

Outline

- **Background**
- **Main features**
- **Platform choice**
- **System overview**
- **User Interface**
- **The development project**

Background

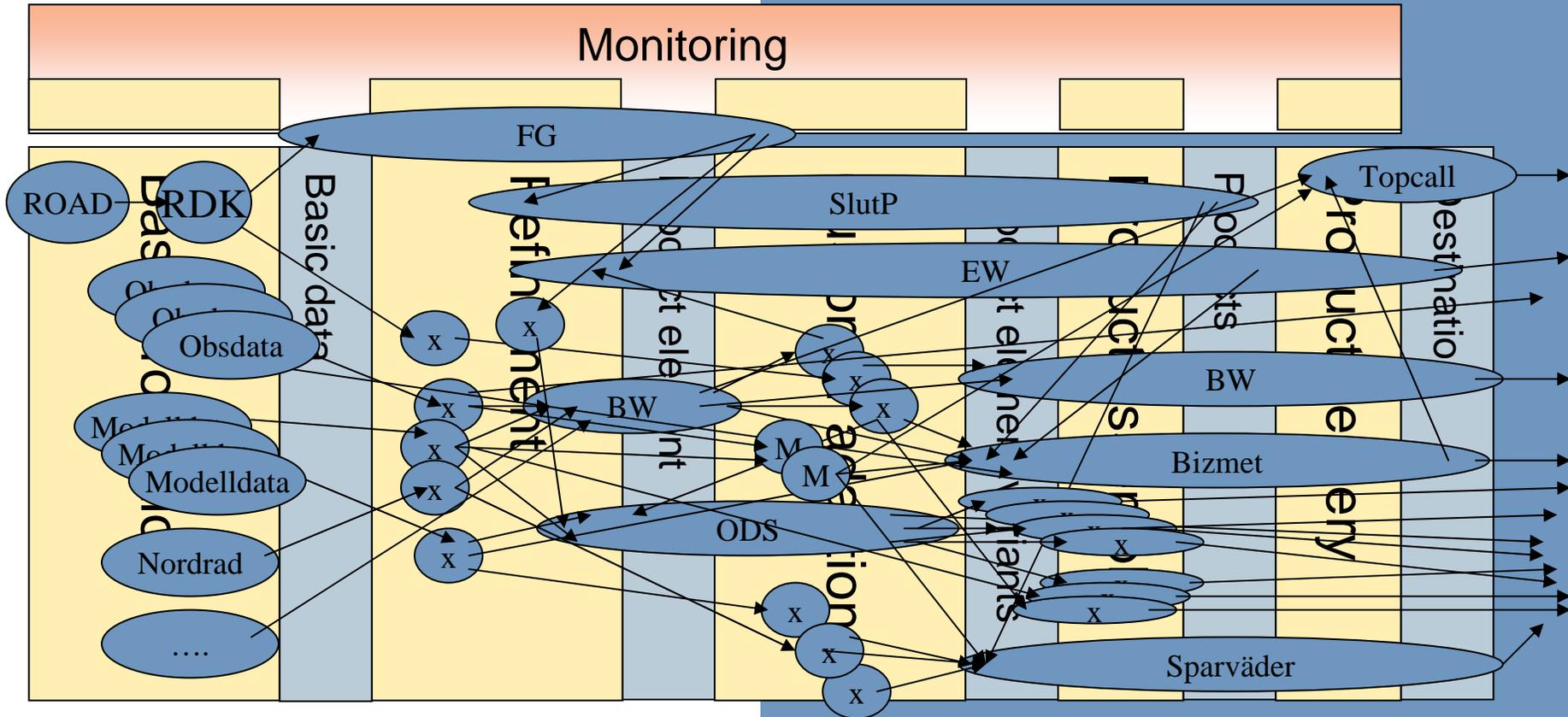
- One of the forecasting departments had problems with rising lead-times developing new products
- An inventory showed that the department had 200+ systems used in forecast production ranging in age from 20 year old to recently developed ones.
- Rising cost of maintenance



Production process

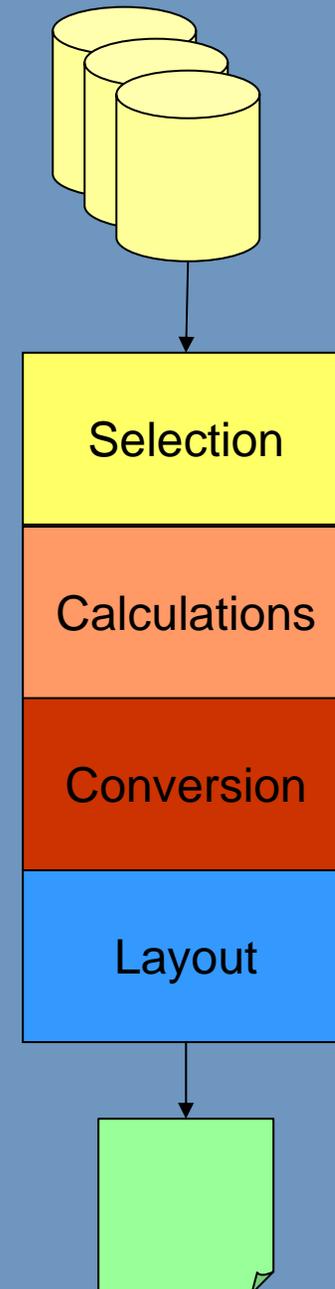
A production process was developed as a template
 “This is how we want to work”

When the old systems where mapped into the process it was clear the they didn't support the process fully



Basic flow of a production system

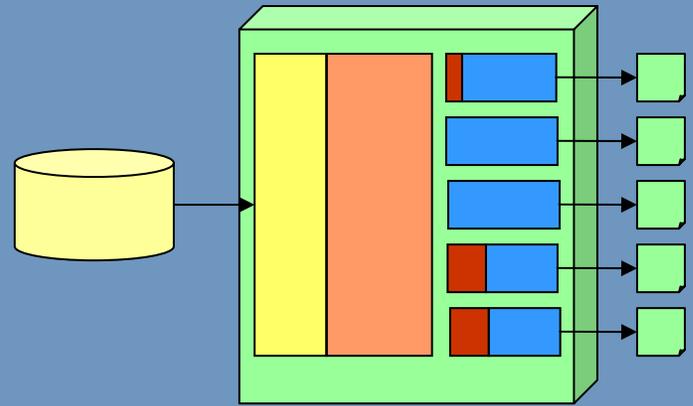
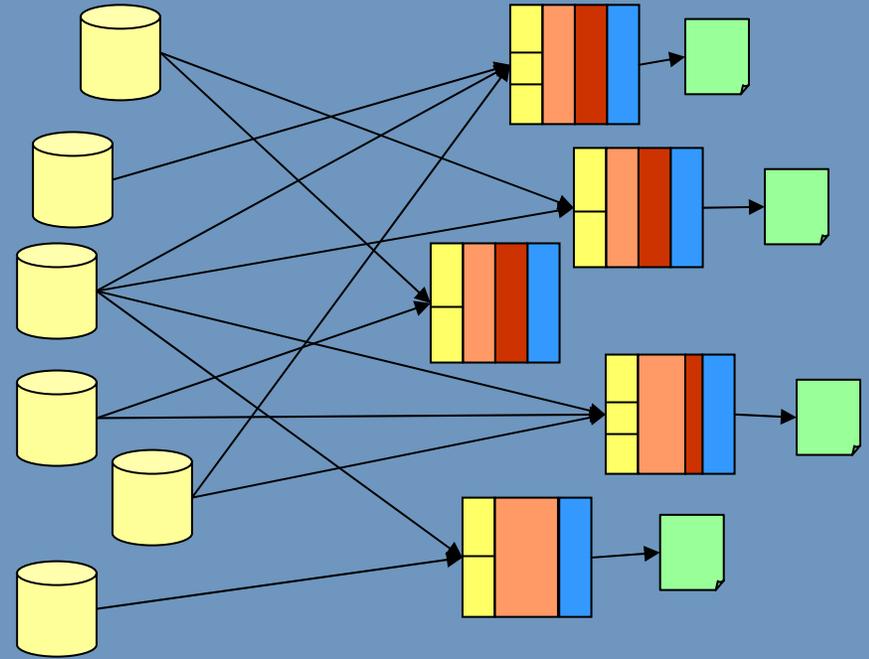
- Data storage
- Data selection
- Calculation
- Conversion
- Layout
- Product delivery



Many systems that do basically the same thing

How do we solve this?

One modular highly configurable system



Main features

- **Data selection**
- **Replacement of missing data**
- **Interpolation**
- **Smoothing**
(between different data sources)
- **Statistical correction**
 - Kalman filter (A Persson)
- **Aggregation**
(Max, Min, Average...)

• Calculations

- Derived parameters
- Probabilistic forecast
- Automatic text generation
- **Unit conversion**
- **Data editing**
- **Product formatting**

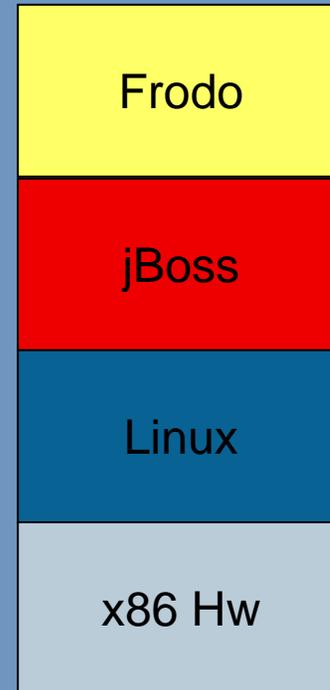
Platform

x86 64bit Hardware

Linux

Java

jBoss application server

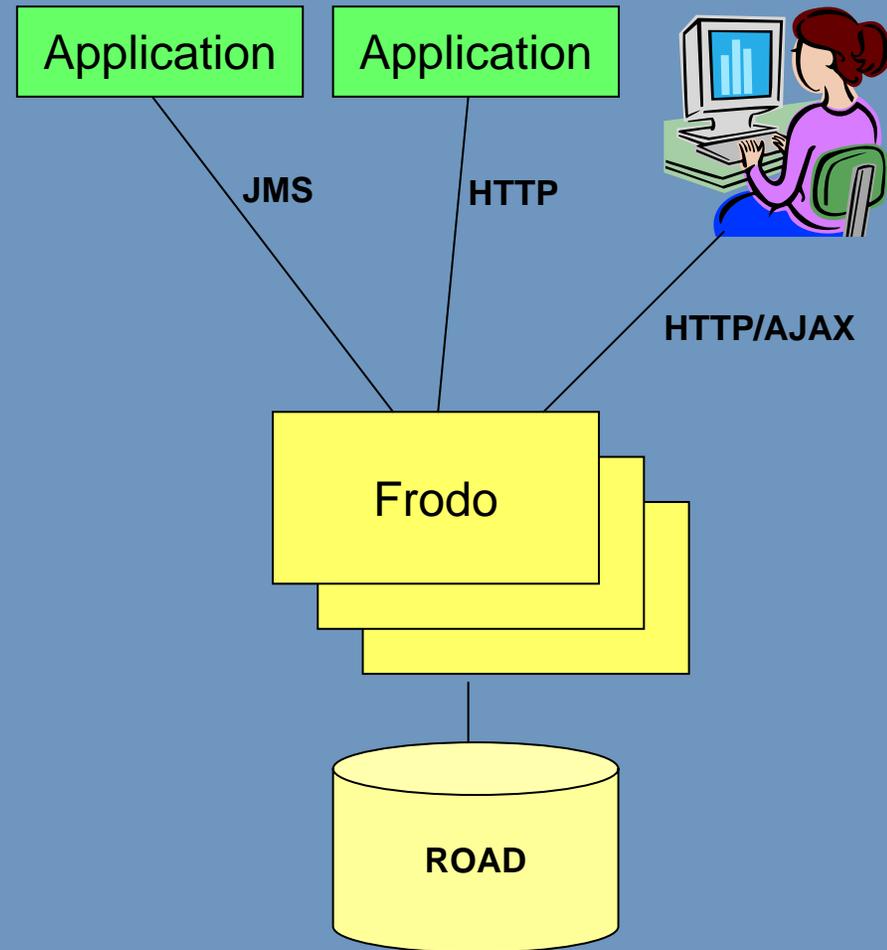


System overview

Forecasters and other users use a web interface to edit data and monitor the system.

Applications can retrieve data from frodo using http or JMS (Java Message Service).

The main data source is ROAD (Real-time and Archive Database). It contains observations as well as analysis and forecast fields.



Supervision interface

Startsidan											
Filter: <input type="text" value="Sista 2h"/> Beställning: <input type="text"/> Enhet: <input type="text"/> System: <input type="text"/>											
Uppdaterad 07:42:53 UTC Uppdatera Kör/Editeras Fel Varning Info OK											
Visa	Produkt	Beställning	Mall	Startad	Tidsåtg.	Kompletthet	Enhet	Användare	System	Kluster	Nod
Lista	Detaljer Editor	DK	DK	07:40:02	00:00:05	6/6(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
Beställningar	Detaljer Editor	DK	DK	07:35:01	00:00:03	6/6(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
Ändra befintlig	Detaljer Editor	Vaderindex	default	07:32:24	00:00:05	19/19(100%)	Fbh	johan.hansson@10.131.1.31	frodo gui	lxserv103_50051	
Skapa ny	Detaljer Editor	DK	DK	07:30:00	00:00:05	4/4(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
Mallar	Detaljer Editor	Vaderindex	default	07:27:14	00:00:48	56/57(98%)	Fbh	johan.hansson@10.131.1.31	frodo gui	lxserv103_50051	
Ändra befintlig	Detaljer Editor	DK	DK	07:25:00	00:00:04	4/4(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
Skapa ny	Detaljer Editor	Aegir-Inforc-ptbvv	-	07:23:01	00:01:13	2520/2520(100%)	HydProd	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
Övervakning	Detaljer Editor	Vaderindex	default	07:22:08	00:00:04	2/2(100%)	Fbh	johan.hansson@10.131.1.31	frodo gui	lxserv102_50051	
Övervaka ordrar	Detaljer Editor	DK	DK	07:20:03	00:00:03	4/4(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
Systemövervakning	Detaljer Editor	Aegir-klimpt	-	07:17:02	00:02:39	748/748(100%)	HydProd	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
Diagram	Detaljer Editor	ENQZSTK5	ENQZSTK5	07:15:04	00:00:10	11/12(92%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
Metadata	Detaljer Editor	DK	DK	07:15:02	00:00:04	4/4(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
Observationsstationer	Detaljer Editor	Swebbuoy	SwebbuoyDbInsert	07:15:01	00:00:08	9033/9050(100%)	ITs/ITb	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
Tidszoner	Detaljer Editor	Swebbuoy Havsboj	SwebbuoyDbInsert	07:10:30	00:00:13	7426/7439(100%)	Saknas	frodo.u@lxvmw47.smhi.se	Swebbuoy	lxserv103_50051	
Administration	Detaljer Editor	Swebbuoy Vagboj	SwebbuoyDbInsert	07:10:10	00:00:17	1555/1559(100%)	Saknas	frodo.u@lxvmw47.smhi.se	Swebbuoy	lxserv102_50051	
Ändra info	Detaljer Editor	DK	DK	07:10:10	00:00:04	4/4(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
JBossAdmin	Detaljer Editor	Aegir-nbd10dpr	-	07:08:03	00:02:50	3570/3570(100%)	HydProd	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
JMX Console	Detaljer Editor	Aegir-tmp10dpr	-	07:07:02	00:00:58	3190/3190(100%)	HydProd	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
Web Console	Detaljer Editor	MesanLaddningKoll	default	07:05:03	00:00:01	24/24(100%)	its	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
Klient	Detaljer Editor	DK	DK	07:05:01	00:00:03	4/4(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
Nedladdning	Detaljer Editor	Aegir-Inforc-ptbvv	-	07:02:03	00:01:57	2520/2520(100%)	HydProd	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
Dokumentation	Detaljer Editor	HYDRNDB1	-	07:01:04	00:02:17	104/104(100%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
Frodo	Detaljer Editor	DK	DK	07:00:06	00:00:06	4/4(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
frodo_2_0_0_fas2_38	Detaljer Editor	DJF-MESAN	DJF	07:00:03	00:01:30	2322/2322(100%)	Fbh	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
20071108 1220	Detaljer Editor	Bizmet klimat 06utc sverige	Bizmet obsar	07:00:02	00:02:33	800/1334(60%)	Fbh	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
Instans: Utveckling	Detaljer Editor	Aegir-astnxxx	-	06:57:03	00:00:11	57/73(78%)	HydProd	aegir.u@10.120.1.238	aegir	lxserv102_50051	
Databaser	Detaljer Editor	EONBS4	EONBS4	06:55:20	00:00:20	22/29(76%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
Frodo: frodo@pluto	Detaljer Editor	TC_158	ENQZSVK3	06:55:07	00:00:07	26/34(76%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
Road: road3g@road3g	Detaljer Editor	EPSOGRAM_KALMAN	EPSOGRAMOBS	06:55:07	00:00:20	84/90(93%)	Fbm	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
slutP: slutp@pluto	Detaljer Editor	TC_296	EONBS4	06:55:06	00:00:06	22/29(76%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
RDK nyckeln går ut	Detaljer Editor	MesanFbe2	MesanFbe	06:55:06	00:00:30	976/976(100%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
2010-02-28	Detaljer Editor	ENQZSVK3	ENQZSVK3	06:55:05	00:00:07	26/34(76%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
	Detaljer Editor	VFDATA2	VFDATA2	06:55:04	00:00:06	18/18(100%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
	Detaljer Editor	ENQZSVK3	ENQZSVK3	06:55:04	00:00:05	22/29(76%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
	Detaljer Editor	TC_282	ENQZSVK3	06:55:02	00:00:04	22/29(76%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	
	Detaljer Editor	DK	DK	06:55:02	00:00:03	6/6(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
	Detaljer Editor	Aegir-autosynop	-	06:54:01	00:00:43	417/736(57%)	HydProd	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
	Detaljer Editor	DRYDATA	DRYDATA_V2	06:52:03	00:00:04	5/5(100%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_50051	
	Detaljer Editor	Meti sv	metline	06:52:02	00:00:25	253/336(75%)	Fbh	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_50051	

Product definition and product formatting

Selection, interpolation aggregation etc of data is defined using XML

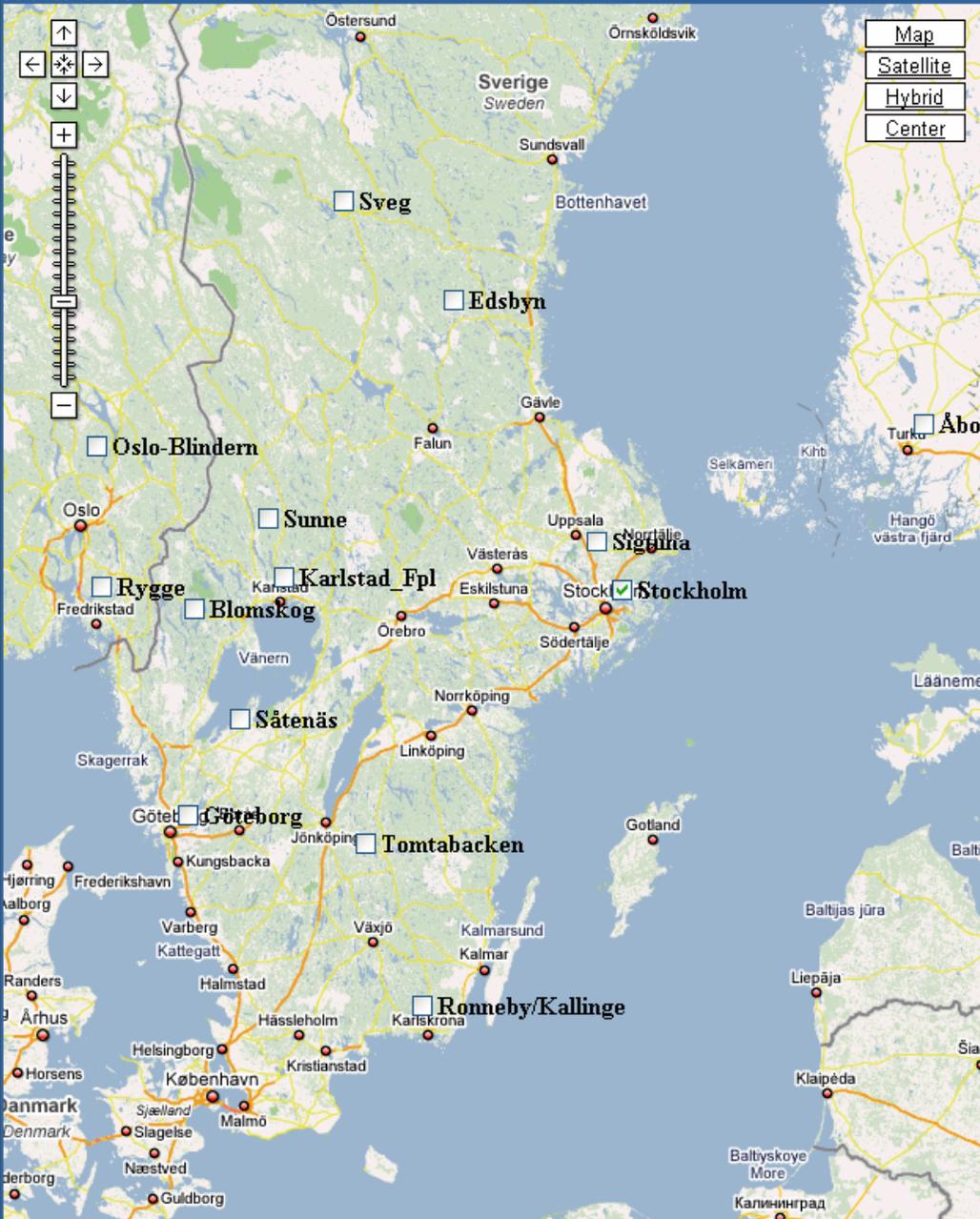
Product format is defined using XSLT style sheets.

```
<?xml version="1.0" ?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/"
  <xsl:output method="text" encoding="ISO-8859-1" />
  <xsl:strip-space elements="*" />
  <xsl:key name="primitive-lookup" match="parameter" use="name" />
  <xsl:template match="/">
    <xsl:for-each select = "///source">
      <xsl:sort select="@time" />
      <xsl:value-of select="@name" />
      <xsl:text> </xsl:text>
      <xsl:value-of select="substring(@time,0,5)" />
      <xsl:text> </xsl:text>
```

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
<!DOCTYPE frodo-order SYSTEM "http://www.smhi.se/xmldef/dtd/frodo-order_2_0.dtd">
<frodo-order>
  <orderer>
    <responsible production-unit="Fbe" person="I Hedenvik" />
  </orderer>
  <parameters id="synop">
    <parameter
      id="4" name="Temp 24h"
      operator="average"
      format="0.0" unit="Cel"
      time-interpolation="null">
      <time
        start-ref="yyyy-MM-dd 00:00:00" end-ref="yyyy-MM-dd 00:00:00"
        start="-0000-00-01 00:00:00" end="-0000-00-00 00:00:00" />
      </time>
    </parameter>
  </parameters>
  <sources>
    <source
      database="road3g" sourcetype="observation"
      name="Stockholm" geocode="02485"
      geotype="vmo" geosubtype="0"
      timezone="UTC" parameters="synop">
      <altsource
        name="Stockholm" geocode="02484"
        database="road3g" sourcetype="observation"
        geotype="vmo" geosubtype="0"
        parameters="synop" />
      </altsource>
    </source>
  </sources>
</frodo-order>
```



FRODO Forecast Editing



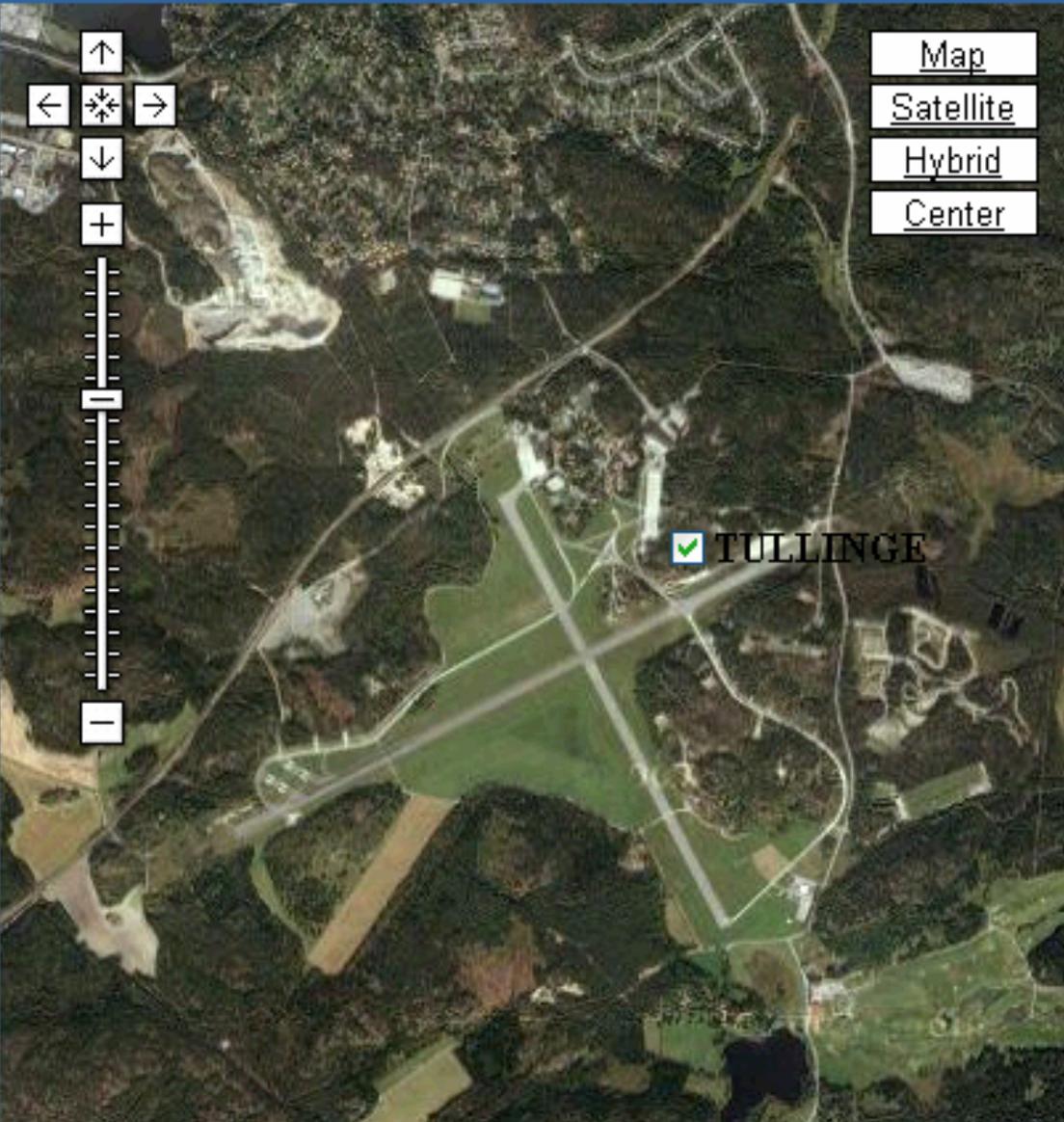
Weather data Parameter chart Weather text Result XML Settings

Save ProdApproval

	1000558- Molnighet (octas)	10011-Temperatur (Cel)	10032- Vindhastighet (m/s)
2007-11-06 12:00:00	<input type="text" value="8"/>	<input type="text" value="7"/>	<input type="text" value="3"/>
2007-11-06 18:00:00	<input type="text" value="8"/>	<input type="text" value="5"/>	<input type="text" value="5"/>
2007-11-07 00:00:00	<input type="text" value="7"/>	<input type="text" value="2"/>	<input type="text" value="4"/>
2007-11-07 03:00:00	<input type="text" value="1"/>	<input type="text" value="0"/>	<input type="text" value="3"/>
2007-11-07 06:00:00	<input type="text" value="4"/>	<input type="text" value="-2"/>	<input type="text" value="2"/>
2007-11-07 12:00:00	<input type="text" value="8"/>	<input type="text" value="0"/>	<input type="text" value="1"/>
2007-11-07 18:00:00	<input type="text" value="8"/>	<input type="text" value="1"/>	<input type="text" value="2"/>
2007-11-08 00:00:00	<input type="text" value="8"/>	<input type="text" value="0"/>	<input type="text" value="2"/>
2007-11-08 06:00:00	<input type="text" value="0"/>	<input type="text" value="-2"/>	<input type="text" value="2"/>
2007-11-08 12:00:00	<input type="text" value="0"/>	<input type="text" value="2"/>	<input type="text" value="3"/>
2007-11-08 18:00:00	<input type="text" value="8"/>	<input type="text" value="1"/>	<input type="text" value="3"/>
2007-11-09 00:00:00	<input type="text" value="8"/>	<input type="text" value="6"/>	<input type="text" value="6"/>
2007-11-09 06:00:00	<input type="text" value="8"/>	<input type="text" value="6"/>	<input type="text" value="8"/>
2007-11-09 12:00:00	<input type="text" value="8"/>	<input type="text" value="7"/>	<input type="text" value="4"/>
2007-11-09 18:00:00	<input type="text" value="4"/>	<input type="text" value="6"/>	<input type="text" value="3"/>
2007-11-10 00:00:00	<input type="text" value="6"/>	<input type="text" value="6"/>	<input type="text" value="5"/>
2007-11-10 06:00:00	<input type="text" value="8"/>	<input type="text" value="6"/>	<input type="text" value="7"/>
2007-11-10 12:00:00	<input type="text" value="8"/>	<input type="text" value="5"/>	<input type="text" value="6"/>
2007-11-10 18:00:00	<input type="text" value="8"/>	<input type="text" value="4"/>	<input type="text" value="2"/>
2007-11-11 00:00:00	<input type="text" value="7"/>	<input type="text" value="4"/>	<input type="text" value="4"/>



FRODO Forecast Editing



Map navigation controls:

- ↑ (Up arrow)
- ← * → (Left, Home, Right arrows)
- ↓ (Down arrow)
- + (Zoom in)
- Vertical zoom slider
- (Zoom out)

- Map
- Satellite
- Hybrid
- Center

Weather data Parameter chart Wea

2007-11-06
12:00:00

10011-Temperature (Cel)	<input type="text" value="6.6"/>
10031-Wind direction (GRADER)	<input type="text" value="210"/>
10032-Wind speed/wind velocity (m/s)	<input type="text" value="2"/>
10348-Present weather (code)	<input type="text" value="0"/>

The development project

- **Challenges**

- **How do you migrate products from 100+ old systems plus keep up with new product development at the same time?**
- **How do you define a common methodology and common metadata definitions to enable consolidation of 100+ systems?**

Development methods

- **Agile development**
- **Continuous close cooperation with forecasters.**
- **Almost daily builds to the test system.**
- **Forecasters develop new products and test new features at the same time in the test system.**



Methods and metadata

- **A metadata group was formed to keep a consistent set of metadata for all systems and databases in the production chain.**
- **A also a methods group was formed to define SMHI standard methods for common problems and document methods in a way that both frodo developers and end users/forecasters understand.**

T2M = T at 2m?

**MCC = CC
between 2500m
and 6000m?**

**How do we
calculate average
temperature?**