# IPV6 Initiative Status Report

## Review of overall project plan

The objectives of the IPv6 initiative are to enable IPv6 at WIS centres for WIS/GTS related exchanges, in particular, a rolling assessment of IPv6 capabilities of WMO Members, a capacity building strategy, update of technical regulations if necessary, and a pilot project for IPv6 based data exchange of meteorological data until 2016.

The IPv6 initiative consists of six main components: an assessment of current situation, a Review of WMO regulatory material, the Provision of guidance material, Raising of Members’ awareness of IPv6, the IPv6 Pilot, and reporting to ET-CTS and CBS.

The main parts of the project[1] are the IPv6 pilot project, the IPv6 capabilities assessment and the development of a capacity development strategy as well as the Provision of guidance material. The update of the regulatory material is expected to be trivial, as references to IPv4 can be updated or amended with IPv6 ones.

The first 2 years of the project have shown that a continued assessment of IPv6 requirements in the meteorological community is required. What is more, WMO Members are only starting to acquaint themselves with IPv6, as concrete operational IPv6 projects are not currently being implemented and the global context of IPv6 is one of uncertainty despite government efforts for IPv6 readiness.

## Review of activities in 2012/2013

The IPv6 initiative project plan foresees activities for deliverables “assessment of IPv6 capabilities”, “implement IPv6 pilot project”, “awareness raising” and “Provision of guidance material” to take place.

A survey of WMO Members IPV6 capabilities was successfully conducted in early 2013, the results of which are detailed in a separate document.

The IPv6 pilot project was to take place during 2013 and 2014. In 2013 IPv6 connectivity was to be established between the participating sites, and regular data exchange to be performed in late 2013 and 2014.

The pilot project established IPv6 connectivity between 6 IPv6 enabled sites, but no conclusions on the reliability of data exchange through these connections can yet be drawn since only few sites have exchanged regular traffic and reported on the stability of these connections. It showed that some but not all WMO Members interested in IPv6 are currently able to obtain native IPv6 connectivity through their Internet providers.

To raise Member’s awareness of IPv6 and the IPv6 Initiative in particular, an article was published in the RTH newsletter in Q2/2013.

The provision of guidance material was agreed to build on the outcomes of the IPv6 pilot project. No other work has so far been done on the guidelines, as the IPv6 pilot project is not yet completed.

## IPv6 pilot project

The IPv6 pilot is a subproject of the IPv6 Initiative with the objective to gather and share technical experience of IPv6 in a non-operational environment in order to support other parts of the IPv6 Initiative such as documentation.

The pilot began in 2013 with the following principles:

1. Two groups of participants - early adopters then wider community involvement;
2. Establish network layer communications before application layer (data transfer);
3. Data exchange methodologies agreed bilaterally between pilot participants.

### Pilot Participants

As of March 2014 the following pilot participants have confirmed IPv6 connectivity to the Internet:

* CMA (China)
* DWD (Germany)
* ECMWF
* Environment Canada
* INAMHI (Ecuador)
* JMA (Japan)
* Météo France
* NIMH (Bulgaria)

Most sites receive native IPv6 connectivity from their Internet Service Provider (often the national academic and research network). It is also possible to obtain IPv6 access to the Internet via a tunnel broker[3] service, where the local site remains on IPv4 only.

The IPv6 Initiative project team support the view that tunnel services are a temporary transition mechanism only, and therefore the documentation produced by this Initiative will not discuss tunneling mechanisms. Nevertheless, there is no reason to require native IPv6 connectivity for the pilot. Participating sites may need to deal with the limitations of tunneling as they arrange bilateral transfer agreements with other sites.

### Network Layer Communications

Each of the pilot participants is monitored for the stability and performance of their IPv6 connection to the Internet. The tool used for this is SmokePing[4], which sends several ICMP Echo messages to the targets every five minutes, and records changes in round-trip time (RTT). The Echo messages are sent from ECMWF and also from a server located with a commercial hosting provider[5] in France (OVH). In some cases firewalls at the remote sites will block this monitoring.

Below is a SmokePing graph for four participant sites:

Figure 1 - IPv6 ICMP Echo Monitoring from ECMWF Sites

It should be noted that the IPv6 connectivity between ECMWF’s two sources and each of the four sites has been very stable for many months. The RTT for IPv6 is comparable with that observed using IPv4.

### Data Transfer

A basic Linux-based software appliance[6] (TESLA) was made available to pilot participants to facilitate the activation of monitoring and data transfer. The system can be easily deployed as a bootable CD or VMware image, and is fully IPv6 enabled. A version of the system was used in the past for multicast and testing on the RMDCN.

The appliance has been used by most pilot participants to enable basic SmokePing monitoring. It also includes a rudimentary file transfer application based on FTP of synthetically generated data files. However, this is intended only as a proof-of-concept, and sites are encouraged to build a data transfer mechanism that more closely reflects the volume and type of data which they normally exchange. As agreed in the IPv6 Initiative plan, sites will establish bilateral data transfer agreements with other pilot participants, so there is no requirement for all sites to use the same technology or methodology.

### Current Status

According to the pilot project schedule, early adopters should have been connected by summer 2013 and regular data exchange commenced from September 2013 on. Later participants should have established IPv6 connectivity by the end of November 2013 and regular data exchange started from December 2013 on.

No regular bilateral data exchange has so far been reported by any sites, except ECMWF and NIMH using the proof-of-concept system in the TESLA appliance. The formation of a first and second wave of participants also did not happen in the way established by the plan, but sites joined one single group on an ad-hoc basis as they came online.

## Lessons Learned

Although the project is not complete, with the pilot underway and some parts not yet started, it is useful to review some issues observed so far by the project team:

* It takes some participants little effort and others a great deal of work (and time) to connect their sites to the IPv6 Internet. Any initiative depending on the community participating should take this into account.
* Perhaps it is optimistic to expect community members to spontaneously establish bilateral agreements and then design test methodologies from the ground up. It would be better to propose a framework on which the sites can easily build a solution.
* There are many resources on the Internet for technical best practices, but far fewer for other aspects such as: establishing a good business case for IPv6, integrating IPv6 into operational support practices, and a structured approach to deployment (hardware lifecycles, etc).

## Plans for 2014

### IPv6 Pilot

The pilot will continue and widen its participation to other members of the community who have gained IPv6 connectivity since 2013.

Regular data transfers should begin, and sites should be encouraged to form bilateral agreements for non-operational data exchange over IPv6, supported by the Initiative project team.

### Raising Awareness

Identify an “IPv6 advocate” per WMO region to help disseminate reference materials (both the products of this Initiative and also general resources from the Internet). Those occupying this role will first be trained and then can ensure that their local sites have up-to-date documentation and that questions are fed back to the Initiative project team.

### Reference Material

Review and update the ET-CTS reference materials such as Attachment II.15 (Use of TCP/IP on the GTS) and the Manual on WIS Information Systems to ensure the content remains relevant and accurate in an IPv6 context.

### Guidance Material

Prepare a document toolkit for those seeking to deploy IPv6, to include a draft business case, high-level technical recommendations, and discussion of security and network application aspects of IPv6.

## References

[1] IPv6 project plan

[2] [ET-CTS report 2012](http://www.wmo.int/pages/prog/www/ISS/Meetings/ET-CTS_Geneva2012/Report-ET-CTS_Geneva2012.doc)
http://www.wmo.int/pages/prog/www/ISS/Meetings/ET-CTS\_Geneva2012/Report-ET-CTS\_Geneva2012.doc (accessed 10 March 2014)

[3] [Hurricane Electric Tunnel Broker Service](https://tunnelbroker.net/)
https://tunnelbroker.net/ (accessed 10 March 2014)

[4] [SmokePing](http://oss.oetiker.ch/smokeping/)
http://oss.oetiker.ch/smokeping/ (accessed 10 March 2014)

[5] [OVH Dedicated Servers](http://www.ovh.co.uk/dedicated_servers/)
http://www.ovh.co.uk/dedicated\_servers/ (accessed 10 March 2014)

[6] [TESLA - Testing Services Linux Appliance](http://tesla.ecmwf.int/)
http://tesla.ecmwf.int/ (accessed 10 March 2014)

## Recommended Text

The Pilot network has been useful to gain knowledge of the issues surrounding commissioning of IPv6 Internet connectivity. However there remains no clear business case for operational deployment of IPv6 and this is likely to be the reason for bilateral data transfer on the Pilot having little or no uptake.

Taking into account other components of the IPv6 Initiative yet to be worked on, it is proposed to continue the Pilot network in its current form only (basic network connectivity), welcoming new Pilot participants in 2014, and then direct other effort within the Initiative to documentation review and production. Members of ET-CTS will support the Initiative through work on:

1. The RTH IPv6 Survey, which has been reviewed, and will be re-issued once more, in time to report at ET-CTS 2016
2. Establishing a draft business case
3. Reviewing the Guide to Information Technology Security (WMO doc No. 1115)

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