



IPv6, More Than Your Desktop

Air Force Network Integration Center

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UNCLASSIFIED

- **1837 – Commercial electric telegraph**
- **1866 – First reliable Trans-Atlantic cable**
- **1956 – Trans-Atlantic telephone cable**
- **1957 – DARPA created by Eisenhower in response to Sputnik**
- **1958 – Under-sea cables connecting the civilized globe**
- **1969 – ARPANET goes live between UCLA and Stanford**
- **-- Man landed on the moon**
- **1983 – TCP/IP(v4) replaces Network Control Program**
- **1983 – First commercial cellular service begins**
- **1990 – ARPANET merges with the NSFNET**
- **1992 – First commercial text message over cell phone**
- **1995 – US Gov transfers management to independent organizations and IPv6 first recommended in RFC 1752**
- **2000 – Digital Wireless users outnumber analog subscribers**
- **2003 – First official Swiss online election**
- **2004 – More instances of DNS root servers outside US and CERNET2 stood up as the first IPv6 backbone in China**

- **Internal combustion engine**
 - **Enabled: propulsion**
 - **Application: trains, planes, ships, and automobiles**

- **Electric power transmission**
 - **Enabled: distributed power**
 - **Application: industry, refrigeration, light**

- **Telegraph**
 - **Enabled: faster communication**
 - **Application: global trading, near real time global news**

- **Internet**
 - **Enabled: packet switching – robust, survivable networks**
 - **Application: file sharing, World Wide Web, remote access**

- **Current Network**
 - **Human-centric**
 - **Limited by maintainable connections**
 - **Desktop, laptop, VOIP phone, routers, servers, net monitoring (work)**
 - **Laptop, DVR, cell phone(s), router, tablet(s) (home)**
- **Future networks**
 - **Human interaction will be minority of network traffic**
 - **Autonomous machines, sensors, sentient programs**
 - **Current + entry control, emergency response systems, environmental control (work)**
 - **Current + environmental control, travel (home)**



Surfboard



Scale



Refrigerator

Internet Access & Control
Multiple programs allow you to control and see the status of your home from anywhere via the Internet.

Energy Management
Be comfortable at home; save energy when away. Control temperatures in greenhouses, humidors, wine cellars, aquariums, & attics. HAI's communicating programmable thermostats for heating and cooling control easily monitors energy use.

Multi-Room Audio
Share your favorite music throughout every zone of your home. No expensive proprietary components are required.

Motion Detection
Detect intrusion, automatically turn on lights, and activate automation functions when entering a room.

Pool & Spa
Secure pool areas with access control. Control pumps, filters, timers, heating, temperatures, solar control, and more.

Home Theater
Use an HAI Touchscreen or an iPad to control your theater and home automation functions.

Lighting
Set warm and comfortable moods for dining, movies or entertaining. Have lights automatically turn off when leaving your home. Provide architectural quality lighting control and passive security for the "lived-in" look when on vacation.

Irrigation
Control irrigation solenoid valves for lawn sprinklers, plus inputs for rain sensing.

Surveillance Cameras
View and/or record guests arriving at the front door, or check on kids in the pool from any Touchscreen or the Internet.

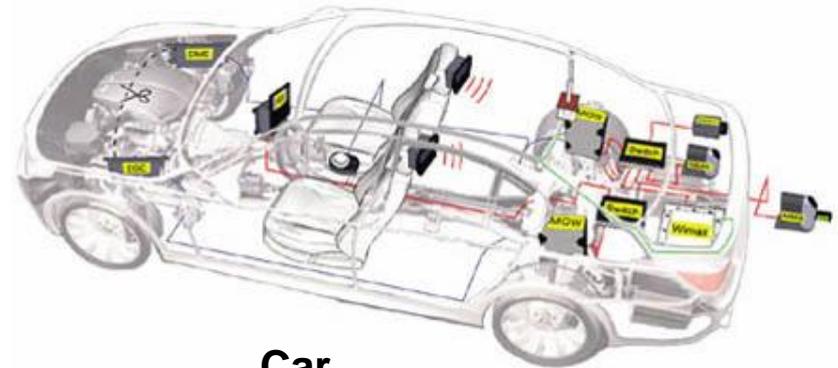
Access Control
Limit admission to designated areas. When you swipe a card or key tag, security arms or disarms and door strikes are activated. Video intercom confirms who has arrived.

Security
Professional quality UL Listed security is built-in to HAI's Omni family controllers. If desired, Lamina family controllers can integrate with an existing security system.

Telephones
Check and adjust security, temperatures, and lights via any phone at home or away. Monitor and control with your Smartphone or iPhone.

Vehicle Detection
Announce visitors, turn on lights, and switch on a television to view the driveway or other outdoor area.

Home



Car

WORLD INTERNET USAGE AND POPULATION STATISTICS December 31, 2011

World Regions	Population (2011 Est.)	Internet Users Dec. 31, 2000	Internet Users Latest Data	Penetration (% Population)	Growth 2000-2011	Users % of Table
Africa	1,037,524,058	4,514,400	139,875,242	13.5 %	2,988.4 %	6.2 %
Asia	3,879,740,877	114,304,000	1,016,799,076	26.2 %	789.6 %	44.8 %
Europe	816,426,346	105,096,093	500,723,686	61.3 %	376.4 %	22.1 %
Middle East	216,258,843	3,284,800	77,020,995	35.6 %	2,244.8 %	3.4 %
North America	347,394,870	108,096,800	273,067,546	78.6 %	152.6 %	12.0 %
Latin America / Carib.	597,283,165	18,068,919	235,819,740	39.5 %	1,205.1 %	10.4 %
Oceania / Australia	35,426,995	7,620,480	23,927,457	67.5 %	214.0 %	1.1 %
WORLD TOTAL	6,930,055,154	360,985,492	2,267,233,742	32.7 %	528.1 %	100.0 %

NOTES: (1) Internet Usage and World Population Statistics are for December 31, 2011. (2) CLICK on each world region name for detailed regional usage information. (3) Demographic (Population) numbers are based on data from the [US Census Bureau](#) and local census agencies. (4) Internet usage information comes from data published by [Nielsen Online](#), by the [International Telecommunications Union](#), by [GfK](#), local Regulators and other reliable sources. (5) For definitions, disclaimers, and navigation help, please refer to the [Site Surfing Guide](#). (6) Information in this site may be cited, giving the due credit to [www.internetworldstats.com](#). Copyright © 2001 - 2012, Miniwatts Marketing Group. All rights reserved worldwide.

RIR Address Pool Exhaustion

IANA UNALLOCATED ADDRESS POOL EXHAUSTION **FEBRUARY 3, 2011**



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 - **Enabled: distributed power**
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 - **Enabled: packet switching – robust, survivable networks**
 - **Application: file sharing, World Wide Web, remote access**
- **IPv6**
 - **Enabled: limitless, scalable networks**
 - **Application: end-to-end communication, machine dominant networks**

- **Communication w/coalition & commercial partners**
- **IPv6 is a 'killer enabler' of future capabilities (e.g., true mobility, sensors & ad-hoc networks, Unified Capabilities)**
- **Key component of Network Centric-Warfare**
 - **Sensors and devices directly connect to the network**
 - **End-to-end Traceability**
 - **Enables P2P model with end-to-end security - IPSec built-in**
 - **Neighbor discovery and self-forming networks (auto-configuration)**
- **Expanded address space (3.4×10^{38})**
 - **Enables "everything over IP" capabilities**
- **Features built-in, multilevel-security compatibility**
 - **Authentication and privacy**
 - **IPSec**

- **Reduces network complexities eliminating old network workarounds and enabling new features**
 - **Eliminates need for NAT**
 - **Simplified header (40 bytes)**
 - **Extension headers and options**
- **Source routing (no fragmentation)**
- **Flow labels (QoS)**
- **Leverage emerging technologies in air, space and cyberspace domains mutually supporting the joint construct**
 - **Sensors, UAV storming, force protection, safety, and logistics**

It's impossible to fully predict how IPv6 will be used... but we know it will spur innovation!

Rapid and agile IT infrastructures with the capability to “discover” adjacent network systems and plug-n-play enable quicker, more dynamic responses..



Ubiquitous, robust and scalable end-to-end networks enable integrated operations.

Proliferation of IP addressed Sensors, munitions, logistics tracking, applications, ...will enhance situational assessments and information availability.



IPv6 Enabled Battlefield of the Future

Real time collaboration using integrated voice, video and data capabilities enabled by performance and QoS improvements.



Increased OPTEMPO supported by rapid reorg capabilities, shared situational awareness and improved wireless and mobility support. Support for communications on the move.

End-to-end security, authentication and nonrepudiation Will enable new IA strategies that support mission assurance.



- **Established in July 2003**
- **Supported Joint criteria testing**
- **Guide AF transition as the link between SAF and operations**
- **Develop, regulate, and control AF transition to IPv6**
- **Develop and publish AF IPv6 transition guidance**
- **Assist AF organizations with transition efforts**
- **Monitor all IPv6 activities and IT investments and report status quarterly to SAF CIO**
- **Represents the AF at DoD and other service IPv6 working groups (Army, Navy, and VA)**

- **2009 FAR Update - Requires all IT purchases to include IPv6 requirement beginning Jul 10**
- **28 Sep 2010 OMB memo - Federal CIO directs all Federal agencies to enable IPv6 in 2 phases:**
 - **“Upgrade public/external facing servers and services (e.g., web, email, DNS, ISP services, etc.) to operationally use native IPv6 by the end of FY 2012”**
 - **“Upgrade internal client applications that communicate with public Internet servers and supporting enterprise networks to operationally use native IPv6 by the end of FY 2014”**
- **7 Mar 2011 DoD memo – Restates OMB requirements, adds interim deadlines to ensure services on track**

- **IPv6 Enclaves**
 - **Initial DoD implementation method**
 - **Limited environment**
 - **Eglin AFB infrastructure**
 - **Requesting core services**
- **Enterprise Information Technology Data Repository (EITDR) is the AF system of record and compliance reporting tool for all AF IT investments**
- **TMO uses EITDR to report IPv6 readiness to SAF CIO**
 - **2487 Investments**
 - **62.6% AF IP-based IT investments report IPv6 capable**
 - **76.2% of NIPRNet enclaves reported as IPv6 capable**

- **World IPv6 Day: 8 Jun 11**
 - **400+ websites participated in World IPv6 Day joining together to make it a successful IPv6 global-scale trial**
 - **Military websites: AF.mil, Navy.mil & DoD.gov**
 - **Public websites: Google, Facebook & Yahoo!**
 - **Service providers: Akamai, Limelight Networks & Hurricane Labs**
 - **AFNIC hosted IPv4 & IPv6 workstations allowing user comparison of participating sites**
 - **IPv6 traffic increased, but minimal compared to IPv4**
- **World IPv6 Launch Day: 6 Jun 12**
 - **Global permanent enabling of some IPv6 sites across the Internet**
 - **www.af.mil permanently enabled to support v4/v6**
- **All AF PA sites to support v4/v6 by 30 Sep 12**

- **Continue with enclave implementation efforts**
- **Identify public-facing servers & enable IPv6 (end of FY12)**
- **Enable IPv6 on NIPRNet (end of FY14)**
- **Keep AF strategy aligned w/DoD transition strategy**
- **Ensure each IT program plans for its own IPv6 transition and funding**
 - **IPv6 transition primarily occurring via tech refresh**
 - **Non-infrastructure programs enable IPv6 per own schedules after core infrastructure**
- **No sundown date established by DoD for IPv4**

- **Network equipment**
 - **Need greater maturity in IPv6 products (e.g., firewalls, forensic tools, IDS, IPS, and network/address management)**
- **Budget management**
 - **Upgrade via tech refresh effects timeline**
 - **Operator training/readiness**
- **Operational assurance/risk**
 - **Maintain interoperability/security throughout transition**
 - **Training**
 - **Evolving IPv6 standards**
 - **Accommodate residual legacy systems**

- **IPv6 is critical to achieving DoD's net-centric vision and allows next generation of advanced applications**
- **Challenges/dependencies in DoD IPv6 transition:**
 - **Managing/resourcing the transition within existing budgets**
 - **Maintaining interoperability and security during/after the transition**
 - **Accommodating residual legacy equipment**
- **Requirements for IPv6 capability have been integrated into acquisitions/technology refreshment**
- **Transition strategy: networks first; then systems/applications**
- **We must change the way we perceive our networks**
- **We must implement "killer enablers" before we can implement or even realize "killer applications"**

Video available at:

<http://www.youtube.com/watch?v=-Uwjt32NvVA>

**“The future belongs to those who prepare for it”
- Ralph Waldo Emerson**



*Enterprise perspective...
The AFNIC Advantage!*



Enterprise perspective...The AFNIC Advantage!