FFI Forsvarets forskningsinstitutt

Semantically Enabled QoS Aware Service Discovery and Orchestration for MANETs

15th ICCRTS

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Background

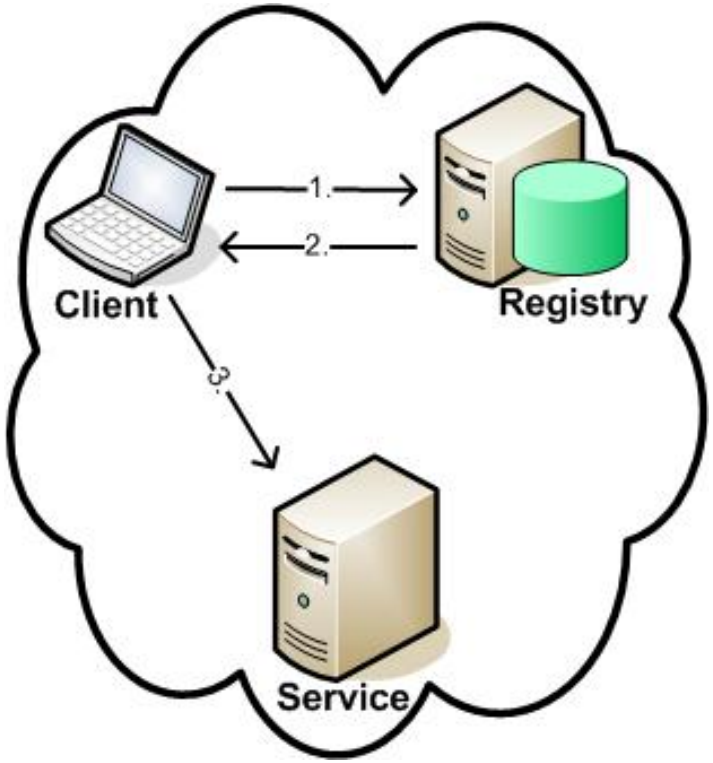
- SOA, implemented as Web services, is a key enabler for NEC
- The ability to find services dynamically is a requirement
  - but challenging in dynamic settings
- At the same time, we need flexibility
  - clients must be able to access information in a manner that is suited to their needs and abilities

Background

- To achieve this we need:
  - a service discovery mechanism
  - support for automatic service selection and orchestration
  - support for QoS

- Combining all these needs raises a number of issues:
  - Semantic Web Services give flexibility, but are verbose
  - Tactical military networks have limited capabilities

Service Registries

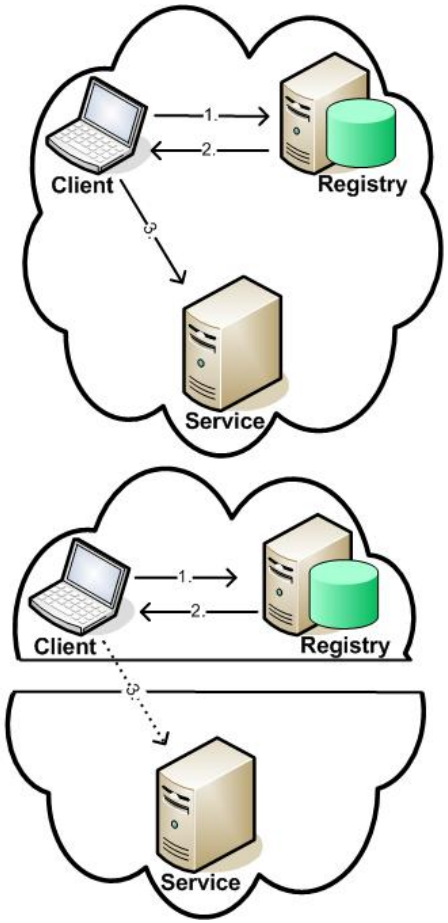


Communication between client, registry and service:

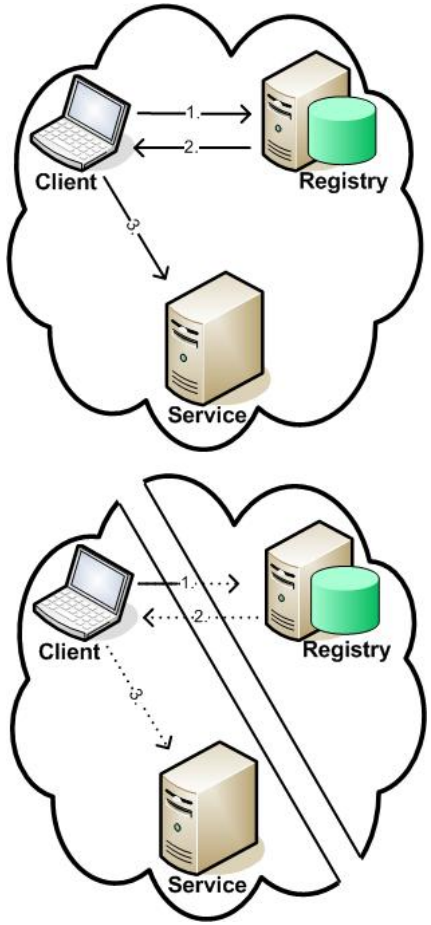
1. Look-up/Search
2. Response
3. Contacting the service

Service Registries

The liveness problem



The availability problem



Non-registry solutions

- Fully decentralized mechanism:
  - Robustness: Resilience to partial failure of the network.
  - Liveness: An up to date view of available services.
- Decentralized solutions are “chatty”:
  - Need to optimize data rate requirements!
    - Compression etc.

SAM

- Service Advertisements in MANETs (SAM)
  - Advertisements of available Web services
  - Support for additional metadata
  - Bandwidth efficient:
    - only transmits information that changes over time
    - static information is assumed to be pre-distributed

SAM Service Advertisements

- Advertisements contain the following data:
  - Position information (optional)
  - A list of services containing:
    - Service ID (required)

      A hash over the static parts of a WSDL
    - Endpoint URL (required)

      The dynamic part of the WSDL, i.e. service endpoint
    - Metadata (optional)

      Semantic data, etc.

Service Selection Challenges

- Operations vary in complexity
  - the number of units and their capabilities are difficult to predict.
- Different clients will use the same service in different ways
  - to define these differences we use QoS as a selection parameter

QoS in Mobile Services

- We divide QoS for mobile service in:
  - Static QoS
    - parameters that do not change
    - e.g. max resolution of an image
  - Dynamic QoS
    - parameters that can change
    - e.g. position of camera (mounted on a UAV)

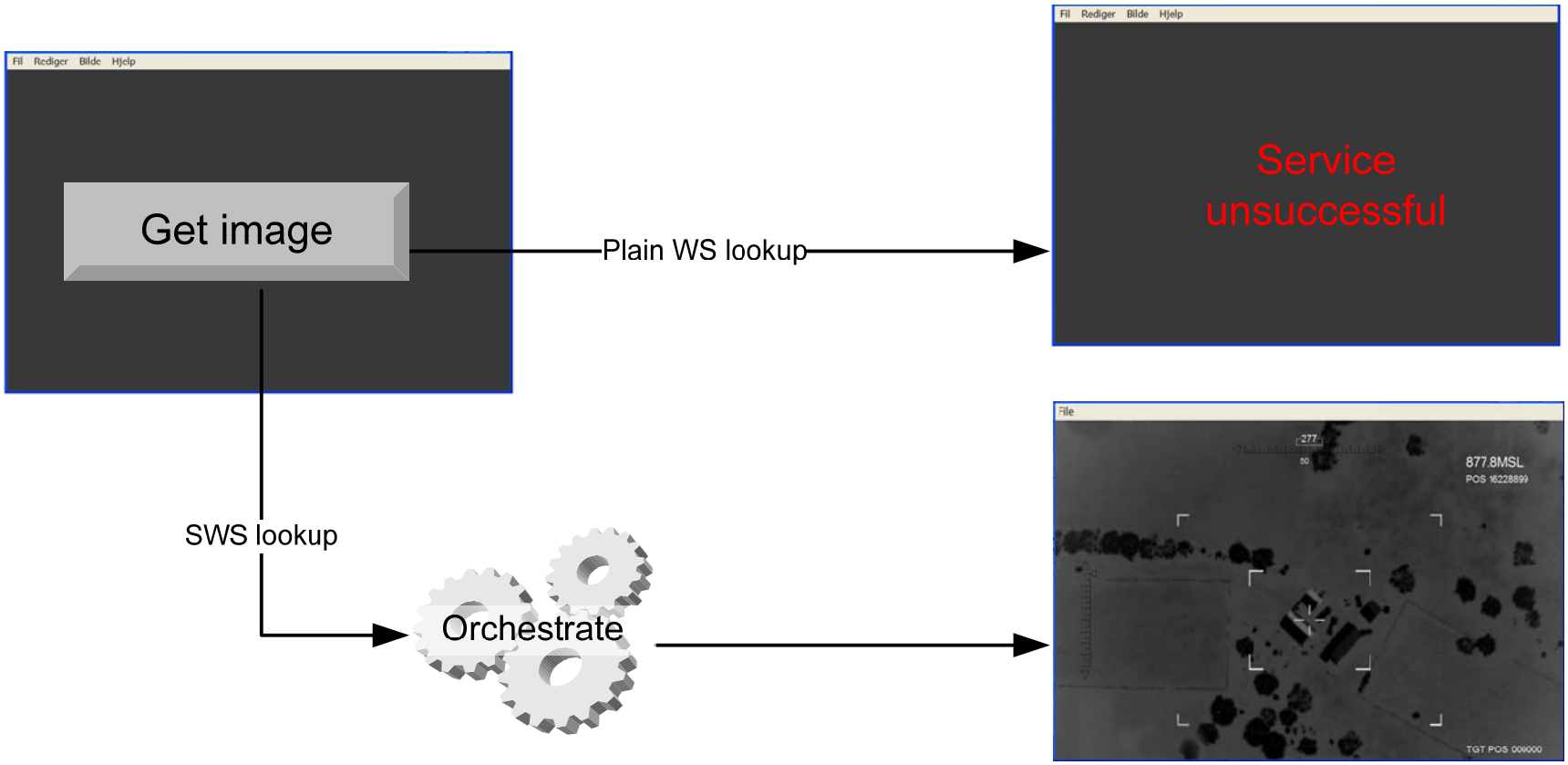
- This requires an extended service description

Semantic Web Services in MANETs

- Web Services give:
  - manual selection of service type
  - best case: dynamically finds instances of known types
- Semantic Web Services give:
  - dynamically discover both service types and instances
  - dynamic orchestration
  - automated selection of instances

- OWL-S is a service ontology defined using OWL
  - We use a subset of OWL-S with a extended QoS description

Experimental Implementation



Conclusion and Future Work

- An experimental QoS aware semantically enabled service environment with:
  - SAM service advertisement distribution in dynamic networks
  - LiQ service discovery, selection and orchestration using semantic technology
  - Both aimed at non-register solutions

- Future work encompass
  - defining a further concepts in our QoS ontology
  - implementation of the QoS algorithm
  - further work on different degrees of matching