

ECMWF Status: Current IFS Benchmark and Fortran 2003 requirements

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History of the IFS

- **ECMWF Forecast System first developed in 1985**
 - Written in Fortran 77 with CRAY extensions
- **Re-written in Fortran 90 during 1993**
 - Implemented as the Integrated Forecast System in March 1994
- **3D Var Data Assimilation introduced in January 1996**
- **4D Var Data Assimilation introduced in November 1997**
- **Three or four upgrades of the operational system per year**
 - Includes both scientific and technical upgrades

Future evolution of IFS

Application	2007		2010	
	Horizontal	Vertical	Horizontal	Vertical
4D-Var	T799 (25 km) (T95/159/255)	91	T1279 (16 km) (T399)	135
Deterministic forecast (10 day)	T799 (25 km)	91	T1279 (16 km)	135
EPS forecast (10 day)	T399 (50 km)	62	T639 (32 km)	90

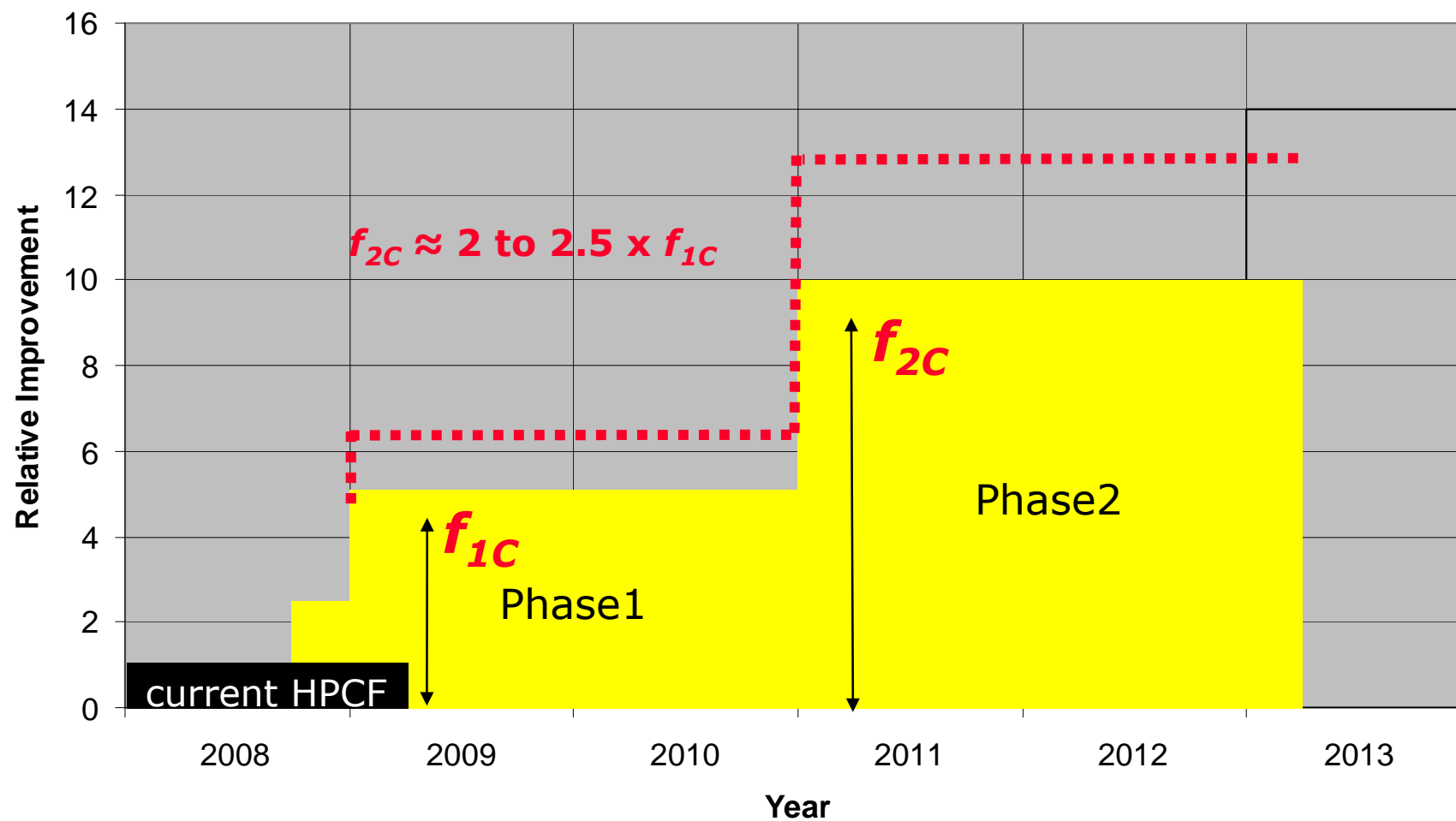
- **ECMWF Strategy (2006-2015) calls for a sustained performance of 20 TFlops by early 2009 with a gradual increase to 150-200 (sustained) TFlops by 2015**

Acquisition of new HPCF

- **Invitation to Tender issued 30 March 2007**
 - Closing date for receipt of tenders was 1 June 2007
- **Service contract for a production service for period 1 January 2009 to 31 March 2013**
 - Phase 1 “Ready for trial” in October 2008 (preferred timetable)
- **“Approved” funding scenario agreed by ECMWF Council in December 2006**
 - Contract value £ 42.2 M (less associated ancillary costs)
 - Approval of contract and decision on possible additional funding in December 2007
- **For further details see:**

<http://www.ecmwf.int/newsevents/itt/2007-192>

Performance Profile



Current IFS Benchmark (RAPS-10)

Application	Resolution
4D-Var	T799 (~25 km) L91 – Inner loops T95/159/255
Deterministic forecast	T1279 (~16 km) L126
EPS forecast	T639 (~32 km) L91

- **Based on the current operational IFS**
- **Released ahead of the ITT at end February 2007**
- **Development of earlier RAPS releases**
 - RAPS-9 version of IFS (released in February 2006) has been implemented successfully by many HPC vendors

Fortran 2003 – the current status ?

- “Fortran 2003 has not been implemented in any compilers”
 - *Fortran 95/2003 explained*, Metcalf, Reid & Cohen (OUP: 2006)
- IBM XL Fortran V11.1 (5 June 2007)
 - Adds significant Fortran 2003 enhancements
 - Now supports the *majority* of the Fortran 2003 standard
- Are there any joint discussions among vendors?
- When will it realistically be available ?

Fortran 2003 – General requirements

- **Need all vendors to agree on a fully compliant Fortran 2003 compiler**
- **We can experiment with a partial implementation**
- **We cannot commit until a standard exists among the vendors**
 - **We cannot impose restrictions on the computer procurement of our collaborators**
- **Enhanced features must not come with a loss of performance**

Fortran 2003 – Features we want to use

- Allocatable objects in derived types
- Dummy subroutine and function arguments with allocatable attribute
- Enhanced module features

Fortran 2003 – Features we *may* use

- Stream I/O
- Integration with host OS
- Interoperability with C
- IEEE error handling
- Object oriented features
 - For example – type extension

Summary

- **IFS Benchmark**

- **Current IFS Benchmark (RAPS-10) released in February 2007**
- **Based on current operational IFS**

- **Fortran 2003 requirements**

- **There are features we would like to use**
- **Need all vendors to agree on a fully compliant Fortran 2003 compiler before we can commit**

Any questions ?