



Short Development Time
Proven Quality

Radiocrafts
Embedded Wireless Solutions

Presentation will start shortly....

Radiocrafts

How to create an IP mesh network
September, 2019



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An easy way to create an IP Mesh network

September 2019

- Omar Khalil, Applications Engineer
- Ørjan Nottveit, R&D Director

House-keeping

- The seminar today is scheduled for 30 minutes with a 10-15 minutes Q&A afterwards.
- Please introduce yourselves in the chat window, so we know who is listening.
- Post your questions in the chat window during the seminar, and we will answer the best we can in the Q&A session.
- We will post a recorded version of the webinar on our website after the webinar, if you want to go back and see it again.



Agenda

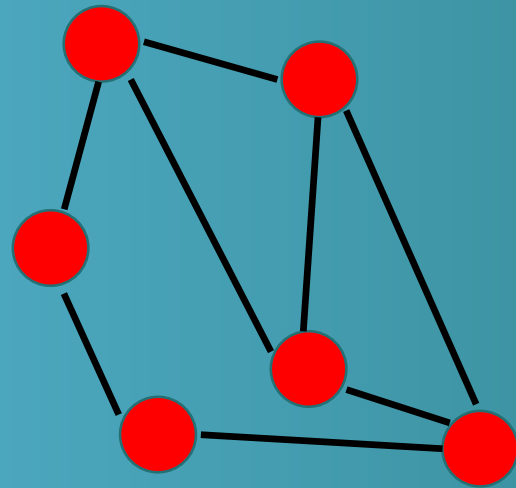
- Mesh Topology
- Advantages/features compared to other topologies

- Benefits of introducing IP
- Advantages over other Long-range star networks
- How RIIM solves many of the conceived mesh challenges

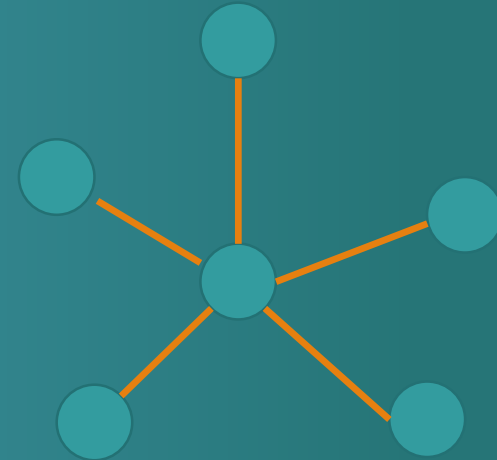


Network Topologies

Mesh Network



Star Network

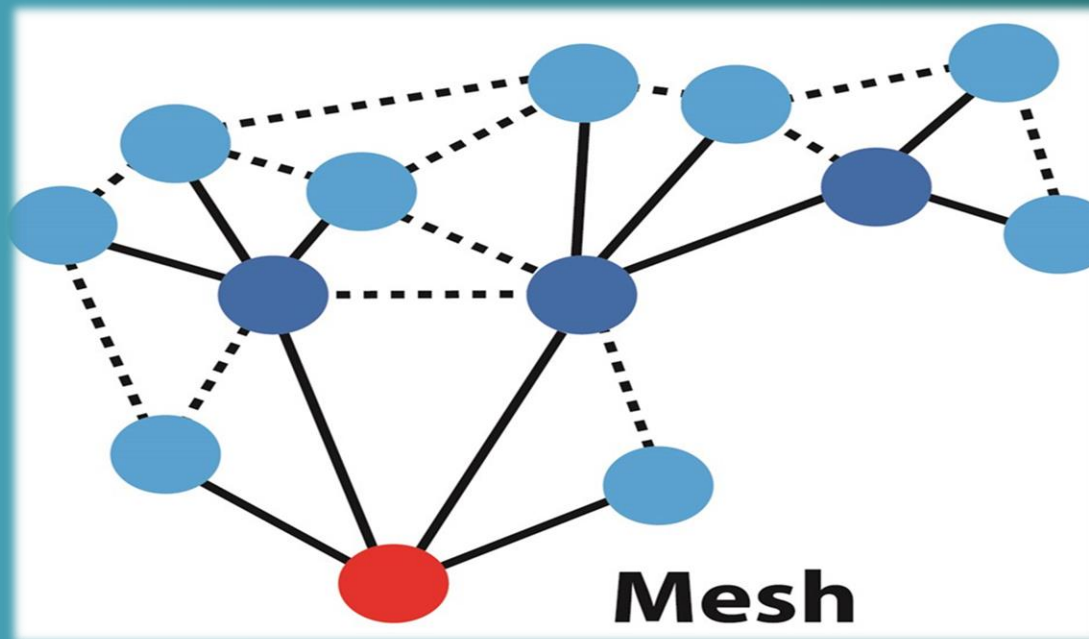


- Main idea of Mesh: nodes are connected in a way by which nearly all nodes have more than one path to the gateway!



Mesh Networks

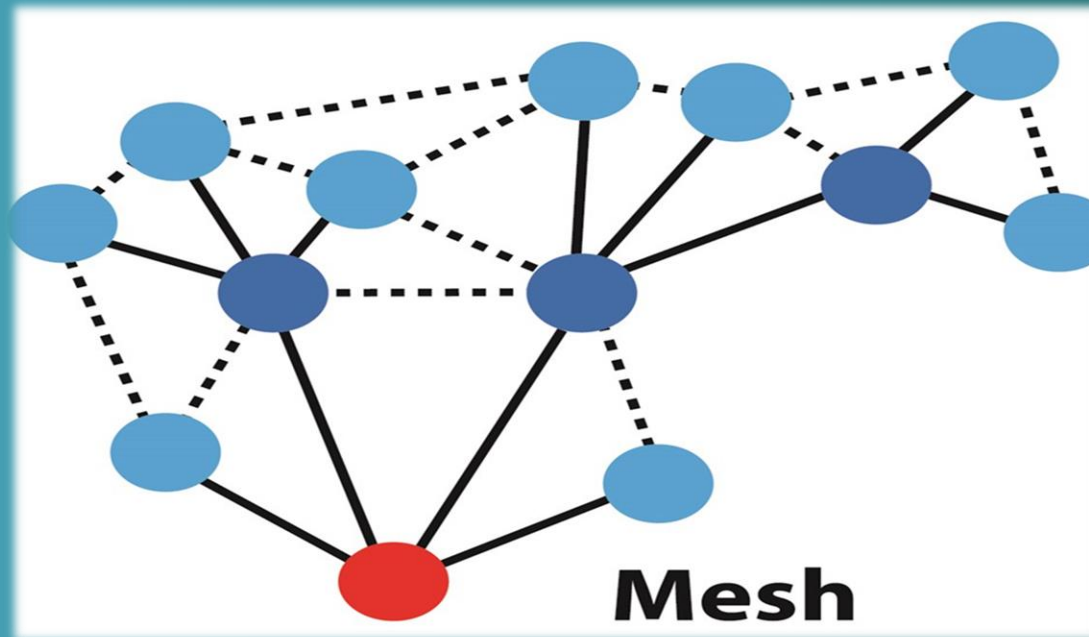
- End-nodes, leaf-nodes
- Routers
- Gateway





Mesh Networks

- Messages propagate along a route by hopping from the end node, to the router, then to the gateway.
- The network configures new routes along broken links, thus mesh networks are Self-organizing/ self-healing.



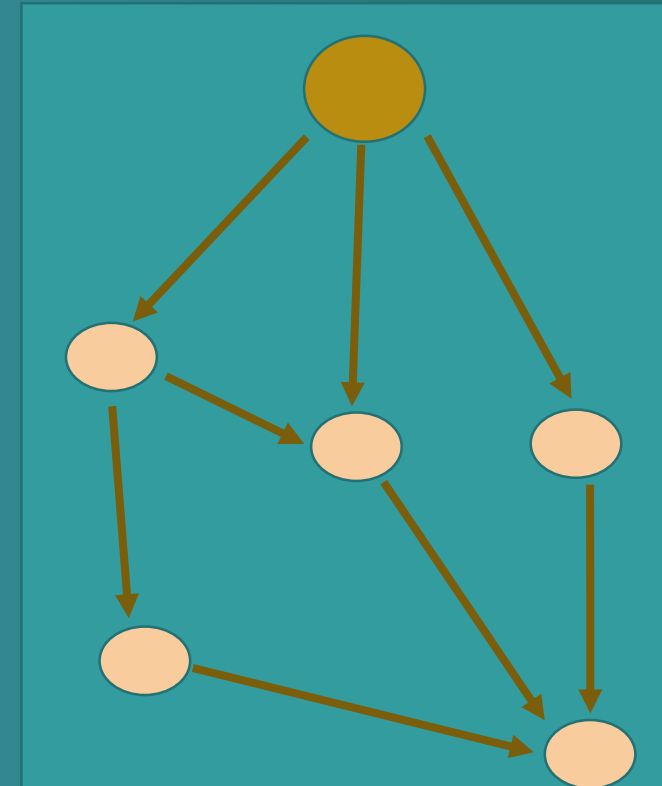
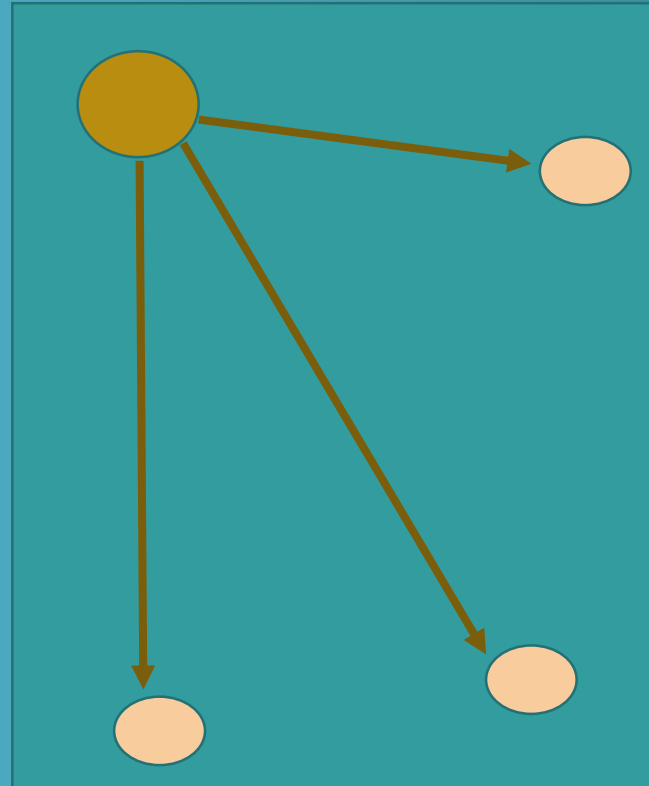


Advantages of Mesh networks vs. Star

- Failure of one node does not mean outage of the whole network (Self healing)
- New devices can be added easily (Self forming)
- Large coverage as the packets are re-transmitted from the mesh nodes further out in the network



Advantages of Mesh networks vs. Long-range Star networks (ex: LoRaWAN) with long transmit pulses



- Same coverage, but mesh networks transmit to shorter distances so they can maintain a better data rate and higher QoS. In addition, mesh networks consume less power.



In what scenarios is an IP mesh a favourable solution?

- Controlled/accessible infrastructure available
 - Buildings
 - Street lighting
- Large covered area with low power sensor
 - Sensor use less energy to send as receiver is closer
- 2-way symmetric communications
 - Actuators
 - QoS



What is an IP mesh network

- An IP network uses the Internet Protocol (IP) to send and receive data between various network nodes.
- Each node is assigned a unique IP address, which it uses to send and receive data.
- All nodes must be equipped with a IP stack.



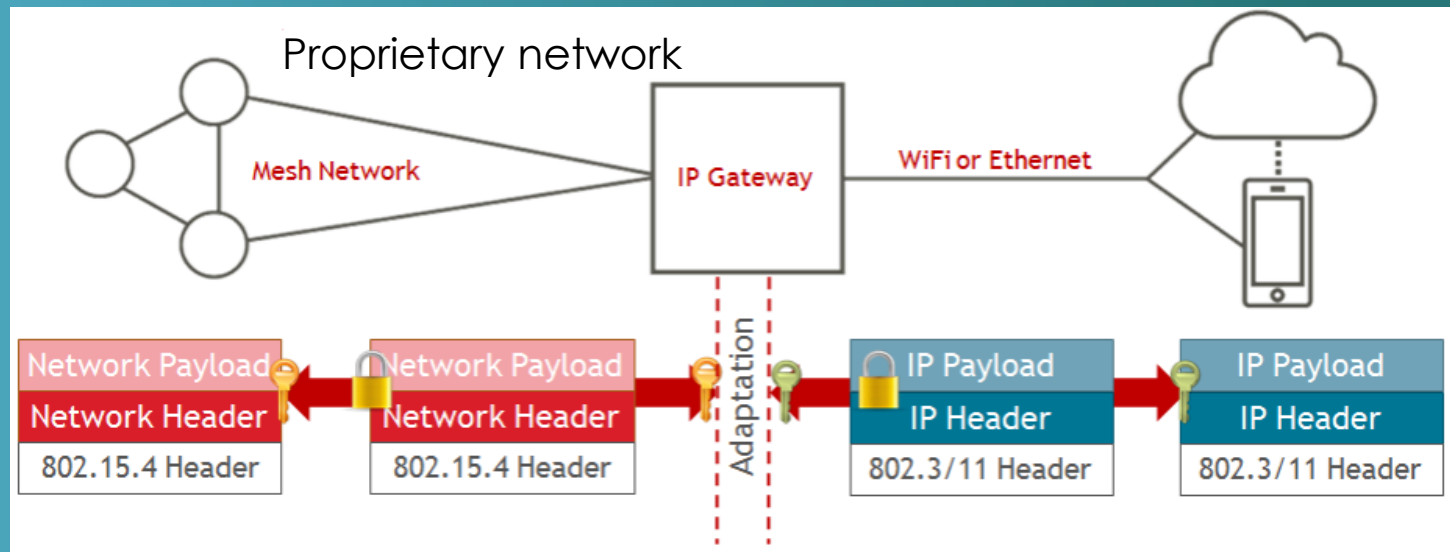
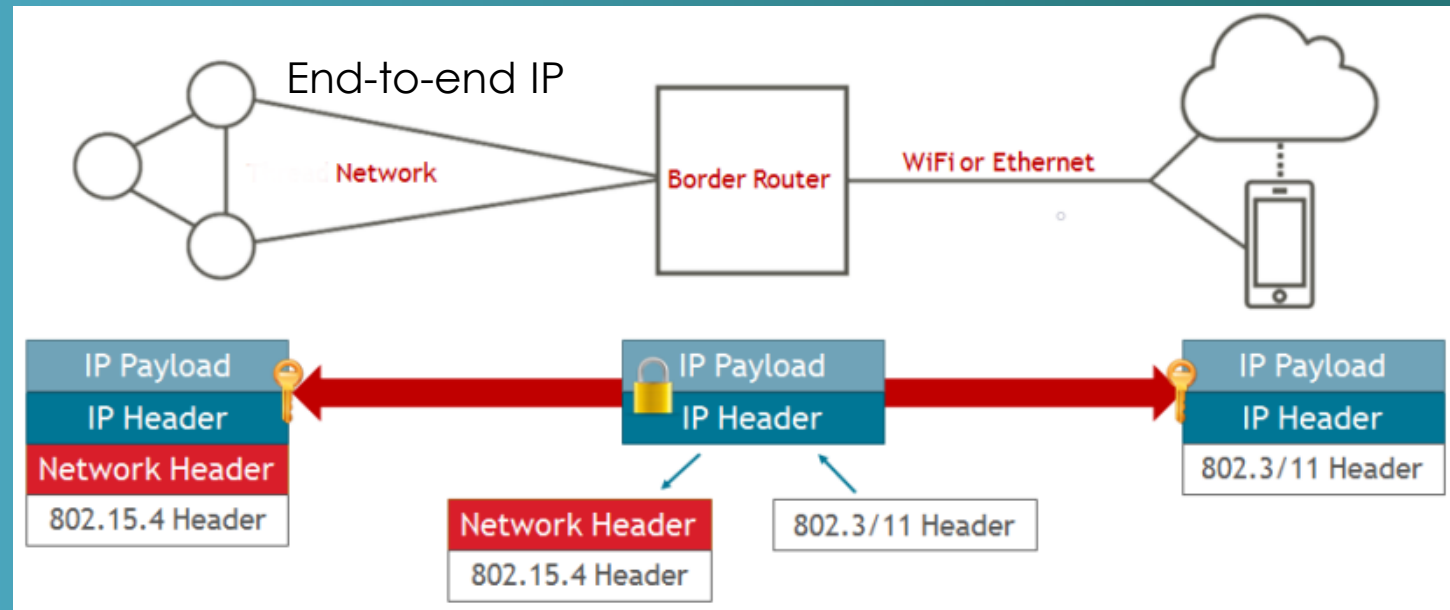
Benefits of introducing IP

- Future proof
- Scalable
- Security
- Simplified bridging to other IP networks
- Easy integration with cloud solutions

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Simplified bridging to other IP networks





Routing

- In mesh a routing protocol is needed to forward packet
- Routing strategy can be different with different use cases
- RIIM uses RPL
- RPL is an open standard
- RPL is optimized for one-to-many / many to one
- RPL is optimized for semi-static network



IP overhead

- IP was originally made for high capacity network like ethernet, fiber or Wi-Fi.
- IP is not originally designed to be bandwidth efficient
- With wireless low power network the bandwidth is limited.
- 6LoWPAN is a open standard on how to compress and minimize IP overhead



Truly low power

- Due to higher data rate the energy it takes to send a message is less.
- Transmitting a 20 bytes packet takes 100 times less battery capacity compared to LPWAN star type of network (LoRAWAN 297b/s used in calculation)
- Sending CoAP packets with all the overhead and acknowledge included every 15 minutes give a battery lifetime of >5 years with a 500 mAh coin cell battery
- Minimum sleep current of 8 μ A



CoAP cloud connectivity

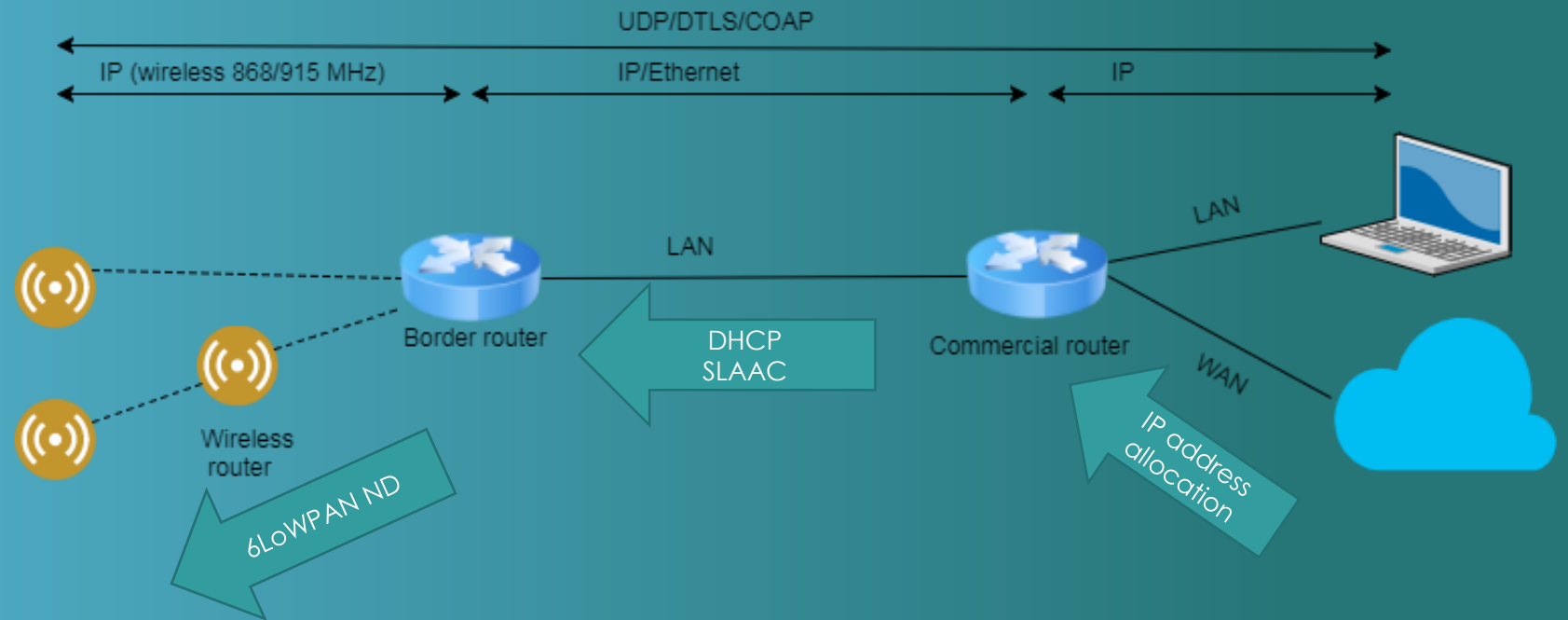
- CoAP is an application protocol shared between “the thing” and the “cloud”
- CoAP gives interoperability on application layer
- CoAP allows cloud/backend to communicate with devices without having to consider what medium the communication is based on
- CoAP is an open standard



Security

- In most IoT solution the gateway is a vulnerable point
- Data is decrypted and encrypted as part of the gateway functionality
- With IP DTLS offers end to end encryption
 - No man-in-the-middle attack
- DTLS is a standard
- RIIM offer DTLS with cipher suite, AES128-CCM encryption

IP address allocation

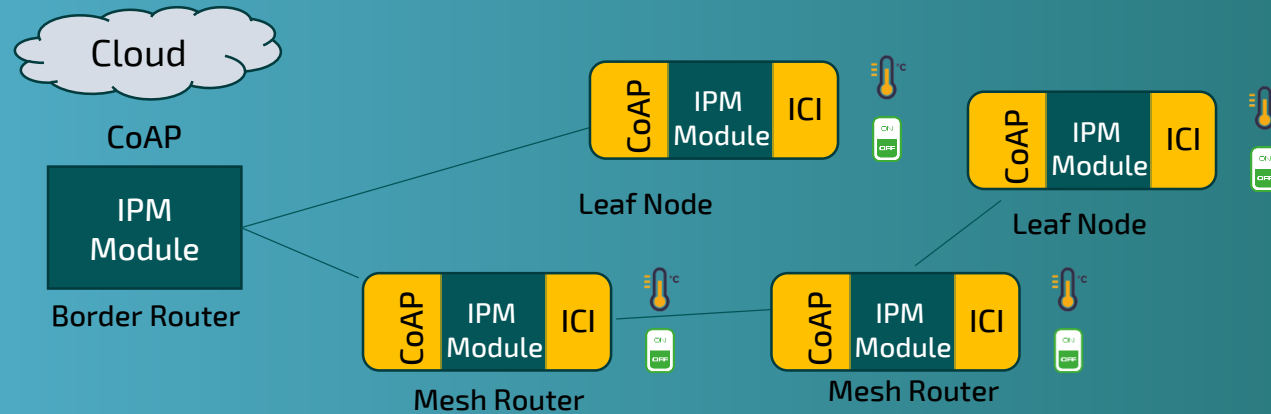


- IP address of sensor not known before installation
- Initial communication must go up in system to register device and open path. (Also important for firewall)



RIIM™ by Radiocrafts, An IIoT Wireless IP mesh network in a module

Developed for you to easily create your own industrial grade access network with direct IP connectivity



The IPM Module is the core of the network nodes and supports the complete RIIM network. The IPM module can be configured as border router, mesh router or leaf node.

Each Node has a CoAP client/server to provide IP level access

A complete Border Router boxed product with Ethernet interface is available from Radiocrafts

- Self forming / Self healing mesh
- Connects:
 - any sensors
 - any controllers
- No license fee
- No subscription
- Long Range RF
 - 20x 20 km coverage
 - 915 / 868 MHz
- 50 kbps data-rate
- Pre-certified

Development by the customer:

- Sensor/Controller chips and interfaces
- Sensor/Controller data formatting & data processing
- PCB and power
- Enclosure



Summary

- Different network topologies
- Mesh networks advantages
- Benefits of introducing IP
- How RIIM offers a easy to use IP mesh solution

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Q&A

- Any questions?

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Read more on RIIM for

<https://radiocrafts.com/products/rf-network-solutions/>

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Thank you for your
attention!