RAFAEL DA SILVA CARRASCO

UM MODELO PARA IDENTIFICAÇÃO DE TRÁFICO DE ANIMAIS SILVESTRES NA INTERNET

Dissertação apresentada à Universidade Federal de Viçosa, como parte das exigências do Programa de Pós-Graduação em Ciência da Computação, para obtenção do título de *Magister Scientiae*.

VIÇOSA
MINAS GERAIS – BRASIL
2012

Ficha catalográfica preparada pela Seção de Catalogação e Classificação da Biblioteca Central da UFV

T
C313m
2012

Carrasco, Rafael da Silva, 1983-
Um modelo para identificação de tráfico de animais silvestres na internet / Rafael da Silva Carrasco. – Viçosa, MG, 2012.
113f. : il. ; 29cm.

Inclui anexos.
Texto em português e inglês.
Orientador: Alcione de Paiva Oliveira.
Dissertação (mestrado) - Universidade Federal de Viçosa.
Inclui bibliografia.

1. Inteligência artificial. 2. Agentes inteligentes (Software). 3. Ontologia. 4. Processamento de linguagem natural (Computação). 5. Animais silvestres. I. Universidade Federal de Viçosa. II. Título.

CDD 22. ed. 006.3

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APROVADA: 07 de agosto de 2012.

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Este trabalho é dedicado aos inúmeros heróis anônimos, que lutam incansavelmente para proteger a nossa fauna.

Agradecimentos

Um trabalho tão árduo e longo como uma dissertação de mestrado é apenas possível devido ao apoio de muitas pessoas. Sem muitas delas, este trabalho certamente não seria possível. Dessa forma, eu certamente devo agradecimentos a muitas pessoas, algumas inclusive por me ajudarem em momentos muito anteriores a esta dissertação. E para aqueles que não foram citados, peço desculpas juntamente com o meu oferecimento de gratidão.

Agradeço primeiramente a meus pais, Lúcia e Carlos, por sempre batalharem para prover uma educação de qualidade para meus irmãos e para mim, apesar de todas as dificuldades. Além disso, o ambiente em que fui criado me permitiu desde cedo criar um gosto especial por ciências e criatividade, ambos certamente indispensáveis em qualquer trabalho científico. Agradeço também por todo amor, carinho e paciência que me foi dedicado, mesmo nas horas em que eu mais merecia uns tapas. Juntamente com meus pais, agradeço também a meus irmãos, Ismael e Carlos Júnior, por inúmeras horas de discussões construtivas sobre ciências, trabalho, e até mesmo sobre filosofia, ocasionalmente.

Agradeço também ao meu orientador, Alcione. A participação dele nesta história começa já na graduação, por ter me orientado também durante a iniciação científica. Embora os trabalhos desenvolvidos na época não tenham relação direta com esta dissertação, muitos dos seus conceitos fundamentais foram pincelados nesse momento. Tanto durante a iniciação científica quanto na dissertação, uma paciência quase infinita foi dedicada a me orientar, por mais tempo e esforço que isso demandasse.

Também quero agradecer a todo o pessoal do Departamento de Informática pelo trabalho tão bem feito em um curso superior que certamente superou muito as minhas expectativas. Algo que parecia grandioso e difícil demais tornou-se possível graças à dedicação e talento de vocês. E não apenas pude contar com o apoio de vocês durante a graduação, como novamente fui bem acolhido também durante o mestrado.

Finalmente, agradeço à minha esposa e musa, Josiane, cujo amor e apoio sempre serviram de inspiração para trabalhar até mesmo quando eu me sentia exaurido por tantas tribulações. Sempre tentando me ajudar, e de fato, ajudando. Seu trabalho voluntário no Cetas da UFV me fez perceber a importância de tais iniciativas. Além da inspiração, obrigado também pela paciência ao me deixar dedicar a esta dissertação. Obrigado também pela ajuda prática, pacientemente coletando *corpora* para os testes finais do protótipo.

A todos vocês, muito obrigado. Este trabalho não seria possível sem vocês.

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Resumo

CARRASCO, Rafael da Silva, M.Sc., Universidade Federal de Viçosa, agosto de 2012. **Um Modelo para Identificação de Tráfico de Animais Silvestres na Internet**. Orientador: Alcione de Paiva Oliveira. Coorientador: Jugurta Lisboa Filho.

O tráfico de animais silvestres figura entre as várias formas de crime praticadas na Internet. A dimensão do tráfico de animais silvestres demanda muito esforço por parte das autoridades especializadas em combatê-lo. Infelizmente, estes últimos dispõem de poucos recursos. Acredita-se que sistemas de monitoramento automático sejam capazes de oferecer um grande ganho em termos de produtividade no combate ao tráfico de animais silvestres. O monitoramento de tais atividades criminosas na Internet provavelmente já seria de grande valia na sua prevenção. O objetivo deste trabalho é desenvolver um modelo que seja capaz de detectar indícios de atividades do tráfico de animais silvestres na Internet, com foco nas redes sociais. Essa detecção deve fornecer informações que sejam úteis nas medidas de combate à ação em questão. O sistema deve ser capaz de extrair informações suspeitas, apresentando um valor numérico que expresse uma estimativa de que a atividade reportada realmente esteja ocorrendo. Para que isto seja possível, o sistema deve se basear em uma ontologia de domínio e em *frames* semânticos durante a etapa de análise. Ambos, ontologia e *frames*, também são desenvolvidos por este trabalho. A conciliação destas duas técnicas em um mesmo propósito é o maior desafio do modelo, e por isso ambas foram exploradas em maior profundidade. A arquitetura proposta pelo modelo é a de Sistemas Multiagentes, muito embora qualquer outra possa ser usada. O modelo de análise das sentenças foi projetado e implementado. Os testes realizados com o módulo indicaram um nível de acerto acima de 80%.

Abstract

CARRASCO, Rafael da Silva, M.Sc., Universidade Federal de Viçosa, August 2012. **A Multiagent Model for Wildlife Trafick Monitoring in the Internet.** Adviser: Alcione de Paiva Oliveira. Co-Adviser: Jugurta Lisboa Filho.

Wildlife traffic is amongst the many criminal activities conducted over the Internet. The dimension of wildlife traffic requires a great effort by the specialized authorities to fight it. Unfortunately, such organizations have few resources. It's common sense in these organizations that automatic monitoring systems could offer a great help in productivity terms, in the combat against wildlife traffic. The monitoring of such criminal activities in the Internet probably would already be of great value in it's prevention. The main goal of this work is to develop a Multi-Agent model able to hint wildlife traffic activities conducted over social networks. This detection should provide data useful to coordinate any action taken to prevent the detected activity. The system should be able to extract suspicious data, presenting a numerical rank that express an estimation that the reported activity is really happening. The sentence analysis module was designed and constructed. It bases it's conclusions in a domain ontology and a semantic frame. Tests executed in this module indicate a rate of success of at least 80%.

1 Introdução Geral

Segundo Miniwatts (2010), no período do ano 2000 até 2009, o número de usuários da Internet aumentou em quase 400%, alcançando cerca de 360 milhões de usuários. Essa taxa de crescimento tem diminuído, mas ainda assim a quantidade de usuários que já existem é impressionante.

Infelizmente, a popularização da Internet também se deu para o crime organizado. Para se ter uma ideia da dimensão de crimes que são praticados ou facilitados pela Internet, o governo dos Estados Unidos criou uma departamento apenas para receber denúncias sobre crimes virtuais, o Internet Crime Complaint Center (IC3). O IC3 é uma parceria entre o Federal Bureau of Investigation (FBI) e o National White Collar Crime Center (NW3C), e desde 2000 recebe várias denúncias de crimes praticados na Internet. Mais detalhes sobre esta organização podem ser obtidos em seu sítio: http://www.ic3.gov.

O tráfico de animais silvestres figura entre as várias formas de crime praticadas na Internet. Segundo o IBAMA (2003), em 2003 o tráfico de animais silvestres retirava cerca de 12 milhões de animais silvestres apenas das matas brasileiras. Parte desses animais são negociados ilegalmente na Internet (Tráfico, 2003), em sítios de relacionamentos ou em serviços como o Mercado Livre (http://www.mercadolivre.com.br).

A dimensão do tráfico de animais silvestres demanda muito esforço por parte das autoridades especializadas em combatê-lo (Renctas, 2001). Infelizmente, estes últimos dispõem de poucos recursos. Acredita-se que sistemas de monitoramento automático sejam capazes de oferecer um grande ganho em termos de produtividade no combate ao tráfico de animais silvestres. O monitoramento de tais atividades criminosas na Internet provavelmente já seria de grande valia na sua prevenção.

O monitoramento de dados de qualquer natureza ainda representa um desafio. Métodos convencionais tem sido substituídos por abordagens sofisticadas. O Google, por exemplo, substituiu recentemente seu tão bem sucedido sistema de busca baseado em camadas por um novo método chamado Caffeine (Aguiari, 2010), devido à grande velocidade com que novo conteúdo é publicado diariamente.

As soluções para problemas de busca desta natureza envolvem diversas abordagens, tais como processamento de linguagem natural, mineração de dados e processamento distribuído. Essas características são um forte indício de que um modelo baseado no paradigma de Sistemas Multiagentes é adequado para a solução desse problema (Wooldridge, 2002).

Os dados que devem ser coletados pelo sistema estão disponíveis nas mais variadas formas. Em diversas situações apenas textos em linguagem natural, sem nenhum metadado explicativo, estarão disponíveis para estudo. Eventualmente bancos de dados estruturados ou semi-estruturados relevantes também serão encontrados, mas possivelmente em menor grau.

Finalmente, é importante notar que o problema em questão constitui uma subárea da busca de pessoas, onde sistemas são desenvolvidos com o objetivo de coletar informações sobre determinadas pessoas e suas atividades na Internet. A demanda por estes sistemas tem aumentado consideravelmente, principalmente devido às necessidades específicas das empresas.

1.1 O Problema e sua Importância

O tráfico de animais silvestres é uma atividade criminosa, causadora de sérios impactos ambientais e sociais. Infelizmente, os dados disponíveis pelas autoridades sobre essa atividade são antigos. O Relatório Renctas (Renctas, 2001), por exemplo, é um relatório redigido pelo Renctas – Rede Nacional de Combate ao Tráfico de Animais Silvestres – cuja única publicação data de 2001. O IBAMA fornece dados mais recentes (IBAMA, 2003), mas ainda assim antigos. Portanto, todos os dados apresentados a seguir já sofrem de uma certa idade.

Segundo (Renctas, 2001), o tráfico de animais silvestres faz o escoamento dos animais principalmente por vias rodoviárias, em alguns casos podendo trafegar por mais de cinco mil quilômetros. As fronteiras dos estados da região amazônica constituem pontos estratégicos de escoamento. Durante essa atividade, diversas outras formas de crime acabam apoiando-a. Como exemplo, podemos citar o uso de contrabando (ou seja, a carga ilegal é escondida e não declarada) e documentos falsificados para encobrir a ilegalidade da ação.

No Relatório Renctas também foi detectado, já em 1999, 4.892 anúncios na Internet de animais silvestres oferecidos de forma ilegal. Os traficantes consideram esta mídia mais segura para suas negociações, por permitirem um certo anonimato. Podemos também supor que, com o grande aumento de 400% da Internet na última década (Miniwatt, 2010), o poder de penetração desta mídia na sociedade também deve ser um fator decisivo em sua adoção.

Os impactos ambientais causados pelo tráfico de animais são tremendamente nocivos. Segundo (Renctas, 2001), a retirada desses animais, dentre outros problemas, acelera o processo de extinção de espécies ameaçadas. Mesmo que a espécie retirada não esteja ameaçada, os outros animais sofrem com essa atividade criminosa. Todo o processo evolutivo desses espécies se deu em conjunto, e atualmente uma espécie depende de outra. Os tamanduás por exemplo têm um papel importante no controle da população de formigas na mata. Sem esse controle, todas as outras

espécies (incluindo as próprias formigas) seriam prejudicadas pela explosão populacional desses insetos. Paralelamente, as formigas também têm seu papel no ecossistema, e sua retirada também seria nociva. Temos portanto que a retirada de uma espécie de um ecossistema gera efeitos colaterais imprevisíveis, e em muitos casos, catastróficos.

Infelizmente, argumentos puramente ecológicos contra o tráfico não são suficientes para convencer as pessoas do impacto negativo destas atividades. Deve-se portanto frisar que o tráfico de animais silvestres também tem impactos sociais, por alimentar e movimentar outras formas de crime. Em (Renctas, 2001), dados são apresentados da interação destas atividades com o tráfico de armas, drogas e pedras preciosas.

As autoridades que atuam no sentido de combater esta prática criminosa sofrem grandes problemas relacionados à falta de contingente, equipamentos e veículos (Renctas, 2001). A grande dimensão do tráfico faz com que o seu combate exija um grande esforço por parte das autoridades, e que ainda assim é insuficiente.

1.2 Hipótese

A hipótese na qual este trabalho se baseia é que um sistema de monitoramento de redes sociais, desenvolvido sob o paradigma de Sistemas Multiagentes e análise de linguagem natural é capaz de detectar indícios de atividades relacionadas ao tráfico de animais silvestres.

Mais detalhes sobre a Inteligência Artificial, linguagem natural e Sistemas Multiagentes serão apresentados adiante. Por hora basta saber que os Sistemas Multiagentes constituem uma técnica da Inteligência Artificial que vem ganhando espaço nos últimos anos, por permitir a construção de sistemas com maior modularidade e escalabilidade (Wooldridge, 2002).

1.3 Objetivos

O objetivo principal deste trabalho é desenvolver um modelo de Sistema Multiagente que seja capaz de detectar indícios de atividades do tráfico de animais silvestres na Internet. Essa detecção deve fornecer informações que sejam úteis nas medidas de combate à ação em questão. O sistema deve ser capaz de extrair o máximo de informações suspeitas, se possível apresentando algum grau numérico de embasamento que expresse uma estimativa de que a atividade relatada realmente esteja ocorrendo.

Como objetivos secundários, também possuímos:

- desenvolver uma ontologia (Noy e Mcguiness, 2000) capaz de descrever o domínio do

tráfico de animais silvestres;

- desenvolver um *frame* (Ruppenhofer *et al*, 2010) que seja compatível com os diálogos empregados em negociações de animais silvestres realizadas na Internet; e
- avaliar as consequências de um sistema de busca baseado em linguagem natural, que empregue uma ontologia.

1.4 Organização da Monografia

Dentre os formatos de monografia recomendados pela Pró-Reitoria de Pesquisa e Pós-Graduação da Universidade Federal de Viçosa, optou-se pela monografia baseada em artigos. Desta forma, o corpo desta monografia será composto por dois artigos publicados ou submetidos. Estes dois artigos ilustram completamente todo o trabalho desenvolvido na dissertação.

Sendo assim, a monografia está organizada da seguinte forma: o presente capítulo apresenta o problema do tráfico de animais silvestres na Internet, justificando a necessidade de resolvê-lo e apresentando a hipótese e os objetivos do trabalho. Em seguida, o capítulo 2 é composto exclusivamente pelos dois artigos propostos, que em conjunto abordam completamente o trabalho desenvolvido. Finalmente, o capítulo 3 discorre sobre os resultados, tecendo algumas conclusões e apresentando algumas sugestões de trabalhos futuros.

O primeiro artigo do capítulo 2 apresenta o *frame* semântico desenvolvido para a dissertação. Este *frame* captura a forma como tipicamente se dão as negociações de animais silvestres pela Internet. Em seguida, o segundo artigo aborda em detalhes a ontologia que foi construída com base no *frame* do primeiro artigo. Este artigo também apresenta o modelo de Sistema Multiagente proposto pelo trabalho, completando assim o conteúdo abordado nesta dissertação.

A seguir apresenta-se a referência completa do primeiro artigo, que já foi publicado. O segundo artigo ainda está em submissão, e por isso sua referência completa ainda não pode ser determinada.

- CARRASCO, R. S.; OLIVEIRA, A. P.; LISBOA-FILHO, J.; MOREIRA, A.; ARROYO, J. E. C. Linguistic Structures to Support an Evidence Tracking System for Wildlife Trafficking. In Proceedings of XXXVII Conferencia Latinoamericana de Informática (XXXVII CLEI), 2011, Quito.

2 Artigos

Conforme citado no capítulo 1, este capítulo contém os dois artigos produzidos nesta pesquisa. Espera-se que ao menos mais um artigo seja ainda publicado, mas por questões de prazo a monografia não pôde aguardar a sua submissão para incluí-lo. De qualquer forma, os dois artigos apresentados a seguir cobrem completamente o trabalho desenvolvido nesta dissertação.

O primeiro artigo aborda o *frame* semântico desenvolvido. Um *frame* semântico é uma formalização linguística de sentenças, dentro de um contexto bem definido. De posse de um *frame*, é possível verificar se uma dada sentença encaixa-se neste, o que é um indício de que a sentença realmente trata do contexto especificado.

O segundo artigo tem como foco a ontologia desenvolvida neste trabalho. Uma ontologia é uma formalização de entidades de um determinado domínio, de forma a especificar suas propriedades e relações com outras entidades, de forma que seja possível aplicar técnicas de lógica formal para realizar inferências. Além da ontologia, este segundo artigo apresenta também o modelo de sistema multiagente proposto nesta dissertação, além de avaliar o desempenho do subsistema de quantificação de sentenças, que chegou a ser desenvolvido.

2.1 Artigo 1: Linguistic Structures to Support an Evidence Tracking System for Wildlife Trafficking

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Abstract

The illegal trade of wild animals is one of the most lucrative criminal activities. In Brazil, the wide variety of native wildlife has helped feed this illegal market, causing serious environmental and social implications. The fight against illegal trade of wild animals is crucial to protect natural resources and preventing the spread of other forms of crime. This type of illegal trade has been making increasingly use of the Internet to carry out their activities. In order to fight against this crime front, an automatic monitoring system would be of great help. However, to effectively perform this task, the monitoring system should be able to analyze the dialogues that take place during this activity. According to the latest cognitive theories, the dialogues conducted by a community in a specific activity obey linguistic pre-defined schemas (frames). This paper presents the frames that occur in this area, how they were obtained and how they are used in a computer system for tracking wild animals illegal trade.
Keywords: Semantic Frames, Ontology, Wildlife Trafficking.

1 This work is partially sponsored by FAPEMIG and CNPq
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2.1.1 Introduction

According to [14], during the years 2000 through 2009, the number of Internet users increased by almost 400%, reaching nearly 360 million users. This growth rate has declined, yet the number of users that already exist is impressive. Unfortunately, the popularization of the Internet also helped people to carry out criminal activities. The rise in crime being committed or facilitated by the Internet has been so great that the U.S. government created a department only to receive complaints about cybercrime, the Internet Crime Complaint Center (IC3). The IC3 is a partnership between the Federal Bureau of Investigation (FBI) and the National White Collar Crime Center (NW3C), and since 2000 it receives several complaints of crimes perpetrated on the Internet. More details about this organization can be obtained on its website: http://www.ic3.gov. The trafficking of wild animals is one of several forms of crime committed on the Internet. According to [5], the illicit trade in wildlife brings in US$10 billion annually and 2 to 5 million wild birds are traded illegally every year, numbers estimated by the State Department. According to [10], in 2003 the wild animals trade withdrew about 12 million wild animals from the Brazilian forests. Some of these animals are traded illegally on the Internet [4], on community sites or trading community sites like OLX (http://www.olx.com.br).

The dimension of the illegal trade of wild animals requires much effort by the specialized authorities to combat it. Unfortunately, the fight against this type of activity is done with few resources. It is possible that automatic monitoring systems are capable to offer a great gain in productivity to combat the trafficking of wild animals. The monitoring of such criminal activities on the Internet probably would be of great value in prevention. But for these systems be developed one must use various techniques, such as natural language processing, data mining and distributed processing.

From the point of view of natural language processing, it is necessary to understand the speech and the terms used by the actors who work in wildlife illegal trade. This is an activity that has its own codes and dialogues and to identify the evidence of this activity it is necessary to know them. One way to establish the linguistic elements (syntactic and semantics) of this activity is to register the prototypical scenes underlying the domain discourses, detected through *corpus* linguistic analysis. These prototypical scenes called semantic frames (hereinafter frames), were proposed by Fillmore [6] with the purpose of presenting an alternative model of semantics for the syntactic elements in an utterance. Frames, as proposed by Fillmore, are conceptual frameworks established in permanent memory, the result of our interaction with the world and the consolidation of our daily experience. It's a knowledge built through experience and experimentation, forming a body of stereotyped knowledge.

This paper presents the frames that occur in the domain of wildlife illegal trade, how they were obtained and how they are used in a computer system for tracking wild animals illegal trade. The rest of this paper is structured as follows. The next section briefly discusses the concept of semantic frames. Section 3 reports on related work. Section 4 shows how the frame for the analyzed field was obtained and presents the frame. Section 5 presents the ontology used in this work. Section 6 shows the application in a system for monitoring animal traffic on the Internet. Finally, section 7 presents the conclusions of the research carried out.

2.1.2 Semantic Frames

Frames are schematic scenes that are used to establish the meaning of each term in a sentence [18]. Each frame has a well-defined context, where the events and roles involved in the discourse semantics are fixed. Thus, the analysis of some words in a text may allow the deduction of the underlying context. The context set by a frame has a limited scope and is well defined. To describe a given domain a number of frames may be needed. Some terms of the sentence may be specific to a particular frame and its presence is enough to instantiate the frame.

Interestingly, frames and ontologies may play a complementary role in natural language processing. While ontologies are responsible for formalizing the concepts in a domain, the different frames involved in the domain formalize the semantics of a speech – which in turn can then be formalized by the established ontological concepts. We have then, roughly speaking, the analysis of natural language could be done through two passes. At first a semantic analyzer would study the text under a perspective based on frames. From this analysis, another would be made where the terms would then be described by an ontology suitable for the situation.

2.1.3 Related Work

Related works are difficult to find, since in general are developed by agencies to combat crime and intelligence agencies, which prefer to keep their work confidential. The FBI has the Carnivore system [13], which operates on private messages of Internet users, which leads to discussions of privacy violation. However, no systems were found in the literature that analyzes natural language sentences to detect illegal activities. As a somewhat

related work one can cite the work in identifying social networks [12], and association of persons to documents [1], which analyze texts to identify people.

The combination of frames and its corresponding lexical base, the FrameNet database [2] with ontologies is not new. There is a project that combines SUMO top-level ontology with FrameNet for linguistic inference [19]. In this case the FrameNet semantic types are mapped to the ontology concepts. This combination is important because it combines the inferential ability of ontologies (absent in the FrameNet) with the language resources of the FrameNet (missing in the ontology). Chow and Webster [3] proposed the integration of WordNet with FrameNet and SUMO ontology in order to perform the classification of verbs according to the analysis of the ideational metafunction of the Systemic functional grammar (SFG) [9].

Lopez et al. [11] used the FrameNet aligned with the DOLCE ontology (Descriptive Ontology for Linguistic and Cognitive Engineering) [8] to describe emotions. The system is being used to develop computer interfaces sensitive to emotions. Ofoghi et al. [17] and Ofoghi [16] proposed to extend the FrameNet through an ontology to enable implementation of a Question Answering System that were able to deal with questions where the answers involve the processing of chains of predicates. Chains of predicates, as defined by [15], are lexical chains that are sequences of semantically related terms.

Although related, none of these works have combined ontology with FrameNet in order to collect evidence of a specific event. And the approach of using ontology to annotate the terms to allow the connection of the frame with the expression and enable the measurement of the degree of this connection is the aspect that differs this proposal from previous ones.

2.1.4 Obtaining the Frame

A semantic frame shall be supported by *corpus* evidence in order to establish the linguistic link with the semantics proposed by the scene described by the frame. Therefore, it is necessary first to obtain a *corpus* to provide the evidence needed for the frames creation. For this purpose we created a *corpus* obtained from conversations on relationships sites that dealt with this kind of trade.

The animal traffic on the Internet is a type of commercial transaction, but has specific roles and peculiarities since it is an illegal trade. The goods is one or more animals and there are some elements that are not present in an ordinary commercial transaction, such as whether the animal is registered, the transfer to another communication environment to complete the transaction, the shipping method, the animal value when it is not registered, etc.. The recognition of these elements is essential for the recognition of a trafficking scene. The analysis of the *corpus* sentences resulted in the frame shown in Fig. 1. In the representation of the frame we used the same notation used by the Berkeley FrameNet. The lexical units are shown with black background and frame elements are shown with colored background.

The types of transaction, purchase or sale, requires a perspective view at the scene of animal trafficking, which can result in a subdivision on the **Transação_trafico_animais** (Animal_Trafficking_Transaction) frame. In this work we are only interested in the perspective of the seller, since this is the one that can provide more evidence on the occurrence of trafficking. So we only designed the seller perspective **Venda_ilegal_animais** (Illegal_Animal_Selling) frame, as shown in Fig. 2. This perspective is used in the system described below.

Transação_trafico_animais (Animal_Trafficking_Transaction)

Definition:
Commercial transaction involving a **buyer** and a **seller** (dealer) and where the item purchased is one or more **animals**. The animal is not **authorized** to trade and have illegal origin. Because of its informal nature, the animal is not always exchanged for **money** and can be exchanged for other **goods**.

Frame Elements

Core

Buyer - buyer wants an animal and offers a Good to a dealer in return.

[eu] Compro femea de trinca ferro pago ate 200,00 ou troco por par de alto falante novo no valor de 299,00 alto falante de carro corsa sedan e astra

Animal - animal, illegal, that is exchanged for a good.

Good - anything that can be exchanged for an animal.

Dealer - the seller of unregistered animals.

[eu] tenho 1 sagui macho para troca ou venda! … obs: não é legalizado !

Non-Core:

Location original - where the animal is being offered.

Destination location - Location where the animal will be sent.

Transfer way - Indicates how the animals are delivered.

Vendo Iguanas Jovens, Animais Lindos, … Entrego em mãos p/ SP Capital e Grande ABC.

quero comprar filhote de iguana mas eu moro em BH/MG e nao quero que meu animal seja tramportado via sedex.

Legal state - Indicates whether it haves legal registration.

Frame-frame Relations:

Inherits from: **Transfer**
Subframe of: **Commercial_transaction**
Is Perspectivized in: **Venda_ilegal_animais**

Lexical Units:

Vender.v
Comprar.v
Troco.v
Rolo.v
Transaciono.v

Fig. 1. Frame Transação_trafico_animais

Venda_ilegal_animais (Illegal_Animal_Selling)

Definition:
Commercial transaction involving a **buyer** and a **seller** (dealer) and where the item purchased is one or more **animals**, taking the **seller** view perspective. The animal is not **authorized** to trade and have illegal origin. Because of its informal nature, the animal is not always exchanged for **money** and can be exchanged for other **goods**.

Frame-frame Relations:

Is Perspectivized in: **Transação_trafico_animais**
Lexical Units:

Vender.v
Troco.v
Rolo.v
Transaciono.v

Fig. 2. Frame Venda_ilegal_animais

2.1.5 The Ontology

The main purpose of an ontology, as normally happens in Computer Science, is to formally describe the elements of a given domain and their relationships. The ontology developed in this work aims at describing the elements of wild animals trafficking domain in websites. It was developed as a domain ontology, and then merged with the DOLCE ontology, in its lite version DUL (DOLCE+DnS Ultralite)[7].

The process of ontology development has adopted an ad-hoc approach. During the ontology development, many changes were made. Entities were created, while others were replaced. No need to discuss each of the small structural changes, so this section will only present two versions of the ontology: before the merging with DUL and after the merging. This latest version represents the final result.

The structure of the first version is shown in Fig. 3. At top level of the class hierarchy, we have the entity "Thing", which is defined as being the standard OWL top level entity. Just below, the structure is divided into two major entities: "Entidade" (entity), which represents any physical or abstract object that exists entirely in a given instant of time, and "Evento" (event), which includes all events. Events are entities whose parts do not occur together in a given time. Parts occur at different times, unlike the Entities.

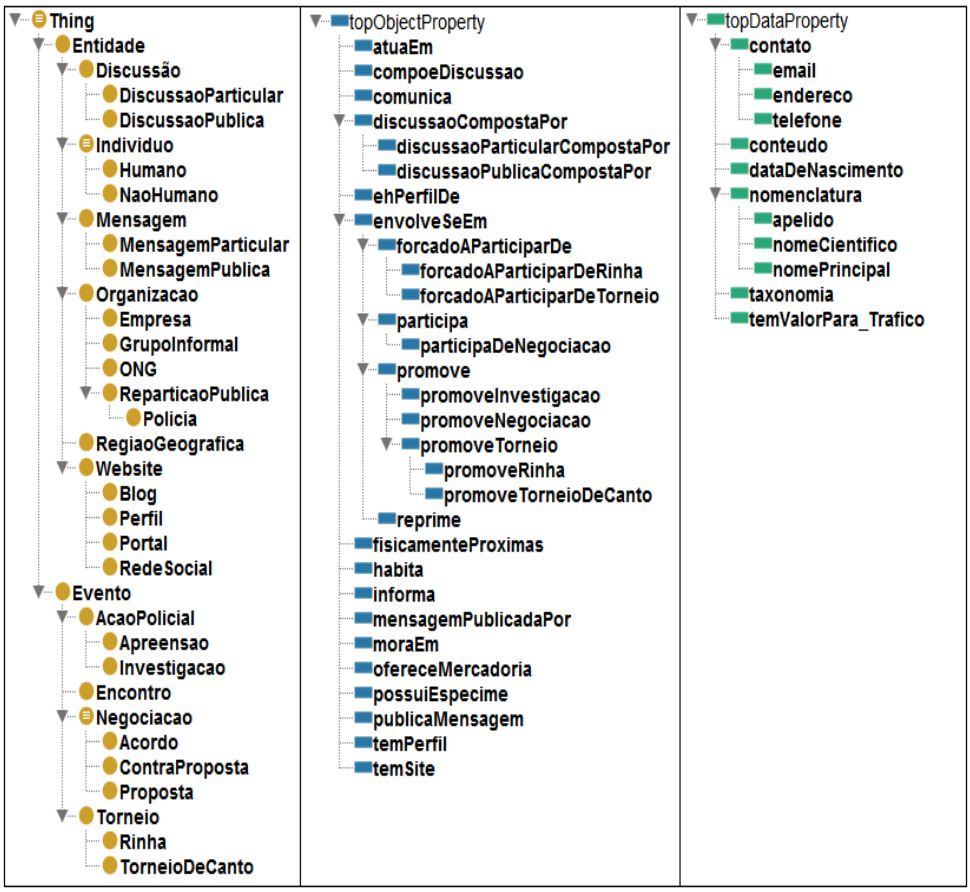

Fig. 3. Ontology before the merging with the DUL. From left to right are presented, respectively, classes, object properties and data properties.

One or more entities may be part of an event and no event occurs without the action of at least one entity. This relationship is expressed by the object property "envolveSeEm", which reflects the participation of an entity within an event. The subclasses of this property specify how such participation took place, covering four possibilities: forced participation, event promotions, conventional participation and negative participation, which inhibit the event.

Some misconceptions occurred at this stage and were corrected after merging with the DUL ontology. A serious conceptual error was to treat the Class Agreement, Proposal and counter proposals being subclass of Negotiation. While certainly these items comprise a negotiation, they are not alone, Negotiations. This is a type relationship "is part of".

7 http://ontologydesignpatterns.org/wiki/Ontology:DOLCE%2BDnS_Ultralite

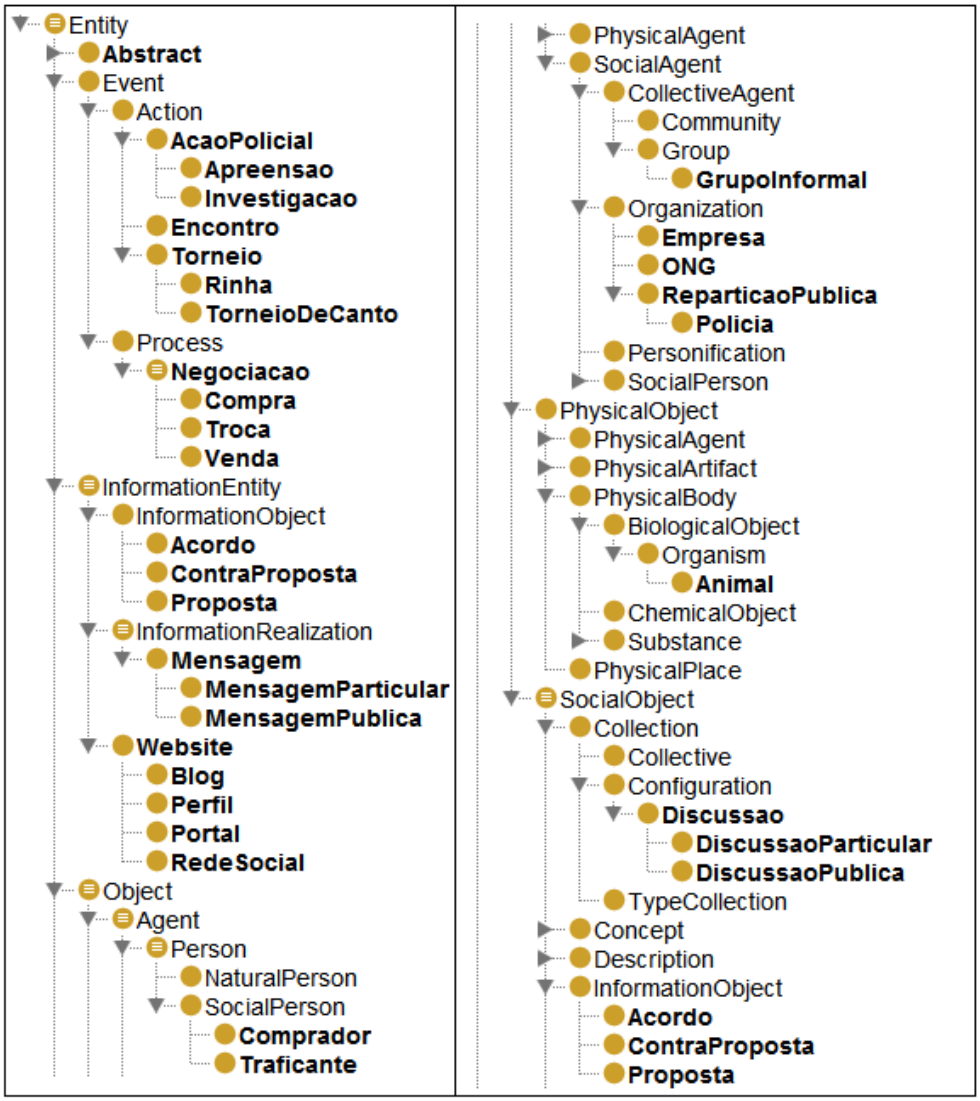

Fig. 4. Structure of the entities after the merger with DUL

The use of the term "NaoHumano" (nonhuman) instead of simply "Animal" was another correct decision after the merger. In this case, the correct is that "NaoHumano" encompassed all "Thing" instances that do not belong to the class Human. Thus, a message would also be a "NaoHumano", and also a "AcaoPolicial" (police action). The term "animal" was adopted after the fusion. Other minor conceptual errors and some absences were corrected with the merger. Although the use of ontology DUL did not directly correct these defects, the necessity of having to adjust them to DUL caused the topology to be rethought from a different perspective. The final result is shown in Fig. 4.

Fig. 4 does not show the structure of the object properties or data, because the changes were not substantial. Basically, the properties became subclasses of the top of the DUL property. The biggest changes were in the class hierarchy, so only this aspect is presented if Fig. 4. Importantly, the DUL ontology is very extensive, and is not being displayed in full. Some classes in Fig. 4 are not expanded, i.e. have subclasses that are not being displayed. These sub-classes have a duplicate hierarchy, presented in another section of the structure.

One important change in the merged ontology is that duality Entity/Event disappeared. In DUL, Entity is the top class and Event is a subclass of it. Thus, many structural changes have occurred. Some new classes have also been added, as "Comprador" (Buyer) and "Traficante" (trafficker), which replace the human entity. The entity "NaoHumano" has been converted to the entity "Animal", a more appropriate term for the concept, as discussed above. Some entities, such as "RegiaoGeografica" (Geographic Region), disappeared entirely. This is because the DUL had already an equivalence class (in this case PhysicalPlace), and we chose to keep the DUL top classes of the ontology, so that its structure was unchanged.

2.1.6 Application in Monitoring System

The frame will be used in conjunction with the domain ontology by a software agent that analyzes the dialogues that takes place on social networking sites. The agent is inserted into the tracking system that is implemented according to the approach of multi-agent systems. The agent that analyzes the dialogue uses the ontology and a database of names to identify the elements of dialogue. Next, apply the frame to check if the conversation has elements that indicate the possibility of whether it is an arrangement involving wildlife trade.

The basic condition for the analysis is the detection of a wild animal offer. After that, weak and strong evidence of the occurrence of an illegal sale is collected. Table 1 shows the evidence that, at the moment, is used. There are future plans to insert other evidences, such as geographic location.

Table 1. Trafficking of wild animals evidence

Evidence	Grade
Low price	medium
Animal species	weak
Informal language	weak
Confidential Transaction	weak
Inadequate delivery	medium
Not registered	strong

The ontological analysis identifies the nature of sentence elements, thus enabling a later fit of the frame elements. The lexical units and the core elements are the basic conditions for invoking the scene. But the elements that establish the possibility of an occurrence of an illegal trade are not nuclear, such as value, shipping, transfer form and legal status. In general, registered animals have a higher value than the illegal ones. It is also illegal to send by postal live or dead animals and plants. Other features of the transaction, such as no mention of the registration of the animal, secret negotiation and personal delivery, could indicate the occurrence of illegal activity. In any case the system will never categorically claim that the illicit is occurring.

Now we explain, with examples, the steps carried out by the agent that examines the conversations.

Level	*rolo* *somente rj* *coleiro baiano de gola,anilhado sem rg e raçudo..* (Orkut)
ontological	[negotiation] [GeographicRegion] [animal] [LegalState]
frame	Lex. unit Destination location animal Legal state

Fig. 5. Example of a frame matching

In the example of Fig. 5 the ontological parser identifies the classes of some lexical items, which are then matched to the elements of the frames. It is essential to identify an animal being sold or offered for an exchange. Note that the element frame **Legal Status** indicates the possibility of an offer of an animal that is not a legal one.

level	*[vendo] Casal de iguanas babys 200,00$ C/ Sedex10 Incluso.* (Orkut)
ontological	[negotiation] [animal] [currency] [shipping method]
frame	Lex. unit animal Good Transfer way

Fig. 6. Example of a frame matching

In the example in Fig. 6 the low price of the animal and the form of shipment indicate a possibility of an offer of a not legalized animal.

2.1.7 Concluding Remarks

This paper presented a linguistic schema (frame) to be used by a monitoring system for wild animal trafficking. The system is under development, but the application of the frame can already be tested. The matching of the

frame with the sentence, mediated by domain ontology allows us to see whether it may have been enunciated in a scene of animal trafficking. The system, once deployed, can help the authorities to fight this type of situation. The work being developed in parallel with the one presented in this article is the development of a multi-agent system with several features such as capture of evidence and the establishment of their geographical location.

The frame was obtained from a *corpus* developed especially for this purpose. The *corpus* was compiled from open conversations taken of social networking sites. From the sentences that make up the *corpus* were removed any reference that could identify the authors of the sentences. This was done because we have no legal power to investigate or indict citizens in any crime. The developed system should be used by people and agencies with that power.

2.1.8 References

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2.2 Artigo 2: An ontology supported system for searching evidence of wild animals trafficking

Abstract. *The illegal trade of wild animals is one of the most lucrative criminal activities. In Brazil, the wide variety of native wildlife has fed the illegal market, which has serious environmental and social implications. The fight against illegal trade of wild animals is crucial to help protect natural resources and preventing the spread of other forms of crime. This type of illegal trade has been making increasingly use of the Internet to carry out their activities. In order to combat this criminal activity, an automatic monitoring system is essential. However, for the effective realization task, the monitoring system should be able to analyze the dialogues that are carried out this activity. For this to occur one need the knowledge of the concepts and relationships that occur in this domain. This paper presents a domain ontology supported system that search for evidence of illegal trade of wild animals. It shows how the ontology was developed and how the ontology is used in the system for tracking wild animals illegal trade. It also presents the results of applying the system in a small corpus.*

2.2.1 Introduction

The wildlife traffic is amongst the most successful and lucrative criminal activities in the world. In a 2008 report to the U.S. Congress, Wyler and Sheikh (2008) stated that "*Global trade in illegal wildlife is a growing illicit economy, estimated to be worth at least $5 billion and potentially in excess of $20 billion annually*". Because of being generally labeled as a "minor crime", it runs rampant in several countries, especially in those which have a rich biodiversity, as is the case of Brazil. The Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA) stated that just in 2003 at least 12 million specimens have been illegally taken from Brazilian ecosystems [IBAMA 2003]. Still according to them, it could well be 38 million. In fact, these criminal activities goes along with other forms of traffic, such as valuable stones, goods and drugs. Being highly regarded as one of the most pernicious activities in almost every modern city, its quite impressive that drug trafficking is in fact being helped by wildlife traffic, and not the opposite.

In 2001, the National Network of Combat Against Wildlife Traffic (Renctas) has published a report (Renctas 2001) in which it analyzes, among other issues, challenges of the authorities in fighting wildlife traffic. One of the top issues is the monitoring of such activities in social networks in the Internet. This is astonishing, given the fact that the Internet was not widespread in Brazilian homes in 2001.

A quick visit to the one of the most popular social network in Brazil, Orkut[8], shows that the situation hasn't changed. Smugglers post ads of unlicensed animals, and the mail service is illegally used to deliver spiders, turtles, snakes and even iguanas. All of this is stated in plain sight, without masquerading by code words, abbreviations or any form of text deception.

Given this situation, this work describes a computer system that was built to monitor traffic negotiations in social networks. This system applies an ontology developed to this purpose that helps to understand the nature of the collected posts. The ontology helps to perform a matching between the sentences and the animal trafficking scene described by a semantic frame [Fillmore, 1977; 2006] previously built [Carrasco et al., 2011].

This paper is organized as follows. Section 2 cites some related works. Section 3 presents some hindsights about ontologies, and the development of an ontology to cover the domain of wildlife traffic conducted over social networks. Section 4 outlines the model proposed to monitor such activities. A computer system was developed as a proof of concept to test the idea of using natural language processing allied to an ontology in order to evaluate the chance of wildlife traffic occurring in some manually collected posts. Finally, section 6 presents a quick analysis of the results, and draws some conclusions.

2.2.2 Related Works

The authors couldn't find any work that deals directly with detection of wildlife traffic by analyzing natural language sentences posted in social networks. Most of similar studies try to solve a different problem with similar techniques. This section cites some of them.

The FBI developed a system called Carnivore [Mccarthy, 2001] that was used to sniff packets sent from a given IP address, in order to capture emails that contain suspicious messages. Given its application as a security tool, its exact behavior was never entirely exposed. So, one can only guess at its inner workings, which seems to be based in some kind of detection of black-list words, maybe such as “bomb”, for terrorism, or “pedo” for pedophiles. The Carnivore system was useful to raise evidence to convict a suspect, but the assumption of a suspect prevents it from finding unexpected criminal activities.

Lupiani-Ruiz, E. et al. (2011) presented a financial news semantic search engine based on Semantic Web technologies. The search engine used an ontology population tool that assists in keeping the financial ontology up-to-date.

8 http://www.orkut.com

As another somewhat related work we can cite the work of Balog et al. (2008) that associates people to documents.

2.2.3 Ontology

This section discusses how an ontology was developed to be applied in the computer system and its final structure. Its usage in real conversations will be presented in section 2.2.5.

2.2.3.1 Top-level Ontologies and Domain Ontologies

The main purpose of an ontology, as normally happens in Computer Science, is to formally describe the elements of a given domain and their relationships so that it can be shared and processed by automate systems. There are several ways to characterize and classify the different types of ontologies, but the distinction which is relevant for this work is the one that distinguishes top-level ontology from domain ontology. The domain ontologies focus on describing the elements from a particular domain. A domain ontology that aims more specifically on the taxonomic structure they are referred to as lightweight ontologies [Masolo et al 2003].

On the other hand, top-level ontologies attempts to present an overview of the nature of the objects that make up the world. They are domain independent and are based on philosophical principles as the identity, uniqueness, etc. [Guarino and Welty, 2000]. The alignment of a domain ontology with a top-level ontology can produce better structured and better defined concepts, allowing a more natural merge with other domain ontologies.

The ontology presented in this article was developed aiming to describe the elements of the domain of wild animals illegal trafficking held in websites and social networks. It was developed as a domain ontology, and then merged with the DOLCE ontology [Borgo and Masolo, 2009], in its light version, named DUL [Gangemi, 2010].

2.2.3.2 Ontology Development

The specification of ontologies is not a trivial task. Difficult decisions regarding the scope and granularity of the ontology, for instance, will have a tremendous impact on the outcome. Moreover, the philosophical principles underlining the task and the perspective from which the domain is seen will define the entire ontology class hierarchy. Without proper care, one could end up with an ontology which does not meet the proposed requirements, and therefore unsuitable for the role it should play. This fact may be detected only when the ontology is already in use, increasing considerably the cost of correction.

In order to support this work, several ontology development processes were analyzed. Some of these processes are summarized in [Öhgren and Sandkuhl 2005], where they also presented an unnamed new process, developed from the previous analysis. This process is similar to the process of software development, involving an initial stage of requirements analysis. Techniques such as brainstorming and interviews with domain experts are also employed. In the end, the author concluded that the best strategy was to develop the ontology based on *corpus* evidence and to, and afterward, adjust it to a consolidated top-level ontology. The remainder of this section will describe how this was done.

The basic criterion for selection of the concepts of the ontology was its occurrence in a corpus previously constructed for the domain. The corpus was constructed upon dialogues extracted from social networking sites dealing with the trading of wild animals. The ontology was expressed in OWL [McGuinness and van Harmelen 2003], using the Protégé editor (http://protege.stanford.edu/). After the domain ontology construction, it was adapted to fit in a top-level ontology to enable a better adjustment of its structure and future sharing. The ontology selected was the top-level ontology DUL [Gangemi, 2010].

2.2.3.3 Final Ontology Structure

During the ontology development, many changes were made. Entities were created, while others were replaced. No need to discuss each of the small structural changes, so this section will only present two versions of the ontology: Before the merging with DUL and after the merging. This latest version represents the final result. The structure of the first version is shown in Figure 1.

At top level of the class hierarchy (left column), there is the entity *Thing*, which is defined as being the standard OWL top level entity. The middle column depicts the *object properties*, and at the top of that hierarchy is the OWL standard topObjectProperty. Object properties stands for the relations between objects. Finally, the right column presents the *data properties*, whose hierarchy has the OWL standard topDataProperty at the top. Data Properties stands for the object attributes.

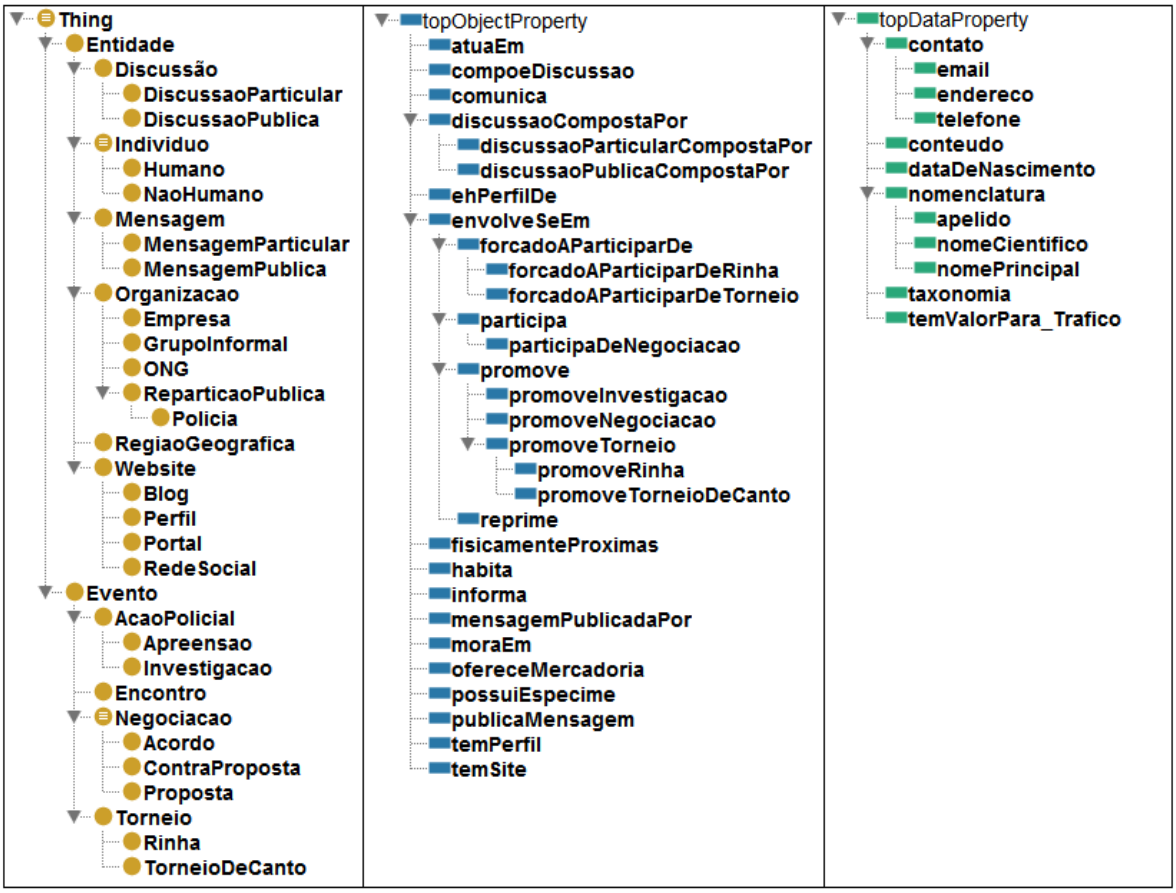

Figure 1: Ontology before the merging with the DUL. From left to right are presented, respectively, classes, object properties and data properties.

Just below, the structure is divided into two major entities: *Entidade* (entity), which represents any physical or abstract object that exists entirely in a given instant of time (an *endurant*), and *Evento* (event), which includes all events. Events are entities whose parts do not occur together in a given time (a *perdurant*). A perdurant occurs in time, and can only be seen partially at any instant where it exists. An endurant, on the other hand may change over time, but at any instant is a complete entity. See Gangemi et al. (2003) for a better explanation of the perdurant-endurant distinction.

One or more entities may be part of an event and no event occurs without the action of at least one entity. This relationship is expressed by the object property *envolveSeEm*, which reflects the participation of an entity within an event. The subclasses of this property specify how such participation takes place, covering four possibilities: *forced participation* (e.g.: dogs in a dog fight tournaments), *event promotions* (e.g.: dog fight tournaments organizers), *conventional participation* (e.g.: the owners of the dogs in a dog fight tournaments and dog fight tournaments audience), and *suppression* (e.g.: the police).

Some mistakes occurred in this stage and were corrected after the merge with the ontology DUL. A

serious conceptual error was to treat the classes *Deal*, *Proposal* and *Counter Proposals* as being subclasses of *Negotiation*. While certainly these items comprise a negotiation, they are not alone, a full Negotiation. In fact what exists is a part-whole relationship. Since this was the case, the classes *Deal, Proposal* and *Counter Proposal* now inherits from *Information Entity*, which is a sibling of *Process*, the superclass of *Negotiation*.

The use of the term *Animal* instead of *NaoHumano* (nonhuman) was another correction done after the merger. Nonhuman encompassed all instances that do not belong to the class *Human* and would be more comprehensive then we intended. Thus, a message would also be a *NaoHumano* as a *AcaoPolicial* (police action). Other minor conceptual errors and some absences were corrected with the merger. Although the use of ontology DUL did not directly correct these issues, the necessity of having to adjust them to DUL caused the topology to be rethought by a different perspective. The final result is shown in Figure 2. Some entities are duplicated, because OWL allows for multi-inheritance, and in these cases, they may appear under each superclass.

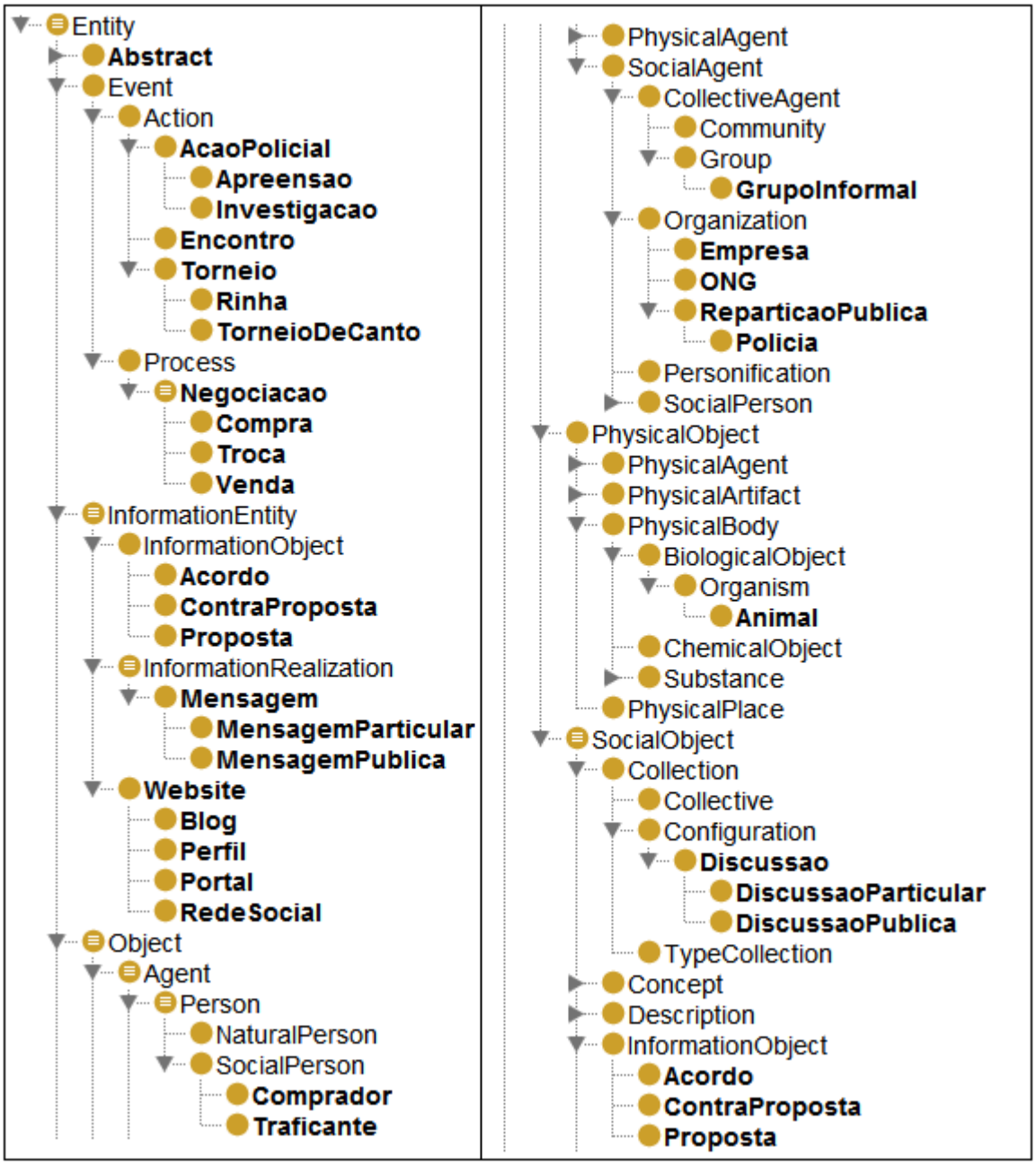

Figure 2: Structure of the entities after the merge with DUL.

Figure 2 does not show the structure of the object properties or data, because the changes were not substantial. Basically, the properties became sub-properties of the DUL properties. The biggest changes occurred in the class hierarchy, so only this hierarchy is shown. Since the DUL ontology is very extensive, it is not being fully displayed. Some classes in Figure 2 are not expanded, e.g. have subclasses that are not visible. These subclasses have a duplicate hierarchy, presented in another section of the structure.

One very clear change in the merged ontology is the exclusion of the *Entity/Event* duality. In DUL,

Entity is the top class and even *Event* is a subclass of it. Thus, many structural changes have occurred. Some new classes have also been added, as *Comprador* (buyer) and *Traficante* (trafficker), replacing the *Human* entity by the role played by the actor. The entity *NaoHumano* has been converted to the entity *Animal*, a more appropriate term for the concept, as discussed above. Some entities, such as *RegiaoGeografica* (geographic region) were simply left out. This occurred due to the existence of the class *PhysicalPlace* in DUL ontology and we chose to preserve its structure.

2.2.4 Proposed System

The ontology presented in this paper was developed in order to be added to a broader system of natural language processing. This system will not only analyze the messages of the social network, but also apply techniques of pattern recognition and data mining. To better understand the role of ontology in the system is important to understand the overall system architecture.

2.2.4.1 Multiagent Systems

Multiagent Systems (MAS) is a paradigm for designing and implementing computer systems where the system is modularized into independent units called *agents*. The agents communicate, working cooperatively and competitively, according to its own goals, allowing the system to meet their overall goal. This model was adopted during the modeling of the monitoring system, in order to reduce the complexity of system design. This paradigm is based on the concept of an *agent*, whose definition has not yet reached a consensus in the literature. One of these definitions is proposed in Russell and Norvig (2010):

A*n agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators.*

So, there are two main behaviors associated with an agent. First, it should be able to somehow perceive the environment in which it is located. An agent doesn't need to be able to perceive anything, nor should it always perceive correctly. It just needs to be able to recognize some meaningful information, and some occasional failures are accepted. Second, it needs to able to alter its environment by some kind of mechanism. Again these mechanisms need not to be perfect, and definitely there is no need to be able to act in every way possible.

There is a third, hidden behavior in this definition that, in fact, is more interesting from a development point of view. Since an agent can sense and act, it's expected to say that as agent could act *based* on its perceptions. This means that an agent may reason on what it perceives and acts

accordingly. To resonate about something, the agent needs to have its own interests in the situation, no matter how unsophisticated is.

MAS are composed by more than one agent (Wooldrige, 2002). Through the social interactions of its agents, a MAS expects to come to a solution for the problem it's trying to solve. The agents may not be aware of the system goal, and certainly will just try to get going its own business. This may conflict, resonate or have no relation at all with others agents goals. Nothing prevents two agents in the same MAS to compete with each other because of conflicting goals.

Since each agent is totally decoupled of each other and from the system as a whole, a MAS is inherently distributed (Wooldrige, 2002), with the possibility of having a single instance executing in multiple computers. Each computer can have just a subset of every agent on the system, and yet all of them would be able to interact.

Given the vagueness of the agent definition, there is a great myriad of agents and MAS that can be developed. This work is based on the cognitive MAS approach (Bordini et al., 2001). A cognitive MAS is based on elaborated agents, capable of sophisticated reasoning and communication. These agent interact directly, exchanging messages as if they were speaking to each other. Complex architectures were proposed for cognitive MAS, most of them based in psychology and anthropology.

The cognitive MAS approach has several advantages that culminated on its choice and the strongest one was the elaborate nature of cognitive agents enable a high level view of some specific subset of the solution. It's possible to envision the system as an organization, with each agent working as a collaborator of the team, each one performing a specific duty through the desire to accomplish its individual goal.

2.2.4.2 Actor Diagram

An actor diagram (Spanoudakis and Moraitis 2007) was elaborated in order to obtain a better understand of the whole system. This simple model consists of circles representing each actor, and rounded rectangles representing goals. A goal that has one corner under an agent pertains to it. This means that this actor doesn't need any other to fulfill its goal. Its sole effort will suffice. In the cases where an actor needs the help of another one to accomplish some goal, an arrow points from the latter to the goal, and another leaves the goal to reach the former actor. The terms *actor* and *agent* mean the same thing in this context, and the former is preferred in this section because of the diagram name.

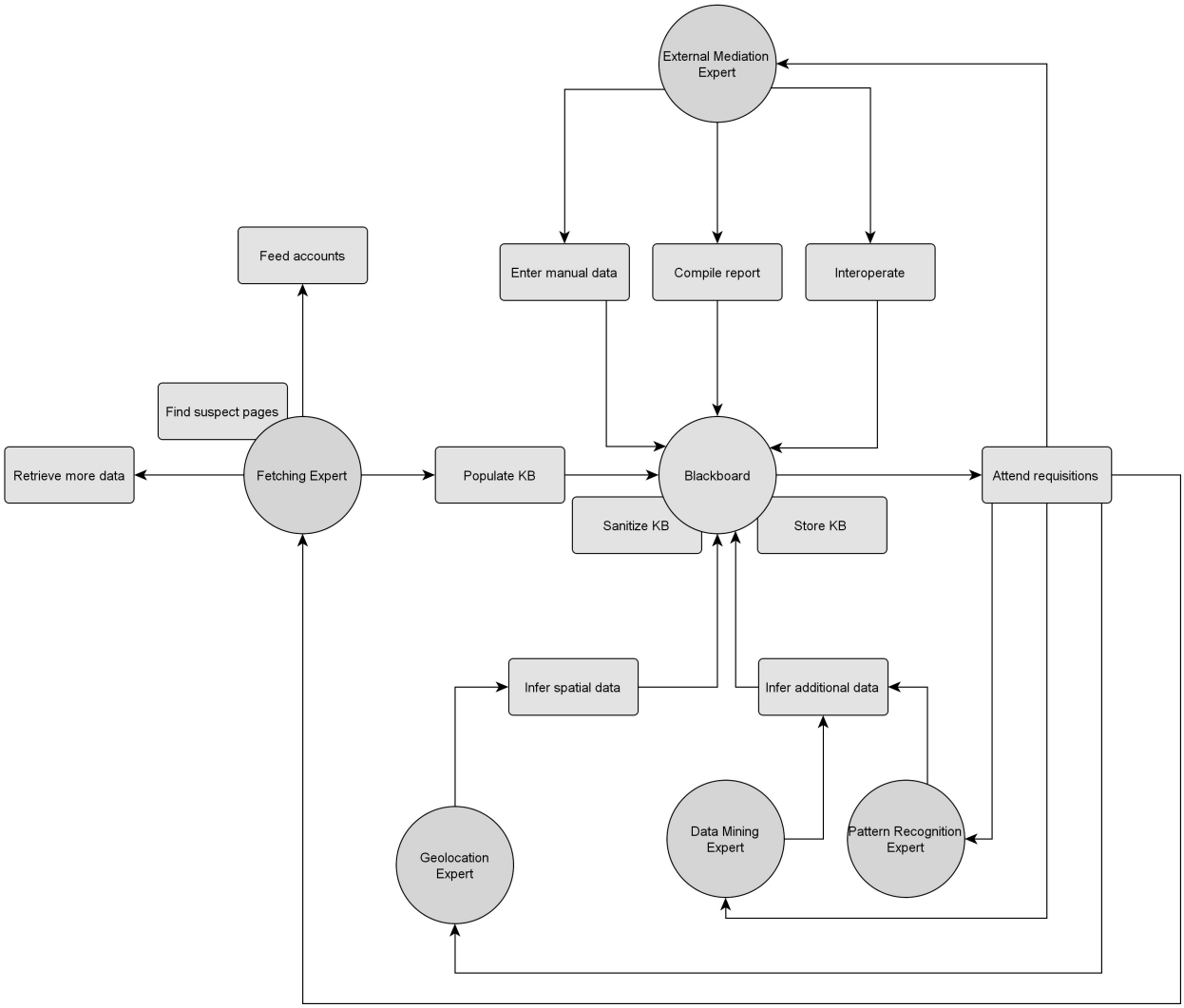

Figure 3: Proposed actor diagram.

Figure 3 shows a central view of the obtained model. In it, there are two kinds of actors. The first kind is solely represented by the central *Blackboard* [Garlan and Shaw 1994] actor. This agent is responsible for storing and delivering data to the system, in a way that centralizes every datum on it. The second kind of agents illustrated in Figure 3 is the *Expert* ones. Each expert has the means to possibly derive more data for the Blackboard. Expert agents can communicate with the Blackboard, but are forbidden to interact directly. This constraint assures that the communication will be simplified to interactions expert-blackboard, and not also expert-expert. Since the idea is that each expert holds all expertise on its own, their interactions would be minimal, mostly forwarding data – as the Blackboard already does.

These architectural choices diminish the work involved in attaching a new Expert in this system.

This happens mainly by lowering the reliance that each expert needs to have in each other. The experts need only to know how to reach and communicate with the Blackboard. Also, by storing it's deductions on the Blackboard, each agent grants everyone else with his findings, with no need of direct communication.

The Experts agents are named so because that is how they show up in the context of Figure 3. The truth is that each Expert can be in reality a mediator between the Blackboard and another MAS, possibly developed to implement its expertise. These MAS are called the Expert group, and should not intersect in any way, or then the constraint that each expert communicates via the Blackboard can be rendered false. Besides this, there are no restrictions on how these groups should behave, except the expectation that the Expert rules its group in some way. This is not enforced, but is advised, since if that's not the case, then the group is of little use to the Expert in question.

The presented expert agents illustrated in Figure 3 figures only as examples of how the system can be organized. There is no constraint preventing that some of these gets suppressed in some implementation. Also other Experts can be included in the MAS at any time. Only the Fetching Expert and the External Mediation Expert presents as an exception to this rule. The first is needed in order to fetch new data from the Web, and the second to allow a direct communication with other systems.

Given the importance of the Fetching Expert, this agent and it's corresponding group will be addressed in the remainder of this section. The Fetching Expert assignment – locate and retrieve possible wildlife trafficking discussion over social networks – is central to the execution of every other Expert agent. If the Fetching Expert group fails to feed useful data into the Blackboard, there will be little to be done by each other Expert. And since the Fetching Expert performs the first pass of any natural language analisys of the system, it's of great importance to this work.

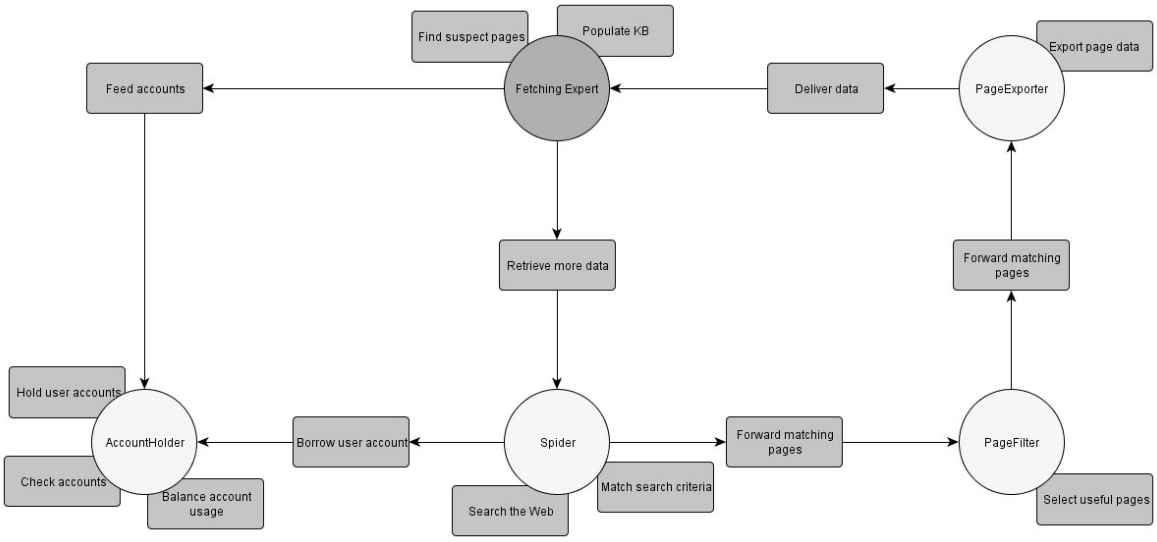

Figure 4: The Fetching Expert group

Figure 4 presents an Actor Diagram model of the Fetching Expert group. In this group, The Fetching Expert acts just as a proxy between the Blackboard and the Fetching group, forwarding data in both ways. It forwards profile accounts of any social network that it finds in the Blackboard. It's expected that some accounts will be fed in the Blackboard by other experts (specially the External Mediator Expert), and the Fetching Expert should retrieve them, and then put these accounts into use on it's group, since some social networks only allows access to authenticated users. The agent AccountHolder is responsible for storing profile accounts. It should also respond to requests of profile accounts of other agents, sending any amount of accounts as it believes that is appropriate – even no account at all, if it believes that the requisition comes from a untrusted source.

The Spider agent receives data acquisition requests from the Fetching Expert. These requests may be to just search some social network for clues, or to follow specific discussions. In any way, the Spider may interact with the AccountHolder in search for an appropriate account, if it believes that is necessary. It will then go after new data, preferentially following the Fetching Expert directions. Any data that it finds relevant is forwarded to the PageFilter agent. The Spider should not be too much selective, as this is the job of the PageFilter. Since each social network have a unique organization of it's HTML code, Spiders may specialize in only a limited number of services, refusing any request from the Fetching Expert to access a website that it does not understand.

With some candidate pages containing possible relevant data, the PageFilter agent is responsible for filtering useful pages among the Spiders selection. As is the case with the Spiders, PageFilters may

act only on pages from specific social networks, refusing to filter anything that it dos not understand. To accomplish this task, the PageFilter should perform natural language analysis on the page content, discarding anything unrelated to the discussion, such as navigational content and ads. The computer system discussed in section 2.2.5 prototypes the PageFilter analysis.

Any filtered page content should then be converted to the Blackboard understandable data, in a serialized form. This data structure should represent posts, threads, authors and metadata, such as original URL and date collected. This job is performed by the PageExporter, that forwards this serialized data to the Fetching Expert, which in turn send it to the Blackboard.

Despite that each agent appears only once in Figure 4, while in execution the system is allowed to create any number of them. This behavior encourage that many Spiders, PageFilters and PageExplorers, each one constrained to support possibly just one social network, get along in a distributed fashion. As an example, an overburdened PageFilter could refuse to filters any Spider data, which in turn should locate another compatible PageFilter. Only the Fetching Expert should be unique, since it there is no need to duplicate the Fetching Expert Group on the system

2.2.5 The Computer System

To verify the claiming that an ontology-based natural language analysis is able to detect wildlife traffic evidences, a computer system was built as a proof of concept.

The system was built using Python 2.6.6 programming language, with the aid of NLTK (Natural Language Toolkit) version 2.0b9. The ontology was accessed using OWL API 3.2.4 and the reasoner HermiT 1.3.5. The system analyzes plain text files containing sentences in Brazilian Portuguese collected from the Orkut social network, in 2011. About half of these posts negotiate animals in a way that was kind of suspect. The other half trade a wide range of goods, and none of them are animals. After the analysis, the system stores a HTML report with the evaluation of traffic for each sentence.

As was previously stated, the computer system is composed of four main steps, united as a process by a Python script. Each step receives some files to process and outputs another file for each one of them. These outputs store the processing of the given step, and are used as input in the next step.

2.2.5.1 Step 1: Normalization

Before any processing takes place, it's necessary to fix orthographic errors, what is very common to occur in an informal communication medium. Each token is compared with a dictionary relating misspelled words and its correct writing. Not only common misspellings were put in this file, but

also specific abbreviations used in traffic. For example, the bird Green-winged Saltator (*Saltator similis*), known in Brazil as *Trinca-Ferro* (iron cracker, in a free translation), is commonly called *tf*. These misspellings are placed in a table that serves as input and the normalization phase outputs a more correct version of the text.

The later stages assume the step 1 outputs as *sufficiently correct*, because there is no way to fix every possible misspelling. Also, there are instances where the misspelling simply cannot be detected. For example, consider another bird: the Rufous-bellied Thrush. This bird is known in Brazil as *Sabiá Laranjeira* (Orange-Tree Sabia), commonly called just *sabiá*. A recurrent misspelled form of *sabiá* is *sabia*, without the acute accent. Because the word *sabia* is the word in Portuguese to *knew*, the computer system can't state that it is a misspelling of *sabiá*. This is a kind of misspelling that cannot be fixed without a more powerful analysis, which is not in the scope of this computer system.

2.2.5.2 Step 2: POS-Tagging

With the text fixed, it's viable to proceed with the analysis. The step 2 is where NLTK is used for its capabilities to POS-tag a token. “POS” stands for parts of speech, a grammatical evaluation which states the grammatical class of a given token. This step is in reality a POS-tagger that annotates each token, outputting the original text plus each token. The pair token and tag are stored as *token/tag*. For example a token *bird* would be tagged *bird/N*.

To better understand this step, it's useful to introduce some concepts first. The NLTK provides a number of POS-taggers, which one of them tags a token based on some criteria. A tagger may not be able to tag every word, but NLTK taggers are built in a way that allows composition. So a tagger may try to tag a word, and if it fails, it will pass the token to a fallback tagger, and so on. Last in this queue is a *DefaultTagger*, which tag anything as N (*noun*).

Among the myriad of taggers that NLTK presents, a common category is the n-gram taggers. An n-gram refers to the neighborhood of some token. A 1-gram (or unigram) is the given token. A 2-gram (or bigram) is the given token and the token before it. A 3-gram is the given token and the two tokens that precede it, and so on. The *n* can be arbitrarily large, but rarely is, since there is no use to tag a token based also on a token from the last sentence, as these two will not directly relate. Also, a large *n* will eventually only be able to tag a really specific combination of tokens that possibly will not happen in the entire text.

The n-gram taggers of NLTK based their analysis in a pos-tagged corpus. This corpus is statistically analyzed by the tagger, and will provide a basis for its tagging. The statistical nature of this analysis

makes an n-gram tagger prone to error, since there is no way to guarantee that the same combination of tokens will really result in a given tag. This imprecision is inherent from natural languages, which extensively employs ambiguities.

The computer system employs a BigramTagger, that falls back to a UnigramTagger, that falls back to a DefaultTagger. The first two taggers base their analysis on the MAC-MORPHO corpus [Aluisio et al., 2004], which encompass manually tagged sentences taken from popular newspaper on Brazil.

2.2.5.3 Step 3: Ontology Tagging

The POS tagging isn't of much use to spot wildlife traffic in conversations on social networks, since nothing can be extracted from the nature of the talking with just that. In order to really understand what is happening, the step 3 tries to tag key tokens with some possible individual that represents it. This process is aided by the POS-tags.

Exceptionally, this step is the only one coded in Java. That's the case because the OWL API was the best OWL framework found by the authors. The OWL API provides basic operations on OWL ontologies. These features were extended by the use of the HermiT reasoner, mainly to discover the class of some individual.

The output token of this step is the original POS-tagged token, plus a tag of the form *[individual:class]*. Tokens that were not tagged were marked so with an empty brackets, e.g. []. To determine the class of some individual, a collection of criteria can be defined. Currently, the main one is to match a token with an individual that have it as a nickname, if and only if the token was POS-tagged as *N*. The second criteria is to verify it the token is a class name, and then tag it as *[:class]*.

2.2.5.4 Step 4: Evaluation

The final step summarizes the entire work of the previous ones, rating each sentence with a grade that states the amount of certainty that it's related in some way to wildlife traffic. To do this it was necessary to define previously the elements that make up a typical scene of illegal trade of animals. The elements were registered in a semantic frame [Fillmore, 1977]. The details of the frame and how it was built can be accessed in Carrasco et al. (2011). Suffice it here to point out that a semantic frame involves the definition of the role of the participants of the scene (the frame elements) and the evocative language units of the frame (lexical units). The semantic frame was built based on corpus evidence in order to establish the linguistic link with the semantics proposed by the scene described by the frame. Therefore, it was necessary first to obtain a corpus to provide the evidence needed for

the frames creation. For this purpose we created a corpus obtained from conversations on relationships sites that dealt with this kind of trade.

The animal traffic on the Internet is a type of commercial transaction, but has specific roles and peculiarities since it is an illegal trade. The goods is one or more animals and there are some elements that are not present in an ordinary commercial transaction, such as whether the animal is registered, the transfer to another communication environment to complete the transaction, the shipping method, the animal value when it is not registered, etc.. The recognition of these elements is essential for the recognition of a trafficking scene. The analysis of the corpus sentences resulted in the frame **Transação_trafico_animais** (Animal_Trafficking_Transaction) with the following definition:

Definition 1. **Transação_trafico_animais** – Commercial transaction involving a **buyer** and a **seller** (dealer) and where the item purchased is one or more **animals**. The animal is not **authorized** to trade and have illegal origin. Because of its informal nature, the animal is not always exchanged for **money** and can be exchanged for other **goods**.

Once obtained the semantic frame it is possible to check the degree of membership of a statement to the scene in terms of ontological annotation of its units, as suggested by Moreira (2012). The grade that a sentence can receive starts at 0 for sentences where no evidence of traffic was found at all. A grade 1 indicates a high relevance to the scene of trafficking. Actually there is no superior limit. Yet, given the limited size of a sentence, there was not a single case in that the grade has exceeded the value of 1, which is the practical superior limit. What we are establishing is a fuzzy mapping between the sentence and the scene from the ontological evidence that occur in the statement. Figure 4 shows the system steps and its input/output.

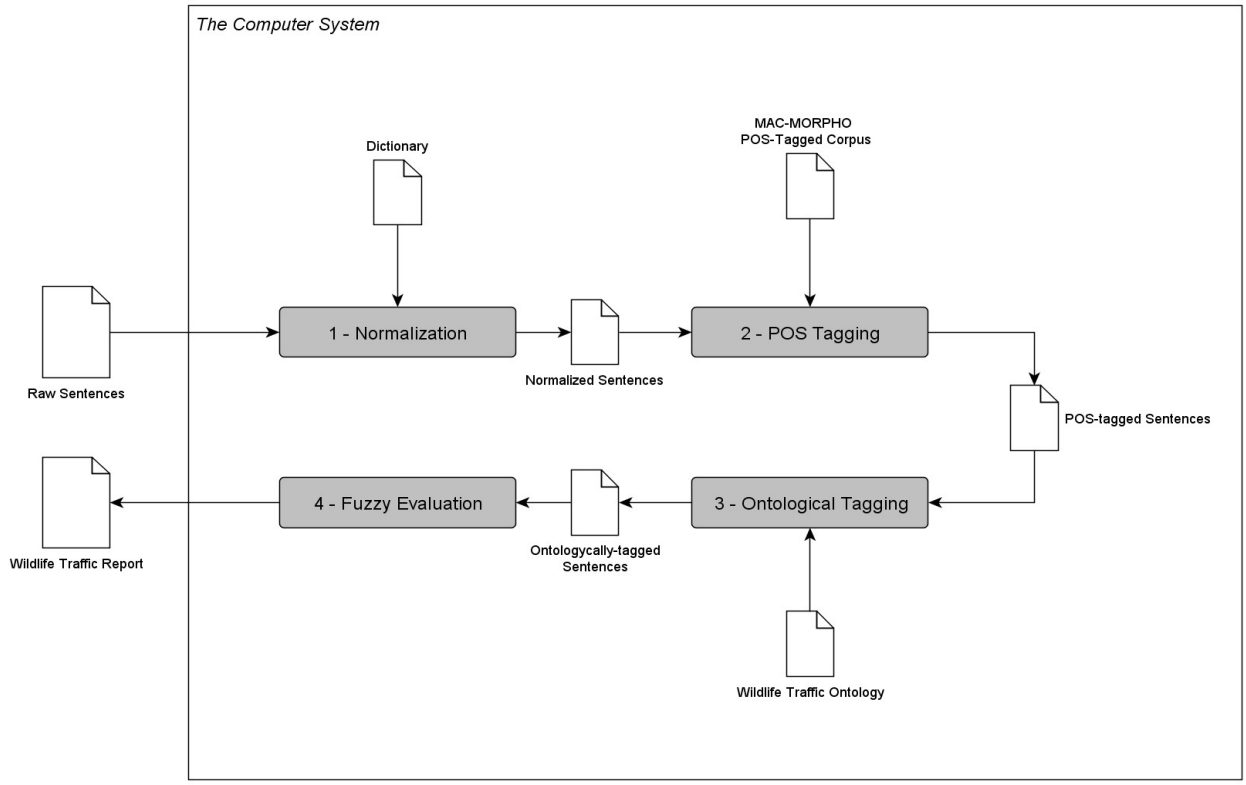

Figure 4. The system steps.

To rate the evidences of a sentence, the evaluation first assigns a degree to each token. This is based on the ontological tag of the token, as stated in Table 1:

Table 1: Grading criteria for ontologically-tagged tokens

Token Grade	Ontological Tag
1.3	Shipment via mail service
1.2	Any animal
1.1	Operations of commerce (acquisition, selling or exchange of some goods)
1.0	Any other tag, even empty ones

With each token rated, it's possible to assigns a degree to the sentence. It would be possible now to use an API for fuzzy systems to estimate the degree of relevance. However, the simplicity of calculation showed that it was not necessary. The criterion to assigns a degree to the sentence is the following: if a sentence does not contain any mention to an animal, its grade is zero. Otherwise multiply the grades of each token, and deduce 1 from the result. That is the sentence rate.

2.2.6 Results Analysis

With the computer system implemented, a sequence of four tests was conducted, each one

analyzing manually collected sentences taken from the social network Orkut. The first two tests were based on sentences which obviously contained traffic negotiations, while the last two contains general goods trading. The results of this test are summarized in Table 2:

Test	Quantity of sentences	Hits	Score
1	88	74	84.09%
2	91	77	84.62%
3	106	106	100.00%
4	159	159	100.00%
Total	444	416	93.69%

Table 2: Test results

The fact that the system accomplished 100% of success while evaluating corpora without traffic was something expected. Since the analysis is based on the words present on each sentence, there is no way that sentences that don't mention any animal will get anything different from 0 – a result that is in accordance with the common sense. It is noteworthy that during the analysis no false positives occurred. In cases of homonyms the system will generate a false positive.

The number of sentences without traffic is also greater than the amount in tests 1 and 2. That is the case because posts that don't offer wildlife traffic tend to larger, openly describing features. After all, the people involved aren't trying to hide anything, in most cases. There is no need to be discreet, as is while illegally offering wildlife animals.

Test 1 and 2 have similar results, bearing a difference of just 0.53%. The minimum score of 84.09%, achieved by test 1 was still quite impressive. An implementation with finer adjustments could heighten this number. For example, evaluating not only sentences, but the entire posting could bear better results. We analyzed only at the level of sentence but we recognize that conversation analysis is in many cases necessary to characterize an illegal transaction. In test 1, one post containing several sentences was able to trick the analysis, by scoring a low value on each one. If thepost was analyzed as a whole, it should surely spot a great chance that some proposal of traffic was made.

Overall, these results are promising, and it is evidence that natural language techniques, powered by domain-specific ontologies, can be applied to evaluate the association of a sentence to a scene, particularly to a wildlife traffic scene. It's even possible to replace the ontology with another domain ontology (like consumer satisfaction about some product), allowing the system to evaluate other domains without further changes.

2.2.7 Conclusions

The scores achieved by the system in the previous tests hints that the combination of semantic frames and ontology is a viable choice to natural language analysis. Only the most basic features of ontologies and semantic frames were used by the computer system developed, so it is expected that even better results could be achieved if more features were explored.

The *ad hoc* approach used on the ontology development proved to be very ineffective. The ontology was tweaked too many times, and in the end, its merging with DUL spotted fundamental errors, such as the misunderstanding of *Deal*, *Counter Proposals* and *Proposals* as *Negotiations*. So, a great deal of rework had to be done to fix such common errors. Ontology processes have been proposed, but their poorly-documented state prevents their use to solve real problems.

Not even good modeling tools were found, what raised the cost to fix each error. A modeling language could minimize the amount of rework, by directing it to the model and not the ontology itself.

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3 Conclusões Gerais

O objetivo principal de elaborar um modelo de Sistema Multiagente foi atingido satisfatoriamente. Embora não tenha sido implementado, notou-se que o maior desafio por trás desta proposta jazia não na elaboração de um modelo desta natureza, mas sim na intenção de utilizar o processamento de linguagem natural aliado a uma ontologia de domínio, a fim de detectar evidências de tráfico.

A verificação desta possibilidade demandou um esforço substancial. As altas taxas de acerto atingidas pelo sistema desenvolvido indicam que esta estratégia é viável. Com o refinamento desta tecnologia, é perfeitamente possível atingir marcas ainda maiores que as obtidas neste trabalho. Exemplos de ajustes que poderiam ser feitos para aumentar a precisão incluem a identificação de palavras compostas na etapa de canonização e a avaliação de publicações ao invés de sentenças.

Quanto aos objetivos secundários estabelecidos, todos foram atingidos. Tanto o *frame* semântico quanto a ontologia foram desenvolvidos. A ontologia se mostrou útil na etapa de anotação ontológica, muito embora seu potencial não tenha sido usado integralmente. O *frame* gerou consequências indiretas, permitindo um maior entendimento do domínio e auxiliando na construção da ontologia. Isso não significa que o *frame* não poderia ser utilizado na análise de mensagens. Ao contrário, a verificação de que uma sentença se encaixa ou não no *frame* proposto pode ser crucial a fim de decidir se ela deve ser analisada pelas demais etapas, devido ao custo significativo de processamento.

A elaboração da ontologia sofreu com a inexistência de ferramentas de modelagem adequadas. Durante algum momento, tentou-se empregar diagramas de classe UML, mas estes logo se mostraram inadequados, devido a diferenças fundamentais entre o paradigma de Orientação a Objetos e ontologias OWL. Sendo assim, a elaboração de ferramentas de modelagem adequadas a ontologias seria um trabalho futuro de grande valia.

Além de ferramentas de modelagem, estratégias, práticas e talvez até padrões de projeto específicos para ontologias teriam sindo bem-vindos. Sem tais artifícios, o desenvolvimento da ontologia foi forçado a seguir de forma *ad hoc*, o que resultou em muito retrabalho. Também não encontrou-se nenhuma técnica que permitisse avaliar, ainda que de forma heurística, a qualidade da ontologia. Sem este tipo de retorno, diversas falhas são identificadas apenas quando a ontologia já está em uso, sendo portanto muito difícil corrigi-las devido ao alto custo envolvido.

A — Corpus Coletado

A seguir são apresentadas as sentenças que compõem o *corpus* utilizado na elaboração do *frame* semântico. Estas sentenças foram retiradas da rede social Orkut, em outubro de 2010. Os erros de português foram propositalmente preservados, pois ao estudar a linguagem de um meio é imperativo que se analise como as comunicações são realmente feitas, e não como elas seriam, caso a norma culta da língua fosse empregada. Também é proposital a ausência de informações que levem diretamente aos participantes das diversas sentenças, visto que este trabalho não possui poderes legais para realizar tais acusações – afinal, considera-se que todas as sentenças a seguir estão diretamente relacionadas ao tráfico de animais silvestres.

1) compro femea de trinca ferro

2) pago ate 200,00 ou troco por par de alto falante novo no valor de 299,00 alto falante de carro corsa sedan e astra

3) tenho 2 femeas vc faz rolo em um cachorro desses ai ???

4) cel: 8130-0601

5) depende sua femea sao registra e qual valor delas

6) quero um trinca

7) caros amigos amantes de trinca ferro!

8) gosto muito de tf pois tive 2!

9) um morreu de velho e o outro foi roubado pelo ibama pois foi apreendido na porta da loja em que trabalho e nao me deram multa ou me notificaram pois apreenderam para vender!!!

10) por gostar mas nao ter condiçao de ter um registrado eu tinha sem registro mesmo!!

11) mas agora estou me registrando no ibama para nao passar mais por isso!!

12) por isso pesso a ajuda de vcs sobre o endereço ou telefone de criadouros registrados pelo ibama que eu possa comprar(de preferencia os mais baratos pois nao disponho de muito) sou de bangu rj

13) amigo eu crio trincas mais não tenho pra dispor mais o lugar mais serto de vc achar é um torneio que acontece todos os sabados aí em bangu todos são registrados e sempre tem alguem que está vendendo um ok boa sorte.

14) Eu fui em Bangu RJ Sabado e o torneio é bem organizado e vc vai encontrar trinca bons e registrados la.

15) Acho que até vi uma mulher parecida com vc ali perto de Campo Grande!?

16) O torneio é na Av Santa Cruz perto do posto Katito.

17) vc falou que cria!

18) sao registrados?

19) no caso vc nao tem p vender agora!

20) quando tem qual o valor?um abraço!!!

21) amigo gostaria muito de te ajudar mais estou começando agora a formar meu plantel mais o apollo ai acima ele tambem cria eu gostaria muito de te ajudar mais .....

22) um forte abraço entre na meu orkut convide passarinheiros para amizade e anuncie o que quer fica bem mais fácio e queloque seu msn rapidim vc encotra está tendo muita procura de trincas nesse periodo boa sorte

23) encontro de trinca ferro no gama-df 15/08/2010

24) caro amigo quanto custa ?

25) registrado?

26) Vendo meu trinca de roda

27) quanto vale o trinca?

28) estou vendendo por 4 mil

29) TROCO CURIO POR TRINCA

30) tenho 2 coleiros pra rolo... troco por trinca.

31) olá amigos tenho 2 coleiros pra rolo ...

32) tui tui cantando na mão e que canta em qualquer lugar , na roda ainda não canta pois só quer briga

33) estou passando pois não tenho tempo pra treinar ele

34) O outro coleiro é novinho é rescem virado e ainda está com as costas esverdiadas …

35) COMPRO SAGUII

36) Moro em Florianopolis , quero muito um sagui, mas não faço ideia de onde posso comprar.

37) Quero comprar um sagui

38) Oi, estou procurando um filhote de sagui para comprar, URGENTE.

39) Onde e quanto?

40) Henrique, de que cidade veio e quanto pagou?

41) COMPRO SAGUI

42) Olá, estou interessado em comprar um sagui, legalizado, com microship, nota fiscal, e tudo mais.

43) Quero um Sagi!!

44) Quero comprar um Sagui!!

45) Meu sagui morreu faz 1 ano e não aguento mais de tristeza...

46) Quero comprar um Sagi!!

47) Eu Quero Um Sagui Pigmeu!

48) vendo saguis mansinhos 350

49) Daniel Qual Sagui Que Vc Tem Para Vender???

50) tenho 1 sagui macho para troca ou venda!

51) Ele é adulto , acostumado em cativeiro ,se alimenta bem …

52) obs: não é legalizado !

53) interessados deixar recados em meu orkut

54) E ai voce já vendeu ou trocou seu sagui?

55) Se ainda não o fez, quanto vc quer por ele ou trocar pelo que?

56) estou a procura de uma femea, pode ser adulta, tenho um macho e como trabalho fora de casa gostaria de arrumar uma parceira para ele nao ficar sozinho.

57) Vendo Iguana Red Mexicana

58) QUERO UMA IGUANA

59) PESSOAL QUERO MUITO UMA IGUANA, TENHO UM MACHO DE JIBOIA BCA

60) QUERO UMA IGUANA

61) PESSOAL QUERO MUITO UMA IGUANA, TENHO UM MACHO DE JIBOIA BCA21/08/09

62) Vendo Iguana Baby

63) vendo iguana com terrerio de vidro lindo 500.00

64) Moro em Praia Grande litoral sul de São Paulo vendo minha iguana com terrario muito grande de vidro lindo, tenho tbm umas 4 tipos de lampadas diferentes

65) Iguana verde linda aproximadamente com um ano novinha e muito mansa estou pedindo muito barato no kit completo 500.00 e não abro mão de nada

66) Tem que vim retirar aqui no local

67) troco cobra por iguana ou vendo

68) troco cobra por iguana ou vendo por 100 reais, filhote ainda linda masinha;

69) To pedindo R$ 350 com o terrario e tudo... o mesmo preço q eu paguei no berço!!!

70) Casal de iguanas babys 200,00$ C/ Sedex10 Incluso.

71) Pra quem tiver interesse em adquirir um casalzinho de iguanas babys, com ótimo preço.

72) Animais saudáveis, comendo bem, aproveitem a oportunidade.

73) Vendo casal de iguanas, 100 reais.

74) Vendo casal de iguanas pequenas, uma delas está com uma parte do rabo quebrada, ambas saudáveis.

75) Preço: 100,00 o casal.

76) Quanto fica com frete para salvador – ba

77) eu não sou de são paulo, gostaria de saber quanto vc cobra pra enviar p Salvador - BA...

78) assisi femea 250 ferty incluzo,

79) bcc femea red teil 200+fret,

80) iguanas babys 120,220 casal fret incluzo,

81) phillomedusa 120 fret incluzo fotos no meu album.

82) COMPRO IGUANA AQUI EM SÃO PAULO, porque eu não curto ver bixo sendo entregue pelo sedex –'

83) compro em sampa tb..

84) COMPRO IGUANA – RJ

85) pessoal quem tiver ai uma pra vender eu aceito sou do Rio de Janeiro, não compro de otro estado 1º que isso n se manda por correio 2º prefiro ir pegar pessoalemnte.

86) Alguém tem filhote no RS, preferência no noroeste?

87) Região de Santa Rosa.

88) Tenho interesse em comprar, mas não acho nada por aqui.

89) Se alguém tiver entre em contato.

90) Compro Iguana BH. MG

91) quero uma iguana.

92) Moro em BH/MG.

93) Tambem Moro em Bh

94) quero Uma Iguana

95) Tambem moro em Bh ..

96) quero criar iguana …

97) Se alguem estiver disposto a me vender …

98) Me add agente conversa...

99) qro um casal

100) tbm estou a procura..

101) qro um casal de iguanas verdes.

102) add nu msn para negociação

103) panetone_salva@hotmail.com

104) moro em Sete Lagoas

105) e tbm qro uma iguana !

106) akii em MG naum tem nenhum Pet-shop naum?

107) onde consigo uma autorizada ?

108) Compro filhotes de iguana

109) Tenho muito interesse em adiquirir de preferencia compro o casal!

110) sou de Foz do Iguacu, PR

111) Favor deixar scrap ou me adicionar: loganzz@hotmail.com

112) Compro Iguana / Pogonas

113) Quero um Iguana ou pogona (preferencia macho.)

114) SOMENTE para retirar em maos em SP-SP..

115) Valor ate 100,00 pode me procurar que pego no dia seguinte...

116) "troco iguana"

117) troco iguana com terario muito bem cuidada e saldavel

118) iguana jovem com 2 anos

119) aceito troca por um trompete

120) Vendo Iguanas, casal.

121) Compro Iguana em Curitiba/PR

122) Estou procurando alguem que queira vender uma iguana aqui em curiba ou região

123) se tiver alguem que esteja interessado me mande um e-mail (edgar-rcl@hotmail.com)

124) Compro iguana

125) Vendo iguana, 80 reais.

126) Vendo iguana jovem, 75cm, macho.

127) R$80,00. Somente pra Osasco e região.

128) Vendo iguana

129) Vendo uma iguana macho, de 4 anos.

130) interessados deixem seu msn, ou me adcionem no orkut que darei mais informações.

131) O Valor ?

132) A COMPRO IGUANA – RJ

133) ESTOU MTO AFIM DE UMA IGUANA, MAIS SÓ COMPRO RETIRANDO EM MAOS NO RJ .

134) Compro IGUANA-SE

135) Galera se tiver alguem que venda iguanas filhotes aki para Aracaju-se(sergipe)...entrem em contato

136) Richard, tenho interesse e dúvidas, favor entrar em contato

137) Richard, quero comprar um casal, acho que meu irmão ja te ligou, entre em contato comigo pelo msn sayonaranagel@hotmail.com

138) quem estiver vendendo filhotes de iguanas baratos me add no orkut .. ou deixem um scraps (yY" [/barato¬¬\] abraçãoo

139) COMPRO IGUANA MACHO

140) ESTOU A PROCURA DE IGUANA MACHO COM APROXIMADOS 2 ANOS POIS TENHO UMA FEMEA DE 1 ANO E MEIO...

141) MORO EM SÃO PAULO.. ZONA SUL...

142) SE ALGUEM SE INTERESSAR EM VENDER SÓ DEIXAR RECADO NESTE MESMO TOPICO

143) COMPRO IGUANA CASAL OU SÓ UMA – TUBARAO-SC

144) Compr casal de iguanas ou apenas uma.. moro em tubarao Santa Catarina.. quem estiver alguma deixa recado orkut ou email : bistecktb@hotmail.com

145) Vendo Casal de Iguanas - R$150,00 os dois.

146) Opa, por motivos de mudança eu to vendendo meu casal de iguanas (45-50cm e 60-65cm) por R$150,00.

147) Ambos comem muito bem e são saudáveis.

148) Interessados que tenham um terrário adequado e que sejam de sp, deixa um depoimento ou add no msn: fe_cruzasilva@hotmail.com

149) Alguem do RJ tem pra vender?

150) COMPRO!

151) compro iguana em curitiba-pr

152) quem tiver manda um scrap p/ mim!

153) Tbm tó afim de uma

154) Sou aki de Minas Gerais

155) Quem quiser vender só dar um toke ..

156) compro iguana em brasilia ou goias.

157) é so entrar em contato pelo orkut.

158) Saudações tenho uma IGUANA p/ venda...

159) qq coisa me procura, por depoimento*

160) vendo filhote lindo

161) vendo iguana, nascida em cativeiro filhote lindo!

162) estou interessado joaojunior321@gmail.com

163) onde vc mora?

164) Haa to interesada

165) OLA EU TENHO INTERESSE EM COMPRAR …

166) aINDA TEM P VENDER.

167) Eu compro.

168) Eu moro em São José do Rio Preto.

169) Morei em São Paulo um tempo mais não sei andar muito bem ai como faço para a gente se encontra to afinzão de compra uma quero saber como a gente faz pra se encontrar

170) Entre em contato comigo

171) Msn:HeltonSanchez@hotmail.com

172) Vendo Iguanas Jovens

173) Animais Lindos, Nascidos em cativeiro, extremamente mansos e se alimentando muito bem.

174) Entrego em mãos p/ SP Capital e Grande ABC.

175) Envio P/ Todo Brasil.

176) Fotos e Infos no Album

177) compro iguana EM BH

178) COMPRO iguana casal ou mais moro em BH quero comprar de alguem de BH tbm ou q me entregue em mãos !

179) se alguem ai tiver me procure no orkut ou me liga (31) 83456600

180) luizinhomial@hotmail.com = msn

181) luizinhomial@yahoo.com.br = orkut

182) COMPRO IGUANA EM BH LIGA OU ADC NO MSN OU DEIXA RECADO NO ORKUT !

183) Vendo Iguana Baby

184) Fotos e informações no meu album.(Aberto a negociações)

185) tenho iguanas para venda

186) msn muniz_jiu@hotmail.com.br

187) quero comprar uma iguana?por quanto voçe vende? e legalizada?

188) voçe tambem vende cobras jiboia?quanto?

189) e legalizada?

190) aguardo resposta....

191) compro iguanas na regiao de londrina-pr

192) se alguem tiver alguma pra vender me add no orkut!

193) só pego em maos!

194) se morar perto posso ir até a cidade buscar!

195) se alguem tive add!

196) quero comprar uma iguana moro no espirito santo

197) ola pessoal criadores e adeptos,gotaria que me ajudasem a adiquirir meu email rafael_banda_8@hotmail.com se souberem por fovor enre en contato obrigado!

198) COMPRO-IGUANA EM BELO HORIZONTE- OU REGIAO

199) QUEM VENDE IGUANA EM BELO HORIZONTE OU REEGIAO MEW DA UM TOK NU MEU ORKUT PQ ESTOU KERENDU COMPRAR UMA, EU JA TENHU UMA MAIS KERU OUTRA DE COMPANHIA.

200) AGRADEÇO. E AGUARDO RESPOSTA

201) Compro Iguana.

202) BH

203) Sou de BH.

204) Quero comprar uma iguana.

205) Preferencia de quem for da msma cidade.

206) Favor deixar Scrap!!

207) quero comprar uma iguna filhote

208) quero comprar filhote de iguana mas eu moro em BH/MG e nao quero que meu animal seja tramportado via sedex

209) vendo iguana 350 R$ DANIEL MUNIZ 28644966// 72691949 IGUANAS LINDAS VERDES

210) Venda de Filhotes !!

211) corn snakes

212) Pogonas

213) Iguana

214) Teiu

215) Bcc

216) Bca

217) Jaboti

218) cynops orientalis

219) Dendrobates

220) vendo iguana verde e vermelha

221) Vendo filhote de iguanas

222) Msn: super_pet@hotmail.com

223) vendo iguana nascidas em cativeiro

224) tenho lindas iguanas a venda

225) VENDO PEIXEs BETTAs ou TROCO por um IGUANA BABY

226) VENDO OU TROCO bettas reprodutores de ótima qualidade POR IGUANA BABY..

227) .betta mámore com aquario individual

228) .betta branco com nadadeira neom

229) .betta multi cores com calda dupla

230) + 3 lindos filhotes

231) são 6 peixes betta entroca de um iguana baby

232) FOTOS NO MEU ALBUM (ENTEREÇADO ENTRAR EN CONTATO PELO ORKUT)

233) ou vendo tudo

234) são 3 betas machos adulto + 3 aquario + acessorios pedras, flores + 3 filhotes vendo por 150 reais + frete...

235) alguem do rj q vende iguana baby?????

236) quero compra um iguana baby alguem vende aqui no rio de janeiro

237) ALGUEM VENDE IGUANA BABY AQUI NO RIO DE JANEIRO

238) QUERO COMPRAR UMMMMM.....

239) vendo iguanas mansinhas verdes

240) vendo iguanas msn muniz_jiu@hotmail.com.br cel 72691949

241) vendo iguanas mansinhas verdes

242) alguem vendendo iguana

243) gostaria de comprar uma iguana , se alguem tiver pra vender, por favor deixe uma mensagem no meu orkut, de preferencia q seja aki do RJ.

244) Iguana 190,00 Frete Grátis fotos no album, Nao tome calote, compre com quem tem!

245) vendo iguanas e saguis mansinhos

246) VENDA DE ANIMAIS DE ESTIMAÇAO ´´TODAS AS ESPÉCIES´´(11)68644966

247) VC Q ESTA A PROCURA DE UM COMPANHEIRO DE ESTIMAÇAO SAGUI /IGUANA

248) TODAS AS RAÇAS E ESPÉCIES

249) ENTRE EM CONTATO DANIEL MUNIZ 6864-4966 / SAMUEL 7467-7805 ou VALTER 9619-7776

250) FOTOS NO ORKUT PARA MAIORES INFORMAÇOES ADICIONEM NO MSN j

251) muniz_jiu@hotmail.com.br - samueldesouzza@hotmail.com - valtermascarenhas@yahoo.com.br

252) email ldanielmuniz@yahoo.com.br

253) quantoé´uma iguana

254) Vendo Filhotes

255) 150 com frete + Pedra aquecida

256) PROMOÇÃO !

257) Iguana + pedra aquecida + Lampada Uv + frete por R$ 300,00

258) Vendo Iguanas, fotos no album.

259) eu quero uma iguana

260) eu moro no rio e quero comprar uma iguana so que so em contro pessoas fora do rio ai fica muito difissil ja morndo aqui no rio fica mais facil

261) vendo iguanas

262) VENDO iguanas bebes bem verdes ,lisas e mansas 250,00

263) VENDA DE ANIMAIS DE ESTIMAÇAO ´´TODAS AS ESPÉCIES´´(11)68644966

264) VC Q ESTA A PROCURA DE UM COMPANHEIRO DE ESTIMAÇAO SAGUI /IGUANA TODAS AS RAÇAS E ESPÉCIES ENTRE EM CONTATO DANIEL MUNIZ 6864-4966 / SAMUEL 7467-7805 ou VALTER 9619-7776

265) qro compra uma iguana rio de janeiro

266) estou mto afim de compra uma iguana quem estiver afim de vender me fale pelo orkut mto obrigada

267) compro iguana filhote RJ

268) olá sou de niterói e gostaria de adiquirir uma iguana, se alguem tiver entrar em contato por favor.

269) VENDO!

270) IGUANA COM 25cm E TBM TENHO IGUANA COM 50cm INTERESSADOS ENTRE EM CONTATO PELO ORKUT, OU PELO MSN rogerio_mattos_t@hotmail.com

271) Vendo novos filhotes...

272) peguei mais alguns filhotes lindos mansinhos e saudaveis podem ver as fotos e referencias recentes no meu orkut

273) quero comprar uma iguana!

274) estou afim de comprar uma iguana só que gostaria de saber c tem alguem de cascavel paraná, ou proximo que gostaria de faze negocio!

275) Alguem?

276) deixe recado no meu perfil!

277) iguans 150 com frete incluso

278) mostro pela web cam

279) filhotes de Iguanas 95,00

280) Frete por conta do comprador.

281) VENDO IGUANA

282) vendo iguana linda nasceida em cativeiro saldavel

283) IGUANA

284) QTO PELA IGUANA COM FRETE PRA BLUMENAU-SC???

285) iguanas nascidas em cativeiro

286) Vendo Fêmea de 1 ano e maio, R$150,00

287) QUEM QUER IGUANA ????

288) CHEGA DE ENROLAÇÃO!!!

289) LINDAS IGUANAS VERMIFUGADAS E SE ALIMENTANDO SOZINHAS SOU DE SP Z/O AOS INTERESSADOS DEIXAR SCRAP OU PODEM ME LIGAR DOU GARANTIA E SUPORTE 24Hs pra vc que nunca teve uma iguana 1186921602

290) quem tem iguana para vender aqui no ES desejo adquiri uma contato amigo-dosanimais@hotmail.com

291) iguanas de ótima saude

292) estou vendendo lindas iguanas!

293) nascidas e criadas em cativeiro saude 100% interesados, entre no meu orkut

B — Código OWL da Ontologia Desenvolvida

O código fonte completo da ontologia desenvolvida é apresentado a seguir. Este código está descrito de acordo com o padrão OWL, que é uma linguagem desenvolvida sobre XML, pelo W3C.

```
<?xml version="1.0"?>


<!DOCTYPE Ontology [
    <!ENTITY xsd "http://www.w3.org/2001/XMLSchema#" >
    <!ENTITY xml "http://www.w3.org/XML/1998/namespace" >
    <!ENTITY rdfs "http://www.w3.org/2000/01/rdf-schema#" >
    <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns#" >
]>


<Ontology xmlns="http://www.w3.org/2002/07/owl#"

xml:base="http://www.semanticweb.org/ontologies/2010/7/Ontology128
3167091087.owl"
     xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
     xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
     xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
     xmlns:xml="http://www.w3.org/XML/1998/namespace"

ontologyIRI="http://www.semanticweb.org/ontologies/2010/7/Ontology
1283167091087.owl">
    <Prefix name="xsd" IRI="http://www.w3.org/2001/XMLSchema#"/>
    <Prefix name="owl" IRI="http://www.w3.org/2002/07/owl#"/>
    <Prefix name="" IRI="http://www.w3.org/2002/07/owl#"/>
    <Prefix name="rdf" IRI="http://www.w3.org/1999/02/22-rdf-
syntax-ns#"/>
    <Prefix name="rdfs" IRI="http://www.w3.org/2000/01/rdf-
schema#"/>

<Import>http://www.ontologydesignpatterns.org/ont/dul/DUL.owl</Imp
ort>
    <Annotation>
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        <AnnotationProperty abbreviatedIRI=":versionInfo"/>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">0.9.2</Literal>
    </Annotation>
    <Annotation>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Evidências de que um animal está
sendo traficado:

Seu valorMonetario é algo em torno de metade ou menos do valor
tabelado.

O vendedor afirma que não possui registro, ou que este está
vencido.

A formaDeEnvio é totalmente inapropriada, como sedex.

Animal silvestres não são tipicamente vendidos de forma
desleixada, devido ao seu alto custo. O fato do animal ser de uma
espécie silvestre já é um indício de que ele está sendo traficado.

RegiaoGeografica do vendedor é rica nestes espécimes ou é palco de
vários Torneios envolvendo a espécie.

O vendedor possui ántecedentes como traficante de animais
silvestres.

O animal é oferecido em troca de bens de pequeno valor, como alto
falantes de carro.</Literal>
    </Annotation>
    <Annotation>
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datatypeIRI="&rdf;PlainLiteral">2011-04-09</Literal>
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```

```
        <Literal xml:lang="pt-br"
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FUSÃO COM DUL:

NaoHumano se tornou animal.
Humano foi substituíudo por Comprador e Traficante.
Organização foi substituído por Organization (DUL).
RegiãoGeográfica foi substituída por PhysicalPlace (DUL).
Evento deixou de existir.</Literal>
    </Annotation>
    <Annotation>
        <AnnotationProperty
IRI="http://purl.org/dc/elements/1.1/creator"/>
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datatypeIRI="&rdf;PlainLiteral">Rafael da Silva Carrasco</Literal>
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datatypeIRI="&rdf;PlainLiteral">Alcione de Paiva
Oliveira</Literal>
    </Annotation>
    <Annotation>
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do tráfico de animais silvestres realizado na Web. Implementada
para dissertação de mestrado do aluno Rafael da Silva Carrasco,
sob a orientação do professor Alcione de Paiva Oliveira (D.S.).
</Literal>
    </Annotation>
    <Annotation>
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Departamento de Informática</Literal>
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</Declaration>
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    <ObjectProperty IRI="#forcadoAParticiparDe"/>
</Declaration>
```

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</Declaration>
<Declaration>
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</Declaration>
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</Declaration>
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</Declaration>
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    <ObjectProperty IRI="#neighbors"/>
</Declaration>
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    <ObjectProperty IRI="#participa"/>
</Declaration>
<Declaration>
    <ObjectProperty IRI="#participaDeNegociacao"/>
</Declaration>
```

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        <DataProperty IRI="#conservationSatus"/>
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        <DataProperty IRI="#contact"/>
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        <DataProperty IRI="#currencyValue"/>
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        <DataProperty IRI="#nickname"/>
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        <DataProperty IRI="#scientificName"/>
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</Declaration>
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    <NamedIndividual IRI="#SanhacuDaAmazonia"/>
</Declaration>
<Declaration>
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</Declaration>
<Declaration>
    <NamedIndividual IRI="#TrincaFerro"/>
</Declaration>
<Declaration>
    <NamedIndividual IRI="#VilaIsabel"/>
</Declaration>
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    <NamedIndividual IRI="#compraGenerica"/>
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    <Declaration>
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    </Declaration>
    <Declaration>
        <NamedIndividual IRI="#trocaGenerica"/>
    </Declaration>
    <Declaration>
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t"/>
        <Class
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/>
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lObject"/>
    </SubClassOf>
    <SubClassOf>
        <Class IRI="#Apprehension"/>
        <Class IRI="#PolicialAction"/>
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    <SubClassOf>
        <Class IRI="#Blog"/>
        <Class IRI="#Website"/>
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        <Class
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erson"/>
    </SubClassOf>
    <SubClassOf>
        <Class IRI="#Company"/>
        <Class
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#Organiz
ation"/>
    </SubClassOf>
    <SubClassOf>
        <Class IRI="#CounterProposal"/>
        <Class
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#Informa
tionObject"/>
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    <SubClassOf>
        <Class IRI="#Deal"/>
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tionObject"/>
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        <Class
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ration"/>
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    <SubClassOf>
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        <Class IRI="#Discussao"/>
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    <SubClassOf>
        <Class IRI="#DiscussaoPublica"/>
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    <SubClassOf>
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        <Class
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        <Class
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    <SubClassOf>
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tionRealization"/>
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    <SubClassOf>
        <Class IRI="#NGO"/>
        <Class
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ation"/>
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    <SubClassOf>
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"/>
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    <SubClassOf>
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/>
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        <Class IRI="#Message"/>
    </SubClassOf>
    <SubClassOf>
        <Class IRI="#Profile"/>
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tionObject"/>
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ation"/>
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    <SubClassOf>
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    <SubClassOf>
        <Class IRI="#Selling"/>
        <Class IRI="#Negotiation"/>
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        <Class IRI="#Skirmish"/>
        <Class IRI="#Tournament"/>
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/>
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erson"/>
    </SubClassOf>
    <SubClassOf>
        <Class IRI="#Website"/>
        <Class
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#Informa
tionEntity"/>
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        <Class IRI="#Investigation"/>
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    <Class IRI="#DiscussaoPublica"/>
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    <Class IRI="#PolicialAction"/>
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    <Class IRI="#PublicMessage"/>
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lPlace"/>
        <NamedIndividual IRI="#Brasil"/>
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    </ClassAssertion>
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lPlace"/>
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    <ClassAssertion>
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lPlace"/>
        <NamedIndividual IRI="#RioDeJaneiro"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Animal"/>
        <NamedIndividual IRI="#SabiaLaranjeira"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Animal"/>
        <NamedIndividual IRI="#SanhacuDaAmazonia"/>
```

```
    </ClassAssertion>
    <ClassAssertion>
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lPlace"/>

        <NamedIndividual IRI="#SaoPaulo"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Animal"/>
        <NamedIndividual IRI="#TrincaFerro"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class
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lPlace"/>
        <NamedIndividual IRI="#VilaIsabel"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Acquisition"/>
        <NamedIndividual IRI="#compraGenerica"/>
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        <NamedIndividual IRI="#envioViaCorreio"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Negotiation"/>
        <NamedIndividual IRI="#envioViaSispass"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Exchange"/>
        <NamedIndividual IRI="#trocaGenerica"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Selling"/>
        <NamedIndividual IRI="#vendaGenerica"/>
    </ClassAssertion>
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        <NamedIndividual IRI="#Bicudo"/>
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    </DataPropertyAssertion>
    <DataPropertyAssertion>
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        <NamedIndividual IRI="#Bicudo"/>
        <Literal datatypeIRI="&xsd;string">Bicudo preto</Literal>
    </DataPropertyAssertion>
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        <NamedIndividual IRI="#Bicudo"/>
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    </DataPropertyAssertion>
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Finch</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#nickname"/>
        <NamedIndividual IRI="#Bicudo"/>
        <Literal datatypeIRI="&xsd;string">Bicudo-preto</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#scientificName"/>
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    <DataPropertyAssertion>
        <DataProperty IRI="#taxonomy"/>
        <NamedIndividual IRI="#Bicudo"/>
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&gt; Aves &gt; Passeriformes &gt; Passeri &gt; Passerida &gt;
Emberizidae</Literal>
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    <DataPropertyAssertion>
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        <NamedIndividual IRI="#Coleirinho"/>
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Emberizidae</Literal>
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        <NamedIndividual IRI="#Curio"/>
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        <NamedIndividual IRI="#Curio"/>
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finch</Literal>
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        <NamedIndividual IRI="#Curio"/>
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        <DataProperty IRI="#taxonomy"/>
        <NamedIndividual IRI="#Curio"/>
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&gt; Aves &gt; Passeriformes &gt; Emberizidae &gt;
Oryzoborus</Literal>
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        <NamedIndividual IRI="#Grauna"/>
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    </DataPropertyAssertion>
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    <DataPropertyAssertion>
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&gt; Aves &gt; Passeriformes &gt; Passeri &gt; Passerida &gt;
```

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        <DataProperty IRI="#taxonomy"/>
        <NamedIndividual IRI="#SabiaLaranjeira"/>
        <Literal datatypeIRI="&xsd;string">Animalia &gt; Chordata
&gt; Aves &gt; Passeriformes &gt; Passeri &gt; Passerida &gt;
Turdidae</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#conservationSatus"/>
        <NamedIndividual IRI="#SanhacuDaAmazonia"/>
        <Literal datatypeIRI="&xsd;string">LC</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#nickname"/>
        <NamedIndividual IRI="#SanhacuDaAmazonia"/>
        <Literal datatypeIRI="&xsd;string">Sanhaçu-azul</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#nickname"/>
        <NamedIndividual IRI="#SanhacuDaAmazonia"/>
        <Literal datatypeIRI="&xsd;string">Sanhaçu azul</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#nickname"/>
        <NamedIndividual IRI="#SanhacuDaAmazonia"/>
        <Literal datatypeIRI="&xsd;string">Blue-gray
```

```
Tanager</Literal>
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        <DataProperty IRI="#nickname"/>
        <NamedIndividual IRI="#SanhacuDaAmazonia"/>
        <Literal datatypeIRI="&xsd;string">Sanhaçu da
amazônia</Literal>
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        <NamedIndividual IRI="#SanhacuDaAmazonia"/>
        <Literal datatypeIRI="&xsd;string">Saí azul</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
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        <NamedIndividual IRI="#SanhacuDaAmazonia"/>
        <Literal datatypeIRI="&xsd;string">Sanhaçu-da-
amazônia</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
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        <NamedIndividual IRI="#SanhacuDaAmazonia"/>
        <Literal datatypeIRI="&xsd;string">Saí-azul</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#scientificName"/>
        <NamedIndividual IRI="#SanhacuDaAmazonia"/>
        <Literal datatypeIRI="&xsd;string">Tangara
episcopus</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#taxonomy"/>
        <NamedIndividual IRI="#SanhacuDaAmazonia"/>
        <Literal datatypeIRI="&xsd;string">Animalia &gt; Chordata
&gt; Aves &gt; Passeriformes &gt; Passeri &gt; Passerida &gt;
Thraupidae</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#nickname"/>
```

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    <NamedIndividual IRI="#SaoPaulo"/>
    <Literal datatypeIRI="&xsd;string">São Paulo</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#SaoPaulo"/>
    <Literal datatypeIRI="&xsd;string">Sampa</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#SaoPaulo"/>
    <Literal datatypeIRI="&xsd;string">SP</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#conservationSatus"/>
    <NamedIndividual IRI="#TrincaFerro"/>
    <Literal datatypeIRI="&xsd;string">LC</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#TrincaFerro"/>
    <Literal datatypeIRI="&xsd;string">Trinca</Literal>
</DataPropertyAssertion>
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    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#TrincaFerro"/>
    <Literal datatypeIRI="&xsd;string">TF</Literal>
</DataPropertyAssertion>
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    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#TrincaFerro"/>
    <Literal datatypeIRI="&xsd;string">Trinca-ferro</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#TrincaFerro"/>
    <Literal datatypeIRI="&xsd;string">Trinca ferro</Literal>
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<DataPropertyAssertion>
```

```
        <DataProperty IRI="#nickname"/>
        <NamedIndividual IRI="#TrincaFerro"/>
        <Literal datatypeIRI="&xsd;string">Green-winged
Saltator</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#scientificName"/>
        <NamedIndividual IRI="#TrincaFerro"/>
        <Literal datatypeIRI="&xsd;string">Saltator
similis</Literal>
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    <DataPropertyAssertion>
        <DataProperty IRI="#taxonomy"/>
        <NamedIndividual IRI="#TrincaFerro"/>
        <Literal datatypeIRI="&xsd;string">Animalia &gt; Chordata
&gt; Aves &gt; Passeriformes &gt; Passeri &gt; Passerida &gt;
Thraupidae</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#nickname"/>
        <NamedIndividual IRI="#VilaIsabel"/>
        <Literal datatypeIRI="&xsd;string">Vila Isabel</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#nickname"/>
        <NamedIndividual IRI="#compraGenerica"/>
        <Literal datatypeIRI="&xsd;string">comprar</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#nickname"/>
        <NamedIndividual IRI="#compraGenerica"/>
        <Literal datatypeIRI="&xsd;string">compro</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#nickname"/>
        <NamedIndividual IRI="#compraGenerica"/>
        <Literal datatypeIRI="&xsd;string">compra</Literal>
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    <DataPropertyAssertion>
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    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#envioViaCorreio"/>
    <Literal datatypeIRI="&xsd;string">correios</Literal>
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<DataPropertyAssertion>
    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#envioViaCorreio"/>
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    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#envioViaCorreio"/>
    <Literal datatypeIRI="&xsd;string">sedex</Literal>
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<DataPropertyAssertion>
    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#envioViaCorreio"/>
    <Literal datatypeIRI="&xsd;string">correio</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
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    <NamedIndividual IRI="#envioViaSispass"/>
    <Literal datatypeIRI="&xsd;string">sispass</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#envioViaSispass"/>
    <Literal datatypeIRI="&xsd;string">sispas</Literal>
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    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#trocaGenerica"/>
    <Literal datatypeIRI="&xsd;string">trocar</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#trocaGenerica"/>
    <Literal datatypeIRI="&xsd;string">troco</Literal>
</DataPropertyAssertion>
```

```
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    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#vendaGenerica"/>
    <Literal datatypeIRI="&xsd;string">venda</Literal>
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    <DataProperty IRI="#nickname"/>
    <NamedIndividual IRI="#vendaGenerica"/>
    <Literal datatypeIRI="&xsd;string">vender</Literal>
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    <NamedIndividual IRI="#vendaGenerica"/>
    <Literal datatypeIRI="&xsd;string">vendo</Literal>
</DataPropertyAssertion>
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    <ObjectProperty IRI="#actsOn"/>
    <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#comunicates"/>
    <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#discussionComposedBy"/>
    <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#forcadoAParticiparDe"/>
    <ObjectProperty IRI="#getInvolvedIn"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#forcadoAParticiparDeRinha"/>
    <ObjectProperty IRI="#forcadoAParticiparDe"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#forcadoAParticiparDeTorneio"/>
    <ObjectProperty IRI="#forcadoAParticiparDe"/>
</SubObjectPropertyOf>
```

```
    <SubObjectPropertyOf>
        <ObjectProperty IRI="#getInvolvedIn"/>
        <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
    </SubObjectPropertyOf>
    <SubObjectPropertyOf>

<ObjectProperty IRI="#groupInDiscussion"/>
        <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
    </SubObjectPropertyOf>
    <SubObjectPropertyOf>
        <ObjectProperty IRI="#hasProfile"/>
        <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
    </SubObjectPropertyOf>
    <SubObjectPropertyOf>
        <ObjectProperty IRI="#hasSpecimen"/>
        <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
    </SubObjectPropertyOf>
    <SubObjectPropertyOf>
        <ObjectProperty IRI="#hasWebsite"/>
        <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
    </SubObjectPropertyOf>
    <SubObjectPropertyOf>
        <ObjectProperty IRI="#inhabits"/>
        <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
    </SubObjectPropertyOf>
    <SubObjectPropertyOf>
        <ObjectProperty IRI="#livesOn"/>
        <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
    </SubObjectPropertyOf>
    <SubObjectPropertyOf>
        <ObjectProperty IRI="#neighbors"/>
        <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
    </SubObjectPropertyOf>
    <SubObjectPropertyOf>
        <ObjectProperty IRI="#offersGood"/>
        <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
    </SubObjectPropertyOf>
    <SubObjectPropertyOf>
        <ObjectProperty IRI="#participa"/>
```

```
    <ObjectProperty IRI="#getInvolvedIn"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#participaDeNegociacao"/>
    <ObjectProperty IRI="#participa"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#postMessage"/>
    <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#postedBy"/>
    <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#privateDiscussionComposedBy"/>
    <ObjectProperty IRI="#discussionComposedBy"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#profileOf"/>
    <ObjectProperty abbreviatedIRI=":topObjectProperty"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#promove"/>
    <ObjectProperty IRI="#getInvolvedIn"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#promoveInvestigacao"/>
    <ObjectProperty IRI="#promove"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#promoveNegociacao"/>
    <ObjectProperty IRI="#promove"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#promoveRinha"/>
    <ObjectProperty IRI="#promoveTorneio"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
```

```
    <ObjectProperty IRI="#promoveTorneio"/>
    <ObjectProperty IRI="#promove"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#promoveTorneioDeCanto"/>
    <ObjectProperty IRI="#promoveTorneio"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#publicDiscussionComposedBy"/>
    <ObjectProperty IRI="#discussionComposedBy"/>
</SubObjectPropertyOf>
<SubObjectPropertyOf>
    <ObjectProperty IRI="#reprime"/>
    <ObjectProperty IRI="#getInvolvedIn"/>
</SubObjectPropertyOf>
<InverseObjectProperties>
    <ObjectProperty IRI="#neighbors"/>
    <ObjectProperty IRI="#neighbors"/>
</InverseObjectProperties>
<InverseObjectProperties>
    <ObjectProperty IRI="#postMessage"/>
    <ObjectProperty IRI="#postedBy"/>
</InverseObjectProperties>
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</FunctionalObjectProperty>
<FunctionalObjectProperty>
    <ObjectProperty IRI="#promoveNegociacao"/>
</FunctionalObjectProperty>
<SymmetricObjectProperty>
    <ObjectProperty IRI="#neighbors"/>
</SymmetricObjectProperty>
<IrreflexiveObjectProperty>
    <ObjectProperty IRI="#hasWebsite"/>
</IrreflexiveObjectProperty>
<IrreflexiveObjectProperty>
    <ObjectProperty IRI="#inhabits"/>
</IrreflexiveObjectProperty>
<IrreflexiveObjectProperty>
```

```
    <ObjectProperty IRI="#offersGood"/>
</IrreflexiveObjectProperty>
<IrreflexiveObjectProperty>
    <ObjectProperty IRI="#participaDeNegociacao"/>
</IrreflexiveObjectProperty>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#comunicates"/>
    <Class IRI="#Message"/>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#discussionComposedBy"/>
    <Class IRI="#Discussao"/>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#forcadoAParticiparDeRinha"/>
    <Class IRI="#Animal"/>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#forcadoAParticiparDeTorneio"/>
    <Class IRI="#Animal"/>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#groupInDiscussion"/>
    <ObjectUnionOf>
        <Class IRI="#PrivateMessage"/>
        <Class IRI="#PublicMessage"/>
    </ObjectUnionOf>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#inhabits"/>
    <Class IRI="#Animal"/>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#livesOn"/>
    <ObjectUnionOf>
        <Class IRI="#Buyer"/>
        <Class IRI="#Trafficker"/>
    </ObjectUnionOf>
</ObjectPropertyDomain>
```

```
<ObjectPropertyDomain>
    <ObjectProperty IRI="#offersGood"/>
    <Class IRI="#Proposal"/>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#participaDeNegociacao"/>
    <ObjectUnionOf>
        <Class IRI="#CounterProposal"/>
        <Class IRI="#Deal"/>
    </ObjectUnionOf>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#postMessage"/>
    <Class IRI="#Profile"/>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#postedBy"/>
    <Class IRI="#Message"/>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#privateDiscussionComposedBy"/>
    <Class IRI="#DiscussaoParticular"/>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#profileOf"/>
    <Class IRI="#Profile"/>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#promoveInvestigacao"/>
    <Class IRI="#Police"/>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#promoveNegociacao"/>
    <Class IRI="#Proposal"/>
</ObjectPropertyDomain>
<ObjectPropertyDomain>
    <ObjectProperty IRI="#publicDiscussionComposedBy"/>
    <Class IRI="#DiscussaoPublica"/>
</ObjectPropertyDomain>
```

```
    <ObjectPropertyRange>
        <ObjectProperty IRI="#comunicates"/>
        <Class IRI="#Negotiation"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#discussionComposedBy"/>
        <Class IRI="#Message"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#forcadoAParticiparDeRinha"/>
        <Class IRI="#Skirmish"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#forcadoAParticiparDeTorneio"/>
        <Class IRI="#SingingTournament"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#groupInDiscussion"/>
        <Class IRI="#Discussao"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#hasProfile"/>
        <Class IRI="#Profile"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#hasSpecimen"/>
        <Class IRI="#Animal"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#hasWebsite"/>
        <Class IRI="#Website"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#inhabits"/>
        <Class
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#Physica
lPlace"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
```

```
        <ObjectProperty IRI="#livesOn"/>
        <Class
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#Physica
lPlace"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#offersGood"/>
        <Class IRI="#Animal"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#participaDeNegociacao"/>
        <Class IRI="#Negotiation"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#postMessage"/>
        <ObjectUnionOf>
            <Class IRI="#PrivateMessage"/>
            <Class IRI="#PublicMessage"/>
        </ObjectUnionOf>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#postedBy"/>
        <Class IRI="#Profile"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#privateDiscussionComposedBy"/>
        <Class IRI="#PrivateMessage"/>
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        <ObjectProperty IRI="#promoveNegociacao"/>
        <Class IRI="#Negotiation"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#promoveRinha"/>
        <Class IRI="#Skirmish"/>
```

```
</ObjectPropertyRange>
<ObjectPropertyRange>
    <ObjectProperty IRI="#promoveTorneio"/>
    <Class IRI="#Tournament"/>
</ObjectPropertyRange>
<ObjectPropertyRange>
    <ObjectProperty IRI="#promoveTorneioDeCanto"/>
    <Class IRI="#SingingTournament"/>
</ObjectPropertyRange>

<ObjectPropertyRange>
    <ObjectProperty IRI="#publicDiscussionComposedBy"/>
    <Class IRI="#PublicMessage"/>
</ObjectPropertyRange>
<DisjointObjectProperties>
    <ObjectProperty IRI="#forcadoAParticiparDe"/>
    <ObjectProperty IRI="#participa"/>
</DisjointObjectProperties>
<DisjointObjectProperties>
    <ObjectProperty IRI="#forcadoAParticiparDe"/>
    <ObjectProperty IRI="#promove"/>
</DisjointObjectProperties>
<DisjointObjectProperties>
    <ObjectProperty IRI="#forcadoAParticiparDe"/>
    <ObjectProperty IRI="#reprime"/>
</DisjointObjectProperties>
<DisjointObjectProperties>
    <ObjectProperty IRI="#participa"/>
    <ObjectProperty IRI="#reprime"/>
</DisjointObjectProperties>
<DisjointObjectProperties>
    <ObjectProperty IRI="#promove"/>
    <ObjectProperty IRI="#reprime"/>
</DisjointObjectProperties>
<SubDataPropertyOf>
    <DataProperty IRI="#address"/>
    <DataProperty IRI="#contact"/>
</SubDataPropertyOf>
<SubDataPropertyOf>
```

```
        <DataProperty IRI="#birthday"/>
        <DataProperty
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#hasEven
tDate"/>
    </SubDataPropertyOf>
    <SubDataPropertyOf>
        <DataProperty IRI="#conservationSatus"/>
        <DataProperty
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#hasData
Value"/>
    </SubDataPropertyOf>
    <SubDataPropertyOf>
        <DataProperty IRI="#contact"/>
        <DataProperty
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#hasData
Value"/>
    </SubDataPropertyOf>
    <SubDataPropertyOf>
        <DataProperty IRI="#contents"/>
        <DataProperty
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#hasData
Value"/>
    </SubDataPropertyOf>
    <SubDataPropertyOf>
        <DataProperty IRI="#currencyValue"/>
        <DataProperty
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#hasData
Value"/>
    </SubDataPropertyOf>
    <SubDataPropertyOf>
        <DataProperty IRI="#email"/>
        <DataProperty IRI="#contact"/>
    </SubDataPropertyOf>
    <SubDataPropertyOf>
        <DataProperty IRI="#mainName"/>
        <DataProperty IRI="#name"/>
    </SubDataPropertyOf>
    <SubDataPropertyOf>
        <DataProperty IRI="#name"/>
```

```
        <DataProperty
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#hasData
Value"/>
    </SubDataPropertyOf>
    <SubDataPropertyOf>
        <DataProperty IRI="#nickname"/>
        <DataProperty IRI="#name"/>
    </SubDataPropertyOf>
    <SubDataPropertyOf>
        <DataProperty IRI="#scientificName"/>
        <DataProperty IRI="#name"/>
    </SubDataPropertyOf>
    <SubDataPropertyOf>
        <DataProperty IRI="#shipment"/>
        <DataProperty
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#hasData
Value"/>
    </SubDataPropertyOf>
    <SubDataPropertyOf>
        <DataProperty IRI="#taxonomy"/>
        <DataProperty
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#hasData
Value"/>
    </SubDataPropertyOf>
    <SubDataPropertyOf>
        <DataProperty IRI="#telephone"/>
        <DataProperty IRI="#contact"/>
    </SubDataPropertyOf>
    <DataPropertyDomain>
        <DataProperty IRI="#conservationSatus"/>
        <Class IRI="#Animal"/>
    </DataPropertyDomain>
    <DataPropertyDomain>
        <DataProperty IRI="#contents"/>
        <Class IRI="#Message"/>
    </DataPropertyDomain>
    <DataPropertyDomain>
        <DataProperty IRI="#currencyValue"/>
        <ObjectUnionOf>
```

```
            <Class IRI="#CounterProposal"/>
            <Class IRI="#Proposal"/>
        </ObjectUnionOf>
    </DataPropertyDomain>
    <DataPropertyDomain>
        <DataProperty IRI="#mainName"/>
        <ObjectUnionOf>
            <Class
IRI="http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#Organiz
ation"/>
            <Class IRI="#Buyer"/>
            <Class IRI="#Trafficker"/>
        </ObjectUnionOf>
    </DataPropertyDomain>
    <DataPropertyDomain>
        <DataProperty IRI="#scientificName"/>
        <Class IRI="#Animal"/>
    </DataPropertyDomain>
    <DataPropertyDomain>
        <DataProperty IRI="#shipment"/>
        <Class IRI="#Proposal"/>
    </DataPropertyDomain>
    <DataPropertyDomain>
        <DataProperty IRI="#taxonomy"/>
        <Class IRI="#Animal"/>
    </DataPropertyDomain>
    <DataPropertyRange>
        <DataProperty IRI="#birthday"/>
        <Datatype abbreviatedIRI="xsd:date"/>
    </DataPropertyRange>
    <DataPropertyRange>
        <DataProperty IRI="#conservationSatus"/>
        <Datatype abbreviatedIRI="xsd:string"/>
    </DataPropertyRange>
    <DataPropertyRange>
        <DataProperty IRI="#contents"/>
        <Datatype abbreviatedIRI="xsd:string"/>
    </DataPropertyRange>
    <DataPropertyRange>
```

```
        <DataProperty IRI="#currencyValue"/>
        <Datatype abbreviatedIRI="xsd:float"/>
    </DataPropertyRange>
    <DataPropertyRange>
        <DataProperty IRI="#email"/>
        <Datatype abbreviatedIRI="xsd:string"/>
    </DataPropertyRange>
    <DataPropertyRange>
        <DataProperty IRI="#mainName"/>
        <Datatype abbreviatedIRI="xsd:string"/>
    </DataPropertyRange>
    <DataPropertyRange>
        <DataProperty IRI="#nickname"/>
        <Datatype abbreviatedIRI="xsd:string"/>
    </DataPropertyRange>
    <DataPropertyRange>
        <DataProperty IRI="#scientificName"/>
        <Datatype abbreviatedIRI="xsd:string"/>
    </DataPropertyRange>
    <DataPropertyRange>
        <DataProperty IRI="#shipment"/>
        <Datatype abbreviatedIRI="xsd:string"/>
    </DataPropertyRange>
    <DataPropertyRange>
        <DataProperty IRI="#taxonomy"/>
        <Datatype abbreviatedIRI="xsd:string"/>
    </DataPropertyRange>
    <DataPropertyRange>
        <DataProperty IRI="#telephone"/>
        <Datatype abbreviatedIRI="xsd:string"/>
    </DataPropertyRange>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Acquisition</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Operação complementar à venda, sob
a perspectiva de outro indivíduo envolvido (o comprador).
</Literal>
    </AnnotationAssertion>
```

```
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Animal</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Qualquer ser vivo que não seja
Homo sapiens sapiens.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Apprehension</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Operação onde criminosos são
detidos,e qualquer material ilegal é confiscado.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Blog</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Website que atua como um canal de
informações entre seus editores e seu público.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Buyer</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Pessoa que participa de uma
transição online na posição de comprador.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Company</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Organização criada com o
propóisito de obter lucro por meios legais.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#CounterProposal</IRI>
        <Literal xml:lang="pt-br"
```

```
datatypeIRI="&rdf;PlainLiteral">Uma oferta que rediscute os termos
de uma oferta anterior.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Deal</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Consenso geral que encerra uma
Negociação.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Discussao</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Lista de Mensagens, onde cada uma
dá continuidade ao tópico discutido na Discussão.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#DiscussaoParticular</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Discussão onde todas as suas
mensagens constituintes são particulares</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#DiscussaoPublica</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Discussão onde todas as suas
mensagens constituintes são públicas</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Encounter</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Evento geral que reúne um grande
grupo de pessoas.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
```

```
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Exchange</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Transações onde um animal é
trocado por outros bens, além de alguma possível diferença
monetária.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#InformalGroup</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Grupo de pessoas de cunho mais
social, como turmas, equipes e quadrilhas</Literal>

    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Investigation</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Operação sigilosa, onde uma
suspeita de atividade criminosa é averiguada.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Message</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Qualquer conjunto de texto que
seja publicado em algum Website por uma pessoa.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#NGO</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Uma organização sem fins
lutrativos, que em geral visa algum propósito nobre.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Negotiation</IRI>
```

```
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Debate onde o preço de uma
mercadoria oferecida é discutido, com o propósito de venda. No
contexto  desta ontologia, apenas negociações onde a mercadoria
ofertada é um animal tem valor para o tráfico são
consideradas.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Police</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Corporação pública, que visa
proteger a comunidade dos malefícios de atividades ilíicitas
conduzidas em sua jurisdição.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#PolicialAction</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Qualquer operação conduzida pela
Polícia.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Portal</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Website que promove vários outros
Websites associados.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#PrivateMessage</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Trata-se de uma mensagem enviada
especificamente para um Perfil, e que não pode ser visualizada por
ninguém além do dono deste Perfil.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
```

```
        <IRI>#Profile</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Página onde são descritas as
informações de um determinado usuário, seja ele uma organização ou
uma pessoa.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Proposal</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Oferta inicial de mercadoria, sob
algum valor monetário.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#PublicDivision</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Toda e qualquer organização que
seja constituinte do poder público.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#PublicMessage</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Mensagens desta subclasse não
possuem um destinatario especifico, sendo publicada em discussões
onde qualquer Perfil tem acesso.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Selling</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Operação onde um animal é trocado
por um valor em dinheiro.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#SingingTournament</IRI>
        <Literal xml:lang="pt-br"
```

```
datatypeIRI="&rdf;PlainLiteral">Torneio onde aves devem cantar
exaustivamente.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Skirmish</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Torneio violento onde dois animais
são incitados a agredirem um ao outro.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#SocialNetwork</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Serviços da Web 2.0 cujo foco
reside na interação social entre seus usuários, representados por
Perfis.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Tournament</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Evento ilegal onde animais que tem
valor para o trafico são forçados a competir entre si, de forma
cruel e desumana.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Trafficker</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Pessoa que possui um animal ilegal
e está tentanto negociar a sua venda ou troca.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#Website</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Conjunto de páginas HTML
relacionadas, distribuídas sobre a World Wide Web.</Literal>
```

```
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#actsOn</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Estabelece a participação
construtiva de um Humano dentro de uma Organização por meio de
vínculos como empregatício, voluntário, etc.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#address</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Endereço onde a entidade pode ser
encontrada.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#birthday</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">A data de nascimento de uma
pessoa.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#comunicates</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Relaciona uma Mensagem com o
conteúdo que ela pode comunicar. Do ponto de vista desta
ontologia, qualquer conteúdo que não faça parte do conjunto imagem
desta Propriedade possivelmente não é relevante para o escopo
representado.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#contact</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Engloba formas de contactar uma
pessoa, ou uma Organização.</Literal>
```

```
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#contents</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Armazena o corpo do texto de uma
mensagem.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#currencyValue</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Indica o valor monetário de um
espécime à venda.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#discussionComposedBy</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Relaciona uma Discussão com todas
as Mensagens que a compõe.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#email</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Email de contato</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#forcadoAParticiparDe</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Indica um envolvimento forçado da
Entidade em um Evento (i.e. a Entidade pariticipa do Evento contra
a sua vontade).</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#forcadoAParticiparDeRinha</IRI>
```

```
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Relaciona o envolvimento forçado
entre algum animal e uma rinha.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#forcadoAParticiparDeTorneio</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Representa a participação forçada
de um animal em um torneio de canto. Note que o animal deve ser
algum espécime de ave canora para que essa relação faça
sentido.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#getInvolvedIn</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Indica que cada Entidade pode
estar envolvida em alguma forma de Evento.</Literal>
    </AnnotationAssertion>

    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#groupInDiscussion</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Estabelece que uma Mensagem
participa de uma Discussão.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#hasProfile</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Relaciona uma pessoa ou uma
organização ao algum eventual perfil que possua.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#hasSpecimen</IRI>
        <Literal xml:lang="pt-br"
```

```
datatypeIRI="&rdf;PlainLiteral">Indica que alguma pessoa está de
posse de um animal.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#hasWebsite</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Relaciona uma pessoa ou uma
organização a algum website que possua.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#inhabits</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Relaciona um animal com o seu
habitat natural, representado por uma região geográfica.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI=":deprecated"/>
        <IRI>#livesOn</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Indica onde uma pessoa vive, em
termos de uma região geográfica.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#mainName</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Principal nome pelo qual uma
pessoa ou uma Organização são chamados.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#name</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Abrange propriedades relativas a
nomes de entidades.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
```

```
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#neighbors</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Estabelece uma relação de
vizinhança física por parte de duas entidades da classe
RegiaoGeografica.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#nickname</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Nome popular conferido
informalmente.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#offersGood</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Estabele que uma proposta oferece
um animal como mercadoria.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#participa</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Indica que uma entidade qualquere
participou de um evento.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#participaDeNegociacao</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Define a participação de uma
Mensagem em uma Negociacao, seja realizando uma ContraProposta ou
chegando em um Acordo.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#postMessage</IRI>
```

```
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Liga um perfil a uma mensagem que
ele tenha publicado.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI=":deprecated"/>
        <IRI>#postedBy</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Relaciona uma mensagem com o
perfil que a publicou.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#privateDiscussionComposedBy</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Estabelece que uma
DiscussaoParticular só pode ser composta por
MensagensParticulares.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#profileOf</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Relaciona um perfil a uma pessoa
ou uma organização.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#promove</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Especifica a situação em que um
evento é promovido por uma entidade.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#promoveInvestigacao</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Associa a polícia à  sua
participação em uma Investigação policial.</Literal>
```

```
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#promoveNegociacao</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Uma Negociacao sempre é promovida
por uma Mensagem inicial, que atua como a Proposta.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#promoveRinha</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Estabelece a promoção de Rinhas
por parte de uma pessoa ou uma quadrilha
(GrupoInformal).</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#promoveTorneio</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Estabelece a promoção de torneios
ilegais por parte de uma pessoa ou uma quadrilha
(GrupoInformal).</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#promoveTorneioDeCanto</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Estabelece a promoção de um
torneio de canto ilegal por parte de uma pessoa ou uma quadrilha
(GrupoInformal).</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#publicDiscussionComposedBy</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Estabelece que uma
DiscussaoPublica só pode ser composta por
MensagensPublicas.</Literal>
```

```
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#reprime</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Indica uma participação negativa
por parte de uma entidade em um evento, onde a primeira tentou de
alguma forma inibir o desenrolar da segunda.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#scientificName</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Nome científico de uma
espécie.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#shipment</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">A forma como uma mercadoria será
transportada do vendedor para o comprador.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#taxonomy</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Classificação taxonômica de um
animal. Apesar de também possuírem uma taxonomia, esta propriedade
não é relevante para pessoas, pois sua classificação é bem
conhecida e não varia de pessoa. Ou seja, a taxonomia de um humano
está implícita, e por isso não será representada.</Literal>
    </AnnotationAssertion>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#telephone</IRI>
        <Literal xml:lang="pt-br"
datatypeIRI="&rdf;PlainLiteral">Número de telefone de
contato.</Literal>
```

```
    </AnnotationAssertion>
</Ontology>



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```