

# Interoperability Challenges and Solutions

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# Interoperability

## Challenges and Solutions

- Trends in Interoperability Demand
- Core Interoperability
  - Infrastructure Interoperability
  - Command / Tactical Comms Vehicles
- Edge Interoperability
  - VOIP / SIP
    - Technology
    - Public Safety Applications
  - STACS

# Trends in Interoperability Needs

- Increased incidence of wildfires due to drought
- Budget restrictions force increased dependence on mutual response
- Need for readiness to respond to multi-site and large scale events (civil unrest, infrastructure failure, internal and external terrorism)
- Public Expectations

# Centralized (Infrastructure) Interoperability

Pervasive network of trunked radio repeaters interconnected via microwave or lease lines

## ■ Pros

- Same procedures as normal day-to-day radio operations, minimal training

## ■ Cons

- Infrastructure dependent
- Usually does not degrade gracefully as infrastructure fails
- Often provides minimal interop with outside agencies equipment

# Command / Tactical Comms Vehicles

Vehicle mounted radio interop switch with multiple radios, independent power and often satellite uplink

## ■ Pros

- Provides comfortable working environment for IC staff

## ■ Cons

- Complex, fragile technology
- High level of training required for comms operator
- Often does not provide usable phone service
- Satellite systems are usually slow
- Expensive, depends on road infrastructure

# General Interop Problems

- Vendor Lock-in
- Infrastructure Cost
- Project Risk and Lead Time
- Shifting Standards
- Lack of Real Interoperability

# Introduction to VOIP / ROIP

- Analog voice signals are converted to digital form and transmitted over IP networks.
- Many signalling standards exist
  - SIP (IETF)
  - H.323 (ITU)
  - MGCP / SCCP (IETF/Cisco)
  - IAX (Asterisk)
- Many compression standards exist
  - uLAW/aLAW (G.711)
  - G.729/a/b
  - GSM
  - iLBC, LPC10, G.723, etc etc etc

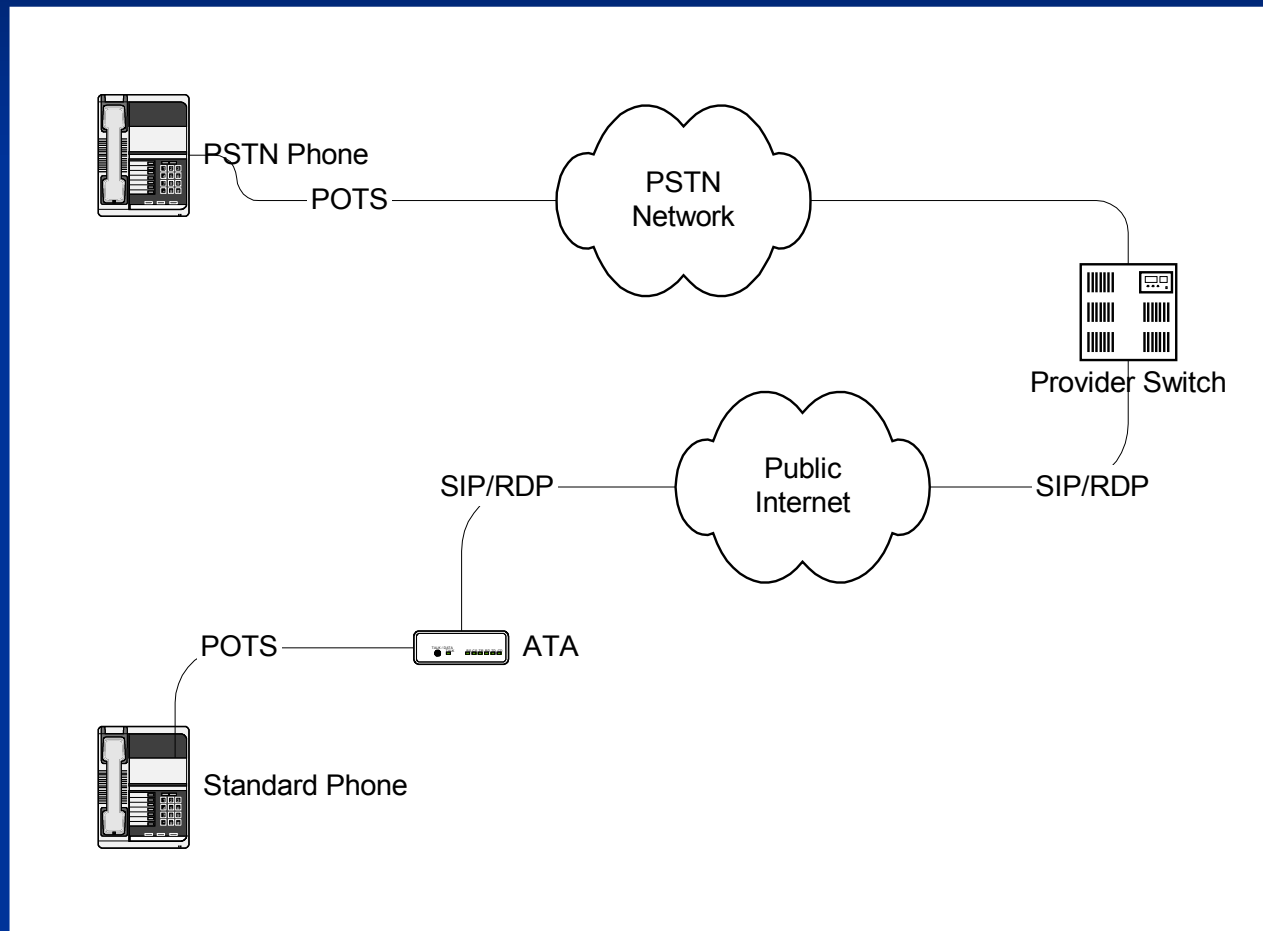
# VOIP Terms

- **SIP** – primary network protocol used to handle VOIP calls on IP networks
- **CODEC** – COmpressor/DECompressor – program or hardware to manage compression of digital audio
- **FXS** – a device that provides dialtone
- **FXO** – a device that consumes dialtone
- **ATA** – Analog Terminal Adapter – convert digital VOIP signal on ethernet to FXS analog port

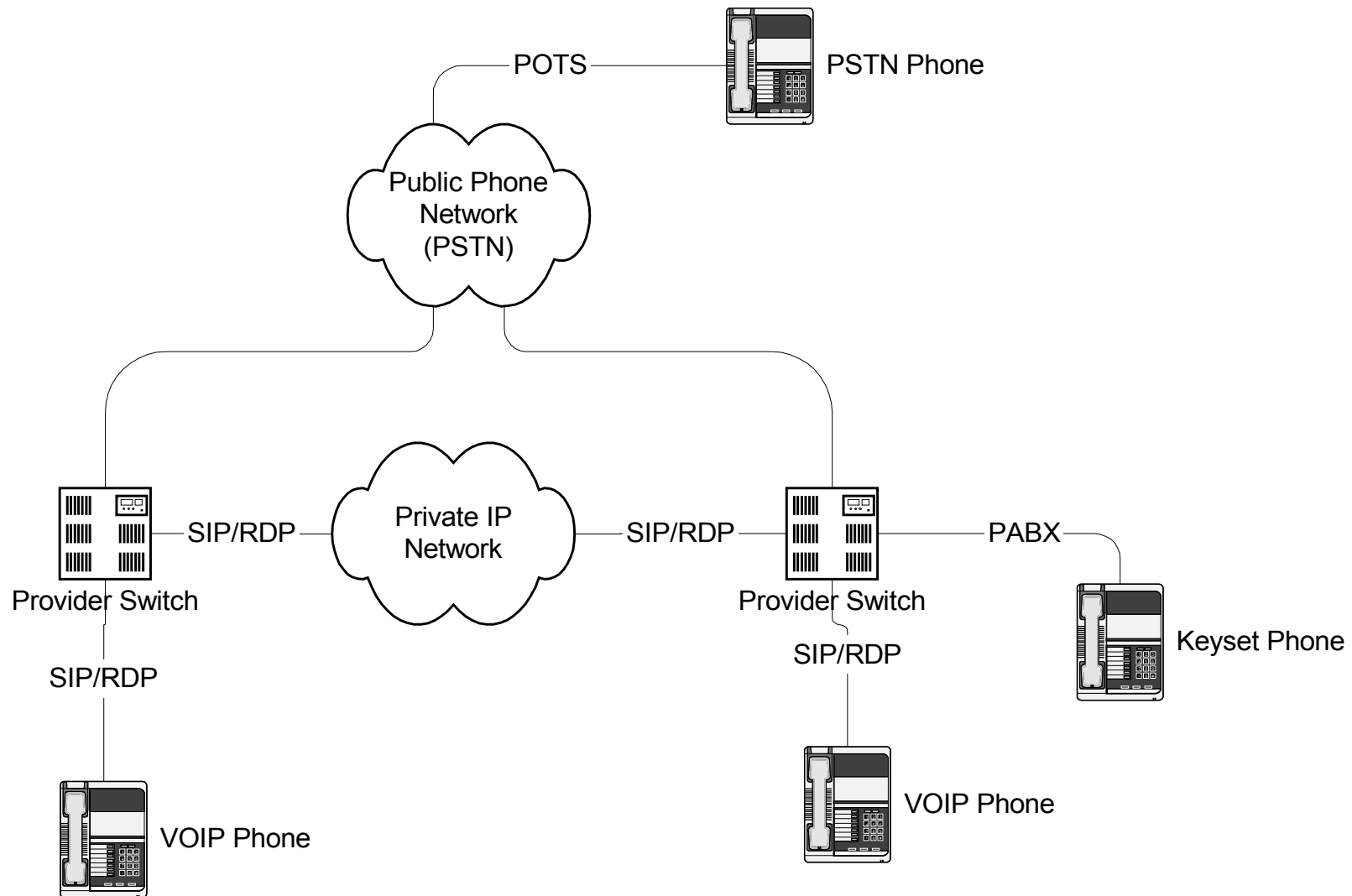
# VOIP – SIP / RTP

- SIP – Session Initiation Protocol
  - TCP or UDP based
  - Allows a device to register with a server
  - Allows a device to initiate a call
  - Allows server to notify device of incoming call
  - Signals call accept / decline / busy
  - Allows for call transfer
- RTP – Real-time Transport Protocol
  - Transports all audio
  - UDP based
  - Subject to packet loss and jitter

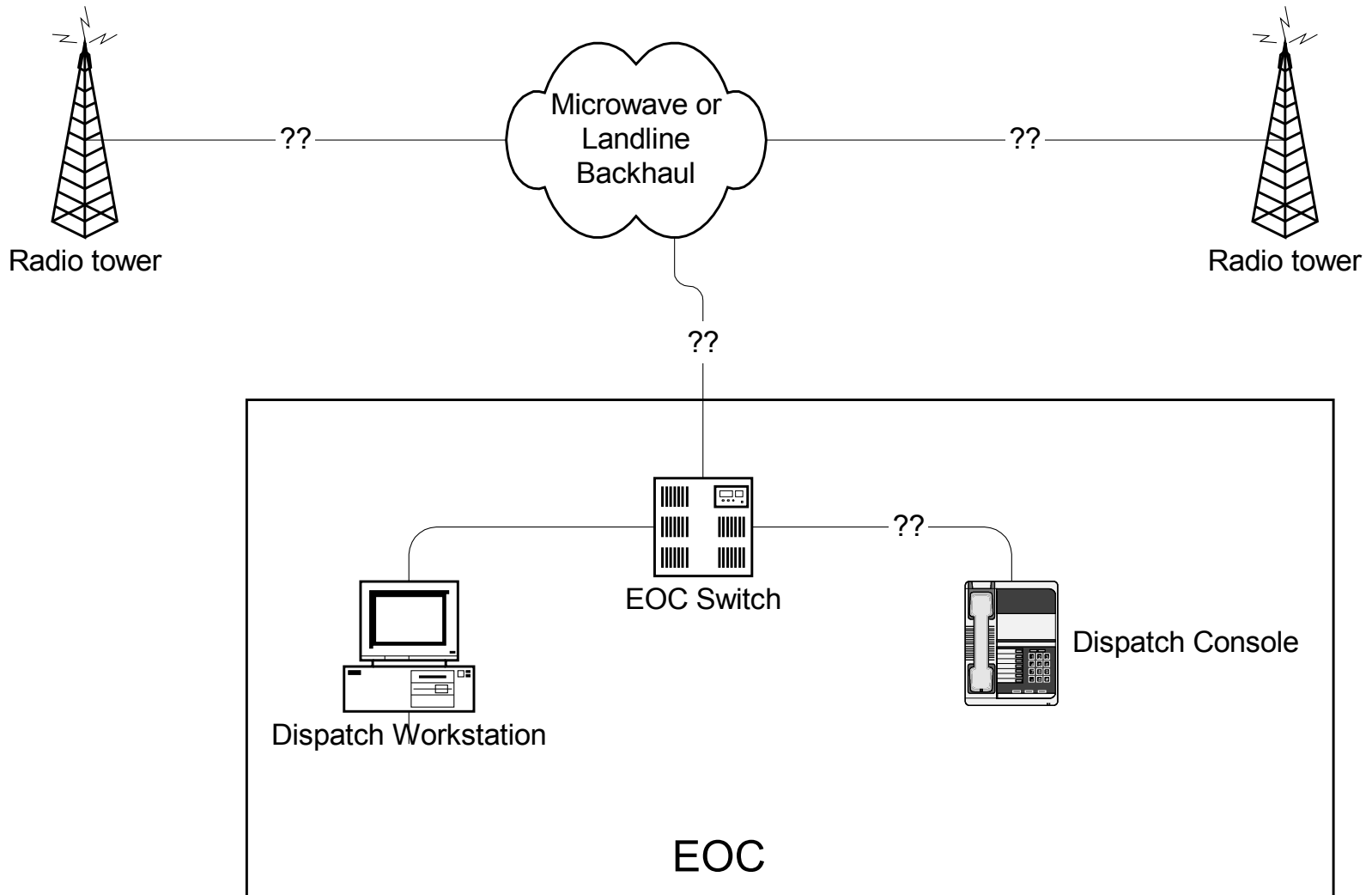
# VOIP Structure - Consumer



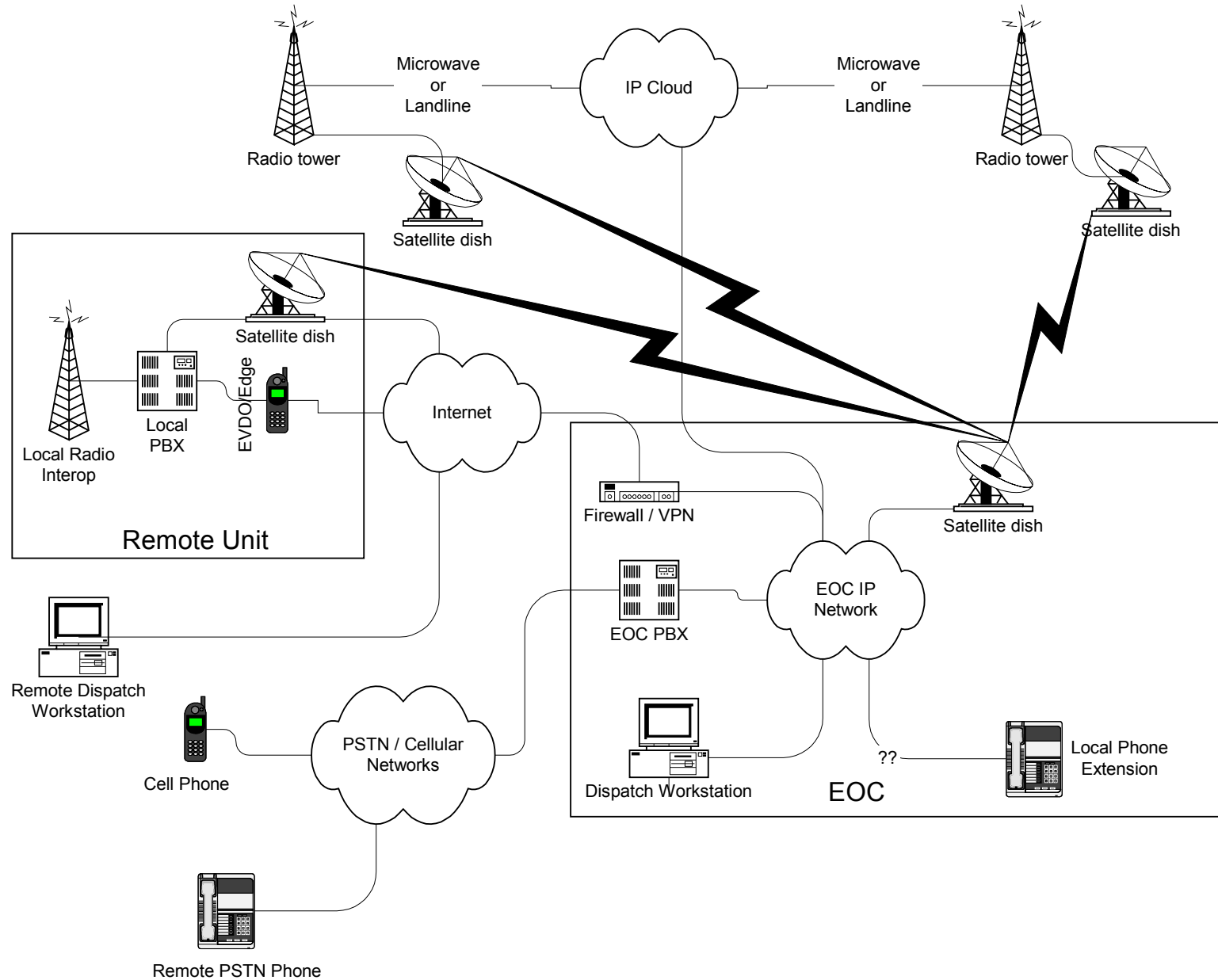
# VOIP Structure - Corporate



# ROIP – Public Safety



# ROIP / VOIP Convergence



# ROIP / VOIP Convergence

- Talk from any device to any device
  - Radio
  - Cell phones
  - Office & public phones
  - Dispatch console
  - PC based remote dispatch
- Redundant data links
  - Use inexpensive IP based networks
  - Use expensive satellite networks only during infrastructure failures or in remote locations without infrastructure

# VOIP / ROIP / SIP Standards

- Standardization effort in progress
- Sponsors
  - NIST / OLES – Office of Law Enforcement Standards
  - DHS / OIC – Office of Interoperability and Compatibility
- Roundtable Notes:  
[www.safecomprogram.gov/SAFECOM/library/technology/1293\\_roundtableon.htm](http://www.safecomprogram.gov/SAFECOM/library/technology/1293_roundtableon.htm)
- Contact: Dereck Orr: [dereck.orr@nist.gov](mailto:dereck.orr@nist.gov)

# Current State of Discussions

- Solution is very likely to be SIP centric
- Multiple CODECs will be supported
- Layering VOIP on existing networks without adequate planning and analysis can be disastrous
- SIP protocol will be extended for authentication, OOB messaging and PTT signalling
- No trace of encumbering IP yet

# Open Source / Open Protocols

- Asterisk
  - VOIP switch with support for all common protocols and CODECs
- APP-RPT
  - Repeater, Simplex and Trunked radio support for Asterisk
  - Support for remote bridging and remote dispatch
- Linux
  - Stable platform providing for hybrid VOIP/Data systems with QOS routing and excellent security

# Open Source / Open Protocols

- Solomon Technology is committed to enhancing Asterisk/App-rpt to support the DHS/NIST standard for SIP based radio interop.
- Solomon Technology implementation will be provided free of charge with full open source.
- Asterisk / App-rpt provides IAX2 based remote radio bridging today.

# STACS

- A small 40lb single case
- BGAN Broadband Satellite
- EV-DO/Edge cellular broadband
- Full VOIP PBX including voicemail and a real conference bridge
- 2 port radio interop bridge supporting simplex, repeater and trunked radios, remote bridging and remote dispatch
- WiFi mesh technology
- Local WiFi for notebooks, PDAs, VOIP phones, video and telemetry
- Battery powered, 4-8+ hours of operation
- IP-55+ – weatherproof and reliable in heavy rain and smoke, cold and heat
- “Big Red Button” operation, ready to use in 2 minutes

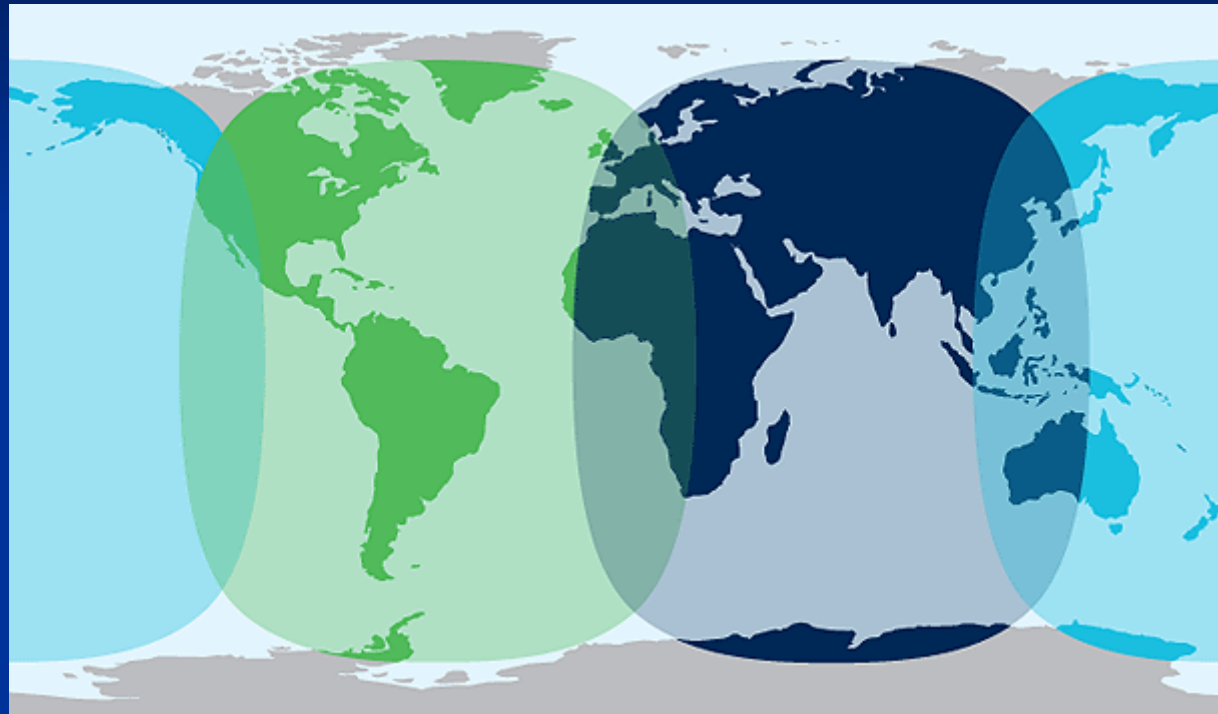
# STACS

- Automatic Least Cost operation
- Basic Incident Management software
- Outbound voicemail
- Self-healing computer system
- Rugged and Reliable
- 100% open standards and protocols
- Works anywhere in Continental US
- Minimal training necessary, no techies needed in field
- Flexible external power, 10-18v (ovp), 110-240v

# STACS

- 3-5 outbound phone lines
- 5-10 phones + up to 15 notebooks
- Inbound/Outbound VPN capability
- 2/4Mb/s EV-DO data
- EV-DO often works even when cellular network is congested
- 220/360Kb/s BGAN data
- BGAN service is \$40/month + usage
- EV-DO service is \$59/month unlimited
- Remote Dispatch Console available at no charge

# INMARSAT 4 Satellite Coverage



INMARSAT BGAN service is currently available for the continental US, South America, Africa, Europe and Asia.

The F3 satellite is scheduled for launch 2Q2008 providing global coverage and redundant service for the Western US (cyan oval).

# Questions / Demo

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