Technology Work Session for the South African Army; Hosted by the CSIR

Static & Tactical Communications and Communications Electronic Warfare in the Battle Space

Tactical Communications

Corné Smith
CSIR Defence, Peace, Safety and Security

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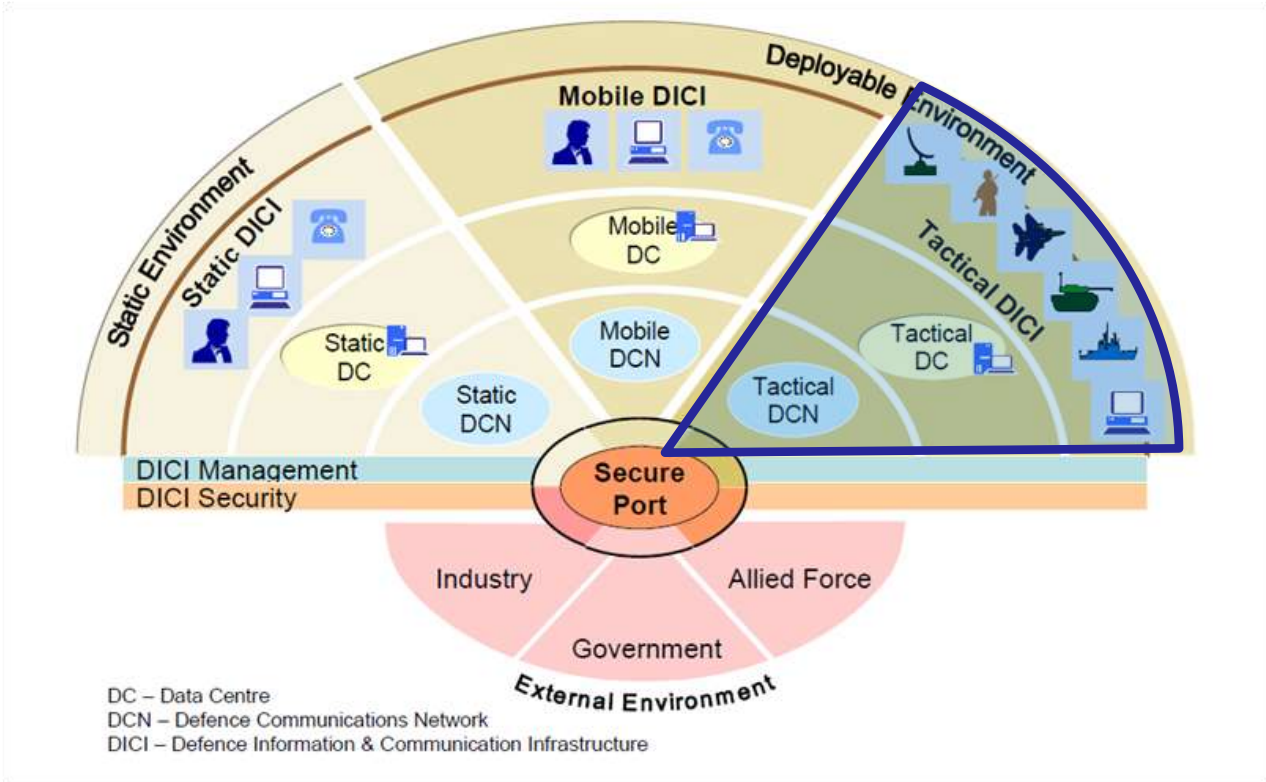
Scope

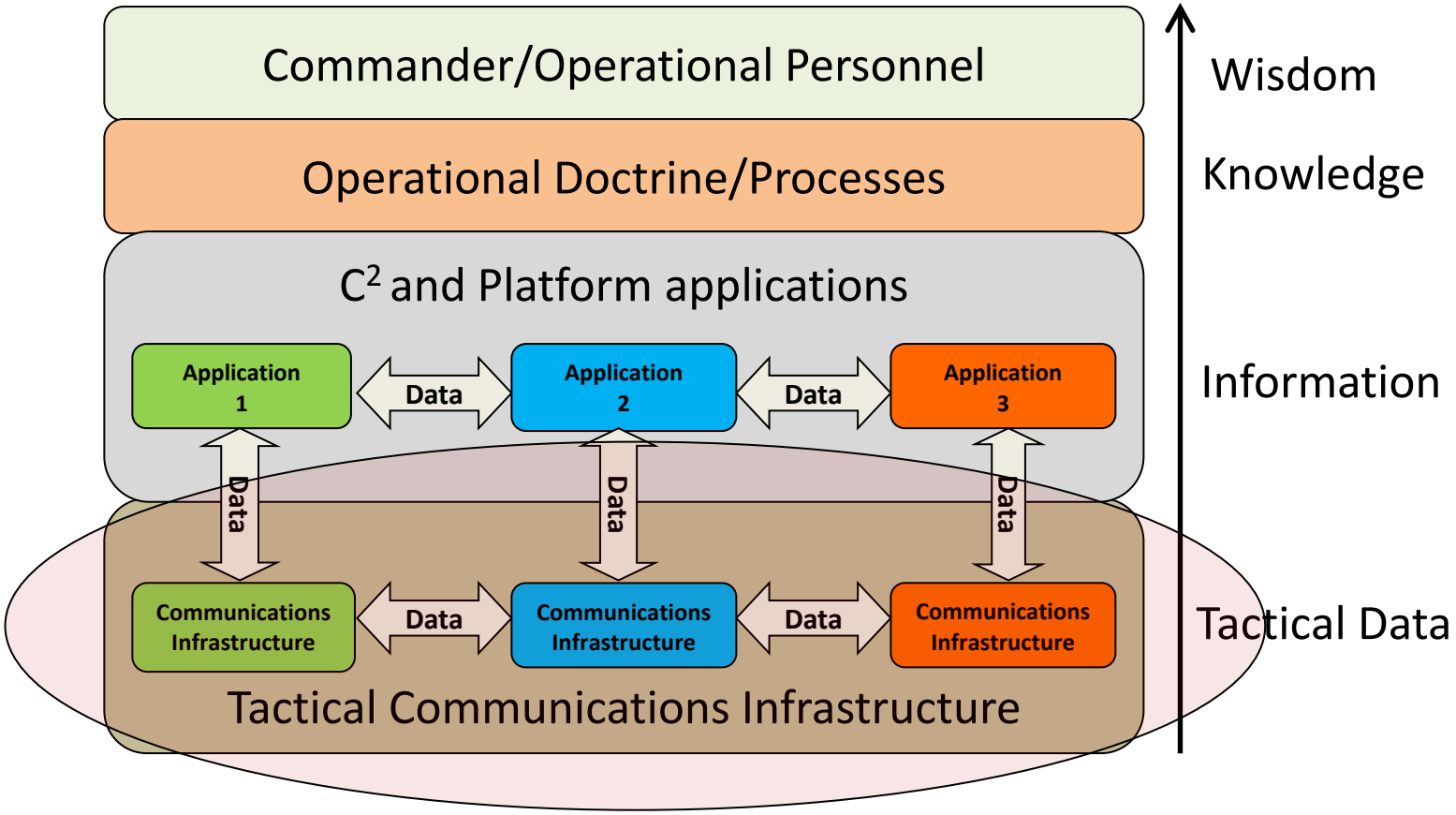
- Tactical communications introduction
- Technologies available:
  - Project RADIATE
    - COTS Technologies
    - SANDF MOTS technologies
  - Tactical Data Links
  - Interoperability technologies and approaches
  - Next Generation Tactical Radios (What is possible?)
  - Technologies for OOTW

Tactical Communication Introduction

Tactical Communications is combat oriented networks that enables secure communication and data interchange between SANDF ground, air, maritime forces and coalition/allied forces if required, whilst on the move.



Tactical Communication Introduction



Tactical Communications is a Command and Control Network Enabling Capability for Network Centric Warfare.

Objectives of Tactical Communications

- Information interchange primarily through wireless communication.
- Scalable networks.
- Denial of service to adversaries.
- Interoperability to the static and/or mobile networks.
- Should accommodate different information formats. (voice, data, video)
- Should accommodate the processing, storage and distribution of these formats. (within technology restrictions applicable to the tactical domain)
- Shall support Joint, Interdepartmental and Multinational (JIM) operations.

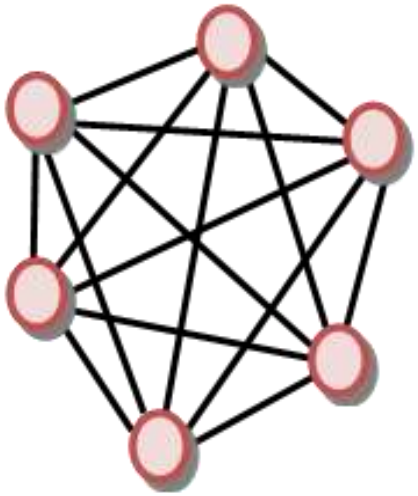
Project RADIATE : Architecture

Project RADIATE is the SANDFs future Tactical Communications acquisition project.

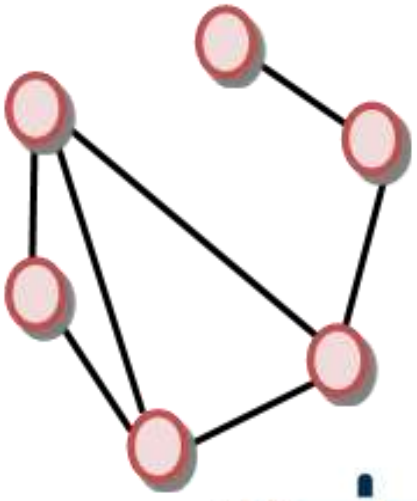
The project is in its development phase and is responsible to deliver the tactical communications capability in the near short term.

RADAITE aims to provide a Partially Interconnected Mesh Structure.

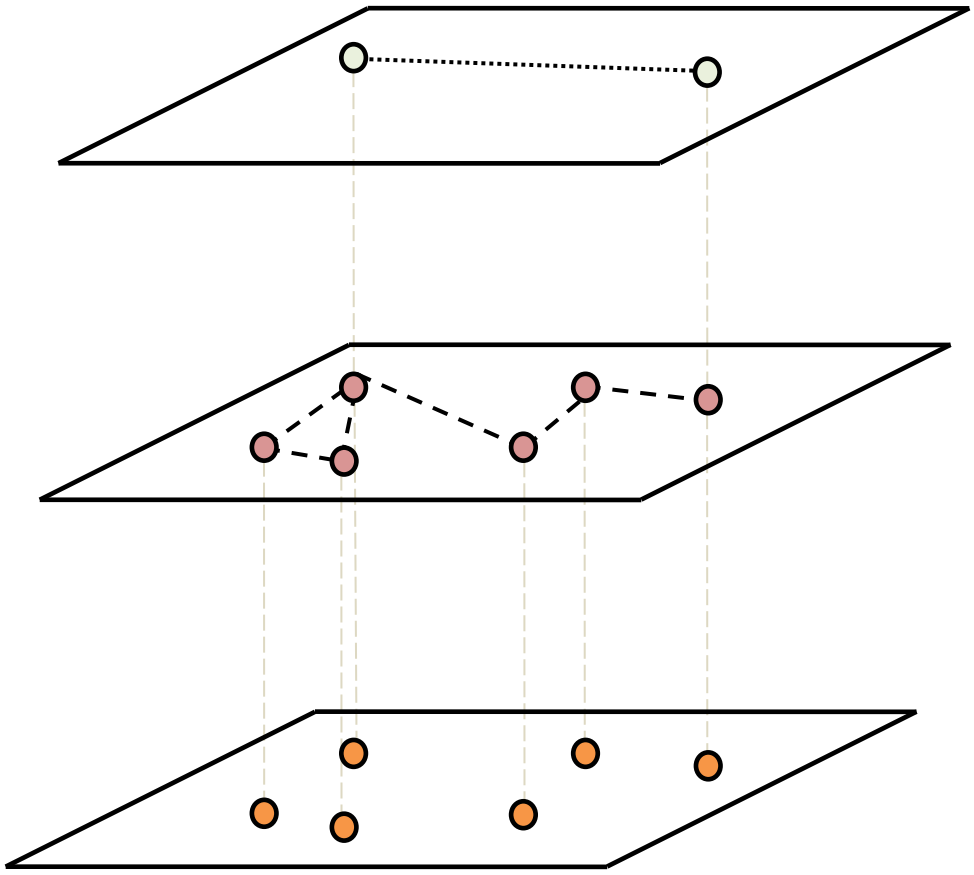
Interconnected Mesh Structure



Partially Interconnected Mesh Structure



Project RADIATE : Architecture



Layer 3:
Mix of operation on the move and tactical deployable links.
Network backbone: Wide-Area Network.

Layer 2:
Partially meshed network designed for an operation on the move.
Numerous Layer 2 sub-networks can be combined into a single compound Layer 2 network.

Layer 1:
This will be known as a Local Distribution Network that is used to connect local users together.

Project RADIATE : Operational Environment

RADIATE shall accommodate different physical environments:

- Man portable
- Vehicle or ship based
- Fixed installations
- Airborne

And require different Communications Capabilities to support:

- Short Range: Line of Sight communications (to 1000m).
- Medium Range: Line of Sight communications (to 50 km ground-ground, above 50km ground-air).
- Long Range: Beyond Line Of Sight communications.
- Intra-Platform: Communications contained within a single platform.

Project RADIATE : Technologies Employed

	Short Range	Medium Range	Long Range	Intra-Platform
Man Portable	• UHF Personal Role Radio	• VHF or UHF Man Portable Radio • VHF or UHF Hand Held Radio	• HF Man Portable Radio • Satcom (Iridium) • Satcom (Inmarsat) • Airborne repeater • Aerostat	• Wired communications • Bluetooth
Vehicle/Ship	• UHF Fixed Vehicle Transceiver	• VHF or UHF vehicle transceiver • WiMAX	• HF vehicle transceiver • Satcom (BGAN, VSAT) • Airborne repeater • Aerostat	• Digital Harness (Copper or Fibre Optic)
Fixed Installation		• VHF or UHF fixed installation transceiver	• HF fixed installation transceiver • Satcom (BGAN, Fleet-77, VSAT) • Airborne Repeater • Aerostat	• Digital Harness (Copper or Fibre Optic) • Communications bus supplied by platform OEM
Airborne		• VHF or UHF airborne transceiver	• HF airborne transceiver • Satcom (Inmarsat)	• Communications bus supplied by OEM

Project RADIATE : COTS technologies

WiMAX – This technology has been chosen as a vehicle based Tactical HQ solution for ***inter vehicle communications***. Characteristics include:

- High data rate (to 54 Mbps)
- Voice and data
- Low probability of intercept
- Moderate range (8-10 km)

Since this technology uses a star topology it will not be used further than for this application.

Iridium Satcom –

Chosen for application in ***man portable environments***.

Project RADIATE : COTS technologies

Inmarsat Satcom –

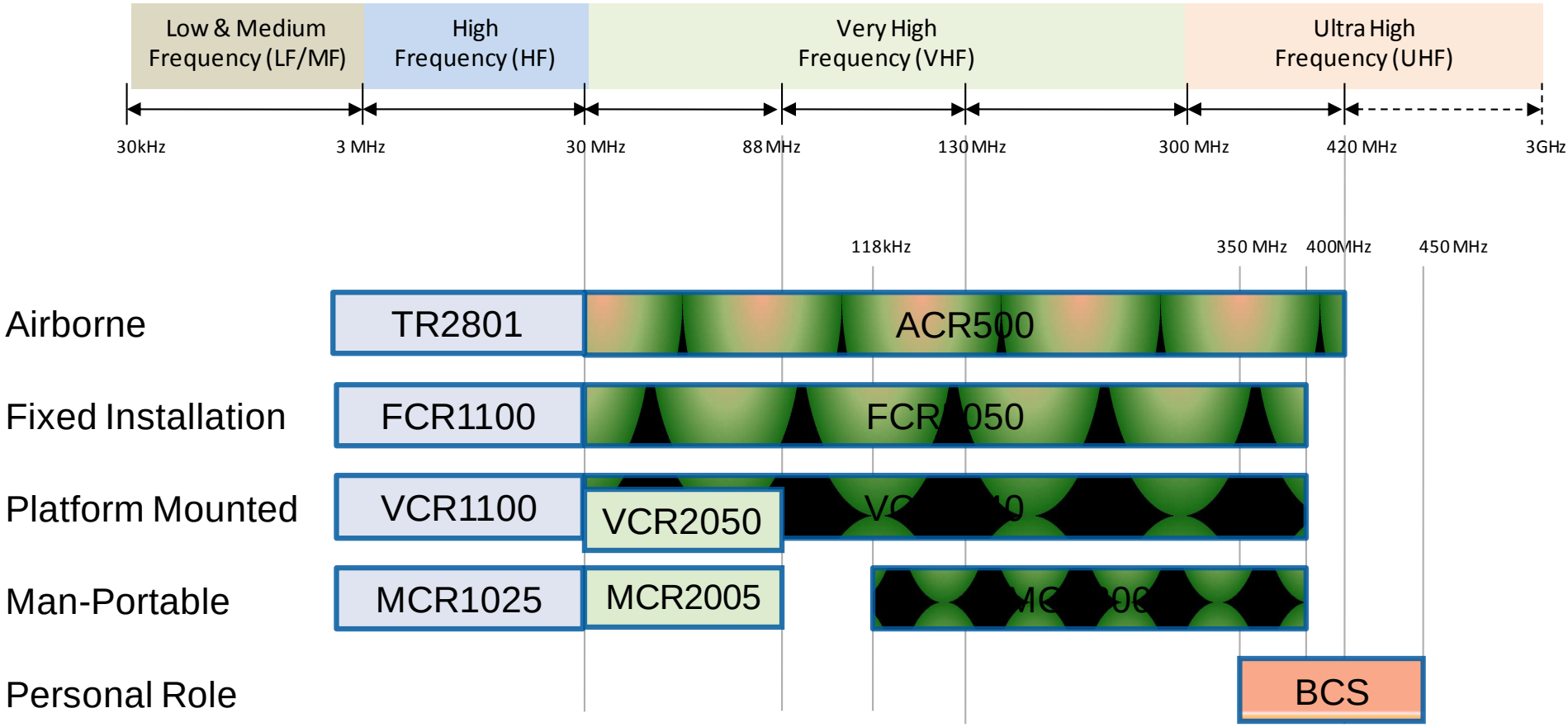
Inmarsat technologies include:

- Broadband Global Area Network (BGAN)
- Fleet 77

This application is ideal for
man portable requirements

Project RADIATE : MOTS technologies

Project RADIATE : MOTS technologies



Project RADIATE : Features of RADIATE radios

VCR5040

MCR2/3005

VCR2050

- The ability to send Link-ZA data and analog-voice on a single channel.
- Digital voice mode.
- RADAITE radios will be able to connect to applications via USB, Bluetooth or Ethernet.
- The radios shall have built-in GPS and SMS functions.
- Most resent South African Communications Security Agency (SACSA), Information Security (INFOSEC) and Transmission Security (TRANSEC) techniques are incorporated.
- RADIATE radios will be backward compatible to second generation radios (ACR500 and TR2/4/6/800/1) on all modes (voice, data, INFOSEC and TRANSEC).
- Radiate radios will be backward compatible to first generation radios (A43, B46, C21) on voice modes with first generation TRANSEC and INFOSEC.
- Common Human Machine Interface (HMI) throughout the range of radio infrastructure.

Tactical Data Links: LINK-ZA

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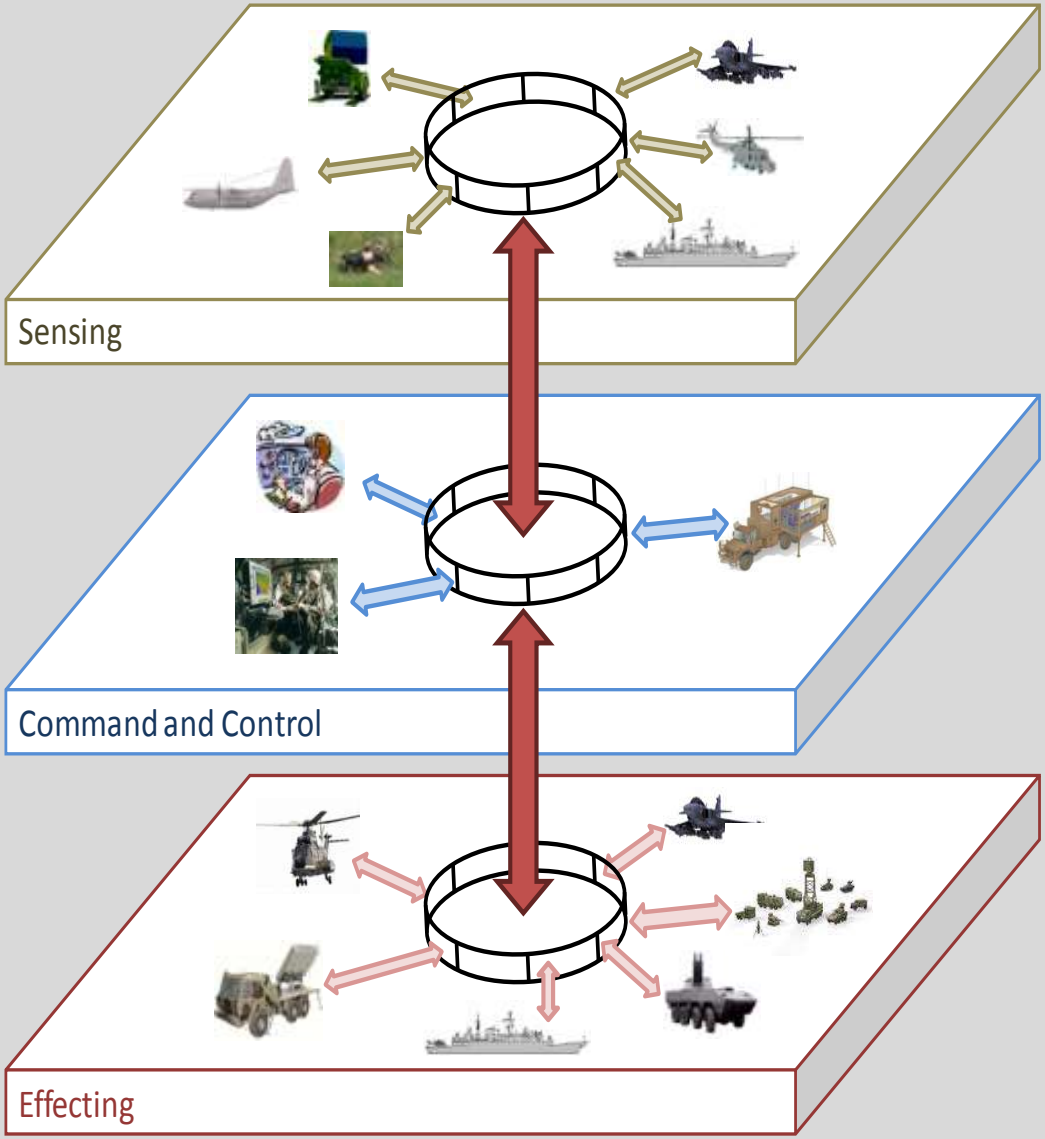

TDLs consist of:

- a Standardised message set Data Model
- a Standardised transmission format called a Data Transfer Protocol.

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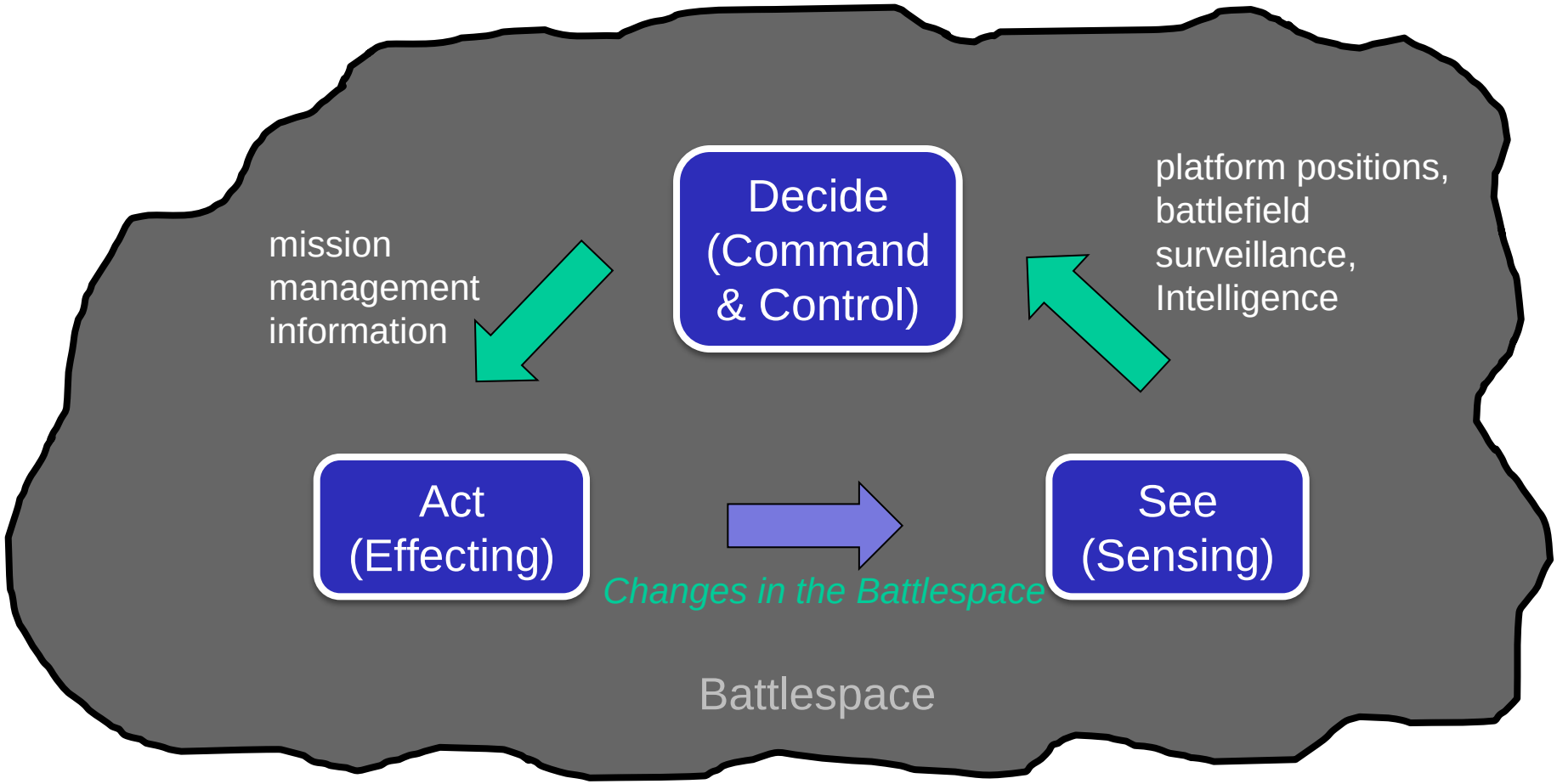
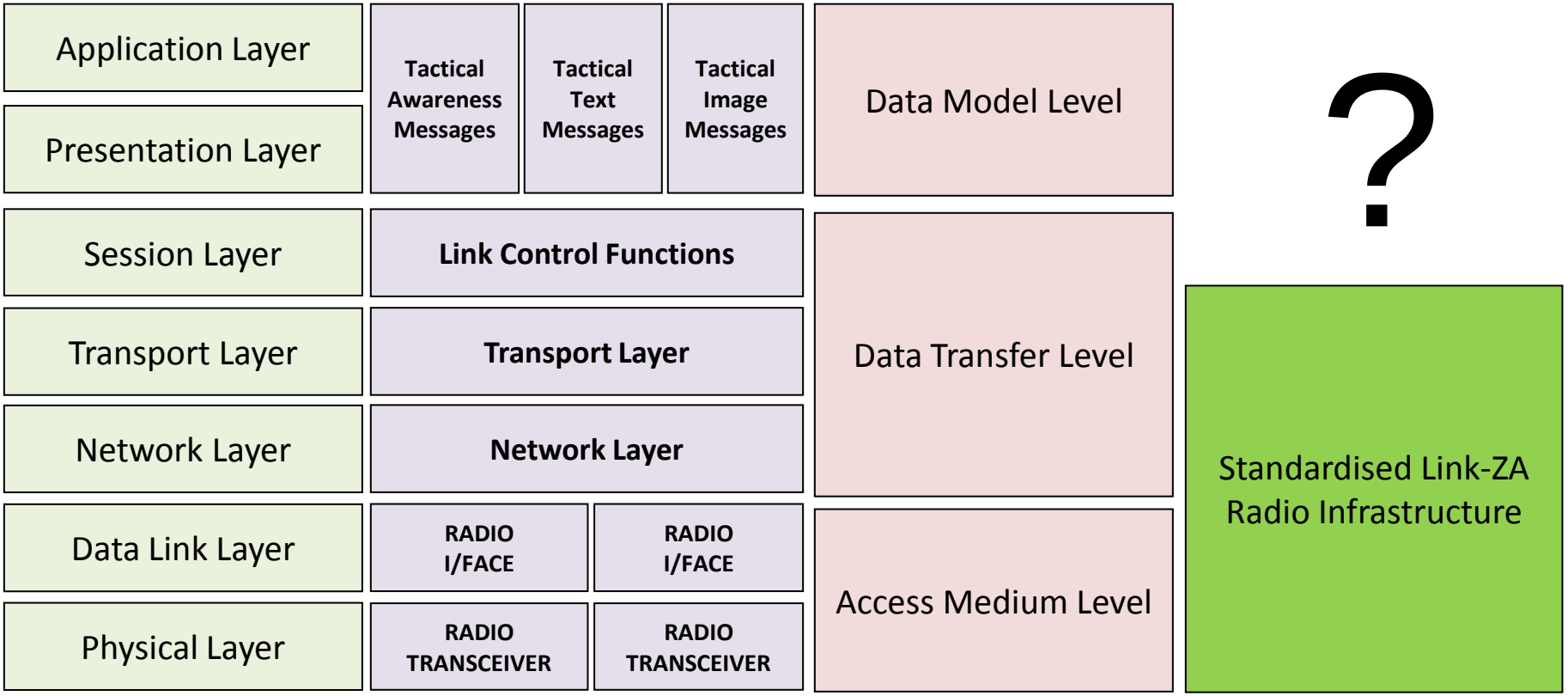
Tactical Data Link: C2 Enabler

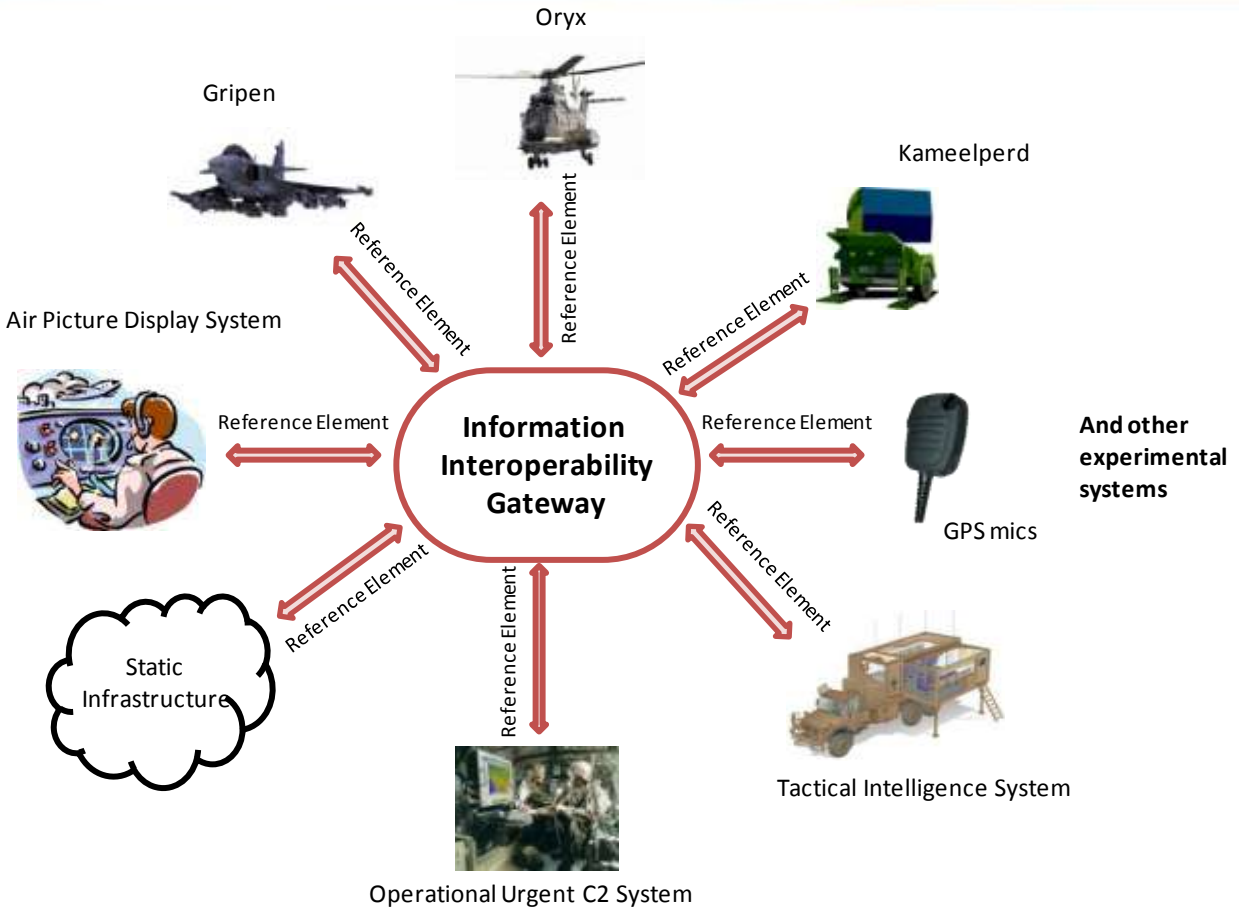


Data interoperability: Link-ZA

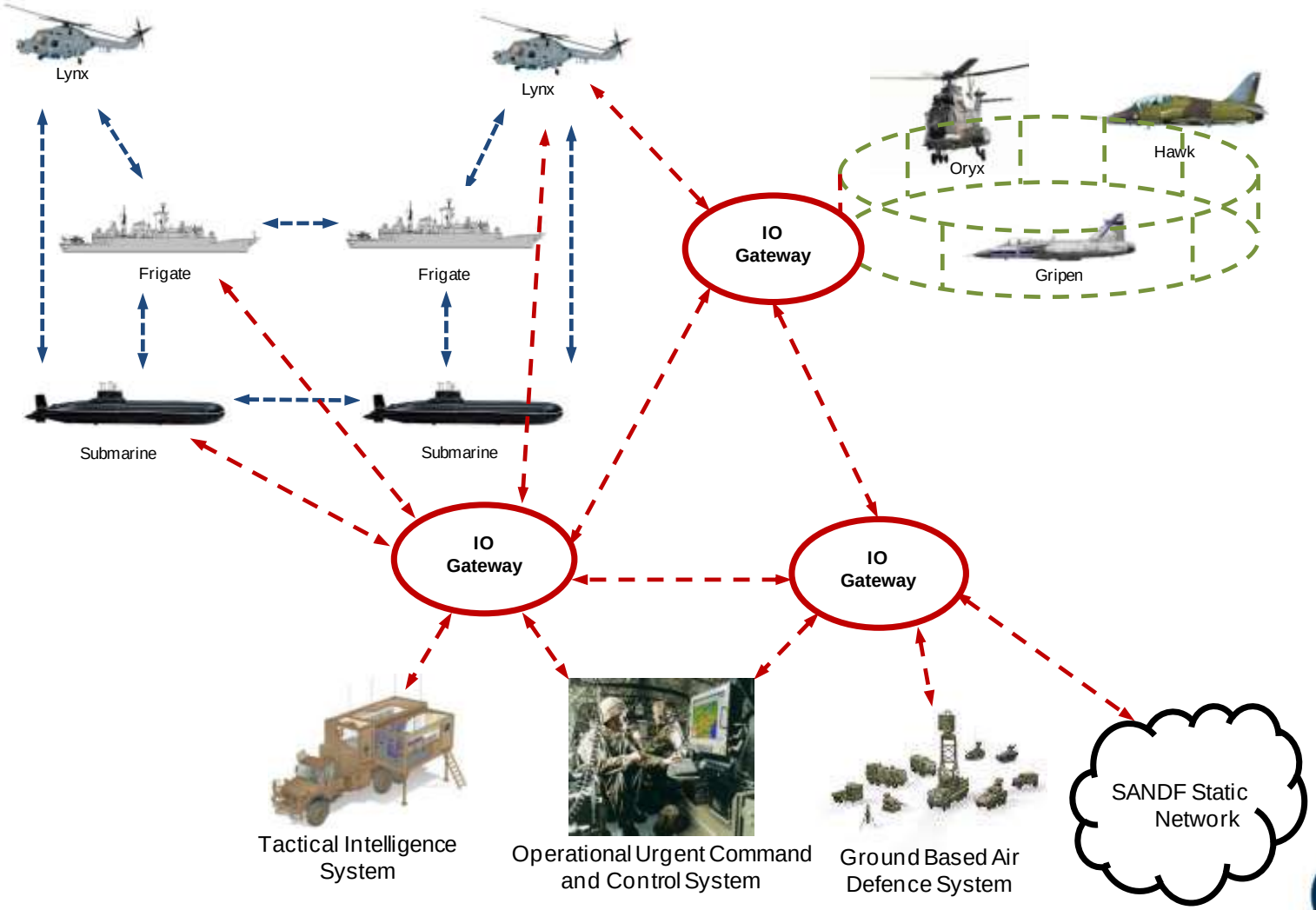


Information Gateway Technologies

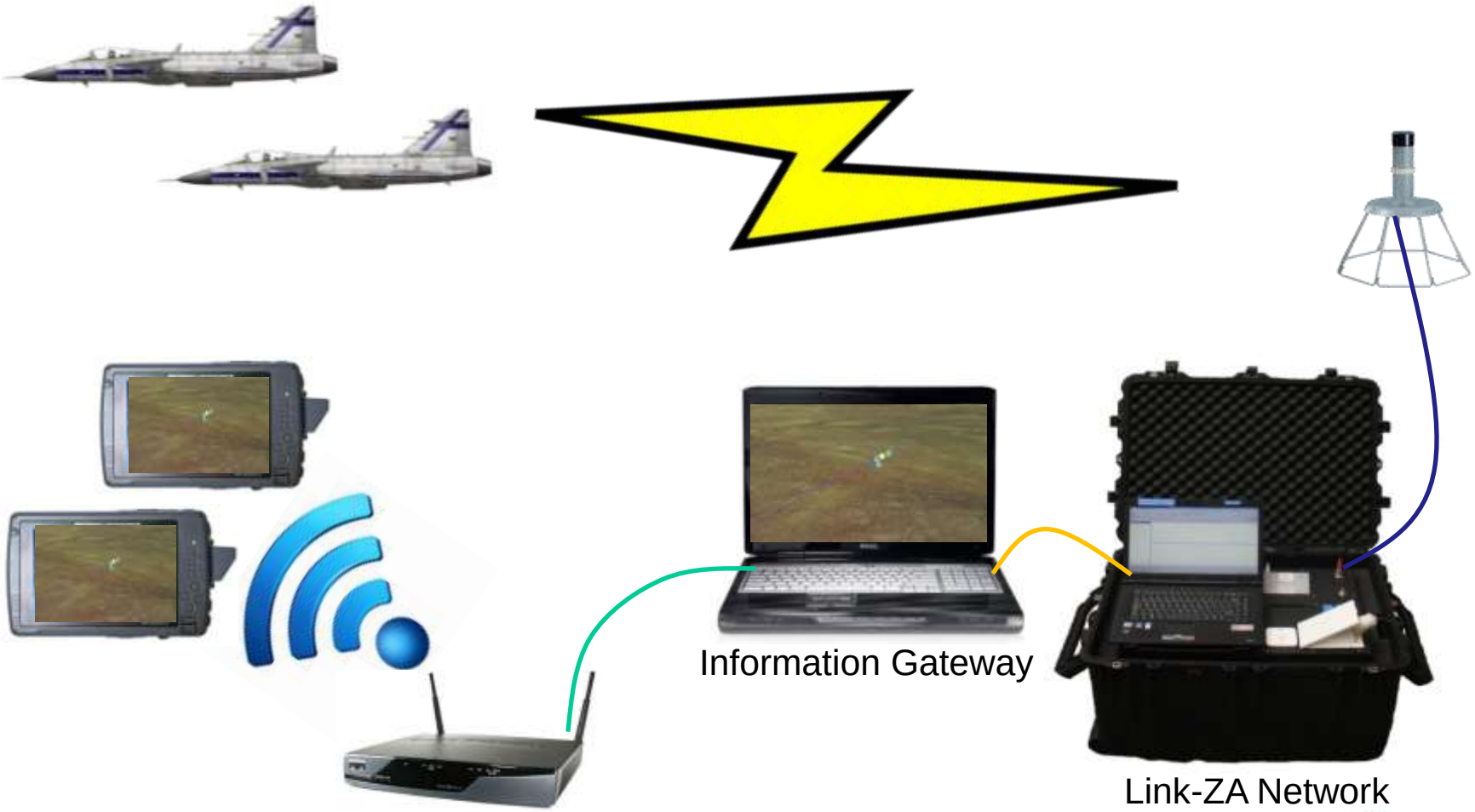
- Resolve dissimilar Link-ZA message implementations.
- Provide routing capabilities for information.
- Provide filtering capabilities to manage limited bandwidth.
- Integrate tactical communications information from the tactical DICI into the mobile and fixed DICI (L4).
- Inclusion of non-Link-ZA compliant systems to exchange data with Link-ZA compliant systems.



Information Gateway Technologies



Information Gateway Technologies



Information Gateway Technologies

Radio Frequency Gateway Technologies

The adoption of Link-ZA as an indigenous data link allows national military interoperability of tactical information but does not allow for interoperability in the context of JIM operations.

Numerous RF waveforms used by government departments and possible collaboration partners should be considered. A few such waveforms could include:

- TETRA
- Kenwood
- Vertex
- Link-11 (Protocol)
- Link-16 (Protocol)
- Link-22 (Protocol)

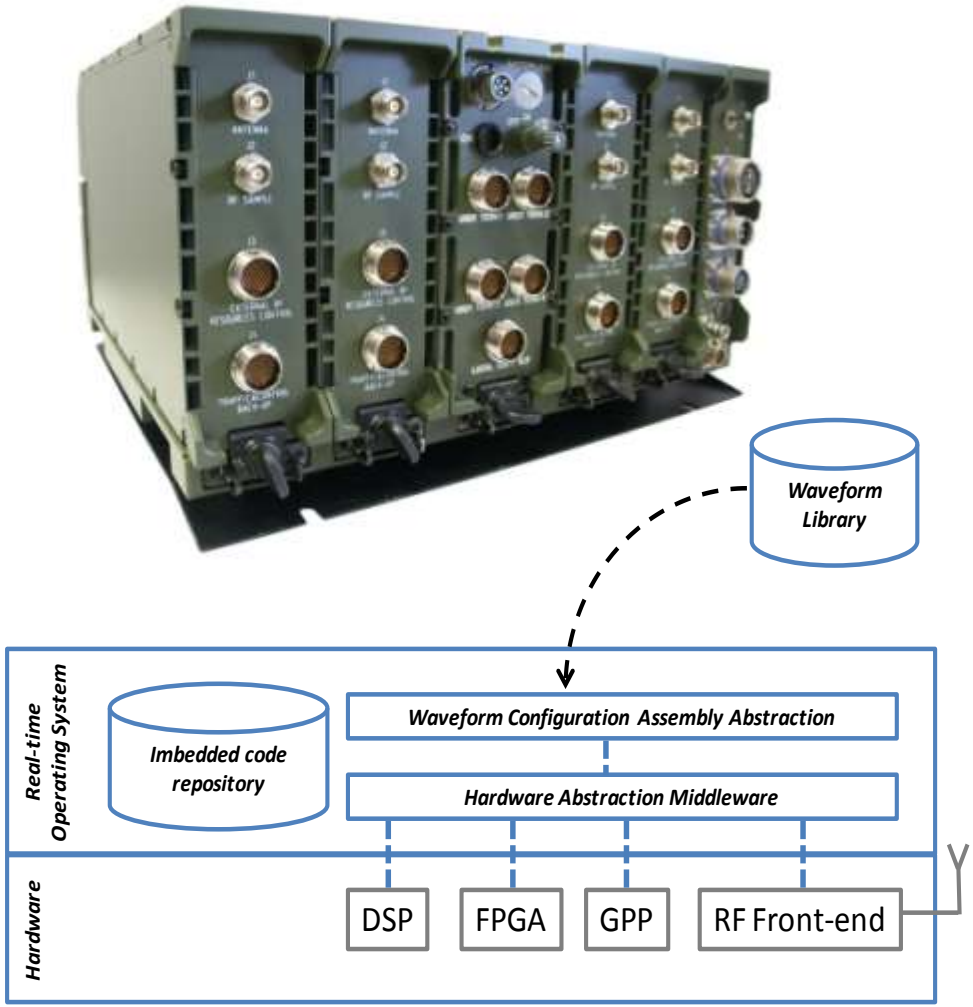
Radio Frequency Gateway Technologies

It is also expected that in future commercial communications networks shall utilised more and more by defence forces as threats move towards requirements for rapid and flexible deployments in the context of Operations Other Than War (OOTW).

In this context, military interoperability to commercial networks shall be a valuable resource to handle broadband information exchange requirements such as real-time video etc. Waveforms that might be applicable in this context could include:

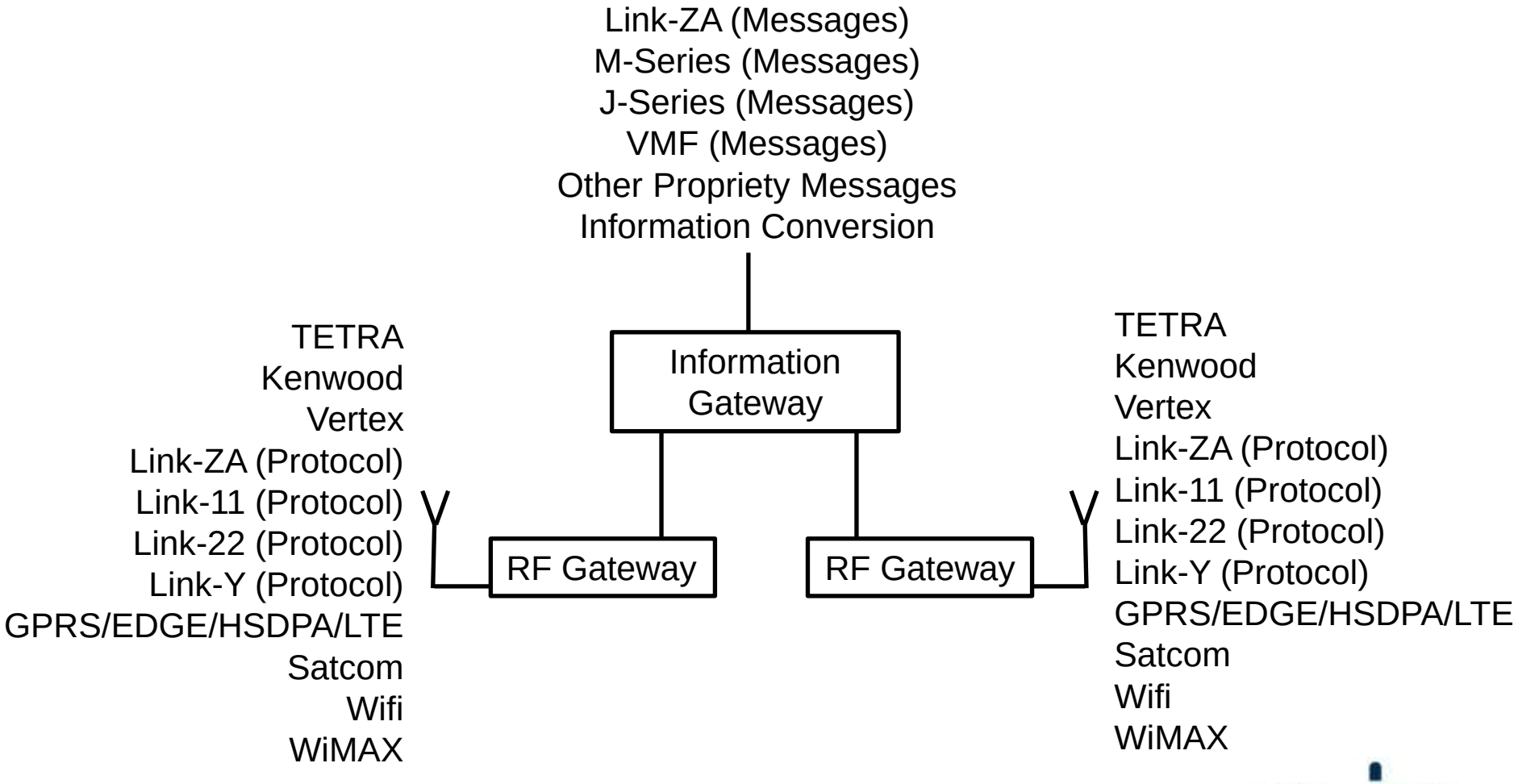
- Wifi (IEEE 802.11)
- WiMAX (IEEE 802.16)
- GPRS/EDGE/HSDPA/LTE
- L-band Satcom
- S-band Satcom

Radio Frequency Gateway Technologies

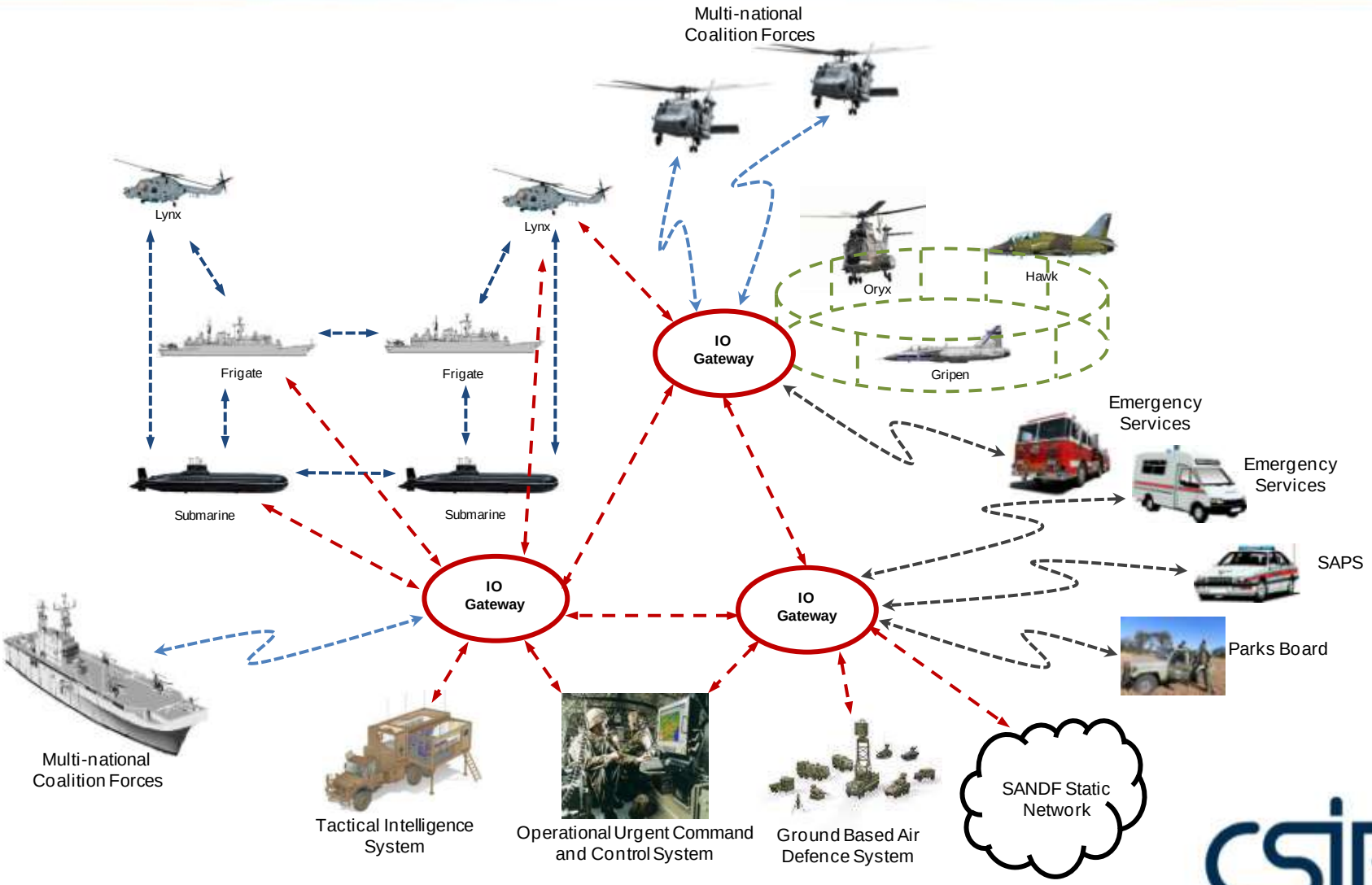


- Software Defined Radio (SDR) as an established technology has been identified as an appropriate technology to perform RF-gateway research.
- Examples of RF-gateway technology is already internationally starting to appear within the realm of Software Communications Architecture (SCA) SDR.
- An example is a future Selex SWave Vehicular radio. This single radio infrastructure will aim to accommodate four different radio channels simultaneously. Each channel operate different waveforms within a 2 MHz – 2 GHz frequency band.
- Waveforms shall be loadable on the radio to enable waveform re-configurability of each channel.
- This radio is a prototype being developed under the OCCAR-EA ESSOR programme in Europe.

Combined Interoperability Gateway Solution



Combined Interoperability Gateway Solution



Next Generation Tactical Radios (What does it look like?)

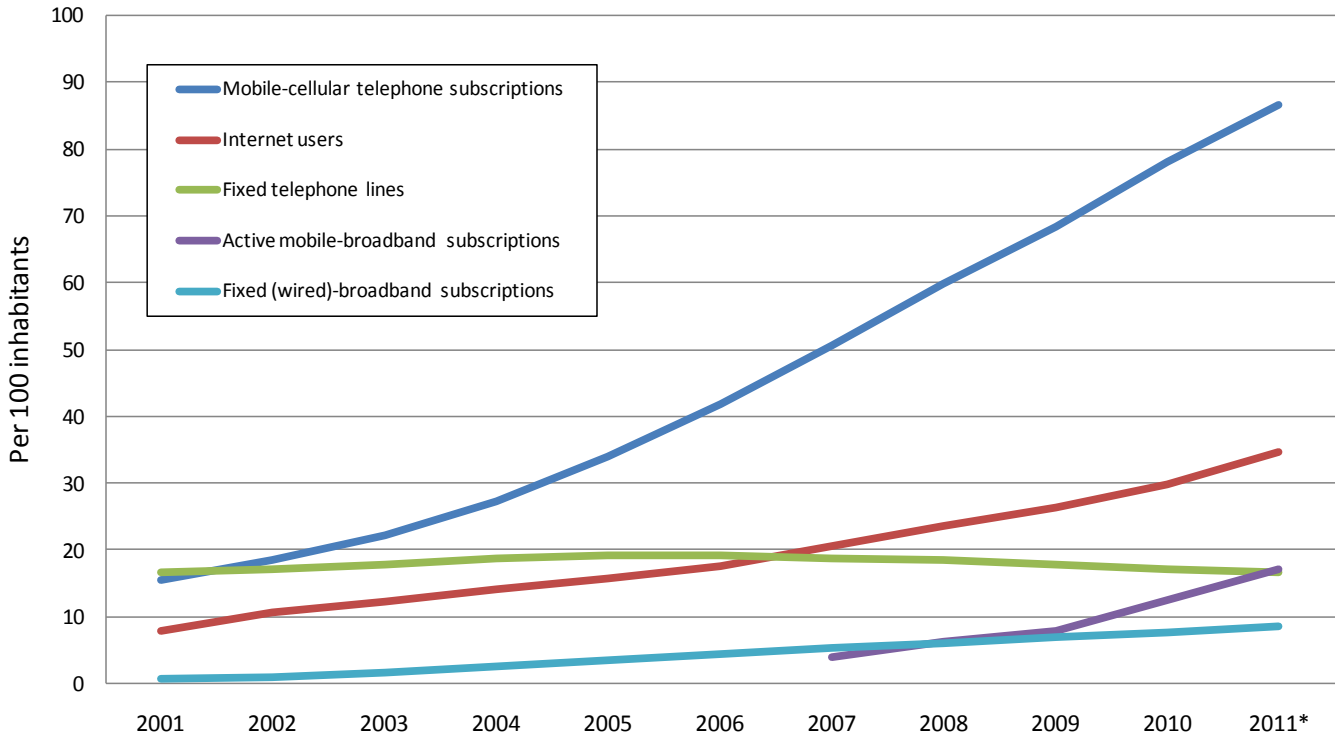
- Gateway technologies is leading to new technologies to facilitate more flexible and adaptable networks.
- The future interoperability gateway node could be foreseen to have the potential to become a next generation tactical radio due to its ability to:
  - Accommodate a wide frequency band.
  - Numerous waveform types.
  - Numerous information types.
  - Its ability to interface to numerous networks. (DICI, collaboration networks, commercial networks or interdepartmental networks)
  - Simultaneous access to dissimilar networks through multiple radio slots.
- Advances in Cognitive radio, could provide a waveform sensing ability in the frequency domain. By analysing waveforms it could identify what waveform is present in a frequency band and could reconfigure itself to become part of that network.

Tactical Networks for OOTW

- In the scope of Operations Other Than War (OOTW), the utilisation of commercial networks could be considered since they would vastly improve the performance of the Command & Control cycle by meeting the requirements for fast high bandwidth tactical communications networks through:
  - Wide range of wireless technologies.
  - Highly meshed and scalable networks.
  - Easy integrated into defence networks.
  - Supports almost all know information formats including voice, data and video.
  - Supports processing, storage and distribution of all formats.
  - Support interoperability between devices.

Global Trends for Mobile Communications Technology

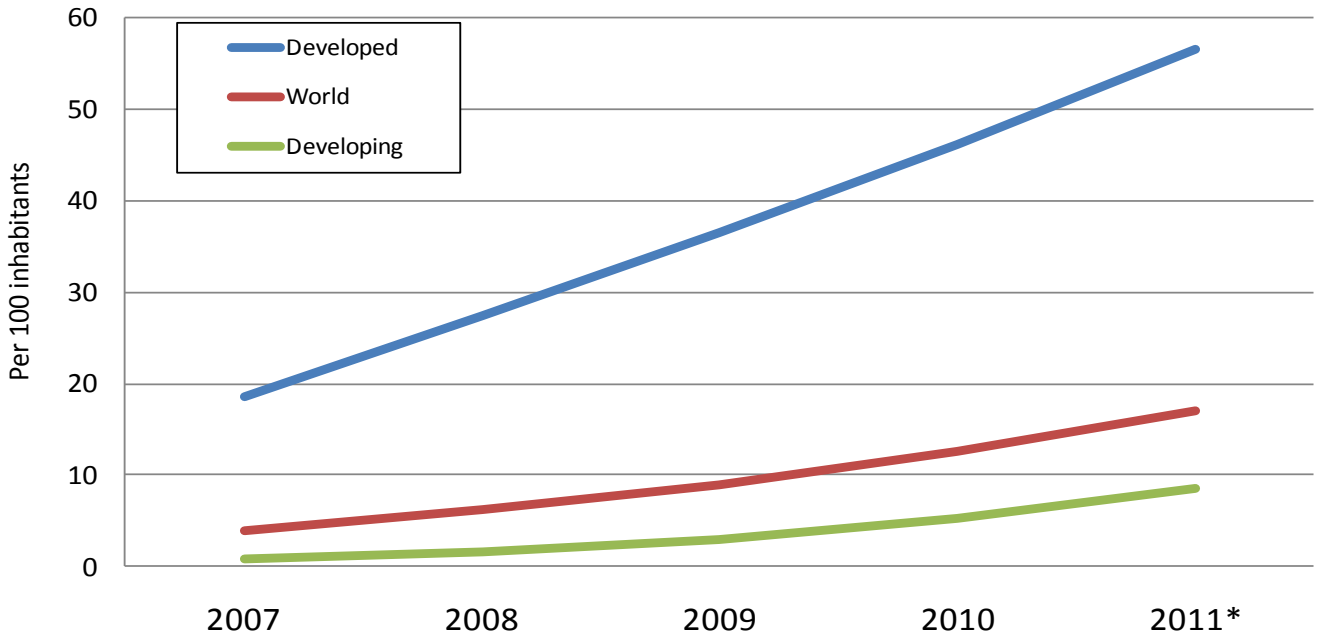
Global ICT Developments from 2001 to 2011



* Estimate.
Source: ITU World Telecommunication /ICT Indicators database

Global Trends for Mobile Communications Technology

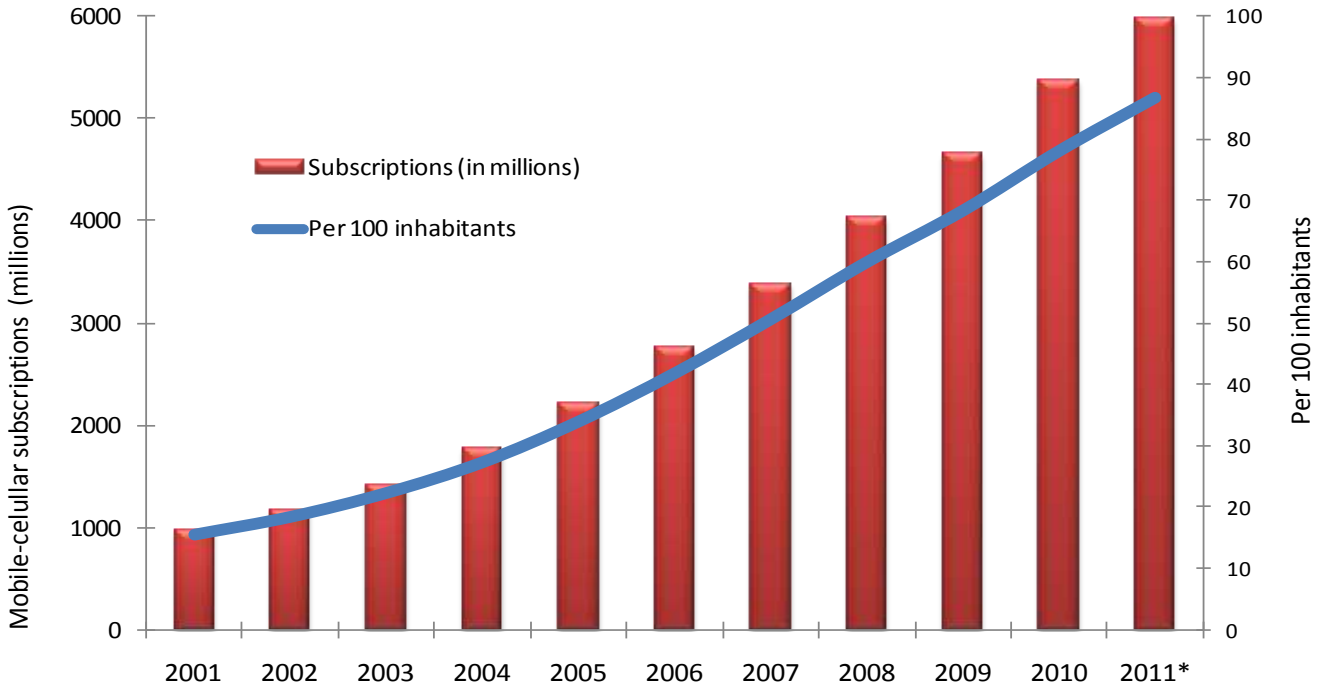
Active Mobile-Broadband Subscribers (2007 to 2011)



* 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

Global Trends for Mobile Communications Technology

Global Mobile-Cellular Subscriptions, Total and per 100 Inhabitants, 2001-2011



*Estimate
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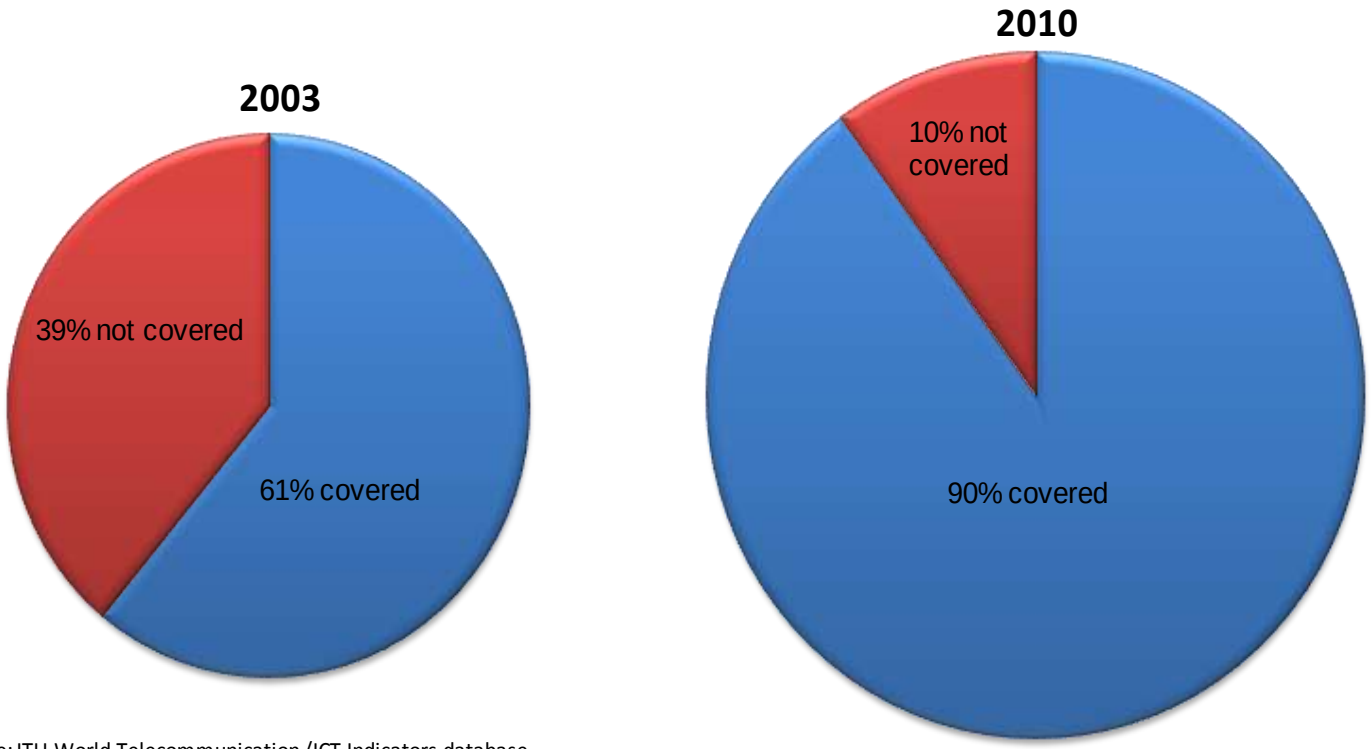
Global Trends for Mobile Communications Technology

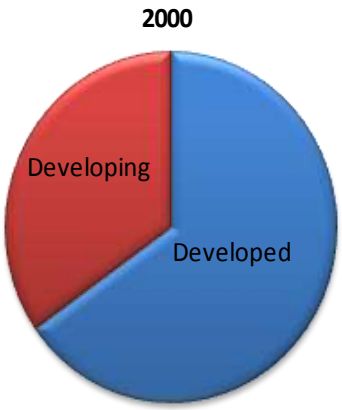
Percentage of the World's Population covered by a Mobile Cellular Signal, 2003 compared to 2010



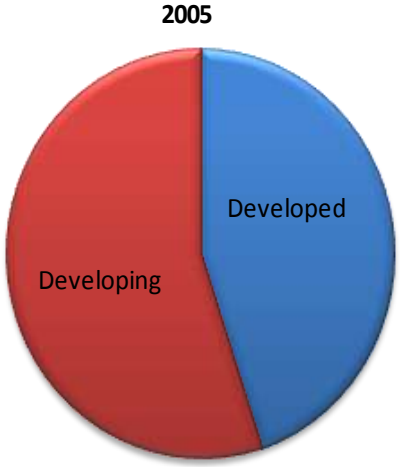
Source: ITU World Telecommunication /ICT Indicators database

Global Trends for Mobile Communications Technology

Mobile-Cellular Subscriptions, by Level of Development



Total 719 million



Total 2.2 billion

Total 6 billion

*Estimate.
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

Smartphone Technology

- The US is leading the race to use mobile broadband smartphones as a tool to manage information on the battlefield through commercial mobile networks.
- The philosophy around the use of smartphones is based on a strategy to connect soldiers to a defence network whether they are in a battle or on vacation.
- The US DOD has acknowledged that this approach shall require radical changes of DOD policies and doctrine as well as new ways of thinking in systems engineering, requirements analysis and acquisition.
- This approach aims to arm soldiers with information and would allow deployed soldiers to access the same information and awareness information that is currently only available at command posts.

Conclusion

- It has been shown what the strategic objectives are for tactical communications in the SANDF.
- It was shown what contribution COTS and SANDF specific MOTS technologies will provide in the near future for conventional scenarios through project RADIATE.
- A brief overview of Link-ZA as the SANDF Tactical Data Link capability was given with some focus on interoperability of Link-ZA.
- Gateway technology was explored as means to solve interoperability concerns to enable Joint, Inter-departmental and Multi-national operations from a tactical operations perspective leading to possibilities for Next Generation Tactical Radios.
- Finally future technologies of OOTW scenarios were explored showing how the US DOD is exploring the use of mobile cellular communications networks with Smartphone technology.

Thank You

Corné Smith
csmith@csir.co.za

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