

Seminar WSN

Using Dynamic WSNs in smart logistics for fruits and pharmacy

Sensys '11 Ambient Systems

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Outline

- Introduction
- Ambient systems
- Monitoring of perishable products
 - Distributed sensing
- Network Infrastructure requirements
- Ambient Network Infrastructure
- Ambient protocol stack
 - DDI ,MAC ,ARTP ,RUP
- Ambient middleware
- Messaging efficiency
- Lessons learend
- Conclusion

Introduction

- Temperature-Controlled Supply Chain
 - Problems
 - Challenges



An
Apple a Day
Really Does Keep
the Doctor Away



Ambient systems

- Smartpoints
 - (chipcon CC2340 radiochip) 8bit 8051 and 2mb flash memory
- Connect box

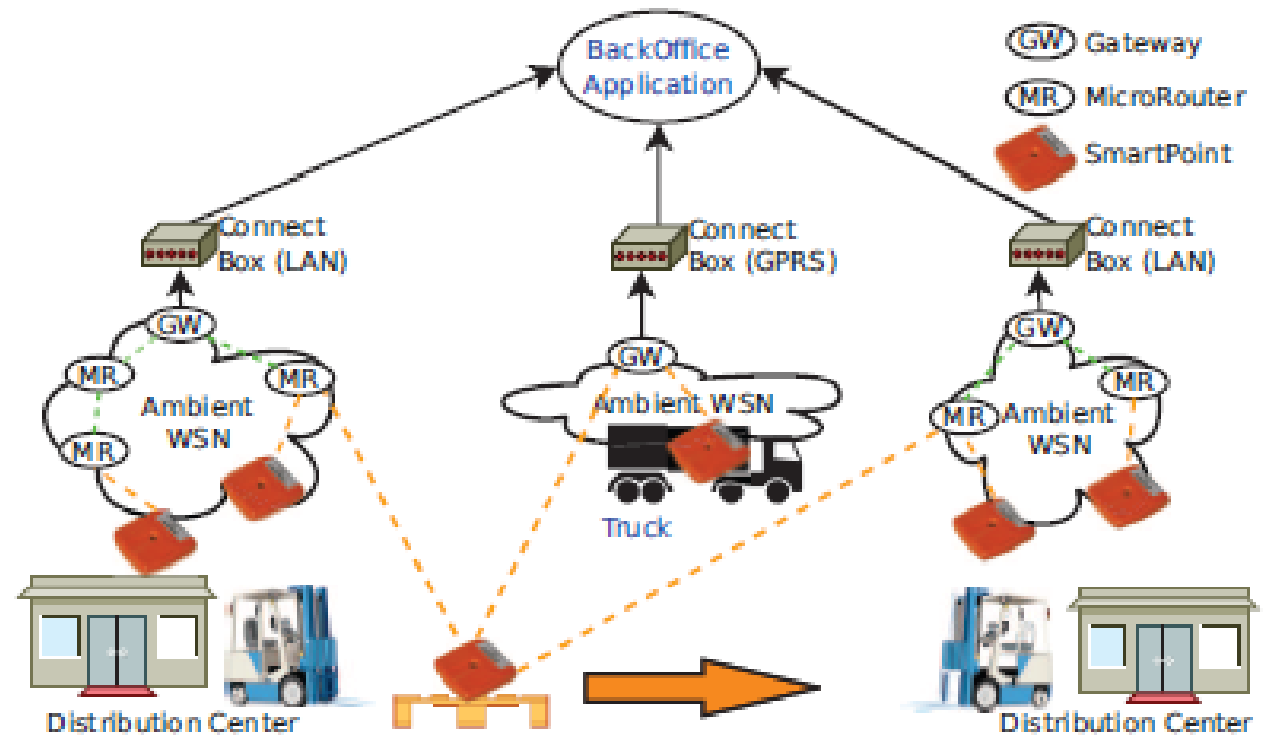


Figure 1. Moving networks in logistics

Monitoring of perishable products

- Distributed sensing
 - Shelf predication algorithm travels along with products
 - Tagged sensors
 - Infrastructure sensors



Network infrastructure Requirements

- Dynamics
- Reliability and Congestion control
- High scalability
- Multiple network coexistence

Ambient Network infrastructure

- Dynamic WSN (DWSN)
 - IEEE 802.15.4 PHY

- Two layers
 - Infrastructure
 - Smartpoints

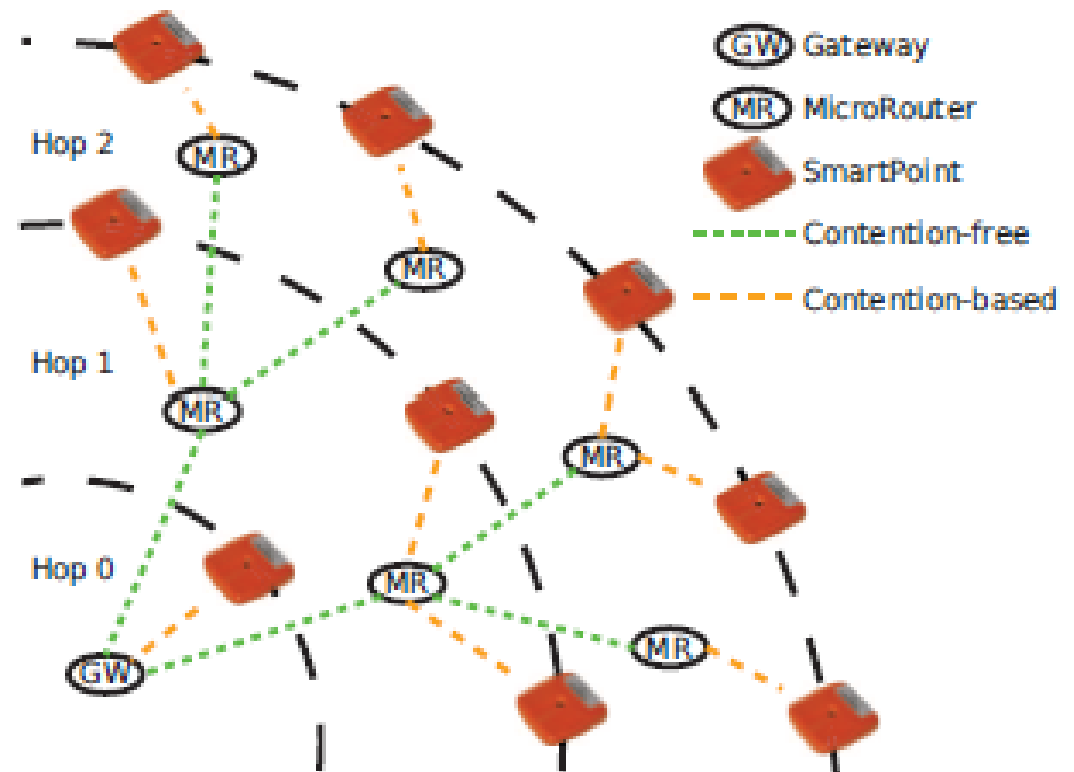


Figure 3. Ambient sensor network

Ambient protocol stack:

- ARTP(Ambient reliable Transport protocol)
- RUP-Remote update Protocol
- DDI-Device Driver Interface
- RRP –rapid reader protocol
- MAC-Medium access control

ARTP- Ambient reliable Transport protocol

- End –to End reliability protocol
- Criteria
- Three phases
- Cache

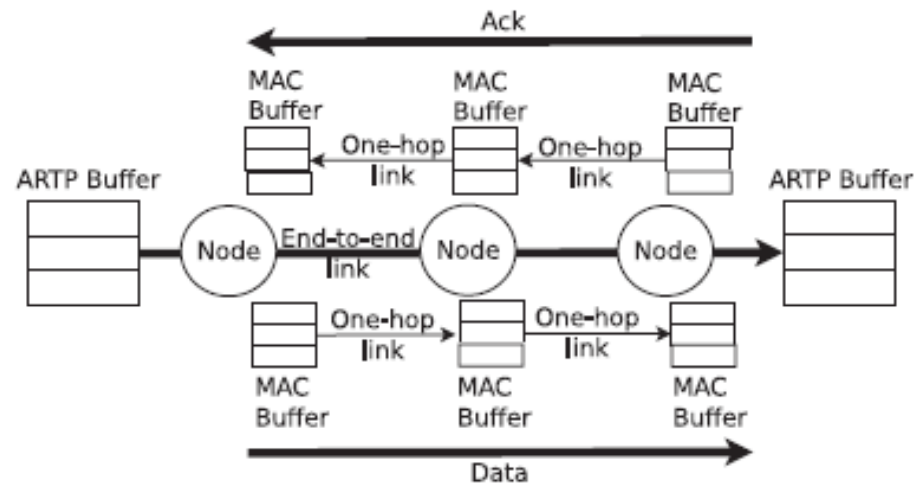


Figure 5. ARTP Buffers

ARTP vs TCP



- Fixed size segments
- Smaller overhead
- Cross –layer approach
- Cache prevent unnecessary forwarding
- Congestion control is different

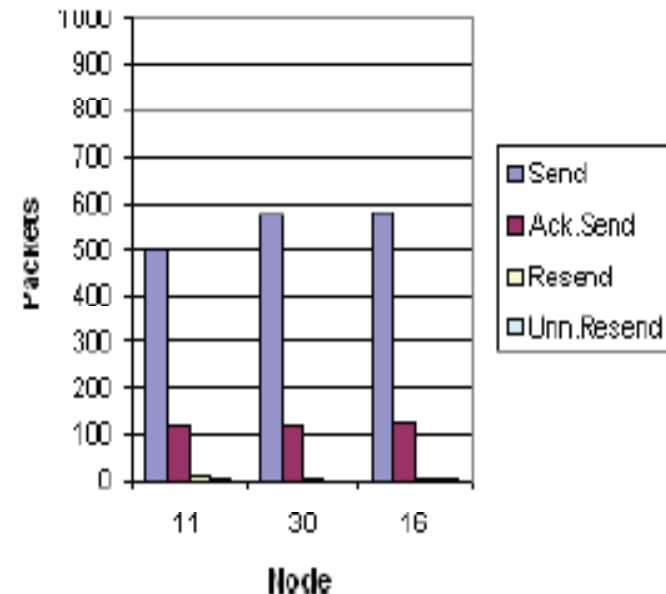
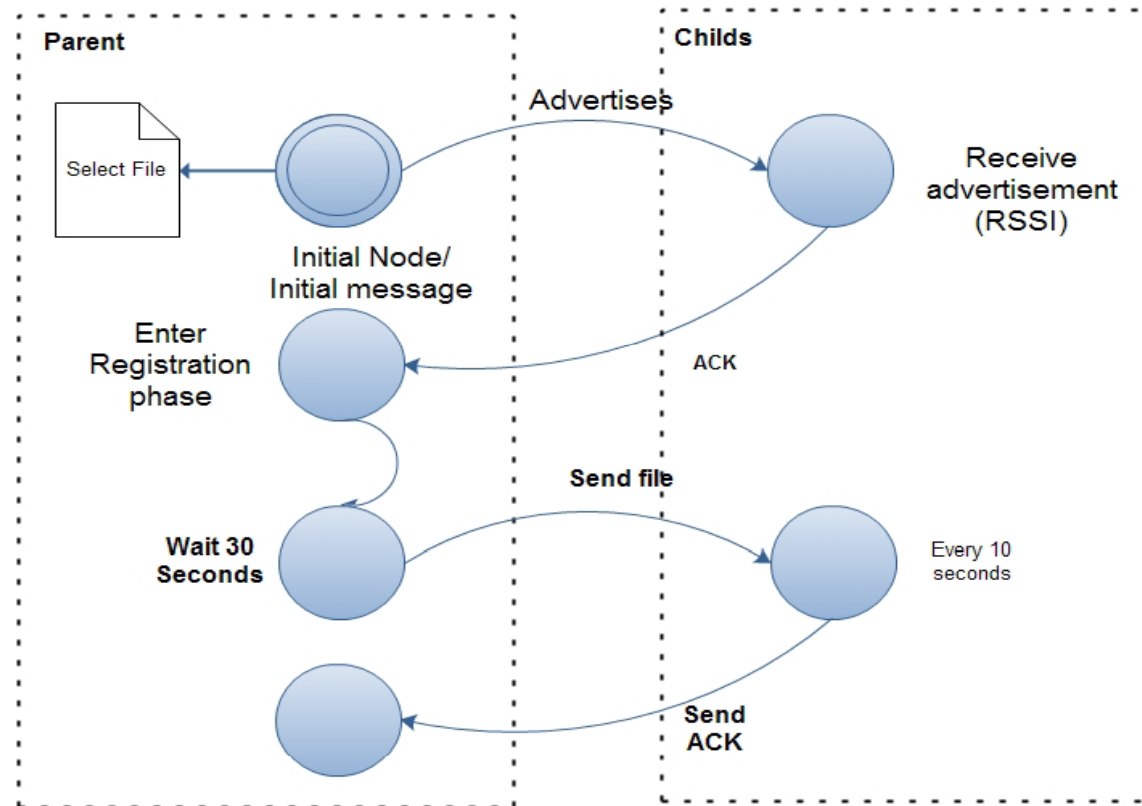


Figure 7. Performance of selective acknowledgments

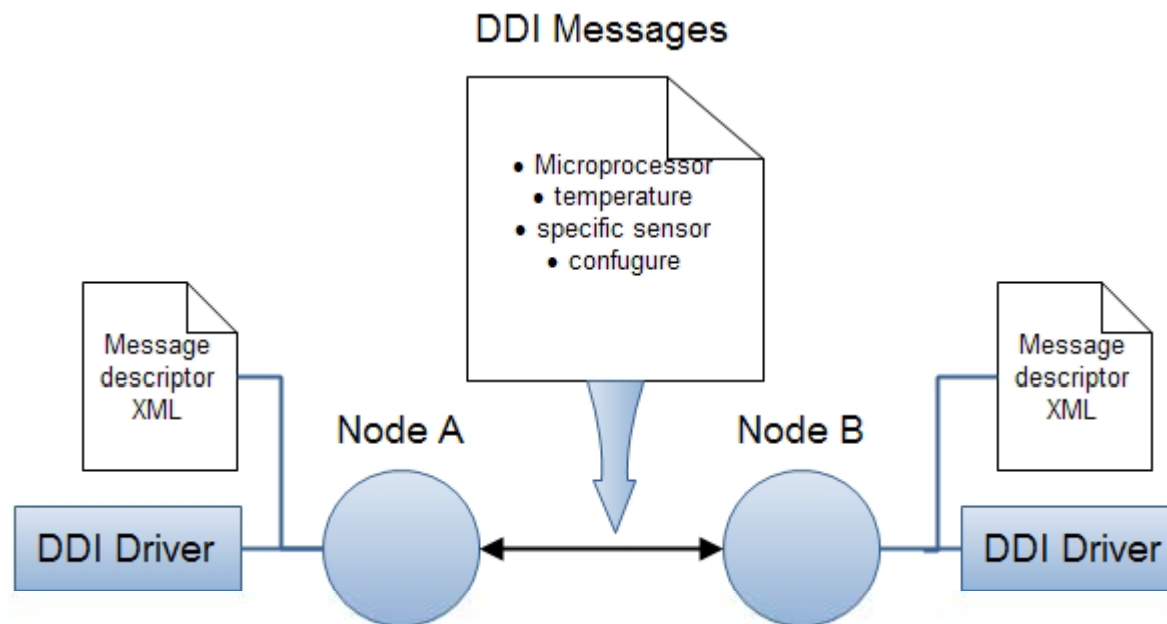
RUP-Remote update Protocol

- Designed to disseminate large files
- Based on deluge dissemination protocol



DDI-Device Driver Interface

- Asynchronous communications



MAC



- TDMA Based protocol
- Contention free (similar to LMAC)
- Contention based (CSMA)
- Priority levels & Lifebeat signal

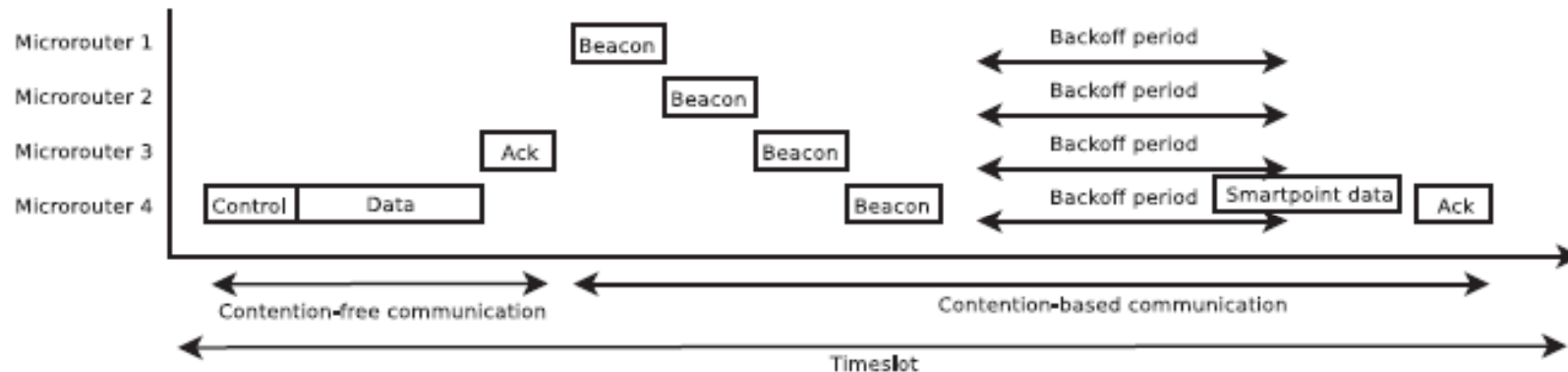


Figure 4. Layout of a MAC TDMA timeslot containing a contention-free and a contention-based communication part

Ambient middleware (AmbientMW)

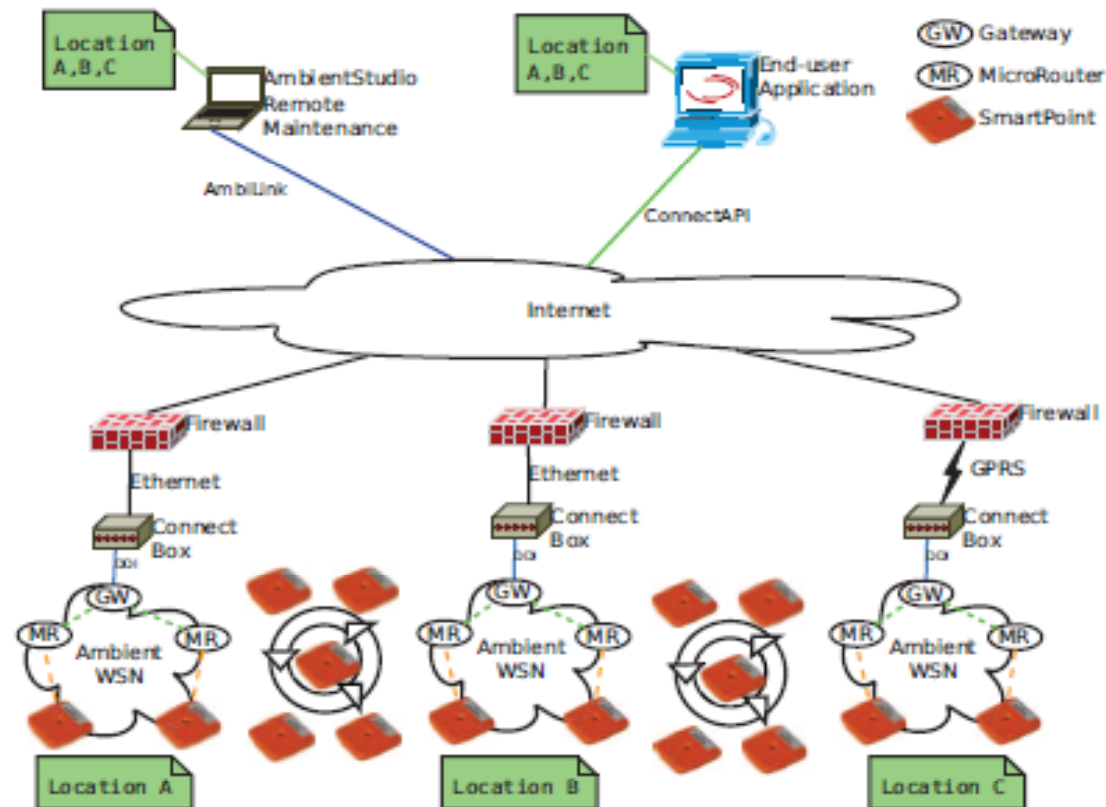


Figure 8. Ambient connect framework

Messaging efficiency

Table 1. AmbiLink versus ConnectAPI features

Protocol	Usage	Transport	Security	Format	Filter	Destination	Merged WSNs
ConnectAPI	3 rd -party applications	TCP/IP	SSL option	XML	header fields	Broadcast to all applications	Using multiple clients
AmbiLink	Monitoring & maintenance	TCP/IP	SSL option	binary	per WSN	Routing to AmbiLink instance(s)	At client or server

Table 4. Comparison of Ambient middleware protocols

Protocol	Availability	Impact	Latency	Reliability	Bandwidth	Security
AmbiLink	+	ds+dc	low	+	low	SSL
ConnectAPI	+	ds+dc+lc	low	+	medium	SSL

Messaging efficiency continued

Table 5. Comparison of Bandwidth (in bytes) & latency for N message exchanges, and bandwidth for N=10

Protocol	TCP/IP headers 48 bytes	HTTP headers 256 bytes	request messages	response messages	typical message size	bandwidth N=10 and 1 TCP connect
XML-RPC	$5+4N..9N$	$N*2$	$N*XML$	$N*XML$	XML=1024	27760
SOAP	$5+4N..9N$	$N*2$	$N*(envelope+XML)$	$N*(envelope+XML)$	envelope=172	36790
REST	$5+4N..9N$	$N*2$	$N*(URL XML other)$	$N*(XML OK other)$	URL OK=100	19000
JSON-RPC	$5+2N..5+4N$	0	$N*JSON$	$N*(optional\ JSON)$	JSON=900	10200..20160
AmbiLink	$5+2N$	0	$N*AmbiLink$	0	AmbiLink=250	3700
ConnectAPI	$5+2N$	0	$N*ConnectAPI$	0	ConnectAPI=900	10200

Example deployment

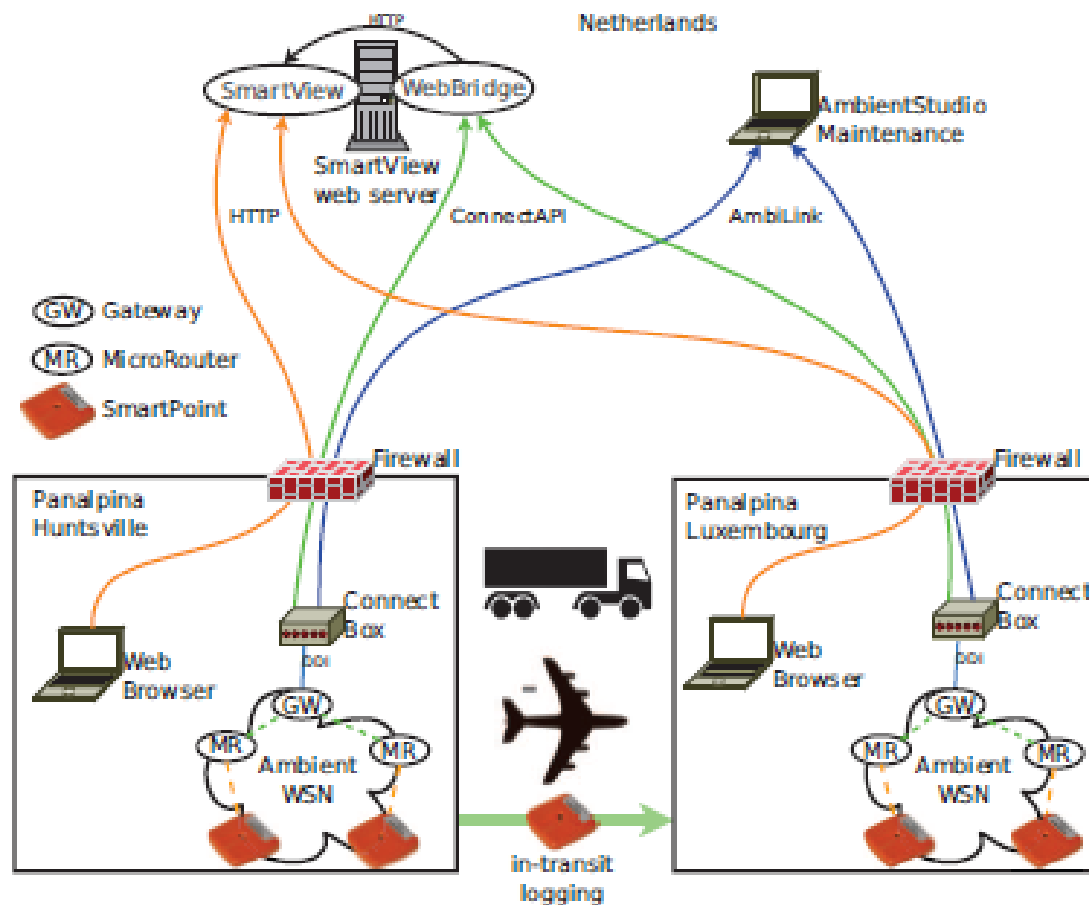


Figure 9. Panalpina remote sensing and maintenance

Lessons learned

- High delivery ratio demand
- Scalability and available bandwidth
- Congestions
- Small available bandwidth

Conclusions

- Distributed processing
- Network /system architecture
- Remote upgrades
- Deployment challenges