



National WIC Association (NWA)  
2009 Technology Conference

Use of Wireless & Satellite Service for Data  
Transmission in WIC

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# Overview

- Present Texas WIC WAN
  - Satellite VSAT for Texas WIC
  - VSAT experience summary
- Challenges and Opportunities
  - Change and Growth
  - Unmet Needs
  - Build On Success
- Texas WIC Solution Strategy & Approach
  - Overview of Analysis Strategy and Procurement approach
  - The Winning WIC WAN Solution is ...
  - New technology opportunities
- Texas Expectations
  - Bandwidth
  - Latency
  - Reliability Advances
  - Management
  - New Capabilities

# Present WIC WAN

Texas WIC WAN is Satellite Very Small Aperture Terminals (VSAT) - since 2003 VSAT Satellite provides two-way connectivity for clinics

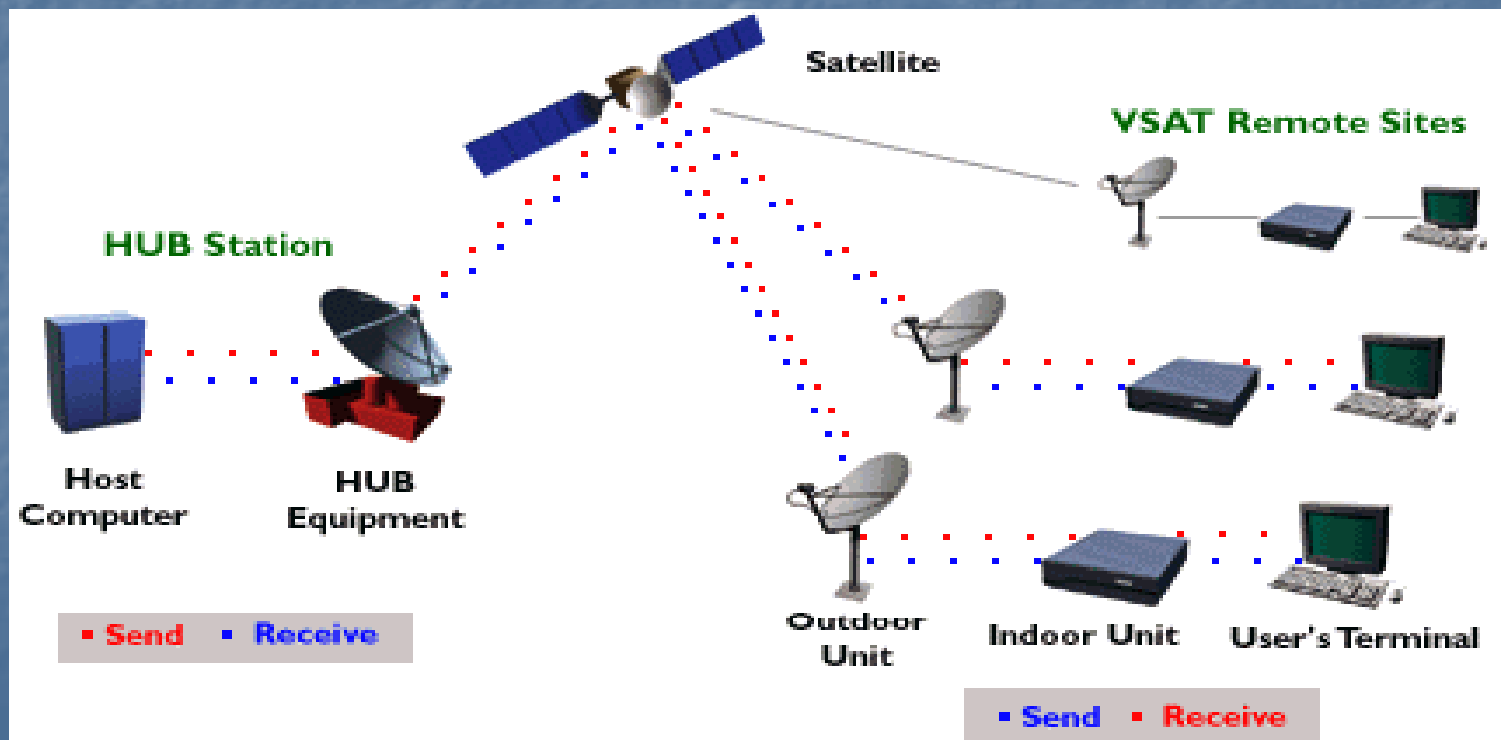
- Satellite VSATs cost-effectively replaced analog 56 Kbps modems for all fixed clinics;
- Mobile clinics (laptops) periodically connect via VSAT at a fixed site somewhere on their circuit;
  - Turn-key Satellite vendor managed, ubiquitous availability;
  - Total aggregate bandwidth is 2 Mbps down and ~ 1.3 Mbps up
  - Can scale, connectivity is 24x7, highly reliable (99.999 at hub and 99.95 overall), with SLA;
  - Latency (roundtrip delay) is relatively high i.e. 500 ms;
  - Includes a highly effective Interactive Distance Learning (IDL) broadcast studio in Austin and classrooms at hundreds of clinics;
  - Uses WAN Optimization i.e. Dedicated bandwidth for latency sensitive applications and shared bandwidth pool for others.

# Current WIC Applications

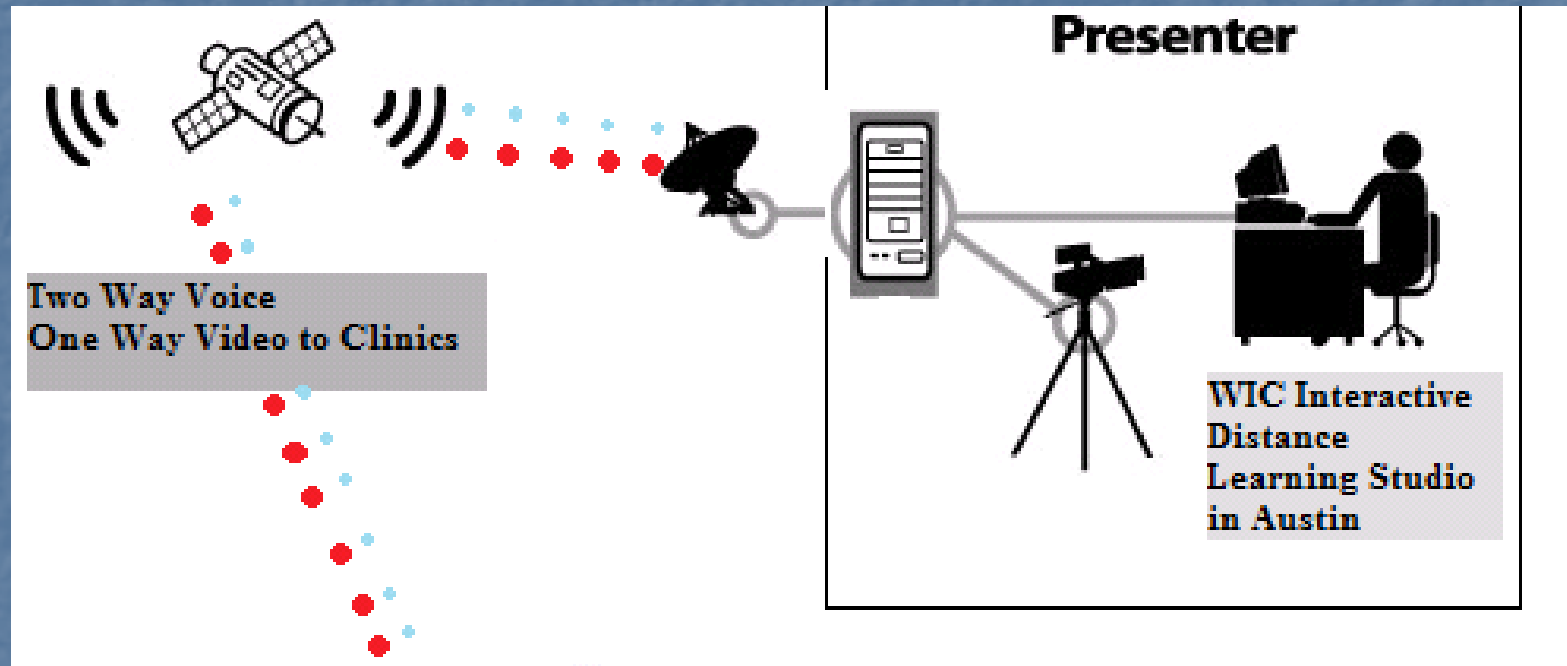
- **WIC participant data**
  - ftp WIC files
  - ftp tables
- **Helpdesk**
  - PC Anywhere
  - MS Terminal Services
- **Training** – Interactive Distance Learning (IDL)
  - Video
  - Voice
  - Documents
- **Patch, Security and Application Updates** i.e. Antivirus

# WIC Data over Satellite-VSAT

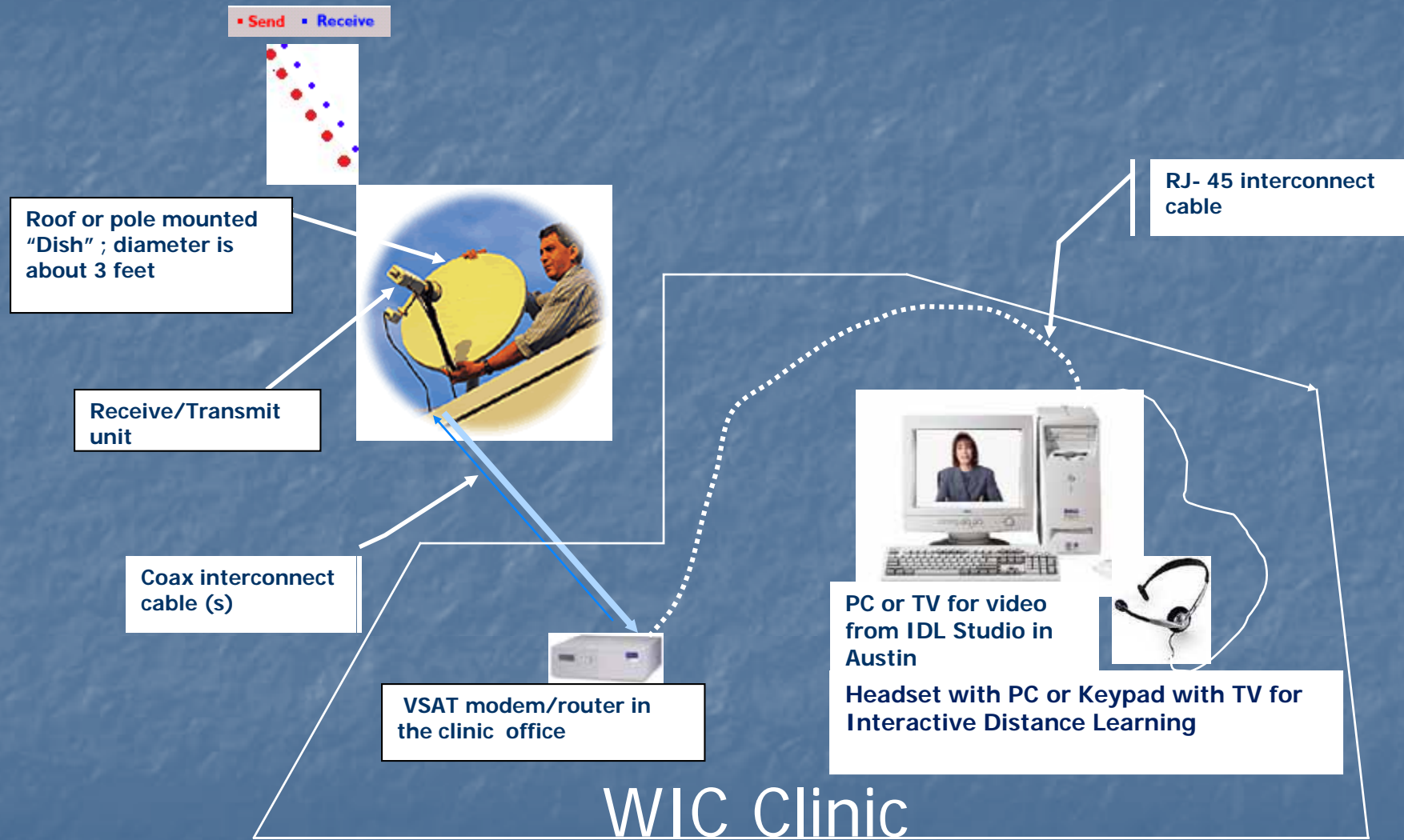
- Clinics = VSAT remote sites; 384 fixed and 110 Mobile (serving ~ 600 locations)
- Hub Station = Shared Hub Equipment in NE with T1(s) to Austin
- Host Computer = Austin WIC central host
- Satellite = "bent pipe" amplifier – 22,500 miles high over the equator



# IDL Broadcast Studio in Austin, TX



# WIC Interactive Distance Learning (IDL) over Satellite-VSAT

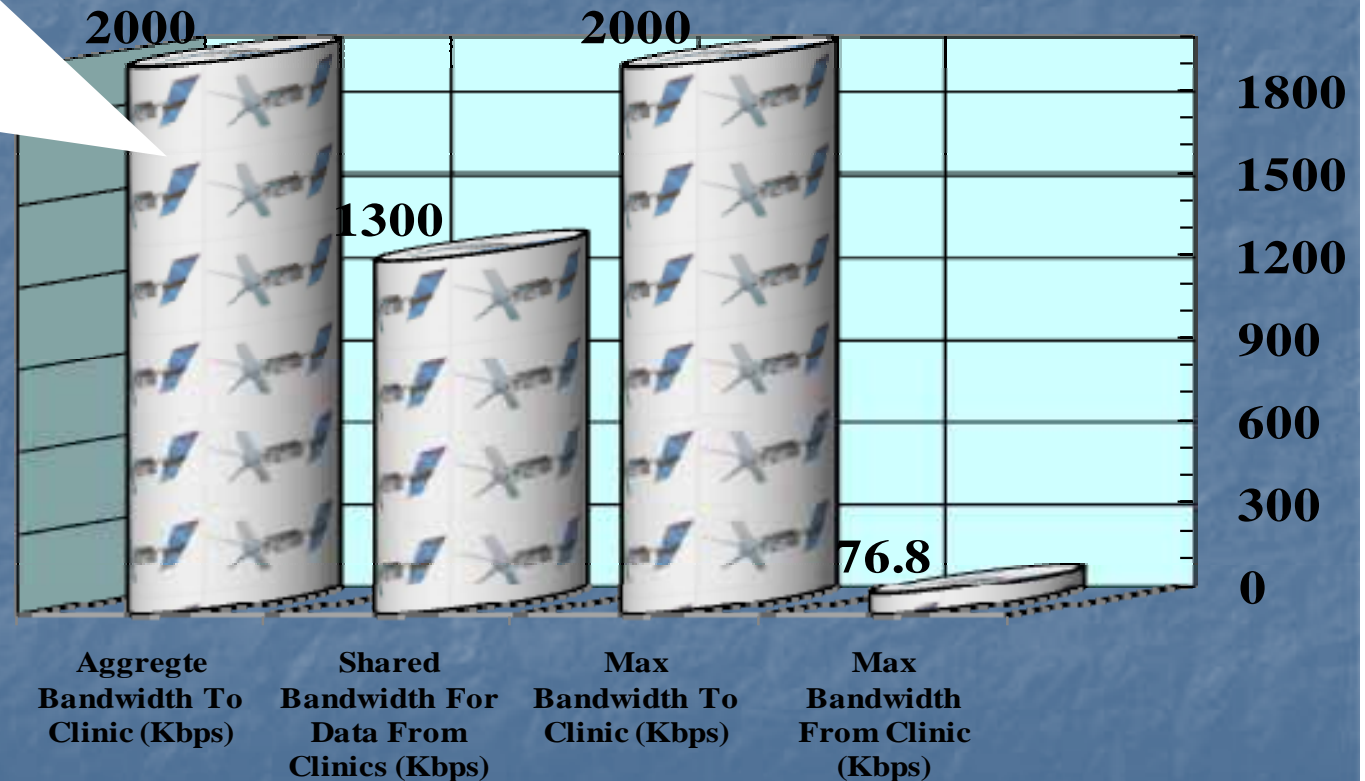


If only *one* clinic is sent data it gets the entire 2 Mbps bandwidth.

To send *every* clinic data, each clinic gets a time slice of the 2 Mbps bandwidth.

If the data is multicast (IDL video/voice) sent at 780 Kbps then all clinics that are IDL capable simultaneously get the same content @ 780 Kbps

# Clinic Bandwidth

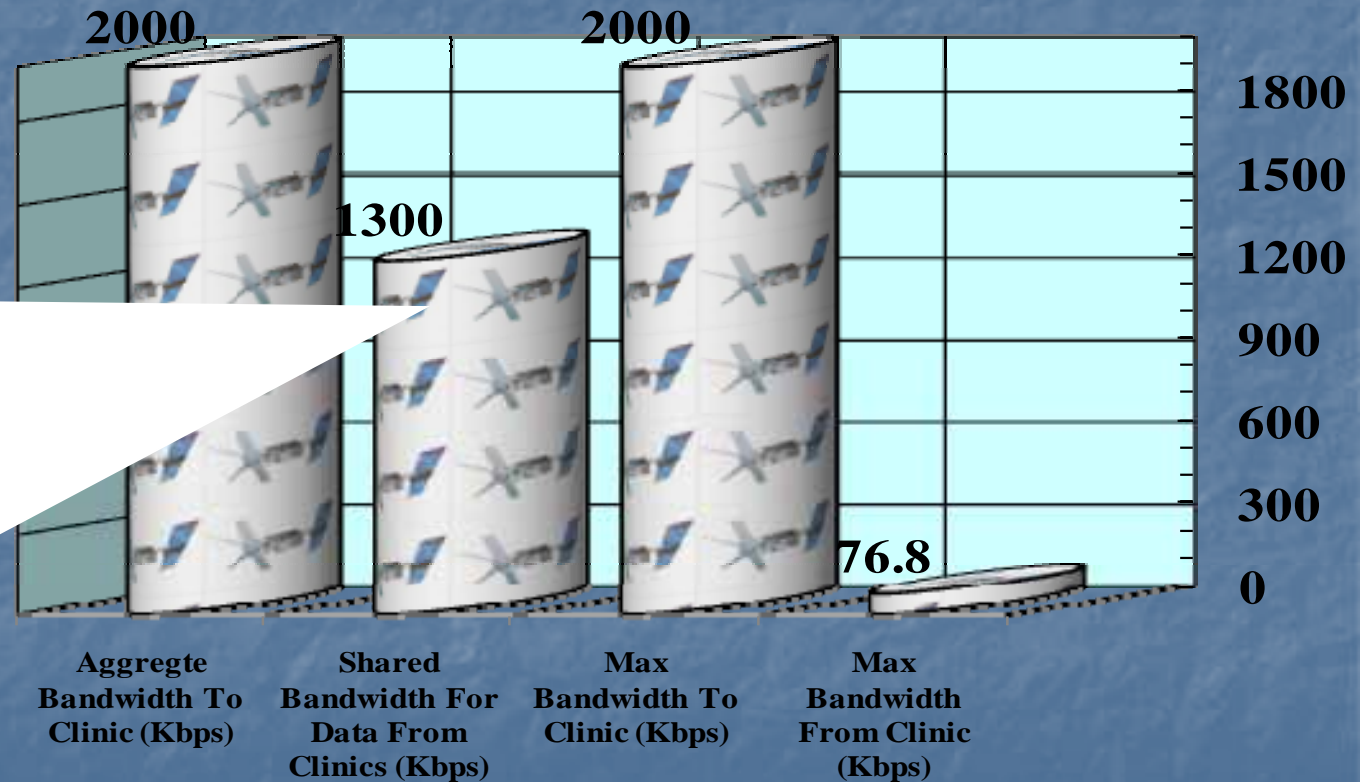


The total return bandwidth from the clinics is a shared pool of 1305 Kbps.

This pool is composed of 7 dedicated channels for latency sensitive applications i.e. PC Anywhere and a return IDL voice. These channels are on a 1<sup>st</sup> come basis and are ~95% efficient.

There are 10 non-dedicated channels for all other application data traffic from the clinics i.e. ftp and these channels are ~23% efficient.

# Clinic Bandwidth



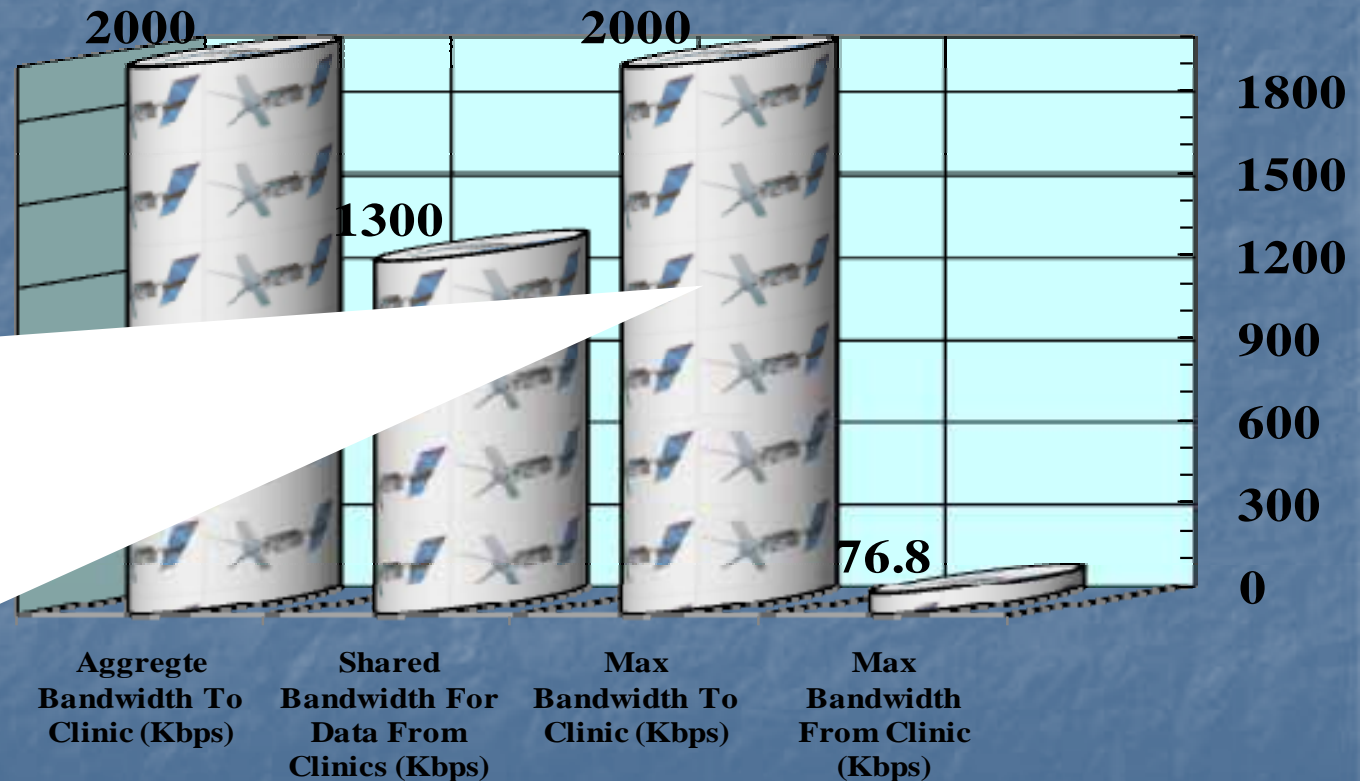
The Maximum bandwidth out of Austin data center and IDL studio is presently 2 Mbps.

The IDL during the work day takes 780 Kbps of bandwidth on the outbound to the clinics.

Take away ~200 Kbps for protocol and housekeeping overhead and that leaves 1020 for data applications and the helpdesk to use.

IDL does not need bandwidth at after hours or weekend so all 2 Mbps is available for data applications and helpdesk.

# Clinic Bandwidth

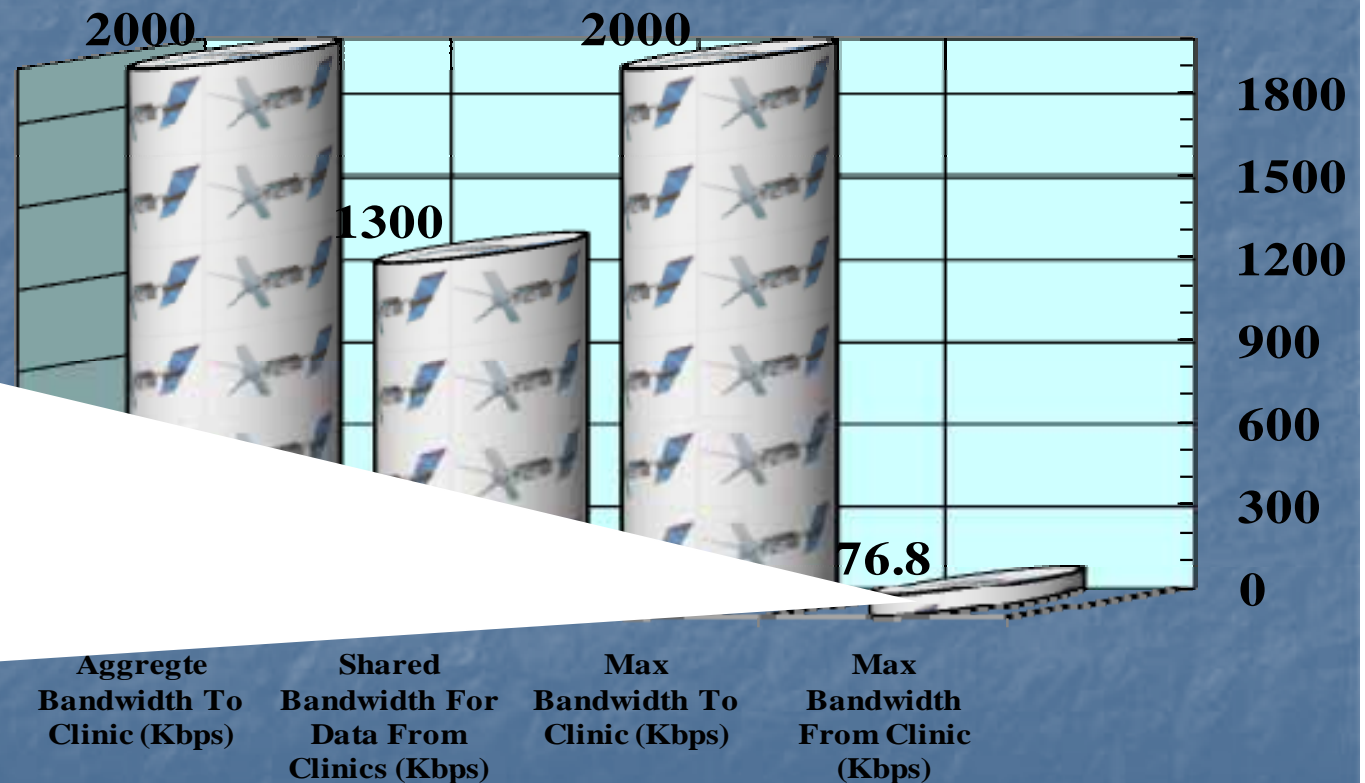


The Maximum bandwidth from a single clinic to Austin data center is 76.8 Kbps.

If the helpdesk is using PC Anywhere to this site then the site gets a dedicated channel that is almost 100% efficient and holds that dedicated channel until the session is completed.

If WIC data is transferring from the clinic a channel from the NON dedicated shared pool is used and other clinics are able to also get slices of this channel also.

# Clinic Bandwidth



# Satellite VSAT Experience Summary

- Turn-key Vendor managed Satellite VSAT WAN has been cost-effective for Texas;
- WAN is optimized and data flows more visibly, reliably, and more quickly than with analog telephone modems;
- IDL provides advanced training delivery with significant cost-avoidance;
- Helpdesk is able to use both PC Anywhere and MS Terminal Services;
- Network Management
  - Initially there was minimal WAN performance visibility available;
  - More Network Management capability added
    - for more granularity and visibility
    - via a non-VSAT add-on tool (SolarWinds with Cisco Netflow)
  - Benefits: can see and manage how much traffic flows into the WAN from Austin and proactively avoid contention, saturation, avoid business application impact;
  - Can trend and forecast for bandwidth/other WAN factors

WIC WAN  
Challenges  
and  
Opportunities

# Challenges and Opportunities

- Why Texas WIC needs more than Satellite VSAT -

- **Beneficial Change:** New applications coming;
- **Growth:** Participation, HW, OS and SW Patches, as well as security updates;
- **Existing needs unmet due to technology limitations:** Laptop mobile clinics serve multiple locations and need connectivity similar to fixed clinics;
- **Build on success:** Increase and improve Training and Helpdesk services delivered across the VSAT

## Change: New applications

- Will save big \$\$\$ i.e. WIN Evolution;
  - More applications will need more and better WAN
  - **Example:** .NET Web 2.0 SSL SQL over WAN;
  - More bandwidth and less latency than VSAT alone can feasibly provide;
- Network management applications
  - Have advanced considerably;
  - Able to provide application aware WAN management visibility and control;

# Growth: Participation is climbing

- Currently over 1 Million WIC participants in Texas;
- And growing – economics suggest further increase may not be small;
- **Grow that success** -- More participants and improved modernized applications with new WAN are coming
  - All need to operate in concert to decrease impact of growth on participants and associated support staff;
  - Ease-of-use, more responsive, less participant waiting, system and WIC staff more productive;
  - Network, Training, Helpdesk, all staff and participants are less stressed
  - The most meritorious Federally funded and State Managed System becomes even more meritorious! (as WAN becomes more capable to match and accommodate improvements elsewhere in the system)

## Existing unmet need:

- Success with laptop mobile clinics serve multiple locations
- Last mile technology limitations have previously hindered mobile clinic operational efficiency
- **Grow that success**
  - Remove WIC application and support impacts;
  - Provide connectivity similar to fixed clinics;
  - Provide benefits similar to those for fixed site computers that are always on the WAN.

## Build on success:

- **Helpdesk and Network Management**
  - Support across the WAN has improved overall performance and reliability;
- **Grow that success**
  - Updates and patches steadily increasing
  - Security/Antivirus applications control;
  - Remote admin and application service and support;
  - Needs more bandwidth, lower and consistent latency for interactive helpdesk applications;
  - As well as improved tools for increased more granular visibility and control.

## Build on success:

- **WIC Training** delivered across the WAN saves \$\$\$ with numerous improvements/benefits
  - Increases in quality, quantity and intangibles possible;
  - but needs lower latency WAN pathways and more bandwidth;
- **Grow that success**
  - Could benefit from a more advanced and flexible Learning Management System;
  - Increase stability, performance visibility;
  - Add On-demand training delivery capability (more bandwidth);

Texas WIC Solution

# Strategy & Approach

## Phase I

- Mike Montgomery (Texas WIC) commissioned a network/WAN analysis initiative that includes many of the former Satellite VSAT team participants;
- Maximized project, staff, technical and management involvement and focus;
- Job 1: Analyze performance of existing Satellite VSAT systems;
  - Capture granular performance data against current systems;
  - Turn data into information to trend and forecast WAN needs;
    - Against foreseen challenges and opportunities;
    - Peer review and staff discussion;
  - Get actionable information before decision makers;

# Strategy & Approach

## Phase II

- Refine and improve process per management direction;
- Leverage advances in technology;
- Leverage existing umbrella contracts (DIR and HHSC/DSHS/WIC)
- Avoid drowning in minute details that could hinder and constrain progress toward the best solutions
  - State the requirements generally but with enough specificity to get moving toward what is needed;
  - Allow some design creativity and interact with potential vendors about capabilities and expectations before releasing a SOW/RFO;
- Make the solution flexible and scalable;
- Leverage incentives quickly for both short (Quick WINS) and longer term;
  - Implement as much as possible toward WIN Evolution;
  - Quickly, in phases.

# Procurement Process

- Texas Legislature, **DIR, HHSC, and DSHS** are **partners** in WAN procurement technology initiatives
  - that provide cost and time saving technology **umbrella contracts**;
  - **Leveraging these** fully and able to negotiate/tailor if necessary;
- Our recent SOW and RFO requires the winning WAN vendor to provide
  - **All available last-mile options for each fixed clinic**;
  - A recommended last-mile option;
  - A required absolute minimum bandwidth for any offered last mile connectivity option of **512 Kbps down and 256 Kbps up**;
  - **Latency mitigating solutions**
    - **WAN Optimization** to mitigate latency (equivalent or better than Cisco WAAS);
    - **MPLS** as a customer option but in the design up front.
  - **Advanced Network Management System (ISO FCAPS or better) and Tools**;
  - Encouraged to bid a **Learning Management System (LMS)** and **two-way video conferencing** system.

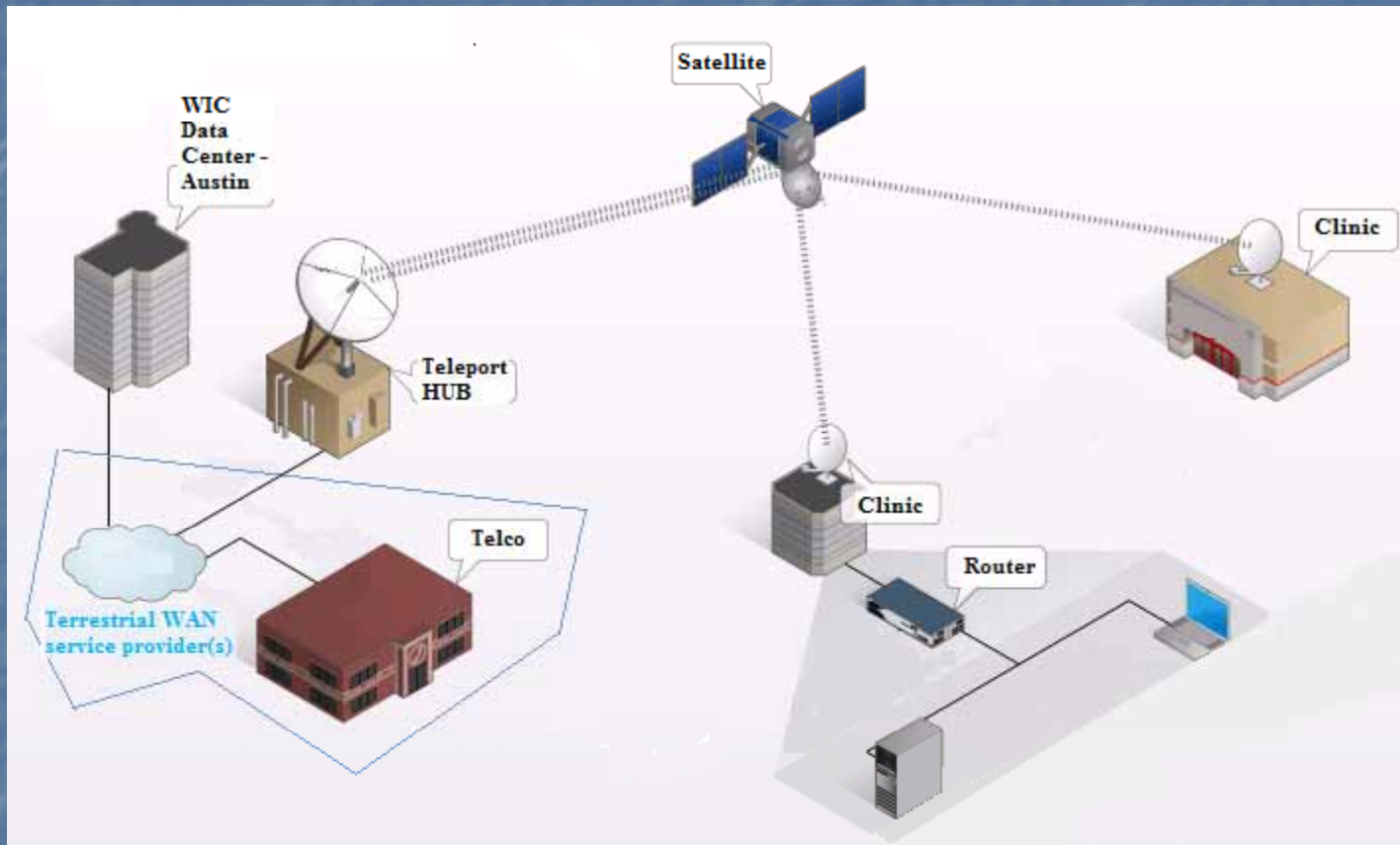
1. **ISO** = International Standards Organization

2. **FCAPS** = Fault, Configuration, Admin/Accounting, Performance, Security Management Framework

## And the winning solution is ...

- A **hybrid WAN** composed of a mix of
  - cellular wireless
  - Terrestrial (DSL, Cable, ...)
  - and Satellite VSAT technologies
- Along with **advanced WAN applications**
  - to garner overall operational suitability
  - with attractive ROI and TCO

# Satellite VSAT WAN Example

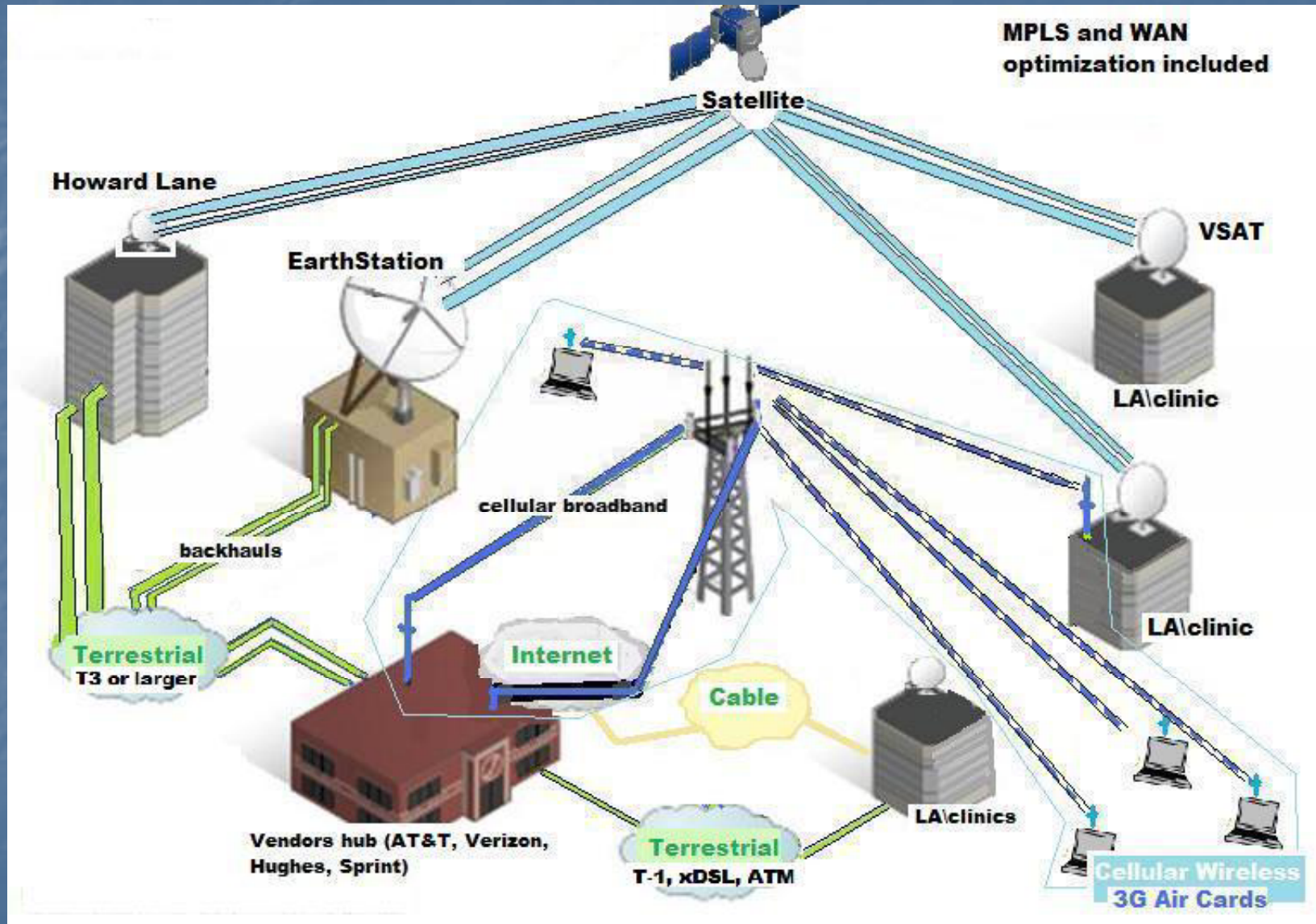


## Communications Technology

VSAT	Satellite networks send and receive data via high-frequency radio waves bounced off a satellite in orbit, providing a single continent-wide wireless last-mile solution. A Very Small Aperture Terminal (VSAT) is a device used for sending and receiving high-speed video, data and audio, via satellite.	<ul style="list-style-type: none"><li>• Independent of terrestrial infrastructure</li><li>• Up to 6 Mbps</li><li>• Designed for multicast and broadband</li><li>• Available virtually anywhere – one provider for broad coverage</li></ul>
DSL/Cable	DSL is a family of technologies that provide digital data transmission over the wires of a local telephone network. A cable modem is a type of modem that provides access to a data signal sent over the cable television infrastructure. Cable modems are primarily used to deliver broadband Internet access in the form of cable Internet, taking advantage of unused bandwidth on a cable television network.	<ul style="list-style-type: none"><li>• Uses existing last mile infrastructures (phone lines/cable)</li><li>• Up to 6 Mbps (Cable) and 3 Mbps (DSL)</li><li>• Designed specifically for broadband</li><li>• Increasing geographic availability – requires multiple providers for broad coverage</li></ul>
Fixed Wireless/ Ev-DO	Fixed Wireless services connect two fixed locations with a radio or other wireless link to enable data communications. The point-to-point signal transmissions occur through the air over a terrestrial microwave platform. EV-DO is a form of fixed wireless that provides high-speed digital data service through 3G cellular carriers that uses CDMA or GPRS technology.	<ul style="list-style-type: none"><li>• Common carrier technology</li><li>• Up to 1.5 Mbps</li><li>• Designed for broadband</li><li>• Available in most metropolitan U.S. cities</li></ul>
T-1/ Leased Line	A leased line is a symmetric telecommunications line connecting two locations. It is sometimes known as a 'Private Circuit' or 'Data Line', and can be used for telephone, data or Internet services. T-1 lines are a popular type of leased line option that provides a dedicated phone connection configured to carry voice or data traffic.	<ul style="list-style-type: none"><li>• Common carrier technology</li><li>• Up to 1.5 Mbps</li><li>• Designed for broadband</li><li>• Available in most locations – requires multiple providers for broad coverage</li></ul>

A single WAN-vendor-managed hybrid network solution will simplify the challenge of managing a complex network and keep critical business communications/applications online so WIC staff can focus on WIC business.

# Hybrid WAN example



# Why a Hybrid WAN makes sense for Texas WIC

- **Research, analysis, review, and discussion among all parties leads us to an advanced Hybrid solution**
  - A mix of wireless and terrestrial technologies;
  - WAN technology has advanced dramatically in the past five years;
- **Texas WIC WAN (WIN) can become hybrid in 2010**
  - Procure and implement newer advanced last mile and WAN technologies;
  - Continue to include the present Satellite VSAT WAN until 2013 (contract expires)
  - Newer terrestrial and wireless last-mile access capabilities will provide;
    - More individual clinic bandwidth (which is also a huge aggregate increase);
    - Less latency than Satellite VSAT;
    - More advanced WAN management and Helpdesk capabilities;
    - More advanced Learning Management System;
    - More reliability, more cost effective flexibility and greater ability to scale;
    - New collaboration applications.

# Target Technologies

- **Last mile access:**
  - Cellular 3G+ Air Cards are feasible for fixed and mobile clinics
  - DSL or cable are suitable for fixed clinics;
  - Satellite VSAT or T-1s where necessary;
  
- **WAN operational suitability**
  - WAN Optimization to mitigate latency for delay intolerant applications;
  - MPLS to assure consistency and priority for business critical applications;
  - SLA for each type of WAN technology;
  - Advanced Network Management System
    - For WAN and Network management visibility and control;
    - For trending and forecasting performance;
    - To proactively avoid impact to business critical applications.
  
- **Improved application service and support**
  - Learning Management System over WAN
  - Two-way video conferencing over WAN

# The Younger Other Type of Wireless

- Focus on our second type of wireless for data transfer
- Namely Cellular Wireless Air Cards
- Overview the differences between Satellite VSAT wireless and Cellular Wireless
- Today wireless networks operate at data speeds five to ten times greater than dial-up telephone or earlier wireless networks. New networks will offer even greater speeds, equivalent to DSL and beyond.
- These faster networks mean that Internet services formerly available only on desktop PCs are becoming available anywhere, in the palm of your hand, as a result of digital wireless technology.

# Quick look into Wireless 3G

(compared to present Satellite VSAT alone)

## Wireless cellular broadband – Air Cards:

- Adds tremendous bandwidth improvements
  - For laptops
  - And fixed locations i.e. 10 to 20X or more bandwidth than current WIC VSAT;

# How Cellular Sites Work

Whether it's handling simple phone calls or 12Mbps WiMax data, cell sites are organized with more or less the same flow:

1. An Air Card wireless modem radios the nearest towers, saying, basically, "I'm here!" (when you make an Air Card call and logon, your Air Card sends a message via radio wave that's picked up by the wireless antenna array.)
2. A wire or fiber optic line carries the call down to a wireless access point, connected to a multi-port switch/router in a small building at the base of the tower (base station).
3. The data call, along with many others, gets routed to a terrestrial backhaul, usually down to an underground wired T1 or T3 line, but sometimes back up the mast to a powerful line-of-sight wireless microwave antenna.
4. Out the backhaul to its destination, say a web server
5. Then the incoming data comes back to the cell site from the backhaul
6. and up through the switch to the antenna, propagates wirelessly through the air to your Air Card, presuming your Air Card is still communicating with the same site.
7. If you are moving, then there's a handoff—a new but more or less identical cell site transmits the data to your Air Card, once your Air Card checks in and says "I'm here."

All of this happens in about the blink of an eye.



Don't see a MW antenna so must be a landline backhaul



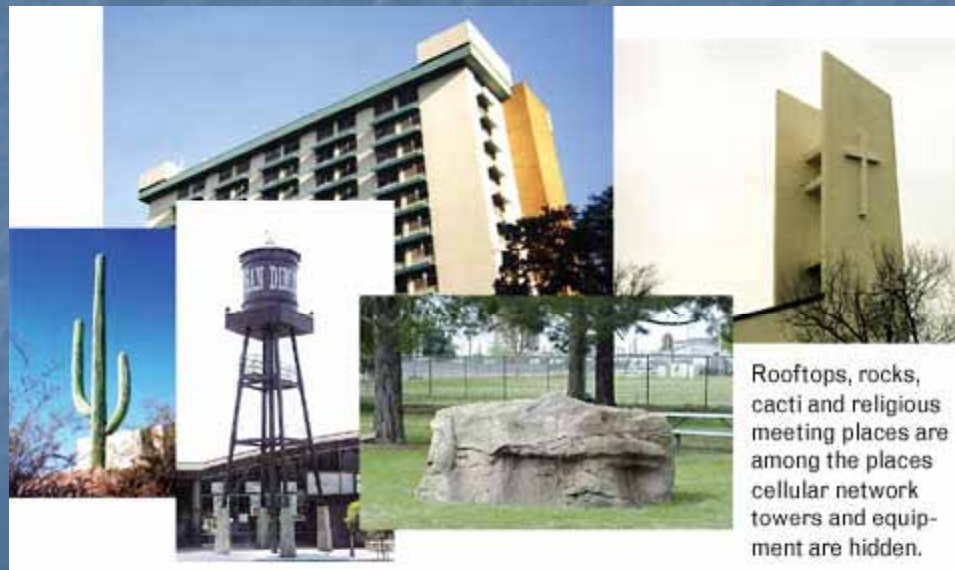
Microwave antenna backhaul

Two cellular and one Microwave tower



Microwave antennae galore

# Recognize these cell towers?

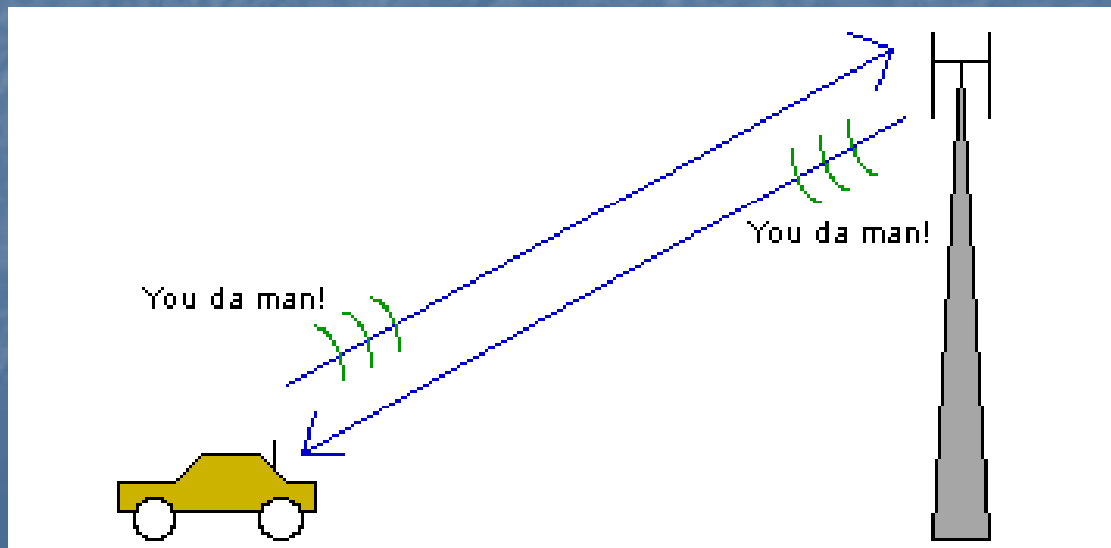


Rooftops, rocks, cacti and religious meeting places are among the places cellular network towers and equipment are hidden.



# Area Coverage and Frequencies

1. Each cell site has a base station with a computerized ~800 or ~1900 megahertz transceiver and an antenna.
2. This radio equipment provides **coverage for an area** that's usually **two to ten miles in radius**.
3. Even smaller cell sites cover tunnels, subways and specific roadways.
4. The area size depends on, among other things, topography, population, and traffic.



# Wireless Cellular Air Card Implementation Factors

- Theoretical access availability is provided initially, however actual availability by service level is determined by site visits;
  - Site visits are a potential cost multiplier during installation phase;
  - A given site might not qualify for *any* wireless, then out of scope or other last mile option;
  - May take multiple visits for install.
- Example: AT&T "LaptopConnect" = "DSL-type speeds";
- Antenna options available for 3G wireless;
- Last mile alternatives ready if needed i.e. xDSL, Cable, T-1, or VSAT options i.e. clinic re-location;

One reason for (improved) decreased latency across 3G wireless pathways (as compared to VSAT);

Typically 80 to 150 ms with controls applied;  
Which is less than 1/2 VSAT latency (delay) of 500 ms minimum

Typically 20 to 500 feet high



22,500 miles from earth's surface



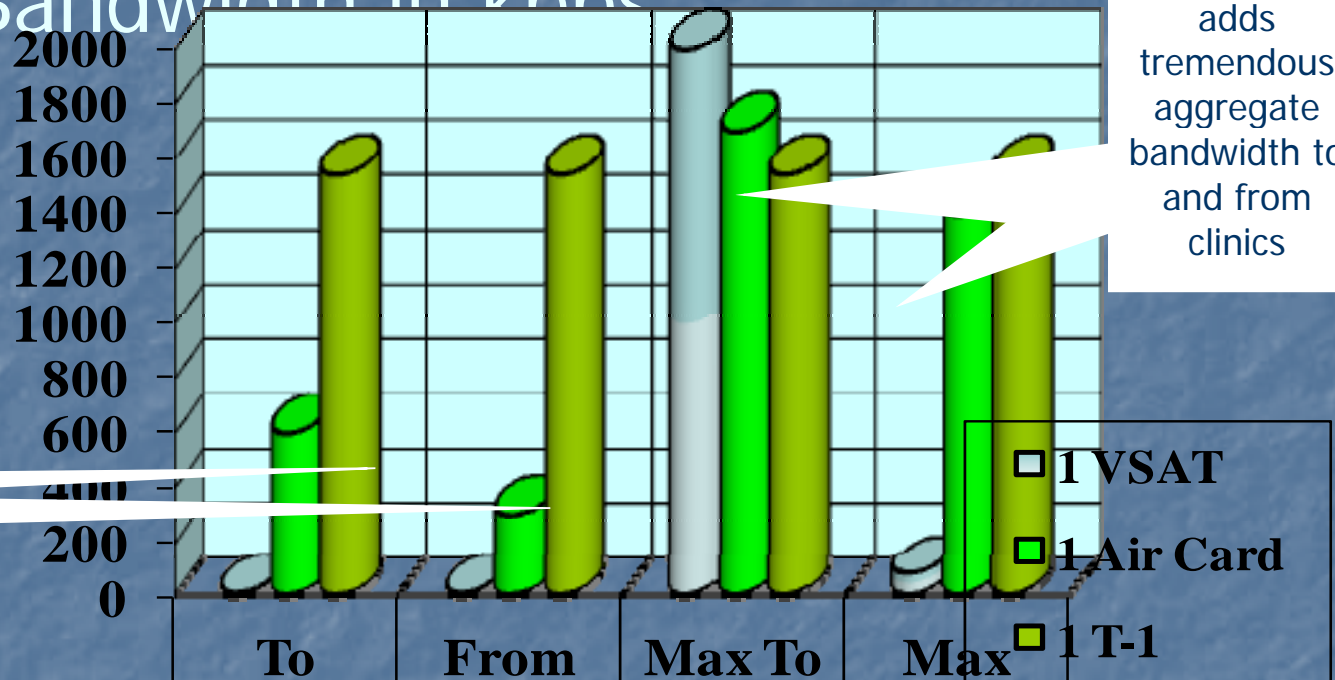
And the earth station  
a.k.a teleport/hub

QUALITY INDICATORS AND RELATED PERFORMANCE INDICATORS

<b>Quality indicator</b>	<b>Performance parameter</b>	<b>Acronym</b>	<b>Unit</b>	<b>Application</b>
Accessibility (A)	Connection success rate	CSR	-	Connect
	Connections set-up time	CT	second	
Speed (S)	Session throughput	ST	kb/s	FTP get/put
	Transmission throughput	TT	kb/s	
Reliability (RL)	FTP session success rate	SSR	-	
Responsiveness (RS)	Round trip delay	RTT	millisecond	PING

# Cellular 3G Air Cards

Bandwidth in kbps



	To Clinic	From clinic	Max To clinic	Max From clinic
1 VSAT	3.3	2.175	2000	76.8
1 Air Card	600	300	1700	1400
1 T-1	1544	1544	1544	1544

# Air Card Speed Broadband access

[Speedtest.net](http://Speedtest.net) test Rev-A NationalAccess – ping 90 – 95 ms

View Upload Speed

**DOWNLOAD SPEED**

MP3 File (5 MB)	1 min
Video Clip (35 MB)	7 min
Movie (800 MB)	158 min

Your Result

ISP Average

**SPEEDTEST.NET** 11/5/2009 2:56 AM GMT

**DOWNLOAD** 0.67 Mb/s

**UPLOAD** 0.50 Mb/s

PING 90ms

ISP: Cellco Partnership DBA  
★★★★★ 3.0/5

SERVER: Los Angeles, CA  
DISTANCE: < 50 mi

75.217.245.169  
Cellco Partnership DBA Veri

Rate Your ISP

Copy Forum Link Copy Direct Link

What is Speedtest.net?

View Upload Speed

**DOWNLOAD SPEED**

MP3 File (5 MB)	2 min
Video Clip (35 MB)	12 min
Movie (800 MB)	263 min

Your Result

ISP Average

**SPEEDTEST.NET** 11/5/2009 3:08 AM GMT

**DOWNLOAD** 0.41 Mb/s

**UPLOAD** 0.52 Mb/s

PING 95ms

ISP: Cellco Partnership DBA  
★★★★★ 3.0/5

SERVER: Los Angeles, CA  
DISTANCE: < 50 mi

75.217.245.169  
Cellco Partnership DBA Veri

View Upload Speed

**DOWNLOAD SPEED**

MP3 File (5 MB)	1 min
Video Clip (35 MB)	9 min
Movie (800 MB)	211 min

Your Result

ISP Average

**SPEEDTEST.NET** 11/5/2009 3:02 AM GMT

**DOWNLOAD** 0.51 Mb/s

**UPLOAD** 0.35 Mb/s

PING 95ms

ISP: Cellco Partnership DBA  
★★★★★ 3.0/5

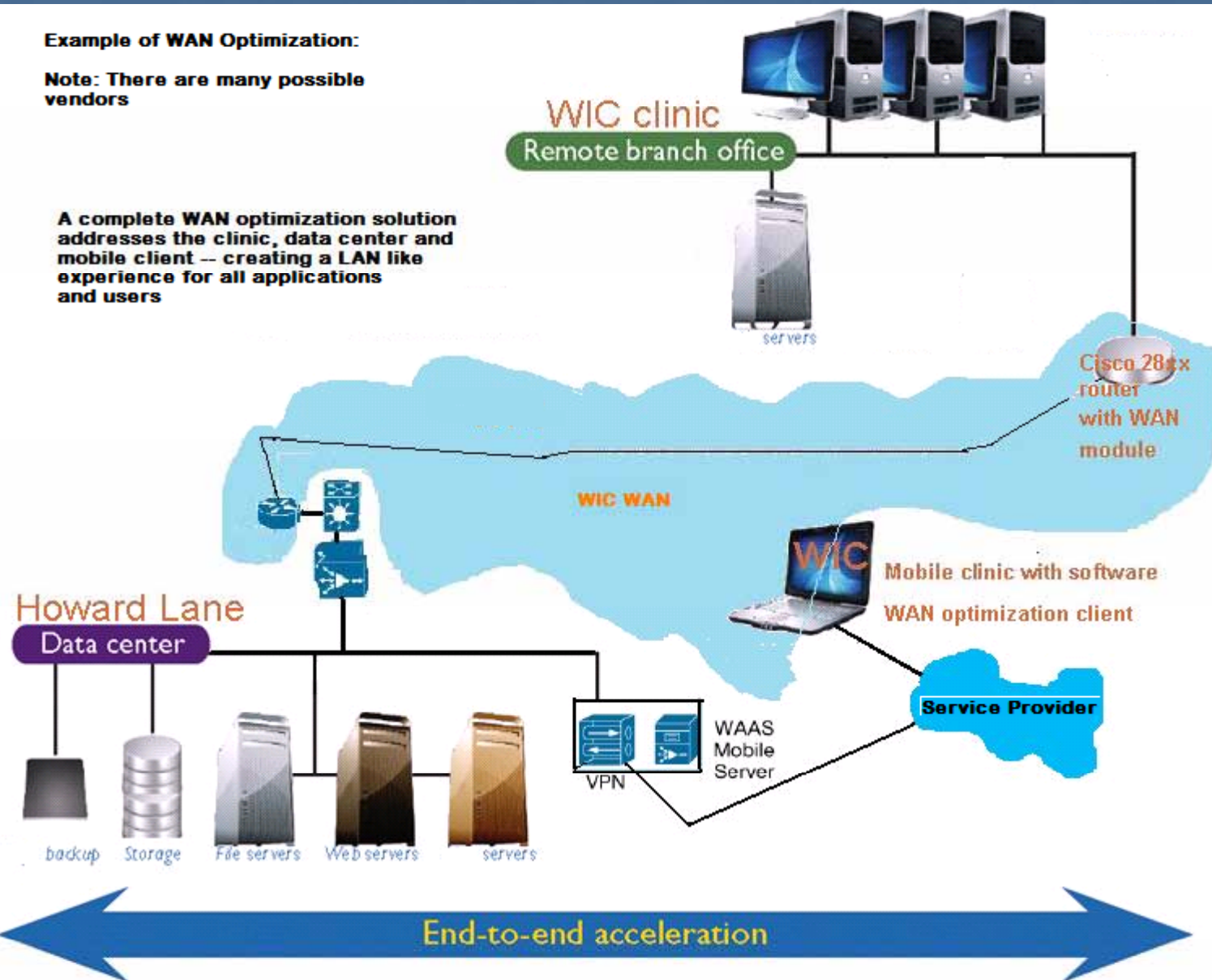
SERVER: Los Angeles, CA  
DISTANCE: < 50 mi

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**Example of WAN Optimization:**

**Note: There are many possible vendors**

**A complete WAN optimization solution addresses the clinic, data center and mobile client – creating a LAN like experience for all applications and users**



# Cellular Wireless Air Card Performance Factor Terminology

- Why the war: over coverage maps: the white spots (AT&T suing Verizon over)
- Levels of service –
- RSSI - Signal strength and attenuation i.e. -87 dBm
- RTT – delay/latency i.e. round trip ping time
- 3G Tower and antenna info
- Photos of cellular towers
- How 3G works

# Security

- Air Cards with WAN optimization software use a VPN *with SSL* for Mobile Laptop WAN connectivity and possibly some fixed sites;
- WAN optimization *hardware* provides encryption at rest and in flight;
- Integrate with present infrastructure security applications/hardware
  - Authentication via Cisco Secure ACS ;
  - Intrusion protection via Cisco 4270 IPS appliances;
  - Cisco ASA Firewall and VPN terminations;
- Consider reducing dependency on signature based only security i.e. Cisco Security Agent.
- Content and Internet blocking control via proxy server and applications like WebSense may be considered

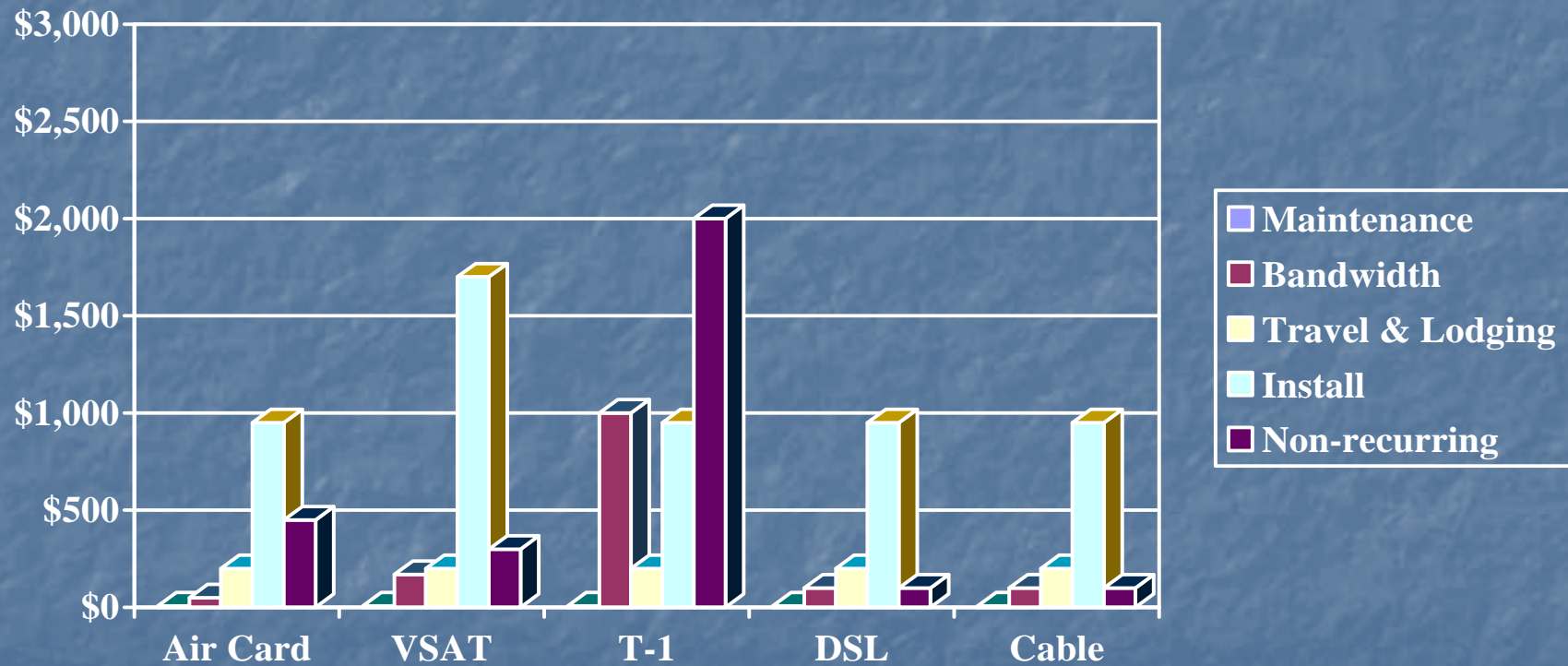
# Expectations

## Goals/Objectives

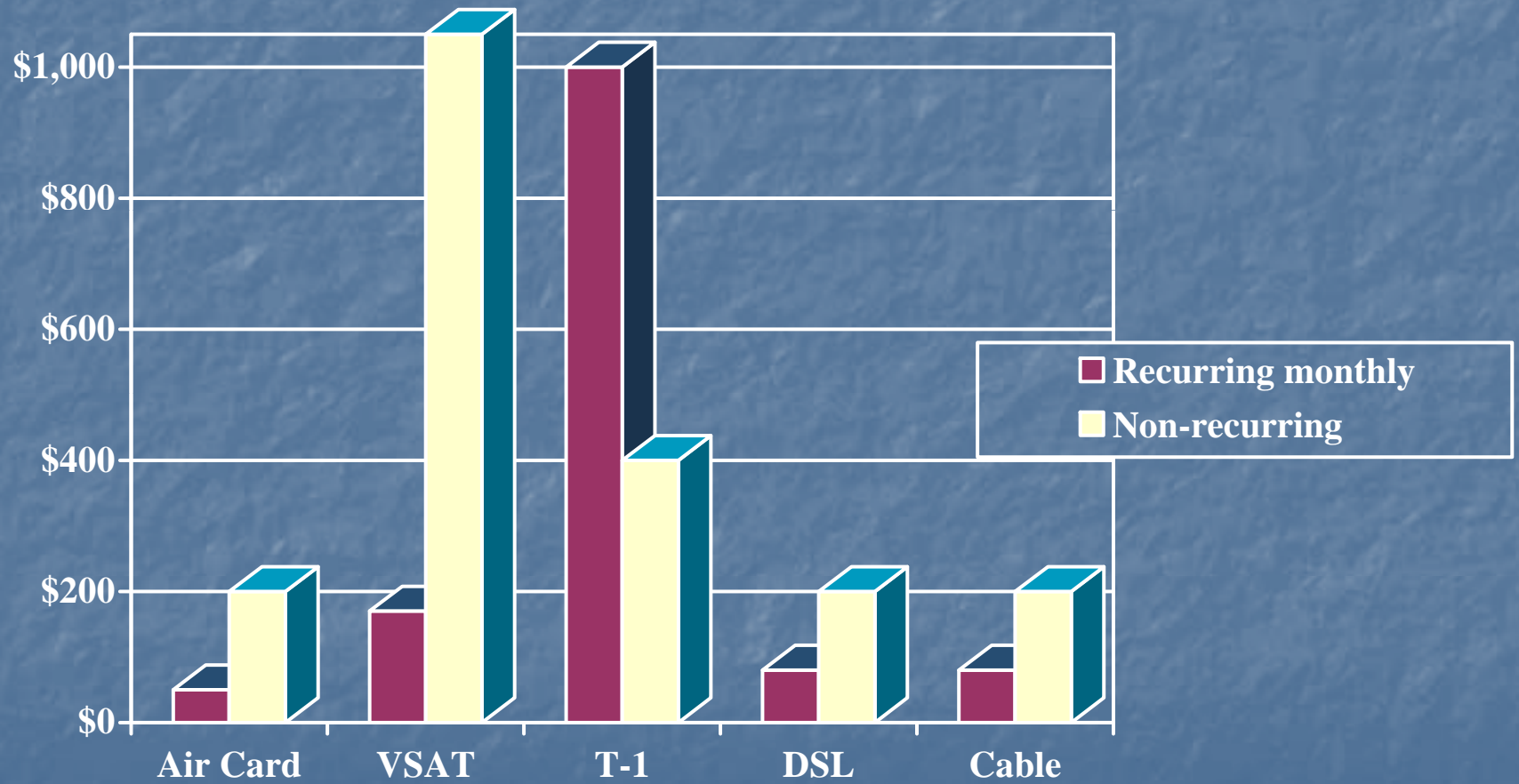
- Increase bandwidth dramatically **at reasonable cost**;
  - **Current VSAT bandwidth and latency is limiting** and relatively costly compared to present alternatives;
  - **More** WAN traffic: Applications are being added and centralized;
  - **More** manual processes being automated;
  - **More** traffic: Participation growing; Over 1 Million Texas WIC participants;
- Reduce latency/delay;
  - **Introducing delay sensitive applications that overall reduce complexity and cost** i.e. SQL/Web2.0/SSL to centralized database and higher quality interactive training;
  - **There is a way to make the WAN seem like a LAN to clinic staff and customers**;
- **Scalability** – able to flex and scale for > participant growth, > **near term** applications, > training, and **WIN Evolution**
  - Easily, timely;
  - Cost effectively;
  - Minimal impact on clinics and staff;
  - Facilitate clinic adds, moves and changes

# Pricing Approximations

# Price Comparison Approximations



## Overall TCO Approximations



# Summary 1

- If true Cellular Wireless Broadband 3G/3G+ is available at a location
  - Then it is likely feasible for fixed-site clinics as well as laptops;
  - and there are other viable options for many clinics;
  - All access availability (e.g. DSL, T-1, Cable) is being determined for clinic locations;
- Cellular Wireless Air Card bandwidth and availability
  - Are increasing in both metro *and* rural areas;
  - and especially in Texas;

# Summary 2

Analysis  
supports

- A hybrid WAN with a technology mix including:
  - For mobile clinics: Wireless (cellular) 3G/3G+ broadband;
  - For fixed clinics: Wireless (cellular) 3G/3G+ broadband where varying and/or moderate latency is not a problem;
  - WAN optimization and/or MPLS will broaden cellular broadband applicability;
  - Otherwise, a T-1, xDSL, Cable connection (where cost justified and available);
  - Satellite VSAT remains a wildcard ubiquitous availability option (and is especially suitable for Multicast applications);

# Summary 3

- Single WAN service provider management of WAN as a system;
- Include an advanced FCAPS Network Management System;
- An advanced Learning Management System is feasible;
- Two way video conferencing is feasible;
  
- Overall

Procure and implement the new Hybrid WIC WAN so  
that it seems like a LAN to staff and participants;  
Make it visible, manageable, and application aware;

# End of Presentation

Who knows what the future will bring

i.e. [PortaBella](#)

Announced Star date -312563.48601598165 (a.k.a. June 9<sup>th</sup>, 2010)

[TM] Combines Up to Four Cellular Data Cards into a Single High-Speed Shared Connection

SAN DIEGO -- Mushroom Networks, Inc., innovators of [Broadband Bonding \[TM\] technology](#), today announced the second generation of their wireless Broadband Bonding appliance called PortaBella. Targeting the [SMB](#) and enterprise markets along with verticals such as news-gathering agencies, mobile TV broadcasting, military, and emergency response, transportation, point-of-sale kiosk and digital signage connectivity - PortaBella combines up to four cellular data cards from multiple providers into a single high-speed shared connection. For example: ***utilize the full bandwidth of a Verizon, AT&T, Sprint and T-Mobile data cards (or any other carrier) fused together to access the Internet or stream video with low latency***

*with four times the speed of a single cellular air-card.*

visit <http://www.mushroomnetworks.com>

Definitely the  
End of presentation  
- supporting info follows -

# Summary

- Example new application: Video and voice are just another type of data to the WAN;
- Training delivery technology can be grown into an advanced Learning Management System (LMS) so it is able to
  - Operate gracefully with latency variations and lower bandwidth pathways;
  - Even while delivering video and voice based live training;
  - Basically able to deliver effective interactive training via virtually any last-mile choice;
  - On-demand training delivery becomes possible due to the larger bandwidth achieved;
  - Fixed or mobile laptops able to participate;
  - Add better performance monitoring and LMS management tools;
  - An LMS equivalent to or better than Learn.net/com capability;
  - Pilot at first opportunity in parallel with current IDL system;
- Big benefits of newer last mile and WAN technologies:
  - Tremendous boost in individual site bandwidth over current system -- rivals T-1s for a fraction of the cost;
  - Provided bandwidth is not undersized, latency can be reduced to less than half of Satellite VSAT
  - And is controllable for consistency;
- Futures: a hybrid solution is likely to get better each year as several of the technologies have a frequent refresh cycle

# Summary

## ■ Last Mile Access by Application

- T-1, non-shared DSL or true 3G Cellular Air Cards for the sites that will have an **IDL classroom** (best latency);
- DSL, true 3G+ Air Cards, Cable, or VSAT to **fixed sites that don't have heavy IDL or requirements**;
- 3G /3G+ cellular Air cards for **all laptops**;

## ■ Latency mitigation:

- WAN optimization to all fixed sites and mobile laptops using
  - Appliances/router modules for fixed clinics
  - Software client for laptops;
- MPLS with several Classes of Service that put WIC business critical applications into the best available WAN pathways;

# Expectations

- Technical Functionality
- Leverages Texas DIR/HHSC umbrella contracts
  - Meets minimum functions i.e.
    - Increase bandwidth across the WAN including local access to an amount that will provide enough capacity for current traffic, even during peaks;
    - Provide a capability to scale bandwidth to meet anticipated future capacity cost effectively and in a timely manner;
    - Improve Application Performance Across The WAN for business critical applications i.e. SQL, .NET, Web, centralized database.
    - A one service provider turn-key fully managed WAN solution;
    - Reliability, consistency, SLA (s) specified
    - Secure
  - Several major Telecomm vendors are able to do this well

# Technical Functionality

- **Increase bandwidth across the WAN including local access to an amount that will provide enough capacity for current traffic, even during peaks;**
  - AT&T, Verizon, Calence, and Quest have bid and one or more (e.g. subcontracting possibility) will negotiate and win;
  - Will implement a hybrid mesh WAN to include:
    - Some optimal number of Cellular wireless 3G+ Air Cards;
    - xDSL/Cable Modems;
    - T-1s;
    - Existing VSATs there until 2013 for backup and IDL
  - Minimum bandwidth per node is to be 512Kbps/256Kbps;

# Technical Functionality

- **Scalability: Provide a capability to grow bandwidth to meet anticipated future capacity cost effectively and in a timely manner;**
- Air Cards, xDSL, Cable, VSATs, and T-1s will scale;
  - Minimum bandwidth per node is to be 512Kbps/256Kbps;
  - Initial bandwidth per node will be more than tripled;
  - Aggregate bandwidth hundreds of times greater than current.
  - Still room to grow and scale.

# Technical Functionality

- **Accommodate and Improve Application Performance Across The WAN for business critical applications i.e. IDL, SQL, .NET, Web, centralized database.**
  - Latency is addressed by MPLS and WAN optimization technologies;
  - Latency cut to 1/3 of VSAT or less and is consistent;
  - User experience: WAN seems LAN-like to LA and clinic staff;

# Technical Functionality

- **A one vendor (service provider) turn-key fully managed solution;**
- Winning vendor manages the hybrid WAN end-to-end;
- Advanced network management system
  - Provides system visibility for vendor management and for WIC network management;
  - Information is granular and FCAPS and TMN;
  - Reports, alerts, resolution typically before clinic staff notice a problem.

# Technical Functionality

- **Reliability, consistency, SLA (s) specified**
  - Overall network design must accommodate moves and scale;
  - SLAs are specified per last mile access technology and for overall system;
  - WAN/Network Management systems provide timely granular information to vendor and WIC Network staff;
  - Technology update and refresh are frequent and tested in a WIC lab prior to implementation;
  - Vendors work proactively with WIC staff.

## Summary

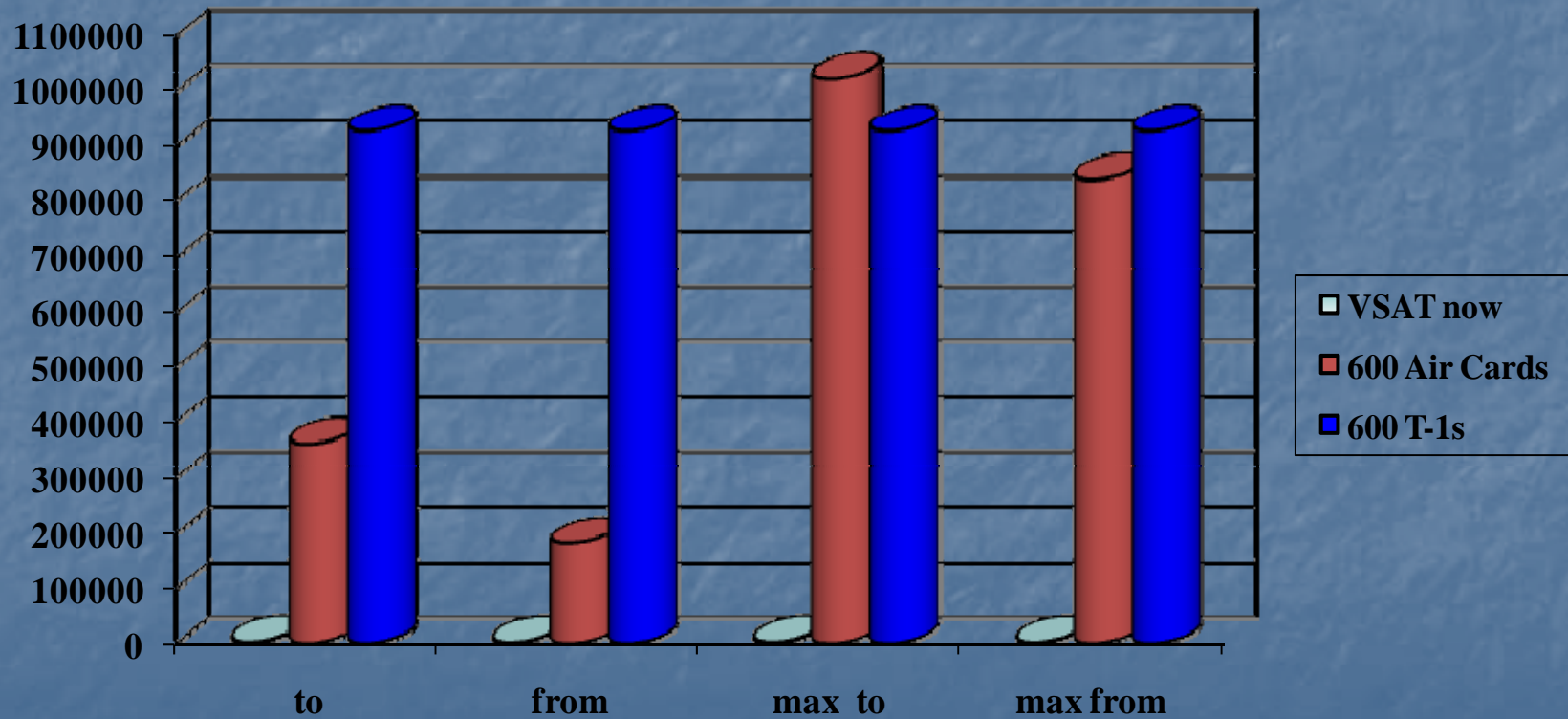
- With better WAN latency factors and increased bandwidth growing some applications promise to reap rapid ROI and TCO
- Big benefits of newer last mile and WAN technologies:
  - Tremendous boost in individual site bandwidth over current system -- rivals T-1s for a fraction of the cost;
  - Provided bandwidth is not undersized, latency can be reduced to less than half of Satellite VSAT and controlled for consistency;
- Futures: Such a hybrid solution is likely to get better each year.

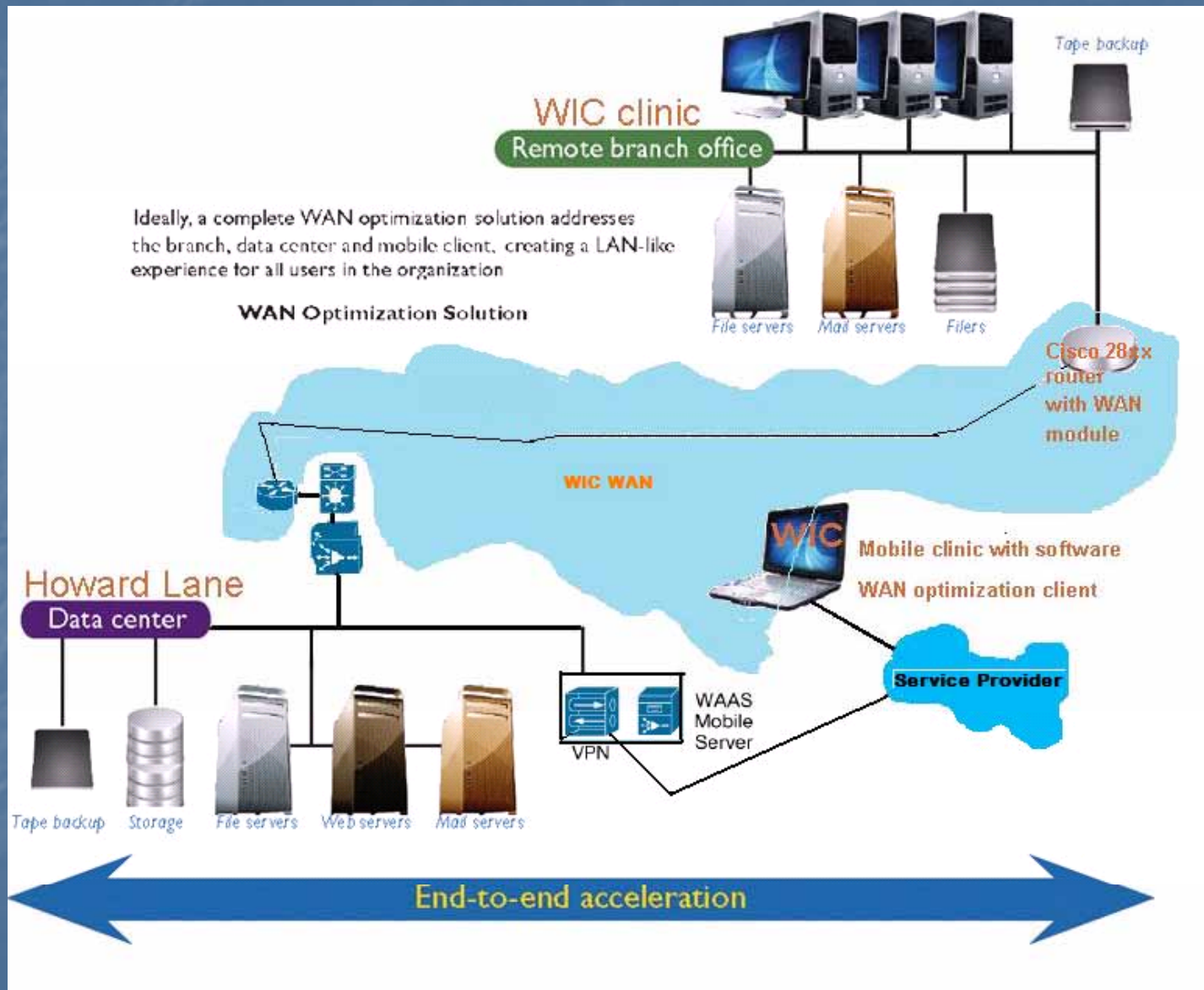
# Contrast Technologies

- Satellite VSAT WAN has:
  - Pros - inherent Multicast, ubiquitous availability, are highly reliable, and are optimized;
  - Cons – relatively high latency and VSATs are for rooftops or pole mounts not for laptops;
  - Moves
  - are relatively expensive i.e. installation costs.
- **However**, more recently other last mile technologies offer:
  - Far less latency/delay;
  - Huge bandwidth increases at reasonable pricing;
  - Air Cards for laptop connects;
  - WAN optimization and/or MPLS are able to make the Terrestrial or Air Card WAN technologies seem like a LAN to end users and network staff;

~ 600 locations

## Aggregate Bandwidth if all of one type of access technology







**Hans Leutenegger**  
SEARUC Annual Convention  
Telecommunications/Broadband

**Verizon 4G-LTE Overview**  
June 23, 2009





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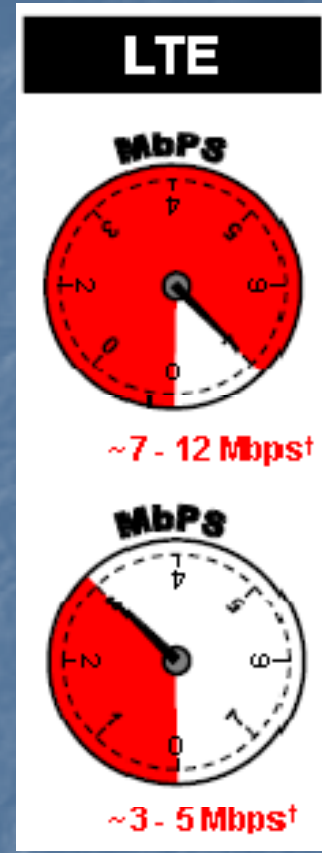
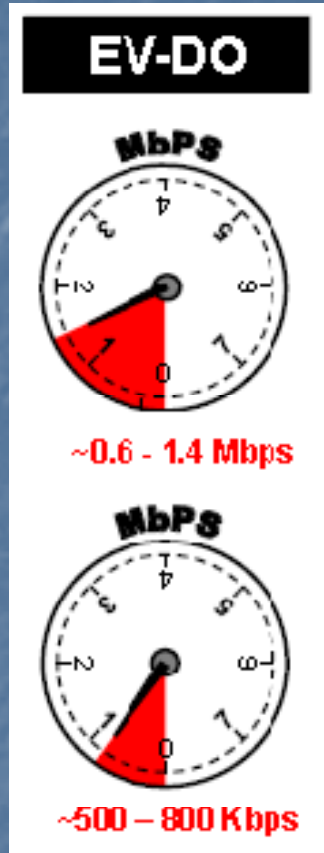


**Hans Leutenegger**  
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# Long Term Evolution (LTE)



†based on preliminary analysis

# Cellular 3G and WLAN

both established themselves as separate wireless technologies:

- WLAN has low mobility, high throughput; while
- cellular 3G has high mobility but lower throughput.

# Speed

Depending on the coverage of the area you're in,

- you may automatically be shifted from 3G/HSDPA to 3G, Edge, or GPRS.
- While this ensures seamless coverage, it means that your Internet speeds will slow down a little.

# Voice vs. Data and 3G

- You cannot make/receive cellular (voice) calls with a 3G Data Card, although it does have a sim card & cellular number like an ordinary cellular phone.
- Although you can make/receive VoIP calls from the Laptop or PC that the 3G Data Card is in.

# Speed

- A 3G network provides for download speeds of 14.4 megabits per second and upload speeds of 5.8 megabits per second. The minimum speed for a stationary user is 2 megabits per second. A user in a moving vehicle can expect 348 kilobits per second.

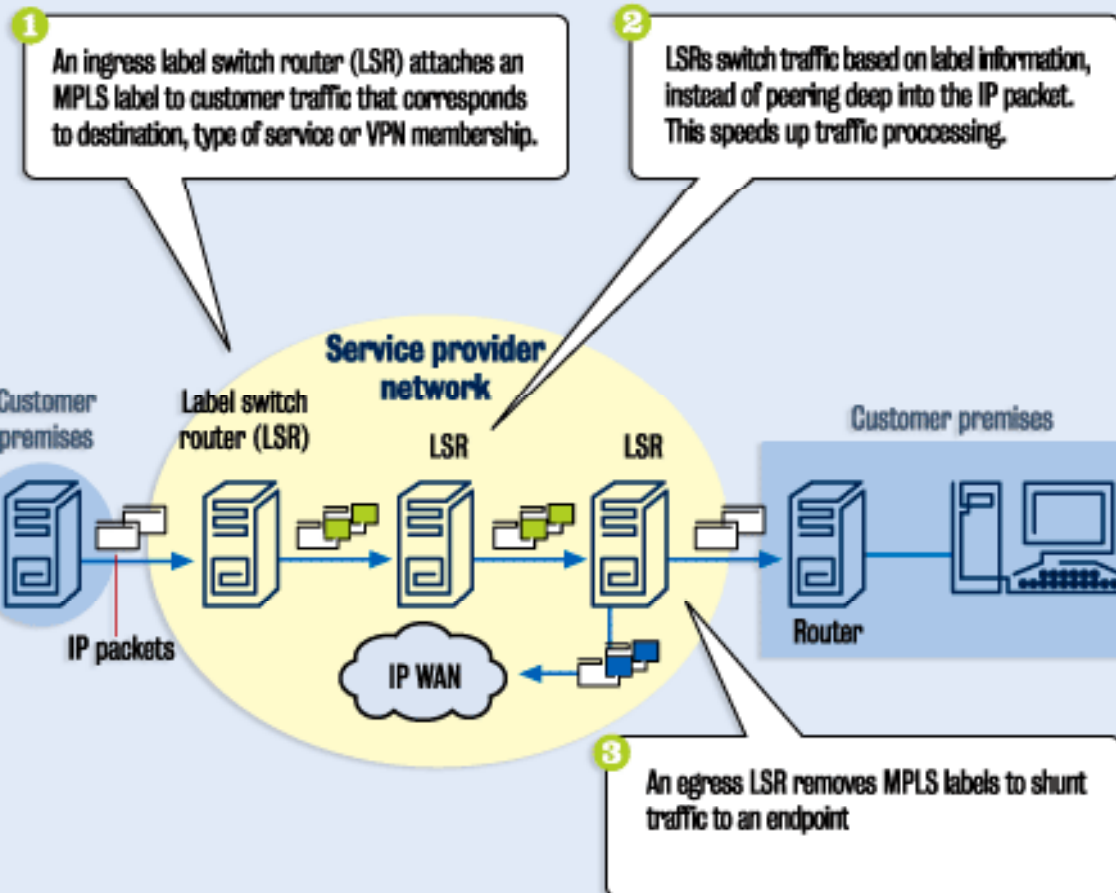
# 3G security

- Security concerns over 3G networks have been primarily mitigated. The system uses the KASUMI block crypto encryption rather than the older A5/1 stream cipher on the 2G network. While a number of weaknesses have been identified, the system is overall secure.

# Multi-Protocol Label Switching

## MPLS at work

How Multi-Protocol Label Switching keeps the WAN traffic flowing.



# Bandwidth

- Bandwidth represents the capacity of the connection. The greater the capacity, the more likely that greater performance will follow, though overall performance also depends on other factors, such as latency.

# Latency

- Satellite Internet connections, average 500 ms or higher latency;
- DSL or cable Internet connections, latencies of less than 100 milliseconds (ms) are typical and less than 25 ms desired
- Cellular Wireless connections have latencies in the 90 to 150 ms range typically;
- Besides propagation delays, latency also may also involve transmission delays (properties of the physical medium) and processing delays (such as passing through proxy servers or making network *hops* on the Internet).
- Excessive latency creates bottlenecks that prevent data from filling the network pipe, thus decreasing effective bandwidth.

# Air Card Speed Broadband access

[Speedtest.net](http://Speedtest.net) test Rev-A NationalAccess – ping 90 – 95 ms

View Upload Speed

**DOWNLOAD SPEED**

MP3 File (5 MB)	1 min
Video Clip (35 MB)	7 min
Movie (800 MB)	158 min

Your Result

ISP Average

**SPEEDTEST.NET** 11/5/2009 2:56 AM GMT

**DOWNLOAD** 0.67 Mb/s

**UPLOAD** 0.50 Mb/s

PING 90ms

ISP: Cellco Partnership DBA  
★★★★★ 3.0/5

SERVER: Los Angeles, CA  
DISTANCE: < 50 mi

75.217.245.169  
Cellco Partnership DBA Veri

Rate Your ISP

Copy Forum Link Copy Direct Link

What is Speedtest.net?

View Upload Speed

**DOWNLOAD SPEED**

MP3 File (5 MB)	2 min
Video Clip (35 MB)	12 min
Movie (800 MB)	263 min

Your Result

ISP Average

**SPEEDTEST.NET** 11/5/2009 3:08 AM GMT

**DOWNLOAD** 0.41 Mb/s

**UPLOAD** 0.52 Mb/s

PING 95ms

ISP: Cellco Partnership DBA  
★★★★★ 3.0/5

SERVER: Los Angeles, CA  
DISTANCE: < 50 mi

75.217.245.169  
Cellco Partnership DBA Veri

View Upload Speed

**DOWNLOAD SPEED**

MP3 File (5 MB)	1 min
Video Clip (35 MB)	9 min
Movie (800 MB)	211 min

Your Result

ISP Average

**SPEEDTEST.NET** 11/5/2009 3:02 AM GMT

**DOWNLOAD** 0.51 Mb/s

**UPLOAD** 0.35 Mb/s

PING 95ms

ISP: Cellco Partnership DBA  
★★★★★ 3.0/5

SERVER: Los Angeles, CA  
DISTANCE: < 50 mi

75.217.245.169  
Cellco Partnership DBA Veri

# QoS

- refers to measuring and maintaining consistent performance on a network by managing both bandwidth and latency in a coordinated fashion

# Speed Test Sites

- [Speedtest.net Internet Speed Test](#)
- [AuditMyPC.com Internet Speed Test](#)
- [CNET Bandwidth Meter Speed Test](#)

## Coverage Legend Terms

**BEST:** In general, the areas shown in dark orange should have the strongest signal strength and be sufficient for most in-building coverage. However, in-building coverage can and will be adversely affected by the thickness/construction type of walls, or your location in the building (i.e., in the basement, in the middle of the building with multiple walls, etc.)

This AT&T owned network provides GSM, GPRS, and EDGE service. [Learn more about our technology.](#)

**GOOD:** The areas shown in the medium orange should be sufficient for on-street or in-the-open coverage, most in-vehicle coverage and possibly some in-building coverage. This AT&T owned network provides GSM, GPRS, and EDGE service. [Learn more about our technology.](#)

**MODERATE:** The areas shown in the light orange should have sufficient signal strength for on-street or in-the-open coverage, but may not have it for in-vehicle coverage or in-building coverage. This AT&T owned network provides GSM, GPRS, and EDGE service. [Learn more about our technology.](#)

**PARTNER:** The areas shown as an orange stripped pattern represent the coverage of unaffiliated carriers and should have sufficient signal strength for on-street or in-the-open coverage, but may not have it for in-vehicle coverage or in-building coverage. Excessive use of Partner coverage may subject your service to early termination, in accordance with your service terms. Data services may not be available.

**3G/Mobile Broadband:** 3G coverage is available in select metropolitan areas. 3G capable device and eligible rate plan required. However like all coverage it can and will be adversely affected by distance from cell site, weather, foliage, tower congestion and other factors. You'll know you're in our 3G coverage area when the 3G network indicator appears beside the signal bars on your phone. If you are outside our 3G coverage area, you can still access services using our EDGE network. [Learn more about 3G.](#)

**EDGE/GPRS:** The areas shown in the medium blue represent AT&T owned GSM network providing Enhanced Data rates for GSM Evolution with typical speeds of 75 to 135 kbps, advanced mobile services like video and music clips, full picture & video messaging, high-speed color Internet access, and email on the move are possible. [Learn more about our technology.](#)

**Partner EDGE:** The areas shown in the medium blue striped pattern represent unaffiliated partner network providing Enhanced Data rates for GSM Evolution with typical speeds of 75 to 135 kbps, advanced mobile services like video and music clips, full picture & video messaging, high-speed color Internet access, and email on the move are possible. Excessive use of Partner service may result in the loss of coverage in Partner areas as provided in your service terms. [Learn more about our technology.](#)

**Partner GPRS:** The areas shown in the light blue striped pattern represent unaffiliated partner network coverage providing General Packet Radio Service with average speeds of about 35 kbps. GPRS allows nationwide text and email service and basic WAP (Wireless Application Protocol) Internet browsing. GPRS is the service of choice for many text messaging PDAs, including Blackberry, Treo, and others. Excessive use of Partner service may result in the loss of coverage in Partner areas as provided in your service terms. [Learn more about our technology.](#)