



## **Technical Solutions**

### **Console-Console Patch**

## **THIS CONSOLE-CONSOLE PATCH SOLUTION ANALYSIS HIGHLIGHTS THE FOLLOWING**

- Technical description and conceptual drawings
- Appropriate uses
- Advantages and disadvantages
- Costs
- Spectrum requirements
- Management issues
- Security and standards issues
- Implementations

## **AGENCIES CAN ACHIEVE INTEROPERABILITY BY ESTABLISHING AN AUDIO CONNECTION BETWEEN THEIR DISPATCH CONSOLES**

- Typically, public safety agencies use a central dispatch console for an audio interconnect
- The console audio interface can be—
  - 2-wire or 4-wire audio with E & M (i.e., receive signaling and transmit signaling), with or without ringback tones
  - 600 ohm balanced audio is typical
- Console-console patches can be implemented in any way that accommodates available audio interfaces. Three ways are typically used:
  - The public switched telephone network (PSTN) (dial up console access)
  - A dedicated leased line (3002 or equivalent)
  - A dedicated microwave or fiber link (voice channel assignment in multiplex)

## **AGENCIES CAN ACHIEVE TEMPORARY INTEROPERABILITY BY USING THE PSTN**

- The PSTN is used when the dispatch console at each participating agency has 2-wire E & M or loop start without ringback tones and 600 ohm balanced transmit-and-receive audio
  - Dispatchers simply use an ordinary analog telephone line to call a designated telephone number at each agency
  - A dispatcher must be available at each end of the interconnection to establish, maintain, and terminate the connection; the initiating dispatcher typically controls the conversation
  - The communication method depends on the interconnection capabilities of the dispatch console
    - If possible, the console establishes and controls the interconnection between baseband audio and PSTN audio
    - If the console cannot provide direct PSTN interconnection, a dispatcher must repeat messages from the telephone to the radio system and vice versa
    - Automatic phone patch connects PSTN audio to/from radio system
- If the dispatch console has 600 ohm balanced or unbalanced transmit-and-receive audio, agencies can construct a custom interface to allow PSTN interconnection

**A DEDICATED LEASED LINE IS USED WHEN PARTICIPATING AGENCIES DETERMINE THAT THEIR INTEROPERABILITY NEEDS REQUIRE A PERMANENT CONSOLE CONNECTION**

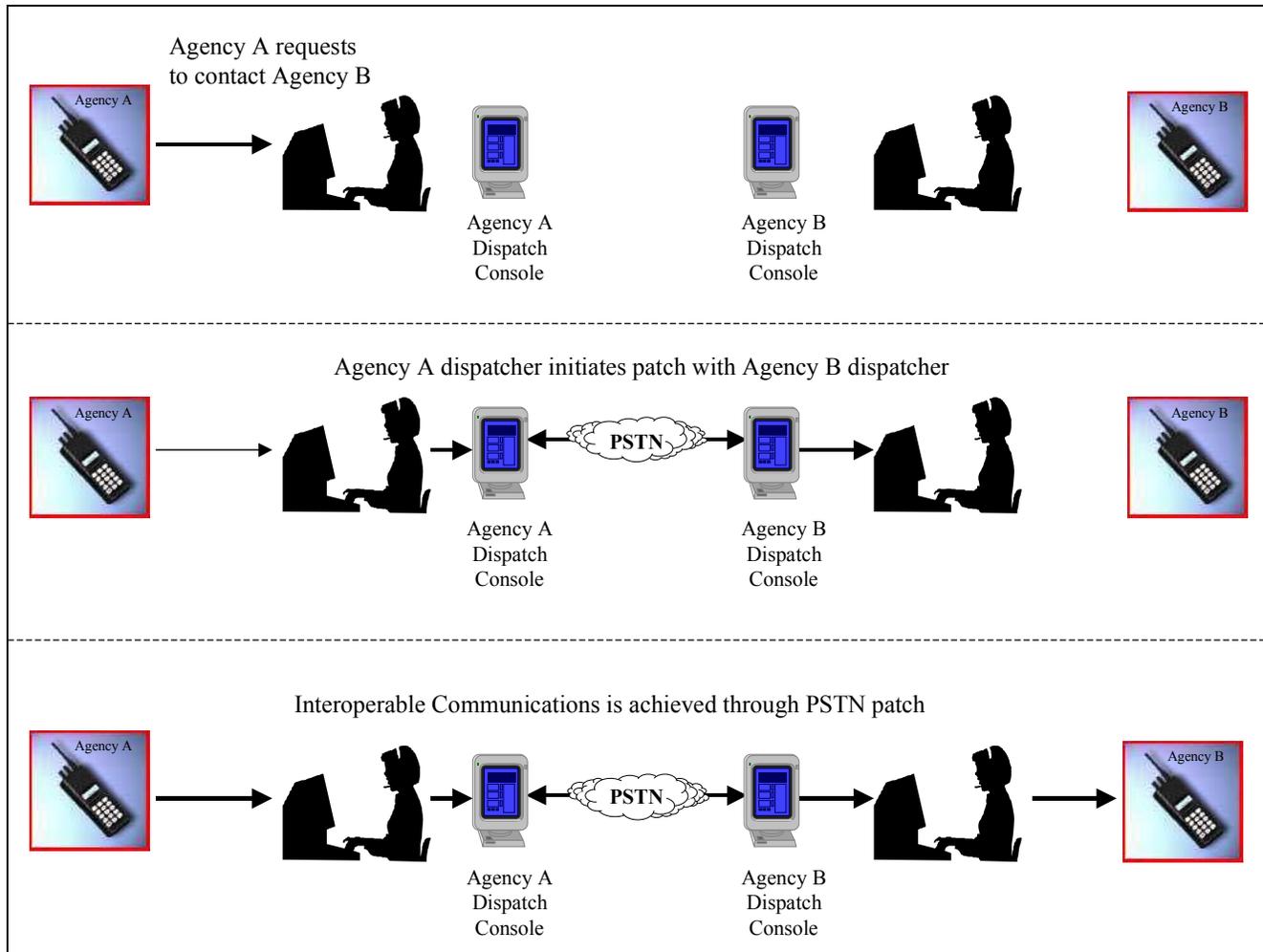
- The leased line is a dedicated 3002 analog telephone line or a DS-0 or T-1 digital line
- This method is most effective when each participating agency's console can directly interface a switch or other demarcation that can accommodate dedicated 2-wire, 4-wire, or a DS-0 or T-1 line
- Permanent connections usually require minimal dispatch intervention
- Dispatchers simply coordinate initiation and termination of communications through the permanent interconnection. They need not relay messages once connection is established

**AGENCIES ACHIEVE INTEROPERABILITY BY USING A DEDICATED MICROWAVE OR FIBER LINK WHEN THAT ALTERNATIVE IS MORE PRACTICAL THAN A LEASED LINE**

- Terrain obstructions or low population density (e.g., in rural areas) may make leased line costs prohibitive
- A microwave link if available for use can cross long distances and difficult terrain with minimal recurring costs
- Digital services (generally via metro fiber rings) may be available near a participating console center, allowing the systems to obtain these services more easily

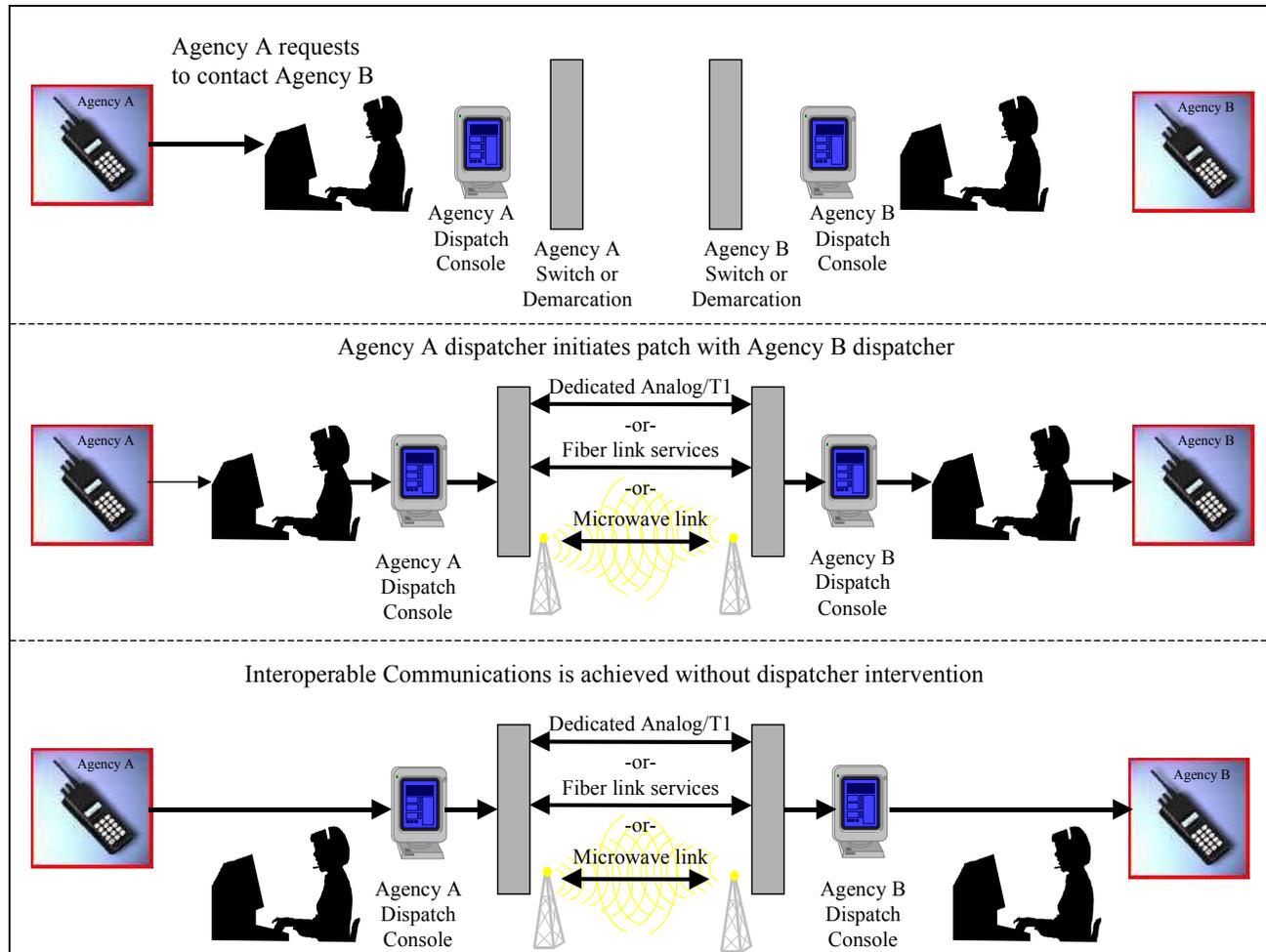
Console-Console Patch Solution...Conceptual Drawings...

**THE DRAWING BELOW ILLUSTRATES THE CONCEPT OF CONSOLE-CONSOLE PATCH USING THE PSTN**



Console-Console Patch Solution...Conceptual Drawings...

**THE DRAWING BELOW ILLUSTRATES THE CONCEPT OF CONSOLE-CONSOLE PATCH USING A DEDICATED LINE (ANALOG/T1, FIBER OR MICROWAVE)**



Console-Console Patch Solution...Appropriate Uses...

## **THE CONSOLE-CONSOLE PATCH IS A VIABLE SOLUTION WHEN THE PUBLIC SAFETY AGENCIES THAT NEED TO INTEROPERATE USE—**

- Different bands (for either conventional or trunked communications)
- Incompatible trunked protocols
- Otherwise incompatible systems, including—
  - Analog versus digital modulation
  - Wideband versus narrowband
  - Digital versus analog squelch codes
  - Incompatible digital modulation types and vocoders

Console-Console Patch Solution...Advantages...

**EACH CONSOLE-CONSOLE PATCH SOLUTION HAS SEVERAL ADVANTAGES**

Advantage	PSTN	Dedicated Leased Line	Microwave or Fiber Link
Ease of implementation	Usually very easy <sup>1</sup>	Usually fairly easy <sup>2</sup>	If available between switches or demarcations
No specific system required; participation open to any agency with a dispatch console	✓	✓	✓
No subscriber equipment requirements; no need to buy, trade, or reprogram radios	✓	✓	✓
No subscriber feature requirements: basic features adequate; no need to switch frequency bands or operating modes	✓	✓	✓
Fairly minimal costs	✓	✓	
Patch delays minimized because dispatcher intervention minimized (no need for dispatchers to relay messages)		✓	✓
PSTN cloud avoided, increasing security, reliability and availability		✓	✓
Patch initiation speed increased: patch not removed when interoperability no longer required		✓	✓

<sup>1</sup> Standard telephone line must be connected to each console.

<sup>2</sup> Dedicated line (standard telephone or T-1) must be connected to a switch or equivalent demarcation to pass circuit to console

Console-Console Patch Solution...Disadvantages...

**EACH CONSOLE-CONSOLE PATCH SOLUTION ALSO HAS SEVERAL DISADVANTAGES**

<b>Disadvantage</b>	<b>PSTN</b>	<b>Dedicated Leased Line</b>	<b>Microwave or Fiber Link</b>
Users must be trained to initiate patch with dispatcher and accommodate patch delays	✓ <sup>1</sup>	✓	✓
Dispatchers must be trained to use equipment, recognize dispatching cues from field agents, and initiate a patch with participating agencies	✓	✓	✓
Solutions differ in level of dispatcher involvement	Heavy <sup>2</sup>	Moderate <sup>3</sup>	Moderate <sup>3</sup>
Additional equipment may be required at console	✓ <sup>4</sup>	✓ <sup>4</sup>	✓ <sup>5</sup>
Patch must be removed when interoperability not required	✓		
Patch latency increases transmission time per message, possibly limiting radio system capacity temporarily during patch in "transmission trunked" systems	✓	✓	✓
Initial equipment investment may be heavy			✓
If desired, Federal Communications Commission (FCC) licenses for microwave bands may slow implementation, require legal support, and increase costs			✓ <sup>6</sup>

<sup>1</sup> Users must also learn to handle dispatcher relays of information.

<sup>2</sup> If the console has no direct PSTN connection, the dispatcher's verbal relays are vital and require complete attention. Otherwise, the dispatcher must still monitor the conversation.

<sup>3</sup> The dispatcher may be required to monitor the conversation.

<sup>4</sup> Equipment will be needed to set up the patch.

<sup>5</sup> Equipment will be needed to interface with microwave or fiber equipment.

<sup>6</sup> FCC-licensed microwave bands provide federal protection against interference. Unlicensed band equipment is less expensive but does not offer the same protection.

## **COSTS VARY, DEPENDING ON HOW THE CONSOLE-CONSOLE PATCH IS IMPLEMENTED**

- PSTN implementation costs are fairly minimal
  - They include the recurring telephone line charge, labor costs for a dispatcher at each console, and possibly equipment purchase for the PSTN interconnection
  - Dispatchers are usually already available, and the equipment requires minimal investment
- Dedicated leased line costs are fairly minimal
  - They include the recurring telephone line or T-1 charge, labor costs for a dispatcher at each console, and possibly equipment purchase for the PSTN interconnection
  - Dispatchers are usually already available, and the equipment requires minimal investment
- Initial costs for dedicated microwave or fiber link may be high
  - A microwave link (if not already available) requires heavy initial equipment investment, especially if FCC-licensed microwave bands are desired
  - Optical fiber equipment requires high initial investment, especially if the fiber path must be modified or augmented
  - Dispatching costs are fairly minimal because dispatchers are usually already available at each console

## **CONSOLE-CONSOLE PATCH SOLUTIONS GENERALLY REQUIRE NO ADDITIONAL SPECTRUM**

- These patches typically use previously licensed spectrum
- If FCC-licensed microwave bands are desired, however, they require additional spectrum

## **CONSOLE-CONSOLE PATCHES REQUIRE SIGNIFICANT MANAGEMENT BY THE PUBLIC SAFETY AGENCIES INVOLVED**

- Console-console patches require training, staffing, and communications system monitoring
  - Users and dispatchers must be trained
  - Dispatchers must be available at each end of the interconnection to establish and terminate connection
  - PSTN patches also require dispatcher involvement during the communications
  - Radio managers must monitor message transmission time and radio system capacity to ensure acceptability
  
- Console-console patches also require significant coordination
  - Interconnection capabilities of each agency's central dispatch console must be identified
  - Requirement for a temporary or permanent connection must be determined
  - Formal interoperability procedures should be developed to ensure that users follow established procedures

## **CONSOLE-CONSOLE PATCHES CAN AFFECT COMMUNICATIONS SYSTEM SECURITY**

- Using a PSTN patch can raise security issues
- Using a dedicated leased line or dedicated microwave or fiber link avoids the PSTN cloud, thereby increasing security
- Console-console patches do not raise standards issues; they circumvent incompatibility in systems and subscriber equipment

Console-Console Patch Solution...Implementations...

## **CONSOLE-CONSOLE PATCH HAS BEEN IMPLEMENTED IN LOCAL, STATE, AND FEDERAL PUBLIC SAFETY ENVIRONMENTS**

- Many public safety agencies across the United States achieve interoperability by using console-to-console patches
- The Public Safety Wireless Network (PSWN) Program has implemented this solution in South Florida and in the Salt Lake City region