Some Thoughts On Residential Ethernet Services And Their Definition

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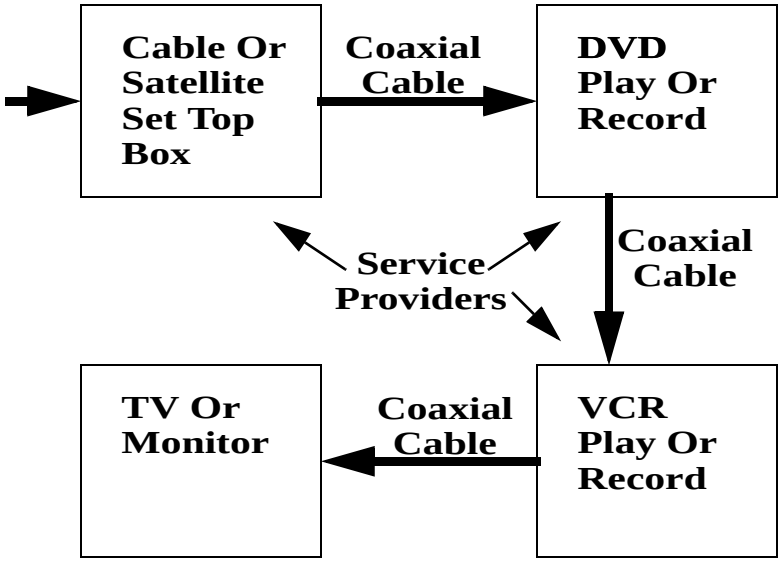
Traditional Service Model



- The Customer presses play on the Remote Control, but the question is play what where?

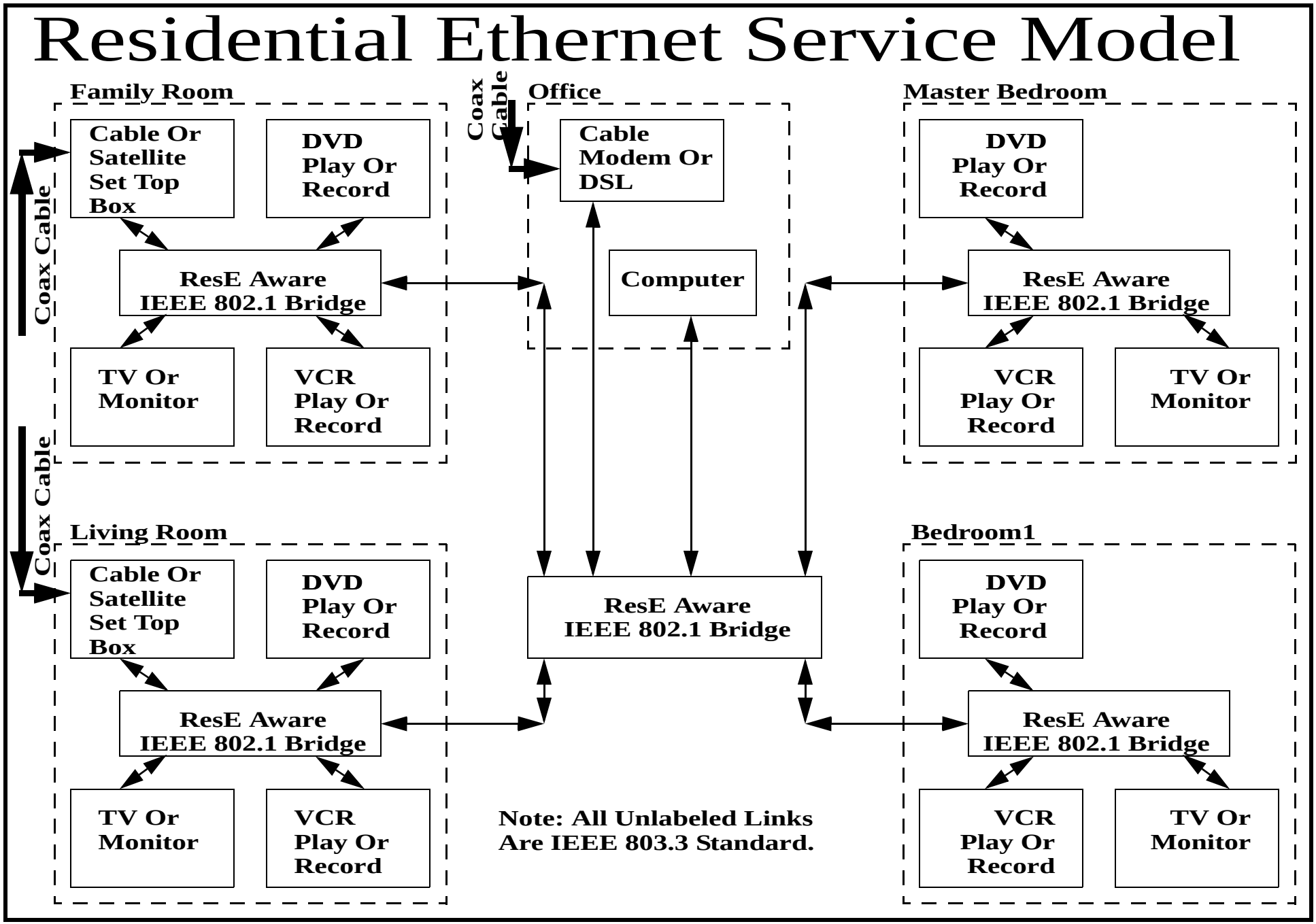
- Well in the Traditional Service Model (TSM) the answer is trivial!

- For the context or this presentation I have defined the term Service Provider (SP) to mean any ResE Aware Device that sources content onto the Data Link such as a Set Top Box, VCR, or DVD.

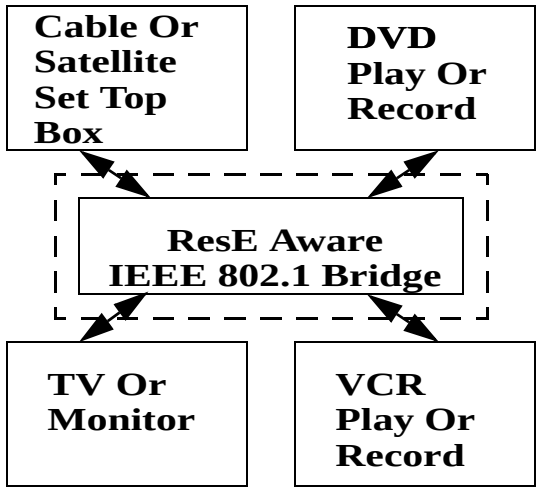
- Play What? Is answered implicitly by a one to one relationship of Remote Controls (RC) to Service Providers (SP), with a few exceptions.

- Play Where? Is answered by the traditional daisy chained coaxial cable interconnect of the Service Providers (SP).

Residential Ethernet Service Model



ResE Service Dilemma



- Referring To Slide 3 we ask the question again.

- The Customer presses play on the remote control but the question is play what where?

The answer is not so obvious now!

- Play What? Can be answered implicitly in the trivial case by a one to one relationship of IR Remote Controls to Service Providers with a few exceptions. Most home entertainment devices come with a remote control of their own (1 to 1 relationship).

- Play Where? Is now more complex! It could be anywhere in the house! (Oh No!)

ResE Channel Concept

- To solve the dilemma I propose a solution based on the existing Television Channel Model (TCM).

- Currently devices which source information onto the daisy chained coaxial cable network do so on “Channels”, where the channels are differentiated via Frequency Domain Multiplexing (FDM).

- The existing customer base is familiar with this channel concept.

- The transmit channel on the coax used in most cases is user selectable in a small range. Say channels 2, 3, 4. Probably set by a selector wheel located on the back of the device.

- I would propose that for the ResE concept that we extend and reuse the traditional channel model!

- All devices that wish to source content onto a ResE Data Link will do so on a selected unique channel (mono) or channels (stereo).

- Each Channel maps to a single ResE Content Flow (CF) which is really just a multicast flow.

- The number of channels should be extended to say 2^{24}?

ResE Channel Defaults

- To insure out of the box Plug And Play (PAP) operation each device type that desires to act as a Content Source (CS) needs to be assigned a default Ether Channel Identifier (ECI).

- I would propose that 802.3 not standardize application to ECI assignments, but instead offer guidance on the issue to external Industry Standards Groups (ISG) that would formalize default assignments. For example a TV might default to EChannel 2, a VCR to EChannel 3, and a musical instrument to EChannel 1024.

- The Extended Ethernet Channel Identifier (EECI) which includes the source devices MAC Address should be defined. The EECI concept will allow unique assignments for large ResE commercial deployments such as on orchestra composed or tens of instruments or a security system composed of tens or even a few hundred cameras and monitors.

- Of course the default ECI values can be changed by the knowledgeable user.

ResE Channel Example

- Please note that all devices which wish to receive a Content Flow (CF), which implies they behave as a content sinks (CSINK), are equipped with a logical Ethernet Tuner (LET) which allows the user select which Echannel to receive. Note also that since the LET just selects a multicast stream to receive in comes at very low cost!

- For example a customer purchases a TV, Video Recorder (VR), DVD Recorder (DVDR), Cable Set Top Box (CSTB), and of course a ResE Aware IEEE 802.1 Bridge (RBridge).

- Each of these devices comes out of the box equipped with a Default ECI. For example the CSTB defaults to Echannel 2, VR defaults to Echannel 3, the DVD defaults to Echannel 4.

- The customer connects the devices together with the required CAT 5 (or better) cabling and powers up the new system. The user now should be able to operate the new system using traditional IR remote controls.

- For example the customer wishes to view Cable TV, so he selects channel 2 on the TV, and selects his desired viewing channel on his CSTB Tuner. If the user wishes to record on the VR a CF from the CSTB he selects Echannel 2 on the VR's LET and starts the recorder.

ResE Terminology

- Content Source (CSRC) - A source of ResE Entertainment Content such as a VCR Playing or a Cable Set Top Box.

- Content Sink (CSINK) - A sink of ResE Entertainment Content such as a VCR Recording or an TV.

- ResE Content Flow (CF) - Any Layer 2 flow of ResE Entertainment Content from any higher layer application formatted as a series of 802.3 frames traveling from a source or CSRC to a destination or CSINK. GSRP PDUs are not part of CFs.

- ResE CFs may be point to point or point to multipoint.

- ResE CFs shall always use a multicast DA. This facilitates seamless uninterrupted add and drops of ResE CSINKs.

- A existing point to point CF may have an additional destination CSINKs added to become a point to multipoint CF and visa versa.

ResE GSRP Protocol

- We define a set of ResE service semantics along with a frame based slow protocol which provides for the communication and registration of ResE Service Semantics at each ResE aware Bridge.

- This new protocol will likely be defined as an IEEE 802.1 GARP Application named the “Generic Service Registration Protocol (GSRP)” and will provide the necessary semantics to communicate and register Service Attributes (SA).

- Some basic GSRP Requirements:

- Supports a reliable registration and de registration protocol which allows Content Sources (CSRC) to register source information tuples with RBridges, maintaining a coherent Service Registration Data Base (SRB) at each RBridge, and which allows RBridges to share the registered SRB information with each other, thus maintaining a coherent SRB image across the Bridged Data Link.

- Supports a reliable query an respond protocol which allows subscribing sinks (CSINK) to share the registered SRB information.

- Supports a reliable Service Add and Drop protocol which allows CSINKS to subscribe and unsubscribe on demand to a previously registered Content Source (CSRC).

ResE Semantics

- Details of the definition GSRP as a GARP based protocol will be presented in future presentations, but first we need to think about the ResE Service Semantics (RSS).

- To move ahead we must now define the details of the ResE Service Semantics (RSS). When a ResE Aware Device (RDevice) is connected to a ResE Aware Bridge (RBridge) it registers the ResE CSRC Services (RS) that it provides with its RBridge via GSRP. Only Content Sources (CSRC) are required to register.

- Other RBridges then share the registered information via the GSRP Protocol.

ResE Services

- Set Top Box Services Registered:

Service
{
CSRC(ECh(2), Mcast_ID(Mcast_ID_2), Name(Cable_Family_Rm));
{

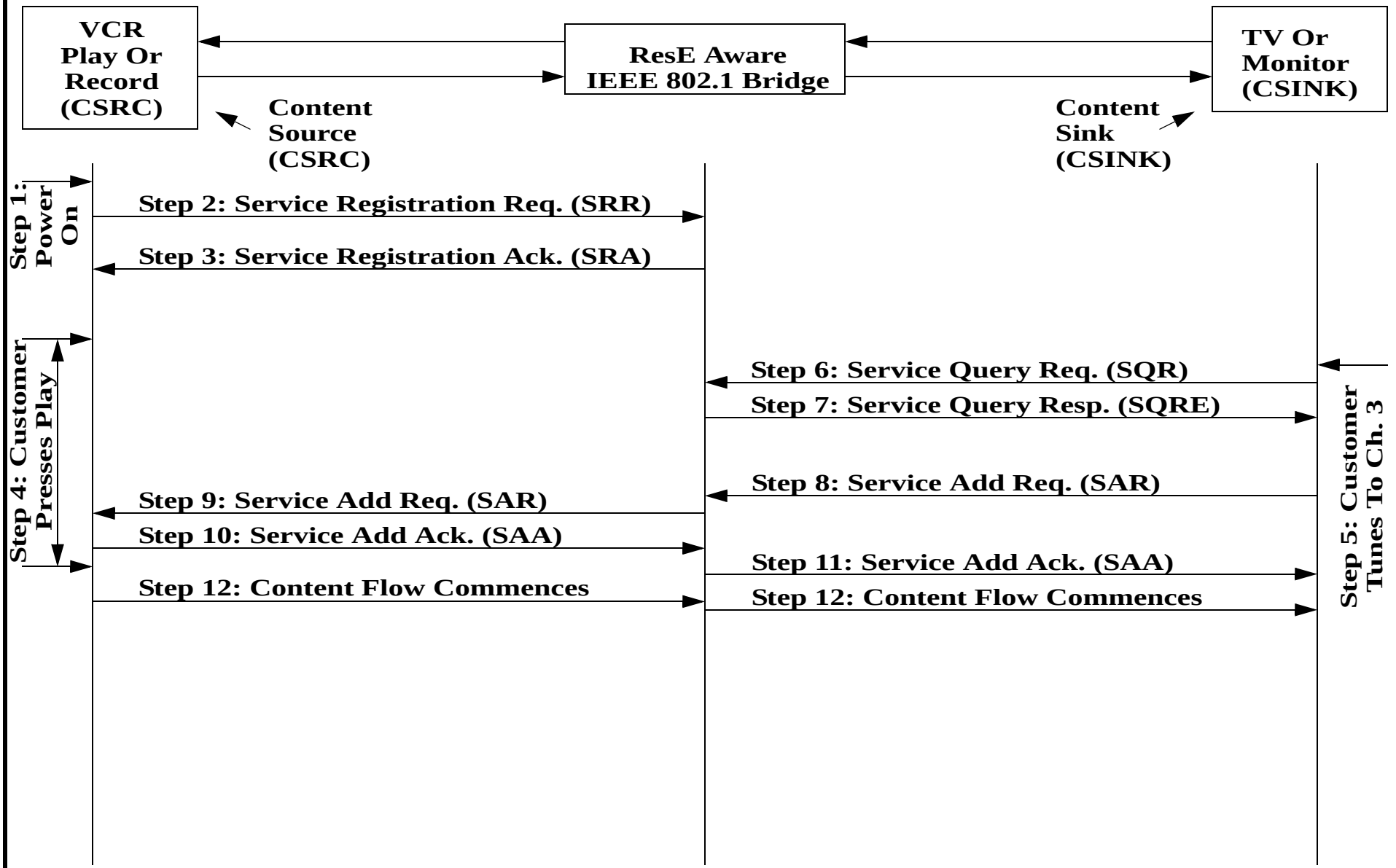
- VCR Services Registered:

Service
{
CSRC(ECh(3), Mcast_ID(Mcast_ID_3, Name(VCR_Den));
{

- DVD Services Registered:

Service
{
CSRC(ECh(4), Mcast_ID(Mcast_ID_4, Name(DVD_Living_Rm));
{

GSRP CF Add Diagram



Service Registration

- Step 1: At Power On each CSRC RDevice (VCR) registers the Source Services it plans to make available with its directly attached RBridge.

- Step 2: To do this each CSRC RDevice sends one or more Service Registration Requests (SRR) to its locally attached RBridge.

- On receipt of each SRR PDU the RBridge parses the PDU and if found to be valid extracts the encapsulated Service Attributes (SA), adding them to its Service Registration Data Base (SRB).

- In this example the tuple (CSRC, Src_Ucast_ID, Ch(3), MCast_ID3, Name(VCR_Den)) is registered, indicating that the RDevice whose Unicast Address is Src_Ucast_ID is a ResE CSRC operating on EChannel 3 whose Multicast Address is MCast_ID3, and whose name is VCR_Den.

- Step 3: Valid SRR PDUs are acknowledged via a Service Registration Acknowledge (SRA) PDU.

- RBridges use a similar protocol to that defined by Steps 1-3 above to share Share Service Registration Information, such that each maintains a SRB.

Service Registration Continued

- What about graceful stop or power down? We will include GSRP Service Deregistration Request (SDR) and Acknowledge (SDA) PDUs.

- What about ungraceful Power Down or disconnect? We need to include a keep alive or heart beat protocol. We will define the GSRP Service Ping Request (SPR) and Ping Acknowledge (SPA).

- RBridges send SPR PDUs to connected RDevices and RBridges. On reception the SPR is parsed by the receiver and if valid an SPA response is issued.

- RBridges will maintain a Watch Dog Timer which is started on transmission of an SPR and stopped on reception of a valid SPA Response.

- If no valid SPA Response is received the Watch Dog Timer expires and the SAs associated with the failed device will be deregistered from the SRB.

CF Add Description

- Step 4: The Customer Presses Play! The VCR performs its normal start up. But no content flow is started! Why? No CSINK has requested the Service Yet! This conserves RBridge resources, we do not forward flows if there is no requesting subscriber (CSINK).

- Step 5: The Customer tunes the TV to Channel 3. At this point the RDevice (TV) which plans to act as a CSINK needs to find a CSRC or source for the new proposed Channel 3 CF. Note: This protocol places no requirement on the ordering of steps 4 and 5.

- Step 6: The RDevice (TV) sends a GSRP Service Query Request (SQR) to its directly connected RBridge.

- Step 7: In response to each valid SQR the RBridge responds with one or more GSRP Service Query Responses (SQRE). From the valid responses the RDevice (TV) builds a current local version of the shared SRB.

- A search of the SRB for the requested Channel 3 results in the selection of the tuple (CSRC, Src_Ucast_ID, Ch(3), MCast_ID3, Name(VCR_Den)). Now the TV knows how to find the source of the Channel 3 CF. It now need to subscribe to the CF.

CF Add Description Continued

- Step 8: The RDevice (TV) issues a GSRP Service Add Request (SAR) addressed to the directly attached bridge (RBridge), containing the identification tuple of the selected CSRC (VCR). Any required local TV resources are allocated as pending.

- On reception the RBridge validates the SAR and confirms that the requested local queueing resources are available. If the required resources are available the RBridge allocates as pending the requested resources to the request.

- Step 9: The RBridge issues a SAR addressed to the CSRC (VCR).

- On reception the CSRC RDevice (VCR) validates the SAR and confirms the requested Service (CSRC) and resources are available. If the requested Service and resources are available they allocated to the requested content flow (CF) and the content flow begins.

- Step 10: The CSRC RDevice (VCR) issues a GSRP Service Add Acknowledge (SAA) to the RBridge.

- Step 11: On SAA Reception the RBridge validates the SAA. If valid it moves requested pending resources to allocated and issues an SAA to the CSINK RDevice (TV).

CF Add Description Continued

- Step 12: On SAA reception the CSINK RDevice (TV) validates the SAA. If valid it moves the requested pending resources to allocated and reception of the Content Flow (CF) begins.

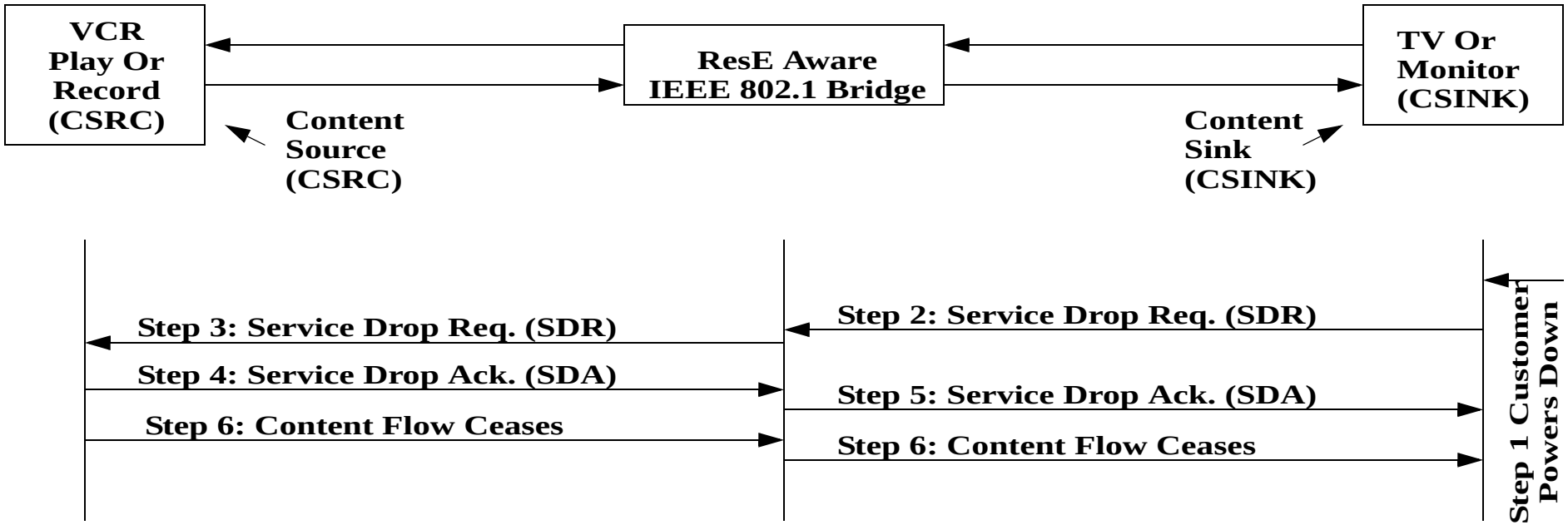
- If any device in the above sequence lacks the requested resources it simply responds with a GSRP Service Add NAck (SAN), which is propagated back to the requestor CSRC RDevice (VCR), releasing pending resources.

- If a SAR fails for any reason the SAR should be repeated continuously (after a suitable time out) until a suitable service is achieved. Remember resources may not be available for the original SRR, or the CSRC may not be available at the time of the original SRR. For example if the VCR was not actually playing there is no active CF so why waste the RBridge resources.

- Content Sources (CSRC) are required to Register as a soon as the CSRC is connected to the Data Link and powered on.

- Content Sinks (CSIN) are required to Query and Add when the Customer selects a channel. Note: If a Customer changes the Channel on a CSINK RDevice the CSINK first Drops the current CF and then performs the Query and Add of the new selected CF.

GSRP CF Drop Diagram



CF Drop Description

- Step 1: The Customer Powers Down the TV.

- Step 2: The CSINK RDevice (TV) issues a GSRP Service Drop Request (SDR) addressed to its directly attached bridge (RBridge), containing the identification tuple of the selected CSRC (VCR). Any local TV resources which are previously allocated to the CF are moved to pending.

- Step 3: On SDR reception the RBridge validates the SDR. If valid any resources which are previously allocated to the CF are moved to pending. The RBridge issues a SDR addressed to the CSRC RDevice (VCR).

- Step 4: On SDR reception the CSRC RDevice (VCR) validates the SDR. If valid the CF is terminated, and previously allocated resources are moved to deallocated. The CSRC RDevice (VCR) issues a GSRP Service Drop Acknowledge (SDA) to the RBridge.

- Step 5: On SDA reception the RBridge validates the SDA. If valid it moves pending resources to deallocated, and issues an SDA to the CSINK RDevice (TV).

- Step 6: On SDA reception the CSINK RDevice (TV) validates the SDA. If valid it moves pending resources to deallocated, and the CF is considered gracefully dropped.

CF Drop Description

- When dropping CFs CSRCs and RBridges must consider that a CF may have multiple subscribers consequently an acknowledged SDR command may cause in effect a pruning of a single CSINK from a multicast distribution tree which is composed of a single CSRC, one or more RBridges, and several CSINKs.

- A CSINK issuing an SDR Command may fail to receive an acknowledge due to device failure or ungraceful power down. As mentioned previously we will need to include a keep alive or heart beat protocol based on the SPR and SPA concept. On Watch Dog Time-out stale resources will become deallocated and thus available for reuse.

Straw Pole

- Is this the right direction or wrong Direction?

Right:

Wrong:

- Dose the group want to see more work in this area?

More Work:

Stop Now (Please!):