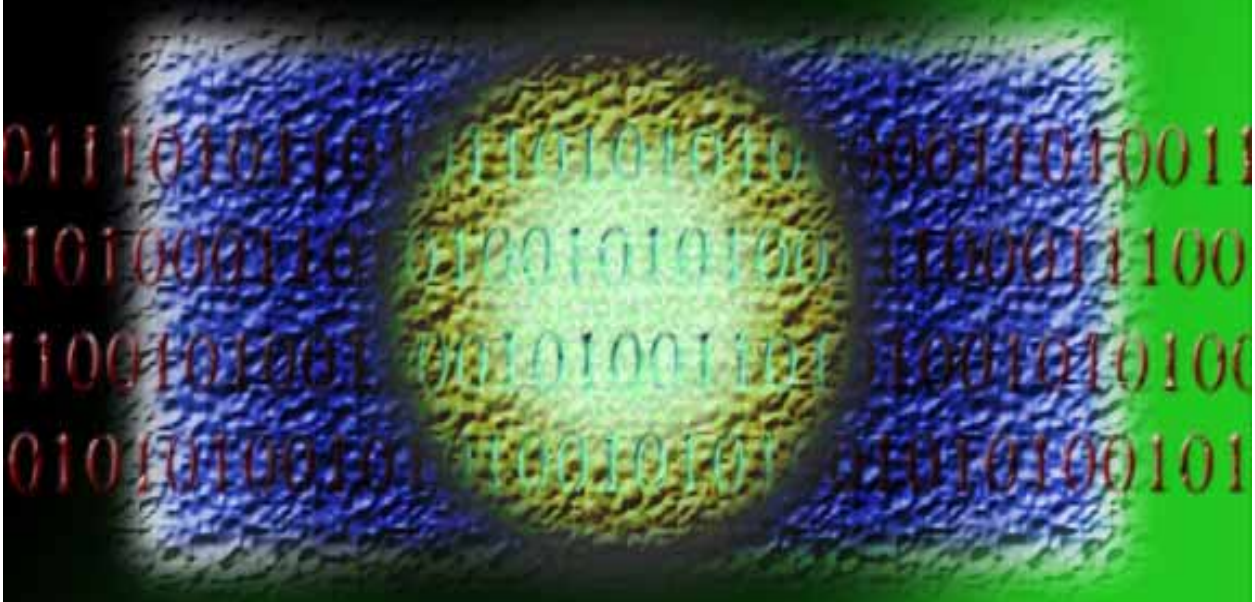
Project Proposal
September 2003



Team ISE

Image Selective Encryption

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A constant amount of traffic flows between computers connected to the Internet. A large volume of information may take a long time traveling from destination to destination. The resulting speed reduction makes it desirable to compress the file as much as possible in order to send the smallest amount of data. Compression of data has allowed for the high-speed data transfers that have made Internet communication and business very workable.

In addition to sending the smallest amount of information possible, users also attempt to maintain a certain level of security upon their information. Due to the fact that common encryption methods generally manipulate an entire file, most encryption algorithms tend to make the transfer of information more costly in terms of time and bandwidth. Thus, users pay a price for security relative to their desired level of security. One possible solution would be a system of encryption that works cooperatively with the standard compression schemes. *Selective Encryption* of only a small percentage of the file's bits will facilitate this solution. Because most encryption schemes will make the file larger, selective encryption seeks only to encrypt portions of the file that will make it unusable. In other words, if a user does not have the proper decryption device, the file should not be usable. Selective encryption will minimize the necessary increase in file size due to encryption while maintaining a maximum level of uselessness, or damage, to the product.

An image could be encrypted with any of the sufficiently secure encryption algorithms available to the open source community, but this will usually result in a dramatic increase in file size that will severely increase transfer time over the Internet. However, selecting key parts of a file for encryption and only encoding those bits can actually render an image unusable. The initial statistical analysis done by the team will consist of specifically breaking down the standard JPEG compression scheme into its usable parts and evaluate which of these, if encrypted, will cause a potential user to pay for rights to the image or force subscription to the provider service.

Team ISE (Image Selective Encryption) will deliver a package for selectively encrypting JPEG (Joint Photographic Experts Group) still image files. The package will provide the tools necessary to encrypt the critical information of a JPEG file in cooperation with existing standard compression tools. This package will handle JPEG files in such a way that only a small percentage of the total file will be encrypted. Selective Encryption security will not extend to the level of military secrecy, but rather a level that would deter all but brute force attacks, allowing users to securely protect private JPEG images.

An additional aspect of the encryption analysis will be the determination of the specific targets in the file for encryption. For example in an MPEG file there are headers that contain a small portion of the overall number of bits but which are extremely vital to the reproduction of the movie by the user. So, if certain headers were to be encrypted the percentage of the file being manipulated would be less than ten percent of the total number of bits in the file. Although only a small portion will be encrypted, the resulting

damage experienced by an unauthorized user would be sufficient to cause the user to pay for the decryption package. However, there are other targets that, while they can be encrypted and will do sufficient damage, can be guessed by an attacker. The attacker could, with some degree off effort, render the file useful without use of the decryption software. For example, if the frame rate of an MPEG file was encrypted, an attacker could try all three of most common frame rates and one of these is certain to produce the correct rate for the particular video. In the case of JPEG Selective Encryption, Team ISE will have to balance the targets for encryption against ease of simple attacks.

A permanent website will be constructed by the team to make the software package available to anyone interested in the software process. As it is vital to the world of cryptography to let the community view the approach, the first form of the working prototype will be made available on the website. From this, feedback can be received not only from the team itself, but also from the cryptography community at large.

So, following the guidelines of the ongoing MPEG research (also being guided by the sponsor), the team will study the JPEG process and earlier attempts at encryption. With the sponsor's assistance, Team ISE will devise a workable approach to handling individual JPEG images following the concept of selective encryption.

It is possible that the team will complete the JPEG process early enough in the year that they will able to apply the same approach to other types of compressed files (text, audio, etc.) However, this initial specifications document applies only to the envisioned JPEG project.