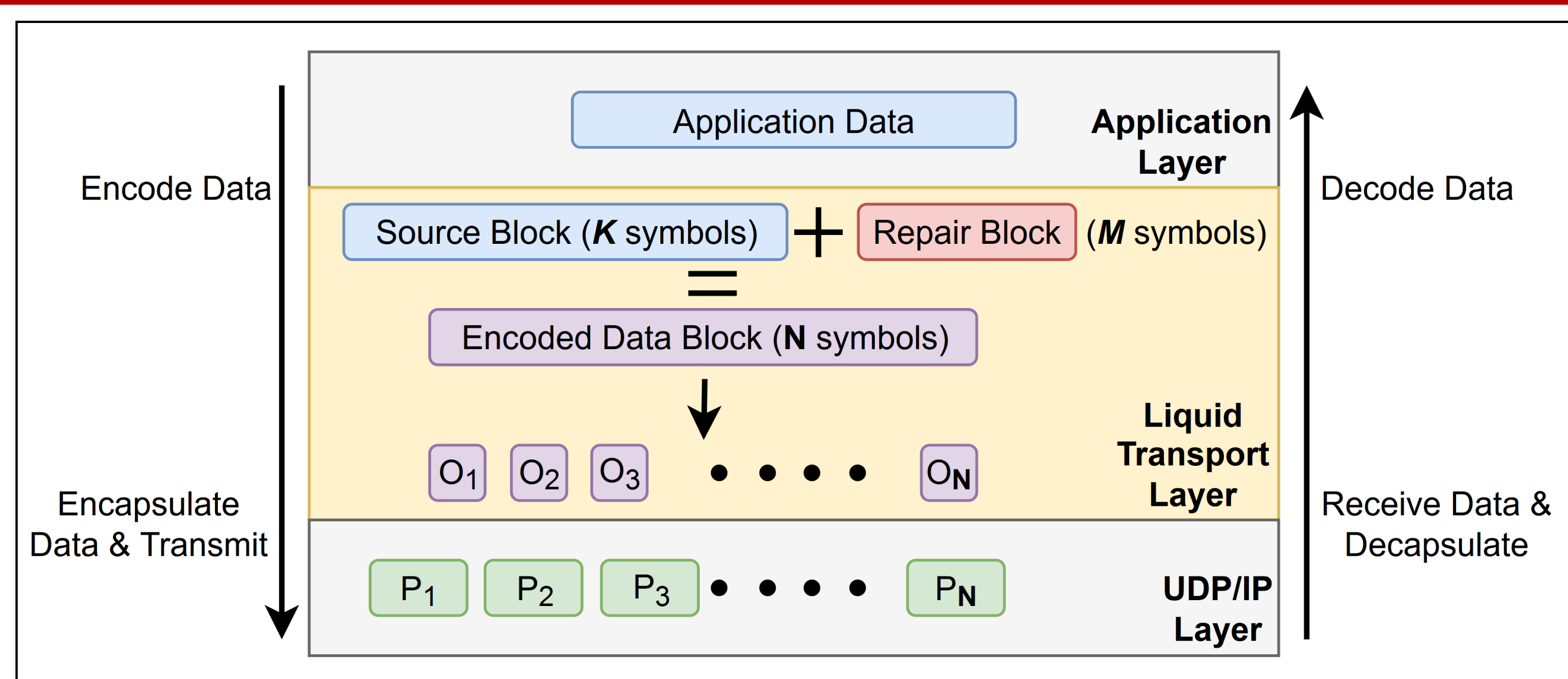
- TCP's reliability via retransmissions incurs significant delay
- UDP's unreliable transmission allows for real time transport at the cost of dropped data
- How to solve UDP's inherit unreliability?

Wireless networks are required for rural regions

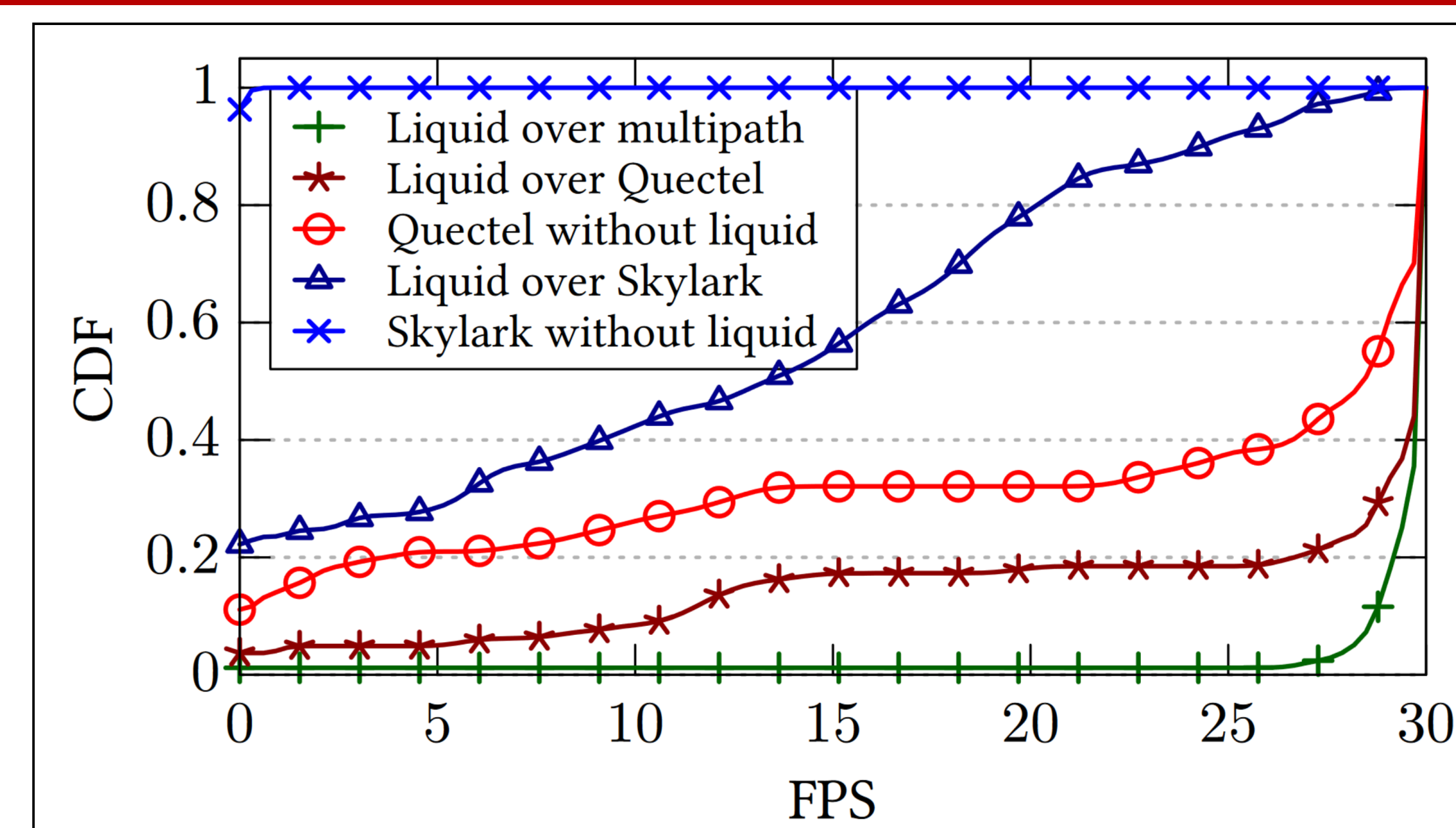
- Lower cost than fiber
 - Connects ground and air vehicles
- However wireless can be unreliable
- Highly dynamic and variable links
 - Connection quality subject to weather, terrain, crop types and densities, distance from tower



Liquid Transport Solution

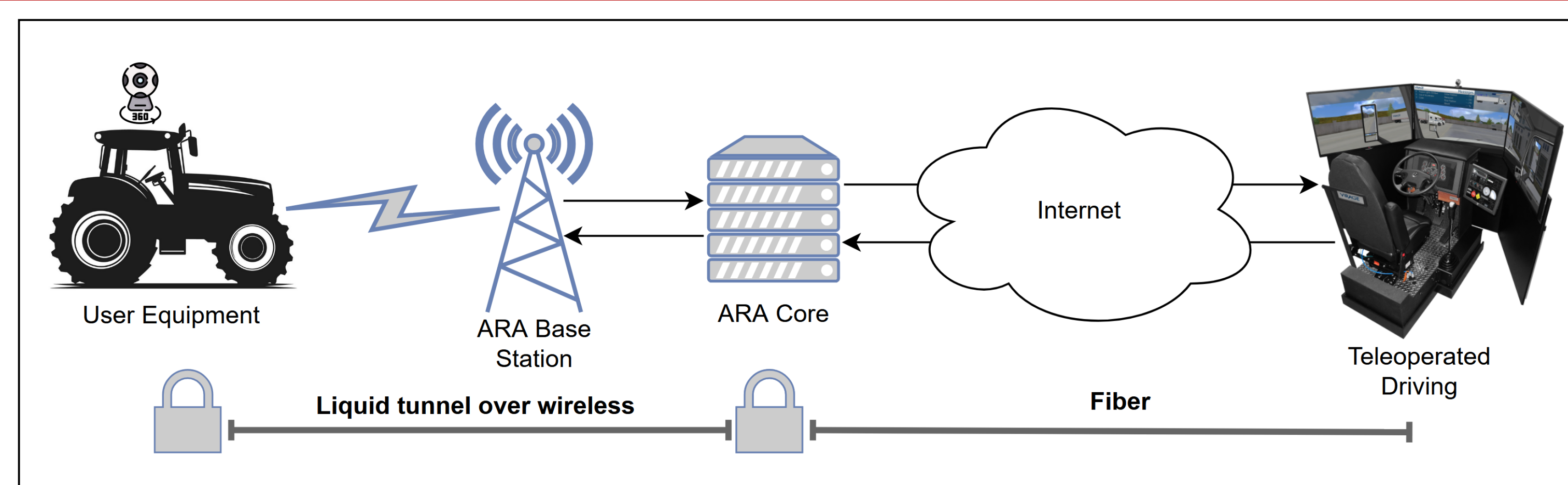
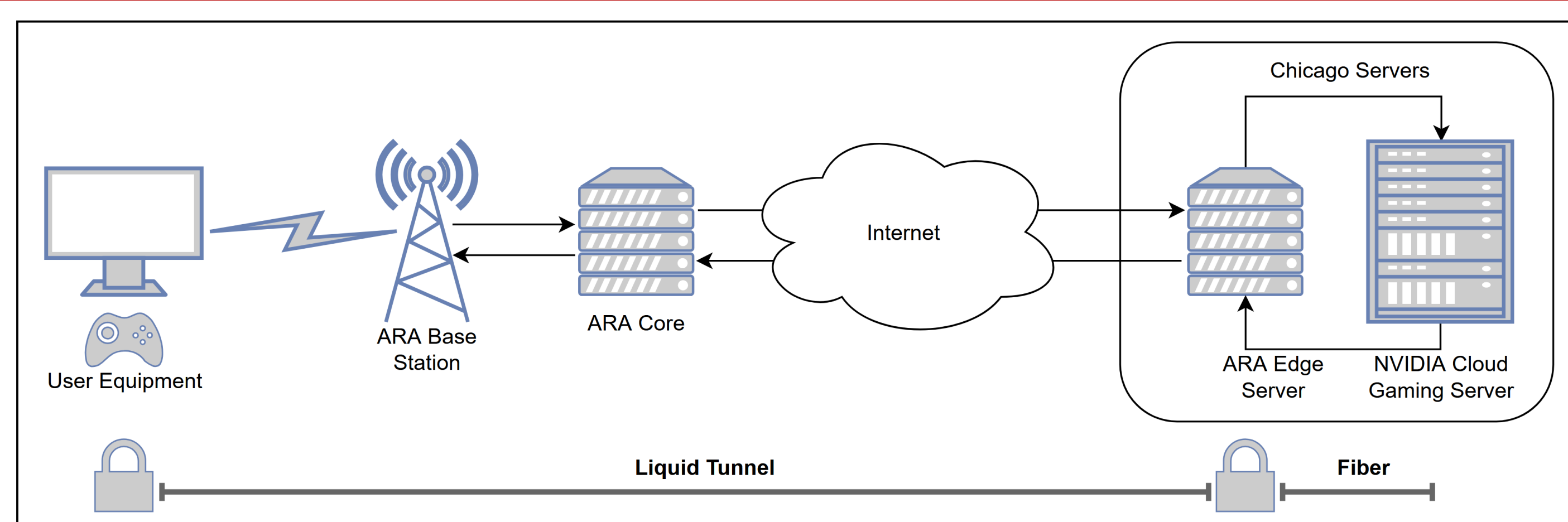


- RaptorQ erasure codes encode application data into symbols before being transmitted over UDP
- N symbols = K source symbols + M generated repair symbols
- Only K source symbols required to recover original data
- Increases reliability of data transmission while retaining real-time capabilities



- Liquid (multitpath and single) vs. normal single path
- CDF showing probability of having less than X FPS at any time
- Liquid (and multitpath) provides much higher and stable FPS

Cloud Gaming & Ag Applications



- With cloud gaming, the machine running the game is located in a remote NVIDIA GeForce Now server in Chicago
- The game's video and audio is streamed to the UE where user's input controls to the game are sent back to the server
- An unstable connection will cause user input to be delayed and the video stream to artifact and stutter
- Usage of erasure coding can significantly increase performance as shown in the figure
- The CDF figure shows liquid increasing and stabilizing the frames per second from a video stream
- We can also see how adding multipath can increase performance as well
- Video streaming and cloud gaming are just two scenarios, liquid encoding can also be used in remote teleoperation (such as teleoperated farm equipment) or live video streams in rural farms



← Read our
paper or watch
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Launch Event