Satellite Communications & NCS Services

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NS/EP USER COMMUNITY

- National Security Leadership
- National Security Posture and U.S. Population Attack Warning
- Public Health, Safety, and Maintenance of Law and Order
- Public Welfare and Maintenance of National Economic Posture
- Disaster Recovery

Non-Federal users require Federal Agency sponsorship

(* EOP: Executive Office of the President)

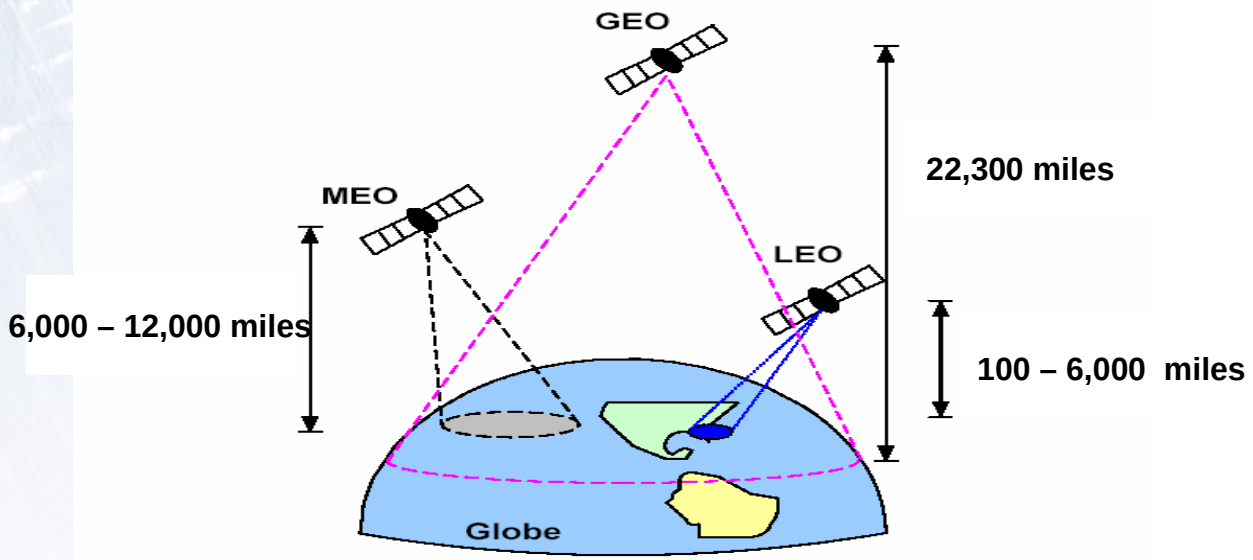
Objective

- Describe alternate satellite communications
- Implementation of satellite communications systems
- Risk Analysis of satellite communications
- National Communications System (NCS) & Priority Service Programs Overview

Describe alternate satellite communications

Satellite Communications

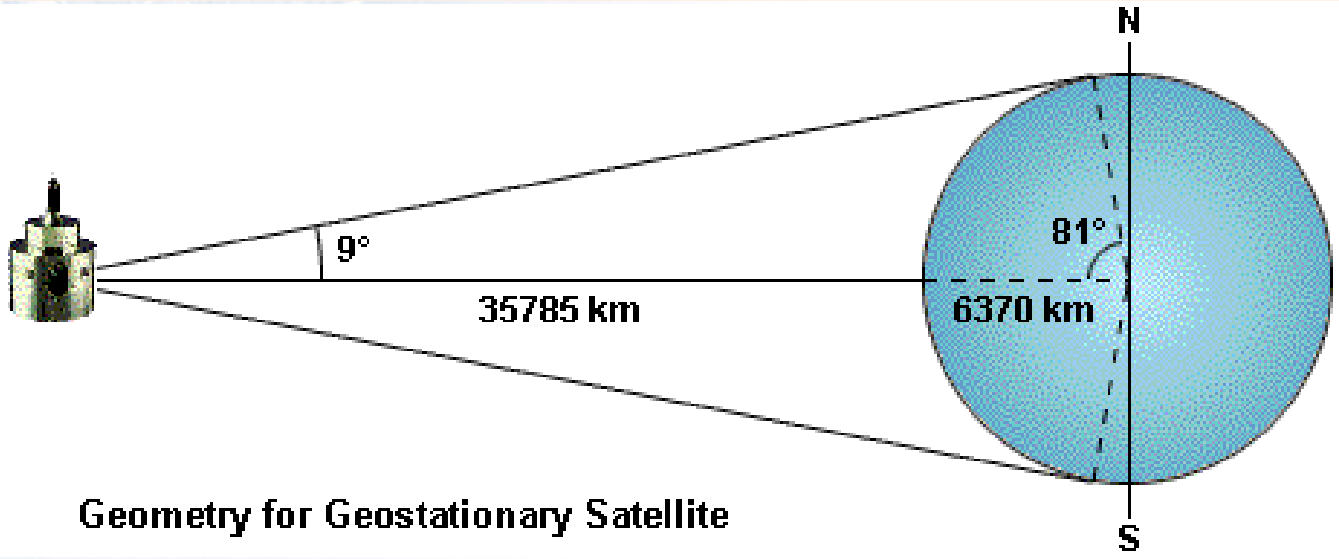
- Satellite operators use a network of terrestrial and space components to provide services such as telecommunications, broadcasting, remote sensing, and GPS Navigation
- Orbital location (altitude) is a primary factor that drives satellite applications
  - Geosynchronous Earth Orbit (GEO): One satellite covers one-third of the globe, so only three satellites are required for global coverage
  - Non-Geosynchronous {Low Earth Orbit (LEO) and Middle Earth Orbit (MEO)}: Global coverage requires numerous satellites



Satellite Services

<u>Geosynchronous</u>: use ground stations that are fixed relative to the satellite

- **Fixed Satellite Services (FSS)**
  - Support voice, data, and video broadcast services; typically used for enterprise services
- **Broadcast Satellite Services (BSS)**
  - Support video programming (e.g., DirecTV) and digital radio services; typically used for wholesale and retail media distribution



Geometry for Geostationary Satellite

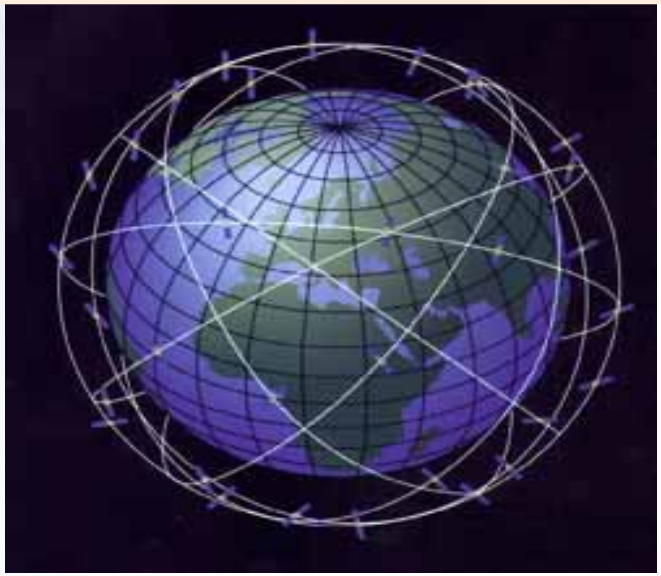
Satellite Services

Non-Geosynchronous (MEO/LEO):

- **Mobile Satellite Services (MSS)**
  - Use devices that are mobile relative to the satellite
  - Support voice, voice band data, fax, and Short Message Service; typically used by an individual user

Emerging high speed data services

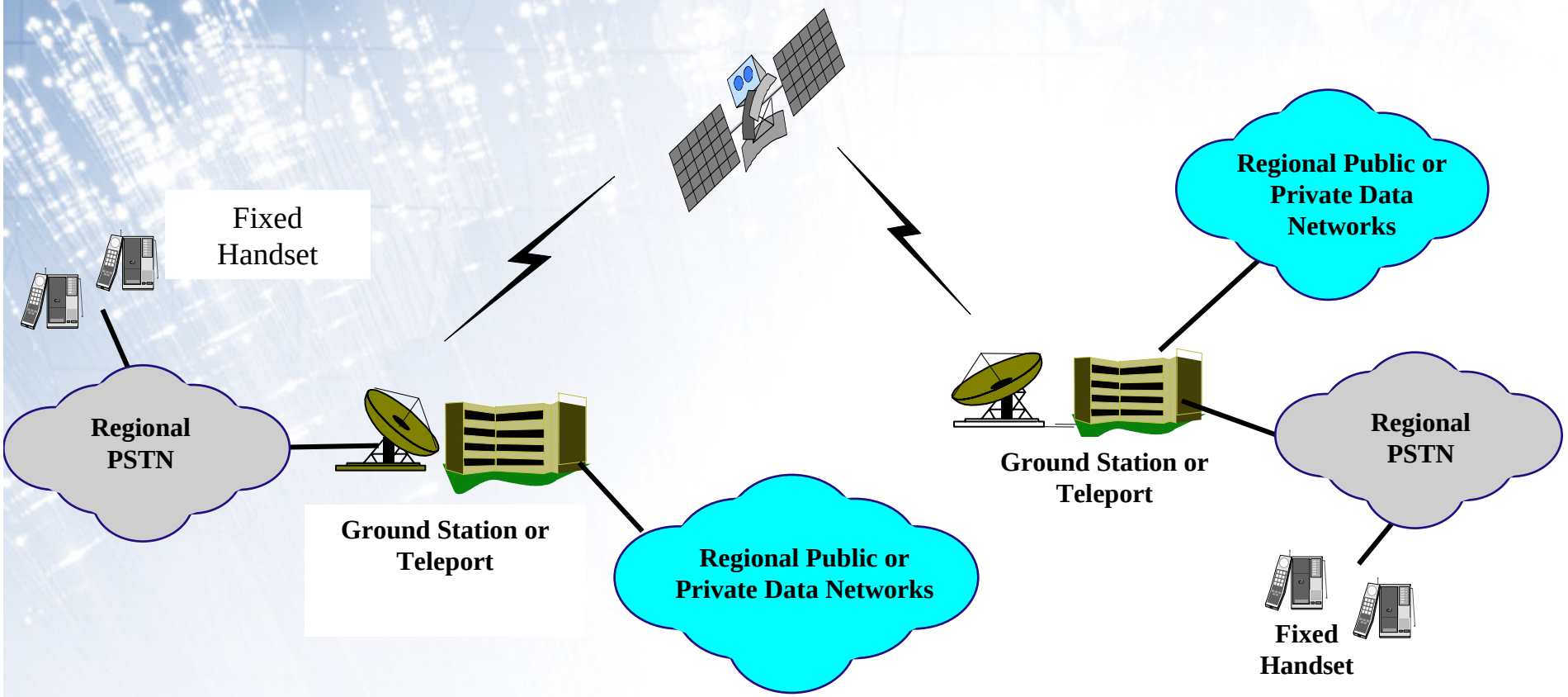
- Wild Blue (Internet Services)



Fixed Satellite Services

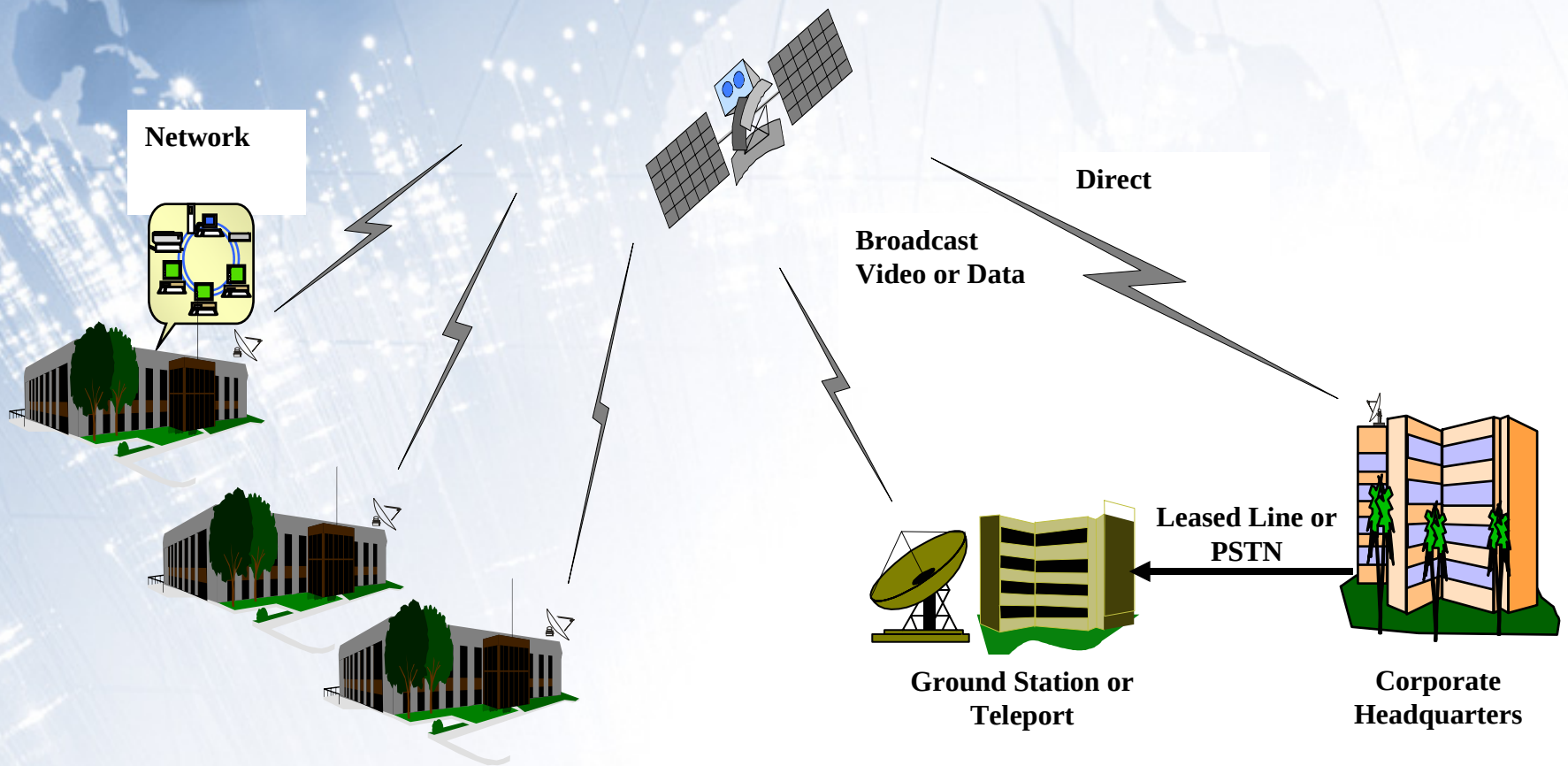
- **Transponder Services**
  - Full or part-time C, Ku, and Ka band; customarily a wholesale service
- **Shared and Dedicated Bandwidth**
  - Voice, data, and video
- **Television Services**
  - Full-time or occasional use television
- **Closed Networks**
  - VSAT or private line networks (one or two way)
- **Point-to-multipoint broadcast**
  - Data and TV distribution

Voice and Data Trunking Satellite Network

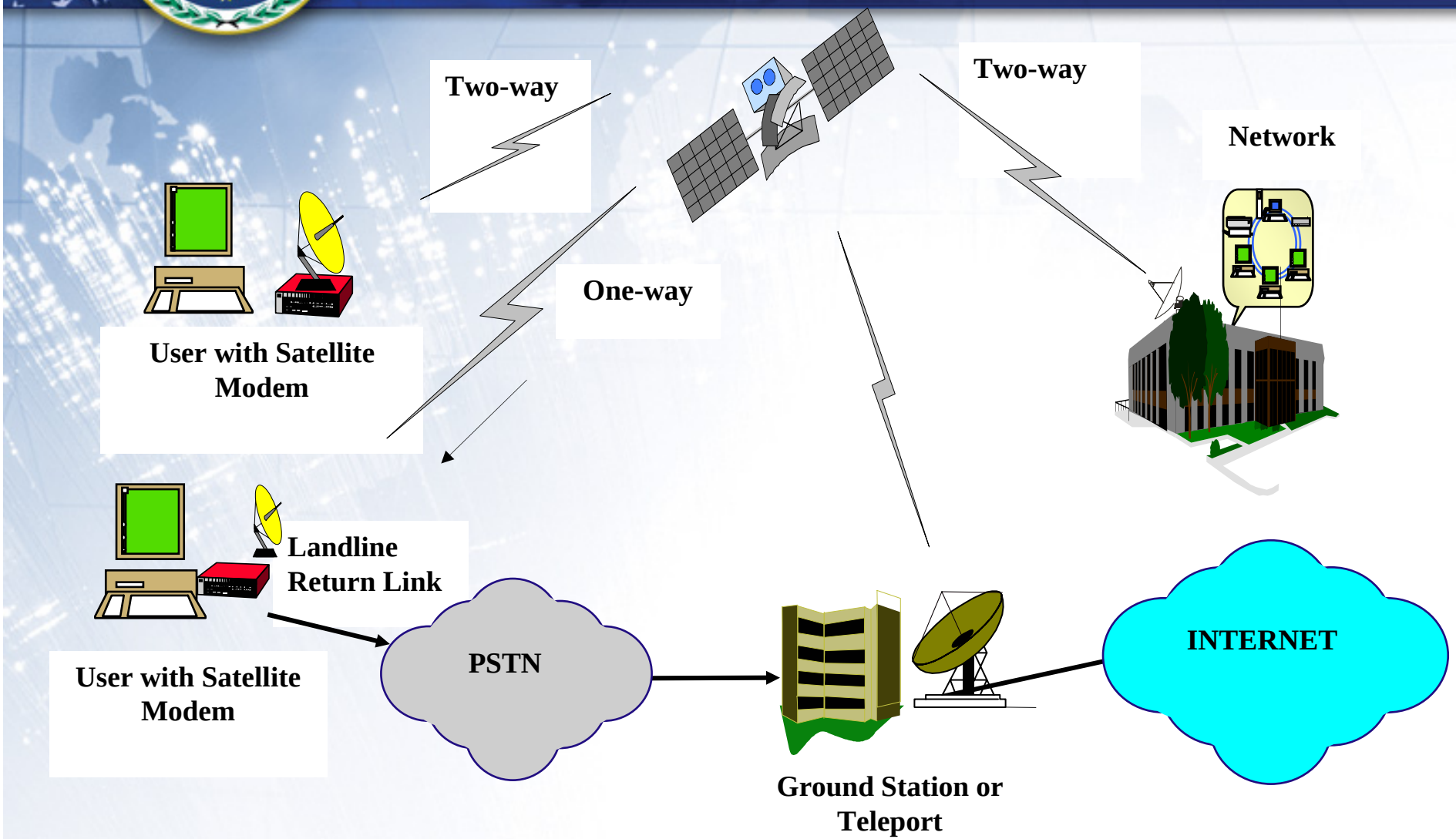


PSTN = Public Switch Telephone Network

TV and Radio Direct Satellite Broadcast Service



Internet Access Satellite Network



PSTN = Public Switch Telephone Network

Advantages of FSS

- Remote coverage to locations lacking terrestrial service
- Backup for leased lines, frame relay, and other communication services to mitigate terrestrial disruptions
- Deployment of closed enterprise / government networks (e.g., USPS)
- Simultaneous distribution of large files to multiple sites (point to multipoint) especially when combined with TCP/IP multicast

Limitations of FSS

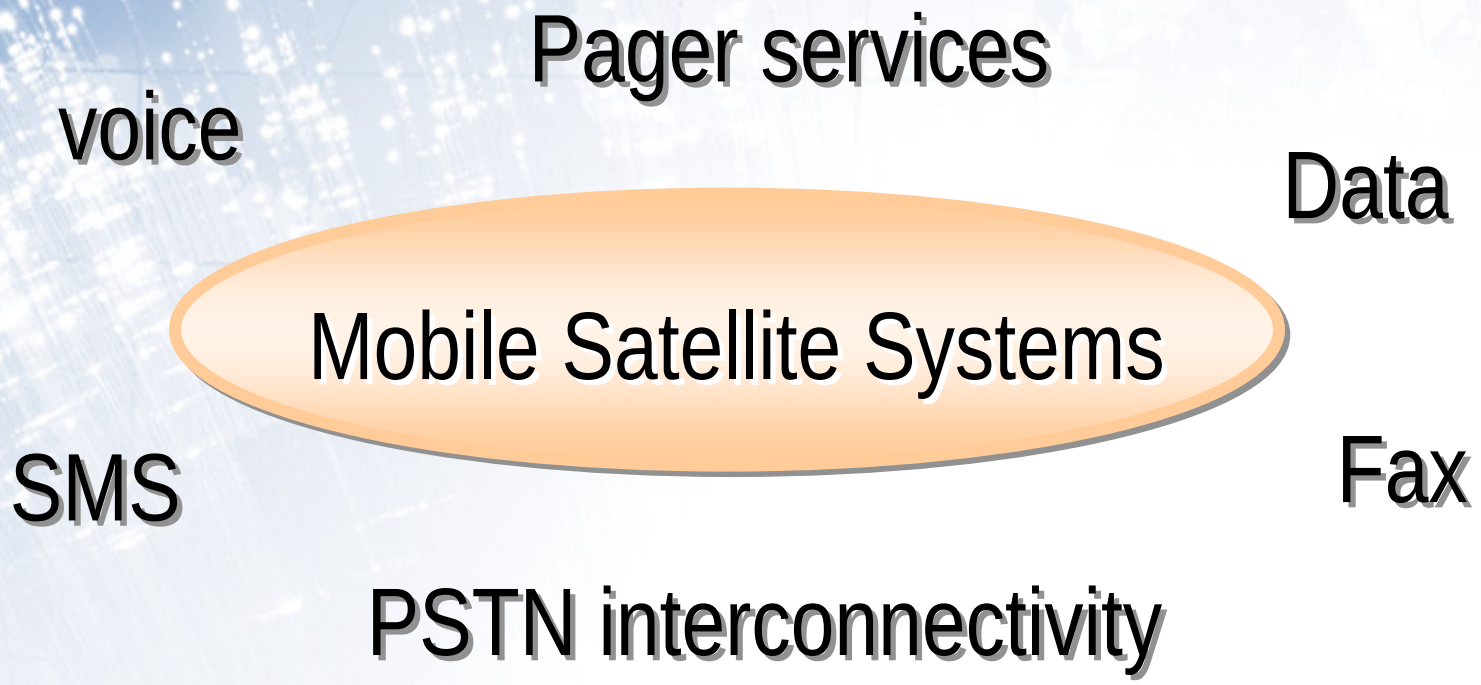
- Some applications remain dependent on terrestrial infrastructure
- Severe weather can disrupt communication
- Complex installation and maintenance
- High hardware installation costs and recurring monthly charges
- Limited bandwidth (e.g., full transponder is equivalent to DS-3 (45 Mbps))
- Current technology only allows for preemptive services
- Delay of real time applications of .25 seconds one way

Key FSS Service Providers

- SES Americom
- Intelsat
- PanAmSat
- Eutelsat
- New Skies
- Hughes (DirecTV)

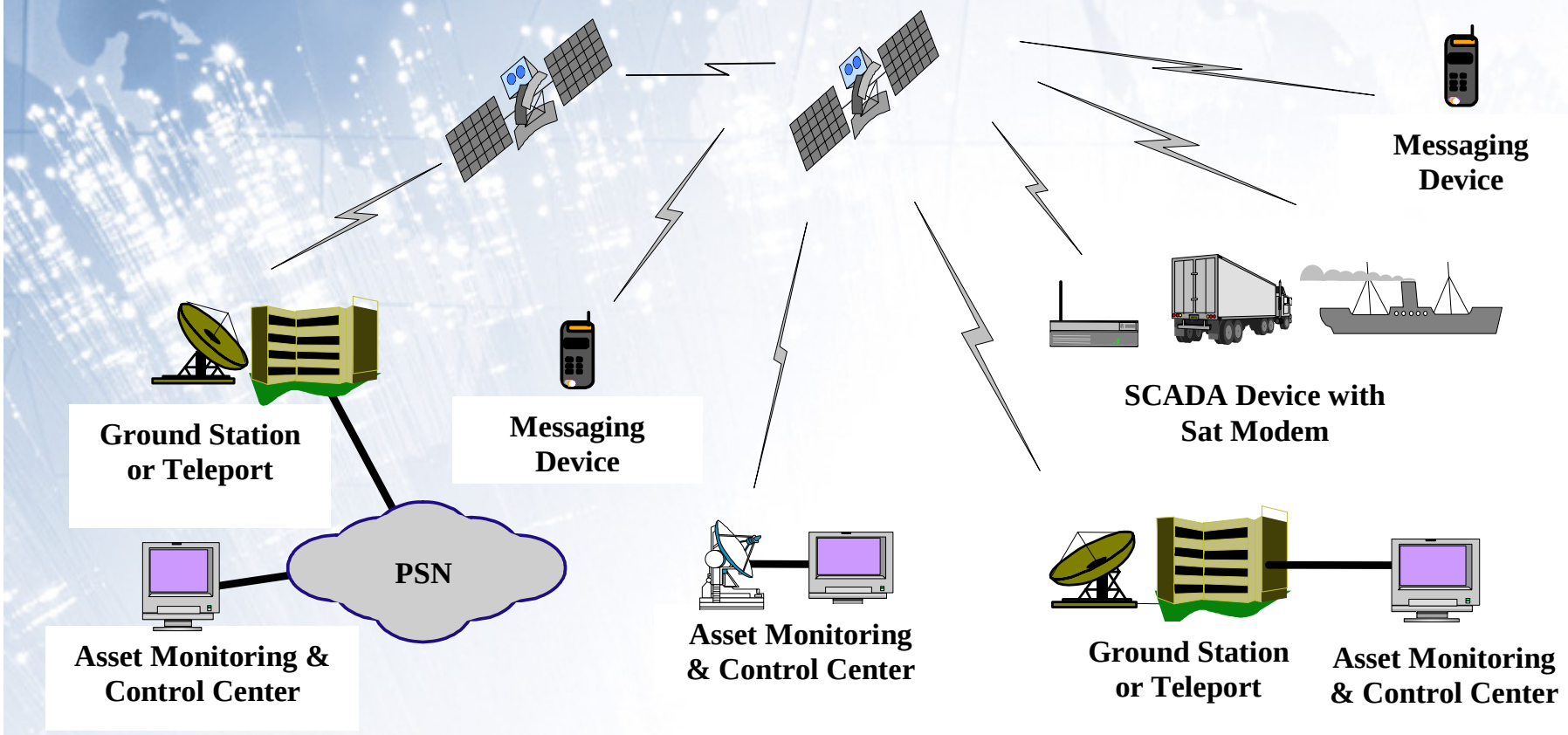
Value added service providers distribute integrated services to end users

Mobile Satellite Services



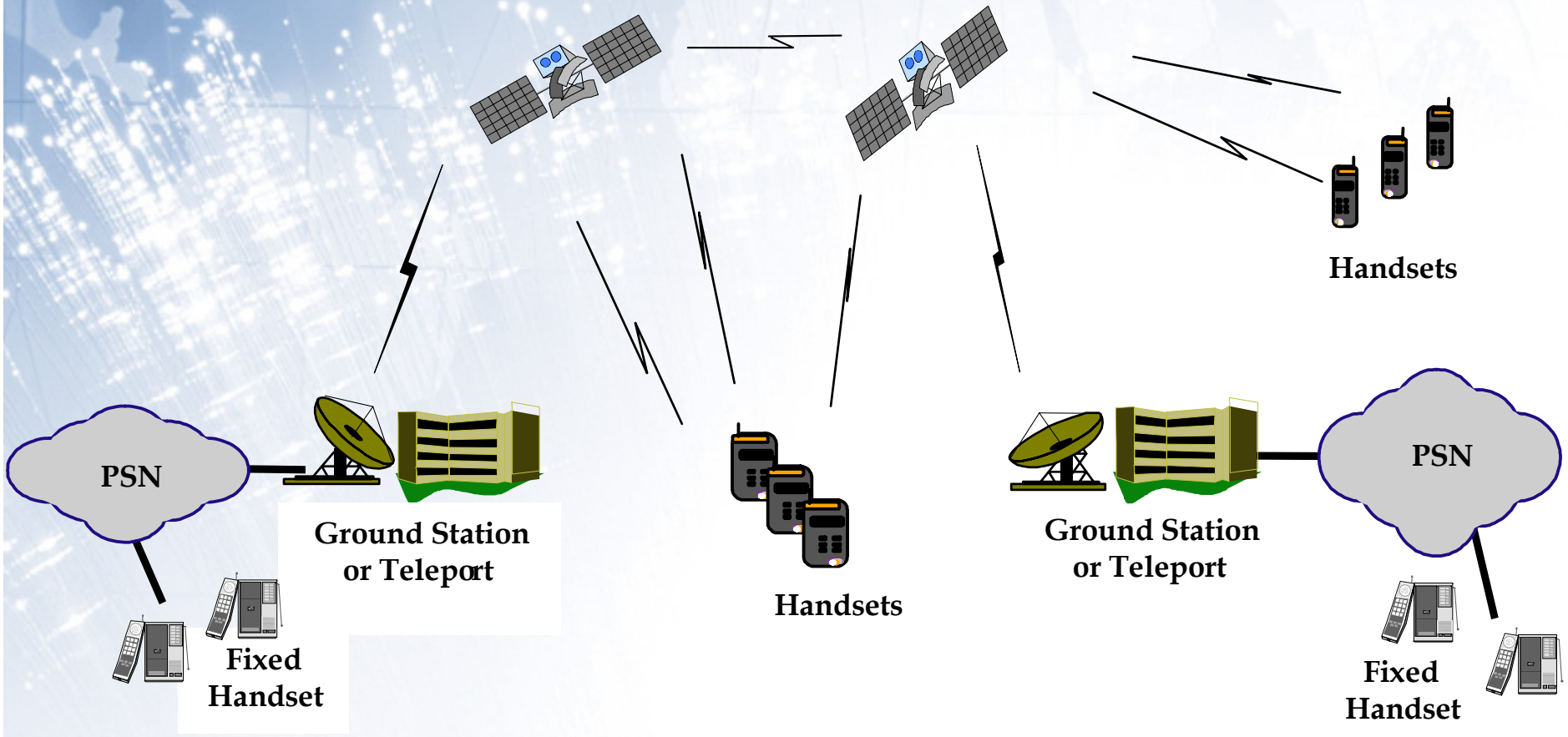
PSTN = Public Switch Telephone Network
SMS = Short Message Service

Mobile Data Satellite Network



PSN=Packet Switch Network

Mobile Voice Satellite Network



PSN=Packet Switch Network

Advantages of Mobile Satellite Services

- The choice when there is no alternative
- Personal communications
- Highly mobile
  - May offer global coverage
  - Small low power devices
- Independent of local infrastructure
- Support for voice, data, fax, and SMS

Limitations of Mobile Satellite Services

- Most applications are dependent on terrestrial networks (e.g., PSN and internet)
- Require line of sight (i.e., no coverage inside buildings)
- Very low speed data service
- Limited network capacity (e.g., number of subscribers)
- Expensive compared to terrestrial options
- Financial instability of service providers
  - Short life span of satellites requires ongoing investment

Mobile Satellite Services Service Providers

- **Globalstar**
  - LEO, 12 Gateways, Dual-mode handsets, GMPCS
  - NA Gateways: Dallas, TX; Puerto Rico; BC & ON Canada
- **Iridium**
  - LEO, 38 Gateways, Dual-mode handsets, GMPCS
- **ICO Global Communications**
  - MEO, 12 Gateways, Dual-mode handsets, GMPCS
- **Inmarsat**
  - Oceanic coverage, GEO, and Maritime specialization

GMPCS = Global Mobile Personal Communications Services
LEO = Low Earth Orbit
MEO = Medium Earth Orbit
GEO = Geosynchronous Earth Orbit

Implementation of satellite communications systems

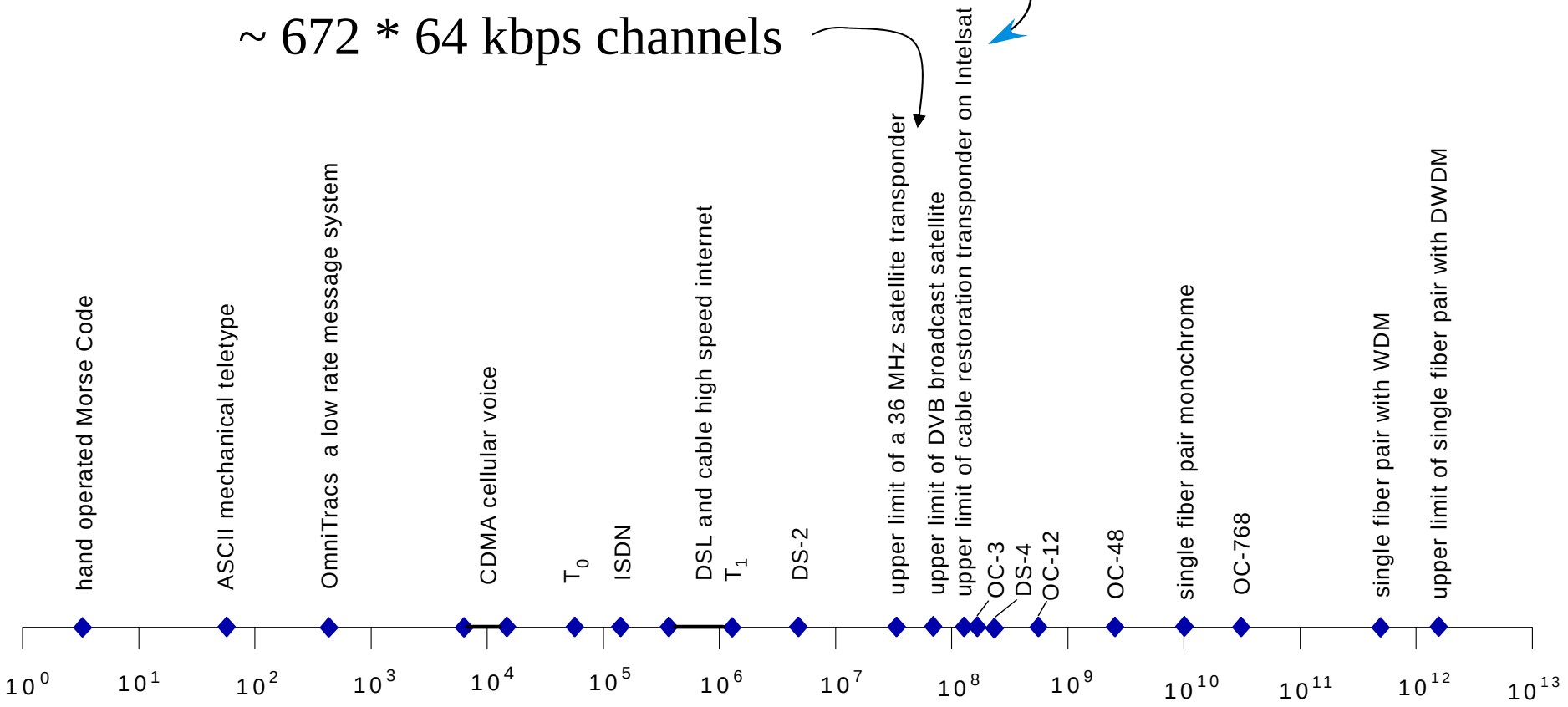
NS/EP Satellite Applications

- **Personal communications: Several agencies use satellite phones for emergency communications**
  - Support for Salt Lake City Olympics (Feb ‘02) using MSS
- **PSN bypass**
  - Continuity of Operation (e.g., HHS) using FSS
- **Long-haul communications transport**
  - Commercial Satellite Interconnectivity (CSI) supported in 1980s
- **Satellites equipments on wheels**
  - Red Cross uses SUVs equipped with satellite links for communications during disasters
- **Specialized VSAT applications**
  - USPS is the largest operator of private Very Small Aperture Terminal (VSAT) network

Modern Communication Data Rate Spectrum

The Satellite Bandwidth Barrier

~ 672 * 64 kbps channels

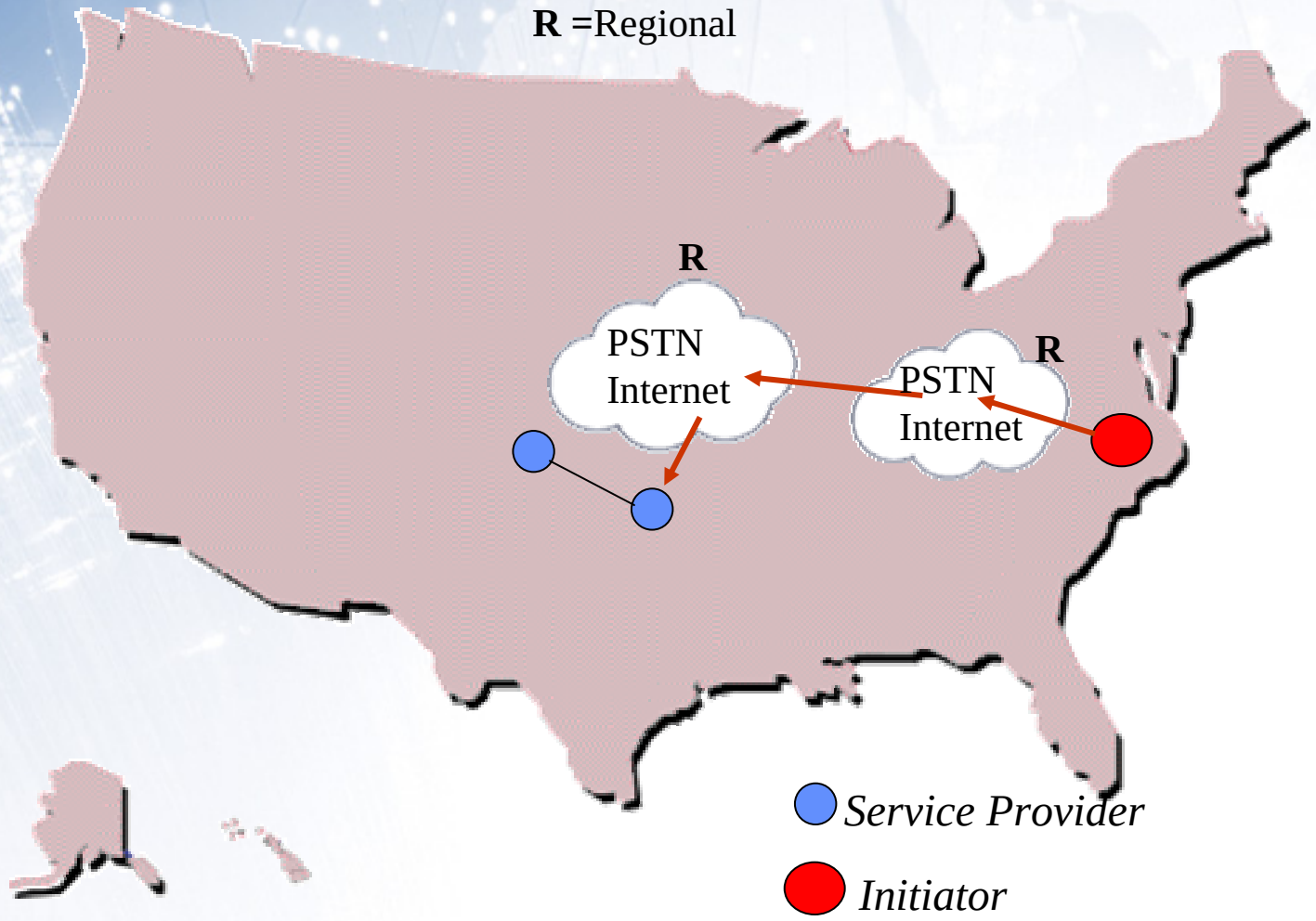


Satellite Use in Notification Study

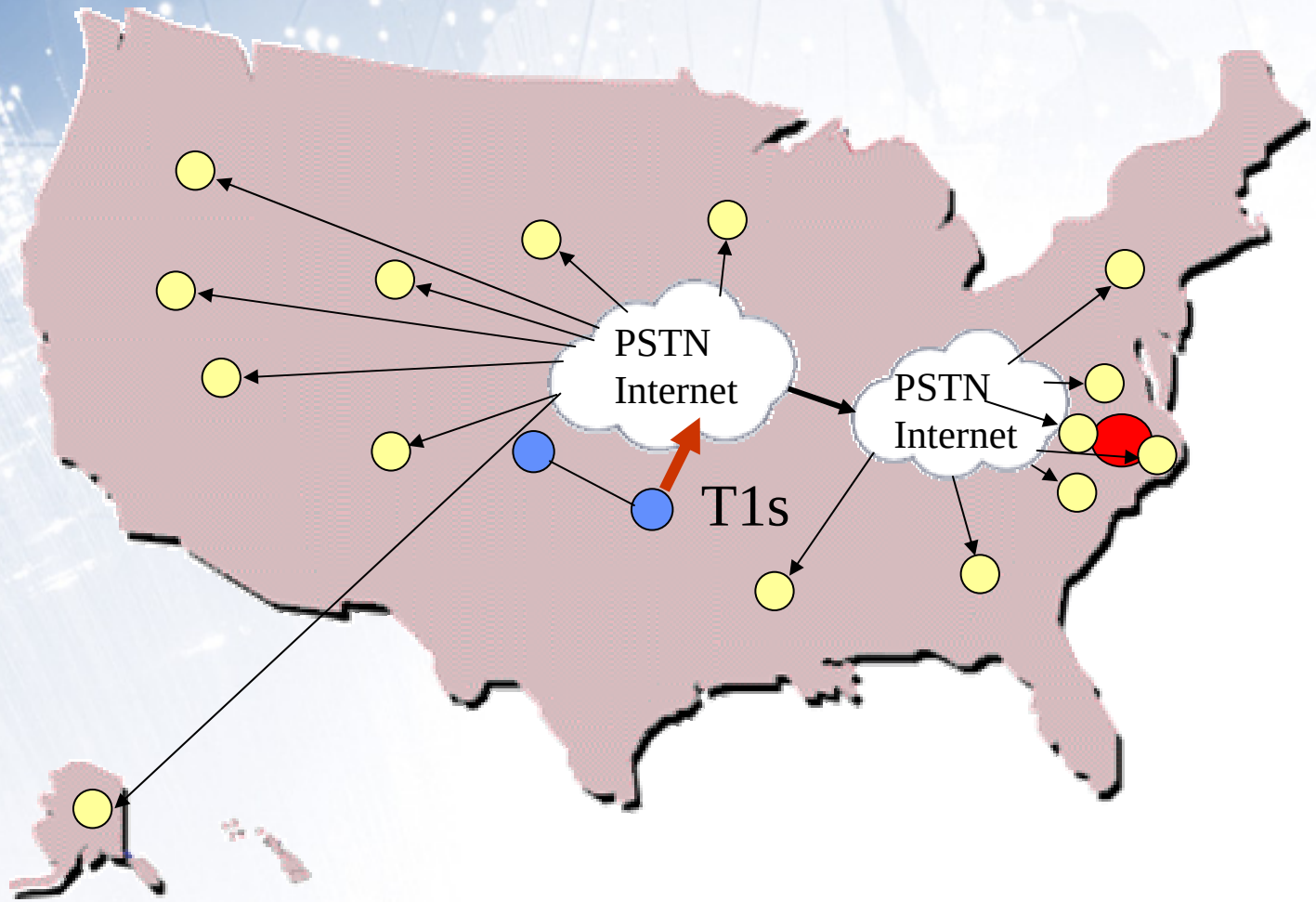
- **Emergency Notification Service Pilot**
  - Capability to Notify 2000 users in 15 minutes
  - Delivery time flexible
- **Channels of communication**
  - Cellular, Landline (Office, Home), Pagers, Email, Short Message Service, Etc.
- **Service Provider**
  - Midwest, Backup 100 miles apart, 24/7 support
- **Notifications**
  - Initiated by Agency's initiators
  - Initiated through secure web-portal, telephone
- **Satellite backup**

Normal Initiation of a Notification/Alert

PSTN = Public Switch Telephone Network
R =Regional

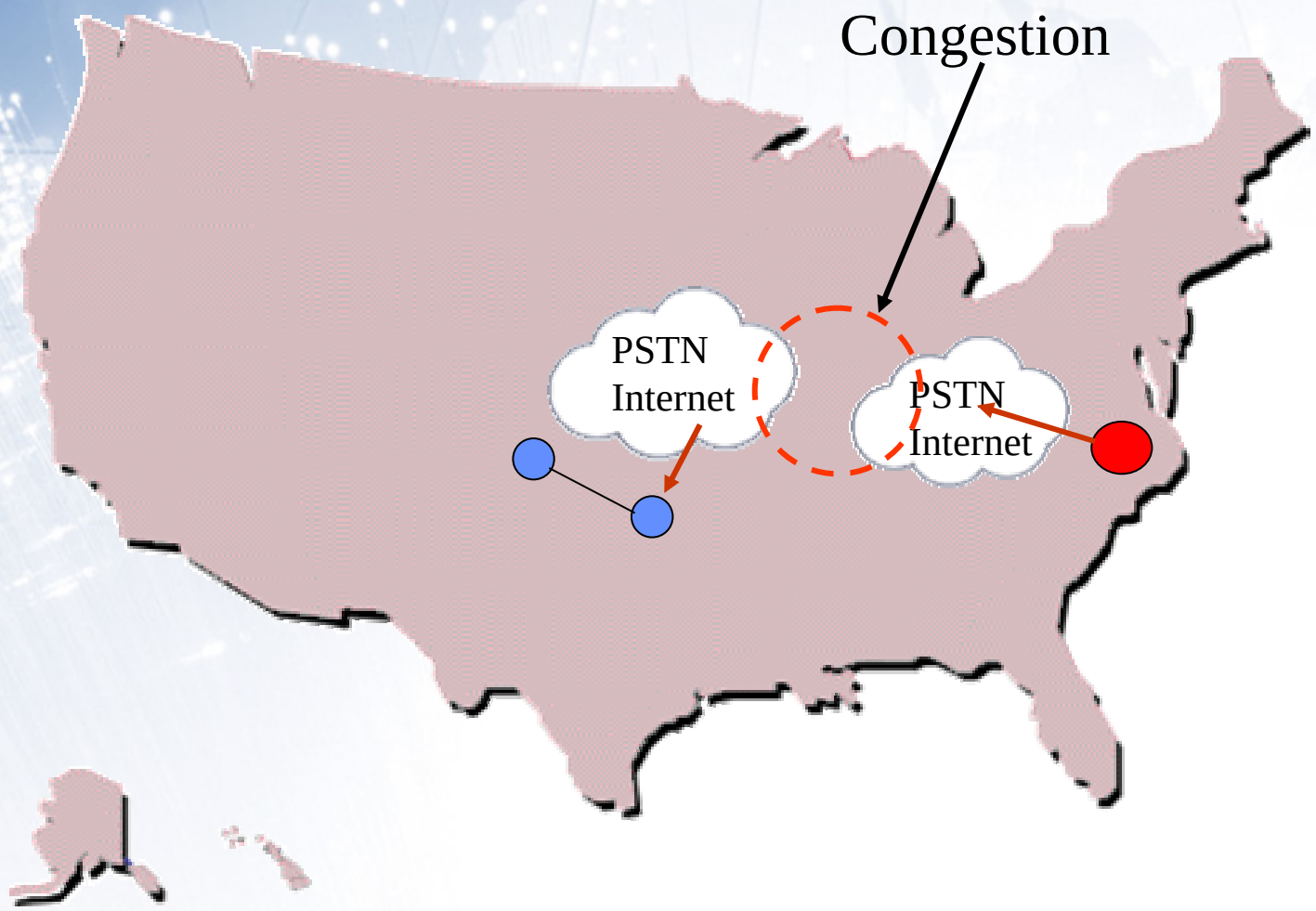


Notification in Progress

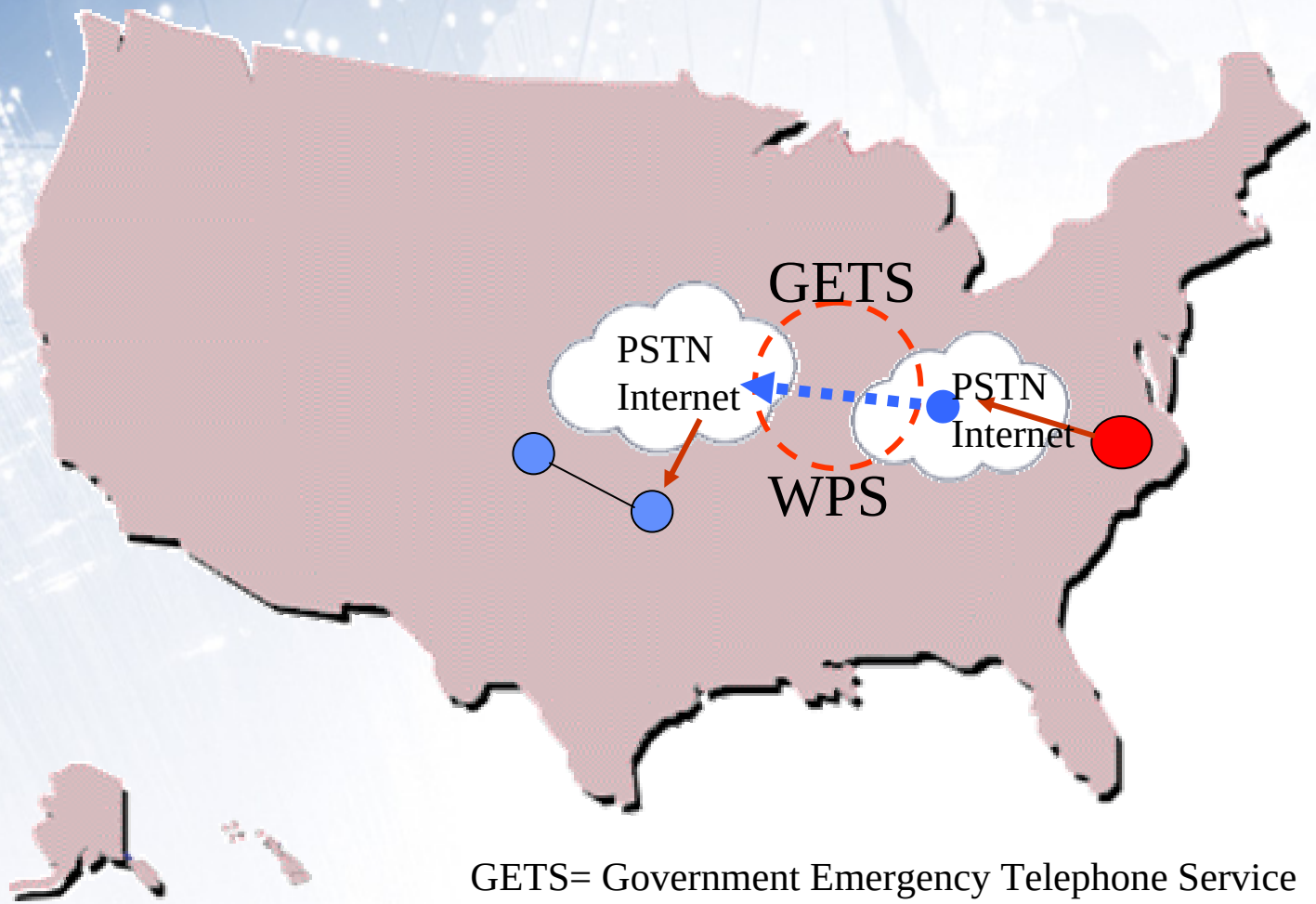


T1 = 1.544 Mbps

Congested Scenario / Unable to start Notification/ Alerts through PSN

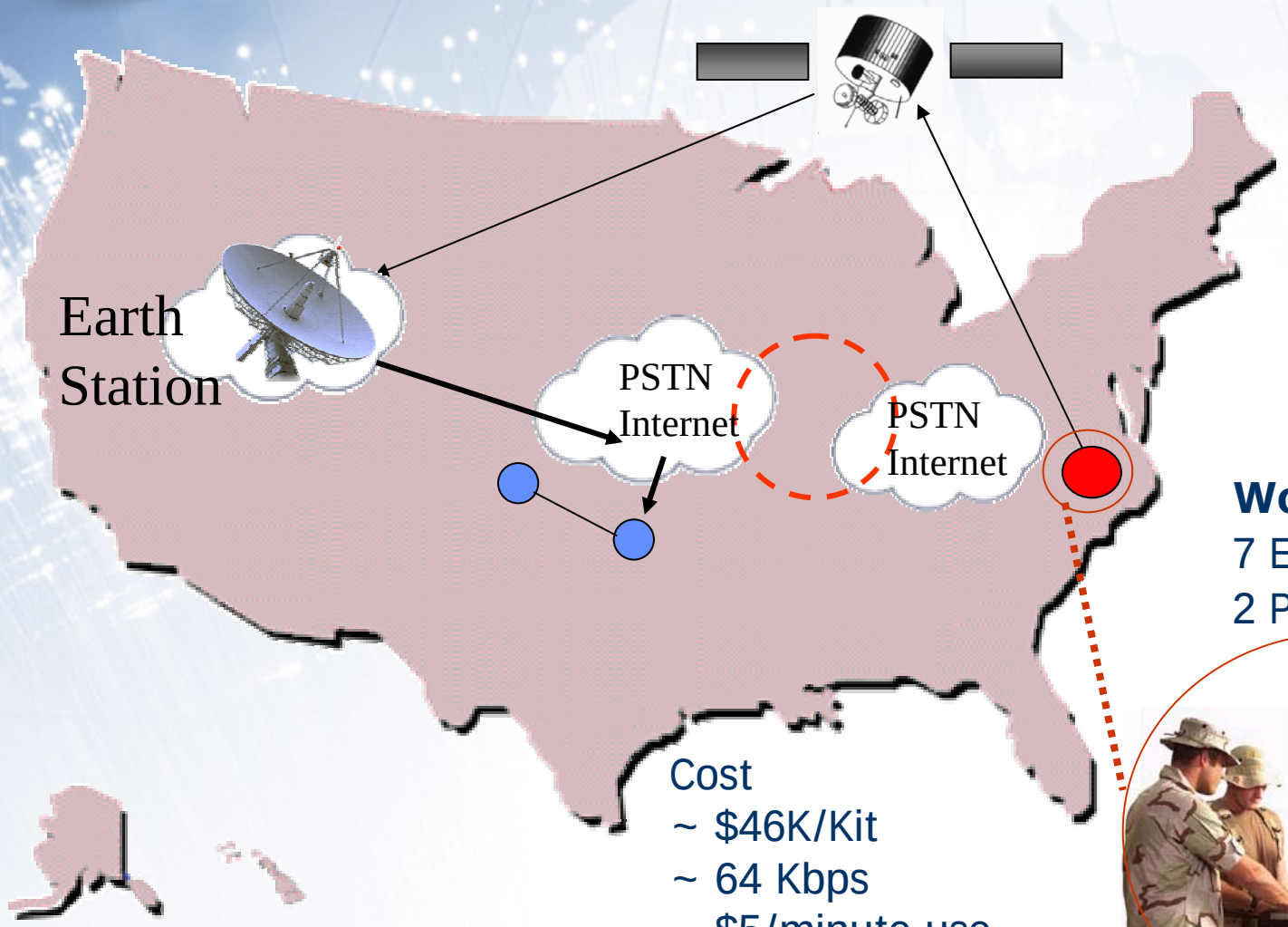


Alternate Communications



GETS= Government Emergency Telephone Service
WPS = Wireless Priority Service

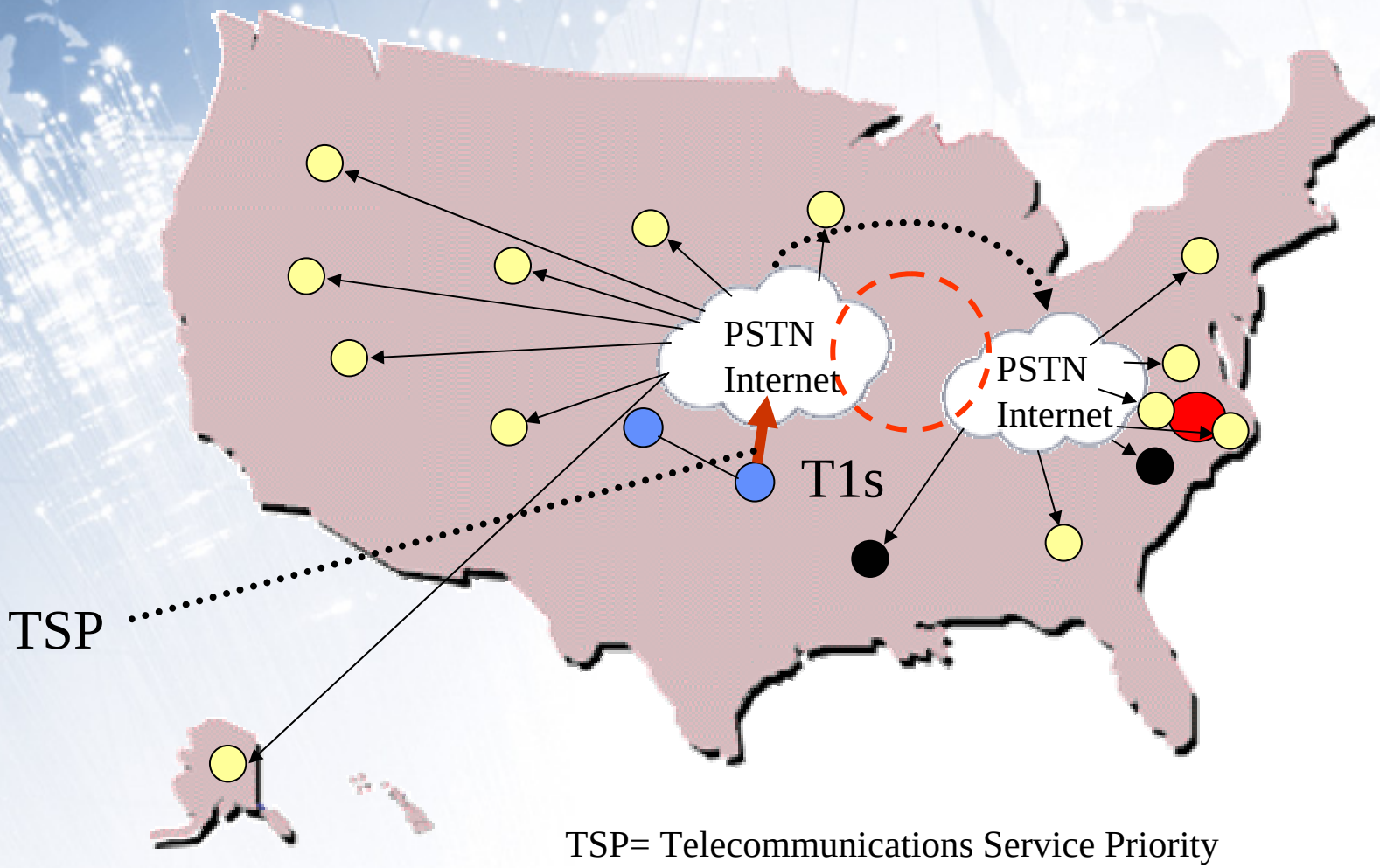
Alternate Communications



Workgroup
7 Ethernet Ports
2 Phone Ports

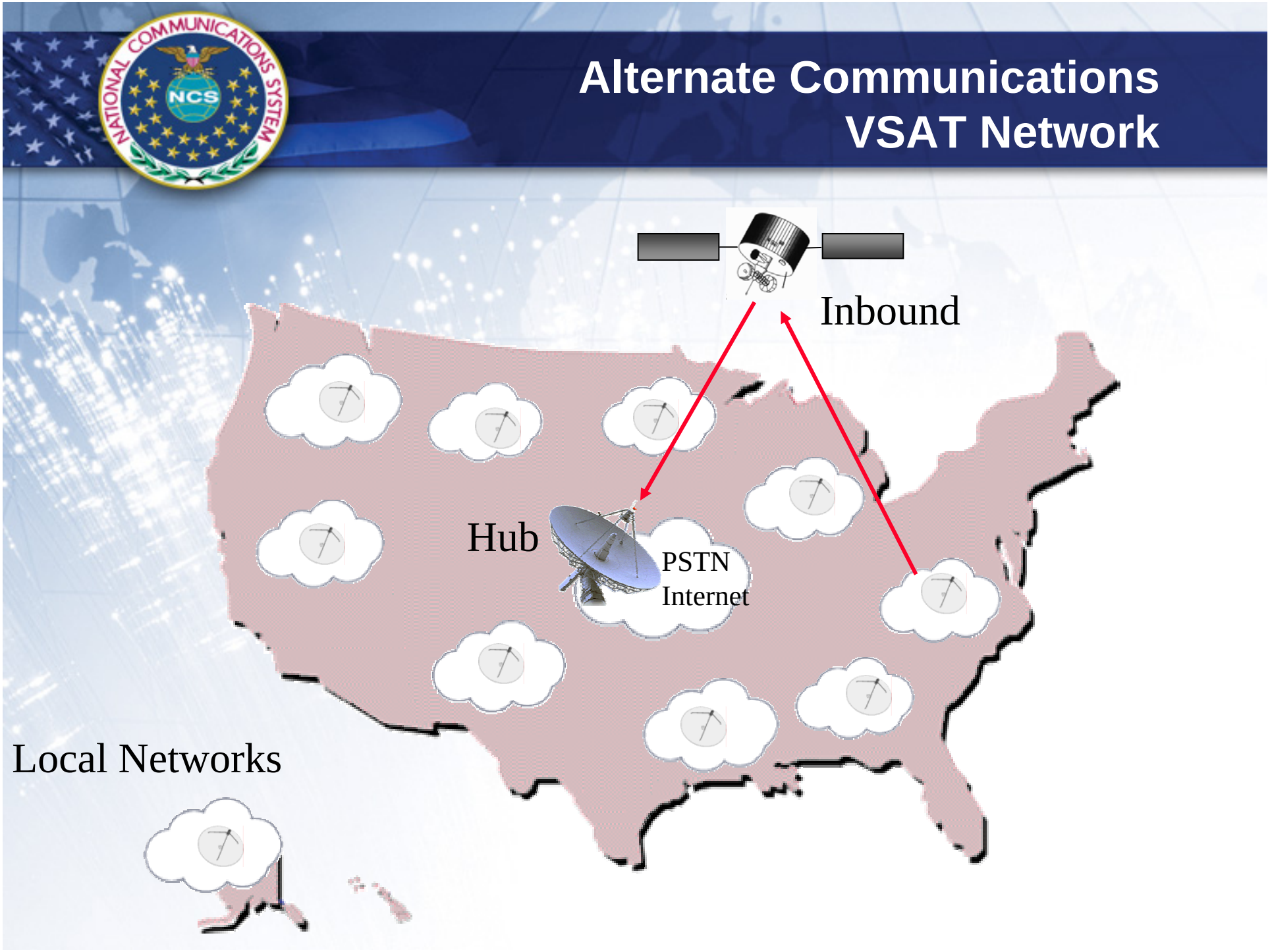
Cost
~ $46K/Kit
~ 64 Kbps
~ $5/minute use

Notification in Progress

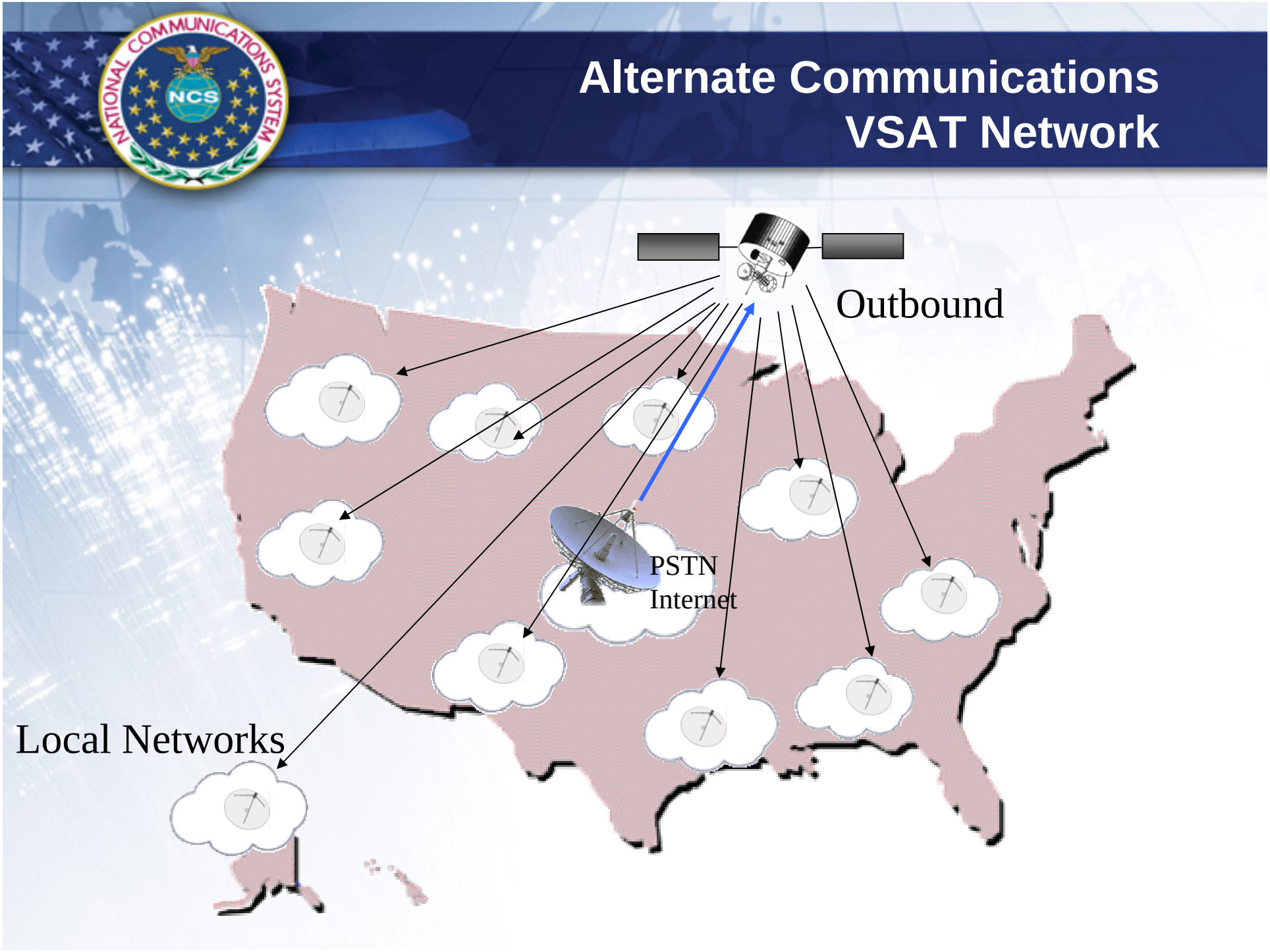


TSP= Telecommunications Service Priority

Alternate Communications
VSAT Network



Alternate Communications VSAT Network



VSAT Approximate Cost

APPROXIMATE COST of a VSAT Star Network			
VSAT, Hub, Satellite Lease, and Licence Costs			
# of VSAT Units	30	300	1000
Satellite Lease/Year	1.25 Mhz	12.5 Mhz	42.5 Mhz
Total Cost per Vsat	$ 443	$ 360	$ 309

VSAT Networks, Wiley - Second Edition - by Gerard Maral

Risk Analysis of satellite communications

Satellite System Risk Analysis

- **Satellite system components**
  - Ground station
  - Signal jamming
    - TT&C
    - Data link
  - Terrestrial interfaces
    - Public Switched Network (PSN)
    - Data networks
- **Eavesdropping**
- **Infrastructure dependencies (e.g., electric power)**

Satellite System Risk Analysis

- **Single point of failure**
  - VSAT hub station failure can jeopardize the entire VSAT networks
  - Redundant downlink (VSAT Hub) are technically challenging and expensive
- **Satellite carrier financial stability**
  - Financial distress within satellite sector
  - Industry consolidation
- **Foreign ownership considerations**

Conclusions

- **Satellites benefit National Security and Emergency Communications during Crisis situations where portability and backup communications are important**
- **Satellites provide alternative communications in areas where terrestrial communications are not available or not cost effective (Rural Areas)**
- **Services offered are comparable to wireline and wireless services including voice, video, and data applications**

Conclusions

- Some applications remain dependent on the terrestrial infrastructure
- The trend of industry is toward hybrid networks
- Industry is working with Internet Protocol Over Satellites

National Communications System (NCS) & Priority Service Programs Overview

Telecommunications Service Priority (TSP) Program

The TSP program contains two primary and distinctive components:

Restoration

A restoration priority is applied to new or existing telecommunications services to ensure restoration before a non-TSP program user.

Must be requested and assigned *before* a service outage occurs

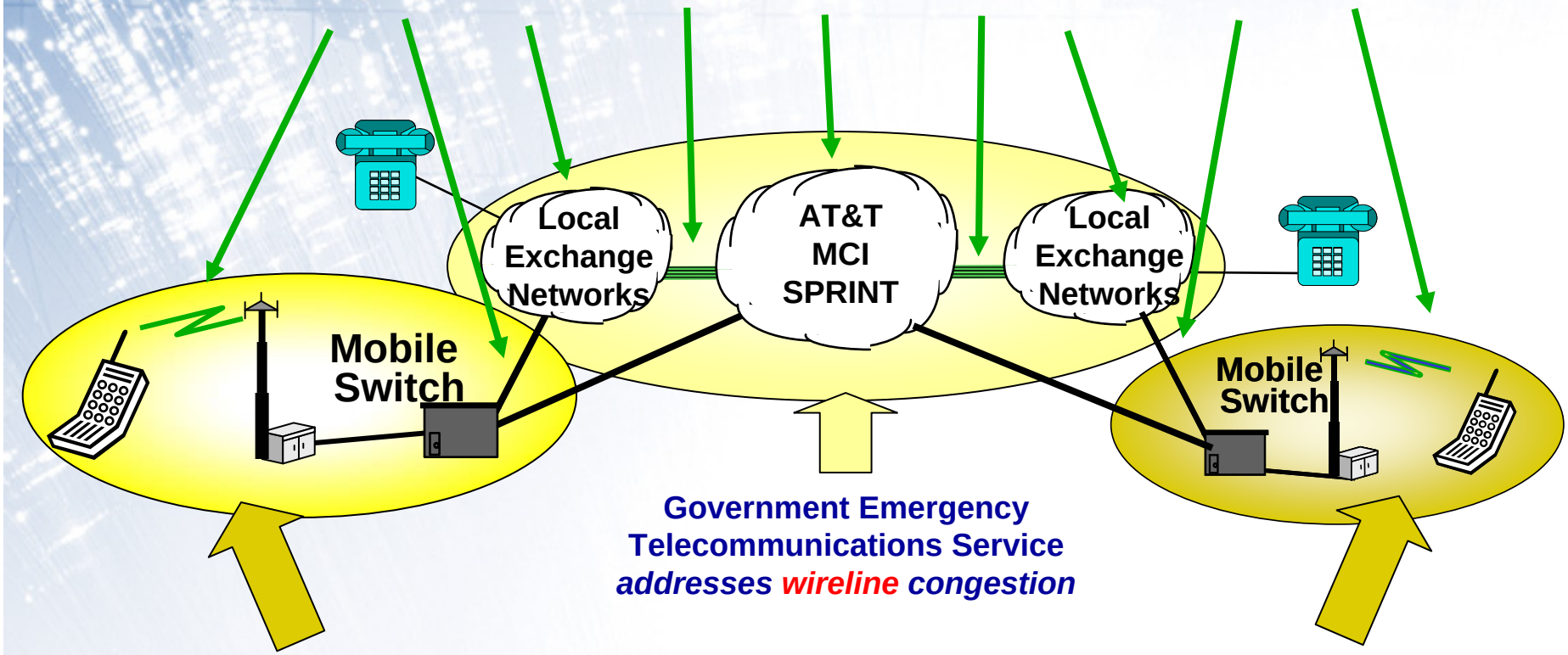
Provisioning

A provisioning priority is obtained to facilitate the priority installation of *new* telecommunications services in a shorter than normal interval.

Cannot be used to compensate for inadequate planning

The Fundamental Issue: Network Congestion

Congestion, at <u>many</u> points, can block a call !



Government Emergency Telecommunications Service *addresses wireline congestion*

Wireless Priority Service *addresses wireless congestion at call origination and call termination*

The GETS Calling Card

Government Emergency Telecommunications Service

123 456 789 012

Name: David Clark

Organization: CDC

Calling cards are in widespread use and easily understood by the NS/EP User, simplifying GETS usage

GETS priority is invoked "call-by-call"

GETS authority is vested in the individual, not the phone number, through use of a calling card approach

TO MAKE GETS CALLS

TOUCH-TONE PHONES

Dial **1 + 710-NCS-GETS (627-4387)**
After the tone enter your PIN. When prompted, dial your destination number (Area Code + Telephone Number).

CANNOT COMPLETE

Try a different long-distance carrier by dialing:

For AT&T: **1010+288**
For MCI: **1010+222** } **+1+710-627-4387**
For Sprint: **1010+333**

For AT&T: 1+888-288-4387
For MCI : 1+800-900-4387
For Sprint: 1+800-257-8373

FTS OR DISN USERS

Use normal procedures to get a FTS or DISN dial tone, then dial **710-627-4387**

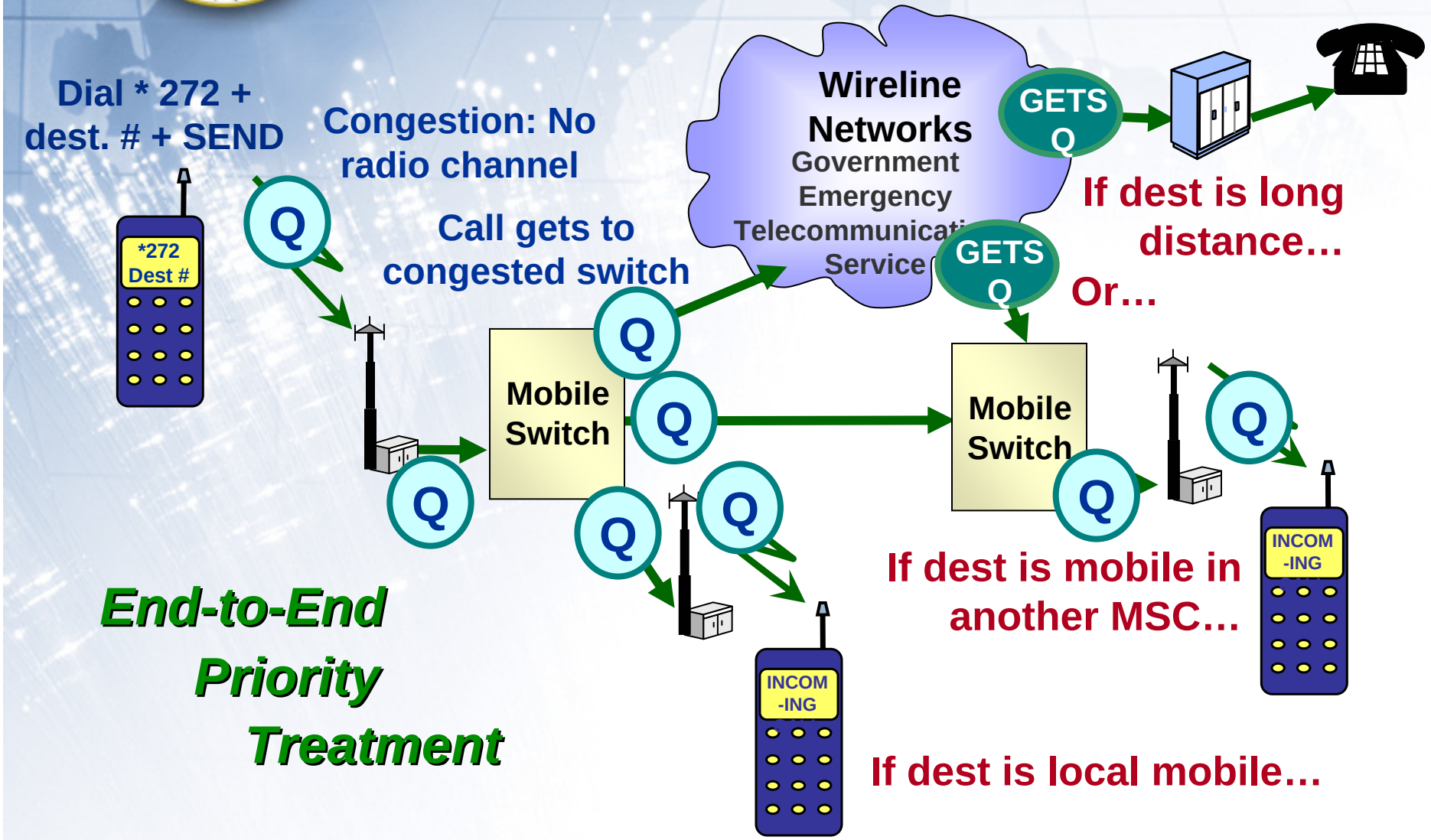
NEED ASSISTANCE?

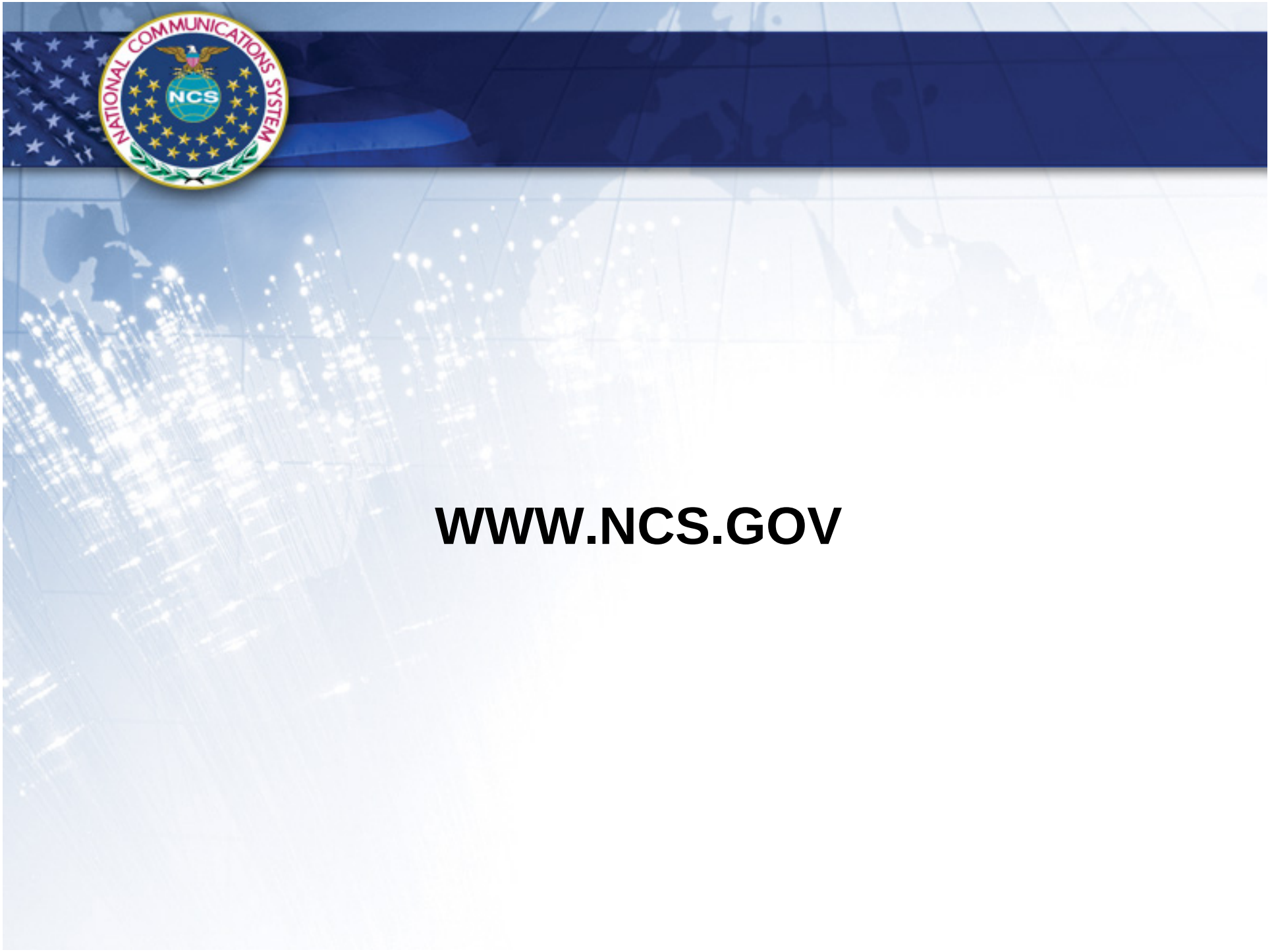
Dial **1+800-818-GETS (4387)** to get help or report trouble at any time. You can also obtain user assistance through GETS. When prompted for your destination number dial **703-818-GETS.**

What is WPS?

- An enhancement to basic wireless service that allows your National Security/Emergency Preparedness (NS/EP) calls to queue for priority service in order to complete the call
- Together with GETS, WPS dramatically improves “end-to-end” call completion during emergencies
- Designed for 95% call completion at FOC

Full Operating Capability

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