Agility through Automated Negotiation for C2 Services

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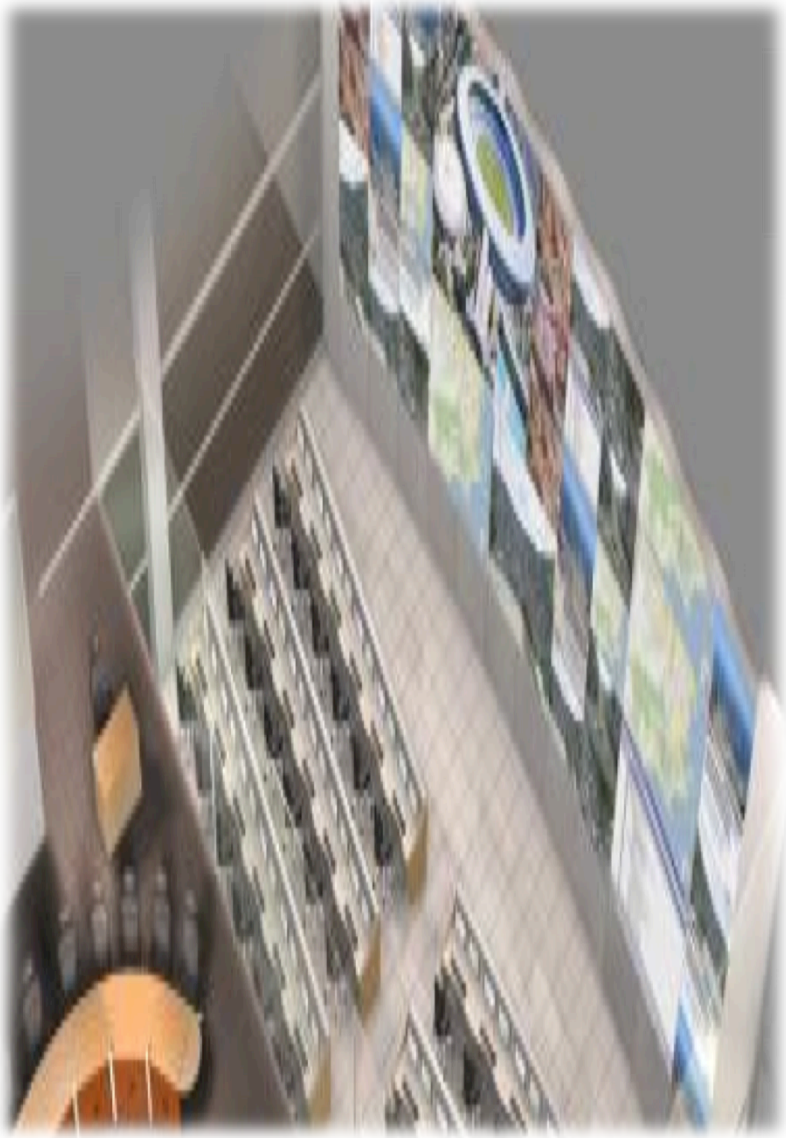
Outline

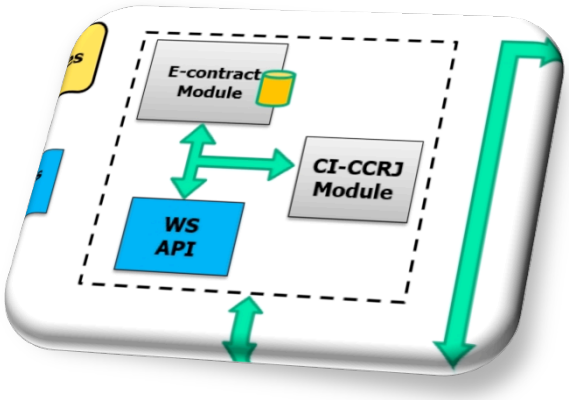


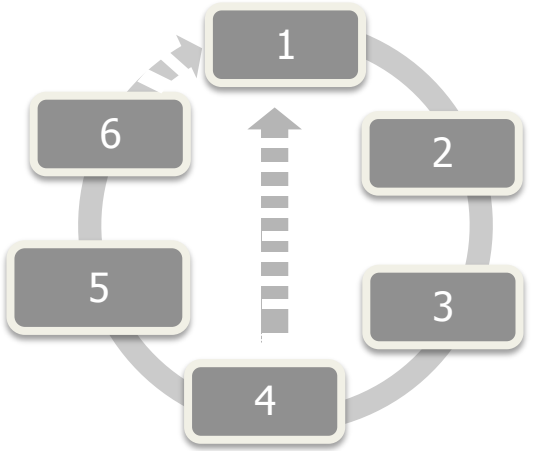
- Methodology
- Application
  - Scenario
  - C2 Testbed Framework
- Practical Example and Analysis
- Conclusion

Interoperability via E-contracts

- We are developing an innovative method using E-contract Web Services inspired by E-business (Amazon, Google, etc.)
- The specific problem is how to best respond to an incident given many Organizations with many Resources
- We use E-contracts to represent agreements between the Organizations in the CICC-RJ for how they will use their Resources (e.g. Helicopters, UAVs, Trucks) to respond to incidents
- By consulting the E-contracts, organizations can respond *dynamically* to evolving situations, using the C2 systems they currently have, through a new layer of web services

Overview of E-Contract Lifecycle





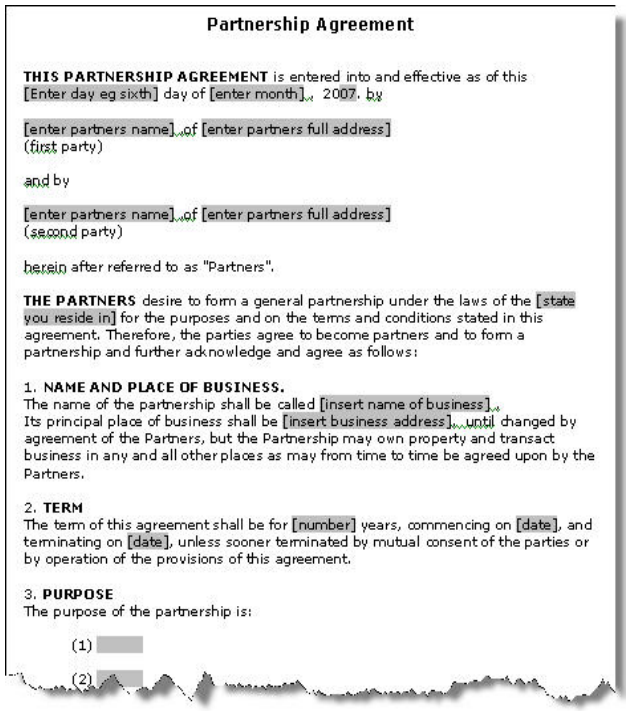
- The Lifecycle has 6 sequential phases
- Each phase has an input (requirement) and produces an output, which is the input for the next phase
- The solid arrows connect the phases in the regular workflow
- The broken lines represent an update of the draft or signed e-contract, requiring new signatures

Phases
1-Proposal
2-Configuration
3-Publication
4-Negotiation
5-Operation
6-Closure

E-contracts contain Services to be Performed in the Future

Contract

Service



Partnership Agreement

THIS PARTNERSHIP AGREEMENT is entered into and effective as of this [Enter day eg sixth] day of [enter month], 2007, by

[enter partners name], of [enter partners full address]
(first party)

and by

[enter partners name], of [enter partners full address]
(second party)

herein after referred to as "Partners".

THE PARTNERS desire to form a general partnership under the laws of the [state you reside in] for the purposes and on the terms and conditions stated in this agreement. Therefore, the parties agree to become partners and to form a partnership and further acknowledge and agree as follows:

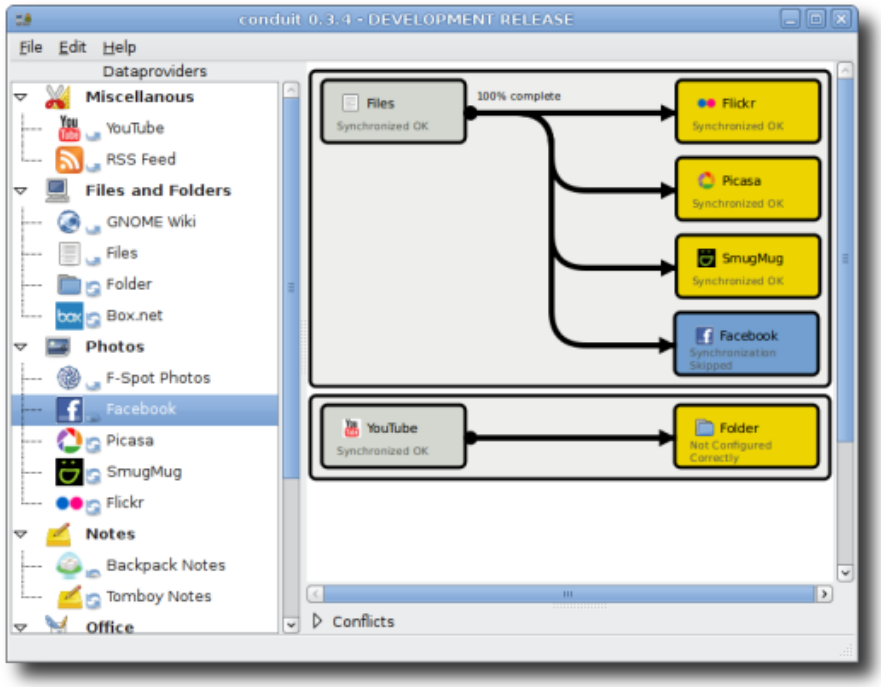
1. **NAME AND PLACE OF BUSINESS.**
The name of the partnership shall be called [insert name of business].
Its principal place of business shall be [insert business address], until changed by agreement of the Partners, but the Partnership may own property and transact business in any and all other places as may from time to time be agreed upon by the Partners.

2. **TERM**
The term of this agreement shall be for [number] years, commencing on [date], and terminating on [date], unless sooner terminated by mutual consent of the parties or by operation of the provisions of this agreement.

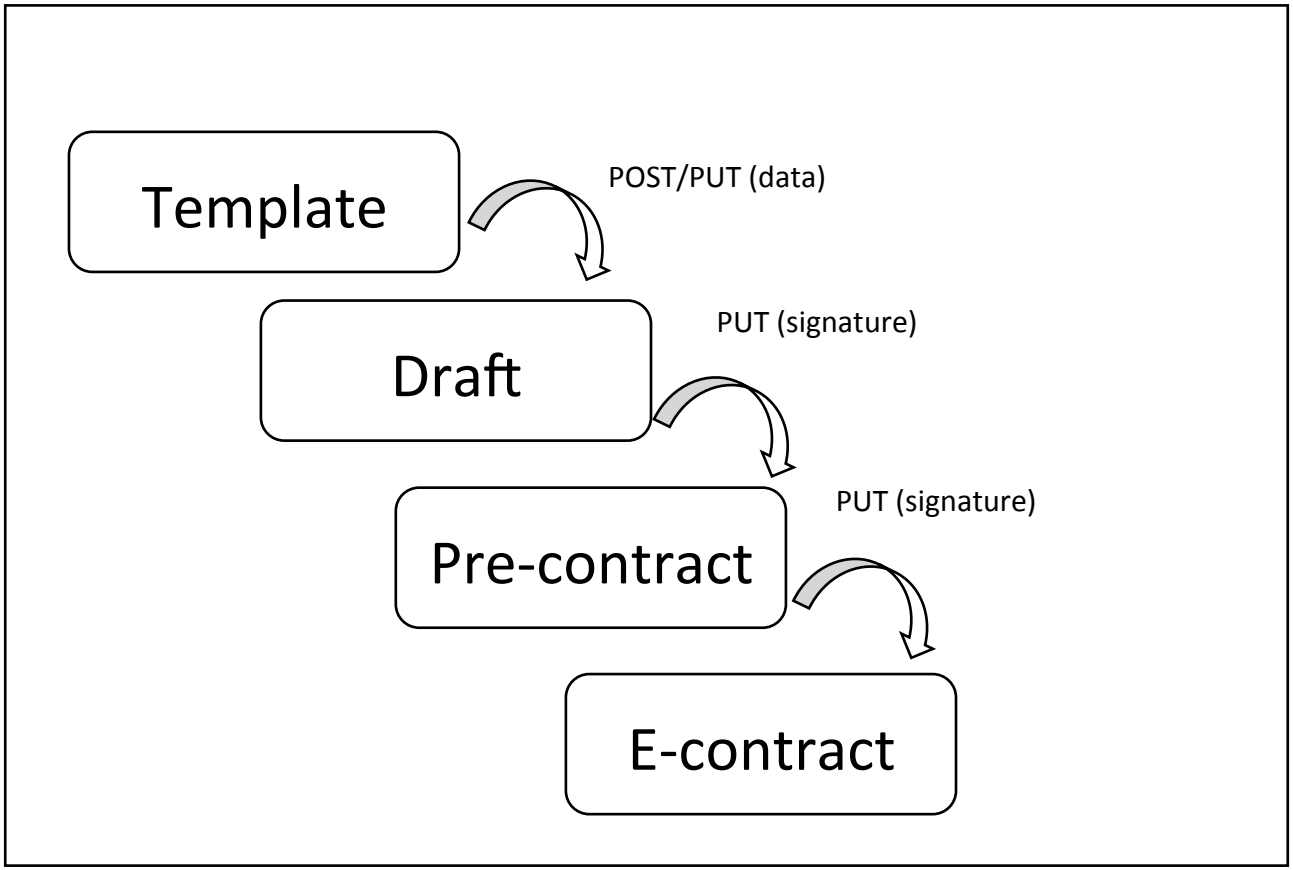
3. **PURPOSE**
The purpose of the partnership is:

(1)

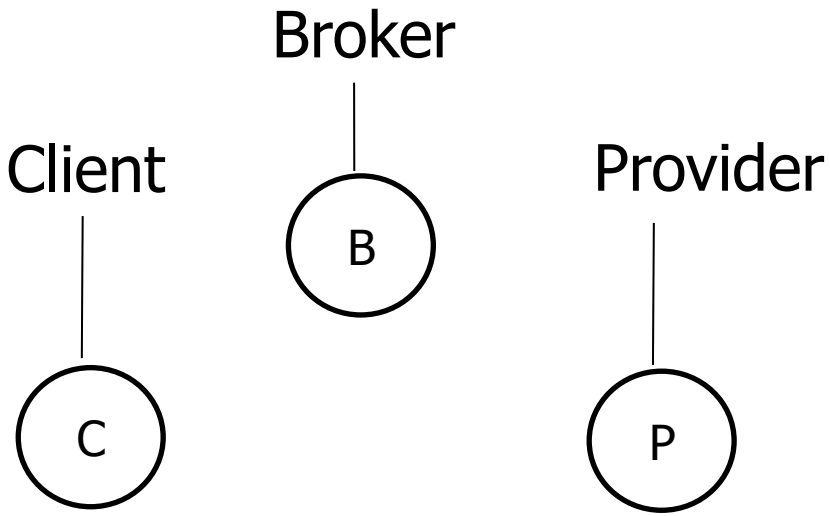
(2)



Types of E-contracts

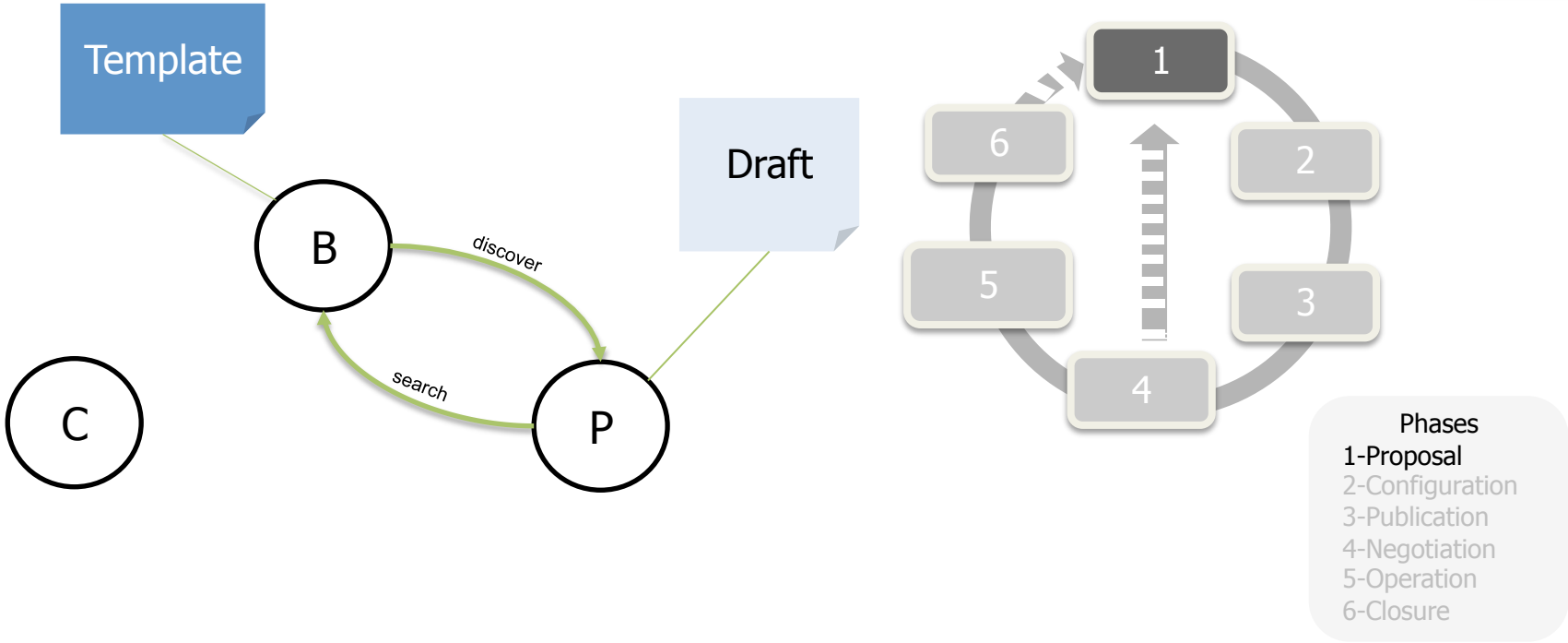


Roles used in E-contract Lifecycle



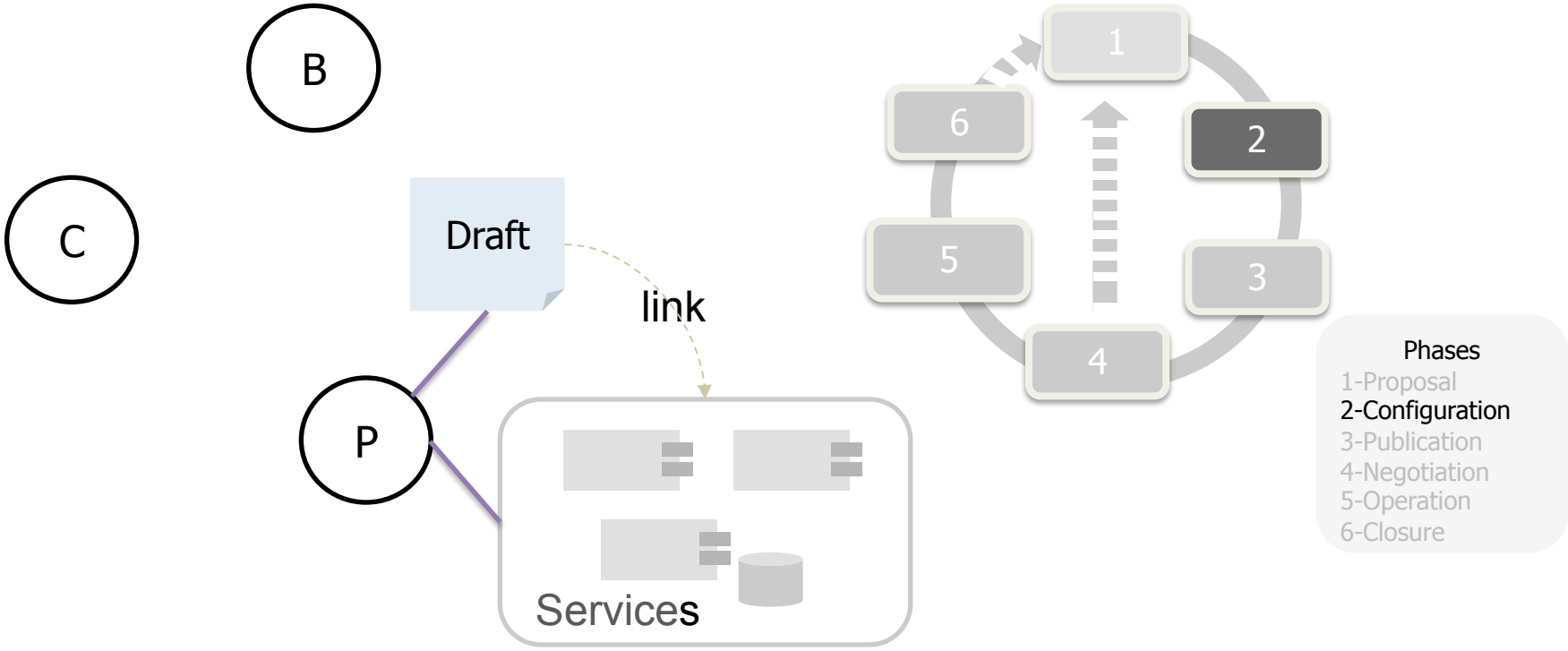
- The Provider (P) has Services to offer and builds a Draft e-contract (D) by using a Template (T), stored in the Broker
- The Broker (B) is a filter and responsible for formatting agreements, validating signatures, and saving the e-contracts in use
- The Client (C) wishes to purchase and use Services

Proposal Phase (1)



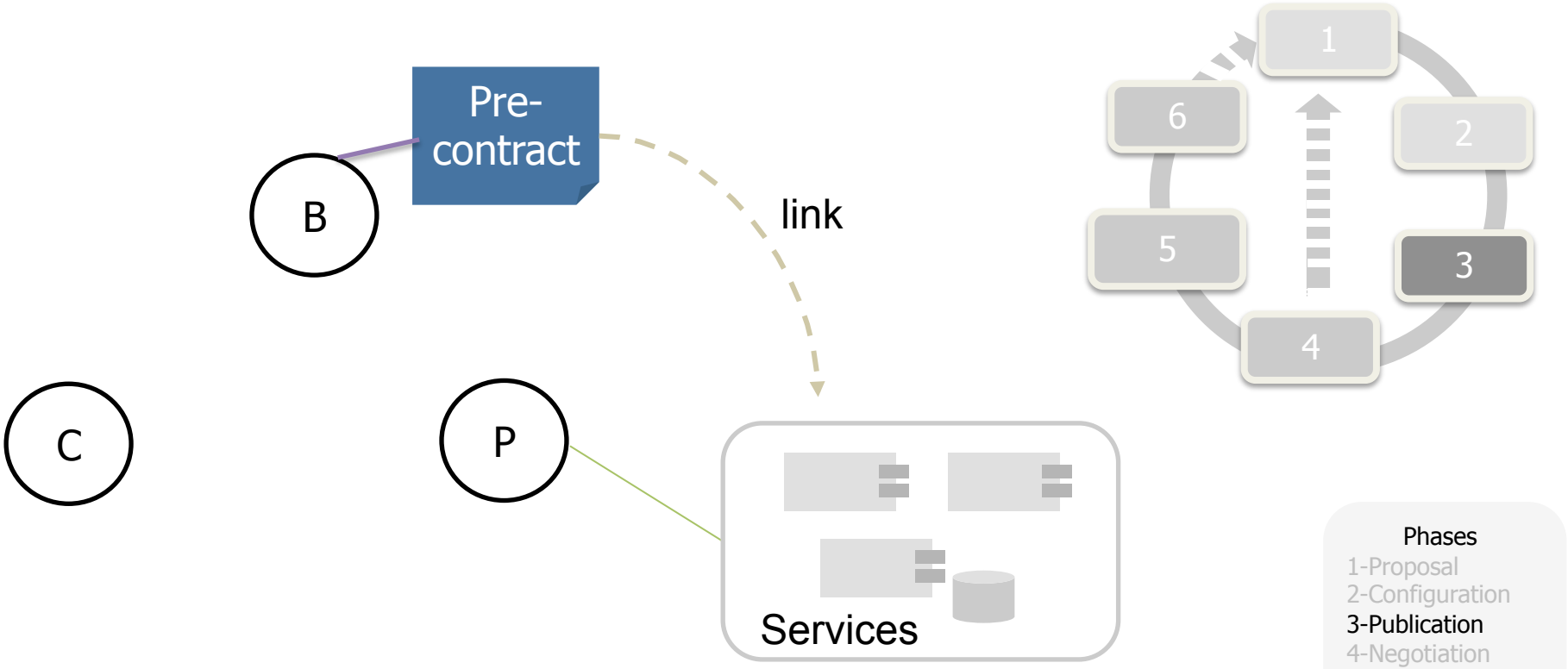
- The Provider (P) talks to the Broker (B) about what Services it has to offer
- The Provider (P) searches for a Template (T) to build a Draft E-contract (D) that has the right constraints for the Services it has

Configuration Phase (2)



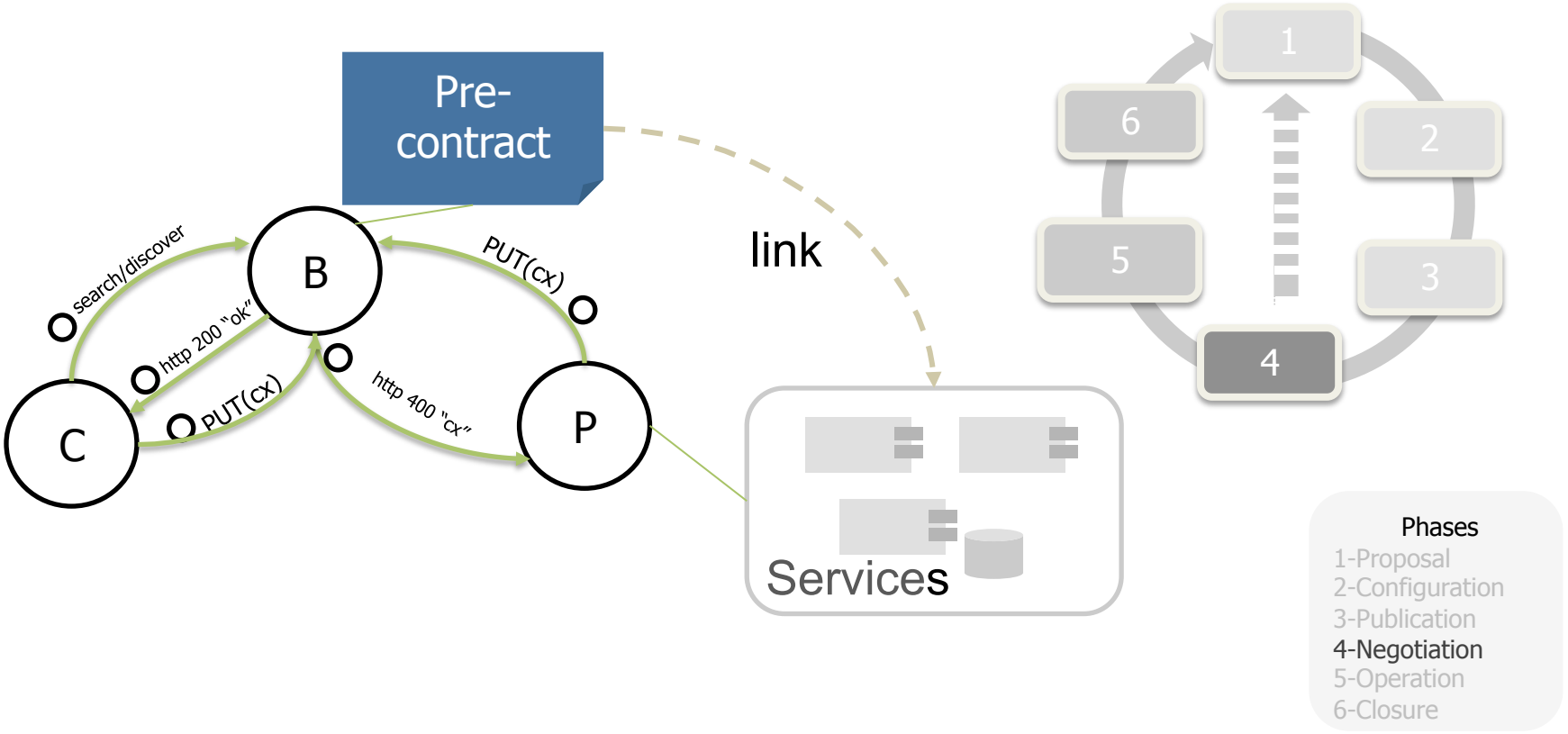
- The Draft E-Contract (D) is linked to the provider's services

Publication Phase (3)



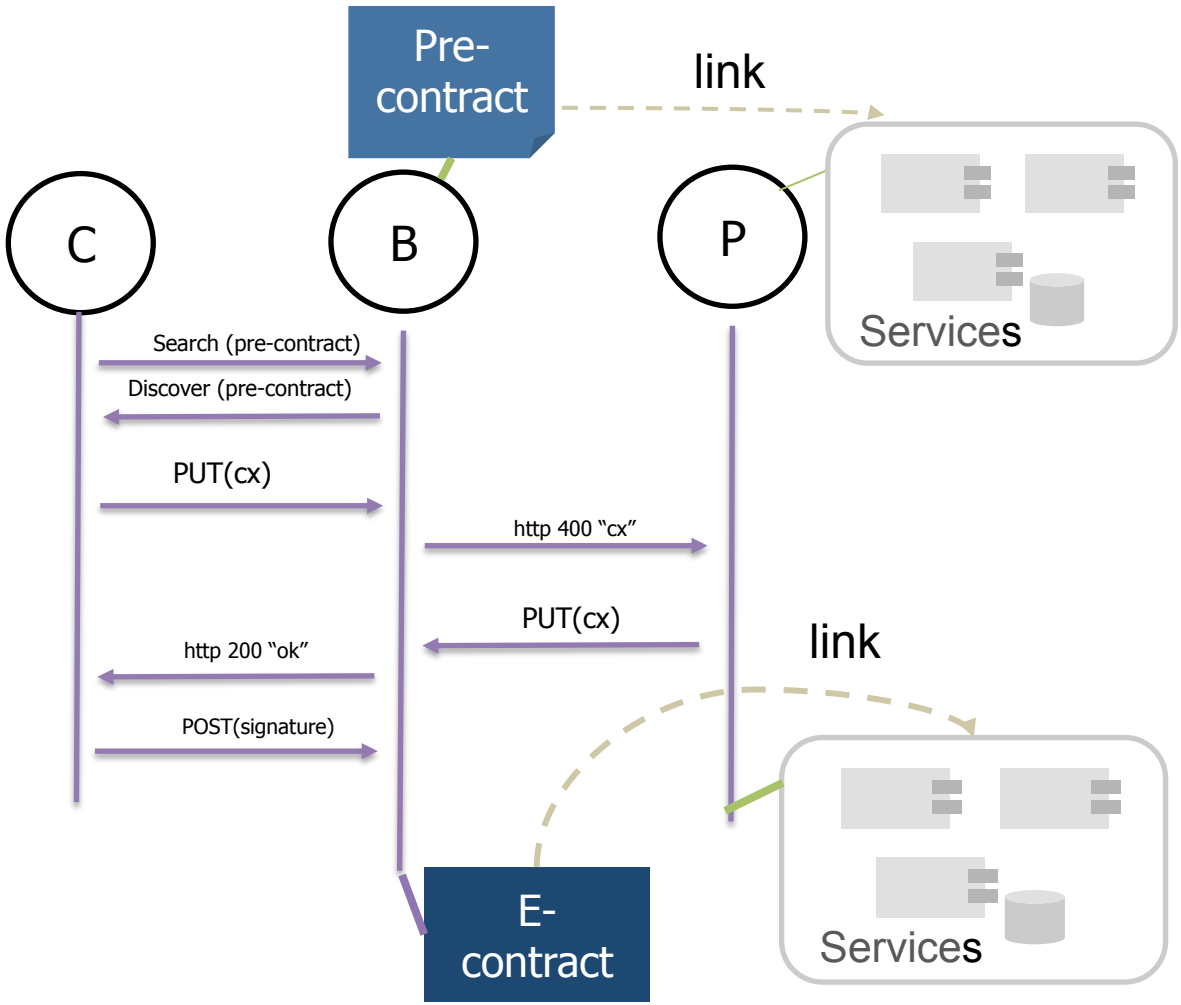
- The Draft E-contract (D) is signed, turned into a Pre-contract (P) and sent to the Broker (B)
- The Pre-contract (P) is available to search

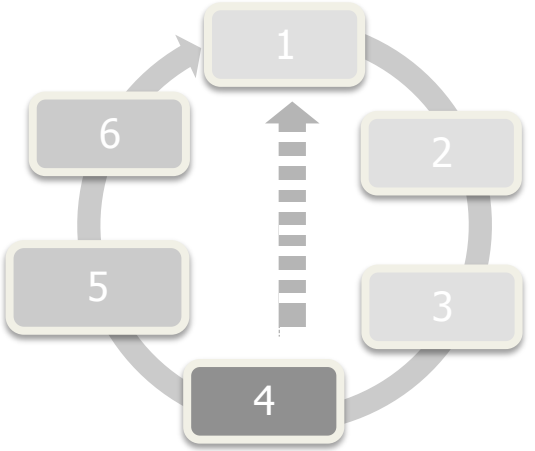
Negotiation Phase (4.1)



- The Client (C) searches and discovers the Pre-contract (P)
- Client (C) negotiates the clauses (cx) and fields
- Client (C) signs the Pre-contract (P) which becomes an E-contract (E)

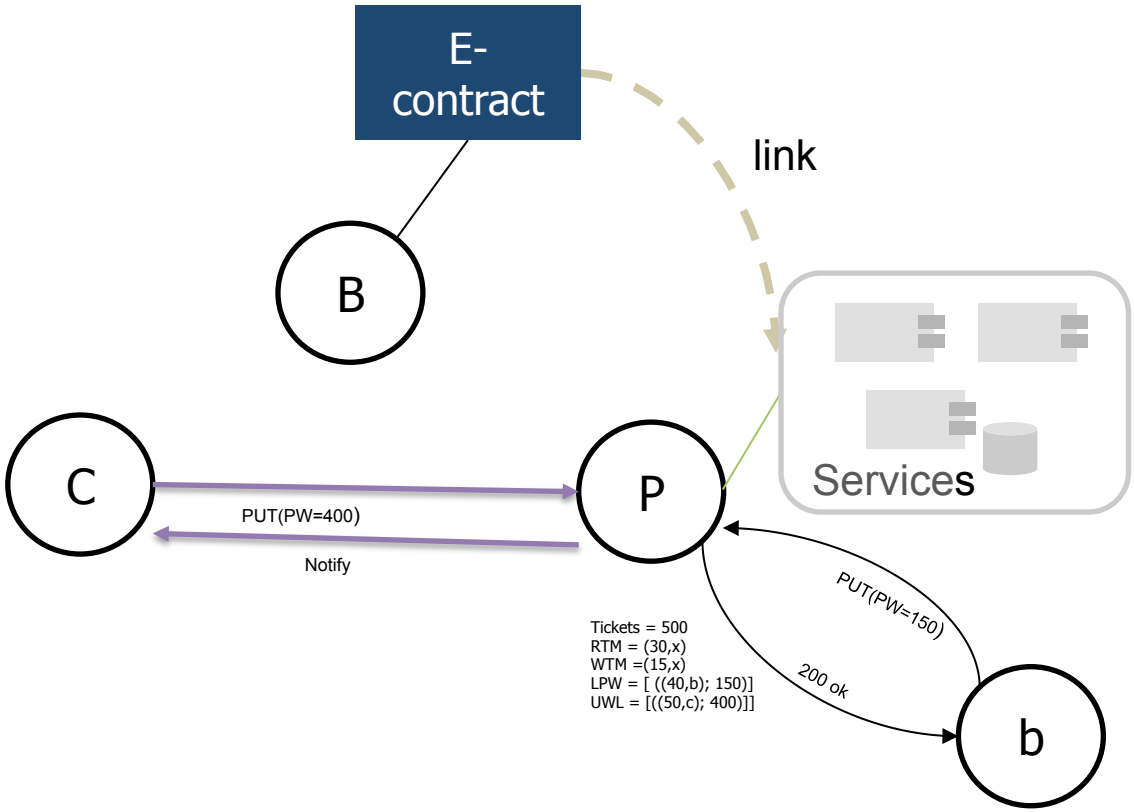
Negotiation Phase (4.2)

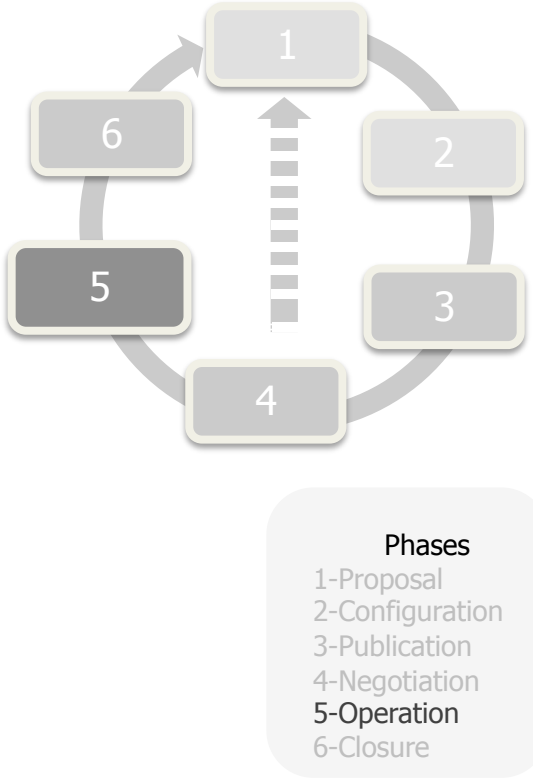




Phases
1-Proposal
2-Configuration
3-Publication
4-Negotiation
5-Operation
6-Closure

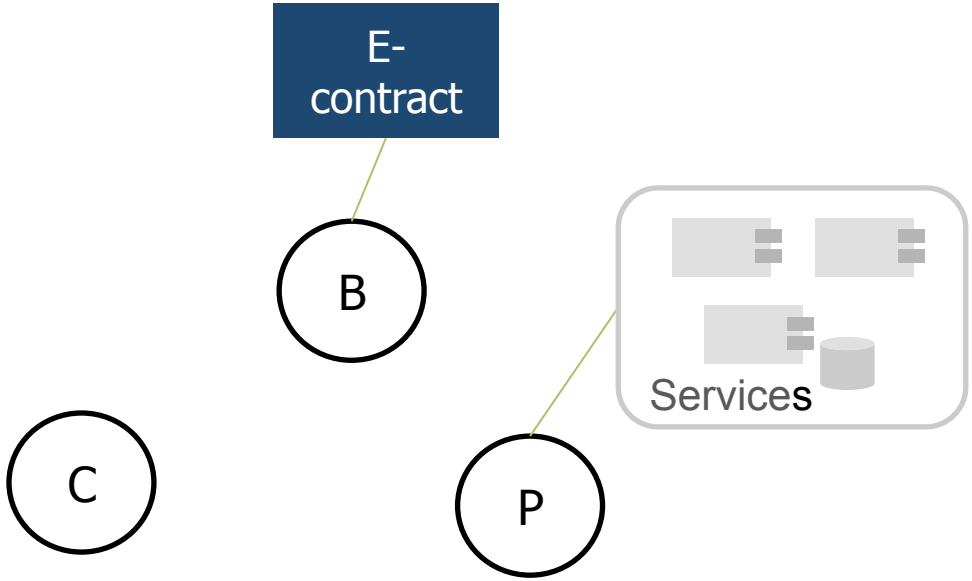
Operational Phase (5)

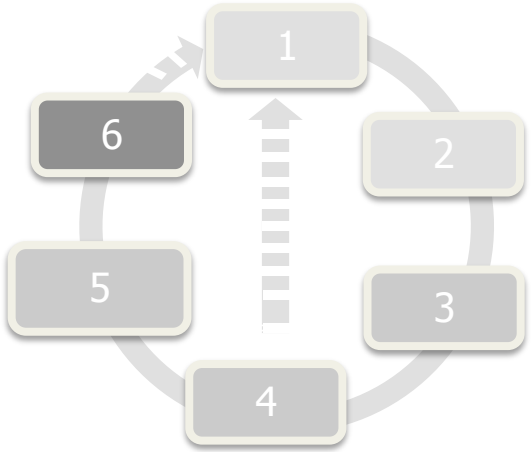




- Client (C) accesses the Provider's (P) Services directly
- The Broker (B) still holds the E-contract (E)

Closure Phase (6)





Phases
1-Proposal
2-Configuration
3-Publication
4-Negotiation
5-Operation
6-Closure

- When the Client (C) is finished the obligation between the parties ends
- There is then no link between the E-contract (E) and the Provider's (P) Services
- The E-contract (E) can be renewed if all parties agree

Problem

- Public Safety
  - The number of homicides decreased but continues to be high by the first world standards
- Transport
  - Infrastructure highways and airports
- Telecommunications
  - Maintenance of communication links during events
- Infrastructure in general
  - Availability in Hotels

INTERNATIONAL

Domestic Problems Arise As Brazil Prepares For World Cup, Summer Olympics

Comments (0) | Brazil, Confederations Cup, fifa, International, Maracana, Olympics 2016, rio de janeiro, World Cup 2014

Greg Asciutto | December 3, 2012 | 9:03 p.m. PST
Staff Reporter

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Rio de Janeiro's Maracana Stadium (Creative Commons)

With only months remaining before the FIFA Confederations Cup kicks off in Brazil, organizers and officials in Rio de Janeiro are battling domestic disturbances as they prepare their city to host the 2014 FIFA World Cup and 2016 Summer Olympic Games.

For the second time in three weeks, hundreds of protesters gathered near the Estadio Maracana on Saturday to voice their displeasure toward the pending privatization of the historic stadium.

The Maracana, originally built to host the 1950 World Cup, is set to be sold by the Rio state government after current renovations are completed, according to the BBC.

Those in opposition of the sale say the stadium belongs to the people of Rio and that related construction will have disastrous consequences for the local indigenous population.

According to the Associated Press, the city plans to demolish Maracana's neighboring indigenous museum, the Museu Do Índio, as well as a public school and surrounding athletic facilities.

Rio de Janeiro Center of Command and Control (CICC-RJ)

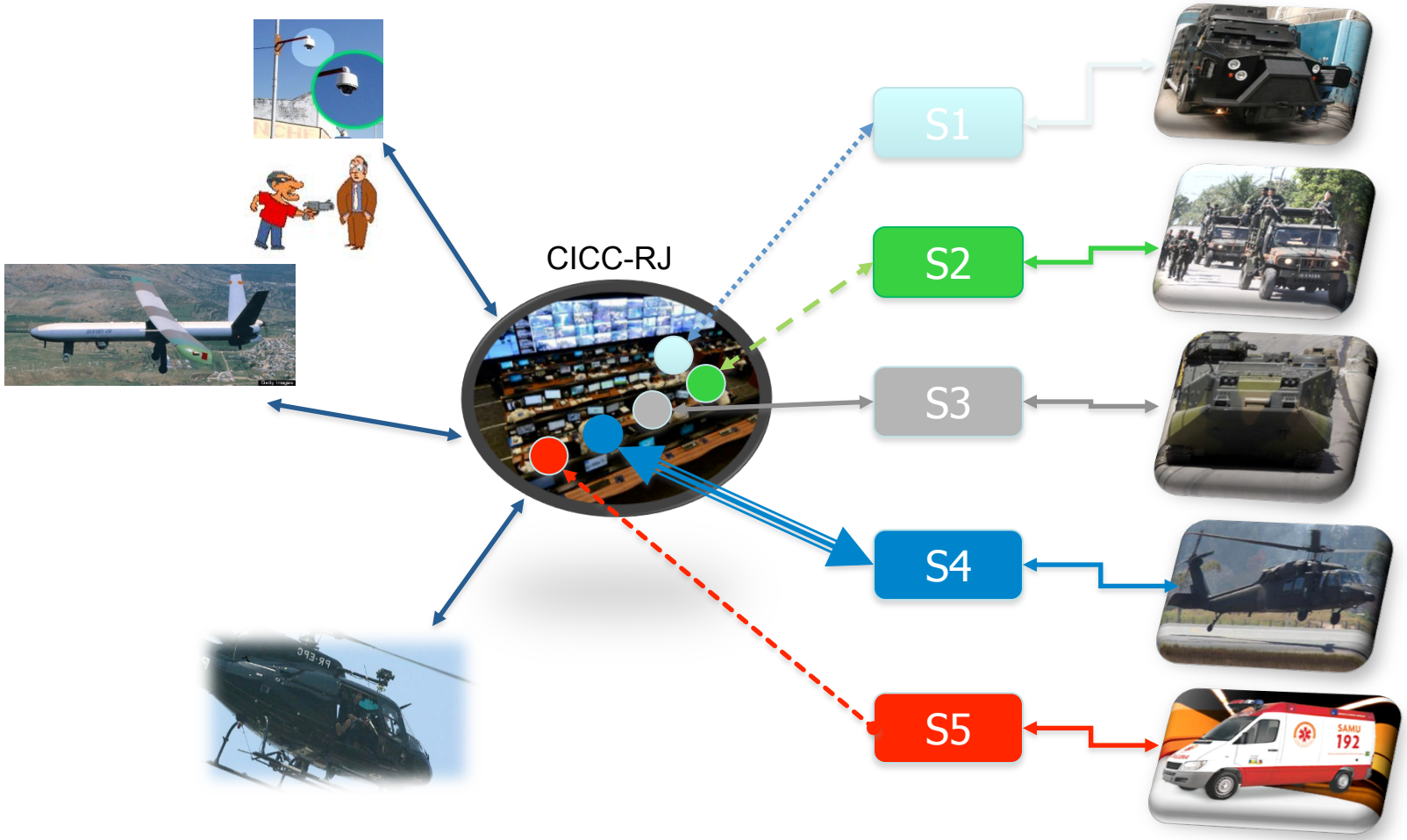
- Created for World Cup and Olympics
- Meant to support daily operations in the city of Rio de Janeiro
- Integrate eight different agencies

CICC-RJ Includes:

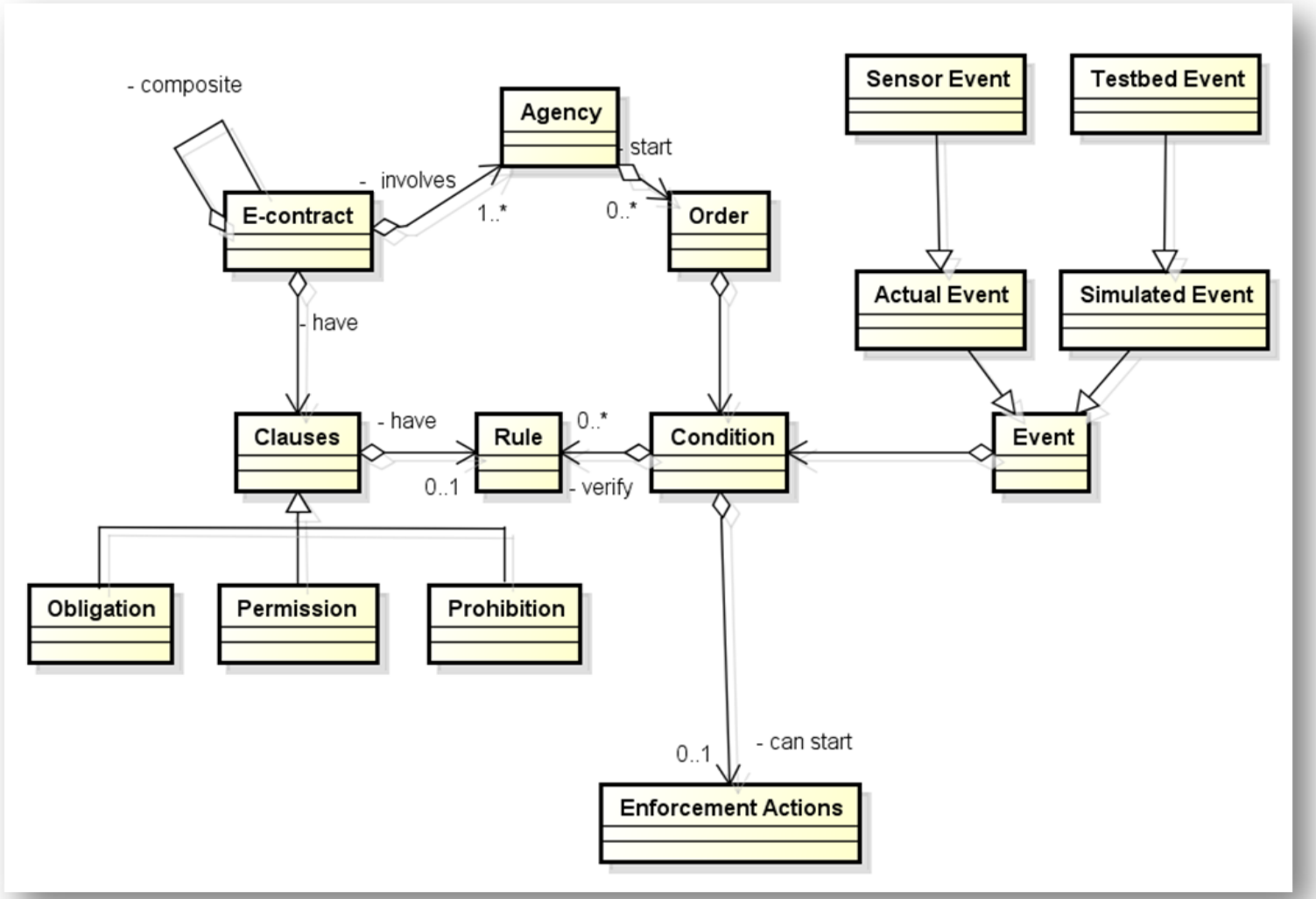
- Ministry of Defense
- Federal Police
- National Force
- Civil Defense

Branch \ System	C2 System	Central Command	Network	Operational System
Navy	SisNC2	CCTOM	IntraMar	Carta-SAGBD
Army	SC2FTer	CC^{2}FTer	EBNEt	C2 in Combat
Air Force	SISCENDA	COMGAR	INTRAER	HERCULES
Space	SISDABRA	COMDABRA	-	DACOM
Supreme Command	SISMC2	CC2CS	DEFESA	SIPLOM

CICC-RJ Current Connection Schema



Unified Modeling Language Diagram



E-contracts in a C2 Environment

E-contract CI-CCRJ / AF

7898888 e-contract CI-CCRJ/Police
7898889 e-contract CI-CCRJ/Army

Identification **CI-CCRJ and BAF**
Signature CICCRJ **S##@#!!!!!**
Signature BAF **&&***!!!!**

Numbers of helicopters **4**
Description **H1H 9258 CH-13 2843** AH-64 5849 link for current information (lat/lon)

Clauses

(1) **must** used for military operation only
(2) **must** monitoring, rescue and relief operation
(3) **must** Brazilian air force pilots only
(4) **can** for transporting of authorities
(5) **don't shall** use more than number of hours available SILOMS application

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Important informations

Validation: September **18, 2013**
Operation: **Spider** in Rio de Janeiro
Airport based : **Santos Dumont**
Maximum Altitude : **2000ft**
Autonomy : **3 hours**

Testbed current Date and time is: Thu Aug 29 15:25:13 PDT 2013

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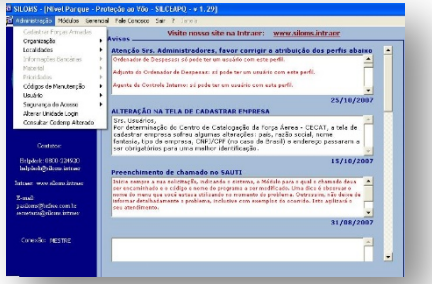
empty form link

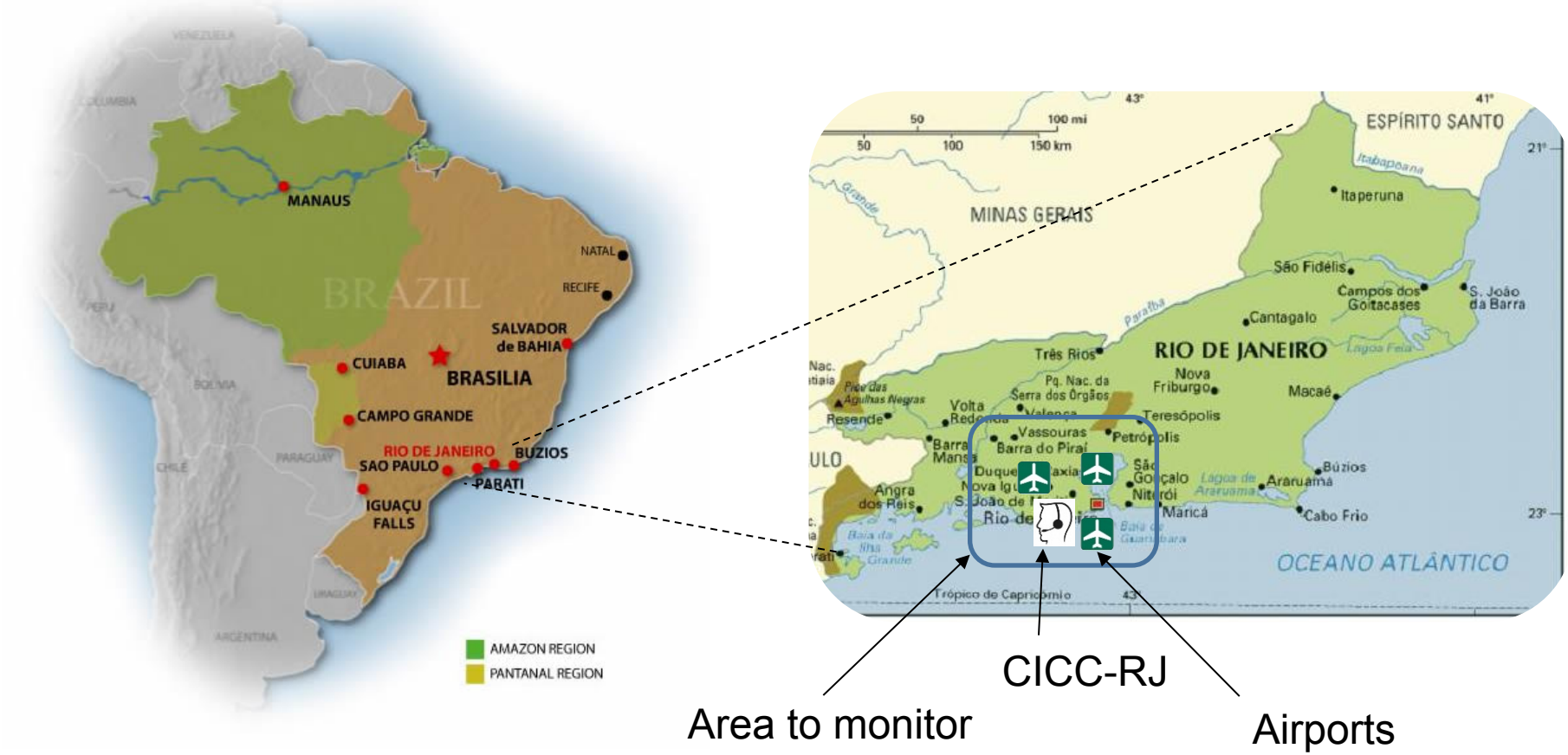


http://192.168.0.4:8080/Testbed/users/Af01

Scenario


AT&T
5/14 - 5:11 - 34MB
66%
911
http//192.168.1.4:8080/TESTBED/AF1
Google

Soccer World Cup In Rio De Janeiro



Overview of Simulation Scenario

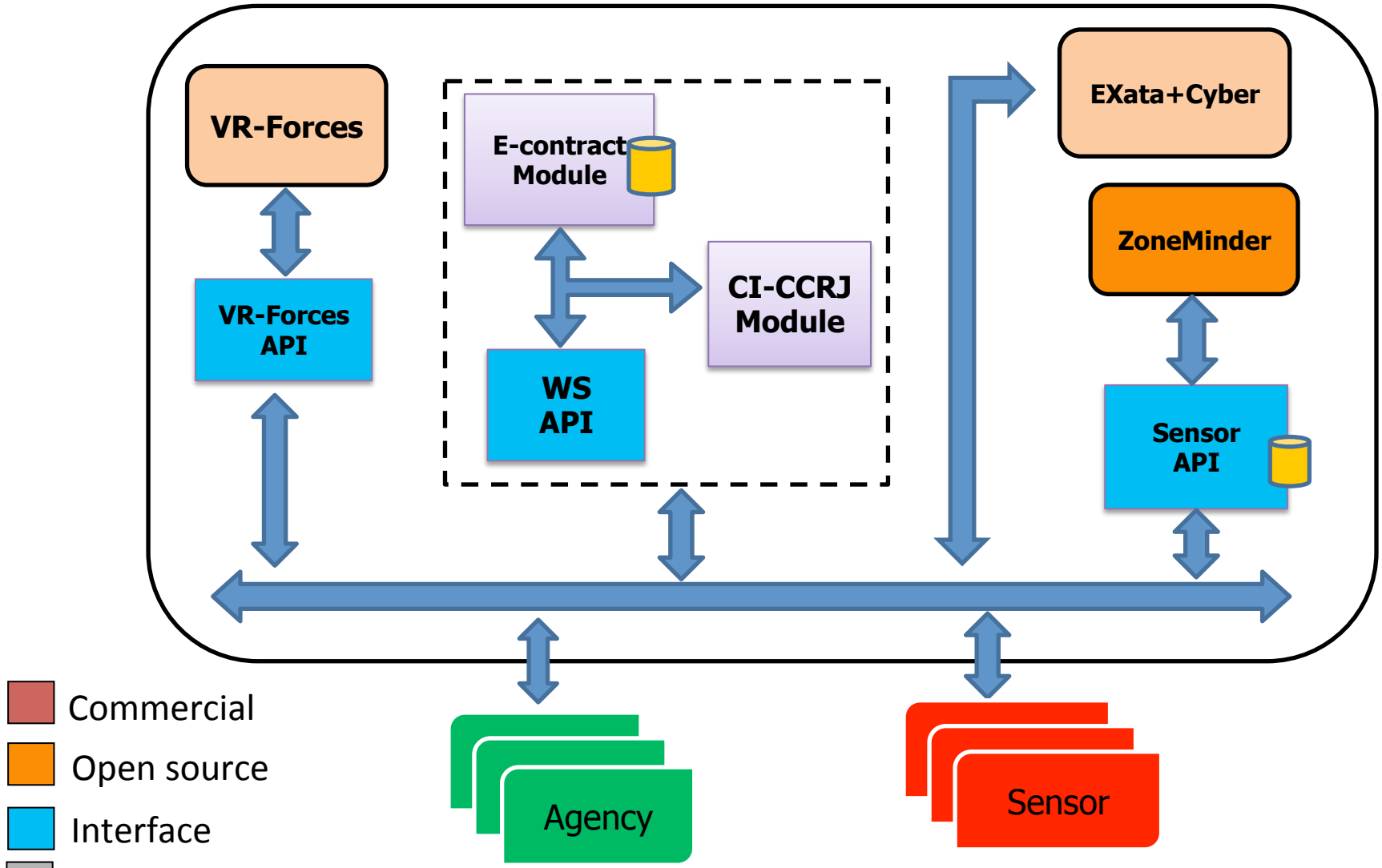
Airports

Dangerous areas

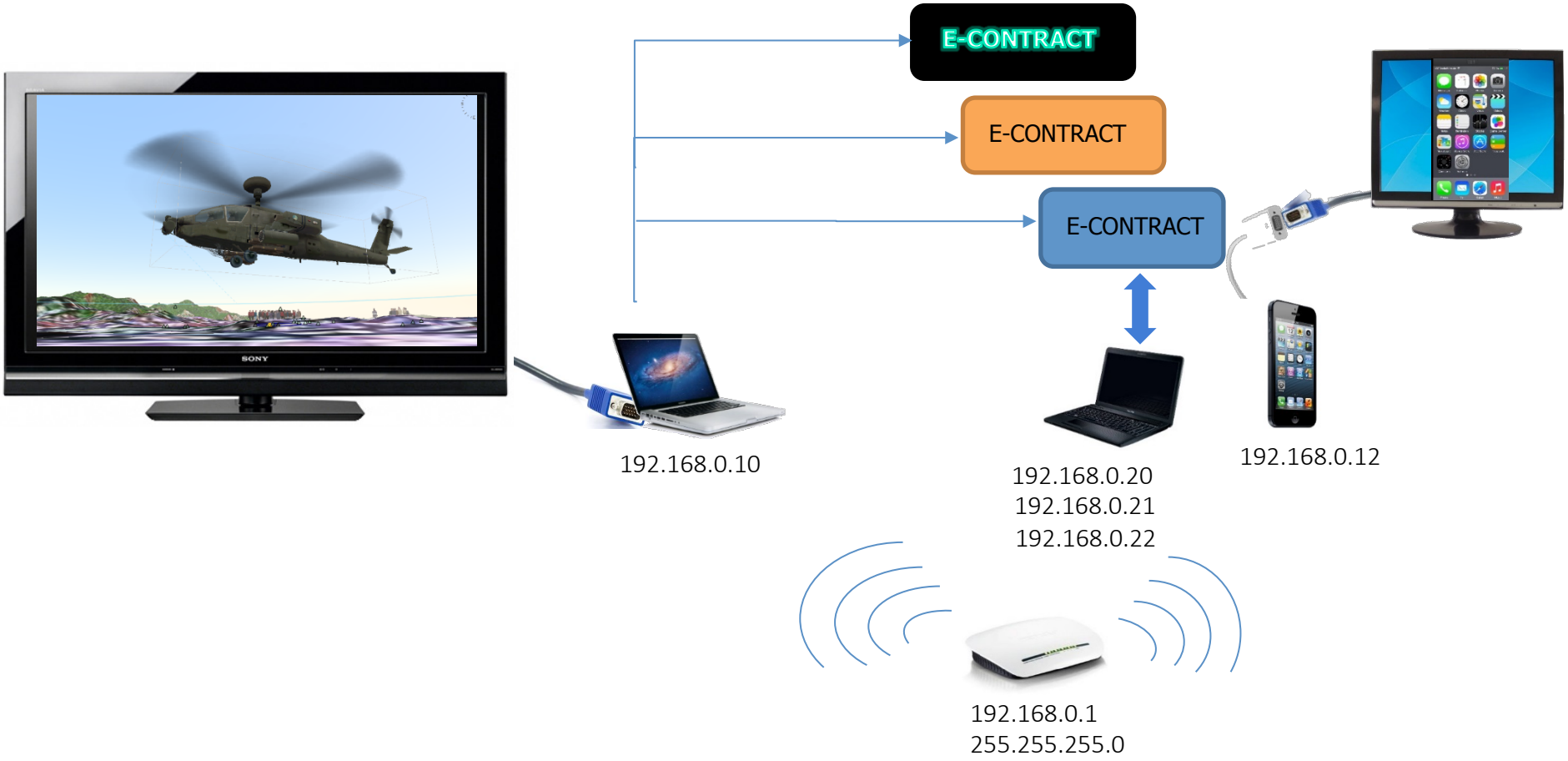
Maracanã Stadium

Area of Hotels

Rio de Janeiro Scenario Architecture



Implementation of the Testbed



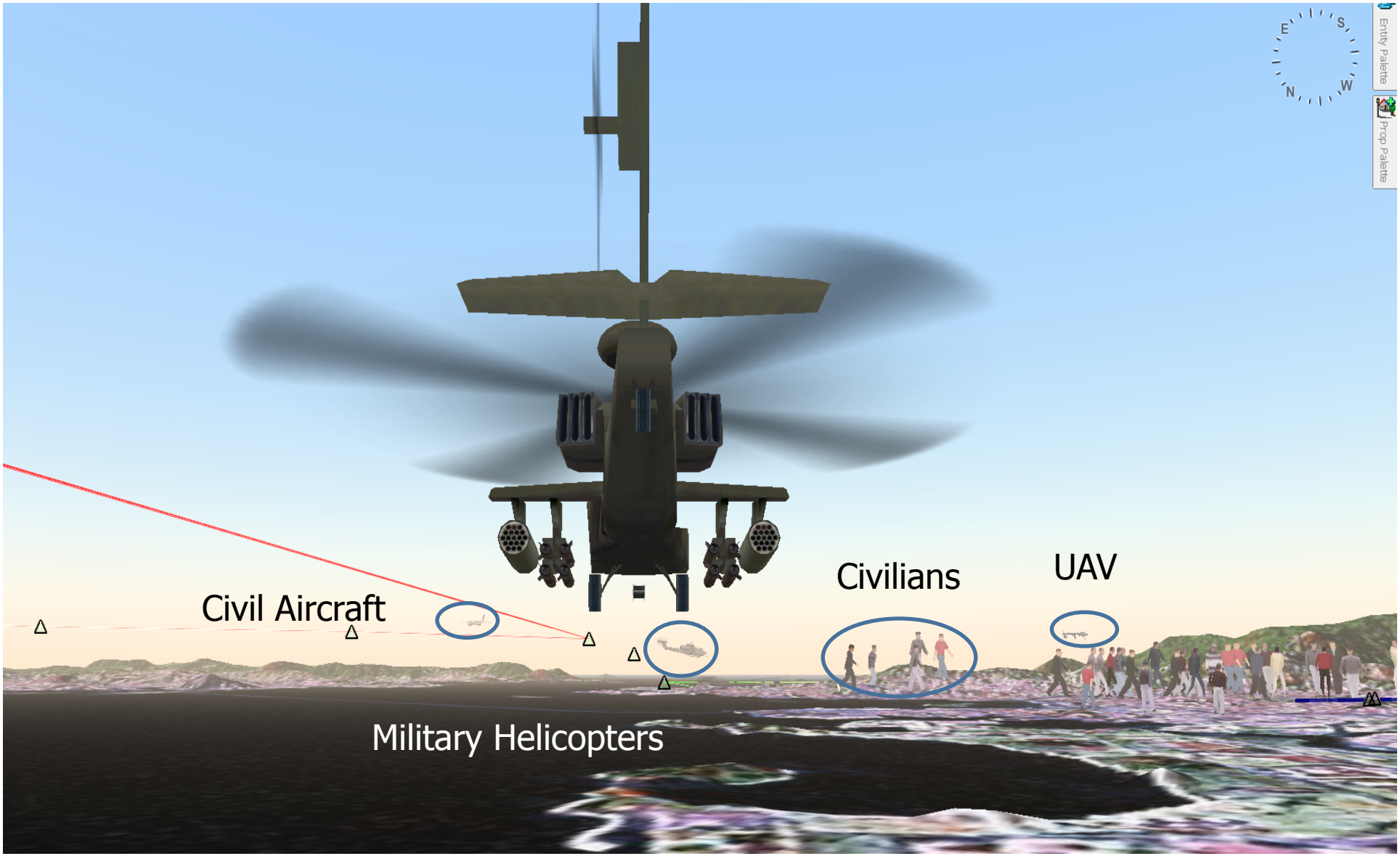
Practical Schema


```
<e-contract>
<id>5631</id>
<party_1>CICCRJ</party_1>
<party_2>BAF</party_2>
<description>
helicopters AH-64 operation Rio
</description>
<URI>http:192.168.0.1/Rio </URI>
<number>10</number>
<H1>7865</H1>
<1URI>http://192.168.0.1/H1</1URI>
<H2>7862</H2>
<2URI>http://192.168.0.1/H2</1URI>
<H3>7852</H3>
<3URI>http://192.168.0.1/H3</1URI>
</e-contract>
```

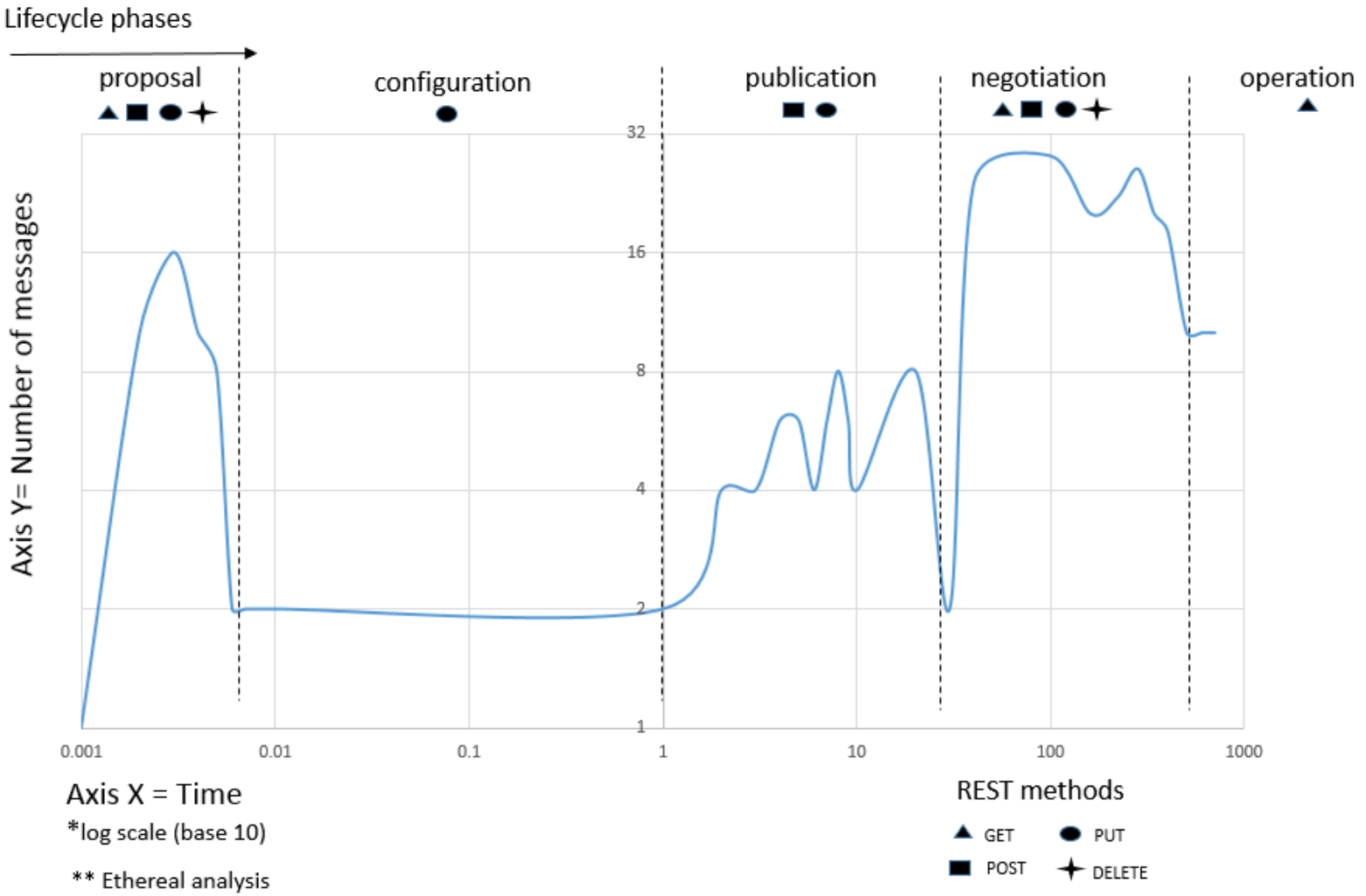
GET(http://192.168.0.1/H3)
response:
Owner:**BAF**
Order : **34**
Speed: **140 O_x, 10 O_y .5 O_z**
Altitude: **120**
Autonomy: **2.5**
E-contract: **5631**

POST(**http://192.168.0.1/EVENT**)
Parameters:
Latitude: **38.8060**
Longitude: **-77.3001**
Type: **Bomb Blast**

GET(**http://192.168.0.1/H2**)
response:
Owner:**BAF**
Order : **31**
Speed: **3.5 O_x, 2 O_y .15 O_z**
Altitude: **240**
Autonomy: **1.5**
E-contract: **5631**


Civil Aircraft
Civilians
UAV
Military Helicopters

Analysis


Lifecycle phases
proposal
configuration
publication
negotiation
operation
Axis Y= Number of messages
32
16
8
4
2
1
0.001
0.01
0.1
1
10
100
1000
Axis X = Time
*log scale (base 10)
** Ethereal analysis
REST methods
GET
PUT
POST
DELETE

Conclusions

- We have presented an innovative approach to both Interoperability and Integration of C2 Services
- The E-contract approach using RESTful web services allowed the team to share data to more efficiently manage tasks dynamically in the simulation
- Web Service technology is useful for integration because each agency involved in the combined operation has a different Information Technology Environment
- We believe that using E-contracts and Automated Negotiation would result in more agile and flexible C2, but this remains to be examined in more detail

Thanks, Any Questions?

For any additional questions, please contact

Bernardo Neto or Michael Hieb
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mhieb@c4i.gmu.edu

C2 Testbed Project (2010-2013)

- Joint Use Cases running on Commercial Simulations in both Brazil (ITA) and the US (George Mason / C4I Center)
- Facilitates collaborative C2 research by University Faculty, PhD/Masters Students and Industry. The end product of this research is:
  - Conference and Journal Publications,
  - Research Demonstrations, and
  - Research Prototypes
- The Testbed simulates a complex endeavor involving different agencies through the Simulation of Physical Environments, Sensors and Networks

Publications to Date

- LTC Marques
  - Marques, H. (2012) “An Inference Model With Probabilistic Ontologies To Support Automation In Effects Based Operations Planning”, PhD Dissertation, Aeronautics Institute of Technology, São José dos Campos, SP – Brazil.
- Major Barreto
  - Barreto, A.. (2013) “Cyber-ARGUS Framework - Measuring Cyber-Impact on the Mission”, PhD Dissertation, Aeronautics Institute of Technology, São José dos Campos, SP – Brazil.
  - Barreto, A., Yano, E., Hieb, M. (2012) “Developing a Complex Simulation Environment for Evaluating Cyber Attacks”, *The Interservice/Industry Training, Simulation & Education Conference,* Orlando FL, November 2012.
- LTC Bernardo
  - Neto, J. B., Hieb, M., Hirata, C., Paulo, C. (2013) “Simulating the Allocation of Resources for Command and Control with E-Contracts”, *The Interservice/Industry Training, Simulation & Education Conference,* Orlando FL, December 2013.