Applying S88, S95 and B2MML in Dairy Enterprise

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ABSTRACT

This paper describes the experiences of an end-user project at Arla Foods with the use of the B2MML schemas as a corporate standard for communication between their business systems and MES systems.
This presentation will present the real-life experiences using the B2MML schemas.
The focus will be on the Schedule and Performance schemas.
A short introduction on the general use of S88 and S95 within Arla Foods is also included.

NOTES TO POWER POINT PRESENTATION

The objective of this text is to make it stand-alone-readable, in a way that it can be used as a supplement or replacement for those not able to join the session.

Contents:

The section numbering matches the PPT file of the same topic !

In this document, you will find some "exstra" slides, that had to be let out of the presentation to keep the timeframe.

1.1   SLIDE: Title page.

I will start out with a very short personal introduction:

I work with Arla Foods as a coordinator on Production-IT and Automation. My background is an engineering education followed by some years with software development.

In my current job I have a responsibility for setting standards in the Production-IT & Automation environment of our dairies, which are quite big production sites on the average.

Opposed to most other enterprises our Production-IT group (which also could be named something like corporate engineering & automation) is placed <u>inside</u> the corporate IT organisation.

This gives the advantage of close links to departments working with LAN-technology, security procedures, onsite-support, internal SAP-consultants a.o.

This extra challenge it gives, is to keep the tight relations to the production managements of the 5 producing division (Milk production DK, SE and UK plus the cross-country Cheese/Spreadable and Ingredients divisions). The production directors at divisional level are the key internal customers, as it is this level to which selling of new standards, platforms etc. must be done.

1.2   SLIDE: Contents

The content of the presentation has our views on B2MML integration projects: Background, scope and primarily the experiences and conclusions, we can bring.

<u>Please adjust your expectations: I take primarily the view of an end-user, therefore some of you may be slightly disappointed on the technical details of this presentation.</u> Never the less feel free to mail any questions at any level to Arne.Svendsen@ArlaFoods.com.

If I can't answer, I will find people in our projects, who will be able to find the detailed answers, and come back to you.

I shall try to conclude the presentation with benefits we see using the standards.

For this presentation I have collected input and experiences from colleagues working with B2MML implementations, primarily Bo Rønn on the strategic level, and René Nørgaard, project manager on the first implementation that went live 1th Feb. 2004.

1.3   SLIDE: Introduction to ARLA FOODS

I have tried to indicate some figures on the size of our production facilities. As we have quite a large number of sites, that have been brought together by a number of acquisitions over the last decade, we have a dozen or more different PLC & PCS systems.

A few – approx. 5 sites- have a full blown S88 batch engine in place. These sites have high demands on production flexibility. Eg. one cheese dairy, which is able to produce a large number of different products, that used to be produced in a number of smaller dairies.

So at the floor we have a bit of every system on the market.

Yet at the top level we have been in the process of harmonising our business processes to become one business, "EttArla", since 2002 – the result of this huge IT-project is to be rolled out to all sites, starting October 2003. This is the business model for the SAP roll-out:

1.3.1   Extra slide: SAP business model
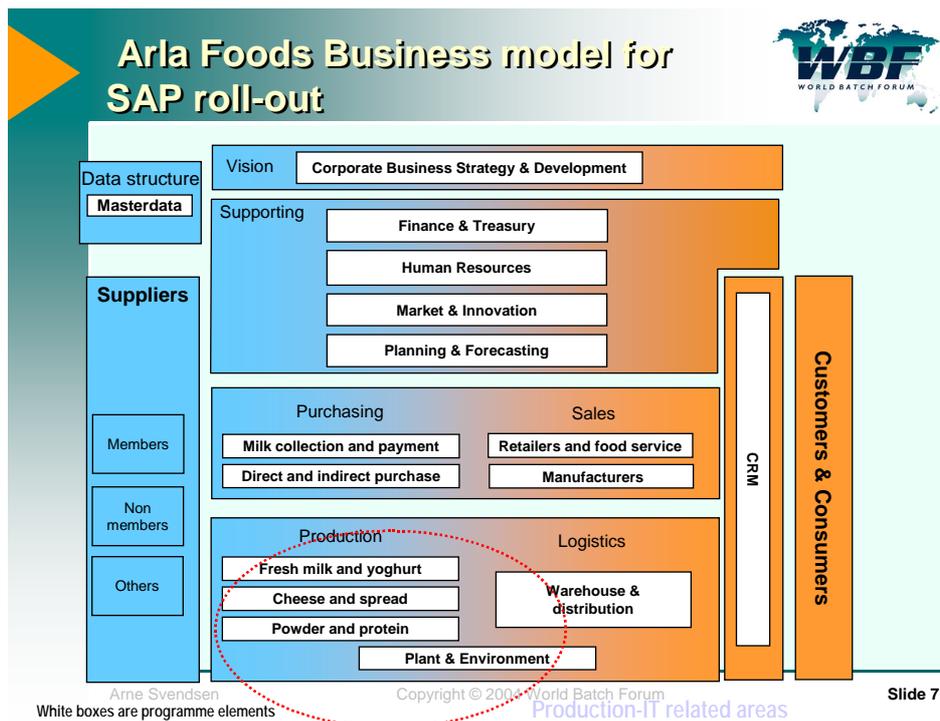
Having B2MML schemas out April 2003 in fact was a good timing for our SAP implementation. (Actually a reason for B2MML taking time to become accepted in the market , is that most customers either have a custom designed integration quite far down to line, OR they are not yet seeing the need. Same matter roughly with the vendors of software).

1.4   SLIDE: Production-IT focus areas

See section below:

1.4.1   Extra SLIDE: Production-IT focus areas(2) in terms of S88,S95

The focus areas we have in the Arla Production-IT & Automation group are:

1. To bring out the terminology of the S95 standard to all sites, typically on a need-based schedule, i.e. we try to bring knowledge in during major upgrades of the sites. There is still a long way for most sites.

2. To use B2MML as the only standard of ERP/MES integration. This is well in progress, even if we have other non-standard integrations.

3. On the MES-level – the S95 part3 level – we are in the progress of defining a standard platform, that shall deliver a reporting and optimising tool for the production people on site. This includes a Arla standard Dairy database and a library of modules to be built for e.g. Energy consumptions, KPI/OEE reporting, traceability etc.. This project is called "ARLA standard production server".

4. The production-server project may evolve to also include an Arla S88 module library, including the PLC-level. This part is not yet started.

5. A need for more consistent specifications (eg. functional specs. that are more S88-compliant) is to be taken care of by the group.
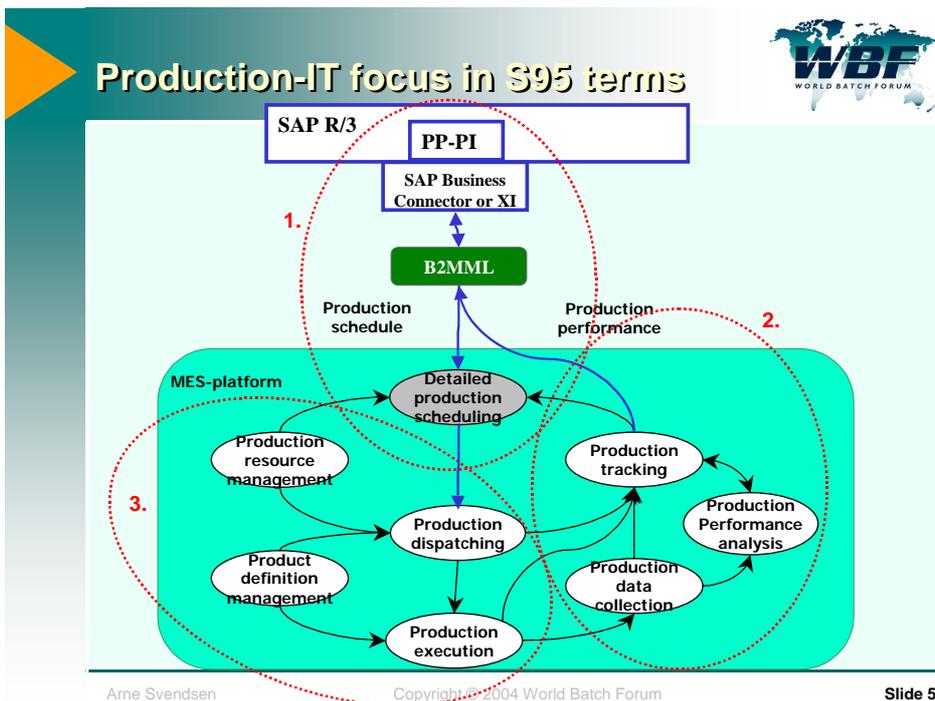
On this extra slide, the numbers 1-2-3 refers to the three big steps in which we plan to implement the Arla version of the part-3 architecture. The scheduling bubble is in grey, indicates that we to a large extent is supposed to use SAP at the ERP level for detailed scheduling. So perhaps a more correct picture would be to place this bubble above the B2MML border. (But that would be against the terminology of S95 part 3)

1.5 SLIDE: Background

The requirements driving our Production-IT 6 Automation group are many. Some of the more important ones are the need to have efficient tools for production:

1. To be able to document product quality. This is done today using a variety of tools: Paper, Excel, Access a.o.

2. A more interesting requirement to fulfil is the need to be able to optimise production. There is more day-to-day bottom line in this point than the customer requirements on quality and traceability.

The EFSA and anti-terrorism laws could be mentioned here. We do care about them, but there is not yet a direct requirement for MES systems, derived from these regulations. (Personally I expect this to come during 2004, and therefore we try in our group to prepare for our internal customers coming to us with a short delivery time)

A crucially important matter to our strategy and the systems we are about to choose: They must be cheap, they must be able to deliver value hand-in-hand with the project costs. Production does not want to wait more than 1 quarter or two to see results.

If we want to fulfil the requirements from the production to have tools to optimise, and have these tools cheap, fast and flexible, we have only one choice, align to standards and hope for the best possible re-use of engineering efforts from our own as well as others experiences. (Eg. building libraries on S88 modules might well be a joint effort between Arla and other big food industry players, same with production database applications).

1.6 SLIDE: ARLA Production-IT overview

This slide will appear several times as a guide to the sub-sections of the presentation.

The shaded arrow will indicate which area we are currently covering.
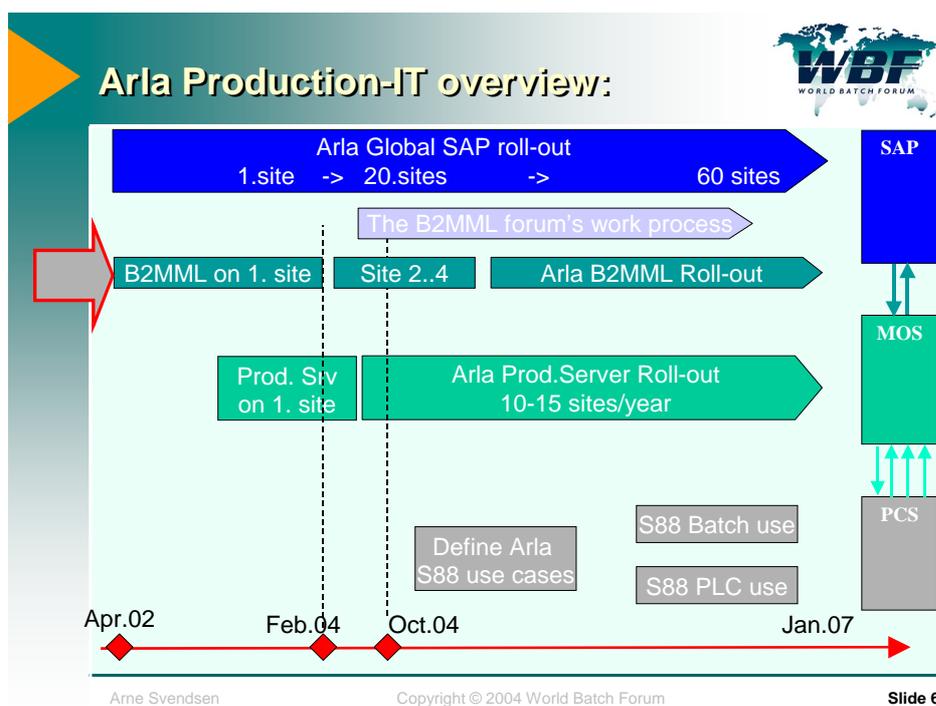
We will now turn to the B2MML work going on at Arla Foods, first by looking back on experiences from 1. site implementation.

The background for choosing B2MML was of course that we believed it IS the right track, and the timing for us was perfect.

Since spring 2002 we have worked on the B2MML as our standard interface between ERP and systems in the factory. During this time we have tried to push on any given chance to get the key vendors in the MES area to move in the direction of B2MML. There had been no immediate

adoption from vendors – mainly only power points. This has changed now, as we see several big players having pilot projects going on.

Projects:

At the moment Arla Foods is working with 4 different parties on B2MML implementations, two of these being standard MES systems and two of these being dairy system integrators doing "dedicated" dairy MES solutions. The reason we have so many different players in process is that business demands are driving 2 new production sites, and a couple of major upgrades, where ERP-integration gives benefit.

On the new sites: vendors have been chosen for their capability in doing dairy process automation, and have then been asked to add to their solution the B2MML capability.

Could we have chosen one integrator to make the B2MML interface for all sites ?

If we had done this, we would just have pushed the interfacing (= delivery border) to some level in the middle of the MES solution – somewhere between the XML and SQL levels inside the MES box. So we are not doing any shortcuts, we are pushing our vendors to deliver B2MML, even if it may give us a risk in the first place, being their first customer asking for it. In the long run, we expect cleaner solutions. And to be closer to standard.
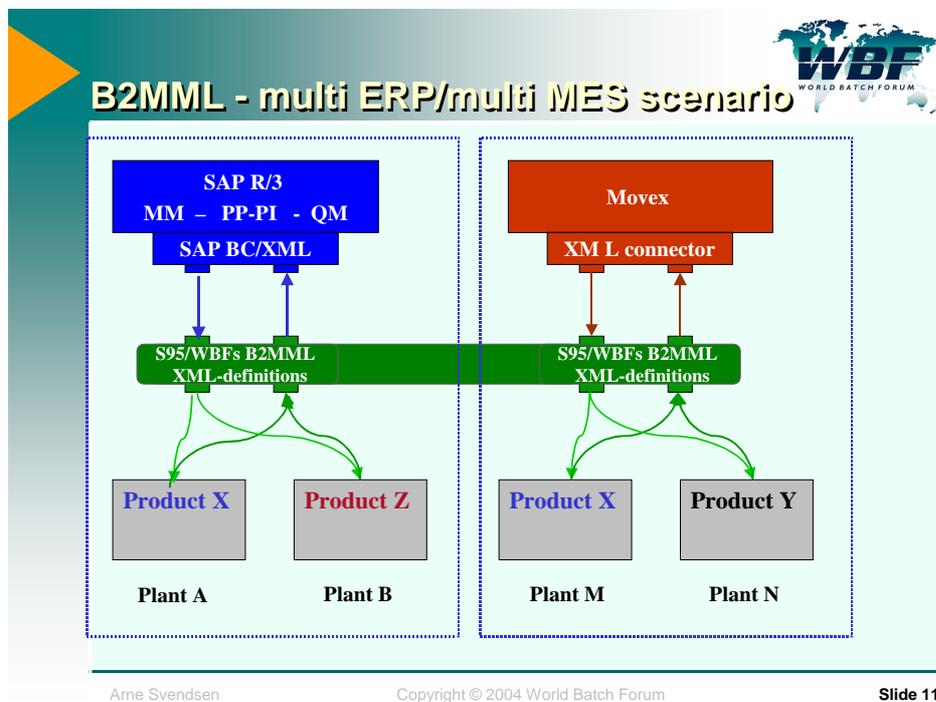
1.7   SLIDE: B2MML because ..

This figure will be familiar to most of you, it has been used on several earlier occasions.

Clearly we want to go for the right-side solution, using B2MML and the standard data-interface.

The figure should speak for itself..

1.7.1 Extra SLIDE: More than one ERP-system

When starting on B2MML a year ago Arla had 3 ERP-systems, now reduced to SAP and Movex. At the moment we are "only" working on the SAP-integration, already here we have plenty of projects coming.

Still I feel the drawing is relevant – it shows both the benefits we could have within Arla Foods, but also the benefits seen from the MES vendor point of view. (Also in the future, Arla will merge with other dairy companies, which might have different ERP-systems in place. Also here it may make sense)

1.8 SLIDE: Which SAP modules to integrate with..

This is a slide, that is very SAP specific. The following SAP modules are referred:

- MM – Material Management module
- QM - Quality Management module
- PP-PI – Production Planning for Process Industries
- PM – Plant Maintenance module

This slide shows possible SAP modules, that we may want to integrate to in the future:

1. Towards the MM we work on milk-reception integration

2. Towards the PP-PI we have come far on using the schedule and performance schemas

3. Towards the QM module, specifications have been made, not yet implemented. (We are holding back a while here, because Arla has not yet decided enterprise wide on how to use QM. One division is using QM heavily as the one and only LIMS, another division is using external LIMS, and yet other divisions are about to decide how to go about it)

4. Towards the PM module: An Arla global-template is being built for the PM module at the moment, going live mid 2004. This leaves an expectation of integrating towards PM, ie. delivering maintenance detail figures from the process systems in 2nd half of 2004.

Generally PP-PI and MM integration are highest priority at the moment. This will become clear when we get to talk about current project needs.

1.8.1 Extra SLIDE: Specific implementations.

One B2MML implementation went live February 1st 2004, and the conclusions to bring in the following slides are based on the project. We believe our experiences to a large extent are transferable to other companies and other industries as well.

Other sites are at the moment in the specification phase on their projects. In all we have four different MES vendors working on B2MML projects right now. As we choose the vendors for at given site based on their ability to deliver machinery+automation that will do the primary job of production, the consequence has been that all of them on the B2MML area had to do their first learnings.

B2MML implementations

- Specific projects
  - Arla Foods Ingredients division
    - Danmark Protein/DP: SAP/MES vent-live Feb. '04
    - Arinco: SAP-controlled production, 2Q2004
    - Vimmerby (1Q2005)
  - UK, Leeds Stourton (4Q2004)
    - B2MML Integration to Milk processing area
    - B2MML Integration to Filling/packaging area
  - Challenges from changing business needs:
    - Different ways of batch management
    - Different ways of QA handling

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1.9   SLIDE: Requirements to 1. wave of B2MML

Although the previous slide showed several ERP modules to interface with, we are at the moment focusing on the production schedule and performance part.

Our approach is to pass a "conservative amount" of data between SAP and MES – in practice this may mean that we transfer a fairly complicated data structure, so even going conservative there is quite a job for B2MML to do for us.

We transfer data necessary for the planning and costing made in the ERP system.

1.10   SLIDE: Some Steps in B2MML specification

The most important step is to decide on the production requirement hierachy and relations.

The definition of which parameters are needed at the ERP level is important, as it <u>may</u> be difficult to change later on.

Material master data: We have <u>not</u> at this any sort of automated replication of new material numbers to the MES level. There is a manual procedure to create new material numbers in both systems in parallel. Later this may be automated by transferring the material schema.

Important is to consider where thing can go wrong in the data loop (Schedule data down and performance data back up). We have error checking when receiving data into MES and into SAP, where mail are auto generated to support in case of faults.

Apart from these basic data checks it critical to be able to run the dispatch of order in manual or auto mode – as the interface application matures. Same counts for the release of data into performance schemas back to ERP level.

1.10.1 Extra SLIDE: Some inputs to a B2MML guide (2)

B2MML implementation & testing

Implementation phase:
- SAP recipe configuration
- SAP Business Connector (or XI) config
- MES configuration of B2MML module + some programming
- Config. of MES/Batch for delivery of data

Testing:
- FAT test ?
- Integration test ? (all inside Arla domain)

Supervision:
- The PP-PI monitor (data into SAP)
- BC/XI (active mail msg -> support)
- MQ-series queue SW (Arla std.)
- MES XML/SQL level

SAP-recipe

SAP -> XML   SAP -> XML

SAP BUSINESS CONNECTOR:

B2MML   B2MML

Mail

ARLA WAN FIREWALL

Onsite server

B2MML   B2MML

Vendor FAT test system

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Implementation phase:

This is a plain list of parallel activities taking place. Especially the MES part will change over time, as the products get more mature. As of to day we shall expect more that simple configuration, programming is involved – make sure to get full documentation of this part, if it is tailor made for you !

Testing:

Fairly early in your project, you should consider how to do testing, including integration testing between MES vendors systems placed in his facility and your ERP testing environment.

This means that you probably need to consider, how to give MES-vendors access to communications queues, and if this is not possible how to give him VPN access to eg. a MES test server inside your WAN domain. There is of course some very important security issues to adress here, that may take a while to be solved with your corporate IT department.

Support:

In a big organisation it may be a challenge to have defined who is responsible for support on these new interface level we introduce (PP-PI, BC/XI, MQ, MES).

1.11 SLIDE: Example of process order / batch relations.

This is the single most important topic to focus on, when starting the specification of a B2MML integration.

The two views on the execution of the production – from ERP and from MES/floor level must be brought together into one common understanding.

The figure shall illustrate just one example on the 1-to-1 and 1-to-many relations to be decided.

E.g. the figures shows that at the first processing step:

- We often see just one SAP process order covering a period of up to a week.

- Then at the floor level, we have to split this up in day batches or shorter periods. This could be due to the fact, that we may have to do CIP cleaning every xx hours.

In general, consider to business rules of the production execution on both sides of the B2MML border, and use this as input for the definition of the B2MML Production Schedule schema.

The classical question of using non-speaking numbers or not – thats is also to be decided quite early in the process. At Arla we use the SAP standard non-speaking numbers on process orders and control recipes, where as on the batch code level, it is legal to have a site-local syntax for the coding.

1.12 SLIDE: B2MML documentation example

To document the B2MML interface, and our interpretation of the standard, we have decided to use Visio to make a one-picture documentation of the interface.

The single part we found hardest to handle in our projects was the "SAP to XML" part.

Therefore this drawing describes in detail, which instructions to use in the SAP protocol towards the PP-PI module. Here shown in the left column.

On the right is shown the structure and fields of the B2MML schedule schema.

The drawing makes visible to everybody how the SAP recipe is tied to the XML schema.

In fact the model we are going with now is much cleaner than our first try, which had quite a few wildcard at several levels.

Complete schema documentation can be requested at: Arne.Svendsen@arlafoods.com

1.13 SLIDE: B2MML conclusions on the project-process of 1.site implementation

This slides adresses some few important point in the handling of the project.

The most important learning for us, was to realise how many parties we had to deal with to get the integration in place. It must not be under estimated that integration toward the ERP level is for the few key persons, both when trying to find SAP-consultants and MES-consultants that has knowledge and even experience.

Our key to success was perhaps our own persistense in digging into understanding in detail both B2MML but even more important the integration possibilities within SAP. Not many SAP consultants have experience with PP-PI and especially not with the PI-PCS protocol, which by the way turns out to match quite fine with the structure of the B2MML schemas. (When first you have decided to use the PI-PCS rather than IDOC or BAPI objects, that is)

1.14 SLIDE: Specific feedback from 1.site

Note that, this slide is the unfiltered site specific feedback. Not all bullets may be of general relevance to other customers.

1.15 SLIDE: Production-IT overview: End users needs towards B2MML

1.16 SLIDE: Example of process order / batch relations

As already covered under experience section, the most important part of a B2MML project is the business requirements specification. See also slide 11 above.

Here the slides is used as an introduction to the segment modelling slides to follow.

Following the "Manufacturing Inter operability workshop" July 2004 at SAP, Philadelphia, there has been significant focus from both SAP and user side on the segment modelling. Several WebEx'es have been held, and it will be a key topic on this WBF conference too.

The next slides is a series to higlight what is important to consider here:

1.17 SLIDE: Segment modelling(1) – SAP recipe to B2MML schema

A couple of ways of doing the modelling from an SAP control recipe in PP-PI to the corresponding segment requirements in the B2MML schedule schema has been shown in previous presentations by Polar, Nestlé, Proctor&Gamble and Arla.

The modelling shown here is the "nested" version, where segment nesting is used to map the levels of the SAP recipe.

Even if many segment models can be used and still validate with the B2MML schema, we as an end-user prefer the simplicy of having a default way of modelling.

Over to the implementation parts of projects this gives SAP the possibility of introducing genering SAP XI mappings to send and receive B2MML schemas. This without us end-users having to change very much on the XI side of the interface.

1.18 SLIDE: Segment modelling(2) – B2MML to S88 – Use case dependent

On the next step: Mapping from the B2MML schema into the the manufacturing side is equally important of course, BUT THIS SIDE MUST REMAIN ADAPTABLE TO INDIVIDUAL CUSTOMER NEEDS.

The slides show that it is perfectly possible to have customers needing to connect differently to the S88 procedure levels, dependent of way of using S88.

Even customers NOT using S88 – eg. electronics industry – will be able to use their industry specific or indvidual connections from the schema to the shop floor equipment.

1.19 SLIDE: Segment modelling(3) – B2MML to S88 – how we see it:

This slides show how we expect to do the connecting between fields in the schema and recipe parameters on the S88 level.

1.20 SLIDE: Segment modelling(4) – B2MML to S88 – fullblown or light:

In our world we have 5-6 sites with S88 batch engine and the rest using traditional PLC control. This picture may change slightly to the S88 batch side, but not very rapidly.

Therefore we have a clear need to have any one given MES system in use in our environment – be able to connect to either S88-batch or S88-light (could be simple PLC control with "all in one unit" or PLC control with recipe procedure – only fixed in the PLC).

1.21 SLIDE: B2MML: Elements to complete the picture(1)

This slide is a graphics to show what we think is important to carry on with on the level of the WBF and other parties involved in bringing the B2MML standard forward to being easy usable for a much wider audience.

I have tried to show needs seens from Arla, and following terms introduced at the July workshop in Philadelphia. (Use the animation of this slide if possible)

Users input:

- Give good example of uses, good requirements, pilot projects

- Give input to a generic segment modelling, usable for many of us.

SAP input:

- SAP is already working intensively on XI mappings to make B2MML easier.

WBF, ISA and others input:

- The extension mechanisms for the schemas are the most critical piece to have ready to use. This is a discussion point in each implementation project.

- The transactions are also important, but experience show, its possible to get far without them.

MES-vendor input:

- Arla Foods expect B2MML connector to be available and finished MES components, that should be possible to use with little extra consulting needed. (We don't expect it to be out-of-the-box for some time still)

1.22 SLIDE: B2MML: Elements to complete the picture(2)

Se section above.

1.23 SLIDE: Production-IT overview: MES-section

B2MML integration has been step 1 in our process of putting standard into use. The next and already ongoing step is what we have called "Production server" the purpose of this project is the have a lighter and more scalable MES-impelementation. The purpose is to have the exact same database model in use in all sites – no matter if the production is milk, cheese or powder.

The scope is limited to data collection, i.e. the execution or data download part is not of primary focus, although you cannot start collecting data without having a discussion on how to handle eg. recipe data. There is typically a requirement of documenting the recipe data as part of the "batch report" – i.e. to see both required and actual values from the production process.

1.24 SLIDE: From "all-different apps. used" to "One toolbox to tailor site-solutions"

The production server is a Manufacturing Operations Platform to server a number of different needs for the local production management on the sites. Even if it is a common platform, the tool is still there to serve sitespecific requirements.

We want to offer to the sites an efficient, cheap and scalable tool, where reporting can be done from local database (realtime data, eg. within an up to the minute live batch report with graphs if needed)

– as well as with the option of replicating all relevant data to a central database for drill-down analysis and for benchmarking across the sites.

The modules shown on the slide indicate the most commonly required functional needs – but it is by far a complete list.

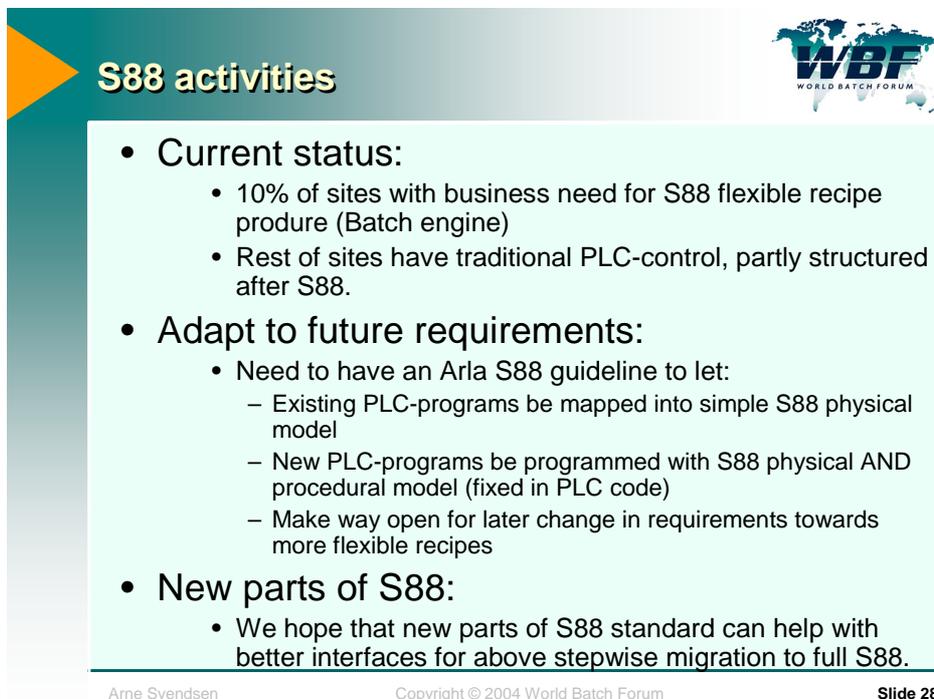### 1.25 SLIDE: Production server architecture

This slide shows:

- The MES platform to collect data from many different sources on the shop floor.

- The library of modules being built on top of the platform

- The database with relational (MS SQL) and realtime-trend database parts. The database is built by the vendor to be S95 compatible to a large degree.

- The integration between SAP and MES.

- The link to a central database, having the exact same database structure and the local instance, allowing for dairy sites to be benchmarked from this central place.

- The reporting tools able to pull data from the local instance or from the central database.

1.26 SLIDE: Production-IT overview: S88-section

1.27 SLIDE: S88 activities

Due to lack of resources, this important area is a bit behind currently.

We are investing in new process control on many locations, mostly as extension to existing systems.

We see a clear need to have S88 guidelines to present to system-integrator and other suppliers (and we have very many of them on Arla global basis).

The longterm goal is to have S88 guidelines control how PLC-programs are designed and implemented. In many cases we do not need the full flexibility of S88 recipe procedures, and can have them hardcoded in PLCs. However we are looking to take care of the situation, where such a site meets new flexibility requirements. There is would be vere nice to be able to convert well-defined parts of the PLC-programs recipe model into the control of a batch engine.

The requires interfaces between the parts of the PLC program, that is compliant to S88 standards.

1.28 SLIDE: Summary

You are most welcome to mail questions to: Arne.Svendsen@ArlaFoods.com