Multi-Agent MicroServices (MAMS)

Associate Professor Rem Collier

UCD School of Computer Science, Ireland

University College Dublin
Ireland's Global University

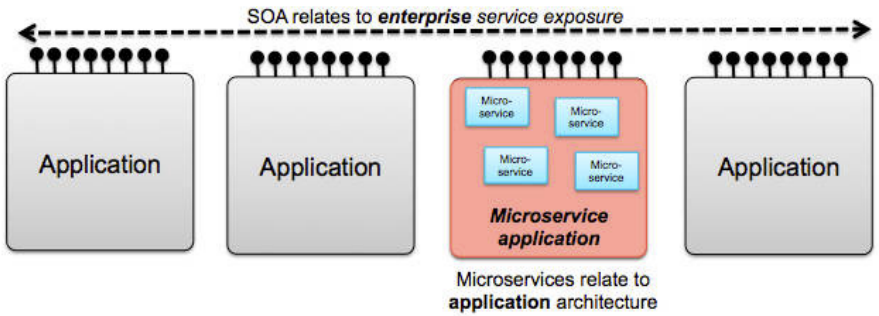
Modern Software Practice…

- Microservices are:

  "an approach to developing a single application as a suite of small services, each running in its own process and communicating with lightweight mechanisms, often an HTTP resource API"

  Martin Fowler, 2014

- Microservices is **Service Oriented Architecture** applied at the **application level** rather than the **enterprise level**.



- Microservices does not rely on a single API style
  - SOAP, REST, JMS, gRPC, ...

An Observation

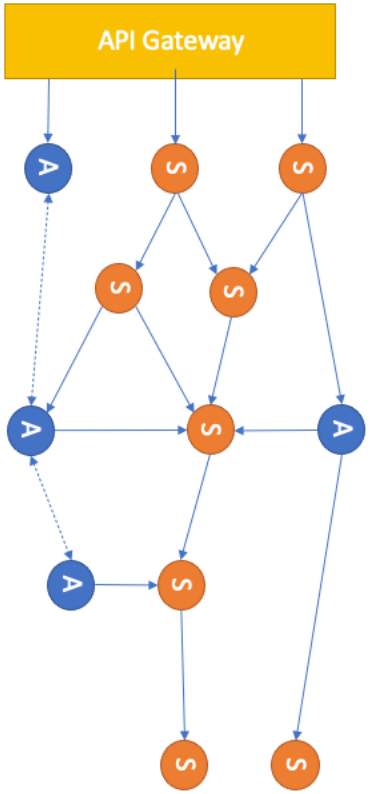
- *"A **Multi-Agent System** is a computer system that is composed of **multiple computational entities**, that **interact** with one another in order to solve problems that are **beyond their individual capabilities**."*

- *"A **Microservices-based System** is a computer system that is composed of **multiple services** that **interact** with one another to deliver a set of business processes that **span multiple individual services**…"*

Multi-Agent MicroServices (MAMS)

(Collier et al., 2019)

- Approach for embedding MAS technologies within microservices architecture.
  - Enable integration between plain-old microservices (POMS) and agent-oriented microservices (AOMS) **without** the need to learn MAS concepts.
- Adopts view of agents as hypermedia entities.
  - Agents have hypermedia bodies that are modelled as a set of resources.
  - External systems interact with MAMS agents through those exposed resources.
  - Agents also given the tools needed to interact directly with other hypermedia resources.
- The AOMS becomes a **black box** to the external services.



Agents as Microservices

- Two conceptual deployment styles:

One agent per service (container).

Multiple Agents per service (container)

Agents as Microservices

- Two conceptual deployment styles:

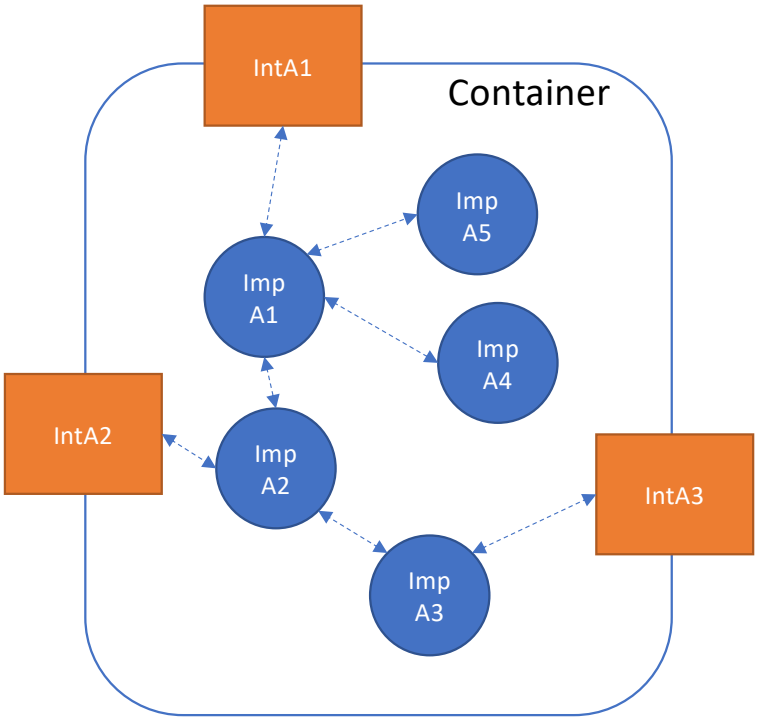
One agent per service (container).

Multiple Agents per service (container)

Co-Location to handle chattiness

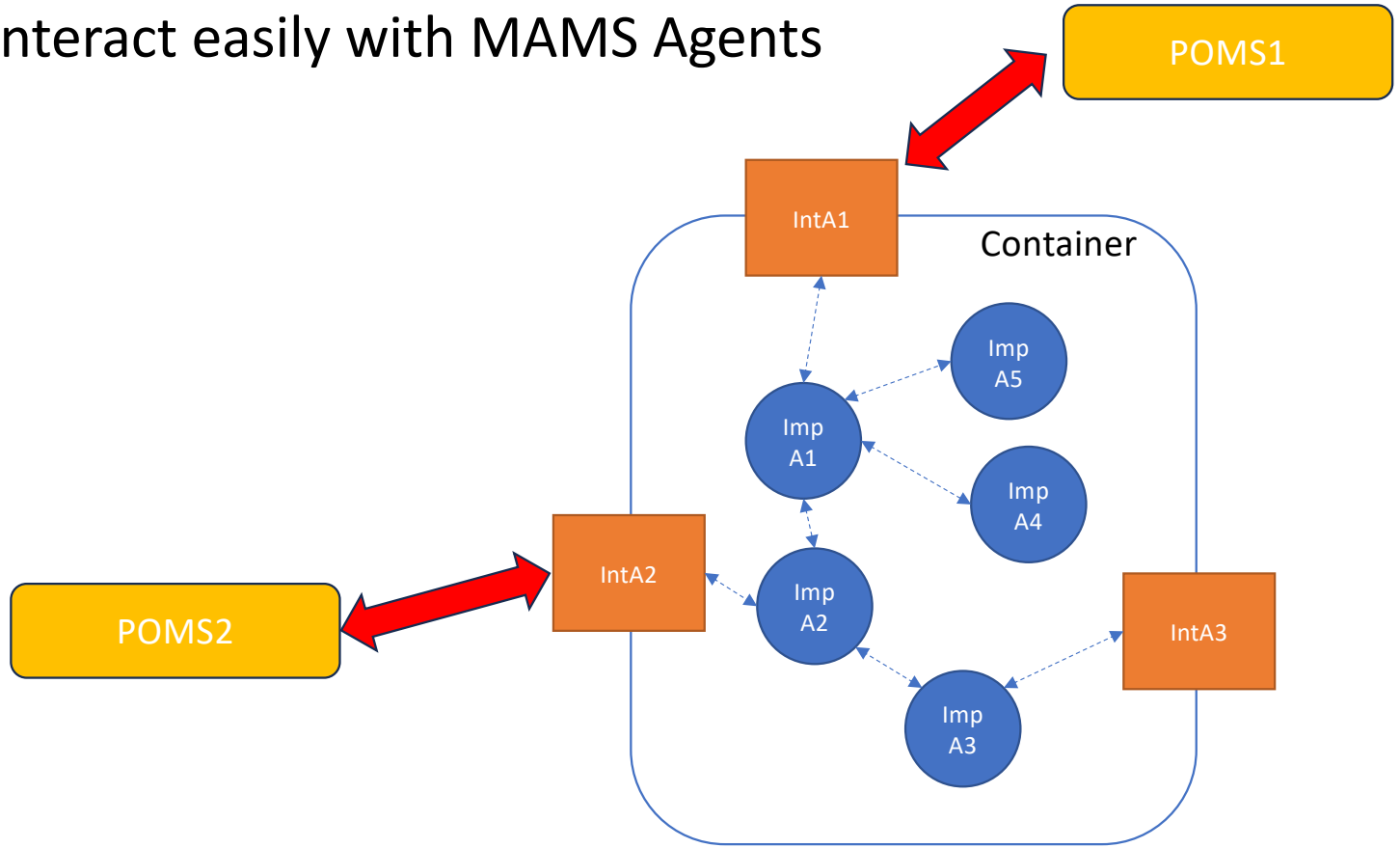
MAS in a Box…

- MAMS allows both Interface (External) agents and Internal agents



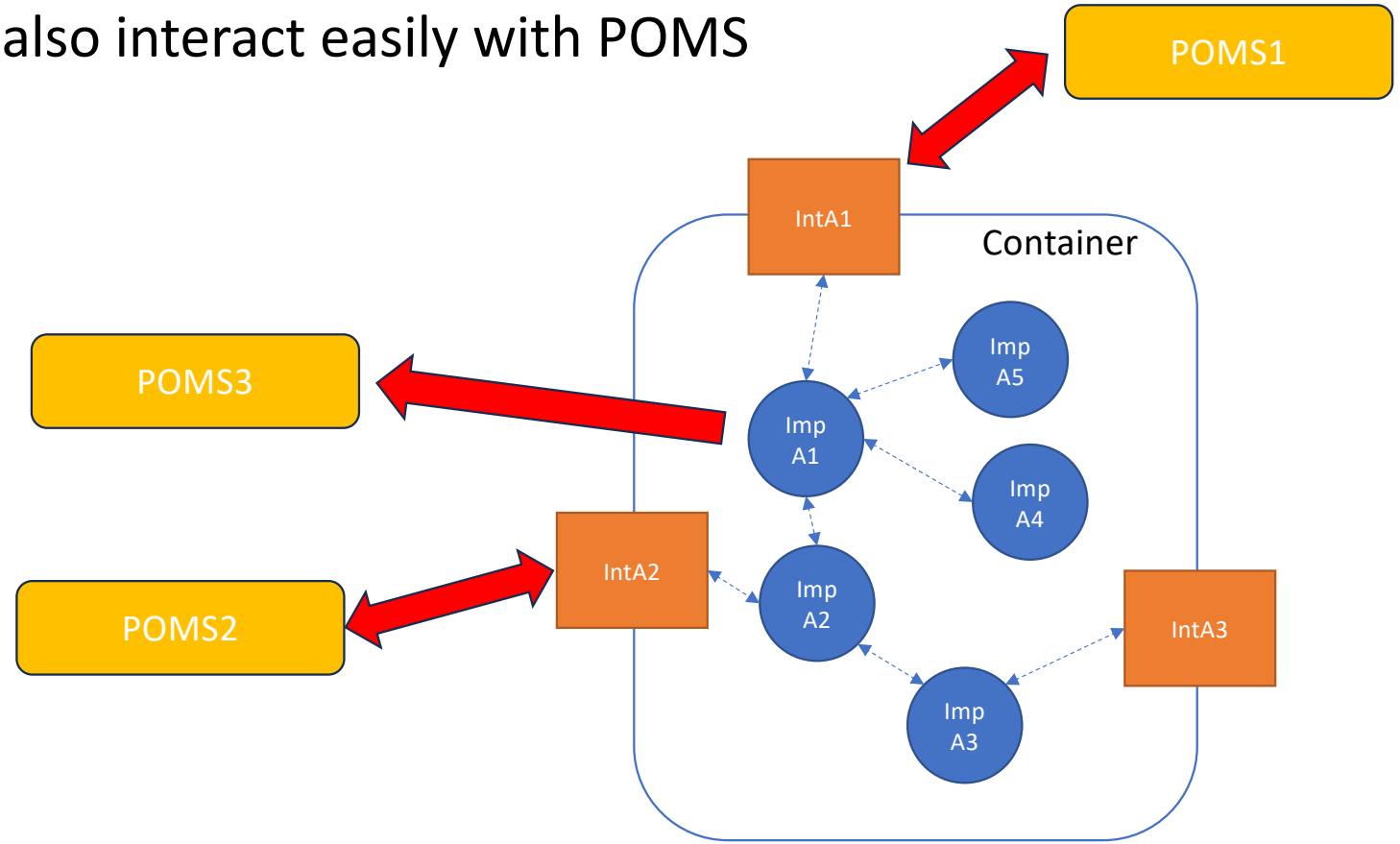
MAS in a Box…

- External Services can interact easily with MAMS Agents



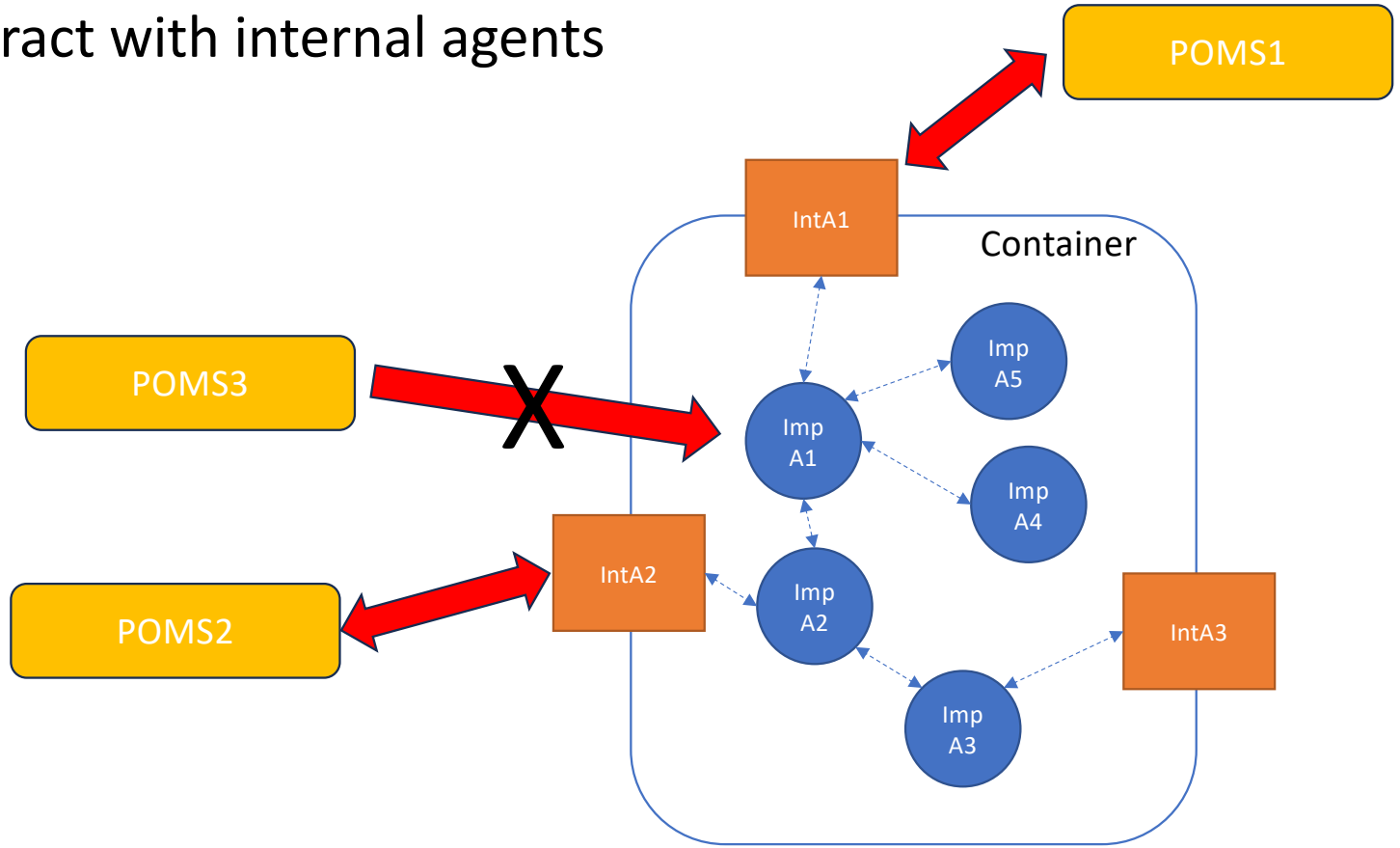
MAS in a Box…

- All MAMS Agents can also interact easily with POMS



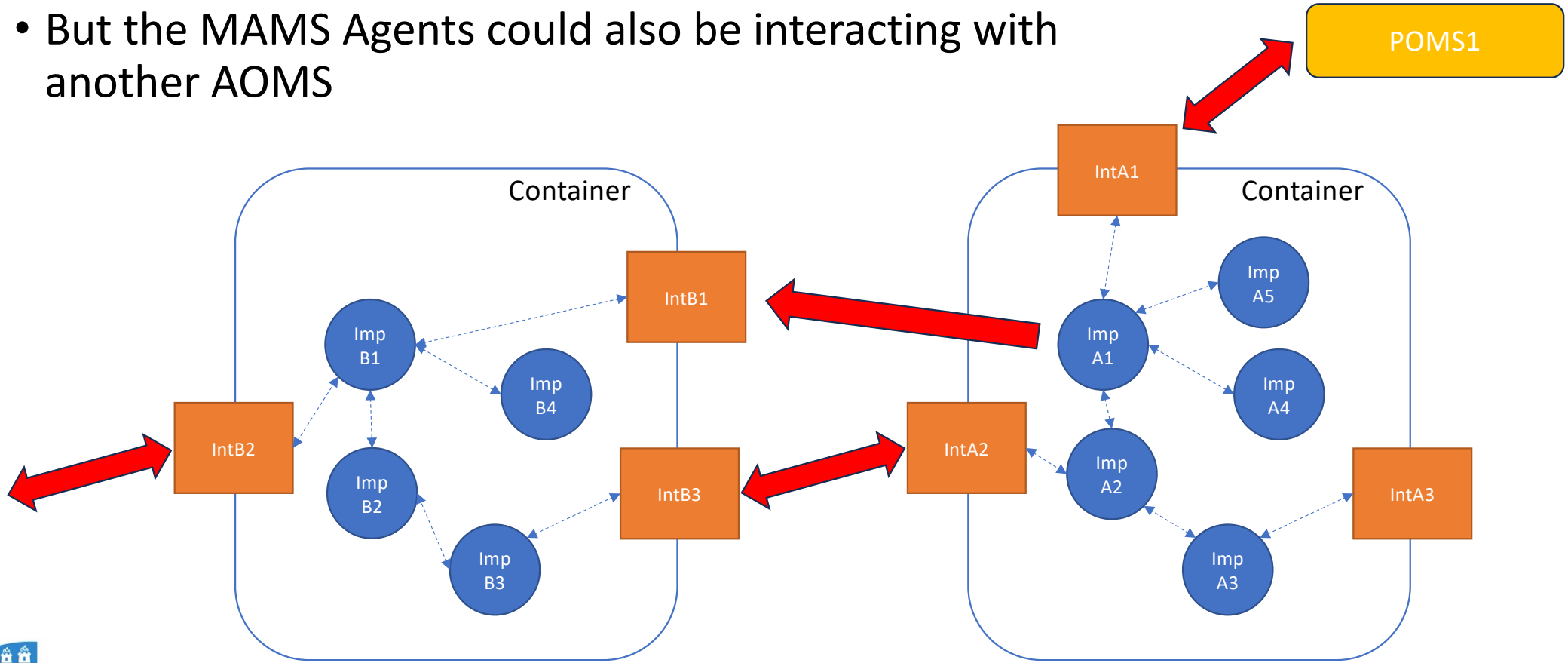
MAS in a Box…

- But POMS cannot interact with internal agents



MAS in a Box…

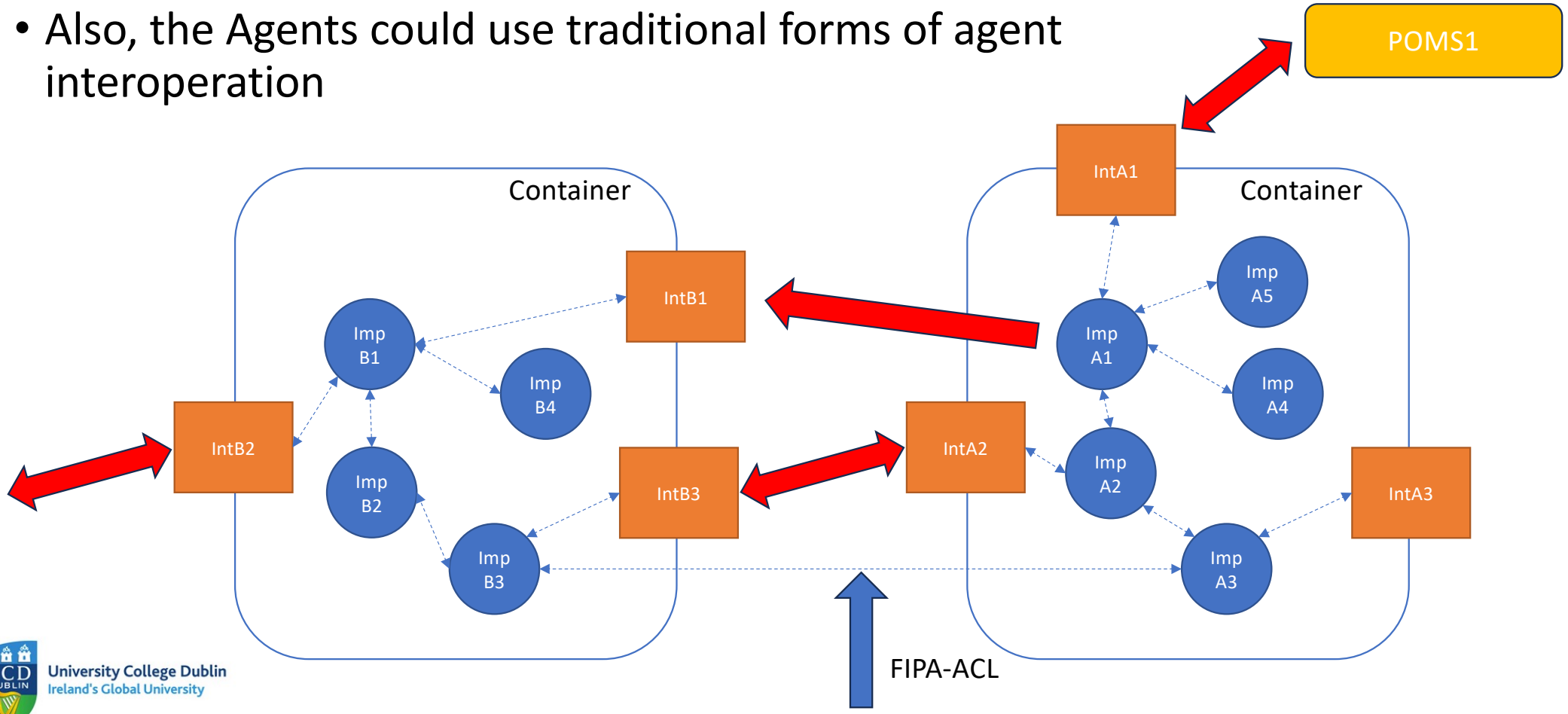
- But the MAMS Agents could also be interacting with another AOMS



University College Dublin
Ireland's Global University

MAS in a Box…

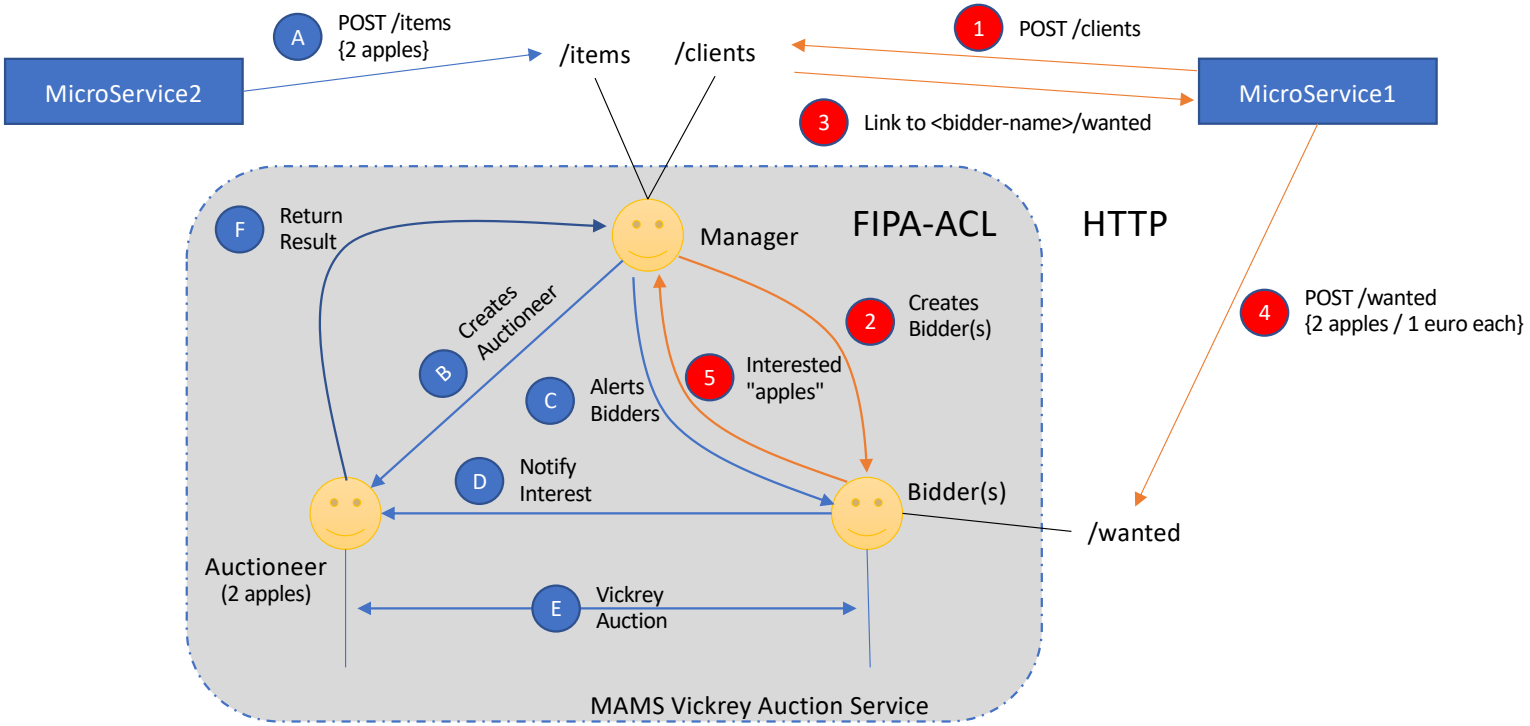
- Also, the Agents could use traditional forms of agent interoperation



University College Dublin
Ireland's Global University

Demo: First Price Auction

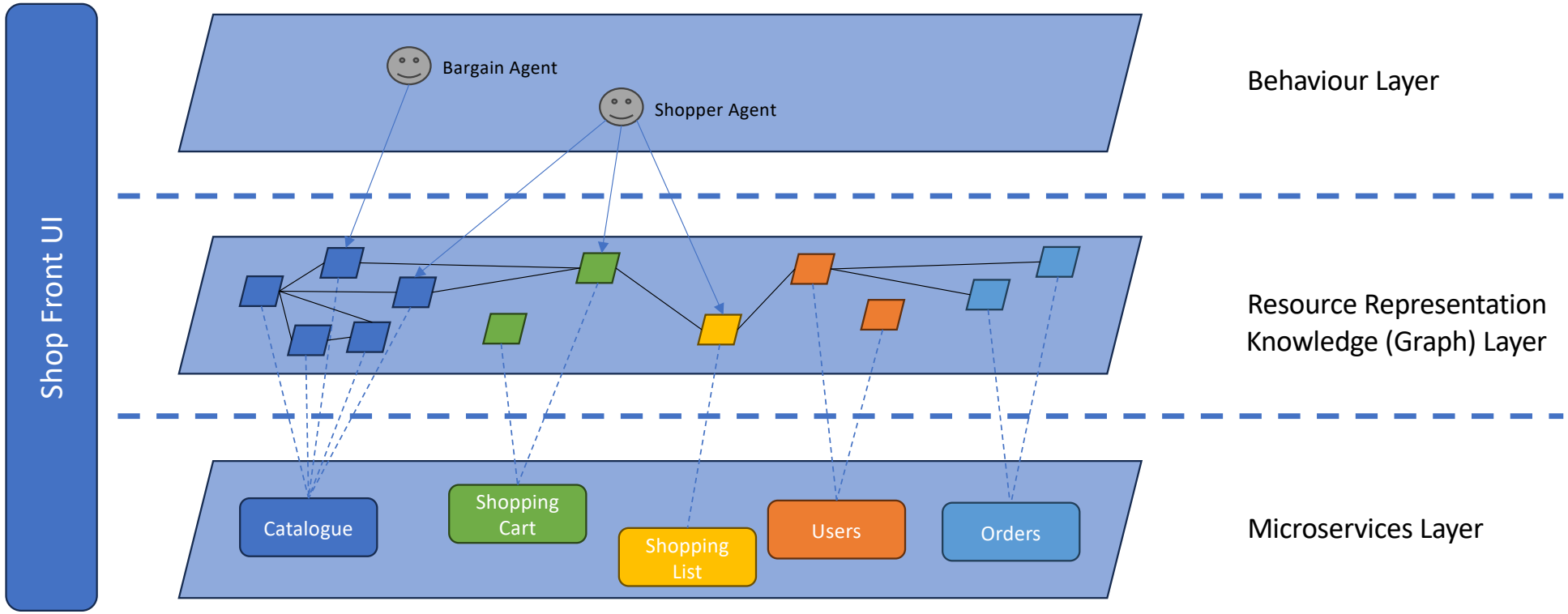
Demo: First Price Auction



University College Dublin
Ireland's Global University

Applying MAMS

Applying MAMS



Thank You!

Questions?

University College Dublin
Ireland's Global University