



JUBILEUMI
TUDOMÁNYÜNNEP
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Field use of low latency systems

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What is the latency?

I wish you a successful and happy New Year in 2020!



Low latency refers to the minimum delay between processed input and corresponding output.
Technically speaking, it is the short interval of time during which data travels from its source to its destination.

Source: <https://www.maris-tech.com/blog/low-latency-its-impact-on-security-and-commerce-maris-tech/>

Historical example

„ Whoever possesses information possesses the world”.
Nathan Rotschild



Napoleonic Wars – message sent via Rothschild's telegraph network.

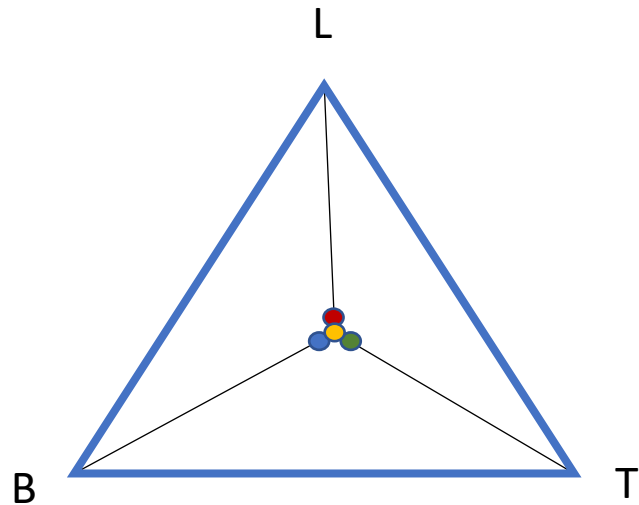
From Waterloo, Belgium, to London, Great Britain. Distance: 400 km.

- June 18, 1815 – British army victorious at Waterloo. **WE WON**
- June 19, 1815 – 6-bit message delivered to London in 1 day
- June 21, 1815 – Official message in London from the royal messenger – three times slower.

This example illustrates that low-latency communication was already a key strategic resource in the 19th century.

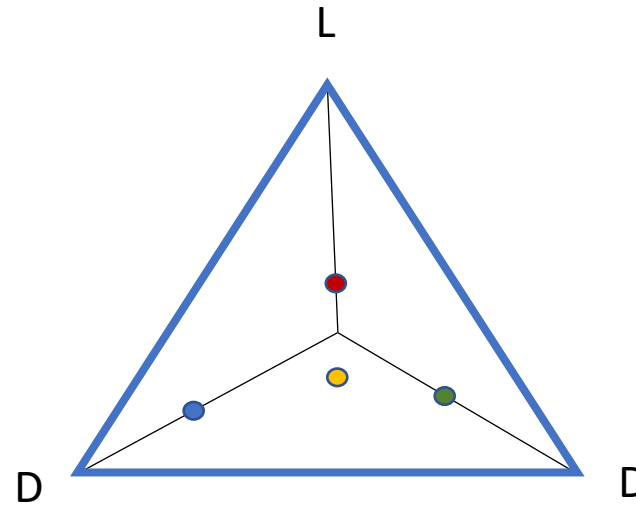
Bandwidth, distance, latency

XIX. century and first half of XX. century



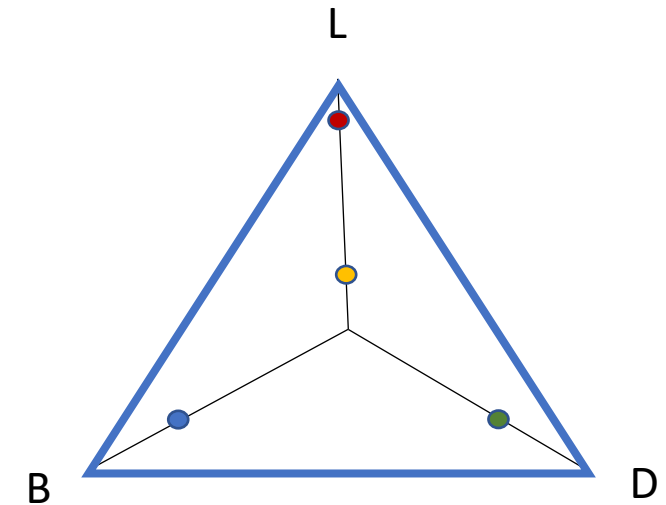
Telegraph equipment, Telephone Herald, Invention of the radio (1895)

Second half of XX. century



Fiber optics for communication purposes (1966), Digitalization, The advent of modern computers

Nowadays



CDN, 5G (URLLC), Edge Computing, Gigabit bandwidth even on the last mile

Why the latency is necessary?

Highlighted: civil, military, financial sector

✓ Critical infrastructure

- Stock exchange (trading systems)
- Healthcare systems (telemedicine)
- Traffic control (autonomous vehicles)

✓ User experience

- VR/AR applications
- Online games (cloud gaming)
- Real-time video conferencing

✓ Industrial applications

- Industry 5.0 – human-machine collaboration
- Computationally intensive tasks
- Predictive maintenance

✓ Military applications

- Autonomous combat systems
- C4ISR systems
- Battlefield status indication



Classification of the latencies

Low latency

- Machine-human interaction.
- Extreme values: zero latency and the limits of the technology used.

Zero latency

- Machine-machine interaction.
- Maximum (ultra) 50-150 ms (depending on technology) ITU-T 114G – for one-way communication.

Real-time data transfer

- Machine-to-machine interaction.
 - Does not exist, physical limit is the speed of light in a vacuum.
 - We mean a delay between 0 and 50 ms.
 - Mathematical functions, statistics, edge network, AI.
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Real-time data transfer systems

IT solutions: CDN, edge network devices

Statistical methods:

- Jitter buffering
- Adaptive bitrate (streaming)
- Algorithm or AI-based prediction – 95% certainty

Mathematical models:

- Time series forecasting (machine learning)
 - Network traffic profiling
 - FEC (forward error correction)
 - Differential coding (change transfer)
 - Delay compensation (time transposition)
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Low latency – from military POV

Theoretical basics → Practical implementation

Zero- and low-latency systems are not just theoretical concepts, but decisive factors in modern warfare.

Predictive methods and hardware innovations (e.g., CPU, GPU, FPGA) enable real-time decision-making.

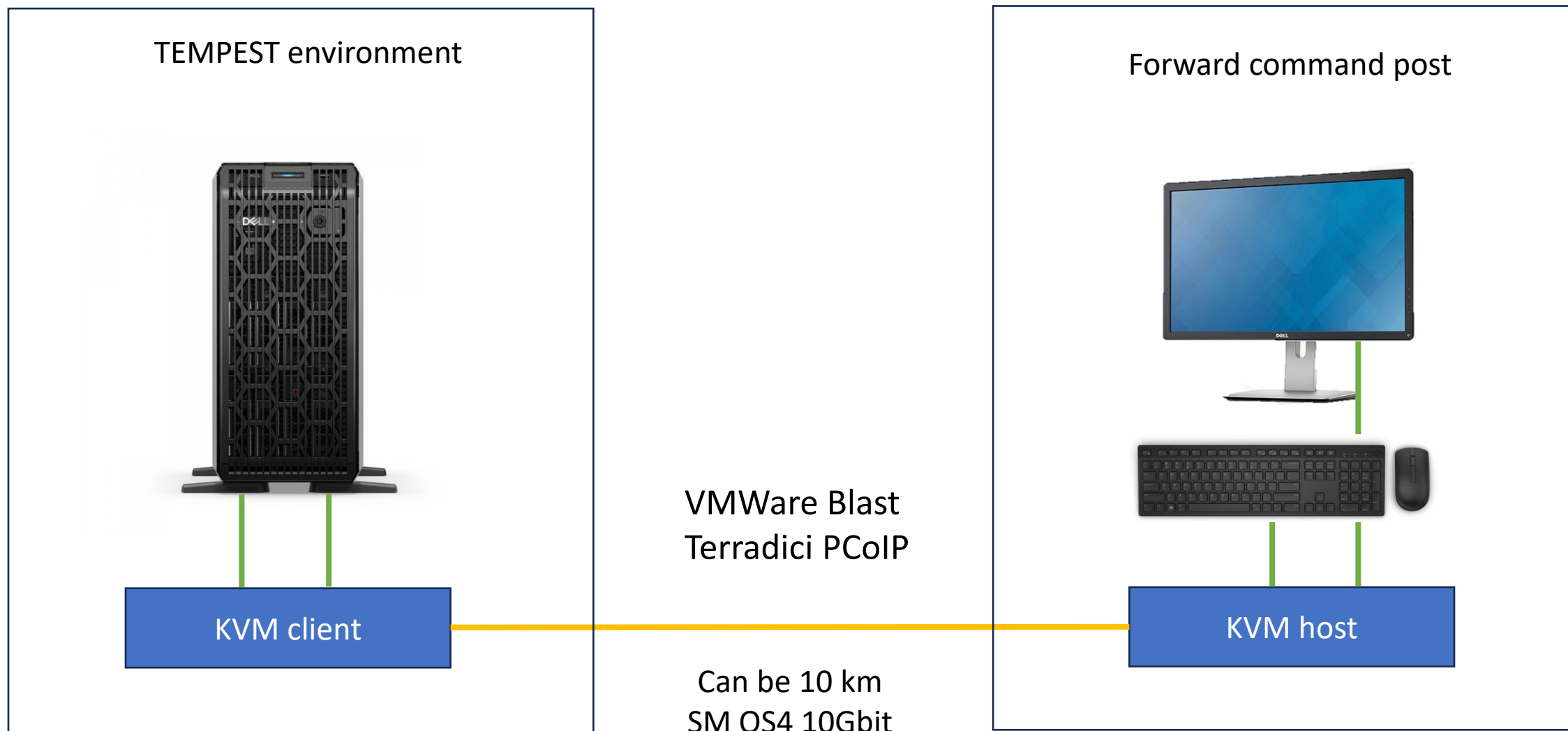
System integration enables:

- Immediate situation updates
- Accurate threat detection
- Fast and effective responses

Analysis of specific systems:

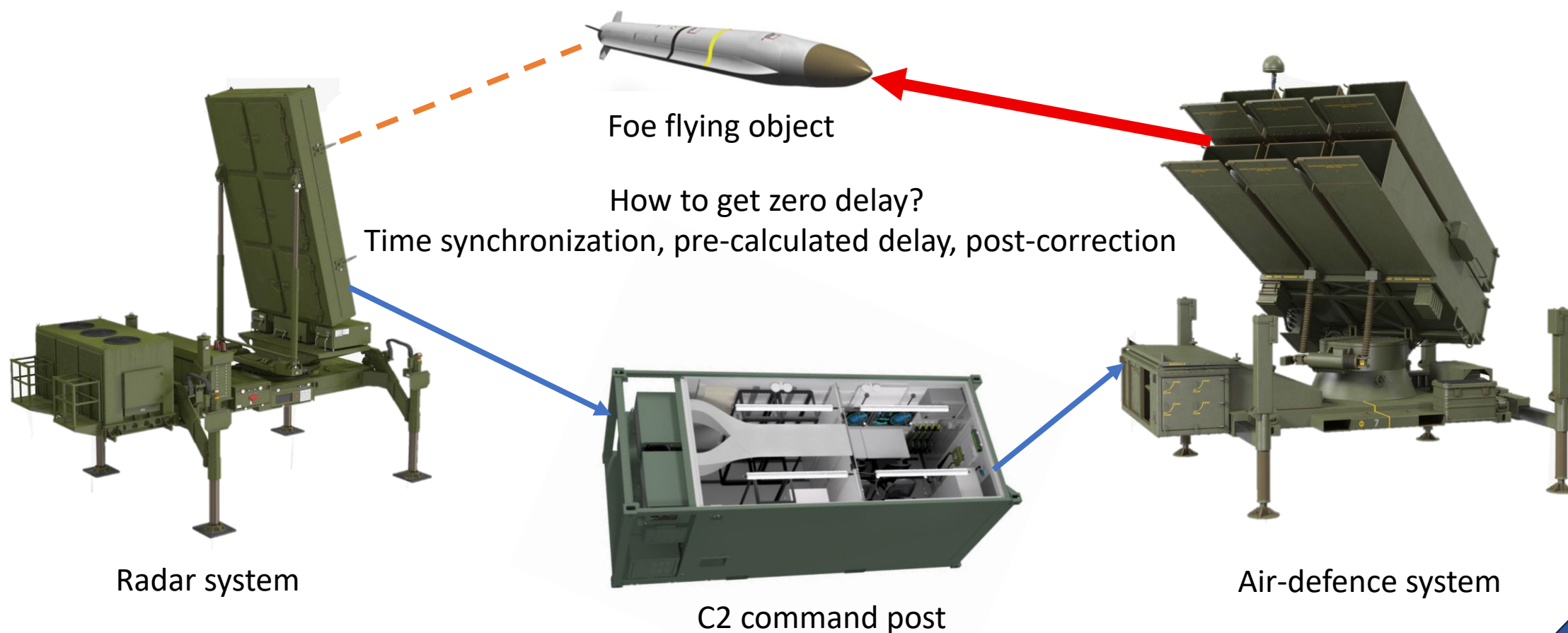
- Zero latency radar systems (e.g., ELM-2084)
 - Zero latency missile control (e.g., NASAMS)
 - Real-time video transmission in command systems (PCoIP, BlastExtreme)
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Simple example from the field



Complex example from the field

Missile interception with radar and destruction with anti-missile





Beyond the technology: the organisational latency

Low Latency (National) Defence (outlook)

The Challenge: Organizational Slowness in an Age of Rapid Threats
From Tactics to Strategy

Technology is not everything: Technical delays can be reduced, but decision-making is hampered by bureaucracy and outdated procedures.

Example: The Microsoft Exchange incident (2021) – attacks went unnoticed for weeks because the reporting chain is slow and information gathering is not real-time.

Cultural Barrier: There is resistance even to new technologies (e.g., AI) – preference for old manual processes that seem secure.

Source: Mun Hwa C. (2025). Beyond the Briefing: Building a Zero Latency Defence for the Next Wave of Threats [Post]. <https://www.linkedin.com/pulse/beyond-briefing-building-zero-latency-defence-next-wave-mun-hwa-chooi-vuiqc/>



Beyond the technology: the organisational latency

Low Latency (National) Defence (outlook)

The Solution: Low Latency (National) Defence (LLD)

Goal: Accelerate decision-making and action.

Three key elements:

- Break down data silos: Uninterrupted, automated information flow.
- Mission-oriented leadership: Independent decision-making onsite, without unnecessary approvals.
- AI integration: Real-time threat detection and analysis.

The bottom line: Success is determined by management's commitment to reviewing traditions and digital transformation.





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Thanks you for your attention!

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