Center of Excellence
WIRELESS AND
INFORMATION TECHNOLOGY

Sensing and Communication Services for Food Transport Logistics

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Abstract

- Food Transport Logistics
  - Rising Oil prices
  - Dynamically assigned first-expire first-out
- Sensing Service
  - Wireless Sensor Network
- Communication Service
  - Satellite and Cellular Networks

Biography

- **Markus Becker**
  Communication Networks, University Bremen
- Markus Becker received his Diploma in Electrical Engineering and Information Technology in 2004 at the Aachen University of Technology, Germany. Currently he is involved in a technology transfer project bringing Wireless Sensor Networks to logistics. His research interests include Sensor Networking, Simulation of Communication Networks and Applications of Communication Networks.

Agenda

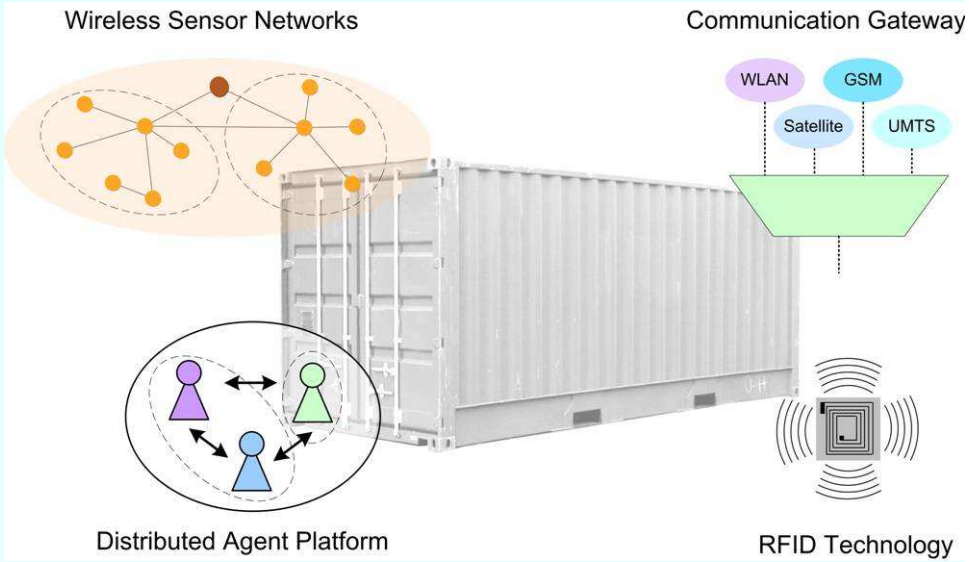
- Project Overview
- System Architecture
- Propagation Measurements in Container
- Radio Propagation Model
- Communication on the Ship
- Web Interface

Project Overview

- Collaborative Research Center (CRC) 637
  - Autonomous Cooperating Logistic Processes – A Paradigm Shift and Its Limitations
  - German Research Foundation funded project
- CRC 637 T4
  - Monitoring Technologies for Food Transports
  - Partners:
    - Cargobull Telematics, Dole, Rungis Express

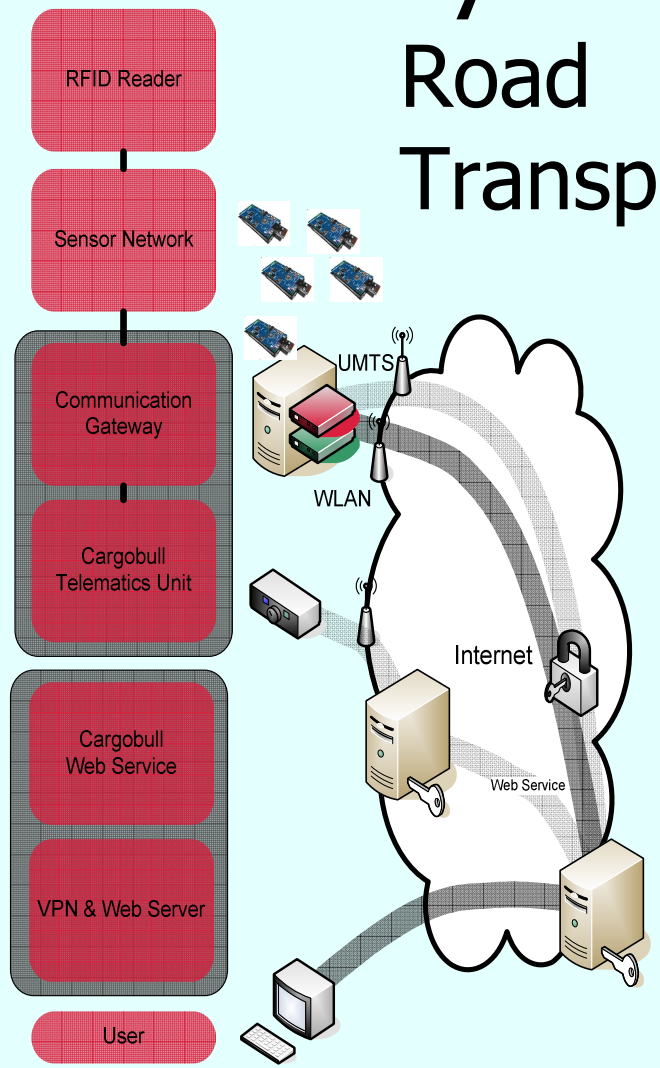
Intelligent Container

- Food Transport Logistics
  - Rising oil prices
  - Dynamically assigned first-expire first-out
- Sensing Service
  - Wireless Sensor Network
- Communication Service
  - Satellite and Cellular Networks

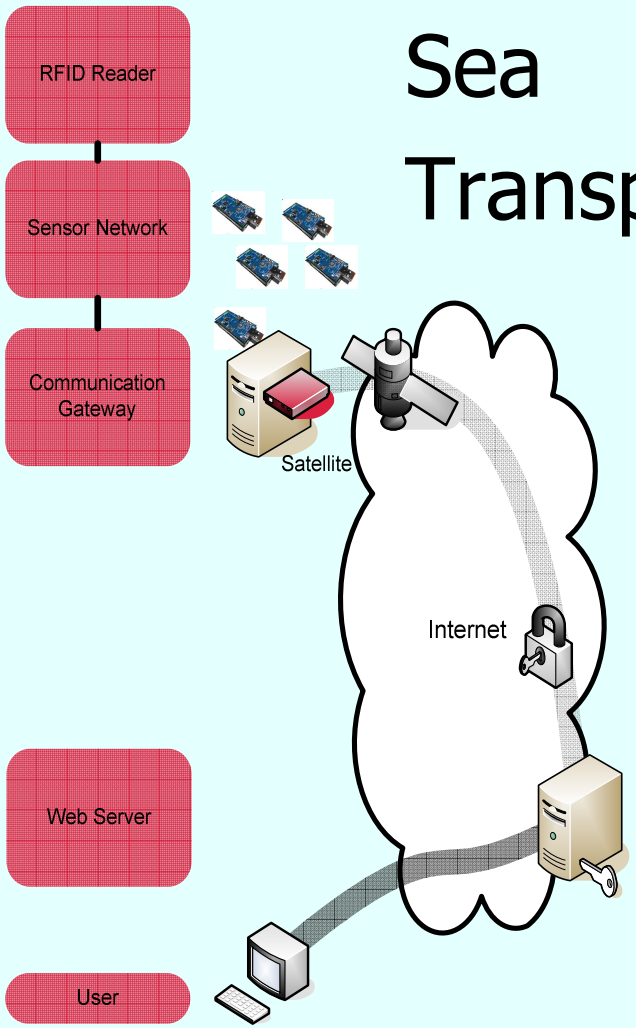


System Architecture

Road Transport



Sea Transport

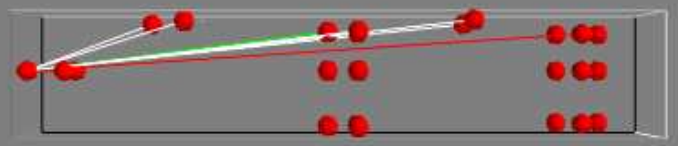


WSN for Food Transports

Single-Hop: LQI, PRR

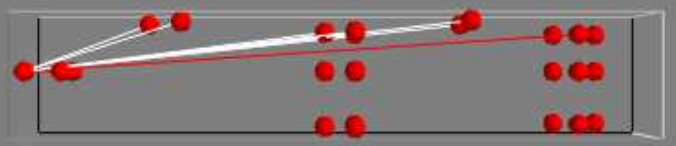
- Link Quality Indicator (LQI)
- Packet Reception Ratio (PRR)

Excellent: LQI > 105.0
Good: 100.0 < LQI < 105.0
Fair: 95.0 < LQI < 100.0
Bad: 0.0 < LQI < 95.0



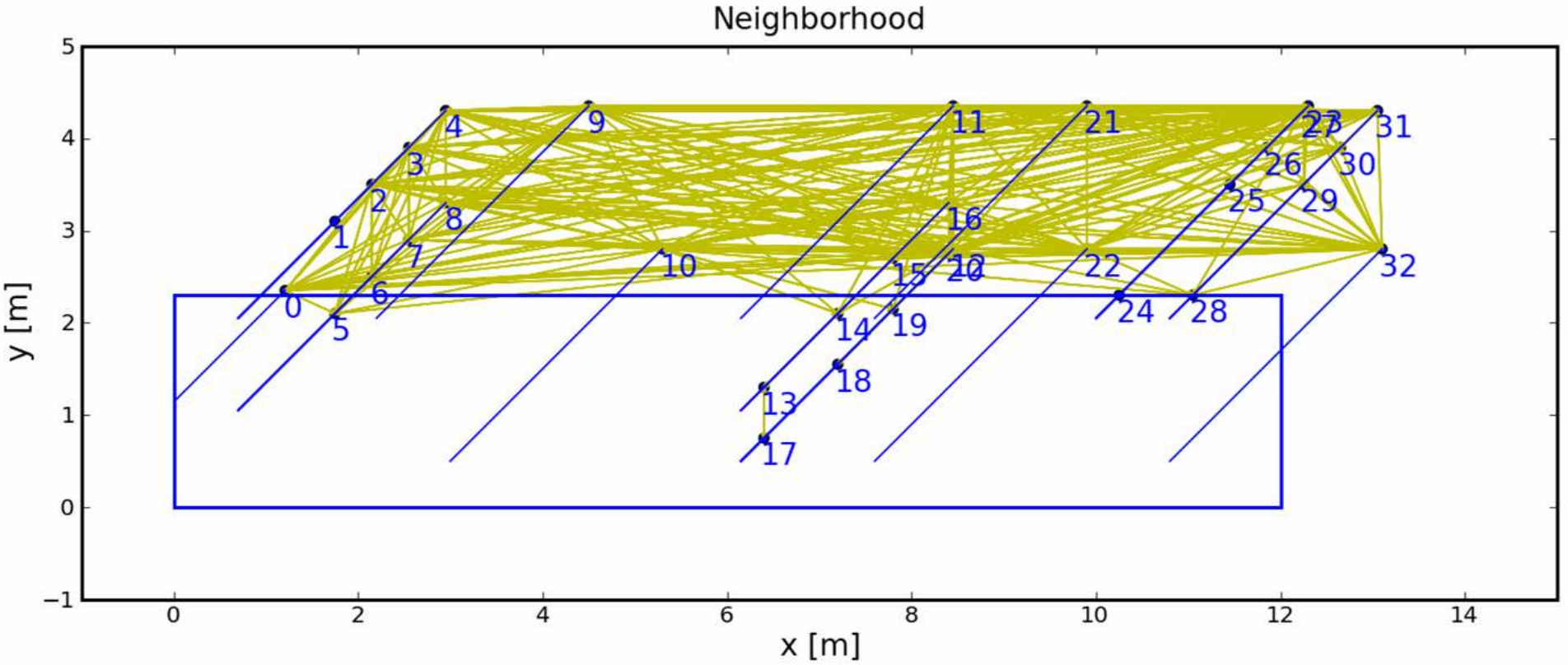
LQI Mean

Excellent: PRR > 0.95
Good: 0.8 < PRR < 0.95
Fair: 0.7 < PRR < 0.8
Bad: 0.0 < PRR < 0.7

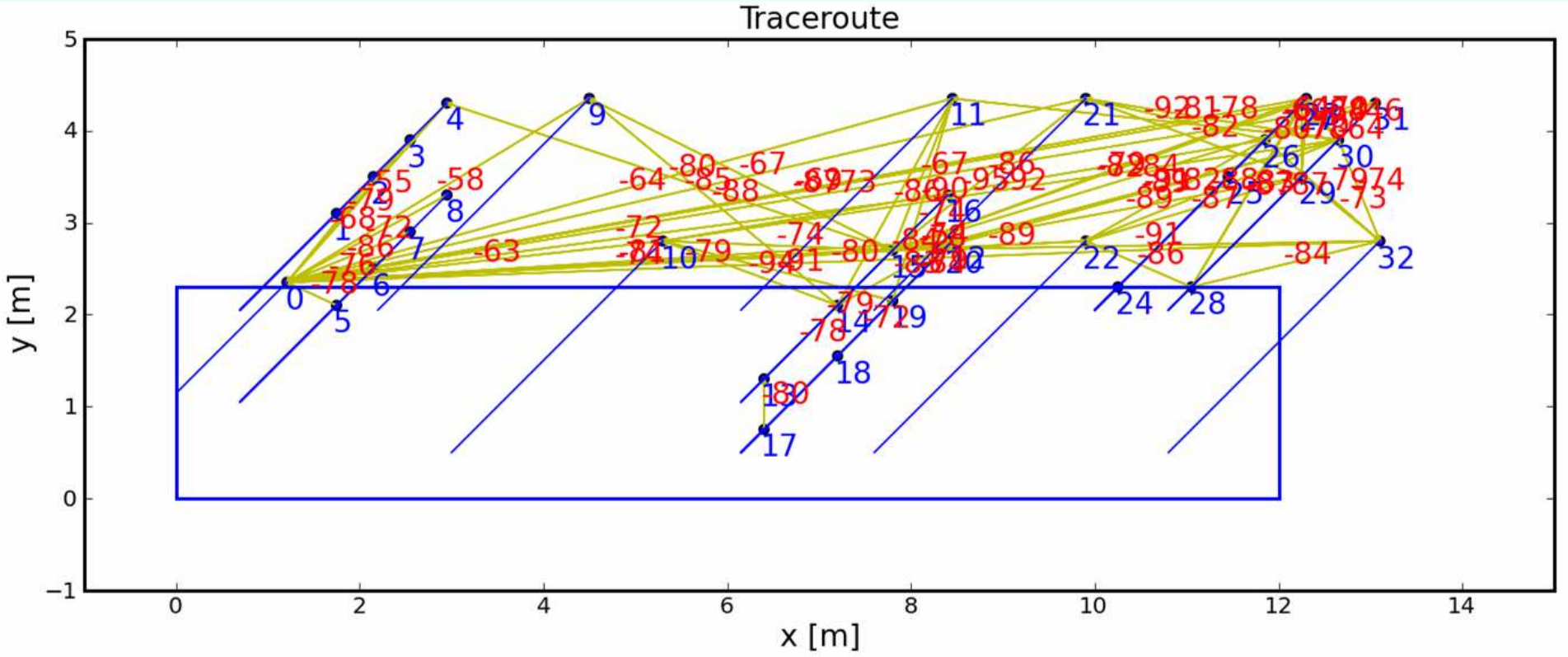


PRR

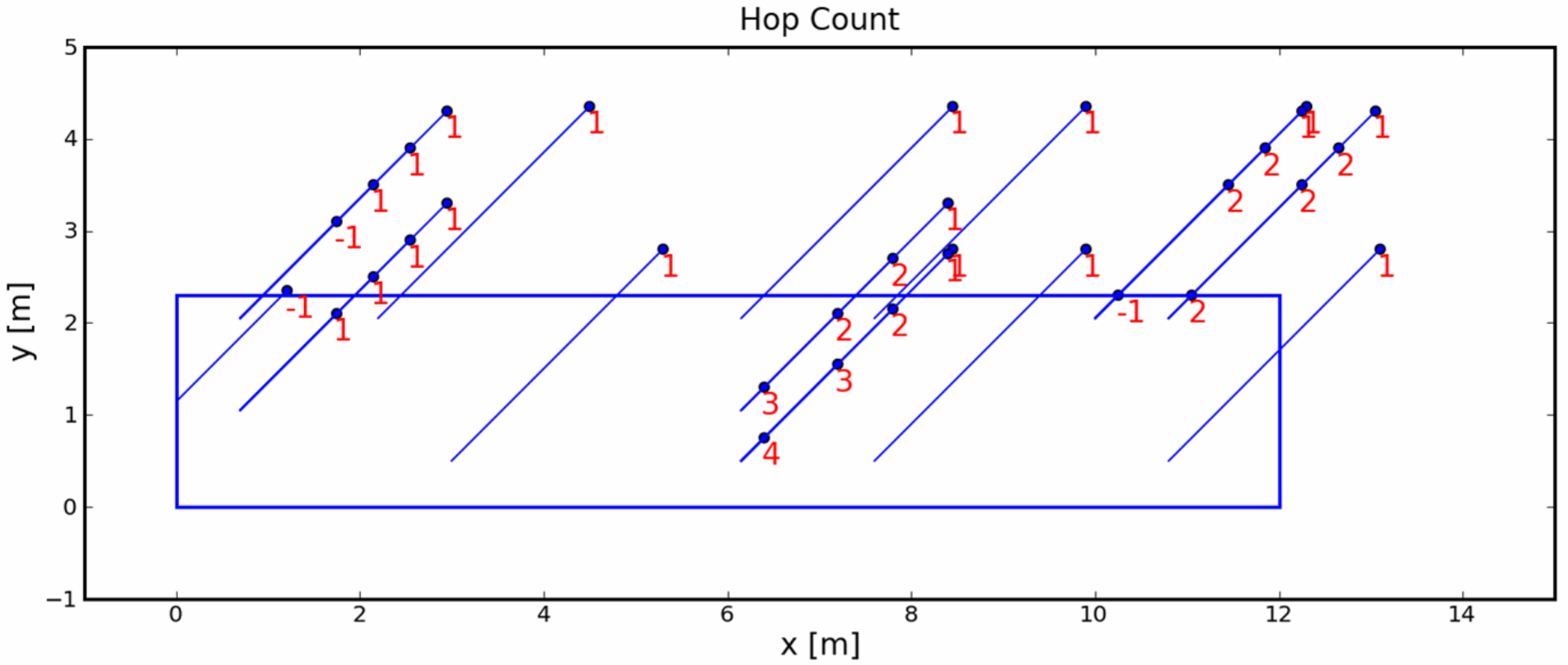
Multi-Hop: Neighborhood



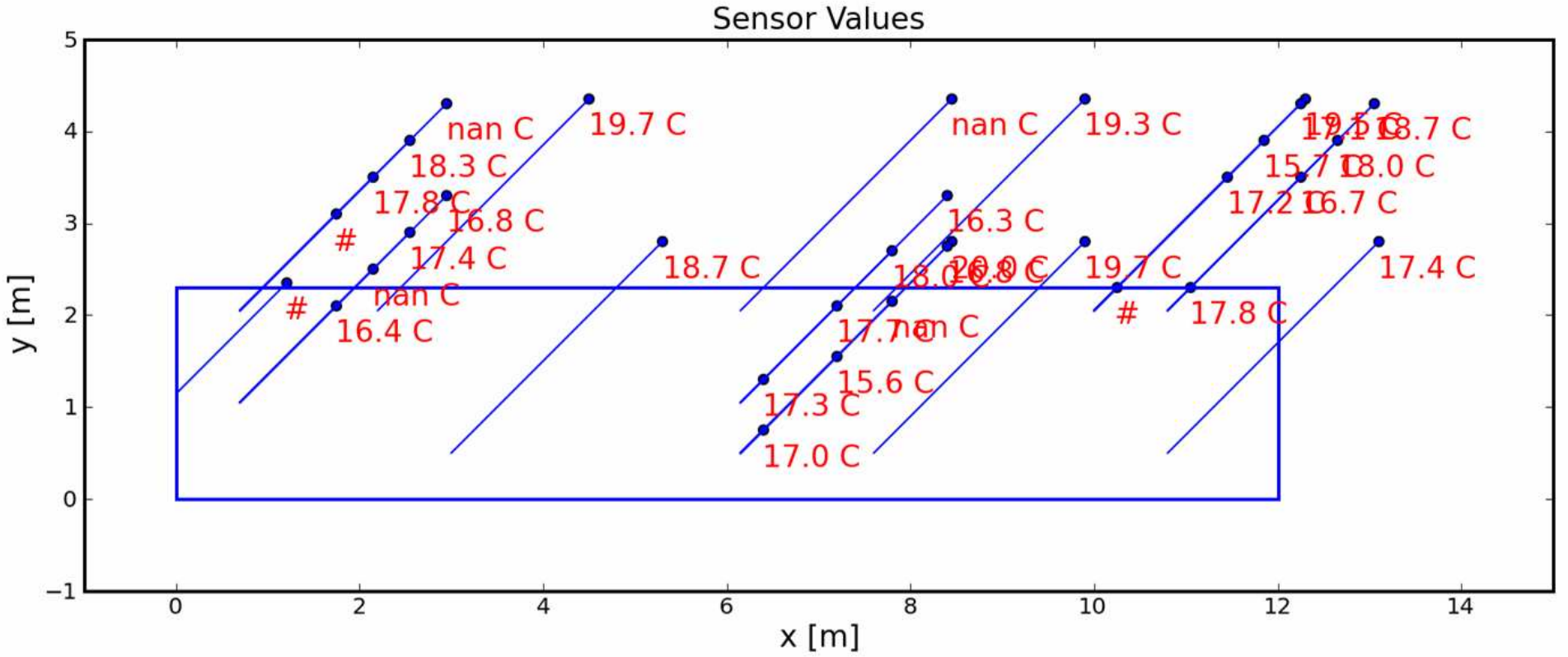
Multi-Hop: Traceroute



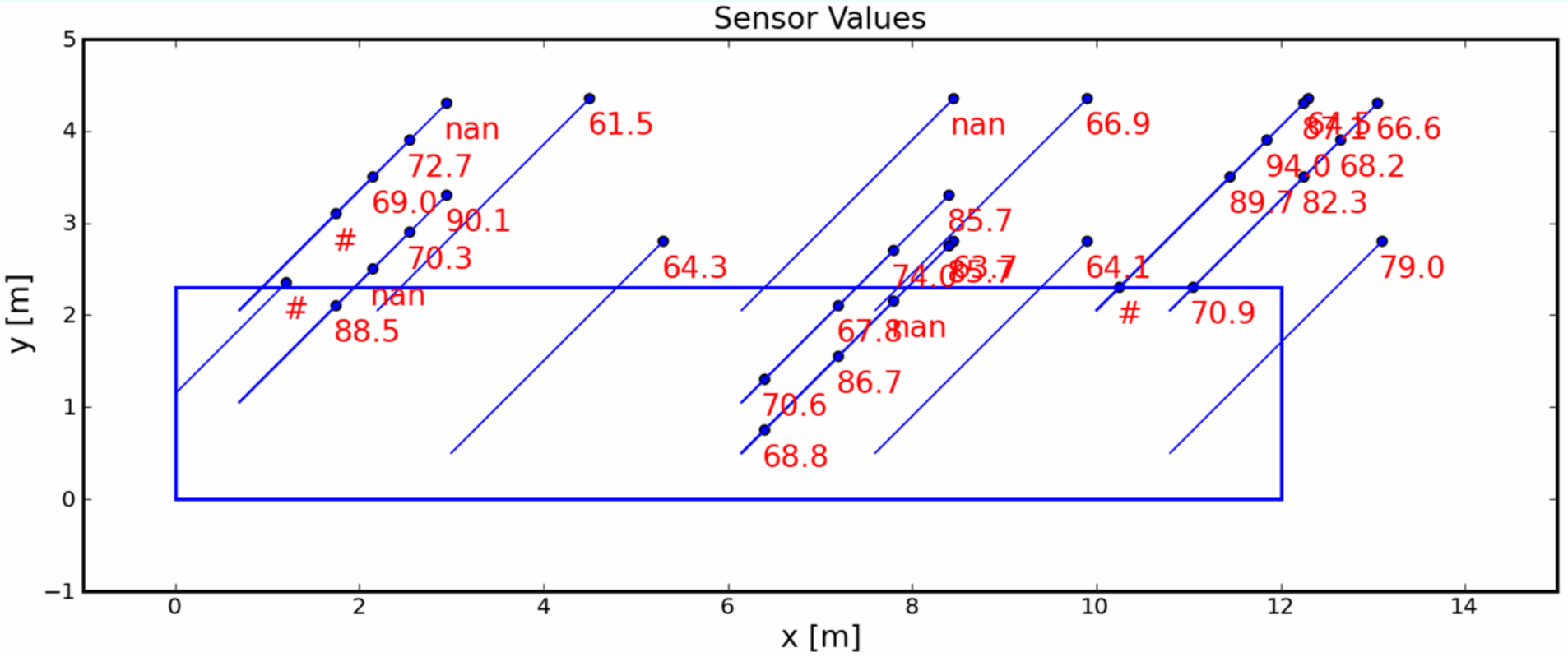
Multi-Hop: Hop Count



Multi-Hop: Temperature

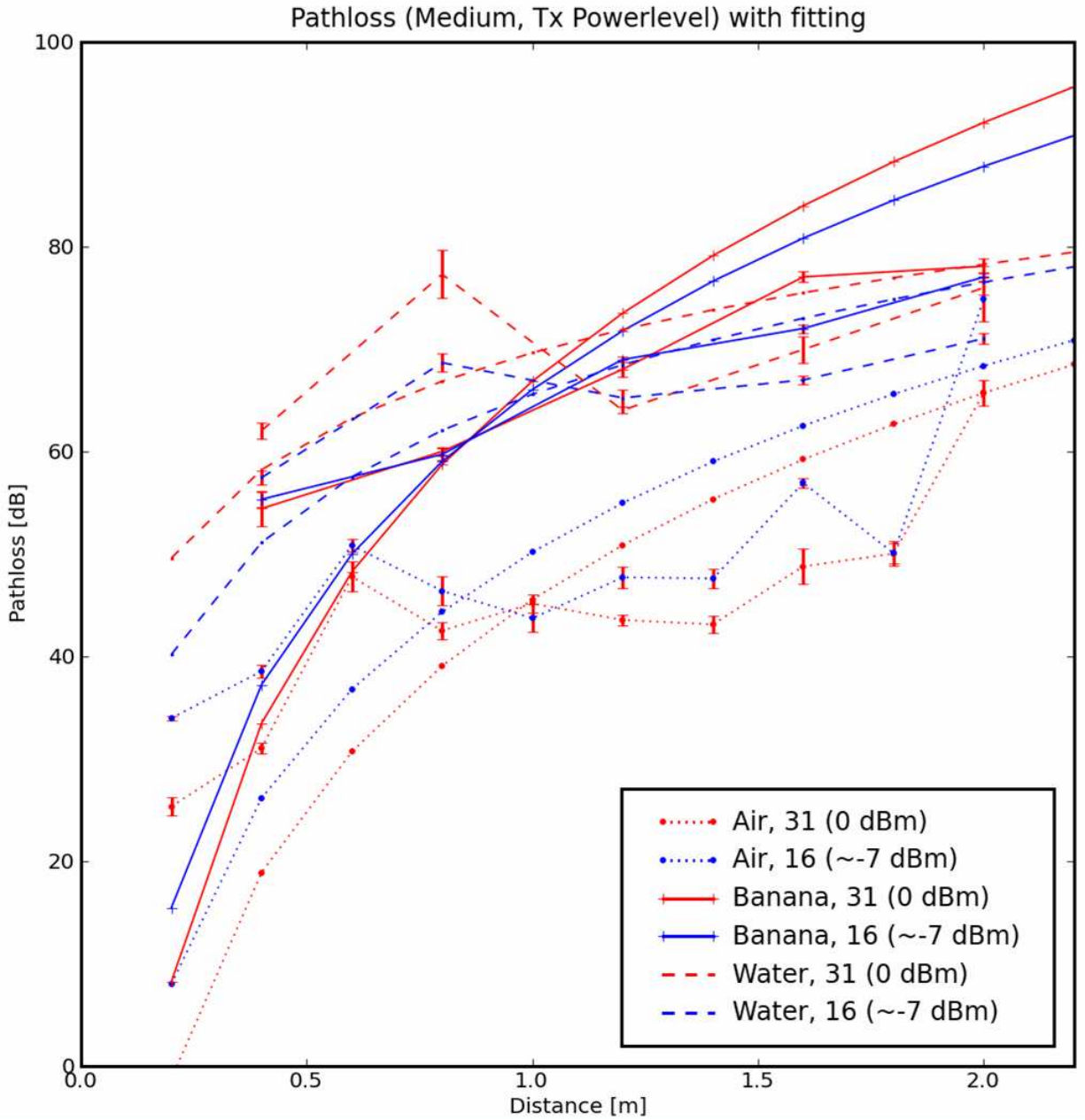


Multi-Hop: Humidity

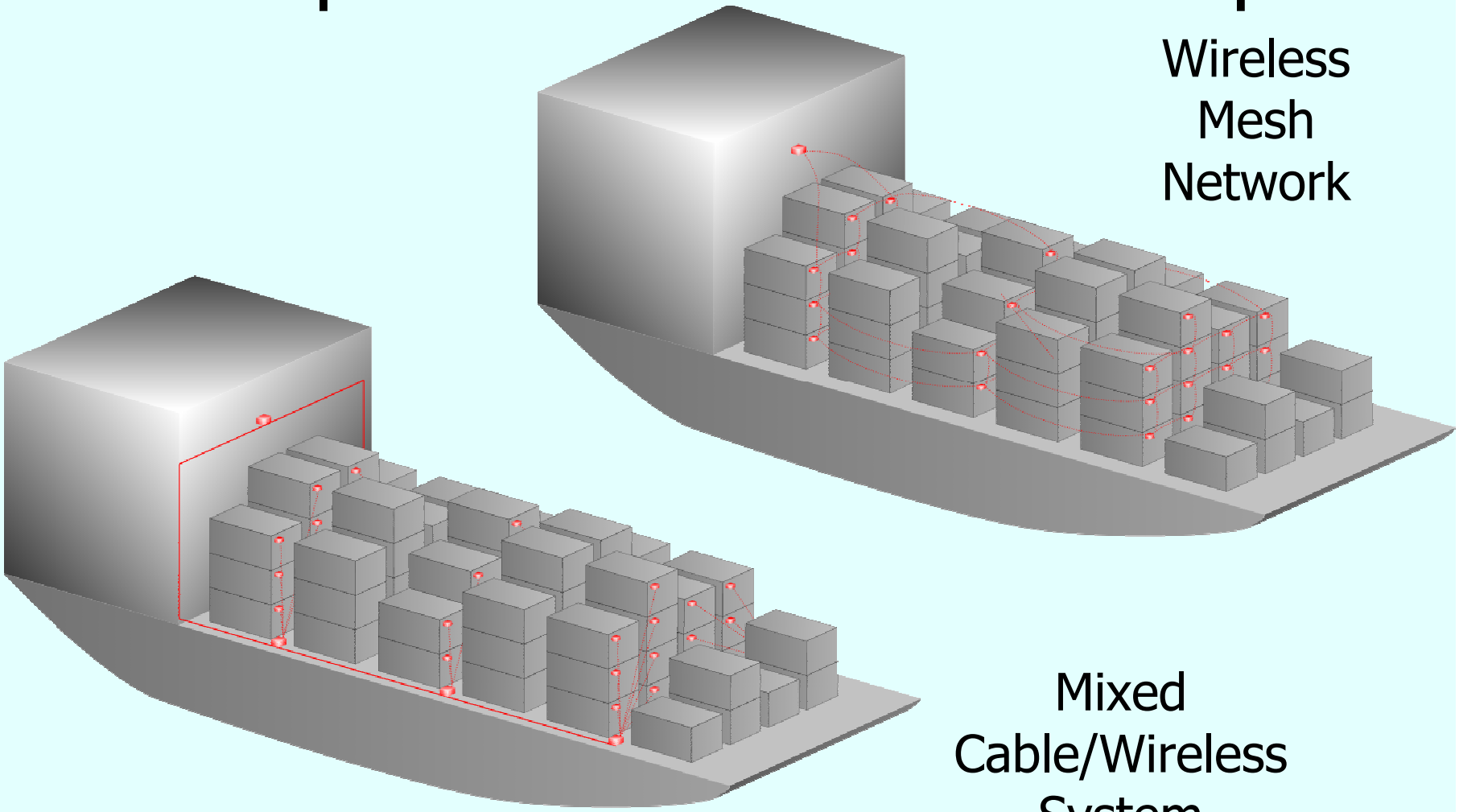


Radio Propagation Model

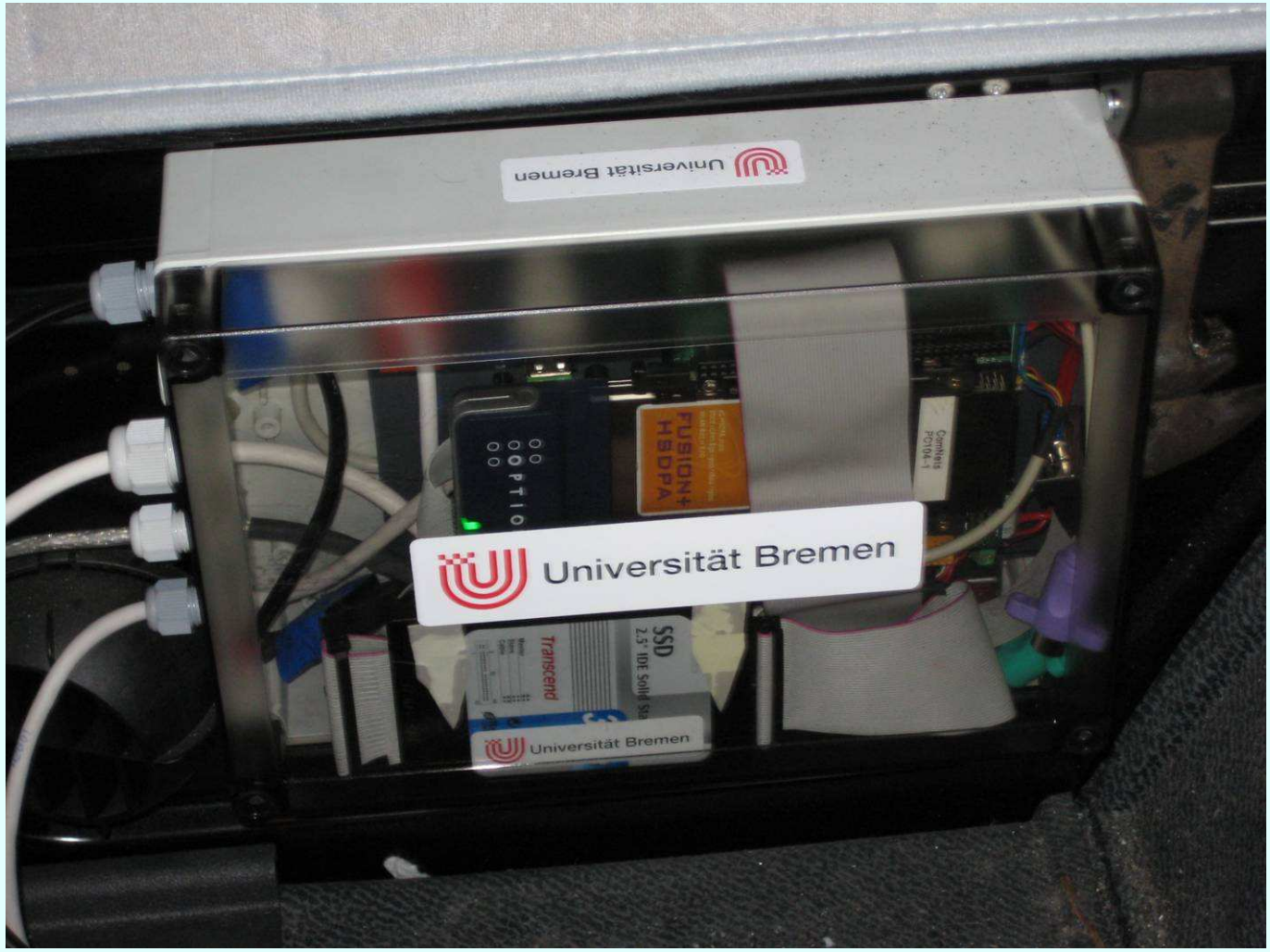
- Banana, 0 dBm:
  - L =
    66.8 dB+
    36.4 dB * log(d/d0)
  - L0 = 66.8 dB
  - Gamma = 3.6 dB
  - d0 = 1 m



On-Ship Communication Concept



Communication Service Module



Web Interface

ComNets Communication Networks — IMSAS — SCHMITZ CARGOBULL — LogDynamics Lab

SFB 637 T4 Intelligent Container Webinterface: Start

- List all Chassis
- List all Status Data
- RSS Feed
- Admin Interface

	Position	Map	Status	Status EBS	Temperatur	Temperatur erw.	Kühlaggregat	Kühlaggregat erw.	Reifendruck
2008-09-11 12:37:25.983175	2008-09-11 07:51:57		2008-09-11 07:55:07		2008-08-22 08:24:58		2008-09-11 07:47:29		
2518651	Entfernung (km)	4.6	True		17.1	None	Setpoint 1 (°C) None	Setpoint 2 (°C) None	
	Richtung	64°	None		17.5	None	Kühlaggregat None	Setpoint 3 (°C) None	
	Nächste Stadt	Bremen, Germany	True				Abtauzyklus None	Betrieb elektrisch (h) None	
	Positionszeit	2008-09-11 07:51:57	11.1				Status None	Betrieb Diesel (h) None	
	Position	Map	Status	Status EBS	Temperatur	Temperatur erw.	Kühlaggregat	Kühlaggregat erw.	Reifendruck
2008-05-19 16:33:49.150168	2008-05-19 14:34:37		None	2008-05-19 14:34:37					
5043462	Entfernung (km)	20.1	True	19658.3			Setpoint 1 (°C)	Setpoint 2 (°C)	
	Richtung	163°	True	85			Kühlaggregat	Setpoint 3 (°C)	
	Nächste Stadt	Magdeburg, Germany	True	13.6			Abtauzyklus	Betrieb elektrisch (h)	
	Positionszeit	2008-05-19 14:34:37	10.7	None			Status	Betrieb Diesel (h)	
	Position	Map	Status	Status EBS	Temperatur	Temperatur erw.	Kühlaggregat	Kühlaggregat erw.	Reifendruck
2008-05-15 14:16:08.941323	2008-05-15 12:02:45			2008-05-15 12:02:45					
55553462	Entfernung (km)	12.7		18073.7			Setpoint 1 (°C)	Setpoint 2 (°C)	
	Richtung	28°		68			Kühlaggregat	Setpoint 3 (°C)	
	Nächste Stadt	Bayreuth, Germany		7.2			Abtauzyklus	Betrieb elektrisch (h)	
	Positionszeit	2008-05-15 12:02:45		None			Status	Betrieb Diesel (h)	

Summary

- ICT for logistics: sensing and communication services
  - Economically and ecologically expedient
- Multi-Hop communication necessary in loaded containers
- Specific Radio Propagation in containers

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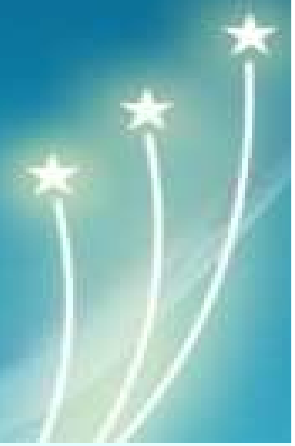

Questions & Answers

www.sfb637.uni-bremen.de/?L=2

www.comnets.uni-bremen.de

www.intelligentcontainer.com