A Translucent Caching API

Communication between Venus and the Advice Monitor occurs in both directions. Thus, Venus is a server for the Advice Monitor as well as a client of the Advice Monitor. For this reason, I present the interface is two segments. The first shows those calls for which Venus acts as a server and the Advice Monitor as a client. The second shows those calls for which Venus acts as a client and the Advice Monitor as a server.

A.1 Calls Serviced By Venus

The first half of the API includes those calls serviced by Venus. These calls expose certain *data* to the Advice Monitor.

A.1.1 NewAdviceService

Call:

```
long NewAdviceService (IN RPC2_String Hostname,
        IN RPC2_Integer UserID,
        IN RPC2_Integer Port,
        IN RPC2_Integer PGrpID,
        IN RPC2_Integer AdSrvVersion,
        IN RPC2_Integer AdMonVersion,
        OUT RPC2_Integer VenusMajorVersion,
        OUT RPC2_Integer VenusMinorVersion);
```

Parameters:

Hostname	Hostname on which Advice Monitor is running (must be “localhost”)
UserID	uid that Advice Monitor represents
Port	Port
PgrpID	Process Group ID of Advice Monitor
AdSrvVersion	Version of adsrv.rpc2 in use
AdMonVersion	Version of admon.rpc2 in use
VenusMajorVersion	Venus’s major version number

VenusMinorVersion	Venus's minor version number

Completion Codes:

CAEVERSIONSKEW	AdSrvVersion or AdMonVersion passed from the Advice Monitor do not match those of Venus.
CAENOSUCHUSER	The user with UserID does not match any user known to this Venus.
CAEADVICEPENDING	A request for advice is outstanding to another Advice Monitor for this user. (Try again.)
CAESUCCESS	No errors were detected.

Description:

The NewAdviceService call announces the existence of a new Advice Monitor to Venus. This call sets up the advice connection within Venus and allows Venus to detect version skew between itself and the Advice Monitor.

A.1.2 ConnectionAlive

Call:

long ConnectionAlive(IN RPC2_Integer UserID);

Parameters:

UserID	UserID owning requesting Advice Monitor

Completion Codes:

CAENOSUCHUSER	The user with UserID does not match any user known to this Venus.
CAENOTVALID	Connection to this user is not currently valid.
CAESUCCESS	No errors were detected.

Description:

An Advice Monitor uses this call to verify the status of its connection to Venus.

A.1.3 GetServerInformation

Call:

long GetServerInformation(IN RPC2_Integer MaxServers, OUT ServerEnt servers[]);

Parameters:

MaxServers	The maximum number of servers for which Venus should return information.
servers[]	An array of server entries each containing the name of a server and an estimate of Venus's connectivity to that server

Completion Codes:

CAENOSERVERS	Venus is not currently in contact with any servers.
CAESUCCESS	No errors were detected.

Description:
An Advice Monitor uses this call to determine the names of all servers with which Venus is currently communicating. The ServerEnt type is defined as follows:

```
typedef RPC2_Struct {
    RPC2_String name;
    RPC2_Integer bw;
    } ServerEnt;
```

N.B. The implementation of arrays in RPC2 requires a long parameter before the array parameter. The value of the long should be the number of elements in the array.

A.1.4 RegisterInterest

Call:
long RegisterInterest(IN RPC2_Integer UserID, InterestValuePair events[]);

Parameters:

UserID	UserID owning requesting Advice Monitor
InterestValuePair[]	An array of events each with an indication of user's interest in them

Completion Codes:

CAENOSUCHUSER	The user with UserID does not match any user known to this Venus.
CAESUCCESS	No errors were detected.

Description:
An Advice Monitor uses this call to register the user's interests in various events. The InterestValuePair type is defined as follows:

```
    typedef RPC2_Struct {
        InterestID event;
        RPC2_Integer value;
    } InterestValuePair;
```

The list below shows the valid interest identifiers:

TokensAcquiredID	HoardWalkPeriodicOnID
TokensExpiredID	HoardWalkPeriodicOffID

ActivityPendingTokensID	ObjectInConflictID
SpaceInformationID	ObjectConsistentID
ServerAccessibleID	ReintegrationPendingTokensID
ServerInaccessibleID	ReintegrationEnabledID
NetworkQualityEstimateID	ReintegrationActiveID
ReconnectionID	ReintegrationCompletedID
ReadDisconnectedCacheMissEventID	TaskAvailabilityID
WeaklyConnectedCacheMissEventID	TaskUnavailabilityID
DisconnectedCacheMissEventID	ProgramAccessLogsID
HoardWalkAdviceRequestID	ReplacementLogsID
HoardWalkBeginID	InvokeASRID
HoardWalkEndID	

N.B. The implementation of arrays in RPC2 requires a long parameter before the array parameter. The value of the long should be the number of elements in the array.

A.1.5 GetCacheStatistics

Call:

```
long GetCacheStatistics(OUT RPC2_Integer FilesAllocated,
        OUT RPC2_Integer FilesOccupied,
        OUT RPC2_Integer BlocksAllocated,
        OUT RPC2_Integer BlocksOccupied,
        OUT RPC2_Integer RVMAllocated,
        OUT RPC2_Integer RVMOccupied);
```

Parameters:

FilesAllocated	Number of fsobjs allocated by Venus
FilesOccupied	Number of fsobjs occupied by hoarded objects
BlocksAllocated	Number of cache blocks allocated by Venus
BlocksOccupied	Number of cache blocks occupied by hoarded objects
RVMAllocated	Amount of RVM space allocated
RVMOccupied	Amount of RVM space occupied

Completion Codes:

CAESUCCESS	No errors were detected.

Description:

An Advice Monitor uses this call to determine the current space usage within Venus. Files and Blocks refer to the number of fsobjs and blocks maintained by Venus for its cache. RVM refers to the internal recoverable virtual memory used by Venus to store persistent state.

A.1.6 OutputUsageStatistics

Call:

long OutputUsageStatistics(IN RPC2_Integer UserID,
    IN RPC2_String Pathname,
    IN RPC2_Integer DisconnectionsSinceLastUse,
    IN RPC2_Integer PercentDisconnectionsUsed,
    IN RPC2_Integer TotalDisconnectionsUsed);

Parameters:

UserID	User owning requesting Advice Monitor
Pathname	Pathname of file in which to dump usage statistics
DisconnectionsSinceLastUse	Number of active disconnections since an object was last used during disconnected operation
PercentDisconnectionsUsed	Percentage of active disconnections during which object has been used
TotalDisconnectionsUsed	Number of active disconnections during which object was used

Completion Codes:

CAENOSUCHUSER	The user with UserID does not match any user known to this Venus.
CAESUCCESS	No errors were detected.

Description:

An Advice Monitor uses this call to request that Venus output disconnected usage statistics for cached files. Venus identifies objects which have not been used during the N most recent disconnections, where N = DisconnectionsSinceLastUse. Venus also identifies objects which have been used for fewer than M% of active disconnections (where M = PercentageDisconnectionsUsed) and which have been used during a minimum of T disconnections (where T = TotalDisconnectionsUsed). It outputs the relevant data to the specified file.

A.1.7 SetParameters

Call:

long SetParameters(IN RPC2_Integer UserID, IN ParameterValuePair parameters[]);

Parameters:

UserID	User owning requesting Advice Monitor
parameters	An array of parameters, each with a new value

Completion Codes:

CAENOTAUTHORIZED	This user is not authorized to change Venus parameter values.
CAESUCCESS	No errors were detected.

Description:

An Advice Monitor can use this call to set certain Venus parameters dynamically. The current list of parameters that can be set dynamically is small, but can be extended with minimal effort. This list contains:

AgeLimit	Minimum age of records (in seconds).
ReintLimit	Work Limit (in milliseconds).
ReintBarrier	Included for future extension to allow the Advice Monitor to modify the location of the reintegration barrier (see Section 9.2.3.2.)
WeakThreshold	Threshold below which Venus transitions into weakly connected operation (in Bytes/second).
PatienceAlpha	alpha parameter of the user patience model (in seconds)
PatienceBeta	beta parameter of the user patience model
PatienceGamma	gamma parameter of the user patience model

N.B. The implementation of arrays in RPC2 requires a long parameter before the array parameter. The value of the long should be the number of elements in the array.

A.1.8 ResultOfASR

Call:

long ResultOfASR(IN RPC2_Integer ASRid, IN RPC2_Integer result);

Parameters:

ASRid	Identification of ASR
result	Result of that ASR's execution

Completion Codes:

CAENOASR	No ASRs are currently in progress.
CAEUNEXPECTEDASR	ASRid does not match the ID of the ASR currently in progress.
CAESUCCESS	No errors were detected.

Description:

An Advice Monitor uses this call to return the result of an application-specific resolver.

A.1.9 Imminent Death

Call:

long ImminentDeath(IN RPC2_String HostName,
IN RPC2_Integer UserID,
IN RPC2_Integer Port);

Parameters:

HostName	HostName on which Advice Monitor running (ignored)
UserID	User owning requesting Advice Monitor
Port	Port on which Advice Monitor listening (ignored)

Completion Codes:

CAENOSUCHUSER	The user with UserID does not match any user known to this Venus.
CAESUCCESS	No errors were detected.

Description:

The Advice Monitor can use this call to inform Venus of its imminent death.

A.2 Calls Serviced By Advice Monitor

The second half of the API includes those calls serviced by the Advice Monitor. These calls expose certain *events* to the Advice Monitor.

A.2.1 LostConnection

Call:

long LostConnection();

Parameters:

None.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:

The LostConnection() call serves to inform an Advice Monitor that it has lost its connection with Venus.

A.2.2 TokensAcquired

Call:

long TokensAcquired(IN RPC2_Integer EndTimestamp);

Parameters:

EndTimestamp	The time at which the user's tokens are scheduled to expire.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:

Venus makes this RPC call when the user obtains new tokens.

A.2.3 TokensExpired

Call:

long TokensExpired();

Parameters:

None.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:

Venus makes this RPC call when a user's tokens have expired.

A.2.4 ActivityPendingTokens

Call:

long ActivityPendingTokens(IN ActivityID activityType, IN RPC2_String argument);

Parameters:

ActivityType	Used to identify the type of activity that requires the user to obtain tokens.
argument	An optional argument to specify a file or volume name requiring the specified activity.

Completion Codes:

CAEINVALIDARG	Activity provided is not valid.
CAESUCCESS	No errors were detected.

Description:

Venus makes this RPC call when a subsystem requires authentication before proceeding. For example, when an object needs to be repaired or when a reintegration is pending.

A.2.5 SpaceInformation

Call:

long SpaceInformation(IN RPC2_Integer PercentFilesFilledByHoardedData
    IN RPC2_Integer PercentBlocksFilledByHoardedData,
    IN RPC2_Integer PercentRVMFull,
    IN Boolean RVMFragmented);

Parameters:

PercentFilesFilledByHoardedData	The percentage of cache files filled with hoarded data.
PercentBlocksFilledByHoardedData	The percentage of cache blocks filled with hoarded data.
PercentRVMFull	The percentage of RVM that is filled.
RVMFragmented	An indication of whether or not RVM is fragmented.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:

Venus makes this RPC call to inform the Advice Server about the current space status.

A.2.6 ServerAccessible

Call:

long ServerAccessible(IN RPC2_String ServerName);

Parameters:

ServerName	The server that has become accessible.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:

Venus makes this RPC call when a server becomes accessible.

A.2.7 ServerInaccessible

Call:

long ServerInaccessible(IN RPC2_String ServerName);

Parameters:

ServerName	The server that has become inaccessible.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when a server becomes inaccessible.

A.2.8 ServerConnectionWeak

Call:
long ServerConnectionWeak(IN RPC2_String ServerName);

Parameters:

ServerName	The server whose connection has become weak.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when the connection to a server becomes weak.

A.2.9 ServerConnectionStrong

Call:
long ServerConnectionStrong(IN RPC2_String ServerName);

Parameters:

ServerName	The server whose connection has become strong.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when the connection to a server becomes strong.

A.2.10 NetworkQualityEstimate

Call:
long NetworkQualityEstimate(IN QualityEstimate serverList[]);

Parameters:

ServerList[]	An array of QualityEstimate structures specifying the estimated network quality for a number of servers.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call to inform the Advice Monitor of the strength of its connections to servers. The QualityEstimate structure contains the following information:

```
typedef RPC2_Struct {
        RPC2_String ServerName;
        RPC2_Integer BandwidthEstimate;
        Boolean Intermittent;
} QualityEstimate;
```

N.B. The implementation of arrays in RPC2 requires a long parameter before the array parameter. The value of the long should be the number of elements in the array.

A.2.11 Reconnection

Call:
long Reconnection(IN ReconnectionQuestionnaire Questionnaire,
OUT RPC2_Integer ReturnCode);

Parameters:

Questionnaire	A data structure containing statistics about the recent disconnected session.
ReturnCode	(Not used.)

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when a volume transitions into the Hoarding state from any other state. The input structure contains the following information:

```
typedef RPC2_Struct {
        RPC2_Integer RQVersionNumber;
        RPC2_String VolumeName;
        VolumeId VID;
        RPC2_Unsigned CMLcount;
        RPC2_Unsigned TimeOfDisconnection;
        RPC2_Unsigned TimeOfReconnection;
        RPC2_Unsigned TimeOfLastDemandHoardWalk;
        RPC2_Unsigned NumberOfReboots;
        RPC2_Unsigned NumberOfCacheHits;
        RPC2_Unsigned NumberOfCacheMisses;
        RPC2_Unsigned NumberOfUniqueCacheHits;
        RPC2_Unsigned NumberOfObjectsNotReferenced;
} ReconnectionQuestionnaire;
```

A.2.12 ReadDisconnectedCacheMissEvent

Call:

```
long ReadDisconnectedCacheMissEvent(IN ObjectInformation objInfo,
        IN ProcessInformation processInfo,
        IN RPC2_Unsigned TimeOfMiss,
        OUT CacheMissAdvice Advice,
        OUT RPC2_Integer ReturnCode);
```

Parameters:

objInfo	Information about the missing object.
processInfo	Information about the requesting program.
TimeOfMiss	Time at which the miss occurred.
Advice	User's advice regarding this miss.
ReturnCode	Return value.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:

Venus makes this RPC call when a cache miss occurs while Venus is operating read disconnected.

A.2.13 WeaklyConnectedCacheMissEvent

Call:

```
long WeaklyConnectedCacheMissEvent(IN ObjectInformation objInfo,
        IN ProcessInformation processInfo,
```

IN RPC2_Unsigned TimeOfMiss,
IN RPC2_Integer Length,
IN RPC2_Integer EstimatedBandwidth,
IN RPC2_String Vfile,
OUT CacheMissAdvice Advice,
OUT RPC2_Integer ReturnCode);

Parameters:

objInfo	Information about the missing object.
processInfo	Information about the requesting program.
TimeOfMiss	Time at which the miss occurred.
Length	Size of the missing object.
Estimated Bandwidth	Current estimated bandwidth.
Vfile	Name of cache file (on the local disk) in which Venus will store the data.
Advice	User's advice regarding this miss.
ReturnCode	Return value.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when a cache miss occurs while Venus is operating weakly-connected.

A.2.14 DisconnectedCacheMissEvent

Call:
long DisconnectedCacheMissEvent(IN ObjectInformation objInfo,
IN ProcessInformation processInfo,
IN RPC2_Unsigned TimeOfMiss,
IN RPC2_Unsigned TimeOfDisconnection,
OUT RPC2_Integer ReturnCode);

Parameters:

objInfo	Information about the missing object.
processInfo	Information about the requesting program.
TimeOfMiss	Time at which the miss occurred.
TimeOfDisconnection	Time at which disconnection occurred.
ReturnCode	Return value.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when a cache miss occurs during disconnected operation.

A.2.15 HoardWalkAdviceRequest

Call:

long HoardWalkAdviceRequest(IN RPC2_String InputPathname,
    IN RPC2_String OutputPathname,
    RPC2_Integer ReturnCode);

Parameters:

InputPathname	Name of file containing information about this hoard walk request.
OutputPathname	Name of file that should be used to provide advice for the objects contained in InputPathname.
ReturnCode	Not Used.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:

Venus makes this RPC call to request hoard walk advice from the user.

A.2.16 HoardWalkBegin

Call:

long HoardWalkBegin();

Parameters:

None.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:

Venus makes this RPC call when a hoard walk begins.

A.2.17 HoardWalkStatus

Call:

long HoardWalkStatus(IN RPC2_Integer Percentage);

Parameters:

Percentage	Percentage of the hoard walk completed to date.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call to inform the Advice Monitor of the walk's progress.

A.2.18 HoardWalkEnd

Call:
long HoardWalkEnd();

Parameters:
None.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when a hoard walk completes.

A.2.19 HoardWalkPeriodicOn

Call:
long HoardWalkPeriodicOn();

Parameters:
None.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when periodic hoard walks are enabled.

A.2.20 HoardWalkPeriodicOff

Call:
long HoardWalkPeriodicOff();

Parameters:
None.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when periodic hoard walks are disabled.

A.2.21 ObjectInConflict

Call:
long ObjectInConflict(IN RPC2_String Pathname, IN ViceFid fid);

Parameters:

Pathname	Pathname of object in conflict.
fid	File identifier of object in conflict.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when it detects that an object is in conflict.

A.2.22 ObjectConsistent

Call:
long ObjectConsistent(IN RPC2_String Pathname, IN ViceFid fid);

Parameters:

Pathname	Pathname of object now consistent.
fid	File identifier of object now consistent.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when an object in conflict is successfully repaired.

A.2.23 ReintegrationPendingTokens

Call:
long ReintegrationPendingTokens(IN RPC2_String volumeID);

Parameters:

volumeID	Identifier of volume needing to be reintegrated.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when a volume needs to be reintegrated, but for which the user's tokens are not valid.

A.2.24 ReintegrationEnabled

Call:
long ReintegrationEnabled(IN RPC2_String volumeID);

Parameters:

volumeID	Identifier of volume for which reintegration has been enabled.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when a volume has modification that need to be reintegrated, but which have not yet aged.

A.2.25 ReintegrationActive

Call:
long ReintegrationActive(IN RPC2_String volumeID);

Parameters:

volumeID	Identifier of volume currently being reintegrated.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when a volume is actively being reintegrated.

A.2.26 ReintegrationCompleted

Call:
long ReintegrationCompleted(IN RPC2_Volume volumeID);

Parameters:

volumeID	Identifier of volume for which reintegration has completed.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when reintegration of a volume completes.

A.2.27 TaskAvailability

Call:
long TaskAvailability(IN TallyInfo taskList[]);

Parameters:

TaskList[]	An array of TallyInfo structures describing the current availability of numerous tasks.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call to inform the Advice Monitor of the availability of hoarded tasks. The call is triggered upon completion of each hoard walk.

N.B. The implementation of arrays in RPC2 requires a long parameter before the array parameter. The value of the long should be the number of elements in the array.

A.2.28 TaskUnavailability

Call:
long TaskUnavailability(IN RPC2_Integer TaskPriority, RPC2_Integer ElementSize);

Parameters:

TaskPriority	Priority of unavailable task.
ElementSize	Size of unavailable item.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when it evicts or invalidates a hoarded object.

A.2.29 ProgramAccessLogAvailable

Call:
long ProgramAccessLogAvailable(IN RPC2_String LogFile);

Parameters:

LogFile	Name of file containing program access log.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:
Venus makes this RPC call when it fills a program access log.

A.2.30 ReplacementLogAvailable

Call:

long ReplacementLogAvailable(IN RPC2_String LogFile);

Parameters:

LogFile	Name of file containing replacement log.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:

Venus makes this RPC call when it fills a replacement log.

A.2.31 InvokeASR

Call:

```
long InvokeASR(IN RPC2_String Pathname,
        IN RPC2_Integer uid,
        OUT RPC2_Integer ASRid,
        OUT RPC2_Integer ReturnCode);
```

Parameters:

Pathname	Pathname of object needing application-specific resolution (ASR).
Uid	Identification of user invoking ASR.
ASRid	Identifier of applicaton-specific resolver.
ReturnCode	Return value.

Completion Codes:

CAESUCCESS	No errors were detected.

Description:

Venus makes this RPC call when it detects an object that is in conflict. The value of the ReturnCode will be either ADMON_SUCCESS (if the ASR was successfully started) or ADMON_FAIL (if the ASR was not successfully started).