IPv6 Applications

Dakar, Sénégal
24 -26 Octobre 2006

Philippe.Bereski@alcatel.fr
Simon.Muyal@renater.fr
Bernard.Tuy@renater.fr

Copy …Rights

- *This slide set is the ownership of the 6DISS project via its partners*
- *The Powerpoint version of this material may be reused and modified only with written authorization*
- *Using part of this material must mention 6DISS courtesy*
- *PDF files are available from www.6dis.org*
- *Looking for a contact ?*
  - *Mail to : martin.potts@martel-consulting.ch*
  - *Or bernard.tuy@renater.fr*

Introduction

- Most IPv4 Applications can be IPv6 enabled
  - If certain precautions are taken
  - Good Programming discipline is applied
- If there are IPv4 and IPv6 versions, most can be made dual stack
- Benefiting from IPv6 is much more difficult
  - Requires assumptions on underlying stacks
- Particularly satisfactory if written in a language that allows for IPv6
  - Java is good example

Effects on higher layers

- Changes TCP/UDP checksum “pseudo-header”
- Affects anything that reads/writes/stores/passes IP addresses (just about every higher protocol)
- Packet lifetime no longer limited by IP layer (it never was, anyway!)
- Bigger IP header must be taken into account when computing max payload sizes
- New DNS record type: AAAA
- …

Sockets API Changes

- Name to Address Translation Functions
- Address Conversion Functions
- Address Data Structures
- Wildcard Addresses
- Constant Additions
- Core Sockets Functions
- Socket Options
- New Macros

Core Sockets Functions

- Core APIs
  - •Use IPv6 Family and Address Structures
  - •socket() Uses PF_INET6
- Functions that pass addresses
  - •bind()
  - •connect()
  - •sendmsg()
  - •sendto()
- Functions that return addresses
  - •accept()
  - •recvfrom()
  - •recvmsg()
  - •getpeername()
  - •getsockname()

Name to Address Translation

- getaddrinfo()
  - Pass in nodename and/or servicename string
    - Can Be Address and/or Port
  - Optional Hints for Family, Type and Protocol
    - Flags – AI_PASSIVE, AI_CANNONNAME, AI_NUMERICHOST, AI_NUMERICSERV, AI_V4MAPPED, AI_ALL, AI_ADDRCONFIG
  - Pointer to Linked List of addrinfo structures Returned
    - Multiple Addresses to Choose From
- freeaddrinfo()

```
int getaddrinfo(
    IN const char FAR * nodename,
    IN const char FAR * servname,
    IN const struct addrinfo FAR * hints,
    OUT struct addrinfo FAR * FAR * res
    );
```

```
struct addrinfo {
    int ai_flags;
    int ai_family;
    int ai_socktype;
    int ai_protocol;
    size_t ai_addrlen;
    char *ai_canonname;
    struct sockaddr *ai_addr;
    struct addrinfo *ai_next;
    };
```

Address to Name Translation

- getnameinfo()
  - Pass in address (v4 or v6) and port
    - Size Indicated by salen
    - Also Size for Name and Service buffers (NI_MAXHOST, NI_MAXSERV)
  - Flags
    - NI_NOFQDN
    - NI_NUMERICHOST
    - NI_NAMEREQD
    - NI_NUMERICSERV
    - NI_DGRAM

```
int getnameinfo(
    IN const struct sockaddr FAR * sa,
    IN socklen_t salen,
    OUT char FAR * host,
    IN size_t hostlen,
    OUT char FAR * serv,
    IN size_t servlen,
    IN int flags
    );
```

Porting Environments

- Node Types
  - IPv4-only
  - IPv6-only
  - IPv6/IPv4
- Application Types
  - IPv6-unaware
  - IPv6-capable
  - IPv6-required
- IPv4 Mapped Addresses

Porting Issues

- Running on ANY System
  - Including IPv4-only
- Address Size Issues
- New IPv6 APIs for IPv4/IPv6
- Ordering of API Calls
- User Interface Issues
- Higher Layer Protocol Changes

Specific things to look for

- Storing IP address in 4 bytes of an array.
- Use of explicit dotted decimal format in UI.
- Obsolete / New:
  - AF_INET replaced by AF_INET6
  - SOCKADDR_IN replaced by SOCKADDR_STORAGE
  - IPPROTO_IP replaced by IPPROTO_IPV6
  - IP_MULTICAST_LOOP replaced by SIO_MULTIPOINT_LOOPBACK
  - gethostbyname replaced by getaddrinfo
  - gethostbyaddr replaced by getnameinfo

IPv6 literal addresses in URL's

- From RFC 2732

Literal IPv6 Address Format in URL's Syntax To use a literal IPv6 address in a URL, the literal address should be enclosed in "[" and "]" characters. For example the following literal IPv6 addresses: FEDC:BA98:7654:3210:FEDC:BA98:7654:3210

3ffe:2a00:100:7031::1

::192.9.5.5

2010:836B:4179::836B:4179

would be represented as in the following example URLs:

http://[FEDC:BA98:7654:3210:FEDC:BA98:7654:3210]:80/index.html

http://[3ffe:2a00:100:7031::1]

http://[::192.9.5.5]/ipng

http://[2010:836B:4179::836B:4179]

Other Issues

- Renumbering & Mobility routinely result in changing IP Addresses –
  - Use Names and Resolve, Don't Cache
- Multi-homed Servers
  - More Common with IPv6
  - Try All Addresses Returned
- Using New IPv6 Functionality

Porting Steps -Summary

- Use IPv4/IPv6 Protocol/Address Family
- Fix Address Structures
  - in6_addr
  - sockaddr_in6
  - sockaddr_storage to allocate storage
- Fix Wildcard Address Use
  - in6addr_any, IN6ADDR_ANY_INIT
  - in6addr_loopback, IN6ADDR_LOOPBACK_INIT
- Use IPv6 Socket Options
  - IPPROTO_IPV6, Options as Needed
- Use getaddrinfo()
  - For Address Resolution

Heterogeneous Environments

Precautions for Dual Stack

- **Avoid any explicit use of IP addresses**
  - **Normally do Call by Name**
- **Ensure that calls to network utilities are concentrated in one subroutine**
- **Ensure that libraries and utilities used support both stacks**
- **Do not request utilities that would not exist in both stacks**
  - **E.g. IPsec, MIP, Neighbour Discovery may vary**

New Applications

- For new Apps, some can use high-level language
  - JAVA fully supports dual stack
- Examples of utilities that must so support
  - DNS, SSH, FTP, Web server, Resource Location
- Examples of libraries and applications that must so support
  - RTP library, NTP time protocol, Web browser, IPsec library

Legacy Applications

- If most parts are written in say Java, and small parts in say C, try to rewrite C part to be in Java or at least make sure that I/O is concentrated in certain regions
- Potentially re-arrange code so that it fits needs of earlier slide
- Adjust I/f to code to fit dual-stack specs
  - Or do all networking via a utility which is IPv6-enabled
  - VIC, RAT using RTP are good example

Heterogeneous IPv4/IPv6 Environments

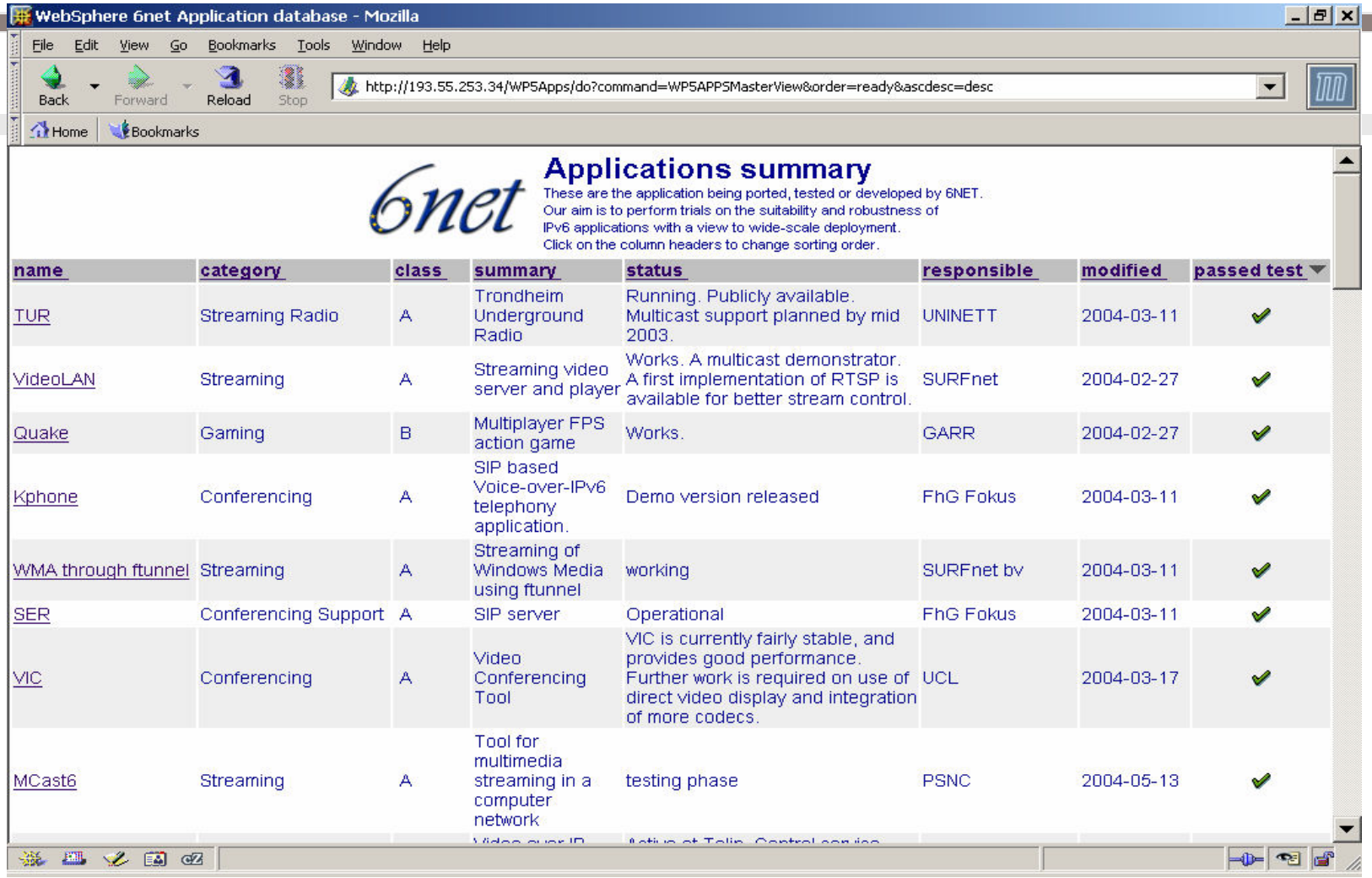
- May require dual-stack client/server, accessible by both stacks
  - Often used, for example, with Web services and with SIP signalling
- May require transition gateway
  - As for example with IPv4 telephones accessing other IPv6 ones
- May be very difficult, as when encrypted IPv4 messages are passed into the IPv6 networks with packet header encrypted, or certificate cryptographically bound to IP4 address

Available Applications

Available IPv6 Enabled Applications

- Many have been tested under 6NET, Description given in http://6net.iif.hu/ipv6_apps
- Most currently useful utilities exist, e.g.
  - SIP, WWW, RTP, SSH, MIP, IPsec, NTP
- 6NET Deliverables discuss their use
  - Particularly those of WP5

6net Application DB



6net

Applications summary

These are the application being ported, tested or developed by 6NET.
Our aim is to perform trials on the suitability and robustness of
IPv6 applications with a view to wide-scale deployment.
Click on the column headers to change sorting order.

name	category	class	summary	status	responsible	modified	passed test
TUR	Streaming Radio	A	Trondheim Underground Radio	Running. Publicly available. Multicast support planned by mid 2003.	UNINETT	2004-03-11	✔
VideoLAN	Streaming	A	Streaming video server and player	Works. A multicast demonstrator. A first implementation of RTSP is available for better stream control.	SURFnet	2004-02-27	✔
Quake	Gaming	B	Multiplayer FPS action game	Works.	GARR	2004-02-27	✔
Kphone	Conferencing	A	SIP based Voice-over-IPv6 telephony application.	Demo version released	FhG Fokus	2004-03-11	✔
WMA through ftunnel	Streaming	A	Streaming of Windows Media using ftunnel	working	SURFnet bv	2004-03-11	✔
SER	Conferencing Support	A	SIP server	Operational	FhG Fokus	2004-03-11	✔
VIC	Conferencing	A	Video Conferencing Tool	VIC is currently fairly stable, and provides good performance. Further work is required on use of direct video display and integration of more codecs.	UCL	2004-03-17	✔
MCast6	Streaming	A	Tool for multimedia streaming in a computer network	testing phase	PSNC	2004-05-13	✔

Applications/Services

- Basic applications
  - MUAs, MTAs
  - Web browsers & servers,
  - FTP, SSH, Telnet
- Advanced applications
  - Videoconferencing tools, streaming, …
  - Editors, Games, …
  - Management and monitoring tools

Basic applications: Mail

- Server:
  - Qmail (Unix/Linux/xBSD)
  - Sendmail (Unix/Linux/xBSD)
  - …
- Client:
  - Thunderbird (all platforms)
  - Inframail (windows/xBSD)
  - …

Basic applications: Web

- Server:
  - Apache2 (all platforms)
  - thttpd (Unix/Linux/xBSD)
  - …
- Client:
  - Firefox (all platforms)
  - Internet Explorer (windows)
  - Wget (Unix/Linux/xBSD)
  - …

Basic applications: FTP

- Server:
  - Ftpd(Unix/Linux/xBSD)
  - Pure-ftpd(all platforms)
  - …
- Client:
  - Filezilla (all platforms)
  - Ncftp (Windows, MAC, Linux)
  - Fget (Unix/Linux/xBSD)
  - …

Basic applications: SSH,telnet

- Server:
  - sshd (Unix/Linux/xBSD)
  - Openssh (Unix/Linux/xBSD)
  - telnet (Unix/Linux/xBSD)
- Client:
  - puTTY (all platforms)

Advanced applications

- Videoconferencing tools, streaming:
  - Three degrees (windows)
  - Videolan (all platforms)
    - IPv6 unicast/multicast streaming
  - Gnome meeting (Linux)
    - H323 application
  - OpenH323 (all platforms)
  - ISABEL
  - DVTS

Advanced applications (2)

- Peer to peer applications
  - Three degrees (windows)
  - Gnutella (all platforms)
- Games
  - Quake3 (all platforms)
  - Xtris (Unix, Linux, xBSD)

Conclusion

- Some IPv4 existing applications are available in IPv6
  - Basic & Advanced
- New services/applications are based on IPv6:
  - Grids
  - Peer to peer