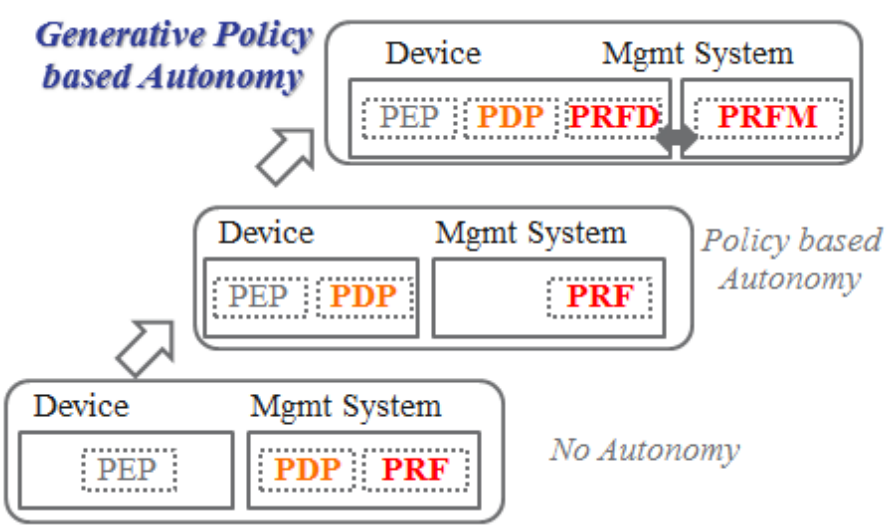
A Cognitive Policy Framework for Next-Generation Distributed Federated Systems

Elisa Bertino (Purdue University), **Seraphin Calo** (IBM Research), **Maroun Touma** (IBM Research), **Dinesh Verma** (IBM Research), **Christopher Williams** (DSTL), Brian Rivera (ARL)

Goal

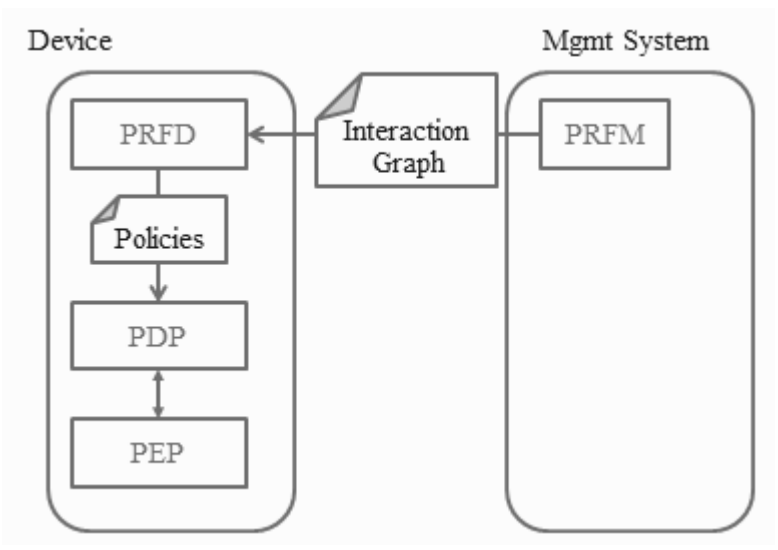
Create intelligent systems that leverage increased processing power to generate autonomic management policies

Generative Policy based Autonomy



Main Challenge
How to guide the policy generation process

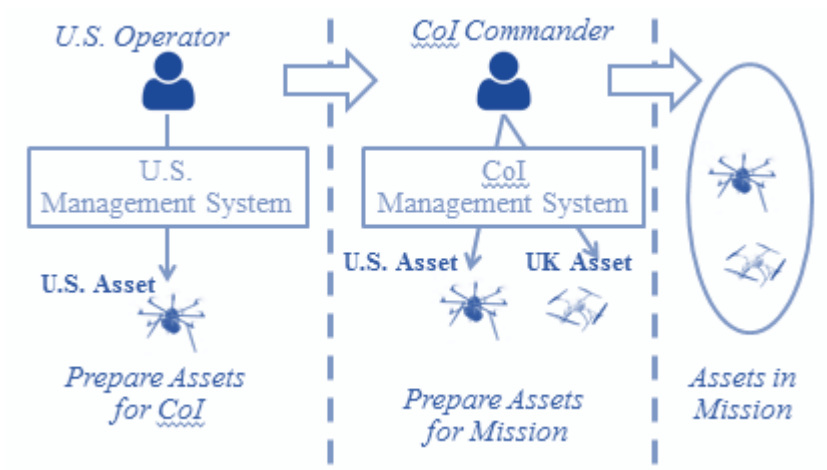
Interaction Graph (IG)



An IG provides a managed device *D* with information on:

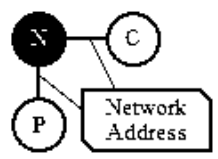
(i) the other types of devices *D* would encounter;
(ii) the attributes expected from these devices;
(iii) how these devices should be authenticated.

Scenario: Software Defined Coalitions (SDC)



Autonomic Authorization in SDC

- Roles
  - N: this device
  - P: Peer device
  - C: Coalition device
- Grammar
  - Access to services in different roles
- Access Control
  - Discover devices and grant access as needed



N-P Link Grammar

S→ allow **X** access to **U**
U→ {$R_1, R_2, \ldots R_N$}
X→ *v(Network-Address)*

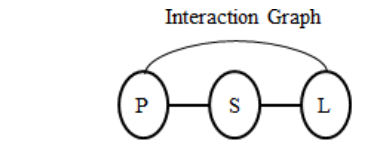
N-C Link Grammar

S→ allow **X** access to **V**
V→ {$R_1, R_2, \ldots R_M$}
X→ *v(Network-Address)*

Assume each device has a set of resources/services

Fault Management in SDC

- Roles
  - P: Surveillance
  - S: Scout
  - L: leader
- Grammar
  - Access to services on a drone
- Discover devices and grant access as needed
- Leader assigns roles



P – Peer/Surveyor
S – Scout
L - Leader

P-S Link Grammar

S→ allow **X** access to **U**
U→ {**R**}
X→ *v(Identity)*

S-L Link Grammar

S→ allow **X** access to **U**
U→ {**Q**, **T**, **V**}
X→ *v(Identity)*

P-L Link Grammar

S→ allow **X** access to **U**
U→ {**Q**, **V**}
X→ *v(Identity)*

V – Role assignment service
R – Route Status service
Q – Route Control service
T – Surveillance Status service

Conclusions

- A simple but powerful architecture
  - Allows manager control over what types of policies are generated
  - Allows the definition of roles and what to do for devices in different roles
- Each device
  - Needs a discovery process for other devices in different roles
  - Generates policy grammars for each discovered device

Distributed Analytics and Information Science International Technology Alliance
Annual Fall Meeting, September 2017