Metering Atlas

A portal to create transparency in production and fiscal measurement data

by

Lex Scheers (Shell Global Solutions International),

Oi-Mee Voon (Brunei Shell Petroleum)

and Tjidde Boers (Magion)

Summary

The paper describes the development and implementation of a tool that will optimize work processes between the **Metering Data Consumers** (Reservoir Engineers, Production Technologists, Operators, Programmers, Metering Engineers, etc) and **Metering Data Providers** (Facility or Metering Engineers, Maintenance/Production Operators and Production Chemistry). The connecting link between the Metering Data Consumers and the Metering Data Providers is a web-based portal, called Metering Atlas. This portal collects data related to measurement equipment from the various software applications and data sources that are used in the oil and gas business. Examples of these software applications and data sources are an instrument and meter engineering master database, data historian, hydrocarbon oil and gas production administration system, laboratory information systems, financial, resource and work planning systems, etc. Although all these software applications are in principle independent and they all have their own workflow processes, their own data flow and their own custodian, it is obvious that combining the information from these independent software applications will results in valuable additional information regarding the status of a metering system. Combining all this information it is possible to judge the health status of a metering system, whether it can be trusted or distrusted. By having all this information available in an easy accessible web-based system, with easy navigation, similar to an atlas, also creates transparency of the company's metering system with the Metering Data Consumers and might initiate discussions regarding improvements (or relaxations) of requirements of metering facilities. Ultimately this will lead to an optimal focus on metering equipment and delivering production data of adequate quality.

1) Introduction

The production measurement process is more than just measurement hardware in the field but is the entire chain from data collection with meters in the field up to the final production reporting. It includes all intermediate steps such as measurement and sampling guidelines, operational procedures like maintenance and calibration procedures, data processing (pVT algorithms), data transmission and reconciliation/allocation algorithms. In this entire chain, many software applications and databases are used to gather, validate and store information about individual flow rates of oil, water and gas and the quality of production streams. Generally, fiscal or custody transfer measurements show the lowest degree of uncertainty, i.e. the best that is technically achievable. That is why the fiscal measurements, traditionally are well covered with extensive procedures to maintain and calibrate the measurement equipment. Simple reason is that a 1% systematic error in a fiscal measurement results in a 1% systematic error in the payments between two companies (either loss or gain). However, it can also be argued that the uncertainty in far upstream measurements (well tests measurements, platform or station discharge measurements) are linked to uncertainty in money flow (see Fig. 1). Although, it is not as straight forward as in a fiscal or custody transfer measurement, also here systematic errors will eventually influences the economics of a development. Upstream production measurements have an economic impact on the business as they not only costs money (both Capital and Operational Expenditures), but they also deliver data that is used in decision-making processes such as production optimisation, reservoir modelling and in measuring the economic returns (see Fig. 2).

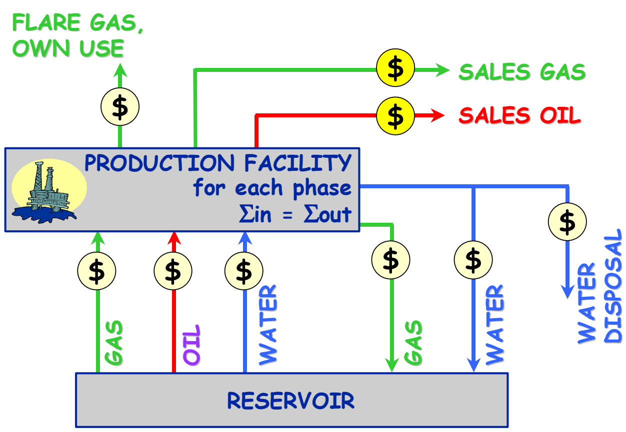

Fig. 1
Although most focus is on fiscal or sales allocation measurement (because of their direct impact on money transfer between companies), also the far upstream measurements (production as well as injection or disposal streams) are impacting the economics of a project

These economics then not only set the uncertainty requirements for the various production measurements but often also indicate what the most critical measurements are. This could be oil flow rate, gas flow rate, GOR or even water flow rate or watercut in water-constrained facilities. The customers of the measurement and allocation process, i.e. the "Metering Data Consumers", are generally spread over several disciplines in the oil and gas companies, their partners or located in government bodies. Examples are reservoir engineers, petroleum engineers, facility and process engineers, operators, finance, legal and contract staff. Moreover, each of these Metering Data Consumers has their own requirements regarding the measurement process.

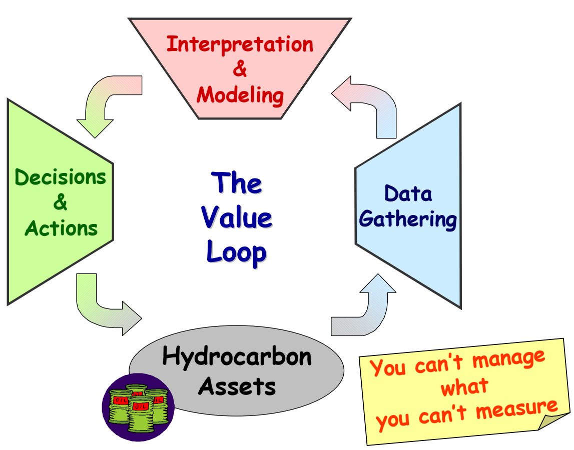

Fig.2
The value loop, wrong data leads to poor modelling and ultimately leads to sub-optimal or poor decisions

During the last decade a large number of new measurement concepts have been introduced, examples are Coriolis meters for mass flow rate and net-oil measurement, Ultrasonic gas flow meters, MultiPhase Flow Meters (MPFM) and Wet Gas Meters (WGM). With the introduction of all this new and more advanced measurement equipment in the upstream area of the oil and gas business one should ask the question whether we can still manage the production measurement chain with the resources we were using in the old days of orifice plates and positive displacement meters. The introduction of more advanced electronics, sophisticated fluid flow models, wet gas over-reading correlations, the number of additional fluid parameters required to properly run the modern measurement equipment also makes it necessary to adapt the skills of the staff in the field. Moreover, the organisation should be adapted and process tools should be made available, such that proper management (custodianship) of this "production measurement chain" can be done. Further below it is explained that "Metering Atlas" is one of the tools, which will create transparency on the metering data quality and improves the communication between Metering Data Providers and Metering Data Consumers.

As every field development has its own specific requirements for the production measurement process it has been demonstrated in earlier publications[1] that an "engineering phase" and "operations phase" should be established. In the engineering phase the requirements from the Metering Data Consumers are investigated and, together with the input from Meter Data Providers, compiled into a measurement and allocation philosophy. Subsequently, this results in detailed design and description of the system. Once the operation phase has started the measurement process should be managed through proper custodianship (see Fig. 3). This management should be transparent and auditable and Metering Atlas is a tool that is specifically designed to create that transparency for all the Metering Data Consumers. In other words, Metering Atlas moves the measurement process from a **"trust me"** to a **"show me"** process.

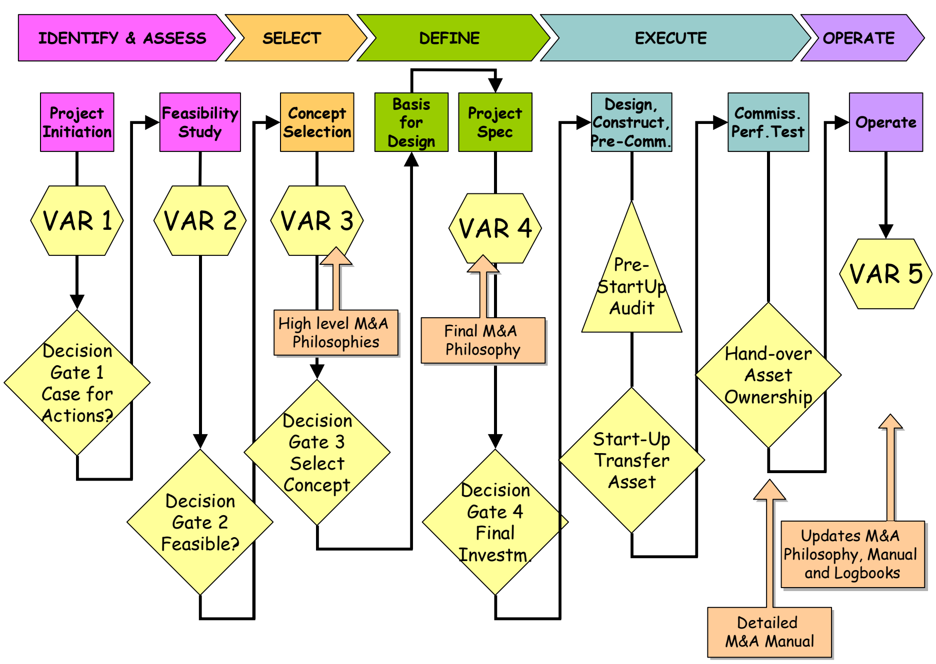

Fig. 3
Various stages for Metering and Allocation in de conceptual and final design phase and in the operating phase.

2) Metering Data Quality (current situation)

The quality of production data collected in the field, whether done with conventional metering equipment like orifices, Venturies, positive displacement meters (PD), turbine meters or with the more advanced multi-phase and wet-gas flow metering equipment, is often with doubts. All metering systems do have uncertainties and often these uncertainties are specified by the manufacturer or determined either through standard calculations or through tests in a dedicated flow or calibration loop. However, this in many cases the uncertainty is calculated with simplified and limited assumptions, i.e. often with a constant fluid (fixed fluid parameters) or without any disturbing factors like gas presence (in case dealing with liquid streams), or the other way around liquid presence (in case dealing with gas streams), wax deposition, sand, hydrates, etc. etc. Furthermore, one can ask the question what is the uncertainty of a cumulative product stream if it is only metered intermittently, i.e. using a test separator with its auxiliary measurement equipment that is only used one day every month to execute a well test. What actually happens in between two well tests can be followed by monitoring several other parameters but definitely not as accurate as using a continuous flowrate measurement. Note that Metering Atlas will not deliver actual uncertainty figures for a measured stream but Metering Atlas is able to roughly indicate the status of a metering point in the form of a traffic light, green, amber or red.

What Metering Data Consumers see is often just numbers in a production report (see Fig. 4). As an example a monthly report showing the following: 1,000 bbl/day of oil, 500,000 Sm3/day of gas and 35% watercut. What you can't see from these reports is whether these numbers are highly accurate numbers or just a bit of a guess? Are the numbers obtained through a continuous measurement process or is it the result of a one-day well test that is extrapolated to a month. Is the watercut just a yearly well head sample or is it a continuous measurement with properly calibrated equipment ?

Wells	Production [days]	Net Oil [Sm3]	Gas [k Sm3]	Water [Sm3]	Watercut [%]
XX-122	30.43	77,774.7	7,451.7	0.0	0.0%
XX-123	30.43	28,385.8	3,002.9	800.0	2.7%
XX-124	16.93	18,467.3	4,455.9	8,234.0	30.8%
XX-125	30.43	30,255.3	3,220.9	0.0	0.0%
XX-126	0.00	0.0	0.0	0.0	NA
XX-127	30.43	71,432.4	6,252.1	0.0	0.0%
XX-128	21.47	23,126.9	3,334.9	8,924.0	27.8%
XX-129	30.43	54,469.5	5,616.7	0.0	0.0%
XX-130	30.43	56,935.1	6,424.6	345.0	0.6%
XX-131	12.90	14,392.9	3,449.0	0.0	0.0%
XX-132	29.44	17,194.6	3,047.3	6,789.0	28.3%
XX-133	27.71	16,453.9	2,230.8	545.0	3.2%
XX-134	8.90	5,839.0	1,364.5	4,567.0	43.9%
Total		414,727.4	49,851.4	30,204.0	

How is this information determined ?

1) Spot sample once a year (month) at well head

2) Average of well test separator reading

3) Continuous with a Multi-Phase Flow Meter

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How is this information determined ?

1) What equipment has been used ?

2) How often is the data gathered ?

3) Is equipment calibrated and operating OK ?

4) What is uncertainty indication ?

Fig. 4.
Monthly production report just shows numbers but do not reveal any information how these numbers are obtained, i.e. extremes could be a continuous measurement with high accuracy or a spot measurement once a year.

The Metering Data Consumers need to know what this data quality is in order to judge the risks they take when they use these data to run their business. Examples are reservoir engineers optimizing their reservoirs, operators optimizing their production or making abandonment decisions but also finance and sometimes contract staff judging the risks in sales allocation processes. In order to bring all relevant information related to the quality of production measurement data closer to the Metering Data Users and create some transparency on production measurement data, Metering Atlas was developed. With the creation of this transparency we also give the Metering Data Consumers the status of measurement data and the possibility to challenge data collection, i.e. they can request better or more frequent data if that is required or even suggest a relaxation in the data gathering process.

3) Metering Atlas Objectives

With the arguments from the previous sections Metering Atlas has been developed and has been implemented in one of the Royal Dutch Shell Operating Units in Brunei (Brunei Shell Petroleum). The ultimate objective for BSP is to provide a means to improve the quality of production data, which is used by so many in BSP to make important business decisions. Note that Metering Atlas will not cure metering problems, it just provides information on the quality and status, users need to take action to cure. The objective can be further split in two sub-objectives:

1) Metering Atlas shall be a portal to make the entire chain of fiscal and production data gathering and the subsequent calculations transparent. The aim is to provide a friendly and easy accessibility for users who have an interest in metering data. Preferred way is a web-based system with an “atlas look”, showing quality tagged values, in relation to the infrastructure and the metering/sampling points. Hence, the name Metering Atlas.
2) Metering Atlas shall optimise the work processes between the Meter Data Consumers and the Meter Data Providers. Therefore Meter Data Consumers shall view all metering related data via a single portal. This greatly improves the changes that incorrect or missing data is challenged with the Metering Data Providers.

Metering Atlas, is an internal Shell development funded by Brunei Shell Petroleum and developed in close co-operation with Shell Global Solutions. It is a portal that retrieves data from various existing and independent data sources like an oil and gas accounting system, an instrument master engineering database, a laboratory database, a real time data historian, a maintenance and work-order tool and uses all the collected data in a health checking process and presents that data in a coherent and user-friendly form. Metering Atlas has been developed with an “atlas-look” allowing the users to easily navigate through the various facilities and finally zoom in to specific metering, sampling or analyzer equipment to reveal all basic information, including specifications, drawings, photos, calculation routines and other meter trivia. Two additional modules have been added to Metering Atlas. One is the health module, which determines the quality based on meter type templates and the various source data. The second one is a collaborative module to initiates workflow processes based on quality changes or user entry is also included. Both will be discussed further below. As a last add-on, Metering Atlas also provides a framework for company wide metering engineering calculations such that consistency throughout the company is achieved. For this used is made of the Kelton’s iFloCalc package.

Metering Atlas is built on Shells Production Portal architecture that uses OsiSoft’s Analysis Framework (AF2) to collect, integrate and analyze data, and Microsoft Sharepoint Services to visualize the data. Webservices are used to communicate data between the portal components.

The various software applications that will provide data into Metering Atlas are briefly discussed below.

3.1) Geographical Information System (ArcGis)

Metering Atlas will be a sub-application of Shell's Production Portal. The latter is a web-based tool that allows staff to easily access production related data for monitoring and analyses. All data is accessible through the Shell network and the Production Portal is equipped with various levels of security and with standard reporting functionality. The reason to combine Production Portal and Metering Atlas is very simple; Production Portal reveals the information on various production, injection and disposal streams where as Metering Atlas provides background on how that information is obtained. Another big advantage to integrate Production Portal and Metering Atlas is that is becomes feasible to use the same navigation in both systems. ArcGis is the Shell corporate Geographical Information System (GIS) suite and refers to an organized repository or database of geographically referenced information. ArcGis enables the visualization of data in a geographic way. Currently it only runs on Vista Operating System. Basically, it lets you query or analyse a database and receive the results of the query in the form of some kind of map. In a GIS, geographic information is described explicitly in terms of geographic coordinates (latitude and longitude or some national grid coordinates). With ArcGis it becomes very simple to zoom into production facilities, platforms, separators and finally select metering equipment (see Fig. 5).

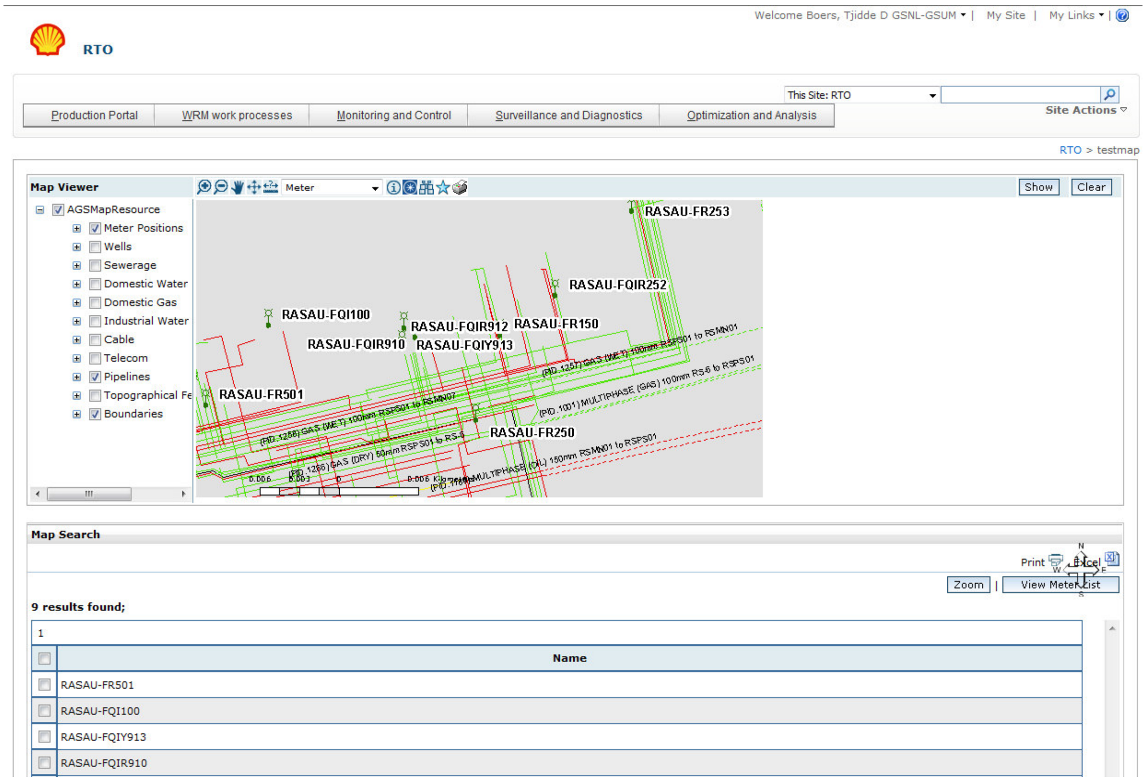

Fig. 5

Example of the "atlas-type" screen for easy navigation and selection of Metering Points.

3.2) Systems Applications and Products (SAP)

Systems Applications and Products (SAP) is the brand name of the company, which provides web-based integrated business solutions (so called Enterprise Resource Planning systems). Within Royal Dutch Shell, this integrated business system/solution and has been rolled out globally, which resulted in standardized and simplified businesses, processes and IT systems.

In principle a number of modules are available in SAP all with the aim to monitor and record business processes, e.g. resource planning, inventory management, procurement of good and services, financial control, human resources, etc. Specifically for measurements it is the maintenance and calibration activities (scheduling and results) that are monitored and recorded in SAP. The interface between SAP and Analysis Framework (AF) will be via Facility Status Report (FSR) holding table

3.3) Document Management System (LiveLink)

LiveLink, an electronic document management system, is a 3rd party product from Opentext and is used for storing and sharing files on a Web-based platform. LiveLink offers functionality like applying metadata to documents, auditing all document events and managing version history. Main benefits of LiveLink are the sharing of data files with controlled access and version control. LiveLink is the Royal Dutch Shell standard Group platform for facilitating the global exchange of knowledge and information throughout Shell. Specifically for Metering and Allocation LiveLink is the place to store information like metering installation and operating manuals, reconciliation or allocation procedures, sales allocation contracts and possibly other trivia regarding the meters like photographs, publications, Maintenance Job Routines (MJR), etc.

3.4) Data Historian (PI)

A Data Historian is a database that collects Real Time data from systems like SCADA, DCS and flow computers. Typical this data is collected at intervals of 1 sec to 10 minutes. The data historian can store large amounts of data and save the information for many years. The Data Historian is used for data trending and is interfaced with Real Time Operations applications and with the Office Domain applications. Today data historians are gaining their own processing capability and are able to perform more and more complex calculations within the process historian. The global Shell standard process historian is OSI-PI. With respect to measurement equipment it is obvious that the output of many meters and analyzers can be made available in PI, this can be flow rates, pressures, temperatures, composition, etc. Quite often we also see that data, which is processed by other tools, will be put back into the PI system and make it available for storage and further accessibility.

3.5) Hydrocarbon Allocation System (Energy Components or EC)

Production or Sales Allocation is used to describe a process that apportions the bulk flow (or individual oil, water and gas flow) of a hydrocarbon evacuation system to the respective contributors to that bulk flow. These contributors can be wells, reservoirs, concessions or companies. There are many different algorithms (on the basis of the volumetric, mass or composition) that can be used to allocate production but all have in common that they try to close the product balance over a production facility (or parts thereof). It also covers volumes that are recycled (e.g. gas lift volumes), volumes for own use (e.g. compressors), volumes flared, volumes disposed off, line packing, etc. Energy Components (EC) is an application suite within EP, that comes in 4 modules, EC Production, EC Transport, EC Sales and EC revenue) and is delivered by TietoEnator. Energy Components is the Royal Dutch Shell corporate tools for the Hydrocarbon Allocation process.

3.6) Laboratory Information Management System (LIMS or Sample Manager)

Sample manager is the Shell corporate tool used to manage the analysis of samples, i.e. from sample entry into the laboratory through to the completion of the analyses and reporting of the results. It contains various calculation routines, ISO, AGA or other standards, to determine the various fluid properties of the sampled oil, gas and water.

3.7) Instrument Engineering Tools (INTools)

INtools (or now called SmartPlant Instrumentation) is an Instrument Engineering Master Application/Database that facilitates the design and management of instruments. It is designed for instrumentation specialists involved in the definition and specification of field instrumentation and process control systems. INtools manages instrumentation data during design, engineering, commissioning, operation, systems maintenance, upgrades and re-vamps or during expansion projects in a variety of facilities. It covers information about the instrument index, process data, operating envelopes, instrument specification sheets, calculations, specifications, hook-ups, etc.

4) Metering Atlas

In Fig. 6 below, a schematic is presented with all the above-mentioned tools feeding data into Metering Atlas. The core of Metering Atlas is OSIsoft Analysis Framework (AF). It acts as an integrator for all data that is used in Metering Atlas. Note that OSIsoft also delivers the PI system (Data Historian) for storing real-time data. Another component is Microsoft's SharePoint that enables easy viewing and searching of data. Once data is available in Metering Atlas, data can only be viewed, there is no additional functionality in Metering Atlas that "modifies" data and hence there is no data transfer back from Metering Atlas into one of the data sources. Next to making all the data visible, the data will also be used in two additional modules that have been added to Metering Atlas:

1) Health Monitoring Module; this module contains high value business functions of the Metering Atlas. It compares the input from the various sources and provides a conclusion in the form of a traffic light and thus indicate whether a metering system is healthy or not. In particular this overview is relevant for higher-level management.
2) Collaborative Module; the purpose of the module is to stimulate knowledge sharing and metering related discussions between Shell employees usually not in daily contact with each other. The module also gives background information on metering related decisions, so these discussions can be held at a high functional level, eliminating much of the introductions usually needed.

One of the key objects in Metering Atlas is a Metering Point. This is defined as a metering installation that provides data to the Data Consumers. As an example an orifice arrangement, including all its auxiliary equipment like differential pressure, pressure or temperature measurements or density measurement is considered as a metering point. The data consumer, in principle, is only interested in the outcome of a flowrate of x Sm^3 of gas and not so much in the pressure or temperature measurement. However, the temperature and pressure measurement are important in assessing the quality of that flowrate of x Sm^3. A wrong pressure measurement results in a wrong flowrate. As such the information related to the pressure measurement contributes to the health of the system and is taken into account in setting the Metering Point traffic light to green, amber or red. Similar considerations apply to all other metering Points.

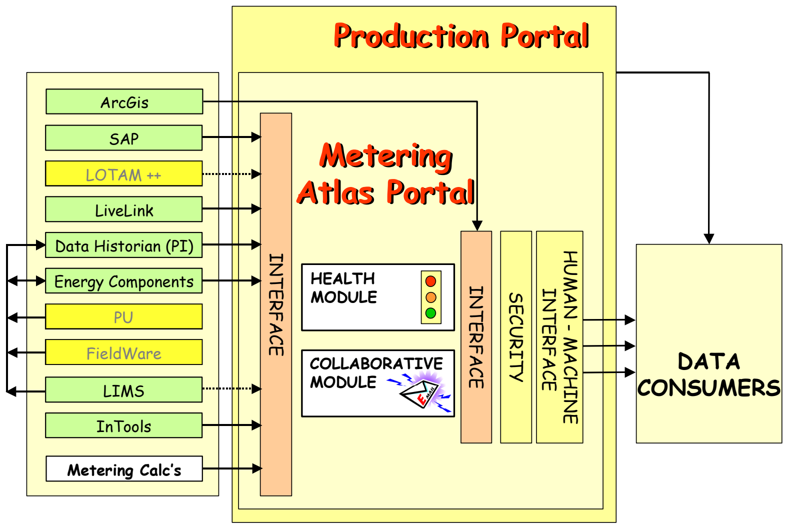

Fig. 6
Schematic of Metering Atlas, information is pulled from various existing independent systems that are used to manage specific tasks in the business. If all this information is combined, better indications on the health of a metering point can be obtained

Hence, a Metering Point is defined by

1. Location, this could be any location in the production process, i.e. well flow lines, separator outlets, platform discharge meters or fiscal flow meters. But also other locations like disposal and flare meters.
2. Meter type
   Currently the following meter types are implemented in Metering Atlas but new meter types can easily be added:
   - DP devices like; Orifice, Venturi and Cone flow meters
   - Turbine and Positive Displacement (PD) flow meters,
   - The more advanced flow meters like Coriolis or UltraSonic flow meters,
   - Electromagnetic flow meters en Vortex flow meters,
   - Multi-Phase Flow Meters and Wet Gas flow Meters
3. Type of fluid
   - Gross Oil (oil and water emulsions)
   - Net Oil (dry crude oil with small amounts of water)
   - Gas (gas without any liquids present, either from separator or sales gas)
   - Water,
   - MultiPhase Fluid,
   - Wet Gas
4. Shell's Metering Class, note that each class does have it’s own requirement for uncertainty.
   - Class I for Fiscal measurement
   - Class II for Sales Allocations Measurements
   - Class III for Upstream Production Measurement
   - Class IV for Environmental Measurements

For each of the above combination of meter type, fluid and class there is a dedicated health template defined.

In Fig. 7 below an overview is given of information that is pulled from the various applications and nicely listed on one single web page.

MeterDetails

Meter Details Service

Details			**Design Condition**		
Metering Point Name	SETG27-00FR040		Base Pressure	1.0135	bar
OU	BSP		Base Temperature	15	°C
OU Sub Unit	Darat		Design Accuracy	± 2%	
Production Area Sub Unit	SETG-27		Design Compressibility	0.992	
Class	ClassIII		Design Maximum Pressure	400	kPag
Evaluation Result	Red		Design Maximum Temperature	50	°C
Fluid	Gas		Design Minimum Pressure	100	kPag
InTools Component	DARAT_TG27_00FE -040		Design Minimum Temperature	20	°C
InTools DeltaP Component	DARAT_TG27_00FR -040		Design Operating Density	2.21	kg/sm3
InTools Flow Computer Component	DARAT_TG27_00FQIY -040		Design Operating Pressure	250	kPag
InTools Pressure Component	DARAT_TG27_00PR -040		Design Operating Temperature	35	°C
Sample Point	SETG27.TG27LP_NGCP		Design Repeatability	± 0.2%	
SAP Reference Code	BN.SE03.SETG27.PIPE.VALVE_00FR040		Volume Flowrate High	XXXXXX	Sm3/d
Service	Export Gas to NGCP		Volume Flowrate Low	XXXXXX	Sm3/d
Type	Orifice		**Production**		
Devices Specification			Flow Computer Status	Normal	
Calculation Method	ISO 5167		Line Delta Pressure	3.16	kPa
Coefficient of Discharge	0.602		Line Pressure	200	kPag
Delta Pressure Sensor Manufacturer	ROSEMOUNT		Measured Volume Flow Day Total	XXXX	Sm3
Delta Pressure Sensor Model	R1151DP4E22I1B4		Measured Volume Flow Month Total	XXXXXX	Sm3
DeltaP Spec Change Date	14/07/2009 08:11		Measured Volume Flowrate	XXXX	Sm^3/d
Flow Computer Type	SCADA		PI Flow Computer Status Tag	SETG27-SIM-	
Flow Computer Spec Change Date	02/09/2009 07:52		PI Line Delta Pressure Tag	SETG27-XTR-00FR040DP	
Flow Computer Model	-		PI Line Pressure Tag	SETG28-SIM-00PT040	
Line Delta Pressure High	25	kPa	PI Measured Volume Flowrate Tag Name	SETG27-00FR040	
Line Delta Pressure Low	0	kPa	**Sample**		
Line Flowrate High	450000	Sm3/d	C1	77.35	%
Line Flowrate Low	0	Sm3/d	C2	7.83	%
Line Pressure High	500	kPag	C3	7.32	%
Line Pressure Low	0	kPag	C4-i	1.76	%
Orifice Bore Diameter	130.18	mm	C4-n	2.26	%
Orifice Plate Material	316 S.S.		C5-i	0.44	%
Orifice Plate Type	Square Edge Orifice		C5-n	0.25	%
Meter Manufacturer	Daniel		C6+	0.62	%
Meter Model	Senior		CO2	2.13	%
Meter Serial Number	826509		Gas Compressibility	0.99	
Orifice Calibration Temperature	20	°C	Gas GHV	48207.31	KJ/Sm3
Specification Change Date	17/09/2009 05:50		Gas Standard Density	0.94	kg/sm3
Tube Calibration Temperature	20	°C	H2	0	%
Tube Class	1141		H2S	9	ppm
Tube Material	Carbon Steel		Molar Weight	22.35	kg/mol
Tube Pipe Diameter	202.72	mm	N2	0.04	%
Pressure Sensor Manufacturer	FOXBORO		O2	0	%
Pressure Sensor Model	821GM-1S15M1-A		Sample Date	02/09/1997 16:00	
Pressure Spec Change Date	14/07/2009 08:17		Sampled Line Pressure	250	kPag
Maintenance			Sampled Line Temperature	34	°C
Corrective Work Order Open	NO		Specific Gravity	0.77	
Last Maintenance Work Order Date	01/04/2009 00:00		Speed of sound	373.4	m/s
Last Maintenance Work Order Number	WO 123456789		Total percentage	100	%
Maintenance Strategy	180	d			
Next Maintenance Scheduled	01/04/2010 04:00				

Fig. 7,
A typical example of how all information for one particular metering point, retrieved from the various IT systems, can be displayed in one single overview screen

4.1) Health Module

In the health module the various input is compared based on a set of rules. In fact each group of meters have one health evaluation template assigned. As an example, all ultrasonic meters of series "A" from manufacturer "B" for class II gas flow measurement will be assigned to one specific health template with a dedicated set of rules. The Metering Custodian will design and administer the health templates, while the Metering Atlas custodian (or programmer) build the template into the Metering Atlas. When no heath template is assigned to a metering system, Metering Atlas will indicate a warning. Templates can easily be configured or modified; in fact a metering engineer without any specific IT knowledge can configure these templates. Examples of possible rules that can make up a template are given below and an example of the a health screen for a metering point is given in Fig. 8.

- Comparison actual flow rates (PI) and design operating envelope (InTools)
- Comparison actual flow rates (EC) and design operating envelope (InTools)
- Comparison watercut (EC) and watercut samples (LIMS)
- Calibrations overdue by xx days (SAP)

- Sampling overdue by xx days (LIMS)
- Comparison p and T measurement (PI) and their operating envelope (InTools)
- Comparison measured density (PI) and density in samples (LIMS)
- Comparison of speed of sound in US Gas Flow Meter (PI) and calculated from gas composition with AGA 10 algorithm (LIMS)
- Comparison composition from GC (PI) and sample (LIMS)
- Comparison density in Coriolis meter (PI) with sample (LIMS)
- ……. and many more that can be implemented.

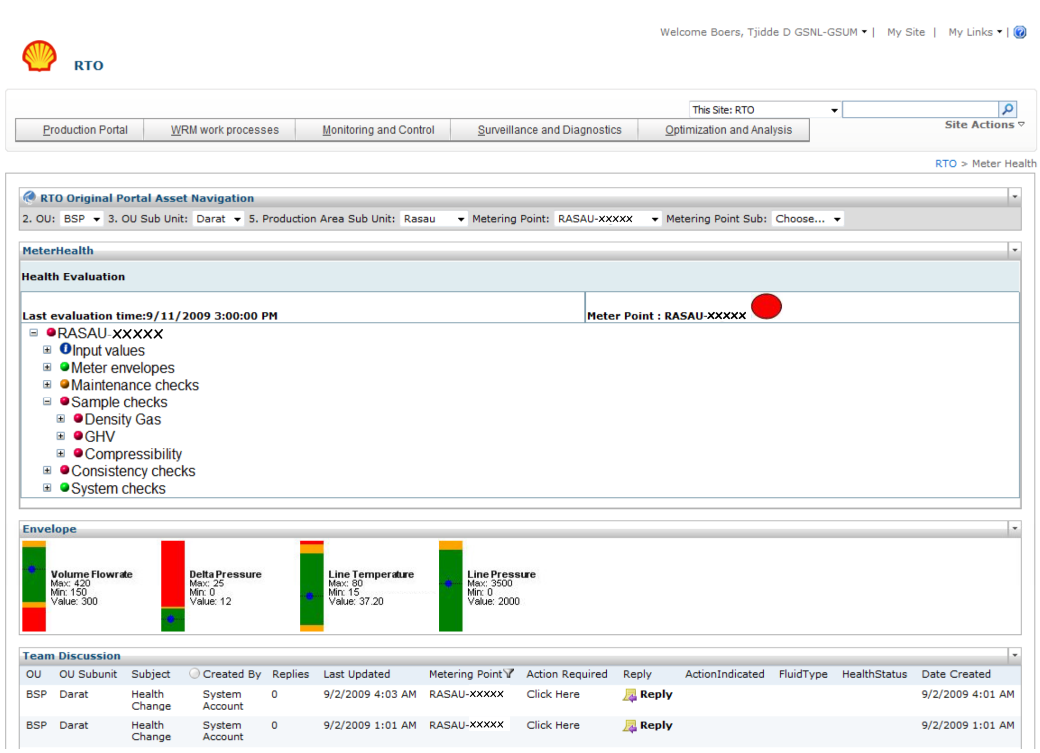

Fig. 8,
The health screen indicating the status of a metering point, in this case samples are out of date, hence fluid properties might be wrong and the final reading should be questioned.

4.2) Collaborative Module

This module comprises two separate functionalities:

1. A module with forum-like functionality where multiple users share knowledge and where users can start discussions or ask for certain actions.
2. A system for automated notifications on meters or meter types where a user can subscribe to via personalized subscriptions.

Regarding the forum-like functionality the user can view discussions by selecting a metering point or the user can start a discussion by selecting a metering point. There are also possibilities to start a “freeform” topic. In principle any user can contribute to that discussion, however, a user should ask the administrator to be subscribed to certain discussion topics.

Regarding the actions, everybody can re quest an action, but only the discussion leader can acknowledge and start the action. This starts a human workflow that assigns an action to another user. The completion of the workflow can be tracked.

Metering Atlas is also able to “publish” events that a user is subscribed to (automatic events). For this a user can be a “listener” by subscribing to those events. Per Metering Point a user can subscribe to a pre-defined set of events, examples are:

- On change of a health status.
- On change of engineering value, a user subscribes to be notified that the value has changed; he cannot specify an actual value.
- On change of physical property, same as above, a user subscribes to notification that the value has changed; he cannot specify an actual value.
- On demand, the system can generate up to date lists of events where a user subscribed (RSS feed).

5) Conclusion

Metering Data Consumers, like reservoir engineers, petroleum engineers but also operators, have a clear requirement to be able to judge the quality of the production data that they are using in their day-to-day business. In the ideal world the metering equipment is specified in the engineering phase and equipment should be maintained such that it is kept in its original specifications during the operations phase. However, in the real world this seldom happens, metering hardware will change, fluid parameters will change, pipeline configurations might change, samples will not be taken or calibrations and maintenance jobs will be postponed or even cancelled. Metering Data Consumers then can go back to the various systems that are in use to manage the various aspects of a metering set-up (InTools, EC, SAP, PI, LIMS, etc). However, these systems often require dedicated training and are far from user-friendly for a “once-a-week” or “once-a-month” user. Metering Atlas has the ability to retrieve all data from these independently data applications/sources and present the data through a web-based system to the various Metering Data Consumers. Hence, in a glance they can judge whether the production data that they use are adequate enough for their business. With the integration of the Metering Atlas in the Production Portal, which is the web-based view on the production environment, not only the absolute values of production data are displayed but with just one click away also information of the underlying measurement system are revealed.

[1] Scheers, A.M. Production Measurement Management, North Sea Flow Measurement Workshop, Oct 2002, St. Andrews, Scotland

References

[1] Paper presented at the North Sea Flow Measurement Workshop, a workshop arranged by NFOGM & TUV-NEL

Note that this reference was not part of the original paper, but has been added subsequently to make the paper searchable in Google Scholar.