

oueees-202306 topic 06:

Wireless/radio and internet
Information warfare and radio surveillance
"Artificial Intelligence" and the reality

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On the internet

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Lecture notes and reporting

- <https://github.com/jj1wdx/ouees-202306-public/>
- Check out the README.md file and the issues!
- Keyword at the end of the talk
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Wireless/radio and internet



Direct wired network at the maximum extent
This is the old Stockholm telephone tower in 1890 (see Topic 02)

Lessons learned: wired networks do not necessarily scale well

- Difficult to install, often impossible
- Easily get cut/disconnected by accidents
- Difficult to reconfigure/rewire
- Individual link management is complex and often erratically done

Remove the wire!

Wireless/radio networks as a replacement of wired networks

Limitations of radio networks by physics

- Speed limited by radio frequency bandwidth
- Latency increased by (de)modulation and packetization
- Excessively large error rate due to obstacles (burst errors), fading, interference, and etc.: *Error-correction encoding required*
- Radiation spillover causes content disclosure: *encryption required*
- The source of interference is immensely difficult to locate
- Still requires a lot of wiring to the base stations



Advantages of radio networks: Mobility

- Providing connections to where no wires can connect
- Nodes can move around while maintaining the connectivity

Implementation issues to overcome for 5G era:

Low channel capacity and short reachability

- Trade-off between frequency bandwidth, reachable range, and base station installation
- Massive interference between nodes and networks
- Latency issues due to (de)modulation will persistently remain

Information warfare and radio surveillance

Information warfare

Information warfare (IW) (as different from cyber warfare that attacks computers, software, and command control systems) is a concept involving the battlespace use and management of information and communication technology (ICT) in pursuit of a competitive advantage over an opponent.

– Wikipedia¹

¹ https://en.wikipedia.org/wiki/Information_warfare

What Russo-Ukraine War has revealed so far as of June 2023

DON'T: unencrypted communications are still widely used in the battlespace (?!)

Unencrypted communications are thoroughly monitored and actually exploited to neutralize weapons, soldiers and commanders: many commanders of Russian Forces became KIA²

All radio airwaves are heard and can be heard from several hundred kilometers (or even more from satellites or through the ionospheric propagation)

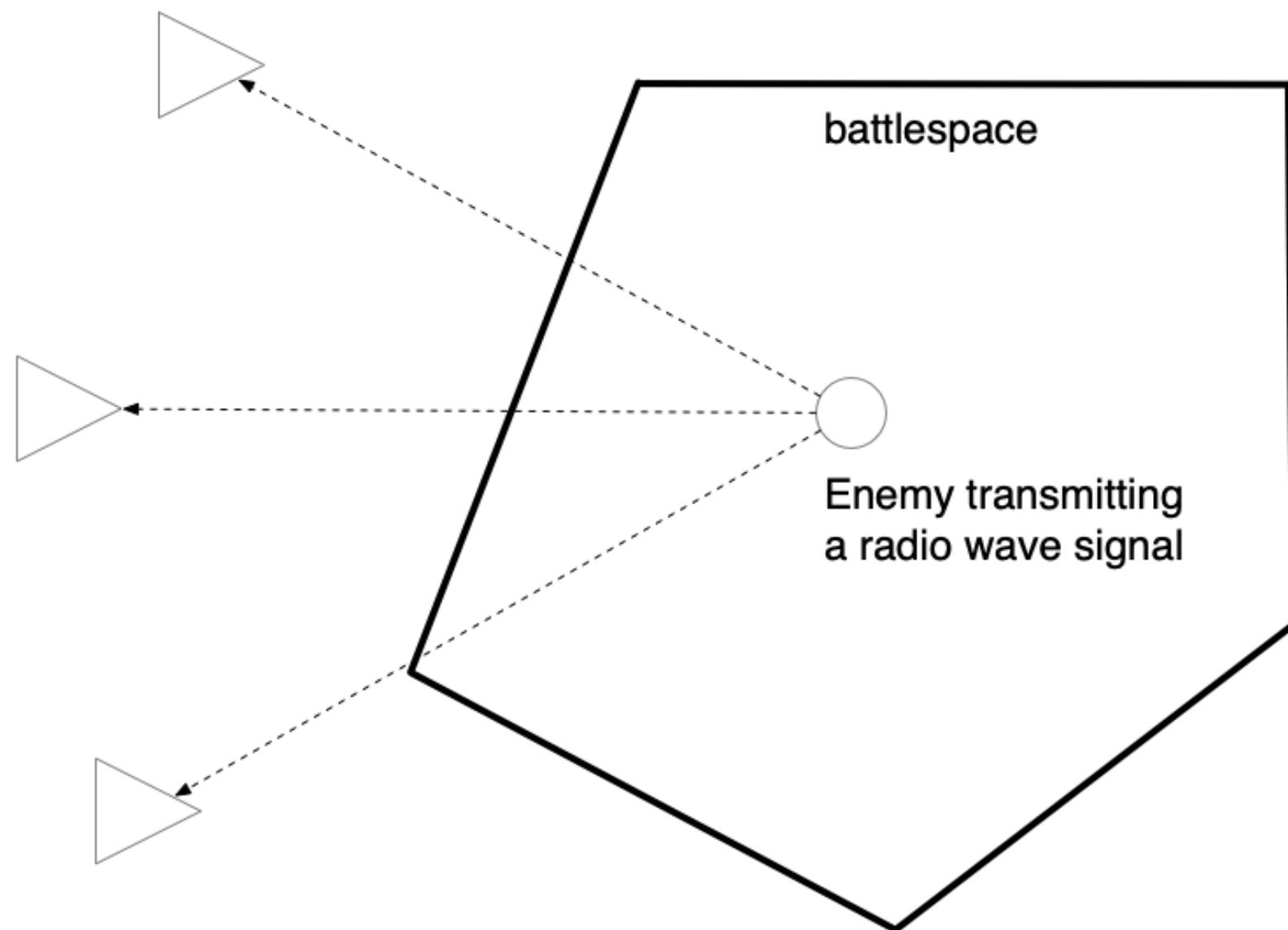
² Killed in Action (NATO definition) Wikipedia: https://en.wikipedia.org/wiki/Killed_in_action

Locating enemies by triangulation from outside the battlespace

Aircrafts outside the battlespace can find the direction of the incoming signal

Aggregating the reception timing difference information of three (3) or more aircrafts receiving the signal for the enemy, the position of the enemy can be precisely estimated (four (4) or more for also locating the altitude)³

Surveillance aircrafts outside the battlespace



³ Hyperbolic navigation / Wikipedia: https://en.wikipedia.org/wiki/Hyperbolic_navigation

*DON'T: smartphone and cell phone networks are
NOT protected end-to-end and can be
monitored!*

*Using a SIM card provided by the adversaries on your smartphone means all
your communication contents are thoroughly wiretapped and can be exploited
against you!*

TLDR: don't use a SIM card dropped on the floor or given by an untrusted person!

*Corollary: don't use an USB memory or a MicroSD card dropped on the floor or
given by an untrusted person!*

DO: always use encryption during (or even not during) the war

Modern TLS and HTTPS encryption is strong enough to thwart an attempt to eavesdrop the communication

Using a strong end-to-end encryption such as OpenPGP and GnuPG is a plus (though the user interface is still clumsy)

NOTE WELL AND CAUTION: "safe" messaging services are not necessarily really so, especially the centralized ones!

TLDR: your radiowave emission can be monitored by unwanted and untrusted people and can be exploited and used against you at any time. You have been warned.

Wartime social engineering: how to *lie*

Fake photographs are all around from the beginning of the war ⁴ and it's continuing ⁵: *old images and videos are falsely quoted* as the ongoing ones

Claiming something without evidence and related facts are so common among all stakeholders of the war, and this is how war propaganda is conducted; see what Japan had done in World War II ⁶

⁴ BBC News, 25 February 2022, Ukraine conflict: Further false images shared online

⁵ France24.com, 06/06/2023, Nova Kakhovka dam breach: Old image resurfaces to falsely illustrate today's damage

⁶ Wikipedia contributors, Propaganda in Japan during the Second Sino-Japanese War and World War II, Wikipedia, The Free Encyclopedia, 7 June 2023, 03:40 UTC [accessed 13 June 2023]

Finding the truth where totally conflicted views are presented⁷

- Check credentials: do the background check of the author
- Look for the bias in the presented views and your own detection bias
- Evaluate the source: reputation of the past publishing
- Apply critical thinking: questioning ideas and assumptions
- Consider relativistic reasoning than pursuing singular truth

⁷ A summary of an answer by perplexity.ai with the question "Can you tell me how to find the truth where totally conflicted views are presented?"

"Artificial Intelligence" (AI)

and the reality

Fundamental question:
is intelligence only for human?

AI as a buzzword in computer science (1/2)⁸

- LISP and "symbolic" (text) processing (1950s)
- AI Winter in the 1970s
- Logic programming / expert systems (1980s)
 - Japan: The Fifth Generation Computer Systems (1982-1994)
- AI Winter in the 1990s

⁸ Wikipedia contributors, [History of artificial intelligence](#), Wikipedia, The Free Encyclopedia, 9 June 2023, 15:53 UTC [accessed 13 June 2023]

AI as a buzzword in computer science (2/2)⁸

- Breakthrough made by large-scale computing
 - Internet, massive parallelism, cloud computing
- Since 2010s: generative AI
 - Machine learning -> deep learning
 - Massive "big data" from the internet
 - Large language models (LLMs) (e.g., GPT-4, ChatGPT)

⁸ Wikipedia contributors, [History of artificial intelligence](#), Wikipedia, The Free Encyclopedia, 9 June 2023, 15:53 UTC [accessed 13 June 2023]

The (non-)goals of current AI

- *Non-deterministic* problem solving
 - Probabilistic answers computed by neural networks
 - Questionable reproducibility
 - *Errors may quite often occur*
- *No one really knows why LLMs work and what they actually do*
 - You cannot *fully logically* explain the behavior

Generative AI can only assume answers

- Don't: expect the definitive answers
- Do: treat the output as the *synthesized summary*
 - The behavior is limited by the *given data*
 - Prompting (directives by words) largely affects the output
- Do: review the output by yourself
- *Don't: blindly believe the answers!*
- *Also don't: use the output without proper citation*

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