OPC and MES 2014 Finland

OPC UA Security

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Getting real about the risk

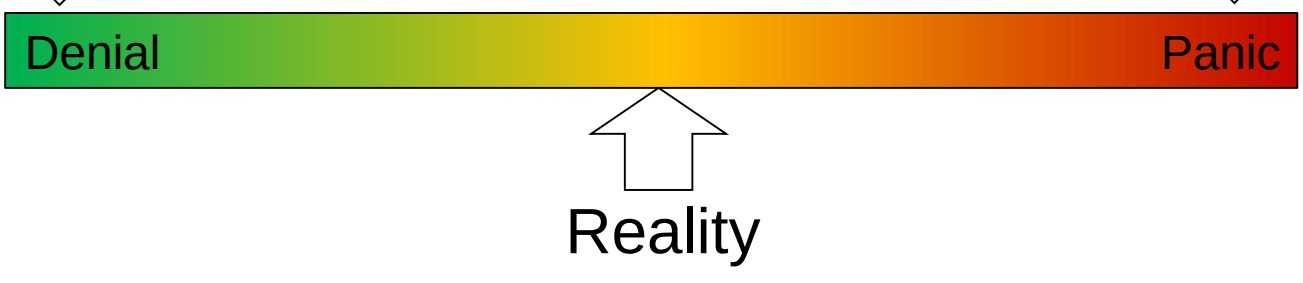
Stephen Cummings, director of the British government's Centre for the Protection of National Infrastructure,

"Cyberterrorism is a myth"

CNN INTERNATIONAL .com/US

September 27, 2007 -- Updated 1317 GMT (2117 HKT)

Mouse click could plunge city into darkness, experts say



- Cyber incidents are real and cyber security for industrial control systems must be taken seriously
- **but** it is a challenge that **can** be met

OPC FOUNDATION

Why, what and how to use?

- Thread

Why?
- Which security concerns are addressed by OPC UA?
- Which are not addressed by OPC UA security?

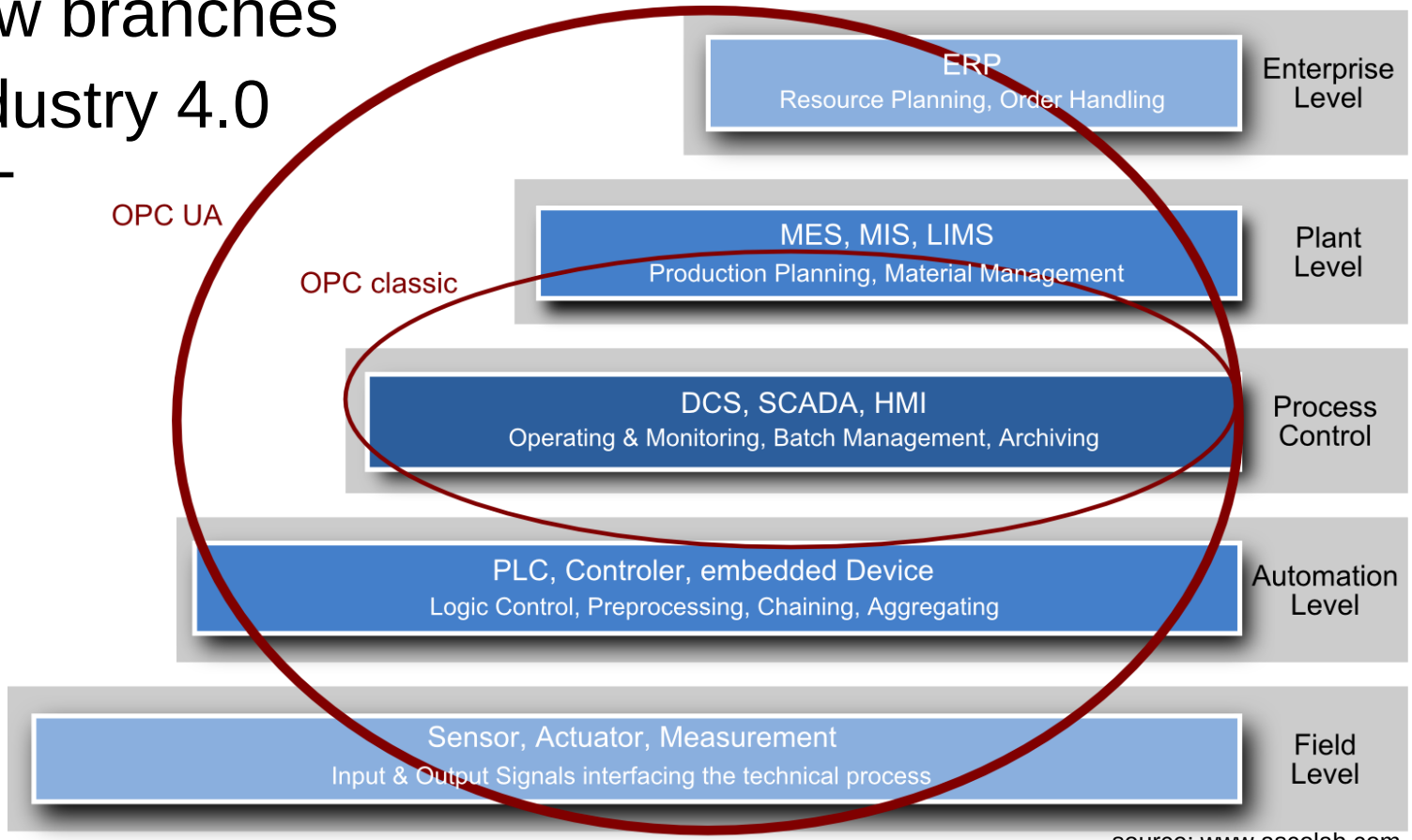
What?
- What are the concepts of OPC UA security?

How to Use?
- How to choose the target security level?
- How to manage OPC UA certificates?

- Secure

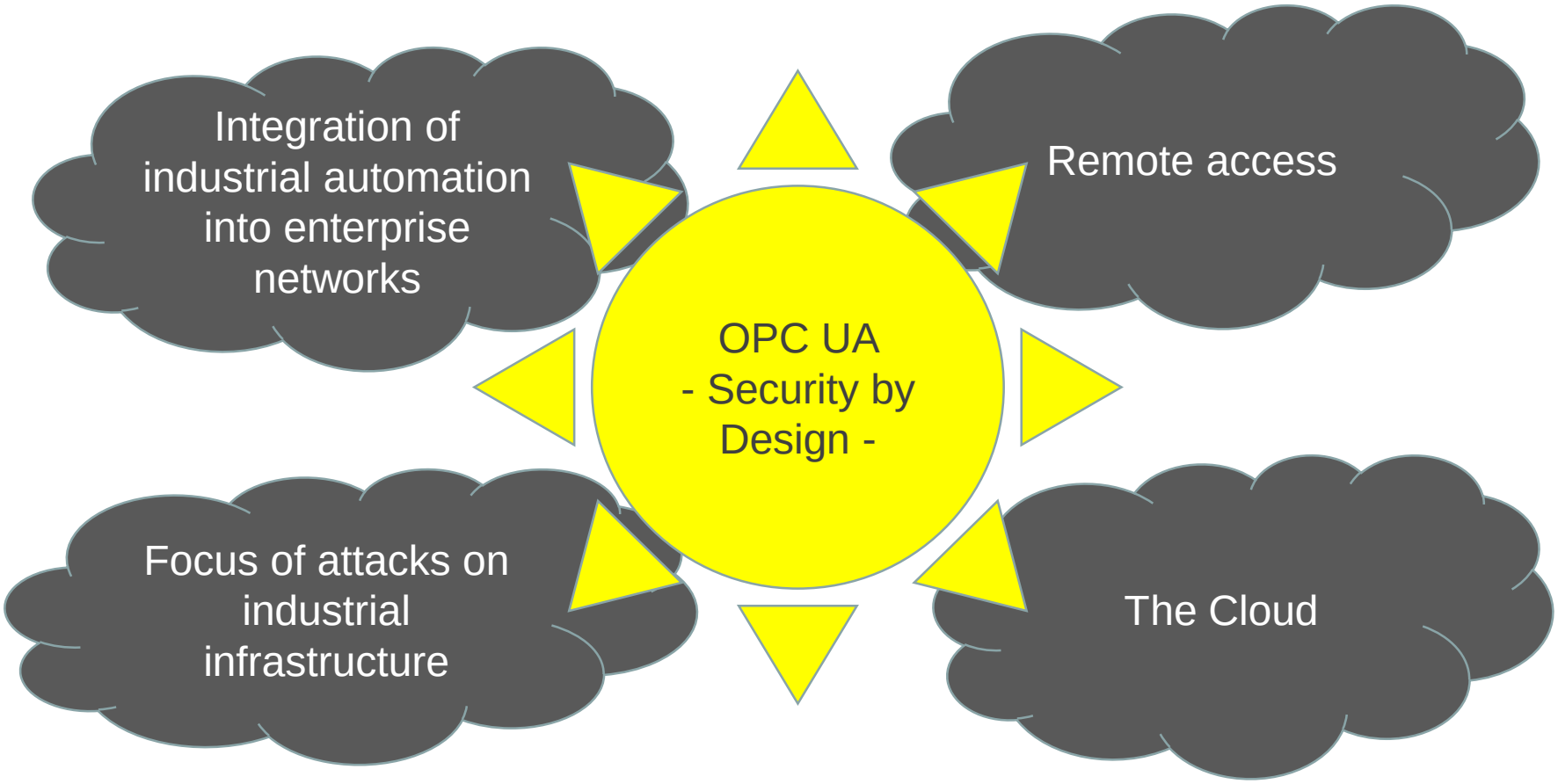
OPC UA - Communication

- OPC UA covers more applications
- new branches
- Industry 4.0
- IoT



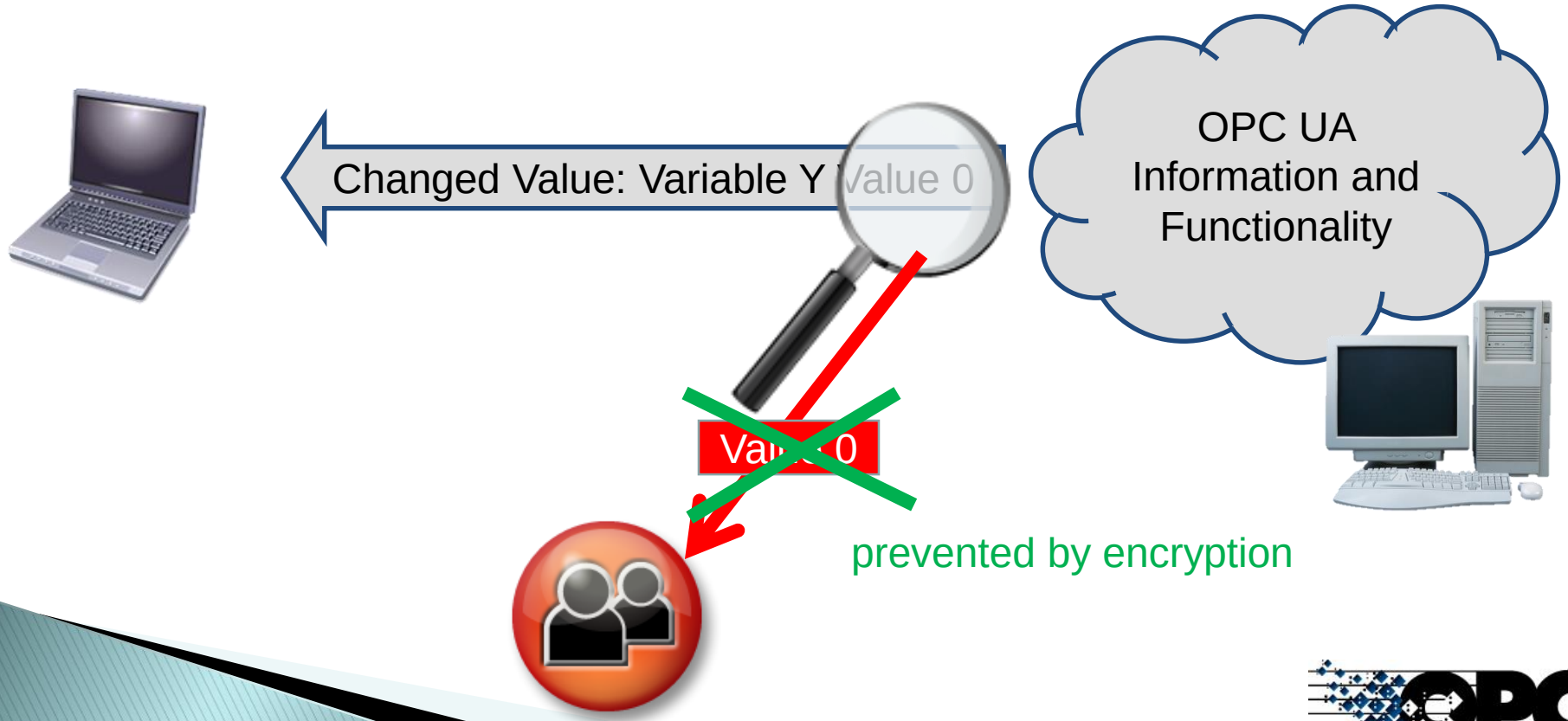
source: www.ascolab.com

Why – OPC UA Security?



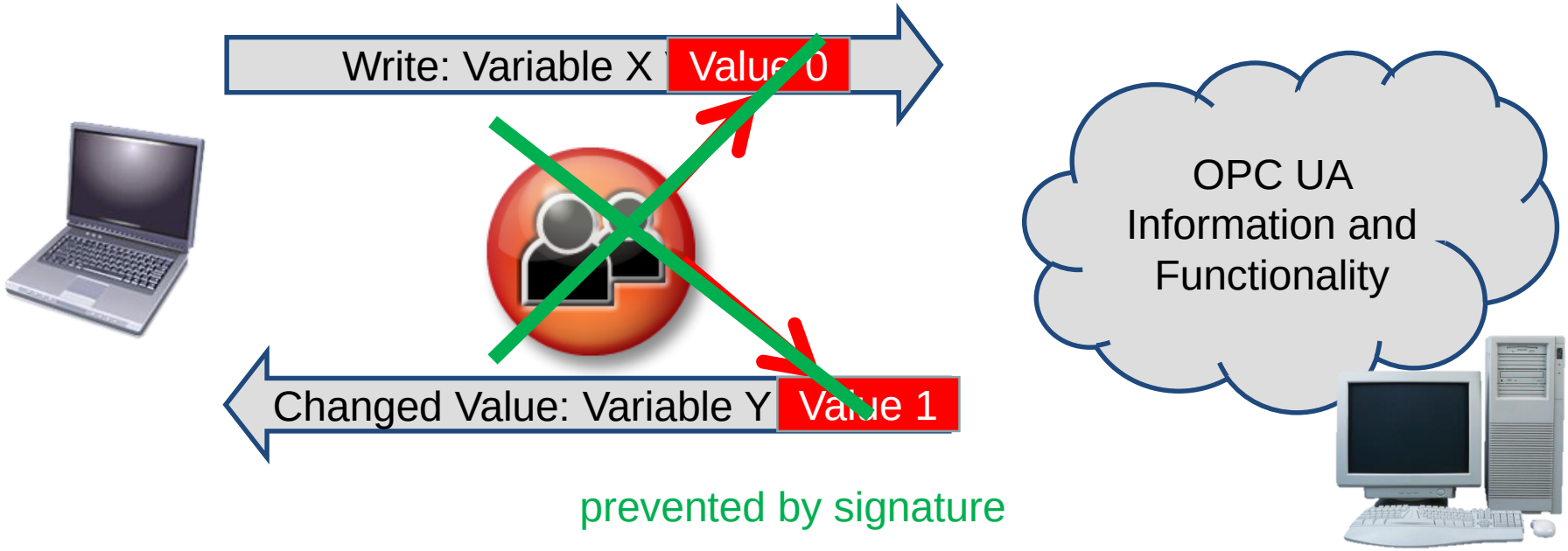
Security Aspect - 1

- Confidentiality
  → Not reading the content of a message



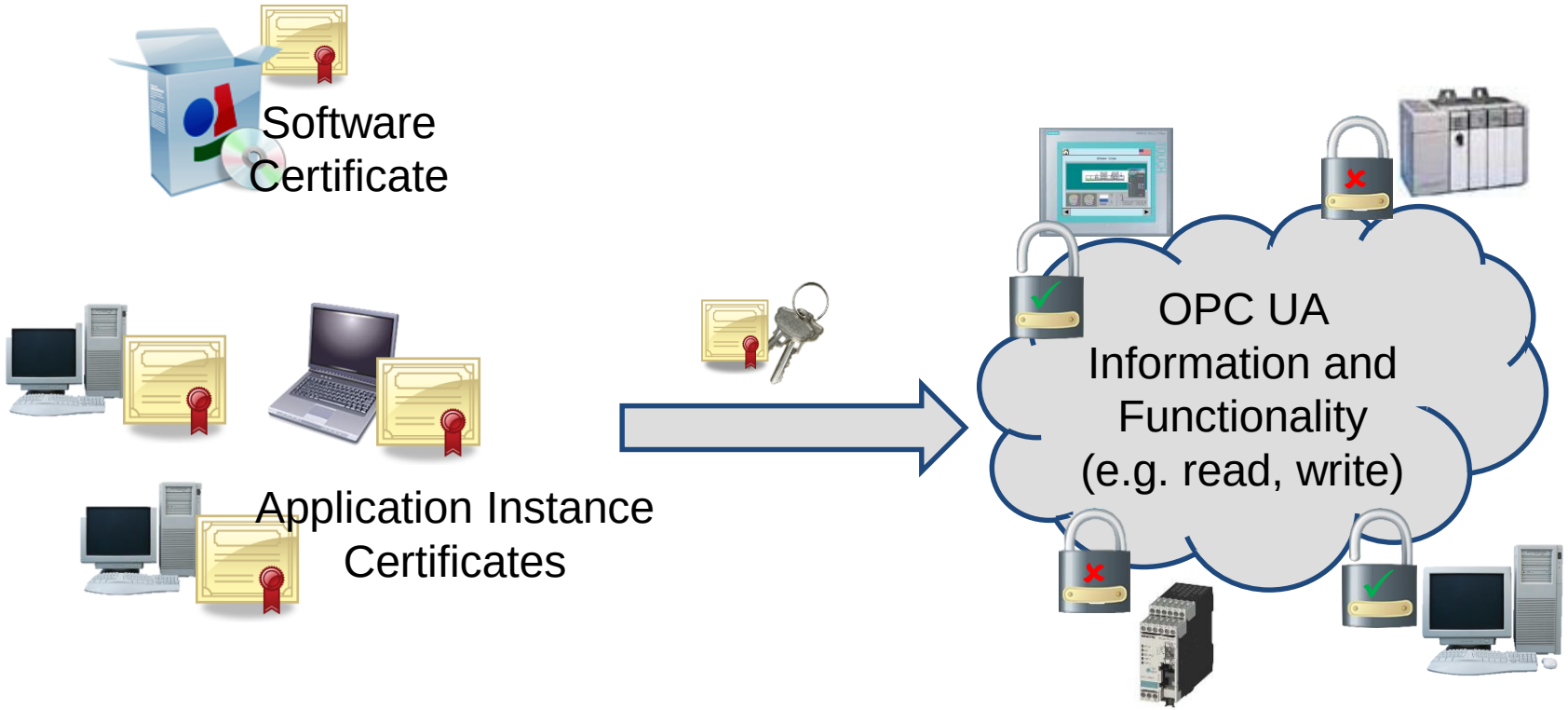
Security Aspect - 2

- Integrity
  → Not manipulating the content of a message



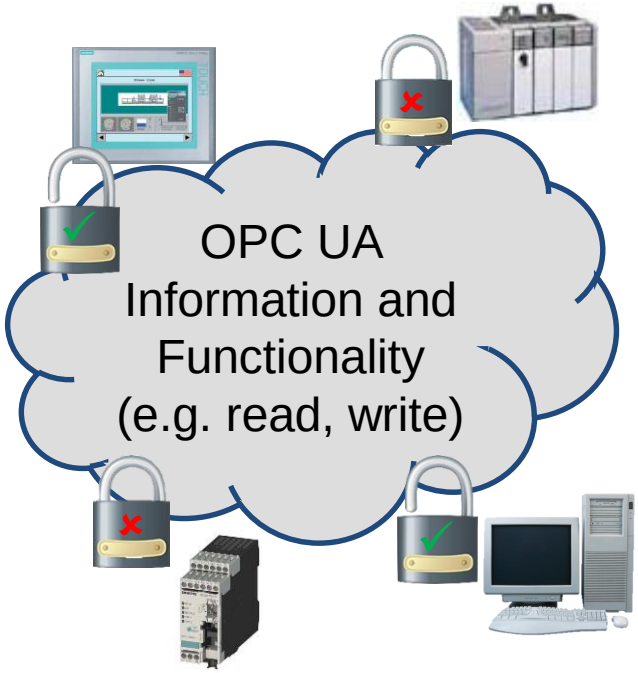
Security Aspect - 3

- Application Authentication
  → Identification and access control for applications



Security Aspect – 4 + 5

- User Authentication and Authorization
  → Identification and access control for users
  → Access/execution rights on item level

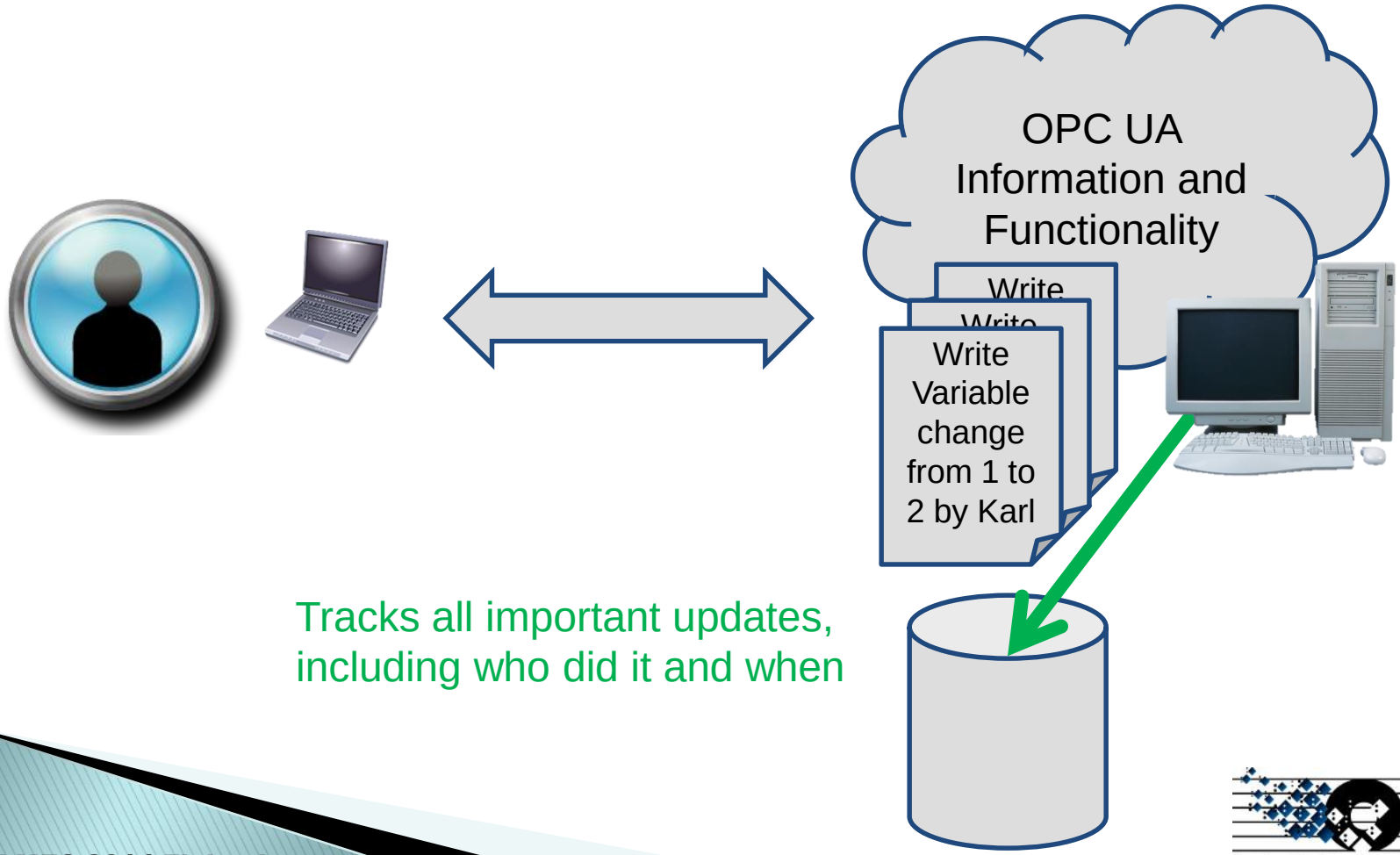


1. Authenticate User
(e.g. username and password)

2. Authorize for specific operations and information (e.g. writing a specific value)

Security Aspect - 6

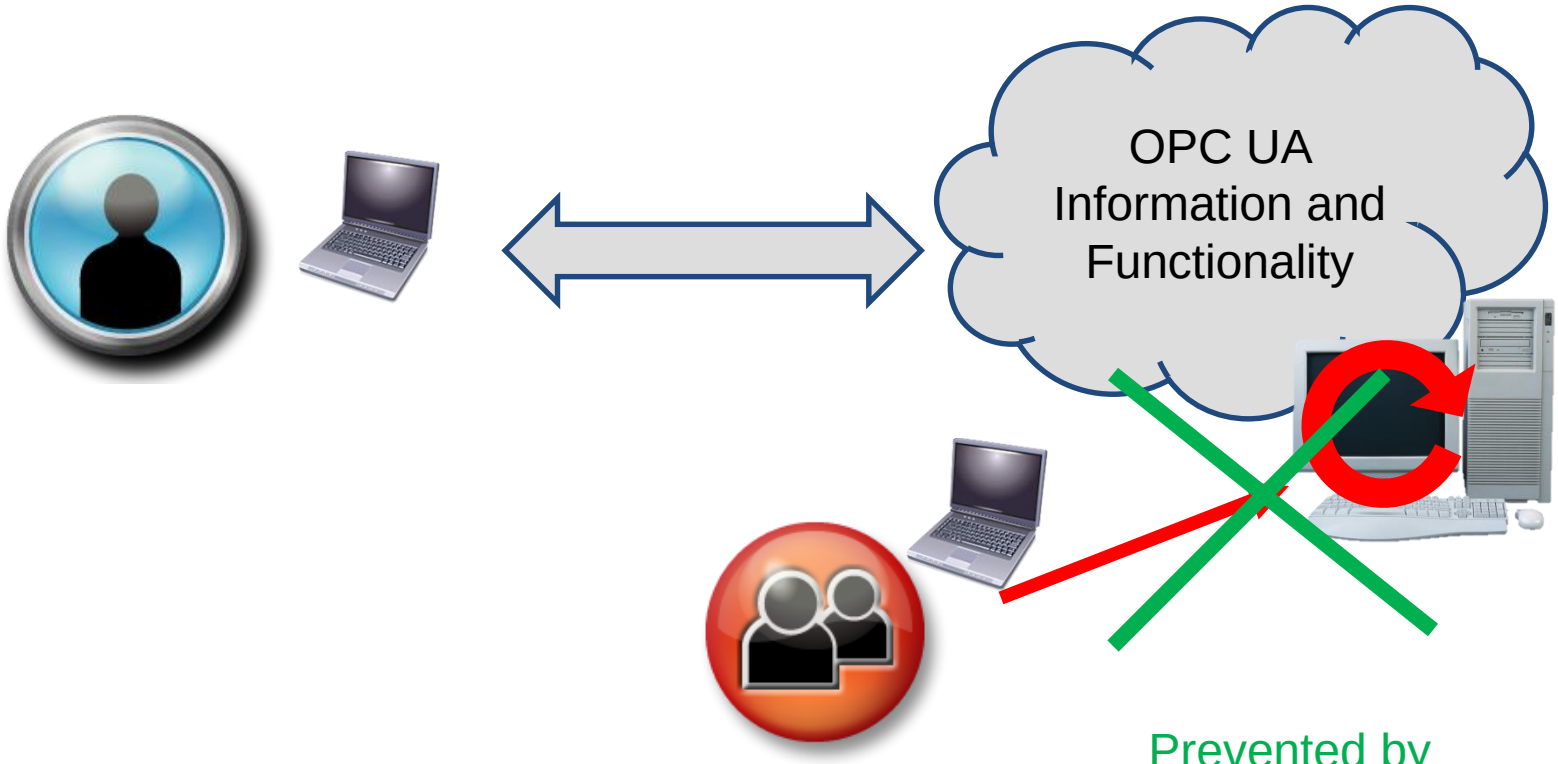
- Auditability
  →Tracking all important interactions



Tracks all important updates, including who did it and when

Security Aspect - 7

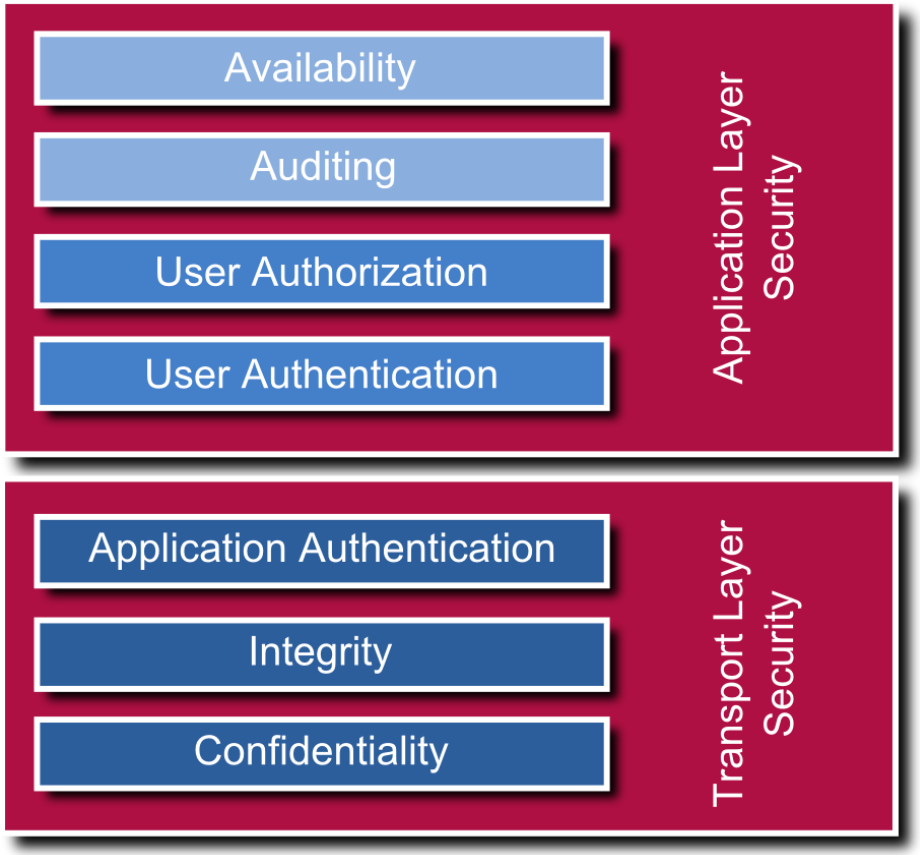
- Availability
  → Always be functional



Prevented by
availability controls

OPC UA Security-Concept

OPC UA covers 7 security aspects, which are in the core of the technology:



source: www.ascolab.com

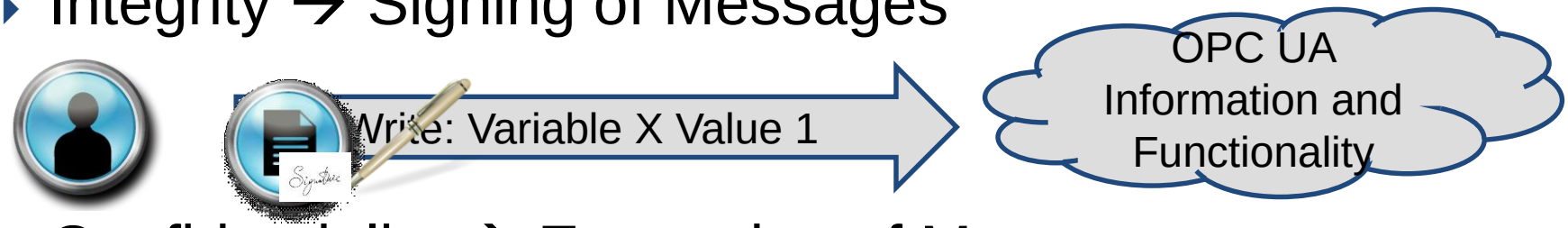
Application Layer Security

- Authentication of users
  - Username / password, WS-Security Token or X.509
  - Fits into existing infrastructures like Active Directory
- Authentication of individual installations
  - Application instance certificates
  - Certificate Authority (CA)

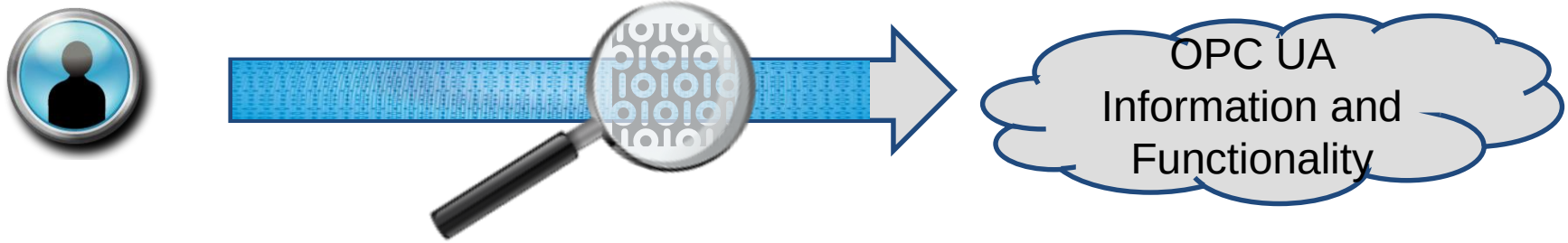
- Authorization
  - Enforcement of authorization is server-specific
  - Fine-granular information in address space
    - *AccessLevel* and *UserAccessLevel* – Reading and writing of values and their history
    - *WriteMask* and *UserWriteMask* – Writing of meta data
    - *Executable* and *UserExecutable* – Calling methods
    - Information not accessible is not visible to client (references, events, …)
- Auditability
  - Generating audit events for security related operations

Transport Layer Security

- Availability
  - Depends primarily on the site for protection
  - Minimum processing before authentication
    - Restricting message size
    - No security related error codes returned
    - …
- Integrity → Signing of Messages



- Confidentiality → Encrypting of Messages



NOT addressed by OPC UA

- **User Management**
  - No standard way how to manage users like adding, deleting, assignment to roles
  - No standard user roles
  - > This is server-specific or defined in companion specifications
- **User Authorization Management**
  - No standard way to define access rights
  - > This is server-specific or defined in companion specifications
- **User Authentication Management**
  - Not addressing mechanisms like biometric authentication, etc. directly, but can be used by the OPC UA infrastructure
  - No rules for passwords
    - Syntax rules (min. length, requires upper case, number, special characters, …)
    - How often they need to change
    - Where (not to) store passwords (e.g. note on screen)
- **Organizational issues**
  - No definition how to handle physical access to site
  - No definition of zones, security lifecycle or security policies
  - Not addressing training of personal
- Those **things are addressed by other specifications** like
  - IEC 62443 (ISA 99)
  - NERC CIP
  - Regulations and Corporate Standards

Practical Approach

- **Identify and Verify your Security Risks**

Drivers of cyber security

Compliance vs. risk management

- Many cyber security activities are motivated by regulation or similar compliance regulation
  - "Checking the boxes" exercises with least effort possible
  - Defining out of scope as much as possible

- Cyber security is a risk management activity
  - Should be driven by understanding of the risk
  - Should follow an organization's risk management framework

?

Consequence assessment

Answer the "*what if*" ?!

- What if I cannot operate this asset?
- What if someone else can operate this asset?
- What if this information gets disclosed?

What if someone opens this valve?
What if it does not close when it should?

Likelihood assessment

Accident / Error

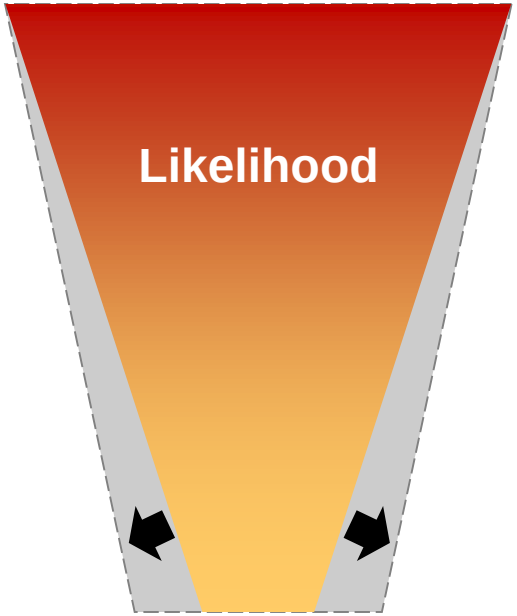
Rogue insider/employee

Malware/Virus/Trojans

Thieves / extortionists

Sabotage / competitors

Enemies / nation states / terrorists



→ Not enough recorded incidents or statistical data

Choosing appropriate security

Risk management based approach

- Identify critical assets
- Identify potential threats
- Assess likelihood of attack types
- Assess potential consequences of different types of security breaches
- Derive security objectives
- Select appropriate security controls

Using OPC UA security

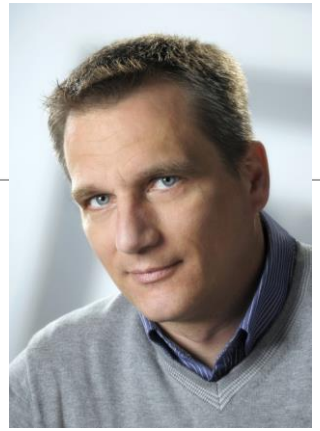
- Select appropriate security controls for each of the critical assets
- Implement and maintain selected security controls

- The OPC UA Security Model support includes
- Different security policies specified in the standard
- Product design and system engineering define when to use which policies
- Endpoints support security policies, exposed in Discovery Services
- SecureChannel Services utilize supported policies

Conclusion

- **Use of OPC UA security must be embedded in a security management system to provide meaningful security**
- **OPC UA is secure-by-design** and addresses security concerns by providing
  - Authentication of
    - Users
    - Application instances
    - (Software)
  - Confidentiality and integrity by signing and encrypting messages
  - Availability by minimum processing before authentication
  - Auditability by defined audit events for OPC UA operations
- OPC UA allows to setup different levels of security
- OPC UA certificate management can be
  - integrated into existing infrastructure of the site or
  - newly set up based on requirements

Thanks for Your Attention !



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