

High availability Profibus radiolinks for industrial automation



Schildknecht AG

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For this presentation I got
some piece of advice:

Not to keep a paper in
German in the UK

Don't mention the digit 4 as
a German

Agenda Schildknecht AG



- company founded 1981
- 1993 first radiolink for Simatic S5
- more than 3000 successful projects with industrial radiolinks
- 15 employees in Development, Sales, Marketing
- nominated for Hermes Award 2006 for the most innovative products
- since 2000 work in several associations (GMA VDI ZVEI) committee for radiocommunication
- coauthor VDI Guideline 2185 „Coexistence of radiocommunication in industrial automation “



The best electrical connection
is still a cable!

Reasonable use cases for radio communication

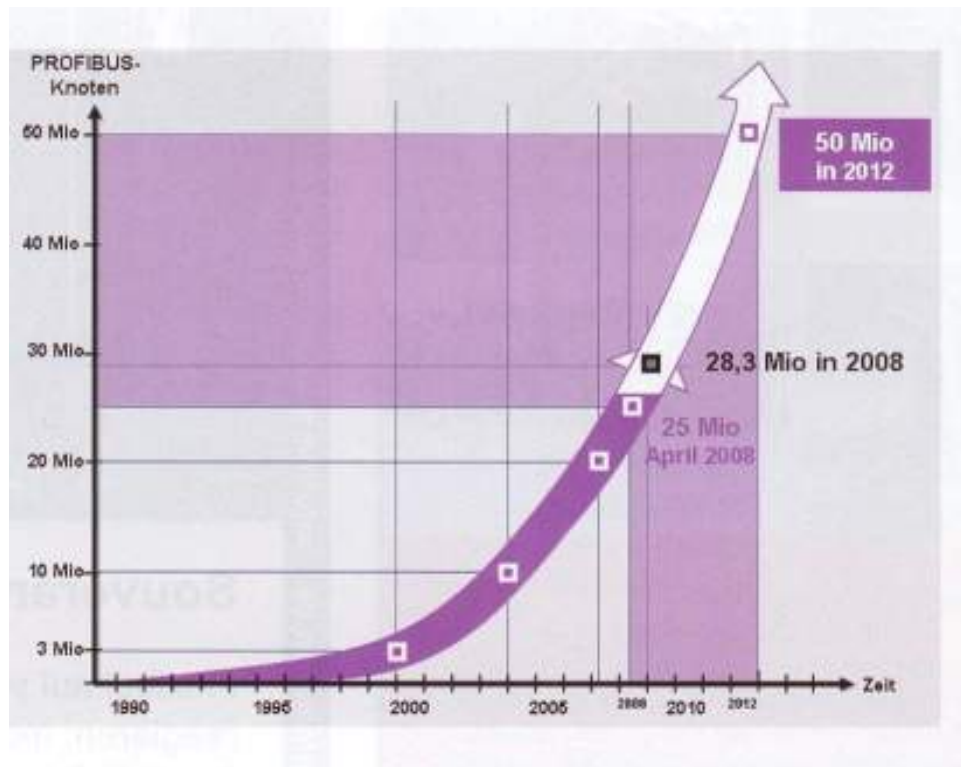


- As alternative technology for slip rings, trailing cable, waveguides, light barrier or inductive data transmission
- Mobile or rotating machine systems e.g. AGV, cranes
- Bridging roads, buildings, premises, railroad line or rivers
- datacommunication for a limited time period

Wireless QoS classification ISA-100

Application	Description
class 0 Emergency action	always critical
class 1 Closed loop regulatory control	often critical
class 2 Closed loop supervisory control	usually non-critical
class 3 open loop control	human in the loop
class 4 Alerting / Visualisation	e.g. event-based maintenance
class 5 Logging, Up- Download	historic data collection

Profibus market growing



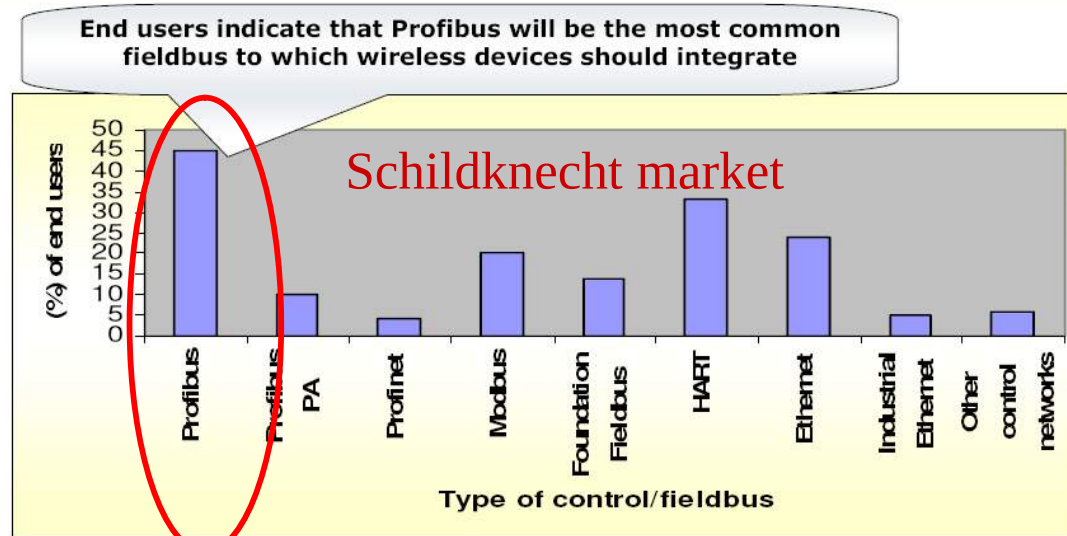
SPS Magazin 4/2009:

Expected growing of Profibus nodes
2008 -2012:

100% 25 million to 50 million

User's requirements

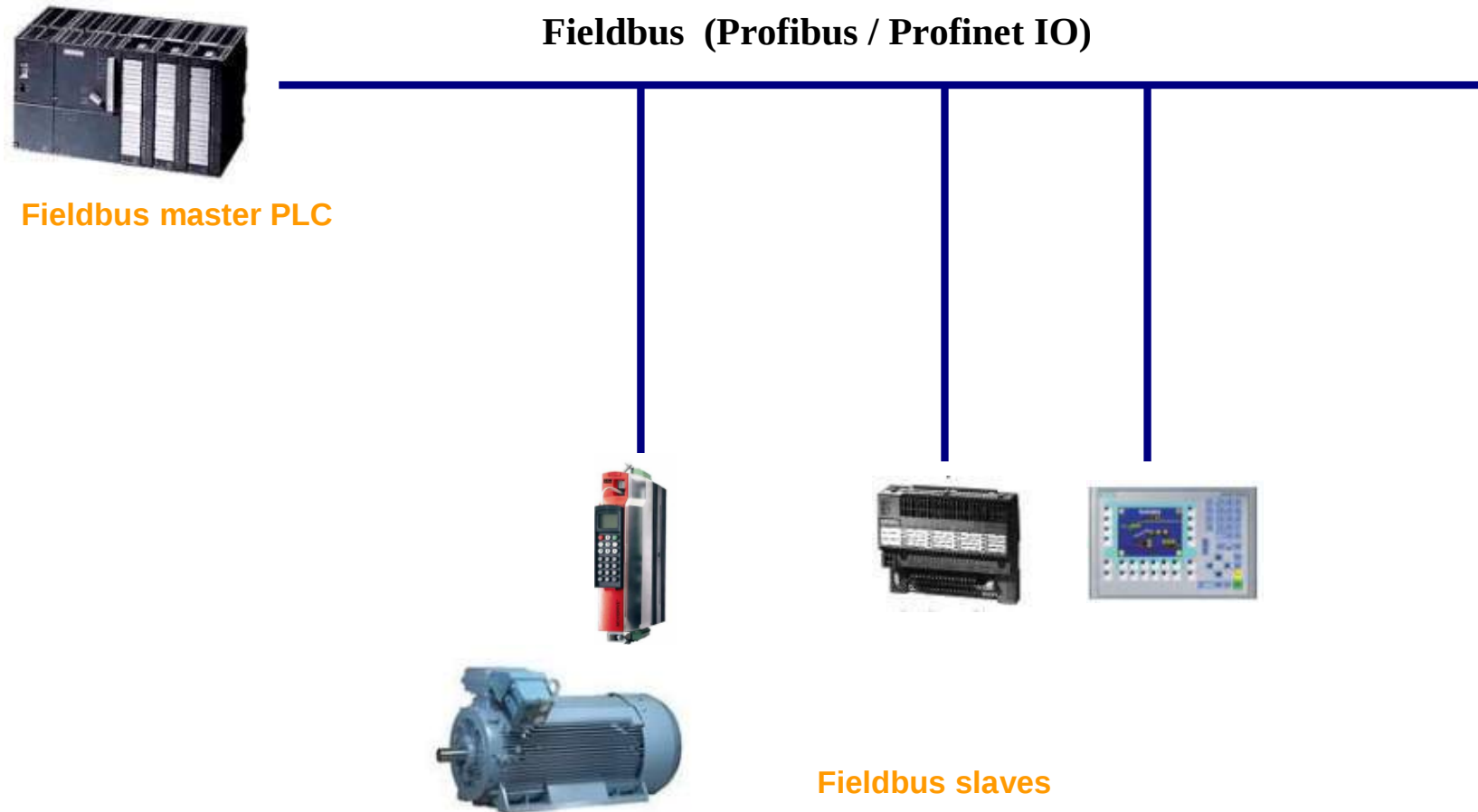
To What Protocols Should Wireless Devices be Compatible With???



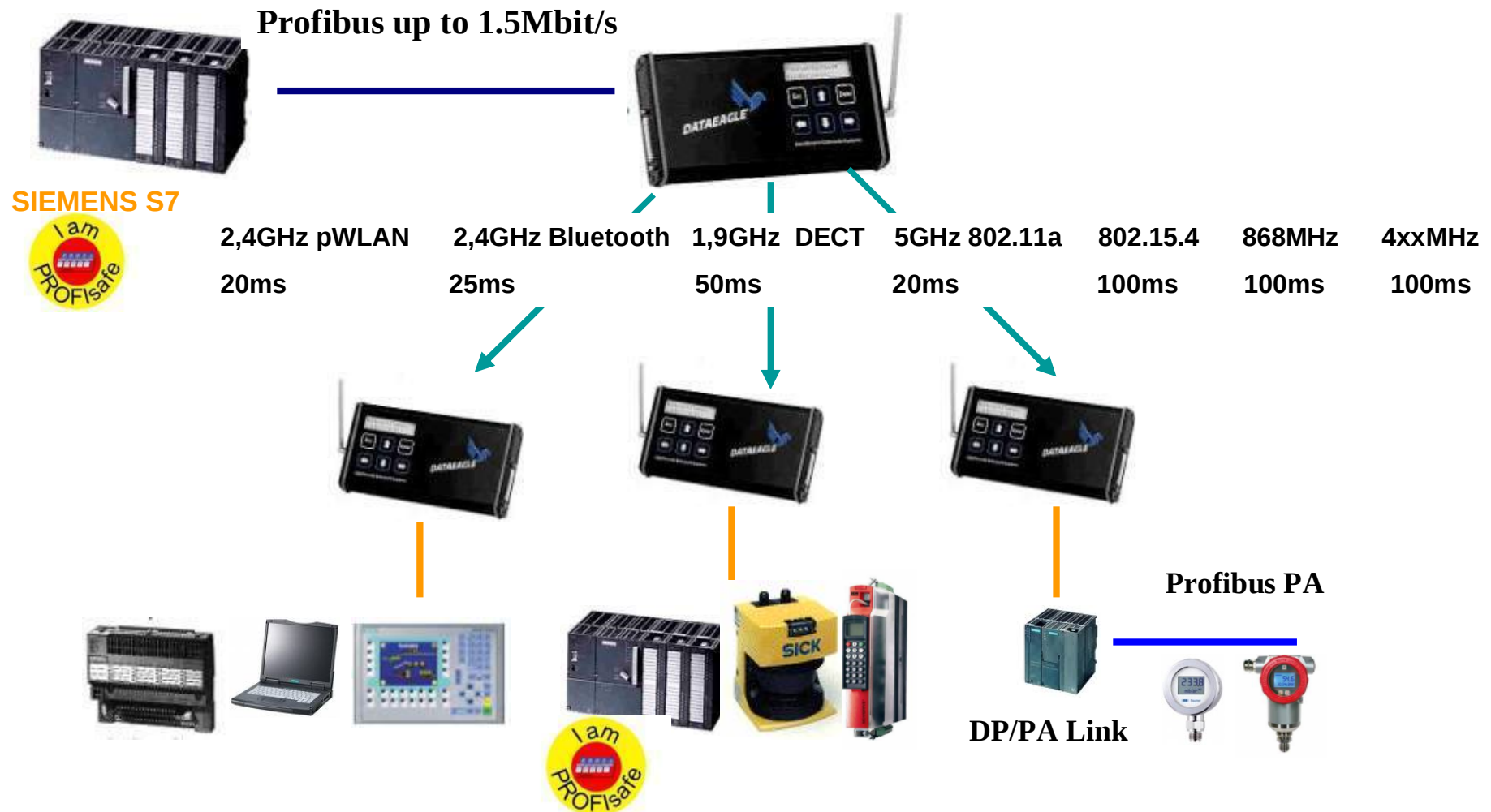
Frost & Sullivan 2009

- Having made the change to Fieldbus over last decade, end users emphasize that wireless compatibility with existing fieldbus in the plant is critical
- Current HART users could move to wireless HART to extend measurements to untapped areas and maximize the benefits of HART

Typical closed control loop



Closed control loop with wireless Profibus





Airbus body montage A319 –automated guided vehicle system AGV

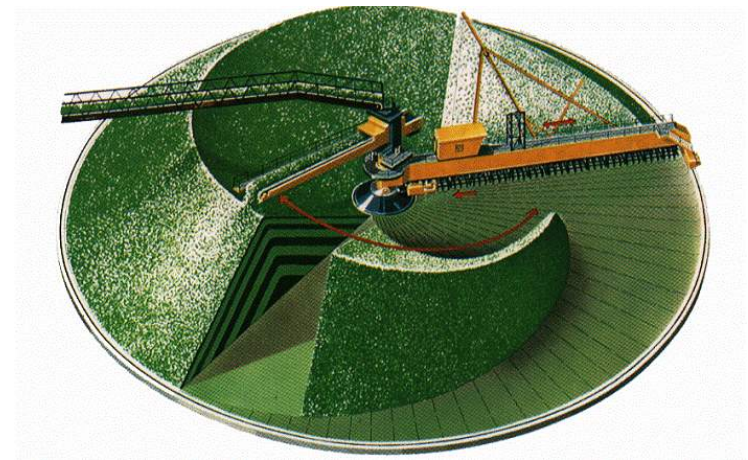
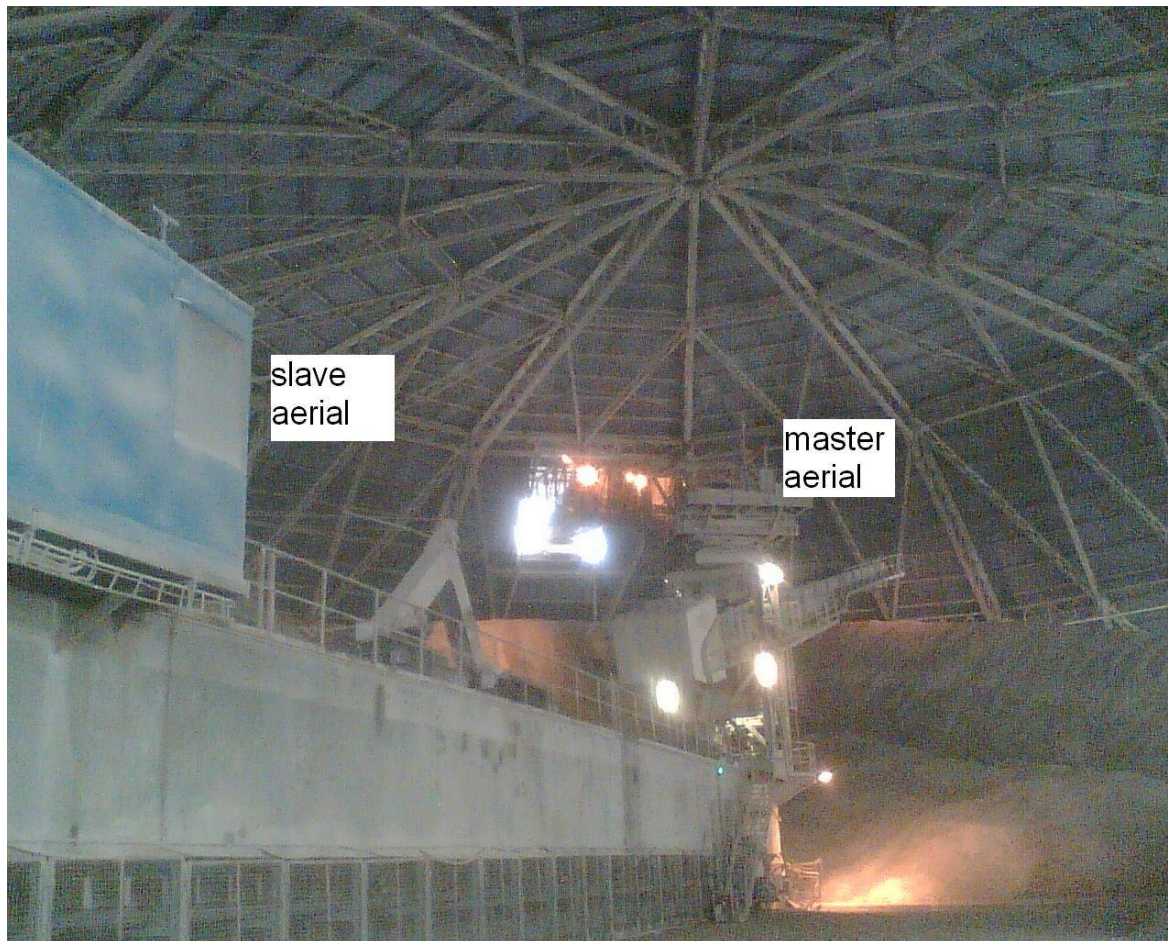
Distance about 70m

Transparent Profibus/Profisafe radio communication

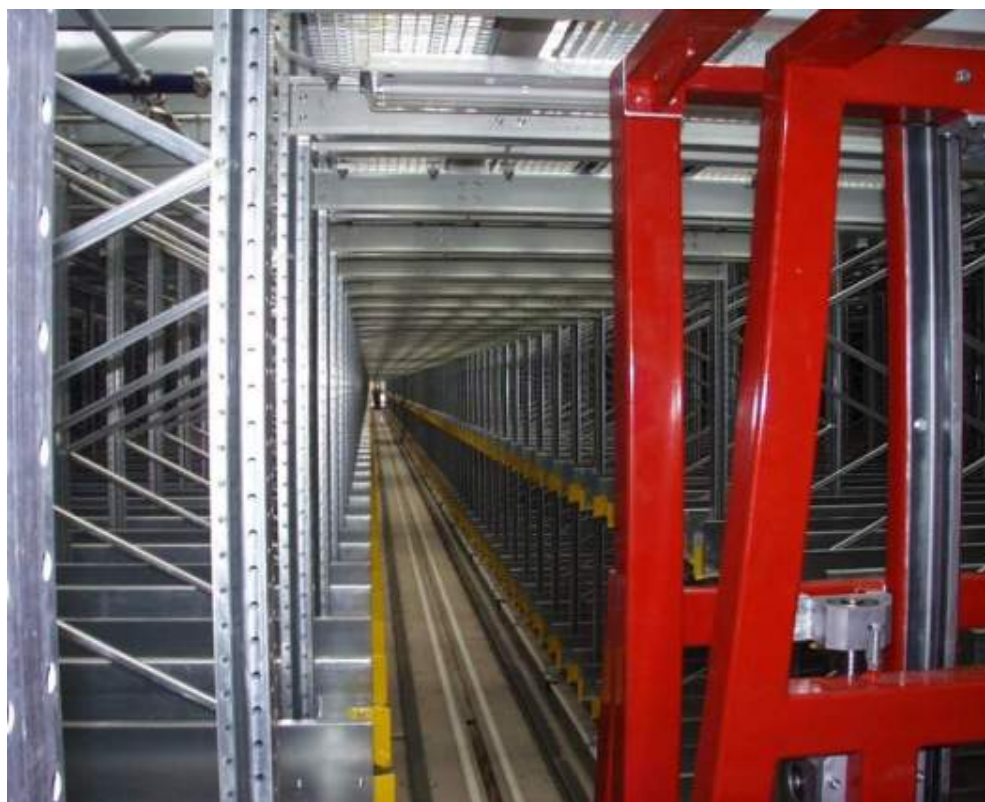
Radio technology: 2.4GHz DSSS

PLC: 2 x Simatic S7 315F

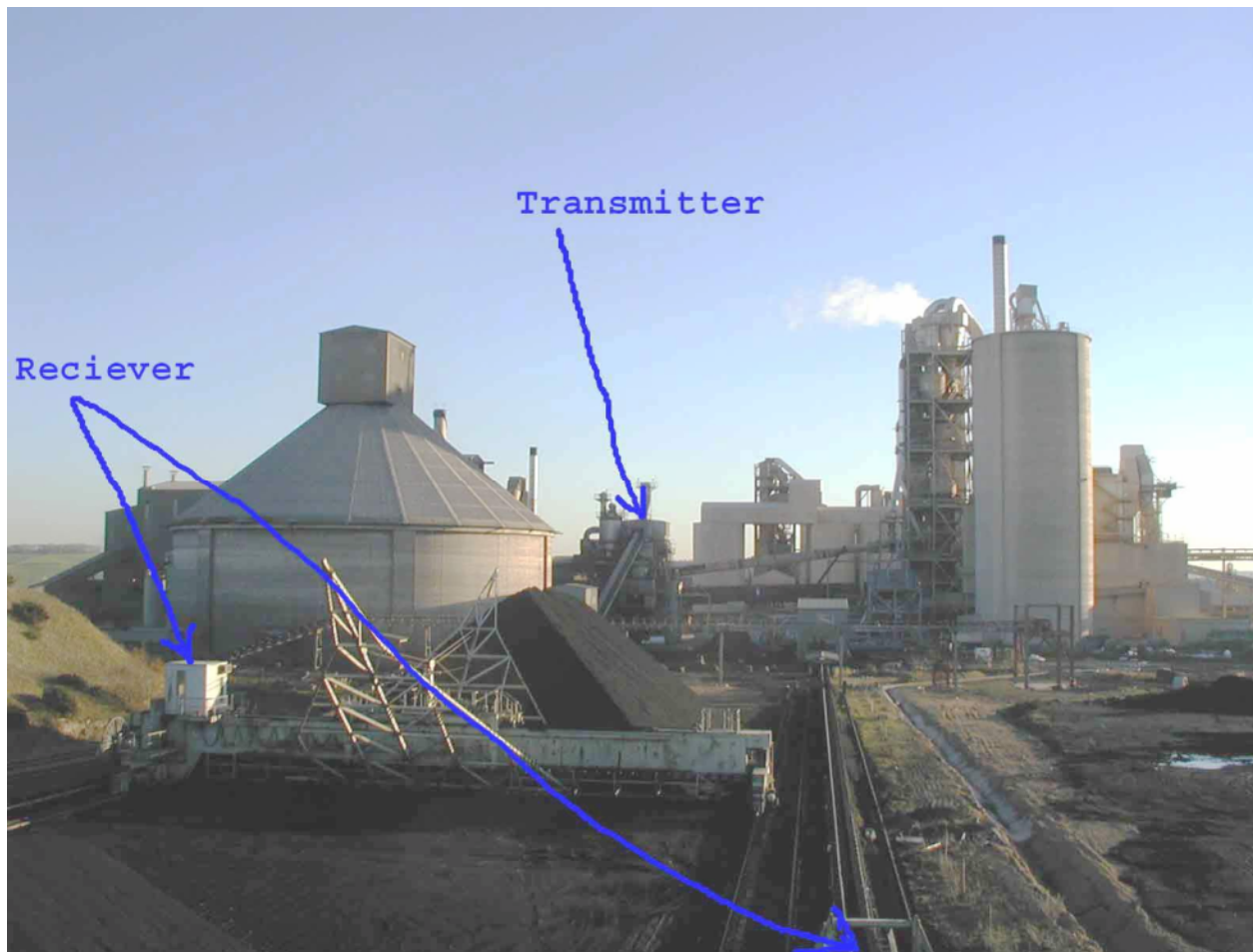




Castle Cement UK Wireless Profibus to reclaimer



Battery driven AGV in Warehouse stock in Austria
Radio: 2.4GHz Bluetooth for 2 x S7 315 communication
Distance 70m



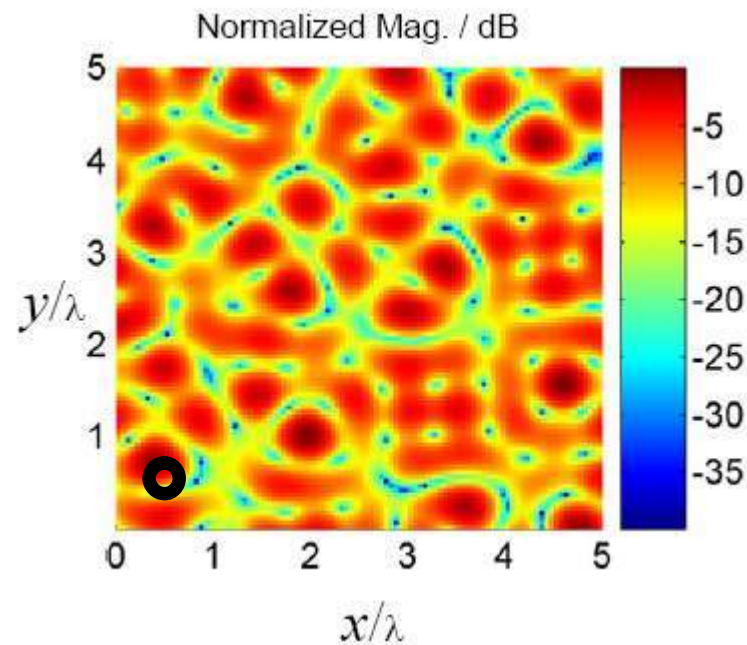
NAB Services UK

Wireless Profibus
to 2 stacker



Wireless Profibus with B&R PLC in Oslo Skijumping arena
Lift up to the jumping stage

Snap-shot radio surrounding area

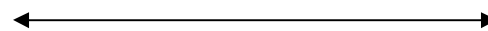


RF Fieldstrength =100%

= tenth

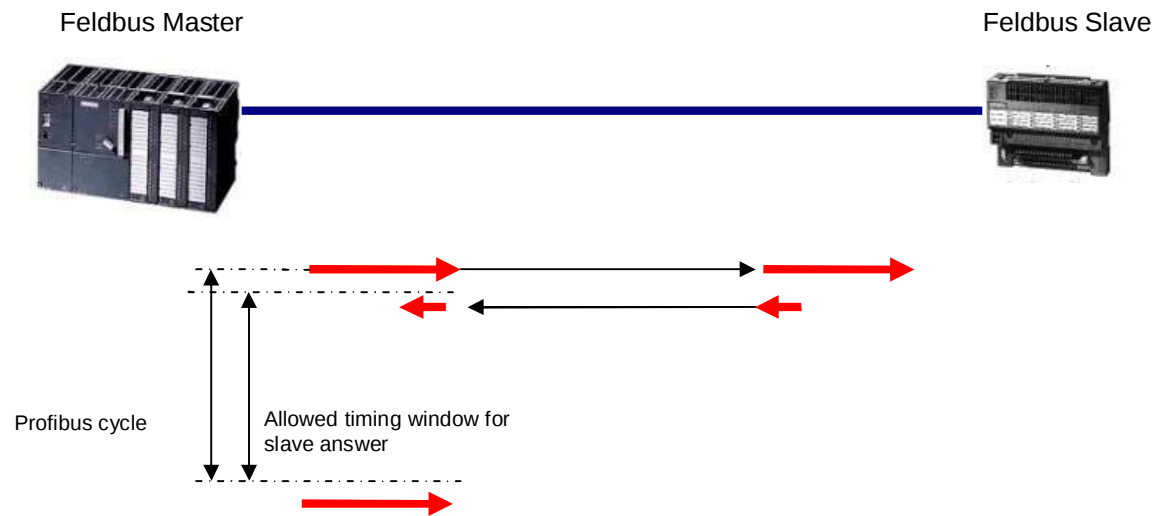
= hundredth

= thousandth

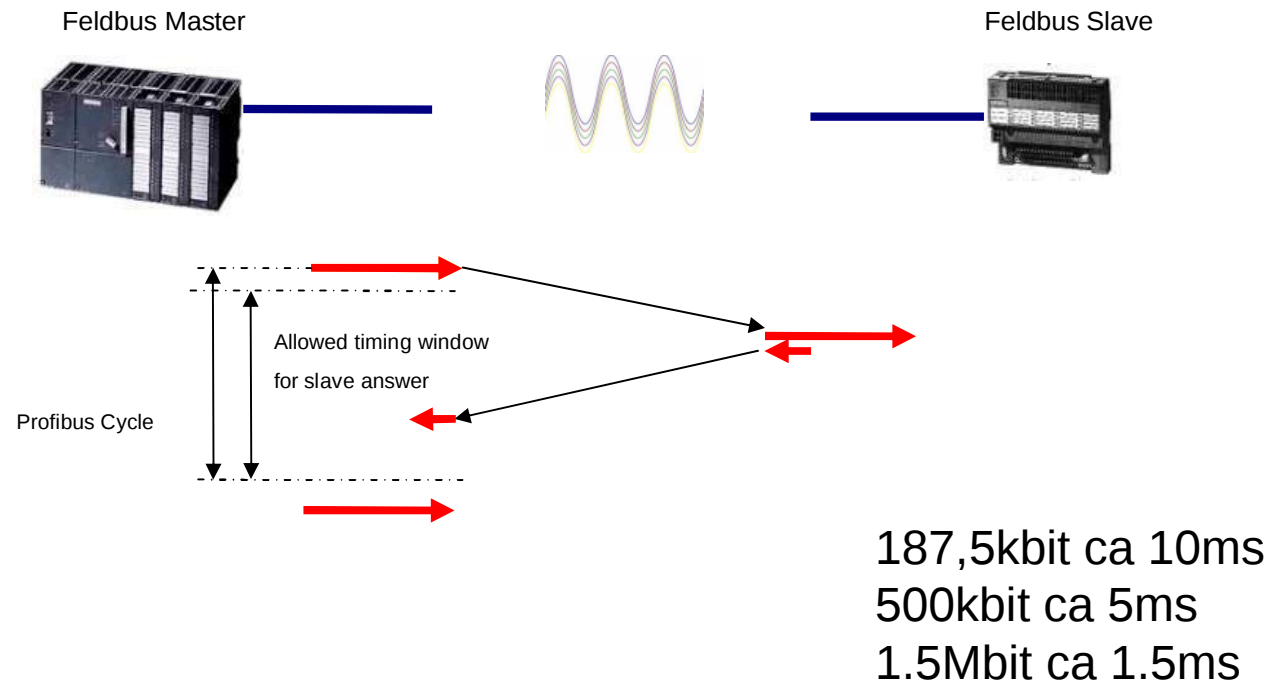


20 inch@2.4Ghz

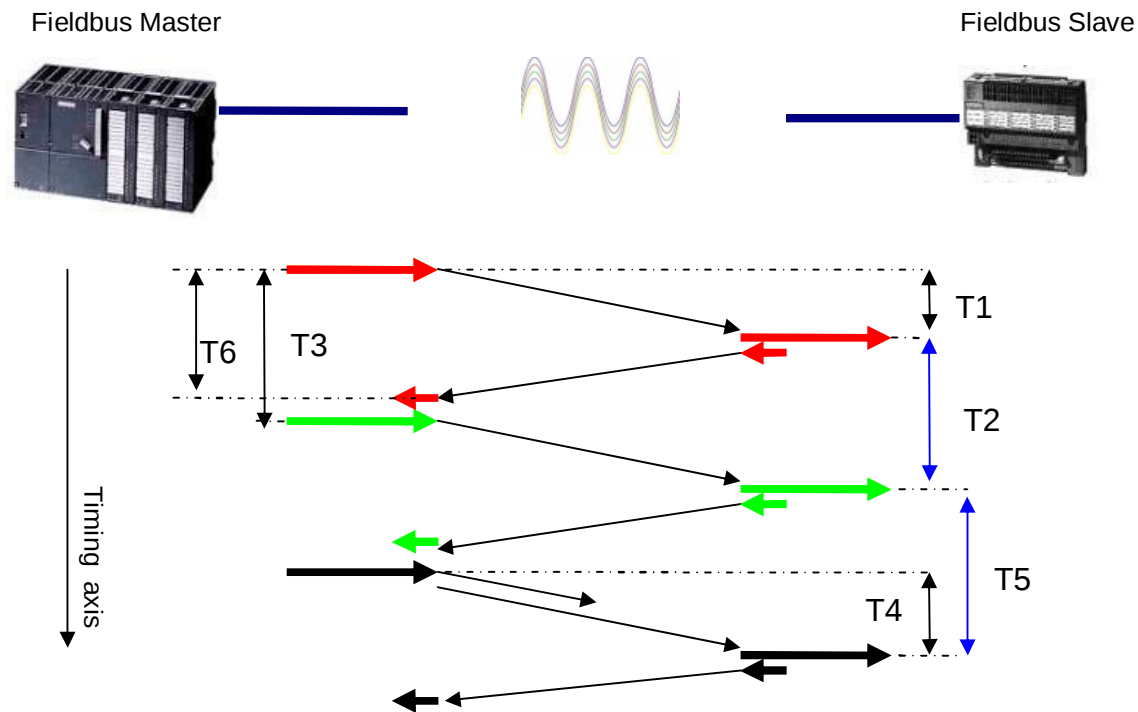
Profibus Timing



Profibus Timing



DATAEAGLE Wireless Profibus

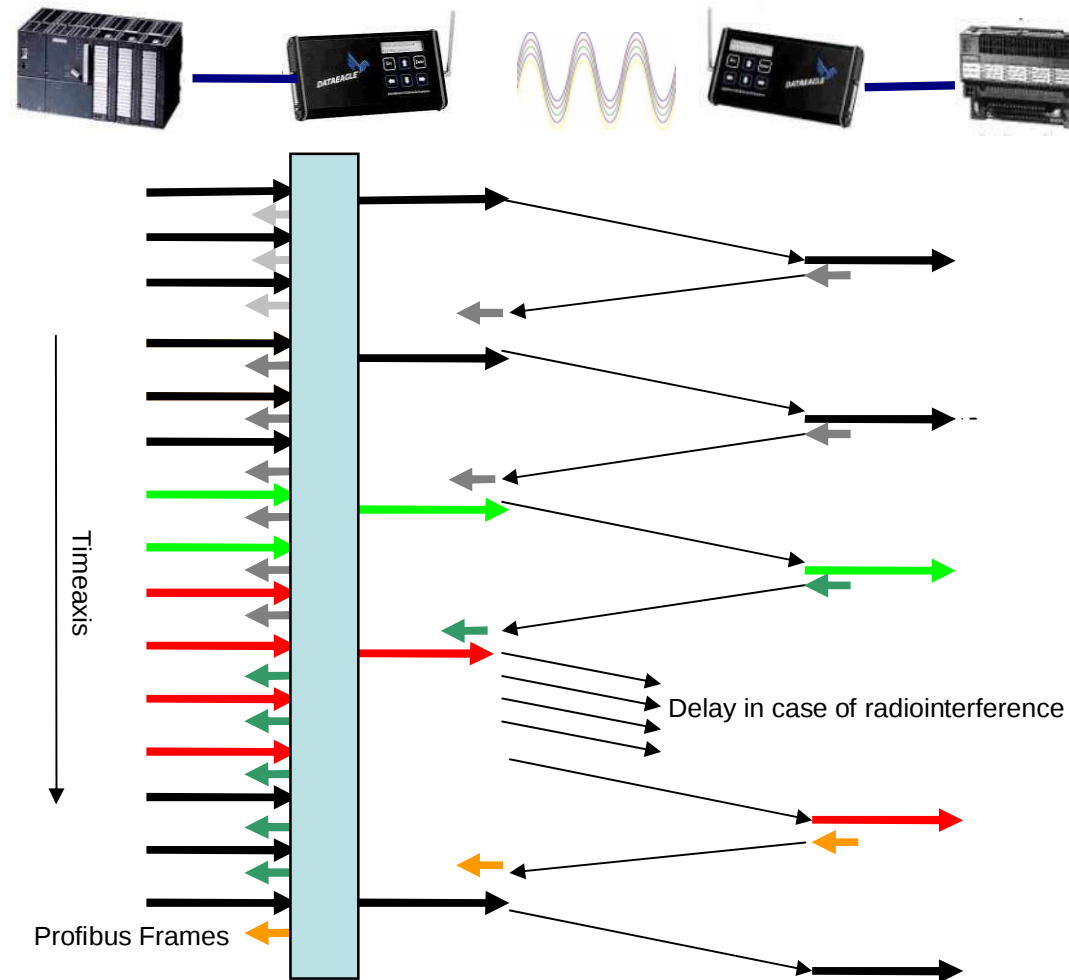


Patent-registered wireless communication strategy by Schildknecht AG



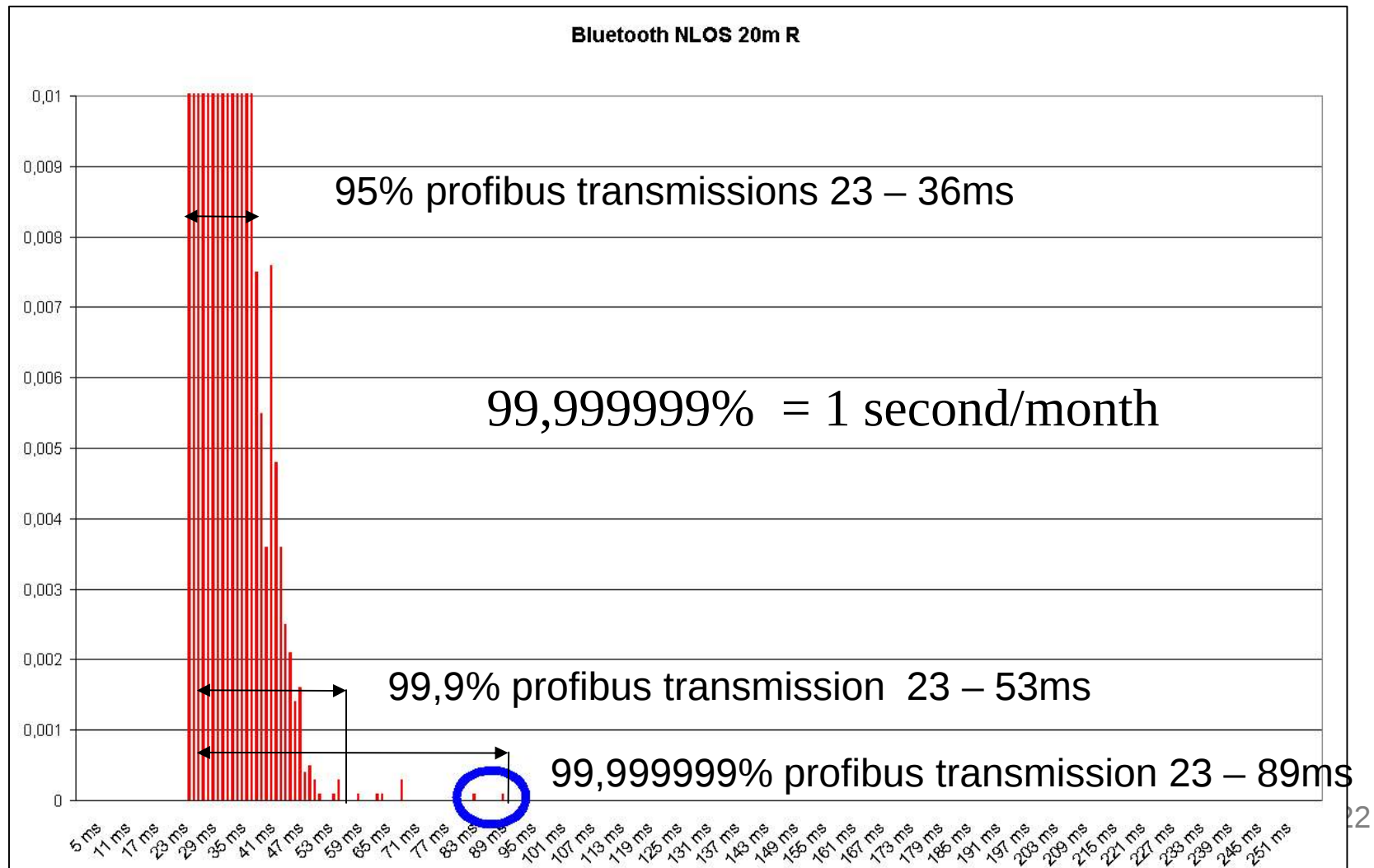
Profibus Master

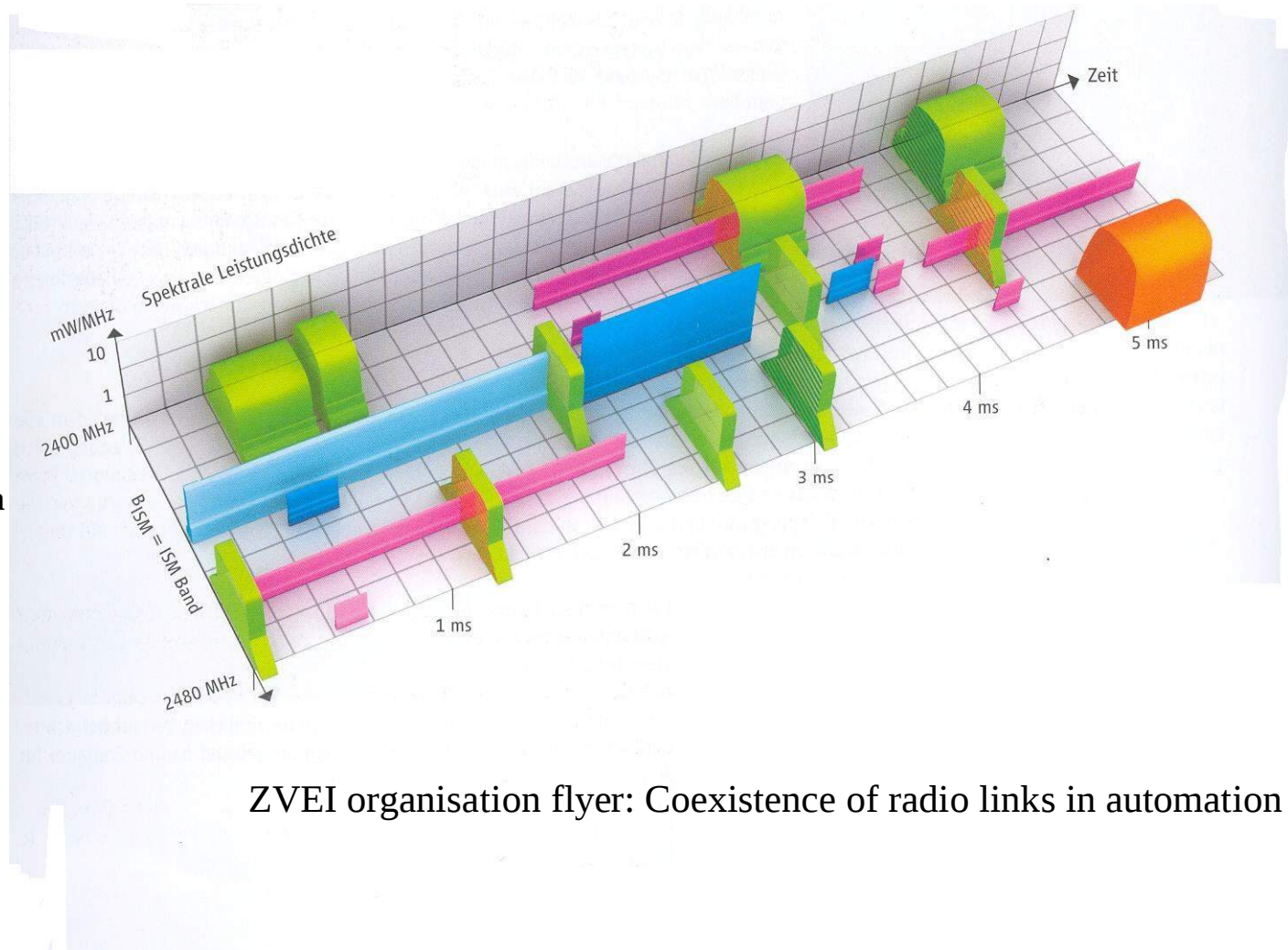
Profibus Slave



PI UK 30.6.2010

Delay spreading using wireless Profibus

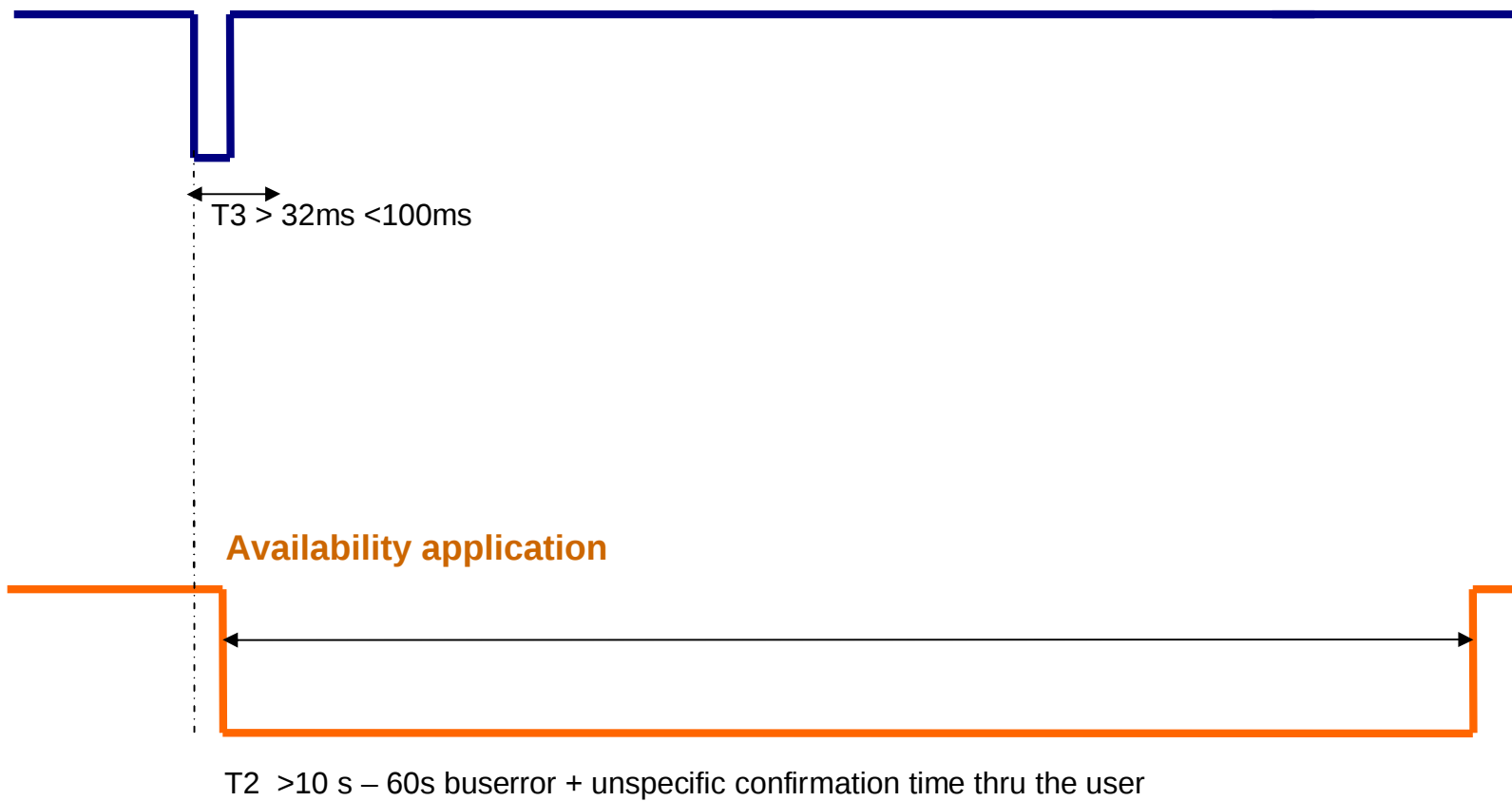




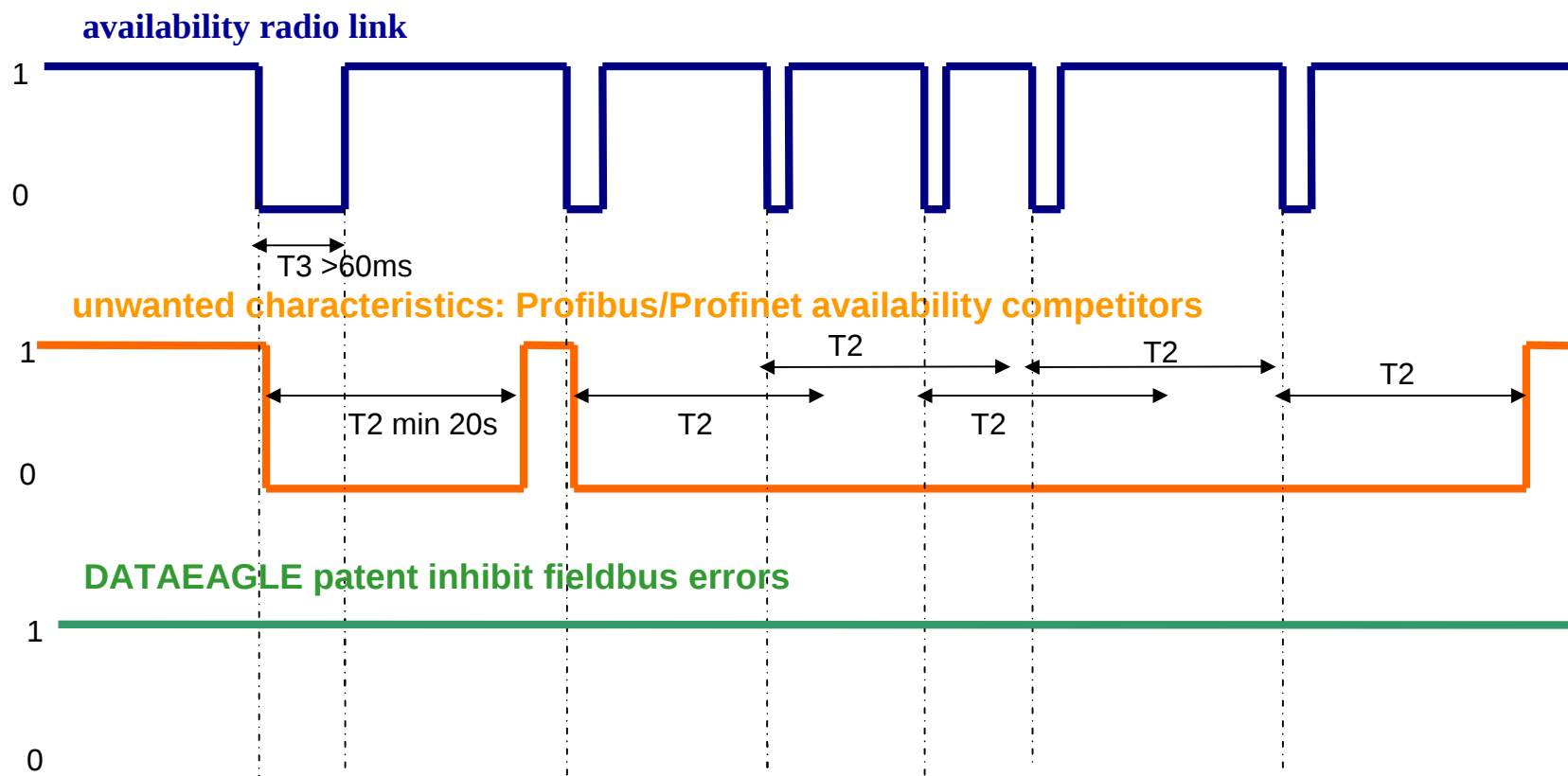
Coherence radio - application



availability radio link



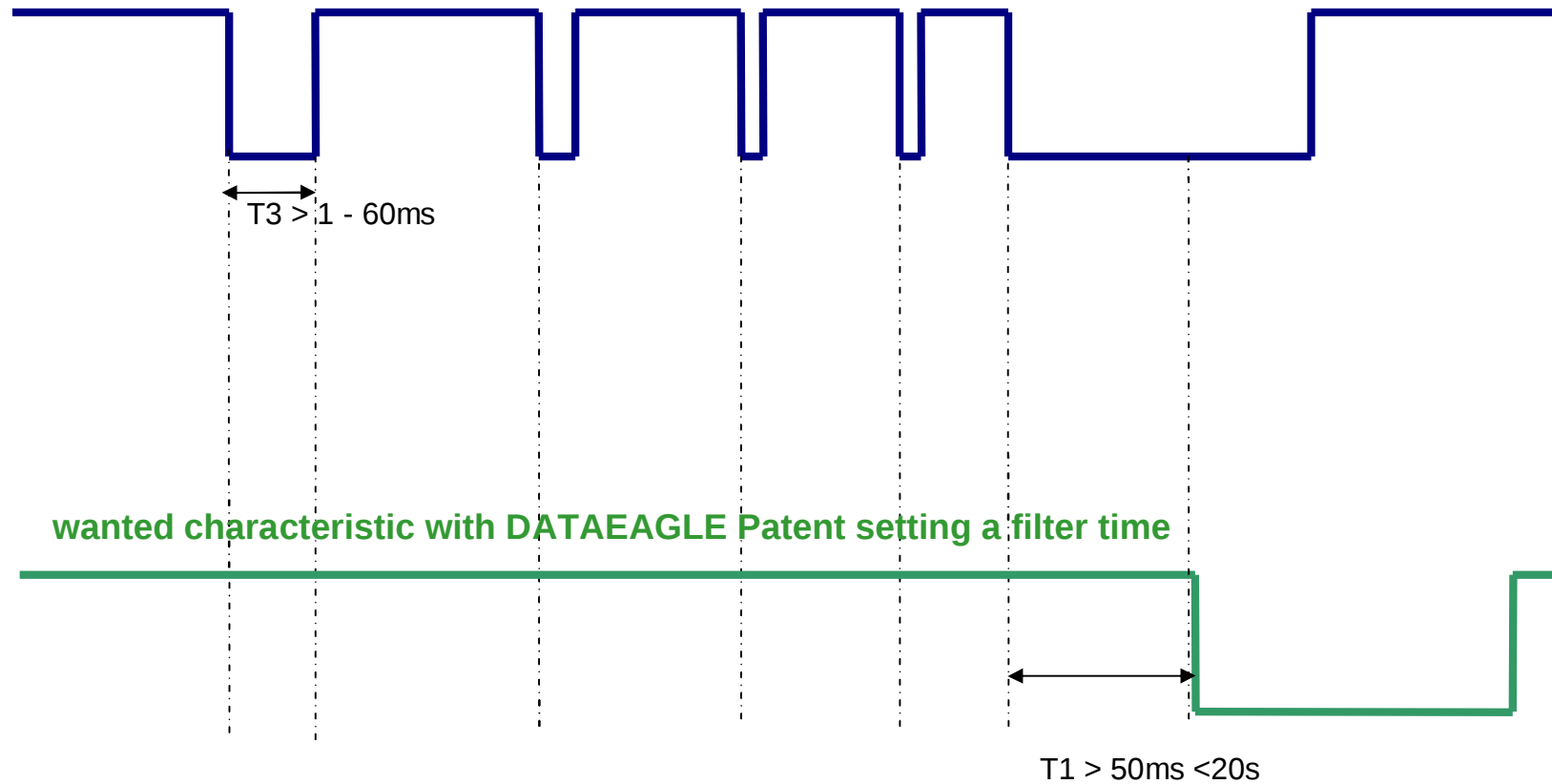
Coherence compared with competitors



Compatibility cable - wireless



availability radio link



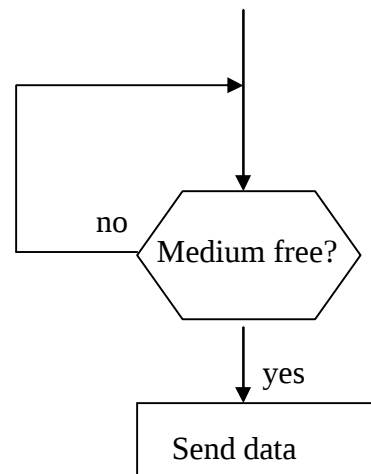
Wireless Competitors: Don't mention availability guarantee

Schildknecht does!

Features of radio technologies

	SRD	DECT	WLAN	DE-WLAN	Bluetooth	802.15.4	Nanonet	WLAN
Frequeny	868MHz	1.9GHz	2.4GHz	2.4GHz	2.4GHz	2.4GHz	2.4GHz	5GHz
transmitting power	bis 500mW	250mW	30mW	100mW	100mW	50mW	10mW	20mW
Modulation	schmalband	schmalband	DSSS	DSSS	FHSS	DSSS	CSS	OFDM
band width	25kHz	1MHz	22MHz	22MHz	1MHz	1MHz	80MHz	20MHz
medium access		TDMA	CSMA/CA		TDMA	CSMA/CA	TDMA, CSMA/CA	CSMA/CA
nominell data thruput	10kBit/s	1.1MBit/s	54MBit/s	1MBit/s	700kBit /s	250kBit/s	2Mbit/s	54Mbit/s
effective datathruput	10kBit/s	32kBit/s	20Mbit/s	1MBit/s	100kBit/s	128kBit/s	2Mbit/s	20Mbit/s
parallel radiolinks	10	120	3	3	ca 200	16	2	19
adressable clients	100	100	100	100	7	65000		8
receiver sensibility	-100dbm	- 87dbm	-65dbm	-89dbm	-89dbm	-90dbm	-92dbm	-74dbm
indoor radio cell diameter	1000m	300m	18m	200m	200m	50m	20m	20m
Roaming	no	yes	yes	yes	no	no	no	yes
Mesh network	yes	no	no	no	no	yes	no	no
fullduplex	no	yes	no	no	no	no	no	no
power consumption	high	low	high	high	middle	very low	middle	high
time radio startup	<1 Sek	3 Sek	< 10 Sek	< 1 Sek	3 Sek	<1 Sek	<1 Sek	<10 Sek
usability in large industrila halls	yes	yes	yes	yes	yes	yes	no	yes
usability steal enviroment	no	no	no	yes	yes	yes	no	no
usability mobile applications	no	yes	yes	yes	yes	?	no	yes
neccessary SNR @Bit Error rate10 ⁻⁶			20db	3db	14db	2db		20db
coexistence: influence to other systems	high	very low	high	very low	very low (BC)	very low	high	high
coexistence: influence because of other sy	high	very low	high	very low	very low	very low	very low	high

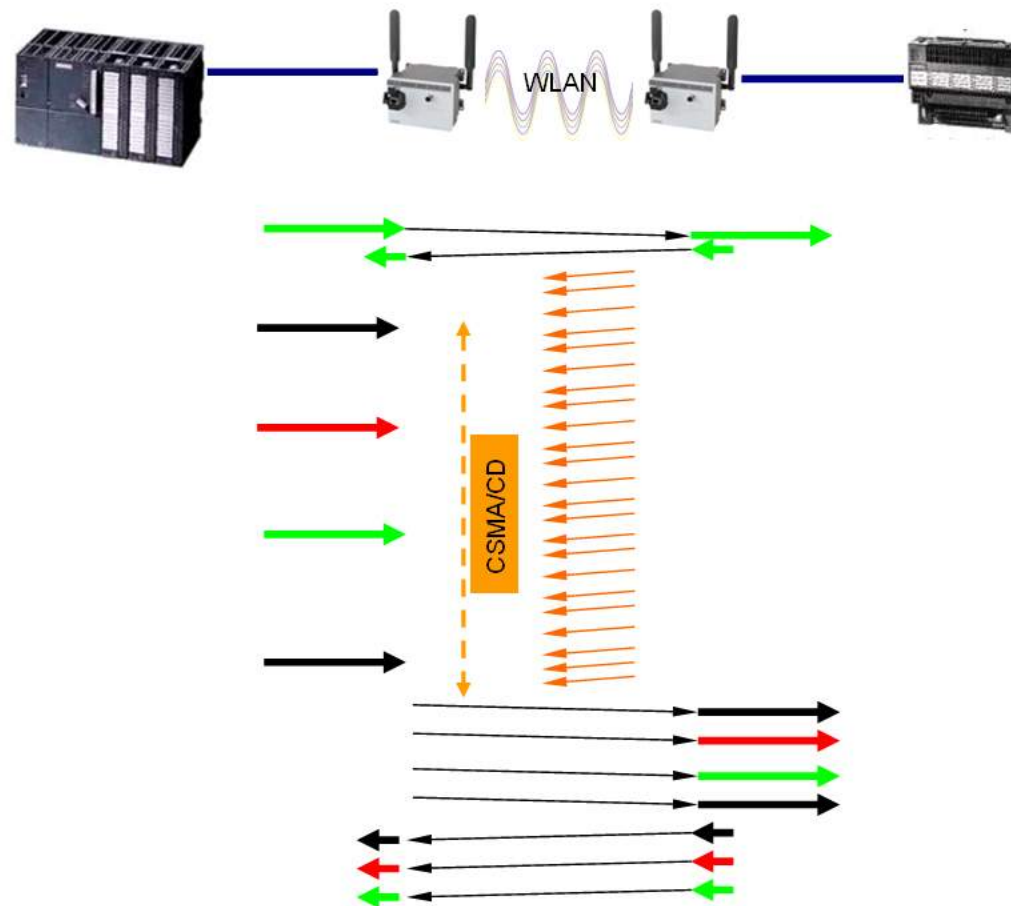
WLAN CSMA medium access



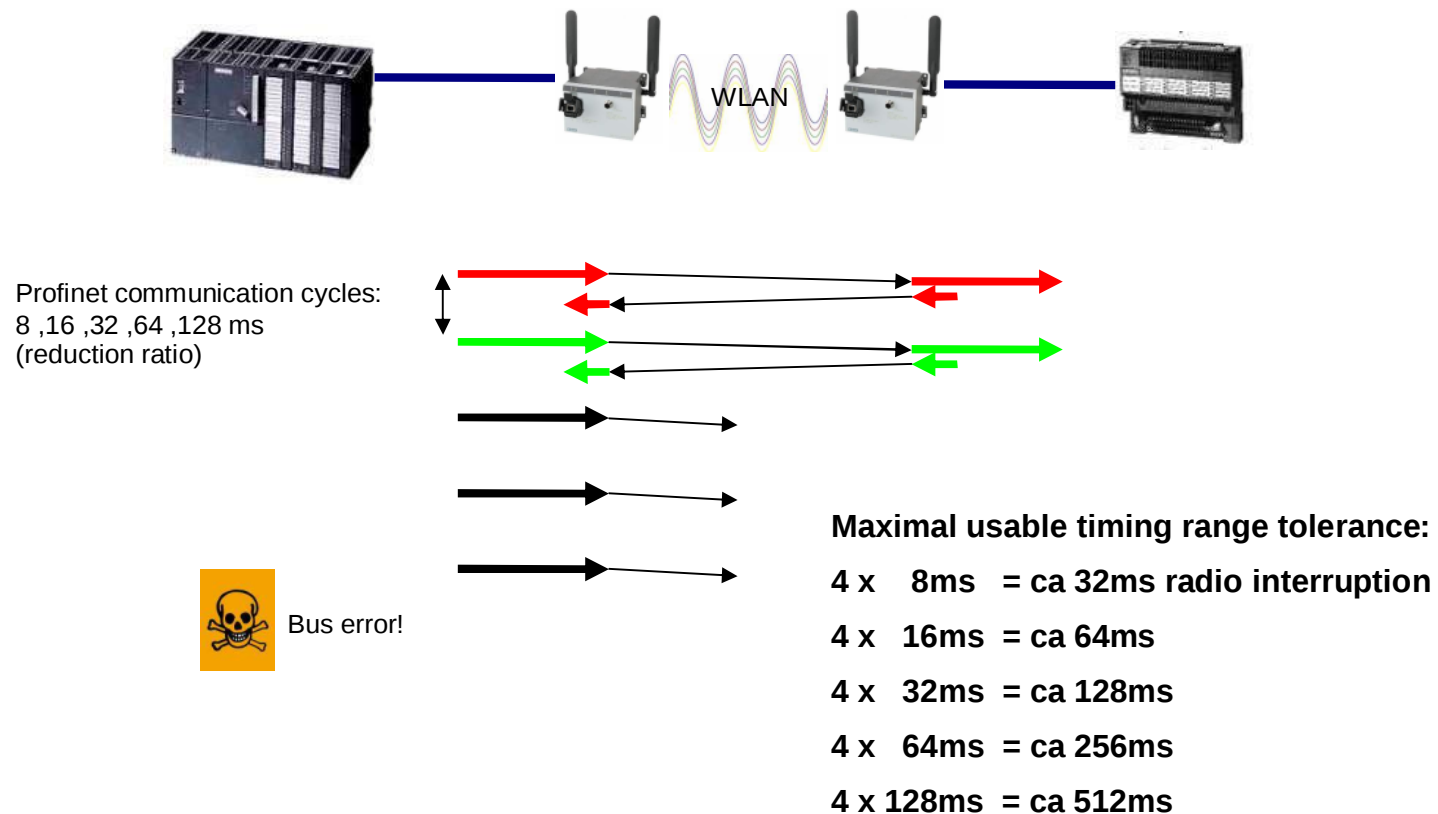
Big disadvantage of CSMA:

If little energie on the band is detected,
transmitter waits not definded
& unpredictable

WLAN CSMA

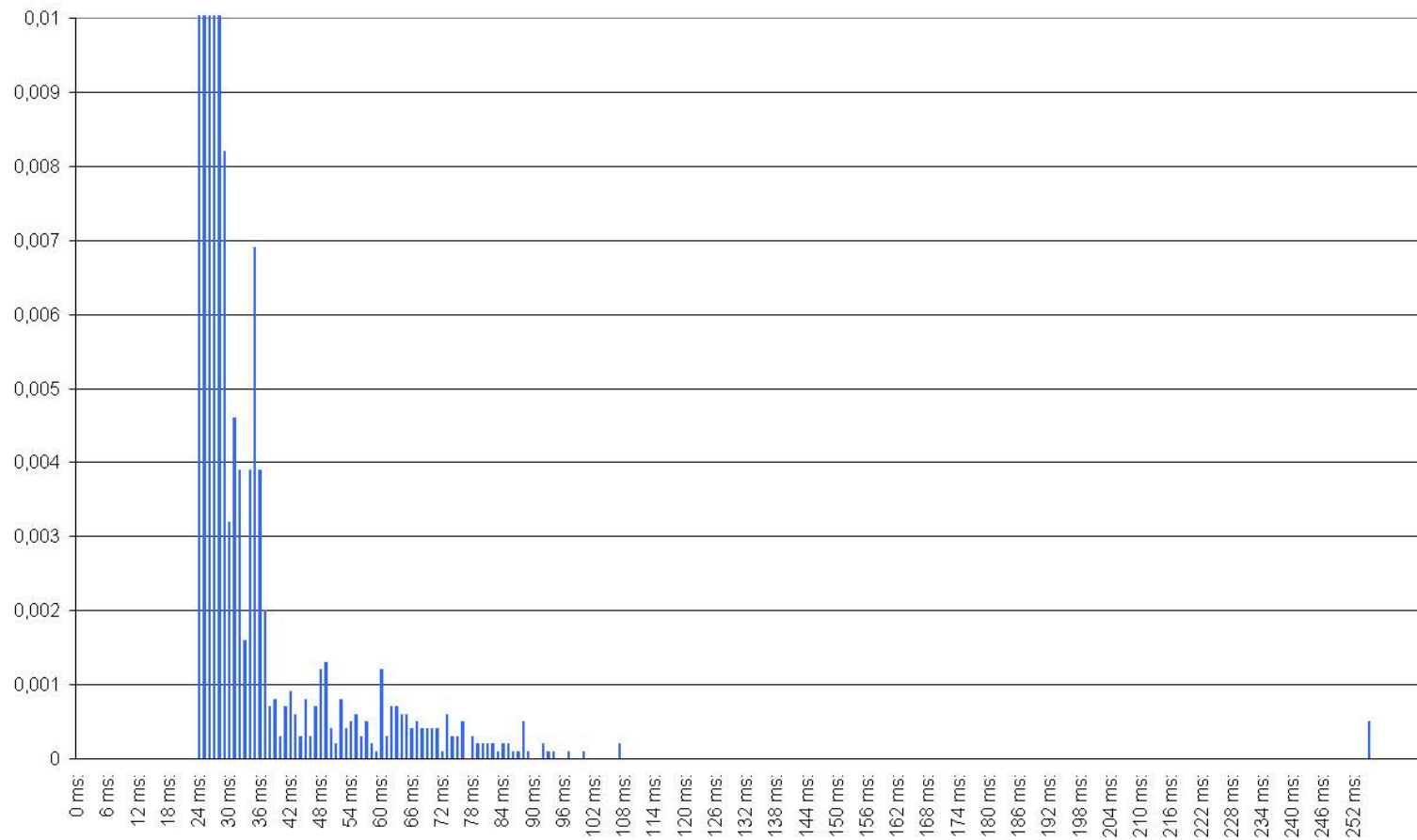


Profinet retries

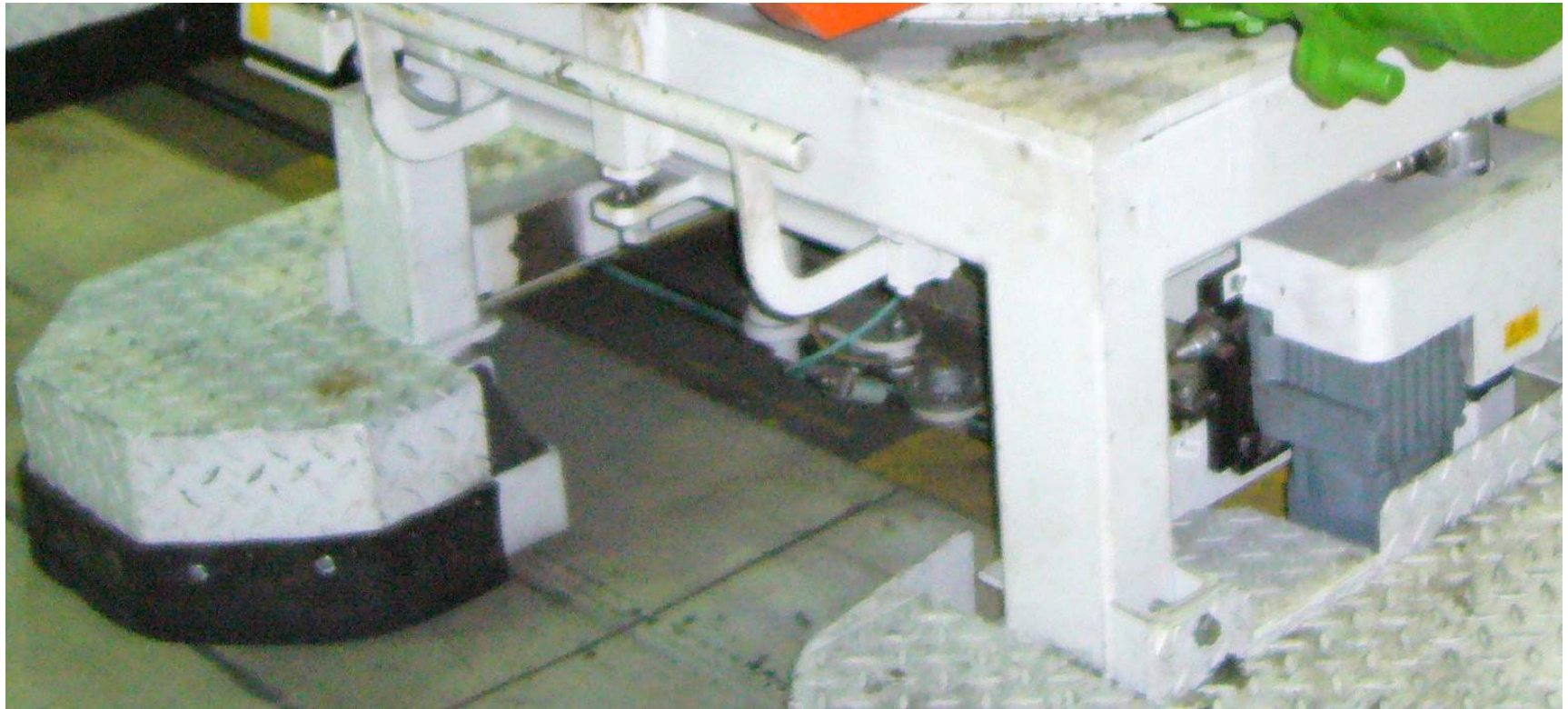


WLAN

WLAN 802.11 NLOS 20m







Competitors: Don't mention CSMA

Schildknecht does!

Wireless Limits



- Datathruput and distance of the radio link are opposed demands
- Bandwidth is valuable resource (UMTS 2.1GHz Band: 50 Billion Euro/Pound in Germany 2001, 4 Billion 2010)
- Increasing usage of wireless technologies
- only 2.4GHz is a worldwide band
- No additional frequency bands for industrial use in the next 10 years

Results



There is not a unique radio technology available on the market, there are, depending on the application, practical or no practical

Only using Schildknecht patent strategy, you can reach high availability with wireless fieldbusses

Wireless Profibus & Profinet yes,
but 802.11 b/g/h WLAN is not a good technology for industrial environment

Keep in mind: “No Wires” doesn’t mean “no Problems!”

Thank you for listening

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