Hacking 911:
Adventures in Disruption, Destruction, and Death

quaddi, r3plicant & Peter Hefley

August 2014

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Emergency Medicine
Open CTF champion sudoers- Defcon 16
Speaker, Defcon 20

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Pediatrics
Wrote a program for his TI-83 graphing calculator in middle school
Speaker, Defcon 20

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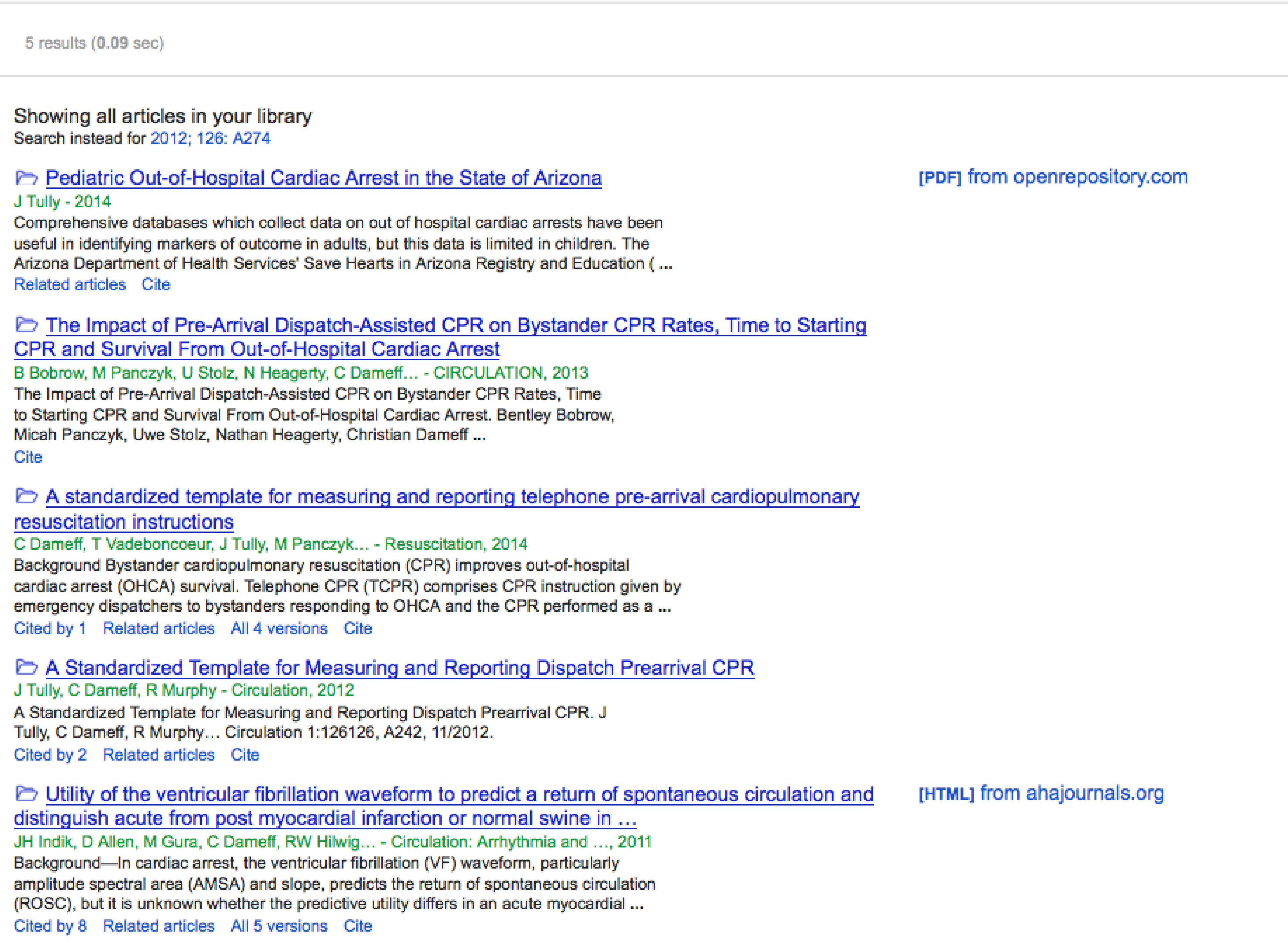
This talk includes disturbing audio clips.



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Comprehensive databases which collect data on out of hospital cardiac arrests have been useful in identifying markers of outcome in adults, but this data is limited in children. The Arizona Department of Health Services' Save Hearts in Arizona Registry and Education (**...**
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The Impact of Pre-Arrival Dispatch-Assisted CPR on Bystander CPR Rates, Time to Starting CPR and Survival From Out-of-Hospital Cardiac Arrest
B Bobrow, M Panczyk, U Stolz, N Heagerty, C Dameff... - CIRCULATION, 2013
The Impact of Pre-Arrival Dispatch-Assisted CPR on Bystander CPR Rates, Time to Starting CPR and Survival From Out-of-Hospital Cardiac Arrest. Bentley Bobrow, Micah Panczyk, Uwe Stolz, Nathan Heagerty, Christian Dameff **...**
Cite

A standardized template for measuring and reporting telephone pre-arrival cardiopulmonary resuscitation instructions
C Dameff, T Vadeboncoeur, J Tully, M Panczyk... - Resuscitation, 2014
Background Bystander cardiopulmonary resuscitation (CPR) improves out-of-hospital cardiac arrest (OHCA) survival. Telephone CPR (TCPR) comprises CPR instruction given by emergency dispatchers to bystanders responding to OHCA and the CPR performed as a **...**
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Background—In cardiac arrest, the ventricular fibrillation (VF) waveform, particularly amplitude spectral area (AMSA) and slope, predicts the return of spontaneous circulation (ROSC), but it is unknown whether the predictive utility differs in an acute myocardial **...**
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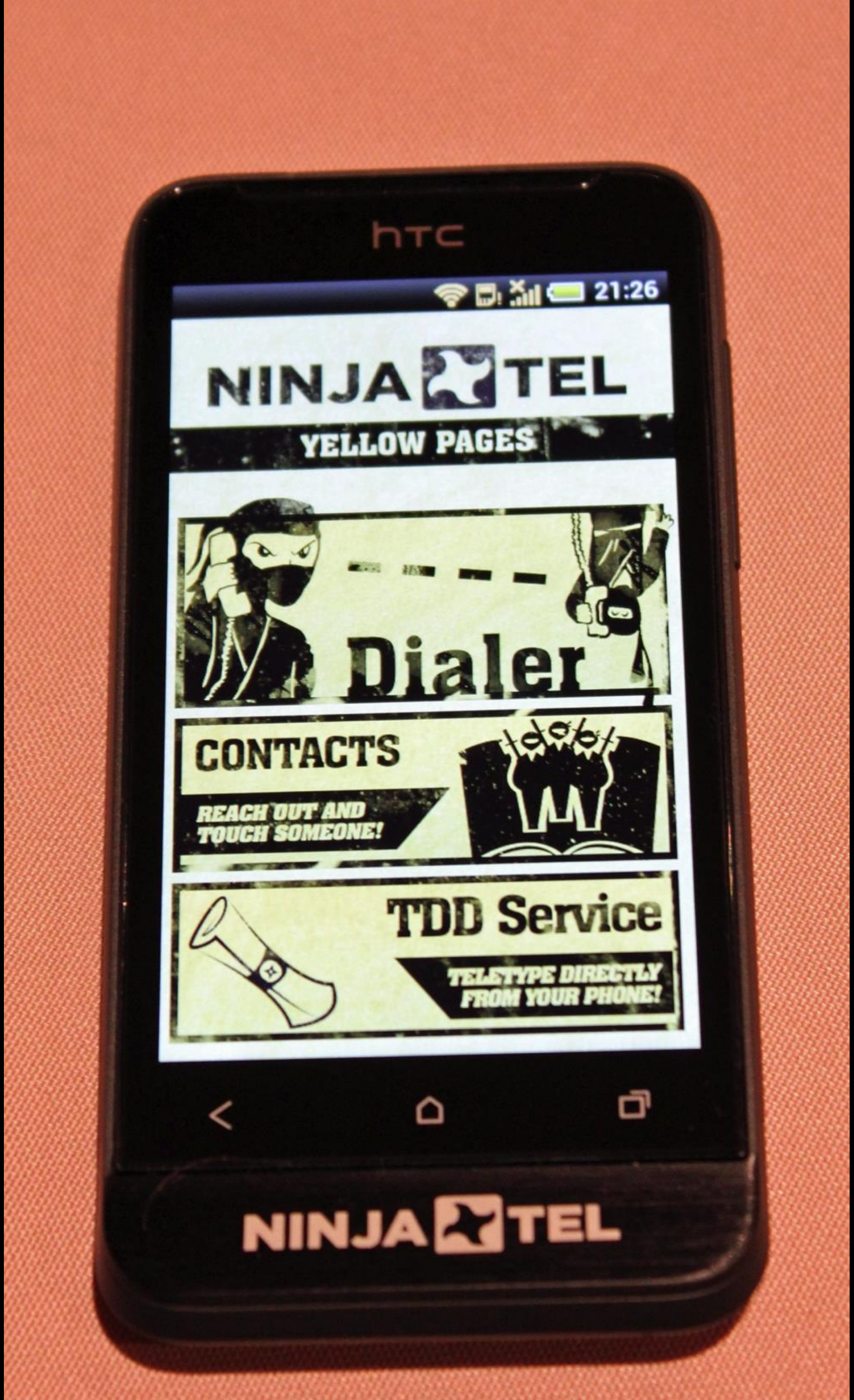
Outline

- Why This Matters (Pt. 1)
- 911 Overview
- Methodology
- Attacks
- Why This Matters (Pt. 2)

Why This Matters (Pt. 1)

4/26/2003 9:57pm

Emergency Medical Services (EMS)


htc
21:26
NINJA TEL
YELLOW PAGES
Dialer
CONTACTS
REACH OUT AND TOUCH SOMEONE!
TDD Service
TELETYPE DIRECTLY FROM YOUR PHONE!
NINJA TEL

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comcast

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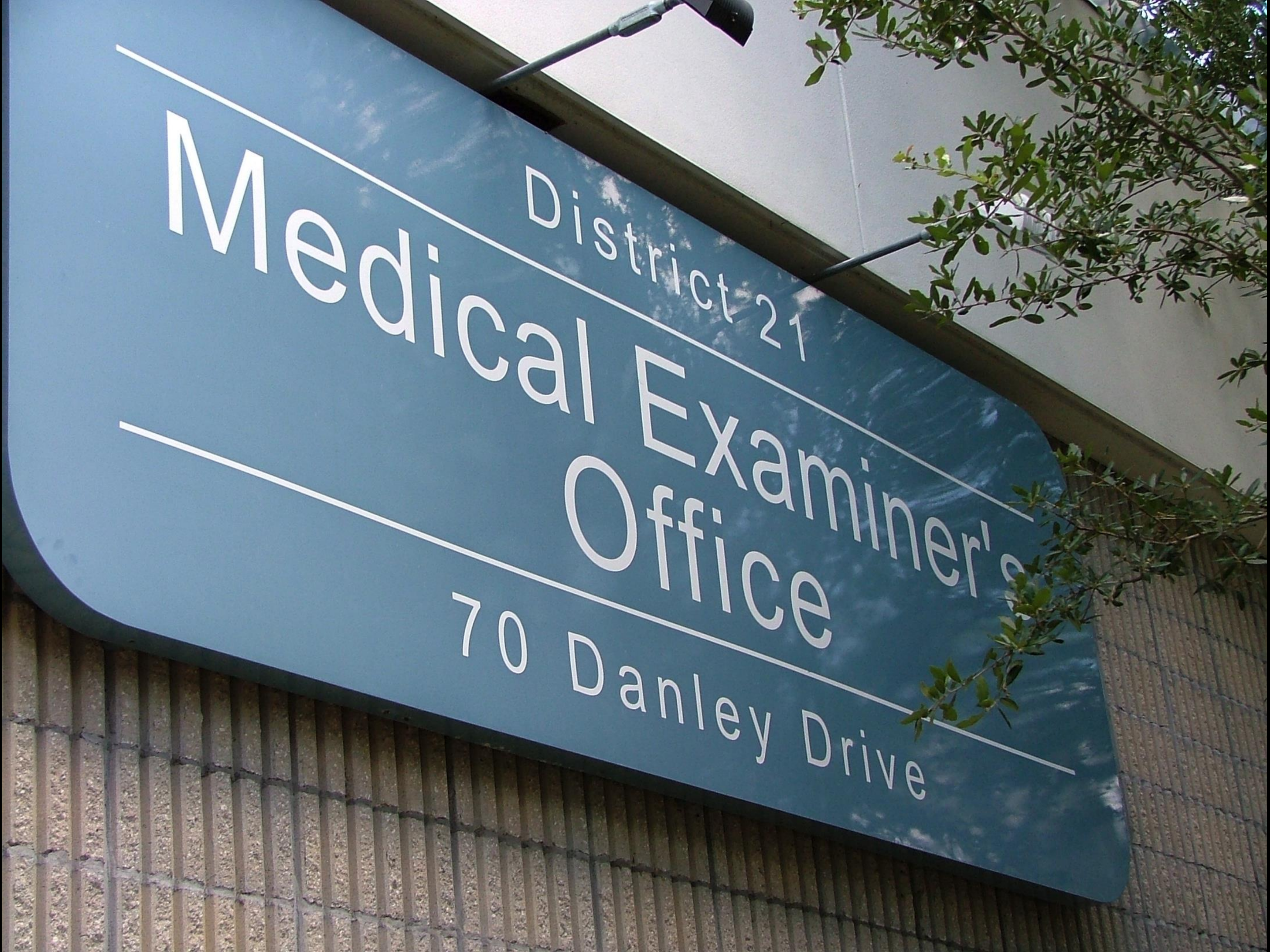
EMS

HOSPITAL ENTRANCE


District 21
Medical Examiner's
Office
70 Danley Drive

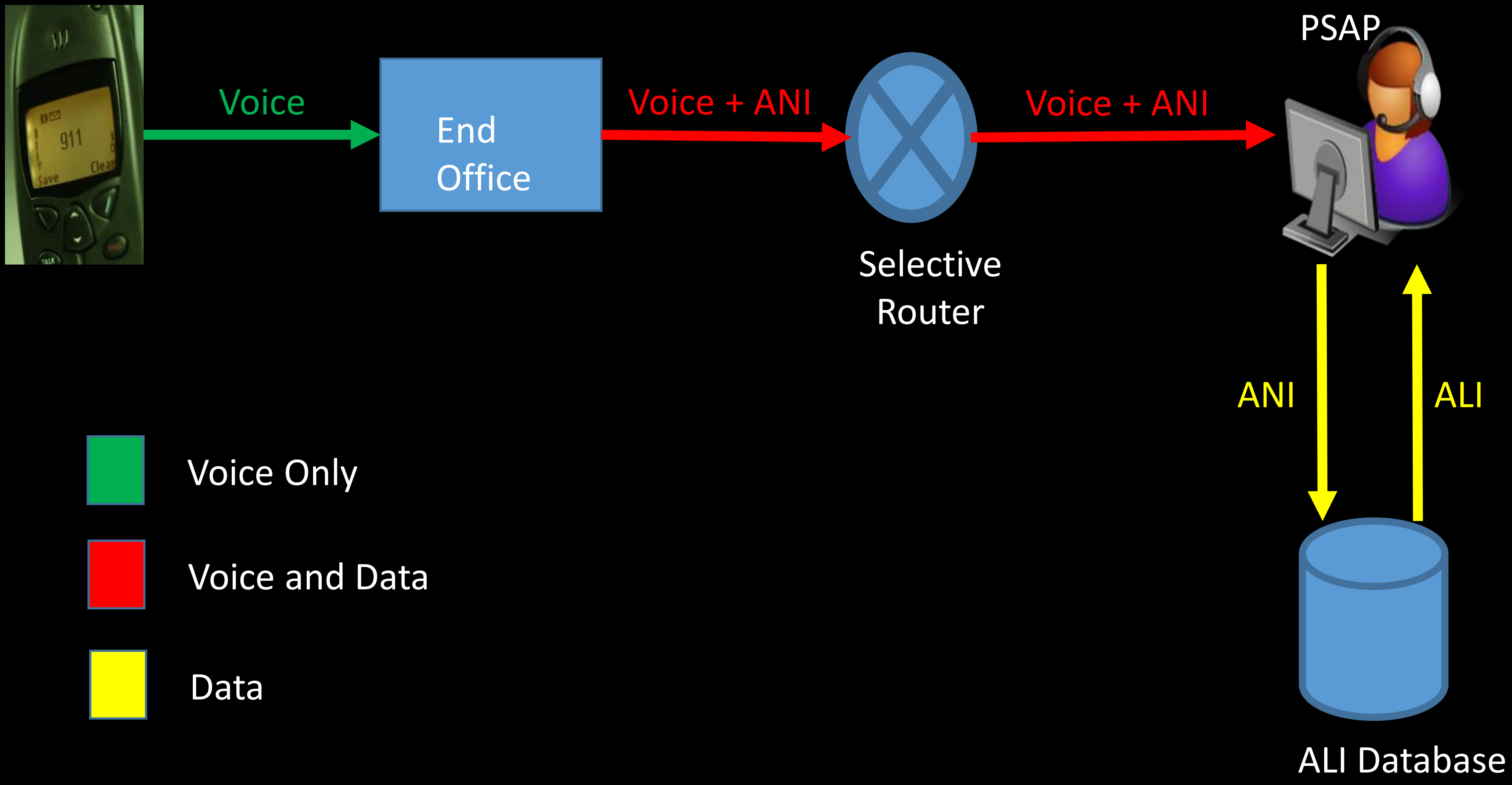
Research Aims

- Investigate potential vulnerabilities across the entire 911 system
- Detail current attacks being carried out on the 911 system
- Propose solutions for existing vulnerabilities and anticipate potential vectors for future infrastructure modifications

Methodology

- Interviews
- Regional surveys
- Process observations
- Practical experimentation
- Solution development

Wired Telephone Call

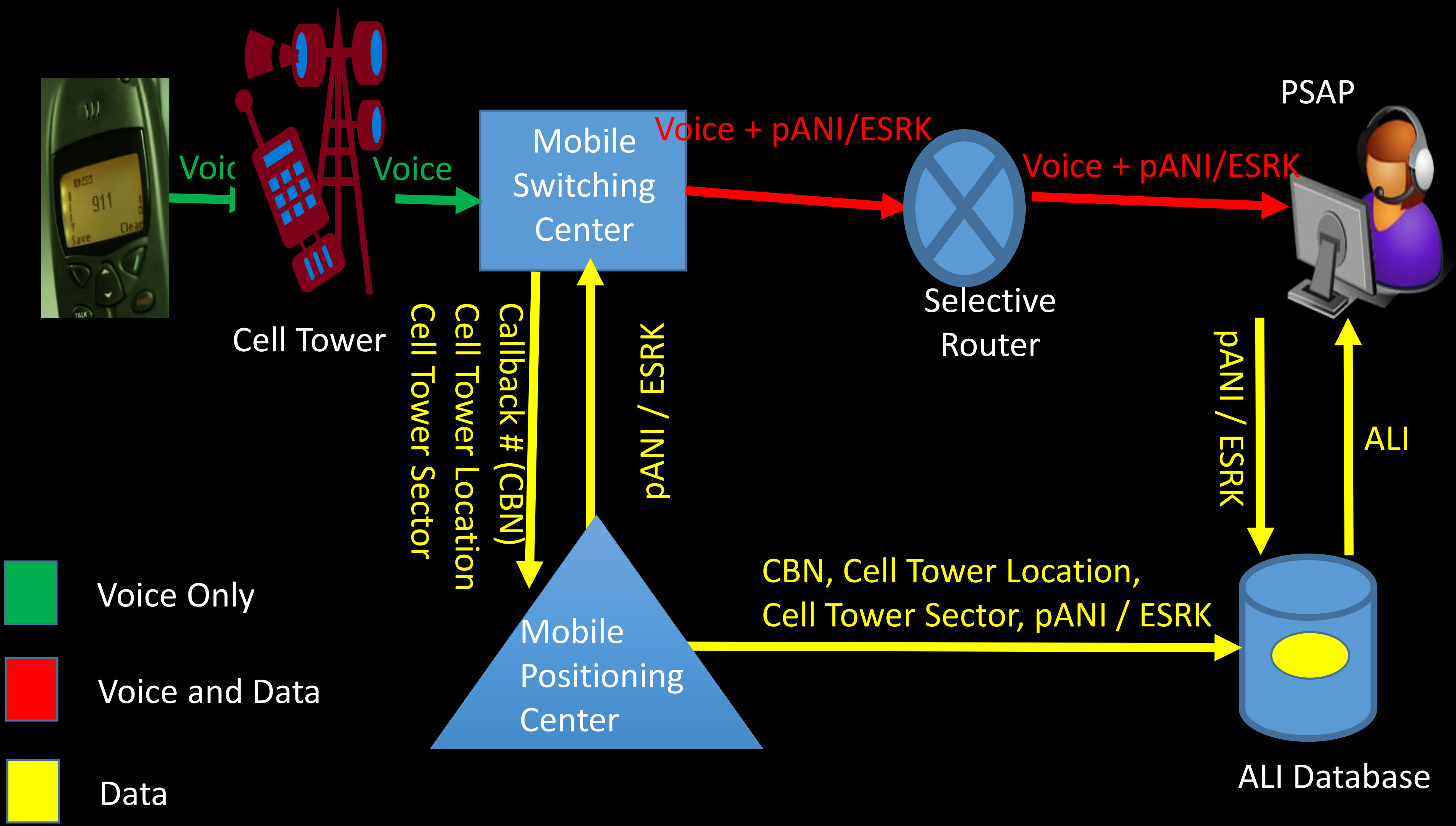


🟩 Voice Only

🟥 Voice and Data

🟨 Data

Wireless Phase 1 Telephone Call



Voic

Voice

Cell Tower

Mobile Switching Center

Voice + pANI/ESRK

Selective Router

Voice + pANI/ESRK

PSAP

Cell Tower Sector

Cell Tower Location

Callback # (CBN)

pANI / ESRK

pANI / ESRK

ALI

Mobile Positioning Center

CBN, Cell Tower Location,
Cell Tower Sector, pANI / ESRK

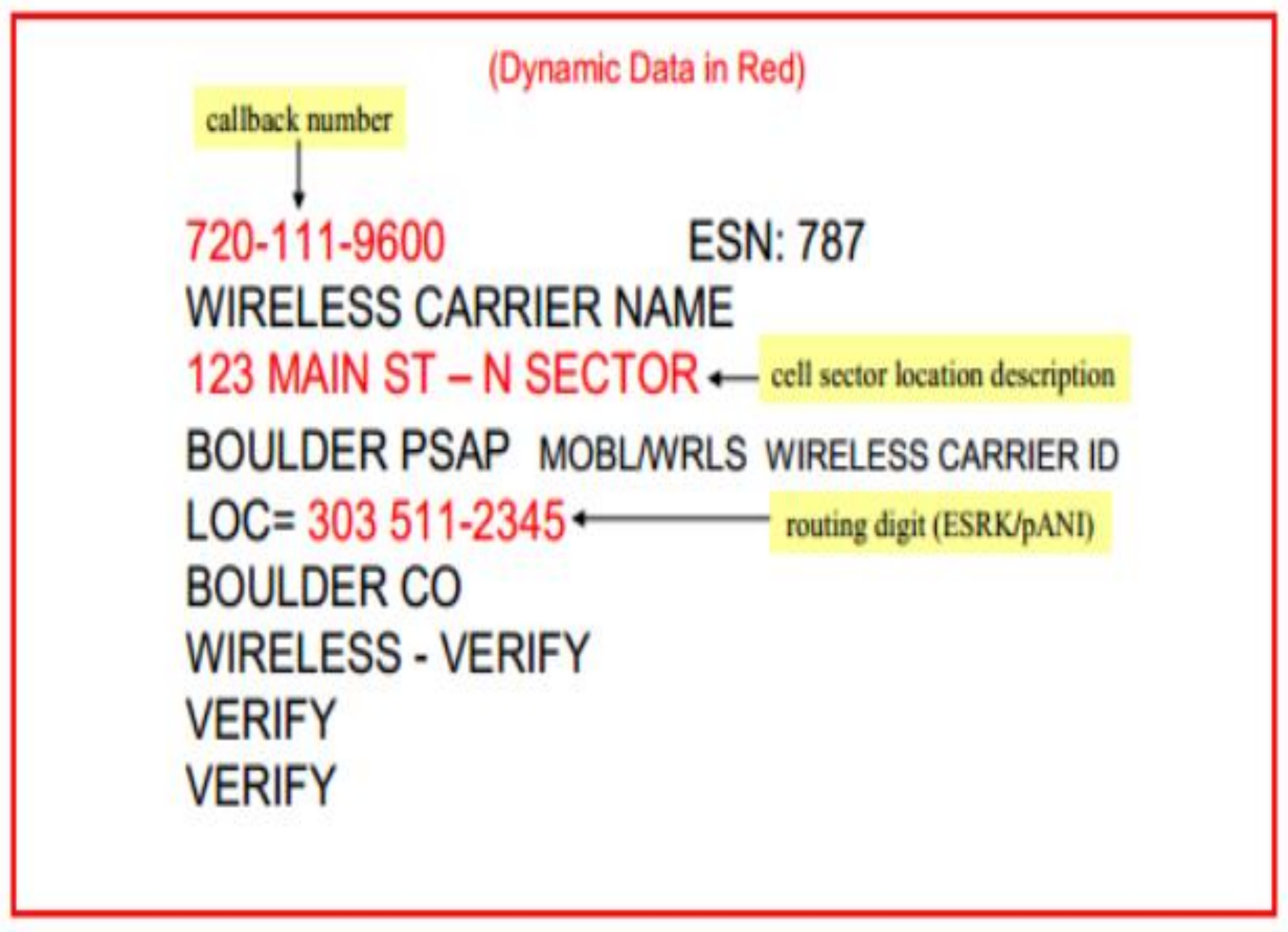
ALI Database

🟩 Voice Only

🟥 Voice and Data

🟨 Data

Wireless Phase 1 Data



(Dynamic Data in Red)

callback number

720-111-9600 ESN: 787

WIRELESS CARRIER NAME

123 MAIN ST – N SECTOR ← cell sector location description

BOULDER PSAP MOBL/WRLS WIRELESS CARRIER ID

LOC= 303 511-2345 ← routing digit (ESRK/pANI)

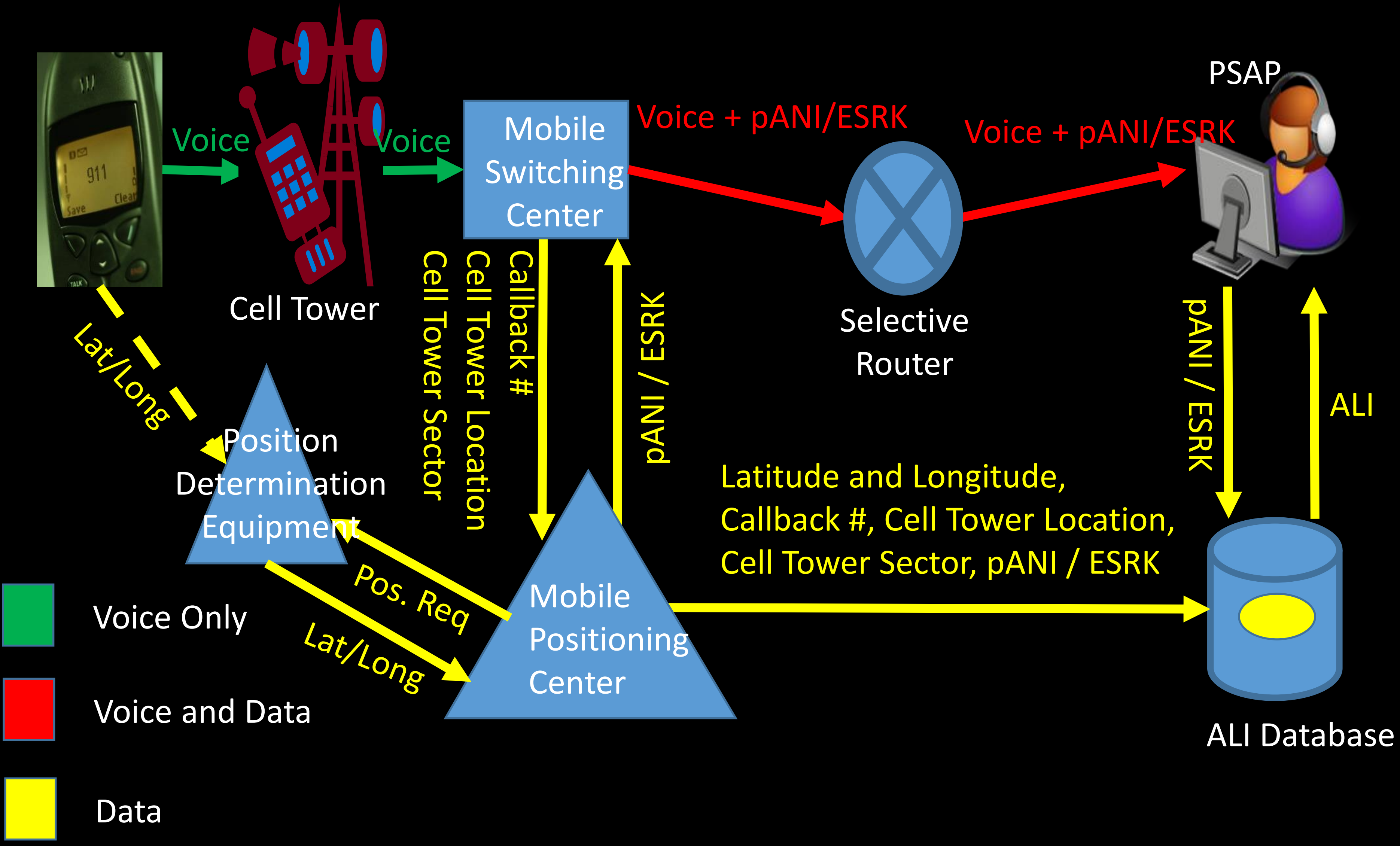
BOULDER CO

WIRELESS - VERIFY

VERIFY

VERIFY

Wireless Phase 2 Telephone Call



Voice

Voice

Cell Tower

Mobile Switching Center

Voice + pANI/ESRK

Voice + pANI/ESRK

PSAP

Selective Router

Lat/Long

Position Determination Equipment

Cell Tower Sector

Cell Tower Location

Callback #

pANI / ESRK

pANI / ESRK

ALI

Latitude and Longitude, Callback #, Cell Tower Location, Cell Tower Sector, pANI / ESRK

Pos. Req

Lat/Long

Mobile Positioning Center

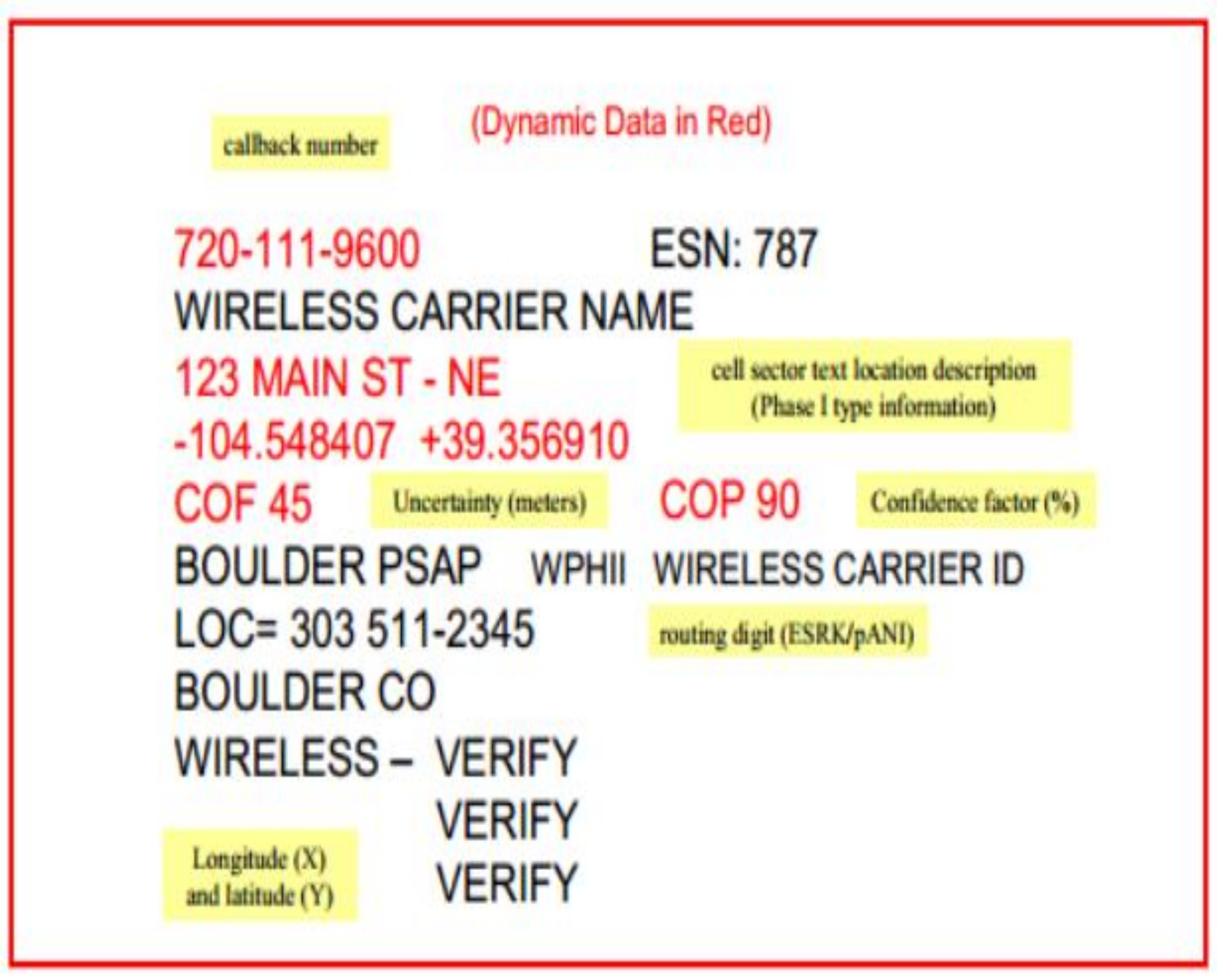
ALI Database

🟩 Voice Only

🟥 Voice and Data

🟨 Data

Wireless Phase 2 Data



callback number

(Dynamic Data in Red)

720-111-9600 ESN: 787

WIRELESS CARRIER NAME

123 MAIN ST - NE

cell sector text location description
(Phase I type information)

-104.548407 +39.356910

COF 45 Uncertainty (meters) COP 90 Confidence factor (%)

BOULDER PSAP WPHII WIRELESS CARRIER ID

LOC= 303 511-2345 routing digit (ESRK/pANI)

BOULDER CO

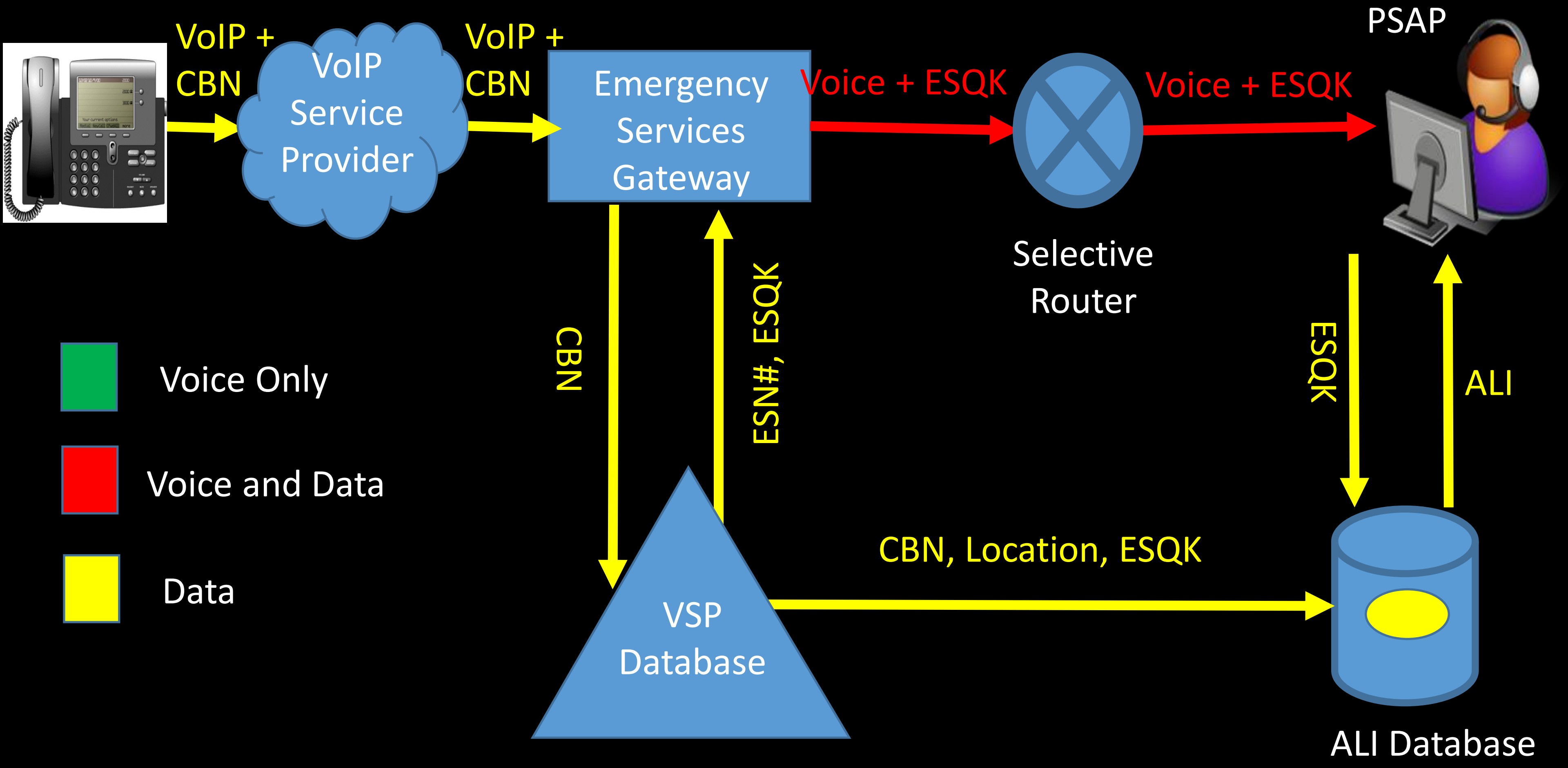
WIRELESS – VERIFY

VERIFY

VERIFY

Longitude (X)
and latitude (Y)

VoIP Call



VoIP + CBN

VoIP Service Provider

VoIP + CBN

Emergency Services Gateway

Voice + ESQK

Selective Router

Voice + ESQK

PSAP

CBN

ESN#, ESQK

VSP Database

CBN, Location, ESQK

ESQK

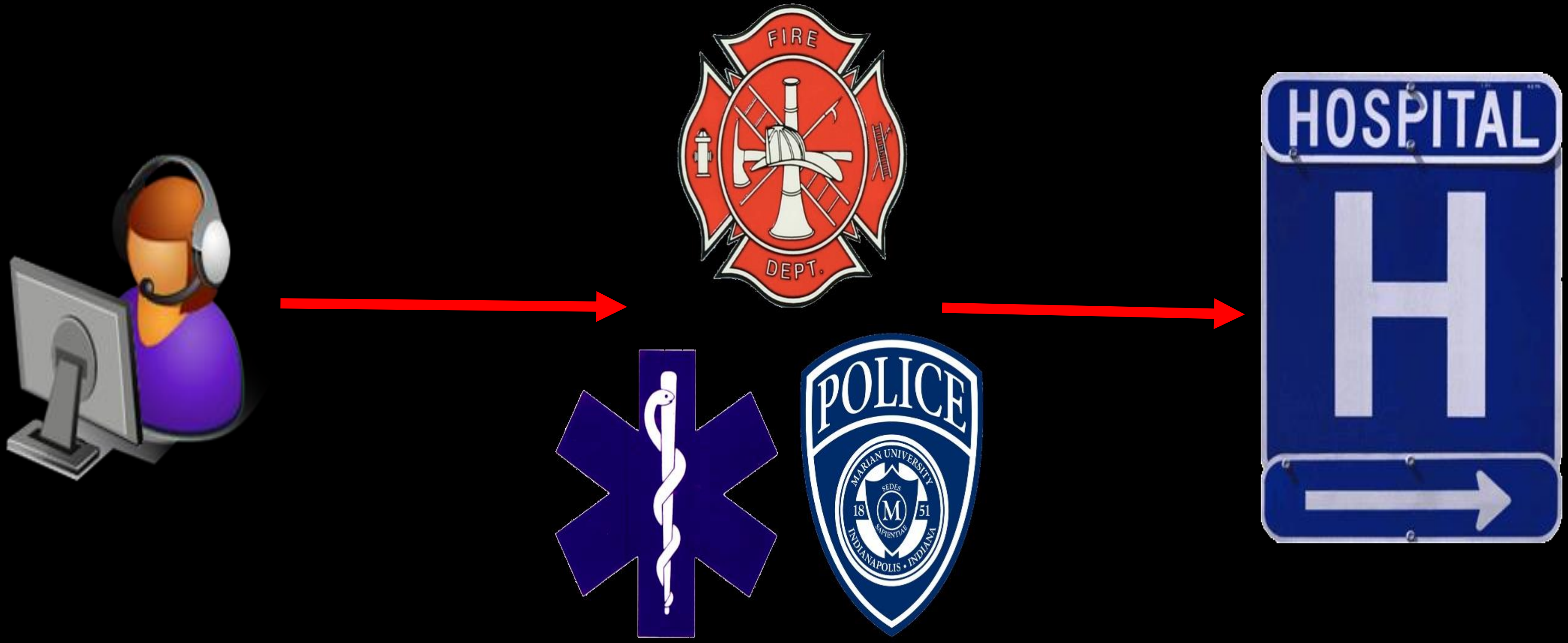
ALI

ALI Database

🟩 Voice Only

🟥 Voice and Data

🟨 Data

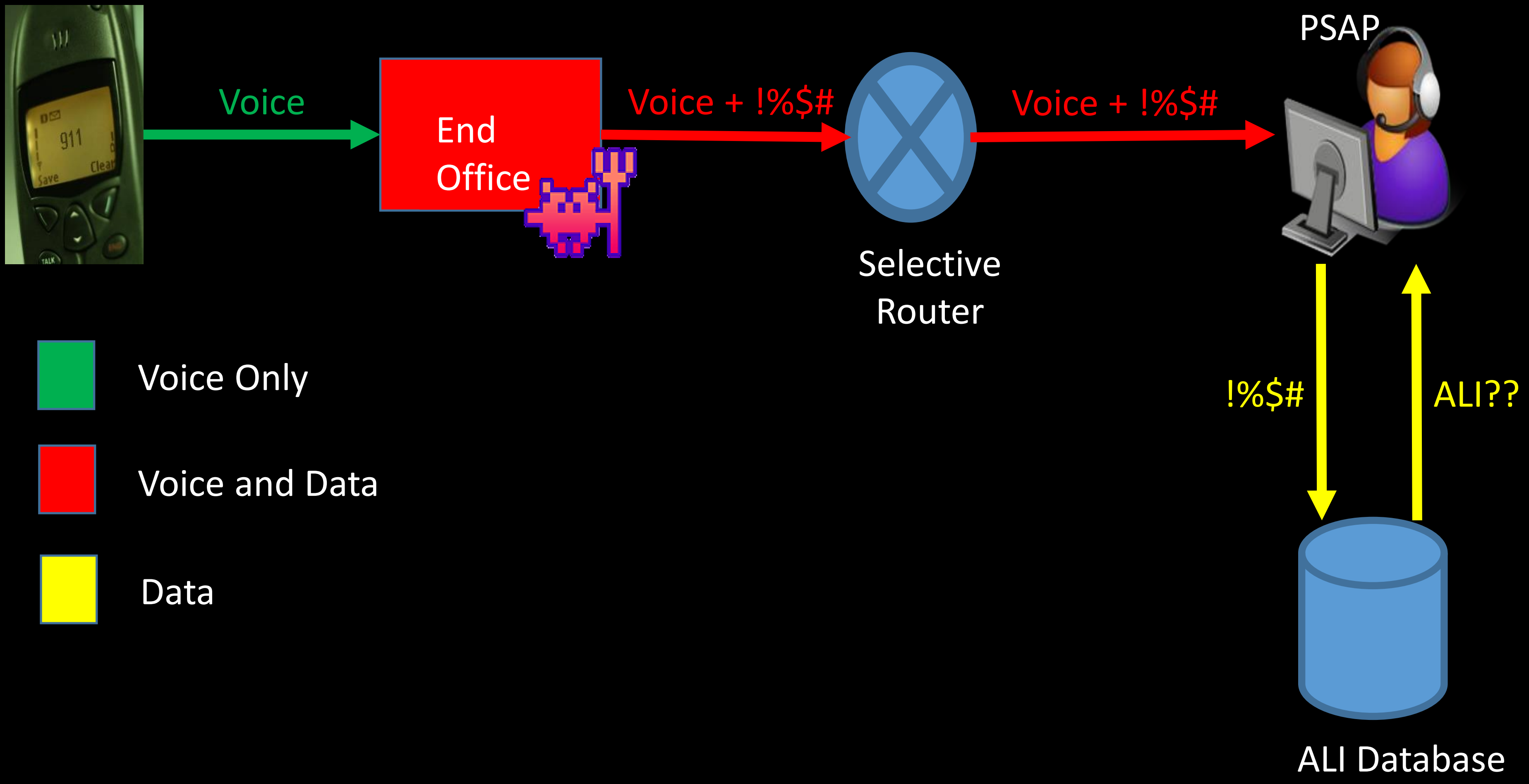

FIRE
DEPT.
POLICE
MARIAN UNIVERSITY
SEDES
18
M
51
SAPIENTIAE
INDIANAPOLIS • INDIANA
HOSPITAL
H

The Three Goals of Hacking 911

- Initiate inappropriate 911 response
- Interfere with an appropriate 911 response
- 911 system surveillance

System Weaknesses

Wired – End Office Control

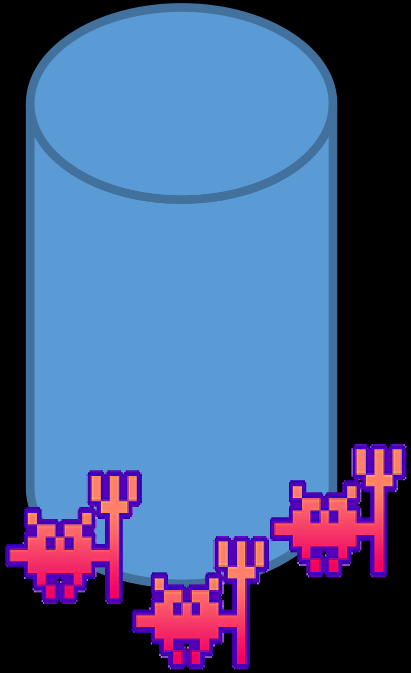


🟩 Voice Only

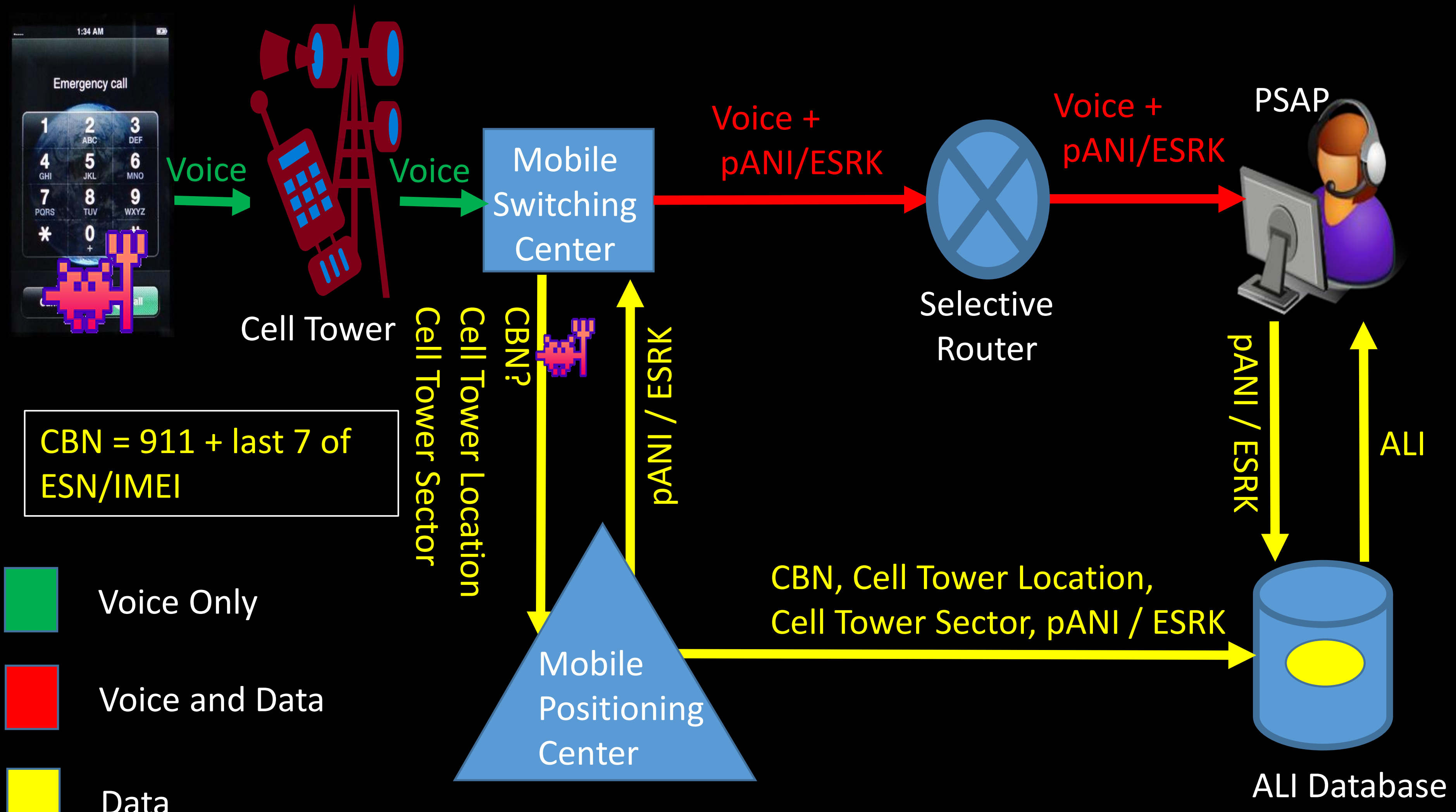
🟥 Voice and Data

🟨 Data

ALI Database



NSI Emergency Calls



Voice

Cell Tower

Voice

Mobile Switching Center

Voice + pANI/ESRK

Selective Router

Voice + pANI/ESRK

PSAP

CBN?

Cell Tower Location

Cell Tower Sector

pANI / ESRK

Mobile Positioning Center

CBN, Cell Tower Location, Cell Tower Sector, pANI / ESRK

pANI / ESRK

ALI

ALI Database

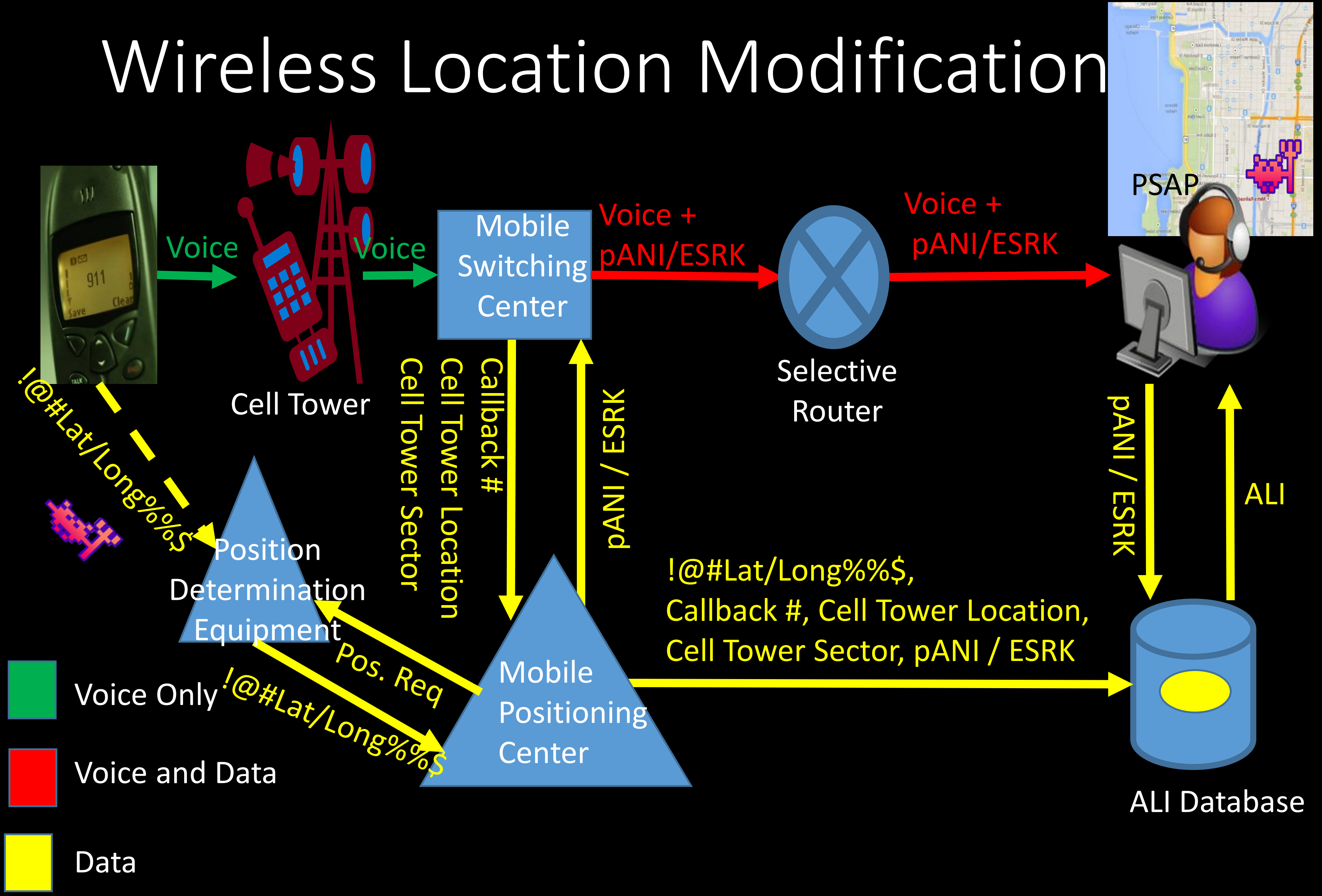
CBN = 911 + last 7 of ESN/IMEI

🟩 Voice Only

🟥 Voice and Data

🟨 Data

Wireless Location Modification



Voice

Cell Tower

Voice

Mobile Switching Center

Voice + pANI/ESRK

Selective Router

Voice + pANI/ESRK

PSAP

Callback #

Cell Tower Location

Cell Tower Sector

pANI / ESRK

pANI / ESRK

ALI

!@#Lat/Long%%$

Position Determination Equipment

Pos. Req

!@#Lat/Long%%$

Mobile Positioning Center

!@#Lat/Long%%$, Callback #, Cell Tower Location, Cell Tower Sector, pANI / ESRK

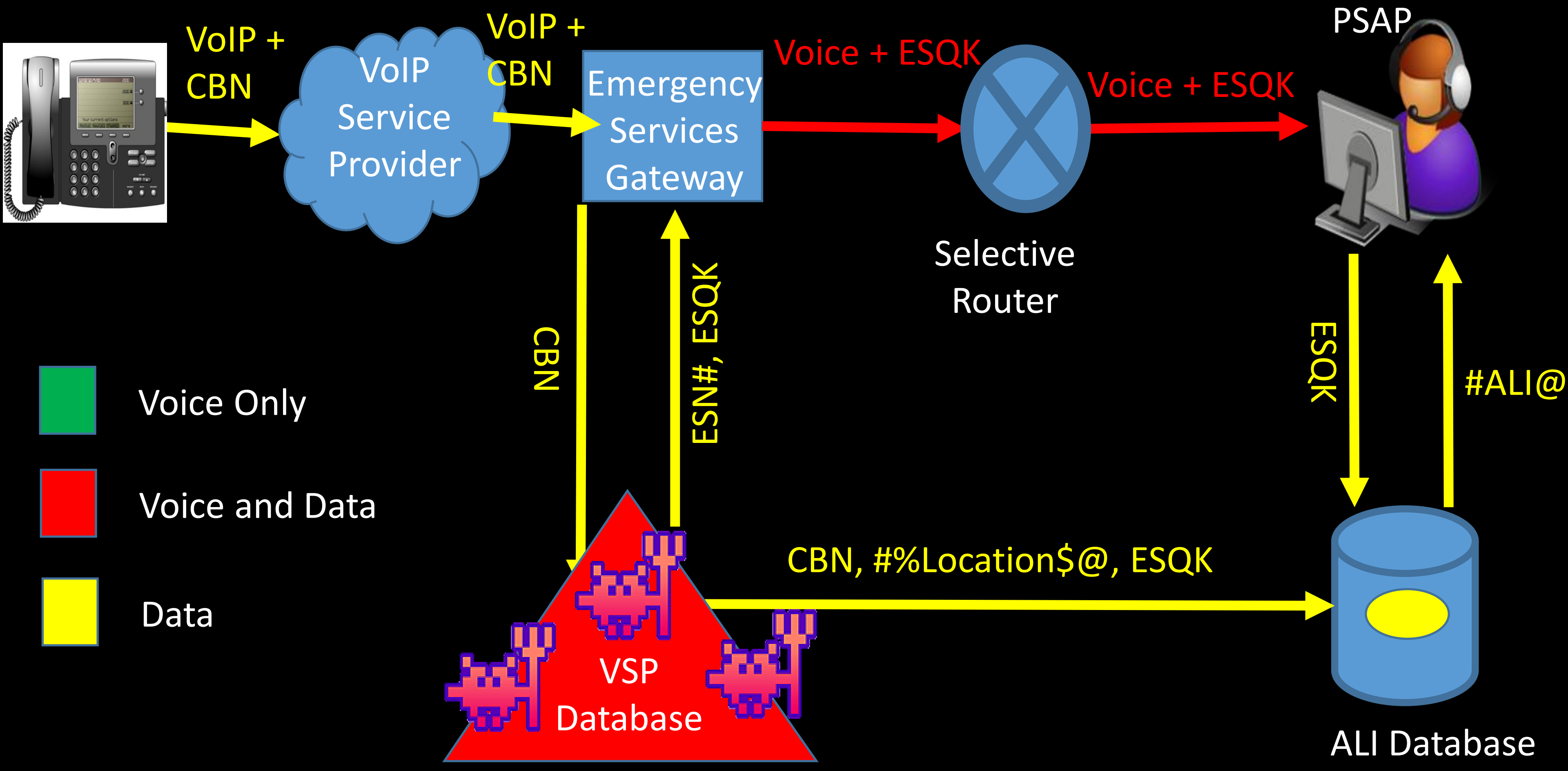
ALI Database

🟩 Voice Only

🟥 Voice and Data

🟨 Data

VSP Modification



VoIP + CBN

VoIP Service Provider

VoIP + CBN

Emergency Services Gateway

Voice + ESQK

Selective Router

Voice + ESQK

PSAP

CBN

ESN#, ESQK

VSP Database

CBN, #%Location$@, ESQK

ESQK

#ALI@

ALI Database

🟩 Voice Only

🟥 Voice and Data

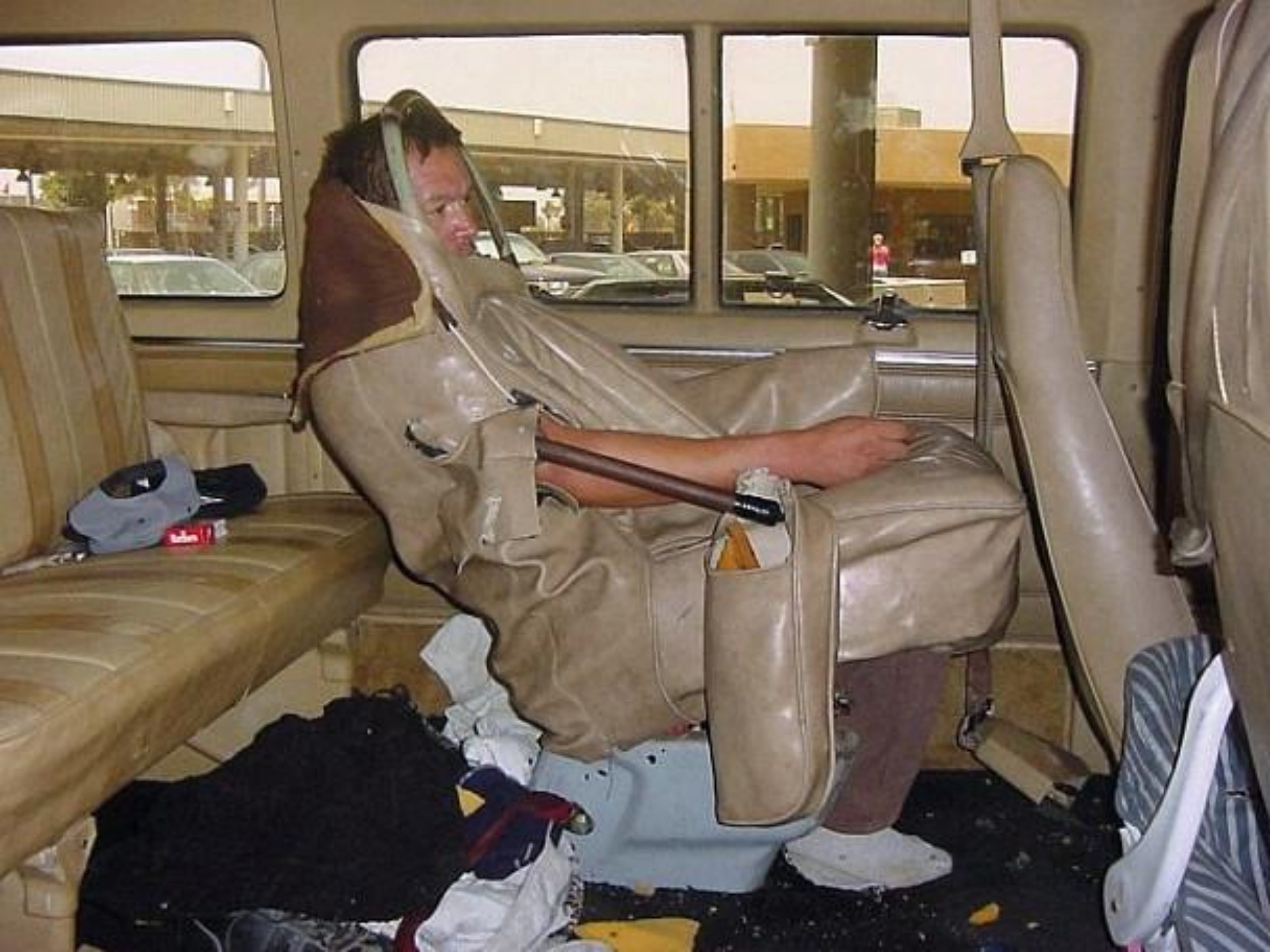
🟨 Data

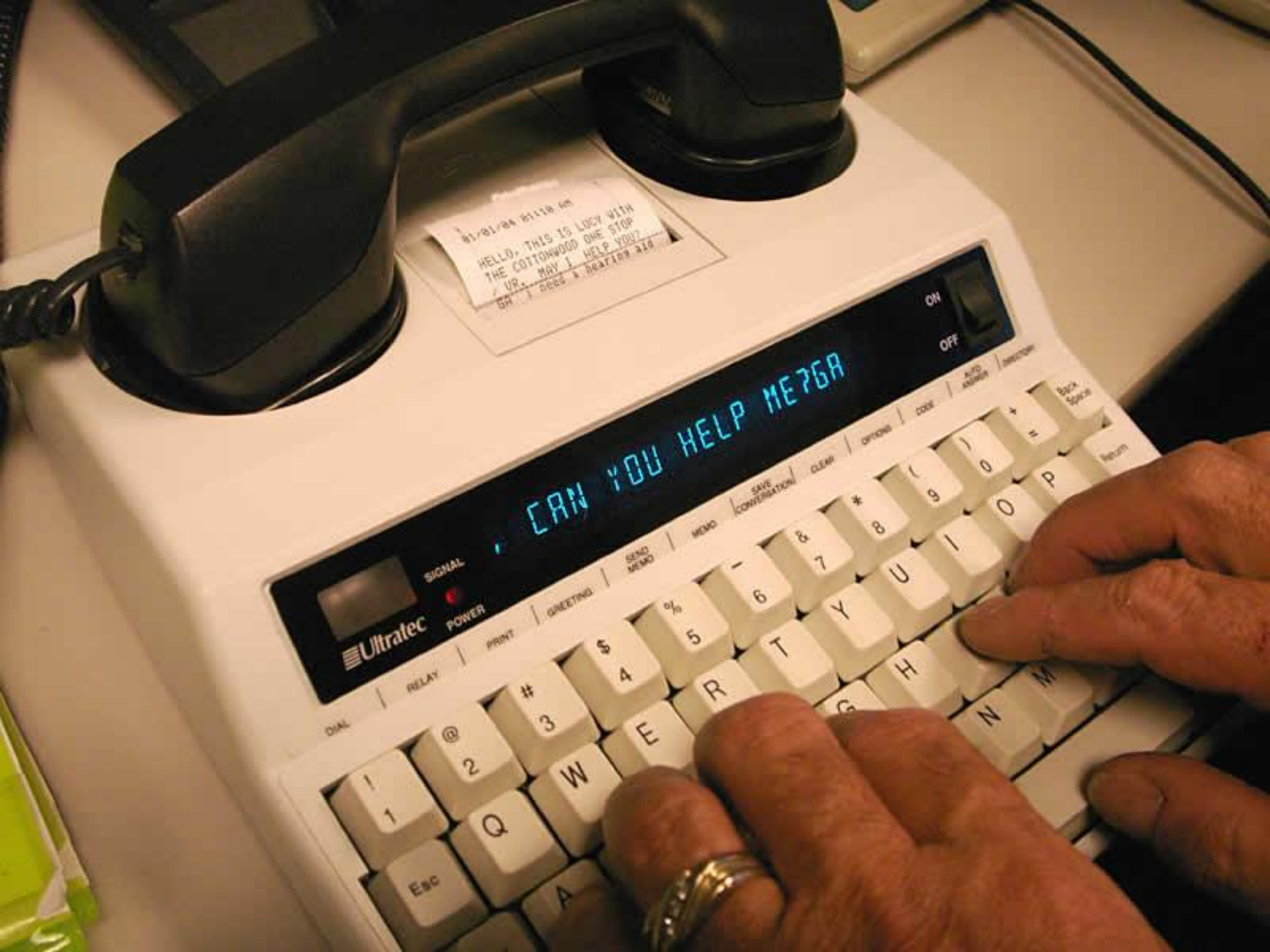
FIRE
DEPT.
POLICE
MARIAN UNIVERSITY
SEDES SAPIENTIAE
18 M 51
INDIANAPOLIS • INDIANA
HOSPITAL
H

System Attacks

TAC
POLICE
POLICE
POLICE

Swatting Call



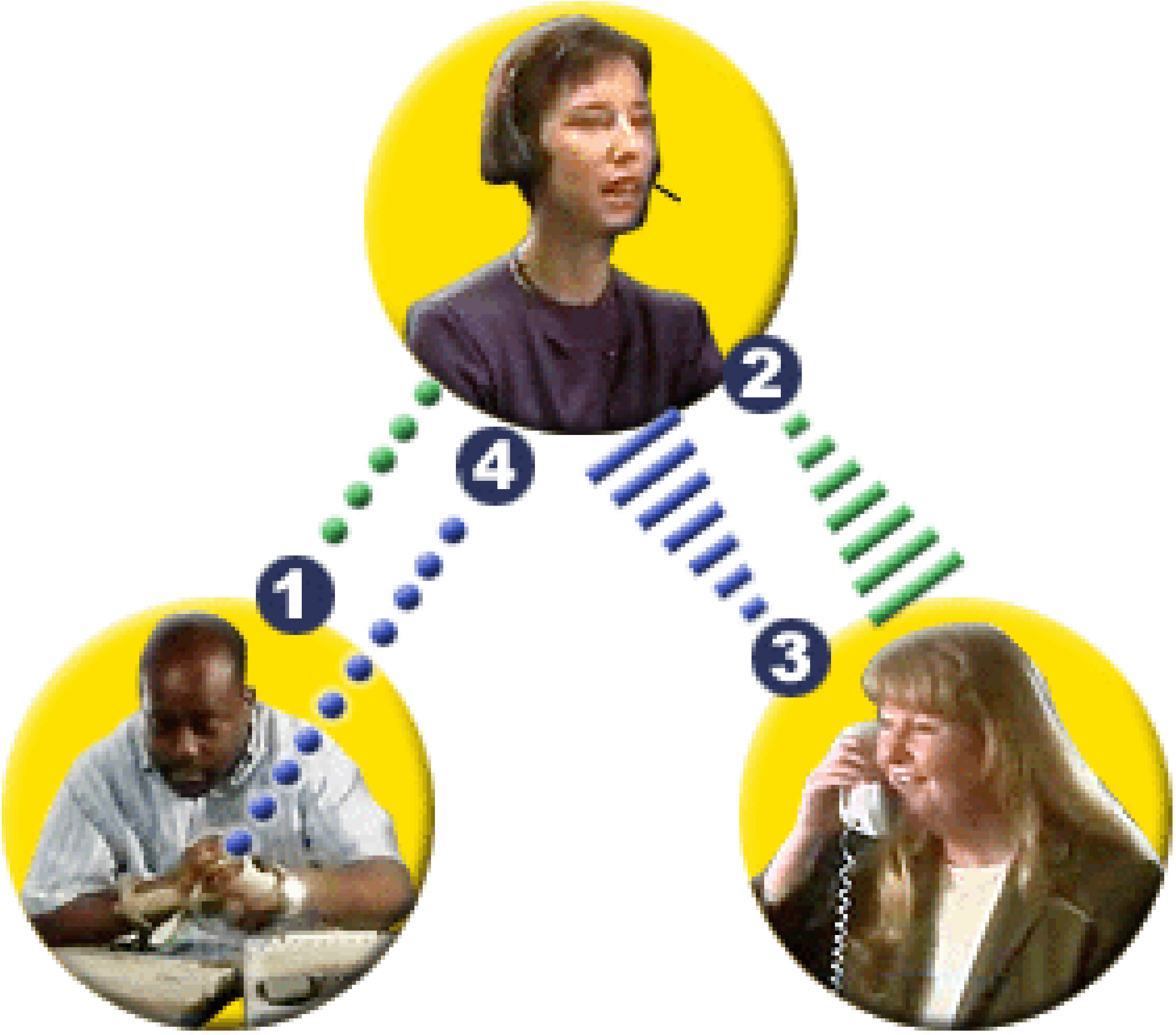


01/01/04 01:10 AM

HELLO, THIS IS LUCY WITH
THE COTTONWOOD ONE STOP
/ VR. MAY I HELP YOU?
GA I need a hearing aid

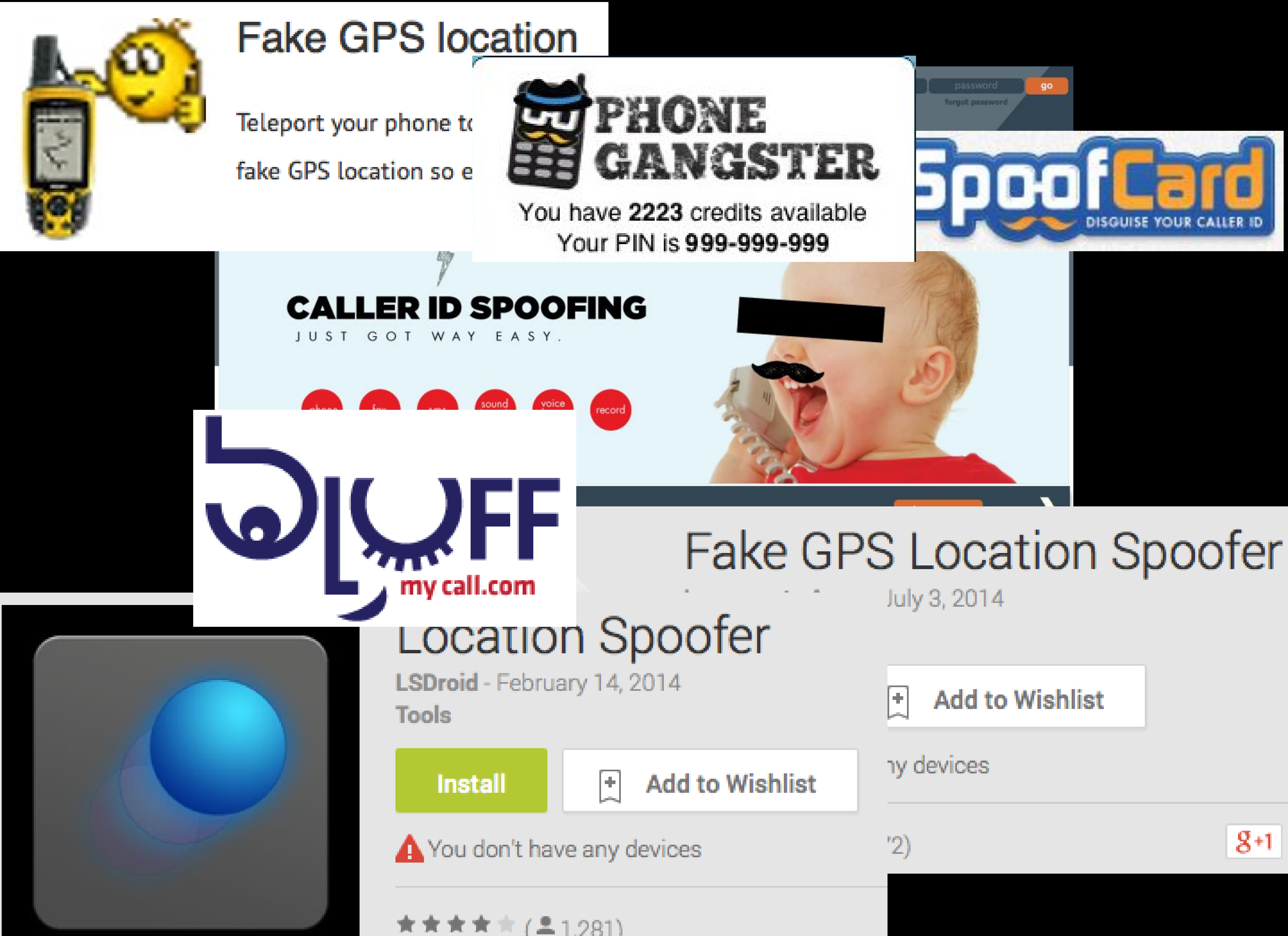
CAN YOU HELP ME?GA

Relay Operator



TTY User

Voice Caller



Fake GPS location

Teleport your phone t

fake GPS location so e

PHONE GANGSTER

You have **2223** credits available

Your PIN is **999-999-999**

CALLER ID SPOOFING

JUST GOT WAY EASY.

Fake GPS Location Spoofer

July 3, 2014

Add to Wishlist

ny devices

2)

Location Spoofer

LSDroid - February 14, 2014

Tools

Install

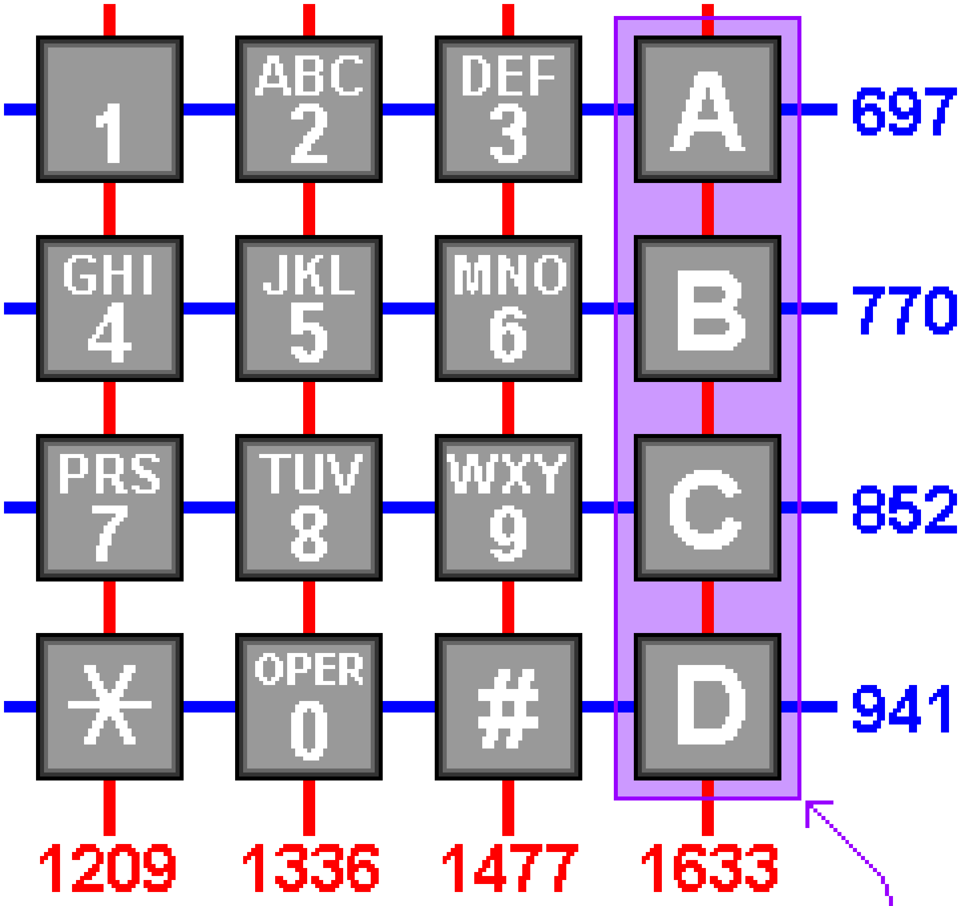
Add to Wishlist

You don't have any devices

SOLACOM

Dual-Tone Multi-Frequency (DTMF) Frequency Standards

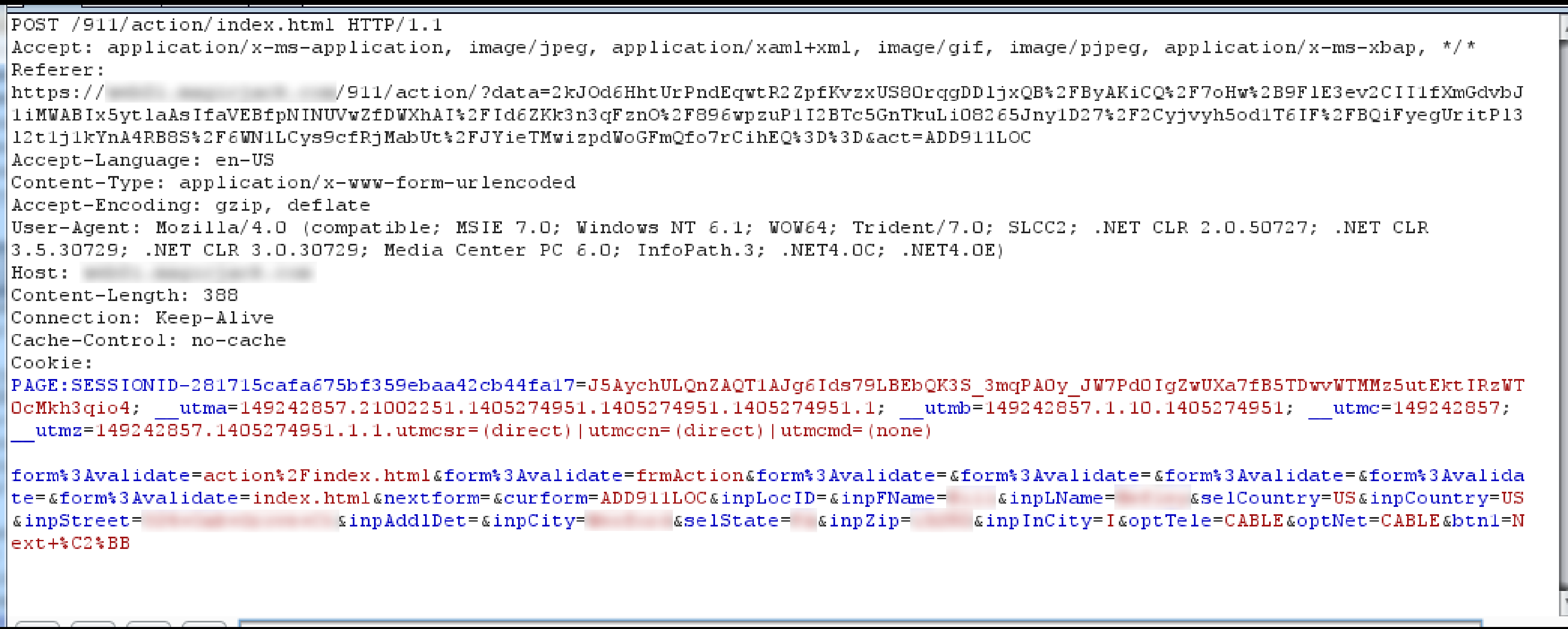
Frequencies shown are in Hertz



	1209	1336	1477	1633
697	1	ABC 2	DEF 3	A
770	GHI 4	JKL 5	MNO 6	B
852	PRS 7	TUV 8	WXY 9	C
941	*	OPER 0	#	D

NOTE: The last column (A-B-C-D) is not normally found on telephones

BlackBerry
SAMSUNG
verizon
US Cellular
WORLD EDITION



```
POST /911/action/index.html HTTP/1.1
Accept: application/x-ms-application, image/jpeg, application/xaml+xml, image/gif, image/pjpeg, application/x-ms-xbap, */*
Referer:
https://[redacted]/911/action/?data=2kJOd6HhtUrPndEqwtR2ZpfKvzxUS8OrqgDDljxQB%2FByAKiCQ%2F7oHw%2B9FlE3ev2CII1fXmGdvbJ
1iMWABIx5ytlaAsIfaVEBfpNINUVwZfDWXhAI%2FId6ZKk3n3qFznO%2F896wpzuP1I2BTc5GnTkuLi08265Jny1D27%2F2Cyjvyh5od1T6IF%2FBQiFyegUritP13
12t1j1kYnA4RB8S%2F6WN1LCys9cfRjMabUt%2FJYieTMwizpdWoGFmQfo7rCihEQ%3D%3D&act=ADD911LOC
Accept-Language: en-US
Content-Type: application/x-www-form-urlencoded
Accept-Encoding: gzip, deflate
User-Agent: Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 6.1; WOW64; Trident/7.0; SLCC2; .NET CLR 2.0.50727; .NET CLR
3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0; InfoPath.3; .NET4.0C; .NET4.0E)
Host: [redacted]
Content-Length: 388
Connection: Keep-Alive
Cache-Control: no-cache
Cookie:
PAGE:SESSIONID-281715cafa675bf359ebaa42cb44fa17=J5AychULQnZAQT1AJg6Ids79LBEbQK3S_3mqPAOy_JW7PdOIgZwUXa7fB5TDwvWTMMz5utEktIRzWT
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&inpStreet=[redacted]&inpAddlDet=&inpCity=[redacted]&selState=[redacted]&inpZip=[redacted]&inpInCity=I&optTele=CABLE&optNet=CABLE&btn1=N
ext+%C2%BB
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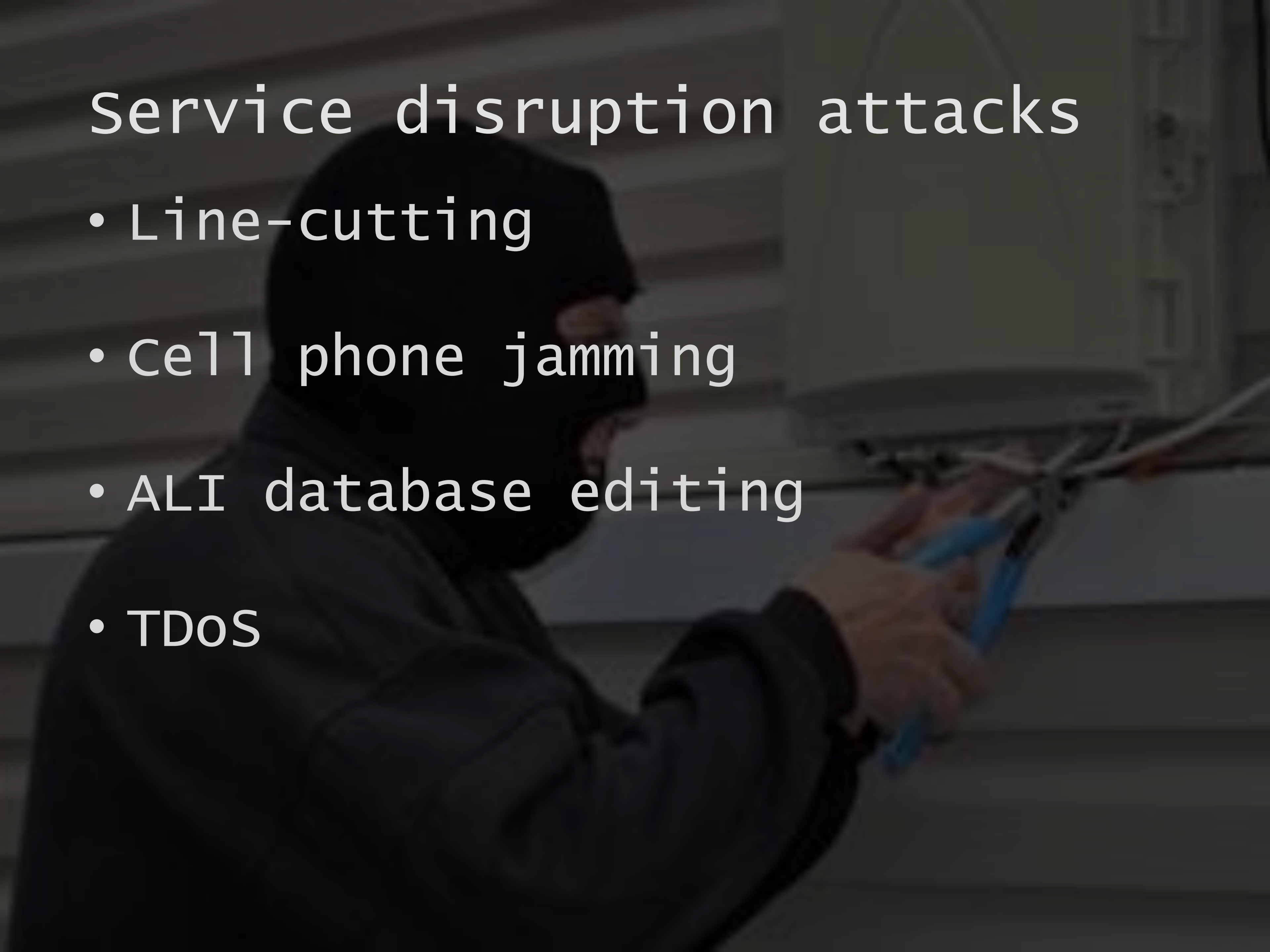
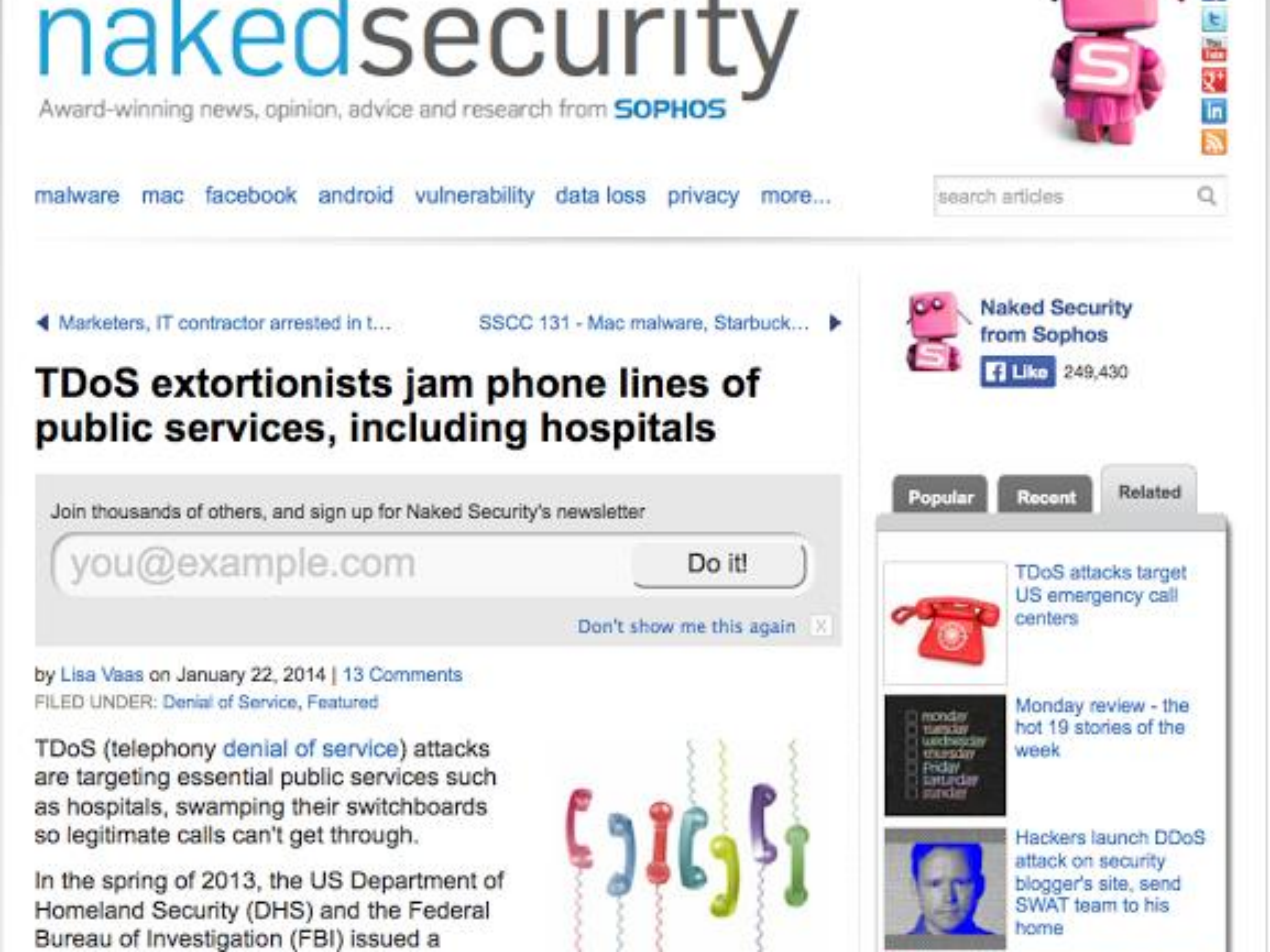
VoIP Service Providers

Service disruption attacks



- Line-cutting
- Cell phone jamming
- ALI database editing
- TDoS



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TDoS extortionists jam phone lines of public services, including hospitals

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Do it!

Don't show me this again X

by Lisa Vaas on January 22, 2014 | 13 Comments

FILED UNDER: Denial of Service, Featured

TDoS (telephony denial of service) attacks are targeting essential public services such as hospitals, swamping their switchboards so legitimate calls can't get through.

In the spring of 2013, the US Department of Homeland Security (DHS) and the Federal Bureau of Investigation (FBI) issued a

Naked Security from Sophos

Like 249,430

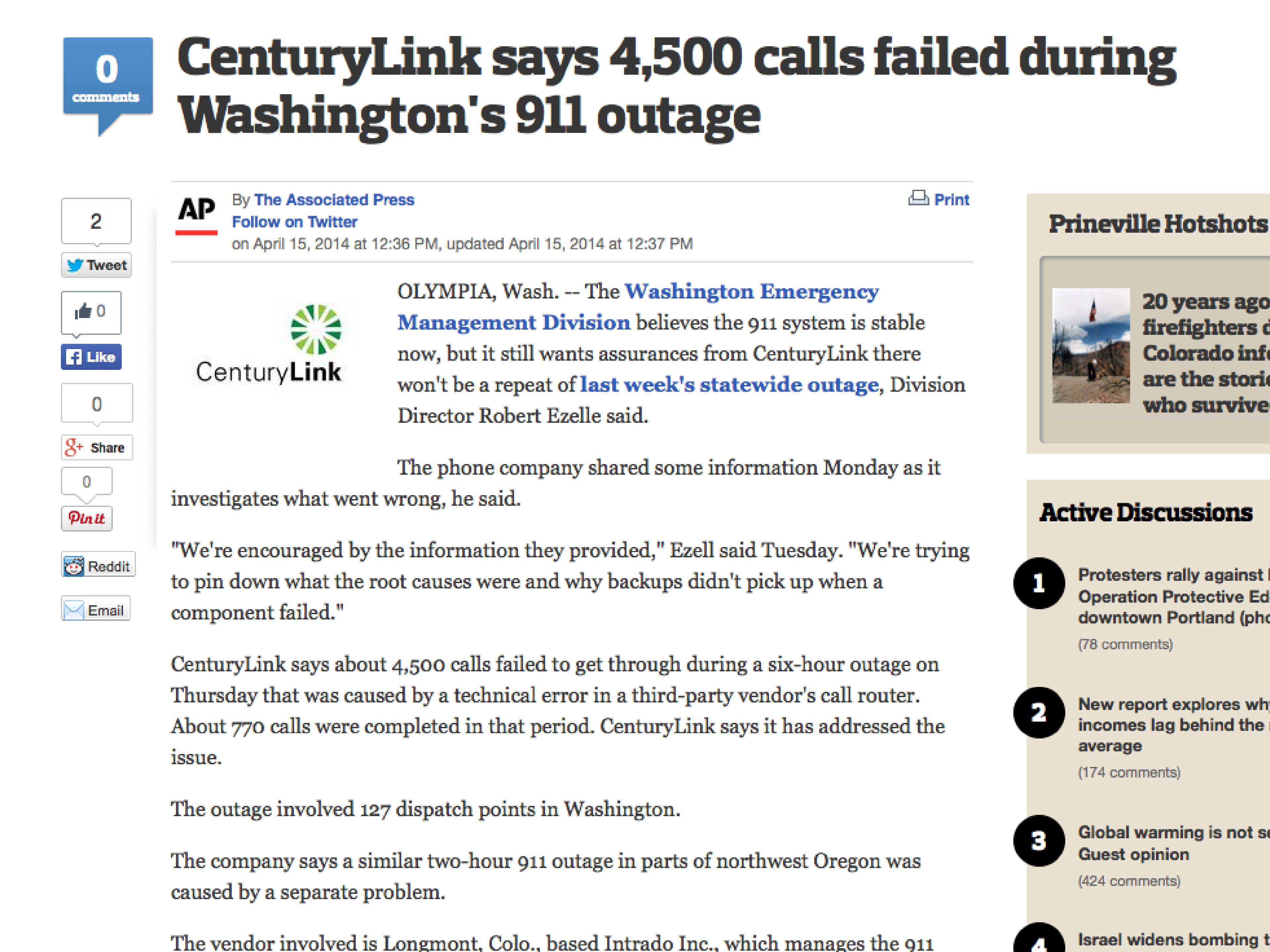
Popular Recent Related

TDoS attacks target US emergency call centers

Monday review - the hot 19 stories of the week

Hackers launch DDoS attack on security blogger's site, send SWAT team to his home

- Resource exhaustion (virtual/personnel)
- Outdated system architectures
- Lack of air-gapping
- Privacy



CenturyLink says 4,500 calls failed during Washington's 911 outage

By The Associated Press
Follow on Twitter
on April 15, 2014 at 12:36 PM, updated April 15, 2014 at 12:37 PM

OLYMPIA, Wash. -- The Washington Emergency Management Division believes the 911 system is stable now, but it still wants assurances from CenturyLink there won't be a repeat of last week's statewide outage, Division Director Robert Ezelle said.

The phone company shared some information Monday as it investigates what went wrong, he said.

"We're encouraged by the information they provided," Ezell said Tuesday. "We're trying to pin down what the root causes were and why backups didn't pick up when a component failed."

CenturyLink says about 4,500 calls failed to get through during a six-hour outage on Thursday that was caused by a technical error in a third-party vendor's call router. About 770 calls were completed in that period. CenturyLink says it has addressed the issue.

The outage involved 127 dispatch points in Washington.

The company says a similar two-hour 911 outage in parts of northwest Oregon was caused by a separate problem.

The vendor involved is Longmont, Colo., based Intrado Inc., which manages the 911

Prineville Hotshots

20 years ago
firefighters d
Colorado inf
are the stori
who survive

Active Discussions

1 Protesters rally against
Operation Protective Ed
downtown Portland (ph
(78 comments)

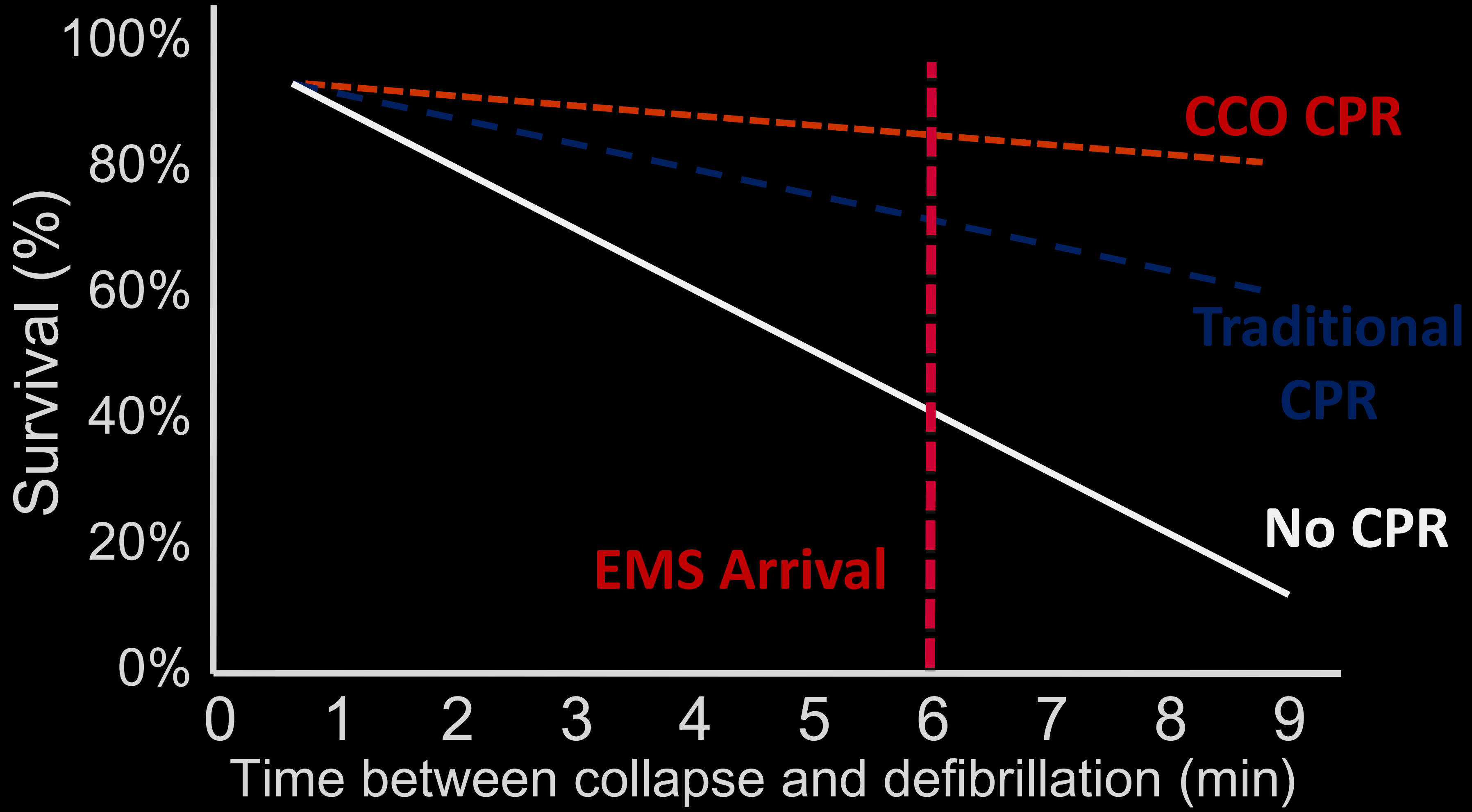
2 New report explores wh
incomes lag behind the
average
(174 comments)

3 Global warming is not s
Guest opinion
(424 comments)

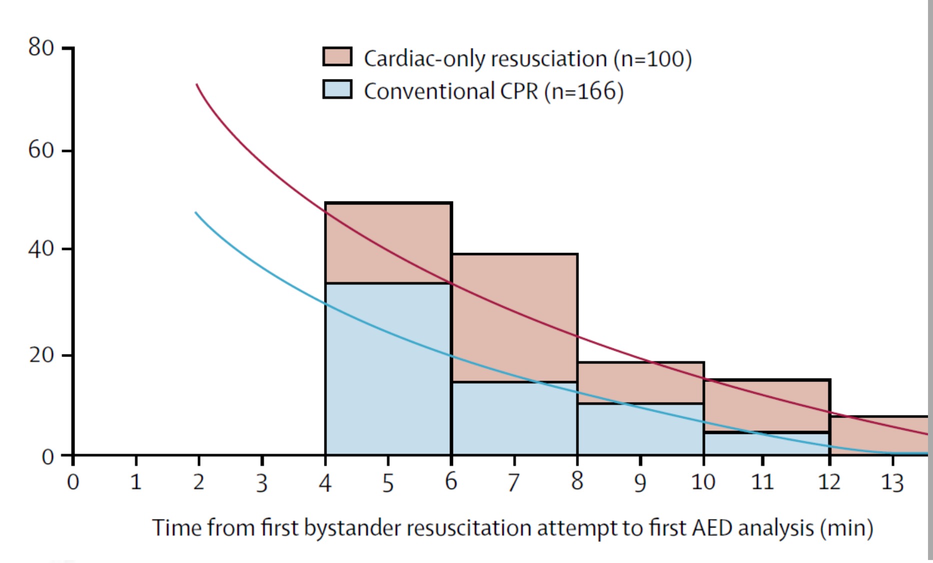
4 Israel widens bombing t

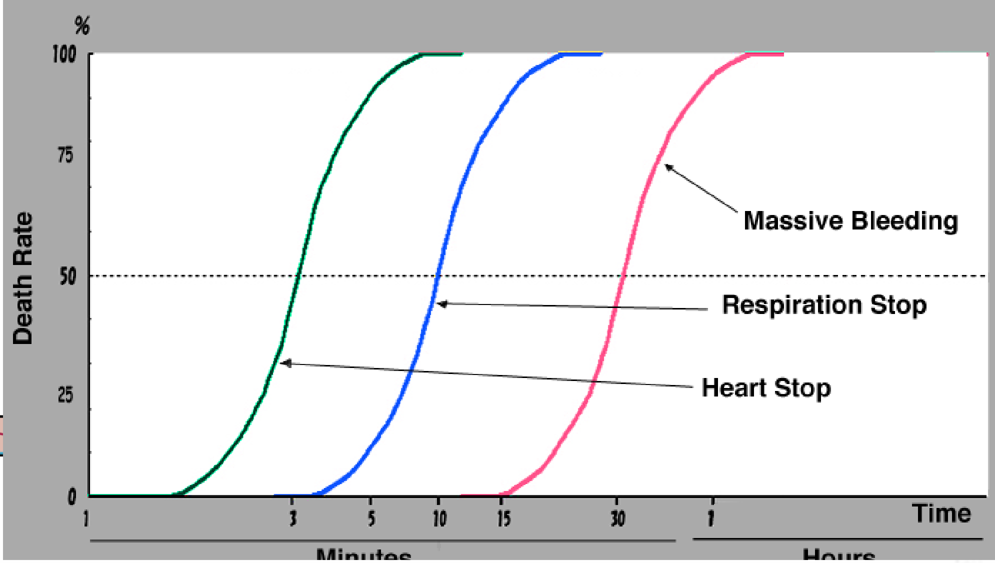
Health Impacts

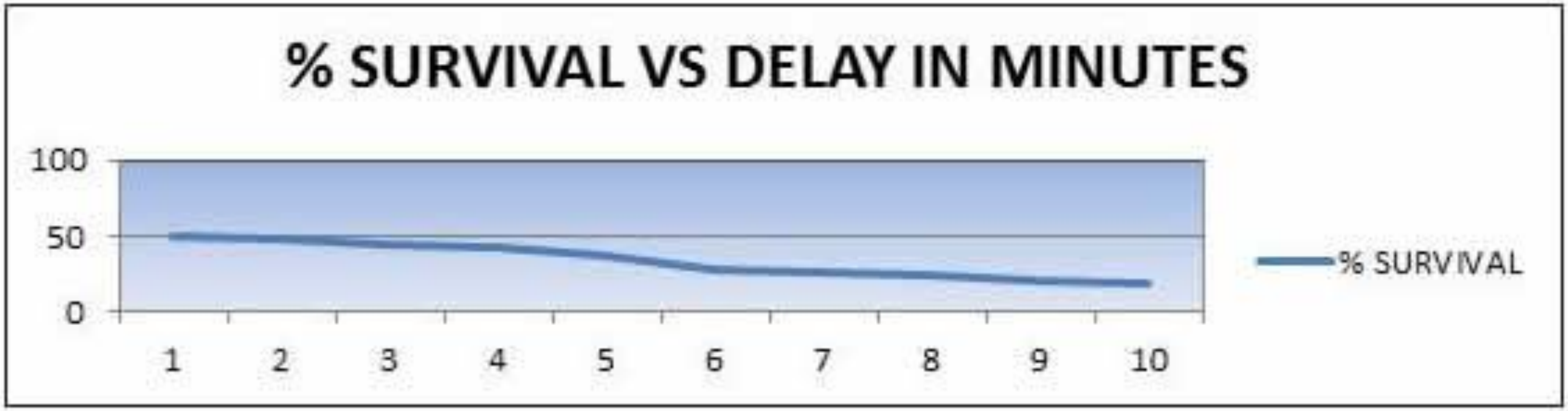
Bystander CCO CPR Improves Chance of Survival from Cardiac Arrest

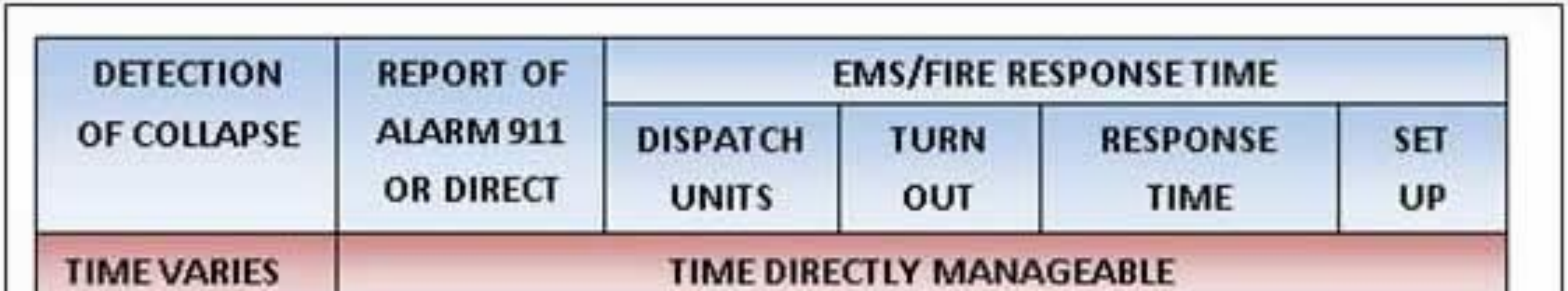


Nagao, K Current Opinions in Critical Care 2009
EMS Arrival Time based on TFD 90% Code 3 Response in FY2008. Standards of Response Coverage 2008.






% SURVIVAL VS DELAY IN MINUTES



DETECTION OF COLLAPSE	REPORT OF ALARM 911 OR DIRECT	EMS/FIRE RESPONSE TIME			
		DISPATCH UNITS	TURN OUT	RESPONSE TIME	SET UP
TIME VARIES	TIME DIRECTLY MANAGEABLE				

Strategic Threat Agents

- 6000 PSAPs taking a combined 660,000 calls per day
- Fundamental building block of our collective security
- Potential damage extends beyond individual people not being able to talk to 911

Solutions

- Call-routing red flags
- Call “captchas”
- PSAP security standardizations
- Increased budgets for security services
- Open the Black Box

Call-Routing Red Flags

Call “Captchas”

Para Español,
Oprima Número Dos

Security Standardization

Budget Hard Looks

OPENING THE
BLACK
BOX

Q&A