

Frodo a system for production of Meteorological, Hydrological and Oceanographic products.

> Tomas Karlsson IT-Architect Swedish Meteorological and Hydrological Institute

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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.

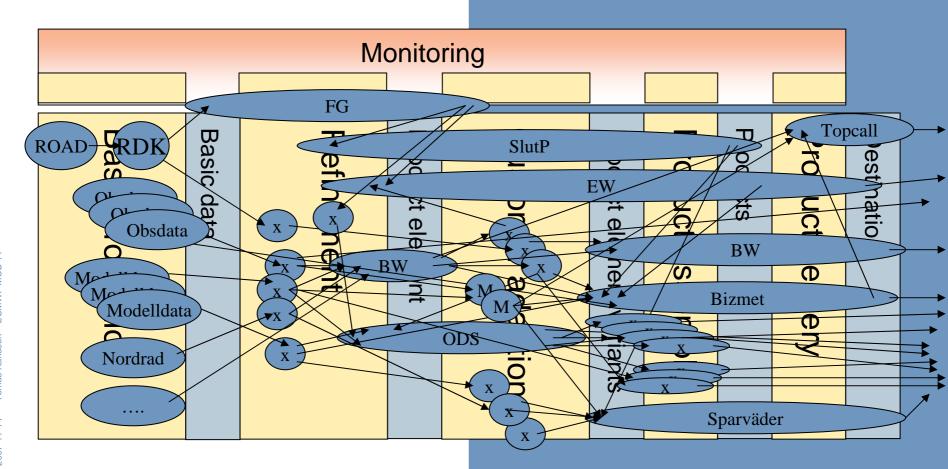
• Rising cost of maintenance





Production process

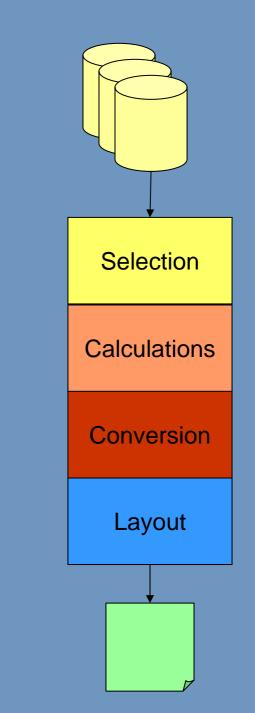
A production process was developed as a template "This is how we want to work" When the old systems where mapped into the process it was clear the they didn't support the process fully





Basic flow of a production system

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

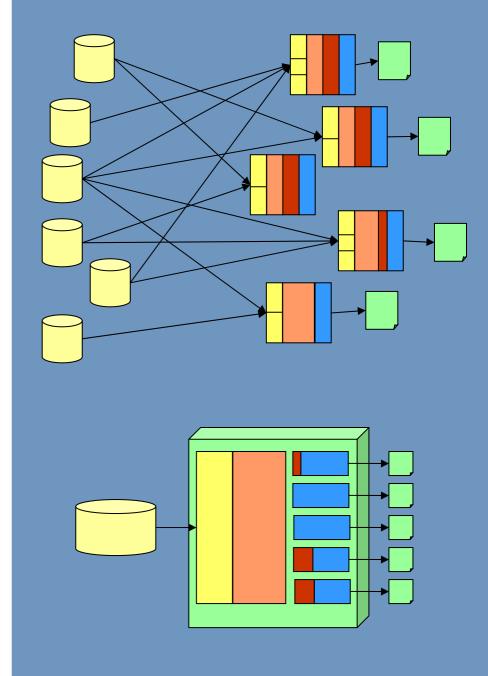




Many systems that do basically the same thing

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



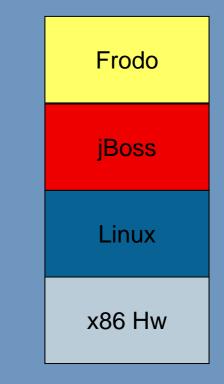
Platform

x86 64bit Hardware

Linux

Java

jBoss application server



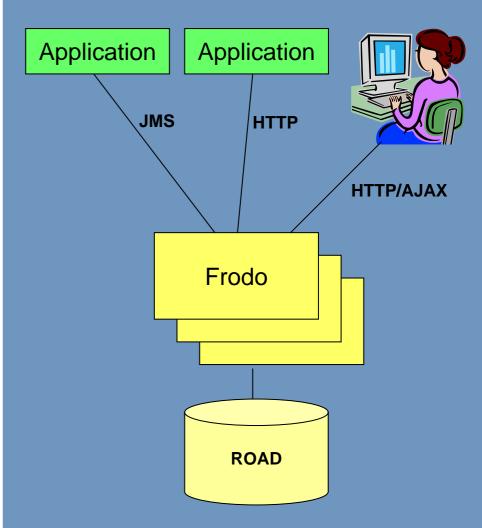


System overview

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

<u>Startsidan</u>	Filter: Sista		tällning:	Enhet:	Syster	n:					
Produktdefinitioner	Uppdaterad 07:42:53 UTC <u>Uppdatera</u> Kör/Editeras <mark>Fel</mark> Varning Info Ok										
<u>Lista</u>	Visa	Produkt	Beställning	Mall			Kompletthet	Enhet	Användare	System	Klustern
	<u>Detalier Edit</u>	tor D		DK			6/6(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_5
Beställningar	Detalier Edit			DK			6/6(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_5
<u>Ändra befintlig</u>	Detalier Edit		aderindex	default			19/19(100%)	Fbh	johan.hansson@10.131.1.3		
<u>Skapa ny</u>	Detaljer Edit			DK			4/4(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_5
Mallar	<u>Detaljer</u> Edit		aderindex	default	07:27:14	00:00:48	56/57(98%)	Fbh	johan.hansson@10.131.1.3	1 frodo gui	lxserv103_5
Ändra befintlig	Detaljer Edit		к	DK	07:25:00	00:00:04	4/4(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_5
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<u>Skapa ny</u>	Detaljer Edit	tor V	aderindex	default	07:22:08	00:00:04	2/2(100%)	Fbh	johan.hansson@10.131.1.3	1 frodo gui	lxserv102_9
Övervakning <u>Övervaka ordrar</u> Systemövervakning	Detaljer Edit	tor V	aderindex	default	07:21:23	00:00:08	1/1(100%)	Fbh	johan.hansson@10.131.1.3	1 frodo gui	lxserv103_5
	Detaljer Edit	tor D	ĸ	DK	07:20:03	00:00:03	4/4(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_5
	Detaljer Edit	tor A	egir-klimpt	-	07:17:02	00:02:39	748/748(100%)	HydProd	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_5
Diagram	Detaljer Edit	tor Ef	NQZSTK5	ENQZSTK5	07:15:04	00:00:10	11/12(92%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_9
	Detalier Edit	tor D	к	DK	07:15:02	00:00:04	4/4(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv102_9
Metadata	Detaljer Edit	tor S	webbuoy	SwebbuoyDbInsert	07:15:01	00:00:08	9033/9050(100%)	ITs/ITb	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_
Observationsstationer	Detaljer Edit	tor S	webbuoy Havsboj	SwebbuoyDbInsert	07:10:30	00:00:13	7426/7439(100%)) Saknas	frodo.u@lxvmw47.smhi.se	Swebbuog	/lxserv103_
Tidszoner De	Detaljer Edit	tor S	webbuoy Vagboj	SwebbuoyDbInsert	07:10:10	00:00:17	1555/1559(100%)) Saknas	frodo.u@lxvmw47.smhi.se	Swebbuoy	/lxserv102_
	Detaljer Edit	tor D	к	DK	07:10:02	00:00:04	4/4(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_
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lient	Detaljer Edit		к	DK			4/4(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	Ixserv102
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	Detaljer Edit		egir-astnxxx	-			57/73(78%)		aegir.u@10.120.1.238	aegir	Ixserv102
rodo	Detaljer Edit		DNOBS4	EONOBS4			22/29(76%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	Ixserv102_
frodo_2_0_0_fas2_38	Detaljer Edit		C_158	ENQZSVK3			26/34(76%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	lxserv103_
20071108 1220	Detaljer Edit		PSOGRAM KALMAN	EPSOGRAMOBS			84/90(93%)	Fbm	frodo.u@lxserv78.smhi.se	frodo2.0	Ixserv102_
nstans: Utveckling	Detaljer Edit		C_296	EONOBS4			22/29(76%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	Ixserv103_
Databaser	Detalier Edit		esanFbe2	MesanFbe			976/976(100%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	Ixserv103
Frodo: frodo@pluto	Detaljer Edit		NQZSVK3	ENQZSVK3			26/34(76%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	Ixserv103_
	Detaljer Edit		FDATA2	VFDATA2			18/18(100%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	Ixserv102_
Road: road3g@road3g slutP: slutp@pluto	Detaljer Edit		NQZSYK3	ENQZSYK3			22/29(76%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	Ixserv103_
	Detaijer Edit		C_282	ENQZSYK3 ENQZSYK3			22/29(76%)	Fbe	frodo.u@lxserv78.smhi.se	frodo2.0	Ixserv102_
RDK nyckeln går ut	Detalier Edit			DK			6/6(100%)	Itn	frodo.u@lxserv78.smhi.se	frodo2.0	Ixserv103_
2010-02-28			egir-autosynop				417/736(57%)		frodo.u@lxserv78.smhi.se	frodo2.0	Ixserv102_
	<u>Detailer Edit</u>		RYDATA	- DRYDATA_V2				Fbe	-	frodo2.0	Ixserv102_5
	Detailer Edit		RTDATA etli sv	DKTDATA_V2			5/5(100%) 253/336(75%)	Fbb	frodo.u@lxserv78.smhi.se frodo.u@lxserv78.smbi.se	frodo2.0	Ixserv102_5
	n eraner Fan	M		HIPHINE	116-57-117		7 5 57 5 5 5 FL 7 5 7% I	FUN	THUR HURINSPENZA STODI SP	Funda 2 11	TYSERWINK (



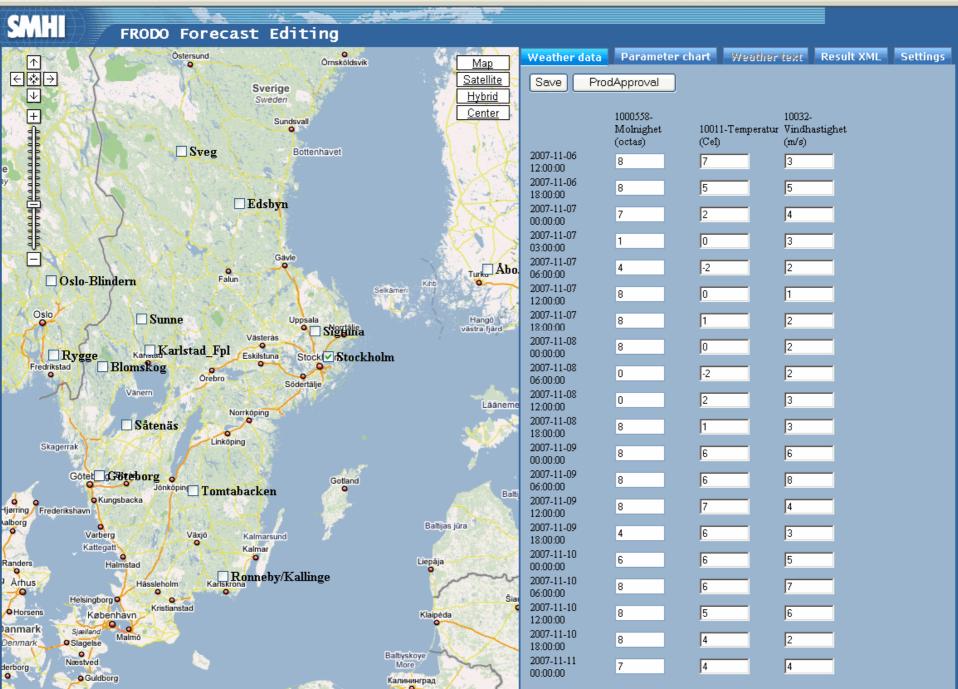
Product definition and product formatting

Selection, interpolation aggregation etc of data is defined using XML

Product format is defined using XSLT style sheets.

```
?xml version="1.0"?
     <xs1:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/)</pre>
       <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</p>
     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"/>
   </parameter>
  </parameters>
  <sources>
   <source
     database="road3q" sourcetype="observation"
     name="Stockholm" geocode="02485"
     geotype="wmo" geosubtype="0"
     timezone="UTC" parameters="synop">
     <altsource
       name="Stockholm" geocode="02484"
       database="road3g" sourcetype="observation"
       geotype="wmo" geosubtype="0"
       parameters="synop"/>
   </source>
  </sources>
 /frodo-order>
```

<u>File Edit View Favorites Tools Help</u>



FRODO Forecast editing - Microsoft Internet Explorer provided by SMHI

<u>File Edit View Favorites Tools Help</u>





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?