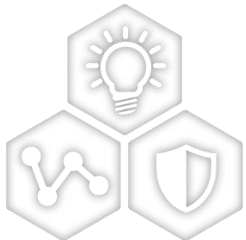


Enhancing Power Line Communications Leveraging Simulation Tools



A Leading Provider of Smart, Connected and Secure Embedded Control Solutions

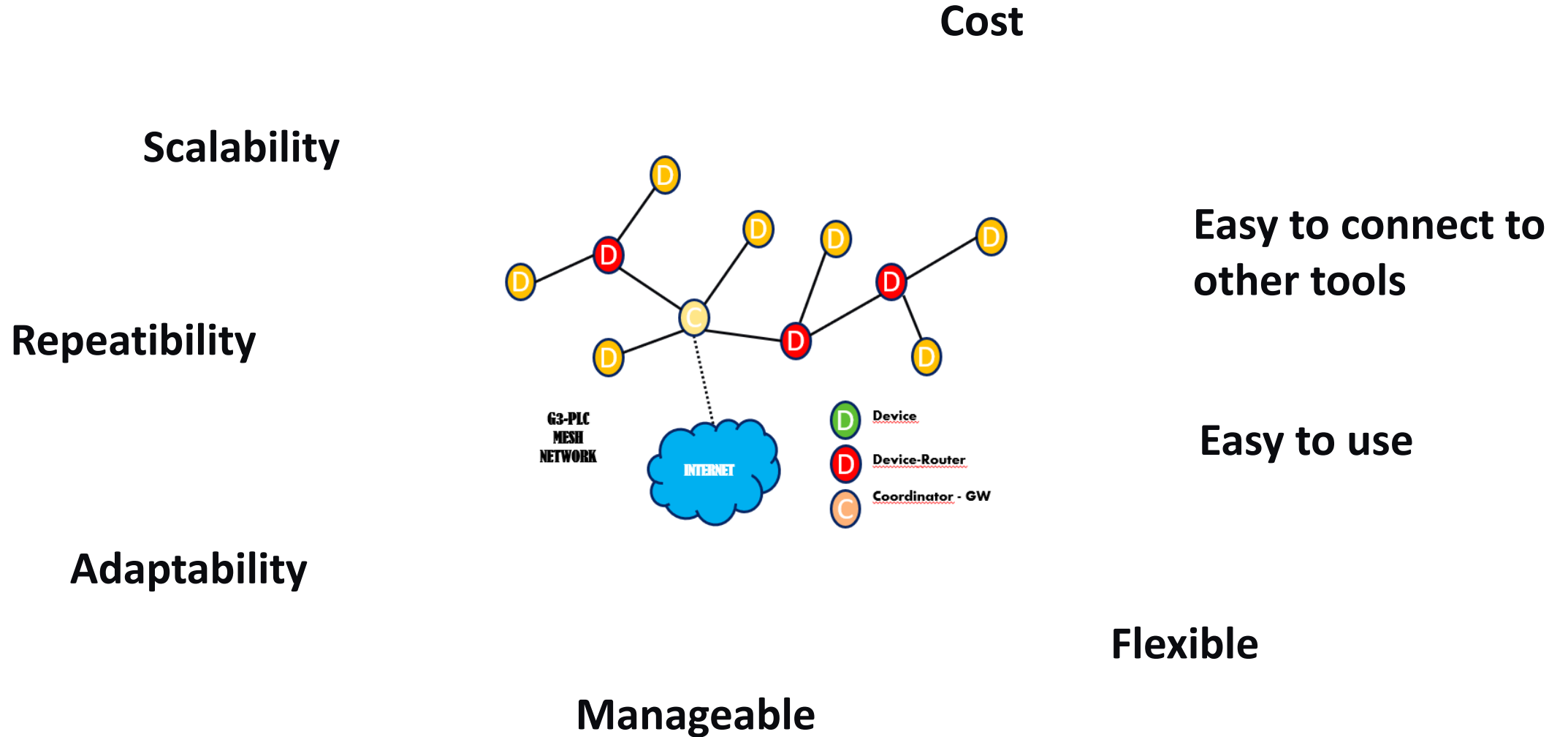


SMART | CONNECTED | SECURE

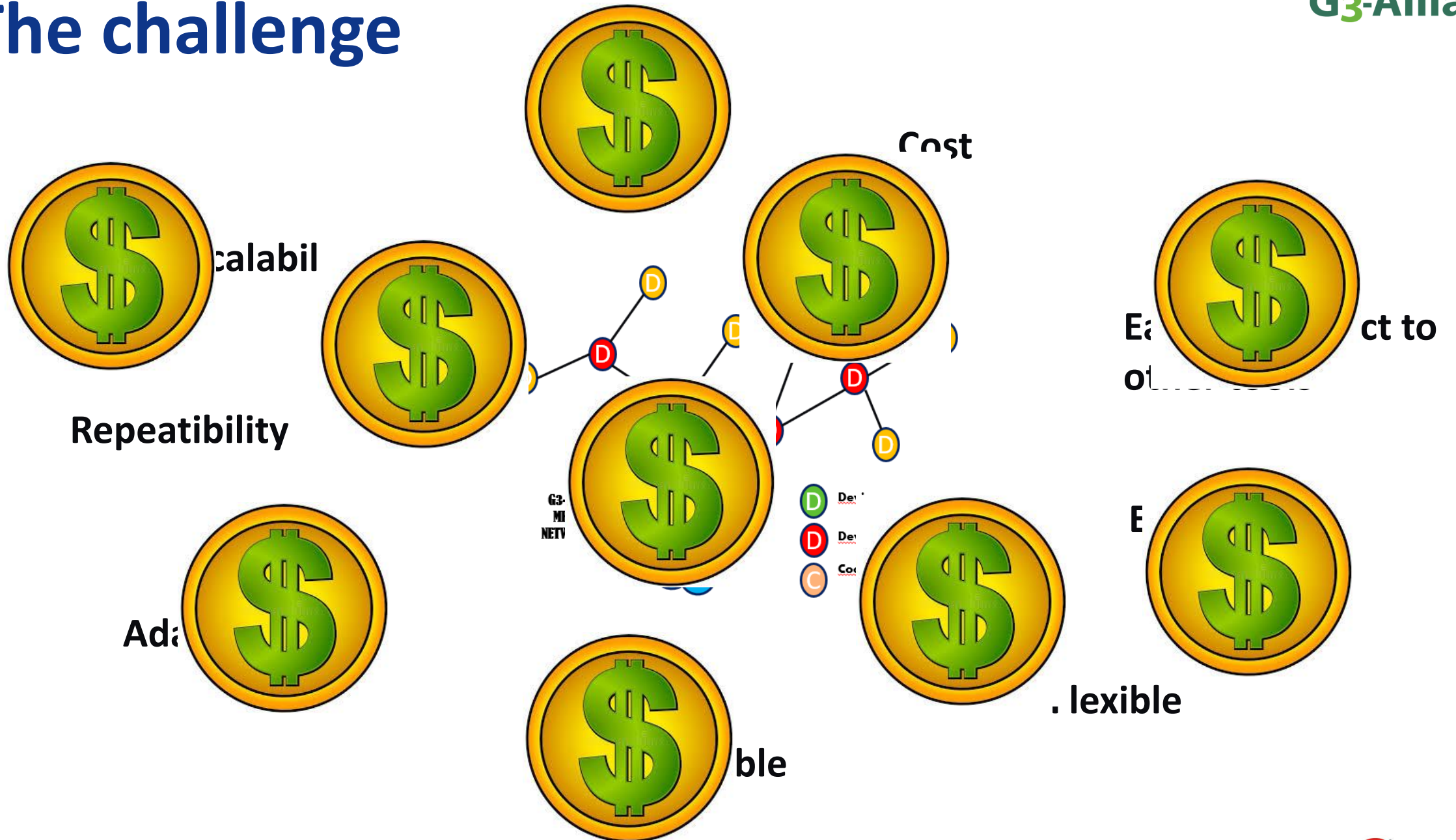
Andrés Muñoz
MCU Business Development Manager (EMEA)

Nov 2025

The challenge



The challenge

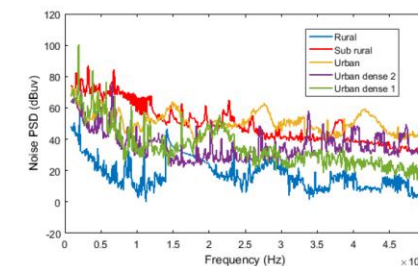
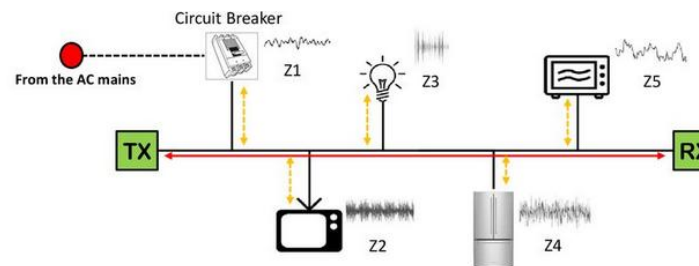
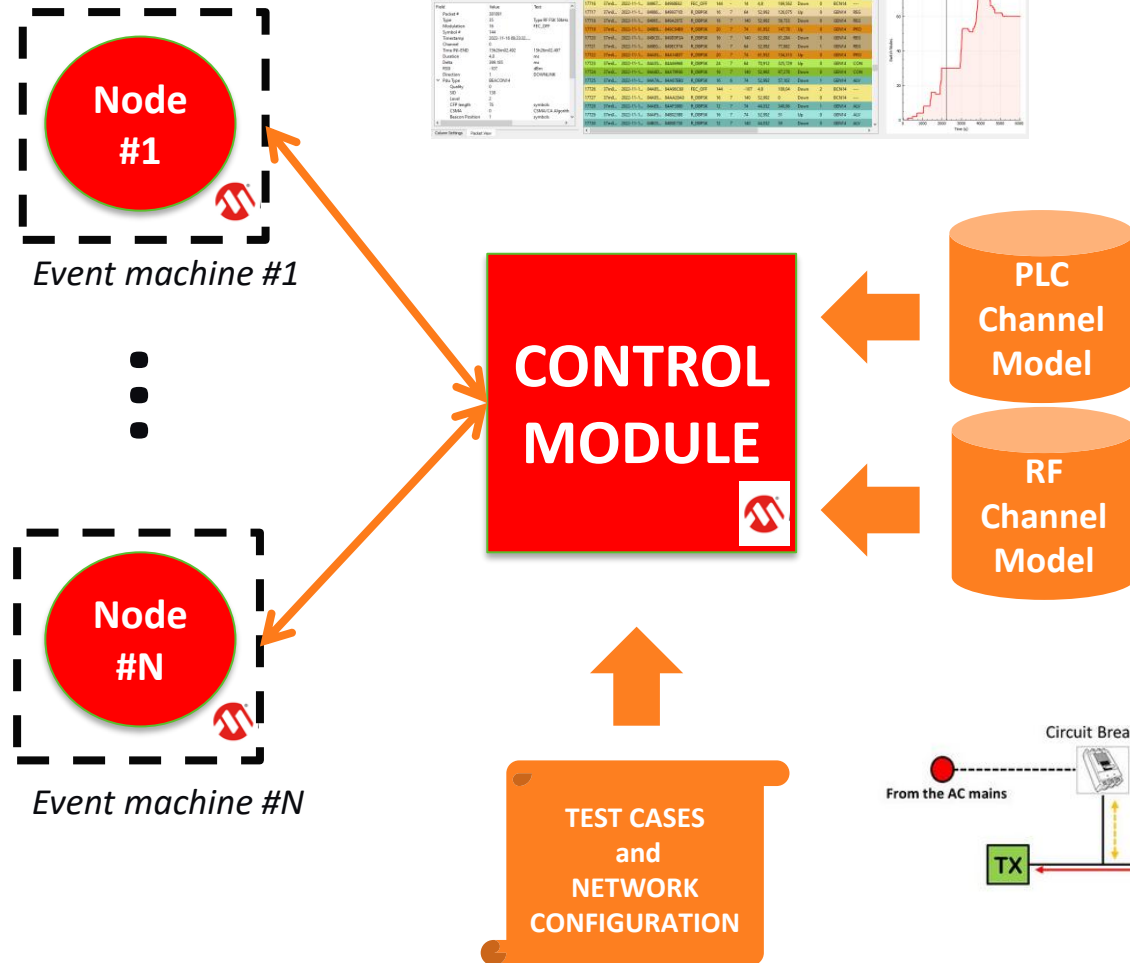




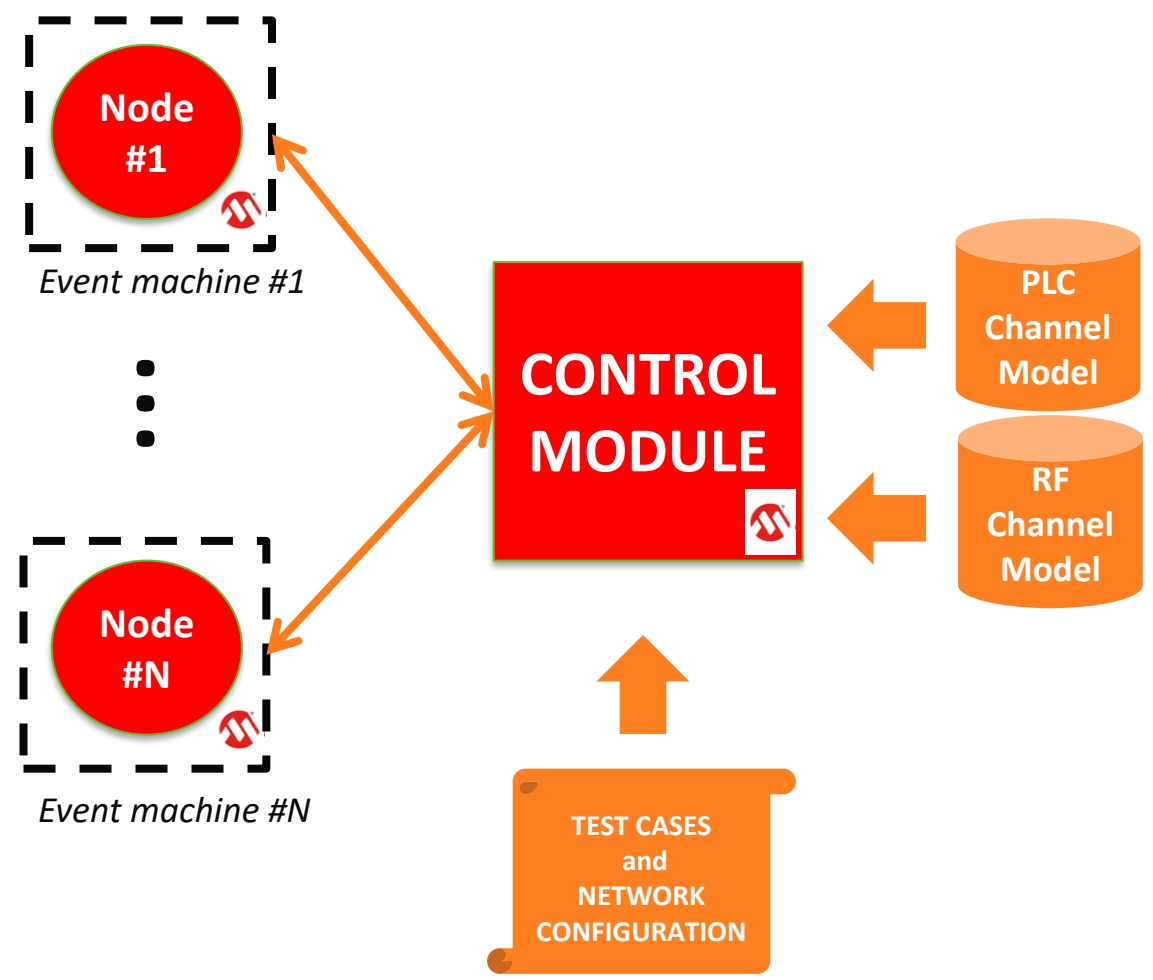
Microchip Network Simulator

RF and PLC physical layer models obtained by means of extensive field measurements

[1] José Carlos Ibar, Alfredo Sanz, Luis Lacasa, "PLC-RF hybrid communication systems, model and simulation" in Proceedings of the IEEE International Conference on Smart Grid Communications, 2021.



Microchip Simulator: Added Value



- + SCALABILITY
- + TEST COMPLEX SCENARIOS
- + DEBUG NETWORKS
- + DEVELOPMENT PROCESS

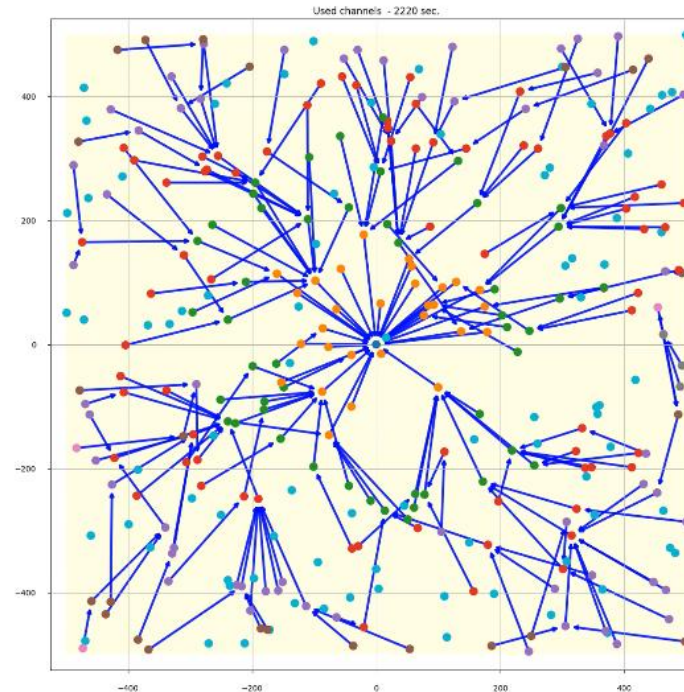
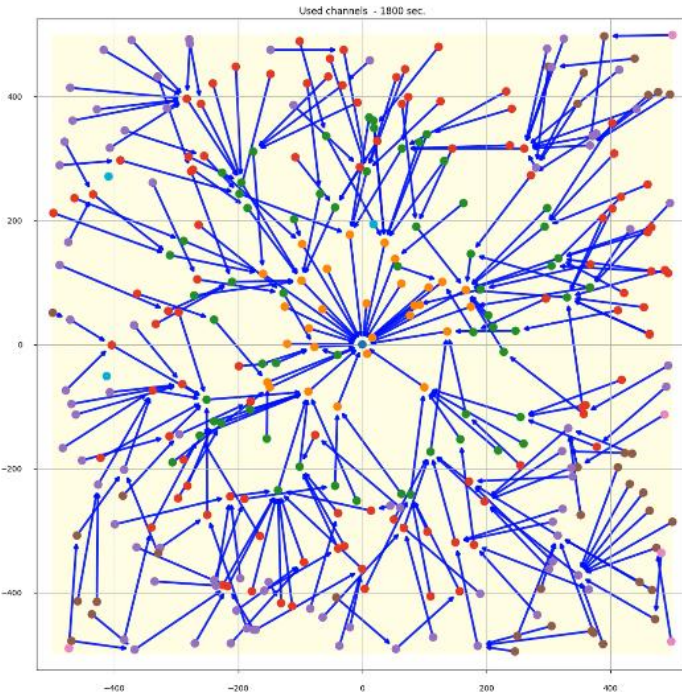
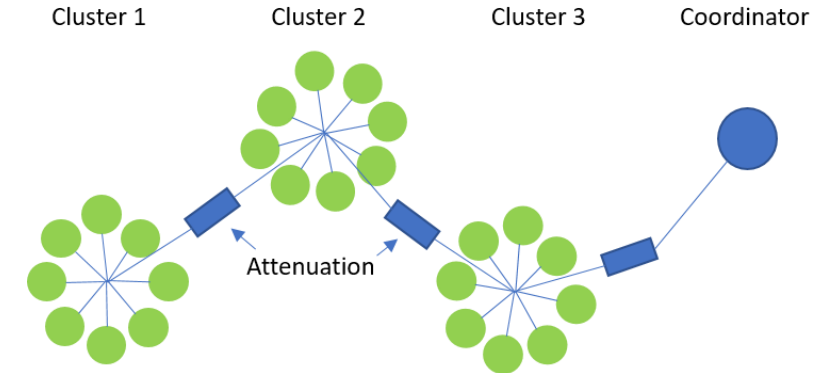
ETT_DLL 38: Cluster Forwarding Scheme

❖ LOADng's routing protocol uses network flooding for route establishment:

Network Congestions

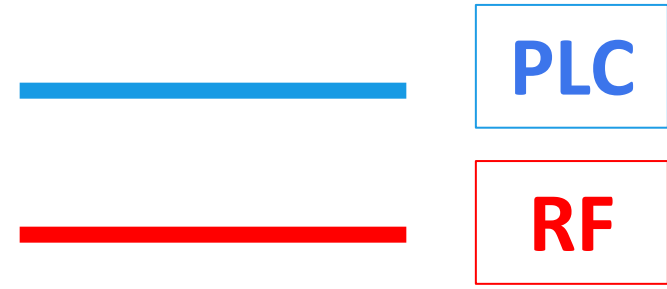
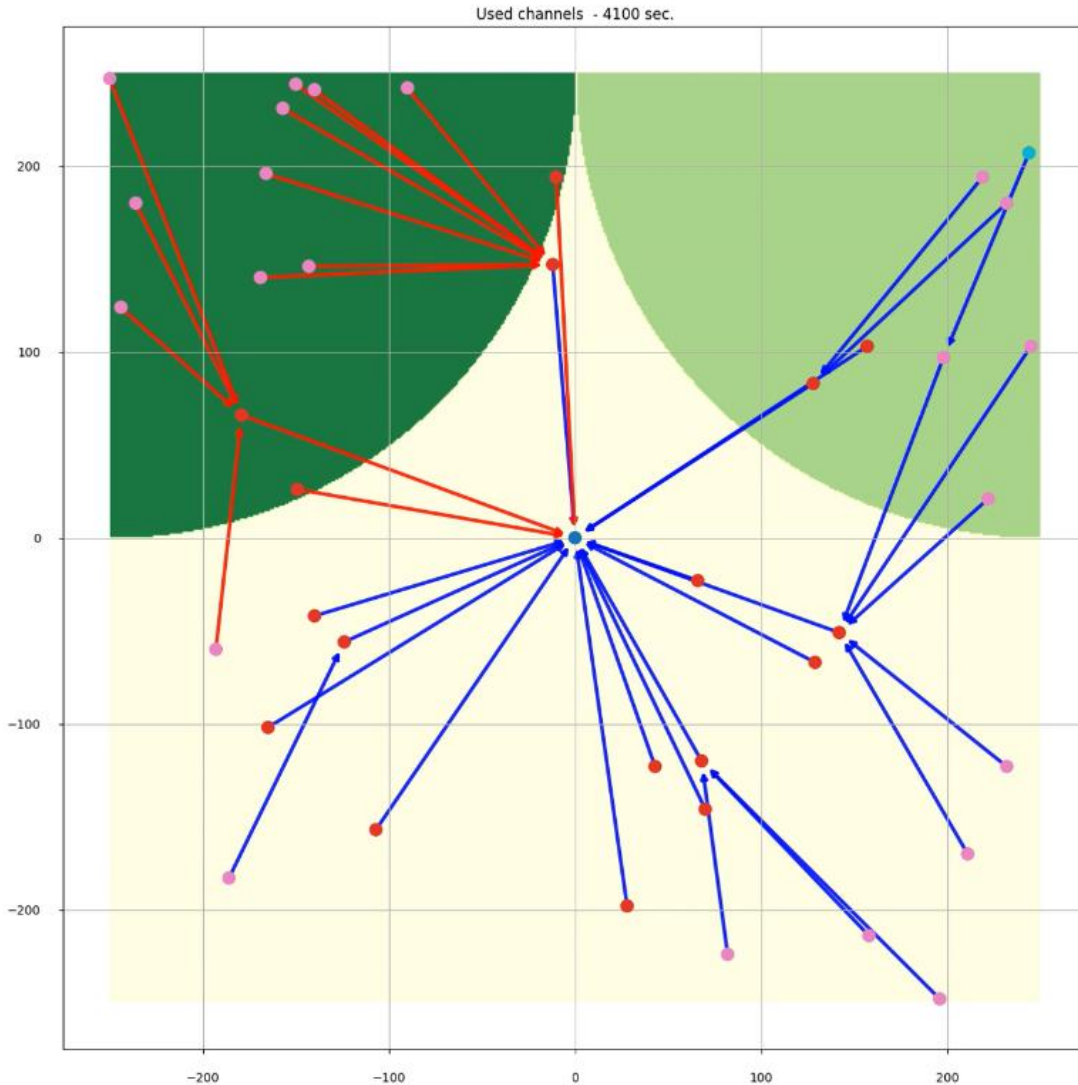
✓ Combine "cluster head chaining scheme" with RREQ Jittering and Trickle:

Reduce RREQ flooding problem



	BROADCAST RREQ STATS	
	Cluster Trickle Enabled	No Enhancements
Node count	321	321
Network Formation (s)	1.852	3.413
Total Broadcast RREQ count	23.925	75.495
Broadcast RREQ / hour	46.483	79.615
Broadcast RREQ / node / hour	144	248

Debug Networks: G3 Hybrid



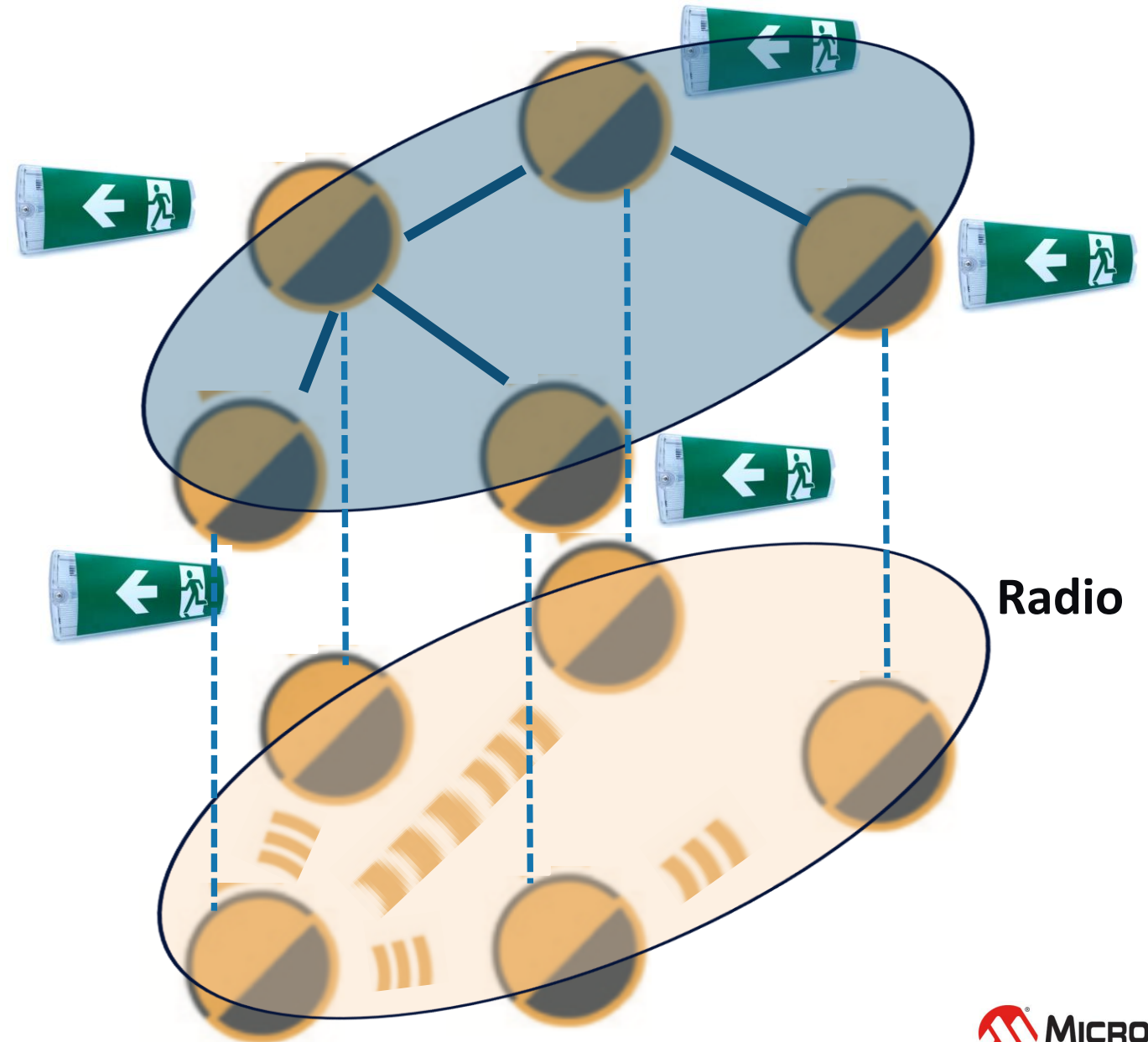
Simulation steps

1. G3 Hybrid network without noise
2. Add noise (PLC: top left // RF: top right)
3. G3 Hybrid stack changes the PHY channel selection dynamically

Smart Alarm Systems

Test Complex Scenarios (I)

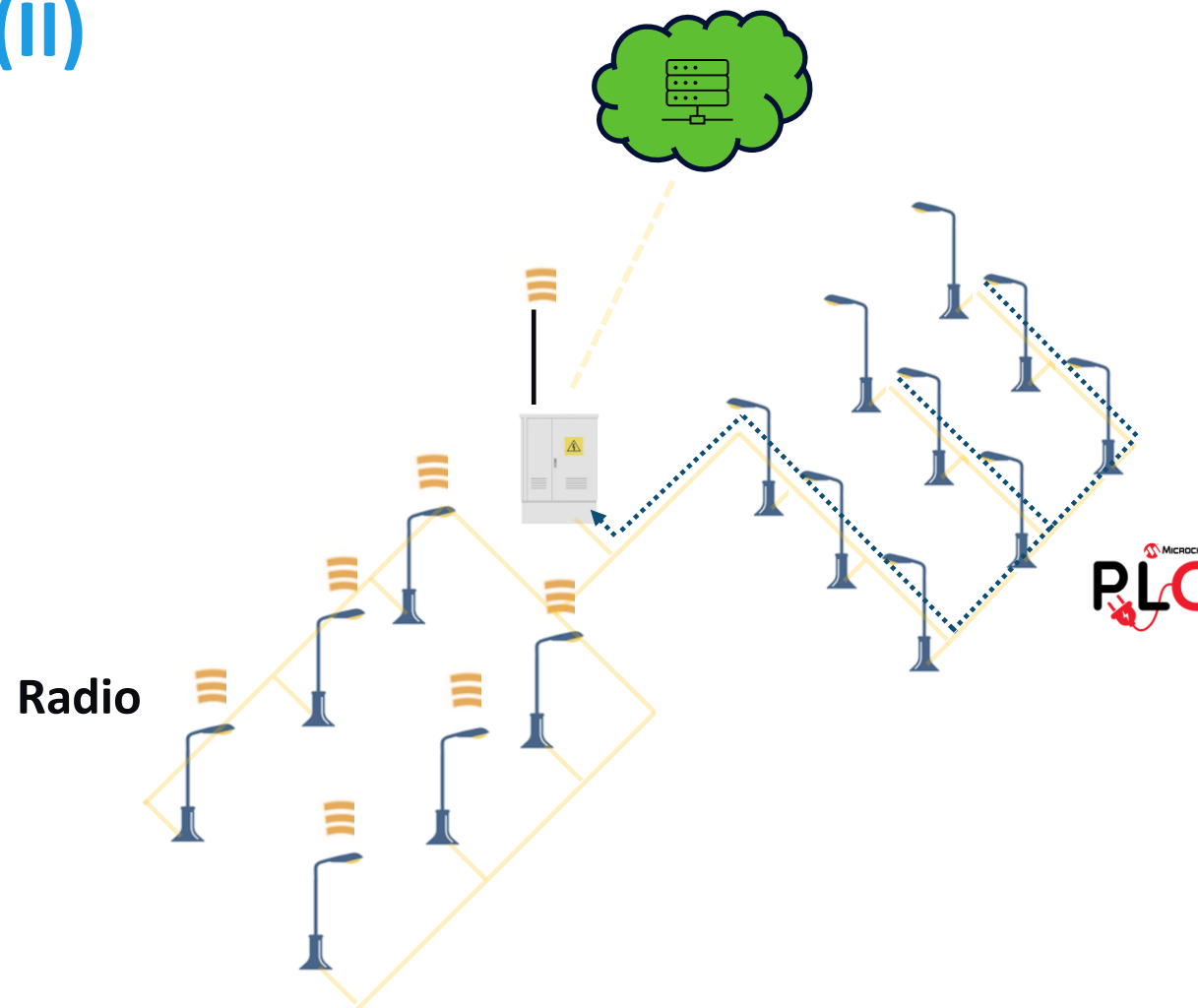
- **Area of Application:** Skyscrapers, Airports, Train Stations, Office Buildings
- **Differentiator:** Dynamic Signalling; Robustness (failure is NOT an option)
- **Why Hybrid:**
 - PLC (high latency, robustness)
 - RF (low latency, speed)



Smart Lighting

Test Complex Scenarios (II)

- **Area of Application:** Smart Luminaire control for Smart City, Smart Industry, Smart Office
- **Differentiator:** Unified Cloud-based Platform, covering equipment and services; Reduced energy consumption (and cost).
- **Why Hybrid:**
 - Efficiency
 - Scalability
 - Coverage



Thank you!

