Wireless Development roadmap

Cognitive Radio platform Nederland

Koen Mioulet, Marketing4B2B

Overview

- **Introductie**

- De Wireless Roadmap
  - Hybride systemen
  - Cognitive Radio
  - Reconfigurable (SDR)

- Toepassingen Hybrid/Cognitive Radio

- Ontwikkelingen industrie

Marketing4B2B:

Business Development for B to B markets

Portfolio-, market-, funnel development

Hands-on marketing & sales execution

'developing markets skyhigh'

Marketing4B2B highlight: Wireless Roadmap developments

- Seminar
  'frequenties in beweging'
  met o.a. EZ (juni '07)

Trends en ontwikkelingen in de ether

- Seminar 'Wireless roadmap
  voor OOV' met o.a. TNO, WMC
  (okt '09)

Trend naar hybride radionetten en software defined ra
'Wireless roadmap'
voor openbare orde
en veiligheid

- Artikelen Wireless in
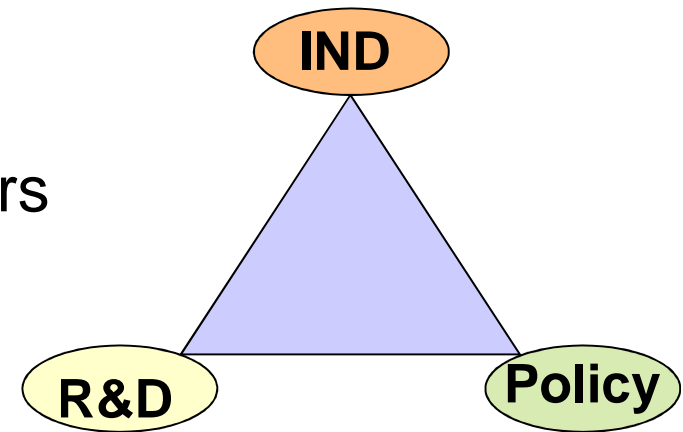 Verbinding,TM, FMT, Uneto
  - hand out

- Oprichting CR platform jan'10 (+ TUD, EZ)

CRplatformNL; scope

De partijen

- Technologie ontwikkelaars
- System integrators, vendors, operators
- Beleid en *regulatory*

IND
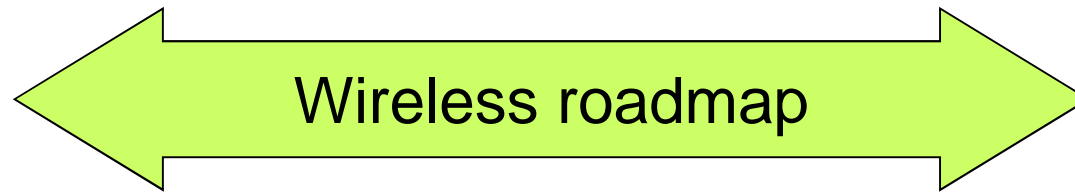
R&D

Policy

Toepasbaarheid:

- Concrete *use cases* ter tafel
  - TV white space
  - Events & venues
  - Traffic Telematics
  - (air)ports & harbours
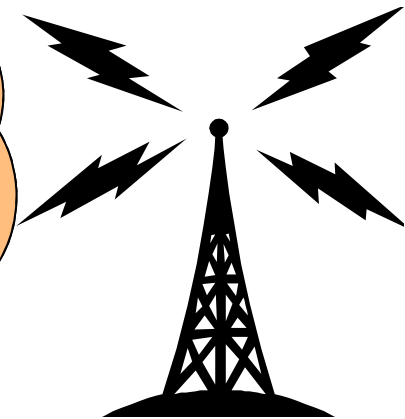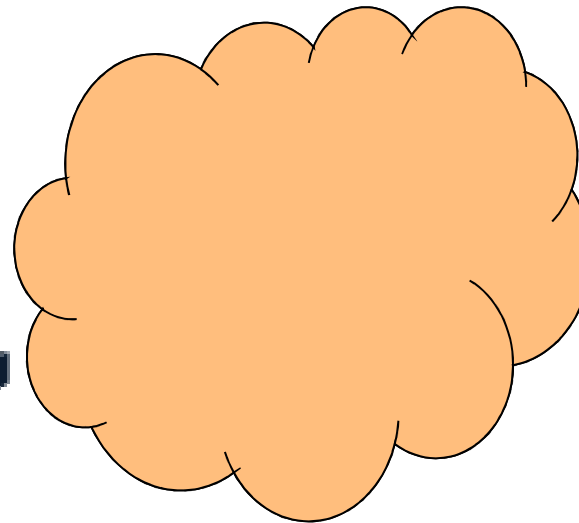
'developing markets skyhigh'
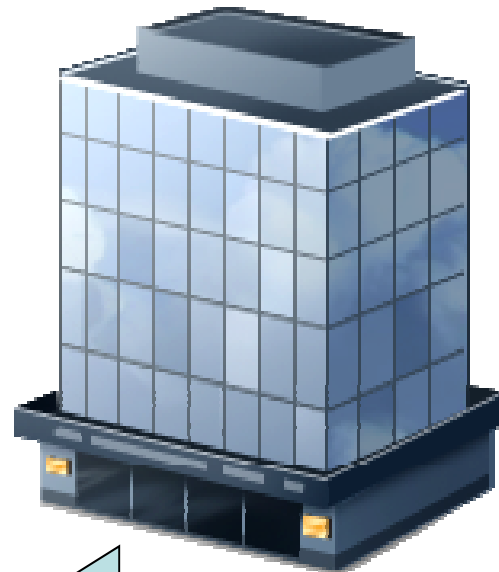
Opbouw van de middag

Wireless roadmap

Koning en Hartman   WMC, Nomad

INDOOR   OUTDOOR

Overview

- Introductie
- De Wireless Roadmap
  - Hybride systemen
  - Cognitive Radio
  - Reconfigurable (SDR)
- Toepassingen Cognitive Radio
- CRplatform .....

The Wireless Roadmap….
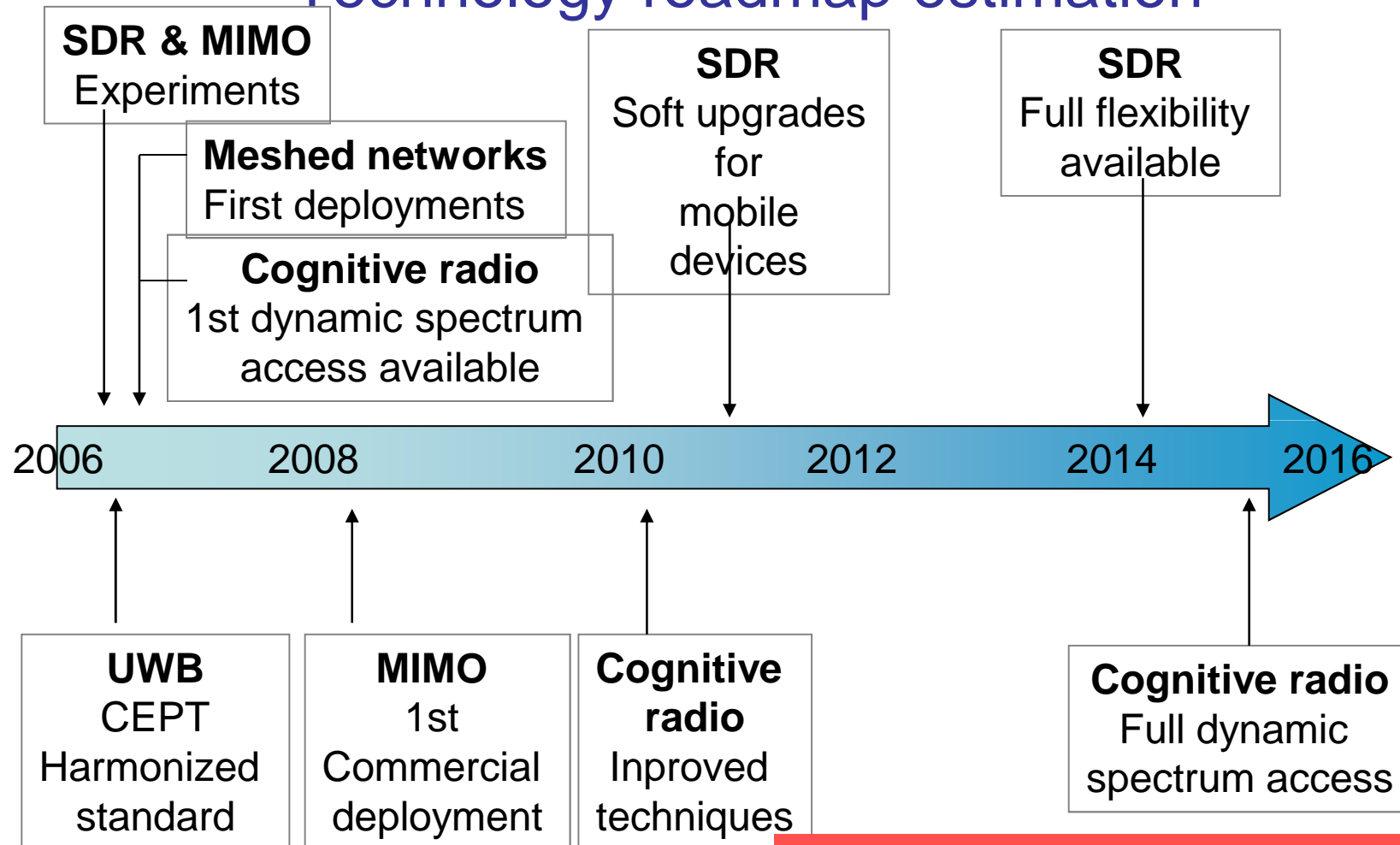
Technology roadmap estimation

SDR & MIMO
Experiments

Meshed networks
First deployments

Cognitive radio
1st dynamic spectrum access available

SDR
Soft upgrades for mobile devices

SDR
Full flexibility available

2006   2008   2010   2012   2014   2016

UWB
CEPT Harmonized standard

MIMO
1st Commercial deployment

Cognitive radio
Inproved techniques

Cognitive radio
Full dynamic spectrum access

Source: EU project 'SPORTVIEWS', 2007

Spectrum POlicies and Radio Technologies Viable In Emerging Wireless Societies

Technology roadmap clustered

Multiple paths

Meshed networks

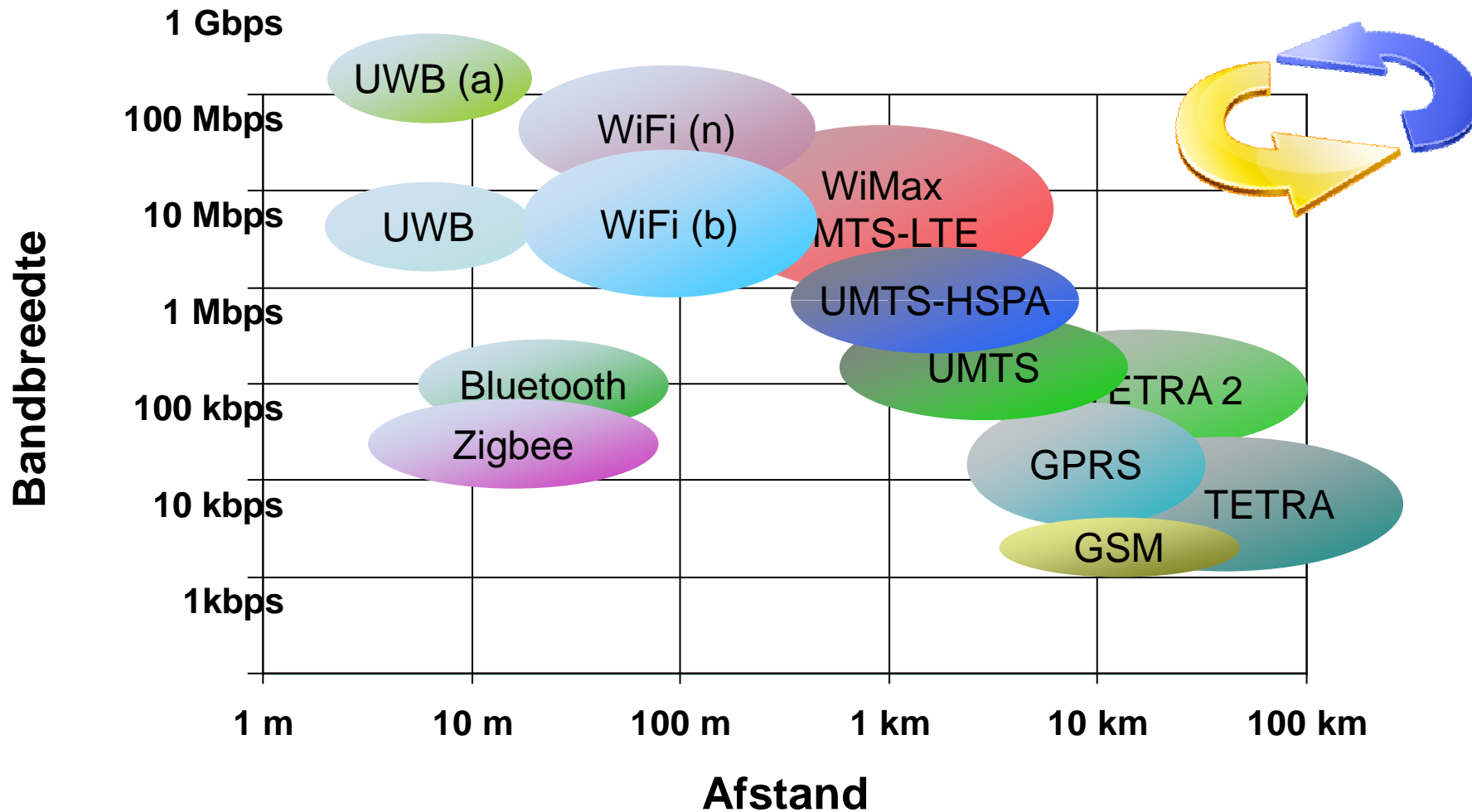Hybrid networking

Multi bearer

Software Defined Radio

2006
2008
2010
2012
2014
2016

Full Cognitive radio

Spectrum sensing CR

Band Selective CR

2-3-4 G

modulation

MIMO

More bit/Hz

Smart Spectrum access
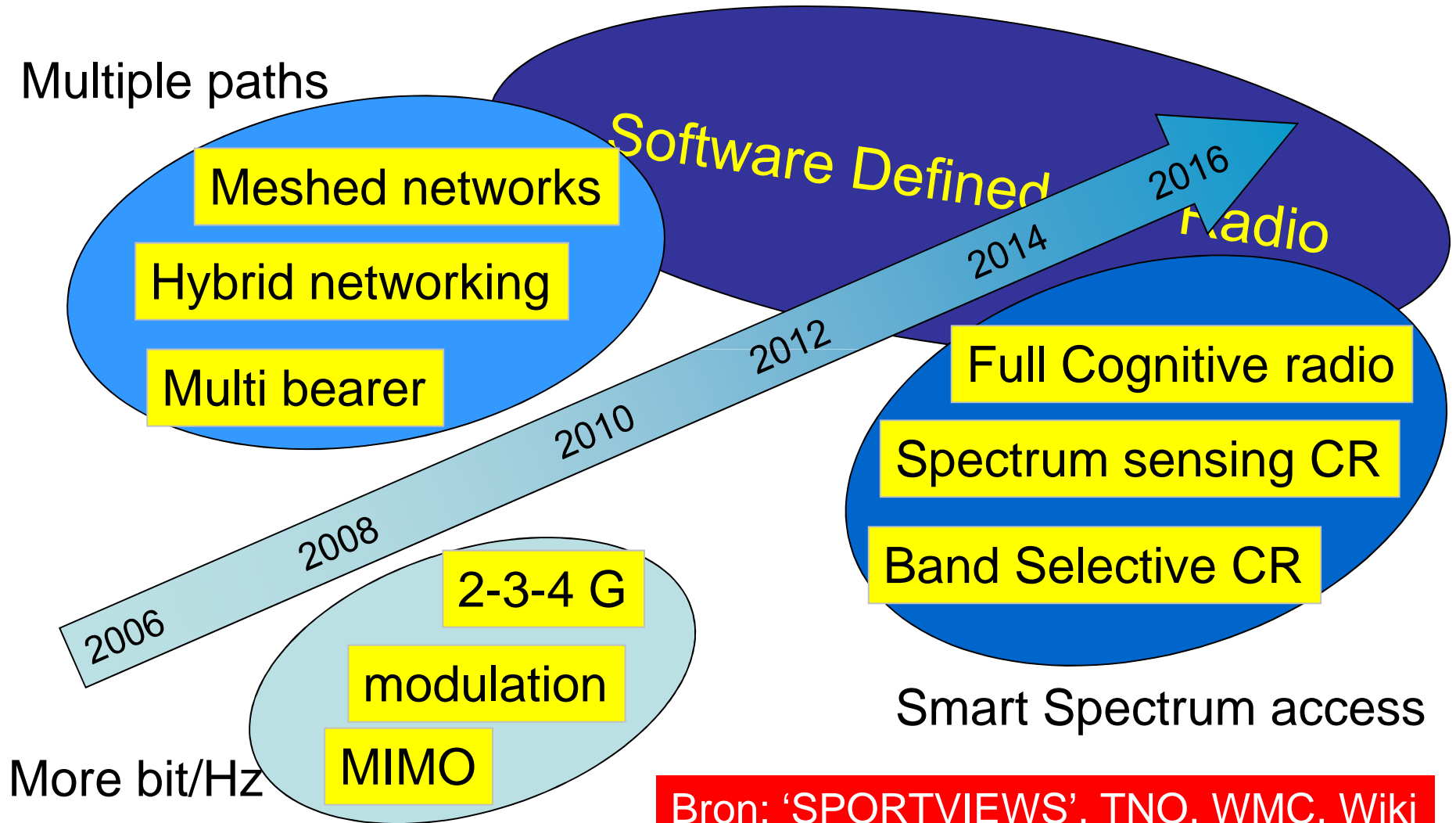
Bron: 'SPORTVIEWS', TNO, WMC, Wiki

'developing markets skyhigh'

Hybride radio:
Combineer afstand en capaciteit; trade-off blijft

Hybride (1) : de meeste mobieltjes !

Hybrid radio solutions (2); combining multiple bearers of same protocol

High Bandwidth

4 X HSPA

Data, Video

Made in Holland !

Wireless Multiplexing Terminal

Source: Triple IT

Hybride (3): Robuust door meerdere paden; voorbeeld 'FiGo' hybrid radio voor OOV

WLAN UMTS andere   WLAN UMTS andere

WMC. made in Holland

Nomad. made in UK !

Hybrid (4): Nomad on vehicle hybrid systems
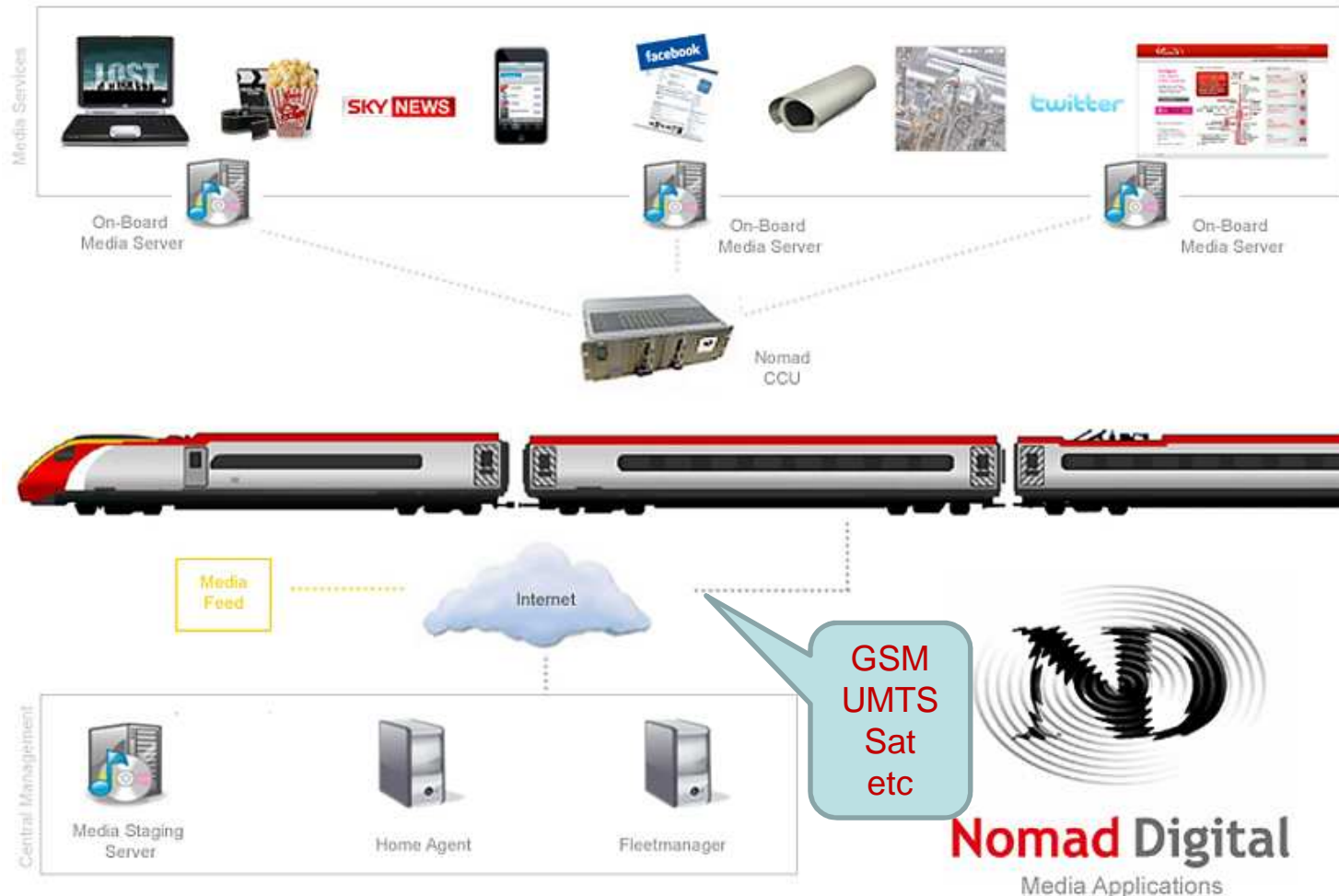
Cognitive of reconfigurable radio; Mitola

- A Cognitive Radio is an adaptive, multi dimensionally aware autonomous radio system that learns from its experience to reason, plan and decide future actions to meet user needs (SDR forum)

- A cognitive radio is a smart radio

Levels of cognitive radio (1), *white space use*

National mobile
network,
eg UMTS

Band
selective

National
wireless broadband,
eg Wimax
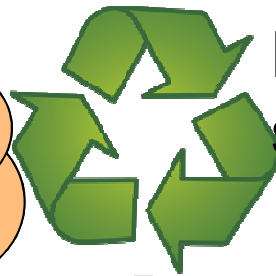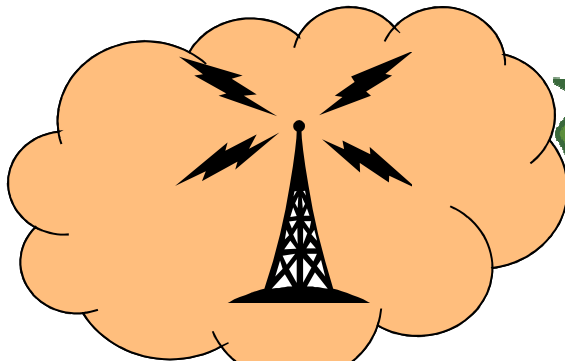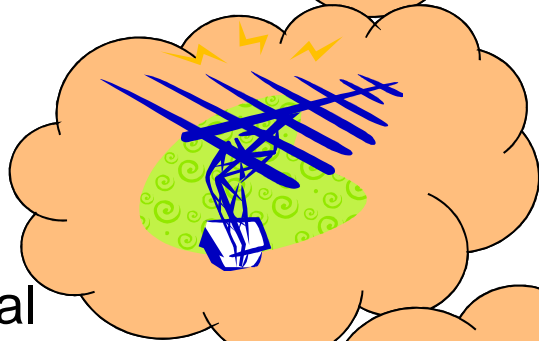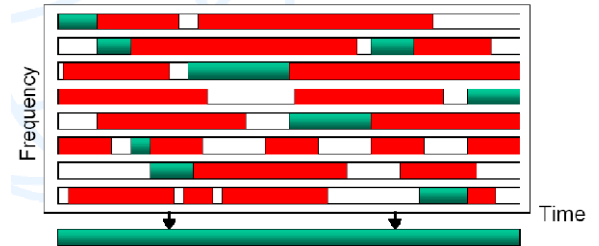
Spectrum
selective

Cognitive
radio device
scans for
spectrum
availability

Local wireless
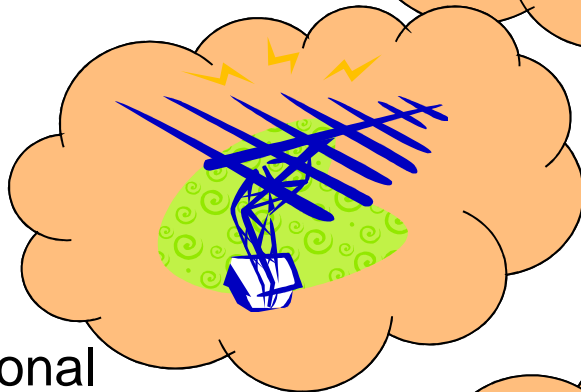broadband, eg WiFi

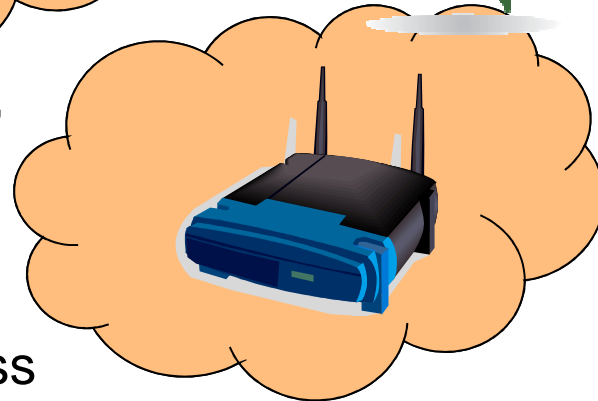Bron:
WMC, Wiki

Levels of cognitive radio (2): user requirements

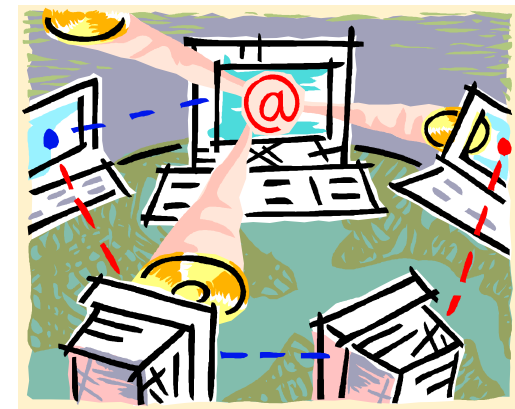National mobile
network,
eg UMTS
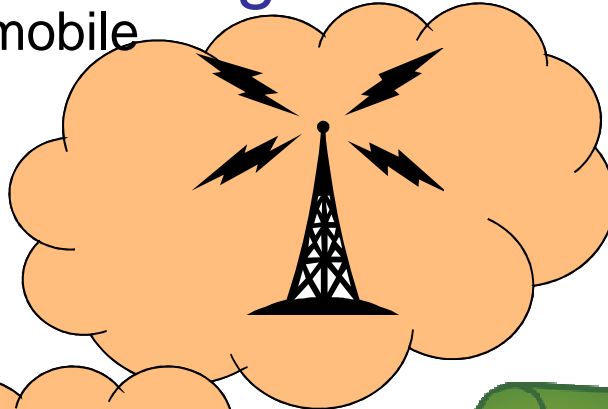
Smart radio device
matches QoS requirements
with network(s) available

National
wireless broadband,
eg Wimax

Local wireless
broadband, eg WiFi

Traffic requirement

Cognitive radio in gradaties

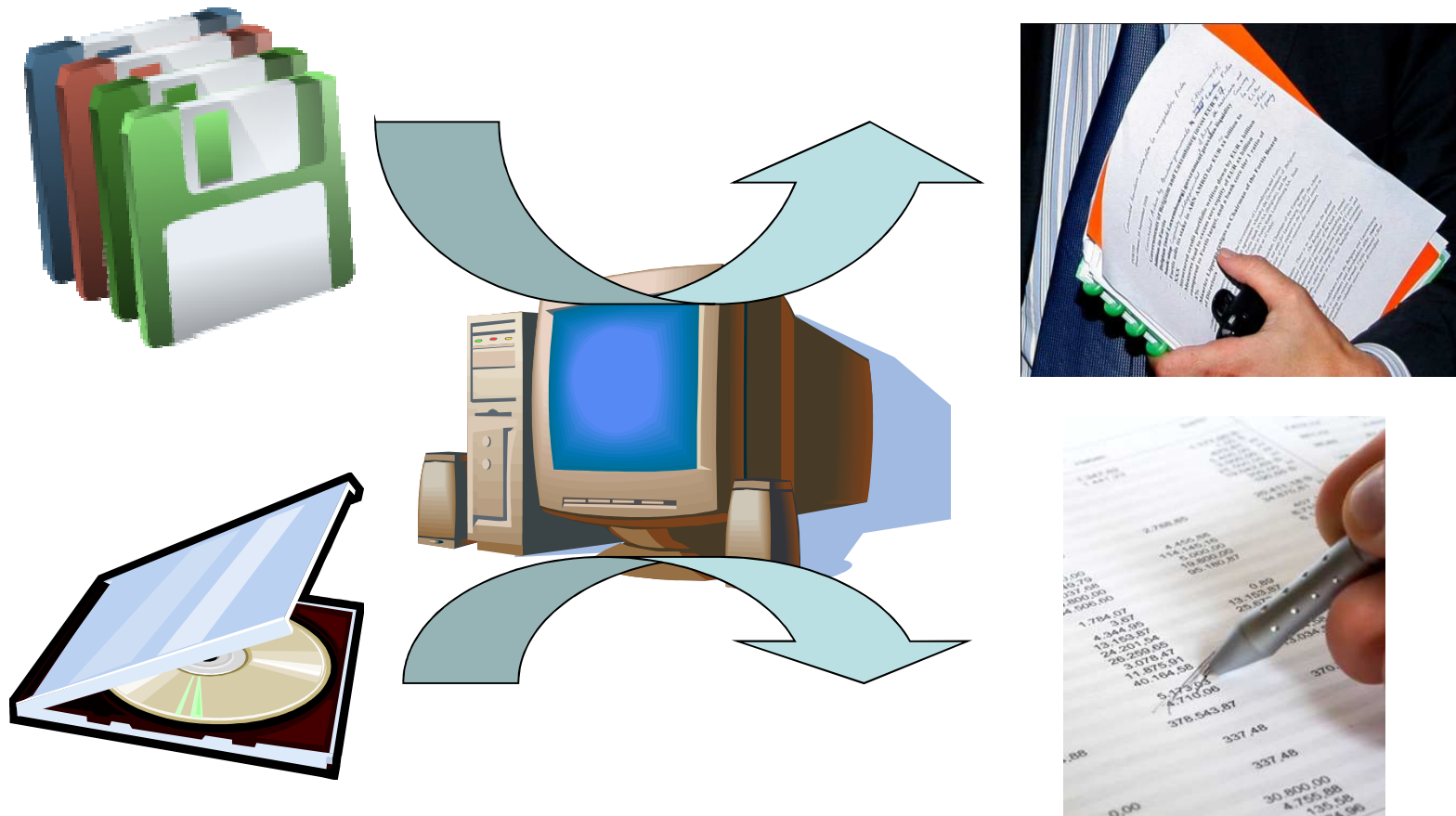DECT = mid '90 s !

DECT kent al *dynamic channel allocation*
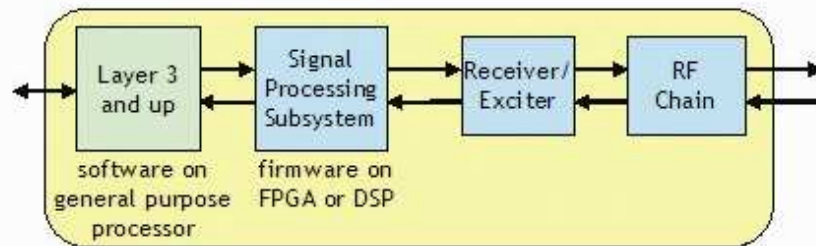
Dat is een gradatie van cognitive !

Reconfigurable or Software Defined Radio
als concept zeer voorstelbaar

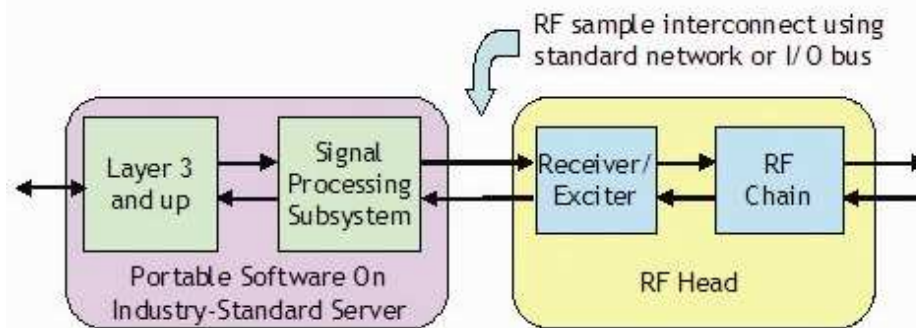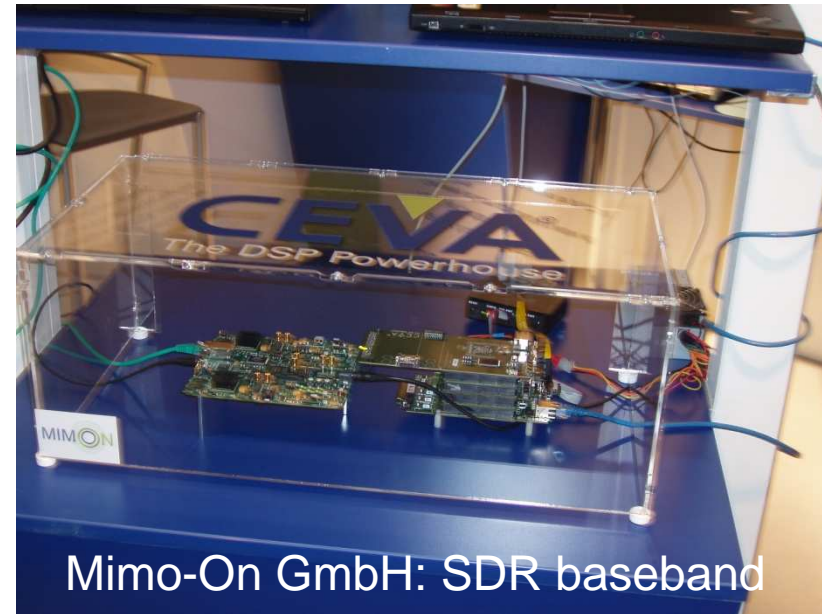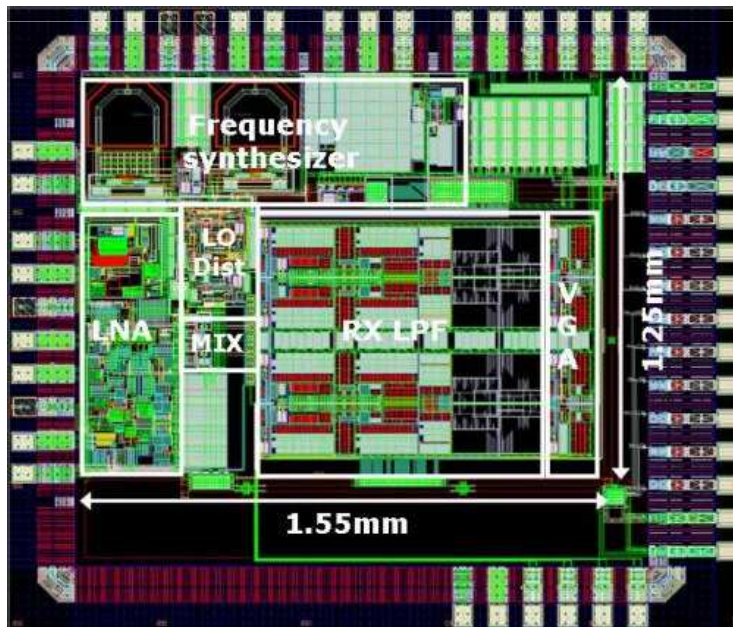# Convenient bij Hybrid & Cognitive Radio: de "software defined" radio

- In plaats van meerdere fysieke radio boards

- Gebruikt generieke radio hardware

- Met software die bepaalt welk spectrum, protocol, modulatie, etc

- DE facilitator of *enabler* van hybride en cognitive ontwikkeling

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SDR, de eerste stapjes
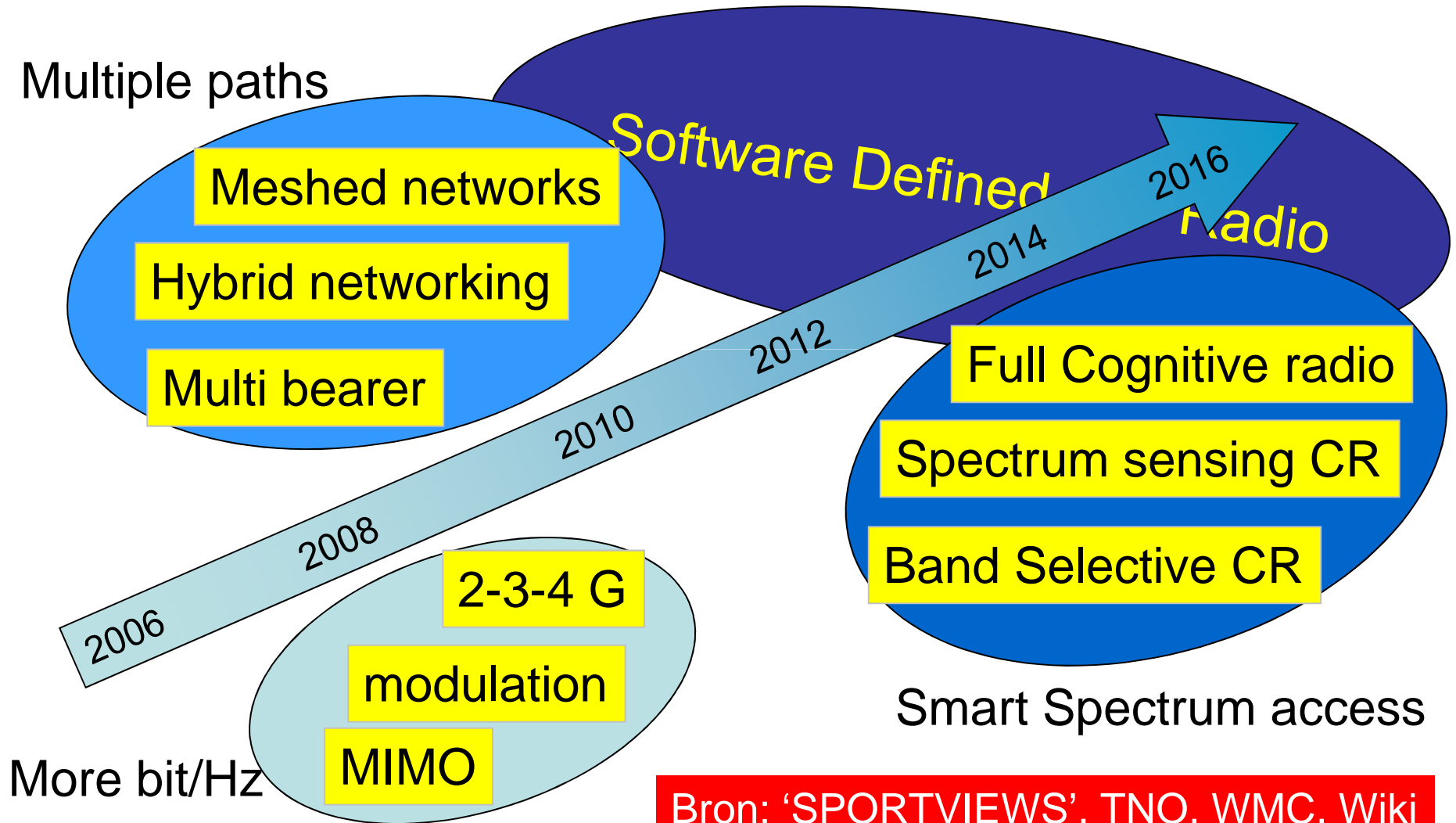
Barcelona (MWC):

Mimo-On GmbH: SDR baseband

IMEC reconfigurable receiver chipset

Technology roadmap clustered

Multiple paths

Meshed networks

Hybrid networking

Multi bearer

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Toepassingsgebieden nieuwe radio techniek (1)

Komen best tot hun recht in omgeving met:

- Ad hoc, dynamische setting
  - *Self configuring* networks
  - *Opportunistisch* gebruik ether
  - Ongeplande netwerkdeelnemers, 'anarchistisch'
- QoS gevoelige of *mission critical* datastromen
  - Robuuste netwerken; QoS behoeftes
- Vele en verschillende devices en standaarden
  - Self scanning (cognitive) elementen
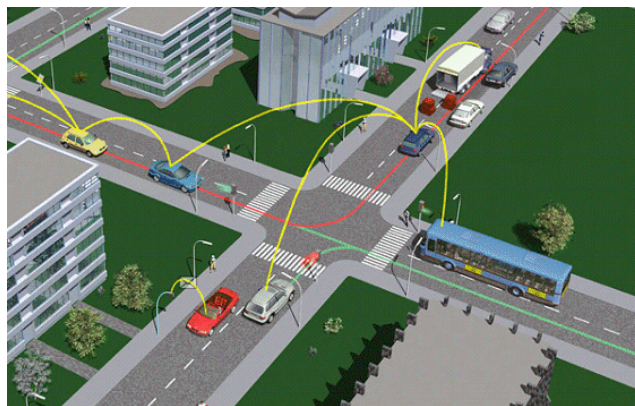
Toepassingsgebieden nieuwe radio techniek (2)

- ## OOV, defensie
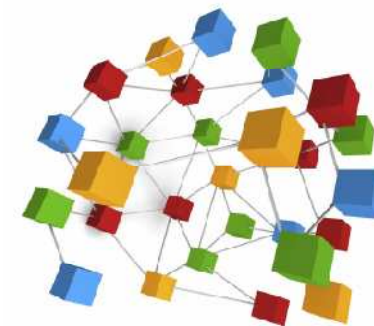
  Hans Borgonjen
  in laatste CRpNL !

- ## Verkeer en Vervoer

  Paul Potter
  in eerste CRpNL !

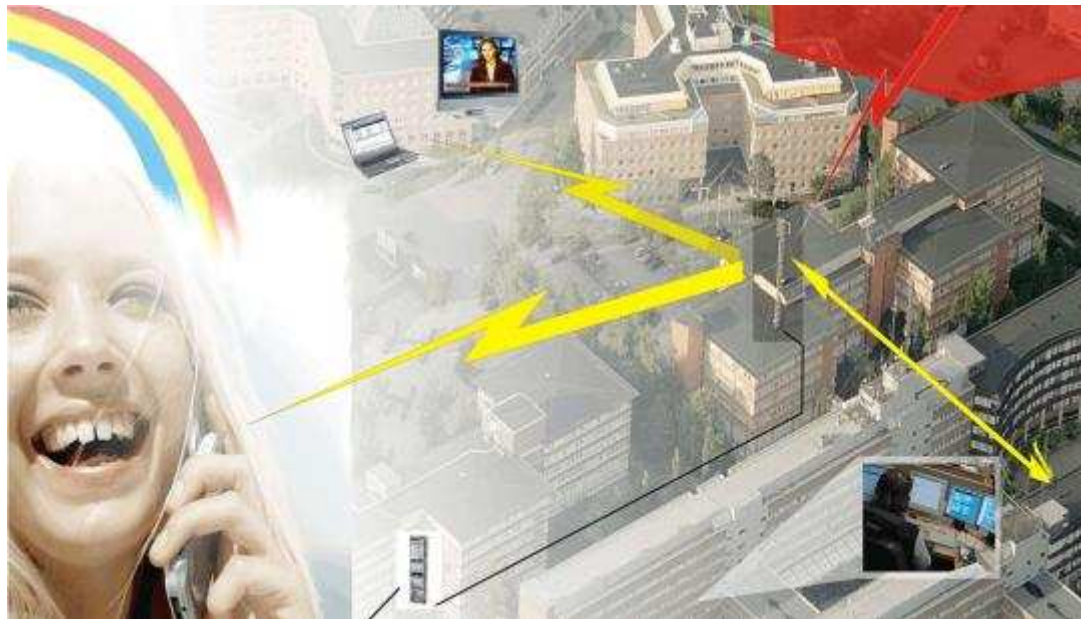- ## Public wireless

- ## Domotica

Toepassingsgebied: (public) Wireless networks

- Netwerk tbv meerdere protocollen => SW defined

- Zelf configurerend, zonder management => mesh

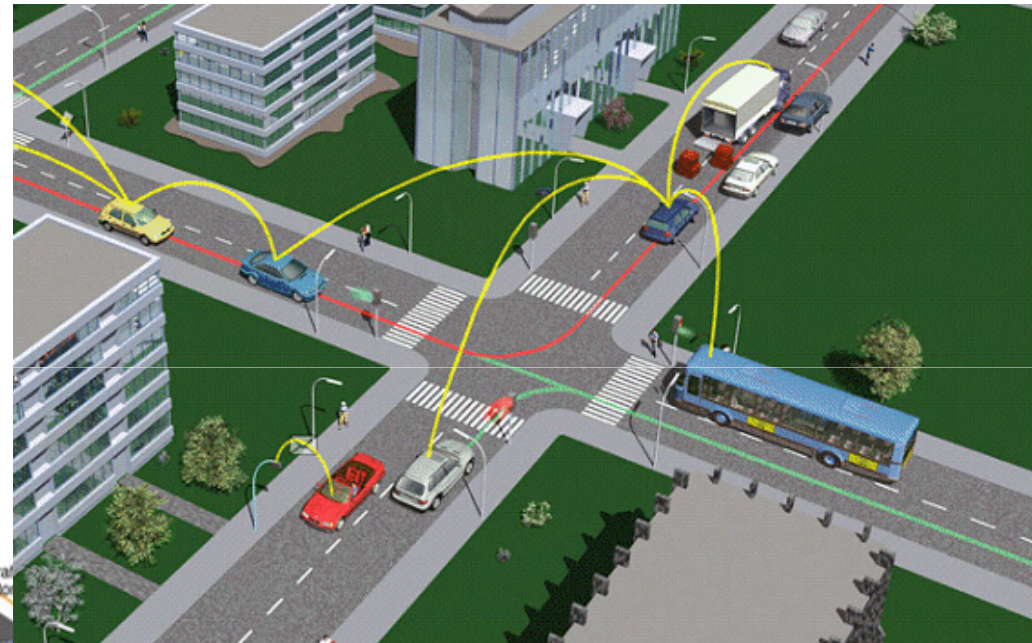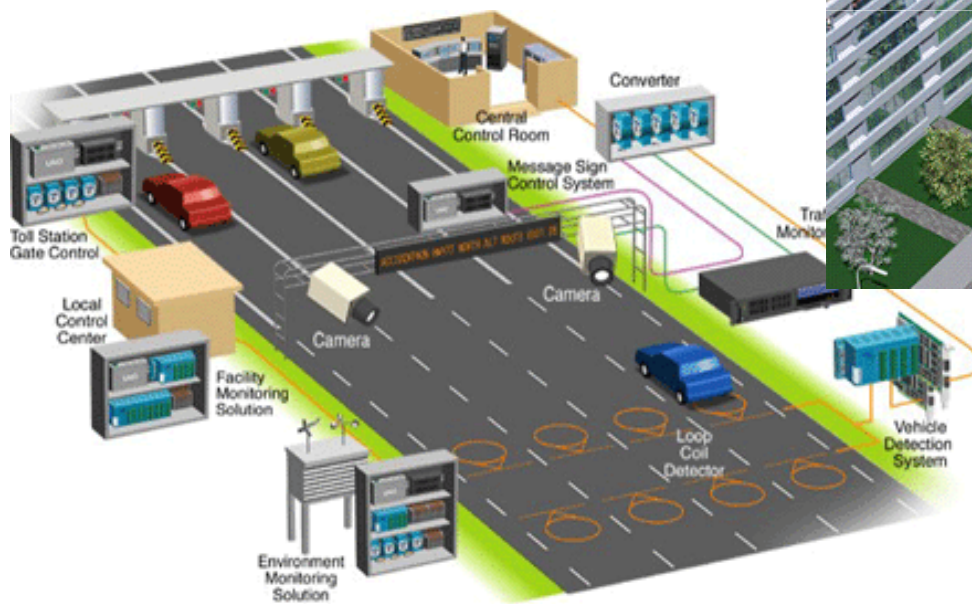- Voor *devices* die zelf een netwerk opzoeken =>cognitive

Bron: Ericsson

Toepassingsgebied Verkeer & Vervoer;
Intelligent Transport Systems, verkeersmanagement

Vehicle to vehicle communication; 'swarming'

Smarter roadsides

⇒Efficientere verkeerstromen,
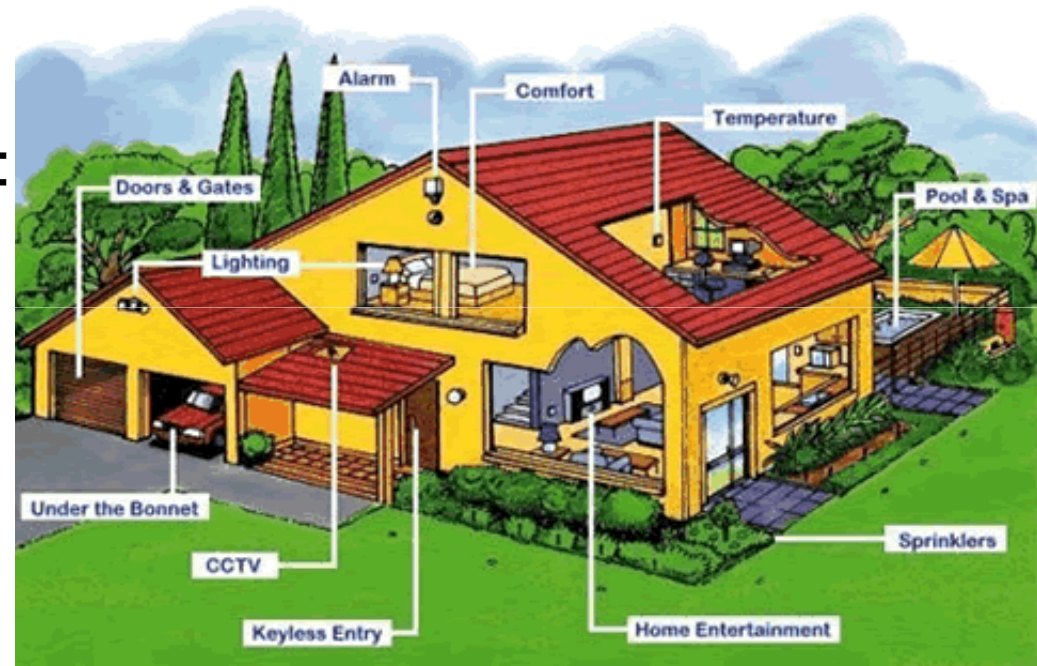⇒Congestie
⇒Veiligheid, Milieu

Toepassingsgebied: domotica en home automation

Self configuring: mesh

Propagatie niet managed:
Multi bearer, hybride

Short range, low power

Anarchie deelnemers:
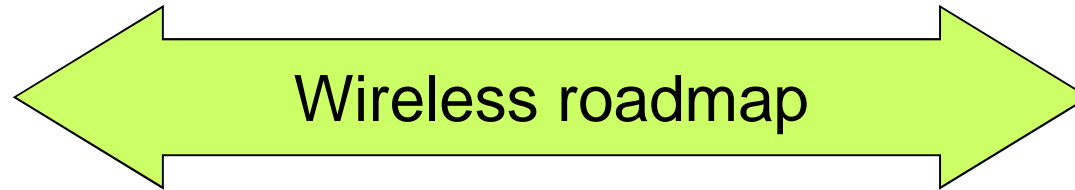cognitive radio's

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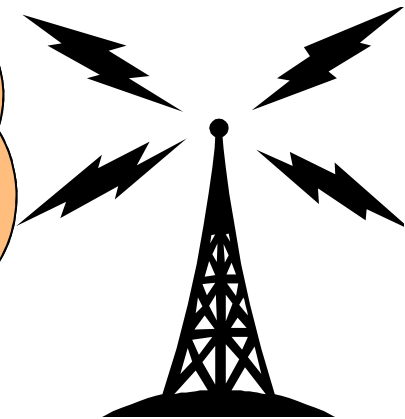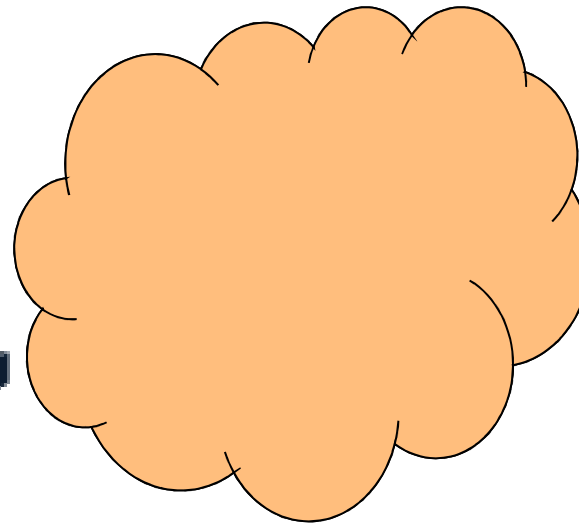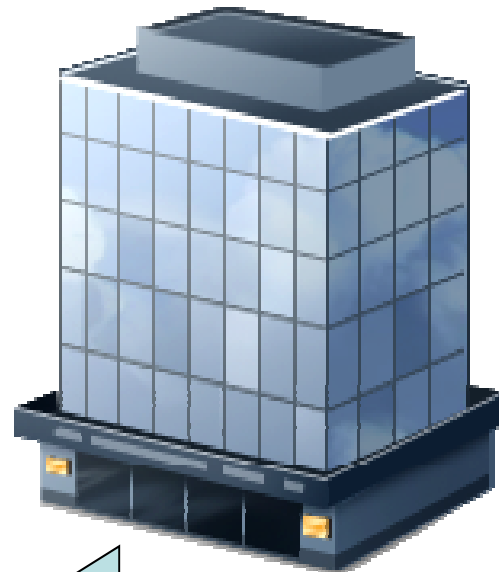

Wireless roadmap

Koning en Hartman   WMC, Nomad

INDOOR   OUTDOOR

Samenhang presentaties

	Hybrid	Cognitive
Nederland -Triple IT	$\sqrt{}$(N x UMTS)	≈(Smart re-assembly)
- WMC (Twente Institute for Wireless and Mobile Communications)	$\sqrt{}$ (N protocols)	$\sqrt{}$
Internationaal - Nomad Digital	$\sqrt{}$ (N protocols)	≈(Smart re-assembly)
- Powerwave technologies / KONING &HARTMAN	$\sqrt{}$ (any protocol)	≠ (inherent niet)