SweGRIDS

DPS2: **Integration effort prediction for asset management data collection**

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Background & Motivation

- Assessing the cyber security of IT and ICS infrastructures is becoming increasingly important because:
  - We greatly depend on such infrastructures (e.g. Internet and Power Grids)
  - The complexity of such infrastructures is increasing
  - The number of IT security issues and cyber-attacks increases
- Opportunity
  - Many common properties exist among different IT and ICS systems

Objective of the project

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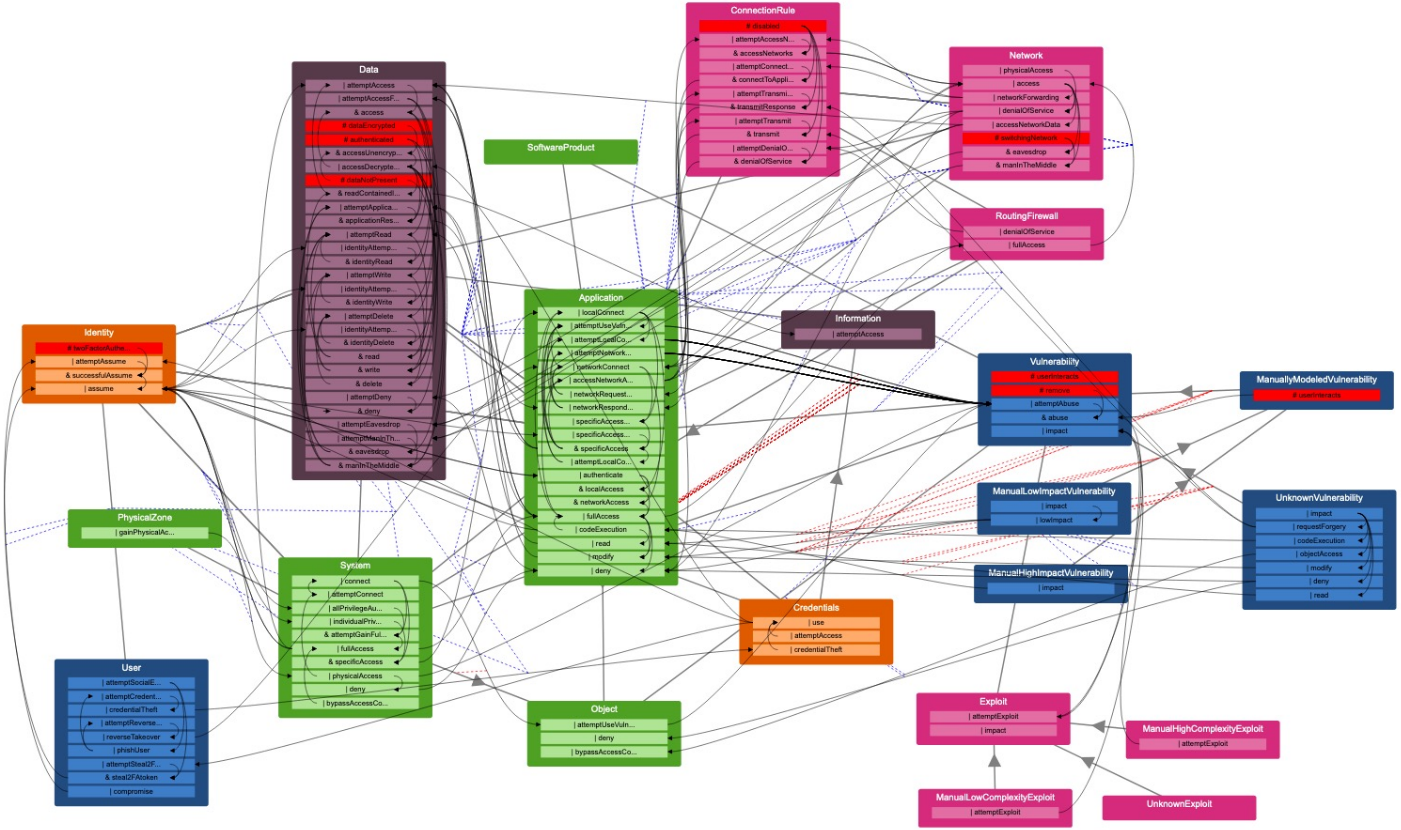
Create Domain Specific Languages (DSLs) for the IT and ICS domains (as well as for subparts of them)

- Using those languages, create models of the real infrastructures
- Simulate cyber attacks and analyse the results
- Facilitate integration efforts and security by design
    - Legitimate operations are also simulated
    - Vulnerabilities will be known at design/testing time

Approach: Using MAL

- MAL (the Meta Attack Language) (https://mal-lang.org)
  - Is a meta-language
    - Is a way to avoid creating new attack graphs for every case
    - Specifies the rules and elements for domain specific languages (DSL)
    - Those are: i) Assets, ii) Attack steps iii) Defenses, iv) Risks
  - Makes modeling of new domains easier & allows reusability of elements
  - Exploits attack graphs and probabilistic simulations

Approach: Using MAL (1/2)



ConnectionRule
# disabled
| attemptAccessN...
& accessNetworks
| attemptConnect...
& connectToAppli...
| attemptTransmi...
& transmitResponse
| attemptTransmit
& transmit
| attemptDenialO...
& denialOfService

Network
| physicalAccess
| access
| networkForwarding
| denialOfService
| accessNetworkData
switchingNetwork
& eavesdrop
& manInTheMiddle

RoutingFirewall
| denialOfService
| fullAccess

Data
| attemptAccess
| attemptAccessF...
& access
# dataEncrypted
# authenticated
& accessUnencryp...
| accessDecrypte...
dataNotPresent
& readContainedI...
| attemptApplica...
& applicationRes...
| attemptRead
| identityAttemp...
& identityRead
| attemptWrite
| identityAttemp...
& identityWrite
| attemptDelete
| identityAttemp...
& identityDelete
& read
& write
& delete
| attemptDeny
& deny
| attemptEavesdrop
| attemptManInTh...
& eavesdrop
& manInTheMiddle

SoftwareProduct

Application
| localConnect
| attemptUseVuln...
| attemptLocalCo...
| attemptNetwork...
| networkConnect
| accessNetworkA...
| networkRequest...
| networkRespond...
| specificAccess...
| specificAccess...
& specificAccess
| attemptLocalCo...
| authenticate
& localAccess
& networkAccess
| fullAccess
| codeExecution
| read
| modify
| deny

Information
| attemptAccess

Identity
# twoFactorAuthe...
| attemptAssume
& successfulAssume
| assume

Vulnerability
# userInteracts
# remove
| attemptAbuse
& abuse
| impact

ManuallyModeledVulnerability
# userInteracts

ManualLowImpactVulnerability
| impact
| lowImpact

UnknownVulnerability
| impact
| requestForgery
| codeExecution
| objectAccess
| modify
| deny
| read

ManualHighImpactVulnerability
| impact

PhysicalZone
| gainPhysicalAc...

System
| connect
| attemptConnect
| allPrivilegeAu...
| individualPriv...
& attemptGainFul...
| fullAccess
& specificAccess
| physicalAccess
| deny
| bypassAccessCo...

Credentials
| use
| attemptAccess
| credentialTheft

User
| attemptSocialE...
| attemptCredent...
| credentialTheft
| attemptReverse...
| reverseTakeover
| phishUser
| attemptSteal2F...
& steal2FAtoken
| compromise

Object
| attemptUseVuln...
| deny
| bypassAccessCo...

Exploit
| attemptExploit
| impact

ManualHighComplexityExploit
| attemptExploit

ManualLowComplexityExploit
| attemptExploit

UnknownExploit

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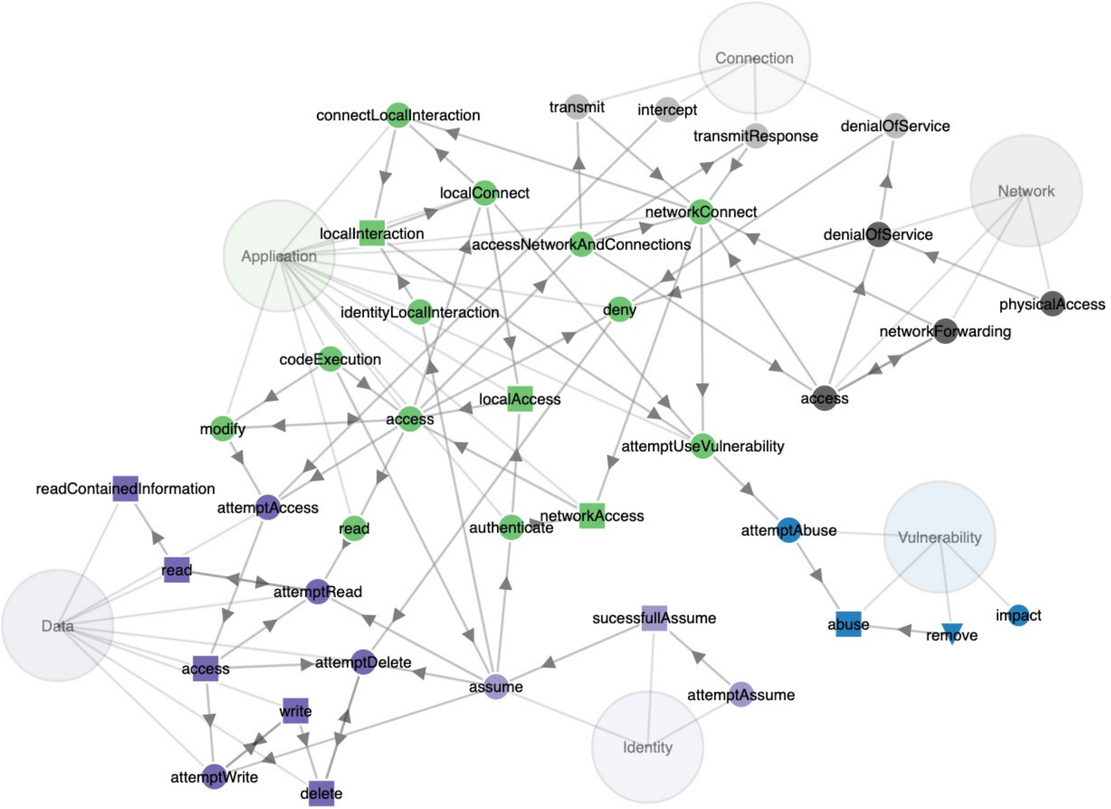
Approach: Using MAL (2/2)



Results: Work so far

- **Research Communities in Cybersecurity**: A Comprehensive Literature Review
- **archiLang**: A prototype for transforming ArchiMate models to MAL instances
- **coreLang**: A MAL-based DSL for the generic IT domain is already developed
  - Publicly available on GitHub at: https://github.com/mal-lang/coreLang
- **icsLang**: A MAL-based DSL for the ICS domain is under active development
  - Also available on GitHub at: https://github.com/mal-lang/icsLang

Future work:

- Evaluation methodology for MAL-based DSLs and application on coreLang
- "Dynamic MAL": Use of Dynamic Programing on MAL models to optimize the attacker's value from attacking a system
- A MAL-based DSL for smart buildings and cities (Thesis project under supervision)

Thank you for your time!

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Visit: https://www.kth.se/profile/sotkat

Or contact me at sotkat@kth.se!