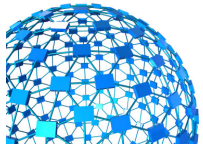
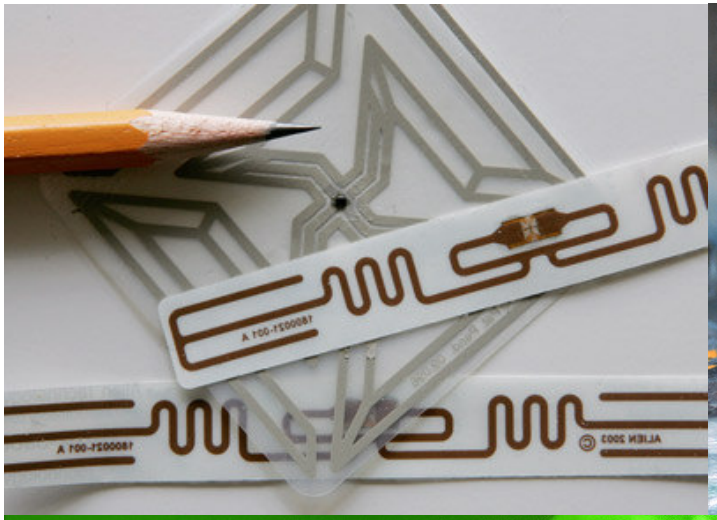
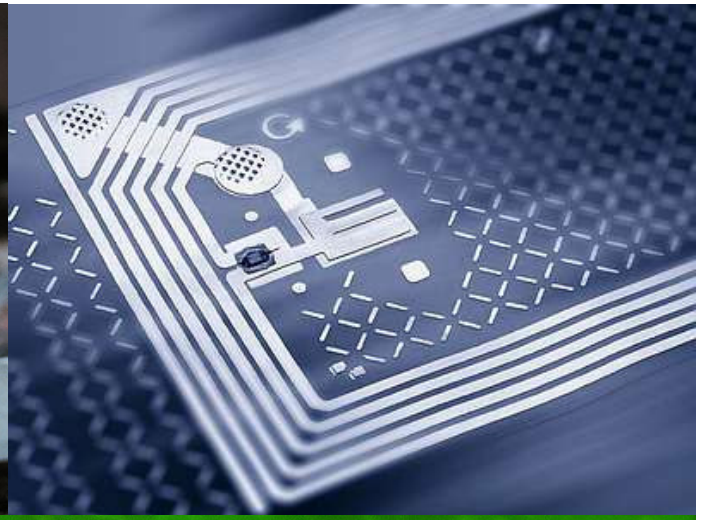
HYBRID

RFID



TWO-WAY TAG SYSTEM





ENG281-S1, Group:17, Girish N. Jadhav,
San Jose State University.

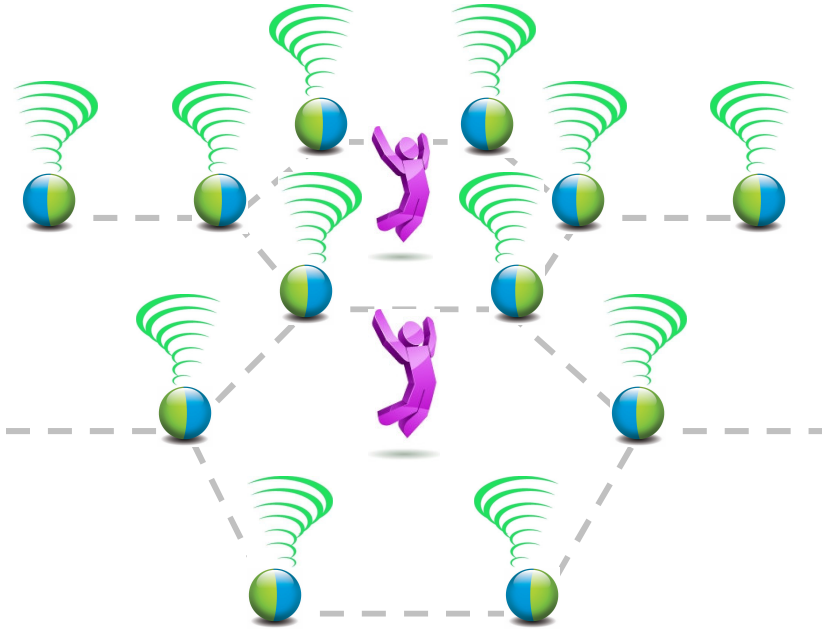
Outline:

1. Abstract.
2. Problem Statement.
3. Hypothesis.
4. Application.
5. Vision, Mission, Goals, Objectives.
6. Technology, Industry, and Architecture Survey.
7. Preliminary Scope and Evaluation.
8. Reason to Fund.
9. Development Cost, Feasibility Analysis.
10. Schedule and Milestone.
11. Committee Structure.
12. References.

Hybrid RFID-based System using active two-way tags.

Abstract:

The RFID-based system is used by most of the industries for tracking objects . In spite of it's widely used the limitation to track when the objects goes out of range has been a biggest problem.



RFID: Radio-Frequency Identification.

Problem Statement…

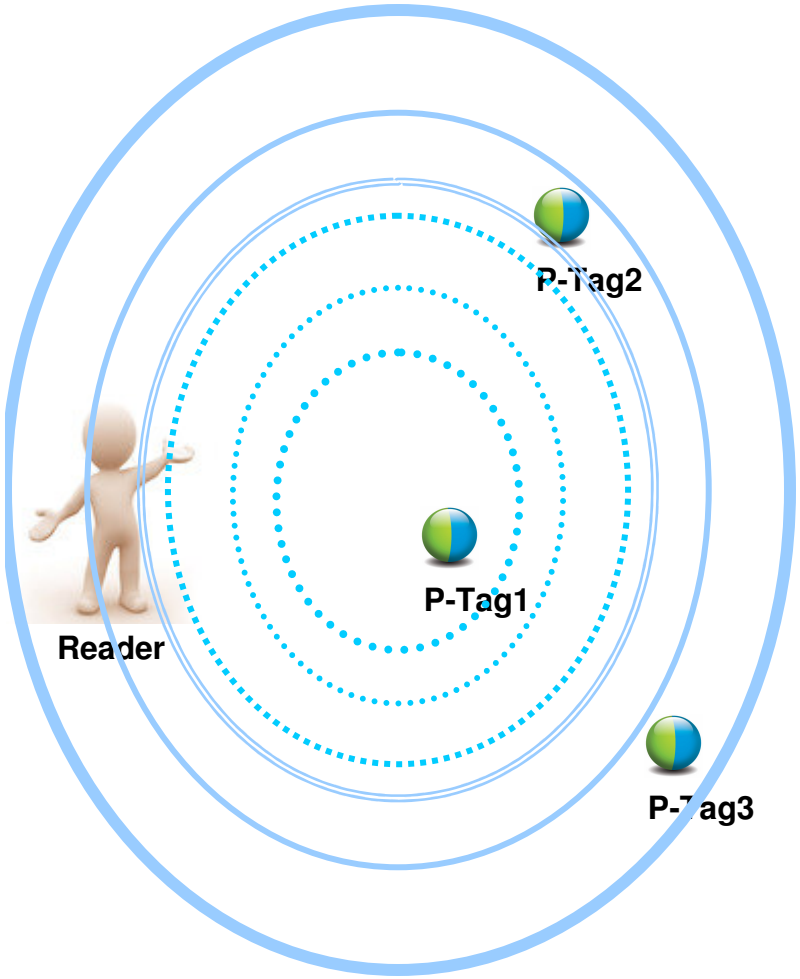
P-Tag2

Reader

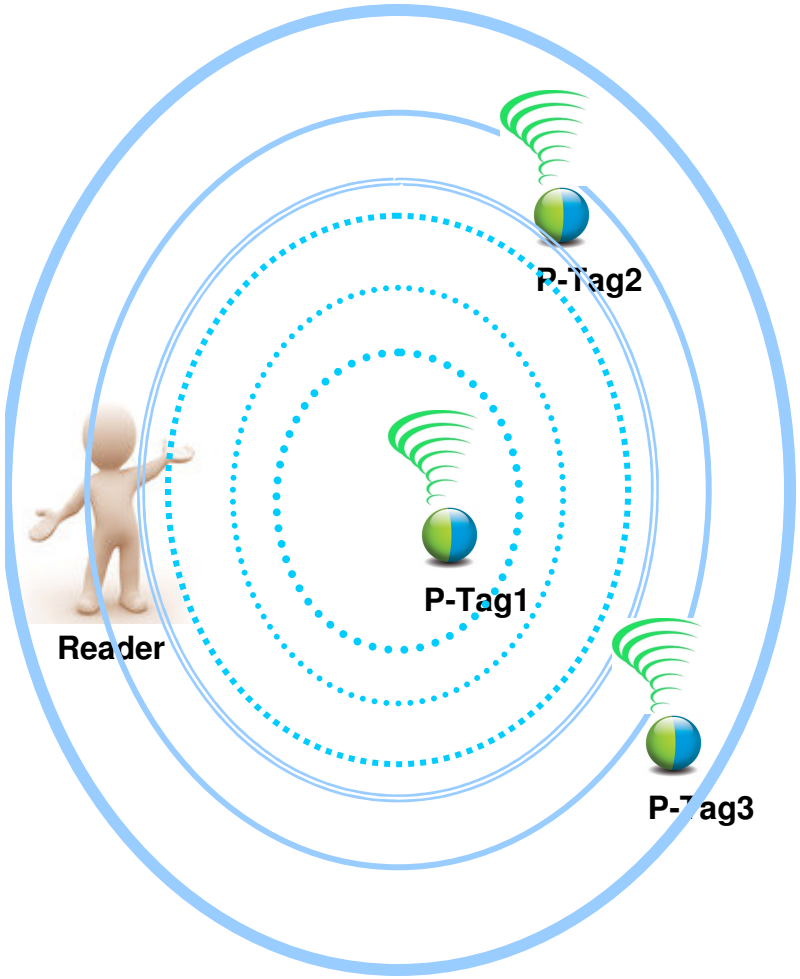
P-Tag1

P-Tag3

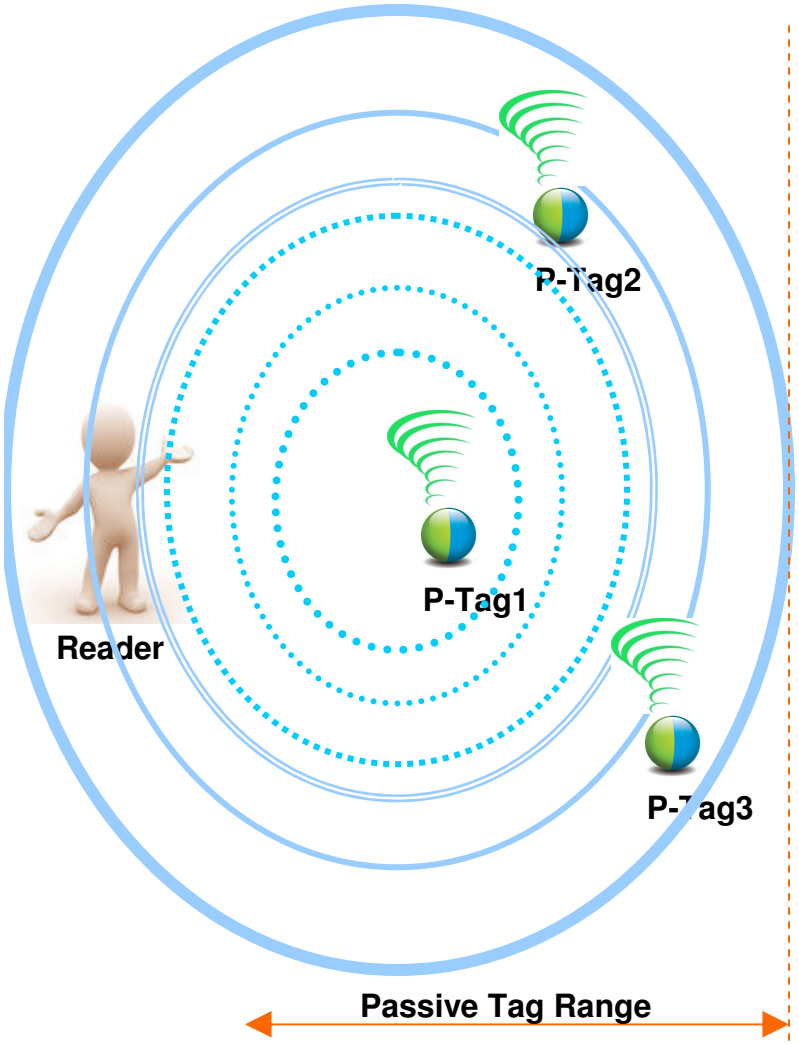
Problem Statement…



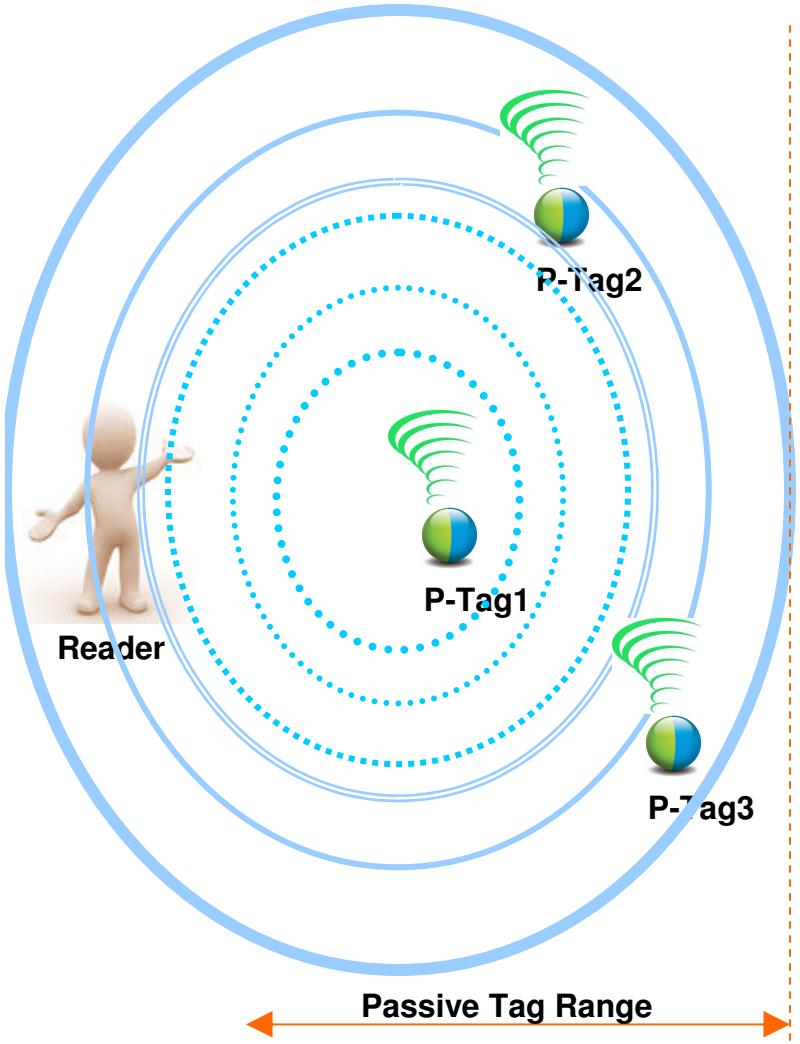
Problem Statement…



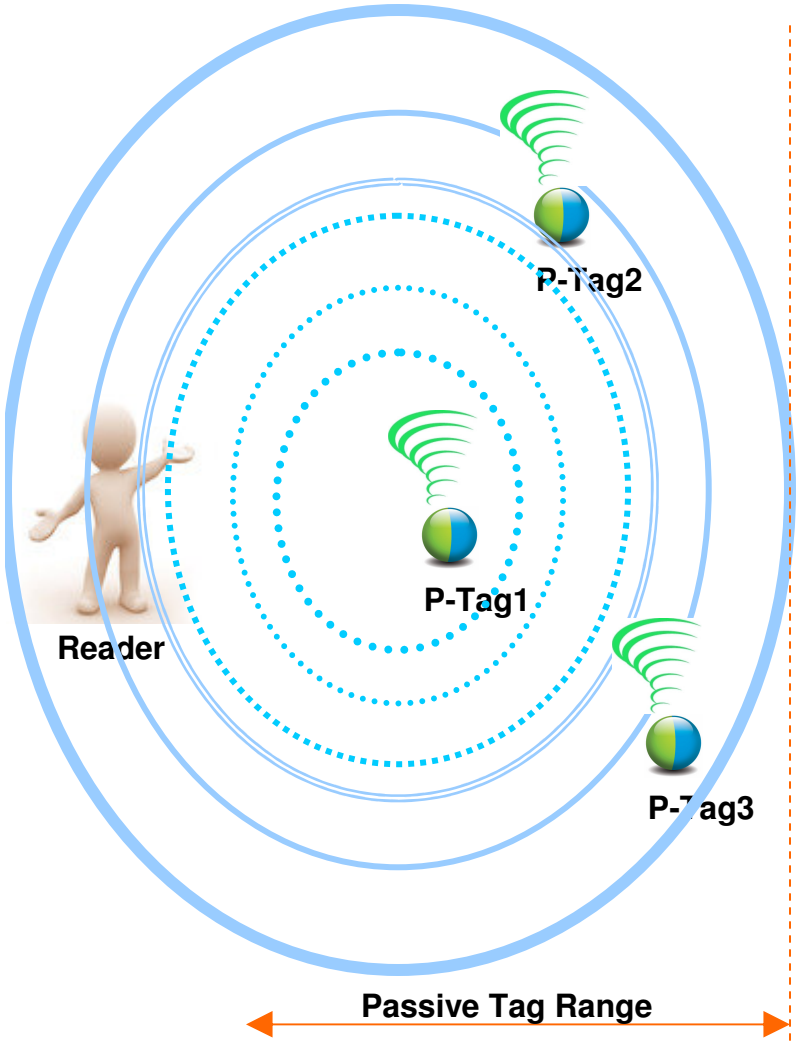
Problem Statement…



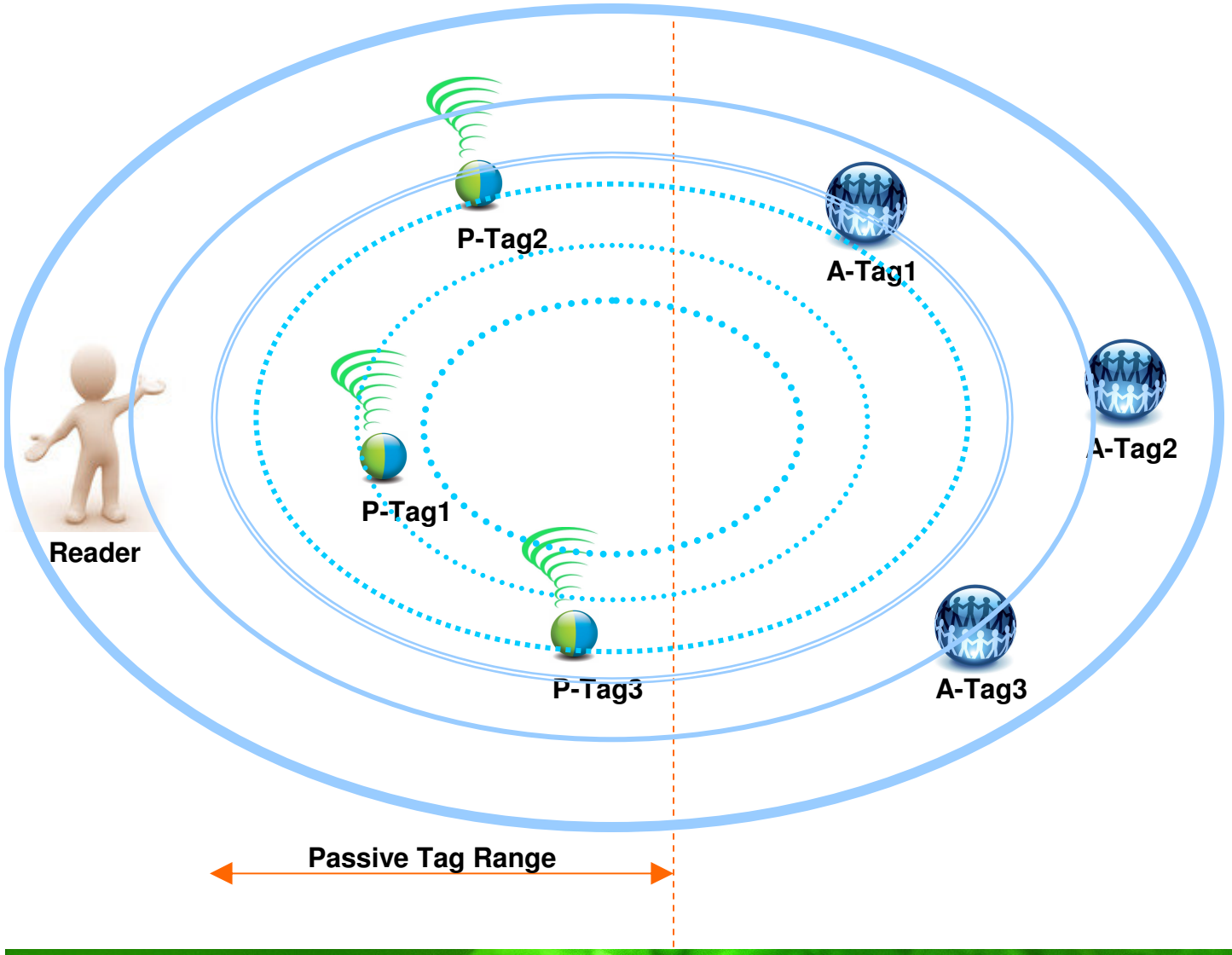
Problem Statement…



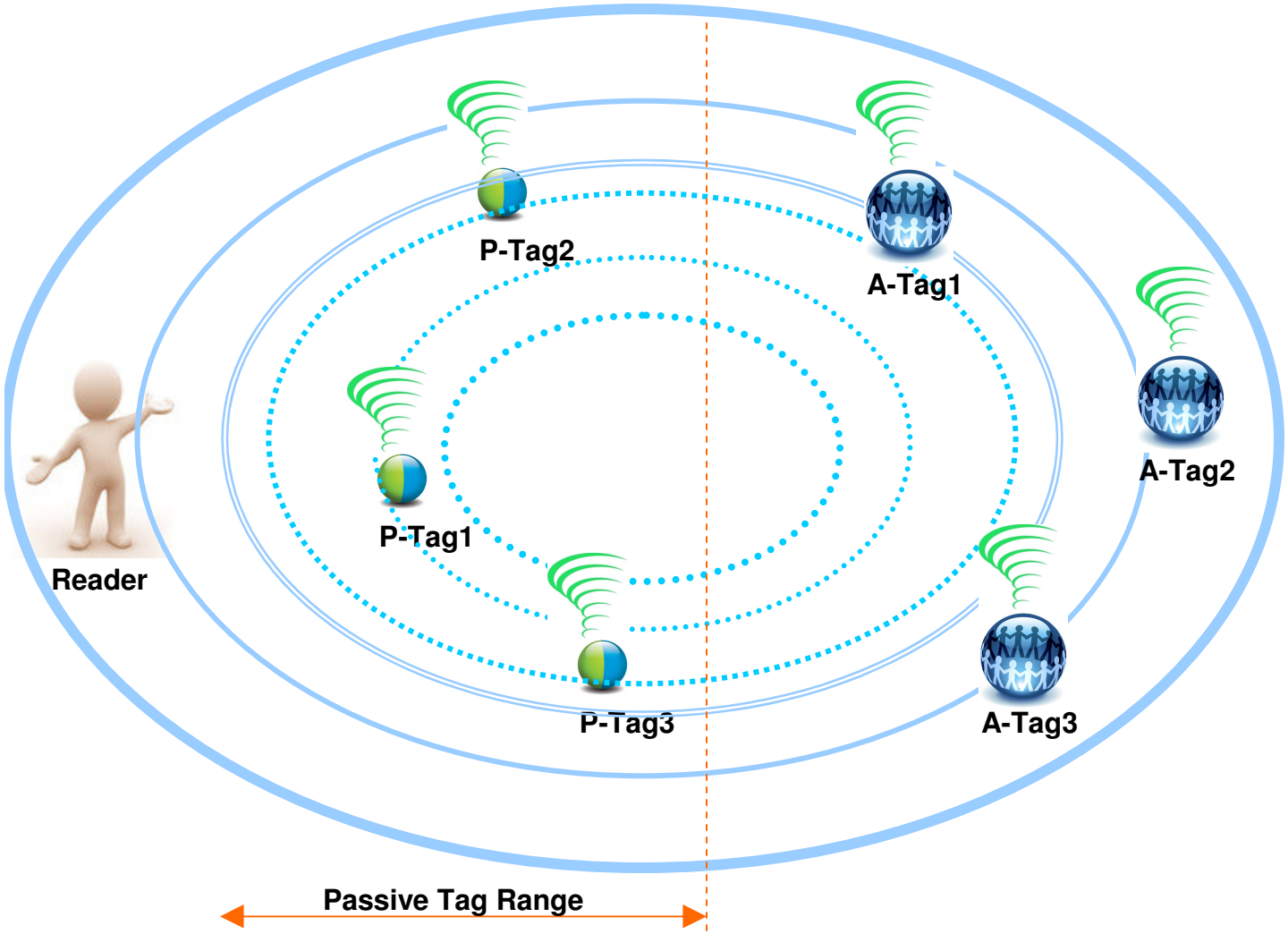
Problem Statement…



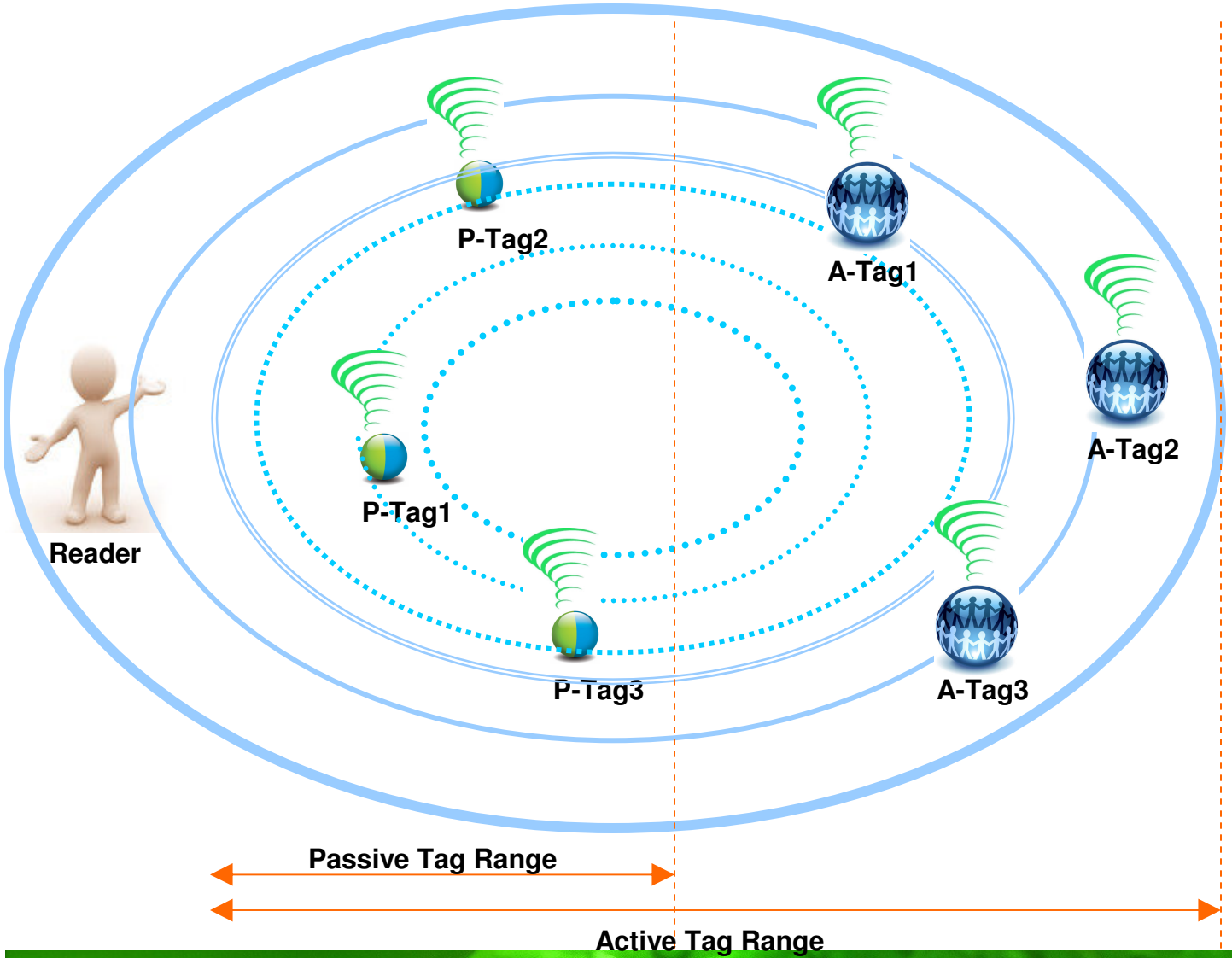
Problem Statement…



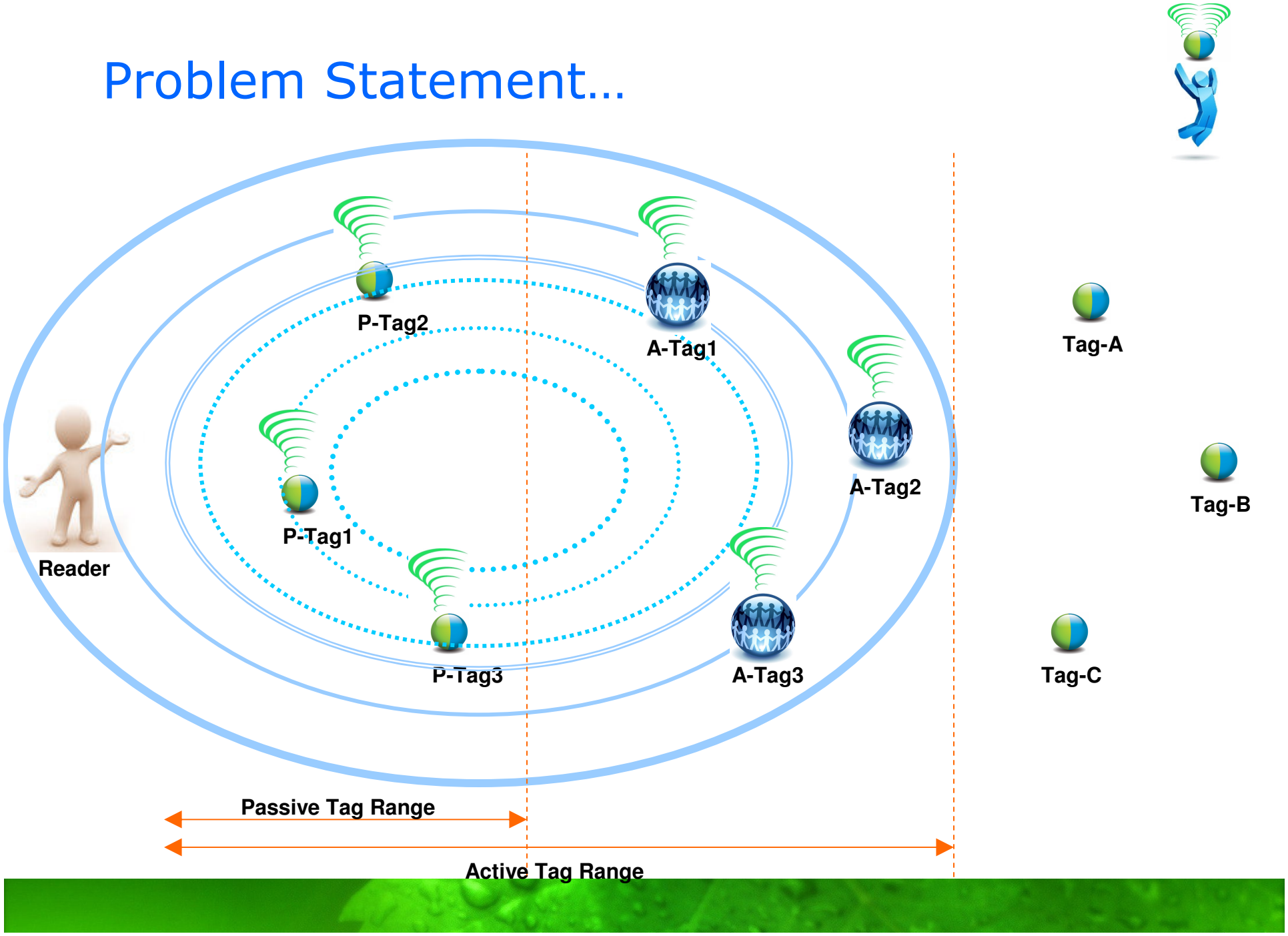
Problem Statement…



Problem Statement…

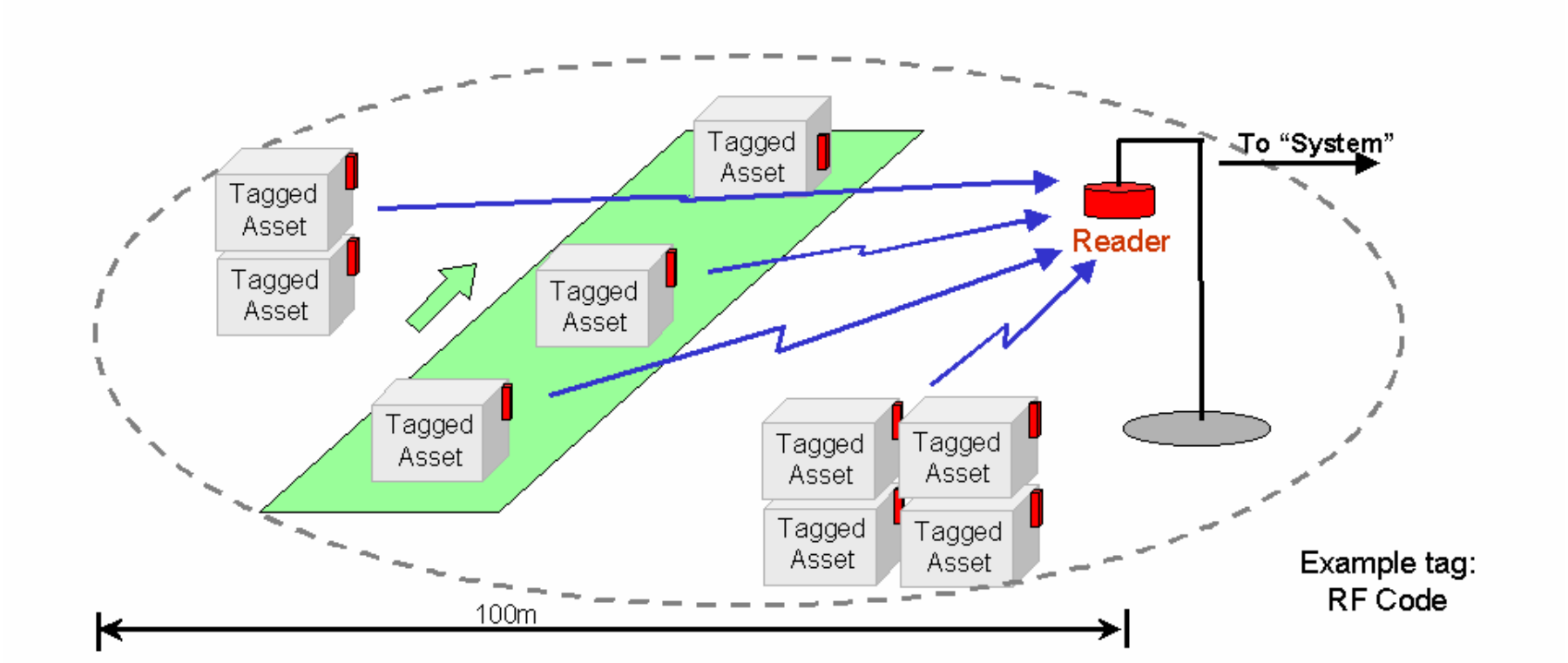


Problem Statement…

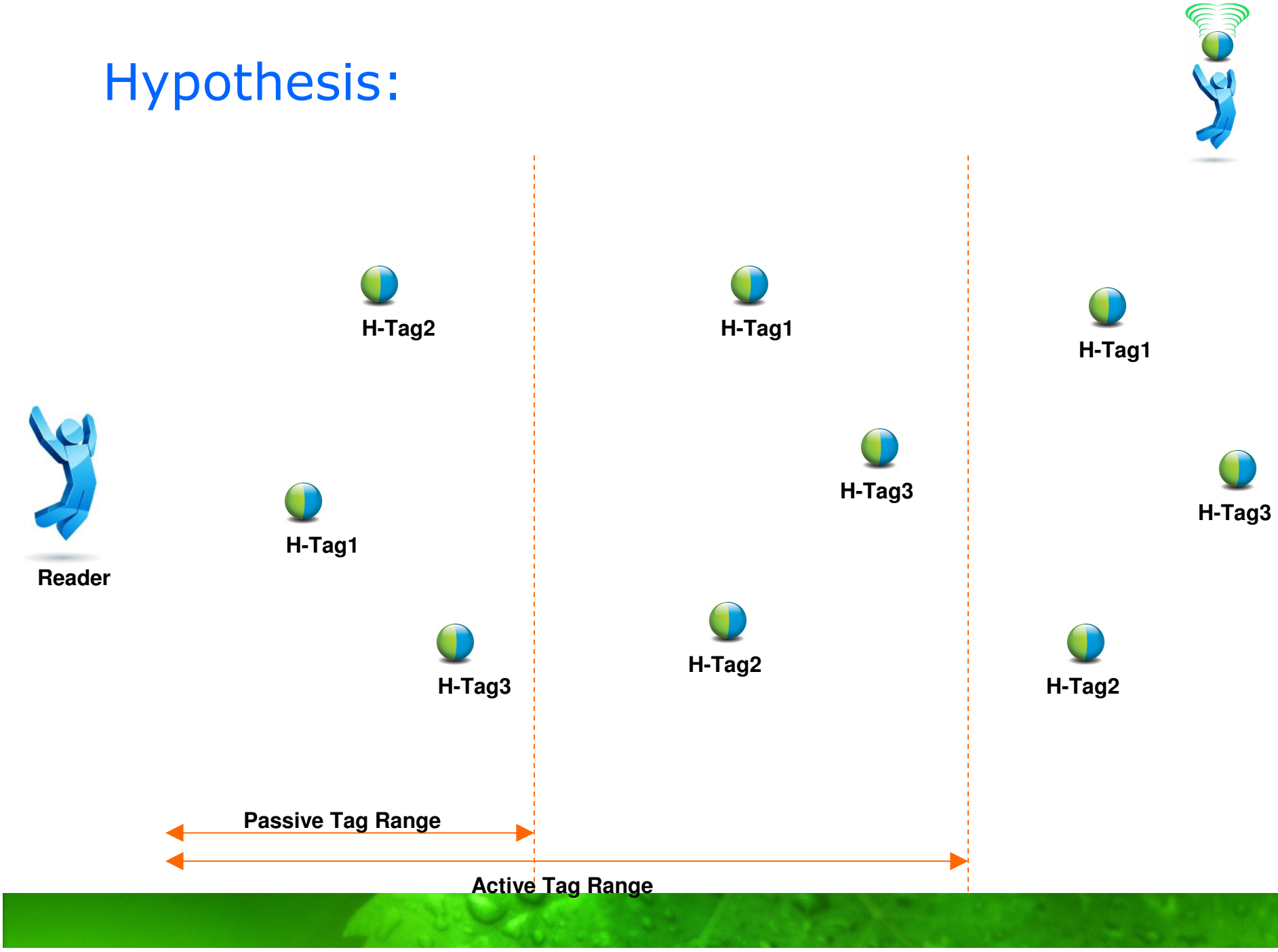


Problem Statement…

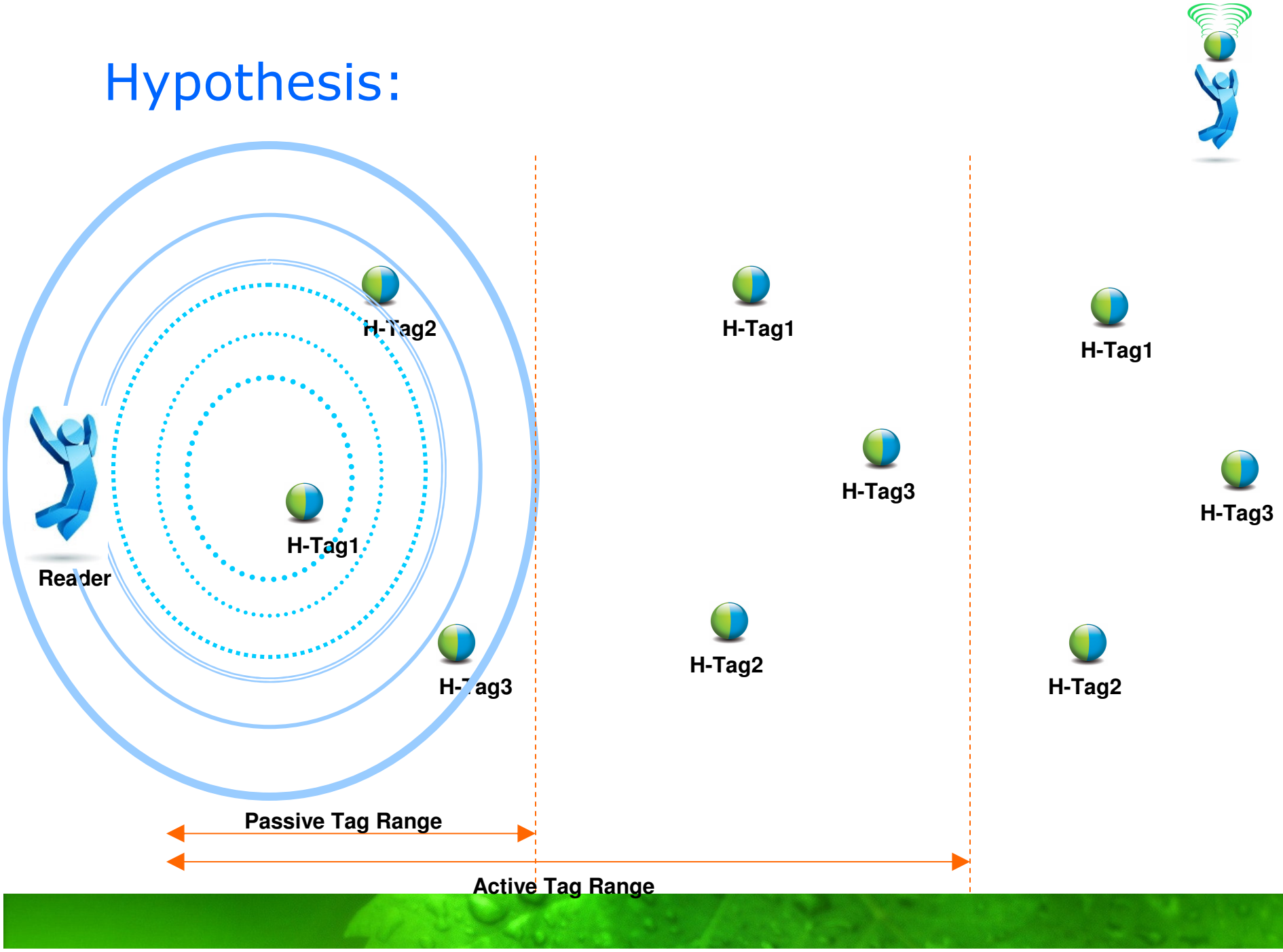
Present situation: example



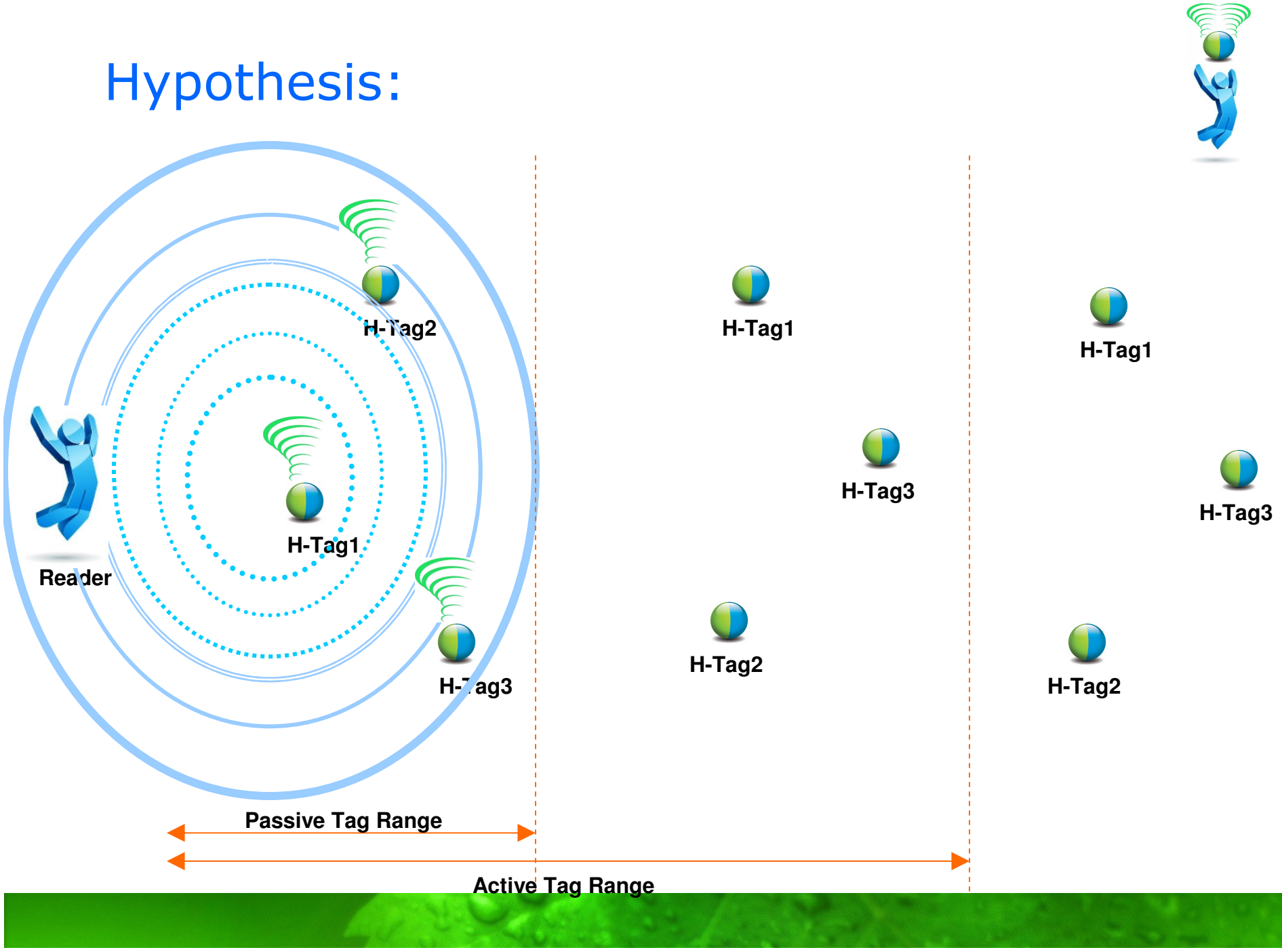
Hypothesis:


H-Tag2
H-Tag1
H-Tag1
H-Tag3
H-Tag3
H-Tag1
Reader
H-Tag3
H-Tag2
H-Tag2
Passive Tag Range
Active Tag Range

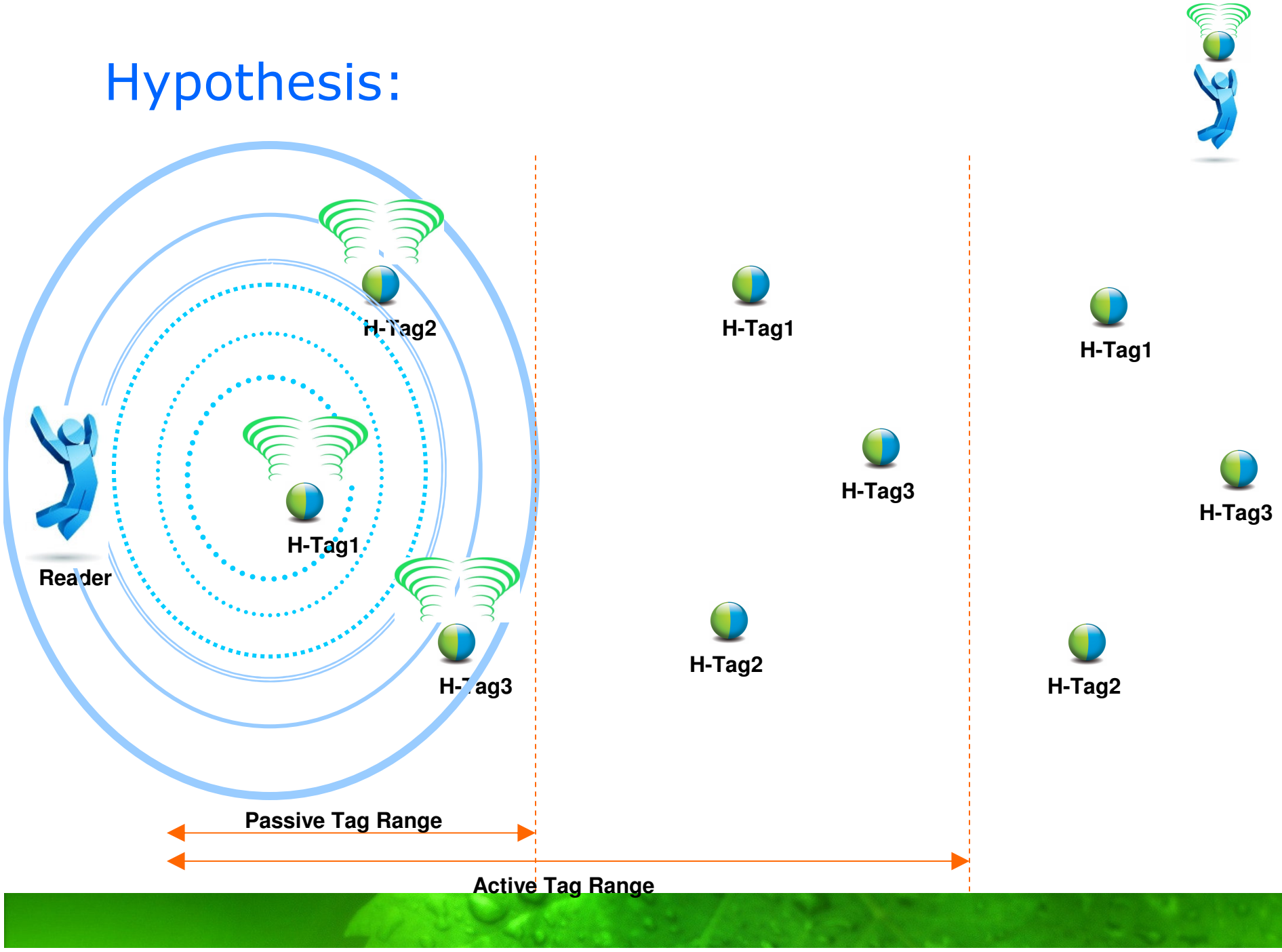
Hypothesis:


H-Tag2
H-Tag1
H-Tag1
H-Tag3
H-Tag3
Reader
H-Tag1
H-Tag3
H-Tag2
H-Tag2
Passive Tag Range
Active Tag Range

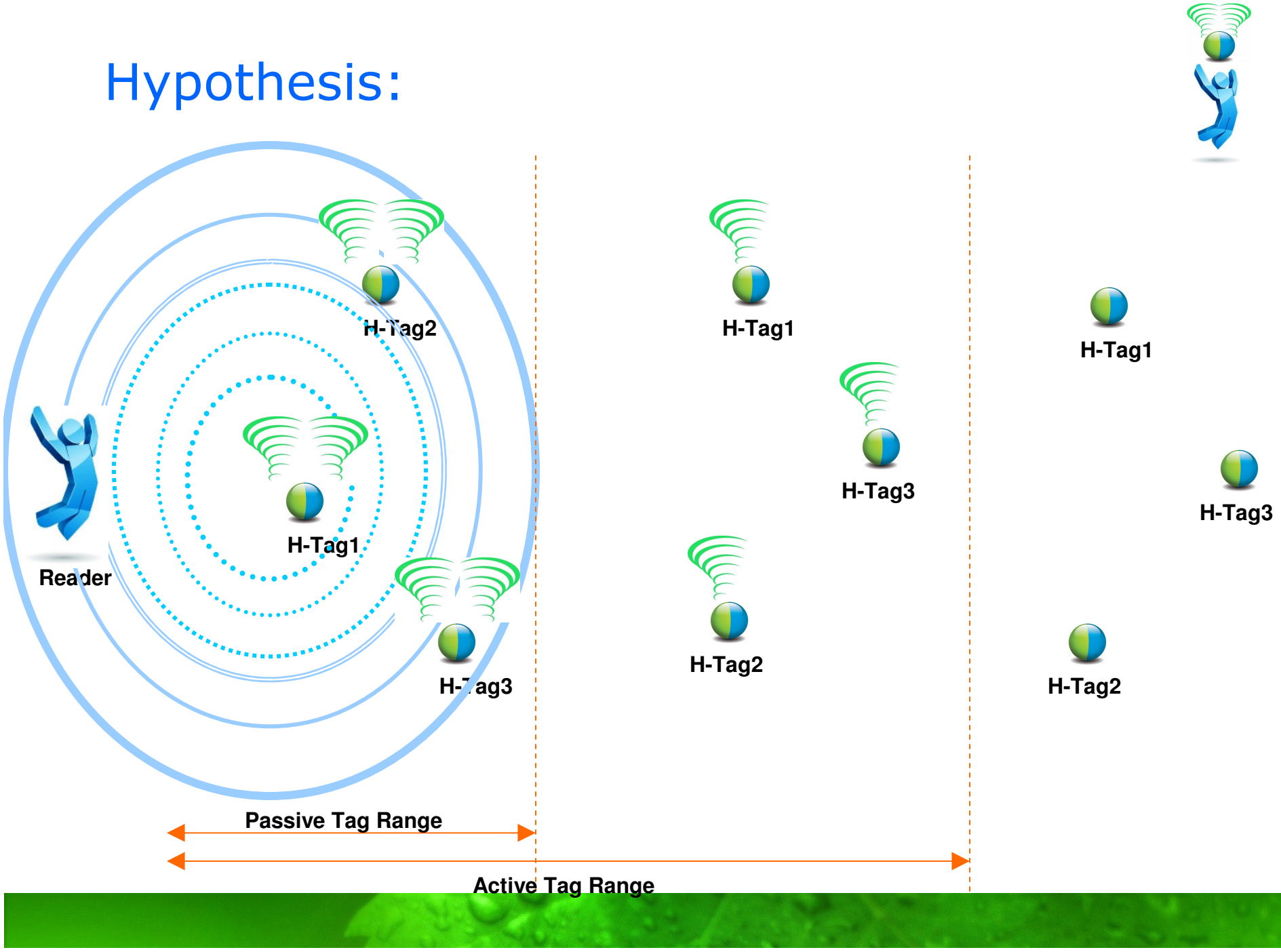
Hypothesis:


H-Tag2
H-Tag1
H-Tag1
H-Tag3
H-Tag3
Reader
H-Tag1
H-Tag3
H-Tag2
H-Tag2
Passive Tag Range
Active Tag Range

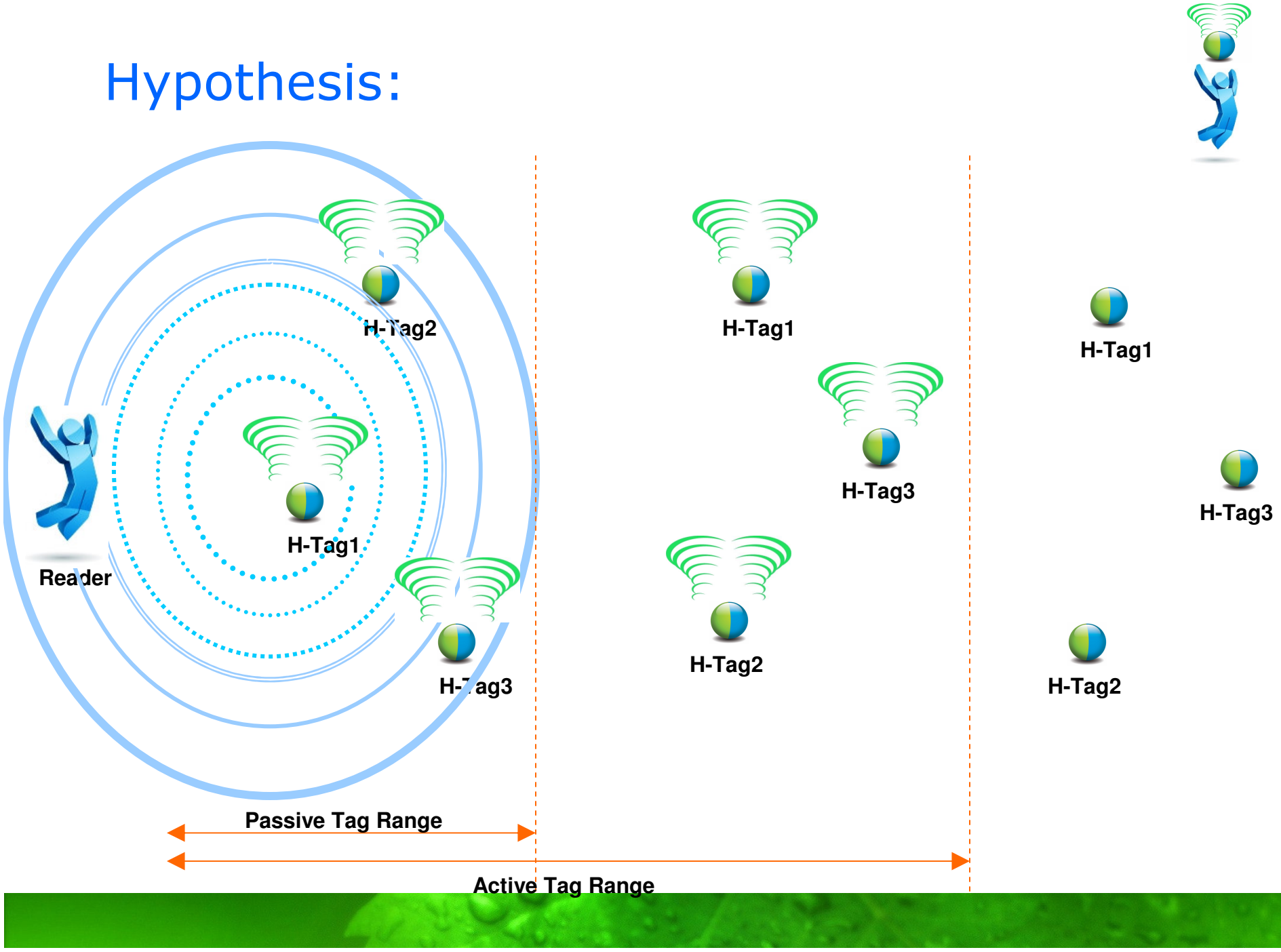
Hypothesis:


H-Tag2
H-Tag1
H-Tag1
H-Tag3
H-Tag3
Reader
H-Tag1
H-Tag2
H-Tag2
H-Tag3
Passive Tag Range
Active Tag Range

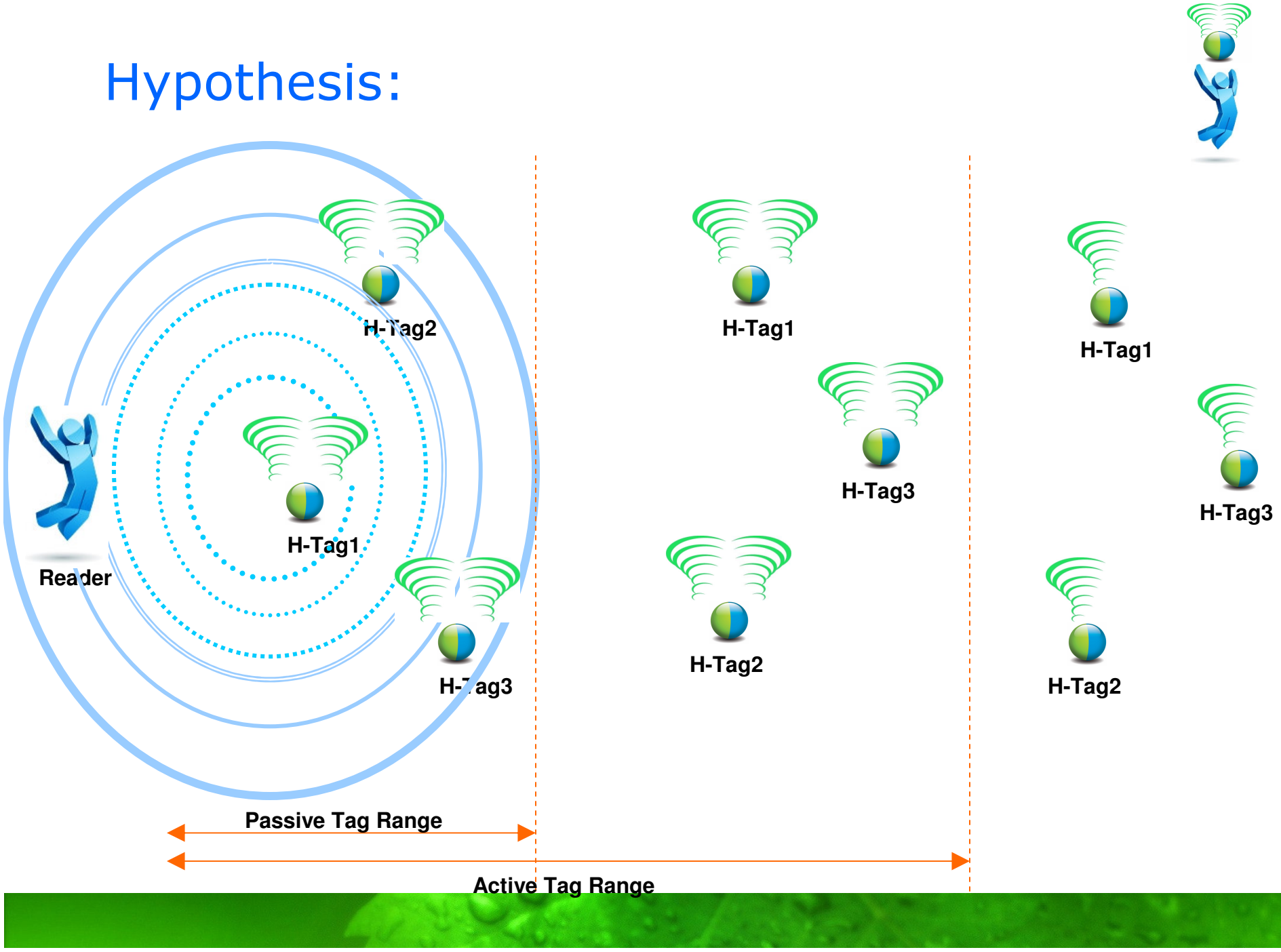
Hypothesis:


H-Tag2
H-Tag1
H-Tag1
H-Tag3
H-Tag3
Reader
H-Tag1
H-Tag3
H-Tag2
H-Tag2
Passive Tag Range
Active Tag Range

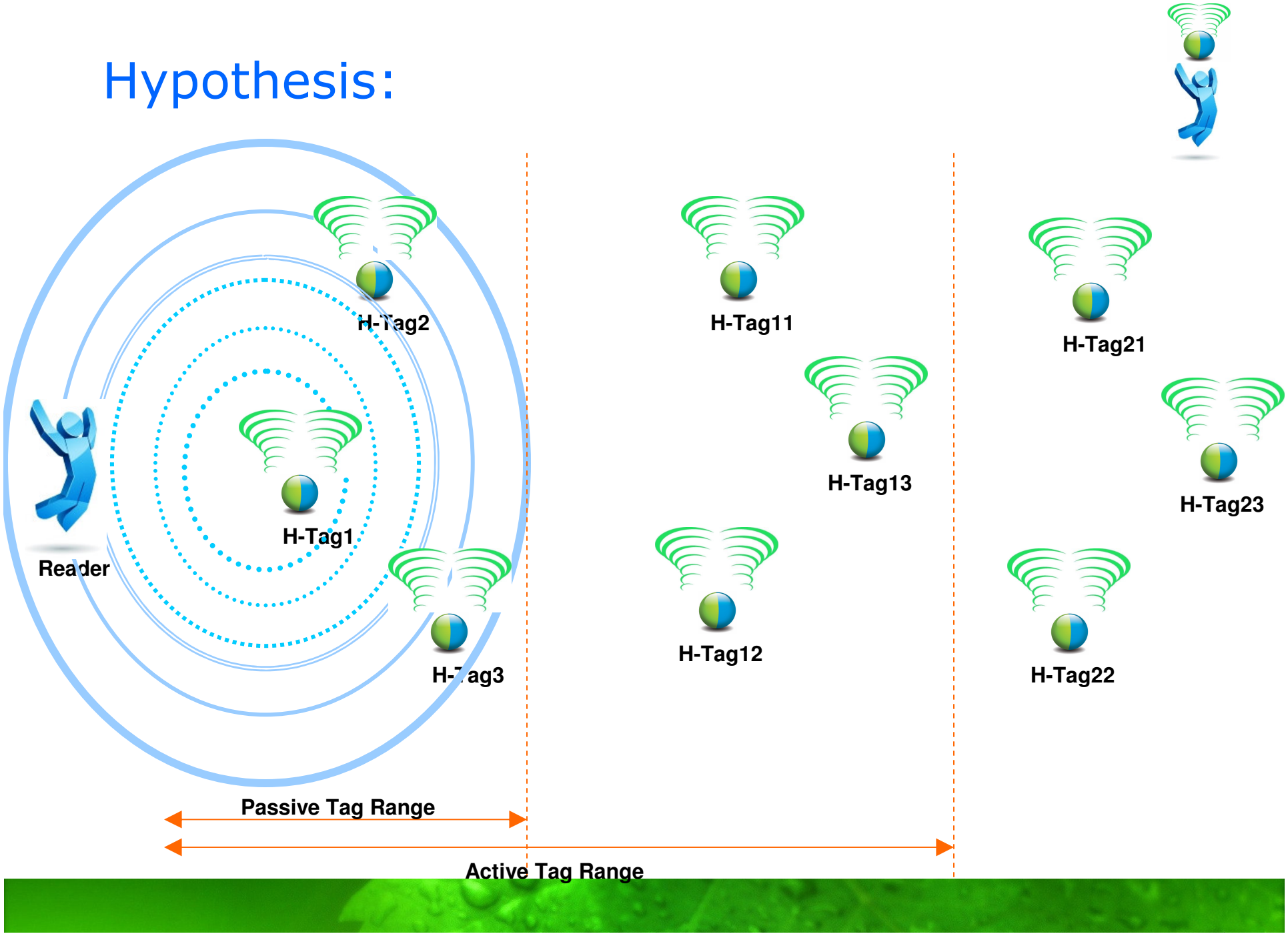
Hypothesis:


H-Tag2
H-Tag1
H-Tag1
H-Tag3
H-Tag3
Reader
H-Tag1
H-Tag3
H-Tag2
H-Tag2
Passive Tag Range
Active Tag Range

Hypothesis:


H-Tag2
H-Tag1
H-Tag3
Reader
H-Tag3
H-Tag1
H-Tag3
H-Tag1
H-Tag2
H-Tag2
Passive Tag Range
Active Tag Range

Hypothesis:


H-Tag2
H-Tag11
H-Tag21
H-Tag13
H-Tag23
H-Tag1
Reader
H-Tag12
H-Tag22
H-Tag3
Passive Tag Range
Active Tag Range

Hypothesis:

Based on the analysis, provide a new system which overcomes the existing deficiency of limited range. The thesis focus will be to provide a new RFID-based system by using active two-way tag that can communicate to other tags by powering their own communications.

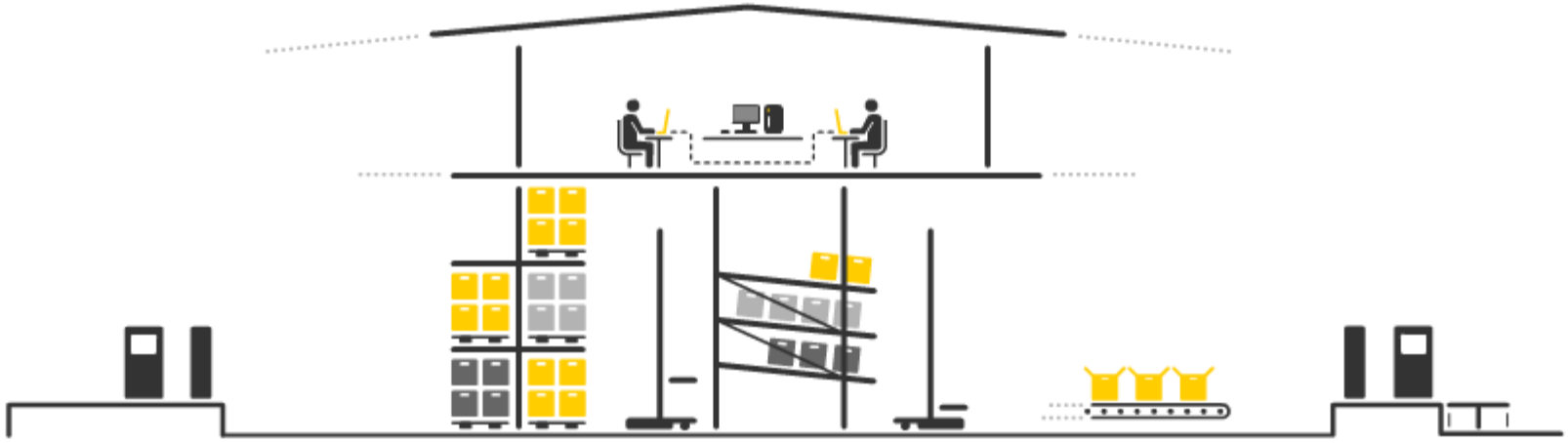
Developing an prototype of active two-way tag and integrating with hybrid RFID-based system to increase the tracking range.

Note:
RFID: Radio-Frequency Identification.
LF: Low Frequency
HF: High Frequency
UHF: Ultra High Frequency.

Applications

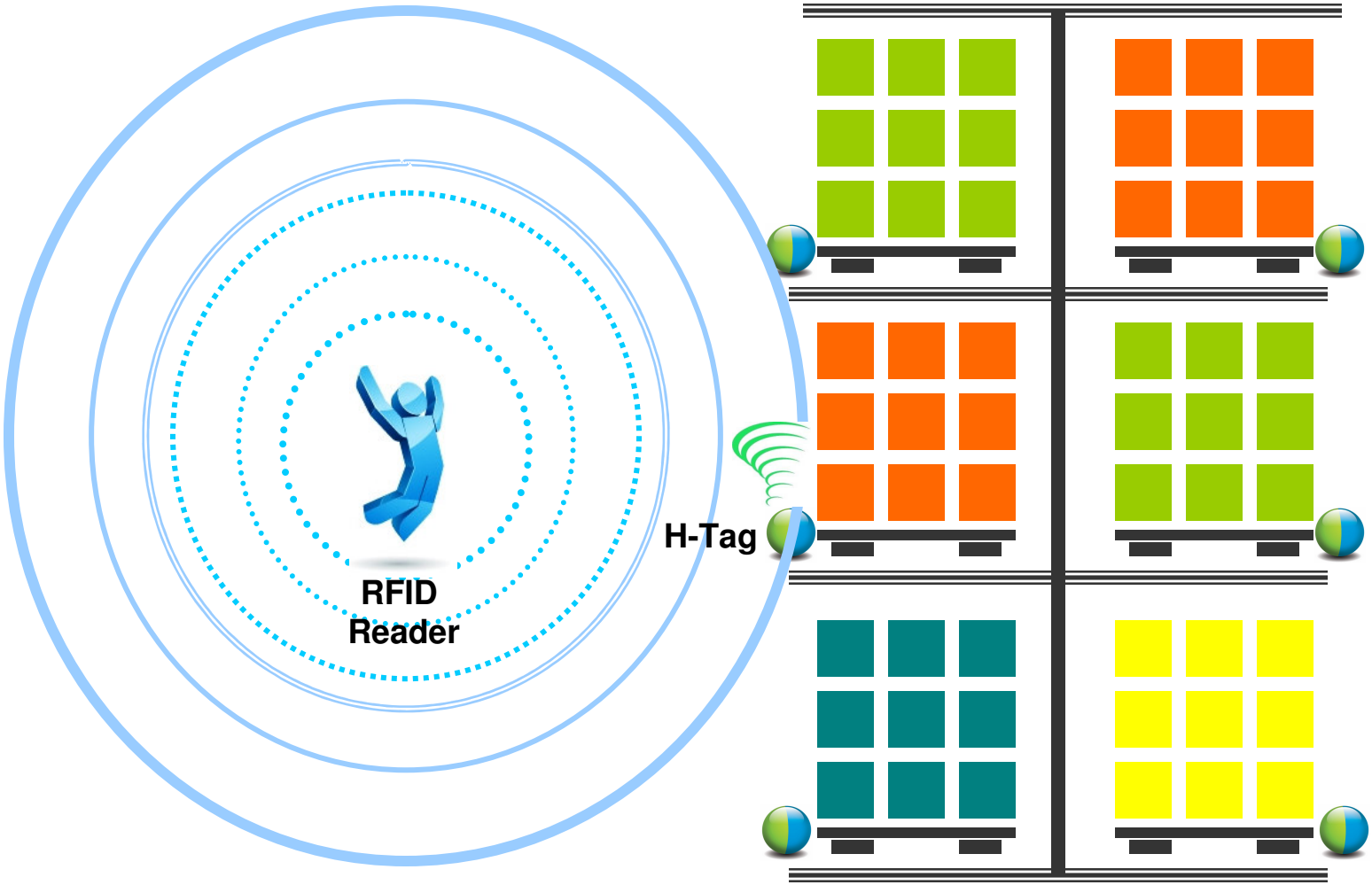
1. Multiple Level of Asset tracking in
   Warehouse, Manufacture, Production, e.t.c.

2. Item Locator in Warehouse or in dock.



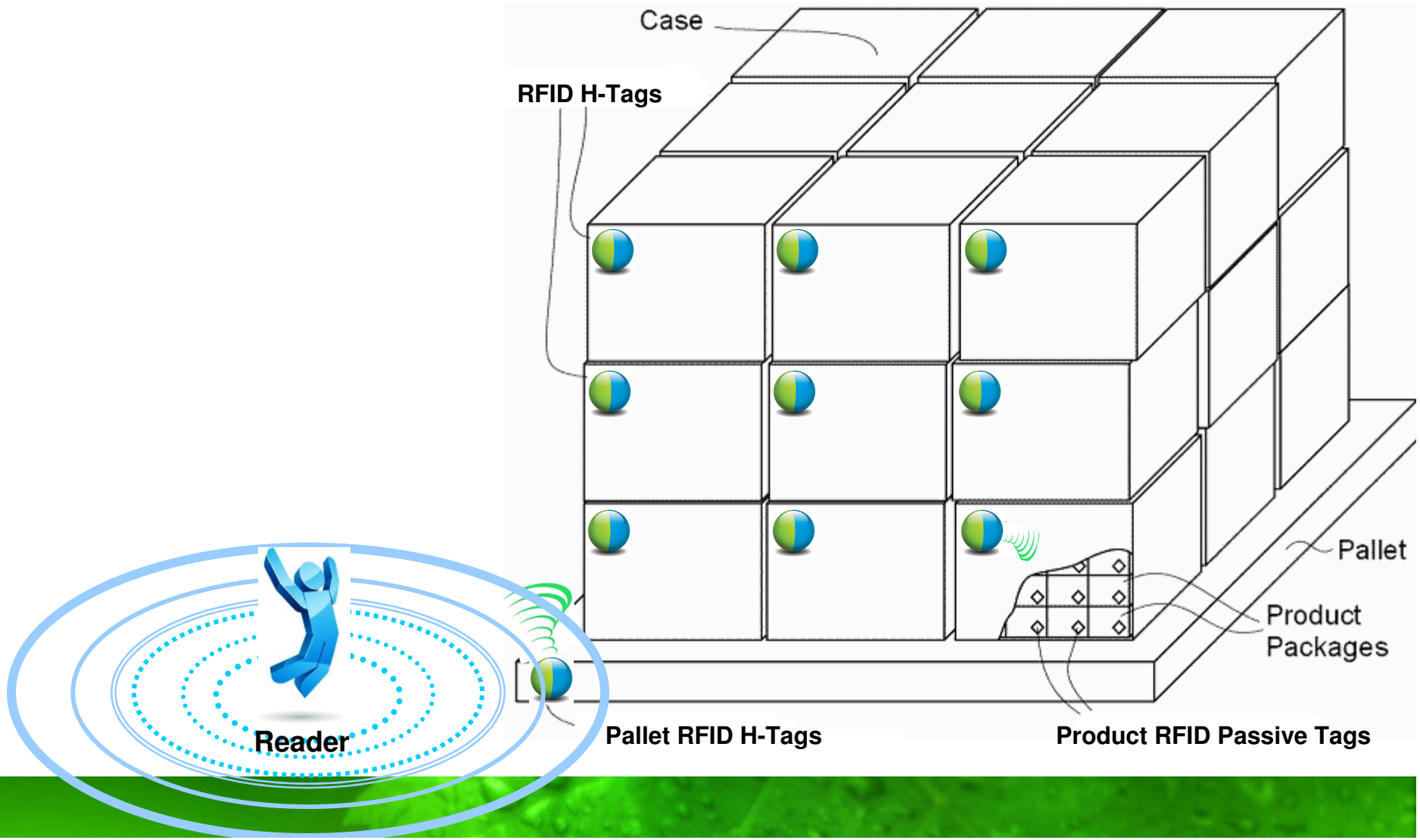
Application Diagram

1. Multiple Level of Asset tracking



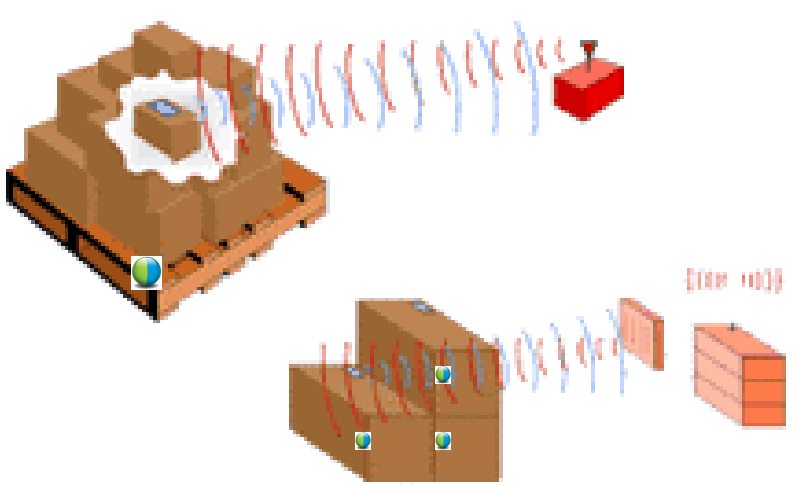
Application Diagram

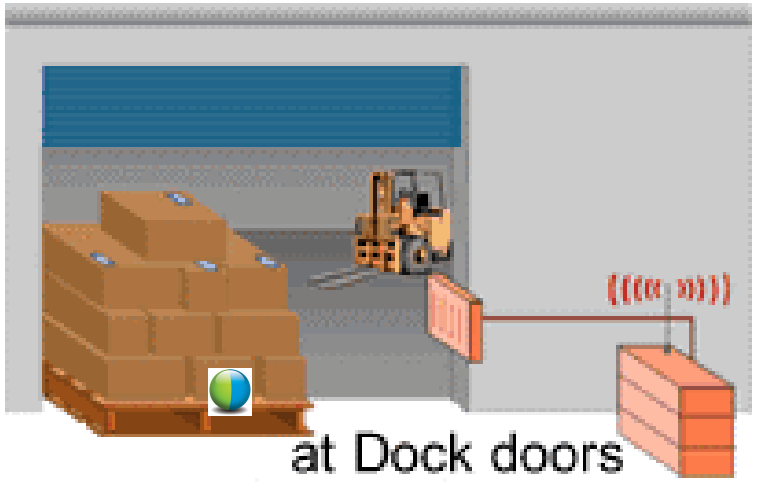
1. Multiple Level of Asset tracking



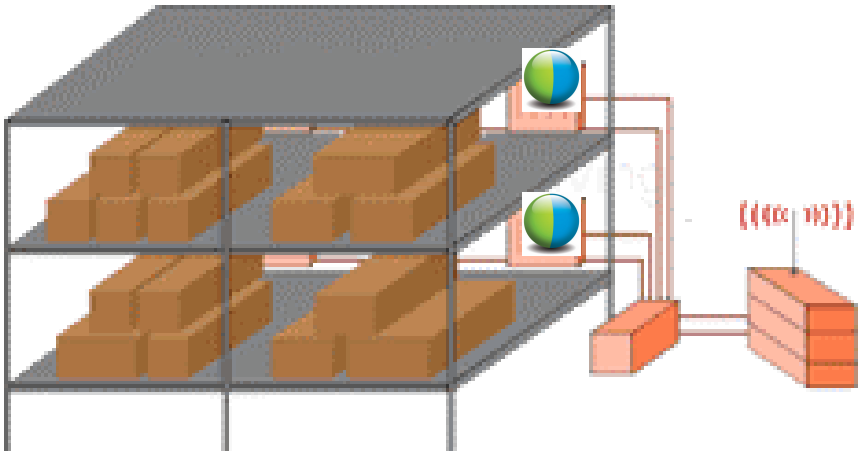
Application Diagram

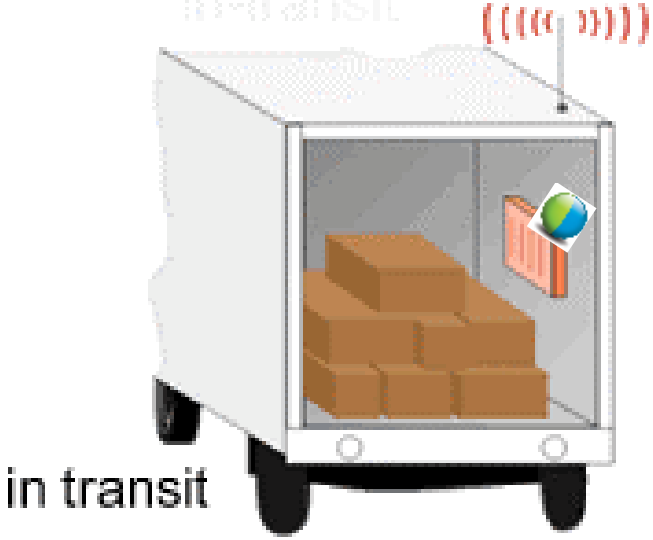
2. Item Locator in Warehouse or in dock.





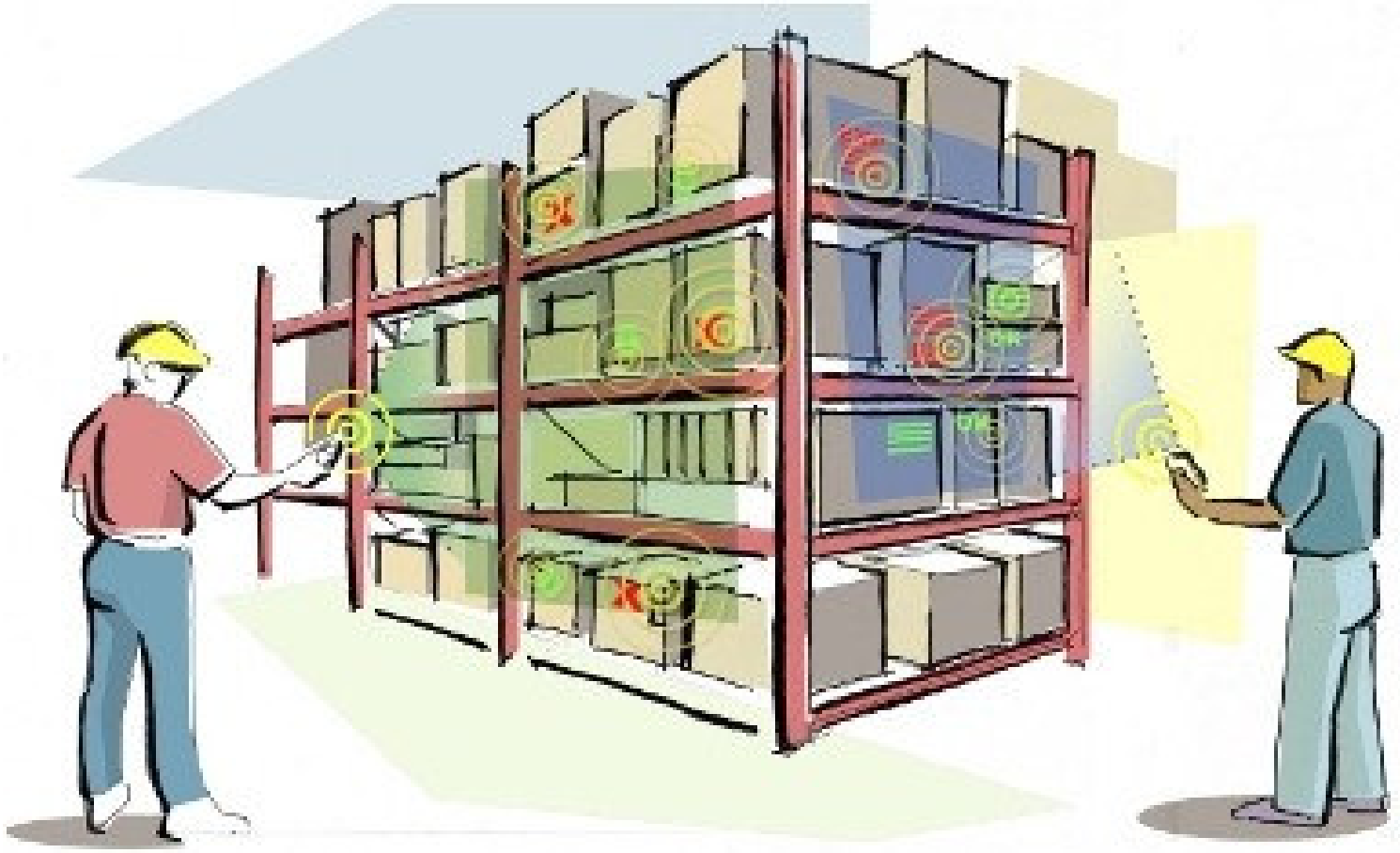
Rack and Shelving





Application Diagram

2. Item Locator in Warehouse or in dock.



Application Diagram

Enable or develop

Wide Read Range, high performance

&

cost effective

semiconductor

Hybrid RFID-based System

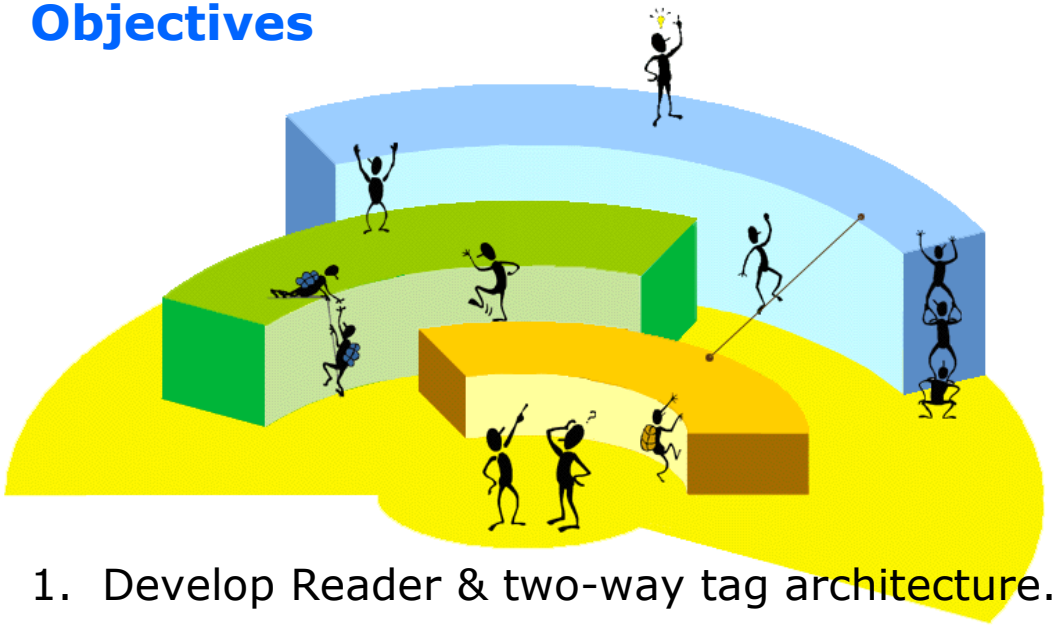
to Consumers.


mission
Develop interactive tracking
Hybrid RFID-based System
that enable consumers to track
wide read range by using
enhanced active two-way tag.
possible

Hybrid RFID-based System is high performance hardware for interactive tracking. The Hybrid RFID-based System will provide the

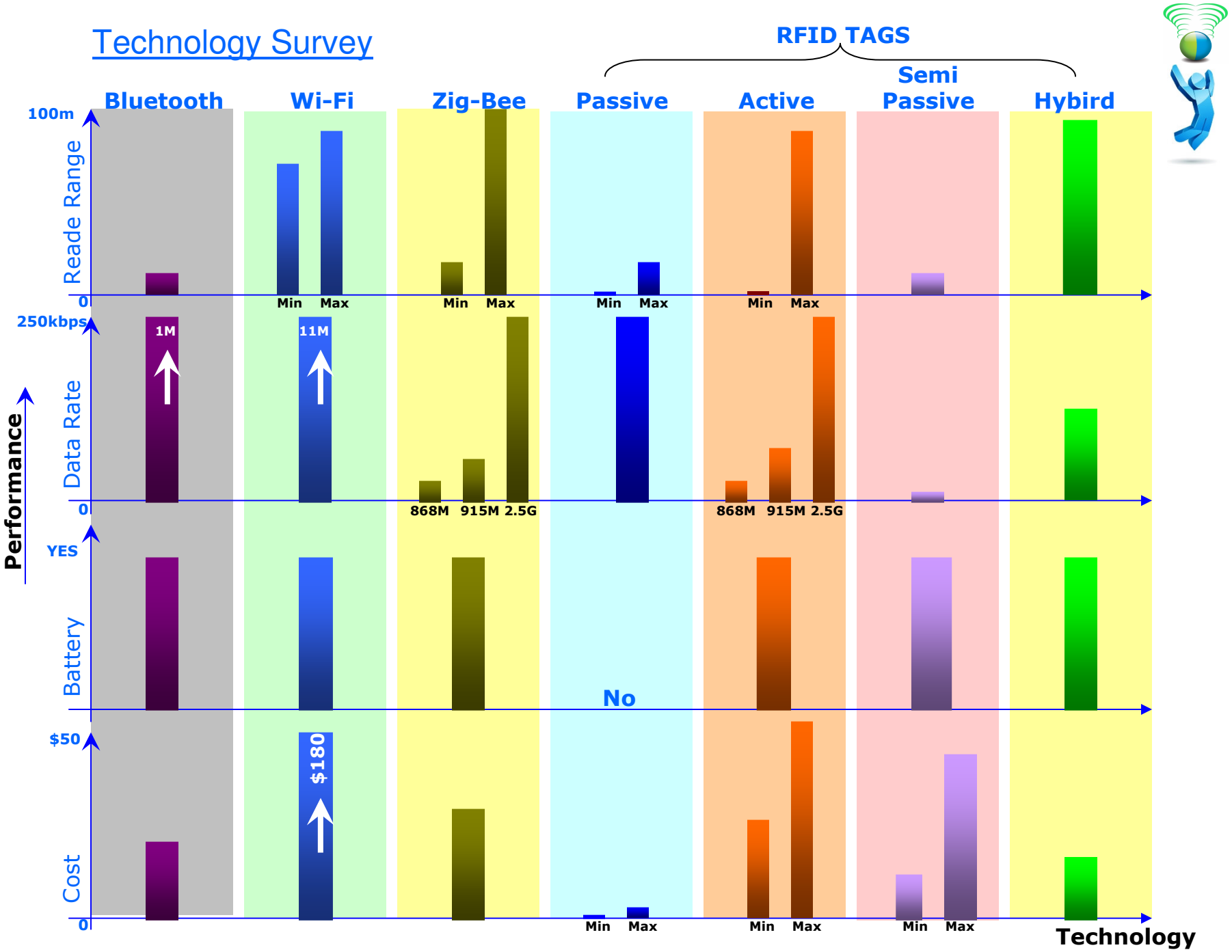
- **Wide Read range** or Tracking range.
- **Low Power consuming**.
- High Quality **performances** and low **cost** Hybrid RFID-based system for customer.
- Provide **customer support**.
- Create **best environment friendly** design.

Objectives

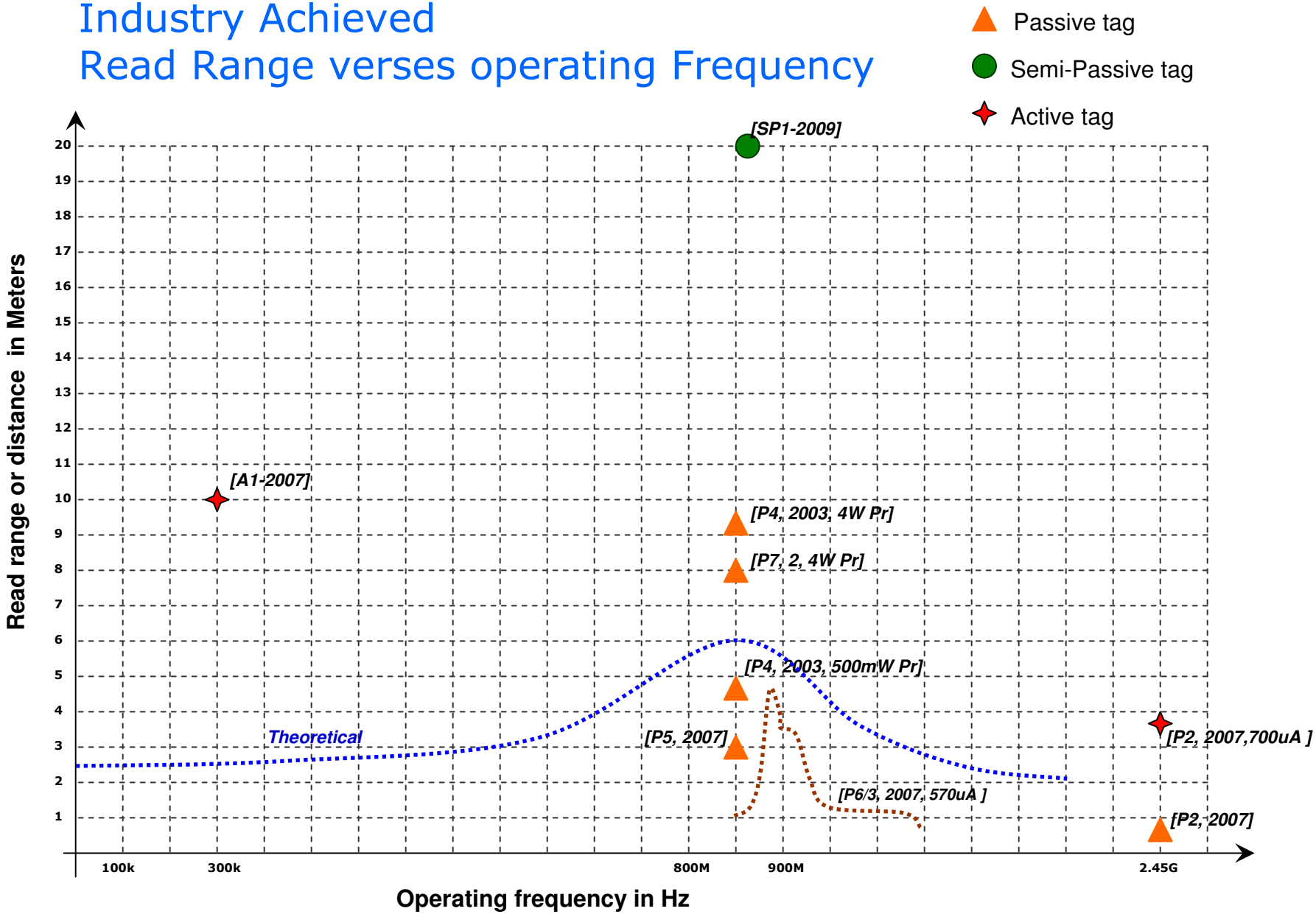


1. Develop Reader & two-way tag architecture.
2. Develop a reader-to-tag and tag-to-tag identification protocol for efficient discover or track an tag.
3. Develop a Reader and Two-way tag prototype.
4. Characterize the Hybrid RFID-based system.
5. Develop high quality product this satisfies our customers.
6. Implementation of design for environment in our products i.e. products manufactured can be recyclable.

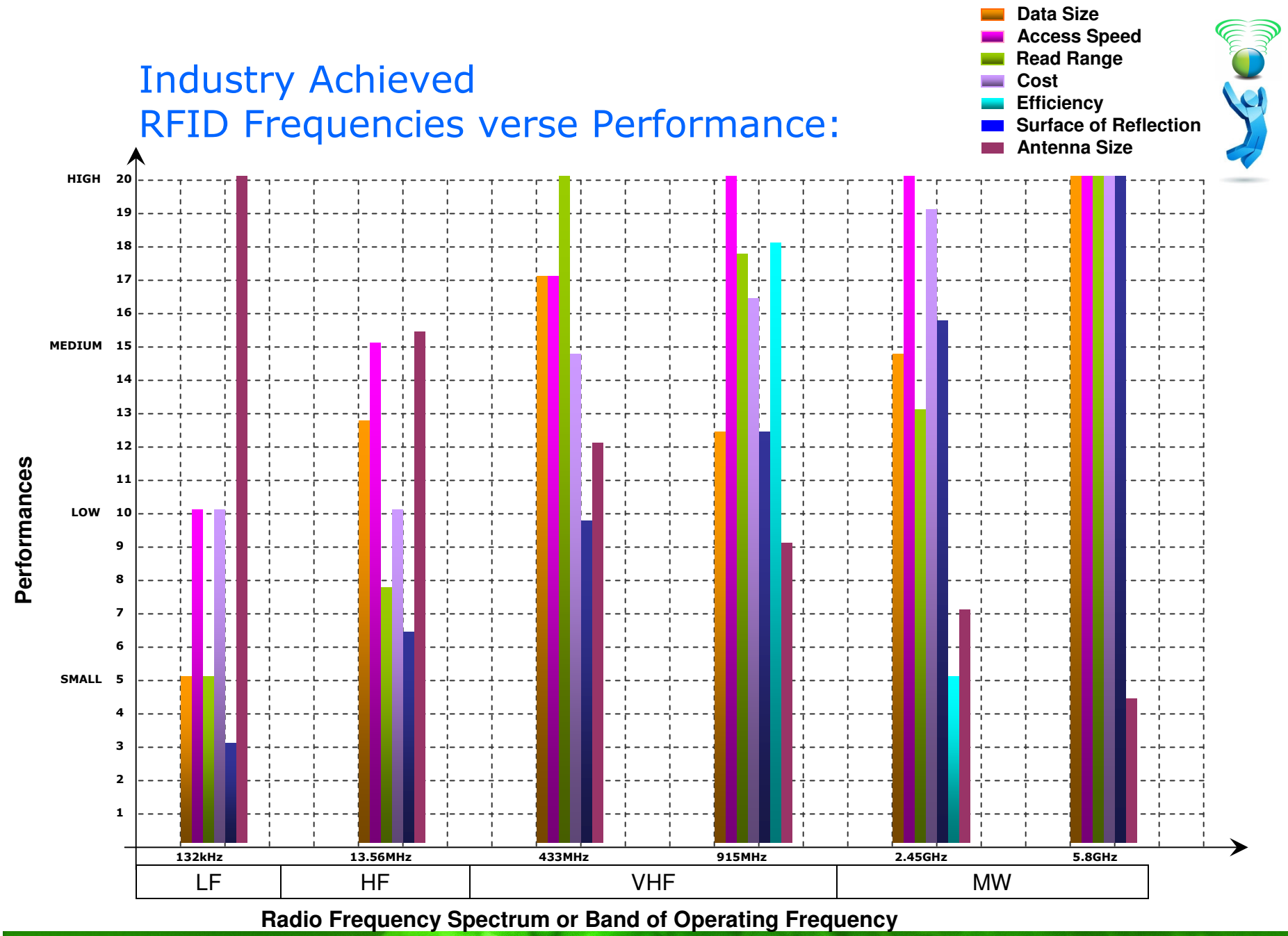
Technology Survey



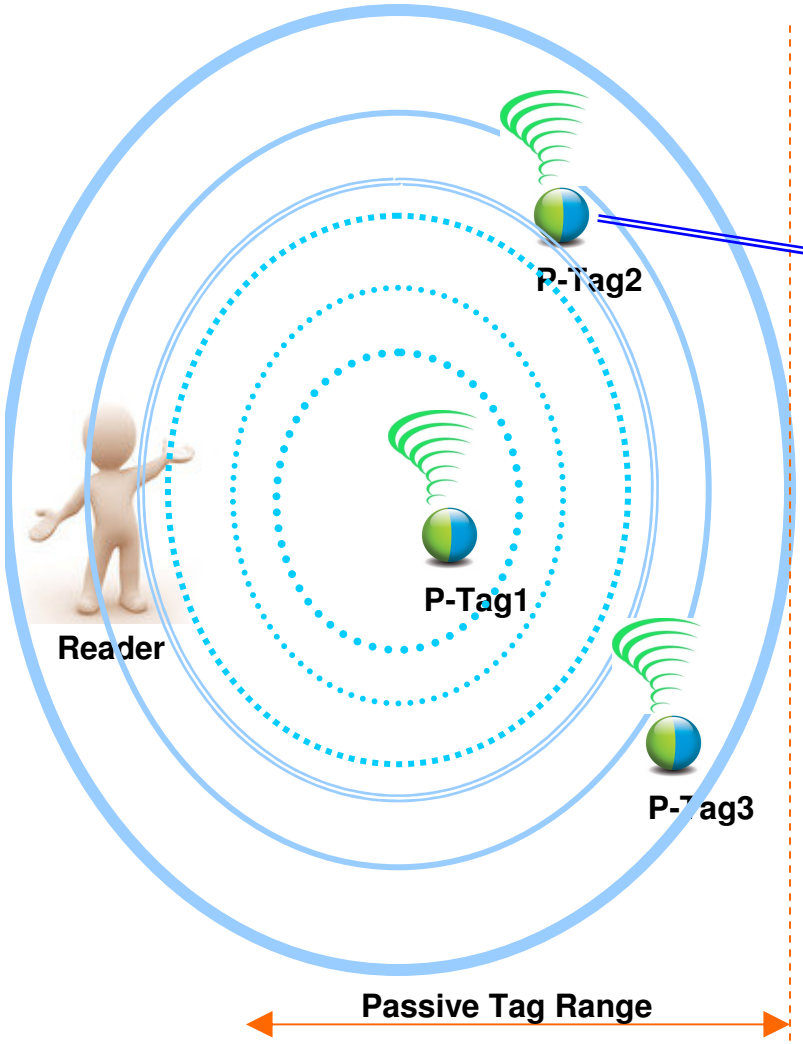
Industry Achieved
Read Range verses operating Frequency

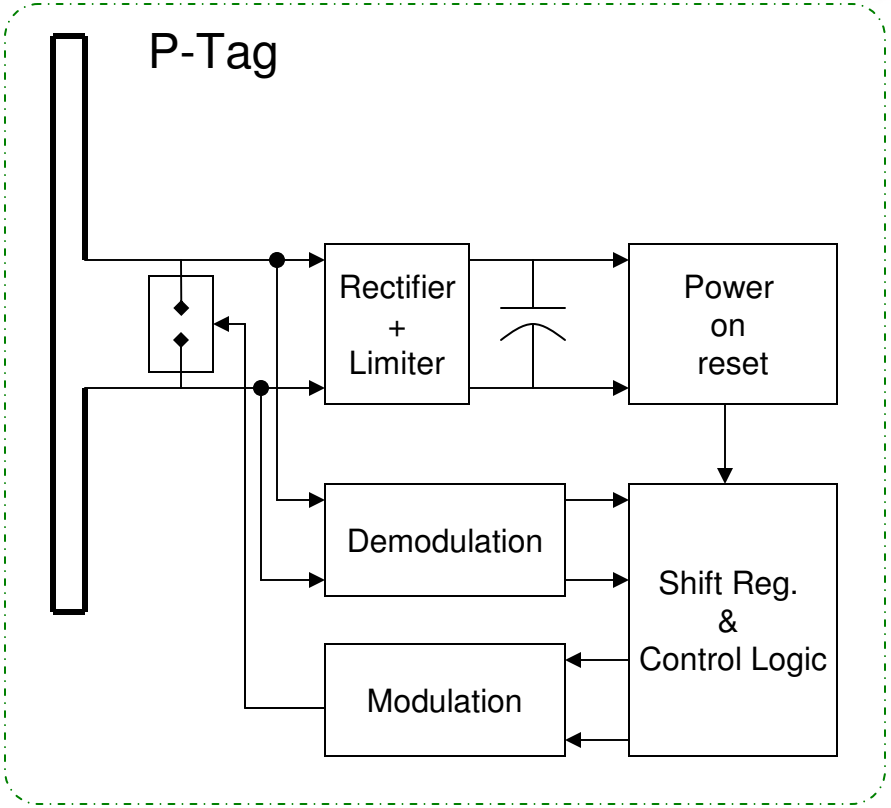


Industry Achieved
RFID Frequencies verse Performance:

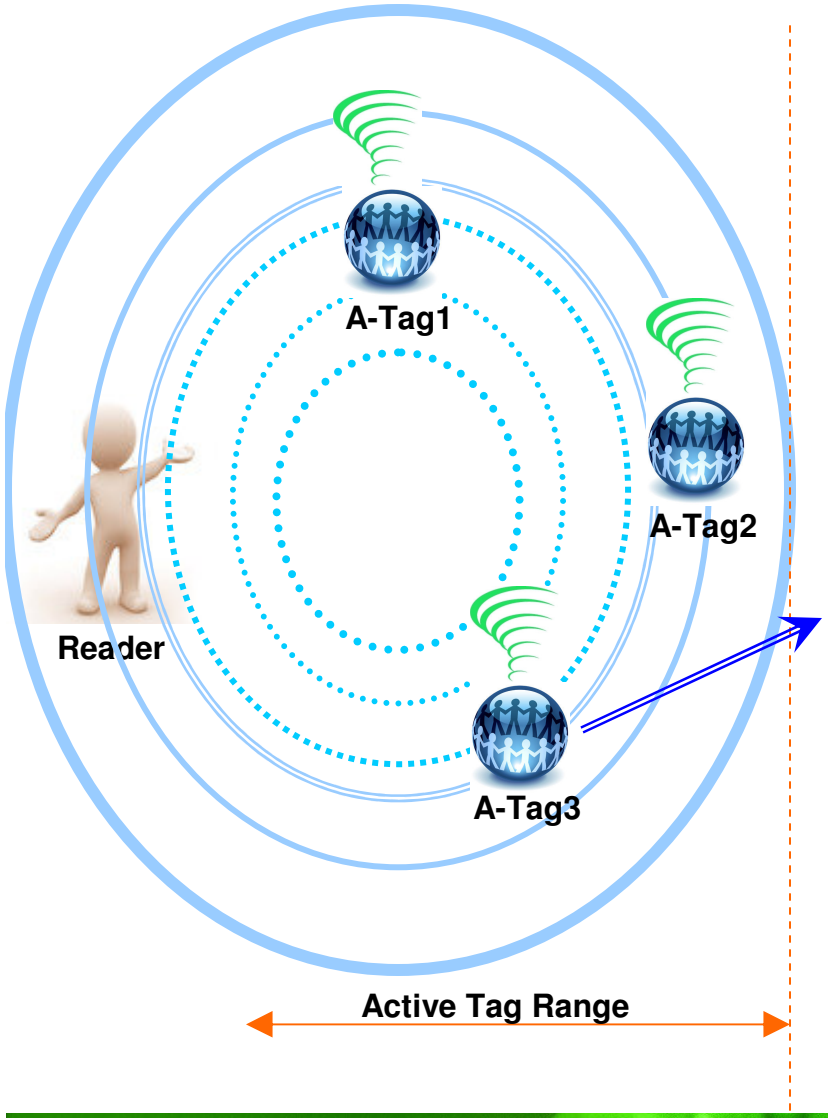


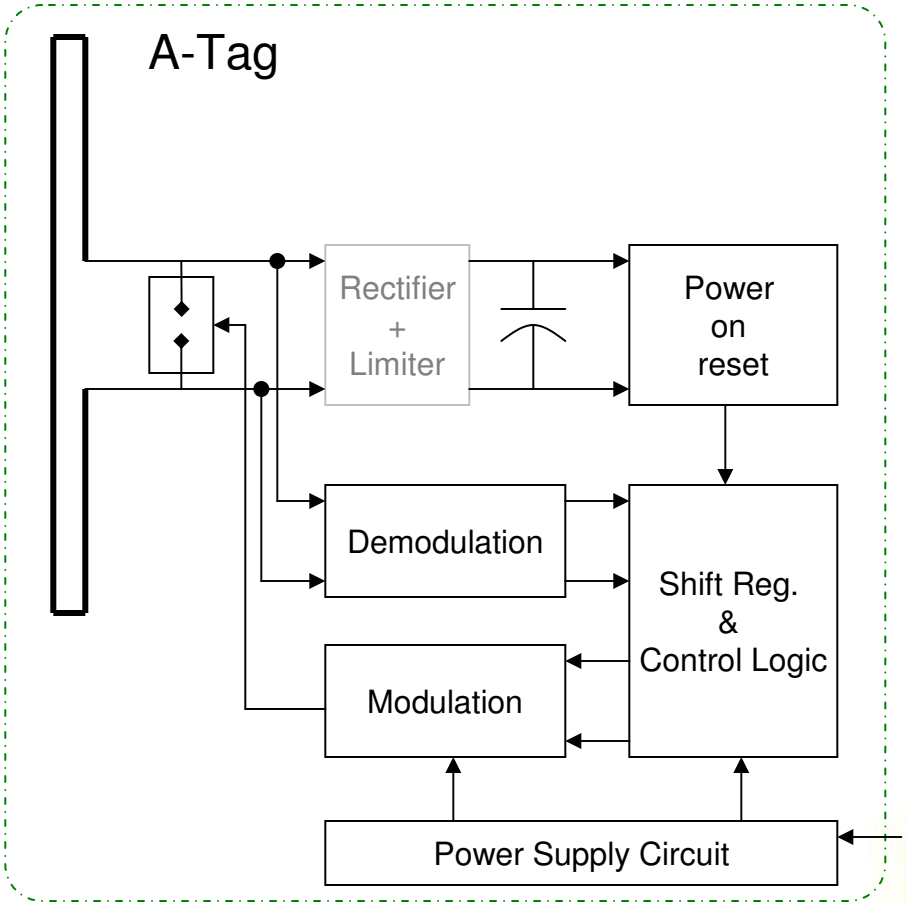
Architecture Survey: Passive Tag



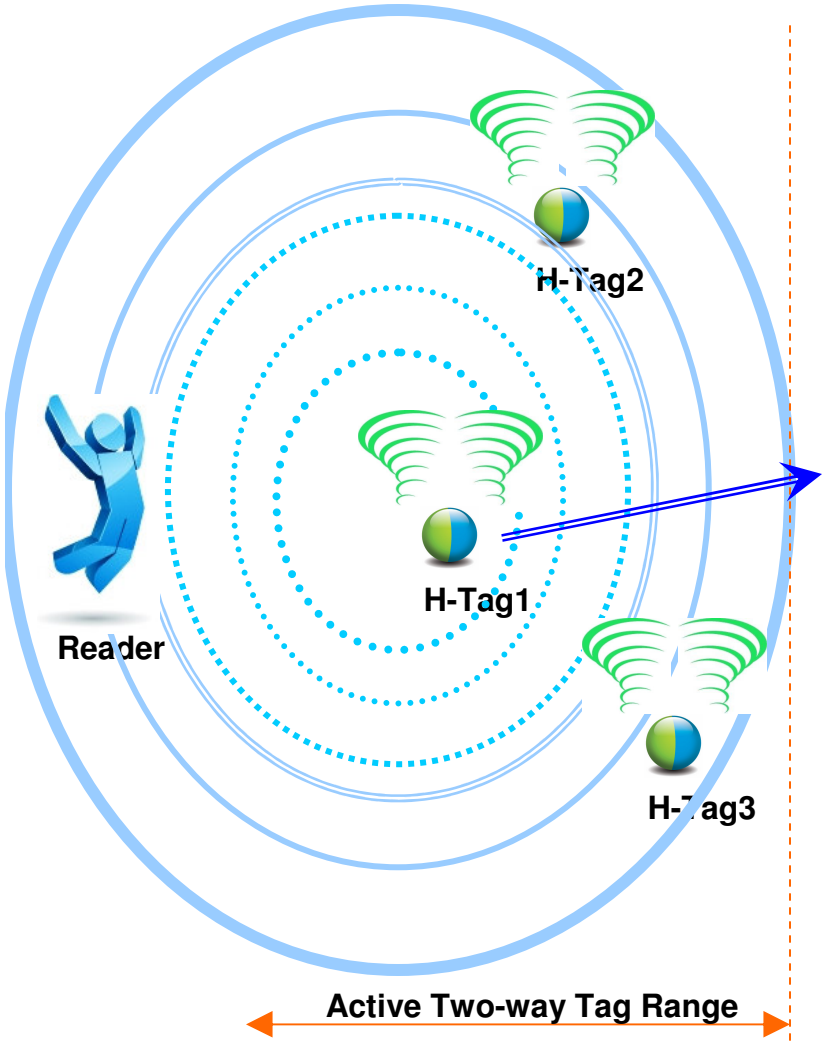


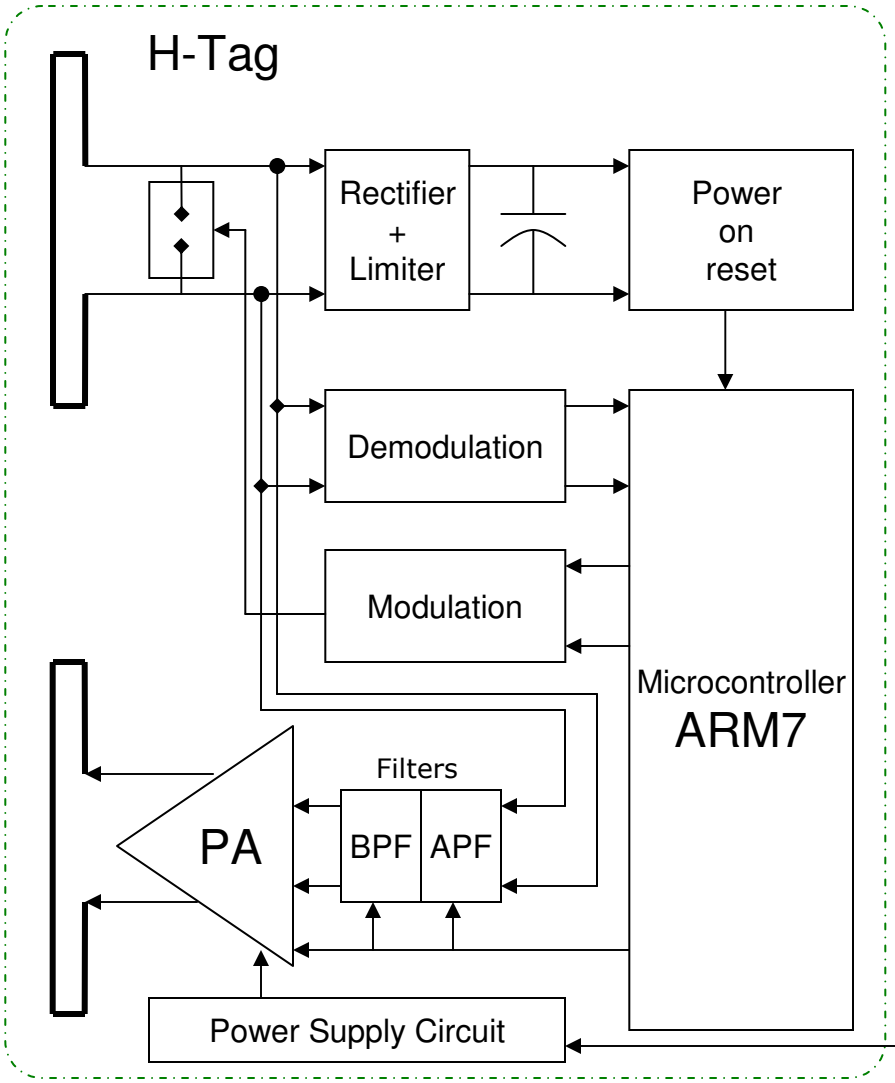
Architecture Survey: Active Tag





Proposed Active Two-way tag





Proposed System Specification:

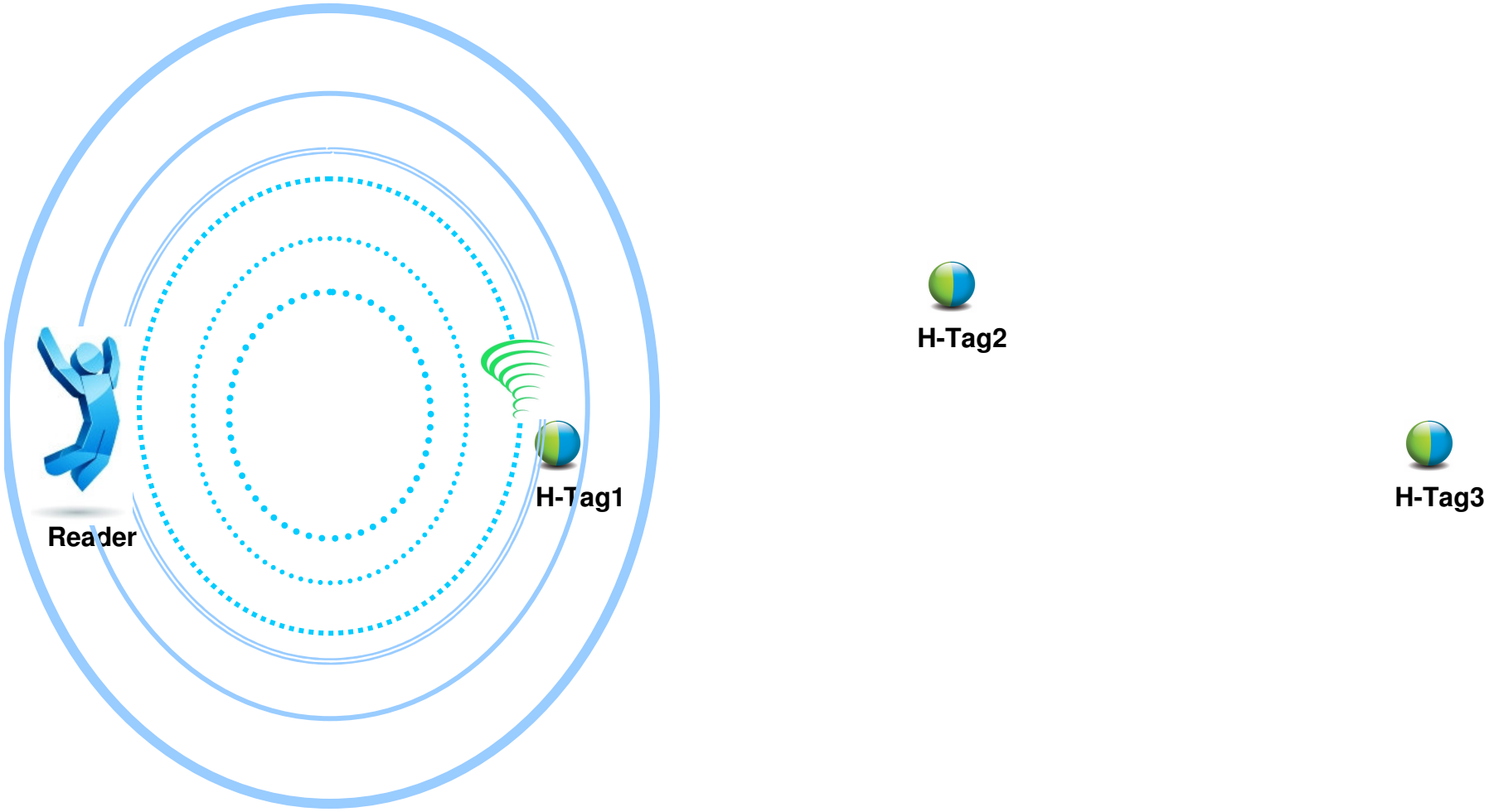
Parameters	Value	Comments
Frequency Range	13.64MHz, 860MHz, 2.4GHz	Still in the discussion stage
Available Power	4 W or 2 W	4 W EIRP indoor in EU & US 0.5W EIRP indoor & outdoor in EU
Tag Power Consumption	Low Power	
Size	Smallest	
Read Range	~6 m	
Tracking Range	Increase	
Tag to Reader Communication	?	
Reader to Tag Communication	?	
Process	90nm RF-CMOS-GPDK	
Supply Voltage	1V or 3.3V	Still in the discussion stage

Preliminary Scope:

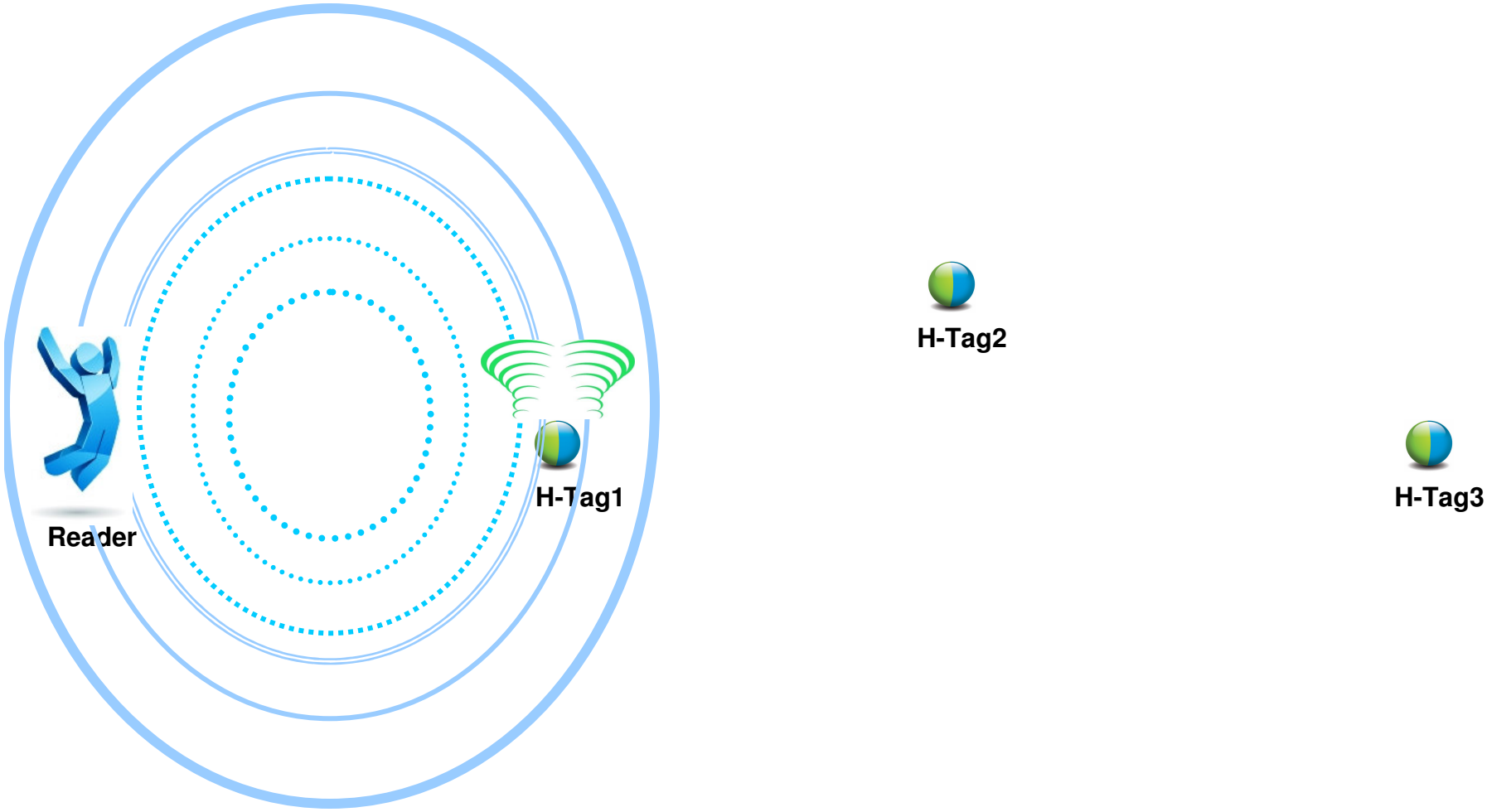
1. Develop Reader & Active two-way tag architecture.
   - *Survey on Reader and Tag Architectures with features.*
   - *Developing a reader-to-tag and tag-to-tag identification protocol for efficient discover or track two- tag.*

2. Develop a Reader and Active Two-way tag prototype.
   - *Characterize the Hybrid RFID-based system.*

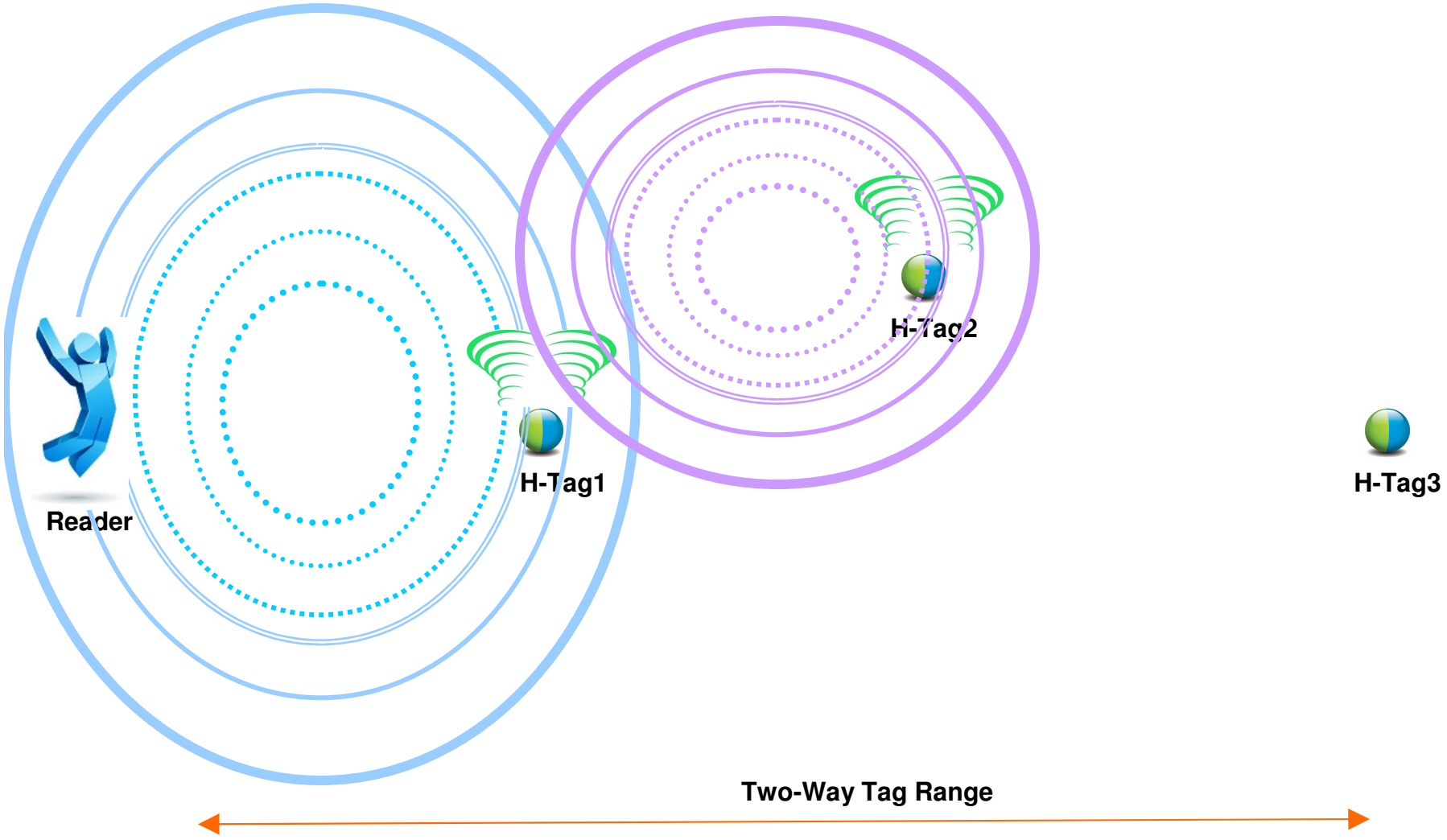
Two-Way Tag Range Evaluation:



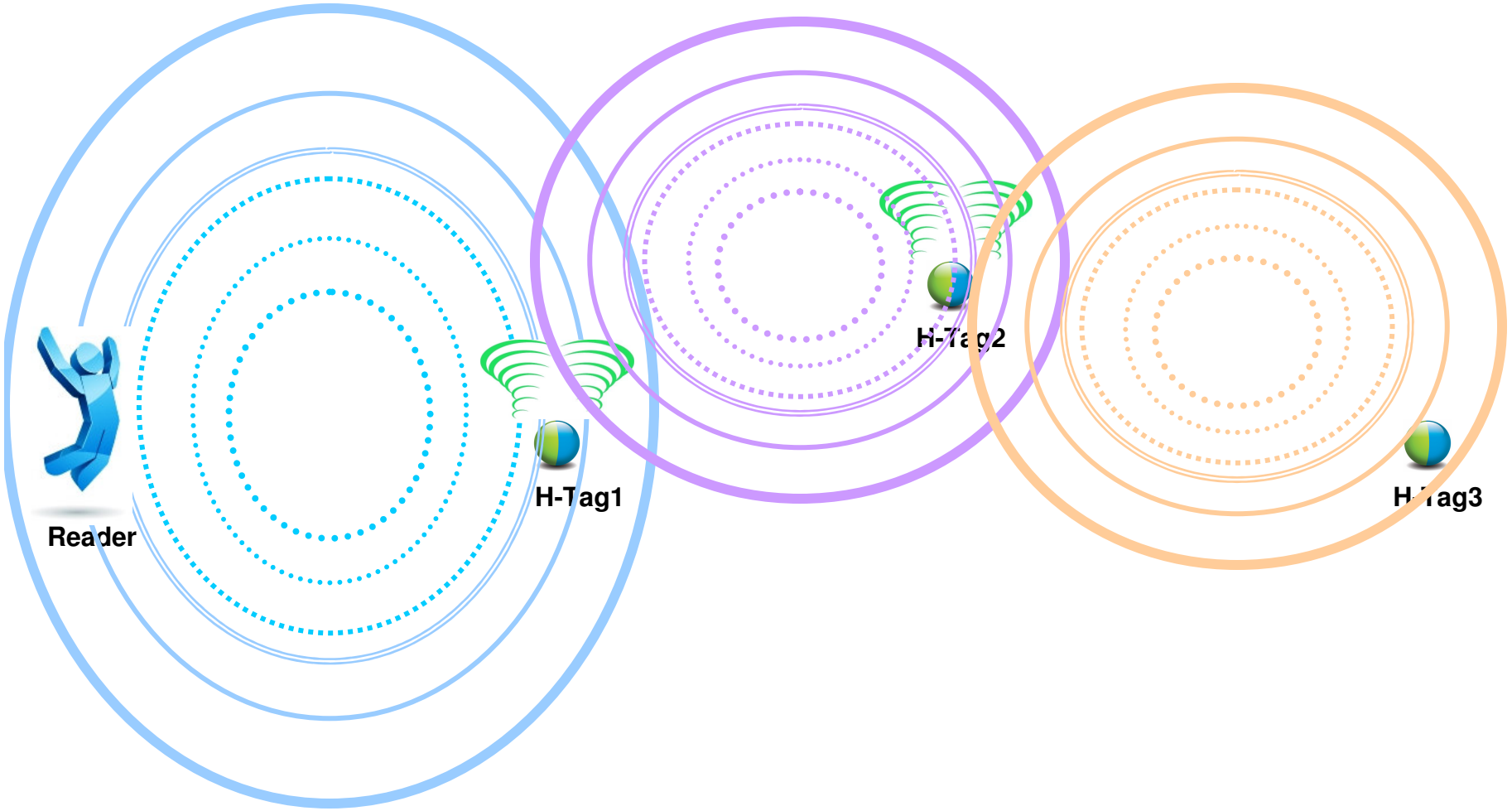
Two-Way Tag Range Evaluation:



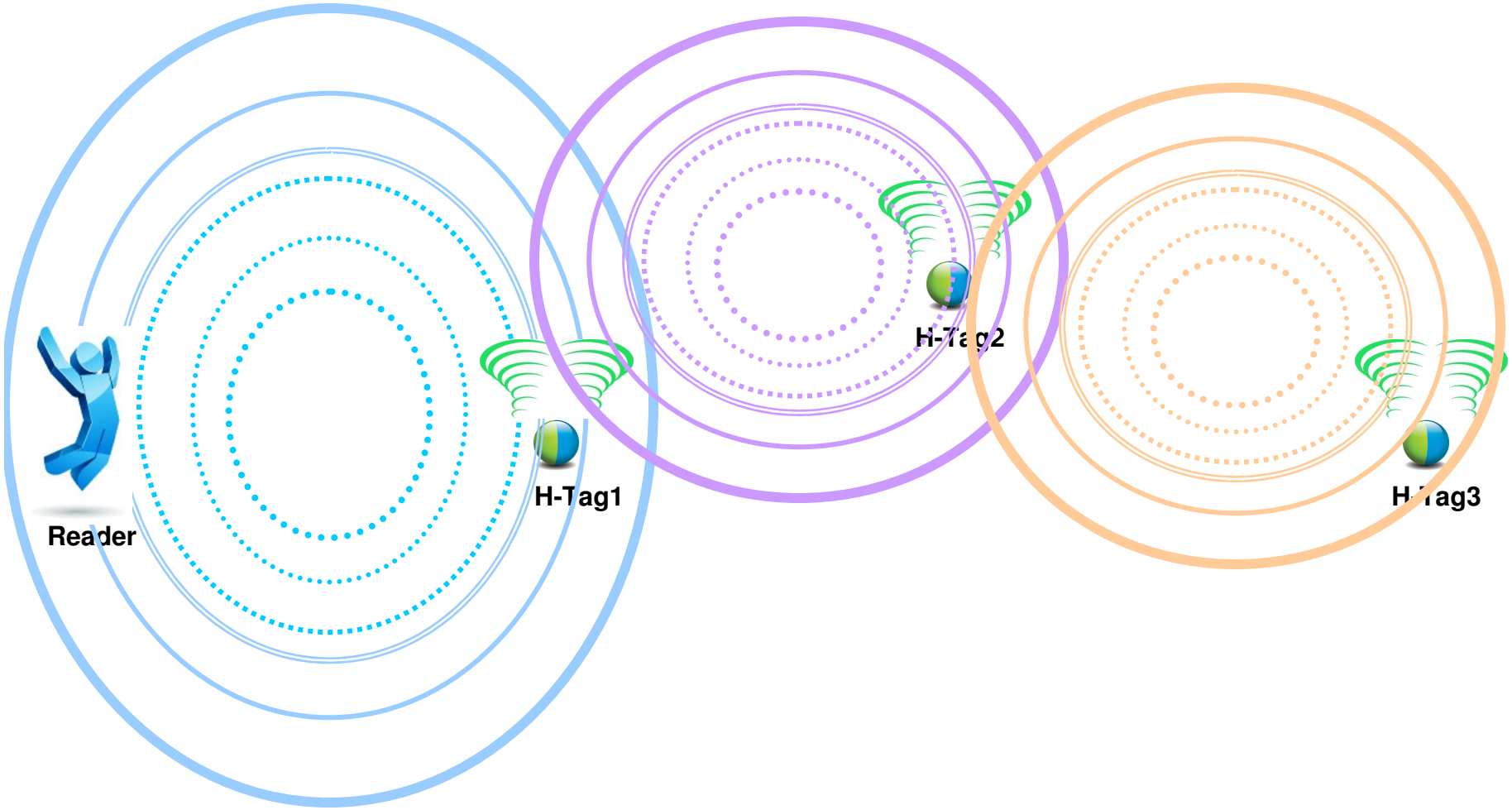
Two-Way Tag Range Evaluation:



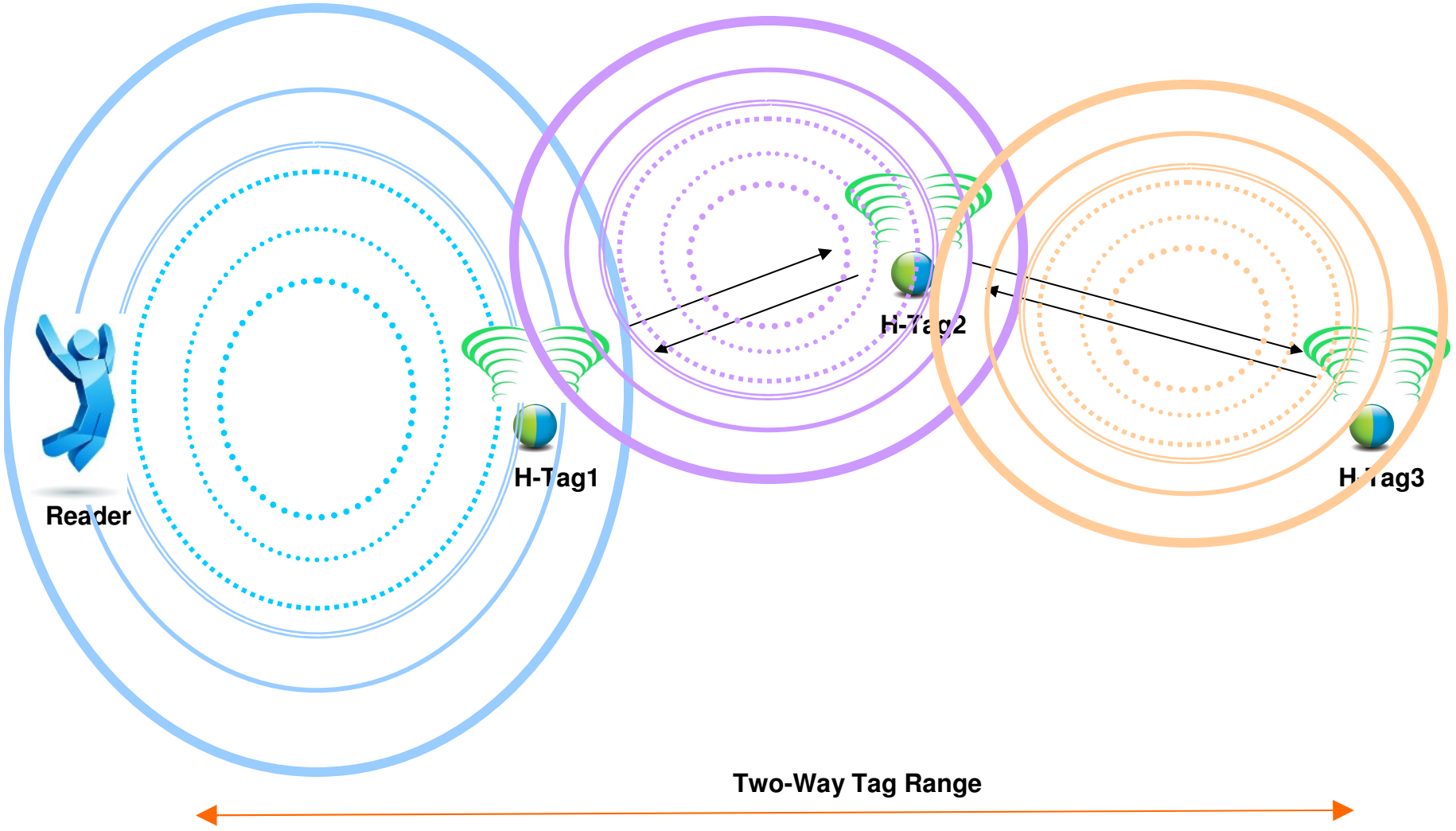
Two-Way Tag Range Evaluation:



Two-Way Tag Range Evaluation:



Two-Way Tag Range Evaluation:



Reasons to be funded…

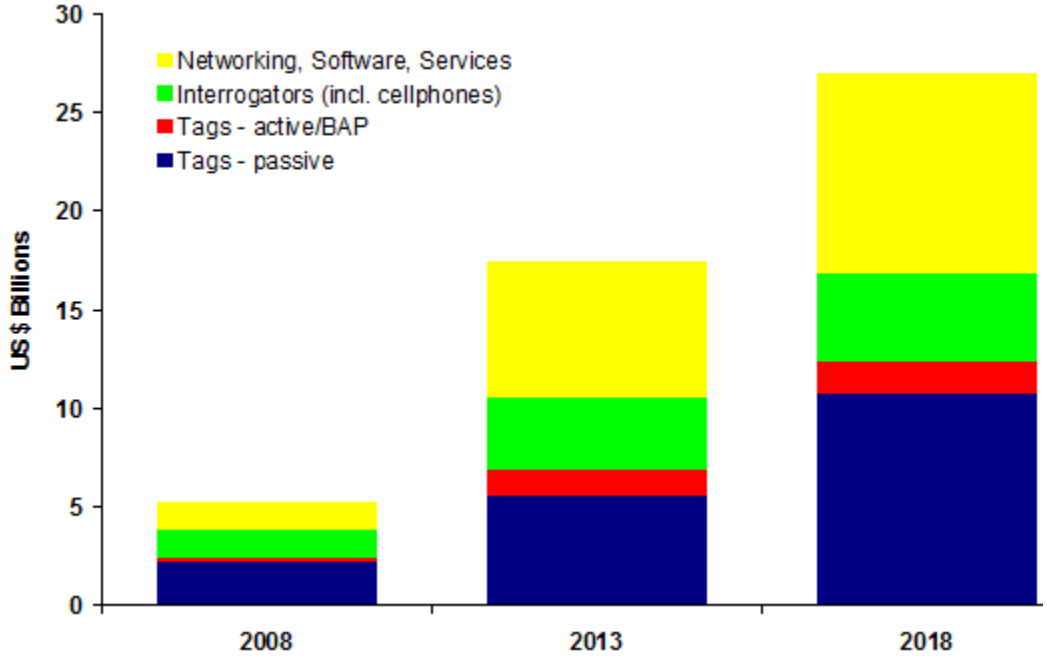
Hybrid RFID-based System using active two-way tags,

thesis should be funded because of customer demand.
Also its increase sales
and/or
low cost.

Reasons to be funded…

Global RFID Forecasts, and Market Opportunities:

RFID Market Seen Surpassing **$5 Billion in 2008.**



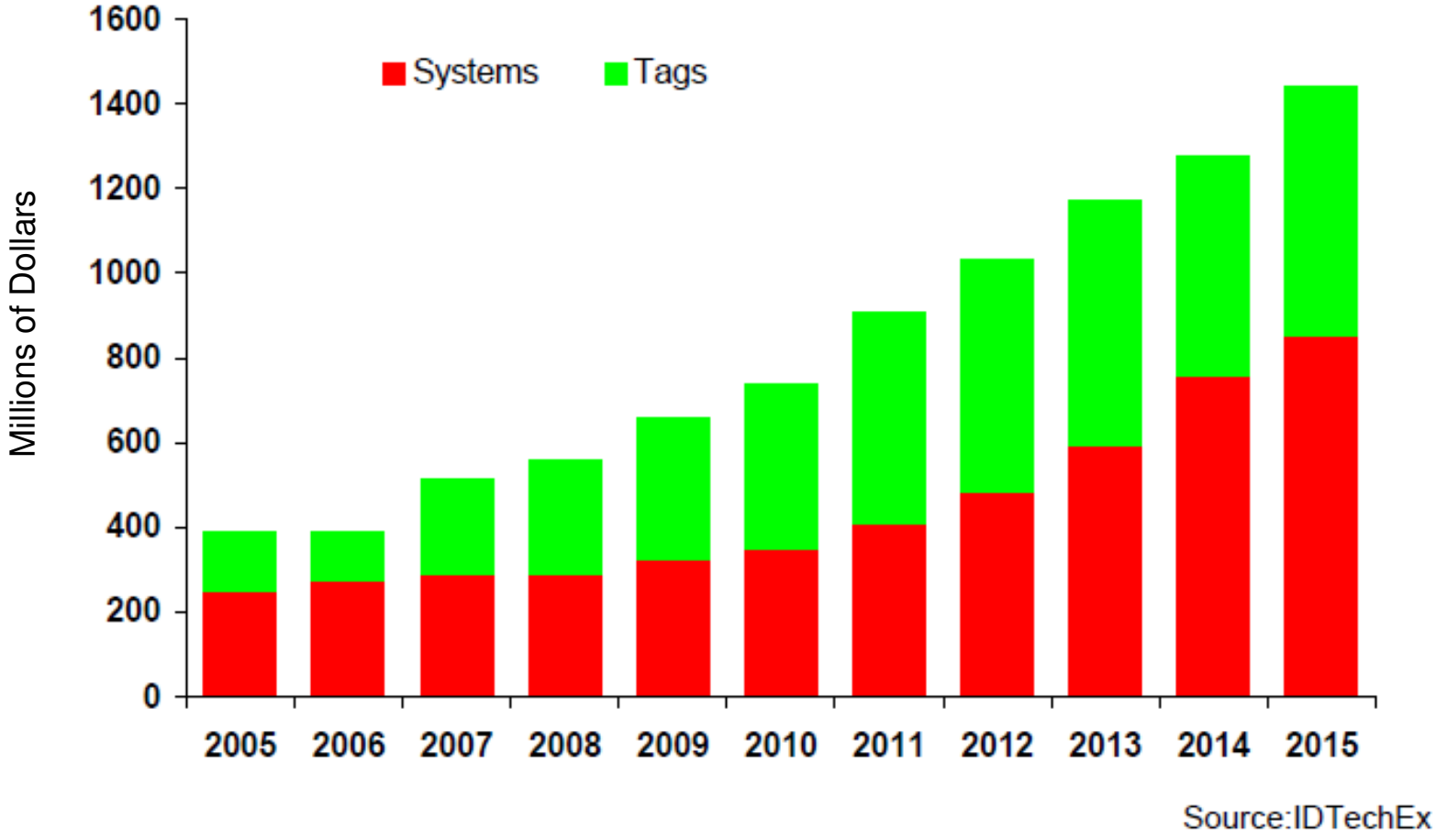
RFID market **$5.29 billion in 2008**, up from **$4.93 billion in 2007**,
including tags, readers and software/services for RFID cards, labels, fobs and all other form factors.

In total, **~ 2.16 billion tags** sold in **2008** compared with
1.74 billion in 2007 and
1.02 billion in 2006.

***Source:* www.idtechex.com**

Reasons to be funded…

Global sales of Active RFID Systems and Tags:



Conservative forecast

Reasons to be funded…

Global RFID market value achieved

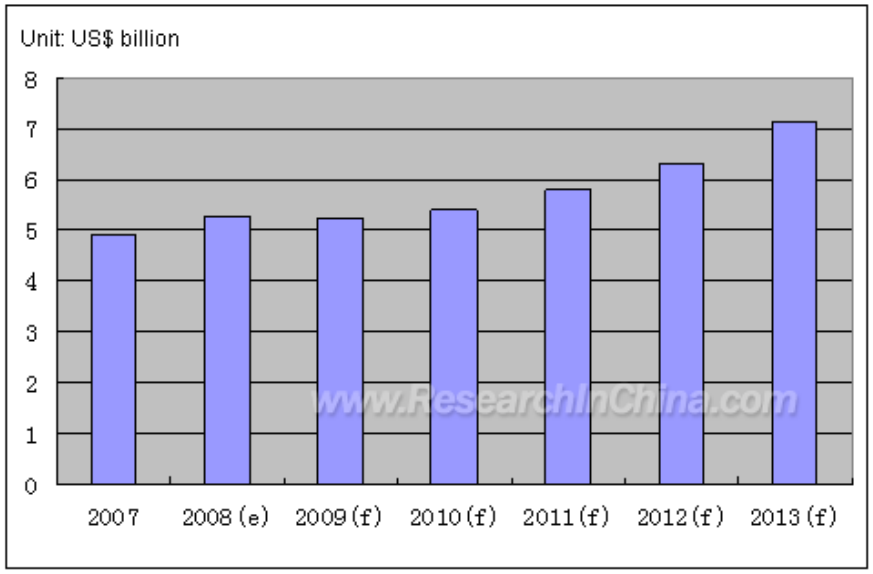
US$ 4.92 billion in 2007,

US$ 5.29 billion in 2008, up 7.5% year on year.

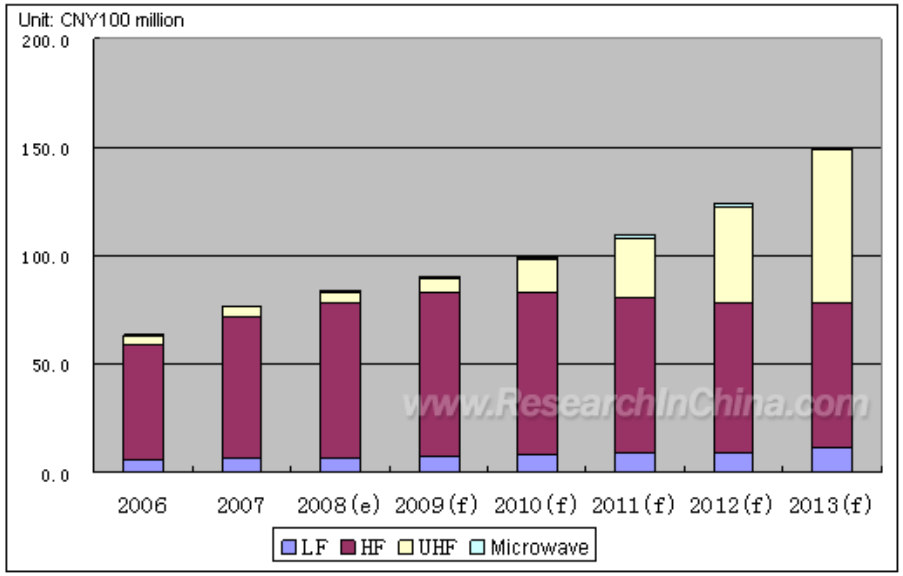
Impacted by financial crisis, global RFID market value will decline to

US$ 5.24 billion in the year of 2009.

Global and China RFID Industry Report, 2008-2009



Global RFID Market Scale, 2007-2013

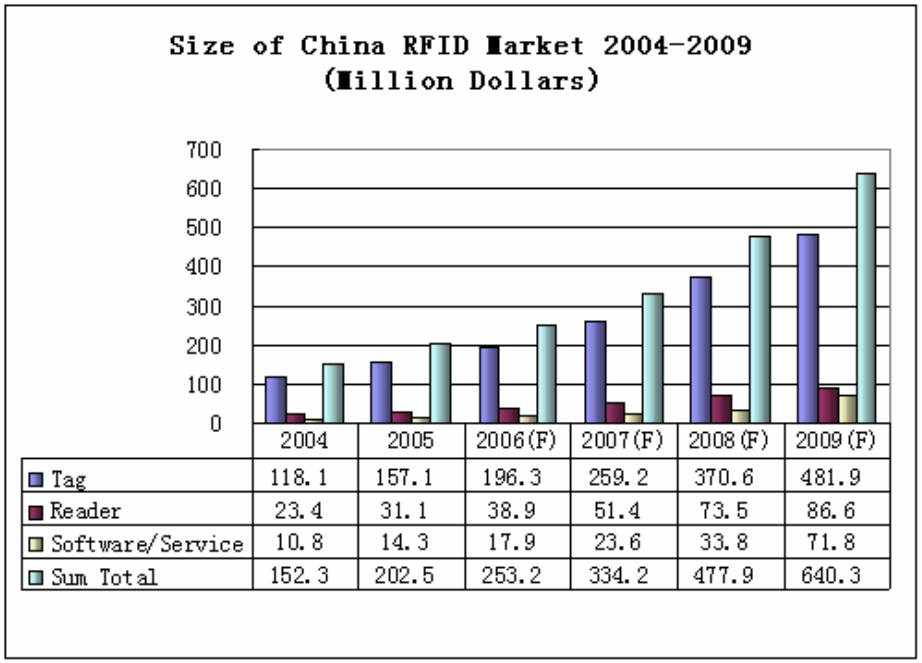


Source :http://www.researchinchina.com/Htmls/Report/2009/5633.html also IDTechEx

Reasons to be funded…

China's RFID market

202.5 million dollars in 2005 and
253.2 million dollars in 2006, …



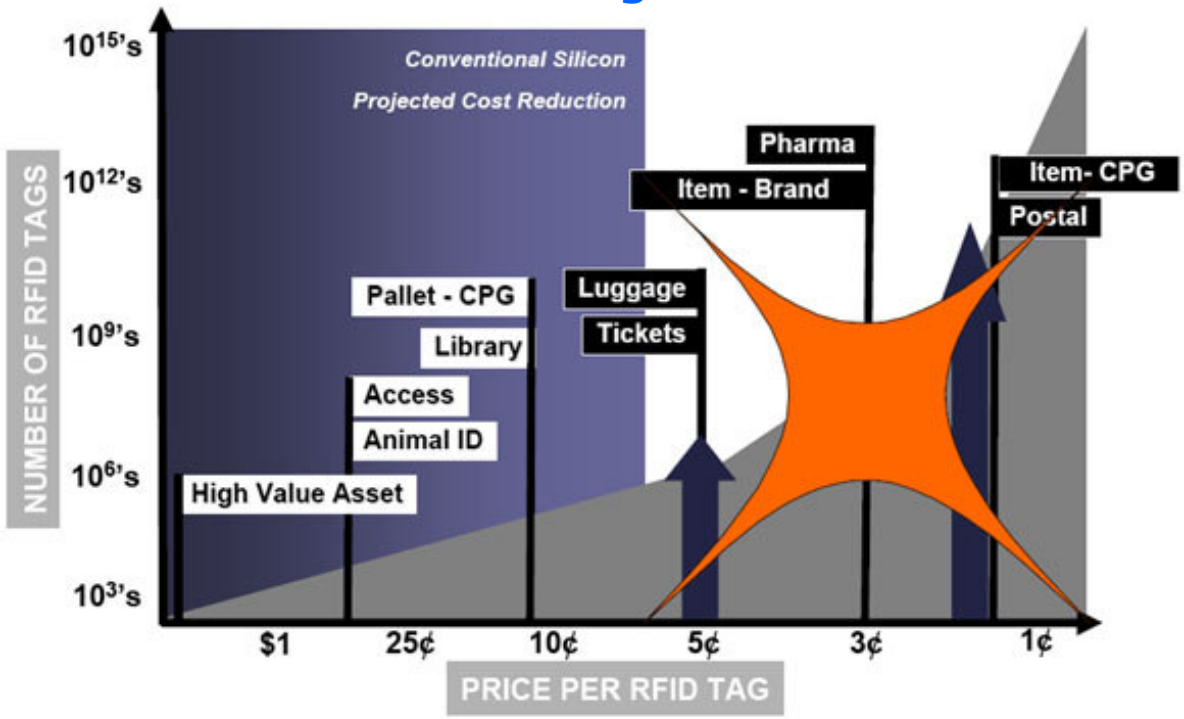
	2004	2005	2006(F)	2007(F)	2008(F)	2009(F)
Tag	118.1	157.1	196.3	259.2	370.6	481.9
Reader	23.4	31.1	38.9	51.4	73.5	86.6
Software/Service	10.8	14.3	17.9	23.6	33.8	71.8
Sum Total	152.3	202.5	253.2	334.2	477.9	640.3

In the whole market, RFID tags took up the biggest share with
157.1 million dollars in 2005 and
196.3 million dollars in 2006.

Source :http://www.researchinchina.com/Htmls/Report/2009/5633.html

Reasons to be funded…

Kovio Inc. (Milpitas, Calif.) has a goal to reduce the cost of an RFID tag from about **20 cents (today) to 3 cents by 2015**,
Estimated **165 billion RFID tags will be manufactured**.



Kovio is **sampling** now to customers that will begin **trials in Q109**.
Kovio expects to be in ***volume production at its Milpitas fab by Q209***.
Its first tags will be used in smart transit systems and for event tickets that have embedded security features, using the printed 128 bits of unalterable ROM.

Source: Kovio Demonstrates RFID Tags Using Printed Electronics, Kovio Inc. (Milpitas, Calif.) announced today at a conference in Chicago that it is demonstrating RFID tags based on its printed ICs (PICs). The startup is getting ready to begin manufacturing at its Milpitas fab, using nine electronics-use inks that it developed internally. "Printed electronics is no longer a vision -- it is here," said CEO Amir Mashkoori.David Lammers, News Editor -- Semiconductor International, 10/16/2008

Discrete Prototype Development cost:

1.	Laptop.	
2.	NXP or Samsung ARM Development Microcontroller.	$130
3.	Discrete component for Reader and Tag(6).	$800

Silicon Development cost:

1.	Laptop. (Cadence Tools)	
2.	Silicon Fabrication cost	$4000

Feasibility Analysis

Included Annual tag cost, Development Cost, Maintenance cost, Infrastructure cost, etc.

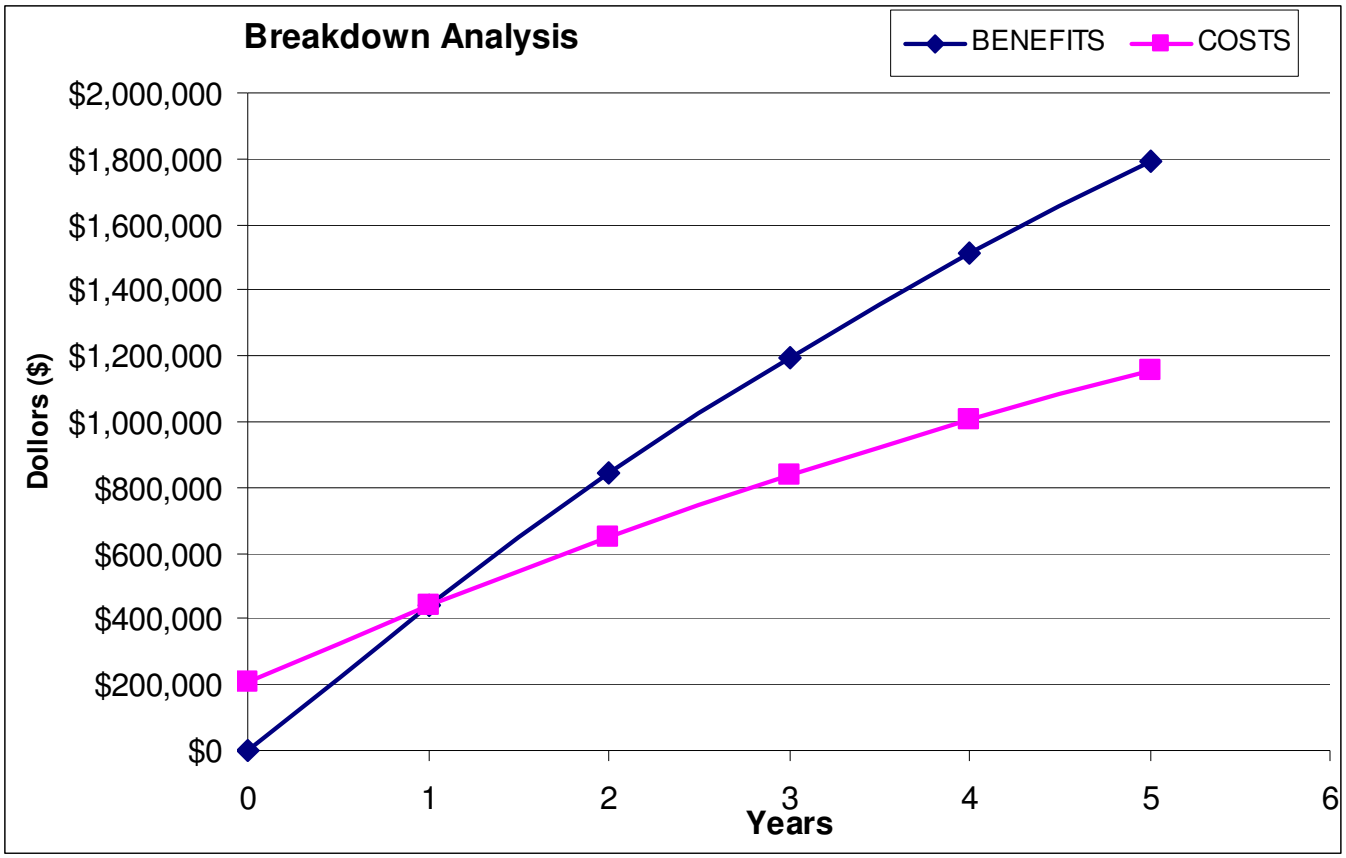
Organization	Department	Employees	Salary	Cost
CEO		0	200,000	0
VP		0	110000	0
Design	R&D	6	85000	510000
Operation	Production	2	72000	144000
	Material	1	72000	72000
	QA	2	65000	130000
Marketing	Adv	1	72000	72000
	Sales	2	75000	150000
	Research	1	80000	80000
	services	2	72000	144000
Finance	A/c	1	70000	70000
	Admin	1	65000	65000
Final Cost		**19**		**1437000**

Calculation for recurring cost of the current system	
Hardware Maintenance	9000
Software Maintenance	7000
Employees	479000
Accessories Supply	800
Internet Connection	800
Customer Support	1000
Total	**497600**
Calculation for development cost for the new system	
Hardware Purchase	10000
Software development	6000
Employees	179625
Internet connection	1000
testing	9000
Total	**205625**
Calculation for recurring cost for the new system	
Hardware Maintenance	6000
Software Maintenance	9000
Employees	239500
Internet Connection	600
Customer Support	8000
Total	**263100**

ROI Analysis

YEAR	0	1	2	3	4	5	Total
Net Benefit	0	497600	497600	497600	497600	497600	
Discount Factor by 12%	1	0.8929	0.7972	0.7118	0.6355	0.5674	
PV of Benefit	0	444307.04	396686.7	354191.7	316224.8	282338.2	
Cumulative PV of Benefit	0	444307.04	840993.8	1195185	1511410	1793748	1793748
One-time Costs	-205625						
Recurring Costs		-263100	-263100	-263100	-263100	-263100	
Discount Factor by 12%	1	0.8929	0.7972	0.7118	0.6355	0.5674	
PV of Costs	-205625	-234921.99	-209743	-187275	-167200	-149283	
Cumulative PV of Costs	-205625	-440546.99	-650290	-837565	-1004765	-1154048	-1154048
	205625	440546.99	650290.3	837564.9	1004765	1154048	
NPV							**639700.6**
Yearly NPV cash flow	-205625	209385.05	186943.4	166917.1	149024.8	133055.3	
Cumulative NPV of Cash flow	-205625	3760.05	190703.5	357620.6	506645.3	**639700.6**	
Interest rate = 12%							
Payback period							**0.876866**
Overall ROI							**55.43103**
Break-Even Ratio				**0.982042**			

ROI Analysis

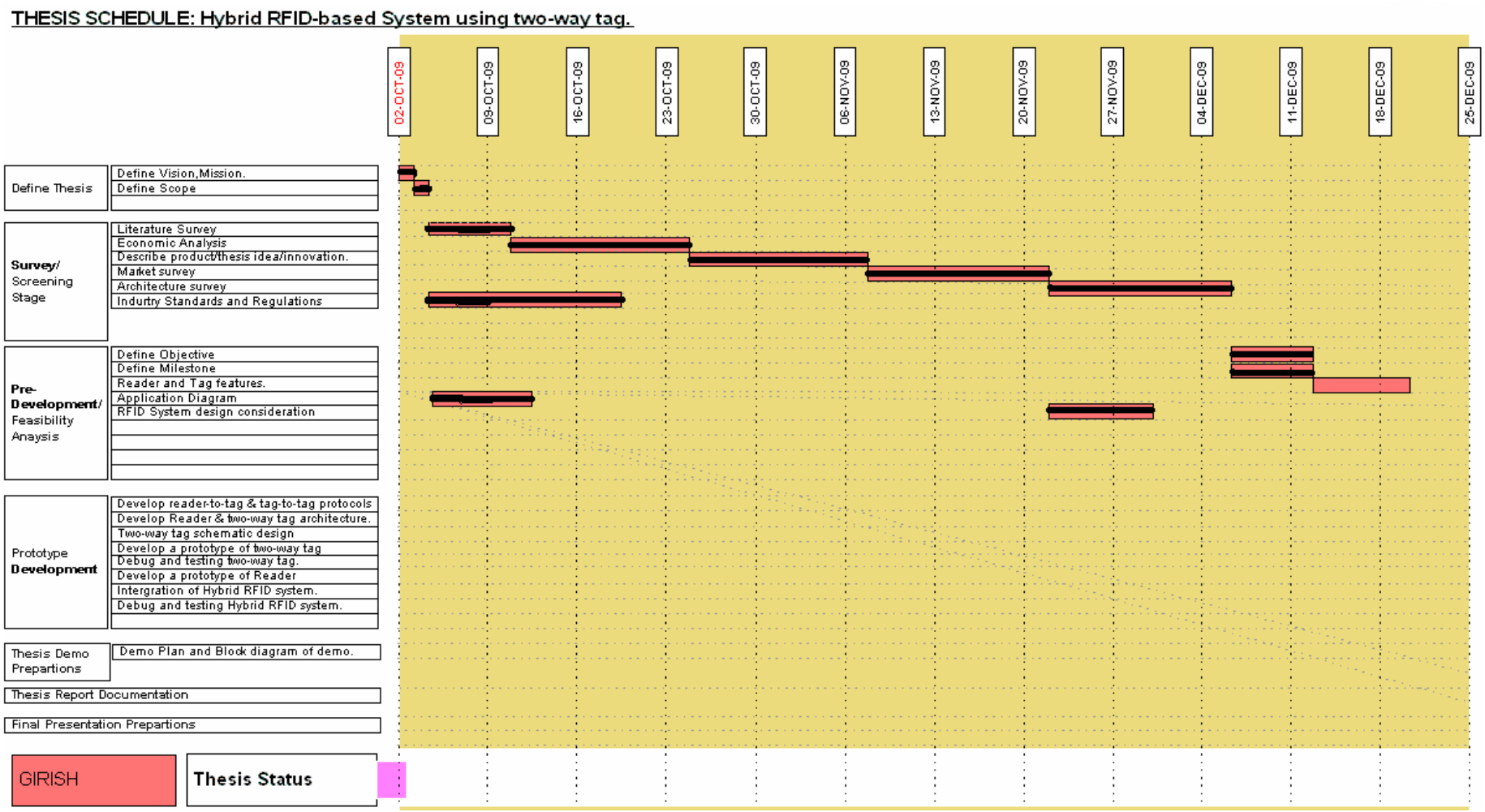


Discount factor calculation

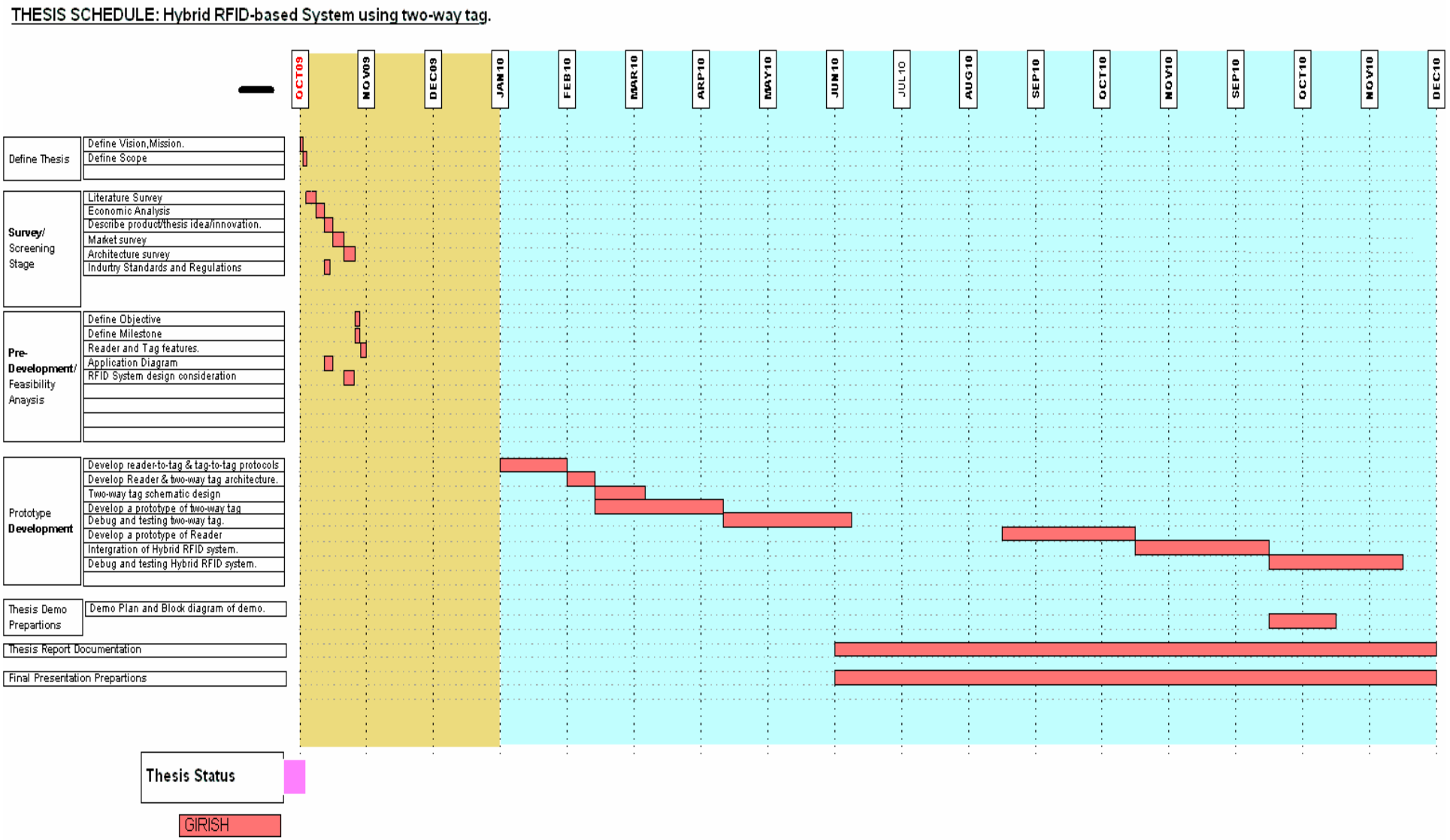
I	n	F()
0.12	1	0.8929
0.12	2	0.7972
0.12	3	0.7118
0.12	4	0.6355
0.12	5	0.5674

Return on Investment (ROI):
The ratio of money gained or lost on an investment relative to the amount invested. The amount gained or lost may be referred to as interest, profit/loss, gain/loss or net income/loss, while the money invested may be referred to as the asset, capital, principal or cost basis of the investment. ROI is sometimes also known as "rate of profit" or "rate of return."

Schedule:(Fall-09)

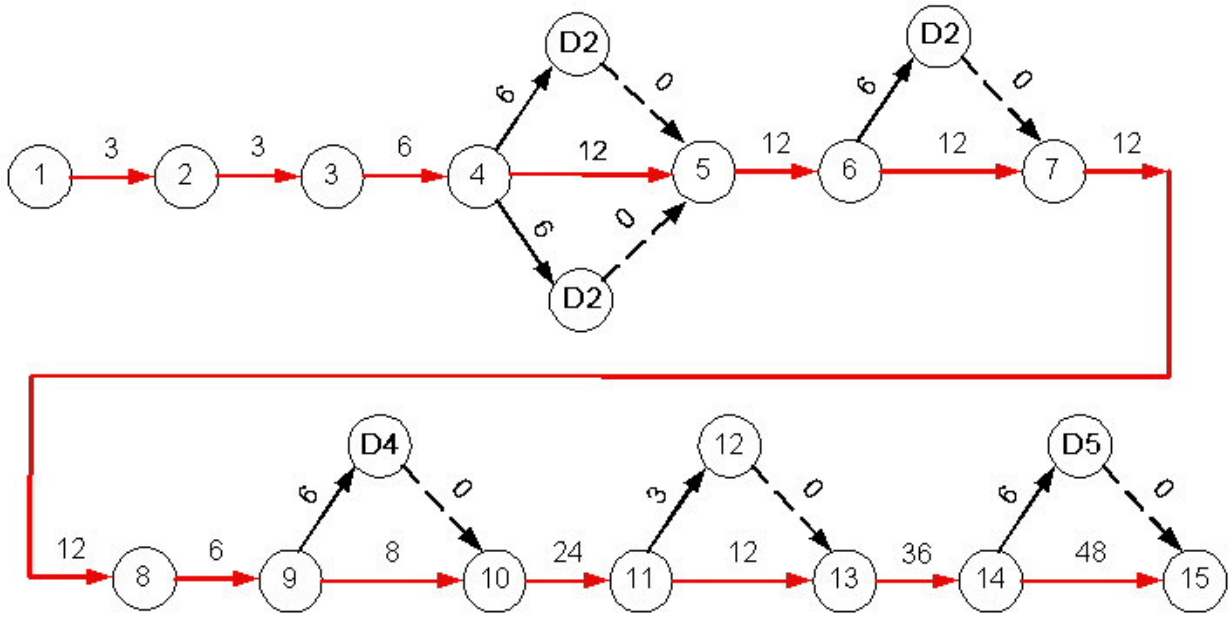


Schedule:(Fall-09, Spring-10, & Fall-10)



NETWORK SCHEDULING

Activity	Hybrid RFID-based system using two-way tags	Activity	Hybrid RFID-based system using two-way tags
Ai	**Description**	**Ai**	**Description**
1	Vision, Mission	**11**	Reader & two-way tag architecture.
2	Scope	**12**	Two-way tag schematic design
3	Literature Survey	**13**	Two-way tag prototype and debug.
4	Economic Analysis	**14**	Reader prototype and debug.
5	Describe Thesis idea	**15**	Integration of Hybrid RFID system.
6	Market Survey	**D1**	Industry Standards and Regulations
7	Architecture Survey	**D2**	Application Diagram
8	Objective and Milestone	**D3**	RFID System design consideration
9	Reader and Tag features.	**D4**	Survey on protocols
10	Reader & Tag Protocols	**D5**	Demo preparation



NETWORK SCHEDULING

		Time	
Activity	Hybrid RFID-based system using two-way tags	Event Earliest	Event Latest
Ai	Description	**EE-i**	**EL-i**
1	Vision, Mission	0	0
2	Scope	3	3
3	Literature Survey	6	6
4	Economic Analysis	12	12
5	Describe Thesis idea	24	24
6	Market Survey	36	36
7	Architecture Survey	48	48
8	Objective and Milestone	60	60
9	Reader and Tag features.	66	66
10	Reader & Tag Protocols	74	74
11	Reader & two-way tag architecture.	98	98
12	Two-way tag schematic design	101	110
13	Two-way tag prototype and debug.	110	110
14	Reader prototype and debug.	146	146
15	Integration of Hybrid RFID system.	194	194
D1	Industry Standards and Regulations	18	24
D2	Application Diagram	18	24
D3	RFID System design consideration	42	48
D4	Survey on protocols	72	74
D5	Demo preparation	152	194

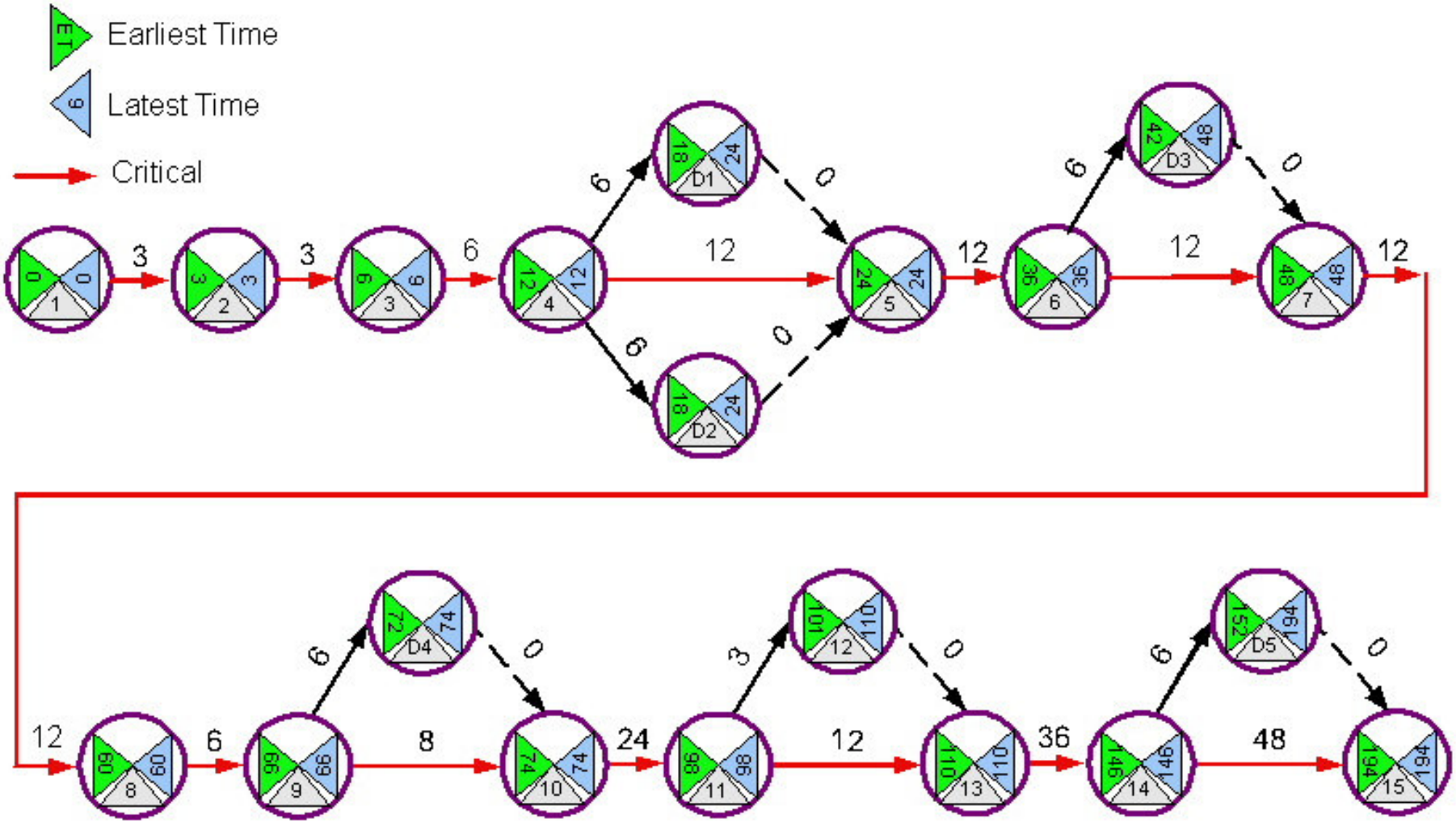
Earliest and Latest time for Hybrid RFID-based system using two-way tags :

NETWORK SCHEDULING

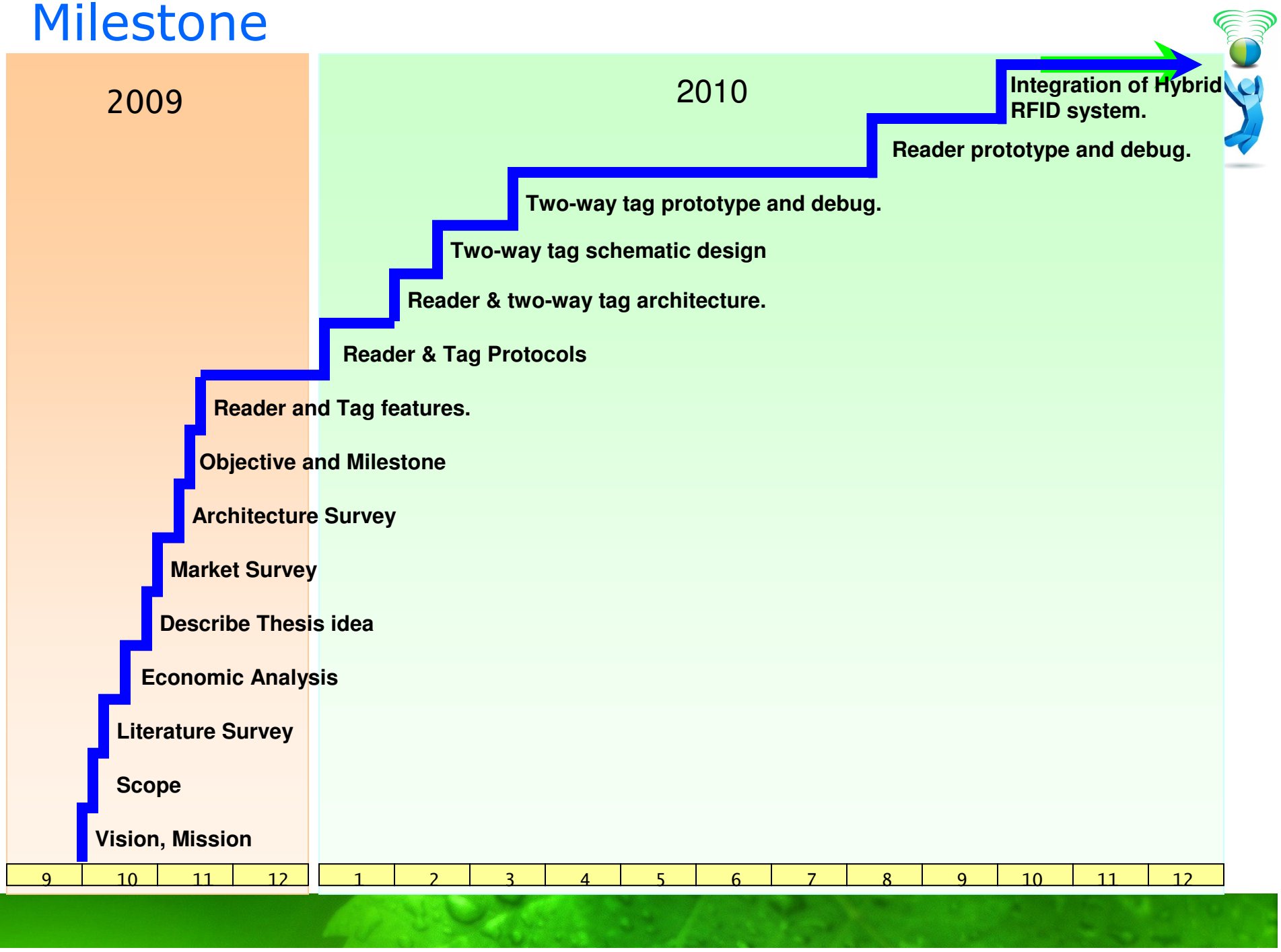
		Time				Start		Finish				
Activity	Hybrid RFID-based system using two-way tags	Event Earliest	Event Latest			EE-i	LF-AD	ES+AD	EL-j	SLACK		ES=LS
Ai	Description	**EE-i**	**EL-i**	A-ij	AD	**ES**	**LS**	**EF**	**LF**	Total	Free	Critical
1	Vision, Mission	0	0	A1,2	3	0	0	3	3	0	0	Critical
2	Scope	3	3	A2,3	3	3	3	6	6	0	0	Critical
3	Literature Survey	6	6	A3,4	6	6	6	12	12	0	0	Critical
4	Economic Analysis	12	12	A4,5	12	12	12	24	24	0	0	Critical
5	Describe Thesis idea	24	24	A5,6	12	24	24	36	36	0	0	Critical
6	Market Survey	36	36	A6,7	12	36	36	48	48	0	0	Critical
7	Architecture Survey	48	48	A7,8	12	48	48	60	60	0	0	Critical
8	Objective and Milestone	60	60	A8,9	6	60	60	66	66	0	0	Critical
9	Reader and Tag features.	66	66	A9,10	8	66	66	74	74	0	0	Critical
10	Reader & Tag Protocols	74	74	A10,11	24	74	74	98	98	0	0	Critical
11	Reader & two-way tag architecture.	98	98	A11,12	3	98	107	101	110	9	9	
12	Two-way tag schematic design	101	110	A12,13	0	101	110	101	110	9	9	
13	Two-way tag prototype and debug.	110	110	A11,13	12	98	98	110	110	0	0	Critical
14	Reader prototype and debug.	146	146	A13,14	36	110	110	146	146	0	0	Critical
15	Integration of Hybrid RFID system.	194	194	A14,15	48	146	146	194	194	0	0	Critical
D1	Industry Standards and Regulations	18	24	A4,D1	6	12	18	18	24	6	6	
D2	Application Diagram	18	24	A4,D2	6	12	18	18	24	6	6	
D3	RFID System design consideration	42	48	A6,D3	6	36	42	42	48	6	6	
D4	Survey on protocols	72	74	A9,D4	6	66	68	72	74	2	2	
D5	Demo preparation	152	194	A14,D5	6	146	188	152	194	42	42	
				AD1,5	0	18	24	18	24	6	6	
				AD2,5	0	18	24	18	24	6	6	
				AD3,7	0	42	48	42	48	6	6	
				AD4,10	0	72	74	72	74	2	2	
				AD5,15	0	152	194	152	194	42	42	

NETWORK SCHEDULING

Activity Network diagram redrawn with earliest and latest event times.



Milestone


2009
2010
Vision, Mission
Scope
Literature Survey
Economic Analysis
Describe Thesis idea
Market Survey
Architecture Survey
Objective and Milestone
Reader and Tag features.
Reader & Tag Protocols
Reader & two-way tag architecture.
Two-way tag schematic design
Two-way tag prototype and debug.
Reader prototype and debug.
Integration of Hybrid RFID system.
9
10
11
12
1
2
3
4
5
6
7
8
9
10
11
12

Committee Structure would be,

1. Chair Advisor

   Prof.Dr.Sotoudeh Hamedi-Hagh

   RF, Analog and Mixed-Signal Integrated Circuits

2. Industrial Advisor

   Prof.Dr.Raymond Kwok.

   Solid State Physics, Applied Superconductivity, RF Engineering, Wireless Technologies, Microwave and Antenna Designs.

3. Co-Advisor

   Prof.Dr.Robert H. Morelos - Zaragoza

   RFID system, Error correcting codes and wireless communication systems.

List of contacts concerning to my thesis

	Name	Email	Question
[T1]	*Tabesh, Maryam*	tabesh@eecs.berkeley.edu	Discuss on proposed idea and potential value.
[B1]	*Harvey Lehpamer*	harveylehpamer@hltelecomconsulting.com	
[B2]	*Jari-Pascal Curty, Michel Declercq, Catherine Dehollain, Norbert Joehl*	jp.curty@sokymat.com	
[P3/ P6]	*Yao-Huang Kao, Chia-Chuan Liu, Hung-Chang Kuo*		
[P4]	*Udo Karthaus Martin Fischer*		
[P5]	*Daniel Pardo, Alexander Vaz, Santiago Gil, Josean Gómez, Aritz Ubarretxena, David Puente, Ricardo Morales-Ramos2, Andrés García-Alonso*		
[P7]	*Alessio Facen, Andrea Boni*		

References Sources:

1. Primary Collection

IEEE Published Papers, Books, Thesis

*[B1].**RFID Design and principles**, by Harvey Lehpamer, 2008.*

*[B2].**Design and Optimization of Passive UHF RFID Systems** by Jari-Pascal Curty, Michel Declercq,Catherine Dehollain, Norbert Joehl*

2. Engineering Articles and Data Bases.

From IEEE Xplore

(http://libaccess.sjlibrary.org/login?url=http://ieeexplore.ieee.org.libaccess.sjlibrary.org)

3. Patents

Based on Patents survey their was no patent available under the proposed Idea and Architecture.

4. Standards

No standards available for Hybrid Two-Way RFID Tag.

References:

[1].**RFID Design and principles**, by Harvey Lehpamer, 2008.

[2].**Design and Optimization of Passive UHF RFID Systems** by Jari-Pascal Curty, Michel Declercq, Catherine Dehollain, Norbert Joehl

[3] **Performance Limitations of Passive UHF RFID Systems**, Pavel V. Nikitin* and K. V. S. Rao,Intermec Technologies Corporation, ASP, 2006

[P2] **An Ultra-Low-Power Long Range Battery/Passive RFID Tag for UHF and Microwave Bands With a Current Consumption of 700 nA at 1.5 V,** Vijay Pillai, Harley Heinrich, David Dieska, Pavel V. Nikitin, Rene Martinez, and K. V. Seshagiri Rao, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS—I: REGULAR PAPERS, VOL. 54, NO. 7, JULY 2007.

[P3/P6] **Study of Front End of CMOS RFID Tag with Inductively-coupled Broadband Antenna,** Yao-Huang Kao, Chia-Chuan Liu, and Hung-Chang Kuo, JSC, Vol. 5, No. 4, pp. 15-19 (2007)

[P4] **Fully Integrated Passive UHF RFID Transponder IC with 16.7uW Minimum RF input power**., Udo Karthaus and Martin Fischer, IEEE Journal of Solid-State Circuits, VOl. 38, No.10, October 2003.

[P5] **Design Criteria for Full Passive Long Range UHF RFID Sensor for Human Body Temperature Monitoring**, Daniel Pardo, Alexander Vaz, Santiago Gil, Josean Gómez, Aritz Ubarretxena, David Puente, Ricardo Morales-Ramos2, Andrés García-Alonso, IEEE International Conference on RFID, 2007.

[P7] **A CMOS Analog Frontend for a Passive UHF RFID Tag**, Alessio Facen, Andrea Boni, ISLPED'06, October 4-6, 2006, Tegernsee, Gemiany. ACM.

[A1] **A -Mbps 1.6-gA Micro-power Active-RFID CMOS LSI for the 300-MHz Frequency Band,** Kenji Suzuki, Mamoru Ugajin and Mitsuru Harada, NTT Microsystem Integration Laboratories, 243-0198, Japan

[SP1] **Analysis, Design and Implementation of Semi- Passive Gen2 Tag**, Wenyi Che, Yuqing Yang, Conghui Xu, Na Yan, Xi Tan, Qiang Li, and Hao Min, Jie Tan. IEEE International Conference on RFID, 2009.

List of Thesis References

[T1]. Tabesh, Maryam, *Design and analysis of an ultra low power Ultra High Frequency Radio Frequency Identification front-end* , SJSU, 2007.
[T2].

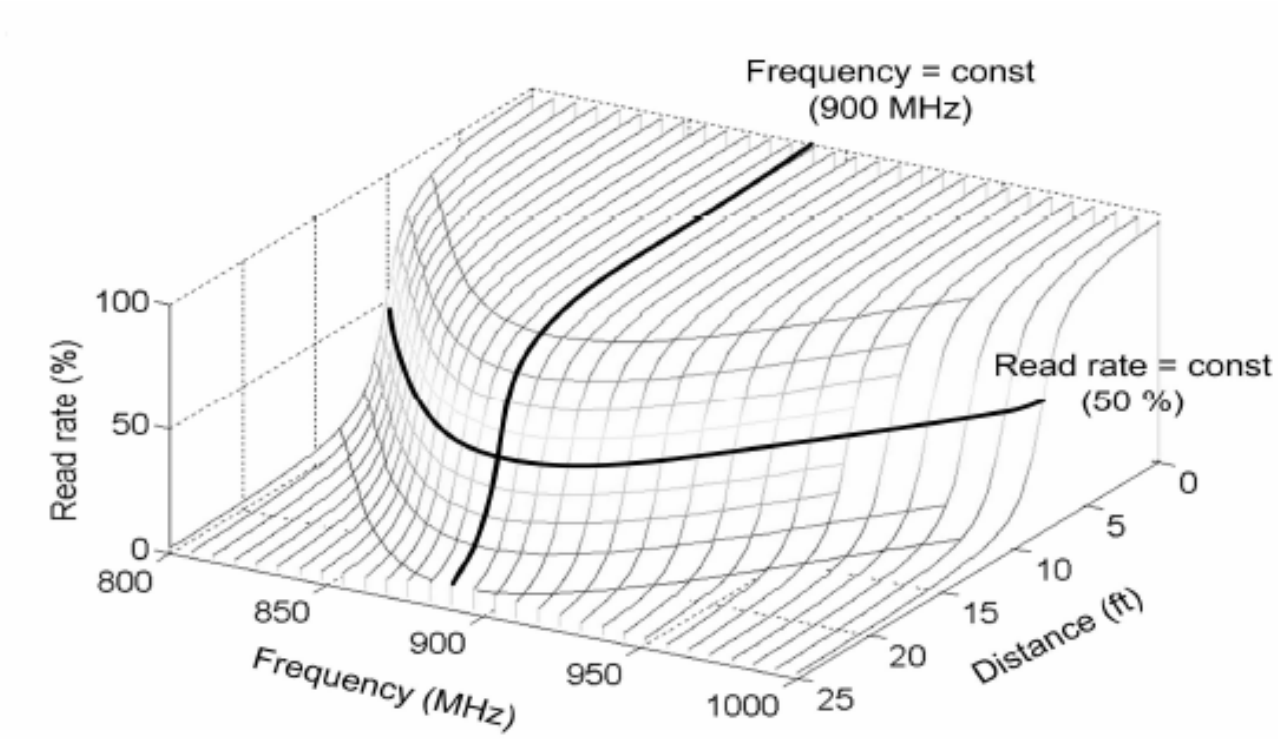
Acknowledgments

I would like to take this opportunity to convey my thanks to
Prof.Dr.Sotoudeh Hamedi-Hagh,
Prof.Dr.Raymond Kwok,
Prof.Dr.Robert H. Morelos – Zaragoza,
And Prof. Dr.Michael B. Jennings
for providing me the theoretical & practical aspects and valuable suggestion.

Also would like to convey my thanks to the members for providing suggestions, recommendation, comments, etc.

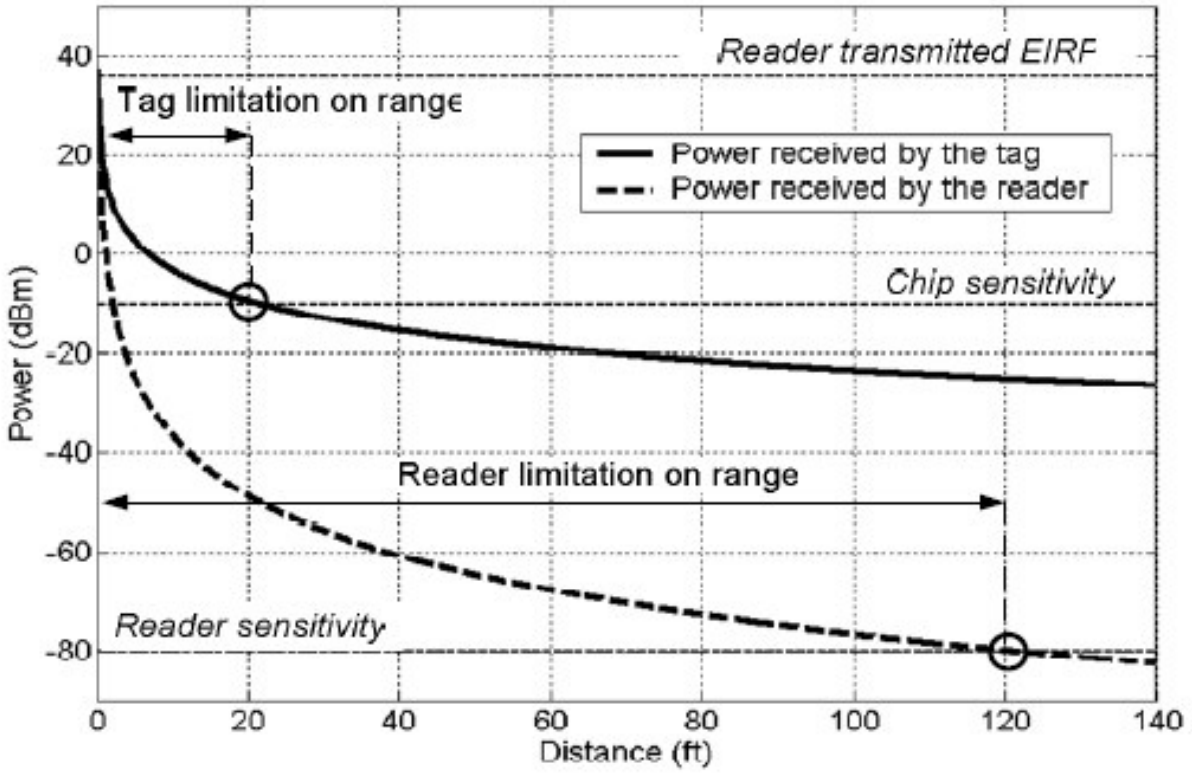
Q & A ...

Read rate vs. distance and frequency in a typical RFID system.



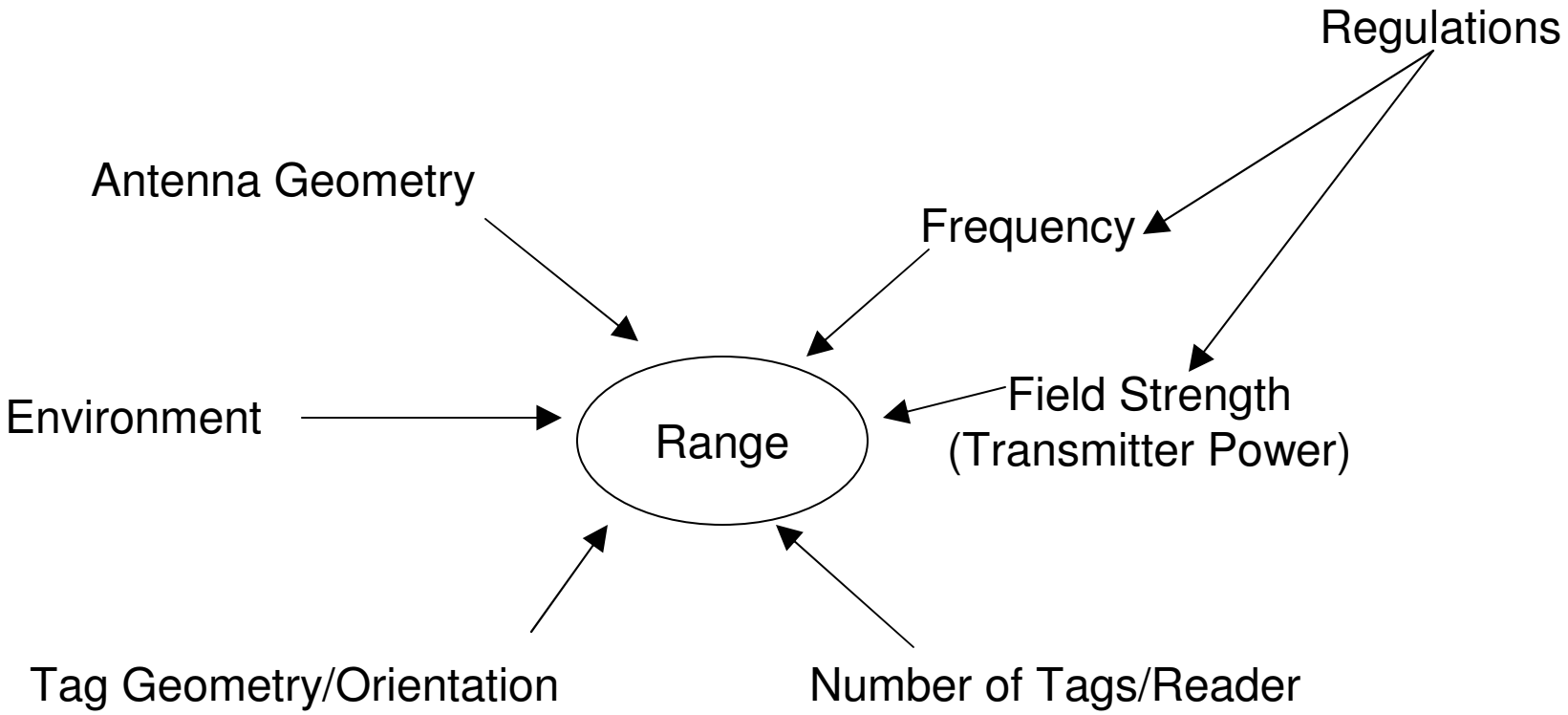
[a] Performance Limitations of Passive UHF RFID Systems, Pavel V. Nikitin and K. V. S. Rao, Intermec Technologies Corporation, ASP, 2006*

Received Power vs. Distance for tag and reader in RFID system.

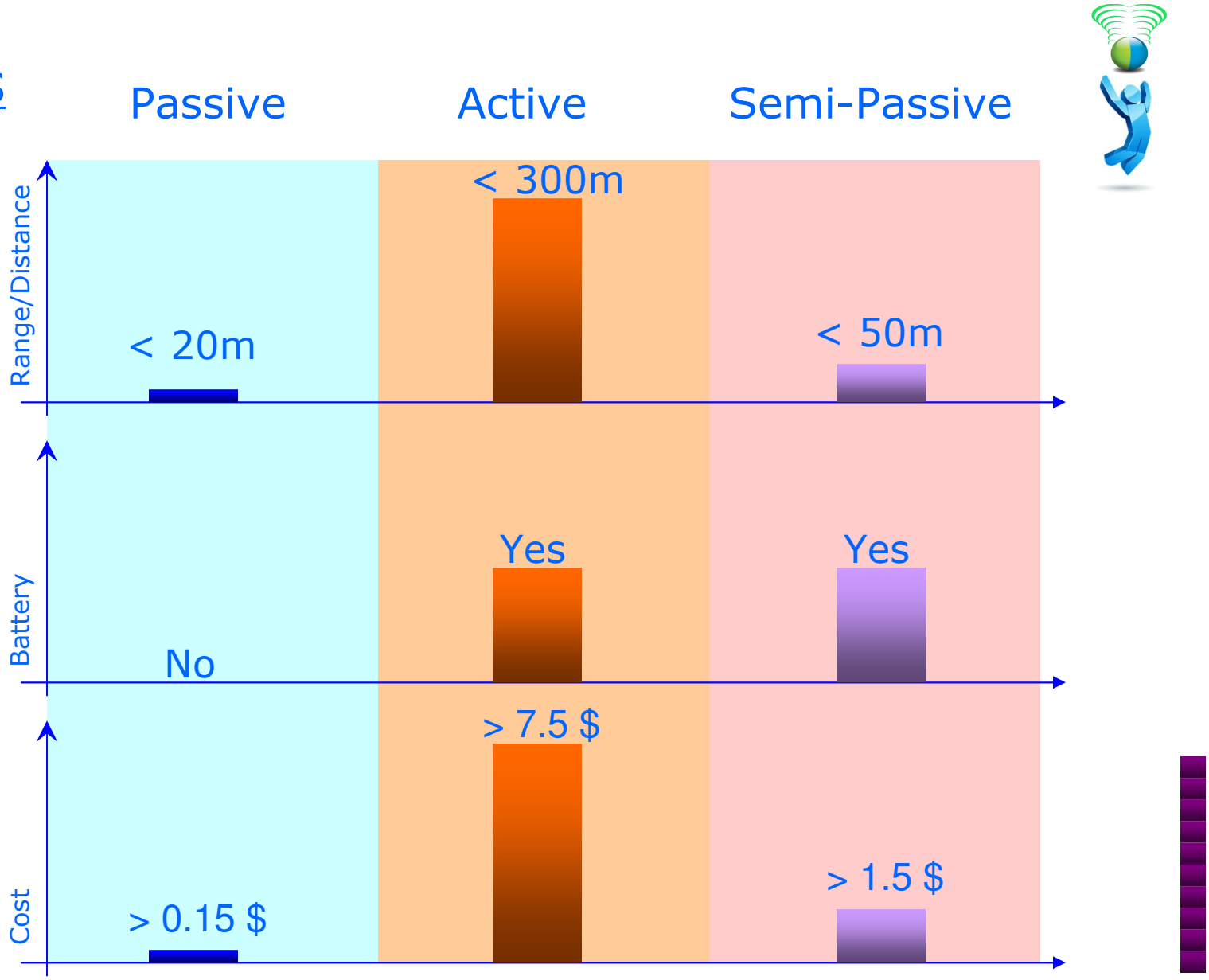


[a] Performance Limitations of Passive UHF RFID Systems, Pavel V. Nikitin and K. V. S. Rao, Intermec Technologies Corporation, ASP, 2006*

Constraints on Read/Write Range:

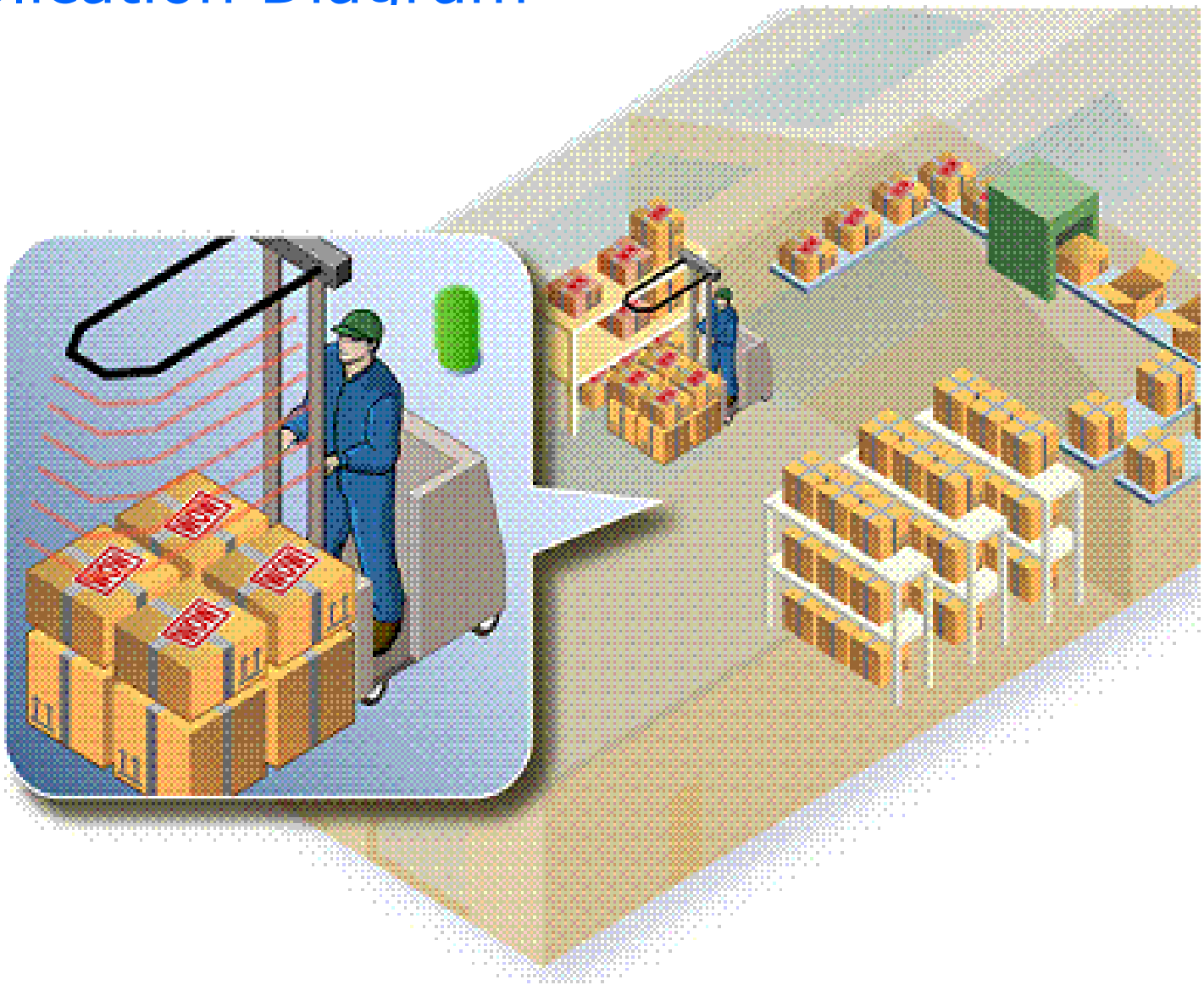


RFID TAGS



Source: RFID Tutorial, Dr. Jari-Pascal Curty CTO Deputy, SOKYMAT SA, International Telecommunication Union, ITU-T Workshop "Networked RFID: Systems and Services", Geneva, 14-15 February 2006

Application Diagram



Application Diagram