Port Operations, Safety, Information Technology Seminar

Biometrics 101

Brad Jenson	Port of Seattle
Walter Hamilton	IDTP
Christer Wilkinson	DMJMH+N

April 25
1:30pm

April 24-26
Jacksonville FL

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Christer Wilkinson

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Access Control

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Typical card reader

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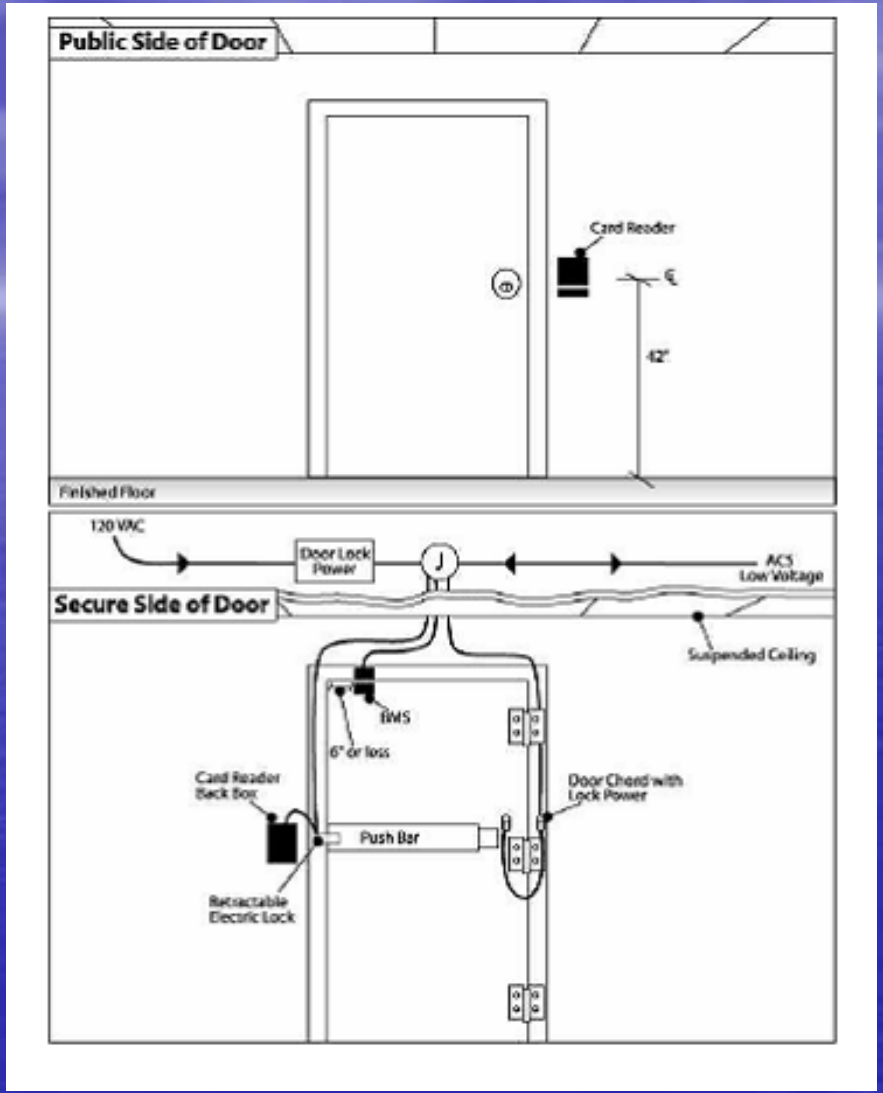
Typical Door



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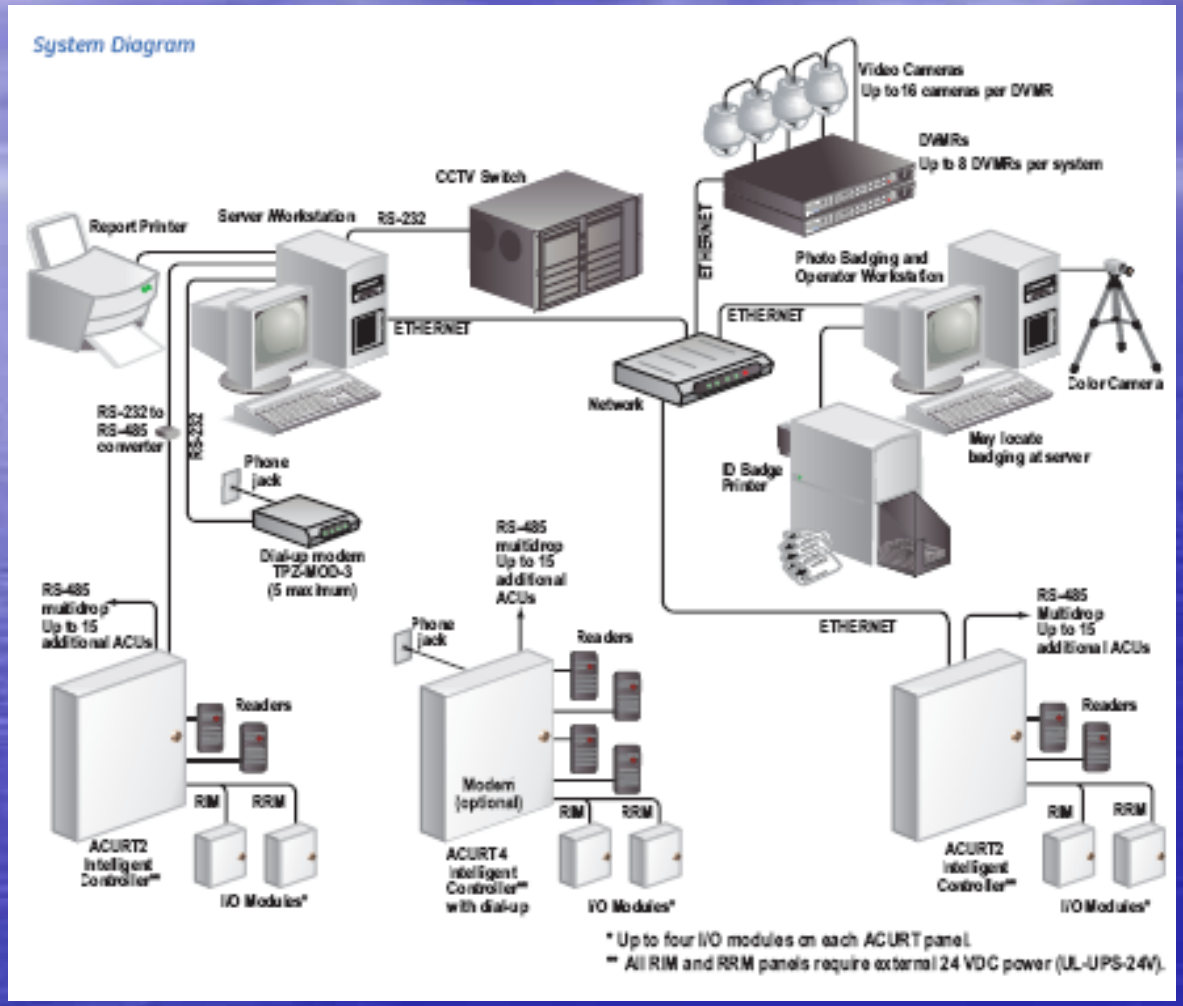
Typical Access control system



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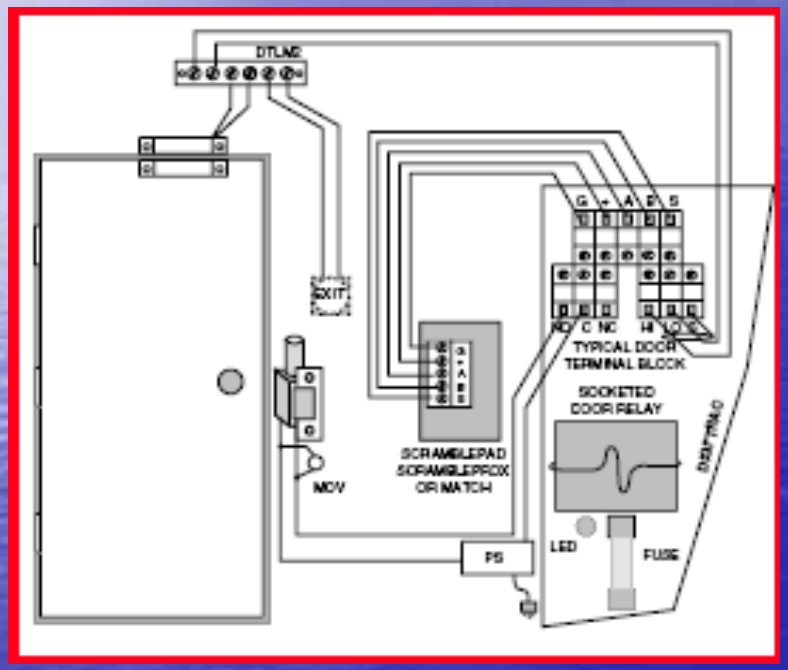
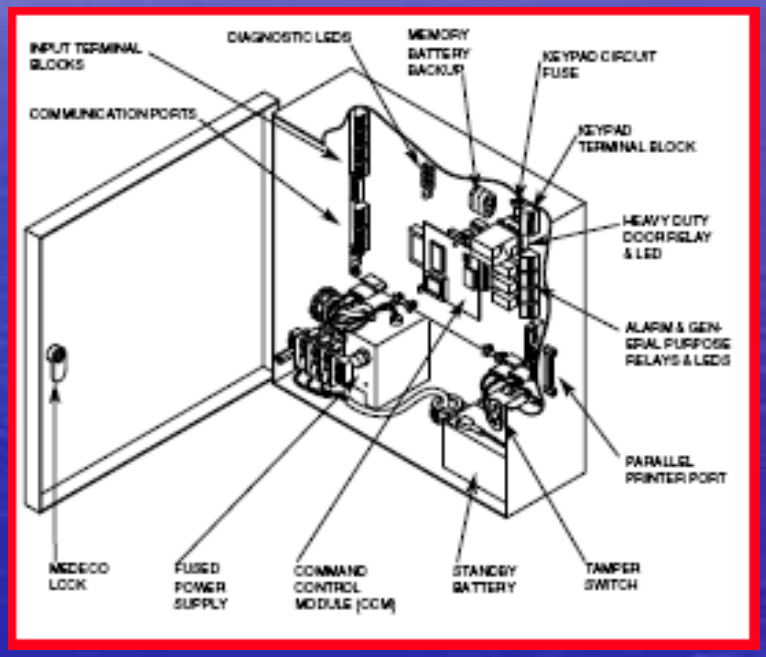
Typical Access Control System panel





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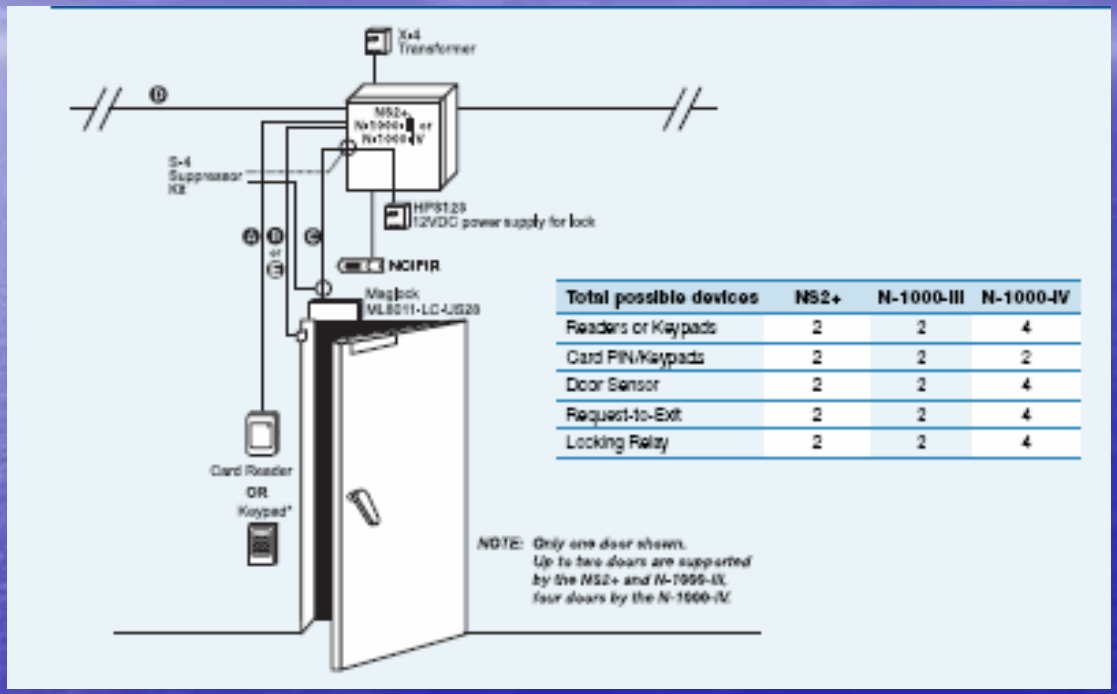
Typical Access Control System Panel



Total possible devices	NS2+	N-1000-III	N-1000-IV
Readers or Keypads	2	2	4
Card PIN/Keypads	2	2	2
Door Sensor	2	2	4
Request-to-Exit	2	2	4
Locking Relay	2	2	4

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Typical current technology reader

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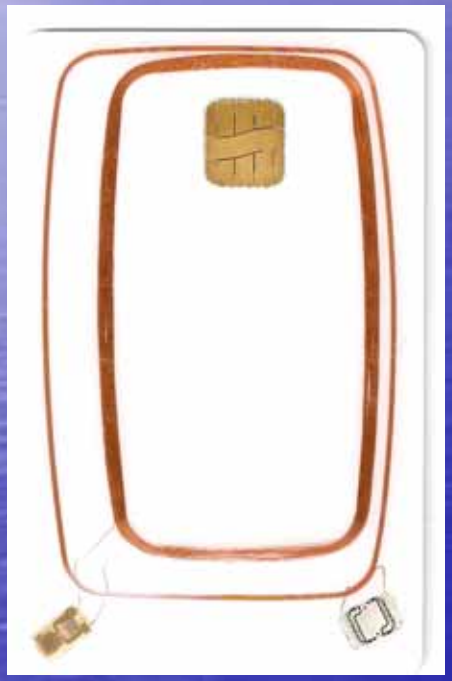
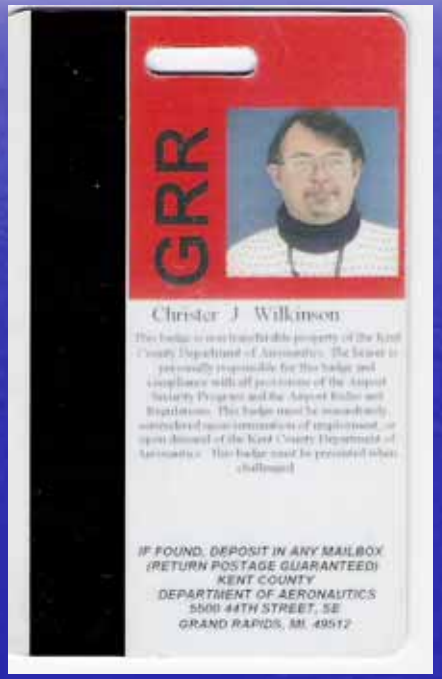
Typical proximity technology reader

Typical cards





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Biometric technology reader

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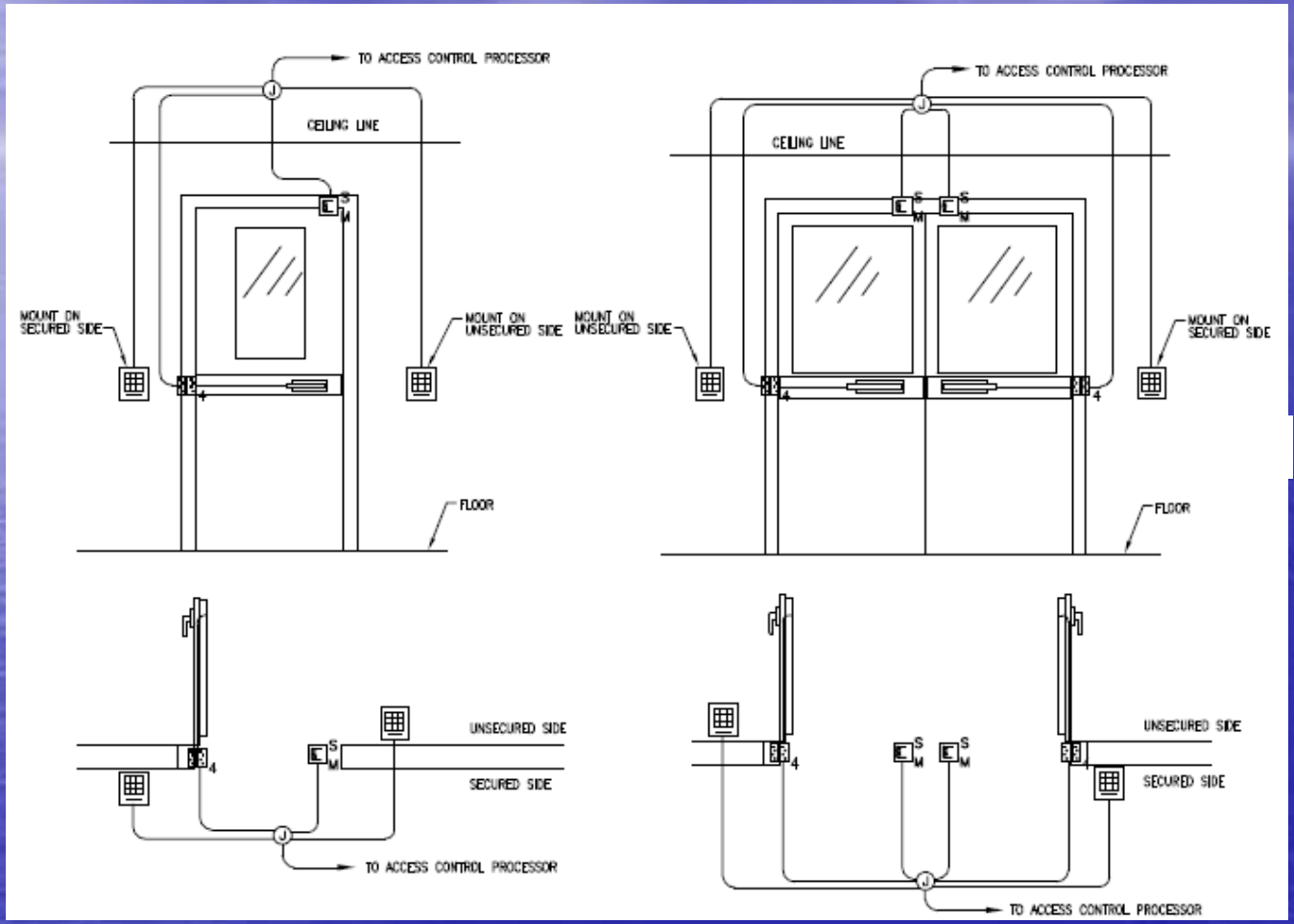
Double sided door for zone control



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Anti Piggybacking

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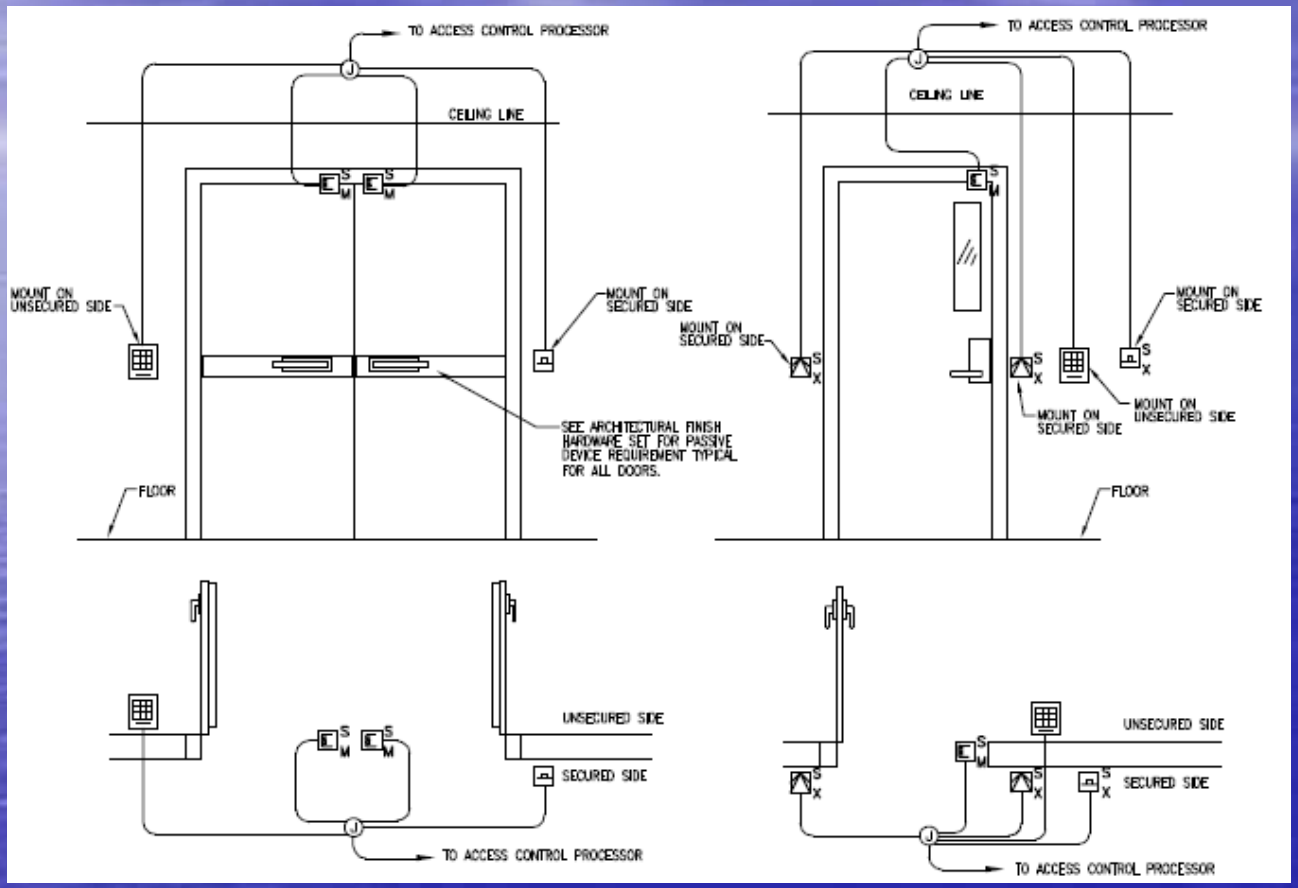
Anti Tailgating



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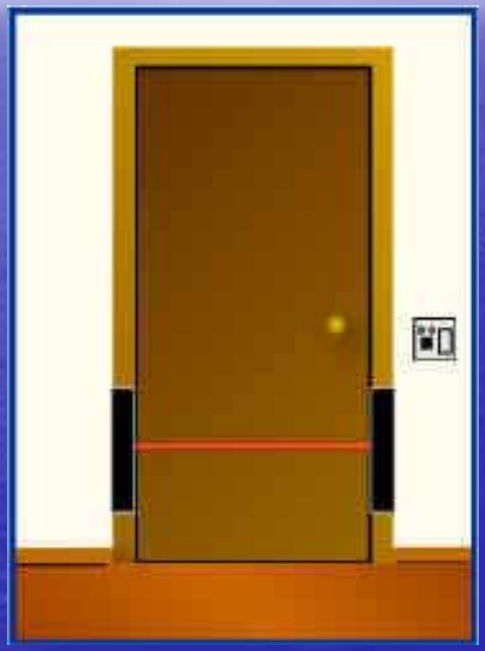
Anti Tailgating



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Airport Experience

- Access control has been regulated since late 80s
- Regulations updated in 1992 and 2001
- Subject to continuous SD changes
- Initial trial TWIC programs 2001-2006

Scale of Airport Systems

- 475 regulated airports
- Estimate of 400 ACS systems
- Estimate of 75,000-100,000 access controlled points
- Estimate of 5,000,000 card holder data records.
- Estimate of 2,500,000 active card holder records

Airport System characteristics

- Mostly internal doors
- About 15% external
- Many doors per airport (LAX has 1200)
- Most do not have Biometrics
- Most do not use smart cards

Biometric selection at Airports

•Seatac	finger print
•SFO	hand geometry
•Boston	Finger print
•Sarasota	Finger print

Plus numerous test sites

Environmental problems

- Cleveland — Snow
- Phoenix — Heat and Dust
- Miami — Humidity

Result: move to contact-less card

ID TECHNOLOGY PARTNERS

Walter Hamilton

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Fundamentals of Biometrics

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Biometric Overview

Biometrics: **"Automated recognition of individuals based on their behavioral and biological characteristics"**

Examples of Biometric Types:

- Fingerprint
- Face
- Iris
- Hand
- Signature
- Retina
- Speech
- Keystroke
- Palm
- Veins
- DNA
- Skin

Three Basic Functions

Enrollment

- Adding biometric information to a data file
  - Can include screening for duplicates in database

Verification (one-to-one)

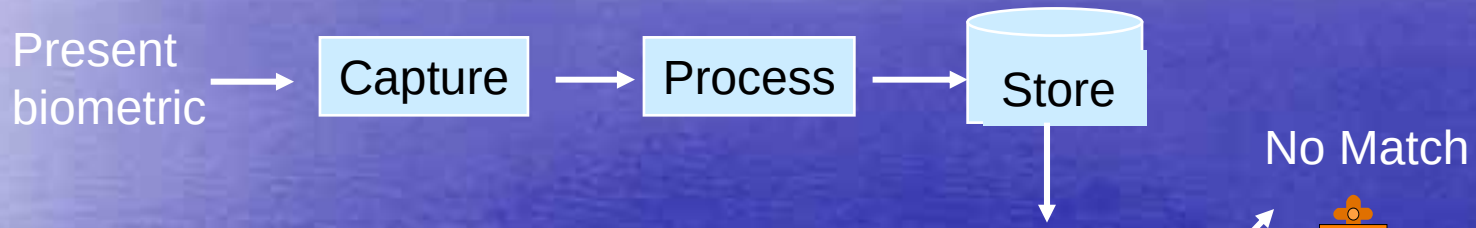
- Matching against a single record
- Answers "Is this person who they claim to be?"

Identification (one-to-many)

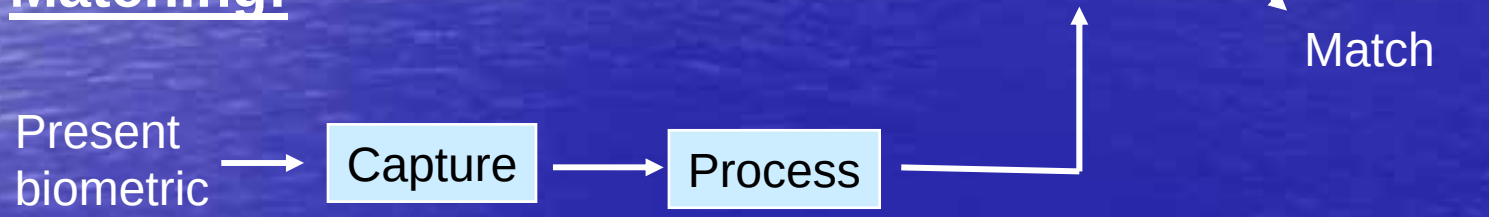
- Matching against all records in the database
- Answers "Do we have a record of this person?"

How do Biometrics Work?

Enrollment:



Matching:



Biometric System Components

What do I need to make it work?

- Capture device (sensor)
  - Fingerprint reader, video camera, etc.
- Algorithms
  - Processing (feature extraction)
  - Matching
- Repository
  - Place to store enrolled biometric templates (for matching)
  - Should be protected (secure area, signed/encrypted, etc.)

Reasons to Use Biometrics

- Biometrics link an event to a particular individual
  - Not just to a password or token
- Convenient – nothing to remember
- Can't be guessed, stolen, shared, lost, or forgotten
- Prevents impersonation
  - Protects against identity theft
  - Higher degree of non-repudiation
- Enhances privacy
  - Protects against unauthorized access to personal information
- Complementary with other authentication mechanisms
  - Smart cards
  - Proximity cards
  - PIN entry pads

Biometrics in Ports

- Employee and authorized worker access to secure areas of port facilities and vessels
- Employee access to information systems
- Employee timekeeping
- Employment background vetting

What Makes a Good Biometric?

- Unique
- Permanent
- Easy to use
- Fast
- Accurate
- Low cost
- Positive public perception

Biometric Technologies Suitable for Access Control Applications

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Fingerprint Recognition

Measures characteristics associated with the friction ridge pattern on the fingertip

One of the oldest and most widely used biometrics

Capture techniques

- Flat scan
- Swipe across
- Rolled ("ten print")
- Slap (four flat fingers at a time)

Sensor types

- Optical
- Multi-spectral imaging
- Silicon
- Ultrasonic

Fingerprint Recognition

Features

- Mature - proven
- Each finger is unique
- Patterns don't change with age
- High accuracy
- Easy to use with some training
- Supports both 1:1 verification and 1:N identification
- Databases already exist for background checking
- Numerous vendor choices

Considerations

- Small % of population have poor prints due to injury, age, disease, or occupation
- Requires physical contact with sensor
- Historical association with law enforcement

Fingerprint Minutiae Template

Starts with fingerprint image

Typical size 70-90 KBytes

Fingerprint Minutiae Template (cont.)

Find Minutiae:

- Ridge Endings
- Ridge Bifurcations
- Ridge Direction

Assign values to Minutiae:

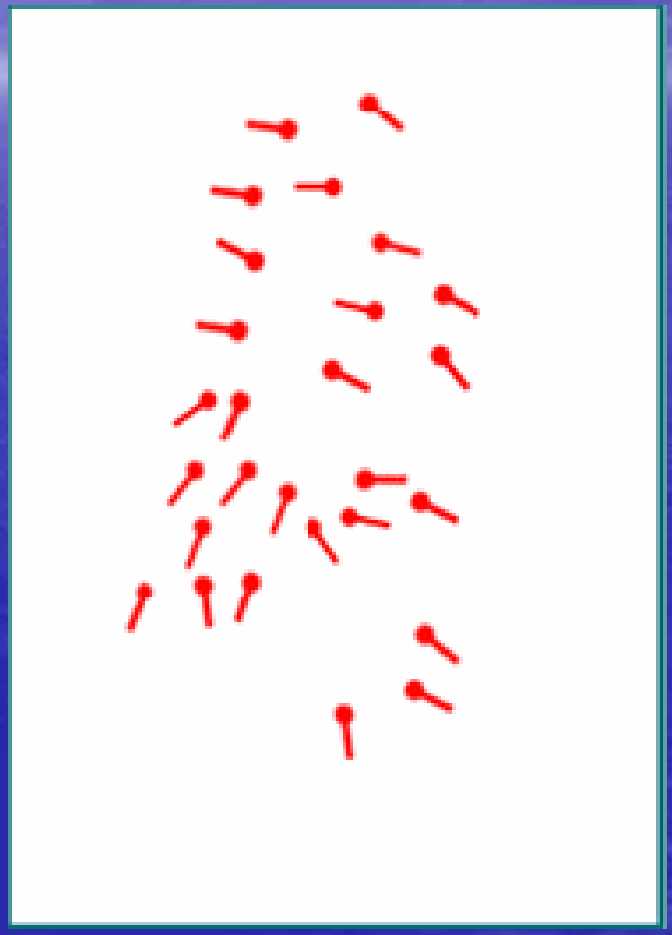
- X, Y position in coordinate space
- Θ (Theta) angle from the minutiae point along the ridge

Fingerprint Minutiae Template (cont.)

Generate template record

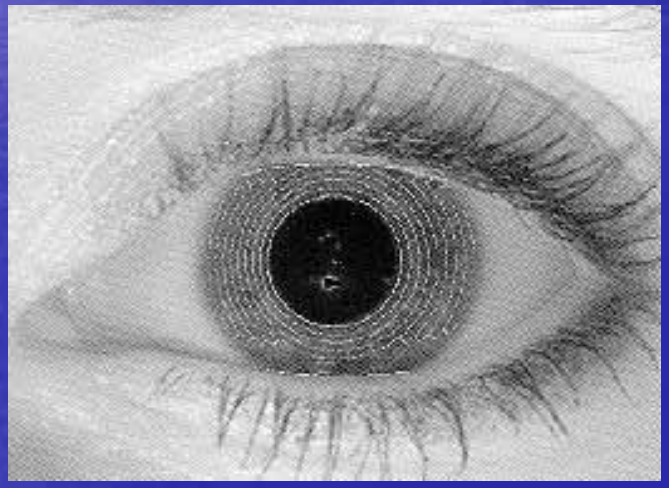
Store in template repository

Typical size <500 bytes



Iris Recognition

- Measures features associated with the random texture of the colored part of the eye
- Measures up to 266 unique features
- Uses near infrared sensor from a distance of 6 in. to 2 ft.
- Popular for facility access and transportation/border security



Iris Recognition (cont'd)

Features

- Highly accurate
- Very stable over lifetime
- Works through glasses and contacts
- No physical contact required
- Not affected by common eye surgeries
- Less prone to injury
- Supports both 1:1 verification and 1:N identification

Considerations

- Can be obscured by eye lids, lashes, reflection
- Public perception that scanning may be harmful
- Can be difficult to capture
  - Requires more training
- No existing database

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Hand Geometry

Measures dimensions of hand, including shape and length of fingers

Used extensively for physical access control

- Installed at SFO

Also widely used for employee timekeeping

Hand reader configuration

- Typically lay hand flat
- Pegs guide placement
- Cameras positioned above and to side

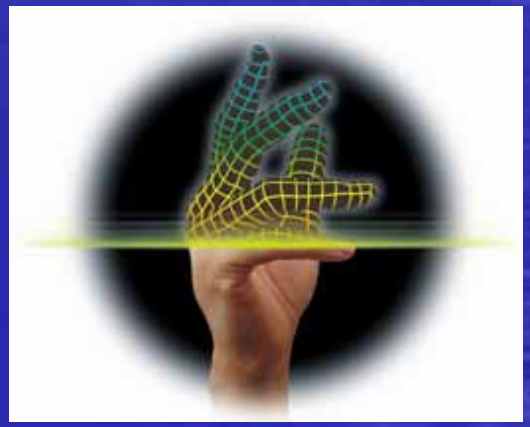
Hand Geometry (cont'd)

Features

- Easy to use
- High public acceptance
- Very low Failure to Enroll Rate
- Proven over many years of use
- Primary applications are physical access and time/attendance
- Very small, adaptive template
  - Fits on any card media
- Works well in outdoor environments
- Rugged

Considerations

- Not as accurate
- Characteristics may change with age
- Best used in 1:1 contexts
- Sensor is relatively large



Is There One Best Biometric?

No - A biometric should be selected based on specific application requirements

Each technology exhibits differences in

- Cost
- Ergonomics
- Matching accuracy
- Physical packaging
- User acceptance
- Maturity

Accuracy

Generally defined in terms of two parameters:

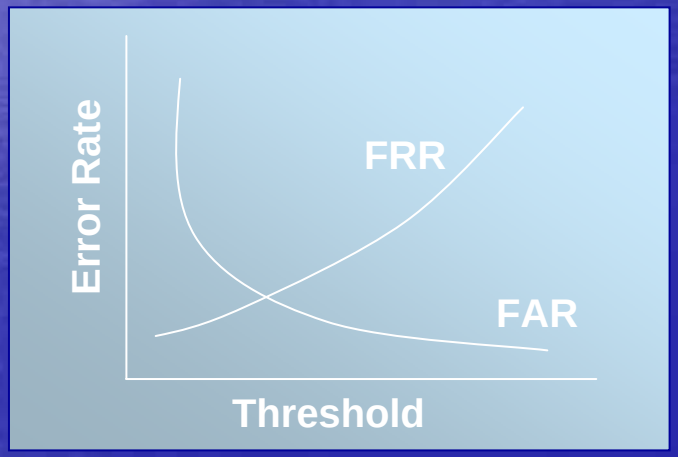
- False Reject Rate (FRR):
  - Measures how often an authorized user, who should be granted access, is not recognized
  - FRR = Percentage of false rejections of the total number of valid recognition attempts
  - Also called "False Non-Match Rate"
- False Accept Rate (FAR):
  - Measures how often a non-authorized user, who should not be granted access, is falsely recognized
  - FAR = Percentage of false acceptances of the total number of imposter recognition attempts
  - Also called "False Match Rate"

Accuracy (cont'd)

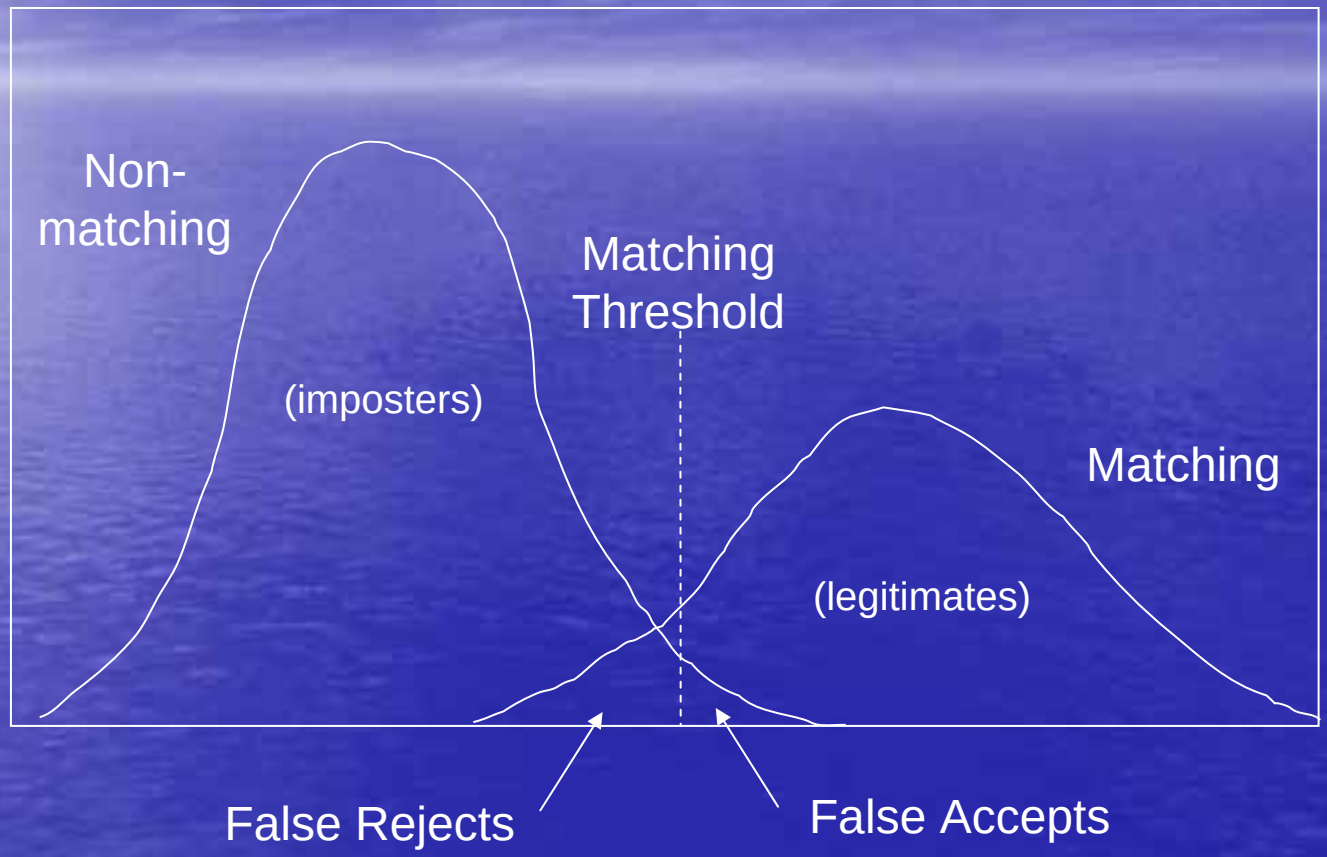
Equal Error Rate (EER):

- Point where FRR = FAR

FAR/FRR are inversely related



Match Score distribution



Additional Performance Consideration

Failure to Enroll Rate (FTER)

- Measures how often users are unable to enroll a biometric characteristic
  - Physical characteristic of user prevents creation of template
    - Characteristic not present or obscured
  - User is not capable or willing to present biometric properly

FTER = Percentage of failures to enroll of the total number of enrollment attempts

Biometrics & TWIC

- Biometric credential for maritime workers mandated by Maritime Transportation Security Act
- Ten finger images captured for background check
- Two finger images converted to minutiae templates and stored in chip memory of TWIC card
- Readers will use contactless interface to transfer templates to reader for matching
- Expected reader performance requirements
  - Must be capable of working in harsh maritime environment
  - Transaction time of 3 seconds or less
  - Matching accuracy of at least 99%
- Coast Guard and TSA planning pilot reader tests in 5 locations this year
  - Mandated by SAFE Ports Act

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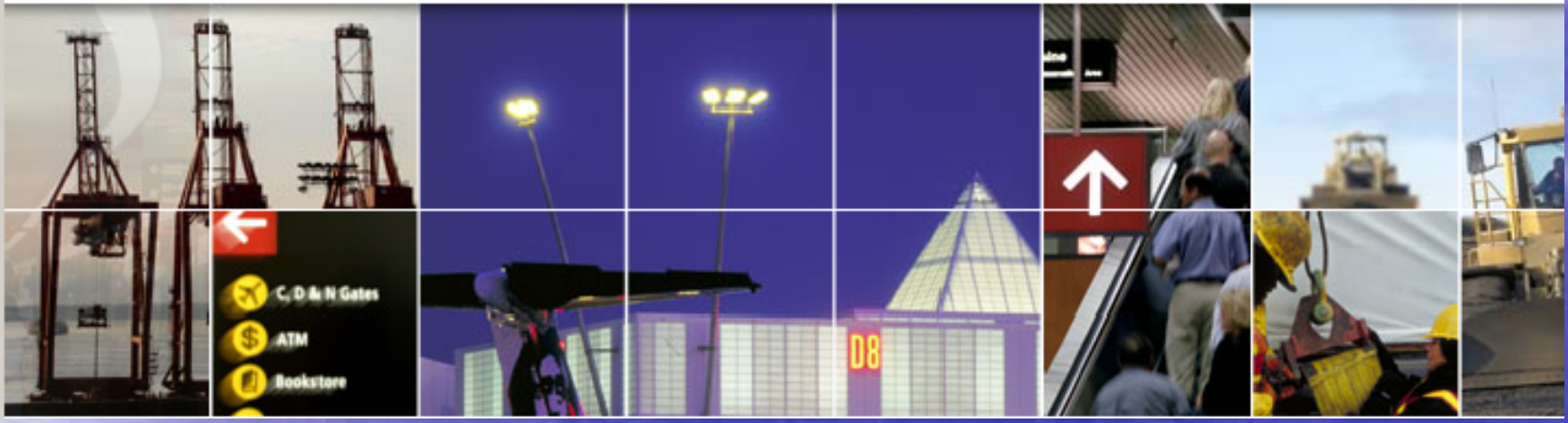
Port of Seattle



Seattle-Tacoma International Airport (SEA)

Seattle Seaport Harbor

Fishing and Pleasure Boat Moorage

Cruise Terminal Facilities

Other Commercial Operations

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Seaport Statistics – 2006

Total TEU Containers: 1,987,360

Total Cruise Passengers: 735,000

Total Vessel Calls:

Container – 814 Cruise - 196

1,200 Active Cardholders

Access Control deployed March 2004

Source: www.portseattle.org

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Airport Statistics - 2006

Total Air Passengers:	29,979,097
Total Aircraft Operations:	340,058
Total Air Cargo (metric tons):	341,844

15,00 Active Cardholders

Biometric Cards October 2003

Source: www.portseattle.org

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Changes in ID Badge Technologies

Photo Technology…

Specialized PC Technology…

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Security System Technology Changes

- Proprietary solutions gave way to Windows desktop standards
- Use of standard SQL databases rather than proprietary or desktop-grade file systems
- Field devices, door readers may be IP addressable
- Wireless technology
- The IT department meets the Security Department

What IT Can Offer

- System integration skills. Was a non-issue in the proprietary era
- Setting technology standards to reduce maintenance costs
- Handle data privacy issues. Systems may now require more PPI
- Best practices for cyber security & evaluating vendor compliance

September 10, 2001

The Port of Seattle had plans to construct and implement a new access control system at Seattle-Tacoma International Airport using standard proximity card technology. This new system was critical to completion of a $587M airport terminal expansion project.

But the world changed… an so did we

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Transportation Security Administration

Following 9/11

- Increased focus on biometrics
- Emphasis on identification and authentication of transportation workers – TWIC emerges on scene
- Formation of the TSA, DHS, etc
- Development of information sharing networks and systems
- Grant funding for Seaport Security

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Our directives…

- In light of 9/11, reevaluate our plans
- Install a forward looking biometric solution
- Identify and recommend viable, cost effective biometric technologies
- Insure that it would not jeopardize airport terminal construction project
- Integrate into existing project for access control system replacement

Reasons for Our Biometric Success

- Stakeholder involvement
- Scheduled/Managed Re-issuance
- FAQ's provided to cardholders
- Running in parallel with old ACS
- Cardholder used test reader first
- Skilled and dedicated team
- Examined Privacy Concerns
- Labor Relations Issues

Seattle's Card Reader:
BIO, PIN, LCD, MIFARE

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Non-Bio Card Reader: Card Only, or Card + PIN

- Less Expensive
- Compatible with same ID card
- Non-critical uses
- Be sure to plan for both bio and non-bio reader

Interoperability and Transition

Can your legacy access control system run in parallel with a new system during installation?

Can it be upgraded to utilize biometric technologies?

Is this this the mandate you always wanted to replace a legacy system?

Biometric Readers: Wiring and Power Issues

- Biometric smart card readers are like small computers
- Higher power requirements
- Infrastructure must support required UPS/Battery backup
- New readers *may* require more wire strands than you have now or maybe wire is OK as is

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Corporate ID/Access System

- Will EVERY employee requiring electronic facility access *really* NEED a TWIC?
- Can your existing ID badge system enroll external cardholder credentials?
- Will "corporate" cards share TWIC readers?
- Does the existing system meet current computing standards and can it quickly adapt to a changing world?

If you adopt TWIC as the solitary Port ID card...
Will that compel all types of cardholders to enter the TWIC system?

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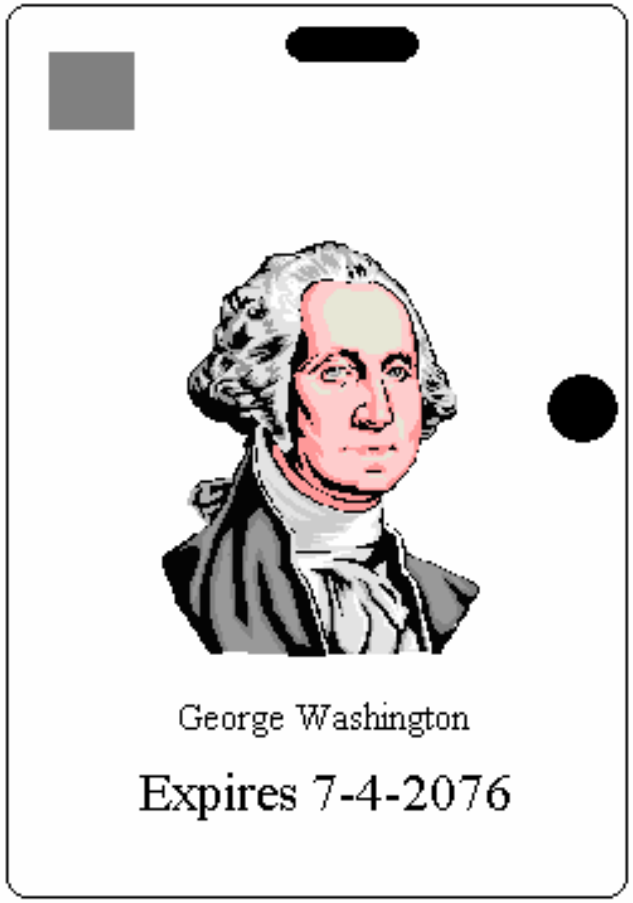
Badge Failure points

Encoded biometric data no longer matches cardholder due to finger damage



Hole severs antenna or lanyard wears through antenna

Cardholder punches their own hole to fit their preference

Cardholder Actions That Can Kill a Card

- Inform cardholder that punching holes in a card will damage it

- Educate cardholder that certain lanyards with metal clasps could damage card
- Educate guards to recognize dead cards

Biometric Deterioration

- Deteriorating finger quality due to abrasion, injury, hobbies, etc.
- If the finger (and the spare) no longer match, the cardholder will be denied access
- May require reproducing card (another trip to the TSA TWIC issuing facility)
- Seattle: Approximately 2 per month

Failure to Enroll

- Certain cardholders will be physically unable to render a biometric
- Our failure rate is 0.42%
- Not tied to any demographic
- An alternative to biometrics must be provided for unattended access points

Perceived cardholder comfort level w/ readers (Following initial roll-out of biometric cards)

(Per ID Office Mgr)

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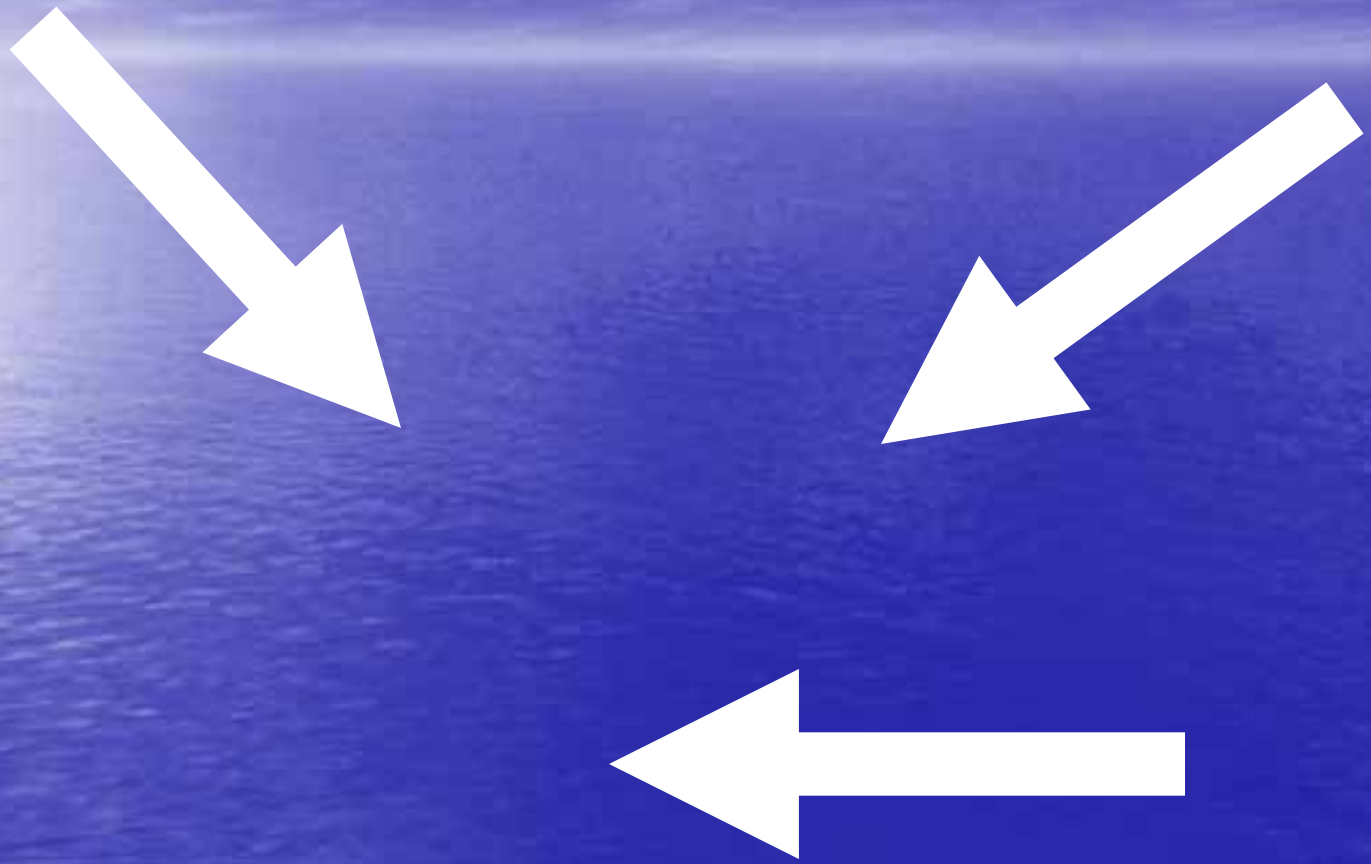
The Biggest Cause of Reader Problems in Seattle

See next slide for the answer...

The Biggest Cause of Reader Problems in Seattle



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Typical Reader Problems We've Seen

- Rain in Seattle !!
- Key Pads – Water, Wear & Tear on #
- Ambient light on outdoor reader
- Dirty fingers or dirty read surface
- User error and impatience
- Broken card antenna
- Ergonomics for height on vehicle access

Multi-Height Readers for Varying Vehicle Heights

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Consideration of Delays

- What will you will do to avoid undesired backups of cardholders due to reader usage problems?

- How will you handle problems, exceptions at the reader?
- Biometric smart cards are NOT the old "swipe and go" world

Possible Exception Handling Techniques

- Very short time out periods
- A "cancel" button on reader
- Corrective prompts on LCD
- Intercoms to guards or support staff

Primary Biometric Lessons Learned

- Educate stakeholders
- Address privacy issues
- Install non-bio readers based on usage
- Account for failure to biometrically enroll
- Staff and cardholder training
- Quality implementation team
- Test, test, test in all environmental conditions
- Consider ergonomic issues

Possible Access Control Challenges Post-TWIC

Seattle's Experience

- Homogenous industry
- Primarily Indoors
- Established communication channels to Cardholder
- One primary biometric device to learn
- Sensitized to Federal security requirements

In the world of TWIC

- Diverse industry
- Primarily Outdoors
- Varied and complex communication channels to Cardholder
- Transients: Multiple biometric devices
- Acquiring exposure to Federal Security issues

Q&A and Discussion

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April 24-26
Jacksonville FL

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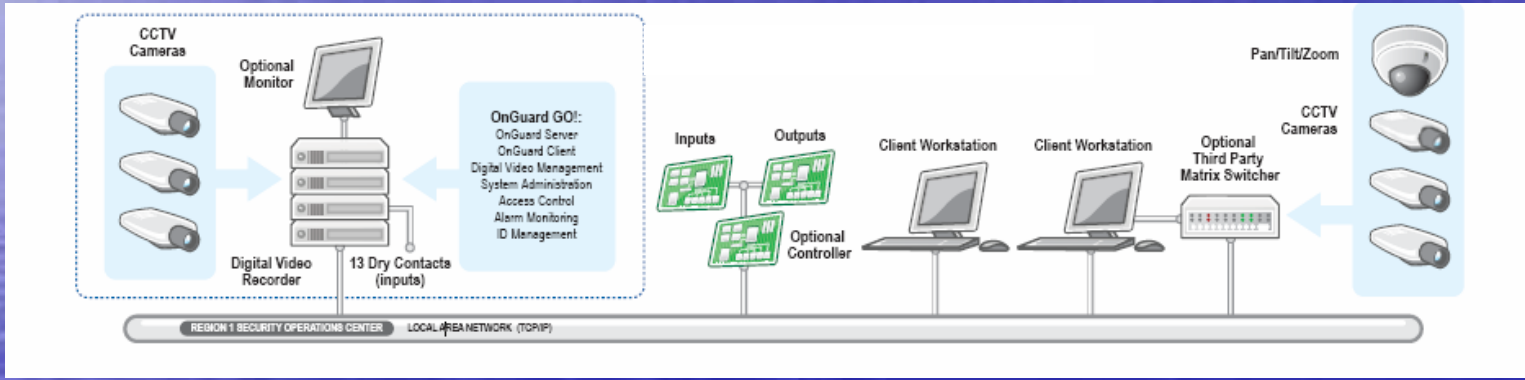
Typical access Control system



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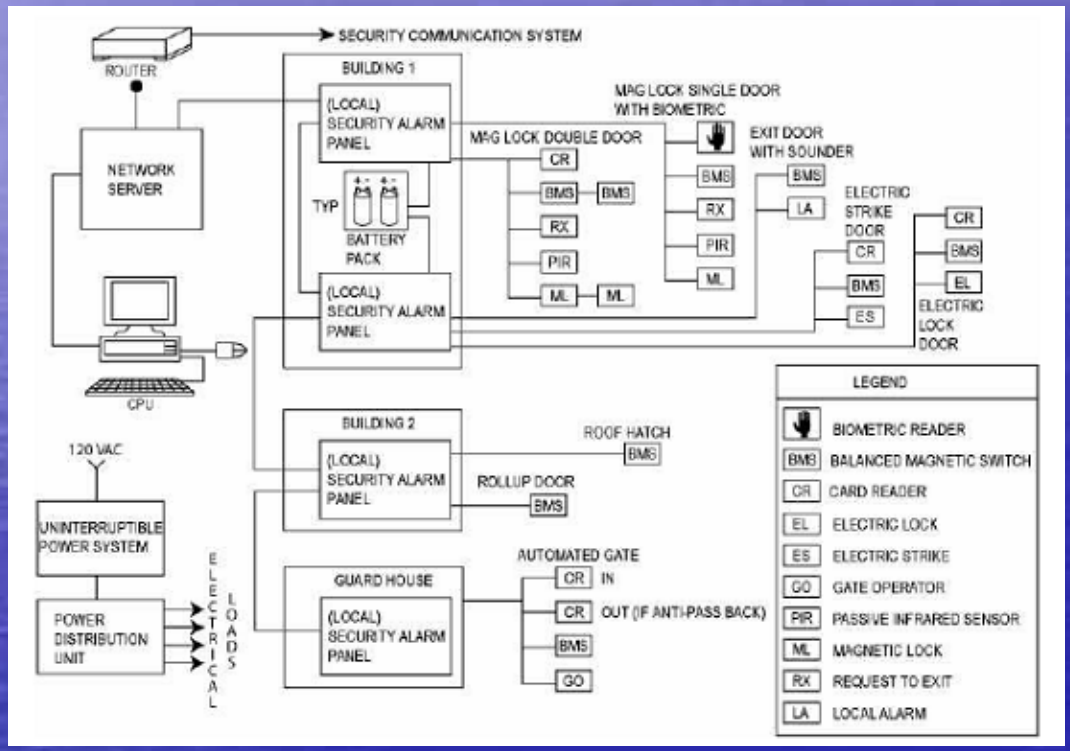
Components of an access control system



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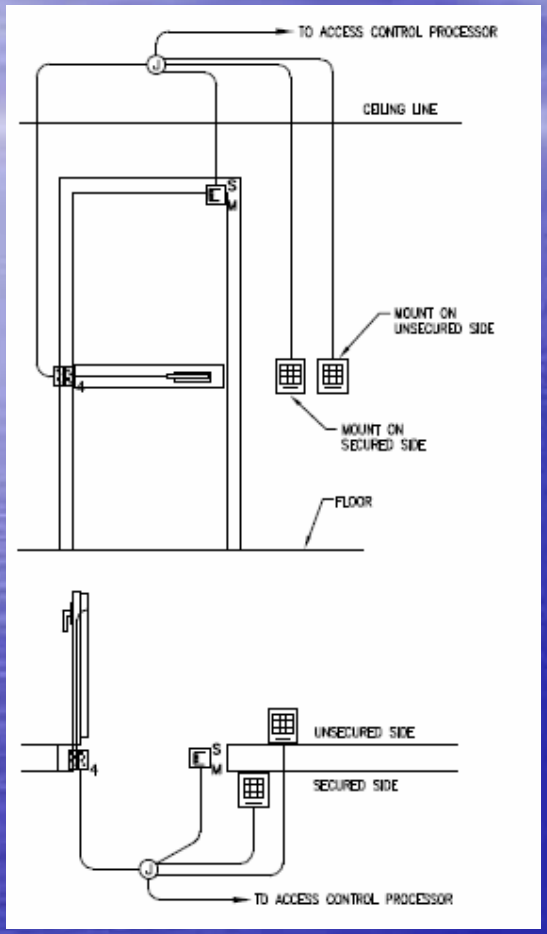
Double sided door for zone control



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A useful resource

Framework for Evaluating and Deploying Biometrics in Air Travel Applications: Surveillance, Trusted Travel, Access Control

International Biometric Group April 3, 2002

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Approximate Airport Stats; Excluding Seaport

Badges per month: 900

Total time to enroll: 35 minutes

Biometric enrollment: 30 secs

Deteriorated biometrics: 2 / mo*

Approximately 500+ readers

* Smart card program < 3 years old