Broadband Mobile Communications for Public Safety Applications
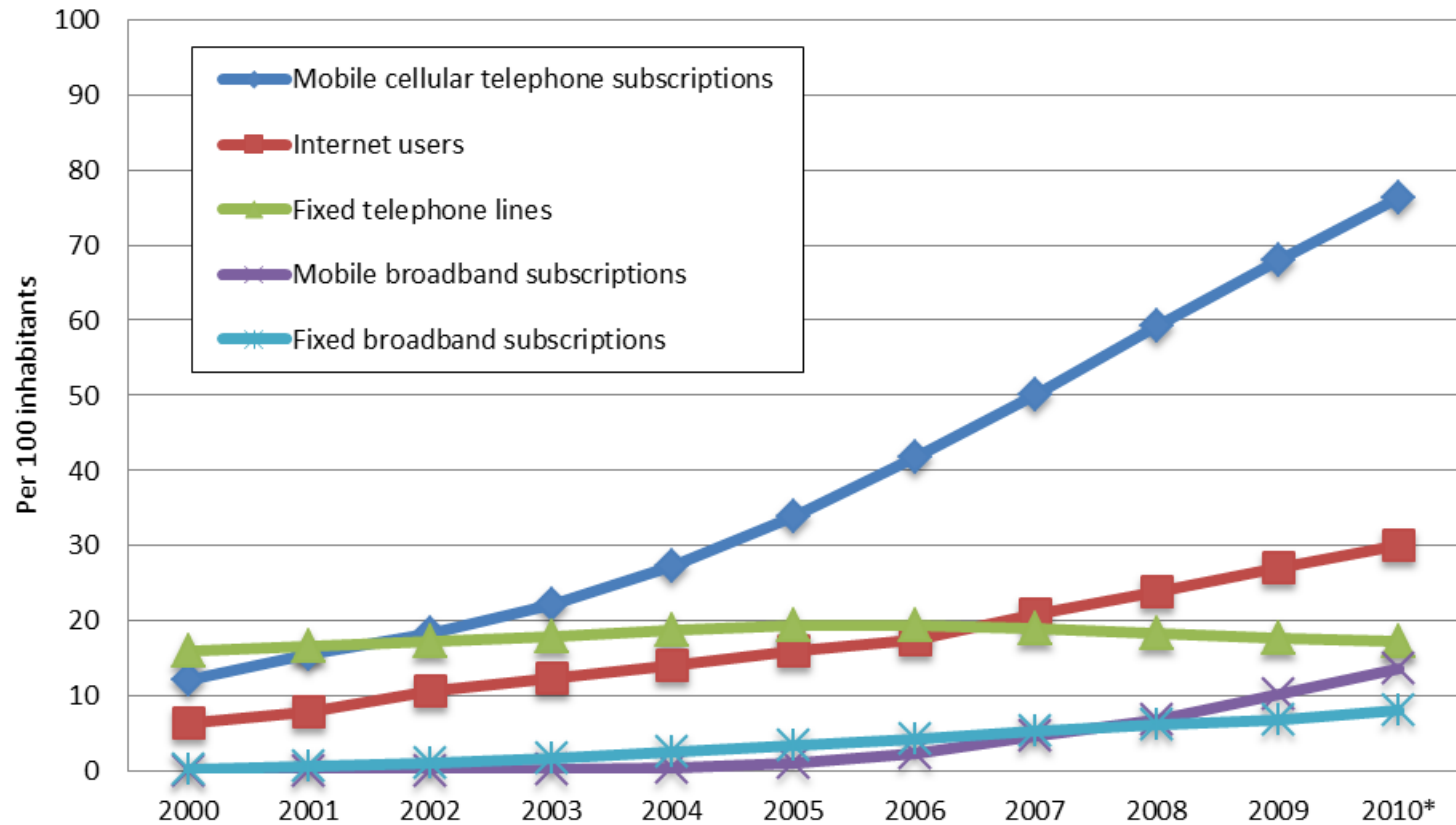
Ir Frank Brouwer

CWTe 2012 Research Retreat

October 9, 2012

TRENDS AND STATISTICS
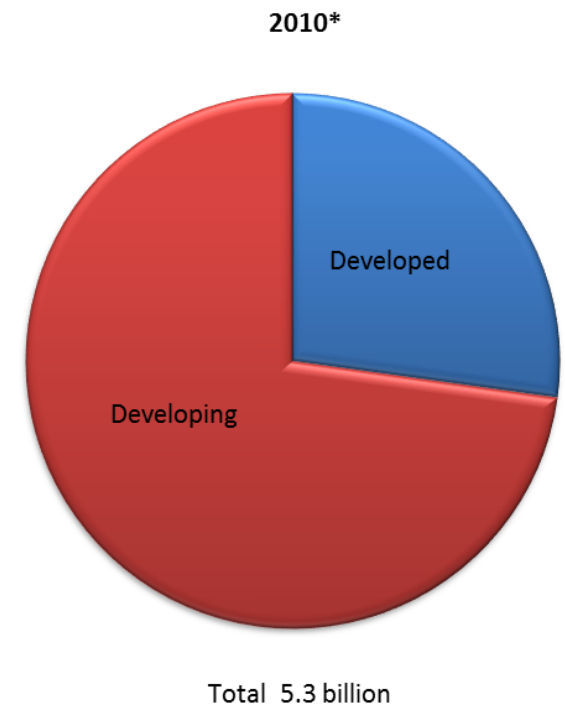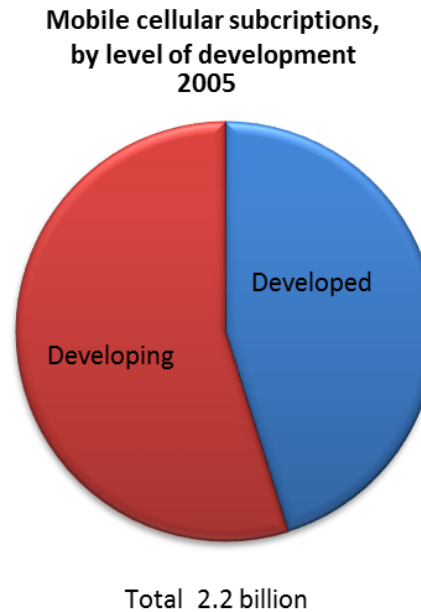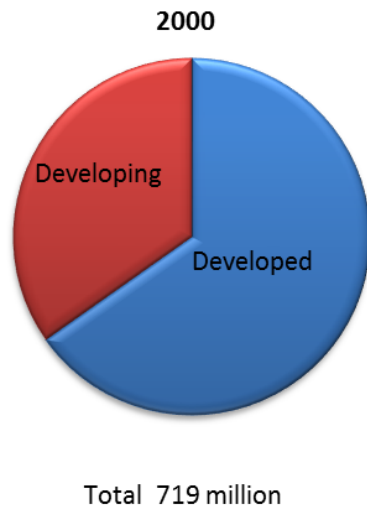
ICT Statistics

Global ICT developments, 2000-2010*

*Estimates
Source: ITU World Telecommunication /ICT Indicators database

Number of users

Mobile cellular subcriptions, by level of development

2000

Developing

Developed

Total 719 million

2005

Developed

Developing

Total 2.2 billion

2010*

Developed

Developing

Total 5.3 billion

*Estimates
The developed/developing country classifications are based on the UN M49, see:
http://www.itu.int/ITU-D/ict/definitions/regions/index.html
Source: ITU World Telecommunication/ICT Indicators database

Worldwide usage

Mobile cellular subscriptions per 100 inhabitants, 2000-2010*
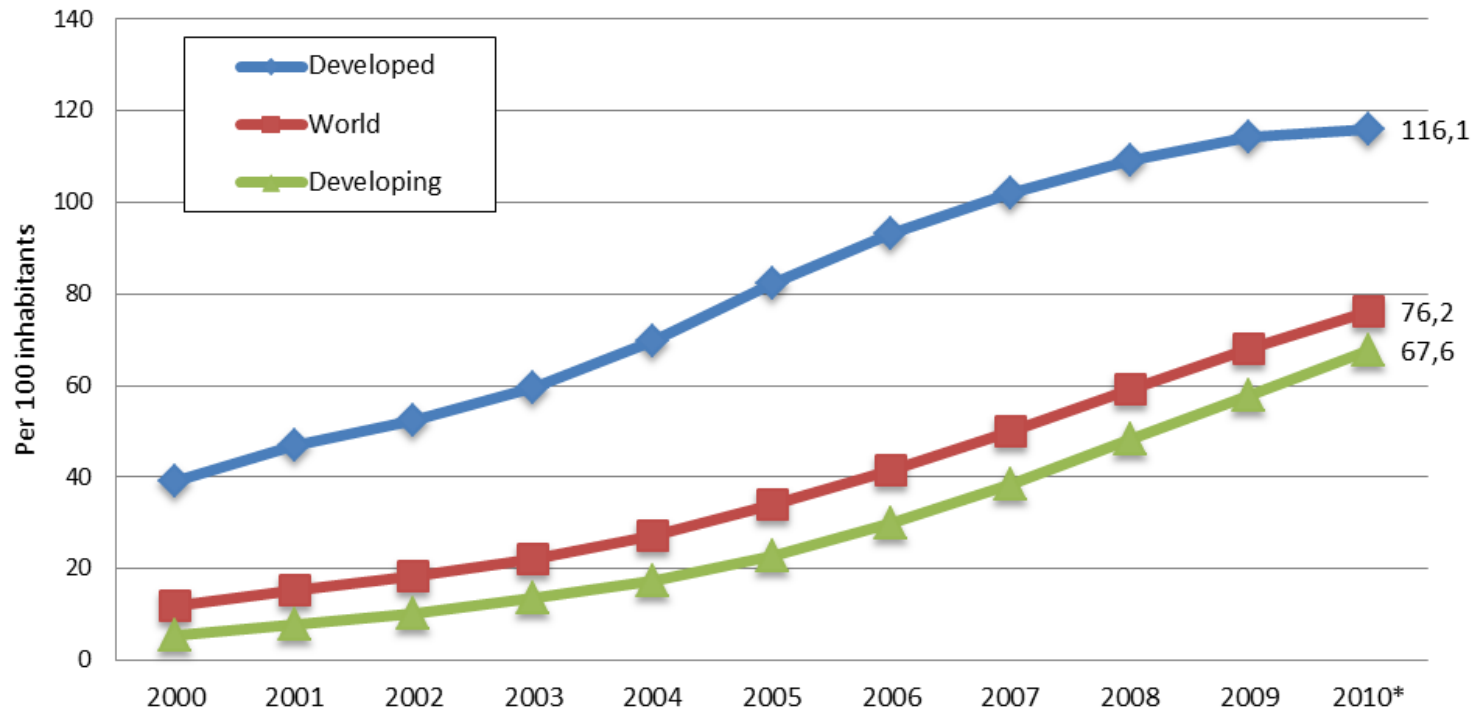
*Estimates
The developed/developing country classifications are based on the UN M49, see:
http://www.itu.int/ITU-D/ict/definitions/regions/index.html
Source: ITU World Telecommunication /ICT Indicators database

Expectations

Source: GSMA

- 2 million/day added
- >1.1 billion 3G (end 2011)
- 50 billion subscribers 2020

Mobile communication necessity of life!

Billion mobile subscribers
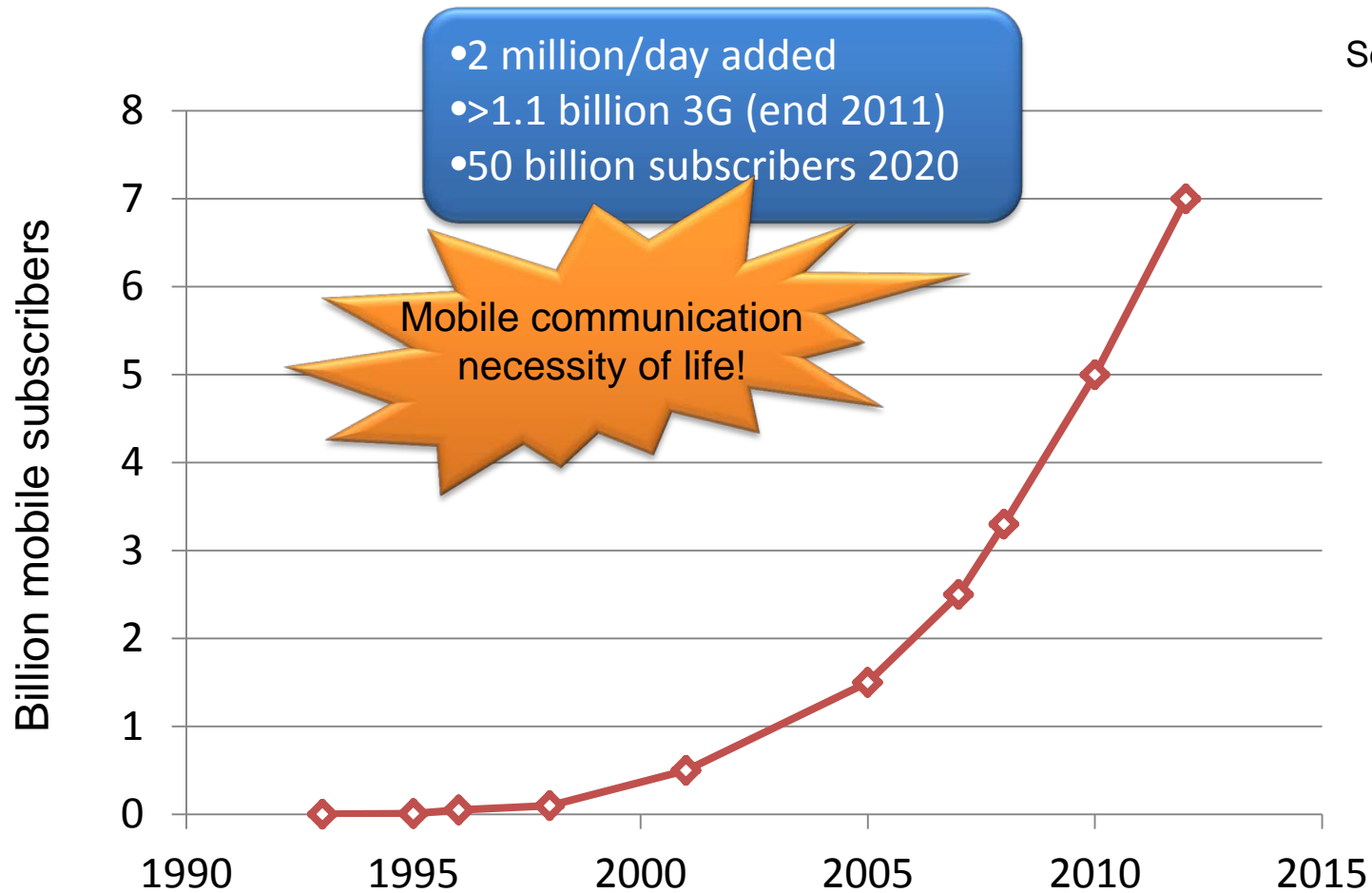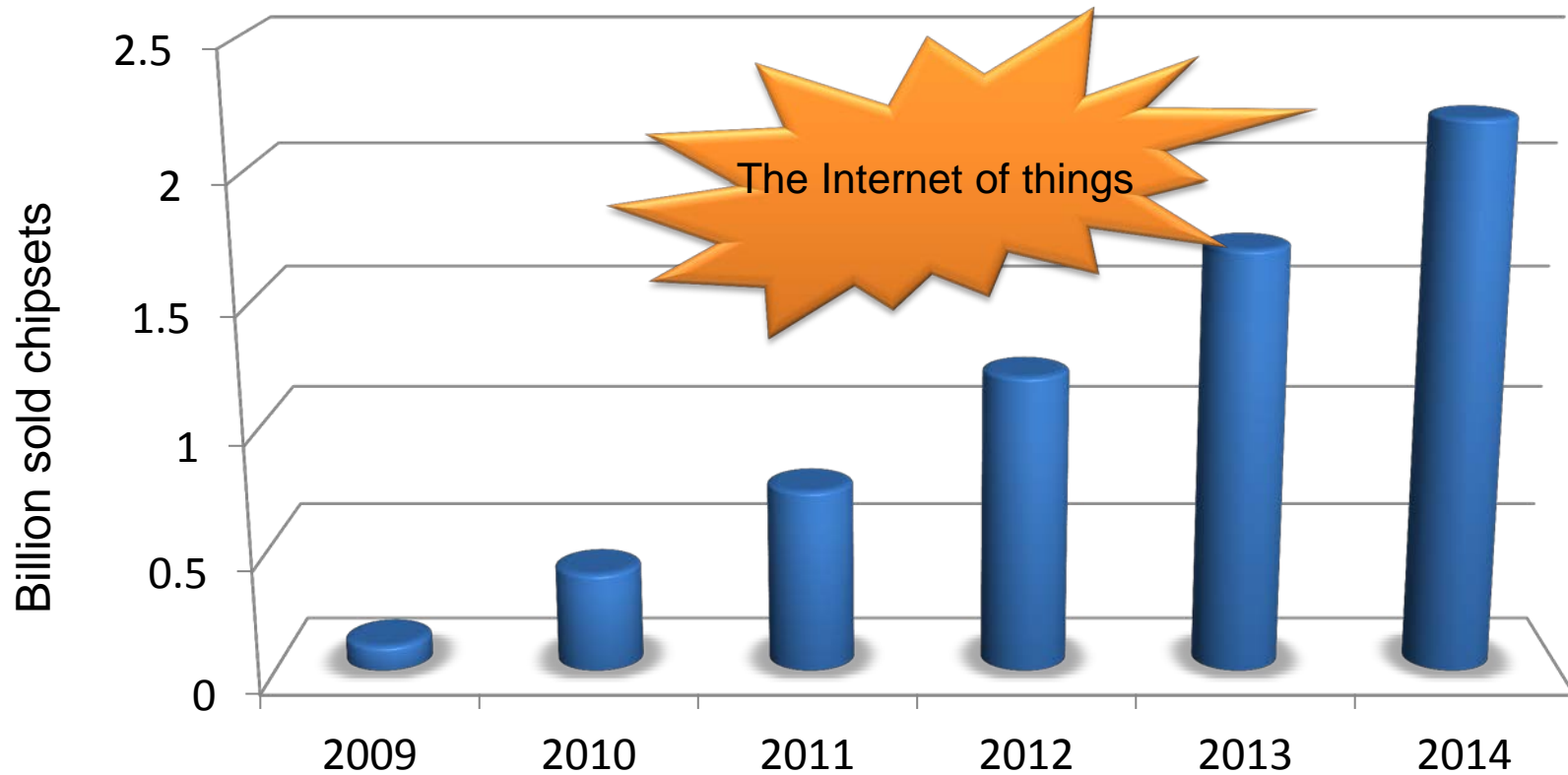
WLAN sales

Source: IHS iSuppli

Generations

- Mobile communication
- Always on
- Always connected
- Always best connected

COMMUNICATIONS FOR PUBLIC SAFETY

Large scale train exident

High speed train and freight train with propane and liquid chloride ride parallel tracks in opposite directions.

Centre track is closed
due to replacement of rails.

The situation

A football stadium is next to the three tracks.

The wind is from the tracks to the stadium.

It's Saturday afternoon. 65000 people are watching a match.
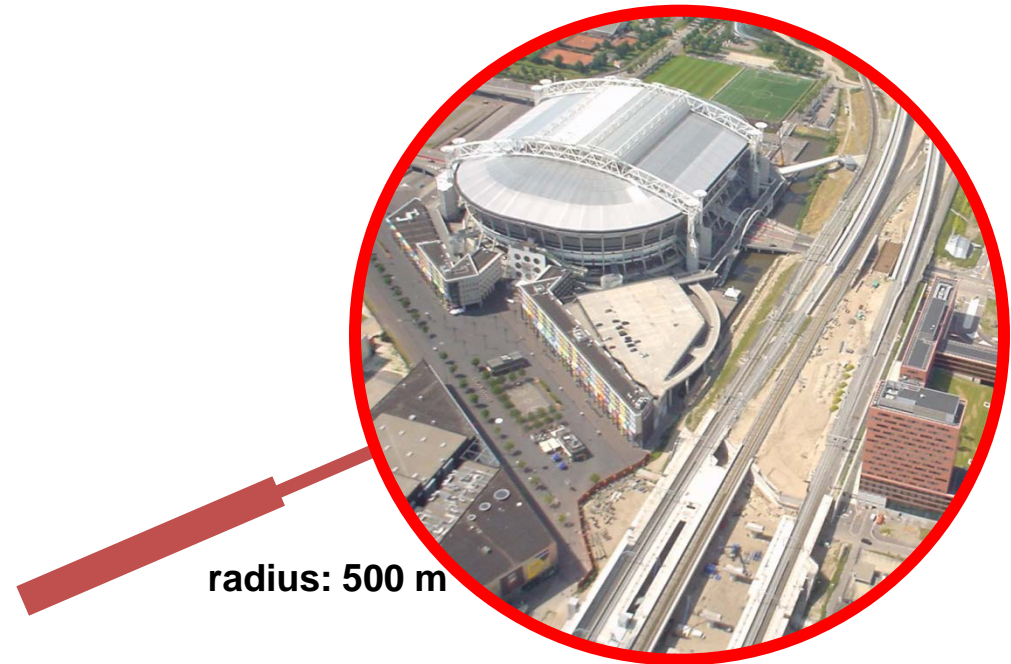
Broadband estimation

- Fire fighters
- Para-medics
- Police
- Hazmat experts
- Relief workers
- First responder vehicles
- Ambulances
- Command trucks
- Robots for inspection
- Helicopter for observation

radius: 500 m

The on-site disaster and relief teams require a capacity of 100 Mbps during the operation.

Combining distance and capacity
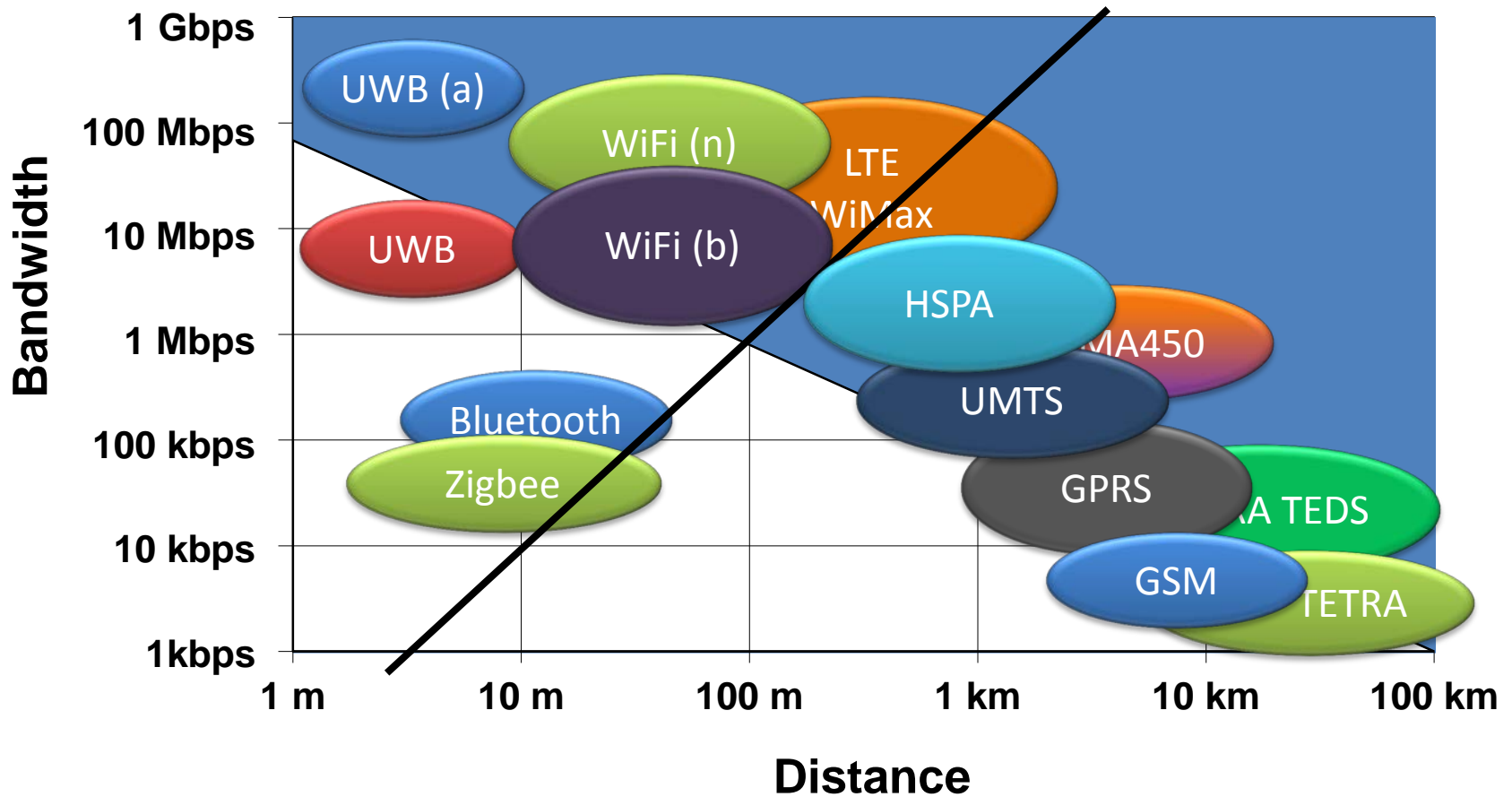
Effect of location in cell

Max performance
(ideal + 1 user)

Avg performance
(ideal + 10 users)

Min performance
(border or 10 users)

Throughput

Cell centre /
good condition

Cell edge /
bad condition

Cell edge /
bad condition

Position in the cell / radio condition

Max vs cell edge

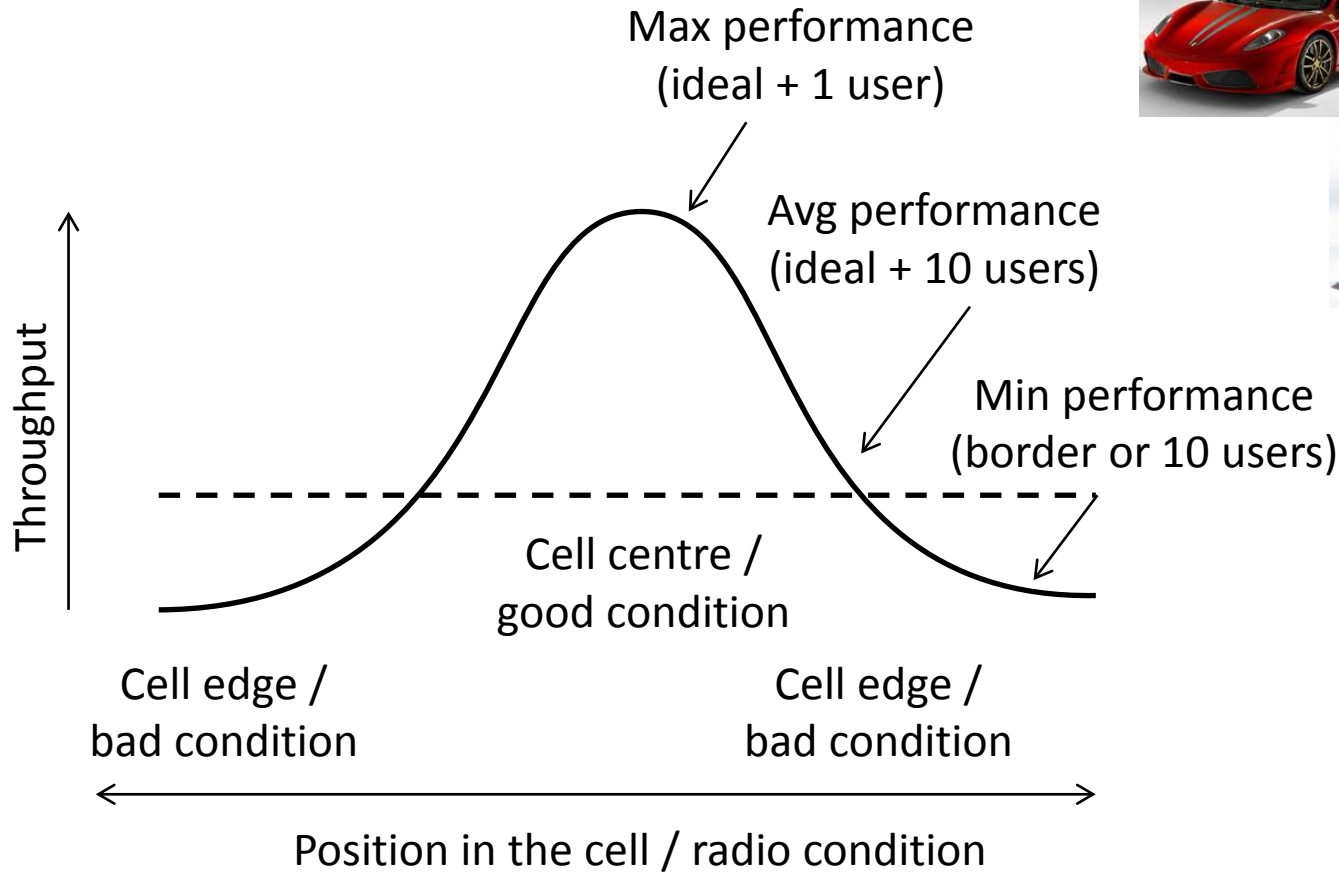|	BW	Max	Avg	Cell edge	Max/edge
GSM (1 slot)	1 MHz	9.6 kbps	9.6 kbps	9.6 kbps	1
GPRS (4 slot)	4 MHz	81.6 kbps	50 kbps	36.2 kbps	2.3
EDGE (4 slot)	4 MHz	236.8 kbps	70 kbps	36.2 kbps	6.5
UMTS (rel 99)	5 MHz	384 kbps	100 kbps	30 kbps	12.8
HSDPA (rel 5)	5 MHz	3.6 Mbps	250 kbps	80 kbps	45
HSDPA (rel 7)	5 MHz	42 Mbps	350 kbps	120 kbps	350
HSDPA (rel 8)	10 MHz	84 Mbps	800 kbps	240 kbps	350
LTE 4x4	20 MHz	300 Mbps	5.34 Mbps	1.6 Mbps	187
LTE-Adv 4x4	20 MHz	600 Mbps	7.4 Mbps	2.4 Mbps	250

Source: Agilent Technologies

ROAD MAPPING TOWARDS A BROADBAND FUTURE

Roadmap TETRA MOU
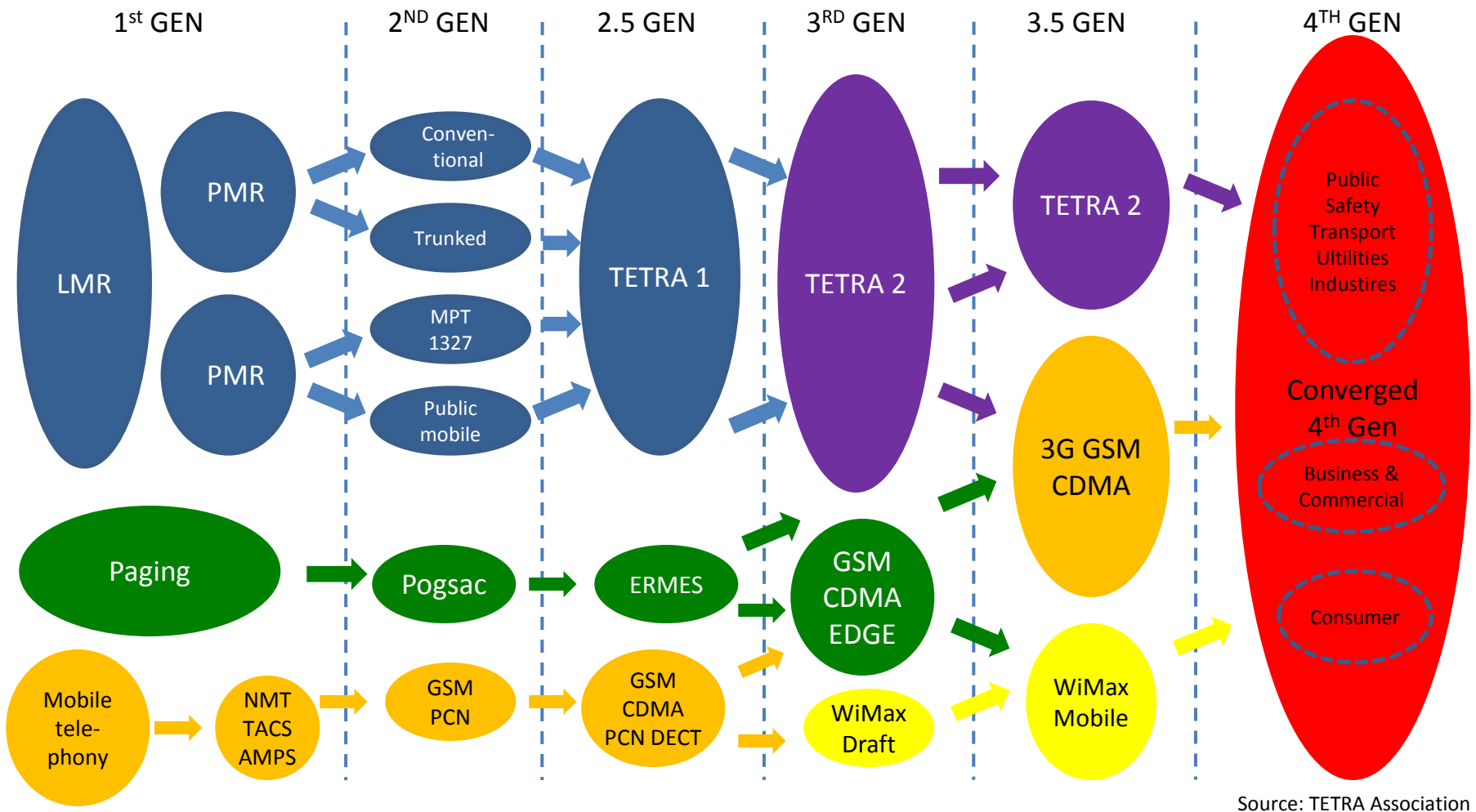
Source: TETRA Association

Roadmap TCCA

- 2012:
  - TETRA, Tetrapol, P25, GSM-R, in use for many years for voice
  - Have only limited (narrowband) data capabilities (<9.6 kbps)
  - TETRA-2 / TEDS available: offers wideband data capacity (<192 kbps)

Capacity

TEDS (TETRA-2)

TETRA-1 / Tetrapol / P25 / GSM-R – mission critical data

TETRA-1 / Tetrapol / P25 / GSM-R – mission critical Voice

2005   2012   2020   2025/2030

Roadmap TCCA

- 2012: Commercial networks can provide wide / broadband data
- 2012-2020:
  - European harmonization dedicated broadband solution technology/standard & spectrum
- ± 2020: realization dedicated data networks

Capacity

Data via commercial networks

Mission critical data via dedicated networks

TEDS (TETRA-2)

TETRA-1 / Tetrapol / P25 / GSM-R – mission critical data

TETRA-1 / Tetrapol / P25 / GSM-R – mission critical Voice

2005   2012   2020   2025/2030
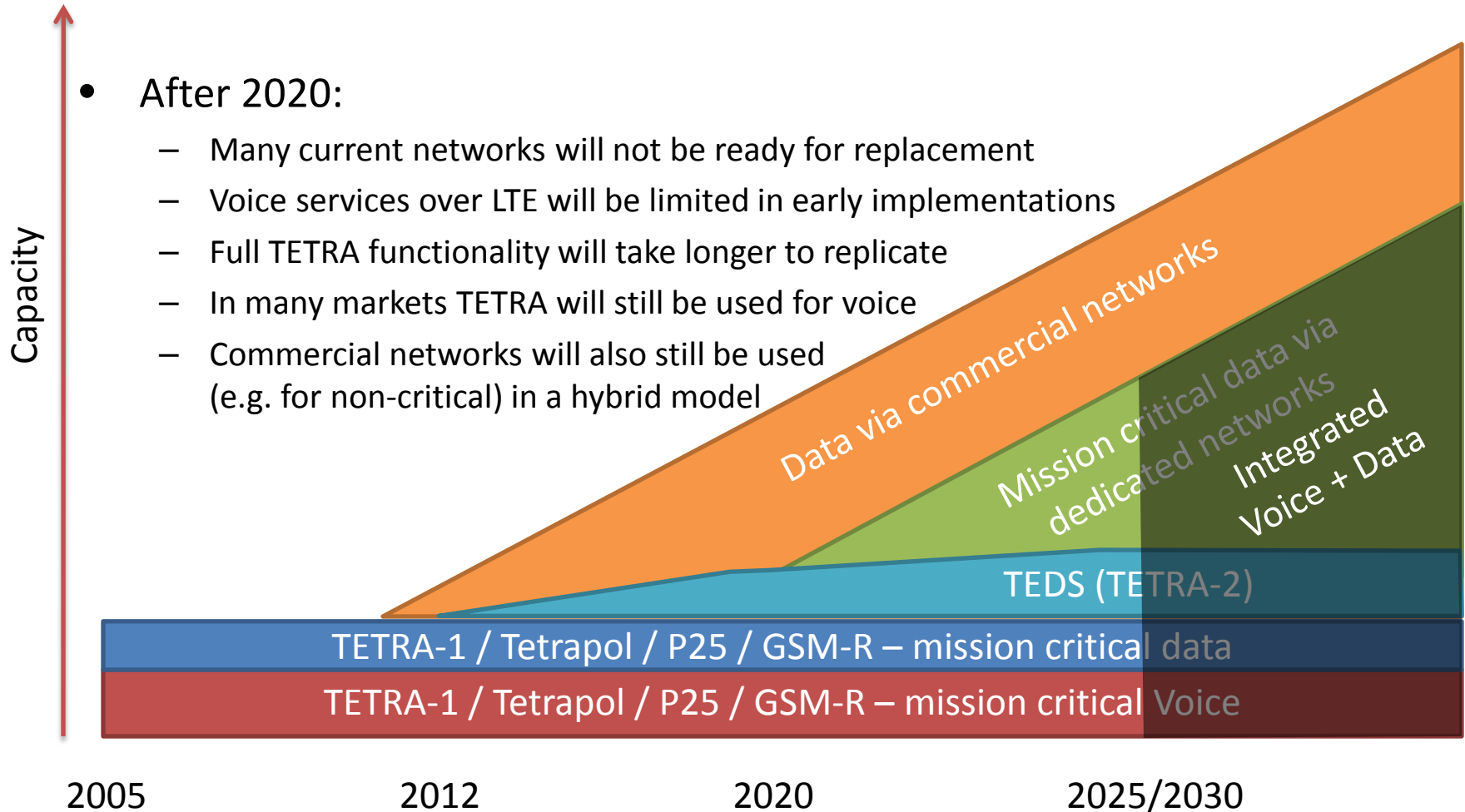
Roadmap TCCA

- After 2020:
  - Many current networks will not be ready for replacement
  - Voice services over LTE will be limited in early implementations
  - Full TETRA functionality will take longer to replicate
  - In many markets TETRA will still be used for voice
  - Commercial networks will also still be used (e.g. for non-critical) in a hybrid model

Capacity

Data via commercial networks

Mission critical data via dedicated networks

Integrated Voice + Data

TEDS (TETRA-2)

TETRA-1 / Tetrapol / P25 / GSM-R – mission critical data

TETRA-1 / Tetrapol / P25 / GSM-R – mission critical Voice

2005   2012   2020   2025/2030

Research in FP7-SALUS

"Preparation of the next generation of PPDR communication network"

- **Capability project: preparation for Integrated project**

- **Core:**
  - **How to organise this new solution?**
  - **Supporting political questions for the next 5-10 years.**

- **Project duration: 2012 – 2015**

  S**ecurity **A**nd Interoperabi**L**ity in Next Generation PPDR Comm**U**nication Infrastructure**S

Goals FP7-SALUS

- Standardization and training

- Interoperability of safety equipment
  - Both short and long term
  - Reliability, integrity, confidentiality of information exchange between first responders

- Co-operation with and migration from TETRA(POL) functionality
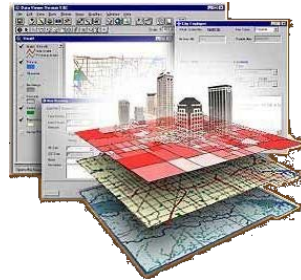
Topics FP7-SALUS

- User scenarios coming 10-20 years
- Technological – organizational – economical aspects
- Migration scenarios
  - Cost
  - Training
  - Current communication solution
  - Business cases
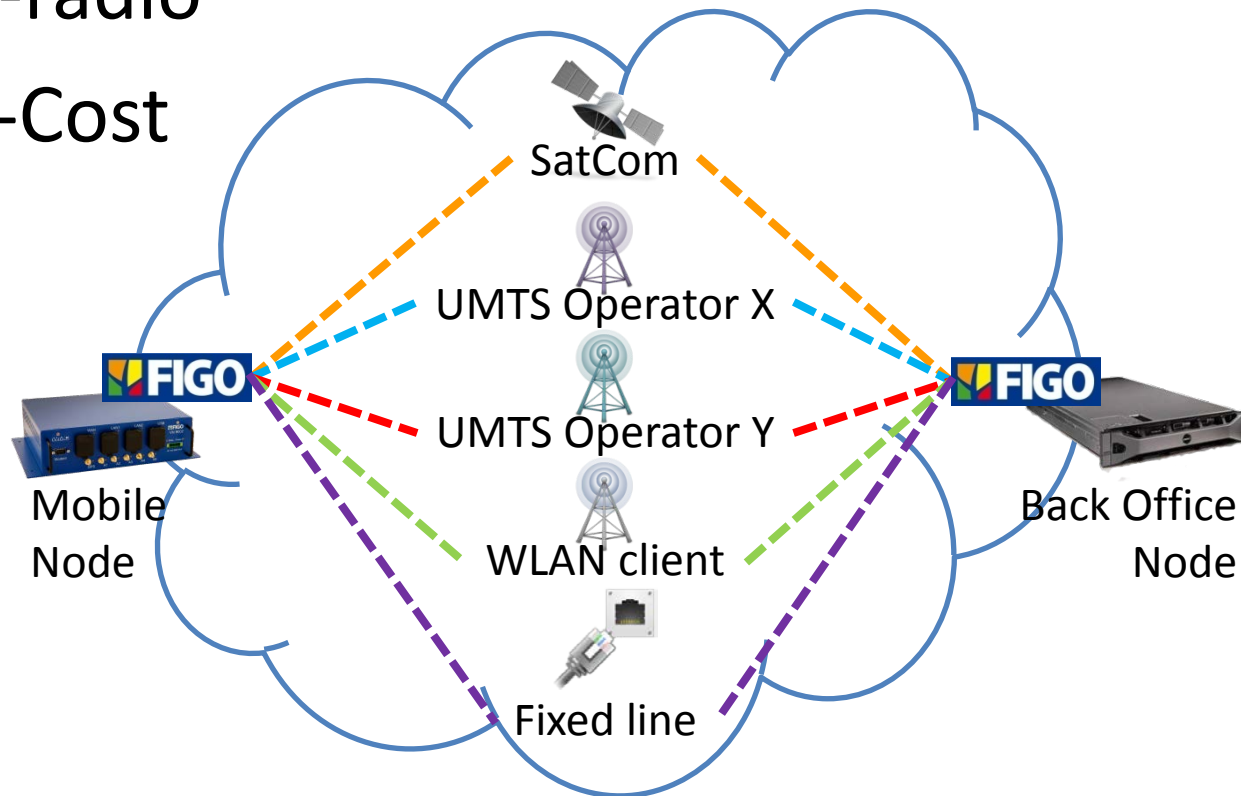
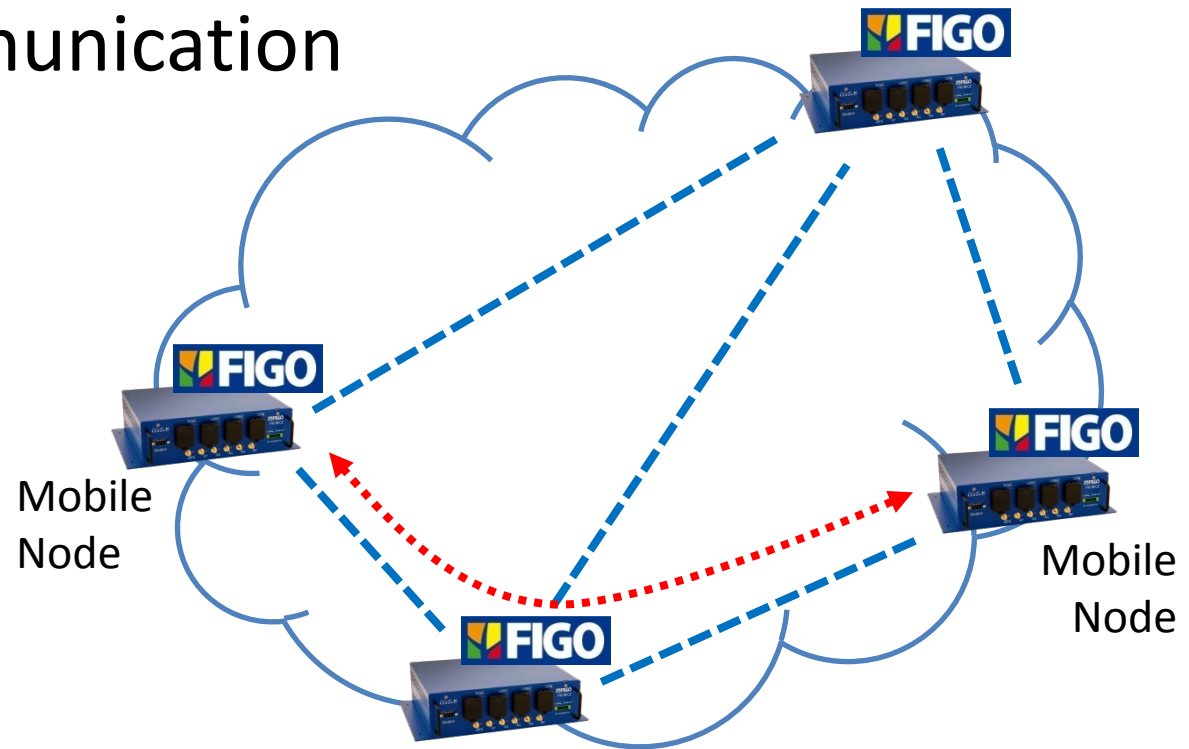The current solution towards

HYBRID NETWORKS

Classic solution

MIND THE GAP

MIND THE GAP

To and from the field

- Multi-radio
- Least-Cost
- VPN

Mobile Node

SatCom
UMTS Operator X
UMTS Operator Y
WLAN client
Fixed line

Back Office Node

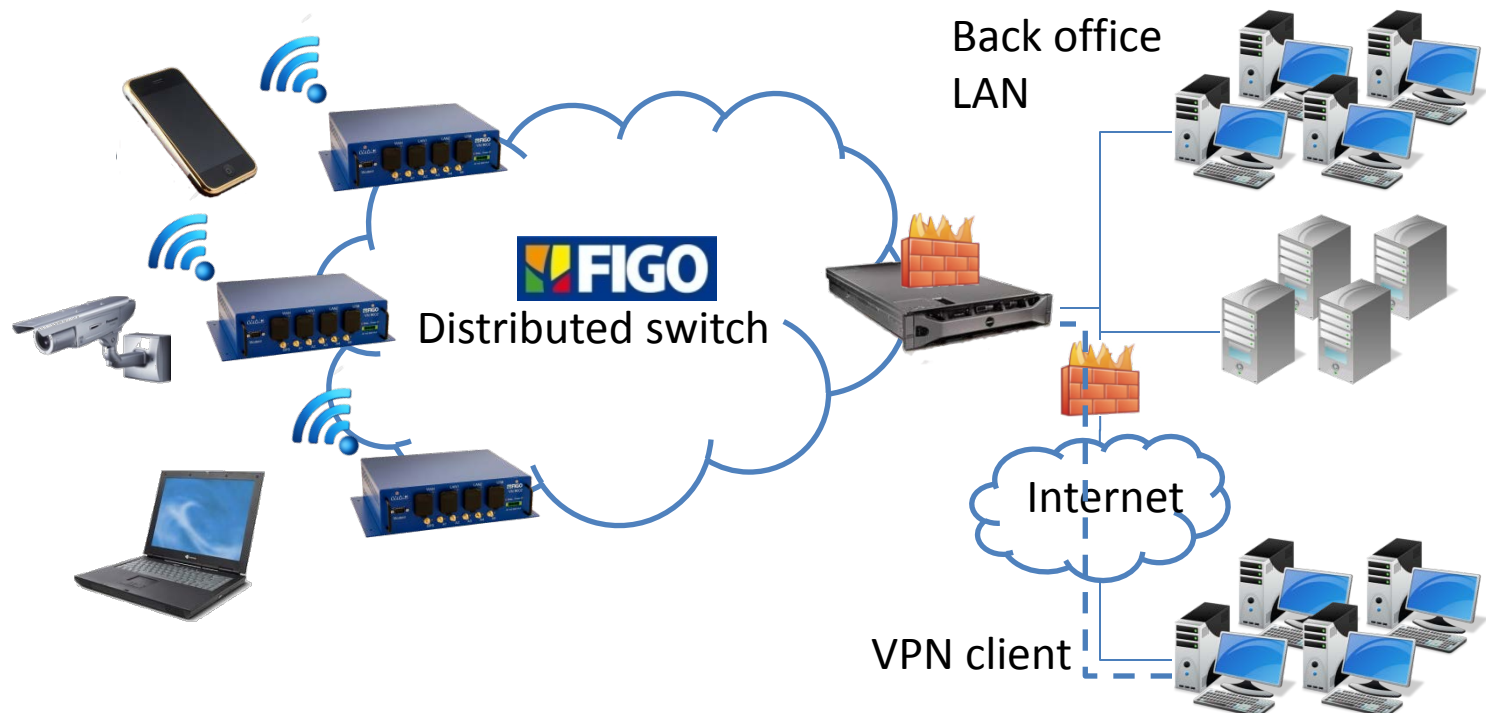# Local network

- Ad-hoc WLAN network
- Local communication
- Relay

Mobile
Node

Mobile
Node

Reliable due to relay

- Reliable due to multiple alternatives
- Least cost: best quality for lowest cost

SatCom

FIGO

UMTS Operator X

FIGO

Back Office
Node

Mobile
Node

FIGO
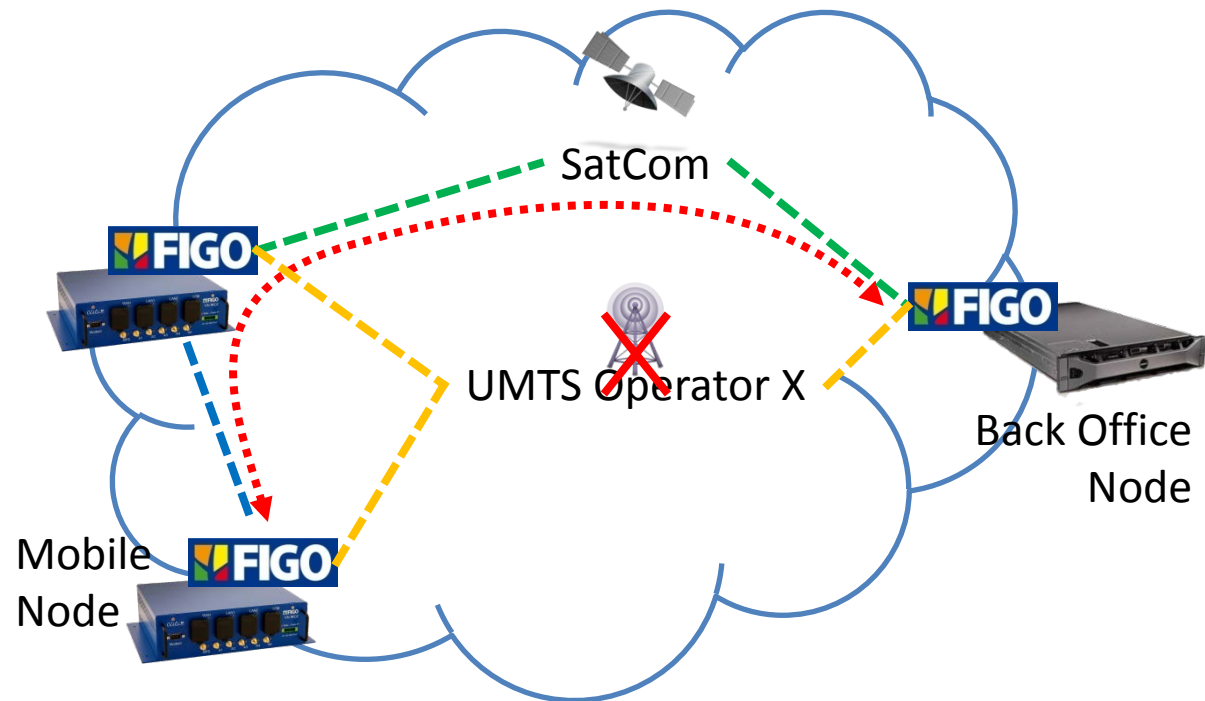
Distributed Switch

- All clients part of the Office LAN
- VPN for Mobile Nodes and fixed clients

KLPD test on the Waal

UMTS 1:   85% available
UMTS 2:   95% available
UMTS 1 & 2:   99,5% available
SatCOM: 100% available – 0,5% used

100 % availability for lowest possible cost!

Test at SAIL2010

UMTS 1:   90,5% available
UMTS 2:   97,4% available
UMTS 1 & 2:   99,4% available
SatCOM: 100% available – 0,6% used

100 % availability for lowest possible cost!

Hybrid radio networks

- Always best connected
    - Capacity on demand
    - Coverage comes with the user

- Using multiple networks
    - Extremely high availability
    - Trade-offs in latency, throughput, etc.

Hybrid networks for Mission Critical Applications

- Leverages the huge development efforts for public systems to private solutions

- The best possible solution for now

- Road to **Broadband Mobile Communications for Public Safety Applications**

Thank you for your attention

ir. Frank Brouwer
CTO

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