Coalition Situational Understanding Using a Vector Symbolic Architecture

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Challenge

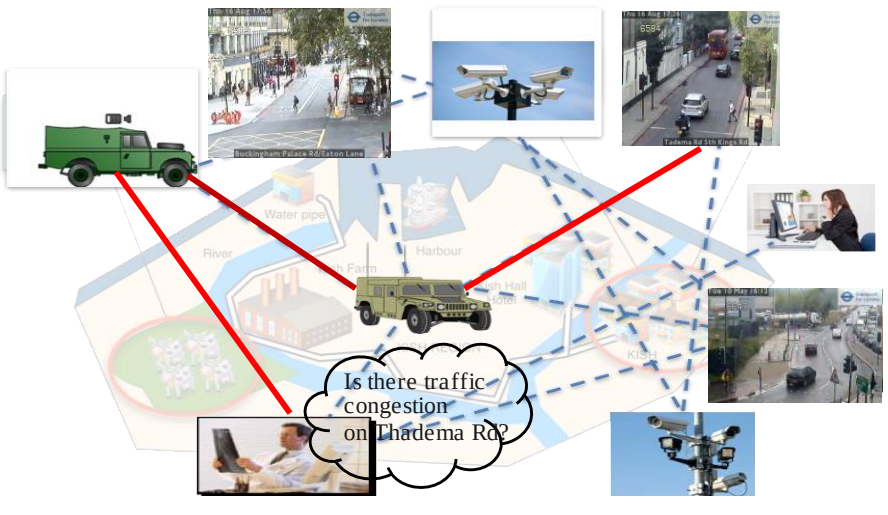
The problem of coalition situational understanding (CSU) involves the utilization of distributed sensors and services that are maintained by multiple partner organizations to build a picture of the current state of the world and predict future states. The ultimate goal is to have networks of coalition service elements that can automatically configure themselves together to perform analysis tasks based on user specified goals.

Joint P4/P5 Demonstration

In this demonstration, we take prior P5 work that tackles an applied CSU problem of traffic monitoring and show that the proposed solution can be facilitated by work that uses P4 work on vector symbolic representations for the distributed resources to automatically construct abstract service pipelines and perform discovery of appropriate service instances. Specifically, we show how Node-RED can be VSA enabled to semantically describe and cognitively wrap the existing services and how the constructed workflow vector is used to orchestrate service discovery and execution of the workflow across distributed resources.

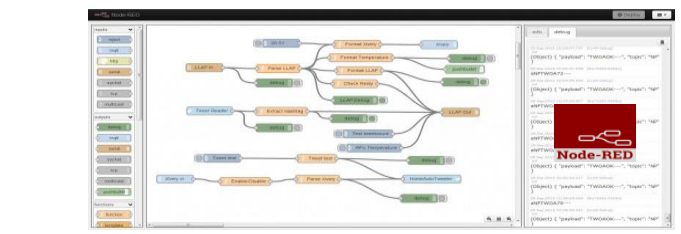
Scenario

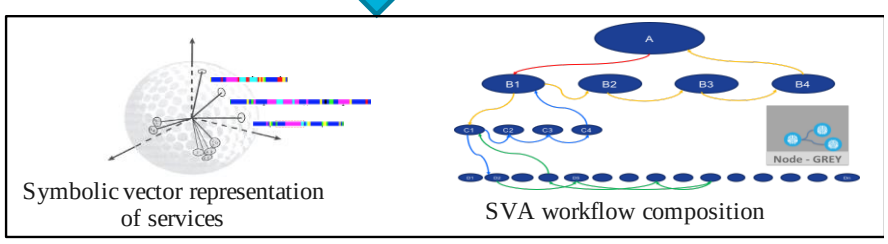
The scenario assumes sensors (TfL cameras) and the processing resources required are owned by multiple coalition partners. All discovery and processing is performed peer-to-peer with no central point of control.



Auto Generation of VSA Workflow from Node-Red

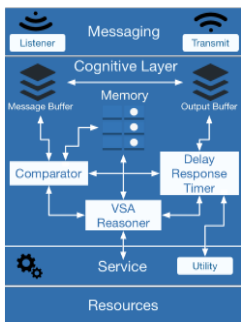
Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click. Currently Node-RED manages the flows centrally.



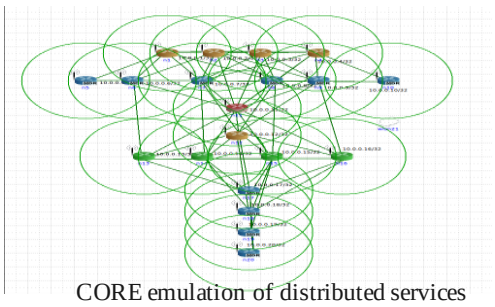


Symbolic vector representation of services

SVA workflow composition



Cognitive wrapping of existing services and resources



CORE emulation of distributed services

Our VSA enabled Node-Red generates the required symbolic vectors which are used to orchestrate the traffic congestion in a CORE emulation of distributed sensors and analytic services operating in a wireless network.

Future Work

The demonstration is a major step towards our goal of fully self-describing services and data using symbolic vector representations that enable alternative service compositions to be automatically constructed and orchestrated to perform tasks specified at higher levels of semantic description.

Distributed Analytics and Information Science International Technology Alliance
Annual Fall Meeting, September 2018