**Thoughts on Joint Action**

Joint action (slightly modified from RAF Section 3.1.2.2):

A joint action is a coordinated set of actions involving the efforts of two or more actors to achieve a common set of Real World Effects.

Message exchange is a common example of joint action: one actor assumes the role of the speaker and sends a message, a second actor assumes the role of listener and receives the message. If the message exchange results in a response, then the actors reverse their roles, with the original listener becoming the speaker and the original speaker becoming the listener. Note, each speaker also engages in private actions required to generates the message and each receiver engages in private actions to interpret the message received.

A joint action is likely to imply other joint actions. For example, for someone buying a book from a book store, the joint action is the purchase of the book. This implies the joint actions of the buyer presenting the book to the cashier (i.e., a representative of the book store), the buyer providing payment to the cashier, and the cashier handing over the book and a receipt.

*The interaction between the actors is the set of joint actions that proceed in order to satisfy the intent of the participating actors.* Context often determines the detail to which the interaction needs to be resolved, i.e. which joint actions need to be considered. For someone engaged in buying the book, the detailed joint actions must be understood and completed. However, that same person telling someone they purchased a book does not have to be explicit about the details because the “higher level” joint action is sufficient to express the interaction.

The book buying example also demonstrates private actions for which one of the actors has no interest in knowing more details of other possible joint actions. The book buyer knows the book store engaged in some actions to obtain the book being purchased. The buyer in our example sees this as a private action on the part of the book store. However, from the perspective of the book store, there were joint actions with publishers and/or distributors to create a book inventory. Conversely, if the buyer paid cash for the book, the cashier knows the buyer engaged in private actions to obtain the cash, but doesn’t know if those private actions involved joint actions with an ATM or cash back from a grocery store.

The results of private actions often satisfy preconditions for a joint action, where the preconditions may or may not be explicitly stated. If a credit card is used in the book buying example, a private action on the part of the book store is to verify the credit card is valid. The details of this verification, i.e. the set of joint actions between the store and the credit card issuer, are typically of no interest to the book buyer – the details may not even be visible to the cashier – but this private action becomes part of a public joint action if the credit card is denied. Thus, private actions may initiate additional joint actions when anticipated preconditions are not satisfied.

*Joint action, intent, and real world effect*

A joint action will likely result in more than one real world effect, and the relative importance of the real world effects may vary with the actors involved. For example, a home buyer may be interested in owning a home in which to raise a family, while the real estate agent working with the buyer has more interest in the commission earned from a prospective sale. In this example, the real world effect that both actors desire is the purchase of a house.

While each actor is aware of the real world effect that is likely the priority of the other actor, this is not a barrier to interaction as long as the intent of the other actor does not interfere with the real world effect both have in common. Consider, however, if the seller of the house has learned that there is asbestos in the house and the seller does not want to pay for remediation. The intent of the seller is to make the asbestos someone else’s problem. A joint action will be required between the seller and the prospective buyer, but here the difference in intent signifies the desire for incompatible real world effects. This raises the ideas of trust and willingness as an integral part of joint action, and this will be explored further below.

*Joint action, visibility, and willingness*

Visibility (RM section 3.2.1):

Visibility is the relationship between service consumers and providers that is satisfied when they are able to interact with each other. Preconditions to visibility are **awareness**, **willingness** and **reachability**. The initiator in a service interaction MUST be aware of the other parties, the participants MUST be predisposed to interaction, and the participants MUST be able to interact.

There must be Visibility for joint action to occur. In particular, the actors in the joint action must be aware of each other and must be willing to do their parts in the joint action. In addition, the actors in the joint action must be able to interact to carry out their joint aspects. A simple example is the joint action of message exchange.

* At a minimum the sending actor knows of the receiving actor and the receiving actor is aware or becomes aware of the sending actor.
* The sending actor has intent and is willing to send the message to the receiving actor. The receiving actor also has intent and may be willing to receive the message. Receiving the message does not mean that the receiving actor is willing to carry out any actions in response to the message.
* The sending actor and receiving actor must each have reachability with the other for the physical exchange of bytes to occur. The passing of the bytes does not indicate the receiving actor is willing to do more than recognize a stream of bytes is directed to the receiving location.

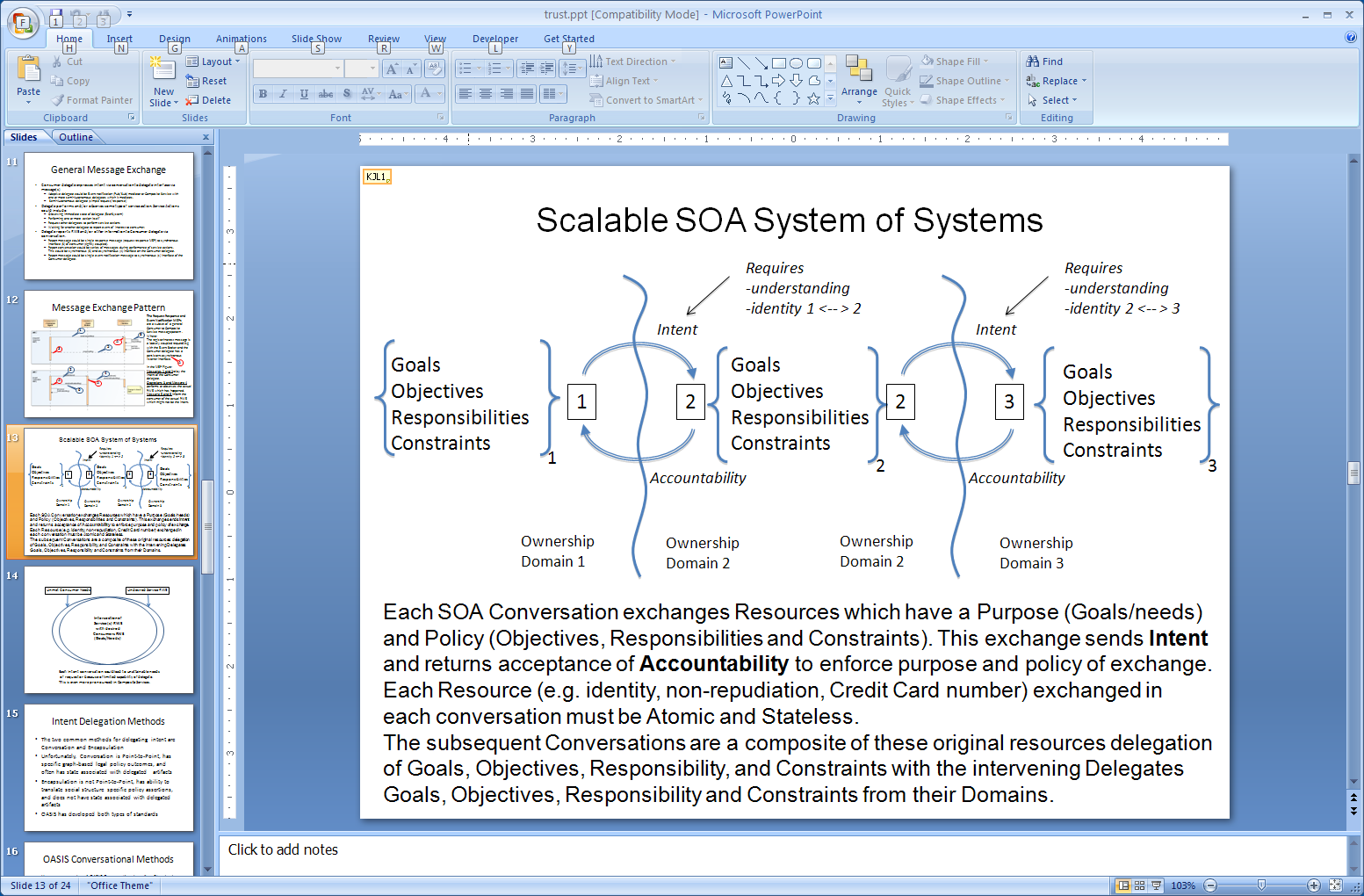
Note, this simple joint action is part of every joint action that involves message exchange and may itself be resolved into joint actions within and among the layers of the OSI stack. In most cases of joint actions involving message exchange, the details of the message exchange are ignored. However, if a factor contributing to the assessment of willingness involves real world effects that can be observed within the stack, such as determination of the integrity of a message, then the communication medium itself becomes an actor and joint actions in which the medium is involved may need to be considered. Note, there is an implicit assumption that all conditions that contribute to a willingness factor are assumed to be satisfied if the joint action is not resolved to a level where these conditions can be observed.

Willingness to engage in a joint action must be established by each actor. This requires an assessment of the trust each actor has with other actors, an assessment of risk in taking part in the joint action, and an eventual balancing of the trust and risk to decide if the benefits of the expected real world effects are sufficient to merit willingness. Many factors could contribute to an assessment of willingness, such as whether there is past experience or an otherwise proven track record with the other actors, whether preconditions have been met, or whether procedures are in place to resolve potential incompatibilities, such as differences in policies. Implicitly or explicitly, willingness is required before participants can establish the execution context for the joint action.

The assessments that result in willingness may be redone for every joint action in a sequence or, once established, may represent a default willingness until conditions change. In the case of reachability over a particular communications network, access to the network implies certain organizational policies are being satisfied and do not need to be more explicitly considered. This may provide a sufficient criterion for willingness. For example, after establishing a VPN connection, a user likely does not reevaluate willingness that depends on the integrity of the actor on the other end. Similarly, communications over a limited access network, such as one used for classified information, may lessen the concern when exchanging sensitive information. However, some joint actions may require a reevaluation of willingness. For example, many users will browse on an unencrypted connection but require https before sending credit card information. Such users have assessed risk of the joint action and require a change in previous conditions in order to maintain willingness to proceed.

Willingness also depends on an actor’s understanding of the proposed joint action; in the case of joint action through message exchange, this includes understanding of the message content and understanding the intent of the sending actor in providing the message and expecting private actions or subsequent joint actions in response. An actor’s confidence in their ability to interpret a message and to both understand and accurately interpret the intent of the sending actor are critical components in the assessment of trust and risk and whether the balance merits continued willingness to interact.

*The effect on willingness of chaining of joint and private actions*



[figure may need some revision for current text]

Each actor in a joint action has its own goals and objectives, responsibilities and constraints. Some of these come from the individual actor and some come from the ownership domain of which the actor is a part. In the course of a joint action, the requesting actor (i.e. the speaker if the joint action is done through message exchange) makes its intent known to the responding actor (i.e. the listener if the joint action is done through message exchange) in terms of the real world effects the requesting actor wants to occur, including effects that reflect policies or other conditions of use. When participating in a joint action, each actor strives to satisfy its own goals and, as described above, the joint action leads to a satisfactory conclusion if the goals of the actors are satisfied by a common set of real world effects. The accountability of the responding actor, as assessed by the requesting actor, is based on how well the intent was satisfied.

In the simplest case of SOA services, the service provider uses service description to state what real world effects will result from an interaction with the service and the service consumer requests those effects. For example, the provider states that certain content will be delivered, e.g. a certain video clip, and the consumer makes the appropriate request for the clip. Both the consumer and the provider may express conditions under which they manifest willingness for the interaction to occur; for example, the provider requires a valid email address to be part of the request and the consumer states a policy that the email address should not be shared outside what is necessary for the current interaction. If there is agreement on the conditions, the interaction is straightforward, predictable, and requires little on the part of the provider in the way of insight into the larger intent of the consumer.

The consumer may express its intent through characteristics of the real world effects rather than something as specific as requesting a particular video clip. For example, the consumer may request a clip covering a certain geographic area, taken during a certain time period, and from one of a number of preferred sources. The provider must understand the characteristics that express the consumer’s intent and be able to apply these in order to identify an adequate response. Indeed, some providers may look exclusively for exact matches to the expressed characteristics and some providers may have the capability to balance the value of potential responses that only partially fulfill the consumer’s request. It is beyond the scope of the current discussion to explore the range of possible responses to a consumer request, but it is up to the consumer to choose the provider that it feels will appropriately interpret its request and perform actions that will best satisfy its intent. Again, the willingness on the part of the consumer to initiate and continue to engage in an interaction is based on how well the consumer expects its intent to be satisfied. The willingness of the provider may be based on whether it expects to meet the consumer’s intent within the parameters of its own goals and constraints.

As noted above, a joint action may require private actions on the part of an actor in order for the joint action to be completed. In the video clip example, the provider engages in private actions to retrieve and deliver the video clip but the consumer is likely not to know the details of the private actions. Thus, the provider may maintain its own video library or it may request content from another provider. The latter is illustrated in the figure. Actor 1, an actor that is a member of ownership domain 1, is the initial consumer and makes a request to Actor 2, an actor that is a member of ownership domain 2. If Actor 2 can act as consumer of another video source, e.g. Actor 3 and ownership domain 3, and Actor 2 can satisfy conditions of use agreed upon with Actor 3, such as limitations on redistribution of content, then the joint action between Actors 1 and 2 can proceed without Actor 1 having explicit knowledge of the joint action between Actors 2 and 3.

In the previous example, it was assumed that the joint actions between Actors 1 and 2 and between Actors 2 and 3 could proceed independently. In particular, it was assumed that any limitations on redistribution rights could be satisfied by Actor 2 without impact on Actor 1. However, the set of joint actions illustrated in the figure implies situations that may require the chaining of joint actions and effects from one joint action to be propagated to another. For example, if Actor 3 requires an acknowledgement be attached to the content that it is the originator, then when Actor 2 complies with this policy, Actor 1 gains some awareness of private actions in which Actor 2 is engaged. Actor 3’s willingness is based on an agreement with Actor 2 to have the acknowledgement in place; Actor 2’s willingness is based on the acknowledgement not conflicting with its other goals. If there is a cost to Actor 2 in dealing with Actor 3, Actor 2 may pass that cost onto Actor 1, again providing a glimpse into Actor 2’s private actions.

Awareness of private actions could also affect Actor 3. For example, in order for Actor 3 to be willing to provide the requested video clip, Actor 3 may need to verify that Actor 1, as the ultimate consumer, is authorized to receive the requested content. In this case, Actor 3 will need awareness of the portion of Actor 2’s private actions that deal with Actor 2 getting identity information from Actor 1. Actor 1 may or may not know its identity information is part of the private action between Actors 2 and 3.

To this point, the discussion has focused on actors who have independent but, to some extent, complementary goals and whose goals are satisfied by an overlapping set of desired real world effects. However, if the goal of Actor 2 is to act on behalf of Actor 1 and to effectively see that Actor 1’s goals are satisfied, then we are dealing with a much tighter bond between the actors and the level of awareness between Actors 1 and 2 of desired – and undesirable – effects increases significantly. An example of this situation is Actor 1 granting Actor 2 a power of attorney. It is incumbent on Actor 2 to have a thorough understanding of Actor 1’s goals so Actor 2 can take independent actions as may be necessary to satisfy those goals. Moreover, when Actor 2 interacts with Actor 3 in this role, Actor 2 will likely be explicit that it is acting on behalf of Actor 1.

Note, the looser levels of interaction are more common in commerce, e.g. the book buyer and the consumer both are merely interested in a book being purchased. However, when one actor is acting on behalf of another or when there are critical preconditions that will affect willingness, there may be more need for joint actions to be explicit and the real world effects of those actions to be included in the determination of willingness.

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*Modeling considerations for joint action*

* joint action must be conducted by actors engaged in the joint action
* joint action may be composed of other joint actions and/or private actions
* private actions may be composed of other private actions or joint actions
* joint actions should indicate the resulting real world effects
* joint actions may indicate policies/constraints/precursor actions that convey preconditions for willingness on the part of an actor

How to “indicate” RWE, policies, etc.?

* As a modeling construct, i.e. thinking of this in the DM2 context, the joint action class would connect to the RWE class (many-to-many) and to other classes that represent policies/constraints/precursor actions (many-to-many). Thus, a joint action is related to effects from the joint action and is (supposed to be) carried out per constraining/defining conditions.
* As part of a service interaction, there would likely be a connection to the process model, but I’m not sure the process model has to be to the detail of every joint action. Does it? Back to the idea that a single interaction may be made up of many joint actions, what needs to be said about every joint action? Is saying something about every joint action only needed if you need to reestablish willingness for every joint action? Is the detail unnecessary if willingness from a previous joint action carries over or if willingness has been established for a higher level joint action and that carries over – something like inheritance?