

**State and Behavior Working Group  
Dated 7 April 2004, V 1.0**

**The information provided below is subject to change and reflects the current knowledge of the Working Group.**

<p style="text-align: center;"><b>Management Problem(s) and Environment</b></p>	<p>Today CIM is an information model. It is an object modeling definition with an extensive model defining much of the core resources of IT systems. However, as an information model, CIM has to date avoided the issues of behavior (i.e. changes or actions that the model may take part in together with the constraints on those actions.)</p> <p>We have already established through the first general usage of CIM in SNIA that the information model itself is not sufficient for interoperable management. SNIA has already been required to add several concepts to CIM including scripts that define sequences of actions on multiple CIM objects to accomplish its function and interoperability goals (ex. Add a disk which may involve creating or modifying several instances and creating multiple associations). This is an example of behavioral characteristics which could not be defined within the current definition of the CIM model.</p> <p>At the same time newer models such as the application runtime model will be heavily based on being able to model behavioral characteristics of the components of the model to achieve their long term goals. Thus, within applications, there is a real need for controlled state change of business applications which involves ordering of actions between components as well as changes to the components that are based on the state of the component. As an example, starting an application may involve the ordered change of state of many distributed lower level components with alternate actions based on the results of the lower level state changes (started, failed, etc.).</p> <p>Many of the existing management standards (ex. ISO) attacked at least some of these behavioral issues within the constraints of the standards. To date CIM has taken a very limited view of anything beyond the information model itself.</p> <p>In order to provide more complete standards based solutions, define and allow the enforcement of management/manageability interoperability, and become a more complete manageability model, CIM must solve some of the problems of defining behavior of the manageability model. Without technologies such as the behavior/state mechanisms we are defining as the objective of this group, the DMTF cannot efficiently and effectively deliver the solutions required by its users such as SNIA.</p> <p>Several of the DMTF work groups are already beginning to apply these concepts today and we feel that a unified approach to the concepts of state management, as well as the concept of policy, can be useful to many of the models.</p>
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## WG Charter

The charter for this group will be to model the concepts and characteristics required for defining more active or behavioral aspects of management built on CIM. In particular, this group will work on the behavior in terms of state and events but will consider all of the aspects of the behavioral view defined in the UML model (sequence, collaboration, state, activities).

Just as the industry is beginning to agree that management is much more than just monitoring, it is important that the DTMF begin to incorporate behavioral characteristics both into the schemas and into the model to allow a definition of manageability that extends CIM and its models beyond simply information exchange.

The group will take a three-step approach:

1. Requirements and use case development. This includes definition of a precise nomenclature for behavioral issues. It is proposed that one of the major use cases in this phase be the use of profiles since profiles are a behavioral issue and any behavioral solutions must support the extension into formalized profiles.
2. Short term objectives primarily for CIM Version 2. This includes the following concepts:
  - Definition of properties that represent state within our behavior concepts.
  - Enforcement of legal state transitions
  - Triggers that signal state transitions or illegal attempts at state transitions
  - Clearer definition of Profile/subprofile constructs.
3. Long term extensions to behavior definition that could be incorporated into future versions of CIM, e.g. recipes (a formal definition of an action sequence), method action signatures (formal description of the effects of methods)

Both the concepts of models to effect management and extensions to the CIM model to effect state-based management may be important as this work progresses. It is not the intention that the short term state schema concept be superseded by adding state concepts to the model in the future, but rather that they probably play two different roles in state management. In particular, the concepts of a class to represent state management is much more flexible since any state chart concepts defined in the CIM model in the future will be incorporated into the language for defining CIM and therefore fixed.

<p><b>Alliance Partnerships</b></p>	<p><b>SNIA</b> – development of common concepts for behavioral issues that will work in the real world management solution defined by SNIA. SNIA clarified many of the problems and limits of the models today and they can heavily contribute to more general solutions and in particular to the development of use cases for these technologies.</p> <p><b>Open Group AQRM</b> (Application Quality and Resource Management) – This group is defining standards for QOS in application environments that heavily depends on effective behavioral definition. The group is planning to use policy as a key behavior defining mechanism. The models within CIM and the capabilities of CIM are required but appear not to be sufficient to complete this work.</p> <p><b>OASIS WSDM</b> – Insure that any work on lifecycle concepts, and the overall strategies developed by the Oasis WSDM (Web Services Distributed Management) group are compatible and that any modeling of state and behavior is compatible with OASIS WSDM specifications being developed.</p> <p><b>GGF OGSA</b> – Development of use cases and behavior concepts.</p> <p><b>OMG (UML)</b> – Utilize the concepts of state, action, etc. that represent much of the OMG UML models. It is not clear yet whether this work simply depends on the OMG UML or has some influence back but the work <b>MUST</b> take the OMG state work heavily into account.</p>
<p><b>Reliance/Coordination with other WG Models</b></p>	<p>This group must interact with many of the other working groups including:</p> <p><b>DMTF Application Work Group</b> – We expect that the work of this group would be a major user of the concepts developed by a behavior and state work group.</p> <p><b>DMTF Policy Work Group</b> - Policy is expected to be a primary user of any behavioral work and should have a significant input since policy itself is already a component of the mechanisms for behavioral definition.</p> <p><b>DMTF SysDev Work Group</b> - This group is responsible for the core model and has already implemented state definition high in the CIM model the work of the behavior group must work with <b>SysDev</b> to assure that future work in compatible, that the work is relevant to the requirements of the core model, and that the output is usable with the core models.</p> <p><b>DMTF Interop Work Group</b> – This group is currently defining profiles and the profile mechanisms so that this group must work with Interop and SNIA to develop the concepts for formalizing profiles.</p> <p><b>OASIS</b> – While there is no formal relationship with the WSDM group it is clear that there is a significant parallel activity involved in defining state, managing state, life cycle definition, etc. This group must work with the WSDM group to assure that the modeling and the work they produce converge and that there is no duplication of standards.</p>

	<p><b>Prior Work</b></p> <p>There has been considerable prior work on at least some of these concepts within the OO community and within the management infrastructure community. This includes:</p> <ul style="list-style-type: none"> <li>• <b>UML</b> which incorporates both the concepts of object state and state transition and of inter-object interaction definitions within its modeling concepts. These concepts will be very important to any CIM behavior modeling.</li> <li>• <b>ISO</b> management standards which included extensive state management definitions as part of the standards.</li> <li>• <b>SNIA</b> which has established that many of the concepts of behavior must be somehow specified to provide an interoperable management/manageability interaction. They are accomplishing their definitions through the use of profiles and of scripting of the management actions.</li> <li>• <b>CIM Model today</b> which has begun to define the concepts of state within properties of the model but which finds itself unable to define behavior related to those states in any way other than the descriptions and which also does not have a means to effectively define inter-object interactions.</li> <li>• <b>Policy Working Group</b> which has establish a CIM model for policy rules and is now working to integrate that model with other functions of the CIM model an WBEM (ex. Event driven conditions).</li> </ul>
<p><b>Prior Work</b></p>	<p>There is a rich set of work in the concepts of state and behavior applicable generally to object models, much of which has coalesced around the UML model and the concepts of state and actions defined in that model. Other computer science fields including compilers have also use the concepts of state and state transition as the basis for behavior definition and this is thoroughly documented in many papers.</p> <p>In addition, there are clear examples of state based management throughout the industry. In particular, those products that include descriptions like “desired-state management” “goal-driven management”, etc. are based heavily on state management concepts. In fact they carry it beyond simply the monitor and control of state to using state as the basis for automation.</p> <p>ISO in their documents on management recognized the importance of state and the clear definition of state and of states as a core principle of management and documented this in one of the ISO documents (See CCITT X.731: State Management Function).</p> <p>The OMG bases much of their UML modeling behavior mechanisms on the state of classes and corresponding state diagrams which we assume is closely related to our objectives.</p>

## Current Work – Overview, Deliverables and Timeline

**Requirements and Use Case gathering Phase** — It is already clear that a number of groups both within DMTF and in other organizations are working at least in the area of developing state definitions today and have requirements for functionality which this work group could help to satisfy. Therefore it is proposed that the initial work of this work group is to gather and document use cases that would be used as the basis for any work. Work with other DMTF work groups and the defined external groups to develop a cohesive set of the requirements and use cases of each of these groups in the area of state and behavior management. The output of this work would be a requirements document that would be used to validate the following steps. Until this initial work is completed, we can not be certain of exactly what are the high priority requirements. Therefore, the following paragraphs define a set of straw man work that today appears to be a valid approach to the solution. The goal of this immediate work would be to determine if this work would be valid and useful, particularly the work proposed for CIM V2 below. This should also include background on the current state of behavior and state work, particularly in other object models technologies such as UML. **Target:** within the first 2 months of the group's formation (February 2004). **Deliverable:** white paper.

**Short term,** Note that this is a straw man proposal and the final definition will depend on the output of the requirements phase above. The group will produce a model for the concept and definitions of a state machine and state variables, consistent state definitions and basis for its implementation as CIM classes that can be implemented within CIM V2. The objective of this state machine model would be to allow state machines (the state matrix, the definition of state attributes, state transitions, etc.) to be defined as CIM objects so that state, state transitions and corresponding actions, conditions, etc. could be defined with CIM objects and applied to other CIM objects (for example, within the CIM applications model). This will allow the implementation of state and state change management concepts in a standard way within the CIM specification. **Target:** an initial model extension for CIM 2.10 preliminary. **Deliverables:** White paper, possible state transition model and any extensions required to other parts of model to allow enabling concepts like state properties.

**Long term,** Based on the output of the requirements gathering and the short-term work, this group will define extensions to CIM to incorporate behavior into the CIM model itself, by defining the concepts of state behavior and intra-model interactions as extensions to the CIM definition. This work could be used as a driving activity to incorporate some of the characteristics of UML that represent behavior into the CIM model itself.

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<b>Link to Subteam Charter(s)</b>	There are no subteams defined to date.

To join the DMTF and/or the WG, see <http://www.dmtf.org/join> and <WG link>.