

# MASTER OF SCIENCE IN COMPUTER SCIENCE

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## FRAMEWORK FOR MANAGING METADATA SECURITY TAGS AS THE BASIS FOR MAKING SECURITY DECISIONS

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This thesis presents an analysis of a capability to employ CAPCO (Controlled Access Program Coordination Office) compliant Metadata security tags as the basis for making security decisions. This research covers all the security aspects of the related technologies, such as XML, Web Services, Java API's for XML, .NET Architecture to help determine how security conscious enterprises such as the Intelligence Community can implement this approach in the real insecure world, with commercial-off-the-self products, to meet their needs. There were many concerns about using the XML Metadata Label Tags as the basis for making security decisions, due to an untrusted environment. By using appropriate trusted parts, when really necessary, and new technologies, secure solutions for creating, storing and disseminating XML documents can be found.

Besides the theoretical research, this thesis also presents a prototype development of a Web Service that can handle most of the tasks (save, save locally, review, etc.), which are required to securely manage XML documents. In order to implement the above Web Service, open source products, such as Java and Apache Tomcat Web Server, are used. These are not only available free, easily testable and commonly used, but they provide a great interoperability among almost all the platforms. The implementation can also be done by using other competitive technologies or platforms or can even use similar or related commercial products.

**KEYWORDS:** Metadata, Web Service, XML, XSL, DTD, Schema, SAX, Security, Policy, XML Editor, XML Parser, Validate, Security Attributes, Labels, Objects

## PERFORMANCE EVALUATION OF VOICE OVER INTERNET PROTOCOL

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Voice over Internet Protocol (VoIP) was developed to emulate toll services with lower communication cost. In VoIP applications, voices are digitized and packetized into small blocks. These voice blocks are encapsulated in a sequence of voice packets using the Real-time Transport Protocol (RTP) and delivered by the User Datagram Protocol (UDP). To help VoIP applications deal with unpredictable network performance, the Real-time Transport Control Protocol (RTCP) is developed to monitor the performance of RTP packets and provide feedback to the VoIP applications. The feedback on packet delay, jitter, and loss rate enables the applications to adapt to network conditions to maintain a certain level of voice quality. With this architecture, the quality of service of VoIP relies on the effectiveness of the RTCP network performance report mechanism.

This research collects RTCP performance reports from live traffic over real networks and compares their values with the statistics derived from direct measurements of RTP packets to evaluate the effectiveness of RTCP. The live experiments were conducted on networks resembling respectively, Local Area Network (LAN), Wide Area Network (WAN), campus network, and encrypted wireless LAN. Results from these

experiments show that RTCP is effective for low delay networks but RTCP performance reports can be inaccurate for networks with large, volatile delays

**KEYWORDS:** VoIP, Telephony, RTCP, MOS, Performance Evaluation

## **3D VISUALIZATION OF INVARIANT DISPLAY STRATEGY FOR HYPERSPECTRAL IMAGERY**

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Spectral imagery provides multi-dimensional data, which are difficult to display in standard three-color image formats. Tyo, et al. (2001) propose an invariant display strategy to address this problem. This approach is to mimic the dynamics of human perception. The dimensionality of the data are reduced by using a Principal Component (PC) transformation, and then displayed by making use of a Hue, Saturation, and Value (HSV) display transform.

This study addresses the PC transformation strategy, looks for a global eigenvector via 3D visualization of HSV color space information, and examines the suggested algorithm to provide the most intuitive display. The user interface created in this thesis is capable of computing the necessary implementation of the proposed strategy, viewing selected Region of Interest (ROI) in HSV color space model in 3D, and viewing the 2D resultant image. A demonstration application uses Java language including Java2D, Xj3D Player, Document Object Model (DOM) Application Program Interfaces (API), and Extensible 3D Language (X3D). The Java2D API enables the user to load imagery, process data, and render results in a two-dimensional (2D) view. Xj3D and DOM APIs are introduced to visualize Tyo's invariant display strategy in three-dimensional (3D) views and then to save results as X3D scenes. These techniques appear to be inherently valuable and can serve as the basis for further research.

Through this thesis, 3D visualization of the proposed algorithm successfully showed PC transformed data does form a conical shape in HSV color space. Also, a comparison of PC transformed data with HSV color space revealed the hue angle needed to be adjusted. The application of this adjustment to multiple scenes produced consistent results. However, this hue adjustment left other scene elements in non-ergonomic colors and brought up the issue of further enhancement of the algorithm.

**KEYWORDS:** Hyperspectral Imagery, 3D Visualization, X3D, Java Xj3D Player

## **ALTERNATE HIGH SPEED NETWORK ACCESS FOR THE LAST MILE**

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Existing copper wire infrastructure no longer provides the required bandwidth for today's bandwidth-intense Internet applications. Homes and businesses in the last mile require the same access speeds offer by fiber optic cables. It is however, economically unfeasible to bring fiber optic cable to each and every house and business in the last mile.

Free Space Optics and IEEE 802.11 are two technologies that offer high-speed capability and are potential last mile network access options. Free Space Optics uses lasers and IEEE 802.11 uses radio waves to send large amounts of data from one place to another. Both are wireless and use license-free frequency band for transmission. Both are quickly deployable, easily scalable and cheaper to install and upgrade compared to wired infrastructures. These characteristics support applications that require high bandwidth and a high degree of mobility, which are common in the military and civil networks.

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This thesis addresses the last mile problem and the current available access technologies which are unable to provide a high speed solution. Free Space Optics and IEEE 802.11 wireless technologies are explored and applied to a fictitious city for an economic analysis as possible high-speed network access methods.

**KEYWORDS:** Free Space Optics, IEEE 802.11b, IEEE 802.11a, IEEE 802.11g, Wireless Networking, Radio Frequency, Network Infrastructure

## **A METHODOLOGY FOR THE DEVELOPMENT OF SECURE VERTICAL WEB PORTALS**

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In this thesis, the development of vertical web portals (vortals) that fulfill targeted organizational mission needs is investigated. This specific type of portal provides narrow-scoped data, information and services while affording the user accessibility over a public network, such as the Internet. As part of the investigation, a methodology for architecting such portals with explicit consideration of security policy is presented. The methodology, along with some preliminary guidelines, is intended to serve as a first approximation of a framework for both the development of vertical portals and the definition of doctrine on the application of vortals. This methodology is illustrated with an application to a Navy ship.

**KEYWORDS:** Vertical Web Portal, Secure Vertical Web Portal, Security Architecture, Security Policy, Knowledge Management, Portal, Vortal, Methodology