X.509 Certification Practice Statement
for the
VT Root
Certification Authorities

March 28, 2006
Amended March 16, 2011

OBJECT IDENTIFIER 1.3.6.1.4.1.6760.5.2.3.1. 1

Release 1.0, Version 3.0

Identification and Validation of this Policy

This Certification Practice Statement (CPS) has been assigned the global Object Identifier (OID) 1.3.6.1.4.1.6760.5.2.3.1.1. A Virginia Tech Certificate Authority (VTCA) MAY NOT SIGN ANY PUBLIC KEY CERTIFICATE (PKC) OR OTHER DOCUMENT THAT ASSERTS BY REFERENCE TO THIS OID ITS CONFORMANCE TO THIS CERTIFICATION PRACTICE STATEMENT UNLESS ALL ASPECTS OF ITS MANAGEMENT AND OPERATION CONFORM COMPLETELY WITH THE REQUIREMENTS CONTAINED HEREIN.

Minor modifications will be indicated by a suffix to this OID. Any significant changes to this policy, as determined by the Policy Management Authority (PMA), will result in a document with a different OID assignment.

A copy of this document is digitally signed using SHA-1 with RSA encryption and the private key associated with the authority certificate of the Virginia Tech Root CA, operating under this policy.

Identification: Virginia Polytechnic Institute and State University; VPI&SU; Virginia Tech

Data Universal Number System: 003137015

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RECORD OF CHANGES

1. **Cover Page** Change made July 7, 2009

Removed: X.509 Certification Practice Statement for the VT Root Certification Authority
March 28, 2006
OBJECT IDENTIFIER 1.3.6.1.4.1.6760.5.2.3.1. 1
Release 1.0, Version 0.0

Added: X.509 Certification Practice Statement for the VT Root Certification Authority
March 28, 2006
Amended July 7, 2009
OBJECT IDENTIFIER 1.3.6.1.4.1.6760.5.2.3.1. 1
Release 1.0, Version 2.0

2. **1.1.1 Certificate Policy (CP)** Change made July 7, 2009

Removed: The RCA has digitally signed a copy of the VTCA CP, using SHA-1 with RSA encryption and its primary PKC signing key. The digitally signed copy of the RCA CPS is available online at http://www.pki.vt.edu/rootca/cps .

Added: The C1SCA has a copy of the VTCA CP and CPS which has been digitally signed by the VTPKI-PMA chairman and one other member of the VTPKI-PMA. The VTPKI-PMA has the primary responsibility for approving policies/standards of the Virginia Tech Public Key Infrastructure (PKI) and the related Certificate Authorities operating within it. The web administrator of the VTCA PKI website publishes CP and CPS document updates to the website at the request of the VTPKI-PMA chairman and notifies the VTPKI-PMA membership whenever these updates occur.

- A digitally signed copy of the VTCA CP (Certificate Policy) is available at http://www.pki.vt.edu/rootca/cp..
- A digitally signed copy of the RCA CPS (Certification Practice Statement) is available at http://www.pki.vt.edu/rootca/cps.

3. **1.4 CONTACT DETAILS** Change made July 7, 2009

Removed: Questions about interpretation of this CPS are directed in writing to Information Resource Management. Concerns about possible abuse of this CPS, are directed in writing to the Virginia Tech Public Key Infrastructure Policy Management Authority (VTPKI PMA).
Information Resource Management
1700 Pratt Dr.

Blacksburg, VA 24060

Chair, VTPKI PMA
1700 Kraft Dr., Suite 2000
Blacksburg, VA 24060

Added: Questions about interpretation of this CPS are directed in writing to Identity Management Services. Concerns about possible abuse of this CPS, are directed in writing to the Virginia Tech Public Key Infrastructure Policy Management Authority (VTPKI PMA).

Identity Management Services
1700 Pratt Dr.
Blacksburg, VA 24060

Chair, VTPKI PMA
1700 Pratt Dr.
Blacksburg, VA 24060

4. **2.1.3 Subscriber Obligations** Change made July 7, 2009

Removed: notifies Information Resource Management immediately upon either suspected or known compromise of the private key associated with a PKC issued by the RCA

Added: notifies Identity Management Services immediately upon either suspected or known compromise of the private key associated with a PKC issued by the RCA

5. **2.4 INTERPRETATION AND ENFORCEMENT** Change made July 7, 2009

Removed: Interpretation of this CPS is the responsibility of the PMA and Information Resource Management.

Added: Interpretation of this CPS is the responsibility of the PMA and Identity Management Services.

6. **4.5.4 Protection of Security Audit Data Change** made July 7, 2009

Removed: Access to audit logs is controlled by IRM, and access is restricted to authorized employees only.

Added: Access to audit logs is controlled by IMS, and access is restricted to authorized employees only.

7. **4.5.5 Security Audit Data Backup Procedures Change** made July 7, 2009

Removed: The audit log is backed up immediately after subordinate CA key generation ceremonies using a backup utility (vtBackup) which was developed at Virginia Tech. Backup audit logs of the RCA are protected against unauthorized viewing, modification, or deletion by encrypting the backup and using offsite storage in a separate secure location from the RCA host.

Added: The audit log is backed up on the same schedule as the rest of the data on VTCA servers using VT Information Systems and Computing network backup service providing:

- **Scheduled daily backup of server files and directories**
- **Offsite storage in compliance with computing standards**
- **Restoration of files as needed**

8. **4.6.3 Protection of Archive** Change made July 7, 2009

Removed: Archived records are protected against unauthorized viewing, modification, and deletion by using cryptographic protection and offsite storage in a physically secure and trustworthy location. The cryptographic protection is implemented using a 512 bit DES3 symmetric key that is unique to each backup instance. The DES3 symmetric key is then encrypted using 4096 bit RSA public key encryption.

Added: Archived records are protected against unauthorized viewing, modification, and deletion by using offsite storage in a physically secure and trustworthy location. The offsite backup location provides the following key features:

- **Storage in a secure, fire resistant Vault Room**.
- **A stable, secure storage environment:** The room is maintained at a constant 70 degrees and 35% - 55% humidity. It's secured with intrusion alarms and motion detectors.
- **Controlled access:** The interior door to the building remains locked at all times. After admittance to the building, access to the Vault Room can only be obtained with the use of a valid VT ID card entered into the cipher lock.
- **Enhanced fire protection:** Constructed with a concrete floor, and walls, the Vault Room is rated to withstand as a minimum three hours of fire. Additionally the entire building has an automated fire suppression system and a fire alarm wired into the campus police office.

9. **4.6.7 Procedures to Obtain and Verify Archive Information** Change made July 7, 2009

Removed: On request by the auditors, the VT Root CA Administrator will retrieve media containing archived information from the offsite storage location. The VT Root CA Administrator maintains the record of where backups are stored as part of the VTCA Resource

Inventory document. To view the CA archive, it must be decrypted. The private key needed to decrypt the symmetric key used to encrypt the backups is stored on zip disk labeled "Backup Encryption RSA Key Pair" at the offsite storage location. A duplicate copy of the private key is stored on a BIO drive kept in a locked file cabinet in the eProvisioning office area.

Added: The office that provides maintenance and support for the Certification Authority application is responsible for restoration of files from backup archives as needed.

10. **5.1.5 Media Storage** Change made July 7, 2009

Removed: The encrypted backup media of the RCA are stored in an offsite physically secure and trustworthy location.

Added: The backup media of the RCA are stored in an offsite physically secure and trustworthy location.

11. **5.1.7 Offsite Backup** Change made July 7, 2009

Removed: In the event of a system failure there are sufficient backups that can be used to restore the RCA system. These backups are made immediately after every subordinate CA key signing ceremony or other modifications to the RCA using the vtBackup utility. The three most recent full backups are stored at a secure offsite location which can only be accessed by authorized personnel.

Added: In the event of a system failure there are sufficient backups that can be used to restore the RCA system. Full monthly, weekly differential, and daily incremental backups are created during normal daily scheduled backups by the Information Systems and Computing network backup service. The backup media of the RCA are stored in an offsite physically secure and trustworthy location.

12. **5.2.1.1 Certification Authority Administrator** Change made July 7, 2009

Removed: The Certification Authority Administrator (CAA) role is appointed by the Office of the Vice President for Information Technology. The CAA's responsibilities are:
• certificate generation and revocation
• CRL generation
• certificate profile, certificate template, and audit parameter configuration
• administration of the RCA Hardware Security Module

Added: **The Certification Authority Administrator (CAA) role is appointed by the Office of the Vice President for Information Technology. Primarily, a CAA's responsibilities are:**

• Certificate profile, certificate template, and audit parameter configuration
• Develop VTCA key generation and backup procedures
• Assignment of VTCA security privileges and access controls of users
• Install and configure new CA software releases
• Startup/Shutdown of the VTCA

13. **7.1 CERTIFICATE PROFILE** Change made July 7, 2009

Removed: The certificate profiles for the RCA and the subordinate CA certificates issued by the RCA are published at http://www.pki.vt.edu/vtroot/cps/.

Added: The certificate profiles for the RCA and the subordinate CA certificates issued by the RCA are published at http://www.pki.vt.edu/rootca/cps/.

14. **Cover Page** Change made March 16, 2011

Removed: X.509 Certification Practice Statement
for the
VT Root
Certification **Authority**
March 28, 2006
Amended July 7, 2007
OBJECT IDENTIFIER 1.3.6.1.4.1.6760.5.2.3.1. 1
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Amended March 16, 2011
OBJECT IDENTIFIER 1.3.6.1.4.1.6760.5.2.3.1. 1
Release 1.0, Version 3.0

15. **Acronyms** Change made March 16, 2011

Add: RCA Root Certification Authority

16. **1. INTRODUCTION** Change made March 16, 2011

Removed: This Certification Practice Statement (CPS) defines the operational implementation of the terms and conditions, described in the Virginia Polytechnic Institute and State University (hereinafter Virginia Tech) Certificate Authority (VTCA) Certificate Policy identified by the object identifier 1.3.6.1.4.1.6760.5.2.1.1.1, for the VT Root Certificate Authority, (RCA), a VTCA.

Added: This Certification Practice Statement (CPS) defines the operational implementation of the terms and conditions, described in the Virginia Polytechnic Institute and State University (hereinafter Virginia Tech) Certification Authority (VTCA) Certificate Policy identified by the object identifier 1.3.6.1.4.1.6760.5.2.1.1.1, for the VT Self Signed Root and Global Root Certification Authorities.

17. **1.1 OVERVIEW** Change made March 16, 2011

Removed: This CPS defines the operational implementation of the requirements set forth by the VTCA CP.

Added: This CPS defines the operational implementation of the requirements set forth by the VTCA CP for the Virginia Tech Self Signed Root and Global Root CAs. The term RCA (Root Certification Authority) is used throughout this document as a reference to both the Virginia Tech Self Signed Root and Global Root Certification Authorities.

18. **1.1.1 Certificate Policy (CP)** Change made March 16, 2011

Removed: The **C1SCA** has a copy of the VTCA CP and CPS which has been digitally signed by the VTPKI-PMA chairman and one other member of the VTPKI-PMA. The VTPKI-PMA has the primary responsibility for approving policies/standards of the Virginia Tech Public Key Infrastructure (PKI) and the related Certificate Authorities operating within it. The web administrator of the VTCA PKI website publishes CP and CPS document updates to the website at the request of the VTPKI-PMA chairman and notifies the VTPKI-PMA membership whenever these updates occur.

• A digitally signed copy of the VTCA CP (Certificate Policy) is available at http://www.pki.vt.edu/rootca/cp.

• A digitally signed copy of the RCA CPS (Certification Practice Statement) is available at http://www.pki.vt.edu/rootca/cps .

Added: A RCA has a copy of the VTCA CP and CPS which has been digitally signed by the VTPKI-PMA chairman and one other member of the VTPKI-PMA. The VTPKI-PMA has the primary responsibility for approving policies/standards of the Virginia Tech Public Key Infrastructure (PKI) and the related Certificate Authorities operating within it. The web administrator of the VTCA PKI website publishes CP and CPS document updates to the website at the request of the VTPKI-PMA chairman and notifies the VTPKI-PMA membership whenever these updates occur.
A digitally signed copy of the VTCA CP (Certificate Policy) and RCA CPS is available at http://www.pki.vt.edu/rootca/cps

19. **1.3.4 Applicability** Change made March 16, 2011

Removed: A PKC certificate issued by the RCA is .....

Added: A PKC issued by the RCA is .....

20. **3.1.3 Rules for Interpreting Various Name Forms** Change made March 16, 2011

Removed: {*}The Subject names of a PKC must be in the following format:
CN = < name of subordinate CA as determined by the PMA >,
O = Virginia Polytechnic Institute and State University,
C = US,
DC = vt,
DC = edu{*}

Added: The Subject names of a PKC must be in the following format for certificates issued by the VT Self Signed Root CA:
CN = < name of subordinate CA as determined by the PMA >,
O = Virginia Polytechnic Institute and State University, C = US,
DC = vt,
DC = edu
Subject names for certificates issued by the VT Global Root CA must follow naming convention formats specified by the root key signing vendor, GlobalSign as follows:
CN = < name of subordinate CA as determined by the PMA >,
OU=Global < Server | User | SoftPDC > CA,
O=Virginia Tech,
C=US

21. **GLOSSARY** Change made March 16, 2011

Removed: VTPKI: Virginia Tech Public Key Infrastructure refers to the Virginia Tech Root CA and all of the Subordinate CAs within the PKI hierarchy.

Added: VTPKI: Virginia Tech Public Key Infrastructure refers collectively to the Self Signed Root and Global Virginia Tech Root CAs and all of the Subordinate CAs within each PKI hierarchy.

1. INTRODUCTION

This Certification Practice Statement (CPS) defines the operational implementation of the terms and conditions, described in the Virginia Polytechnic Institute and State University (hereinafter Virginia Tech) Certification Authority (VTCA) Certificate Policy identified by the object identifier 1.3.6.1.4.1.6760.5.2.1.1.1, for the VT Self Signed Root and Global Root Certification Authorities. Unless otherwise specified, all stipulations and requirements contained in this CPS are in addition to the VTCA CP with the CP taking precedence in the event of conflicting stipulations.

This CPS is structured in accordance with RFC 3647 [1]. Within this document the words MUST, MUST NOT, REQUIRED, SHALL, SHALL NOT SHOULD, SHOULD NOT RECOMMENDED, MAY, OPTIONAL are to be interpreted as in RFC 2119 [2].

Acronyms

ABADSG	American Bar Association Digital Signature Guideline
ANS	Advanced Encryption Standard
CA	Certification Authority
CAA	Certification Authority Administrator
CARL	Certificate Authority Revocation List
CN	Common Name
CP	Certificate Policy
CPS	Certification Practice Statement
CRIN	Certificate Revocation Identification Number
CRL	Certificate Revocation List
DES	Data Encryption Standard
DN	Distinguished Name
DPE	Digital Processing Entity
DSA/DSS	Digital Signature Algorithm / Digital Signature Standard
EDI	Electronic Data Interface
FIPS PUB	(US) Federal Information Processing Standard Publication

IETF	Internet Engineering Task Force
IMS	Identity Management Services
ISO	International Standards Organization
ITU	International Telecommunications Union
LOA	Level of Assurance
NIST	National Institute of Standards and Technology
NSA	National Security Agency
OCSP	Online Certificate Status Protocol
OID	Object Identifier
PIN	Personal Identification Number
PKC	Public Key Certificate
PKCS	Public Key Certificate Standard
PKI	Public Key Infrastructure
PKIX	Public Key Infrastructure X.509
PMA	Policy Management Authority
RA	Registration Authority
RAA	Registration Authority Administrator
RCA	Root Certification Authority
RFC	(IETF) Request for Comments
RSA	Rivest-Shimar-Adleman
SHA-1	Secure Hash Algorithm
S/MIME	Secure Multipurpose Internet Mail Extension
SSL	Secure Sockets Layer

TCP/IP Transmission Control Protocol/Internet Protocol

TLS Transport Layer Security

UPS Uninterrupted Power Supply

URI Uniform Resource Identifier

URL Uniform Resource Locator

URN Uniform Resource Name

VTCA Virginia Tech Certification Authority

VTPKI Virginia Tech Public Key Infrastructure

WWW World Wide Web

1.1 OVERVIEW

This CPS defines the operational implementation of the requirements set forth by the VTCA CP for the Virginia Tech Self Signed Root and Global Root CAs. The term RCA (Root Certification Authority) is used throughout this document as a reference to both the Virginia Tech Self Signed Root and Global Root Certification Authorities.

This CPS is used by a PKC Relying Party to help in deciding whether a certificate and the information therein and the binding of that information to the Subject are sufficiently trustworthy for a particular application.

All PKCs issued by the RCA contain a valid reference to this CPS.

By relying on information contained in a PKC issued by the RCA, the Relying Party is agreeing with the provisions and stipulations of the VTCA CP and this CPS under which the PKC was issued.

1.1.1 Certificate Policy (CP)

A RCA has a copy of the VTCA CP and CPS which has been digitally signed by the VTPKI-PMA chairman and one other member of the VTPKI-PMA. The VTPKI-PMA has the primary responsibility for approving policies/standards of the Virginia Tech Public Key Infrastructure (PKI) and the related Certificate Authorities operating within it. The web administrator of the VTCA PKI website publishes CP and CPS document updates to the website at the request of the VTPKI-PMA chairman and notifies the VTPKI-PMA membership whenever these updates occur.

- A digitally signed copy of the VTCA CP (Certificate Policy) and RCA CPS (Certification Practice Statement) is available at http://www.pki.vt.edu/rootca/cps .

1.1.2 Relationship between the CP and the CPS
No additional stipulations.

1.1.3 Interoperation with CAs External to this Policy Domain
The RCA may interoperate with CAs external to this policy domain for the sole purpose of having the Virginia Tech Root Certificate signed by an external CA. The VT PKI PMA must explicitly approve any external CA signature.

1.2 IDENTIFICATION
Each PKC issued by the RCA has the OID 1.3.6.1.4.1.6760.5.2.1.1.1, which identifies the VTCA CP document, in the PKC's *Certificate Policies* field. The PKC includes a URL reference to this CPS in the PKC's *CPSuri* field.

1.3 COMMUNITY AND APPLICABILITY
The RCA serves as the root certificate authority within the VTPKI certificate hierarchy. Its sole function is to issue subordinate authority certificates within the VTPKI hierarchy.

1.3.1 PKI Authorities
The RCA has the authority to issue authority PKCs.

1.3.2 Registration Authorities
No additional stipulations

1.3.3 End Entities
The end entity that is the Subject of a PKC issued by the RCA under this policy is a subordinate authority certificate within the VTPKI hierarchy.

1.3.4 Applicability
A PKC issued by the RCA is a subordinate authority certificate which provides certificate issuing services to a specific community. The requirements for issuing subordinate CA certificates are determined by the needs of different types of certificates within the university and are approved by the PMA. Only Relying Parties that accept in its entirety without any limitations (financial or otherwise) the VTCA CP and this CPS can make use of a PKC issued by the RCA.

The table below summarizes the recommended applicability of PKCs at each of the five levels of assurance covered by this document. The Level of Assurance specified in the authority certificate for the subordinate CA will be determined by the nature of the subordinate CA. Subordinate CAs created prior to the designation of the specific levels of assurance herein contain the policy identifier OID for the X.509 Certificate Policy for the Virginia Polytechnic Institute and State University Certification Authorities (1.3.6.1.4.1.6760.5.2.1.1.1).

Assurance Level OID	Applicability
Test 1.3.6.1.4.1.6760.5.2.2.1.1	This level is used to identify PKCs that are used in testing environments. It is solely used for this purpose and conveys no assurance information. Production systems SHOULD never trust PKCs with this LOA.
Rudimentary 1.3.6.1.4.1.6760.5.2.2.2.1	This level is not used.
Basic 1.3.6.1.4.1.6760.5.2.2.3.1	This level provides a sufficient level of assurance relevant to production environments where there are risks and consequences of data compromise. PKCs issued at this assurance level require the approval and signature of the subscriber's dean, director, department head, or designee. This guarantees that the subject entry named in the PKC is a member of the C1SCA communities
Medium 1.3.6.1.4.1.6760.5.2.2.4.1	This level is reserved for future use when stricter identity verification mechanisms are available and in use.
High 1.3.6.1.4.1.6760.5.2.2.5.1	This level is reserved for future use when stricter identity verification mechanisms are available and in use.

1.4 CONTACT DETAILS

Questions about interpretation of this CPS are directed in writing to Identity Management Services. Concerns about possible abuse of this CPS, are directed in writing to the Virginia Tech Public Key Infrastructure Policy Management Authority (VTPKI PMA).

Identity Management Services
1700 Pratt Dr.
Blacksburg, VA 24060

Chair, VTPKI PMA
1700 Pratt Dr.
Blacksburg, VA 24060

2. GENERAL PROVISIONS

2.1 OBLIGATIONS

By making use of a subordinate authority PKC issued by the RCA within the VTPKI infrastructure, a Relying Party is accepting its obligations hereunder.

2.1.1 CA Obligations

No additional stipulations.

2.1.2 RA Obligations

No additional stipulations.

2.1.3 Subscriber Obligations

In addition to the obligations stipulated in the VTCA CP, a Subscriber:

- Adheres to or complies with the terms and conditions of this CPS
- Adheres to or complies with the Usage Terms and Conditions described in the VT Subordinate CA CPS documents
- Notifies Identity Management Services immediately upon either suspected or known compromise of the private key associated with a PKC issued by the RCA

2.1.4 Relying Party Obligations

No additional stipulations

2.1.5 Repository Obligations

No additional stipulations.

2.2 LIABILITY

2.2.1 CA Liability

No additional stipulations.

2.2.2 RA Liability

No additional stipulations.

2.3 FINANCIAL CONSIDERATIONS

No additional stipulations.

2.3.1 Fiduciary Relationships

No additional stipulations.

2.3.2 Administrative Processes

No additional stipulations.

2.4 INTERPRETATION AND ENFORCEMENT

Interpretation of this CPS is the responsibility of the PMA and Identity Management Services.

2.4.1 Governing Law
No additional stipulations.

2.4.2 Severability, Survival, Merger, Notice
No additional stipulations.

2.4.3 Dispute Resolution Procedures
No additional stipulations.

2.4.4 Section Headings
No additional stipulations.

2.5 Fees

2.5.1 Certificate Issuance or Renewal Fees
No fee is charged for this service.

2.5.2 Certificate Access Fees
No fee is charged for this service.

2.5.3 Revocation or Status Information Access Fees
No fee is charged for this service.

2.5.4 Fees for Other Services such as Policy Information
No fee is charged for this service.

2.5.5 Refund Policy
No additional stipulations.

2.6 PUBLICATION AND REPOSITORY
All information about the operation of the RCA and the PKCs it issues are available online, except as indicated in this section. Each PKC issued includes information sufficient to locate this online Repository.

2.6.1 Publication of CA Information
No additional stipulations.

2.6.2 Frequency of Publication
PKCs issued by the RCA are made available on the www.pki.vt.edu website as part of the issuance process. Changes to this CPS are published as soon as they are approved by the PMA. Previous versions remain available online 365 days beyond the latest expiration date of any PKC that references this CPS.

Archived copies of all CPSs for which the RCA has ever issued a PKC are kept in accordance with the Commonwealth of Virginia records retention policy.

2.6.3 Access Controls
There are no limitations on access to this CPS and PKCs issued by the RCA.

2.6.4 Repositories
The repository is reliably web accessible.

2.7 COMPLIANCE AUDIT
No additional stipulations.

2.7.1 Frequency of Entity Compliance Audit
No additional stipulations.

2.7.2 Identity/Qualifications of Auditor
No additional stipulations.

2.7.3 Auditor's Relationship to Audited Party
No additional stipulations.

2.7.4 Topics Covered by Audit
No additional stipulations.

2.7.5 Actions taken as a result of deficiency
No additional stipulations.

2.7.6 Communication of Results
No additional stipulations.

2.8 CONFIDENTIALITY
No additional stipulations.

2.8.1 Types of Information to be Kept Confidential
No additional stipulations.

2.8.2 Types of Information Not Considered Confidential
No additional stipulations.

2.8.3 Disclosure of Certificate Revocation Information
No additional stipulations.

2.8.4 Release to Law Enforcement Officials
No additional stipulations.

2.8.5 Release as Part of Civil Discovery
No additional stipulations.

2.8.6 Disclosure upon Subscriber's Request
No additional stipulations.

2.8.7 Other Information Release Circumstances
No additional stipulations.

2.9 INTELLECTUAL PROPERTY RIGHTS
No additional stipulations.

3. IDENTIFICATION AND AUTHENTICATION

3.1 INITIAL REGISTRATION
Initial registration requires prior approval by the PMA.

3.1.1 Types of Names
A Subject name is present in all PKCs issued by the RCA and conforms to Section 3.1.3.

3.1.2 Need for Names to be Meaningful
The CN component of a Subject name in a PKC issued by the RCA identifies the subordinate CA and represents the certificate services it provides.

3.1.3 Rules for Interpreting Various Name Forms
The Subject names of a PKC must be in the following format for certificates issued by the VT Self Signed Root CA:
CN = < name of subordinate CA as determined by the PMA >,
O = Virginia Polytechnic Institute and State University, C = US,
DC = vt,
DC = edu
Subject names for certificates issued by the VT Global Root CA must follow naming convention formats specified by the root key signing vendor, GlobalSign as follows:
CN = < name of subordinate CA as determined by the PMA >,
OU=Global < Server | User | SoftPDC > CA,
O=Virginia Tech,
C=US

3.1.4 Uniqueness of Names
The CN component of a Subject name in a PKC refers to a unique and identifiable subordinate CA. Including the serial number that is assigned by the CA ensures the uniqueness of the Subject name. A unique Subject name is not reused.

3.1.5 Name Claim Dispute Resolution Procedure
No additional stipulations.

3.1.6 Recognition, Authentication and Role of Trademarks
No additional stipulations.

3.1.7 Method to Prove Possession of Private Key
The subordinate CA CSR provides proof of the corresponding private key possession.

3.1.8 Authentication of Organization Identity
No additional stipulations.

3.1.9 Authentication of Individual Identity
The identity of the subordinate CA is authenticated by the PMA.

3.1.10 Authentication of Component Identities
No additional stipulations.

3.2 CERTIFICATE RENEWAL, UPDATE, AND ROUTINE REKEY

3.2.1 Certificate Rekey
PKCs issued by the RCA are rekeyed ten years after issuance. Rekeying a PKC means that a new PKC is created that has the same characteristics as the old one, except that the new PKC has a new, different public key (corresponding to a new, different private key), and a different serial number.

3.2.2 Certificate Renewal
PKCs issued by the RCA are not renewed.

3.2.3 Certificate Update
PKCs issued by the RCA are not updated.

3.3 OBTAINING A NEW CERTIFICATE AFTER REVOCATION
No additional stipulations.

3.4 REVOCATION REQUEST
The RCA revokes certificates upon PMA approval or request.

4. OPERATIONAL REQUIREMENTS

4.1 APPLICATION FOR A CERTIFICATE

4.1.1 Delivery of Public Key for Certificate Issuance
A PEM encoded the CSR containing the public key of a subordinate CA is submitted using external storage media to the RCA for approval and issuance.

4.2 CERTIFICATE ISSUANCE

4.2.1 Delivery of Subscriber's Private Key to Subscriber
The RCA does not deliver private keys to the subordinate CAs, hence keys are generated onboard a FIPS 140-2 Level 3 hardware security module.

4.3 CERTIFICATE ACCEPTANCE
Upon issuance of the PKC by the RCA, the certificate is exported using removable external storage media.

4.4 CERTIFICATE SUSPENSION AND REVOCATION
The RCA revokes PKCs at the request and approval of the PMA. The RCA does not suspend PKCs that it issues.

4.4.1 Circumstances for Revocation of a Certificate
No additional stipulations.

4.4.2 Who Can Request Revocation of a Certificate
No additional stipulations.

4.4.3 Procedure for Revocation Request
No additional stipulations.

4.4.4 Revocation Request Grace Period
No additional stipulations.

4.4.5 Suspension
No additional stipulations.

4.4.6 Who Can Request Suspension
The RCA does not suspend PKCs that it issues.

4.4.7 Procedure for Suspension Request
The RCA does not suspend PKCs that it issues.

4.4.8 Limits on Suspension Period
The RCA does not suspend PKCs that it issues.

4.4.9 Certificate Authority Revocation Lists / Certificate Revocation Lists
The RCA does issue Certificate Authority Revocations Lists (CARL).

4.4.9.1 CARL/CRL Issuance Frequency
CARLs are issued as needed.

4.4.10 CARL/CRL Checking Requirements
CARLs are published as part of the issuance procedure to the www.pki.vt.edu website.

4.4.11 Online Revocation / Status Checking Availability
No additional stipulations.

4.4.12 Online Revocation Checking Requirements
No additional stipulations.

4.4.13 Other Forms of Revocation Advertisements Available
No additional stipulations.

4.4.14 Checking Requirements for Other Forms of Revocation Advertisements
No additional stipulations.

4.4.15 Special Requirements Related to Key Compromise
No additional stipulations.

4.5 SECURITY AUDIT PROCEDURE

4.5.1 Types of Events Recorded
Logfiles are created either electronically or manually and include, but are not restricted to, the following events:

- system logfiles
  - o Startup/shutdown of system
  - o Changes to user accounts
  - o Backup and log information
  - o Tasks performed by users with trusted roles
- CA logfiles
  - o Certification requests
  - o Issued certificates
  - o Issued CRLs

The RCA database is configured to log connections made to the database, queries, query results, and errors. The database logs contain date and time of the database event.

4.5.2 Frequency of Processing Data
The audit log is consolidated and reviewed upon request of the auditors.

4.5.3 Retention Period for Security Audit Data
The RCA retains audit logs of a minimum period consistent with policies established by the university.

4.5.4 Protection of Security Audit Data
Access to audit logs is controlled by IMS, and access is restricted to authorized employees only.

4.5.5 Security Audit Data Backup Procedures
The audit log is backed up on the same schedule as the rest of the data on VTCA servers using VT Storage Management Team of the Systems Support Department network backup service providing:

- **Scheduled daily backup of server files and directories**
- **Offsite storage in compliance with computing standards**
- **Restoration of files as needed**

4.5.6 Security Audit Collection System (Internal vs. External)
The audit trail collection system is internal to the RCA and operating system software. Both onsite and offsite secure storage facilities are used to maintain the audit trail logs.

4.5.7 Notification to Event Causing Subject
No additional stipulations.

4.5.8 Vulnerability Assessments
The audit logs will be inspected upon request of the auditors.

4.6 RECORDS ARCHIVAL

4.6.1 Types of Events Archived
No additional stipulations.

4.6.2 Retention Period for Archive
No additional stipulations.

4.6.3 Protection of Archive
Archived records are protected against unauthorized viewing, modification, and deletion by using offsite storage in a physically secure and trustworthy location. The offsite backup location provides the following key features:

- **Storage in a secure, fire resistant Vault Room**.
- **A stable, secure storage environment:** The room is maintained at a constant 70 degrees and 35% - 55% humidity. It's secured with intrusion alarms and motion detectors.
- **Controlled access:** The interior door to the building remains locked at all times. After admittance to the building, access to the Vault Room can only be obtained with the use of a valid VT ID card entered into the cipher lock.
- **Enhanced fire protection:** Constructed with a concrete floor, and walls, the Vault Room is rated to withstand as a minimum three hours of fire. Additionally the entire building has an automated fire suppression system and a fire alarm wired into the campus police office.

4.6.4 Archive Backup Procedures
No additional stipulations.

4.6.5 Requirements for Time Stamping of Records
System Time is monitored on a regular basis.

4.6.6 Archive Collection System (Internal or External)
No additional stipulations.

4.6.7 Procedures to Obtain and Verify Archive Information
The office that provides maintenance and support for the Certification Authority application is responsible for restoration of files from backup archives as needed.

4.7 KEY CHANGEOVER
No additional stipulations.

4.8 COMPROMISE AND DISASTER RECOVERY

4.8.1 Computing Resources, Software, and/or Data Are Corrupted

4.8.1.1 Compromise Recovery
No additional stipulations.

4.8.1.2 Disaster Recovery
No additional stipulations.

4.8.2 CA Signature Keys Are Revoked
No additional stipulations.

4.8.3 CA Signature Keys Are Compromised
No additional stipulations.

4.8.4 Secure Facility Impaired after a Disaster
The RCA disaster recovery plan is provided by the Office of the Vice President for Information Technology.

4.9 CA TERMINATION
No additional stipulations.

5. PHYSICAL, PROCEDURAL AND PERSONNEL SECURITY CONTROLS

5.1 PHYSICAL CONTROLS FOR THE VTCA OR AUTHORIZED CA

5.1.1 Site Location and Construction

The RCA operations center is located in room 118 of the Andrews Information Systems Building. The RCA operations center has been designed to provide a physically protected environment that deters, detects, and prevents unauthorized use of, access to, and disclosure of sensitive information and systems. Access to the building and to the operations center is protected by procedural as well as technical control measures. The facility is further protected using biometric access devices and camera monitoring systems.

5.1.2 Electrical Power
The RCA operations center operates its own backup generator to provide a fail safe power supply in the event of power failure.

5.1.3 Water Exposures
No additional stipulations.

5.1.4 Fire Prevention and Protection
A fire prevention, detection and suppression system is installed to meet security and safety measure at the RCA facility.

5.1.5 Media Storage
The backup media of the RCA are stored in an offsite physically secure and trustworthy location.

5.1.6 Waste Disposal
Records containing sensitive information are destroyed in a manner to prevent the unauthorized access to the information. Paper shredders are available throughout the facility.

5.1.7 Offsite Backup
In the event of a system failure there are sufficient backups that can be used to restore the RCA system. Full monthly, weekly differential, and daily incremental backups are created during normal daily scheduled backups by the Information Systems and Computing network backup service. The backup media of the RCA are stored in an offsite physically secure and trustworthy location.

5.2 PROCEDURAL CONTROLS FOR THE VTCA

5.2.1 Trusted Roles
No additional stipulation.

5.2.1.1 Certification Authority Administrator
The Certification Authority Administrator (CAA) role is appointed by the Office of the Vice President for Information Technology. Primarily, a CAA's responsibilities are:

- Certificate profile, certificate template, and audit parameter configuration
- Develop VTCA key generation and backup procedures

- Assignment of VTCA security privileges and access controls of users
- Install and configure new CA software releases
- Startup/Shutdown of the VTCA

5.2.1.2 Registration Authority Administrator (RAA)

The Registration Authority Administrator (RAA) role is constituted by the PMA. The PMA accepts requests to implement a subordinate CA and is responsible for reviewing the request and insuring a CPS has been written and approved.

5.2.1.3 Other Trusted Roles

No additional stipulations.

5.2.2 Number of Persons Required Per Task

No additional stipulations.

5.2.3 Identification and Authentication for Each Role

Identification and authentication for RCA personnel follow requirements identified in sections 5.3, 5.3.1, and 5.3.2. The items in these sections are performed before RCA personnel are:

- Authorized for access to the RCA site
- Authorized for physical access to the RCA system
- Given a certificate and account on the RCA system for the performance of their role

Each of these certificates and accounts (with the exception of RCA signing certificates) are:

- Directly attributable to an individual
- NOT shared
- Restricted to actions authorized for that role through the use of the RCAs
- Software, operating system, and procedural controls

RCA operations are secured, using mechanisms such as token based strong authentication and encryption, when accessed across a shared network.

5.3 PERSONNEL CONTROLS

Personnel performing duties with respect to the operation of the RCA are:

- Known and appointed by the Vice President for Information Technology
- Trained with respect to the duties they are to perform

• NOT assigned duties that may cause a conflict of interest with their RCA duties.

5.3.1 Background, Qualifications, Experience, and Security Clearance Requirements
All persons filling trusted roles are selected on the basis of loyalty, trustworthiness, and integrity.

5.3.2 Background Check Procedures
All persons filling trusted roles as described in Sections 5.2.1, 5.2.1.1, 5.2.1.2 and 5.2.1.3 of this CPS are required to have a background check. Such checks are to be performed solely to determine the suitability of a person to fill a RCA role and are not released except as required by law.

The Department of Human Resources will perform background check procedures for these employees. Using social security verification, criminal history checks will be made in all localities where the search indicates the employee has resided. For resident aliens, a criminal history check will be made with the country of origin.

Factors revealed in a background check that may be considered grounds for rejecting candidates for trusted positions or for taking action against existing trusted persons generally include:

- Misrepresentations made by the candidate or trusted person
- Highly unfavorable or unreliable professional references
- Certain criminal convictions

5.3.3 Training Requirements
No additional stipulation.

5.3.4 Retraining Frequency and Requirements
No additional stipulation.

5.3.5 Job Rotation Frequency and Sequence
No additional stipulation.

5.3.6 Sanctions for Unauthorized Actions
The PMA initiates appropriate administrative and disciplinary actions against personnel who have performed unauthorized actions involving the RCA or its Repository.

5.3.7 Contracting Personnel Requirements
No additional stipulations.

5.3.8 Documentation Supplied to Personnel
No additional stipulations.

6. TECHNICAL SECURITY CONTROLS

6.1 KEY PAIR GENERATION AND INSTALLATION

6.1.1 Key Pair Generation by the Subscriber
During a key generation ceremony, the RSA cryptographic keys are generated onboard a FIPS 140-2 Level 3 hardware security module. A hardware based random number generator is used to generate the RSA keys.

6.1.2 Private Key Delivery to Subscriber
The private key is generated onboard a hardware security module and therefore does not need to be delivered.

6.1.3 Public Key Delivery to Certificate Issuer
The Public Key is encrypted in a CSR and delivered to the RCA using removable storage media.

6.1.4 VTCA Public Key Availability
No additional stipulations.

6.1.5 Key Sizes
Key sizes have a minimum of 4096 bits.

6.1.6 Public Key Parameters Generation
No additional stipulations.

6.1.7 Parameter Quality Checking
No additional stipulations.

6.1.8 Hardware/Software Subscriber Key Pair Generation
No additional stipulations.

6.1.9 Key Usage Purposes (as per X.509 v3)
No additional stipulations.

6.2 PRIVATE KEY PROTECTION

6.2.1 Standards for Cryptographic Module
The RCA follows the FIPS 140-2 Level 3 specification.

6.2.2 CA Private Key Multi Person Control
Multi person control is implemented using an M of N authentication scheme. It also requires additional authentication from a separate person.

6.2.3 Key Escrow of CA Private Signature Key

The RCA does not escrow private keys.

6.2.3.1 Escrow of End Entity Decryption Keys
The RCA does not escrow decryption keys.

6.2.4 Private Key Backup
No additional stipulations.

6.2.4.1 Backup of CA Private Signature Key
No additional stipulations.

6.2.4.2 Backup of End Entity Private Signature Key
The RCA does not backup subordinate CA private signature keys.

6.2.5 Private Key Archival
The RCA does not archive subordinate CA private keys.

6.2.6 Private Key Entry into Cryptographic Module
No additional stipulations.

6.2.7 Method of Activating Private Keys
No additional stipulations.

6.2.8 Methods of Deactivating Private Keys
No additional stipulations.

6.2.9 Method of Destroying Subscriber Private Signature Keys
No additional stipulations.

6.3 OTHER ASPECTS OF KEY PAIR MANAGEMENT

6.3.1 Public Key Archival
No additional stipulations.

6.3.2 Usage Periods for the Public and Private Keys
No additional stipulations.

6.4 ACTIVATION DATA

6.4.1 Activation Data Generation and Installation
No additional stipulations.

6.4.2 Activation Data Protection
The RCA uses a hardware security module (HSM) that is certified as FIPS 140-2 level 3. The

HSM implements strong multifactor M of N authentication. This requires the RCA CAAs to use M of N key tokens in addition to another token that is PIN protected in order to access the private area of the HSM which contains the RCA public/private key pair.

6.4.3 Other Aspects of Activation Data
No additional stipulations.

6.5 COMPUTER SECURITY CONTROLS

6.5.1 Specific Computer Security Technical Requirements
No additional stipulations.

6.5.2 Computer Security Rating
No additional stipulations.

6.6 LIFE CYCLE TECHNICAL CONTROLS

6.6.1 System Development Controls
No additional stipulations.

6.6.2 Security Management Controls
No additional stipulations.

6.6.3 Life Cycle Security Ratings
No additional stipulations.

6.7 NETWORK SECURITY CONTROLS
No additional stipulations.

6.8 CRYPTOGRAPHIC MODULE ENGINEERING CONTROLS
No additional stipulations.

7. CERTIFICATE AND CARL/CRL PROFILES

7.1 CERTIFICATE PROFILE
The certificate profiles for the RCA and the subordinate CA certificates issued by the RCA are published at http://www.pki.vt.edu/rootca/cps/.

7.1.1 The profiles for the CA certificates issued by the VT Root CA
No additional stipulations.

7.1.2 Certificate Extensions
Standard extensions, when populated, are described in an appropriate Certificate Profile. PKCs issued by the RCA have the following values in their *Key Usage* field:

- KeyCertSign

• CRLSign

7.1.3 Algorithm Object Identifiers
No additional stipulations.

7.1.4 Name Forms
No additional stipulations.

7.1.5 Name Constraints
No additional stipulations.

7.1.6 Certificate Policy Object Identifier
No additional stipulations.

7.1.7 Usage of Policy Constraints extension
No additional stipulations.

7.1.8 Policy Qualifiers Syntax and Semantics
No additional stipulations.

7.1.9 Processing Semantics for the Critical Certificate Policy Extension
No additional stipulations.

7.1.10 Certificate Serial Numbers
No additional stipulations.

7.2 CARL/CRL PROFILE

7.2.1 Version Numbers
The RCA will issue CARLs or CRLs.

7.2.2 CARL and CRL Entry Extensions
No additional stipulations.

7.2.3 OCSP Services
No additional stipulations.

8. SPECIFICATION ADMINISTRATION

8.1 SPECIFICATION CHANGE PROCEDURES
No additional stipulation.

8.2 PUBLICATION AND NOTIFICATION POLICIES
The RCA will notify its subscribers of any changes to the certificate policy via the VT Root Announce List.

8.2.1 Amendments Generally
The PMA and the sponsor of the RCA may jointly amend this CPS prospectively but not retroactively.

8.2.2 Urgent Amendments Exception
An amendment that is deemed "urgent" becomes effective immediately. "Urgent" will be designated if, in the sole discretion of the PMA, failure to make the amendment may result in a compromise of the RCA or services dependent on it.

8.2.3 Assent to Amendments
No additional stipulations.

8.2.4 Maintenance of Prior Versions
No additional stipulations.

8.3 CPS APPROVAL PROCEDURES
No additional stipulation.

8.4 WAIVERS
No additional stipulations.

9. BIBLIOGRAPHY

The following documents SHALL be used as guidance in interpretation of this CP to the extent that information in these documents is not inconsistent with this CP:

ABADSG	Digital Signature Guidelines, 1996-08-01. http://www.abanet.org/scitech/ec/isc/dsgfree.html.
FIPS 112	Password Usage, 1985-05-30 http://www.itl.nist.gov/fipspubs/fip112.htm
FIPS 140-1	Security Requirements for Cryptographic Modules, 1994-01-11 http://csrc.nist.gov/publications/fips/fips1401.pdf
FIPS 180-1	Secure Hash Standard, 1995-04-17 http://csrc.nist.gov/publications/fips/fips180-1/fip180-1.pdf
FIPS 186-2	Digital Signature Standard, 2001-01-27
FOIACT	5 U.S.C. 552, Freedom of Information Act. http://www4.law.cornell.edu/uscode/5/552.html
	Federal Certificate Profile DRAFT, April 2000 http://csrc.nist.gov/pki/documents/FPKI_Certificate_Profile_20000418.xls
ISO9594-8	Information Technology-Open Systems Interconnection-The Directory: Authentication Framework, 1997.
ITMRA	40 U.S.C. 1452, Information Technology Management Reform Act of 1996. http://www4.law.cornell.edu/uscode/40/1452.html
NAG69C	Information System Security Policy and Certification Practice Statement for Certification Authorities, rev C, November 1999.
NSD42	National Policy for the Security of National Security Telecom and Information Systems, 5 Jul 1990. http://www.cpsr.org/cpsr/privacy/computer_security/nsd_42.txt (redacted version)
NS4005	NSTISSI 4005, Safeguarding COMSEC Facilities and Material, August 1997.
NS4009	NSTISSI 4009, National Information Systems Security Glossary, January 1999.

PKCS — Public Key Cryptography Standards
http://www.rsasecurity.com/rsalabs/pkcs/index.html

PKCS-12 — Personal Information Exchange Syntax Standard, April 1997.
http://www.rsasecurity.com/rsalabs/pkcs/pkcs-12/

RFC 2510 — Certificate Management Protocol, Adams and Farrell, March 1999.

RFC 2527 — Certificate Policy and Certificate Practices Framework, Chokhani and Ford, March 1999

RFC 3280 — INTERNET X.509 PUBLIC KEY INFRASTRUCTURE CERTIFICATE AND CERTIFICATE REVOCATION LIST (CRL) PROFILE ,R. HOUSLEY, W. POLK, W. FORD, D. SOLO.

Planning for PKI, Russ Housley, Tim Polk, Willey, John Wiley & Sons; 1 edition (March 13, 2001), ISBN: 0471397024

Security Requirements for Certificate Issuing and Management Components, 3 November 1999, Draft

"Secure Electronic Commerce: Building the Infrastructure for Digital Signatures and Encryption", Warwick Ford and Michael S. Baum, Prentice Hall, April 1997, ISBN: 0134763424

United States Department of Defense X.509 Certificate Policy, Version 5.0, 13 December 1999

10. GLOSSARY

Activation Data	Private data, other than keys, that are required to access cryptographic modules (i.e., unlock private keys for signing or decryption events).
Applicant	The subscriber is sometimes also called an "applicant" after applying to a certification authority for a certificate, but before the certificate issuance procedure is completed. [ABADSG footnote 32]
Arc	An arc is an individual sub tree of an Object Identifier (OID) tree.
Archive	Long term, physically separate storage.
Audit	Independent review and examination of records and activities to assess the adequacy of system controls, to ensure compliance with established policies and operational procedures, and to recommend necessary changes in controls, policies, or procedures. [NS4009]
Audit Data	Chronological record of system activities to enable the reconstruction and examination of the sequence of events and changes in an event. [NS4009, "audit trail"]
Authenticate	To confirm the identity of an entity when that identity is presented.
Authentication	Security measure designed to establish the validity of a transmission, message, or originator, or a means of verifying an individual's authorization to receive specific categories of information. [NS4009]
Authority certificate	A PKC that contains the distinguished name of the CA in the Subject Name field and contains the value TRUE in the Basic Constraints CA field and in which the KeyUsage keyCertSign bit is set. The cRLSign bit should be set also.

Authorized CA	A CA for which another CA signs an authority certificate in accordance with this CP.
Backup	Copy of files and programs made to facilitate recovery if necessary. [NS4009]
Binding	Process of associating two related elements of information. [NS4009]
Certificate	A digital representation of information which at least (1) identifies the certification authority issuing it, (2) names or identifies its Subscriber, (3) contains the Subscriber's public key, (4) identifies its operational period, and (5) is digitally signed by the certification authority issuing it. [ABADSG] As used in this CP, the term "Certificate" refers to certificates that expressly reference the OID of this CP in the "Certificate Practices Statement" (CPS) referenced in the CPSuri field of an X.509 v.3 certificate
Certificate Policy (CP)	A Certificate Policy is a specialized form of administrative policy tuned to electronic transactions performed during certificate management. A Certificate Policy addresses all aspects associated with the generation, production, distribution, accounting, compromise recovery and administration of digital certificates. Indirectly, a certificate policy can also govern the transactions conducted using a communications system protected by a certificate based security system. By controlling critical certificate extensions, such policies and associated enforcement technology can support provision of the security services required by particular applications.
Certificate Revocation List (CRL)	A list maintained by a Certification Authority of the certificates it has issued which have been revoked prior to their stated expiration date.
Certificate Status Authority	A trusted entity that provides online verification to a Relying Party of a subject certificate's trustworthiness, and may also provide additional attribute information for the subject certificate.
Certificate Related Information	Information, such as a subscriber's postal address, that is not included in a certificate. May be used by a CA managing certificates.

Certification Authority (CA)	An authority trusted by one or more users to issue and manage X.509 Public Key Certificates and CARLs or CRLs. The term "CA" as used in this CP includes Authorizing and Authorized CAs that operate under this CP.
Certification Authority Revocation List (CARL)	A signed, time stamped list of serial numbers of CA public key certificates, including cross certificates that have been revoked.
Certification Practice Statement (CPS)	A statement of the practices that a CA employs in issuing, suspending, revoking and renewing certificates and providing access to them, in accordance with specific requirements (i.e., requirements specified in this CP, or requirements specified in a contract for services).
Client (application)	A system entity, usually a computer process acting on behalf of a human user that makes use of a service provided by a server.
Community	The community or group of individuals or other entities for which the CA will issue a PKC.
Compromise	Disclosure of information to unauthorized persons, or a violation of the security policy of a system in which unauthorized intentional or unintentional disclosure, modification, destruction, or loss of an object may have occurred. [NS4009]
Confidentiality	Assurance that information is not disclosed to unauthorized entities or processes. [NS4009]
CPSuri	A PKC standard extension that provides a URI pointing to an online copy of the CA's CPS.
Cross Certificate	A PKC used to establish a trust relationship between two CAs.
Cryptographic Module	The set of hardware, software, firmware, or some combination thereof that implements cryptographic logic or processes, including cryptographic algorithms, and is contained within the cryptographic boundary of the module. [FIPS1401]
Cryptoperiod	Time span during which each key setting remains in effect. [NS4009]

Data Integrity	Assurance that the data are unchanged from creation to reception.
Digital Signature	The result of a transformation of a message by means of a cryptographic system using keys such that a Relying Party can determine: (1) whether the transformation was created using the private key that corresponds to the public key in the signer's digital certificate; and (2) whether the message has been altered since the transformation was made.
Dual Use Certificate	A certificate that is intended for use with both digital signature and data encryption services.
Encryption Certificate	A certificate containing a public key that is used to encrypt electronic messages, files, documents, or data transmissions, or to establish or exchange a session key for these same purposes.
End Entity	Relying Parties and Subscribers.
Firewall	Gateway that limits access between networks in accordance with local security policy. [NS4009]
Integrity	Protection against unauthorized modification or destruction of information. [NS4009]. A state in which information has remained unaltered from the point it was produced by a source, during transmission, storage, and eventual receipt by the destination.
Intellectual Property	Useful artistic, technical, and/or industrial information, knowledge or ideas that convey ownership and control of tangible or virtual usage and/or representation.
Intermediate CA	A CA that is subordinate to another CA, and has a CA subordinate to itself.
Issuer	The issuer is the entity who has signed and issued the certificate.
Key Escrow	A deposit of the private key of a subscriber and other pertinent information pursuant to an escrow agreement or similar contract binding upon the subscriber, the terms of which require one or more agents to hold the subscriber's private key for the benefit of the subscriber, an employer, or other party, upon provisions set forth in the agreement. [adapted from ABADSG, "Commercial key escrow service"]

Key Exchange	The process of exchanging public keys in order to establish secure communications.
Key Generation Material	Random numbers, pseudo random numbers, and cryptographic parameters used in generating cryptographic keys.
Key Pair	Two mathematically related keys having the properties that (1) one key can be used to encrypt a message that can only be decrypted using the other key, and (ii) even knowing one key, it is computationally infeasible to discover the other key.
LOA	Level of Assurance. Certificates are differentiated by the level of assurance they provide regarding the identity of the subject entry named in the certificate. The assurance level depends on how a subject's identity is verified during the certification request process.
Naming Authority	An organizational entity responsible for assigning distinguished names (DNs) and for assuring that each DN is meaningful and unique within its domain.
Non Repudiation	Assurance that the sender is provided with proof of delivery and that the recipient is provided with proof of the sender's identity so that neither can later deny having processed the data. [NS4009] Technical non repudiation refers to the assurance a Relying Party has that if a public key is used to validate a digital signature, that signature had to have been made by the corresponding private signature key. Legal non repudiation refers to how well possession or control of the private signature key can be established.
Object Identifier (OID)	A unique specially formatted number that is composed of a most significant part assigned by an internationally recognized standards organization to a specific owner and a least significant part assigned by the owner of the most significant part. For example, the unique alphanumeric/numeric identifier registered under the ISO registration standard to reference a specific object or object class. In the Higher Education PKI they are used to uniquely identify policies and cryptographic algorithms and possibly other elements contained in a PKC.
Out of Band	Communication between parties utilizing a means or method that

	differs from the current method of communication (e.g., one party uses U.S. Postal Service mail to communicate with another party where current communication is occurring online).
Outside Threat	An unauthorized entity from outside the domain perimeter that has the potential to harm an Information System through destruction, disclosure, modification of data, and/or denial of service.
PKC	Public Key Certificate. As used in this CP, refers to an object conforming to X.509v3 or higher.
PKI Sponsor	Fills the role of a Subscriber for non human system components that are named as public key certificate subjects, and is responsible for meeting the obligations of Subscribers as defined throughout this CP.
Policy Management Authority (PMA)	Body established to oversee the creation and update of Certificate Policies, review Certification Practice Statements, review the results of CA audits for policy compliance, evaluate non domain policies for acceptance within the domain, and generally oversee and manage the PKI certificate policies.
Private Key	(1) The key of a signature key pair used to create a digital signature. (2) The key of an encryption key pair that is used to decrypt confidential information. In both cases, this key MUST be kept secret.
Public Key	(1) The key of a signature key pair used to validate a digital signature. (2) The key of an encryption key pair that is used to encrypt confidential information. In both cases, this key is made publicly available normally in the form of a digital certificate.
Public Key Infrastructure (PKI)	A set of policies, processes, server platforms, software and workstations used for the purpose of administering certificates and public private key pairs, including the ability to issue, maintain, and revoke public key certificates.
Registration Authority	An entity that is responsible for identification and authentication of

(RA)	certificate subjects, but that does not sign or issue certificates (i.e., a Registration Authority is delegated certain tasks on behalf of an authorized CA).
Rekey (a certificate)	To change the value of a cryptographic key that is being used in a cryptographic system application; this normally entails issuing a new certificate on the new public key.
Relying Party	A individual who has received information that includes a PKC and a digital signature verifiable with reference to a public key listed in the PKC, and is in a position to rely on that information.
Renew (a certificate)	The act or process of extending the validity of the data binding asserted by a public key certificate by issuing a new certificate.
Repository	A database containing information and data relating to certificates as specified in this CP; may also be referred to as a directory.
Responsible Individual	A trustworthy person designated by a sponsoring organization to authenticate individual applicants seeking certificates on the basis of their affiliation with the sponsor.
Revoke a Certificate	To prematurely end the operational period of a certificate effective at a specific date and time.
Risk	An expectation of loss expressed as the probability that a particular threat will exploit a particular vulnerability with a particular harmful result.
Risk Tolerance	The level of risk an entity is willing to assume in order to achieve a potential desired result.
Root CA	In a hierarchical PKI, the CA whose public key serves as the most trusted datum (i.e., the beginning of trust paths) for a security domain.
Server	A system entity that provides a service in response to requests from clients.
Signature Certificate	A public key certificate that contains a public key intended for verifying digital signatures rather than encrypting data or performing any other cryptographic functions.

Subject	The subject is the entity associated with the public key stored in the subject public key field of the certificate.
Subordinate CA	In a hierarchical PKI, a CA whose certificate signature key is certified by another CA, and whose activities are constrained by that other CA. (See superior CA).
Subscriber	A Subscriber is an individual who (1) either (a) is the Subject named or identified in a certificate issued to that individual or (b) is the owner or operator of an entity that is the Subject named or identified in a certificate issued to that individual, and (2) holds a private key that corresponds to the public key listed in the certificate.
Superior CA	In a hierarchical PKI, a CA who has certified the certificate signature key of another CA, and who constrains the activities of that CA. (See subordinate CA).
Technical non repudiation	The public key mechanisms that contribute technical evidence supporting a non repudiation security service.
Trust List	Collection of trusted certificates used by Relying Parties to authenticate other certificates.
Trusted Agent	Entity authorized to act as a representative of an Institution in confirming Subscriber identification during the registration process. Trusted Agents do not have automated interfaces with Certification Authorities.
Trusted Certificate	A certificate that is trusted by the Relying Party on the basis of secure and authenticated delivery. The public keys included in trusted certificates are used to start certification paths. Also known as a "trust anchor."
Trusted Timestamp	A digitally signed assertion by a trusted authority that a specific digital object existed at a particular time.
Trustworthy System	Computer hardware, software and procedures that: (1) are reasonably secure from intrusion and misuse; (2) provide a reasonable level of availability, reliability, and correct operation; (3) are reasonably suited to performing their intended functions; and (4) adhere to generally accepted security procedures.

Two Person Control	Continuous surveillance and control of positive control material at all times by a minimum of two authorized individuals, each capable of detecting incorrect and/or unauthorized procedures with respect to the task being performed and each familiar with established security and safety requirements. [NS4009]
Update (a certificate)	The act or process by which data items bound in an existing public key certificate, especially authorizations granted to the subject, are changed by issuing a new certificate.
URI	A Uniform Resource Identifier (URI) is a compact string of characters for identifying an abstract or physical resource. It is a superset of URLs and URNs and may include other UR types. See RFC2396.
URL	A Uniform Resource Locator (URL) refers to the subset of URI that identify resources via a representation of their primary access mechanism (e.g., their network "location"), rather than identifying the resource by name or by some other attribute(s) of that resource. See RFC1738 and RFC1808.
URN	A Uniform Resource Name (URN) refers to the subset of URI that are required to remain globally unique and persistent even when the resource ceases to exist or becomes unavailable. A URN differs from a URL in that its primary purpose is persistent labeling of a resource with an identifier. See RFC2141.
Validity Period	The period of time during which a PKC is intended to be valid as of the time of issuance. This is specified as a pair of fields labeled “not before” and “not after” containing universal time indicators.
VTCA	Virginia Tech Certification Authority refers to any one of the CAs comprising the VTPKI.
VTPKI	Virginia Tech Public Key Infrastructure refers collectively to the Self Signed Root and Global Virginia Tech Root CAs and all of the Subordinate CAs within each PKI hierarchy.
Zeroize	A method of erasing electronically stored data by altering the contents of the data storage to prevent the recovery of the data. [FIPS 140-1]

11. ACKNOWLEDGEMENTS

This Certificate Policy was derived largely from the Higher Education PKI Certificate Policy draft document developed by the Policy Activities Group (HEPKI-PAG). The HEPKI activity groups represent the cooperative efforts of CREN, EDUCAUSE/Net@EDU, and Internet2 in furtherance of PKI development for the higher education community.