

The Challenges of Current and Future Technologies in Providing 911 Services to the City of Cambridge

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The Cambridge 911 Center (PSAP)

Evolution of 911

1968-1970's:	Basic 911 was established in many urban areas
1980's to 2000	911 was enhanced (E911) to provide the caller's telephone number ("ANI") and address ("ALI") and to route calls by specific address to the proper 911 center
Late 1990's to the present	E911 artfully jury-rigged to support cell phones and VoIP devices
2012 onwards	IP-based NG911 provides a platform for text, video, smart call flow, alarm info, and much more

Through this time period, 911 has achieved unparalleled brand recognition

It's Location, Location, Location

Not real estate, but emergencies

911 Call Answering Screen

VESTA Titlebar - vanrell
 File Options Window Help Monday, February 7, 2005 13:03

0

ALI Display

ALI Retransmit Options

Calling Number: (401) 497-8466

ALI History (18) Supp Info (0)

```

206
WPH2 13:03 02/07
(401) 497-8466 COID=
T-MOBILE USA (973) 291-1111
165
FOREST

SE SECTOR
Marlborough MA

ESN=603 MTN=508-7
LAT:+042.333691 LON:-071.573610
ELV:+0000 COF:0 COP:000

Region 3
Region 3
Region 3
          
```

Current/Last ANI

Queue Display

Queue	Calls	Agents	Longest Call
Wireline_911	0	6	
One_Way	0	6	
Two_Way	0	6	
Framingham_800	0	6	
Wireless_911	0	6	

VESTA Toolbar

ALI Display

Auto Dial

IRR

Line Status

Master Volume

TTY

VESTA Titlebar

Call Control

Queue Display

MapStar

Call Control

Ready Hold Emergency Park Release

Auto Dial

Last Number Dialed: Sharon

Boston Police	Boston EMS	Boston Fire
Cambridge	Lawrence PD	Worcester PD
PSAP Directory...	STATE POLICE...	SPEED DIAL...
ANI Callback...	Intercom...	Internal Transfer
Transfer	Cancel	Recording
		Redial

Line Status

911 WSBO 2
508 5-
(401) 497- 00:57

In Calls ◀ DN 3106 DN 6210

Start VESTA Titlebar - vanrell 1:03 PM

Wireline Call Location Presentation

```
206  
RESD 10:00 06/09  
(617) 868-0001 COID=VERIZ  
ROGERS, FRED  
  114  
  ADAMS  
  
APT 27  
CAMBRIDGE MA  
CI  
ESN=152 MTN:617-868-0001  
LAT:     LON:  
ELV:    COF:    COP:  
  
CAMBRIDGE POLICE  
CAMBRIDGE FIRE  
CAMBRIDGE EMS
```

Call is from a Residential Phone

Calling Phone Number

Subscriber's Name

Street Address matching Municipally-Specified MSAG format (a valid

Address within the min to max number range permitted for each street in a Municipality e.g., 1 to 200 Adams St)

This phone is in Apartment 27!

Wireline **PBX** Call Location - **BAD**

```
206  
PBXb 20:00 06/09  
(617) 253-1250 COID=VERIZ  
UNIVERSITY OF NORTHEAST  
200  
MAIN ST  
  
SUITE 212  
CAMBRIDGE MA  
CI  
ESN=152 MTN:617-253-1250  
LAT: LON:  
ELV: COF: COP:  
  
CAMBRIDGE POLICE  
CAMBRIDGE FIRE  
CAMBRIDGE EMS
```

Call is from a PBX

Calling Trunk Line (**cannot be called back**)

Subscriber's Name (Business Name)

Street Address of PBX switch

Room of PBX!

**But caller is actually in the Gym
which is 4 blocks away at 452
Cambridge Street!**

Caller, choking and alone, DIES

Wireline **PBX** 911 ALI Screen with E911 Solution – **GOOD!**

Call is from a PBX

Calling Phone (**but CAN be called back**)

Subscriber's Name (Business Name)

Street Address of Caller

Location at Address of Caller

```
206
PBXb 20:00 06/09
(617) 253-1025 COID=VERIZ
UNIVERSITY OF NORTHEAST
452
CAMBRIDGE ST

GYM 1ST FL
CAMBRIDGE MA
CI
ESN=152 MTN:617-253-1025
LAT: LON:
ELV: COF: COP:

CAMBRIDGE POLICE
CAMBRIDGE FIRE
CAMBRIDGE EMS
```

Help can now find caller

Caller, choking and alone, LIVES

Wireless Call Location Presentation

ALI Display

ALI

Retransmit Options

Calling Number: (401) 497-8466

ALI History (18) Supp Info (0)

206
WPH2 13:03 02/07
(401) 497-8466 COID=
T-MOBILE USA (973)292-
165
FOREST

SE SECTOR
Marlborough MA

FSN=603 MTN=508
LAT:+042.5555 LON:-071.05888
ELV:0000 COP:33 COP:062

Region 3
Region 3
Region 3

Current/Last ANI

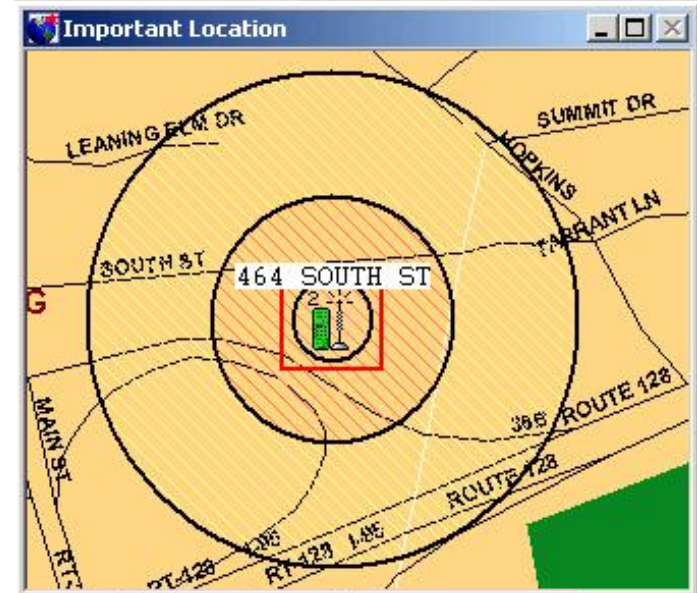
CJIT Wireless Event Address

Position
Latitude: 42.083265
Longitude: -72.642589

Closest Intersection
HOPKINS && SOUTH ST

Address
Address: 464 SOUTH
Boundary: NORTHBOROUGH

OK Cancel Apply



Location Issues in a Wireless World

- Location was street address with unit information in a wireline, telcom regulated environment
- VZ (our LEC) asks Cambridge 911 to check any out-of-range phone location address
- 70% of calls are wireless now, about 1/3 come in initially with only the tower's sector address
- Accuracy poor esp. in urban areas
- The calling public is geographically challenged and moving
- The Z axis problem

Location in a VoIP World...

The Little Boy in North Cambridge

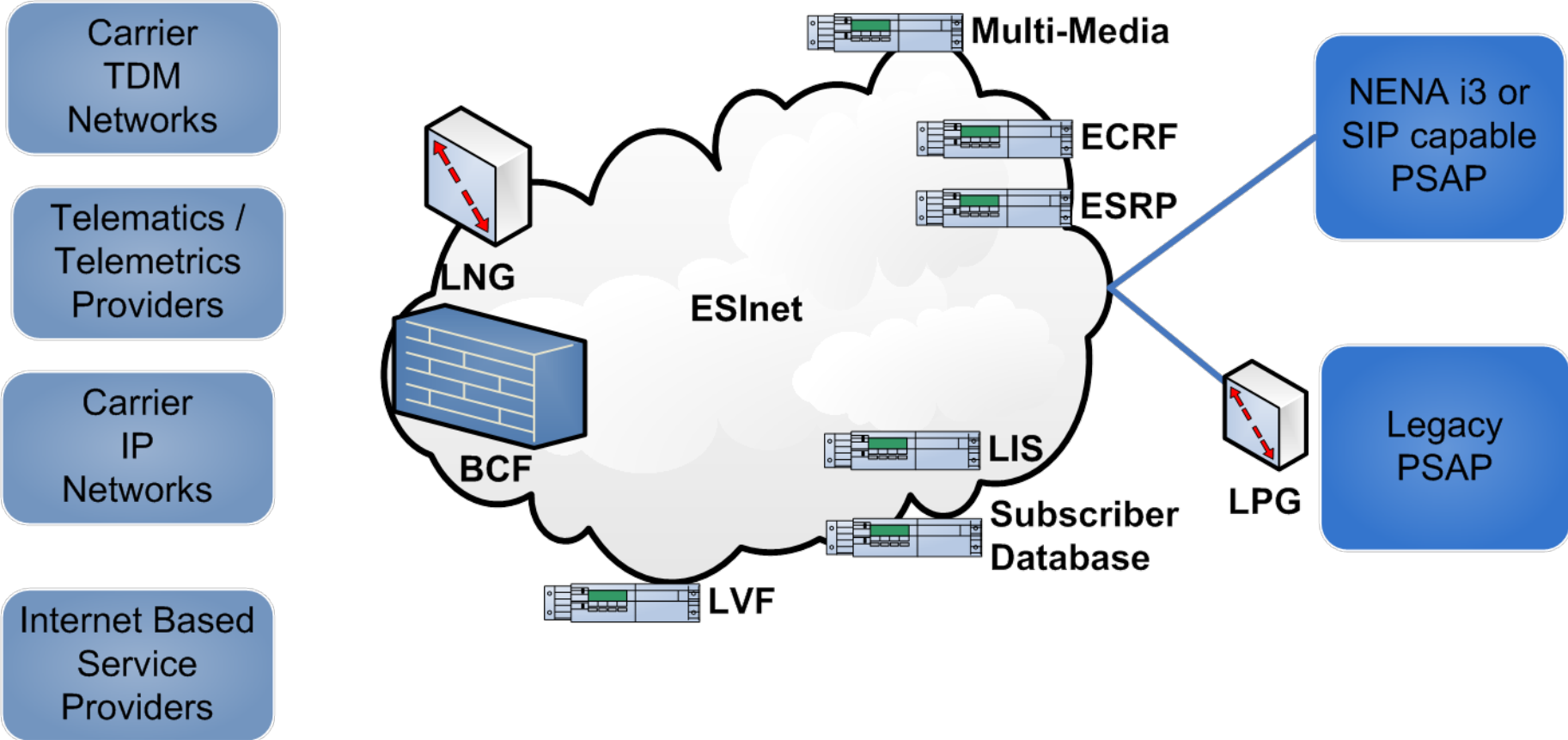
Wireless Call Routing

- Currently:
 - Route by cell sector (also called cell ID)
 - A pie-shaped wedge of 120 degrees with 1 Km legs
 - 30K sectors in MA each have a routing number (ESN) that routes to the covering PSAP
 - Very gross routing!
- Future
 - Route by the lat/long of the phone's location
 - Point to polygon match routes call to PSAP
 - Barriers:
 - Too slow
 - Unwilling to adopt an x/y-lookup delay (hold for up to 5 sec to get x/y then route by cell sector).

Data, Data, Data is coming

Good news and bad for 911 centers

From Circuit Switched E911 to the IP world of NG911



NG911 Calls can

Be Text messages	Frightening to 911 call takers and 911 center managers (e.g., TTD)
Have an accompanying picture	Appears of most value to responders
Have accompanying data	Medical record of patient, map of premise with locations of hazardous materials,
Come from machines	Airbag deployment, security alarm, heart monitoring fob, wristband on autistic child wanderer – you name it.

AND: 911 has unparalleled brand recognition

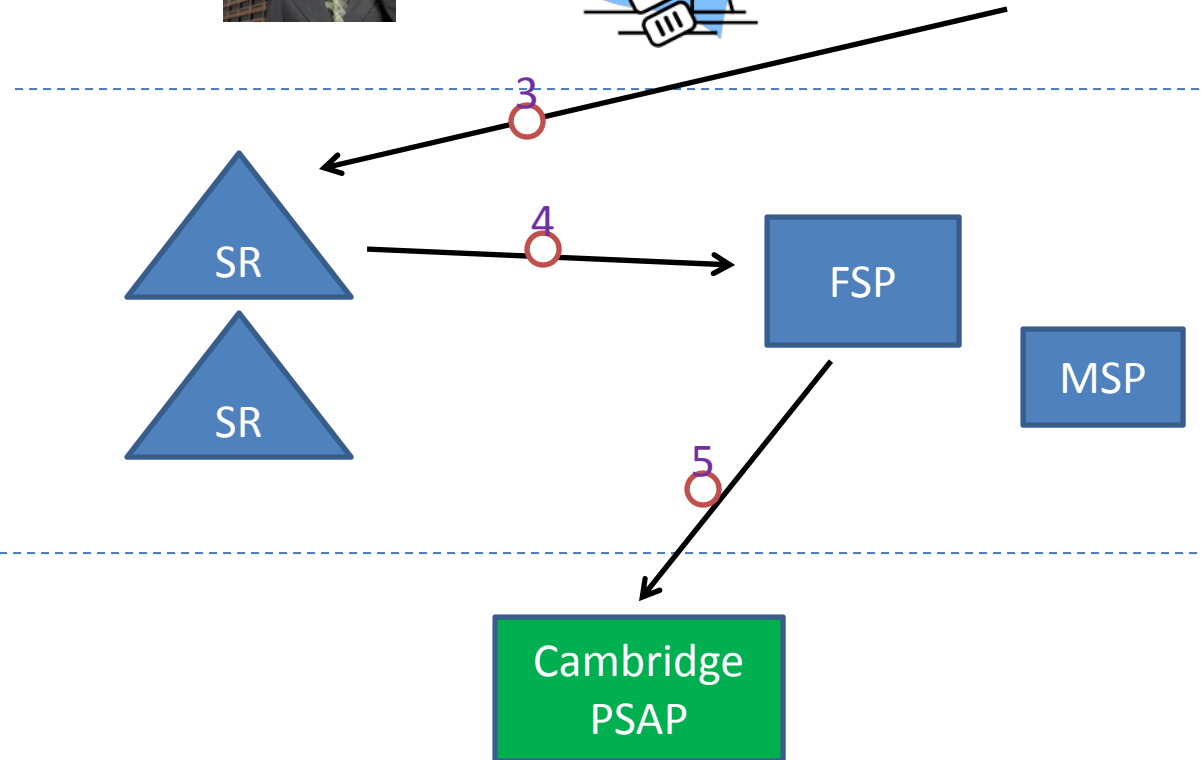
What Does Data Mean for 911

- More info can help make better dispatch choices (example of EMD)
- An airbag deployment message can initiate a much faster response
- Impact on workload
- The Cambridge false alarm ordinance
- 911 centers are usually staffed at the margin
- Too much information?

***Its all about Smart Call Handling
(Routing and Bursts)***

NG911 offers the opportunity to
manage call flow properly

Cambridge-Related 911 Cell Call Flow – Simplified Primary Routing



#	Blocking Points
1	Calls blocked at cell sites
2	Calls blocked from site to MSC
3	Calls blocked from MSC into SR
4	Calls blocked from SR into Wireless PSAP
5	Calls blocked from Wireless PSAP into Primary PSAP

Gross Analysis for 2009

Interval	SP 911 Calls on Camb Towers	SP 911 Calls Transferred to Cambridge	Comment
Yearly	31,771 (not incl 2,974 abandoned for 34,746 tot)	11,456	Camb E911 data is 14,992 but includes rebids
Monthly Average	2,648	955	277% more calls (more than double)
Weekly Average	611	220	
Daily Average	87	31	
Hourly Average	3.6	1.3	
Per Minute	.06 (1 call every 16 minutes)	.02 (1 call every 46 minutes)	

Cluster Analysis – Cluster from 11/2/07

Transformer Explosion and Power Out, ECamb

Time	SP wireless calls	Camb received wireless calls	Camb wireline calls	Total Camb Calls	Tot with WD on all	Comment on wireline calls
19:29	6	3	0	3	6	6 on duty in Cambridge PSAP on this Friday evening shift
19:30	7	0	2	2	9	151 Clark and 21 Market (near explosion)
19:31	7	0	1	1	8	3 Market (near explosion)
19:32	2	1	1	2	3	<u>8 May St (the heart attack), 2 miles away in west Camb</u>
19:33	0	0	2	2	2	232 Broadway, 228 Broadway – both near explosion
	22 calls	4 transferred	6 wireline received	10 (incl transferred and wireline)	28 (compare to 10)	<u>All calls but 1 appear related to event</u>

Cambridge Call Answering Resources

Minimum staffing by shift: includes 1 Supervisor and the rest 911 Dispatchers

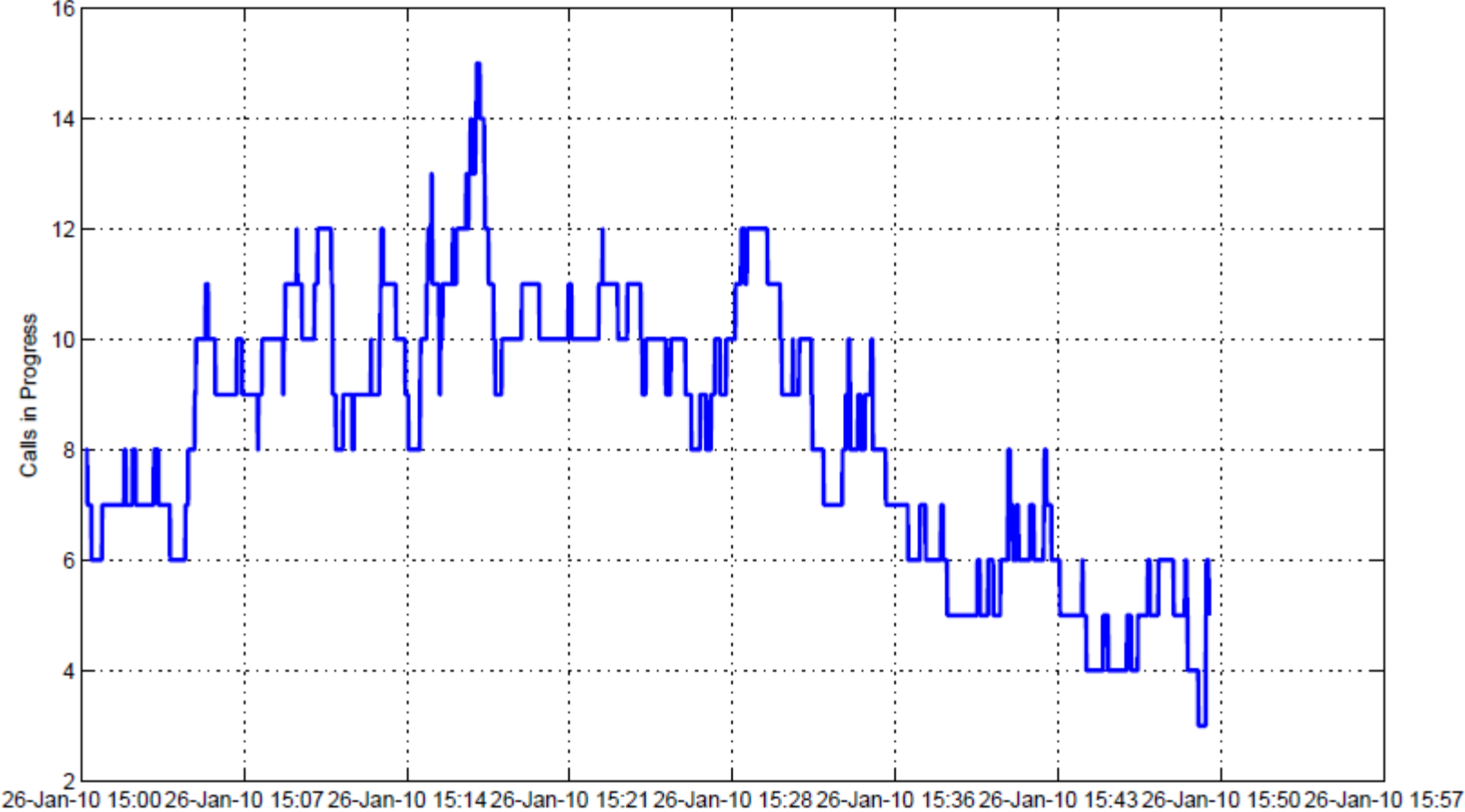
	SUN	MON	TUE	WED	THU	FRI	SAT
Day 7-3	5	7	7	7	7	7	6
Even 3-11	6	6	6	6	6	6	6
Night 11-7	5	5	5	5	5	5	5

Typical minimum staffing by those Ready to Answer on the 911 ACD during 2-hour Meal break period. In other words, while on a Tuesday 3-11 shift there may be 1 911 Supervisor and 5 dispatchers working, only 3-4 are ready to answer 911 calls during significant parts of the shift (e.g., with 1 person on meal break at a time, rest breaks).

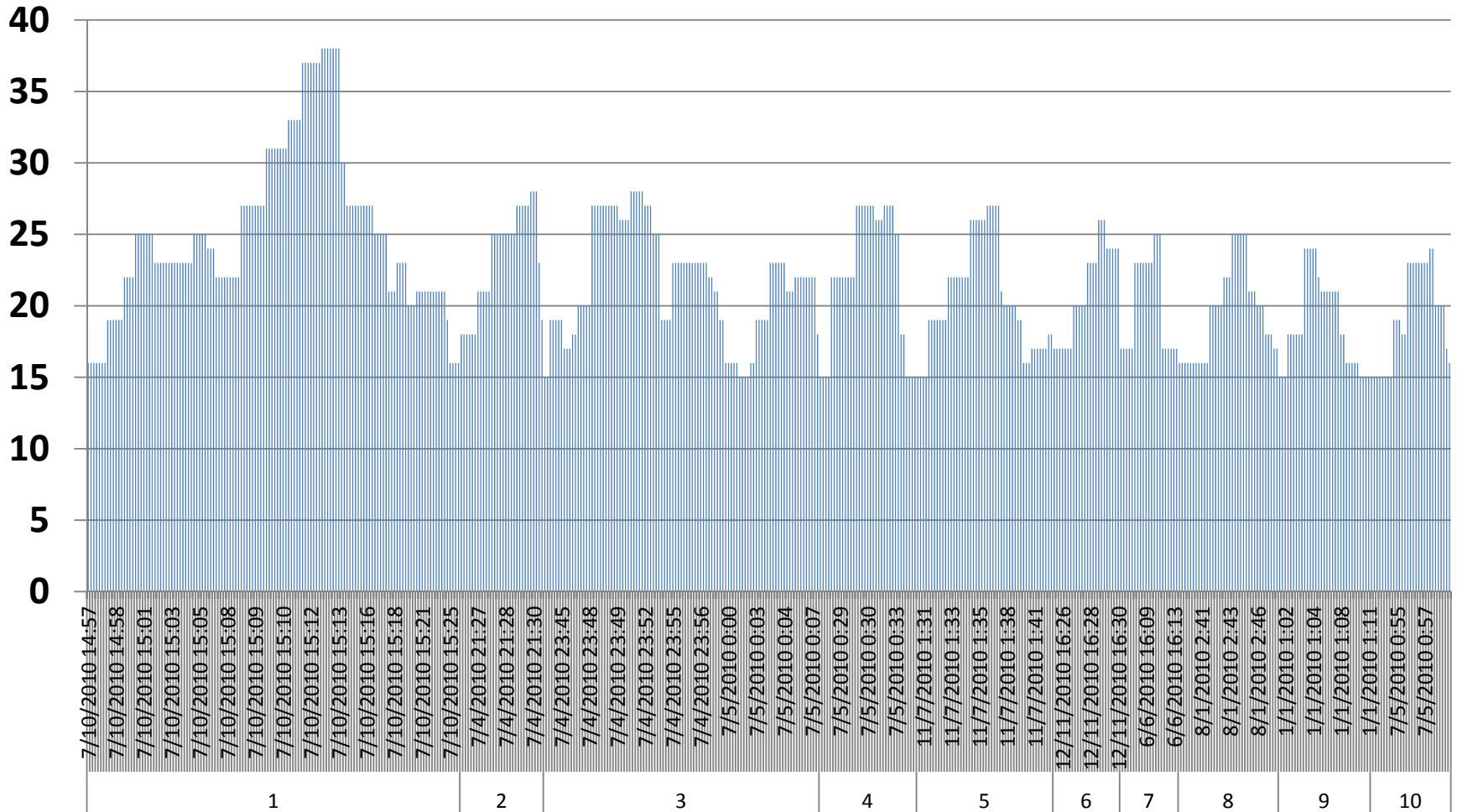
	SUN	MON	TUE	WED	THU	FRI	SAT
Day 7-3	3	4	4	4	4	4	3
Even 3-11	4	4	4	4	4	4	4
Night 11-7	3	3	3	3	3	3	3

Calls in progress for one hour on 1/26/10

Boston PSAP Wireless What-If Study



Top 10 2010 Boston Police 911 Call Clusters with the Most calls in a 5 minute Interval within the Cluster



Today's 9-1-1 vs. NG9-1-1 *

“NG9-1-1 improves capabilities for all stakeholders”

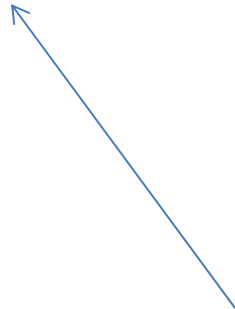
911 Capability	E911	NG911
Voice Calls	Yes	Yes
Transfer Misrouted Calls	Limited	Yes
Location Delivered with Calls	No	Yes, if carriers provide
Policy Based Routing	Managed by Sys Provider	Managed by 911 PSAPs
Text/Multi-Media	No	Yes
Additional Data	No	Yes
Data Sharing with Responders	Limited (if passthrough)	Robust
Virtual PSAPs	Limited	Yes
Standard IP Interfaces	No	Yes

7/18/2009 12:00

508: [redacted]
 7/18/2009 12:18:21
 508: [redacted]
 7/18/2009 12:00:50
 508: [redacted]
 7/18/2009 12:05:11
 508: [redacted]
 7/18/2009 12:03:33
 7/18/2009 12:10:37
 508: [redacted]
 7/18/2009 12:13:27

9112070020

7/18/2009 12:03:53
 7/18/2009 12:05:19
 7/18/2009 12:05:39
 7/18/2009 12:06:16
 7/18/2009 12:06:45
 7/18/2009 12:07:59
 7/18/2009 12:10:27
 7/18/2009 12:11:15
 7/18/2009 12:11:58
 7/18/2009 12:13:10
 7/18/2009 12:14:27
 7/18/2009 12:15:46
 7/18/2009 12:16:05
 7/18/2009 12:16:24
 7/18/2009 12:16:43
 7/18/2009 12:17:54



UNANTICIPATED CONSEQUENCES!

Calls from Uninitialized Phones

2010 911 Calls From Boston Cell Sectors

Carrier	Total	(911) AC	Percent
ATTMO	93,980	21,851	23.3%
MPCSI	36,856	2,186	5.9%
NXTL	12,839	604	4.7%
SPPCS	37,148	2,114	5.7%
TMOB	111,116	23,346	21.0%
VZW	60,198	1,398	2.3%
Other	9	1	11.1%
(blank)	370	72	19.5%
Grand Total	352,516	51,572	14.6%

They cause many of the peaks (Nantucket example)