The Session on Cyber Security

A View on Cyber Security Topics Relating Automated Driving

Tsutomu Matsumoto

tsutomu@ynu.ac.jp

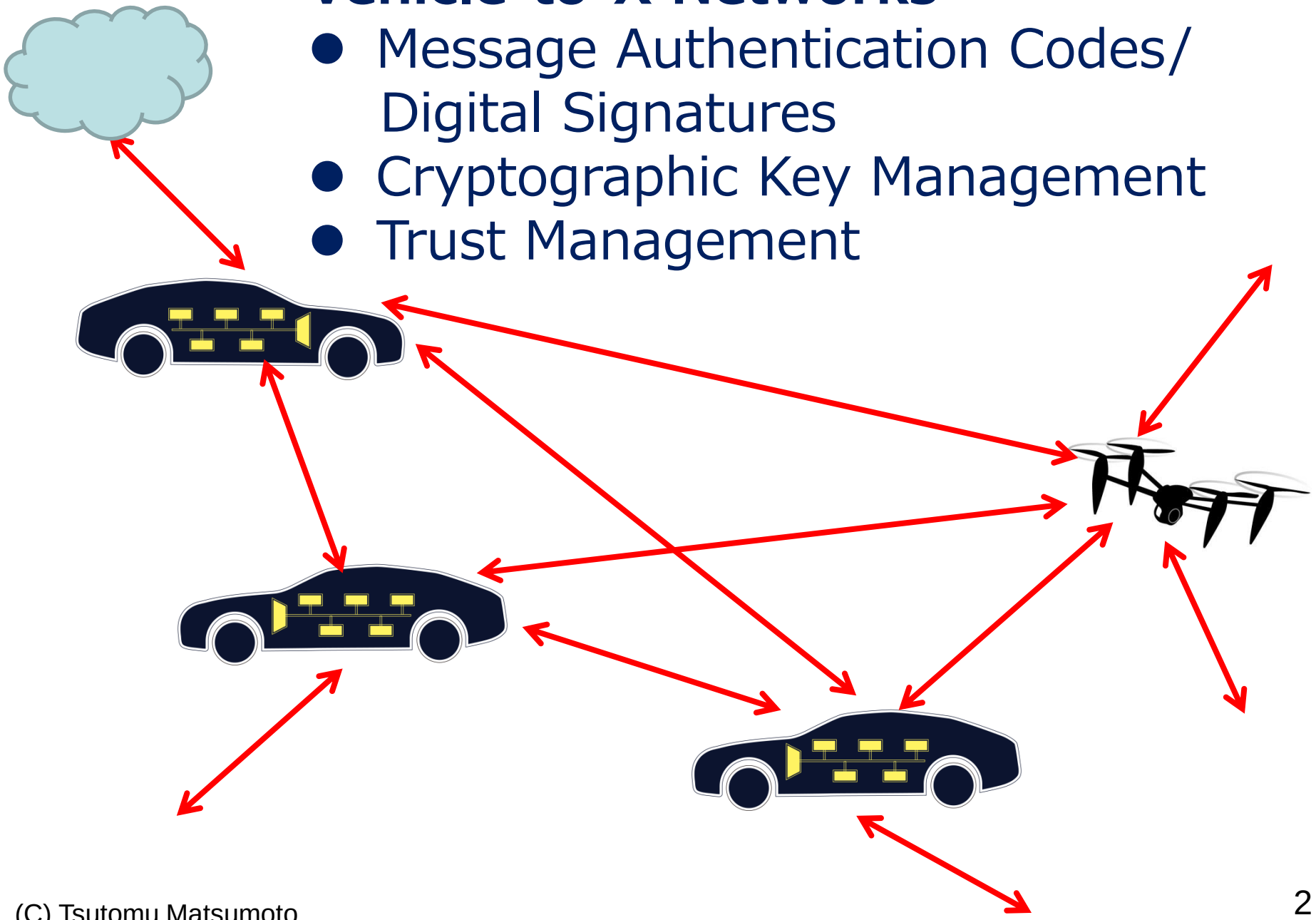
Faculty of Environment and Information Sciences
and
Institute of Advanced Sciences

YNU YOKOHAMA National University

Institute of Advanced Sciences
Yokohama National University

Vehicle-to-X Networks

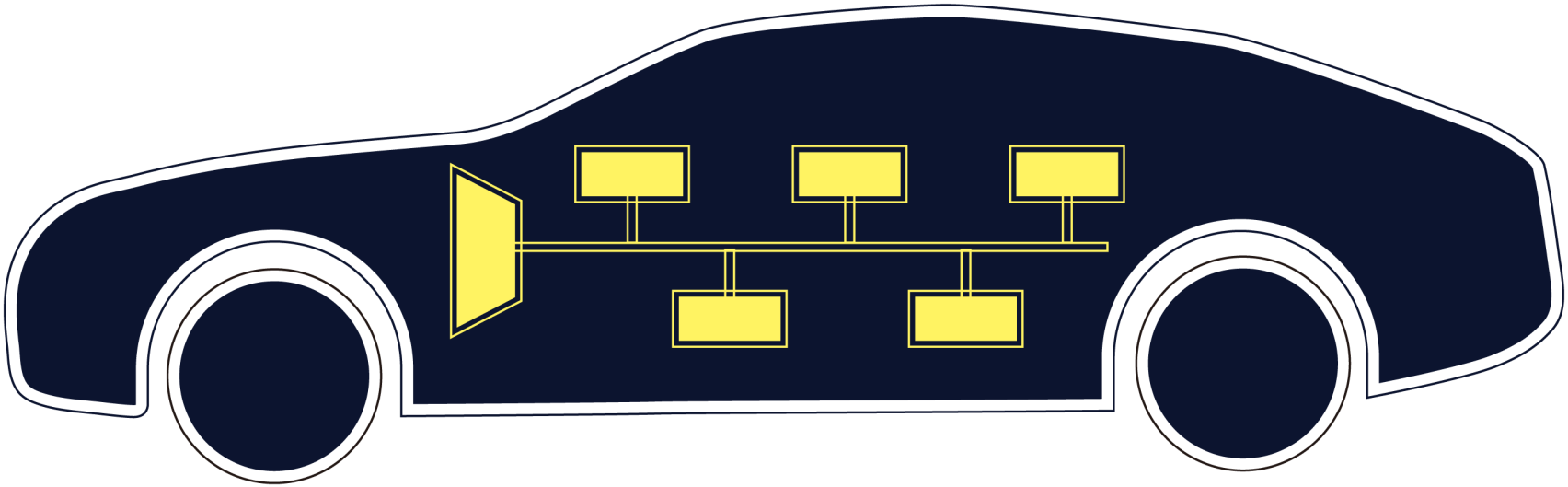
- Message Authentication Codes/ Digital Signatures
- Cryptographic Key Management
- Trust Management



In-Vehicle Network

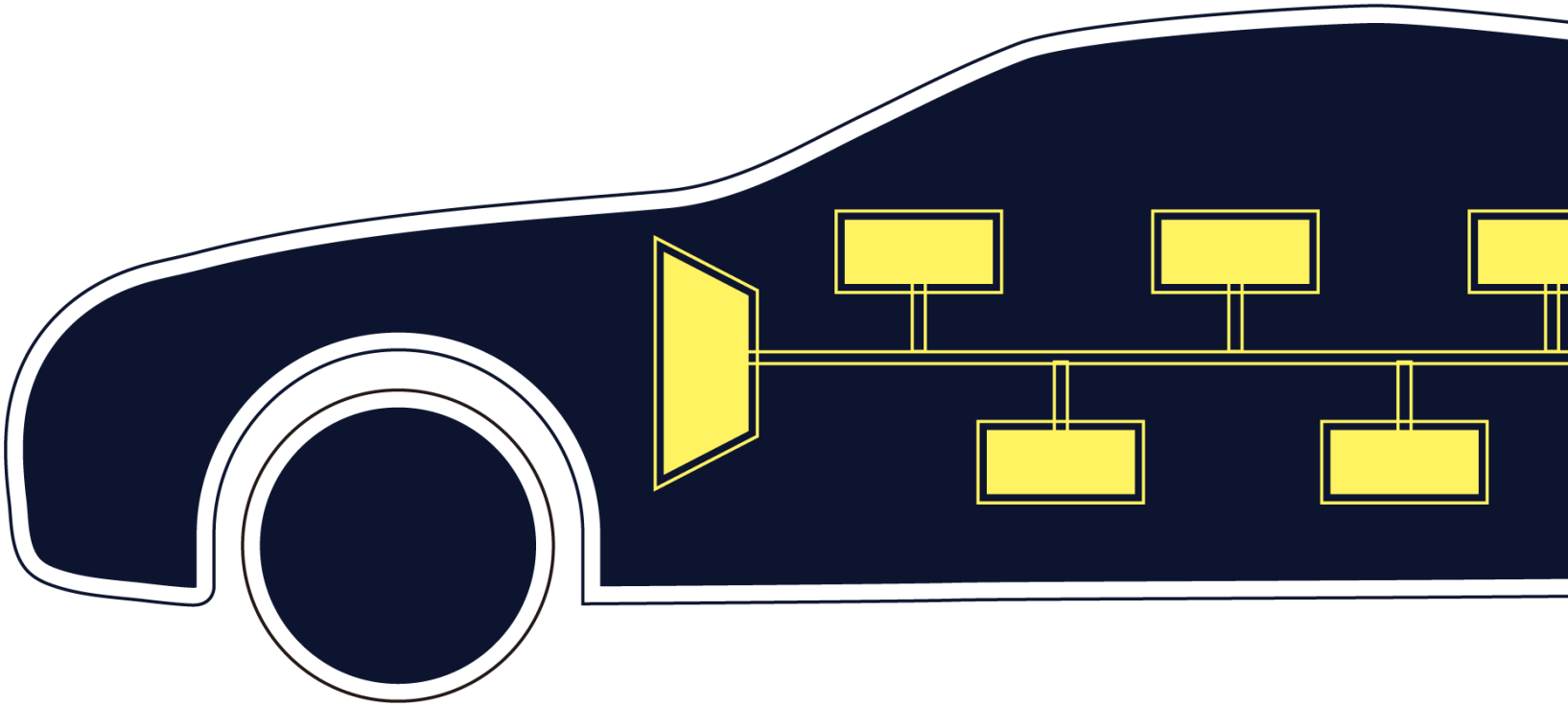
- Message Authentication Codes/ Digital Signatures

- Cryptographic Key Management
- Security Supply Chain Management

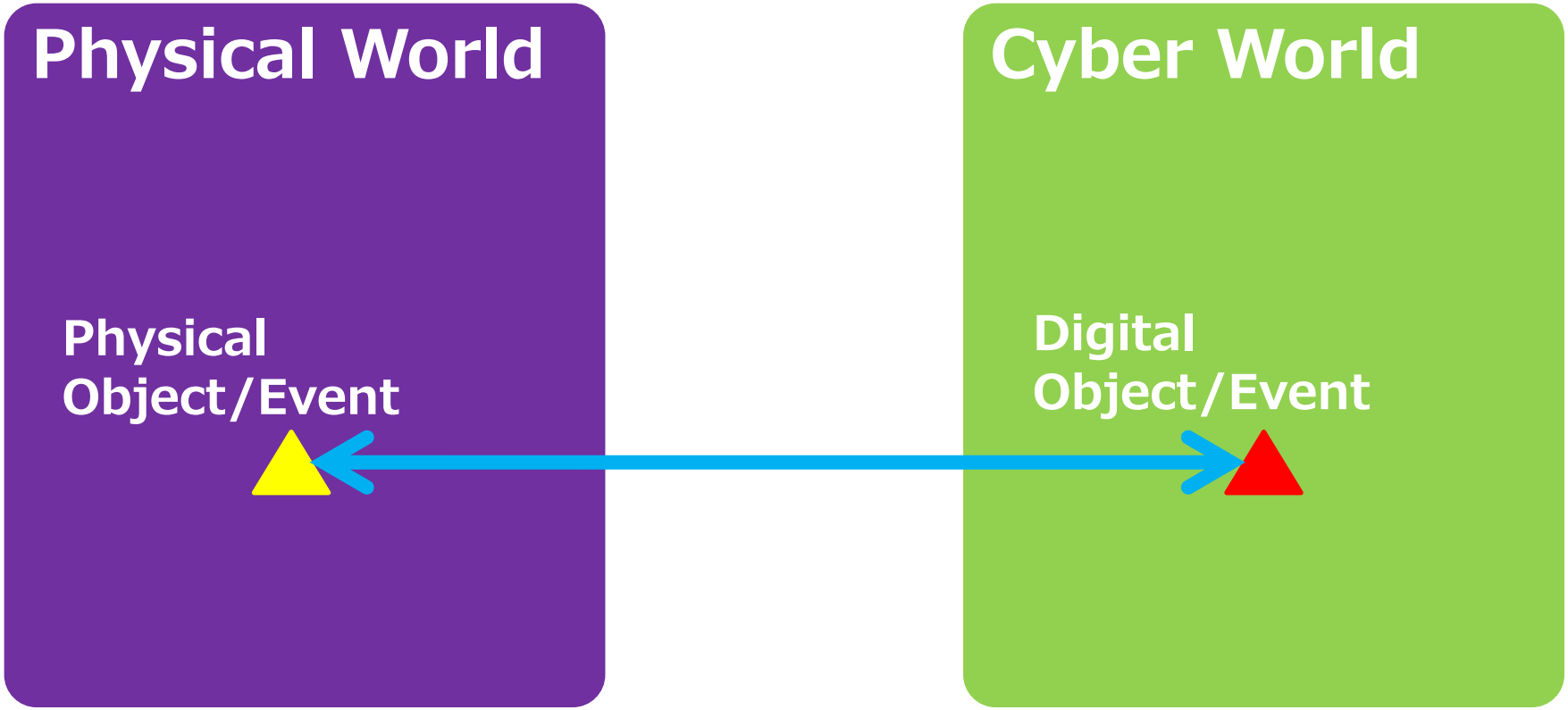


Automatic Driving

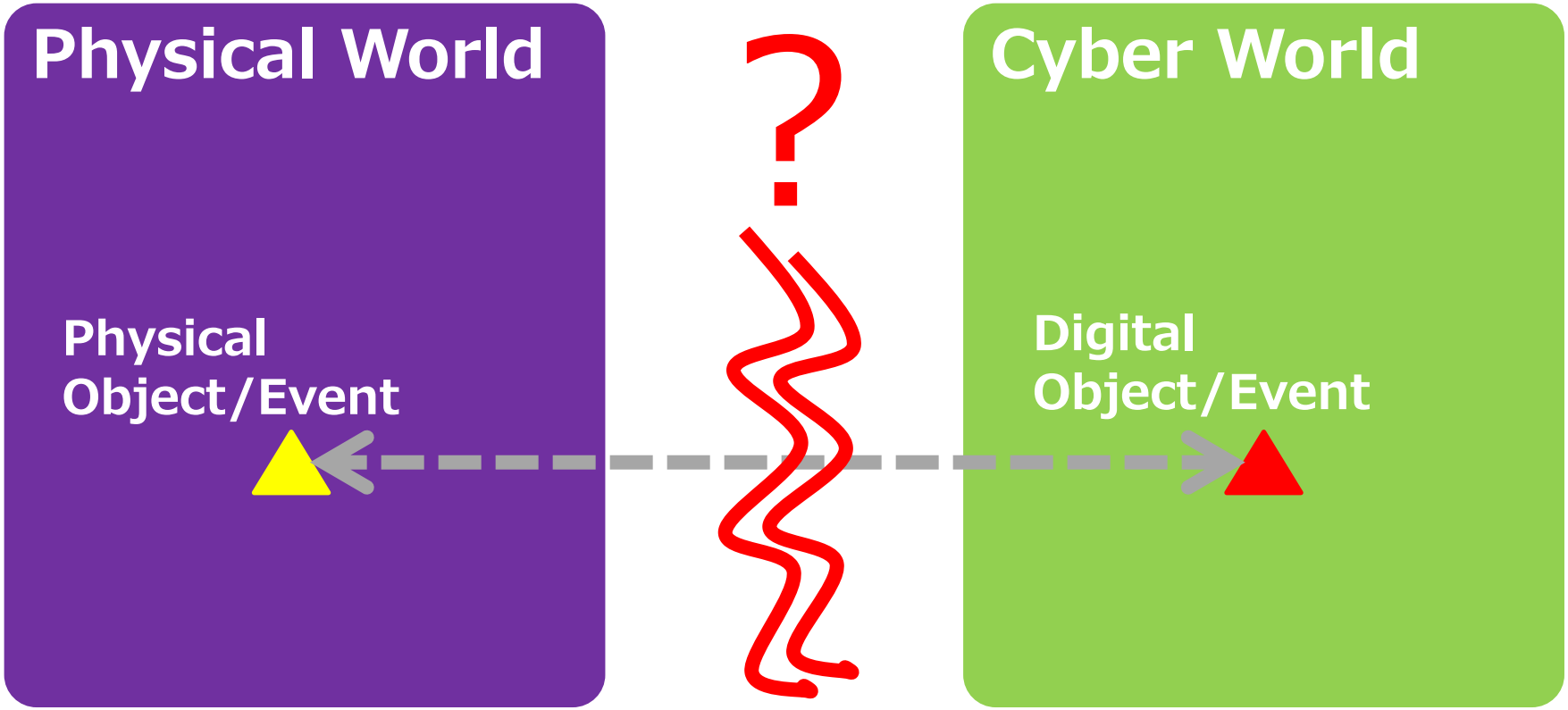
- Control Mechanisms
  - Algorithms
  - Data

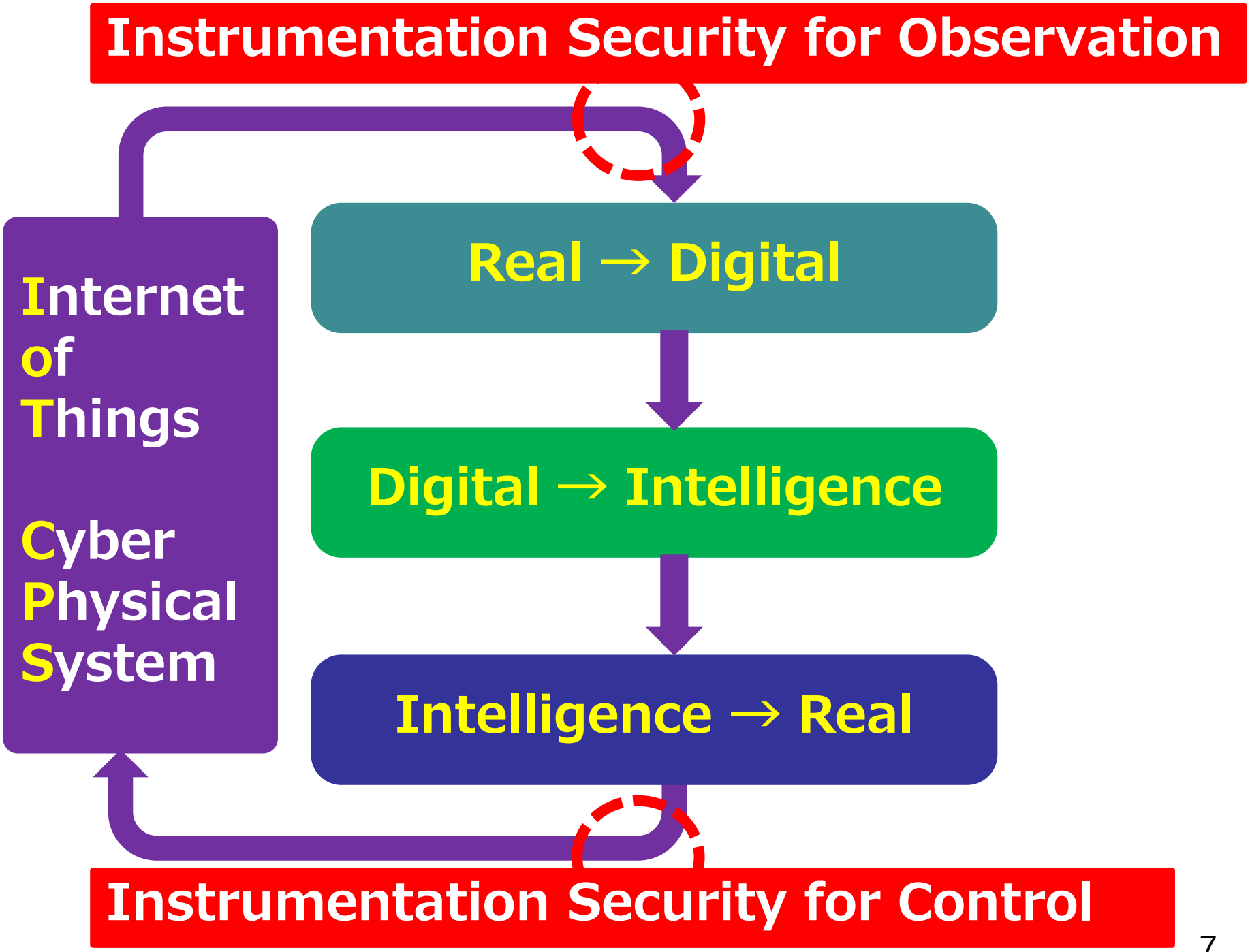


Mapping
Between Physical and Cyber Worlds



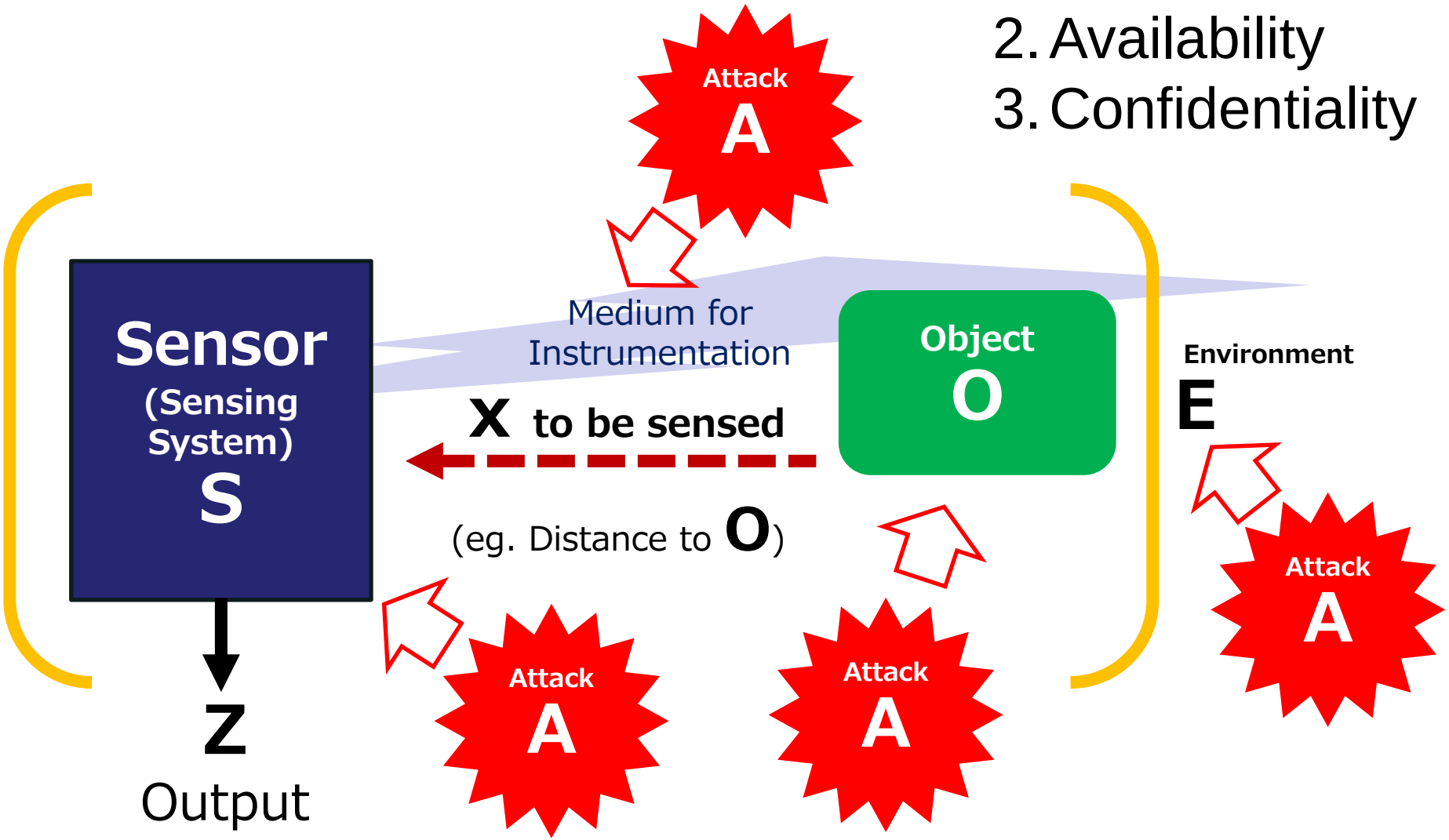
Threats on Mapping
Between Physical and Cyber Worlds



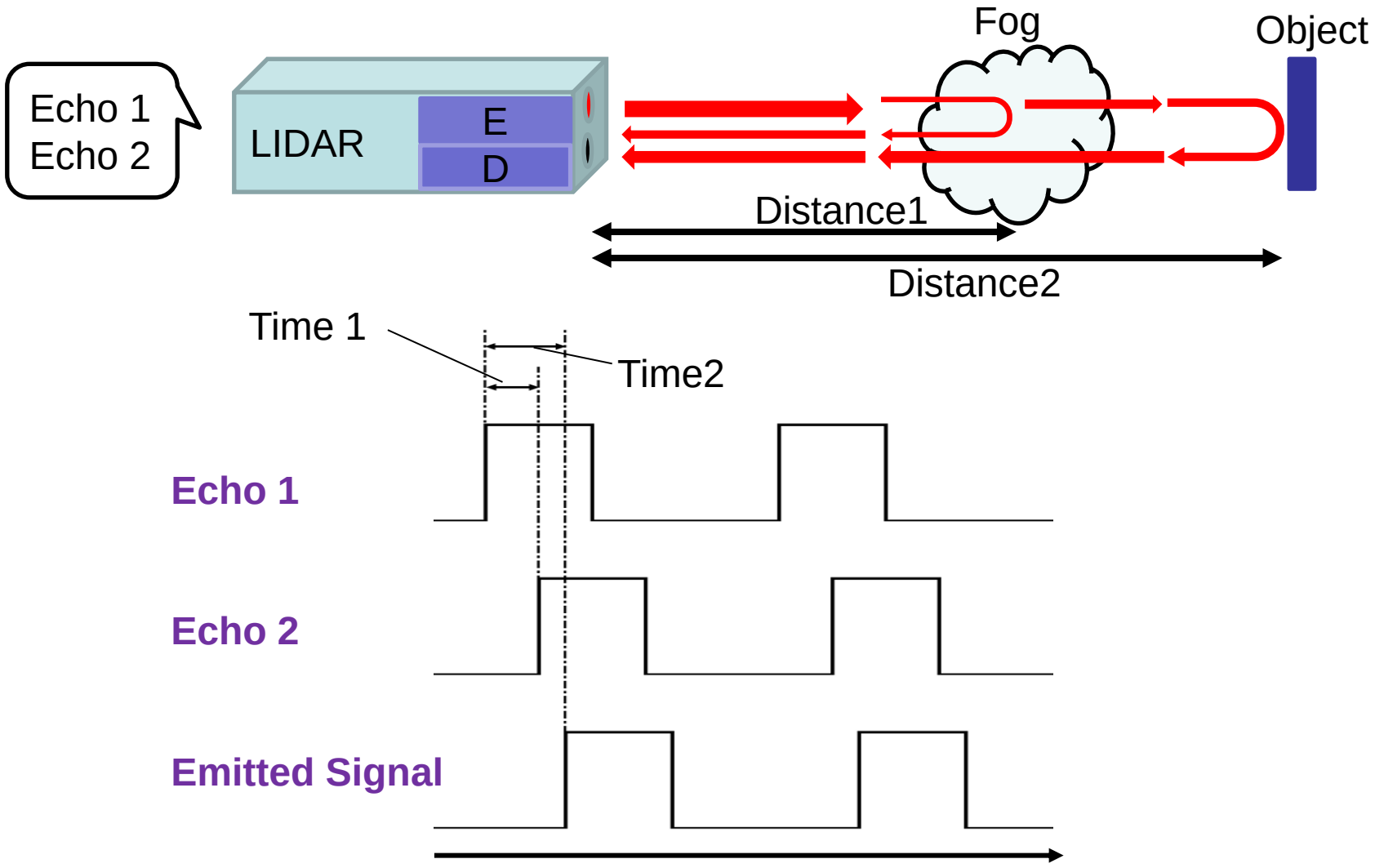


Threats to Instrumentation

Attack to
1. Integrity
2. Availability
3. Confidentiality

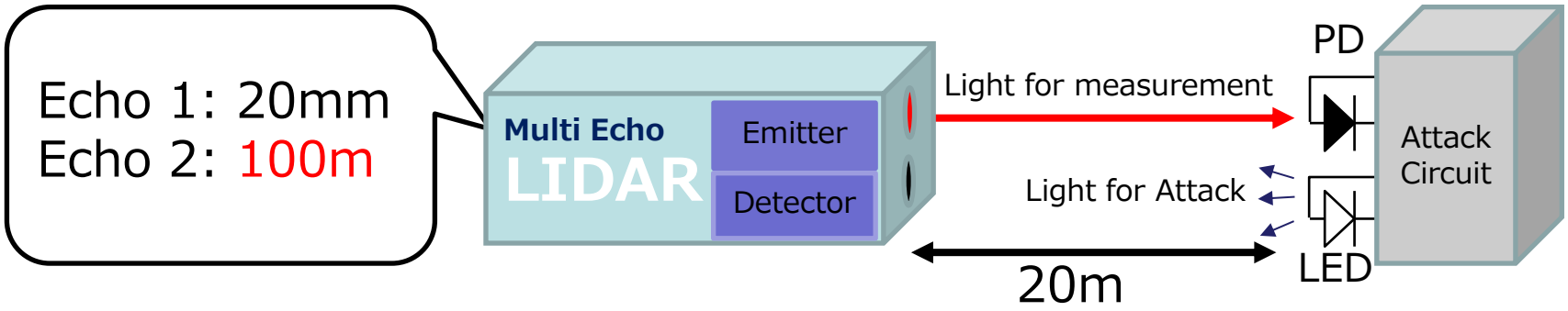


LIDAR ToF Multi Echo Detection



LIDAR: Light Detection and Ranging ToF: Time of Flight

Instrumentation Security Evaluation for LIDAR



- **Light for Attack which is mimicking the Light for Measurement is emitted to the Sensor → Distance Masquerading**

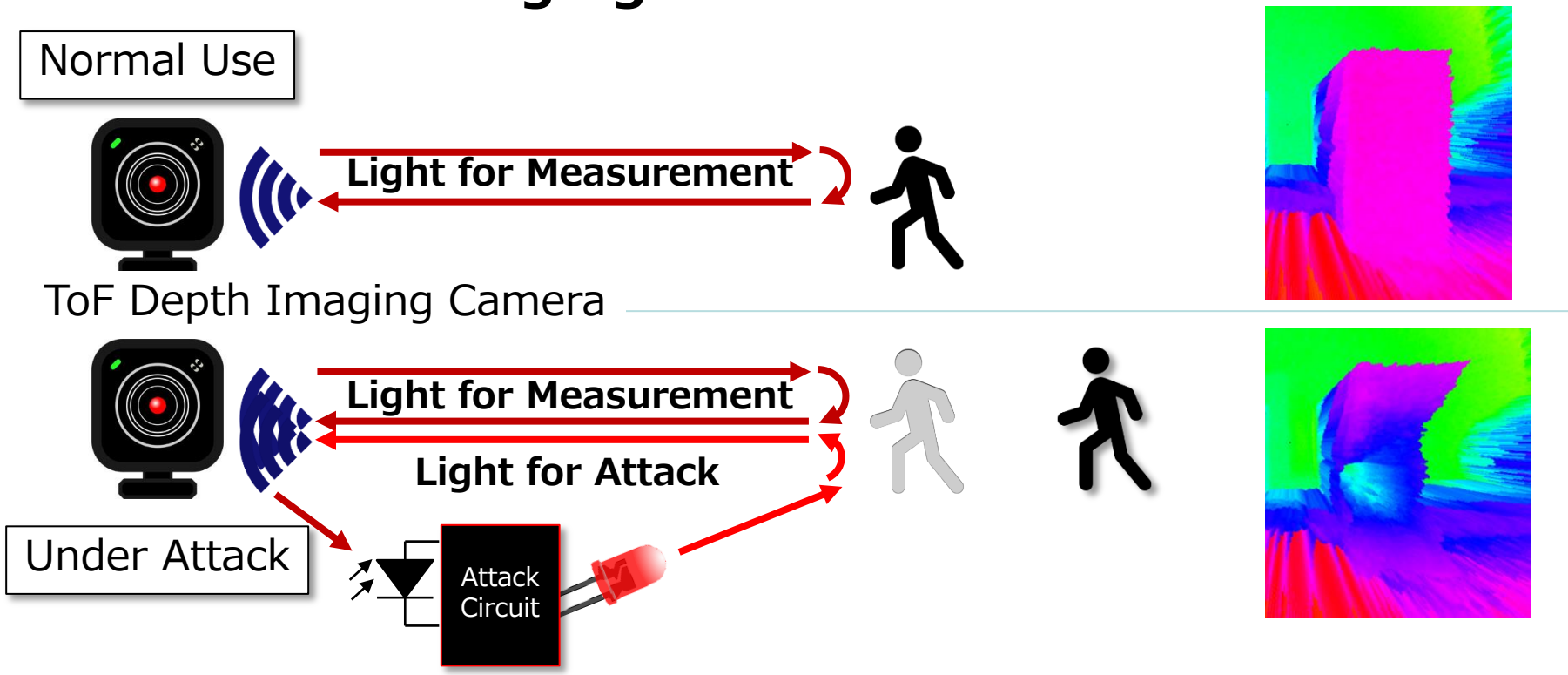
Type of Distance Masquerading \ Existence of Attack Equipment	Detectable	Undetectable
Far than Real	[1], [2]	[3]
Near than Real	[3]	

[1] J. Petit, B. Stottelaar, M. Feiri, F. Kargl, "Remote Attacks on Automated Vehicles Sensors: Experiments on Camera and LiDAR," Black Hat Europe 2015.

[2] K. Soma, D. Fujimoto, T. Matsumoto, "Instrumentation Security of a Pulse LIDAR System against Reflected Light Masquerading", IEICE Tech. Rep., vol.116, no.35, ISEC2016-9, pp.37-44, May 2016.

[3] K. Soma, D. Fujimoto, T. Matsumoto, "Instrumentation Security of a Ranging Pulse LIDAR System Against Reflected Light Spoofing", IEICE Symposium on Cryptography and Information Security, SCIS 2017, 2E1-2, Okinawa, January 2017.

Instrumentation Security Evaluation for ToF Distance Imaging Camera



- **Light for Attack which is mimicking the Light for Measurement is emitted to the Object → Distance Masquerading**

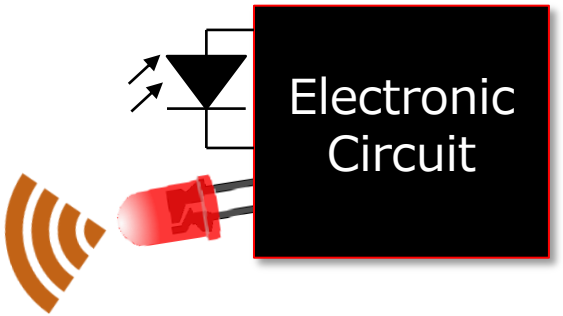
[4] S. Sakurazawa, D. Fujimoto, and T. Matsumoto, "Demonstrating Pulse-Light Spoofing for a ToF Depth Image Camera", IEICE Symposium on Cryptography and Information Security, SCIS 2017, 2E1-1, Okinawa, January 2017. CIS 2017, Okinawa, January 2017.

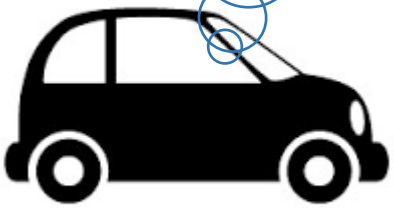
(1) z = n (< d)

(2) z = f (> d)

(3) No output
(z is unavailable)

Detector





Vehicle's Sensor with Output **z**

(1) **z =n < x**
May cause crush against the following vehicles

x
(the real distance)

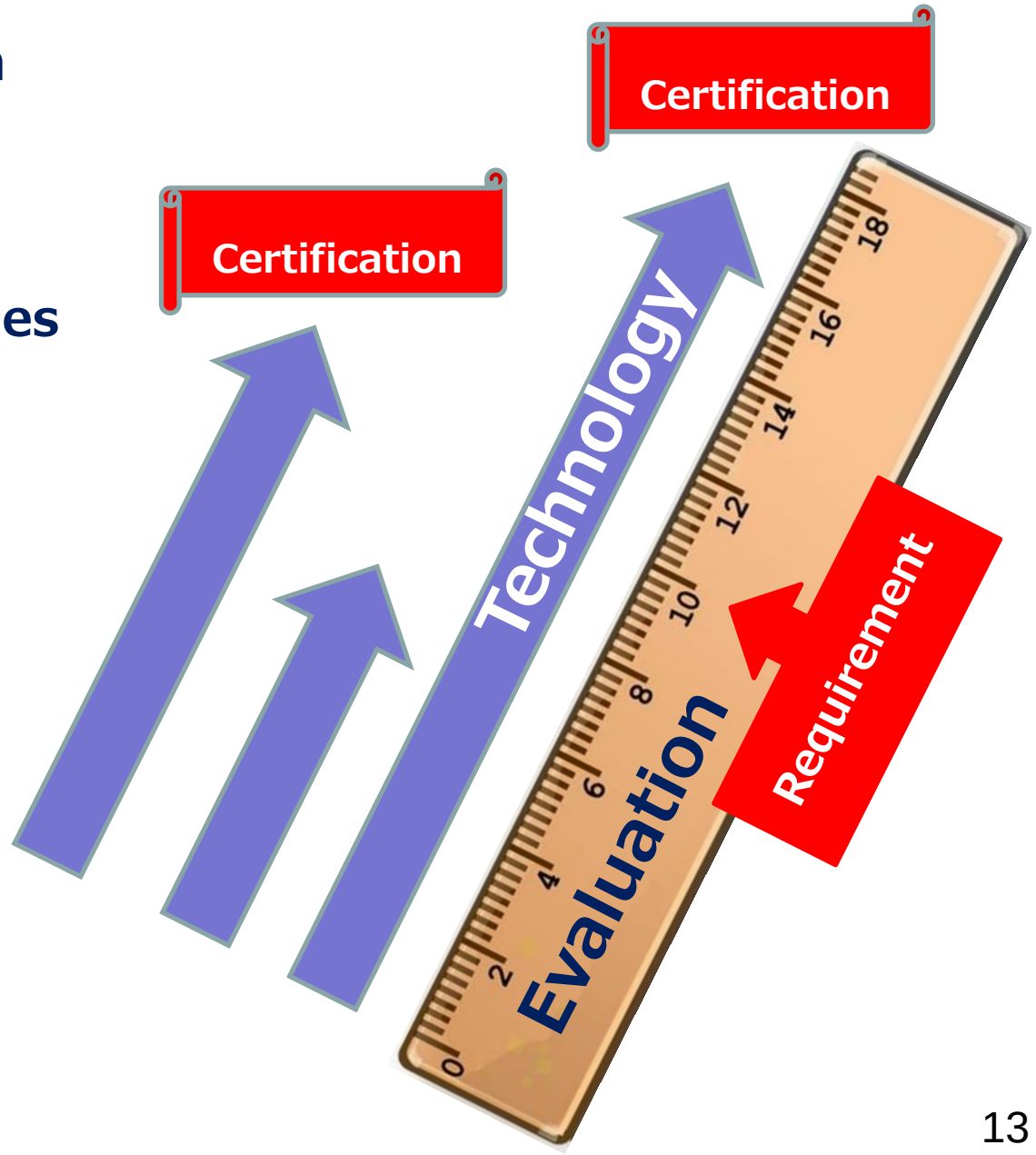
(2) **z = f > d**
May cause a severe traffic accident with personal injury

Instrumentation Security

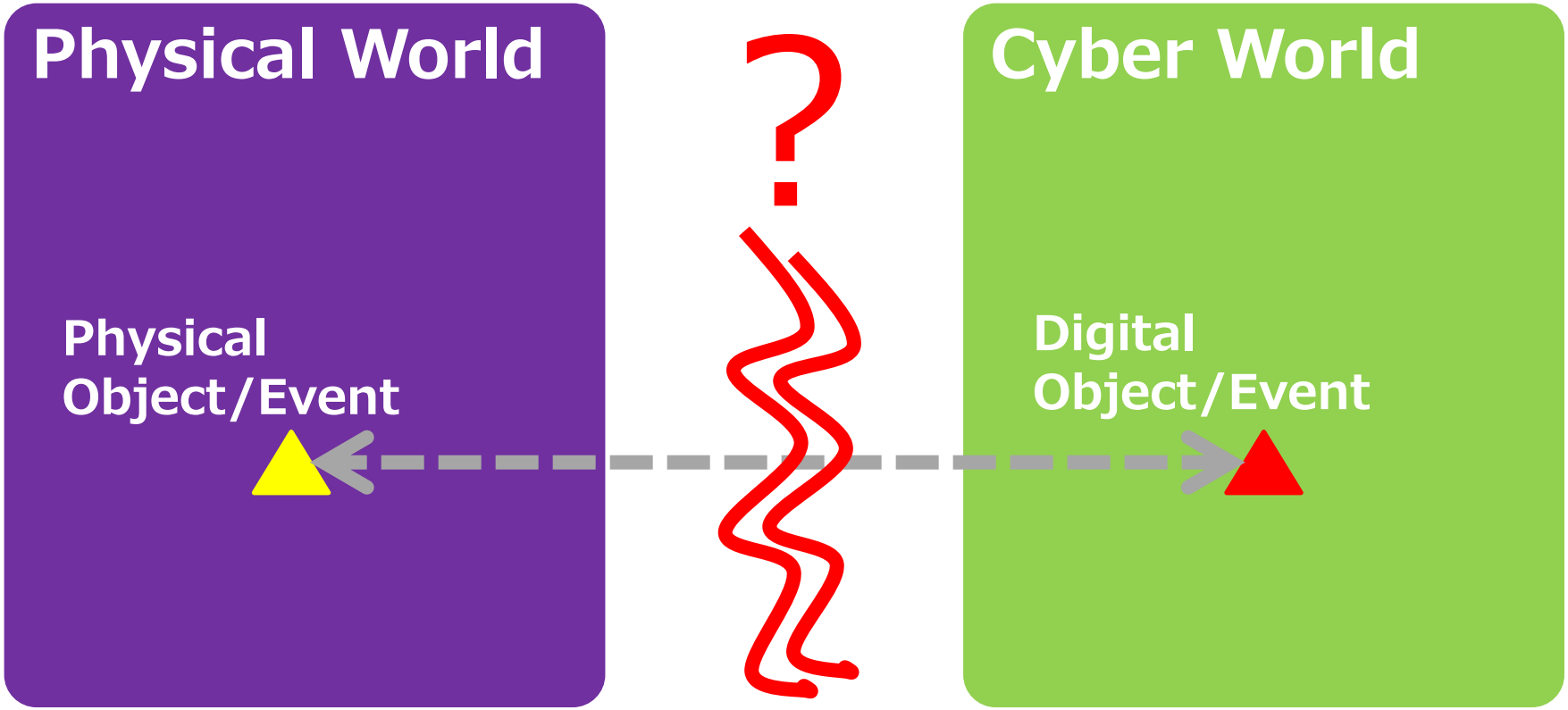
Need for Evaluation and Strengthening Technologies

and/or

Certification Schemes



Threats on Mapping
Between Physical and Cyber Worlds



Thank you!

Tsutomu Matsumoto

URL: http://ipsr.ynu.ac.jp/

YNU YOKOHAMA National University

IAS Institute of Advanced Sciences Yokohama National University