Collaboration between NMHSs and with the public and academic sector in high performing computing infrastructure

Roar Skålin, Director General, MET Norway
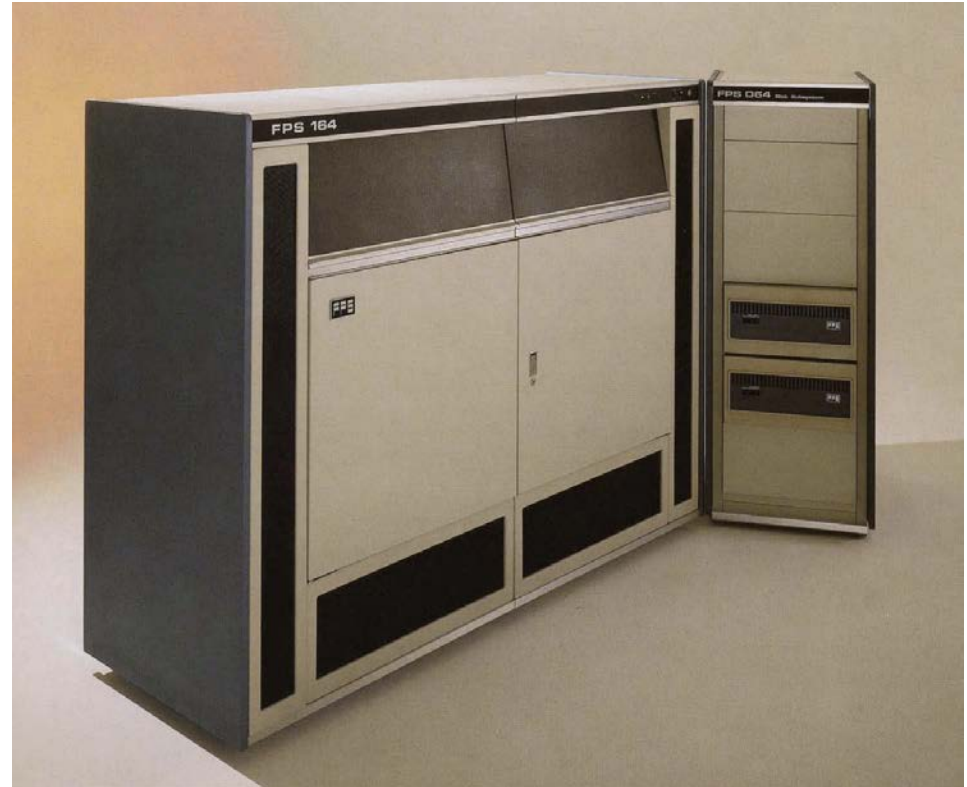RA VI Regional Forum of the Open Consultative Platform, 03.11.2023

The last HPC operated by MET Norway….

- Floating Point Systems FPS-164 Scientific Computer

- 1982 - 1987

We have powerful clusters in-house and operate them ourselves, but the main HPCs are located outside MET Norway and operated by partners

1987 - 2018

- Cray X-MP
- Cray Y-MP
- Cray T3E
- SGI Origin 3000
- IBM Power P5+
- SGI Altix ICE X

The two first operated by SINTEF (research institute)

The four last operated by the Norwegian University of Science and Technology
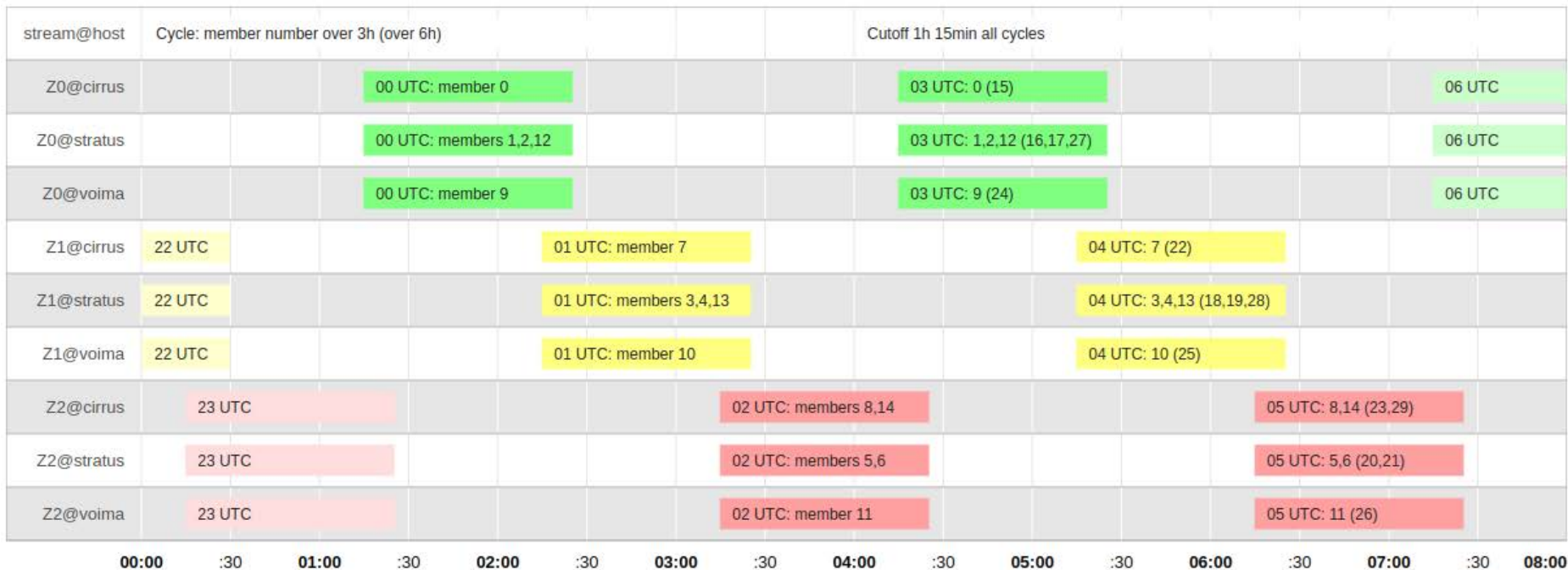
From 2014: MetCoOp

- MetCoOp is a *cooperation on operational NWP* between the national meteorological institutes of Estonia (*ESTEA*), Finland (*FMI*), Norway (*MET*) and Sweden (*SMHI*)

- It was established in 2011 (Norway and Sweden), and went operational in 2014. Finland joined 2016 and Estonia 2018

- The common model used is *Harmonie AROME*. The main product is an *ensemble of forecasts* (started from different initial conditions and using different lateral boundary conditions), with 30 members (over a 6 hour period)

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MEPS production schedule

stream@host	Cycle: member number over 3h (over 6h)				Cutoff 1h 15min all cycles			
Z0@cirrus		00 UTC: member 0			03 UTC: 0 (15)			06 UTC
Z0@stratus		00 UTC: members 1,2,12			03 UTC: 1,2,12 (16,17,27)			06 UTC
Z0@voima		00 UTC: member 9			03 UTC: 9 (24)			06 UTC
Z1@cirrus	22 UTC		01 UTC: member 7			04 UTC: 7 (22)		
Z1@stratus	22 UTC		01 UTC: members 3,4,13			04 UTC: 3,4,13 (18,19,28)		
Z1@voima	22 UTC		01 UTC: member 10			04 UTC: 10 (25)		
Z2@cirrus	23 UTC			02 UTC: members 8,14			05 UTC: 8,14 (23,29)	
Z2@stratus	23 UTC			02 UTC: members 5,6			05 UTC: 5,6 (20,21)	
Z2@voima	23 UTC			02 UTC: member 11			05 UTC: 11 (26)	

| 00:00 | :30 | 01:00 | :30 | 02:00 | :30 | 03:00 | :30 | 04:00 | :30 | 05:00 | :30 | 06:00 | :30 | 07:00 | :30 | 08:00 |

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HPC systems used in MetCoOp operations

- **Cirrus** (SMHI, Norrköping). 256 compute nodes, 8192 cores, 96 GiB ram/node, Intel OmniPath 100 Gb/s interconnect.

- **Stratus** (NSC, Linköping). 520 compute nodes, 16640 cores, 96 GiB ram/node, Intel OmniPath 100 Gb/s interconnect.

- **Voima** (FMI, Helsinki). Cray XC40, 172 compute nodes, 128 GB ram/node. Cray Aries/Dragonfly interconnect.

- **Teho** (FMI, Helsinki). Cray XC40, 172 compute nodes. 128 GB ram/node. Cray Aries/Dragonfly interconnect.

Cirrus and Stratus are operated by National Supercomputing Centre at Linköping University, Sweden

35 years with external HPCs - lessons learned

- Research institutes and universities have delivered professional services
  - Excellent understanding of 24/7 operations
  - Risk management
  - Highly qualified personnel

- Legal and economical issues have required some clarification
  - Public procurement
  - State aid
  - Value added tax

- Difficult to recruit HPC experts - collaboration reduces the problem

- Need for high performance network (for external datacenters this is required anyway)

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Prerequisites for a successful collaboration with academia

- Mutual understanding of the societal missions and legal framework for both parties

- "Science for Service"

- Create ownership among all participants

- Building trust over time

- Involvement of academia in R&D also when the collaboration is on infrastructure

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Eight years of NMHS cooperation on NWP - lessons learned

- Common HPCs is not the goal - it is a means to produce world class very short-range and short-range NWP for the geographical areas of interest

- Sharing competence and resources gives additional value for all

- We have been able to exploit the value of different cultures - "best of both worlds"

- On my "top two" list of successful collaborations

- Why do the countries in RA VI want to run NWP models on so many overlapping domains?

We are on the way to extending the collaboration - United Weather Center (UWC) with 10 (soon 11) NMHSs

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