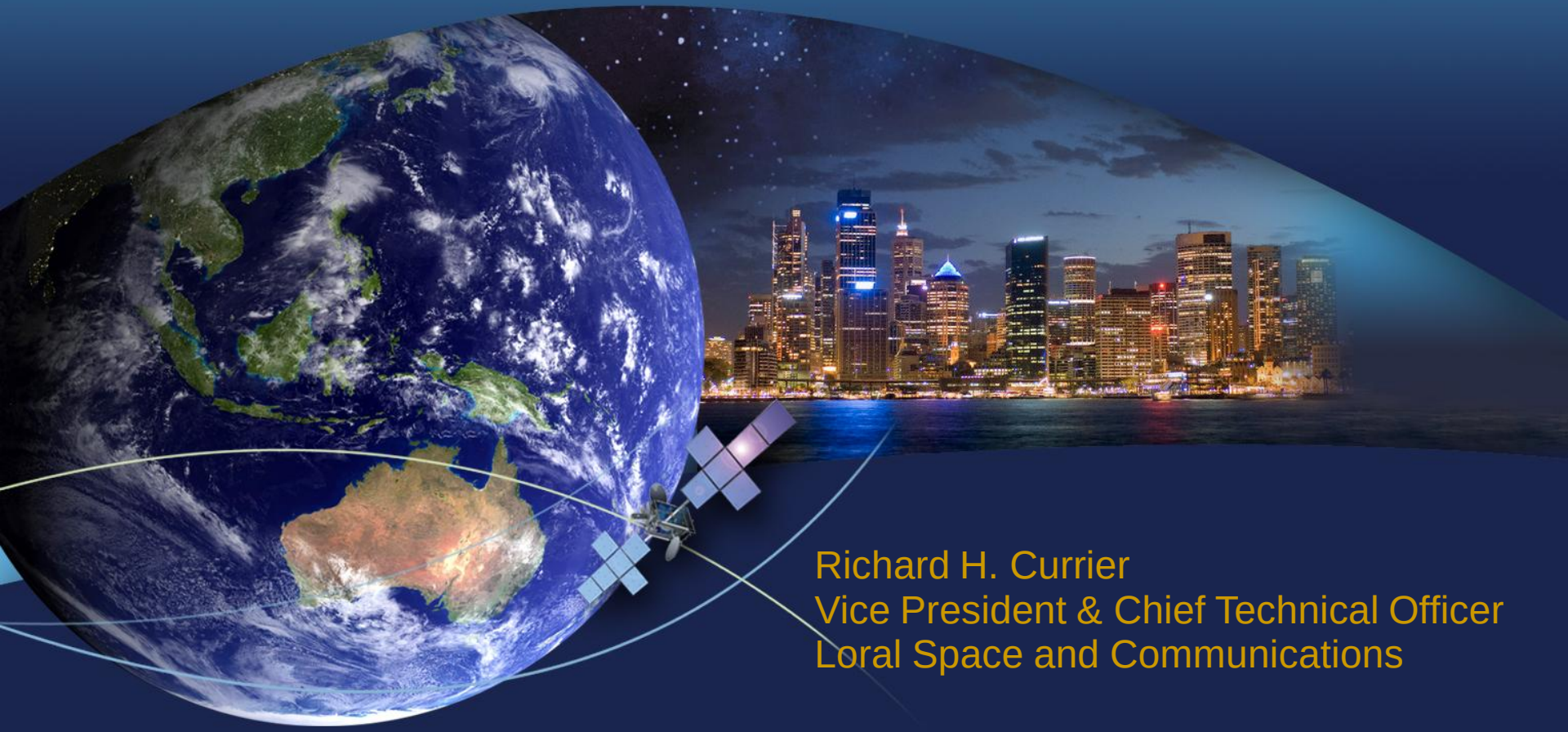
Satellite Broadband:
Industry Trends; Opportunities for Australia



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2008–41450 • 23–07–08

Topics

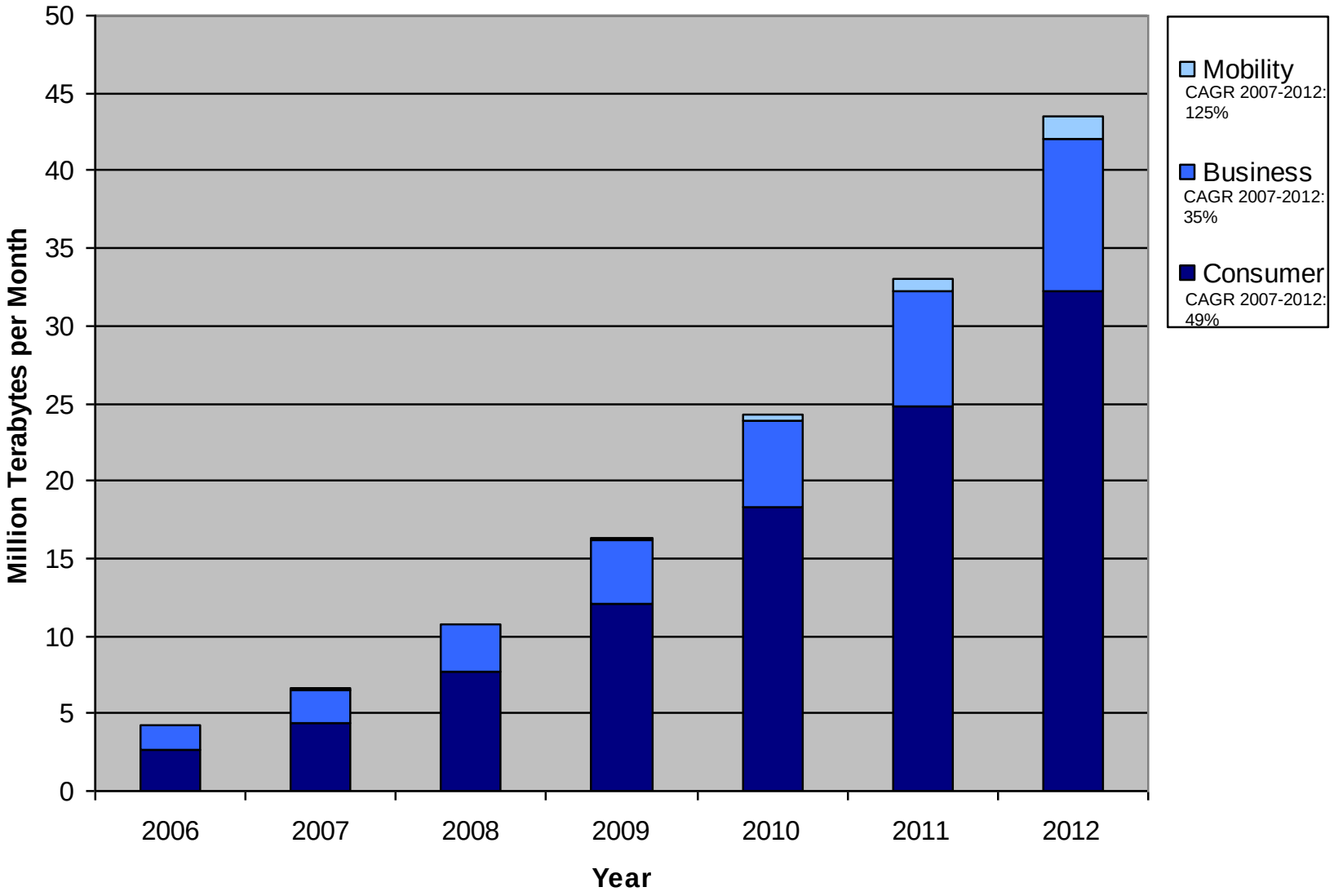
- The Demand for Broadband
- Three Generations of Satellite Broadband
- Satellite Solutions to Extend the National Broadband Network to all Australians

Significant Growth Will Occur in Global Broadband Usage

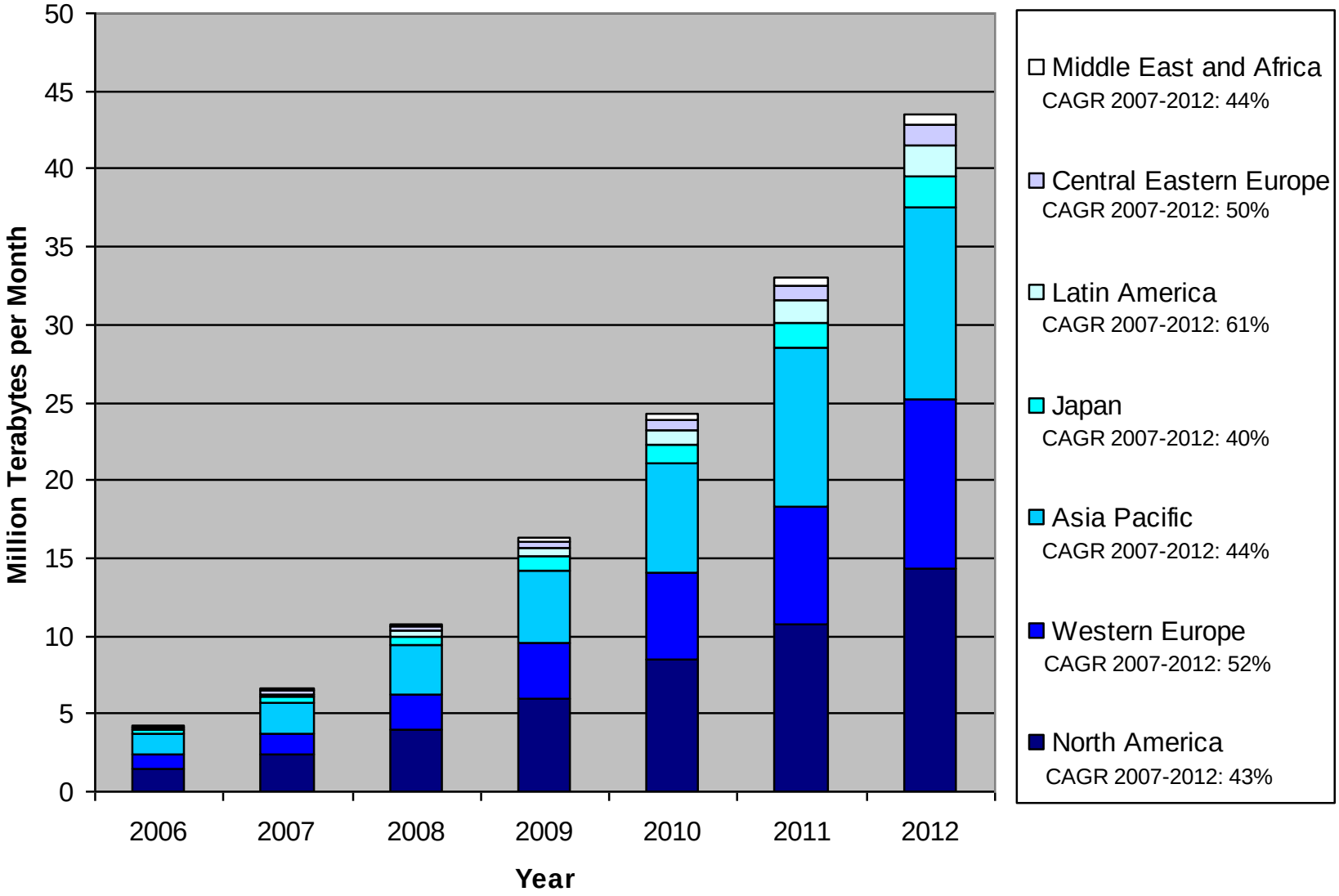
- **Cisco projects global IP traffic will experience a combined annual growth rate (CAGR) of 46% from 2007 to 2012, nearly doubling every two years[1]**
  - **In the consumer market, the forecast CAGR is 49% with video communications (video on demand, IPTV, peer-to-peer video, Internet video) being forecast to drive the greatest percentage of growth and to account for the majority of all consumer IP traffic in 2012**
  - **Business IP traffic is forecast to grow strongly at a CAGR of 35% from 2007 to 2012**

[1]Cisco Visual Networking Index — Forecast and Methodology, 2007–2012, 16 June 2008, Cisco Public Information, newsroom.cisco.com/visualnetworkingindex/

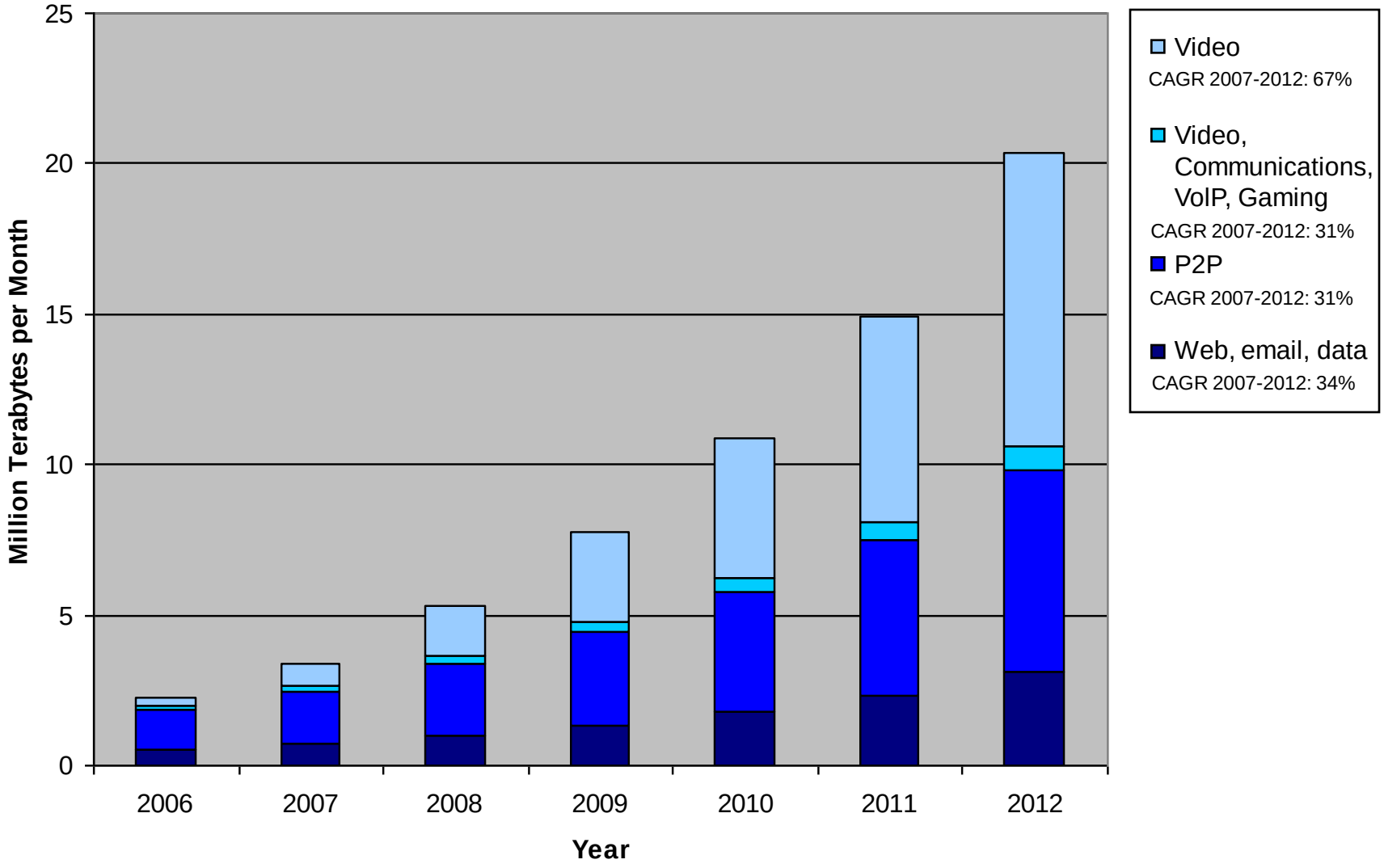
Global IP Traffic 2006 – 2012: By Segment



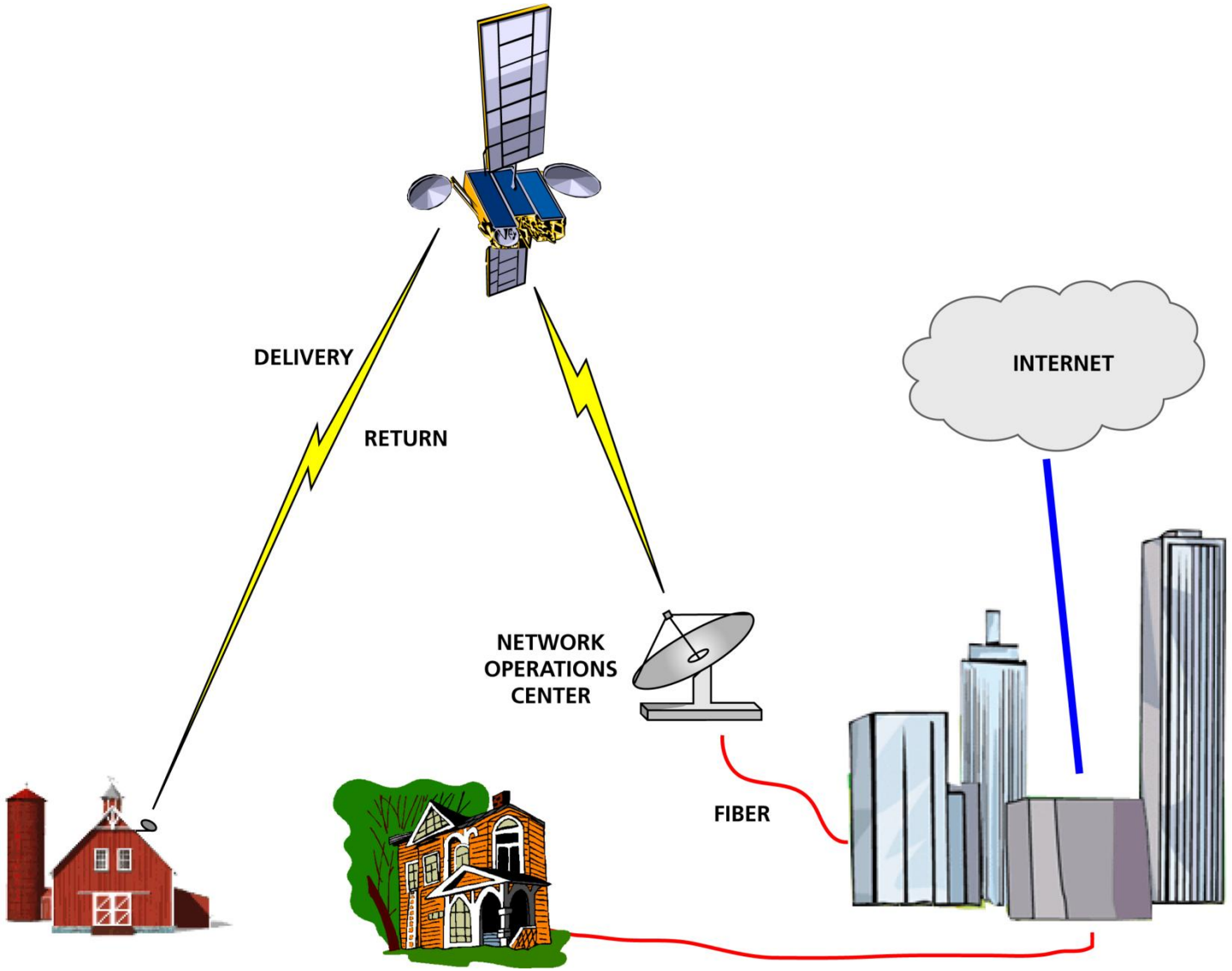
Global IP Traffic 2006 – 2012: By Geography



Global Consumer Internet Traffic 2006 – 2012: By Sub-Segment



Satellites Have Provided "Network Extension" Data Access Since the 1980s



Evolution of Satellite Technology for Network Access

- Satellite technology has evolved through two generations of data network access capability since the 1980s and will evolve to the third generation in the next few years.
- Each succeeding generation has improved performance and reduced costs
- The earlier deployments of satellite technology for connectivity to the telephone network in remote, unwired locations were based on analog technology and pre-Internet Protocol (IP) digital technology that were subject to bandwidth limitations and quality limitations due to such artifacts as echo and excessive delay (latency)
- By combining the increased bandwidth available on newer, higher capacity satellites with the advanced processing surrounding the transmission of IP data, these artifacts have been greatly reduced, throughput and quality have been increased, and costs have been reduced
- In the next few years, third generation technology will extend these improvements so that NBN-compatible performance, i.e., ≥12 Mb/s download speeds, can be achieved for Australians located beyond the practical reach of wired FTTP solutions
- The following pages chronicle this evolution through three generations of technology and demonstrate the resultant benefits for Australians

“First Generation” Satellite Broadband VSAT Systems

- 1980s to present
- 56 kbps – 256 kbps throughput per user
- Primarily business networks for corporate users with dispersed operations
  - “Point of Sale” transaction verification for retail companies
  - Corporate LAN extension to all locations
- Characterized by bursty data usage with limited need for continuous, real-time circuits
- Early systems deployed before general availability of Internet and designed with proprietary, non-IP-based standards
- Typically use a portion of a transponder on a satellite shared among many customers and applications
- Enabled by satellite modem and terminal technology from companies such as Hughes Network Systems, Gilat, ViaSat, others
- “Business grade” VSAT terminals costing US $5,000 – US $10,000

“Second Generation” Satellite Broadband VSAT Systems

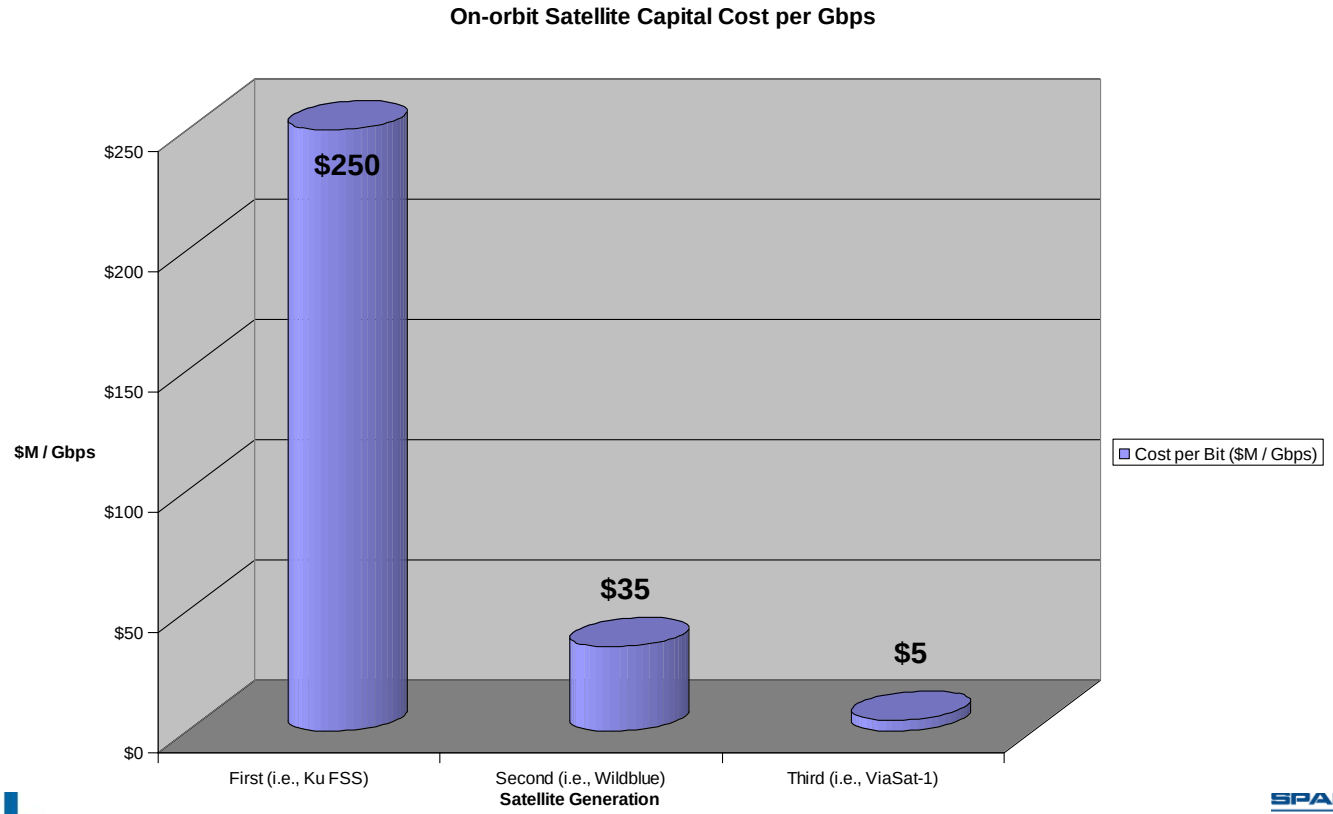
- Systems launched 2005 – 2007
- 256 kbps – 3 Mbps throughput per user
- “Born of the Internet Age” to extend Internet connectivity and feature-rich applications to underserved users
- Majority of current customers are consumers and small businesses
- Largest systems use dedicated satellites (IPSTAR, Wildblue, Spaceway) and are migrating from Ku-band to Ka-band to increase system capacity and user throughput via high-gain spot beams with frequency re-use
- Enabled by integration of IP routing technology and IP Quality of Service (QoS) management with software-defined modems and advanced coding and modulation schemes resulting in smaller, more capable “consumer-grade” VSAT terminals costing ~US $500
- Introduced advanced latency-management technology
  - Compensating for latency-sensitive TCP/IP protocols via Protocol Enhancing Proxy (PEP) to allow TCP/IP transmission over satellite links at arbitrarily high data rates
  - Accelerating latency-sensitive applications via pre-fetching of subsequently requested and commonly requested information to reduce response time
  - Prioritizing traffic to meet timing and jitter requirements
  - Compressing IP headers and payloads to reduce transmission time

“Third Generation” Satellite Broadband VSAT Systems

- Systems planned for launch starting 2010
- Throughput per user compatible with ADSL2+ ≥12 Mbps
- Designed to deliver video-driven capacity requirements of the next generation Internet applications
- Will use dedicated satellites with ~100 Gbps capacities that are 10x “second generation” system capacities of ~10 Gbps
  - Each satellite can serve up to 2-3 million users
  - The instantaneous throughput per user can be as high as ~100 Mbps
- Enabled by high power Ka-band spot-beam satellites with efficient frequency re-use and next-generation terminal modems that increase physical layer capacity 10x from ~50 Mb/s to ~500 Mb/s in VSAT terminals costing under US $500 with a clear trend towards even lower prices
- The first third-generation satellite systems KA-SAT and ViaSat-1 will be deployed in 2010 and 2011 to serve Europe, the United States, and Canada

Cost Reductions Across Three Generations of Satellite Technology

- **Third generation satellite and terminal technology is increasing by ~10x the capacity per satellite, reducing the cost per bit and increasing average throughput per subscriber**
  - **Bandwidth per spot beam increasing from ~50 MHz to ~500 MHz**
  - **Data receiving capacity of consumer VSAT terminals increasing from ~80 Mb/s to ~800 Mb/s while keeping cost < $500**

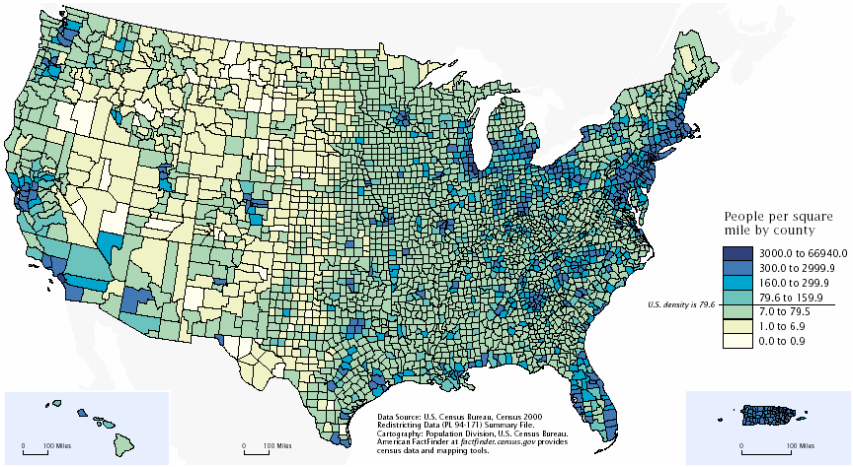


Evolution of Three Generations of Satellite Broadband Systems

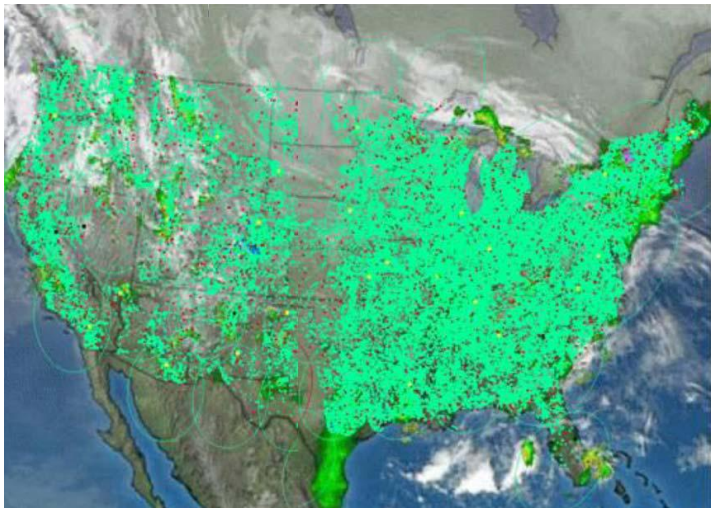
Characteristic	First Generation	Second Generation	Third Generation
Timeframe of Operation	1980s to present	mid 2005 to present	2010+
	Increasing Satellite Capacity		
Satellite Capacity	1 Gbps	10 Gbps	100 Gbps
	Increasing Data Rate per User (Improved User Experience)		
Typical Data Rate per Terminal	56 kbps - 256 kbps	256 kbps - 3 Mbps	2 Mbps - 30 Mbps
	Increasing Number of Subscribers		
Maximum Number of Subscribers per Satellite	100,000 - 500,000	750,000 - 1,000,000	2 million - 3 million
Satellites	All FSS satellites; Example: Hughes leases 126 xpnders worldwide	IPStar; SES ASTRA2Connect; Eutelsat TooWay; Wildblue; Telesat; Spaceway	ViaSat-1; KA-SAT; KaComm; SpaceWay 4
Satellite Payload Characteristics	24 Ku-band transponders w/ regional coverage & 36 - 72 MHz bandwidth	Ku-band & Ka-band spot beams w/ 36 - 72 MHz bandwidth	Ka-band spot beams w/ ~500 MHz bandwidth
Major VSAT Terminal Suppliers	Hughes, Gilat, ViaSat, iDirect	Hughes, Gilat, ViaSat, iDirect	Hughes, Gilat, ViaSat, iDirect
Cost of VSAT Terminal	$5,000 - $10,000	$500 - $1,000	< $500
Typical Applications	Point-of-sale transactions	Broadband access for enterprise & consumer	Broadband access for enterprise & consumer
Data Protocol	Proprietary and non-IP based	IP based	IP based
Connection Type	Bursty; Non-real-time data	Continuous; VoIP & video streaming capable	Continuous; VoIP & video streaming capable

Status in North America: Spaceway, Telesat, and Wildblue

- These three suppliers have amassed ~900,000 subscribers in 2-3 years of service time (with Hughes incorporating legacy DirectPC customers)
  - Hughes and Wildblue adding 15,000 subscribers per month each
  - ~5 million U.S. homes will be unwired for broadband anytime soon
- Satellite Broadband subscribers follow the population



U.S. Population Density



Satellite Broadband Subscriber Distribution

Comparison of Existing Second Generation Systems

Characteristic	IPSTAR	SES ASTRA2Connect	Eutelsat TooWay
Service Area	Southeast Asia — 14 nations	Europe	Europe
Launch Date	August 2005	March 2007	August 2007
Satellite and Orbital Location	IPSTAR @ 120 EL	Astra 1E @ 23.5 EL	Hotbird 6 @13 EL for Ka service; Eurobird 3 @ 33 EL for Ku service
Band	Ku-band to users; Ka-band feeder links	Ku-band	Ku-band and Ka-band
Number Spot Beams	84 user beams; 14 feeder link beams	Europe regional beam	4 Ka-band transponders with Europe regional beam; Ku regional beam
Satellite Payload Type	Bent Pipe	Bent Pipe	Bent Pipe
User Terminal Antenna Size	120 cm – 180 cm	80 cm	96 cm Ku; 67 cm Ka
Maximum Throughput per User	256 kbps up (consumer); 256 kbps – 2 Mbps down (consumer)	128 kbps up: 1 Mbps down	156 kbps (Ku); 384 kbps (Ka) (up); 2 Mbps (Ku and Ka) (down)
System Capacity (throughput)	20 Gbps	~50 Mbps per transponder	~50 Mbps per transponder
Maximum Number of Users	5 million	~20,000 per transponder	~20,000 per transponder 2 million on Ka-Sat
Subscribers Realized	146,810 in 2Q 08	30,000 YE 2008	2,800 terminals with 11,000 equivalent customers YE 2008

Comparison of Existing Second Generation Systems (Cont'd)

Characteristic	WildBlue	Telesat	Spaceway
Service Area	United States	Canada	United States
Launch Date	December 2006	July 2005	August 2007
Satellite and Orbital Location	WildBlue 1 @ 111.1 WL	Anik F2 @ 111.1 WL Anik F3 @ 118.7 WL	Spaceway 3 @ 95 WL
Band	Ka-band	Ka-band	Ka-band
Number Spot Beams	65 (30 on F2 + 35 on WB-1)	16 (15 on F2 + 1 on F3)	-110 hopping beams 68 transponders
Satellite Payload Type	Bent Pipe	Bent Pipe	Processing
User Terminal Antenna Size	66 cm	66 cm	75 cm
Maximum Throughput per User	256 kbps up; 1.5 Mbps down	500 kbps up; 2 Mbps down	128 kbps – 500 kbps up; 750 kbps – 3 Mbps down
System Capacity (throughput)		~1 Gbps	10 Gbps
Maximum Number of Users	750,000	150,000	600K to 1 million
Subscribers Realized	390,000 in March 2009	~50,000	455,000 on 3/31/09 with 148,000 on Spaceway;

Third Generation Satellite Broadband Systems Will Bring the Benefits of the National Broadband Network to All Australians

- Within the five-year roll-out timeframe of the NBN, third-generation broadband satellite systems will be online delivering ADSL2+ compatible (≥12 Mbps) broadband services ubiquitously to all users throughout the satellite footprint
- KaComm Communications Pty Ltd, an Australian company, in partnership with Space Systems/Loral and Loral Space and Communications, seeks to use third-generation satellite broadband to extend the NBN to all residents of Australia and New Zealand, especially those in rural and remote areas
  - KaComm has signed a Deed of Agreement with the Australian Communications and Media Authority (ACMA) and submitted filings to the International Telecommunication Union (ITU) giving it access to four excellent Ka-band orbital slots for the service: 137.9° EL, 152° EL, 154° EL, and 160° EL
  - Space Systems/Loral built the IPSTAR and Wildblue satellites, and is building the ViaSat-1 satellite
  - Loral has successfully managed several space-based programs and is 2/3 owner of the fourth largest global satellite services company, Telesat
  - Third-generation terminal technology will be developed for the KA-SAT and ViaSat-1 programs

Australia's National Broadband Network Will Deliver Next Generation Internet Capabilities

- The National Broadband Network will be the single largest investment in broadband infrastructure in Australia's history
  - Up to $43 billion committed for roll-out over five year period
- Will deliver download speeds of up to 100 Mbps to 90% of Australian homes and businesses
- Satellite broadband can be used to extend the National Broadband Network to the remaining 10% of Australian homes and businesses in rural locations and, in fact, in any location that proves to be efficient for satellite service
- BuddeComm[1] estimates that broadband will add over $100 billion to the Australian economy

[1]BuddeComm is an independent global telecommunications research and consultancy group based in Bucketty, Australia