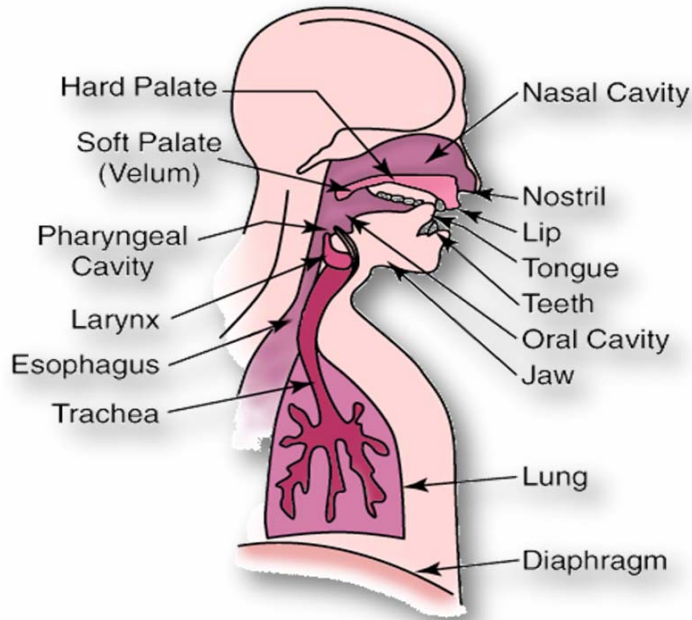


# Voice Biometrics

Exciting capabilities of a new biometric modality

Speech Technology Center



- ▶ **Each voice is absolutely unique**
- ▶ **Over 70 body parts participate in creating speech**
- ▶ **Not what we say, but who is talking**
- ▶ **Over 20 years of voice biometrics as forensic application**
- ▶ **2010 - from forensic products to automatic large scale solutions**

**Accuracy similar or better than other biometric modalities**

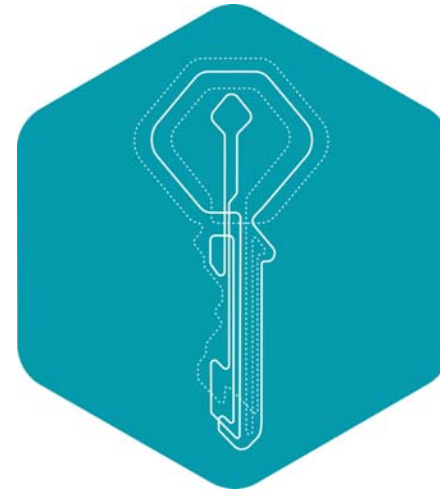
- ▶ **Most natural way to communicate**
  - ▶ In person
  - ▶ On the phone
  - ▶ Online
- ▶ **Easy to collect – microphones everywhere**
  - ▶ Remote collection
  - ▶ Low cost (no need for costly collection devices)
- ▶ **Easy to enroll – just say a few words**
- ▶ **Ability to conduct verification / identification during regular communication**
- ▶ **Existing audio archives**
  - ▶ 911 calls
  - ▶ Call center recordings
  - ▶ CCTV
  - ▶ Wired operations





## Identification

- ▶ Ability to match “unknown” sample to a database of “knowns” (1 vs N)
- ▶ Real-time
- ▶ Forensic



## Verification

- ▶ Confirmation of identity (1 vs 1)
- ▶ On-device
- ▶ Server based
- ▶ Remote access
- ▶ Call-centers

# What if...

**Phrases are not the same**

**Different language**

**Twin sibling**

**Sickness**

**Actor**



- ▶ **Ideal tool to capture criminal leaders**
  - ▶ Organized crime tend not to leave irises on crime scenes
- ▶ **Extremely useful to fight**
  - ▶ Terrorism
  - ▶ Drug and human trafficking
  - ▶ Organized crime
  - ▶ Corruption
- ▶ **2-tier solution**
  - ▶ Operational
    - ▶ Fast ID cross match turnaround
    - ▶ Real time monitoring
  - ▶ Forensic
    - ▶ Most courts accept voice based ID
- ▶ **Information management**
  - ▶ Large masses of information already exist
- ▶ **Availability of further analysis**





## Automatic:

- ▶ Language ID
- ▶ Emotional State
- ▶ Gender
- ▶ Key word search
- ▶ Audio enhancement



## Expert:

- ▶ Recording device
- ▶ Authenticity analysis
- ▶ Educational background
- ▶ Sickesses
- ▶ Body features

## ▶ Investigative tool

- ▶ Wired operations
- ▶ Database checks for suspects / persons of interest
- ▶ Audio monitoring

## ▶ Intelligence tool

- ▶ Wealth of information from available voice samples

## ▶ Fraud prevention

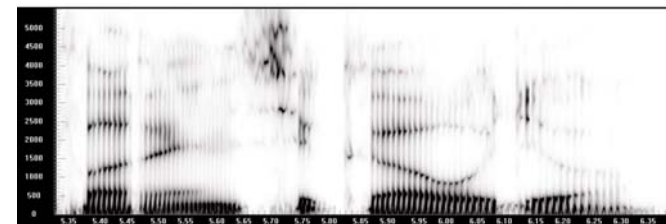
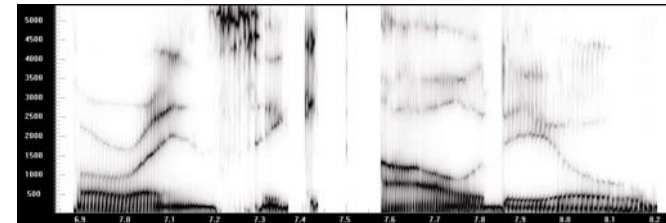
- ▶ Real time cross check for call centers

## ▶ Remote and physical access control

- ▶ Voice-based ID for government services

## ▶ Secondary biometric (multi-modal ID)

- ▶ Border crossings
- ▶ Bookings at arrest
- ▶ Interviews



## Voice

**Convenient biometric identifier**

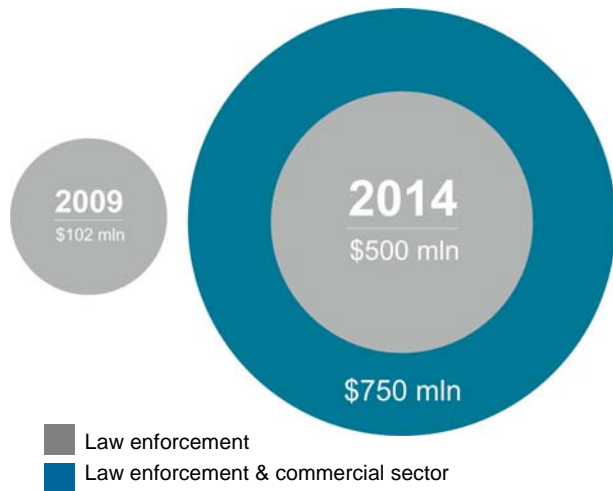
**Wealth of information**

**Reliable results**

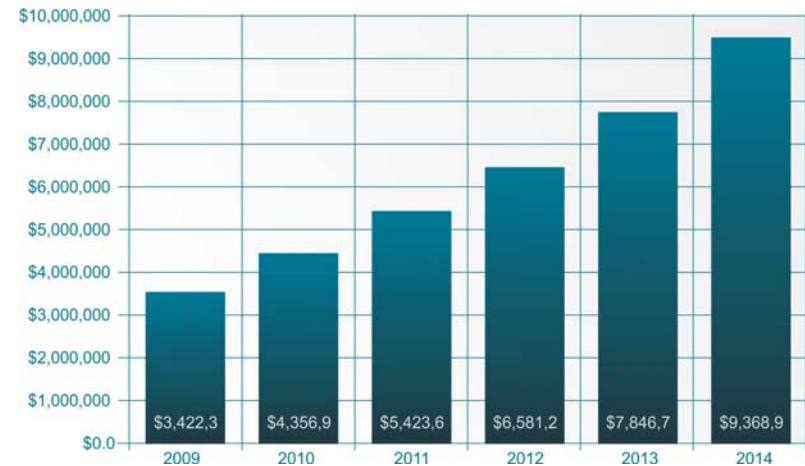




- ▶ **Background noise**
  - ▶ Different type of noise – different algorithms of audio enhancement
- ▶ **Differences between recording channels**
  - ▶ Cross-channel normalization
- ▶ **Emotional State of a speaker**
- ▶ **Elimination of pauses and non-speech segments**
- ▶ **Algorithms productivity**



Source: OPUS Research 2010



Source: US Government

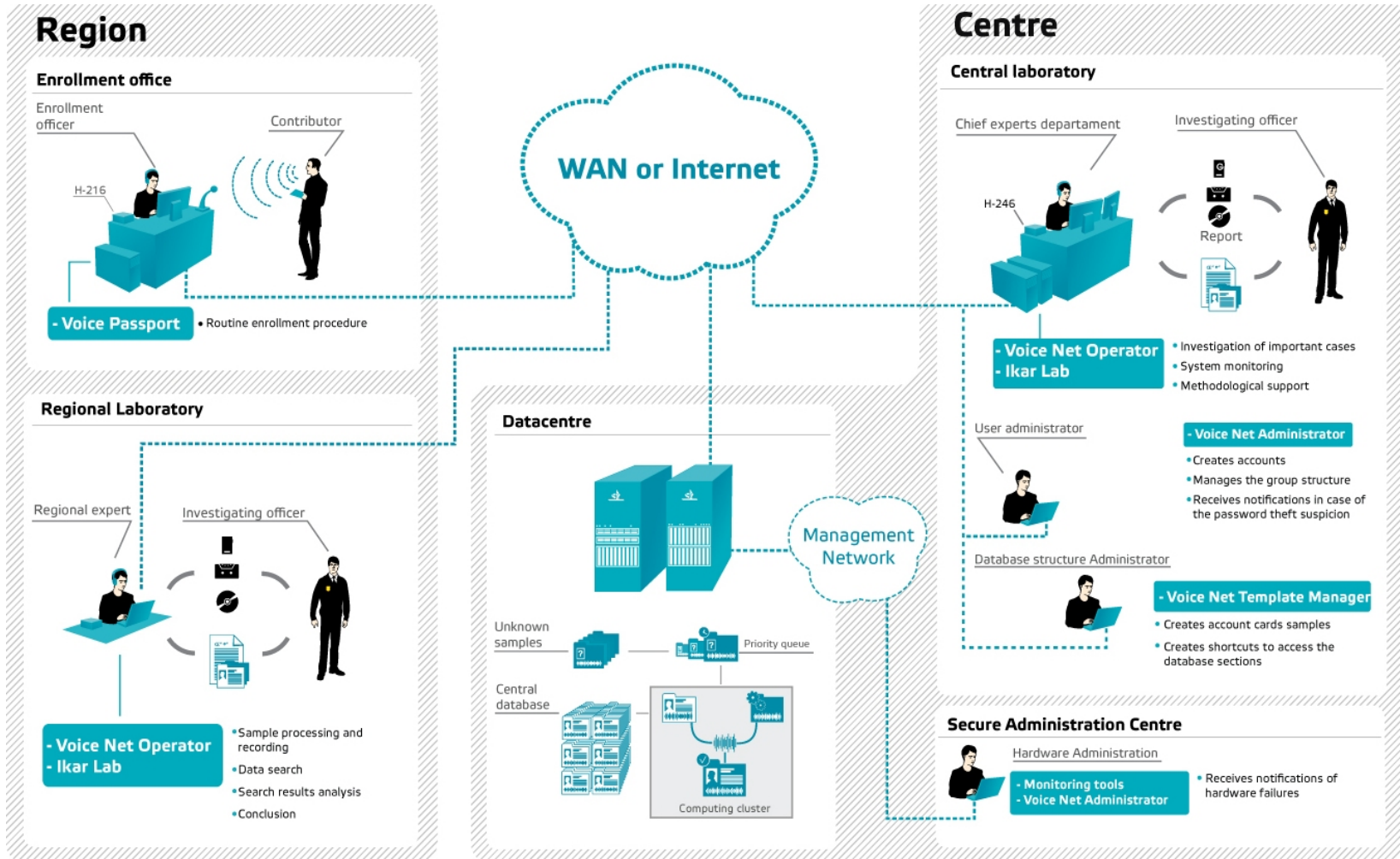
- ▶ **Long history of forensic voice biometrics**
- ▶ **Some commercial use of voice verification**
- ▶ **Small scale deployments with law enforcement agencies**

- ▶ **New Era started in 2010**
  - ▶ **First nation-wide AVIS deployment (breakthrough of 2010!)**
  - ▶ **Real life large scale monitoring**
- ▶ **Strong projections**



## Nation-wide voice biometric platform in Mexico (first in the world)

- ▶ Current capability of the database: **600.000** voice samples
- ▶ Number of samples by 2011 – over **1 000 000**
- ▶ Access by **250** jurisdictions across the country
- ▶ Peak performance - **3 000 000** matchings in **10** minutes
- ▶ Growing number of solved cases including arrests of high profile kidnapping gangs



## Voice is one of the most reliable biometric identification methods

### Comparison chart of biometric identification methods

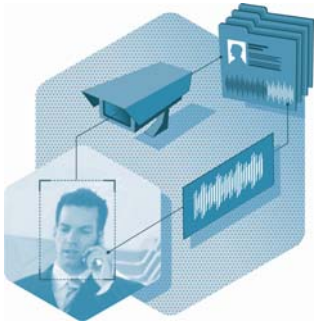
Identification method	Pattern cost	Search speed	Accuracy*	Intrusion
Voice	↓	↑	~ ↑↑	↓
Face	↓	↑	~	↓
Fingerprint	~	↑	~	~
Iris	↑	~	↑	~
3D Face	↑	~	↑	↑
DNA	↑	↓	↑	↑

\* Accuracy of a particular method changes significantly depending on the quality of the given pattern.

\*\* ↑ — High, ~ — Medium, ↓ — Low



**AVIS – Automatic Voice Identification System in every country**



**Multi-modal biometric systems to include voice capability**



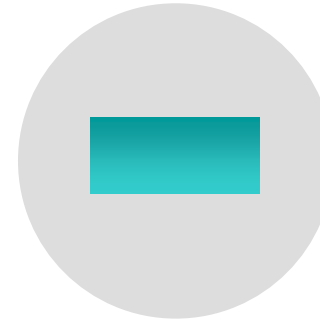
**Voice identification for phone and online transactions in real-time**

## Voice biometrics and ethical issues



### Pro:

- ▶ Non-intrusive
- ▶ Non-discriminatory
- ▶ Warnings everywhere
- ▶ Helps to fight crime



### Contra:

- ▶ Possibility of identification without knowledge of the subject
- ▶ Denial of anonymity in some environments (hot lines)



## R&D driven leader in speech related technologies

**Offices:**

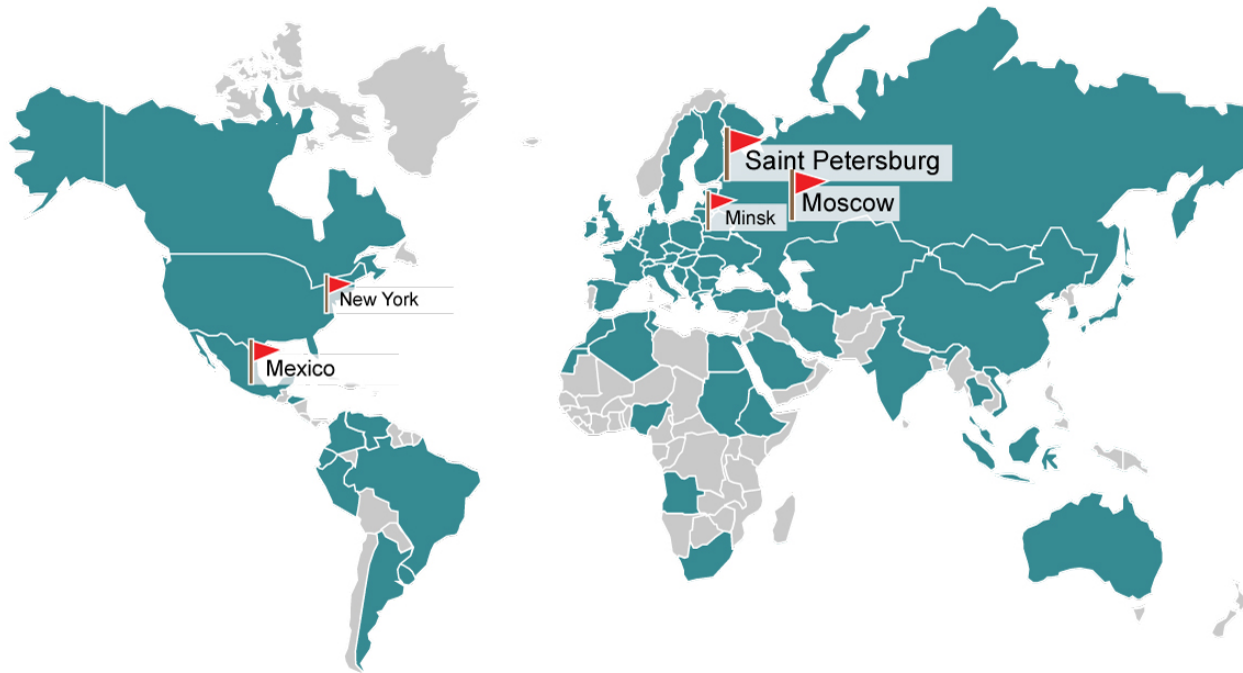
- ▶ Russia, Finland, Mexico, Germany, USA

- ▶ **20** years of background in speech technologies
- ▶ **300** employees
- ▶ **120** specialists' strong R&D cluster

«**STC has established a leadership position in a fast-growing and potentially large sector of the voice biometrics marketplace**» – Dan Miller, Senior Analyst at Opus Research, USA

## Strong distribution network

- ▶ More than **100** partners all over the globe
- ▶ Sales and projects in **65** countries



# Thank You!

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