

**SERVICE-WIDE TECHNICAL ARCHITECTURE:
INTEROPERABILITY THROUGH CONSENSUS**

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Good afternoon Ladies and Gentlemen. It was interesting listening to John Weigelt from Canada talking about Enterprise Architecture. I think some of the issues that we face are all very similar. Just maybe to give it a bit of balance, I will be talking about the technical architecture side of it in more detail, and you will see that the processes are very similar. It is a very challenging task! Here is my presentation agenda. I will give a brief background of the environment before this project; explain what is service; what technical architecture is and how we developed it. Next I will talk about the governments and communication aspects of implementing the architecture and finally I will share some of the lessons that we learnt, and give a sneak peek at some of the next steps. Let me start with the ICTM environment of the Singapore government.

We have more than a hundred agencies in our island state, some of them, in particular the statutory boards, actually self funded. That means, they get their funds from collection of fees, and even many of the centrally funded agencies are given full autonomy to manage their own expenditure. So this also means that there is no fine, a very tight central control over IT investments in various agencies.

However, the Government Chief Information Office of the Intercom Development Authority does provide some central direction into it. Firstly, we develop ICP policies and standard that all agencies must comply with. We got this our funding source. Secondly we manage the service wide IT initiatives and infrastructure, some of which I will be describing later. In addition, we also provide professional IT manpower to twenty-six agencies on a cost recovery basis. These people assume the role of IT staff in the various agencies. Let me start with some initiatives in our ICT implementation history that are elements of IT architecture although we did not recognise them as that at that time. In the mid 80s we focused on linkages across agency IT systems for example the integrated land use system consolidated land related data from different agencies such as Urban Redevelopment Authority, Public Utilities Board and Housing and Development Boards. I guess I do not need to elaborate on the benefits of our sharing land information among these agencies. So similarly the one stop change of address reporting system allow citizens to report a change of address at any nearby police post and then have that change propagated to a number of different agencies. These services are actually enabled by having an authoritative source of data about people, land and commercial establishments so these were all set up with the three data hubs. I guess that forms a basis of the service wide information architecture. Starting in the mid 90s we started the consolidate infrastructure. Firstly we linked up all the agencies together in the private network known as Singapore Government Network. With the network in place we were able

to offer a centralised Singapore Government E-mail system which facilitated communications across agencies. We were also able to provide a central hosting environment for internet and internet applications and these provide better security management and economy. So from 2000 onwards we improved on this common infrastructure. Firstly upgrading many of the agency network links through broadband so we have faster connections now. We also set up the public e-services infrastructure which is a platform for agencies through rapidly deployed e-services without making the heavy investments needed to set up their own infrastructure. We have also recently implemented the SingPass authentication system so it is essentially a single sign on service where citizens can access any agencies e-service with a single ID and password so agencies do not need to manage all the different users when they forget their passwords and similarly the citizen does not need to remember hundreds of different passwords just to access different agency services.

So in summary we have a de facto technical architecture that already exists through the provision of these common infrastructure services. So even before the service wide technical architecture we already have some level of technical standardisation across agencies partly through the switch policies of some of the central services that I mentioned earlier. For example agencies have to comply with some of the network standards that are enforced through the Singapore Government Network Team. In addition we also manage period contracts which makes it easier for agencies to buy IT products without going through a lengthy procurement process and so we have some level of product standardisation because agencies are buying off these period contracts. Also some larger agencies with sub-units have developed their own technical architectures. Of necessity they discovered they needed to do this. So for example the Ministry of Home Affairs includes units such as the Police Force, Civil Defence, Presidents Department. They have already established technical architecture more than two years ago so this is all before the project. But even then we recognised that this situation at that point in time was not ideal, we were starting to do more integrated e-services integrated across different agencies and we recognised that there is a need to do standardisation beyond just the natural means that I mentioned earlier that was not sufficient. So we used the needs of integrated e-services as our basic driving force and then backed on this development of the service by technical architecture. So this slide shows the five stated objectives of the project. The first priority is definitely to enable interoperability among the agency systems and next for systems within an agency we also want to provide a framework for coherent system design and to reduce integration complexity and finally we hope to make it easier for agencies to reuse existing investments.

So what is this SWTA Servicewide Technical Architecture. Let me give a bit of detail. The SWTA consists of a framework, a set of architecture principles, nine domain architectures and very importantly a set of Government policy and processes.

Firstly the framework is the first SWTA document. It is an organised structure to describe the components of the architecture and describes a common format for informity and standardisation. We also have a set of fourteen principles to guide the development of the architecture. These principles are expressed in non-technical language as far as possible. They are meant to express the strategic intent of the architecture in a way that non IT management can understand and more importantly it should be specific enough to guide the development of the architecture. I will illustrate with an example later. Now the domain architectures are the meat of the technical architecture. There are nine of them and they are grouped logically. There is of course many different ways that we can group technology. The way we chose our grouping is to reflect how the IT staff responsibly organise within the agencies so that we are able to identify the domain experts needed to develop the architectures. These are the nine domain architectures don't worry I will not be going through them in detail but I will be happy to discuss them with anyone after should they be interested. The key points I am trying to cover here is that the domains try to cover all the general technical aspects of IT as far as possible. Each domain architecture follows the same

structure as you can see in the slide. We start off with a set of design principles which are primarily derived from the architectural principles that I mentioned earlier. The domain is further broken down into categories which are listed in the finer print on the slides. For each category we would define a set of technology and product standards. As interoperability is a key goal of the architecture we also have a section to highlight standards that are needed for interoperability. We also capture some best practices and the area to watch for future developments. Maybe to better understand this let me walk through an example from the internet and internet domain. Let me start off with one of the design principles which is to minimise browser standards. Note that we highlight the business value for doing so which is to reduce technical support costs and development costs of web sites. This is easily understandable by non IT management and we use it to defend decisions later. Note also there is a linkage to the generic architect principle which is to have standard user interfaces and access protocols. So let's consider the web browser technology category in this domain. The team of experts took into consideration all the applicable design principles such as the use of international standards and I have mentioned earlier minimise browser standards. So based on the design principles we define a specific version of HTML as the standard.

Next coming to product standards you will note that we have also chosen to adopt Internet Explorer as our product standard and only a few specific versions at that. Now the reason we did this is not because we love Microsoft in fact we had some resistance from people who had preference for other browsers. However by using the principles I mentioned earlier which has nothing to do with technology of specific vendors we were able to defend this position which is one single browser will be cheaper for people to develop their system and so on. Bearing in mind our goals we also softened the recommendation we just say that there is a requirement for service wide systems only. So that means that agencies are free to use and support other browsers on their own but they will need to use Internet Explorer to access common systems. So finally we provided also some guidelines on browser settings for accessing the internet and also new standards to monitor.

So I hope I have given you a sense of the considerations that we make as we develop the architecture and these considerations are repeated across the many categories in the nine domains. In this slide I am showing you some of the key standards in other domains that we have identified for interoperability. So for example in middle of the domain we have defined various standards for different ways of collecting IT systems for different agencies. And I would also like to highlight the messaging infrastructure category, where you have actually gone beyond just specifying specific technology or products. Some of us know that if you just use internet standards alone you will not be able to support the rich functions needed for collaboration such as shared calendars or discussion databases. So hence the architecture specifies that the central government e-mail system should be used when these functions are needed.

Next I want to share the process that we went through to develop this architecture. This project was sponsored by the Ministry of Finance and reports to the public sector ICT Steering Committee. That is what PS ICT stands for. This is the committee that sets direction and formulates policies for INFOCOMM initiatives in the public sector and is chaired by the Ministry of Finance. The SWTA main committee was considered specifically for this project and is chaired by the Infocomm Development Authority. Eleven agencies are represented in this committee. These agencies were carefully selected primarily because their own major ICT systems. For example, remember I mentioned the three data hubs, perhaps all the owners of the data hubs are represented in this committee. These agencies then contribute to the main aspects to develop the nine domains that I mentioned earlier. In total, we had more than sixty experts working on various parts of the architecture. The entire effort was co-ordinated by a three-member core team, of which I am a member. In addition, the core team is also responsible for liaison communications with all the other agencies. The SWTA main committee started working in July 2001, that's about two years ago. The core team

kicked off the process, developing the framework principles and governance process that I mentioned earlier. The nine domains were then broken into two phases for development. As part of the development process we also issued RFI's – request for information to the industry for additional input, and subsequently the draft architecture documents were again published on our government internet, so that the use of all the other agencies that were not represented. And finally all SWT documents were just published in April this year. You may wonder why it took almost two years to develop this architecture. The main reason is that we chose the approach of collaboration and consensus. Although it would have been more expedient to just commission a team of consultants, to just draft the architecture. You know we have a perfect technical architecture then. It may have resulted in documents that would not have been acceptable to the agencies. So the collaborative process of developing the documents can be a long and painful one, especially since the experts were often very busy people in their own agencies. However, I must say that the quality of the documents is due in a very large part to the sincere efforts of these domain experts. We in the core team were very much just facilitators of the process.

Next, it took a lot of effort to achieve consensus at the various levels. We started with the main committee, where the members could scrutinise the documents and debate them at length, sometimes until late into the evening. But through these discussions we were able to ensure that most single agencies needs are considered at the expense of others. That was just to cover eleven agencies, and subsequently after the drafts were published we again we see feedback from the various agencies and this were again tabled at the committee for discussion and, more importantly, all the responses to the agencies is published for all to see. That is enough about the development.

Let me talk about the governance aspect. It was very clear to us that the publishing the architecture documents is not the final goal of this project. The result must be real interoperability and reduction of integration complexity; the goals that I mentioned earlier. What we really do not want is for the SWTA to become a 'shelfware', essentially a set of big documents that are left on people's shelves and has no relevance to real systems. Also at times we understand that the optimal choice for the entire public service may result in some not so optimal choices in the agency. Say, for example, a case where if 90% of the government agencies are using product A but particular agencies heavily invested in product B, even though A may be the standard, the SWTA standard, it is economic sense for agencies from that agency's perspective, to migrate from B to A. So hence we need policy and processes which are the key to implementing the architecture.

We have a government instruction manual – this is published on our internet and describes all policies that all agencies must comply with. These are not just IT policies, group policies in financial management, procurement, etc. And the ICT policies is a fairly recent addition to this manual. So what we did was to introduce a new technical architecture policy to the manual. The policy managed two things: one is that all agencies shall develop an agency wide technical architecture, and two that all agencies shall ensure that the necessary IT systems comply with the architecture. Of course, there are always sometimes good business reasons for certain systems to be non-compliant. But the intruder in exception process, make sure that these cases are handled in a well-governed manner. Not all systems need to be compliant. We have specifically classified the compliance requirements based on the system type. And what I mean by system type is how the inter agency aspects come into play. So, for example, only the service wide systems in the central infrastructure need to comply with all the standards. In inter-agency systems they only comply with subset standards known as the inter-operability standard. So we make sure that the burden of compliances is not so heavy on the agencies. And finally, the systems that are within an agency alone they need not comply. However, it is interesting to note that some agencies have decided to adopt all the standards in SWTA, regardless of compliance requirements. This is partly because, I guess, they see the value in the evaluation effort by the inter-agency committee and especially so for

smaller agencies. Now, these agencies often do not have a lot of IT resources to do their own evaluation so they can leverage on this effort. So we found that it is not always necessary to have a big stick just to implement an architecture.

Next, we will talk about communications which I feel is a very key piece to implementing the architecture. We can never communicate enough. And we have done so through various channels. So all the documents and announcements are published on the SWTA website, on the government internet: this is the quickest way to release information to all agencies. We also conduct seminars on architecture at different levels. We communicate to agencies, CIO, that there is a need to develop architecture and then for the technical staff the committee technical details. We have an e-learning module that we developed to explain to SWTA another way for people to get this information offline. Interestingly, we have also worked with the Institute of Higher Learning to develop a three-day workshop and this targets the agency staff who are responsible for developing their own agency's architectures. We also produce collaterals, some of which I have got with me, and finally communication is two way, so we have an e-mail account to which we receive enquiries and feedback, and these have been very useful source of input for ongoing maintenance.

Finally, let me share some of the lessons that we have learnt. The first point, I know is a common cliché. You see it in almost every single project presentation, but in this case I want to highlight that it was the willingness of the various committee members to contribute the right people. To develop these domain architectures that led to the success of this project. Like I said, these people are often very much needed in their own agencies for other projects, and hence I feel that the contribution of their time was more important than money. Next, collaborative development is not easy – we have to make sure the benefits of participation is very clear to all who are involved at the different levels; the committee or the main experts. And the establishment of clear principles also helped to steer the discussion away from agencies' specific implementation issues. In the area of compliance it is not just enough to tell agencies to comply. We must also explain why it benefits them to comply and we have also to be very careful in spelling out the compliance requirements for different types of systems, like I mentioned earlier. And also to differentiate between new systems and existing systems. So this is done to make sure that compliance is more acceptable to agencies. For example, we don't force people to migrate out from existing systems; they are now compliant straight away. You know, we leave them room to evolve. And finally, we cannot expect agencies to comply just because there is a central decree. We can never commit enough, like I said again, and we also need to provide resources and tools. In fact, the workshops were so successful that we have a backlog of agencies that are waiting to attend a workshop. We also have some agencies that are sending additional staff, that need to have people who came and then they say "I want to send more people in for the future".

So finally, where do we go from here? Unfortunately, or perhaps fortunately for us IT professionals, the technology will, is not static. Industry evolves, new products are introduced, and also the government have business needs change. Hence, we need to maintain the architecture to ensure that this continues to be relevant. So we conduct half yearly reviews of the architecture and the first review was just published last week. We have to re-constitute the domain teams to do this but it turns out it is not so difficult after all. It is almost like a little reunion for us! We are also leveraging some of the lessons that we have learnt through this process and we are moving into new areas beyond technical architecture. For example, we have started a similar initiative known as the Singapore Government Metadata Standards, and that's the service initiative to develop metadata for unstructured content. You know, the kind of content you find on websites and on intranet, and the goal of that is to improve the effectiveness and position of searches and navigation. We have also embarked on another initiative to develop service-wide management framework for web services. I guess web services is another hot topic for everyone. Not just the technical component, but policies, procedures shared components that agencies need.

And finally, one more initiative that is not on the slide. We have actually recently also completed what we call the Government Services Map and this maps government services against the agencies. The idea there is to identify common areas, any potential for integration.

Right, this completes my presentation. I hope it has given you a sense of the general overview. Thank you.