PDF-XCHANGE Click to buy NOW! www.docu-track.com

IP Networking over Satellite for Business Continuity and Disaster Recovery

Dr. Klaus-P. Dörpelkus

Global Government Solutions Group (GGSG)

Cisco Systems

http://www.cisco.com/go/space

Santa Clara, July 1st 2007

Speaker Information

Dr. Klaus-P. Dörpelkus

Space Initiatives Europe & Emerging Markets
Global Government Solutions Group
Cisco Systems Inc.

Tel.: +49 (0) 811 - 554 3112
Fax: +49 (0) 89 - 7499 7048
Cell: +49 (0) 172 - 832 3443
kdoerpel@cisco.com

http://www.cisco.com/go/space

PDF-XCHANGE Click to buy NOW! www.docu-track.com

A Space Vision from a Networking Company

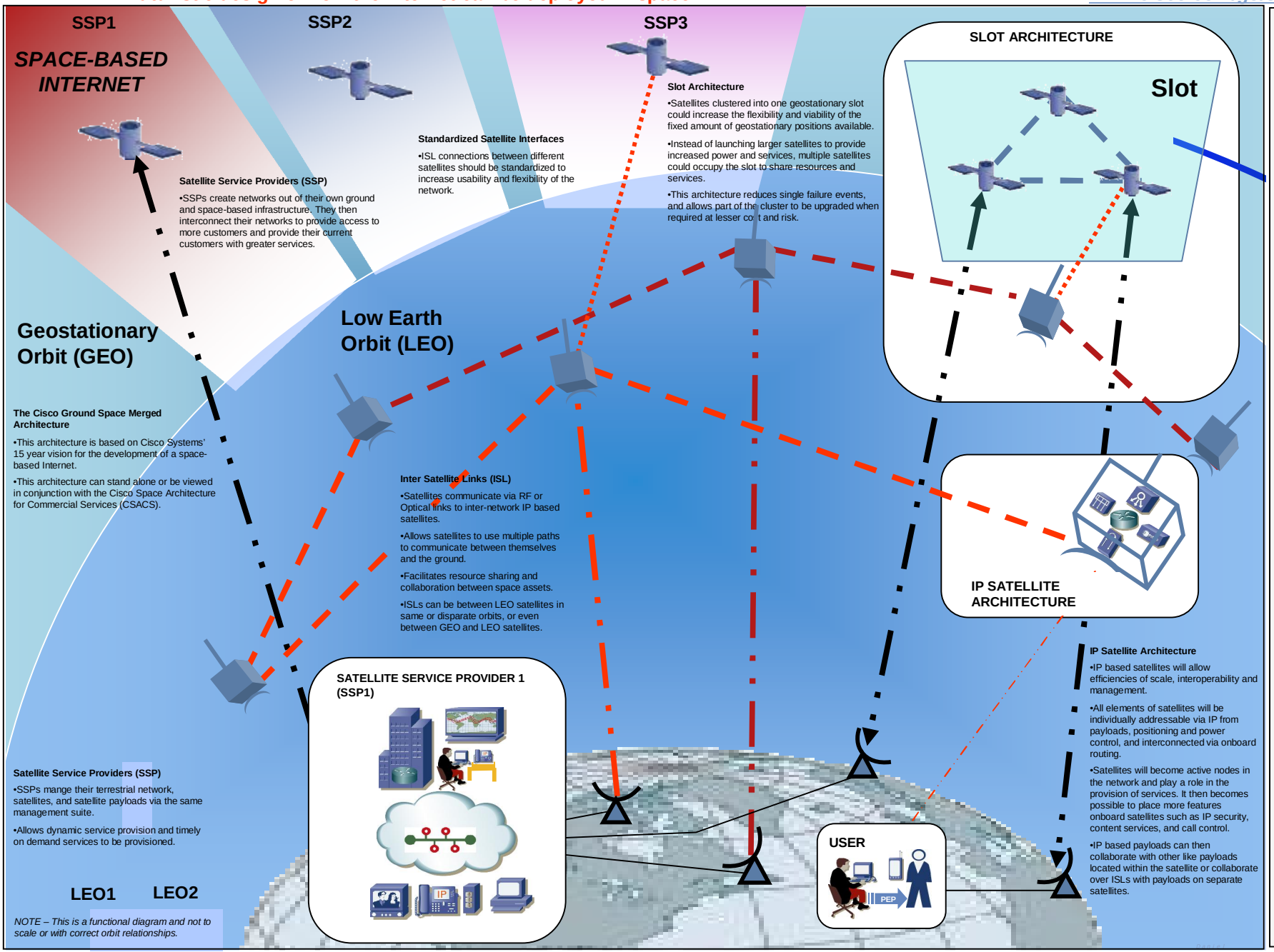
One day, each and every manned and unmanned spacecraft, high altitude platform, unmanned aerial vehicle, airframe… will be a node on the network.

Terrestrial and space communications will be indistinguishable.

CISCO Ground Space Merged Architecture (CGSMA)

A futuristic design of how the Internet can be deployed in space

www.cisco.com/go/space



PDF-XCHANGE Click to buy NOW! www.docu-track.com

Agenda

- Motivation:
  - Disasters and Business Continuity
  - Satellite Communication & VSATs
- IP in Space: Not a Lecture
- A VSAT Module for Cisco‘s Integrated Services Routers
- Application Scenarios
- IP-based instant and mobile Communications
- Satellite Services
- Conclusion and Summary

PDF-XCHANGE
Click to buy NOW!
www.docu-track.com

Motivation

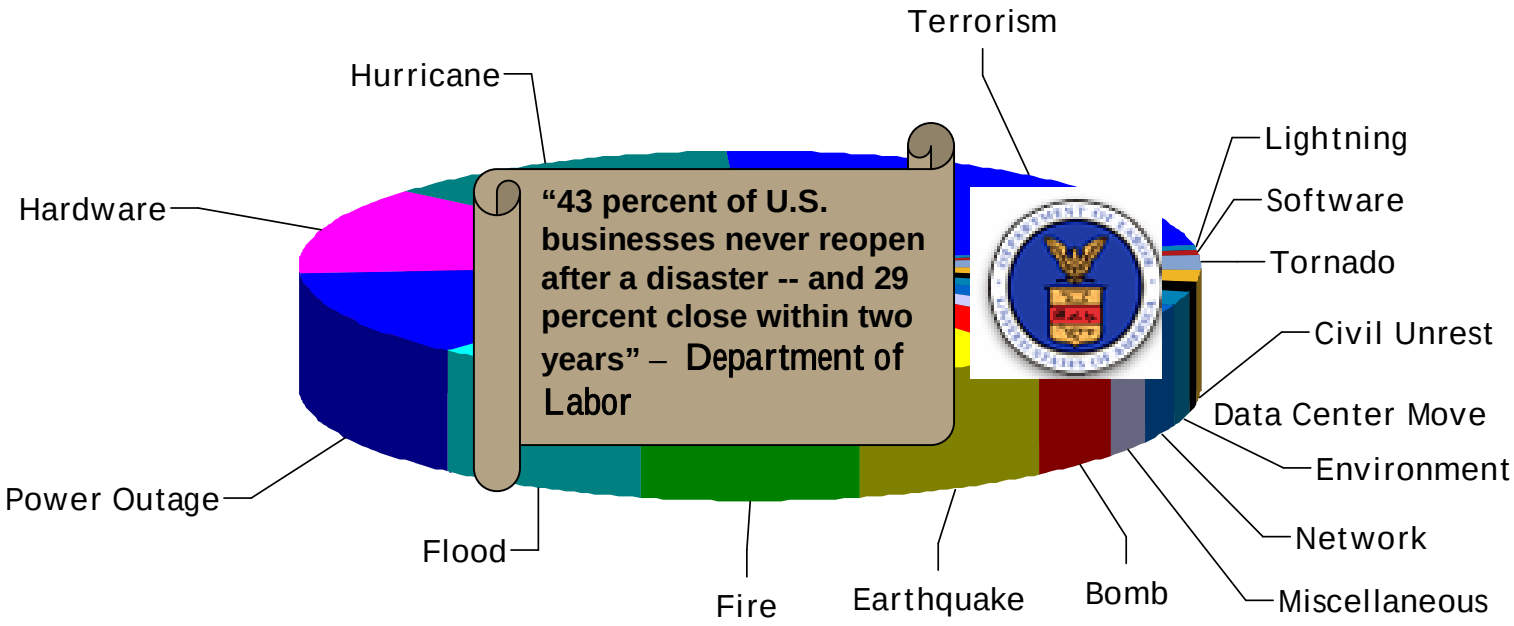
Business Continuity - Cost of Downtime

Industry	Application	Average cost per hour of downtime (US$)
Financial	Brokerage operations	$ 7,840,000
Financial	Credit card sales	$ 3,160,000
Media	Pay-per-view	$ 183,000
Retail	Home shopping (TV)	$ 137,000
Retail	Catalog sales	$ 109,000
Transportation	Airline reservations	$ 108,000
Entertainment	Tele-ticket sales	$ 83,000
Shipping	Package shipping	$ 34,000
Financial	ATM fees	$ 18,000

Source: Contingency Planning Research, 2000

Distribution of Disasters Causes

More than 25% of companies experienced a disruption averaging 8 hours = 1 business day (in the last 5 years)



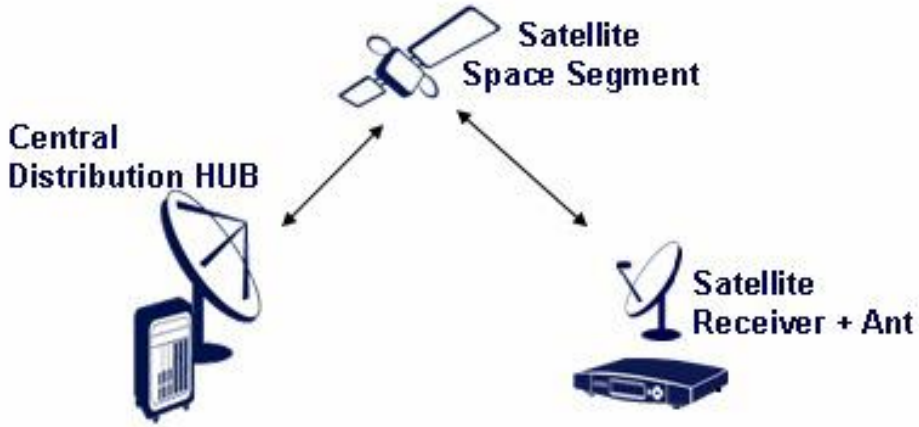
Source: Comdisco Vulnerability index (USA data)

VSAT Communication in Brief

§ VSAT (Very Small Aperture Terminal) technology is a bidirectional satellite communication that is very well positioned to support and deliver

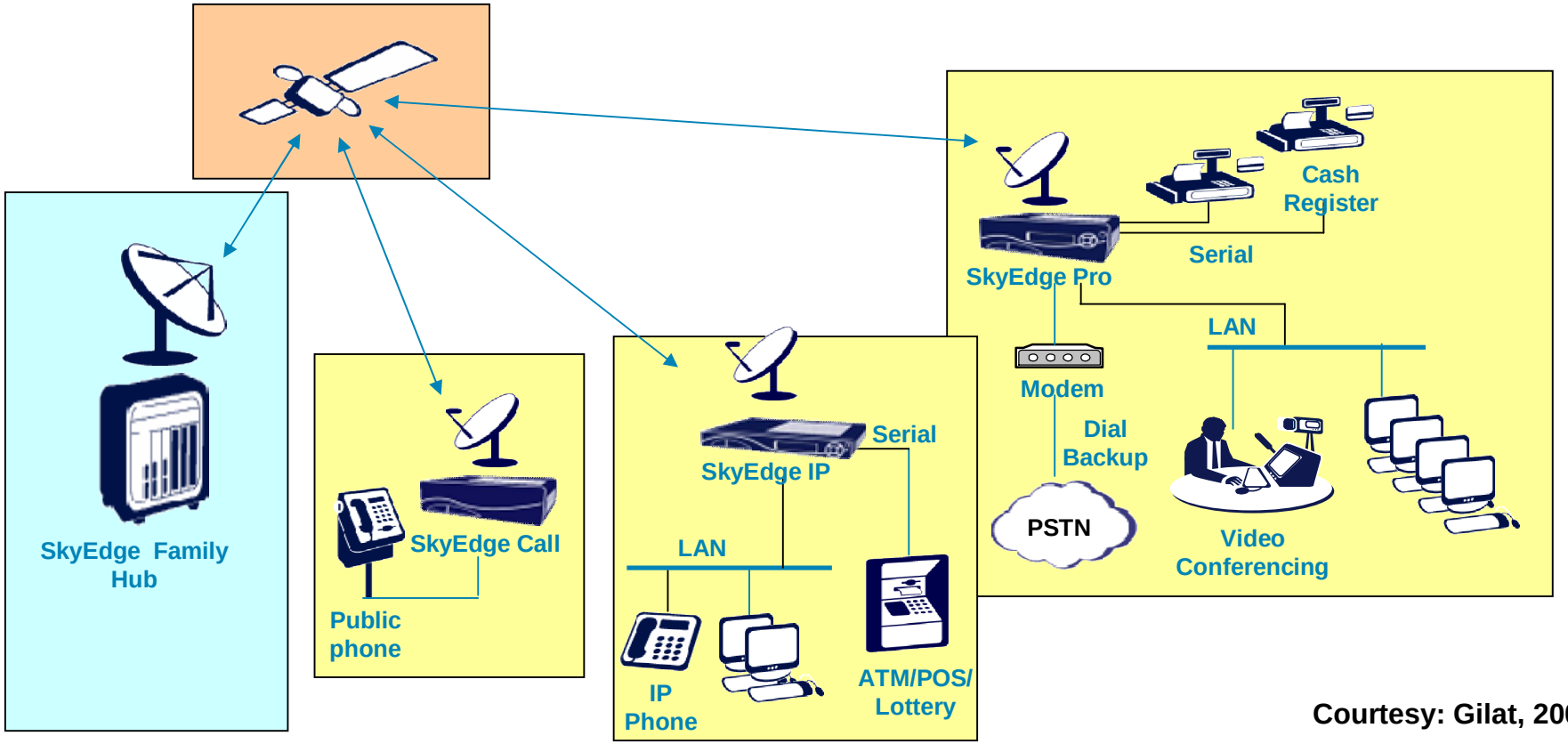
- Ø **Corporate Communication** for e.g. document and video distribution for multi-branch enterprises (retail, finance, ...)
- Ø **Business Continuity / Backup Service** for enterprises to prevent from network outages
- Ø **Disaster Recovery** independent of (damaged) terrestrial infrastructures in case of natural disasters, power outages etc.
- Ø **Mobile / Deployable Communication Services** for enterprises (oil drilling, mining, construction) and governments (public safety, military)

- A VSAT solution consists out of a hub station (large satellite dish operated by a Satellite Service Provider SSP), the space segement and small VSAT receive and transmit terminals at remote sites / branches



Satellite Network Elements

- Hub
- Satellite
- Remote stations (VSATs)



Courtesy: Gilat, 2006

The Traditional VSAT

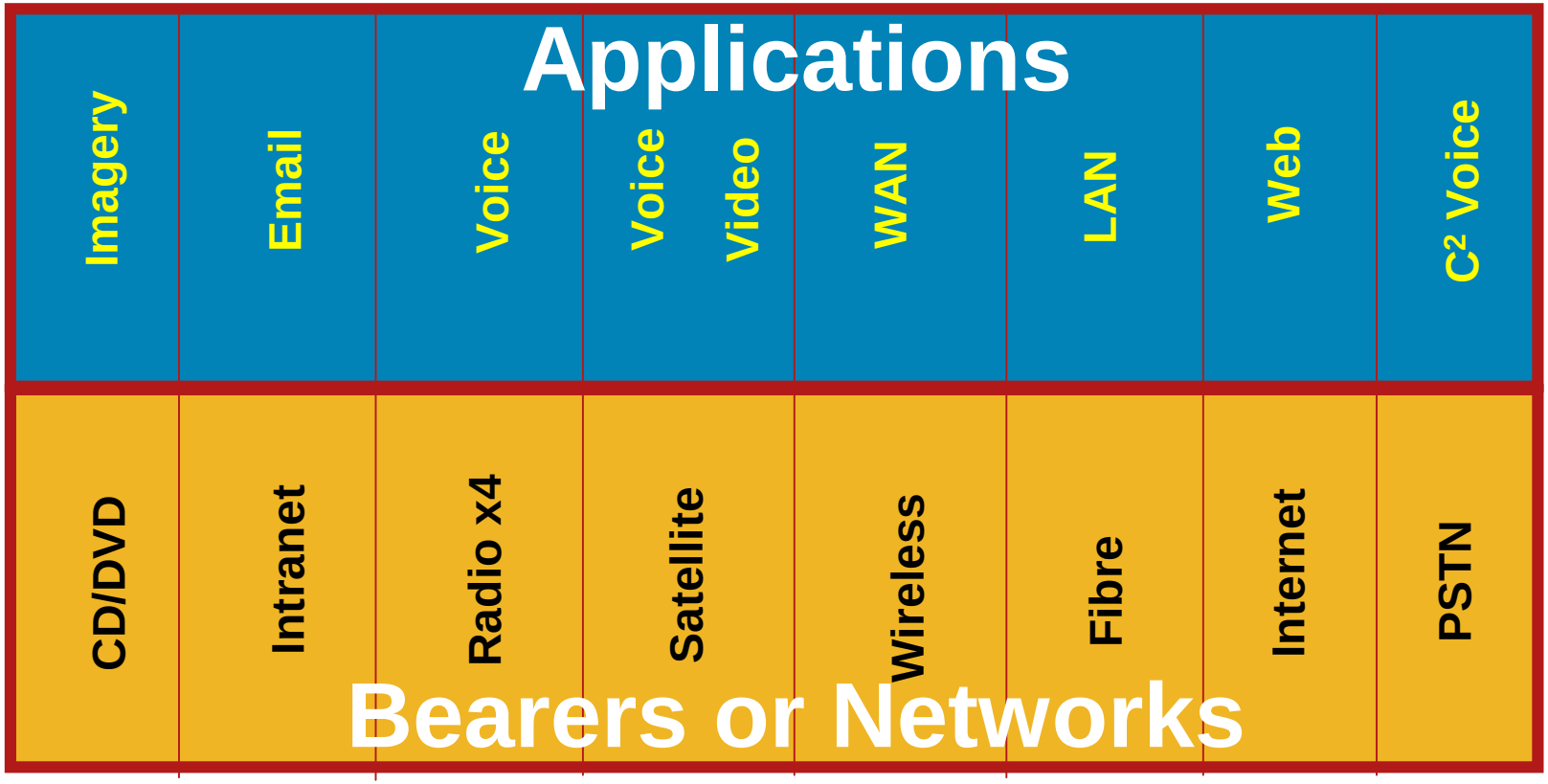
- VSAT = Very Small Aperture Terminal
  - Very small satellite earth station
  - Transmit & receive capabilities
- A VSAT includes three major parts:
  - Indoor Unit (IDU) - satellite modem operating at an intermediate frequency
  - Outdoor Unit (ODU) - transmitter, receiver, high frequency
  - Satellite dish - size varies from 60 cm to 2.4 meters

Courtesy: Gilat and Satlynx, 2006

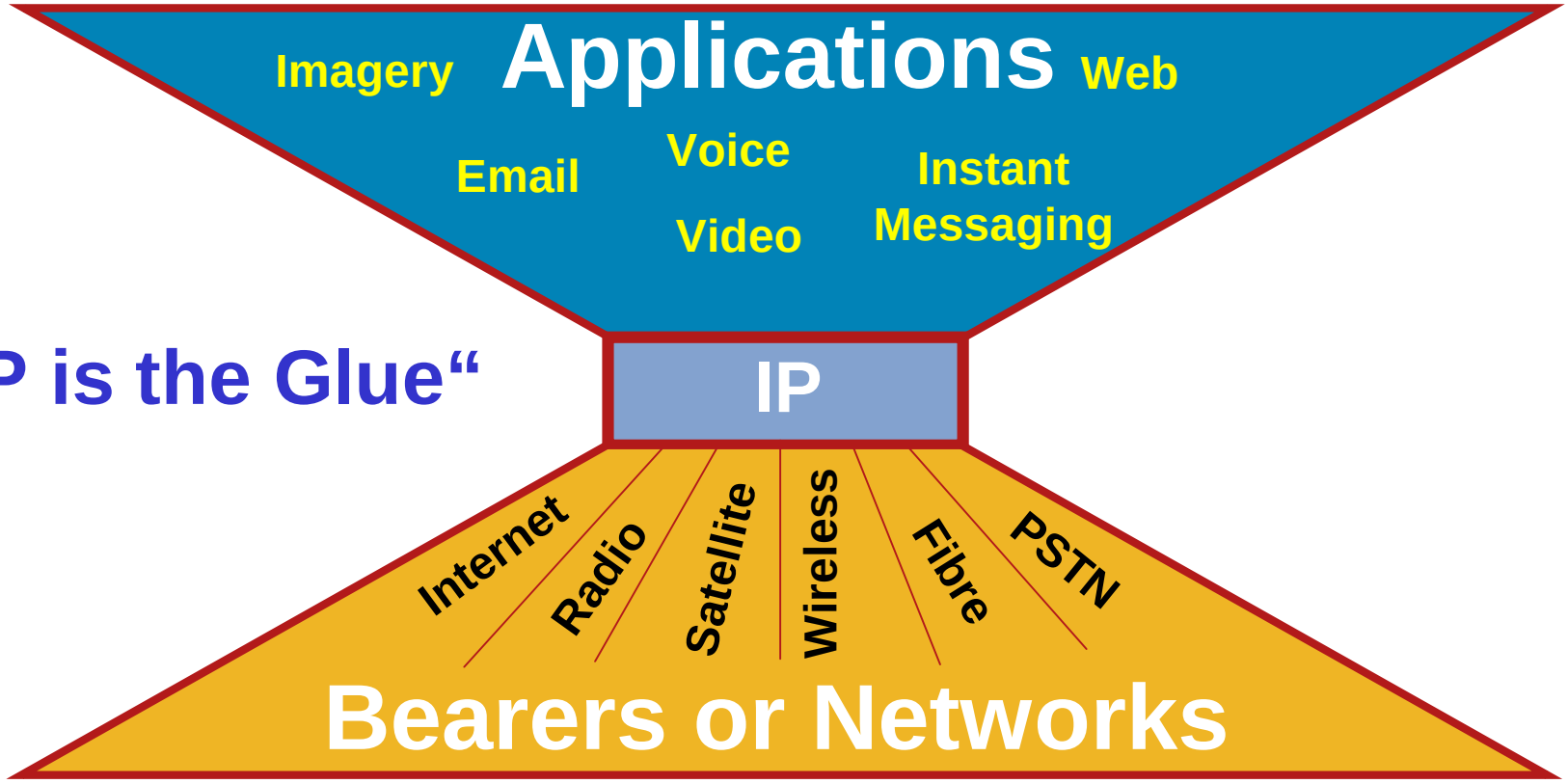
PDF-XCHANGE
Click to buy NOW!
www.docu-track.com

IP in Space

Non-Converged Architecture



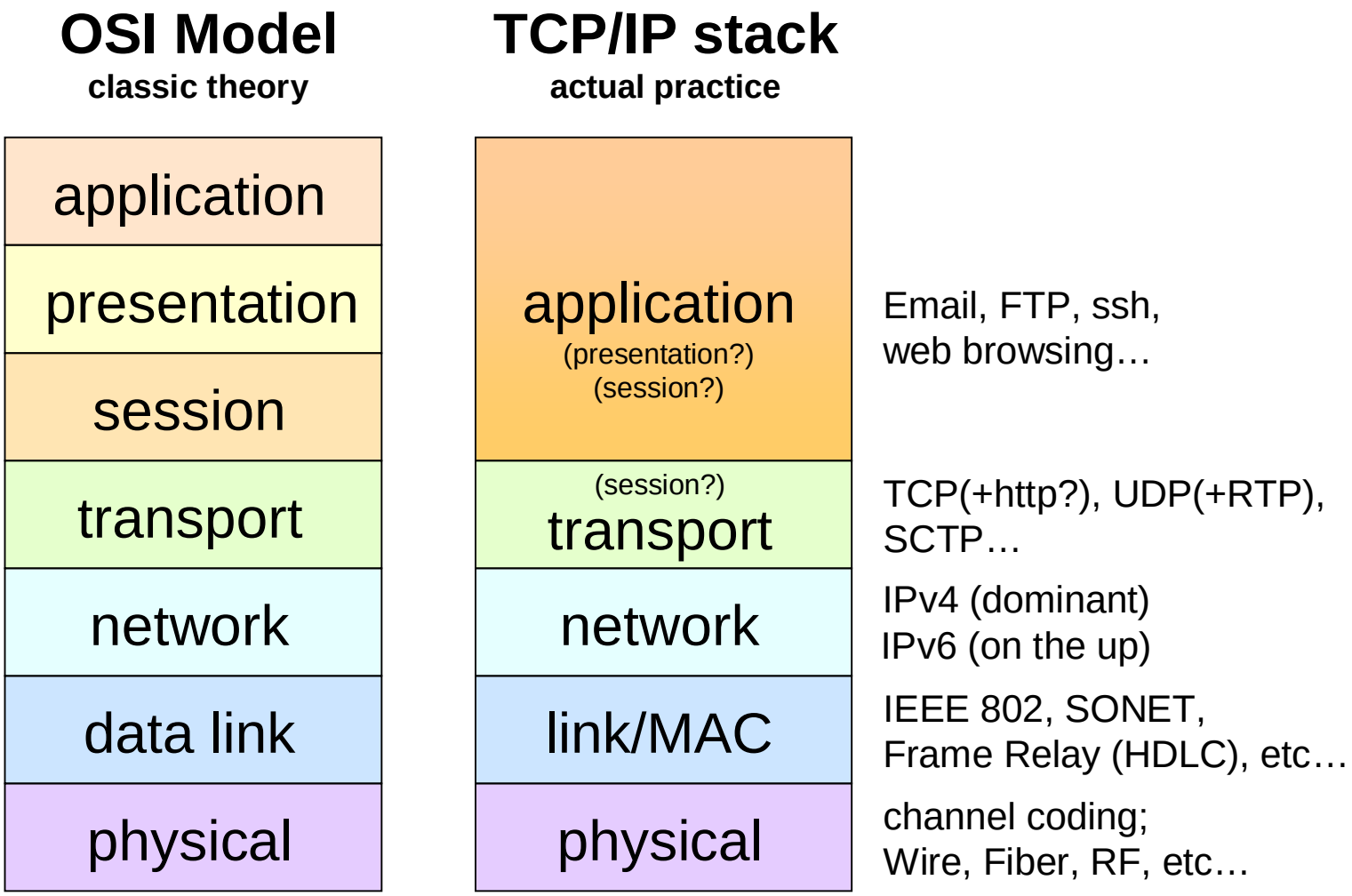
Converged IP Architecture



„IP is the Glue“

„The IP Hourglass“

Protocol Stack Layering and the Internet



TCP Connection Establishment

- TCP uses a *3-way handshake* scheme for connection establishment.
- Connection Establishment as defined in RFC 2581:

  In order to prevent network congestion, TCP uses the slow-start mode during the start phase of a connection.

  Initially, the congestion window is set to 1, and a single data segment is transmitted.

  After return of each acknowledgment (ACK), the window size is increased by 1 segment.

  Thus, the window size grows exponentially, up to a maximum window size.

- Effects:

  - long duration of connection establishment using 3-way handshake

  - long duration of slow-start phase: For short connections, inefficient link usage.

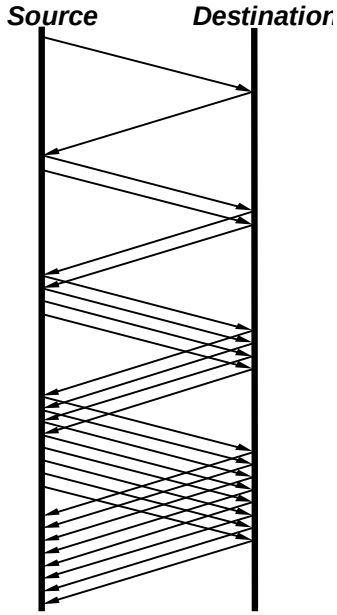
  This is particularly disturbing when downloading Web pages, since here several short-term TCP connections are used.

- Countermeasures (TCP Tuning):

  Larger initial window size (e.g. 4 segments)

  Persistent TCP connections for HTTP and Pre-fetching

  ...



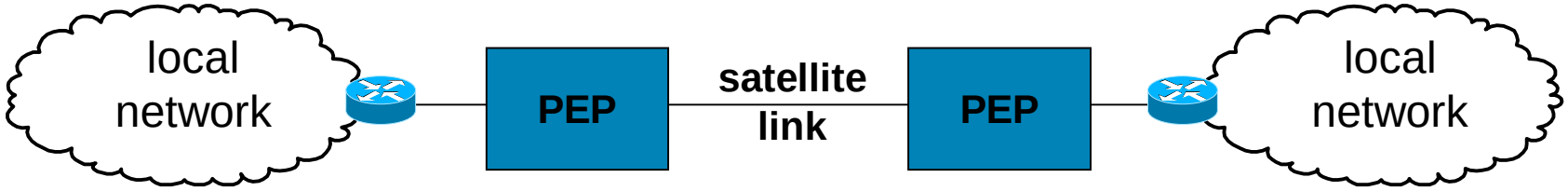
PDF-XCHANGE Click to buy NOW! www.docu-track.com

IP and the Internet are *not* TCP

- Internet has hundreds of protocols running over IP. TCP is just one protocol; many others (DNS, ssh, streaming video) use UDP instead.
- TCP performs poorly over satellite. So?
- TCP's operating assumptions: Competition; loss is congestion. Backoff ensures fairness.
- Once outside our shared terrestrial Internet, TCP's assumptions become less useful.
- Other protocols don't share TCP's design assumptions; have different delay limitations.

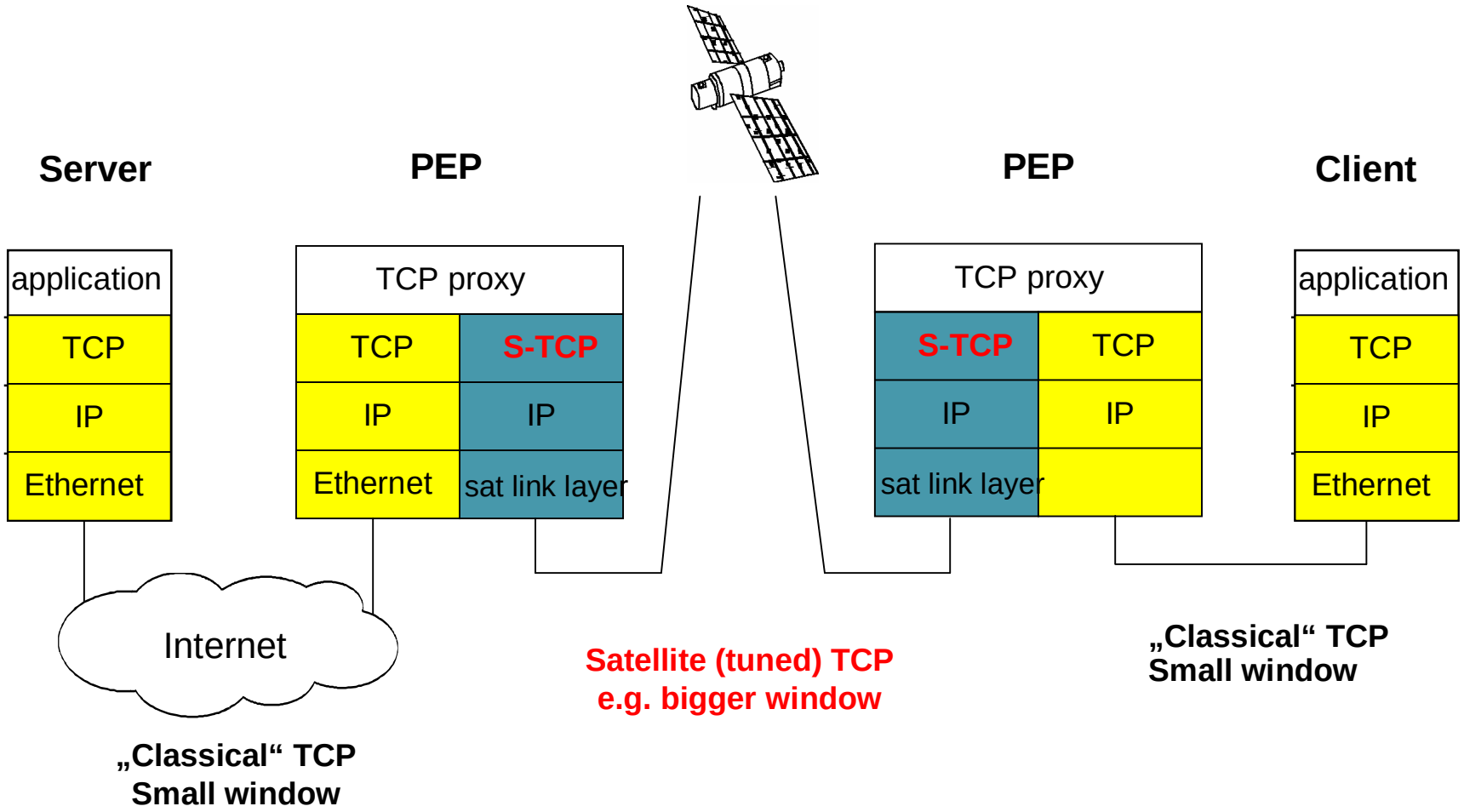
TCP Acceleration (1)

- A popular approach to address performance problems of TCP is called a „Performance Enhancing Proxy“ (PEP). It splits the communication path into 3 segments:
  - standard TCP connection between the local application and the local PEP
  - The space segment with a specialized “inter PEP protocol” to transmit data across the satellite link (optimized and fine tuned)
  - standard TCP connection between the peer PEP and the peer application



- PEPs are available as standalone boxes; now becoming an add-on feature with other functionality.
- Various types of TCP acceleration are described in IETF RFC 3135 and RFC 2488.
- Sometimes, ‘PEP’s perform a technique called spoofing in which they intercept the TCP connection in the middle and send “fake ACKs” to the source as if the gateway were the intended destination => not good!
- Some TCP acceleration ‘tricks’ vanish as endhosts become more paranoid about being spoofed, security may become a problem as well.

TCP Acceleration (2)

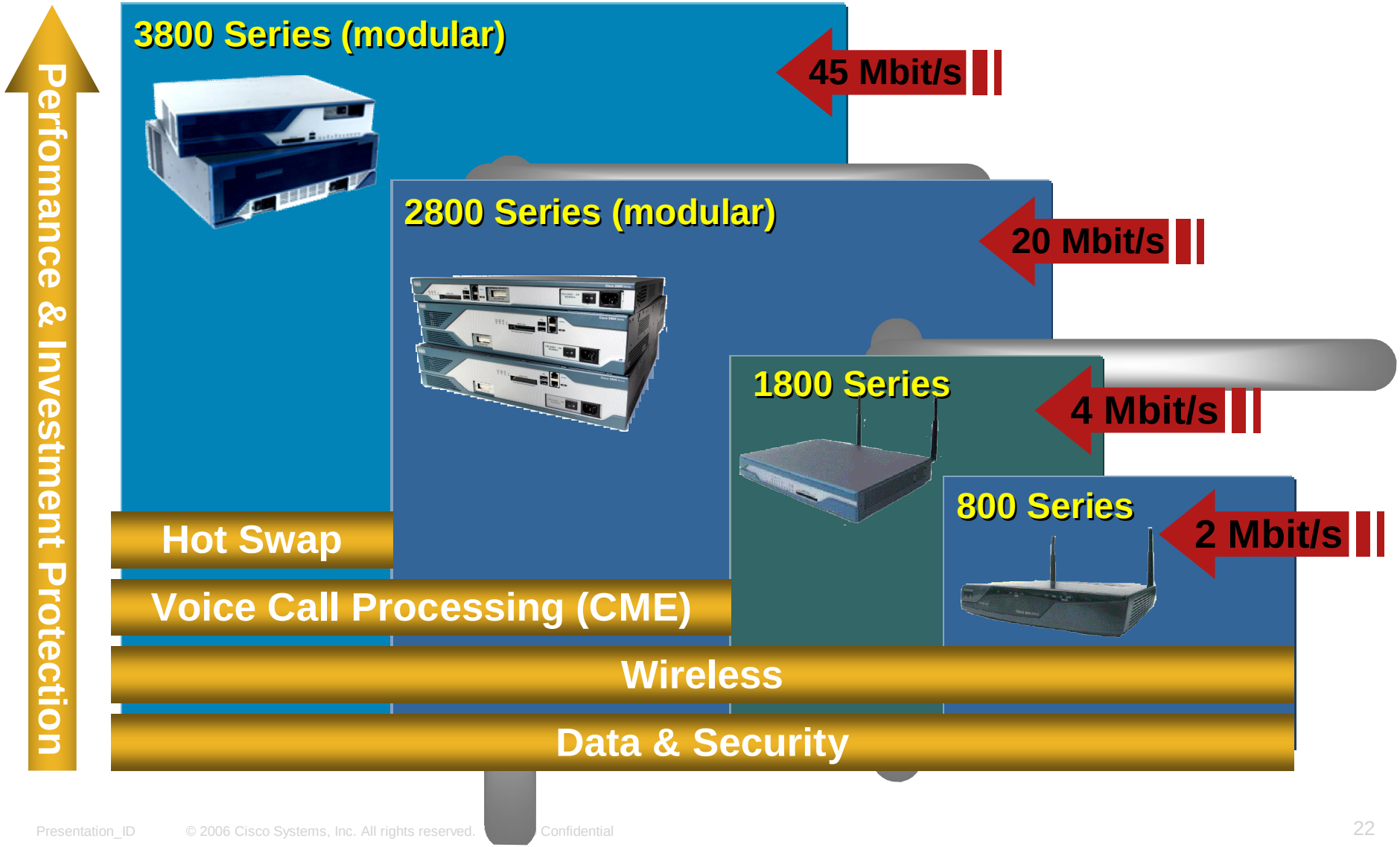


Alternative Transport Protocols for Space

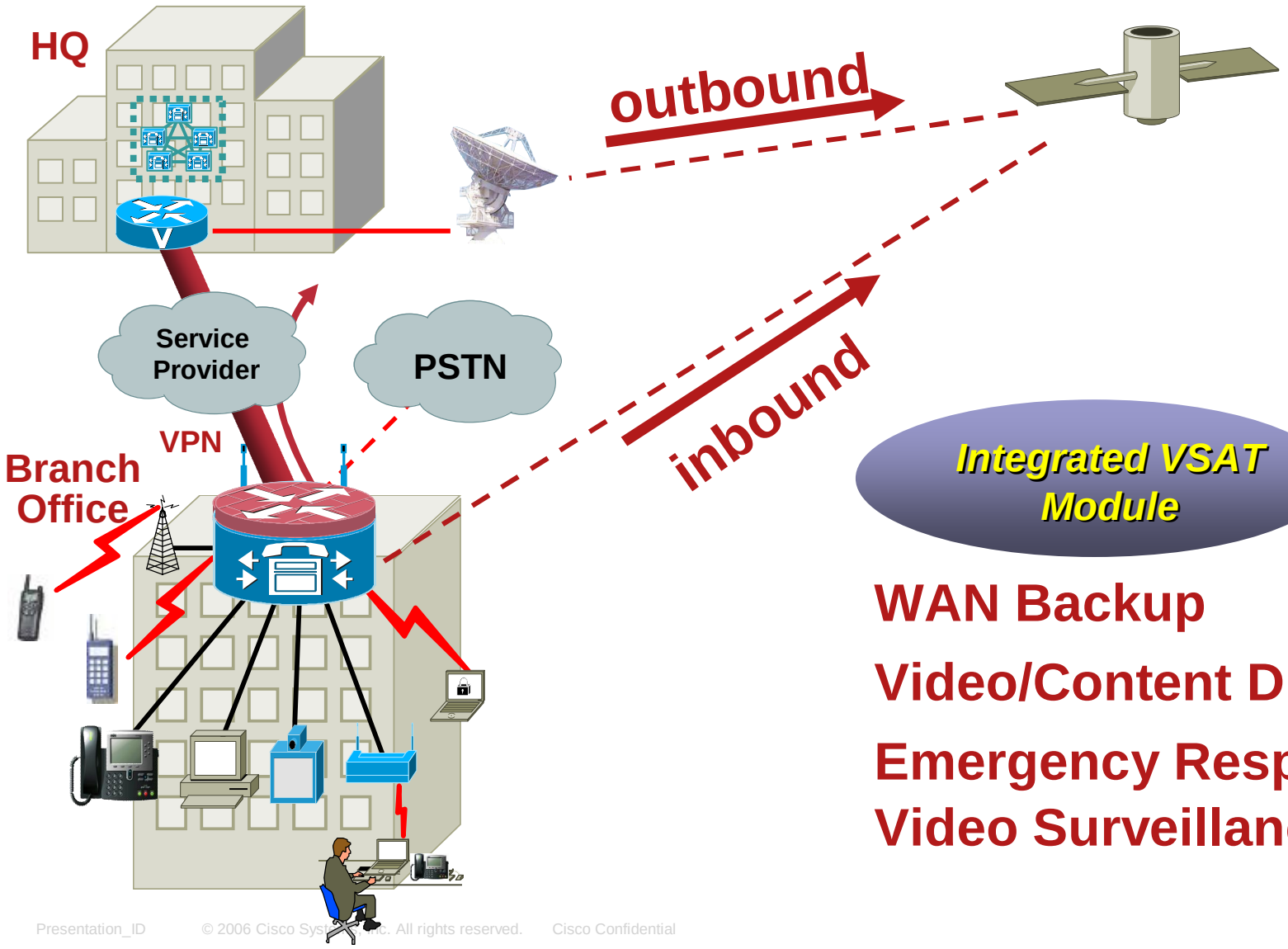
- Reliable UDP: basically an application adding windowing, ACKs and retransmission algorithms to UDP
- Xpress Transport Protocol XTP: an open, high-speed transport protocol which runs over IP (optionally directly over the link layer), includes a NACK-based retransmission algorithm and a window size of up to 2^{64} bits
- Space Communications Protocol Standards (SCPS) http://www.scps.org: A suite of protocols especially designed for communications with space vehicles:
  - SCPS File Protocol, SCPS-FP (FTP-based).
  - SCPS Transport Protocol, SCPS-TP (TCP-based).
  - SCPS Security Protocol, SCPS-SP, providing end-to-end security and integrity.
  - SCPS Network Protocol, SCPS-NP, based on, but not interoperable with IP.

A VSAT Module for Cisco's Integrated Services Routers

Integrated Services Router Models



Introducing the Integrated VSAT Module



Integrated VSAT Module

- WAN Backup
- Video/Content Distribution
- Emergency Response
- Video Surveillance

Cisco's VSAT Module Overview

- VSAT indoor unit (IDU) integrated on a Network Module
- Connects to outdoor unit (ODU) using coaxial cable
- Works in a star topology
- Ku and Extended Ku, C & Exten C band
- Works with GILAT-SkyEdge compatible hub
- Supports up to 10 mbps of data in outbound direction (hub to VSAT)
- Up to 2 mbps of data in inbound direction (vast to hub)

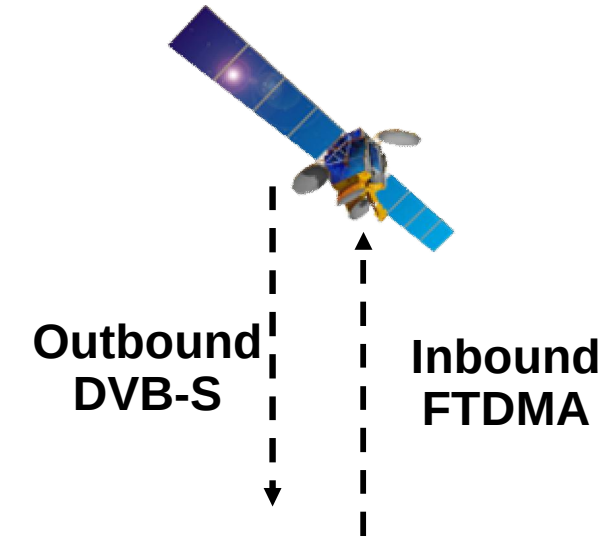
Single Slot NM Form Factor

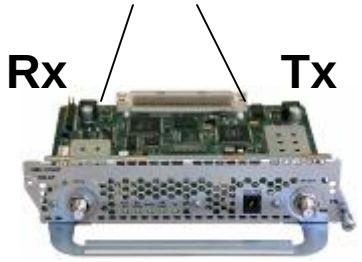
C: 3.7 – 4.2GHz, Ku: 10.95 – 12.75 GHz

Outdoor Unit (ODU)

Features of the VSAT Module

- DVB Outbound, GILAT-SkyEdge proprietary FTDMA Inbound
- Integrated TCP/HTTP acceleration
- 2-way IP Unicast and Multicast connectivity
- Dedicated Access (DA) for high priority traffic, like Voice
- Centralized management from hub NMS
- OSPF/EIGRP/PIM Support (Transparent tunneling)
- Integrated Accelerated VPN and QoS Support



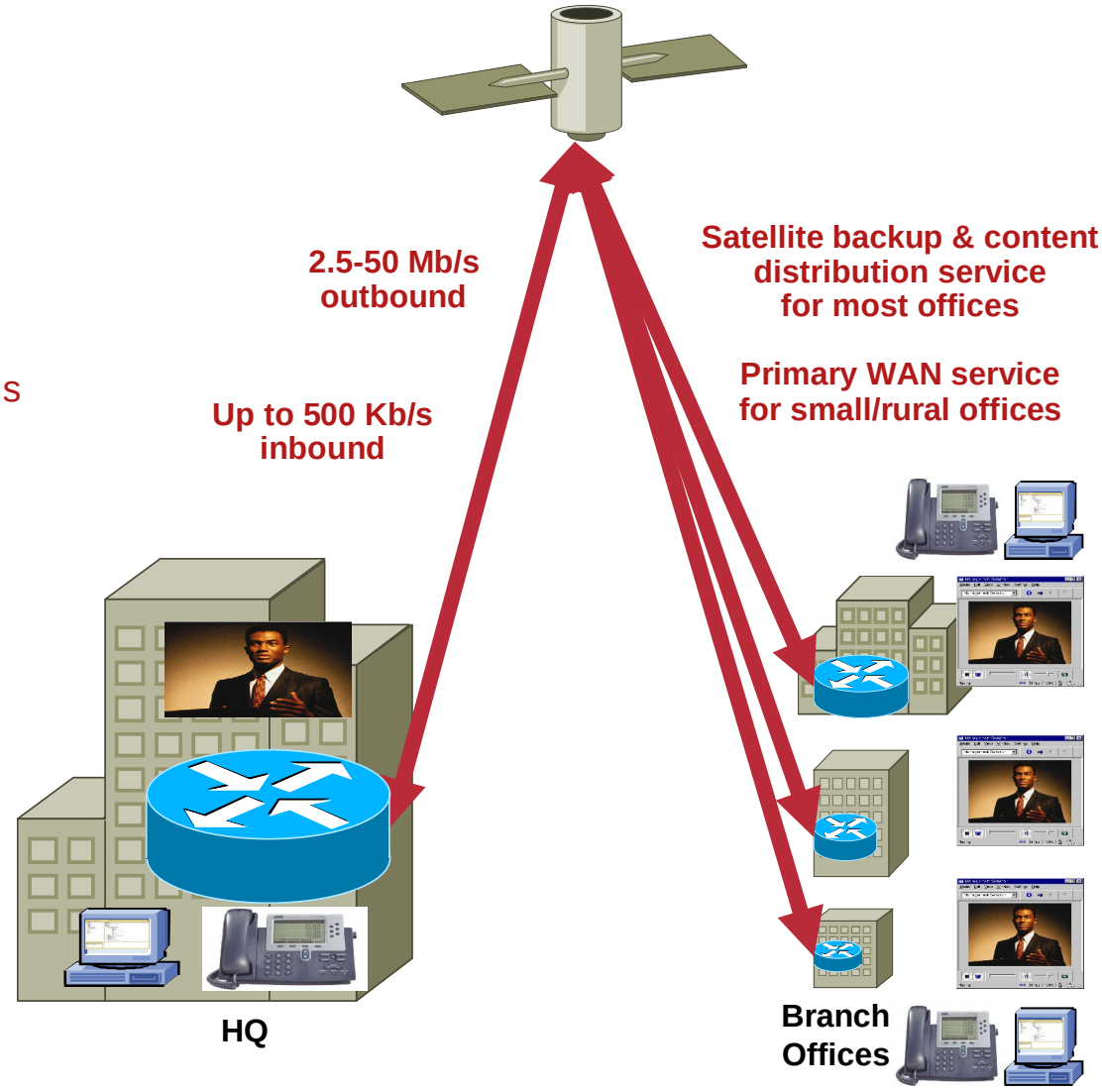


DVB = Standard Digital Video Broadcasting T-Terrestial, S-Satellite
FTDMA = Prorietary Frequency and Time Division Multiple Access

Application Scenarios

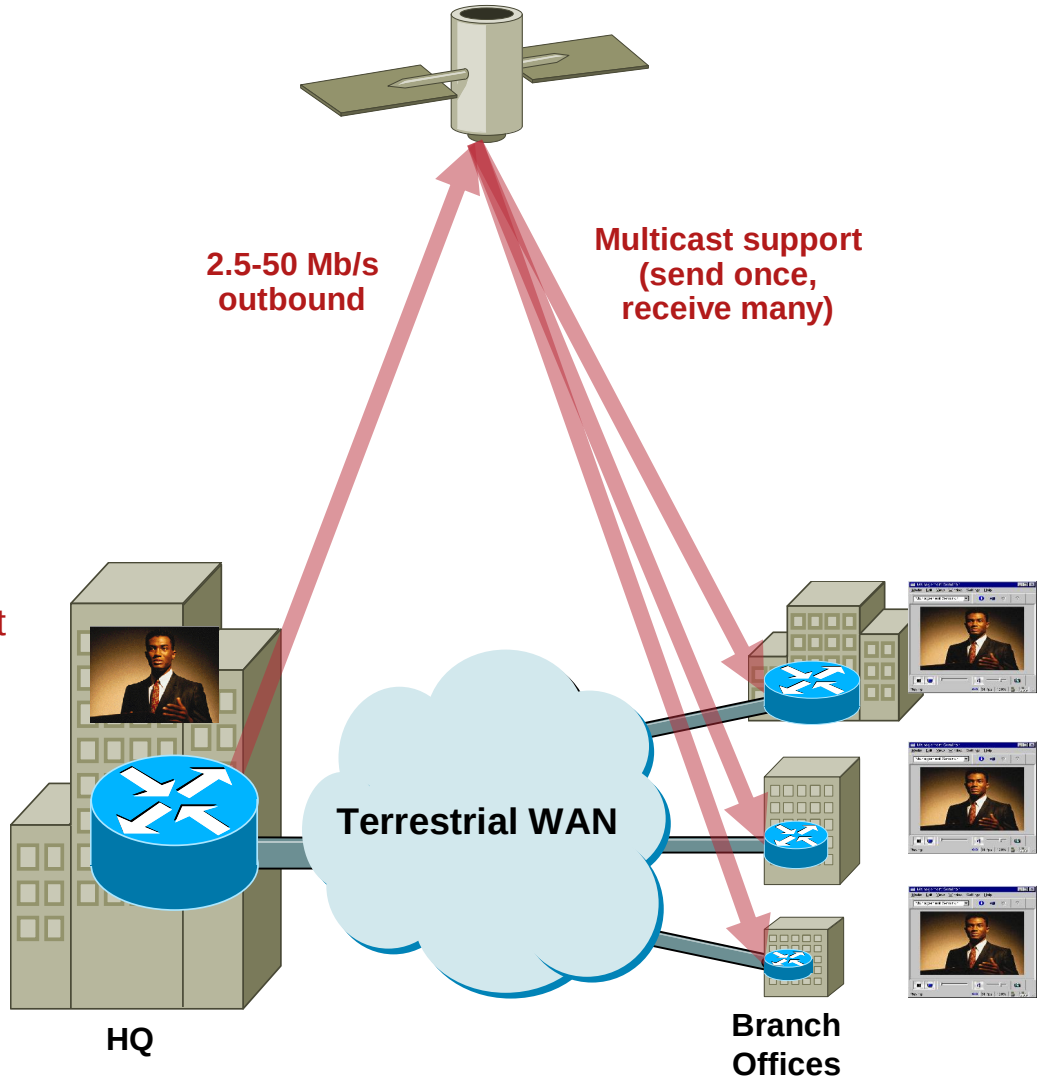
Primary WAN Service for Branch Offices

- Two-Way Satellite Service
  - Broadband WAN service (with dial backup) for rural/small/remote sites
  - Often used where DSL is not available
- Business Application Examples
  - Broadband IP Communications (VoIP)
  - Broadband business critical applications (order entry, POS, billing, inventory)
  - Broadband internet access
  - Distribution of content from HQ
- Benefits
  - Single router at remote site integrates primary and backup WAN services
  - Asymmetric bandwidth (2.5+ Mb/s outbound, 500 Kb/s inbound from HQ) can be shared by multiple remote sites
  - Cost per site is comparable is DSL



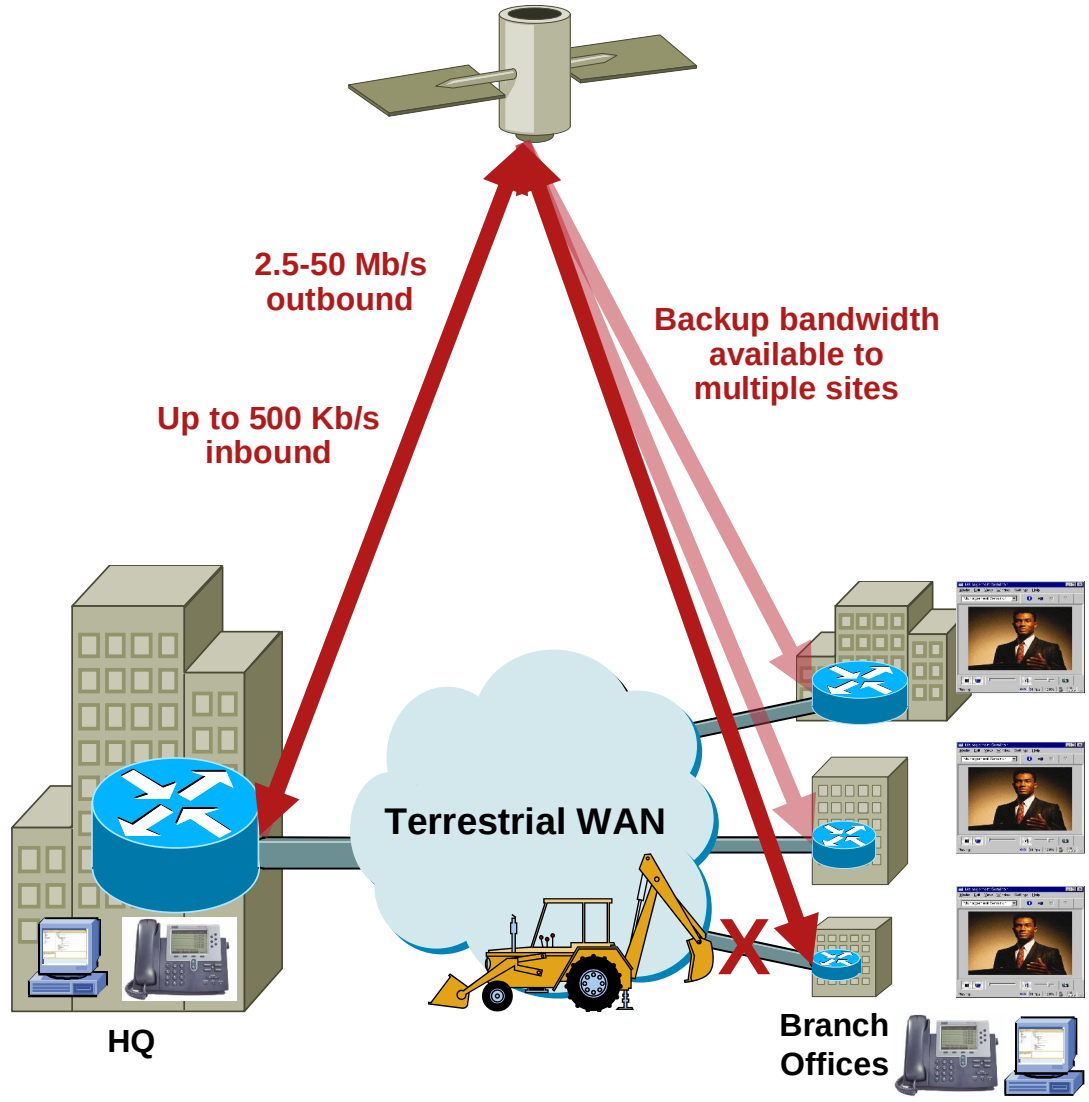
Business Video & Content Distribution

- Broadband satellite distribution
  - Live streaming video
  - Video-on-Demand (VoD)
  - Bandwidth intensive content – software updates, sales collateral etc.
- Business Application Examples
  - Corporate communications
  - Training / E-learning
  - Video display advertising
  - Software & database distribution
- Benefits
  - Single router at remote site integrates content engine and satellite modules
  - High speed distribution – 2.5 Mb/s to 50 Mb/s outbound from HQ to remote sites
  - Satellite is more economical than adding terrestrial WAN bandwidth at each site
  - Multicast optimizes bandwidth & cost



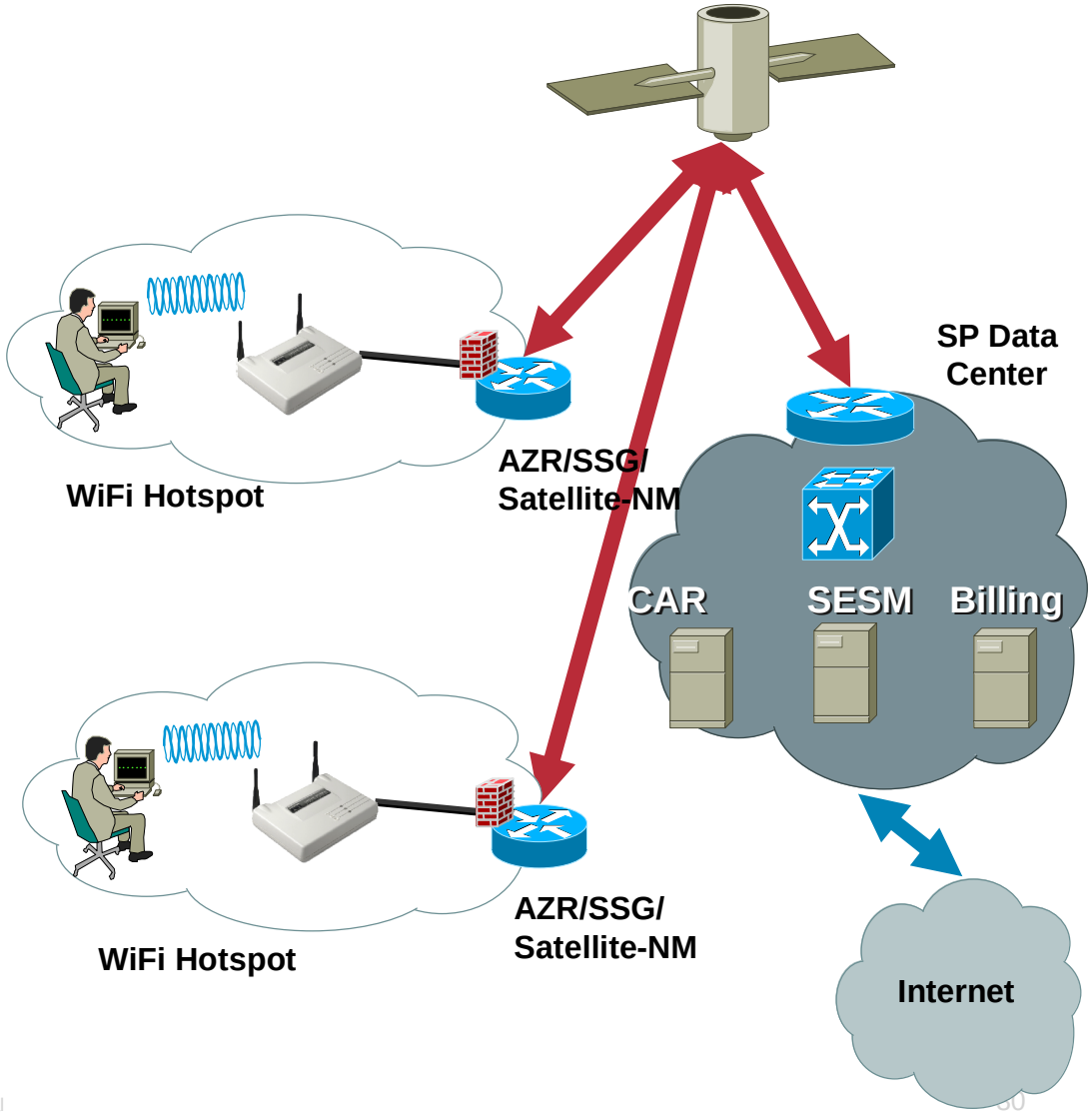
Resilient Backup for Terrestrial WAN

- Two-Way Satellite Service
  - Backup for terrestrial WAN service, resilient to line cuts etc.
- Business Application Examples
  - Resilient IP Communications (VoIP)
  - Resilient business critical applications (order entry, POS, billing, inventory)
  - Resilient internet access
- Benefits
  - Single router at remote site integrates primary and backup WAN services
  - Maintains business-connectivity when primary WAN fails
  - Satellite service is resilient to common failures like line cuts
  - Asymmetric bandwidth (2.5+ Mb/s outbound, 500 Kb/s inbound from HQ) can be shared by multiple remote sites
  - Cost per site is comparable to DSL



WiFi Hotspots over Satellite

- Two-Way Satellite Service
  - Broadband WAN service for Public WLAN (WiFi) hotspots, temporary/rural/mobile sites
- Business Application Examples
  - WiFi Hotspots, including rural areas
  - Construction sites & temporary event venues (concerts, mobile clinics, etc.)
  - Rural sites without broadband access
- Benefits
  - Single router at remote site integrates PWLAN (AZR/SSG) & satellite services
  - Regional/global connectivity is virtually independent of location
  - Asymmetric bandwidth (2.5+ Mb/s outbound, 500 Kb/s inbound from HQ) can be shared by multiple remote sites
  - Cost per site is comparable is DSL



Target Markets by Verticals

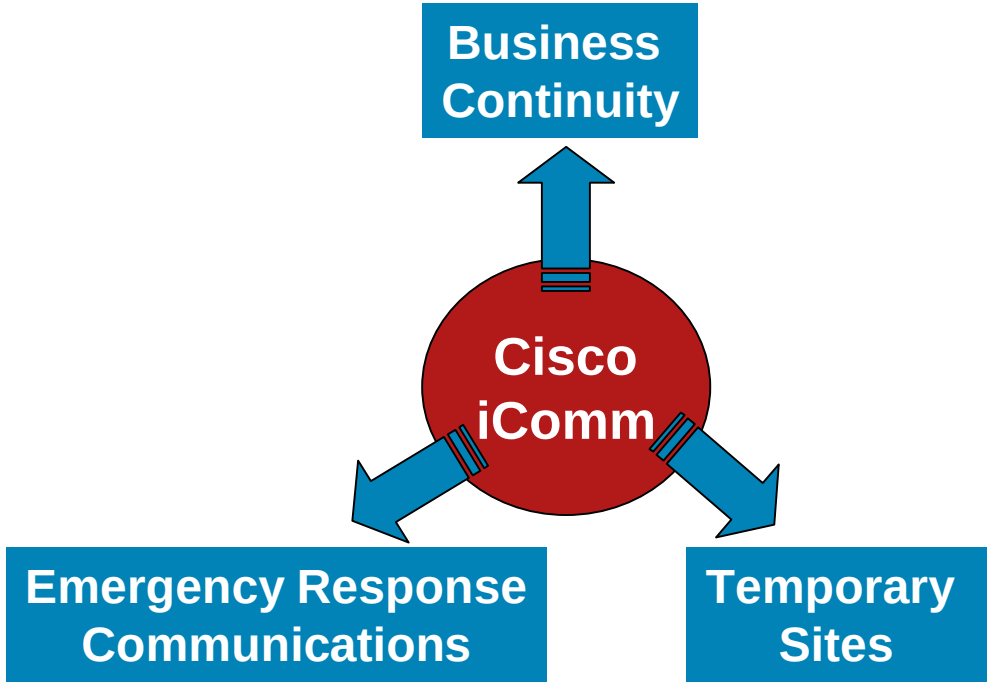
Verticals	Customer Examples	Primary Applications	Value adds with Integrated VSAT
Retail	Big Retailers (Walmart, Metro…)	Video Streaming WAN Backup	Content caching Integrated VPN
Financials	Banks, Institutions, Brokerage Firms	Business Continuity Content Distribution	Integrated Security features
Federal/ Government	FEMA, State Emergency, Border Security, Police	Business Continuity Mobile Comm Kit	Enhanced VoIP, Integrated VPN, Highly mobile 1 box solution for ER
Enterprise	Large and Medium Businesses	Business Continuity Primary Connectivity for remote branches Distance Learning	IP Services Easy migration from dialup/ISDN to Satellite
Industrial	Construction Sites, Oil Rigs, Mines	Temporary Connectivity, Remote Data Acquisition	Deployable / mobile Communication

PDF-XCHANGE Click to buy NOW! www.docu-track.com

IP-based Instant and Mobile Communications

Need for Instant and Mobile Communications

- Businesses need it for staying operational during network outages caused by natural disasters or SP failures
- Critical component of Disaster Recovery preparedness for State and Local governments
- Public Safety Agencies need mobile communications for acting fast and decisively
- Connectivity needs for temporary sites



iComm can be used to set up a temporary branch office. Public Safety agencies could use it as an extension to the Mobile Command Center.

Mobile Command Center with Cisco IPICS

iComm (Remote Site)

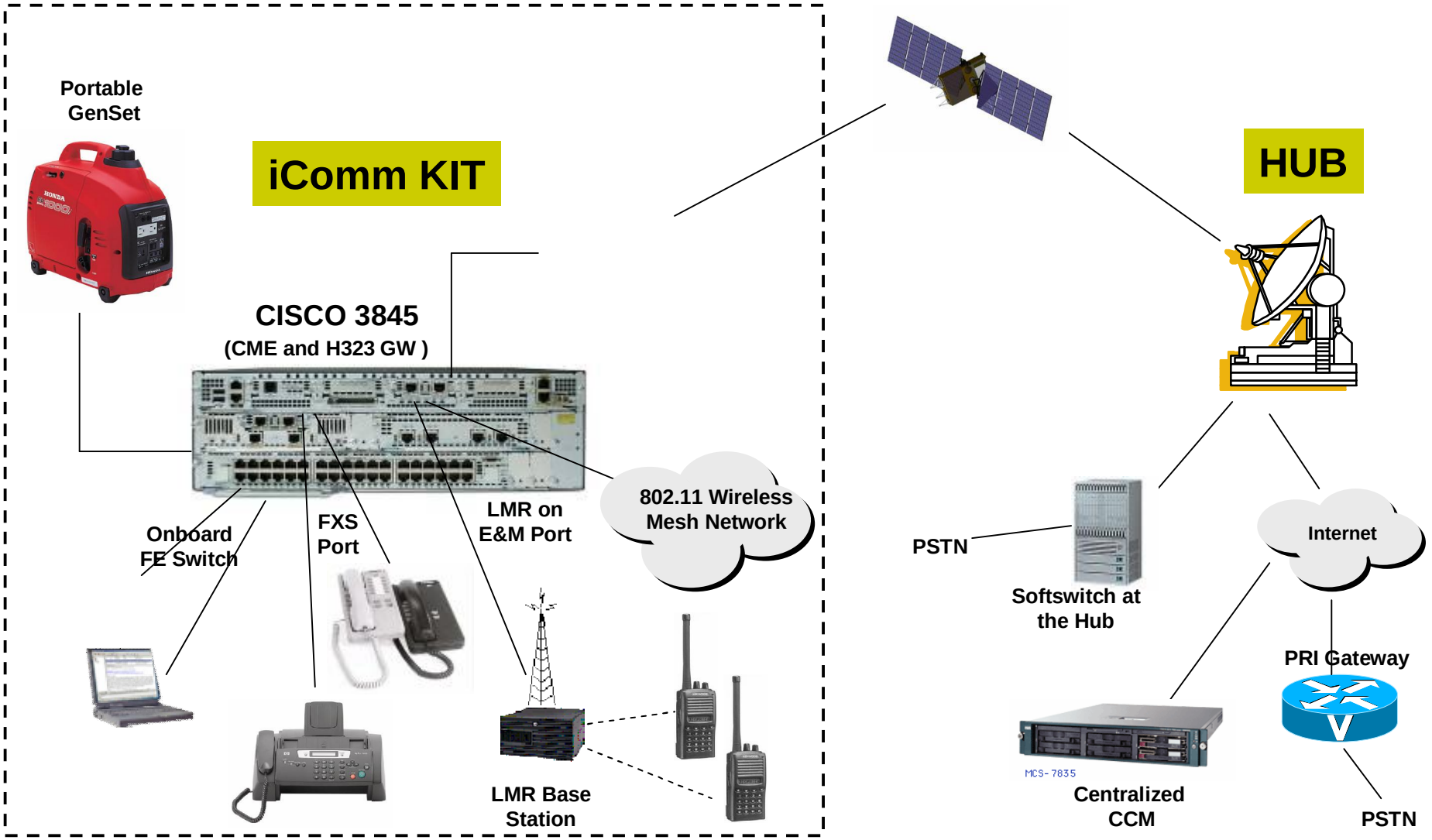
The Cisco iComm solution

- Plug n play operation in under 10 minutes
- VSAT technology is tried and tested
- Satellite coverage is available everywhere, Sky is the limit
- Based on rich ISR feature set, Swiss-Knife of the networking world
- Weighs under 200 pounds, auto-acquiring antenna, plug-n-play
- Integrated Wireless Access Point and LMR Gateway functionality
- All service built on top of IP, Interoperable and Scalable
- Autonomous unit, independent power and connectivity

iComm Kit Functionalities

- Internet connectivity over satellite with TCP/HTTP optimization
- VoIP with both Cisco IP Phones as wel as Analog POTS Phones
- Local Call Control with Call Manager Express
- Local Voice mailbox
- WiFi connectivity for data and voice
- Simplified WLAN Management and Mesh Networking
- Land Mobile Radio (LMR) over IP, radio interoperability with Cisco IPICS
- Video/Content Distribution and Caching

iComm System Architecture



iComm Components

Hardened Case with Router, Antenna Controller and optional UPS	Pelican Case with phones, radios and connectors	Auto-acquiring Antenna in a Fly Away case	1000 watt portable Generator
			
Weighs around 50lbs fully populated Connects to the Antenna and power Generator	Weighs from 10-20lbs based on number of devices Custom made to end user specifications	Weighs about 150lbs, Fedex shippable Connects to the antenna controller and VSAT module	Not shippable, Consumer grade

Katrina Emergency Response Trailers

- 30 Trailers deployed by USPS immediately after hurricane Katrina
- 3 telephony endpoints and 3 POS stations per trailer
- Used to set up Mobile Kiosks in affected areas through out Louisiana
- Similar emergency communications sites were set up by Cisco volunteers at schools and hospitals

PDF-XCHANGE
Click to buy NOW!
www.docu-track.com

Satellite Services:

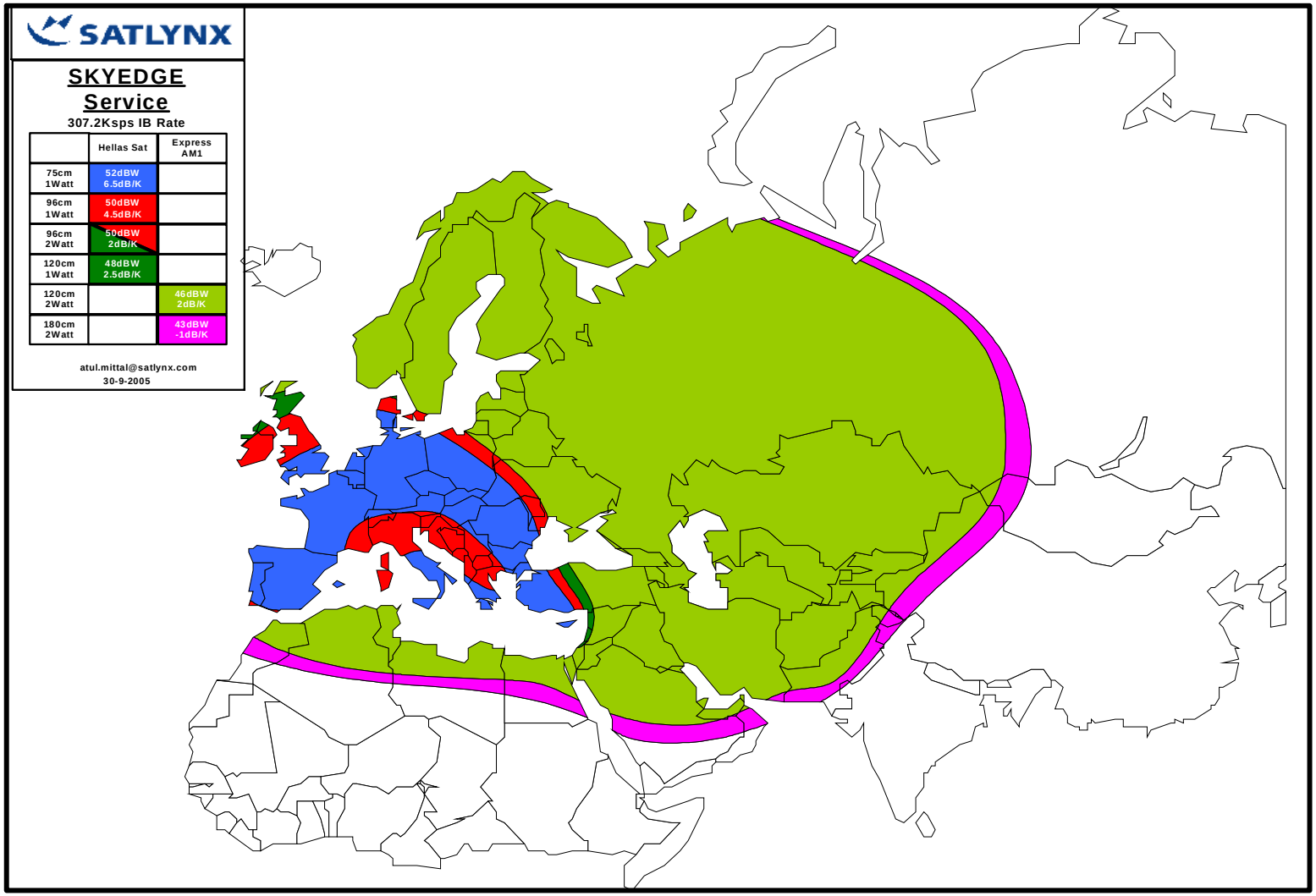
Satlynx

Satlynx at a Glance

Leading provider of two-way satellite broadband communication services throughout Europe

- **Ownership** — Fully owned subsidiary of General Electric (100 %)
- **Founded** — 2002 as a Joint Venture between SES, Gilat and Alcatel
- **Employees** — ~ 120
- **Headquarter** — Luxembourg
- **Technical facilities** — Technical Operations Centers in Backnang (DE), Düsseldorf (DE), Betzdorf (LU) and Leuk (CH)
- **Market sectors** — Corporate, Government & Defense and Broadband.
- **Services** — *Connect Solutions, Connect Global, Connect Wholesale*
- **Applications in use** — Transactional, Credit card verification, SCADA, Internet access, Telephony, ERP, Disaster Recovery, Transportable, VPN, Point of Sale, Community Access, Broadcasting, Surveillance
- **Satellites in use** — Total use of about 20 different satellites including SES-ASTRA, SES-NSS, SES-AMC, ISS, PAS, Eutelsat, Yamal, etc.
- **Satellite Platforms** — Gilat, Alcatel, EMS, Comtech, Paradise, iDirect, SkyWAN, etc.
- **Portfolio** — Turnkey solutions: Equipment, Network Design and Operations, Installation, Maintenance, Technical support, etc.
- **Service Coverage** — Europe, Middle-East, Africa and global networks out of EMEA.
- **VSATs in operation** — Over 12,000 VSATs in direct operations

Satlynx SkyEdge Service Coverage



PDF-XCHANGE Click to buy NOW! www.docu-track.com

Summary and Conclusions

- Instant Mobile Communications is needed for Emergency Response, Business continuity and On Demand connectivity for Temporary Sites.
- Satellite and especially VSAT communication can be used to respond to natural or man-made disasters and to provide continuity of businesses or operations.
- IP has become the most important platform for communication and support of business processes.
- Although there are issues with some protocols in the TCP/IP protocol suite efficient IP-based communication over satellites is possible. The integration of VSAT capabilities into IP networks is the next logical step.
- iComm provides a portable and rapidly deployable IP-based Communications solution

more information: http://www.cisco.com/go/isr
http://www.cisco.com/en/US/products/ps6989/index.html

PDF-XCHANGE
Click to buy NOW!
www.docu-track.com

Thank you!

Questions?

PDF-XCHANGE
Click to buy NOW!
www.docu-track.com