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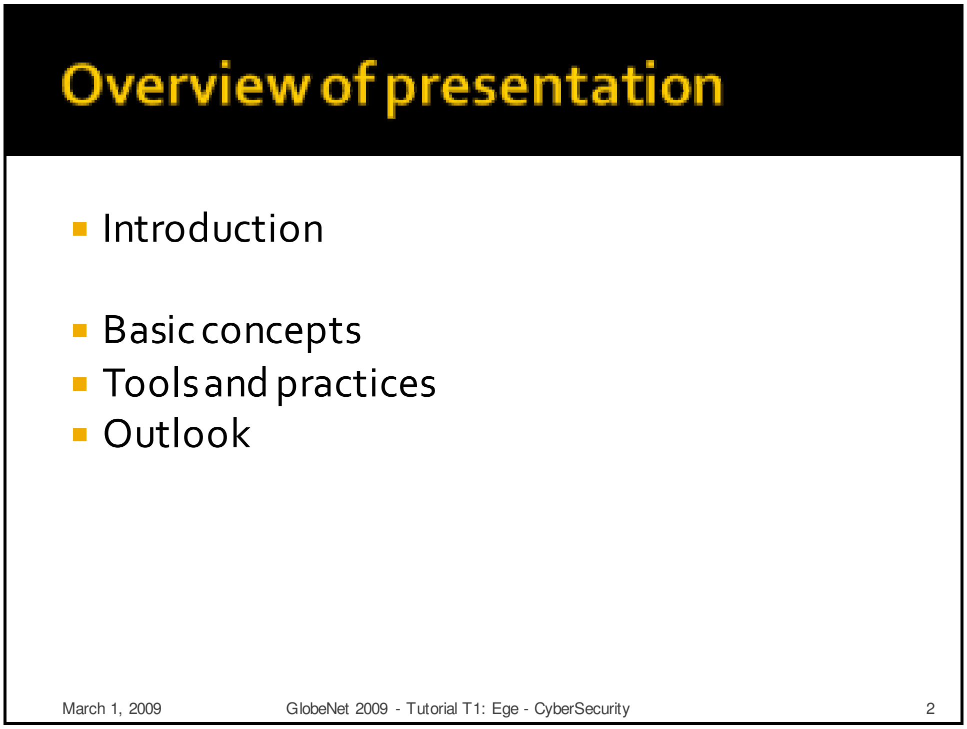
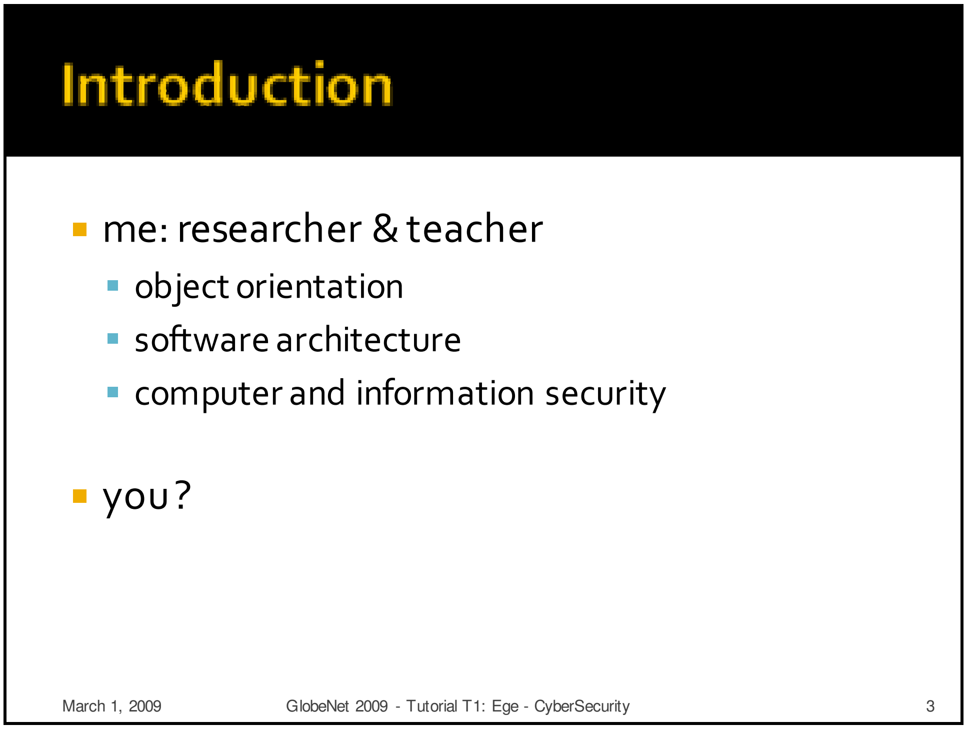
Cyber-Security: Current Practice and Future Trends



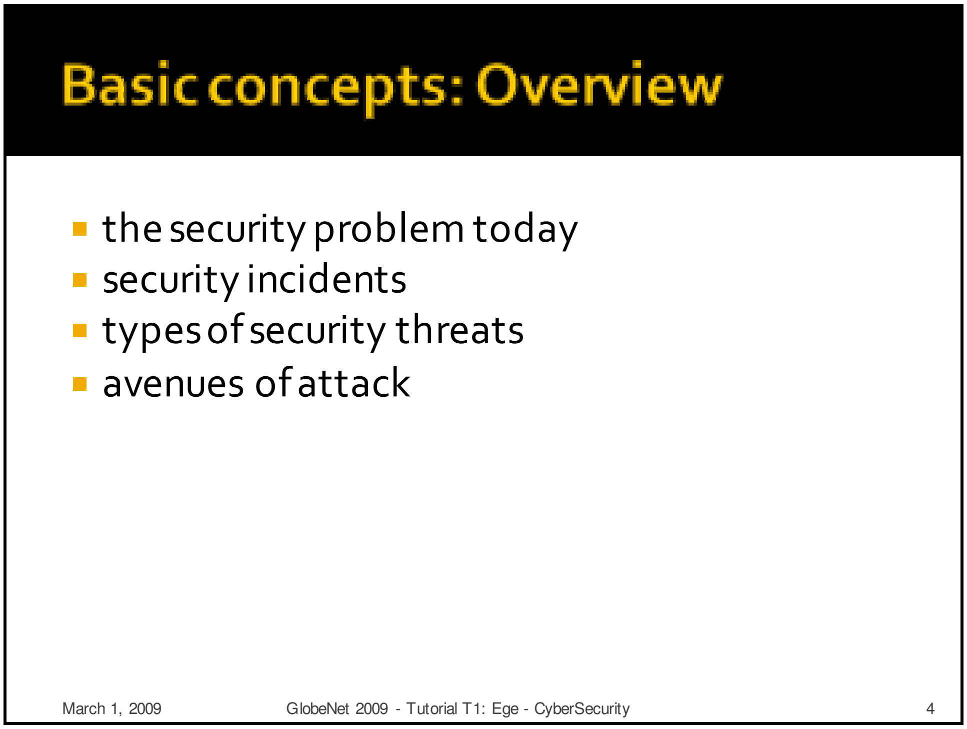
Overview of presentation

- Introduction
- Basic concepts
- Tools and practices
- Outlook



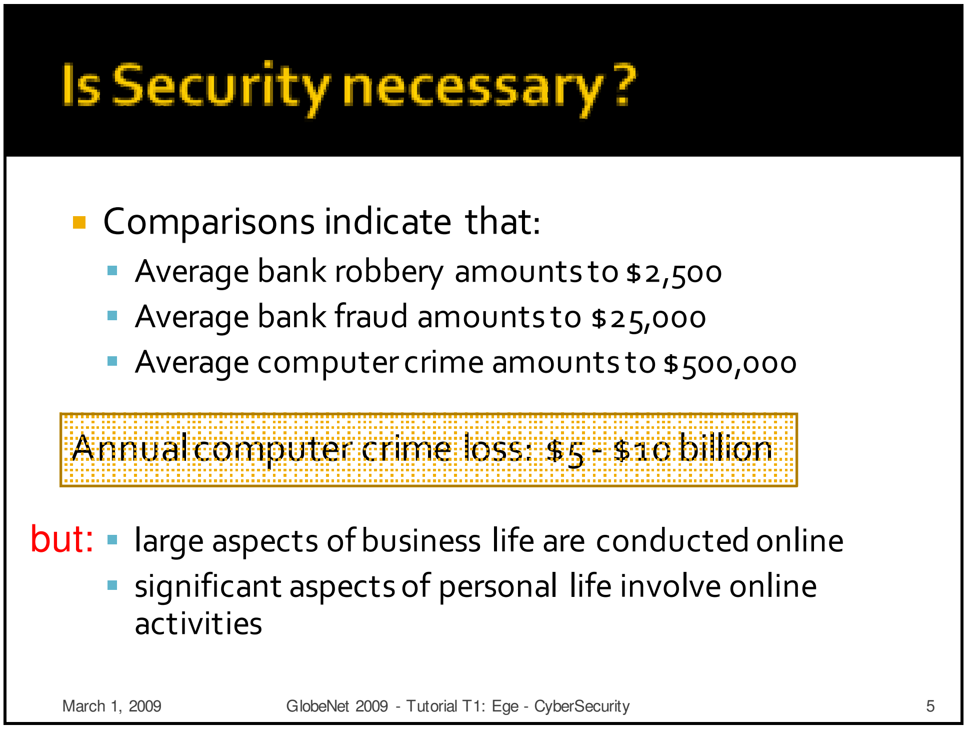
Introduction

- me: researcher & teacher
  - object orientation
  - software architecture
  - computer and information security
- you?



Basic concepts: Overview

- the security problem today
- security incidents
- types of security threats
- avenues of attack

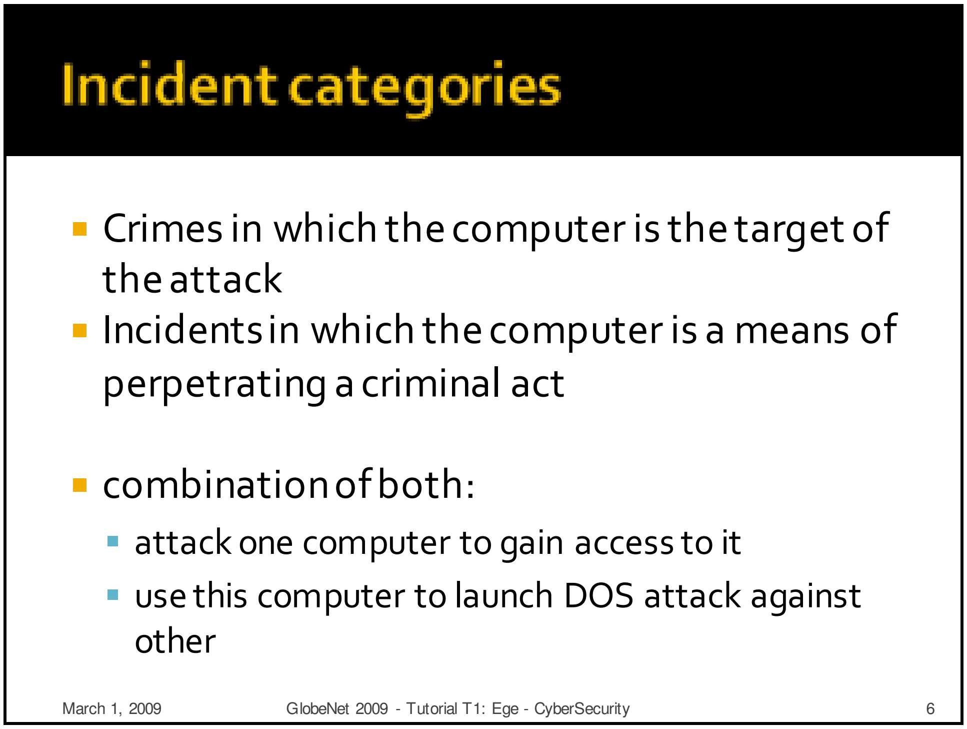


Is Security necessary?

- Comparisons indicate that:
  - Average bank robbery amounts to $2,500
  - Average bank fraud amounts to $25,000
  - Average computer crime amounts to $500,000

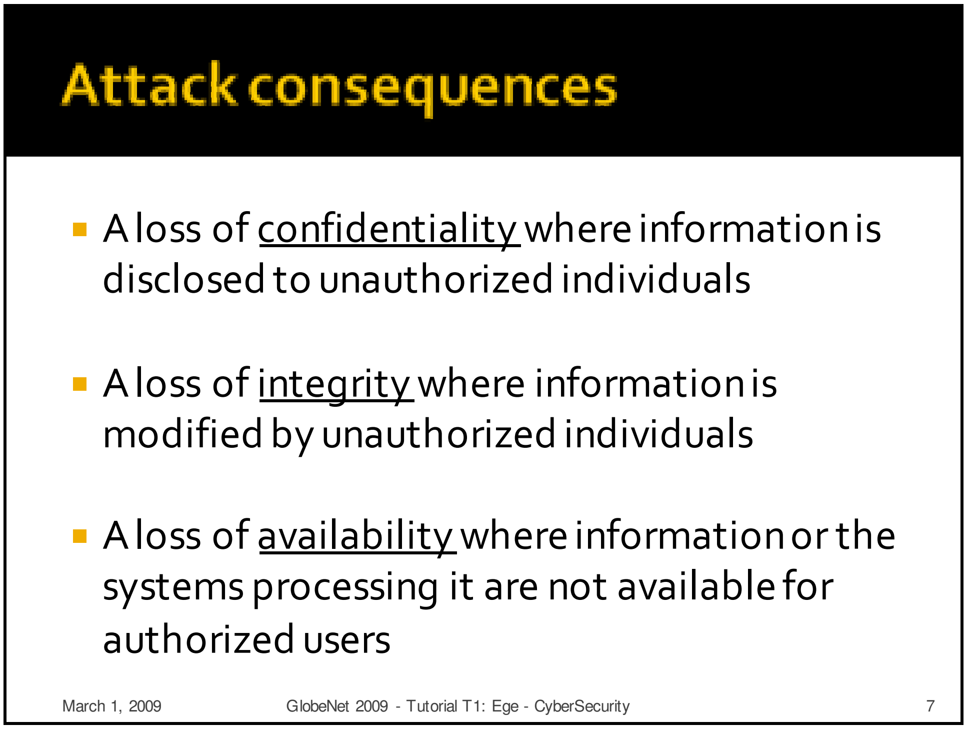
Annual computer crime loss: $5 - $10 billion

but:
- large aspects of business life are conducted online
- significant aspects of personal life involve online activities



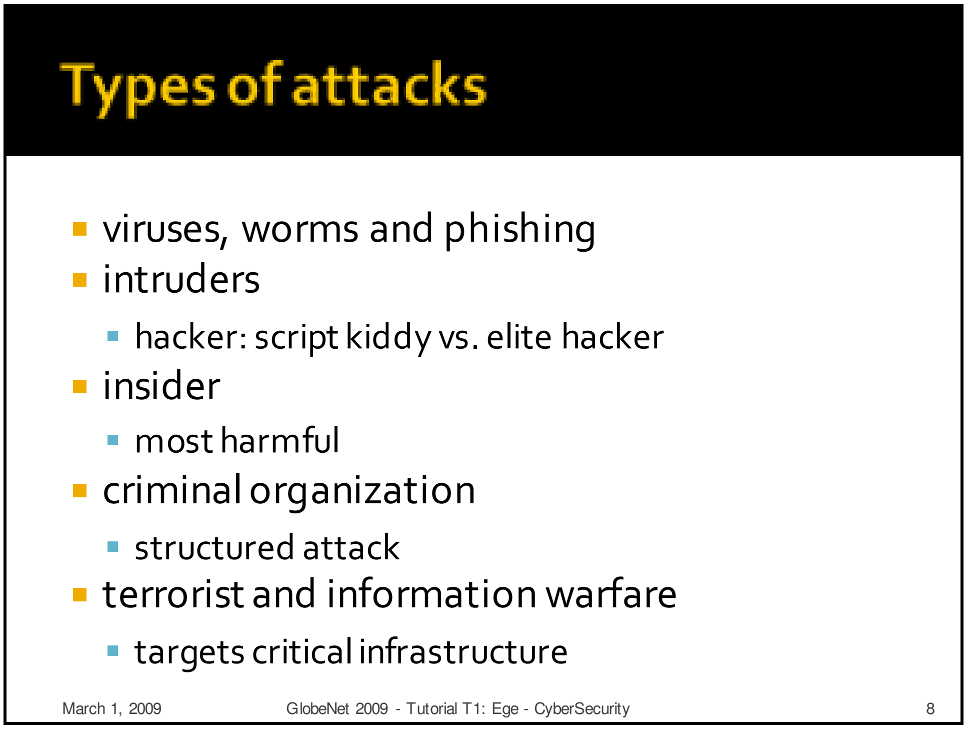
Incident categories

- Crimes in which the computer is the target of the attack
- Incidents in which the computer is a means of perpetrating a criminal act
- combination of both:
  - attack one computer to gain access to it
  - use this computer to launch DOS attack against other



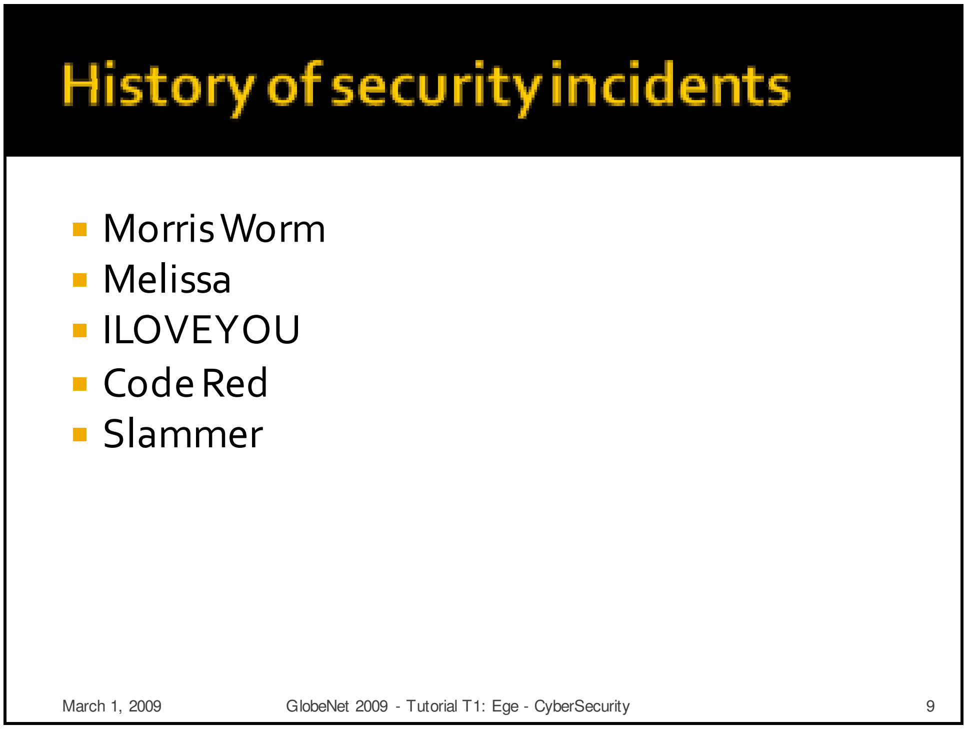
Attack consequences

- A loss of confidentiality where information is disclosed to unauthorized individuals
- A loss of integrity where information is modified by unauthorized individuals
- A loss of availability where information or the systems processing it are not available for authorized users



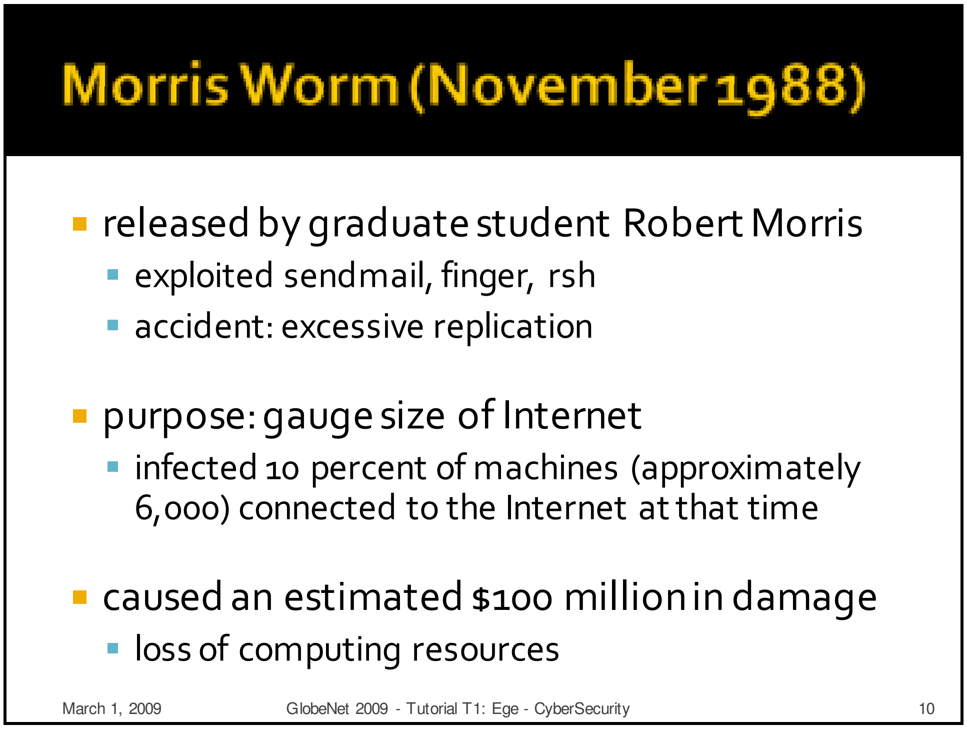
Types of attacks

- viruses, worms and phishing
- intruders
  - hacker: script kiddy vs. elite hacker
- insider
  - most harmful
- criminal organization
  - structured attack
- terrorist and information warfare
  - targets critical infrastructure



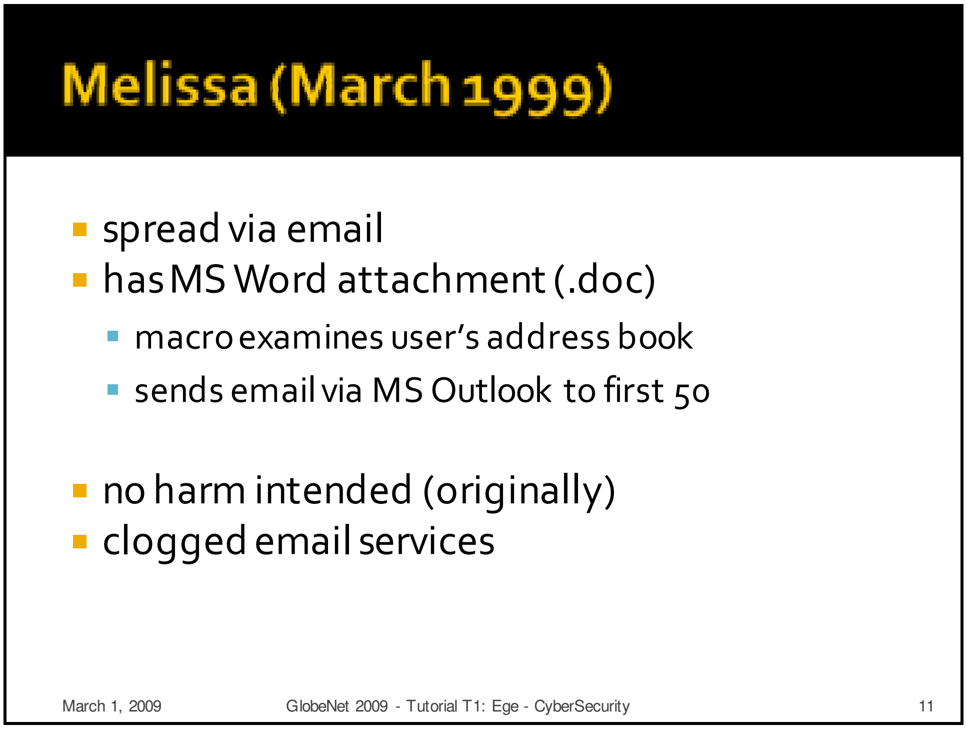
History of security incidents

- Morris Worm
- Melissa
- ILOVEYOU
- Code Red
- Slammer



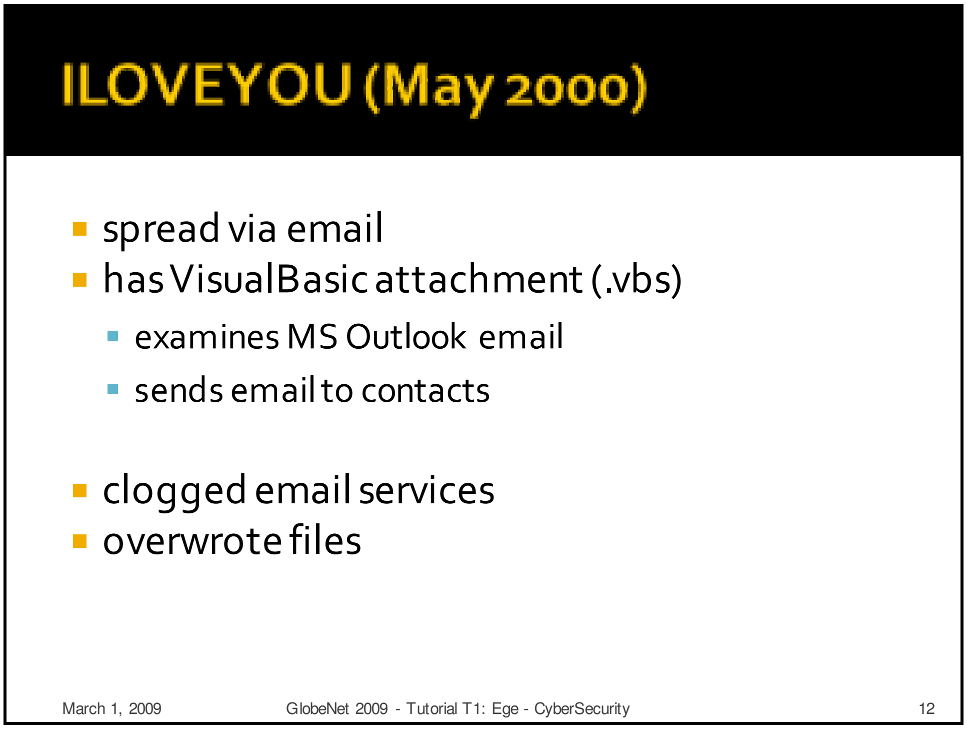
Morris Worm (November 1988)

- released by graduate student Robert Morris
  - exploited sendmail, finger, rsh
  - accident: excessive replication
- purpose: gauge size of Internet
  - infected 10 percent of machines (approximately 6,000) connected to the Internet at that time
- caused an estimated $100 million in damage
  - loss of computing resources



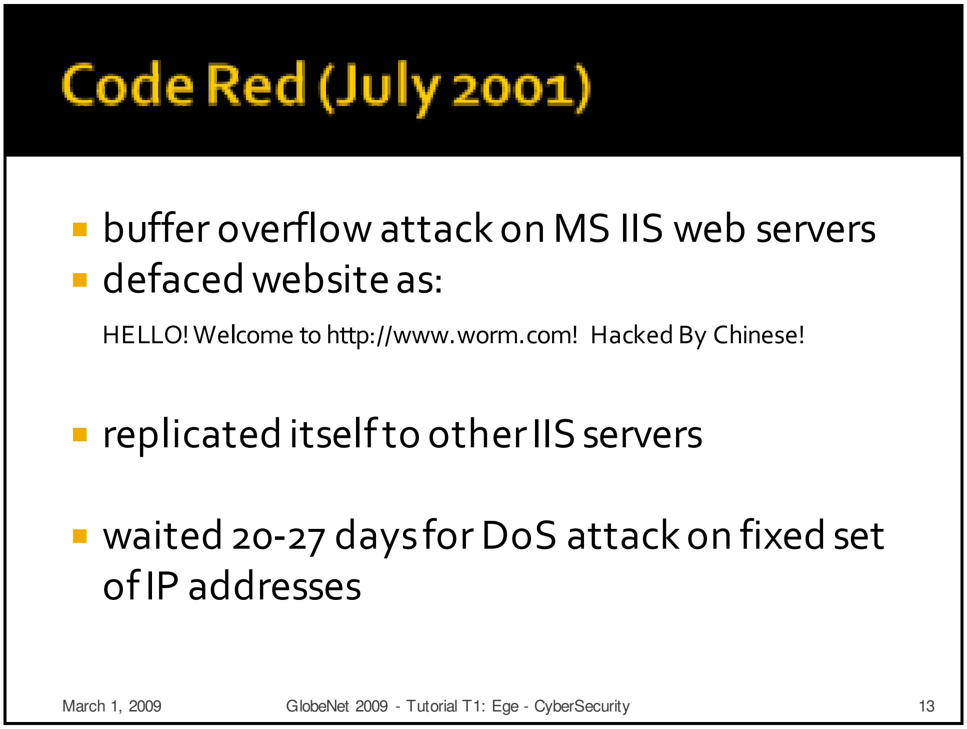
Melissa (March 1999)

- spread via email
- has MS Word attachment (.doc)
  - macro examines user's address book
  - sends email via MS Outlook to first 50
- no harm intended (originally)
- clogged email services



ILOVEYOU (May 2000)

- spread via email
- has VisualBasic attachment (.vbs)
  - examines MS Outlook email
  - sends email to contacts
- clogged email services
- overwrote files

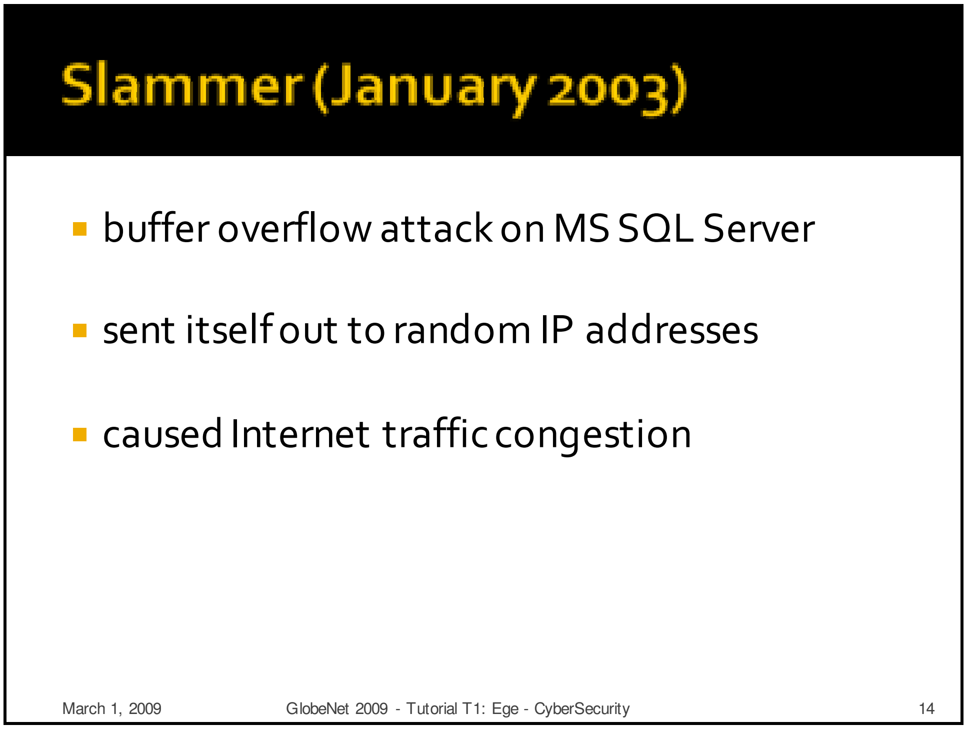


Code Red (July 2001)

- buffer overflow attack on MS IIS web servers
- defaced website as:

HELLO! Welcome to http://www.worm.com! Hacked By Chinese!

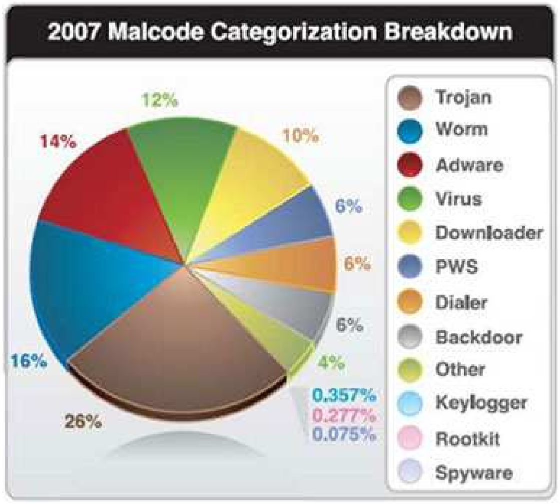
- replicated itself to other IIS servers
- waited 20-27 days for DoS attack on fixed set of IP addresses



Slammer (January 2003)

- buffer overflow attack on MS SQL Server
- sent itself out to random IP addresses
- caused Internet traffic congestion

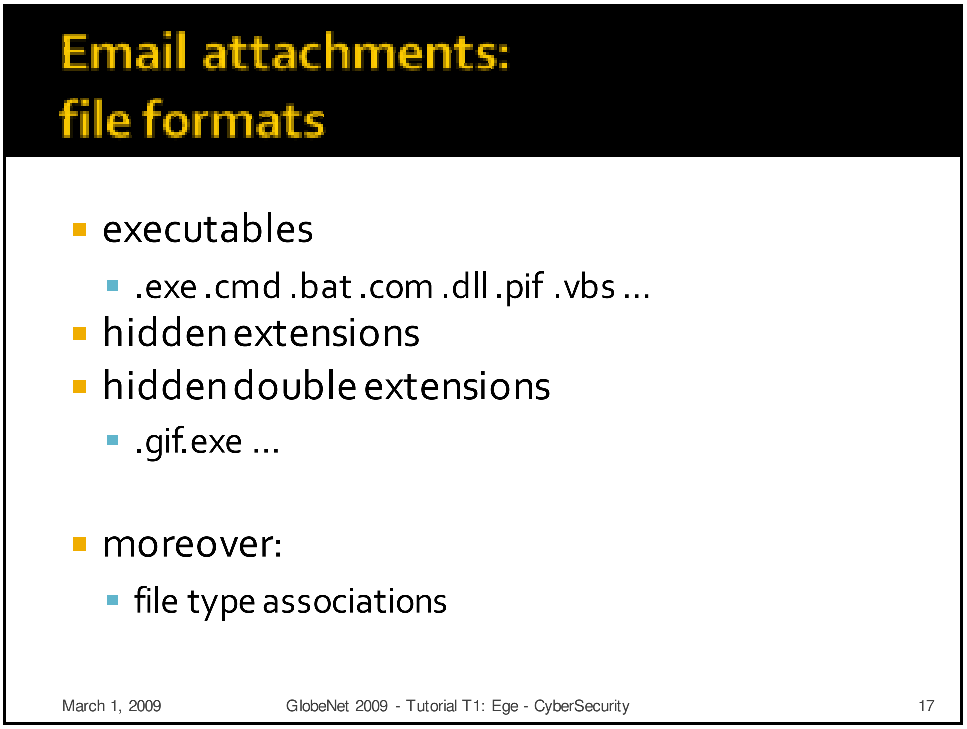
... more attacks



Lessons from history

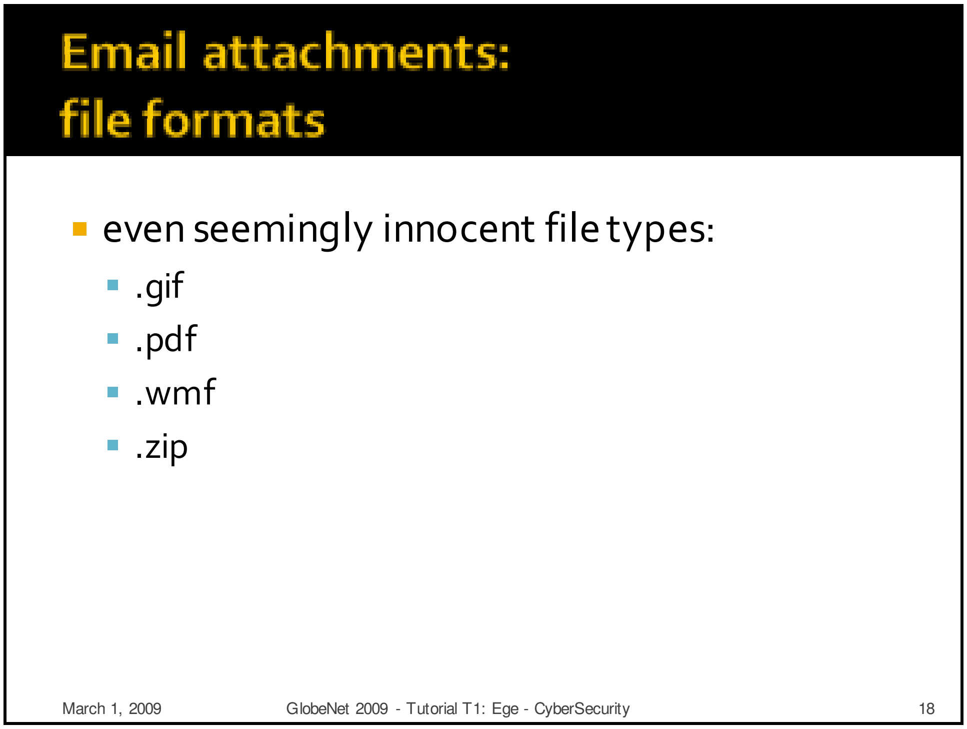
- as Internet became more prevalent, it became vehicle for malicious exploits

- recent threats:
  - email → spam
  - websites



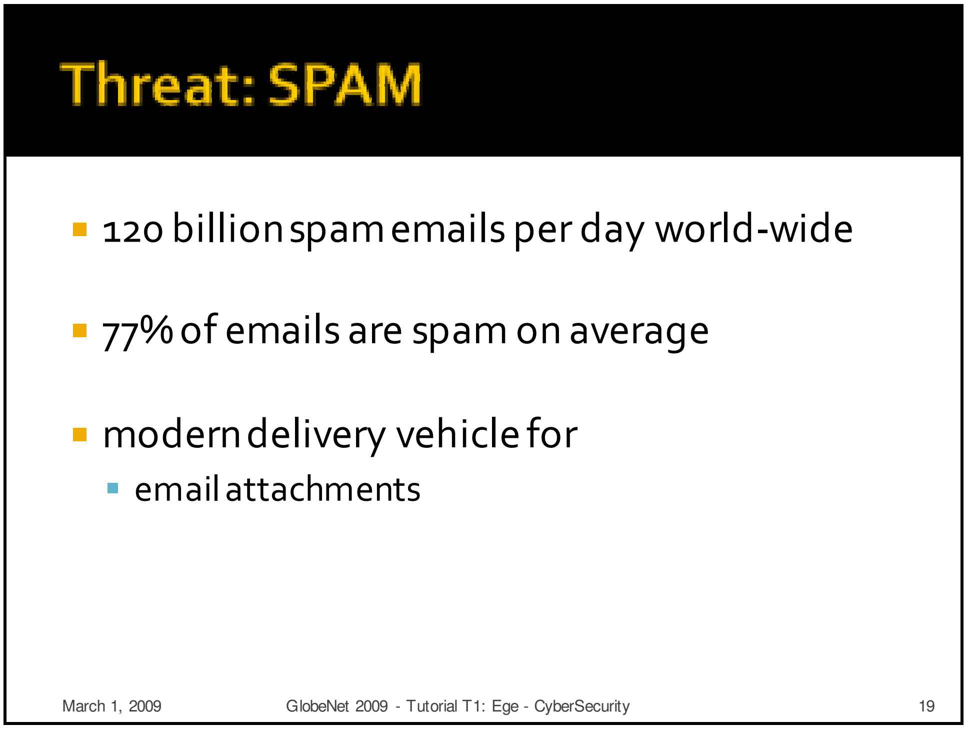
Email attachments: file formats

- executables
  - .exe .cmd .bat .com .dll .pif .vbs …
- hidden extensions
- hidden double extensions
  - .gif.exe …
- moreover:
  - file type associations



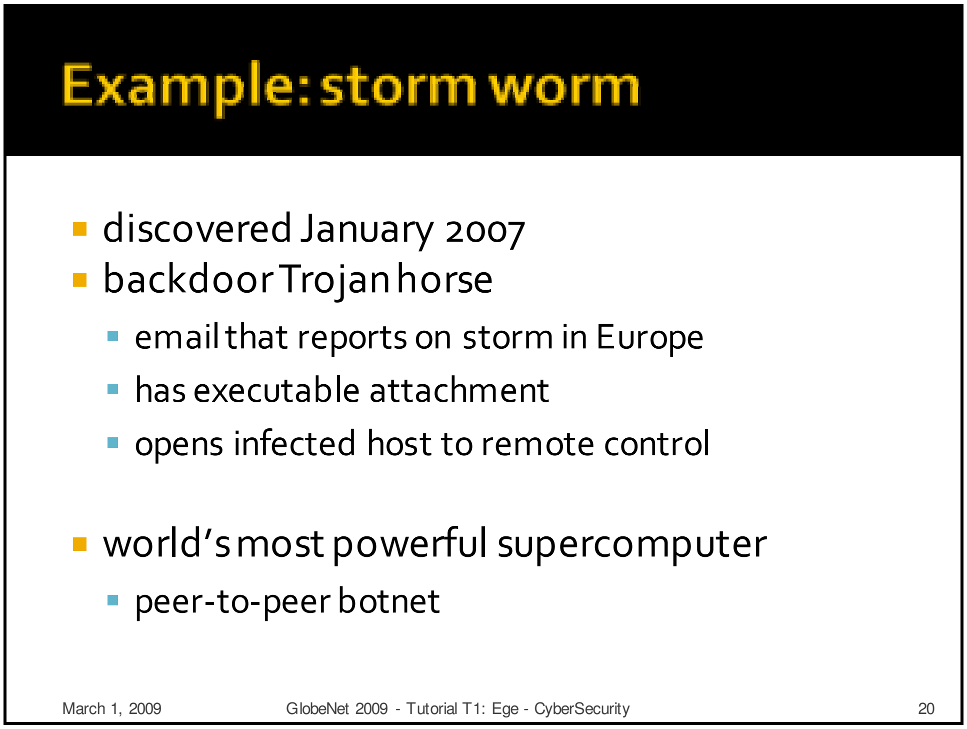
Email attachments: file formats

- even seemingly innocent file types:
  - .gif
  - .pdf
  - .wmf
  - .zip



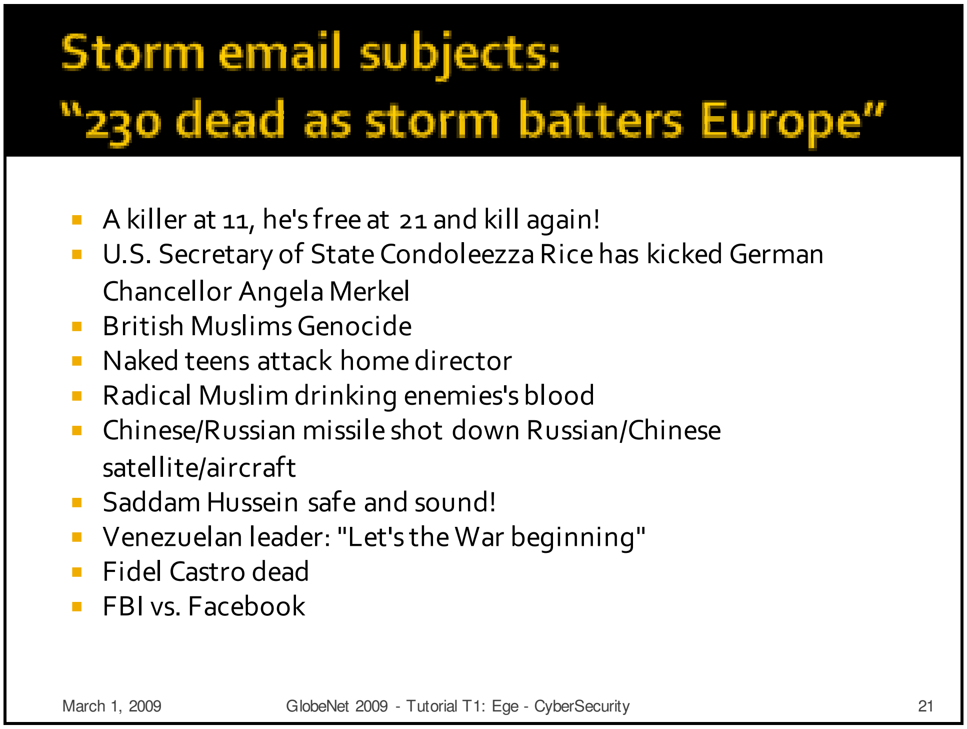
Threat: SPAM

- 120 billion spam emails per day world-wide
- 77% of emails are spam on average
- modern delivery vehicle for
  - email attachments



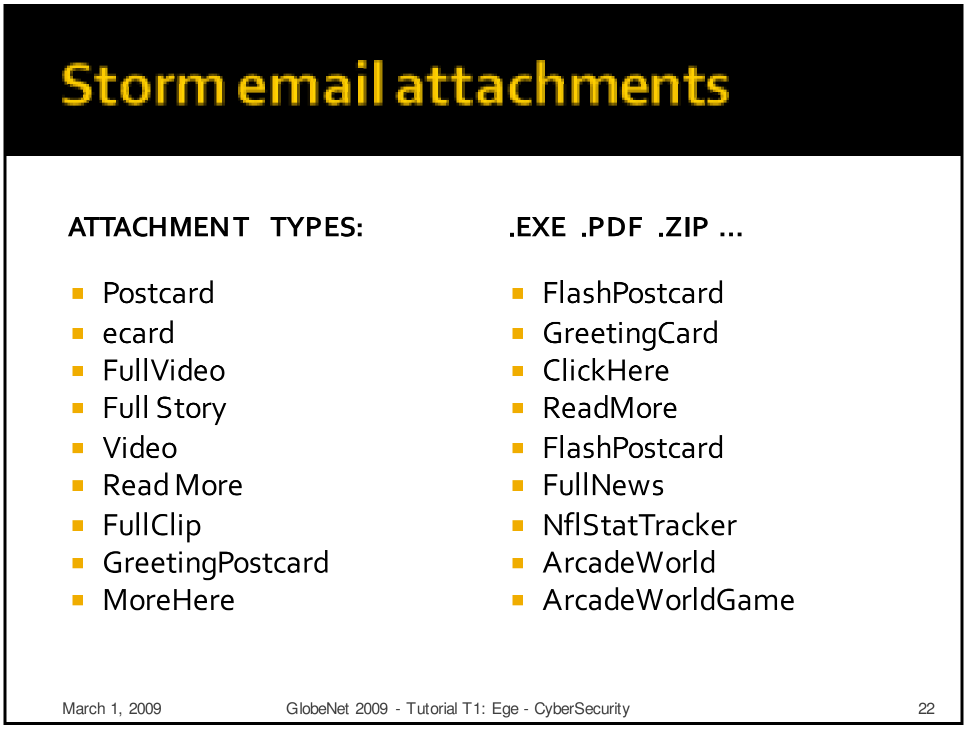
Example: storm worm

- discovered January 2007
- backdoor Trojan horse
  - email that reports on storm in Europe
  - has executable attachment
  - opens infected host to remote control
- world's most powerful supercomputer
  - peer-to-peer botnet



Storm email subjects: "230 dead as storm batters Europe"

- A killer at 11, he's free at 21 and kill again!
- U.S. Secretary of State Condoleezza Rice has kicked German Chancellor Angela Merkel
- British Muslims Genocide
- Naked teens attack home director
- Radical Muslim drinking enemies's blood
- Chinese/Russian missile shot down Russian/Chinese satellite/aircraft
- Saddam Hussein safe and sound!
- Venezuelan leader: "Let's the War beginning"
- Fidel Castro dead
- FBI vs. Facebook



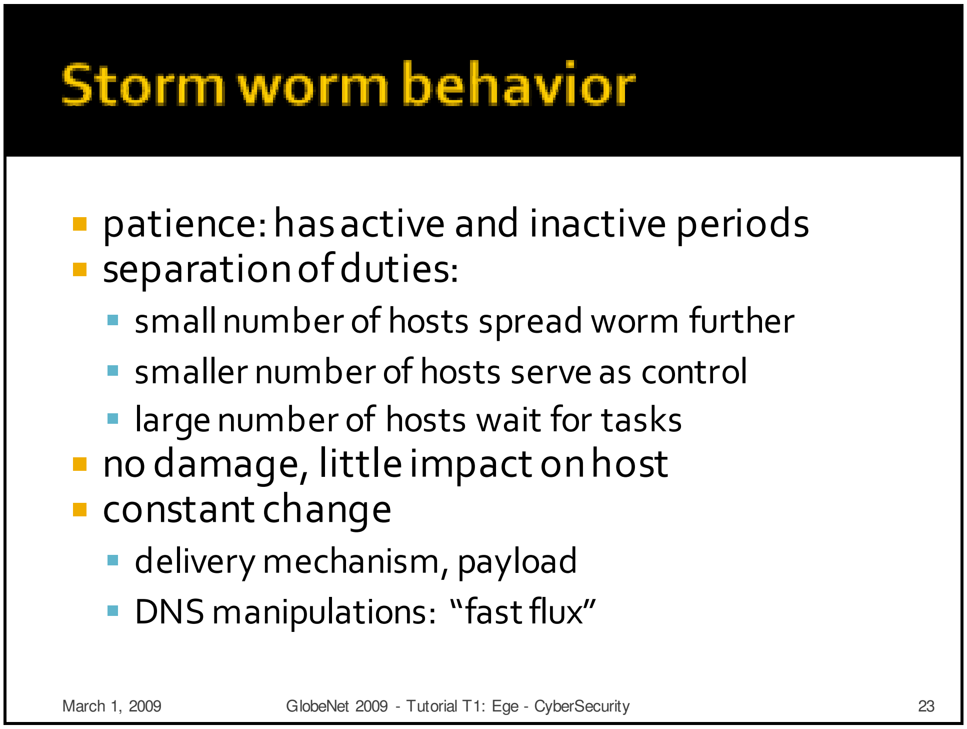
Storm email attachments

ATTACHMENT TYPES:

- Postcard
- ecard
- FullVideo
- Full Story
- Video
- Read More
- FullClip
- GreetingPostcard
- MoreHere

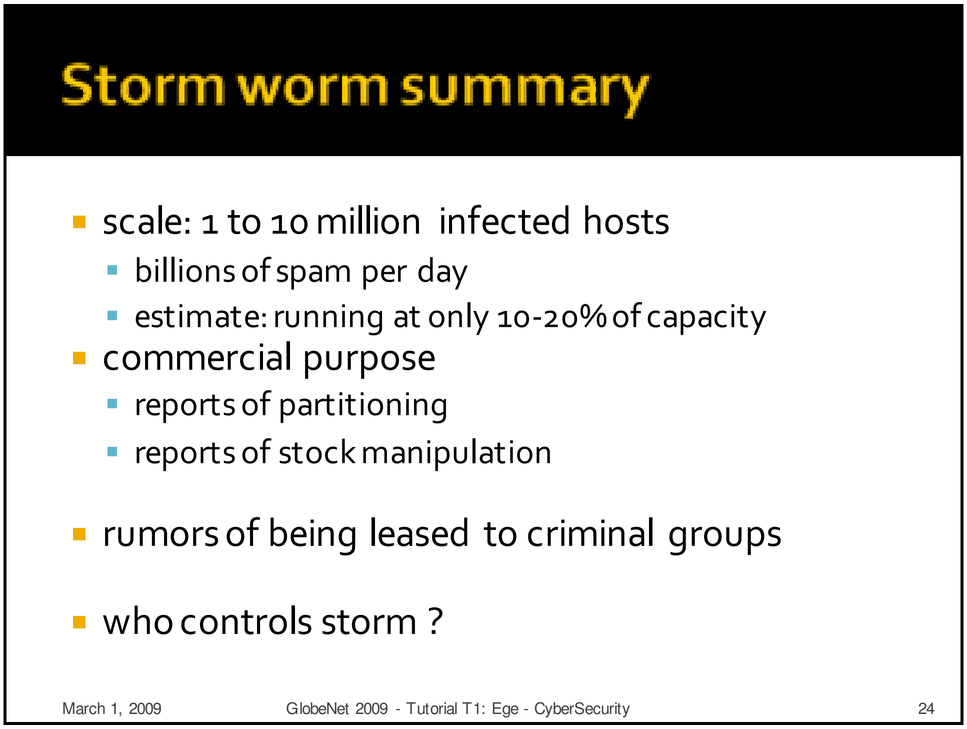
.EXE .PDF .ZIP ...

- FlashPostcard
- GreetingCard
- ClickHere
- ReadMore
- FlashPostcard
- FullNews
- NflStatTracker
- ArcadeWorld
- ArcadeWorldGame



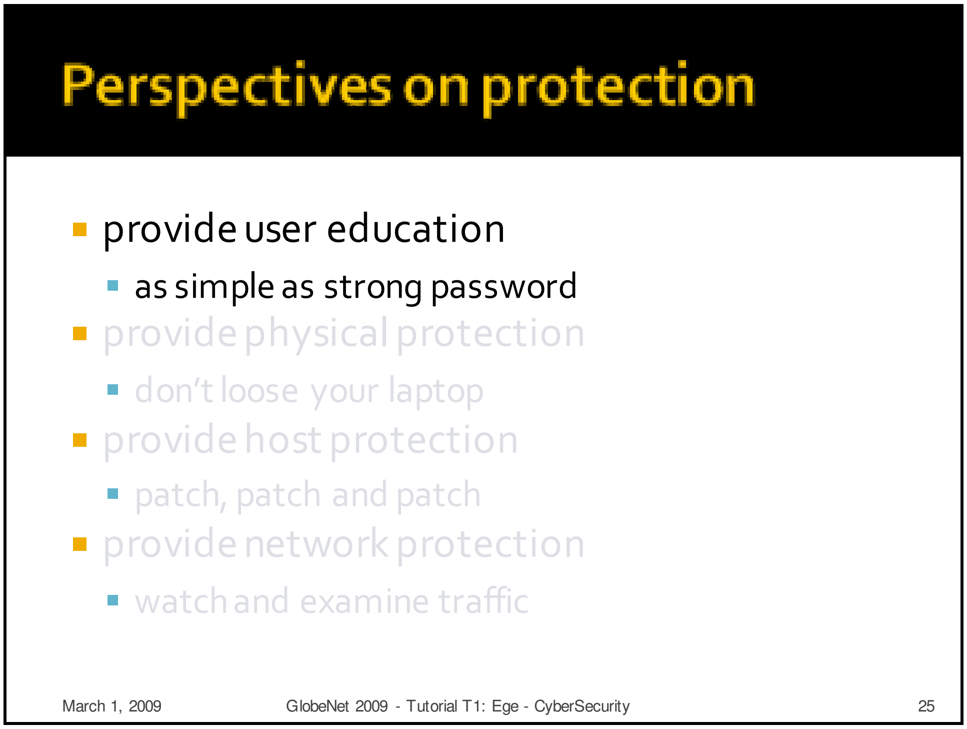
Storm worm behavior

- patience: has active and inactive periods
- separation of duties:
  - small number of hosts spread worm further
  - smaller number of hosts serve as control
  - large number of hosts wait for tasks
- no damage, little impact on host
- constant change
  - delivery mechanism, payload
  - DNS manipulations: "fast flux"



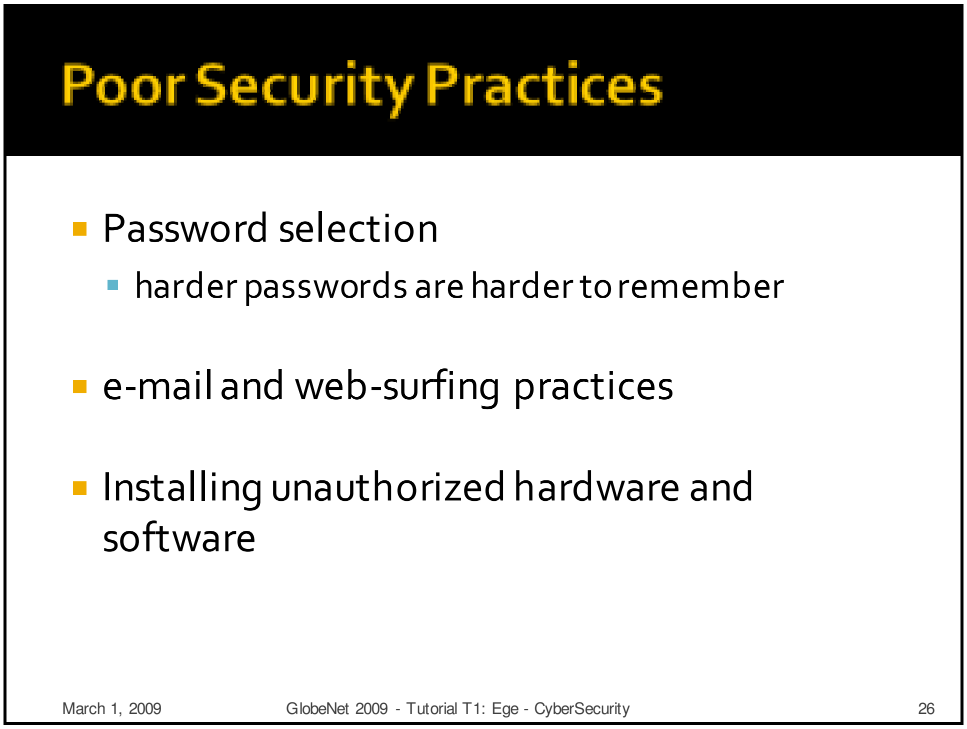
Storm worm summary

- scale: 1 to 10 million infected hosts
  - billions of spam per day
  - estimate: running at only 10-20% of capacity
- commercial purpose
  - reports of partitioning
  - reports of stock manipulation
- rumors of being leased to criminal groups
- who controls storm ?



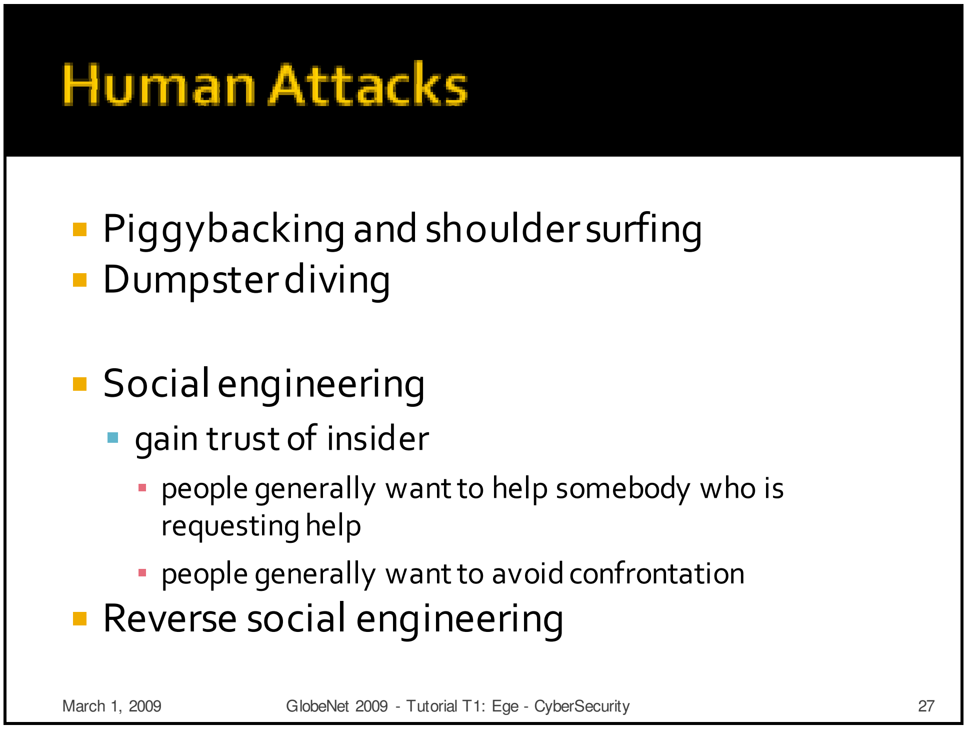
Perspectives on protection

- provide user education
  - as simple as strong password
- provide physical protection
  - don't loose your laptop
- provide host protection
  - patch, patch and patch
- provide network protection
  - watch and examine traffic



Poor Security Practices

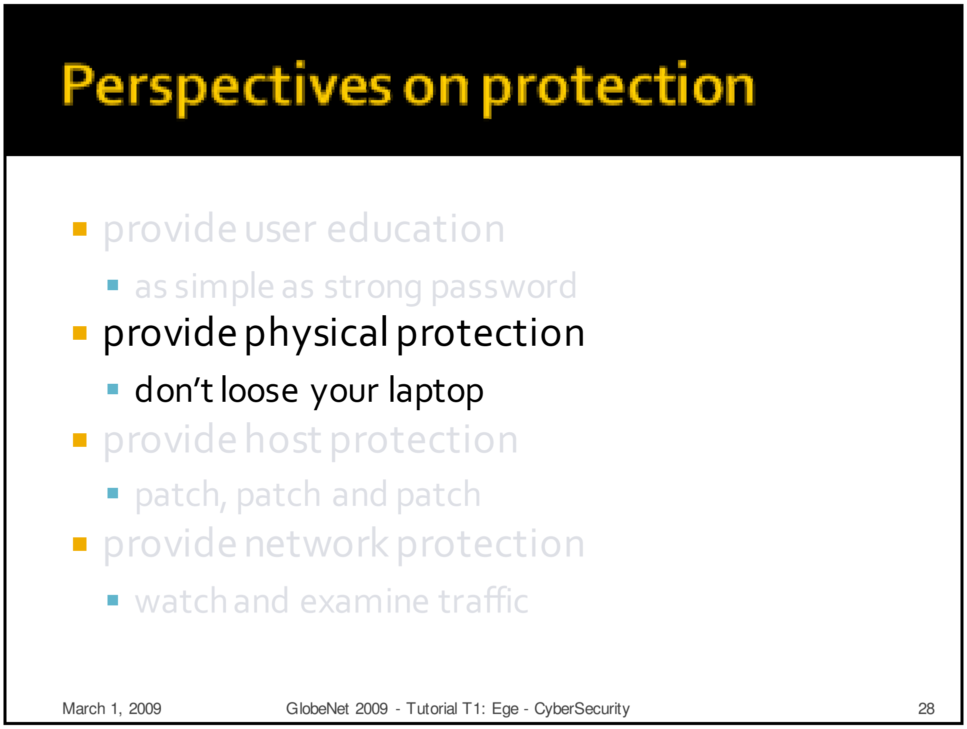
- Password selection
  - harder passwords are harder to remember
- e-mail and web-surfing practices
- Installing unauthorized hardware and software



Human Attacks

- Piggybacking and shoulder surfing
- Dumpster diving

- Social engineering
  - gain trust of insider
    - people generally want to help somebody who is requesting help
    - people generally want to avoid confrontation
- Reverse social engineering



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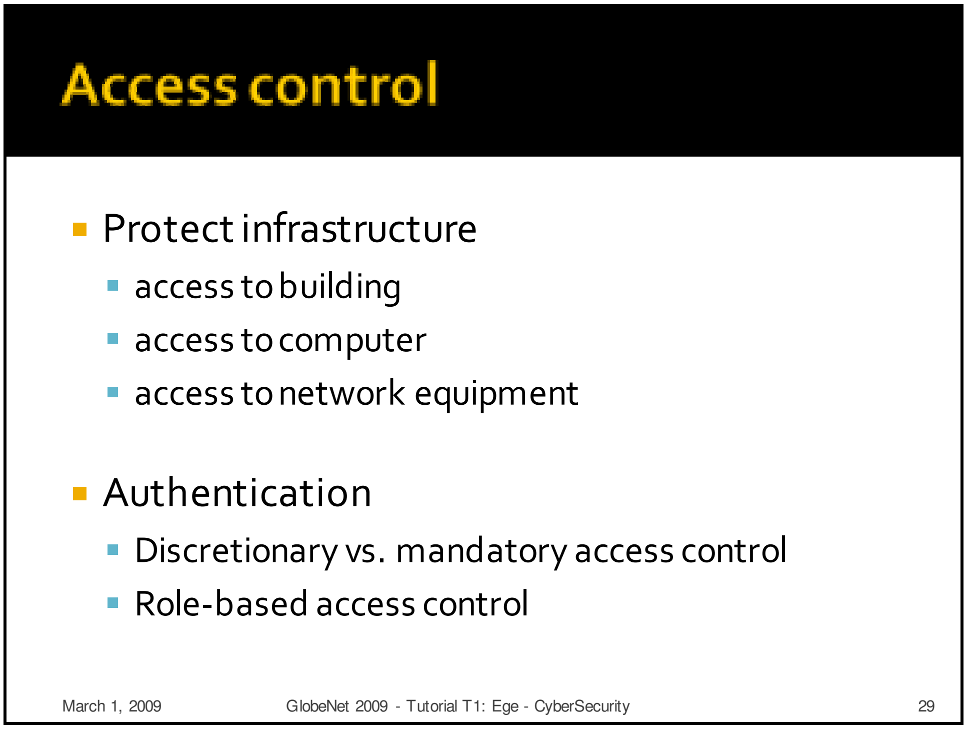
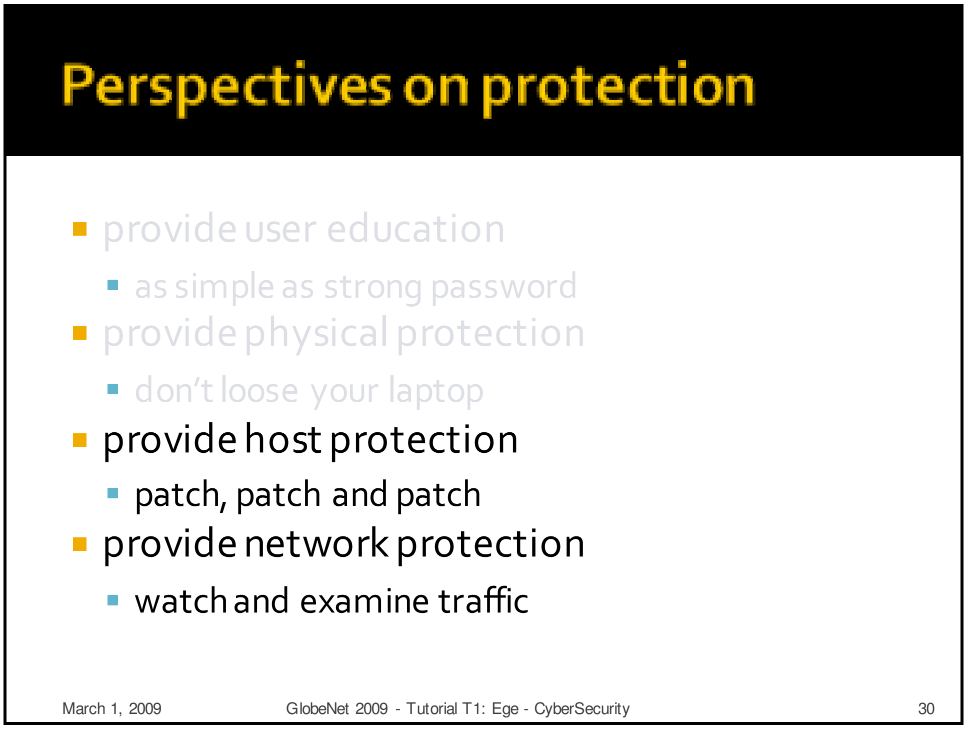


Access control

- Protect infrastructure
  - access to building
  - access to computer
  - access to network equipment
- Authentication
  - Discretionary vs. mandatory access control
  - Role-based access control



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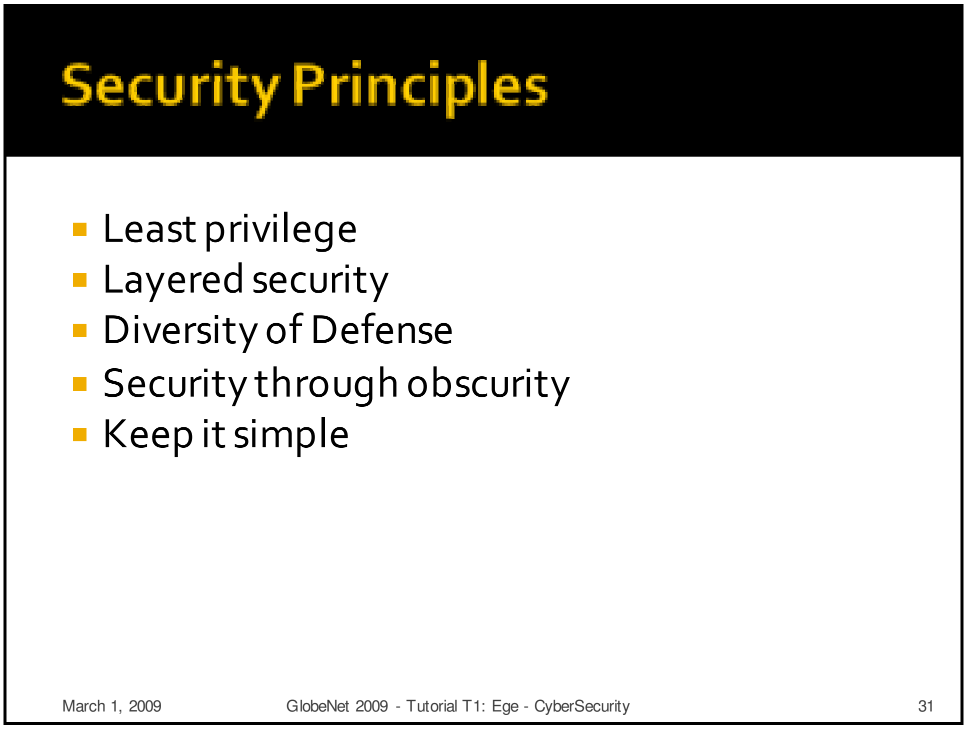
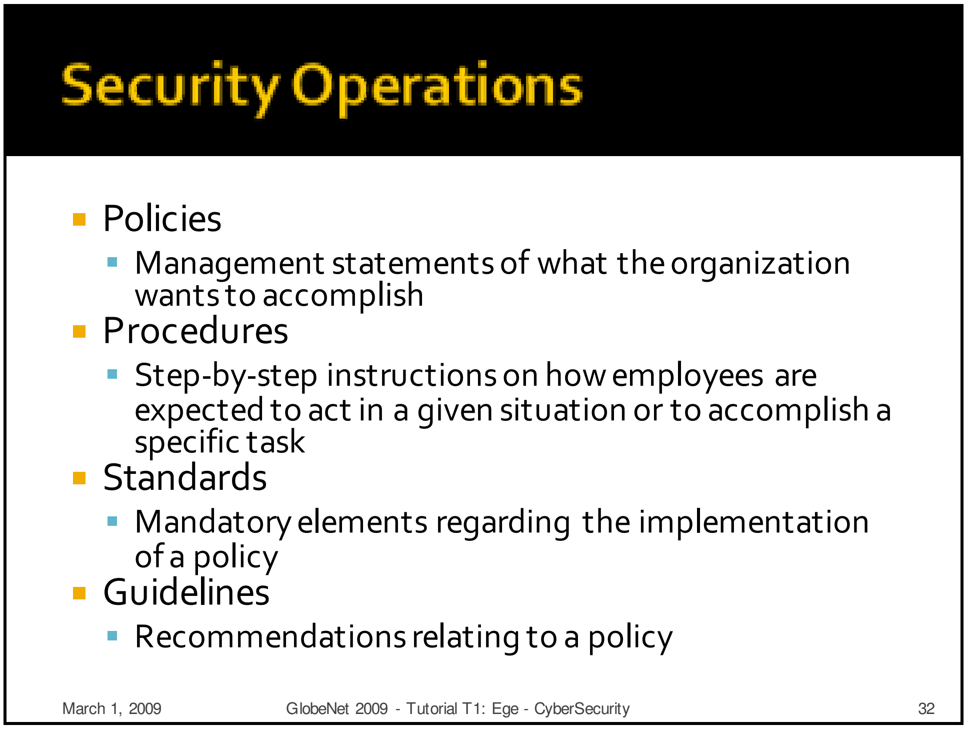


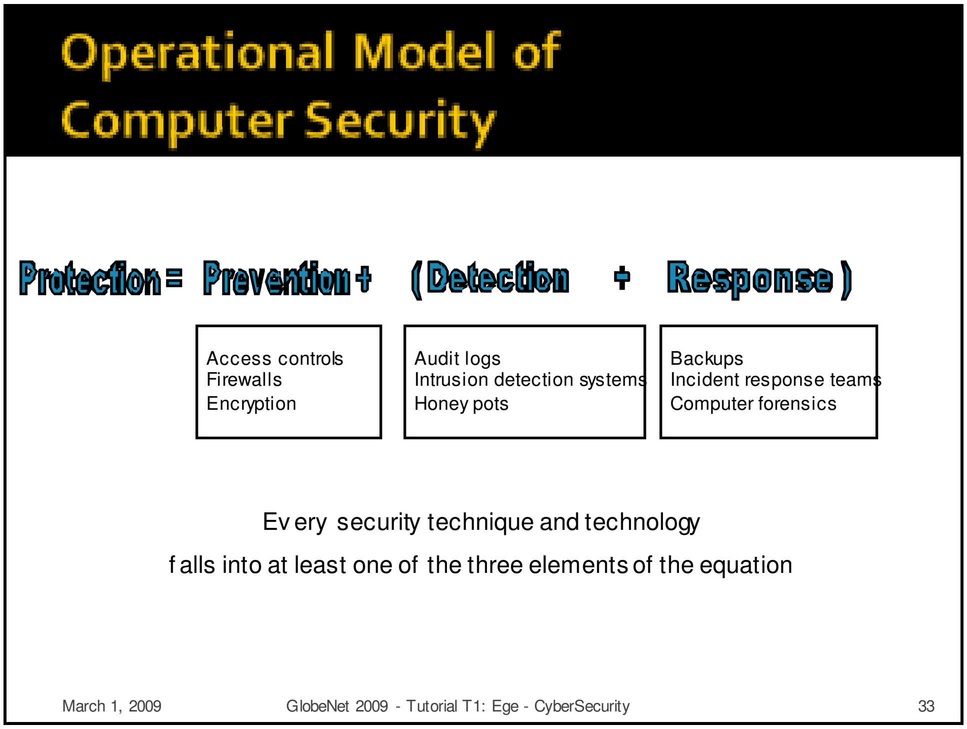
Security Principles

- Least privilege
- Layered security
- Diversity of Defense
- Security through obscurity
- Keep it simple



Security Operations

- Policies
  - Management statements of what the organization wants to accomplish
- Procedures
  - Step-by-step instructions on how employees are expected to act in a given situation or to accomplish a specific task
- Standards
  - Mandatory elements regarding the implementation of a policy
- Guidelines
  - Recommendations relating to a policy

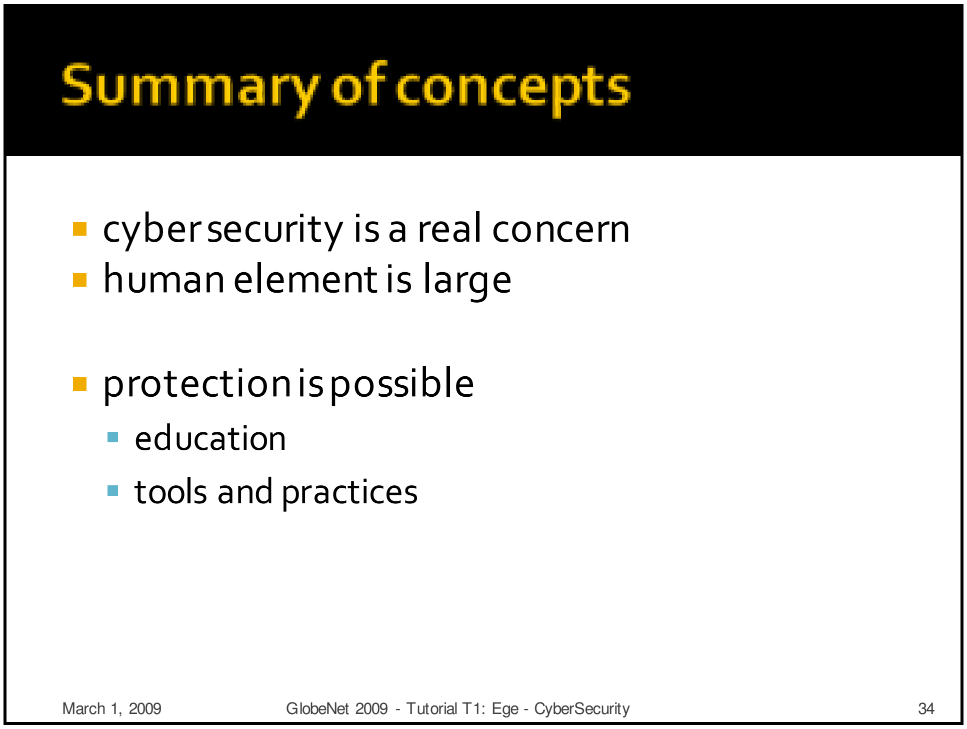


Operational Model of Computer Security

Protection = Prevention + (Detection + Response)

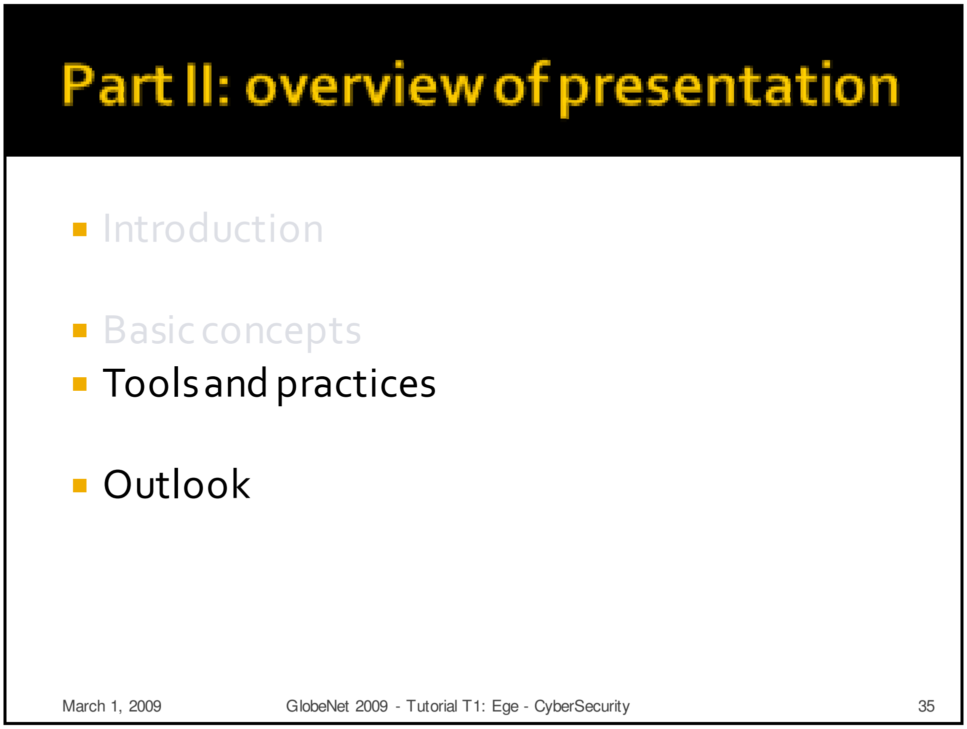
Prevention	Detection	Response
Access controls Firewalls Encryption	Audit logs Intrusion detection systems Honey pots	Backups Incident response teams Computer forensics

Every security technique and technology
falls into at least one of the three elements of the equation



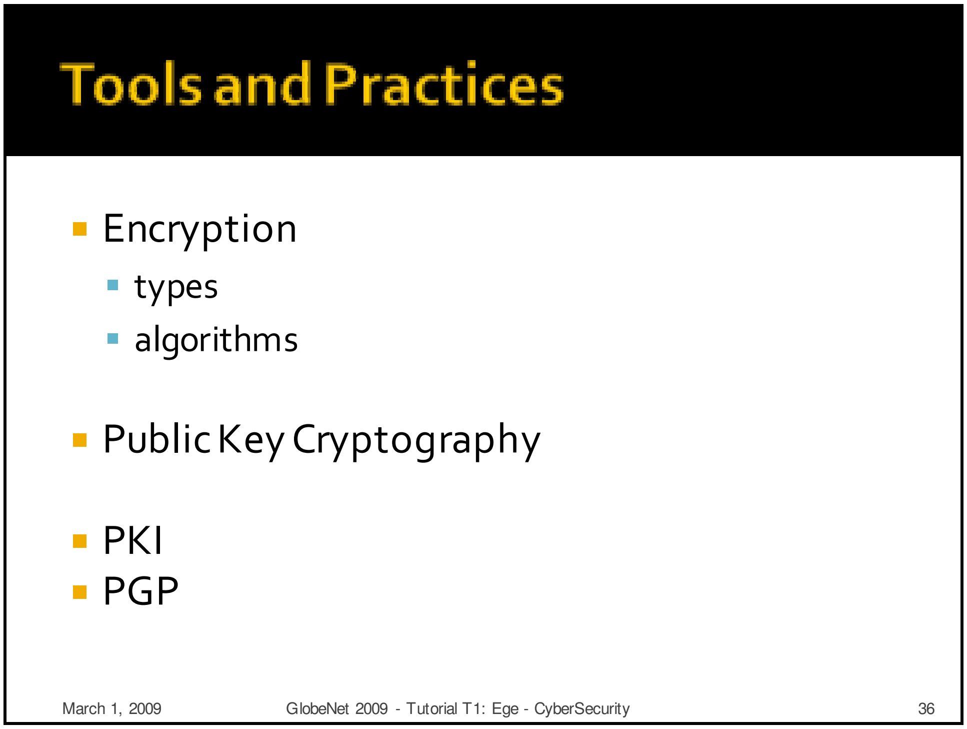
Summary of concepts

- cybersecurity is a real concern
- human element is large
- protection is possible
  - education
  - tools and practices



Part II: overview of presentation

- Introduction
- Basic concepts
- Tools and practices
- Outlook



Tools and Practices

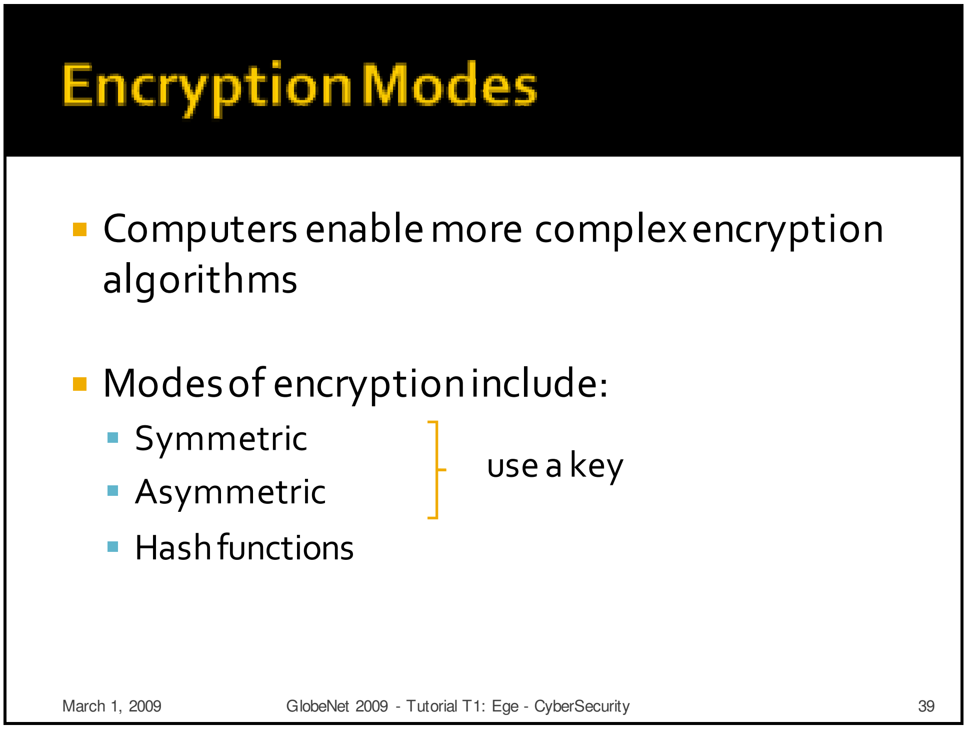
- Encryption
  - types
  - algorithms
- Public Key Cryptography
- PKI
- PGP

Encryption concepts

- plain-text vs. cypher-text
- encryption algorithm: public
  convert plain-text into cypher-text
- encryption key: secret
  additional input to encryption algorithm

Encryption history

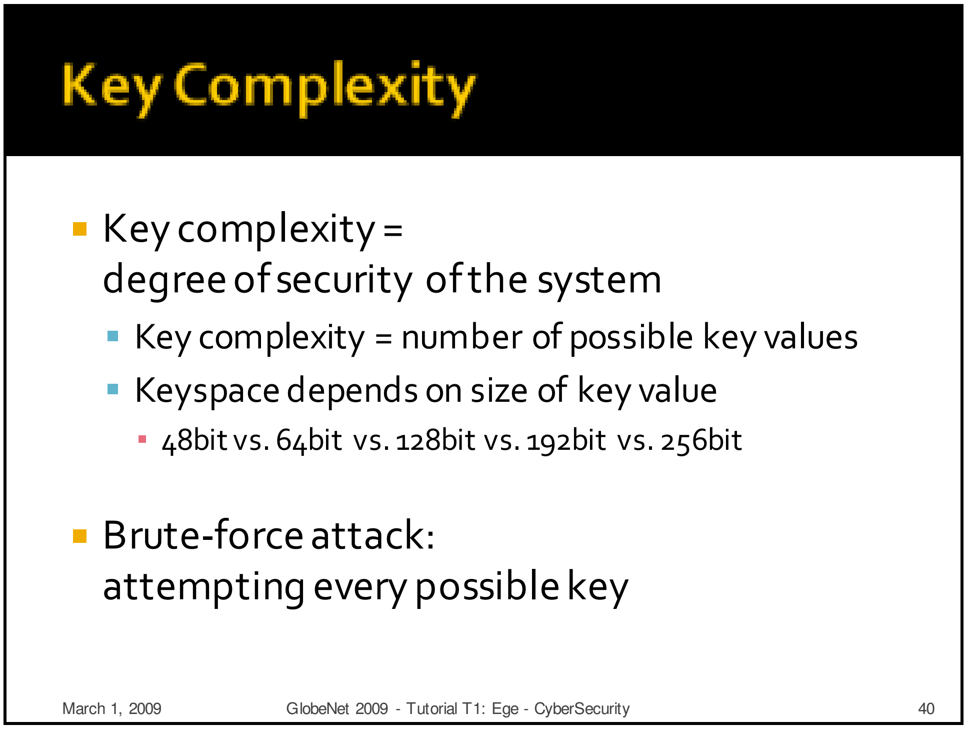
- Spartans used a ribbon wrapped around a specific gauge cylinder and then wrote on the ribbon
  - when unwrapped, the ribbon appeared to hold a strange string of letters
  - message could be read only when someone wrapped the ribbon back around the same gauge cylinder
- Romans used shift cipher
  - One letter of the alphabet is shifted a set number of places in the alphabet for another letter



Encryption Modes

- Computers enable more complex encryption algorithms
- Modes of encryption include:
  - Symmetric
  - Asymmetric
  - Hash functions

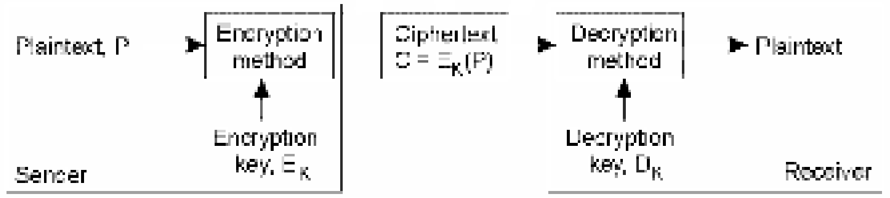
use a key



Key Complexity

- Key complexity =
  degree of security of the system
  - Key complexity = number of possible key values
  - Keyspace depends on size of key value
    - 48bit vs. 64bit vs. 128bit vs. 192bit vs. 256bit
- Brute-force attack:
  attempting every possible key

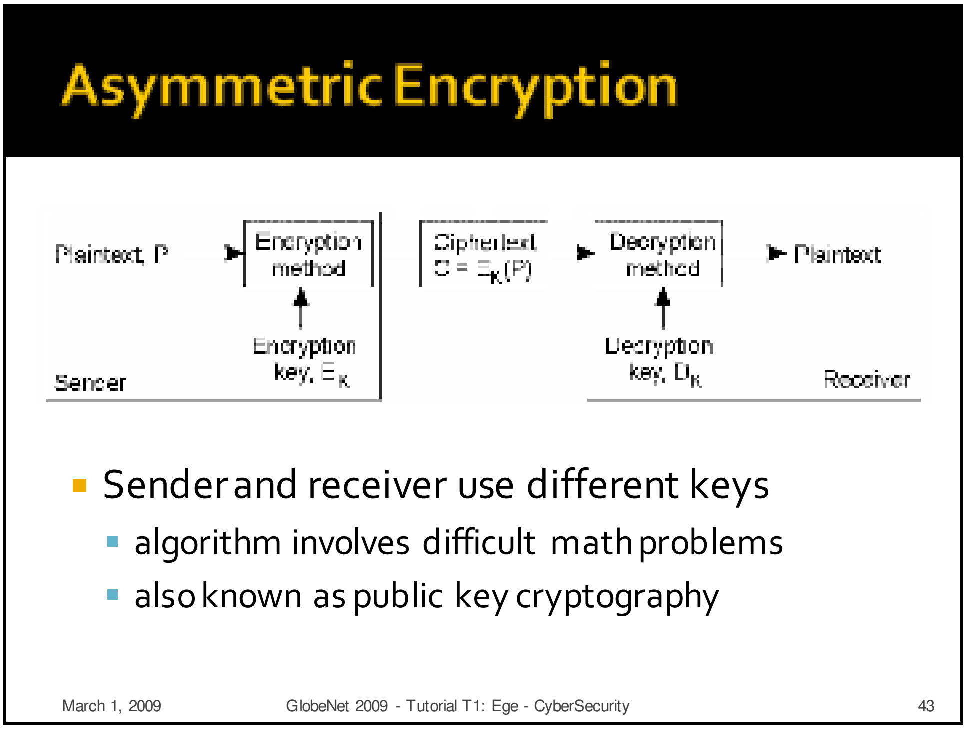
Symmetric Encryption



- Sender and the receiver use same key
  - requires key management
  - key must be exchanged by other means

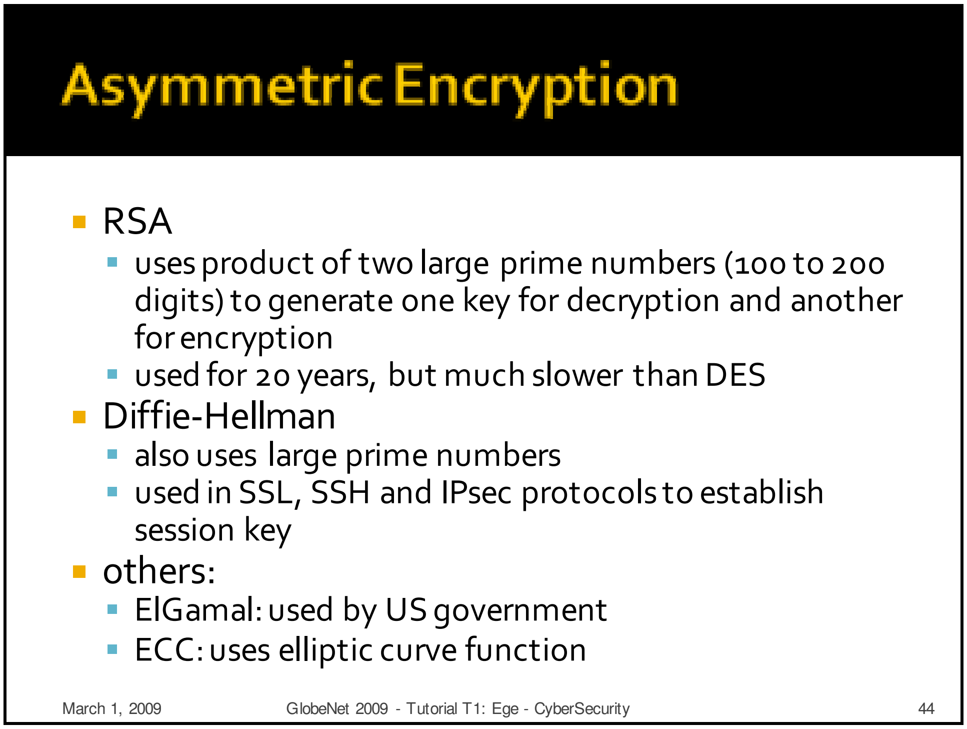
Symmetric Encryption Algorithms

- DES: Data Encryption Standard
  - 54bit shared key, judged as weak
- 3DES (Triple DES)
  - uses three keys instead of the single key
  - spins through the DES algorithm three times
- AES (Advanced Encryption Standard)
  - key sizes: 128, 192, 256 bits
  - no known successful attacks
- others:
  - CAST, Rivest Cipher (RC)
  - Blowfish, IDEA (International Data Encryption Algorithm)



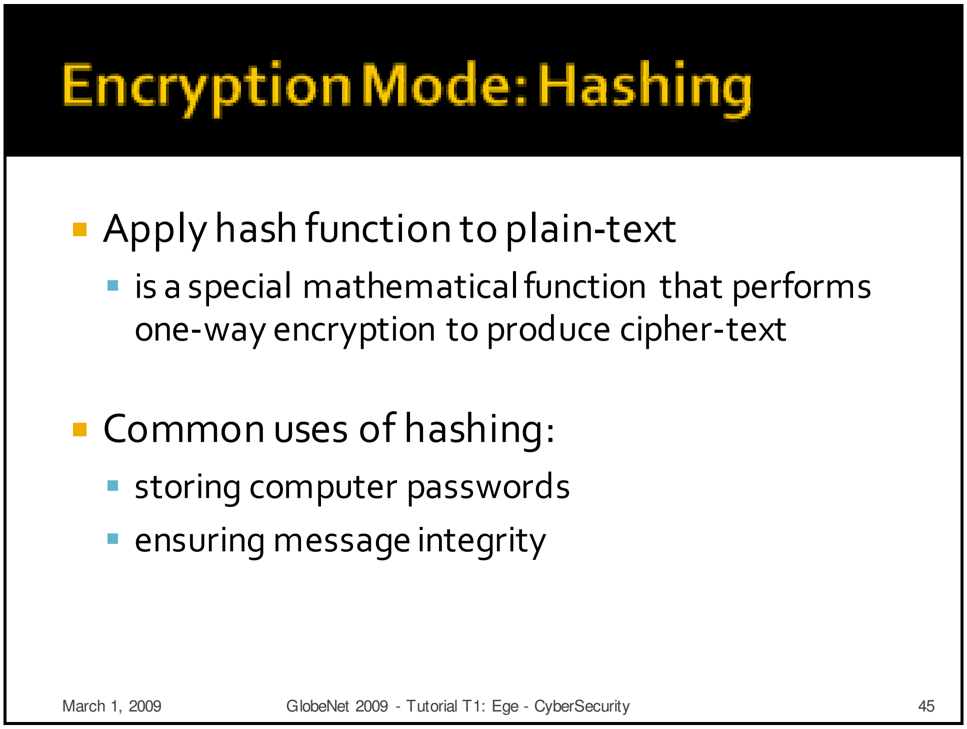
Asymmetric Encryption

- Sender and receiver use different keys
  - algorithm involves difficult math problems
  - also known as public key cryptography



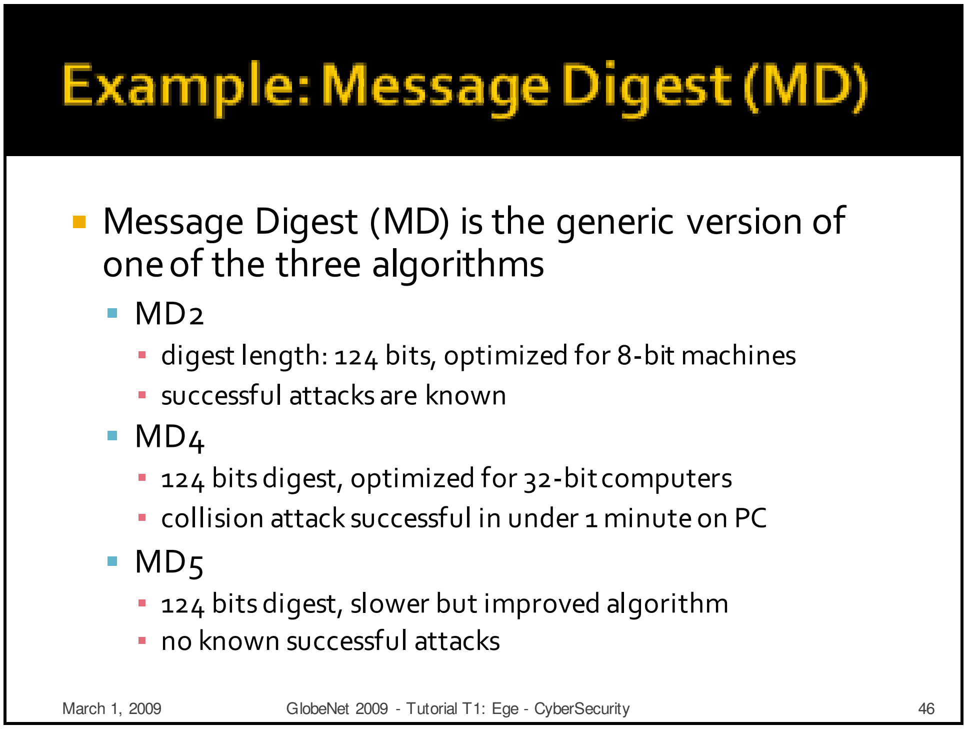
Asymmetric Encryption

- RSA
  - uses product of two large prime numbers (100 to 200 digits) to generate one key for decryption and another for encryption
  - used for 20 years, but much slower than DES
- Diffie-Hellman
  - also uses large prime numbers
  - used in SSL, SSH and IPsec protocols to establish session key
- others:
  - ElGamal: used by US government
  - ECC: uses elliptic curve function



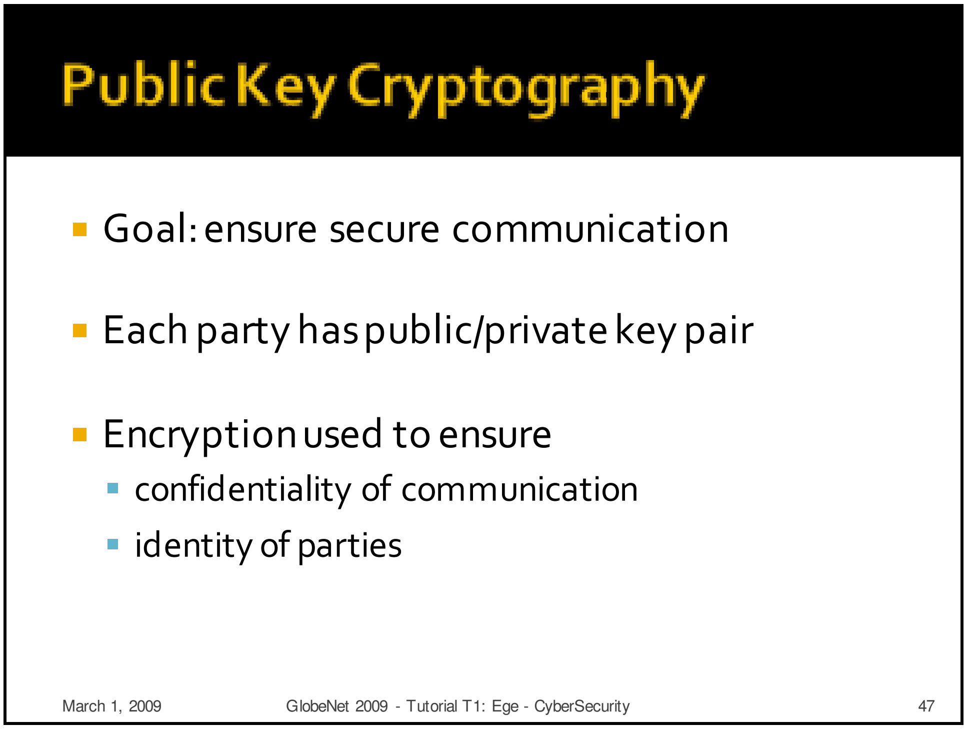
Encryption Mode: Hashing

- Apply hash function to plain-text
  - is a special mathematical function that performs one-way encryption to produce cipher-text
- Common uses of hashing:
  - storing computer passwords
  - ensuring message integrity



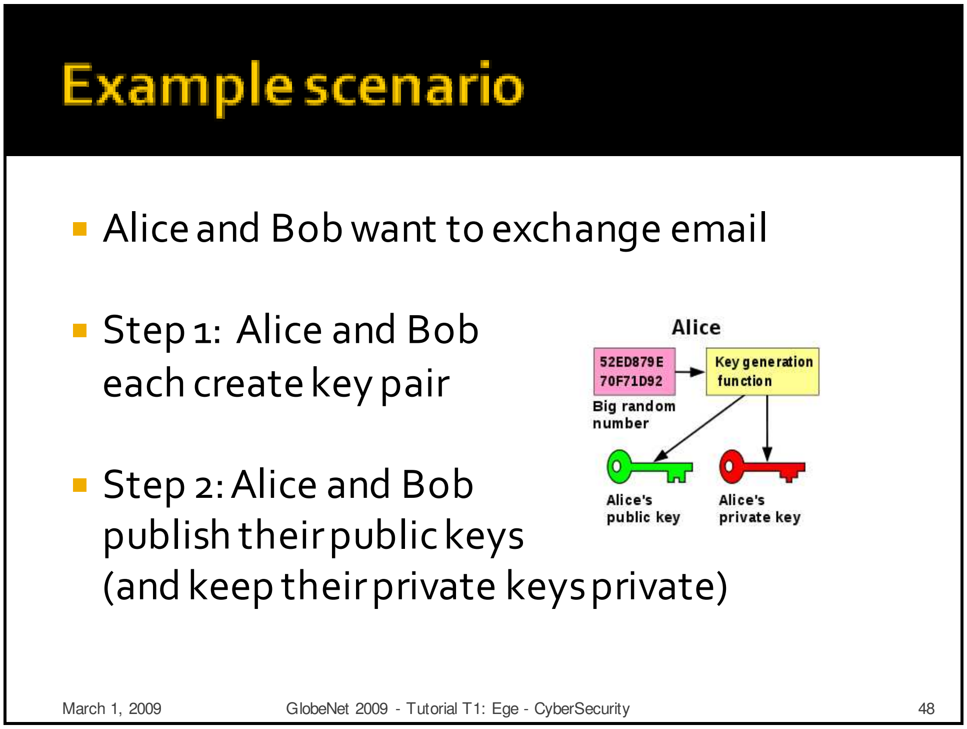
Example: Message Digest (MD)

- Message Digest (MD) is the generic version of one of the three algorithms
  - MD2
    - digest length: 124 bits, optimized for 8-bit machines
    - successful attacks are known
  - MD4
    - 124 bits digest, optimized for 32-bit computers
    - collision attack successful in under 1 minute on PC
  - MD5
    - 124 bits digest, slower but improved algorithm
    - no known successful attacks



Public Key Cryptography

- Goal: ensure secure communication
- Each party has public/private key pair
- Encryption used to ensure
  - confidentiality of communication
  - identity of parties



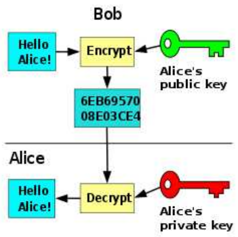
Example scenario

- Alice and Bob want to exchange email
- Step 1: Alice and Bob each create key pair
- Step 2: Alice and Bob publish their public keys (and keep their private keys private)

Alice
52ED879E
70F71D92
Big random number
Key generation function
Alice's public key
Alice's private key

Example scenario:
Bob sends email to Alice

- Bob encrypts email with Alice's public key



Observations:

- email is confidential
- only Alice can read email

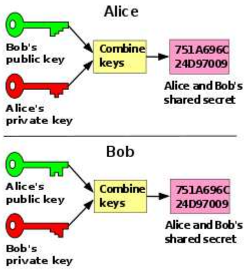
but:

- Alice is not assured that Bob sent email

- Alice decrypts email with her private key

Example scenario:
secure emails between Alice & Bob

- Bob encrypts email with Alice's public key
- Bob signs email with his private key



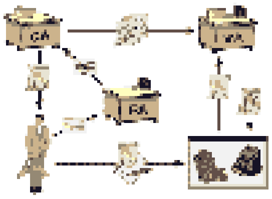
- Alice authenticates email with Bob's public key
- Alice decrypts email with her private key

Facit: can we trust a public key ?

- need public key repository
- protocols to ensure integrity of keys
- approaches:
  - PGP
  - PKI

Public Key Infrastructure

- framework to enable secure communication



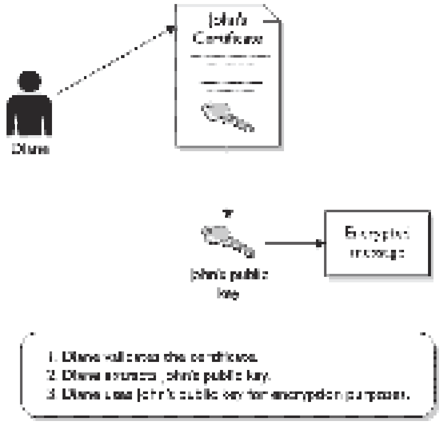
- via
  - key management for encryption
  - certification of identities

PKI elements

- Keys: public and private
- Certificates, to hold keys
- Authorities, to register & verify

- For:
  - E-mail clients
  - Virtual private network products
  - Web server components
  - Domain controllers

Example: email from Diane to John

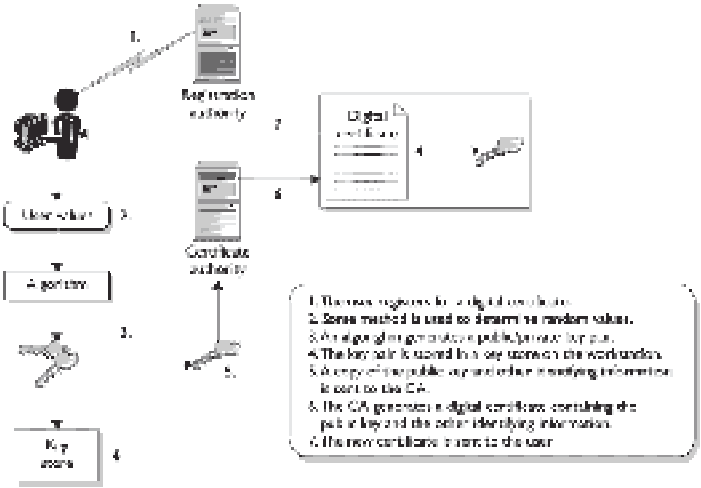


1. Diane validates the certificate.
2. Diane extracts John's public key.
3. Diane uses John's public key for encryption purposes.

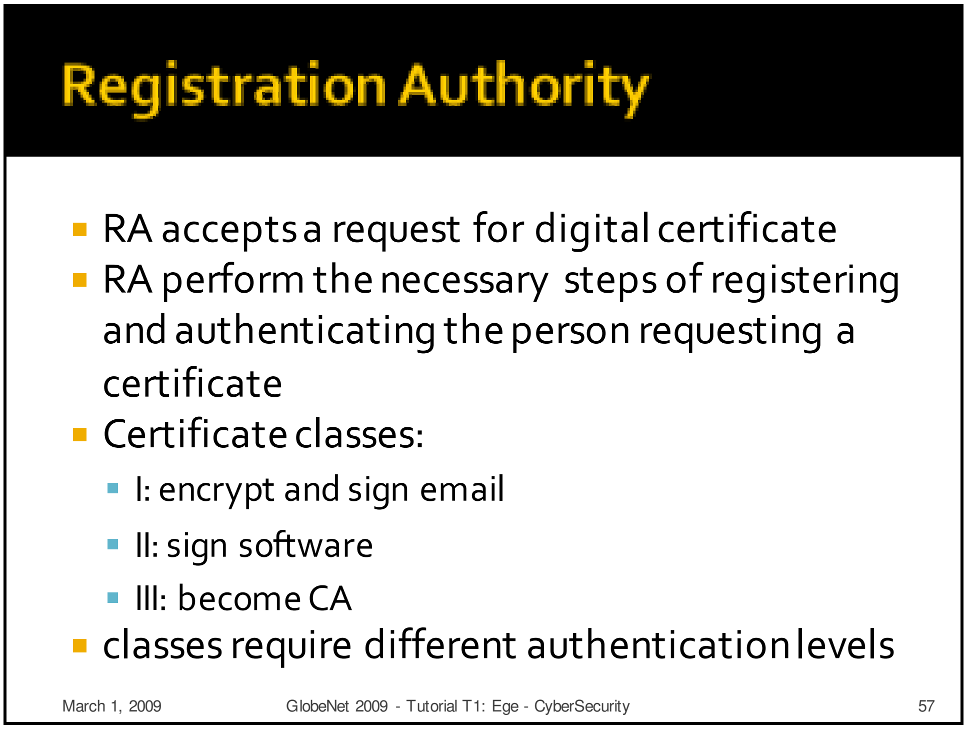
Basics of Public Key Infrastructures

- PKI involves registration & certificate authorities
  - individual requests registration
    - requires proof of identity
    - identity information is validated
  - registration authority (RA) tells certificate authority (CA) to generate a certificate
  - certificate authority signs certificate with its private key

Obtaining a Digital Certificate

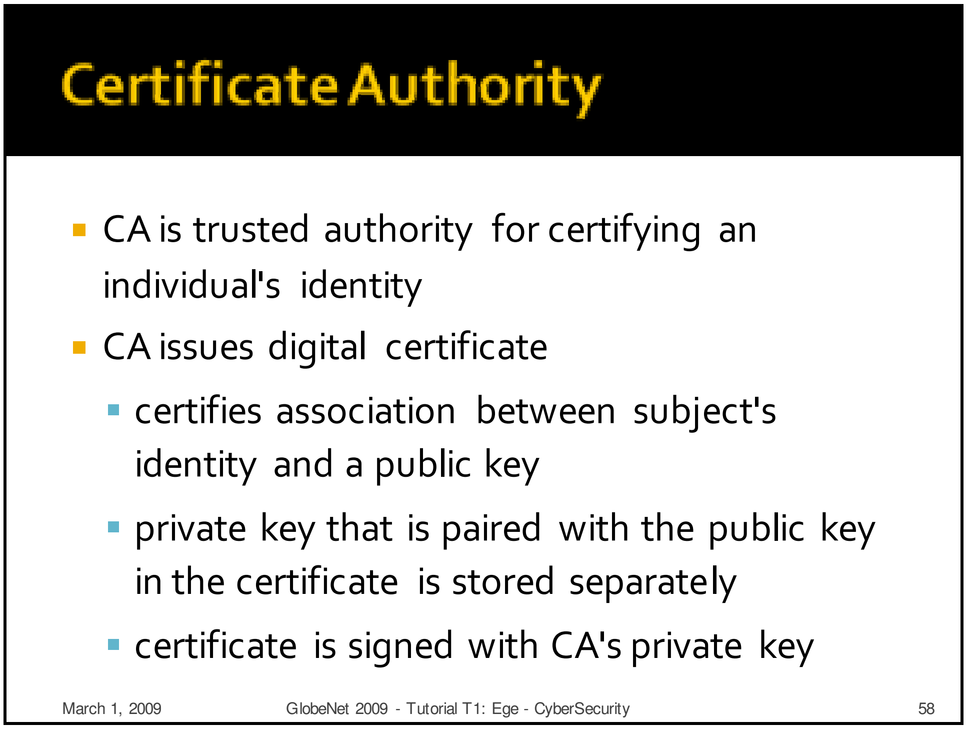


1. The user registers for a digital certificate.
2. Some method is used to determine random values.
3. An algorithm generates a public/private key pair.
4. The key pair is stored in a key store on the workstation.
5. A copy of the public key and other identifying information is sent to the CA.
6. The CA generates a digital certificate containing the public key and the other identifying information.
7. The new certificate is sent to the user



Registration Authority

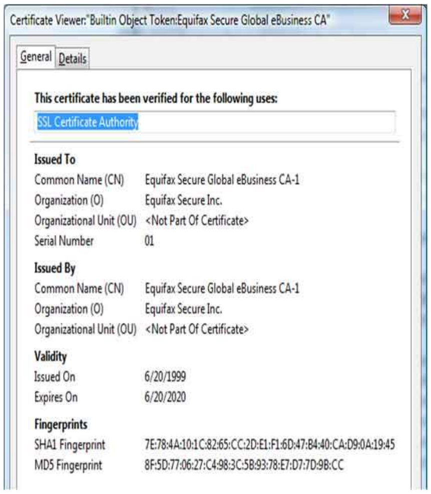
- RA accepts a request for digital certificate
- RA perform the necessary steps of registering and authenticating the person requesting a certificate
- Certificate classes:
  - I: encrypt and sign email
  - II: sign software
  - III: become CA
- classes require different authentication levels



Certificate Authority

- CA is trusted authority for certifying an individual's identity
- CA issues digital certificate
  - certifies association between subject's identity and a public key
  - private key that is paired with the public key in the certificate is stored separately
  - certificate is signed with CA's private key

Certificate Example



Certificate Viewer:"Builtin Object Token:Equifax Secure Global eBusiness CA"

This certificate has been verified for the following uses:

SSL Certificate Authority

Issued To

Common Name (CN)	Equifax Secure Global eBusiness CA-1
Organization (O)	Equifax Secure Inc.
Organizational Unit (OU)	<Not Part Of Certificate>
Serial Number	01

Issued By

Common Name (CN)	Equifax Secure Global eBusiness CA-1
Organization (O)	Equifax Secure Inc.
Organizational Unit (OU)	<Not Part Of Certificate>

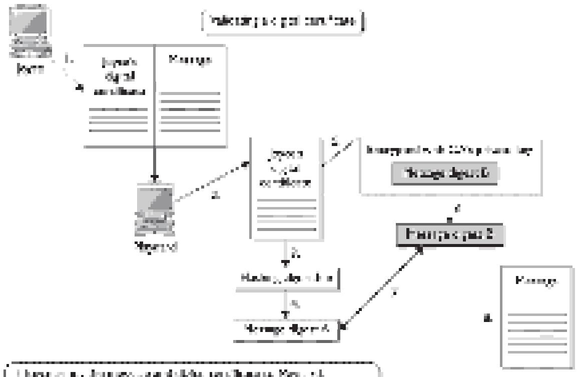
Validity

Issued On	6/20/1999
Expires On	6/20/2020

Fingerprints

SHA1 Fingerprint	7E:78:4A:10:1C:82:65:CC:2D:E1:F1:6D:47:B4:40:CA:D9:0A:19:45
MD5 Fingerprint	8F:5D:77:06:27:C4:98:3C:5B:93:78:E7:D7:7D:9B:CC

PKI example: email from Joyce to Maynard

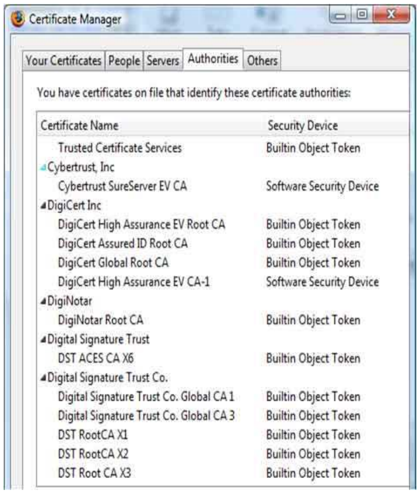


Validating a digital certificate
Joyce
1.
Joyce's digital certificate
Message
Maynard
2.
Joyce's digital certificate
3.
4.
Hashing algorithm
Message digest A
5.
Encrypted with CA's private key
Message digest B
6.
Message digest B
7.
8.
Message

1 Joyce [illegible] digital certificate [illegible] Maynard.
2 Maynard extracts the certificate.
3 Maynard [illegible]
4 The algorithm calculates a value of A.
5 Maynard extracts the encrypted message digest [illegible] certificate.
6 Maynard decrypts the value with the CA's public key.
7 Maynard [illegible] certificate [illegible]
Maynard compares values A and B.
8 [illegible] Maynard [illegible] message.

Trust and Certificate Verification

- Browsers have a long list of CAs configured to be trusted by default

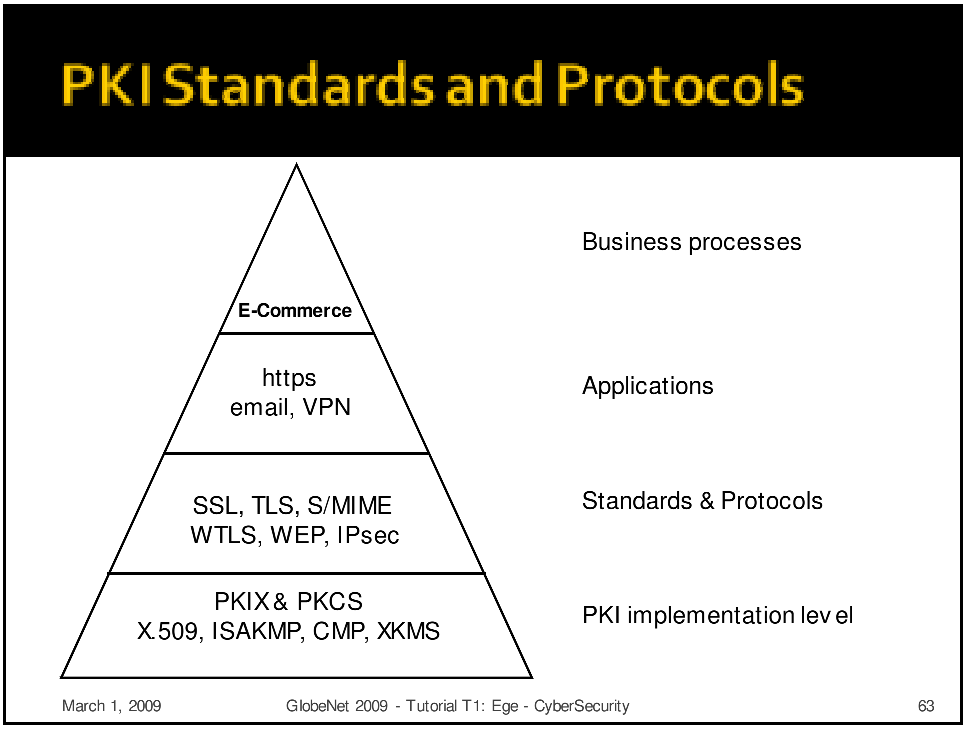


You have certificates on file that identify these certificate authorities:

Certificate Name	Security Device
Trusted Certificate Services	Builtin Object Token
◢Cybertrust, Inc	
Cybertrust SureServer EV CA	Software Security Device
◢DigiCert Inc	
DigiCert High Assurance EV Root CA	Builtin Object Token
DigiCert Assured ID Root CA	Builtin Object Token
DigiCert Global Root CA	Builtin Object Token
DigiCert High Assurance EV CA-1	Software Security Device
◢DigiNotar	
DigiNotar Root CA	Builtin Object Token
◢Digital Signature Trust	
DST ACES CA X6	Builtin Object Token
◢Digital Signature Trust Co.	
Digital Signature Trust Co. Global CA 1	Builtin Object Token
Digital Signature Trust Co. Global CA 3	Builtin Object Token
DST RootCA X1	Builtin Object Token
DST RootCA X2	Builtin Object Token
DST Root CA X3	Builtin Object Token

Revocation

- Certificates are revoked when the certificate's validity needs to be ended before its actual expiration date:
  - private key has been exposed
    - ex.: social engineering attack, laptop lost, …
  - data in certificate no longer applies to subject
    - ex.: employee left a company
- CA maintains certificate revocation list (CRL)
  - CRL must be secured:
    - signed with CA's private key
  - CRL should be distributed



PKI Standards and Protocols

E-Commerce

https
email, VPN

SSL, TLS, S/MIME
WTLS, WEP, IPsec

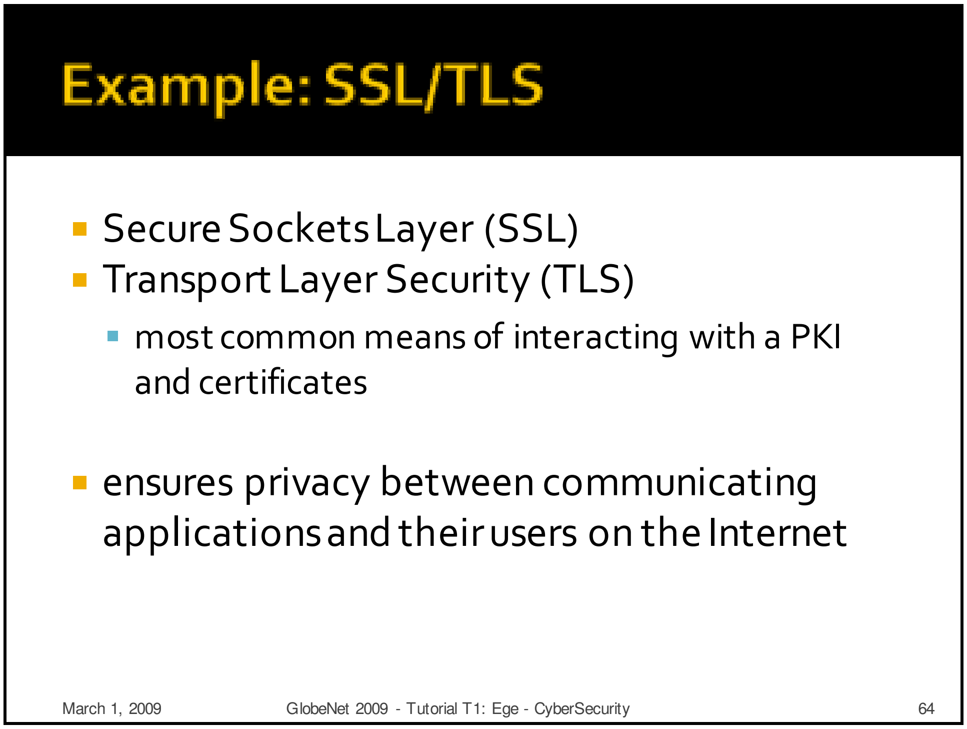
PKIX & PKCS
X.509, ISAKMP, CMP, XKMS

Business processes

Applications

Standards & Protocols

PKI implementation lev el



Example: SSL/TLS

- Secure Sockets Layer (SSL)
- Transport Layer Security (TLS)
  - most common means of interacting with a PKI and certificates
- ensures privacy between communicating applications and their users on the Internet

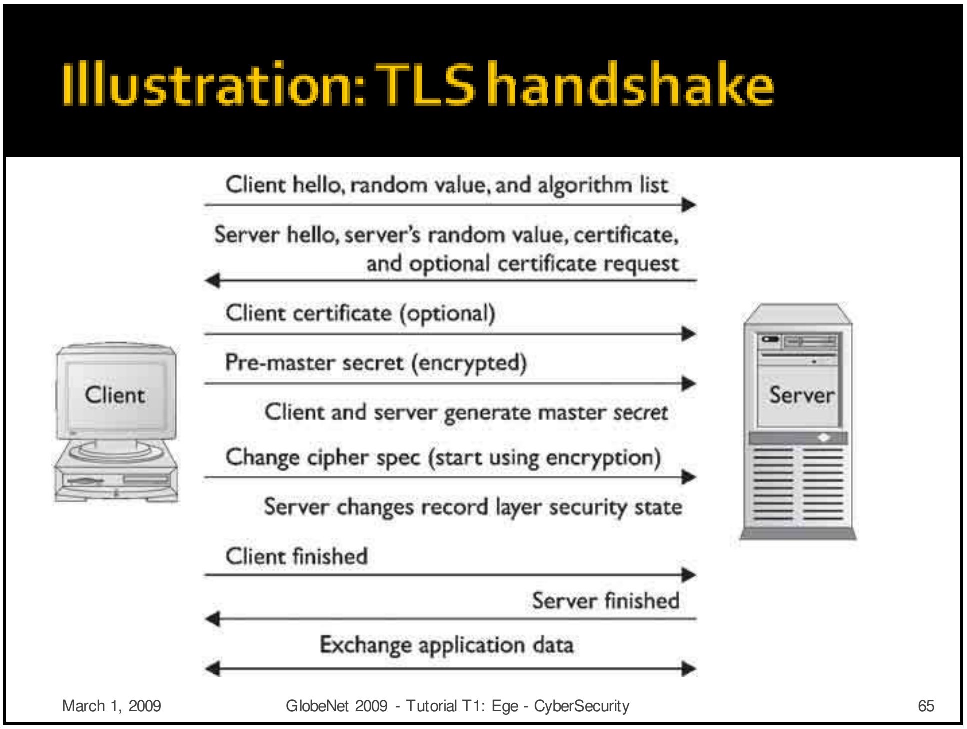


Illustration: TLS handshake

Client hello, random value, and algorithm list

Server hello, server's random value, certificate, and optional certificate request

Client certificate (optional)

Pre-master secret (encrypted)

Client and server generate master secret

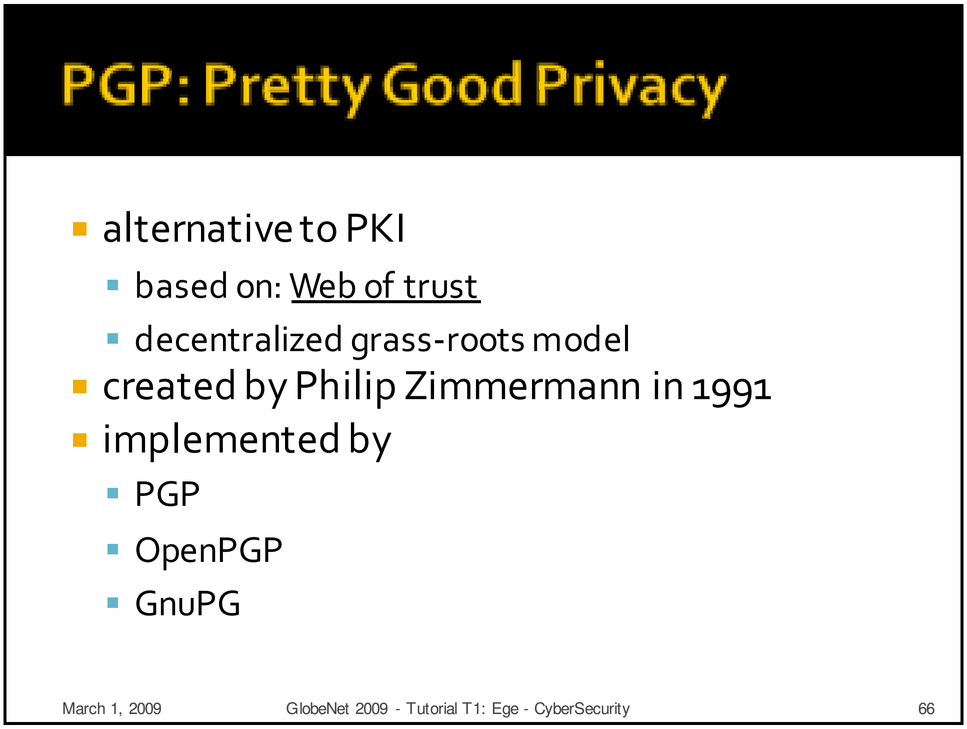
Change cipher spec (start using encryption)

Server changes record layer security state

Client finished

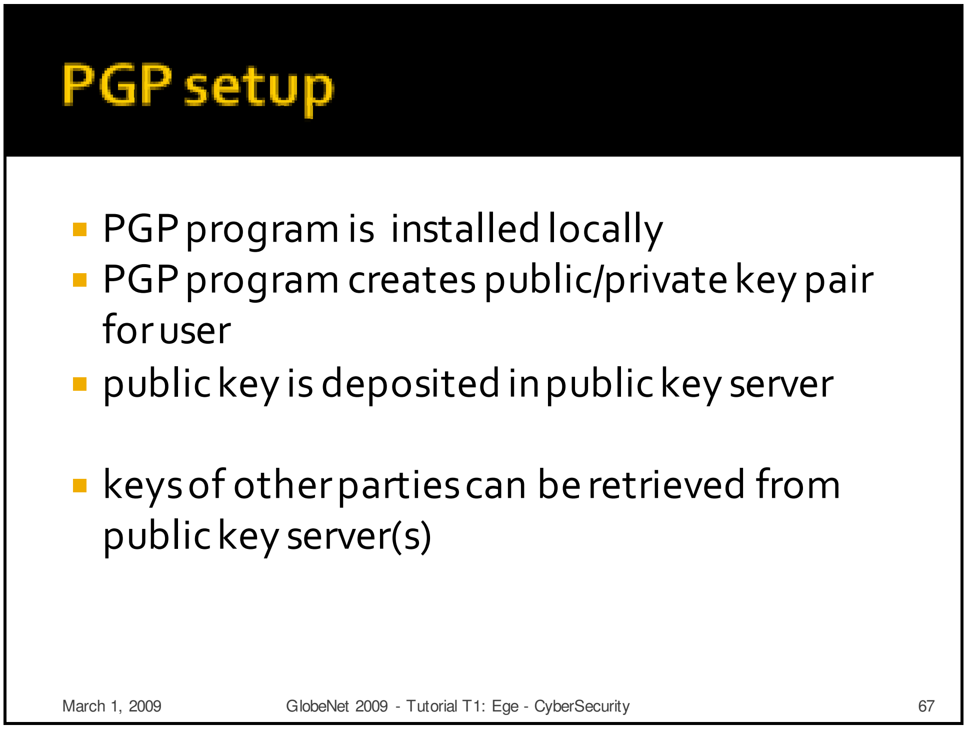
Server finished

Exchange application data



PGP: Pretty Good Privacy

- alternative to PKI
  - based on: Web of trust
  - decentralized grass-roots model
- created by Philip Zimmermann in 1991
- implemented by
  - PGP
  - OpenPGP
  - GnuPG



PGP setup

- PGP program is installed locally
- PGP program creates public/private key pair for user
- public key is deposited in public key server

- keys of other parties can be retrieved from public key server(s)

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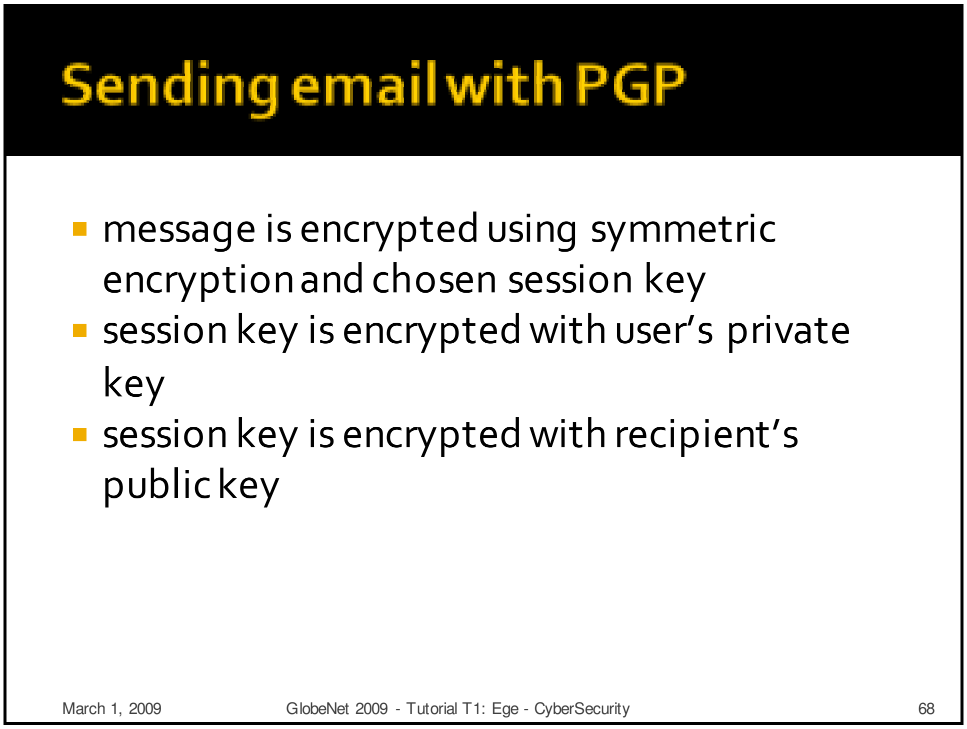

Sending email with PGP

- message is encrypted using symmetric encryption and chosen session key
- session key is encrypted with user's private key
- session key is encrypted with recipient's public key

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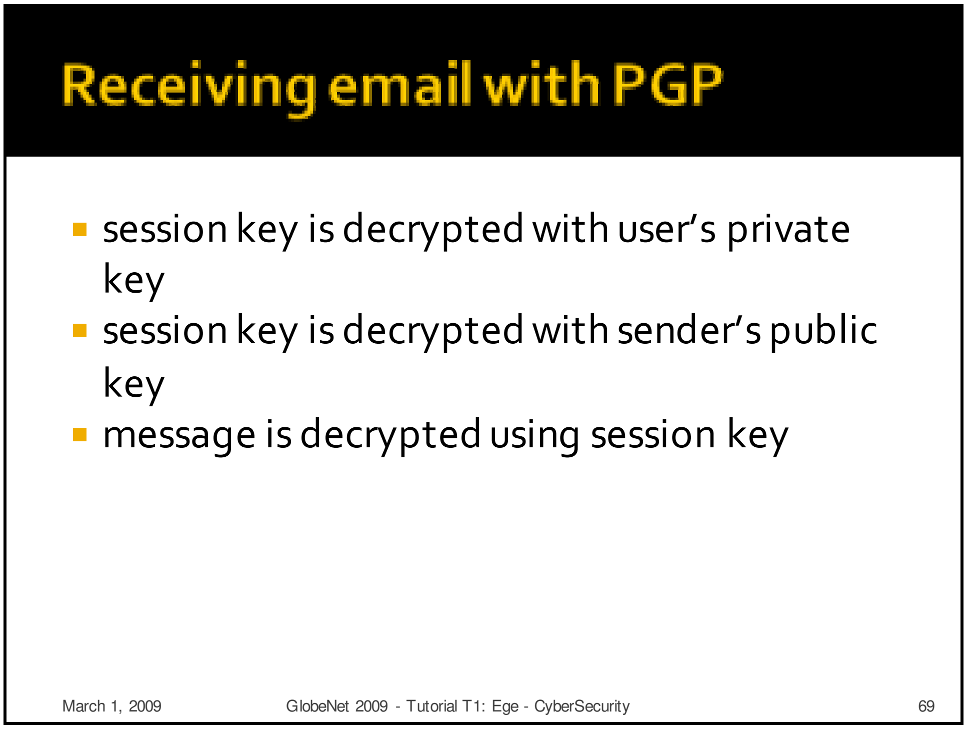
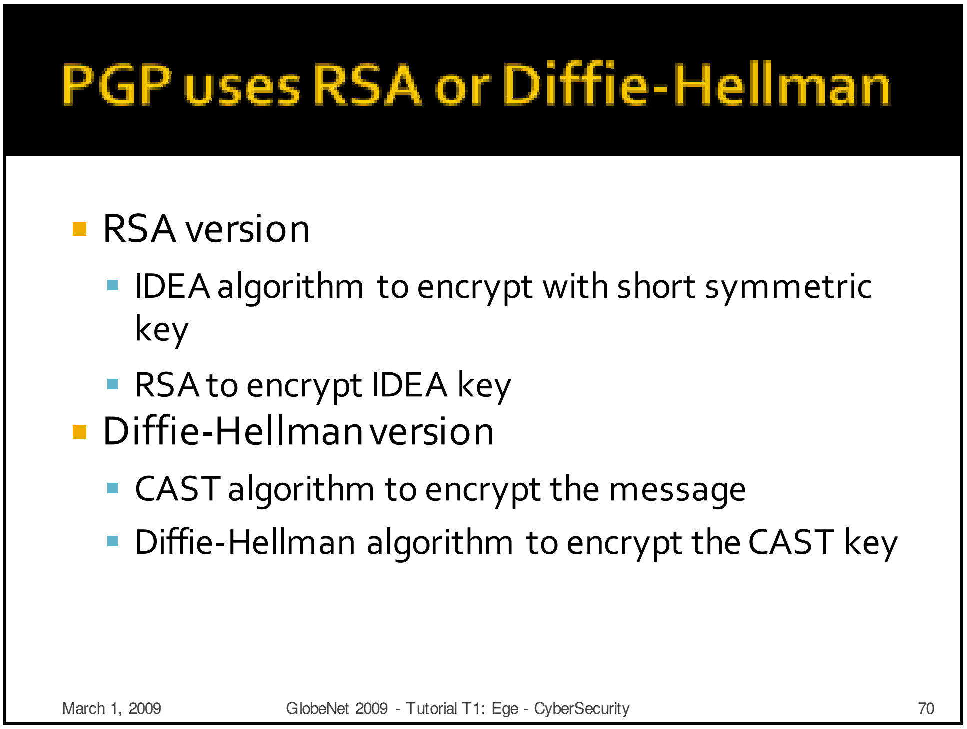


Receiving email with PGP

- session key is decrypted with user’s private key
- session key is decrypted with sender’s public key
- message is decrypted using session key



PGP uses RSA or Diffie-Hellman

- RSA version
  - IDEA algorithm to encrypt with short symmetric key
  - RSA to encrypt IDEA key
- Diffie-Hellman version
  - CAST algorithm to encrypt the message
  - Diffie-Hellman algorithm to encrypt the CAST key

PGP Digital Signature

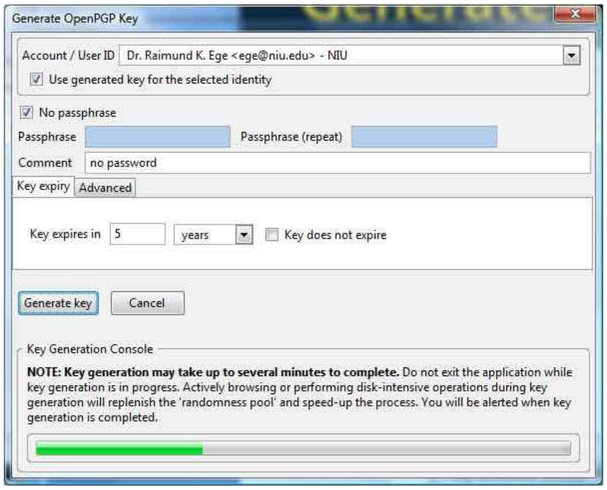
- digital signature created by hash function on user's name and other signature information
  - hash value is encrypted with the sender's private key
  - receiver uses the sender's public key to decrypt the hash value
  - decrypted hash value must match hash value sent as the digital signature for the message

PGP example: GnuPG

- Open source software
- Gnu Privacy Guard
  - gnupg.org

- Thunderbird email client plugin
  - EnigMail
  - enigmail.mozdev.org

Generate Key pair



Account / User ID: Dr. Raimund K. Ege <ege@niu.edu> - NIU

☑ Use generated key for the selected identity

☑ No passphrase

Passphrase:

Passphrase (repeat):

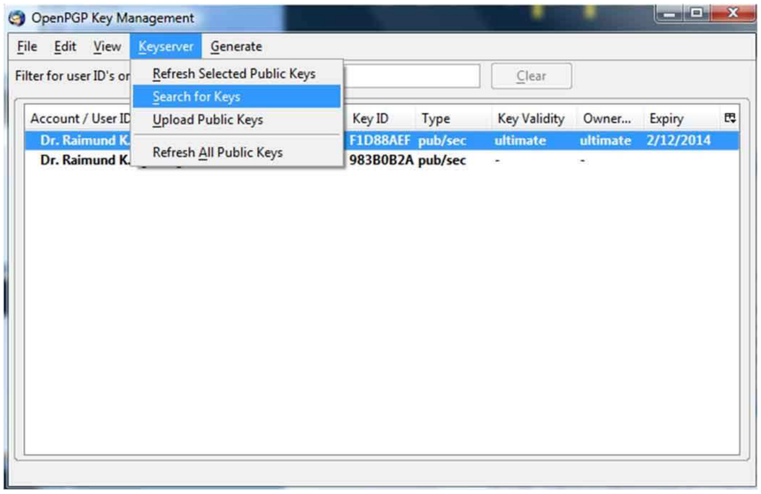
Comment: no password

Key expires in 5 years □ Key does not expire

Key Generation Console

NOTE: Key generation may take up to several minutes to complete. Do not exit the application while key generation is in progress. Actively browsing or performing disk-intensive operations during key generation will replenish the 'randomness pool' and speed-up the process. You will be alerted when key generation is completed.

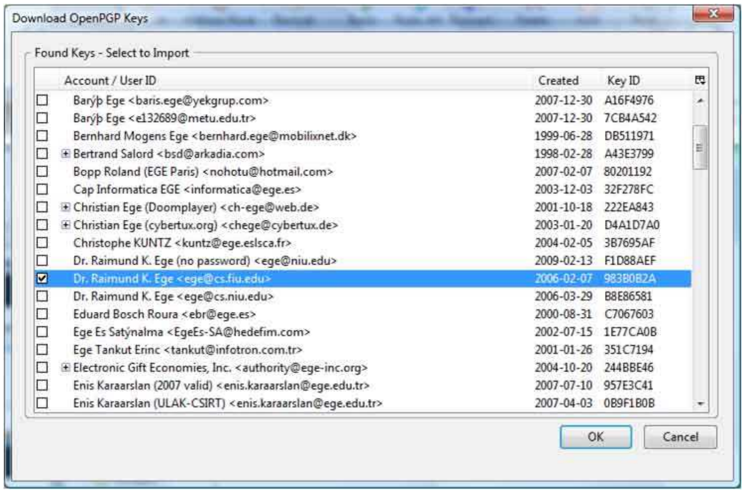
Look up public key



Filter for user ID's or

Account / User ID	Key ID	Type	Key Validity	Owner...	Expiry
Dr. Raimund K.	F1D88AEF	pub/sec	ultimate	ultimate	2/12/2014
Dr. Raimund K.	983B0B2A	pub/sec	-	-	

Look up public key

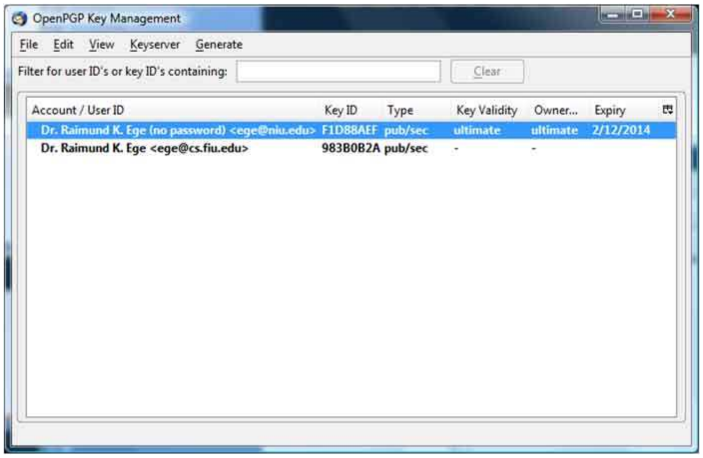


Download OpenPGP Keys

Found Keys - Select to Import

	Account / User ID	Created	Key ID
□	Barýþ Ege <baris.ege@yekgrup.com>	2007-12-30	A16F4976
□	Barýþ Ege <e132689@metu.edu.tr>	2007-12-30	7CB4A542
□	Bernhard Mogens Ege <bernhard.ege@mobilixnet.dk>	1999-06-28	DB511971
□	⊞ Bertrand Salord <bsd@arkadia.com>	1998-02-28	A43E3799
□	Bopp Roland (EGE Paris) <nohotu@hotmail.com>	2007-02-07	80201192
□	Cap Informatica EGE <informatica@ege.es>	2003-12-03	32F278FC
□	⊞ Christian Ege (Doomplayer) <ch-ege@web.de>	2001-10-18	222EA843
□	⊞ Christian Ege (cybertux.org) <chege@cybertux.de>	2003-01-20	D4A1D7A0
□	Christophe KUNTZ <kuntz@ege.eslsca.fr>	2004-02-05	3B7695AF
□	Dr. Raimund K. Ege (no password) <ege@niu.edu>	2009-02-13	F1D88AEF
☑	Dr. Raimund K. Ege <ege@cs.fiu.edu>	2006-02-07	983B0B2A
□	Dr. Raimund K. Ege <ege@cs.niu.edu>	2006-03-29	B8E86581
□	Eduard Bosch Roura <ebr@ege.es>	2000-08-31	C7067603
□	Ege Es Satýnalma <EgeEs-SA@hedefim.com>	2002-07-15	1E77CA0B
□	Ege Tankut Erinc <tankut@infotron.com.tr>	2001-01-26	351C7194
□	⊞ Electronic Gift Economies, Inc. <authority@ege-inc.org>	2004-10-20	244BBE46
□	Enis Karaarslan (2007 valid) <enis.karaarslan@ege.edu.tr>	2007-07-10	957E3C41
□	Enis Karaarslan (ULAK-CSIRT) <enis.karaarslan@ege.edu.tr>	2007-04-03	0B9F1B0B

Key Management

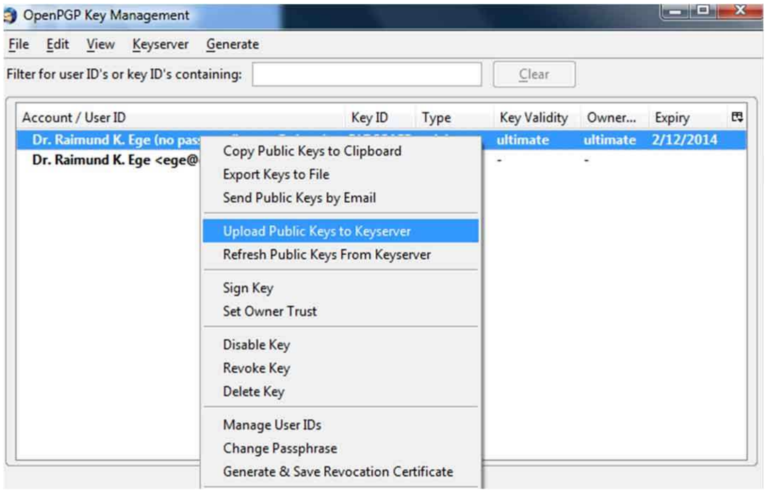


OpenPGP Key Management

Filter for user ID's or key ID's containing:

Account / User ID	Key ID	Type	Key Validity	Owner...	Expiry
Dr. Raimund K. Ege (no password) <ege@niu.edu>	F1D88AEF	pub/sec	ultimate	ultimate	2/12/2014
Dr. Raimund K. Ege <ege@cs.fiu.edu>	983B0B2A	pub/sec	-	-	

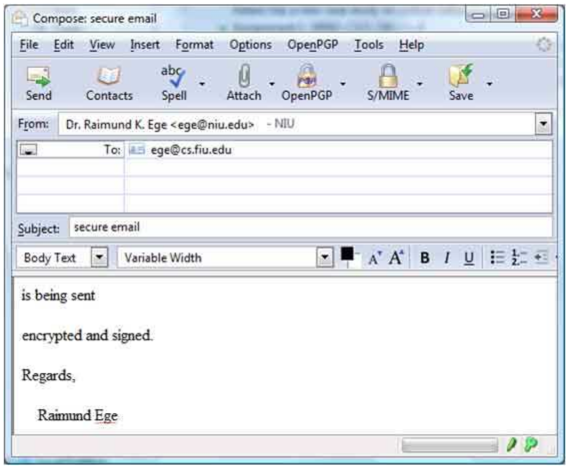
Upload public key



Filter for user ID's or key ID's containing:

Account / User ID	Key ID	Type	Key Validity	Owner...	Expiry
Dr. Raimund K. Ege (no pass			ultimate	ultimate	2/12/2014
Dr. Raimund K. Ege <ege@			-	-	

Compose email



From: Dr. Raimund K. Ege <ege@niu.edu> - NIU

To: ege@cs.fiu.edu

Subject: secure email

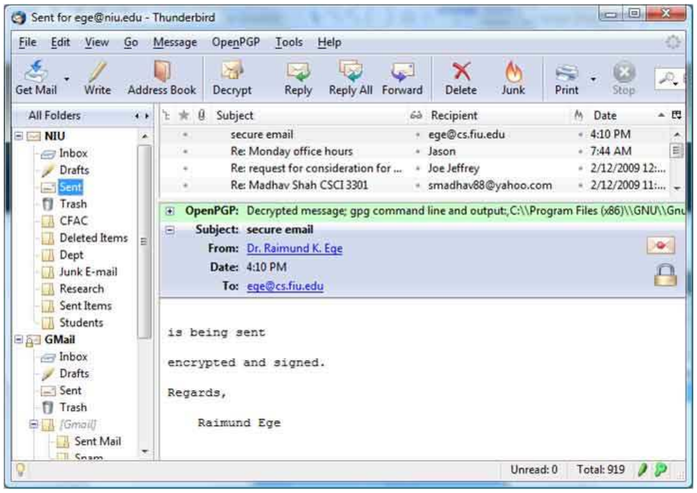
is being sent

encrypted and signed.

Regards,

Raimund Ege

Send email



Subject	Recipient	Date
secure email	ege@cs.fiu.edu	4:10 PM
Re: Monday office hours	Jason	7:44 AM
Re: request for consideration for ...	Joe Jeffrey	2/12/2009 12:...
Re: Madhav Shah CSCI 3301	smadhav88@yahoo.com	2/12/2009 11:...

OpenPGP: Decrypted message; gpg command line and output:, C:\\Program Files (x86)\\GNU\\Gnu

Subject: secure email

From: Dr. Raimund K. Ege

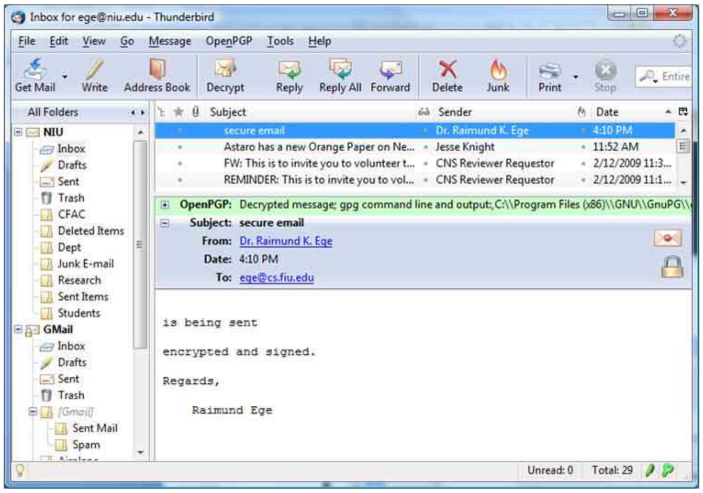
Date: 4:10 PM

To: ege@cs.fiu.edu

```
is being sent

encrypted and signed.

Regards,

    Raimund Ege
```

Unread: 0 Total: 919

Receive email



Subject	Sender	Date
secure email	Dr. Raimund K. Ege	4:10 PM
Astaro has a new Orange Paper on Ne...	Jesse Knight	11:52 AM
FW: This is to invite you to volunteer t...	CNS Reviewer Requestor	2/12/2009 11:3...
REMINDER: This is to invite you to vol...	CNS Reviewer Requestor	2/12/2009 11:1...

OpenPGP: Decrypted message; gpg command line and output:, C:\\Program Files (x86)\\GNU\\GnuPG\\

Subject: secure email

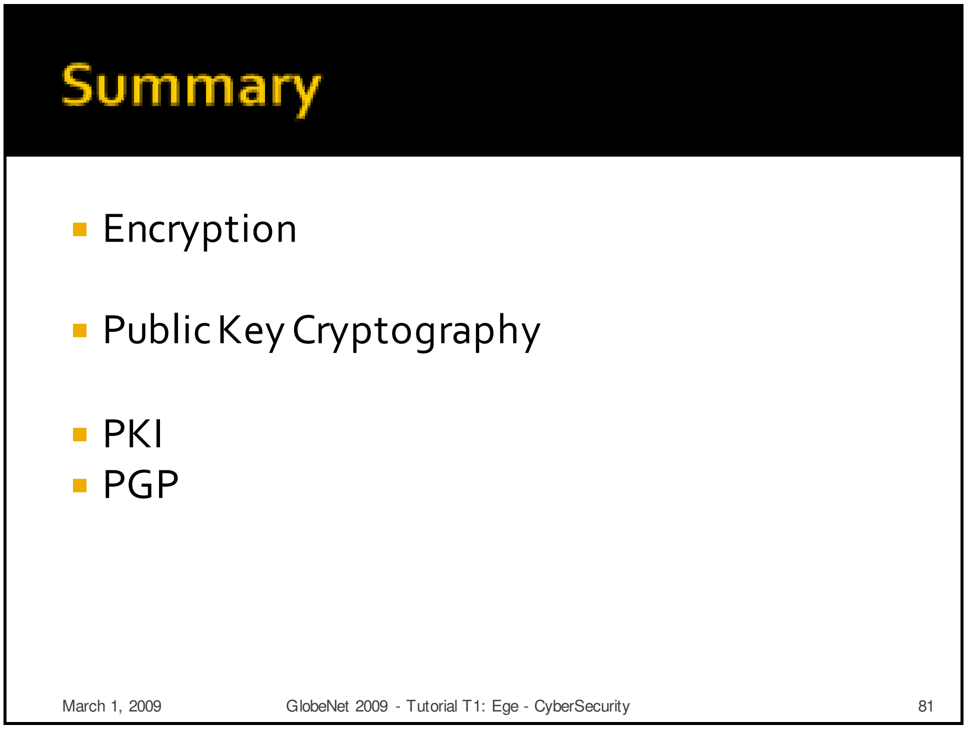
From: Dr. Raimund K. Ege

Date: 4:10 PM

To: ege@cs.fiu.edu

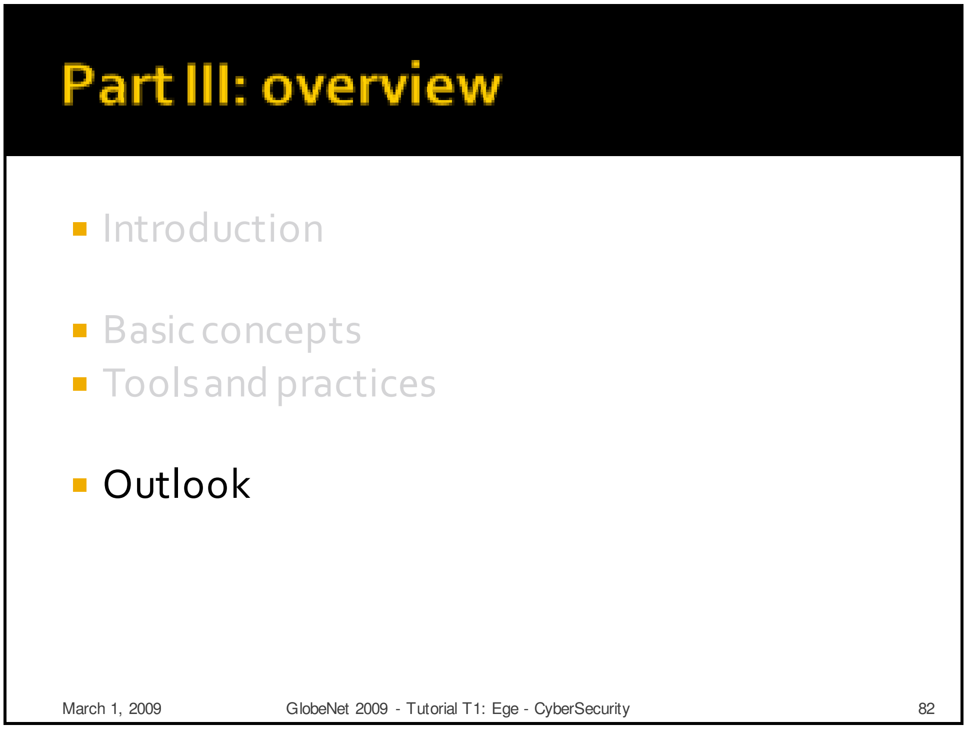
```
is being sent

encrypted and signed.

Regards,

    Raimund Ege
```

Unread: 0 Total: 29



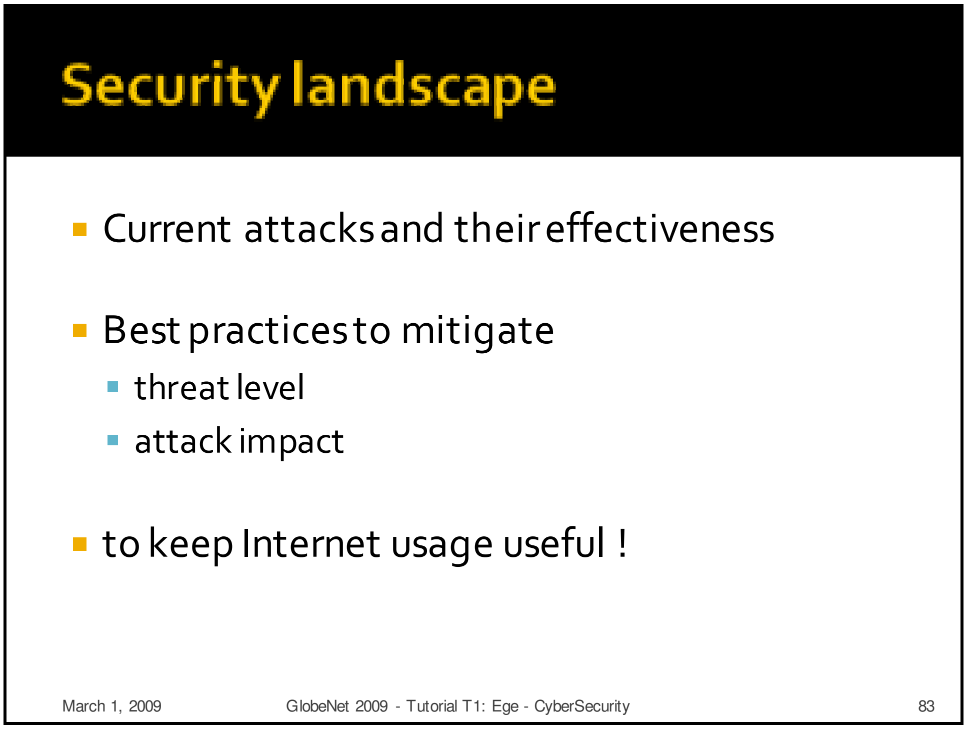
Summary

- Encryption
- Public Key Cryptography
- PKI
- PGP



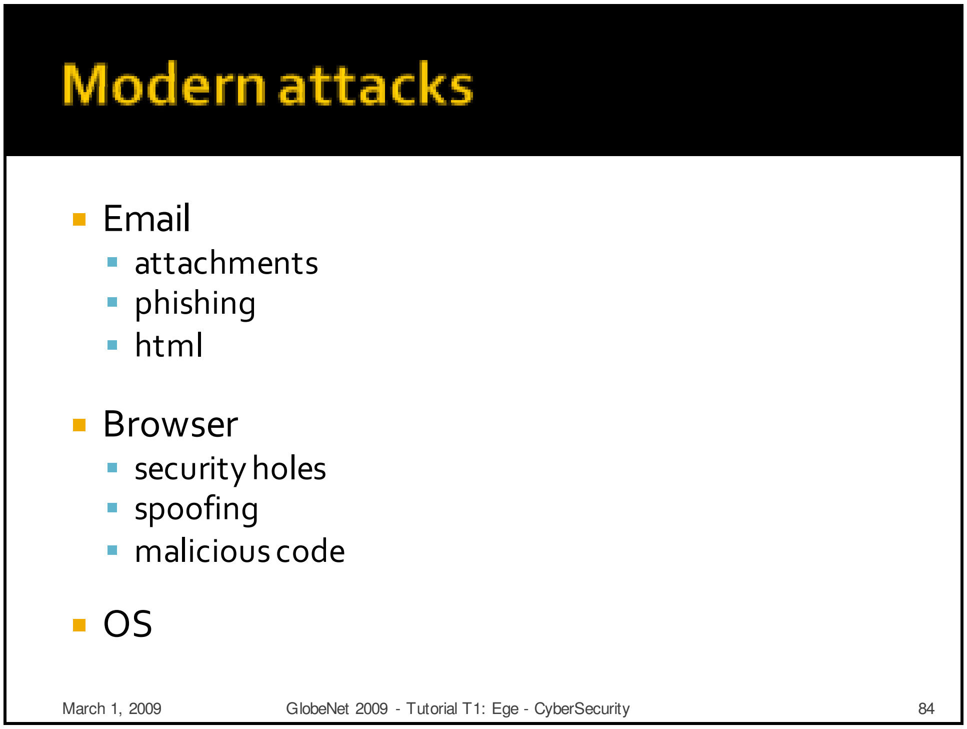
Part III: overview

- Introduction
- Basic concepts
- Tools and practices
- Outlook



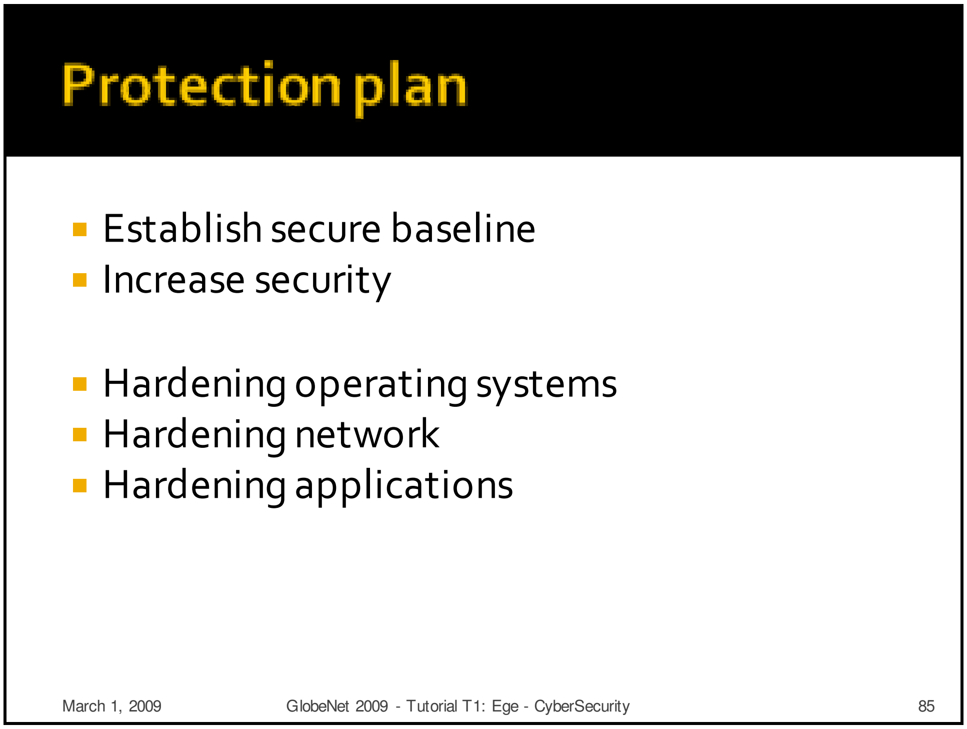
Security landscape

- Current attacks and their effectiveness
- Best practices to mitigate
  - threat level
  - attack impact
- to keep Internet usage useful !



Modern attacks

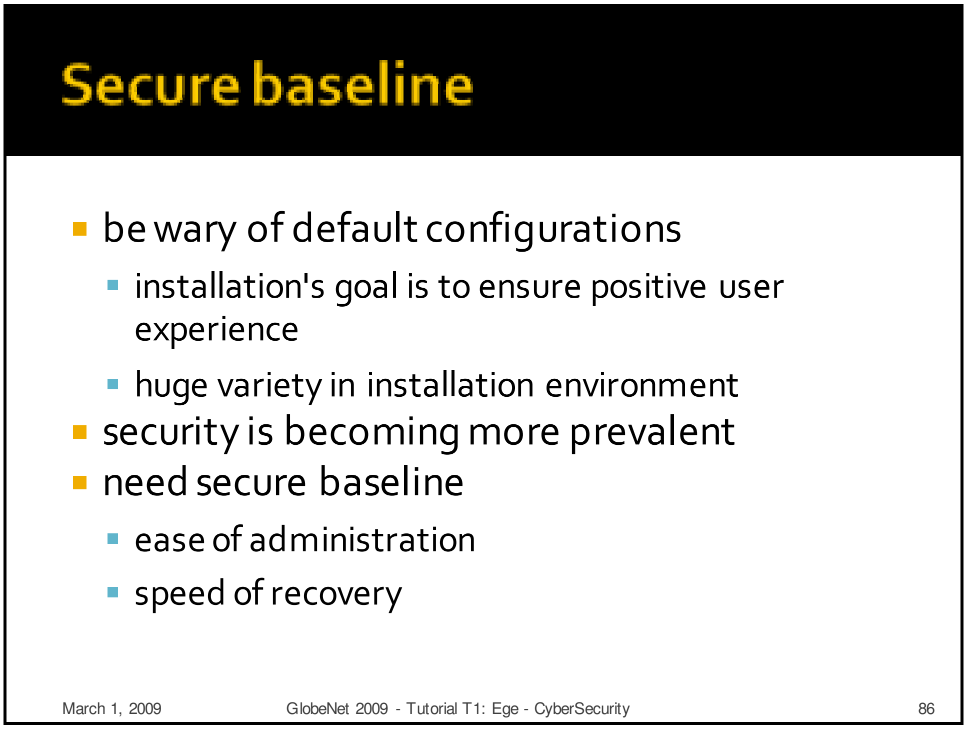
- Email
  - attachments
  - phishing
  - html
- Browser
  - security holes
  - spoofing
  - malicious code
- OS



Protection plan

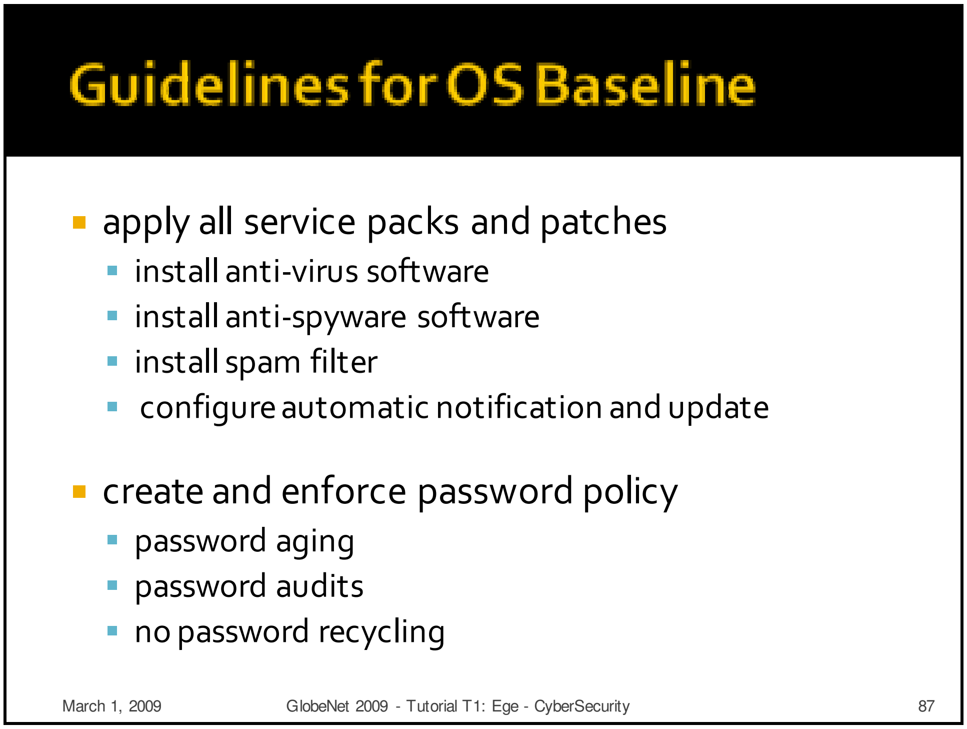
- Establish secure baseline
- Increase security

- Hardening operating systems
- Hardening network
- Hardening applications



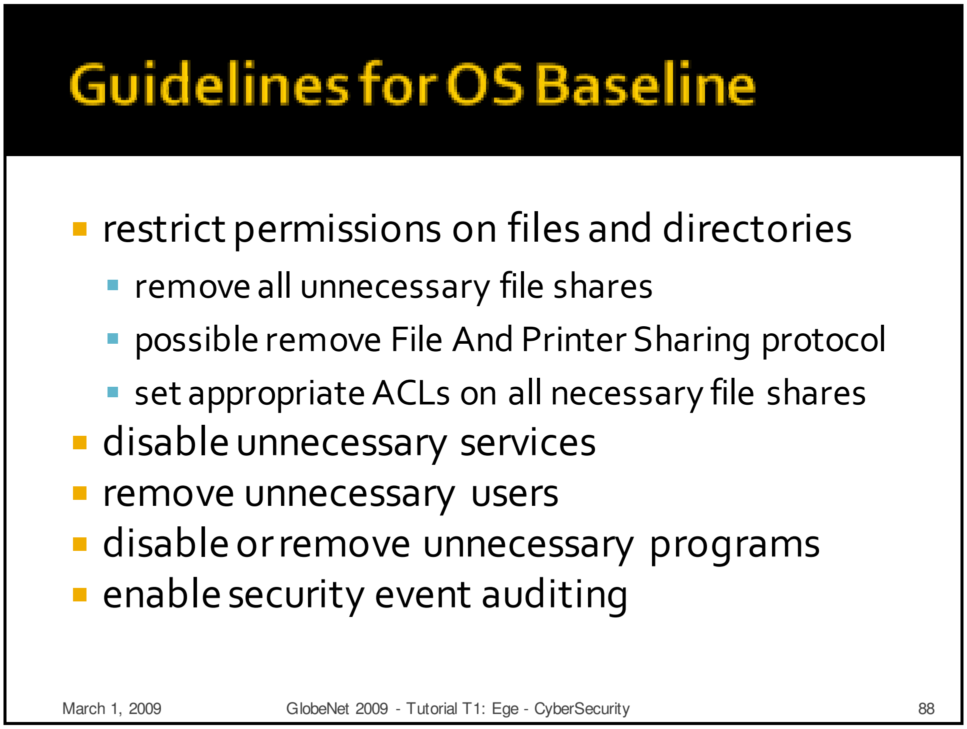
Secure baseline

- be wary of default configurations
  - installation's goal is to ensure positive user experience
  - huge variety in installation environment
- security is becoming more prevalent
- need secure baseline
  - ease of administration
  - speed of recovery



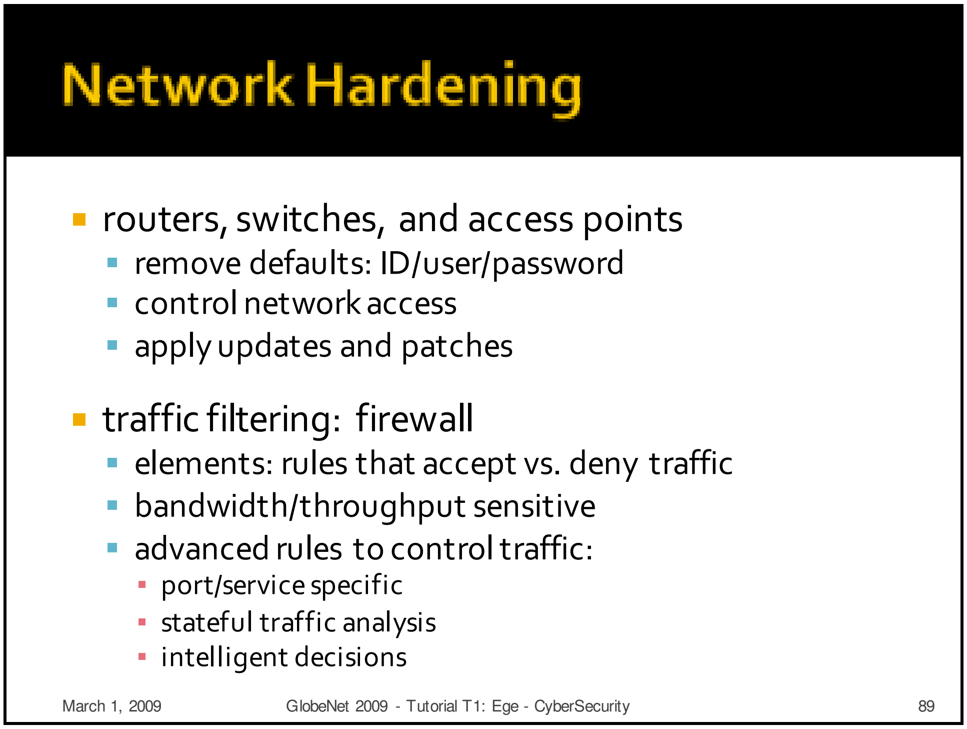
Guidelines for OS Baseline

- apply all service packs and patches
  - install anti-virus software
  - install anti-spyware software
  - install spam filter
  - configure automatic notification and update
- create and enforce password policy
  - password aging
  - password audits
  - no password recycling



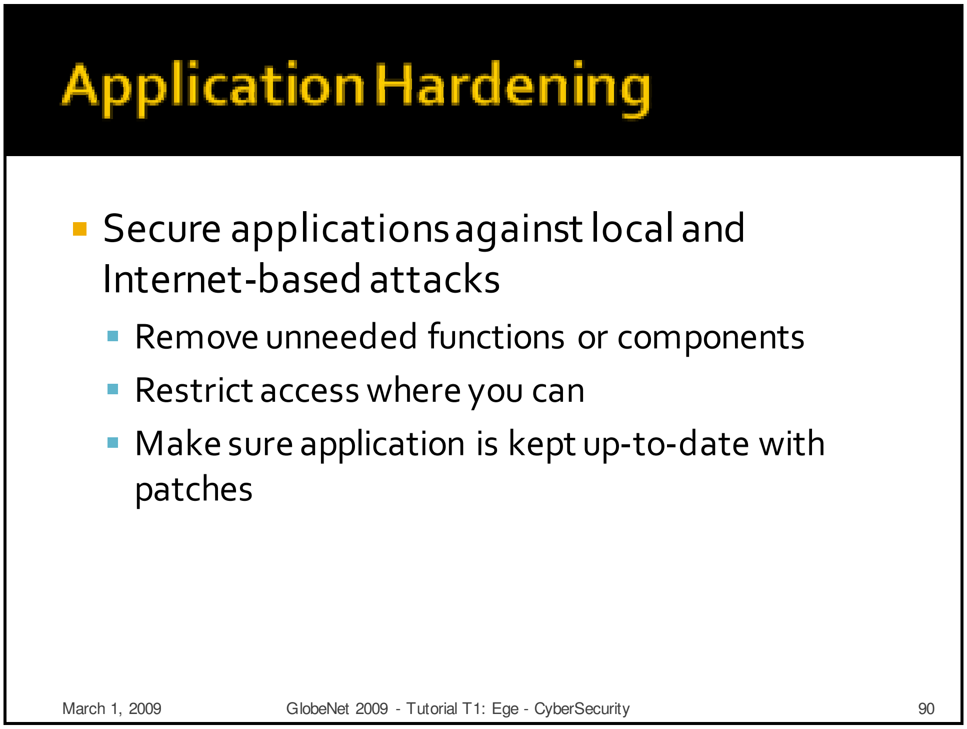
Guidelines for OS Baseline

- restrict permissions on files and directories
  - remove all unnecessary file shares
  - possible remove File And Printer Sharing protocol
  - set appropriate ACLs on all necessary file shares
- disable unnecessary services
- remove unnecessary users
- disable or remove unnecessary programs
- enable security event auditing



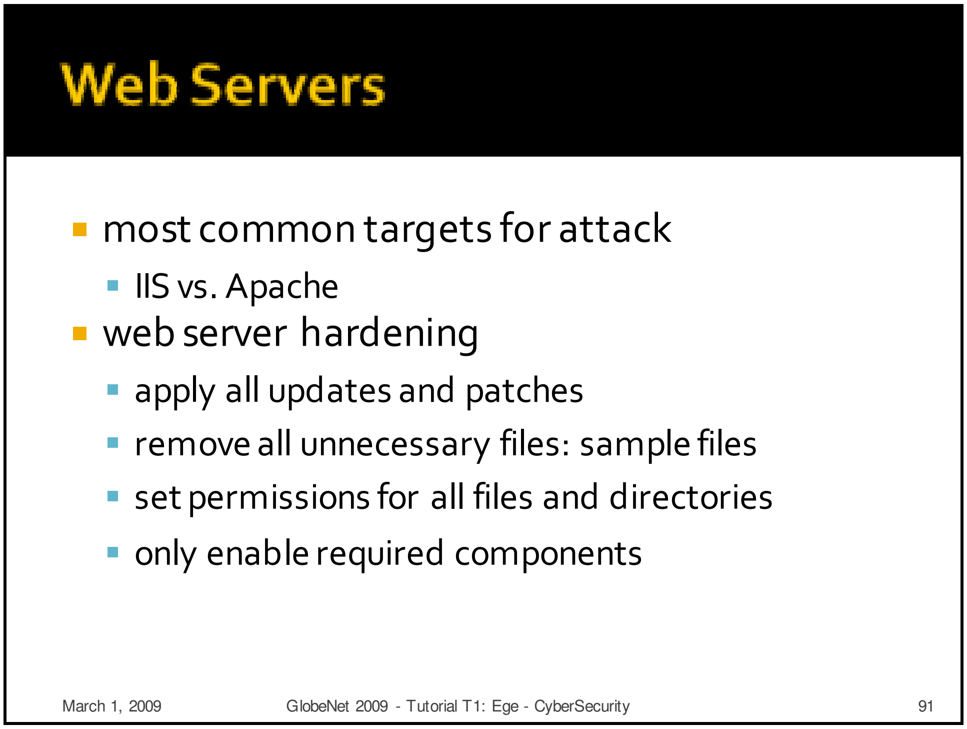
Network Hardening

- routers, switches, and access points
  - remove defaults: ID/user/password
  - control network access
  - apply updates and patches
- traffic filtering: firewall
  - elements: rules that accept vs. deny traffic
  - bandwidth/throughput sensitive
  - advanced rules to control traffic:
    - port/service specific
    - stateful traffic analysis
    - intelligent decisions



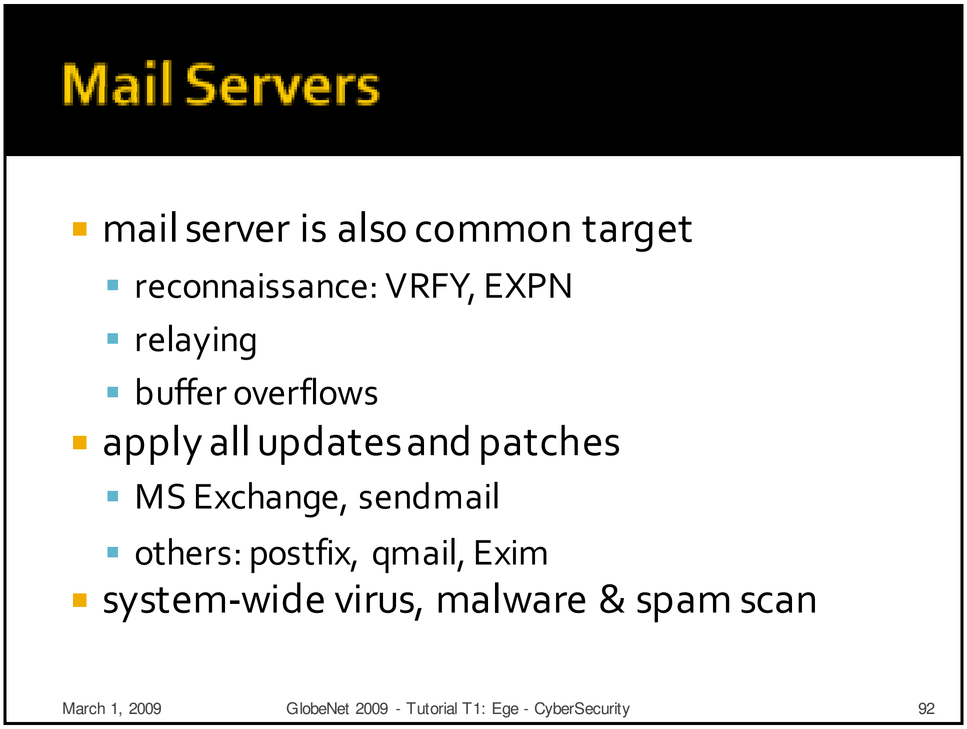
Application Hardening

- Secure applications against local and Internet-based attacks
  - Remove unneeded functions or components
  - Restrict access where you can
  - Make sure application is kept up-to-date with patches



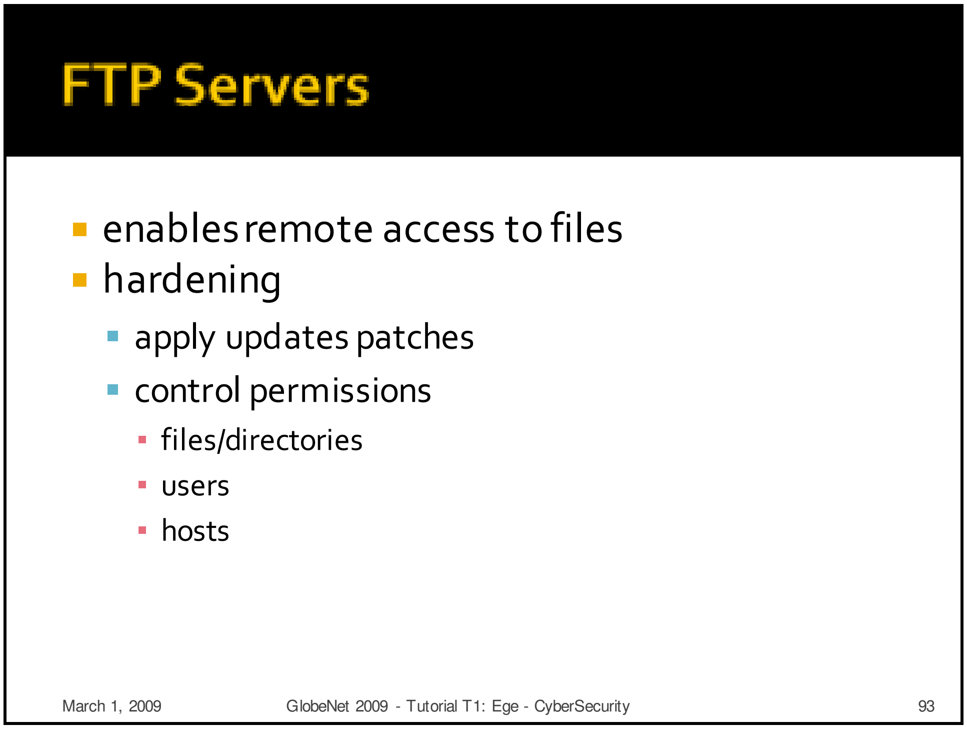
Web Servers

- most common targets for attack
  - IIS vs. Apache
- web server hardening
  - apply all updates and patches
  - remove all unnecessary files: sample files
  - set permissions for all files and directories
  - only enable required components



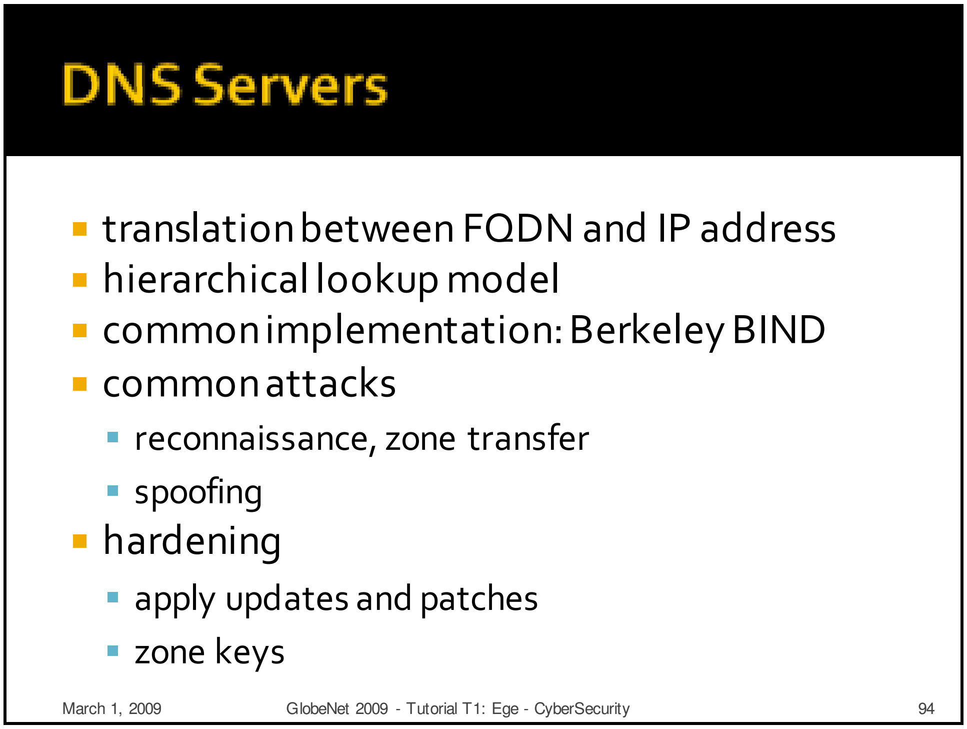
Mail Servers

- mail server is also common target
  - reconnaissance: VRFY, EXPN
  - relaying
  - buffer overflows
- apply all updates and patches
  - MS Exchange, sendmail
  - others: postfix, qmail, Exim
- system-wide virus, malware & spam scan



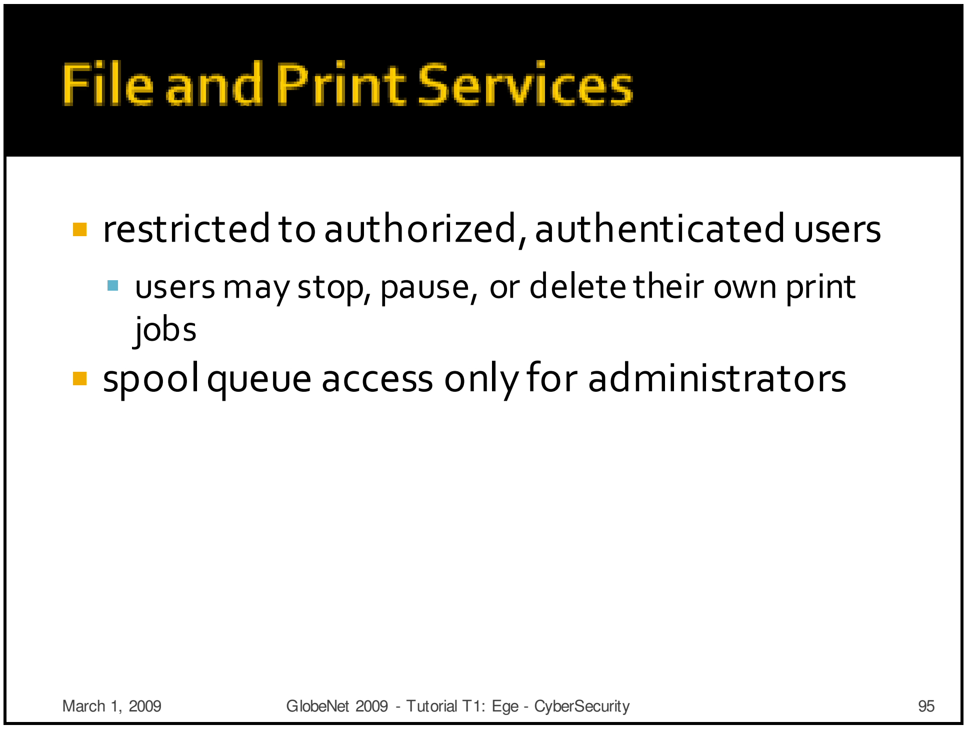
FTP Servers

- enables remote access to files
- hardening
  - apply updates patches
  - control permissions
    - files/directories
    - users
    - hosts



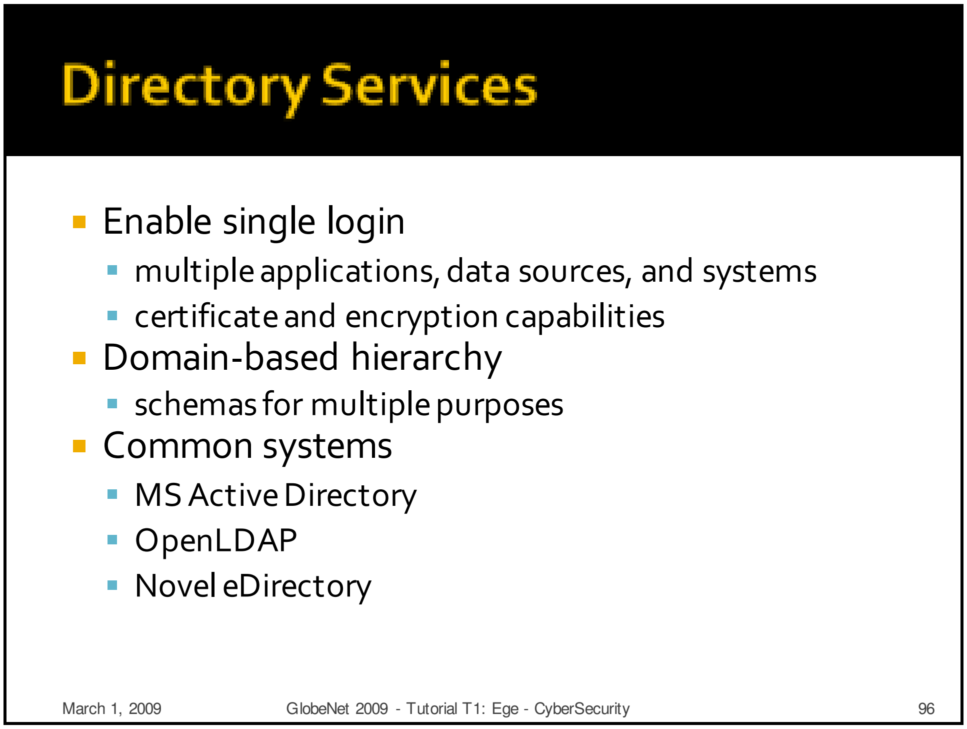
DNS Servers

- translation between FQDN and IP address
- hierarchical lookup model
- common implementation: Berkeley BIND
- common attacks
  - reconnaissance, zone transfer
  - spoofing
- hardening
  - apply updates and patches
  - zone keys



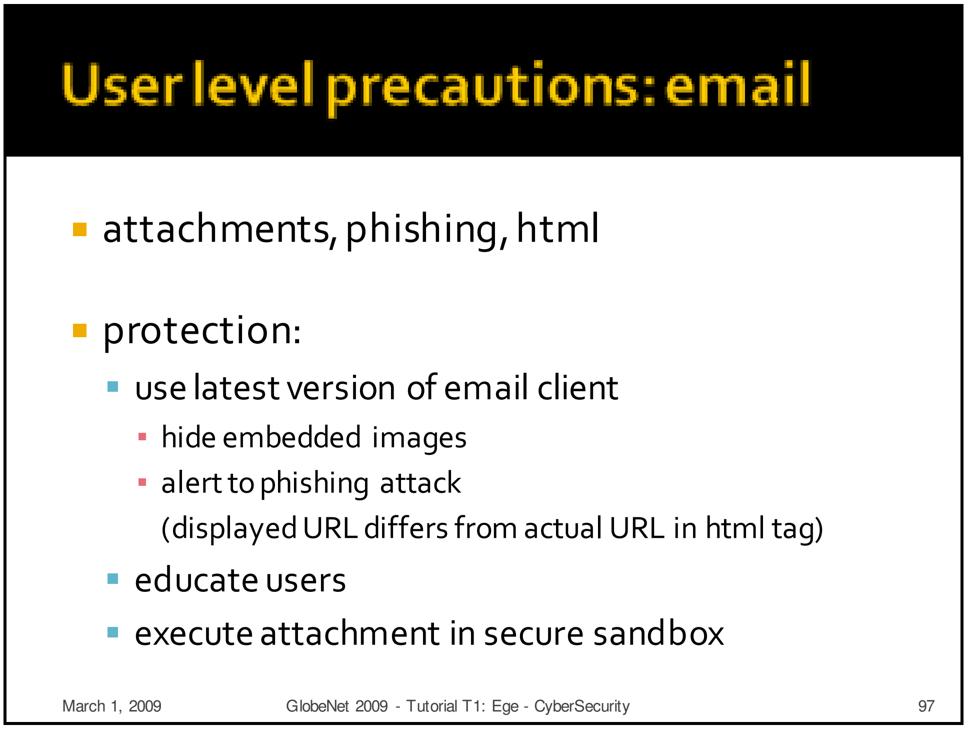
File and Print Services

- restricted to authorized, authenticated users
  - users may stop, pause, or delete their own print jobs
- spool queue access only for administrators



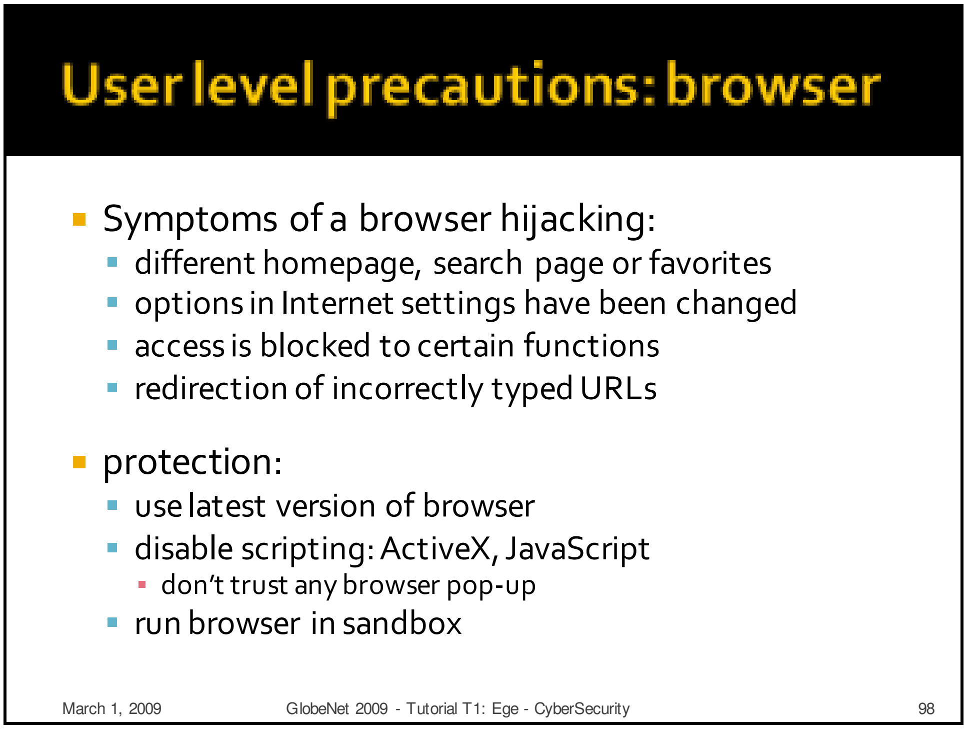
Directory Services

- Enable single login
  - multiple applications, data sources, and systems
  - certificate and encryption capabilities
- Domain-based hierarchy
  - schemas for multiple purposes
- Common systems
  - MS Active Directory
  - OpenLDAP
  - Novel eDirectory



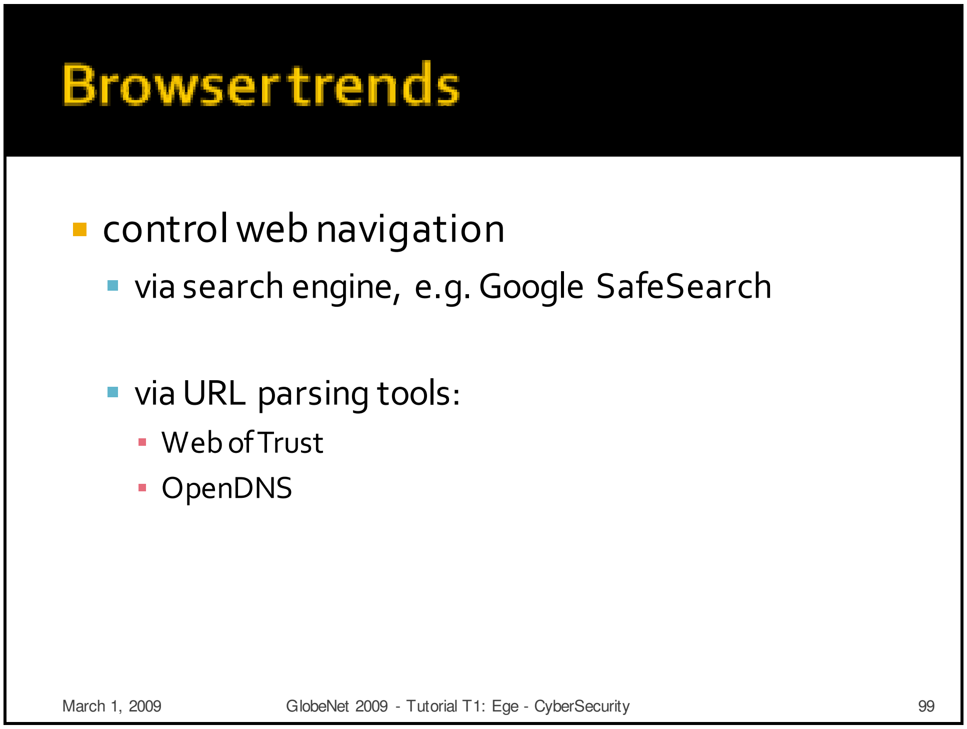
User level precautions: email

- attachments, phishing, html
- protection:
  - use latest version of email client
    - hide embedded images
    - alert to phishing attack
      (displayed URL differs from actual URL in html tag)
  - educate users
  - execute attachment in secure sandbox



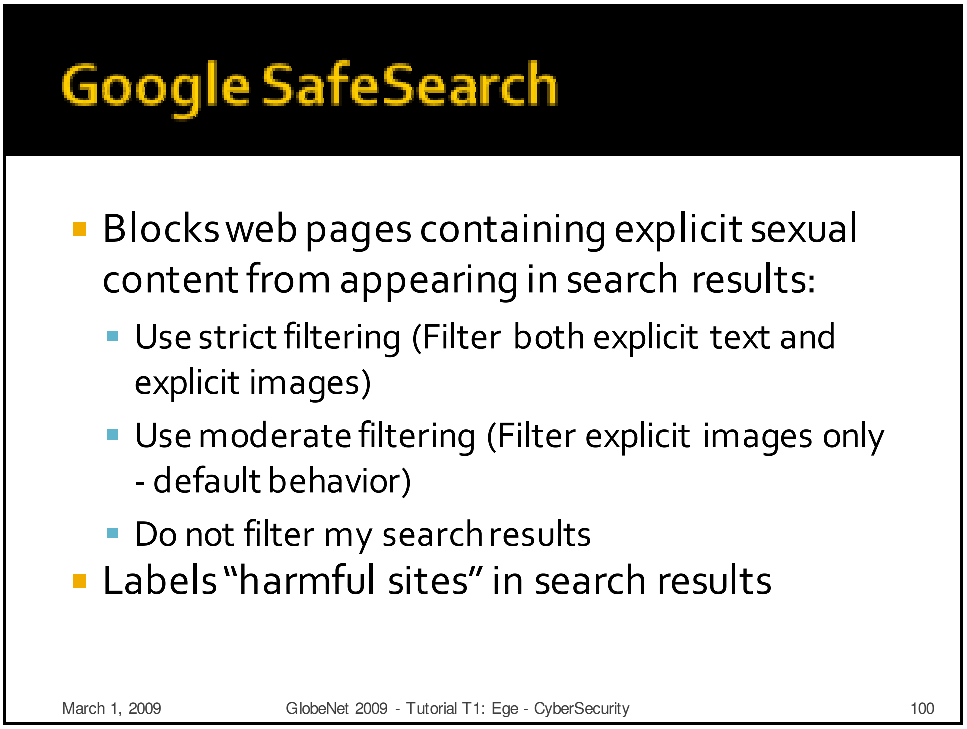
User level precautions: browser

- Symptoms of a browser hijacking:
  - different homepage, search page or favorites
  - options in Internet settings have been changed
  - access is blocked to certain functions
  - redirection of incorrectly typed URLs
- protection:
  - use latest version of browser
  - disable scripting: ActiveX, JavaScript
    - don't trust any browser pop-up
  - run browser in sandbox



Browser trends

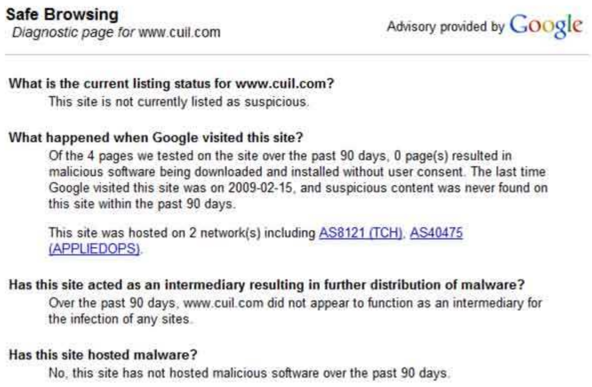
- control web navigation
  - via search engine, e.g. Google SafeSearch
  - via URL parsing tools:
    - Web of Trust
    - OpenDNS



Google SafeSearch

- Blocks web pages containing explicit sexual content from appearing in search results:
  - Use strict filtering (Filter both explicit text and explicit images)
  - Use moderate filtering (Filter explicit images only - default behavior)
  - Do not filter my search results
- Labels "harmful sites" in search results

Harmful sites?



Safe Browsing
Diagnostic page for www.cuil.com

What is the current listing status for www.cuil.com?

This site is not currently listed as suspicious.

What happened when Google visited this site?

Of the 4 pages we tested on the site over the past 90 days, 0 page(s) resulted in malicious software being downloaded and installed without user consent. The last time Google visited this site was on 2009-02-15, and suspicious content was never found on this site within the past 90 days.

This site was hosted on 2 network(s) including AS8121 (TCH), AS40475 (APPLIEDOPS).

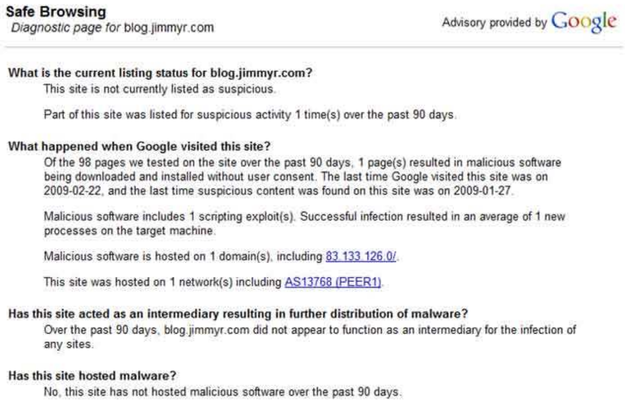
Has this site acted as an intermediary resulting in further distribution of malware?

Over the past 90 days, www.cuil.com did not appear to function as an intermediary for the infection of any sites.

Has this site hosted malware?

No, this site has not hosted malicious software over the past 90 days.

Harmful sites?



Safe Browsing
Diagnostic page for blog.jimmyr.com

What is the current listing status for blog.jimmyr.com?

This site is not currently listed as suspicious.

Part of this site was listed for suspicious activity 1 time(s) over the past 90 days.

What happened when Google visited this site?

Of the 98 pages we tested on the site over the past 90 days, 1 page(s) resulted in malicious software being downloaded and installed without user consent. The last time Google visited this site was on 2009-02-22, and the last time suspicious content was found on this site was on 2009-01-27.

Malicious software includes 1 scripting exploit(s). Successful infection resulted in an average of 1 new processes on the target machine.

Malicious software is hosted on 1 domain(s), including 83.133.126.0/.

This site was hosted on 1 network(s) including AS13768 (PEER1).

Has this site acted as an intermediary resulting in further distribution of malware?

Over the past 90 days, blog.jimmyr.com did not appear to function as an intermediary for the infection of any sites.

Has this site hosted malware?

No, this site has not hosted malicious software over the past 90 days.

Harmful sites?

"This site may harm your computer" on every search result?!?!
1/31/2009 09:02:00 AM

If you did a Google search between 6:30 a.m. PST and 7:25 a.m. PST this morning, you likely saw that the message "This site may harm your computer" accompanied each and every search result. This was clearly an error, and we are very sorry for the inconvenience caused to our users.

What happened? Very simply, human error. Google flags search results with the message "This site may harm your computer" if the site is known to install malicious software in the background or otherwise surreptitiously. We do this to protect our users against visiting sites that could harm their computers. We maintain a list of such sites through both manual and automated methods. We work with a non-profit called StopBadware.org to come up with criteria for maintaining this list, and to provide simple processes for webmasters to remove their site from the list.

www.OpenDNS.com

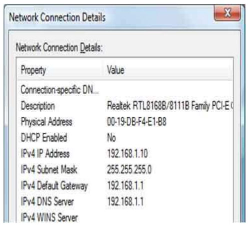
OpenDNS

- customized DNS lookup
  - modify name server setting
- filters FQDN translation to IP address
- provides:
  - anti phishing
  - parental controls
  - useful shortcuts
  - type correction

www.OpenDNS.com

OpenDNS

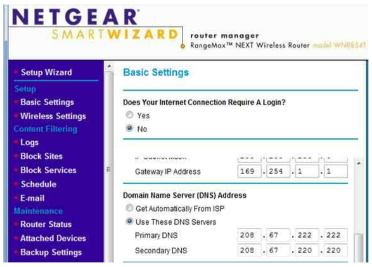
- setup via DNS server setting at:
  - individual workstation IP connection settings
  - router for whole network



Network Connection Details

Network Connection Details:

Property	Value
Connection-specific DN...	
Description	Realtek RTL8168B/8111B Family PCI-E (
Physical Address	00-19-DB-F4-E1-B8
DHCP Enabled	No
IPv4 IP Address	192.168.1.10
IPv4 Subnet Mask	255.255.255.0
IPv4 Default Gateway	192.168.1.1
IPv4 DNS Server	192.168.1.1
IPv4 WINS Server	



Basic Settings

Does Your Internet Connection Require A Login?

○ Yes
● No

Gateway IP Address 169 . 254 . 1 . 1

Domain Name Server (DNS) Address

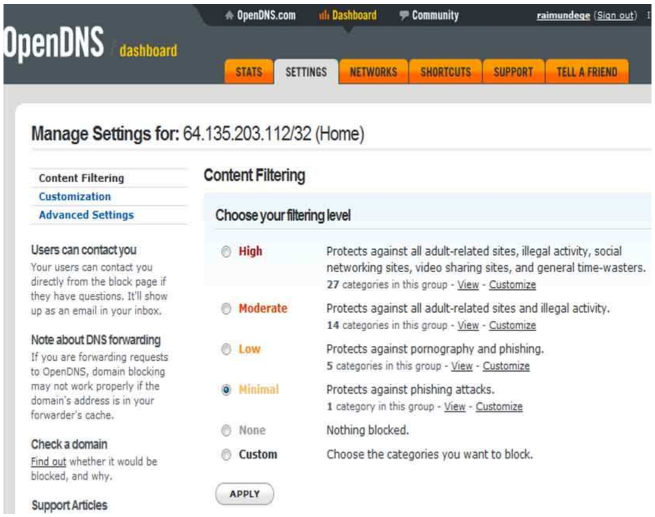
○ Get Automatically From ISP
● Use These DNS Servers

Primary DNS 208 . 67 . 222 . 222

Secondary DNS 208 . 67 . 220 . 220

- control via account at www.opendns.com

www.OpenDNS.com



Manage Settings for: 64.135.203.112/32 (Home)

Users can contact you

Your users can contact you directly from the block page if they have questions. It'll show up as an email in your inbox.

Note about DNS forwarding

If you are forwarding requests to OpenDNS, domain blocking may not work properly if the domain's address is in your forwarder's cache.

Check a domain

Find out whether it would be blocked, and why.

Support Articles

Content Filtering

Choose your filtering level

○ High — Protects against all adult-related sites, illegal activity, social networking sites, video sharing sites, and general time-wasters. 27 categories in this group - View - Customize

○ Moderate — Protects against all adult-related sites and illegal activity. 14 categories in this group - View - Customize

○ Low — Protects against pornography and phishing. 5 categories in this group - View - Customize

● Minimal — Protects against phishing attacks. 1 category in this group - View - Customize

○ None — Nothing blocked.

○ Custom — Choose the categories you want to block.

APPLY

Web of Trust

WOT WEB OF TRUST

- www.mywot.com
- community rating of websites
- implemented as browser add-on
  - Firefox or Internet Explorer
- as of February 2009:
  - Number of rated sites: 21,625,169
  - New this month: 275,365
  - Number of dangerous sites: 1,534,704

www.mywot.com

WOT WEB OF TRUST

- annotates search results
- rates website

🟢 Excellent reputation

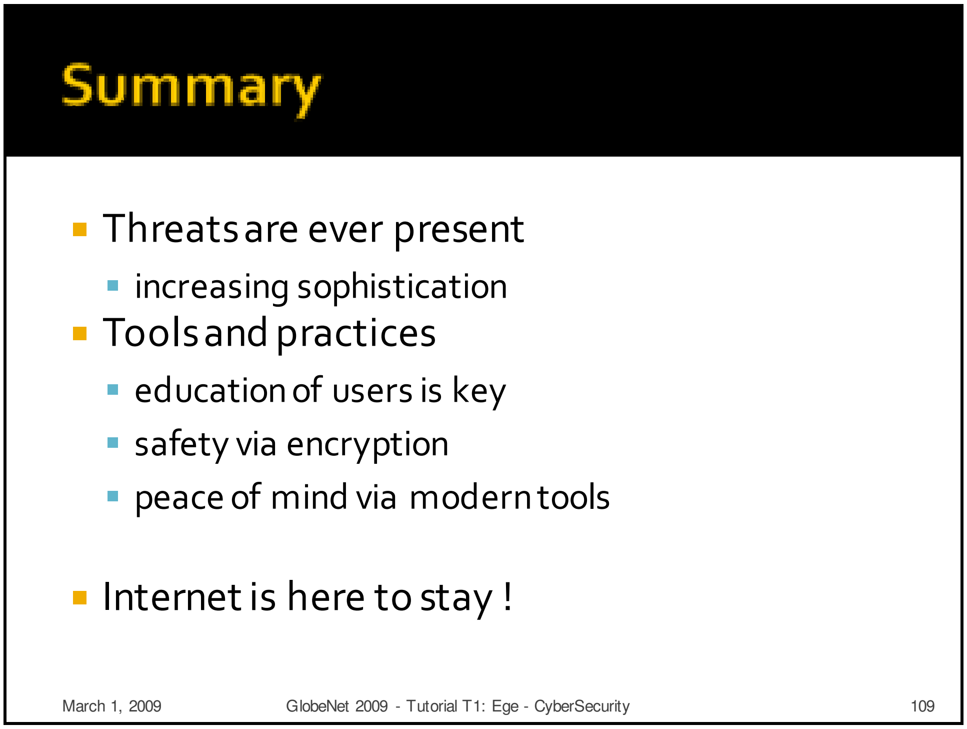
🟢 Good reputation

🟡 Unsatisfactory reputation

🟠 Poor reputation

🔴 Very poor reputation

- controls hyperlinks on page
- demo at www.mywot.com/demo



Summary

- Threats are ever present
  - increasing sophistication
- Tools and practices
  - education of users is key
  - safety via encryption
  - peace of mind via modern tools
- Internet is here to stay !