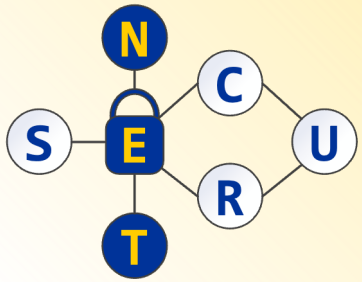

Enhancing Cross-Sectoral Collaboration in Cybersecurity in Estonia, Czechia, Lithuania, Ukraine, and the Netherlands

Funded by the European Union

Security Risk Management of Baseboard Management Controller

Raimundas Matulevičius

Professor of Information Security, University of Tartu, Estonia
Lead of the InfoSec Research Group
Coordinator of the SECURE-NET project

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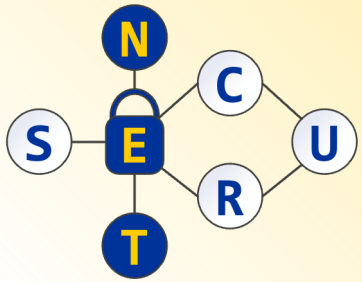

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What is Security Risk Management?

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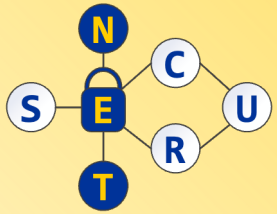
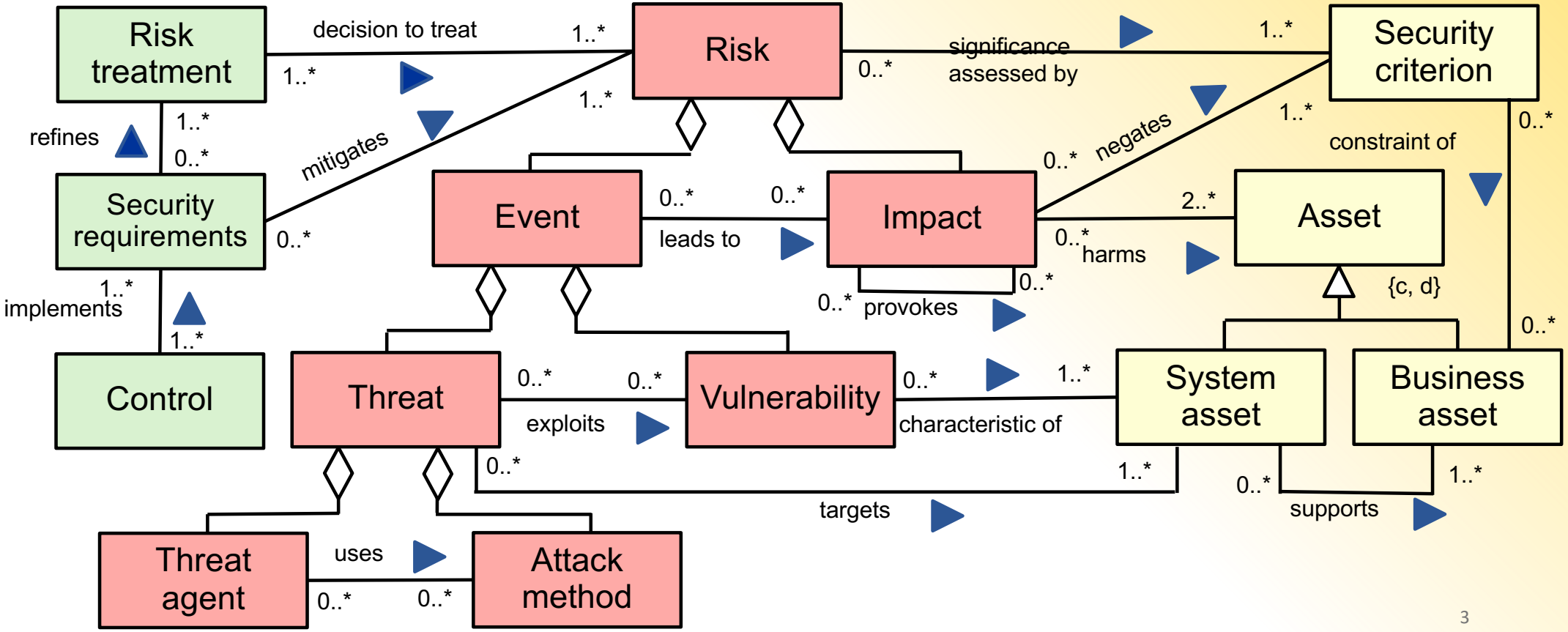
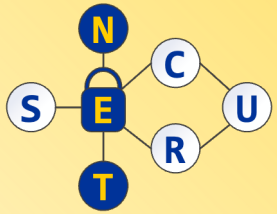
Domain Model for
Security Risk Management





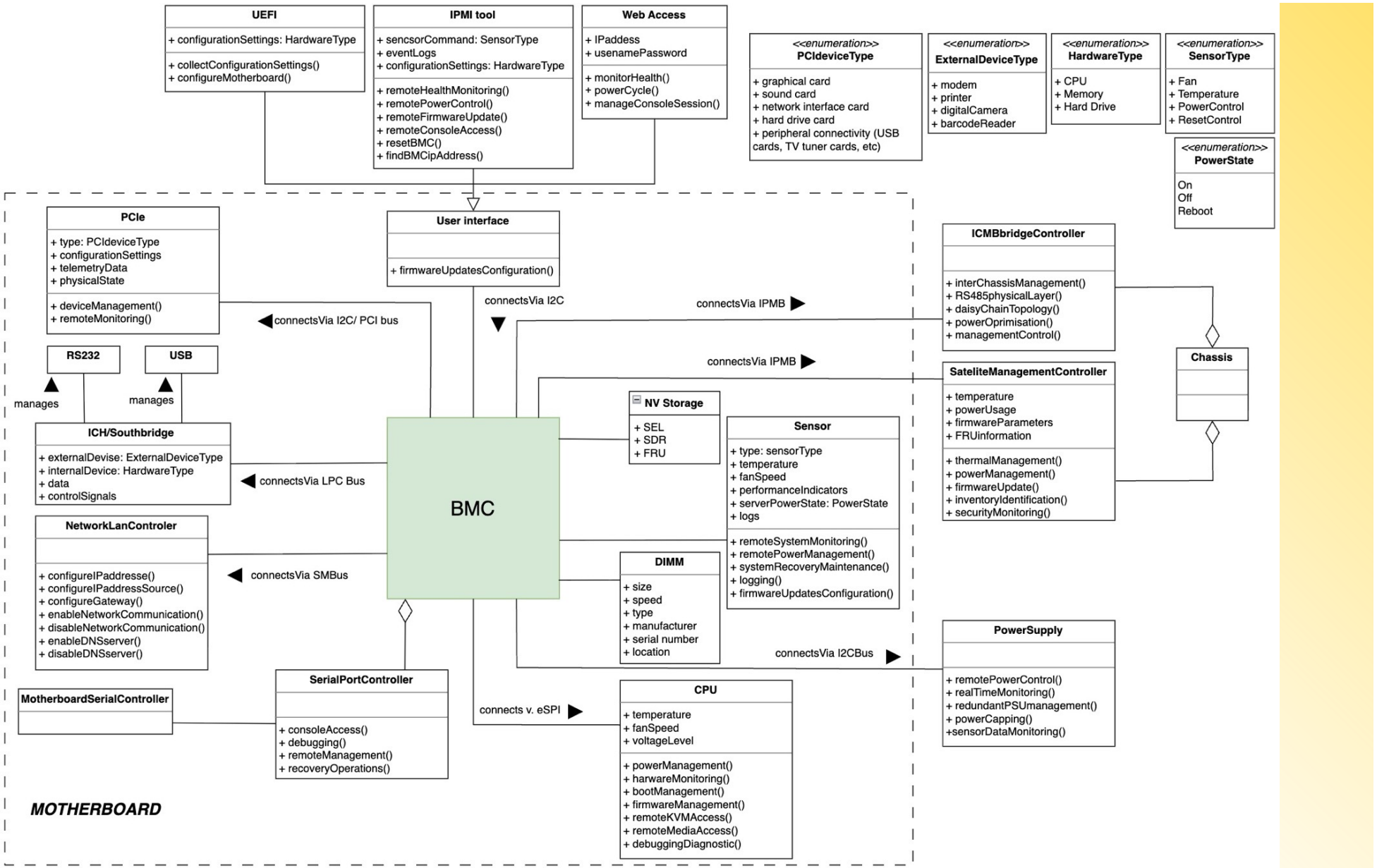
Security Appraisal Framework

OCP: Open Compute Project



- **Critical Assets**
  - A listing of all security-impacting assets within the firmware, and the corresponding Confidentiality, Integrity and Availability requirements for each
- **Attack Surface Enumeration**
  - A listing of all remote, local and physical attack surfaces exposed by the device
- **Adversarial Model**
  - A listing of all threat actors along with their motivation and capabilities
- **Security Objectives**
  - The high-level security objectives or key risks exposed by the firmware

https://github.com/opencomputeproject/OCP-Security-SAFE/blob/main/Documentation/framework.md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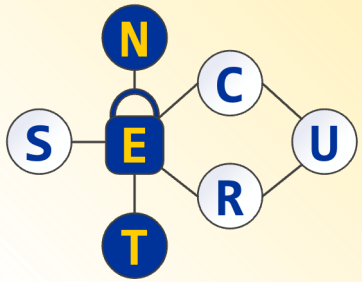
MOTHERBOARD



Enhancing Cross-Sectoral Collaboration in Cybersecurity in Estonia, Czechia, Lithuania, Ukraine, and the Netherlands

- Critical assets
- Attack Surface Enumeration
- Adversarial model
- Security Objectives

Application of Security Appraisal Framework for BMC

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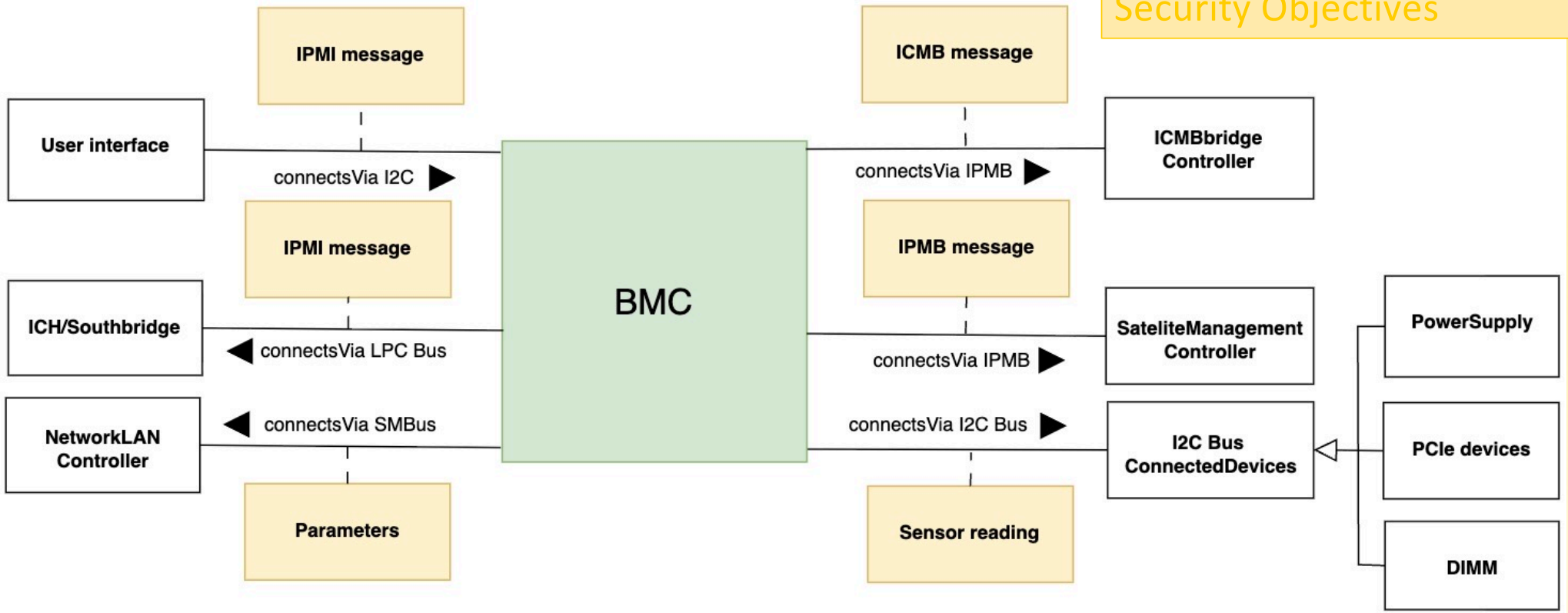
Critical Assets

- Critical assets
- Attack Surface Enumeration
- Adversarial model
- Security Objectives



"Treating firmware, credentials, and out-of-band channels as primary assets" [LinkedIn comment]

Attack Surface Enumeration

Critical assets

Attack Surface Enumeration

Adversarial model

Security Objectives

Capture: How does the system capture data? How is data entered into the system?

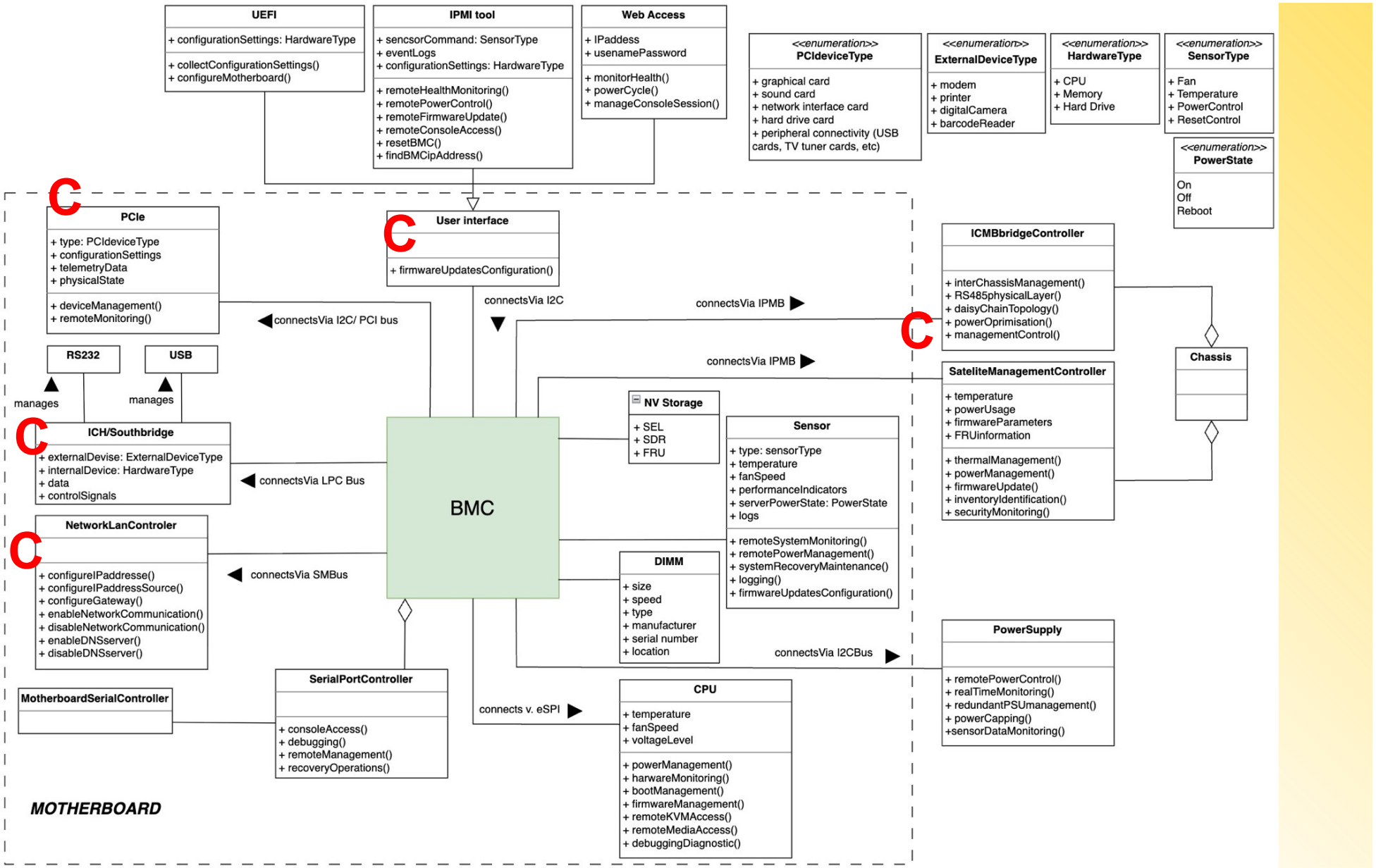
Transmit: How is data transmitted between different devices?

Store: How is data stored in the device (format, type, structure of storing, etc)?

Retrieve: How isdata are retrieved from the device (permissions)?

Manipulate: How is data calculated, compared, estimated, changed, aggregated, etc?

Display: How data is displayed to the user/ administrator (correctness of display, authorised access to see the displayed data, use of the received/ displayed data)?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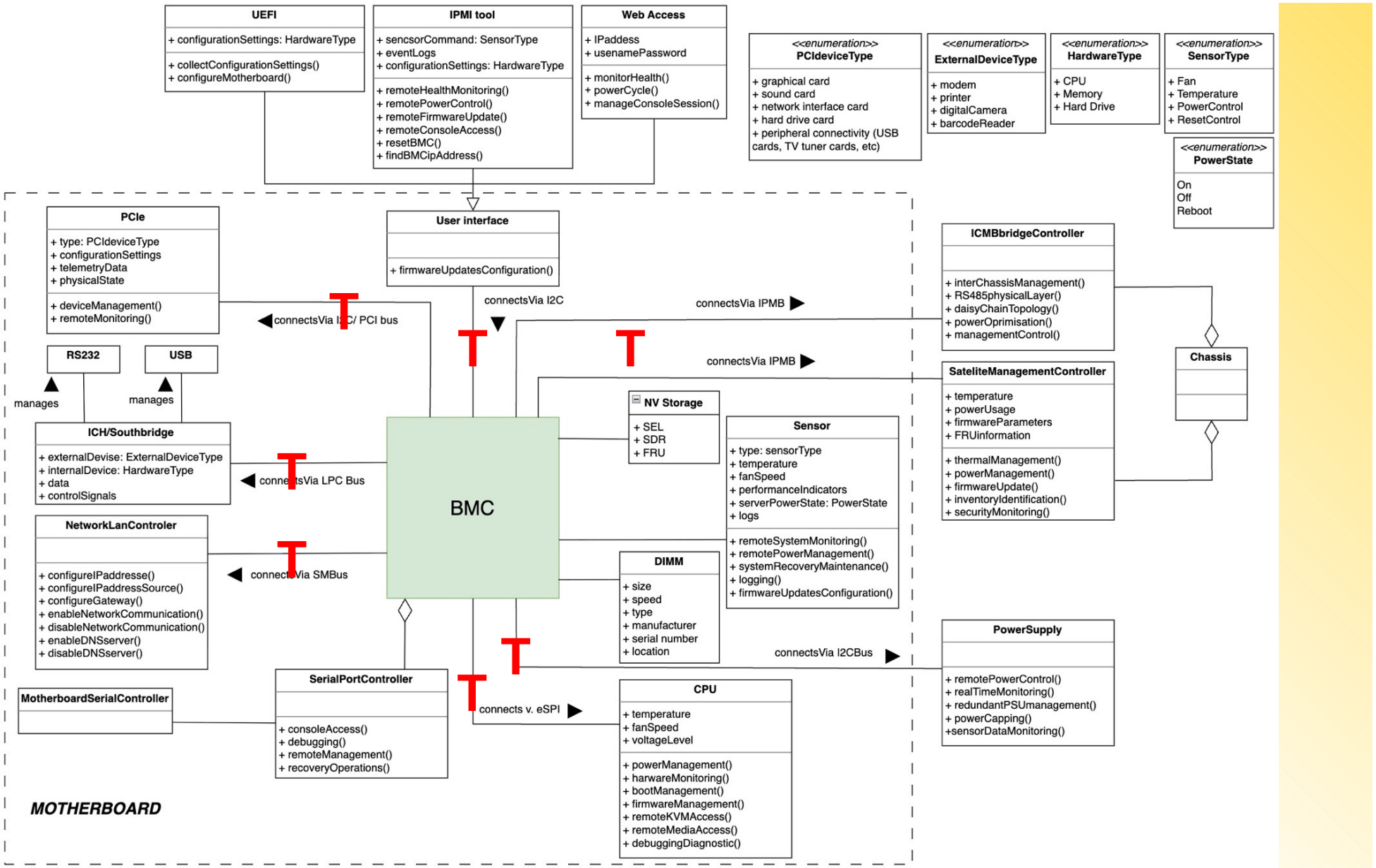
MOTHERBOARD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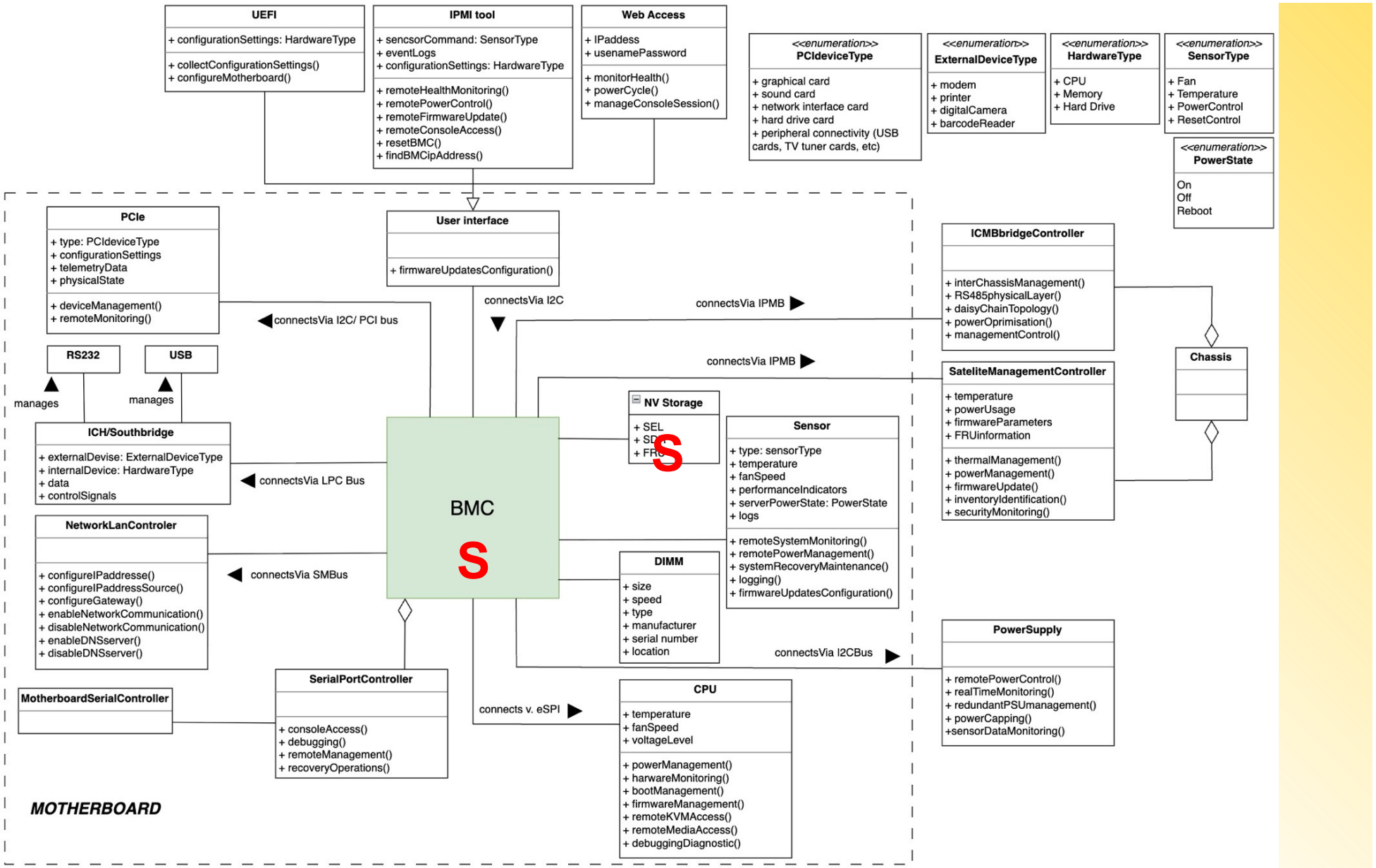
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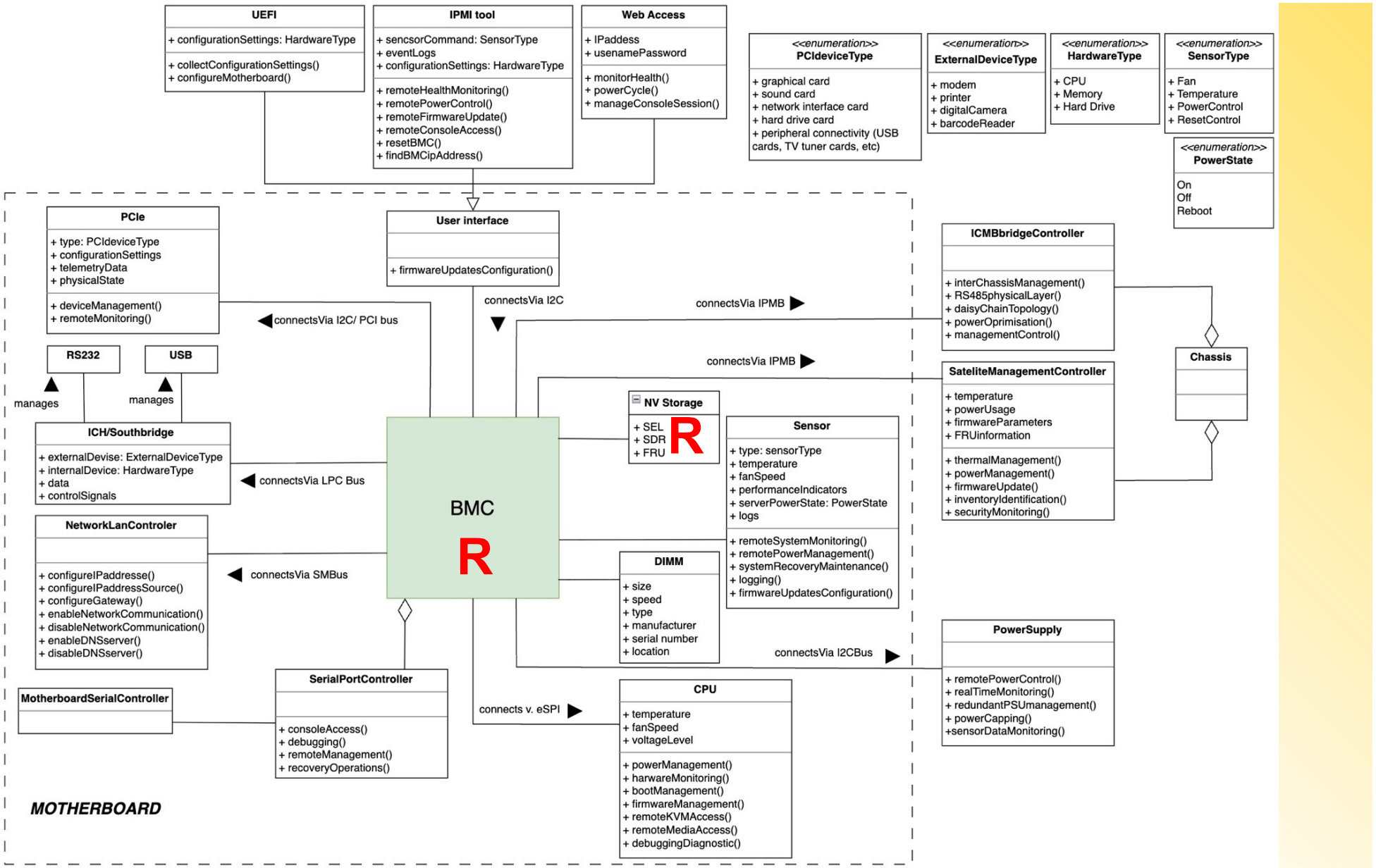
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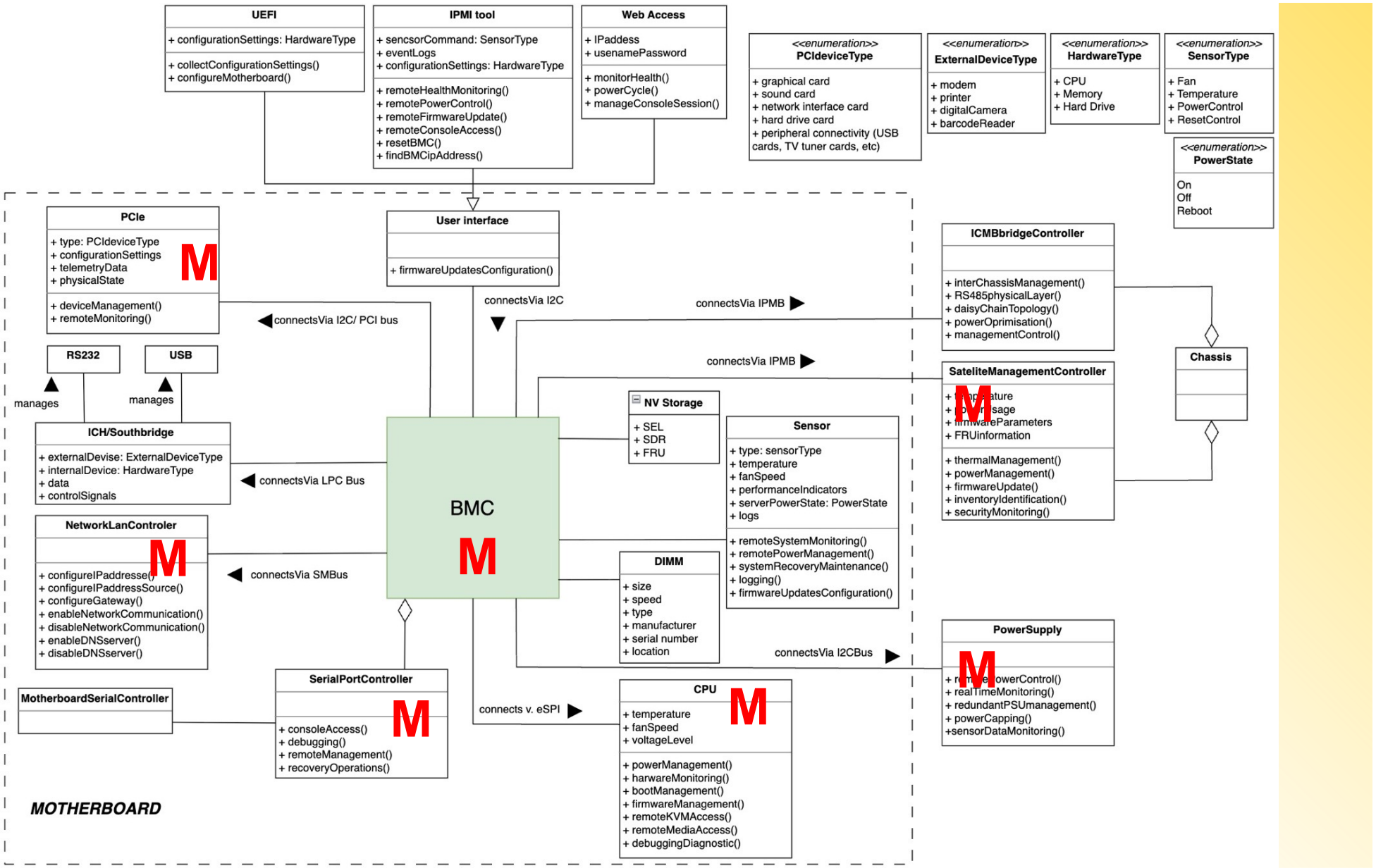
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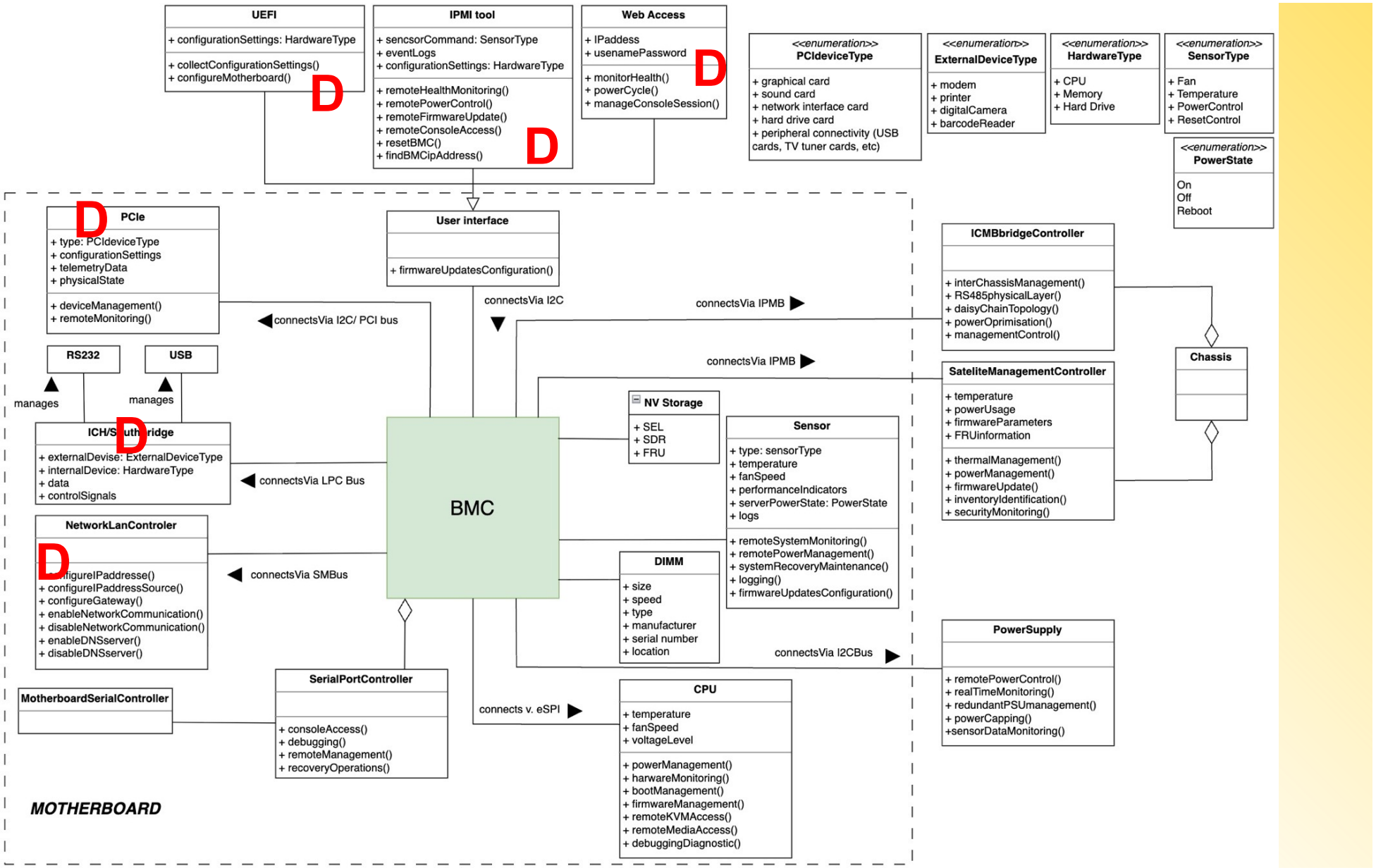
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MOTHERBOARD

Adversarial Model

- Opportunistic Internet-based attack
- Targeted intranet-based attack
- Targeted host-based attack

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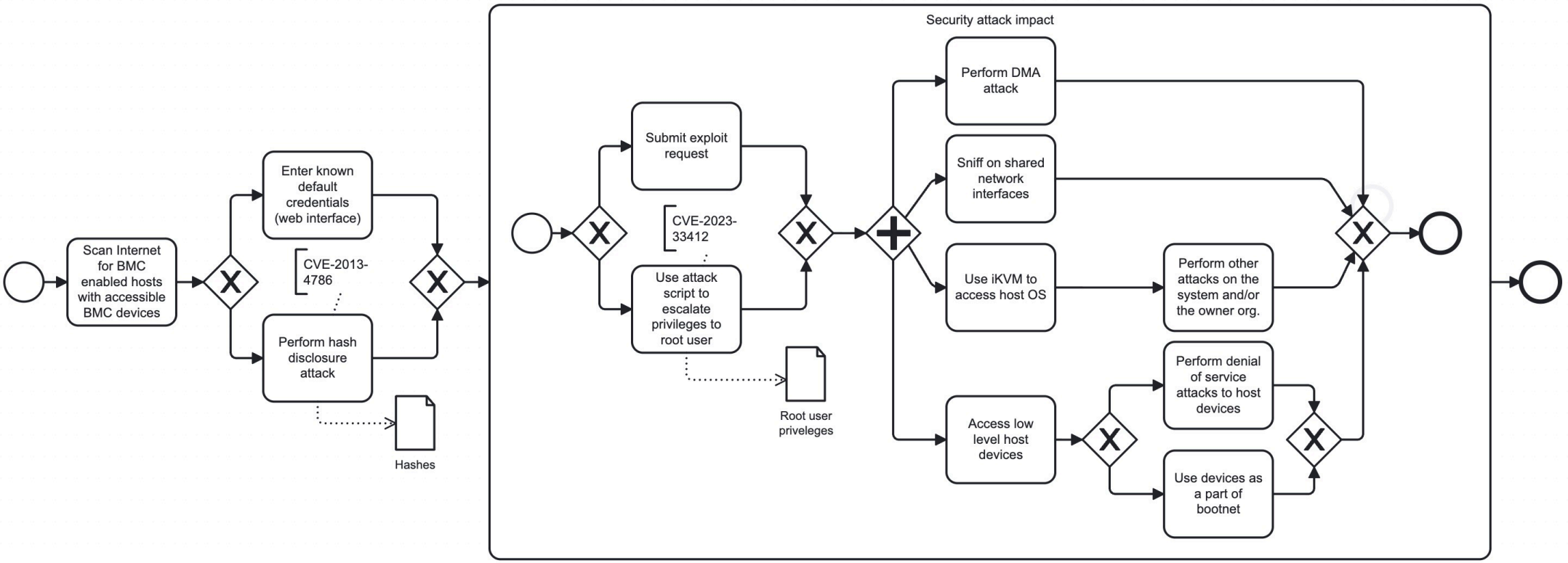

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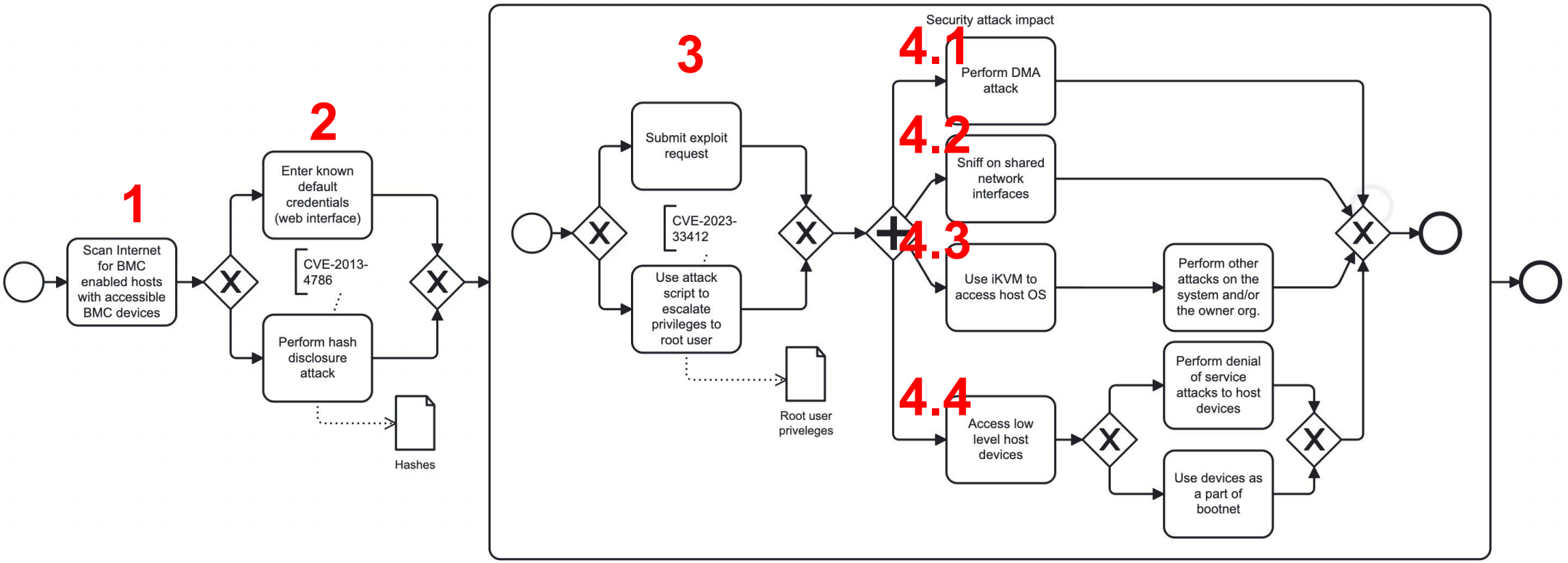

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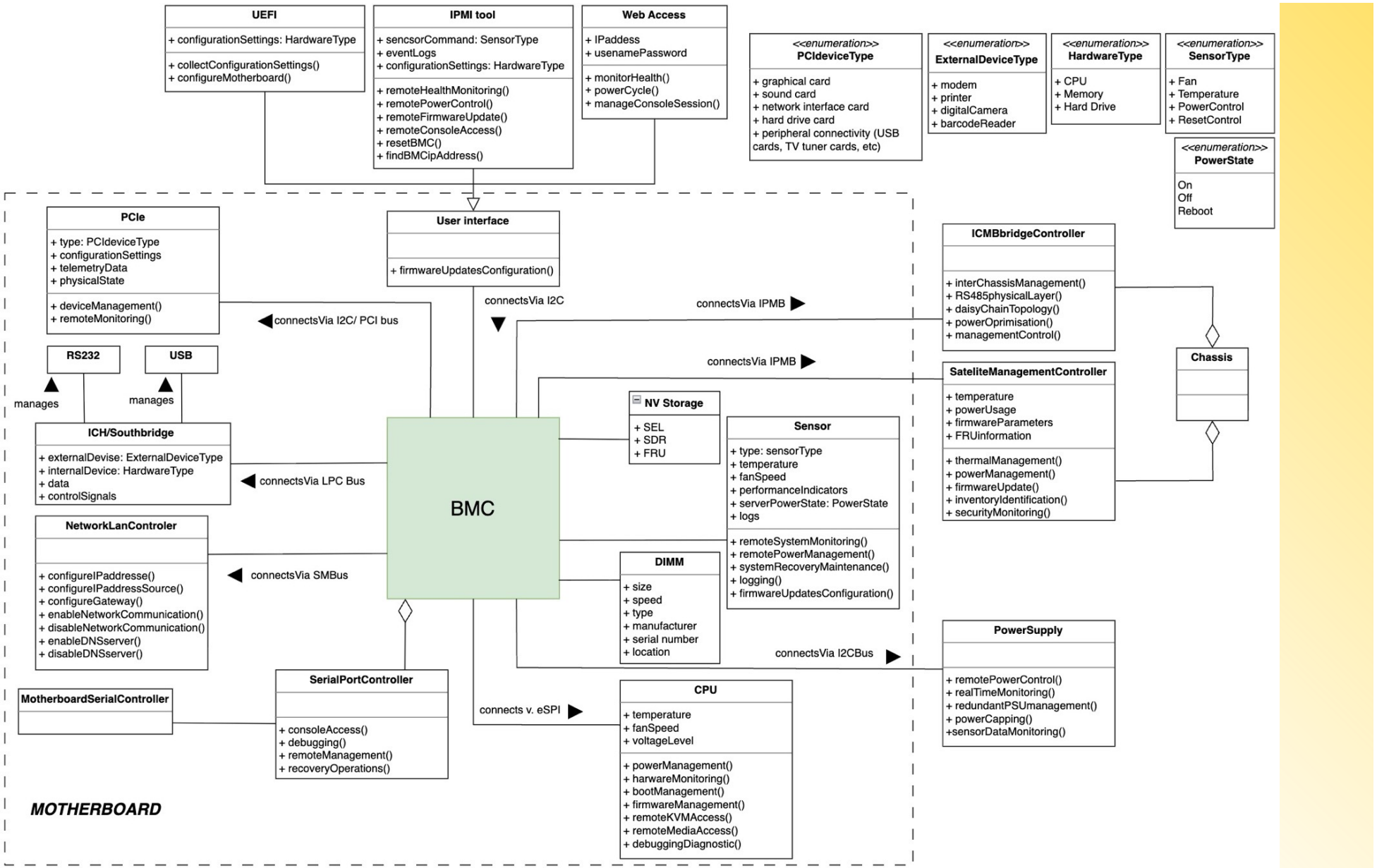
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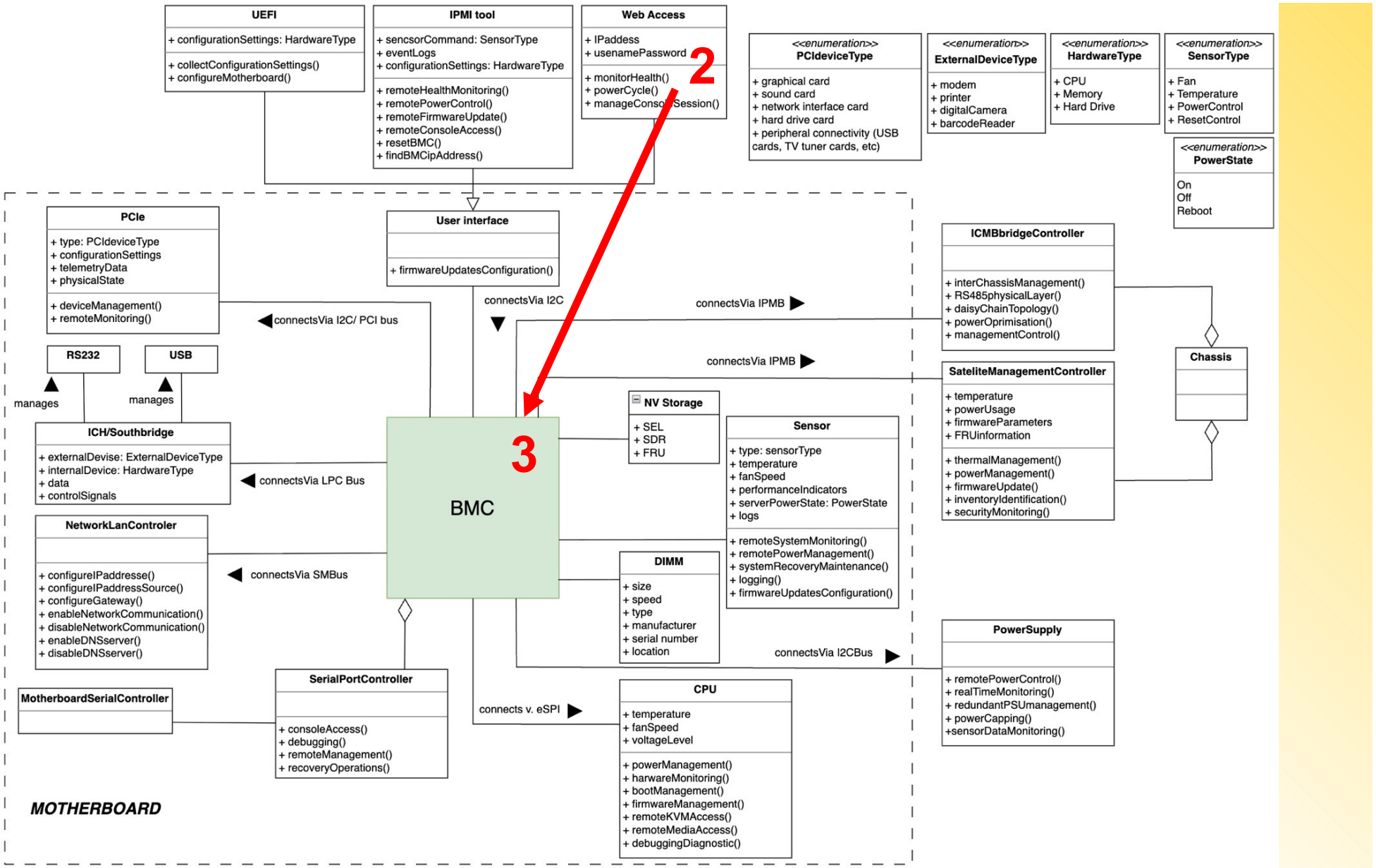
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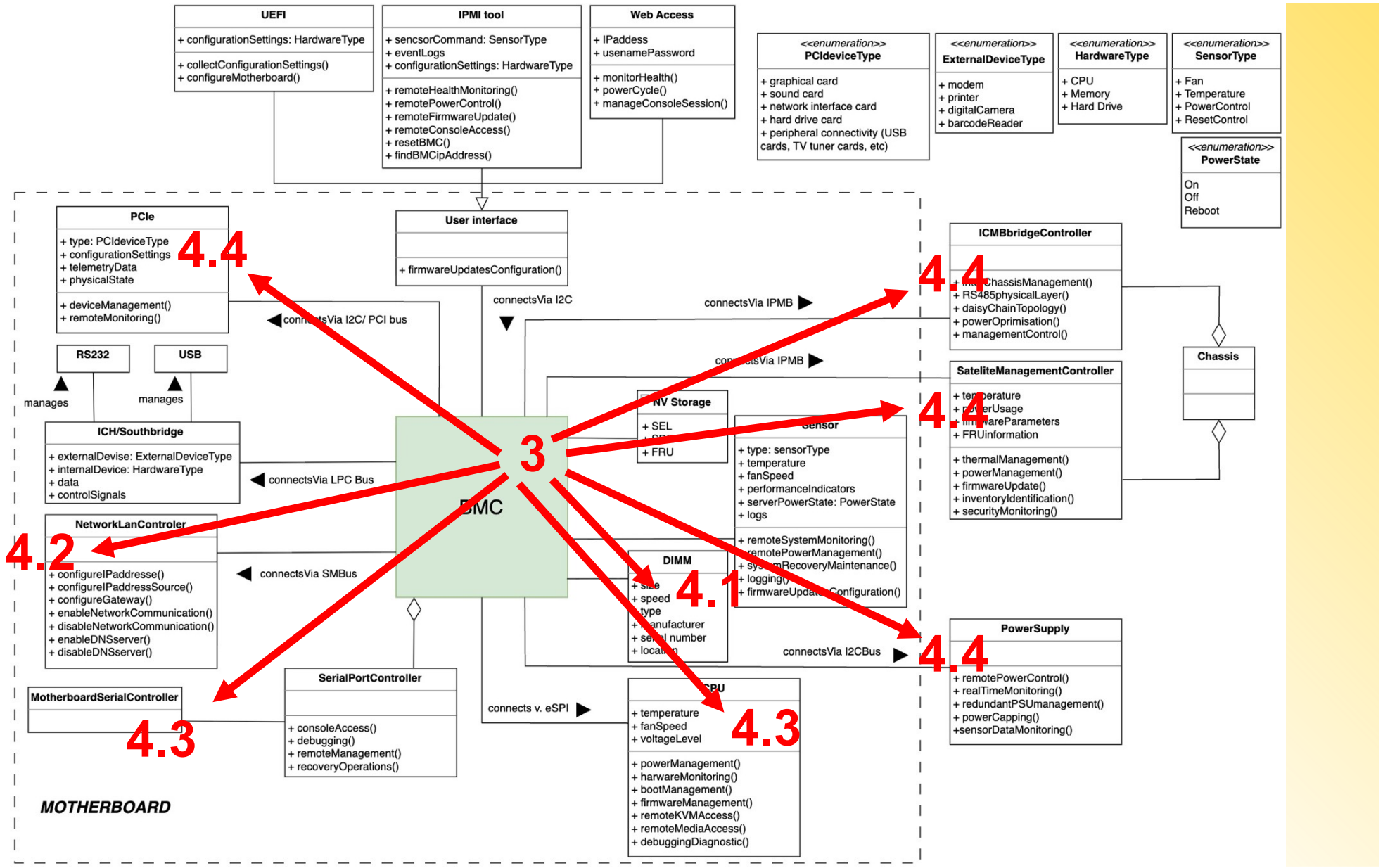
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+ remotePowerControl()
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4.3
MOTHERBOARD

Adversarial Model

Critical assets

Attack Surface Enumeration

Adversarial model

Security Objectives

- Opportunistic Internet-based attack
- Targeted intranet-based attack
- Targeted host-based attack

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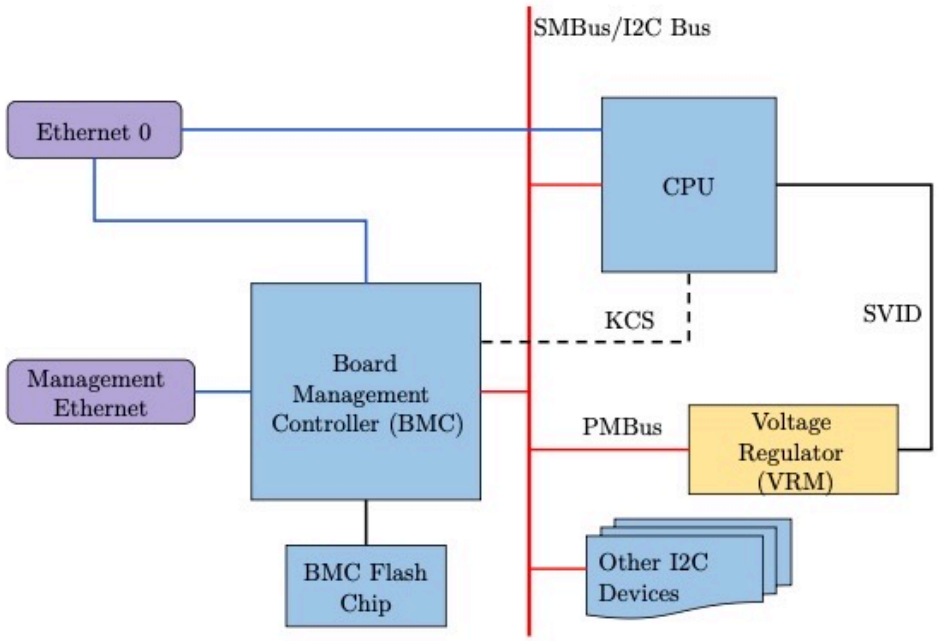
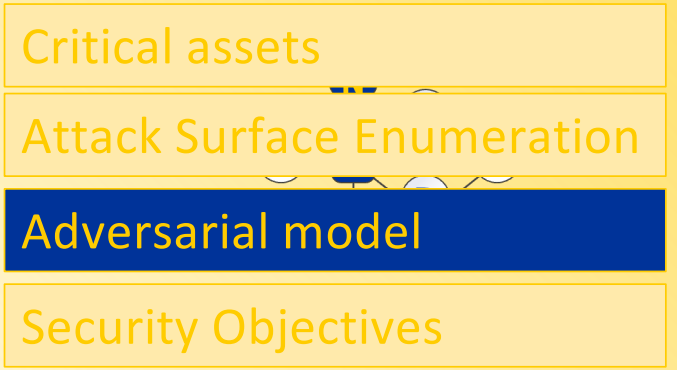
PMFault: Faulting and Bricking Server CPUs through Management Interfaces

- Critical assets
- Attack Surface Enumeration
- **Adversarial model**
- Security Objectives



Chen, Z., & Oswald, D. (2023). PMFault: Faulting and Bricking Server CPUs through Management Interfaces: Or: A Modern Example of Halt and Catch Fire. IACR Transactions on Cryptographic Hardware and Embedded Systems, 2023(2), 1-23.

Adversarial Models



Code problem

Configuration errors

- The latest version is not used
- Encryption configuration
- Authentication configuration
- Communication configuration

Security problems in the BMC architecture

- Potential DMA attack
- The interface has security defects
- Fragile update mechanism

Network Attacks

Software modifications

Attacking Firmware from the Operating System

Hardware Upgrades

Establishing Persistence

Option ROM Attack

Direct Memory Access (DMA)

Processor-Level Vulnerability Exploitation

Device Disabling

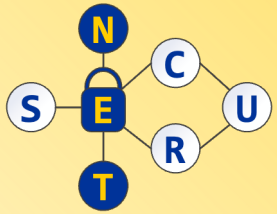
doi: 10.1109/ICET61945.2024.10673073

doi: 10.1109/iThings-GreenCom-CPSCom-SmartData-Cybermatics62450.2024.00026

Security Objectives

- BMC configuration
- Network configuration
- Additional measures

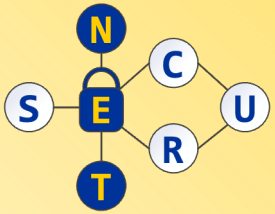
BMC Configuration



- Change the default password during installation
- Create user policies and roles on BMC
- Use the IP Access Policy to enable BMC access from management servers
- Customise notifications and alerts for high-severity event log and maintenance event log entries
- Configure BIOS security features by OOB management
- Configure the BMC management account security feature
- Customise service ports information on the BMC to your data centre specifications
- Configure the BMC lockdown feature

https://www.supermicro.com/products/nfo/files/IPMI/Best_Practices_BMC_Security.pdf

Network and Additional Measures



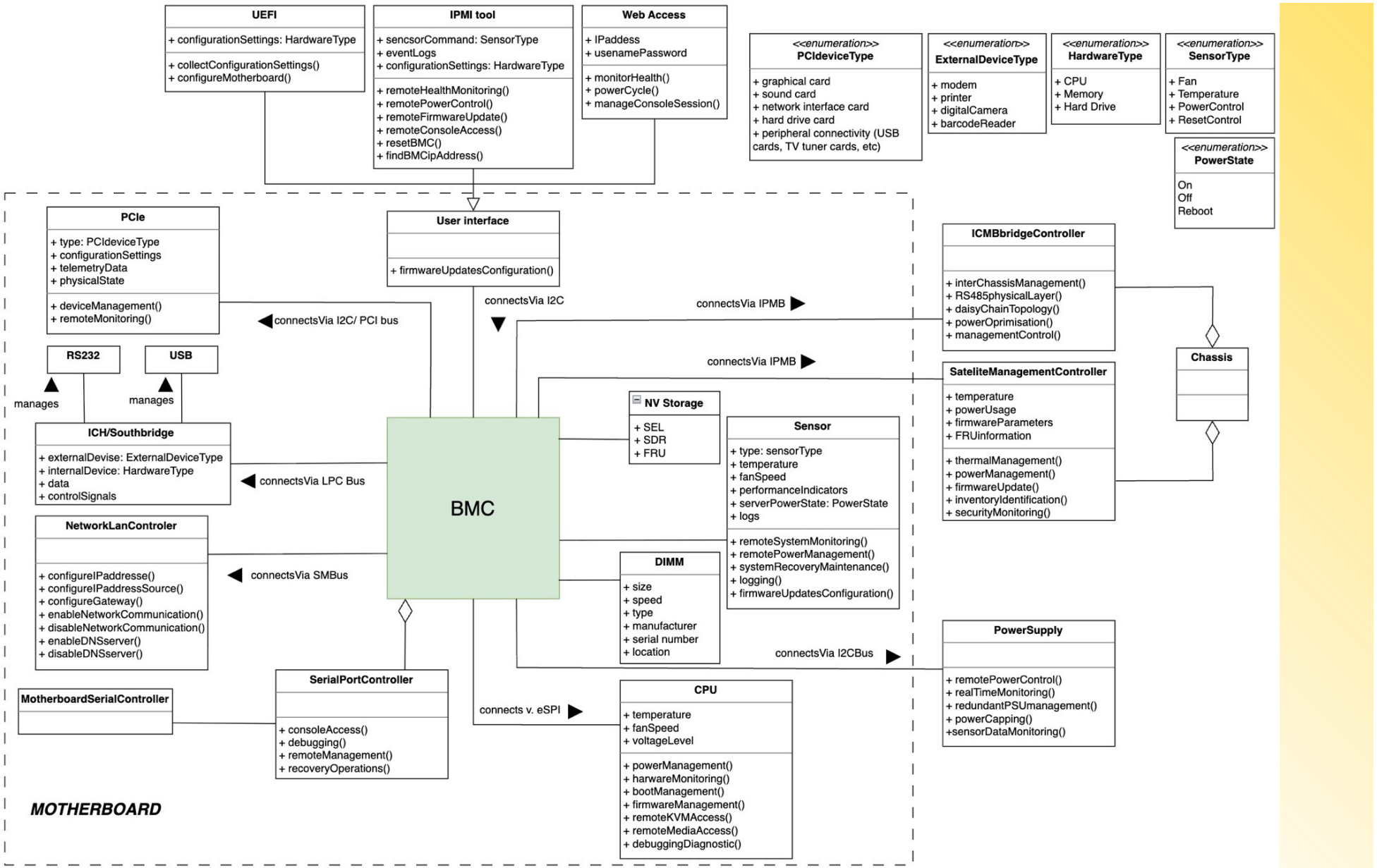
Network configuration

- Restrict inbound traffic over the internet directly to BMCs
- Reserve a special IP address range (private subnets) for BMC management interfaces and management servers
- Configure the firewall to restrict outbound traffic from BMC, including alerts, within the reserved IP range

Additional measures

- Monitor for unusual traffic between BMC and other machines in the network
- Pay attention to firmware release notes
  - Especially related to security fixes
  - Plan upgrades of the firmware during maintenance cycles

https://www.supermicro.com/products/nfo/files/IPMI/Best_Practices_BMC_Security.pdf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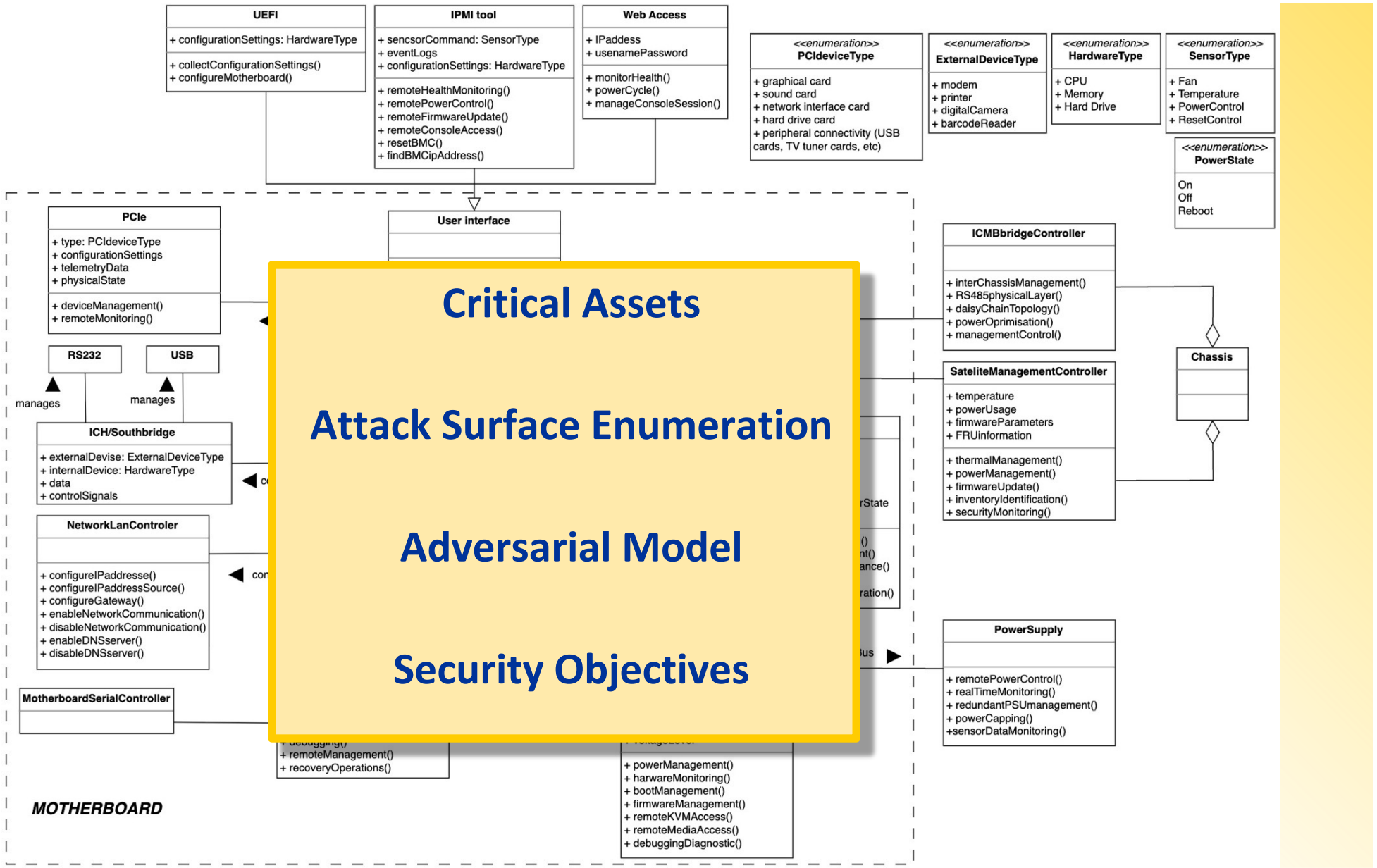
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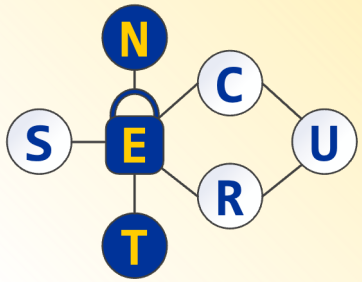

Enhancing Cross-Sectoral Collaboration in Cybersecurity in Estonia, Czechia, Lithuania, Ukraine, and the Netherlands

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