




Emergency Services 



Location-based Services 



Location Surveillance 

# Using Wireless Location Technology to Improve E911

January 2012

Global Leader in Wireless Location Solutions



# Agenda

Company Introduction

Overview of Location Technologies

911 Use Case

Solving the Problem of Indoor Location

Regulatory and Industry Development

Where Do We Go From Here?

Questions

# Company Introduction



# Introduction – Who is Polaris Wireless?



Location Technology → Wireless Location Signatures (WLS)

# Company Details

- Leader in software-based location solutions for wireless operators and government agencies for over 10 years
- Headquartered in Mountain View, CA with global presence (sales and support offices worldwide, development office in Bangalore, India)
- 120 employees
- Deep patent portfolio (50+ patents awarded or pending)
- Backed by leading investors including Draper Fisher Jurvetson and Palisades Ventures



*Mountain View, CA*



*Bangalore, India*

## Government



Government customers: law enforcement and intelligence agencies – 14 deployments

### Law Enforcement / Intelligence Agencies

*(Middle East, Africa & Asia)*

## Wireless Operators



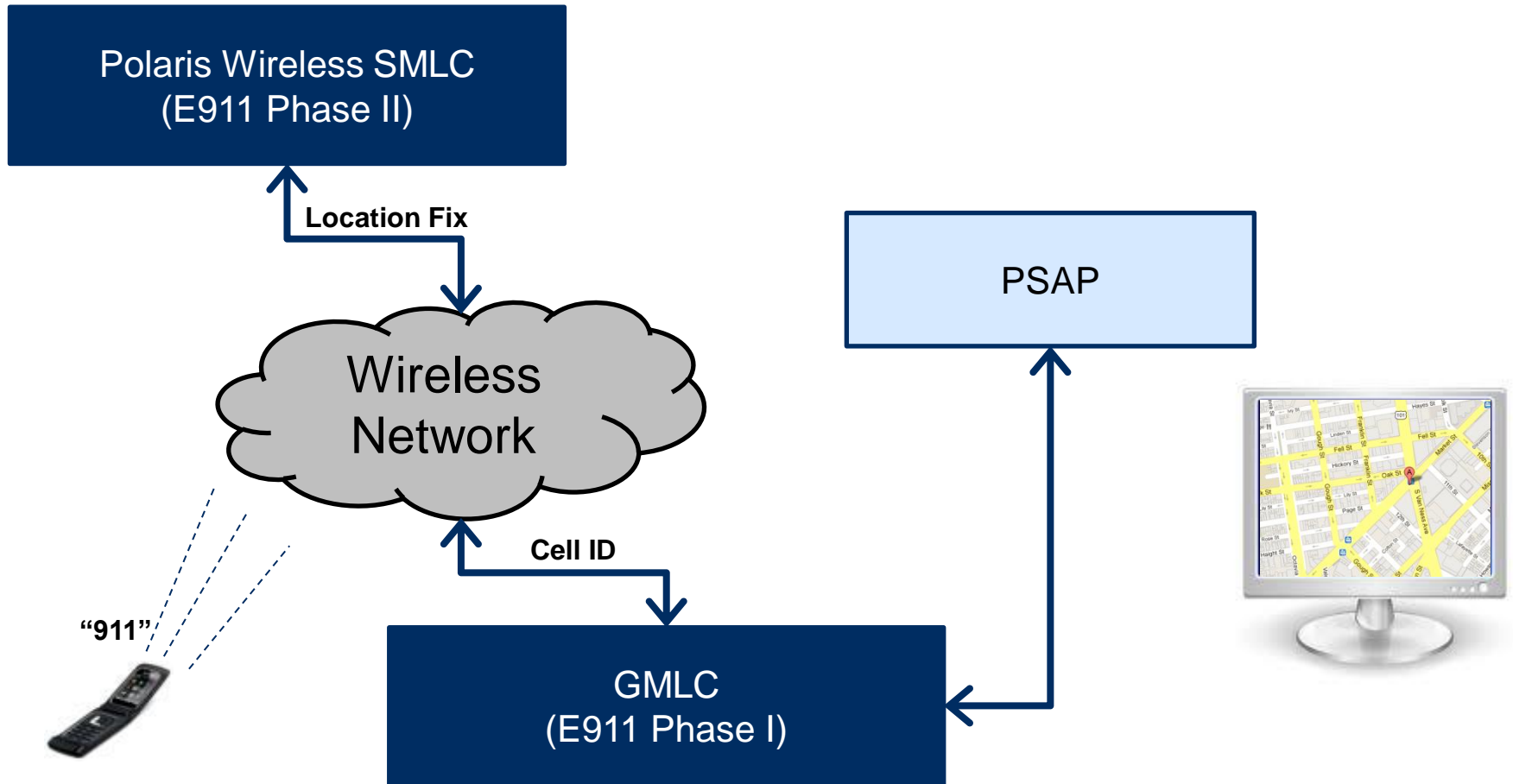
Public safety and location based services customers: wireless operators globally – 24 deployments



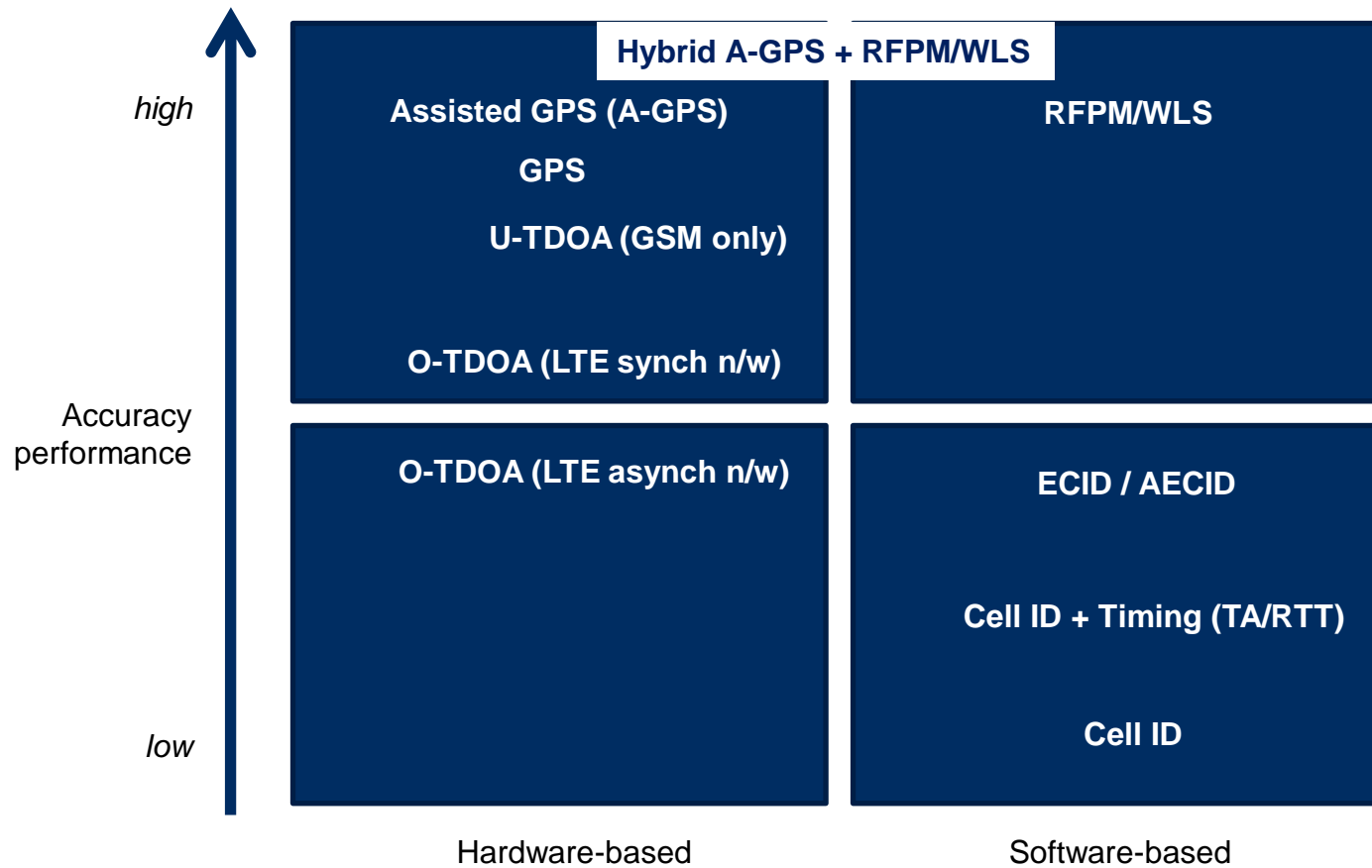
# Overview of Location Technologies



# 911 Architecture



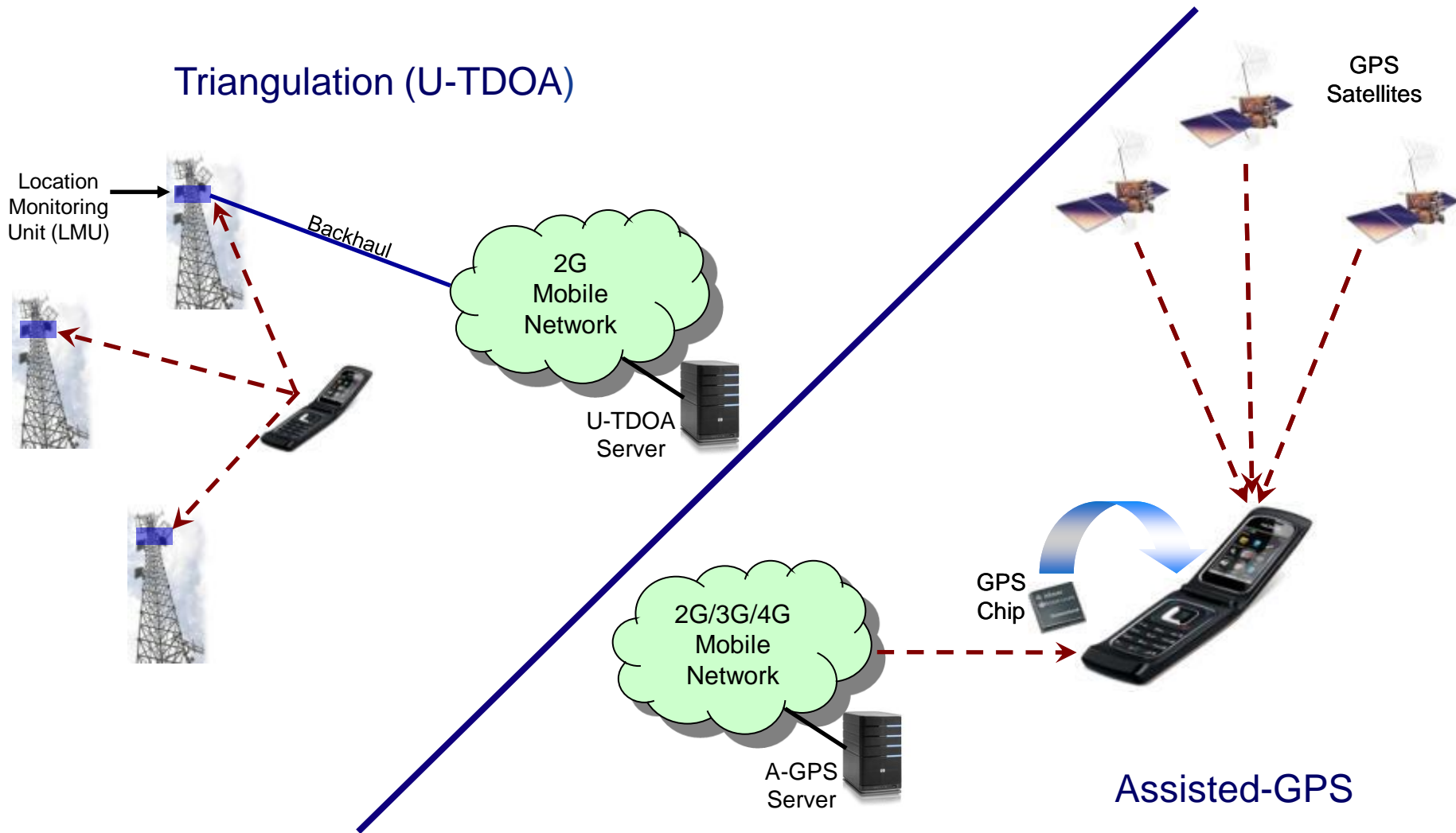
# Location Technology Landscape



Note: Location technologies such as Wi-Fi, Bluetooth, RFID, SIM-based GPS etc. are not included since they are unreliable for macro usage

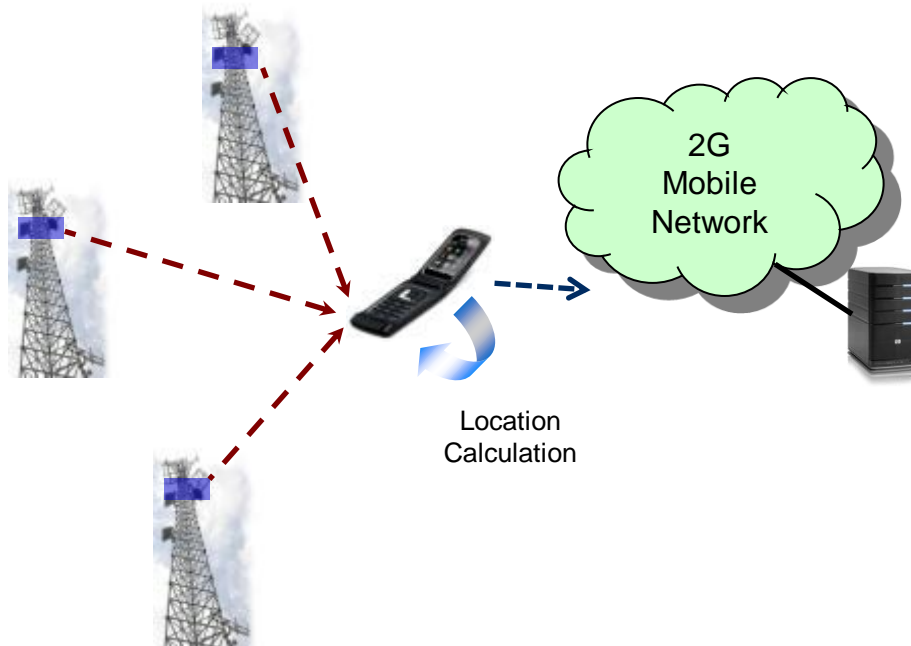


# Alternative Location Solutions



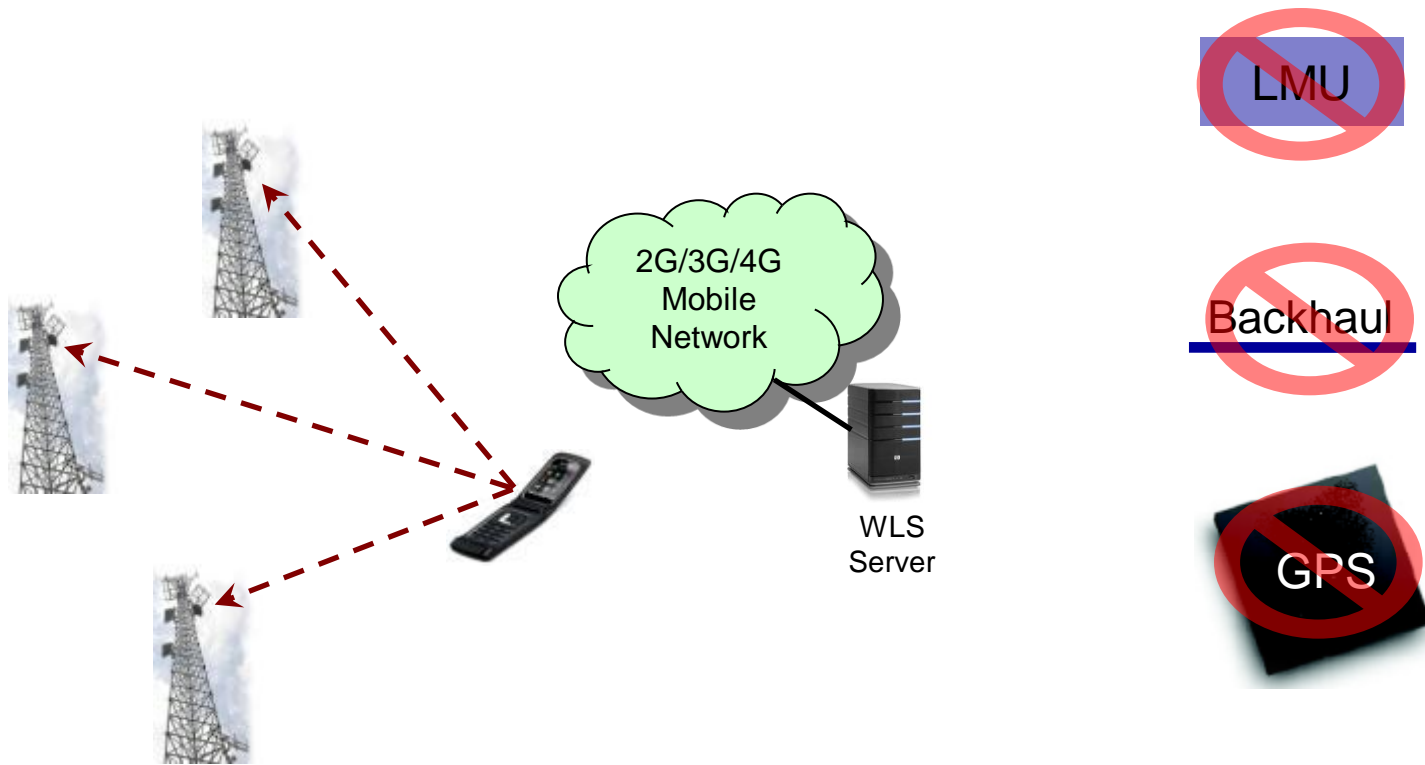
# AFLT – Advanced Forward Link Trilateration

## Triangulation (AFLT)



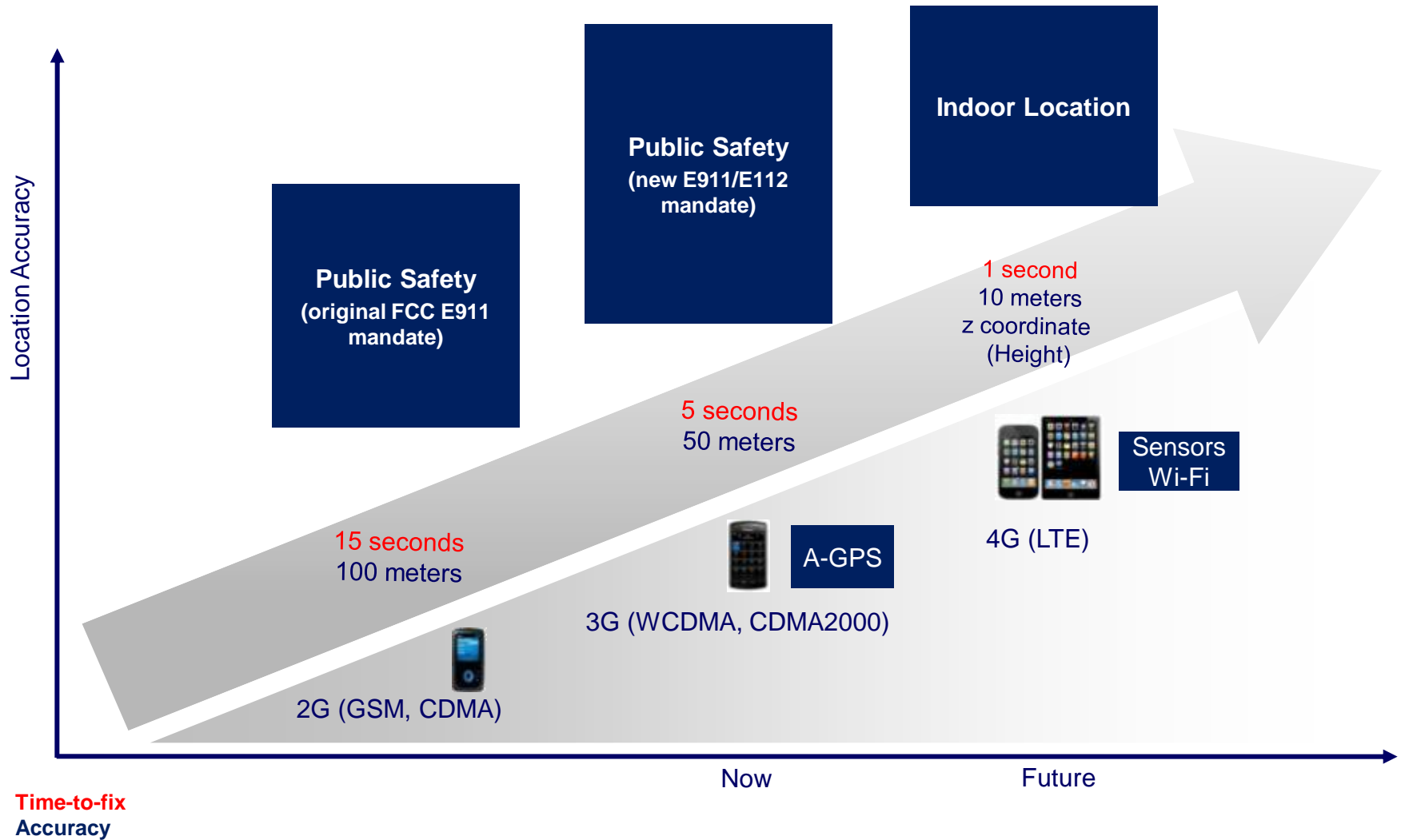
the phone takes measurements of signals from nearby cellular base stations, or towers, and reports the time/distance readings back to the network, which are then used to triangulate an approximate location of the handset. In general, at least three surrounding base stations are required to get an optimal position fix. AFLT requires new phones or software in phones with precise timing,

# Polaris Wireless Location Signatures (WLS)



Polaris WLS → A software-only solution

# WLS Technology Vision

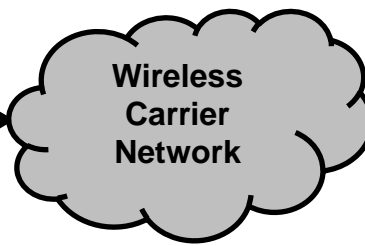


## 911 Use Case



# Emergency Services Systems – Location Information

**EMERGENCY**  
**999**  
One Nation One Number



Public Safety Answering Point  
Emergency Call Center

1. Accident
2. Fire
3. Medical
4. Crime
5. Others

Location information critical to effective emergency response management

- Used by responder to decide where to go
- Used by network operator to automatically direct incoming call appropriate center (for e.g. in the US system appropriate PSAP is chosen, which has immediate control over set of responder resources)



Emergency Responders

# Emergency Call Case Study



## 4 people meet for a drug/money exchange

- Money is given but drugs are not provided in return
- Buyer is asked to come back the next day



## 3 of the 4 people kidnap the 4<sup>th</sup> person

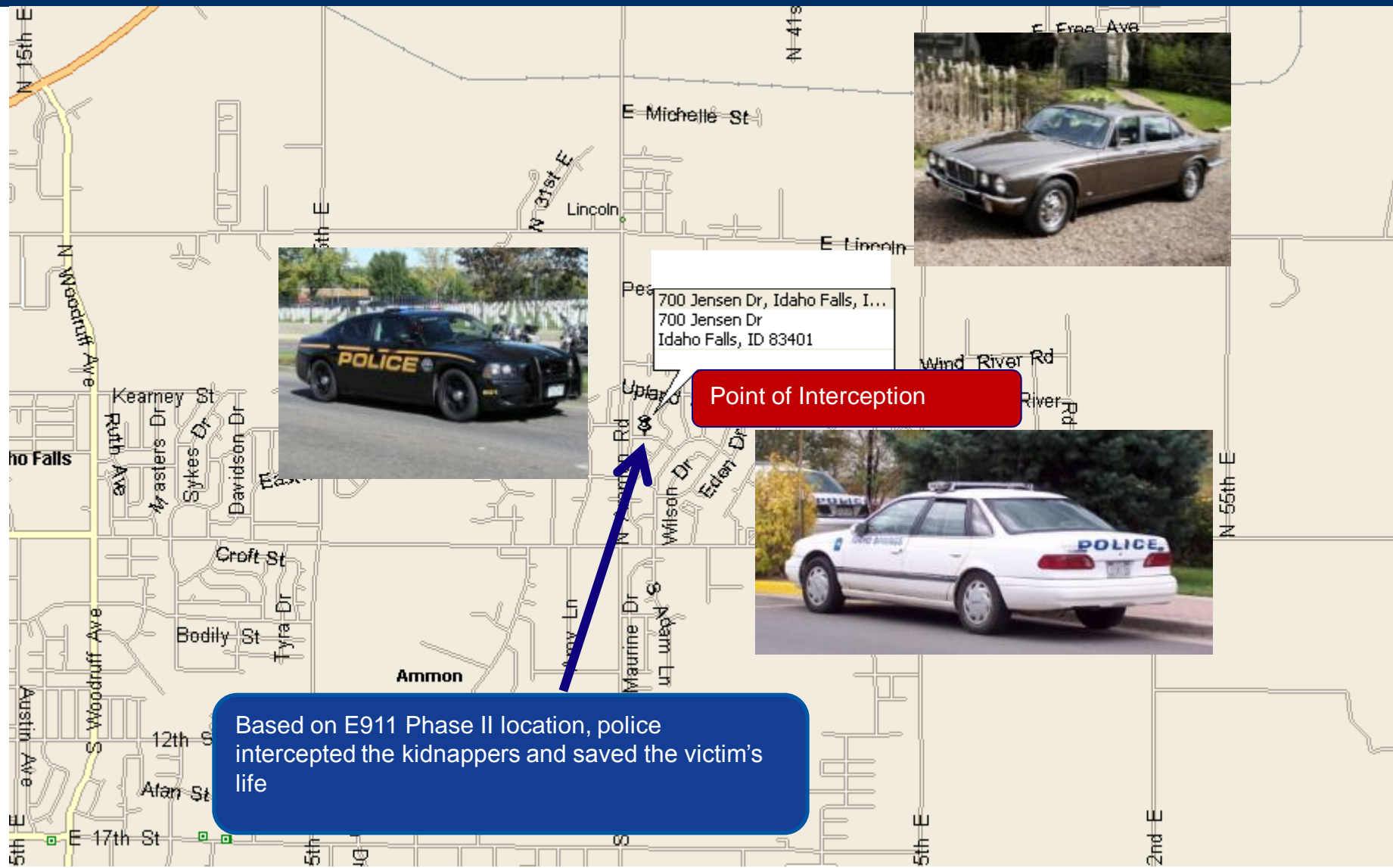
- Buyer is thrown to the ground on arrival
- Buyer is then forced into a vehicle by the other people



## Kidnappers try and whisk the buyer away in a car

- Victim still has her cell phone with her
- Victim dials 911 from her phone but cannot talk to the operator

# Emergency Call Case Study





# Emergency Call Case Study

## Three Arrested For Kidnapping Girl



*Updated: 10:11 PM, Jan. 9, 2007*

**By Local News 8**

Three people are being held by police for allegedly kidnapping a 17 year old girl.

Dispatchers in Bonneville County received a 911 call early Tuesday morning from a cell phone with a girl who was screaming for help. Dispatchers used the Phase 2 Wireless program to locate the cell phone on the 700 block of Jensen in Idaho Falls.

**Three people were arrested Tuesday morning for allegedly kidnapping a 17 year old girl after a drug deal went bad.**

Deputies found a vehicle with four subjects inside, one of them the girl who was calling for help. They arrested the other three adults, Joshua Perotto, Mallory Harris and Denise Morris.

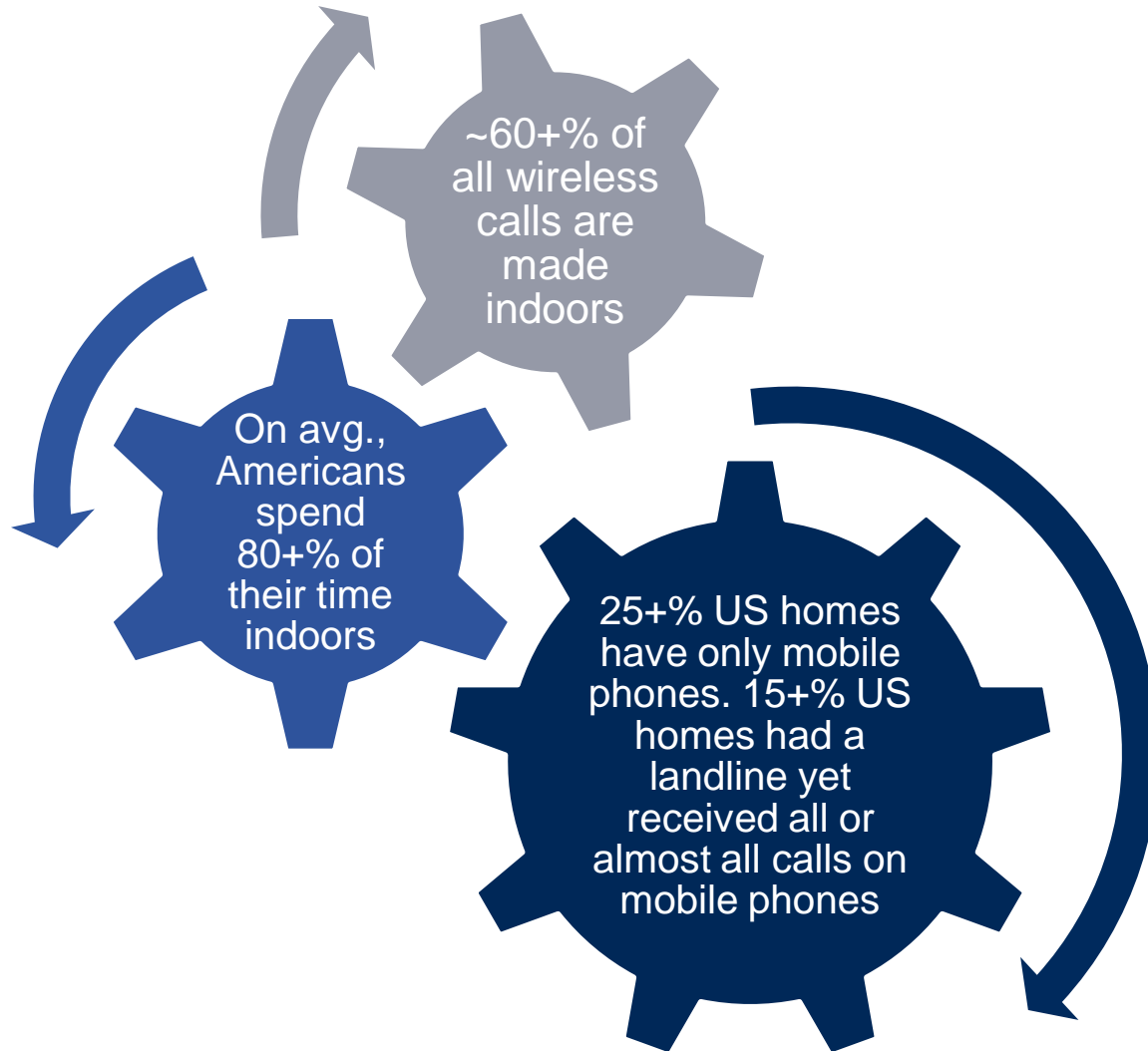
Deputies report that the kidnapping may have stemmed from a drug deal that went wrong. They say Perotto and a 17-year old girl went to Blackfoot on Monday to buy a controlled substance. Perotto gave the girl money for the drugs, but didn't receive the drugs. The female hid in Blackfoot for five hours to avoid him.

**Kidnapping Avoided In Less Than 5 minutes**

# Solving the Problem of Indoor Location



# Key Drivers for Indoor Location



**Indoor Location will become more and more important for 911**

# The Complete Solution: Hybrid Combination of A-GPS and WLS

## A-GPS



- Excellent outdoor accuracy



- Poor indoor accuracy
- Slow Time to Fix (TTF)
- High Battery Consumption
- Poor accuracy in dense urban areas



A-GPS and WLS perfectly complement each other to form a Hybrid solution

## WLS (Cellular, Wi-Fi)



- Robust indoor performance
- Fast Time to Fix (TTF)
- Low Battery Consumption
- High accuracy in dense urban areas



- Poor accuracy for large cell spacing



# Regulatory and Industry Developments



# Regulatory Developments

## CSRIC -

- E911 Outdoor Location
  - Recommendations to the FCC Due on **March 1, 2012**
- E911 Indoor Location
  - Recommendations to the FCC Due on **June 1, 2012**
- E911 New Technology
  - Recommendations to the FCC Due on **March 1, 2013**

## ATIS/ESIF -

- **ATIS Technical Report 0500001-R1**
  - High Level Requirements for Accuracy Testing Methodologies
- **ATIS Technical Report 0500009**
  - High Level Requirements for End-to-End Functional Testing.
- **ATIS Technical Report 0500010**
  - Maintenance Testing
- **ATIS Technical Report 0500011**
  - Define Topologies & Data Collection Methodologies
- **ATIS Technical Report 0500013**
  - Wireless Indoor E-911 Location Performance Testing

- **IP and Next-Generation Services**

- “**Carriers**” will need to change to “**Service providers**”
  - WiFi, LTE, WiMAX, VoIP, Skype, etc
- **Smartphones, Smartphones, Smartphones**
- Non-voice emergency calls (NG911)

- **Cellular Network Changes**

- 2G → 3G → 4G → ???
  - No dedicated voice channels
  - All communication will be IP
- Femto-cells and Home-Node B's

- **Applications**

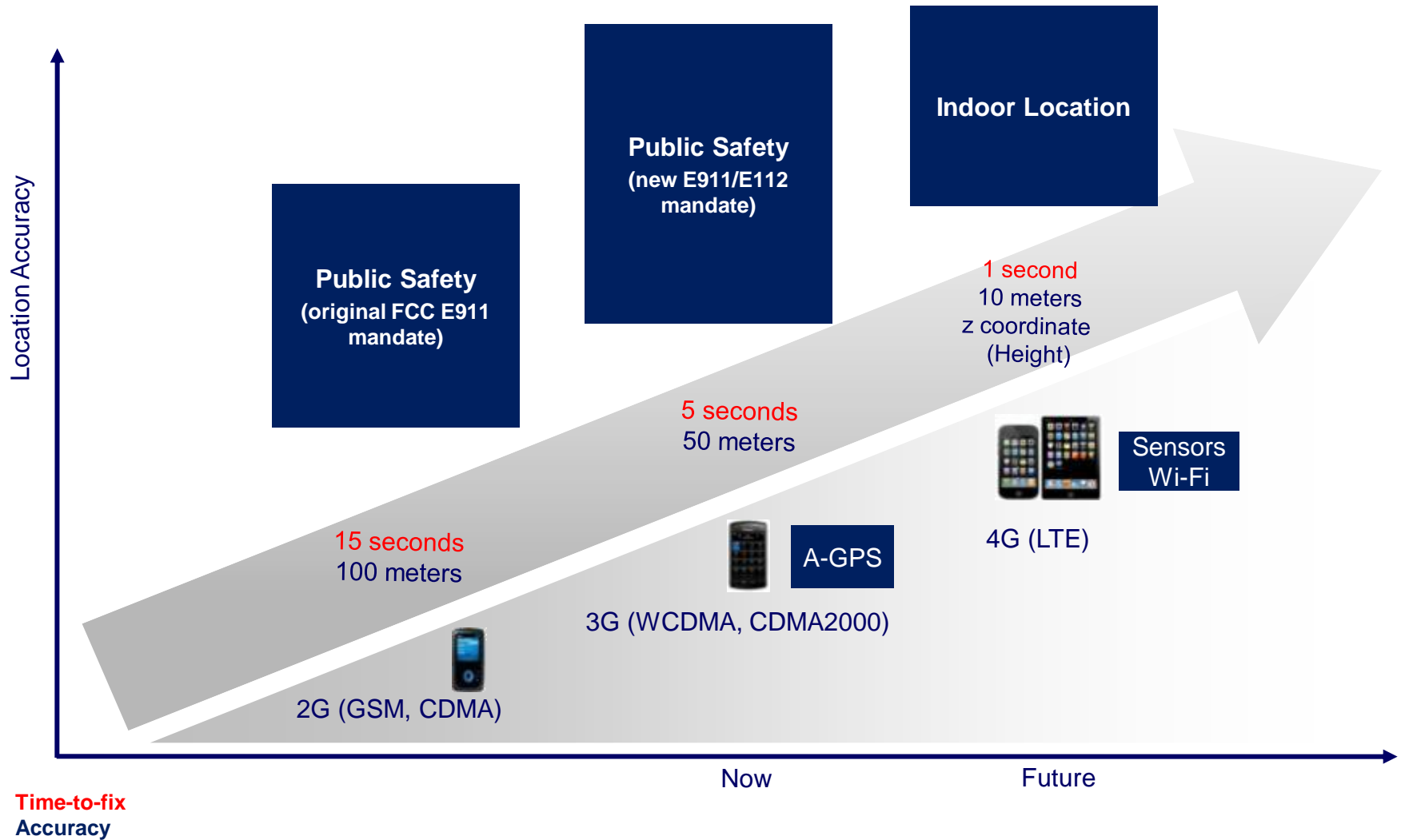
- Networks become secondary to Apps → Google, Facebook, etc.

Where Do We Go From Here?





# WLS Technology Vision



# Questions?

Polaris Wireless is the global leader in providing high accuracy, software-based, location solutions. In standalone mode or as a Hybrid solution with A-GPS, Polaris enables a variety of high value-added applications, across business segments, devices, technologies and environments.

## Global Headquarters

301 North Whisman Rd.  
Mountain View,  
CA USA 94043

## MEA Headquarters

Office 313, Building No. 3  
Dubai Internet City,  
Dubai UAE

## APAC Headquarters

Anjaneya Techno Park,  
Ground Floor, No.147,  
Old Airport Road,  
Kodihalli,  
Bangalore, IN 560008

## Contact Us

Tel: +1-408-492-8900  
[info@polariswireless.com](mailto:info@polariswireless.com)  
[www.polariswireless.com](http://www.polariswireless.com)

Thank you

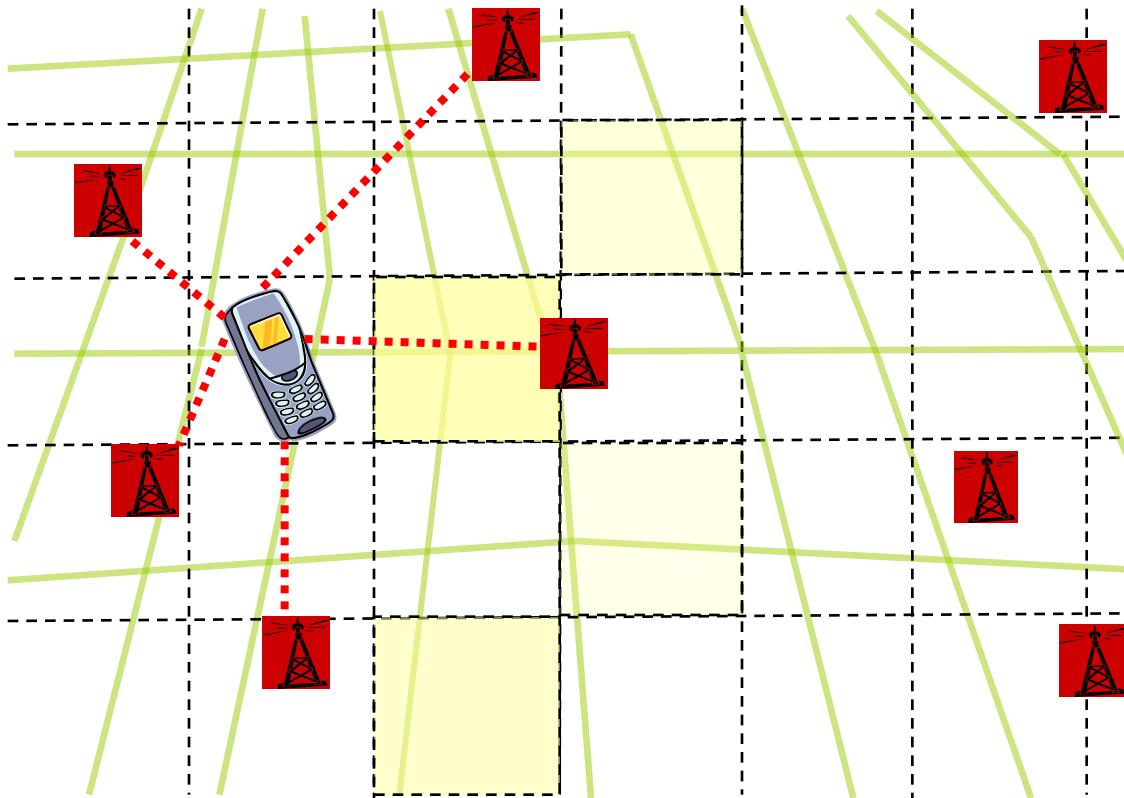


Backup



# Wireless Location Signatures (WLS)

- WLS compares a Signature from the handset against the PSD
- Calculates best pattern match to determine handset location



- WLS is fully supported in GSM and UMTS -- No handset changes
- Software-only solution

## High Accuracy Location Solutions

Technology	Accuracy Performance	Reliability	E911	LI	LBS	Air Interfaces	Cost	Vendors
<b>WLS</b>	Very high in dense urban and indoors (<50m @ 67%) Medium in suburban (<100m @ 67%)	Very high	Yes	Yes	Yes	All	Medium	Polaris Wireless
<b>UTDOA</b>	High in line-of-sight urban (<75m @ 67%) Medium in non-line-of-sight and indoor urban (<100m @ 67%)	Medium	Yes	Yes	No	GSM, UMTS	Very high	TruePosition , Commscope (Andrew)
<b>A-GPS</b>	High in suburban and rural (<50m @ 67%) Very low in dense urban and indoors (cell area only)	Medium	Yes	No	Yes	All	Very high	All infrastructure and location solution vendors

## Medium Accuracy Location Solutions

Technology	Accuracy Performance	Reliability	E911	LI	LBS	Air Interfaces	Cost	Vendors
<b>OTDOA</b>	1/8 <sup>th</sup> of cell coverage area in line-of-sight conditions (average 250m)	Low	No	No	Yes	(fallback to A-GPS) Possible in future LTE	Medium	All infrastructure and location solution vendors
<b>AFLT</b>	1/8 <sup>th</sup> of cell coverage area in line-of-sight conditions (average 250m)	Medium	No	No	Yes	CDMA2000 (fallback to A-GPS)	Medium	Qualcomm
<b>ECID</b>	1/8 <sup>th</sup> of cell area (average 300m)	Low	No	No	Yes	All	Low	All infrastructure vendors and location solution vendors including Verint, NICE, Creativity etc.

## Low Accuracy Location Solutions

Technology	Accuracy Performance	Reliability	E911	LI	LBS	Air Interfaces	Cost	Vendors
<b>CID+TA</b>	1/4 <sup>th</sup> of cell area (average 500m)	Very low	No	No	Yes (limited)	All (RTT has to enabled for UMTS)	Low	All infrastructure vendors and location solution vendors , etc.
<b>CID Phase I</b>	Cell area	Very low	No	No	Yes (limited)	All	Low	All infrastructure vendors and location solution vendors including, etc.



Technology	Pros	Cons	Status
WiFi	<ul style="list-style-type: none"> <li>•Augments A-GPS</li> <li>•Large data set</li> </ul>	<ul style="list-style-type: none"> <li>•Drive Testing</li> <li>•Database Maintenance</li> <li>•Unregistered Hotspots</li> </ul>	Implemented
OTDOA	<ul style="list-style-type: none"> <li>•Augments A-GPS</li> <li>•Improved Acquisition</li> </ul>	<ul style="list-style-type: none"> <li>•Unproven</li> <li>•Technology Challenges in GSM</li> </ul>	Not Deployed for E911
Boeing-BTL	<ul style="list-style-type: none"> <li>•Improves A-GPS Performance</li> </ul>	<ul style="list-style-type: none"> <li>•Unproven</li> <li>•Handset Changes</li> <li>•Indoor challenges</li> </ul>	Not Deployed
Rosum	<ul style="list-style-type: none"> <li>•Handset Solution</li> <li>•No network impacts</li> </ul>	<ul style="list-style-type: none"> <li>•Unproven</li> <li>•Significant Handset Impacts</li> <li>•Battery Impacts</li> </ul>	Defunct
WiMAX	<ul style="list-style-type: none"> <li>•Augments A-GPS</li> </ul>	<ul style="list-style-type: none"> <li>•Unproven</li> <li>•Technology Viability</li> </ul>	Not Deployed

## Hybrid-Location Technology is the Future... and the future is now.

### Comments to the FCC on Hybrid Location Technology

*Specifically, the Commission sought comment on the capabilities and limitations of existing and new location technologies, the advantages of combining handset-based and network-based location technologies (a hybrid solution)...*

- Positive replies on the immediate potential of “hybrid” technologies were submitted by many of the commenter's; including Verizon Wireless, several vendors and members of the public safety community.
- **Association of Public-Safety Communications Officials (APCO)** – “We also believe that hybrid technology approaches need to be considered as no single technology appears (at least to date) to be ideal in all types of locations.”
- “Based on our understanding of the architectures deployed by the major carriers utilizing a Network-based location solution and now rolling out A-GPS capable handsets, **TruePosition** believes a Selection-based Hybrid solution could be put in place relatively easily.”

## Vertical Location Technology is “Not Ready for Prime Time” ...we’re working on it.

### Comments to the FCC on Vertical (Z-Axis) Locations

*The Commission made query in the FNPRM, “...and whether location accuracy standards should include an elevation (Z-axis) component.” The responses from all stakeholders within the Carrier and Technology Vendor Community were consistent in their replies.*

- Most all respondents agreed that this capability is not feasible at present
- **TCS** - does not think we are ready for elevation accuracy. The inclusion of Z-axis information in location accuracy is very premature and its utility remains undefined.
- **T-Mobile** - Accurate Elevation Information Is Still Unattainable
- **Polaris** - understands the desire to add vertical location information to the current latitude-longitude E911 reporting. Unfortunately, no currently mature technology exists to meet this goal, and . it is too early to adopt vertical location requirements. However, Polaris’s WLS technology, with additional research and development, can provide accurate vertical location information.